

Raycap

Surge Protection Solutions
for Photovoltaic Systems





Raycap Products Provide the Ultimate Lightning Surge Protection for Photovoltaic Systems

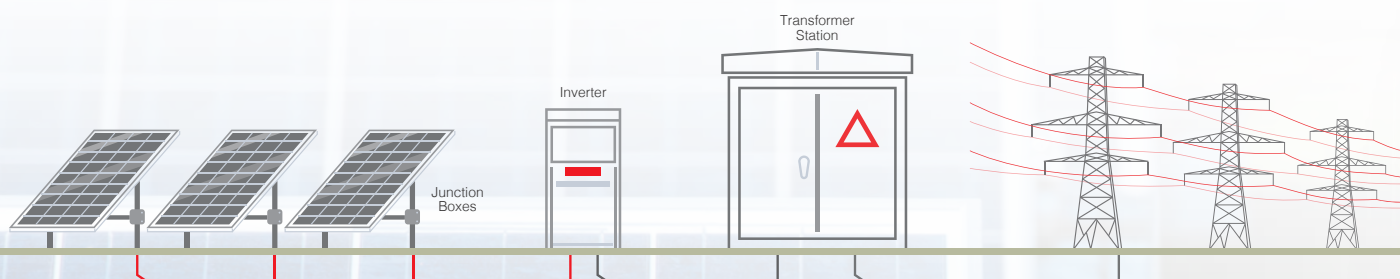
The remote locations, exposed surface areas and extensive layouts of solar power plants put them at high risk of damage from the elements, particularly electrical storms. A significant concern for photovoltaic (PV) power plant operators is equipment damage caused by direct or indirect lightning strikes. 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.

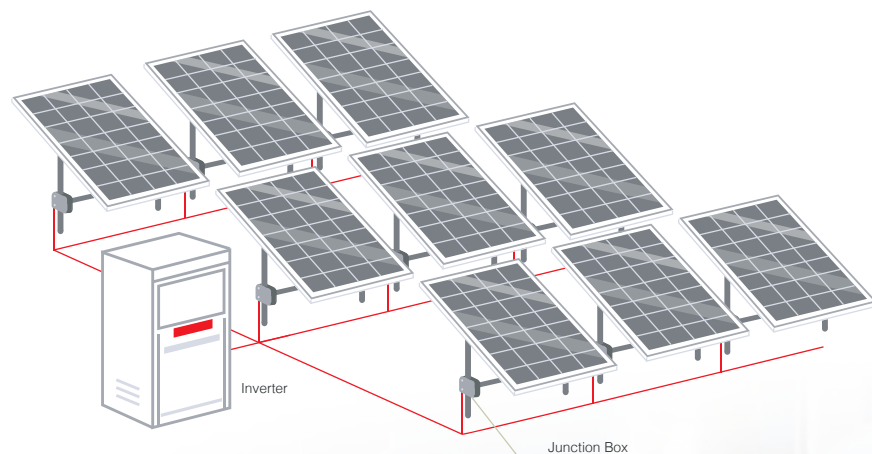


Install Raycap lightning protection at the inverter, junction boxes and panels to protect both the AC and DC sides of the solar power plant.

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.

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



Strikesorb 35 designed for photovoltaic DC power circuits.



Most of the Raycap facilities are certified and conform to international quality, environmental and safety standards, visit our website for a complete listing. Raycap surge protection solutions are manufactured in the company's Post Falls, Idaho, USA; Drama, Greece; Komenda, Slovenia and Munich, Germany facilities. 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.

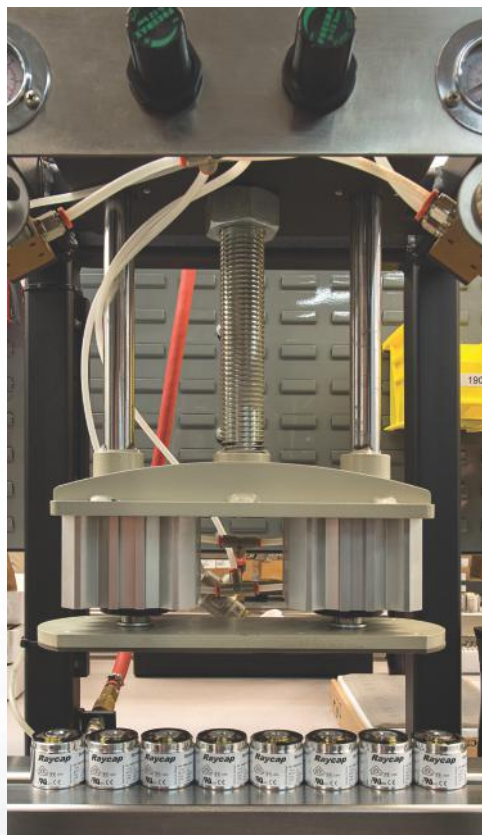
Raycap AC SPDs are offered in Class I, Class II, Type 1, Type 2 and Type 4 CA configurations to deliver the most effective lightning and surge protection solutions available. They have been tested to surge current waveforms as defined by international standards for surge protective devices IEC 61643-11,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

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. The enhanced performance characteristics of the Strikesorb 35 enable protection of DC power circuits in photovoltaic systems rated up to 1500V DC.

