

DEHN protects Photovoltaic Systems

www.dehn.de



Reliable power supply thanks to lightning and surge protection

Using the power of the sun

Energy needs are steadily rising throughout the world. However, reserves of fossil fuels are on the wane and the oil and gas production is becoming more and more complex. What alternatives are there? Energy turnaround leads the way: The future belongs to renewable energies.

In the future, wind, water, biomass and of course the sun will ensure that the lights do not go out in industrial plants and private households.

Photovoltaics (PV) are on the rise and a key pillar of the globally growing electricity supply from renewable energies. The International Energy Agency (IEA) predicts that the share of renewable energies in power generation worldwide will be between 12 % and 23 % in 2035. In particular power generation in PV power plants will experience very rapid growth.

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. This development involves large-scale changes of electrical equipment. Every PV system installed must be maintained to ensure continuous yield. To prevent failure and increase the service life of the inverter, reliable lightning and surge protection is required.

The selection and arrangement of lightning and surge protection measures is based on the lightning protection zones 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 result of a risk analysis according to IEC/EN 62305-2 or the state building code. A lightning protection system provides optimal protection due to the interaction of

- External lightning protection including air-termination system, down conductor, earth-termination system and
- Internal lightning protection including lightning equipotential bonding, surge protection and separation distance

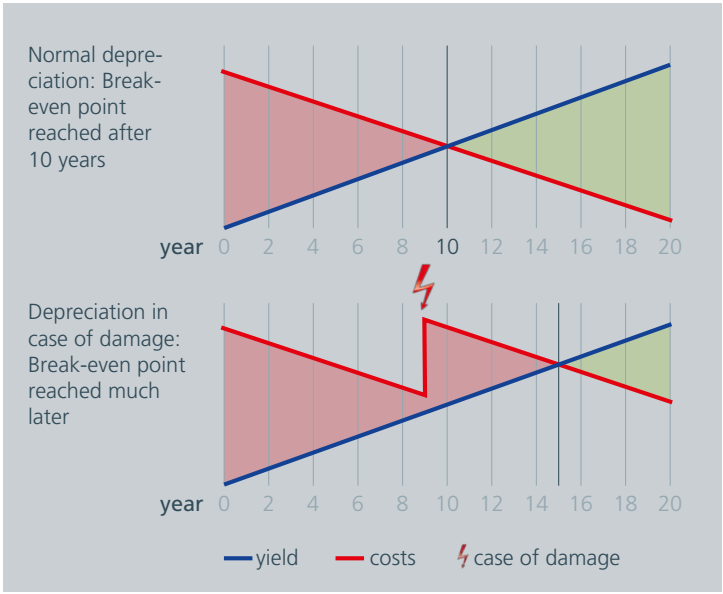


DEHN protects roof-mounted systems and solar parks

DEHN is a world-renowned lightning and surge protection expert – also in the field of photovoltaics. We already applied our knowledge of lightning and surge protection when photovoltaic technology was still in its infancy. Thanks to our long-standing experience in the field of photovoltaics, we are able to offer the best products – be it for roof-mounted systems or solar parks. Operators and installers of PV systems can rely on our products that always comply with the relevant standards and directives. We are thus making a major contribution to reliable power supply, high system availability and sustainable investment protection.

Surge protection is investment protection

PV systems are exposed to various external influences. However, according to insurance companies, overvoltage is the most frequent cause of damage. 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 lower. For this reason, smart system operators will choose a protection concept that is also increasingly required by financial institutions and property insurances. At the same time, long-term profitable installations serve as references for installers and secure follow-up orders.





Lightning protection for roof-mounted systems

Integrated: System planning and lightning protection

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

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 PV system installers 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 kindergardens, schools or hospitals. However, coordination between roofers / installers of lightning protection systems and installers of photovoltaic systems / electricians is essential not only when constructing a new building, but also when retrofitting roof-mounted systems.

Feasible: Risk analysis with the DEHN Risk Tool

A risk analysis according to IEC/EN 62305-2 shows whether an external lightning protection system must be installed. To this end, the use of the building and the associated risks are analysed. A risk analysis can be easily performed by means of the DEHNsupport Toolbox including the DEHN Risk Tool. This globally proven software ensures a technically and economically sound lightning protection concept.

