Surge and Fire Protection
Arresters with SCI Technology for D.C. Circuits
Surge Arresters with SCI Technology for D.C. Circuits
Surge and fire protection for photovoltaic systems…

DEHN globally protects photovoltaic systems in the kilo-watt to megawatt range against interruption and failure caused by lightning currents and surges. These systems require special protection especially on the d.c. side. The direct current generated by the PV modules poses a considerable challenge to the switching devices. During switching operations, the characteristic of these PV current sources can cause dangerous arcs in surge protective devices which must be handled. The EN 50539-11 test standard therefore requires to test the short-circuit current rating $I_{SCP}$ for surge protective devices used in PV systems. The maximum d.c. short-circuit current of the PV system must not exceed the typical $I_{SCP}$ value of the arrester.

… thanks to arresters with SCI technology from DEHN

DEHN is the only company that offers surge arresters with the innovative Short Circuit Interruption (SCI) technology. This patented technology provides maximum safety and prevents fire. The specifically dimensioned fuse integrated in the short-circuit path ensures safe disconnection of short-circuit currents in case of overload at any time. Moreover, the Y circuit of DEHN arresters has proven its worth over many years. The interaction of the SCI technology and the Y circuit ensures reliable surge protection – and thus maximum operational reliability and fail-safe performance.

DEHN surge arresters with SCI technology
– Made in Germany –

- saves additional backup fuses up to the $I_{SCP}$ value
- fulfils customer needs and international standards for surge protective devices
- provides excellent surge and fire protection
- offers permanent active protection
The function of fuses in PV systems with central inverters is to protect against return currents. The maximum available current depends on the actual radiation. In certain operating states which depend on the time of day these fuses only trip after some minutes. Therefore, surge protective devices in generator junction boxes must be dimensioned for the possible total current (operating current and return current) and must be independently disconnected in case of overload without arc formation.

**Requirements on arresters for use in PV systems depending on the time**

The possible total current $I_{\text{max}}$ of the PV system is given by the sum of the operating current and the return current. The tripping time depends on the available current.

### Conclusion: $I_{\text{SCPV}} > I_{\text{max}}$ PV system

- $I_{\text{SCPV}}$: Short-circuit current rating of the SPD
- $I_{\text{max}}$: Total current of the PV system
Selection of surge arresters for use in PV systems

Roof-mounted and ground-mounted PV systems are equipped with string or central inverters. Correctly dimensioned surge protective devices (SPDs) combine surge protection, personal protection and fire protection in a single device.

The following criteria are relevant for the selection of d.c. arresters:
- Place of installation and distance from terminal equipment
- SPD class: type 1 or type 2
- Earthing of live conductors
- Maximum short-circuit current $I_{SCPV}$

The short-circuit current is extremely important due to the special characteristic of the d.c. voltage sources of the PV system. The following applies to the selection of an arrester: The maximum d.c. short-circuit current of the PV system must not exceed the short-circuit current rating of the arrester.

The datasheet of surge protective devices specifies the $I_{SCPV}$ value determined according to the EN 50539-11 standard. $I_{SCPV}$ is the short-circuit current rating for which the surge protective device is dimensioned. This value must be greater than the maximum short-circuit current of the PV system:

$$I_{SCPV} > I_{max\ PV\ system}$$

String inverters are used for all PV systems ranging from small rooftop systems to large solar parks in the multi-megawatt range. Installation devices for protecting the d.c. side against surges (at least type 2 arresters) are required for each MPP input. They are either connected upstream of the inverters in generator junction boxes or are already integrated in the string inverters. D.c. short-circuit currents typically do not exceed 100 A.

Central inverters frequently with ratings of 1 MW are mainly used in solar parks. The d.c. lines from the field are routed in parallel to a common busbar. Several hundred amperes of direct current accumulate here. Overvoltage pulses from the entire area are centrally collected on the busbar. Correctly dimensioned surge protective devices protect the input circuits from damage and increase the service life and availability of the inverter.

