

White paper

Ultra-High Voltage Solar Power Plant SCADA Solution

A comprehensive, fully integrated monitoring and management system, including component supply and on-site installation (with fiber optic cabling installation)

1 The Importance of Billion Watts' Pixel View Smart Cloud Monitoring SCADA System ?

The Pixel View Smart Cloud Monitoring SCADA System plays a critical role in renewable energy management. Through real-time monitoring, data analysis, and automated dispatch, it ensures stable operation of renewable energy sources and supports grid stability, even in the face of fluctuating energy inputs.

Real-Time Monitoring and Data Transmission : Pixel View enables real-time monitoring of power generation at large-scale solar and wind power plants, with immediate data transmission to Taiwan Power Company' s Area Dispatch Control Center (ADCC). This capability helps the grid respond quickly to power fluctuations, ensuring that supply strategies can be adjusted in real time to minimize the impact of voltage variations on end-users.

Forecasting and Automated Dispatch : By collecting and analyzing historical generation data, the Pixel View Smart Cloud Monitoring SCADA System employs AI technology to develop more accurate power generation forecasting models, predicting future generation trends and adjusting output based on weather forecasts. Additionally, Pixel View' s automated dispatch function allows renewable energy sources to integrate seamlessly with traditional energy, ensuring a balanced supply during demand peaks and low generation periods.

Integration with Energy Storage Technology : As energy storage technology advances, storage systems have become essential to grid stability. Pixel View' s SCADA system integrates with both front-of-meter and behind-the-meter energy storage, storing surplus electricity to release during peak demand or when renewable resources are insufficient. This functionality effectively smooths grid fluctuations, further enhancing stability.

Pixel View' s Smart Cloud Monitoring SCADA System has become a vital tool for addressing the challenges of intermittent power generation. By leveraging real-time monitoring, data analysis, forecasting models, and energy storage integration, it supports stable grid operation and enhances energy management efficiency. This not only improves the reliability of renewable energy but also increases the overall flexibility and adaptability of the grid, ensuring balance amidst an unstable energy supply.



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2 What is SCADA?

SCADA, or Supervisory Control and Data Acquisition, refers to any software system that collects and monitors data. In solar power plants, SCADA plays a critical monitoring role. Data collected by various data acquisition devices is transmitted to the system, where SCADA can use historical records to document optimal production conditions under normal environments. When there are changes in the power generation environment, SCADA can issue relevant alerts. Through its alarm system, SCADA promptly notifies managers of any issues through multiple channels, such as SMS, Line, and email, or to an unmanned monitoring workstation, ensuring that operators have real-time awareness of site conditions. In a solar power plant, the production environment is typically controlled by PLC (Programmable Logic Controller) or RTU (Remote Terminal Unit). Through the SCADA system, administrators can monitor production status and set conditions for alert notifications, such as high temperatures. The PLC or RTU, equipped with sensors for temperature, pressure, and other variables, regulates power generation within the solar plant, while SCADA serves as the overarching monitoring system.

Below are the main components of a SCADA system in a solar plant :

Data Collectors : Devices such as pyranometers, anemometers, and surface temperature sensors collect data and execute control commands.

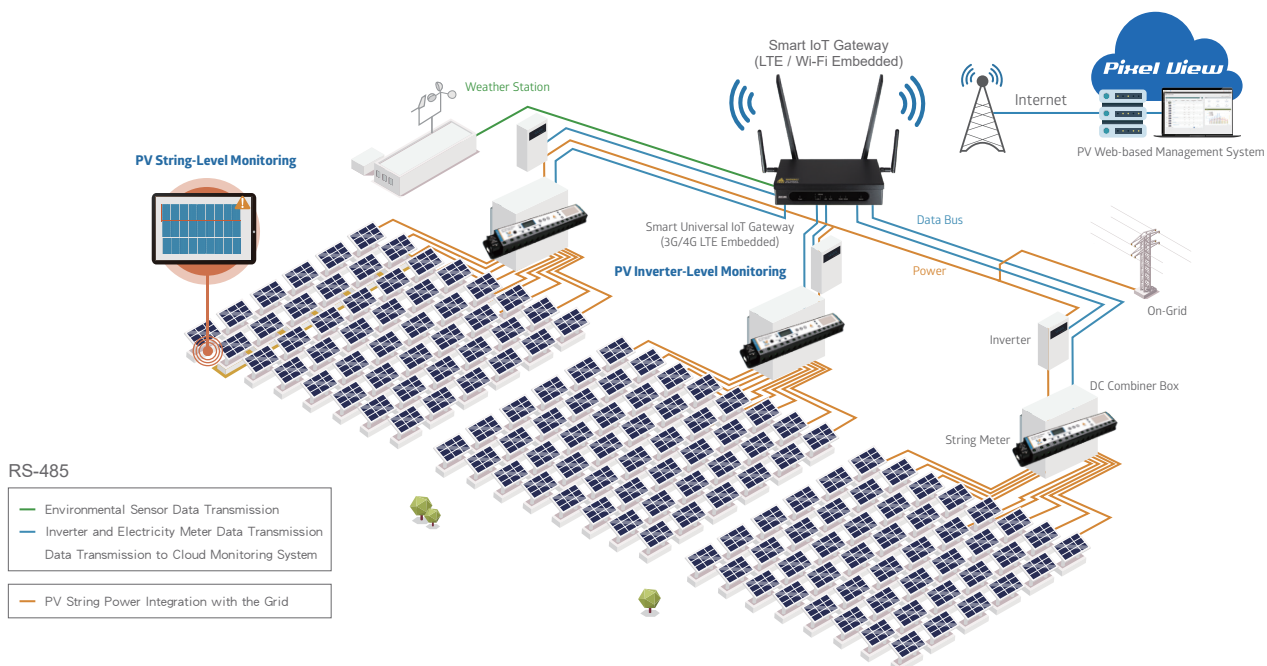
Ring Main Unit (RMU) : Adjusts various medium-voltage distribution needs, providing open or radial network transformer connections, power supply, and protection.

