PRS-7000 Integrated Monitoring System Instruction Manual

CYG SUNRI CO., LTD.

Preface

Introduction

This guide and the relevant operating or service manual documentation for the equipment provide full information on safe handling, commissioning and testing of this equipment.

Documentation for equipment ordered from CYG SUNRI CO., LTD. is dispatched separately from manufactured goods and may not be received at the same time. Therefore this guide is provided to ensure that printed information normally present on equipment is fully understood by the recipient.

Before carrying out any work on the equipment, the user should be familiar with the contents of this manual and must read to the relevant chapters carefully.

This chapter describes the safety precautions recommended when using the equipment. Before installing and using the equipment, this chapter must be thoroughly read and understood.

Health and Safety

The information in this chapter of the equipment documentation is intended to ensure that equipment is properly installed and handled in order to maintain it in a safe condition.

When electrical equipment is in operation, dangerous voltages will be present in certain parts of the equipment. Failure to observe warning notices, incorrect use, or improper use may endanger personnel and equipment and cause personal injury or physical damage.

Before working in the terminal strip area, the equipment must be isolated.

Proper and safe operation of the equipment depends on appropriate shipping and handling, proper storage, installation and commissioning, and on careful operation, maintenance and servicing. For this reason, only qualified personnel may work on or operate the equipment.

Qualified personnel are individuals who:

- Are familiar with the installation, commissioning, and operation of the equipment and of the system to which it is being connected;
- Are able to safely perform switching operations in accordance with accepted safety engineering practices and are authorized to energize and de-energize equipment and to isolate, ground, and label it;
- Are trained in the care and use of safety apparatus in accordance with safety engineering practices;
- Are trained in emergency procedures (first aid).

Instructions and Warnings

The following indicators and standard definitions are used:



DANGER! means that death, severe personal injury and considerable equipment damage will occur if safety precautions are disregarded.



WARNING! means that death, severe personal and considerable equipment damage could occur if safety precautions are disregarded.



CAUTION! means that light personal injury or equipment damage may occur if safety precautions are disregarded.

NOTICE! is particularly applies to damage to device and to resulting damage of the protected equipment.



DANGER!

NEVER allow the current transformer (CT) secondary circuit connected to this equipment to be opened while the primary system is live. Opening the CT circuit will produce a dangerously high voltage.



WARNING!

ONLY qualified personnel should work on or in the vicinity of this device. This personnel **MUST** be familiar with all safety regulations and service procedures described in this manual. During operating of electrical device, certain part of the device is under high voltage. Severe personal injury and significant device damage could result from improper behavior.



WARNING!

Do **NOT** touch the exposed terminals of this device while the power supply is on. The generated high voltage causes death, injury, and device damage.



WARNING!

Thirty seconds is **NECESSARY** for discharging the voltage. Hazardous voltage can be present in the DC circuit just after switching off the DC power supply.



CAUTION!

Earthing

Securely earthed the earthing terminal of the device.



• Operating environment

ONLY use the device within the range of ambient environment and in an environment free of abnormal vibration.

• Ratings

Check the input ratings **BEFORE** applying AC voltage/current and power supply to the device.

• Printed circuit board

Do NOT attach or remove printed circuit board if the device is powered on.

• External circuit

Check the supply voltage used when connecting the device output contacts to external circuits, in order to prevent overheating.

• Connection cable

Carefully handle connection cables without applying excessive force.

NOTICE!

The firmware may be upgraded to add new features or enhance/modify existing features, please **MAKE SURE** that the version of this manual is compatible with the product in your hand.

Copyright © 2017 CYG SUNRI. All rights reserved.

We reserve all rights to this document and to the information contained herein. Improper use in particular reproduction and dissemination to third parties is strictly forbidden except where expressly authorized.

The information in this manual is carefully checked periodically, and necessary corrections will be included in future editions. If nevertheless any errors are detected, suggestions for correction or improvement are greatly appreciated.

We reserve the rights to make technical improvements without notice.

CYG SUNRI CO., LTD.	Tel: +86-400-678-8099
Headquarters: No.13, Keji North 1st Road, North Area of Hi-tech Industral Park, Nanshan District, Shenzhen, China	Website: http://www.sznari.com

 $\label{eq:prod} \mathsf{P/N:}\ \mathsf{ZL}_\mathsf{PRS}\text{-}7000_X_\mathsf{Instruction}\ \mathsf{Manual}_\mathsf{EN}_\mathsf{Overseas}\ \mathsf{General}_X$

Version: 1.03

Table of Contents

Preface	a
Introduction	a
Health and Safety	a
Instructions and Warnings	b
Table of Contents	d
1 Profile	8
1.1 Background description	8
1.2 Technical features	8
1.3 Technical indexs	12
1.3.1 System capacity	12
1.3.2 System response index	12
1.3.3 Reliability index	13
1.3.4 Load rate	13
1.3.5 Working environment and power supply	14
1.3.6 Software version	14
1.3.7 System Hardware Environment	14
1.3.8 System software environment	14
2 Supervisory Control and Data Acquisition System (SCA	ADA) 16
2.1 Profile	16
2.2 Data Acquisition	16
2.2.1 Grid –Running Data Acquisition	16
2.2.2 Equipment Operation Information Acquisition	18
2.2.3 Auxiliary Equipment Data Acquisition	19
2.3 Data Processing	20
2.3.1 Processing of Analog Quantity Data:	20
2.3.2 Status Quantity Data Processing	22
2.3.3 Processing of Electrical energy Data	26
2.4 Event Management	26

CYG

2.4.1 Classification of Event Information	26
2.4.2 Event Alarm Modes	26
2.5 Command Management	27
2.6 Script Calculation	27
2.7 Post Disturbance Review	27
3 Database Configuration	29
3.1 Database management system	29
3.2 Database configuration tool	30
3.2.1 User configuration strategy	31
3.2.2 Database configuration strategy	33
3.2.3 Configuration process	33
3.2.4 Configuration guidance	34
3.2.5 Graphic configuration	39
3.2.6 Basic configuration tool - basiccfgtool	58
3.2.7 Configuration of communication device	89
3.3 Data bus	92
3.3 Data bus3.4 Management module of external communication interfaces	
	92
3.4 Management module of external communication interfaces	92 93
3.4 Management module of external communication interfaces 4 On-line Operations	92 93 93
 3.4 Management module of external communication interfaces 4 On-line Operations 4.1 System console 	92 93 93
 3.4 Management module of external communication interfaces 4 On-line Operations	92 93 93 93 93
 3.4 Management module of external communication interfaces 4 On-line Operations	92 93 93 93 93 97
 3.4 Management module of external communication interfaces 4 On-line Operations	
 3.4 Management module of external communication interfaces 4 On-line Operations	92 93 93 93 93 97 97 97
 3.4 Management module of external communication interfaces 4 On-line Operations	
 3.4 Management module of external communication interfaces 4 On-line Operations	
 3.4 Management module of external communication interfaces 4 On-line Operations	
3.4 Management module of external communication interfaces 4 On-line Operations 4.1 System console 4.1.1 Overview 4.1.2 Instructions 4.2 HMI monitoring 4.2.1 Overview 4.2.2 Panoramic data display. 4.2.3 Instructions 4.3.1 Overview	

4.4 Report system	120
4.4.1 Report type	120
4.4.2 Report edit	123
4.4.3 Report display	123
4.4.4 Report print	124
4.5 Anti-maloperation blocking	124
4.5.1 Overview	124
4.5.2 Anti-maloperation blocking mode	125
4.5.3 Independent anti-maloperation mode	126
4.6 Setting operation management	126
4.7 Control of voltage and reactive power	128
4.7.1 Overview	128
4.7.2 Operating principle	129
4.7.3 VQC configuration tool vqccfgtool	145
4.7.4 Setting value and parameter list	162
4.7.5 Mode of connection	167
4.8 Alarm window application	168
4.8.1 Overview	168
4.8.2 Main functions	169
4.9 Description of fault analysis software	174
4.9.1 Overview	174
4.9.2 Analysis function	174
4.9.3 Security mechanism	
5 Installation	
5.1 Installation steps	182
5.2 Configuration Check	184
6 Common Configuration Maintenance	
6.1 How to Add New bays?	185
6.1.1 Database Backup	
6.1.2 Modification of Graph Configuration	

8 Manual Version History2	241
7 Appendix2	241
6.3 Where to Save "PrtScn" Screen Shot Files	240
6.2.2 Modification of CT Ratio	.238
6.2.1 odification of Bay Names	.232
6.2 How to Modify Bay Names and CT Ratio?	232
6.1.6 Restart Monitoring Program	.231
6.1.5 Exit the Monitoring System	.230
6.1.4 Once-Again Modification on Graph Configuration	.219
6.1.3 Modification of Basic Configuration Tools	.208

1 Profile

1.1 Background description

PRS-7000 integrated monitoring system is a monitoring operating system self-designed and deeply-developed by CYG SUNRI based on SAS research achievements and field operating experience for many years. PRS-7000 is designed by integration of the advanced distributed-type network technology, object-oriented database technology and cross-platform visualization technology, fully complied with multiple international standards (IEC60870-5-103, IEC-61850 etc.). Adhere to the basic requirements for station information digitalization, communication platform networking and information sharing standardization, PRS-7000 can achieve unified access, storage and display of information in the whole station through system integration opimization. Besides, other functions can be realized, e.g. operational monitoring, operation and control, integrated analysis of information, record analysis, operating management, auxiliary application etc. PRS-7000 integrated monitoring system can also be applied to human-machine interface systems of general substation, digital substation, power plant etc.

PRS-7000 integrated monitoring system adopts distributed-type and extensible system frameworks, which can be applied to various system structures. The application program and database can be flexibly configured in each computer node, and no modification of application program is required. PRS-7000 integrated monitoring system can be installed in a computer with different operating systems, e.g. Linux, Windows, and Unix. The system is easy to be extended to user demands, which can meet requirements from users in aspects of system flexibility and extendibility to the greatest extent.

This product is suitable for:

Electric system

Traditional substation, power station (hydropower station, thermal power plant and wind-power or PV new energy substation), and digital substation of different voltage levels;

• Other systems

Metro system, light rail system, electrified railway system;

Other industrial automation applications: mine, petrochemical industry, metallurgy etc.

1.2 Technical features

PRS-7000 integrated monitoring system provides a development platform which can meet various monitoring demands for intelligent substations. The main platform module includes data configuration (modeling) tool, database system supporting dynamic model, communication unit configuration tool, graphic configuration, communication protocol processing module, data bus module, system function redundant control module, statistical calculation, SCADA module, etc. which are designed crossing the Unix/Linux/Windows operating system platform.

Main technical features of the PRS-7000 integrated monitoring system are shown as follows:

- 1. The system is crossing multiple software and hardware platforms with great extendibility.
- 2. Based on the 64-bit system programming, multiple processes and multiple threading modes, the system reasonably utilizes the 64-bit system resources and dispatching model, and guarantees the reliability and timeliness of the monitoring system.
- 3. Unified data configuration modeling
- As a data platform applied to the substation, PRS-7000 integrated monitoring system adopts the dynamic modeling mode to conveniently build data models of various application in the system, and save in the commercial database by using the unified configuration tool. The real-time database adopts the method of resident memory, so each data object has an overall object index number, and the hierarchical index relation between objects is kept by each data object. All application programs at the platform can save the hierarchical relations between all data models and data objects through the unified data interface, so that all application data can be integrated seamlessly.
- The unified configuration tool can be used to configure different application information related to the various data sheets in the system database, including adding, deleting and modifying various data models, etc.
- The unified configuration tool can transform engineering data, and can transform engineering data of low version to the new system engineering data;
- On-line modification and easy maintenance for all data models and graphic pictures in the database can be realized.
- 4. Dynamically extensible communication protocol management
- The system communication management unit supports dynamic extension methods of communication protocol. For the new external communication unit, the new protocol analysis shall be opened, and the protocol configuration item shall be added to the database.
- The communication protocol management module is separated from the real-time monitoring module. The interactive interface of them is unified, which can prevent any unsafe information from violating the system; the extension of external communication protocol will not impact normal operation of the real-time monitoring module with its great extendibility.
- 5. Organic unification between IEC60870-5-103 and IEC61850
- IEC60870-5-103 is a main communication standard applied to most of the substations at present. IEC61850 is the latest seamless communication standard for substations, which will be the dominant communication standard in the future with its wide application, but the new and old equipment will be applied to the substation automation systems at the same time over a period of time.
- During the design and development of PRS-7000 integrated monitoring system, co-existence

of the aforementioned two standards is considered. Besides, supports of the two standards in aspects of database, communication management, signal processing are all realized.

- 6. Graphic system unrelated to application
- Based on MVC framework, the graphic interface subsystem separates the view display (V) and specific application model (M). The application controller (C) is applied to interpret all information and operating instructions of the system and control the output results displayed by the view, which can maintain the conformity between application model and view display and cut down differences between all kinds of application models (M). Separation between view and application business brings low coupling and high extensibility to the system, so the system can be conveniently applied to the thermal power plants, wind power plants, PV power plants, substations, etc.
- The graphic system supports some standard graphic formats (SVG, CIM/G, etc), with good interaction.
- 7. Integrated Anti-maloperation technology
- Based on the system control rule settings of the script engine, flexible and professional bay anti-maloperation configuration, and the built-in operating order management module, the system can realize integrated anti-maloperation blocking functions;
- The microcomputer anti-maloperation system and SCADA systems have the unified data bus. The anti-maloperation module acquires data from the same real-time database which provides data for other application modules in SCADA systems;
- The microcomputer anti-maloperation system and SCADA systems have the unified database configuration. The anti-maloperation data directly selects measuring points from automation data and edits anti-maloperation attributes, including close/open rule, operational terms, etc;
- The microcomputer anti-maloperation system and SCADA systems have the unified graph editing. The graphic picture of automation system can be directly used as that of anti-maloperation system;
- The microcomputer anti-maloperation system and the bay-layer measuring and control device share the rule base. Equipment on bay-layer can judge the blocking conditions of current interval, and realize mutually blocking between cross-bay equipment.
- 8. Protection management integrated technology
- The monitoring system and protection management system adopt the unified modeling tool, graphic configuration and database, achieving integration of configuration;
- Setting calling, setting modification, setting section switching, setting inspection and other functions are possessed by the monitoring host;
- The monitoring host realizes the fault record acquiring function. The acquired fault record is



stored in the data server to be provided for data gateway device;

- The monitoring hose realizes on/off function of the soft switch.
- 9. Load sharing and redundancy technology

61850 client adopts multiple backup redundancy mode. When fatal error occurs to the process providing 61850 client services and related service cannot be provided further, or the machine providing services are under high load for a long time, 61850 client in other machines will apply for providing primary services to the system management and service program. The primary services will select and set the suitable services to master server according to the queuing strategy. By overall consideration of system information of the work station, including system information, CPU usage information, memory usage information, disk usage information, disk occupancy information, network card usage information, etc, the work station under the lightest load will be selected to provide 61850 client primary services.

Based on the multiple backup redundancy, combined with rational consideration of load of workstations providing services, this technology can effectively avoid the overload condition of some workstations and guarantee the overall stability of the system.

10. Flexible networking mode

- The background networking mode of the system is flexible; the master-slave server mode and dual-single network mode can be selected as required; number of network nodes can be added or deleted flexibly; the specialized LAN management module and WAN WEB interface management module provide multiple system network functions;
- Data can be synchronized between multiple systems.
- The system background is designed with the soft-bus technology "SoftBus", ensuring the stable access of each functional module.
- 11. Powerful script calculation function
- The powerful embedded script engine and operating machine are easy to use, which can achieve a variety of calculation signal expression and complex operating and control rules logic configuration;
- Analog quantity, status quantity and metering quantity can be calculated.
- 12. Complete simulation commissioning tool
- The system provides the specialized communication commissioning tool to simulate data generating tool, build internal diagnosis and maintenance module to maintain reliable operation of the monitoring system;
- The system contains complete communication message monitoring tool, which facilitates checking and positioning of communication problems and improves commissioning efficiency;
- The system provides the remote browsing and alarming direct transmission simulation master

station tools, which makes remote browsing and field commissioning of alarming direct transmission easy.

1.3 Technical indexs

The system indexes mainly contain the following aspects: system capacity, system response index, reliability index, load rate, working environment, power supply, etc, which all meet technical requirements for integrated monitoring system, as shown in the following table:

1.3.1 System capacity

No.		ltem	Unit	System Capacity
		Analog quantity	Sample point	≥50000
1	Capacity of real-time	Status value	Sample point	≥100000
1	database	Remote control	Sample point	≥10000
		Calculated quantity	Sample point	≥2000
		Historical curve sampling interval	min	1∼30 (Adjustable)
2	Storage capacity of historical database	Historical trend curve, storage duration of daily report, monthly report and annual report	year	≥2
		Number of historical trend curves	PCS.	≥300
3	Synchronous vector storage	Continuous recording time	day	≥14

Table 1.3.1 System Capacity Index

1.3.2 System response index

Table 1.3.2 System Response Index

No.	lte	Unit	System Capacity	
	Station layer		ms	≤2
1	Event sequence record resolution (SOE)	bay layer measuring and control unit	ms	≤1
2	Over deadband transmission time of analog quantity (to station layer)		S	≤2
3	Status value change trans	mission time(to station layer)	S	≤1
4	Response time of analog information (from I/O input terminal to remote communication device output)		S	≤3
5	Status quantity change response time (from I/O input end to remote communication device outlet)		S	≤2
6	Time from generating to outputting of control execution command		S	≤1
7	Picture response		S	≤1
8	Image refreshing period		S	≤1
9	Scada master-slave switching time		S	≤10

CYG

1.3.3 Reliability index

No.	Item			System Capacity
1	Measuring error of current, voltage			≤0.2
2	Measuring error of active	power and reactive power	%	≤0.5
3	Measuring error	of grid frequency	Hz	≤0.01
4	Over deadband transmission	setting value of analog quantity	%	<0.1 rated value, each point can be adjusted
5	Availability ratio o	f dual-host system	%	≥99.9
6	Response ratio	of remote signal	%	100
7	Accuracy of co	ontrol operation	%	100
8	Mean time between failur	res (MTBF) in station layer	h	≥30000
9	Mean time between failures of bay level measure and control unit			≥30000
10	Mean load rate of CPU in each	Under normal condition (within 30min)	%	≤30
11	workstation	Power system breakdown (within 10s)	%	≤50
12	Mean load rate of network	Under normal condition (within 30min)	%	≤20
13	Mean load fale of helwork	Power system breakdown (within 10s)	%	≤40
14	Time from automatic switching to functional recovery of dual host			≤15
15		Amplitude	%	≤0.2
16	Accuracy of synchronous phase	Phase angle	o	≤0.2
17	P	Time synchronization	μs	≤1
18	Storage of synchronous phase Continuous recording time		day	≥14

Table 1.3.3 System Reliability Index

1.3.4 Load rate

CPU load rate and network mean load rate indexs of the computer are shown as follows:

Table 1.3.4 System Load Rate Index

No.	Item		Unit	System Capacity
1	CPU mean load rate	Under normal condition (within 30min)	%	≤30
2	of each workstation	Power system breakdown (within 10s)	%	≤50
3	network average load	Under normal condition (within 30min)	%	≤20
4	factor	Power system breakdown (within 10s)	%	≤40

1.3.5 Working environment and power supply

Table 1.3.5 System Working Environment and Power Supply Index

No.	Item	Unit	System Capacity	
1	AC voltage	V	176V~264V AC	
2	Cycle	HZ	48Hz~52Hz	
3	Ground resistance	Ω	<0.5Ω	
4	Temperature	°C	≤55°C	
5	Related humidity	%	5%~95%	
6	Ambient environment	None	No explosion hazards, no corrosive gas, no conducting dust, no severe mycete, no violent vibration and impulse source	

1.3.6 Software version

Product Name	Software Name	Version
PRS-7000 Integrated Monitoring System	PRS-7000	V2.20

1.3.7 System Hardware Environment

The selection of each server in the PRS-7000 integrated monitoring system is based on the high-end selection in the industry, and the hardware parameters and performance indicators of the machine are not lower than the parameter indicators required for the server in the technical specifications for intelligent substation construction.

The hardware configuration description is as follows:

No.	Item	Capacity
1	Processor Word Length	≥ 64 bits
2	CPU	≥ 2 sockets (≥ 4 cores/socket)
3	CPU Speed	≥ 2 GHz
4	Memory	≥ 4 GB
5	Graphics Memory	≥ 1 GB
6	Hard Disk (SAS)	≥ 500 GB
7	Number of Ethernet	≥ 4
8	Network Speed	≥ 100/1000 Mbps adaptive
9	Operating System	LINUX or WINDOWS
10	Installation type	Rack-mounted
11	Graphics Cards	Dual Graphics Cards

1.3.8 System software environment

1.3.8.1 operating system

The PRS-7000 integrated monitoring system supports multiple operating systems, mainly including the following:



- ➤ Linux
- ➢ Window

1.3.8.2 System software

The database system can be designated by other commercial databases by the user. The system adopts an object-oriented programming method, adopts Visual C++, GCC, Qt, and JAVA development environments, and uses database configuration tools and reports to generate popular configuration interfaces for window screen output and graphical reports with both text and graphics. The system has excellent features such as modular structural design, flexible and convenient networking method, efficient database access operation, multi process and multi thread mode, etc., making it highly reliable, convenient human-machine interaction operation, high-quality image display, and good scalability.

2 Supervisory Control and Data Acquisition System (SCADA)

2.1 Profile

SCADA kernel is the data processing and function realization core of the whole integrated automation system. SCADA kernel has two working modes (main server SCADA and standby server) according to different topology and role during operation. During operation of SCADA kernel, the network processing layer is loaded to handle transmit-receive of real-time data message, and the configuration information is obtained from configuration database of data server system. In addition, SCADA can realize interaction with real-time database and historical database.

The real-time database describes the collection of monitoring points and management data points of the power automation system with the unit of variable (point). Based on that, PRS-7000 monitoring system real-time database is a collection of monitoring and management points (variables) organized in a certain form. The functions of running monitoring, operation and control, information comprehensive analysis, intelligent warning, auxiliary application, etc are based on the real-time database.

In Client/Server mode, the main server SCADA kernel handles real-time data of the 103/61850 direct-connecting secondary equipment and the front-endprocessor, updating the local real-time database, saving the historical database records into the data server and distributing synchronous data to all client ends and backup servers to main the conformity between real-time and historical data. The front-end processor uploads real-time data.

2.2 Data Acquisition

SCADA system collects grid steady, dynamic and transient data, and running status data of primary, secondary and auxiliary equipment. It can also send all kinds of control commands to IED and auxiliary systems within the station, supporting DL/T860 and accomplishing unified access of data.

2.2.1 Grid – Running Data Acquisition

2.2.1.1 Steady Data Acquisition

The main grid steady running data packages collected include:

No.	Item	Source	
1	Status data acquisition	Positions of feeder, connecting line, bus-bar (section), breaker on side of transformer	
		Positions of capacitor, reactor, breaker on side of transformer	

Table 2.2.1 Grid Steady Running Data

		Positions of bus, feeder, connecting line, and disconnector of main transformer
		Positions of ground switch
		Positions of PT disconnector and bus ground switch
		Positions of main transformer tap, ground switch at neutral point, etc
		Feeder, connecting line, bus-bar (section), current, voltage, active power, reactive power, and power factor on each side of transformer
		Bus voltage, zero-sequence voltage, frequency
		Current of breaker with the 2/3 wiring method
		Electric energy data:
2	Measurement data	a. Active/reactive power on sides of the main transformer
	acquisition	b. Active/reactive power of connecting line and transmission line
		c. Active/reactive power of by-pass switch
		d. Active/reactive power of feeder
		e. Reactive power of compensating capacitor and reactor in parallel
		f. Active/reactive power of transformer for station use
		Statistics, calculated data
3	Grid operating condition information is acquired by measuring and control device	The information source is a primary equipment auxiliary contact, which is directly connected to measuring and control device or intelligent terminal through the cables. The measuring and control device adopts the transmission mode of MMS message, and the intelligent terminal adopts the transmission mode of GOOSE message.
4	Grid operating measurement data is acquired by measuring and control device	The information source is the mutual inductor (output through merging unit)
5	Electric quantity data	The information source is the electric energy metering terminal or electronic watt-hour meter

2.2.1.2 Dynamic Data Acquisition

The grid dynamic operating data acquired is shown as follows:

Table 2.2.2 Grid Dynamic	Operating Data
--------------------------	-----------------------

No.	o. Type Contents	
1	Range of information	Positive-sequence fundamental wave voltage phasor, positive-sequence fundamental wave current phasor of line and bus
		Frequency, change rate of frequency



No.	Туре	Contents	
		Active and reactive calculated quantity	
2	Source of data	The dynamic data is acquired through PMU device; the information source is the mutual inductor (output through merging unit)	
		The acquisition and transmission rate of dynamic data can be adjusted according to control command or grid operation event	

2.2.1.3 Transient Data Acquisition

The grid transient operating data acquired is shown as follows:

No.	Туре	Contents
		Main-transformer protection wave recording data
		Line protection wave recording data Bus protection wave recording data Capacitor/reactor protection wave recording data Switch opening/closing wave recording data
1	Range of information	
		Abnormal measurement wave recording data
2	Source of data	The wave recording data is collected with fault recording device

2.2.2 Equipment Operation Information Acquisition

2.2.2.1 Primary Equipment Data Acquisition

On-line monitoring information of primary equipment acquired is shown as follows:

Table 2.2.4 On-line Monitoring In	nformation of Primary Equipment
-----------------------------------	---------------------------------

No.	Туре	Contents	
	winding, oil level, grounding current of iron core, partial discharge data Gas content in the oil chromatography of transformer Range of GIS, SF6 gas density (pressure) of breaker, partial discharge data, e	Temperature of transformer oil, temperature of winding hot-spot, deformation of winding, oil level, grounding current of iron core, partial discharge data, etc.	
		Gas content in the oil chromatography of transformer	
1		GIS, SF6 gas density (pressure) of breaker, partial discharge data, etc	
		Stroke-time character of breaker, waveform of opening/closing coil current, working status of energy-storage motor, etc.	
		Leakage current, resistance current and action times of arrester	
		Other monitoring data	



2	Source of data	The on-line monitoring device shall upload equipment status information and abnormal warning signal
		The primary equipment on-line monitoring device

2.2.2.2 Secondary Equipment Data Acquisition

Operating status information of secondary equipment acquired is shown as follows:

Table 2.2.5 Operating Status Information of Secondary Equipment

No.	Туре	Contents	
	Range of information	Information about operating condition of device	
		on/off signal of device soft switch	
		Device self-check, blocking and time synchronization status, channel communication status monitoring and alarm signal	
1		Abnormal alarm signal of device SV/GOOSE/MMS link circuit	
1		Control, operating and blocking status signal of measuring and control device	
		Setting value and current setting zone number of protective device	
		Operating status and abnormal alarm signal of network communication equipment	
		Health status diagnosis results and abnormal warning signals of secondary equipment	
2	Source of data	Provided by equipment of station control layer, bay-layer equipment and process-layer equipment	

2.2.3 Auxiliary Equipment Data Acquisition

Operating status information of auxiliary equipment acquired is shown as follows:

Table 2.2.6 Operating Status Information of Auxiliary Equipment

No.	Туре	Contents	
	Range of information		Voltage of DC power supply bus, input voltage/current of battery charger, load current, etc.
			AC/DC input voltage and AC output voltage of inverter, etc.
1			Ambient temperature, humidity, etc.
			density of oxygen or SF_6 in the switch gear room, etc.
			Positions of inlet/outlet switch of AC and DC power supply
			Working condition, abnormal and loss-of-power



No.	Туре	Contents	
			alarm signal of equipment, etc.
			Security, fire protection, entrance guard alarm signals, etc.
			Abnormal alarm signals about environmental monitoring, etc.
2	Source of data	Provided by power supply, security, fire protection, video, entrance guard and environmental monitoring device, etc.	

2.3 Data Processing

SCADA system acquires and processes real-time grid operating data, primary and secondary equipment operating data, auxiliary equipment data in the station, and finally display the data to HMI.

2.3.1 Processing of Analog Quantity Data:

Processing of analog quantity data includes:

2.3.1.1 Conversion and Processing of Analog Quantity Raw Material:

The received original value of analog quantity data is converted and processed according to the scale, ratio and other parameters. Finally, the displayed actual value is in conformity with the actual quantity of engineering.

2.3.1.2 Analog Quantity Calculation:

The calculated quantity measurement measured value can be generated automatically according to related self-defined formula.

2.3.1.3 Manual Number-setting:

Manual number-setting for the analog quantity measured value can be performed. Under the manual number-setting status, the tab can be used to prompt. The analog will recover refreshing after relieving manual number-setting.

2.3.1.4 Zero-drifting Processing:

Zero-drifting range of each analog quantity can be set. When the measured value of analog quantity is within this range, the analog quantity will deem as zero.

2.3.1.5 Jumping Change Data Processing:

No.	Processing mode
1	The jumping change maximum increment of each analog quantity can be set. When the increment between the received measured value and the previous measured value exceeds the limit, current

Table 2.3.1 Jumping Change Data Processing Mode



No.	Processing mode
	measured value shall be abandoned.
2	When the measured value of analog quantity is out of the range of jumping change limit value, the post disturbance review will be triggered to record the data information before and after the jumping change;
	limit value of the jumping change can be set.

2.3.1.6 Judgment of Effectiveness and Rationality of Analog Quantity Data

No.	Judgment model	Criteria	
1	Effectiveness	When communication between the secondary equipment and monitoring system interrupts, corresponding analog quantity status of the secondary equipment will be invalid; when the communication recovers, the analog quantity status will be valid.	
		When the status is invalid, the tab shall be used to prompt.	
2	Rationality	The minimum and maximum rational value of each analog quantity can be set. When the measured value is larger than the maximum value or smaller than the minimum value, the analog quantity status will be invalid, and the tab will be used to prompt; when the measured value recovers to the normal range, the status will be valid.	
		When the analog quantity data does not refresh for a long time, the tab shall be used to prompt. The alarming differential value of not refreshing for a long time and the alarm delay can be set.	

Table 2.3.2 Judgment of Effectiveness and Rationality of Analog Quantity Data

2.3.1.7 Analog Quantity Returns to Zero

When the status quantity information (for example position of breaker) is not corresponding to the analog quantity, alarm will work. For example, when the circuit breaker is open, but the circuit current and power are above zero, alarm signal will be given out.

2.3.1.8 Over limit Monitoring and Alarm of Analog Quantity

Table 2.3.3 Over limit Monitoring and Alarm of Analog Quantity

No.	Contents		
1	Monitoring of analog quantity exceeding upper limit, extremely upper limit, lower limit or extremely lower limit. When the analog quantity exceeds the limit, the "over-limit" alarm will work with the alarm level of "over-limit". The "over-limit" alarm records will be formed and saved into the historical database.		
2	The "over-limit" alarm records include name of analog quantity, "over-limit" type, "over-limit" setting value, measured value, time of "over-limit". A "over-limit" recovery record will generate when the "over-limit" recovers.		



3	The upper limit, extremely upper limit, lower limit and extremely lower limit of each analog quantity can be set.	
4	The "over-limit" alarm should be set with time delay. The time delay can be set	
5	When it is over limit, the multiple-level alarm modes can be adopted: "over-limit" records display, audio alarm, voice alarm, pushing picture, etc.	
6	Over-limit alarm inhibition can be realized.	
7	Over-limit alarm blocking and relief can be realized.	
8	Over-limit dead band of each analog quantity can be set to avoid frequent alarm around the over-limit value.	

2.3.2 Status Quantity Data Processing

The status quantity data processing adopts event driven mode, that is to say when status quantity appears, it will be processed immediately. SCADA system mainly performs the following processing for status quantity data.

2.3.2.1 Judgment of Fault Trip

Judge whether it is the fault tripping or manual open according to total fault signal and breaker operation information. After the breaker trips, the SCADA system will judge whether the total fault signal exists within a certain time period before and after COS of breaker. If the total fault signal exists, the accident trip alarm will work.

2.3.2.2 Manual Statue-setting of Status Quantity Data

No.	Operating mode	Operational contents	
	Manual status-setting	Manual status-setting and manual negating can be performed to status quantity	
1		The tab can be used to prompt when manual status-setting is carried out.	
		Recovery refreshing can be realized. Real-time status quantity can be adopted after recovery refreshing.	
	Manual labeling	Manual labeling can be performed to the primary equipment, including maintance signboard and grounding signboard.	
2		After the equipment is labeled, the behavior property of the signboard will be valid at once, e.g. "prohibit operation", "prohibit alarm", etc.	
		After label of the equipment is removed, the behavior property of the signboard will be invalid at once.	

Table 2.3.4 Manual Statue-setting of Status Quantity Data

2.3.2.3 Judgment of Effectiveness and Rationality of Status Quantity Data

No.	Judgment model	Criteria	
1	Effectiveness	When communication between the secondary equipment and monitoring system interrupts, status of the status quantity send by the secondary equipment will be invalid; when the communication recovers, the analog quantity status will be valid.	
1		When the status is invalid, the invalid tab will be used to prompt. If this status quantity is the position signals of primary equipment, e.g.breaker, disconnector, etc., the remote control of related primary equipment will be blocked.	
2	Rationality	Check for the consistency of the dual-position status quantity of primary equipment. When the dual-position is not consistent, the status of status quantity will be under abnormal status. When the dual-position recovers, it will be under normal status.	
		When it is under abnormal status, abnormal alarm will work, and remote control of related primary equipment will be blocked.	

Table 2.3.5 Judgment of Effectiveness and Rationality of Status Quantity Data

2.3.2.4 Logic Calculating and Processing of Status Quantity Data

No.	Processing mode	Contents processed		
1	Calculation of status quantity	Calculation formula can be edited casually to achieve the calculation functions of status quantity signal.		
		The signal types involved in formula calculation can be status quantity or measured quantity.		
2	Negation	After setting the negation attribute, the status quantity will be negated according to the status quantity raw data, and the actual status quantity will be obtained.		
	Signal synthesis	"And" logic	Through "And" logic, multiple signals will become new signal values	
		"Or" logic	Through "Or" logic, multiple signals will become new signal values	
3		"Exclusive Or" logic	Through "Exclusive Or" logic, multiple signals will become new signal values	
		"Not Exclusive Or" logic	Through "Not Exclusive Or" logic, multiple signals will become new signal values	
		Single points synthesize to dual-point	Synthesize two single-point signals to a dual-point signal according to the sequence of "open position first, and then the closing".	

Table 2.3.6 Logic Calculating and Processing of status quantity data



		Dual-point decomposes into open position	Extract the value of open position signal from the dual-point signal value, and the single-point open position signal will generate.
		Dual-point decomposes into closed position	Extract the value of closing position signal from the dual-point signal value.
		Synthesis of total fault signal	The t total fault signal can be obtained through switch closing and jumping signal calculation; or obtained through protective action signal and switch jumping signal.

2.3.2.5 Anti-maloperationAnti-maloperation Key Assignment

If the monitoring system is configured with integrated anti-maloperation, some primary equipment (e.g. ground wire) whose actual status cannot be collected, the status quantity can be assigned value by using the anti-maloperation key;

The original status of equipment with the value assigned by the anti-maloperation key can be set;

During actual operation, the status quantity of equipment can be refreshed according to the anti-maloperation steps. For example, if current status of the ground wire is open, after the ground wire is closed and the anti-maloperation operation orders have passed back to the monitoring system, the monitoring system will set the status of ground wire as "closed".

2.3.2.6 Processing of Status Quantity Alarm

Table 2.3.7 Processing of Status Quantity Alarm

No.	Processing mode	Contents	
	Alarm keeping	The status	s quantity alarm can be set as closed keeping or open keeping
1		closed keeping	When the status quantity is from "open" to "closed", the COS and SOE will alarm normally. The element will display normally.
			When the status quantity is from "closed" to "open", COS and SOE will alarm normally, but the element will stay in closed position. Meanwhile, the tab is used to prompt that the current status is the closed keeping status.
			Under the closed keeping status, the closed keeping can be removed through operation. And the element will recover to the open position after removal of closed keeping.
		When set as open keeping	When the status quantity is from "closed" to "open", the COS and SOE will alarm normally. The graphic element will display normally.

			 When the status quantity is from "open" to "closed", COS and SOE will alarm normally, but the element will stay in open position. Meanwhile, the tab is used to prompt that the current status is the open keeping status. Under the open keeping status, the open keeping can be removed through operation. And the graphic element will recover to the closed position after removal of openkeeping.
2	Alarm shielding	The COS or SOE alarm can be selected to shield. When the alarm is shielded, the COS or SOE will not be generated whether the status quantity is from "open" to "closed", or from "closed" to "open".	
	Selection of alarm mode	Pushing picture	When alarm generates, the picture will jump to the pre-settingpicture, e.g. when fault occurs, the picture will jump to the sub diagram of the fault bay.
3		Twinkling	When alarm generates, the graphic element related to this status quantity will twinkle
		Annunciator	When alarm generates, annunciator alarm can be available
4	Selection of alarm level	Alarm levels of status quantity can be divided into: fault alarm, abnormal alarm, COS alarm, notification alarm.	
5	Re-alarm	Re-alarm can be set for each status quantity. When the re-alarm is enabled and th status quantity alarm does not recover within the delayed time, re-alarm will work, ar the re-alarm signs will be used to prompt .	
			"Open" or "closed" can be selected to start re-alarm.
6	Calculation of alarm times	Calculation of alarm times can be set for status quantity alarm, e.g. calculation of breaker tripping times etc.	
7	Delayed alarm	Delayed alarm can be set for the status quantity. The alarm will generate after the delayed time from the status quantity signal acts. The delayed time can be set.	

2.3.2.7 Status Quantity Triggers Post Disturbance Review

- When the post disturbance review function is enabled, and the total fault signal acts, the post disturbance review will be triggered automatically to record all signal status within a certain time period before and after the accident;
- 2) The time recorded by post disturbance review and the sampling cycle can be set;
- 3) The post disturbance review can display the picture status, primary equipment status, signal status saved before and after the fault in the form of picture broadcasting so that the fault is easy to trace. The post disturbance review broadcasting can be paused.

2.3.3 Processing of Electrical energy Data

The electrical energy mainly includes pulse electrical energy and micro-computer calculation electrical energy. Processing of electrical energy data is shown in the following table:

No.	Processing mode	Contents
1	Calculation of electrical energy	The calculated value can be obtained by using calculation formula, e.g. the total electrical energy can be calculated according to electrical energy of all lines.
2	Manual number-setting	Electrical energy value can be set manually
3	Judgment	When the communication between the electrical energy collection equipment and the monitoring system interrupts, the values of electrical energy collected by the equipment is invalid; the electrical energy will recover and be valid after the communication becomes normal.

Table 2.3.8 Processing of Electrical energy Data

2.4 Event Management

All information in a timed sequence during operation of the monitoring system will be classified into related alarm event management queue by SCADA.

2.4.1 Classification of Event Information

Event information mainly includes SOE event, COS event, protective operation event, self-check event, measurement over-limit event, operating command event, system information event, intelligent alarm information, etc. All the events will be distributed to the alarm window for real-time and dynamic display. All event information will be stored to the historical database for query.

All events have their own alarm levels. The alarming levels can be divided into: fault, abnormal, COS, over-limit and notification.

2.4.2 Event Alarm Modes

There are multiple displaymodes of event alarm, shown as follows:

No.	Display mode	Contents
1	Information display	Event information will be timely distributed to the alarm display window for display according to different types and levels.
2	Audio alarm	The event information can trigger audio alarm. Different audio documents can be selected according to event information of different types.
3	Voice alarm	The event information can trigger voice alarm. The voice alarm will broadcast specific contents of event. Male or female voice can be selected for voice alarm.

Table 2.4.1 Event Alarming DisplayModes



4	Automatic pushing picture	The event information can trigger pushing picture operation. The picture will automatically jump to the pre-setting picture after the event occurs.				
5	Automatic printing of event	The event information can trigger automatic printing. The event information will drive the printer to print all the contents of event line-by-line.				

2.5 Command Management

After receiving the operation from HMI, SCADA system will manage the commands and form related operating records. The operating records will be distributed to each HMI client. The main command management types are shown as follows:

Table 2.5.1	Types of	Command	Management
-------------	----------	---------	------------

No.	Types of command management
1	Remote-control
2	Sequential control
3	Setting operation
4	Other commands: e.g. manual number-setting, manual negation, clear twinkling, labeling, label removing, VQC adjustment, etc.

2.6 Script Calculation

No.	Contents
1	The monitoring system can not only collect a number of actual measurements, signals and remote pulses, but also calculate and generate calculated quantity signal through script calculation, including calculating measurement, calculating signal and calculating remote pulse.
2	Whether calculating measurement, calculating signal or calculating remote pulse, the signals involved in script calculation can bemeasurement, signal, remote pulse, or system time, remote control (remote close/remote open), etc.
3	The logic symbols used for calculation can be "+", "-", "×", "÷", or ">", "<" , "=" , "≠" , "and", "or" , "no", etc.

2.7 Post Disturbance Review

No.	Contents
1	When the post disturbance review function is enabled and the total fault signal acts, the post disturbance review will be triggered automatically to record all signal status within a certain time period before and after the fault, including analog quantity, status quantity, COS, SOE, protective operation event, protective self-check event, over-limit alarm, command operating records, etc.



No.	Contents					
2	The time recorded by post disturbance review and the sampling cycle can be set.					
3	Specific post disturbance review window is used to display the post disturbance review interface. Thepost disturbance review can display the picture status, primary equipment status, signal status etc. saved before and after the fault in the form of picture broadcasting so that the accident is easy to trace. The post disturbance review broadcasting can be paused.					
4	The fault records can be invoked according to the storage list. After invoking specific faults from the records, the user can enter this fault interface to analyze them. he or she can check the signal and status value and review the operating and monitoring events occurred from the start time to the selected moment.					
5	Fault recording name can be modified by user as required.					

3 Database Configuration

Based on the lasted technology in computer field, PRS-7000 integrated monitoring system has been approved a lot in aspects of scalability, reducibleness, openness, standardization, object orientation and data sharing, thus ensuring that it can easily be expanded, maintained, connected with other systems and can be compatible with other commercial software.

The supporting platform subsystem of this system is mainly composed of database management system, database configuration, communication device configuration, graph configuration, data bus, external communication interface management module, etc.

3.1 Database management system

PRS-7000 integrated monitoring system has very high requirement for real-time performance. So, it has been configured with a set of rapid and complete database management system, so as to meet the requirement of various applications. The database management system has following functions:

- Rapid data access;
- Data organization
- Relation establishment between data;
- Establishment of grid data model;
- Standard access interface.

This system consists of commercial database management and real-time database management systems. The commercial one adopts the currently popular relational database with Client/Server mode. It is mainly used to establish database model, store historical data, save management information, check database consistency and ensure the consistency and completeness. The real-time one adopts the object-oriented design and includes Client/Server and Producer/Consumer modes. It has the extremely fast real-time responsiveness, so as to perfectly meet the requirement for real-time performance of power system. Meanwhile, it is also a network database management system, which can manage all distributed databases distributed on various nodes in network, thus ensuring the flexible configuration and random function combination of system as well as real-time synchronization of distributed databases on all network nodes. The real-time database is of hierarchical and relational structure, which provides clear structure and efficient access. The measuring point model of power grid is described by layer from plant station, to equipment (bay), then to measuring point, which is the typical tree structure. The real-time database still has many other trees and branches, which relate with each other in various forms and ask for extremely high requirement for real-time performance. Therefore, the database structure is designed mainly according to the main line of plant station - equipment - measuring point and in combination of other trees and some pure relational tables, so as to ensure good real-time performance, less disk space occupancy and convenient and efficient query.

These two kinds of databases are uniformly managed by system. They are organically combined together in system to provide the uniform access interface and human-machine interface to users. Besides, the system supports the consistent and complete data in database. In this way, all machines can access all data at any time and the consistent data can be viewed on all machines.

The commercial relational database mainly includes configuration database (basic configuration information & application configuration information) and historical database. The former one mainly stores the configuration data information of system and latter one stores various historical data produced during normal running of system, such as alarm record, operation record and sampling statistical data and so on.

The real-time database is mainly used to realize the real-time storing of real-time data collected by monitoring system, the value of which is updated consistently according to the variation of operational conditions, and always records the current operation status of monitored equipment.

The database can interface with other systems. Furthermore, it is featured with good expandability, thus facilitating the upgrade and update of system.

3.2 Database configuration tool

The database configuration tool, i.e., the database configuration software of PRS-7000 integrated monitoring system, also called as basic configuration tool, configures and establishes model for substation monitoring equipment and protection information in monitoring system. It is incorporated into the basic platform supporting module of monitoring system. Its main function is to provide the modeling tool for configuration and maintenance of monitoring system, thus rapidly and conveniently generating the engineering database required by monitoring system. This tool is featured with friendly configuration software interface, convenient operation, simple steps and user-friendly operation.

The database configuration tool adopts the modular configuration process according to the actual configuration procedure of substation. It strengthens the template concept, adopts simple and clear configuration for channel signal collection and is capable of copying bay, primary equipment and signals, thus avoiding the repetitive configuration. Since users are divided into different classes according to the authorization , this tool still can be used to separately configure the authorization of some user. What's more, it organizes the primary equipment and signals in station according to the hierarchical relation of plant station \rightarrow bay \rightarrow equipment \rightarrow signal. And this tool configures virtual signals and complex control logic rules through the operation expression. The modification content of engineering database will be saved into the memory if the modification is done before selecting "Save" and will be written into the engineering database after selecting "Save".

Because of the complete function of data check in configuration program, the probability of error database configuration is reduced to zero.

The interface of database configuration tool is as shown in following Figure 3.2.1.



Edit View Check Tools Config	Wein					CfgTool							
	0												
ation Tree		Device Name	Model Name	ID	Logic Node	Sequence No.	Bay Affiliate	et A/B Hot Backu	IP of Net A	IP of Net B	Port of Net	A Port of Net	B onnec
ser Manager Configure	4	11Kv#1 box-type protectio-	·· ISA367G5A10···	6	Server	6	#1 box-type	NO	222, 111, 112, 5		2420	0	UDP
atNode Configure nit Nodel Configure	5	11kv#2 box-type protectio-	·· ISA367G5A10····	7	Server	7	#2 box-type	NO	222. 111. 112. 6		2420	0	UDP
ation Configure ICD 11KV SUBSTATION	6	11Kv#1 RMG protection and-	·· ISA367G5A10····	8	Server	8	#1 RHG	NO	222.111.112.7		2420	0	UDP
+ Unit Configure + Voltage	7	11kv#Z RMC protection and-	·· ISA367G5A10····	9	Server	9	#Z RHG	NO	222. 111. 112. 8		2420	0	UDP
PowerTransformer	8	11kv#3 RMG protection and-	·· ISA367G5A10···	10	Server	10	#3 RHG	NO	222.111.112.9		2420	0	UDP
+ Time Sync Dual Terminal	9	11kv#4 RHG protection an-	·· ISA367G5A10···	11	Server	11	#4 RHG	NO	222. 111. 112. 10		2420	0	UDP
puts arm System Parameter	10	11kv#1 Altemate protectio-	·· ISA367G5A10····	12	Server	12	#1 Alternate	NO	222, 111, 112, 11		2420	0	UDP
lculate Configure er Limit Plans	11	11kv#2 Altemate protectio-	·· ISA36705A10···	13	Server	13	#2 Alternate	NO	222. 111. 112. 12		2420	0	UDP
ve-prevention	12	11kv Busbar protection an-	·· ISA367G5A10····	14	Server	14	Busbarl	NO	222, 111, 112, 13		2420	0	UDP
gn Hodel T Config	13	11kv segment prepared fro-	·· ISA358GAV32···	15	Server	15	Busbar1	NO	222, 111, 112, 14		2420	0	UDP
armDirect	14	11kvTH1 protection and co-	·· ISA381GC5A1···	17	Server	4	THI	NO	222. 111. 112. 3		2420	0	UDP
	15	11kvTH2 protection and co-	·· ISA381GC5A1···	18	Server	5	TH2	NO	222.111.112.4		2420	0	UDP
	16	Public monitoring and con-	·· IEC103PRS77···	19	Server	16	Common Bay	NO	222, 111, 112, 15		2420	0	TCP
	17	electric meter 26	SFRDIANBIA01	22	DataGateVay	30	Common Bay	NO			0	0	TCP
	18	electric meter		23	DataGateVay	31	Common Bay	NO			0	0	TCP
	19	electric meter 27	SFRDIANBIA01	24	DataGateVay	32	Common Bay	NO			0	0	TCP
	20	electric meter 28	SFRDIANBIA01	25	DataGateVay	33	Common Bay	NO			0	0	TCP
	•												
	Units												
0	Jutput	Hessage ¥indov									-		
		Occur Time	Туре				essage		Level				
1		7-11-29 14:23:07.006 System			Hain fault signal is not configured Hint								
		7-11-29 14:23:07.006 System			Remote/local cont				Hint				
		7-11-29 14:23:07.006 System		Client frequency analog signal is not configured Hint									
		017-11-29 14,23,07.006 System			Client panel 1 display analog signal is not configured Hint								
		7-11-29 14:23:07.006 System	1		Client panel 2 di	splay analog sig			Hint				

Figure 3.2.1 Database Configuration

3.2.1 User configuration strategy

- 1. The user configuration interface is as shown in Figure 3.2.2.
- Login users can be classified into two types as per their administration authority to user configuration, i.e., system administrator (including: system managers and super users) and non-system administrator (including: maintainers, operators and persons on duty);
- The system administrator can add and delete users and edit basic attributes of users, such as work ID, membership group, duty role, monitoring authorization and anti-maloperation authorization and so on;
- System managers and super users can delete themselves. Non-system administrators only can change their own password;
- All users of each group and duty role have corresponding default monitoring and anti-maloperation authorities. Users can also freely customize the related permission as required when created.

Database Configuration

	User		User
User Name	a	User Name	a
Original Password	Check Pawssword	Original Password	Check Pawssword
Password	×	Password	×
New Password	×	New Password	*
Timeout(min)	480	Timeout(min)	480
1 ♥ SUPERUSER 2 □ opreater 3 □ watcher		USER ROLE 1 Image: SUPERUSER 2 Image: Opreater 3 Image: Watcher	
	Cancel OK		Cancel OK

Figure 3.2.2 User Editing

- 2. The configuration of user authorization is described as follows:
- 1) The user authorization is configured according to following basic principles:
- Distinguish the authorization of equipment. Only specific persons are allowed to operate it;
- Different operators shall have different operation authorization .
- 2) Set different operation authorizations for operators according to different kinds of operation.
- The management of operation authorization includes: login authorization, check setting, change setting, view report, change report, view configuration, change configuration, inverting operation, manually set value, maintain & label, switch on/off, remote control authority of each voltage class, mal-operation authority, sequential control authority and alarm event confirmation, etc.
- Users with super authority can add or delete users and set the authority of other users.
- It is allowed to have multiple users with super authority in system at the same time.
- All users can modify their own password.
- Operators with operation authority can carry out control, manual value setting, labeling ,etc.
- The supervisory personnel shall monitor the control and operation carried out by operators and can enter his/her supervising password on same the machine or on the other one.
- User with protection setting authorization can modify the protection setting value.
- Users with report maintaining authorization can modify and generate reports.



- Users with database maintaining authorization can modify the definition of database.
- Users with operating maintaining authorization can modify the configuration of network node, node function and manually switch the master and slave hosts.
- All authorization modification shall be recorded in details, including modifier, modification time and authorization modified.
- All control operation needs password entering.
- At the time of online operation, related operators shall log in system. Otherwise, the corresponding operation menu will hide automatically and the operation on interface is also forbidden. Such operators also have to log out at the time of shift change.

3.2.2 Database configuration strategy

Users authorization to database configuration depends on users' authorization .

- In case the authorization "View Configuration" or "Change Configuration" is not configured, no database information will be loaded and the database operation function will be prohibited;
- If only "View Configuration" is configured, only database is loaded, the database operation function still prohibited;
- If "Change Configuration" is configured, all database operation prohibited will be available.

