Overall Solutions and Typical Application for Substation Automation

Business Challenge

Substation automation should continuously adapt to the rapid development of communication technology, information technology, control technology, software technology and dispatching-control integration technology, and it plays an important role in security and stability of power system. The substation automation system provides various functions for the substation, such as operation monitoring, operation control, safety management, repair & maintenance, aid decision-making and information support, etc. In order to guarantee the security, stability and easy-maintenance of substation, the substation automation system must ensure the accuracy, timeliness and integrity of information.

Description of Solution

The overall solution is provided for substation automation system, and is applied to substations with voltage from 10kV to 1000kV. Basic functions include measurement, control, remote communication, smart communication, monitoring, protection-control integration, etc. Automatic voltage and reactive power regulation, programmed control, remote browsing and graphic warning are the advanced applications.

Many factory and substation automation systems can be realized, such as integrated automation system, comprehensive monitoring system with smart auxiliary (fire fighting, security, on-line monitoring, etc), video monitoring system, microcomputer anti-misoperation & interlocking system, clock synchronous system, relay protection and fault information system, fault recording system, safety stability control, remote browsing and alarm system, protection-control integration system for MV and LV, power angel measurement system, etc.

Business Values

The operation and maintenance personnel of substation can utilize substation automation system to complete the work of running, monitoring, control, operation, examining, repairing, etc. The accident of misoperation can be avoided, and the safe, stable operation of substation and the stability operation of power grid can be guaranteed.

The real-time monitoring and control can be also realized. Various data acquisition, processing of station, and real-time running monitoring, operation analysis of power grid can be obtained, as well as operation monitoring, maintenance, management of station equipment.

What’s more, non real-time data can also be acquired and processed, including data of power quality monitoring, status monitoring of primary equipment (transformer, breaker, etc), status monitoring of secondary equipment, auxiliary system monitoring (station service power supply, safety guard, fire control, environmental monitoring, etc), etc.

The advanced application functions can be realized, such as automatic voltage and reactive power regulation, programmed operation and control, data management protection, device maintenance, schedule repair, information analysis, comprehensive warning, auxiliary decision support.

Business of dispatching and control integration is supported. Real-time information of power grid, accurate real-time information, remote data transmission and remote browsing service for panoramic data in station can
be supplied to master station.

Related Products

- NS2000 substation comprehensive automation system
- NS3000 integrated monitoring system of substation
- EPS series industrial Ethernet switch
- NSR600RF series protection and control integration unit
- WEBX Microcomputer anti-misoperation interlocking system

1. NS2000 substation comprehensive automation system

NS2000 substation comprehensive automation system is suitable for IEC 61850 rule, embedded operating system, and the hardware of server, workstation, PC, embedded device, etc. The system can be applied to substation automation systems with voltage between 10kV to 1000kV. It has the basic functions of measurement, control, remote communication, smart communication, monitoring, protection and control integration, etc.

1) NSC330 series communication control unit

NSC330 series communication control unit adopts the embedded design of Linux real-time operation system and meet the requirements of IEC 61850. It supports multi-process and multi-processing task, data acquisition and transmission by priorities and different communication media and protocols. It can not only communicate with smart device in station, but also realize information exchange with dispatching (control) center and centralized control center.

2) NSD500 series measurement and control unit

NSD500 series measurement and control unit has embedded software & hardware architecture, which follows IEC 61850 standard. Software and hardware possesses modular design with reasonable division and convenient
maintenance. And it can be applied to acquisition and control for voltage, current, circuit breaker, disconnector, equipment status, temperature, DC, etc. Besides, it is suitable for the measurement and control for line, transformer, bus coupler and bus of various voltage classes.

2. **NS300 substation integrated monitoring system**

![Diagram of substation integrated monitoring system]

**Solution for substation integrated monitoring system**

NS300 substation integration monitoring system meets the requirements of smart power grid and it is compatible with NS2000 substation comprehensive automation system. What’s more, it completes the function of smart substation, and provides smart advanced application, which shows the characteristics of information, automation and interaction of smart substation. In addition, it supplies integrated solution, station control layer, bay layer and process layer equipment to substation and realizes seamless connection with substation electronic transformer and optical transformer. One platform, multi-application and free cutting combination can be realized, as well as the unified platform, hierarchical design and modular encapsulation for monitoring system, remote unit, information protection substation, graphical gateway machine, auxiliary system, etc. In addition, application is of on-demand configuration, which can meet different demands of various-scale substations for automatic system. Many factory automation systems can be realized, such as integrated automation system, comprehensive monitoring system with smart auxiliary, video monitoring system, microcomputer anti-misoperation & interlocking system, clock synchronous system, relay protection and fault information system, fault recording system, safety stability control, remote browsing and graphic gateway system, protection-control integration system for MV and LV, power angel measurement system, etc.

3. **EPS series industrial Ethernet switch**

![EPS series industrial Ethernet switch image]
EPS series industrial Ethernet switch has embedded software & hardware architecture, which follows IEC 61850 specification, and takes the severe working environment and network communication needs. It adopts carrier-grade Ethernet, hardware timestamp, smart content identification and other advanced technologies, making the communication system of smart substation more reliable, effectively resisting DOS attack, ensuring the preferential forwarding of GOOSE message. This device supports IEEE 1588 PTP precise time synchronization protocol and can transmit precise synchronous time for smart electronic device.