Human-Machine Interface (PLC) : Manages the operation of field terminal units, bridging local equipment (e.g., inverters) and remote devices.

Remote Terminal Unit (RTU) : Monitors the status points of equipment in the step-up station and transmits collected data to the SCADA system.

Communication Network : Facilitates data transmission between field equipment and the SCADA system.

SCADA System (Pixel View) : Manages the entire system on the cloud, performing data storage and processing.



3 Billion Watts SCADA Monitoring

In the era of automation, SCADA plays a vital role, providing not only remote control but also automated monitoring and data collection at industrial sites or power generation facilities. Through its alarm system and integration with video surveillance technology, SCADA enables effective remote monitoring.

The Billion Watts SCADA system is a comprehensive monitoring solution specifically designed for large-scale solar power plants and ultra-high voltage systems, with the following key features :

High-Voltage Grid Connection Monitoring : This system offers precise, real-time monitoring tailored for solar power plants connected to 69kV and 161kV ultra-high voltage grids. It displays critical parameters, such as switch status, power data, and control buttons, and monitors digital meters, IEDs, and transformer temperatures.

Event and Data Logging : The system provides detailed event logging (SOE list) with time-stamping accuracy down to milliseconds. Equipped with a time synchronization feature, it ensures data alignment with Taiwan Power Company's systems.

Data Transmission and Predictive Modeling : In compliance with Taiwan Power Company requirements, the SCADA system provides real-time power generation data. It also collects solar power generation data to build predictive models, supporting real-time grid dispatching for Taiwan Power.

IEC61850 Compliance : The Pixel View system and PV Gateway (SG6400NZL) monitoring device, developed in-house, enable integration across substations and booster stations. This single system covers power station monitoring from distribution to transmission levels. With deployments in over 550MW of power equipment, it not only monitors generation efficiency but also supports remote management capabilities.

