SIFANG

Renewable Energy Solution Brochure

LEADING PROVIDER
OF POWER SYSTEM SOLUTIONS

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OVERVIEW

SIFANG provides a comprehensive portfolio of products, systems, solutions, and services designed to optimize the performance and reliability of renewable energy plants, including wind, solar, energy storage, and microgrid applications, ranging from residential rooftops to commercial and utility-scale projects.

SIFANG has supported numerous customers in building highly efficient and grid-friendly solar plants and wind farms by delivering complete automation solutions. The all-in-one solution integrates key components such as SCADA/PPC, protection IEDs, and BCU/RTUs. Leveraging its deep expertise in power systems, SIFANG's automation solutions ensure stable power output, precise voltage control, and reliable grid frequency regulation at the point of interconnection as well as during islanded operation.

In addition to automation solutions, SIFANG also supplies primary equipment for renewable energy plants, including SVGs, BESS, and switchgear.

Scenarios

Large-Scale Renewable Power Plants

❯ Wind Power Plants

❯ Solar Power Plants

❯ Wind–Solar–BESS Hybrid Plants

Microgrids
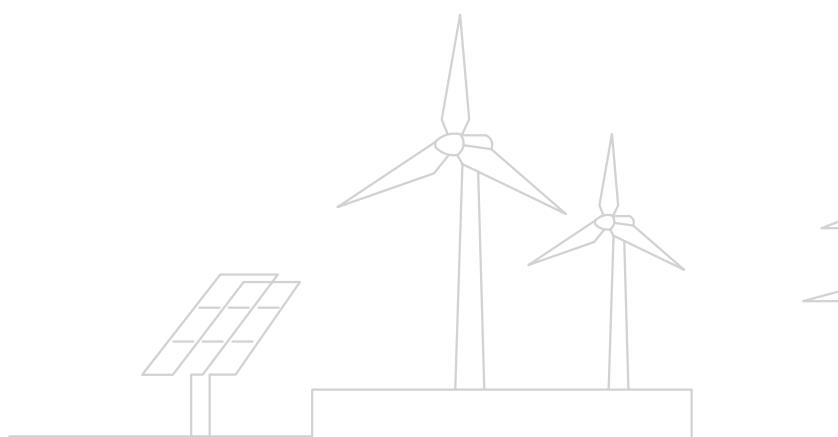
❯ Village & Island Microgrids

❯ Industrial & Campus Microgrids

❯ On-Grid & Off-Grid Microgrids
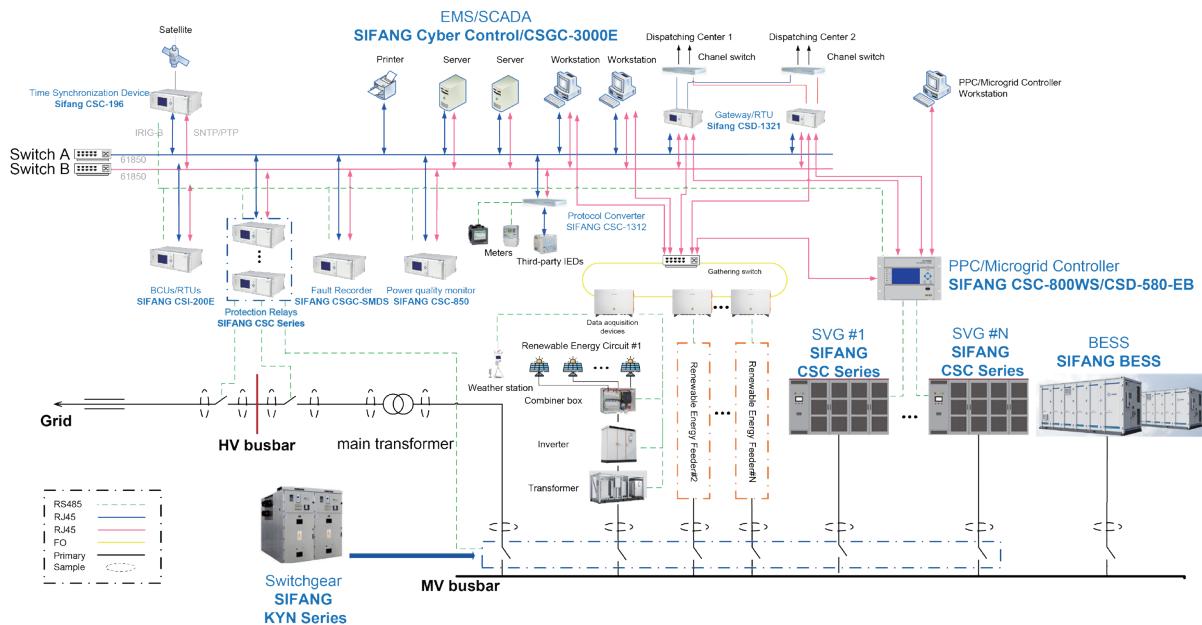
Generation–Grid–Load–Storage

❯ Distributed Renewable Energy Plants, BESS and Loads

❯ Renewable Energy Plants Cluster

Product Portfolio

No.	Products	Type
1	SCADA/EMS	CyberControl
2	SCADA/EMS	CSGC-3000E
3	Power Plant Controller (PPC)	CSC-800WS
4	Microgrid Controller	CSD-580-EB
5	RTU	CSI-200E-ER
6	Protection IEDs	CSC Series
7	STATCOM/SVG	GSC Series
8	Switchgear	KYN Series
9	BESS	CSD-5831 Series

Key Projects

Terra Solar 3.5 GW PV 4.5GWh BESS Project, The Philippines, 2025

The Terra Solar Project became the world's largest hybrid solar facility, integrating a 3,500 MWp solar power plant with a 4,500 MWh BESS to deliver 850 MW of renewable energy.
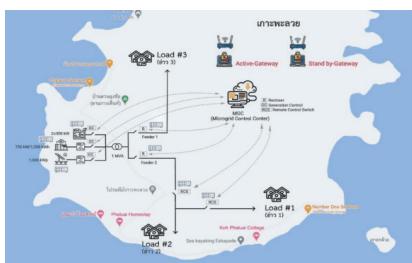
SIFANG provided the centralized SCADA system, Master & Slave PPC, and PV SCADA, enabling large-scale data integration, coordinated control, and spot market trading optimization.

Serentica Kallam 350MW Wind Farm 2*70Mvar SVG, India, 2025

At one of India's largest wind farms, SIFANG delivered two 70 Mvar STATCOM/SVG systems, providing robust reactive power compensation and ensuring full compliance with stringent grid codes.

Phaluai Island Microgrid Project, Thailand, 2023

As Provincial Electricity Authority (PEA)'s first off-grid microgrid project, the system integrates a 750 kW / 1,500 kWh BESS, 1,000 kWp PV, and two 1,300 kW diesel generators. SIFANG delivered the EMS, microgrid controllers, and full BESS integration, enabling reliable and efficient microgrid operation.

145MW Bacolod Solar Power Project, The Philippines, 2025
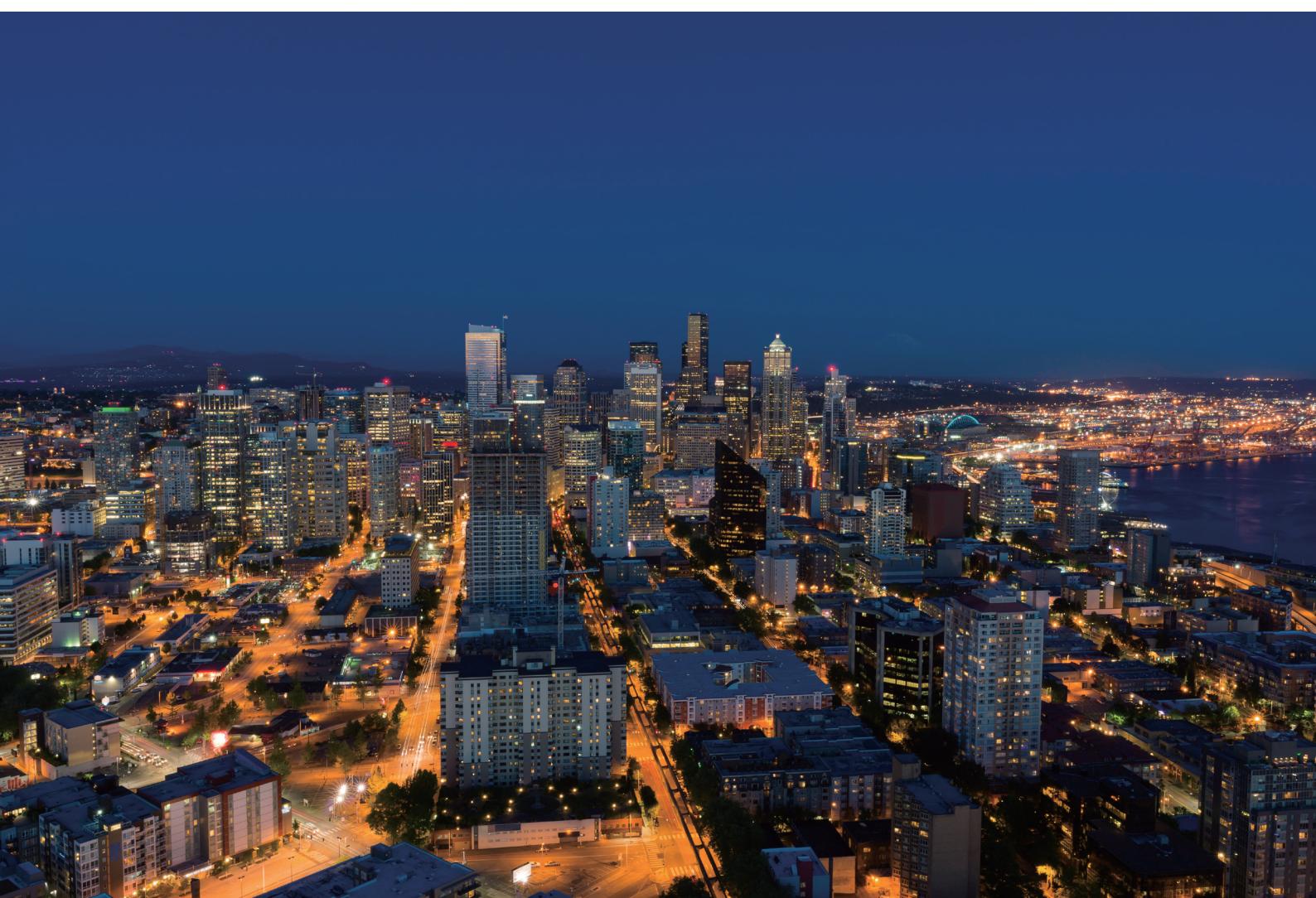
For a large-scale solar power project in the Philippines, SIFANG delivers comprehensive substation protection and automation, advanced PPC/SCADA systems for plant control, and a 25 MVAR STATCOM (SVG) to ensure grid stability.

