SALTEK®

Overvoltage controlled. ANYWHERE.

SOLUTION

Railway stations and railways

Surge Protection and Voltage Limiting Devices

Why to protect?
Protection of railway systems. Trains – metro – trams.

In the rail transport, both the underground and the above-ground railway or tram transport, attention is turned to the safety and reliability of the traffic, and to the unconditional protection of persons. Installed electrical and electronic equipment of the infrastructure (control systems, signalling ones, information ones), has to provide a high level of reliability corresponding to the needs of a safe traffic and protection of persons. Due to economic reasons, equipment does not have a sufficient dielectric strength for all potential overvoltages, and therefore, the overvoltage protection has to be adapted to specific requirements of the rail transport.

Costs of a complex protection of electrical and electronic systems of the rail transport and the tramway one against the effects of overvoltage are usually a fraction of the costs of the protected technology equipments. Costs of the protection are insignificant in relation to potential damages caused by the failure or destruction of equipment or infrastructure. Damages are caused by overvoltages due to the direct or indirect lightning strikes, transient overvoltages due to switching, faults, or the excessive high voltage induced on metallic parts of railway equipment. Complexity and coordination of surge protective devices (SPD), and a rigorous equalization of potentials by the direct or indirect interconnection are main principles of the design of a proper overvoltage protection. The complexity of protection is ensured by the installation of overvoltage protections on all inputs and outputs of the device – all power lines, measuring and communication interfaces have to be protected. The coordination of protections is ensured thanks to the installation of protections with a different protective effect by cascading them in a correct order. That way, overvoltage pulses are progressively limited to the level safe for the protected device.

Voltage limiting devices (VLDs) are an essential part of the comprehensive protection of electrified railway systems. VLDs limit the dangerous contact voltage on exposed conductive parts of railway equipment by connecting parts of equipment with the traction system grounding (temporarily or permanently). That way, persons getting in touch with these parts, are protected.



How to protect?
SALTEK solutions for railway stations and railways

Power line 230/400 V AC

Railway stations are primarily used to stop the train so that passengers can get on or off the train, and the goods can be transported. The traffic is controlled by information and control systems. Railway stations also include a variety of amenities (restaurants, shops, etc.). Amenities connected to a common electrical supply network are at risk of overvoltage or potential failure in a power traction, due to an electrically near location.

To ensure a reliable operation of these systems and devices, the three-stage overvoltage protection is recommended to be installed on the power line:

- Main switchboard (the distribution point, beginning of the power line): the first stage of protection, SPD Type 1, e.g. 3x **FLP-SG50 V/1**, or a combined lightning and surge arrester Type 1 and 2, e.g. **FLP-B+C MAXI V/3**
- Secondary switchboards: the second stage of protection, SPD Type 2, e.g. **SLP-275 V/3+1**
- Switchboards of technical devices: the third stage of protection, SPD Type 3:
  - If the devices are located directly in the switchboard or close to it, then the SPD Type 3 is recommended to be used in DIN 35 mm bar mounting, e.g. **DA-275 V/3+1**.
  - To protect electrical and electronic devices connected to socket circuits (cash registers, copiers, computers, etc.), a module of SPD is suitable to be used, e.g. **DA-275-A**.
  - To protect control devices and measurement-and-regulation (MaR) systems, which are interference-sensitive, the SPD Type 3 combined with high-frequency filters, e.g. **DA-275-DF16**. The integrated RF filter effectively reduces high-frequency interferences. Installation of these combined protections is recommended if an unmanned and failure-free operation is required (e.g. an operating room, a control center, etc.).

Fig. 1 Surge Protective Devices for low-voltage supply networks

FLP-SG50 V/1 | FLP-B+C MAXI V/3 | SLP-275 V/3+1 | DA-275 V/3+1 | DA-275-A | DA-275-DF16

The basic part of the railway infrastructure consists of the railway track with a wide range of objects that are a part of the railway or its accessories (information and control systems including signal devices, electronic interlocks, rail-crossing protecting devices, axle counters, heat indicators of bearing of wagon wheels, etc). Their protection against the effects of overvoltage is very important from the viewpoint of safety and reliability of operation.

- To protect these devices, we recommend to install the SPD Type 1 (e.g. **FLP-SG50 V/1**), or a combined lightning and surge arrester SPD Type 1 and 2, range **FLP-B+C MAXI V**, which provides a lower voltage protection level. An example of a real installation is in *Fig. 2*.

