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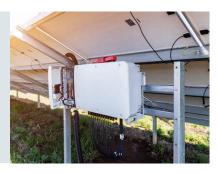
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The progressing energy revolution can no longer be reversed, and the development of PV power generation systems is therefore increasing. New PV systems of around 5.3 GW were installed in 2021 in Germany alone. In order to drive the energy revolution forwards, free-field PV systems play a major role in certain countries. The reliable operation of these systems, and thus stable power generation, must be ensured. It is therefore important to protect these systems against lightning currents and surges. If string inverters are used, it is important to protect them with additional type-1 SPDs (SPD: Surge Protective Device) against partial lightning currents on the AC side, even if they are already equipped with internal surge protection. In the event of lightning strikes within the free-field PV system, partial lightning currents can be injected into the AC side of the string inverter and damage or even destroy it.

### Structure of a free-field PV system with string inverter

The basic structure of free-field systems with string inverters consists of:

- PV strings
- String inverters
- AC distribution units
- Step-up transformer to the power grid

Nowadays, the voltages of PV strings are as much as 1,500 V DC. In systems with a string inverter design, the majority of the power cabling is on the AC side. The inverters are mostly installed under the module racks of the PV strings. Most of the string inverters available since 2019 for utility-scale PV plants have an output voltage of 800 V (L-L) on the AC side. Cables from the AC

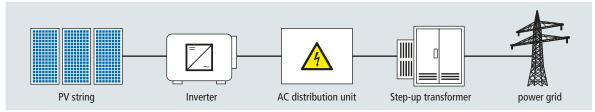


Figure 1 Systematic structure of a free-field PV system with string inverters

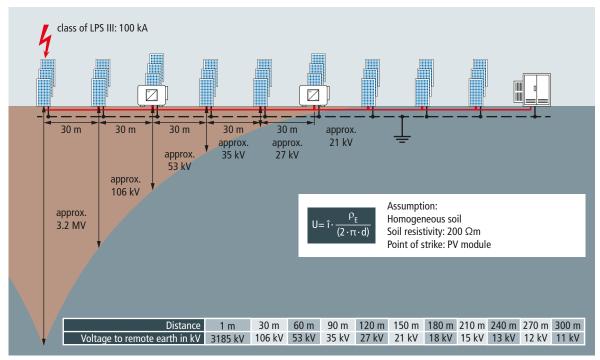


Figure 2 Rise in the local earth potential



side of several string inverters are often joined and fused before the transformer in an AC distribution box. The transformer then converts the 800 V AC to levels appropriate for a medium- or high-voltage grid system. (**Figure 1**). In most cases, the electrical connection from the inverter to the transformer station is established as a three-phase IT system. By omitting the neutral conductor, costs associated with wiring are optimised.

#### What risks are inverters exposed to?

In the event of a lightning strike into the PV modules or into air-termination systems, the distribution of lightning current is influenced significantly by the power cabling. This is also explained in IEC TR 63227. In systems with a string inverter design, the majority of the power cabling is on the AC side. This acts as an equipotential bonding conductor between the

local earth potential of the modules and the distant equipotential surface of the step-up transformer.

Due to the free-field PV system's intermeshed earthing system as per IEC TR 63227, all components are interconnected for electrical conduction.

If lightning strikes a PV module, or an air-termination rod, the lightning current is channelled through the PV frame into the

ground and then spreads in all directions from that point. This leads to a rise in the local earth potential (Figure 2). Since the transformer station is located some distance away in most cases, this value is still at "0 potential". Partial lightning currents will take the path of the largest voltage difference and the lowest resistance. Therefore, partial lightning currents will be injected through the SPDs on the inverter AC side and flow towards the transformer station, where they are then distributed through the earthing system of the transformer station (Figure 3). As the inverters are installed close to the modules and are conductively connected with the earthing arrangement through an intermeshed earthing system as per IEC TR 63227, a local equipotential surface is created so that partial lightning currents on the DC side are not expected. Therefore, type-2 SPDs suffice on the DC side, because only induced surges are anticipated. The fact that partial lightning currents are to be expected on the AC side in PV systems with string inverters is also described in the standard IEC 61643-32. However, as most string inverters are only fitted with integrated type-2 SPDs on the AC side, additional protection with type-1 SPDs is necessary in order to safely dissipate the high-energy partial lightning currents so the inverter is not damaged or destroyed as a result.

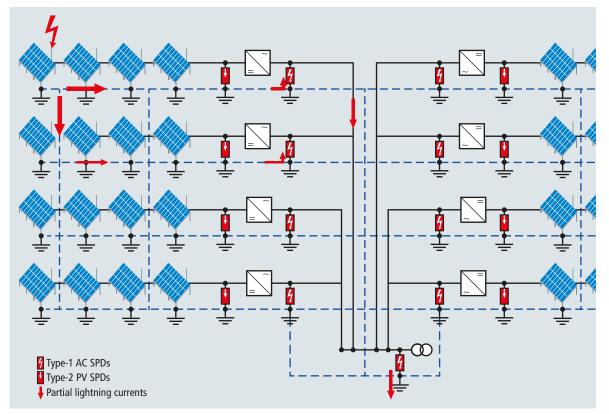


Figure 3 Partial lightning current flow from the point of strike to the earthing system of the transformer station



In the DEHN Test Centre, tests have been conducted on commonly used inverters from market leaders. In these tests, a lightning current was fed into the AC side of the inverter to check whether the selected protection solution protected the inverter against damage. It was demonstrated that additional protection on the AC side with type-1 SPDs safely protected the systems from lightning damage and the integrated type-2 SPDs in the inverter were not overloaded.

### Protection of the AC side with DEHNbloc Maxi 440 in a "Neptune" (3+1) configuration.

To protect the inverter, a "Neptune" (3+1) configuration is necessary. This consists of 4x DEHNbloc Maxi 440 (DBM 1 440). They are installed on the AC side close to the inverter (**Figure 4**). The DEHNbloc Maxi (DBM) is a robust type-1 SPD based on spark gap technology. Due to the "Neptune" (3+1) configuration, two SPDs are always in series (L-L; L-GND). The DBM 1 440 has a max. continuous operating voltage of 440 V AC. With a series connection, the max. continuous operating voltage of the arrester combination is raised to 880 V AC and is therefore perfectly suited for use in 800 V AC grids.

#### Things to bear in mind when choosing a type-1 SPD

When using additional type-1 SPDs on the AC side, the coordination of the individual protection stages must be ensured. If there is no coordination between integrated type 2 and external type 1 SPDs, the inverter can become damaged or even destroyed. A tested protection solution should always be used to prevent failure of the inverter and the associated costs (new procurement, installation, losses due to failure, etc.). If there is a threat of power overload to the type-2 SPDs in the inverter, the more powerful upstream type-1 SPD must respond to dissipate the interfering excess energy. In order to test the coordination of the DEHNbloc Maxi 440 with the integrated type-2 SPDs, a coordination test was successfully conducted for this purpose as per CLC/TS 61643-12:2009. One of the advantages of the DEHNbloc Maxi 440 is the integrated spark gap technology. Spark gaps are voltage-switching components with a quick sparkover performance in the nanosecond range. After an extremely short period of time, the voltage drops to the arc voltage (typically in the range of the supply voltage).

