



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

White Paper



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Nowadays conventional satellite and terrestrial antennas are almost exclusively installed on the roofs of buildings. Therefore, the IEC 60728-11 (EN 60728-1) 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 earthing measures for antenna systems installed at locations with a low risk of lightning strikes and equipotential bonding in case of let-go threshold currents ≤ 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 mm² (copper) or 90 mm² (galvanised or stainless steel) (typical: flat strip 30 x 35 mm; cross-section of 105 mm²).

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

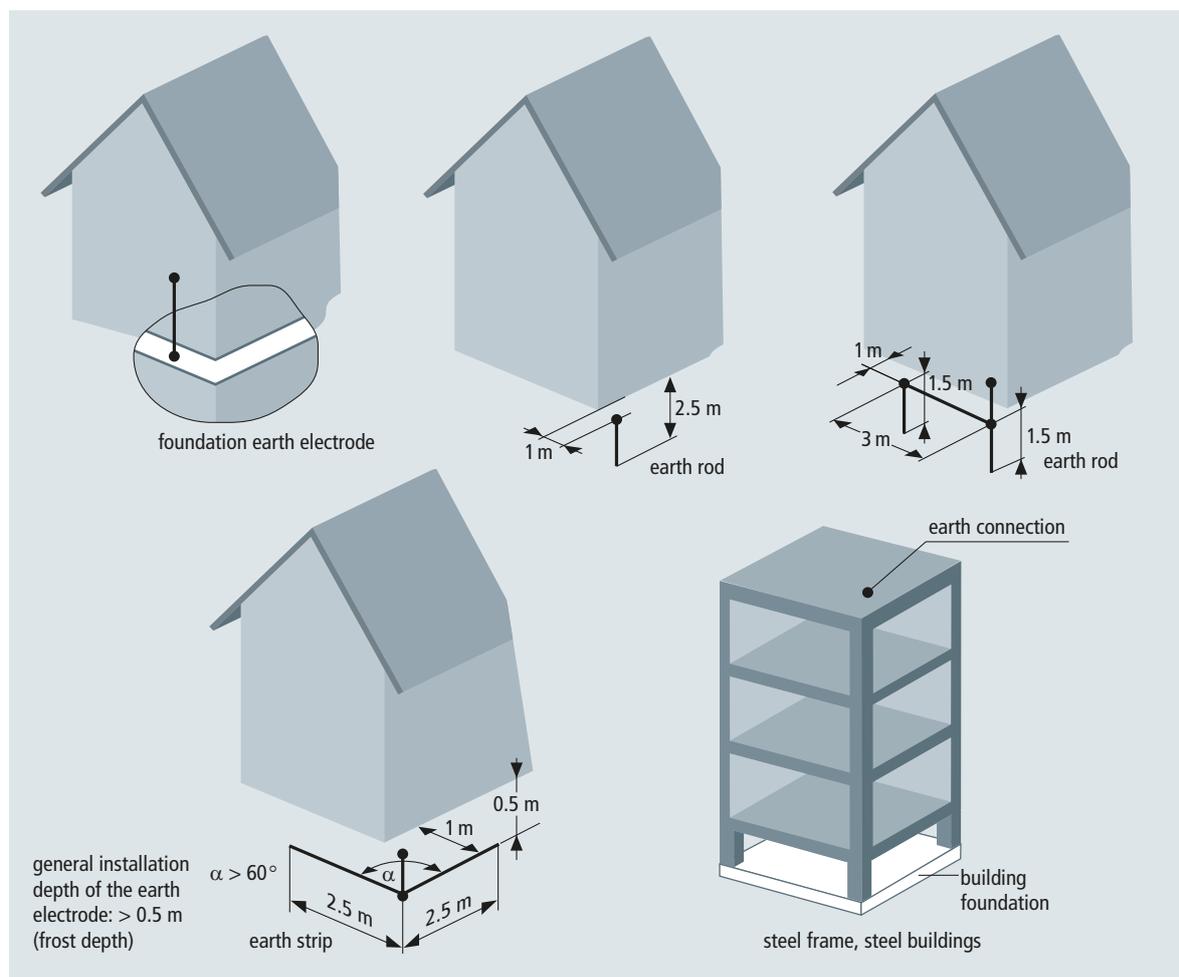


Figure 1 Permitted earth electrodes

