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1995–2020

SALTEK®
Overvoltage controlled. ANYWHERE.

SOLUTION

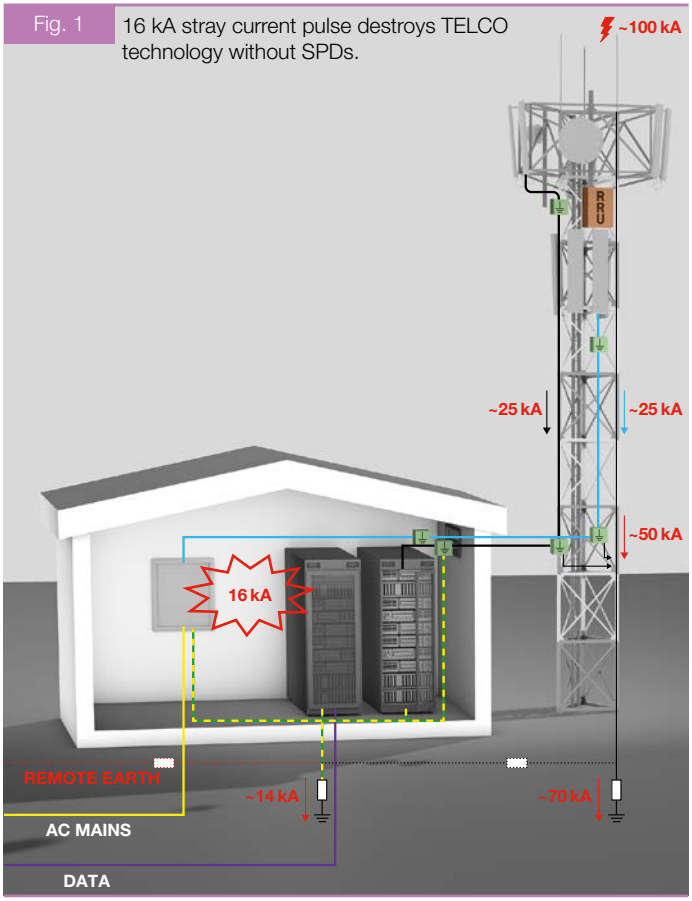
Telecommunications

Surge protection of TELCO and radio systems

Why to protect?

Telecommunications have become a central nervous system of modern times, since the capability of communicate belongs to the key elements of all areas of human activities. The collapse of communications may result in critical loss of life or property, and bring about other damages. It is therefore necessary to protect the communication technologies from atmospheric or industrial overvoltages which endanger them fatally.
Such a danger may also be enhanced by a nearby transmission tower situated on the top of a hill and functioning as a large lightning conductor. In the case of a lightning strike extremely high current levels (up to 200 kA) may be generated, followed with strong electromagnetic impulses, huge differences of electric potential across short distances (hundreds of kV/m) and high discharge currents.
These absolutely destroy sensitive electronic circuits and the related infrastructure if such is not consistently protected with surge protection devices (SPDs) mounted at proper locations (see Fig. 1).
SALTEK is ready to offer comprehensive solutions to all types of TELCO installations, starting from conventional 19" racks and aerials connected through coaxial cables, up until state-of-the-art Remote Radio Unit (RRU) and other type of solutions, including all the auxiliary power supply (AC/DC/solar), security, GPS and other technologies.

Fig. 1 16 kA stray current pulse destroys TELCO technology without SPDs.



What to protect?

Protection of AC/DC power supply circuits

Power supply for base transceiver stations (BTS) usually consists of a power inlet from an AC distribution cable of overhead mains. Either of the latter cases constitutes a potential source for the spreading of overvoltage pulses of atmospheric (nearby lightning strike) or industrial origin. We protect both cable inlets into the building object (coarse T1 and T2 protection) and the sensitive built-in technology (fine T3 protection). In such a case the combine type FLP-B+C MAXI VS ❶ can preferably be used, which combines the T1 + T2 protection in one protection element mounted at the cable entry into the BTS. Less threatened stations (e.g. in urban areas) can use smaller types of SPDs, such as FLP-12,5 V ❷. Power supply to technology racks can be protected with multiple sockets combined with SPDs, such as the RACK PROTECTOR F6-1U. Similarly to the power inlets also the power distribution of back-up AC diesel generator sets should be cared for (in particular if these are installed outside of the BTS object). In case of backup DC power sources the most frequently encountered problem are interferences from to the inverters, battery chargers etc. The cases mentioned above or places endangered by conducted industrial disturbances may be encountered by special SPDs with a built-in filter (DPF-048DC-16-S ❸). Another particular case is the protection of photovoltaic power units used to supply power to nearby BTS (SLP-PV500 V/U S ❺). Detailed information about the protection of power supply systems and the application of SPDs can you find at **www.saltek.eu**, section Support.

