



## Surge Protection Solutions for Photovoltaic Systems





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

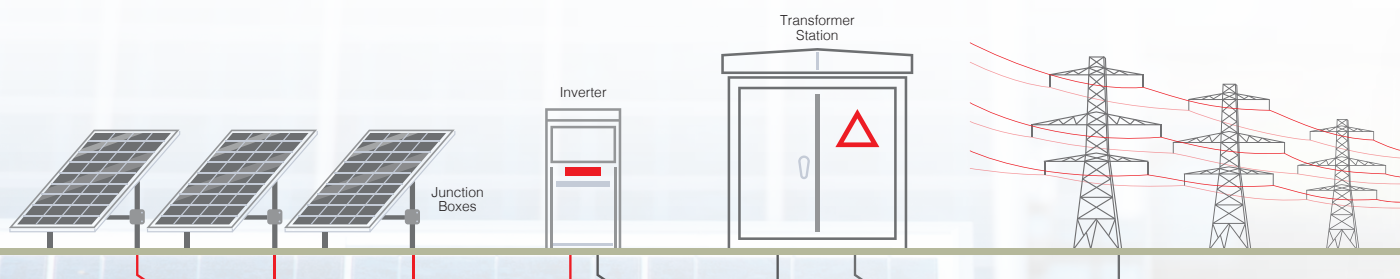
Raycap products deliver superior lightning surge protection for photovoltaic systems. Remote locations, large surface areas, and spread-out layouts make solar power plants highly vulnerable to harsh weather, especially electrical storms. Equipment damage from lightning strikes is a major concern for photovoltaic (PV) plant operators. Such events can shut a PV installation down for days or weeks, causing power outages and revenue loss. To prevent damage, overvoltage protection is needed at the inverter and throughout the PV facility.

Lightning strikes cause surges that travel through a PV plant's wiring. These power surges can damage sensitive electronics, including inverters, PV modules, control circuits, and communication systems. Direct lightning strikes cause immediate damage. Repeated surge exposure can also result in delayed equipment failure over time.

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
- Lost revenue
- Expensive repairs
- Equipment replacement
- Control and monitoring failures
- Higher maintenance costs.

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.



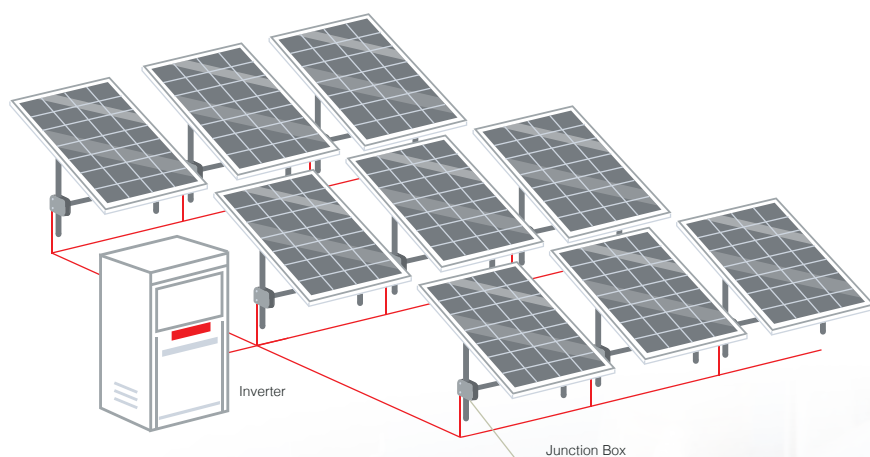
*Install Raycap lightning protection at the inverter, junction boxes and panels to protect both the AC and DC sides of the solar power plant.*



Maximize profitability and minimize risk at your solar power site with Raycap's integrated surge protection. By safeguarding your operation from damaging surges, Raycap's innovative technology ensures:

