Raycap

# Surge Protection & Monitoring Solutions for Photovoltaic Systems

# Raycap Products Provide the Ultimate Lightning Surge Protection for Photovoltaic Systems

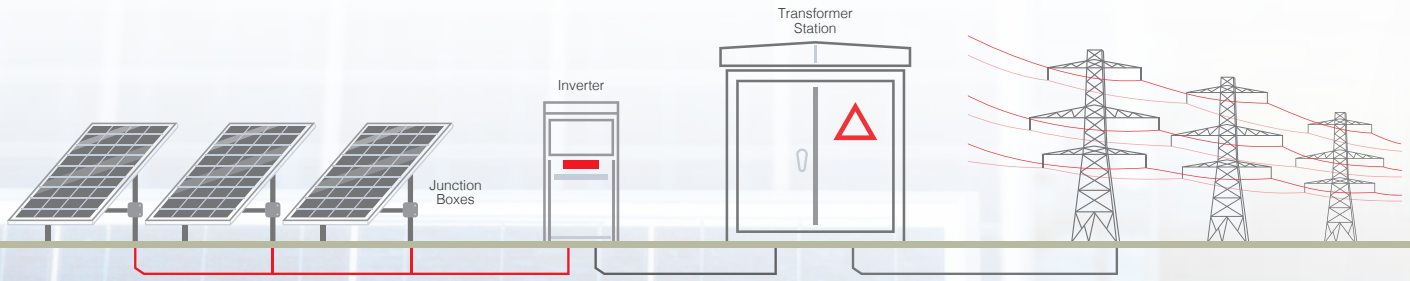
The remote locations, exposed surface areas and extensive layouts of solar power plants put them at high risk of damage from the elements, particularly electrical storms. A significant concern for photovoltaic (PV) power plant operators is equipment damage caused by direct or indirect lightning strikes. Damage from these events can bring a PV installation offline for days or perhaps weeks, resulting in power interruption and revenue losses. To avoid the destructive effects of lightning strikes, overvoltage protection must be installed at the inverter and at various other locations in the PV facility.

Lightning strikes cause surges which propagate inside a PV plant's wiring structure, sending powerful impulses throughout the electrical system and severely damaging sensitive electronic equipment such as inverters, PV modules, control circuits and communication systems. While damage resulting from a direct lightning strike may be immediate, delayed equipment failures can also occur at any time due to the cumulative effect of repetitive exposure to surge anomalies.

There are always serious threats of operational and economic impact whenever inappropriate or ineffective surge protective devices (SPDs) are used. These threats include but are not limited to:

- Extended downtime due to long lead times for replacement parts
- Loss of revenue during downtime
- High repair and replacement cost of damaged PV equipment
- Control and monitoring system malfunctions
- Increased maintenance cost

Many inverter manufacturers have already discovered the benefits of integrating Raycap's lightning and surge protection modules into their inverter equipment to provide optimum levels of surge protection for PV systems against lightning and power surges.

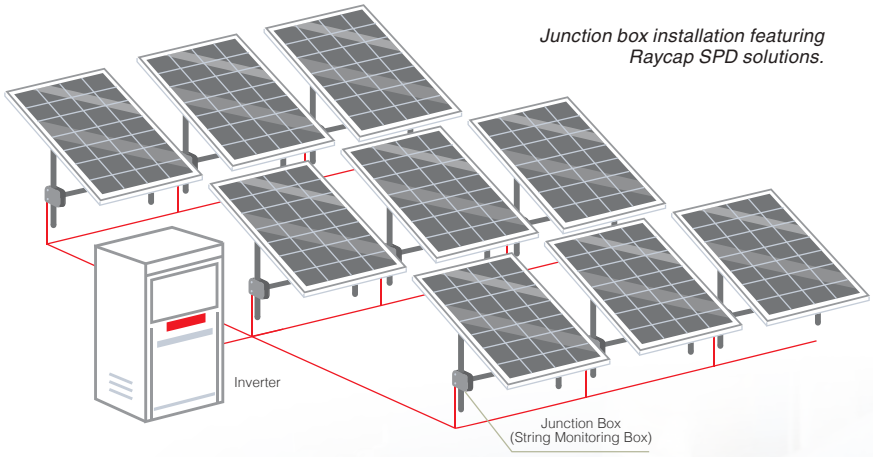



*Install Raycap lightning protection at the inverter, junction boxes and panels to protect both the AC and DC sides of the solar power plant.*

