

The background of the entire page is a photograph of a photovoltaic system. In the foreground, the blue, hexagonal cells of a solar panel are visible, arranged in a grid pattern. The panel is tilted upwards. In the background, a dark, stormy sky is filled with heavy, dark grey clouds. Several bright, white lightning bolts are visible, striking down from the clouds. The overall scene conveys a sense of power and protection against natural elements.

DEHN protects Photovoltaic Systems

Reliable power supply thanks to
lightning and surge protection



Using the power of the sun with photovoltaics

The global demand for energy is growing rapidly. Fossil fuel reserves are running out and oil and gas production is becoming increasingly complex. The future lies in renewable energy as the alternative to fossil fuels: wind, water, biomass and the sun will make sure that the lights do not go out in industrial plants and private households. Photovoltaics are seen as one of the fastest growing technologies for producing 'green' energy. According to the German Solar Industry Association, photovoltaics with a capacity of approx. 70 GW were installed in Germany in 2016 ¹⁾. The capacity installed globally increased to approx. 300 GW. The prognosis for the coming years sees a further increase in the number of new installations. This is without a doubt partly the result of a study conducted by the World Economic Forum which revealed that, in the meantime, economically viable operation of photovoltaic systems without subsidies is possible in more than 30 countries ²⁾.

The number of photovoltaic systems – both roof-mounted systems and ground-mounted systems such as solar parks – will continue to grow in the long term. Decentralised energy generation leads to extensive changes in electrical equipment. Every PV system installed must be maintained to ensure continuous yield and requires reliable lightning and surge protection to prevent failure and increase the service life of the inverter.

The selection and implementation of lightning and surge protection measures is based on the lightning protection zone concept according to IEC/EN 62305. This standard defines protection zones in which different coordinated protective devices are installed. External lightning protection systems are installed as a result of a risk analysis according to IEC/EN 62305-2 or according to the state building code ³⁾.

Decide in favour of a professional lightning protection system consisting of

- external lightning protection using air-termination and down conductor systems
- internal lightning protection with surge protective devices for lightning equipotential bonding.

¹⁾ German Solar Industry Association: www.solarwirtschaft.de

²⁾ World Economic Forum: www.weforum.org

³⁾ IEC 62305-2 Protection against lightning – Part 2: Risk management



Be it a roof-mounted system or a solar park – DEHN protects

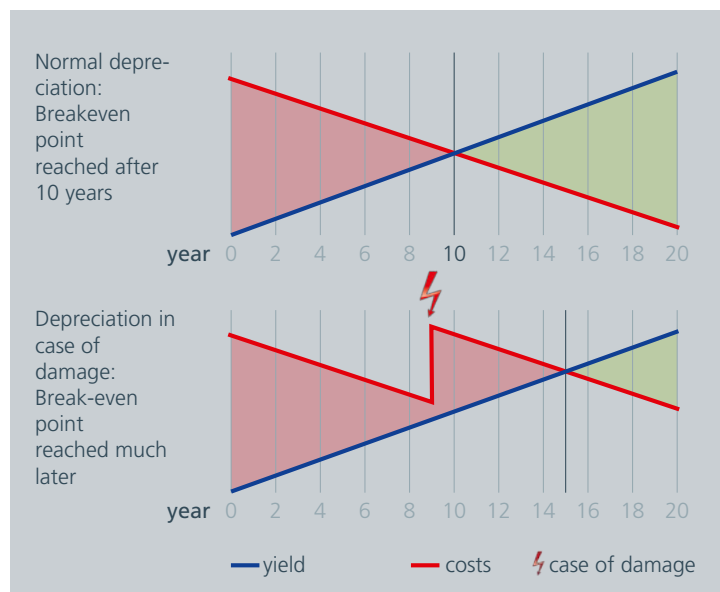
DEHN is a world-renowned lightning and surge protection expert – also in the field of photovoltaics. Back when photovoltaic technology was still in its infancy, we were out there applying our knowledge of lightning and surge protection. Today, thanks to our long-standing experience in this field, we are able to offer the best products for both roof-mounted systems and solar parks. Operators and installers of PV systems can rest assured that our products always comply with the relevant standards and guidelines. DEHN therefore makes a major contribution towards reliable power supply, high system availability and sustained investment protection.



