



Surge protection for smoke and heat venting systems

White Paper



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In the event of a fire it is only possible to leave the building safely if the escape routes are free from smoke because smoke leads to a loss of orientation and breathing problems. Smoke and heat extraction systems are equipped with both manual call points and automatic detectors which register the development of smoke and heat and extract it from the escape route via electromechanically or pneumatically driven windows or domelights. In addition to this main function, these controllable windows or domelights are also used for ventilation. For this purpose, additional switching devices are available which are capable of issuing switching commands of lower importance. Since the availability of smoke and heat extraction systems must be ensured even during a power cut, the fire control panels are equipped with accumulators which supply the smoke alarm system. As a result, the actuators of the windows and domelights are dimensioned for DC operation.

The surge protective devices in the examples described below are dimensioned based on a voltage of 24 V DC which is usual in this industry. We will also look at the domelights of the smoke and heat extraction systems which are driven electro-mechanically with a maximum nominal current of less than 1.8 A or 4 A DC.

Structure with a non-metal roof and external lightning protection system

Embedded or protruding roof-mounted structures on structures with an external lightning protection system must be located in the protected volume of air-termination systems as per IEC 62305-3 (EN 62305-3) under consideration of the separation distance s if the following limit values are exceeded:

Embedded or protruding metal roof-mounted structures:

- ➔ Height above roof level: 0.3 m
- ➔ Total area of the roof-mounted structure: 1.0 m²
- ➔ Length of the roof-mounted structure: 2.0 m

Embedded or protruding non-metal roof-mounted structures:

- ➔ Height above the air-termination system: 0.5 m

Due to the above requirements, domelights of a certain size need to be protected against lightning strikes. If air-termination rods are installed, the domelights are located in LPZ 0_B which means that no lightning current is injected into the equipment installed in this zone (**Figure 1**). A surge arrester fulfils its purpose in this zone by preventing inductive coupling.

