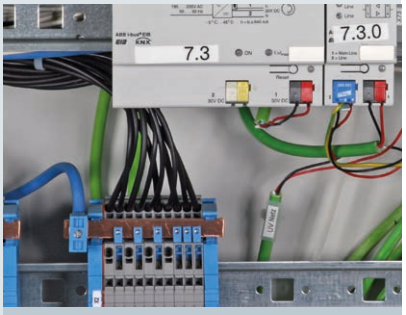
Surge protection for KNX systems

White Paper



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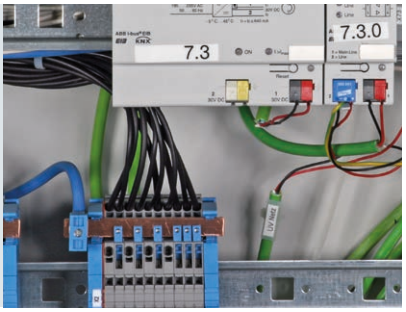

Electrical installations in buildings with complex operator control units, displays and control devices are frequently equipped with an installation bus system. The EIB (European Installation Bus), developed at the beginning of the 1990s, is a widely used installation bus system and is today still the core of the KNX system which is the world's first open standard described in the European standard EN 50090.
The advantage of the KNX standard is the universal interoperability between different devices independent of the manufacturer. Thus, the values of a wind and rain sensor or a temperature and sun sensor can be processed in different building systems. Lighting systems can be switched on or off as needed depending on the light level and different lighting scenarios can be programmed. Consumption values can be recorded and used for load management. These are only some of the many applications where KNX systems can be used. In addition to these advantages, the installation time and expense of such systems can be considerably reduced.

The smallest installation unit in the bus topology is a line. It consists of a maximum of 64 devices. If more than 64 bus devices are required, up to 15 lines can branch off from each main line via line couplers. The area line connects a maximum of 15 area couplers to each other (**Figure 1**).

The KNX bus is supplied with a safety extra-low voltage (SELV) of max. 29 V. The cable length within a line segment and the length of the bus cable between two devices is limited. In case of a maximum length of 1000 m per line segment, KNX systems may be destroyed by coupling despite their high dielectric strength.

Moreover, it must be observed that no induction loops are formed when installing the cables (**Figure 2**). Therefore, the bus and low-voltage cables leading to the bus devices must be installed close to each other.
Loops are also formed if a metal construction or pipe is connected to the main earthing busbar (**Figure 3**). Here too, it is advisable to install the cables as closely as possible to the construction or pipe.

Structure with an external lightning protection system

The standard calls for lightning equipotential bonding, therefore all cables at the zone transition from LPZ 0_A to 1 must be protected by lightning current arresters. Since the electromagnetic field inside a structure with an external lightning protection system is higher in case of a direct lightning strike than in case of a remote lightning strike, such structures must be equipped with surge arresters (**Figure 4**).