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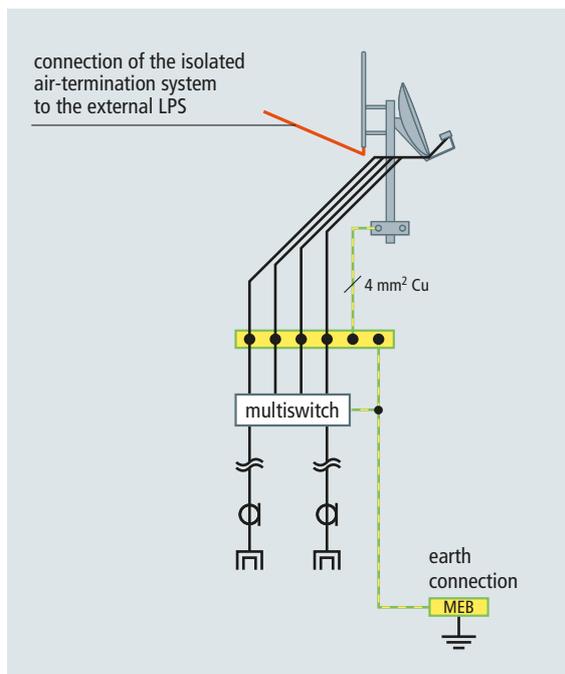


Figure 2 Protective equipotential bonding of the cable network and the devices

that they are/are not mechanically protected, the minimum cross-section is at least 2.5 mm²/4 mm² (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 integrated 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 content 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 mm² copper conductor and the installation of surge protective devices between the inner and outer conductor to avoid sparking.

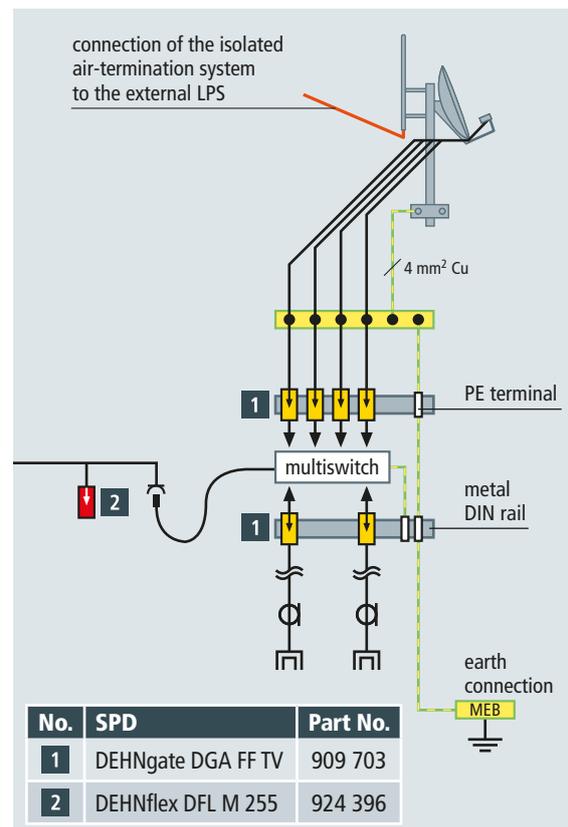


Figure 3 Antenna system with equipotential bonding at the lowest point of the installation and surge protective devices

Surge protection

The protection goal of the surge protective devices at the head-end described in 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.

