



DC Surge Protection For Solar Power Systems

White Paper

The popularity of solar power is on the rise in the U.S. and worldwide. With it is a growing need to protect photovoltaic (PV) power systems from transient voltage caused by [lightning strikes](#) and other factors. This paper touches on growing solar use projections before discussing the special [surge](#) protection needs of PV systems. It concludes with information about a new line of Transtector DC surge protectors that are designed for PV systems and several other applications.

Solar Power on the Rise

Over the past decade, there has been a big increase in the adoption of solar power, both in the U.S. and worldwide. It is being driven by falling costs, favorable policies, and increasing public awareness of the benefits of renewable energy.

In 2020, solar power accounted for 43% of all new electricity-generating capacity added to the U.S. grid, making it the largest source of new power capacity for the second year in a row. Additionally, the number of homes and businesses with solar panels installed has been steadily increasing, with over 2 million solar installations across the country as of 2021.

Worldwide, solar photovoltaic (PV) is the cheapest source of electricity in history in most parts of the world, and should continue to decline in cost, according to the International Energy Agency (IEA). In 2020, the world added a record 127 gigawatts of new solar capacity, bringing the total global capacity to over 760 GW, enough to power over 100 million homes. This growth is expected to continue, with the IEA projecting that solar PV will be the largest source of electricity generation by 2035, accounting for about 25% of global power generation.

How a Photovoltaic Power System Works

A photovoltaic power system, aka solar power system, works by converting sunlight into electricity through the use of photovoltaic (PV) cells. These cells are made up of semiconductor materials such as silicon and are designed to generate a flow of electrons when exposed to sunlight.

Here's a basic explanation of how a photovoltaic power system works:

- **Solar panels:** The PV power system begins with the solar panels, which are made up of multiple photovoltaic cells that are wired together to produce a specific voltage and current. When sunlight strikes the solar panel, the electrons in the photovoltaic cells generate an electrical current.
- **Inverter:** The electrical current generated by the solar panels is in the form of direct current (DC) electricity, which is not suitable for use in most homes and businesses. Therefore, it needs to be converted into alternating current (AC) electricity, which is used by most appliances and other electronics. This is done by an inverter, which converts DC electricity to AC electricity.
- **Meter:** The AC electricity produced by the inverter is sent to an electricity meter, which measures how much electricity your system produces and sends back to the grid (if you are connected to it).
- **Battery:** In some cases, a battery is included in the photovoltaic power system to store excess electricity generated by the solar panels for use when there is little or no sunlight. This can help to provide a more stable and reliable source of electricity.
- **Grid connection:** If the photovoltaic power system is connected to the electricity grid, any excess electricity generated by the system can be fed back into the grid and used by other homes and businesses. This process is known as "net metering."

Other components in a typical PV power system include:

- **Racking and mounting system:** Holds the solar panels in place and supports the weight of the panels.
- **Wiring and electrical components:** Connect the solar panels, inverter, and other components together to form a complete system.
- **Monitoring system:** Allows you to monitor the performance of your PV system and track energy production.

Surge Protection Needs of Photovoltaic Power Systems

PV power systems require surge protection to safeguard the equipment from transient voltage events that could damage or even destroy the system components. Surge protection is necessary because PV systems are often exposed to external factors that can cause electrical surges or spikes, such as lightning strikes, power grid fluctuations, and switching operations. These surges can cause irreparable damage to sensitive electronic components.

Surge protection is the most important for the solar panels. They are not only the most expensive component of a PV power system but are typically located outdoors and exposed to the elements.

Surge protection devices (SPDs) are used to protect the photovoltaic power system by absorbing or diverting transient voltage surges before they can reach and damage the electronic components. SPDs are designed to limit the voltage that reaches the equipment and provide a safe path for excess current to flow to the ground.