4. **NSR600RF series protection and control integration unit**

NSR600RF series protection and control unit adopts embedded software & hardware architecture, which follows IEC 61850 standard. It is with low power consumption, stable performance and convenient design and installation, besides, it adopts the method of Centralized assembly into panel and separate assembly. It is applied to a number of protection and control integration functions, such as line, bus bar, capacitor, reactor, main transformer, automatic bus transfer, station service transformer, generator, etc. The product can be applied to protection and control equipment with voltage not more than 110kV, as well as industrial automatic fields of power plant, transportation, mine, petrochemical, metallurgy, ports, water supply, environmental protection, etc.

5. **WFBX microcomputer five-prevention & interlocking system**

WFBX microcomputer anti-misoperation & interlocking system combines the technologies of computer and network communication, substation automatic, anti-misoperation, monitoring, control, etc, which can avoid the misoperation of site operation personnel in substation.
Relevant successful cases

Since NARI Group Corporation promoted substation automation system from the start of 1990s, it has been widely used in 31 domestic provinces, cities, autonomous regions, as well as other countries, such as Sudan, Thailand, Indonesia, the Philippines, etc. There are more than 9000 sets of substation comprehensive automation systems at site, as well as more than 400 systems with voltage of 750kV or 500 kV and more than 2300 systems with voltage of 330kV or 220kV. NARI will keep its advantage of substation automation system, and passionately fulfills its responsibility as an electrical equipment manufacturer.

The complete automation solution for the North China Power Grid National Wind & PV Power Storage Demonstration Project includes a number of factory automation systems, such as substation integrated monitoring, microcomputer anti-misoperation & interlocking, video monitoring, clock synchronous, relay protection, fault information, fault recording, protection-control integration system for medium voltage and low voltage, EPS industrial Ethernet switch, power angel measurement system, etc.

1000kV UHV Changzhi Substation in Jiangxi adopts NS2000 comprehensive automation system and WFBX microcomputer anti-misoperation & interlocking operation system, etc. 1000kV Jindongnan – Nanyang – Jingmen AC Transmission & Transformation Demonstration Project is the first UHV demonstration one with voltage of class of million. And this project is the compensation for the voltage class of million, and it has the duty to promote the industry of electrical equipment. Besides, it is the starting project of the development of UHV power transmission & transformation, and the innovative one leads the progress of power transmission and transformation.

EPS series switch has been put into use in more than 1000 projects in our country. National Wind & PV Power Storage Demonstration Project of North China Power Grid is “Golden Sun Demonstration Project”. Sate Grid invested into the project. And it is the largest four-in one renewable energy project with wind power, pv power generation, energy storage and power transmission project. The project is to build the wind power field of 500 thousand kilowatt, the pv power plant of 100 thousand kilowatt, and energy storage device of 110 thousand kilowatt. The total construction scale will be up to 700 thousand kilowatt, and the whole investment will be 12 billion Yuan. The project lies in Zhangjiakou district, Hebei province, and it is supported by relevant ministries and commissions, State Grid and every government level in Hebei.

Thailand general contracting project is the second one we got in Thailand Bangkok, which includes one terminal station and nine transformer substations, and all the substations were established around 1990s, 9 of them are equipped with RTU and one of them has no communication with the master station. Most substations are still using relay protective equipment to protect the primary equipment. MEA is the Party A of this project. During the bidding competition, NARI-TECH is the only company whose products comply with all technical specifications MEA required comparing with other competitors, and therefore finally MEA signed the contract with NARI-TECH after bid negotiation.

This project includes reconstruction for 10 transformer substations covering design, equipment procurement, construction and debugging. YK, MM and SSA station are located in center of Bangkok, M1, M3 and KRT station in northwest, BCN in Northeast, KMS in western part and KSC and PN in Southwest. This project applies IEC61850 design standards and the monitoring system applies NS3000 transformer substation comprehensive automatic system. Up to now all the YK, BCN, SSA, MM, M1, M3, KSC and KMS station are put into production, which covers one fourteenth power supply of Bangkok City, and even includes important facilities and buildings such as two embassies, Thailand Airline Headquarter, Mahasawat branch bureau of Thailand civil water supply bureau, quite a number of banks and large scale commercial buildings. After the construction, the target that primary equipment of the s
Controlled by the center control room was fully realized and working load for the station staff was cut down a lot. With the implementation of this project, customer MEA becomes more confident in our products, service and future cooperation, which also set up a firm foundation to realize our company’s strategy of “stepping into foreign market”.

**Key projects: Recent key projects introduction**

The complete automation solution for the North China Power Grid National Wind & PV Power Storage Demonstration Project includes a number of factory automation systems, such as substation integrated monitoring, microcomputer anti-misoperation & interlocking, video monitoring, clock synchronous, relay protection, fault information, fault recording, protection-control integration system for MV and LV, EPS industrial Ethernet switch, power angel measurement system, etc.

The substation automation system, microcomputer anti-misoperation & interlocking system and phase II
extension project of 1000kV Jindongnan – Nanyang – Jingmen EHV AC Demonstration Project

Thailand substation protection and control general contract project is the second generalcontract project gained in Bangkok, Thailand, which includes one terminal station and nine substations.