

The DEHN logo is positioned in the upper right corner of the page. It features the word "DEHN" in a bold, white, sans-serif font, flanked by two white lightning bolt symbols pointing outwards.

# Protection of cell sites (4G / LTE)

White Paper



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- Cell sites with remote radio heads/units
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# Protection of cell sites (4G / LTE)

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In the wake of the commercial launch of UMTS technology in 2003, mobile data communication experienced a breakthrough alongside voice communication. The increasing need for data volume is, in part, responsible for the global demand for more bandwidth. Increasing use of smartphones and other mobile devices means a much higher utilisation of the existing and conventional mobile radio networks.

Mobile network operators who favour modern, innovative technology are faced with high investment costs for new network infrastructures and system technology but also high maintenance and operating costs for existing cell sites. As a result, their aim is to effectively reduce maintenance and operating costs whilst also providing a better and more reliable service for the ever growing mobile phone community.

Mobile network operators and system technology manufacturers worldwide are increasingly using remote radio head/unit technology for UMTS (3G) and LTE (4G). Remote radio heads/units (RRHs/RRUs) are a further development of third generation mobile radio.

Remote radio head technology is not only used for commercial mobile radio applications, but also for the digital radio systems of security authorities (BOS) such as police departments and rescue services or in railway communications since these systems require high reliability and availability.

### Conventional cell sites

Conventional cell sites use coaxial cables, also referred to as corrugated sheath cables. One clear disadvantage of this tech-

nology is the high transmission loss (up to 50 %), depending on the cable length and cross-sections of the high-frequency cables. Another is that all the radio transmission technology is integrated in the base station/radio base station (RBS). This requires permanent cooling of the technical equipment rooms and leads to increased energy consumption and running costs (Figure 1).

### Cell sites with remote radio heads / units

Remote radio heads/units incorporate the high-frequency technology which was originally centrally integrated in the base station. The high-frequency signal is directly generated at the antenna and is then transmitted. RRHs/RRUs are installed directly on the antennas, thus reducing loss and increasing the transmission speed and range. Another benefit is that less air-conditioning is required due to the self-cooling of the remote radio heads. Optical fibre cables allow the transmission of data between the base station/radio base station and the remote radio heads/units over a distance of up to 20 km. The use of remote system technology and modern small-sized base stations not only saves energy costs but also lease and location-related costs. As less technical equipment rooms are required, rental and site costs are also lower (Figure 1).

### External lightning protection

The antennas of the aforementioned systems are often installed on rented roof space. The antenna operator and the building

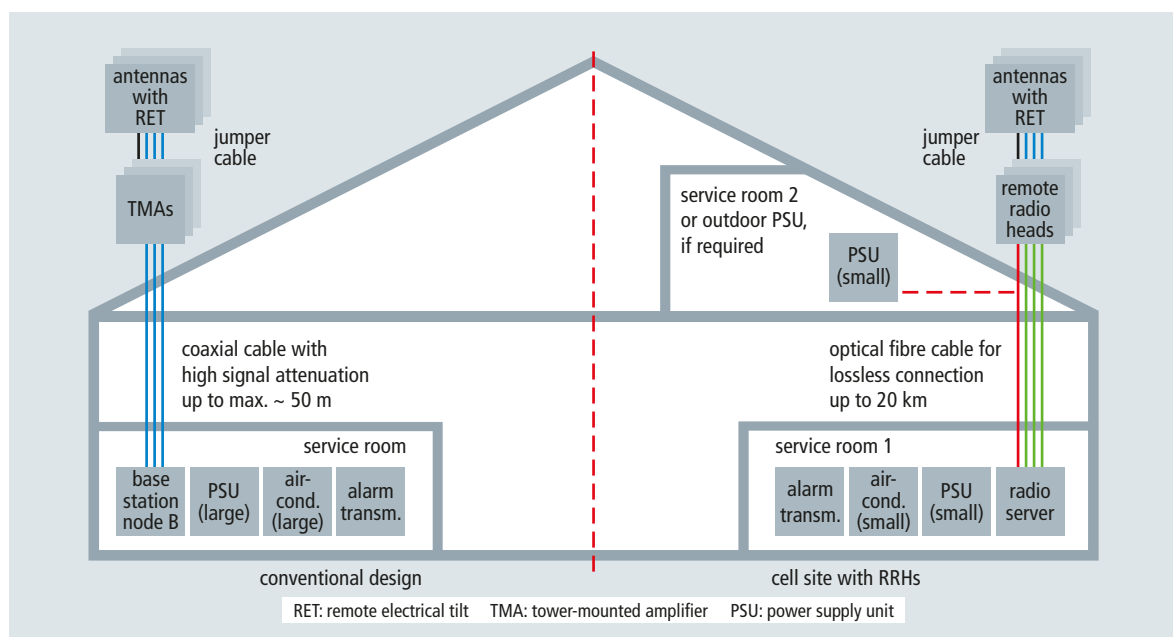


Figure 1 Comparison: Conventional cell site (left) and cell site with remote radio head technology (right)

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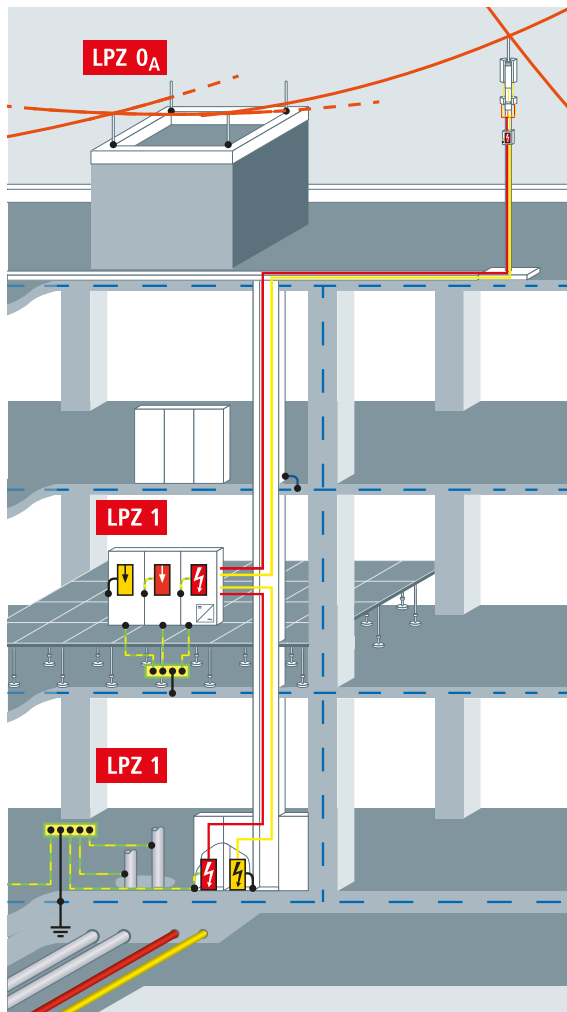


Figure 2 Basic design of the remote radio head/unit in case of roof-mounted systems

owner usually have an agreement that the placement of antennas will not present an additional risk for the building. For the lightning protection system this means that no partial lightning currents may enter the building in case of a lightning strike to the antenna tower since partial lightning currents inside the building would threaten the electrical and electronic devices (Figure 2).

Figure 3 shows an antenna tower with an isolated air-termination system.

The air-termination tip must be attached to the antenna tower by means of a supporting tube made of non-conductive material. The height of the air-termination tip depends on the antenna tower, any electrical equipment in the antenna system and the base station (RBS) and must be selected in such a way

that these elements are located within the protected volume of the air-termination system. In case of buildings with several antenna systems, several isolated air-termination systems must be installed.

### Protection of the power supply of radio base stations (RBS)

The power supply unit of the RBS must have a separate feeder cable that is independent of the power supply unit of the building. A separate power sub-distribution board/floor distributor should be provided for cell sites. Every sub-distribution board is equipped with lightning and surge arresters (type 1 combined arresters) as standard. In addition, a type 1 combined arrester is installed downstream of the meter panel, namely downstream of the fuses. To ensure energy coordination, surge protective devices (SPDs) from the same manufacturer should be used at both places of installation. Extensive laboratory tests at DEHN with power supply units from different manufacturers confirm that coordination of combined arresters such as DEHNvap CSP (CSP = Cell Site Protection) with the integrated input circuits of the power supply unit is essential.