	User role	
SUP	ERUSER superuser	
1	Authority	<u> </u>
1	APPLICATION_EXIT	
2	CHANGE_PASSWORD	
3	CFGDATA_VIEW	
4	CFGDATA_MODIFY	

Figure 3.2.3 User Roles

In following instructions, it is assumed that the logged-in user has authorization to "Change Configure".

3.2.3 Configuration process

- The database of new project during installation and debugging is configured as follows:
- Obtain the template file of devices at bay level;
- Configure SCD;
- Generate the basic database of monitoring SCADA based on SCD;
- Configure users;



- Configure partial system parameters;
- Configure network nodes of system;
- Add secondary equipment;
- Add bay and primary equipment;
- Select points from the basic database to form remote measurement, remote signal, remote pulse and remote control library;
- Realize information layering and classification as well as data optimization;
- Configure advanced applications, such as anti-maloperation, sequential control, VQC, intelligent alarm, alarm direct transmission and remote browsing and so on;
- Configure communication device (configuration information needed by data gateway device);
- Configure graphics.

3.2.4 Configuration guidance

If 61850 monitoring station is configured for SCADA, it is necessary to create SCD. It is allowed to import ICD or CID files. The basic configuration tool can be used to import SCD (ICD or CID), 103 or TXT templates of device of other manufacturers.

Configuration process:

- graphcfgtool (graphics configuration tool): based on the bay graphic element of the template
 → drawing the main diagram → create voltage levels → create bay and primary equipment;
- basiccfgtool (basic configuration tool): import SCD to create secondary equipment automatically → carry out the correlation of secondary equipment and bay as well as the remote signal correlation of primary equipment;
- graphcfgtool (graphics configuration tool): draw sub-diagrams → generate four types remote signals on interface → automatically generate the bay sub-diagram of the same type based on typical bay sub-diagram.

3.2.4.1 dbManager

The dbManager (database maintenance tool) is used to import, upgrade or back up databases.



			- 8 ×
🗐 Database Maintenance Tool Database Help			- D X
	× Database name	Database type	Station name
 Database Host List MySQL 			
127.0.0.1		47.	
10.1.101.251			
10.1.101.75			
10.1.101.124 10.1.101.82			
✓ ORACLE			
127.0.0.1			
10.1.101.251			
10.1.101.75			
		N	
		B	
Output Message Window			8 ×
2019-05-29 15:36:38			

Figure 3.2.4 Interface of Database Maintenance Tool

Select the content to be imported into database from the IP list tree on the left side of above figure. The local host address is 127.0.0.1 and database type is mysql. Select 127.0.01 (mys) with mouse left key. Then, click the mouse right key and select "Open" to pop up the dialog of password entering, as shown in the following figure.

Database Help				
[] ₽				
Database Host List	ē ×	Database name	Database type	Station name
 Database Host List MySQL 				
127.0.0.1				
10.1.101.251				
10.1.101.75				
10.1.101.124		📱 Password ? 🗙		
10.1.101.82				
✓ ORACLE		Please input administrator's password:		
127.0.0.1				
10.1.101.251		OK Cancel		
10.1.101.75		OK Cander		

Figure 3.2.5 Login Interface of Database Maintenance Tool

The password to be entered is prs7000.sunroof. Enter the password to open the interface. Then, click the mouse right key again and select "Import database" to import prs7000cfg (configuration database) and prs7000his (historical database) in the path of bin\BaseDB\MySQL. under the SCADA installation directory. Upon the completion of importing, upgrade the database.

NOTICE!

Passwords for database importing and upgrading are both sa, which shall not be changed.

3.2.4.2 prs7000runset

The prs7000runset is used to set system parameters for server.



	PRS70	000 System Settings			
Password					
Password **					
New Password		Confirm Password			
Database Configuration					
Port 3306					
Config Database Name	zhudy	History Database	Name	zhudyhis	
Config Database Username	zhudy	History Database	Username	zhudyhis	
Double Server					
Main Database Server Iwj		Main SCADA Se	rver Iwj		
Slave Database Server		Slave SCADA Se	erver		
VQC Module					
☑ On					
☑ Debug(Man-Settings)					
		Ok Cancel			
Rucon	runsecom	scaua	200	ntoot	30

Figure 3.2.6 Window of System Parameter Setting

The Initial password is 0755isa; the new password must be changed to sa; the port number is fixed to 3306. The configuration database name is consistent with user name of configuration database. The historical database name is also consistent with user name of historical database. For the setting of master database server and master SCADA server, please fill in the server name of the local host. In case of master-slave redundancy host, please check ($\sqrt{}$) the space on the left side of dual-server, as shown in the following figure.

Double Server			
Main Database Server	lwj	Main SCADA Server Iwj	
Slave Database Server	centos	Slave SCADA Server	entos

Figure 3.2.7 Dual-server Setting of System Parameters

For the setting of slave database server and slave SCADA server, please fill in the server name of salve host.

NOTICE!

all database names and user names are lowercase.

3.2.4.3 Graphic Element configuration tool - elementeditor

The graphic element configuration tool can be used to randomly edit elements. All elements are saved in the format of G file. In files, elements can be created, saved, deleted and imported or exported. All imported and exported elements are also in the format of G file. Therefore, if some



elements are multiplexed by several stations, they can be directly imported into other stations from one station.

Edit Alignment Element Help		
▙▋▋\$		
e 🖊 💭 🗔 🔿 T 🔹 🖪 🚺 🖳 🖳 Wide Latin 🗸 14 🗸 🖍 — SolidLine 🔹 — 2 🔹 MoBrush	•	
h Element Browser 🔗 🗙	Properties Browser	6
Graph Element List		
✓ Southern China Grid		
✓ Breaker		
switch		
✓ Disconnector		
Knife gate		
✓ GroundStub		
Temporary ground		
✓ Two-volume transformer		
Two-volume transforme		
✓ Three-volume transformer		
Three-volume transfor		
Three-volume transfor		
Three-volume transfor		
✓ Generator		
generator		
Capacitor		
capacitance		
× Reactor		
Reactance		
Fuse		
✓ Ascoil		
Petersen Coil		
✓ Arrester		
lightning arrester		
v pt		
Voltage transformer		

Figure 3.2.8 Graphic Element Configuration Tool

When creating new element, please select the height and width of new element. The state type number supports 1, 2, 3 and 4. Several kinds of status are set at the time of element drawing. So, the corresponding states also need to be drawn according to the selected type number. Select the element type from the left element list. If the space "Whether color" is checked, it means that the different state color will be displayed when the associated signal state changed. This option can be checked for state value. However, for the primary equipment with electrical attribute, it doesn't need to check this option. Because the coloring of primary equipment is determined by program. Depending on the related specification, different voltages are colored differently.

At the time of creating element, it is necessary to pay attention to the graphic element classification and note that the graphic element name cannot be repetitive.

For the monitoring graphics of new power plant (e.g., wind power plant and photovoltaic power station), the cubical transformer or the small switches of inverter may need to be drawn in the main diagram. In this case, it is feasible to add small switch element in state element and color the element according to field requirement.



Gra	aph	Elen	ment Browser	5	x
~	Gr	aph	Element List		^
	¥	So	uthern China Grid		
		\sim	Breaker		
			switch		
		~	Disconnector		
			Knife gate	N	
		~	GroundStub	2	
			Temporary ground		П
		>	Two-volume transformer		
		>	Three-volume transformer		
		~	Generator		
			generator		
		~	Capacitor		
			capacitance		
		~	Reactor		
			Reactance		
			Fuse		
		~	Ascoil		
			Petersen Coil		
			Arrester		
		~	PT		
			Voltage transformer		
		~	CT		
			Current Transformer		
			Other		
			Device		
			Status		
		~	ElectricLine		
			Outgoing (top)		
			Outgoing (right)		Y

Figure 3.2.9 Graphic Element List

Graphic elements "Others", "Device", "State" and "Ground" can be interpreted as the state element. If the graphic element of primary equipment has to be added, please add the new one in the corresponding classification of primary equipment.

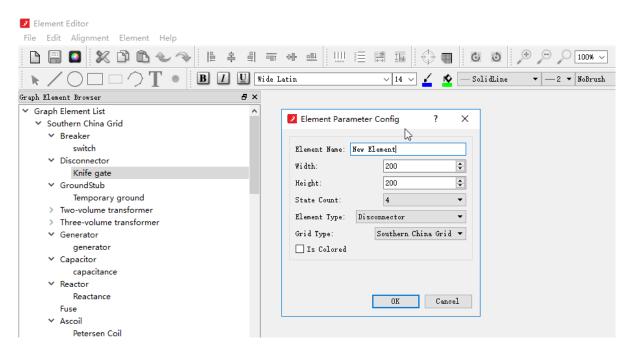


Figure 3.2.10 Configuration of graphic Element Parameters

As for the graphic element of non-primary equipment, if the remote control function has been

configured, it is necessary to change the remote signal sub-type correlated to the element to switch state and make the remote control signal correlate the corresponding remote signal.

3.2.5 Graphic configuration

3.2.5.1 Overview

The graphic configuration and connection configuration of PRS-7000 integrated monitoring system are realized through the graphic configuration software.

As the supporting platform module of monitoring system, this kind of software can provide a application construction platform for monitoring system, by means of which, users can rapidly and flexibly construct a visual application system with friendly interface in the form of "what you see is what you get". Meanwhile, it expands the graphic element control (function unit) to continuously enhance the function and interface performance of system. It flexibly configures graphics (interface unit) to obtain various friendly interfaces, so as to meet the demand of different users. Furthermore, it provides a variety of normative interface templates for monitoring system to assist the engineering personnel to well finish the system configuration.

- 1) This graphic configuration tool provides following functions:
- Draw, copy and cut picture, including index diagram for sub-diagram, main diagram, index diagram for all annunciator, bay diagram, function diagram, system structure diagram, communication monitoring diagram, etc.
- Configure the correlation between signal and graphic element, so as to display the information correlation between primary and secondary equipment;
- Support various display modes, including bar graph, pie graph, trend curve, three-dimensional graph, photo and various indicating instruments, etc.;
- Can generate graphic files of standard SVG format.
- 2) Characteristics of this module:
- The software interface is of MDI style, through which, several pictures can be opened for design at the same time;
- Can add and delete controls in canvas;
- Can edit controls in canvas, including editing the position (move), size (zoom), orientation (rotate), color, style and font of controls and copying and pasting controls;
- Can set the layout of controls in canvas, including alignment and positioning (forward and backward) of controls;
- Can set the attribute in each control through the dialog of attribute provided by each control itself;
- Provide the correlation function between control and monitoring data. In this way, the control can correlate to the monitoring data quantity;



- Can edit controls through mouse and keyboard;
- Can set the canvas size and provide scrolling function when the canvas size exceeds the main window;
- Can zoom in or out canvas for display or operation;
- Can set the SCADA color of canvas;
- Save the diagram configuration result in the form of binary data files;
- Can index diagrams and save the indexing information into files for the purpose of diagram searching at the time of perating monitoring system;
- Can print diagrams;
- Can compile the diagram configuration data and check its correctness and report the statistical information of configuration data;

3.2.5.2 Interface description

The interface of graphic configuration software is composed of title bar, menu, component bar, tool bar, drawing area, information output window, status bar and window list and so on, as shown in Figure 3.2.11.

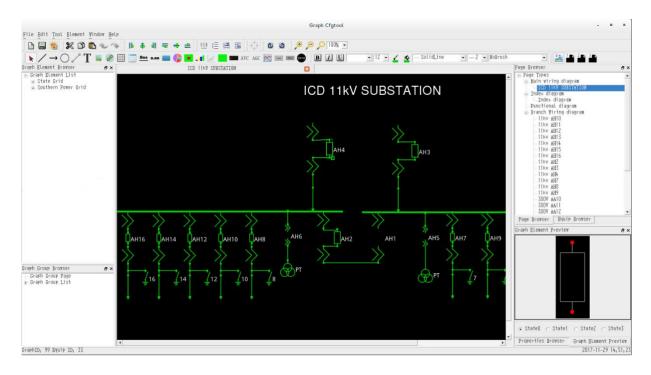


Figure 3.2.11 Main Menu Window of Configuration Graphics Editor

Table 3.2.1 Menu Description

Name	Description
Title bar	display the program module name - drawing configuration tool
Menu bar	when put the mouse is put onto this bar, the displayed



Name	Description
	drop-down box includes operable content
Tool bar	all tools used for graphic plotting, e.g., text, circle and pie graph
	the working area of monitoring graphics, which can be used to
Drawing area	draw various elements and controls and name of current
	monitoring picture
Element browser	the selection area of all equipment elements; can be directly
Element browser	dragged into the drawing area for use
Day template browser	some commonly used bay templates, which facilitate rapid
Bay template browser	drawing
	the drawing browser displays all graphical interfaces; the
Drawing browcor/oguinment browcor	equipment browser includes the primary and secondary
Drawing browser/equipment browser	equipment of all bays under each voltage class; these two
	browsers can be switched to each other
	display the specific attribute of all equipments in attribute
Attribute browser/element browser	browser after clicking all equipments; the element browser
	displays the element shape and status

3.2.5.3 Graphic configuration tool - graphcfgtool

This program is graphic configuration tool. The configuration of current graphic tool is graph-module integrated. That is to say, create the corresponding voltage class, bay and primary equipment during the creation of main diagram, as shown in the following figure.

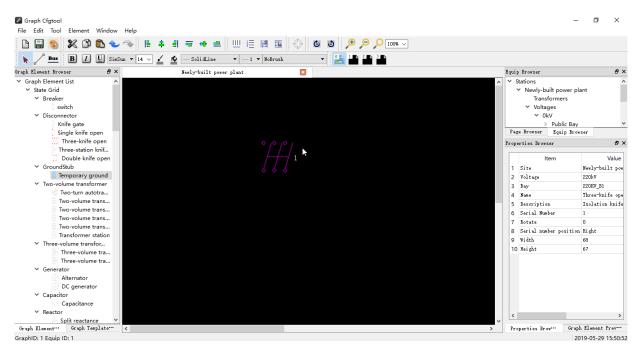


Figure 3.2.12 Window of Graphic Configuration Tool

For the newly create substation, it is feasible to carry out configuration according to the voltage class actually included by the station and manually create the bay under the voltage class node. If one substation has the bay of the same primary equipment, the bay temperate can be prepared to automatically generate multiple bays (see Configuration of Bay Template). When the substation,

voltage class and bay all have been created, please create the main diagram.

	Site	Information	
Basic Info —			
Site Name:	Station		
Description:			
Site RID:			
Area Name:			
Area RID:			
GID:			
Voltage Info)		
🗆 Voltagei		1000k¥	v
🗖 Voltage2		1000kV	v
🗖 Voltage3		1000k¥	Y
		OK	Cancel

Figure 3.2.13 Diagram Dialogue of Station Information Adding

quip Browser		8×
🖻 Stations		
😑 Station		
Transf	formers	
🖃 Voltag		
⊡ OkV		
	Public Bay	
	i Secondary equipment	
Net no		
TIC.0 MC		

Figure 3.2.14 Introduction Interface of Equipment Browser

Draw the primary equipment element and create the actual primary equipment at the same time on the main diagram. For the equipment information, please select the voltage class and bay type under the voltage class; the equipment voltage defaults to the bay voltage class; the equipment name and number are filled in according to the actual name on field. The device ID will be



displayed directly around the primary equipment. Options include Up, Down, Left & Right. The primary equipment element will be automatically colored according to the corresponding equipment class voltage and related specifications.

Notes: when creating the bay of main transformer, it is defaulted to put this bay under the node of the highest voltage class and put the primary equipment at each side of main transformer into transformer bay. However, it is necessary to select the equipment voltage according to the actual voltage class at each side.

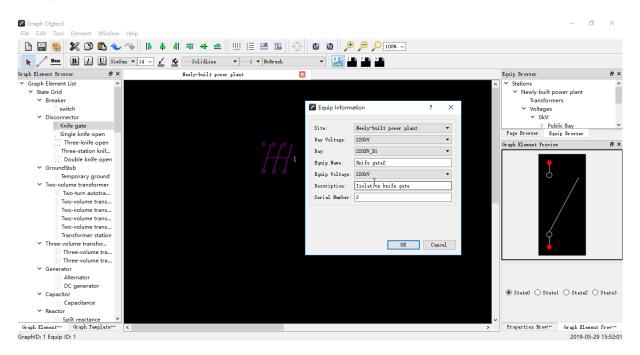
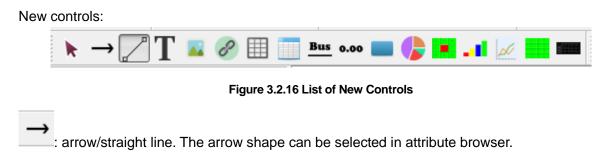


Figure 3.2.15 Equipment Information Diagram





Pro	perties Browser	8 ×
	Item	Value
1	Start point arrow type	None
	End point arrow type	Arrow
3	Related Signal	Click to configure
4	open state color	#00ff00
5	close state color	#ff0000
→		<u>•</u>
Pi Pi	roperties Browser 🛛 Gra	aph Element Preview

Figure 3.2.17 Arrow Line

connecting line. It is used to connect elements in picture. Each element has the connecting point. The connecting line only can connect the connecting point of each element. After using the connecting line, the connecting point (i.e., a red dot) between elements or between element and line can be seen;

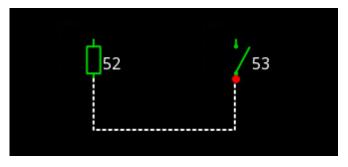


Figure 3.2.18 Connecting Line

When this red dot appears, click the mouse left key to finish the connecting operation. The random dragging of such elements will not result to their connection broken up. Finally, click "File - check topology" in the left upper corner to verify the correctness of connecting point of wiring diagram.

: diagram linking button. It can be used to select the diagram to be linked. The overall remote signal list of annunciators defaults to read the correlated signal of annunciators of the bay diagram, excluding primary equipments, operating handle s and switch status, but supports the manual subscripted switch status and operating handles. The required signal can be configured as per user's requirement. If the remote signal state changing occurs in the picture, it is feasible to trigger the overall annunciators diagram and display the corresponding color according to the actual alarm level.



Bus

	Item	Value
IF	Rotate	0
2 L	LinkPage	-1
5 (Compose Signal ID List	Click to configure
	Display Text	11kv#1 Incoming protection and control dev

Figure 3.2.19 Diagram Linking Attribute

: data table. This table displays remote measurment and remote signal.

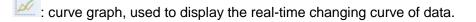
: create the busbar primary equipment.

: dynamic text, which can be used to correlate the remote measurement and remote pulse.

Figure : function key, which can be used to correlate remote regulating, remote control, equipment status and remote signal.

P: pie graph, used to display the occupancy percentage of different data.

Is bar graph, used to display remote measurement and remote pulse in the form of bars.



E VQC region graph, which can be set to standard 9-region graph, 15-region graph, 17-region graph and Shanghai 17-region graph.

word bit chart of VQC blocking information, which can be set to VQC general blocking information graph as well as blocking information graphs of low-voltage bus, medium-voltage bus, capacitor and main transformer.

GOOSE/SV table, which can be used to make GOOSE and SV two-dimensional tables rapidly. After the creation of sub-diagram, click this icon to pop up the following table. For the signal type, select the element to be displayed. Tags similar to Excel form in first row and first column are used to display the device name when dragging the scroll bar vertically or horizontally. The second row and second column display the name of device which can be correlated or be filled in by users themselves. Signals in two-dimensional table can be dragged from the signal list.



Each one correlates to three signals at most. The signal can be dragged out from the list to cancel the correlation. The signal can also be dragged into other space to modify the correlation.

nit name		unit name	atection and cou	ection and con	3	
— 11kv#1 box-type protection and control devic — 11kv#2 box-type protection and control devic		witte traile	11kv#2 Altemate pr	11kv Busbar	J	
	11kv#1 RMG protection and control devices AH11	11kv#1 RMC protection				
11kv#3 RMG protection and control devices AH13 11kv#4 RMG protection and control devices A····	11kv#3 RMG protection and controL devices AH13	11kv#3 RMC protection				
- 11kv#1 Altemate protection and control devic… - 11kv#2 Altemate protection and control devic…	11kv#4 RMG protection and control devices AH14	11kv#4 RMC protection				
11kv Busbar protection and control devices AHZ -11kv segment prepared from the vote device AHZ	4					
- 11kvTM1 protection and control devices AH7 🛄 🔳	5					
electric meter 1 electric meter 27	6					
-electric meter 28 -electric meter 29	7					
electric meter 30 electric meter 31	8					
— electric meter 32 — electric meter 33	9					
_electric meter 34 _electric meter 35 _electric meter 36	10					



> Prepare bay template

Click the template drawing to enter the corresponding interface. The standard template can be drawn according to the primary connection mode on field.

raph Group Browser	8 ×
- Graph Group Page	
Ŧ Graph Group List	

Figure 3.2.21 Bay Template Diagram

Select primary equipment. At the time of creation, for equipment name and equipment number, use @ to substitute different bay numbers of different places. For example, 220kV line has 4 bays. IDs of bay switches are 2201 - 2204 and those of disconnecting switches are 22011 - 22041. When creating the template, the equipment name and equipment ID are respectively @ switch and @. At the time of creating switch, the equipment name and equipment ID are respectively @1 switch and @1.



☑ Graph Cfgtool File Edit Tool Element Window Help	
	🌲 🗐 🖷 🕂 💷 📖 🔚 🌆 🚸 🙆 🔯 🔎 🔎 🔎 🔎
▶ <mark>▶ Bus</mark> B 7 U ▼ 12 ∨] 🖌 🏠 — SolidLine 🔻 — 2 🔻 MoBrush 🔹 🔛 🔛 🏝
Graph Element Browser 🗗 🛪	Newly-built power plant 🛛
✓ Graph Element List	
✓ State Grid	
✓ Breaker	
switch	
✓ Disconnector	
Knife gate	🖉 GraphCfgTool ? 🗙
🛛 Single knife open	
III Three-knife open	name:Three-knife open2
Three-station knif	please input new name:
🔀 Double knife open	
✓ GroundStub	OK Cancel
Temporary ground	
✓ Two-volume transformer	
Two-turn autotra	
Two-volume trans	
Two-volume trans	
Two-volume trans	

Figure 3.2.22 Creation of Switch Template

Upon the completion of template creation, select the right key "Generate bay template". If any modification is required, click the right key on the corresponding template list to modify bay template or equipment name. After modification, select the right key "Generate bay template" to cover the current template drawing or create a new template drawing.

		GraphGroup	Dlg	
@1001	Group Name:	group bay name18		
@1002			OK)ance

Figure 3.2.23 Naming of New Template

Use the bay template to generate bays in batches. Then, drag the bay template into the main diagram to pop up the following dialog, in which, the voltage class, bay name, starting bay ID and ending bay ID (to replace the character @ in template) of created bay. The sequence defaults to from left to right according to from starting bay ID to ending bay ID. The inverted sequence stands for reversed process.



raph Element Browser	Newly-built power plant	Equip Browser
 ✓ Graph Element List ✓ State Grid 		 ∧ Stations ✓ Newly-built power plant
✓ Breaker switch	Bay Information ? ×	Transformers ✓ Voltages
 ✓ Disconnector Knife gate , Single knife open , Three-knife open , Three-station knif , Double knife open > GroundStub 	Site: [Mexly-built power plant v Voltage Level: Bay Nume: Bay Type: Bay v Description: v	 ✓ 0kV > Public Bay ✓ 220kV > 220kV_B1 ✓ Net nodes Server
Temporary ground ✓ Two-volume transformer Two-turn autotra Two-volume trans Two-volume trans Two-volume trans	OK Cancel	Fage Browser Equip Browser Properties Browser Item 1 Site Welly-built power plant 2 Voltage 220kV

Figure 3.2.24 Bays Generated in Batches

After confirmation, fill in the bay name and bay number to be created and select bay creation. If there is no 2202 bay, please uncheck the select box in front of it. In case actual bays are 2201, 2203, 2205 and 2207, please modify the corresponding sequence numbers and bay IDs. Use the bay ID to replace the character @, which can only be digital and cannot be letter or other character. After confirmation, the required bay and primary equipment will be created automatically, with no need to modify the bay name and primary equipment name again.

Graph Group Browser 🛛 🗗 🗙		new	bay
⊢ Graph Group Page ⊨ Graph Group List	Useable	NO	Bay Name
🖵 🌆 group bay name18	1	2201	new bay name1
	2 💌	2202	new bay name2
	3 🖌	2203	new bay name3
	4 🗸	2204	new bay name4
		Previo	ous preview Cancel

Figure 3.2.25 Naming of Bays Generated in Batches

Sub-diagram of connection

Since the primary equipment element only can be generated in the main diagram, the primary equipment in sub-diagram can only be drawn through two methods.

1) After the creation of sub-diagram drawing, copy the primary equipment of the bay from the main diagram to the corresponding sub-diagram.

2) Then, find the bay sub-diagram to be generated on the main diagram and select any primary equipment of the bay. Click the right key "Generate the bay sub-diagram" to create the bay sub-diagram. In this way, the corresponding wiring diagram of primary equipment appears in the bay sub-diagram, as shown in the figure below.





Figure 3.2.26 Generate Bay Sub-diagram

After the generation of sub-diagram, click the blank space in the sub-diagram with right key to generate state value, annunciator, measurement form and other related information, as shown in the figure below.

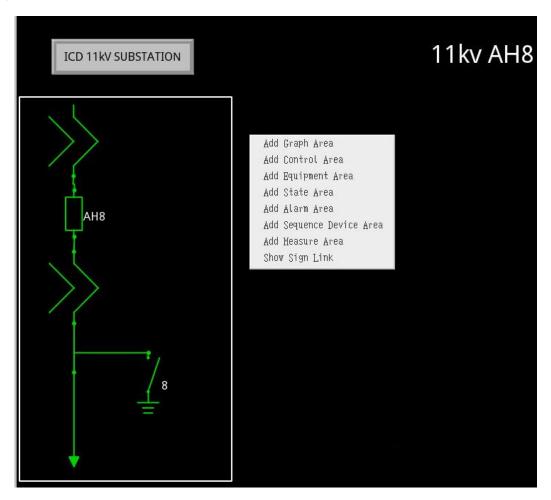


Figure 3.2.27 Add Bay Sub-diagram Information

1) Add wiring diagram: to be used to generate the wiring diagram of primary equipment for some



bay.

2) Add control quantity: not used for the time being.

3) Add equipment quantity: can be used to automatically generate the secondary equipment diagram and network communication state diagram under the bay.

4) Add State Value: can be used to generate the switch, signal light, handle and other state elements. Select the displayed element type. Select the bay to find its corresponding secondary equipment. Drag the signal into the right blank space to realize automatic generation. The column number to be generated can be selected.

AlarmPlate 🕳 软压板		•	Bay P	ublic Bay		_ [Column 1	-		
Name]	D	bay	dev	ice		name		
⊕ electric meter 28 ⊕ electric meter 29		1 554	1 Pub	lic Bay	electric	mete	YX01			
🛓 electric meter 30		2 554	3 Pub	lic Bay	electric	mete	YX03			
electric meter 31 electric meter 32 electric meter 32		3 554	2 Pub	lic Bay	electric	mete	YX02			
. electric meter 33 ⊕ electric meter 34		4 554	4 Pub	lic Bay	electric	mete	YXO4			
⊕ electric meter 35 ⊨ electric meter 36				5		1.0				
- YX01		6								
YXO2 YXO3		7								
electric meter 37 ⊢ YX01	•	8								

Figure 3.2.28 Add State Value Information

5) Add annunciator: can be used to generate annunciator automatically. Select the bay and column number of annunciator to be generated. Then, drag the required signal into the right blank space from left. In case of deletion required, select the corresponding one and click the right key to delete it, or drag the signal out from the right box.

6) Add sequential control area: to be used to automatically generate the device status of the bay corresponding to the sequential control operation, including operation, hot standby, cold standby and maintenance, etc.

7) Add quantity measurement: can be used to automatically generate the remote measurement or remote pulse forms. The remote measurement or remote pulse can be selected as data type. The title can be customized. Drag the required remote measurement to the right side to modify the signal description and unit. It also supports the generation of multi-dimensional table. The row number and column number are both selectable. Drag the required remote measurement into the corresponding table to modify the row name, column name and unit. The number of decimal can be 1-6.



						DataTableDlg			
	CT 50/5	e. ¹²⁷	data type yc 👻 Bay	Pub	ic Bay	▼ Title e t	itle decimal 2 🕂	🗖 Mult	i Tabl
itemname	value	unit							
Ia	00000.00	А	Name	•	ID	bay	device	name	
18	00000.00	<u></u>	⊖ Public monit…		1 515	Public Bay	Public monito	Ual	Ua1
Ib	00000.00	А		-	2 516	Public Bay	Public monito	Ub1	Ub1
Ic	00000.00	А	Uc 1 3U0 1	-	3 517	Public Bay	Public monito	Uc1	Uc1
Ua	00000.00	kV	<mark>Ial</mark> Ibl	-	4 518	Public Bay	Public monito	3U01	300
	000000			-	5 519	Public Bay	Public monito	Ial	Ial



After the form editing, move the mouse onto the form. Click the right key to select "Form modifying" to modify it.

data type yc 👻 Bay Pi	ublic Bay 🔄	- T	itle [C	r 50/5	decimal 🛛 📑 🗆 Multi Table				
Name		-	ID	bay	device	name	desc	unit	
Ual Ubl		1	318	#4 RMG	11kv#4 RMG protection and control	Ia	Ia	A	
Uc1		2	319	拱 RMG	11kv#4 RMG protection and control	Ib	Ib	A	
		3	320	拱 RMG	11kv#4 RMG protection and control	Ic	Ic	A	-
Ib1 Ic1		4	321	拌4 RMG	11kv#4 RMG protection and control	Ua	Ua	k¥	
3I01 Ua2		5	322	井 RMG	11kv#4 RMG protection and control	Ub	Ub	k₩	
- Ub2		6	323	#4 RMG	11kv#4 RMG protection and control	Uc	Uc	k₩	
UC2	<u> </u>	7	777	אזת זיי	Himmed mure medication and control	n	n	1,-107	

Figure 3.2.30 Modify Quantity Measurement Information

8) Element correlated information: can be used to view the primary equipment, State Value, annunciator as well as signal name and ID of quantity measurement. The remote signal correlated to the generated state value and annunciator can be viewed and modified in the attribute browser at right side.



	PrimaryDeviceSelect	յլց		-11kv A - 11kv A	H7		_
Site.	ICD 11KV SUBSTATION	•		<mark>11kv A</mark> 11kv A 380V A	Н9		
Voltage:	10KV	<u> </u>		- 380V A			
Bay:	TM2	•		- 380V A			
Device	List			- 380V A - 380V A			+
AH8 st			Pa	ge Browser	Equip Bro	Wser	
AH8 ha	andcard Saker	P	rOķ	perties Brow	ser		₽×
				It	em	¥alue	
			1	Rotate		0	
				Related Equ		AH breake	r
				Show Serial		Yes	_
				Serial numb	er position	Right TM2	127
			2	Bay		TIVIZ	

Figure 3.2.31 Modify Graphic Element Correlated Information

Upon the completion of one bay sub-diagram, Other bays of the same type can rapidly generate sub-diagrams of other bays based on the finished bay sub-diagram.

Take the following figure for example. The Bay of Changxing Line 1 includes two diagrams, i.e., one bay sub-diagram (including the connection diagram of bay primary equipment) and one protection sub-diagram. The sub-diagram of Changxing Line 2 can be directly generated according to the two finished sub-diagrams of Changxing Line 1. Find the primary equipment of Changxing Line 2 on the main diagram. Select it and click the right key "Generate the bay sub-diagram based on existing bay". Then, fill in the name of generated sub-diagram. After confirmation, select the bay sub-diagram template "Bay Sub-diagram of Changxing Line 1" or "Protection Sub-diagram of Changxing Line 1".

		Page Para	meter Config		
TION	Page Name: 220)kV Chang×ing	line		
	Width:	1920 ÷	Height:	1080	*
	Layer Count:		4		×
	Page Type:		Branch Wiring	diagram	×
АНЗ	Page Color:				
	▼ YK Allow		🔽 YT Allow		
	🔽 Ground YT A	llow			
	🗖 Layer One		🗖 Layer Two		
	🗖 Layer Third		🗖 Layer Four		

Figure 3.2.32 Interface Parameter Configuration Information

In case of the bay sub-diagram to be generated, check "Draw the primary connection diagram"; in case of the protection sub-diagram to be generated, uncheck this option. Then, the dialog of secondary equipment correlation will pop up. Generally, the program will automatically match the secondary equipment of the two bays respectively. However, if any non-corresponding conditions happen, the non-correspondence can be modified manually.

CBay Page CfgDlg		
all cfg select a Page <mark>11kv AH3</mark> ▼		
<pre>viring graph</pre>	graphct Source name	f gtool target name
	1 11kv#1 Incoming protection and control …	11kv#1 Incoming protection and control , ✓
OK Cancel		OK

Figure 3.2.33 Mapping Relationship between Secondary Equipment of Target Bay and Template Bay

Functional diagram

The network structure diagram can be generated automatically.

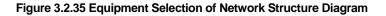
Select "drawing browser" and then "drawing type". Then, click the left key to select "Function diagram". Next, click the right key to "Create picture" to pop up a dialog of "Picture parameter configuration", as shown in the following figure.

Pag	e Parameter Config	Page Browser	₽×
Page Name, Functional	diagram	 ⊨ Page Types ⊕ Main wiring diagram ⊕ Index diagram 	*
Width: 1920		Functional diagram Branch Wiring diagram	
Layer Count:	4		
Page Type:	Functional diagram 🗾		
Page Color:			
▼ YK Allow	▼ YT Allow		
Ground YT Allow	🗖 Layer Two		_
🗆 Layer Third	□ Layer Four	— 11kv AH9 — 220kV Changxing line — 380V AA10	
	977 - Oceanol	3807 AA11 	¥
	OK Cancel	Page Browser Equip Browser	

Figure 3.2.34 Generation of Functional Diagram

Click "OK" to enter the interface of function diagram. click the right key to select "Generate network structure diagram". Select the secondary equipment from the left list. The type of secondary equipment, including protection, measurement and control, can be edited through selecting basic configuration tool - secondary equipment - unit type in turns. The network structure diagram of secondary equipment dragged into the right list can be automatically generated, as shown in the following diagram.

Name		ID	name		
È-Server Protect Devices	1				
Measurement Devices	2				
≟ Communicator ⊨ Protect Devices	3				
- Measurement Devices	4				





Click OK. Then, the network structure diagram generated automatically can be seen, the arrangement of which can be adjusted freely, as shown in the following diagram.

	A		A
l	11kv#2 box-type protection and control devices AH10	11kvTM1 protection and control devices AH7	11kv#2 Incoming protection and
-			

Figure 3.2.36 Generation of Network Structure Diagram

The device name and port element in secondary equipment can also be generated automatically. The setting of device element in element tool can be viewed.

	Pro	operties Browser	
		Item	Value
11kv#3 RMG protection and control devices AH13		Related Device	11kv#3 RMG protection and control devices AH13

Figure 3.2.37 Diagram of port Status

> Index diagram

Select "drawing browser" and then "drawing type". Then, click the left key to select "Index diagram". Next, click the right key to "Create picture" to pop up a dialog of "Canvas parameter configuration", as shown in the following figure.

Pa	ge Parameter Config		Page Browser	₽×
Page Name: Index diag		*	⊨-Page Types ⊨-Main wiring diagram □ ICD 11kV SUBSTATION <u>Index diagram</u> -Functional diagram	_
Layer Count: Page Type: Page Color:	4 Index diagram	•	Branch Wiring diagram	
✓ YK Allow ✓ Ground YT Allow	VT Allow			
Layer One Layer Third	🗖 Layer Two		— 11kv AH7 — 11kv AH8 — 11kv AH9 — 380V AA10	
	OK	Cancel		-

Figure 3.2.38 Generation of Index Diagram

Click "OK" to enter the interface of index diagram. Click the right key to select "Generation of index diagram". Then, linking buttons of all picture will be generated as diagram index, as shown in the figure below.



Figure 3.2.39 Generation of Index Diagram

Picture topological function

This drawing tool has been configured with topological relation at the time of drawing. It is necessary to check whether the topological connection line is correct. The wrong connection line will be marked. Click the file in menu bar. Then, select "Check topology" in the popped-up drop-down menu.



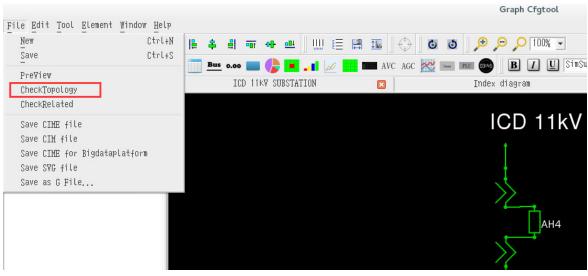


Figure 3.2.40 Check of Topology Diagram

Select the incoming line as the starting point of topology coloring. Set the starting mark of topology coloring of incoming line to "Yes" and correlate the voltage signal Ua of the line. In the HMI, select "configuration" – "operating parameter", then check the picture coloring function in system setting. When Ua>0, color the primary equipment according to the breaker on/off position of the primary equipment and topological connection; when Ua<=0, all primary equipment is displayed with power-loss color (i.e., gray).

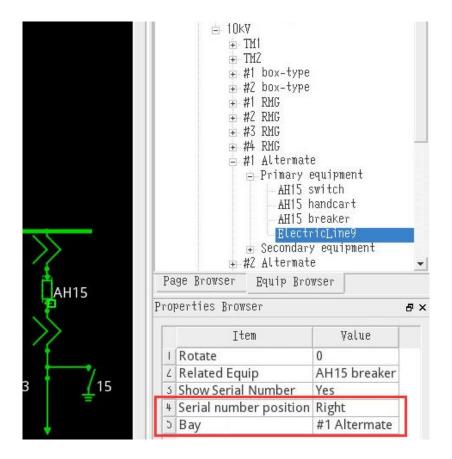


Figure 3.2.41 Setting of Topology Coloring



Tidal current diagram

Click the right key to select "Generate tidal current diagram" on the main diagram. If the breaker is vertically installed, the icon is generated at the right side and the positive direction defaults to from top to bottom. If the breaker is horizontally installed, the icon is generated at the downside and the positive direction defaults to from left to right. The icon position can be adjusted through dragging. The correlation signal defaults to the remote measurement active power of the bay. If the bay doesn't have the active power character P, no signal is correlated and the tidal current icon is red. In this case, it is necessary to intervene the correlation signal manually. The correlation signal of tidal current is active power of the bay.

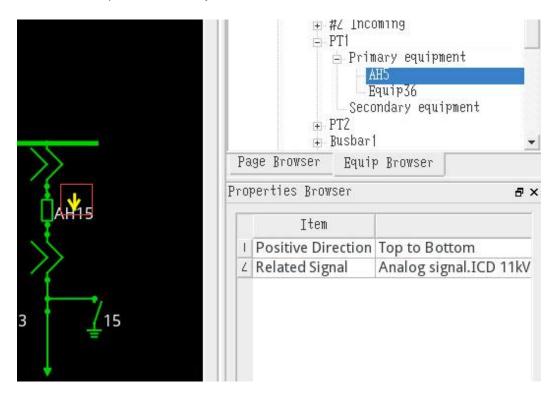


Figure 3.2.42 Generation of Tidal Current Diagram

3.2.6 Basic configuration tool - basiccfgtool

The basic configuration tool is mainly used to provide the configuration and modeling tool for configuration and maintenance of monitoring system, thus rapidly and conveniently generating the engineering database required by monitoring system. There are two kinds of method to open the basic configuration tool.

First method: click the mouse right key in the blank space of desktop to select "Open terminal". Then, enter basiccfgtool and press Enter to pop up the dialog "Login: basic configuration tool".

🧈 Select Data	base	? X
Log	in : Basic Cfgtool	1
Db Server	yuyangwin64	•
DbName	prs7000encfg	Y
User	cygsunri	
Password	•••• <u></u> •••	
	Ok Cancel	

Figure 3.2.43 Login of Basic Configuration Tool

Database server: host name, i.e., server name;

Database: name of configuration database;

User: user name;

Password: password of corresponding user;

The interface of configuration tool will open after entering the user name and password.

CfgTool							-	٥	×
Eile Edit View Check Tools Config		9							
Navigation Tree 🛛 🗗 🗙		Nan			Value				•
System Information Configure User Manager Configure	1	Project Name	ie	Newly-built p					
> NetNode Configure	2	First Service Date		2016-12-20					
 Unit Model Configure Station Configure 	3	Main Fault Signal of TI	ne Station	Not configur	e				
> Inputs	4	Status of Remote Cont	rol of SCADA	Not configur	e				
Alarm System Parameter Calculate Configure	5	Frequency Signal of H	MI	Not configur	e				
Over Limit Plans	6	Signal of HMI Panel1		Not configur	e				
 Five-prevention Sign Model 	7	Signal of HMI Panel2		Not configur	e				
CVT Config > AlarmDirect	8	Status of Remote Cont	rol Signal of Mas	Not configur	e				
Control Link	9	Interval of Getting Wa	ve Recording (mi	3					
	10	Link vedio enable		OFF					
	11	CVT System		OFF					
	12	Fault Diagnosis using I	Low Current	OFF					
	13	VQC enable		OFF					-
	S	ysten	\						
	Outp	it Message Window	5						8:
		Occur Time	Туре			Message	Level		
	1 20	019-05-29 16:10:06.001	System		Dual machine control enable signal is	not configured	Hint		
	2 2	019-05-29 16:10:06.001	System		Client panel 2 display analog signal is	s not configured	Hint		
	3 20	019-05-29 16:10:06.001	Server		The correcting time mode is rejecting	g correcting: -1	Hint		
Search	4 20	019-05-29 16:10:06.001	System		Client panel 1 display analog signal is	s not configured	Hint		

Figure 3.2.44 Introduction of Basic Configuration Tool

1) Menu bar: move mouse to the menu bar to display the specific application; then, select the corresponding application;

2) Tool bar: move mouse to the tool bar to display the specific application; then, select the corresponding application with left key;

3) Navigation tree: all applications of configuration tool are in the navigation tree. For details, please refer to Chapter 3.

- 4) System parameter: the content displayed by default after entering the configuration tool;
- 5) Display the current login user and configuration database;
- 6) System time: display current machine time;

Second method: under the path of /home/PRS7000/bin, double click the icon basiccfgtool, the enter user name and password and click "Log in".

	Select Database	
L	ogin : Basic Cfgtool	
Db Server	lwj -	basiccfgtool
DbName	zhudy	
User		
Password		csgjkcfgtool
	Ok Cancel	

Figure 3.2.45 Login of Basic Configuration Tool

3.2.6.1 Model file import

At present, the basic configuration tool supports the import of SCD, ICD or TX module files. SCD has to be created in all 61850 monitoring stations. Besides, both IP and APPID of station level in SCD have to be filled in. The modification of signal name (if required) has to be finished in SCD before importing into SCADA. SCD shall be consistent with the database information in station. So, it is not recommended to modify the signal name separately in SCADA.

1) Import SCD files. Whether to check "Process level Goose information" means whether to analyze the secondary equipment of process level in SCD. Usually, it doesn't have to be checked. For the option "Delete IED undefined in SCD file from database", if any 61850 device no longer exists in SCD newly imported into database, check this option to delete the device. The deletion of some 61850 IED usually occurs when updating SCD.



A SCL	<pre>= version = encoding = xmlns = xmlns: sxnari = xmlns: xsi = xsi:schemaL A Header</pre>	Import SCD Configure Coose Choose the IEDs need to be delete IED Name manufacturer
	→ Communication	

Figure 3.2.46 SCD Import Operation

Click "Next" to pop up the list of all secondary equipment in SCD, the defaulted selection is "select all". The batch selection or canceling of several items at the same time is also supported.

NOTICE!

Notes: after SCD importing and secondary equipment creating, all subsequent SCD importing is updating operation. At the time of updating, the program will update the IED information as long as the IEDname is consistent.



8ML	version 1				Check all]	(Cancel check all	
SCL	= encoding l	Г		IE	D Name	desc	type	manufacturer	configVersion
	= xmlns = xmlns:sgnari	1	Mdd	ABB_REL670	0 20170920	RE×670	670 series	ABB	RE×670ver2.2.0
	= xmlns: xsi = xsi.schemaL	2	-	- NR_SCL_Ed2	-	Feeder Relay	PCS-9611	NRR	V1.00
	A Header	-			ransformer_ED2	Model 5	P645	ALSTOM	P645v20A
		4	🗆 Add	RSPbridge	ied		RSP35	Hirschmann Automa…	1
	- Communication								

Figure 3.2.47 Selection of Imported SCD Equipment

Notes: Chinese characters are not allowed in neither SCD nor file path.

2) Import ICD files. Whether to check "Process level Goose information" means whether to analyze the secondary equipment of process level in ICD. Usually, it doesn't have to be checked. After ICD importing, the secondary equipment will be automatically generated as per configurations. If ICD is modified, click the ICD file with mouse right key and select "Update" in the popped-up menus.

NOTICE!

Chinese characters are not allowed in neither ICD nor file path.

3) For importing of TX template, import secondary equipment template firstly; then, create secondary equipment manually.

NOTICE!

TX temperate must be of utf8 code, which can be converted with UE or Notepad. The TX template name doesn't analysis Chinese characters again. It is forcibly represented with English letters.

3.2.6.2 System parameters

Operating parameters of SCADA server: the HMI display style is modified in these settings. The default selection is suggested. There is no need to carry out modification.



Navigation Tree	8×		1
- System Information Configure		Name	Value
Server Configure Client Configure	1	Project Name	ICD 11KV SUBSTATION
RlyStation Configure	2	First Service Date	2016-12-20
Data Server Configure + User Manager Configure	3	Main Fault Signal of The Station	Not configure
+ NetNode Configure + Unit Model Configure	4	Status of Remote Control of SCADA	Not configure
+ Station Configure + Inputs	5	Frequency Signal of HMI	Not configure
Alarm System Parameter Calculate Configure	6	Signal of HMI Panel1	Not configure
Over Limit Plans	7	Signal of HMI Panel2	Not configure
+ Five-prevention Sign Model	8	Status of Remote Control Signal …	Not configure
CVT Config + AlarmDirect	9	Interval of Getting Wave Recordi	3
	10	History Data Dump	Click to set up
	11	Link vedio enable	OFF
	12	CVT System	OFF
	13	Fault Diagnosis using Low Current	OFF
	14	VQC enable	OFF
	15	Sequential operation enable	OFF
	16	AGVC enable	
	Sy	stem	

Figure 3.2.48 System Parameters

Operating parameters of SCADA server: selection of parameter configuration at the time of server running;

Operating parameters of SCADA client: referring to operating parameters of HMI, which subject to default configuration, with no need of modification;

Operating parameters of protection engineer station: subject to default configuration, with no need of modification;

Operating parameters of data server: subject to default configuration, with no need of modification;

3.2.6.3 Network configuration

Adding network node as per role is supported. The previous method, i.e., adding customized network node, is also OK.

Create role of monitoring host: fill in the name and IP of the host. If there are double servers, check "Dual Host". Select the client type according to the actual server configuration. In case the monitoring host doesn't integrate the mal-operation workstation, select the operating client as client type. If the monitoring host is integrated with the mal-operation workstation, select the the mal-operation client as client type.



ole:	Monitor				
Server A			🛛 🔽 Dual Server		
Host name	lwj		Host name	centos	
Net A IP:	222.111.112.200		Net A IP:	222.111.112.201	
Net B IP:			Net B IP:		
Client type:	Operator client	•	Client type:	Operator client	
Instance No:	1	*	Instance No:	<u>∫</u> 2.	
Create alarm	transfering node				
				Cancel	OK

Figure 3.2.49 Role Creation of Monitoring Host

New operator station: the creation of this role only needs HMI and alarm window, both of which can be automatically generated after filling in IP. HIM type is operating client.

	Net Node Role
Role:	Operator 💌
Server A	Dual Server
Net A IP:	Net A IP:
Net B IP:	Net B IP:
	Cancel OK

Figure 3.2.50 Role Creation of Operator Station

Create data gateway: only need to input name and IP of gateway device. "Dual computer" can be selected.



	Net N	lode Role		
Role:	Data gate way			•
Server A		Dual Server		
Date gateway	n: DataGateWayA	Date gateway n	DataGateWayB	
Net A IP:	222.111.112.215	Net A IP:	222.111.112.216	
Net B IP:		Net B IP:	Ĺ	
Instance No:	3	Instance No:	4	*
☑ SCADA connec	t to this net node	🗖 Has protect i	nformation function Cancel	OK

Figure 3.2.51 Role Creation of Station Gateway

Create protocol converter: multiple nodes of protocol converter can be created in batches. IP of protocol converter is subjected to auto increment.

	Net No	ode Role	
Role: Server A Add Num: FEP name Net A IP:	FEP 1 FepA 222.111.112.225	Dual Server FEP name Net A IP:	
Net B IP: ▼ SCADA conne	ect to this net node	Net B IP:	OK

Figure 3.2.52 Role Creation of Protocol converter

At present, only protocol converter and data gateway device are reserved in network node type. The protocol converter communicates with equipment of other manufacturers and data gateway device communicates with master station.

3.2.6.4 Configuration of secondary equipment

The secondary equipment will be generated automatically after importing SCD or ICD. The difference is that the correlation between remote signal and remote control can be analyzed automatically according to 61850 template file. Check by default the status of remote signal equipment correlated with remote control. In case the actual secondary circuit on field doesn't correspond to the remote control and remote signal in 61850 modeling, please modify the remote signal correlated with remote control. If the secondary equipment template is 103 type or the secondary equipment is of other manufacturers, the correlation between remote control and remote signal cannot be analyzed. In this case, it is necessary to manually check the "Equipment Status" of remote signal and then correlate the remote control.

Modification of position remote signal correlated with remote control:

- 1) For 61850 model:
- The status signal correlated by default can be viewed in the remote control channel of secondary equipment. Select the remote signal to be changed; then, select the secondary equipment —— status signal in the attribute window at right side, and drag them to the required space.

Navigation Tree 🛛 🖉 🗙								Right Dock⊮idget	đ×
11kv#2 RMG protection and control devices 🔺		ID	Name	ipment Affilia	State Signal	Control Type	HMS Name of Turning On	Signal Unit	
11kv#3 RMG protection and control devices		1 550	YK1	AH7 breaker	KIO9 YCB CLOSED[ID=4319]	General Con…	YK1 (48)		
	1	2 551	YK2		<u>.</u>	General Con	YK2(49)	rotection and control de	evices AH/ 💌
-11kv#2 Altenate protection and control de…								YXSignal Source	
kv Busbar protection and control device kv segment prepared from the vote device								Signal Name	ID
[[kvTM] protection and control devices AH7								1 KIO9 YCB CLOSED	4319
 11kvTM2 protection and control devices AH8 Public monitoring and control device 									
electric meter 26								2 KI11 WORKING POSITION	
electric meter 1								3 KI14 ES CLOSED	4324
electric meter 27 electric meter 28	Ŀ	∢ Remote Measu	u con con d	Remote Signal	Remote Pulse Remote Co	ntual VC	<u>}</u>		
electric meter 29		Venore Measo	IT CHIEFT I	Venors 218ligr	Vemore Lurse Keunte fu	11101 15			



• The function of signal query is included in the right attribute window. Enter the related information in the secondary equipment query box. Then, the matched secondary equipment will be searched out.