Transceivers, transmitters

Danger for the transmitter/receiver units come from the aerial side and the coaxial feeders which usually need to be installed at an exposed site (mast/tower, roof structure,...), outside the facility. They feature an ideal path for lightning currents. Continuous equipotential bonding of outer conductors of the coaxial cables (at least at the place of aerial installation and at points where the cable leaves the aerial mast structure) is able to lead in a part of the discharge current into the earth, but a part of the energy still penetrates into the technology installed. The danger is less if bandpass filters or diplexers are included in the power path the design of which makes it possible to divert the lightning currents into the earth. However, also in these cases the usage of coaxial protective elements is recommended, as the high down-lead currents may damage the surface treatment of the filter and impair its function. In applications where the transmission a broad frequency range and adequate capacity to lead down the lightning current is required, the HX ❻ series of surge protectors can be used (coaxial coupling with built-in surge protector; typical frequency range is from DC to 3,8 GHz). For applications with narrower frequency ranges special SPDs of the ZX ❼ series are recommended, using the principle of quarter-wave short circuit transformer and providing a still higher protection efficiency. All the protection types mentioned can be supplied with a special surface finish consisting of gilt white bronze to achieve a minimum level of PIM (passive intermodulation). Still higher protection efficiency is provided with the HX types with different protective voltage levels. When selecting the proper SPD the lowest protective voltage level is to be chosen, but, at the same time, the chosen protective voltage level is to be higher than the peak voltage encountered during peak power output of the signal transmitted (otherwise the SPD would be ignited, followed by the activation of reflectometric protection of the transmitter). Modern modulation methods, based in particular on frequency multiplex, achieve high values of PAPR (Peak to Average Power Ratio), which needs to be considered. Below is a formula for the determination of the maximum transmitted power in one single carrier depending on the voltage level protective element chosen (where: P is the maximum transmitted power; U_C = highest operation voltage of

the protective element; U_N = DC power supply voltage provided that a coaxial cable is being used for power distribution, which especially applies for receivers; Γ = 0,1 at a VSWR ratio of typically 1,2; Z = impedance of the line – typ. 50 Ω).

$$P \leq \left(\frac{U_C - U_N}{1+\Gamma} \right)^2 \div 2Z$$

When transmitting more complex multicarrier signals (vector sum of OFDM carriers , etc.) a correction resulting from the PAPR ratio (approx. -3 dB for 3G, -8 dB for 4G and up to -12 dB for 5G) is to be considered. The specific correction value, however, depends on the technology used and is determined by the transmitter manufacturer (mostly by the Crest Factor Reduction parameter). If you are unsure about choosing the proper correction value or U_C you may contact SALTE experts who will be pleased to help you with the selection. Endangered DC power inputs of RRUs can be protected by FLP-B+C MAXI 150 VS 4 accommodated inside IP68 box.

Receivers

Protection of sensitive receiver inputs requires special attention. You must bear in mind that the input circuits connected to the outdoor aerial (exposed to atmospheric overvoltage) must be adequately sensitive for very low signals levels (e.g. of approx. -150 dBm for the reception GPS signals). The system integrators resolve this problem mostly by using coaxial protection with lightning arrester, only. The pulse (1 kV/µs) protection voltage level of the arresters, however, turns around 700 V !, with the consequence that in case of a lightning strike near the aerial protected by such a coarse protection the receiver inevitably becomes damaged. This is why SALTEK recommends using this HX 6 coarse type of protection at the input point of the coaxial cable into the building (choosing always the lowest protection level, i.e. HX-090) to lead down the maximum of lightning energy, but in addition to provide the receiver input with a special SPD of the SX-090 9 type featuring a low protection level of 80 V and equipped with circuits for fast limitation of residual voltage peaks (nanoseconds).
The SX-090 …50 type is specially designed for professional applications with impedances of 50 Ω (or 75 Ω), and for operating frequencies of DC to 3 GHz, i.e. making it possible to provide power supply to the aerial via a cable, similarly to the HX series. For applications with a passive aerial (without power supply) may of course the ZX 7 protections be used.