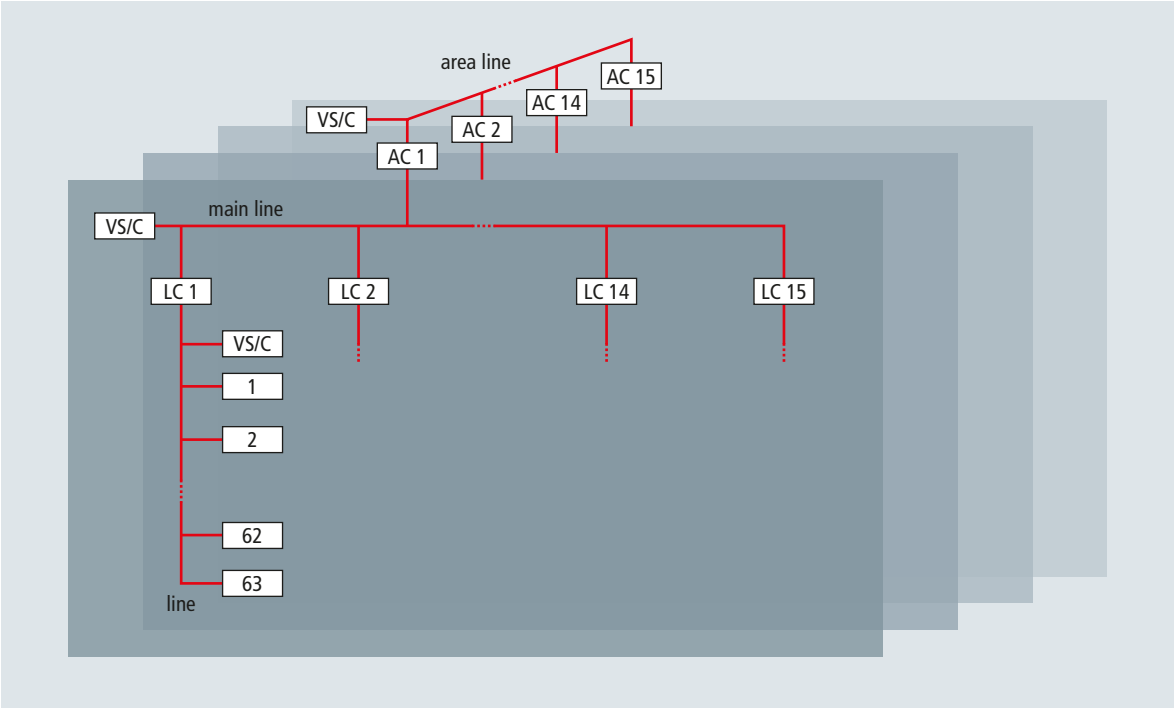

Figure 1 KNX bus topology

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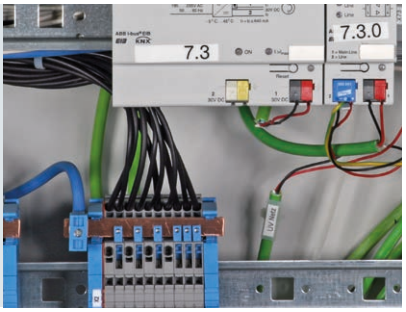