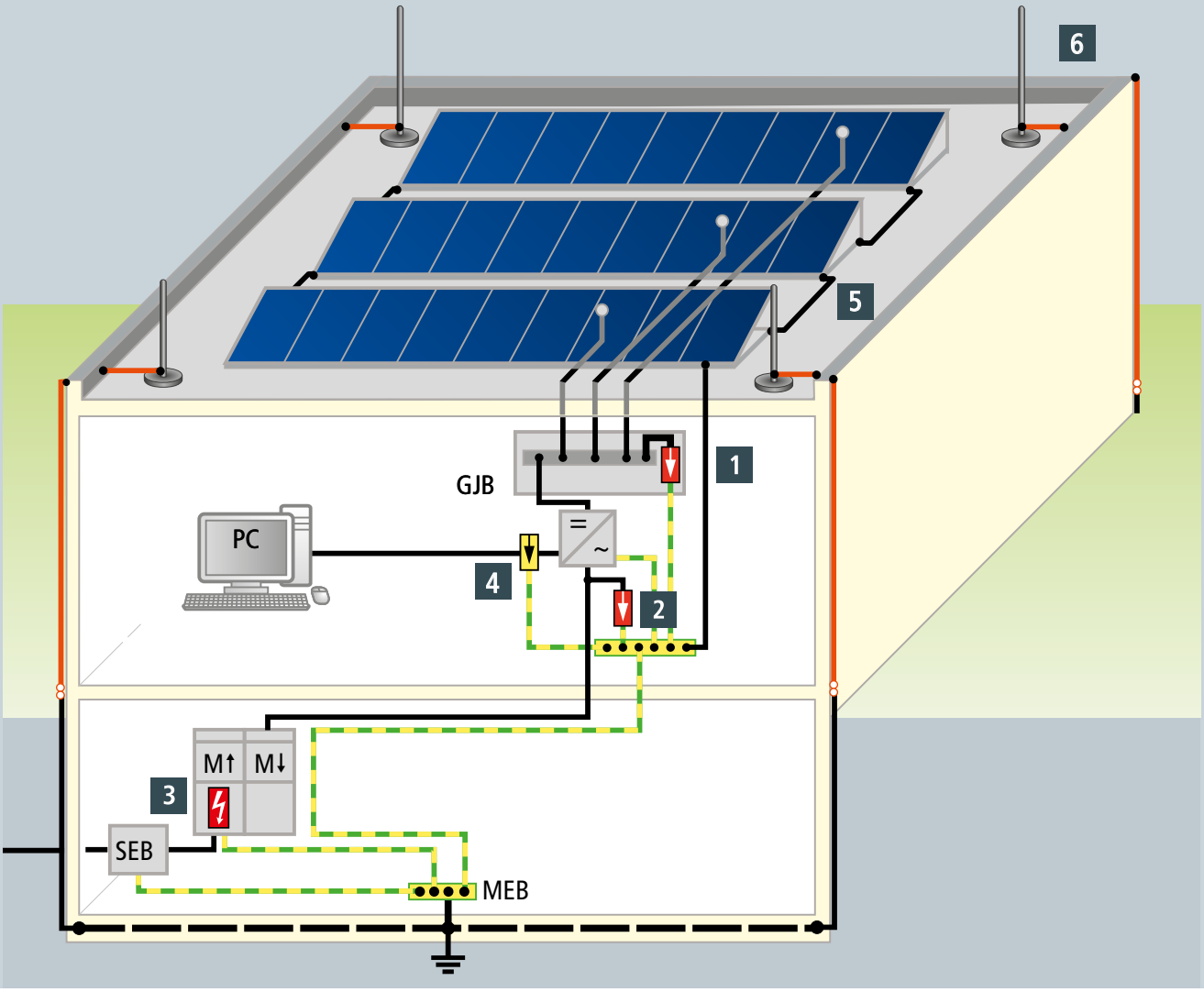
Isolated and shade-optimised air-termination systems are the ideal lightning protection system for roof-mounted PV systems. They ensure that the separation distance between the down conductor and the PV system is maintained and prevent the injection of partial lightning currents. Shade-optimised air-termination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

Variable and slim: the HVI® conductor from DEHN

The height adjustable isolated air-termination system with a high-voltage-resistant HVI conductor from DEHN is the optimal solution for roof-mounted PV systems. Its unique design allows to maintain a separation distance of 0.75 m. 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. Another benefit of the HVI conductor is its slim design, hardly casting any shadow on the modules.