4 Project Case Studies



Tainan 77 MWp



Tainan 20 MWp

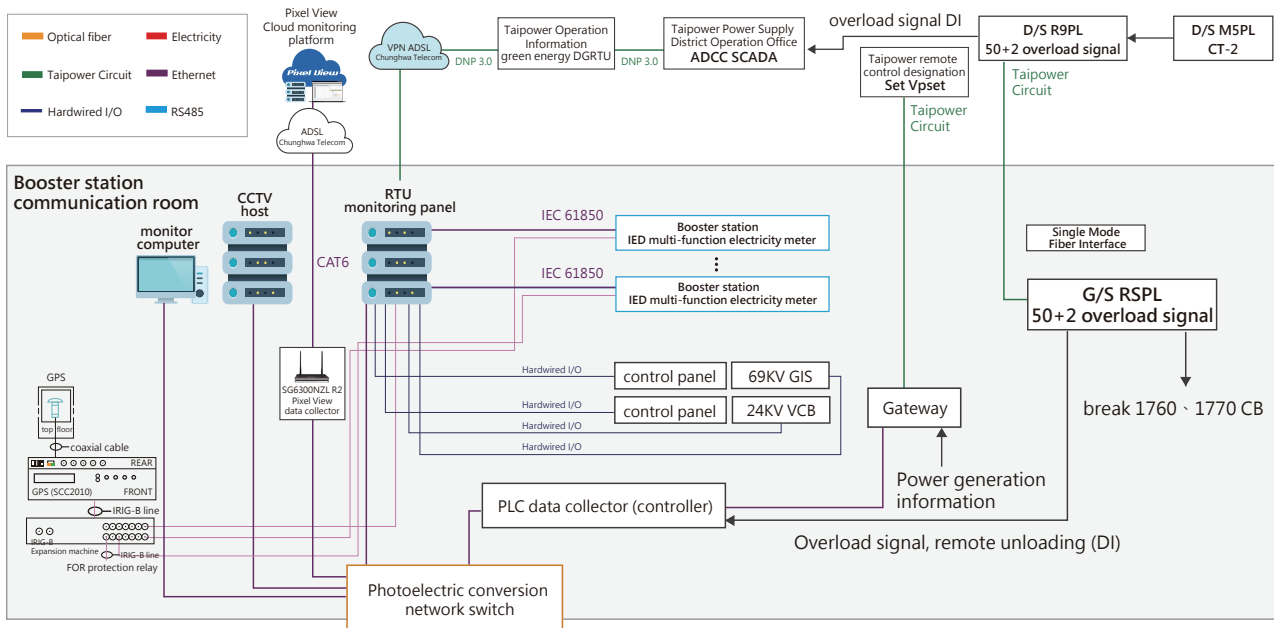


Pingtung 40 MWp

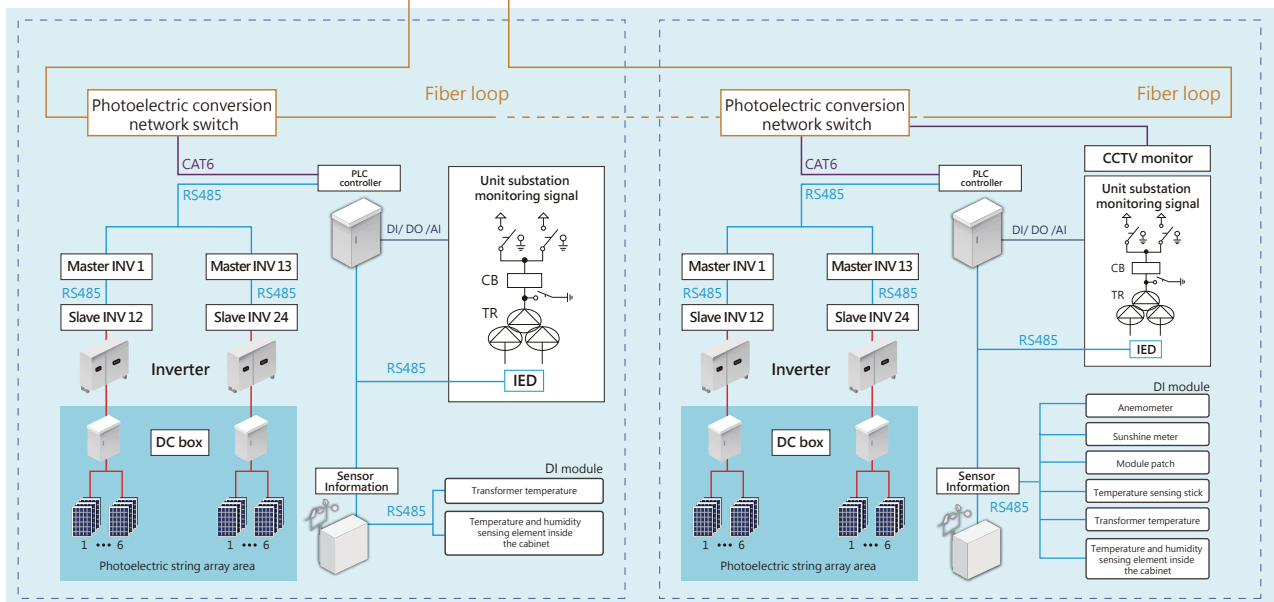


5 How to Plan SCADA Monitoring for Ultra High Voltage Solar Power Plants

A large-scale solar power system (with a capacity of over 20MW at transmission voltage levels) typically comprises multiple unit substations, each ranging from 1MW to 3MW, which must be connected to an ultra-high voltage step-up substation (such as 69kV, 161kV, etc.) SCADA system. Each unit substation is responsible for monitoring associated inverters, high-voltage transformers, instruments, switches, relays, as well as collecting data from connected photovoltaic panels and meteorological information. These unit substations are connected via fiber optic networks to the central monitoring and management system. This system integrates with the SCADA at the ultra-high voltage interconnection substation, including monitoring meters, Intelligent Electronic Devices (IEDs), and time synchronizers to accurately record event information and status of the step-up substation, ensuring compliance with Taiwan Power Company's data upload and dispatch requirements.



Photoelectric plant area
20MWp SCADA monitoring example
(69kV step-up station in District 1, 22.8kV unit substation in District 10)



Monitor the DC combiner boxes, inverters, transformer temperatures, digital meters, switch statuses, protective relays, and meteorological information associated with each 22.8kV step-up substation. Additionally, monitor the digital meters, Intelligent Electronic Devices (IEDs), transformer temperatures, and switch statuses of the Extra High Voltage (EHV) step-up stations. Integrate with time synchronization systems to accurately record event information and statuses at the step-up stations, meeting Taiwan Power Company's requirements for data upload and dispatch. This comprehensive solar power monitoring and management system provides photovoltaic investors with a centralized, one-stop monitoring solution.