Fig. 2 View to power distribution box of signalling system with installed SPD Type 1 and 2 FLP-B+C MAXI V/3

- For railway devices which are a part of a railway or are located close to it (e.g. axle counting devices), we have to ensure equalization of potential differences between rails and the switchboard protective ground by installing the VLD, e.g. type **BVL-25-120-R01**, designed for DIN 35 mm bar mounting. If rails are not connected in between, then each rail should be connected separately, see *Fig. 6*.

Communication devices

All communication devices and their securing are an important part of railway transport systems. Communication devices comprise different digital and analog communication systems implemented on metallic cables or wirelessly. For protection of terminal devices, SALTEK data and signal networks SPDs can be used in these circuits. Examples below.

- Telephone line with ADSL or VDSL2: **BDG-230-V/1-FR** at the entrance of the building and **DL-TLF-HF** in vicinity of the protected device
- Ethernet networks: **DL-1G-RJ45-PoE-AB** (universal protection for data lines combined with PoE) for single lines or modular **DL-PL-RACK-1U** for multichannel applications
- Coaxial antenna lines: e.g. **HX-090 N50 F/F** for transmitters, **SX-090-B50 F/F** for receivers

Control circuits and data networks

Measuring and control devices, which are part of a railway, have to be protected from overvoltage effects to ensure reliability and safety. SALTEK protections for data and signal networks can be used here.

- Protection of signal lines of measuring and control railway equipment: surge protection ST 1+2+3, e.g. **BDM-024-V/1-FR1**

Fig. 3 SPDs for data/signal/communication lines

BDG-230-V/1-FR | DL-TLF-HF | SX-090-B50 F/F

DL-1G-RJ45-PoE-AB | HX-090 N50 F/F | BDM-024-V/1-FR1

Voltage limiting devices (VLD) SALTEK®

Safety of persons

During the regular operation of the train traffic, an excessive contact voltage can occur at accessible locations between the return circuit and the ground or on grounded structures (masts, hand-railings, and other devices) due to the voltage drop in the return circuit or due to the failure state. At locations accessible to persons (railway stations, rails), this voltage is necessary to be limited to a safe value by installing voltage limiting devices (VLDs). VLDs are aimed to create a temporary or permanent connection of exposed parts of the traction system with the grounding if the acceptable value of the contact voltage is exceeded. When selecting a VLD, we have to consider (depending on the location of installation) if the VLD-F function or the VLD-O function or both the functions are required as defined in EN 50122-1.

Exposed conductive parts of trolley or traction lines are connected to a return circuit directly (AC) or via VLD-F (DC). The VLD-F voltage limiters are designed for failure states when the traction line touches the exposed conductive part.

Voltage limiting devices of the VLD-O type are used in case of a regular operation; VLDs limit the increased contact voltage caused by the train traffic.

Due to the new standard EN 50526-2, requirements on VLDs have significantly changed, and are the subject to considerably higher technical requirements. Newly, VLDs are classified as class 1 and class 2.2.

The SCG range of VLD class 1, type VLD-F

VLDs of the SCG range limit voltages caused by lightning strikes, failure states, or the induced excessive contact voltage on exposed parts of railway devices, both in AC traction systems and DC ones. Persons who can get in touch with these parts, are protected by creating a transient or permanent connection of exposed conductive parts with the return circuit if the acceptable value of the contact voltage is exceeded.

If the traction line gets in contact with an exposed conductive part of railway equipment (due to breaking and falling, e.g.), the **SCG** creates a conductive connection with the return circuit. The short-circuit current is evaluated by appropriate sensors in the traction substation, and the corresponding segment of the traction line is immediately disconnected by a circuit breaker.

When passing the short-circuit current, a permanent guaranteed bridging of the protective element is achieved by a patented internal short-circuit device. That way, the protective function is guaranteed in these cases in accordance with requirements of the standard. (the CZ patent no. 307 373).

The used protective element simultaneously eliminates high pulse overvoltage induced on the traction line or the railway device by the lightning strike.

The BVL range of VLD class 2.2, type VLD-O

VLDs of the **BVL** range provide a temporary connection of the return circuit with the grounding of the traction system for as long as the acceptable value of the contact voltage is exceeded. This protects persons, who can come into contact with these parts, from the excessive voltage caused by the potential of the return circuit induced due to the train traffic. The BVL voltage limiting devices can conduct the compensating current for a long time, and therefore are suitable for the installation in railway or switching stations.

