



**Rayvoss®**

**Next Generation  
Lightning and Surge Protection  
for Photovoltaic Systems  
& Solar Power Plants**

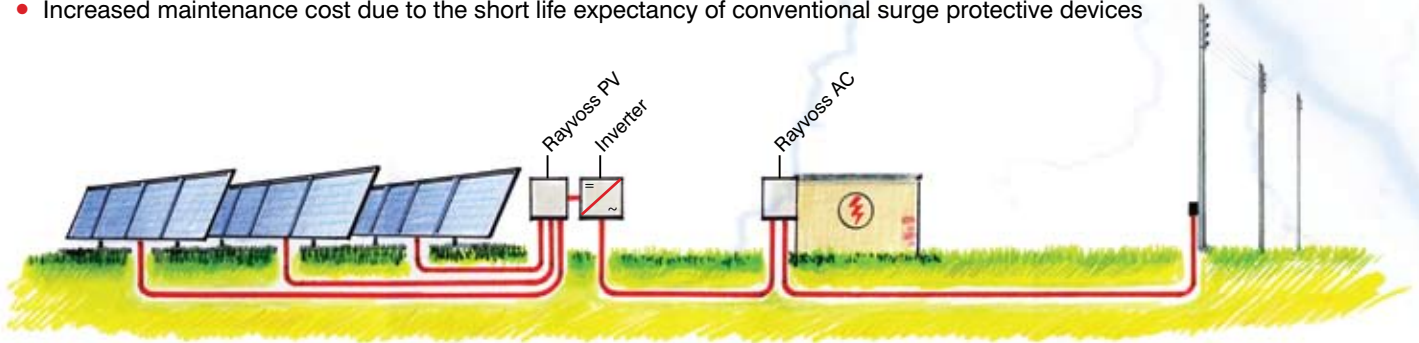
**Raycap**

The photovoltaic systems and solar power plants' exposed surface area and protracted layouts put them in high risk of being directly struck by lightning, but also make them prone to damage resulting from indirect surge events.

Lightning activity generates intense electromagnetic fields that produce transient overvoltages throughout the photovoltaic system's wiring structure. These powerful electrical surges propagate throughout the PV electrical system to severely damage sensitive electronic equipment including inverters, PV modules, control circuits and communication systems. While damage resulting from a direct lightning strike may be immediate, delayed equipment failures can occur at any time due to the cumulative effect of repetitive exposure to surge anomalies.

Serious operational and economic impact can be anticipated whenever improper or ineffective surge protective devices (SPD) are employed to protect photovoltaic equipment from direct lightning and induced surge activity. The equipment operator faces consequences that include, but are not limited to:

- Loss of revenue during down time
- Extended down time due to long lead times for replacement parts
- High repair and replacement cost of damaged PV equipment
- Control and monitoring system malfunctions
- Increased maintenance cost due to the short life expectancy of conventional surge protective devices



Raycap's Rayvoss stand-alone overvoltage protection systems employing next generation Strikesorb surge suppression modules provide optimum levels of surge protection for photovoltaic (PV) systems against lightning and power surges. That, in turn, secures the profitability of PV/solar park investments. The benefits realized with the utilization of Raycap's innovative surge protection systems include:

- Continuous equipment protection
- Longer PV equipment life
- Safe and maintenance free operation resulting in reduced operational costs
- High availability of the PV system eliminating down time and revenue losses

Raycap's patented Strikesorb technology is based on cutting-edge design parameters that resolve SPD aging issues and preclude the common failures associated with conventional surge protective devices (SPD). Strikesorb based Rayvoss systems are proven in their ability to sustain multiple and successive lightning strikes and power surges without requiring maintenance. They are available in configurations that offer unparalleled overvoltage protection in virtually every possible low voltage AC and DC power configuration utilized by photovoltaic power plants.

Raycap's surge protection systems are manufactured in Raycap Corporation's total quality control (ISO 9001 and ISO 14001) manufacturing facilities. They comply with all relevant international SPD surge performance and safety standards including IEC, EN, IEEE and UL. Individual SPD component qualification testing and monitoring by automatic tracking procedures ensure the highest quality end products are delivered to customers worldwide.