The generator junction boxes used for these systems are interconnected in parallel via the central inverter. The return currents must be safely discharged even if a surge arrester is overloaded. The resulting short-circuit current must not exceed the short-circuit current rating $I_{SCPV}$ of the arrester.

DEHN has the optimal surge arresters for every application. The table on page 6 allows to select a suitable arrester for d.c. circuits.

SPD: Surge protective device
MPP: Maximum power point
MPP input: Separate input electronics of an inverter
## For every application: SCI arresters from DEHN

### Central inverter (CIV) > 200 A
- PV direct currents of less than hundred amps
- Parallel use of several multistring generator junction boxes
- Short-circuit current rating $I_{SC}$ of the SPDs according to the maximum input current of the CIV

<table>
<thead>
<tr>
<th>Type 1 + Type 2</th>
<th>CIV central inverter</th>
<th>GJB generator junction box for central inverter</th>
<th>SIV string inverter</th>
<th>GJB generator junction box for string inverter</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NEW: DEHNcombo YPV SCI</strong></td>
<td>✔ ✔ ✔ ✔</td>
<td>✔ ✔</td>
<td>✔</td>
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</table>

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

### DEHNguard® M YPV SCI

Universal type 2 arrester for PV systems of any size, configuration and operating voltage from 600 V to 1200 V.

<table>
<thead>
<tr>
<th>Type</th>
<th>Part No.</th>
<th>✔ ✔ ✔ ✔</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ DG M YPV SCI 600 FM</td>
<td>952 516</td>
<td>✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>☐ DG M YPV SCI 1000 FM</td>
<td>952 515</td>
<td>✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>☐ DG M YPV SCI 1200 FM</td>
<td>952 517</td>
<td>✔ ✔ ✔ ✔</td>
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</tbody>
</table>

### DEHNguard® S PV SCI

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Part No.</th>
<th>✔ ✔ ✔ ✔</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ DG S PV SCI 150 FM</td>
<td>952 556</td>
<td>✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>☐ DG S PV SCI 600 FM</td>
<td>952 555</td>
<td>✔ ✔ ✔ ✔</td>
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</tbody>
</table>

### DEHNguard® YPV SCI - compact

Compact type 2 arrester designed for protecting the d.c. side of string inverter systems against surges.

<table>
<thead>
<tr>
<th>Type</th>
<th>Part No.</th>
<th>✔ ✔ ✔ ✔</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ DG YPV SCI 600</td>
<td>950 531</td>
<td>✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>☐ DG YPV SCI 1000</td>
<td>950 530</td>
<td>✔ ✔ ✔ ✔</td>
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</tbody>
</table>

### DEHNguard® ME YPV SCI

Maximum performance, safety and availability for a new generation of PV power plants with an operating voltage up to 1500 V.

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<tr>
<th>Type</th>
<th>Part No.</th>
<th>✔ ✔ ✔ ✔</th>
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</thead>
<tbody>
<tr>
<td>☐ DG ME YPV SCI 1500 FM</td>
<td>952 525</td>
<td>✔ ✔ ✔ ✔</td>
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</tbody>
</table>

### DEHNguard® PCB

Base allows to directly integrate type 2 arresters on printed circuit boards, e.g. inverters, monitoring systems.

<table>
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<tr>
<th>Type</th>
<th>Part No.</th>
<th>✔ ✔ ✔ ✔</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ DG PCB PV SCI 500 FM</td>
<td>952 751</td>
<td>✔ ✔ ✔ ✔</td>
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<tr>
<td>☐ DG PCB PV 500 FM</td>
<td>952 741</td>
<td>✔ ✔ ✔ ✔</td>
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</tbody>
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**Central inverter (CIV) < 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 $I_{SC}$ of the SPDs according to the maximum input current of the SIV

**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 $I_{SC}$ of the SPDs according to the maximum input current of the SIV
SCI technology ensures maximum safety and fire protection

SCI stands for **Short Circuit Interruption** and thus for all DEHN surge arresters with a three-step d.c. switching device.

