

# **Study on the application of Microcomputer remote control technology in unattended substation**

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**Abstract:** Aiming at the limitation of the traditional substation in the control and management, computer remote control technology was used to ensure the personnel on duty in the remote control center can obtain monitoring information of unmanned attended substation to realize the substation intelligent management and relay protection. Based on the lack of the traditional control method, control integration concept and the prospect of the unattended substation control technology development trend were proposed. Then, with the introduction of the computer remote control technology, application of the unattended substation on-line simulation, alarm, intelligent diagnosis system, remote monitoring browsing technology and maintenance technology in unmanned substation intelligent control system were conceived to realize relay protection and control integration.

## **1. Introduction**

With the increase of power consumption in all walks of life, the stability of the power system is getting more and more attention. Substation as the power system to connect the power supply side and the end of the hub, its workload is also increasing, the use of manual monitoring and management of the traditional work mode, more and more can not meet the needs of social development, the development of computer technology for the substation remote control provides a possible[1]. The use of substation automation system, can realize unmanned monitoring, not only effectively save the human cost, but also improve the level of the substation management. But at present, the automation equipment, the use of different automation equipment, the use of the standard is not uniform, so the lack of compatibility between each other, which gives the user the use of more difficult[2].

Aiming at the development demand of the structure and function of the substation automation system, the development trend of the future development trend is studied[3]. Has great significance to realize the automation of dispatching and reduce the operation reliability of the operation, improve the reliability of the equipment, enhance the ability of accident response, and improve the operation management level of the power network.

## **2. Substation Status**

### **2.1 Problems of relay protection in Substation**

Traditional relay protection of transformer substation has the following problems: 1, the traditional relay protection, automatic and remote devices, etc. Most of the electromagnetic type or small scale integrated circuit, lack of self and self diagnostic capability. 2, relay protection is mainly dependent on a large number of cables, through contacts, analog signals to exchange information. Small amount of information, poor flexibility, low reliability. 3, the traditional relay protection volume is large, heavy, the main control room, the room covers an area of large, high land acquisition investment, voltage transformer, current transformer burden, two redundant configuration of equipment[4]. 4, not suitable for the power system fast calculation and real-time control requirements. 5, electromagnetic or small scale integrated circuit debugging and

maintenance workload, can not be far from the protection of the protection, automatic device setting value and check its working state. 6, the traditional relay protection according to the functional configuration, the correlation is very little, and the coordination of each other is difficult, need to be on duty personnel more intervention.

## **2.2 Substation control status**

First, different regulatory systems to different technicians were designed, maintained by different operation and management staff, resulting in the waste of human resources; Second, provided by different suppliers of power supply system communication protocol is not compatible with the general level of automation, uneven, difficult to realize network management system; improve system stability, coordination technology limited it is difficult to implement; sub system linkage can not be involved; Third, no hierarchical feedback and filtering, plus communication and other causes of "error message" mixed meantime, attendant on the face of massive information, can not get decision-making information in the shortest time, the key information is really useful annihilation, delay the accident found, analysis, positioning time[5]. Service center of information service is too general, the duty officer can not determine the cause of the accident. In summary, the development of the existing substation control system has lagged behind the development of intelligent substation, can not meet the needs of unmanned duty, intelligent management, the urgent need to optimize the integration, improve the overall level of automation system.

## **3. Demand of unattended substation**

Compared with the one on duty substation, unattended substation has higher design requirements for the maneuverability, reliability, safety and reliability[6]. Maneuverability: refers to the main one, the two device can be controlled, but also remote control, the remote control center on the substation operation and equipment information, but also requires information transmission channel reliability: refers to a time, two equipment operation is accurate, reliable, low failure rate; safety: to meet the conditions of unmanned monitoring security measures, and these auxiliary system to have automatic start stop or remote control function.