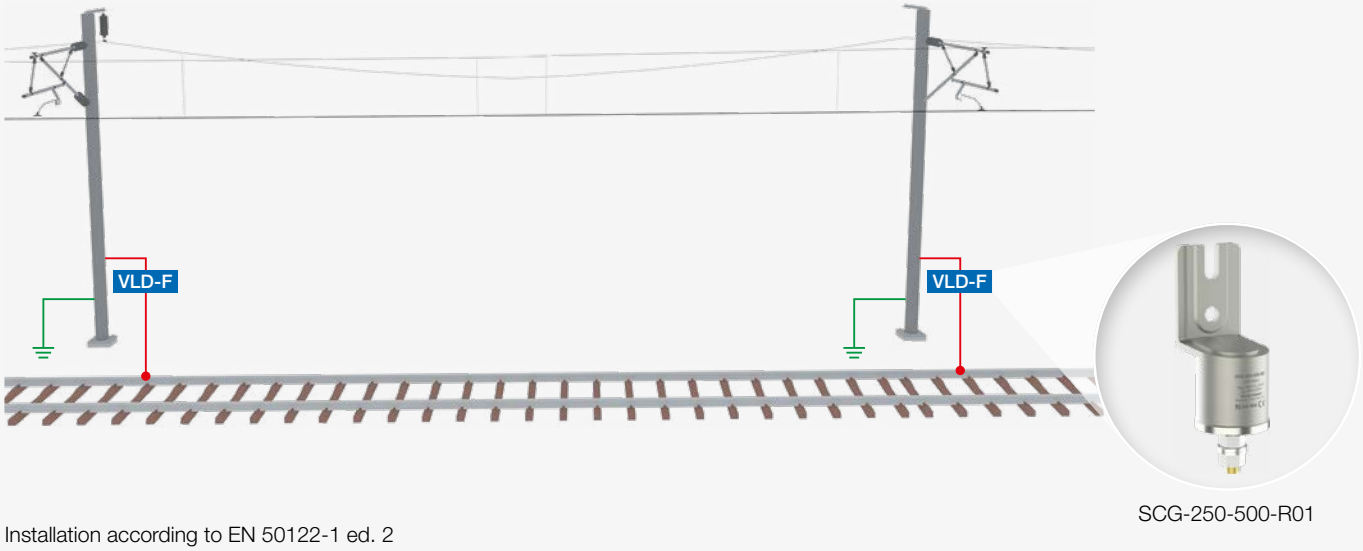
The types BVL-50 and BVL-100 meet requirements of the standard EN 50122-1 ed. 2, Attachments F, on voltage limiting devices of the type VLD-F and VLD-O, at the same time.

The BVL range is equipped with two main terminals. Two power thyristors and an electronic detection circuit, which are connected to these terminals bi-directionally, form a voltage limiting device together. A surge arrester is connected in parallel to them. The voltage limiting device responds to all slow and fast, short and long, DC and AC pulses. The varistor responds to the voltage pulse always as the first, and protects the other components from the effects of overvoltages. A pulse lasting for a longer time could cause its destruction, and therefore, one of the thyristors is activated with a delay of about 1.5 ms, depending on the impulse polarity, to reduce the excessive voltage. The thyristor will switch off if the current decreases below the value of the latching current of the thyristor. Then, the high impedance state of the whole VLD is restored. VLD is a passive device which does not require auxiliary supply. The design is protected by the patent no. CZ 307 422.

Typical applications of VLD:

- “Rail grounding” of catenary masts: VLD class 1, type **SCG-250-500-R01**. Connection principle is shown in *Fig. 4*.
- Protection of persons by connecting exposed conductive parts in railway stations and switching stations to the return circuit: VLD class 2.2, type **BVL-50-120-R02** or **BVL-100-120-R02** and VLD class 1, type **SCG-250-75-R01**. An example of a possible use is shown in *Fig. 5*.
- Equipotential bonding bar connection of the measuring device to the return circuit: VLD class 2.2, type **BVL-25-120-R01** see *Fig. 6*.