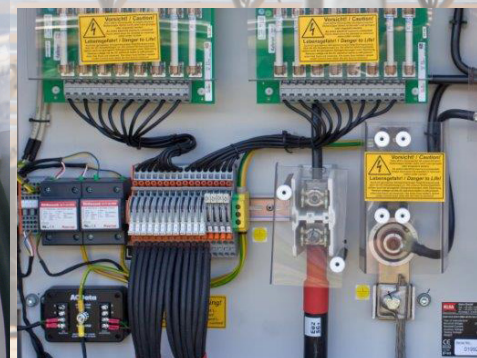
- Continuous equipment protection and increased uptime
- Extended lifespan for PV equipment
- Safe, maintenance-free operation with lower operating costs
- Reliable system availability, securing revenue streams
- The elimination of costly downtime and related revenue loss

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.*





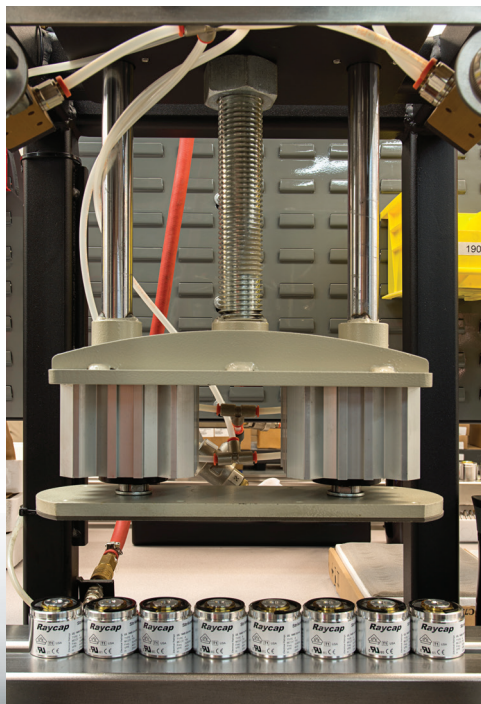
*Strikesorb 35 designed for photovoltaic DC power circuits.*



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 at facilities in Idaho, New Jersey, and South Carolina in the USA; and in Greece, Slovenia, and Germany in the EU. Individual SPD component qualification testing and monitoring by automatic tracking procedures ensure the highest quality end customers worldwide. Individual SPD component qualification testing and monitoring by automatic tracking procedures ensure the highest quality end products are delivered to customers worldwide.



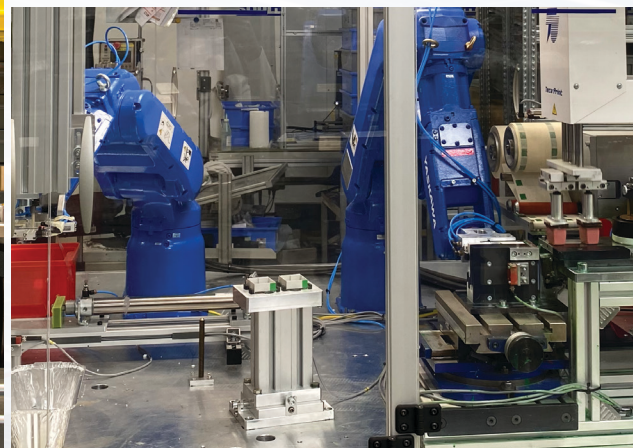
*Strikesorb, ProTec PV and RayDat products are manufactured and tested at Raycap's state-of-the-art facilities in Europe and North America, under the strictest guidelines for SPD production and testing standards.*



Raycap AC SPDs are offered in Class I, Class II, Type 1 and Type 2 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 5th 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 61643-31 and UL 1449 5th Edition standards which define the requirements and tests for SPDs intended for installation on the DC side of photovoltaic power systems.