Surge protection protects your investments

Although PV systems are exposed to various external influences, the statistics of insurance companies reveal that surges are the most frequent cause of damage to PV systems. If the inverter of a PV system is damaged, reinvestment costs may be high.

As a consequence, the return on investment is delayed and the break-even point is reached much later. For this reason, smart system operators choose fore-sighted protection concepts which are also increasingly becoming a prerequisite for financial institutions and property insurance companies. Moreover, long-term profitable installations serve as references for installers and secure follow-up orders.





Lightning protection for roof-mounted systems

Integrated: Planning of PV systems and lightning protection zone concept

Professional planning is indispensable for the safe and reliable operation of PV systems. It must be coordinated with the relevant project and include lightning and surge protection measures right from the planning stage.

Installers of PV and lightning protection systems consider the roof area under different aspects. While installers of lightning protection systems want to maintain the separation distance for the lightning protection system, the aim of installers of PV systems is to optimise the use of space on the roof. Lack of communication and coordination may lead to yield and safety problems.

State building codes or insurance companies require that a lightning protection system is installed. State building codes call for lightning protection systems in public buildings such as nurseries, schools or hospitals. However, coordination between roofers / installers of lightning protection systems and installers of PV systems / electricians is essential not only when constructing a new building, but also when retrofitting roof-mounted systems.

Feasible in practice: Risk analysis by means of DEHN Risk Tool

A risk analysis according to IEC/EN 62305-2¹⁾ shows whether an external lightning protection system must be installed. To this end, the use of the building and the associated risks are analysed. To ensure a technically and economically sound lightning protection concept, a risk analysis can be easily performed by means of the globally proven DEHNsupport Toolbox software including the DEHN Risk Tool.



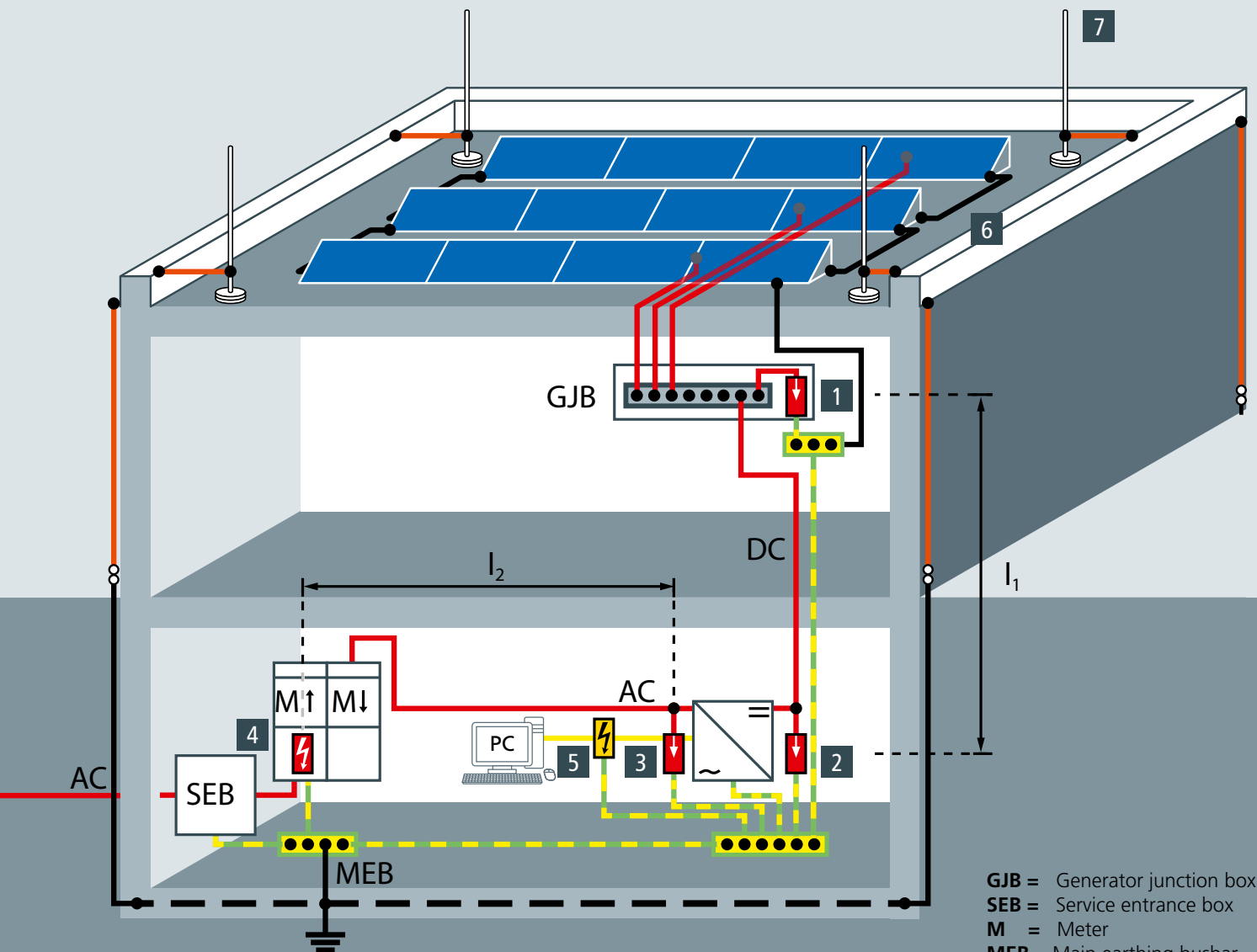
Isolated and shade-optimised air-termination systems are the ideal lightning protection system for roof-mounted PV systems. They ensure that the separation distance between the down conductor and the PV system is maintained and prevents the injection of partial lightning currents. Shade-optimised air-termination systems do not cast an umbra on the modules, thus securing the yield.