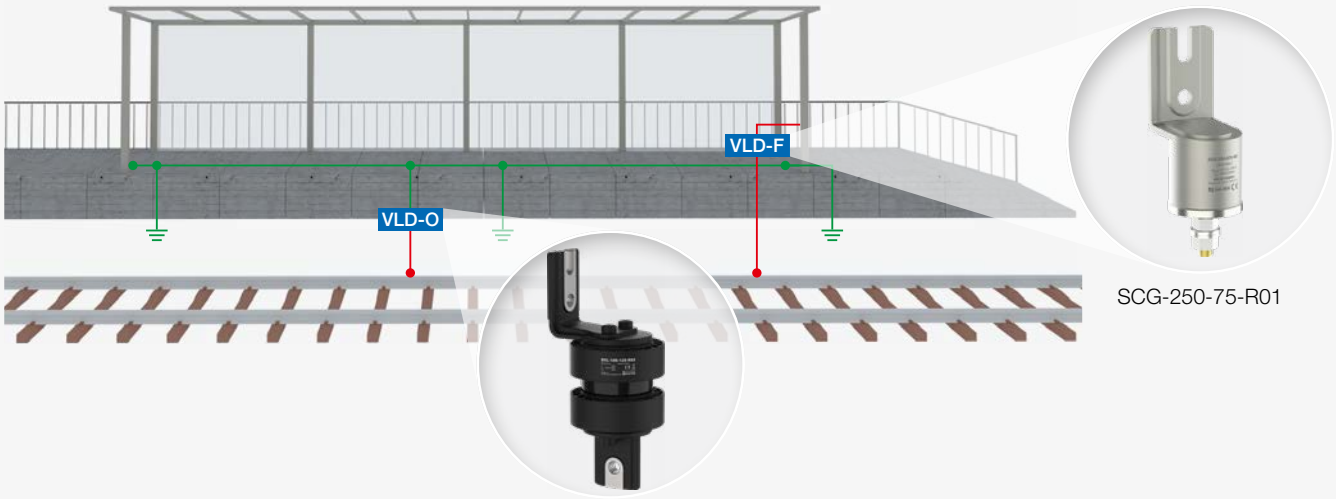
Fig. 4 Installation of VLD-F class 1



SCG-250-500-R01

Installation according to EN 50122-1 ed. 2

Fig. 5 Installation of VLD-0+F class 2.2 or VLD-F class 1 at railway and switching station