With Raycap surge protection integrated into the solar power site, liability and damages can be diminished and profitability secured. The benefits of using Raycap's innovative surge protection include:

- Continuous equipment protection and more uptime
- Longer PV equipment life
- Safe and maintenance-free operation resulting in reduced operational costs
- High availability of the PV system, more secure revenues
- Elimination of downtime and the resulting revenue losses

Raycap's Strikesorb®, ProTec PV, and RayDat product lines are based on cutting-edge surge technologies that eliminate many common failures seen in PV installations. Strikesorb SPDs have a proven ability to sustain multiple and successive lightning strikes and power surges without requiring any maintenance. Other Raycap products are available in DIN rail configurations and also offer significant surge protection in virtually every possible low voltage AC and DC power configuration utilized by photovoltaic power plants.




*Junction box installation featuring Raycap SPD solutions.*

*Protect the PV system, power inverter and transformer station with Raycap lightning and overvoltage protection solutions.*

*Strikesorb 35 designed for photovoltaic DC power circuits.*

Raycap's surge protection solutions are manufactured in the company's total quality control ISO 9001 and ISO 14001 certified manufacturing facilities in Europe and North America. Products comply with all relevant international performance and safety standards. Individual SPD component qualification testing and monitoring by automatic tracking procedures ensure the highest quality end products are delivered to customers worldwide.

Raycap SPDs are offered in Class I, Class II, Type 1, Type 2 and Type 4 CA configurations to deliver the most effective lightning and surge protection solutions available. They have been tested to surge current waveforms as defined by international standards for surge protective devices IEC 61643-11, UL 1449 4th Edition and IEEE C62.41.

The enhanced performance characteristics of the Strikesorb 35 enable protection of DC power circuits in photovoltaic systems rated up to 1500 volts DC. Ultra-safe Strikesorb modules endure UL 3-cycle testing in order to ensure their safe operation when exposed to high levels of short circuit current.

All Raycap products developed for use in PV environments deliver reliable, high performance lightning surge protection while fully complying with the EN 50539-11 standard which defines the requirements and tests for SPDs intended for installation on the DC side of photovoltaic power systems.

*Strikesorb, ProTec PV and RayDat products are manufactured and tested at Raycap's state-of-the-art facilities in Europe and North America, under the strictest guidelines for SPD production and testing standards.*

*Strikesorb family of products.*

# Strikesorb®

## Lightning Protection Solutions

### *Strikesorb Benefits*

- High lightning and multiple surge current handling capability
- Maintenance-free operation
- Safe elimination of internal fusing to ensure protection at all times and under all circumstances
- Low let-through voltage to enhance system reliability
- High short circuit current ratings
- Compliance to ANSI UL 1449 4th Edition and to IEC 61643-11
- Full compliance with EN 50539-11 (Strikesorb 35)
- 10 year global product warranty

Lightning surges are one of the primary causes of failures in photovoltaic and solar power plants.

Operators investing in solutions using Strikesorb surge protection realize significant returns resulting from uninterrupted PV and solar power plant operations, minimized operating costs, greater revenue security and a maximum return on investment (ROI).

Strikesorb provides state-of-the-art technology, excellent Class I protection from lightning induced surges, and is a well justified investment.