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



Surge protection for roof-mounted systems

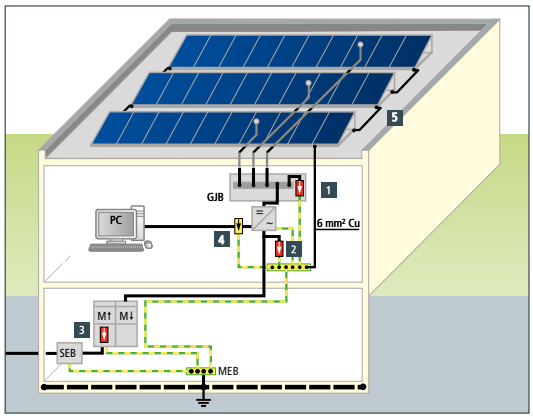
Roof-mounted systems are widely used. Due to their exposed location, roof-mounted systems are particularly prone to direct and indirect lightning strikes. Since the PV system is directly connected to the electrical installation of the building, lightning effects may have serious consequences for the building and persons inside. The IEC/EN 62305-2 standard also has to be used for analysing the risk of roof-mounted systems.

When installing a PV system, a distinction is made between buildings with and without external lightning protection.

1 d.c. side (pv modules / inverter)

Building without external lightning protection

If a PV system is retrofitted and no external lightning protection system is installed, the solution according to the supplement 5 of the german version of the IEC/EN 62305-3 can be used. It recommends to install a type 2 surge protective device on the d.c. and a.c. side to protect the PV system.



DEHNguard® M YPV SCI type 2 arrester

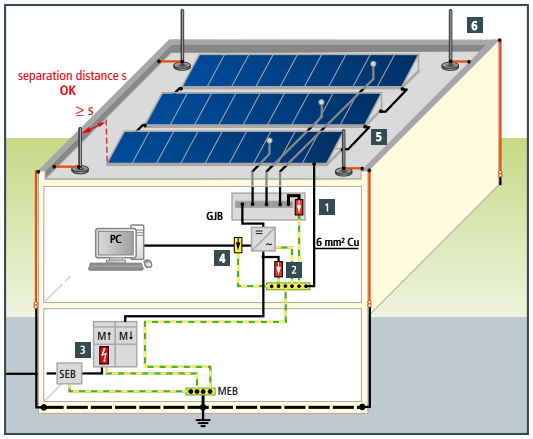


Multipole, modular surge arrester for PV systems: The patented SCI technology prevents fire damage caused by d.c. switching arcs

Type	Part No.	U_c
DG M YPV SCI 600 FM*	952 516	600 V
DG M YPV SCI 1000 FM*	952 515	1000 V
DG M YPV SCI 1200 FM*	952 517	1200 V

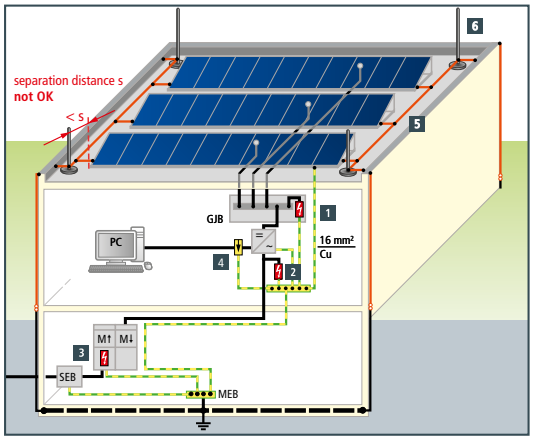
Building with external lightning protection and sufficient separation distance

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



Building with external lightning protection and insufficient separation distance

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



DEHNlimit PV 1000 V2 FM type 1 combined lightning current and surge arrester

Multipole spark-gap-based combined lightning current and surge arrester capable of carrying lightning currents for PV generator circuits with wave breaker function



Type	Part No.
DLM PV 1000 V2 FM*	900 345

2 a.c. side (inverter)

DEHNguard® M ... 275 FM type 2 arrester



Multipole, 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

Application-optimised DEHNshield® ... 255 combined lightning current and surge arrester



Multipole spark-gap-based combined lightning current and surge arrester capable of carrying lightning currents with impulse current parameters which are sufficient for this place of installation.

