

Technological Breakthroughs Based on Market Demands Is the Core Competitiveness of Enterprises

—MORNSUN's Development and Persistent Pursuit in the PV Field

Abstract: The rapid development of the PV industry is followed by a series of constantly updated solutions. MORNSUN Guangzhou Science & Technology Co., Ltd. (hereinafter called "MORNSUN") is a global provider of power supply solutions. Integrating R&D, production, and sales, MORNSUN has been involved in the PV industry for more than ten years. Focusing on the PV power supply characteristics, MORNSUN has designed products that can be widely used in the entire system equipment for the PV industry. The One-stop solutions of power supply provided by MORNSUN can effectively help customers reduce costs and improve system efficiency.

Environmental protection and energy security leading to the great-leap-forward development of the PV industry

Since Germany took the lead in commercializing PV power generation in 2004, the PV industry has developed rapidly in just over ten years. From early PV industry research, MORNSUN learned that the development of the PV industry is based on two keywords, i.e., "environmental protection" and "energy security".

Due to the instability of the political and economic situation in oil and gas production areas worldwide, many governments are taking active measures to reduce their dependence on importing traditional energy. As a natural "nutrient", solar energy can be an attractive solution for power generation. This solution is conducive to solving environmental problems by reducing carbon dioxide and other greenhouse gas emissions. Also, it ensures the energy security of the nation.

Nowadays, the PV industry is still growing strongly over the world. In 2021, the global PV industry is in the fast-growth stage of parity PV systems. The China PV Industry Association predicted that in the 14th five-year plan period, the average annual growth of PV installed capacity would reach 287 GW (CAGR16%) worldwide and 90GW (CAGR22%) in China, which is a great leap.

Obstacles in PV power supply

"Taking power from PV high-voltage bus and convert it into 24Vdc " - the key to reducing the "load" of the PV tracking system.

To maximize the economic benefits of PV power generation, the PV power generation system uses a solar tracking system to drive the PV panel following the sun throughout the day, ensuring the PV array is under the direct sunlight, and thereby increasing the power generation. Generally, the installation of solar tracking devices could improve the performance of PV panel systems by 25%

to 50% but would lead to higher costs, more complex systems, and higher maintenance costs.

Figure 1.
PV Uniaxial Tracking Device
PV Double-axial Tracking Device

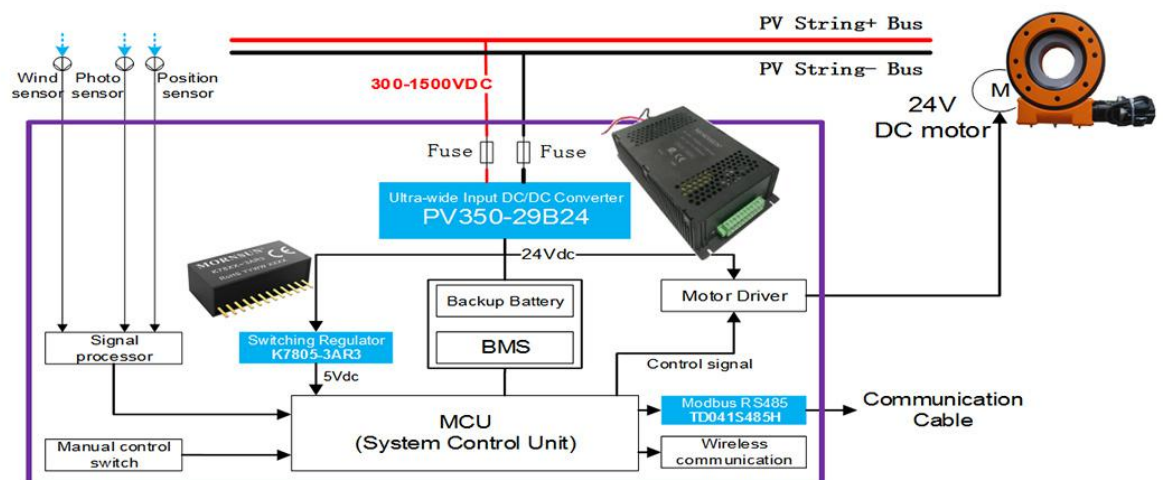


In the PV tracking system, the following two types of power supply solutions are generally used:

1. Converting power from 220Vac to 24Vdc. However, there are problems with AC wiring and waste of power;
2. Adopting independent PV panel with low voltage to supply power and charge the battery in real-time, and using electricity at intervals. However, it would lead to waste of PV panels and space.

Both solutions lead to low long-term comprehensive cost but would cause more or less waste as above. From the perspective of the system, the PV panel itself can generate power. Also, the primary power source of the system has the characteristics of ultra-high and ultra-wide input voltage range. Considering this, MORNSUN developed its products that can direct conversion from the existing PV string into 24Vdc to supply power to the system.