Variable and slim: HVI®Conductors from DEHN

An height adjustable isolated air-termination system with an high-voltage-insulated HVI®Conductor from DEHN is an ideal solution for roof-mounted PV systems. Its unique design allows to maintain separation distances up to 0.90 m in air. Like an installation cable, it can be installed downstream of the sealing end directly next to or below the PV modules, thus ideally using the roof area.



HVI®Conductor from DEHN: Efficient use and protection of the PV system



Surge protection for roof-mounted systems

Roof-mounted systems with a mounting structure on the roof are most commonly used. Due to their exposed location, roof-mounted systems are particularly prone to direct and indirect lightning strikes. Since the PV system is directly connected to the electrical installation of the building, lightning effects may have serious consequences for the building itself as well as devices and people inside the building. The IEC/EN 62305-2 standard is also used for analysing the risk for roof-mounted systems ¹⁾.

The applicable standard when installing a PV system is IEC 60634-7-712 which provides requirements for surge protective devices in PV power systems. The technical specification CLC/TS 50539-12 provides detailed requirements on the subject and differentiates between three applications ²⁾.

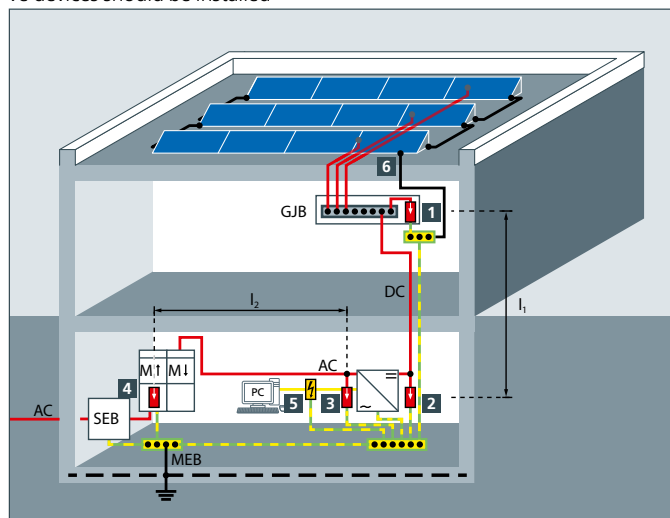
¹⁾ IEC 62305-2 Protection against lightning – Part 2: Risk management

²⁾ IEC 60634-7-712: Low-voltage electrical installations - Part 7-712: Requirements for special installations or locations - Photovoltaic systems

³⁾ CLC/TS 50539-12: Low-voltage surge protective devices - Surge protective devices for specific application including d.c.