**Strikesorb Electrical Specifications**

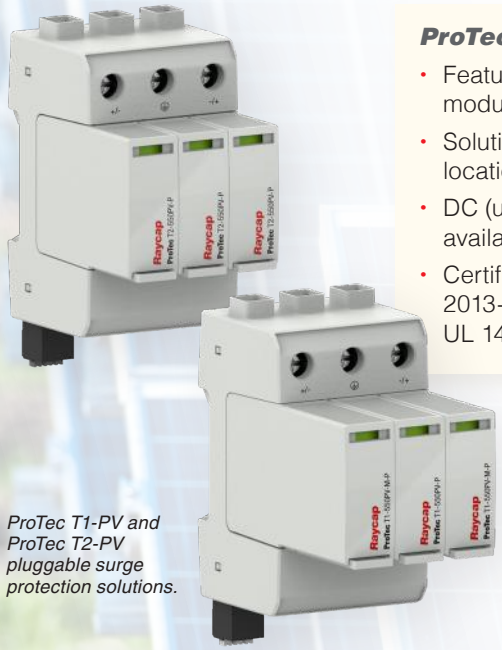
| Strikesorb Modules | | 35-F-HV | 35-G-HV | 40-A | 40-B | 40-C | 40-D | 40-E | 40-F | 40-G |
|---|---|---|---|---|---|---|---|---|---|---|
| | | DC | | AC | | | | | | |
| Category | per IEC 61643-11 & EN 50539-11 | Class I | | Class I | | | | | | |
| | per UL 1449 4th Edition | Type 2 CA | | Type 2 CA | | | | | | |
| Nominal Operating AC Voltage [$U_n$] | | | | 120V | 240V | 277V | 400V | 480V | 600V | 1000V |
| Maximum Continuous Operating AC Voltage [$U_c$] | | | | 150V | 300V | 350V | 480V | 600V | 750V* | 1200V |
| Maximum Continuous Operating DC Voltage [$U_c$] | | 1100V | 1500V | | | | | | | |
| Nominal Discharge Current (8/20 µs) [$I_n$] | | 20 kA | | 20 kA | | | | | | |
| Maximum Surge Current Capacity (8/20 µs) [$I_{max}$] | | | | 140 kA | | | | | | |
| Maximum Impulse Current (10/350 µs) [$I_{imp}$] | | 12.5 kA | | 12.5 kA | | | | | | |
| Voltage Protection Rating (VPR) | | 2500V | 4000V | 600V | 1200V | 1200V | 1800V | 2000V | 2500V | 4000V |
| Voltage Protection Level [$U_p$] | | 2800V | 4400V | 700V | 1200V | 1300V | 1800V | 2300V | 2800V | 4400V |

**690 V per IEC 61643-11*

*For additional information on Raycap surge protection technology visit us at: raycap.com.*

# ProTec PV

## Pluggable Low Voltage DIN Rail SPDs for DC Photovoltaic Applications



*ProTec T1-PV and ProTec T2-PV pluggable surge protection solutions.*

### *ProTec PV Benefits*

- Features a high energy MOV in a modular design
- Solutions for Type 1 and Type 2 locations (EN)
- DC (up to 1500 V) solutions available
- Certified to EN 50539-11: 2013+A1: 2014 and UL 1449 4th Edition

ProTec PV industrial surge protection utilizes high performance varistors and integrates a state-of-the-art thermal disconnector. Raycap PV solutions provide good protection against overvoltage surges and transients. The products are available for Type 1 and Type 2 locations, and can cover practically all power system configurations. ProTec T1-PV and ProTec T2-PV solutions for PV applications are available up to 1500 V.

**ProTec T1-PV(R) & ProTec T2-PV(R)**

| Surge Protective Device (SPD) | ProTec T1-1100PV-3+0(R) | ProTec T1-1500PV-3+0(R) | ProTec T2-1100PV-3+0(R) | ProTec T2-1500PV-3+0(R) |
|---|---|---|---|---|
| **EN Electrical** | | | | |
| Category per EN 50539-11 | Type 1+2 | Type 1+2 | Type 2 | Type 2 |
| per UL 1449 4th Edition | | Type 1 Component Assembly | | |
| Maximum Continuous Operating DC Voltage [$U_{CPV}$] | 1100 V | 1500 V | 1100 V | 1500 V |
| Nominal Discharge Current (8/20 µs) [$I_n$] | 20 kA | 20 kA | 20 kA | 20 kA |
| Maximum Discharge Current (8/20 µs) [$I_{max}$] | 40 kA | 30 kA | 40 kA | 30 kA |
| Impulse Discharge Current (10/350 µs ) [$I_{imp}$] | 6.25 kA | 5 kA | | |
| Total Discharge Current (10/350 µs ) [$I_{Total}$] | 12.5 kA | 10 kA | | |
| Total Discharge Current (8/20 µs ) [$I_{Total}$] | 50 kA | 40 kA | 50 kA | 40 kA |
| Voltage Protection Level [$U_p$] | 3800 V | 5000 V | 3800 V | 5000 V |
| Short-Circuit Current Rating[$I_{SCPV}$] | 11 kA | 11 kA | 11 kA | 11 kA |
| **UL Electrical** | | | | |
| Maximum Permitted DC Voltage [$V_{pvdc}$] | 1100 V | 1500 V | 1100 V | 1500 V |
| Voltage Protection Rating (VPR) | 2500 V | 4000 V | 2500 V | 4000 V |
| Nominal Discharge Current (8/20 µs) [$I_n$] | 20 kA | 20 kA | 20 kA | 20 kA |
| Short-Circuit Current Rating (SCCR) | 50 kA | 65 kA | 50 kA | 65 kA |
| Single Unit DIN 43880 Dimension | 3 TE | 3 TE | 3 TE | 3 TE |

