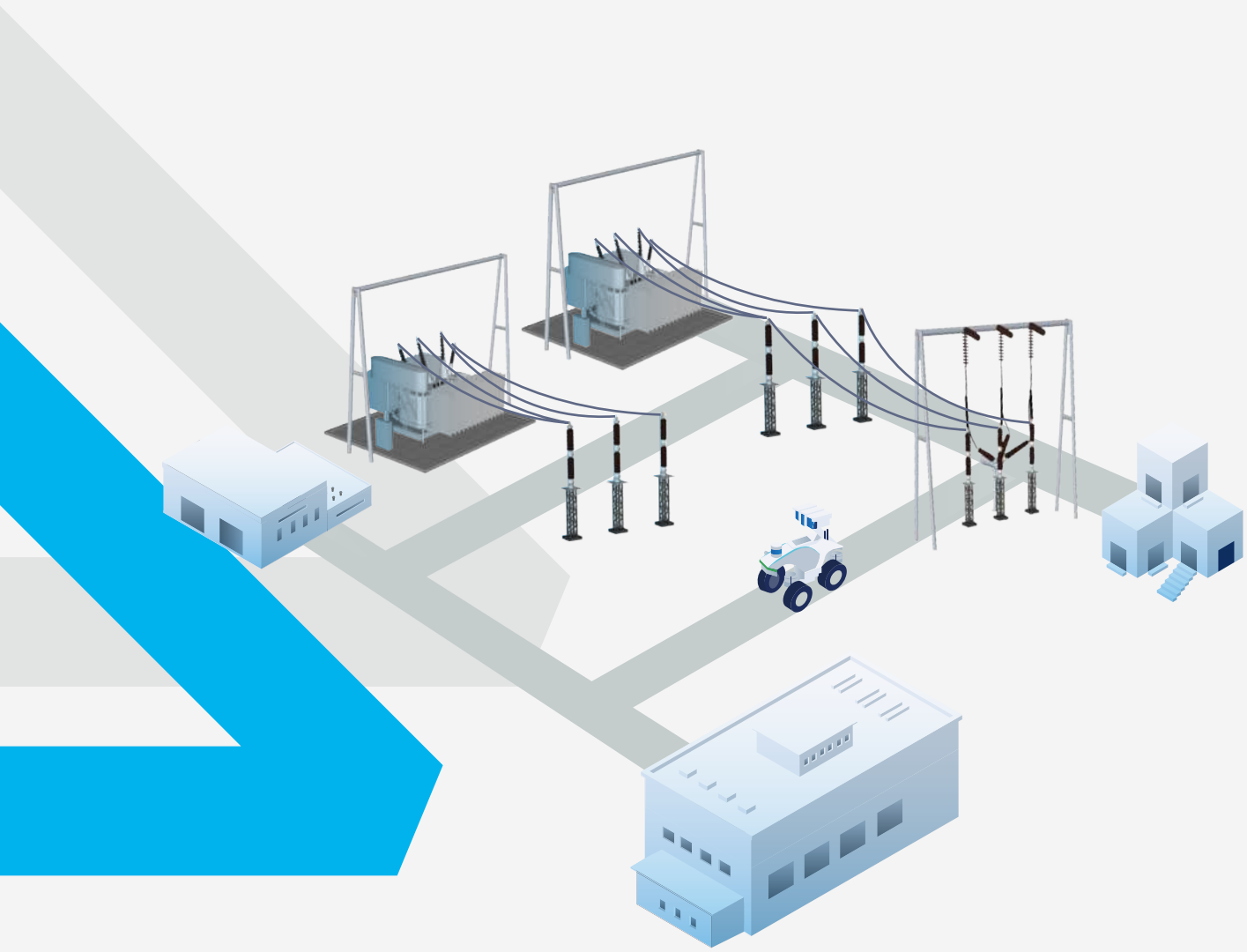
SIFANG

Digital Substation Solution Brochure



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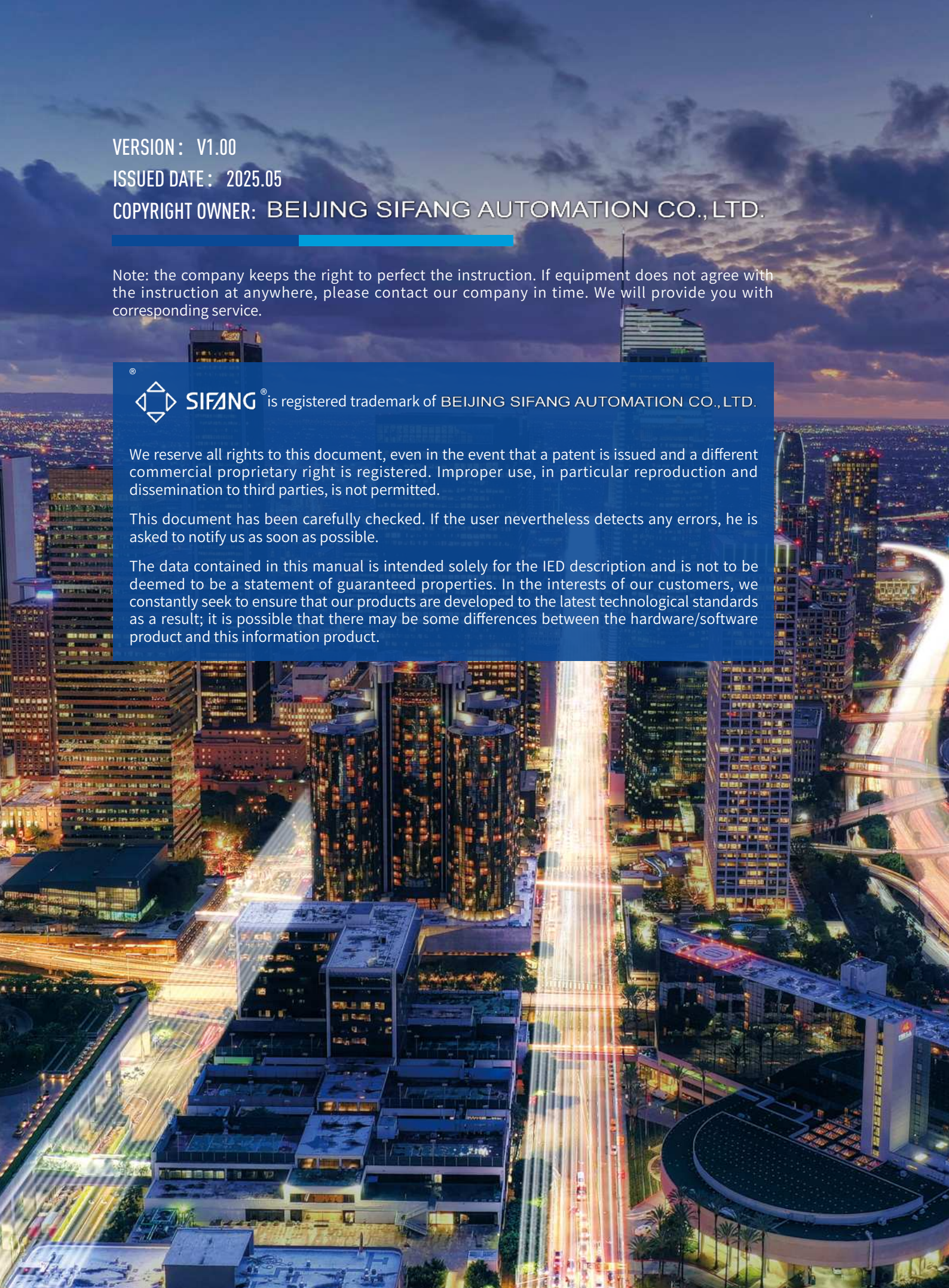

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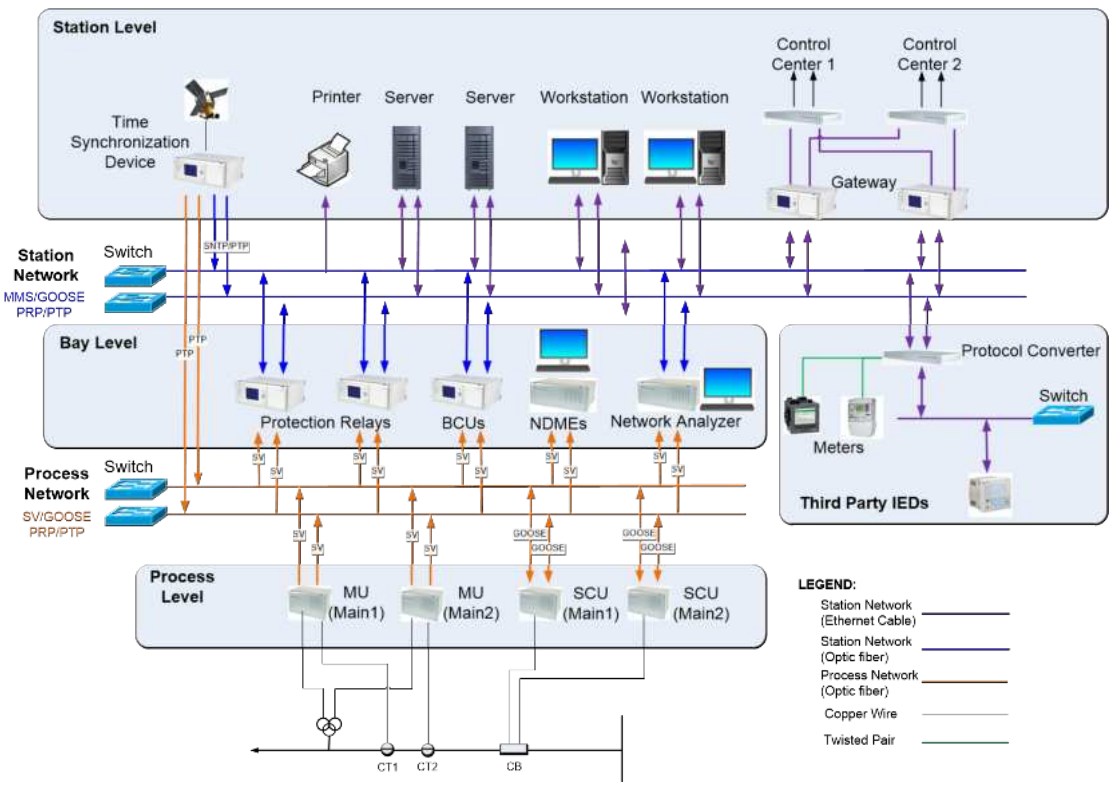
Note: the company keeps the right to perfect the instruction. If equipment does not agree with the instruction at anywhere, please contact our company in time. We will provide you with corresponding service.