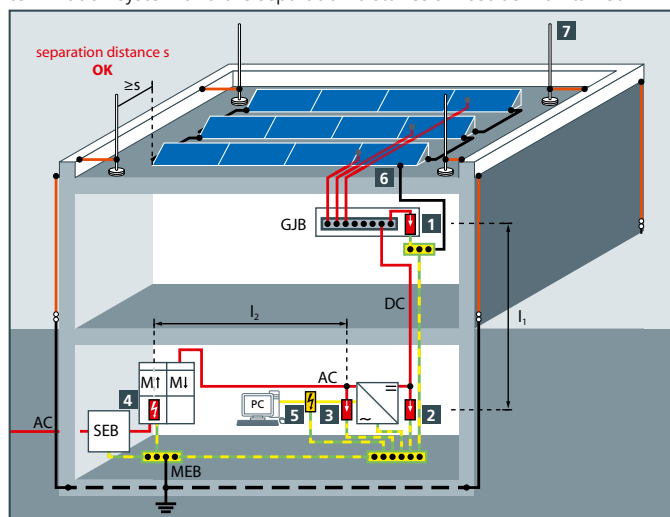
Building without external lightning protection system

Even if no external lightning protection system is installed, surge protective devices should be installed



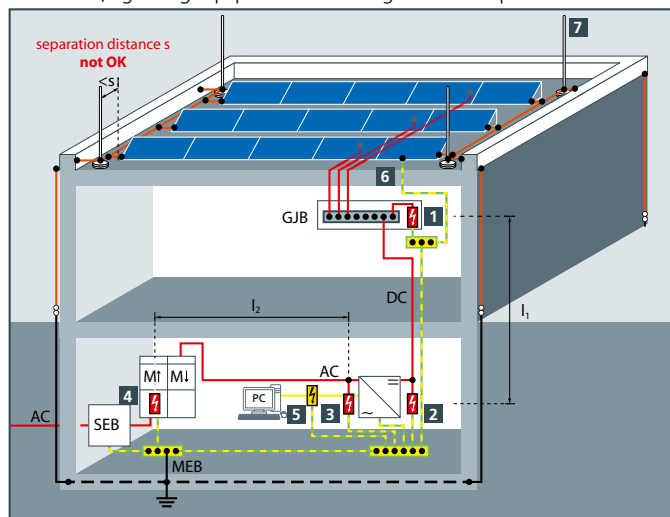
Building with external lightning protection system and sufficient separation distance

The PV modules must be located in the protected zone of the isolated air-termination system and the separation distance s must be maintained.



Building with external lightning protection system but insufficient separation distance

If the separation distance s cannot be maintained, for example in case of a metal roof, lightning equipotential bonding must be implemented.



1 * + 2 d.c. side

DEHNguard® M YPV 1200 FM

Pluggable, modular type 2 arrester for PV systems of any size and configuration. For 1170 V and 1500 V.

Type	Part No.
DG M YPV 1200 FM	952 565
DG M YPV 1500 FM	952 567



$I_{SCPV} = 10 \text{ kA}$

DEHNCube YPV SCI

Prewired type 2 arrester with IP65 degree of protection for one MPP tracker (1 M) and two MPP trackers (2 M) can be used up to 1000 V. Accessory: Connecting cable

Type	Part No.
DCU YPV SCI 1000 1M	900 910
DCU YPV SCI 1000 2M	900 920
AL DCU Y PV L1000	900 949
AL DCU X PV L1000	900 947



$I_{SCPV} = 1000 \text{ A}$

DEHNcombo YPV SCI

This compact type 1 and type 2 arrester is a cost-effective solution for roof-mounted and ground-mounted systems. Four modules. For 600 V, 1000 V and 1500 V.

Type	Part No.
DCB YPV SCI 600 FM	900 065
DCB YPV SCI 1000 FM	900 066
DCB YPV SCI 1500 FM	900 067



$I_{SCPV} = 1000 \text{ A}$

* Distance $I_1 > 10 \text{ m}$ = additional protection at the PV generator

3 ** a.c. side (inverter)

Type 2 arrester DEHNguard® M

Pluggable, modular surge arrester: High reliability due to "Thermo Dynamic Control" monitoring device.