DEHNvap CSP 3P 100 S FM spark-gap-based combined arresters are used to protect the power supply unit (PSU) of a base station (Figure 4). These type 1 arresters are specifically designed for protecting power supply units in transmitting/receiving systems. This arrester can be used in any kind of power supply system. DEHNvap CSP 3P 100 S FM has a compact design of only 4 modules and a total current of 100 kA (10/350  $\mu$ s). It fulfils the maximum requirements on the lightning current discharge capacity of EN 60364-5-53 and EN 62305 according to class of LPS I/II.

When using combined arresters, "disconnection selectivity" with respect to upstream fuses must be ensured. Only arresters



Figure 4 Protection for the AC power supply unit of a base station with DEHNvap CSP 3P 100 S FM

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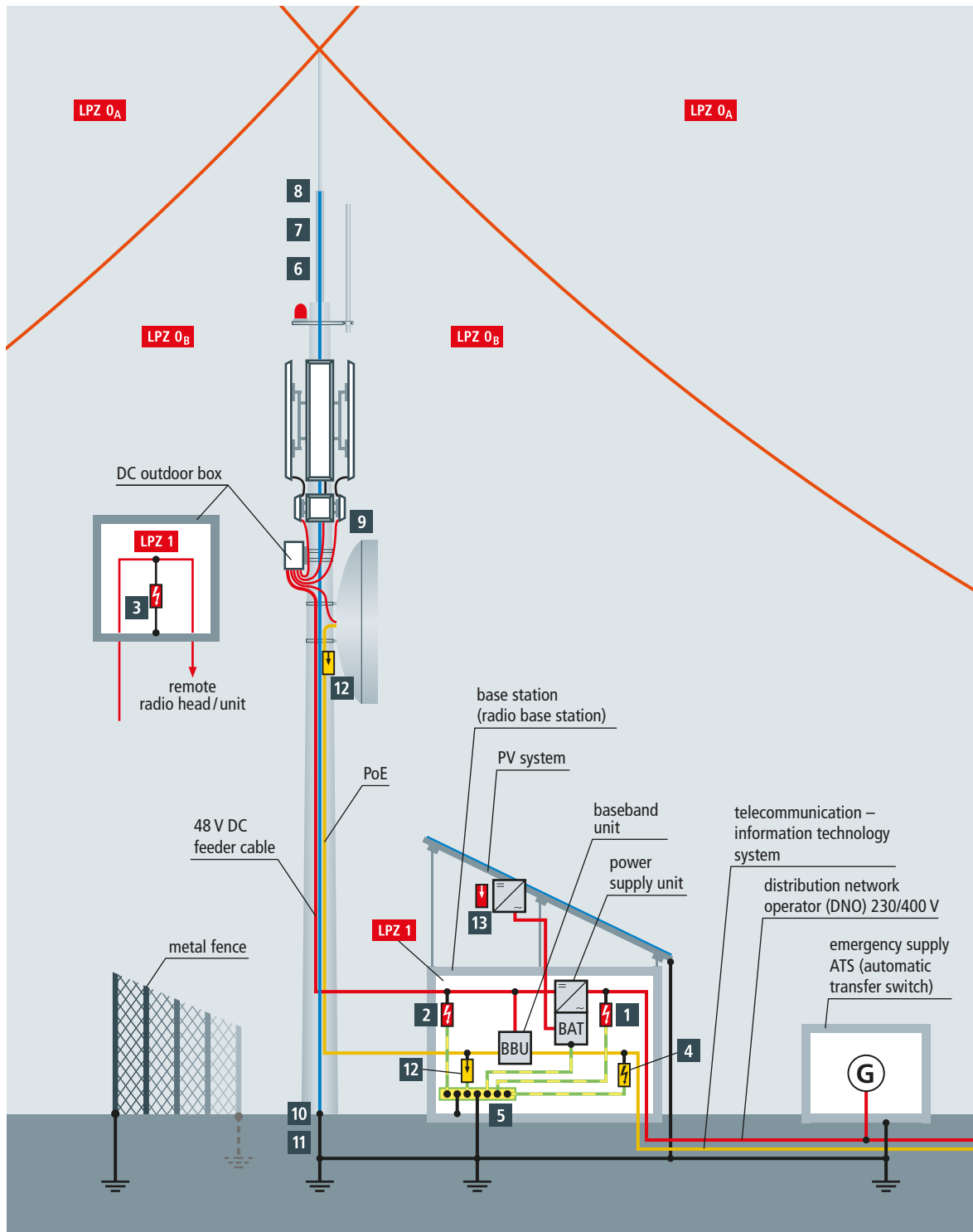


Figure 3 Remote radio head/unit and radio base station (RBS) in case of ground-mounted masts

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No. in Fig. 3	Protection	Type	Part No.
<b>AC power supply</b>			
1	Base station 230/400 V AC	DEHNvap DVA CSP 3P 100 S FM	900 367
<b>DC power supply</b>			
2	Power supply unit 48 V DC	DEHNsecure DSE M 1 60 FM or DEHNsite DSIT CSP DC 48 FM	971 126 921 098
3	Remote radio head 48 V DC	DEHNsecure DSE M 2P 60 FM or 2 x DEHNsite DSIT CSP DC 48 FM	971 226 921 098
<b>Fixed-line connection</b>			
4	Telecommunication lines	BLITZDUCTOR XT BXT ML4 BD 48 + BXT BAS base part	920 345 + 920 300
<b>External lightning protection</b>			
5	Ground-mounted system / roof-mounted system	Equipotential bonding bar, 10 terminals	472 219
6	Ground-mounted system / roof-mounted system	HVI long conductor + connection element	819 223 + 410 229
7	Ground-mounted system / roof-mounted system	GRP/Al supporting tube	105 306
8	Ground-mounted system / roof-mounted system	Connection element	819 288
9	Ground-mounted system / roof-mounted system	Pipe clamp for antennas	540 100
10	Ground-mounted system	Stainless steel terminal bracket	620 915
11	Ground-mounted system	Stainless steel earth rod	620 902
<b>Power over Ethernet</b>			
12	Radio relay system	DEHNpatch DPA M CLE RJ45B 48 or DEHNpatch DPA CLE IP66	929 121 929 221
<b>DC input</b>			
13	Charge controller	per MPPT: DEHNguard DG M YPV SCI 150 FM	952 518

Table 1 Lightning and surge protection for cell sites according to Figure 3

with sufficient follow current extinction and limitation make it possible to avoid false tripping of system fuses and thus disconnection of the power supply unit.

As can be seen in **Figure 3**, remote locations often have an additional alternative source of power. If necessary, power can be provided by, e.g. a diesel motor or a photovoltaic system (PV) in combination with a battery storage system. Whatever the case, it is important to include the power producer in the total protective concept for the cell site. This means that, beside meshed low-impedance equipotential bonding between the structural elements like radio masts, base station, PV racks, generator and perimeter protection, it is also advisable to integrate all electrical installations in the protective zone  $O_B$  in the vicinity of the mast. If this is not possible, additional lightning protection measures may

be necessary (**Figure 5**). Due to the large surface area of PV modules, the electromagnetic lightning field induces voltage peaks in the string conductors which can destroy the DC charge controller. For a safe and cost-effective energy in-feed, it is therefore advisable to install type 2 surge arresters which have been specially designed for and adapted to the needs of PV systems.

### Remote radio head / unit applications

Cell sites consist of:

- ➔ Base station / radio base station (indoor or outdoor cabinet)
- ➔ Baseband unit / radio server
- ➔ Remote radio heads / units (RRHs / RRU)
- ➔ Radio relay system



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Figure 5 Lightning equipotential bonding of the fence

The remote radio heads/units (active system technology) require a separate 48 V DC power supply from the service room. To this end, shielded multi-wire copper cables with a cross-section of 6 to 16 mm<sup>2</sup> are typically used. In the majority of cases, these DC cables are installed outside the building up to the roof surface and the RRHs/RRUs or from the base station to the mast. Data communication between RRHs/RRUs and system technology takes place via prewired glass fibre cables instead of the cables with corrugated sheath previously used. In case of both types of installation, the DC feeder cables and system technology are exposed to lightning currents in the event of a direct lightning strike.

Thus, lightning current and surge arresters must be capable of safely conducting lightning currents to the earth-termination system. To this end, type 1 lightning current arresters in conformity with EN 61643-11 (class I, IEC 61643-1/-11) are used. Only spark-gap-based type 1 arresters ensure reliable energy coordination with downstream protective circuits integrated in the input of terminal equipment. If spark gaps are used to protect base stations, power supply units and remote radio heads/units, lightning currents are prevented from entering system technology, thus providing maximum protection and ensuring the availability of the station even under lightning conditions (Figures 2 and 3).

