

The background of the entire page is a photograph of a solar panel array. The panels are dark with a grid of cells, and they are arranged in rows. Above the panels, a dark blue sky is filled with heavy, dark clouds. Several bright, jagged lightning bolts are striking down from the clouds, illuminating the scene. The overall mood is dramatic and emphasizes the need for surge and fire protection in solar systems.

Surge and fire protection

SCI technology for PV circuits



Surge arresters with SCI technology
for d.c. circuits

DEHN protects photovoltaic systems ...

DEHN is an international family-owned company that is active in the fields of surge protection, lightning protection/earthing as well as safety equipment. We are a leading manufacturer of lightning and surge protection products for photovoltaic systems and have been setting trends in this industry for more than two decades. Be it systems from the kilowatt to the megawatt range, we globally protect your investment against interference and failure caused by lightning currents and surges.

Photovoltaic systems require special protection – especially on the d.c. side. The direct current generated by the modules poses a considerable challenge for the installation devices used in the system. During switching operations, the characteristic of these PV current sources leads to the formation of dangerous arcs which must be handled. The EN 50539-11 test standard for surge protective devices used in PV systems specifies the short-circuit current rating I_{SCPV} of the devices that must be observed. The maximum d.c. short-circuit current of the PV system must not exceed the short-circuit current rating of the arrester.

... by means of arresters with SCI technology

DEHN is the only company that offers surge arresters with innovative Short Circuit Interruption (SCI) technology. This technology provides maximum safety and fire protection for photovoltaic systems. A fuse specifically dimensioned for PV systems in the short-circuit path ensures safe electrical isolation of the surge protective device at any time. This fuse is combined with a disconnection and short-circuiting device with Thermo Dynamic Control. Moreover, the Y circuit has proven its worth in practice. The interaction of these functions in a single device ensures maximum operational reliability and fail-safe performance.

In this brochure, we will introduce you to our surge protective devices with SCI technology.

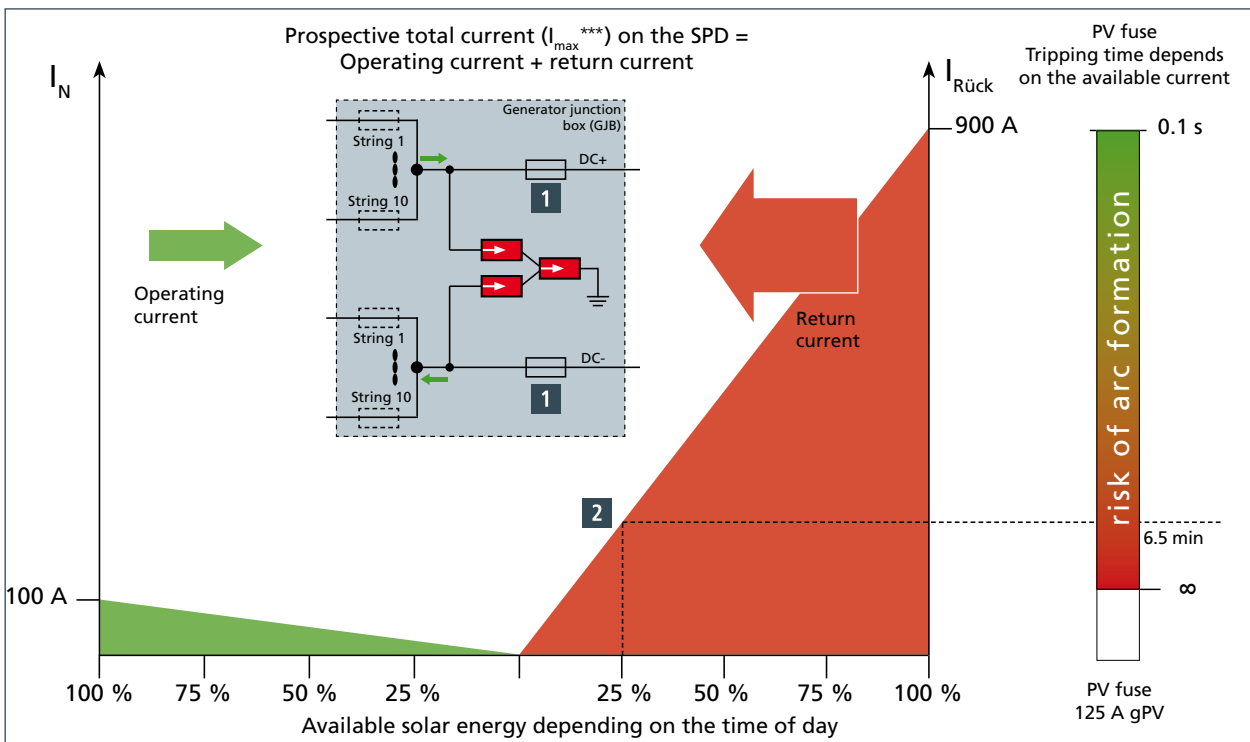




Requirements on PV arresters depending on the time of day

The function of fuses **1** in PV systems with central inverters is to avoid return currents. The maximum available current depends on the actual radiation. In certain operating states **2** these fuses only trip after some minutes. Therefore, in case of overload surge protective devices in generator junction boxes must be capable of independently disconnecting the actual total current (operating and return current) without arc formation.