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

3 a.c. side (power supply)

DEHNguard® M ... CI 275 FM type 2 arrester



Multipole, modular surge arrester with integrated backup fuse: High reliability due to "Thermo Dynamic Control" monitoring device

Type	Part No.
DG M TNC CI 275 FM*	952 309
DG M TNS CI 275 FM*	952 406
DG M TT CI 275 FM*	952 327

DEHNventil® M ... 255 FM type 1 combined lightning current and surge arrester



Multipole spark-gap-based combined lightning current and surge arrester capable of carrying lightning currents 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

DEHNventil® ZP combined lightning current and surge arrester



based on RADAX Flow spark gap technology .
Quick and easy installation by snapping the arrester onto 40 mm busbar systems. Capable of protecting terminal equipment

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

*FM = floating remote signalling contact

4 Data interface

BLITZDUCTOR® XTU

DIN rail mounted combined lightning current and surge arrester with actiVsense® and LifeCheck® technology for protecting two pairs of balanced interfaces (for example RS485) (BXT BAS base part required, Part No. 920 300).

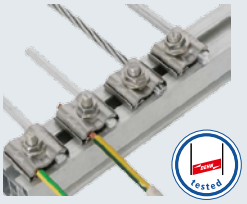


Type	Part No.
BXTU ML4 BD 0-180	920 349

5 Equipotential bonding

UNI earthing clamp

Earthing clamp for integrating the mounting systems of PV systems into functional equipotential bonding / functional earthing or lightning equipotential bonding.



Type	Part No.
UNI earthing clamp	540 250

6 External lightning protection system

Air-termination rod with concrete base

Air-termination rod (1.5 m) tapered to a diameter of 10 mm that reduces umbra formation and the wind load.



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

HVI® conductor

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

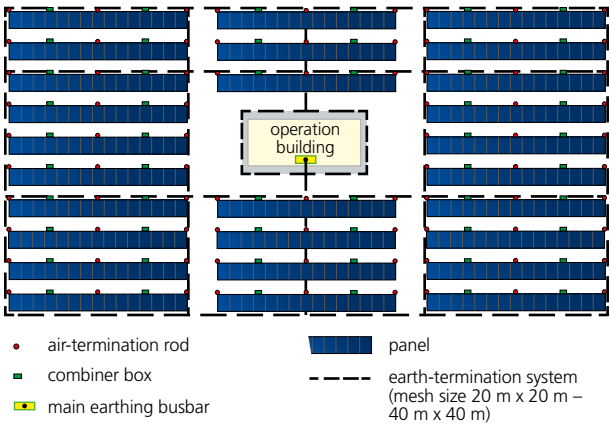


Type	Part No.
HVI conductor III	819 022

Lightning protection for solar parks

To ensure investment protection and the availability of solar parks, the risk of damage posed by a lightning strike must be calculated according to IEC/EN 62305-2. The results must be taken into account for planning and are used for due diligence considerations.

Internationally active insurance companies often require equipotential bonding and surge protection in their contract terms. The aim is to protect power plants from lightning-induced damage as well as modules, inverters and monitoring systems from the effects of an electromagnetic pulse.