CONTENTS

OVERVIEW

In digital substations, which enable real-time data exchange of voltage, current, and status information among IEDs via SV and GOOSE protocols, there is a growing trend of substations into process and station levels. Interface IEDs, such as SCUs and MUs, traditionally responsible for managing binary and analog data with primary equipment, are now installed directly in the yard. This shift offers multiple benefits, including reduced cabling, lower civil infrastructure costs, simplified installation, and improved safety, especially when using fiber optic technology.

The SIFANG digital substation solution enables multi-protocol data acquisition through hard-wired connections, GOOSE, or Sampled Value (SV) protocols, while ensuring accurate time synchronization via SNTP, IRIG-B, or IEEE 1588 Precision Time Protocol (PTP). This integrated solution incorporates digital protective relays, bay control unit (BCU), network analyzer, and network disturbance monitoring equipment, (NDME) to achieve comprehensive system control and monitoring.



SIFANG Digital Substation Solution Typical Architecture

FEATURES

Cost saving

Simplify hardwiring to significantly reduce Capital Expenditure.

Space saving

Decrease the substation footprint with a more compact control room design.

Engineering efficiency

Reduce engineering work and associated costs with simplified secondary circuits.

Operation efficiency

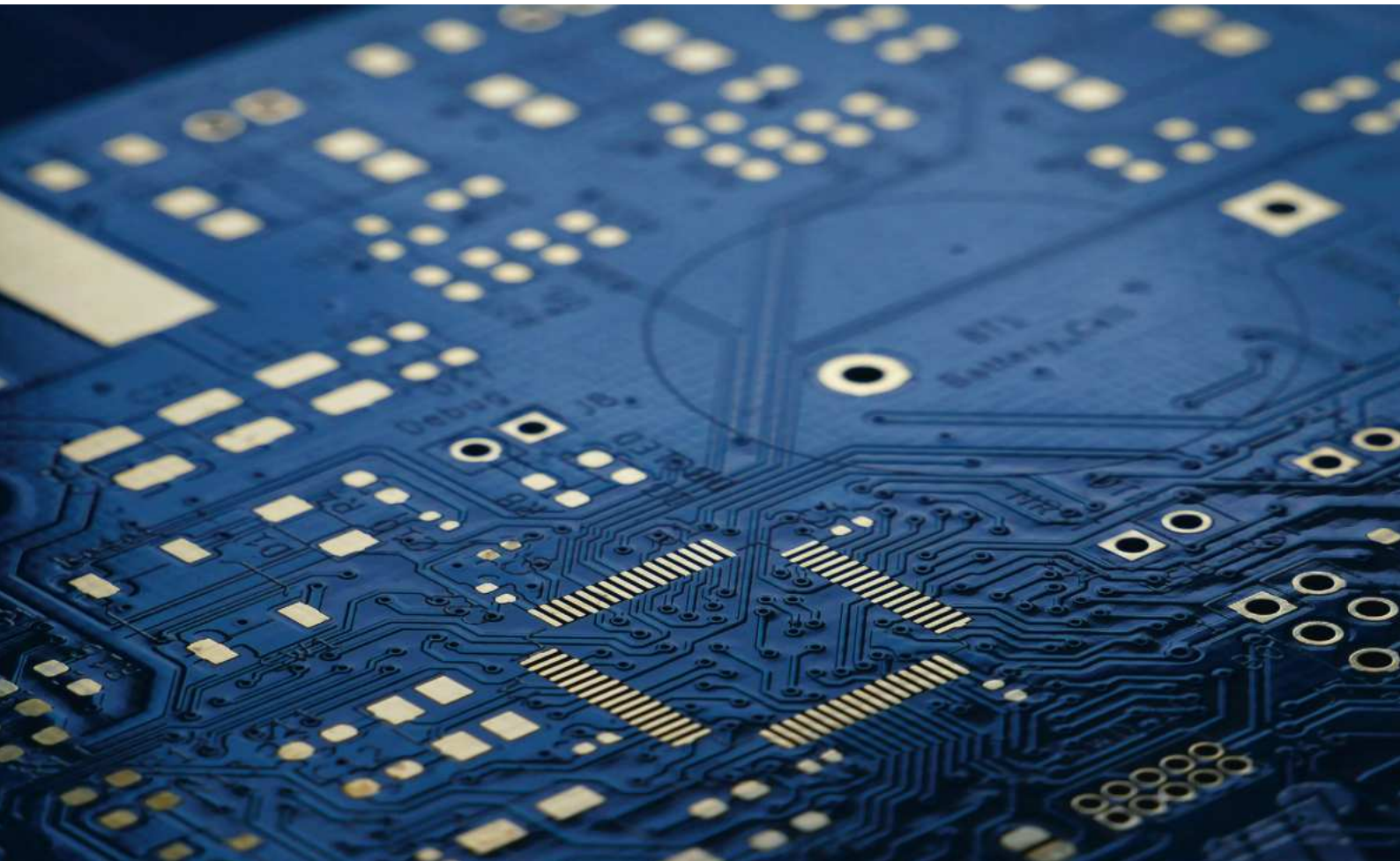
Enable easier, faster, and remote commissioning to improve operational efficiency.

Operation safety enhancement

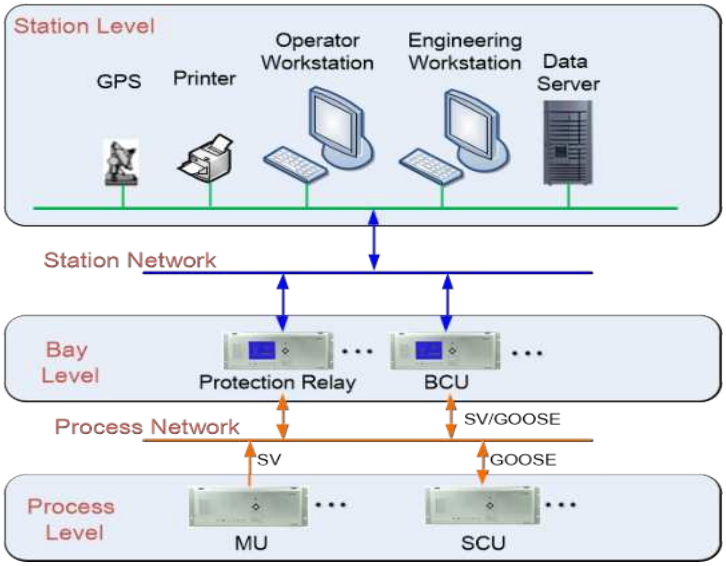
Enhance workforce safety by replacing extensive copper wiring with fiber-optic cables.

Smart operation capability

Increase situational awareness and asset utilization to enhance overall system reliability.



ARCHITECTURE



The typical architecture of a SIFANG digital substation is the Three-Levels-Two-Networks configuration.

It comprises three levels: station level, bay level, and process level. Additionally, it incorporates two networks: the station network and the process network.

Station Level

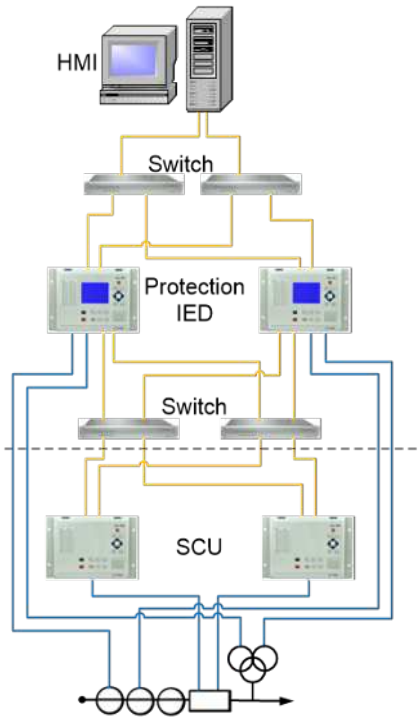
The station level equipment consists of servers, operator workstations, engineer workstations, gateway, and printers, etc.

Bay Level

The bay level is composed of protection rely, BCU, and NDME, etc. The network failure at the station network will not affect the function of the bay level equipment.

Process Level

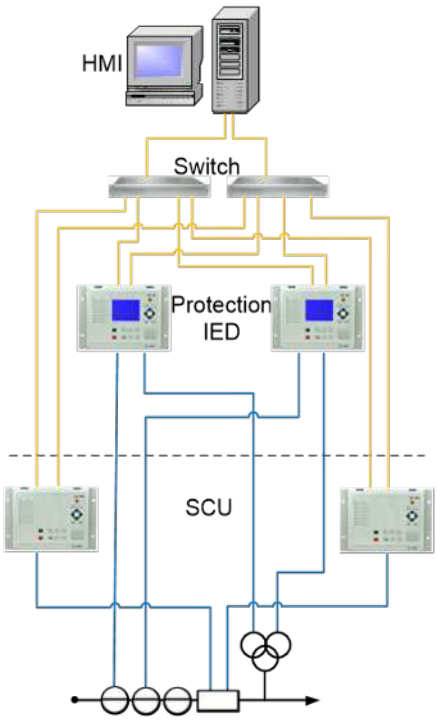
The Process Level contains the Smart Control Unit (SCU) and Merging Unit (MU) Typically, Merging Units (MU) are used to convert analog signals from the secondary of CTs and VTs to a digital interface. The interface to breakers and disconnect switches is digitized by Switchgear Control Units (SCU). SCUs have a hardwired interface to the breaker trip/close coil to operate the breaker by receiving GOOSE messages from the protection and control IEDs.