Malaysia Series of PV Projects

SIFANG has a lot of PV project experience in Malaysia. As one of the very few Chinese companies that have been approved by the Malaysian Grid，SIFANG provides SACADA, PPC,SVG protection relay and other equipment.

Typical projects

- Malaysia Kuala Ketil 50MW Photovoltaic SVG
- LSS4 50MW Bukit Selambau PPC+SCADA
- Kuala Ketil 50MW Photovoltaic Monitoring, PPC, Weather Station
- 30MWac Photovoltaic Energy Generating
- LSS4 Kuala Muda PPC+SCADA Project
- Malaysia LSS3 100MW Merchang Solar PPC/SCADA Project

PRODUCT

SCADA/EMS CyberControl

Overview

The CyberControl SCADA/EMS system integrates real-time monitoring, precise control, and an intuitive graphical interface for utility-scale renewable energy plants and microgrids. It enables comprehensive monitoring and control of a wide range of devices, from step-up substations to plant-level equipment, including inverters, solar trackers, combiner boxes, battery energy storage systems (BESS), diesel generators, meteorological stations, transformers, switchgear, and other substation and plants assets. The system offers a powerful and extensible function library that goes beyond basic data acquisition, monitoring, and control. Advanced applications include energy optimization, power forecasting, interlocking logic, Volt/Var Control (VQC), and switching sequence management. In addition, the system provides customizable and specialized reports and graphical interfaces for renewable energy equipment—such as inverters and combiner boxes— to support detailed performance analysis and operational optimization. CyberControl SCADA/EMS is highly scalable, capable of integrating more than 2,000 IEDs and up to 1,000,000 data points. It supports a wide range of industry-standard communication protocols, including IEC 61850, IEC 60870-5-103, IEC 60870-5-101/104, and DNP3.0.

Features

➤ Full range monitoring, from step-up substation to plant area, including inverters, solar array, trackers, combiner boxes, BESS, meteorological stations, transformers, switchgear, etc

➤ Supports a wide range of communication protocols: IEC61850, DNP3.0, Modbus, IEC60870-5-101 or 104, etc

➤ High reliability with redundancy technology, including host redundancy, network redundancy and remote communication channel redundancy

➤ Supports heterogeneous system architecture with different operating systems

➤ A user-friendly graphic interface allowing operators to perform their tasks easily, efficiently, and directly

➤ Provide an interface to the PPC and its functions

➤ Reliable and flexible switching sequence management can satisfy the requirements for different operating conditions

➤ 3 level control modes: remote control, SCADA control and local control

➤ Modular and scalable architecture with off-the-shelf components

➤ Web-Service interfaces and web access are available

➤ Complete cyber security measures such as authentication and authorization management，malware protection，antivirus and secure remote access

System Architecture

The general SCADA system can be divided into three parts:

The Station Level

includes the servers or/and workstations to operate the SCADA software. Gateway and time synchronization devices are also provided. The station communication networks are also included. It inter-connects and integrates the bay level intelligent electronic devices (RTU, BCU and protection relays) using the well-proven IEC 61850 standard.
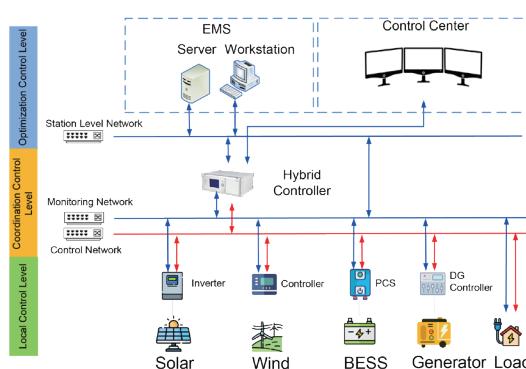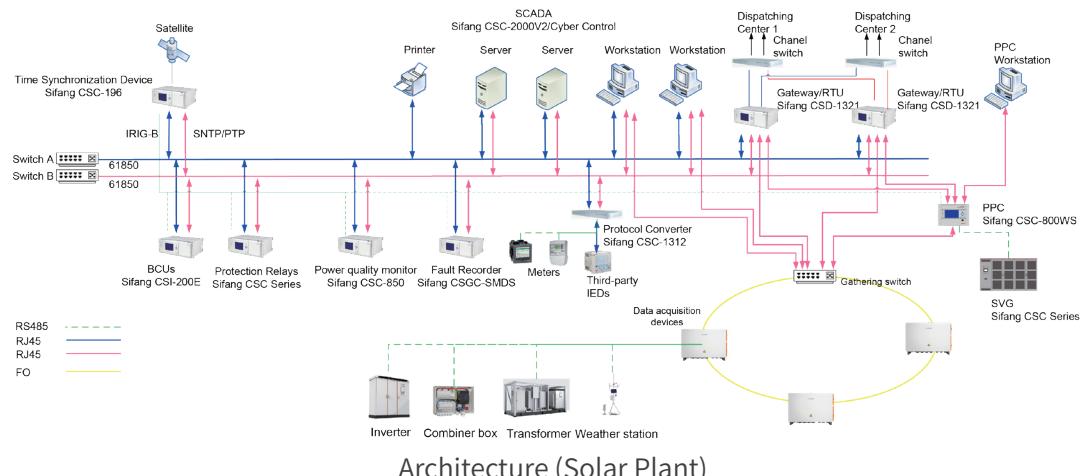
The Bay Level

consists of the individual IEDs, such as protection IEDs, BCU and other integrated devices in the substations. All the devices which support IEC61850 can be connected to the station control layer network via Ethernet directly.

The devices from third parties can be connected to station level network via protocol converters by IEC60870-5-103, DNP 3.0, Modbus or even private protocols via RS485 or Ethernet.

The Renewable Energy Assets Data Acquisition Level

is equipped with data acquisition devices such as data logger and communication box. The data acquisition devices collect and stores data, and centrally monitors and maintains the devices such as combiner box monitors, inverters, batteries, transformer, RMU, meters, and meteorological stations. The data acquisition devices are connected to SCADA through a gathering switch. All data acquisition devices can be connected to form a fiber ring network and gather in the gathering switch.

Architecture (Solar Plant)

Architecture (Microgrid)

Functions

Data Acquisitions

The SCADA system will acquire all available analog data, status data and perform control signal from PV plant facilities such as inverters, solar array trackers, combiner boxes, meteorological stations, transformers, switchgear and other substation devices. The system can fully compatible with all mainstream brand of data acquisition devices such as Huawei, Sungrow, SMA, etc. The sophisticated database is set up and manages real-time data exchange with other devices and systems.

Graphical Monitoring

Operational parameters, devices status is displayed in full or partial window such as single line diagram window, plant overview window, Inverter window, transformer window, RMU window and Weather station window. Operational parameters can be displayed including real-time and historical data.

Various of analog parameter can displayed vividly such as current, voltage, power, power factor, frequency, operation time; of each inverter, surface temperature and evaluate efficiency and operation time of each PV string.

Besides, the system can display current value of weather conditions such as solar radiation, ambient temperature, atmospheric pressure, wind direction and speed, humidity, etc.

Control

The SCADA can control different devices such as circuit breakers, disconnectors, RMU, OLTC by a graphic interface. Besides, it provide a interface to the PPC and its functions. It Make the PV plant, wind farm and BESS adjustable and controllable for the dispatching center. It ensures effective plant management and optimize power generation.

Forecasting and Optimal Scheduling

Power generation and load forecasting provide key inputs for the microgrid energy management system, enabling optimal scheduling of distributed energy resources, energy storage, and grid power exchange. The scheduling strategy aims to minimize operating cost while ensuring power balance and reliable operation under system constraints.

Event and Alarm Management

Event and alarm management is also part of the standard functions offered by a SCADA system. An alarm or event can be raised by the SCADA system in an alarm and event window based on predefined criteria. The operator can then acknowledge it and clear it when the value of the point the alarm was created on goes back to its normal status.

The alarm system supports User-defined alarm filtering and classification. It can define various of voice alarm notifications that can be enabled according to the importance of the event. It can retrieve the historical alarm with various filter criteria. The important alarm or event can be pushed to the operator by a pop-up window. The graphical alarm indicator can also be used to indicate the alarm more vividly.

Report Management

The SCADA system can produce reports based on customized templates. The Report can be printed or exported into the file (excel, text, pdf, etc.). Reporting scope can be managed. It contains Operational parameters (line/transformer loads, bus-bar voltage, power consumption and loss, etc.) that are editable with office tools when necessary.

Historian

Historian capability is an essential aspect of an HMI or SCADA. The Cybercontrol has a true historian feature and is designed to provide you with a complete record of all substation data, alarms and events. Using professional third-party professional database engines PostgreSQL or Microsoft SQL Server. It can always realize safe backup of all historical data. The data size is only limited by your hardware infrastructure. It can define different filter criteria to retrieve data such as time frames or types.

Topology Analysis and Dynamic Coloring Function

Topology analysis and dynamic coloring function can identify the electrical status in graphical interface according to status of primary devices, which helps operator grasp the entire working circumstance in the substation.

Authentication and Authorization Management

Authentication management is the selective restriction of access to the application by authenticating users and authorizing them by granting appropriate permissions. Authorization management is the definition of different user accounts with suitable privileges with unified security policies. The SCADA can support operators' work in a hierarchical authentication and authorization management system.

Cyber Security
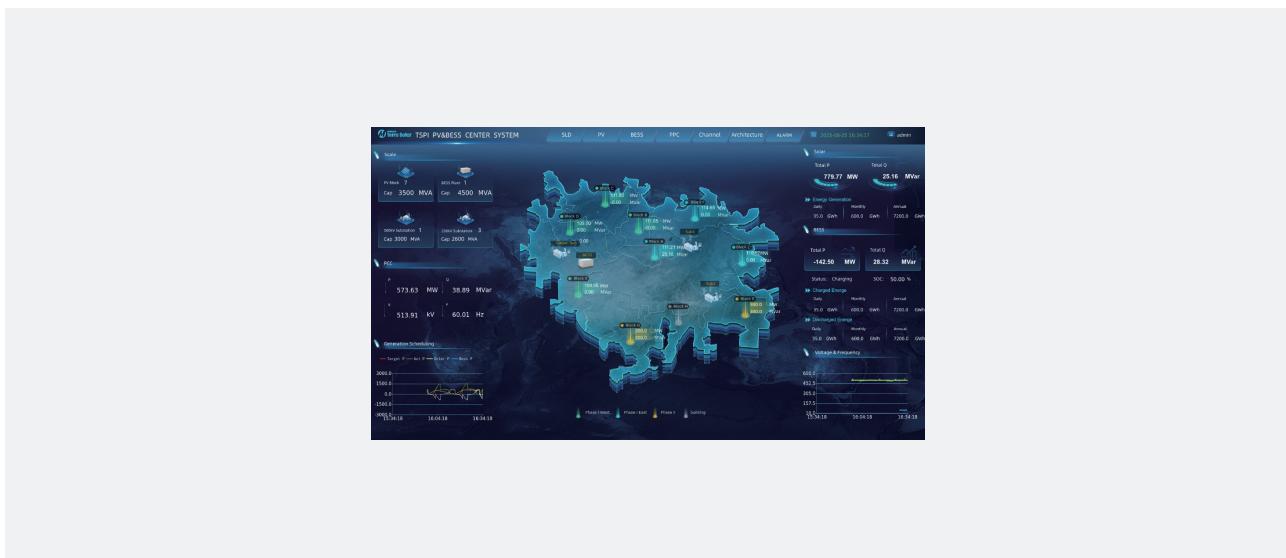
Except for the authentication and authorization management，malware protection，antivirus，secure remote access and security patch management are also the cybersecurity measures.