Conclusion: $I_{SCPV} > I_{max}$ PV system



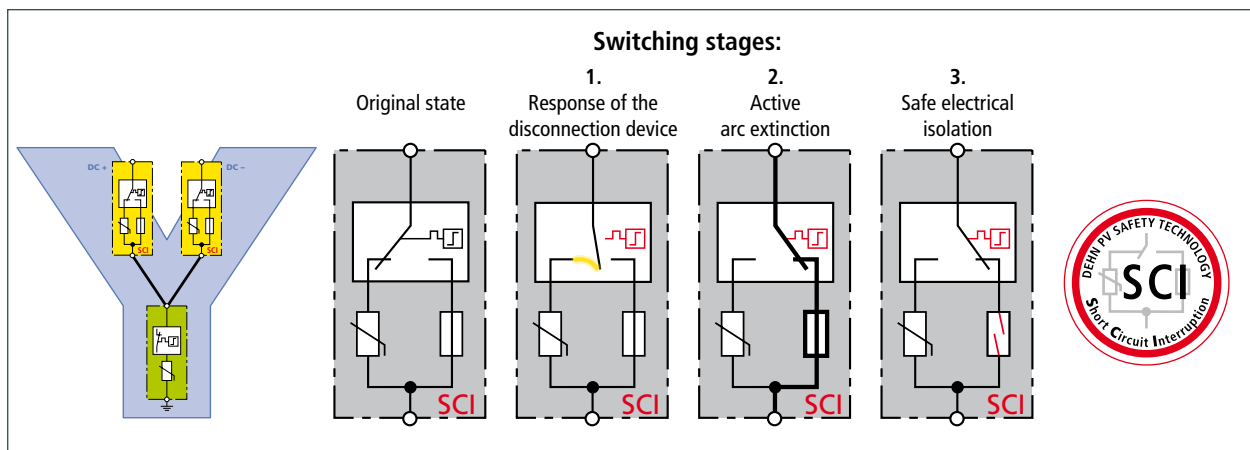
SPD: Surge protective devices
 I_{SCPV} : Short-circuit current rating of the SPD
 I_{max} : Total current of the PV system



SCI technology for maximum safety and fire protection

SCI stands for **Short Circuit Interruption** and thus for all surge arresters with three-step d.c. switching device from DEHN. If the disconnection device is activated, the PV follow current flows into the bypass path of the arrester. Thus, electric arcs are immediately extinguished. The fuse in the bypass path interrupts the flow of direct current.

DEHNguard arresters with SCI technology and a fuse integrated in the bypass path combine efficient surge protection and maximum personal and fire protection.



The tried and tested technology of the fault-resistant **Y circuit** and the combined disconnection and short-circuiting device with Thermo Dynamic Control developed by DEHN is supplemented by an additional bypass with d.c. fuse. The picture above shows the switching stages of the d.c. switching device.

String inverter SIV < 200 A

- PV direct currents of less than hundred amps
- In some cases with a generator junction box connected in series
- Short-circuit current rating ISCPV of the SPDs according to the maximum input current of the string inverter

Central inverter CIV > 200 A

- PV direct currents of some hundred amps
- Parallel use of several multistring generator junction boxes
- Short-circuit current rating ISCPV of the SPDs according to the maximum input current of the central inverter

SCI arresters from DEHN

DEHNguard® YPV SCI - compact

Compact type 2 arrester specifically designed for surge protection on the d.c. side in string inverter systems up to 200 A.

Type	Part No.
DG YPV SCI 600	950 531
DG YPV SCI 1000	950 530



$I_{SCPV} = 200 \text{ A}$

ZWR
Central
inverter

GAK
Generator
junction box for
central inverters

SWR
String
inverter

GAK
Generator
junction box for
string inverters

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✓

✓

DEHNguard® M YPV SCI

Universal type 2 arrester series suited for PV systems of any size, configuration and operating voltage up to 1200 V.