Typical Architecture 1
Half Digital

Conventional Sampling
GOOSE network tripping

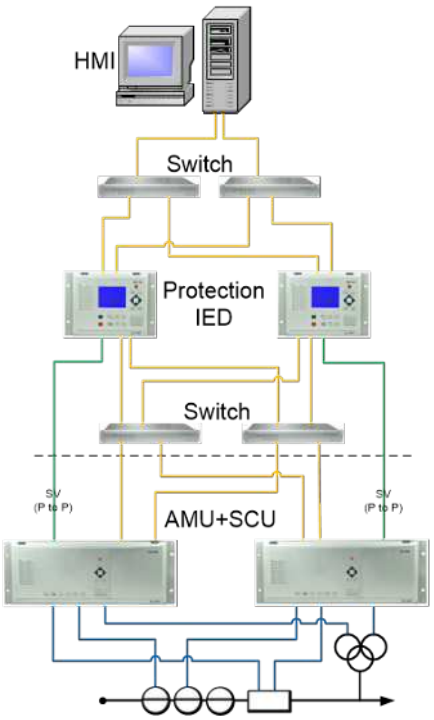
Station network - MMS/GOOSE, PRP
Process network - GOOSE, PRP



Typical Architecture 2
Half Digital

Conventional Sampling
GOOSE network tripping

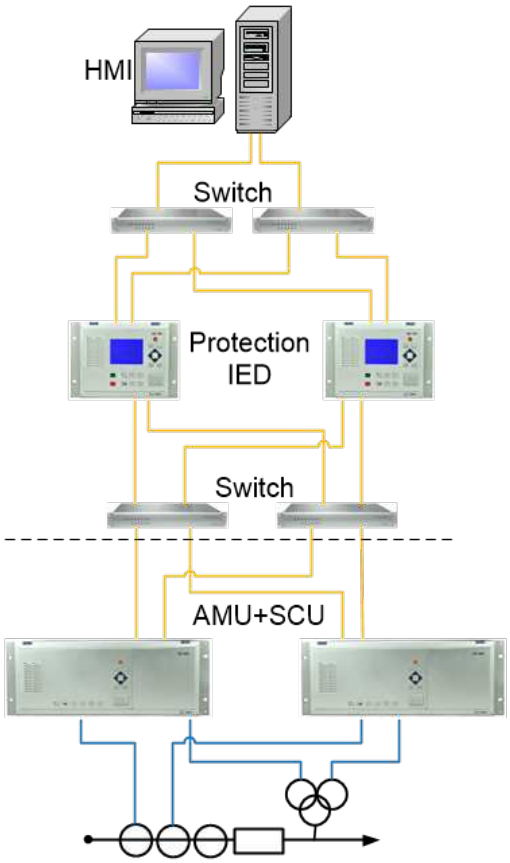
Station network - MMS/GOOSE, PRP
No Process network



Typical Architecture 3
Full Digital

SV point to point connection
Goose network tripping

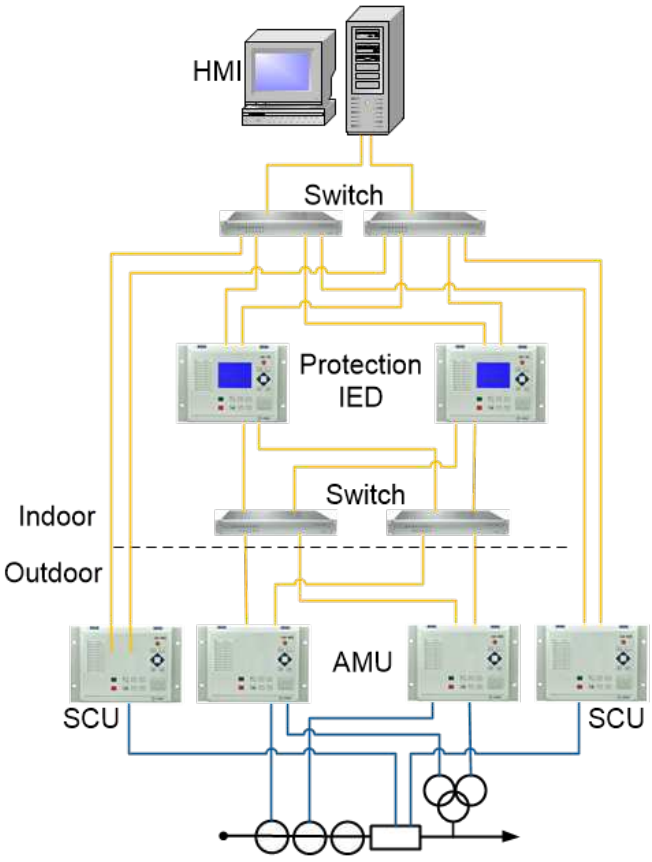
Station network - MMS/GOOSE, PRP
Process network - SV/GOOSE, PRP



Typical Architecture 4 Full Digital

Full network

Station network - MMS/GOOSE, PRP
Process network - SV/GOOSE, PRP



Typical Architecture 5 Full Digital

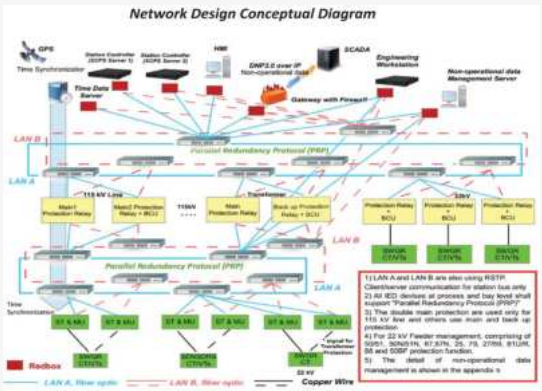
Full network with dedicated process network for SV

Station network - MMS/GOOSE, PRP
Process network - SV, PRP

KEY PROJECTS

THAILAND PEA DIGITAL SUBSTATION PROJECT

- Provincial Electricity Authority (PEA)'s First Digital Substation
- Seven 115kv digital substations.
- Use fully network mode in process level.
- PRP, 1588 time synchronization for station level.
- PRP, Optical IRIG-B time synchronization for process level.



NGCP 138KV ISABEL DIGITAL SUBSTATION PROJECT

- National Grid Corporation of the Philippines (NGCP)'s First Digital Substation
- Digital renovation of one 138kv substations.
- Half digital mode with conventional sampling and GOOSE tripping.
- Use SNTP for station level, and IEEE1588 (through process network) for bay level and process level.
- The redundant protection relay and SCU are respectively connected to the process network A and network B.

PRODUCTS

Product Series

Products	Type
Protection Relays *	CSC Series
MU/SCU *	CSD-603
SCADA	CSC-2000(V2)
Gateway	CSD-1321
BCU/RTU *	CSI-200
Time Synchronization Device	CSC-196
Switch	CSD-187
Travelling wave fault locator	CSD-193
Fault Recorder *	CSGC-SMDS-DG
Network Analyzer *	CSRA-2000

*** Smart Device**

PROTECTION CSC SERIES

SIFANG Protection IEDs cover the entire power system, from 1000kV transmission to 6kV distribution. They serve power generation, transmission, distribution, storage and diverse industrial sectors—including petrochemical, iron & steel, metallurgy, rail transportation.

Types:

CSC-103 Line Differential Protection IED
CSC-101 Line Distance Protection IED
CSC-326 Transformer Protection IED
CSC-150 Busbar Protection IED
CSC-306 Generator Protection IED
CSC-316 Generator Transformer Protection IED
CSC-211 Multifunction Protection IED
CSC-237 Motor Protection IED
CSC-280 Series Multifunction Protection IED
CSS-100BE System Stability Control IED

Features:

High-performance hardware platform

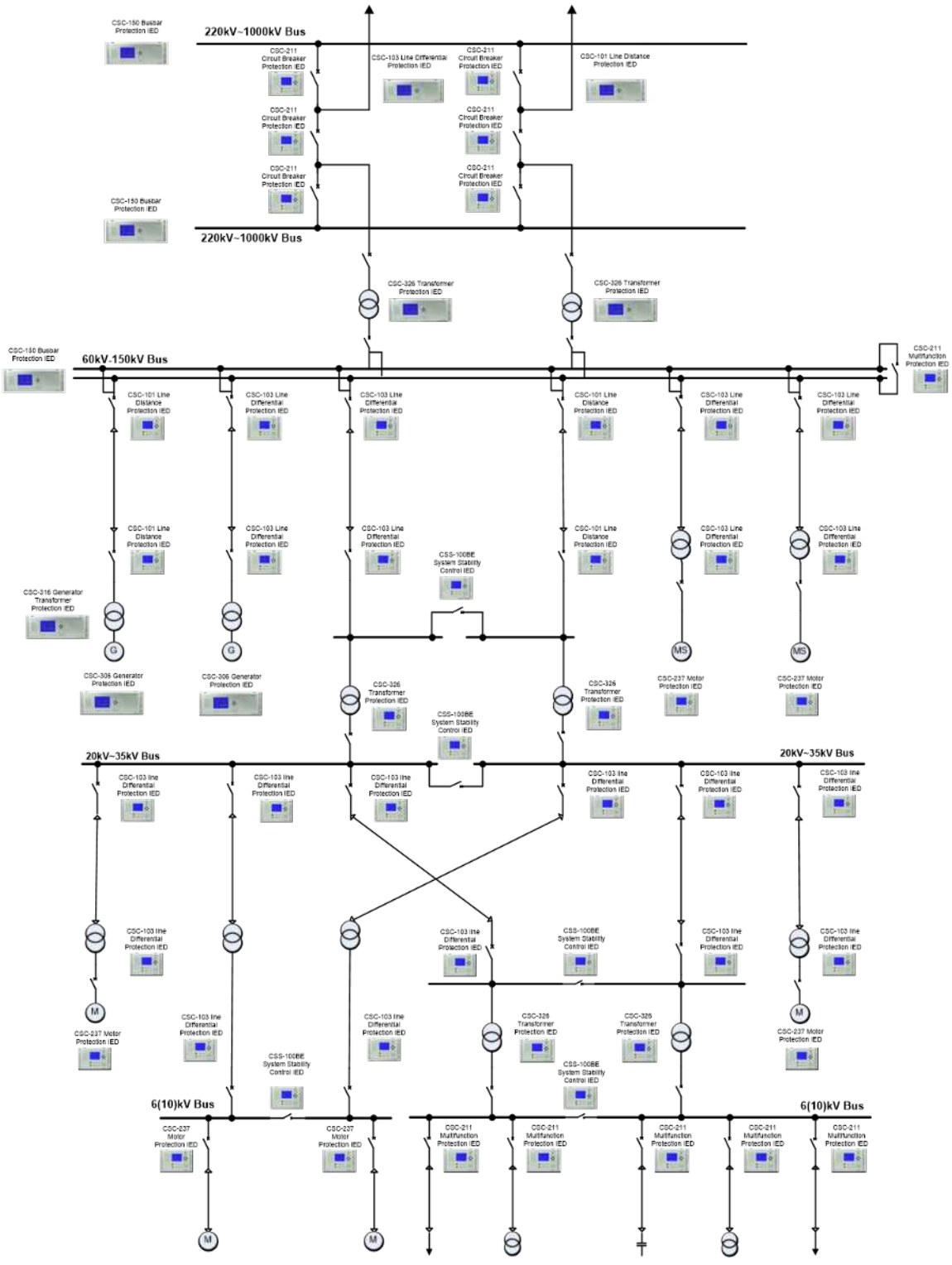
- Robust hardware with excellent EMC performance and IP54 protection under -40°C to +70°C operating temperature.
- Powerful scalable hardware capability, for present and future application.
- Mixable CT&VT inputs / SV (Sampling Value) input /output.
- Mixable Binary inputs & output relays / GOOSE inputs / 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



Application Diagram

SCU/MU CSD-603AWE

The CSD-603AWE serves as both a Smart Control Unit (SCU) and a Merging Unit (MU), providing a physical interface between primary and secondary equipment. It measures currents and voltages from instrument transformers while also exchanging status signals and control commands with primary equipment. All data transmission is performed in a standardized digital format via optical fiber.