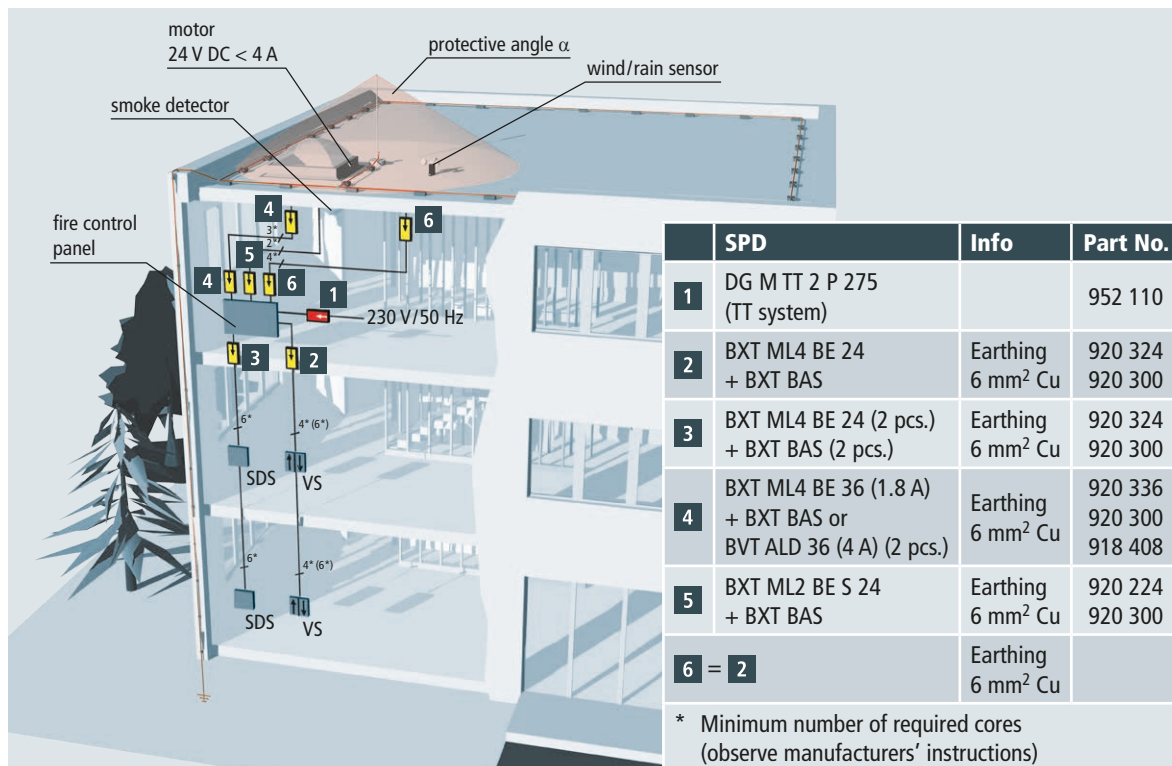


Figure 1 Domelight located in the protected volume of an air-termination rod on a non-metal roof of a structure with external lightning protection system

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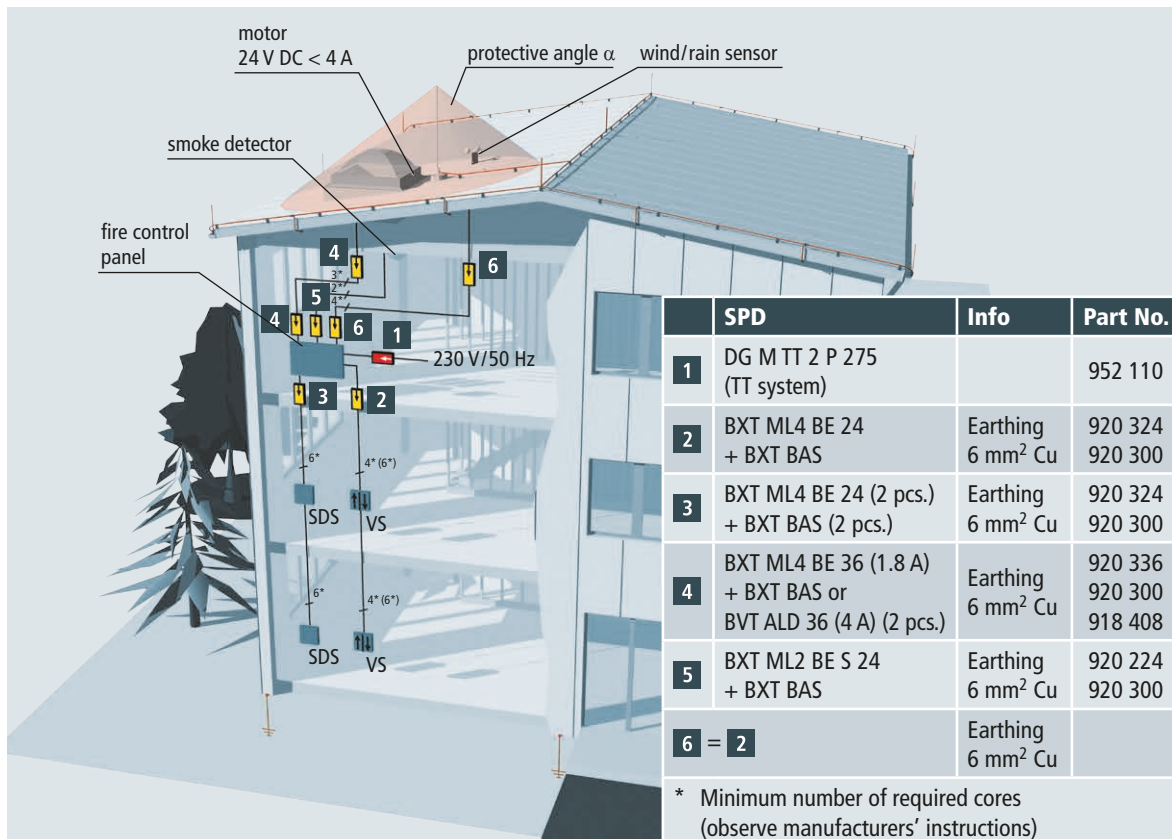