This characteristic of the spark gap equates to a kind of wave-breaker function. The lightning current wave is "switched away", thus considerably reducing the impulse duration through the device. This reduction of the impulse duration reduces the remaining current-time area to an extremely low value (**Figure 5**). Even with high impulse currents, only a low amount of power is thus let into the inverter and dissipated by the integrated type-2 SPDs.

Varistors, by contrast, are voltage-limiting components. When using varistor-based type-1 SPDs, the voltage is limited throughout the entire period of the discharge process of the impulse current. During the entire impulse duration, a current thus flows into the inverter (**Figure 5**).

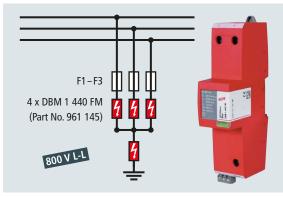


Figure 4 Protection solution with DBM 1 440 FM in "Neptune" (3+1) configuration

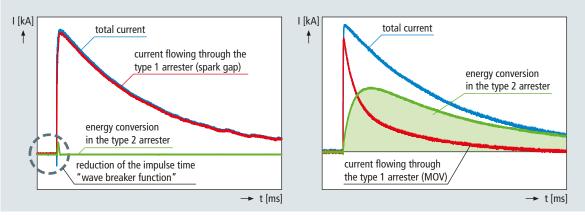


Figure 5 Comparison of a spark-gap-technology based type-1 SPD with a varistor-technology-based type-1 SPD



If the quantity of energy let through exceeds the value  $W_{max}$  (max. energy that may flow through the varistor) of the varistor integrated in the inverter (type-2 SPD), then the integrated type-2 SPDs will be damaged or even destroyed. The inverter is then no longer protected. In order for the type-2 SPDs integrated in the inverter to be protected in the event of an overload, upstream spark-gap-based type-1 SPDs, like the DEHNbloc Maxi 440, are required.

#### IT system cabling in systems with string inverters

According to IEC 60364-4-44, TOVs (Temporary Overvoltages) can be carried over to the low-voltage side in IT systems in the event of an earth fault in the high-voltage system. These voltages are limited to 1,200 V AC for a maximum of 5 seconds. For an AC system with 800 V, the maximum permitted TOV in the low-voltage system would thus be 2,000 V (1,200 V + nominal AC inverter voltage). Standard SPDs are not usually designed for these voltages. Due to the system design of free-field PV systems, however, these high TOVs can, under certain conditions, be ignored.

According to IEC TR 63227, an intermeshed earthing system must be set up. Here, the individual components (PV frame, string inverter, transformer station, etc.) are conductively linked to the intermeshed earthing system. In addition, it is also the case that the neutral point on the low-voltage side of the transformer does not have a direct link to earth. That is why, in the event of an earth fault on the high-voltage side, there will be no direct voltage increase on the 800 V secondary side of the transformer.

If there is an earth fault on the high-voltage side, there is indeed a local potential increase on the transformer station, but this has no effects on the PV system. The reason for this is that this rise in potential generates currents of less than 100 A in the ground. Due to the intermeshed earthing system, these small currents do not lead to any significant potential difference in the earthing system, and thus no high TOVs appear on the AC side. This is why SPDs can be installed for a mains voltage of merely 800 V without them becoming overloaded.

#### **Tested protection solution**

In order to verify the protective effect of the DBM 1 440 and thus to protect the AC side of the inverter against lightning and surges, the following tests were performed in the DAkkS-certified DEHN Test Centre.

- Coordination test for the integrated type-2 SPD (CLC/TS 61643-12:2009 Annex J)
- Test with increased voltage for use with an integrated anti-PID unit

#### Coordination test of the DBM 1 440 with pre-integrated SPDs in the inverter

In order to reliably protect systems during surges, it may be necessary, depending on the impulse withstand voltage of the equipment to be protected (e.g. inverters) and the cabling of the electrical system (cable length, routing etc.), to use two or more SPDs. In such cases, effective coordination of the SPDs must be considered, so that downstream SPDs are not overloaded with power.

Furthermore, the overvoltages that arise must be limited so that the limiting voltage is below the dielectric strength of the electrical equipment to be protected.

In order to verify this, a coordination test was performed in line with CLC/TS 61643-12:2009 and successfully passed. Therefore, coordination of the DMB 1 440 with the type-2 SPDs integrated in the inverters is ensured..

#### Test with increased voltage for the use of an anti-PID unit

PID stands for "Potential-Induced Degradation". This is an effect that occurs with PV modules with crystalline Si cells and can lead to a gradual loss in performance. If the PV modules

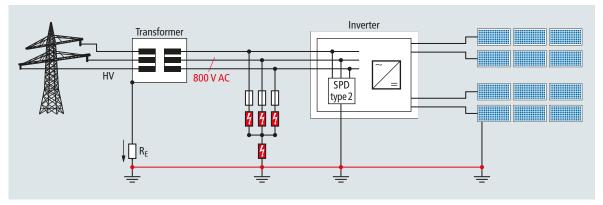


Figure 6 Neutral point of the low-voltage side without earth connection



in operation have a negative potential to earth, a correspondingly high negative voltage arises between the individual cells of the PV module and the earthed aluminium frame. It can therefore be the case that electrons from the PV module follow this electric field and ultimately flow out via the earthed aluminium frame.

This flow of electrons has a significant influence on the properties of the Si cells and impairs the efficiency of the modules. As a counter-measure, "anti-PID units" are used. Depending on the manufacturer and the type of inverter, these units might already be integrated. Otherwise, there are anti-PID units that can be additionally installed. How such anti-PID units function can vary depending on the manufacturer. The tested inverters already have such units integrated. These anti-PID units feed in DC voltage between the phases and earth on the AC side. As a result, the virtual negative voltage on the DC side is raised to earth potential. The DC voltage fed by the anti-PID unit can be up to 50% of the string voltage. In the event of a voltage of 1,500 V DC, up to 750 V DC of offset voltage can thus arise on the AC side. Such superimposed voltage will affect SPDs on the AC side. These SPDs must not trip in the case of increased voltage through the use of the anti-PID unit. In the DEHN Test Centre, a superimposed voltage with peaks of 1,450 V was reconstructed and connected to the AC side of the inverter.

Our "Neptune" (3+1) configuration made up of DBM 1 440 SPD units was tested with such increased voltages. It successfully passed the test and did not trip.

#### Conclusion

Through the use of the DBM 1 440 in a "Neptune" (3+1) configuration on the AC side of the inverter, the inverter was protected against injected partial lightning currents. By means of the spark gap technology, the majority of the lightning current is discharged through the DBM 1 440

and the type-2 SPDs in the inverter are not overloaded. This was tested by means of a coordination test in line with CLC/ TS 61643-12:2009. Also, when using an anti-PID unit, the protection of the inverter is ensured without the SPDs tripping.

The "Neptune" (3+1) configuration for protecting the inverters can be implemented with the following products.

| Protective device | Part no. |
|-------------------|----------|
| DBM 1 440         | 961 140  |
| DBM 1 440 FM      | 961 145  |
| DBM 1 CI 440 FM   | 961 146  |

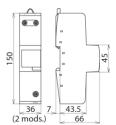
For a system design with a central inverter, you can find a protection solution at: <u>Free-field PV systems – Lightning protec-</u> tion from DEHN

### **DBM 1 440 (961 140)**

- Extremely high lightning current discharge capacity
- High follow current extinction and limitation due to RADAX Flow technology
- Directly coordinated with DEHNguard surge protective devices without additional cable length







Dimension drawing DBM 1 440

Figure without obligation

Basic circuit diagram DBM 1 440

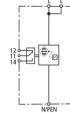
Coordinated single-pole lightning current arrester with high follow current limitation for  $U_c$  = 440 V.