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
- Certified per UL 1449 5th Edition and to IEC 61643-11
- Certified per IEC 61643-31:2018, EN 61643-31:2019 and UL 1449 5th 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 IEC 61643-31   IEC 61643-11 per UL 1449 5th Edition	Class I-II Type 2 CA		Class I Type 2 CA						
Nominal Operating AC Voltage [U <sub>n</sub> ]				120V	240V	277V	480V**	480V	600V	1000V
Maximum Continuous Operating AC Voltage [U <sub>c</sub> ]				150V	300V	350V	550V***	600V	750V*	1200V
Maximum Continuous Operating DC Voltage [U <sub>CPV</sub> ]		1100V****	1500V							
Nominal Discharge Current (8/20μs) [I <sub>n</sub> ]		20kA		20kA						
Maximum Surge Current Capacity (8/20μs) [I <sub>max</sub> ]				140kA						
Impulse Discharge Current (10/350μs) [I <sub>imp</sub> ]		12.5kA		12.5kA						
Voltage Protection Rating (VPR)		2500V	4000V	600V	1200V	1200V	1500V	2000V	2500V	4000V
Voltage Protection Level [U <sub>p</sub> ]		2800V	4500V	600V	1200V	1300V	1800V	2300V	2800V	4400V

\*690 V per IEC 61643-11

\*\*400V per IEC 61643-11

\*\*\*480V per IEC 61643-11

\*\*\*\*1000V per UL 1449

## PV Box

### Enclosure with Multi-Pole SPD for Photovoltaic Systems

#### PV Box Benefits

- Ships assembled with customer specified connection configuration
- Available for 1100V and 1500V PV systems
- 3Y, 5Y and 7Y configuration for 1, 2 and 3 string systems
- Compact UV-stable housing with protection class up to IP 67
- Transparent cover with failure status indicator on plugs
- Compliant to IEC/EN 61643-31 PV surge protection device standard

Space-saving surge protection connection boxes were developed for the protection of Photovoltaic (PV) inverters. The pre-assembled enclosures feature Class I & II / EN Type 1 & 2 arresters for 1100V and 1500V DC. Designed for quick on-wall installation at the DC side of the inverter, the compact UV-stable housing is suitable for indoor and outdoor installations. A transparent cover enables viewing of module failure status indicators. Multiple connection options are available depending on the installation needs.



#### ProTec T1 PV 3Y-5Y-7Y PV Box • ProTec T2 PV 3Y-5Y-7Y PV Box

Box with Multi-Pole SPD	ProTec T1-1100 PV Box	ProTec T1-1500 PV Box	ProTec T2-1100 PV Box	ProTec T2-1500 PV Box
<b>EN Electrical</b>				
Category	per EN 61643-31	Type 1 + 2	Type 1 + 2	Type 2
Maximum Continuous Operating DC Voltage [ $U_{CPV}$ ]		1100V	1500V	1100V
Nominal Discharge Current (8/20 $\mu$ s) [ $I_n$ ]		20 kA	20 kA	20 kA
Maximum Discharge Current (8/20 $\mu$ s) [ $I_{max}$ ]		40 kA	50 kA	40 kA
Impulse Discharge Current (10/350 $\mu$ s) [ $I_{imp}$ ]		6.25 kA	6.25 kA	
Total Discharge Current (10/350 $\mu$ s) [ $I_{Total}$ ]		12.5 kA	12.5 kA	
Total Discharge Current (8/20 $\mu$ s) [ $I_{Total}$ ]		50 kA	60 kA	40 kA
Voltage Protection Level [ $U_p$ ]		4400V	5200V	4200V
Short-Circuit Current Rating [ $I_{SCPV}$ ]		11 kA	30 kA	9 kA

Connection Options	Rubber grommets	Double MC4	MC4
Features & Benefits	<ul style="list-style-type: none"> <li>• IP 65 ingress protection</li> <li>• T and V connection</li> </ul>	<ul style="list-style-type: none"> <li>• IP 67 ingress protection</li> <li>• Fast installation</li> <li>• V connection</li> </ul>	<ul style="list-style-type: none"> <li>• IP 67 ingress protection</li> <li>• Fast installation</li> <li>• V connection</li> </ul>
Connection	Quick connect terminals on PCB		Connectors on PCB pre-connected to MC4