Figure 2 Domelight located in the protected volume of an air-termination rod on a metal roof of a structure with metal down conductor (steel frame, interconnected reinforced concrete or earthed metal facade)

Structure with a metal roof and external lightning protection system

In contrast to structures with non-metal roofs and an external lightning protection system, there are several ways of using a metal roof as an air-termination system:

1. The metal roof can be used as a natural air-termination system if the manufacturer confirms that it suited for this purpose (DIN EN 62305-3, Supplement 4).
2. The metal roof does not have the required thickness t' (IEC 62305-3 (EN 62305-3), Table 3) and must be protected against direct lightning strikes by means of air-termination systems because if it were perforated by lightning it could set fire to the highly flammable materials (or wooden boards) underneath the tin roof and the roof would no longer be water-tight. The air-termination systems must be interconnected by means of lightning current carrying conductors if there is no other lightning current carrying connection (e.g., tested terminals, brazing, welding, squeezing, seaming, screwing or riveting).

3. The metal roof has the required thickness t (IEC 62305-3 (EN 62305-3), Table 3)

There are two types of down conductors for the different types of metal roof described above:

- A. The walls consist of an interconnected lightning current carrying steel reinforcement or a steel frame construction. The steel reinforcement has to be equipped with a functional bonding conductor in a grid of 5 m x 5 m, which is connected with the reinforcement at intervals of 2 m (max. mesh size of the reinforcement: 0.2 m x 0.2 m). This measure is necessary for all walls and ceilings (except the base plate). In these cases, the separation distance need not be considered since either the current is very low due to the large number of current paths (reinforcements) or there is no danger of puncturing other metal systems due to the low inductance (steel beams). Metal façades which are connected to the earth-termination system at intervals of 5 m at the lowest point (ground) also meet the requirements described above.

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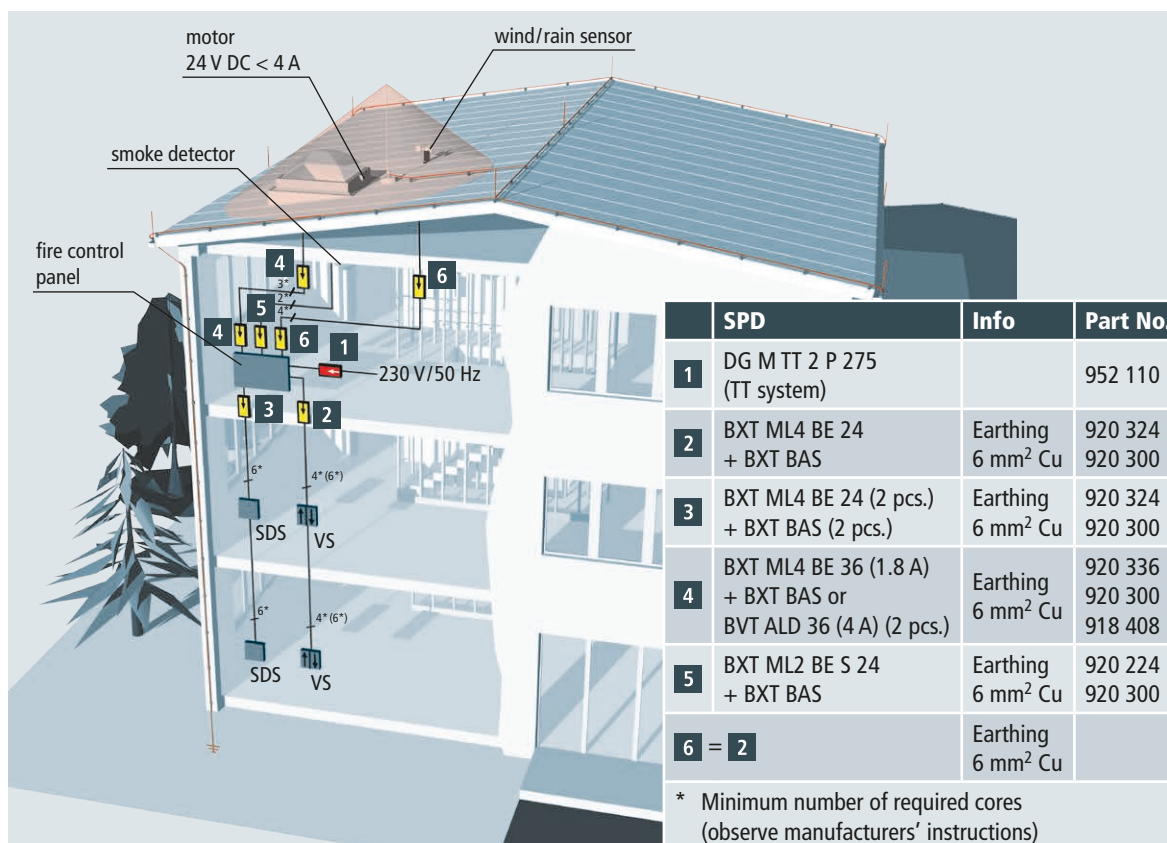