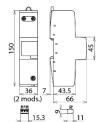
| Part No.         961 140           SPD according to Ex 161643-11 (EC 61643-11)         type 1 / class I           Nominal voltage (a.c.) (U.)         400 V           Max. continuous operating yoltage (a.c.) (U.)         440 V           Lightning impuise current (10/350 µs) (U.,)         35 kA           Specific energy (VIR)         306 25 k.Johtms           Nominal discharge current (10/20 µs) (U.)         35 kA           Voltage protection level (U.)         \$2 5 kV           Follow current textinguishing capability (a.c.) (I.)         50 KA           Follow current textinguishing capability (a.c.) (I.)         50 KA           Follow current textinguishing capability (a.c.) (I.)         50 KA           Response time (I.)         \$10 nm           Max. backup fuse (L) up to [L = 50 kA   | Turne   | DBM 1 440   |
|--|---|---|
| SPD according to EN 61443-11 / EC 61643-11         ype 1 / class I           Nominal voltage (a.c.) (U,)         400 V           Lighting impulse current (10/350 µs) (U <sub>m</sub> )         35 kA           Specific energy (W/R)         306 25 kJ Johns           Nominal discharge current (8/20 µs) (L)         35 kA           Voltage protection level (U <sub>P</sub> )         52 S kV           Follow current stringuishing capability (a.c.) (k)         50 kAm,           Follow current stringuishing capability (a.c.) (k)         50 A Ag           Nax, backup fuse (L) up to L = 50 kAm, (t, ≤ 0.2 s)         500 AgG           Max, backup tuse (L) up to L = 50 kAm, (t, ≤ 0.2 s)         500 AgG           Max, backup tuse (L) up to L = 50 kAm, (t, ≤ 0.2 s)         500 AgG           Max, backup tuse (L) up to L = 50 kAm, (t, ≤ 0.2 s)         500 AgG           Max, backup tuse (L) up to L = 50 kAm, (t, ≤ 0.2 s)         500 AgG           Operating temperature range (parallel connection) (T <sub>uw</sub> )         40 °C  |   |   |
| Max. continuous operating voltage (a.c.) (U.c.)     440 V       Lighthing impulse current (10/350 µs) (L <sub>m</sub> )     35 kA       Specific energy (WR)     306 25 kJ/ohms       Nominal discharge current (8/20 µs) (L)     35 kA       Voltage protection level (U.b)     5 kA       Follow current stinguishing capability (a.c.) (L)     50 kAm, (prosp.)       Follow current stinguishing capability (a.c.) (L)     50 kAm, (prosp.)       Response time (L)     50 kAm, (prosp.)       Response time (L)     50 kAm, (prosp.)       Max. backup tise (L) up to L = 50 kAm, (t, s C S S)     200 A gG       Max. backup tise (L) up to L = 50 kAm, (t, s C S S)     200 A gG       Operating temperature range (series connection) (Tus)     40 °C  |   |   |
| Lightning impulse current (10/350 µs) (lmg)         35 kA           Specific energy (W/R)         35 kA           Nominal discharge current (8/20 µs) (l,)         35 kA           Voltage protection level (U,)         \$ 2.5 kV           Follow current initiation / Selectivity         no tripping of 32 A g G fuse up to 50 kAmg (prosp.)           Response time (t_a)         \$ 100 ns           Max. backup tos (L) up to 1,= 50 kAmg (t_s 5 0.2 s)         500 A g G           Max. backup tos (L) up to 1,= 50 kAmg (t_s 5 0.2 s)         200 A g G           Max. backup tos (L) up to 1,= 50 kAmg (t_s 5 0.2 s)         200 A g G           Max. backup tos (L, U) to 1,= -50 kAmg (t_s 5 0.2 s)         200 A g G           Operating temperature range (series connection) (Tw)         40 °C +60 °C           Operating temperature range (series connection) (Tw)         40 °C +60 °C           Operating temperature range (series connection) (Tw)         10 mm <sup>*</sup> solid / flexible           Cross-sectional area (L, NPEN) (max.)         50 mm <sup>*</sup> stranded / 35 mm <sup>*</sup> flexible           Cross-sectional area (L, NPEN) (max.)         50 mm <sup>*</sup> stranded / 35 mm <sup>*</sup> flexible           Cross-sectional area (L, NPEN) (max.)         50 mm <sup>*</sup> stranded / 25 mm <sup>*</sup> flexible           Cross-sectional area (L, NPEN) (max.)         50 mm <sup>*</sup> stranded / 25 mm <sup>*</sup> flexible           Cross-sectional area (L, NPEN) (max.)         50 mm <sup>*</sup> s  | Nominal voltage (a.c.) (U <sub>N</sub> )  | 400 V   |
| Specific energy (W/R)         306.25 k.l/ohms           Nominal discharge current (8/20 µs) (L)         35 kA           Voitage protection lovel (L,)         5 2 5 kV           Follow current extinguishing capability (a.c.) (h)         50 kA  | Max. continuous operating voltage (a.c.) (U <sub>c</sub> )                              | 440 V   |
| Nominal discharge current (8/20 µs) (h,)         35 kA           Voltage protection level (Up)         \$ 2.5 kV           Follow current timitation / selectivity         no tripping of a 32 A gG fuse up to 50 kA, (prosp.)           Response time (t <sub>x</sub> )         \$ 100 ns           Max. backup fuse (L) up to I <sub>x</sub> = 50 kA, (t <sub>x</sub> ≤ 0.2 s)         500 A gG           Max. backup fuse (L) up to I <sub>x</sub> = 50 kA, (t <sub>x</sub> ≤ 5 s)         250 A gG           Max. backup fuse (L) (U) - Orbaracteristic         760 V / 120 min. – withstand           Operating temperature range (series connection) (T <sub>w</sub> )         -40° C+60° C           Operating temperature range (series connection) (T <sub>w</sub> )         -40° C+60° C           Operating temperature range (series connection) (T <sub>w</sub> )         10 mm² solid / flexible           Cross-sectional area (L, L', NPEN) (min.)         10 mm² solid / flexible           Cross-sectional area (L, L', NPEN) (mix.)         50 mm² stranded / 25 mm² flexible           Cross-sectional area (L, L', MPEN) (mix.)         10 mm² solid / flexible           Cross-sectional area (L, L', MPEN) (mix.)         10 mm² stranded / 25 mm² flexible           Cross-sectional area (L') (max.)         50 mm² stranded / 25 mm² flexible           For mounting on         35 mm² stranded / 25 mm² flexible           Cross-sectional area (L') (max.)         10 m² stranded / 25 mm² flexible           Cold point   | Lightning impulse current (10/350 µs) (I <sub>imp</sub> )                               | 35 kA   |
