

Application of Electrical Automation Technology in Power System

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How to cite this paper: Wang, K. and Li, W.Q. (2019) Application of Electrical Automation Technology in Power System. *Journal of Power and Energy Engineering*, 7, 8-13.

<https://doi.org/10.4236/jpee.2019.75002>

Received: April 22, 2019

Accepted: May 18, 2019

Published: May 21, 2019

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Abstract

With the continuous development and progress of science and technology in China, automation technology has occupied an important position in many fields while its application in power system is increasingly widespread. Therefore, the application of electrical automation technology in power system is of great significance for power supply stability and work efficiency. In this paper, the author analyzes the application of electric automation technology in power system and makes contributions to the sustainable and stable development of power enterprises.

Keywords

Power System, Electrical Automation Technology, Application

1. Introduction

With the rapid development of science, technology and social economy in the new era, people's living standards are constantly improving, whose demand for electricity is also increasing. Since the traditional power supply mode cannot meet people's power demand anymore, relevant enterprises need to innovate the power system. Electrical automation technology has the characteristics of intellectualization and multiple functions, which can effectively solve various problems existing in power system. The introduction of electrical automation technology into the power system can greatly improve work efficiency, reduce the consumption of manpower and material resources in power enterprises, and effectively reduce the probability of human error.

2. Application Direction

2.1. Simulation System

Because of the development and progress of science and technology, electrical

automation technology has gradually been widely used due to the increasingly perfect computer technology. On the basis of sufficient experimental data provided by the simulation system, electrical automation technology can conduct synchronous experiments for steady state and transient state of varieties and different power systems, assist researchers in testing new devices. A variety of different control devices can form a closed loop system with them, flexibly providing high quality conditions for transmission systems and experiments on intelligent protection control strategies [1]. The introduction of real-time simulation system in the power system provides convenient conditions for the in-depth study of real-time simulation modeling of power system and dynamic load characteristic monitoring, so as to build a laboratory with real-time simulation conditions.

2.2. Intelligent Protection

Nowadays, Chinese strength of experimental research has reached the advanced level in the integrated automation field. At the same time, in the field of intelligent protection of automation technology, its leading position is obvious in the worldwide. The device of hierarchical integrated automation, developed by China, is suitable for power stations with different voltage levels. In the electric automatic protection device, the latest network communication, artificial intelligence, integrated automatic control theory, adaptive theory, computer new technology and so on are applied to it. A new study on the automatic protection principle of electrical system was carried out to continuously improve its safety level, so that the new protection device has the advantage of intelligent control [2].

2.3. Artificial Intelligence

Design planning, operation analysis, fault diagnosis of power system and its components are carried for practical application research on the aspects of evolutionary theory, expert systems, and fuzzy logic. Combined with the development needs of relevant enterprises, the intelligent control and application of power system are studied. On the basis of studying above practical software, the operation of power system and intelligent control level are improved.

2.4. Distribution Network

Distribution network of automation technology adopts the public information model, which is the minimum standard of internationally recognized. Transmission network adopts the theoretical algorithm, which has combined the practical operation with advanced application software. Adding the coordination of gray neuron algorithms for artificial intelligence in the process of load forecasting, and using the recursive virtual-flow algorithms of distribution network, the calculation is completed in the final process of power flow calculation. The major breakthroughs of distribution network automation technology in distribution system are shown in advanced application software, information distribution

network integration, medium and low voltage network digital and distribution network model, which have effectively solved the carrier in the distribution network of the decline, routing and other technical problems. It is mainly because of the application of digital signal processing technology that the sensitivity of carrier receiving and receiving is improved [3].

3. Application Advantages

3.1. High Controllability

With the continuous development and progress of social economy, science and technology in China, breakthrough has been made in power industry and power automation technology. It is also due to the acceleration of the development of modern cities, the dependence of automation technology on the development of many industries is becoming stronger and stronger. Therefore, electrical automation technology occupies an increasingly high position. With the increasing expansion of electricity market, the controllability of electrical automation technology also faces higher requirements from people. Because electrical automation technology is an indispensable key link in the power system, a lot of peripheral information can be obtained when using electrical automation technology. These information needs to be processed to form an information control management system with strong controllability, which improves the controllability of electrical automation technology and makes the system more stable. Improving the controllability of electrical automation can not only promote the safety and stability of power system operation, but also greatly promote the development of China's power industry.

3.2. Integration

With widely use in many industries and fields, automation technology achieves quite ideal effect [4]. However, because the process flow of automation technology is complex, technical researchers optimize and improve it to promote the further use of automation technology in various industries. The most obvious change is to simplify the links of electrical control, measurement, power protection and so on. The optimization and improvement of electrical automation technology not only promotes the improvement of production quality and efficiency of electrical enterprises, but also effectively reduces the workload of manual production, thus greatly reducing the error rate of technical operation in the manual production process, and to a certain extent, reducing the probability of safety accidents in the production and operation process of electric enterprises.

3.3. The Support of Advanced Information Technology

Information technology is a kind of protective operation of power information system and its development and progress benefits from the application of electrical automation technology in power system to a certain extent. Therefore, the development of information technology in power system can not only make the

power system more convenient, but also promote it to deal with the system fault more effectively. Furthermore, as far as enterprise is concerned, it can improve the role in management system of power information and promote the healthy, sustainable and stable development of enterprises.