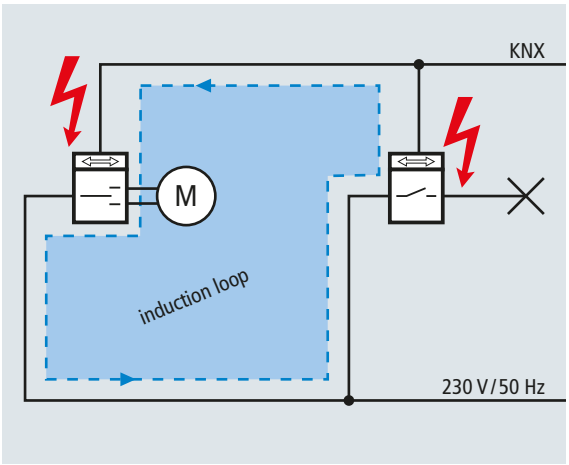


Figure 2 Induction loop formed by two KNX bus devices supplied with low voltage

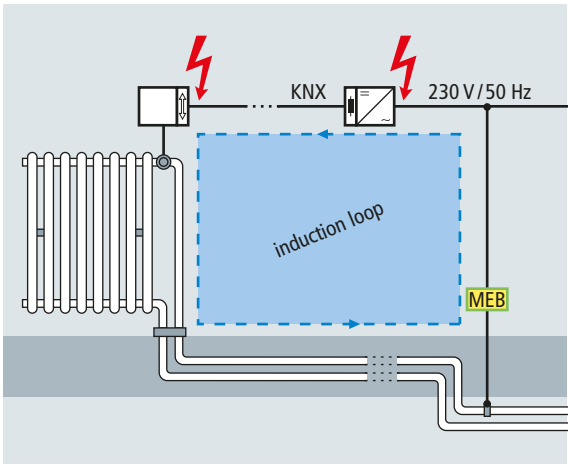
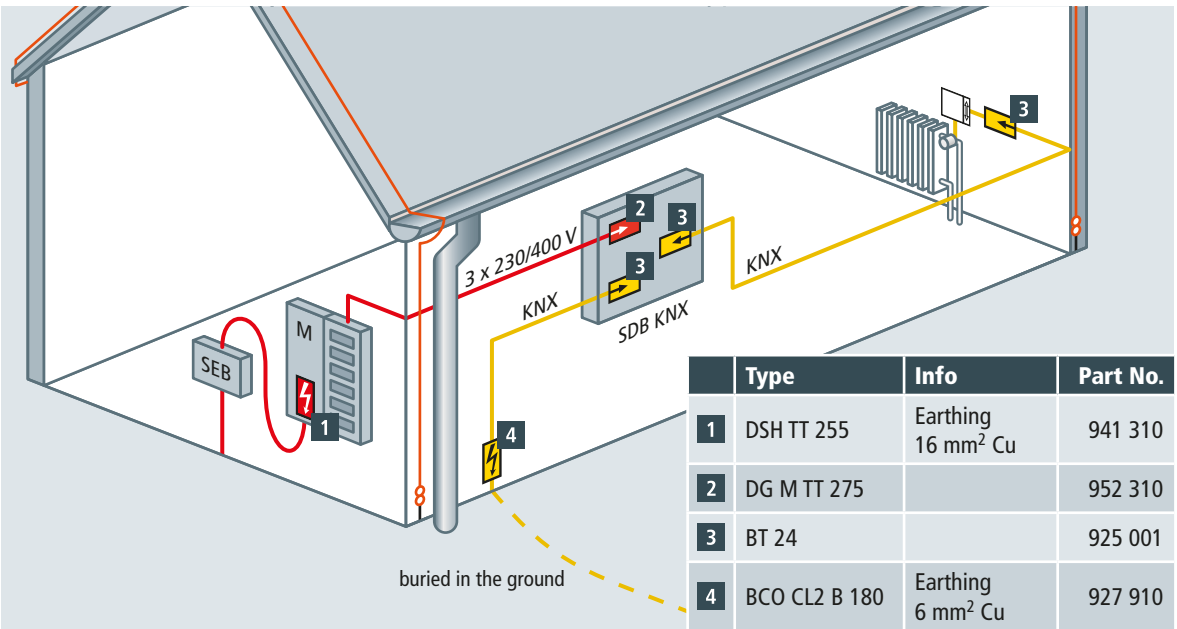


Figure 3 Induction loop formed by one KNX bus device installed at a metal construction or pipe



	Type	Info	Part No.
1	DSH TT 255	Earthing 16 mm² Cu	941 310
2	DG M TT 275		952 310
3	BT 24		925 001
4	BCO CL2 B 180	Earthing 6 mm² Cu	927 910

Figure 4 Lightning equipotential bonding at the entrance point of the KNX bus cable into the building and surge protective devices installed at the distribution board of the KNX system and at the actuator of the heater

If the bus cable is routed between different buildings in a lightning current carrying and shielded duct/metal pipe that is earthed on both ends, lightning equipotential bonding does not have to be established for the KNX cable extending beyond the buildings and it is sufficient to install surge arresters (**Figure 5**).

Structure without an external lightning protection system

Regarding the risk of lightning strikes to the low-voltage overhead line, lightning current carrying combined arresters should be installed to protect the incoming power cable at the point where it enters the building. It is advisable to install