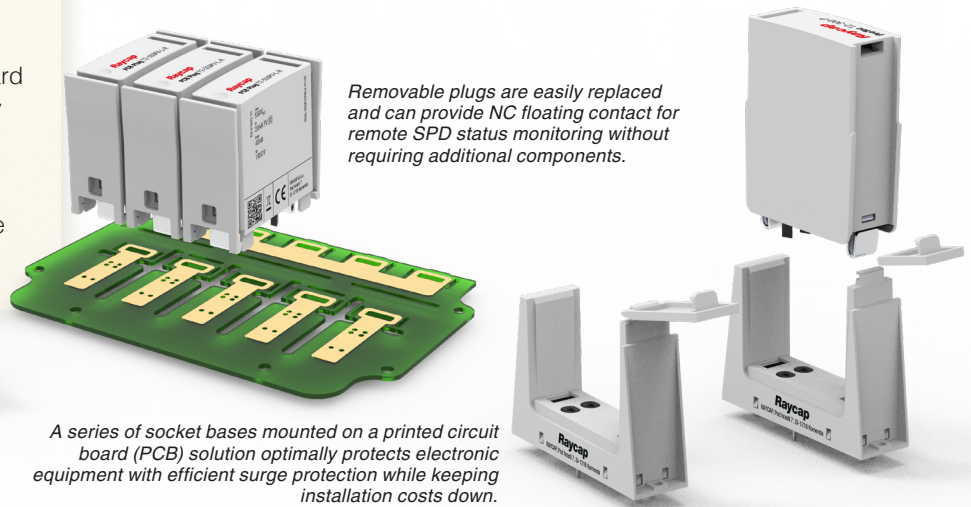
# PCB Solution for PV Systems

## A Versatile Protection Solution for PV Systems: Direct-mounted SPDs

### Benefits of Direct-mounted Plugs

- High customization
- Space saving
- Optimum surge protection
- Compliant to IEC 61643-31 PV surge protection device standard
- Available for 1100V and 1500V
- $I_{Total}$  (10/350) up to 12.5 kA
- Optional remote signalization
- Removable and non-removable options available

Raycap SPDs mounted directly on a PCB enable high integration levels and custom PCB designs. These solutions are low in overall height, ensuring the most efficient utilization of space. Installation requires no soldering and can be easily implemented at any stage of production or in the field.



A series of socket bases mounted on a printed circuit board (PCB) solution optimally protects electronic equipment with efficient surge protection while keeping installation costs down.

### Direct Mount SPD Plugs

Solutions	Type 1		Type 2	
EN Electrical				
Maximum Continuous Operating DC Voltage [U <sub>CPV</sub> ]	1100V	1500V	1100V	1500V
Nominal Discharge Current (8/20µs) [I <sub>n</sub> ]	20 kA	20 kA	20 kA	15 kA
Maximum Discharge Current (8/20µs) [I <sub>max</sub> ]	40 kA	50 kA	40 kA	40 kA
Impulse Discharge Current (10/350µs) [I <sub>imp</sub> ]	6.25 kA	6.25 kA		
Total Discharge Current (10/350µs) [I <sub>Total</sub> ]	12.5 kA	12.5 kA		
Total Discharge Current (8/20µs) [I <sub>Total</sub> ]	40 kA	40 kA	40 kA	40 kA
Voltage Protection Level [U <sub>p</sub> ]	< 4400V	< 5200V	< 4200V	< 4800V

### PCB Socket

Solutions	Type 1	Type 2
Maximum Continuous Operating PV Voltage [ $U_{CPV}$ ]	up to 750V	up to 750V
Nominal Discharge Current (8/20 $\mu$ s) [ $I_n$ ]	up to 20 kA	up to 40 kA
Maximum Discharge Current (8/20 $\mu$ s) [ $I_{max}$ ]	up to 40 kA	up to 40 kA
Impulse Discharge Current (10/350 $\mu$ s) [ $I_{imp}$ ]	up to 6.25 kA	
Short-Circuit Current Rating [ $I_{scpv}$ ]	up to 30 kA	up to 11 kA