Technical Specifications

Item	Data
System Operation	
MTBF	20000h
Active-standby switch time	< 10s
Average net load rate	< 25%
Average CPU load rate	< 35%
Capacity of Real-time Database	
Number of analog tags	≤ 1000000
Number of digital tags	≤ 1000000
Number of tags	≤ 1000000
Data Scanning	
HMI refresh rate	> 100ms
History data	all change data

SCADA/EMS CSGC-3000E

Overview

The CSGC-3000E EMS/SCADA is a cutting-edge monitoring and control platform for large-scale renewable energy plant clusters and distributed energy resources. By seamlessly integrating SCADA, DMS, EMS, and OMS capabilities, it delivers intelligent, digital, and centralized monitoring with high-performance data acquisition across multiple plants and substations. The system empowers operators with accurate power forecasting, advanced energy optimization, efficient dispatch execution and market participation, coordinated joint dispatch control, and comprehensive performance analysis and reporting, enabling smarter operations, higher efficiency, and enhanced grid compatibility.

Features

Integrated Control Platform

Seamlessly integrates SCADA, DMS, EMS, and OMS into a unified centralized system.

Large-Scale Monitoring & Data Acquisition

Supports intelligent, digital, and high-performance data acquisition across multiple renewable plants and substations.

Advanced Forecasting & Energy Optimization

Enables accurate power forecasting and optimized energy management to improve efficiency and reduce operational costs.

Coordinated Dispatch Control

Supports joint dispatch and coordinated control of large-scale renewable energy plant clusters.

Dispatch & Market Interface

Enables dispatch execution and interaction with grid operators and electricity markets.

Grid-Friendly Operation

Supports flexible switching among multiple grid-compliant operation modes.

Performance Analysis & Reporting
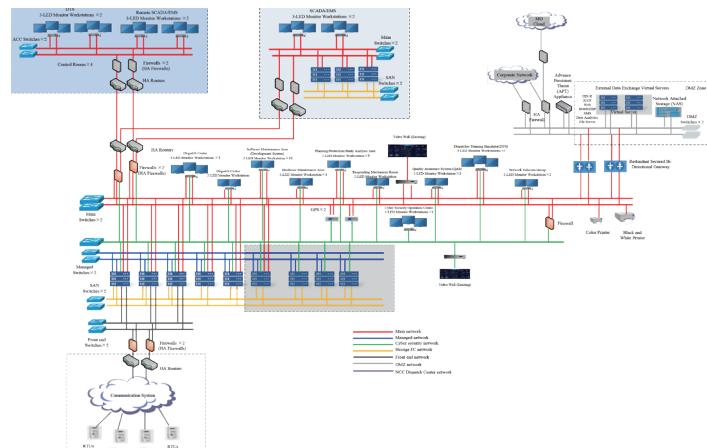
Provides comprehensive performance evaluation, statistics, and reporting capabilities.

Scalable & Open Architecture
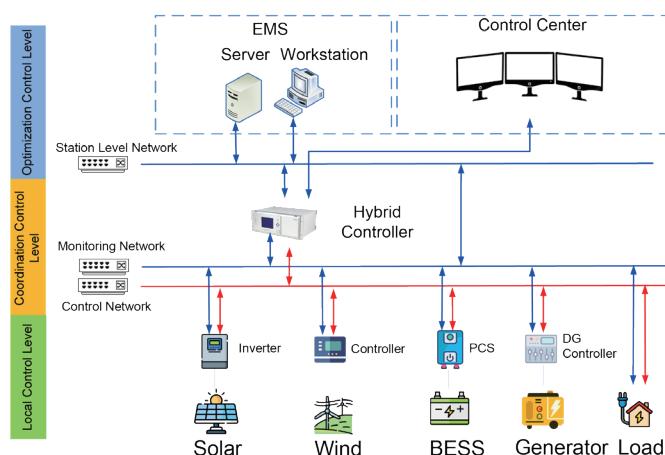
Offers platform-level support for business applications and future functional expansion.

Architecture

The EMS typically adopts a layered and security-zoned network architecture that clearly separates Operational Technology (OT) and Information Technology (IT) domains. The OT network hosts real-time control systems such as EMS/SCADA and front-end processors, while the IT network supports management, analytics, and business applications. A front-end communication network is deployed between the EMS and field substations or plants to handle protocol processing and provide secure buffering. A DMZ (demilitarized zone) is established between the OT and IT networks to enable controlled data exchange, such as data publishing and system interfacing, while preventing direct access to critical control systems. Through multi-layer architecture, strict security zoning, and redundant network design, the dispatch EMS ensures secure, reliable, and scalable operation of power system monitoring and control.

Architecture for plants cluster EMS/SCADA

Architecture for Microgrid EMS

Functions

Monitoring and Data Acquisition

➤ Real-time monitoring of power output, equipment status, and alarms

➤ Integration of asset status, measurement, and monitoring devices

➤ Collection of meteorological data (irradiance, wind speed, temperature)

Load and Generation Forecasting

➤ Manual input or import of power and weather forecast

➤ Electrical / thermal load and generation forecast based on historical data and weather forecast

Energy Optimization

➤ Maximization of renewable energy utilization

➤ Minimization of losses and curtailment

➤ Optimal coordination with on-site energy storage or hybrid resources

➤ Economic dispatch under technical constraints

Energy Storage Coordination

➤ Charge/discharge scheduling

➤ State-of-charge (SoC) management

➤ Power smoothing and fluctuation mitigation

➤ Support for peak shaving and grid services

Dispatch and Market Interface

➤ Execution of grid operator dispatch commands

➤ Support for market participation (energy and ancillary services)

➤ Bid submission and schedule tracking (market-integrated EMS)

Fault Management and Protection Coordination

➤ Fault detection and isolation support

➤ Alarm management and event logging

➤ Coordination with protection systems

Performance Analysis and Reporting

➤ Energy yield calculation

➤ Availability and efficiency analysis

➤ KPI tracking and compliance reporting

Distribution Automation

➤ Topology analysis, dynamic network coloring and outage management

➤ Fault Location, Isolation, and Service Restoration
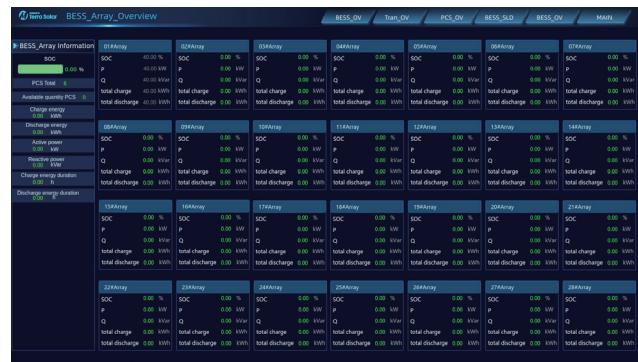
SLD interface

Generation forecast interface

Inverter interface
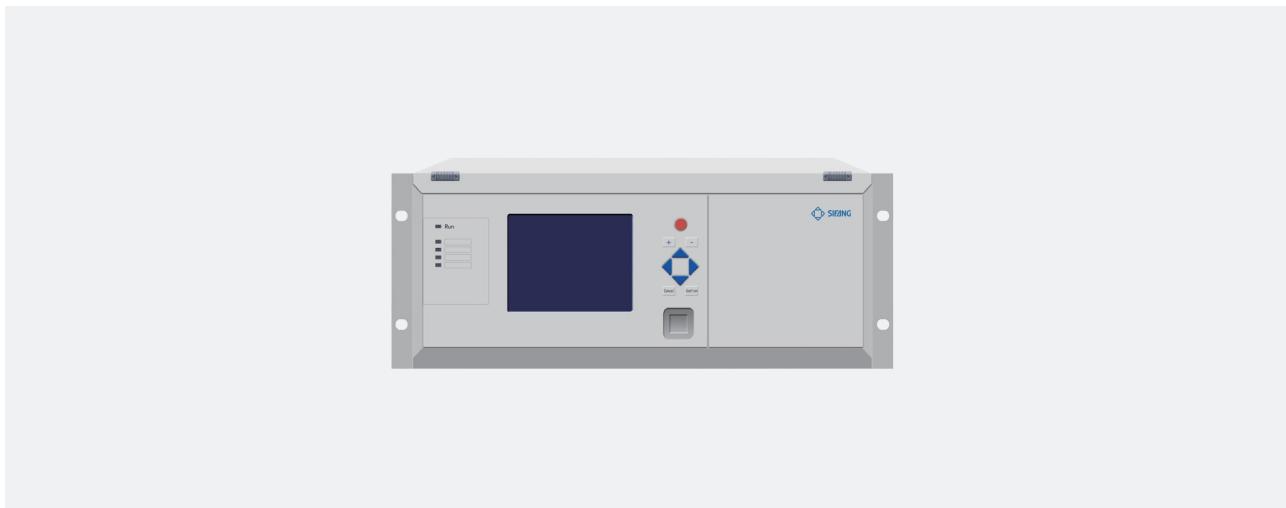
BESS interface

Technical Specifications
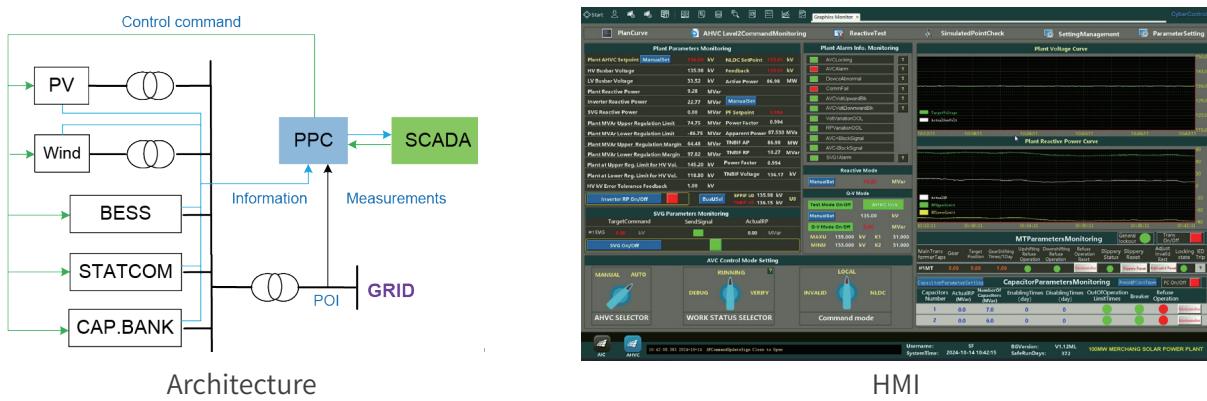
No.	Item	Data
1	Real-time analog points	>10 million points
2	Real-time digital points	>8 million points
3	Real-time energy points	>2 million points
4	Control points	>500,000 points
5	SOE quantity	Unlimited
6	Access channels	>3,000
7	Forwarding channels	>500
8	Device quantity	>200,000
9	Number of computer nodes	>30
10	Number of graph user interfaces	Unlimited
11	Historical data storage capacity	Data stored for at least 10 years based on hardware configuration
12	Protocol and interface	IEC 60870-5-101, 104, ICCP, DNP3.0，IEC 61970/61968 CIM standards，XML/SVG file
13	Cyber security standard	IEC 62351, IEC 62443

Power Plant Controller CSC-800WS

Overview

Power Plant Controller (PPC) is an advanced automation and control system for renewable energy plants such as solar and wind farms. Acting as the "brain" of the plant, the PPC manages and optimizes power generation while ensuring grid stability and full compliance with utility grid codes. It regulates voltage, frequency, and active/reactive power at the Point of Interconnection (POI) by coordinating and controlling inverters, energy storage systems, meters, circuit breakers, STATCOMs, capacitor banks, and other equipment.SIFANG PPC provides centralized control of hybrid power plants at the POI and seamlessly interfaces with a wide range of inverter manufacturers, offering high adaptability to diverse project requirements. The system is designed with flexibility in mind, allowing new or updated grid code requirements to be implemented upon customer request, ensuring long-term compliance with evolving grid standards.