| Voltage protection level (U, f)         \$ 2.5 kV           Follow current textinguishing capability (a.c.) (li,)         50 kAmm           Follow current limitation / Selectivity         no tripping of a 32 A gG fuse up to 50 kAmm (prosp.)           Response time (l)         \$ 100 ns           Max. backup fuse (L) up to l <sub>x</sub> = 50 kAmm (ls ≤ 0.2 s)         500 A gG           Max. backup fuse (L) up to l <sub>x</sub> = 50 kAmm (ls ≤ 5 s)         250 A gG           Max. backup fuse (L) Up to l <sub>x</sub> = 50 kAmm (ls ≤ 5 s)         250 A gG           Max. backup fuse (L) Up to l <sub>x</sub> = 50 kAmm (ls ≤ 5 s)         250 A gG           Operating temperature range (erries connection) (T <sub>uv</sub> )         -40 °C +80 °C           Operating temperature range (erries connection) (T <sub>uv</sub> )         -40 °C +80 °C           Operating state / fault indication         green / red           Number of ports         1           Cross-sectional area (L, IVPEN) (mix.)         10 mm² solind / fexible           Cross-sectional area (L, IVPEN) (max.)         35 mm² stranded / 25 mm² fiscible           Cross-sectional area (L, IVPEN) (max.)         35 mm² stranded / 25 mm² fiscible           For mounting on         IP 20           Capacity         2 module(s), INI 43880           Approvals         UL, CSA           Capacity         2 module(s), INI 43880           Approvals   | Specific energy (W/R)   | 306.25 kJ/ohms  |
| Follow current extinguishing capability (a.c.) (l,)         50 kA <sub>ma</sub> Follow current limitation / Selectivity         no tripping of a 32 A gG fuse up to 50 kA <sub>ma</sub> (prosp.)           Response time (l,)         ≤ 100 ns           Max. backup fuse (l,) up to l, = 50 kA <sub>ma</sub> (f, ≤ 0.2 s)         500 A gG           Max. backup fuse (l,) up to l, = 50 kA <sub>ma</sub> (t, ≤ 5 s)         250 A gG           Temporary overvoltage (TOV) (U) - Characteristic         760 V / 120 min withstand           Operating temperature range (parallel connection) (T <sub>us</sub> )         -40 ° C+60 ° C           Operating temperature range (parallel connection) (T <sub>us</sub> )         -40 ° C+60 ° C           Operating temperature range (parallel connection) (T <sub>us</sub> )         -40 ° C+60 ° C           Operating temperature range (series connection) (T <sub>us</sub> )         -40 ° C+60 ° C           Operating temperature range (series connection) (T <sub>us</sub> )         1           Cross-sectional area (L, L', N/PEN) (min.)         10 mm² solid / flexible           Cross-sectional area (L, U, MPEN) (max.)         50 mm² stranded / 25 mm² flexible           Cross-sectional area (L, U, MPEN) (min.)         10 mm² solid / flexible           Cross-sectional area (L, U, MPEN) (max.)         50 mm² stranded / 25 mm² flexible           Cross-sectional area (L, U, MPEN) (max.)         50 mm² stranded / 25 mm² flexible           Cross-sectional area (L, U, MA         10 mm² solid /  | Nominal discharge current (8/20 µs) (I <sub>n</sub> )                                   | 35 kA   |
| Follow current limitation / Selectivity       no tripping of a 32 A gG fuse up to 50 kA,m, (prosp.)         Response time (t,)       \$ 100 ns         Max. backup fuse (L) up to 1x, = 50 kA,m, (t, ≤ 0.2 s)       500 A gG         Max. backup fuse (L) up to 1x, = 50 kA,m, (t, ≤ 5 s)       250 A gG         Max. backup fuse (L-L)       125 A gG         Temporary overvoltage (TOV) (U) – Characteristic       760 V / 120 min. – withstand         Operating temperature range (series connection) (Tun)       -40 °C+80 °C         Operating temperature range (series connection) (Tun)       -40 °C+80 °C         Operating temperature range (series connection) (Tun)       -40 °C+80 °C         Operating temperature range (series connection) (Tun)       -40 °C+80 °C         Operating temperature range (series connection) (Tun)       -40 °C+80 °C         Operating temperature range (series connection) (Tun)       10 mm² solid / flexible         Cross-sectional area (L, L', N/PEN) (min.)       10 mm² solid / flexible         Cross-sectional area (L, V, NEN) (max.)       50 mm² standed / 25 mm² flexible         For wounting on       35 mm² tranded / 25 mm² flexible         For wounting on       10 mr² solid / flexible         Degree of protection       IP 20         Capacity       2 module(s), DIN 43880         Approvals       UL, CSA  | Voltage protection level (U <sub>P</sub> )  | ≤ 2.5 kV  |
| Response time (t,)       i s 100 ns         Max. backup fuse (L) up to Ix, = 50 KA (t, s 0.2 s)       500 A gG         Max. backup fuse (L) up to Ix, = 50 KA (t, s 5 s)       250 A gG         Max. backup fuse (L-U)       125 A gG         Temporary overvoltage (TOV) (Ur,) – Characteristic       760 V / 120 min. – withstand         Operating temperature range (parallel connection) (Tus)       -40 °C + 80 °C         Operating temperature range (series connection) (Tus)       -40 °C + 80 °C         Operating temperature range (series connection) (Tus)       -40 °C + 80 °C         Operating tate / fault indication       green / red         Number of ports       1         Cross-sectional area (L, U, NPEN) (min.)       10 mm <sup>2</sup> solid / flexible         Cross-sectional area (L, U, NPEN) (max.)       50 mm <sup>2</sup> stranded / 35 mm <sup>2</sup> flexible         Cross-sectional area (L, U, NPEN) (max.)       35 mm <sup>2</sup> stranded / 35 mm <sup>2</sup> flexible         For mounting on       35 mm <sup>2</sup> stranded / 25 mm <sup>2</sup> flexible         For mounting on       1         Degree of protection       IP 20         Capacity       2 module(s), DIN 43880         Approvals       UL, CSA         Use in switchpearints allations with prospective short-circuit         Extended technical data:       uurents of more than 50 KA  | Follow current extinguishing capability (a.c.) (I <sub>fi</sub> )                       | 50 kA <sub>rms</sub>  |
| Max. backup fuse (L) up to Ix = 50 kA <sub>mu</sub> (t <sub>x</sub> ≤ 0.2 s)         500 A gG           Max. backup fuse (L) up to Ix = 50 kA <sub>mu</sub> (t <sub>x</sub> ≤ 5 s)         250 A gG           Max. backup fuse (L-1)         125 A gG           Temporary overvoltage (TOV) (U <sub>1</sub> ) - Characteristic         760 V / 120 min withstand           Operating temperature range (parallel connection) (T <sub>ux</sub> )         -40 °C +60 °C           Operating temperature range (series connection) (T <sub>ux</sub> )         -40 °C +60 °C           Operating temperature range (series connection) (T <sub>ux</sub> )         -40 °C +60 °C           Operating temperature range (series connection) (T <sub>ux</sub> )         -40 °C +60 °C           Operating temperature range (series connection) (T <sub>ux</sub> )         -40 °C +60 °C           Operating state / fault indication         green / red           Number of ports         1           Cross-sectional area (L, L', N/PEN) (min.)         10 mm <sup>2</sup> solid / flexible           Cross-sectional area (L, NPEN) (max.)         50 mm <sup>2</sup> stranded / 25 mm <sup>2</sup> flexible           For mouting on         35 mm DIN rails acc. to EN 60715           Enclosure material         interromplastic, red, UL 94 V-0           Place of installation         indoor installation           Degree of protection         IP 20           Capacity         2 module(s), DIN 43880           Approvals         U <sub>L</sub> c SA  | Follow current limitation / Selectivity   | no tripping of a 32 A gG fuse up to 50 kA <sub>rms</sub> (prosp.) |