# RayDat

## Modular DIN Rail SPDs for Signal Line Protection in Photovoltaic Applications

*RayDat SBH-3, SPH-2 and SPH-4 one and two pair modular protection options available with or without Quick Connect feature.*

### *RayDat Benefits*

- Power protection for signal and data lines
- Modular design available in voltages from 5 to 110 VDC
- DIN rail format
- IEC/EN Categories: D1/C1/C2/C3

RayDat solutions are available in a variety of surge discharge ratings and in voltages from 5 VDC to 110 VDC. The products protect signal and data lines from overvoltage surges and electrostatic discharges created by switching transients in an electrical network. Common applications include protection of DC power and data lines, local area networks (LAN), data circuits, shielded cables, and more.

*The RayDat antivibration locking feature ensures the pluggable module remains secure even in the most severe vibration conditions.*

*RayDat NET 6 POE local area network protection.*

**PV Signal & Data Protection Solutions**

| Surge Protective Device (SPD) | SBH-3 | | | SPH-2 | | SPH-4 | RayDat Net 6 POE | |
|---|---|---|---|---|---|---|---|---|
| **Electrical Specifications** | | | | | | | | |
| Category | D1/C1/C2/C3 | | | D1/C1/C2/C3 | | D1/C1/C2/C3 | D1/C1/C2/C3 | |
| Maximum Continuous Operating DC Voltage [$U_C$] | 6V | 15V | 33V | 33V | 320V | 33V | L-L<br>P-P | 50V<br>72V |
| Nominal Discharge Current (8/20µs) [$I_n$] | | 10kA | | | 10kA | 10kA | L-L | 150A |
| Maximum Discharge Current (8/20µs)[$I_{max}$] | | 20kA | | | 20kA | 20kA | L-G | 10kA |
| Impulse Current (10/350µs) [$I_{imp}$] | | 2.5kA | | | 2.5kA | 5kA | | 1kA |
| Voltage Protection Level at $I_n$ [$U_p$] | | | | | | | L-L<br>L-G | 150V<br>550V |
| Residual Voltage at 5kA (8/20µs) [$U_{res}$] | < 22V | < 42V | < 80V | < 80V | < 700V | < 80V | | |
| Rated Spark Overvoltage | PG-G<br>L-L | 184-276V<br>7-10V | 184-276V<br>16-19V | 184-276V<br>35-43V | L-G<br>L-L | 184-276V<br>36-44V | 350-550V<br>350-429V | 184-276V<br>36-44V | | |
| Single Unit DIN 43880 Dimension | 2/3TE | 2/3TE | 2/3TE | 2/3TE | 2/3TE | 2/3TE | | |

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# Raycap Worldwide Locations


**Raycap Inc.**
806 South Clearwater Loop
Post Falls, ID 83854
United States of America

**STEALTH**
Concealment Solutions, Inc.
a Raycap Group Company
7555-A Palmetto Commerce Pkwy
North Charleston, SC 29420
United States of America

**Raycap GmbH**
Parkring 11
85748 Garching Munich
Germany

**Raycap S.A.**
Telou & Petroutsou 14
15124 Maroussi Athens
Greece

**Raycap S.A. Manufacturing**
Industrial Area of Drama
66100 Drama
Greece

**Raycap d.o.o.**
Pod hrasti 7
Poslovna cona Žeje pri Komendi
1218 Komenda
Slovenia

**Raycap Cyprus Ltd.**
46 Lefkosias Street
Industrial Area of Dali
2540 Nicosia
Cyprus

**Raycap SAS**
84 rue Charles Michels
Building B
93200 Saint-Denis
France

**Raycap Corporation SRL**
4A, Johann Strauss, 4 Floor,
Sector 2, 020312 Bucharest
Romania

**Raycap (Suzhou) Co. Ltd.**
Block B, Phase II
of New Sea Union
No. 58 Heshun Road
SIP, Suzhou 215122
Jiangsu Province
China

Raycap

raycap.com • info@raycap.com


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