Architecture

HMI

Features

Grid Compliance

➤ Fully compliant with the most stringent grid codes

➤ Meets demanding utility interconnection requirements

High Performance

❯ Maximizes energy revenue while reducing O&M costs

❯ Advanced power balancing for BESS, optimizing ESS asset utilization

Flexibility

❯ Adaptable to diverse plant topologies and project scales

❯ Applicable to all types of renewable power generation

❯ Compatible with all major inverter manufacturers and a wide range of meter models

Scalability

❯ Hierarchical control architecture for very large-scale power plants

Rich Interfaces
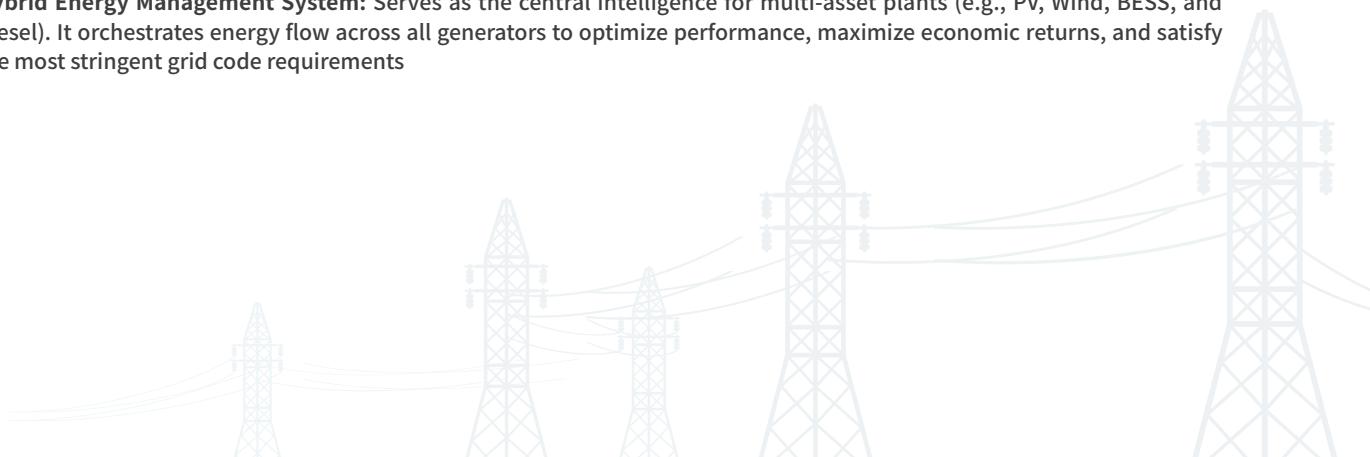
❯ IEC60870-5-104 Modbus TCP, Modbus RTU, DNP3 Serial, IEC 61850, Goose, others

Comprehensive Functions

❯ Active power control/Frequency control/Reactive power control/Voltage control

Functions

❯ **Active Power Control:** Regulates the plant's real-time active power output to precisely match dispatch setpoints, maximizing yield while ensuring operational limits are respected

❯ **Frequency Control:** Provides immediate response to grid frequency disturbances. By utilizing **droop modes**, the system automatically adjusts output to mitigate over-frequency or under-frequency events at the Point of Interconnection (POI)

❯ **Virtual Inertia:** Mimics the mechanical inertia of traditional synchronous generators using high-speed power electronics. It rapidly injects or absorbs power to reduce the **Rate of Change of Frequency (RoCoF)**, providing critical stability to grids with high renewable penetration

❯ **Voltage Control:** Stabilizes voltage levels at the POI through **droop characteristics** or **PI controllers**, preventing fluctuations that could damage equipment or lead to grid instability

❯ **Power Factor & Reactive Power Control:** Allows operators to define and maintain specific Reactive Power or Power Factor setpoints at the POI, ensuring compliance with utility interconnection requirements and reducing transmission losses

❯ **Ramp Rate Control:** Limits the maximum rate of change for power output. This "smooths" the transition during sudden shifts in solar irradiance or wind speed, preventing sharp generation spikes that could destabilize the local grid

❯ **Hybrid Energy Management System:** Serves as the central intelligence for multi-asset plants (e.g., PV, Wind, BESS, and Diesel). It orchestrates energy flow across all generators to optimize performance, maximize economic returns, and satisfy the most stringent grid code requirements

Technical Specifications

General	
Operation temperature	-10°C～ +55°C
Operation humidity	5% ～ 90%
Dimensions (L x W x H)	483 x 286 x 177mm
Dual power supply	AC: 220V/110V -20% ~ +15%, 47 Hz ~ 63 Hz DC: 220V/110V -20% ~ +15%
Time Synchronization	IRIG-B/SNTP
Redundancy	Support dual controller redundancy
HMI	Cybercontrol
Power consumption	≤ 50w
IP standard	IP20

Analog Input	
Voltage	100V(100/ $\sqrt{3}$),0V - 120V
Current	5A or 1A, 0 IN ～ 1.2 IN
Frequency	50Hz or 60Hz, 45Hz ～ 65Hz
Accuracy of AC current, voltage	0.2
Accuracy of power	0.5
Accuracy of power factor	0.5
Accuracy of frequency	≤ 0.002Hz
Number of analog inputs	6 voltages and 6 currents

Binary Input	
Rated voltage	DC220V/110V
Number of BI	Up to 28

Binary Output，Analog Output	
Number of BO	Up to 16
Number of AO	Up to 8

Communication	
Ethernet ports(RJ45)	5 in default and can be extended to 10
Serial Ports	6 in default and can be extended to 12
Max. Number of control units or data logger	240
Communication protocol	IEC60870-5-104 Modbus TCP, Modbus RTU, DNP3 Serial, IEC 61850, Goose, others

Microgrid Controller CSD-580-EB

Overview

The CSD-580-EB microgrid controller is the central control system that monitors, coordinates, and controls all components within a microgrid to ensure safe, reliable, and optimal operation under both grid-connected and islanded conditions. The microgrid controller acts as the "brain" of the microgrid, managing power generation, energy storage, loads, and grid interaction in real time.

Architecture

HMI

Features

High Performance

- High-reliability hardware and software platform with modular design

- Dedicated control network supporting **IEC 61850 GOOSE** with millisecond-level control response

- Direct measurement of system voltage and frequency for fast and accurate control

- Compliant with **IEC 61131-3**, enabling flexible and customizable control logic

High Availability and Security

- Dual-controller redundancy

- Hierarchical architecture for large scale system

- Fault self-diagnosis with automatic protection and locking

Multiple Control Strategies

- Active and reactive power control

  Frequency and voltage regulation

- Peak shaving and spinning reserve management

- Battery state-of-charge (SoC) control

  Load shedding and black start sequencing

- Seamless on-grid and off-grid operation switching

Rich Communication Interfaces

- Supports **IEC 60870-5-104, Modbus TCP**, and **IEC 61850 GOOSE**

- Web service interfaces and browser-based access supported

Functions

Active Power Control

Regulates the plant's real-time active power output to precisely track dispatch setpoints, maximizing energy yield while ensuring all operational constraints are respected.

Frequency Control

Provides fast response to grid frequency disturbances. Using droop control modes, the system automatically adjusts power output to mitigate over-frequency and under-frequency events at the Point of Interconnection (POI).

Hybrid Energy Management System

Acts as the central intelligence for multi-asset plants (e.g., PV, wind, BESS, and diesel generators), coordinating energy flow among all resources to optimize overall performance, maximize economic returns, and comply with stringent grid code requirements.

Spinning Reserve Management

Maintains adequate spinning reserve capacity by dynamically coordinating generators and energy storage, ensuring rapid response to load changes and contingencies.

Battery State of Charge (SoC) Control

Actively manages battery charging and discharging to keep SoC within a healthy operating range, extending battery lifetime while ensuring availability for peak shaving, frequency support, and backup power.

Load Shedding

Automatically prioritizes and sheds non-critical loads during power shortages or emergency conditions to protect system stability and ensure continuous supply to critical loads.

Black Start Sequence

Supports autonomous black start operation, coordinating BESS and DGs to restore power and gradually reconnect loads and generation following a system outage.

On-Grid and Off-Grid Switching

Enables seamless transition between grid-connected and islanded operation modes, maintaining voltage and frequency stability during mode changes.

DG Healthy Operation Control

Continuously monitors diesel generator operating conditions and loading levels, ensuring operation within optimal efficiency and safety ranges. The system coordinates DG start/stop and load sharing to prevent low-load operation, reduce fuel consumption, and extend generator service life.

Technical Specifications

General	
Operation temperature	-10°C～ +55°C
Operation humidity	5% ～ 90%
Dimensions (L x W x H)	483 x 286 x 177mm
Dual power supply	AC: 220V/110V -20% ~ +15%, 47 Hz ~ 63 Hz DC: 220V/110V -20% ~ +15%
Time synchronization	IRIG-B/SNTP
Redundancy	Support dual controller redundancy
HMI	Cybercontrol
Power consumption	≤ 50w
IP standard	IP20
Analog Input	
Voltage	100V(100/ $\sqrt{3}$),0V - 120V
Current	5A or 1A, 0 IN ～ 1.2 IN
Frequency	50Hz or 60Hz, 45Hz ～ 65Hz
Accuracy of AC current, voltage	0.2
Accuracy of power	0.5
Accuracy of power factor	0.5
Accuracy of frequency	≤ 0.002Hz
Number of analog inputs	6 voltages and 6 currents
Binary Input	
Rated voltage	DC220V/110V
Number of BI	Up to 28
Binary Output，Analog Output	
Number of BO	Up to 16
Number of AO	Up to 8
Communication	
Ethernet ports(RJ45)	5 in default and can be extended to 10
Serial ports	6 in default and can be extended to 12
Max. Number of control units or data logger	240
Communication protocol	IEC60870-5-104 Modbus TCP, Modbus RTU, DNP3 Serial, IEC 61850, Goose, others

RTU CSI-200E-ER

Overview

The CSI-200E-ER Remote Terminal Unit (RTU) is a robust automation solution for substations, power plants, and industrial facilities. Its modular design integrates the controller, power supply, and high-density I/O modules within a single chassis, supporting up to 544 points for mid- to large-scale applications. Engineered with Level 4 EMI immunity and a flexible, scalable architecture, the CSI-200E-ER delivers reliable performance in complex industrial and harsh electromagnetic environments.