Layout of a solar park with panel and operation building



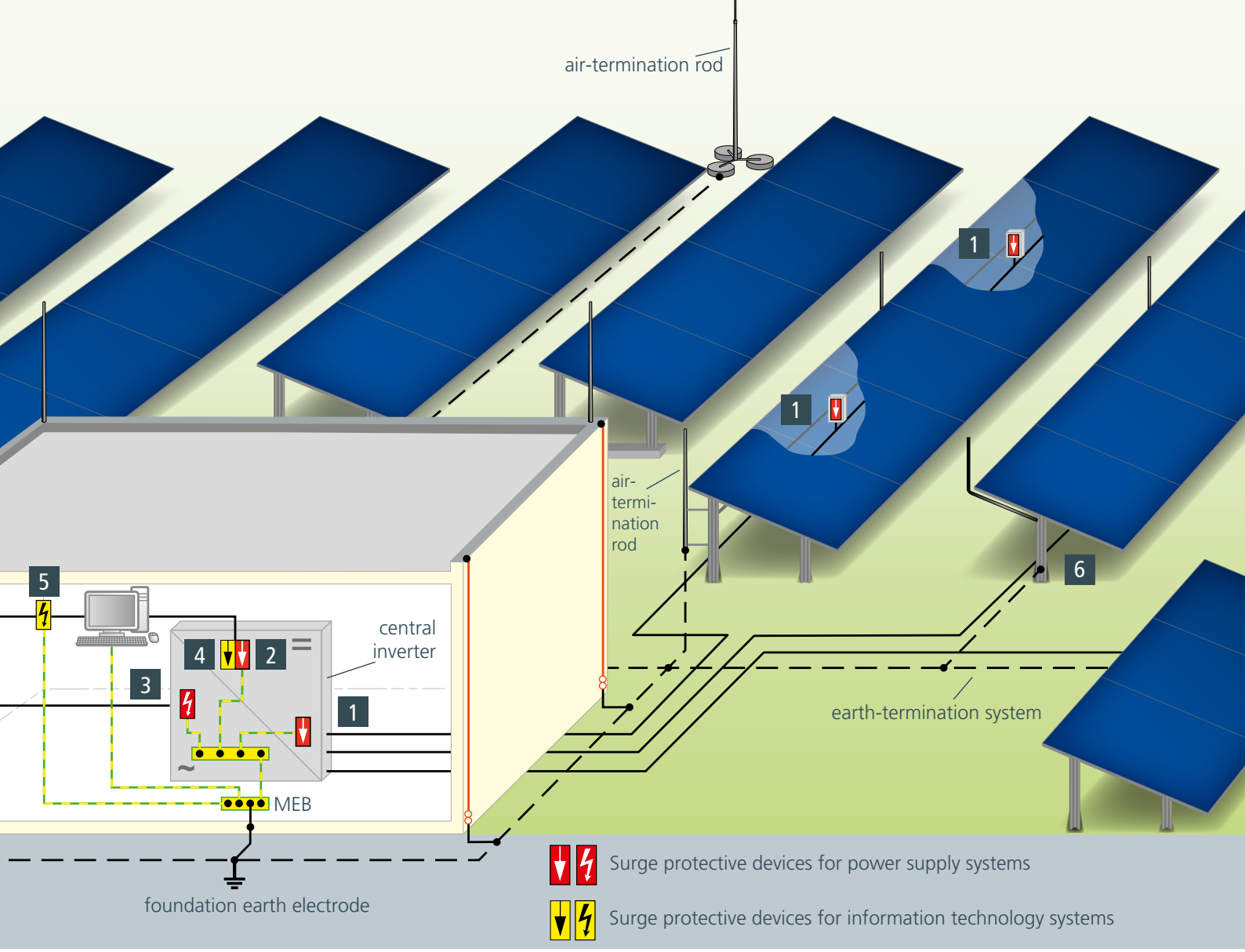
Air-termination system, down conductors, earth-termination system

Air-termination systems protect the panel and operation building in case of direct lightning strikes. The metallic supporting frames 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 supporting frames 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 supporting frames.

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





Surge protection in a PV panel

If PV modules are located in the protection zone of the isolated air-termination system, a type 2 arrester is to be installed in the generator junction box. The modular DEHNguard M Y PV surge arrester with its unique SCI technology provides ideal protection. It is an internationally accepted surge protective device for d.c. circuits recommended by leading inverter manufacturers for system operation without downtime.

Lightning equipotential bonding

In operation buildings the metallic systems must be directly connected, and live systems indirectly connected to the equipotential bonding structure via lightning current arresters.

Surge protection for data transmission

It is essential to monitor the PV system of solar power plants to protect it from burglary, control its performance and optimise the yield. The data lines inside the power plant and the connection to external devices form loops which may inject highly energetic pulses. For this reason, surge protective devices are indispensable. Yellow/Line surge protective devices from DEHN protect the data flow and make monitoring systems resistant to lightning effects. Permanent condition monitoring ensures reliable system operation and optimises the yield.

1

DEHNguard® M YPV SCI

Multipole, modular surge arrester with SCI technology for PV systems.



Type	Part No.
DG M YPV SCI 600	952 511
DG M YPV SCI 1000	952 510
DG M YPV SCI 1200	952 512

2

DEHNguard® M ... 275 (FM)

Multipole, 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

3

DEHNventil®

Multipole, modular spark-gap-based combined lightning current and surge arrester.



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

4

BLITZDUCTOR® XTU

Combined lightning current and surge arrester with actiVsense and LifeCheck® technology for voltages ranging from 0 to 180 V with superimposed data signal (+5V/50 MHz). Automatically detects the signal voltage and adapts the voltage protection level. An BXT BAS base part (Part No. 920 300) is required.