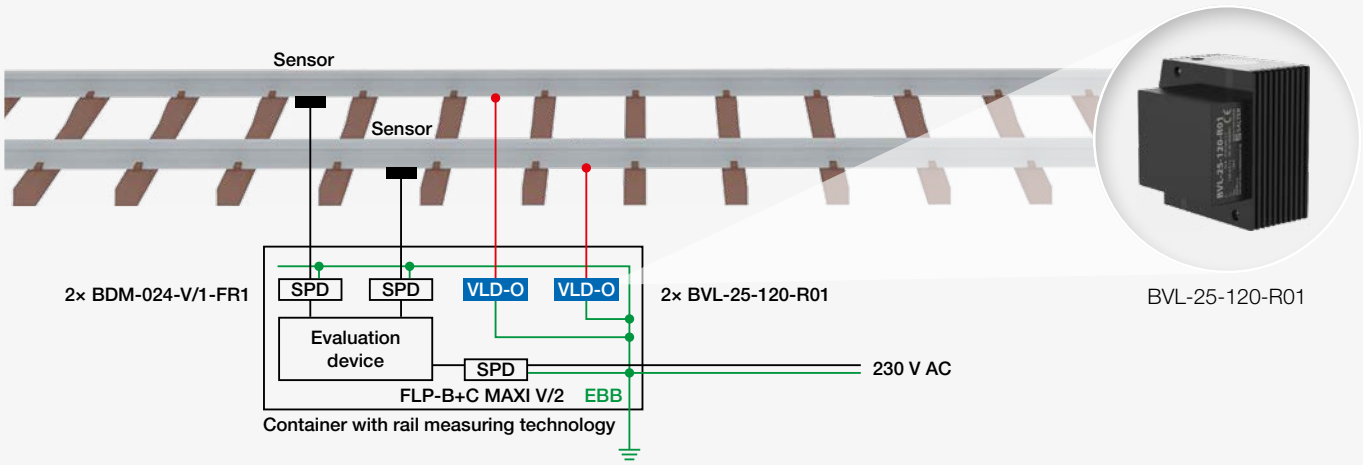


SCG-250-75-R01

BVL-100-120-R02

Installation according to EN 50122-1 ed. 2

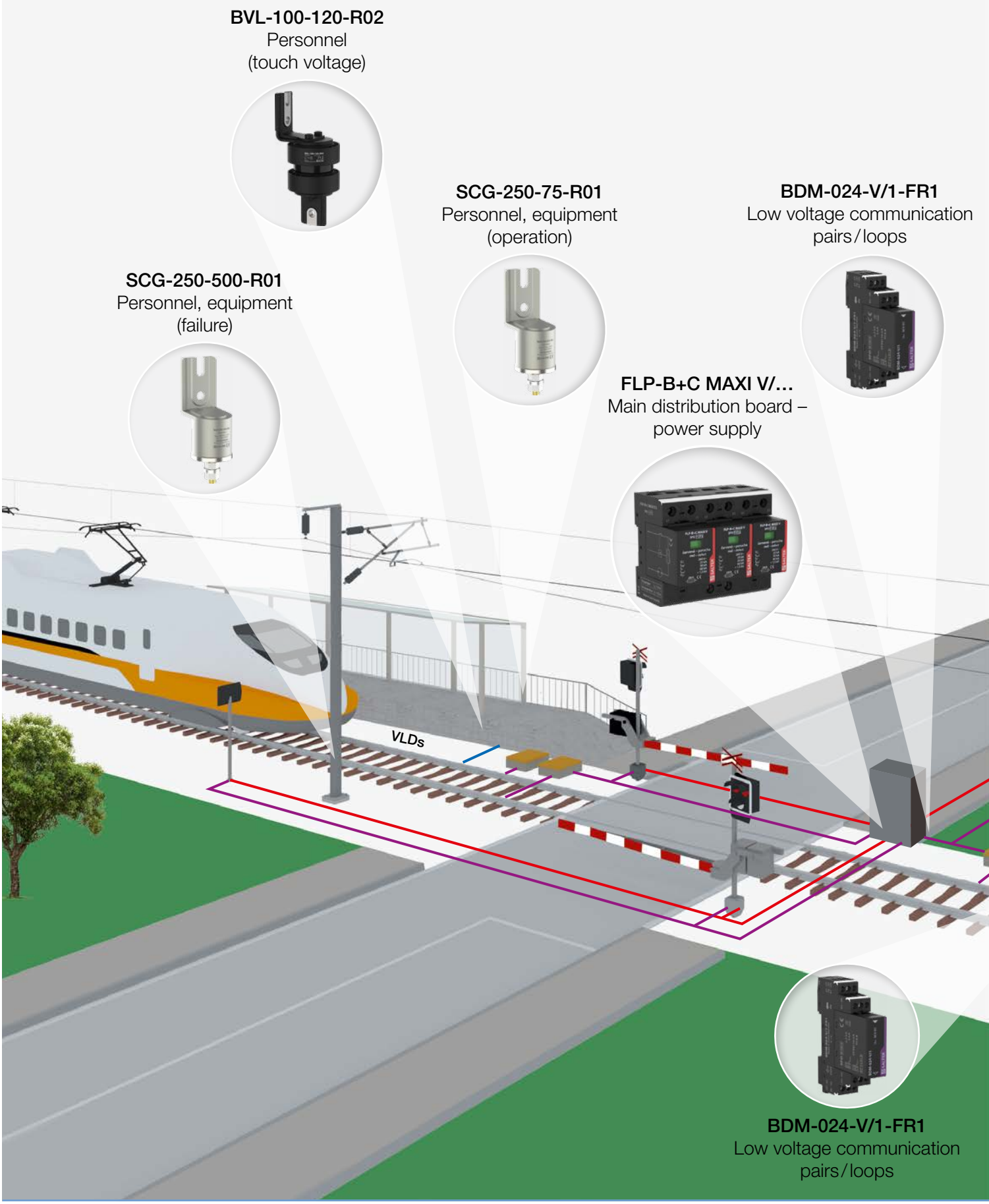
Fig. 6 Installation of VLD-O class 2.2 for potential equalizing between return circuit and technology's equipotential bounding bar