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) light-

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ning 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 mm² 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 mm² (copper), 25 mm² (insulated aluminium) or 50 mm² (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 IEC 62561-1 (EN 62561-1). The equipotential bonding conductor must be installed as far

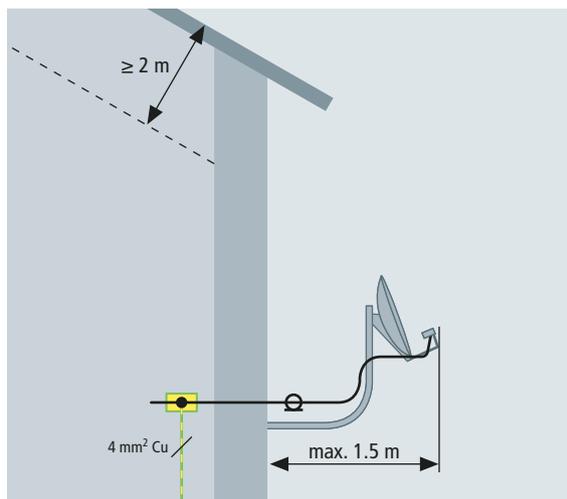


Figure 4 Arrangement of antennas which do not have to be earthed

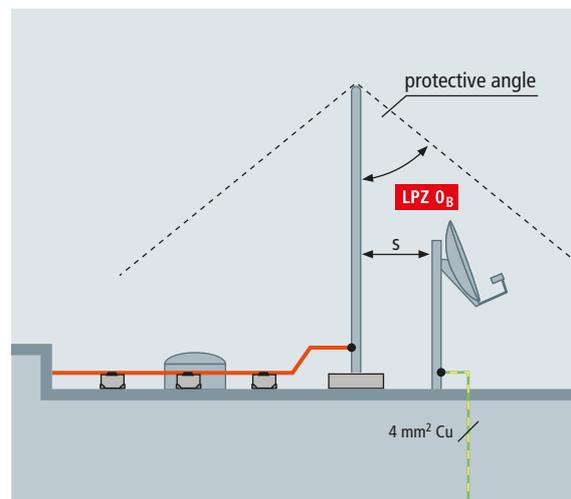


Figure 5 Antenna system located in the protected volume of an existing air-termination system

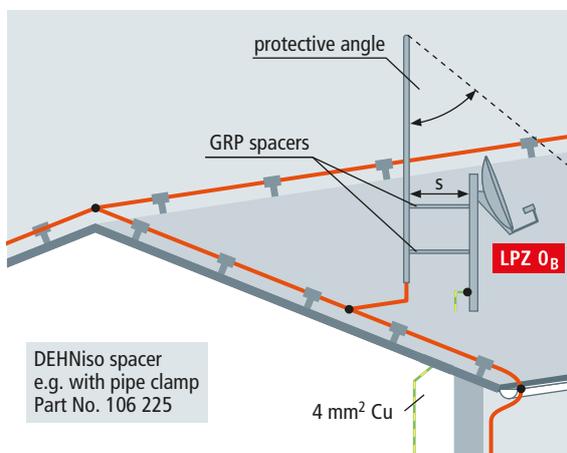


Figure 6 Antenna system with an air-termination rod isolated by DEHNiso spacers (insulating clearance made of glass-fibre reinforced plastic (GRP))

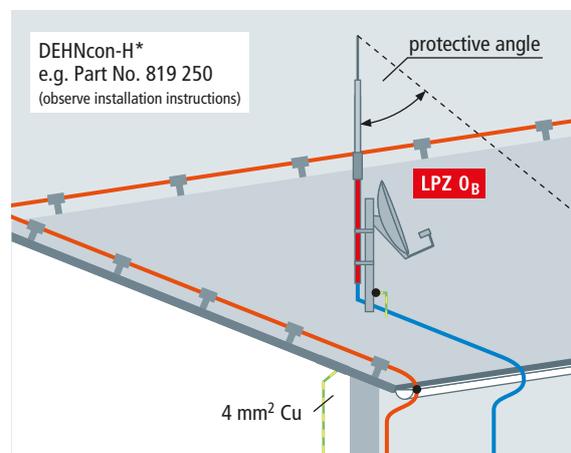


Figure 7 Antenna system with high-voltage-resistant, insulated down conductor DEHNcon-H