### Customised solutions for 48 V DC remote radio heads/units (type 1 arresters)

#### DC arresters: Modular DEHNsecure 60 ... (FM) type 1 lightning current arresters

RRHs/RRUs are centrally supplied with direct current from the service room. The shielded feeder cable must be integrated in the antenna earthing as per IEC 60728-11

(EN 60728-11) and, if a lightning protection system is installed on the building, as per IEC 62305-3 (EN 62305-3).

Type 1 DC arresters with a low voltage protection level that are specifically developed for RRH/RRU applications are installed in the DC indoor box near the power supply unit in the technical equipment room and in the DC outdoor box at the antenna mast. The DC box at the mast features a "1+1" circuit, meaning that the positive pole and cable shield are interconnected indirectly via a so-called total spark gap to prevent corrosion and stray currents. In the power supply unit, the positive pole is directly earthed and single-pole type 1 DC arresters are typically installed.

Prewired DC assembly systems (DC box) for indoor and outdoor installations with DEHNsecure DSE M 1 60 FM and DSE 2P 60 FM type 1 DC lightning current arresters ensure efficient protection. The voltage protection level  $U_p$  of the type 1 lightning current arresters must be lower than the dielectric strength of the system technology.

Benefits of the new DC arrester concept are, for example, enough leeway for future extensions of the site in case of nominal load currents up to 2000 A, no mains follow currents up to max. 60 V DC, no leakage currents and a high degree of protection for terminal equipment due to the low residual voltage of  $\leq 0.4$  kV at 5 kA (voltage protection level of 1.5 kV (10/350  $\mu$ s)).

Figure 5 shows the protection concept for RRHs/RRUs in case of physically separate functional equipotential bonding levels.

### Customised solutions for 48 V DC remote radio heads/units (type 2 arresters)

Type 2 assembly systems as per IEC 61439-1 (EN 61439-1)/IEC 61439-2 (EN 61439-2) are also used depending on the protection philosophy of mobile network operators and system manufacturers, technical specifications and country-specific conditions. Varistor-based type 2 arresters with an extremely low voltage protection level such as DEHNguard DG S 75 FM protect terminal equipment and are used for RRH/RRU installations with a nominal voltage up to 48 V DC

Figure 7 shows a prewired type 2 assembly system in the form of a hybrid box (DC box) for indoor and outdoor installations. The lockable glass-fibre reinforced (GRP) enclosure with an IP 66 degree of protection provides space for up to six RRHs/RRUs. All incoming and outgoing lines up to 48 V DC are wired on terminal blocks. This provides significant installation benefits for the installer, in particular in case of mast installation and retrofitting. For data communication, the DC hybrid box houses up to 12 LC Duplex adapters to accommodate the prewired glass fibre cable from the technical equipment room. These adapters are connected to the RRHs/RRUs via so-called jumper cables by the most direct path. Easy-to-install accessories such as

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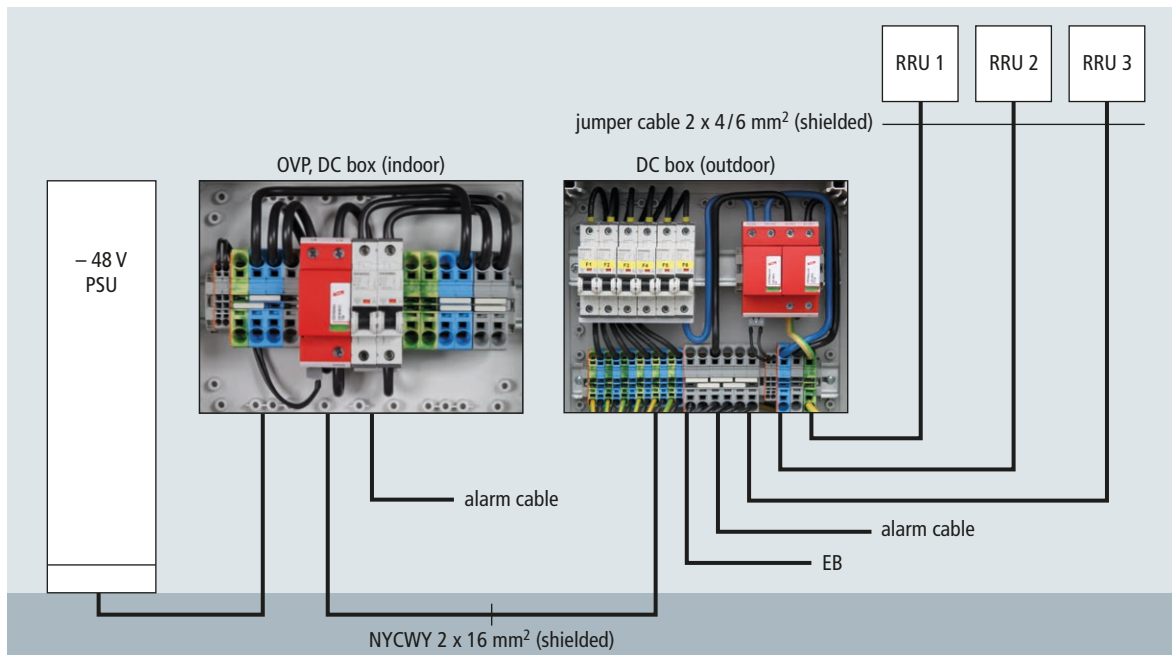


Figure 6 Basic circuit diagram of remote radio heads (RRHs) in case of physically separate functional equipotential bonding levels with DC box (outdoor) and DEHNsecure DSE M 2P 60 FM as well as with OVP box (indoor) and DEHNsecure DSE M 1 60 FM

wall and mast brackets with tensioning strap ensure easy and fast installation.

The data connection with cell sites is often achieved using radio relay antennas. If an antenna is operated through a coaxial cable or through optical fibre cables in combination with a

48 V DC power supply, one can revert analogously to the measures previously described. However, for reasons of cost-efficiency, radio relay antennas are also supplied with Power over Ethernet (PoE). As Ethernet cables generally have small cross-sections, it is advisable to keep the direct lightning current input on the active cores as low as possible by taking external lightning protection measures (e.g. isolated lightning protection). In order to protect the active technology from surges, the arrester requires a low protection level but, above all, it must be able to transmit operation current and data without interruption.

### Comparison of the protective effect of spark-gap-based and varistor-based type 1 arresters

Energy coordination with the terminal equipment to be protected is an important criterium for the use of spark gaps as type 1 arresters (10/350  $\mu$ s) rather than MOVs (metal oxide varistors).

A so-called "wave breaker function" is achieved by the fast triggering of the spark gap within a matter of microseconds, meaning that almost no current flows into the terminal equipment to be protected after the spark gap has ignited (Figure 8). Thus, a relatively small amount of energy enters the terminal equipment even in case of extremely high impulse currents. This energy, however, is uncritical for the protective circuit integrated in the input of the terminal equipment.

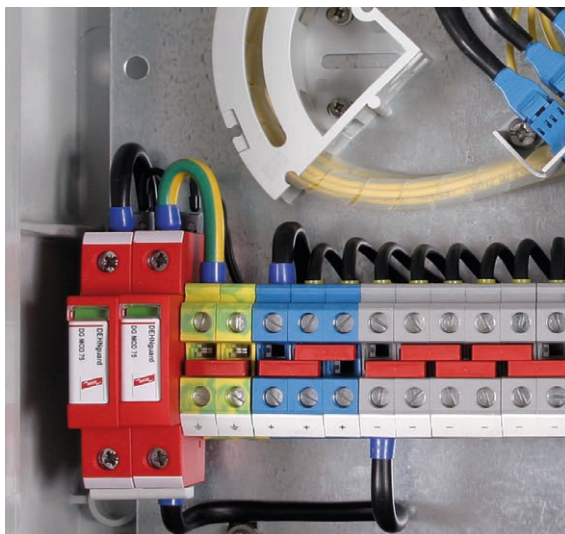


Figure 7 Prewired hybrid box for 48 V DC outdoor installations with DEHNguard type 2 arrester

