

# Electric Automation Control System and Design Based on Power System

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**ABSTRACT.** With the continuous growth of social economy, modern technology has been widely used in power enterprises. With the increasing safety and working efficiency of power enterprises, it also increases the economic benefits of power enterprises. In the design process of electrical automation technology, the design of automation system is of great significance, and it is also a difficult problem that must be overcome to promote the automation of power system. The application of power system plays an important role in promoting China's economic recovery, upgrading and technological progress of China's power system. Distribution automation is an important part of strong power system construction, and it is also a key means to further improve the power supply quality and reliability of power system. This paper discusses the composition of distribution automation terminal equipment and analyzes its application in power system. It is hoped that the application technology of power system terminal equipment can be enhanced and the automation level of power system can be improved.

**KEYWORDS:** Electrical automation, Power system, Terminal equipment

## 1. Introduction

The development of electrical automation technology has penetrated into various industries in China, and occupies an important position in the development process of power enterprises. With the continuous growth of social economy, modern technology has been widely used in power enterprises. With the increasing safety and working efficiency of power enterprises, it also increases the economic benefits of power enterprises. Under the urgent demand of the whole transformation and innovation, the power system, which plays an important role, is in a prominent position, and the change of resource use is closely related to the innovation and construction of power system [3]. Electrical automation terminal equipment is used in power system automation, which not only realizes the functions of remote control, telemetry and remote communication efficiently, but also plays an important role in the maintenance and inspection of cable system [4]. These modes are compatible from low to high, combined with each other according to the different distribution network structure and user importance, and inherited and transformed from low to high with the upgrading of distribution network structure and user importance [5]. How to improve the operation level of electrical automation and manage the level of water and electricity automation has become an urgent problem in my country's power system, and how to achieve both energy saving and enhance corporate brand image has become a major problem faced by power companies.

Electrical automation control technology is a technology based on a certain knowledge of electronic technology, computer control technology and computer network technology, and requires practitioners to be able to master the basic principles and methods of commonly used electrical equipment and computer technology to achieve electrical control [6]. Under the condition of normal operation of the distribution network, electrical automation optimizes the operation mode of the power grid by constructing the operating conditions of the power system [7]. Electrical automation is an important part of the construction of a strong power system, and is a key means to further improve the power supply quality of distribution networks and improve the reliability of power supply [8]. The automatic construction of distribution is not only to make the power configuration more efficient and high-quality, but also to ensure the safety and reliability of the entire power grid system. When the distribution network operates abnormally, electrical automation can quickly detect the fault area and abnormal conditions, thereby quickly isolate the fault area and quickly restore the normal power supply in the non-fault area [9]. As far as my country's power system is concerned, whether it is from the perspective of automation, intelligence or self-healing and optimization capabilities of the network, the level of the distribution network is far behind the transmission grid. This paper discusses the composition of distribution automation terminal equipment and analyzes its application in power systems. It is hoped that it can promote the enhancement of power system terminal equipment application technology and improve the automation level of the

power system.

## **2. Necessity of Electrical Automation Construction**

The effective application of electrical automation technology in power system can improve the defects and deficiencies in power system, and at the same time, it can effectively improve the operation efficiency of power system. As the core of the electrical automation monitoring and management system, the master station system is mainly responsible for collecting real-time information of distribution electronic stations in various regions, and monitoring, controlling and effectively managing the entire distribution network. Most power outages are caused by distribution system failures, and the quality of power is closely related to the performance of distribution network. The development of power industry needs to be carried out scientifically. It is far from enough to blindly consume energy and increase electric energy production. The construction of electrical automation based on power system can improve the operation quality of power grid and make the power grid system meet more demands. As far as China's power system is concerned, the level of distribution network lags far behind that of transmission network in terms of automation degree, intelligence degree and network self-healing and optimization ability. The wide application of electrical automation control technology in power system can effectively cope with the complexity, universality and functionality of the power grid, and make full use of the functional and systematic functions of the power grid, thus maintaining the safe and stable operation of the power grid.

Power system technology contains many technical fields, which are based on intelligent technology and automation technology. According to the essence of power system operation, it is the process form of integrating information and communication technology into the whole power system through certain internal needs and ways. The communication terminal can effectively connect with the communication medium of the control unit and communicate [10]. The electrical automation control technology will develop towards a higher level and more diversified technology like China's science and technology. In the future electrical automation control technology, advanced science and technology such as information communication technology and multimedia information technology will also be incorporated. The types of communication channels are classified as carrier terminals, optical fiber terminals and wireless terminals. According to the demand of distribution network, automation can be better integrated into power production, power transmission, line maintenance and fault emergency repair. As the link between the main station system and the terminal equipment of distribution network, the communication network must have high stability and reliability. Sub-stations can detect power grid faults within the region by themselves, adjust the voltage, improve the working efficiency of the power grid, and reduce the work of the master station to a certain extent.

## **3. Practical Application of Electric Automation System in Power System**

### **3.1 Specific Composition of Automation System**

One of the bottlenecks in the development of power system is that it is difficult to maintain the power system, which is mainly because the development of electrical automation technology in China is not very mature at present. According to the composition of automation system, it mainly consists of communication interface, system management, monitoring system and main station. In the process of electrical automation construction, it is clearly stipulated that the electrical automation construction should be solidified in the power grid production and construction. In view of system management, it mainly takes the monitoring system as its main basic content, and adjusts the possible problems in all aspects of management to ensure the normal operation of equipment to the maximum extent. In the system with low resistance grounding, the distribution terminal can detect whether the single-phase grounding short circuit occurs by judging whether the zero-sequence current exceeds the set value. In the early stage of the construction of electrical automation system, the first consideration is safety. Only when the construction is carried out on the premise of ensuring safety will the construction become meaningful. When the line load is small, the measured current is close to zero, which will lead to the failure to effectively monitor the change of load current.