Typical RTU Application in Substation

Features

High-Performance Processing

➤ 4-core high-performance CPU with 1 GB RAM and 8 GB storage; supports **IRIG-B** and **PTP** time synchronization

➤ Redundant CPU, network, and power modules; supports single-rack, dual-rack, and dual-network redundancy.

➤ Online configuration and logic modification during operation.

➤ Fast control performance with **minimum 10 ms logic cycle** (up to 10 I/O modules).

➤ Scalable architecture supporting up to **32 CPU modules, 4 local I/O stations, 32 remote I/O stations**, and **512 I/O boards** per system.

Advanced Cybersecurity

➤ Designed in accordance with **IEC 62351**.

➤ User and device authentication and access control.

➤ Disabling of high-risk services.

➤ Encrypted, authenticated, and integrity-protected communications.

➤ Network segmentation and continuous security monitoring and auditing.

Flexible and Reliable Communications

➤ Up to **5 Ethernet ports** (optical and electrical) with rear redundant port support.

➤ Up to **4 RS485 ports** and **1 CAN port**.

➤ Supports high-speed fieldbus and Ethernet ring I/O extensions.

➤ Compatible with **IEC 101/104/103/61850, Modbus, ProfiBus, HART, CAN, DNP3.0, OPC**, and more.

Rich and Robust I/O Capabilities

➤ Intelligent I/O with built-in diagnostics and ring-redundant remote I/O.

➤ High analog accuracy (< 0.1%) with 2 kV I/O isolation.

➤ Short-circuit protection for analog inputs.

➤ Full SOE support for all binary inputs.

➤ Hot plug-and-play for all I/O modules.

➤ Wide operating temperature range: –40° C to +70° C.

Functions

Data Acquisition

➤ Status Monitoring: Acquires real-time status information (Single Point & Double Point) from substation equipment, such as circuit breaker positions, isolator switch positions, and alarm signals from protection devices and power supplies.

➤ Analog Measurement: Measures electrical values like voltage, current, active/reactive power, frequency, and transformer tap positions.

➤ Energy Metering: Counts and accumulates pulses from external energy meters for calculating values like MWh and MVARh.

Remote Control & Regulation

➤ Device Control: Executes remote commands (Single Point & Double Point controls) from the control center to open/close circuit breakers, isolators, etc.

➤ Setpoint Control: Outputs analog signals (e.g., 4-20mA, 0-10V) to remotely adjust device parameters, such as a transformer's tap changer reference setting.

Data Processing & Management
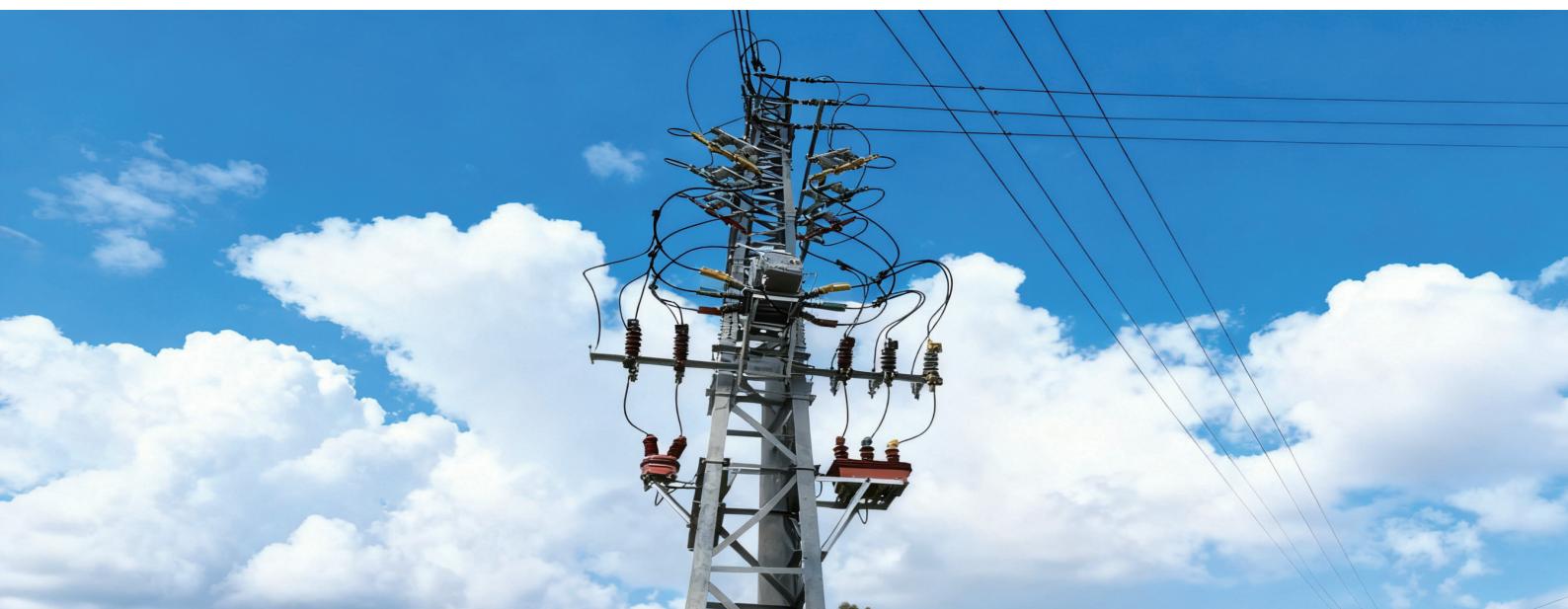
> **Signal Conditioning:** Applies processing mechanisms like debounce filtering, uncomplimentary state filtering for double points, and oscillating input detection to ensure data quality and reliability.

> **Sequential Event Recording:** Time-tags and logs all status changes with high resolution (0.1 ms), storing them in a buffer for accurate post-mortem analysis of events.

> **Data Logging:** Records various events (status changes, measurement changes, system alarms) locally.

> **Local Reporting & HMI:** Allows for local retrieval of real-time database reports (signal status, measurements, system state) via a connected laptop, providing basic SCADA-like functions for testing and diagnostics.

Communication

> **Clock Synchronization:** Synchronizes via GPS, control center commands , or a local laptop. Supports protocols like IRIG-B, SNTP and optionally IEEE 1588 PTP.

> **Multi-Protocol Communication:** Communicates with the control center(s) using standard protocols (IEC 60870-5-101, IEC 60870-5-104，DNP3.0) and with Intelligent Electronic Devices (IEDs) within the substation using protocols like IEC 60870-5-103 and IEC 61850.

System Configuration & Maintenance Support

> **Remote Configuration:** Allows its configuration to be downloaded and modified remotely from the control center, eliminating the need for on-site visits for changes.

> **System Monitoring & Diagnostics:** Self-monitors its health, detecting and reporting internal faults related to hardware modules (CPU, I/O cards, power supply), software, and communication links to the control center.

Technical Specifications

Module Type	Data
Case	
850-BB1901	19 slot racks
850-BB0801	8 slot racks
CPU Module	
850-CM302	Controller
Communication Modules	
850-CA302	Communication modules
Power Supply Modules	
850-PW4001	24V power supply modules
850-PW7502	110/220V power supply modules
850-PW7503	48V power supply modules
I/O Modules	
850-DI3201	32 channels digital input modules
850-DI3202	32 channels digital input modules
850-AI0802	8 channels analogue input modules
850-AI1601	16 channels analogue input modules
850-RTD1601	16 channels RTD input module
850-TC1601	16 channels thermocouple input module
850-DO3201	32 channels digital output modules
850-AO1601	16 channels analogue output modules
850-PI0801	8 channels pulse input module
850-ACI3U3I	6 channels AC input module
850-ACI3U4I	7 channels AC input module
850-ACI4U3I	7 channels AC input module
850-ACI7U	7 channels AC input module
850-ACI7I	7 channels AC input module
Terminal Board	
850-DIB1601	16 channels digital input terminal board
850-DOB1601	16 channels digital output terminal board

Protection IEDS CSC Series

Overview

From 1000kV protection IEDs to 6kV distribution multifunction protection IED, SIFANG protection IED family covers the whole electrical power system, including power generation, transmission, distribution, industrial, such as petrochemical, iron and steel, metallurgy, rail transportation, and commercial power consumption. Up to now, over one million of protection relays made by SIFANG have been in service worldwide. With highly reliable products and excellent service, SIFANG always stands in the top group of protection relay manufacturers.

Features

High-performance hardware platform

Robust hardware with excellent EMC performance and IP54 protection under -40℃ to +70℃ operating temperature;

Powerful scalable hardware capability, for present and future application

Mixable CT&VT inputs / SV(Sampling Value) input /output;

Mixable Binary inputs & output relays / GOOSE inputs /outputs;

Dual (single) CPU, dual A/D acquisition and mutual blocking, avoid mal-operation due to internal failure or inference

The flexible, scalable and compatible hardware architecture is able to satisfy user's tailor-made hardware scheme