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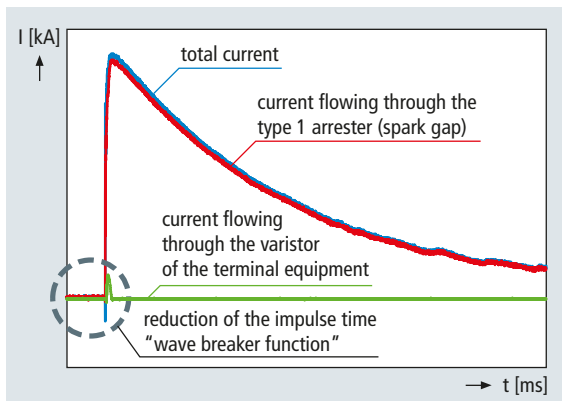


Figure 8 Spark-gap-based type 1 arrester (typical characteristic curve)

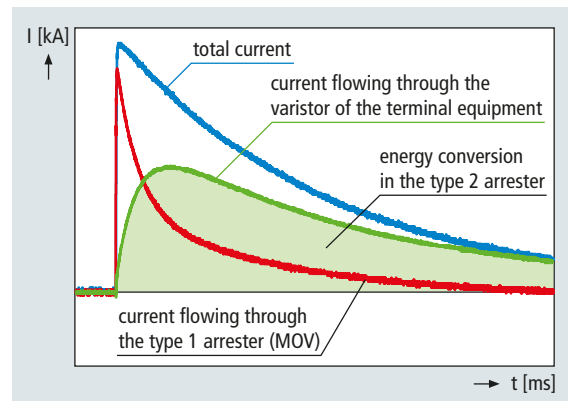


Figure 9 Varistor-based type 1 arrester (typical characteristic curve)

If MOV-based surge protective devices are used, the current flows into the terminal equipment to be protected over the entire impulse duration. In many cases, the connected AC/DC power supply unit and system technology is damaged and at worst destroyed (**Figure 9**).

System tests with mobile radio equipment from different manufacturers clearly show that only spark gaps ensure the required degree of protection in this field of application.



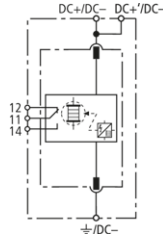
## DEHNsecure

### DSE M 1 60 FM (971 126)

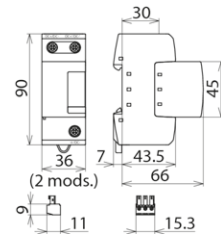
- Coordinated spark-gap-based lightning current arrester consisting of a base part and a plug-in protection module
- Spark gap technology particularly suited for use in d.c. circuits
- Directly coordinated with DEHNguard SE DC 60 (FM) surge protective devices



Figure without obligation



Basic circuit diagram DSE M 1 60 FM



Dimension drawing DSE M 1 60 FM

Coordinated and modular single-pole lightning current arrester for d.c. applications from 12 to 60 volts; with remote signalling contact for monitoring device (floating changeover contact).

Type Part No.	DSE M 1 60 FM 971 126
SPD classification according to EN 61643-11 / IEC 61643-11	type 1 / class I
Max. continuous operating voltage (d.c.) ( $U_c$ )	60 V
Lightning impulse current (10/350 $\mu$ s) ( $I_{imp}$ )	25 kA
Specific energy (W/R)	156.25 kJ/ohms
Nominal discharge current (8/20 $\mu$ s) ( $I_n$ )	25 kA
Voltage protection level ( $U_p$ )	$\leq 1.5$ kV
Directly coordinated with DEHNguard	DG S 150 FM (Part No. 952 092)
Response time ( $t_A$ )	$\leq 100$ ns
Short-circuit withstand capability for max. mains-side overcurrent protection d.c. ( $I_{SCCR}$ )	25 kA
Max. mains-side overcurrent protection	250 A gL
Max. backup fuse (DC+/DC- -> DC+/DC-)	125 A gL
Operating temperature range (parallel connection) ( $T_{UP}$ )	-40 °C ... +80 °C
Operating temperature range (series connection) ( $T_{US}$ )	-40 °C ... +60 °C
Operating state / fault indication	green / red
Number of ports	1
Cross-sectional area (DC+/DC-, DC+/DC-, ⊕/DC-) (min.)	10 mm <sup>2</sup> solid / flexible
Cross-sectional area (DC+/DC-, ⊕/DC-) (max.)	50 mm <sup>2</sup> stranded / 35 mm <sup>2</sup> flexible
Cross-sectional area (DC+/DC-) (max.)	35 mm <sup>2</sup> stranded / 25 mm <sup>2</sup> flexible
For mounting on	35 mm DIN rails acc. to EN 60715
Enclosure material	thermoplastic, red, UL 94 V-0
Place of installation	indoor installation
Degree of protection	IP 20
Capacity	2 module(s), DIN 43880
Approvals	UL
Type of remote signalling contact	changeover contact
Switching capacity (a.c.)	250 V / 0.5 A
Switching capacity (d.c.)	250 V / 0,1 A; 125 V / 0,2 A; 75 V / 0.5 A
Cross-sectional area for remote signalling terminals	max. 1.5 mm <sup>2</sup> solid / flexible
Extended technical data:	when used in safety lighting systems
- d.c. and a.c. operation	no
Weight	288 g
Customs tariff number (Comb. Nomenclature EU)	85363090
GTIN	4013364138599
PU	1 pc(s)

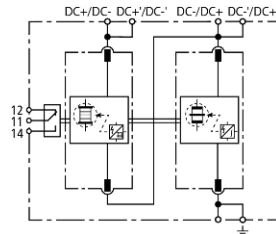
## DEHNsecure

### DSE M 2P 60 FM (971 226)

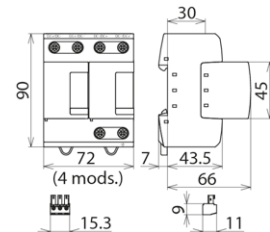
- Coordinated spark-gap-based lightning current arrester consisting of a base part and a plug-in protection module
- Spark gap technology particularly suited for use in d.c. circuits
- Directly coordinated with DEHNguard SE DC 60 (FM) surge protective devices



Figure without obligation



Basic circuit diagram DSE M 2P 60 FM



Dimension drawing DSE M 2P 60 FM

Coordinated and modular two-pole lightning current arrester for d.c. applications from 12 to 60 volts (1+1 configuration); FM version with floating remote signalling contact.

Type Part No.	DSE M 2P 60 FM 971 226
SPD classification according to EN 61643-11 / IEC 61643-11	type 1 / class I
Max. continuous operating voltage (d.c.) ( $U_c$ )	60 V
Lightning impulse current (10/350 $\mu$ s) (DC+/DC- $\rightarrow$ DC-/DC+) / (DC-/DC+ $\rightarrow$ $\pm$ ) ( $I_{imp}$ )	25 / 50 kA
Specific energy (DC+/DC- $\rightarrow$ DC-/DC+) / (DC-/DC+ $\rightarrow$ $\pm$ ) (W/R)	156.25 / 625.00 kJ/ohms
Voltage protection level (DC+/DC- $\rightarrow$ DC-/DC+) / (DC-/DC+ $\rightarrow$ $\pm$ ) ( $U_p$ )	$\leq 1.5$ / $\leq 1.5$ kV
Response time ( $t_A$ )	$\leq 100$ ns
Short-circuit withstand capability for max. mains-side overcurrent protection d.c. ( $I_{SCCR}$ )	25 kA
Max. mains-side overcurrent protection	250 A gL
Max. backup fuse (DC+/DC- $\rightarrow$ DC+/DC-')	125 A gL
Operating temperature range (parallel connection) ( $T_{UP}$ )	-40 °C ... +80 °C
Operating temperature range (series connection) ( $T_{US}$ )	-40 °C ... +60 °C
Operating state / fault indication	green / red
Number of ports	1
Cross-sectional area (min.)	10 mm <sup>2</sup> solid / flexible
Cross-sectional area (DC+/DC-, DC-/DC+, $\pm$ ) (max.)	50 mm <sup>2</sup> stranded / 35 mm <sup>2</sup> flexible
Cross-sectional area (DC+/'DC-', DC-/'DC+') (max.)	35 mm <sup>2</sup> stranded / 25 mm <sup>2</sup> flexible
For mounting on	35 mm DIN rails acc. to EN 60715
Enclosure material	thermoplastic, red, UL 94 V-0
Place of installation	indoor installation
Degree of protection	IP 20
Capacity	4 module(s), DIN 43880
Approvals	UL
Type of remote signalling contact	changeover contact
Switching capacity (a.c.)	250 V / 0.5 A
Switching capacity (d.c.)	250 V / 0.1 A; 125 V / 0.2 A; 75 V / 0.5 A
Cross-sectional area for remote signalling terminals	max. 1.5 mm <sup>2</sup> solid / flexible
Weight	614 g
Customs tariff number (Comb. Nomenclature EU)	85363090
GTIN	4013364138629
PU	1 pc(s)

