



# White Paper

Safety requirements for cable networks, remote signals, sound signals and interactive services



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## Safety requirements for cable networks, remote signals, sound signals and interactive services



Nowadays conventional satellite and terrestrial antennas are almost exclusively installed on the roofs of buildings. Therefore, the IEC 60728-11 standard calls for earthing measures in addition to equipotential bonding and lightning equipotential bonding of the cable network (cable shields). This standard typically applies to stationary systems and devices. Mobile systems (e.g. caravans), which are also covered by the standard, are not dealt with here.

Moreover, this practical solution does not describe how to earth antenna systems installed at locations with a low risk of lightning strikes and equipotential bonding in case of releasing currents  $\leq 3.5$  mA, which are both not required.

In general, antennas installed in conformity with this standard do not increase the probability of a lightning strike and earthed antenna standpipes are no substitute for a lightning protection system.

### Earth-termination system

An earth-termination system may consist of one foundation earth electrode, two horizontal earth electrodes (earth strips) with a length of 2.5 m and an angle  $> 60^\circ$  each, one vertical earth electrode (earth rod) with a length of 2.5 m or two vertical earth electrodes with a length of 1.5 m each spaced at intervals of 3 m (Figure 1). It must be observed that earth-termination systems must be connected to the main earthing busbar (MEB). The earth electrode must have a minimum cross-section of 50 mm<sup>2</sup> (copper) or 90 mm<sup>2</sup> (galvanised or stainless steel) (typical: flat strip 30 x 35 mm; cross-section of 105 mm<sup>2</sup>).

### Equipotential bonding

To ensure that persons and property are protected, the cable network must be integrated in the protective equipotential bonding of the building. If cables are installed in such a way

