



Surge protection for public address systems

White Paper



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Public address systems are used for voice, music and alarm transmission. To this end, the useful signal is modulated onto a carrier voltage (50 V, 70 V, 100 V) and reaches the loudspeaker via a transmitter. This transmitter transforms the low impedance of the loudspeaker to a higher value, thus reducing the current. Therefore, telecommunication lines with a diameter of 0.6 mm or 0.8 mm can be used.

There are different kinds of loudspeakers. Flush and wall loudspeakers typically have a rated power between 6 and 30 W, column loudspeakers between 20 W and 100 W and horn loudspeakers between 10 W and 60 W. Modular amplifiers have a rated power between 100 W and 600 W (in some cases even higher).

Loudspeakers with different power ratings can be jointly used in a line or group. The minimum power of the amplifier is the sum of the individual loudspeaker power ratings in the public address system. When determining the minimum power of the amplifier, the sum of the loudspeaker power ratings is not decisive, but instead the sum of the selected power ratings at the transmitters.

Subsection 7.2.1 of the EN 50174-2 standard describes the protection from lightning strikes and induced surges and compares the risk of damage with the risk which is accepted by the operator. If this risk assessment reveals that surge protection measures are required, surge protective devices must be installed for the relevant installations and systems in need of protection.

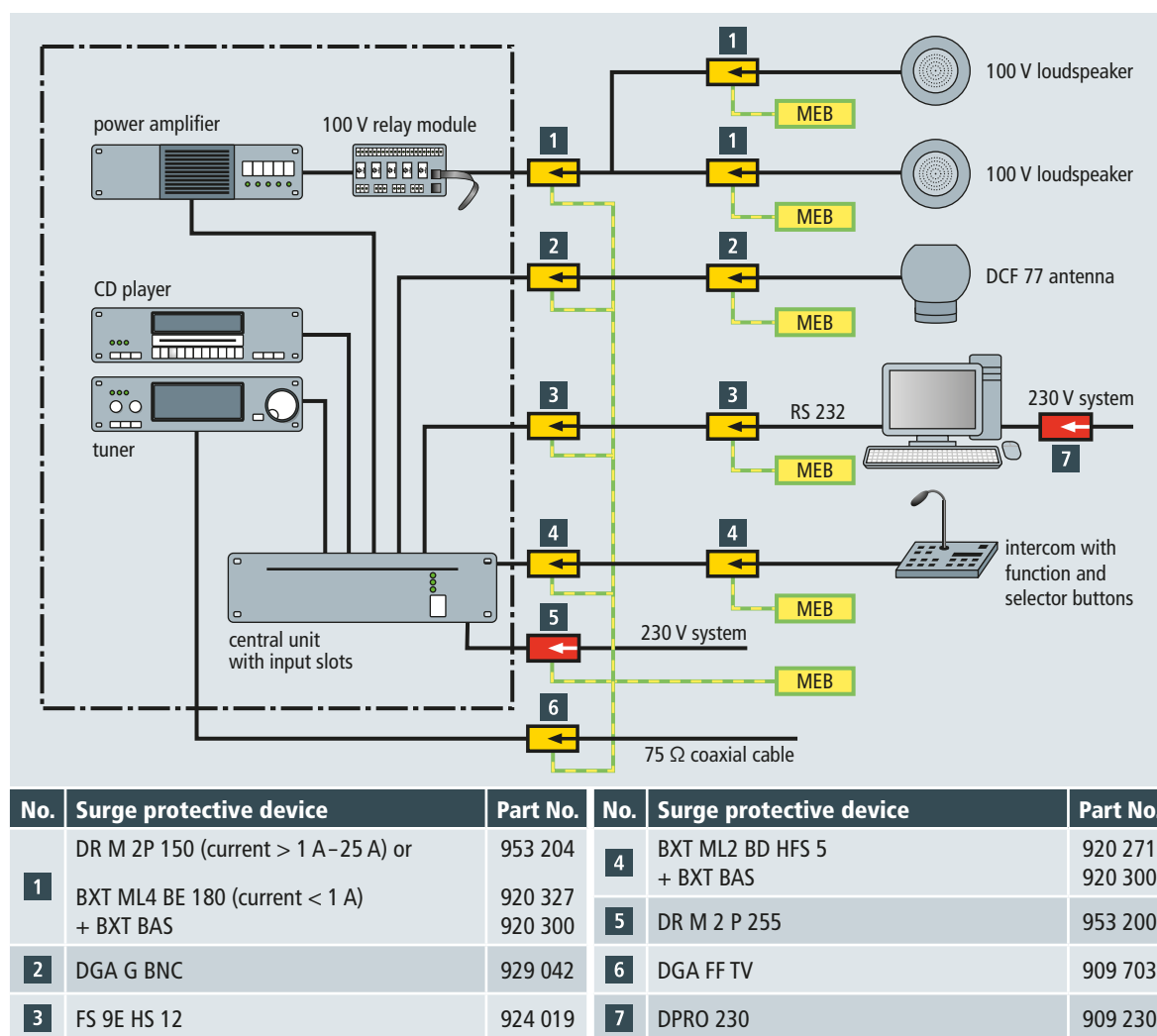
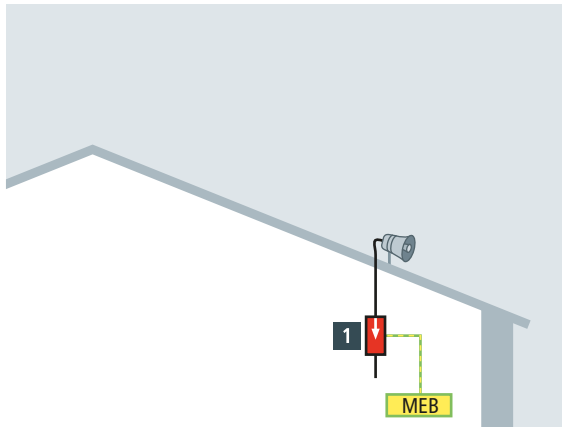