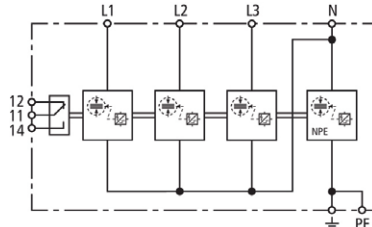
## DEHNvap

### DVA CSP 3P 100 S FM (900 367)

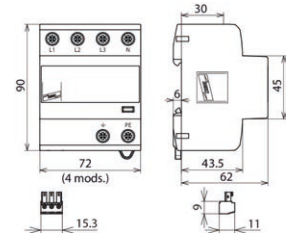
- Prewired combined lightning current and surge arrester, energy-coordinated with power supply systems for cell sites (DEHNvap CSP ... Cell Site Protection)
- Encapsulated spark gap technology with a width of only 1 module / pole allows compact and space-saving design for easy installation within the power supply cabinets



Figure without obligation



Basic circuit diagram DVA CSP 3P 100 S FM



Dimension drawing DVA CSP 3P 100 S FM

Combined lightning current and surge arrester for use in triphase TT and TN systems (3+1 configuration) for protecting 230 V power supply systems of cell sites

Type Part No.	DVA CSP 3P 100 S FM 900 367
SPD according to EN 61643-11 / ... IEC 61643-11	type 1 + type 2 / class I + class II
Energy coordination with terminal equipment ( $\leq 10$ m)	type 1 + type 2 + type 3
Nominal voltage (a.c.) ( $U_N$ )	230 / 400 V (50 / 60 Hz)
Max. continuous operating voltage (a.c.) [L-N] / [N-PE] ( $U_C$ )	255 V (50 / 60 Hz)
Lightning impulse current (10/350 $\mu$ s) [L-N] / [N-PE] ( $I_{imp}$ )	25 / 100 kA
Specific energy [L-N] / [N-PE] (W/R)	156.25 kJ/ohms / 2.50 MJ/ohms
Nominal discharge current (8/20 $\mu$ s) ( $I_n$ )	25 / 100 kA
Voltage protection level [L-N] / [N-PE] ( $U_p$ )	$\leq 1.5$ kV / $\leq 1.5$ kV
Follow current extinguishing capability [L-N] / [N-PE] ( $I_{fc}$ )	25 kA <sub>rms</sub> / 100 A <sub>rms</sub>
Follow current limitation/Selectivity	no tripping of a 32 A gG fuse up to 25 kA <sub>rms</sub> (prosp.)
Response time ( $t_A$ )	$\leq 100$ ns
Max. backup fuse (L) up to $I_k > 25$ kA <sub>rms</sub>	250 A gG
Temporary overvoltage (TOV) [L-N] ( $U_T$ ) – Characteristic	440 V / 120 min. – withstand
Temporary overvoltage (TOV) [N-PE] ( $U_T$ ) – Characteristic	1200 V / 200 ms – withstand
Additional abnormal voltage test: 485 V AC / 50 Hz for 24 h	withstand
Let-Through-Energy in combination with an MOV S20K275 ( $I_{imp} = 2.5 \dots 25$ kA)	$< 0.5$ J
Safe behavior at $U = 320$ V and $I_{SCCR} = 13.5$ kA in combination with a fuse 63 A gG	withstand
Operating temperature range [parallel] / [series] ( $T_U$ )	$-40^\circ\text{C} \dots +80^\circ\text{C}$
Operating state/fault indication	green / red
Number of ports	1
Cross-sectional area (L1, L2, L3, N, PE, $\pm$ ) (min.)	1.5 mm <sup>2</sup> solid / flexible
Cross-sectional area (L1, L2, L3, N, PE, $\pm$ ) (max.)	35 mm <sup>2</sup> stranded / 25 mm <sup>2</sup> flexible
For mounting on	35 mm DIN rails acc. to EN 60715
Enclosure material	thermoplastic, red, UL 94 V-0
Place of installation	indoor installation
Degree of protection	IP 20
Capacity	4 module(s), DIN 43880
Approvals	KEMA
Type of remote signalling contact	changeover contact
Switching capacity (a.c.)	250 V / 0.5 A
Switching capacity (d.c.)	250 V / 0.1 A; 125 V / 0.2 A; 75 V / 0.5 A
Cross-sectional area for remote signalling terminals	max. 1.5 mm <sup>2</sup> solid / flexible
Weight	469 g
Customs tariff number (Comb. Nomenclature EU)	85363090
GTIN	4013364322288
PU	1 pc(s)

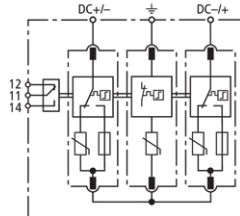
## DEHNguard

### DG M YPV SCI 150 FM (952 518)

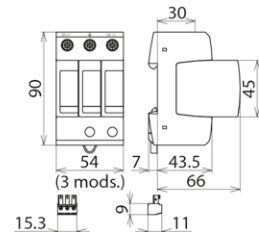
- Prewired modular complete unit for use in photovoltaic systems consisting of a base part and plug-in protection modules
- Combined disconnection and short-circuiting device with safe electrical isolation in the protection module (patented SCI principle)
- Tried and tested fault-resistant Y circuit



Figure without obligation



Basic circuit diagram DG M YPV SCI 150 FM



Dimension drawing DG M YPV SCI 150 FM

Modular multipole surge arrester with three-step d.c. switching device for use in PV systems; with remote signalling contact (floating changeover contact).

Type Part No.	DG M YPV SCI 150 FM 952 518
SPD according to EN 50539-11	type 2
Energy coordination with terminal equipment ( $\leq 10$ m)	type 2 + type 3
Max. PV voltage ( $U_{CPV}$ )	150 V
Short-circuit current rating ( $I_{SCPV}$ )	10 kA
Total discharge current (8/20 $\mu$ s) ( $I_{total}$ )	40 kA
Nominal discharge current (8/20 $\mu$ s) [(DC+/DC-) --> PE] ( $I_n$ )	10 kA
Max. discharge current (8/20 $\mu$ s) [(DC+/DC-) --> PE] ( $I_{max}$ )	20 kA
Voltage protection level ( $U_p$ )	$\leq 0.8$ kV
Voltage protection level at 5 kA ( $U_p$ )	$\leq 0.6$ kV
Response time ( $t_A$ )	$\leq 25$ ns
Operating temperature range ( $T_U$ )	-40 °C ... +80 °C
Operating state / fault indication	green / red
Number of ports	1
Cross-sectional area (min.)	1.5 mm <sup>2</sup> solid / flexible
Cross-sectional area (max.)	35 mm <sup>2</sup> stranded / 25 mm <sup>2</sup> flexible
For mounting on	35 mm DIN rails acc. to EN 60715
Enclosure material	thermoplastic, red, UL 94 V-0
Place of installation	indoor installation
Degree of protection	IP 20
Capacity	3 module(s), DIN 43880
Approvals	KEMA, UL, CSA
Type of remote signalling contact	changeover contact
Switching capacity (a.c.)	250 V / 0.5 A
Switching capacity (d.c.)	250 V / 0.1 A; 125 V / 0.2 A; 75 V / 0.5 A
Cross-sectional area for remote signalling terminals	max. 1.5 mm <sup>2</sup> solid / flexible
Weight	276 g
Customs tariff number (Comb. Nomenclature EU)	85363030
GTIN	4013364136670
PU	1 pc(s)



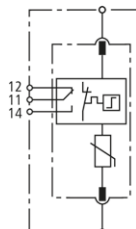
## DEHNsite

### DSIT S CSP DC 48 FM (921 098)

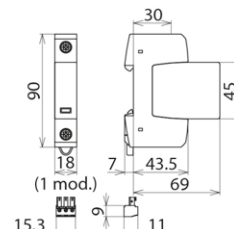
- Multi-purpose surge arrester consisting of a base element and plug-in protection module
- High discharge capacity due to heavy-duty zinc oxide varistor
- High reliability due to "Thermo Dynamic Control" SPD monitoring device



Figure without obligation



Basic circuit diagram DSIT S CSP DC 48 FM



Dimension drawing DSIT S CSP DC 48 FM

Pluggable single-pole surge arrester consisting of a base part and plug-in protection module; with floating remote signalling contact.