Navigation Tree 🛛 🗸 🖉	r==			Right Dock⊮idget
+ System Information Configure	State Signal	Control Type MHS Name of Turning On	Cha 📩 📔	Signal Unit
+ User Manager Configure	1 KIO9 YCB CLOSED[ID=1255]	General Con… YK1(48)	YK1 (48)	Jigner on t
+ NetNode Configure + Unit Hodel Configure	2	General Con YXZ(49)	YK2(49)	AB+ •
 Station Configure ICD 11kV SUBSTATION 	3	General Con YK3(50)	YK3(50)	11kv#2 Incoming protection and conti
- Unit Configure 计算量信号二次设备	4	General Con YK4(51)	YK4 (51)	
11kv#[Incoming protection and control de 11kv#2 Incoming protection and control de	5	Ceneral Con UFLS_Soft_Switch(52)	UFLS_St	YXSignal Source
11kv#1 box-type protection and control de	6	General Con UVLS_Soft_Switch(53)	UVLS_Sc	
11kv#2 box-type protection and control de… 11kv#1 RMC protection and control devices…	7	General Con AR_Soft_Switch(54)	AR_Soft+	Signal Name ID I KIO9 YCB CLOSED 1255
 11kv#2 RMG protection and control devices… 11kv#3 RMG protection and control devices… 	Remote Measurement Remote Signal	Remote Pulse Remote Control YS	•	
11kv#4 RHG protection and control device	Venore Deaparement Kenore 218uar	Vennie Linie Kennie fouition 19		2 KI11 WORKING POSITION 1257

Figure 3.2.54 Query of Secondary Equipment

• Enter keywords in the remote signal query box. Then, the matched remote signal of the same keywords will be queried in the selected secondary equipment.

ion Tree 🗸 🖉 🛪							Right DockWidget	8
11kv#2 RMG protection and control devices	ID	Name	ipment Affilia	State Signal	Control Type	MHS	Signal Unit	
11kv#3 RMG protection and control devices	1 550	YKI	AH7 breaker	KIO9 YCB CLOSED(ID=4319)	General Con YK1(48)			
11kv#4 RMG protection and control device…							rotection and contro	l devices AH7 -
11kv#1 Altemate protection and control de	2 551	YKZ			General Con YKZ(49)		YXSignal Source YCB	
11kv#2 Altemate protection and control de 11kv Busbar protection and control device							IV218ligr 2061ce 109	
11kv segment prepared from the vote device							Signal Name	ID
IKVTMI protection and control devices AH7							1 KIO9 YCB CLOSED	4319
11KvTH2 protection and control devices AH8							I KIU9 ICB CLUSED	4213
Public monitoring and control device								
electric meter 26								
electric meter 1								
electric meter 27	4							
electric meter Z8	Remote Mea	surement Remote Signal	Remote Pulse Re	mote Control YS				
electric meter 29								

Figure 3.2.55 Query of Signal keywords

- 2) For 103 model:
- For the signal attribute of remote signal need to select the equipment status manually, It is feasible to select several ones and edit them in batches with right key.



stem Information Configure		Open Point Channel	pment Affili	Equipment Type	Point Type	Subtype	Alarn Level	Attribute	Signal Type	Return Type
er Hanager Configure	25				Event	General Signal	Not Configure	Sample		Single Return
etNode Configure nit Hodel Configure	26	BI2(153)			Channel	General Signal	变位	Sample	Single Node	No Return
ation Configure ICD 11KV SUBSTATION	27				Event	General Signal	Not Configure	Sample		Single Return
E Unit Configure	28	BI3(154)			Channel	General Signal	李位	Sample	Single Node	No Return
计算量信号二次设备 11kv#1 Incoming protection and control de	29				Event	General Signal	Not Configure	Sample		Single Return
11kv#2 Incoming protection and control de 11kv#1 box-type protection and control de	-	Buchholz 1(155)			Channel	General Signal		Sample	Single Node	No Return
11kv#2 box-type protection and control de	30	Brcuuors 1(100)			Channet	General Signal	变位	Sample	Sindre Mode	No Return
11kv#1 RHG protection and control devices	31	Buchholz_2(156)			Channel	General Signal	变位	Sample	Single Node	No Return
11kv#2 RMG protection and control devices 11kv#3 RMG protection and control devices	32	Ext_Reset(157)			Channel	General Signal	变位	Sample	Single Node	No Return
	33	Buchholz_3(158)			Channel	General Signal	变位	Sample	Single Node	No Return
11kv#2 Altemate protection and control de	34	Buchholz_4(159)			Channel	General Signal	变位	Sample	Single Node	No Return
11kv Busbar protection and control device 11kv segment prepared from the vote devic	35	Maintenance(160)			Channel	General Signal	变位	Sample	Single Node	No Return
11kvTH1 protection and control devices AH7 11kvTH2 protection and control devices AH8	36	Buchholz_5/BI7(161)			Channel	General Signal	变位	Sample	Single Node	No Return
Public monitoring and control device electric meter 26	37	Buchholz_6/BI8(162)			Channel	General Signal	变位	Sample	Single Node	No Return
electric meter 1	38	Buchholz_7/BI9(163)	AH7 breaker	Breaker/disconnector	Channel	General Signal	变位	Sample, Equipment Status	Single Node	No Return
electric meter 27 electric meter 28	39	Buchholz_8/BI10(164)			Channel	General Signal	变位	Sample	Single Node	No Return
electric meter 29 electric meter 30	40	Buchholz_9/BI11(165)	AH7 handcart	Breaker/disconnector	Channel	General Signal	变位	Sample, Equipment Status	Single Node	No Return
electric meter 31 electric meter 32	41	BI12(166)			Channel	General Signal	变位	Sample	Single Node	No Return
electric meter 33 electric meter 34	42	BI13(167)			Channel	General Signal	变位	Sample	Single Node	No Return
electric meter 35	43	BI14(168)	AH7 switch	Breaker/disconnector	Channel	General Signal	变位	Sample, Equipment Status	Single Node	No Return
electric meter 36 electric meter 37	44	BI15(169)			Channel	General Signal	变位	Sample	Single Node	No Return
electric meter 38	45	BailSafe/KI16(170)			Channel	General Signal	变位	Sample	Single Node	No Return
electric meter 39 electric meter 40	43	baresaje/R110(110)			Citorates	Benerat Stignat	天世	Jankee	Suger Hour	no Kerann

Figure 3.2.56 Remote signal Attribute of 103 Model

• Select the secondary equipment and status signal from the right attribute window; then, drag them into the corresponding remote control channel.

Navigation Tree	8×	-	1					Right DockWidget 🗗 🖉 🛪
11kv#2 Altemate protection and control	de 🔺	ID	Name	ipment Affilia	State Signal	Control Type	MMS	Signal Unit
11kv Busbar protection and control dev		1 550	YKI	AH7 breaker	KIO9 YCB CLOSED[ID=4319]	General Con YK1(48)		
11kv segment prepared from the vote de								rotection and control devices AH7 🗸
[]KvTM] protection and control devices		2 551	YK2			General Con YK2(49)		YXSignal Source
11kvTM2 protection and control devices Public monitoring and control device	AHō							TAS I GIRLE
electric meter 26								Signal Name ID
electric meter 1								1 KIO9 YCB CLOSED 4319
electric meter 27								I KT0A JCB CF02ED +214
electric meter 28								2 KI11 WORKING POSITION 4321
electric meter 29		4					•	
electric meter 30		Remote Meas	urement Remote Signal	Remote Pulse Re	note Control XX			3 KI14 ES CLOSED 4324
electric meter 31			and to brighter		10			
electric meter 32								

Figure 3.2.57 Remote Signal Correlated with 103 Model Remote Control Channel

• If 103 template is modified, click the template with right key to update it.



Figure 3.2.58 Update 103 Device Template

At present, an independent template (identified with 9) is used for calculation signals in SCADA. After importing this template, a secondary equipment with composite signal will be automatically created. All signal attributes belonged to the secondary equipment is of calculation. The primary equipment is not more created for soft switch. So, if it is switch signal, the remote signal sub-type is analyzed to be switch status in SCADA. In this way, the remote control through HMI can be realized. The dispatching sign is no longer correlated with the primary equipment, but with remote control. Fill in the dispatching sign in the last column of remote control attribute, which will be used as the remote control ID at the time of HMI remote controlling.

3) Five-remote configuration duplication of secondary equipment: after configuring the five-remote attribute of one secondary equipment, it is feasible to copy the five-remote configuration for other devices with same template files.

Navigation Tree 🛛 🕹 🛪		Device Name	Model Name	ID	Logic Mode	Sequence No.	ay Affiliate	t A/B Hot Back	IP of Net A	IP of *
+ User Manager Configure	1	计算量信号二次设备	JISUANLIANG	1	Server	1	Connon Bay	NO	0. 0. 0. 0	0.0.0.0
+ NetNode Configure - Unit Model Configure	2	11kv#1 Incoming protection and control devices AH3	ISA367GV322	2	Server	2	#1 Incoming	NO	222.111.112.1	
VOC VUFANG	3	kv#2 Incoming protection and control devices AH4	ISA367GV322	3	Server	3	#2 Incoming	NO	222.111.112.2	
SHURKONG HECHENGSIGNAL	4	11kv#1 box-type protection and control devices AH9	ISA36765A10	6	Server	6	#1 box-type	NO	222.111.112.5	
XDL	5	11kv#Z box-type protection and control devices AHID	ISA367G5A10	7	Server	7	#Z box-type	NO	222.111.112.6	
DANXIANGCVT SANXIANGCVT	6	11kv#1 RMG protection and control devices AH11	ISA367G5A10	8	Server	8	#1 RMG	NO	222, 111, 112, 7	
JISUANLIANG ISA358GAV3212103EN	7	11kv#2 RHG protection and control devices AH12	ISA36705A10	9	Server	9	#2 RMG	NO	222, 111, 112, 8	
ISA36765A1037321CX ISA367673225A103161109EN	8	11kv#3 RHG protection and control devices AH13	ISA36705A10	10	Server	10	#3 RMG	NO	222.111.112.9	
ISA381GC5A103V321CX	9	11kv#A RHG protection and control devices AH14	ISA367G5A10	11	Server	11	#4 RMG	NO	222.111.112.10	
IEC103PRS7741DB ISA367GV3225A103EN	10	11kv#1 Altemate protection and control devices AHIS	ISA36705A10	12	Server	12	#1 Alternate	NO	222, 111, 112, 11	
SFRDIANBIA01 CYFDJ	11	11kv#2 Alterate protection and control devices /016	TSA36705A10	13	Server	13	#2 Alternate	NO	222.111.112.12	
Station Configure - ICD 11KV SUBSTATION	12	Delete selected unit	SA367G5A10	14	Server	14	Busbar1	NO	222.111.112.13	
- Unit Configure	13	11kv segment prepared from the vote device AHZ	TSA358GAV32	15	Server	15	Busbar1	NO	222, 111, 112, 14	
计算量信号二次设备 11kv# Incoming protection and control de	14	11kvTM1 protection and control devices AH7	ISA381GESA1····	17	Server	4	THI	NO	222, 111, 112, 3	

Figure 3.2.59 Signal Duplication of The Secondary Equipment

Click the configured secondary equipment with right key. Then, select the corresponding option to duplicate the five-remote signal configuration. Next, click the corresponding secondary equipment with right key (pasting several equipment synchronously can also be achieved) to paste the five-remote signal configuration.

Navigation Tree 🛛 🖉 🗙	_									
SFRDIANBIA01		Device Name	Hodel Name	ID	Logic Node	Sequence No.	ay Affiliate	t A/B Hot Back	IP of Net A	IP of*
CYFDJ - Station Configure	1	计算量信号二次设备	JISUANLIANG	1	Server	1	Connon Bay	NO	0. 0. 0. 0	0.0.0.0
= ICD 11KV SUBSTATION	2	11kv#1 Incoming protection and control devices AH3	ISA367GV322	2	Server	2	#1 Incoming	NO	222.111.112.1	
- Unit Configure 计算量信号二次设备	3	11kv#2 Incoming protection and control devices AH4	ISA367GV322	3	Server	3	#2 Incoming	NO	222.111.112.2	
11kv#1 Incoming protection and control de 11kv#2 Incoming protection and control de	4	11kv#1 box-type protection and control devices AH9			Server	6	#1 box-type	NO	222.111.112.5	
11kv#1 box-type protection and control de 11kv#2 box-type protection and control de	5	11ku#2 how tune neotection and control devices AHIO Delete selected unit	ISA367G5A10	7	Server	7	#2 box-type	NO	222.111.112.6	
11kv#1 RMG protection and control devices 11kv#2 RMG protection and control devices	6	11 Copy Five Remote Signal Configuration	ISA367G5A10…	8	Server	8	#1 RHG	NO	222.111.112.7	
11kv#3 RMG protection and control devices	7	11) Paste Five Remote Signal Configuration	ISA367G5A10	9	Server	9	#2 RHG	NO	222.111.112.8	
11kv辨 RMC protection and control device… 11kv弊1 Altemate protection and control de…	8	11kv#3 RMG protection and control devices AH13	ISA367G5A10	10	Server	10	#3 RHG	NO	222.111.112.9	

Figure 3.2.60 Duplicate and Paste Five-remote Signal Configuration

Select the five-remote attribute of the source secondary equipment to be pasted from the popped-up window, which includes the setting as shown in following figure. If major options as remote measurement, remote signal, remote pulse and remote control are checked, all sub-options under them will also be checked. The canceling of any sub-option will result in the unchecking of corresponding major option. It is defaulted that all sub-options are checked except for primary-secondary ratio. Click OK to paste into the target equipment.



avigation Tree 🛛 🕹 🛪	-		Set Paste Property	-				(
SFRDIANBIA01		Device Name		ıde	Sequence No.	ay Affiliate	t A/B Hot Back	IP of Net A	IP of
CYFDJ - Station Configure	1	计算量信号二次设备	- 🖉 Analog 🔺		1	Common Bay	NO	0. 0. 0. 0	0.0.0.0
- ICD 11KV SUBSTATION	2	kv# Incoming protection and control de	Analog Channel		2	#1 Incoming	NO	222.111.112.1	
= Unit Configure 计算量信号二次设备	3	11kv#2 Incoming protection and control de	Subtype Division		3	#2 Incoming	NO	222.111.112.2	
11kv#1 Incoming protection and control de 11kv#2 Incoming protection and control de	4	11kv∰1 box-type protection and control de	Ratio		6	≇1 box-type	NO	222. 111. 112. 5	
11kv#1 box-type protection and control de 11kv#2 box-type protection and control de	5	11kv#2 box-type protection and control de	- ☑ Secondary Rated Value		7	#2 box-type	NO	222.111.112.6	
11kv#1 RMG protection and control devices	6	11kv#1 RHG protection and control devices	Add Factor			#1 RHG	NO	222.111.112.7	
11kv#2 RMG protection and control devices… 11kv#3 RMG protection and control devices…	7	11kv#2 RMG protection and control devices	Secondary Value of Full Scale		9	#2 RHG	NO	222.111.112.8	
11kv## RHG protection and control device 11kv#1 Altemate protection and control de	8	11kv#3 RHG protection and control devices	🖉 Digital Name		10	#3 RHG	NO	222.111.112.9	
11kv#2 Altemate protection and control de… 11kv Rusbar protection and control device…	9	11kv∰4 RMG protection and control device	— □ Digital Channel — ☑ Point Type		11	#4 RHG	NO	222.111.112.10	
11kv segment prepared from the vote devic	10	11kv#1 Altemate protection and control de	₩ Subtype ₩ Alarm Level		12	#1 Alternate	NO	222. 111. 112. 11	
11kvTH1 protection and control devices AH7 11kvTH2 protection and control devices AH8	11	11kv#2 Altemate protection and control de	🕅 Signal Attribute 🖃		13	#2 Alternate	NO	222. 111. 112. 12	
Public monitoring and control device electric meter 26	12	11kv Busbar protection and control device	Cancle OK		14	Busbar1	NO	222. 111. 112. 13	

Figure 3.2.61 Set Pasted Attribute

The signal shielding means to shield remote signal state changing and soe event. The alarm description refers to on/off description in alarm configuration. All other attribute options can be found in the popped-up five-remote window.

4) Batch modification of four-remote attribute based on keywords: this function can be used to check repetitive signal attributes and adjust coefficients. Click the application above the basic configuration tool with mouse left key. Then, select the four-remote attribute based on keywords with left key for batch modification.

File Edit View Check	Tools Config Help		G	fgTool			
Navigation Tree	Remote Measurement Data Storage Set Remote Pulse Data Storage Setting	ting					
SFRDIANBIA01	Four Remote Attribute Batch Changes	Based On Keyword	Device Name	Model Name	ID	Logic Node	Sequence No.
CYFDJ - Station Configure	Remote Signals Batch Changes Based		(设备	JISUANLIANG	1	Server	1
- ICD 11KV SUBSTATIC	Anti-Misoperation Rules Batch Setti	ng	g protection and control devices AH3	ISA367GV322	2	Server	2
- Unit Configure 计算量信号二		3 11kv#2 Incomi	ng protection and control devices AH4	ISA367GW322	3	Server	3
	ng protection and control de	A libutt how to	ne nectection and control devices AUG	T0476705410	6	Conven	6

Figure 3.2.62 Batch Modification of Four-remote Attribute Based on keywords

Select the remote measurement, remote signal, remote pulse or remote control; enter the name keyword of secondary equipment to be queried in the corresponding box, such as protection device, measurement and control device and so on (can be defaulted; if defaulted, query within the range of all secondary equipment at the time of signal searching); enter the keyword of signal name in the signal query box, e.g., breaker and switch (also can be defaulted. If defaulted, all signals of queried secondary equipment will be searched); if both of them are defaulted, the search button will become gray, i.e., invalid when clicking; after entering the keyword, click Search to display the queried signal. Then, the signal attribute can be modified.



				Four Remote Batch Modific	ation					
	ndary Unit : al Keyword	Keyword 11 Ua		Search						Exit
10	ID	Name	MMS Variable Name	uipment Affiliat 3quipment Type	Attribute	Subtype	Division	Ratio	Unit	ndary L
1	130	Ua	Ua(95)		Sample	U	17.05830	0.11000	k₹	1
2	134	Uab	Uab(99)		Sample	U	17.05830	1.00000	k₹	19
3	152	Ua	Ua(95)		Sample	U	17.05830	0.11000	k₩	1
4	156	Uab	Uab(99)		Sample	U	17.05830	1.00000	k₩	1
5	216	Ua	Ua(95)		Sample	U	17.05830	0.11000	k₹	1
6	220	Uab	Uab(99)		Sample	U	17.05830	1.00000	k₹	1
7	237	IJa	Ua(95)		Sample	U	17.05830	0.11000	kŲ	1
8	241	Uab	Uab(99)		Sample	U	17.05830	1.00000	k₹	1
9	258	Ua	Ua(95)		Sample	U	17.05830	0.11000	k₩	1
10	262	Uab	Uab(99)		Sample	U	17.05830	1.00000	k₹	10
11	279	IJa	Ua(95)		Sample	U	17.05830	0.11000	k₹	1
12	283	Uab	Uab(99)		Sample	U	17.05830	1.00000	k₹	1
13	300	Ua	Ua(95)		Sample	U	17.05830	0.11000	k₹	1
4	701	** 1	** 1 (00)		a 1		13.05030	1 00000		•

Figure 3.2.63 Batch Modification of Four-remote Attribute Based on Keywords

Select all the attributes to be modified. Then, click the right key to select Edit, entering the editing of multiple options. Then, modify listed signal attributes in batches.

	ondary Unit nal Keyword			Search						_	Exit
	ID	Name	MMS Variable Name	uipment Affiliat	3quipment Typ	Attribute	Subtype	Division	Ratio	Unit	nda.#
1	130	Ua	Ua(95)			Sample T Edit	1	17.05830	0.11000	k₩	1
2	134	Uab	Uab(99)			Sample u	J	17.05830	1.00000	k₩	1
3	152	Ua	Ua(95)			Sample U		17.05830	0.11000	k₩	1
4	156	Uab	Uab(99)			Sample 🛛		17.05830	1.00000	k₩	1
5	216	Ua	Ua(95)			Sample U		17.05830	0.11000	k₩	1
6	220	Uab	Uab(99)			Sample U		17.05830	1.00000	k₩	1
7	777	IIa	IIa(95)		1	Sample II		17 05830	0 11000	k₩	1, *

Figure 3.2.64 Batch Modification of Four-remote Attribute Based on Keywords

The operation of remote signal attribute which is not displayed (e.g., signal display shielding) is as shown in the figure below. Select several signals to be adjusted at the same time. Then, click them with right key to select Batch Modification of Remote Signal.



	ondary Unit nal Keyword			Search							Exit
	ID	Name	HHS Variable Name	ipment Affilia	quipment Typ	Attribute	Subtype	Division	Ratio	Unit	ida_4
1	130	Ua	Ua(95)			Sample	U	17.05830	0.11000	kŲ	1
2	134	Uab	Uab(99)			Sample	U	17.05830	1.00000	kŲ	1
3	152	Ua	Ua(95)			Sample	U	17.05830	0.11000	k₹	1
4	156	Uab	Uab (99)			Sample	U	17.05830	1.00000	k₩	1
5	216	Üa	Ua(95)					17.05830			1
6	220	Batch Edit Remo	te Metering			Sample		17.05830			1
7	237	IIa	IIa(95)			Sample	Π	17 05830	0 11000	kV	1

Figure 3.2.65 Batch Modification of Remote signal Attribute

Upon the completion of signal editing, click Quit to complete the batch modification of four-remote attribute.

5) Modification of remote signal attribute based on remote signal sub-type: when modifying the remote signal attribute, it is feasible to modify the description of a certain type of remote signal of same attribute in batches.

		Ct	fgTool			
File Edit View Check	Tools Config Help					
Navigation Tree	Remote Measurement Data Storage Setting Remote Pulse Data Storage Setting					
SFRDIANBIA01	Four Remote Attribute Batch Changes Based On Keyword	Device Name	Model Name JISUANLIANG	ID		
CYFDJ	Remote Signals Batch Changes Based On SubType	设备		1		
Station Configure ICD 11kV SUBSTATIC	Anti-Misoperation Rules Batch Setting	g protection and control devices AH3	ISA367GV322	2		
- Unit Configure 计算量信号二	-1人以田 "	ng protection and control devices AH4	ISA367GV322	3		
KV井 Incom	ing protection and control de	tune protection and control devices AND TSA76705410				

Figure 3.2.66 Modification of Remote signal Attribute Based on Remote signal sub-type

Click the corresponding application. Then, click Modification of Remote signal Attribute Based on Remote Signal Sub-type to pop up the window related to remote signal type selection.

	Remote Signal Type		
3	Select a type:		
1	Common Alarm	•	
ľ	Common Alarm		
	Breaker/Switch		
-	Relay Action		L
Æ	Relay Plate handcart switch		1
A	Remote/Local Communication Status		1

Figure 3.2.67 Signal Type Selection

Select the required type to pop up the corresponding interface. Then, modify its alarm description



and ON/OFF description in the interface.

Figure 3.2.68 Modification of Remote signal ON/OFF Description

3.2.6.5 Correlation of bay and primary equipment

The voltage class, bay and primary equipment information all have been created in the drawing configuration tool. After importing SCD, it is necessary to finish the correlation of bay and secondary equipment. Select the bay. Then, select the uncorrelated secondary equipment from the right attribute window and drag it into "Correlated secondary equipment".

DANXIANGCVT III TMI Not Configure	
SANCLANECYT International of configure Inte	attached Device
I ISIAMULANG I ISASOBARYZ [21] GIBN I ISASOBARYZ [2	Device Name
3 3 4 1 box-type Not Configure 15A5677222A103521CX 109EN 1 box-type Not Configure 15A5677222A103521CX 1 box-type Not Configure 1 box-type 15A567722CA103521CX 1 box-type Not Configure 1 box-type 15A5677722CA103521CX 1 box-type Not Configure 1 box-type 15A5677722CA10352N 5 #1 BHG Not Configure 15A5677732CA10352N 7 7 #3 RHG Not Configure - 1 box-type 9 # A BHG Not Configure - 2 box-type 9 # A Hermate Not Configure - 1 box-type 9 # A Hermate Not Configure - 1 box-type - 2 box-type - 1 box-type - - 2 box-type - 1 box-type - 1 box-type - - - 2 box-type - 1 box-type - 1 box-type - - - - - - - - - 10 10	Dealce Malle
ISA567073225A103101109EN ISA567073225A103101109EN ISA567073225A103101109EN ISA567073225A10310100 SEDILARIADI CYPEJ Station Configure Station Configure Voltage - Donnen.Bay - Multi IDU IVX SUBSTATION - Don Ivx SUBSTATION <td></td>	
Table (DSA (10392) rick Not Configure TEC (10597/41 DB SE DIAMINEAL SEPDIAMINEAL S CPTHJ Station Configure = ICD 11/W SUBSTATION V + Unit Configure Not Configure - Voltage A HENG - Porto Yoltage Level Not Configure - TUZ Mit - TUZ H A Larmate - TUZ Not Configure - TUZ H A Larmate - TUZ H A Dartype - H RUG Not Configure	
TASAGOVIZZANOSEN ST ST Not Configure SEDIAMBIAI SEDIAMBIAI Not Configure Station Configure - LOD 114V SUBSTATION 7 7 #3 EMG Not Configure - Voltage - Voltage 8 # HRUC Not Configure - Voltage - Voltage 9 # Alternate Not Configure - Voltage - Voltage - Voltage - Voltage - Voltage - Voltage Not Configure	
SEPTIANSIA01 6 6 #2 EMG Not Configure E Station Configure 1 7 #3 EMG Not Configure - Lot INV SUBSTATION * Unit forfigure 1 8 #4 EMG Not Configure - Voltage - Zero Voltage Level 9 9 #1 Altermate Not Configure - Dit Voltage - Zero Voltage Level 10 10 #2 Altermate Not Configure - HUN - HUN - HUN - HUN Not Configure 1 - HUN - HUN - HUN Not Configure 1 - HUN - HUN - HUN Not Configure 1 - HUN - HUN - HUN Not Configure 1 - HUN - HUN - HUN Not Configure 1 - HUN - HUN - HUN Not Configure 1 - HUN - HUN - HUN Not Configure 1 - HUN - HUN - HUN Not Configure 1 - HUN - HUN - HUN Not Configure 1	
CYEDJ = Station Configure - Ditky SUBSTATION + Unit Configure - Voltage - Zero Noltage Level - DUNA - DUNA - HUK	
 ICD 11KY SUBSTATION UDit Configure Voltage Level 2 ero Voltage Level 0 10 #2 Altermate Not Configure 10 10 #2 Altermate Not Configure 11 11 #1 Incoming Not Configure 12 12 #2 Incoming Not Configure 13 13 PT1 Not Configure 	
 Ibit Configure Voltage Zero Yoltage Level Common Bay Ibit Thi Thi<td></td>	
 Voltage Zero Voltage Løvel Dommon, Bay ID 10 #2 Alternate Not Comfigure ID 10 #2 Alternate Not Comfigure II 11 #1 Incoming Not Configure II 11 #1 Incoming Not Configure II 11 #1 Incoming Not Configure II 11 II 11 #1 Incoming Not Configure II 11 II 11<!--</td--><td></td>	
- Zero Voltage Level Comann Bay - UUX - UUX - HI - HI	
Image: The state of the incoming Not Configure	
Thi 11 11 #1 Incoming Not Configure Thi Thi #1 Incoming Not Configure #1 box-type 12 12 #2 Incoming Not Configure #2 box-type 13 13 PTI Not Configure	
#1 box-type 12 12 12 12 12 #2 box-type 13 13 PTI Not Configure	
#2 box-type #1 RMG	
72/ RMi DT7 Not Configure	
#3 RMC	
## RHG 15 Busbarl Not Configure	
#1 Alternate #16 16 CYFDJ Not Configure	
#2 Attemate 16 16 CYFUJ Not Configure	
#2 Incoming	
PT2 Bays	

Figure 3.2.69 Signal Correlation of Secondary Equipment in Bay

The created primary equipment can be viewed in the main window of bay node. Then, make the primary equipment be correlated with remote signal or remote measurement.



Navigation Tree 🛛 🗗 🗙	c _								1			
XDL		ID	Equipment Name	ti-Misoperation	Remote Signal	Measurement	Remote Control omer	t Host Identif	ing Identific	·ation Monitor	k Synchroniza	heck
DANXIANGCVT SANXIANGCVT	1		AH7 switch	1	KI14 ES CLOSED[ID=4324]	Not configure	Not configure DD	switch	NO		NO	NO
JISUANLIANG ISA358GAV3212103EN	2		AH7 handcart	2	KI11 WORKING POSITION(ID=4321)	Not configure	Not configure SC	handcart	NO	1	NO	NO
ISA367G5A103V321CX	3	3	AH7 breaker	3	KIO9 YCB CLOSED[ID=4319]	Not configure	YK1 [ID=550] KG	breaker	NO	1	NO	NO
ISA36707322AND3161109EN ISA36707322AND316 IEC1039E374108 ISR014981AND CYFUJ = Station Configure = ICD 114% SUBSTATION • Dnit Configure - Tottage - 2ero Vottage Level - Comon Ray - Comon Ray - Int]			

Figure 3.2.70 Remote signal Selection of Primary Equipment

Click "Correlate remote signal" to pop up the attribute window on the right side, which displays the secondary equipment of the bay. Select the corresponding secondary equipment. Then, the remote signal with "Equipment status" checked will be automatically screened out. Next, drag it to the corresponding space to finish the correlation. Since the correlation of remote control and remote signal has been finished at the four-remote place of secondary equipment, the correlated signal of remote control can be automatically read here. Upon the completion of remote signal correlation of primary equipment, the corresponding signal of primary equipment will exist in the HMI. Therefore, the graphic configuration has no need to correlate the primary equipment again.

_		ſ.	1		1		Rig	ht Dock₩idget		5 ×
	ID	Equipment Name	ti-Misoperation	Remote Signal	Measurement		Si	gnal Unit		
11		AH7 switch	1	KI14 ES CLOSED[ID=4324]	Not configure	Notic		kvTM1 protection and	control devices AU7	
22		AH7 handcart	2	KI11 WORKING POSITION[ID=4321]	Not configure	Not (1		controt devices MNY	<u> </u>
33		AH7 breaker	3	KIO9 YCB CLOSED[ID=4319]	Not configure	YKLE	ΥX	Signal Source		
					1		Γ	Signal Name	ID	
							1	KIO9 YCB CLOSED	4319	
							2	KI11 WORKING POSITIO	N 4321	
							3	KI14 ES CLOSED	4324	
•						Þ				
Bre	aker/	disconnector Bus	Ac Line Segment	Shunt Compensator Seris Com	npensator					

Figure 3.2.71 Remote signal Signal Correlation of Primary Equipment

Duplication of primary and secondary equipment correlation: for the bay with primary and secondary equipment correlation configured, it is feasible to duplicate its primary and secondary equipment correlation in other bays with same template files, so as to simplify the configuration.

Click the right key in the bay to pop up the duplication button of primary and secondary equipment correlation. Click this button to duplicate the correlation of the template bay. Then, click the bay which needs the duplicated with right key to pop up the button Paste. Click it to paste the correlation into the bay.



- Station Config - ICD 11KV SU + Unit Con - Voltage	BSTATION		
	Voltage Level		
	nmon Bay		
= 10kV			
TM	(m)		
#	Copy Bay Equipment Relation		
#.	Paste Bay Equipment Relation		
井口 井口	KIIG	-	
	RMG RMG		
	RMG		
- #1	Altermate		

Figure 3.2.72 Correlation Duplication of Primary and Secondary Equipment

After pasting, the mapping relation of primary equipment between source bay and target bay will pop up firstly. Both source and target primary equipment are listed by default in a sequence of ID. After the completion of configuration, click OK to enter next step.

Sc	urce Equipment	Target Equi	pment
AH8 switch		AH8 switch	
AH8 handcar	t	AH8 handcart	
AH breaker		AH breaker	
reaker/Switc	h Bus Ac Line S	egment Shunt Compensat	or Seris Compense

Figure 3.2.73 Target Configuration of Correlation Duplication of Primary and Secondary Equipment

Then, the selection window of source and target devices will pop up. The system has provided the fuzzy matching by default. Select the target device and click OK to paste the duplicated bay correlation into the target bay through matching the channel number. For bays of same type, only need to copy the correlation of source bay once and then paste it into different bays.



	Sour	ce Unit		Tar	get Onit	
11kvTM2	protection a	ind control	devices AH8	electric meter	1	

Figure 3.2.74 Target Selection of Correlation Duplication of Primary and Secondary Equipment

3.2.6.6 Update primary equipment

When configuring the database with basic configuration tool and graphic configuration tool both started, if the graphic configuration tool updates the primary equipment, the basic configuration tool can update synchronously only after it is restarted. Therefore, the function of updating primary equipment is added.

The button of updating primary equipment is located in the position shown in the figure below. Click it to reload the primary equipment in database, so as to update the primary equipment in basic configuration tool.

🤔 CfgTool										
File Edit View Check Tools Config	File Edit View Check Tools Config Help									
🔚 🖿 🔚 😹 🔁 🛅 🔍										
Navigation Tree 🗗 🛪		Name	Value							
 System Information Configure Server Configure 	1	Project Name	Obra nova da Subestação de 60/30							
Client Configure	2	First Service Date	2017-08-30							
RlyStation Configure Data Server Configure	3	Main Fault Signal of The Station	Not configure							
✓ User Manager Configure User Role Configure	4	Status of Remote Control of SCADA	Not configure							
User Configure	5	Frequency Signal of HMI	Not configure							
 NetNode Configure Unit Model Configure 	6	Signal of HMI Panel1	Not configure							
 ✓ Station Configure 	7	Signal of HMI Panel2	Not configure							
✓ Nova construo de sudestao Lu										

Figure 3.2.75 Primary Equipment Updating

3.2.6.7 Alarm configuration

Configuration of alarm level: can be used to configurate alarm name according to alarm level. Click Alarm Level Configuration in factory configuration to enter the corresponding configuration interface.



File Edit View Check Tools Config Help			
Navigation Tree 🛛 🗗 🕹		_	
😑 System Information Configure 🔷	ĩ		Name
Server Configure Client Configure		1	Security Zone of The Database
RlyStation Configure		2	Directory of Data Store
Data Server Configure		7	Cuper Hear of Data Courses
🛞 User Manager Configure		15	Super User of Data Server
⊕ NetNode Configure ⊖ Unit Model Configure		4	Password of Super User

Figure 3.2.76 Configuration of Alarm Level

Customize the alarm name according to the alarm level, thus changing the signal attribute as well as the alarm name at alarm window. Four kinds of level are included by default, i.e., accident, abnormal, COS & report, all of which can be deleted with right key.

-	👂 CfgTool									
F	File Edit View Check Tools Config	Hel	lp							
*****	🔚 🖿 🔚 🍂 🔁 💷 🛛		6)						
Ne	avigation Tree 🗗	×								
[> System Information Configure	1		av n	natch			name match		
	> User Manager Configure			P	AlarmLevel Conf	ig			? ×	
	> NetNode Configure			_			æ			lame
	> Unit Model Configure		н		aralm ID	alarm name			exit	
	Station Configure			1	1	Accident				
	> Inputs			.	<u> </u>	,				
	Alarm System Parameter			2	2	Abnormal				
	Calculate Configure			3	3	Change				
	Over Limit Plans			ľ		chunge				
	> Five-prevention			4	4	Inform				
	Sign Model									
	CVT Config									
	✓ AlarmDirect									
	Communication host config AlarmDirect			ren	nove the invalid	alarm level pleas	e			
	Control Link		Ľ				-			

Figure 3.2.77 Deletion of Alarm Level

Alarm system parameter: can be configured, added or deleted as required. The re-alarm time refers to the duration from pausing refreshing the alarm configuration window to restoring refreshing. Click the option "Setting of alarm automatic confirmation" to pop up the right attribute window. Then, the number of automatically confirmed number of each event is determined in alarm configuration window. When the number reaches to the corresponding threshold value, the tag of such events will automatically confirm half of configured entries.



avigation Tree	ē×			R	ght DockWidget		a
+ System Information Configure		Name	Value		Alarm auto acknowledg	ent	
+ User Hanager Configure + NetNode Configure		1 Alarm level mode	State Grid				
 Unit Hodel Configure 		2 Alarm gain delay time(0~3600s	> 10			number of automai	Time of automatic acked(minu:
- Station Configure		3 Alarm auto acknowledgment	CLICK		1 COS	1000 2	
+ ICD 11KV SUBSTATION + Inputs		3 Hears and a considered active	U. T. W.		Z SOE	1000 2	
Alarn System Parameter Calculate Configure					3 Event	1000 2	
Over Limit Plans + Five-prevention					4 Over Limit	1000 2	
Sign Model					5 Self check	1000 2	
CVT Config + AlarmDirect					6 System information	1000 2	
					7 700	1000 2	
					8 Sequence Control	1000 2	
					9 Operation	1000 -	

Figure 3.2.78 Parameter Setting of Alarm System

3.2.6.8 Configuration of statistics storage

The batch modification of storage attribute of remote measurement and remote pulse is supported. Select "Batch Modification of Remote measurement Storage Configuration" or "Batch Modification of Remote pulse Storage Configuration" in corresponding application. The remote measurement or remote pulse to be stored can be selected manually. Both storage cycle and value type can be modified. The storage cycle includes 30S, 1min, 2min, 3min, 4min, 5min, 6min, 10min, 12min, 15min, 30min & 60min.

Recommended configuration: the program defaults to recommend Ia, P and Q, which storage time is 3 minutes ;

ignal Name	Storage Cycle Storage Type Remarks ^ All
>	Recommend
> LS2ISA367G	
> 🗌 LS3ISA367G	OK
> LS4ISA367G	Cancel
> LS5ISA367G	
> LS6ISA367G	AfterZeroCal
> LS7ISA367G	
> 30KVPT7741	
Linhas1PRS7741	
> 60KVPT7741	
Linhas1PRS711	
> TPHBCU7741	
> TPHPRO338G	
✓ ☐ TPLPRO338G	N2
medicao_remota_la	Not configure Instantaneous Recommended
medicao_remota_lb	Not configure Instantaneous
medicao_remota_lc	Not configure Instantaneous
medicao_remota_Ua	Not configure Instantaneous
medicao_remota_Ub	Not configure Instantaneous
medicao_remota_Uc	Not configure Instantaneous
medicao_remota_10	Not configure Instantaneous
medicao_remota_U0	Not configure Instantaneous
medicao_remota_Uab	Not configure Instantaneous
medicao_remota_Ubc	Not configure Instantaneous
medicao_remota_Uca	Not configure Instantaneous
medicao_remota_Pa	Not configure Instantaneous
medicao_remota_Pb	Not configure Instantaneous
medicao_remota_Pc	Not configure Instantaneous
🗌 medicao remota P	Not configure Instantaneous Recommended

Storage attribute: the storage cycle and value type can be set in batches.

Figure 3.2.79 Setting of Storage Attribute



3.2.6.9 Over-limit alarm scheme

The remote measurement over-limit alarm is configured in the form of scheme. A new scheme has to be created when configuring the remote measurement over-limit alarm. The settable options includes "Out of lower limit ON", " Out of upper limit ON", " Out of lower lower limit ON" and " Out of upper upper limit ON".

Navigation Tree	₽×						
+ System Information Configure		Name	Ranges	Lower	Upper	Low Lower	Up Upper
+ User Manager Configure + NetNode Configure		1 Plan	1	YES	YES	YES	YES
+ Unit Model Configure							
- Station Configure							
+ Inputs Alarm System Parameter							
- Over Limit Plans							
+ Plan							

Figure 3.2.80 Setting of Over-limit Alarm

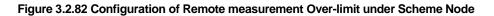
After the creation of new scheme, set the actived time period of the scheme and the setting of each limit.

Start DateTime	End DateTime	Lower Linit	Lower Deadband	Recovery From Lower Limit	Upper Linit	Upper Deadband	Recovery From Upper Limit	Low Lower Limit	Low Lower Deadband	Recovery
1 01-01 00:00	01-01 00;00	10.1	0	0	10.6	0	0	8	0	0

Figure 3.2.81 Setting of Over-limit Fixed Value

Select the remote measurement under scheme node. The configuration of remote measurement over-limit under the scheme is same.

Navigation Tree 🛛 🖉 🗙		1	1		1				
+ System Information Configure	ID	Name	Bay	Unit	MMS Variable Name				
↓ User Manager Configure ↓ NetNode Configure	1 213	Ia #1 box-type		11kv#1 box-type protectio…	Ia(92)				
• Unit Model Configure	2 214	Ib	#1 box-type	11kv#1 box-type protectio…	Ib(93)				
 Station Configure ICD 11KV SUBSTATION 									
+ Inputs Alarm System Parameter	Signal Nam	ie	▲ OK						
⊂Calculate Configure ≂ Over Limit Plans		1kv#2 Incoming protection and 1kv#1 box-type protection and	Cancel						
- Plan									
Rent: Hessurement ID + Five-prevention IC Sign Hodel IV GVT Config ID + AlaraDirect ID									
Sign Model CVT Config									
+ AlarmDirect		j Uc							



3.2.6.10 Mal-operation configuration

The configuration related to mal-operation is integrated into the mal-operation module of configuration tool, so as to facilitate the configuration at project site. Select the mode of mal-operation system according to the mode on site.



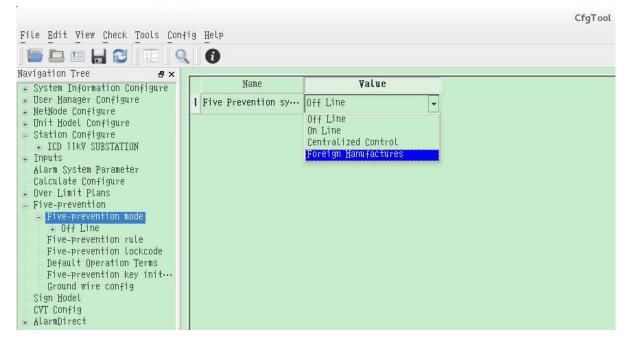


Figure 3.2.83 Selection of Mal-operation Mode

1) Mal-operation rules: all primary equipment will be listed here. Click the primary equipment which needs mal-operation configuration to pop up the Edit Bar of mal-operation rules. After edition of mal-operation rules, the content "Configured" will be displayed at the place of mal-operation rules. Besides, the customized operational term editing is supported for each primary equipment.



Equip ID	Equip Name	Bay Name	[isoperation	stom Operation '
1	AH7 switch	TMI		
2 double die	AH7 handcart	TH1		
	АН/ handcart k AH7 breaker	TH1		
		e-prevention rule editor		
equipment ID 1			search rule	
equipment main nu	umber 1		search rule	
	>>equipment ID numl	per format[click to switch]		global variables
				analog
				digital
				equipment
				ОК
				Cancel
				writing rules>>

Figure 3.2.84 Configuration of Mal-operation Rules

2) Mal-operation encryption code: list all primary equipment. Click the place where needs the configuration of mal-operation encryption code to pop up the right attribute window. Then, add the mal-operation encryption code in the window. After configuration, the content "Configured" will be displayed at the place of mal-operation encryption code.

	Equip ID	Equip Name	Bay Name	[isoperation	ustom Operation Term		it Dock#laget	
1	1	AH7 switch	THI				Name	¥alue
7	2	AH7 handcart	THI			1	Close Enable	
7	7	AH7 breaker				2	Close Rule	Not Configure
С	2		THI	-		3	Open Enable	Not configure
4	4	AH8 switch	TH2					
5	5	AH8 handcart	TH2			4	Open Rule	Not Configure

Figure 3.2.85 Configuration of Mal-operation Encryption Code

3) Default operational term: add the operational term according to the type of primary equipment.

4) Initialization file of mal-operation key: when there is mal-operation key installed under the integrated mal-operation, the initialization file of mal-operation key will be generated.

5) Status of ground wire library: switch on this function through selecting System Parameter — Operating Parameter of SCADA Server — Ground Wire Library Management. For the place of secondary equipment, it is necessary to create "Mal-operation virtual device".

Batch creation of equipment in ground wire library: select the batch creation of equipment in ground wire library with right key; then, fill in the number of ground wire libraries.



Navigation Tree 🛛 🗗 🗙 🗖		1	
 System Information Configure Server Configure Client Configure Bata Server Configure User Manager Configure WetNode Configure Unit Model Configure Station Configure Station Configure Alarm System Parameter Calculate Configure Over Limit Plans Five-prevention Five-prevention mode Five-prevention rule 	ID	GroundWire Name	Related Yx
Five-prevention lockcode Default Operation Terms		Build New Grou	ndWire
Five-prevention key init Ground wire config Sign Modet	Ne	W GroundWire Number:	Cancel
↔ XDL CVT Config ↔ AlarmDirect			

Figure 3.2.86 Create New Equipment in Ground Wire Library

After confirmation, the equipment in ground wire library will be generated automatically.

	ID	Ground∀ire Name	Related Yx	Right DockWidget	
			-	Signal Unit	
1	52	GroundWire1	GroundWirel[ID=5873]	WfxZZ	
2	53	GroundWire2	GroundWire2[ID=5874]	YXSignal Source	
3	54	GroundWire3	GroundWire3[ID=5875]		70
4	55	Ground¥ire4	GroundWire4[ID=5876]	Signal Name	
	56	GroundWire5	GroundWireSfID=58771	1 GroundWire1	5873
	1.2.2		GLORING#1162[TD=2011]	2 GroundWire2	5874
6	57	GroundWire6	GroundWire6[ID=5878]	3 GroundWire3	5875
				4 GroundWire4	5876
				5 GroundWire5	5877

Figure 3.2.87 Generate New Equipment in Ground Wire Library

The correlated remote signal will automatically correlate the virtual remote signal in mal-operation virtual device. The name of virtual remote signal is consistent with that of ground wire library. Besides, both "Equipment Status" and "Mal-operation Key Value Set" in the signal attribute are checked.

	ID	x	Name	HHS Variable Nam	ne e Point Cha	Point Che	∦ en 'oint Type	Subtype	Alarn Level	Attribute	Signal Type	1.
1	5873		GroundWire1	Yx1(1)	¥×1(1)	¥×1(1)	Channel	General Signal	Not Configure	Sample,Equipment Status,Anti Mis-OP Key	Single Node	1
2	5874		GroundWire2	Yx2(2)	¥x2(2)	Yx2(2)	Channel	General Signal	Not Configure	Sample,Equipment Status,Anti Mis-OP Key	Single Node	1
3	5875		GroundWire3	Yx3(3)	Yx3(3)	Yx3(3)	Channel	General Signal	Not Configure	Sample,Equipment Status,Anti Mis-OP Key	Single Node	1
4	5876		GroundWire4	Yx4(4)	¥x4(4)	Yx4(4)	Channel	General Signal	Not Configure	Sample,Equipment Status,Anti Mis-OP Key	Single Node	1
5	5877		GroundWire5	Yx5(5)	¥x5(5)	Yx5(5)	Channel	General Signal	Not Configure	Sample,Equipment Status,Anti Mis-OP Key	Single Node	1
6	5878		GroundWire6	Y×6(6)	Yx6(6)	Yx6(6)	Channel	General Signal	Not Configure	Sample,Equipment Status,Anti Mis-OP Key	Single Node	ł

Figure 3.2.88 Automatic Correlation of Ground Wire Library Signal

6) Mal-operation configuration of bay: mal-operation rules of bay supports the batch import of remote control rules. Select "application" —— "Batch import of mal-operation rules", to pop up the following dialog. Click "Import rules" to generate all remote control mal-operation sharing rules.



If the interlock between bay mal-operation devices has to be realized through SCD connection, the option "Include program-controlled configuration information" has to be "On".

	Navigation Tree 🛛 🗗 🗙										
Ì	- System Information Configure		Name	Value							
	Server Configure	1	Default host	Not Configure							
	RlyStation Configure	2	Lock signal	Not configure							
Data Server Configure + User Manager Configure			Bay five-prevention enable	ON							
	 NetNode Configure Unit Model Configure 	4	4 Bay five-prevention auto enable ON								
- Station Configure + ICD 11KV SUBSTATION		5	Bay five-prevention enable time interva \cdots	50							
+ Inputs			Use text rule	ON							
	Alarm System Parameter Calculate Configure		Include sequence control configuration	ON							
	+ Over Limit Plans - Five-prevention	8	Picture integration	ON							
	 Five-prevention mode + Off Line 	9	Monitor Layer	First Layer Second Layer Third Layer Fourth Layer							
	Five-prevention rule Five-prevention lockcode	10	Five-prevention Layer	First Layer Second Layer Third Layer Fourth Layer							
	Default Operation Terms	11	Five-prevention Machine can be operated	ON							
	Five-prevention key init… Ground wire config Sign Model										

Figure 3.2.89 Bay Mal-operation Configuration On

Take the following figure as example. The interlocking double-point input 2 of CL2201 in SCD connection corresponds to the object 2 of CM2201.

Edit View Check Tools Confi	g He	lp											
i 🖿 🔚 🍂 🔁 🏗	Q	0)										
ation Tree 🗗	×		Channel	Na	me	Private Data	MMS Variable	Name	Signal Source	Protection Type	Rivinfo Send To Host	Signal Subtyp	e Alar
-,	^	1	1	Yx1		-1			Single Node	Not configure	Yes	General Signal	Not
User Manager Configure NetNode Configure			-						-	-			
Unit Model Configure		2	2	Yx2		-1			Single Node	Not configure	Yes	General Signal	Not
VOC		3	3	Yx3		-1			Single Node	Not configure	Yes	General Signal	Not
WUFANG		4	4	Yx4	6	-1			Single Node	Not configure	Yes	General Signal	Not
SHUNKONG		÷.,	· ·			- 1					105		Not
HECHENGSIGNAL		5	5	Yx5		-1			Single Node	Not configure	Yes	General Signal	Not
XDL		6	6	Yx6		-1			Single Node	Not configure	Yes	General Signal	Not
DANXIANGCVT		-	-										
SANXIANGCVT		7	7	Yx7		-1			Single Node	Not configure	Yes	General Signal	Not
JISUANLIANG PL3001		8	8	Yx8		-1			Single Node	Not configure	Yes	General Signal	Not
PL3002		9	9	VxQ		-1			Single Node	Not configure	Yes	General Signal	Not
PL3003		,	9	123		- 1			Single Node	Not conligure	105	General Signal	Not
PL3004		10	10	Yx10		-1			Single Node	Not configure	Yes	General Signal	Not
PL3005		11	11	Yx11		-1			Single Node	Not configure	Yes	General Signal	Not
PL3006												, i i i i i i i i i i i i i i i i i i i	
PL3007		12	12	Yx12		-1			Single Node	Switch	Yes	General Signal	Not
GGCK2		1	**						et 1 51 1			0 10 1	
CL6001 GGCK01		_	ote Measureme		note Sign	al Remote H	Pulse Remote	Control	Remote Setting	Fault/Event/Self Check	Measurement Settin	ss Setting zone	Harmonic Wa
PL6001		Item	ore measureme.	at Kei	Note Sign	tar itemote i	dise nemore	Control	Remote Setting	Tadit/Svent/Sell Check	measurement Sectin	is Setting fone	Add monthe ma
CT6003	Ou	tput	Message Wind)w									
PTH6001			Occur Time			Type				Message		Level	
PTL6001										-			
PTN6001	1	201	9-05-29 20:48	:03.929	Net nod	e	cvt: I	he IP o	f Net A is not configur	red		Error	
PTC6001	2	201	9-05-29 20:48	:03.927	System		Sing	le data	base server!			Hint	
M500F	v 3	201	9-05-29 20:48	:03.927	System		Clier	nt pane	2 display analog sign	al is not configured		Hint	
Search			9-05-29 20:48		-,				ne control enable sign			Hint	

Figure 3.2.90 Interlocking Signal Mapping of SCD Virtual Terminal

When configuring mal-operation rules, for mal-operation rules of primary equipment of CL2201 bay, if there is interlocking of CM2201 object 2, the related rules are as shown in Figure 3.2.91 and the judgment condition is subject to the positon of CM2201 object 2.

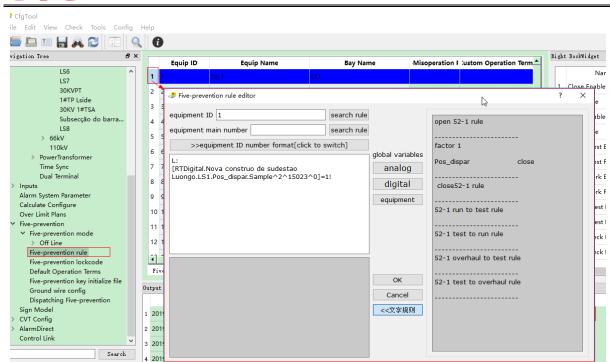


Figure 3.2.91 Rule Compiling of Station Control Layer

When it is required to convert to the mal-operation rule of bay level, please refer to Figure 3.2.92. It is defaulted to import all mal-operation rules of primary equipment remote control channel. Select "Batch import of mal-operation rules" in the drop-down box of menu bar "Application", as shown in figure below.