To see the complete line of Raycap product solutions and ask for dedicated case applications contact us: [info@raycap.com](mailto:info@raycap.com)

## ProTec PV

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



#### 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 61643-31:2019, UL 1449 5th Edition & Open Type 1 SPD Listed (ProTec T1-PV-S)

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

ProTec PV industrial surge protection utilizes high-performance varistors and integrates a state-of-the-art thermal disconnecter. 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-S and ProTec T2-PV solutions for PV applications are available up to 1500V. Devices have a short-circuit rating up to 30kA, the highest on the market.

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

Surge Protective Device (SPD)	ProTec T1-1100PV-3+0-R	ProTec T1-1500PV-3+0-S-R	ProTec T2-1100PV-3+0-R	ProTec T2-1500PV-3+0-R
<b>EN Electrical</b>				
Category	per EN 61643-31	Type 1 + 2	Type 1 + 2	Type 2
	per UL 1449 5th Edition	Type 1 CA	Type 1	Type 1 CA
Maximum Continuous Operating DC Voltage [ $U_{CPV}$ ]		1100V	1500V	1100V
Nominal Discharge Current (8/20 $\mu$ s) [ $I_n$ ]		20 kA	20 kA	20 kA
Maximum Discharge Current (8/20 $\mu$ s) [ $I_{max}$ ]		40 kA	60 kA	40 kA
Impulse Discharge Current (10/350 $\mu$ s) [ $I_{imp}$ ]		6.25 kA	6.25 kA	
Total Discharge Current (10/350 $\mu$ s) [ $I_{Total}$ ]		12.5 kA	12.5 kA	
Total Discharge Current (8/20 $\mu$ s) [ $I_{Total}$ ]		50 kA	60 kA	50 kA
Voltage Protection Level [ $U_p$ ]		3800V	4500V	3800V
Short-Circuit Current Rating [ $I_{SCPV}$ ]		11 kA	30 kA	11 kA
<b>UL Electrical</b>				
Maximum Permitted DC Voltage [ $V_{pVDC}$ ]		1100V	1500V	1100V
Voltage Protection Rating (VPR)		2500V	3000V	2500V
Nominal Discharge Current (8/20 $\mu$ s) [ $I_n$ ]		20 kA	20 kA	20 kA
Short-Circuit Current Rating (SCCR)		50 kA	100 kA	50 kA
Single Unit DIN 43880 Dimension		3 TE	3 TE	3 TE



## ProTec PV 5Y

### Space-saving Surge Protection for PV Inverter and Connection Boxes



#### ProTec PV 5Y Benefits

- For use with 2 or 3 PV Strings
- Low height modules
- Shock and vibration resistant
- Optional remote contacts
- Compliance:  
IEC 61643-31:2018,  
EN 61643-31:2019,  
UL 1449 5th Edition

*ProTec T1-PV-5Y  
and ProTec T2-PV-5Y  
pluggable surge  
protection solutions.*

The ProTec T1-PV Din Rail product series includes pluggable high-performance protective devices for 1100V DC photovoltaic systems. The products are classified as Type 1 and Type 2 SPDs per IEC. All products in this series feature low height modules and can protect two or three PV strings. The products are a perfect solution for the electrical protection of string combiner boxes and PV inverters, and feature two different terminal connection options.