Type	DSIT S CSP DC 48 FM
Part No.	921 098
SPD according to EN 61643-11 / IEC 61643-11	type 1 + type 2 / class I + class II
Nominal voltage (d.c.) ( $U_N$ )	48 V
Nominal voltage (a.c.) ( $U_N$ )	60 V (50 / 60 Hz)
Max. continuous operating voltage (d.c.) ( $U_C$ )	100 V
Max. continuous operating voltage (a.c.) ( $U_C$ )	75V (50 / 60 Hz)
Lightning impulse current (10/350 $\mu$ s) ( $I_{imp}$ )	12.5 kA
Specific energy (W/R)	39.06 kJ/Ohm
Nominal discharge current (8/20 $\mu$ s) ( $I_n$ )	12.5 kA
Max. discharge current (8/20 $\mu$ s) ( $I_{max}$ )	60 kA
Voltage protection level ( $U_p$ )	$\leq 0.4$ kV
Response time ( $t_A$ )	$\leq 25$ ns
Max. mains-side overcurrent protection	160 A gG
Short-circuit withstand capability for max. mains-side overcurrent protection ( $I_{SCCR}$ )	25 kA <sub>rms</sub>
Operating temperature range ( $T_U$ )	-40 °C ... +80 °C
Operating state / fault indication	green / red
Number of ports	1
Cross-sectional area (min.)	1.5 mm <sup>2</sup> solid / flexible
Cross-sectional area (max.)	35 mm <sup>2</sup> stranded / 25 mm <sup>2</sup> flexible
For mounting on	35 mm DIN rails acc. to EN 60715
Enclosure material	thermoplastic, gray, UL 94 V-0
Place of installation	indoor installation
Degree of protection	IP 20
Capacity	1 module(s), DIN 43880
Approvals	UL
Type of remote signalling contact	changeover contact
Switching capacity (a.c.)	250 V / 0.5 A
Switching capacity (d.c.)	250 V / 0.1 A; 125 V / 0.2 A; 75 V / 0.5 A
Test values according to UL 1449	-----
- SPD classification according to UL 1449	type 1 component assembly
- Voltage Protection Rating (VPR)	0,3 kV
- Nominal discharge current (8/20 $\mu$ s) ( $I_n$ )	20 kA
Weight	124 g
Customs tariff number	85363030
GTIN	4013364269996
PU	1 pc(s)

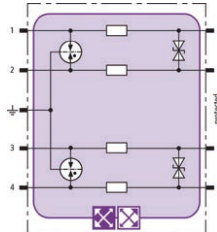
## BLITZDUCTOR XT

### BXT ML4 BD 48 (920 345)

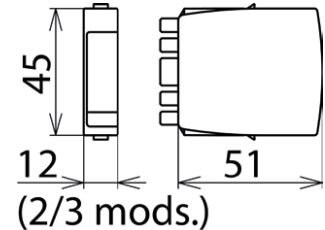
- LifeCheck SPD monitoring function
- Optimal protection of two pairs
- For installation in conformity with the lightning protection zone concept at the boundaries from  $0_A -2$  and higher



Figure without obligation



Basic circuit diagram BXT ML4 BD 48



Dimension drawing BXT ML4 BD 48

Space-saving combined lightning current and surge arrester module with LifeCheck feature for protecting two pairs of unearthed balanced interfaces. If LifeCheck detects thermal or electrical overload, the arrester has to be replaced. This status is indicated contactlessly by the DEHNrecord LC / SCM / MCM reader.

Type	BXT ML4 BD 48
Part No.	920 345
SPD monitoring system	LifeCheck
SPD class	<b>TYPE 1P</b>
Nominal voltage ( $U_N$ )	48 V
Max. continuous operating voltage (d.c.) ( $U_c$ )	54 V
Max. continuous operating voltage (a.c.) ( $U_c$ )	38.1 V
Nominal current at 45 °C ( $I_L$ )	1.0 A
D1 Total lightning impulse current (10/350 $\mu$ s) ( $I_{imp}$ )	10 kA
D1 Lightning impulse current (10/350 $\mu$ s) per line ( $I_{imp}$ )	2.5 kA
C2 Total nominal discharge current (8/20 $\mu$ s) ( $I_n$ )	20 kA
C2 Nominal discharge current (8/20 $\mu$ s) per line ( $I_n$ )	10 kA
Voltage protection level line-line for $I_{imp}$ D1 ( $U_p$ )	$\leq 80$ V
Voltage protection level line-PG for $I_{imp}$ D1 ( $U_p$ )	$\leq 550$ V
Voltage protection level line-line at 1 kV/ $\mu$ s C3 ( $U_p$ )	$\leq 70$ V
Voltage protection level line-PG at 1 kV/ $\mu$ s C3 ( $U_p$ )	$\leq 550$ V
Series resistance per line	1.0 ohm(s)
Cut-off frequency line-line ( $f_c$ )	8.7 MHz
Capacitance line-line (C)	$\leq 0.7$ nF
Capacitance line-PG (C)	$\leq 16$ pF
Operating temperature range ( $T_U$ )	-40 °C ... +80 °C
Degree of protection (with plugged-in protection module)	IP 20
Pluggable into	BXT BAS / BSP BAS 4 base part
Earthing via	BXT BAS / BSP BAS 4 base part
Enclosure material	polyamide PA 6.6
Colour	yellow
Test standards	IEC 61643-21 / EN 61643-21, UL 497B
Approvals	CSA, UL, EAC, ATEX, IECEx, CSA & USA Hazloc, SIL
SIL classification	up to SIL3 <sup>*</sup>
ATEX approvals	DEKRA 11ATEX0089 X: II 3 G Ex nA IIC T4 Gc
IECEx approvals	DEK 11.0032X: Ex nA IIC T4 Gc
CSA & USA Hazloc approvals (1)	2516389: Class I Div. 2 GP A, B, C, D T4
CSA & USA Hazloc approvals (2)	2516389: Class I Zone 2, AEx nA IIC T4
Weight	24 g
Customs tariff number (Comb. Nomenclature EU)	85363010
GTIN	4013364108998
PU	1 pc(s)

<sup>\*</sup>For more detailed information, please visit [www.dehn-international.com](http://www.dehn-international.com).

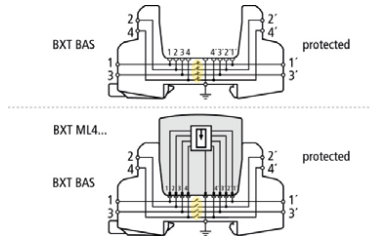
## BLITZDUCTOR XT

### BXT BAS (920 300)

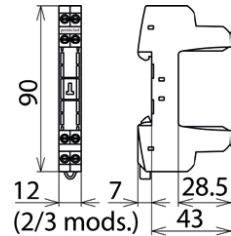
- Four-pole version for universal use with all types of BSP and BXT / BXTU protection modules
- No signal interruption if the protection module is removed
- Universal design without protection elements



Figure without obligation



Basic circuit diagram with and without plugged-in module



Dimension drawing BXT BAS

The BLITZDUCTOR XT base part is an extremely space-saving and universal four-pole feed-through terminal for the insertion of a protection module without signal disconnection if the protection module is removed. The snap-in mechanism at the supporting foot of the base part allows the protection module to be safely earthed via the DIN rail. Since no components of the protective circuit are situated in the base part, maintenance is only required for the protection modules.