Type	Part No.
DG M TNC 275 FM	952 305
DG M TNS 275 FM	952 405
DG M TT 275 FM	952 315



4 a.c. side (power supply)

Our recommendation: DEHNshield® ZP Basic

Combined arrester for use upstream of the meter in buildings **without** external lightning protection. Simple and quick to mount by snapping onto the 40 mm busbar system.

Type	Part No.
DSH ZP B TT 255	900 396
DSH ZP B TNC 255	900 395



Alternative: Type 2 arrester DEHNguard® M

Pluggable, modular surge arrester: High reliability due to "Thermo Dynamic Control" monitoring device.

Type	Part No.
DG M TNC 275 FM	952 305
DG M TNS 275 FM	952 405
DG M TT 275 FM	952 315



Type 1 combined arrester DEHNventil® M

Pluggable, modular, lightning current carrying combined arrester with spark gap technology and wave breaker function.

Type	Part No.
DV M TNC 255 FM	951 305
DV M TNS 255 FM	951 405
DV M TT 255 FM	951 315



Type 1 combined arrester DEHNshield®

Compact lightning current carrying spark-gap-based type 1 combined arrester with impulse current parameters adapted for this place of installation.

Type	Part No.
DSH TNC 255	941 300
DSH TNS 255	941 400
DSH TT 255	941 310



Type 1 combined arrester DEHNventil® ZP

Combined arrester with RADAX Flow spark gap technology. Easy and fast installation by snapping the arrester on a 40 mm busbar system. Capable of protecting terminal equipment.

Type	Part No.
DV ZP TNC 255	900 390
DV ZP TT 255	900 391



** Distance $l_2 > 10$ m = additional protection at the PV generator

FM = floating remote signalling contact

5 Data interface

BLITZDUCTOR® XTU

Combined arrester with actiVsense® and LifeCheck® technology for protecting two pairs of balanced interfaces (for example RS485). Base part required.

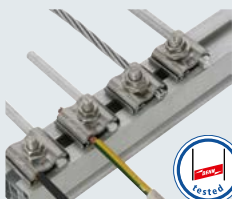


Type	Part No.
BXTU ML4 BD 0-180	920 349
BXT BAS	920 300

6 Equipotential bonding

UNI earthing / saddle clamp

Clamps for integrating the mounting systems of PV systems in the functional equipotential bonding / functional earthing or lightning equipotential bonding.



Type	Part No.
UNI earthing clamp	540 250
UNI saddle clamp	365 250

7 External lightning protection system

Air-termination rod with concrete base

Air-termination rod (1.5 m) tapered from ø 16 mm to 10 mm that reduces the formation of umbras and the wind load.

Wedge-mounted concrete base (17 kg) with adapted base plate, stackable.



Type	Part No.
Air-termination rod	103 210
Concrete base	102 340

HVI®Conductor

High-voltage-resistant insulated down conductor for maintaining the separation distance from conductive parts according to IEC/EN 62305-3.

One equipotential bonding connection element and one connection element are enclosed.



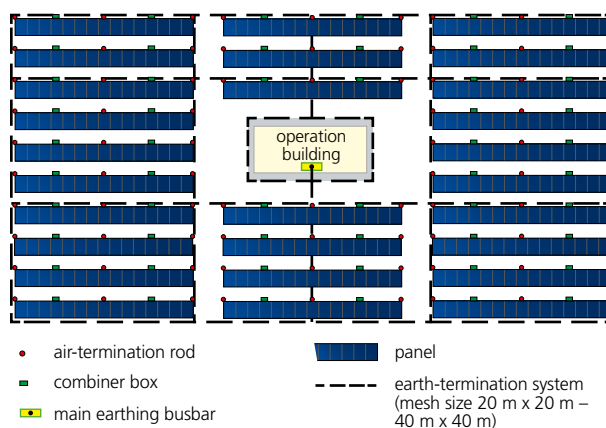
Type	Part No.
HVI®Conductor III	819 022



Lightning protection for solar parks

The investment volumes and requirements on the availability of solar parks demand that the risk of damage posed by a lightning strike be calculated according to IEC/EN 62305-2¹⁾. The results are to be taken into account when planning and included in due diligence.