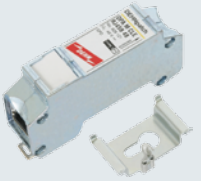


Type	Part No.
BXTU ML4 BD 0-180	920 349

4

DEHNpatch DPA

Universal surge arrester for Ethernet, Power over Ethernet and similar applications in structured cabling systems according to class E up to 250 MHz.



Type	Part No.
DPA M CLE RJ45B 48	929 121

5

DEHNbox

Combined lightning current and surge arrester with actiVsense technology. Degree of protection IP 65 for wall mounting, protection of two pairs.

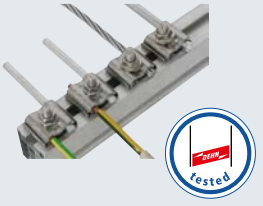


Type	Part No.
DBX U4 KT BD S 0-180	922 400
DBX U2 KT BD S 0-180	922 200

6

UNI earthing clamp

Earthing clamp for integrating the mounting systems of PV systems into functional equipotential bonding / functional earthing or lightning equipotential bonding.



Type	Part No.
UNI earthing clamp	540 250

*FM = floating remote signalling contact



Protection solutions for stand-alone systems

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

DEHNguard® S PV SCI (FM)

Single-pole, modular type 2 surge arrester, patented SCI technology prevents fire damage caused by d.c. switching arcs.



Type	Part No.
DG S PV SCI 150 FM	952 556
DG S PV SCI 600 FM	952 555

DEHNguard® M Y PV SCI

Multipole, modular type 2 surge arrester, patented SCI technology prevents fire damage caused by d.c. switching arcs.



Type	Part No.
DG M YPV SCI 150 FM	952 518
DG M YPV SCI 600 FM	952 516



Maximum safety for your service personnel

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

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

Insulating gloves

- For nominal voltages up to 1000 V
- Excellent fit and high elasticity
- Two versions available



Type	Part No.
IHS O M 10 NS	785 464

PHE III voltage detector

- 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.
PHE3 10 30 S	767 731



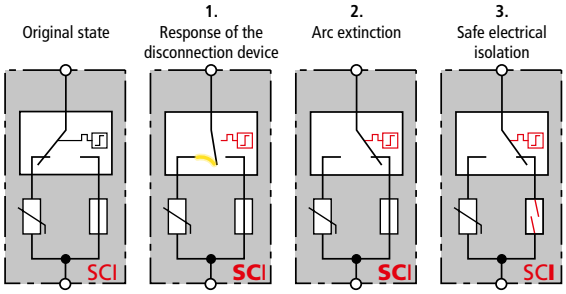




Innovative products for PV systems

DEHNguard® M YPV SCI: Type 2 arrester with SCI technology for maximum safety and fire protection

The proven technique of the fault-resistant Y circuit and of the combined disconnection and short-circuiting device with Thermo Dynamic Control is supplemented by an additional d.c. fuse.



The figure shows the switching phases of the three-step d.c. switching device in the DEHNguard M YPV SCI.

The fuse particularly dimensioned for PV systems in the short-circuit path was integrated to ensure disconnection at any time. This allows to replace an overloaded protection module without special tools – in a de-energised state and without arcing.

DEHNguard M Y PV SCI type 2 arresters with integrated d.c. fuse combine efficient surge protection with personnel and fire protection.

DEHNventil® and DEHNshield®: Type 1 spark-gap-based arresters for directly protecting the inverter

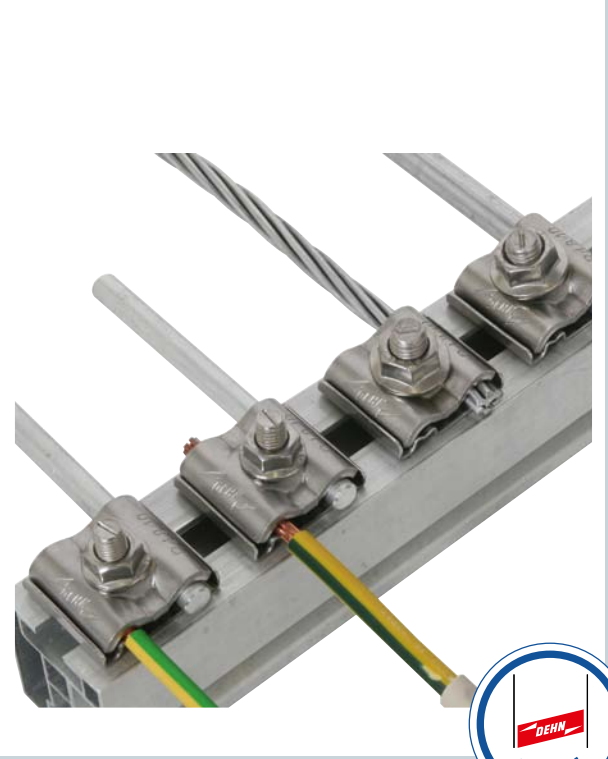
Only spark-gap-based combined lightning current and surge arresters such as DEHNventil or DEHNshield combine lightning equipotential bonding and protection of the inverter in a single device.