Figure 3 Domelight located in the protected volume of an air-termination rod on a metal roof of a structure equipped with conventional arresters

B. The walls consist of non-conductive material (bricks, wood, etc.) and the down conductors are connected to the earth-termination system at the intervals required by the class of LPS.

Air-termination systems should be installed to prevent lightning strikes to the domelights. However, the latter are not located in LPZ 0_B since the air-termination systems directly conduct the lightning current to the metal roof. Installation of a lightning current arrester is therefore recommended (Figure 2).

A structure with a metal roof and conventional down conductors is regarded as being critical (Figure 3). In case of a lightning strike, the lightning current will be evenly distributed between the down conductors. Nevertheless, it is still neces-

sary to keep the required separation distance. In this type of structure, too, an air-termination system should be installed to prevent direct lightning strikes, but it does not put the domelight of the smoke and heat extraction system in LPZ 0_B here either. Consequently, a lightning current arrester is required here, too.

Structure without external lightning protection system

No distinction need be made between metal or non-metal roofs since every direct lightning strike to the structure presents a fire hazard. Lightning current arresters are not capable of coping with direct lightning strikes to the domelights. Therefore, surge arresters must be installed to protect the structure from inductive coupling (Figure 4).

Surge protection for smoke and heat venting systems

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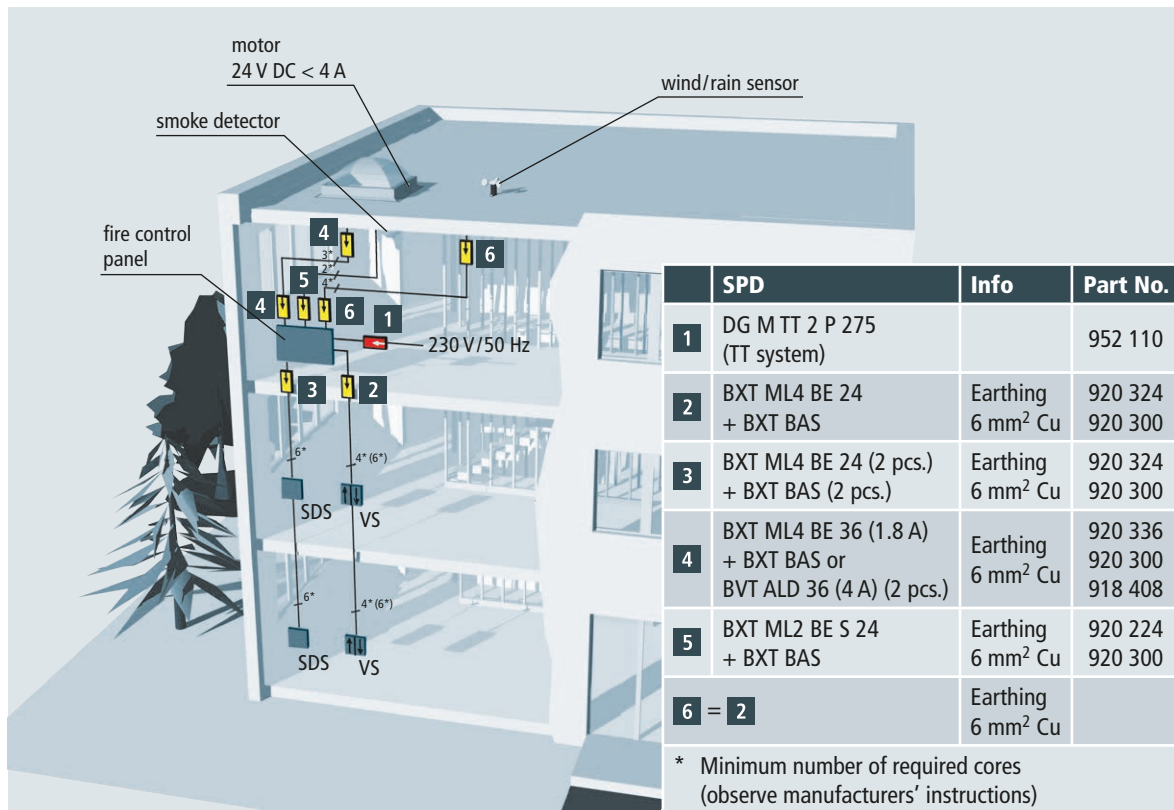


Figure 4 Domelight located on a non-metal roof of a structure without external lightning protection system

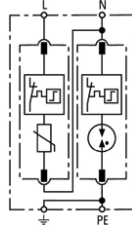
DEHNguard