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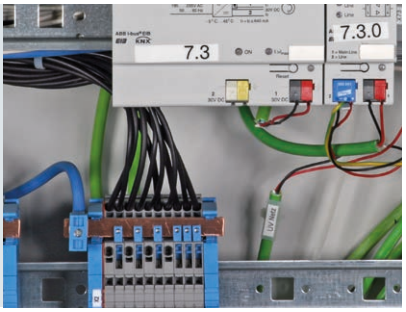
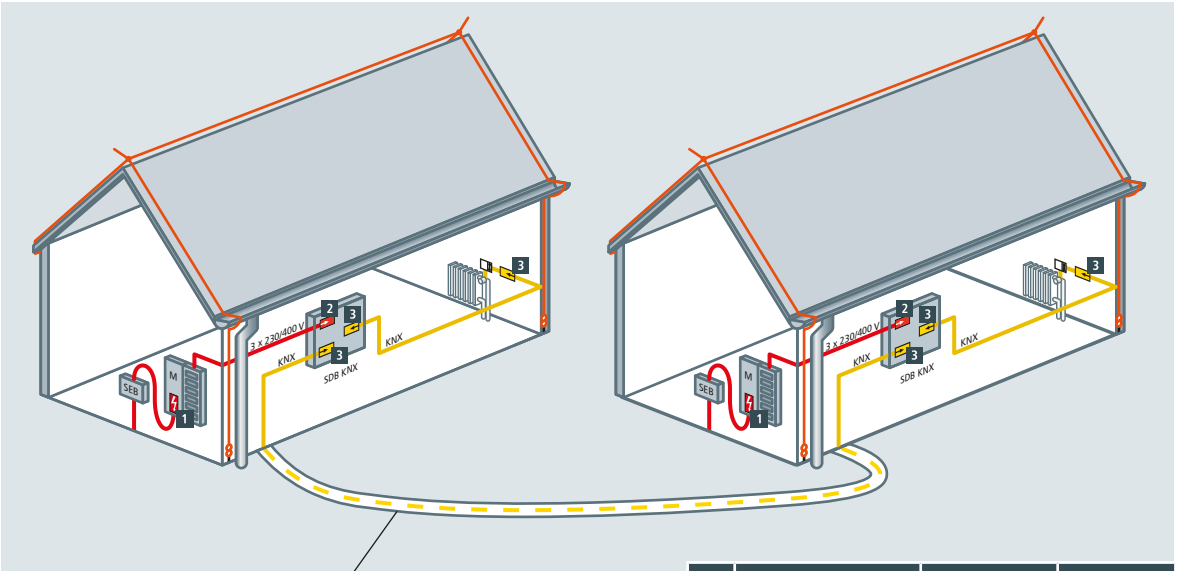
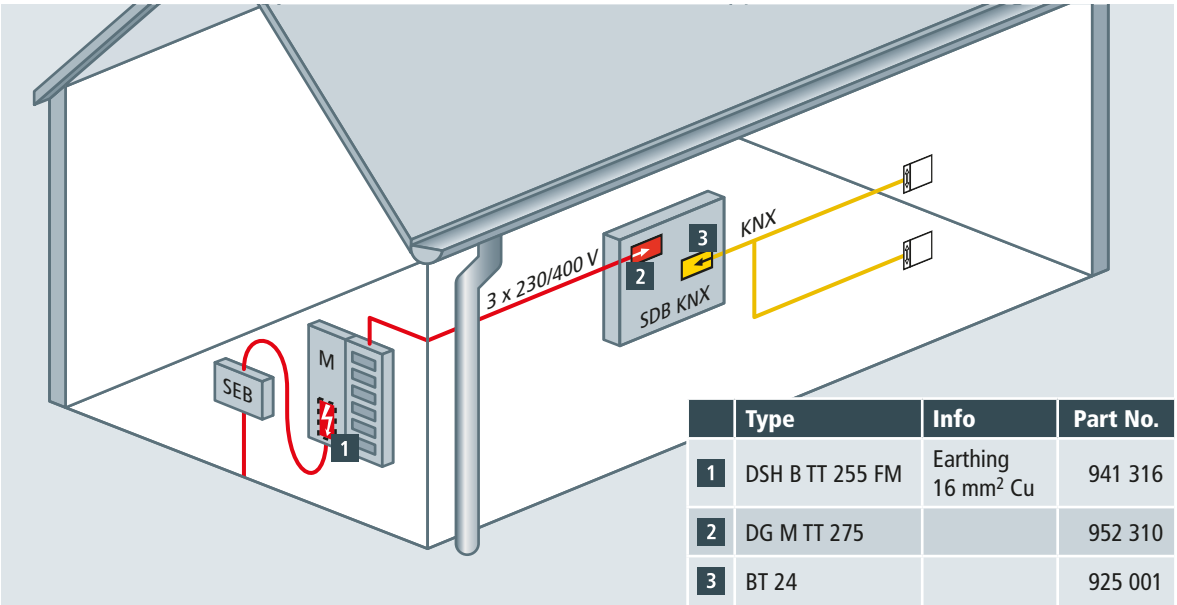




	Type	Info	Part No.
1	DSH TT 255	Earthing 16 mm² Cu	941 310
2	DG M TT 275		952 310
3	BT 24		925 001

Figure 5 Lightning equipotential bonding is not required for the KNX cable due to zone expansion