Check	Tools Config Help
10	Remote Measurement Data Storage Setting
	Remote Pulse Data Storage Setting
ation Co	Four Remote Attribute Batch Changes Based On Keyword
igure	Remote Signals Batch Changes Based On SubType
igure Contig	Anti-Misoperation Rules Batch Setting
Configu	

Figure 3.2.92 Batch Import of Mal-operation Rules

Click "Import rules". Then, the progress bar of 100% completion will be displayed.



Database Configuration

Check Tools Config H	Anti-misoperation Rules of Remote Control		? ×
E × tion Configure Configure gure ofigure	Signal Name ✓ Newly-built power plant ☐ Computational signal secondary device	Progress Status	Import Rules OK Cancel
GNAL EVT	L.		

Figure 3.2.93 Mal-operation Rules Importing of Bay Level

For the generated bay mal-operation rules, please refer to Figure 3.2.94. It can be seen that the judgment condition of generated rules is their interlocking double-point input 2.

Five-prevention rule editor		
equipment ID 1	search rule	
equipment main number 1	search rule	
>>equipment ID number format[click to switch]		global variables
[RTDigital.ICD 11kV SUBSTATION.#2 Incoming.KI11 WORKING POSITION.Sample^2/	1257^0]=0!	analog
		digital
		equipment

Figure 3.2.94 Generated Bay Mal-operation Rules

NOTICE!

Notes: The interlocking signal of current bay can be analyzed; besides, only need to directly import mal-operation rules of bay level into rules of station control layer.

In case the SCD connection involves interlocking remote measurement signal, it is necessary to configure the sub-type of interlocking floating remote measurement as per the remote measurement type of the corresponding bay.



93 94 95 96 97 98 98 99	Ic Ua Ub Uc Uc S SID	-1 -1 -1 -1 -1 -1	Not configure Not configure Not configure Not configure Not configure	341.167 17.0583	Not conf… Not conf… Not conf… Not conf…	NO	1	1 1 1		No No No
94 95 96 97 98 99	Ic Ua Ub Uc Uc S SID	-1 -1 -1	Not configure Not configure	17.0583	Not conf		1	1		No
95 96 97 98 99	5 Ua 5 Ub 7 Uc 8 310	-1 -1 -1	Not configure Not configure	17.0583	Not conf		1	1		
96 97 98 99	i Ub 7 Uc 8 310	-1	Not configure			NO	1	1		Mo
97 98 99	UC 310	-1		17.0583	and some					NO
98	3 310		Not continues		Not cout	NO	1	1		No
99			Hor coultigue	17.0583	Not conf····	NO	1	1		No
		-1	Not configure	1705.83	Not conf····	NO	1	1		No
1.1) Uab	-1	Not configure	17.0583	Not conf····	NO	1	1		No
10	10 Ubc	-1	Not configure	17.0583	Not conf	NO	1	1		No
10) Uca	-1	Not configure	17.0583	Not conf····	NO	1	1		No
10	12 300	-1	Not configure	7.75379	Not conf	NO	1	1		No
10	13 Pa	-1	Not configure	1.96973	Not conf	NO	1	1		No
5 10	14 Pb	-1	Not configure	1.96973	Not conf····	NO	1	1		No
10	IS PC	-1	Not configure	1.96973	Not conf	NO	1	1		No
5 10	16 P	-1	Not configure	1.96973	Not conf	NO	1	1		No
10	17 Q	-1	Not configure	1.96973	Not conf	NO	1	1		No
10	18 S	-1	Not configure	1.96973	Not conf····	NO	1	1		No
3 10	19 Cos	-1	Not configure	2047	Not conf····	NO	1	1		No
11	10 Fr	-1	Not configure	102.35	Not conf	NO	1	1		No
11	II I01	-1	Not configure	1705.83	Not conf	NO	1.	1		No
	2 Interlock	-1	Program Con	0	Not conf	YES	0	1705.83		No
11	3 Suit	-1	Not configure	1	Not conf	NO	1	1		No
2 3 5 5 7 8 8 9 9	10 10 10 10 10 10 10 10 11	102 300 103 Pa 104 Pb 105 Pc 106 P 107 Q 108 S 109 Cos 110 Fr 111 Iol 112 Exterlock 113 Suit	102 300 -1 103 Pa -1 104 Pb -1 105 Pc -1 106 P -1 107 Q -1 108 S -1 109 Cast -1 109 F -1 101 Fr -1 111 tol -1 112 Intertock -1 113 stit -1	Not -1 Not configure 103 Pa -1 Not configure 104 Pb -1 Not configure 105 Pc -1 Not configure 106 P -1 Not configure 107 Q -1 Not configure 108 S -1 Not configure 109 Cos -1 Not configure 109 Cos -1 Not configure 110 For -1 Not configure 111 Lot -1 Not configure 112 InterLock -1 Not configure	102 300 -1 Not configure 7.5379 103 Pa -1 Not configure 1.96973 104 Pb -1 Not configure 1.96973 105 Pc -1 Not configure 1.96973 106 P -1 Not configure 1.96973 106 P -1 Not configure 1.96973 107 Q -1 Not configure 1.96973 108 S -1 Not configure 1.96973 109 Cos -1 Not configure 1.96973 100 Fr. -1 Not configure 1.96973 101 Fr. -1 Not configure 10.973 110 Fr. -1 Not configure 10.53 111 Iol -1 Not configure 10.53 112 Intertook Intertook Program Com-0 113 Soft Configure -1 Not configure	102 300 -1 Not configure 7.753/9 Not configure 103 Ps -1 Not configure 1.9673 Not configure 104 Pb -1 Not configure 1.9673 Not configure 105 Pc -1 Not configure 1.9673 Not configure 106 P -1 Not configure 1.9673 Not configure 106 P -1 Not configure 1.9673 Not configure 107 Q -1 Not configure 1.9673 Not configure 108 S -1 Not configure 1.9673 Not configure 108 S -1 Not configure 1.9673 Not configure 109 Cos -1 Not configure 1.9673 Not configure 100 Fr. -1 Not configure 1.255 Not configure 110 Fr. -1 Not configure 1.255 Not configure 110 Intentook <td>102 300 -1 Not configure 7,75379 Not configu</td> <td>101 300 -1 Not configure 7,75379 Not configure Not configure<</td> <td>102 301 -1 Not confyue 7.5379 Not confy No 1 1 103 Pa -1 Sot confyue 1.96973 Sot conf+ No 1 1 104 Pb -1 Not confyue 1.96973 Sot conf+ No 1 1 105 Pc -1 Not confyue 1.96973 Not conf+ No 1 1 105 Pc -1 Not confyue 1.96973 Not conf+ No 1 1 106 PA -1 Not confyue 1.96973 Not conf+ No 1 1 106 PA -1 Not confyue 1.96973 Not conf+ No 1 1 107 Q -1 Not confyue 1.96973 Not conf+ No 1 1 108 S -1 Not confyue 1.96973 Not conf+ No 1 1 109 Cs -1 Not confyue 1.96973 Not conf+ No 1 1 101 FA -1 Not confyue 1.255 Not conf+ No 1 1 101 FA -1 Not confyue<td>100 -1 Not configure 7,7537 Not configure Not c</td></td>	102 300 -1 Not configure 7,75379 Not configu	101 300 -1 Not configure 7,75379 Not configure Not configure<	102 301 -1 Not confyue 7.5379 Not confy No 1 1 103 Pa -1 Sot confyue 1.96973 Sot conf+ No 1 1 104 Pb -1 Not confyue 1.96973 Sot conf+ No 1 1 105 Pc -1 Not confyue 1.96973 Not conf+ No 1 1 105 Pc -1 Not confyue 1.96973 Not conf+ No 1 1 106 PA -1 Not confyue 1.96973 Not conf+ No 1 1 106 PA -1 Not confyue 1.96973 Not conf+ No 1 1 107 Q -1 Not confyue 1.96973 Not conf+ No 1 1 108 S -1 Not confyue 1.96973 Not conf+ No 1 1 109 Cs -1 Not confyue 1.96973 Not conf+ No 1 1 101 FA -1 Not confyue 1.255 Not conf+ No 1 1 101 FA -1 Not confyue <td>100 -1 Not configure 7,7537 Not configure Not c</td>	100 -1 Not configure 7,7537 Not configure Not c



3.2.6.11 Time synchronization management

After the start of time synchronization management system, the six calculation remote signals related to time synchronization in SCADA will automatically be correlated from the secondary equipment of calculation, with no need to change signal name.

		CfgTool
File Edit View Check Tools Config Help		
🔚 🖿 🔚 🔁 🛛 🏗 🖉 🕄 🛈		
avigation Tree 🛛 🗗 > + System Information Configure	Name	Value
+ User Manager Configure	1 Enable Tssm	Yes
NetNode Configure Unit Model Configure	2 Front DiffAlarm Value (ms)	20
Station Configure = ICD 11kV SUBSTATION	3 Bldiff Alarm Value (ms)	20
+ Unit Configure + Voltage	4 SigErr Sync Return Value (s)	3600
PowerTransformer	5 Sync Status YCID	Clock source selection[64]
Communication Device Configure	6 SigErr YXID	Antenna status[513]
Time Device Configure Bay Device Configure	7 SyncErr YXID	Satellite receiver module status[515]
Process Device Configure Dual Terminal	8 ContErr YXID	Clock transition detection status[516]
Inputs Alarm System Parameter	9 LeaPause YXID	Power module status[518]
Calculate Configure Over Limit Plans	10 Sync Fault Alarm YXID	Crystal tame state[519]
+ Five-prevention		

Figure 3.2.96 Start Time Synchronization System for Monitoring

1) Configuration of communication device: add the configuration of time synchronization management under communication device node. The calculation remote signal is automatically correlated from the secondary equipment of calculation.



ID node name	MeasErr YXID	Time DiffHign YCID	Time DiffLow YCID	Diff Alarm YXID	Sync Fault Alarm	YXII
7 DataGateWayA	Antenna status[513]	Clock source selec	Clock source selec	Time source signal	Clock transition	d····
8 DataGateWayB	Antenna status[513]	Clock source selec	Clock source selec	Satellite receiver…	Initialization s	ta
Nodes	 DataGateWayA	CTssmDlg			-	

Figure 3.2.97 Add Configuration of Time Synchronization Management under Communication Device Node

2) Configuration of synchronization device: add the time synchronization management configuration for synchronization device. The first eight signals are self-check signals in clock 61850 model. If it is required to be consistent with the signals in SCADA after modification of signal description in SCD, these signals can realize automatic correlation through matching character strings. The latter two are SCADA calculation signals, which will be correlated automatically by SCADA.

System Information Configure	× [ID	device name	SRCSIGERR YXID	ANTERR YXID	OEHERRYXID	CONTERRYXID	SRCNUHYCID	OSCERRYXID	HWERRYXID	PWRERRYXID
- User Manager Configure - NetNode Configure	1	1	计算量信号二次设备	计算量信号二次设备-Time source …	计算量信号…	计算量信号二次设…	计算量信号二次设…	计算量信号…	计算量信号…	计算量信号…	计算量信号…
- Unit Model Configure - Station Configure											
- ICD 11KV SUBSTATION + Unit Configure											
+ Voltage											
PowerTransformer - Time Sync											
Communication Device Configure											
Bay Device Configure											

Figure 3.2.98 Configuration of Synchronization Device

3) Device configuration of at bay level: add the time synchronization management configuration for device at bay level. The first three signals are self-check signals of bay-level devices. If it is required to be consistent with the signals in SCADA after modification of signal description in SCD, these signals can realize automatic correlation through matching character strings. The measuring method of time difference defaults to "SCADA, NTP". The latter five are calculation signals, which will be correlated automatically by SCADA.

vigation Tree 🛛 🔗 System Information Configure	×	ID	device name	SigErr YXID	SyncErr YXID	ContErr YXID	Heas Type	HeasErr YXID	Time DiffHigh YCID	Time DiffLow YCID	Diff Alarm 1
User Hanager Configure		1 17	11kvTH1 protectio	-		11kvTM1 protection		Setting_Group_in_EEPROM_E···		Ia[473]	Power_Cacu_Par
NetNode Configure Unit Hodel Configure		2 18	11kvTH2 protectio	likvTMI pro	11kvTM1 pro…	likvTM1 protection	NTP	TA/TY_Cfg_Coefficient_Err…	Uc (478)	Ic[475]	Tap_Heas_Para_
Station Configure - ICD 11KV SUBSTATION											
 Unit Configure Voltage 											
 Voltage PowerTransformer 											

Figure 3.2.99 Device Configuration at Bay Level

4) Device configuration at process level: add the time synchronization management configuration for device at process level. Click the main window with right key and select "Add", then select the number of devices at process level.



Figure 3.2.100 Device configuration at Process Level

Fill in the name of device at process level manually. Multiple devices can be selected to correlate the corresponding devices at process level.

ID	Device Name	Unit Name	ID	Device Name
1	pl device name1	11kvTM1 protection and…	17	kvTM1 protection and cont
2	pl device name2	11kvTM2 protection and…	18	11kvTM2 protection and cont
3	pl device name3	11kvTM1 protection and…		
			4	•

Figure 3.2.101 Matching Configuration of Devices at Process Level and Bay Level

The three signals "Time-synchronization signal status", "Time-synchronization service status" and "Time-hopping detection status" are self-check signals of of process-level devices, which are transmitted to measurement and control device through goose. "Response status of time-synchronization measuring service", "Measured value (second) of time difference (remote measurement)", "Measured value (less than second) of time difference (remote measurement)" and "Alarm of accuracy abnormal" are signals generated when the measurement and control device measures process-level devices.

	ID	ocess device nar	unit name	SigErr YXID	SyncErr YXID	ContErr YXID	RespErr YXID	Time DiffHigh YCID	Time DiffLow YCID
1	17	pl device namel	KvTH1 protection and control…	Not configure	Not configure				
2	18	pl device name2	11kvTM2 protection and control…	Not configure	Not configure				
3	17	pl device name3	11kvTH1 protection and control	Not configure	Not configure				

Figure 3.2.102 Device Signal configuration at Process Level

NOTICE!

rules for automatic matching of signals, change the signal name to "process-level device name + SCADA signal column heading name".

For example, for time-synchronization signal status, time-synchronization service status and

Time-hopping detection status of set A merging unit of Changxing Line 1, when devices at process level have been created, corresponding signals can be correlated automatically.

3.2.6.12 CVT configuration

After the creation of CVT secondary equipment, the remote control channel will automatically correlate the corresponding remote signal signal, with on need of manual correlation.



Figure 3.2.103 CVT Configuration

After "CVT function" starts in system parameters, the CVT correlated configuration node will be displayed and all CVT secondary equipment displayed under the node. Both high voltage and low voltage are common configurations of all signal CVT bays. Make the CVT of each bay correlated with "Phase A Voltage ", "Phase B Voltage", "Phase C Voltage" and "Zero-sequence Voltage". After configuration, if it is required to activate CVT process in real-time part, please enter "cvt" in terminal.

Navigation Tree 🛛 🗗 + System Information Configure	× [Name	Value
+ User Manager Configure + NetNode Configure	1	CVT Device	cvt
+ Unit Model Configure	2	? High Voltage	60
 Station Configure + ICD 11KV SUBSTATION 	1.12	S Low Voltage	50
+ Inputs Alarm System Parameter	4	+ Voltage	Not configure
Calculate Configure Over Limit Plans	5	5 Line 1 Voltage	Not configure
+ Five-prevention Sign Model	e	5 Line 1 Break	Not configure
😑 CVT Config	ĩ	7 Line 2 Voltage	Not configure
+ AtarmDirect	8	3 Line 2 Break	Not configure
	9) Line 3 Voltage	Not configure

Figure 3.2.104 CVT Function Start



3.2.7 Configuration of communication device

3.2.7.1 Overview

1) Functions

This function is mainly used to configure the communication device and generate all configuration files required by normal operation of communication device. It also can generate the configuration of SCADA forwarding signal .

2) Role of communication device

The communication device can be configured as station gateway and protocol converter. Different roles are applied to different application cases. The configuration difference of such machines mainly lies in device communicating and signal forwarding. For details, please refer to the following table.

No.	Role	Model	Range of Application	Cooperation with SCADA
1	station gateway	PRS7910 Station Gateway	Be used for communication with in-station protection, BCU, status monitoring of power transmission and transformation equipment as well as information transmission to other master station systems.	The configuration required for operation is generated by the communication configuration tool at SCADA.
2	Protocol converter	PRS7910S Protocol Converter	Be used to connect the protection, BCU not of 61850 communication of other companies, but need to communicate with CYG SCADA.	The configuration required for operation is generated by the configuration tool of communication device at monitoring SCADA.

Table 3.2.2 User Editing

3) Configuration interface of communication tool



ile(F) Help(H)											
🖬 🔍 🔀 🔟											
ndex 🗗 🛪	Γ	Monitor Name	WhetherInUse	ted Forward T HainSite Addr	SubSite Addr	Section Linker	ainPort linke	.avePort links	Dual Channel Backup	Comm Protocol	
- ICD 11KV SUBSTATION	t		Yes	Forward Tab 1	4	Sect	Virtual Net	None	No	ISA扩展 104…	
 Remote unit set DataGateVay 	2	Monitor2	No	Not Configure 0	0	None	None	None	No	None	
 Physic set Section set 	3		No	Not Configure 0	0	None	None	None	No	None	
+ Device set	4	Monitor4	No	Not Configure 0	0	None	None	None	No	None	
 Tiered logic nodes… Forwarding tables 	5	Monitor5	No	Not Configure 0	0	None	None	None	No	None	
 Host set Yk signal set 	6	Monitor6	No	Not Configure 0	0	None	None	None	No	None	
 Virtual signal set Front set 	7		No	Not Configure 0	0	None	None	None	No	None	
 Monitor set 	8		No	Not Configure 0	0	None	None	None	No	None	
- Hodel set + Unit model set	9	Monitor9	No	Not Configure 0	0	None	None	None	No	None	
 Protocol model set 	10	Monitor10	No	Not Configure 0	0	None	None	None	No	None	
	11	Monitor11	No.	Not Configure 0	0	None	None	None	No	None	
	12		No	Not Configure 0	0	None	None	None	No	None	
	13		No	Not Configure 0	0	None	None	None	No	None	
	14	Monitor14	No	Not Configure 0	0	None	None	None	No	None	
	15	Monitor15	No	Not Configure 0	0	None	None	None	No	None	
	16	Monitor16	No	Not Configure 0	0	None	None	None	No	None	
	17	Monitor17	No	Not Configure 0	0	None	None	None	No	None	
	18	Monitor18	No	Not Configure 0	0	None	None	None	No	None	
	19	Monitor19	No	Not Configure 0	0	None	None	None	No	None	
	20		No	Not Configure 0	0	None	None	None	No	None	
	21		No	Not Configure 0	0	None	None	None	No	None	
	22		No	Not Configure 0	0	None	None	None	No	None	
	23	Honitor23	No	Not Configure 0	0	None	Nome	None	No	None	
	24	Honitor24	No	Not Configure 0	0	None	None	None	No	None	
	25	Monitor25	No	Not Configure 0	0	None	None	None	No	None	
	26	Monitor 26	No	Not Configure 0	0	None	None	None	No	None	

Figure 3.2.105 Configuration Interface of Communication tool

3.2.7.2 Hierarchical structure of communication device configuration

The hierarchical structure of communication device configuration is as shown in Figure 3.2.106.

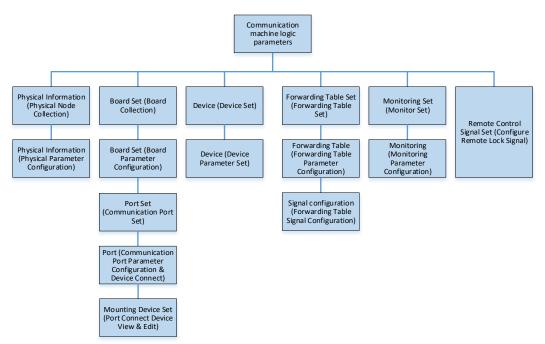


Figure 3.2.106 Hierarchical Structure of communication Device Configuration

3.2.7.3 Configuration tool of communication device - gatewaycfgtool

The configuration of communication tool during project implementation is finished by the service personnel of our company. The configuration has to be processed only when the transmitted dispatching signal changes.



The difference from previous version is that the current version only includes the station gateway group and only the logical node of data gateway machine exists under the node. Since the gateway device may be inconsistent with the protocol converter at site, the configuration file of communication device of current version is put under the node of station gateway group or protocol converter group. The configuration file is still selected from Files - Configuration File Version.

님 🔍 🔀 🕑 ndex			1				1
	₽×	Alias name	Туре	jaster-slav	Version	timing c	10
- Station set - ICD 11KV SUBSTATION		1 DataGateWay	Data G	Enable	3.6Oversion (10 forward tables)	Unrest	U
- Remote unit set - DataGateWay + Physic set + Section set + Device set			1		3.50version (4 forward tables) 3.51version (Relay S…n, 4 forward tables) 3.60version (10 forward tables) 3.61version(AGC/AVC) 3.62version (10 forward tables)		

Figure 3.2.107 Configuration File Version Selection of communication Tools

In addition, the version 3.70 is added into the configuration file version. The newly added content shall be used with communication device 3.70, thus bringing about no influence on the configuration file of low version. New configuration items in forwarding table are only valid for the communication tool 3.70.

	- C ×
File(F) Help(H)	File Version
Save Ctrl+S	generate template info file(TypeInfo.cfg)info contents for choose
Check	✓ generate fault type info ✓ generate measure type info
ConfigSelect	🔽 generate event type info 🛛 🔽 generate constant value type info
AGC Substation Settings	\bigtriangledown generate self-inspection type info \Box generate remote signal type info
 patabateway Physic set Section set Device set Tiered logic nodes Forwarding tables Host set YK signal set 	other files generate 61850 constant value and protect event described files generate 61850 server config files generate smart YD extra config file
 Virtual signal set Front set Monitor set Model set Unit model set Protocol model set 	alarm direct remote browse file generate alarm direct net config file generate remote browse net config file import G file 61850 config files on disk D
3.2.7.1	[Cancel

Figure 3.2.108 Configuration File Version Content Selection of communication tool

3.3 Data bus

The data bus operates based on independent process and communicates with other applications through message interface. It receives network data, transmits it to data demander. Other applications submit the required data to the network. Then, the network transmits such data. In this way, the network forms a independent system isolated with main system, so as to ensure that the system software will not be affected by the upgrade of network hardware. All other software of the whole system can operate in the new network environment with no need of any modification.

The data bus is responsible for the on-line synchronization of panoramic real-time data and synchronous storage of historical data (including file data) in the intelligent substation. When generating or modifying various system parameters on line, it transmits the related data to all nodes in network, ensuring the data consistency.

3.4 Management module of external communication interfaces

This interface is mainly used for communication with bay level protection, measurement & control device, and other intelligent substation equipment and auxiliary application systems (e.g., security, environment monitoring, on-line monitoring and video system). It supports various kinds of communication interfaces and protocols, thus meeting the communication access demand of various devices of intelligent substations.

The system mainly includes following external communication interfaces.

No.	Interface Type	Content				
4	61850 communication	Be used for the communication access of 61850 devices				
1	interface	De used for the communication access of 61850 devices				
2	103 communication	Be used for the communication access of traditional 103 devices				
2	interface	be used for the communication access of traditional 103 devices				
3	103 communication	Be used for the communication access of in-station protocol				
3	interface	converter, protection management host and other devices				
	Customized message					
4	interfaces required by	Can be freely expanded according to actual demands of users				
	other users					

Table 3.4.1 Configuration Interface of Communication Devices

4 On-line Operations

4.1 System console

4.1.1 Overview

System console provides visual interface to call other programs. Applications of PRS7000 integrated monitoring system can be preset in console, and can also be directly started from console.

As a main interface in real-time operation, PRS-7000 system console contains menu bar, toolbar and status bar. Status bar displays user login information, operating status of master and backup server, safe operation days, and current system time. Programs can be added into menu bar and tool bar in customized way, so that the monitoring process and configuration tool can be started by one-click.

4.1.2 Instructions



Figure 4.1.1 System Console

Real-time monitoring process starting: entering prs7000start in a terminal, the console and rtdb, scada, hmi, his_sync, htdata_cala process can be started. Entering prs7000stop or quitting console, all processes triggered by prs7000start can be exited. After the system console has been started, it will always appear on the bottom of the screen. At this time, programs should be started from console, so that the programs will not be sheltered by console.

Concrete meaning of menu bar is described as follows:

lcon	Name	Description
	Main menu of console	Program group includes operation, configuration and maintenance, from which each program can be opened; settings contain system console setting, from which users can add, modify or delete menu or toolbar programs themselves; the permission is user login and logout; if the locking console is checked, the console cannot be moved. If not checked, the console can be moved freely. Quit means exiting from console. In this case, all real-time processes will be exited. It has the same action by entering prs7000stop in terminal.
==	Operation toolbar	Operation includes process of realtime database (rtdb), human-machine interface (hmi), realtime alarm (AlarmWindow), historical information query (InfoQueryTool),

Table 4.1.1 Explanatory Table of Menu Bar of Console



lcon	Name	Description
		report (report), curve (curve), AlarmDirect and remote view of alarm (AlarmDirect).
*	Configuration toolbar	Configuration includes database configuration (basiccfgtool), gateway configuration (gatewaycfgtool), graph configuration (graphcfgtool), element configuration (elementeditor), VQC configuration (vqccfgtool), sequence control configuration (seqctrlcfgtool) and protection information modeling configuration (stationcfgtool).
*	Maintenance toolbar	Maintenance includes process monitoring (pm_server), statistical calculation data browse (htdata_show) and wave recording analysis tool (faultanalyse).
×	Sound alarm icon	When sound alarm occurs, click this icon to silence.
	Alarm window icon	When there is alarm, this icon becomes red. Click this icon to open alarm window.
🌸 sznari	Login/logout	Login and logout of operator
Master	Local status	Display the master and slave status of server node.
Master Safe Operation 344 Days	Safe operation days	Safe operation days of system, calculated since the plant is put into operation. The date can be set in the system parameters of database configuration tool.
16:37:22 2017/11/07	Time	Display the current time of server.
	Leftward icon	After touching the locking console tick in control menu, clicking this icon can lock console. 原文有问题吧

4.1.2.1 Program of system console

Main menu of console is shown as follows:



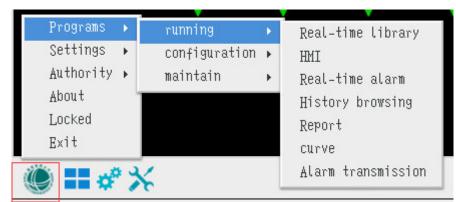


Figure 4.1.2 Main Menu of System Console

Left clicking the program under the corresponding program group, the program can be opened.

4.1.2.2 Setting of system console



Figure 4.1.3 System Console Setting Entry

Selecting "Setting" --- "System console setting" by clicking left mouse button, the following diagram will pop up:



rogram	Path	Add Group
🗄 🜔 Tool Bar		
🚊 👥 running		1
		Add Program
HMI	hmi	
-Real-time alarm		Delete
History browsing		Delete
Report	report	
Curve	curve	
Alarm transmis	AlarmDirect	
🖻 🧬 configuration		
- Database confi		
Communication …		
Graphic config		
Element editing		
VQC configurat…		
Sequence confi		
Confidence con···		Move Up
	/home/V2.10MG/bin/dbManager	nove up
🗄 🔆 maintain	nn aliant	
Process monito		Move Down
Statistics bro… Wave analysis …		HOVE DOWN
mave didiysis	Taulianalyse	
		Property

Figure 4.1.4 System Console Setting

In "system console setting" – "menu configuration" and "toolbar configuration", the operations of program such as add, delete, move up and move down can be made.

Language setting graph is shown as below, where languages can be selected as required.

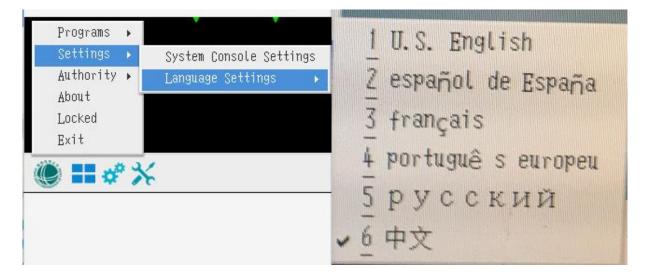


Figure 4.1.5 System Console Language Setting

4.1.2.3 Lock console



Figure 4.1.6 Lock System Console

If $\sqrt{}$ icon displays on the left, it means the console is locked and cannot be moved. Unchecking it by clicking, the console can be moved freely. Clicking "left" icon in toolbar, the console can be minimized.

4.2 HMI monitoring

4.2.1 Overview

Human-machine interface (HMI) of PRS-7000 system consists of status bar, window region and toolbar. Status bar displays the realtime network communication status, operation status of master/backup server, anti-maloperation status, station frequency, and event status. Window region shows main electrical wiring diagram, power flow distribution and flow direction, realtime status of primary devices (i.e. CB, disconnector etc.) and binary signal, distinguishes the electrification state of bus in different colors, provides manual setting interface and operation interface, and visually displays the historical information and comparison information of power flow in curve, bar graph and widget. Meanwhile, all command operations are initiated in HMI, such as remote control, remote regulation, anti-maloperation ticket, call/download protection setting etc.

4.2.2 Panoramic data display

HMI can show the panoramic data of automation system in the whole plant or station, mainly including data as follows:

- Display of network communication status between HMI and master server, operating status of master/standby server, anti-maloperation on/off status;
- Overview and classified display of event signals;
- Display of current system time and login users;
- Display of main electrical wiring diagram and sub-wiring diagram of plant;
- Display of remote metering, remote signaling, remote pulse and protection event signals of each bay in plant;
- Display of position of primary devices such as CB, disconnector, earthing disconnector and

On-line Operations



handcart;

- Display of power flow distribution & direction and topology coloring;
- Display of network structure diagram of secondary devices in the plant;
- Display of realtime and historical curve, bar graph and pie chart of each bay;
- Display of VQC operating & regulating information and blocking information;
- Display of procedural operation status of each bay;
- Display of setting of secondary devices in the plant.

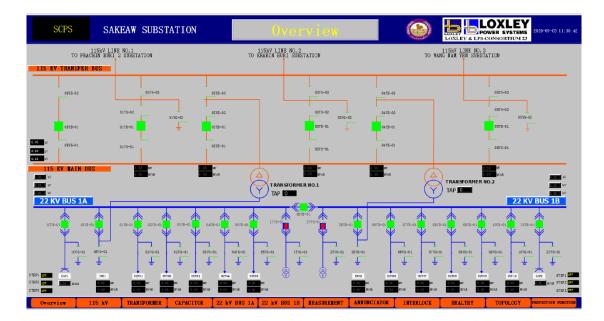


Figure 4.2.1 Human-machine Interface (HMI): Main Wiring Diagram

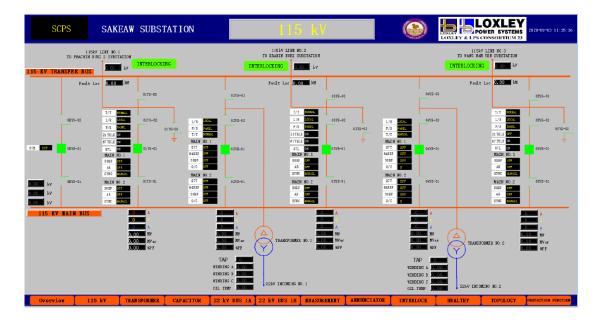


Figure 4.2.2 Human-machine Interface (HMI): Power Flow Direction and Distribution

CYG

000 SAKE	CAW S	SUBS	TAT	ION	ANNUN	CIATO	R			DOLEY & LPS CONSORTIUM	10	1 00:00
115kV LINE 115kV	TP	(115k	V TIH	E 11	5 kV PT) (115kV	RCC COMM	ION ALA	RM 🛛	22kV			
DESCRIPTION		DRMER NO. YB-01) MAINNO.2		ORMER NO.2 YB-01) MAINNO.2	DESCRIPTI	ON (02	ORMER NO. YB-01) J MAINNO. 2	(047	RMER NO.2 3-01) MAINNO.2	DESCRIPTION	TRANSFORME NO. 1 (02YB-01	NO. 2
TRANSFORMER DIFFERENTIAL TRIP	\bigcirc	\bigcirc	\bigcirc	\bigcirc	ST&MU TIME SYNC.	\bigcirc	\bigcirc	\bigcirc	\bigcirc	TRIP TRANSFER STATUS	\bigcirc	
TRANSFORMER DIFFERENTIAL PHASE A	\bigcirc	\bigcirc	\bigcirc	\bigcirc	ST&MU GOOSE ALARM		\bigcirc	\bigcirc	\bigcirc	SPRING CHARGE	\bigcirc	
TRANSFORMER DIFFERENTIAL PHASE B	\bigcirc	\bigcirc		\bigcirc	ST&MU SV ALARM			\bigcirc		GAS LOW PRESSURE WARNING		
TRANSFORMER DIFFERENTIAL PHASE C	\bigcirc	\bigcirc	\bigcirc	\bigcirc	ST&MU STATUS	\bigcirc	\bigcirc	\bigcirc	\bigcirc	GAS LOW PRESSURE LOCKOUT		
RESTRICTED EARTH FAULT	\bigcirc	\bigcirc		\bigcirc	ST&MU DC SUPPLY	\bigcirc		\bigcirc		TRIP CCT. SUPERVISION 1 (TC1)		
O/C RELAY TIME PHASE A	\bigcirc	\bigcirc	0	\bigcirc	ST&MU OPERATION ALARM	\bigcirc	\bigcirc	\bigcirc	\bigcirc	TRIP CCT. SUPERVISION 2 (TC2)	Ō	
O/C RELAY TIME PHASE B	Ō	Õ			ST&MU DEVICE ALARM			\bigcirc		AC SUPPLY TPP PANEL		
O/C RELAY TIME PHASE C	Õ	Õ	Õ	Õ	ST&MU MAINTENANCE STAT	us 🔵	\bigcirc	\bigcirc	\bigcirc	AC SUPPLY ST&MU PANEL	Õ	Õ
E/F RELAY TIME	Ó	Ó	Ó	Ó	VT MCB CIRCUIT BUS TRI	POROFF	\bigcirc	\bigcirc	\bigcirc	DC SUPPLY TPP PANEL	Ó	Ó
O/C RELAY INSTANTANEOUS PHASE A	\bigcirc	\bigcirc	\bigcirc	\bigcirc	TRANSFORMER INTERNAL TRIF	,	\bigcirc	\bigcirc	\bigcirc	DC SUPPLY ST&MU PANEL	Ō	Ō
O/C RELAY INSTANTANEOUS PHASE B	Ó	Ó		Ó	ST&MU PANEL HUMIDITY HIGH	1		C		DC SUPPLY CONTROL CIRCUIT		Ō
O/C RELAY INSTANTANEOUS PHASE C	\bigcirc	\bigcirc	\bigcirc	\bigcirc						BAY CONTROL UNIT STAUS		
E/F RELAY INSTANTANEOUS		\bigcirc								BAY CONTROL UNIT DC SUPPLY		
TIME DELAYED (CB FAIL)	\bigcirc	\bigcirc	\bigcirc	\bigcirc						BAY CONTROL UNIT TIME SYNC.	\bigcirc	
E/F RELAY TIME (GROUND BACKUP)	\bigcirc	0	\bigcirc							BAY CONTROL UNIT GOOSE ALARM		
PROTECTION RELAY STATUS	\bigcirc	\bigcirc	\bigcirc							BAY CONTROL UNIT SV ALARM	\bigcirc	0
PROTECTION RELAY DC SUPPLY	\circ	\bigcirc		\bigcirc						ST&MU PANEL AIR CONDITION SUPPI	. т	
PROTECTION RELAY TIME SYNC.	\bigcirc	\bigcirc	\bigcirc	\bigcirc						ST&MU PANEL TEMPERATURE HIGH		0
PROTECTION RELAY GOOSE ALARM	\circ	0	\bigcirc							TRANSFORMER RELAY 86T1 STATUS	Ŏ	Ŏ
PROTECTION RELAY SV ALARM	\bigcirc	\bigcirc	\bigcirc	\bigcirc						TRANSFORMER RELAY 86T2 STATUS	0	\circ
OVERVIEW 115 kV T	RANSFO	RMER C	APACIT	OR ZZ	KV BUS 22 KV BUS	MEASUREMENT	ANNUNCI	ATOR	INTERLOO	K HEALTHY TOPOLOGY	PROT. F	JNCTION

Figure 4.2.3 Human-machine Interface (HMI): Line Bay Detail

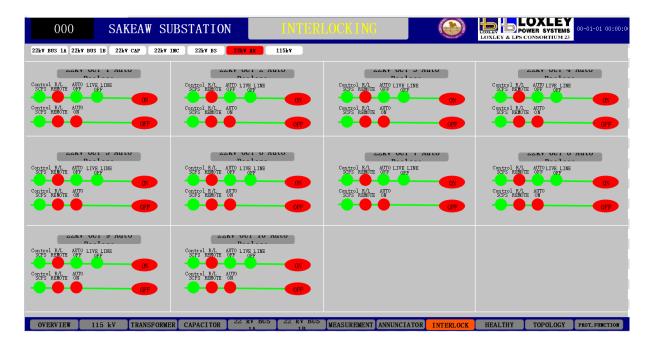


Figure 4.2.4 Human-machine Interface (HMI): INTERLOCKING



On-line Operations

000 SAKEAW SUBSTATION	MEASUREMENT	DOLEY & LPS CONSORTIUM 23
115к7 Z2К7 Z2К7 22К7 22К7 115к7 ПЛС/ЛКС ОПТСОТИС		
INCOMING NO. 1	CAPACITO	DR NO. 1
1,300 1,300 1,000 1,	100 50 50 50 50 50 50 50 50 50	WAD 30 WAD 15 15
1, 500 1, 550 900 450 0 0 500 0 0 500 1 1 22, 9 1 22, 9 1 22, 9 1 22, 9 1 350 1 350 1 350 1 350 1 350 1 350 1 4 22, 9 1 3 50 1 5 7, 5 6 1 5 7, 5 6 1 5 7, 5 6 1 5 7, 5 7 1 5 7,		
BUS SECTION	BUS 1A 30 22.5 15 7.5 0 VKA VKA VCA VKA VCA VKA VCA VKA VCA VCA VCA VCA VCA VCA VCA VC	
OVERVIEW 115 kV TRANSFORMER CAPACITOR 22 kV	BUS 1A 22 kV BUS 1B MEASUREMENT ANNUNCIATOR INTE	RLOCK HEALTHY TOPOLOGY PROT. FUNCTION

Figure 4.2.5 MEASUREMENT

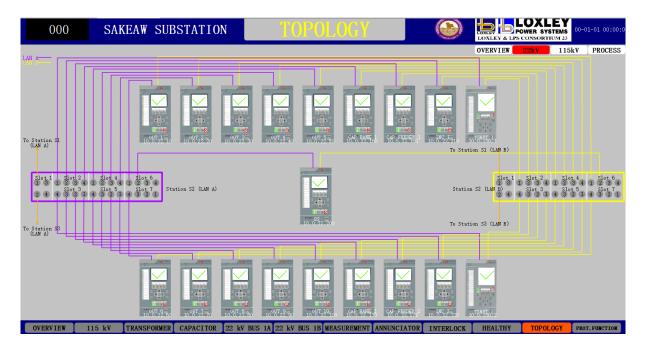


Figure 4.2.6 Human-machine Interface (HMI): System Network Diagram



YG深瑞 Function Config	Appliation View				
	xt Reload Picture Hagnify	Shrink Restore All Clear Flash	Server Switch		
arrent State, Real Time Status Anti-mis	operation host status, Off 🔢 2017-	11-29 20, 28, 21			
evice Management	Rasic Info Setting Value Pressure	Plate Status Value Simulate Value Vave	Recording Peration Repor		
Bay Query	Device Information	Unique code, Non		Call Parameter wnload Paramet Signal Res	et Print
	e paramet vice parameter nam	Device parameter <u>MMS</u> name	paramete vice paramete	er val e parameter Modify	
■ tc DT 104 SUBSTATION D 114/M1 Protection and control D 114/M1 Protection D 114					

Figure 4.2.7 Human-machine Interface (HMI): Secondary Devices Management Detail

4.2.3 Instructions

4.2.3.1 Status bar

There is a status bar lying top of the human-machine interface, composed of safe operation days, current status, anti-maloperation serverstatus and alarm information.

Current State: Real Time Status | Anti-misoperation host status: Off | 1 2017-11-29 20:30:24

Figure 4.2.8 Status Bar of Human-Machine Interface

The display of status is described as follows:

- Safe operation days: display the operation days of current host.
- Current status: the real-time status, indicating it is operating status now.
- Anti-maloperation serverstatus: On or Off, indicating the anti-maloperation serveris on or not.
- Alarm information: display the alarm information in current system, including alarm time, alarm contents.

4.2.3.2 Tool bar

A tool bar lies above human-machine interface. The specific instructions are shown as Figure 4.2.9.

â		0	Ο	C	•	0	•		0
Home Page	Picture Index	Previou	Next	Reload Picture	Magnify	Shrink	Restore	All Clear Flash	Server Switch

Figure 4.2.9 HMI Tool Bar



Table 4.2.1 Introduction of HMI Tool Bar

lcon	Name	Description		
Home Page	Home	Switch HMI screen to home page set in HMI parameters;		
Picture Index	Screen Index	Pop up screen index box;		
O Previou	Page Up	Go to previous screen of this screen;		
) Next	Page Down	Go to next screen of this screen;		
C Reload Picture	Reload screen	Re-load current screen;		
⊕ Magnify	Zoom-in	Zoom in the current screen at certain magnification;		
Shrink	Zoom-out	Zoom out the current screen at certain magnification;		
estore	Restore	Restore current screen to original one (1:1);		
All Clear Flash	Clear all flicker	Stop all flickers on HMI;		
e Server Switch	Dual-unit switchover	Switch between master and slave unit;		
	Anti-maloper ation serverlogin	When the current client node is configured as anti-maloperation serverclient, this button will display. After logs in, the corresponding anti-maloperation menu will pop up;		

Only when the current client node is configured as anti-maloperation client, the anti-maloperation



loging button can be displayed:

🗐 HMI									
CYG深瑞	Function	Config	Appliatio	n View					
n Home Page	Picture Index	C Previou) Next	C Reload Picture	+ Magnify	- Shrink	Restore	NII Clear Flash	e Server Switch

Figure 4.2.10 Anti-maloperation Login on HMI Tool Bar

After anti-maloperation login, the corresponding anti-maloperation menu will pop up. To quit it, click "Exit" button:

🗏 🔜 HMI											-	×
[≦] CYG深瑞	Eunction Config	Appliation	View	Fail-safe interlock								
Picture switc	h Operation ticket managemen	t Current op	eration ticke		E. Manual Ticket		Display operation ticket	😁 Barth wire state	Change state	<mark> </mark> } Exit		
Courrent State: Real Time Status Anti-misoperation host status: Off												
										0.0	10	,

Figure 4.2.11 Change of Toolbar Before and After Anti-maloperation Login

4.2.3.3 Detailed operations

> Exit HMI

Clicking button on the upper left corner, the following dialog box will display. Select a user, enter password to check authorization, and click OK to exit HMI.

	Operation login	
Operation Ir	formation	
Object hmi		
Operation Exi	t system	
Permission C	Check	
Operator	sznari	•
Operator pass	word	
Guarder		-
Guarder passw	ord	
	Yes No	

Figure 4.2.12 Exit HMI

User login

When there is not user logged in the system, clicking the relevant element, the following prompt will display. Users shall go to console for login.



Figure 4.2.13 User Login Prompt

Remote control operation

The closing or opening operation of primary equipment such as circuit breakers, disconnectors, earth disconnectors, etc. shall be supervised by the appropriate predefined interlocking.

Breaker: It functions as a regular breaker remote control, but the closing operation goes through the checking synchronous channel. Close By Pass: It is a bypass closing function that goes through the conventional channel. Recloser: It is a remote-controlled AR soft strap. Tag: It is a locked remote-controlled soft strap. By writing the soft strap's remote signal into the switch's Anti-maloperation rules, the remote control locking of the switch is achieved. Live Line: It also functions as a soft strap remote control, used for locking AR. When Live Line is closed, it indicates that there is human activity on the line. It allows remote control for locking reclosing but does not lock the remote control. At the same time, a corresponding label is attached to the side of the switch.

When the 115kV line is in the Live Line state, the logic for locking the double AR is activated. This means that when the AR soft strap for this line is remotely controlled, the system will disable the AR remote control "Close" button, preventing users from initiating reclosing. However, the remote control for the "Trip" operation is not affected and can still be used normally.

Directly clicking primary element at anti-maloperation disabled status or make remote control by graphic ticketing at anti-maloperation status, the following diaglog box will pop up as Figure 4.2.14.

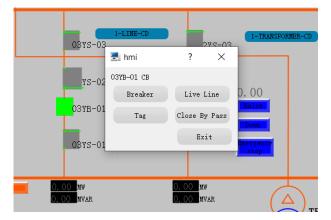


Figure 4.2.14 Remote Control Login

After checkout, the monitoring system can provide with remote presetting. If the remote presetting

is successful, the following dialog box will display as Figure 4.2.15. At this time, the remote control can continue. If clicking Exit, this operation will be exited.

Remote opening process is same to remote closing.

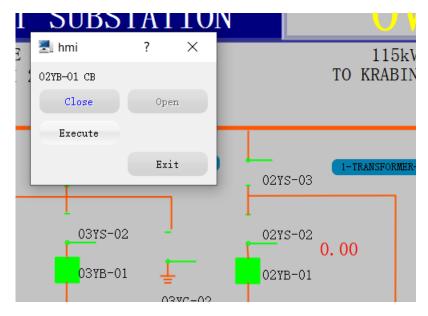


Figure 4.2.15 Remote Preset Succeeded

Clicking remote operation button, the remote command will be sent to secondary device. After the remote operation succeeds and the primary device changes position, the following dialog box will pop up as Figure 4.2.16.

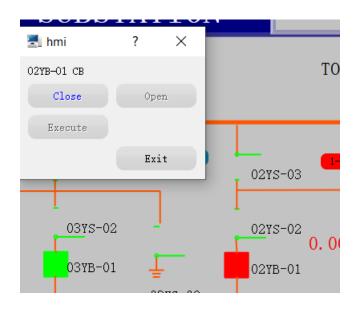


Figure 4.2.16 Remote Control Succeeded

If the remote operation command is sent successfully but the primary device doesn't change position correctly, the following dialog box will display as Figure 4.2.17.



TOU		\vee \downarrow \square	
	🔜 hmi	? ×	E NO. 2
	02ҮВ-01 СВ		SUBSTATION
	Close	Open	
	Execute		
02		Exit	05YS-03
	🛃 Error		×
02	1		mmand Successfully, but The Position of ent, Remote Control Failed
— 💰 <mark>–</mark> 02			OK
YG-02			1

Figure 4.2.17 Remote Control Failed (with device implementing successfully)

Remote regulation operation

For remote regulation of main transformer tap position: directly click Up/Down/Stop button on the screen to make corresponding operation as Figure 4.2.19.

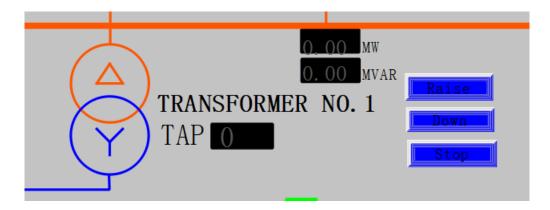


Figure 4.2.18 Up/Down/Stop Button for Remote Regulation

The remote regulation process is same to remote control.

> Manual setting of analog quantity

Right clicking the mouse on the remote metering element, the manual setting menu will pop up for option, as shown in Figure 4.2.20.

Ia	0.00	Manually set the value		
Ic	0.00	Suppress alarm Realtime curve		
Ib	0.00	History curve YC Parameter Substitute Function		
Ua	0.00			
Ub	0.00	kV		

Figure 4.2.19 Manual Setting Menu

After clicking manual setting, the dialog box will pop up, on which the manual setting value can be entered as Figure 4.2.21.

Set value Manual				
Please enter a value	10			
Yes	No			

Figure 4.2.20 Manual Settings

After entering manual setting value and clicking OK, the remote metering will become in manual setting status, expressed in gray background and yellow font. Click cancel to undo manual setting.

At manual setting status, right click "restore refresh", and restore manual setting to normal refresh status, as shown in Figure 4.2.22.

itemname	value		unit	
Ia	10.00	Res	ume refresh	
Ic	0.00	Suppress alarm Realtime curve History curve YC Parameter Substitute Function		
Ib	0.00			
Ua	0.00			
Ub	0.00		kV	

Figure 4.2.21 Restore Refresh

> Manual negation of state value



Right click "Manual Negation" on remote signaling element as shown in Figure 4.2.23.

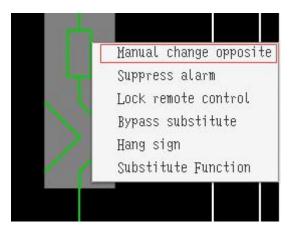


Figure 4.2.22 Manual Negation

After manual inversing operation, for instance, the CB position will be changed from opening to closing. Meanwhile, it will become gray background and have M marking aside to distinguish from

normal state. At manual negation state **used**, if remote control is made, the following prompt will pop up as shown in Figure 4.2.24.

		HI	мі		
Please re	recover	the	signal	refresh	firstļ
		2	<u>o</u> k		
	Please		Please recover the	<i>₹</i> 0K	Please recover the signal refresh

Figure 4.2.23 Manual Negation Blocking Remote Control

At manual inversing state, right click "Restore Refresh" and back to normal refresh state.

> Inhibit alarm

Put the cursor on the state value element such as CB, right click and select "Inhibit Alarm" as Figure 4.2.25.

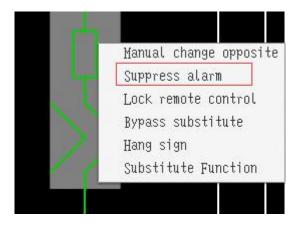


Figure 4.2.24 Inhibit Alarm

After selecting "inhibit alarm", is sign will display on the element. At this state, when the signal acts, the position signal will not change, and event alarm such as COS or SOE will not occur. In this case, right click "Restore Alarm" and return to normal alarm state.

Inhibit alarm operation of analog quantity is same to that of state value.

Remote control lockout

Put the cursor on the primary device element such as CB, and right click "Remote control lockout" as Figure 4.2.26.

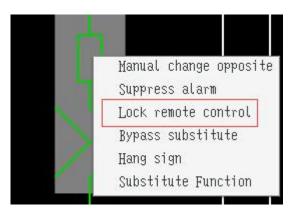


Figure 4.2.25 Remote Control Lockout

After selecting remote control lockout, this CB will be marked with . If making remote control in this case, the following dialog box will pop up to remind of forbidding remote control, as shown in Figure 4.2.27.



Figure 4.2.26 Remote Control Locking

At remote control lockout state, right click "Remote Control Unblock" to release lock.

> Labeling

When the primary devices are under maintenance or other operations are needed, labelingoperation can be made in monitoring system. Put the cursor on the primary device element, and right click "labeling" as Figure 4.2.28.