The German guideline "VDS 2010 – Risk-oriented lightning and surge protection"²⁾ published by the German Insurance Association requires that equipotential bonding be implemented and surge protection measures taken. The aim is to protect both the power plant from lightning damage and modules, inverters and monitoring devices from the effects of the electromagnetic impulse.



Layout of a solar park with PV array and operation building

¹⁾ IEC 62305-2 Protection against lightning – Part 2: Risk management

²⁾ German VdS Brochure 2010 – Risk-Oriented Lightning and Surge Protection; Publisher: Gesamtverband der Deutschen Versicherungswirtschaft e.V. (German insurance association)



Air-termination systems, down conductors, earth-termination system

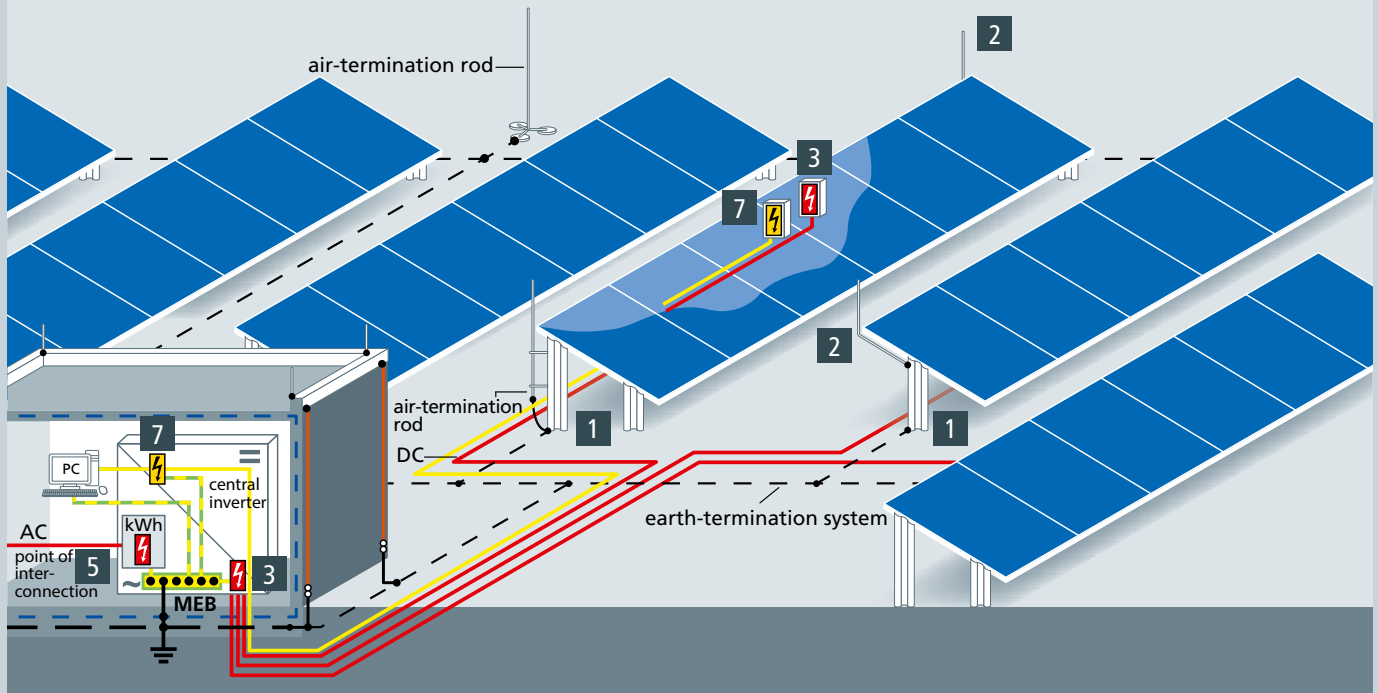
Air-termination systems protect the PV array and operation building in case of direct lightning strikes. The metallic mounting structures on which the module systems are installed can be used to mechanically fix the air-termination rods.