Type Part No.	BXT BAS 920 300
Operating temperature range (T <sub>U</sub> )	-40 °C ... +80 °C
Degree of protection	IP 20
For mounting on	35 mm DIN rails acc. to EN 60715
Connection (input / output)	screw / screw
Signal disconnection	no
Cross-sectional area, solid	0.08-4 mm <sup>2</sup>
Cross-sectional area, flexible	0.08-2.5 mm <sup>2</sup>
Tightening torque (terminals)	0.4 Nm
Earthing via	35 mm DIN rails acc. to EN 60715
Enclosure material	polyamide PA 6.6
Colour	yellow
ATEX approvals	DEKRA 11ATEX0089 X: II 3 G Ex nA IIC T4 Gc <sup>*)</sup>
IECEX approvals	DEK 11.0032X: Ex nA IIC T4 Gc <sup>*)</sup>
Approvals	CSA, UL, EAC, ATEX, IECEX <sup>*)</sup>
Weight	34 g
Customs tariff number (Comb. Nomenclature EU)	85369010
GTIN	4013364109179
PU	1 pc(s)

<sup>\*)</sup> only in connection with an approved protection module

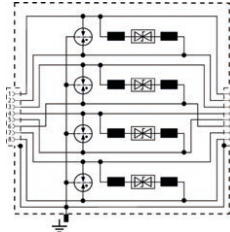
## DEHNpatch

### DPA M CLE RJ45B 48 (929 121)

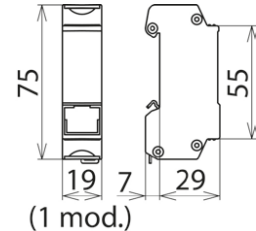
- Ideally suited for retrofitting, protection of all lines
- Cat. 6 in the channel (class E)
- Power over Ethernet IEEE 802.3 compliant (up to PoE++ / 4PPoE)
- For installation in conformity with the lightning protection zone concept at the boundaries from  $0_B -2$  and higher



Figure without obligation



Basic circuit diagram DPA M CLE RJ45B 48



Dimension drawing DPA M CLE RJ45B 48

Universal arrester for Industrial Ethernet, Power over Ethernet (IEEE 802.3 compliant up to PoE++ / 4PPoE) and similar applications in structured cabling systems according to class E up to 250 MHz. Protection of all pairs by means of powerful gas discharge tubes and one adapted filter matrix per pair. Fully shielded type with sockets for DIN rail mounting (up to 1 Gbit Ethernet).

Type	DPA M CLE RJ45B 48
Part No.	929 121
SPD class	TYPE 2 Pt
Nominal voltage ( $U_N$ )	48 V
Max. continuous operating voltage (d.c.) ( $U_c$ )	48 V
Max. continuous operating voltage (a.c.) ( $U_c$ )	34 V
Max. continuous operating voltage (d.c.) pair-pair (PoE) ( $U_c$ )	57 V
Nominal current ( $I_N$ )	1 A
D1 Lightning impulse current (10/350 $\mu$ s) per line ( $I_{imp}$ )	0.5 kA
C2 Nominal discharge current (8/20 $\mu$ s) line-line ( $I_n$ )	150 A
C2 Nominal discharge current (8/20 $\mu$ s) line-PG ( $I_n$ )	2.5 kA
C2 Nominal discharge current (8/20 $\mu$ s) total ( $I_n$ )	10 kA
C2 Nominal discharge current (8/20 $\mu$ s) pair-pair (PoE) ( $I_n$ )	150 A
Voltage protection level line-line for $I_n$ C2 ( $U_p$ )	$\leq 180$ V
Voltage protection level line-PG for $I_n$ C2 ( $U_p$ )	$\leq 500$ V
Voltage protection level line-line for $I_n$ C2 (PoE) ( $U_p$ )	$\leq 600$ V
Voltage protection level line-line at 1 kV/ $\mu$ s C3 ( $U_p$ )	$\leq 180$ V
Voltage protection level line-PG at 1 kV/ $\mu$ s C3 ( $U_p$ )	$\leq 500$ V
Voltage protection level pair-pair at 1 kV/ $\mu$ s C3 (PoE) ( $U_p$ )	$\leq 600$ V
Cut-off frequency ( $f_c$ )	250 MHz
Insertion loss at 250 MHz	$\leq 3$ dB
Capacitance line-line (C)	$\leq 30$ pF
Capacitance line-PG (C)	$\leq 25$ pF
Operating temperature range ( $T_U$ )	-40 °C ... +80 °C
Degree of protection	IP 10
For mounting on	35 mm DIN rails acc. to EN 60715
Connection (input / output)	RJ45 socket / RJ45 socket
Pinning	1/2, 3/6, 4/5, 7/8
Earthing via	35 mm DIN rail acc. to EN 60715
Enclosure material	zinc die-casting
Colour	bare surface
Test standards	IEC 61643-21 / EN 61643-21 / UL 497B
Approvals	CSA, UL, GHMT, EAC
External accessories	fixing material
Weight	109 g
Customs tariff number (Comb. Nomenclature EU)	85363010
GTIN	4013364118935
PU	1 pc(s)



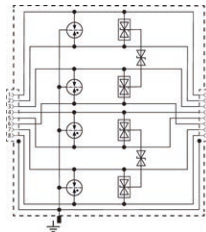
## DEHNpatch

### DPA CLE IP66 (929 221)

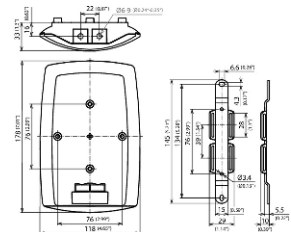
- Indoor / outdoor applications (IP 66)
- GBit Ethernet applications and structured cabling systems according to class E up to 250 MHz
- Power over Ethernet IEEE 802.3 (up to PoE++ / 4PPoE)
- For installation in conformity with the lightning protection zone concept at the boundaries from  $0_B -2$  and higher



Figure without obligation



Basic circuit diagram DPA CLE IP66



Dimension drawing DPA CLE IP66

Universal surge arrester for GBit Ethernet applications, Power over Ethernet (IEEE 802.3 compliant up to PoE++ / 4PPoE) and similar applications in structured cabling systems up to class E in indoor and outdoor areas in an IP66 rated enclosure impervious to dust and water. Protection of all pairs with gas discharge tubes and one adapted filter matrix for each pair. Fully shielded surge protective solution with RJ 45 sockets. Universal mounting bracket for pole and wall mounting.

External accessories: Tensioning straps for pole mounting

Type Part No.	DPA CLE IP66 929 221
SPD class	<b>TYPE 2 Pt</b>
Nominal voltage ( $U_N$ )	5 V
Max. continuous operating voltage d.c. line-line ( $U_c$ )	8.5 V
Max. continuous operating voltage (a.c.) ( $U_c$ )	6 V
Max. continuous operating voltage (d.c.) pair-pair (PoE) ( $U_c$ )	60 V
Nominal current ( $I_L$ )	1 A
D1 Lightning impulse current (10/350 $\mu$ s) per line ( $I_{imp}$ )	0.8 kA
D1 Lightning impulse current (10/350 $\mu$ s) total ( $I_{imp}$ )	4 kA
C2 Nominal discharge current (8/20 $\mu$ s) line-line ( $I_n$ )	400 A
C2 Nominal discharge current (8/20 $\mu$ s) line-PG ( $I_n$ )	2.5 kA
C2 Nominal discharge current (8/20 $\mu$ s) total ( $I_n$ )	10 kA
Voltage protection level line-line for $I_n$ C2 ( $U_p$ )	$\leq 170$ V
Voltage protection level line-PG for $I_n$ C2 ( $U_p$ )	$\leq 600$ V
Voltage protection level line-line for $I_n$ C2 (PoE) ( $U_p$ )	$\leq 120$ V
Voltage protection level line-line at 1 kV/ $\mu$ s C3 ( $U_p$ )	$\leq 180$ V
Voltage protection level line-PG at 1 kV/ $\mu$ s C3 ( $U_p$ )	$\leq 500$ V
Voltage protection level pair-pair at 1 kV/ $\mu$ s C3 (PoE) ( $U_p$ )	$\leq 120$ V
Cut-off frequency ( $f_c$ )	250 MHz
Operating temperature range ( $T_U$ )	-40 °C ... +80 °C
Degree of protection (with installed cables)	IP 66
For mounting on	pole / wall
Connection (input / output)	RJ45 socket / RJ45 socket
Pinning	1/2, 3/6, 4/5, 7/8
Earthing via	enclosure with pole / wall bracket
Enclosure material	aluminium die-cast, nickel plated
Colour	bare surface
Test standards	IEC 61643-21 / EN 61643-21
Approvals	UL, CSA, EAC
External accessories	tensioning straps for pole mounting
Weight	606 g
Customs tariff number (Comb. Nomenclature EU)	85363010
GTIN	4013364342866
PU	1 pc(s)

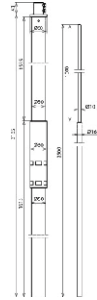
**DEHNiso combi set**

**SR D50 3200 FS16.10 2500 GFK AL (105 306)**

One-piece, combined with air-termination rod Ø16 / 10 mm, length 2500 mm, Al.