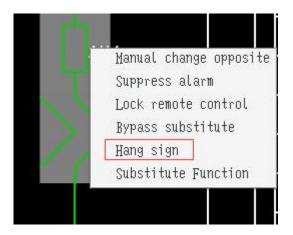


Figure 4.2.27 Labeling

After selecting "labeling", the login diaglog box will pop up. After entering username and password, the user with authority can enter the following page:

Hang Denoter	?	×
📤 Hang Denoter 🔯 Settings		
Object		
Station: PEA test Name: 03YB-01 CB		
C Denoters list		
 No switching on Someone workin No switching on 		
🚖 No switching out		
Coverhaul		
		51
禁止合闸		
Yes No		

Figure 4.2.28 Dialog Box of Labeling

Select a suitable label in the list, click the rightward button to add a label, and click "Yes" to attach



label successfully. The label will be strikingly displayed beside those primary devices.

Hang Denoter	?	×
📤 Hang Denoter 🔯 Settings		
Object		
Station: PEA test Name: 03YB-01 CB		
Denoters list		\exists
Image: No switching on Someone workin Image: No switching on Image: Overhaul Image: No switching out Image: Overhaul Image: No switching out Image: Overhaul Image: No switching out		
禁止合闸		
有人工作業止分前		
Yes No		

Figure 4.2.29 Labeling

Removing label is similar to attaching label. You only need to move the label on theh right list to the left.

Adding or removing tags will generate a log record.

> Context menu operation in the blank space

Right clicking the blank space in the screen, the following context menu will display as Figure 4.2.31.



Clear picture flash
All clear flash
Picture zoom in
Picture zoom out
Picture zoom restore
Previou
Next
Picture index
Sign operation 🔹 🕨
Cancel yx set
Cancel yc set
Print picture

Figure 4.2.30 Context Menu

Name	Description
Clear flicker	Clear the element flicker in the current screen
Clear all flickers	Clear the element flicker in all screens
Zoom-in	Zoom in the current screen
Zoom-out	Zoom out the current screen
Restore original screen	Restore current screen to real size
Page up	Go to previous page
Page down	Go to next page
Screen index	After clicking screen index, you can go to sub-menu corresponding to the
Screen index	name, as shown in Figure 4.2.32
Labeling operation	Make configuration for label
Switch to anti-maloperation view	Switch to anti-maloperation graph layer in configuration tool
Undo remote signal manual	Cancel the remote signal manual setting of the whole station, and restore
setting of whole station	refresh
Undo remote metering manual Cancel the remote metering manual setting in the whole star	
setting of whole station	restore refresh
Print screen	Print the current screen

Picture index	ð×				
raph Query					
🖻 📄 Monitor wiring diagram					
ICD 11KV SUBSTATION					
11kv AH3					
11kv AH4	_				
-11ky AH7					
11kv AH8					
11kv AH9					
11kv AH10					
-11kv AH12					
-11kv AH11					
-11kv AH13					
- 11kv AH14					
-11kv AH15					
- 11kv AH16					
-11kv AH2					
- Index diagram					
- 380V AA8					
- 380V AA9					
柴油发电机 AAE1					
- 380V AA10					
380V AA11					
- 380V AA12					
- 380V AA14 - 380V AA15					
—————————————————————————————————————					
Functional diagram					

Figure 4.2.31 Screen Index

4.3 Curve tool

4.3.1 Overview

Curve tool is a new sub-module added in PRS-7000 integrated monitoring system. With this module, the hourly real-time curve as well as historical curve on a certain day, month and year can be displayed. Besides, it provides curve comparision, curve file storage and print functions.

4.3.2 Realization

Curve module is a online view tool, no need to configure any separate sub-curve. For the remote metering quantity stored in database configuration, by right click on HMI, the real-time curve and historical curve can be called, reading real-time curve from real-time database and reading historical curve from historical database. Curve tool can also be opened from system console, displayed by directly selecting remote metering quantity and curve type. There are several sub-types for curve, basically covering all users' demand.

4.3.3 Toolbar

Tool bar lies above curve tools as shown in Figure 4.3.1.

	Curve Tool
File Config View Curve Type Language	
💾 🥖 🍖 🚘 🖘 \cdots	

Figure 4.3.1 Curve Tool Bar

lcon	Name	Description
M	Save	Save the current curve page to pdf file in local, and view and print it at any time.
đ	Clear	Clear the current signal and curve types.
	Background color	Background defaults to black. Current background color can be modified.
	Print	Print the current curve page. Print file storage path can be selected.
5	Refresh	Refresh the current curve page. When it is real-time curve, refresh the current starting time, and re-make curve plotting.
2	Search	Search the historical curve in self-defined time.

Table 4.3.1 Function Description of Curve Tool Bar

4.3.4 Curve type

Curve type includes hourly real-time curve, today real-time curve, one-day curve, self-defined historical curve, real-time & historical curve comparison, single-signal historical daily curve comparison, single-signal historical monthly curve comparison.

4.3.4.1 Hours real-time curve

Right click remote metering quantity stored in database configuration on HMI to select real-time curve. Such real-time curve defaults to be hourly real-time curve. It is defaulted that a point is plotted every 5s, and the time horizon of horizontal axis on displayed interface is 1 hour, the area in this hour can be magnified for view. The left-side signal list has given the remote metering quantity stored in database configuration. You can check the real-time signal curved to be displayed yourself. After every checking, as the current time has to be re-calculated, the hourly



real-time curve will be re-plotted.

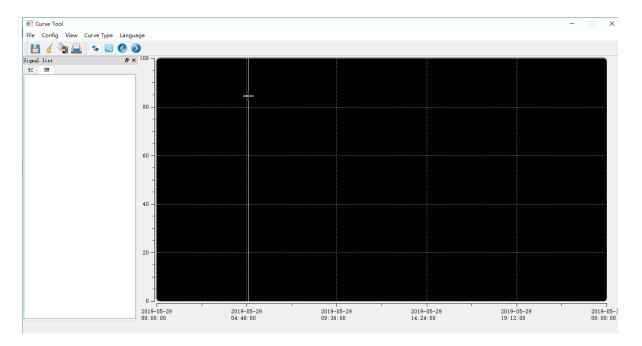


Figure 4.3.2 Hourly Real-time Curve

4.3.4.2 Today real-time curve

Selecting "Today Real-time Curve" in the curve types, the curve changing between the interval of 0:00-24:00 will be displayed. A point is plotted every 5s. It supports magnification display in this interval, and multiple-signal display. As the time horizon is fixed, the curve will not be re-plotted. The right side will show the meaning of signals expressed in different colors.

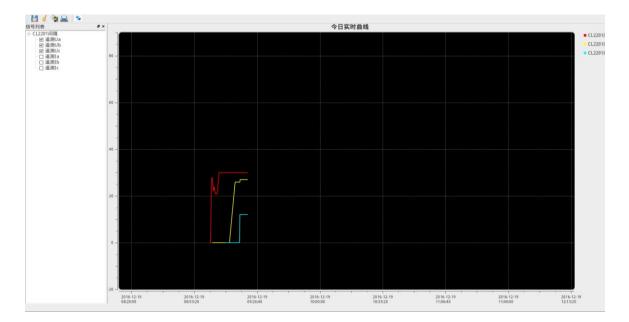


Figure 4.3.3 Today Real-time Curve



4.3.4.3 One-day historical curve

Selecting "one-day historical curve" in the curve type, it will pop up a time query dialog box. Selecting one day, the record of that day can be read out from historical database. When the one-day historical curve is selected, left and right button will be displayed on the top, which can be used to go to the curve of previous or next day quickly. The right side will show the meaning of signals expressed in different colors.

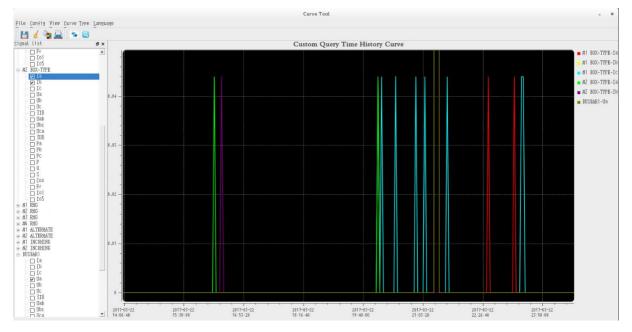


Figure 4.3.4 One-day Historical Curve

4.3.4.4 Self-defined historical curve

Selecting "self-defined historical curve" in the curve types, you can define a time range for query, but the ending time shall not be a future time.

😑 #2 BOX-TYPE		
✓ Ia	-	Custom Time Query
	-	Please input Query begin-end DateTime:
U Ua	0.04 —	Begin Time: 2017-11-22 00:00
	-	End Time: 2017-11-29 00:00
Uab Ubc Uca	-	OK Cancel
3UO Pa	0 07	

Figure 4.3.5 Self-defined Historical Curve Time Query

Zoom display in selected time range is available, but dragging screen is allowed only in this range.



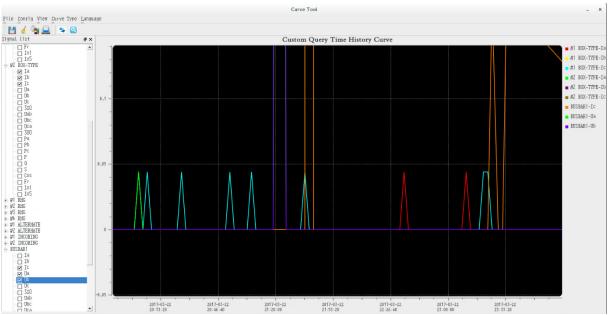


Figure 4.3.6 Self-defined Historical Curve Display

4.3.4.5 Real-time historical curve comparison

Selecting "real-time historical curve comparison" in the curve types, it will compare the real-time curve and historical curve of remote metering object on a certain day. No multiple points shall be selected. At present, it supports for comparison of real-time curve and 12-day historical curve at most. Zoom display is available in a selected time range, but dragging screen is allowed only in this range. The right side will show the meaning of signals expressed in different colors.

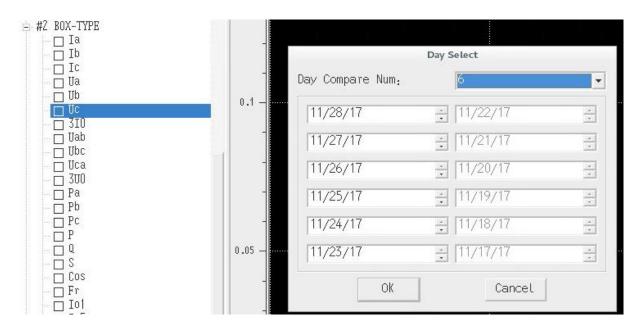


Figure 4.3.7 Selection of Comparison Date of historical & Real-time Curve

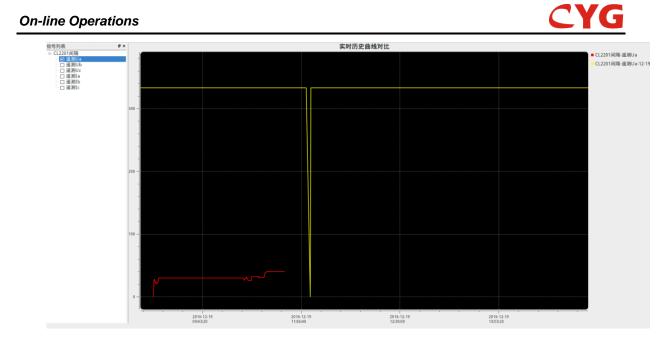


Figure 4.3.8 Single- signal Real-time & Historical Curve Comparison

4.3.4.6 Single-signal historical daily curve comparison

Selecting "single-signal historical daily curve comparison" in the curve types, the initial comparison day is 0, and it supports for comparison of 12 days of curves at most. Select comparison days, select comparison date, and click OK. Then, it will display the comparisons. Free scale is available in the time range on the selected day. The right side will show the meaning of signals expressed in different colors.

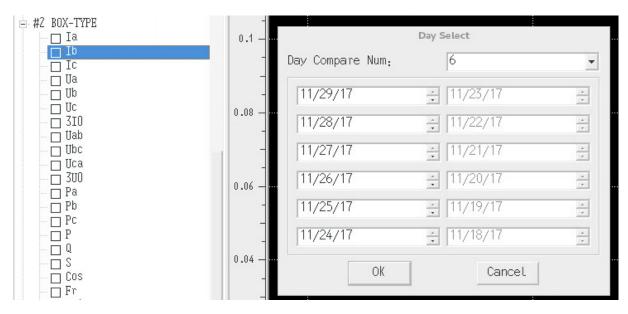


Figure 4.3.9 Date Choose for Single-signal Historical Daily Curve



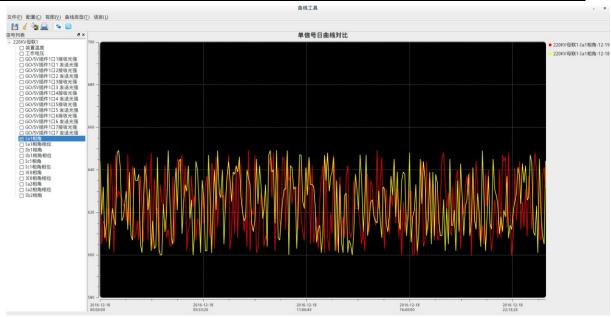


Figure 4.3.10 Single-signal Historical Daily Curve Comparison

4.3.4.7 Single-signal historical monthly curve comparison

Selecting "single-signal historical monthly curve comparison" in the curve types, the initial comparison month is 0, and it supports for comparison of 12 months of curves at most. Select comparison month number, select comparison month, and click OK. Then, it will display the comparisons. Free scale is available in the time range on the selected month. The right will show the meaning of signals expressed in different colors.

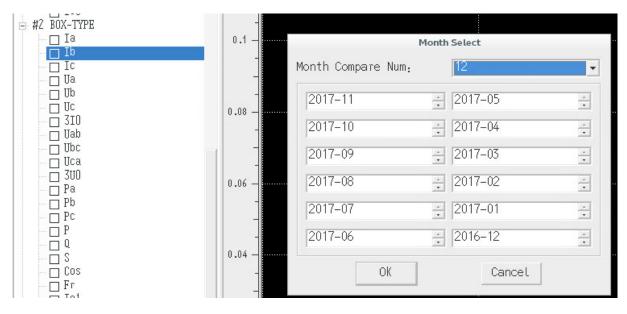


Figure 4.3.11 Selection of Single-signal Historical Monthly Curve

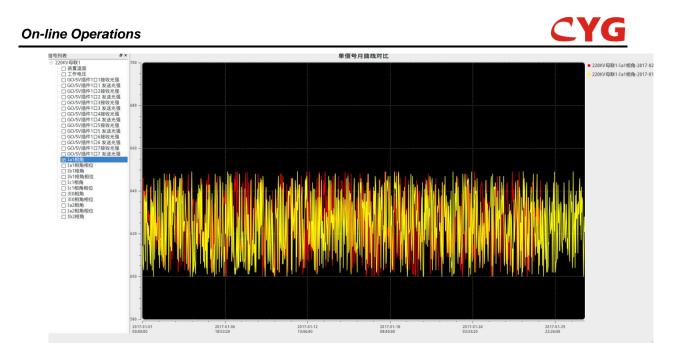


Figure 4.3.12 Single-signal Historical Monthly Curve Comparison

4.4 Report system

Report system is a sub-module of PRS-7000 integrated monitoring system. With this module, the historical data can be queried, displayed in self-defined form and printed out.

Report tool provides two operation modes: "edit state" and "operating state". At edit state, the report can be set and configured for use by report designer; at operating state, the report can be queried and printed for use by general operators.

Report supports for normal and special types. Normal report is used for statistical and sampling data, while special report is used for event data. The two types of report can be divided into several sub-types, basically covering the users' demands.

4.4.1 Report type

4.4.1.1 Sampling statistical report

Sampling statistical report is mainly specific to analog quantity and electric energy quantity. The common basic report consists of daily report, monthly report and annual report. Shift report, weekly report and quarterly report can be specially generated from basic report mentioned above. Statistic type of report are described as follows.

Report type	Signal ty	/pe	Value type
		Offset	value on the hour
			Maximum
			Minimum
Daily report	Analog quantity	Statistics	Maximum moment
			Minimum moment
			Average value
	Electric energy	Offset	Energy metering on the hour

Table 4.4.1 Statistic Type of Daily Report



quantity		Electric energy quantity of hour time
		Daily cumulative electric energy quantity
		Electric energy quantity in daily peak period
		Electric energy quantity in daily valley period
		Electric energy quantity in daily mean period
	Statistics	Daily load factor
	Statistics	Maximum electric energy quantityof hour time
		Minimum electric energy quantity of hour time
		Maximum of hour time
		Minimum of hour time
		Average electric energy quantity of hour time

Table 4.4.2 Statistic Type of Monthly Report

Report type	Sig	nal type	Value type
			Daily maximum
			Daily minimum
		Offset	Daily maximum moment
			Daily minimum moment
	Analog quantity		Daily average
	Analog quantity		Monthly maximum
			Monthly minimum
		Statistics	Monthly maximum moment
			Monthly minimum moment
			Monthly average
		Offset	Daily cumulative electric energy quantity
	Electric energy quantity		Maximum electric energy quantity of hour time
Monthly report			Minimum electric energy quantity of hour time
			Maximum of hour time
			Minimum of hour time
			Average electric energy quantity of hour time
			Monthly cumulative electric energy quantity
			Maximum daily electric energy quantity in a
	quantity		month
			Minimum daily electric energy quantity in a
		Statistics	month
			Monthly maximum electric energy quantity
			day
			Monthly minimum electric energy quantity day
			Monthly average electric energy quantity



Report type	Sig	nal type	Value type
			Monthly maximum
			Monthly minimum
		Offset	Monthly maximum moment
			Monthly minimum moment
	Analog quantity		Monthly average
	Analog quantity		Annual maximum
			Annual minimum
		Statistics	Annual maximum moment
			Annual minimum moment
			Annual average
			Monthly cumulative electric energy quantity
			Maximum daily electric energy quantity in a
	Electric energy		month
		Offset	Minimum daily electric energy quantity in a
Annual report			month
			Monthly average electric energy quantity
			Monthly maximum electric energy quantity
			day
			Monthly minimum electric energy quantity day
			Annual cumulative electric energy quantity
	quantity		Maximum monthly electric energy quantity in
			a year
			Minimum monthly electric energy quantity in a
			year
		Statistics	Average monthly electric energy quantity in a
			year
			Maximum electric energy quantity month in a
			year Minimum electric energy quantity month in a
			Minimum electric energy quantity month in a
			year

Table 4.4.3 Statistic Type of Annual Report

4.4.1.2 Event report

Table 4.4.4 Event Report Type

S/N	Special Report
1	Exceeding limit alarming report
2	SOE report
3	VQC regulation record
4	Protective action event report



5	Self-diagnosis report
6	Operation log
7	Equipment maintenance report
8	Setting modification report
9	Remote signal state change report
10	System information report

4.4.2 Report edit

Report format can be flexibly defined. By menu selection, the data association between report cells and database can be defined conveniently. Data of report is mainly sourced from historical data, self-defined data by users, constant, and all calculated results.

The report supports many types of operations, operators, operating functions and function nest. Users may define calculations, but the expression reasonableness shall be inspected. Besides, some common formulas and functions shall be provided for calling.

Operands supported by the report include floating point number, integer number, characteri string, time variable etc.

Tabular data list can display various types of data. For character string, the data will not be processed, but directly displayed in final table. For real number and integer, the displayed length and position behind decimal point can be specified. Multiple forms of time can be displayed. A data may be concealed, which will not be displayed in the final table.

Three alignment ways can be selected in the table: align left, align center, and align right. Multiple display fonts are optional, line and row width can be adjusted conveniently, and the cell split and merge can be available. Provide table deletion and insertion function. Different types of border can be defined. It supports clipboard. Users can do cut, copy and paste operation conveniently. Relative reference and absolute reference are supported so that the the operational formual is correct after moving cell.

Report shall provide time loop function. Time loop is such a function that displays the value of a data point recorded by database discrete sampling in a series of continuous time. In this case, the user has to input the first data only. Report tool will provide loop iteration horizontally or vertically, automatically generating such data series.

The edit table can be previewed before print so that the print and display table are consistent. Report printing time can be defined freely.

Provide common table templates. Users can select required template as needed. Report can be online modified and self-synchronized. Report can be managed convenienctly.

4.4.3 Report display

Organize and display reports in Excel. Support running log, monthly, annual statistical and special statistical table.

The required report can be displayed conveniently. Provide data modification by manual. After modification, the corresponding manual setting place in database will be labeled to indicate



manual setting.

Select year, month and day, and query the historical report.

Report display interface is shown as Figure 4.4.1.

As Print Call data Save data		📄 🇾 de Quit													
t File List		В	с	D	E	F	c	н	I	J	К	L	м	N	0
Name	4														
Regular Report Daily Report	5			TM1			TM2			#1 box-type			#2 box-type		1
ten 🔣 ICD (1kV SUBSTATION Daily***	6	Datetime	Ia	Р	Q	Ia	Р	Q	Ia	Р	Q	Ia	Р	Q	Ia
	7		A	mW	mVar	A	mW	mVar	A	mW	mVar	A	mW	mVar	A
	8	0:00	*	*	*	*	*	*	*	*	*	*	*	*	*
	9	1:00	*	*	*	*	*	*	*	*	*	*	*	*	*
	10	2:00	*	*	*	*	*	*	*	*	*	*	*	*	*
	11	3:00	*	*	*	*	*	*	*	*	*	*	*	*	*
	12	4:00	*	*	*	*	*	*	*	*	*	*	*	*	,
	13	5:00	*	*	*	*	*	*	*	*	*	*	*	*	,
	14	6:00	*	*	*	*	*	*	*	*	*	*	*	*	,
	15	7:00	*	*	*	*	*	*	*	*	*	*	*	*	,
	16	8:00	*	*	*	*	*	*	*	*	*	*	*	*	1
	17	9:00	*	*	*	*	*	*	*	*	*	*	*	*	
	18	10:00	*	*	*	*	*	*	*	*	*	*	*	*	
	19	11:00	*	*	*	*	*	*	*	*	*	*	*	*	
	2.0	12:00	*	*	*	*	*	*	*	*	*	*	*	*	
	21	13:00	*	*	*	*	*	*	*	*	*	*	*	*	
	22	14:00	*	*	*	*	*	*	*	*	*	*	*	*	,
	23	15:00	*	*	*	*	*	*	*	*	*	*	*	*	- E
	24	16:00	*	*	*	*	*	*	*	*	*	*	*	*	
	25	17:00	*	*	*	*	*	*	*	*	*	*	*	*	1
	26	18:00	*	*	*	*	*	*	*	*	*	*	*	*	1
	1				1	1				1			1	1	-

Figure 4.4.1 Report Display

4.4.4 Report print

Timed print: print required reports at defined time.

Call print: print existing reports by operator's calling on human-machine interface.

Click "Operate (E)" in the toolbar of report query tool, and then click "print" in the drop-down list:

File(F) Operation(E) Options(C)	Help(H)					Report Quei	y Tool. CYG SI	JNRI CO.,LTI
	Save data	🗃 🌄 de Quit						
eport Fi Save As		В	С	D	E	F	G	Н
'ile Name	4							
i in Regular Report i in Inily Report	5			TM1			TM2	
ICD 11kV SUBSTATION	6 Barty-	Datetime	Ia	Р	Q	Ia	Р	Q
	7		A	mW	mVar	А	mW	mVar



4.5 Anti-maloperation blocking

4.5.1 Overview

PRS-7000 integrated monitoring system can realize anti-maloperation function by establishing communication with independent anti-maloperation host of other manufacturer. In addition, as the monitoring system has integrated integration anti-maloperation function, many integrated

anti-maloperation blocking proposal can be provided as demanded, so as to achieve safe and reliable anti-maloperation blocking function.

PRS-7000 integrated monitoring system not only provides integrated anti-maloperation blocking on station level, but also realizes anti-maloperation blocking on bay level, which strictly stops misoperation in the running of system.

4.5.2 Anti-maloperation blocking mode

4.5.2.1 Integrated anti-maloperation mode I

In this mode, the anti-maloperation host makes full use of monitoring system platform. In combination of computer key as well as its encryption technique and computer communication technology, the operation rules are introduced into monitoring system. By combining software and hardware, the anti-maloperation function is improved, which can strictly prohibit maloperation of operators possibly occurred in the operation.

Compared to traditional anti-maloperation host, the anti-maloperation host in this mode adopts a mode closely integrated with monitoring system. The integration is expressed in following aspects:

1) Microcomputer anti-maloperation system and background system have the consistent data bus; anti-maloperation modules and other SCADA application modules obtain data from the same real-time database;

2) Microcomputers anti-maloperation system and SCADA have the unified database configuration. Anti-maloperation data selecting measuring point and edits anti-maloperation properties (i.e. open-close rules, operational tips etc.) directly from SCADA;

3) Microcomputers anti-maloperation system and SCADA have the unified picture. The pictures of automation system can be directly used as proofing pictures, without re-making;

4) Microcomputer anti-maloperation system and measuring & control device of bay level share the operation rule base.

In a word, anti-maloperation system and SCADA have the unified data bus, unified database configuration and unified picture editing. Anti-maloperation system and measuring & control device of bay level share the operation rule base. Compared to traditional mode, this mode has eliminated repeated configuration, the system architecture is simpler, and maintenance is more convenient.

In this mode, the electrical operation process is: Simulated operation ticket issuing, simulates unlocking operation under blocking condition at rehearsal.

As it is seen, the whole electrical operation process is under the strict blocking condition of anti-maloperation host, computer key, anti-maloperation locks and measuring & control device of bay level. Operators are forced to make operation according to the operation sequence checked by anti-maloperation rule, so that the whole anti-maloperation system can realize all-around anti-maloperation blocking in software and hardware.

4.5.2.2 Integrated anti-maloperation mode II

Compared to integrated anti-maloperation mode, the largest difference from this pattern lies in local operating circuit blocking mechanism:

- 1) Not use anti-maloperation locks to make local operating blocking, not provide computer key;
- 2) Local operating blocking is realized by blocking node output from I/O BCU of bay level.

From the aspect of operating circuit, the difference from mode I is that removing "I/O blocking contact" to local operating circuit and substituting anti-maloperation lock with I/O BCU blocking contact of bay level to make local operation blocking.

Use difference from mode I: as the opening/closing of blocking contact of I/O BCU on bay level is judged in real-time according to rules, any unblocking operation is not required by manual in local operation (except abnormal operation).

To be noted that, as the computer key has no code matching function, if several devices of substation have no rules in local electrical operation or the rule of a certain time can be satisfied, the maloperation may be caused to the device. At this point, other methods can be used to meet requirements, for instance, strengthening electrical operation management of operators.

4.5.3 Independent anti-maloperation mode

Anti-maloperation system and SCADA are from different manufacturers. Our integrated monitoring system can match with independent anti-maloperation system by communication, and complete anti-maloperation blocking of station level. Communication protocol with independent anti-maloperation system can be extended so as to establish communication access with different anti-maloperation systems.

4.6 Setting operation management

SCADA provides functions of setting call, setting modification, setting zone switchover, and setting patrolling, and also realizes soft switch's on and off, call and print of state value and analog quantity.

Click "Application" in the menu bar of HMI, and select "Secondary device management" in the drop-down list as following figure:

<u>C</u> onfig	Appliation View	
0	Secondary Devices Management	
Previou	Sequential operation combination ticket Trigger accident recall	Shrir
tus Ant	Time synchronization system monitoring	-11-2
ð×	Over-limit management	
	Sign board management	
	AGVC application management	

Figure 4.6.1 Application



After clicking secondary device management, the following device management interface will display:

YG深瑞 Function Config	Appliation View		a
		r Flash Server Switch	
evice Management	isoperation host status, Off I 2017-11-29 21, 14, 27 Basic Info Setting Value Pressure Plate Status Value Simulate V	Value Wave Recording Peration Report	
ay Query			mload Paramet Signal Reset Print
	e paramet vice parameter nam Device parameter HHS na	ame paramete vice parameter val e parameter Hodify	
w List = ton like SUBSTATION → Thi → Thi → 41 box-type ⊕ → 41 box-type ⊕ → 42 box-type ⊕ → 5xbarl ⊕ → 5xbarl ⊕ → 5xbarl			

Figure 4.6.2 Secondary Device Management Interface

Left bay list: display all secondary devices in all bays. Left clicking means selection;

On the right side, the device parameter, setting, switch, state value and ananlog quantity can be selected successively;

1) Device parameter: retrieve the parameter information of protective, measuring and control device, download and print device parameters, and reset the signal of device, as shown in Figure 4.6.3.



Figure 4.6.3 Device Parameter Management

2) Information management of setting zone: retrieve the setting zone information of protective device, switch the setting zone, output and print the information of setting zone as shown in Figure 4.6.4.



Device Management	Basic Info Setting Value Pressure Plate Status Value	Simulate Value	
Bay Query	Setting Value Information tting Value Ar Setting Value	Unique code, Home	Print
Bay List = tr_ ICD 11kV SUBSTATION TRI TRI INVTRI protection and control VIEZ INVTRI Protection and control	Setting value area operation value area inf i setting value tohing setting (ching set	ting	
v #1 box-type Ilkv#1 box-type protection and # #2 box-type Ilkv#2 box-type protection and	Name mrrent valu pdified valu Return value		

Figure 4.6.4 Setting Zone Information

3) Setting information management: call the setting of current zone and non-current zone, modify the setting, output and print the setting. The function are described as follows:

- Provide setting management function: setting call and modification etc.;
- Receive setting list;
- Provide protection verification at setting and modification display.
- See Figure 4.6.5.

	Setting Value Information	Unique code, None	
t ED 11KV SUBSTATION	Setting value area	Setting value area number Setting value group number Setting value area operation	
THI INVITE Protection and control TH2	Current setting value 👻	0 1 Il setting val load setting v onfirm downloa cancel download	2

Figure 4.6.5 Constant Value Management

- 4) Provide switch state call and print function;
- 5) Provide retrieval of state value and analog quantity;

4.7 Control of voltage and reactive power

4.7.1 Overview

Voltage stability has great significance for national economic production and equipment life extension, while reducing reactive flow on line and power loss and realizing economic power supply is the target of every power supply sector. For this reason, with the load fluctuation, it is always very frequent that the substation has voltage and reactive regulation demands. If making regulation by manual intervention, one one hand, it will increase the burden of person on duty; on the other hand, it is hard to achieve regulation reasonableness by manual judgment.

With the improvement of integrated automation degree of substation, both sampling precision and signal response speed of system are greatly improved. The range of signals connected in different ways is greatly expanded than previous system. In the existing local monitoring system, the necessary conditions to realize automatic regulation of voltage and reactive power by software module control are theoretically fulfilled.

PRS-7000 integrated monitoring system provides reactive voltage control (VQC) function. The



VQC is integrated in the monitoring system, which realizes automatic regulation of voltage and reactive power in pure software. This software is applied to 10kV, 35kV, 110kV and 220kV substation, which can control 1~3 sets of two-winding transformer/three-winding transformer with same specification and 1~16 sets of shunt capacitive reactor, and realize integrated automation control for on-load voltage regulation and switching capative reactor banks.

VQC in monitoring system can automatically identify the primary wiring mode and operation mode of system, and take optimized measures according to system operation mode, working condition and specific site requirements so that the voltage and reactive power satisfy the setting range. In addition, the VQC has abundant blocking function to assure system safety. Users may flexibly set the corresponding remote signal as blocking signal as needed. For switching of capacitor banks, users can sefl-define the switchihng sequence.

4.7.2 Operating principle

The main method to regulate voltage and reactive power of substation is to regulate the main transformer tap and switched capative reactor bank. Regulation of tap and switched capative reactor has influcences on voltage and reactive power: up-regulation of tap, the voltage and reactive power will rise; down-regulation of tap, the voltage and reactive power will drop (it is positive for upshift and voltage rising, and opposite for upshift and voltage dropping); switching on capacitor, the reactive power will drop; switching on reactor, the reactive power will rise and the voltage will drop; switching on reactor, the reactive power will rise and the voltage will drop; switching on reactor, the reactive power will rise (as the same operation to reactor and capacitor causes opposite result, the traditional capacitor will substitute reactor in following section).

As switching off capacitor is equivalent to switching on reactor, switching on capacitor is equivalent to switching off reactor. When the reactor and capacitor are on the same paralleled bus, in order to avoid repeating use, improve service life of device and save energy, the following rule will be used: if the capacitor has to be switched-on on the paralleled bus at a certain time, but the reactor has been operating on the bus, the reactor shall be switched off in priority. If disconnecting capacitor is required, the priority to remove capacity shall be given.

In the operation mode, the VQC considers that if any side of middle-voltage side or low-voltage side of main transformer is in paralleled operation and the main transformer switch correlated to paralleled bus is in operating, the main transformer will be in paralleling operation. In paralleling operation, the main transformer tap shall be kept on the same position. When regulating the main transformer tap, the regulation to main transformer shall be carried out simultaneously. All capative reactor banks related to paralleling main transformer can be regarded to connect to same bus and be switched on/off circularly.

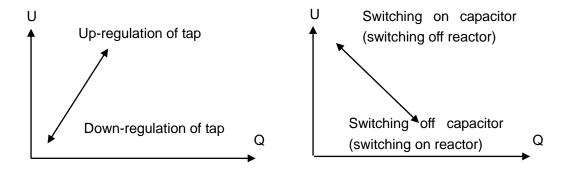


Figure 4.7.1 Influence of tap regulation and capacitor-reactor set switching on voltage and reactive power

VQC supports many control strategies. According to regional requirements, the control strategy can be divided into nine-zone graph method, fifteen-zone graph method and seventeen-zone graph method. Fifteen-zone and seventeen-zone graph method supports six patterns: consider voltage only, consider reactive power only, consider voltage in priority, consider reactive power in priority, comprehensive consideration and manual setting.

4.7.2.1 Nine-zone graph method

Nine-zone graph method means taking the corresponding control policy in nine zones. Nine-zone graph and relevant parameter definitions are as follows:

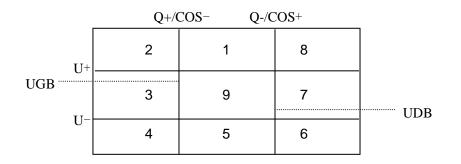


Figure 4.7.2 Nine-zone Graph

Voltage threshold-crossing

1) U>U+: voltage goes over upper limit

2) U<U-: voltage goes over lower limit

3) UGB=(U+) $-\triangle$ Uq: voltage upper limit of zone-3 (\triangle Uq is the maximum voltage change affected by switching on a set of capacitor)

4) UDB=(U-)+ \triangle Uq: voltage lower limit of zone-7 (\triangle Uq is the maximum voltage change affected by switching on a set of capacitor)

Reactive threshold-crossing

Reactive threshold-crossing can judge based on reactive power or power factor. The upper limit value COS+ of power factor can be set to positive or negative: if positive, it is not allowed to compensate reactive power; if negative, it is allowed to compensate little reactive power.

- 1) Q>Q+: reactive power goes over upper limit
- 2) Q<Q-: reactive power goes over lower limit
- 3) COS<COS- and Q>0: power factor goes over lower limit
- 4) COS>COS+ or Q<0: power factor goes over upper limit (COS+ is positive)



5) COS<|COS+| and Q<0: power factor goes over upper limit (COS+ is negative)

Control strategy

Control strategy of nine-zone graph is as following table (Number 1~9 corresponds to the position of represented bus of Figure 4.7.2 in nine-zone graph).

No.	Zone Description	Control Strategy				
1	Voltage goes over upper limit. Reactive power/power factor is normal.	Normal mode: regulate down the tap. If the tap cannot be regulated, switch off the capacitor; Capacitor in priority mode: switch off the capacitor. If disconnecting capacitor will make reactive power/power factor over limit or there is no capacitor for disconnecting, then regulate the tap down. If the tap cannot be regulated, switch off the capacitor forcedly.				
2	Voltage goes over upper limit. Reactive power goes over upper limit/power factor goes over lower limit.	Regulate the tap down. If the tap cannot be regulated, switch off the capacitor.				
3	Voltage is normal. Reactive power goes over upper limit/power factor goes over lower limit.	When voltage is less than UGB, switch on the capacitor. If no capacitor can be switched on, no operation will be made; When voltage is more than UGB, if there is regulable capacitor, regulate the tap down; or else no operation will be made.				
4	Voltage goes over lower limit. Reactive power goes over upper limit/power factor goes over lower limit.	s over power/power factor over limit in opposite direction or there is no or goes capacitor for connecting, then regulate the tap up. If the tap cann				
5	Voltage goes over lower limit. Reactive power/power factor is normal.	Normal mode: regulate up the tap. If the tap cannot be regulated, put on the capacitor; Capacitor in priority mode: switch on the capacitor. If connecting capacitor will make reactive power/power factor over limit or there is no capacitor for connecting, then regulate the tap up. If the tap cannot be regulated, switch on the capacitor forcedly.				
6	Voltage goes over lower limit. Reactive power goes over lower limit/power factor goes over upper limit.	Regulate the tap up. If the tap cannot be regulated, switch on the capacitor.				
7	Voltage is normal. Reactive power goes over lower limit/power factor goes over upper limit.	When voltage is more than UDB, switch off the capacitor. If no capacitor can be switched off, no operation will be made; When voltage is less than UDB, if there is switchable capacitor, regulate the tap up; or else no operation will be made.				
8	Voltage goes over upper limit. Reactive power goes over lower limit/power factor goes	Switch on the capacitor. If connecting capacitor will make reactive power/power factor over limit in opposite direction or there is no capacitor for switching off, then regulate the tap up. If the tap cannot				

Table 4.7.1 Control Strategy of Nine-zone Graph



	over upper limit.	be regulated, switch offthe capacitor forcedly.					
9	Voltage is normal. Reactive power/power factor is normal.	If voltage on medium-voltage side goes over upper limit, regulate the tap down; If voltage on medium-voltage side goes over lower limit, regulate the tap up; If voltage on medium-voltage side is normal, no operation will be made.					
Note	e: before implementing control str	rategy, this module will predict the regulation result based on given					
param	parameters. If reactive power/power factor on low-voltage side or voltage on low-voltage side goes over limit						
	after regulation, the mo	odule will regulate action strategy or have no action.					

4.7.2.2 Fifteen-zone graph method

Fifteen-zone graph method means taking the corresponding control policy in fifteen zones. Fifteen-zone graph and relevant parameter definitions are as follows:

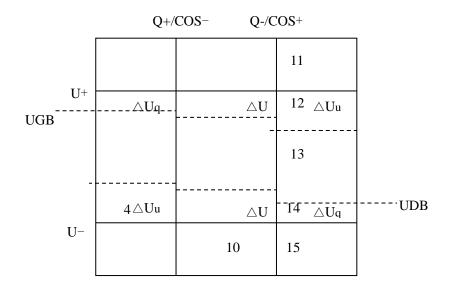


Figure 4.7.3 Fifteen-zone Graph

Voltage threshold-crossing

- 1) U>U+: voltage goes over upper limit
- 2) U<U-: voltage goes over lower limit
- 3) Uq: the maximum voltage change affected by switching on a set of capacitor
- 4) Uu: the maximum voltage change affected by regulating a gear of tap
- 5) U: the higher value of $\triangle Uq$ and $\triangle Uu$

Reactive threshold-crossing

Reactive threshold-crossing can judge based on reactive power or power factor. The upper limit



value COS+ of power factor can be set to positive or negative: if positive, it is not allowed to compensate reactive power; if negative, it is allowed to compensate little reactive power.

- 1) Q>Q+: reactive power goes over upper limit
- 2) Q<Q-: reactive power goes over lower limit
- 3) COS<COS- and Q>0: power factor goes over lower limit
- 4) COS>COS+ or Q<0: power factor goes over upper limit(COS+ is positive)
- 5) COS<|COS+| and Q<0: power factor goes over upper limit (COS+ is negative)

Control strategy

Control strategy of fifteen-zone graph is as following table (Number 1~15 corresponds to the position of represented bus of Figure 4.7.3 in fifteen-zone graph).

When strategy 1 cannot be operated, adopt strategy 2. If manual setting of control strategy is selected, the control strategy can be set by manual.

Zone	-	ulate e only	reactive	ulate e power nly		ge in ority	Reactive in pr	-	Compre consid	hensive eration
No.	Strate	Strate	Strate	Strateg	Strateg	Strateg	Strateg	Strateg	Strateg	Strateg
	gy 1	gy 2	gy 1	y 2	y 1	y 2	y 1	y 2	y 1	y 2
		Switch		Switch		Switch		Switch		
1	Gear	off	Gear	on	Gear	off	Gear	on	Gear	
1	down	capaci	down	capacit	down	capacit	down	capacit	down	
		tor		or		or		or		
			Switch					Switch		
2			on	Gear	Gear		Gear	on	Gear	
2			capacit	down	down		down	capacit	down	
			or					or		
			Switch		Switch		Switch		Switch	
3			on		on		on		on	
3			capacit		capacit		capacit		capacit	
			or		or		or		or	
			Switch		Switch		Switch		Switch	
4			on		on		on		on	
4			capacit		capacit		capacit		capacit	
			or		or		or		or	
	Switch		Switch		Switch		Switch		Switch	
F	off	Gear	on		on	Gear	on	Gear	on	Gear
5	capaci	up	capacit		capacit	up	capacit	up	capacit	up
	tor		or		or		or		or	
6	Gear	Switch			Gear	Switch	Gear	Switch	Gear	Switch

Table 4.7.2 Control Strategy of Fifteen-zone Graph



	down	off			down	off	down	off	down	off
		capaci				capacit		capacit		capacit
		tor				or		or		or
7										
8										
9										
		Switch				Switch		Switch		Switch
10	Gear	on			Gear	on	Gear	on	Gear	on
10	up	capaci			up	capacit	up	capacit	up	capacit
		tor				or		or		or
	Switch		Switch		Switch		Switch		Switch	
11	off	Gear	off		off	Gear	off	Gear	off	Gear
	capaci	down	capacit		capacit	down	capacit	down	capacit	down
	tor		or		or		or		or	
			Switch		Switch		Switch		Switch	
12			off		off		off		off	
12			capacit		capacit		capacit		capacit	
			or		or		or		or	
			Switch		Switch		Switch		Switch	
13			off		off		off		off	
10			capacit		capacit		capacit		capacit	
			or		or		or		or	
				Switch				Switch		
14			Gear	off	Gear		Gear	off	Gear	
• •			up	capacit	up		up	capacit	up	
				or				or		
		Switch		Switch		Switch		Switch		
15	Gear	on	Gear	off	Gear	on	Gear	off	Gear	
	up	capaci	up	capacit	up	capacit	up	capacit	up	
		tor		or		or		or		

Elaboration of fifteen-zone voltage priority strategy is made as follows.

Table 4.7.3 Elaboration of Fifteen-zone Voltage Priority Control Strategy

Zone No.	Zone Description	Control Strategy
1	Voltage goes over upper limit. Reactive power goes over upper limit/power factor goes over lower limit.	Regulate the tap down. If the tap cannot be regulated, switch off the capacitor.
2	Voltage is normal. Reactive power goes over upper limit/power factor goes over lower limit.	If there is regulable capacitor, regulate the tap down; or else no operation will be made.



3	Voltage is normal. Reactive power goes over upper limit/power factor goes over lower limit.	Switch on the capacitor. If there is no switchable capacitor, no operation will be made.
4	Voltage is normal. Reactive power goes over upper limit/power factor goes over lower limit.	Switch on the capacitor. If there is no switchable capacitor, no operation will be made.
5	Voltage goes over lower limit. Reactive power goes over upper limit/power factor goes over lower limit.	Switch on the capacitor. If connecting capacitor will make reactive power/power factor over limit in opposite direction or there is no capacitor for connecting, then regulate the tap up. If the tap cannot be regulated, switch on the capacitor forcedly.
6	Voltage goes over upper limit. Reactive power/power factor is normal.	Normal mode: regulate down the tap. If the tap cannot be regulated, switch off the capacitor; Capacitor in priority mode: switch off the capacitor. If disconnecting capacitor will make reactive power/power factor over limit or there is no capacitor for disconnecting, then regulate the tap down. If the tap cannot be regulated, switch off the capacitor forcedly.
7	Voltage is normal. Reactive power/power factor is normal.	If voltage on medium-voltage side goes over upper limit, regulate the
8	Voltage is normal. Reactive power/power factor is normal.	tap down; If voltage on medium-voltage side goes over lower limit, regulate the tap up;
9	Voltage is normal. Reactive power/power factor is normal.	If voltage on medium-voltage side is normal, no operation will be made.
10	Voltage goes over lower limit. Reactive power/power factor is normal.	Normal mode: regulate up the tap. If the tap cannot be regulated, switch on the capacitor; Capacitor in priority mode: switch on the capacitor. If connecting capacitor will make reactive power/power factor over limit or there is no capacitor for connecting, then regulate the tap up. If the tap cannot be regulated, switch on the capacitor forcedly.
11	Voltage goes over upper limit. Reactive power goes over lower limit/power factor goes over upper limit.	Switch on the capacitor. If connecting capacitor will make reactive power/power factor over limit in opposite direction or there is no capacitor for connecting, then regulate the tap up. If the tap cannot be regulated, switch on the capacitor forcedly.
12	Voltage is normal. Reactive power goes over lower limit/power factor goes over upper limit.	Switch off the capacitor. If there is no switchable capacitor, no operation will be made.
13	Voltage is normal. Reactive power goes over lower limit/power factor goes	Switch off the capacitor. If there is no switchable capacitor, no operation will be made.



	over upper limit.	
	Voltage is normal.	
14	Reactive power goes over	If there is switchable capacitor, regulate the tap up; or else no
14	lower limit/power factor goes	operation will be made.
	over upper limit.	
	Voltage goes over lower limit.	
15	Reactive power goes over	Regulate the tap up. If the tap cannot be regulated, switch on the
15	lower limit/power factor goes	capacitor.
	over upper limit.	
Note	: before implementing control stra	ategy, this module will predict the regulation result based on given
parame	eters. If reactive power/power fac	tor on low-voltage side or voltage on low-voltage side goes over limit
	after regulation, the mo	dule will regulate action strategy or have no action.

4.7.2.3 Seventeen-zone graph method

Seventeen-zone graph method means taking the corresponding control strategy in seventeen zones. Seventeen-zone graph and relevant parameter definitions are as follows:

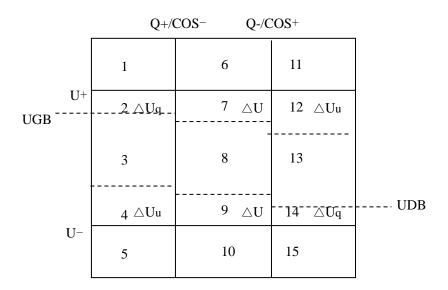


Figure 4.7.4 Seventeen-zone Graph

Voltage threshold-crossing

- 1) U>U+: voltage goes over upper limit
- 2) U<U-: voltage goes over lower limit
- 3) Uq: the maximum voltage change affected by putting on a set of capacitor
- 4) Uu: the maximum voltage change affected by regulating a gear of tap

Reactive threshold-crossing

Reactive threshold-crossing can judge based on reactive power or power factor. The upper limit value COS+ of power factor can be set to positive or negative: if positive, it is not allowed to



compensate reactive power; if negative, it is allowed to compensate little reactive power.

- 1) Q>Q+: reactive power goes over upper limit
- 2) Q<Q-: reactive power goes over lower limit

3) $\triangle Qq$: the maximum reactive power change caused by switching on/off a set of capacitor, i.e. the largest capacity of capacitor

- 4) $\triangle Qu$: the maximum reactive power change caused by regulating a gear of main transformer
- 5) COS<COS- and Q>0: power factor goes over lower limit
- 6) COS>COS+ or Q<0: power factor goes over upper limit (COS+ is positive)
- 7) COS<|COS+| and Q<0: power factor goes over upper limit (COS+ is negative)

Control strategy

Control strategy of seventeen-zone graph is as following table (Number corresponds to the position of represented bus of Figure 4.7.4 in seventeen-zone graph).

When strategy 1 cannot be operated, adopt strategy 2. If manual setting of control strategy is selected, the control strategy can be set by manual.

Action zone	Regi voltag	ulate e only	ate reactive		Regulate reactive power only		Voltage in priority		Reactive power in priority		Comprehensive consideration	
20116	Strate	Strate	Strate	Strateg	Strateg	Strateg	Strateg	Strateg	Strateg	Strateg		
	gy 1	gy 2	gy 1	y 2	y 1	y 1	y 2	y 1	y 2	y 1		
		Switch				Switch		Switch		Switch		
1	Gear	off			Gear	off	Gear	off	Gear	off		
I	down	capaci			down	capacit	down	capacit	down	capacit		
		tor				or		or		or		
		Switch				Switch						
10	Gear	off			Gear	off	Gear		Gear			
10	down	capaci			down	capacit	down		down			
		tor				or						
	Switch				Switch		Switch		Switch			
11	off	Gear			off	Gear	off		off			
11	capaci	down			capacit	down	capacit		capacit			
	tor				or		or		or			
		Switch		Switch		Switch		Switch				
2	Gear	off	Gear	on	Gear	off	Gear	on	Gear			
2	down	capaci	down	capacit	down	capacit	down	capacit	down			
		tor		or		or		or				
3			Switch		Switch		Switch		Switch			

Table 4.7.4 Control Strategy of Seventeen-zone Graph



			on		on		on		on	
			capacit		capacit		capacit		capacit	
			or		or		or		or	
			Switch					Switch		
			on	Gear	Gear		Gear	on	Gear	
30			capacit	down	down		down	capacit	down	
			or					or		
			Switch		Switch		Switch		Switch	
			on		on		on		on	
31			capacit		capacit		capacit		capacit	
			or		or		or		or	
	Switch		Switch		Switch		Switch		Switch	
	on	Gear	on		on	Gear	on	Gear	on	Gear
4	capaci	up	capacit		capacit	up	capacit	up	capacit	up
	tor		or		or		or		or	- 1
		Switch				Switch		Switch		Switch
	Gear	on			Gear	on	Gear	on	Gear	on
5	up	capaci			up	capacit	up	capacit	up	capacit
	чр	tor			ЧР	or	46	or	46	or
		Switch				Switch				0.
	Gear	on			Gear	on	Gear		Gear	
50	up	capaci			up	capacit	up		up	
	up	tor			up	or	up		up	
	Switch	101			Switch	01	Switch		Switch	
		Gear				Gear				
51	on				on		on		on	
	capaci	up			capacit	up	capacit		capacit	
	tor	Switch		Switch	or	Switch	or	Switch	or	
	Coor	Switch	Coor	Switch	Coor	Switch	Coor		Coor	
6	Gear	on	Gear	off	Gear	on	Gear	off	Gear	
	up	capaci	up	capacit	up	capacit	up	capacit	up	
		tor	Queitale	or	Quital	or	Quaitate	or	Quaitate	
			Switch		Switch		Switch		Switch	
7			off		off		off		off	
			capacit		capacit		capacit		capacit	
			or	0	or		or	0	or	
				Switch				Switch		
70			Gear	off	Gear		Gear	off	Gear	
			up	capacit	up		up	capacit	up	
				or				or		
			Switch		Switch		Switch		Switch	
71			off		off		off		off	
			capacit		capacit		capacit		capacit	
			or		or		or		or	
8	Switch	Gear	Switch		Switch	Gear	Switch	Gear	Switch	Gear



	off	down	off	off	down	off	down	off	down
	capaci		capacit	capacit		capacit		capacit	
	tor		or	or		or		or	
9				 					

Elaboration of seventeen-zone voltage priority strategy is made as follows.