Features:

Modular Design

The CSD-603AWE features a modular design, comprising multiple flexible and configurable modules. Key functions—such as analog input, IEC61850-9-2 output, voltage switching and coordination, and digital I/O—can be easily reconfigured through configuration files. This approach enhances both software flexibility and reliability.

Hardware System with High Performance, High Reliability and Massive Resource

CSD-603AWE takes the floating point high performance multi-DSP and industrial grade FPGA with large capacity, integrated transceiver and fast Ethernet technology, to provide the high speed and reliability. It has passed the highest level EMC test for 11 items in the IEC61000 standard for its overall interference immunity.

Time Synchronization with High Precision

CSD-603AWE supports both IRIG-B and IEEE1588 time synchronization. The advanced dedicated time synchronization chip can provide the adjustable time frequency with the time synchronization accuracy excellent than 1us and the time accuracy excellent 24us/1hr.

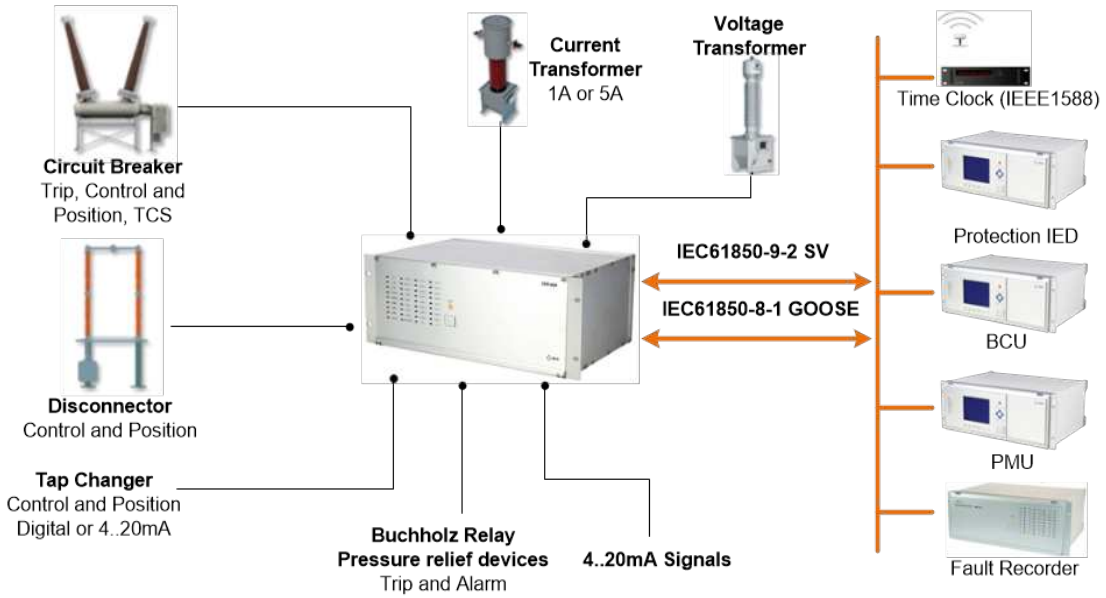
Data Acquisition with High Precision

CSD-603AWE adopts the high resolution 16-bit parallel A/D converter, with dual A/D sampling for each AC channel and it samples 80 points at high speed for each cycle.

Analog channels	Up to 8CT channels (1A/5A settable, 40Ir), 3CT channels (maximum 10A), and 21VT channels (0~180V)
Binary input numbers	Up to 104, input voltage is DC power 110V/125V/220V settable
Binary output numbers	Up to 64
Temperature channels	Up to 16, input signals are 4~20mA or 0~5V
Non-electrical signals	Up to 60 signal inputs, signal input power ⩾ 5W
Tap position signals	BCD code

Functions:

- Interfacing with conventional current and voltage transformers.
- Circuit breaker and disconnector control.
- Mechanical protection.
- Build-in lockout function.



Technical Specifications

Sampling rate	Trigger Recording: 9600, 12000 /sec @ 60 Hz, selectable. 4000, 9600, 10000,120000, 12800 /sec @ 50 Hz, selectable. Continuous Recording: 1200, 2400 /sec @ 60 Hz, selectable. 1000, 1200,2400, 4000 /sec @ 50 Hz, selectable.
Frequency	50Hz or 60Hz
Accuracy	0.1% on voltage 0.2% on current
A/D Conversion Resolution	16 bits
RAM Memory capacity	2GB minimum
Mass storage	320G minimum, Hard Disk
Time resolution	Records tagged to 1ns
Time synchronization	IRIG B and SNTP
Absolute time precision	<500μs with IRIG-B
Timekeeping accuracy	<500ms with 24-hour timekeeping
NDME construction	Microprocessor based/Numerical
Analogy input	64/96/128 selectable Current or Voltage selectable
Binary input	128/192/320/384 selectable
DC acquisition module	(optional) For 4 DC inputs with one module Up to 16 DC inputs with four modules
GOOSE acquisition module	(optional) For 512 GOOSE channels with 4 GOOSE modules

SCADA CSC-2000(V2)

CSC-2000 (V2) SCADA system has been operating at 6kV to 1000kV substations and plants for decades. After continuously technology evolving, the system is widely applied from the latest full digital substations to conventional substations with high scalability and flexible architecture. The system provides a powerful function library including not only basic data acquisition, monitoring and control functions, but also many advanced applications, such as interlocking, VQC, and switching sequence management. It supports rich communication protocols including the latest version of IEC61850, IEC60870-5-103, IEC60870-5-101/104, DNP3.0, etc.

System Architecture:

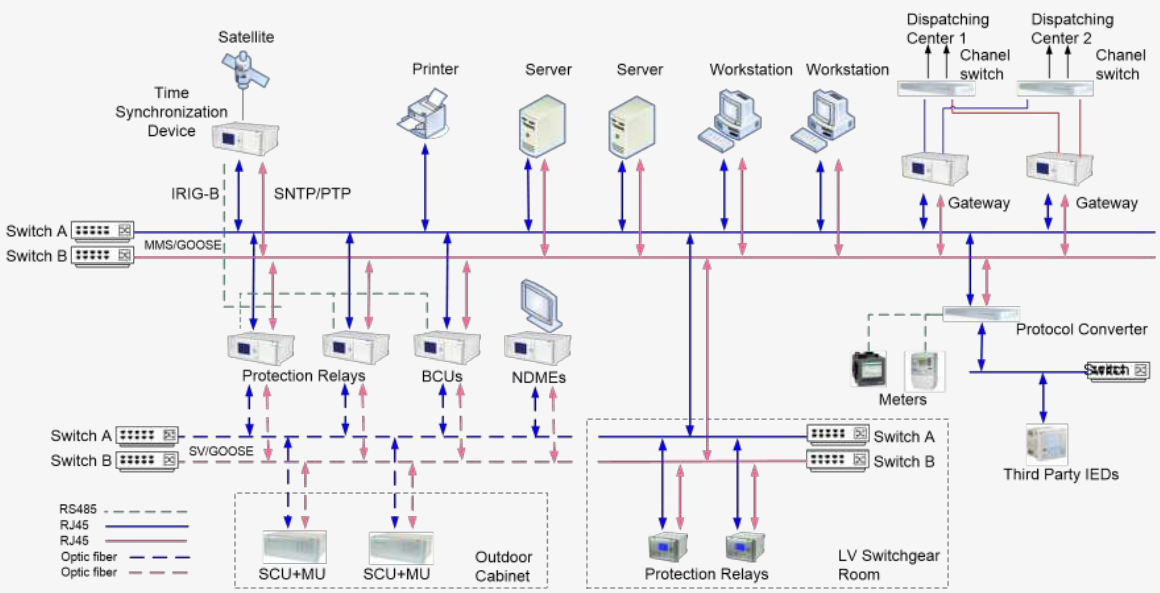
The general SCADA system architecture comprises two primary levels:

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.

For digital substations, the process level and process network will also be provided.

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.



CSC-2000(V2) Typical Architecture

Features:

- Complete hierarchical and distributed architecture makes the system more stable, reliable and efficient.
- System is applicable to mixing platforms with multiple operation systems (Windows/Unix) and multiple hardware systems.
- Redundancy technology is widely used for servers, networks, and gateways to improve system reliability significantly. Different network redundant methods such as PRP, HSR, RSTP, and Dual Lan can be chosen.
- Fully support IEC 61850 and other prevalent communication protocols.
- A user-friendly graphic interface allowing operators to perform their tasks easily, efficiently and directly.
- 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.