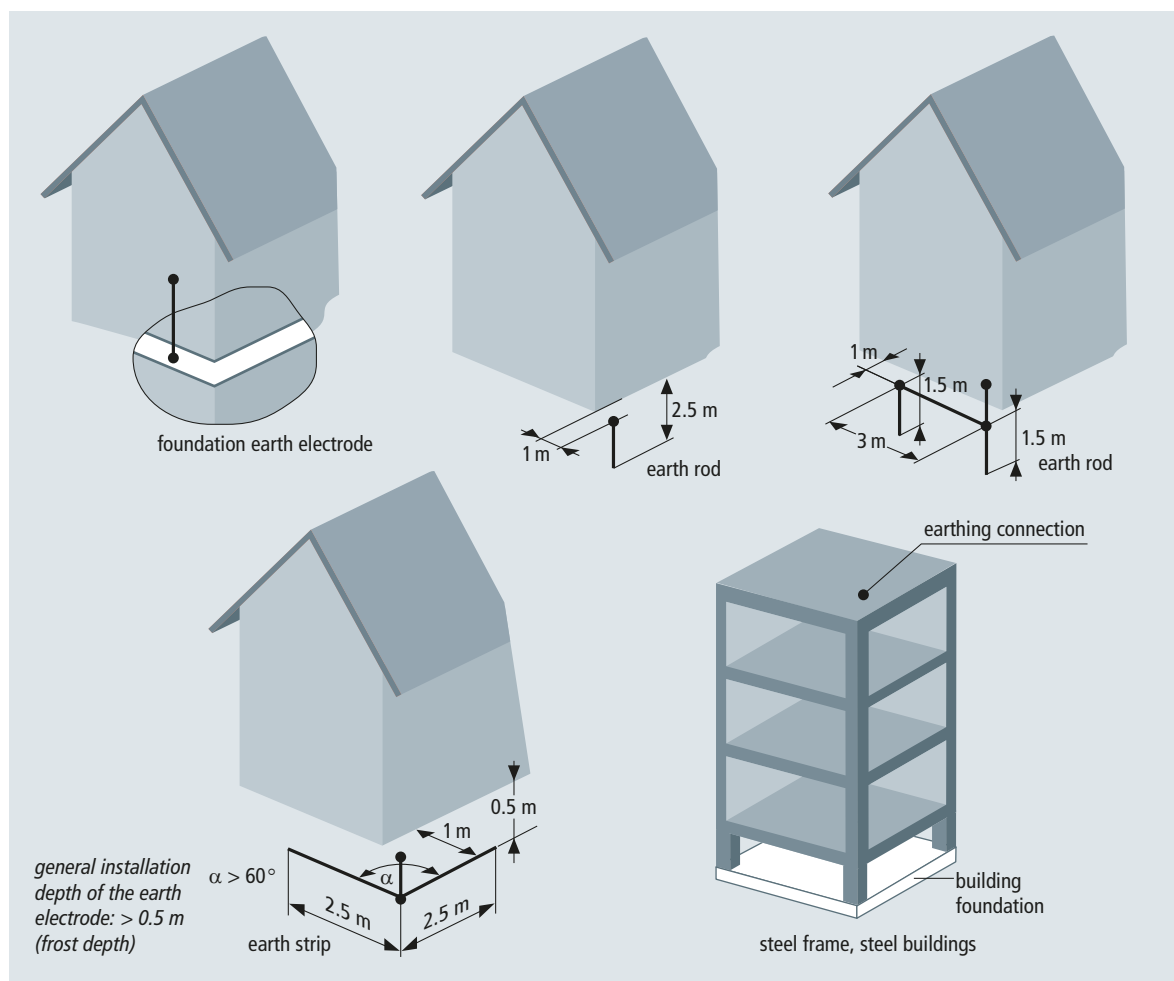


Figure 1 Permitted earth electrodes

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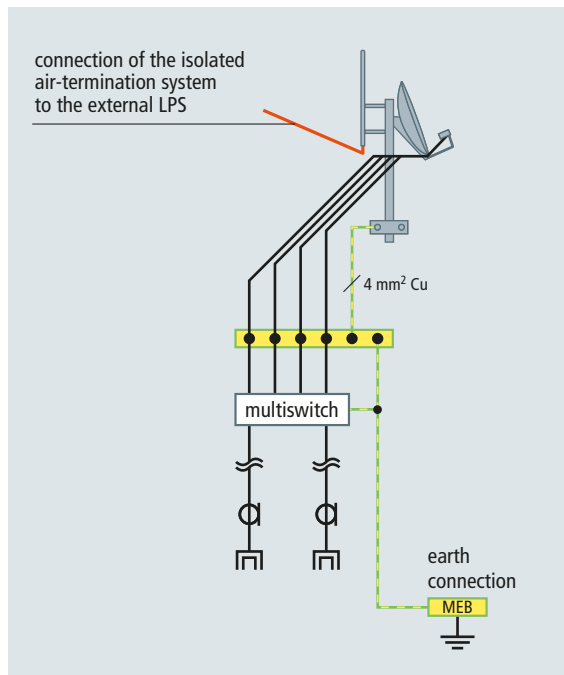


Figure 2 Protective equipotential bonding of the cable network and the devices

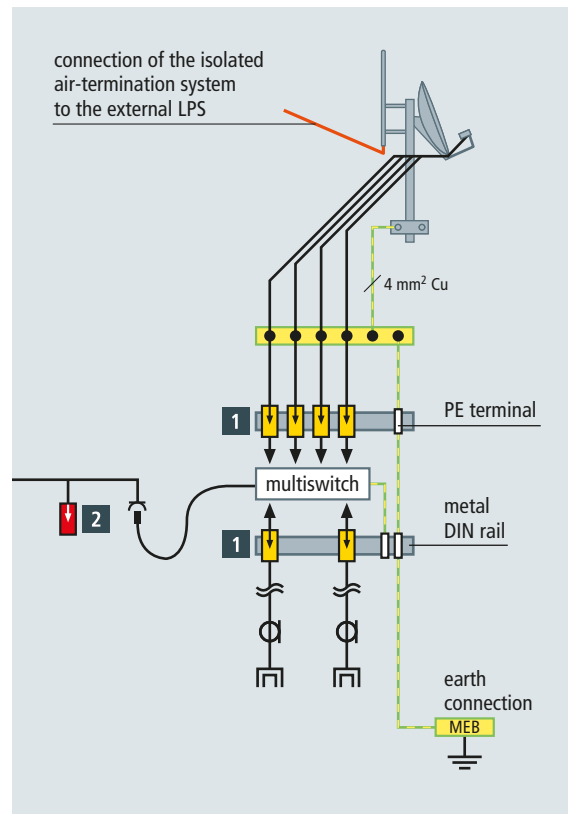
that they are/are not mechanically protected, the minimum cross-section is at least 2.5 mm<sup>2</sup> / 4 mm<sup>2</sup> (copper). This measure is required due to the discharge currents on the mains side which are injected from the devices to the cable network.