Table 4.7.5 Elaboration of Seventeen -zone Voltage Priority Control Strategy

Zone No.	Zone Description	Control Strategy
1	Voltage goes over upper limit. Reactive power/power factor is normal.	Normal mode: regulate down the tap. If the tap cannot be regulated, switch off the capacitor; Capacitor in priority mode: switch off the capacitor. If disconnecting capacitor will make reactive power/power factor over limit or there is no capacitor for disconnecting, then regulate the tap down. If the tap cannot be regulated, switch off the capacitor forcedly.
10	Voltage goes over upper limit. Reactive power/power factor is normal.	Regulate the tap down. If the tap cannot be regulated, switch off the capacitor.
11	Voltage goes over upper limit. Reactive power/power factor is normal.	Switch off the capacitor. If disconnecting capacitor will make reactive power/power factor over limit or there is no capacitor for disconnecting, then regulate the tap down. If the tap cannot be regulated, switch off the capacitor forcedly.
2	Voltage goes over upper limit. Reactive power goes over upper limit/power factor goes over lower limit.	Regulate the tap down. If the tap cannot be regulated, switch off the capacitor.
3	Voltage is normal. Reactive power goes over upper limit/power factor goes over lower limit.	Switch on the capacitor. If there is no switchable capacitor, no operation will be made.
30	Voltage is normal. Reactive power goes over upper limit/power factor goes over lower limit.	If there is regulable capacitor, regulate the tap down; or else no operation will be made.
31	Voltage is normal. Reactive power goes over upper limit/power factor goes over lower limit.	Switch on the capacitor. If there is no switchable capacitor, no operation will be made.
4	Voltage goes over lower limit. Reactive power goes over upper limit/power factor goes over lower limit.	Switch on the capacitor. If connecting capacitor will make reactive power/power factor over limit in opposite direction or there is no capacitor for connecting, then regulate the tap up. If the tap cannot be regulated, switch on the capacitor forcedly.
5	Voltage goes over lower limit.	Normal mode: regulate up the tap. If the tap cannot be regulated,



	Depative power/power factor	quitch on the connectory						
	Reactive power/power factor	switch on the capacitor;						
	is normal.	Capacitor in priority mode: switch on the capacitor. If connecting						
		capacitor will make reactive power/power factor over limit or there is						
		no capacitor for connecting, then regulate the tap up. If the tap						
		cannot be regulated, switch on the capacitor forcedly.						
	Voltage goes over lower limit.	Regulate up the tap. If the tap cannot be regulated, switch on the						
50	Reactive power/power factor	capacitor;						
	is normal.							
	Voltage goes over lower limit.	Switch on the capacitor. If connecting capacitor will make reactive						
51	Reactive power/power factor	power/power factor over limit or there is no capacitor for connecting,						
01	is normal.	then regulate the tap up. If the tap cannot be regulated, switch on the						
	is normal.	capacitor forcedly.						
	Voltage goes over lower limit.							
C	Reactive power goes over	Regulate the tap up. If the tap cannot be regulated, switch on the						
6	lower limit/power factor goes	capacitor.						
	over upper limit.							
	Voltage is normal.							
-	Reactive power goes over	Switch off the capacitor. If there is no switchable capacitor, no						
7	lower limit/power factor goes	operation will be made.						
	over upper limit.							
	Voltage is normal.							
	Reactive power goes over	If there is capacitor, for disconnecting, regulate the tap up; or else no						
70	lower limit/power factor goes	operation will be made.						
	over upper limit.							
	Voltage is normal.							
	Reactive power goes over	Switch off the capacitor. If there is no switchable capacitor, no						
71	lower limit/power factor goes	operation will be made.						
	over upper limit.							
	Voltage goes over upper limit.	Switch off the capacitor. If disconnecting capacitor will make reactive						
	Reactive power goes over	power/power factor over limit in opposite direction or there is no						
8	lower limit/power factor goes	capacitor for disconnecting, then regulate the tap down. If the tap						
	over upper limit.	cannot be regulated, switch off the capacitor forcedly.						
		If voltage on medium-voltage side goes over upper limit, regulate the						
		tap down;						
	Voltage is normal.	If voltage on medium-voltage side goes over lower limit, regulate the						
9	Reactive power/power factor	tap up;						
	is normal.	If voltage on medium-voltage side is normal, no operation will be						
		made.						
Note	Letore implementing control str	ategy, this module will predict the regulation result based on given						
		tor on low-voltage side or voltage on low-voltage side goes over limit						
Parame								
	after regulation, the module will regulate action strategy or have no action.							

4.7.2.4 Blocking logic

> Low-voltage bus blocking

Low-voltage bus blocking will block the VQC regulation of whole bus, including regulation of main transformer and switching on/off of capacitor. If any section of parallel bus is blocked, other bus sections will also be blocked. When the medium-voltage side requires regulation, if there is blocking on the correlated low-voltage bus, the medium-voltage side shall not be regulated.

- Bit 01, configuration error blocking (modify configuration and reset): in the configuration of low-voltage bus, the signal is not configured or the signal has been deleted.
- Bit 03, remote signal blocking (auto reset): for blocking remote signal in the corresponding low-voltage bus, the auto reset remote signal meets blocking condition.
- Bit 04, remote signal blocking (manual reset): for blocking remote signal in the corresponding low-voltage bus, the manual reset remote signal meets blocking condition.
- Bit 05, zero-sequence voltage blocking (auto reset): the zero-sequence voltage blocking of low-voltage bus is enabled, and zero-sequence voltage goes over limit.
- Bit 06, over-voltage and under-voltage blocking (auto reset): the voltage of low-voltage bus goes over limit.
- Bit 07, reactive threshold-crossing (auto reset): the reactive power of main transformer on the low-voltage bus goes over limit.
- Bit 08, no operating main transformer (auto reset): there is no main transformer operating in parallel bus.
- Bit 10, differential voltage blocking (auto reset): the voltage difference between maximum and minimum of parallel low-voltage bus exceeds the differential voltage constant.
- Bit 11, regulation failure blocking (manual reset): if the main transformer on parallel bus has been successfully regulated for three times, the capacitor has been successfully regulated for one time, and the change of voltage or reactive power is less than the minimum of voltage or reactive power on low-voltage side when regulating gear and switching on/off capacitor, the first section of parallel bus will be set as regulation failure blocking.

If the blocking information is converted to binary bit string, the meaning is described as follows (the least significant bit is the first bit):

Device	Bit	Meaning	Bit	Meaning	Remark
	1	Configuration error blocking	2		
Low-vo	3	Remote signal blocking	4	Remote signal blocking	If any section of bus in
		(auto reset)		(manual reset)	several paralleled lines is
Itage	5	Zero-sequence voltage	6	Overvoltage-undervoltageb	blocked, the whole
bus		blocking		locking	paralleled bus will be
	7	Reactive threshold-crossing	8	No operating main	blocked.
				transformer	

Table 4.7.6 Low-voltage Bus Blocking Logic



9	9		10	Differential voltage blocking
11	1	Regulation failure blocking (manual reset)	12	

> Medium-voltage bus blocking

Medium-voltage bus blocking will block the VQC regulation of whole bus, including regulation of main transformer and switching on/off of capacitor on related low-voltage bus of main transformer. If any section of parallel bus is blocked, other bus sections will also be blocked. When the low-voltage side requires regulation, if there is blocking on the correlated medium-voltage bus, the low-voltage side shall not be regulated.

- Bit 01, configuration error blocking (modify configuration and reset): in the configuration of medium-voltage bus, the signal is not configured or the signal has been deleted.
- Bit 03, remote signal blocking (auto reset): for blocking remote signal in the corresponding medium-voltage bus, the auto reset remote signal meets blocking condition.
- Bit 04, telecomand blocking (manual reset): for blocking remote signal in the corresponding medium-voltage bus, the manual reset remote signal meets blocking condition.
- Bit 06, over-voltage and under-voltage blocking (auto reset): the voltage of medium-voltage bus goes over limit.
- Bit 08, no operating main transformer (auto reset): there is no main transformer operating in parallel medium-voltage bus.
- Bit 10, differential voltage blocking (auto reset): the voltage difference between maximum and minimum of parallel low-voltage bus exceeds the differential voltage constant.
- Bit 11, regulation failure blocking (manual reset): if the main transformer on parallel bus has been successfully regulated for three times, the capacitor has been successfully regulated for one time, and the change of voltage or reactive power is less than the minimum of voltage or reactive power on medium-voltage side when regulating gear and switching on/off capacitor, the first section of parallel bus will be set as regulation failure blocking.

If the blocking information is converted to binary bit string, the meaning is described as follows (the least significant bit is the first bit):

Device	Bit	Meaning	Bit	Meaning	Remark
	1	Configuration error blocking	2		If any section of bus in
Mediu	3	Remote signal blocking	4	Remote signal blocking	several paralleled lines is
m-volta	3	(auto reset)		(manual reset)	blocked, the whole
ge bus	5		6	Overvoltage-undervoltageb	paralleled bus will be
			6	locking	blocked.

Table 4.7.7 Medium-voltage Bus Blocking Logic



7		8	No operating main transformer
9		10	Differential voltage blocking
11	Regulation failure blocking (manual reset)	12	

> Main transformer blocking

Main transformer blocking only blocks the regulation of main transformer. If any transformer in paralleled transformer is blocked, other main transformers will also be blocked.

- Bit 01, configuration error blocking (modify configuration and reset): in the configuration of main transformer, the signal is not configured or the signal has been deleted.
- Bit 03, remote signal blocking (auto reset): for blocking remote signal in the corresponding main transformer, the auto reset remote signal meets blocking condition.
- Bit 04, remote signal blocking (manual reset): for blocking remote signal in the corresponding main transformer, the manual reset remote signal meets blocking condition.
- Bit 05, abnormal operation blocking (manual reset): when the main transformer regulation is on and VQC control is not made, the gears of main transformer have change.
- Bit 06, regulating times blocking (auto reset): the daily regulating times reach the maximum.
- Bit 07, reactive threshold-crossing (auto reset): the reactive power of main transformer goes over limit.
- Bit 08, disable blocking (auto reset): when the main transformer is deactivated, the medium-voltage side and low-voltage side are all deactivated.
- Bit 09. Overload/under-load (auto reset): the current of main transformer exceeds limited value.
- Bit 11, refusing operation blocking (manual reset): if the main transformer has been successfully regulated for three times (the device has implemented recheck) and the gear has no change, it is judged that the main transformer refuses operation.
- Bit 12, gear slipping blocking (manual reset): the main transformer has been successfully regulated, but the gear changes more than one.
- Bit 13, gear missing blocking: the gear between main transformers in parallel exceeds one gear per time.
- Bit 14, abnormal CB position of main transformer.
- Bit 15, the gears of main transformer reach limitation and cannot be regulated: the main transformer gears to be regulated have reached the limitation of regulation direction.
- Bit 16, regulation interval not reached: when the related main transformer and busbar group

meets regulation conditions, there is no other blocking and the regulation interval has not reached. Then the bit turn to 1.

If the blocking information is converted to binary bit string, the meaning is described as follows (the least significant bit is the first bit):

Device	Bit	Meaning	Bit	Meaning	Remark
	1	Configuration error blocking (restart, reset)	2		
	3	Remote signal blocking (auto reset)	4	Remote signal blocking (manual reset)	If any main transformer in several paralleled
Main	5	Abnormal operation blocking (manual reset)	6	Regulating times blocking	transformers is blocked, the other transformers
Main	7	Reactive threshold-crossing	8	Disable blocking	correlated will be blocked.
transfor mer	9	Overload/under-load	10		Abnormal operation
mer	11	Refusing operation blocking	12	Gear slipping blocking	means the action of
	13	Gear missing blocking	14	Abnormal CB position of main transformer	controlled object not caused by VQC
	15	Gears of main transformer reach limitation and cannot be regulated	16	regulation interval not reached	regulation.

Table 4.7.8 Main	Transformer	Blocking Logic
------------------	-------------	-----------------------

Capacitor blocking

Capacitor blocking will only block the corresponding capacitor group.

- Bit 01, configuration error blocking (modify configuration and reset): in the configuration of capacitor, the signal is not configured or the signal has been deleted.
- Bit 03, remote signal blocking (auto reset): for blocking remote signal in the corresponding capacitor, the auto reset remote signal meets blocking condition.
- Bit 04, remote signal blocking (manual reset): for blocking remote signal in the corresponding capacitor, the manual reset remote signal meets blocking condition.
- Bit 05, abnormal operation blocking (manual reset): when the capacitor regulation is on and VQC control is not made, the capacitor state has change.
- Bit 06, switching times blocking: the daily regulating times reach the maximum.
- Bit 11, refusing operation blocking (manual reset): if the switching operation has been successfully implemented (the device has implemented recheck) and the state has no change, it is judged that the capacitor refuses operation.
- Bit 12, abnormal CB position of capacitor.

If the blocking information is converted to binary bit string, the meaning is described as follows (the

least significant bit is the first bit):

Device	Bit	Meaning	Bit	Meaning	Remark
	1	Configuration error blocking	2		
	Ι	(restart, reset)	2		
	3	Remote signal blocking	4	Remote signal blocking	
	3	(auto reset)	4	(manual reset)	Abnormal operation
Capacit	5	Abnormal operation	6	Switching times blocking	means the action of
or	5	blocking (manual reset)	0	Switching times blocking	controlled object not
	7		8		caused by VQC
	9		10		regulation.
	11	Polyaing aparation blocking	12	Abnormal CB position of	
	11	Refusing operation blocking	12	capacitor	

Table 4.7.9 Capacitor Blocking Logic

4.7.3 VQC configuration tool vqccfgtool

4.7.3.1 Function ON/OFF and Preset Commissioning

For operating VQC in the monitoring system, it shall make configuration in "VQC module" of "PRS7000 system setting" as shown in following figure:

Password **	
New Password	Confirm Password
Database Configuration	
Port 3306	
Config Database Name Zhudy	History Database Name Zhudyhis
Config Database Username zhudy	History Database Username Zhudyhis
Double Server	
Main Database Server Iwj	Main SCADA Server Iwj
Slave Database Server	Slave SCADA Server
VQC Module	
✓ On	
Debug(Man-Settings)	

Figure 4.7.5 VQC module ON in system setting

There are two configurations related to background VQC.

1) ON. Only this option is selection, the VQC module in monitoring system will be put into

operation.

2) Commissioning (manual setting). Upon selecting this option, the VQC module in monitoring system will preferentially adopt manual setting as reactive regulation criterion. This option is generally used in commissioning or test. At VQC commissioning state, the return time of remote metering out-of-limit blocking will be reduced from 30s to 5s, and the return time of remote signal out-of-limit blocking will be reduced from 45s to 10s.

4.7.3.2 Monitoring signal configuration

There are several configurations related to monitoring system VQC module as follows:

1) Import the VQC template (VQC-V3.0.txt).

2) Configure the VQC device. The logic node shall be configured to server, and the direct connection property on the right can be freely configured but shall not conflict with existing direct connection device as shown in following Figure 4.7.6:

3) Configure the required four remotes of monitoring system in the bay configuration, such as blocking remote metering, current setting, bus operation section, remote control on/off etc.

		Unit Dialog		
Basic Configuration		Direct Property		OK
Unit name Backstage VQC		🗆 Net A/B alternate		Cance
Logic node Server	•	Net A IP ZZZ.111.112.106	Net A Port 2420 🔅	
Sequence 124		Net B IP	Net B Port 🛛 🚊	
Unit model VQC	•	Net C IP	Net C Port 0	
Bay VQC Bay	-	Connection mode TCP		
Operation Property		Protocol Sznari etheric 1		
		Address 112.106		
Recovery		Net A running sta Not configure Clear		
☞ Modifing setting value		Net B runnint sta Not configure Clear		
		Net C runnint sta Not Configure		
🔽 Reading setting value		1		
☞ Retrieving over lilimited log		AppID _Hulticast		
A Verticalità part ristiniscen soà		Multicast Address 01.0C.CD.01.0	0.01 APPID1 0×0000	
🔽 Retrieving measure value		Multicast Address 01.0C.CD.01.0	1.01 APPID2 0×0000	
		- Wave		
Current setting zone Not Configure	Clear	□ Enable retrieve wave		
Reconvery control Not Configure	Clear		lat Continue	
Check status siganl Not Configure	Clear	Retrieve wave finished signal N	ot Configure	
Net A status Not configure	Clear	_Linkage		
Net B statues Not configure	Clear			
Net C status Not Configure	Clear	Protocol Not Configure	<u>*</u>	

Figure 4.7.6 Configuration of VQC Secondary Devices

4.7.3.3 VQC parameter configuration

> Monitoring System VQC Configuration



Double clicking vqccfgtool icon under /home/PRS7000/bin, the following login dialog box will pop up:

RtuConf		Select Database	
	1	Login : VqcCfgTool	
	Db Server	lwj	-
skin	DbName	zhudy	-
	User		
\checkmark	Password		_
vqccfgtool		OK Cancel	

Figure 4.7.7 VQC Login

Enter username and password, and click login as shown in Figure 4.7.7:

				VqcCfgTool
File(F) Help(H)				
H 9 0				
ndex 🗗 🛪		Item	Value	
 WQC configuration m System 	1	Signal source	Monitor system	
 Action policy of manual … Realm Graphic 	2	Related device	Backstage VQC	
🔹 📻 Low voltage bus	3	AVQC mode	No	
∗ ☶ Power transformer ∗ ☶ Middle voltage bus	4	VQC type	General VQC	
∗	5	Transformer combin	Yes	
🔹 📻 Lock return property		K	8	

Figure 4.7.8 Configuration of VQC Signal Source and Correlated Device

Signal source: select "monitoring system" and determine the signal source of monitoring system VQC;

Correlated device: select VQC device configured in database configuration tool;

AVQC mode or not:

VQC type: select normal VQC or other VQC mode;

Joint commissioning of main transformer: provide joint commissioning of main transformer or not. If with main transformer, select "Yes"; otherwise, select "No";

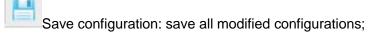
Toolbar is shown as follows:



VqcCfgTool

File(F) Help(H)	
H 9 0	

Figure 4.7.9 Toolbar



Check configuration: with this function, the VQC parameters can be provided with routine check, and the check result will be output in information prompt box;

Close tool: clicking it, a prompt box will pop up. Selecting "Yes", it will exit from VQC configuration tool;

VQC parameter configuration shall observe the following rules:

1) The signal source of VQC configuration node shall not be "None";

2) Correlated device shall be VQC device, i.e. shall not be "none". Module unit identification must be "VQC unit";

3) The number of main transformer and bus shall be correct and consistent (1-1, 2-2, 3-3, 3-4);

4) When 3U0 blocking is on, the zero-sequence voltage on low-voltage bus must be configured;

5) In the order of switching on/off capacitor, the serial number of capacitor shall not exceed that of configured capacitor;

6) The capacitance sum of bus sections shall not exceed the maximum quantity of capacitor;

7) In the configuration of bus, the signals configuration shall have the consistent number as bus, and the signals configuration shall be integrated;

8) In the configuration of main transformer, the signals configuration shall have the consistent number as main transformer, and the signals configuration shall be integrated;

9) If the main transformer has medium-voltage side, the voltage and CB on medium-voltage side must be configured;

10) If the main transformer has dual branches, the parameter signal on each branch must be configured;

11) In the configuration of capacitance, the signals configuration shall have the consistent number as capacitor, and the signals configuration shall be integrated;

12) Medium-voltage bus configuration check depends on medium-voltage side. If there is



medium-voltage side, the corresponding signal on medium-voltage side shall be completelely configured;

13) A suspension time shall be configured in the zone graph parameter configuration. If the reactive power is judged as Cos, the range of Cos shall be correct;

> System parameter setting

System parameter settings contain the following items as shown in Figure 4.7.10:

1) Low-voltage bus number: the number of bus on low-voltage side of main transformer; the maximum number is four;

2) Main transformer number: the quantity of main transformer; the maximum number is three. The system will decide the primary system wiring mode based on the number of bus and main transformer (the wiring method applied to standard configuration is shown in Appendix, and the expansion may also be made according to project);

3) Reactive criterion: reactive/power factor. It means judging the reactive threshold-crossing, corresponding zone graph setting and parameter matching based on reactive power or power factor;

4) Main transformer gear mode: the way of influencing on voltage caused by transformer gear shift, including gear-up voltage-rising/gear-down voltage-rising;

5) Zone type: nine-zne, fifteen-zone and seventeen-zone are optional;

6) Priority mode: the operation object in priority when it is nine-zone, including capacitor priority/normal mode;

7) Control strategy: when it is fifteen-zone and seventeen-zone, it includes considering voltage only, considering reactive only, voltage priority, reactive priority, comprehensive consideration and manual setting;

8) The blocking switch of main transformer in parallel: not block/only block main transformer/block main transformer and capacitor. If only blocking main transformer is selected, it only blocks the main transformer regulation when main transformer is in parallel, and the capacitor can also be switched on/off. If blocking main transformer and capacitor is selected, the paralleled main transformer and related capacitor will not be provided with VQC regulation;

9) 3U0 blocking on/off: if it is on, the inspection on zero-sequence voltage of bus will be started. If the zero-sequence voltage threshold is exceeded, VQC regulation of bus will be blocked;

10) Zero-sequence over-voltage threshold on low-voltage side: the primary value of zero-sequence voltage threshold of bus, which can be self-defined as needed;

11) Over-voltage threshold on low-voltage side: when the bus voltage exceeds the value, it will block VQC regulation of bus;

12) Under-voltage threshold on low-voltage side: when the bus voltage is less than the value, it will block VQC regulation of bus;

13) Upper limit of reactive blocking: when the reactive power of main transformer exceeds this value, it will block VQC regulation of related bus;

14) Lower limit of reactive blocking: when the reactive power of main transformer is less than this value, it will block VQC regulation of related bus;

15) The maximum voltage variation on low-voltage side when regulating a gear of main transformer (Δ Uu): the maximum influence value caused to voltage of low-voltage side when regulating a gear of main transformer tap;

16) The maximum reactive variation when regulating a gear of main transformer (ΔQu): the maximum influence value caused to reactive power of low-voltage side when regulating a gear of main transformer tap;

17) The maximum voltage variation on low-voltage side when switching on/off capacitor once (Δ Uq): the maximum influence value caused to voltage of low-voltage side when switching on/off capacitor once;

18) The maximum reactive variation when switching on/off capacitor once (\triangle Qq): the maximum influence value caused to reactive power of low-voltage side when switching on/off capacitor once; this value shall be properly increased based on actual maximum capacity of capacitor (primary);

19) The maximum voltage variation on medium-voltage side when regulating a gear of main transformer: the maximum influence value caused to voltage of medium-voltage side when regulating a gear of main transformer tap;

20) The maximum voltage variation on medium-voltage side when switching on/off capacitor once: the maximum influence value caused to voltage of medium-voltage side when switching on/off capacitor once;

21) Daily gearshift times: the maximum that VQC shifts gears of each main transformer every day. If the daily shifting times of a main transformer exceed this value, it will block the daily VQC regulation of this main transformer. Generally the value is 10, and can also be set as necessary;

22) Daily switching times: the maximum that VQC makes switching to each capacitor bank every day. If the daily switching times of a capacitor bank exceed this value, it will block the daily VQC regulation of this capacitor bank. Generally the value is 10, and can also be set as necessary;

23) Remote metering confirmation time (s): it means the time required for confirming remote metering when deciding VQC operation region, used to avoid fluctuation of remote metering data. Generally the value is 30s;

24) Regulation interval (minute): the interval between any two regulations of a main transformer and busbar group, including interval between main transformers, capacitors and between capacitor and main transformer. The interval is suggested to above 5 minutes; 25) Gearshifting interval of main transformer (minute): the interval between two regulations of a main transformer and busbar group. If the main transformer regulation is required and the interval time is not reached, the action will not be made temporarily. The interval is suggested to be 15 minutes;

26) Switching interval of capacitor (minute): the interval between two switchings of capacitor in a main transformer and busbar group. If the capacitor switching is required and the interval time is not reached, the action will not be made temporarily. The interval is suggested to be 15 minutes;

27) Reverse gearshifting interval (minute): the interval of reverse regulation of main transformer in a main transformer and busbar group. It shall be bigger than gearshifting interval of main transformer. The interval is suggested to be 20 minutes;

28) Reverse switching interval (minute): the interval between two switchings of capacitor in a main transformer and busbar group. It shall be bigger than switching interval of capacitor. The interval is suggested to be 20 minutes;

29) The minimum voltage variation on low-voltage side caused by gearshifting/switching: the minimum voltage change on the low-voltage side of bus when regulating a gear of main transformer tap or swiching a capacitor bank. If the voltage variation of bus before and after VQC regulation (consecutively shift gear of main transformer for three times, and switch capacitor once) is less than set value, it is considered that the bus regulation is failed, and it will block VQC regulation of bus. It is mainly used to prevent constant VQC regulation due that the acquisition of bus voltage is wrong;

30) The minimum voltage variation on medium-voltage side caused by gearshifting/switching: the minimum voltage change on the medium-voltage side of bus when regulating a gear of main transformer tap or swiching a capacitor bank. If the voltage variation of bus before and after VQC regulation (consecutively shift gear of main transformer for three times, and switch capacitor once) is less than set value, it is considered that the bus regulation is failed.

31) The minimum reactive variation caused by gearshifting/switching: the minimum reactive change when regulating a gear of main transformer tap or swiching a capacitor bank. If the reactive variation before and after VQC regulation (consecutively shift gear of main transformer for three times, and switch capacitor once) is less than set value, it is considered that the bus regulation is failed, and it will block VQC regulation of bus. It is mainly used to prevent constant VQC regulation due that the acquisition of reactive power of main transformer is wrong;

32) Capacitor switching sequence: the sequence of cycled switching of capacitor. When the bus has to switch capacitor bank, it will select switchable capacitors in switching sequence for operation. If the number of capacitor is N, the first N capacitor shall be set only.

33) Is there medium-voltage side: main transformer has medium-voltage side or not. If there is medium-voltage side but the voltage control is not required, it can be set to "None";

34) Medium-voltage side blocking low-voltage side: if the control policy adopted to met

requirements of low-voltage side will cause over-voltage or under-voltage on medium-voltage side, the device will select other control policies or will not have action;

35) Over-voltage threshold on medium-voltage side: if the bus voltage is more than this value, it will block VQC regulation of bus;

36) Under-voltage threshold on medium-voltage side: if the bus voltage is less than this value, it will block VQC regulation of bus;

37) Regulation of medium-voltage side: when the low-voltage side falls in normal range, the main transformer tap can be regulated so that the medium-voltage side meets requirement;

38) Low/medium dropout blocking threshold: when the voltage difference of paralleled bus is larger than this value, it will block VQC regulation of bus.

			VqcCfgTool
e(F) Help(H)			
<u>490</u>			
ex 🗗 🎦 VQC configuration	<	Item	Value
🔹 📰 System	1	Low voltage bus number	Z
 Action policy of manual … manual fraphic 	2	Power transformer number	2
 Ever voltage bus Power transformer 	3	Reactive criterion	Power factor
🔹 🧰 Middle voltage bus	4	Transformer tap mode	Voltage up when tap up
 Capacitors Others 	5	Realm type	9 realm
🔹 📻 Lock return property	6	Priority mode	General mode
	7	Control policy	Voltage first
	8	Transformer parallel locking plate	No lock
	9	3Uo lock	On
	10	Zero-sequence overvoltage threshold of low voltage side	3.000
	11	Overvoltage threshold of low voltage side	40.000
	12	Lower voltage threshold of low voltage side	30,000
	13	Reactive Locking upper	30.000
	14	Reactive locking lower	-8.000
	15	The maximum changed value of voltage at low voltage s…	1.000
	16	The maximum changed value of reactive at low voltage …	2.000
	17	The maximum changed value of voltage at low voltage s	1.000
	18	The maximum changed value of reactive at low voltage …	2.000
	19	The maximum changed value of voltage at middle voltag	1.000
	20	The maximum changed value of voltage at middle voltag	2.000
	21	Adjusting times every day	20
	22	Switching times every day	20
	23	Mesurement confirmed time (s)	40
	24	Adjusting interval (min)	1
	25	Transformer adjusting interval (min)	1
	26	Capacitor switching interval (min)	~ 1

Figure 4.7.10 System Parameter Setting

> Configuration of manual setting of action strategy

When "control strategy" in system parameter is "manual setting", the manual setting configuration node of corresponding zone will display under operation strategy manual configuration nodes as Figure 4.7.11:



File(F) Hele(H)				VqcCfgTool
File(F) Help(H)				
Index 🗗 🗙		Operating region	Policy 1	Policy 2
 WQC configuration System 	1	1	Raise tap	
🗧 🔂 Locking signal = 📻 Action policy of manual …	2	10		
a 17 realm a Realm Graphic	3	11	Switch capacitor on	
∓ 📻 Low voltage bus	4	2		
∗ m Power transformer ∗ m Middle voltage bus	5	3		
 ★ ☐ Capacitors ★ ☐ Others 	6	30	7	Raise tap 🗸 🗸
🔹 🧰 Lock return property	7	31		
	8	4		
	9	5		
	10	50		
	11	51		
	12	6		
	13	7	- <u>1660</u>	
	14	70		
	15	71		
	16	8		
	17	9		

Figure 4.7.11 Configuration of Manual Setting of Operation Strategy

> Zone graph configuration

Zone graph parameters are all primary value. There are 48 groups. Each group corresponds to a time range. User can set the ending time of time range of each group. The starting time is the ending time of previous group as shown in Figure 4.7.11:

1) Voltage upper limit on low-voltage side (U+), voltage lower limit on low-voltage side (U-): it can be self-defnied as necessary, but the maximum upper limit of voltage cannot exceed over-voltage threshold of low-voltage side, and the minimum lower limit of voltage cannot be less than under-voltage threshold of low-voltage side;

2) Cos-/Q+, Cos+/Q-: it refers to reactive crossing upper limit/power factor lower limit and reactive crossing lower limit/power factor upper limit respectively. The upper limit of power factor can be negative, indicating compensating reactive is allowed. If the reactive criterion is reactive, it shall be consistent with the unit of reactive signal in the main transformer configuration;

3) Voltage upper limit on medium-voltage side (U+), voltage lower limit on medium-voltage side (U-): it can be self-defnied as necessary, but the maximum upper limit of voltage cannot exceed over-voltage threshold of medium-voltage side, and the minimum lower limit of voltage cannot be less than under-voltage threshold of medium-voltage side;

90			
8	×	Item	Value
VQC configuration	1	Name	Graphic 1
Action policy of manua Realm Graphic	2	Start time(hhmm)	00:00
Graphic 1 Graphic 7	3	End time(hhmm)	24:00
🖁 Graphic 3	4	Upper limit of voltage at low voltage s \cdots	10.600
Graphic 4 Graphic 5	5	Lower limit of voltage at low voltage s \cdots	10.100
Graphic 6 Graphic 7	6	Cos-	0.000
Graphic 8 Graphic 9	7	Cos+	0.000
Graphic 10	8	Upper limit of voltage at middle voltag	123.000
Graphic 11 Graphic 12	9	Lower limit of voltage at middle voltag \cdots	120.000
Graphic 13	10	Assisted upper limit of voltage at low \cdots	10.500
Graphic 15 Graphic 16	11	Assisted lower limit of voltage at low …	10.200
Graphic 17	12	Assisted upper limit of reactive	1.000

Figure 4.7.12 Zone Graph Configuration

Low-voltage bus configuration

Bus configuration is started from bus 1. If there are N buses only, the parameter configuration of bus 1~N is only required as Figure 4.7.13. Parallels caused by buscouple connecting among bus and main transformer paralleling are called as bus paralleling.

1) Number of capacitor bank: the controllable actual capacitor banks on this bus;

2) Bus voltage: the actual record after dragging is the corresponding remote metering table ID of remote metering signal of busbar voltage in SCADA system database configuration tool;

3) Zero-sequence voltage: the configuration is same to busbar voltage;

4) Buscouple CB: the actual record after dragging is the corresponding remote signal table ID of remote signal of buscouple CB in SCADA system database configuration tool;

5) Buscouple disconnector 1: the actual record after dragging is the corresponding remote signal table ID of remote signal of buscouple disconnector 1 in SCADA system database configuration tool;

6) Buscouple disconnector 2: the actual record after dragging is the corresponding remote signal table ID of remote signal of buscouple disconnector 2 in SCADA system database configuration tool;

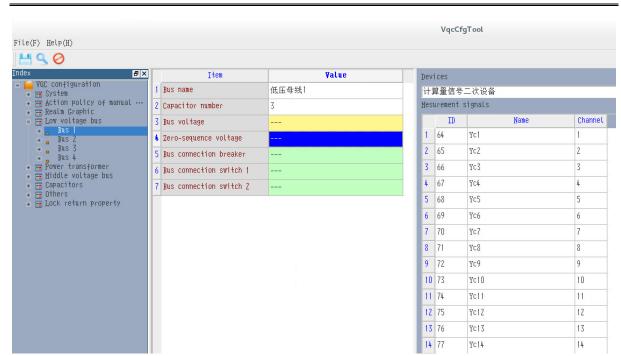


Figure 4.7.13 Bus Configuration

> Medium-voltage bus configuration

Bus configuration is started from bus 1. If there are N buses only, the parameter configuration of bus 1~N is only required as Figure 4.7.14. Parallels caused by buscouple connecting among bus and main transformer paralleling are called as bus paralleling.

1) Bus voltage: the actual record after dragging is the corresponding remote metering table ID ofremote signal of busbar voltage in SCADA system database configuration tool;

2) Buscouple CB: the actual record after dragging is the corresponding remote signal table ID of remote signal of buscouple CB in SCADA system database configuration tool;

3) Buscouple disconnector 1: the actual record after dragging is the corresponding remote signal table ID of remote signal of buscouple disconnector 1 in SCADA system database configuration tool;

4) Buscouple disconnector 2: the actual record after dragging is the corresponding remote signal table ID of remote signal of buscouple disconnector 2 in SCADA system database configuration tool;

|--|

File(F) Help(H)				VqcCf	gTool	
ndex 🗗 🗙	Item	¥alue	De	vices		
= └── VQC configuration	1 Bus name	中压母线1		kv Busba	r protection and control	devices AH2
🔹 📻 Action policy of manual …	2 Bus voltage		Me	surement	signals	
* 🧰 Realm Graphic * 📻 Low voltage bus	3 Bus connection breaker			ID	Name	Channel
🔹 📻 Power transformer 🔤 📻 Middle voltage bus	4 Bus connection switch 1		1	381	Ia	92
E Bus 1	5 Bus connection switch 2		2	382	Ib	93
🔒 Locking signal + 💂 Bus 2			3	383	Ic	94
+ ∎ Bus 3 + ⊞ Capacitors			4	384	Ua	95
■ Others ■ Lock return property			5	385	Ub	96
* E Lock Letall bloberty			6	386	Uc	97
			7	_	310	98
			8		IIab	99
				389	Ubc	100
				-	-	
			_	0 390	Uca	101
			1	1 391	300	102
			1	2 392	Pa	103
			1	3 393	Pb	104
			1	4 394	Pc	105

Figure 4.7.14 Bus Configuration

> Transformer configuration

Transformer configuration is started from transformer 1. If there are N transformers only, the parameter configuration of transformer 1~N is only required as Figure 4.7.15. If there is main transformer operating on any bus section of medium-voltage side or low-voltage side of main transformer and running in parallel by buscouple CB, it is called as main transformer in parallel.

1) Transformer current signal: the position of current flowing through transformer in remote metering database (ID number);

2) Transformer gear signal: the position of telemetering quantity of transformer gear in remote metering database (ID number);

3) Tap remote control signal: the position of corresponding remote regulating quantity of transformer in remote control database (ID number);

4) There is medium-voltage side or not: the transformer has medium-voltage bus or not.

5) High, low and medium side CB signal of transformer: the position of high, low and medium side CB as well as disconnector closing signal in remote signal database (ID number). The device will judge the main transformer is operating or not according to high and low side transformer signal. If the high or low side transformer signal is at opening position, it is considered that the main transformer is out of operation, and the regulation of main transformer will be blocked. medium side transformer signal is used to judge the medium-voltage side is operating or not. If the medium side transformer signal is in opening position, the voltage on medium-voltage side will not be regulated;

6) There is emergency stop or not: Yes/No. If the main transformer is not connected to

CYG

emergency control contact, it shall select "No". In this case, if the main transformer has voltage-regulation and gear-shift, the emergency stop command will not be sent, so that other switches will not be controlled incorrectly;

7) Number of branch: if there are two branches, and active, reactive and power factor are respectively from two branches, then the number of branch will be 2. The device will calculate the active, reactive and power factor of main transformer based on reactive and active power of two branches. If the control targets to high side transformer reactive power or there is only a branch on low-voltage side, then the number of branch will be 1;

8) Active 1, active 2, reactive 1, reactive 2, Cos1, Cos2 signal of main transformer: refer to the number of remote metering quantity on two branches. If the branch number is 1, then the active 2, reactive 2 and Cos2 signal of transformer cannot be set;

9) Action detection time: the time that the system detects position change of main transformer after sending gearshift command. If the gear has no change within the time, it is considered that the change of position is failed. If the position changes more than one gear, it is considered that the gear is slipped. It is suggested that the time will be maximum time required for changing a position on site plus a certain margin.

10) Lowest/highest position: the actual lowest/highest position of main transformer. It is a basiss to judge the regulation of main transformer available or not;

11) Maximum/minimum operating current: the maximum operating current means the maximum current on the high-voltage side of transformer. If the operating current of transformer exceeds this value, it is considered to over-load, and it will block the VQC regulation of relevant main transformer. The minimum operating current means the minimum current on the high-voltage side of transformer. If the operating current of transformer is less than this value, it is considered to under-load, and it will block the VQC regulation of relevant main transformer. Settings may be self-defined as necessary.

File(F) Help(H)				vqcC	fgTool					
H90										
ndex 🗗	× Item	¥alue	Dev	ices						
VQC configuration	1 Transformer Name	变压器1		vTM1 pr	otection and control dev	ices AH7				
 Action policy of manual Realm Graphic 	2 High voltage	2 High voltage				Mesurement signals				
🔹 🧰 Low voltage bus	3 Current			ID	Name	Chann				
- Power transformer Power transformer	4 Tap position	222	1	473	Ia	92				
∗ Power transformer 2 ∗ Power transformer 3	5 Tap control		2	474	Ib	93				
 ■ Middle voltage bus ■ Capacitors 	6 Has middle voltage	No	3	475	Ic	94				
🔹 📻 Others	7 3/2 connection	No	4	476	IJa	95				
🔹 📻 Lock return property	8 High voltage breaker 1		5	477	Ub	96				
	9 High voltage breaker 2		6	478	Uc	97				
	10 Low voltage breaker		7	479	3Iol	98				
	11 Middle voltage breaker		8	480	Uab	99				
	12 Has hard stop	Yes	9	481	Ubc	100				
	13 Branch number	Vende V	10	482	Uca	101				
	14 Active 1		11	483	3Uo	102				
	15 Reactive 1		12	484	Pa	103				
	16 Cosq1		13	485	Pb	104				
	17 Active 2		14	486	Pc	105				
	18 Reactive 2		15	487	P	106				
	19 Cosq 2		16	488	Q	107				
	20 Action checking time(s)		17	489	S	108				
	21 Minimum tap position	0	18	490	Cos	109				
	22 Maximum tap position	17	19	491	Fr	110				
	23 Maximum working current		20	492	Ioi	111				
	24 Minimum working current			493	105	112				
	24 minimum working current	0.000								

Figure 4.7.15 Transformer Configuration

Capacitor Configuration

The capacitor to be configured will be numbered from 1 in the order of bus. The number will be the sum of all busbar capacitors continuously, as shown in Figure 4.7.16:

CB signal of capacitor: the position of closing signal of corresponding CB of capacitor in the remote signal database (ID number)

Remote control signal of capacitor: the position of remote control signal of corresponding CB of capacitor in the remote control database (ID number)

Rules of capacitor switching-on:

1) If a reactor can be removed, it shall disconnect reactor in priority;

2) Re-arrange the capacitor and reactor according to adequate capacity, small capacity and capacity out-of-limit. Each line will be divided into three sub-lines;

3) Sequence the capacitor and reactor queue with adequate capacity, small capacity and capacity out-of-limit based on daily switching times. Arrange the one with fewer switching in front, and form a final queue;

4) In this case, there are six queues. Under the condition that the capacitor is not forcedly switched on, find the first capacitor or reactor in the queue with adequate capacity and small



capacity. Under the forced switching on/off condition, incorporate the queue with capacity out-of-limit into options;

5) After the capacitor refuses action for the first time, if the operation condition is not changed, this capacitor will be operated again until operation is refused.

				VqcCf	gTool	
ile(F) Help(H)						
H 9 0						
ndex 🗗 🗙	Item	¥alue	D	evices		
↓ └── VQC configuration ↓	1 Capacitor name	电容器1	1	ikvTM1 pr	otection and control dev	ices AH7
 ■ Action policy of manual ··· ■ Realm Graphic 	2 Capacitor breaker		М	esurement	signals	
🔹 🧰 Low voltage bus	3 Capacitor control		- 6	ID	Name	Channel
■ Power transformer ■ Middle voltage bus	4 Capacitor measurement			1 473	Ia	92
= 📻 Capacitors	5 Measurement fixed value	1.000		2 474	Ib	93
🔒 Locking signal	6 Capacity	1.000		3 475	Ic	94
↔ Switch time ∗ _ Capacitor 2				4 476	Ua	95
🗙 🖉 Capacitor 3				5 477	Ub	96
📲 🖁 Capacitor 5				6 478	Uc	97
+ Capacitor 6 + Capacitor 7				7 479	3Iol	98
+ Capacitor 8 + Capacitor 9				8 480	IIab	99
+ 🚆 Capacitor 10				9 481	Tibc	100
+ Capacitor 11 + Capacitor 12				10 482	Uca	101
+ Capacitor 13 + Capacitor 14				11 483	3U0	101
+ 🚆 Capacitor 15						
+ _ Capacitor 16 + _ Others				12 484	Pa	103
🔹 🧰 Lock return property				13 485	Pb	104

Figure 4.7.16 Capacitor Configuration

> Blocking remote signal configuration

Each object (system parameter, bus, main transformer, and capacitor) can be configured with 12 remote signals as blocking signal. Wherein, the blocking generated from first six signals will be auto reset after returning, and the blocking generated from later six signal must be manually reset, as shown in Figure 4.7.17:

1) Relative signal: the position of blocking signal in remote signal database (ID);

2) Blocking value: closing/opening position, referring to the state value when the blocking signal has effect. Opening position means the signal is blocked at opening state; closing position means the signal is blocked at closing state;

Description of blocking remote signal type:

1) Total blocking signal will block all VQC operations. Accident total signal can be served as total blocking signal.

2) Bus blocking signal will block all VQC operations on the whole busbar. It is suggested to use bus protection action signal, communication failure signal of bus & relative main transformer and capacitor acquisition device as bus blocking signal.

3) Main transformer blocking signal will block the current main transformer or paralleled main transformer. It is suggested to use disconnector closing position on both sides of main transformer

switch, protective action signal of main transformer, local operation signal of remote regulating as the blocking signal of main transformer.

4) Capacitor blocking signal will only block the current capacitor. It is suggested to use disconnector closing position on both sides of capacitor CB, local/remote signal of capacitor switch and protective action signal of capacitor as the blocking signal of capacitor bank.

(F) Help(H)						VqcCfg	JTool	
990								
< B×			Related signal	Locking value	Dev	ices		
VQC configuration System	1	cking signal 1	200	Open	11k	vTM1 pro	tection and control devices AH	17
🔒 Locking signal	2	cking signal 2		Open	Dig	ital sign	als	
 Action policy of manual Realm Graphic TLOW voltage bus Power transformer Middle voltage bus Capacitors TOthers Lock return property 	3	cking signal 3		Open		ID	Name	Channe
	4	cking signal 4		Open	1	4282	Setting_Group_in_EEPROM_Err	49221
	5	cking signal 5		Open	2	4283	TA/TV_Cfg_Coefficient_Err	49223
	6	cking signal 6		Open	3	4284	Line_Vol_Phase_Cfg_Err	49224
	7	ng signal 1		Open	4	4285	Power_Cacu_Para_Err	49225
	8	ng signal 2		Open	5	4286	Tap_Meas_Para_Err	49226
		ng signal 3		Open	6	4287	Telemeter_DC_Para_Err	49227
		ng signal 4		Open	7	4288	Trans_Winding_Mode_Para_Err	49228
		ng signal 5		Open	8	4289	Spare3	49230
		ng signal 6		Open	9	4290	Spare4	49231
	12	ig signat 0		oren	10	4291	Tap Slid Cfg Err	49232

Figure 4.7.17 Blockign Remote Signal Configuration

Control Switch Configuration

On this interface, the general VQC function can be switched on or off, and the VQC regulation of single device can also be separately switched on or off. In the real-time operation, the device on/off parameters will be written into database in real-time manner as shown in Figure 4.7.18:

Tile(F) Help(H)				
14 9 0 ndex	đ×	Item	¥alue	
= 🛀 VQC configuration = ፹ System	1	VQC function	On	
Locking signal 🕫 🖬 Locking signal	manual 2	Run mode	Open loop	
🔹 🧰 Realm Graphic	3	Half-closed loop	Off	
 ✤ m Low voltage bus ✤ m Power transformer 		Transformer status	Off	
🔹 📻 Middle voltage bu 🔹 📻 Capacitors	s 5	Transformer 2 status	Off	
= 📻 Others	6	Transformer 3 status	Off	
📕 Special	7	Capacitor 1 status	Off	
🔹 📻 Ľock return prope	rty 8	Capacitor 2 status	Off	
	9	Capacitor 3 status	Off	
	10) Capacitor 4 status	Off	

Figure 4.7.18 VQC Control Soft Switch

> Special configurations

VQC switching on/off hard soft switch: selecting "Yes", the hide items of "VQC switching on/off soft switch signal" and "hard switch use mode" will pop up; selecting "No", the above two options will be hidden.

VQC switching on/off hard switch signal: the position of VQC switching on/off hard switch signal in the remote signal database (database signal ID).

Hard switch use mode: if the hard switch is in normal mode, VQC module will decide VQC on/off based on soft switch and hard switch. They have AND relationship. If any one is not switched on, VQC will not make automatic control. Disconnection of hard switch will cause total blocking. If the hard switch is in Shaoxing mode, the hide item of "Local/remote control switching signal" will display;

Local/remote control switching signal: the position of local/remote control switching signal in the remote signal database (database signal ID). If it is 0, that is to say at local control state, VQC switching on/off absolutely depends on hard switch state, and users cannot make remote switching on/off. If the local/remote control switching state is 1, that is to say at remote control state, the hard switch position has nothing to do with VQC switching on/off, and users can make remote control of VQC state.

See details in Figure 4.7.19:

				VqcCfg	Tool		
ile(F)Help(H) 💾 🔍 🥝							
dex 🗗	Item	Value	Devi	ces			
 VQC configuration System Cocking signal Action policy of manual Realm Graphic Dow voltage bus Power transformer Middle voltage bus Capacitors Others Control plate Special 	1 VQC hard plate	Yes	11kvTM1 protection and control devices AH7				
	2 switching plate signal		Digital signals				
	3 plate mode	Common mode		ID	Name	Channel	
	4 sformer middle tap is special	No	1	4282	Setting_Group_in_EEPROM_Err	49221	
			2	4283	TA/TV_Cfg_Coefficient_Err	49223	
			3	4284	Line_Vol_Phase_Cfg_Err	49224	
			4	4285	Power_Cacu_Para_Err	49225	
🔹 📻 Lock return property			5	4286	Tap_Meas_Para_Err	49226	
			6	4287	Telemeter_DC_Para_Err	49227	

Figure 4.7.19 VQC Control Switch

4.7.3.4 Monitoring system VQC graph configuration

Make configuration of VQC graph interface in the graph configuration tool in flexible manner. For those VQCs configured to local database, the relevant information can be displayed on HMI, and the configuration personnel can draw graphics according to actual demands:

Remote control: VQC on/off, main transformer capacitor on/off, open/close loop control, manual blocking and clear remote control can be configured in normal way;

Remote signal and remote metering: various types of remote signal and remote metering generated from VQC, including blocking information, nine-zone graph information and blocking remote signal, can be configured on the interface. The blocking information and nine-zone graph information of components can be displayed by utilization of nine-zone graph element and bitmap space.

4.7.4 Setting value and parameter list

> System parameters

Table 4.7.10 System Parameters

Number of low-voltage busbar	
Number of main transformer	
Reactive power criteria	□Reactive □Power factor
Main transformer tap position mode	□Gear-up voltage-rising □ Gear-down voltage-rising
7	□Nine-zone □Fifteen-zone
Zone type	□Seventeen-zone □Shanghai Seventeen-zone
Priority mode	□Common mode □ Capacitor in priority
	□Consider voltage only □Consider reactive only
Control strategy	□Voltage in priority □Reactive in priority
	□Comprehensive consideration □Manual setting
Dens lle lie e blacking of main (and of and a	□Not block □Block main transformer only
Paralleling blocking of main transformer	□Block main transformer and capacitor
3U0 blocking on/off	□On □Off
Zero-sequence over-voltage threshold on low-voltage	
side (V)	
Over-voltage threshold on low-voltage side (V)	
Under-voltage threshold on low-voltage side (V)	
Reactive power blocking upper limit (VA)	
Reactive power blocking lower limit (VA)	
Maximum voltage variation on low-voltage side when	
the main transformer changes a tap position (ΔUu)	
Maximum reactive power variation when the main	
transformer changes a tap position (ΔQu)	
Maximum voltage variation on low-voltage side when	
the capacitor switches once (ΔUu)	
Maximum reactive variation when the capacitor	
switches once (ΔQu)	
Maximum voltage variation on medium-voltage side	
when the main transformer changes a tap position	
Maximum voltage variation on medium-voltage side	
when the capacitor switches once	
Daily tap-shifting times	
Daily switching times	
Measurement confirmation time (s)	
VQC regulation interval (minute)	
Main transformer tap-shifting interval (minute)	
Capacitor switching interval (minute)	
Reverse tap-shifting interval (minute)	
Reverse switching interval (minute)	



Minimum voltage variation on low-voltage side when	
the main transformer changes a tap position	
Minimum voltage variation on low-voltage side	
when the capacitor switches once	
Minimum voltage variation on medium-voltage side	
when the main transformer changes a tap position	
Minimum voltage variation on medium-voltage side	
when the capacitor switches once	
Mininum reactive changes due to gear shift	
Minimum reactive changes due to switching	
Capacitor closing sequence	1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16
Capacitor opening sequence	1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16
Is there medium-voltage side?	□Yes □No
Medium-voltage blocking switch of low-voltage side	□On □Off
Over-voltage threshold on medium-voltage side (V)	
Under-voltage threshold on medium-voltage side (V)	
Regulating switch on medium-voltage side	□On □Off
Differential voltage blocking threshold on low-voltage	
side (V)	
Differential voltage blocking threshold on	
medium-voltage side (V)	
main transformer tap-shifting times for blocking	
capactior action times for blocking	
Refusal operation times of main transformer	
Refusal operation times of capacitor	

> Zone graph parameters

Table 4.7.11 Zone Graph Parameter

Starting time (hh: mm)	
Ending time (hh: mm)	
Voltage upper limit of low-voltage side U+	
Voltage lower limit of low-voltage side U-	
Cos-/Q+	
Cos+/Q-	
Voltage upper limit of medium-voltage side U+	
Voltage lower limit of medium-voltage side U-	
Auxiliary voltage upper limit of low-voltage side	
Auxiliary voltage lower limit of low-voltage side	
Auxiliary reactive power upper limit	
Auxiliary reactive power lower limit	

NOTICE!

48 time buckets of zone graph parameters can be set at most.



> Busbar parameters

Table 4.7.12 Busbar Parameter

|--|

> Main transformer parameters

Table 4.7.13 Main Transformer Parameter

Is there medium-voltage side?	□Yes □No
Is there 3/2 wiring?	□Yes □No
Is there emergency stop?	□Yes □No
Branch number	
Maximum working current (over-load current)	
Minimum working current (under-load current)	
Lowest tap position	
Highest tap position	
Tap-shifting detection time (s)	

> Capacitor parameter

Table 4.7.14 Capacitor Parameter

Setting measurement value of capacitor	
Capacitor capacity	The capacitance is positive, and the reactance is
Capacitor capacity	negative.