| Max. backup fuse (L) up to lx = 50 kAmm (tx ≤ 5 s)         250 A gG           Max. backup fuse (L-L')         125 A gG           Temporary overvoltage (TOV) (U <sub>7</sub> ) – Characteristic         760 V / 120 min. – withstand           Operating temperature range (parallel connection) (T <sub>UP</sub> )         -40 °C +60 °C           Operating temperature range (series connection) (T <sub>UP</sub> )         -40 °C +60 °C           Operating temperature range (series connection) (T <sub>UP</sub> )         -40 °C +60 °C           Operating temperature range (series connection) (T <sub>UP</sub> )         -40 °C +60 °C           Operating temperature range (series connection) (T <sub>UP</sub> )         -40 °C +60 °C           Operating temperature range (series connection) (T <sub>UP</sub> )         -40 °C +60 °C           Operating temperature range (series connection) (T <sub>UP</sub> )         -40 °C +60 °C           Operating temperature range (series connection) (T <sub>UP</sub> )         -40 °C +60 °C           Operating temperature range (series connection) (T <sub>UP</sub> )         -40 °C +60 °C           Operating temperature range (series connection) (T <sub>UP</sub> )         1           Cross-sectional area (L, N/PEN) (min.)         10 °C m <sup>2</sup> stranded / 35 mm <sup>2</sup> flexible           Cross-sectional area (L) (Nax.)         35 °C m <sup>2</sup> stranded / 25 °C m <sup>2</sup> | Response time (t <sub>A</sub> )   | ≤ 100 ns  |
| Max. backup fuse (L-L')         125 Å g G           Temporary overvoltage (TOV) (U <sub>1</sub> ) – Characteristic         760 V / 120 min. – withstand           Operating temperature range (parallel connection) (T <sub>UR</sub> )         -40 ° C + 80 ° C           Operating temperature range (series connection) (T <sub>UR</sub> )         -40 ° C + 80 ° C           Operating temperature range (series connection) (T <sub>UR</sub> )         -40 ° C + 80 ° C           Operating temperature range (series connection) (T <sub>UR</sub> )         -40 ° C + 80 ° C           Operating temperature range (series connection) (T <sub>UR</sub> )         -40 ° C + 80 ° C           Operating temperature range (series connection) (T <sub>UR</sub> )         -40 ° C + 80 ° C           Operating temperature range (series connection) (T <sub>UR</sub> )         -40 ° C + 80 ° C           Operating temperature range (series connection) (T <sub>UR</sub> )         -40 ° C + 80 ° C           Operating temperature range (series connection) (T <sub>UR</sub> )         -60 ° C           Operating temperature range (series connection) (T <sub>UR</sub> )         -60 ° C           Operating temperature range (series connection) (T <sub>UR</sub> )         10 ° C + 80 ° C           Cross-sectional area (L, L', N/PEN) (max.)         50 °mm <sup>3</sup> strandel / 25 °mm <sup>3</sup> flexible           For mounting on         35 rm Oll raisalitation           Degree of installation         indoor installation           Degree of protection         UL c SA <td< td=""><td>Max. backup fuse (L) up to <math>I_{K}</math> = 50 kA<sub>rms</sub> (<math>t_{a} \le 0.2</math> s)</td><td>500 A gG</td></td<>  | Max. backup fuse (L) up to $I_{K}$ = 50 kA <sub>rms</sub> ( $t_{a} \le 0.2$ s)          | 500 A gG  |
| Temporary overvoltage (TOV) (U <sub>7</sub> ) – Characteristic         760 V / 120 min. – withstand           Operating temperature range (parallel connection) (T <sub>10</sub> )         -40 °C +80 °C           Operating temperature range (series connection) (T <sub>10</sub> )         -40 °C +60 °C           Operating state / fault indication         green / red           Number of ports         1           Cross-sectional area (L, L', N/PEN) (min.)         10 mm² solid / flexible           Cross-sectional area (L, IV, N/PEN) (max.)         50 mm² stranded / 35 mm² flexible           Cross-sectional area (L', IWARL)         35 mm² stranded / 25 mm² flexible           For mounting on         35 mm DIN raits 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         UL, CSA           Extended technical data:         currents of more than 50 KAma (s20 KApasa)           - Max. prospective short-circuit current         100 KAma (s20 KApasa)           - Max. backup fuse (L) up to I <sub>k</sub> = 100 KAma (t_s 5 s)         250 A gG           Weight         516 g           Customs tariff number (Comb. Nomenclature EU)         85363090           Grant         516 g<   | Max. backup fuse (L) up to $I_{K}$ = 50 kA <sub>rms</sub> ( $t_{a} \le 5$ s)            | 250 A gG  |
| Operating temperature range (parallel connection) (Tup) $-40$ °C +80 °COperating temperature range (series connection) (Tup) $-40$ °C +60 °COperating state / fault indicationgreen / redNumber of ports1Cross-sectional area (L, L', N/PEN) (min.)10 mm² solid / flexibleCross-sectional area (L, IN/PEN) (max.)50 mm² stranded / 25 mm² flexibleCross-sectional area (L, (INX-EN) (max.)35 mm² stranded / 25 mm² flexibleCross-sectional area (L) (max.)35 mm² stranded / 25 mm² flexiblePromounting on35 mm DIN rails acc. to EN 60715Enclosure materialthermoplastic, red, UL 94 V-0Place of installationindoor installationDegree of protectionIP 20Capacity2 module(s), DIN 43880ApprovalsUL, CSAExtended technical data:currents of more than 50 KAms (tested by the Germa VDE)- Max, prospective short-circuit current100 kAms (220 kApsa)- Max, backup fuse (L) up to $k_c = 100$ kAms (t $\leq 0.2$ s)500 A gG- Max, backup fuse (L) up to $k_c = 100$ kAms (t $\leq 5$ s)250 A gGWeight516 g200 A gGCustoms tariff number (Comb. Nomenclature EU)85363090GTIN4013364116269  | Max. backup fuse (L-L')   | 125 A gG  |
| Operating temperature range (series connection) (Tus)       -40 °C +60 °C         Operating state / fault indication       green / red         Number of ports       1         Cross-sectional area (L, L', N/PEN) (min.)       10 mm² solid / flexible         Cross-sectional area (L, N/PEN) (max.)       50 mm² stranded / 35 mm² flexible         Cross-sectional area (L, N/PEN) (max.)       50 mm² stranded / 25 mm² flexible         Cross-sectional area (L, IC, N/PEN) (max.)       35 mm² stranded / 25 mm² flexible         Cross-sectional area (L, IC, N/PEN) (max.)       35 mm² stranded / 25 mm² flexible         Cross-sectional area (L, IC, N/PEN) (max.)       35 mm² stranded / 25 mm² flexible         Cross-sectional area (L, IC, N/PEN) (max.)       35 mm² stranded / 25 mm² flexible         Cross-sectional area (L) (max.)       35 mm² stranded / 25 mm² flexible         For mounting on       35 mm? stranded / 25 mm² flexible         Factosure material       thermoplastic, red, UL 94 V-0         Place of installation       indoor installation         Degree of protection       IP 20         Capacity       Que (S), DIN 43880         Approvals       Use in switchgear installations with prospective short-circuit         Extended technical data:       currents of more than 50 kA_mm (tested by the German VDE)         - Max. prospective short-circuit current       1   | Temporary overvoltage (TOV) (U <sub>T</sub> ) – Characteristic                          | 760 V / 120 min. – withstand                                      |