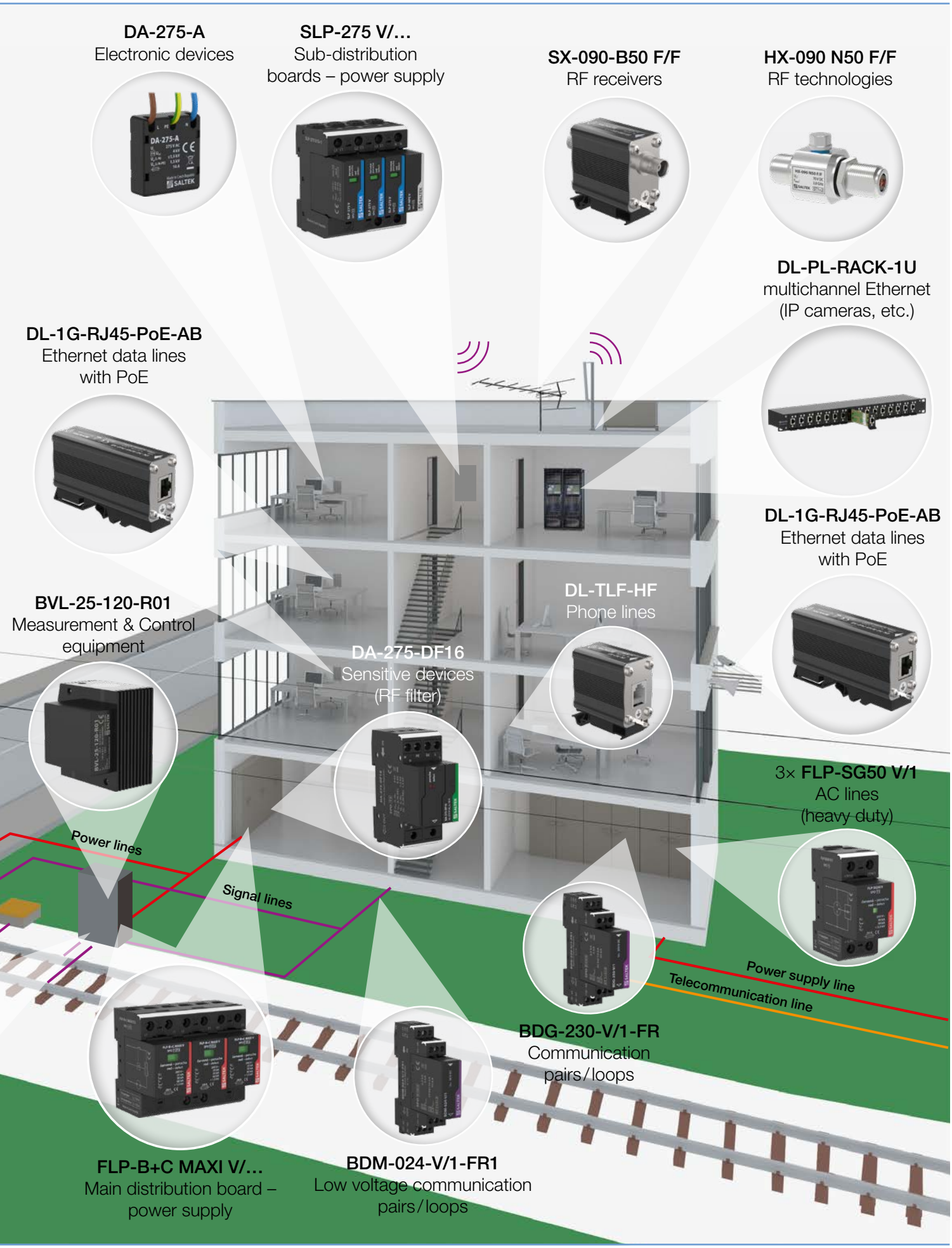


BVL-25-120-R01

Installation according to EN 50122-1 ed. 2

Fig. 7 Example of SPDs and VLDs installation in the model railway application




DA-275-A
Electronic devices
SLP-275 V/…
Sub-distribution boards – power supply
SX-090-B50 F/F
RF receivers
HX-090 N50 F/F
RF technologies
DL-PL-RACK-1U
multichannel Ethernet (IP cameras, etc.)
DL-1G-RJ45-PoE-AB
Ethernet data lines with PoE
DL-1G-RJ45-PoE-AB
Ethernet data lines with PoE
BVL-25-120-R01
Measurement & Control equipment
DL-TLF-HF
Phone lines
DA-275-DF16
Sensitive devices (RF filter)
3× FLP-SG50 V/1
AC lines (heavy duty)
Power lines
Signal lines
Power supply line
Telecommunication line
BDG-230-V/1-FR
Communication pairs/loops
FLP-B+C MAXI V/…
Main distribution board – power supply
BDM-024-V/1-FR1
Low voltage communication pairs/loops

Recommended SPDs and VLDs for railway applications

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 in direct 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_n (8/20 µs)	I_{fi}	Remote signalling	Ordering number
FLP-SG50 V/1	1+0	TN, TT	255 V AC	50 kA	50 kA	50 kA	No	A04054
FLP-SG50 VS/1	1+0	TN, TT	255 V AC	50 kA	50 kA	50 kA	Yes	A04053

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-on current.