The voltage switching characteristic of the spark gap acts like a wave breaker, reducing the energy of the lightning current to an acceptable level. The spark gap absorbs almost the entire energy, thus hardly stressing the inverter.

Varistor-based type 1 arresters, in contrast, do not have a voltage switching, but a voltage limiting characteristic. As a consequence, the use of these arresters must be considered and calculated in detail. The requirements of higher classes of LPS can only be fulfilled to a limited extent.

DEHNventil and DEHNshield spark-gap-based type 1 arresters protect the inverter and thus the heart of the PV system.

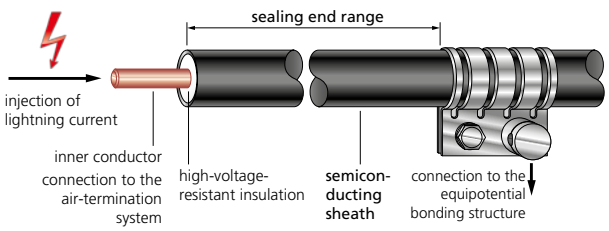




HVI® conductor: Patented solution that allows to maintain the separation distance

Due to their exposed location, photovoltaic systems are particularly at risk. They must be protected in case of a lightning strike while ensuring that the separation distance is maintained to prevent lightning currents from being injected into the structure. This can be implemented by isolated air-termination systems in conjunction with the high-voltage-resistant HVI conductor.

The patented HVI conductor developed by DEHN protects photovoltaic systems. The basic concept of the HVI conductor is to enclose the lightning current carrying conductor by an insulating material so that the separation distance from conductive parts of the building structure and electric lines is maintained.



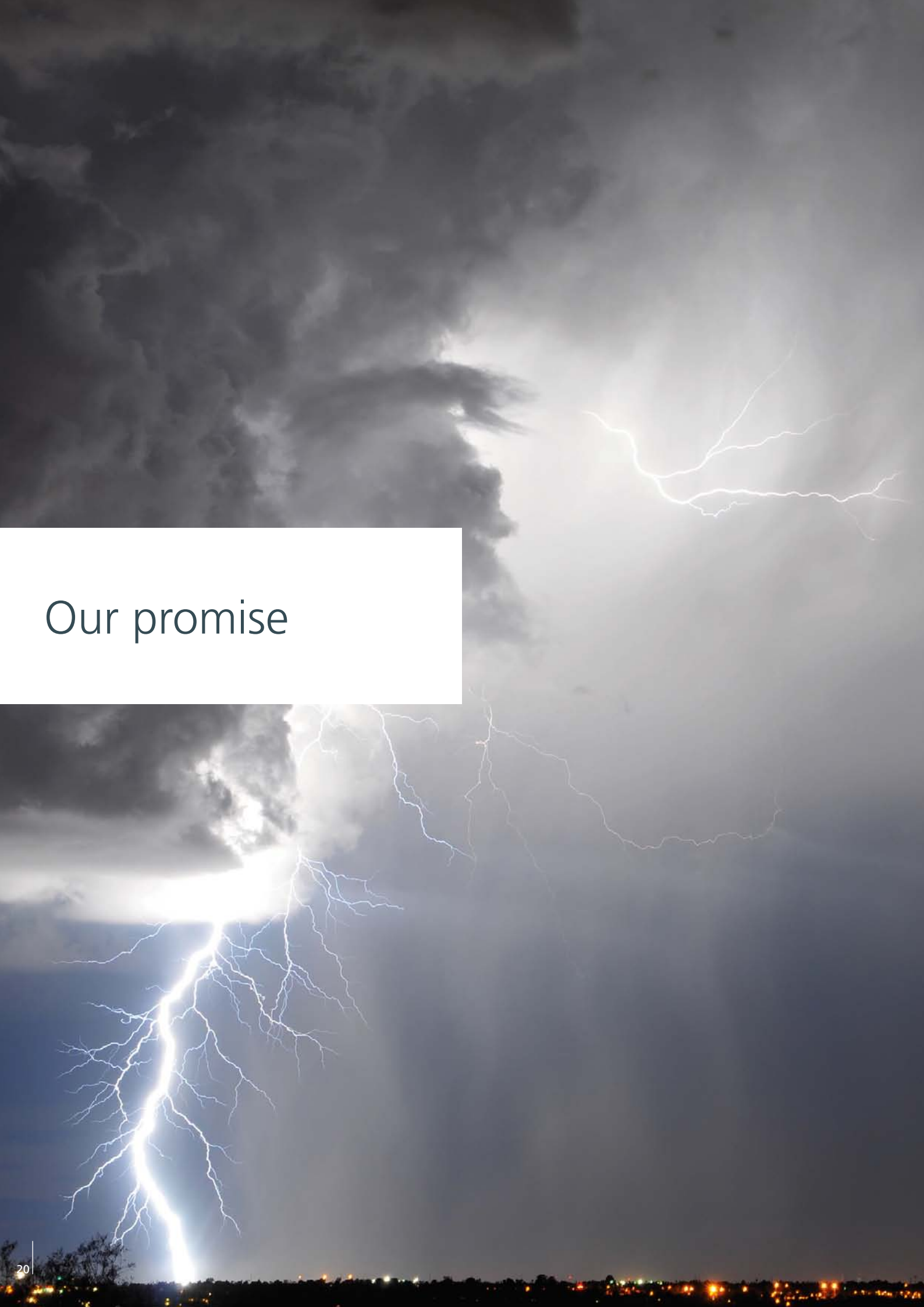
DEHN UNI earthing clamp: Universal connection