RET

Advanced 4G/LTE/5G technologies use the technique of electronic control of the aerial radiation diagram (the so called RET – Remote Electronic Tilting). For this purpose SALTEK developed a highly compact and all-round SPD to protect the RET devices from overvoltages, which conforms to all the currently used AISG standards (v1/2/3) and can easily be installed outdoors (IP67) 8. In order to ensure an absolute protection the fine and fast SPDs need to be used not only on the RS-485 line but also on all used DC power lines.

Security, fire alarm systems, HVAC

Distant BTS locations require an additional equipment to be installed for security reasons, for the provision of access control, fire detection, air conditioning etc. SALTEK offers a broad portfolio of special SPDs for the protection of sensors (cameras, probes, …) and actuators (air conditioning units, servo control units, …) and special protections for RS-485 interfaces, current loops, AC/DC protections etc. A specific description of the various SPD applications can be found in specialized manuals at **www.saltek.eu**, section Support 14, 15, 16.

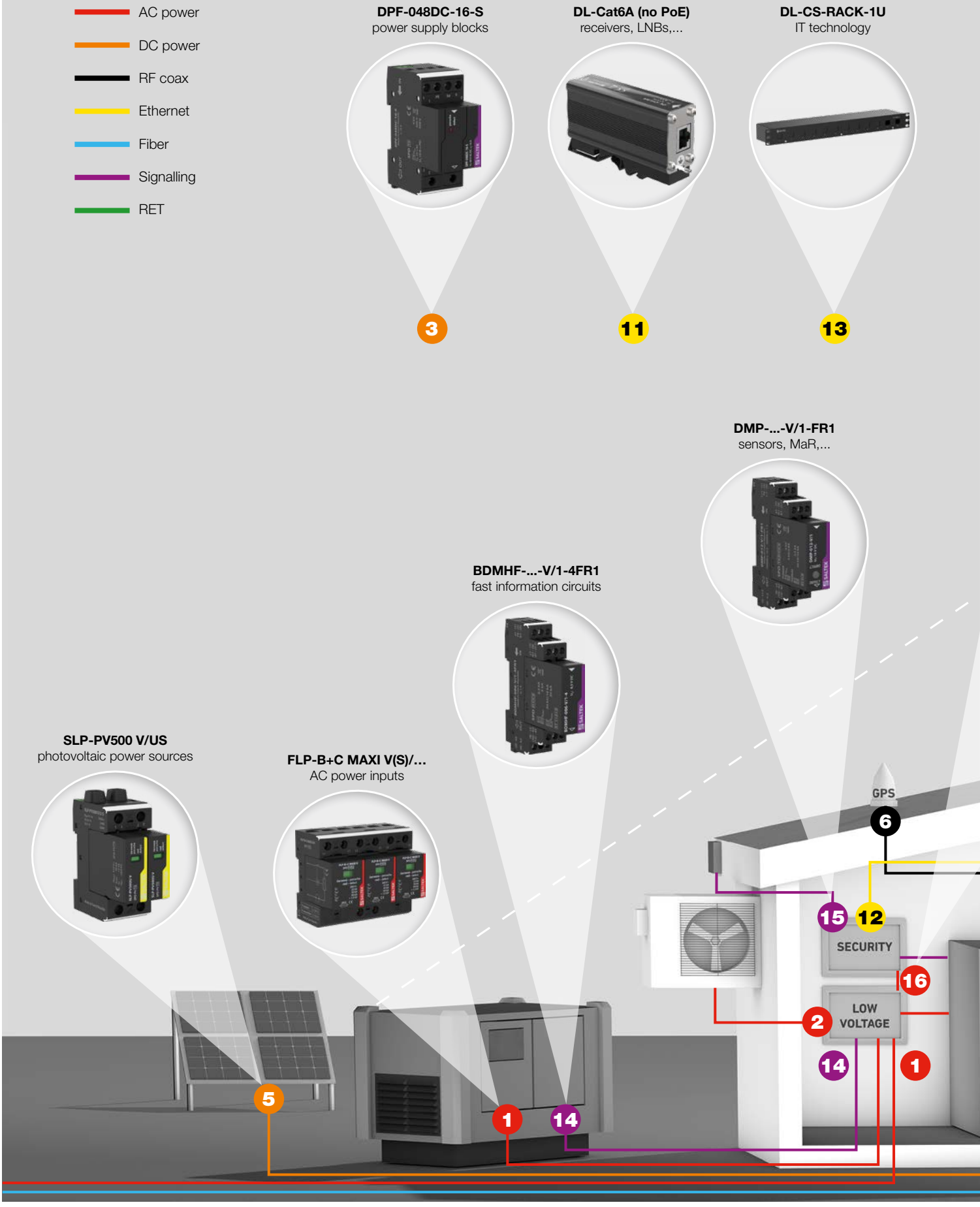
Data (Ethernet, data centres)