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	1+1	TT	275 V AC	25 kA	30 kA	60 kA	No	A05095
FLP-B+C MAXI VS/1+1	1+1	TT	275 V AC	25 kA	30 kA	60 kA	Yes	A03783
FLP-B+C MAXI V/2	2+0	TN-S	275 V AC	25 kA	30 kA	60 kA	No	A05092
FLP-B+C MAXI VS/2	2+0	TN-S	275 V AC	25 kA	30 kA	60 kA	Yes	A03784
FLP-B+C MAXI V/3	3+0	TN-C	275 V AC	25 kA	30 kA	60 kA	No	A05093
FLP-B+C MAXI VS/3	3+0	TN-C	275 V AC	25 kA	30 kA	60 kA	Yes	A03570
FLP-B+C MAXI V/3+1	3+1	TT	275 V AC	25 kA	30 kA	60 kA	No	A05096
FLP-B+C MAXI VS/3+1	3+1	TT	275 V AC	25 kA	30 kA	60 kA	Yes	A03572
FLP-B+C MAXI V/4	4+0	TN-S	275 V AC	25 kA	30 kA	60 kA	No	A05094
FLP-B+C MAXI VS/4	4+0	TN-S	275 V AC	25 kA	30 kA	60 kA	Yes	A03571

Surge arresters (SPD Type 2), MOV based

For LV installations, especially to sub-distribution boards. Protection of installation and devices against impact 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	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

Type	Connection	Suitable networks	U_c	I_n (8/20 µs)	I_{max} (8/20 µs)	Remote signalling	Ordering number
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+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

Surge protections (SPD Type 3) on the DIN rail, 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 impact 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

Surge protections (SPD Type 3) for additional mounting

Surge arresters 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)	Status signalling	Ordering number
DA-275-A	Symmetric	TN, TT	275 V AC	2 kA	4 kV	Acoustic	A06738
DA-275-S	Symmetric	TN, TT	275 V AC	2 kA	4 kV	Remote	A06739

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

A surge arrester 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), DA-… DF … (S)

- Visual fault signalling
- Optional remote fault signalling (S)
- Filter attenuation range ca. 150 kHz ÷ 30 MHz
- $U_p \leq 1{,}5$ 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-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-DFi16	Symmetric	TN, TT	275 V AC	16 A	5 kA	10 kV	Interruption	A05725

Lightning current arrester BDG-…-V/1-FR… range

Lightning current arrester. It is specified for the protection of two-core floating communication, data and other lines and the communication interface of control I&C, electronic security and fire alarm systems, etc., at the boundaries of LPZ 0 and LPZ 1 or higher.

- Installation at the line entry into building, close to protected equipment
- In “F” version is the line separated from protective earth via GDT

Type	Location	Number of lines	U_c	I_L	I_{imp} (D1)	I_n (C2)	U_p (C3) core-core	Floating	Ordering number
BDG-230-V/1-FR	ST 1+2+3	1	250 V DC	0,5 A	2,5 kA	10 kA	350 V	Yes	A05708

Lightning current arrester BDM-…-V/1-FR… range

Lightning current arrester. It is specified for the protection of two-core communication, data and other lines and the communication interface of control I&C, electronic security and fire alarm systems, etc., at the boundaries of LPZ 0 and LPZ 1 or higher.

- Installation at the line entry into building, close to protected equipment
- In “F” version is the line separated from protective earth via GDT

Type	Location	Number of lines	U_c	I_L	I_{imp} (D1)	I_n (C2)	U_p (C3) core-core	Floating	Ordering number
BDM-024-V/1-FR1	ST 1+2+3	1	36 V DC	1 A	2,5 kA	10 kA	46 V	Yes	A05711

Surge arresters for phone lines

Combination of coarse and fine surge protection for one pair of telecommunication lines. Suitable also for high-speed lines e.g. ISDN, ADSL or VDSL2.

DL-TLF-HF

- RJ11 connectors
- Suitable also for VDSL2 lines
- Universal plastic adapter for mounting on DIN rail in the scope of delivery

Type	Location	U_c	I_L	I_n (C2) (8/20 µs)	U_p (C3) core-core	U_p (C3) core-PE	f	Ordering number
DL-TLF-HF	ST 2+3	162 V DC	0,06 A	2,5 kA	240 V	400 V	45 MHz	A06150

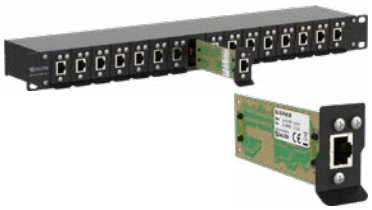
Surge arresters for Ethernet with PoE

Combination of coarse and fine protection of single Ethernet 1G/10G line with possibility of any PoE (Power over Ethernet) against surge voltage. Installation at the boundary of LPZ 0 and LPZ 1 or close to protected equipment.