The earth-termination system is intermeshed with mesh sizes from 20 m x 20 m to 40 m x 40 m. All mounting structures must be connected to the earth-termination system. Pile-driven and screw-in foundations ensure connection to the soil. DEHN offers different types of round conductors and strips for connecting the earth-termination system to the PV mounting structures.

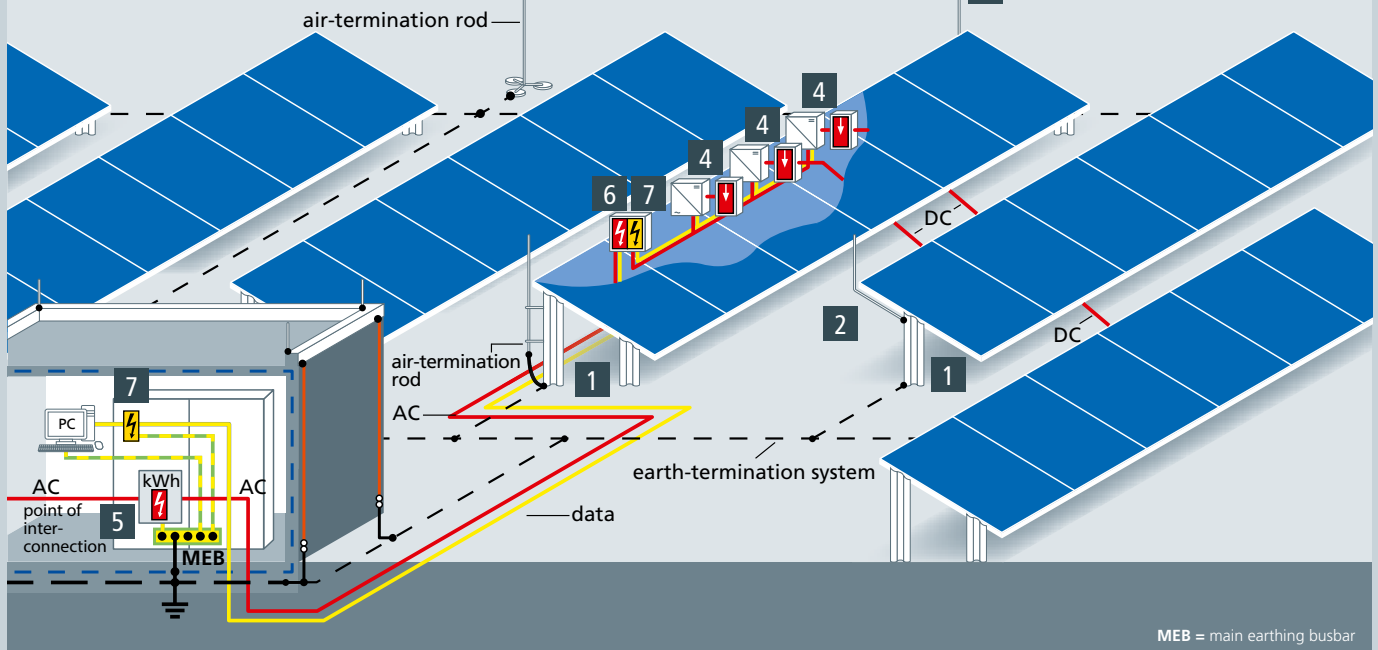
The rolling sphere method must be used to determine the quantity and height of the air-termination rods. To this end, at least class of LPL* III is required.



With central inverter



With string inverter



MEB = main earthing busbar

Measures for protecting PV power plants

An efficient lightning protection system consists of perfectly co-ordinated elements:

- air-termination system
- down-conductor system
- earth-termination system
- lightning equipotential bonding system
- surge protective devices

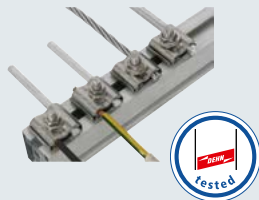
This is true for power stations with central inverters, string inverters or a mixture of the two.

