

The DEHN logo is positioned in the upper right corner of the top image. It features the word "DEHN" in a bold, white, sans-serif font, flanked by two white lightning bolt symbols pointing outwards.

Lightning and surge protection for rooftop photovoltaic systems

White paper



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At present, well above a million PV systems are installed in Germany. Based on the fact that self-generated electricity is generally cheaper and provides a high degree of electrical independence from the grid, PV systems will become an integral part of electrical installations in the future. However, these systems are exposed to all weather conditions and must withstand them over decades.

The cables of PV systems frequently enter the building and extend over long distances until they reach the grid connection point.

Lightning discharges cause field-based and conducted electrical interference. This effect increases in relation to the length of the cables and the size of the conductor loops. Surges not only damage the PV modules, inverters and their monitoring electronics, but also devices in the building installation. In industrial buildings, production facilities may be damaged causing production to come to a standstill.

If surges are injected into systems that are far from the power grid, so-called stand-alone PV systems, the operation of equipment powered by solar electricity (e.g. medical equipment, water supply) may be disrupted.

Necessity of a rooftop lightning protection system

The energy released by a lightning discharge is one of the most frequent causes of fire. Therefore, personal and fire protection is of paramount importance in case of a direct lightning strike to the building.

At the design stage of a PV system, it is evident whether a lightning protection system is installed on a building. Building regulations in some countries require public buildings (e.g. places of public assembly, schools and hospitals) to be equipped with a lightning protection system. In case of industrial or private buildings it depends on their location, type of construction and utilisation whether a lightning protection system must be installed. To this end, it must be determined whether lightning strikes are to be expected or could have severe consequences. Structures in need of protection must be provided with permanently effective lightning protection systems.

According to the state of scientific and technical knowledge, the installation of PV modules does not increase the risk of a lightning strike. Therefore, the request for lightning protection measures cannot be derived directly from the mere existence of a PV system. However, substantial lightning interference may be injected into the building through these systems. Therefore, it is necessary to determine the risk resulting from a lightning strike as per IEC 62305-2 (EN 62305-2) and to take the results from this risk analysis into account when installing the PV system. The DEHNsupport Toolbox software is specially designed to calculate this risk and produce a clear, easily understandable analysis. The software compares the risk with the

technical expenditure and provides economically optimised protection measures.

Section 4.5 (Risk Management) of Supplement 5 of the German DIN EN 62305-3 standard describes that a lightning protection system designed for class of LPS III (LPL III) meets the usual requirements for PV systems. In addition, adequate lightning protection measures are listed in the German VdS 3145 guideline (Risk-oriented lightning and surge protection) published by the German Insurance Association.

As a general rule, rooftop photovoltaic systems must not interfere with the existing lightning protection measures.

Necessity of surge protection for PV systems

In case of a lightning discharge, surges are induced on electrical conductors. Surge protective devices (SPDs) which must be installed upstream of the devices to be protected on the AC, DC and data side have proven very effective in protecting electrical systems from these destructive voltage peaks. Section 8 of IEC 61643-32 calls for the installation of surge protective devices unless a risk analysis demonstrates that SPDs are not required. According to IEC 60364-4-44 standard, surge protective devices must also be installed for buildings without an external lightning protection system such as commercial and industrial buildings, e.g. agricultural facilities. IEC 61643-32 and IEC TR 63227 ** provide a detailed description of the types of SPDs and their place of installation.

Cable routing of PV systems

Cables must be routed in such a way that large conductor loops are avoided. This must be observed when combining the d.c. circuits to form a string and when interconnecting several strings. Moreover, data or sensor lines must not be routed over several strings and form large conductor loops with the string lines. This must also be observed when connecting the inverter to the grid connection. The important thing is that the power (DC and AC) and data lines (e.g. radiation sensor, yield monitoring) are routed together with the equipotential bonding conductors along their entire route.

Earthing of PV systems

PV modules are typically fixed on metal mounting systems. The live PV components on the DC side feature double or reinforced insulation (comparable to the previous protective insulation) as required in the IEC 60364-4-41 standard. The combination of numerous technologies on the module and inverter sides (e.g. with or without galvanic isolation) results in different earthing requirements. Moreover, the insulation monitoring system integrated in the inverters is only permanently effective if the mounting system is connected to earth. Information on the practical implementation is provided in IEC TR 63227 standard. The metal substructure is functionally

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earthed if the PV system is located in the protected volume of the air-termination systems and the separation distance is maintained. Section 7 of IEC TR 63227 requires copper conductors with a cross-section of at least 6 mm² or equivalent for functional earthing (**Figure 1**). The mounting rails also have to be permanently interconnected by means of conductors of this cross-section. If the mounting system is directly connected to the external lightning protection system due to the fact that the separation distance *s* cannot be maintained, these conductors become part of the lightning equipotential bonding system. Consequently, these elements must be capable of carrying lightning currents. The minimum requirement for a lightning protection system designed for class of LPS III is a copper conductor with a cross-section of 16 mm² or equivalent. Also in this case, the mounting rails must be permanently interconnected. The requirements on natural components according to IEC 62305-3 (EN 62305-3) apply here (**Figure 2**).

UNI earthing clamps (**Figure 3**) can be fixed on all common mounting systems. They connect, for example, copper conductors with a cross-section of 6 mm² or 16 mm² and bare round wires with a diameter from 8 to 10 mm to the mounting sys-

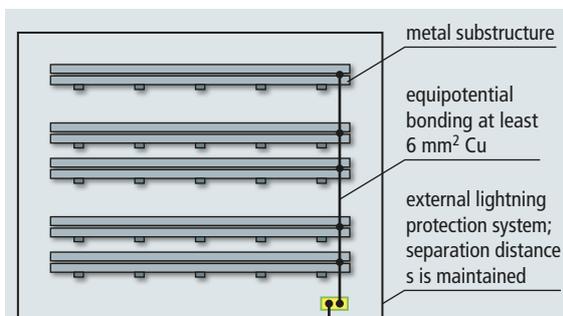


Figure 1 Functional earthing of the mounting systems if no external lightning protection system is installed or the separation distance is maintained (IEC TR 63227)

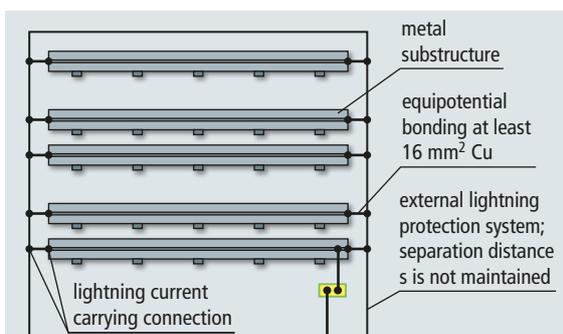


Figure 2 Lightning equipotential bonding for the mounting systems if the separation distance is not maintained



Figure 3 UNI earthing clamp: A stainless steel intermediate element prevents contact corrosion, thus establishing reliable long-term connections between different conductor materials

tem in such a way that they can carry lightning currents. The integrated stainless steel (V4A) contact plate ensures corrosion protection for the aluminium mounting systems.

Separation distance *s* as per IEC 62305-3 (EN 62305-3)

A certain separation distance *s* must be maintained between a lightning protection system and a PV system. It defines the distance required to avoid uncontrolled flashover to adjacent metal parts resulting from a lightning strike to the external lightning protection system. In the worst case, such an uncontrolled flashover can set a building on fire. In this case, damage to the PV system becomes irrelevant. Details on calculating the separation distance *s* can be found in chapter 5.6 and of our Lightning Protection Guide and are easily and quickly calculated using the DEHN Distance Tool software.

Core shadows on solar cells

The distance between the solar generator and the external lightning protection system is an important aspect to be considered in order to prevent excessive shading. Diffuse shadows cast by, for example overhead lines, do not significantly affect the PV system and the yield. However, in case of core shadows, a dark clearly outlined shadow is cast on the surface behind an object, changing the current flowing through the PV modules. For this reason, it should be ensured that solar cells and the associated bypass diodes are not influenced by core shadows. This can be achieved by maintaining sufficient distance. For example, if an air-termination rod with a diameter of 10 mm shades a module, the core shadow is steadily reduced as the distance from the module increases. After 1.08 m only a diffuse shadow is cast on the module (**Figure 4**). Annex A of IEC TR 63227 provides more detailed information on the calculation of core shadows.

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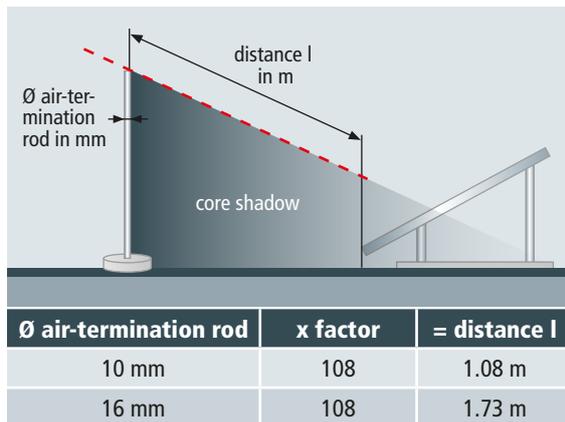


Figure 4 Distance between the module and the air-termination rod required to prevent core shadows

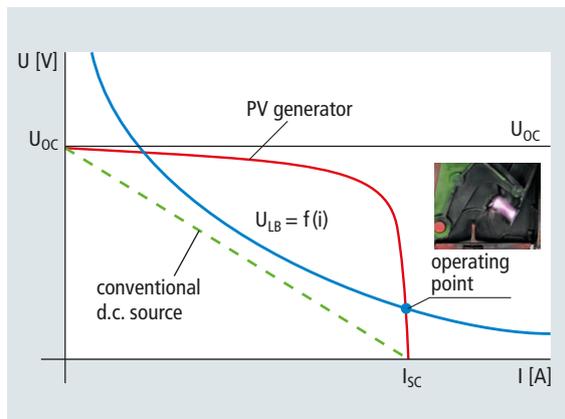


Figure 5 Source characteristic of a conventional DC source versus the source characteristic of a PV generator. When switching PV sources, the source characteristic of the PV generator crosses the arc voltage range

Special surge protective devices for the DC side of photovoltaic systems

The U/I characteristics of photovoltaic current sources are very different from those of conventional DC sources: They have a non-linear characteristic (Figure 5) and cause long-term persistence of ignited arcs. This unique nature of PV current sources not only requires larger PV switches and PV fuses, but also a disconnecter for the surge protective device which is specially designed for the purpose and capable of coping with PV currents. The selection of suitable SPDs is described in sub-section 9.2 of IEC 61643-32 or in Section 5.6 of IEC TR 63227. To facilitate the selection of type 1 SPDs,

Table 1 shows the required lightning impulse current carrying capability I_{imp} depending on the class of LPS and the number of down conductors of the external lightning protection systems.