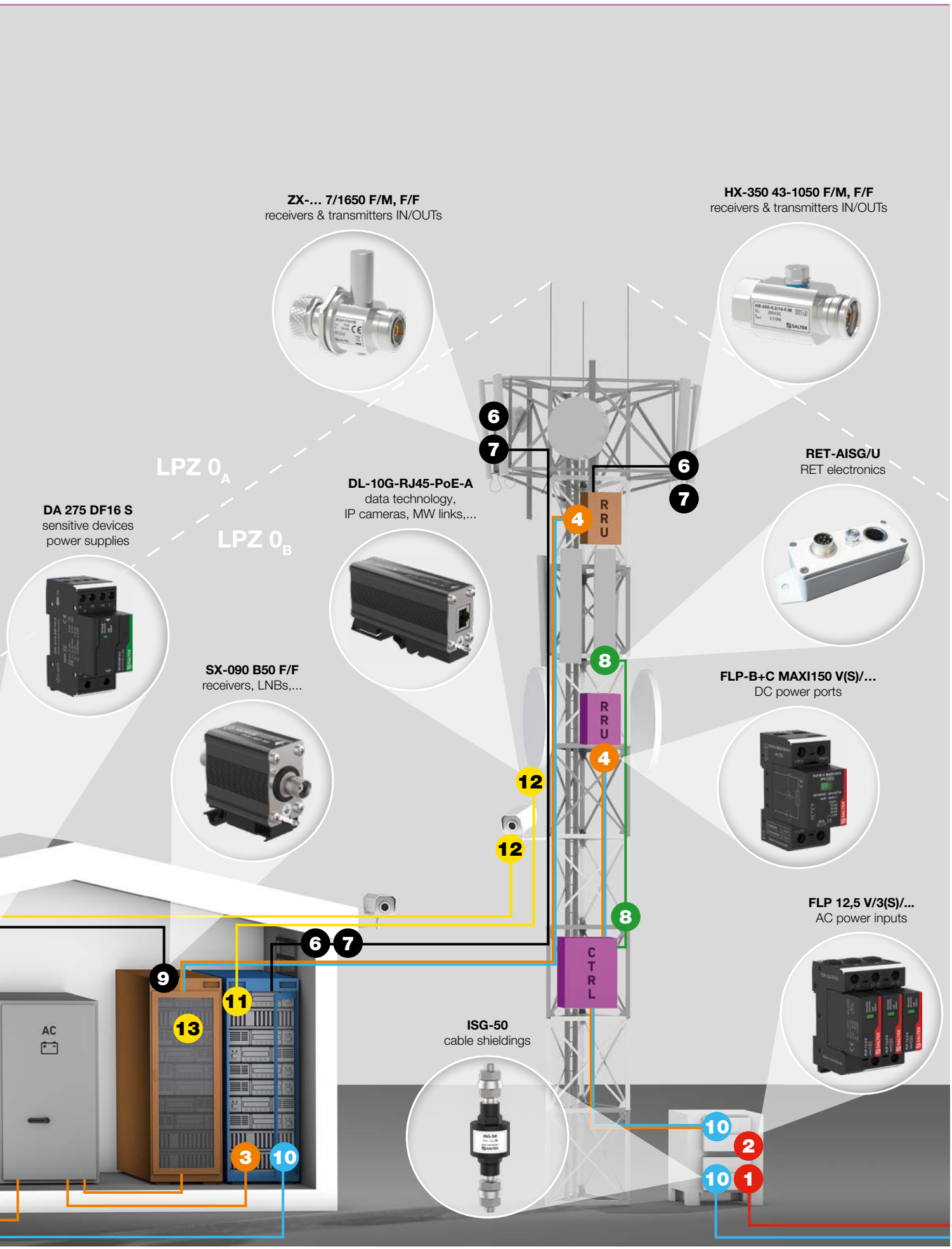
The term “Broadband networks” means a big volume of data transmission via fibre optic or STP/FTP cables (Ethernet). By its very nature the optical cables are not liable to overvoltage spreading, provided that the bundles of optical fibres are not embedded in a metallic shielding, or reinforced with a stranded steel rope. If this is the case the metallic parts, in particular the long ones, have to be additionally earthed via an adequate insulation spark gap, e.g. ISG-50 10. The reason consists in the long-term adverse influence of equalizing currents flowing through specific sections of the cable. Metallic Ethernet cables have to be provided with suitable SPDs against the ingress of overvoltage to the inputs of routers, data centres, communicators etc. using the high-speed DL-Cat. 6A 11 protection. Special, general purpose SPDs of DL-10G-RJ45-PoE 12 type, with transmission capacity of up to 10 Gbps and suitable for any version of PoE are designed to ensure protection of peripheral equipment with PoE power supply, intended for both single line and multi-channel module 1 RU kit for mounting into 19" rack, with the possibility of being combined with up to 12 various protection modules (DL-CS-RACK-1U + corresponding PCB modules, incl. the PoE injectors 13).