| Operating state / fault indication       green / red         Number of ports       1         Cross-sectional area (L, L', N/PEN) (min.)       10 mm² solid / flexible         Cross-sectional area (L, N/PEN) (max.)       50 mm² stranded / 35 mm² flexible         Cross-sectional area (L) (max.)       35 mm² stranded / 25 mm² flexible         Cross-sectional area (L) (max.)       35 mm² stranded / 25 mm² flexible         Cross-sectional area (L) (max.)       35 mm² stranded / 25 mm² flexible         Cross-sectional area (L) (max.)       35 mm² stranded / 25 mm² flexible         Cross-sectional area (L) (max.)       35 mm² stranded / 25 mm² flexible         Cross-sectional area (L) (max.)       35 mm² stranded / 25 mm² flexible         Cross-sectional area (L) (max.)       35 mm² stranded / 25 mm² flexible         Cross-sectional area (L) (max.)       35 mm² stranded / 25 mm² flexible         Cross-sectional area (L) (max.)       35 mm² stranded / 25 mm² flexible         Place of installation       indoor installation         Degree of protection       IP 20         Capacity       2 module(s), DIN 43880         Approvals       UL, CSA         Use in switchgear installations with prospective short-circuit         currents of more than 50 kA <sub>mm</sub> (tested by the German VDE)         - Max. pospective short-circuit current       100 kA <sub>ms</sub> (220 kA <sub></sub>   | Operating temperature range (parallel connection) ( $T_{\text{UP}}$ )                   | -40 °C +80 °C   |
| Number of ports1Cross-sectional area (L, L', N/PEN) (min.)10 mm² solid / flexibleCross-sectional area (L, N/PEN) (max.)50 mm² stranded / 35 mm² flexibleCross-sectional area (L') (max.)35 mm² stranded / 25 mm² flexibleCross-sectional area (L') (max.)35 mm DIN rails acc. to EN 60715Enclosure materialthermoplastic, red, UL 94 V-0Place of installationindoor installationDegree of protectionIP 20Capacity2 module(s), DIN 43880ApprovalsUL, CSAExtended technical data:currents of more than 50 kAme (220 kApeak)- Max. prospective short-circuit current100 kAme (220 kApeak)- Max. backup fuse (L) up to Ik = 100 kAms (t_s ≤ 0.2 s)500 A gG- Max. backup fuse (L) up to Ik = 100 kAms (t_s ≤ 0.2 s)500 A gG- Max. backup fuse (L) up to Ik = 100 kAms (t_s ≤ 5 s)250 A gGWeight516 gCustoms tariff number (Comb. Nomenclature EU)85363090GTIN4013364116269  | Operating temperature range (series connection) (T <sub>US</sub> )                      | -40 °C +60 °C   |
| Cross-sectional area (L, L', N/PEN) (min.)10 mm² solid / flexibleCross-sectional area (L, N/PEN) (max.)50 mm² stranded / 35 mm² flexibleCross-sectional area (L) (max.)35 mm² stranded / 25 mm² flexibleFor mounting on35 mm DIN rails acc. to EN 60715Enclosure materialthermoplastic, red, UL 94 V-0Place of installationindoor installationDegree of protectionIP 20Capacity2 module(s), DIN 43880ApprovalsUL, CSAExtended technical data:Use in switchgear installations with prospective short-circuit<br>currents of more than 50 kA <sub>mes</sub> (t20 kA <sub>peak</sub> )- Max. prospective short-circuit current100 kA <sub>mes</sub> (220 kA <sub>peak</sub> )- Limitation / Extinction of mains follow currentsup to 100 kA <sub>mes</sub> (220 kA <sub>peak</sub> )- Max. backup fuse (L) up to I_k = 100 kA <sub>mes</sub> (t_s ≤ 0.2 s)500 A gG- Max. backup fuse (L) up to I_k = 100 kA <sub>mes</sub> (t_s ≤ 0.2 s)500 A gG- Max. backup fuse (L) up to I_k = 100 kA <sub>mes</sub> (t_s ≤ 0.2 s)500 A gG- Max. backup fuse (L) up to I_k = 100 kA <sub>mes</sub> (t_s ≤ 0.2 s)500 A gG- Max. backup fuse (L) up to I_k = 100 kA <sub>mes</sub> (t_s ≤ 0.2 s)500 A gG- Max. backup fuse (L) up to I_k = 100 kA <sub>mes</sub> (t_s ≤ 5 s)250 A gGWeight516 gCustoms tariff number (Comb. Nomenclature EU)85363090GTIN4013364116269   | Operating state / fault indication  | green / red   |
| Cross-sectional area (L, N/PEN) (max.)       50 mm² stranded / 35 mm² flexible         Cross-sectional area (L') (max.)       35 mm² stranded / 25 mm² 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       UL, CSA         Extended technical data:       currents of more than 50 kArms (tested by the German VDE)         - Max. prospective short-circuit current       100 kArms (220 kApeak)         - Limitation / Extinction of mains follow currents       up to 100 kArms (220 kApeak)         - Max. backup fuse (L) up to I <sub>k</sub> = 100 kArms (ts ≤ 0.2 s)       500 A gG         - Max. backup fuse (L) up to I <sub>k</sub> = 100 kArms (ts ≤ 5 s)       250 A gG         Weight       516 g         Customs tariff number (Comb. Nomenclature EU)       85363090         Gruin Stall       4013364116269  | Number of ports   | 1   |
| Cross-sectional area (L') (max.)       35 mm² stranded / 25 mm² 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       UL, CSA         Extended technical data:       currents of more than 50 kA <sub>ms</sub> (tested by the German VDE)         - Max. prospective short-circuit current       100 kA <sub>ms</sub> (220 kA <sub>peak</sub> )         - Limitation / Extinction of mains follow currents       up to 100 kA <sub>ms</sub> (220 kA <sub>peak</sub> )         - Max. backup fuse (L) up to I <sub>K</sub> = 100 kA <sub>ms</sub> (t <sub>k</sub> ≤ 0.2 s)       500 A gG         - Max. backup fuse (L) up to I <sub>K</sub> = 100 kA <sub>ms</sub> (t <sub>k</sub> ≤ 5 s)       250 A gG         Weight       516 g         Customs tariff number (Comb. Nomenclature EU)       85363090         GTIN       4013364116269   | Cross-sectional area (L, L', N/PEN) (min.)  | 10 mm <sup>2</sup> solid / flexible                               |
| For mounting on35 mm DIN rails acc. to EN 60715Enclosure materialthermoplastic, red, UL 94 V-0Place of installationindoor installationDegree of protectionIP 20Capacity2 module(s), DIN 43880ApprovalsUL, CSAExtended technical data:use in switchgear installations with prospective short-circuit- Max. prospective short-circuit current100 kArms (220 kApeak)- Limitation / Extinction of mains follow currentsup to 100 kArms (220 kApeak)- Max. backup fuse (L) up to Ik = 100 kArms (ta ≤ 0.2 s)500 A gG- Max. backup fuse (L) up to Ik = 100 kArms (ta ≤ 5 s)250 A gGWeight516 gCustoms tariff number (Comb. Nomenclature EU)85363090GTIN4013364116269   | Cross-sectional area (L, N/PEN) (max.)  | 50 mm <sup>2</sup> stranded / 35 mm <sup>2</sup> flexible         |