Type 1 DC arrester for use in PV systems: Multipole type 1 + type 2 combined DC arrester, DEHNcombo YPV

With their proven fault-resistant Y circuit, DEHNcombo YPV (FM) combined arresters (Figure 6) fulfil the above mentioned requirements. PV generators with up to 10,000 A can be protected by DEHNcombo YPV (FM) without an additional backup fuse. This arrester combines a lightning current arrester and a surge arrester in a single device, thus ensuring efficient protection of terminal equipment. With its discharge capacity I_{total} of 12.5 kA (10/350 μ s), it is very flexible and can even be used for the highest classes of LPS. DEHNcombo YPV (FM) is available for voltages U_{CPV} of $\leq 1200V$ and $\leq 1500V$ and has a width of only 4 modules. It is therefore the ideal type 1 combined arrester for use in photovoltaic power supply systems.

Type 2 DC arrester for use in PV systems: DEHNguard M YPV and DEHNcube YPV

Reliable operation of SPDs in DC PV circuits is also indispensable when using type 2 surge protective devices. To this end,

Class of LPS and max. lightning current (10/350 μ s)		Number of down conductors of the external lightning protection system			
		<4		≥ 4	
		Values for the voltage-limiting type 1 SPDs or type 1 combined SPDs (series connection) based on a selection of $I_{8/20}$ (8/20 μ s) and $I_{10/350}$ (10/350 μ s)			
		$I_{SPD1} = I_{SPD2}$ $I_{8/20}/I_{10/350}$	$I_{SPD3} = I_{SPD1} + I_{SPD2} = I_{total}$ $I_{8/20}/I_{10/350}$	$I_{SPD1} = I_{SPD2}$ $I_{8/20}/I_{10/350}$	$I_{SPD3} = I_{SPD1} + I_{SPD2} = I_{total}$ $I_{8/20}/I_{10/350}$
I or unknown	200 kA	17/10	34/20	10/5	20/10
II	150 kA	12.5/7.5	25/15	7.5/3.75	15/7.5
III and IV	100 kA	8.5/5	17/10	5/2.5	10/5

Table 1 Selection of the minimum discharge capacity of voltage-limiting type 1 SPDs (varistors) or type 1 combined SPDs (series connection of varistors and spark gaps); according to IEC 61643-32 (Table A.1) and IEC TR 63227 (Table 2)

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Figure 6 DEHCombo YPV type 1 combined arrester for protecting photovoltaic systems from surges and partial lightning currents

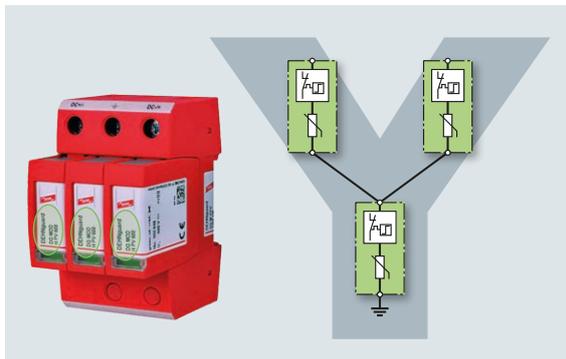


Figure 7 Modular DEHGuard M YPV ... (FM) type 2 surge arrester with fault-resistant Y circuit



Figure 8 Ready-to-install type 2 DEHncube YPV SCI 1000 1M surge arrester

the DEHGuard M YPV SCI ... (FM) and DEHncube YPV SCI ... surge arresters also feature a fault-resistant Y protective circuit (Figures 7 and 8).

Selection of SPDs according to the voltage protection level U_p

The operating voltage on the DC side of PV systems differs from system to system. At present, values up to 1500 V DC are possible. Consequently, the dielectric strength of terminal equipment also differs. To ensure that the PV system is reliably protected, the voltage protection level U_p of the SPD must be lower than the dielectric strength of the PV system it is supposed to protect. The IEC 61643-32 standard requires that U_p is at least 20 % lower than the dielectric strength of the PV system. Type 1 or type 2 SPDs must be energy-coordinated with the input of terminal equipment. If SPDs are already integrated in terminal equipment, coordination between the type 2 SPD and the input circuit of terminal equipment is ensured by the manufacturer (Figure 9).

Application examples:

Building without an external lightning protection system (situation A)

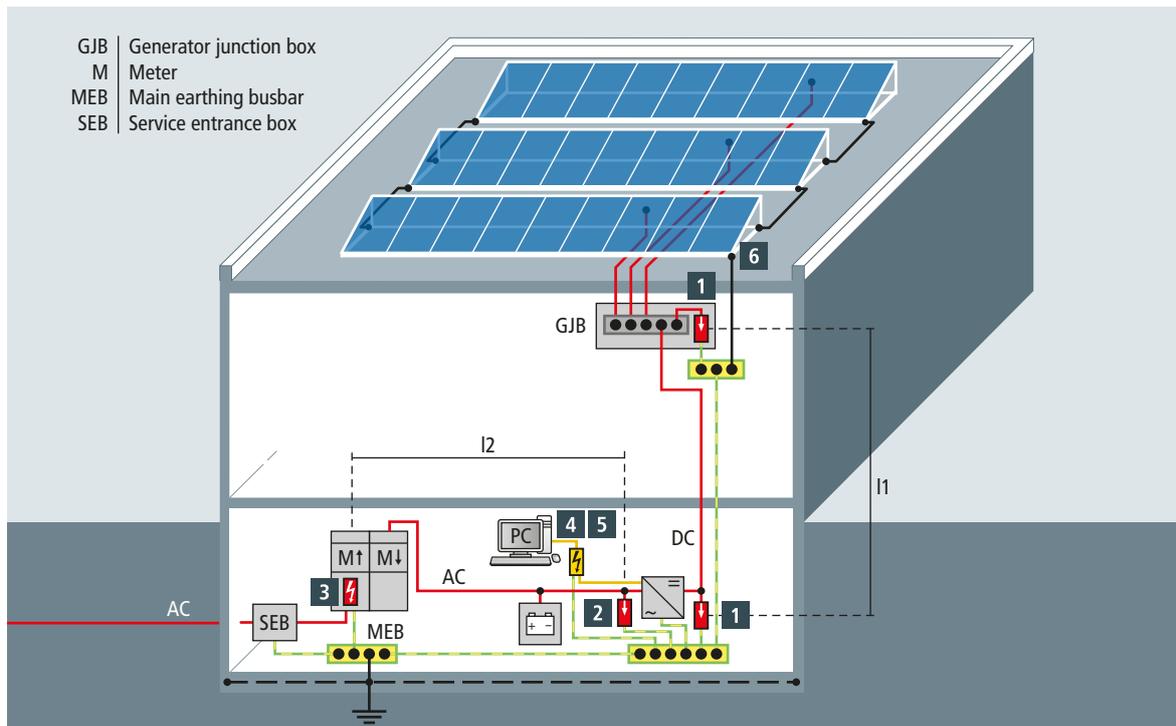
Figure 10 shows the surge protection concept for a PV system installed on a building without an external lightning protection system. Dangerous surges enter the PV system due to inductive coupling resulting from nearby lightning strikes or travel from the power supply system through the service entrance to the consumer's installation. The SPDs can be installed at the following locations:



Figure 9 DEHGuard type 2 SPD integrated in the inverter for the DC side

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No. Fig. 10		SPD	* FM = Floating remote signalling contact	Part No.
DC input of the inverter (if l1 > 10 m, additional SPD required for the PV generator)				
1	For 1 MPPT	DEHNguard DG M YPV 1200 FM*		952 565
		DEHncube DCU YPV SCI 1000 1M + Y connecting cable for simple wiring		900 910 + 900 945
	For 2 MPPTs	DEHNguard DG M PV2 SCI 1000 FM*		952 519
		DEHncube DCU YPV SCI 1000 2M + Y connecting cable for simple wiring		900 920 + 900 945
AC output of the inverter (required, if l2 > 10 m)				
2	TN-S system	DEHNguard DG M TNS 275 FM*		952 405
Low-voltage input				
3	TN-C system	DEHNshield Basic TNC 255 FM		941 306
	TT system	DEHNshield Basic TT 255 FM		941 316
	TN-S system	DEHNshield Basic TNS 255 FM		941 406
Data interface				
4	One pair for operating voltage up to 5 V	BLITZDUCTORconnect ML2 BD HF 5		927 271
5	Unit for monitoring the condition of BLITZDUCTORconnect	DEHNrecord DRC IRCM		910 710
Functional earthing				
5	Functional equipotential bonding	UNI earthing clamp		540 250

Figure 10 PV system installed on a building without external LPS

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- ➔ DC side of the modules and inverters
- ➔ AC output of the inverter
- ➔ Main low-voltage distribution board
- ➔ Wired communication interfaces

Every DC input (MPPT) of the inverter must be protected by a type 2 surge protective device, for example DEHNguard M YPV 1200 FM, that reliably protects the DC side of PV systems. The IEC 61643-32 and the IEC TR 63277 standards require an additional type 2 DC arrester to be installed on the module side if the distance between the inverter input and the PV generator exceeds 10 m.