DL-…-RJ45-PoE-AB

- RJ45 connectors
- Universal plastic adapter for mounting on DIN rail in the scope of delivery

DL-PL-RACK-1U



- Multichannel SPD box for Plug&Play SPD modules
- Free combination of up to 16 SPD modules

Type	Location	Network type	U_c line/PoE	I_L line/PoE	I_n (C2) (8/20 µs)	U_p (C3) core-core	U_p (C3) core-PE	Ordering number
DL-1G-RJ45-PoE-AB	ST 1+2+3	1G	8,5 / 58 V DC	0,5 / 2×1,0 A	0,15 kA	45 / 80 V	500 V	A06148
DL-10G-RJ45-PoE-AB	ST 1+2+3	10G	8,5 / 58 V DC	0,5 / 2×1,0 A	0,15 kA	45 / 80 V	500 V	A06149

Lightning current arresters for coaxial lines

Suitable for coaxial lines of telecommunication equipment against impact of direct or indirect lightning strike. Installation at the boundary of LPZ 0 and LPZ 1 zones at the line entry into building. Suitable for the combined signal and power supply installations.

HX-… N50 F/…

- N 50 Ω connectors
- Suitable for the combined signal and power supply installations
- f = 0 – 3,8 GHz

SX-090-B50 F/F

- dual stage protector of sensitive receivers
- BNC 50 Ω
- f = 0 – 3 GHz

Type	Location	U_C	I_L	I_{imp} (D1) (10/350 µs)	I_n (C2) (8/20 µs)	U_{dyn}	f_{max}	Ordering number
HX-090 N50 F/F	ST 1+2	70 V DC	6 A	2,5 kA	10 kA	700 V	3 800 MHz	A03405
HX-090 N50 F/M	ST 1+2	70 V DC	6 A	2,5 kA	10 kA	700 V	3 800 MHz	A03346
HX-230 N50 F/F	ST 1+2	180 V DC	6 A	2,5 kA	10 kA	800 V	3 800 MHz	A03511
HX-230 N50 F/M	ST 1+2	180 V DC	6 A	2,5 kA	10 kA	800 V	3 800 MHz	A03510
SX-090-B50 F/F	ST 1+2+3	26 V DC	0,7 A	0,5 kA	2,5 kA	85 V	3 000 MHz	A04157

Voltage limiting devices (VLD) class 1

The VLD is used to restrict excessive high contact voltages arising on exposed conductive parts of a railway equipment in case of a disturbance (short circuit). The integrated surge arrester also effectively eliminates induced high impulse overvoltages from a lightning strike.

SCG-250-…-R01

- For AC and DC traction systems
- Easy mounting
- According to standard EN 50526-2
- Other voltages on demand

Type	Type (EN 50122-1)	U_{Tn}	I_r @ 60 min	I_w @ 60 ms	I_{SCC} @ 300 ms	I_{imp-n}	T_t	Ordering number
SCG-250-75-R01	VLD-F	75 V	250 A	1 kA	5 kA	100 kA	< 10 µs	A06153
SCG-250-250-R01	VLD-F	250 V	250 A	1 kA	5 kA	100 kA	< 10 µs	A06154
SCG-250-500-R01	VLD-F	480 V	250 A	1 kA	5 kA	100 kA	< 10 µs	A06155

Voltage limiting devices (VLD) class 2.2

Provides the temporary connection between the return circuit and the earth of the railway electric traction system during the permissible value of touch voltage is exceeded. Protects equipment and persons that might enter into contact with the parts affected, against the excessive voltage caused by the rail potential during the operation and the short-circuit events.

BVL-…-120-R02

- For AC and DC traction systems
- Easy mounting
- According to standard EN 50526-2
- Other voltages on demand

Type	Type (EN 50122-1)	U_{Tn}	I_r @ 60 min	I_w @ 30 ms	I_{SCC} @ 100 ms	I_{imp-n}	T_t	Ordering number
BVL-25-120-R01	VLD-O	120 V	25 A	1 kA (@ 100 ms)	5 kA	25 kA	< 1,5 ms	A06100
BVL-50-120-R02	VLD-O+F	120 V	50 A	16 kA	20 kA	50 kA	< 1,5 ms	A06712
BVL-100-120-R02	VLD-O+F	120 V	100 A	16 kA	20 kA	50 kA	< 1,5 ms	A06715
BVL-100-60-R02	VLD-O+F	60 V	100 A	16 kA	20 kA	50 kA	< 1,5 ms	A06714
BVL-50-60-R02	VLD-O+F	60 V	50 A	16 kA	20 kA	50 kA	< 1,5 ms	A06711

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