> Control switch

Table 4.7.15 Control Switch

VQC total on/off	□On □Off
Working mode	□Open loop □Closed loop
Semi-closed loop on/off	□On □Off
Main transformer on/off (main transformer 1~3)	□On □Off
Capacitor on/off (capacitor 1~16)	□On □Off
On-load voltage regulation of main transformer, and	
capacitor comprehensive control (main transformer	□On □Off
1~2)	
On-load voltage regulation auto control of main	
transformer, capacitor disabled (main transformer	□On □Off
1~2)	
On-load voltage regulation auto control of main	
transformer, timed control of capacitor (main	□On □Off
transformer 1~2)	
On-load voltage regulation manual control of main	
transformer, timed control of capacitor (main	□On □Off
transformer 1~2)	



Blocking signal

S/N	Blocking state value	Blocking signal name
1	Close□ Open□	
2	Close□ Open□	
3	Close□ Open□	
4	Close□ Open□	
5	Close□ Open□	
6	Close□ Open□	
7	Close□ Open□	
8	Close□ Open□	
9	Close□ Open□	
10	Close□ Open□	
11	Close□ Open□	
12	Close□ Open□	

Table 4.7.16 Blocking Signal

NOTICE!

Blocking signal shall be separately set against total blocking, each section of bus, each main transformer and each capacitor bank. The first six signals are auto reset, and the latter six signals are manual reset.

Protective events

Monitoring host VQC has detailed VQC action record and pre-/post-regulation working condition records. Event type codes are listed in following table.

Action type code	Meaning	Action type code	Meaning		
170	Voltage regulation of 1# bus failed	171	1# main transformer tap-slipped		
172	Voltage regulation of 2# bus failed	173	2# main transformer tap-slipped		
174	Voltage regulation of 3# bus failed	175	3# main transformer tap-slipped		
176	Voltage regulation of 4# bus failed	177	Voltage regulation of 1# medium-voltage bus failed		
178	Voltage regulation of 2# medium-voltage bus failed	179	Voltage regulation of 3# medium-voltage bus failed		
220	1# main transformer VQC refusal operation	221	1# main transformer VQC tap up		
222	1# main transformer VQC tap down	223	2# main transformer VQC refusal operation		
224	2# main transformer VQC tap up	225	2# main transformer VQC tap down		
226	3# main transformer VQC refusal operation	227	3# main transformer VQC tap up		

Table 4.7.17 Protective Events

On-line Operations



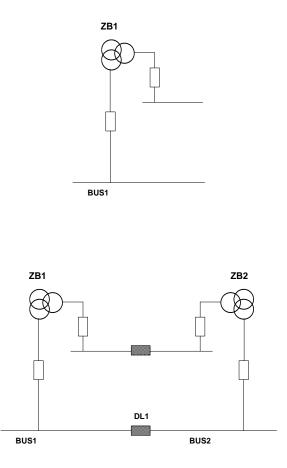
228	3# main transformer VQC tap down	229	1# capacitor VQC refusal operation
230	1# capacitor VQC close	231	1# capacitor VQC open
232	2# capacitor VQC refusal operation	233	2# capacitor VQC closed
234	2# capacitor VQC open	235	3# capacitor VQC refusal operation
236	3# capacitor VQC close	237	3# capacitor VQC open
180	4# capacitorVQC refusal operation	181	4# capacitor VQC close
182	4# capacitor VQC open	183	5# capacitor VQC refusal operation
184	5# capacitor VQC close	185	5# capacitor VQC open
186	6# capacitor VQC refusal operation	187	6# capacitor VQC close
188	6# capacitor VQC open	189	7# capacitor VQC refusal operation
190	7# capacitor VQC close	191	7# capacitor VQC open
192	8# capacitor VQC refusal operation	193	8# capacitor VQC close
194	8# capacitor VQC open		
300	Abnormal action of 1# main transformer	301	Abnormal action of 2# main transformer
302	Abnormal action of 3# main transformer	303	Abnormal action of 1# capacitor
304	Abnormal action of 2# capacitor	305	Abnormal action of 3# capacitor
306	Abnormal action of 4# capacitor	307	Abnormal action of 5# capacitor
308	Abnormal action of 6# capacitor	309	Abnormal action of 7# capacitor
310	Abnormal action of 8# capacitor		
195	9# capacitor VQC refusal operation	196	9# capacitor VQC close
197	9# capacitor VQC open	198	10# capacitor VQC refusal operation
199	10# capacitor VQC close	200	10# capacitor VQC open
201	11# capacitor VQC refusal operation	202	11# capacitor VQC close
203	11# capacitor VQC open	204	12# capacitor VQC refusal operation
205	12# capacitor VQC close	206	12# capacitor VQC open
207	13# capacitor VQC refusal operation	208	13# capacitor VQC close
209	13# capacitor VQC open	210	14# capacitor VQC refusal operation



211	14# capacitor VQC close	212	14# capacitor VQC open
213	15# capacitor VQC refusal operation	214	15# capacitor VQC close
215	15# capacitor VQC open	216	16# capacitor VQC refusal operation
217	16# capacitor VQC close	218	16# capacitor VQC open
311	Abnormal action of 9# capacitor	312	Abnormal action of 10# capacitor
313	Abnormal action of 11# capacitor	314	Abnormal action of 12# capacitor
315	Abnormal action of 13# capacitor	316	Abnormal action of 14# capacitor
317	Abnormal action of 15# capacitor	318	Abnormal action of 16# capacitor

4.7.5 Mode of connection

The following four connection modes apply to monitoring host VQC standard configuration (adjustment can be made according to different demands of project):





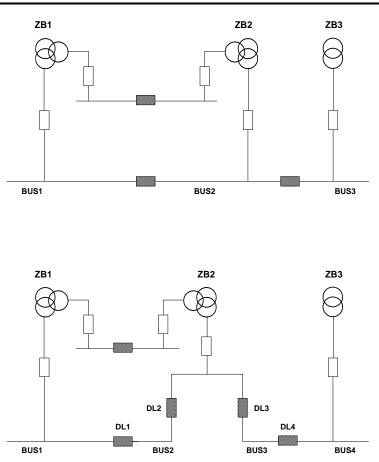


Figure 4.7.20 Connection Mode for Standard Configuration

4.8 Alarm window application

4.8.1 Overview

Nowadays, all signals of devices in substation have been acquired by automation system. The information is abundant in quantity, but no further processing is made. At present, there is a common problem. After collection by monitoring system, all real-time data are displayed according to time order. Hierarchical processing, analysis and optimization are not made to data. Various types of signals have frequent actions. As the monitoring tasks are heavy for watchkeeper, some important alarm signals may be omitted. As soon as there is a fault, it is not convenient for watchkeeper to quickly monitor failure equipment, accurately judge fault and handle it timely, directly leading to increased difficulty in power grid operation monitoring and increased quantity of maintenance.

Based on abovereasons, PRS-7000 integrated monitoring system provides alarm window application and history search function, signal screening by substations and bays, and signal shielding by substations and bays, greatly making up for deficiencies due to different technical levels of watchkeeper. Alarm signal can be processed by classification in the alarm window, and its bay location can be found for comprehensive reasoning and analysis. Besides, the specific analysis can be printed out and shall be able to be exported to pdf and/or excel file formats. The synthetic information analysis and alarm window module of PRS-7000 integrated monitoring system has important significance for reducing the workload of substation watchkeeper, improving

fault/exception handling accuracy and rapidity, and safeguarding safe running of power grid.

Alarm window application can realize the following functions:

1) Alarm information classification and sequential display. Watchkeeper can judge the severity level of alarm according to alarm information classification;

2) Make real-time analysis and judgment of rationality and accuracy of real-time data, and give alarm for abnormal data timely;

3) Provide functions of screening signal and shielding signal by substations substations and bays, and realize quick search of required information;

4) Provide history search interface to retrieve any historical information at any time.

5) Only one (1) alarm shall be shown for a point. An old message for a point shall be deleted when a new alarm is generated for that point.

6) The time field shall flash for unacknowledged alarms

4.8.2 Main functions

4.8.2.1 Alarm classification

Alarm information is classified by types into SOE, COS, protection event, self-check event, VQC event, sequential control record, command record, maintenance information, intelligent alarm information etc.;

Alarm information is classified by significance into faultinformation, abnormal information, change-of-state information, over-limit information and notification information.

Alarm information can be comprehensively displayed by classifications or levels. Watchkeeper can accurately judge the alarm severity based on alarm information level, so as to fastly detect abnormal message of power grid and provide faultpre-warning of power grid.

4.8.2.2 Alarm information display

Alarm signal can be labeled with alarm level according to the significance. Alarm information can be screened and displayed by bays and substations. The historical alarm information can be searched by substations, bays, devices and time.

The real-time display window of alarm information consists of several pages, at least including SOE information, protection event information, change-of-state information, notification information, over-limit information, maintenance information, intelligent alarm information, sequential operation record, command record etc. Main tag pages of alarm window have meanings as follows:

1) Timing sequence information: display all alarms according to time order.

2) Fault information: the signals of breaker tripping (including tripping not operated by manual), protection device tripping & closing due to grid fault and device fault, as well as other signals affecting safe operation of the whole substation. Such information is important and needs real-time

monitoring and immediate handling.

3) Abnormal information: abnormal information is the alarm signal reflecting abnormal situation of device and the signal affecting remote control operation of device, which directly threats grid safety and device running and is important needing real-time monitoring and immediate handling.

4) Change-of-state information: change-of-state information refers to the message regarding state change (closing, opening) of switching devices. Such information directly reflects the change of operation mode of power grid, and is important needing real-time monitoring.

5) Notification information: notification information generally reflects the operationg condition and state monitoring of devices in power grid, mainly including disconnector, earthing switch position signal, tap position of transformer, and related signals in normal operation of device (i.e. protection switch on/off, start signal and abrnomal disapperarance signal of protective device, fault record and transceiver, measuring & control device local/remote signal etc.). Such kind of information neesds regular query.

6) SOE: when the unconfirmed SOE events exist in the operating system, the annunciator will blink. Clicking annunciator, the recent SOE events will be displayed.

7) COS: when the unconfirmed COS events exist in the operating system, the annunciator will blink. Clicking annunciator, the recent COS events will be displayed.

8) Over-limit alarm: over-limit information reflects that some important measurement quantity goes over alarm limit. Those important measurement quantities mainly include active power, reactive power, current, voltage, oil temperature of transformer, section tidal current etc. It is important information needing real-time monitoring and immediate handling.

9) Device self-check: when the unconfirmedself-check events exist in the operating system, the annunciator will blink. Clicking annunciator, the recent slef-check events will be displayed.

10) Protection event: when the unconfirmed protection events exist in the operating system, the annunciator will blink. Clicking annunciator, the recent protection events will be displayed.

11) System information: when the unconfirmed system events exist in the operating system, the annunciator will blink. Clicking annunciator, the recent system events will be displayed.

12) Command information: record information of other operations in monitoring host. When the uncompleted operation commands exist in the operating system, the annunciator will blink. Clicking annunciator, the recent operation information will be displayed.

13) VQC information: when the unconfirmed VQC events exist in the operating system, the annunciator will blink. Clicking annunciator, the recent VQC events will be displayed.

14) Sequential control information: mainly referring to sequential control records, including single-step control information, whole sequential control information etc.

15) Maintenance information: after a device is in "maintenance" state, all signals of this device



will be displayed on maintenance page.

tion												
📝 Confirm All	📝 Delete All	Save	🗞 Print	🔌 Historical	Query	🤣 Set Up	譥 Hide	>>>Timing Informat	ionunconfirmed number:	5, total number: 3<<<		
Status 🗸	Site		Bay	Туре		Occur 1	line		Information			Index
unconfi ICD	11KW SUBSTATION	<u>A</u> larm <u>I</u> nfo1		SysError	2017-	11-29 21:45	5:07.000	Alarm window(Alar	mInfol) and server(lwj)	in 🛦 network communicati	ions	Select Stations
unconfi ICD	11kW SUBSTATION	Hmi 1		SysError	2017-	11-29 21,45	5:06.000	Operator station	⊞mii) and server(lwj) in	A network communication	15 r	Select Bays
unconfi ICD	11KW SUBSTATION	lwj		SysError	2017-	-11-29 21,45	5, 04. 000	Server (lwj) star	t successfully			Shield Stations
												Shield Bays
												Selected Stations neme Selected Bays nome Shielded Stations nome Shielded Bays nome
		L D share	1 1 100 10		UULITY .						System Information	Clear All

Figure 4.8.1 Main Interface of Alarm Window

4.8.2.3 Information query

In order to quickly search information and eliminate other irrelated interference factors, the function of screening and shielding signals by substations and bays is provided. You can select query of information by substations or bays in the index as shown in following figure:



Alarm Window >>>Timing Information--unconfirmed number: 7, total number: 7<<< Index ð × Information Select Bay Select Stations Bay List Selected Bay Select Bays ICD 11kV SUBSTATION->#2 Incoming 🖻 Bay List Shield Stations ICD 11kV SUBSTATION->#1 Incoming □ ICD 11KV SUBSTATION VQC Bay Shield Bays CYFD.T Busbar1 Selected Stations PT2 ICD 11KW SUBSTATION PT1 #2 Incoming Selected Bays #1 Incoming #2 Altermate Incomir ICD 11kV SUBSTATION->#2 Incoming #1 Altermate Shielded Stations 拱 RMG none #3 RMG #2 RMG Shielded Bays #1 RMG none #2 box-type 井1 box-type TM2 TMI Cancel 0K

Figure 4.8.2 Information Query Interface

Screen out the desired bay signals.

4.8.2.4 Information confirmation and deletion

Alarm window information can be confirmed here. After confirmation, a red flag will be labeledas confirmed information. When an alarm is acknowledged, its visual representation shall no longer flash. Confirmed information can also be deleted so as to greatly simplify information quanity as shown in the following figure:

ption Alarm Window									
🕼 Confirm All	📝 Delete All	😯 Pause	Save	🔊 Print	🔌 Historical Query	🤣 Set Up	譥 Hi de	>>>System Informationunconfirmed number,2, total number,	
Status 🗸	Site	Ob	ject		Occur Time			Information	
unconfi… ICI	11KV SUBSTATION	DataGateWayB		2017-1	1-29 21:46:05.000	Data gateway(D	ataGate₩ay	B) and server(lwj) connection failed	
unconfi ICI) 11KV SUBSTATION	DataGate₩ayA		2017-1	1-29 21:46:05.000	Data gateway(D	ataGate⊮ay	☆A) and server(lwj) connection failed	
▶ confirmed ICI	11KV SUBSTATION	AlarmInfol]	2017-1	1-29 21:45:07.000	Alarm window(A	larmInfo1)	and server(lwj) in A network communications…	
▶ confirmed ICI	11KV SUBSTATION	Hmil	confirmed	2017-1	1-29 21:45:06.000	Operator stati	on(Hmil) a	and server(lwj) in A network communications r	
▶ confirmed ICI) 11KV SUBSTATION	lwj		2017-1	1-29 21:45:04.000	Server (lwj) s	tart succe	essfully	



4.8.2.5 History query in time order

Clicking the history information query button in the title bar of alarm window, the previous historical information can be searched. Not only the alarm information can be searched, the measurement or electric quantity saved by sampling can also besearched. It provides powerful evidence for previous problems and is also very convenient for user:



e All	🔒 Pause	🖥 Save 📓	Print 🚺	À Historical	Query 🙍 Set	ah i H 🥝 all	>>>Suctor	Thiomatic	n––unconfirmed number.O.t	otal number 5	
5 AUG			Print _	<u></u>	Query 🦉 Ser	OP in the			niunconfirmed number:0,0	otat number:)(((
	U	bject		Occur Time			Infor	mation			
					Historic	al Information	Browsing				- • ×
	Save databas	e 🥤 Save f	ile 家 H	rint 👩 Sei	tings 🛛 🛃 Exi	t 🔍 Query	🔍 Previo	nus page	🔍 Next page 🛛 💼 Save	template	
St	ation	Bay E	quipment	Datetime	Milliseconds	Alarm type	Alarm level	. Alarm c	ont Index		8
		I						_	Please set query pa Time	rameters settings —	
									Start time 🔟/28/	17 9.49 PM	•
									End time 11/29/	17 9.49 PM	*
									011	ery mode	
									⊙ Alarm leve ⊂ A		Fuzzy quer:
									✓ Selected alarm accident abnormal Variable Bit notify	level.	
									Over-limit		•
									Selec	t settings —	
									Sele	ct station	
									Se	.ect bay	
									Selec:	t equipment	
									Sele	ct device	
									Sele ✔ Selected stati All stations		

Figure 4.8.4 History Query in Chronological Order

4.8.2.6 Alarm window setting

Personalized setting of alarm window can be made, including font size and styles etc. Besides, the displayed color of alarm information can also be set according to different types of alarm information. Audio alarm and voice alarm can also be set for different informations. In addition, the relevant information can be printed according to time.

On-line Operations



		Alarm Wind	ow	
🗞 Print 🛛 🔌 Histor	ical Query 🛛 🧳 Set Up 🔒	Hide >>>Sys	stem Informationunconfirmed number	:O, total 1
Occur		AlarmWindow	Para Setting	
2017-11-29 21:4	Personalized settings Disp	lay settings	Sound settings Print settings	
2017-11-29 21:4	Automatic popup window.		🗖 Enable	
2017-11-29 21:4	Unconfirmed alarm dynamic dis	splay.	🗆 Enable	
2017-11-29 21:4	Font type:		FZSongTi	-
2017-11-29 21:4	Font size.		11	•
	Sort:		Descending by time	•
	Pause refresh self recovery f	time(minute)	3	•
			Cancel	

Figure 4.8.5 Alarm Window Parameter Setting

4.9 Description of fault analysis software

4.9.1 Overview

Monitoring host of PRS-7000 integrated monitoring system realizes fault record callingfunction. The called fault record will be saved under the path of /PRS7000/bin/61850wave in local system.

Acquisition of fault record data: when the protection operates and recording completes, the monitoring host will send signals based on recording, and call the fault record data in triggered way. Patrol inspection can also be used to call record list information of protection device at fixed time. When the new record is detected, it will call the newly-generated recording data.

4.9.2 Analysis function

Various protections in substation have great responsibilities. Either failure in operation or mis-operation will lead to serious consequence or severe fault. Microcomputer protection device generally provides auxiliary functions, such as event record, fault record etc. These information



will record the startup, operationand reset of protection units, as well as sampling data in a period time, so as to analyze the action behavior of protectionunits after accidents, find causes and specify the fault responsibility.

PRS-7000 integrated monitoring system has integrated recording view and analysis function, by which the fault recording file can be viewed in waveform conveniently, and the problem can be detected in timely manner.

4.9.2.1 Software function

Waveform display: analyze the recording data; display the waveform of analog channel and switching channel in sequence in the same window, with horizontal direction as time axis and vertical direction as amplitude axis. Support for recording data display. At default display mode, the horizontal and vertical display scale of waveform shall be appropriate. When the waveforms are many and long, the vertical and horizontal scrolling is available. The waveform and names of channels will be respectively displayed in different colors by phases.

Instantaneous value display: if users click different horizontal axis position in waveform window, the time and value of signal quanity of each channel at corresponding position will be displayed.

Zoom-in/zoom-out: the waveform curve and horizontal/vertical direction can be zoomed-in or zoomed-out. With this function, the local waveform can be specifically observed.

4.9.2.2 Software instructions

Waveform display

Open the program, click "maintenance" icon on console, and select "recording analysis tool" in the dialog box. Left click it to open it:

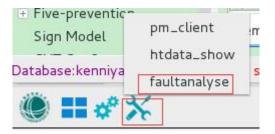


Figure 4.9.1 Open recording analysis tool

Click "File—Open" or 4.9.2.

icon on the toolbar to open the recording file tree as shown in Figure



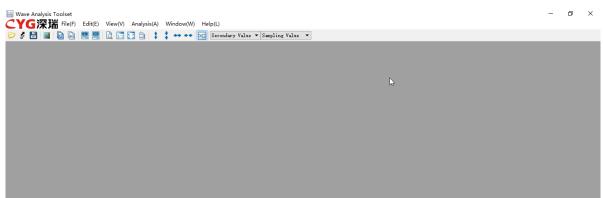


Figure 4.9.2 Starting Interface of Recording File Analysis Tool

If the recording file is actively called by protection engineer station, it will be displayed in 61860wave folder by bays and devices. If the recording file is called by protection management substation, it will be displayed in comtrade folder by bays and devices. The opening interface of recording file is shown as Figure 4.9.3.



			Open \	Vave File				
📝 🖾 home	v1.03wufang	resource	data	61850wa	ive			
Location: PRS713	ADAGC_RCD.	.85_20170	727_1	42109_16	3_f.dat			
Places	Name					~	Size	Modified
🔍 Search	PRS713A	DAGC_RCD	_85_2	20170727_	142109.	.163	120.4 kB	27/07/17
🕙 Recently Used								
🗟 root								- 1
File System								- 1
🕞 Floppy Disk								- 1
Doc								- 1
🛅 Music								- 1
🛅 Picture								- 1
🛅 Video								- 1
🛅 Download								
								- 1
								- 1
+ -							COMTR	ADEFILE ~
							Cancel	Open

Figure 4.9.3 Open recording file

Double click the waveform file to display and open it. If the waveform file is large, you have to wait for a while. The waveform file is shown as Figure 4.9.4.

On-line Operations



Wave Analysis Toolset - [CL1111_LD1_8_20141112_093954_570] File(F) Edit(E) View(V) Analysis(A) Window(W) Help(L)

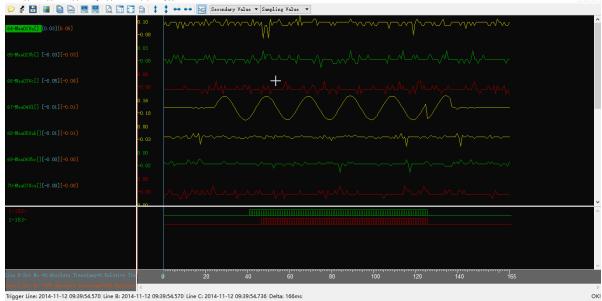
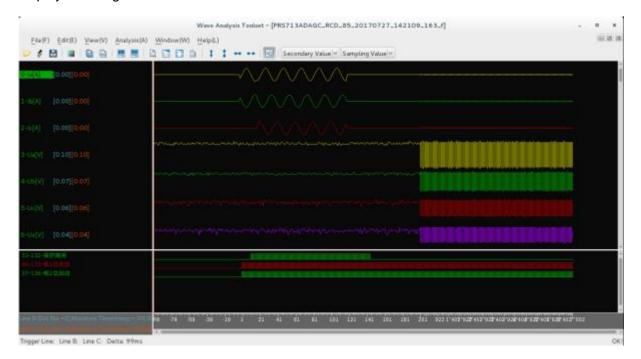


Figure 4.9.4 Reading Interface of Recording File

To exit from current waveform and view other waveforms, click "File-Open" again for operation.

Instantaneous value display

Clicking waveform window, the instantaneous value of all waveforms at the clicking position will be displayed as Figure 4.9.5.





Zoom-in and zoom-out



Click **i i i o** in the toolbar to make zoom-in/zoom-out of curve horizontally and vertically as shown in Figure 4.9.6 and Figure 4.9.7.

	Wave Analysis Toelset - [PRS713ADAGC_RCD_85_20170727_142109_163_f]	- 0 ×
Elle(F) Edit(E) View(V) Analysis(A	A) Window(W) Help(L)	HØB
0-ts[A] (0.00)[0.00]		i
1-lb[A] [0.00][0.00]		
2-lc[A] [0.00][0.00]		
3-Ua(V) (0.10)[0.10]		
4-Ub[V] [0.07][0.07]		
S-Uc[V] [0.06][0.06]		
0-Ux[V] [0.04][0.04]		~~~~~
7-mia[A] [0.00][0.00]		
8-mib(A) [0.00][0.00]		
9-mic[A] [0.00][0.00]		
33-132-保护律师 36-135-版1故启动 37-136-版2故启动		
Line B Dot No.=0,Absolute Timestamp=-9	9,5 m - 79 - 59 - 39 - 19 1 - 21 - 41 - 61 - 81 - 101 - 122	141 161
Trigger Line: Line B: Line C: Delta: 99ms		OK!



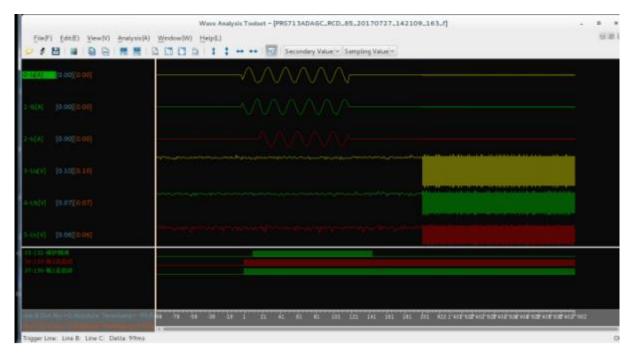


Figure 4.9.7 Longitudinal Magnification of Curve

Print

Clicking "file" in the menu bar, and selecting printer setting in the dropdown list, the dialog box of "waveform print setting" will pop up, where the analog quantity and state quantity for printing, printing range, color and direction can be selected. Besides, the printer can also be set as shown



in Figure 4.9.8.

	Wave Print	Settings	
nalogue Channel I Analogue Channel	Range O Zone Print	Color	Direction • Landscape
0-la	 All 	Black Whit	O Portrait
1-lb 2-lc 3-Ua 4-Ub 5-Uc 6-Ux	Option	Prev	iew
ate Channel	Margin Left Margin	20	
1-100-断路器位置常	Right Margin	20	
2-101-断路器位置常 3-102-其它保护动作	Bottom Margin	20	
4-103-其它保护动作 5-104-其它保护动作	Top Margin	20	2.0
C	Print Preview inter S	ettine Print	OK Cance

Figure 4.9.8 Waveform Print Setting

Selecting the analog or state quanity to be printed and clicking "printer setting", the dialog box for printer setting will pop up as shohwn in Figure 4.9.9.

	Print	
Printer		
<u>N</u> ame:	Print to File (PDF)	Properties
Location:		
Type:		
Type: Output file:	/root/print.pdf	

Figure 4.9.9 Printer Setting

If the printer has been connected correctly, the default configuration will be used. Click "Print" to



make printing directly. The printing effect is shown as Figure 4.9.10. If preview is required, "Print Preview" can be selected from printer setting window.



Figure 4.9.10 Preview of Printing Effect

4.9.3 Security mechanism

PRS-7000 integrated monitoring system provides strict security mechanism for signal reset, setting modification, setting zone switching in the relay protection and fault information management module.

Operator and scrutineer must have different and corresponding rights, and shall operate with password checking. In addition, operating time, operation obeject, operating type, operator, scrutineer and operating result will be fully recorded and saved into historical database to review responsibilities. Besides, every login will have time limit. As soon as time up, the user will automatically log out. Limit time cal be set.

5 Installation

5.1 Installation steps

Double click on the application software to configure it by default throughout the entire process

	X
PRS7000 Setup	
Setup - PRS7000	
Welcome to the PRS7000 Setup Wizard.	
Next	Quit
	×
← PRS7000 Setup	
Installation Folder	
Please specify the folder where PRS7000 will installed.	be
D:\PRS7000	B <u>r</u> owse
Next	Cancel

		×
← PRS7000 Setup		
Ready to Install		
Setup is now ready to begin insta computer. Installation will use 2	alling PRS7000 242 12 WiB of) on your disk space
computer. Installation will use a	242.12 MID 01	uisk space.
	<u>I</u> nstall	Cancel
		×
← PRS7000 Setup		
Installing PRS7000		
		7%
Installing component PRS7000		
<u>S</u> how Details		
	<u>I</u> nstall	Cancel
		\times
PRS7000 Setup		
Completing the PRS7000 Wiza	ırd	
Click Finish to exit the PRS7000		
		<u>F</u> inish

5.2 Configuration Check

After restoring the relevant configuration, check whether the configuration tools are opened normally, and check whether the following configurations are normal, to ensure that the database configuration is correct after the upgrade.



6 Common Configuration Maintenance

The section of common configuration maintenance provides handling methods of frequently asked questions and some problem solutions, and aims at providing convenience for system maintainers. Detailed information is shown in below:

6.1 How to Add New bays?

6.1.1 Database Backup

When modifying any database of the operating stations, the database should be backuped to prevent from errors of modification. With the backup information, the database will be restored at any time. Meanwhile, it is also the basic operational quality of power system maintainers.

1) Creat a new folder under the root directory and name it as "database backup"; for example, under the home route of linux system, click the right button->new folder, and name it as "database backup":

<	>	9	home	database]			
0	Rece	nt		Nam	e	*	Size	Туре
ሰ	Hom	e			database		1 item	Folder
	Desk	top			diaodushunkong.sql		86.1 MB	Text

Figure 6.1.1 New Folder under Root Directory

Then double click the left mouse button to open the database backup folder, click the right button->new folder and name it with "year-month-date" as per the modification time of the day. For example:

<	> C home data	abase		
Ø	Recent	Name 👻	Size	Туре
仚	Home	2017-11-13	0 items	
Ē	Desktop			

Figure 6.1.2 Name the New Folder

2) Click "configuration icon" on consolesonsole and select "database maintenance tools":

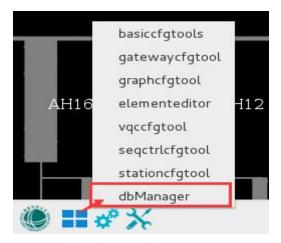


Figure 6.1.3 Database Maintenance Tools

Click the left mouse button and the dialog box of database maintenance tools will pop up:

📕 Database Maintenance Tool				-	- 🗆	×
Database Help						
[] [}						
Database Host List	5 ×	Database name	Database type	Station name		
 Database Host List MySQL 	angelasp		config database	Nova construo de sudestao Luongo		
> 127.0.0.1						
10.1.101.251						
10.1.101.75						
10.1.101.124						
10.1.101.82						
✓ ORACLE						
127.0.0.1		6				
10.1.101.251		45				
10.1.101.75						

Figure 6.1.4 Open Database Maintenance Tools

Click the left mouse button to select 127.0.0.1(MySQL), then click the right button->open.

舅 Database Maintenanc	e Tool				
Database Help					
1 ₽					
Database Host List	₽×		Database name	Database type	
 Database Host List MySQL 		angelasp		config database	Nova construo de suc
> 127.0.0.1					
10.1.101.25	Open	Ctrl+O			
10.1.101.12 à	Import Database	,			
10.1.101.82 😑	Delete Server	Ctrl+D			
 ORACLE 127.0.0.1 10.1.101.251 10.1.101.75 					



The dialog for entering password will pop up.



Fool		
₽×	Database name	Datak
\Im	angelasp	config database
	Password ? × Please input administrator's password: OK Cancel	
	₽×	Image: Second

Figure 6.1.6 Dialog Box for Inputting Password

After entering the password of prs7000.sunri, click Yes and the drop-down box under 127.0.0.1(MySQL) with all database imported from database maintenance tools will pop up.

Database Maintenance Tool atabase Help				- 0
1 ₽				
tabase Host List 🖉 >	٢	Database name	Database type	Station name
Database Host List	angela		config database	Angola Sao Pedro Substation
✓ MySQL				
✓ 127.0.0.1				
angela				
angelasp				
baoxin				
capolo				
futong				
kamailong				
luohe		G		
maonan				
nanfang				
nanfanglvye				
pedreira				
piv				
prs7000base103				
prs7000bf				
prs7000cfg				
prs7000cpl				
prs7000encfg				
prs7000his				
prs7000hisbase103				
prs7000sp				
prs7000taxtang				
pubian				
rengiu				

Figure 6.1.7 Interface of Imported Database

Click the left mouse button to select the database of the machine, then click the right button->export database.



📕 Database Maintenand	ce Tool			-
Database Help				
1 ₽				
Database Host List	Ð×	Database name	Database type	Station name
Database Host List MySQL 127.0.0.1	^ angela		config database	Angola Sao Pedro Substation
angela angelasp	Database Import			
	Database Export			
capolo futong kamailong	 Database Update Database Delete 			
luohe maonan	Lean all config data			
nanfang nanfanglvye pedreira piv prs7000bas prs7000bf prs7000cfg prs7000cfg	e103			

Figure 6.1.8 Export Database

The dialog box requiring for saving will pop up. Select the new route: /home/database backup/2017-11-13 and click "Save".

ase Host List	∂ 搜索"hmi"	م ? ד 🎫
and		
▼ 127.0.0.1		BEE 👻 📿
	修改日期	类型
angelasp 61850wave debug	2019/5/24 11:11	文件夹
baoxin GAHEEM	2019/3/14 18:32	文件夹
capolo 🥥 hmi 🔄 release	2019/3/14 19:05	文件夹
kamailong lubo 🔗 res	2019/3/14 18:32	文件夹
luohe 🖉 🖉 src	2019/5/24 13:56	文件夹
maonan 📃 🖳 🔟 电脑	2019/5/2 15:43	文件夹
nanfang 📲 视频 🗸 🧹	63	
nanfanglvye pedreira 文件夹: res		
pedreira 文件夹: res		
prv prv prs7000base103	选择文件夹	取消

Figure 6.1.9 Selection of Database Exporting Route

When the blank reminding column under the maintenance tool displays "order execution is over", it means that configuration database has been successfully exported:

)atabase Host List	₽×	Database name	Database type	Station name
 Database Host List MySQL 	^	capolo	config database	Angola Capolo Substation
 ✓ 127.0.0.1 				
angela				
angelasp				
baoxin				
capolo				
futong	~			
Jutput Message Window		±		

Figure 6.1.10 Database is Successfully Exported

At this time, find the route of previous new folder and open it, then we will see the ceshi.sql file is



stored under the route:

< > 图 home 数	居库备份 2017-11-13	Q
◎ 最近使用的		
🔂 Home	ceshi.sql	
▶ 桌面		
▶■ 视频		
◎ 图片		

Figure 6.1.11 Exported Databae File

This is the configuration database that we just backuped.

3) Backup the historical database in the same way. As shown in below, backup ceshihis.sql and finish the backup process:

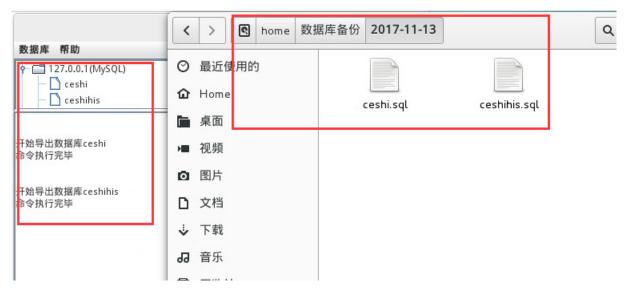


Figure 6.1.12 Exported Database and Historical Database Files

Remarks: Differences between the configuration database and the historical database are explained as below. Whenprogramed, configuration database and historical database are seprated and also corresponding. The most distinct difference can be seen from the naming rules. Name of historical database = configuration database name +his. Detailed information is as shown in the following figure:



Database Help					
1₽					
Database Host List 🗗	×	Database name	Database type	Station name	
 Database Host List MySQL 	angelasp		config database	Nova construo de sudestao Luongo	
✓ 127.0.0.1					
angela					
angelasp					
baoxin			6		
capolo			h3"		
futong					
kamailong					
luohe					
maonan					
nanfang					
nanfanglvye					

Figure 6.1.13 Differences between Database and Historical Database

A completed database backup means to backup configuration database and historical database into our local catalog.

6.1.2 Modification of Graph Configuration

1) Click "configuration icon" on the consoleconsole and select "graph configuration":

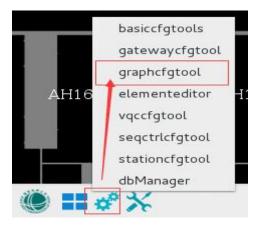


Figure 6.1.14 Select Graph Configuration Tools

Log-in dialogof graph configuration tool will pop up:

Lo	Select Database gin : Graph Cf	gtool
Db Server	huyc	~
DbName	kenniya	~
User	cygsunri	
Password	*****	
	<u>O</u> k <u>C</u> ar	ncel

Figure 6.1.15 Log-in Graph Configuration Tools

Database server: Machine name, which means the server name;



Database: Name of configuration database;

User: User name;

Password: Password of the corresponding user;

2) EnterEnter the user name and password to enter the interface of graph configuration tools:

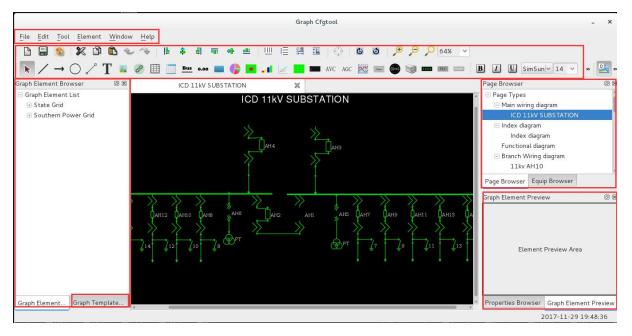


Figure 6.1.16 Interface of Graph Configuration Tools

It mainly includes 7 parts:

- Menu bar: Each menu of the menu bar has an option of drop-down box for realizing functions of saving and previewing, etc.;
- Tool bar: All graphing tools can be selected in the tool bar;
- Metafile browser: For the selection area of the primary equipment which have been put into storage, metafile can be directly dragged into the graphing area;
- Graphing area: The ultimate graphing display area. Arbitrary metafile combination of primary equipment can be performed in this area;
- Graph paper browser/equipment browser: Graph paper browser and equipment browser can be randomly switched. Graph paper browser displays all graphical interfaces. Double click the left mouse button to switch among graphical interfaces; Equipment browser includes bays of main transformers and various voltage classes of substation, primary equipment and secondary equipment of bays, and configuration information of network nodes, etc;
- Bay template browser: It provides some frequently used bay templates, which can be directly utilized;
- Property browser/metafile browser: Property browser and metafile browser can be randomly switched. Property browser displays property information of certain primary equipment in the

graphing area; metafile browser displays layer information of certain primary equipment;

3) Click the right button->equipment browser. Select the appropriate voltage class in the drow-down options of voltage class. Click the right button->create a new bay. Detailed information is as shown in the following figure:

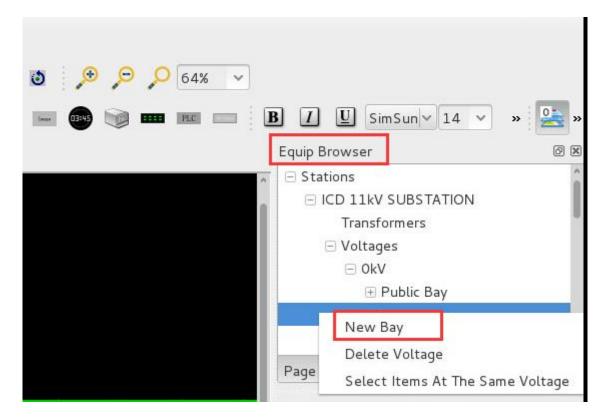


Figure 6.1.17 Interface of Create New Bays

The blockdiagram of bay information will pop up:

🖉 Bay Infomatio	n	?	×
Site:	Newly—built power plant		•
Voltage Level:	1000kV		•
Bay Name:	Bay		
Bay Type:	Default bay		•
Description:			
	OK	Canc	el





Substation and voltage class are confirmed. Manually enter the bay name, such as "999 test bay". Common options of the bay types can be selected in the drow-down box. Here we can select the "feeder outgoing line bay". Description means the introduction to the bay and is generally the same with the bay name. In the current situation, the description is "999 test bay". Deatailed information is as shown in the following figure:

🖉 Bay Infomatio	n ?	×
Site:	Newly-built power plant	•
Voltage Level:	1000kV	•
Bay Name:	1000KV_Nanshan_Bay	
Bay Type:	Transformer	•
Description:	General	
	OK Cancel	

Figure 6.1.19 Filling Bay Information

Afterwards, click "confirm" button to creat "999 test bay" under voltage class of 35kV with corresponding primary equipment and secondary equipment:

	🕀 #1 Altermate	
	🖅 #2 Altermate	
	⊕ #1 Incoming	
	⊕ #2 Incoming	
	⊕ PT1	
	⊕ PT2	
	🕀 Busbarl	
	⊕ CYFDJ	
	⊒ 999TestBay	
	Primary equipment Secondary equipment	
\Box	Net nodes	

Figure 6.1.20 Create New Bays under the Corresponding Voltage Class

4) Select the graph paper browser, then select the main wiring diagram in graph types, double click the drop-down options of the main wiring diagram to display the main wiring diagram of the overall substation:

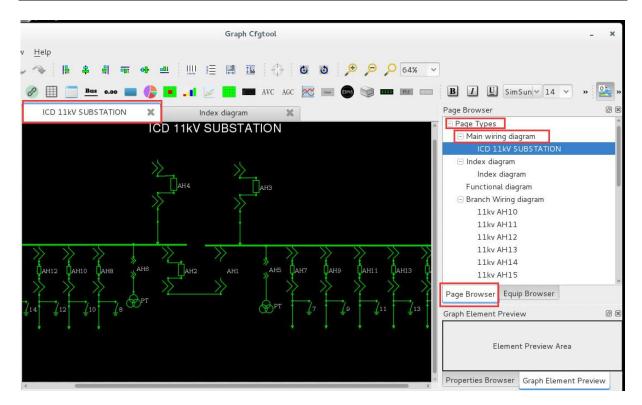


Figure 6.1.21 Main Wiring Diagram

5) Find the position of the new bay as per the main electric wiring diagram and confirm the primary equipment in the new bay. For example, "999 test bay" is on the letter I with one switch, one handcart and one earthing knife-switch. Then it is on the left side of the graph configuration tool. Find the corresponding metafile in the metafile browser and drag it to the corresponding position of main wiring diagram:

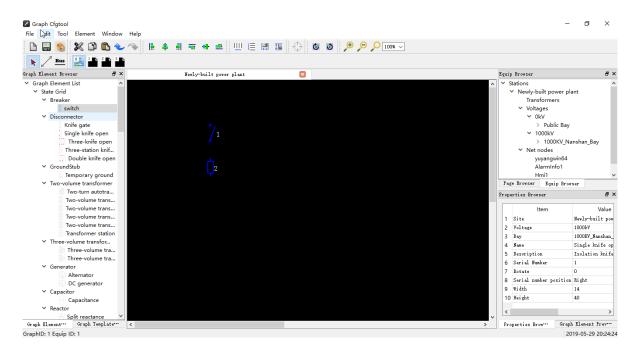


Figure 6.1.22 Metafile Browser

6) Click the switch button in metafile list with the left mouse button and drag the switch icon to the corresponding position of the graphing area. Then the dialog box of "equipment information" will pop up:

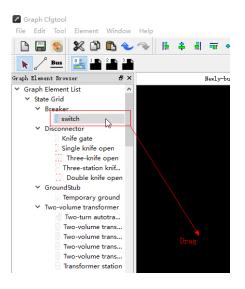


Figure 6.1.23 Creat Primary Equipment

Substation: It displays the substation that the equipment belongs to. Normally it is set by default;

Voltage: Select the voltage class of the equipment. As the voltage class of the new 999 bay bay is 110kV, we need to select 110kV;

Select bays: Select the bays of the equipment. In the current situation, we need to select 999 test bay;

Equipment name: Enter as per names on the electric diagram. For example, we can enter 999 switch;

Equipment voltage: It means the voltage class of electrified equipment. In the current situation, it is 110kV;

Description: It describes types of primary equipment;

Equipment number: The unique number of the primary equipment on the main electric wiring diagram;

Detailed information is as shown in the following figure:

Site:	ICD 11kV SUBSTATION	~
Bay Voltage:	lokV	~
Bay:	999TestBay	~
Equip Name:	999breaker	
Equip Voltage:	lokV	~
Description:	circuit breaker	
Serial Number:	999	

Figure 6.1.24 Information of New Primary Equipment

After verification, click the confirm button and an actual switch icon will be displayed on the position which is originally used to place switch. The color of the icon is confirmed in accordance with electric standards after selecting voltage clasee:

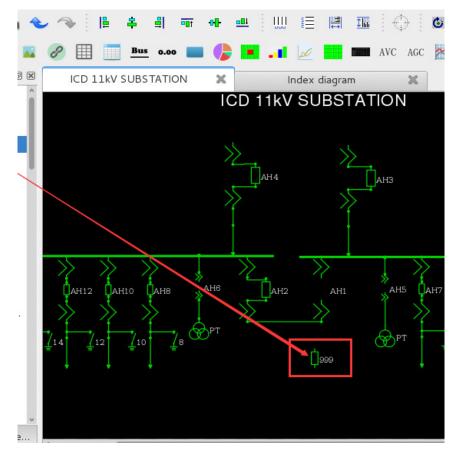


Figure 6.1.25 Creation of Primary Equipment is Finished

Click the swtich with the left mouse button and the corresponding properties will be displayed in the property browser at the bottom right of graph configuration tools:



Rotate	0
Related Equip	999breaker
Show Serial Number	Yes
Serial number position	Right
Bay	999TestBay
	Related Equip Show Serial Number Serial number position

Figure 6.1.26 Property Browser

Rotation angle: It means the rotation angle of the primary equipment;

Associated equipment: It means name of the equipment;

Display number: Select No, then the number of primary equipment will not be displayed;

Number position: Positions of up, down, left and right can be selected;

Bay: It means the belonging bay;

Select the left metafile browser to check the metafile status of the switch: In the following figure, one can see that the switch belongs to the four-state equipment.

Graph Element Preview	0 🗴
 State0	e2 🔾 State3
Properties Browser Graph Elemen	nt Preview

Figure 6.1.27Metafile Browser

Remarks:

• If the breaker name is wrong, double click the breaker with the left mouse button and the dialog box for modifying name will pop up. Click confirm button after modification:

GraphCl	fgTool	Ū.A
		*
Cancel	ОК	
	name:999brea please input ne	GraphCfgTool name:999breaker please input new name:

Figure 6.1.28 Rename Primary Equipment

• Size of breaker is adjustable. Click the left mouse button to select the small rectangle on the bottom right of switch to adjust its size;



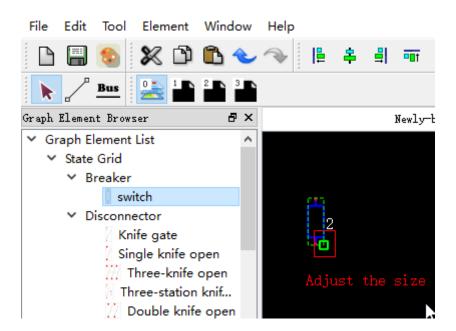


Figure 6.1.29 Adjust Size of Primary Equipment

7) Successively add the handcart, earthing knife-switch and AC outgoing line with the above mentioned method. Detailed information is as shown in the following figure:

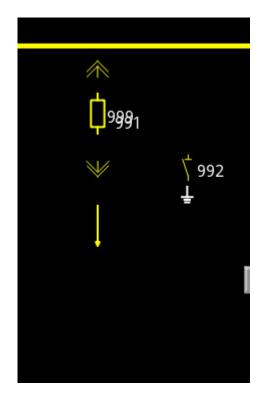


Figure 6.1.30 Adding Primary Equipment is Finished

It means all the primary equipment added in the 999 test bay;

8) Select the connecting line (the straight line with small circles on both ends) in the tool bar on top left corner of the graph configuration tools. After moving the mouse to the corresponding position, there will be relevant illustrations about tools in the tool bar being displayed.



D 🗐 💈 🗶 D 🗈 🔦		of <u>of</u>		$ \oplus $	٩	0 🔎	۰,
★ / → ○ / T ■	8 🗐 🧾 <u>Bus</u> 0.00 💼	6	• • • •	AVC AGC	~		
Graph Element Browser 🛛 🐼	ICD 11kV SUBSTATION	×	Index diagram	×			

Figure 6.1.31 Tool Bar Illustration

Connect the primary equipment with connecting lines. For example, connecting the outgoing line and handcart with a connecting line. Click the connecting line with left mouse button and move the mouse to the connection point, and then a red attachment point will be displayed.

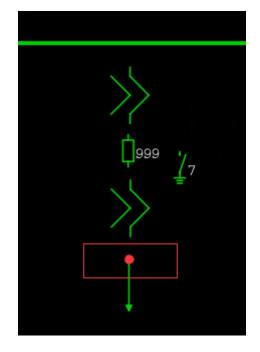


Figure 6.1.32 Starting Point of Primary Equipment Connection Line

Then move the mouse to the attachment point of handcart and a red point will be displayed:



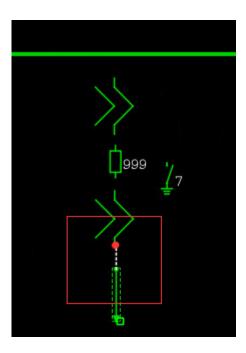


Figure 6.1.33 Ending Point of Primary Equipment Connection Line

Click the left mouse button and the outgoing line and handcart will be connected.

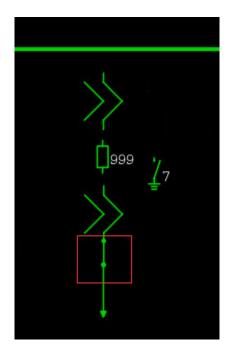


Figure 6.1.34 Primary Equipment is Sussefully Connected

All primary equipments are connected with the connection lines. Adopt the same method to connect all the primary equipments. Then a completed new bay graph will be displayed on the main connection diagram. Detailed information is as shown in the following figure:

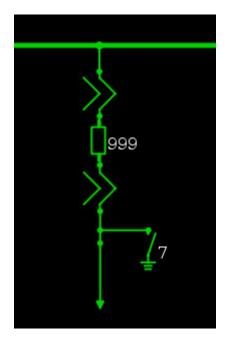


Figure 6.1.35 Graphing of New Bay is Finished

9) Click the "breaker" icon with the left mouse button. Then click the right mouse button and a box will be displayed:

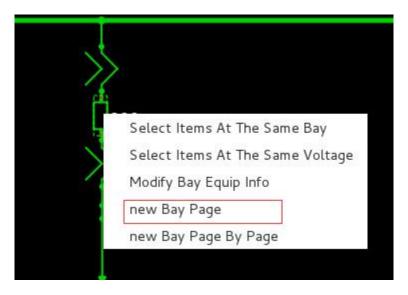


Figure 6.1.36 Generate Detailed Drawing of Bay on Basis of Primary Equipment

After clicking the button of "generate detailed drawing of the bay", a dialog box of "graphics parameter configuration" will pop up:



Page Name:	999TestBay			
Width:	1920	🗘 Height:	1080	
Layer Count		4		-
Page Type:		Branch Wir	ng diagram	-
Page Color:				
🗹 YK Allov	v	🗹 YT Allow	,	
Ground	YT Allow			
	ne	🗆 Layer Tv	vo	
🗆 Layer Or			ur	

Figure 6.1.37 Graphics Parameter Configuration

After clicking the "confirm" button, a detailed drawing of 999 test bay will be automatically generated which includes all primary equipment of the bay. Detailed information is as shown in the following figure:



ICD 11kV SUBSTATION 💥	999TestBay	×		Page Browser	0(
ICD 11KV SUBSTATION		L	999TestBay	 Page Types Main wiring diagram ICD 11kV SUBSTATION 	
				 Index diagram Index diagram 	
				Functional diagram — Branch Wiring diagram	
				11kv AH10 11kv AH11	
>>				11kv AH12 11kv AH13	
				11kv AH14 11kv AH15	
				11kv AH16 11kv AH2 999TestBay	
K (ں د	Page Browser Equip Browser	

Figure 6.1.38 Generation of Bay Detailed Drawing is Finished

10) All open graph lists will be displayed in the graphing area. Detailed information is as shown in the following figure:

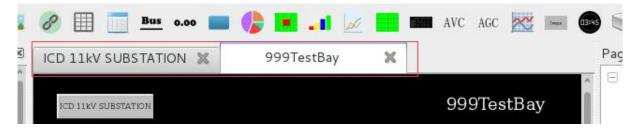


Figure 6.1.39 Graph List

Left-click the "main wiring diagram" button to return to the interface of main wiring diagram.