If PV inverters and further electronic components like, for example, AC coupled battery storage systems, are situated no further than 10 m away from where the arrester is installed at the grid connection point (low-voltage infeed), they are sufficiently protected. In case of greater cable lengths, an additional type 2 surge protective device must be installed.

For the grid connection point we recommend installing the combined type 1 + 2 arrester DEHNventil Basic. Reliable spark gap technology means that it can be used upstream of the meter.

If inverters are connected to data and sensor lines to monitor the yield, suitable surge protective devices are required. The BLITZDUCTORconnect arrester is available for data systems based on RS 485.

Building with external lightning protection system and sufficient separation distance s (situation B)

Figure 11 shows the surge protection concept for a PV system with an external lightning protection system and sufficient separation distance s between the PV system and the external lightning protection system.

The primary protection goal is to avoid damage to people and property (fire) resulting from a lightning strike. In this context, it is important that the PV system does not interfere with the external lightning protection system. Moreover, the PV system itself must be protected from direct lightning strikes. This means that the PV system must be installed within the protected volume of the external lightning protection system. This protected volume is formed by air-termination systems (e.g. air-termination rods) which prevent direct lightning strikes to the PV modules and cables. The protective angle method (**Figure 12**) or rolling sphere method (**Figure 13**) as de-

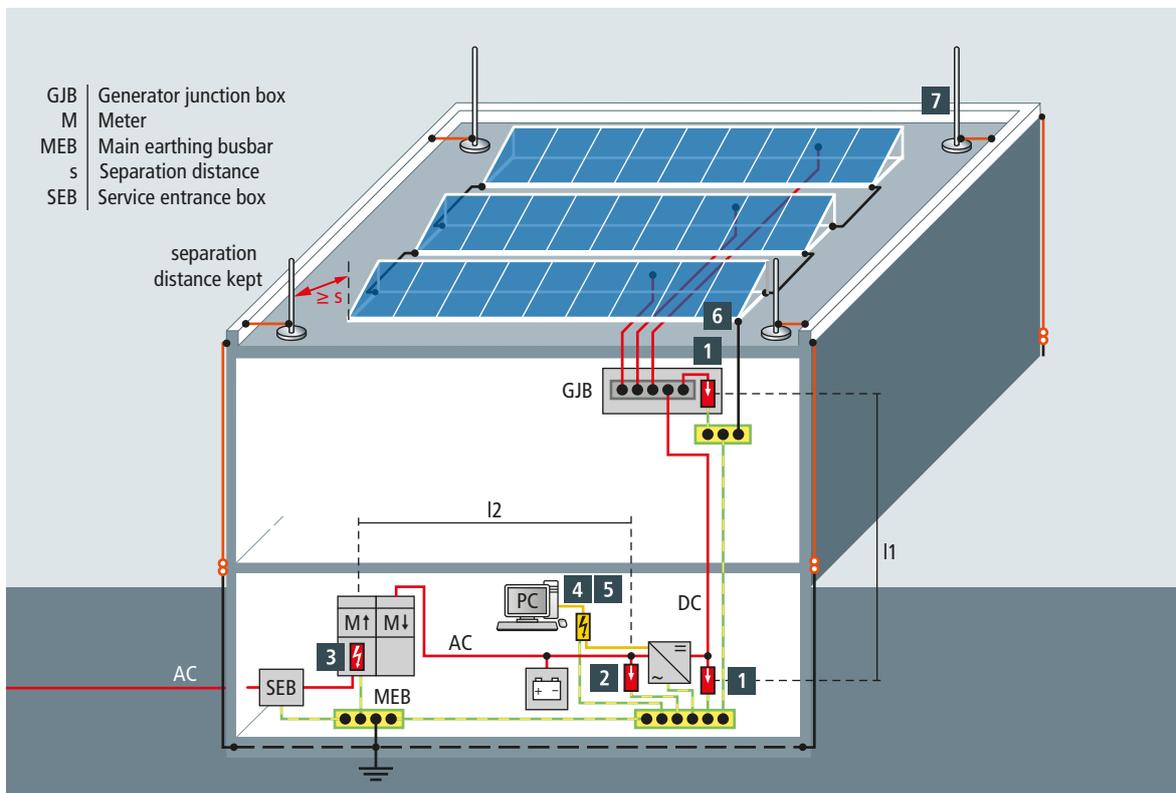


Figure 11 PV system installed on a building with external LPS and sufficient separation distance Table 5 of IEC 62305-1 (EN 62305-1)

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No. Fig. 11		SPD	* FM = Floating remote signalling contact	Part No.
DC input of the inverter (if $l_1 > 10$ m, additional SPD required for the PV generator)				
1	For 1 MPPT	DEHNguard DG M YPV 1200 FM*		952 565
		DEHNcube DCU YPV SCI 1000 1M		900 910
	For 2 MPPTs	DEHNguard DG M PV2 SCI 1000 FM*		952 519
		DEHNcube DCU YPV SCI 1000 2M		900 920
AC output of the inverter (required, if $l_2 > 10$ m)				
2	TN-S system	DEHNguard DG M TNS 275 FM*		952 405
Low-voltage input				
3	TN-C system	DEHNventil DV M2 TNC 255 FM*		954 305
	TN-S system	DEHNventil DV M2 TNS 255 FM		954 405
	TT system	DEHNventil DV M2 TT 255 FM*		954 315
Data interface				
4	One pair for operating voltage up to 5 V	BLITZDUCTORconnect ML2 BD HF 5		927 271
5	Unit for monitoring the condition of BLITZDUCTORconnect	DEHNrecord DRC IRCM		910 710
Functional earthing / External lightning protection system				
6	Functional equipotential bonding	UNI earthing clamp		540 250
7	Air-termination system	Air-termination rod with concrete base (8.5 kg)		101 000 + 102 075

Table 2 Selection of protective devices according to figure 11

scribed in subsection 5.2.2 of the IEC 62305-3 (EN 62305-3) standard may be used to determine this protected volume. A certain separation distance s must be maintained between all conductive parts of the PV system and the lightning protection system. In this context, core shadows must be prevented by, for example, maintaining a sufficient distance between the air-termination rods and the PV module.

Lightning equipotential bonding is an integral part of a lightning protection system. It must be implemented for all conductive systems and lines entering the building which may carry lightning currents. This is achieved by directly connecting all metal systems and indirectly connecting all energised systems via type 1 lightning current arresters to the earth-termination system. Lightning equipotential bonding should be implemented as close as possible to the entrance point into the building to prevent partial lightning currents from entering the building. The grid connection point must be protected

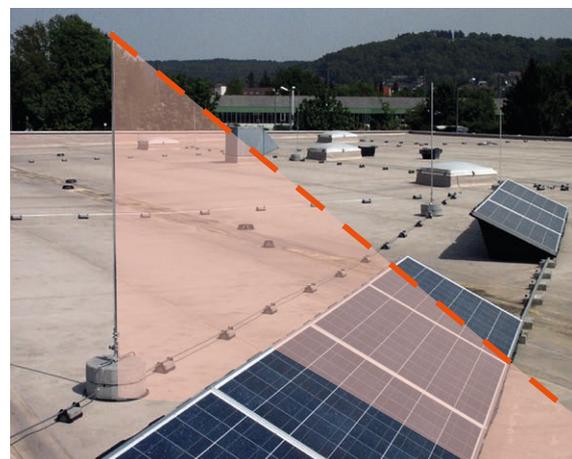


Figure 12 Determination of the protected volume using the protective angle method

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by a multipole type 1 SPD, for example a spark-gap-based DEHNventil combined arrester.

This arrester combines a lightning current arrester and a surge arrester in a single device. If the length of the cables between the arrester, the inverter and further electronic components like, for example, AC coupled battery storage systems is less than 10 m, sufficient protection is provided. In case of longer cables, additional type 2 DEHNguard M surge protective devices must be installed upstream of the devices to be protected.

The DC side of the inverter must be protected by a type 2 PV arrester, for example DEHNCube YPV SCI ... (Figure 14). If the

inverters are connected to data lines, for example to monitor the yield, surge protective devices must be installed to protect data transmission. BLITZDUCTORconnect can be used here to protect both lines with an analogue signal and data bus systems such as RS485. DRC IRCM can be used for permanent condition monitoring of arresters.

High-voltage-resistant, insulated HVI Conductor

Another technical solution for keeping the separation distance s is to use high-voltage-resistant, insulated HVI Conductors which make it possible to maintain a separation distance s up to 0.9 m in air. HVI Conductors may come into direct contact with the PV system downstream of the sealing end range. More detailed information on the application and installation of HVI Conductors is provided in our Lightning Protection Guide or in the relevant installation instructions.