Functions:

- Data Acquisitions
- Graphical monitoring
- Smart Control
- Switching Sequence Management
- Interlock logic
- Event and alarm management
- Report management
- Historian
- Protection management function
- Topology analysis and dynamic coloring function
- VQC subsystem
- Real-time and historical trending
- Authentication and authorization management
- Cyber security

Technical Specifications

Integrated tolerance of analogue measurement	⩽ 0.5%
Tolerance of grid frequency measurement	⩽ 0.01 Hz
Maximal quantity of analogue input signal	⩾ 50000, extendable
Maximal quantity of binary input	⩾ 50000, extendable
Maximal quantity of binary output	⩾ 1000, extendable
SOE	⩽ 2ms
Operation accuracy rate	100%
Telecommand success rate	⩾ 99.99%
Telemetry qualification rate	⩾ 98%
Telesignalization accurate rate in fault	⩾ 99%
System availability rate	⩾ 99.8%
Workstation CPU average load rate	
In normal condition (in any 30mins)	⩽ 30%
In power system fault (in10s)	⩽ 50%
Automation system network average load rate	
In normal condition (in any 30mins)	⩽ 30%
In power system fault (in 10s)	⩽ 50%
Post disturbance review	
Before the fault	5 minutes, extendable
After the fault	10 minutes, extendable
System response time	
Telemetry information response time (from terminals to station level)	⩽ 3s
Telemetry exceeding limit transmission time	⩽ 3s
Tele-signalization change response time	⩽ 2s
Control command output time (from generation to output)	⩽ 1s

GATEWAY CSD-1321

CSD-1321 is developed on the SIFANG new generation software platform and hardware platform CSD+, and is mainly used as station level communication management unit in the occasions of substation automation system (SAS), rail transit, new energy, industrial control, etc., with the following typical application scenarios:

- Communicate with dispatch center as a Gateway.
- Used as a protocol converter.
- Used as protection management system (PMS) slave unit.
- Used as distributed RTU, together with CSI-200E.
- Communicate with remote control center as data concentrator, transmit the information of the BMS (Building Management System), ESADS (Electronic Security Access Door System), CCTV, transformer online monitoring system, etc.

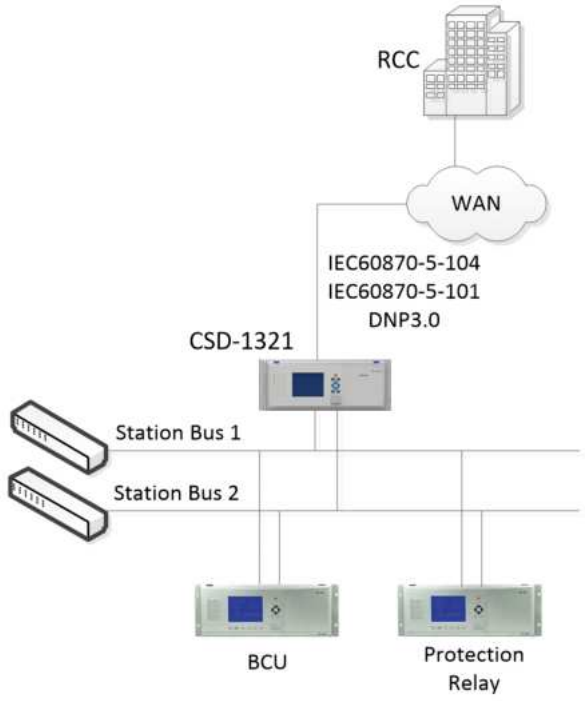
Features:

- 4U height 19 inches width according to IEC 60297-3. Based on SIFANG CSD+ hardware platform with high protection grade: front panel IP54, rear panel IP30, chassis (up, down, left and right) IP30.
- The modules can be plug and pull out from the rear.
- Main module adopts embedded 32-bit dual-core 800MHz processor with 2GB DDR3 memory and 128G SSD (or 480G selectable), no cooling fan, low power consumption.
- Main module is based on embedded real time OS
- Pass EMC test with highest class of IEC 60255.
- Friendly HMI with key and LCD, tools for configuration and debug.
- Distributed architecture, modules are connected through SMBG (smart multi-mode bus group) in the back plate.
- Communication interfaces including Ethernet and serial port can be expanded with modules.
- Support IEC 61850 standard as the station level protocol, also support private protocol like CSC-2000.
- Communicate with RCC via different type of tele-communication protocols, and protocol converter function can also be integrated
- Communicate with PMS master station via protection protocol, such as TCP/IP based IEC 60870-5-103.
- Support time synchronization signal in the mode of SNTP and IRIG-B.

Application:

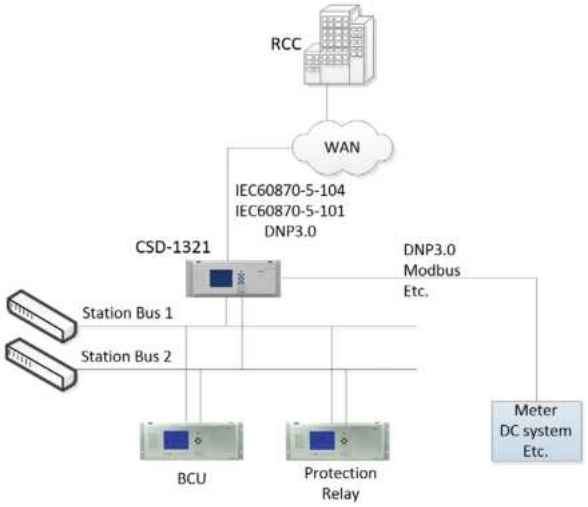
Typical Application 1: Gateway

CSD-1321 communicates with remote control center (RCC) via IEC 60870-5-101, IEC60870-5-104, DNP3.0 and other tele-communication protocols, and communicates with IEDs via IEC61850 and CSC-2000 protocol. The Ethernet network can be redundant.



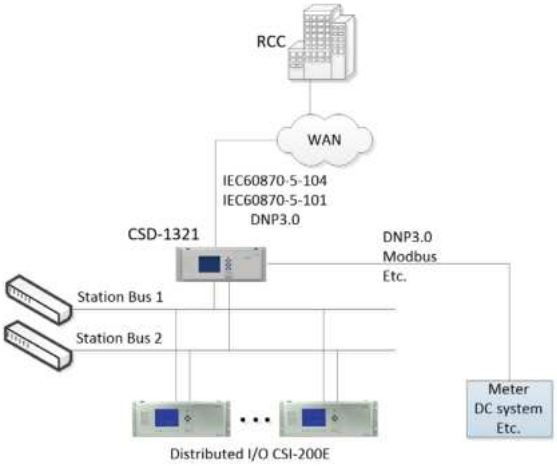
Typical Application 2: Gateway and Protocol Converter

CSD-1321 can be configured as gateway and protocol converter at the same time. The diagram below shows the application case.



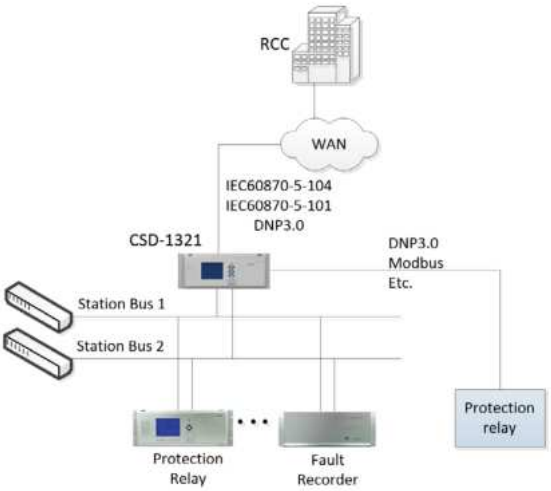
Typical Application 3: Distributed RTU Solution together with distributed I/O CSI-200E

CSD-1321 can provide distributed RTU solution together with SIFANG distributed I/O CSI-200E, this solution is nearly same as the gateway application case, CSD-1321 communicates with RCC via telecontrol protocols and communicate with distributed I/O CSI-200E via IEC 61850 protocol.



Typical Application 4: PMS Slave Station

CSD-1321 can be used as the gateway for PMS slave station which can communicate with PMS master station via protection protocol, such as TCP/IP based IEC 60870-5-103 etc. The DFR can be integrated and the fault wave data can be transferred to PMS master station.



BAY CONTROL UNIT CSI-200E

CSI-200E Bay Control Unit (BCU) is a control and automation device in the applications of substations, power plants and other domains.

CSI-200E offers typical configurations designed for bay-oriented applications, facilitating engineering use. It also allows flexible module customization based on user requirements.

Features:

Flexible configuration

All the modules in CSI-200E are modular designed, connecting through internal bus, and can be plugged-out and installed simply according to the requirements.

The software function can also be configured flexibly. User can operate the configuration tools "AESP" on PC and download the PLC logic diagram to the IED. Bay interlock, synchronization function, on-load tap control and other self-defined logic function can also be achieved.

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

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

Complete event record

Large capacity Flash-ROM is equipped to record fault, alarm, operation and SOE, and data will not lose even when power off, which is convenient for fault analysis.

Powerful communication function

CSI-200E can provide Ethernet interfaces in both electrical and optical, which support protocol IEC 61850.

CSI200E also supports IEC 62439-3 for parallel redundancy protocol e.g. PRP.

Local operation function

Local operation button is designed on the front panel of CSI-200E. In case of emergency, authorized user can directly operate the breakers and switches in SLD on the LCD.

Functions:

SLD (Single Line Diagram) display

SLD can be displayed on the LCD and with the button key the object including CB, DS, ES can be operated. SLD can be configured with the AESP tools.

Telesignalization

Each BI can be configured separately as status input (double input or single input), alarm input, SOE, transformer tap input (BCD or HEX) and so on.

AC measurement

Via AC measurement CSI-200E can calculate the three-phase voltage RMS, three-phase current RMS, 3U0, 3I0, active power, reactive power, power factor, frequency as well as the second to thirteen harmonic.

The functions of CT failure, VT failure, zero sequence over limit alarm, phase sequence inverse alarm are also provided.

Telecontrol

Tele command from local HMI or remote control center via gateway can be accepted by CSI-200E to operate the CB, DS, ES of the bay. The telecontrol function can be interlock by the local button key or PLC interlock logic.

DC measurement

CSI-200E has the function of DC measurement, which is normally used to acquire the signal such as transformer oil temperature, winding temperature, DC bus voltage, and temperature and humidity of intelligent outdoor cabinets.

On-load tap control

The tap position signal (BCD code or HEX code) of primary transform can be collected and submitted. The IED can also respond the telecommand (rise, drop, or stop) from the HMI workstation or RCC to adjust the position of transformer tap.