Rayvoss SPD's are offered in Class I and Class II configurations to deliver the most efficient technical and economic lightning and surge protection solutions available for the PV and solar power plants.

Rayvoss Class II systems have been tested to surge current waveforms (8/20µs), as defined by IEC 61643-1, ANSI/UL 1449 3rd edition and IEEE C62.41. Rayvoss Class I suppressors have additionally been tested and certified in their ability to withstand direct lightning currents (10/350µs) as defined by IEC 61643-1, the international standard for surge protective devices. They are fully compliant to the ANSI/UL 1449 3rd edition safety standard and bear the appropriate UL Mark. They have been UL 3-cycle tested to ensure their safe operation when exposed to high levels of short circuit current to provide great installation flexibility.

## Rayvoss PV

Rayvoss PV is the Rayvoss product family specially developed to match the DC voltage input of the inverters and ensure high level of protection as they limit surge voltages to low values (low let through voltage). The primary performance and operating characteristics of the Rayvoss PV systems intended for installation on the DC side of the inverters are summarized in the table below:



Rayvoss PV model	Class I and II			Class II		
	PV1-D	PV1-E	PV1-F	PV2-C	PV2-BY	PV2-CY
Max. Continuous Operating DC Voltage for PV application [U <sub>CPV</sub> ]	500Vdc	750Vdc	1000Vdc	500Vdc	750Vdc	1000Vdc
Max. Lightning Current [I <sub>imp</sub> ] (10/350µs)	7,5kA	7,5kA	7,5kA	(5kA)	(5kA)	(5kA)
Max. Discharge Current [I <sub>max</sub> ] (8/20µs)	140kA	140kA	140kA	50kA	50kA	50kA
Voltage Protection Level [U <sub>p</sub> ] (at 10kA 8/20µs)	< 1400V	< 2200V	< 2500V	< 1400V	< 2250V	< 2880V
Response Time [t <sub>A</sub> ]	< 1ns					
Operating Temperature (°C)	-40...+85					
Environmental Protection	IP 65					

## Rayvoss AC

The Rayvoss AC product family is designed to install and protect on the PV power plant's AC circuitry. They employ Strikesorb surge suppression modules in configurations and operating voltages to provide the electrical protection required for single phase or three phase power distributions, and for either standard or special applications. The Rayvoss AC three phase protector's performance and operating characteristics for basic models operating at 240VAC are summarized in the table below:



Rayvoss AC Model	Class I and II		Class II
	240-3Y-R1-4-00-B	240-3Y-M3-4-00-B	240-3Y-S5-4-00-B
Nominal Operating AC Voltage [U <sub>N</sub> ]	240V		
Max. Continuous Operating AC Voltage [U <sub>c</sub> ]	300V		
Max. Lightning Impulse Current [I <sub>imp</sub> ] (10/350µs)	25kA	7,5kA	(5kA)
Max. Discharge Current [I <sub>max</sub> ] (8/20µs)	200kA	140kA	50kA
Voltage Protection Level [U <sub>p</sub> ] (at 10kA 8/20µs)	< 800V	< 890V	< 1200V
Response Time [t <sub>A</sub> ]	< 1ns		
Operating Temperature (°C)	-40...+85		
Environmental Protection	IP 65		





# Rayvoss®

**State of the art technology, effective protection, well justified investment!**

Statistical studies and operational experience have proven lightning and power surges to be the primary cause of failures in photovoltaic and solar power plants.

Rayvoss systems, powered by the unique Strikesorb SPD technology, resolve the common issues that plague conventional SPD technologies to provide superior protection and high PV systems availability.

Operators investing in reliable Rayvoss surge protection solutions soon realize significant returns resulting from uninterrupted PV & solar power plant operations, as they minimize their operating costs, secure revenue and maximize their investment returns.

Rayvoss systems feature:

- 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 3rd edition
- Compliance to IEC 61643-1 / Class I or Class II certified
- 10 year warranty

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[www.raycapsurgeprotection.com](http://www.raycapsurgeprotection.com)