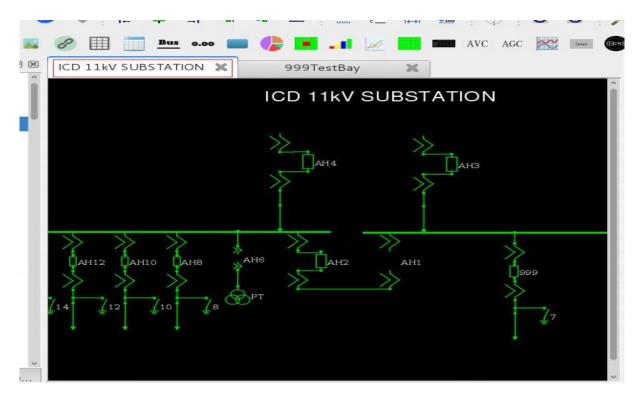


Figure 6.1.40 Main Wiring Diagram

11) Click the "interlinking (P)" in tool bar with the left mouse button. Then click the left mouse button under the new bay graph to draw a rectangle. Then click the left mouse button to have it relased. Detailed information is as shown in the following figure:

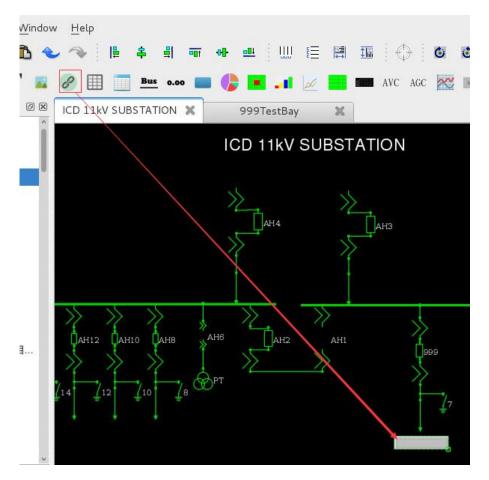


Figure 6.1.41 Interlinking Figure of Added Bay

Click the rectangle which was just finished and click the button of "connection interface" in the property browser. A drop-down box will pop up. Then select the newly created "999 test bay":

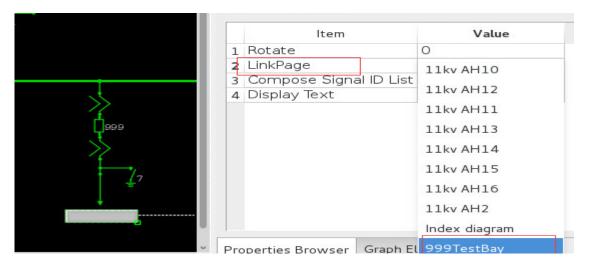


Figure 6.1.42 Interface Association of Bay Interlinking Metafile

Then the text of "999 test bay" will be displayed on the interlinking metafile. It will establish the association relationship between the extension diagram and interlinking metafile. While operating, click the interlinking metafile to directly access the sub-interface of "999 test bay":

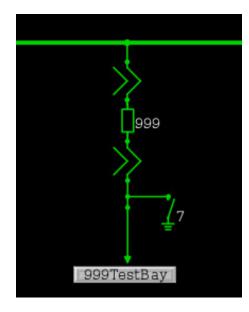


Figure 6.1.43 Graphing of Bay Interlinking Metafile

At present, all works on the mian wiring diagram have been finished. Click the "save" button on top left corner to save all modifications (it is suggested to save after finishing each step, then save all information after finishing the overall process):



Figure 6.1.44 Save Modifications

After clicking the "save" button, a dialog box of "check associated information" will pop up. Click "No":

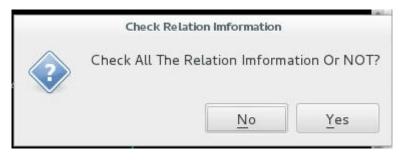


Figure 6.1.45 Ceck Associated Information

Then a dialog box of "save" will pop up. Click "confirm":



Figure 6.1.46 Save Database

Click the "X" button on top right coner of the "graph paper configuration tools" to close the graph paper configuration tools.

6.1.3 Modification of Basic Configuration Tools

1) Click "configuration icon" on the console and select "database configuration":

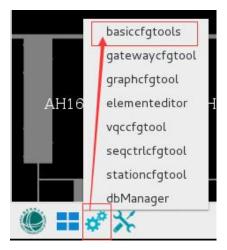


Figure 6.1.47 Database Configuration Selection

Click "database configuration" with the left mouse button and a dialog box of "log in: basic configuration tools" will pop up:



Lo	Select D	sic Cfgtool	
Db Server	huyc		~
DbName	kenniya		~
User			
Password			
	<u>O</u> k	<u>C</u> ancel	

Figure 6.1.48 Log in Database Configuration

Database server: Machine name, which means the server name;

Database: Name of configuration database;

User: User name;

Password: Password of the corresponding user;

2) Enter the user name and password to enter the interface of configuration tools:

			CfgTool	- ×
File Edit View Check Tools	<u>C</u> onfig	Help		
Navigation Tree				
System Information Configure		Name	Value	
User Manager Configure	1	Project Name	ICD 11KV SUBSTATION	
NetNode Configure	2	First Service Date	2016-12-20	
Unit Model Configure Station Configure	3	Main Fault Signal of The Station	Not configure	
Inputs	4	Status of Remote Control of SCADA	Not configure	
Alarm System Parameter	5	Frequency Signal of HMI	Not configure	
Calculate Configure Over Limit Plans	6	Signal of HMI Panel1	Not configure	
Five-prevention	7	Signal of HMI Panel2	Not configure	
Sign Model	8	Status of Remote Control Signal of	Not configure	
CVT Config	0	Interval of Cotting Wave Decording	2	¥
AlarmDirect	Sy	stem		
	Outp	ut Message Window		0 2
		cur Time Type Message	Level	
Database:kenniya@huyc User:a Edit st	tatus: (Offline(Dose not allow to release)		2017-11-29 20:25:40

Figure 6.1.49 Introduction of Database Configuration Interface

- Menu bar: Move the mouse to the menu bar and the corresponding application will be displayed. Then click and select the application;
- Tool bar: Move the mouse to the tools and the cooresponding application will be displayed. Click the left mouse button to select.

- Navigation tree: All applications of configuration tools are included in the navigation tree. See detailed information in Chapter3;
- System parameter: Default content after accessing the configuration tools;
- Display the current log-in user and configuration database;
- System time: It displays the current machine time;

3) Click navigation tree--->configuration of secondary equipment template. Click the "+" icon on the right side with the left mouse button and all imported templates of the station will be displayed:

						CfgTool
File Edit View Check Tools	Config	<u>H</u> elp				
	Q	0				
Navigation Tree 🛛 🙆 🗷		ID		Name	Sequence No.	alf Chack (
System Information Configure	1		VQC	Name	2	6400
User Manager Configure	1	1				
NetNode Configure	2	2	WUFAN	G	1	0
Unit Model Configure	3	3	SHUNK	ONG	1	0
WUFANG	4	4	HECHEN	IGSIGNAL	1	0
SHUNKONG	5	5	XDL		2	6400
HECHENGSIGNAL	6	6	DANXIA	NGCVT	2	6400
XDL	7	7	SANXIAI	NGCVT	2	6400
DANXIANGCVT						
SANXIANGCVT	8	9	JISUANL	IANG	1	0
JISUANLIANG ISA358GAV3212103EN		dels				
ISA367G5A103V321CX	1410	dets				
ISA367GV3225A1031611	Outp	ut Message \	Window			
ISA381GC5A103V321CX	-	ur Time	Туре	Message	Level	
IEC103PRS7741DB	0.000		115			
ISA367GV3225A103EN						
SFRDIANBIA01						
CYFDJ						
+ Station Configure						
Inputs Alarm System Decementer						
Alarm System Parameter	1					

Figure 6.1.50 Secondary Equipment Configuration

Click the right mouse button on the "secondary equipment templatec onfiguration" and a choice box will be displayed:



Navigation Tree	0 ×	-	10
+ System Information		1	1
🗉 NetNode Configu	re	2	2
🖃 Unit Model Config	ure		
VQC	Import Scd File (*		
WUFANG	Import Icd File (*	ICD,)
SHUNKONG	Open 103 model	file ((*.txt)
HECHENGSI	Alter IED Name		
XDL	Clear Scd informa	tion	
DANXIANGC.	· · · ·		
SANXIANGCV	г	8	9

Figure 6.1.51 Import 103 Template

If the new bay equipment is 103 communication, select "import 103 template file (*.tx)";

If the new bay equipment is 61850 communication, select "impot Scd file (*.SCD)" or "import ICD file (*.ICD)";

Taking the 103 template of "999 new bay" as an example, select "import 103 template file (*.tx)" and the choice box of "import 103 equipment template file" will pop up:

			Import 103 model file(s)		
File Edit View Check Tools Image: Construction of the second secon		H A home			
Navigation Tree 🛛 🙆 🛽	3	Location: 999.txt	t		
System Information Configure User Manager Configure NetNode Configure	1 1 2 2	-	Name v	Size	Modified 14/06/17
Unit Model Configure	3 3	🕘 Recently Used	🔁 v1.03debian		15/07/17
WUFANG SHUNKONG	4 4		v1.03wufang		24/07/17 07/06/17
HECHENGSIGNAL	6 6		V2.10		15/08/17
DANXIANGCVT	77		V2.10ddshunkong		28/08/17 31/08/17
SANXIANGCVT JISUANLIANG	<	◎ 又档			16/11/17
ISA358GAV3212103EN ISA367G5A103V321CX	Mode	- 🛅 图片	🔁 V2.10zhejiangsk		01/09/17
ISA367GV3225A1031611 ISA381GC5A103V321CX	Output Occur		℃ V2.11 上海VQC		06/11/17 16/11/17
IEC103PRS7741DB ISA367GV3225A103EN			■ 999.txt	38.6 kB	Thursday
SFRDIANBIAO1 CYFDJ		4 -	myModel.txt	1.3 kB	13/11/17 txt ~
Station Configure Inputs				Cancal	
Alarm System Parameter				Cancel	Open

Figure 6.1.52103 Template Selection

Select the template file under the corresponding route, click to open it, and the "999" template will

be impoted in the drop-down menu of "secondary equipment template configuration".

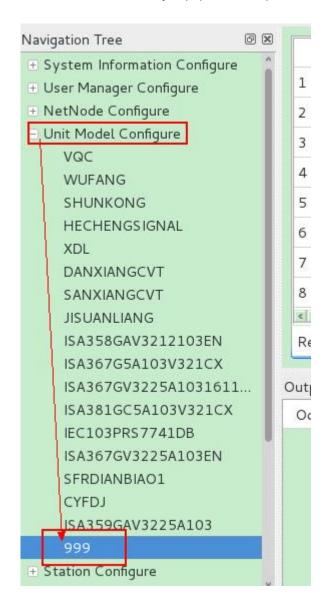


Figure 6.1.53 Importation of 103 Template is Finished

4) Click navigation tree---->substation configuration---->secondary equipment configuration. Click the right mouse button and a choice box will pop up:



Navigation Tree	Ø×
+ System Information Co	onfigure
🗄 User Manager Configu	re 1
🗈 NetNode Configure	2
■ Unit Model Configure	3
Station Configure	4
ICD 11kV SUBSTAT	FION 4
Unit Add un Volta Batch g	it generate script files
Time Sync	7
Dual Terminal	8
🗉 Inputs	×

Figure 6.1.54 Create Seondary Equipment

A"unit configuration dialog box" will pop up after selecting the "creat secondary equipment":

				Unit Dialog	
asic Configu	6]	Direct Property	<u>0</u> K
Unit name	(I			Net A/B alternate	Cancel
Logic node	Not Config	ure	~	Net A IP	
Sequence	124			Net B IP Net B Port 0 ^	
Unit model	Not Config	ure	 ~	Net C IP Net C Port 0	
Bay	Common Bay	Ŷ	 ~	Connection mode TCP	
Operation	Property			Protocol Sznari etheric 103 Protocol 🗸	
🗹 Reco	overy			Address 0.0	
🗹 Modi	ifing setting v	value		Net A running stat Not Configure	
🗹 Read	ding setting v	value		Net B runnint state Not Configure Clear	
🗹 Retri	ieving over lil	limited log		Net C runnint stat Not Configure Clear	
🗹 Retri	ieving measu	re value		AppID _Multicast	
				Multicast Addres: 01.0C.CD.01.00.01 APPID1 0x0000	
Current se	tting zon No	ot Configure	Clear	Multicast Addres: 01.0C.CD.01.01.01 APPID2 0x0000	
Reconvery	control No	t Configure	Clear		
Check stat	us sigan No	t Configure	Clear	Wave Enable retrieve wave	
Net A state	us No	t Configure	Clear	Retrieve wave finished signal Not Configure	
Net B state	ues No	t Configure	Clear	Linkage	
Net C state	us No	t Configure	Clear	Protocol Not Configure	

Figure 6.1.55 Configuration Dialog Box of Secondary Equipment

a, Among all the basic properties:

- Unit name: It means the name of secondary equipment. In the current situation, we should fill in "35kV feeder protection and measurement equipment ISA-999" according to standards (voltage class+function+equipment name);
- Logical node: Select the logical node of secondary equipment. In case of direct communication with monitoring host, select "server"; in case of oursourcing equipment, select "protocol converter" or "DataGateWay". In the current situation, we assume it as the direct communication with monitoring host and select "server";
- Internal node sequence: Automatically distributed by program;
- Unit template: The matching equipment template of secondary equipment. In the current situation, it means the previously imported "999" template;
- Bay: Select the belonging bay of secondary equipment, that is to say, "999 test bay";
- b, Operational property: Select all by default;

c, Among all the direct connection properties:

- AB networks are mutual standby: If the station is equipped with AB dual networks, then select it; if the station is in unit, then don't select it;
- A network IP: Fill in the IP distributed to the equipment, such as 222.111.112.99;
- A network port: Always fill in 2420
- Connection type: Select TCP;
- Communication protocol: Select according to per actual conditions. In case of 103 communication equipment, select "Shenzhen Nari Ethernet 103 protocol";
- Communication address: Fill in the last two number of A network IP. In the current situation, fill in 112.99;
- Related remote signal for A/B networks: Automatical correlation without filling in;

d, AppID and multicast:

- Multicast address 1/2; no need to fill in;
- APPID1/2: Fill in the last two numbers as the last number of A network IP. In the current situation, it is 0x0099;
- e, Record: No need to fill in;
- f, Hitchedcommunication equipment: No need to fill in;
- g, Current setting zone and setting items: Automatically filling in, and no need to fill in manually;

5) Click "confirm" button after finishing the overall process. Then click the secondary equipment to check the corresponding signals of remote signal, measurement, remote control and regulating (all signals in the default template will be automatically imported);



2	X	ID	Name	MMS Variable Name	quipment Affiliate	quipment Type	Attribute	Subtype	Division	Ratio	Uni
电表85	-				1-						
电表86	1	3796	la	la(92)			Sample	<u>.</u>	341.166	1.00000	A
电表87	2	3797	lb	lb(93)			Sample	1	341.166	1.00000	A
电表88 电表89	3	3798	Ic	lc (94)			Sample	j.	341.166	1.00000	А
电表90	4	3799	Ua	Ua(95)			Sample	U	17.05833	1.00000	kV
电表91	5	3800	Ub	Ub(96)			Sample	U	17.05833	1.00000	kV
电表92 电表93	6	3801	Uc	Uc(97)			Sample	U	17.05833	1.00000	kV
dianbiao94	7	3802	310	310(98)			Sample	Î.	1705.83	1.00000	A
999	8	3803	Uab	Uab (99)			Sample	U	17.05833	1.00000	kV
+ Voltage	العام										
PowerTransformer	Re	mote Meas	urement Remote Signal	Remote Pulse Rem	ote Control YS						
Time Sync											
Dual Terminal	Outp	out Message	e Window								

Figure 6.1.56 Signals of Telemetering, Remote Signal, Remote Control and Regulating of the Secondary Equipment

6) In the remote signal list:

Modify signal names as per the electric installation drawing. For example, remote signal 01 refers to the switch position, remote signal 02 refers to the handcart position, remore signal 03 refers to the earthing knife-switch position, etc;

Modification of signal properties. Signal properties of all primary equipment must be selected as equipment status, that is to say, click the right mouse button—>edit. Select equipment status in the pop-up choice box;

f	fix Na	Name	Variable	oint	oint (it nem	Point Type	Subtype	Alarm Level	Attribute	Signal Type	Return
1		Setting_Group_in_EEPROM	Settin					General Signal	Not Config	Sample,Equipm		Single R
2		TA/TV_Cfg_Coefficient_Err	TA/TV				Event	General Signal	Not Config	Sample		Single R
3		Line_Vol_Phase_Cfg_Err	Line				Event	General Signal	Not Config	Sample		Single R
4		Power_Cacu_Para_Err	Powe				Event	General Signal	Not Config	Sample		Single R
5		Tap_Meas_Para_Err	Тар				Event	General Signal	Not Config	Sample		Single Re
6		Telemeter_DC_Para_Err	Telem				Event	General Signal	Not Config	Sample		Single Re
7		Trans_Winding_Mode_Para	Trans				Event	General Signal	Not Config	Sample		Single Re
8		Spare3	Spare				Event	General Signal	Not Config	Sample		Single Re
c i						1 1					9	2

Figure 6.1.57 Configuration of Secondary Equipment Remote Signaling Property

7) Then select remote control property. Modify the remote control name as per the electric installation drawing of secondary equipment. For example, set the remote open1 outlet /remot close 1 outlet as remot switch control:

	ID	Name	Jipment Affiliat	State Signal	Control Type		1
1	550 Y	Kl	Not Configure	KI09 YCB CLOSED[ID=4319]	General Con	YK1(48)	
2	551 Y	К2			General Con	YK2(49)	
<							

Figure 6.1.58 Modification of Remote Controlling Name

8) Click navigation tree----->voltage class----->35kV and select the new "999 test bay". Select "switch/disconnecting link" option (display the primary equipment of all new bays in graph tools). Detailed information is as shown in the following figure:

				CfgTool						_ 3
<u>File Edit View Check Tools Co</u>	nfig <u>H</u> el	Ρ								
	0									
Navigation Tree 🛛 🖉 🗶	ID	Equipment Name	iti-Misoperation S	Remote Signal	Measurement	lemote Contro	guipment Typ	or Host Identifi	:hing Identifica	aration Monitor ck S
ISA367GV3225A1031611 ISA381GC5A103V321CX	1 22	999Breaker	22			Not configure			NO	NO
	2 23	9995C	23		-	Not configure		手车	NO	NO
ISA267CV222EA102EN	3 24	999DZ	24		-				NO	NO
SFRDIANBIA01	3 24	99902	24	KIO9 YCB C	Not configure	YK1[ID=444]	KG	开关	NO	NO
CYFDJ										
ISA359GAV3225A103										
999										
Station Configure										
ICD 11kV SUBSTATION										
🛨 Unit Configure										
Voltage										
+ Zero Voltage Level										
- IOkV										
TM1 TM2										
#1 box-type										
#1 box-type #2 box-type										
#1 RMG										
#1 RMG										
#2 RMG										
	¢									
#1 Altermate	Breaker/d	lisconnector Bus Ac	Line Segment Sh	unt Compensat	or Seris Comp	ensator				
a vice mace										

Figure 6.1.59 Primary Equipment Selection

Associate remote position signal of each equipment. Click the remote position signal of switch and a property window will pop up:



	ID	Equipmer	nt Nam	e ti-Misop	eration !	Remote Signal	Measurement	lemote Contro	: quipment Typ	ır Host I		ØX
1	22	999Breaker		22		Not configure	Not configure	Not configure	DD	地刀	Signal Unit	
2	23	999SC		23		Not configure	Not configure	Not configure		手车	None	~
3	24	999DZ		24		Not configure	Not configure	Not configure	KG	开关	YXSignal Source	
											Signal Name ID	
K										2		
В	eaker/c	lisconnector	Bus	Ac Line Seam	ent Shi	int Compensat	or Seris Comp	ensator				

Figure 6.1.60 Selection of Primary Equipment Remote Position Signal

Click the property window to display drop-down box of secondary equipment. Select the added "35kV feeder protection and measurement equipment ISA-999" and the remote signal of properties of all selected "equipment status" will be displayed:

99	99	
'X	Signal Source	
	Signal Name	ID
1	KI09 YCB CLOSED	1255
2	KI11 WORKING POSITION	1257
3	KI14 SC CLOSED	1260

Figure 6.1.61 Display Remote Signling of Primary Equipment

Click the left mouse button to select signals. Click the signal and drag it to the remote position signal box to automatically associate primary equipment and remote signals:



999Breaker 999SC 999DZ	22 23 24		Not configure		sc	地刀 手车 开关	99		~
									`
999DZ	24	KI14 SC CL	Not configure	Not configure	KG	开关	YXS	Cianal Course	
								Signal Source	
								Signal Name	ID
							-1	KI09 YCB CLOSED	1255
							2	KI11 WORKING POSITION	1257
							3 1	KI14 SC CLOSED	1260
								2	2 KI11 WORKING POSITION 3 KI14 SC CLOSED

Figure 6.1.62 Association of Primary Equipment and Remote Position Signaling

9) Click the save button on top left corner and a choice box will pop up. Click confirm button to save the modifications (it is suggested to save once after finishing each step):

				CfgTool		
	ck <u>T</u> ools <u>C</u> onfig <u>H</u> elp					
Navigation Tree dianbiao92	Notify	Equipment Name	ıti-Misoperation S	Remote Signal	Measurement	lemote Con
dianbiao92 dianbiao93	Check configuration?	99Breaker	22	KI09 YCB C	Not configure	YK1[ID=38
dianbiao94	Ok	99SC	23	KI11 WORK	Not configure	Not configu
999 - Voltage		99DZ	24	KI14 SC CL	Not configure	Not configu

Figure 6.1.63 Save Configuration

When the pop-up progress bar of data saving reaches 100%, the data is saved successfully;

:VT	2		6400	Ur	nknown
32121	1		Saving data		nown
103V3	1	Saving	data to data	base	nown
225A1	1		99%		nown
225A1	1				nown

Figure 6.1.64 Save Data

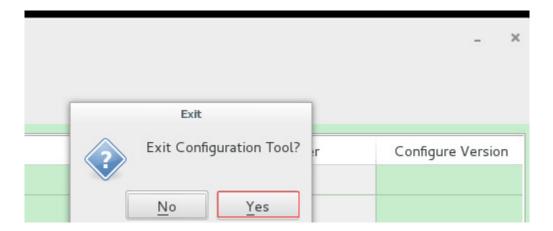
Then the save button will turn to gray and all information will be saved. Detailed information is as shown in the following figure:

e <u>E</u> dit	<u>V</u> iew	<u>C</u> heck	Tools	Config	g <u>H</u> elp
				Q	0
			-		

Figure 6.1.65 Save Data in Progress

10) So far, all works about basic configuration tools have been finished. Click the "X" button on top right corner and select "Yes (Y)" in the pop-up dialog box to exit configuration tools.







6.1.4 Once-Again Modification on Graph Configuration

Open the graph configuration tools in accordance with the method metioned in 5.1.2.1 (detailed steps have been illustrated in previous chapters, so there will be no more detailed description here); graph paper browser----> sub diagram, open "999 test bay". Detailed information is as shown in the following figure:

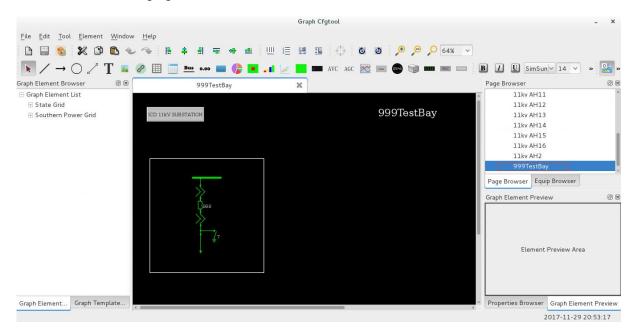


Figure 6.1.67 Open New Bay Interface

It can be seen that there is only one automatically generated detail drawing of the primary equipment in the graphing area without any information about the associated soft switchs, handles, measurement or alarm windows. Further perfection in steps is shown in the following paragraphs:

1) Add measurement information as required. Click the right mouse button in the blank of graphing area and a choice window will pop up:

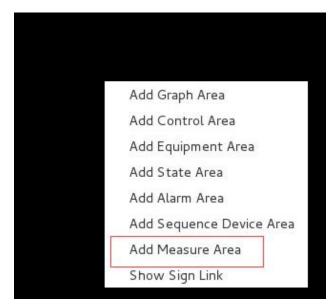


Figure 6.1.68 Increment Measurement

Click and select "increment measurement" with the left mouse button and a database dialog box will pop up:

Data Identify data type yc	~ Bay 999	TestBa	y 😽 Title tabl	e title de	ecimal 2 🗘 🗆	Multi Table	
Name	-	ID	bay	device	name	desc	unit
999TestBay	1	318	999TestBay	ProtectDevice	la	la	А
ProtectDevice999	2	319	999TestBay	ProtectDevice	lb	lb	А
la							
Ib	3	320	999TestBay	ProtectDevice	lc	lc	A
lc	4	321	999TestBay	ProtectDevice	Ua	Ua	kV
Ua	5	322	999TestBay	ProtectDevice	Ub	Ub	kV
Ub	6	323	999TestBay	ProtectDevice	Uc	Uc	kV
Uc							
310	7	324	999TestBay	ProtectDevice	310	310	A
Uab	8	325	999TestBay	ProtectDevice	Uab	Uab	kV
Ubc	9	326	999TestBay	ProtectDevice	Ubc	Ubc	kV
Uca	10	1	,				
300							
Pa Pb	11						
Pb	12						
P	13						
Q							
S							
Cos							
Fr							
la1	<u>د</u>						

Figure 6.1.69 Selection of Increment Measurement

Data type: Telemetering;

Bay: Select the new bay. In the current situation, select "999 test bay";



Title: Double click to have it modified. In the current situation, modify it as measurement quantity;

Decimalnumber: Fill in as required;

Name: Name all measurement signals of new bays;

Drag the necessary measurement quantity to the right table. Click "confirm" button to automatically create a measurement table. Detailed information is as shown in the following figure:

	table title	
itemname	value	unit
Ia	00000.00	А
Ib	00000.00	А
Ic	00000.00	A
Ua	00000.00	kV
Ub	00000.00	kV
Uc	00000.00	kV
Р	00000.00	mW
Q	00000.00	mVar

Figure 6.1.70 Create Measurement Quantity Table

2) Add the information about annunciator as required. Click the right mouse button in the blank of graphing area and a choice window will pop up:

	Add Graph Area
	Add Control Area
	Add Equipment Area
	Add State Area
	Add Alarm Area
	Add Sequence Device Area
	Add Measure Area
59	Show Sign Link

Figure 6.1.71 Add Annunciator

			Data	TableDlg		
ay 999TestBay				✓ Col	umn 1	*
Vame	^	ID	bay	device	name	
Service/KI05		1				
Ext_Close/KI06		2		0		
K107						
KI08 REMOTE		3				
KI09 YCB CLOSED	U 4	4				
KI10						
KI11 WORKING POSITIO	N					
KI12 KI13 SPRING UNCHARGE						
KI13 SPRING UNCHARGE	.0					
KI14 ES CLOSED						
KI15 KI16						
K110 K117						
KI18						
KI19						
K120						
Fault_Signal						
AR_Ready						
UFLS_Soft_Switch						
UVLS_Soft_Switch						
AR_Soft_Switch						
CTBI 01 Open	U I					
						ok car

Click and select " annunciator" and a database dialog box will pop up:

Figure 6.1.72 Annunciator Signal Selection

Bay: Select the new bay. In the current situation, select "999 test bay";

Column number: It means the configuration of annunciator column number. In the current situation, set it as 2;

Remote signal in the left signal list can be dragged into the right table one by one. Or one can click one signal and then press shift button to drag multiple signals to the right side. Detailed information is as shown in the following figure:



L	✓ Colu	umn 1	^
have			×
	1.1		
bay	device	name	
	2		

Figure 6.1.73 Batch Selection of Annunciator Signals

Click confirm button to create the annunciator table:

Ext_Close/KI06	KI12
K107	KI13 SPRIN G UNCHARGED
KI08 REMOTE	
KI09 YCB CLOSED	KI14ES CLOSED
KI10	KI15
	KI16
KI11 WORKI NG POSITION	KI17

Figure 6.1.74 Creation of Annunciator is Finished

Select text button in the tool bar,

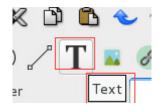


Figure 6.1.75 Text Selection

Click the left mouse button in the blank of graphing area to drag a rectangle, and a typeface will be displayed,

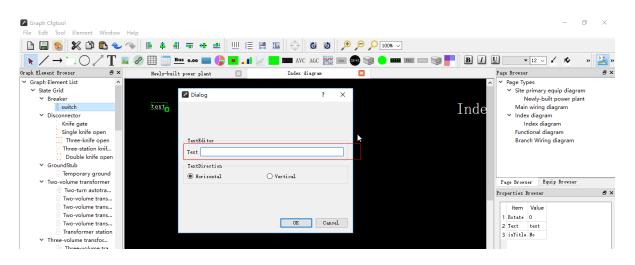


Figure 6.1.76 Text writing

Double click to pop up a dialog box of text property so as to modify it into any desired descriptions. For example, it can be modified as " annunciator". Text arrangement mode can also be adjusted into horizontal and vertical arrangement:

	Dialog
TextEditor Text alarm area	
• Horizontal	Vertical
	OK Cancel

Figure 6.1.77 Configuration of Text Property



After clicking confirm button, the original text will turn to " annunciator":

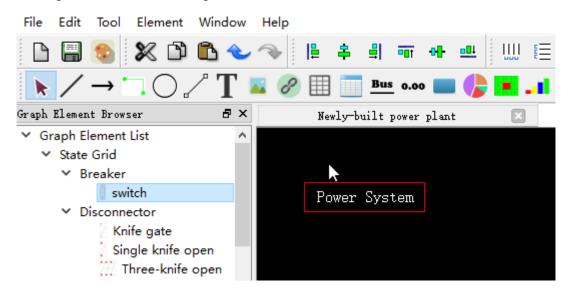


Figure 6.1.78 writing is completed

Click the text with the left mouse button and drag it to the newly added annunciator list or any position. Detailed information is as shown in the following figure:

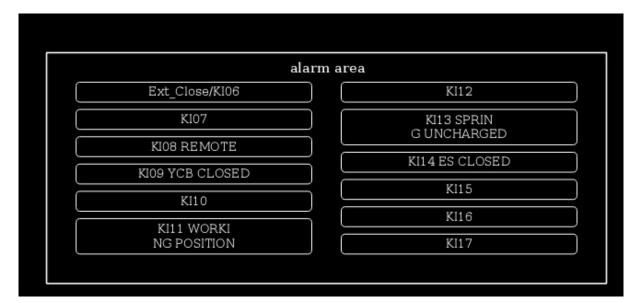


Figure 6.1.79 Text Adition is Successfully Finished

3) Add the net communication status display of equipment as required: Select the net metafile in "net communication status display", press the left mouse button and drag it to the blank of graphing area on the right side:

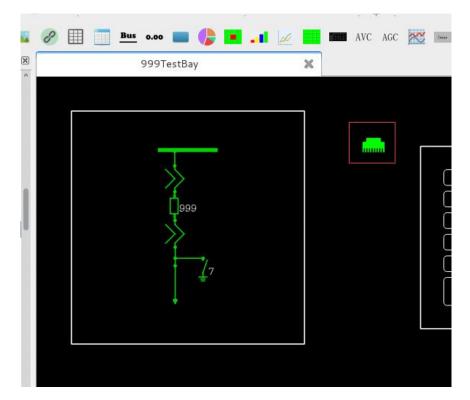


Figure 6.1.80 Status Display Selection of Net Access Port Communication

Click the icon. Click the "remote signal quantity.measured value" of associated signals in the property browser on bottom right corner, and a signal choice box will pop up:

		Page Browser	6 🗴
	Signal Select	11kv AH11	~
Signal Tuna:	Digital signal	11kv AH12	
Signal Type:	Digital signal	11kv AH13	
Site:	ICD 11kV SUBSTATION	11kv AH14	
Barri		11kv AH15	
Bay:	999TestBay	11kv AH16	
Unit	ProtectDevice999	11kv AH2	
Signal List		Page Browser Equip Browser	
DC-45_6		Properties Browser	ðx
DC-45_7 DC-45_8		Item Value	
		1 slated Signal Digital signal.	Real value
key words			
Parameter:	Real value 🗸		

Figure 6.1.81 Display Signal Association of Internet Access Port Communication



- Signal type: Remote signal
- Substation: Default
- Bay: Select the new bay. In the current situation, select "999 test bay";
- Equipment: The belonging equipment of the remote signal. In the current situation, select "35kV feeder protection and measurement equipment ISA-999";
- Measure point: It means the detailed signal names. Select "A network channel failure"; in case of B network, select "B network channel failure";

Click confirm button to finish the association works of the added equipment and signals. Then add texts on right side of icon to provide detailed descriptions (there will be no more detailed information about how to add texts). Detailed information is as shown in the following figure:

ICD 11kV SUBSTATION		999T
	DC-4S-8	

Figure 6.1.82 Create Status Display of Network Access Port Communication

NOTICE!

There is a shortcut to automatically create status information of network access port. In the blank of graphing area, click the right mouse button---->add equipment quantity. Click the left mouse button to display the following figure:

		_
	A	
L35kV馈线保测	则装置ISA-99	9

Figure 6.1.83 Automatic Creation of Network Access Port Communication



4) Add status information about control handles, soft switchs and signal lights. Click the blank space with the right mouse button--->add status quantity, and a block diagram of "data table dialog box" will pop up:

al type ym 🔻 title table title		decimal 2 🔹	mutil table		
y Public Bay 🔻	ID 1	bay name	unit name	signal name	
gnal list	2				
Computational signal secondary	3				
Ym1(1)	5				
Ym2(2)	4				
Ym3(3)					
Ym4(4)					
Ym5(5)					
Ym6(6)				La Ca	
Ym7(7)					
Ym8(8)					
Ym9(9)					
Ym10(10)					
Ym11(11)					
Ym12(12)					
Ym13(13)					
Ym14(14)					
Ym15(15)					
Ym16(16)					
Ym17(17)					
Ym18(18)					
Ym19(19)					
Ym20(20)					
Ym21(21)					
Ym22(22)					
Ym23(23)					
Ym24(24)					
Ym25(25) Ym26(26)					

Figure 6.1.84 Add Signals of Status Quantity

- Display type: Status information can be selected, for example, control handles and switchs, etc;
- Bay: Select new bay. In the current situation, select "999 test bay";
- Name:All remote signal information;

In case of selecting the handle as display type and signal name as remote signal 06, it means the handle is associated with remote signal 06 to realize correspondence of metafile status and signal status. Detailed information is as shown in the following figure:

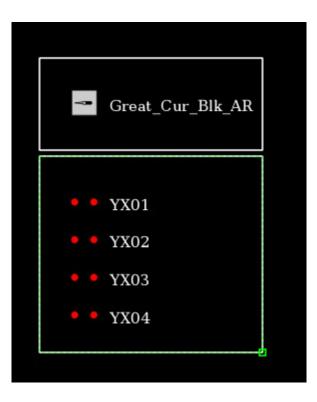


Figure 6.1.85 Creation of Handle and Soft Switch

So far, the detail drawing of new bays has been finished. Detailed information is as shown in the following figure:

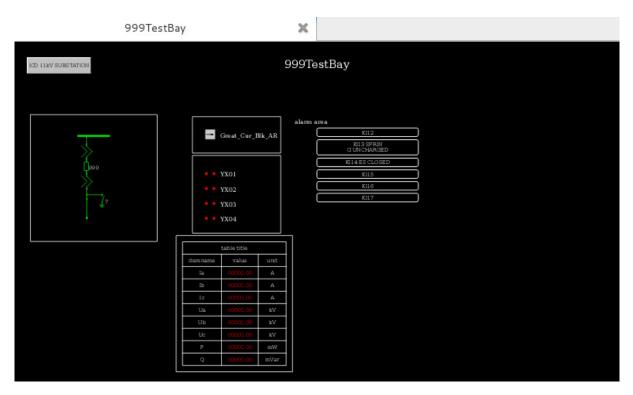


Figure 6.1.86 Detail Drawing of New Bay is Finished

5) Click save button on top left corner of the tool bar and a window of "check association information" will pop up. Select No:



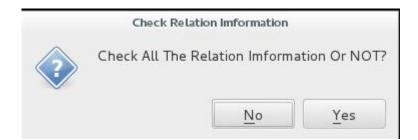


Figure 6.1.87 Check Association Information

Then the "save" window will pop up. Click confirm button:

	save
\bigcirc	dbdata save ok
0	
	<u>O</u> K

Figure 6.1.88 Save Data

Click the "X" button on top right corner of "graph paper configuration tools" to close graph paper configuration tools;

In case of adding other metafiles or operations, perform the same procedure as mentoned above. There will be no detailed information listed here.

6.1.5 Exit the Monitoring System

When creating new bays or performing other modifications, it is normally required to exit the monitoring system. It is very simple to exit the monitoring system. Detailed information about the console is as shown in the following figure:

● ■ * *

【× 🛑 臺用戶未證录 主机 安全运行153天 16:84:17 2017/11/18

Click the power grid icon on the left-most of the console and a dialog box will pop up:

			·/
	Programs	>	1.1
	Settings	>	影(右)
	Authority	>	影(左)
	About		
_	Locked		Grap
G	Exit		
Ĩ		- 2	1
		1	8

Figure 6.1.89 Exit Monitoring Software



Select exit. Enter the user name and password, then click confirm button and the information about closing progress will be displayed on the terminal:

```
QObject::startTimer: QTimer can only be used with threads started with QThread
QObject::startTimer: QTimer can only be used with threads started with QThread
doActionKill: "nb_manager"
doActionKill: "nb_broadcast"
doActionKill: "nb_highway"
doActionKill: "nb_send"
doActionSleep: "1"
rsplock.cc(350) : Highway is not running write failed
doActionExecute: "nb_shutdown"
CDebugWriter: register_id==-1, register_name=nb_shutdown
nb_lib_com.cc(706) : Load from $PRJHOME/bin/conf/sys/dnet.sys
nb_lib_com.cc(712) : base addr is B0000000
nb_lib_com.cc(713) : server buf size is is 6400000
nb_lib_com.cc(714) : client buf is 3200000
nb_lib_com.cc(715) : req buf is A00000
doActionExecute: "shm_manager -f"
 0 shm are released.
 . . . . . . . . . . . . . . . . .
                            rsplock.cc(350) : Highway is not running write failed
直连103--CVirtualNode103ReceiveDataTask quit
CSysVirtualNode quit
CCmdKernelCfg quit
```

Figure 6.1.90 Exiting of Monitoring Software is finished

Click the X button on the top right corner to close the terminal. Then all the monitoring progress will be closed.

6.1.6 Restart Monitoring Program

In the blank space, click the right mouse button---->open the terminal, enter prs7000start and press enter button. After a while, relevant progress about monitoring program will be displayed. All the modification information can be checked on HMI interface!

The modification results are as shown in the following figure:

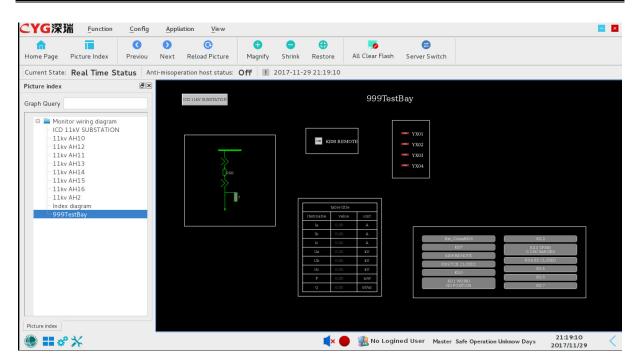


Figure 6.1.91 Display New Bay

6.2 How to Modify Bay Names and CT Ratio?

Modifications of bay names and CT ratio of bays also mean the modification on database. Therefore, exit the monitoring program and backup database before modification. Monitoring program exiting procedure has been illustrated in 5.1.1, and database backup has been illustrated in 5.1.2, so there will be no detailed information here.

6.2.1 odification of Bay Names

1) Click "configuration icon" on the console and select "graph configuration":

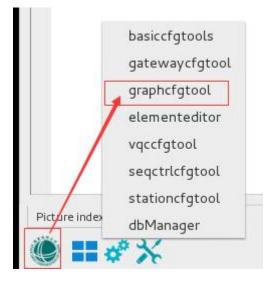


Figure 6.2.1 Graph Configuration Tools Selection

Alog-in box of graph paper configuration tools will pop up:



	Select D	Database	
Lo	gin : Gra	aph Cfgtool	
Db Server	huyc		~
DbName	kenniya	 \	
User			
Password	*		
	<u>O</u> k	<u>C</u> ancel	

Figure 6.2.2 Log-in Graph Configuration Tools

- Database server: Machine name, which means the server name;
- Database: Name of configuration database;
- User: User name;
- Password: Password of the corresponding user;

2) Enter the user name and password to enter the interface of grapg configuration tools. It is the same as step 2 in 5.1.2;

3) Find the bay, name of which needs to be modified, in the equipment browser on the right side. For example, in case of modifying the name of "999 new bay" as "999 feeder outgoing line". Click "999 test bay" with the left mouse button in the drop-down menu of 35kV and relevant information will be displayed in the property browser.

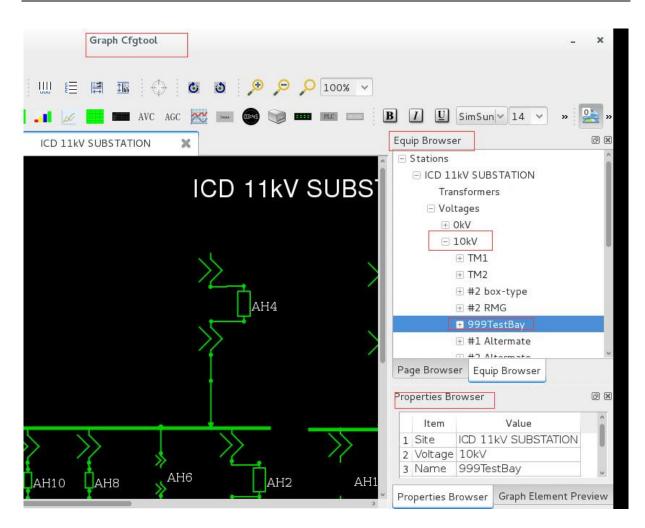


Figure 6.2.3 Find the Bay that Needs to be Modified

- 4) In the "property browser":
- Double click the editable box on the right side of "name" and enter name of the new bay as "999 feeder outgoing line". Then click the blank on the right side and the name will be modified as "999 feeder outgoing line";
- Double click the editable box on right side of "description" and enter name of the new bay as "999 feeder outgoing line". Then click the blank on the right side and the content of "description" will be changed as "999 feeder outgoing line";

Detailed information is as shown in the following figure:



	ltem	Value				
1	Site	Newly-built power plant				
2	Voltage	1000kV				
3	Bay	1000KV_Nanshan_Bay C.B circuit breaker				
4	Name					
5	Description					
6	Serial Number	3				
7	Rotate	0 ition Right				
8	Serial number position					
9	Width	13				
10	Height	40				

Figure 6.2.4 Modify Bay Name and Description

5) Click "drop-down menu of sub diagram" in graph paper browser. Then click "999 test bay" with the left mouse button. Click the right mouse button to pop up the choice box:

Function	nat ulayi ani	1				
🖃 Branch	Wiring diagram					
11k	v AH10					
11k	vAH11					
11k	v AH12					
11k	v AH13					
11k	vAH14					
11k	vAH15					
11k	v AH16					
11k	v AH2					
99	Page Property					
Page Brow:	Delete Page	-				

Figure 6.2.5 Selection of Graph Property

Click the graph property to pop up the dialog box of "graphics parameter configuration". Modify "graph name" as "999 feeder outgoing line":



Page Name	999Out						
Width:	1920	🗘 Height:	1080				
Layer Count	::	4		ŀ			
Page Type:		Branch Wi	Branch Wiring diagram				
Page Color:							
Page Color:	V.	✓ YT Allo	w				
-	-						
YK Allow	YT Allow	☑ YT Allor □ Layer T					

Figure 6.2.6 Graphics Parameter Configuration

Click "confirm" button and the graph name in the drop-down manue of extension diagram will be modified as name of the new bay:

ser	ð						
x diagram							
Index diagram							
ctional diagram							
🖃 Branch Wiring diagram							
1kv AH10							
1kv AH11							
11kv AH12 11kv AH13 11kv AH14 11kv AH15 11kv AH16 11kv AH2							
						999Out	
							ex diagram ndex diagram actional diagram ach Wiring diagram .1kv AH10 .1kv AH11 .1kv AH12 .1kv AH13 .1kv AH14 .1kv AH15 .1kv AH15 .1kv AH16 .1kv AH2

Figure 6.2.7 Graph Paper Browser is Successfully Modified

6) Open the main wiring diagram in graph paper browser. Select and click the bay button under the bay modification with the left mouse button, and relevant information will be displayed in the property browser:

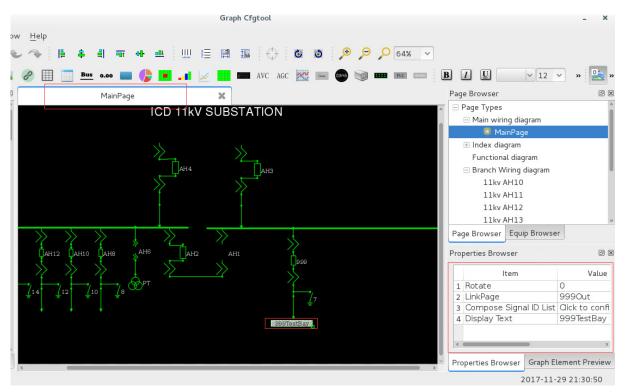


Figure 6.2.8 Check Graph Interlinkage Property

7) Double click the editable box on the right side of "text display" in the property browser, and



modify the name of bay as "999 feeder outgoing line". Then click the blank on the right side and the text of "999 feeder outgoing line" will be displayed. Meanwhile, the left button will be automatically changed into name of the new bay:

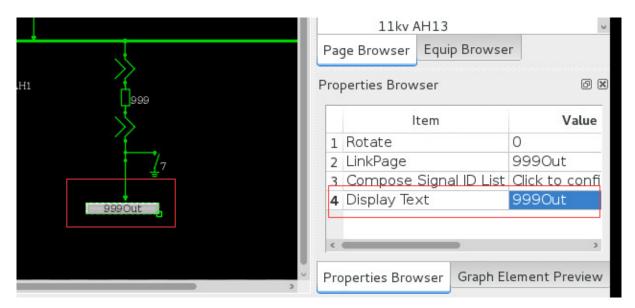


Figure 6.2.9 Modificaiton of Graph Interlinkage Property

Click save button to exit "graph configuration tools". So far, all works about modifying bay names have been finished;

8) Restart the monitoring host and perform the same procedure as described in 5.1.6 and the modification result will be displayed.

6.2.2 Modification of CT Ratio

1) Perform the same procedure as described in the first step of 5.1.3. Open the basic configuration tools, then click navigation tree----->substation configuration----->secondary equipment configuration, and select the secondary equipment that is related with the equipment. For example, select "35kV feeder protection and measurement equipment ISA-999" and the information about remote signal, measurement, remote control and regulating will be displayed on the rigt box:



	ID	Name	MMS Variable Name	quipment Affiliate	quipment Typ	Attribute	Subtype	Division	Ratio	Unit	ondary
Ľ	3796	la	la(92)			Sample	1	341.166	1.00000	A	1
2	3797	ю	Ib(93)			Sample	Í.	341.166	1.00000	A	1
1	3798	lc	lc(94)			Sample	E.	341.166	1.00000	A	1
1	3799	Ua	Ua(95)			Sample	U	17.05830	1.00000	kV	1
5	3800	υь	Ub(96)			Sample	U	17.05830	1.00000	kV	1
5	3801	Uc	Uc(97)			Sample	U	17.05830	1.00000	kV	1
,	3802	310	310(98)			Sample	£	1705.82	1.00000	A	1
3	3803	Uab	Uab (99)			Sample	U	17.05830	1.00000	kV	1
9	3804	Ubc	Ubc(100)			Sample	U	17.05830	1.00000	kV	1
0	3805	Uca	Uca(101)			Sample	U	17.05830	1.00000	kV	1
.1	3806	300	3UO(102)			Sample	U	7.75379	1.00000	kV	1
.2	3807	Pa	Pa(103)			Sample	P	1.96973	1.00000	mW	1
3	3808	РЬ	РЬ(104)			Sample	P	1.96973	1.00000	mW	1
4	3809	Pc	Pc(105)			Sample	P	1.96973	1.00000	mW	1
.5	3810	Р	P(106)			Sample	P	1.96973	1.00000	mW	1
6	2011	0	0(107)			Camala	<u></u>	1 06072	1 00000	mllar	1

Figure 6.2.10 Select to Modify Bays

2) Click "measurement" and select the column of "ratio" tomodify it. For example, modify the ratio of Ua as 100, detailed information is as shown in the following figure:

StgTool										- 0
File Edit View Check Tool	ls Contig	Help								
Navigation Tree	e x		Equipment	t Name Anti-Misoperation SN	Remote Signal	Measurement	Remote Control	Equipment Type	Monitor Host Identification	shing Identifica
> System Information Configur	re ^	11	52-1	1	52-1 fechado[DC-4S 1[ID=2513]		Circuit Breaker	NO
 > User Manager Configure > NetNode Configure 		2 2	D52-1	2	89T fechado[I		Not configure	DD	Ground Switch	NO
> Unit Model Configure						-				1
 Station Configure Nova construo de sudes 		3 3	SC52-1	3	Carrinho do e	Not configure	Not configure	SC	Isolator	NO
 ✓ Voltage ✓ Zero Voltage Leve Common Bay UPS Meter ✓ 35kV LS1 LS2 LS3 LS4 LS5 LS6 LS7 30KVPT 1#TP Lide 		4 Break	r/disconnector	Bus Ao Line Sement Shunt C	ompensator Ser	is Compensator	ţ,			
30KV 1#TSA										
Subsecção do	barra	Uutput Me	-							
LS8			Occur Time	Туре			Message		Level	
110kV		1 2019-	05-29 20:48:03.929	Net node	cvt:The IP of Net	A is not configur	ed		Error	
> PowerTransformer		2 2019-	5-29 20:48:03.927	System	Single database	server!			Hint	
Time Sync	~	3 2019-	5-29 20:48:03.927	System	Client panel 2 dis	play analog sign	al is not configured		Hint	
	Search	4 2019-	15-29 20:48:03 927	System	Dual machine co	ntrol enable sign:	al is not configured		Hint	

Figure 6.2.11 measurement detailed information

Double click the ratio of measurement signals to modify it as actual values. Then click the save button on the top left corner and exit configuration tools; so far, work about modifying CT no-load voltage ratio has been finished.

3) Restart the monitoring host and perform the same procedure as described in 5.1.6. Then the modification results will be displayed in the sub-interface of bay modification.

6.3 Where to Save "PrtScn" Screen Shot Files

Directly press the "PrtScn" to capture screens. However, many people may not know the place for storing screen shot files. In fact, all the screen shot files are stored in the "picture" file. For example, for the root user, screen shots are stored in "/root/picture/".

In addiction, one can click "application program"-"tools"-"screen shot" to capture screens with more functions.

7 Appendix

List of key words is as shown below:

8 Manual Version History

In the current version of the instruction manual, several descriptions on existing features have been modified.

Manual Version		Software	Date	Description of change				
Source	New	Version	Date	Description of change				
Beta	1.00	1.00	2014-04-15	Form the original manual.				
				Updata the number of the binary inputs and binary				
1.01	4.00	1.02	2015-05-21	outputs.				
1.01	1.02			Update the description of IEC61850 dual-MMS				
				Ethernet.				
				Update the description of IEC61850-ED2 MMS				
1.02	1.03	2.00	2017-12-6	Ethernet.				
				Update all the format.				

Table 8-1 Manual version and modification history records