Surge protective devices have an integrated disconnector which isolates in case of overload. Insufficient results are achieved by classical methods of activating the disconnector at the d.c. characteristic of PV sources of current. Due to the formation of an internal arc, damaging of the SPD can not be excluded. In order to prevent this, the disconnector is combined with a bypass path. In case of overload the disconnector will be activated and any arc will be quenched on the low-resistance bypass path. The integrated fuse interrupts the flow of follow current and a safe electrical isolation of the arrester is achieved.

**DEHN SCI arresters provide a safe protection also in case of overload due to the combined disconnecting and short-circuiting device and thus an effective surge protection which meets the highest requirements with regard to personal and fire protection.**

**Switching phases:**
If the disconnector is activated (1) PV follow currents change over to the bypass current path of the arrester. Arising arcs will be directly quenched (2). The fuse which is integrated in the bypass interrupts the d.c. current flow (3).

This operating principle of DEHN SCI arresters ensures surge protection combined with maximum disconnection safety in case of overload.

* SPD: Surge protective device

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![Diagram](image.png)
DEHN offers a complete product range which protects from damage due to lightning and overvoltages. The Red/Line products protect the a.c. and d.c. side of the inverter. The Yellow/Line surge protective devices protect the data flow. Also in the field of earthing and external lightning protection, DEHN products provide sophisticated solutions.

## Comprehensive protection of photovoltaic systems

### DEHNventil® M ... 255 FM
The wave breaker function of this type 1 spark-gap-based combined arrester combines maximum lightning current carrying capability and maximum coordination with inverters on the a.c. side.

<table>
<thead>
<tr>
<th>Type</th>
<th>Part No.</th>
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<tbody>
<tr>
<td>DV M TNC 255 FM</td>
<td>951 305</td>
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<tr>
<td>DV M TNS 255 FM</td>
<td>951 405</td>
</tr>
<tr>
<td>DV M TT 255 FM</td>
<td>951 315</td>
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</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Part No.</th>
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<tbody>
<tr>
<td>BXTU ML4 BD 0-180</td>
<td>920 349</td>
</tr>
<tr>
<td>base part BXT BAS</td>
<td>920 300</td>
</tr>
</tbody>
</table>

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

### UNI earthing clamp
A stainless steel intermediate element prevents contact corrosion, thus creating reliable connections of different conductor materials for many years.

### Protective gloves
The arc-fault-resistant protective gloves tested to IEC 61482-1-1 and IEC 61482-1-2 provide excellent wearing comfort during installation and maintenance.

<table>
<thead>
<tr>
<th>Type</th>
<th>Part No.</th>
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<tr>
<td>APG 10</td>
<td>785 798</td>
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</table>

other sizes available
DEHN arresters with SCI technology protect photovoltaic systems all over the world

On all continents and under very different climatic conditions, DEHN SCI arresters protect PV systems in the gigawatt range from interruption and failure caused by lightning current and surges. DEHN arresters with SCI technology are internationally approved. They withstand extreme climatic conditions and can thus be used in any climate zone.

As a leading manufacturer of lightning and surge protection for PV systems, we have been setting trends in this industry for more than two decades. The DEHN sales team in the German headquarters and 17 international subsidiaries and offices as well as our partner network support PV projects on site – in more than 70 countries worldwide.

Examples of PV systems protected by DEHN SCI arresters representing some hundred thousand systems worldwide:

- 10 MWp solar power plant from Gehrlicher Solar in Helmering, Germany
- 2,5 MWp PV solar power plant from Meridionale Impianti in Palermo, Italy
- 3 MWp PV solar power plant in Yongam, Korea
- 20 MWp Dongtai PV solar power plant, Dongtai City, Jiangsu Province, China
- Systems with inverters from ABB Ltd, Zurich, Switzerland
- Systems with inverters from SMA Solar Technology AG, Niestetal, Germany
- Systems with inverters from Power One, Terranuova Bracciolini, Italy
- Systems with inverters from Solectria Renewables LCC, Lawrence, Massachusetts, USA
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