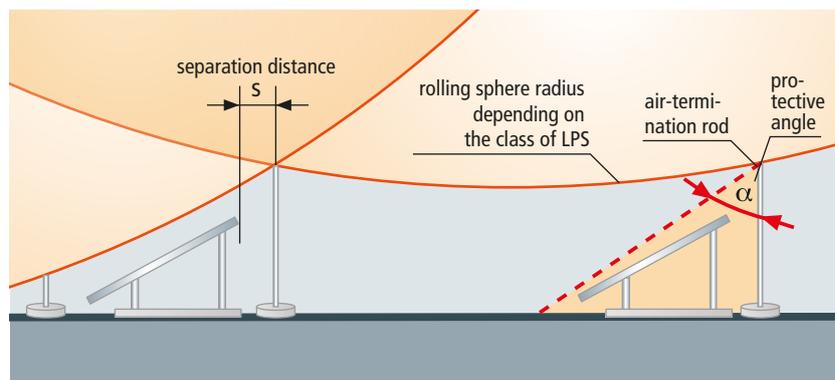


Figure 13 Rolling sphere method versus protective angle method for determining the protected volume

Building with external lightning protection and insufficient separation distance s (situation C)

If the roofing is made of metal or is formed by the PV system itself, the separation distance s cannot be maintained. The metal components of the PV mounting system must

be connected to the external lightning protection system in such a way that they can carry lightning currents (copper conductor with a cross-section of at least 16 mm² or equivalent). This means that lightning equipotential bonding must also be implemented for the PV lines entering the building from the outside (Figure 15). According to IEC 61643-32 and IEC TR 63227, DC lines must be protected by a type 1 SPD for PV systems.

For this purpose, a type 1 and type 2 DEHNcombo YPV (FM) combined arrester is used. Lightning equipotential bonding must also be implemented in the low-voltage infeed. If the inverter and, for example, the battery storage system, are situated more than 10 m from the type 1 SPD installed at the grid connection point, an additional type 1 SPD must be installed (e.g. type 1 + type 2 DEHNshield...255 combined arrester). Suitable surge protective devices must also be installed to protect the relevant data lines for yield monitoring. BLITZDUCTORconnect surge protective devices are used to protect data systems, for example based on RS 485.



Figure 14 DEHNCube YPV SCI 1000 1M type 2 arrester for protecting inverters (1 MPPT)

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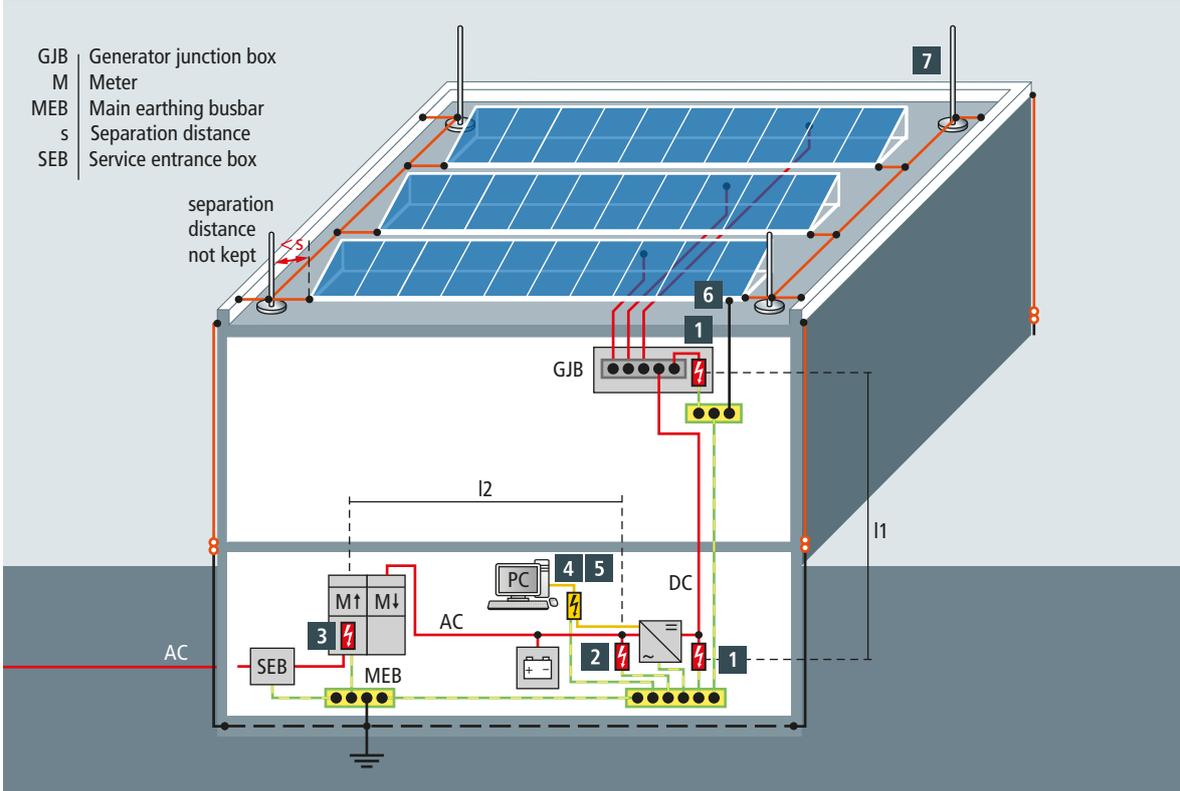


Figure 15 PV system installed on a building with external LPS and insufficient separation distance

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No. Fig. 15		SPD	* FM = Floating remote signalling contact	Part No.
PV generator at the entrance point of the building (if $l_1 > 10$ m, an additional SPD must be installed at the inverter)				
1	Per MPPT	DEHNcombo DCB YPV 1200 FM*		900 075
AC output of the inverter (required, if $l_2 > 10$ m)				
2	TN-S system	DEHNshield DSH TNS 255		941 400
Low-voltage input				
3	TN-C system	DEHNventil DV M2 TNC 255 FM*		954 305
	TN-S system	DEHNventil DV M2 TNS 255 FM		954 405
	TT system	DEHNventil DV M2 TT 255 FM*		954 315
Data interface				
4	One pair for operating voltage up to 5 V	BLITZDUCTORconnect ML2 BD HF 5		927 271
5	Unit for monitoring the condition of BLITZDUCTORconnect	DEHNrecord DRC IRCM		910 710
Functional earthing / External lightning protection system				
6	Lightning equipotential bonding	UNI earthing clamp		540 250
7	Air-termination system	Air-termination rod with concrete base (8.5 kg)		101 000 + 102 075

Table 3 Selection of protective devices according to figure 15

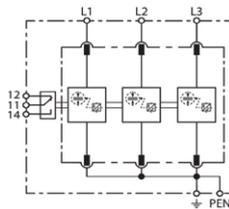
DEHNventil

DV M2 TNC 255 FM (954 305)

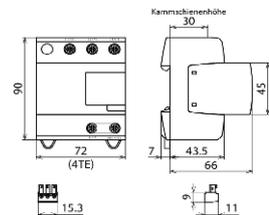
- Prewired type 1, type 2 and type 3 spark-gap-based combined arrester consisting of a base part and plug-in protection modules
- Compact unit meets maximum safety requirements thanks to Rapid Arc Control (RAC)
- Capable of protecting terminal equipment



Figure without obligation



Basic circuit diagram DV M2 TNC 255 FM



Dimension drawing DV M2 TNC 255 FM

Modular combined lightning current and surge arrester for TN-C systems.

Type Part No.	DV M2 TNC 255 FM 954 305
SPD according to EN 61643-11 / IEC 61643-11	type 1 + type 2 + type 3 / class I + class II + class III
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 μ s) [L-PEN] (I_{imp})	25 kA
Specific energy [L-PEN] (W/R)	156.25 kJ/ohms
Nominal discharge current (8/20 μ s) [L-PEN] (I_n)	25 kA
Voltage protection level (U_p)	≤ 1.5 kV
Open-circuit voltage of the combination wave generator (U_{oc})	6 kV
Follow current extinguishing capability (a.c.) (I_e)	50 kA _{rms}
Follow current limitation / Selectivity	No tripping of a 32 A gG fuse up to 50 kA _{rms} (prosp.)
Short-circuit current rating [L-N]/[N-PE] (I_{SCCR})	50 kA _{rms}
Response time (t_A)	≤ 100 ns
Max. backup fuse (L) up to $I_K = 50$ kA _{rms}	250 A gG
Temporary overvoltage (TOV) (U_T) – Characteristic	440 V / 120 min. – withstand
Let-through energy with an S20K275 ($I_{imp} = 2.5$ to 25 kA)	< 1 J
Operating temperature range [parallel] / [series] (T_U)	-40 °C ... +80 °C / -40 °C ... +60 °C
Operating state / fault indication	green / red
Number of ports	1
Cross-sectional area (L1, L2, L3, PEN, \perp) (min.)	10 mm ² solid / flexible
Cross-sectional area (L1, L2, L3, PEN, \perp) (max.)	35 mm ² stranded / 25 mm ² flexible
For mounting on	35 mm DIN rails acc. to EN 60715
Place of installation	indoor installation
Degree of protection	IP 20
Capacity	4 module(s), DIN 43880
Approvals	VDE, KEMA, UL
Type of remote signalling contact	yes / 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
For use in switchgear installations with prospective short-circuit currents of more than 50 kA _{rms} (tested by the German VDE)	-----
– Max. prospective short-circuit current	100 kA _{rms} (220 kA _{peak})
– Limitation / Extinction of mains follow currents	up to 100 kA _{rms} (220 kA _{peak})
– Max. backup fuse (L) up to $I_K = 100$ kA _{rms}	250 A gG

Use for 16.7 Hz traction power supply systems

Type Part No.	DV M2 TNC 255 FM 954 305
– Test voltage AC (U_C)	266 V
– Nominal voltage (a.c.) (U_N)	230 / 400 V
– Nominal frequency (a.c.) (f_N)	16.7 Hz
– Max. backup fuse	160 A gG @ 16,7 Hz
Weight	459 g
Customs tariff number (Comb. Nomenclature EU)	85363090
GTIN	4013364400900
PU	1 pc(s)