	Type	Info	Part No.
1	DSH B TT 255 FM	Earthing 16 mm² Cu	941 316
2	DG M TT 275		952 310
3	BT 24		925 001

Figure 6 Lightning current arresters installed in the main power supply system and surge arresters installed at the distribution board of the KNX system

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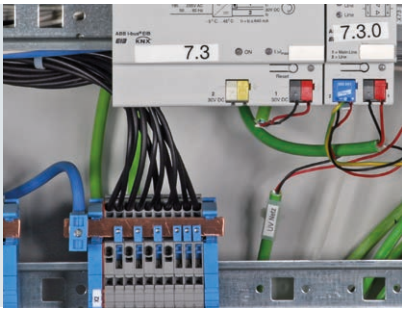
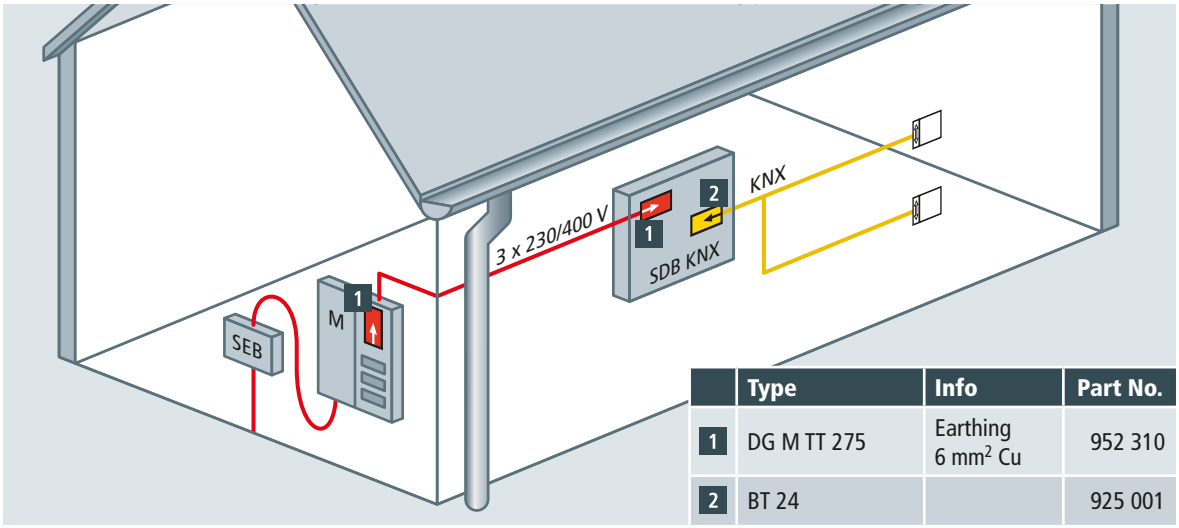




	Type	Info	Part No.
1	DG M TT 275	Earthing 6 mm² Cu	952 310
2	BT 24		925 001

Figure 7 Surge protective devices installed at the main distribution board and at the distribution board of the KNX system

surge protective devices at the distribution board of the KNX system (**Figure 6**).
If the power supply of the building is provided via buried cables, surge protection is always required downstream of the meter and recommended at the distribution board of the KNX system, regardless of the point of strike (**Figure 7**).

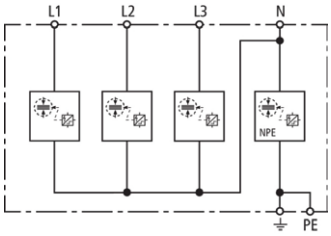
Due to the high dielectric strength of the bus cable, it is unlikely that short bus cables with isolated sensors (e.g. in a socket outlet combination without earthed installation devices) will be destroyed. In this case, it is not necessary to install surge arresters directly at the bus devices (**Figures 6 and 7**).

DEHNshield

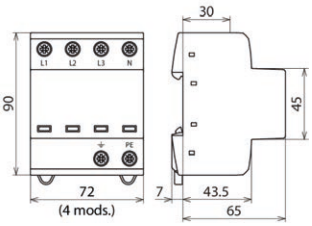
DSH TT 255 (941 310)

- Application-optimised and prewired spark-gap-based type 1 and type 2 combined lightning current and surge arrester
- Compact design due to space-saving spark gap technology with a width of only 1 module / pole
- Allows compact lightning equipotential bonding including protection of terminal equipment

Figure without obligation



Basic circuit diagram DSH TT 255



Dimension drawing DSH TT 255

Application-optimised and prewired combined lightning current and surge arrester for TT and TN-S systems (3+1 configuration).