Microwave links

At many locations the microwave links is an alternative to missing fibre optics. Some of the microwave links have a built-in overvoltage protection, however, this usually is highly inadequate (due to its low stray current capacity), and as such constitutes a danger to a defect-free operation. Older “split” radio stations may utilize coaxial SPDs mentioned above (such as the HX and/or SX series). More advanced “all outdoor” units can be protected with general-purpose Ethernet protections with PoE (DL-10G-RJ45-PoE 12, featuring IP67).

Fig. 2 An Example of surge protection of telecommunication equipment




ZX-... 7/1650 F/M, F/F
receivers & transmitters IN/OUTs
HX-350 43-1050 F/M, F/F
receivers & transmitters IN/OUTs
LPZ 0A
LPZ 0B
DA 275 DF16 S
sensitive devices
power supplies
DL-10G-RJ45-PoE-A
data technology,
IP cameras, MW links,...
RET-AISG/U
RET electronics
SX-090 B50 F/F
receivers, LNBs,...
FLP-B+C MAXI150 V(S)/...
DC power ports
FLP 12,5 V/3(S)/...
AC power inputs
ISG-50
cable shieldings
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Recommended SPDs for TELCO applications

Power supply (parallel connection)

Coarse and fine protection of power supply distribution systems with high level of surge protection.

Type	SPD type / Location	Connection	Networks	U_c	I_{imp} (10/350)	I_n (C2) (8/20)	I_{max} (8/20)	Position Fig. 2
FLP-B+C MAXI V(S)/…	T1 + T2	1+0,1+1, 2+0, 3+0, 3+1, 4+0	TN, TT, TN-S, TN-C,	260 V AC	25 kA	30 kA	60 kA	1
FLP-B+C MAXI150 V(S)/…	T1 + T2	2+0, 1+1, 2+1	TN, DC	150 V AC / 200 V DC	25 kA	30 kA	60 kA	4
FLP 12,5 V(S)/...	T1 + T2	1+0,1+1, 2+0, 3+0, 3+1, 4+0	TN, TT, TN-S, TN-C,	275 V AC	12,5 kA	30 kA	60 kA	2
FLP-SG50 V(S)/1	T1	1+0	TN,TT	255 V AC	50 kA	50 kA	50 kA	1
DA 275 V(S)/…	T3	1+1, 3+1	TN-S, TT	275 V AC	N/A	5 kA	N/A	3
RACK-PROTECTOR-…-1U	T3	5/6/7/8/12 sockets	TN-S, TT	275 V AC	N/A	5 kA	N/A	3

Power supply (serial connection)

Pass-through fine protection of low/extra-low voltage distribution systems and devices.