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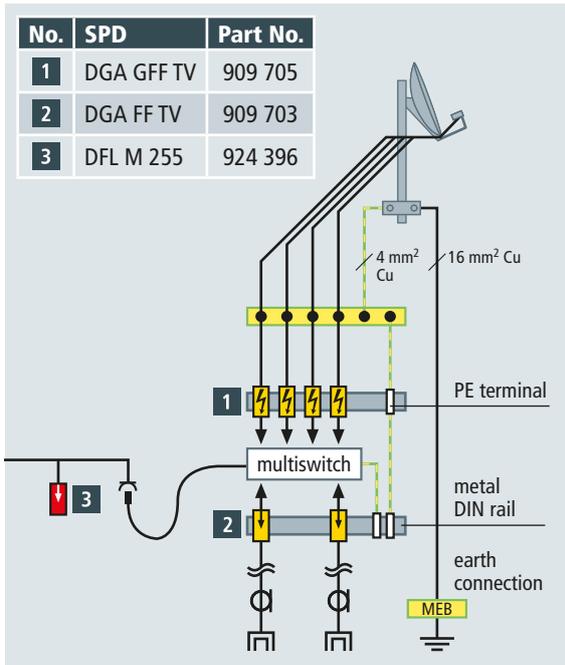


Figure 8 Antenna system with surge protective devices

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. The connection at the mast is made via the existing protective 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).

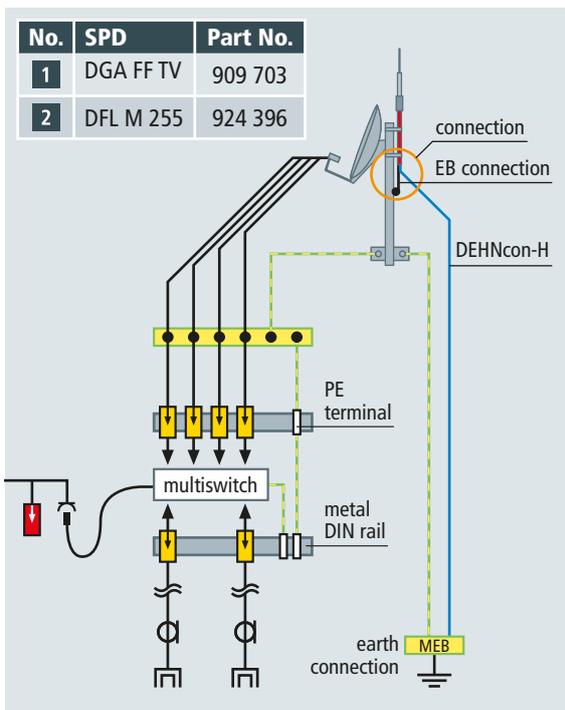


Figure 9 Antenna system with high-voltage-resistant down conductor DEHNcon-H and surge protective devices

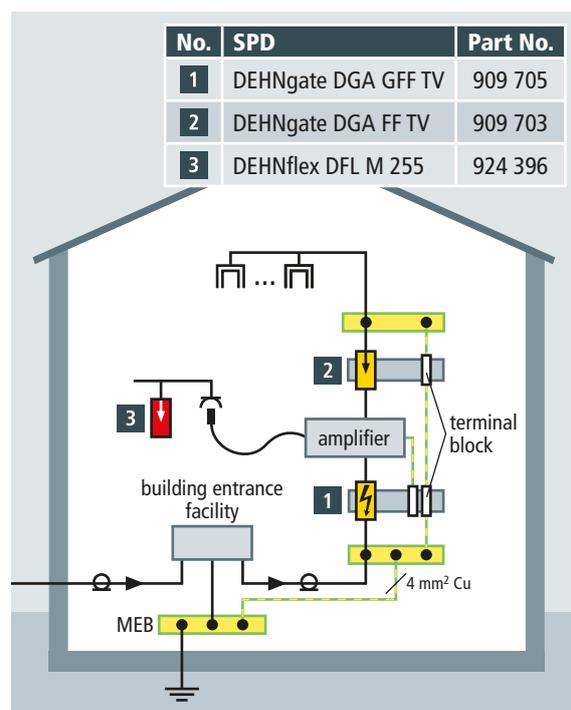


Figure 10 Broadband cable connection with surge protective devices

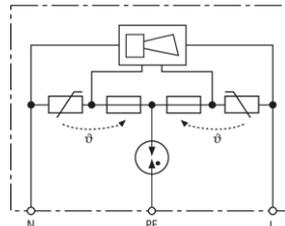
DEHNflex

DFL M 255 (924 396)