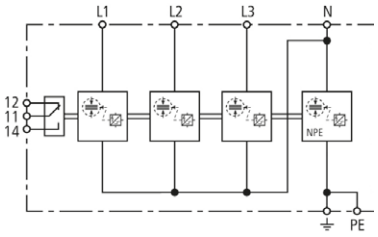
Type Part No.	DSH TT 255 941 310
SPD according to EN 61643-11 / IEC 61643-11	type 1 + type 2 / class I + class II
Energy coordination with terminal equipment (≤ 10 m)	type 1 + type 2 + type 3
Nominal voltage (a.c.) (U_N)	230 / 400 V (50 / 60 Hz)
Max. continuous operating voltage (a.c.) (U_C)	255 V (50 / 60 Hz)
Lightning impulse current (10/350 µs) [L1+L2+L3+N-PE] (I_{total})	50 kA
Specific energy [L1+L2+L3+N-PE] (W/R)	625.00 kJ/ohms
Lightning impulse current (10/350 µs) [L-N]/[N-PE] (I_{imp})	12.5 / 50 kA
Specific energy [L-N]/[N-PE] (W/R)	39.06 / 625.00 kJ/ohms
Nominal discharge current (8/20 µs) [L-N]/[N-PE] (I_n)	12.5 / 50 kA
Voltage protection level [L-N]/[N-PE] (U_P)	≤ 1.5 / ≤ 1.5 kV
Follow current extinguishing capability [L-N]/[N-PE] (I_{fi})	25 kA_{rms} / 100 A_{rms}
Follow current limitation / Selectivity	no tripping of a 32 A gG fuse up to 25 kA_{rms} (prosp.)
Response time (t_A)	≤ 100 ns
Max. mains-side overcurrent protection	160 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
Operating temperature range (T_U)	-40 °C ... +80 °C
Operating state / fault indication	green / red
Number of ports	1
Cross-sectional area (L1, L2, L3, N, PE, ⏚) (min.)	1.5 mm^2 solid / flexible
Cross-sectional area (L1, L2, L3, N, PE, ⏚) (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	4 module(s), DIN 43880
Approvals	KEMA, VDE, UL
Extended technical data:	----------
Voltage protection level [L-PE] (U_P)	2.0 kV
Weight	480 g
Customs tariff number (Comb. Nomenclature EU)	85363090
GTIN	4013364131798
PU	1 pc(s)

DEHNshield

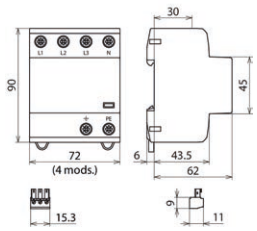
DSH B TT 255 FM (941 316)

- Application-optimised and prewired spark-gap-based type 1 and type 2 combined lightning current and surge arrester
- Compact design due to space-saving spark gap technology with a width of only 1 module / pole
- Meets the minimum requirements according to IEC 60364-5-53 concerning the nominal discharge capacity I_n and the lightning current discharge capacity I_{imp} in case of overhead line supply

Figure without obligation



Basic circuit diagram DSH B TT 255 FM



Dimension drawing DSH B TT 255 FM

Application-optimised and prewired combined lightning current and surge arrester for TT and TN-S systems for use in the main power supply system (3+1 configuration) in case of residential buildings without external lightning protection system (also in case of buildings supplied by overhead lines); with floating remote signalling contact.