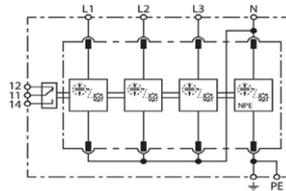
DEHNventil

DV M2 TT 255 FM (954 315)

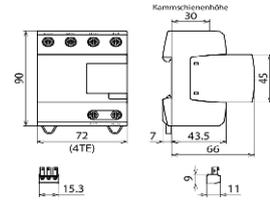
- Prewired spark-gap-based type 1, type 2 and type 3 combined arrester consisting of a base part and plug-in protection modules
- Compact unit meets maximum safety requirements thanks to Rapid Arc Control (RAC)
- Capable of protecting terminal equipment



Figure without obligation



Basic circuit diagram DV M2 TT 255 FM



Dimension drawing DV M2 TT 255 FM

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

Type	DV M2 TT 255 FM
Part No.	954 315
SPD according to EN 61643-11 / IEC 61643-11	type 1 + type 2 + type 3 / class I + class II + class III
Nominal voltage (a.c.) (U_N)	230 / 400 V (50 / 60 Hz)
Max. continuous operating voltage (a.c.) [L-N] (U_C)	255 V (50 / 60 Hz)
Max. continuous operating voltage (a.c.) [N-PE] (U_C [N-PE])	255 V (50 / 60 Hz)
Lightning impulse current (10/350 μ s) [L1+L2+L3+N-PE] (I_{total})	100 kA
Specific energy [L1+L2+L3+N-PE] (W/R)	2.50 MJ/ohms
Lightning impulse current (10/350 μ s) [L-N]/[N-PE] (I_{imp})	25 / 100 kA
Specific energy [L-N]/[N-PE] (W/R)	156.25 kJ/ohms / 2.50 MJ/ohms
Nominal discharge current (8/20 μ s) [L-N]/[N-PE] (I_n)	25 / 100 kA
Voltage protection level [L-N]/[N-PE] (U_p)	≤ 1.5 / ≤ 1.5 kV
Open-circuit voltage of the combination wave generator (U_{OC})	6 kV
Follow current extinguishing capability [L-N]/[N-PE] (I_f)	50 kA _{rms} / 100 A _{rms}
Follow current limitation / Selectivity	No tripping of a 32 A gG fuse up to 50 kA _{rms} (prosp.)
Short-circuit current rating [L-N]/[N-PE] (I_{SCCR})	50 kA _{rms} / 100 A _{rms}
Response time (t_A)	≤ 100 ns
Max. backup fuse (L) up to $I_k = 50$ kA _{rms}	250 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
Let-through energy with an S20K275 ($I_{imp} = 2.5$ to 25 kA)	< 1 J
Operating temperature range [parallel] / [series] (T_U)	-40 °C ... +80 °C / -40 °C ... +60 °C
Operating state / fault indication	green / red
Number of ports	1
Cross-sectional area (L1, L2, L3, N, PE, ϕ) (min.)	10 mm ² solid / flexible
Cross-sectional area (L1, L2, L3, N, PE, ϕ) (max.)	35 mm ² stranded / 25 mm ² flexible
For mounting on	35 mm DIN rails acc. to EN 60715
Place of installation / Degree of protection	indoors / IP 20
Capacity	4 module(s), DIN 43880
Approvals	VDE, KEMA, UL
Type of remote signalling contact	yes / 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)	1.8 kV
For use in switchgear installations with prospective short-circuit currents of more than 50 kA _{rms} (tested by the German VDE)	-----
– Max. prospective short-circuit current	100 kA _{rms} (220 kA _{peak})
– Limitation / Extinction of mains follow currents	up to 100 kA _{rms} (220 kA _{peak})
– Max. backup fuse (L) up to $I_k = 100$ kA _{rms}	250 A gG

Use for 16.7 Hz traction power supply systems

Type	DV M2 TT 255 FM
Part No.	954 315
– Test voltage AC (U_C)	266 V
– Nominal voltage (a.c.) (U_N)	230 / 400 V
– Nominal frequency (a.c.) (f_N)	16.7 Hz
– Max. backup fuse	160 A gG @ 16,7 Hz
Weight	537 g
Customs tariff number (Comb. Nomenclature EU)	85363090
GTIN	4013364400917
PU	1 pc(s)

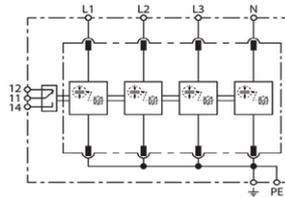
DEHNventil

DV M2 TNS 255 FM (954 405)

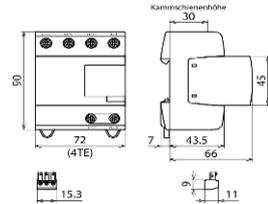
- Prewired spark-gap-based type 1, type 2 and type 3 combined arrester consisting of a base part and plug-in protection modules
- Compact unit meets maximum safety requirements thanks to Rapid Arc Control (RAC)
- Capable of protecting terminal equipment



Figure without obligation



Basic circuit diagram DV M2 TNS 255 FM



Dimension drawing DV M2 TNS 255 FM

Modular combined lightning current and surge arrester for TN-S systems.

Type	DV M2 TNS 255 FM
Part No.	954 405
SPD according to EN 61643-11 / IEC 61643-11	type 1 + type 2 + type 3 / class I + class II + class III
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 μ s) [L1+L2+L3+N-PE] (I_{tot})	100 kA
Specific energy [L1+L2+L3+N-PE] (W/R)	2.50 MJ/ohms
Lightning impulse current (10/350 μ s) [L, N-PE] (I_{imp})	25 kA
Specific energy [L,N-PE] (W/R)	156.25 kJ/ohms
Nominal discharge current (8/20 μ s) [L/N-PE]/[L1+L2+L3+N-PE] (I_n)	25 / 100 kA
Voltage protection level [L-PE]/[N-PE] (U_P)	≤ 1.5 / ≤ 1.5 kV
Open-circuit voltage of the combination wave generator (U_{OC})	6 kV
Follow current extinguishing capability (a.c.) (I_e)	50 kA _{rms}
Follow current limitation / Selectivity	No tripping of a 32 A gG fuse up to 50 kA _{rms} (prosp.)
Short-circuit current rating [L-N]/[N-PE] (I_{SCCR})	50 kA _{rms}
Response time (t_A)	≤ 100 ns
Max. backup fuse (L) up to $I_k = 50$ kA _{rms}	250 A gG
Temporary overvoltage (TOV) [L-N] (U_T) – Characteristic	440 V / 120 min. – withstand
Let-through energy with an S20K275 ($I_{imp} = 2.5$ to 25 kA)	< 1 J
Operating temperature range [parallel] / [series] (T_U)	-40 °C ... +80 °C / -40 °C ... +60 °C
Operating state / fault indication	green / red
Number of ports	1
Cross-sectional area (L1, L2, L3, N, PE, \varnothing) (min.)	10 mm ² solid / flexible
Cross-sectional area (L1, L2, L3, N, PE, \varnothing) (max.)	35 mm ² stranded / 25 mm ² flexible
For mounting on	35 mm DIN rails acc. to EN 60715
Place of installation	indoor installation
Degree of protection	IP 20
Capacity	4 module(s), DIN 43880
Approvals	VDE, KEMA, UL
Type of remote signalling contact	yes / 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
For use in switchgear installations with prospective short-circuit currents of more than 50 kA _{rms} (tested by the German VDE)	-----
– Max. prospective short-circuit current	100 kA _{rms} (220 kA _{peak})
– Limitation / Extinction of mains follow currents	up to 100 kA _{rms} (220 kA _{peak})
– Max. backup fuse (L) up to $I_k = 100$ kA _{rms}	250 A gG

Use for 16.7 Hz traction power supply systems

Type	DV M2 TNS 255 FM
Part No.	954 405
– Test voltage AC (U_C)	266 V
– Nominal voltage (a.c.) (U_N)	230 / 400 V
– Nominal frequency (a.c.) (f_N)	16.7 Hz
– Max. backup fuse	160 A gG @ 16,7 Hz
Weight	524 g
Customs tariff number (Comb. Nomenclature EU)	85363090
GTIN	4013364400894
PU	1 pc(s)

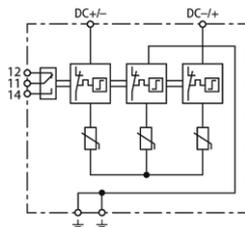
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DCB YPV 1200 FM (900 075)

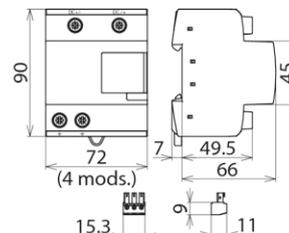
- Applicable in PV systems in accordance with IEC 60364-7-712 / DIN VDE 0100-712
- Universally applicable in earthed and unearthed PV systems
- Prewired type 1 and type 2 combined lightning current and surge arrester for use in photovoltaic generator circuits
- Fault-resistant Y circuit prevents damage to the surge protective device in case of insulation faults in the generator circuit



Figure without obligation



Basic circuit diagram DCB YPV 1200 FM



Dimension drawing DCB YPV 1200 FM

Combined lightning current and surge arrester for use in photovoltaic power supply systems up to 1200 V d.c.; with remote signalling contact.