In general, it is to realize the integration of regulation and control, that is to take the power grid dispatching control center and operation and maintenance operation station management model. Power grid dispatching and control center is mainly responsible for the operation of power network dispatching, substation equipment operation monitoring and remote control operation, operation and maintenance operation station is mainly responsible for the decomposition of the dispatch instructions, equipment inspection, eliminate, on-site operation and emergency disposal. Under the regulation and control of integrated mode, monitoring and scheduling of one, the substation unattended, control center 24h on duty, operation and maintenance operation of a few people on duty.

### **3.1 Requirements of substation control**

#### **3.1.1 Centralized control and function dispersion**

In traditional substation protection, remote control and monitoring is often a function module management multiple unit interval, this case, upon failure of the module function, cause the entire automation system will be affected. So in the future development, it is necessary to develop a module to manage an interval unit, so as to realize the independence and adaptability of the function module and reduce the influence of the system. In particular, the LAN LAN which is widely used in computer application, it has better adaptability to the substation automation system, which has been greatly improved in both communication medium, topology structure, transmission speed, and the number of access network equipment.

#### **3.1.2 From special equipment to platform**

The development of modern computer technology makes the function of the equipment only by software. The hardware is related to the number of I/O required. The development of general standard hardware and software platform, with the characteristics of openness and data consistency, facilitate the different manufacturers to interface with each other and to adapt to all the protection and control. The protection function can be realized by the algorithm and can be set by the user, and

all kinds of algorithms are combined together to achieve better selectivity and higher redundancy. Control equipment can provide control and monitoring tasks of the scattered data processing functions. Data can be distributed to the remote monitoring station system. Programmable logic functions are provided such as the direction of the direction of the monitoring command, chain and switching operations, etc..

### **3.2 Requirements of unmanned duty Technology**

The key technologies of unmanned watch include: Panoramic information display platform, operation and supervision of security, hierarchical and classification of remote information, video technology application. Achieve real-time data, real-time picture, real-time function of the source side maintenance, the whole network share.

#### **3.2.1 Panoramic information display platform**

The establishment of panoramic visual data platform is the core function of the substation, and it is required to support intelligent equipment and all kinds of fault information[7].According to the relevant data, such as switch, accident signal, automatic identification of fault, and the fault of the index, check the operation of the equipment, the order of the switch. According to the system model section of the automatic matching of the fault moment and the response of the system, the data section of the accident occurred before and after the accident to reconstruct the scene.

#### **3.2.2 Operation monitoring security**

Remote operation on the reliability requirements is very high, does not allow the occurrence of false operation, the current use of the responsibility to partition and authentication technology measures to ensure that the operation of the task of the user name, password, authorization level, security responsibility to define the definition of a multi-authentication process, to prevent unauthorized operation[8].

#### **3.2.3 Remote information filtering and classification**

The information of the substation is complex, and it will increase the workload of staff, and will not be easy to filter out the useful signal from the huge information group. The overall principle of information classification is comprehensive and accurate, the primary and secondary is clear, easy to analyze, the total amount is appropriate.

## **4. Application of advanced function of unmanned substation**

### **4.1 Real time simulation**

Real time simulation system can reflect the principle and structure of the DC power supply cabinet and the installation layout of the components, and display the relevant diagrams of DC power source in real time, including the switch closure and wiring of the components, and the real-time current and voltage values.

### **4.2 Intelligent alarm function**

Intelligent alarm function, through the acquisition of the warning information to the appropriate pre-treatment, full use of the full coverage of the starting end equipment information, in the beginning of the monitoring display of the device to display a variety of operating signals, including the location of the switch signal, equipment abnormal signal, system so as to pass the signal to the dispatch terminal. At the same time, the system can also carry out the proof of data, through the screening and the combination of the results, the comprehensive analysis of the formation of the standard format of the alarm command. For example, when a fault occurs, the monitoring display will automatically pop up, showing the type of failure, and issued a warning sound. In the scheduling terminal equipment, through the network query "fault query" module, it can display the type of failure, through the "history fault query" module, can display the history of failure and repair records, can be used for system reliability assessment, can be used as a reference for system maintenance.