Figure 1 Modular public address system with surge protective devices

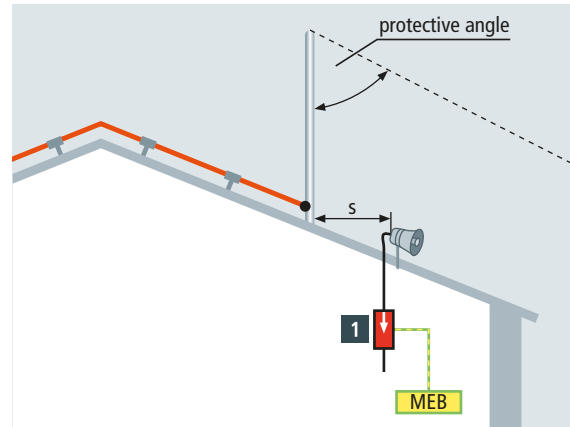
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No.	Surge protective device	Part No.
1	DR M 2P 150 (current > 1 A–25 A) or BXT ML4 BE 180 (current < 1 A) + BXT BAS	953 204 920 327 920 300

Figure 2 Horn loudspeaker installed on a structure without external lightning protection system



No.	Surge protective device	Part No.
1	DR M 2P 150 (current > 1 A–25 A) or BXT ML4 BE 180 (current < 1 A) + BXT BAS	953 204 920 327 920 300

Figure 3 Horn loudspeaker located in the protected volume of an air-termination system on a structure with external lightning protection system

In the following, further applicable regulations will not be specified (e.g. German Sample Directive on Fireproofing Requirements for Line Systems (MLAR), building regulations, regulations concerning electroacoustic emergency warning systems, regulations concerning burglar and fire alarm systems).

Large-scale public address systems feature a modular 19" design (**Figure 1**) and are frequently located in close proximity to a permanently manned workstation. In such cases, the relevant length of the connecting cable to the PC or intercom decides whether the surge arresters shown (4 + 5) must be installed. If this length exceeds 5 m, surge protective devices are required.

To be able to dimension the surge arresters for the loudspeaker lines (1 + 2), the maximum current I in the relevant branch must be determined by means of the ratio $I = P/U$ where P is

the power of the amplifier or loudspeaker (group) and U is the carrier voltage.