4. Practical Application

4.1. Application of Computer Technology

4.1.1. Technology of Smart Grid

The application of information management system is one of the most widely-used technologies in computer technology. The combination of computer technology and electrical automation technology will form an intelligent control technology for the whole called smart grid technology. Smart grid technology is a typical management technology, which covers power generation, transmission and transformation, dispatching, distribution, user and other links. Among the technology, the stability control system and automation system of substation are widely used in computer technology system. To a certain extent, it can be regarded as the prototype of the current smart grid, which also lays a certain foundation for the construction of smart grid in China. The communication technology, as the representative of smart grid, needs to rely on a great number of computer technologies in the process of construction. Therefore, it is necessary to possess the characteristics of reliability, bi-directionality and real-time. This system needs the modern advanced network communication technology, and its existence completely depends on the computer technology, so it has the information management system at the same time. **Table 1** is the introduction about the process management of real-time data.

4.1.2. Substation

The realization of substation automation depends on the development of computer technology to some extent. To realize the modernization of power production, it is necessary to realize substation automation, which is the most important and indispensable key link. The realization of substation automation relies on computer technology. In this process, the computer is fully utilized to realize the digitalization, networking and integration of secondary equipment. It is the signal cable that completely replaces the optical fiber or cable of the computer with the power. The realization of automation on substation achieves the computer

Table 1. The process management of real-time data.

Storage Introduction	Real-Time Library
Users Management	Job Processing
Report	Graphic Browsing
Event Querying	Process Management
Collocation Tool	Calculating Point
Graphic Edition	Preposition

screen as well as the automation record statistics and the movement management. The operation and monitoring are also involved in it. The reason why the automation of substation could be achieved is that the improvement of so many components. In order to facilitate the connection between power users and power plants, transformer substations and related lines for transmission and distribution are essential. The automatic management of substation is realized not only to form the automation of dispatching, but also to meet the needs of different operations in substation.

4.2. PLC Technology

4.2.1. Information Processing

PLC (Programmable Logic Controller) technology can complete the collecting, analyzing and processing of information and possesses the function of table checking, sorting, data converting, computing, bit manipulation and data delivering. The collected and processed data can be transmitted to different intelligent devices with communication functions to complete some control operations, compared with the existing reference values in the packet, and tabulated for printing. These data can also be applied in the process control system to process the data of some large control systems, such as the unmanned flexible manufacturing system [5]. **Figure 1** is the typical circuit structure diagram of PLC.

4.2.2. Close-Loop Process Control

Close-loop process control refers to the close-loop control of continuous change analog quantity such as flow rate, temperate and pressure. PLC technology carries out closed-loop PID control of analog quantity through analog quantity I/O module, and realizes D/A and A/D conversion between analog quantity and digital quantity. The close-loop process control can be achieved by specialized PID module or transformed by the subroutine of PID (Packet Identifier).

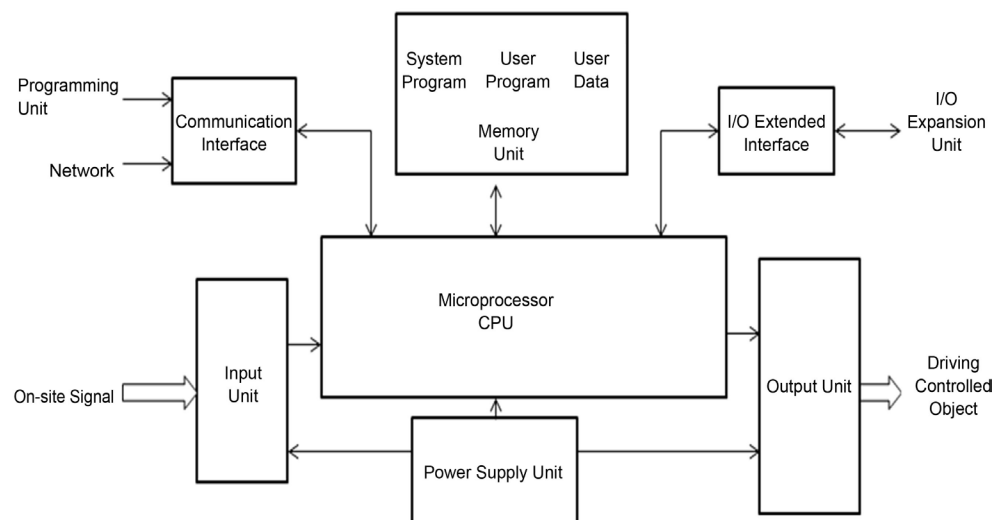


Figure 1. A typical circuit structure diagram of PLC.

4.2.3. On-Off Control

The on-off control order is the most frequently used measures of internal auxiliary process of thermal power system. At present, many domestic industries apply PLC to realize the on-off control such as motor control, automobile assembly line and machine tool electrical control, beer filling production line and elevator operation control and so on. ON/OFF is the switching signal of input and output for PLC technology. The logic control of on-off is quite frequently used in the industrial practices. The number of input and output points can be realized by expansion from a dozen to a hundreds of thousands that can do the automatic control without limits, which saves the human resources and improves the efficiency greatly.

5. Conclusion

In a word, with the development of science and technology, people's demand on electricity has increased day by day. Therefore, power enterprises need to improve the electrical automation technology and operation efficiency of power system, so as to improve the practical application efficiency of electrical automation technology.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Luo, Y. (2017) Brief Introduction to the Application of Electrical Automation Technology in Power System. *China New Communication*, No. 1, 105.
- [2] Wu, Z. and Yu, G. (2017) Application of Electrical Automation Technology in Power System. *Internal Combustion Engine and Accessories*, No. 8, 66-67.
- [3] Dong, G.S. (2018) Application of Electrical Automation Technology in Power System and Thermal Power Generation. *China Equipment Engineering*, **405**, 230-231.
- [4] Wang, B.L. (2018) Application of Electrical Automation Technology in Power System. *Electronic Technology and Software Engineering*, No. 14, 132.
- [5] Yi, Z.C. (2017) Application Strategy of Electrical Automation Technology in Power System Operation. *Time Agricultural Machinery*, **44**, 39.