Here are some unique needs for surge protection in photovoltaic power systems:

- **Direct current (DC) voltage:** PV systems generate high DC voltage, which is not common in most electrical systems. This requires the use of surge protection devices that are specifically designed for DC voltage levels.
- **Lightning protection:** PV systems are often installed on rooftops or other exposed locations, which makes them vulnerable to lightning strikes. SPDs must be able to handle the high voltage and current levels generated by lightning strikes.
- **Grounding:** Proper grounding is essential for effective surge protection in PV systems. Grounding must be done in accordance with local electrical codes and standards to ensure the safety and reliability of the system.
- **System size:** The size of a PV system can affect the surge protection requirements. Larger systems require suitable surge protection devices to handle the higher current and voltage levels.
- **Inverter protection:** The inverter is a critical component of a PV system and must be protected from electrical surges. SPDs must be installed on both the DC and AC sides of the inverter to provide comprehensive protection.

A Surge Protection Solution for DC PV Power Systems

Transtector recently released a line of indoor DC surge protectors that handle the needs of photovoltaic power systems. Our [12R-T2DC line](#) comprises DIN-rail-mount SPDs that use MOV technology (see

below) to protect critical equipment that operates on electrical services ranging from 48 Vdc to 1500 Vdc. These SPDs support long-term reliability by safely shunting high amounts of transient energy while maintaining a low clamping voltage.

Applications:

- Photovoltaic power systems
- Communications base stations
- [Industrial](#) automation
- IT and data centers
- Utilities

Key Features:

- High-capacity, 50 kA MOV protection
- UL 1449 4th Edition Listed, Type 2 SPDs
- Local and remote visual status indicators
- DIN-rail mount

Benefits of MOV Protection

Metal oxide varistor (MOV) is a type of semiconductor device made up of a metal oxide material with a high resistance that decreases as the voltage across it increases. When a voltage spike or surge occurs, the MOV conducts current and shunts the excess voltage to the ground, thus protecting the electrical equipment and systems connected to it.

The benefits of MOV surge protection include:

- **Versatility:** MOV SPDs can be used in a wide range of applications, from small electronic devices to large industrial systems.
- **Fast response time:** MOV SPDs have a very fast response time, which means they can react quickly to voltage spikes and surges. This helps to protect electrical equipment from damage before it occurs.
- **Long service life:** MOV SPDs can provide reliable protection for many years. Also, they require little maintenance and are easy to install.

Summary

The growing popularity of solar power in the U.S. and worldwide has created a need for surge protection for photovoltaic (PV) power systems. Such surge protectors must be able to meet PV power systems' special needs, which include solar panels' vulnerability to lightning strikes and the use of inverters to convert DC to AC power. Transtector's new line of 12R-T2DC DC surge protectors serve the demands of PV systems with many features, including high-capacity MOV technology to prevent overvoltage DC.

Our [12R-T2DC DC surge protectors](#), and our [entire line of DC SPDs](#), is in stock and available for **same-day** shipping. For more info, visit [Transtector.com](https://www.transtector.com) or [contact us](#) at +1 (208) 635-6400.

Transtector 12R, Indoor, SPDs with 50 kA MOV Protection

Product No.	Protects Equip. on What Elec. Service?	Mode	Poles
12R-T2DC-48S-TT	48 Vdc	Single	1
12R-T2DC-48T-TT	48 Vdc	Single	2
12R-T2DC-500S-TT	500 Vdc	Single	1
12R-T2DC-500T-TT	500 Vdc	Dual	2
12R-T2DC-600S-TT	600 Vdc	Single	1
12R-T2DC-600T-TT	600 Vdc	Dual	2
12R-T2DC-600Y-TT	600 Vdc	Triple	3
12R-T2DC-800Y-TT	800 Vdc	Triple	3
12R-T2DC-1000Y-TT	1000 Vdc	Triple	3
12R-T2DC-1200Y-TT	1200 Vdc	Triple	3
12R-T2DC-1500Y-TT	1500 Vdc	Triple	3