Synchronization function

Synchronization-close can be implemented in different modes including synchronization-check, energizing check or automatic quasi-synchronization.

Event record and fault record function

CSI-200E can record fault, alarm, operation and SOE, no less than 2000 pcs for each type record.

CSI-200E also has the function of synchronous closing recording, and the recording data can be flexibly configured.

Technical Specifications

Workstation CPU average load rate	
Operating temperature	-40°C - + 70°C (Except LCD)
Storage temperature	-40°C - + 70°C
Relative humidity	5% - 95%
AC current measurement	
Rated current Ir	1/5 A, settable
CT Measuring range	(0.01 ~ 2) Ir
Accuracy	±0.2%
AC voltage measurement	
Rated voltage $V_{r.ph-ph}$	1V~120 V_{ac}, settable
Measuring range of VT V_{ph-e}	0.4V ~ 180V
Accuracy	0.2 level

Other measurement	
Rated frequency	50/60 Hz, settable
Measuring range of frequency	(0.9 ~ 1.1) F_r
Frequency error	0.005Hz
DC current	4mA~20mA
DC current/voltage accuracy	0.2 level
Power measurement accuracy	0.5 level
Measurement with timestamp	⩽ ±10ms
IRIG-B code/pulse synchronization error	＜ 0.5ms
Binary inputs	
Rated voltage $V_{r.aux}$	110/125/220/250 V_{dc}, settable or 24/48Vdc settable
Operating threshold	⩾ 70% $V_{r.aux}$, guarantee operating ⩽ 55% $V_{r.aux}$, guarantee not to operating
Maximum permissible voltage	286V, at $V_{r.aux}$ =110/125/220/250 Vdc 62V, at $V_{r.aux}$ =24/48 Vdc
Output relay	
Maximum contact voltage	250Vdc / 400Vac
Current carrying capacity	5A continuous 30A, 200ms on,15s off
Making capacity	1000W, at Vaux=220Vdc, L/R=40ms
Breaking capacity	30W, at Vaux=220Vdc, L/R=40ms
Auxiliary power	
Rated voltage $V_{r.aux}$	110V to 250$V_{dc/ac}$ 24/48Vdc
Input voltage range	(0.8~1.2) $V_{r.aux}$
Burden for power supply unit	⩽ 45W

TIME SYNCHRONIZATION DEVICE CSC-196

Developed by SIFANG in compliance with Technical Specification for Synchronization System of Power System, the CSC-196 provides high-precision time synchronization signals for power system equipment (e.g., computers, PMUs, protection devices, fault recorders).

Features:

Compliance & Flexibility

Meets Technical Specification for Time Synchronization of Power System.

Supports multiple synchronization modes (basic, master-slave, hot-standby) with expandable output channels.

Multi-Signal Redundancy

Accepts GPS, Beidou-2, IRIG-B (DC), and IEEE-1588 (PTP) signals.

Up to 4 redundant inputs for high reliability.

High Precision

Combines Beidou/GPS timing with advanced algorithms for accuracy <1μs, meeting PMU requirements.

Diverse Outputs

Pulses, IRIG-B, serial interface time message, network messages (SNTP), and IEEE-1588 (PTP).

Support optical fiber, dry contact, RS-422/485, RS-232, Ethernet and other time synchronization signal interface.

Modular & Robust Design

19-inch 4U chassis with configurable modules.

Embedded crystal oscillator maintains <1μs accuracy for 12 hours if external signals fail.

Dual hot-swappable power supplies.

Smart Compensation & Isolation

Adjustable compensation for signal transmission delays (ensures ±1μs output accuracy).

Monitoring & Maintenance

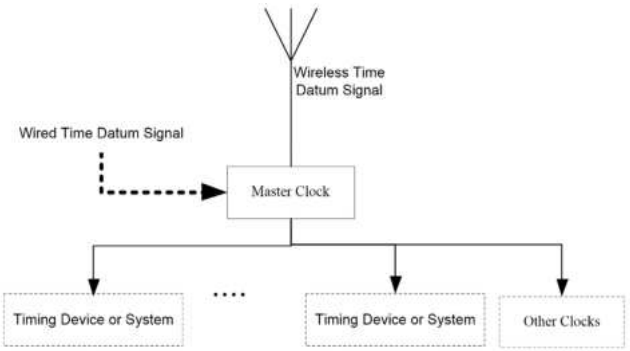
Front-panel status display and Ethernet debug interface for quick fault diagnosis.

Complies with DL/T 860 (MMS reporting) and leap second handling per IEEE C37.118-2005.

Functions:

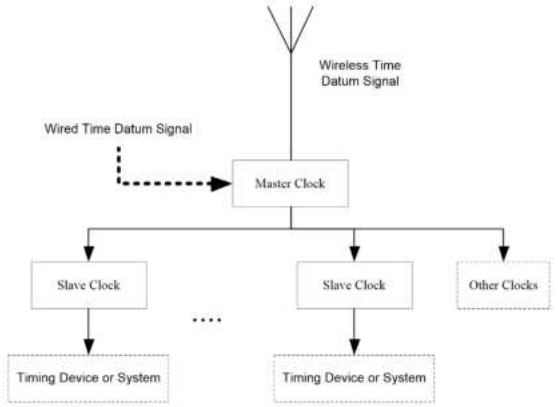
Basic time synchronization system

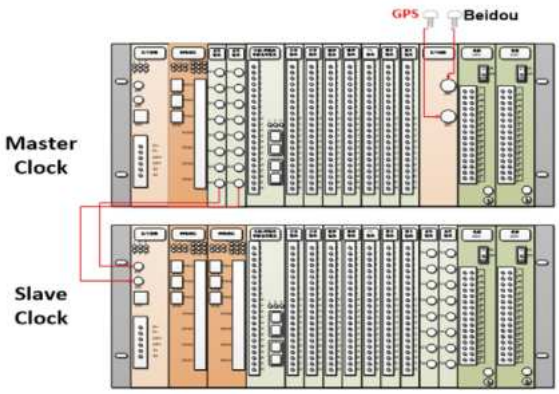
The basic time synchronization system consists of a master clock and a signal transmission medium, serving as a timing device or system (see diagram below).



Master-slave time synchronization system

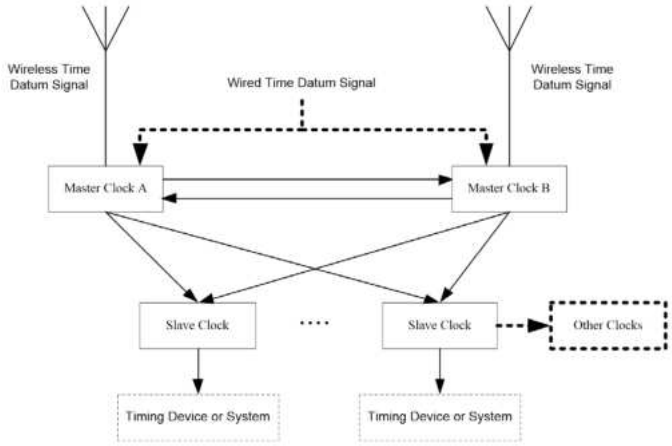
The master-slave time synchronization system consists of: a master clock, multiple slave clocks, and a signal transmission medium.

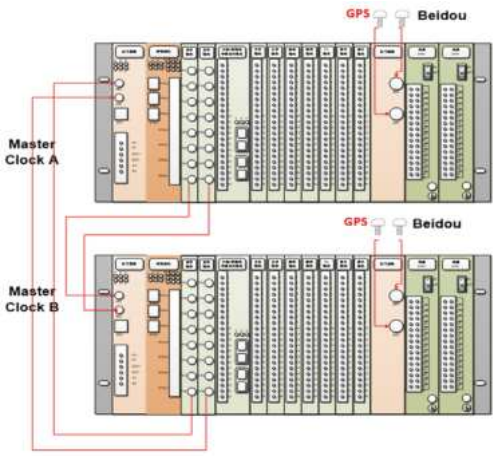




Hot-standby time synchronization system

The hot-standby time synchronization system comprises: two master clocks (operating in main/backup redundancy), multiple slave clocks, signal transmission infrastructure





ETHERNET SWITCH CSD-187CN

The CSD-187CN Series is a high-performance, autonomous, and controllable network switch designed by SIFANG for substation applications. It complies with IEC61850 standards and supports advanced features for power industry scenarios, including automatic configuration, unified management, traffic monitoring, and intelligent alarming.

The CSD-187CN series of substation network switches provide Gigabit Ethernet interfaces, delivering higher data transmission rates to meet the growing demands of equipment communication. The electrical ports default to 100M auto-negotiation but support 1000M operation mode. To enable 1000M, users must configure the port to auto-negotiate at 1000M. The optical ports feature hot-swappable SFP modules, allowing flexible selection of quantity and type based on actual requirements.

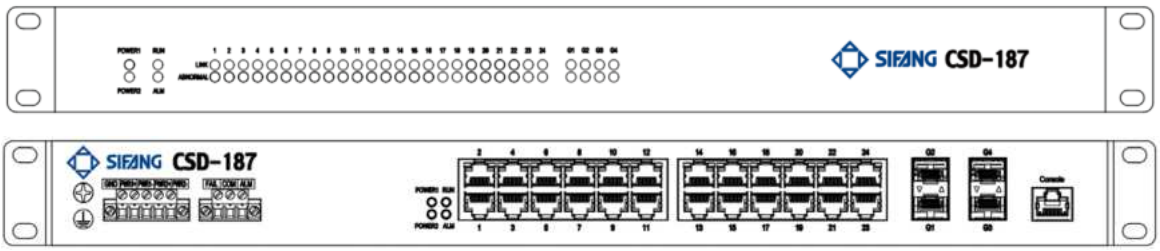
The CSD-187CN series includes the following models

Product Model	Maintenance Port	Service Port			Debugging Port
	RJ45	Electrical Port	100M Optical Port	1000M Optical Port	RJ45
CSD-187CN-Z-E24G4-S	/	1-24[1]	/	G1~G4[2]	1
CSD-187CN-G-F16G4-S	MMS-A/MMS-B	/	1-16	G1~G4[2]	1
CSD-187CN-G-G16-S	MMS-A/MMS-B	/	/	1-16[2]	1

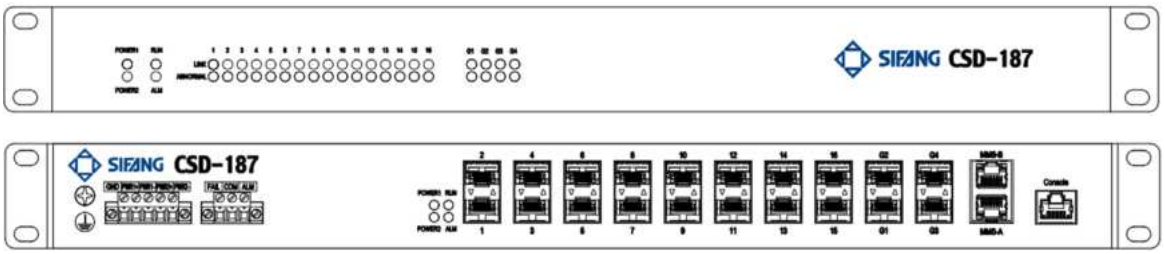
Note:

[1] Default setting is auto-negotiation mode (100M auto-negotiation), and can support 1000M speed by manually configuring the port speed.