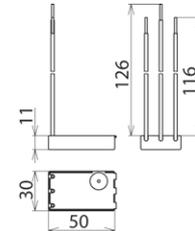
- Acoustic fault indication
- Compact design
- For use in flush-mounted systems, cable ducts and flush-type boxes



Figure without obligation



Basic circuit diagram DFL M 255



Dimension drawing DFL M 255

Surge arrester for use in all types of installation systems for terminal equipment; compact dimensions

Type Part No.	DFL M 255 924 396
SPD according to EN 61643-11	Type 3
SPD according to IEC 61643-1/-11	Class III
Nominal a.c. voltage (U_N)	230 V
Max. continuous operating a.c. voltage (U_C)	255 V
Nominal discharge current (8/20 μ s) (I_n)	1.5 kA
Total discharge current (8/20 μ s) [L+N-PE] (I_{total})	3 kA
Combined impulse (U_{OC})	3 kV
Combined impulse [L+N-PE] ($U_{OC, total}$)	6 kV
Voltage protection level [L-N] (U_p)	≤ 1.25 kV
Voltage protection level [L/N-PE] (U_p)	≤ 1.5 kV
Response time [L-N] (t_A)	≤ 25 ns
Response time [L/N-PE] (t_A)	≤ 100 ns
Max. mains-side overcurrent protection	32 A gL/gG or B/C 32 A
Short-circuit withstand capability for mains-side overcurrent protection with 32 A gL/gG	6 kA _{rms}
Temporary overvoltage (TOV) [L-N] (U_T)	335 V / 5 sec.
Temporary overvoltage (TOV) [L/N-PE] (U_T)	400 V / 5 sec.
Temporary overvoltage (TOV) [L+N-PE] (U_T)	1200 V + U_{CS} / 200 ms
TOV characteristic [L-N]	withstand
TOV characteristic [L/N-PE]	withstand
TOV characteristic [L+N-PE]	safe
Fault indication	acoustic signal on
Number of ports	1
Operating temperature range (T_U)	-25°C...+40°C
Terminal wires	1 mm ² , 120 mm long
Enclosure material	thermoplastic, red, UL 94 V-2
Place of installation	indoor installation
Degree of protection of installed device	IP 20
Dimensions	30 x 50 x 11 mm
Weight	32 g
Customs tariff number	85363010
GTIN	4013364091016
PU	1 pc(s)

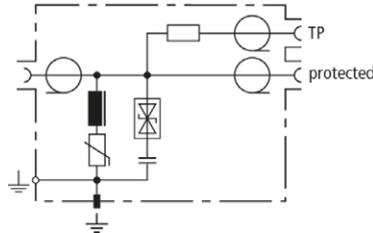
DEHNgate

DGA FF TV (909 703)

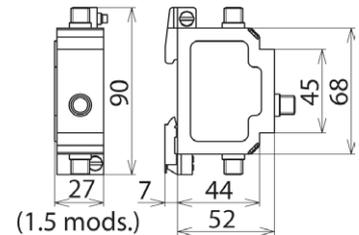
- Frequency range for analogue and digital TV, also suitable for reverse LAN channels
- Arresters of type FF and GFF with integrated measuring output
- Three types for adapted use in conformity with the lightning protection zone concept at the boundaries from $0_A - 2$ (combined lightning current and surge arresters of type GFF), $0_A - 1$ (lightning current arresters of type GF) and $1 - 2$ (surge arresters of type FF)



Figure without obligation



Basic circuit diagram DGA FF TV



Dimension drawing DGA FF TV

DGA ... TV are arresters with F connection for remote supply protect 75 ohm satellite and broadband cable systems and fulfil the high shielding requirements of class A according to EN 50083-2. They allow space-saving installation in all common TV and satellite applications and are available as lightning current arresters, surge arresters as well as combined lightning current and surge arresters with integrated measuring output for testing installations.