Air-termination systems protect the electrical system from direct lightning currents. Type 2 arresters from DEHN provide reliable protection against surges. Due to the length of the cables in the solar park (DC, AC, and data cables), high-energy equipotential bonding currents occur. Type 1 combined arresters from DEHN can withstand this load, protect all terminal devices and prevent puncturing of the cable insulation. This makes for decades of failure-free operation.

1

UNI earthing / saddle clamp

Clamps for integrating the mounting systems of PV systems in the functional equipotential bonding / functional earthing or lightning equipotential bonding.



Type	Part No.
UNI earthing clamp	540 250
UNI saddle clamp	365 250

2

Angled air-termination tip

Air-termination tip mounted on the sub-structure protects from direct lightning strikes. Total length 1m.



Type	Part No.
Air-termination tip (separate)	101 010
Air-termination tip including two saddle clamps	101 110

3

DEHNcombo YPV SCI

This compact type 1 and type 2 arrester is a universal solution for roof-mounted and ground-mounted systems. Four modules. For 600 V, 1000 V and 1500 V.



Type	Part No.
DCB YPV SCI 600 FM *	900 065
DCB YPV SCI 1000 FM *	900 066
DCB YPV SCI 1500 FM *	900 067

$I_{SCPV} = 1000 \text{ A}$ (without additional backup fuse)

4

DEHNGuard® M YPV 1200 FM

Pluggable, modular type 2 arrester for PV systems of all sizes and configurations. For 1170 V and 1500 V.



Type	Part No.
DG M YPV 1200 FM *	952 565
DG M YPV 1500 FM *	952 567

DEHNCube YPV SCI

Prewired type 2 arrester with IP65 degree of protection for one MPP tracker (1 M) and two MPP trackers (2 M) can be used up to 1000 V. Accessory: Connecting cable



Type	Part No.
DCU YPV SCI 1000 1M	900 910
DCU YPV SCI 1000 2M	900 920
AL DCU Y PV L1000	900 949
AL DCU X PV L1000	900 947

$I_{SCPV} = 1000 \text{ A}$ (without additional backup fuse)

5

DEHNventil® M

Multipole, modular, lightning current carrying type 1 spark-gap-based combined arrester with wave breaker function.



Type	Part No.
DV M TNC 255 FM *	951 305
DV M TNS 255 FM *	951 405
DV M TT 255 FM *	951 315

6

DEHNshield®

Compact, lightning current carrying type 1 spark-gap-based combined arrester with impulse current parameters adapted to this place of installation.



Type	Part No.
DSH TNC 255 FM *	941 305
DSH TNS 255 FM *	941 405
DSH TT 255 FM *	941 315

7

BLITZDUCTOR® XTU

Combined arrester with activSense® technology for protecting one pair with either direct or indirect shield earthing. Base part required.



Type	Part No.
BXTU ML2 BD 0-180	920 249
BXT BAS	920 300



Protection solutions for stand-alone systems

Difficult to access and often far away, stand-alone systems must prove their reliability. Whether earthed or totally insulated, DEHNguard type 2 arresters with their unique SCI technology easily master this task.

DEHNguard® S PV SCI (FM)

Single-pole, modular type 2 surge arrester.



Type	Part No.
DG S PV SCI 150 FM	952 556

DEHNguard® M Y PV SCI

Multipole, modular type 2 surge arrester.



Type	Part No.
DG M YPV SCI 150 FM	952 518



Maximum safety for your service personnel

Safety is the top priority of all DEHN safety products for installation and maintenance work. Protect your service personnel during work on roof-mounted systems and solar parks.

DEHNcare® Protective gloves

- For arc fault protection according to IEC 61482-1-2
- For protection against thermal risks according to EN 407



Type	Part No.
APG 10	785 798

DEHNcare® Safety helmet for electricians

- Electrically insulating
- With slots for face shield



Type	Part No.
ESH U 1000 S Y	785 730

DEHNcare® Arc-fault-resistant face shield

- Arc-fault tested
- Natural colour reproduction
- High light transmittance

Type	Part No.
APS 12C SC	785 747

Voltage detector PHE4

- For nominal voltages up to 30 kV / 50 Hz
- With visual and acoustic indication
- With self-testing element
- For use in indoor and outdoor installations

Type	Part No.
PHE4 10 30 S	783 250



www.dehn-international.com/partners



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

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