All earth connections of the surge arresters in the vicinity of the public address system must be connected to a nearby common potential point.

If exterior loudspeakers are located on the roof of a building, they can be damaged by indirect lightning effects (inductive/capacitive coupling) in case of systems with external lightning protection system (**Figure 3**) and without external lightning protection system (**Figure 2**). If the system is equipped with an external lightning protection system (**Figure 3**), the exterior loudspeaker is reliably protected from direct lightning strikes since it is located in the protected volume of an air-termination system.

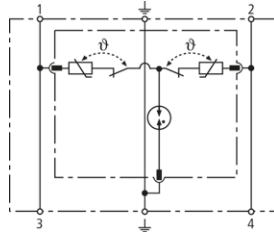
DEHNrail

DR M 2P 255 (953 200)

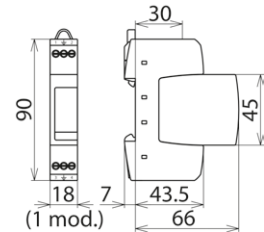
- Two-pole surge arrester consisting of a base element and plug-in protection module
- High discharge capacity due to heavy-duty zinc oxide varistor/spark gap combination
- Energy coordination with other arresters of the Red/Line product family



Figure without obligation



Basic circuit diagram DR M 2P 255



Dimension drawing DR M 2P 255

Two-pole surge arrester consisting of a base part and plug-in protection module

Type	DR M 2P 255
Part No.	953 200
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
Max. continuous operating d.c. voltage (U_C)	255 V
Nominal load current a.c. (I_L)	25 A
Nominal discharge current (8/20 μ s) (I_n)	3 kA
Total discharge current (8/20 μ s) [L+N-PE] (I_{total})	5 kA
Combined impulse (U_{OC})	6 kV
Combined impulse [L+N-PE] ($U_{OC total}$)	10 kV
Voltage protection level [L-N] (U_P)	≤ 1250 V
Voltage protection level [L/N-PE] (U_P)	≤ 1500 V
Response time [L-N] (t_A)	≤ 25 ns
Response time [L/N-PE] (t_A)	≤ 100 ns
Max. mains-side overcurrent protection	25 A gL/gG or B 25 A
Short-circuit withstand capability for mains-side overcurrent protection with 25 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]	withstand
Operating temperature range (T_U)	-40°C...+80°C
Operating state/fault indication	green / red
Number of ports	1
Cross-sectional area (min.)	0.5 mm ² solid/flexible
Cross-sectional area (max.)	4 mm ² solid/2.5 mm ² 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	1 module(s), DIN 43880
Approvals	KEMA, VDE, UL, VdS, CSA
Weight	81 g
Customs tariff number	85363030
GTIN	4013364108301
PU	1 pc(s)

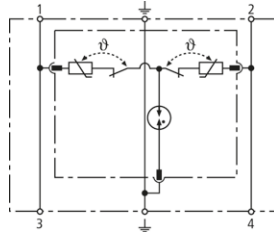
DEHNrail

DR M 2P 150 (953 204)

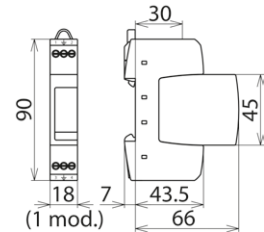
- Two-pole surge arrester consisting of a base element and plug-in protection module
- High discharge capacity due to heavy-duty zinc oxide varistor/spark gap combination
- Energy coordination with other arresters of the Red/Line product family