All Raycap products developed for use in PV environments deliver reliable, high performance lightning surge protection while fully complying with the EN 50539-11 and UL 1449 4th Edition standards which define 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.



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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 and UL 1449 4th Edition (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 EN 50539-11 IEC 61643-11	Type I		Class I						
	per UL 1449 4th Edition	Type 2 CA		Type 2 CA						
Nominal Operating AC Voltage [U_n]				120V	240V	277V	480V**	480V	600V	1000V
Maximum Continuous Operating AC Voltage [U_c]				150V	300V	350V	550V***	600V	750V*	1200V
Maximum Continuous Operating DC Voltage [U_{CPV}]		1100V****	1500V							
Nominal Discharge Current (8/20 μ s) [I_n]		20kA		20kA						
Maximum Surge Current Capacity (8/20 μ s) [I_{max}]				140kA						
Impulse Discharge Current (10/350 μ s) [I_{imp}]		12.5kA		12.5kA						
Voltage Protection Rating (VPR)		2500V	4000V	600V	1200V	1200V	1800V	2000V	2500V	4000V
Voltage Protection Level [U_p]		2800V	4400V	600V	1200V	1300V	1800V	2300V	2800V	4400V

*690 V per IEC 61643-11

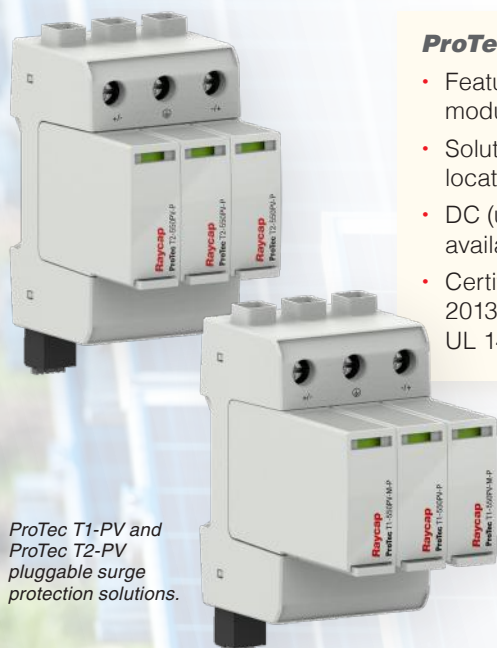
**400V per IEC 61643-11

***480 V per IEC 61643-11

****1000V per UL 1449

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 1500V) 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 disconnect. 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 1500V.

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
	per UL 1449 4th Edition		Type 1 Component Assembly	
Maximum Continuous Operating DC Voltage [U_{CPV}]		1100V	1500V	1100V
Nominal Discharge Current (8/20 μ s) [I_n]		20kA	20kA	20kA
Maximum Discharge Current (8/20 μ s) [I_{max}]		40kA	30kA	40kA
Impulse Discharge Current (10/350 μ s) [I_{imp}]		6.25kA	5kA	
Total Discharge Current (10/350 μ s) [I_{Total}]		12.5kA	10kA	
Total Discharge Current (8/20 μ s) [I_{Total}]		50kA	40kA	50kA
Voltage Protection Level [U_p]		3800V	5000V	3800V
Short-Circuit Current Rating [I_{SCPV}]		11kA	11kA	11kA
UL Electrical				
Maximum Permitted DC Voltage [V_{pdc}]		1100V	1500V	1100V
Voltage Protection Rating (VPR)		2500V	4000V	2500V
Nominal Discharge Current (8/20 μ s) [I_n]		20kA	20kA	20kA
Short-Circuit Current Rating (SCCR)		50kA	65kA	50kA
Single Unit DIN 43880 Dimension		3TE	3TE	3TE

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 5VDC to 110VDC. 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 P-P	50 V 72 V
Nominal Discharge Current (8/20μs) [I _n]			10kA			10 kA		10kA	L-L	150 A
Maximum Discharge Current (8/20μs)[I _{max}]			20kA			20 kA		20kA	L-G	10kA
Impulse Current (10/350μs) [I _{imp}]			2.5 kA			2.5 kA		5 kA	1 kA	
Voltage Protection Level at I _n [U _p]									L-L L-G	150V 550V
Residual Voltage at 5 kA (8/20μs) [U _{res}]			< 22V	< 42V	< 80V	< 80V	< 700V	< 80V		
Rated Spark Overvoltage			PG-G L-L	184-276V 7-10V	184-276V 16-19V	184-276V 35-43V	L-G L-L	184-276V 36-44V	350-550V 350-429V	184-276V 36-44V
Single Unit DIN 43880 Dimension			2/3TE	2/3TE	2/3TE	2/3TE	2/3TE	2/3TE		

To see the complete line of Raycap product solutions visit: www.raycap.com.

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