Type	DCB YPV 1200 FM
Part No.	900 075
SPD according to EN 61643-31 / IEC 61643-31	type 1 + type 2 / class I + class II
Max. PV voltage [DC+ -> DC-] (U_{CPV})	≤ 1200 V
Max. PV voltage [DC+/DC- -> PE] (U_{CPV})	≤ 1200 V
Short-circuit current rating (I_{SCPV})	10 kA
Nominal discharge current (8/20 μs) (I_n)	20 kA
Max. discharge current (8/20 μs) (I_{max})	40 kA
Total discharge current (8/20 μs) [DC+/DC- -> PE] (I_{total})	40 kA
Total discharge current (10/350 μs) [DC+/DC- -> PE] (I_{total})	12.5 kA
Lightning impulse current (10/350 μs) [DC+ -> PE/DC- -> PE] (I_{imp})	6.25 kA
Voltage protection level [(DC+/DC-) -> PE] (U_p)	< 3.8 kV
Voltage protection level [DC+ -> DC-] (U_p)	< 3.8 kV
Response time (t_A)	≤ 25 ns
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
Dimensions	4 module(s), DIN 43880
Approvals	KEMA, UL
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
Weight	511 g
Customs tariff number (Comb. Nomenclature EU)	85354000
GTIN	6942299504538
PU	1 pc(s)

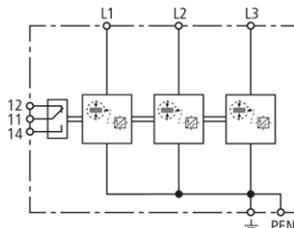
DEHNshield

DSH B TNC 255 FM (941 306)

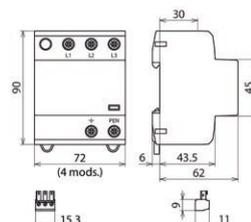
- Application-optimised and prewired spark-gap-based type 1 and type 2 combined lightning current and surge arrester
- Compact design due to space-saving spark gap technology with a width of only 1 module / pole
- Meets the minimum requirements according to IEC 60364-5-53 concerning the nominal discharge 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 TNC 255 FM



Dimension drawing DSH B TNC 255 FM

Application-optimised and prewired combined lightning current and surge arrester for TN-C systems for use in the main power supply system (3+0 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 TNC 255 FM 941 306
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 μ s) [L1+L2+L3-PEN] (I_{total})	22.5 kA
Lightning impulse current (10/350 μ s) [L-PEN] (I_{imp})	7.5 kA
Nominal discharge current (8/20 μ s) [L-PEN]/[L1+L2+L3-PEN] (I_n)	12.5 / 37.5 kA
Voltage protection level (U_P)	≤ 1.5 kV
Follow current extinguishing capability (a.c.) (I_f)	25 kA _{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
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, PEN) (min.)	1.5 mm ² solid / flexible
Cross-sectional area (L1, L2, L3, PEN) (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
Weight	362 g
Customs tariff number (Comb. Nomenclature EU)	85363090
GTIN	4013364328068
PU	1 pc(s)

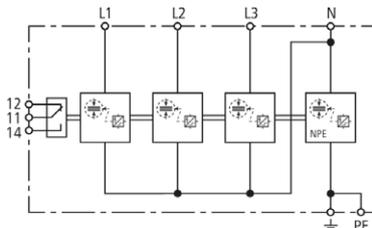
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DSH B TT 255 FM (941 316)

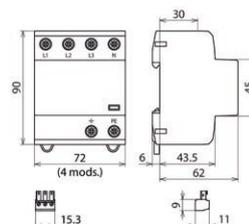
- Application-optimised and prewired spark-gap-based type 1 and type 2 combined lightning current and surge arrester
- Compact design due to space-saving spark gap technology with a width of only 1 module / pole
- Meets the minimum requirements according to IEC 60364-5-53 concerning the nominal discharge 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 μ s) [L1+L2+L3+N-PE] (I_{total})	30 kA
Lightning impulse current (10/350 μ s) [L-N]/[N-PE] (I_{imp})	7.5 / 30 kA
Nominal discharge current (8/20 μ s) [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_f)	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, \ominus) (min.)	1.5 mm ² solid / flexible
Cross-sectional area (L1, L2, L3, N, PE, \ominus) (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)

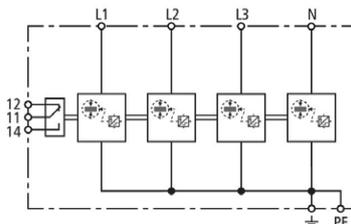
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DSH B TNS 255 FM (941 406)

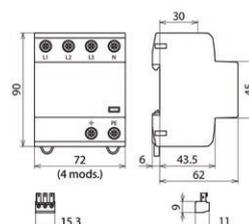
- Application-optimised and prewired spark-gap-based type 1 and type 2 combined lightning current and surge arrester
- Compact design due to space-saving spark gap technology with a width of only 1 module / pole
- Meets the minimum requirements according to IEC 60364-5-53 concerning the nominal discharge 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 TNS 255 FM



Dimension drawing DSH B TNS 255 FM

Application-optimised and prewired combined lightning current and surge arrester for TN-S systems for use in the main power supply system (4+0 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	DSH B TNS 255 FM
Part No.	941 406
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 μ s) [L1+L2+L3+N-PE] (I_{total})	30 kA
Lightning impulse current (10/350 μ s) [L, N-PE] (I_{imp})	7.5 kA
Nominal discharge current (8/20 μ s) [L/N-PE]/[L1+L2+L3+N-PE] (I_n)	12.5 / 50 kA
Voltage protection level [L-PE]/[N-PE] (U_p)	≤ 1.5 / ≤ 1.5 kV
Follow current extinguishing capability (a.c.) (I_n)	25 kA _{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
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, \varnothing) (min.)	1.5 mm ² solid / flexible
Cross-sectional area (L1, L2, L3, N, PE, \varnothing) (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
Weight	429 g
Customs tariff number (Comb. Nomenclature EU)	85363090
GTIN	4013364328082
PU	1 pc(s)

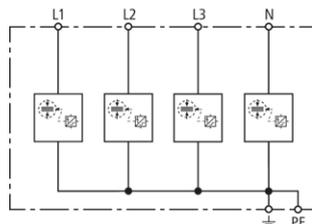
DEHNshield

DSH TNS 255 (941 400)

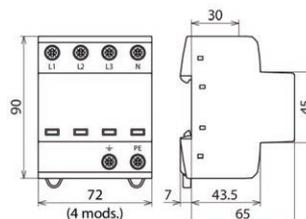
- Application-optimised and prewired spark-gap-based type 1 and type 2 combined lightning current and surge arrester
- Compact design due to space-saving spark gap technology with a width of only 1 module / pole
- Allows compact lightning equipotential bonding including protection of terminal equipment



Figure without obligation



Basic circuit diagram DSH TNS 255



Dimension drawing DSH TNS 255

Application-optimised and prewired combined lightning current and surge arrester for TN-S systems.

Type	DSH TNS 255
Part No.	941 400
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 μ s) [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 μ s) [L, N-PE] (I_{imp})	12.5 kA
Specific energy [L,N-PE] (W/R)	39.06 kJ/ohms
Nominal discharge current (8/20 μ s) [L/N-PE]/[L1+L2+L3+N-PE] (I_n)	12.5 / 50 kA
Voltage protection level [L-PE]/[N-PE] (U_P)	≤ 1.5 / ≤ 1.5 kV
Follow current extinguishing capability (a.c.) (I_e)	25 kA _{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
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, \pm) (min.)	1.5 mm ² solid / flexible
Cross-sectional area (L1, L2, L3, N, PE, \pm) (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
Weight	525 g
Customs tariff number (Comb. Nomenclature EU)	85363090
GTIN	4013364133563
PU	1 pc(s)

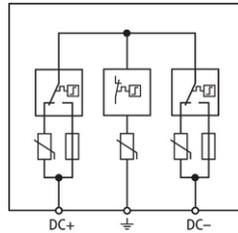
DEHNcube

DCU YPV SCI 1000 1M (900 910)

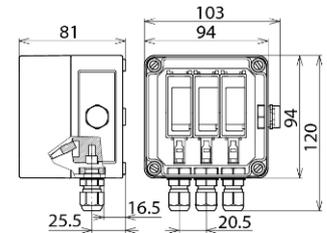
- Prewired multipole surge arrester with IP 65 degree of protection for photovoltaic systems
- Combined disconnection and short-circuiting device with safe electrical isolation in each protective path (patented SCI principle)
- Easy and fast implementation of surge protection measures since no space is required in a separate insulating enclosure



Figure without obligation



Basic circuit diagram DCU YPV SCI 1000 1M



Dimension drawing DCU YPV SCI 1000 1M

Two-pole surge arrester with IP65 degree of protection and three-step d.c. switching device for PV inverters for protecting one MPP input.