Type Part No.	DGA FF TV 909 703
SPD class	TYPE 3 P1
Max. continuous operating d.c. voltage (U_c)	24 V
Nominal current (I_n)	2 A
D1 Lightning impulse current (10/350 μ s) (I_{imp})	0.2 kA
C2 Nominal discharge current (8/20 μ s) (I_n)	1.5 kA
Voltage protection level for I_{imp} D1 (U_p)	≤ 230 V
Voltage protection level for I_n C2 (U_p)	≤ 300 V
Voltage protection level at 1 kV/ μ s C3 (U_p)	≤ 60 V
Frequency range	d.c. / 5-3000 MHz
Insertion loss 5-862 MHz typ.	1.2 dB
Insertion loss 862-2400 MHz typ.	1.4 dB
Insertion loss 2400-3000 MHz typ.	2 dB
Return loss	≥ 14 dB
Return loss (47-2400 MHz)	≥ 18 dB (-1.5 dB/octave)
Return loss test socket (5-47 MHz)	≥ 18 dB
Test socket connection loss	20 dB
Shield attenuation 5-300 MHz	≥ 85 dB
Shield attenuation 300-470 MHz	≥ 80 dB
Shield attenuation 470-1000 MHz	≥ 75 dB
Shield attenuation 1000-2400 MHz	≥ 55 dB
Characteristic impedance (Z)	75 ohms
Operating temperature range (T_u)	-40 °C ... +80 °C
Degree of protection (if lines are connected)	IP 30
For mounting on	35 mm DIN rails acc. to EN 60715 or wall mounting
Connection (input / output)	F socket / F socket
Earthing via	DIN rail or screw connection
Enclosure material	metal
Colour	bare surface
Test standards	IEC 61643-21 / EN 61643-21
Approvals	GOST
Accessories	2x F plugs
Weight	233 g
Customs tariff number	85363090
GTIN	4013364085664
PU	1 pc(s)

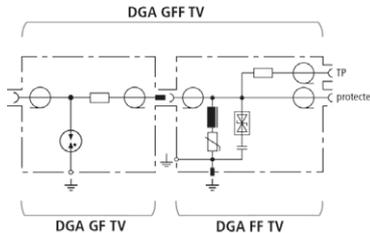
DEHNgate

DGA GFF TV (909 705)

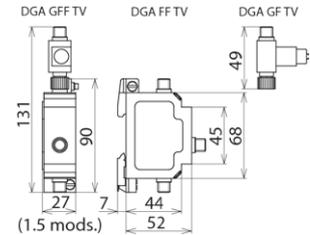
- Frequency range for analogue and digital TV, also suitable for reverse LAN channels
- Arresters of type FF and GFF with integrated measuring output
- Three types for adapted use in conformity with the lightning protection zone concept at the boundaries from 0_A -2 (combined lightning current and surge arresters of type GFF), 0_A-1 (lightning current arresters of type GF) and 1 - 2 (surge arresters of type FF)



Figure without obligation



Basic circuit diagram DGA GFF TV – consisting of DGA GF TV and DGA FF TV



Dimension drawing DGA GFF TV – consisting of DGA GF TV and DGA FF TV

DGA ... TV are arresters with F connection for remote supply protect 75 ohm satellite and broadband cable systems and fulfil the high shielding requirements of class A according to EN 50083-2. They allow space-saving installation in all common TV and satellite applications and are available as lightning current arresters, surge arresters as well as combined lightning current and surge arresters with integrated measuring output for testing installations.