#### ProTec T1-PV-5Y(-R) & ProTec T2-PV-5Y(-R)

Surge Protective Device (SPD)	ProTec T1 PV 5Y 00	ProTec T1 PV 5Y 01	ProTec T2 PV 5Y 00	ProTec T2 PV 5Y 01
Number of Strings per MPPT	2	3	2	3
<b>EN Electrical</b>				
Category	per EN 61643-31	Type 1 + 2	Type 1 + 2	Type 2
	per UL 1449 5th Edition	Type 1 CA		
Maximum Continuous Operating DC Voltage [ $U_{CPV}$ ]	1100V			1100V
Nominal Discharge Current (8/20 $\mu$ s) [ $I_n$ ]	20 kA			20 kA
Maximum Discharge Current (8/20 $\mu$ s) [ $I_{max}$ ]	40 kA			40 kA
Impulse Discharge Current (10/350 $\mu$ s) [ $I_{imp}$ ]	5 kA			
Total Discharge Current (10/350 $\mu$ s) [ $I_{Total}$ ]	10 kA			
Total Discharge Current (8/20 $\mu$ s) [ $I_{Total}$ ]	50 kA			50 kA
Voltage Protection Level [ $U_p$ ]	3800V			3800V
Short-Circuit Current Rating [ $I_{SCPV}$ ]	11 kA			11 kA
<b>UL Electrical</b>				
Maximum Permitted DC Voltage [ $V_{pdc}$ ]	1100V			1100V
Voltage Protection Rating (VPR)	2500V			2500V
Nominal Discharge Current (8/20 $\mu$ s) [ $I_n$ ]	20 kA			20 kA
Short-Circuit Current Rating (SCCR)	50 kA			50 kA
Single Unit DIN 43880 Dimension	5 TE			5 TE

# RayDat

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

### RayDat Benefits

- Narrow form factor - just 6.2mm wide
- The connection lines remain enabled during module replacement
- Equipped with quick connect terminals for fast wiring
- Grounded directly by DIN Rail
- IEC/EN Categories: D1/C1/C2/C3
- Compliance: IEC 61643-2, EN 61643-21, UL 497B 4th Ed.

RayDat surge protection for data and signal line systems provides unsurpassed electrical protection for signal power applications. These products meet the diverse requirements of industrial and commercial signal protection applications. RayDat products are available in a variety of operating voltages and configurations that conform to the latest industry standards and certifications.

Always providing reliable signal protection, remote monitoring, and high-frequency coverage.

Monitoring Unit Transmitter & Receiver available for all product variants,

RayDat NET 6 POE local area network protection.

### PV Signal & Data Protection Solutions

Surge Protective Device (SPD)		NSB-3			NSP-2			RayDat Net 6 POE	
Electrical Specifications									
Category		D1/C1/C2/C3			D1/C1/C2/C3			D1/C1/C2/C3	
Maximum Continuous Operating DC Voltage [U <sub>c</sub> ]		8.5V	15V	30V	30V	170V		L-L P-P	50V 72V
Total Nominal Discharge Current (8/20μs) [I <sub>n</sub> ]		10kA			20kA			10kA	
Impulse Current (10/350μs) [I <sub>imp</sub> ]		2.5kA			5kA			1kA	
Rated Spark Overvoltage		L-L L-G	9-25V 193-311V	16-33V 200-319V	33-51V 217-337V	L-L L-G	33-51V 184-286V	188-255V 184-276V	
Single Unit DIN 43880 Dimension		6.2mm	6.2mm	6.2mm	6.2mm	6.2mm		19mm	

To see the complete line of Raycap product solutions visit: [raycap.com](http://raycap.com).

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## About Raycap

Raycap is an international manufacturer and technology leader with decades of experience providing innovative infrastructure solutions for customers in the telecommunications, energy, defense, transportation, and other industrial markets. Its solutions protect mission-critical applications and ensure the best possible system availability. The company's product portfolio includes lightning and surge protection technologies, structured cabling and connectivity solutions, power management systems, custom enclosures, cabinets, and wireless network concealments.

Since its founding in 1987, the company has experienced continuous growth. Its engineering expertise, test laboratories, and multiple manufacturing facilities in different countries guarantee quality, reliability, and innovation. Product design, testing, and approval processes comply with all international safety standards. Raycap operates in the United States, Germany, Greece, Cyprus, Slovenia, Romania, and China. For more information on Raycap products, visit [www.raycap.com](http://www.raycap.com) or [www.raycap.de](http://www.raycap.de)



## Raycap Worldwide Locations



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United States of America

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United States of America

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