DG M TT 2P 275 (952 110)

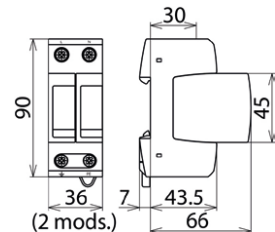
- Prewired complete unit consisting of a base part and plug-in protection modules
- High discharge capacity due to heavy-duty zinc oxide varistors / spark gaps
- High reliability due to "Thermo Dynamic Control" SPD monitoring device



Figure without obligation



Basic circuit diagram DG M TT 2P 275



Dimension drawing DG M TT 2P 275

Modular surge arrester for use in single-phase TT and TN systems (1+1 configuration).

Type	DG M TT 2P 275
Part No.	952 110
SPD according to EN 61643-11 / IEC 61643-11	type 2 / class II
Energy coordination with terminal equipment (≤ 10 m)	type 2 + type 3
Nominal voltage (a.c.) (U_N)	230 V (50 / 60 Hz)
Max. continuous operating voltage (a.c.) [L-N] (U_C)	275 V (50 / 60 Hz)
Max. continuous operating voltage (a.c.) [N-PE] (U_C)	255 V (50 / 60 Hz)
Nominal discharge current (8/20 μ s) (I_n)	20 kA
Max. discharge current (8/20 μ s) (I_{max})	40 kA
Lightning impulse current (10/350 μ s) [N-PE] (I_{imp})	12 kA
Voltage protection level [L-N]/[N-PE] (U_P)	≤ 1.5 / ≤ 1.5 kV
Voltage protection level [L-N] / [N-PE] at 5 kA (U_P)	≤ 1 / ≤ 1.5 kV
Follow current extinguishing capability [N-PE] (I_f)	100 A _{rms}
Response time [L-N] (t_A)	≤ 25 ns
Response time [N-PE] (t_A)	≤ 100 ns
Max. mains-side overcurrent protection	125 A gG
Short-circuit withstand capability for max. mains-side overcurrent protection (I_{SCCR})	50 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) [N-PE] (U_T) – Characteristic	1200 V / 200 ms – withstand
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 ² solid / flexible
Cross-sectional area (max.)	35 mm ² stranded / 25 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	2 module(s), DIN 43880
Approvals	KEMA, VDE, UL
Extended technical data:	-----
Voltage protection level [L-PE] (U_P)	1.5 kV
Weight	242 g
Customs tariff number (Comb. Nomenclature EU)	85363030
GTIN	4013364108417
PU	1 pc(s)