### **4.3 Automatic diagnosis system**

Automatic diagnosis system has powerful data analysis and processing ability, and is complemented by the color touch screen display screen to achieve the visual image. In the process of DC power supply, there will be various systems such as AC power supply, DC bus voltage, under

voltage, DC system grounding, feeder switch tripping, etc., some of which reflect the failure of components, such as the battery pack outlet fuse, charging device, communication disorders, etc.

All kinds of system faults or faults that occur in the DC power supply can be directly or indirectly reflected in the components of the equipment. Automatic diagnosis system is the real-time diagnosis and prediction of every component of the device and the method of troubleshooting.

When the AC / DC system fails, it will display the system failure in the main screen, and the sound alarm is issued at the same time. Main screen click on the "system failure", will enter "the fault" screen, the fault will be displayed in the form of a flash light plate, the intelligent diagnosis system can further show the location of DC cabinet fault device, when a fault occurs in the cabinet, corresponding to the words of the cabinet body color will turn orange and yellow, prompts the operator to further inquiries. Click on the appropriate cabinet, will enter the corresponding cabinet a system diagram, and prompt the fault device is arranged in the cabinet or cabinet, click on the corresponding button can display caused by the failure of components where the position, and on the screen gives the corresponding solutions. Operation personnel according to the method of prompt processing, processing completed, the failure disappeared, the main picture of the system failure to convert the system normal words.

#### **4.4 Remote information browsing**

Use of the existing Internet can lead anywhere, not only is the transmission of data, but also can transmit audio and video signals. Remote monitoring based on Web can not only realize remote data browsing, but also share power enterprise's information resources, and improve power system power supply reliability and service quality through remote terminal mode and graphic gateway. Remote monitoring system, which is a remote login substation background monitoring system, is performed by the end user. Using DC remote maintenance and diagnosis technology, users can use the password, password, random code or dynamic password, etc., through the Internet to actively and field equipment for data and picture link. Can remotely observe the real-time operation of the DC cabinet screen, various parameters and data to achieve synchronization with the field operation. Users and manufacturers through the monitoring center (authorized) in any place to access the system can obtain the information of the system. After the failure of the DC cabinet, the user received a message indicating that the site after the failure of the release of information.

#### **4.5 Remote maintenance core**

The core of the remote diagnosis system is the establishment of the database. To ensure the integrity and confidentiality of the database system as well as the availability, including the identification of the user's identity and permissions to the database system, to ensure that each user and its access to the system is legal, and can be identified. So it is necessary to identify the user's identity and access rights, so that the user can only operate within the scope of the system specified in order to ensure the security of the system data. To ensure the availability of the database system, that is to ensure that the database system resources can access, easy to use and avoid data conflicts, etc.. In the process of data access, to ensure that there is no conflict and contradiction between the datas.

#### **4.6 Application of new technology**

For example, with the application of digital signal processor, it can be used as a measurement control unit, which can be used as a measurement control unit, and it can improve the protection function and realize the effective integration with other functions, so as to improve the communication capacity of the system. For example, optical fiber communication, due to the wide bandwidth, multi-channel, and low attenuation, due to the existence of electromagnetic interference and many other advantages the in long distance and short distance of large capacity information transmission is possible, especially suitable in strong electromagnetic interference environment using, can be used as a communication channel. Therefore, new technology should be applied to substation computer remote control, optimize the system constantly.

## 5. Conclusion

The development of the integrated automation system of the substation in China is only about ten years, which is the reform of the technology of the power system. The introduction of substation automation system is the inevitable choice for the development of electric power system. It is also the important measure to create a power system in the new period.

Unmanned substation through digital technology, remote communication technology to promote the entire grid technology and upgrade, which reduces the cost of the whole life cycle, improve operational efficiency. Current DC remote maintenance and diagnosis technology and intelligence simulation technology, intelligent alarm technology remains to be further developed and standardized, with the development of communication technology, combined with the station video technology and tele communications business, I believe that advanced features a new generation of DC system application can more effectively guarantee the safe and reliable operation of the substation.

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