Type	Part No.
DG M YPV SCI 150 FM	952 518
DG M YPV SCI 600 FM	952 516
DG M YPV SCI 1000 FM	952 515
DG M YPV SCI 1200 FM	952 517



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

✓

✓

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DEHNguard® ME YPV SCI

Meets the high demands on the performance, safety and availability of a new generation of PV power plants with an operating voltage up to 1500 V.

Type	Part No.
DG ME YPV SCI 1500 FM	952 525



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

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✓

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DEHNguard® S YPV SCI

This single-pole surge protective device is ideally suited for directly earthed PV circuits.

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



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

✓

✓

✓

✓

DEHNguard PCB

Base allows direct integration of type 2 arresters on printed circuit boards, e.g. inverters, monitoring systems, etc.

Type	Part No.
DG PCB PV SCI 500 FM	952 751
DG PCB PV 500 FM	952 741



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✓
monitoring

✓

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Selection of surge arresters for PV systems

Roof-mounted and ground-mounted PV systems are equipped with string or central inverters. Correctly dimensioned SPDs* result in an overall solution which combines surge protection, personal protection and fire protection in a single device.

The following criteria are relevant for the selection of d.c. arresters:

- Maximum PV voltage U_{CPV}
- Nominal discharge current I_N
- Voltage protection level U_p
- Maximum short-circuit current I_{SCPV}

The maximum short-circuit current I_{SCPV} must be additionally taken into account due to the special characteristic of the d.c. voltage sources of PV systems.

The I_{SCPV} value determined in conformity with EN 50539-11 is specified in the manufacturer's datasheet. I_{SCPV} is the short-circuit current rating of the surge protective device (SPD). This value must be greater than the maximum short-circuit current of the PV system:

Conclusion: $I_{SCPV} > I_{max}$ PV system

- DEHN surge protective devices with SCI technology have the following benefits:
- Use in PV systems without additional backup fuse
- Proven fault-resistant Y circuit
- No fire damage as a result of d.c. switching arcs
- Coordination within the DEHNguard family



More products for PV systems

Products from DEHN protect PV systems ranging from roof-mounted systems to solar parks from lightning currents and surges.

DEHNventil® M ... 255 FM

The wave breaker function of this type 1 spark-gap-based combined arrester combines maximum lightning current carrying capability with maximum coordination with inverters on the a.c. side.



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

BLITZDUCTOR® XTU

The actiVsense® technology automatically detects the operating voltage and allows universal use for 4 to 20 mA, RS 485 and telecommunication.



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

HVI®

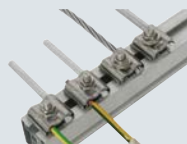
Since the special coating of the HVI®Conductor prevents lightning-induced creepage discharges, down conductors can be routed next to electrical installations.



Type	Part No.
HVI Conductor III	819 022

UNI earthing clamp

A stainless steel intermediate element prevents contact corrosion, thus creating reliable connections between different conductor materials for many years.



Type	Part No.
UNI earthing clamp	540 250

Protective gloves

The arc-fault-protected gloves tested to IEC 61482-1-1 and IEC 61482-1-2 provide excellent wearing comfort.



Type	Part No.
APG 10	785 798



Practical tests in the DEHN test laboratory

Testing of switching operations in PV systems

Our test laboratory is equipped with a direct current source and a PV simulator. Our customers use our laboratory for example to test the lightning current carrying capability of PV mounting systems. Impulse current tests on inverters are also carried out on request in our laboratory. Profit from our knowledge to optimise your protection solutions in the field of photovoltaics.

Devices and components for PV systems must be adapted to meet their special requirements. Especially the operating performance of devices which ensure the protection and switching functions must be verified in laboratory simulations. The laboratory tests should be performed under real operating conditions.

Since conventional d.c. sources are not suitable for exactly simulating the behaviour of PV systems, we have developed a PV simulator. Due to its dynamic i/u characteristic, this simulator allows to realistically simulate switching operations in PV systems.

The PV simulator is an efficient test circuit for testing overcurrent protective devices, mechanical switching devices and surge protective devices under realistic conditions.

Testing of lightning protection components

Metal lightning protection components (clamps, conductors, air-termination rods or earth rods) which are exposed to all weather conditions must be subjected to artificial ageing before they are tested by the manufacturer. The aim is to verify the actual suitability for outdoor use.

Artificial ageing and testing of metal components are performed in two steps: In a first step the metal components are subjected to a salt mist treatment which is followed by a humid sulphurous atmosphere treatment. After that, a lightning current test is carried out.



„PV simulator for simulation of switching operations in PV systems“ (DS192)

Surge Protection
Lightning Protection
Safety Equipment
DEHN protects.

DEHN + SÖHNE
GmbH + Co.KG.

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