Type	SPD type / Location	Connection	Networks	U_c	I_L	I_n (C2) (8/20)	U_P (cores/ core-PE)	Position Fig. 2
DA-075-DJ25	T3	symmetric	TN-S, TT	75 V AC/ 100 V DC	25 A	2 kA	430/750 V	3
DPF-048DC-16-S	T3	symmetric	DC	60 V AC/ 60 V DC	16 A	–	420/500 V	3

Receivers, microwave links, cameras – coaxial lines

Coarse and fine protection of sensitive inputs of communication receivers, GPS receivers, measurement equipments and active antennas (incl. Power supply over coaxial cable).

Type	SPD type / Location	I_L	Connection	I_{imp}	I_n (C2) (8/20)	U_{dyn}	Freq.	Position Fig. 2
HX-090 SMA50 F/M	ST 1+2	6 A	SMA	2,5 kA	10 kA	700 V	DC - 3,8 GHz	6
HX-090 N50 F/M, F/F	ST 1+2	6 A	N	2,5 kA	10 kA	700 V	DC - 3,8 GHz	6
ZX-... N50 F/M,F/F	ST 1+2+3	N/A	N	5 kA	20 kA	0,25 V	on request	7
SX-090 B50 F/F	ST 2+3	0,7 A (24 V)	BNC	–	2,5 kA	80 V	DC - 3,0 GHz	9
SX-090 SMA50 F/F	ST 2+3	0,7 A (24 V)	SMA	–	2,5 kA	80 V	DC - 3,0 GHz	9
SX-090 TNC50 F/F	ST 2+3	0,7 A (24 V)	TNC	–	2,5 kA	80 V	DC - 3,0 GHz	9
SX-090 F75 F/F	ST 2+3	0,7 A (24 V)	F (75 Ω)	–	2,5 kA	80 V	DC - 2 150 MHz	9

Transmitters, Transceivers – coaxial lines

Coarse and fine protection of transmitters and transceivers (with or without power supply over coaxial cable).

Type	SPD type / Location	Power (CW) *	Connection	I_{imp}	I_n (C2) (8/20)	U_{dyn}	Freq.	Position Fig. 2
HX-090 SMA50 F/M	ST 1+2	45 W	SMA	2,5 kA	10 kA	700 V	DC - 3,8 GHz	6
HX-090 N50 F/M, F/F	ST 1+2	45 W	N	2,5 kA	10 kA	700 V	DC - 3,8 GHz	6
HX-230 N50 F/M, F/F	ST 1+2	295 W	N	2,5 kA	10 kA	800 V	DC - 3,8 GHz	6
HX-350 N50 F/M, F/F	ST 1+2	570 W	N	2,5 kA	10 kA	900 V	DC - 3,5 GHz	6
HX-230 7/1650 F/M, F/F	ST 1+2	295 W	7-16 DIN	2,5 kA	10 kA	800 V	DC - 3,8 GHz	6
HX-350 7/1650 F/M, F/F	ST 1+2	570 W	7-16 DIN	2,5 kA	10 kA	900 V	DC - 3,5 GHz	6
HX-230 43-1050 F/M, F/F	ST 1+2	295 W	4,3-10	2,5 kA	10 kA	800 V	DC - 3,8 GHz	6
HX-350 43-1050 F/M, F/F	ST 1+2	570 W	4,3-10	2,5 kA	10 kA	900 V	DC - 3,5 GHz	6
ZX-... N50 F/M, F/F	ST 1+2+3	conn. limited	N	5 kA	20 kA	0,25 V	on request	7
ZX-… 7/1650 F/M, F/F	ST 1+2+3	conn. limited	7-16DIN	5 kA	20 kA	0,25 V	on request	7
ZX-… 43-1050 F/M, F/F	ST 1+2+3	conn. limited	4,3-10	5 kA	20 kA	0,25 V	on request	7

* higher power on request

RET-AISG/U (AISG v1, v2, v3)

Combined (coarse + fine) protection of Remote electrical tilting ports and devices.