Figure without obligation



Basic circuit diagram DR M 2P 150



Dimension drawing DR M 2P 150

Two-pole surge arrester consisting of a base part and plug-in protection module

Type	DR M 2P 150
Part No.	953 204
SPD according to EN 61643-11	Type 3
SPD according to IEC 61643-1/-11	Class III
Nominal a.c. voltage (U_N)	120 V
Max. continuous operating a.c. voltage (U_C)	150 V
Max. continuous operating d.c. voltage (U_C)	150 V
Nominal load current a.c. (I_L)	25 A
Nominal discharge current (8/20 μ s) (I_n)	2 kA
Total discharge current (8/20 μ s) [L+N-PE] (I_{total})	4 kA
Combined impulse (U_{OC})	4 kV
Combined impulse [L+N-PE] ($U_{OC total}$)	8 kV
Voltage protection level [L-N] (U_P)	≤ 640 V
Voltage protection level [L/N-PE] (U_P)	≤ 800 V
Response time [L-N] (t_A)	≤ 25 ns
Response time [L/N-PE] (t_A)	≤ 100 ns
Max. mains-side overcurrent protection	25 A gL/gG or B 25 A
Short-circuit withstand capability for mains-side overcurrent protection with 25 A gL/gG	6 kA _{rms}
Operating temperature range (T_U)	-40°C...+80°C
Operating state/fault indication	green / red
Number of ports	1
Cross-sectional area (min.)	0.5 mm ² solid/flexible
Cross-sectional area (max.)	4 mm ² solid/2.5 mm ² 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	1 module(s), DIN 43880
Approvals	KEMA, VDE, UL, VdS, CSA
Weight	79 g
Customs tariff number	85363030
GTIN	4013364109704
PU	1 pc(s)

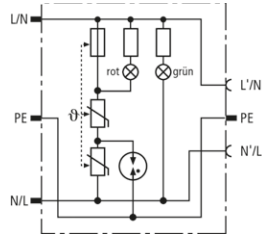
DEHNprotector

DPRO 230 (909 230)

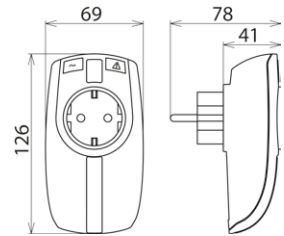
- Surge protection with monitoring device and disconnecter
- Visual operating state (green) and fault indication (red)
- Enhanced safety due to fault-proof Y protective circuit



Figure without obligation



Basic circuit diagram DPRO 230



Dimension drawing DPRO 230

Surge protective adapter with integrated child lock.

Type	DPRO 230
Part No.	909 230
SPD according to EN 61643-11 / IEC 61643-11	type 3 / class III
Nominal a.c. voltage (U_N)	230 V (50 / 60 Hz)
Max. continuous operating a.c. voltage (U_C)	255 V (50 / 60 Hz)
Nominal load current a.c. (I_L)	16 A
Nominal discharge current (8/20 μ s) (I_n)	3 kA
Total discharge current (8/20 μ s) [L+N-PE] (I_{total})	5 kA
Combination wave (U_{OC})	6 kV
Combination wave [L+N-PE] ($U_{OC total}$)	10 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	B 16 A
Short-circuit withstand capability for max. mains-side overcurrent protection (I_{SCCR})	1 kA _{rms}
Temporary overvoltage (TOV) [L-N] (U_T) – Characteristic	335 V / 5 sec. – withstand
Temporary overvoltage (TOV) [L-N] (U_T) – Characteristic	440 V / 120 min. – safe failure
Temporary overvoltage (TOV) [L/N-PE] (U_T) – Characteristic	335 V / 120 min. – withstand
Temporary overvoltage (TOV) [L/N-PE] (U_T) – Characteristic	440 V / 5 sec. – withstand
Temporary overvoltage (TOV) [L+N-PE] (U_T) – Characteristic	1200 V + U_{REF} / 200 ms – safe failure
Fault indication	red light
Operating state indication	green light
Number of ports	1
Operating temperature range (T_U)	-25 °C ... +40 °C
For mounting on	earthed socket outlets according to DIN 49440/DIN 49441
Enclosure material	thermoplastic, pure white, UL 94 V-2
Place of installation	indoor installation
Degree of protection	IP 20
Dimensions	126 x 69 x 41 mm
Weight	190 g
Customs tariff number	85363010
GTIN	4013364117686
PU	1 pc(s)

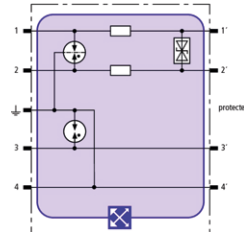
BLITZDUCTOR XT

BXT ML2 BD HFS 5 (920 271)