For this reason, all cables entering a building (Figure 2) must be connected to the protective equipotential bonding (exception: galvanic isolation of the inner and outer conductor). If active and passive devices (e.g. amplifiers, splitters) are removed, the cable shields connected to them must be interconnected before removing the devices and the inner conductors must be insulated.

Special attention must be paid to mains-powered devices of protection class I connected to the cable network. If no consistent TN-S system is installed, the system unbalance and the accumulation of the third harmonic can lead to shield currents which can cause malfunction and fire.

### Internal lightning protection system

An internal lightning protection system protects the interior of a building, in particular the electrical systems and electronic devices. The main function of an internal lightning protection system is to establish lightning equipotential bonding via the 4 mm<sup>2</sup> copper conductor and the installation of surge protective devices between the inner and outer conductor to avoid sparking.



No.	Surge protective device	Part No.
1	DEHNgate DGA FF TV	909 703
2	DEHNflex DFL M 255	924 396

Figure 3 Antenna system with equipotential bonding at the lowest point of the installation and surge protective devices

### Surge protection

The protection goal of the surge protective devices at the head-end of the standard also applies to equivalent installations (Figure 3).

Surge protective devices for a detached house, which are also described in the standard, provide protection from inductive coupling and can also be used for connections in multi-family houses according to the note in the standard.

### Antennas in buildings or underneath the roof

Antenna systems in a building and antenna systems which are located at least 2 m underneath the roof and do not protrude more than 1.5 m from the wall (Figure 4) do not have to be earthed via an earthing conductor. However, equipotential bonding must be established as described before.

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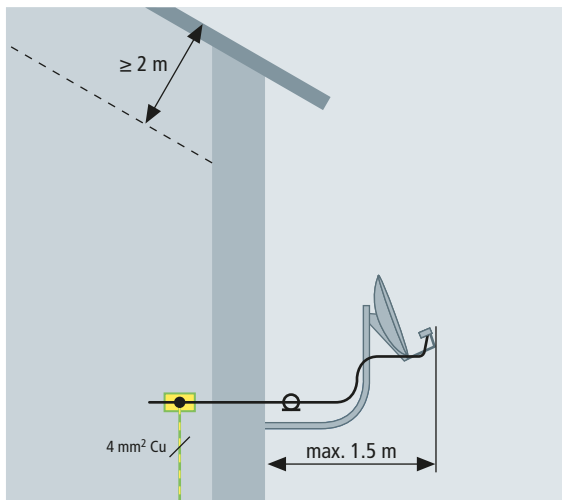


Figure 4 Arrangement of antennas which do not have to be earthed

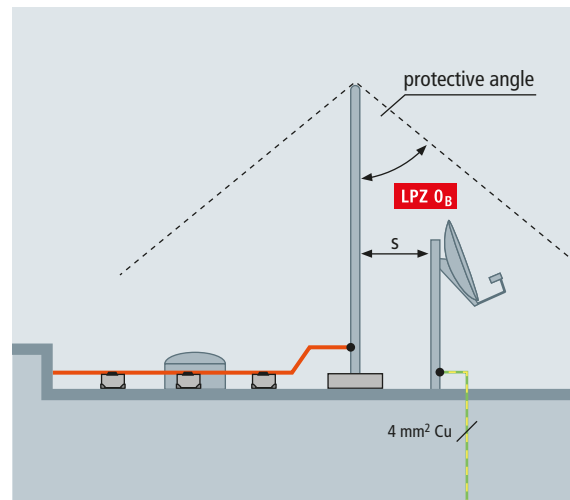


Figure 5 Antenna system located in the protected volume of an existing air-termination system

## Building with lightning protection system

The following considerations have been made in conformity with the protection goal of the IEC 62305-3 (EN 62305-3) lightning protection standard and the so-called "best solution(s)" of the antenna standard.