| Enclosure materialthermoplastic, red, UL 94 V-0Place of installationindoor installationDegree of protectionIP 20Capacity2 module(s), DIN 43880ApprovalsUL, CSAExtended technical data:Use in switchgear installations with prospective short-circuitExtended technical data:100 kArms (tested by the German VDE)- Max. prospective short-circuit current100 kArms (220 kApeak)- Limitation / Extinction of mains follow currentsup to 100 kArms (220 kApeak)- Max. backup fuse (L) up to Ik = 100 kArms (ts ≤ 0.2 s)500 A gG- Max. backup fuse (L) up to Ik = 100 kArms (ts ≤ 5 s)250 A gGWeight516 gCustoms tariff number (Comb. Nomenclature EU)85363090GTIN4013364116269  | Cross-sectional area (L') (max.)  | 35 mm <sup>2</sup> stranded / 25 mm <sup>2</sup> flexible         |
| Place of installationindoor installationDegree of protectionIP 20Capacity2 module(s), DIN 43880ApprovalsUL, CSAExtended technical data:Use in switchgear installations with prospective short-circuit<br>currents of more than 50 kA <sub>rms</sub> (tested by the German VDE)- Max. prospective short-circuit current $100 \text{ kA}_{rms} (220 \text{ kA}_{peak})$ - Limitation / Extinction of mains follow currentsup to 100 kA <sub>rms</sub> (220 kA <sub>peak</sub> )- Max. backup fuse (L) up to I <sub>k</sub> = 100 kA <sub>rms</sub> (t <sub>a</sub> ≤ 0.2 s) $500 \text{ A gG}$ - Max. backup fuse (L) up to I <sub>k</sub> = 100 kA <sub>rms</sub> (t <sub>a</sub> ≤ 5 s) $250 \text{ A gG}$ Weight516 gCustoms tariff number (Comb. Nomenclature EU) $85363090$ GTIN4013364116269   | For mounting on   | 35 mm DIN rails acc. to EN 60715                                  |
| Degree of protectionIP 20Capacity2 module(s), DIN 43880ApprovalsUL, CSAExtended technical data:Use in switchgear installations with prospective short-circuit<br>currents of more than 50 kArms (tested by the German VDE)- Max. prospective short-circuit current $100  kA_{rms} (220  kA_{peak})$ - Limitation / Extinction of mains follow currentsup to 100 $kA_{rms} (220  kA_{peak})$ - Max. backup fuse (L) up to $I_k = 100  kA_{rms} (t_a \le 0.2  s)$ $500  A  gG$ - Max. backup fuse (L) up to $I_k = 100  kA_{rms} (t_a \le 5  s)$ $250  A  gG$ Weight $516  g$ Customs tariff number (Comb. Nomenclature EU) $85363090$ GTIN4013364116269   | Enclosure material  | thermoplastic, red, UL 94 V-0                                     |
| Capacity2 module(s), DIN 43880ApprovalsUL, CSAExtended technical data:Use in switchgear installations with prospective short-circuit<br>currents of more than 50 kArms (tested by the German VDE)- Max. prospective short-circuit current100 kArms (220 kApeak)- Limitation / Extinction of mains follow currentsup to 100 kArms (220 kApeak)- Max. backup fuse (L) up to $I_K = 100 kArms$ ( $t_a \le 0.2 s$ )500 A gG- Max. backup fuse (L) up to $I_K = 100 kArms$ ( $t_a \le 5 s$ )250 A gGWeight516 gCustoms tariff number (Comb. Nomenclature EU)85363090GTIN4013364116269   | Place of installation   | indoor installation   |
| ApprovalsUL, CSAExtended technical data:Use in switchgear installations with prospective short-circuit<br>currents of more than 50 kArms (tested by the German VDE)- Max. prospective short-circuit current100 kArms (220 kApeak)- Limitation / Extinction of mains follow currentsup to 100 kArms (220 kApeak)- Max. backup fuse (L) up to $I_K = 100 kArms (t_a \le 0.2 s)$ 500 A gG- Max. backup fuse (L) up to $I_K = 100 kArms (t_a \le 5 s)$ 250 A gGWeight516 gCustoms tariff number (Comb. Nomenclature EU)85363090GTIN4013364116269   | Degree of protection  | IP 20   |
| Use in switchgear installations with prospective short-circuit<br>currents of more than 50 kArms (tested by the German VDE)- Max. prospective short-circuit current $100 \text{ kArms} (220 \text{ kA}_{peak})$ - Limitation / Extinction of mains follow currentsup to 100 kArms (220 kA_{peak})- Max. backup fuse (L) up to I <sub>K</sub> = 100 kArms (t_a ≤ 0.2 s) $500 \text{ A gG}$ - Max. backup fuse (L) up to I <sub>K</sub> = 100 kArms (t_a ≤ 5 s) $250 \text{ A gG}$ Weight $516 \text{ g}$ Customs tariff number (Comb. Nomenclature EU) $85363090$ GTIN $4013364116269$  | Capacity  | 2 module(s), DIN 43880  |
| Extended technical data:currents of more than 50 kArms (tested by the German VDE)- Max. prospective short-circuit current $100 kA_{rms} (220 kA_{peak})$ - Limitation / Extinction of mains follow currentsup to 100 kArms (220 kA_{peak})- Max. backup fuse (L) up to $I_K = 100 kA_{rms} (t_a \le 0.2 s)$ $500 A gG$ - Max. backup fuse (L) up to $I_K = 100 kA_{rms} (t_a \le 5 s)$ $250 A gG$ Weight $516 g$ Customs tariff number (Comb. Nomenclature EU) $85363090$ GTIN $4013364116269$   | Approvals   | UL, CSA   |
| - Limitation / Extinction of mains follow currentsup to 100 kArms (220 kApeak)- Max. backup fuse (L) up to I <sub>K</sub> = 100 kArms ( $t_a \le 0.2$ s)500 A gG- Max. backup fuse (L) up to I <sub>K</sub> = 100 kArms ( $t_a \le 5$ s)250 A gGWeight516 gCustoms tariff number (Comb. Nomenclature EU)85363090GTIN4013364116269  | Extended technical data:  | <b>o</b>  |
| - Max. backup fuse (L) up to $I_{K} = 100 \text{ kA}_{rms}$ ( $t_{a} \le 0.2 \text{ s}$ )       500 A gG         - Max. backup fuse (L) up to $I_{K} = 100 \text{ kA}_{rms}$ ( $t_{a} \le 5 \text{ s}$ )       250 A gG         Weight       516 g         Customs tariff number (Comb. Nomenclature EU)       85363090         GTIN       4013364116269   | <ul> <li>Max. prospective short-circuit current</li> </ul>                              | 100 kA <sub>rms</sub> (220 kA <sub>peak</sub> )                   |
| - Max. backup fuse (L) up to $I_K = 100 \text{ kA}_{rms}$ ( $t_a \le 5 \text{ s}$ )250 A gGWeight516 gCustoms tariff number (Comb. Nomenclature EU)85363090GTIN4013364116269   | - Limitation / Extinction of mains follow currents                                      | up to 100 kA <sub>rms</sub> (220 kA <sub>peak</sub> )             |
| Weight     516 g       Customs tariff number (Comb. Nomenclature EU)     85363090       GTIN     4013364116269   | – Max. backup fuse (L) up to I_{\rm K} = 100 kA <sub>rms</sub> (t <sub>a</sub> ≤ 0.2 s) | 500 A gG  |
| Customs tariff number (Comb. Nomenclature EU)     85363090       GTIN     4013364116269  | – Max. backup fuse (L) up to $I_{K}$ = 100 kA <sub>rms</sub> (t <sub>a</sub> ≤ 5 s)     | 250 A gG  |
| GTIN 4013364116269   | Weight  | 516 g   |
|  | Customs tariff number (Comb. Nomenclature EU)   | 85363090  |
| PU 1 pc(s)   | GTIN  | 4013364116269   |
|  | PU  | 1 pc(s)   |