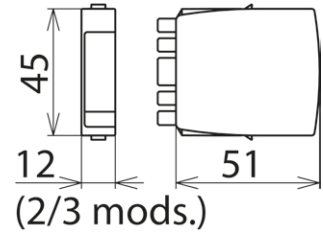
- LifeCheck SPD monitoring function
- Minimal signal interference
- For installation in conformity with the lightning protection zone concept at the boundaries from 0_A –2 and higher



Figure without obligation



Basic circuit diagram BXT ML2 BD HFS



Dimension drawing BXT ML2 BD HFS

Space-saving combined lightning current and surge arrester module with LifeCheck feature for protecting one pair of unearthed high-frequency bus systems or video transmission systems, with direct or indirect shield earthing. 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 ML2 BD HFS 5
Part No.	920 271
SPD monitoring system	LifeCheck
SPD class	TYPE 1P
Nominal voltage (U _N)	5 V
Max. continuous operating d.c. voltage (U _C)	6.0 V
Max. continuous operating a.c. voltage (U _C)	4.2 V
Nominal current at 45 °C (I _L)	1.0 A
D1 Total lightning impulse current (10/350 µs) (I _{imp})	9 kA
D1 Lightning impulse current (10/350 µs) per line (I _{imp})	2.5 kA
C2 Total nominal discharge current (8/20 µs) (I _n)	20 kA
C2 Nominal discharge current (8/20 µs) per line (I _n)	10 kA
Voltage protection level line-line for I _{imp} D1 (U _p)	≤ 25 V
Voltage protection level line-PG for I _{imp} D1 (U _p)	≤ 550 V
Voltage protection level line-line at 1 kV/µs C3 (U _p)	≤ 11 V
Voltage protection level line-PG at 1 kV/µs C3 (U _p)	≤ 550 V
Series resistance per line	1.0 ohm(s)
Cut-off frequency line-line (f _G)	100.0 MHz
Capacitance line-line (C)	≤ 25 pF
Capacitance line-PG (C)	≤ 25 pF
Operating temperature range (T _U)	-40 °C ... +80 °C
Degree of protection (plugged-in)	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
SIL classification	up to SIL3 ^{*)}
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
Approvals	CSA, UL, GOST, VdS
Weight	22 g
Customs tariff number	85363010
GTIN	4013364117556
PU	1 pc(s)

^{*)} For more detailed information, please visit www.dehn-international.com.

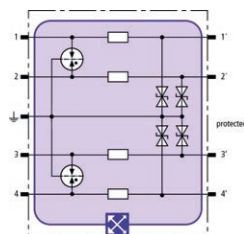
BLITZDUCTOR XT

BXT ML4 BE 180 (920 327)

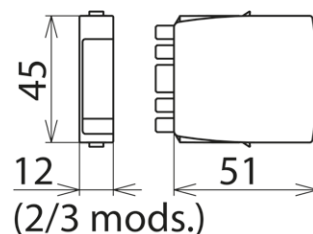
- LifeCheck SPD monitoring function
- Optimal protection of four single lines
- For installation in conformity with the lightning protection zone concept at the boundaries from 0_A – 2 and higher