If buildings are equipped with a lightning protection system, the antenna system must be positioned in the protected volume of an existing air-termination system (**Figure 5**) or protected by an air-termination rod isolated by a DEHNiso spacer (**Figure 6**) or by a DEHNcon-H solution (**Figure 7**). In addition to establishing equipotential bonding as described before, in all these cases, the lowest point of the cable shields must be connected to the main earthing busbar via copper equipotential bonding conductors with a minimum cross-section of 4 mm<sup>2</sup> to reduce the risk of induction loops (**Figure 3**).

## Building without lightning protection system

Earthing measures for antennas do not ensure preventive lightning protection for buildings or any other structures.

If buildings are not equipped with a lightning protection system, the antenna mast must be earthed. The earthing conductor must be installed vertically in a straight line and must have a cross-section of at least 16 mm<sup>2</sup> (copper), 25 mm<sup>2</sup> (insulated aluminium) or 50 mm<sup>2</sup> (steel) (**Figure 8**). The connections of the equipotential bonding conductor, for example to pipe clamps and equipotential bonding bars, must be dimensioned

for lightning currents and tested to EN 50164-1. The equipotential bonding conductor must be installed as far as possible from conductors and earthed systems since in case of a lightning strike the same physical interactions occur that must be observed for keeping the separation distance in an external lightning protection system. In addition, natural components of the building/installation may be used as earthing conductor if they are permitted, electrically conductive and have the same dimensions as standard earthing conductors. Also in this case, equipotential bonding must be established as described before, however, without connecting the lowest point of the cable shields to the main earthing busbar (**Figure 8**).

The DEHNcon-H solution where the high-voltage-resistant, insulated down conductor is routed to the earth-termination system provides more effective protection from the effects of a lightning strike than earthing the antenna mast. Lightning impulse voltages are discharged at the mast via the existing protective equipotential bonding conductor (**Figure 9**).

## Building with broadband cable connection

If a broadband cable enters the building, lightning strikes are to be expected. Therefore, only lightning current carrying surge protective devices such as DEHNgate GFF TV are used (**Figure 10**).

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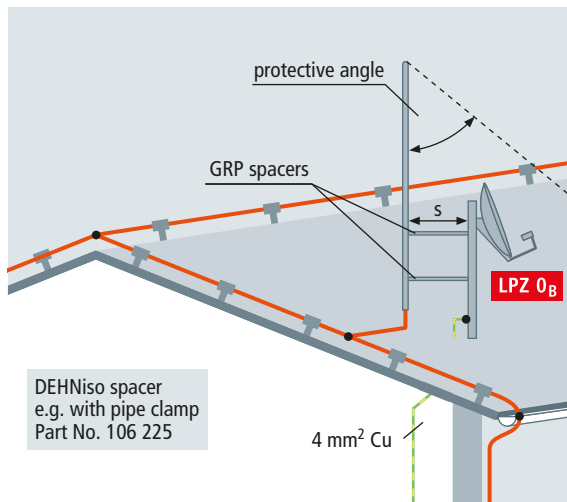


Figure 6 Antenna system with an air-termination rod isolated by DEHNiso spacers (insulating clearance made of glass-fibre reinforced plastic (GRP))