National and international installation guidelines require earthing and lightning equipotential bonding and recommend the following for the connection of the module frame:

- Connection with 6 or 16 mm² Cu at the frame*
- Connection of the equipotential bonding conductor to the main earthing busbar of the building at ground level

DEHN UNI earthing clamps with integrated corrosion protection are ideally suited for integrating mounting systems into lightning equipotential bonding and for functional earthing. The stainless steel contact plate allows to connect different conductor materials (copper, aluminium, steel and stainless steel) to common mounting systems that are, for example, made of aluminium. The clamp allows easy and fast connection of the profiles and ensures permanent and reliable electrical contact.

* without external lightning protection: min. 6 mm² CU conductor
separation distance ok: min. 6 mm² CU conductor
separation distance not ok: min. 16 mm² CU conductor



Our promise

DEHN protects

Our key objective is to protect human life and material assets. It was our pioneering spirit and innovative ideas that have defined our company for more than 100 years and made us a market leader with more than 1,400 employees. Our products and developments reflect our market feasibility, commitment and ideas.

As early as in 1923 our founder Hans Dehn started production of external lightning protection and earthing components to optimise the protection of buildings and installations. In 1954, we launched the first series of surge protective devices. Constant further development of these devices ensures safe operation and permanent availability of electrical and electronic installations. Also in the 1950s, our third sector, safety equipment, was added to our portfolio.



The Bavarian town of Neumarkt is the heart of our activities where product managers and developers advance our protection technologies. Here we manufacture our high-quality safety products.

We offer the best solution

Our concern is to be a reliable and fair partner for our industrial, commercial and technical customers all over the world. To this end, we always focus on the best solution to protection problems. Our sales teams in Germany and our global network of 11 subsidiaries as well as more than 70 international sales partners are committed to competent and customer-oriented distribution of our products. Proximity and close contact with our customers is of utmost importance to us, be it on-site support by our experienced field staff team, our telephone hotline or personal contact at trade fairs.

In hundreds of seminar, workshops and conferences held every year throughout the world we impart practical knowledge on products and solutions. Our specialised book "Lightning Protection Guide" and our brochures will broaden your practical knowledge. Or visit us at www.dehn.de for information around the clock.

Our test laboratory is equipped with a direct current source and a PV simulator. Customers use our laboratory to test, for example, the lightning current carrying capability of PV mounting systems. We also perform impulse current tests on inverters for our customers. Take advantage of our knowledge to optimise your protection solutions for PV systems.

Surge Protection
Lightning Protection
Safety Equipment
DEHN protects.

DEHN + SÖHNE
GmbH + Co.KG.

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