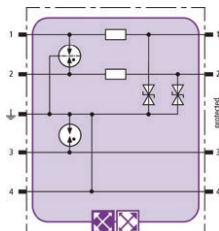
BLITZDUCTOR XT

BXT ML2 BE S 24 (920 224)

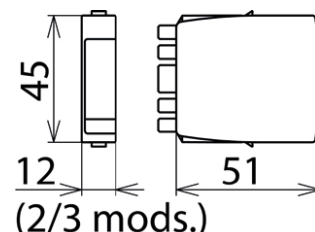
- LifeCheck SPD monitoring function
- Optimal protection of two single lines and the cable shield
- For use in conformity with the lightning protection zone concept at the boundaries from $0_A -2$ and higher



Figure without obligation



Basic circuit diagram BXT ML2 BE S 24



Dimension drawing BXT ML2 BE S 24

Space-saving combined lightning current and surge arrester module with LifeCheck feature for protecting two single lines sharing a common reference potential as well as unbalanced interfaces, 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 BE S 24
Part No.	920 224
SPD monitoring system	LifeCheck
SPD class	TYPE 1 PD
Nominal voltage (U_N)	24 V
Max. continuous operating voltage (d.c.) (U_c)	33 V
Max. continuous operating voltage (a.c.) (U_c)	23.3 V
Nominal current at 45 °C (I_L)	0.75 A
D1 Total lightning impulse current (10/350 μ s) (I_{imp})	9 kA
D1 Lightning impulse current (10/350 μ s) per line (I_{imp})	2.5 kA
C2 Total nominal discharge current (8/20 μ s) (I_n)	20 kA
C2 Nominal discharge current (8/20 μ s) per line (I_n)	10 kA
Voltage protection level line-line for I_{imp} D1 (U_p)	≤ 102 V
Voltage protection level line-PG for I_{imp} D1 (U_p)	≤ 66 V
Voltage protection level line-line at 1 kV/ μ s C3 (U_p)	≤ 90 V
Voltage protection level line-PG at 1 kV/ μ s C3 (U_p)	≤ 45 V
Series resistance per line	1.8 ohm(s)
Cut-off frequency line-PG (f_c)	6.8 MHz
Capacitance line-line (C)	≤ 0.5 nF
Capacitance line-PG (C)	≤ 1.0 nF
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, EAC, ATEX, IECEx, CSA & USA Hazloc, SIL
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
Weight	37 g
Customs tariff number (Comb. Nomenclature EU)	85363010
GTIN	4013364117785
PU	1 pc(s)

*For more detailed information, please visit www.dehn-international.com.

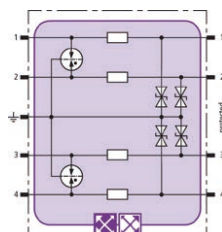
BLITZDUCTOR XT

BXT ML4 BE 24 (920 324)

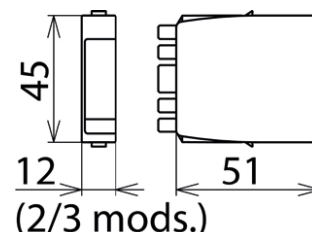
- LifeCheck SPD monitoring function
- Optimal protection of four single lines
- For installation in conformity with the lightning protection zone concept at the boundaries from $0_A - 2$ and higher