Type	SR D50 3200 FS16.10 2500 GFK AL
Part No.	105 306
Material of supporting tube	GRP / Al
Total length	5700 mm
Length of supporting tube	3200 mm
Diameter Ø outside	50 mm
Transport length	3200 mm
Length of insulating clearance	1535 mm
Permanent temperature range	-50 °C ... +100 °C
Weight	5,23 kg
Customs tariff number (Comb. Nomenclature EU)	85389099
GTIN	4013364106024
PU	1 pc(s)

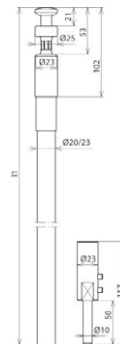


**HVI long conductor**

**HVI RIV 75 23 L6M GR (819 223)**



Figure without obligation



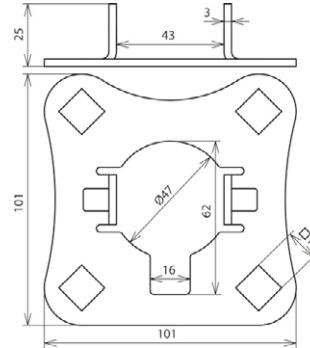
Type	HVI RIV 75 23 L6M GR
Part No.	819 223
Material of conductor	Cu
Material of insulation	PE
Material of coating	PVC
Colour of conductor	grey ●
Colour RAL	similar to 7035
Cross section of core (solid / stranded)	19 mm <sup>2</sup>
Lightning current carrying capability (class / I <sub>imp</sub> )	H1 / 150 kA
Equivalent separation distance s (in air)	≤ 75 cm
Diameter Ø conductor	23 mm
Coating characteristics	UV stabilised and weather resistant
Connection diameter	10 mm
Material of connection elements	StSt
Minimum order length	6 m
Weight	4 kg
Customs tariff number (Comb. Nomenclature EU)	85446010
GTIN	4013364157675
PU	1 pc(s)

Connection element

**AP SR D50 4AE HVI V2A (819 288)**



Figure without obligation



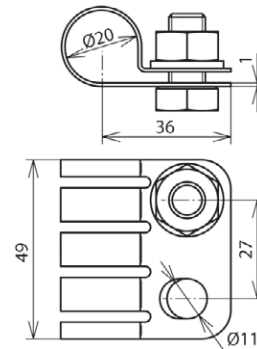
Connection plate (for four conductors, incl. two serrated lock nuts) for installing the HVI long Conductor at the supporting tube D 50 mm (e.g. Part No. 105 330, 105 331, 105 332, 105 333).

Type	AP SR D50 4AE HVI V2A
Part No.	819 288
Material	StSt
Connection plate support	square hole 13
Weight	172 g
Customs tariff number (Comb. Nomenclature EU)	85389099
GTIN	4013364236479
PU	1 pc(s)

**PAE 20 23 AB11 V2A (410 229)**



Figure without obligation



For discharging the electric field of the HVI long Conductor in the sealing end range. Special slotted design for electrically contacting of the semi-conductive sheath.

Type	PAE 20 23 AB11 V2A
Part No.	410 229
Material	StSt
Clamping range Ø	20 mm
Connection bore Ø	11 mm
Screw	● M10 x 20 mm
Material of screw / nut	StSt
Weight	72 g
Customs tariff number (Comb. Nomenclature EU)	85389099
GTIN	4013364107731
PU	1 pc(s)

## Pipe clamp

### BRS 16.168 AK1X10 2X6.8 V2A (540 100)

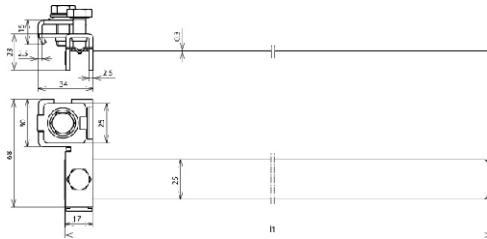



Figure without obligation

Type	BRS 16.168 AK1X10 2X6.8 V2A
Part No.	540 100
Material	StSt
Clamping range pipe Ø	16-168 mm ( <sup>3</sup> / <sub>4</sub> -6")
Dimension of strap (l1 x w x d)	570 x 25 x 0.3 mm
Connection Rd	1-2 conductors Rd Ø6-8 mm / 1x Ø10 mm
Connection (solid / stranded)	4-50 mm <sup>2</sup>
Screw	 M8 x 20 mm
Material of screw	StSt
Standard	EN 62561-1
Weight	133 g
Customs tariff number (Comb. Nomenclature EU)	85389099
Stock No.	5975-12-120-7744
GTIN	4013364094109
PU	10 pc(s)

## Equipotential busbar

### PAS I 10AP M10 V2A (472 219)

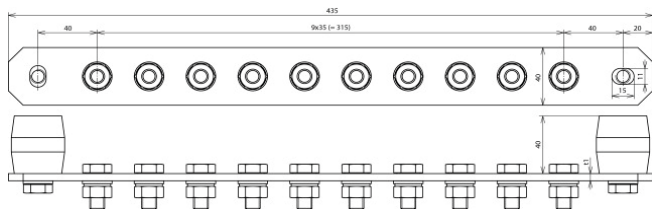



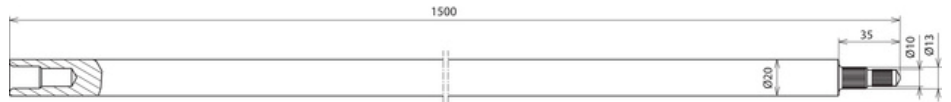
Figure without obligation

Type	PAS I 10AP M10 V2A
Part No.	472 219
Quantity of terminals	10
Material	StSt
Material No.	1.4301 / 1.4303
Dimension (l x w x d1)	435 x 40 x 6 mm
Cross-section	240 mm <sup>2</sup>
Short-circuit current (50 Hz) (1 s; ≤ 300 °C)	8.9 kA
Screw	 M10 x 25 mm
Material of screw / nut	StSt
Design	with spring washer
Material of insulator	UP
Colour of insulator	red •
Standard	EN 62561-1
Weight	1,41 kg
Customs tariff number (Comb. Nomenclature EU)	85389099
GTIN	4013364090958
PU	1 pc(s)



## Earth rod

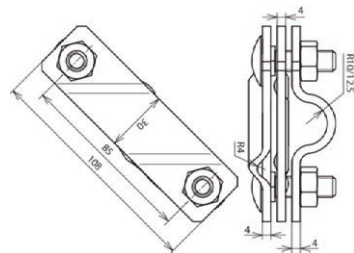
### TE 20 1500 AZ V4A (620 902)



Type	TE 20 1500 AZ V4A
Part No.	620 902
Component protection	German Patent No. P 32 22 201.7
Material	StSt (V4A)
Material No.	1.4571 / 1.4404 / 1.4401
ASTM / AISI:	316Ti / 316L / 316
Rod length (l1)	1500 mm
Diameter Ø (d1)	20 mm
Pin diameter	10 / 13 mm
Tensile strength	500-730 N/mm <sup>2</sup>
Specific conductivity	≥ 1.25 m/Ohm mm <sup>2</sup>
Specific resistance	≤ 0.8 Ohm mm <sup>2</sup> / m
Short-circuit current (50 Hz) (1 s; ≤ 300 °C)	4.2 kA
Standard	EN 62561-2
Weight	3,67 kg
Customs tariff number (Comb. Nomenclature EU)	85389099
GTIN	4013364021914
PU	6 pc(s)

## Connection bracket

### AS S TE 20 7.10 FL40 V4A (620 915)



Type	AS S TE 20 7.10 FL40 V4A
Part No.	620 915
Material	StSt (V4A)
Clamping range Rd / Fl	7-10 / -40 mm
Clamping range (stranded / cable)	35-95 mm <sup>2</sup>
Type for earth rods	Ø20 mm
Screw	⬆ M10 x 35 mm
Material of screw / nut	StSt (V4A)
Material No.	1.4571 / 1.4404 / 1.4401
Short-circuit current (50 Hz) (1 s; ≤ 300 °C)	7.3 kA
Standard	EN 62561-1
Weight	298 g
Customs tariff number (Comb. Nomenclature EU)	85389099
GTIN	4013364026629
PU	20 pc(s)

**Surge Protection**  
**Lightning Protection**  
**Safety Equipment**  
**DEHN protects.**

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