Large capacity of recording and log, up to 800 second oscillation record storage

Multiple communication ports satisfied all kind of communication demand

High reliability hardware and software design concept
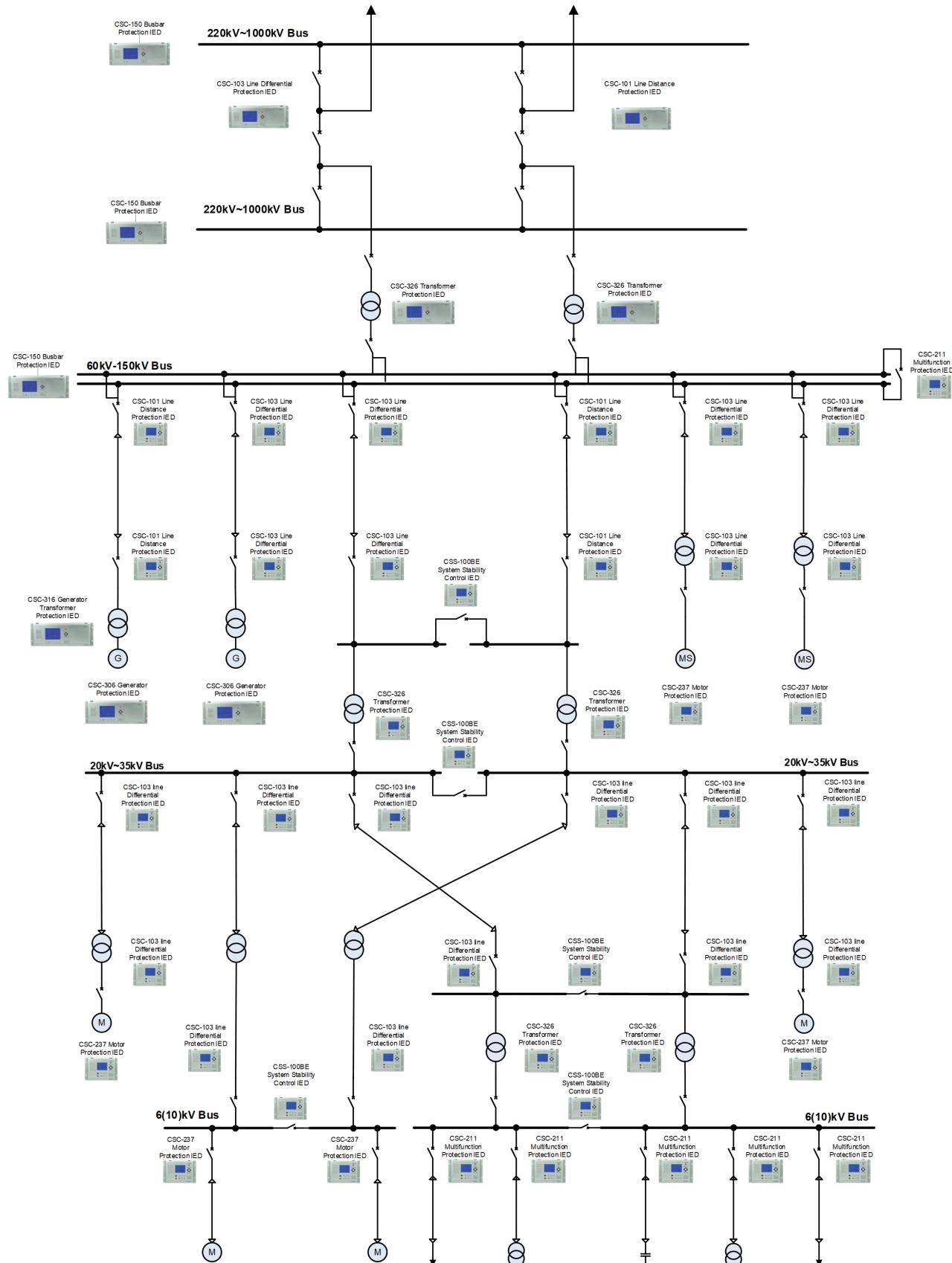
Fully proven and complete protection functions library can be customized into user own function scheme.

Unique principle of startup element guarantee the correct operation in fault and disturbance

Power supply module works correctly even in unstable and intermittent auxiliary power supply system

Multiple protection principle to one protected primary equipment offer complete and sensitive protection

Complete hardware self-supervision

Powerful and friendly software tool

Visual user configuring and logic programming windows make the job convenient and efficient

Capability to precise processing node tracing and fault analysis help engineer catch the fault cause easily and quickly

Applications

CSC-316 Generator Transformer Protection IED	CSC-211 Multifunction Protection IED	CSC-306 Generator Protection IED
CSS-100BE System Stability Control IED	CSC-101 Line Distance Protection IED	CSC-150 Busbar Protection IED
CSC-103 Line Differential Protection IED	CSC-326 Transformer Protection IED	CSC-237 Motor Protection IED

CSC-150 Busbar Protection IED

220kV~1000kV Bus

CSC-103 Line Differential Protection IED

CSC-101 Line Distance Protection IED

CSC-150 Busbar Protection IED

220kV~1000kV Bus

CSC-326 Transformer Protection IED

CSC-326 Transformer Protection IED

CSC-150 Busbar Protection IED

60kV-150kV Bus

CSC-211 Multifunction Protection IED

CSC-101 Line Distance Protection IED

CSC-103 Line Differential Protection IED

CSC-103 Line Differential Protection IED

CSC-101 Line Distance Protection IED

CSC-103 Line Differential Protection IED

CSC-103 Line Differential Protection IED

CSC-101 Line Distance Protection IED

CSC-103 Line Differential Protection IED

CSC-103 Line Differential Protection IED

CSC-103 Line Differential Protection IED

CSS-100BE System Stability Control IED

CSC-101 Line Distance Protection IED

CSC-103 Line Differential Protection IED

CSC-103 Line Differential Protection IED

CSC-316 Generator Transformer Protection IED

CSC-306 Generator Protection IED

CSC-306 Generator Protection IED

CSC-326 Transformer Protection IED

CSS-100BE System Stability Control IED

CSC-326 Transformer Protection IED

CSC-237 Motor Protection IED

CSC-237 Motor Protection IED

20kV~35kV Bus

20kV~35kV Bus

CSC-103 line Differential Protection IED

CSC-103 line Differential Protection IED

CSC-103 line Differential Protection IED

CSC-103 line Differential Protection IED

CSC-103 line Differential Protection IED

CSC-103 line Differential Protection IED

CSC-103 line Differential Protection IED

CSS-100BE System Stability Control IED

CSC-103 line Differential Protection IED

CSC-103 line Differential Protection IED

CSC-237 Motor Protection IED

CSC-103 line Differential Protection IED

CSC-103 line Differential Protection IED

CSS-100BE System Stability Control IED

CSC-326 Transformer Protection IED

CSC-326 Transformer Protection IED

CSC-237 Motor Protection IED

CSS-100BE System Stability Control IED

6(10)kV Bus

6(10)kV Bus

CSC-237 Motor Protection IED

CSC-237 Motor Protection IED

CSC-211 Multifunction Protection IED

CSC-211 Multifunction Protection IED

CSC-211 Multifunction Protection IED

CSC-211 Multifunction Protection IED

CSC-211 Multifunction Protection IED

Application Diagram

STATCOM/SVG GSC Series

Overview

The GSC series SVG/STATCOM from Sifang adopt advanced and mature cascaded converter structures in the field of power electronics. Combined with a powerful control system, these devices not only provide conventional dynamic reactive power compensation but also offer advanced functionalities such as active harmonic filtering, improvement of three-phase imbalance, flicker suppression, and sub synchronous oscillation suppression. They comprehensively address power quality issues across various application scenarios, including renewable energy power plants, electric arc furnaces, rolling mills, petrochemical plants, rail transportation, data centers, and power transmission and distribution.

Features
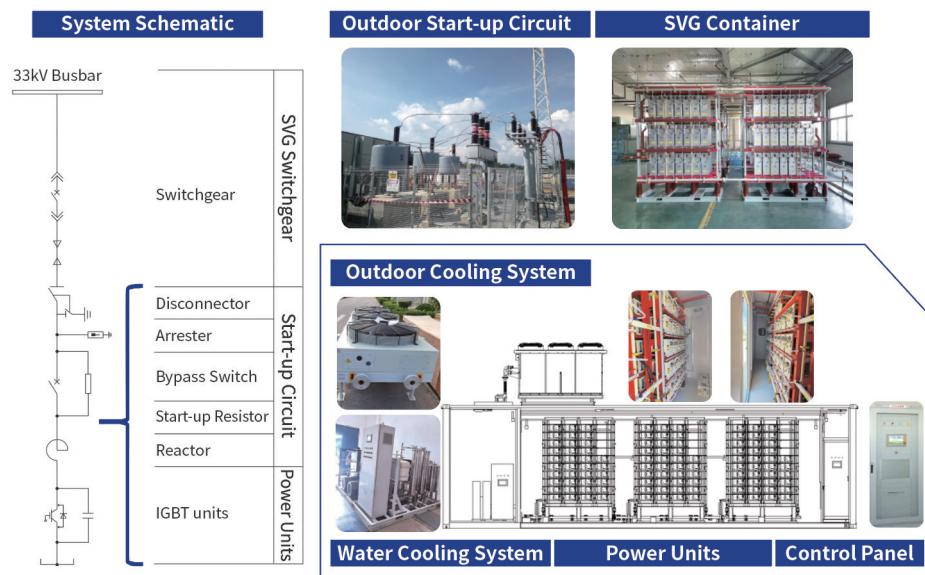
▶ Fast response time, as quick as 5ms.

▶ Equipped with control and protection features such as power unit bypass and voltage ride-through, ensuring long-term stable operation of the device.

▶ Low harmonic current, with the ability to filter typical harmonics below the 25th order, enabling sub synchronous oscillation suppression.

▶ Real-time communication network, supporting master-slave coordinated control.

▶ User-friendly monitoring system with simple operation, making it convenient for users to operate and maintain.

▶ Small footprint, easy installation, and minimal on-site construction work.

Architecture

GSC is connected to the grid in parallel through reactor or transformer, which can be equivalent to a voltage source. By adjusting the amplitude and phase of GSC output voltage, differential voltage is generated at both ends of the reactor, thus capacitive or inductive reactive power is generated.
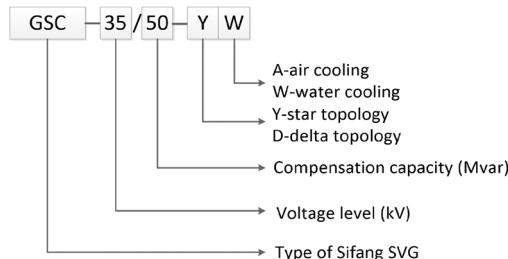
The main components of the GSC series SVG include a control cabinet, power cabinet, startup circuit, and cooling system. The connection reactor and step-down transformer are configured based on the site conditions.