Figure 2.
Diagram of Power Supply Solution for PV Tracking System



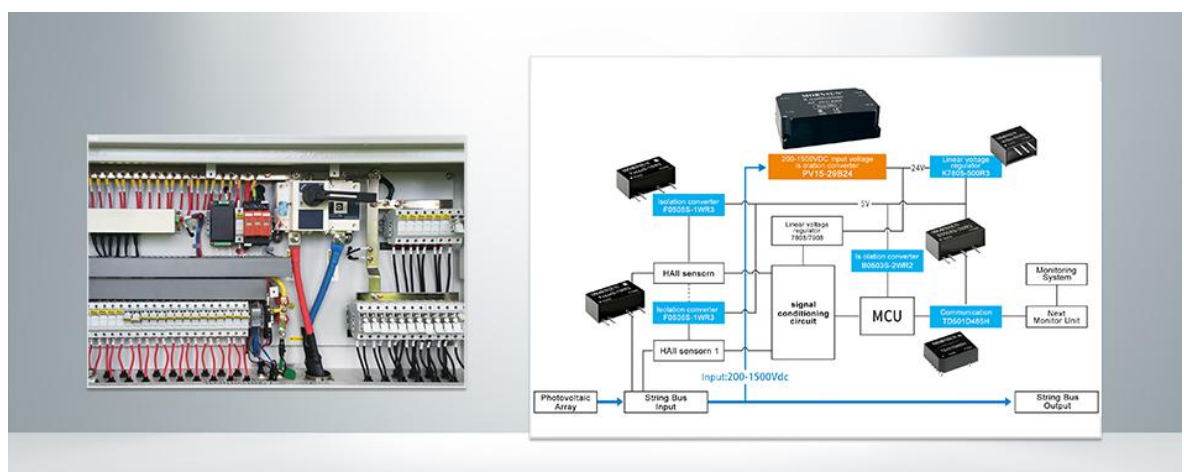
Taking power from PV high-voltage DC bus and converts 24Vdc. In participating in a state-owned power enterprise project in 2020, MORNSUN adopted a self-powered solution to replace the

previous one (independent PV panels): the input voltage is 300-1500Vdc, and the electricity is taken directly from the PV high-voltage bus. Compared with the other two solutions, this one requires no additional PV panels and power supply lines, successfully reducing the cost of the PV tracking system and simplifying the power supply design. Thus, it has become the mainstream design in the current market.

"Ultra-wide input voltage range": the basic requirement of the power supply to operate the combiner box system

The combiner box is a connection device to ensure the orderly connection and confluence of PV modules in the centralized power station system. Its front end is connected to the PV string. The power supply characteristics of the PV string are that the voltage range is ultra-wide. Also, there was no corresponding product when MORNSUN started to develop its products and design solutions. MORNSUN seized the opportunity and created a special [PV power supply](#) to satisfy the ultra-wide input voltage. With the continuous decline of costs and improved power generation efficiency, MORNSUN is also continuously optimizing and upgrading the PV power supply series.

Figure 3. Internal view of the combiner box Diagram of the Power supply solution



The main power supply of the combiner box should meet the following points.

1. Input voltage range: Primary side draws electricity directly from the high-voltage bus, and the upper limit of the input voltage is greater than the highest voltage of the bus;
2. Input under-voltage protection: The PV panel has volt-ampere characteristics, and the bus voltage would be pulled down/up when the inverter system is started/shut down. To prevent the system from restarting and shutting down repeatedly, the main power supply requires input under-voltage protection.
3. Isolation withstand voltage: The voltage level of the mainstream PV power plant is 1500Vdc, which requires a very high insulation voltage level for the main power supply and can pass the corresponding insulation impulse voltage test.
4. Safety design and certification: The PV system has a high voltage. To ensure the safety and

reliability of the system, the main power supply should meet the safety distance (creepage distance, electrical clearance) of the 1500Vdc level, and adopt double insulation or reinforced insulation.

Besides, it is also crucial for the PV industry to focus on reliability issues such as start-up in high and low temperature, storage and impact performance, and life span of the power supply; service levels such as assisting the testing and providing resources; as well as the cost-effectiveness and versatility of products.

MORNSUN's resource investment and development trend in the PV industry

The commercializing PV power generation market has been developing rapidly in just over ten years, and the supporting equipment is changing with each passing day. [MORNSUN](#) began its course in the PV industry ten years ago. For ten years, MORNSUN has been deeply involved in the PV industry and has always focused on the development trend of the PV industry and the global market.

In the course of developing a PV power supply, MORNSUN has seized several important opportunities.

First, in 2011, MORNSUN explored the market opportunity in developing PV power supply by meeting with leading companies in the PV industry. Focusing on the characteristics of PV power and PV power supply design, MORNSUN first developed a PV power supply with ultra-wide voltage DC input (200-1200Vdc), filling the market gap at that time.

Second, in 2015, MORNSUN closely followed the market demand. Following the development trend of rising the maximum voltage of the PV system to 1500Vdc, MORNSUN responded quickly and independently developed a PV29 series with an ultra-wide input voltage of 200-1500Vdc, helping customers simplify the design.

Today, the full range of PV power supply range has been expanded to 40-350W (the only 350W PV power supply product in the world). Meanwhile, MORNSUN has a number of original patented technologies, which can be applied to the entire system equipment for the PV industry, such as PV tracking systems and PV combiner boxes, and inverters. Also, MORNSUN's products have obtained international certification (UL1741, EN62109, CSA-C22.2 No.107.1), ensuring the safety and reliability of the system. At present, MORNSUN has expanded its R&D team to 500+ people. With UL/CSA/CB and other certification laboratories, it can respond quickly to the new market demands of the PV industry and develop corresponding PV power supply solutions.