Figure without obligation



Basic circuit diagram BXT ML4 BE 24



Dimension drawing BXT ML4 BE 24

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 24
Part No.	920 324
SPD monitoring system	LifeCheck
SPD class	TYPE 1 PE
Nominal voltage (U_N)	24 V
Max. continuous operating voltage (d.c.) (U_c)	33 V
Max. continuous operating voltage (a.c.) (U_c)	23.3 V
Nominal current at 45 °C (I_L)	0.75 A
D1 Total lightning impulse current (10/350 μ s) (I_{imp})	10 kA
D1 Lightning impulse current (10/350 μ s) per line (I_{imp})	2.5 kA
C2 Total nominal discharge current (8/20 μ s) (I_n)	20 kA
C2 Nominal discharge current (8/20 μ s) per line (I_n)	10 kA
Voltage protection level line-line for I_{imp} D1 (U_p)	≤ 102 V
Voltage protection level line-PG for I_{imp} D1 (U_p)	≤ 66 V
Voltage protection level line-line at 1 kV/ μ s C3 (U_p)	≤ 90 V
Voltage protection level line-PG at 1 kV/ μ s C3 (U_p)	≤ 45 V
Series resistance per line	1.8 ohm(s)
Cut-off frequency line-PG (f_c)	6.8 MHz
Capacitance line-line (C)	≤ 0.5 nF
Capacitance line-PG (C)	≤ 1.0 nF
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 ^{*)}
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	38 g
Customs tariff number (Comb. Nomenclature EU)	85363010
GTIN	4013364109056
PU	1 pc(s)

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

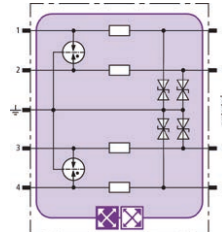
BLITZDUCTOR XT

BXT ML4 BE 36 (920 336)

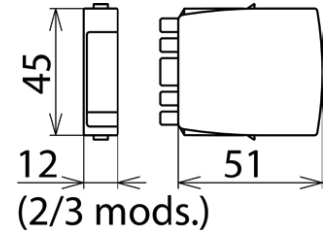
- LifeCheck SPD monitoring function
- Optimal protection of four single lines
- For installation in conformity with the lightning protection zone concept at the boundaries from $0_A - 2$ and higher



Figure without obligation



Basic circuit diagram BXT ML4 BE 36



Dimension drawing BXT ML4 BE 36

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 36
Part No.	920 336
SPD monitoring system	LifeCheck
SPD class	TYPE 1 PI
Nominal voltage (U_N)	36 V
Max. continuous operating voltage (d.c.) (U_c)	45 V
Max. continuous operating voltage (a.c.) (U_c)	31 V
Nominal current at 45 °C (I_L)	1.8 A
D1 Total lightning impulse current (10/350 μ s) (I_{imp})	10 kA
D1 Lightning impulse current (10/350 μ s) per line (I_{imp})	2.5 kA
C2 Total nominal discharge current (8/20 μ s) (I_n)	20 kA
C2 Nominal discharge current (8/20 μ s) per line (I_n)	10 kA
Voltage protection level line-line for I_{imp} D1 (U_p)	≤ 140 V
Voltage protection level line-PG for I_{imp} D1 (U_p)	≤ 85 V
Voltage protection level line-line at 1 kV/ μ s C3 (U_p)	≤ 112 V
Voltage protection level line-PG at 1 kV/ μ s C3 (U_p)	≤ 56 V
Series resistance per line	0.43 ohm(s)
Cut-off frequency line-PG (f_c)	3.8 MHz
Capacitance line-line (C)	≤ 0.8 nF
Capacitance line-PG (C)	≤ 1.6 nF
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
Approvals	UL, EAC, ATEX, IECEx, CSA & USA Hazloc, SIL
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
Weight	40 g
Customs tariff number (Comb. Nomenclature EU)	85363010
GTIN	4013364118539
PU	1 pc(s)