System Schematic

33kV Busbar

Switchgear — SVG Switchgear

Disconnector
Arrester
Bypass Switch
Start-up Resistor
Reactor — Start-up Circuit

IGBT units — Power Units

Outdoor Start-up Circuit

SVG Container

Outdoor Cooling System

Water Cooling System | **Power Units** | **Control Panel**

Functions

❯ Rapid, continuous, and dynamic output of inductive and capacitive reactive power

❯ Maintain the stability of line and load voltage, suppress voltage fluctuations and flicker

❯ Compensate system reactive power, improve power factor, and reduce line losses

❯ Eliminate negative-sequence current and suppress three-phase imbalance

❯ Dynamic harmonic compensation to improve power quality

❯ Hybrid control (SVG+FC)

Technical Specifications

```
GSC ─ 35 / 50 ─ Y W
```

- A-air cooling
- W-water cooling
- Y-star topology
- D-delta topology
- Compensation capacity (Mvar)
- Voltage level (kV)
- Type of Sifang SVG

Electrical Parameters

Rated voltage	3.3kV/6kV/11kV/33kV/66kV
Maximum voltage	<120%, Customized
Overload capacity	110% long-term operation, 120% 1 minutes
Frequency	50/60Hz
Efficiency	>0.99
Capacity	≤ 300Mvar

Compensation Effect

|	
Control function	Reactive power control, power factor control, voltage control, comprehensive control
Power factor	>0.95（Within the compensation capacity）
Response time	<5ms
Protection function	Over current protection, over voltage protection, IGBT driving circuit fault protection, PWM pulse abnormal alarm, power unit protection (DC overvoltage, over temperature, communication fault)
Reliability and availability	Design life: 25 years
	MTBF>75000h, MTTR<5min
Harmonic	Meet the standard IEC61000-3-6
Advanced function	Meet the power quality harmonic standard of public power grid GB/T 14549-93 Negative sequence current compensation, voltage unbalance suppression, flicker control, harmonic compensation

Others

Structure	Modular design, integral transportation
Cooling method	Air cooling/water cooling
Protection class	IP20（Special requirement need customization）
Protocol	IEC61850, Modbus
Communication interface	Ethernet, RS485

Environmental Parameters

Field of use	Indoor, no explosive or corrosive gas
Operating temperature	-10~+40°C
Storage temperature	-40~+70°C
Humidity	20%~90%, Non condensing
Altitude	<1000，If it exceeds 1000m, the external insulation distance shall be increased by 1% and the rated output current capacity shall be reduced by 1% for every 100m increase

PES-12 SF6

Gas-insulated Ring Main Unit With Optional CSC-271E DTU
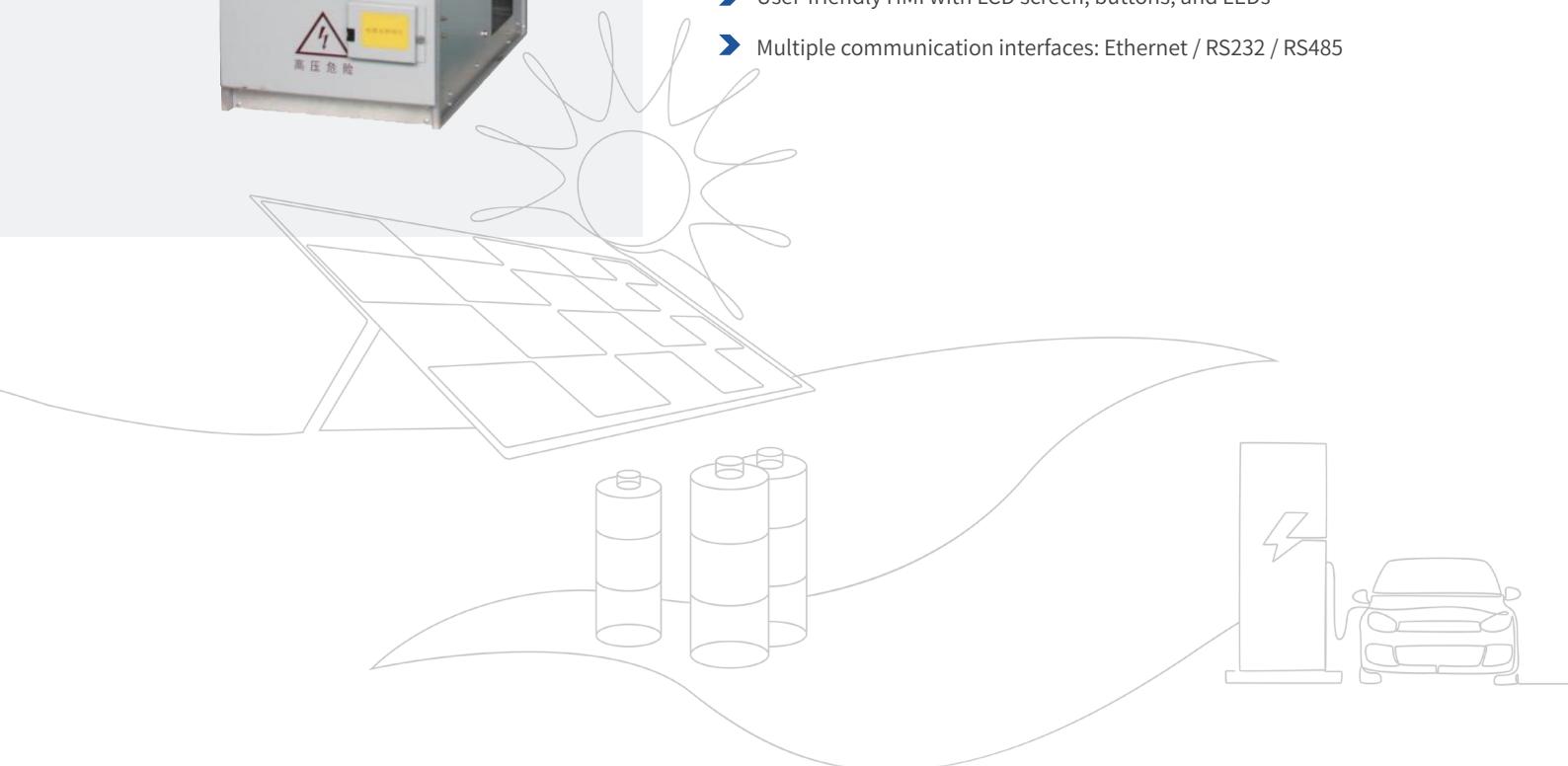
Overview

PES-12 is a gas-insulated ring main unit compliant with IEC 62271-200, suitable for underground cable distribution networks. It performs circuit switching and protection against short-circuit conditions.

The CSC-271F DTU integrates telemetry, remote control, tele-signaling, and protection functions. It can be installed either as part of the panel or locally in the RMU bay, offering real-time monitoring of voltage, current, and faults. Applicable to RMUs, sectionalizing cabinets, and switching stations in distribution networks.

Highlights

- Compact design with 375 mm panel width
- High reliability and corrosion resistance (enclosure in 304 stainless steel)
- Maintenance-free, high-performance mechanisms and accessories
- User-friendly HMI with LCD screen, buttons, and LEDs
- Multiple communication interfaces: Ethernet / RS232 / RS485

Technical Parameters

Items	Unit	Values		
		C-Load break switch unit	F-Load break switch with fuse unit	V-Circuit breaker unit
Unit name	/	C-Load break switch unit	F-Load break switch with fuse unit	V-Circuit breaker unit
Rated voltage	kV	12		
Rated current	A	630	125	630
Rated transfer current	A	/	1750	/
Rated short-circuit breaking current	kA	/	31.5	20
Rated short-circuit closing current (peak)	kA	50	80	50
Rated short-circuit making current (earthing switch, peak)	kA	50	/	50
Mechanical endurance of vacuum circuit breaker	Times	/		⩾ 10000
Mechanical endurance of load/ disconnector switch	Times	⩾ 5000		⩾ 3000
Mechanical endurance of earthing switch	Times	⩾ 3000		
SF$_6$ gas pressure (absolute pressure at 20° C)	Mpa	0.04		
Annual gas leakage rate	/	⩽ 0.01%/year		
Degree of protection for gas tank and live parts	/	IP67		
Degree of protection for switchgear enclosure	/	IP4X		

PEN-12 Eco Friendly Ring Main Unit

Overview

The PEN-12 is an environmentally friendly RMU insulated with dry air, compliant with IEC 62271-200. It is designed for underground cable distribution systems, enabling circuit switching and fault protection.
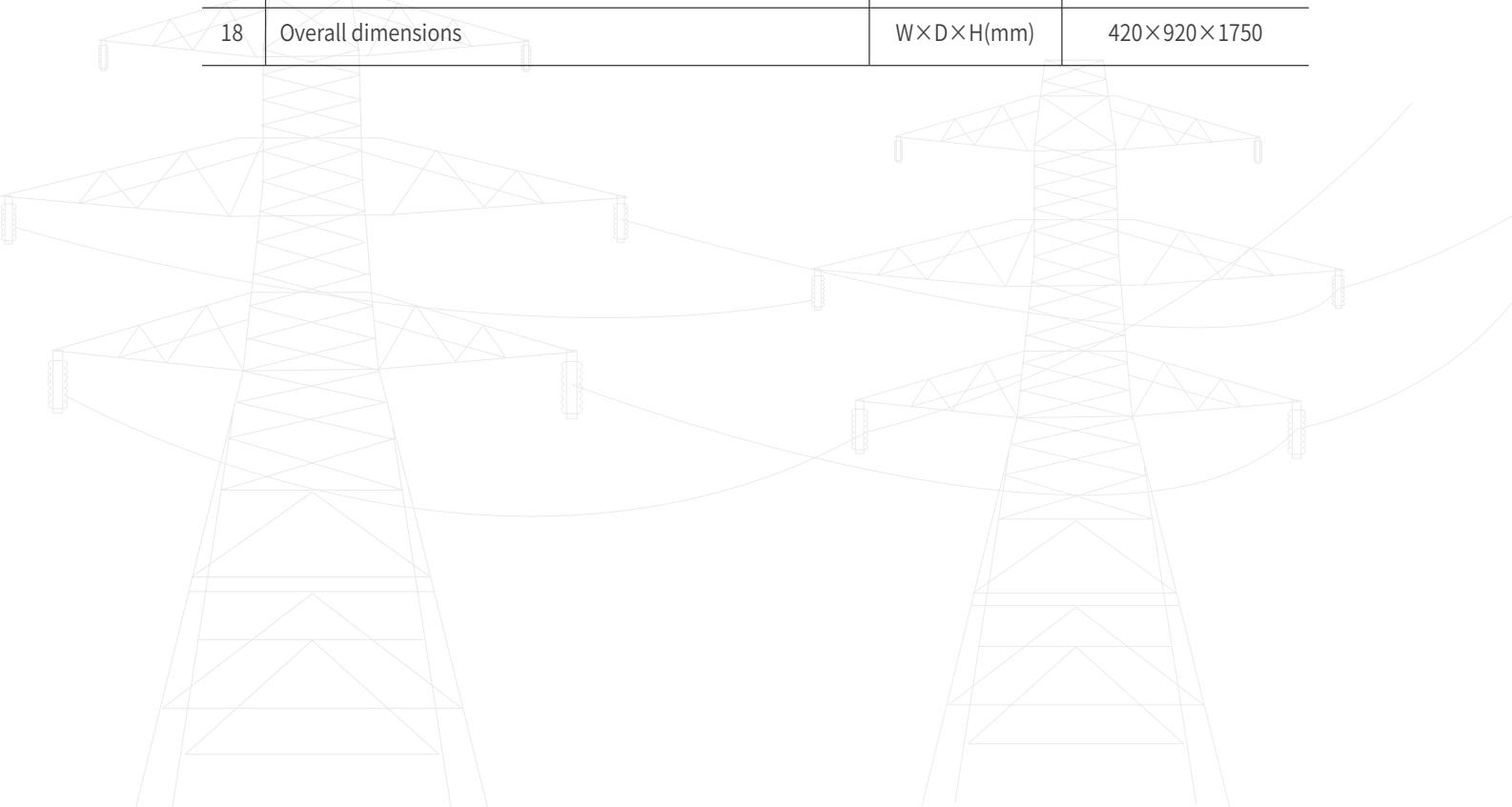
The CSC-271F DTU offers integrated telemetry, remote control, tele-signaling, and protection. It can be installed within the RMU panel or locally, ensuring real-time monitoring in RMUs, sectionalizers, and switch stations.