In view of the role of substation in the whole electrical automation system, the industrial computer in a power field can be taken as the basic form of its operation, or the substation terminal of embedded system can be taken as the foundation. The transmission delay and its influence on service reliability are verified under the switching state of surround protection, and the test results are shown in Table 1. By calculating the difference between the number of packets sent from the source and the number of packets received by the receiver, the number of lost packets is 2472.

*Table 1 Delay and Packet Loss in Switching State*

	Source end	Dormitory end	Packet rate
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Tx Frames	87 129 258	91 337 145	Packet loss number
Rx Frames	89 314 637	87 141 723	2472
Tx Bytes	537 248 317	518 323 215	Switching time
Rx Bytes	526 378 619	521 235 642	2.41E-03

In the distribution network, the impedance on the high voltage side of the system is converted to the low voltage side, and the impedance value becomes smaller. With the increase of distribution network, the negative sequence impedance of the system becomes smaller. The negative sequence impedance of a general line is hundreds of times that of the system. Therefore, there are:

$$\frac{d^2 \omega}{dx^2} - \frac{h}{\alpha^2 EI_0} \frac{d\tau}{dx} = -\frac{M}{EI_\infty} \quad (1)$$

Because the feeder is generally short, the negative sequence impedance of the load is large, and the negative sequence impedance of the load is much greater than the negative sequence impedance of the feeder:

$$\frac{d^2 \tau}{dx^2} - \alpha^2 \tau = -\frac{\alpha^2}{h} \left[ 1 - \frac{EI_0}{EI_\infty} \right] V \quad (2)$$

### 3.2 Function of Automation System

The electrical automation technology can simulate the running state of the power system in real time in the running process of the power system. By sorting out and analyzing the data in the running process of the system, it can simulate the faults well. As a key component of the whole power system, automatic management system and electrical automation take distribution network geographic information system as the basis of its effective implementation and operation. Simulation modeling technology can not only effectively manage the huge data information in the power system, but also build the most suitable simulation operating environment with reference to the actual situation, and then synchronously control the power system [11]. As far as automation system is concerned, it regards distribution network geographic information system as the basic platform for implementing corresponding data entry, and effectively combines distribution network with geographic information. As an important form of detection automation system, monitoring software takes the timely and accurate development of problems as its ultimate goal, so as to minimize or reduce losses. With the joint efforts of all parties, the implementation of electrical automation is constantly improved and upgraded to standardized management, which will surely achieve better results and get greater social and economic benefits.

### 4. Conclusions

With the continuous improvement of electrical automation technology, a more stable and efficient operating environment has been created for the development of power system. Through the cooperation of science and technology and power system, a large amount of manpower can be saved to a great extent, and the development and production of power enterprises have been greatly improved. This paper studies the application of electrical automation terminal equipment in electrical automation, and deeply discusses the composition, function and core technology of related terminal equipment. With the development of power system, the start of large-scale urban and rural power grid construction and reconstruction, and the gradual maturity of international and domestic technologies and equipment, the research and application scope of electrical automation has gradually expanded. The establishment of intelligent distribution network system is also inseparable from the optimization of human resources. As long as the role of talents is effectively brought into play and the human resources are integrated and optimized, the level of intelligent distribution network can be further provided. Advanced electrical automation is a technological revolution under the background of power system. The active application of electrical automation control technology in power system is conducive to the improvement of the intelligent level of power system and can promote the rapid development of power industry.

### References

- [1] Wu Zhe, Yu Gang. Application of electrical automation technology in power system. Internal Combustion Engine and Accessories, No. 008, pp. 66-67, 2017.

- [2] Zhang Liyun, Fang Mengyang, An Xiaoshuo. Discussion on electric automation technology of power system. *Green Environmental Protection Building Materials*, No. 10, pp. 235-236, 2016.
- [3] Li Hong. Discussion on electrical automation in power systems. *Theoretical Research on Urban Construction (Electronic Version)*, Vol. 005, No. 013, pp. 1129-1130, 2015.
- [4] Zeng Tao, Chen Lina. Application of electrical automation technology in production and operation power systems. *Communication World*, No. 21, pp. 157-158, 2016.
- [5] Yin Runxiang. Application of electrical automation technology in power system. *China Equipment Engineering*, Vol. 384, No. 24, pp. 143-145, 2017.
- [6] Liu Bin. Application of electrical automation technology in power system. *Heilongjiang Science and Technology Information*, No. 030, pp. 84-85, 2017.
- [7] Li Qingyuan, Xu Su. Application of electrical automation in power system. *Engineering Construction Standardization*, No. 001, pp. 189-190, 2015.
- [8] An Zhe. Exploration of electrical automation technology in power system. *Communication Power Technology*, Vol. 036, No. 005, pp. 148-149, 2019.
- [9] Xu Minrui, Lu Shufeng, Yang Shihai, et al. Exploration of electrical automation technology in power system. *Power Equipment Management*, No. 011, pp. 28-30, 2018.
- [10] Xie Kai. Application of electrical automation technology in power system. *Electronic Technology and Software Engineering*, No. 024, pp. 102-103, 2018.
- [11] Wang Caixia. Discussion on electrical automation technology in power system. *Power System Equipment*, No. 10, pp. 92-93, 2018.