Type	DGA GFF TV
Part No.	909 705
SPD class	TYPE 1 <input type="checkbox"/> TYPE 3 Pt 1 <input type="checkbox"/>
Max. continuous operating d.c. voltage (U _c)	24 V
Nominal current (I _n)	2 A
D1 Lightning impulse current (10/350 μs) (I _{imp})	2.5 kA
C2 Nominal discharge current (8/20 μs) (I _n)	10 kA
Voltage protection level for I _{imp} D1 (U _p)	≤ 230 V
Voltage protection level for I _n C2 (U _p)	≤ 300 V
Voltage protection level at 1 kV/μs C3 (U _p)	≤ 60 V
Frequency range	d.c. / 5-2400 MHz
Insertion loss 5-862 MHz typ.	1.7 dB
Insertion loss 862-2400 MHz typ.	1.9 dB
Return loss (5-8 MHz)	≥ 10 dB
Return loss (8-47 MHz)	≥ 14 dB
Return loss (47-2400 MHz)	≥ 18 dB (-1.5 dB/octave)
Return loss test socket (5-47 MHz)	≥ 18 dB
Test socket connection loss	20 dB
Shield attenuation 5-300 MHz	≥ 85 dB
Shield attenuation 300-470 MHz	≥ 80 dB
Shield attenuation 470-1000 MHz	≥ 75 dB
Shield attenuation 1000-2400 MHz	≥ 55 dB
Characteristic impedance (Z)	75 ohms
Operating temperature range (T _o)	-40 °C ... +80 °C
Degree of protection (if lines are connected)	IP 30
For mounting on	35 mm DIN rails acc. to EN 60715 or wall mounting
Connection (input / output)	F socket / F socket
Earthing via	DIN rail or screw connection
Enclosure material	metal
Colour	bare surface
Test standards	IEC 61643-21 / EN 61643-21
Approvals	GOST
Accessories	2x F plug
Weight	283 g
Customs tariff number	85363090
GTIN	4013364105706
PU	1 pc(s)

HVI light / DEHNiso distance holder

HVI LI I 20 L6M SR2055 FSP500 AL (819 250)

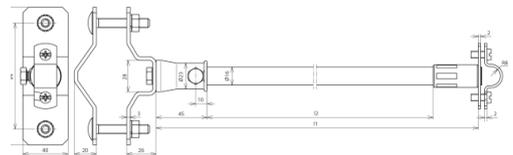
Figure without obligation



Part No.	819 250
Material of conductor	Cu
Material of supporting tube	GRP / Al
Length of air-termination rod	500 mm
Length of supporting tube	2055 mm
Diameter Ø conductor	20 mm
Colour of conductor	grey •
RAL colour	similar to 7000
Cross section of core	19 mm ²
Equivalent separation distance s (in air)	≤ 45 cm
Material of insulation	PE
Material of sheath	PVC
Characteristics of sheath	UV stabilized and weather resistant
Connection diameter	10 mm
EB connection cable	strip StSt 18 x 0.4 mm
Material of connection elements	StSt
Minimum order length	6 m
Max. gust wind speed	228 km/h
Max. free length	1955 mm
Min. clamping length	600 mm
Weight	5,72 kg
Customs tariff number	85389099
GTIN	4013364118232
PU	1 pc(s)

DIDH 16 530 RS40.60 V2A (106 225)

Figure without obligation



Part No.	106 225
Conductor holder support Rd	16 mm
Material of conductor holder	StSt
Length (l1)	530 mm
Insulating distance (l2)	445 mm
Clamping range of pipe	40-60 mm (1 1/4-2")
Diameter Ø of spacer	16 mm
Colour of spacer	light grey (RAL 7035) •
Conductor leading	fixed
Rod / Conductor holder	two-screw cleat
Material of spacer	GRP
Material factor km	0.7
Permanent temperature range	-50 °C ... +100 °C
Material of fixing bush	ZDC
Material of fixing element	StSt
Type	UV stabilised and weather resistant
Max. gust wind speed mounting variant 2	130 km/h
Weight	684 g
Customs tariff number	85389099
GTIN	4013364100299
PU	1 pc(s)

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