Type	DCU YPV SCI 1000 1M
Part No.	900 910
SPD according to EN 61643-31 / IEC 61643-31	type 2 / class II
Max. PV voltage (U_{CPV})	1000 V
Short-circuit current rating (I_{SCPV})	1000 A
Total discharge current (8/20 μ s) (I_{total})	40 kA
Nominal discharge current (8/20 μ s) [(DC+/DC-) --> PE] (I_n)	12.5 kA
Max. discharge current (8/20 μ s) [(DC+/DC-) --> PE] (I_{max})	25 kA
Voltage protection level (U_p)	≤ 4 kV
Voltage protection level at 5 kA (U_p)	≤ 3.5 kV
Response time (t_A)	≤ 25 ns
Operating temperature range (T_U)	-35 °C ... +80 °C
Operating state / fault indication	green / red
Number of ports	1
Cross-sectional area (min.)	2.5 mm ² solid / flexible
Cross-sectional area (max.)	6 mm ² solid / flexible
Place of installation	outdoor
Degree of protection	IP 65
Type	with pressure compensating element
Cover	transparent cover with product label
Colour of enclosure	grey
Number of cable entries	3x \varnothing 3-7 mm
Enclosure dimensions (W x H x D)	94 x 94 x 81 mm
Approvals	KEMA
Weight	426 g
Customs tariff number (Comb. Nomenclature EU)	85363030
GTIN	4013364155046
PU	1 pc(s)

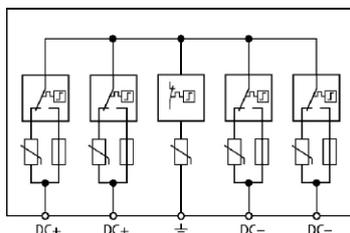
DEHNcube

DCU YPV SCI 1000 2M (900 920)

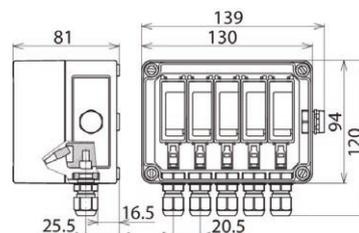
- Prewired multipole surge arrester with IP 65 degree of protection for photovoltaic systems
- Combined disconnection and short-circuiting device with safe electrical isolation in each protective path (patented SCI principle)
- Easy and fast implementation of surge protection measures since no space is required in a separate insulating enclosure



Figure without obligation



Basic circuit diagram DCU YPV SCI 1000 2M



Dimension drawing DCU YPV SCI 1000 2M

Four-pole surge arrester with IP 65 degree of protection and three-step d.c. switching device for PV inverters for protecting two MPP inputs.

Type	DCU YPV SCI 1000 2M
Part No.	900 920
SPD according to EN 61643-31 / IEC 61643-31	type 2 / class II
Max. PV voltage (U_{CPV})	1000 V
Short-circuit current rating (I_{SCPV})	1000 A
Total discharge current (8/20 μ s) (I_{total})	40 kA
Nominal discharge current (8/20 μ s) [(DC+/DC-) --> PE] (I_n)	12.5 kA
Max. discharge current (8/20 μ s) [(DC+/DC-) --> PE] (I_{max})	25 kA
Voltage protection level (U_p)	≤ 4 kV
Voltage protection level at 5 kA (U_p)	≤ 3.5 kV
Response time (t_A)	≤ 25 ns
Operating temperature range (T_U)	-35 °C ... +80 °C
Operating state / fault indication	green / red
Number of ports	1
Cross-sectional area (min.)	2.5 mm ² solid / flexible
Cross-sectional area (max.)	6 mm ² solid / flexible
Place of installation	outdoor
Degree of protection	IP 65
Type	with pressure compensating element
Cover	transparent cover with product label
Colour of enclosure	grey
Number of cable entries	5x \varnothing 3-7 mm
Enclosure dimensions (W x H x D)	130 x 94 x 81 mm
Approvals	KEMA
Weight	617 g
Customs tariff number (Comb. Nomenclature EU)	85363030
GTIN	4013364155053
PU	1 pc(s)

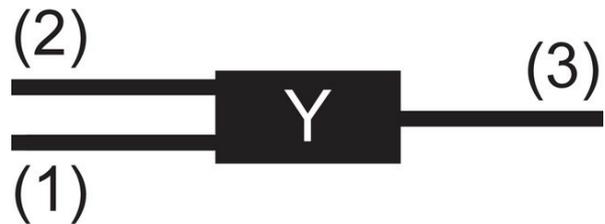
DEHNcube

AL DCU Y PV L3X1000 (900 945)

- For connecting one PV string to DEHNcube and the inverter (or other equipment)
- 6 mm² to keep the voltage drop as low as possible
- Cable can be shortened individually to the optimum length



Figure without obligation



Dimension drawing AL DCU Y PV L3X1000

Y connecting cable for DEHNcube.

Type	AL DCU Y PV L3X1000
Part No.	900 945
For connecting	1 string cable
Cable structure	with double insulation
Cable diameter	6.9 mm
Cable cross-section	6 mm ²
Cable material	Cu
Conductor diameter	3.3 mm
Degree of protection	IP 65
Weight	230 g
Customs tariff number (Comb. Nomenclature EU)	85444991
GTIN	4013364425118
PU	1 pc(s)

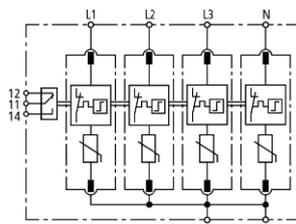
DEHNguard

DG M TNS 275 FM (952 405)

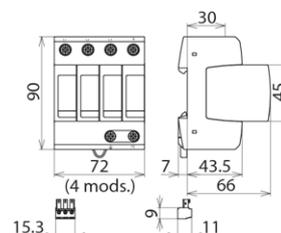
- Prewired complete unit consisting of a base part and plug-in protection modules
- High discharge capacity due to heavy-duty zinc oxide varistors / spark gaps
- High reliability due to "Thermo Dynamic Control" SPD monitoring device



Figure without obligation



Basic circuit diagram DG M TNS 275 FM



Dimension drawing DG M TNS 275 FM

Modular surge arrester for use in TN-S systems; with floating remote signalling contact.

Type	DG M TNS 275 FM
Part No.	952 405
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.) (U_C)	275 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
Voltage protection level [L-PE]/[N-PE] (U_P)	≤ 1.5 / ≤ 1.5 kV
Voltage protection level [L-PE] / [N-PE] at 5 kA (U_P)	≤ 1 / ≤ 1 kV
Response time (t_A)	≤ 25 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) (U_T) – Characteristic	335 V / 5 sec. – withstand
Temporary overvoltage (TOV) (U_T) – Characteristic	440 V / 120 min. – safe failure
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
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
Weight	453 g
Customs tariff number (Comb. Nomenclature EU)	85363030
GTIN	4013364108462
PU	1 pc(s)

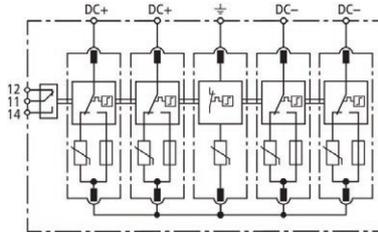
DEHNguard

DG M PV2 SCI 1000 FM (952 519)

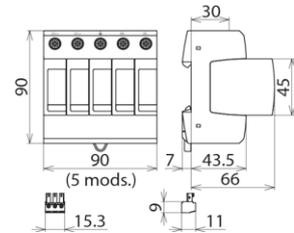
- Prewired modular complete unit for use in photovoltaic systems consisting of a base part and plug-in protection modules for protecting of two MPP-systems
- Combined disconnection and short-circuiting device with safe electrical isolation in the protection module (patented SCI principle)
- Tried and tested fault-resistant Y circuit



Figure without obligation



Basic circuit diagram DG M PV2 SCI 1000 FM



Dimension drawing DG M PV2 SCI 1000 FM

Modular multipole surge arrester with three-step d.c. switching device for use in PV systems with remote signalling contact (floating changeover contact).

Type Part No.	DG M PV2 SCI 1000 FM 952 519
SPD according to EN 61643-31 / IEC 61643-31	type 2 / class II
Max. PV voltage (U_{CPV})	1000 V
Short-circuit current rating (I_{SCPV})	10 kA
Total discharge current (8/20 μ s) (I_{total})	40 kA
Nominal discharge current (8/20 μ s) [(DC+/DC-) --> PE] (I_n)	12.5 kA
Max. discharge current (8/20 μ s) [(DC+/DC-) --> PE] (I_{max})	25 kA
Voltage protection level (U_p)	≤ 4 kV
Voltage protection level at 5 kA (U_p)	≤ 3.5 kV
Response time (t_A)	≤ 25 ns
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	5 module(s), DIN 43880
Approvals	UL, KEMA
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
Weight	509 g
Customs tariff number (Comb. Nomenclature EU)	85363030
GTIN	4013364224971
PU	1 pc(s)

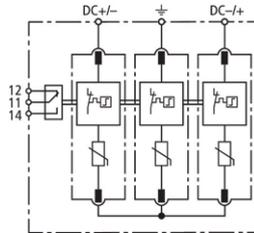
DEHNguard

DG M YPV 1200 FM (952 565)

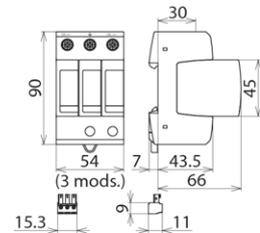
- Modular prewired complete unit for use in photovoltaic systems consisting of a base part and plug-in protection modules
- High reliability due to "Thermo Dynamic Control" SPD monitoring device
- Tried and tested fault-resistant Y circuit



Figure without obligation



Basic circuit diagram DG M YPV 1200 FM



Dimension drawing DG M YPV 1200 FM

Multipole modular surge arrester for use in PV systems; with remote signalling contact for monitoring unit (floating changeover contact).