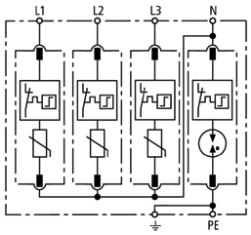
Type Part No.	DSH B TT 255 FM 941 316
SPD according to EN 61643-11 / IEC 61643-11	type 1 + type 2 / class I + class II
Energy coordination with terminal equipment (≤ 10 m)	type 1 + type 2 + type 3
Nominal voltage (a.c.) (U_N)	230 / 400 V (50 / 60 Hz)
Max. continuous operating voltage (a.c.) (U_C)	255 V (50 / 60 Hz)
Lightning impulse current (10/350 µs) [L1+L2+L3+N-PE] (I_{total})	30 kA
Lightning impulse current (10/350 µs) [L-N]/[N-PE] (I_{imp})	7.5 / 30 kA
Nominal discharge current (8/20 µs) [L-N]/[N-PE] (I_n)	12.5 / 50 kA
Voltage protection level [L-N]/[N-PE] (U_P)	≤ 1.5 / ≤ 1.5 kV
Follow current extinguishing capability [L-N]/[N-PE] (I_{fi})	25 kA_{rms} / 100 A_{rms}
Follow current limitation / Selectivity	no tripping of a 32 A gG fuse up to 25 kA_{rms} (prosp.)
Response time (t_A)	≤ 100 ns
Max. mains-side overcurrent protection	160 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
Operating temperature range (T_U)	-40 °C ... +80 °C
Operating state / fault indication	green / red
Number of ports	1
Cross-sectional area (L1, L2, L3, N, PE, ⏚) (min.)	1.5 mm^2 solid / flexible
Cross-sectional area (L1, L2, L3, N, PE, ⏚) (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	4 module(s), DIN 43880
Approvals	VDE
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^2 solid / flexible
Extended technical data:	----------
Voltage protection level [L-PE] (U_P)	2.0 kV
Weight	450 g
Customs tariff number (Comb. Nomenclature EU)	85363090
GTIN	4013364328075
PU	1 pc(s)

DEHNguard

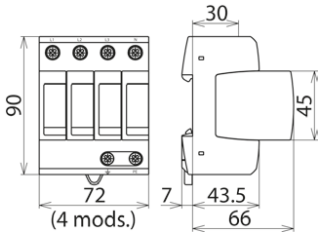
DG M TT 275 (952 310)

- 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 275



Dimension drawing DG M TT 275

Modular surge arrester for use in TT and TN-S systems (3+1 configuration).

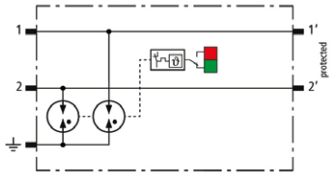
Type Part No.	DG M TT 275 952 310
SPD according to EN 61643-11 / IEC 61643-11	type 2 / class II
Energy coordination with terminal equipment (≤ 10 m)	type 2 + type 3
Nominal voltage (a.c.) (U_N)	230 / 400 V (50 / 60 Hz)
Max. continuous operating voltage (a.c.) [L-N] (U_C)	275 V (50 / 60 Hz)
Max. continuous operating voltage (a.c.) [N-PE] (U_C)	255 V (50 / 60 Hz)
Nominal discharge current (8/20 µs) (I_n)	20 kA
Max. discharge current (8/20 µs) (I_{max})	40 kA
Lightning impulse current (10/350 µs) [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_{fi})	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	4 module(s), DIN 43880
Approvals	KEMA, VDE, UL
Extended technical data:	----------
Voltage protection level [L-PE] (U_P)	1.5 kV
Weight	405 g
Customs tariff number (Comb. Nomenclature EU)	85363030
GTIN	4013364108479
PU	1 pc(s)

BLITZDUCTORconnect

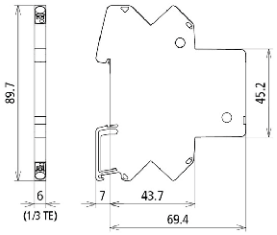
BCO CL2 B 180 (927 910)

- LifeCheck arrester monitoring and integrated status indication
- Compact two-pole arrester for lightning equipotential bonding
- For installation in conformity with the lightning protection zone concept at the boundaries from 0_A – 1 and higher

Figure without obligation



Basic circuit diagram BCO CL2 B 180



Dimension drawing BCO CL2 B 180

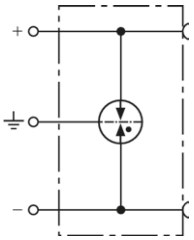
Space-saving, compact lightning current arrester with a width of 6 mm and push-in connection technology with status indication for protecting two single lines for lightning equipotential bonding as well as indirect earthing of shielded cables.