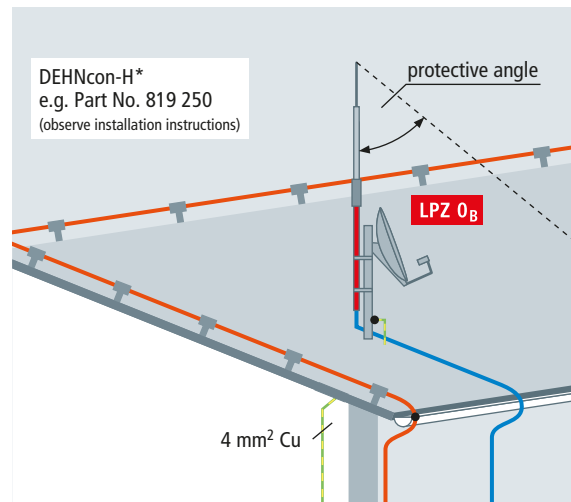
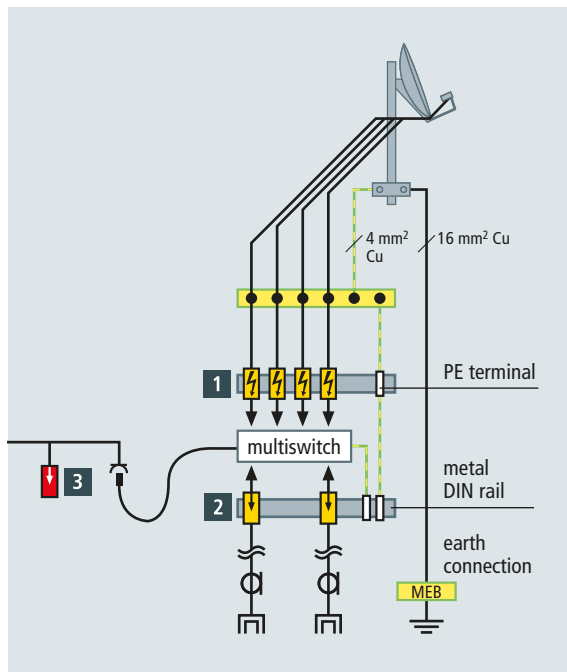
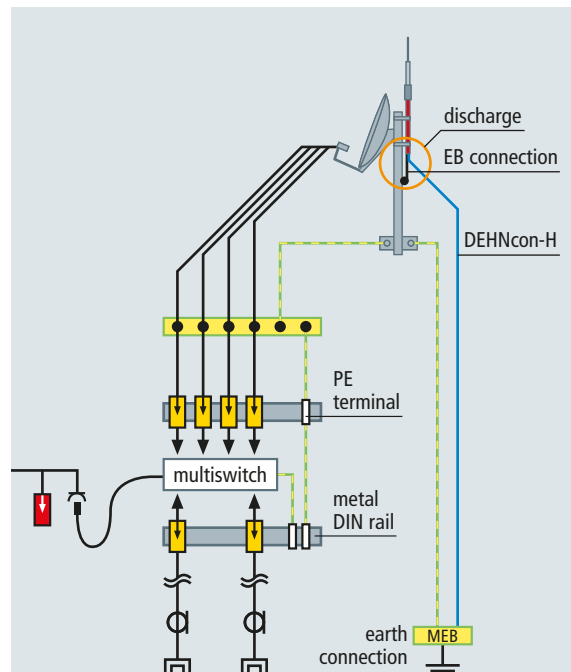


Figure 7 Antenna system with high-voltage-resistant, insulated down conductor DEHNcon-H



No.	Surge protective device	Part No.
1	DEHNgate DGA GFF TV	909 705
2	DEHNgate DGA FF TV	909 703
3	DEHNflex DFL M 255	924 396