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

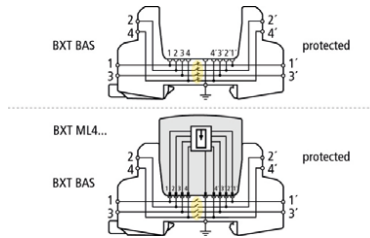
BLITZDUCTOR XT

BXT BAS (920 300)

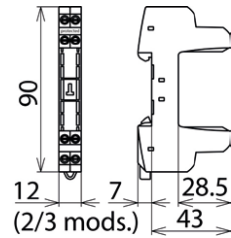
- Four-pole version for universal use with all types of BSP and BXT / BXTU protection modules
- No signal interruption if the protection module is removed
- Universal design without protection elements



Figure without obligation



Basic circuit diagram with and without plugged-in module



Dimension drawing BXT BAS

The BLITZDUCTOR XT base part is 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	BXT BAS
Part No.	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, UL, EAC, ATEX, IECEx ^{*)}
Weight	34 g
Customs tariff number (Comb. Nomenclature EU)	85369010
GTIN	4013364109179
PU	1 pc(s)

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

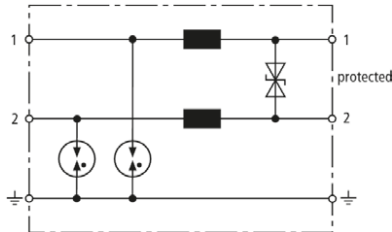
BLITZDUCTOR VT

BVT ALD 36 (918 408)

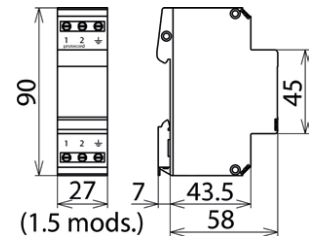
- For d.c. supply systems up to nominal currents of 7 A
- Low voltage protection level
- For installation in conformity with the lightning protection zone concept at the boundaries from $0_A -2$ and higher



Figure without obligation



Basic circuit diagram BVT ALD 36



Dimension drawing BVT ALD 36

Energy-coordinated, DIN rail mounted combined lightning current and surge arrester for protecting unearthed d.c. power supply systems.

Type	BVT ALD 36
Part No.	918 408
SPD class	TYPE 1 Pt
Nominal voltage (d.c.) (U_N)	36 V
Max. continuous operating voltage (d.c.) (U_C)	45 V
Nominal current at 80 °C (I_L)	4 A
Nominal current at 45 °C (I_L)	7 A
D1 Lightning impulse current (10/350 μ s) per line (I_{imp})	2.5 kA
D1 Total lightning impulse current (10/350 μ s) (I_{imp})	5 kA
C2 Nominal discharge current (8/20 μ s) per line (I_n)	10 kA
C2 Total nominal discharge current (8/20 μ s) (I_n)	20 kA
Voltage protection line-line for I_n C2 (U_p)	≤ 80 V
Voltage protection level line-PG for I_n C2 (U_p)	≤ 1000 V
Voltage protection level line-line at 1 kV/ μ s C3 (U_p)	≤ 60 V
Voltage protection level line-PG at 1 kV/ μ s C3 (U_p)	≤ 650 V
Series resistance per line	22 μ H
Capacitance line-line (C)	≤ 1.5 pF
Capacitance line-PG (C)	≤ 100 pF
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
Cross-sectional area, solid	0.5-6.0 mm ²
Cross-sectional area, flexible	0.5-4.0 mm ²
Tightening torque (terminals)	0.8 Nm
Earthing via	screw terminal
Enclosure material	thermoplastic, UL 94 V-0
Colour	yellow
Test standards	IEC 61643-21 / EN 61643-21
Approvals	UL, EAC
Weight	110 g
Customs tariff number (Comb. Nomenclature EU)	85363010
GTIN	4013364125292
PU	1 pc(s)

Surge Protection
Lightning Protection
Safety Equipment
DEHN protects.

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