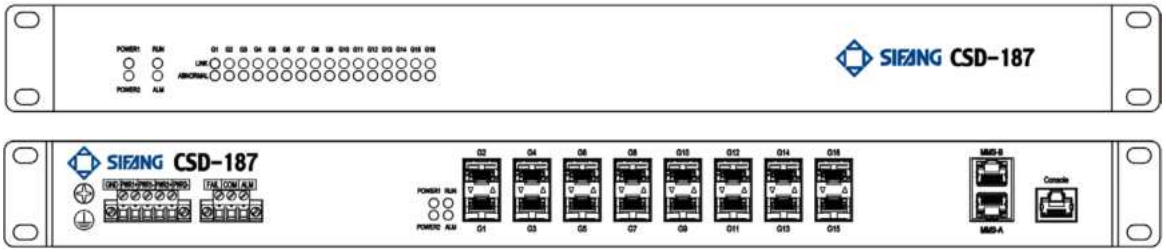
[2] The ports are defaulted to Gigabit optical interfaces and can operate in 100M or Gigabit optical port mode by inserting 100M/Gigabit SFP optical modules, requiring simultaneous port speed configuration to match different speed SFP modules.



CSD-187CN-Z-E24G4-S front view and rear view



CSD-187CN-G-F16G4-S front view and rear view



CSD-187CN-G-G16-S front view and rear view

Features:

Industrial-Grade Design

Operating temperature: -40 ° C to +70 ° C; humidity: 5%–95% (non-condensing).

Redundant dual power supply (AC 220V or DC 110V/220V).

IP40 protection, anti-electromagnetic interference (EMC Level 4 per GB/T 17626).

MTBF ⩾ 200,000 hours.

Network Ports

Electrical Ports: 10/100/1000Mbps auto-negotiation (RJ45).

Optical Ports: SFP slots (100M/1000M, hot-swappable).

Management Ports: MMS-A/MMS-B (RJ45, default IP: 192.168.3.254/192.168.4.254).

Console Port: RJ45 (115200 baud).

Advanced Functions

Auto-Negotiation: Supports speed/duplex auto-negotiation for electrical ports (default: 100M).

VLAN: IEEE 802.1Q (up to 4094 VLANs), port-based VLAN, and PVID configuration.

QoS: IEEE 802.1p priority (8 queues), strict/weighted fair scheduling.

Multicast: Static multicast MAC binding, GMRP dynamic multicast, and storm suppression.

Security: MAC/IP whitelisting, port isolation, SNMPv3 encryption, and user role-based access control.

Reliability: RSTP ring network protocol (<50ms failover), LLDP for topology discovery.

Traffic Control

Flow Control: IEEE 802.3x for full-duplex; broadcast/multicast/unknown unicast storm suppression.

Rate Limiting: Per-port ingress/egress bandwidth control (kbps granularity).

Management

Web GUI: HTTPS-based configuration (default IP: 100.100.100.100).

CLI: Console/SSH access for advanced settings.

SNMP: v1/v2c/v3 support for remote monitoring.

MMS/CMS: IEC 61850-compliant data services (GOOSE/SV support).

Substation-Specific Enhancements

GOOSE/SV Optimization: Hardware-based filtering and rate limiting (2Mbps for GOOSE, 15Mbps for SV).

CSD Offline Configuration: Preload VLANs/multicast via CID/CSD files (IEC 61850 SCL format).

Time Synchronization: SNTP/NTP support (±10ms accuracy).

Robust Security

Role-Based Access: Admin/operator/auditor roles with granular permissions.

Attack Mitigation: Anti-DoS, MAC/IP spoofing prevention, and secure firmware updates.

Monitoring & Diagnostics

Real-time port statistics (errors/drops/throughput).

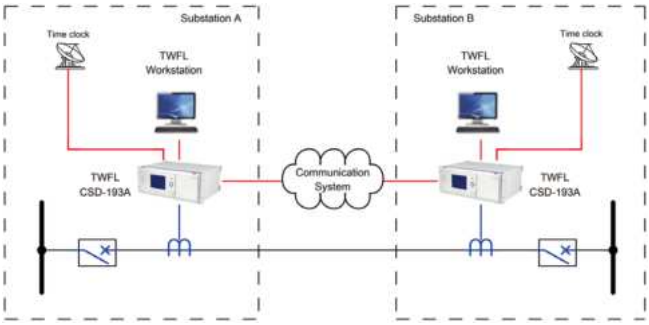
SFP health monitoring (temperature, Tx/Rx power).

Syslog/SNMP traps for alarms (power/temperature/voltage).

FAULT LOCATOR CSD-193A

The CSD-193A Transmission Line Fault Locator integrates two fault location principles, travelling wave and impedance-based methods, combining the reliability of impedance measurement with the high precision of travelling wave detection. This dual-method approach ensures highly accurate and dependable fault location.

Architecture:



Features:

Comprehensive Fault Location Methods

Supports both single-ended and double-ended fault location.

Impedance principle (for reliable distance estimation).

Traveling wave principle (for high-precision detection).

Multi-Line Monitoring

Capable of fault location for 1–4 transmission lines.

High-speed AD sampling with

3.46 MHz (traveling wave signal).

4.8 kHz (power frequency signal).

Large-Capacity Storage & Data Retention

Built-in eMMC storage (⩾ 5,000 fault records).

Non-volatile memory ensures data retention even during power outages.

Enhanced Reliability & Synchronization

Dual-ended sync startup technology: Ensures fault detection even under weak fault conditions.

Self-diagnostic module check for system health monitoring.

Comprehensive Reporting & Logging

Generates operation logs, alarm reports, and fault location records.

Stores up to 2,000 reports with power-loss protection.

Flexible Communication Options

4× electrical Ethernet ports (IEC 61850 / TCP103 for substation automation).

3× configurable optical/electrical Ethernet ports (inter-station communication, and fault locator management station communication).

Precision Time Synchronization

Supports optical & electrical IRIG-B sync (time error <1 μs).

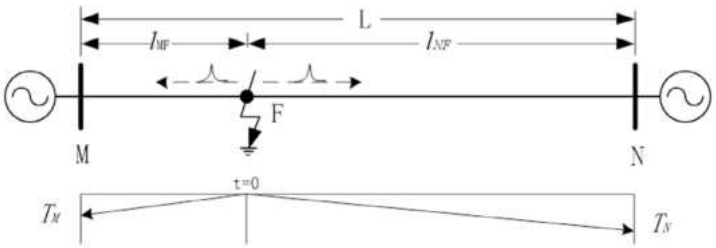
The average error of double terminal fault location is less than 500m

Functions

Description	ANSI code
Double terminal traveling wave principle fault location	FL2TW
Single terminal traveling wave principle fault location	FL1TW
Double terminal impedance principle fault location	FL2Z
Single terminal impedance principle fault location	FL1Z

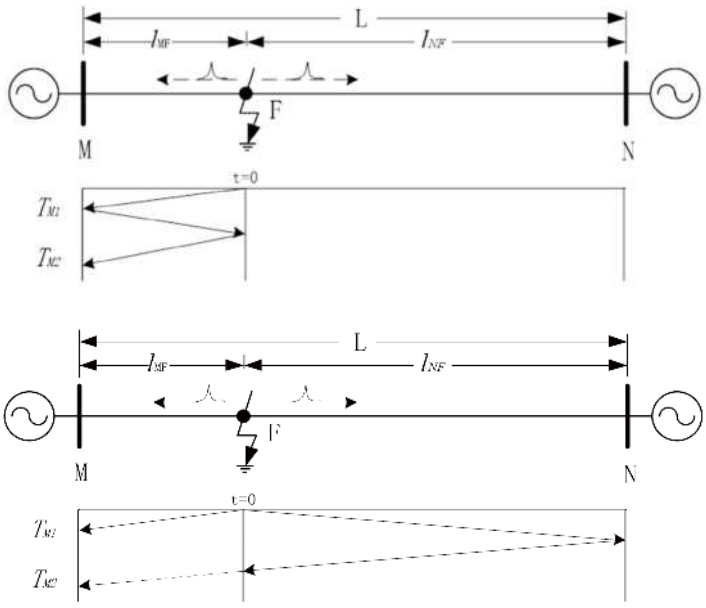
Double-Ended Traveling Wave Fault Location Principle:

The double-ended traveling wave method calculates the fault location by measuring the time difference between the arrival of the initial fault-induced traveling wave at both ends of the transmission line. This method determines the distance from the fault point to each terminal using the absolute time stamps of the detected wavefronts.



Single-Ended Traveling Wave Fault Location Principle:

The single-ended method computes the fault distance based on the time difference between the initial fault traveling wave and its reflected wave detected at the same terminal.



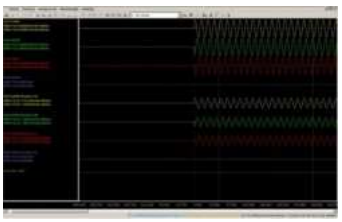
NDME CSGC-SMDS-DG

CSGC-SMDS-DG is a kind of Network Disturbance Monitoring (NDME) and fault-location equipment for 6kV-1000kV power grid. It plays an important role to monitor the operation of protection IEDs, and is able to record the whole process of the fault in detail.