Pins	U_C	I_L	R (serial)	I_{imp}	I_n (C2) (8/20)	U_{dyn}	t_a	Position Fig. 2
1,6 (to DC return 7)	± 36 V DC	3,1 A	0,4 Ω	5 kA	20 kA	60 V	< 10 ps	8
2 (to DC return 7)	± 64 V DC	3,1 A	0,4 Ω	5 kA	20 kA	90 V	< 10 ps	8
3,5 (to DATA return 4)	± 8,5 V DC	1,5 A	0,8 Ω	5 kA	20 kA	30 V	< 10 ps	8
4,7 to PE	N/A	N/A	N/A	5 kA	20 kA	550 V	< 200 ps	8

Security, HVAC, support technology

Protection of data and sensor lines/equipment, power supplies (incl. combinations).

Type	SPD type / Location	U_C	I_L	I_{imp}	I_{total} (8/20)	U_{dyn} (cores/G-PE)	$f_{max.}$	Position Fig. 2
BDMHF-...-V/1-4FR1	ST 1+2+3	6 (24) V	1 A	2,5 kA/core	20 kA	16 (48)/550 V	70 MHz	14
DMP-...-V/1-FR1	ST 2+3	12 (24) V	1/16 A	N/A	20 kA	22 (46)/550 V	4 MHz	15
DA 275 DF16 S	ST 3	275 V	16 A	N/A	5 kA	1,2/1,5 kV	LPF	16

Ethernet, FO, Datacenters, microwave links, IP cameras

Coarse and fine protection of Ethernet/IP technology with up to 10 Gbps throughput and all PoE modes support; shielding grounding.

Type	SPD type / Location	U_C (line/PoE)	I_L (line/PoE)	I_n (8/20)	I_{total} (10/350)	U_p (core-core)	U_p (core-PE)	Position Fig. 2
DL-Cat6A (no PoE)	ST 2+3	8,5 V/N/A	0,5 A/N/A	0,2 kA	N/A	30 V	600 V	11
DL-10G-RJ45-PoE-AB	ST 1+2+3	8,5 V/58 V	0,5 A/1,5 A	0,15 kA	2 kA	22 V/80 V	500 V	12
DL-1G-PoE-INJECTOR	ST 1+2+3	8,5 V/58 V	0,5 A/1,5 A	0,15 kA	2 kA	80 V/80 V	500 V	
DL-CS-RACK-1U	based on used boards (DL-PCB-Cat6A; DL-10G-RJ45-PCB-PoE-AB; DL-1G-PoE-PCB-INJECTOR;...)							13
ISG-50	temporary grounding of long shielding - see datasheet							10

IP67 outdoor enclosures on request

Photovoltaic power sources

Special protective devices for photovoltaic arrays.

Type	SPD type / Location	U_{CPV}	I_{total} (10/350)	I_n (8/20)	U_p	I_{SCPV}	t_a	Position Fig. 2
FLP-PV550 V/4S	T1 + T2	1 120/560 V	25 kA	30 kA	2,4/4,8 kV	1 kA	25 ns	5
SLP-PV500 V/US	T2	1 020/510 V	–	15 kA	2,0/4,0 kV	1 kA	25 ns	5

Quality, warranty, customer support

The quality of products, reliability and efficiency of surge protection devices is the key priority for SALTEK. Our products are being developed and tested both in our own laboratory, and in accredited laboratories of our partners, very often in co-operation with VIP customers. In the course of the manufacture of SPDs, chosen and tested components and precise technology procedures are being used at our parent plant in the Czech Republic (EU). The whole process meets the parameters of ISO 9001 quality standard. Due to the application specific nature of surge protection devices in various industrial segments, SALTEK provides, on request, free-of-charge expert consultations to all customers when choosing the adequate SPD for the particular client´s application. Do not hesitate to contact us.

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02/2020