Type Part No.	BCO CL2 B 180 927 910
SPD class	TYPE 1
Impulse category	D1, C2, C3
Nominal voltage (U_N)	180 V
Max. continuous operating voltage (d.c.) (U_C)	180 V
Max. continuous operating voltage (a.c.) (U_C)	127 V
Nominal current (I_L)	1.2 A
D1 Total lightning impulse current (10/350 µs) (I_{imp})	3 kA
D1 Lightning impulse current (10/350 µs) per line (I_{imp})	1.5 kA
C2 Total nominal discharge current (8/20 µs) (I_n)	10 kA
C2 Nominal discharge current (8/20 µs) per line (I_n)	5 kA
Voltage protection line-line for I_n C2 (U_p)	≤ 1100 V
Voltage protection level line-PG for I_n C2 (U_p)	≤ 800 V
Voltage protection level line-line for 1 kV/µs C3 (U_p)	≤ 950 V
Voltage protection level line-PG for 1 kV/µs (U_P)	≤ 700 V
Series resistance per line	0 ohms
Cut-off frequency line-line at 100 ohms (f_G)	100 MHz
Operating temperature range (T_U)	-40 °C ... +80 °C
Operating state / fault indication	green / red
Degree of protection	IP 20
For mounting on	35 mm DIN rails acc. to EN 60715
Connection (input / output)	push-in / push-in
Cross-sectional area, solid	0.2-2.5 mm²
Cross-sectional area, flexible	0.2-2.5 mm²
Earthing via	35 mm DIN rails acc. to EN 60715
Enclosure material	polyamide PA 6.6
Colour	yellow
Test standards	IEC 61643-21 / EN 61643-21
Approvals	UL, SIL
ATEX approvals	TUR XX ATEX XXXX.X: II 3G Ex ec IIC T4 Gc
IECEx approvals	IECEx TUR XX.XXXXX: Ex ec IIC T4 Gc
Extended technical data:	- - - - - - - - - - - - - - - - - - -
– Discharge current (8/20 µs) [1/2 - PG], [1+2 - PG]	10 kA (10x)
– Voltage protection level line-PG at 1 kV/µs C3 after being subjected to I_{max} (U_p)	≤ 700 V
Weight	33 g
Customs tariff number (Comb. Nomenclature EU)	85363010
GTIN	4013364411739
PU	1 pc(s)

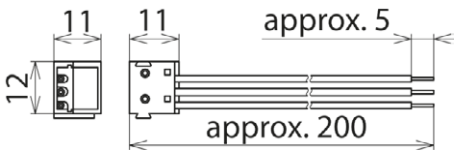
BUStector

BT 24 (925 001)

Figure without obligation



Basic circuit diagram BT 24



Dimension drawing BT 24

Surge arrester with KNX bus terminal design, adapted to the immunity of KNX / EIB systems. EIBA-certified.

Type Part No.	BT 24 925 001
SPD class	TYPE 2
Nominal voltage (U_n)	24 V
Max. continuous operating voltage (d.c.) (U_C)	45 V
Nominal current (I_L)	6 A
D1 Lightning impulse current (10/350 µs) per line	1 kA
C2 Nominal discharge current per line (I_n)	5 kA
Voltage protection level line-line for I_n C2	≤ 1200 V
Voltage protection level line-PG for I_n C2	≤ 650 V
Voltage protection level line-line at 1 kV/µs C3	≤ 750 V
Voltage protection level line-PG at 1 kV/µs C3	≤ 500 V
Cut-off frequency line-line (f_G)	70 MHz
Capacitance line-line	≤ 10 pF
Capacitance line-PG	≤ 10 pF
Operating temperature range (T_U)	-40 °C ... +80 °C
Degree of protection	IP 20
Connection	spring contacts (Ø1 mm) / connecting leads (Ø0.8 mm)
Earthing via	lead (0.75 mm^2), 200 mm long
Enclosure material	thermoplastic
Colour	blue
Test standards	IEC 61643-21
Approvals	EIBA certification No. Z 32/1399/95, EAC
Weight	10 g
Customs tariff number (Comb. Nomenclature EU)	85363010
GTIN	4013364047365
PU	1 pc(s)

Surge Protection
Lightning Protection
Safety Equipment
DEHN protects.

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