Figure without obligation



Basic circuit diagram BXT ML4 BE 180



Dimension drawing BXT ML4 BE 180

Space-saving combined lightning current and surge arrester module with LifeCheck feature for protecting four single lines sharing a common reference potential as well as unbalanced 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 BE 180
Part No.	920 327
SPD monitoring system	LifeCheck
SPD class	TYPE 1P2
Nominal voltage (U _N)	180 V
Max. continuous operating d.c. voltage (U _C)	180 V
Max. continuous operating a.c. voltage (U _C)	127 V
Nominal current at 45 °C (I _N)	1.0 A
D1 Total lightning impulse current (10/350 μs) (I _{imp})	10 kA
D1 Lightning impulse current (10/350 μs) per line (I _{imp})	2.5 kA
C2 Total nominal discharge current (8/20 μs) (I _n)	20 kA
C2 Nominal discharge current (8/20 μs) per line (I _n)	10 kA
Voltage protection level line-line for I _{imp} D1 (U _p)	≤ 520 V
Voltage protection level line-PG for I _{imp} D1 (U _p)	≤ 300 V
Voltage protection level line-line at 1 kV/μs C3 (U _p)	≤ 500 V
Voltage protection level line-PG at 1 kV/μs C3 (U _p)	≤ 250 V
Series resistance per line	1.0 ohm(s)
Cut-off frequency line-PG (f _c)	25.0 MHz
Capacitance line-line (C)	≤ 120 pF
Capacitance line-PG (C)	≤ 240 pF
Operating temperature range (T _U)	-40 °C ... +80 °C
Degree of protection (plugged-in)	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
SIL classification	up to SIL3 ^{*)}
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
Approvals	CSA, VdS, UL, GOST
Weight	24 g
Customs tariff number	85363010
GTIN	4013364109087
PU	1 pc(s)

^{*)} For more detailed information, please visit www.dehn-international.com.

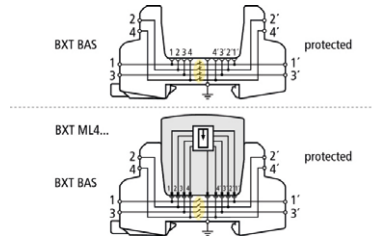
BLITZDUCTOR XT

BXT BAS (920 300)

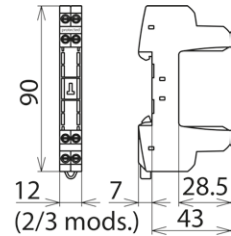
- Four-pole version for universal use with all types of BSP and BXT / BXTU protection modules
- No signal interruption if the protection module is removed
- Universal design without protection elements



Figure without obligation



Basic circuit diagram with and without plugged-in module



Dimension drawing BXT BAS

The BLITZDUCTOR XT base part is a very space-saving and universal four-pole feed-through terminal for the insertion of a protection module without signal interruption 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, only the protection modules must be maintained.

Type Part No.	BXT BAS 920 300
Operating temperature range (T _U)	-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 ²
Cross-sectional area, flexible	0.08-2.5 mm ²
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 ^{*)}
IECEx approvals	DEK 11.0032X: Ex nA IIC T4 Gc ^{*)}
Approvals	CSA, VdS, UL, GOST
Weight	34 g
Customs tariff number	85369010
GTIN	4013364109179
PU	1 pc(s)

^{*)} only in connection with an approved protection module

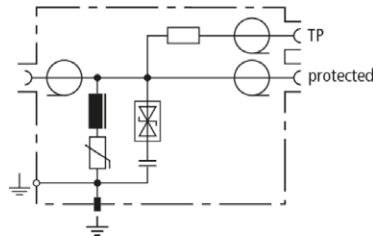
DEHNgate

DGA FF TV (909 703)

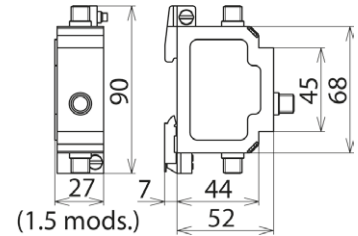
- Frequency range for analogue and digital TV, also suitable for reverse LAN channels
- Arresters of type FF and GFF with integrated measuring output
- Three types for adapted use in conformity with the lightning protection zone concept at the boundaries from 0_A –2 (combined lightning current and surge 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 [P]
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})	0.2 kA
C2 Nominal discharge current (8/20 μs) (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/μs 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)

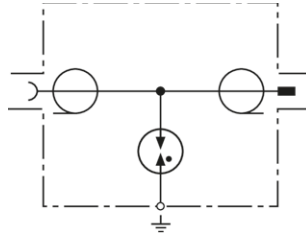
DEHNgate

DGA G BNC (929 042)

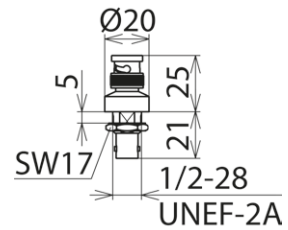
- Compact dimensions
- Extremely wide transmission range
- For installation in conformity with the lightning protection zone concept at the boundaries from $0_B - 1$ and higher



Figure without obligation



Basic circuit diagram DGA G BNC



Dimension drawing DGA G BNC

Surge arrester for remote power supply with integrated gas discharge tube. Ideally suited for wireless applications for the coaxial interfaces of devices and antennas.