Figure 8 Antenna system with surge protective devices



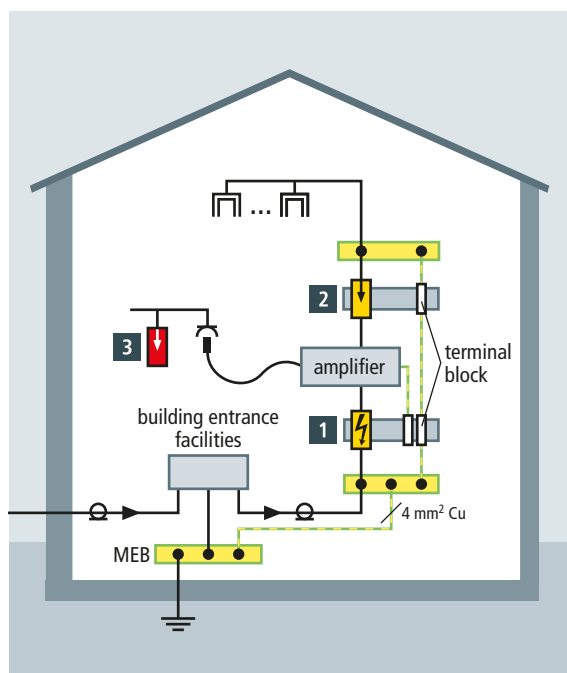
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Figure 9 Antenna system with high-voltage-resistant down conductor DEHNcon-H and surge protective devices



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Figure 10 Broadband cable connection with surge protective devices

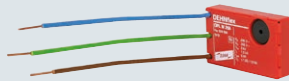
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## Products and technical data

### DEHNflex

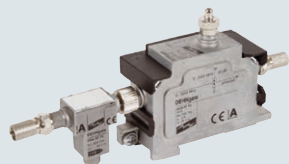


Type	DFL M 255
Part No.	924 396
SPD acc. to EN 61643-11/IEC 61643-11	Type 3 / Class III
Max. continuous operating voltage (a.c.) ( $U_C$ )	255 V
Nominal discharge current (8/20 $\mu$ s) ( $I_n$ )	1.5 kA
Total discharge current (8/20 $\mu$ s) [L+N-PE] ( $I_{total}$ )	3 kA
Combination wave ( $U_{OC}$ ) / [L+N-PE] ( $U_{OC total}$ )	3 kV / 6 kV
Voltage protection level [L-N] / [L/N-PE] ( $U_P$ )	$\leq 1.25$ kV / $\leq 1.5$ kV

### DEHNgate



Type	DGA FF TV
Part No.	909 703
SPD class	<b>TYPE 3P1</b>
Max. cont. operating voltage (d.c.) ( $U_C$ )	24 V
D1 Lightning impulse current (10/350 $\mu$ s) ( $I_{imp}$ )	0.2 kA
C2 Nominal discharge current (8/20 $\mu$ s) ( $I_n$ )	1.5 kA
Voltage protection level at $I_{imp}$ D1 ( $U_P$ )	$\leq 230$ V
Voltage protection level at $I_n$ C2 ( $U_P$ )	$\leq 300$ V
Voltage protection level at 1 kV/ $\mu$ s C3 ( $U_P$ )	$\leq 60$ V
Test standards	IEC 61643-21 / EN 61643-21



Type	DGA GFF TV
Part No.	909 705
SPD class	<b>TYPE 1P1</b> <b>TYPE 3P1</b>
Max. cont. operating voltage (d.c.) ( $U_C$ )	24 V
D1 Lightning impulse current (10/350 $\mu$ s) ( $I_{imp}$ )	2.5 kA
C2 Nominal discharge current (8/20 $\mu$ s) ( $I_n$ )	10 kA
Voltage protection level at $I_{imp}$ D1 ( $U_P$ )	$\leq 230$ V
Voltage protection level at $I_n$ C2 ( $U_P$ )	$\leq 300$ V
Voltage protection level at 1 kV/ $\mu$ s C3 ( $U_P$ )	$\leq 60$ V
Test standards	IEC 61643-21 / EN 61643-21

### DEHNiso Spacer



Part No.	106 225
Total length (I1) / Insulating distance (I2)	530 mm / 445 mm
Clamping range of pipe	40–60 mm (1 1/4–2")
Material of conductor holder / fixing element	StSt
Material of spacer	GRP

[www.dehn-international.com/partners](http://www.dehn-international.com/partners)



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

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GmbH + Co.KG.

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