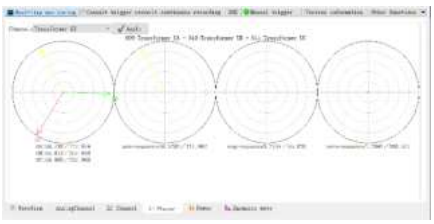
CSGC-SMDS-DG can provide mixable CT&VT inputs / SV (Sampling Value) input, and mixable binary inputs / GOOSE inputs.

When the fault occurs, NDME can record not only the waveform and RMS value of the three-phase current, voltage and zero sequence current, but also the operating action of protection IEDs, and can provide the detailed report of the fault or disturbance, including but not limited:

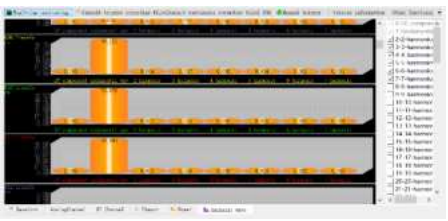
- Fault time.
- Fault type.
- Amplitude and phase of the current and voltage.
- Record the time of the fault or disturbance and the action of the relevant protection IEDs and automation IEDs.
- The whole operating process of tele-protection function, including transmitting time, stopping time.
- The whole operating process of auto reclosing function



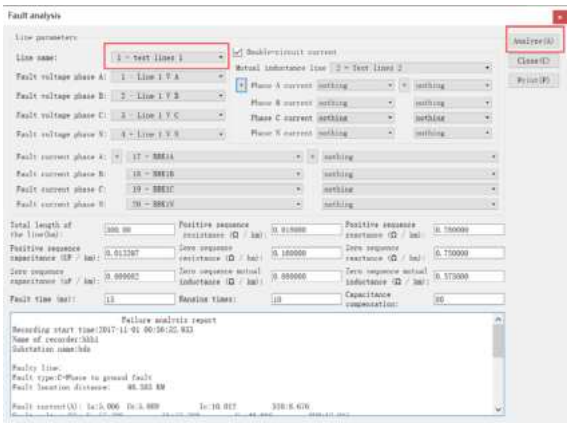
Waveform Analysis



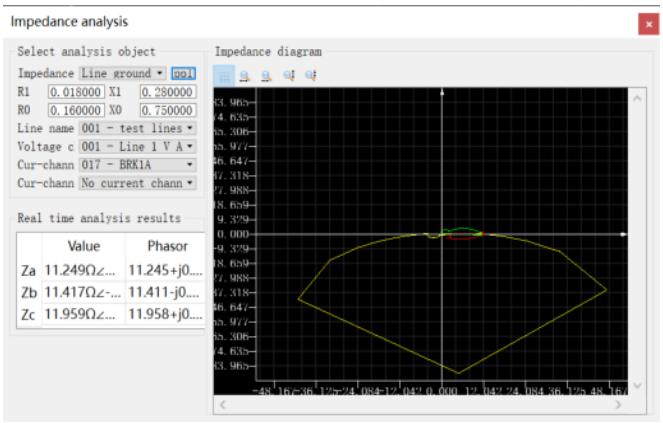
Phasor Analysis



Harmonics Wave



Fault Analysis



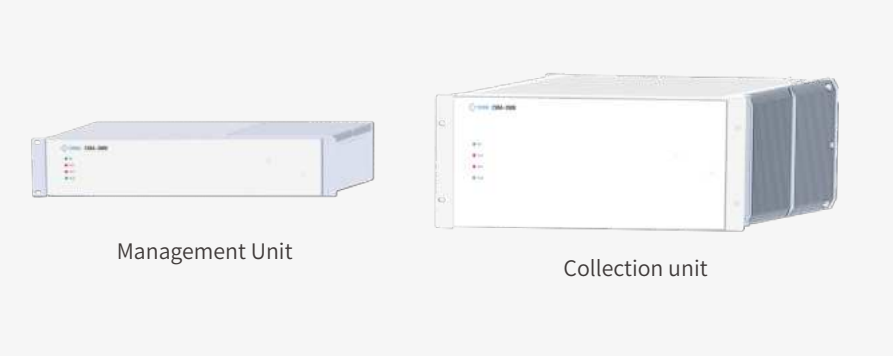
Impedance Analysis

Technical Specifications

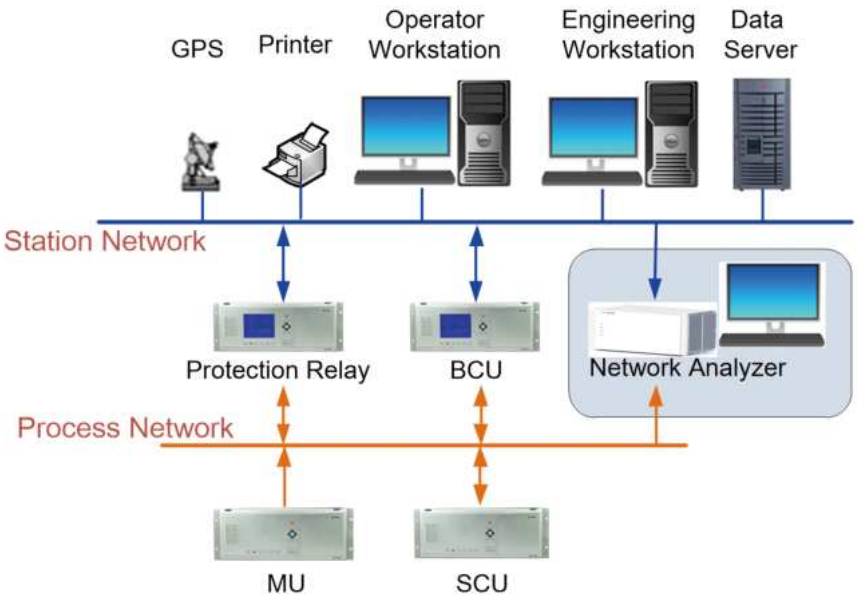
Sampling rate	Trigger Recording: 9600, 12000 /sec @ 60 Hz, selectable. 4000, 9600, 10000,120000, 12800 /sec @ 50 Hz, selectable. Continuous Recording: 1200, 2400 /sec @ 60 Hz, selectable. 1000, 1200,2400, 4000 /sec @ 50 Hz, selectable.
Frequency	50Hz or 60Hz
Accuracy	0.1% on voltage 0.2% on current
A/D Conversion Resolution	16 bits
RAM Memory capacity	2GB minimum
Mass storage	320G minimum, Hard Disk
Time resolution	Records tagged to 1ns
Time synchronization	IRIG B and SNTP
Absolute time precision	<500μs with IRIG-B
Timekeeping accuracy	<500ms with 24-hour timekeeping
NDME construction	Microprocessor based/Numerical
Analogy input	64/96/128 selectable Current or Voltage selectable
Binary input	128/192/320/384 selectable
DC acquisition module	(optional) For 4 DC inputs with one module Up to 16 DC inputs with four modules
GOOSE acquisition module	(optional) For 512 GOOSE channels with 4 GOOSE modules

NETWORK ANALYZER CSRA-2000

The Network Analyzer CSRA-2000 is used to online monitor and record the communication messages of all kinds of protocols in substation communication network, including SV, GOOSE, MMS, IEC104.



Architecture



Management Unit (CSRA-2000-NMU) Functions:

Data Aggregation and Analysis

Collects analysis results from all collection units, performs station-wide communication data statistics and analysis, and uploads results.

Supports retrieval and storage management of recorded files

Real-Time Monitoring and Alarms

Displays the communication link status (normal/abnormal/static configuration) of all station devices, supporting real-time monitoring of MMS, GOOSE, and SV protocols.

Provides alarm functions for anomalies such as device failures, communication interruptions, and model inconsistencies.

Query and Statistics

Supports querying events, statuses, point information, and statistical values by time, device and protocol type, etc.

Statistical dimensions include packet count, byte count, communication interruption frequency, protocol errors, etc.

Packet Analysis Tools

Parses MMS, GOOSE, SV, and other protocol packets, supporting traffic analysis, session statistics, IP-MAC mapping table queries, etc.

Configuration Management

Imports SCD files and configures parameters such as the number of collection units, IP addresses, and storage paths.

Manages user permissions and audits operation logs.

Collection Unit (CSRA-2000-NCU) Functions

Packet Capture and Recording

Uses FPGA hardware for real-time packet capture with timestamping (resolution ⩽ 1μs).

Supports long-term continuous recording: SV/GOOSE/MMS packets ⩾ 7 days (average traffic ⩽ 200Mbps). Storage medium: 4TB hard drive, supports categorized storage.

Online Protocol Parsing

Parses packets at each layer (network layer, protocol layer, application data layer) during communication.

Identifies network anomalies (e.g., traffic spikes, frame loss), protocol errors (e.g., GOOSE StNum inconsistency), and data anomalies.

Performance Specifications

Single-interface capacity: ⩾ 100Mbps (electrical/optical ports).

Long-term stable operation capability: ⩾ 200Mbps (non-SV packets ⩽ 10%).

Supports IRIG-B time synchronization with accuracy <1μs.

Self-Test and Alarms

Features self-reset functionality and monitors hardware status (e.g., CPU, memory, temperature).

Indicates faults/alarms via LEDs and relay outputs (e.g., power loss, storage medium failure).

Technical Specifications

Monitoring interface and access capability

1) Management Unit :

6 10/100/1000M adaptive Ethernet port

Report access capability of a single interface: ⩽ 100Mbps.

2) Collection unit:

8 LC module collection ports, can be configured as optical or electrical ports, and the last 2 support gigabit optical ports;

The maximum reported access capacity of the device during long-term stable operation is ⩽ 250Mbps (25 MUs).

Timing synchronization accuracy

Collection unit: Electric IRIG-B , with a timing accuracy of less than 1us and a 1-hour timing accuracy of less than 1ms;

Management unit: SNTP or electrical IRIG-B, with timing accuracy less than ± 1s.

Data record capability

Capture time resolution<1us;

Continuous recording and storage of SV reports for ⩾ 7 days;

Continuous recording and storage of GOOSE reports for ⩾ 7 days;

Continuous recording and storage of MMS reports for ⩾ 7 days;

Storage of "status" and "event" categories for ⩾ 7 days; "Statistics" storage for ⩾ 3 days;

Reports file recording method: classified storage;

Storage hard disk capacity: 4TB.

Stock Code
601126

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