Type	DG M YPV 1200 FM
Part No.	952 565
SPD according to EN 61643-31 / IEC 61643-31	type 2 / class II
Max. PV voltage (U_{CPV})	1170 V
Short-circuit current rating (I_{SCPV})	10 kA
Total discharge current (8/20 μ s) (I_{total})	40 kA
Nominal discharge current (8/20 μ s) [(DC+/DC-) --> PE] (I_n)	20 kA
Max. discharge current (8/20 μ s) [(DC+/DC-) --> PE] (I_{max})	40 kA
Voltage protection level (U_p)	≤ 4 kV
Response time (t_A)	≤ 25 ns
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	3 module(s), DIN 43880
Approvals	UL, KEMA
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:	-----
- Use in DC battery storage systems up to I_{SCCR}	≤ 50 kA ($t \leq 4$ ms)
- Backup fuse for DC battery storage systems up to I_{SCCR}	Bussman HLS 2000Vdc / 200 A 2+/A173 DST aR, manufacturer's Part. No.: 170M2040
Weight	300 g
Customs tariff number (Comb. Nomenclature EU)	85363030
GTIN	4013364327719
PU	1 pc(s)

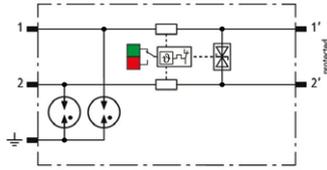
BLITZDUCTORconnect

BCO ML2 BD HF 5 (927 271)

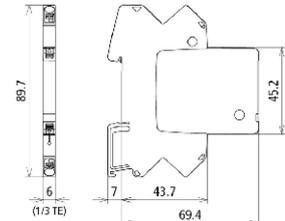
- LifeCheck arrester monitoring and integrated status indication
- Modular two-pole arrester for optimal protection of one pair of high-frequency signal circuits
- For installation in conformity with the lightning protection zone concept at the boundaries from $0_A - 2$ and higher



Figure without obligation



Basic circuit diagram BCO ML2 BD HF 5



Dimension drawing BCO ML2 BD HF 5

Space-saving, modular combined arrester with a width of 6 mm and push-in connection technology with status indication for protecting one pair of unearthed high-frequency bus systems as well as balanced interfaces. With signal disconnection for maintenance purposes.

Type	BCO ML2 BD HF 5
Part No.	927 271
SPD class	TYPE 1P2
Impulse category	D1, C1, C2, C3, B2
Nominal voltage (U_N)	5 V
Max. continuous operating voltage (d.c.) (U_c)	8.5 V
Max. continuous operating voltage (a.c.) (U_c)	6.0 V
Nominal current at 70 °C (I_L)	0.75 A
D1 Total lightning impulse current (10/350 μ s) (I_{imp})	3 kA
D1 Lightning impulse current (10/350 μ s) per line (I_{imp})	1.5 kA
C2 Total nominal discharge current (8/20 μ s) (I_n)	10 kA
C2 Nominal discharge current (8/20 μ s) per line (I_n)	5 kA
Voltage protection level line-line for I_n C2 (U_p)	≤ 42 V
Voltage protection level line-PG for I_n C2 (U_p)	≤ 600 V
Voltage protection level line-line for I_n C1 (U_p)	≤ 42 V
Voltage protection level line-PG for I_n C1 (U_p)	≤ 600 V
Voltage protection level line-line at 1 kV/ μ s C3 (U_p)	≤ 15 V
Voltage protection level line-PG at 1 kV/ μ s C3 (U_p)	≤ 600 V
Series resistance per line	1 ohm(s)
Cut-off frequency line-line (f_c)	100 MHz
Operating temperature range (T_u)	-40 °C ... +80 °C
Operating state / fault indication	green / red
Degree of protection	IP 20
Connection (input / output)	push-in / push-in
Cross-sectional area (solid)	0.2-2.5 mm ²
Cross-sectional area (flexible)	0.2-2.5 mm ²
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, CSA, EAC, ATEX, IECEx, CCC, SIL
ATEX approvals	TÜV 20 ATEX 8527 X: II 3G Ex ec IIC T4 Gc
IECEx approvals	IECEx TUR 20.0063X: Ex ec IIC T4 Gc
China Compulsory Certification	CCC no. 2021312304001192
Extended technical data:	-----
- Max. discharge current (8/20 μ s) [1/2 - PG], [1+2 - PG] (I_{max})	20 kA
- Discharge current (8/20 μ s) [1/2 - PG], [1+2 - PG]	10 kA (10x)
- Voltage protection level line-PG at 1 kV/ μ s C3 after being subjected to I_{max} (U_p)	≤ 600 V
Weight	34 g
Customs tariff number (Comb. Nomenclature EU)	85363010
GTIN	4013364405660
PU	1 pc(s)

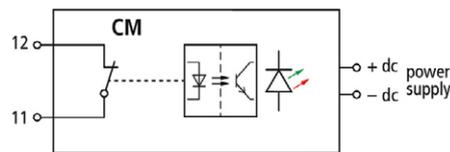
DEHNrecord

DRC IRCM (910 710)

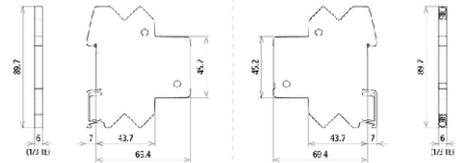
- Condition monitoring of BLITZDUCTORconnect arresters with integrated LifeCheck
- Quick and simple installation and initial operation (without addressing arresters)
- Remote signalling via floating remote signalling contact (break contact)



Figure without obligation



Basic circuit diagram DRC IRCM



Dimension drawing DRC IRCM

Condition monitoring unit DEHNrecord, set for DIN rail mounted devices with integrated visual transmitter/receiver and visual reverse unit for monitoring the condition of BLITZDUCTORconnect arresters with LifeCheck. Visual status indication via LED group display in combination with remote signalling contact (break contact).

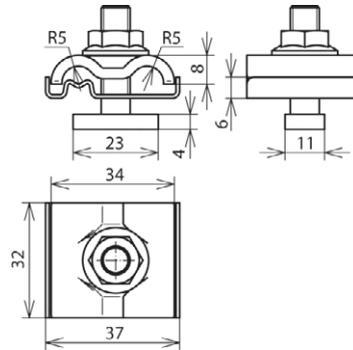
Type	DRC IRCM
Part No.	910 710
Input voltage range (d.c.) (U_{IN})	6-35 V d.c.
Max. rated current consumption (I_{IN})	≤ 10 mA
Distance between transmitter / receiver and reverse unit	≤ 305 mm
Message: Replacing of SPD recommended	LED, remote signalling contact (break contact)
Indicator	two-colour LED (green, red)
Type of remote signalling contact	break contact (nc)
Technical data of remote signalling contact	contact resistance < 2.5 ohms; leakage current < 1 μA
Switching capacity (d.c.)	48 V / 500 mA / Pmax 300 mW
Test cycle	continuous
Operating temperature range (T_U)	-30 °C ... +70 °C
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 mm ²
Cross-sectional area (flexible)	0.2-2.5 mm ²
Enclosure material	polyamide PA 6.6
Colour	grey
Test standards	EN 61010-1
Approvals	UL
Delivery includes	Transmitter-/receiver unit /reverse unit
Weight	52 g
Customs tariff number (Comb. Nomenclature EU)	90308900
GTIN	4013364424678
PU	1 pc(s)

Earth clamp

 **UEK 8.10 AQ4 50 HKSM8 V2A (540 250)**



Figure without obligation



Earthing clamps for integrating mounting systems, e.g. of PV installations in the functional equipotential bonding/functional earthing (black conductor possible) and lightning equipotential bonding according to IEC/EN 62305-3.

The StSt contact plate (intermediate element) allows different conductor materials (Cu, Al, St/tZn and StSt) to be connected to the normal mounting systems, e.g. to aluminium, without the risk of contact corrosion.

The double clamp design allows easy and quick interconnection of the profiles, e.g. by feed-through wiring.



Arrangement:

Type	UEK 8.10 AQ4 50 HKSM8 V2A
Part No.	540 250
Material of clamp	StSt
Clamping range Rd	8-10 mm
Connection (solid / stranded)	4-50 mm ²
Screw	hammer-head bolt M8 x 30 mm
Self-locking nut	width across flats 13 mm
Material of screw / nut	StSt
Lightning current carrying capability (10/350 µs)	 *)
Standard	EN 62561-1
Weight	60 g
Customs tariff number (Comb. Nomenclature EU)	85389099
GTIN	4013364138650
PU	50 pc(s)

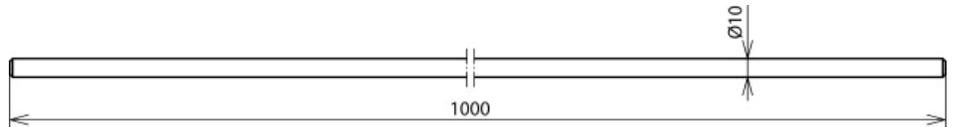
*) For exact assignment, see test certificate.

Air-termination rod

FS 10 1000 AL (101 000)



Figure without obligation



Air-termination rod chamfered on both sides, for protecting roof-mounted structures, chimneys etc., can be fixed in a concrete base (8.5 kg) with fixing wedge or by means of rod holders / spacers.

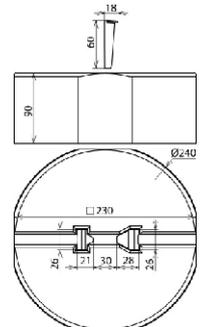
Type	FS 10 1000 AL
Part No.	101 000
Total length (l1)	1000 mm
Material	Al
Diameter Ø	10 mm
Standard	EN 62561-2
Weight	212 g
Customs tariff number (Comb. Nomenclature EU)	85389099
GTIN	4013364094505
PU	20 pc(s)

Concrete base

BES 8.5KG KT10 16 D240 SET (102 075)



Type	BES 8.5KG KT10 16 D240 SET
Part No.	102 075
Total weight	8.5kg
Diameter Ø	240mm
Material	concrete (C45/55)
Material of wedge / adapter	StSt
Weight	8.46 kg
Customs tariff number (Comb. Nomenclature VAE)	68109100
GTIN	4013364094215
PU	120 Stk



Surge Protection
Lightning Protection
Safety Equipment
DEHN protects.

DEHN SE
Hans-Dehn-Str. 1
Postfach 1640
92306 Neumarkt, Germany

Tel. +49 9181 906-0
Fax +49 9181 906-1100
info@dehn.de
www.dehn-international.com



www.dehn-international.com/partners

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