Highlights

➤ Modular design for high production efficiency and reliable quality

➤ Eco-friendly dry-air insulation

➤ Excellent protection: IP67 for tank, IP65 for mechanism

➤ Earthing switch making capacity: 20 kA, 5 times; IAC: 20 kA/1s

➤ High corrosion resistance with 304 stainless steel enclosure

➤ HMI with LCD, intuitive buttons, and LED indicators

➤ Ethernet / RS232 / RS485 communication support

Technical Parameters

No.	Items	Unit	Values
1	Rated voltage	kV	12
2	Rated current	A	630
3	Rated operating sequence		O-0.3s-CO-180s-CO
4	Breaker three-phase opening and closing asynchronism	ms	≤ 2
5	Number of operations at rated short-circuit breaking current	Times	≥ 30
6	Mechanical endurance of circuit breaker	Times	≥ 10000
7	Mechanical endurance of disconnector	Times	≥ 3000
8	Mechanical endurance of earthing switch	Times	≥ 3000
9	Short-circuit making capacity of earthing switch	Times	5
10	2-second short-time withstand current of earthing switch	kA	20
11	Operating mechanism	—	Spring
12	Switch closing time	ms	≤ 80
13	Switch opening time	ms	≤ 50
14	Operating voltage	V	DC48
15	Degree of protection for gas tank and live parts		IP67
16	Degree of protection for operating mechanism	--	IP65
17	Degree of protection for switchgear enclosure	--	IP4X
18	Overall dimensions	W×D×H(mm)	420×920×1750

KYN28A-12 Indoor Withdrawable Metal-enclosed Switchgear

Overview

The KYN28A-12 series indoor metal-clad switchgear is designed for three-phase AC systems with rated voltage from 7.2 kV to 12 kV, rated current from 630 A to 4000 A, and rated frequency of 50 Hz. It is applicable to 10 kV feeders in substations for new energy, utility distribution, and industrial power networks.

Highlights

- Air-insulated primary distribution, 12 kV
- Max rating: 4000 A, 40 kA/4 s
- Widely applicable across industries with multiple configurations
- Withdrawable design for convenient operation and maintenance

Technical Parameters

No.	Items	Unit	Values	
1	Voltage level	kV	7.2~12	
2	Panel width	mm	800	1000
3	Current rating	A	630~1250	1600~4000
4	Rated short-circuit breaking current	kA	20~40	
5	Rated short-circuit making current	kA	50~100	
6	Rated short-time withstand current and duration	kA/s	40/4	
7	Rated peak withstand current	kA	100	
8	Temperature rise	k	1.1Ir: 65	

KYN61A-40.5 Series Indoor Metal-clad Switchgear

Overview

The KYN61A-40.5 series indoor metal-clad switchgear is engineered for three-phase AC systems with a rated voltage of 40.5 kV, rated current of 630–2500 A, and rated frequency of 50 Hz. It is ideal for 35 kV feeders in substations of new energy systems, utilities, and industrial applications.

Highlights

❯ Air-insulated primary distribution, 40.5 kV

❯ Max rating: 3150 A, 31.5 kA/4 s

❯ Flexible solutions for diverse industry needs

❯ Withdrawable structure for ease of operation

Technical Parameters

No.	Items	Unit	Values	
1	Voltage level	kV	33-40.5	
2	Panel width	mm	1440	1650
3	Current rating	A	630~1250	630~3150
4	Rated short-circuit breaking current	kA	31.5	
5	Rated short-circuit making current	kA	80	
6	Rated short-time withstand current and duration	kA/s	31.5/4	
7	Rated peak withstand current	kA	80	
8	Temperature rise	k	1.1Ir：65	

BESS Products

Functions

Transient Support

When grid voltage experiences angle or amplitude jumps, grid-forming BESS provides active and reactive power support to maintain stable equipment operation, with a fault reactive response time of less than 10ms.

Inertia Response

When the power system frequency changes rapidly, grid-forming BESS naturally adjusts active power based on the rate of frequency change, with an inertia time constant configurable between 1-20.

Primary Frequency Regulation

In grid-connected operation, grid-forming BESS can coordinate with the BESS control system or autonomously adjust power output in response to system frequency variations.

Damping Control

When low-frequency oscillations occur in the grid, grid-forming BESS can regulate active power through damping control to suppress oscillations.

Black Start

When the power source side is in a complete blackout state, multiple grid-forming PCS units can start in parallel with zero-voltage synchronization, achieving oscillation-free operation and circulating currents below 5%.

Voltage Regulation

In grid-connected operation, it can coordinate with the BESS control system or autonomously adjust reactive power in response to system voltage changes, enabling active voltage regulation.

Grid-Connected/Islanded Mode Switching

Capable of operating in both grid-connected and islanded modes, with fast, smooth, and seamless transitions between the two modes.

Relay Protection Compatibility

The transient output of grid-forming BESS matches the transient characteristics of synchronous generators, ensuring correct operation of protection elements and accurate phase-selective tripping during faults.

Technological Advantages

Efficient & Compact

ANPC topology, maximum efficiency > 99%，intelligent air cooling, industry-leading power density

Safe & Reliable

IP65high protection level, multiple software and hardware protection

Flexible & Fast

Supporting flexible switching between grid-following and grid-forming modes, charge-discharge transition time ≤ 20ms

Station-level Grid-forming & Full-scenario Operation Capability

- Supporting the parallel operation of large-scale centralized grid-forming BESS and building hundred-MW level grid-forming BESS power stations
- Supporting the entire station's grid-connected, off-grid, and the switching operation

Multi-scenario Grid-forming Capability

- Short-term 300% overload
- Inertia support and primary frequency regulation
- Voltage support and regulation
- Adaptability to weak systems
- Entire-station black start

Specifications

Product Model	CSD-5831F-A	CSD-5831F-B	CSD-5831F-C
DC Side			
Rated DC Power	750kW	1250kW	1500kW
Maximum DC Power	842kW@long-term 2250kW@10s	1403kW@ long-term 3750kW@10s	1684kW@ long-term 4500kW@10s
Rated DC Power Maximum DC Power	842A@ long-term 2250A@10s	1403A@ long-term 3750A@10s	1684A@ long-term 4500A@10s
Maximum DC Bus Voltage	1500V		
Working Range of DC Side Voltage	1000V-1500V		
Number of DC Input Circuits	1	1 or 2	1 or 2
AC Side (Grid-Connected)			
AC Output Power	750kVA @45℃ 825kVA @30℃	1250kVA @45℃ 1375kVA @30℃	1500kVA @45℃ 1650kVA @30℃
Maximum AC Power	825kVA @ long-term 2250kVA @10s	1375kVA @ long-term 3750kVA @10s	1650kVA @ long-term 4500kVA @10s
Maximum AC Current	690A @ long-term 1883A @10s	1151A @long-term 3138A @10s	1381A @ long-term 3765A @10s
Rated Output Voltage	690V		
AC Voltage Range	621-759V		
Rated Grid Frequency	50/60Hz		
Total Harmonic Distortion of Current	< 3% (Rated Power)		
Power Factor	> 0.99 (at >20% Load) / -1 (Leading) ~1 (Lagging)		
Reactive Power Range	-100% ~ 100%		
AC Side (Off-Grid)			
Rated Output Voltage	690V		
AC Voltage Range	621-759V		
Voltage Unbalance Degree	< 2%		
Total Harmonic Distortion of Voltage	< 3% (Linear Load)		
Rated Output Frequency	50/60Hz		
Dynamic Voltage Transient Range	< 10% (when the load changes suddenly from 20% to 100% or from 100% to 20% under the condition of a balanced resistive load)		
Efficiency			
Maximum Efficiency	> 99%		

| Product Model	CSD-5831F-A	CSD-5831F-B	CSD-5831F-C
System Parameters			
Connection Mode	Three-phase three-wire		
Isolation Mode	Non-isolated		
Overload Capacity	1.1 times for long-term operation, 1.2 times for 10min, 3 times for 10s		
Allowable Ambient Temperature	-35℃ ~60℃（Derated operation when the temperature is > 45℃）		
Allowable Relative Humidity	0~100%（Without Condensation）		
Maximum Operating Altitude	5000m（Customized for above 3000m）		
Noise	80dB		
Dimensions (Width × Height × Depth)	1080×2400×1250mm	2160×2450×1150mm	2160×2450×1150mm
Overall Weight	1400kg	2800kg	2800kg
Protection Level	IP65		
Cooling Method	Intelligent Forced Air Cooling		
Communication			
Communication Interface	RS485，CAN，Ethernet，Optical Port		
Communication Protocol	CAN2.0B，Modbus，IEC61850，GOOSE		

MANUFACTURING SYSTEM

SIFANG vigorously promotes the construction of green and intelligent factories, and has obtained national level green factory certification.

Building digital factories based on smart IoT architecture in Baoding, Huzhou, and Nanjing, integrating core systems such as MES/SCADA/WMS/PLM, continuously introducing upgraded fully automated SMT production lines and other equipment, achieving full process automation and intelligence in production, operation, assembly, testing, warehousing, and delivery, and creating smart and transparent factories.

SERVICE SYSTEM

SIFANG's service system has successfully obtained BSI certification from British Standards Association. And we always pay attention to and strive to meet the service needs of users, respond quickly, and make every effort to serve.

Service Network
Relying on China headquarter and overseas subsidiaries such as the Philippines subsidiary, Indian subsidiary and Kenya subsidiary, SIFANG's international services cover more than 90 countries around the world.

Service Content
Commissioning | Operation and Maintenance Service | Technical Training | Technical Support

Contact Us
Beijing: support@sf-auto.com, sf_sales@sf-auto.com
Indian: sf_sales_in@sf-auto.com
The Philippines: sf_sales_ph@sf-auto.com
Kenya: sf_sales_ke@sf-auto.com

COOPERATION AND PARTNERS

国家电网 STATE GRID

中国南方电网 CHINA SOUTHERN POWER GRID

国家能源集团 CHN ENERGY

中国华能 CHINA HUANENG

国家电投 SPIC

中国华电 CHD

DTP 大唐国际

华润電力 CR POWER

中广核 CGN

中核集团 CNNC

中国三峡 China Three Gorges Corporation

中国电建 POWERCHINA

中国电力工程有限公司 CHINA NATIONAL ELECTRIC ENGINEERING CO., LTD.

CEEC 中国能建 ENERGY CHINA

中国中铁

中国石油

中国石化 SINOPEC

中化 sinochem 科学至上

CNCEC 中国化学工程集团有限公司 China National Chemical Engineering Group Corporation Ltd

SDIC 国投

NGCP

PEA Provincial Electricity Authority

PLN

Kenya Power

adani

LARSEN & TOUBRO

ACWA POWER

SCOTTISHPOWER

ELECTRICITE DU LAOS

CI-ENERGIES CÔTE D'IVOIRE ÉNERGIES

kepco

sonatrach

Société Nationale d'Electricité

TCDD

GPL GUYANA POWER & LIGHT