Available with SMA, BNC or N connection for bushing installation.

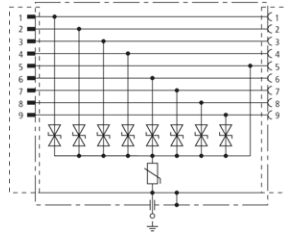
Type Part No.	DGA G BNC 929 042
SPD class	TYPE 2
Max. continuous operating d.c. voltage (U_c)	135 V
Nominal current (I_n)	3.5 A
Max. transmission capacity	25 W
D1 Lightning impulse current (10/350 μ s) (I_{imp})	1 kA
C2 Nominal discharge current (8/20 μ s) (I_n)	5 kA
Voltage protection level for I_n C2 (U_p)	≤ 650 V
Frequency range	0-4 GHz
Insertion loss	≤ 0.2 dB
Return loss (d.c. - 3 GHz)	≥ 20 dB
Return loss (3 GHz-4 GHz)	≥ 20 dB
Characteristic impedance (Z)	50 ohms
Operating temperature range (T_u)	-40 °C ... +85 °C
Degree of protection (if lines are connected)	IP 20
Connection	BNC socket / BNC plug
Earthing via	bushing (Ø12.9 mm)
Enclosure material	brass, gold-plated
Colour	gold
Test standards	IEC 61643-21 / EN 61643-21
Approvals	GOST
Weight	39 g
Customs tariff number	85366910
GTIN	4013364091030
PU	1 pc(s)

FS

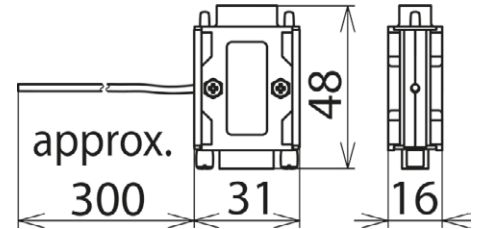
FS 9E HS 12 (924 019)



Figure without obligation



Basic circuit diagram FS 9E HS 12



Dimension drawing FS 9E HS 12

Type Part No.	FS 9E HS 12 924 019
SPD class	TYPE 4P
Nominal voltage (U_N)	12 V
Max. continuous operating d.c. voltage (U_c)	15 V
C1 Nominal discharge current (8/20 μ s) line-SG (I_n)	0.1 kA
C1 Nominal discharge current (8/20 μ s) SG-PG (I_n)	0.1 kA
Voltage protection level line-SG for I_n C1 (U_p)	≤ 24 V
Voltage protection level SG-PG for I_n C1 (U_p)	≤ 200 V
Voltage protection level line-SG at 1 kV/ μ s C3 (U_p)	≤ 21 V
Voltage protection level SG-PG at 1 kV/ μ s C3 (U_p)	≤ 130 V
Cut-off frequency (f_c)	10 MHz
Capacitance line-SG (C)	700 pF
Capacitance SG-PG (C)	350 pF
Operating temperature range (T_U)	-40 °C ... +80 °C
Degree of protection	IP 40
For mounting on	SUB-D (2 threaded screws 4/40 UNC)
Connection (input / output)	SUB-D 9 plug / SUB-D 9 socket
Pinning	line: 1/2/3/4/6/7/8/9, SG: 5
Earthing via	outgoing earthing conductor (0.75 mm ²)
Length of the connecting line	300 mm (PG)
Enclosure material	plastic, metallised
Colour	silver
Test standards	IEC 61643-21 / EN 61643-21
Approvals	GOST
Weight	33 g
Customs tariff number	85363010
GTIN	4013364058590
PU	1 pc(s)



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

DEHN + SÖHNE
GmbH + Co.KG.

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