### **DBM 1 440 FM (961 145)**

- Extremely high lightning current discharge capacity
- High follow current extinction and limitation due to RADAX Flow technology
- Directly coordinated with DEHNguard surge protective devices without additional cable length







Dimension drawing DBM 1 440 FM

Figure without obligation

Basic circuit diagram DBM 1 440 FM

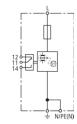
Coordinated single-pole lightning current arrester with high follow current limitation for  $U_c$  = 440 V.

| Туре  | DBM 1 440 FM   |
|---|--|
| Part No.  | 961 145  |
| SPD according to EN 61643-11 / IEC 61643-11   | type 1 / class I   |
| Nominal voltage (a.c.) $(U_N)$  | 400 V  |
| Max. continuous operating voltage (a.c.) (U <sub>c</sub> )                            | 440 V  |
| Lightning impulse current (10/350 µs) (I <sub>imp</sub> )                             | 35 kA  |
| Specific energy (W/R)   | 306.25 kJ/ohms   |
| Nominal discharge current (8/20 µs) (In)  | 35 kA  |
| Voltage protection level (U <sub>P</sub> )  | ≤ 2.5 kV   |
| Follow current extinguishing capability (a.c.) (I <sub>fi</sub> )                     | 50 kA <sub>rms</sub>   |
| Follow current limitation / Selectivity   | no tripping of a 32 A gG fuse up to 50 kA <sub>rms</sub> (prosp.)  |
| Response time (t <sub>A</sub> )   | ≤ 100 ns   |
| Max. backup fuse (L) up to $I_{K}$ = 50 kA <sub>rms</sub> ( $t_{a} \le 0.2$ s)        | 500 A gG   |
| Max. backup fuse (L) up to $I_{K}$ = 50 kA <sub>rms</sub> ( $t_{a} \le 5$ s)          | 250 A gG   |
| Max. backup fuse (L-L')   | 125 A gG   |
| Temporary overvoltage (TOV) (U <sub>T</sub> ) – Characteristic                        | 760 V / 120 min. – withstand   |
| Operating temperature range (parallel connection) (T <sub>UP</sub> )                  | -40 °C +80 °C  |
| Operating temperature range (series connection) (T <sub>US</sub> )                    | -40 °C +60 °C  |
| Operating state / fault indication  | green / red  |
| Number of ports   | 1  |
| Cross-sectional area (L, L', N/PEN) (min.)  | 10 mm <sup>2</sup> solid / flexible  |
| Cross-sectional area (L, N/PEN) (max.)  | 50 mm <sup>2</sup> stranded / 35 mm <sup>2</sup> flexible  |
| Cross-sectional area (L') (max.)  | 35 mm <sup>2</sup> stranded / 25 mm <sup>2</sup> 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   | UL, CSA  |
| 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 <sup>2</sup> solid / flexible  |
| Extended technical data:  | Use in switchgear installations with prospective short-circuit currents of more than 50 kA <sub>rms</sub> (tested by the German VDE) |
| - Max. prospective short-circuit current  | 100 kA <sub>rms</sub> (220 kA <sub>peak</sub> )  |
| - Limitation / Extinction of mains follow currents                                    | up to 100 kA <sub>rms</sub> (220 kA <sub>peak</sub> )  |
| – Max. backup fuse (L) up to $I_{K}$ = 100 kA <sub>rms</sub> (t <sub>a</sub> ≤ 0.2 s) | 500 A gG   |
| – Max. backup fuse (L) up to $I_{K}$ = 100 kA <sub>rms</sub> (t <sub>a</sub> ≤ 5 s)   | 250 A gG   |
| Weight  | 520 g  |
| Customs tariff number (Comb. Nomenclature EU)   | 85363090   |
| GTIN  | 4013364116276  |
| PU  | 1 pc(s)  |

### DBM 1 CI 440 FM (961 146)

- Spark-gap-based lightning current arrester with integrated backup fuse
- Maximum system availability thanks to RADAX Flow follow current limitation
- Directly coordinated with DEHNguard surge protective devices without cable length





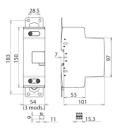


Figure without obligation

Basic circuit diagram DBM 1 CI 440 FM

Dimension drawing DBM 1 CI 440 FM Coordinated single-pole lightning current arrester with integrated backup fuse for 400 / 690 V TN systems and 400 V IT systemss; with remote signalling contact for monitoring device (floating changeover contact).

| Туре   | DBM 1 CI 440 FM   |
|--|---|
| Part No.   | 961 146   |
| SPD according to EN 61643-11 / IEC 61643-11                    | type 1 / class I  |
| Nominal voltage (a.c.) (U <sub>N</sub> )                       | 400 / 690 V (50 / 60 Hz)  |
| Maximum continuous operating voltage (a.c.) (U <sub>c</sub> )  | 440 V (50 / 60 Hz)  |
| Lightning impulse current (10/350 µs) (I <sub>imp</sub> )      | 35 kA   |
| Specific energy (W/R)  | 306.25 kJ/ohms  |
| Voltage protection level (U <sub>P</sub> )                     | ≤ 2.5 kV  |
| Follow current extinguishing capability (a.c.) $(I_{\rm fi})$  | 50 kA <sub>rms</sub>  |
| Follow current limitation / Selectivity                        | no tripping of a 35 A gG fuse up to 50 kA <sub>rms</sub> (prosp.)                             |
| Response time (t <sub>A</sub> )                                | ≤ 100 ns  |
| Max. mains-side overcurrent protection                         | not required  |
| Temporary overvoltage (TOV) (U <sub>T</sub> ) – Characteristic | 760 V / 120 min. – withstand  |
| Operating temperature range (T <sub>U</sub> )                  | -40 °C +80 °C   |
| Operating state / fault indication                             | green / red   |
| Number of ports  | 1   |
| Cross-sectional area (L, N/PE(N)) (min.)                       | 10 mm <sup>2</sup> solid / flexible   |
| Cross-sectional area (L, N/PE(N)) (max.)                       | 50 mm <sup>2</sup> stranded / 35 mm <sup>2</sup> flexible                                     |
| For mounting on  | 35 mm DIN rails acc. to EN 60715 or mounting plate (using the two mounting brackets provided) |
| Enclosure material   | thermoplastic, red, UL 94 V-0   |
| Place of installation  | indoor installation   |
| Degree of protection   | IP 20   |
| Capacity   | 3 module(s), DIN 43880  |
| 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 <sup>2</sup> solid / flexible   |
| Supplementary data:  |   |
| - Nominal discharge current (8/20 μs) (I <sub>n</sub> )        | 35 kA   |
| Weight   | 946 g   |
| Customs tariff number (Comb. Nomenclature EU)                  | 85363090  |
| GTIN   | 4013364250062   |
| PU   | 1 pc(s)   |

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