Application Analysis of PLC Technology in Electrical Automatic Control

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Abstract. With the development of science and technology, automation technology has been widely used in people's daily life. What’s more, electricity has played a very important role in social production. PLC technology has the characteristics of high reliability, flexibility, and easy to use, so it is vitally important for PLC technology to appear in the electrical automatic control. Based on the above features, this paper analyzes and studies the application of PLC technology in electrical automatic control.

Keywords: Automation Technology, PLC Technology, Electrical Automatic Control, Application

PLC technology has been born with the development of fieldbus technology, computer technology, communication and control technologies[1]. The combination of PLC technology and electrical automation further optimizes the automatic control technology of electrical equipment. Its structure mainly includes power supply, program storage, CPU, interface circuit, functional module and communication module, as shown in figure 1, meanwhile, the foundation is power supply, the core is the CPU, and the interface circuit is mainly responsible for data input and output[2]. Among them, when the power supply is unstable, the PLC system will appear problems in the process of operation, which has a very adverse impact on the system, and even disables the system[3]. The PLC system is mainly through the CPU to carry on the effective processing on data, thus carries out the relatively accurate judgment on the system's running state, then inputs the accurate data of the safe operation of the control system into the corresponding pair of transmission equipment to promote the system to work[4]. The application of PLC technology in electrical automatic control is mainly embodied in three fields, namely, numerical control system, traffic control system and central air conditioning, so the emergence and application of PLC technology is of great significance.
1. Development status and trend of PLC technology

The improvement of electrical automatic control technology effectively pushes the development and improvement of PLC technology[5]. With the development of computer technology, the application of computer technology in the design and manufacture of PLC system makes the system present the advantages of quick response, large overall storage and stronger intelligence, which plays an important role in the progress of electrical automatic control technology[6]. With the widely used of PLC technology in the electrical automatic control, electrical equipment can produce more varieties of products which have different specifications to choose. Thus, a better communication equipment is developed to complete the requirements of automatic control of electrical equipment. In fact, as a new technology, the development trend of PLC technology is to realize large PLC electrical equipment control system. In addition, the use of PLC technology is very wide, such as computer cooling control system. Consequently, the application of PLC technology in electrical automatic control has important significance.

2. The characteristics of PLC

2.1. High reliability
Relays are heavily used in traditional control systems, therefore, the electric wire often presents the problem of bad contact in the electrical automatic control system, with the adoption of PLC technology through the software connection module, we can effectively improve the anti-interference ability of the system and eliminate the problem of improper connection.

2.2. Strong flexibility
In the electrical automatic control system, the PLC system is mainly composed of modules, which have high standardization, and different module combinations and system configurations can compose systems of different sizes and functions, so it has been widely used with the strong adaptability in the electrical automatic control system.
2.3. convenient to use
PLC system can be directly used to the computer simulation experiment, which can reduce the workload greatly. Meanwhile, it has the function of self-diagnostic. The automatic control system can detect faults in real time and once it detects the failure of the module, it will repair timely, which has vital importance for the safe operation of the system.

3. Application of PLC technology in electrical automatic control
With the continuous development of PLC technology, PLC technology has been widely used and developed in many fields of electrical equipment control, and the function in the industrial production process should be analyzed from the aspect of control.

3.1. Sequence control
In the electrical automatic control PLC system, the whole production process can be coordinated and controlled by the combination of modules and information, simultaneously, similar to the traditional control technology, it can also control the individual technological process. The electrical automatic control system with PLC technology mainly includes main station layer, remote station and field sensor. And among them, the main station layer is connected with the remote station mainly through the communication bus, while the remote station is connected to the sensor via a secondary cable. Thus, the staff can carry out real-time detection and control of electrical equipment in the control room, in this way, the application of PLC technology can simplify the control work and improve the work quality and inspection quality.

3.2. Switch control
A large number of point magnetic relays are used for circuit control in the traditional electrical control system, so there are many touch spots and lines in the system, and it is very easy to have incorrect contact and complicated wires, which leads to a very high risk. However, the application of PLC technology in the electric automatic control can effectively avoid the problems which exist in the traditional system, and maximize the safety of electrical equipment operation. The application of PLC technology can also shorten the response time of the traditional relay circuit, further enhance the security of control, and promote the accuracy of the measured data, which has a great significance on the safety of operation system.

4. Examples of PLC technology used in electrical automatic control
Machine tools cannot work properly without the integrated control of mechanical, hydraulic and electrical, and the hydraulic can control the time with the cooperation of the electrical, which has the possibility of failure. In the actual control process, the types of faults are diverse and are not easily to eliminate. However, the application of PLC technology to the electrical automatic control of machine tools can maximize the system security. With the characteristic of reliability, PLC can be used to improve the accuracy of time control and realize the real-time detection of the running state of the electrical equipment, thus the changes and faults of the equipment running state can be displayed accurately, eventually, and the combining goal of system control and supervision can be realized.

Large-scale integrated circuits are needed when machine tools use dc motor and PCL control
signal. The advantages of this circuit are fewer components, simple structure, low probability of failure and high reliability. Particularly, PCL technology is used to realize the bus connection of modular structure, the control calculation and system control. With the application of software, the functions can be expanded and the system can run more flexible. With the application of PLC microprocessor in the electrical automatic control of machine tool, the accuracy and stability of control can be improved. The use of PLC technology in the electrical automatic control can maximize the operating efficiency of the system, reduce the system operation consumption and reduce the maintenance cost of the system. For example, table 1 is the I/O assignment list, and we can fulfill some actions through the electrical connection diagram as shown in figure 2, including the signal acquisition, the current time and the degree of the clamping.

### Table 1. I/O assignment list

| SB1     | Pump station start-up | 00000 | KA1 | Pump motor | 01000 |
|---------|-----------------------|-------|-----|------------|-------|
| SB2     | Pump station stop     | 00001 | KA2 | Clamp solenoid valve | 01001 |
| SB3     | Flat steel clamping   | 00002 | KA3 | Cut-off solenoid valve | 01002 |
| SQ1     | Clamped in place      | 00003 | KA4 | Overflow solenoid valve | 01003 |
| SB4     | Flat steel cut        | 00004 |     |             |       |
| SQ2     | Cut in place          | 00005 |     |             |       |
| SB5     | Run automatically     | 00006 |     |             |       |

![Electrical connection diagram](image)

**Figure 2. Electrical connection diagram**

It has been proved that PLC system, which is used to replace the traditional relay system, has achieved a good effect. With the advantages of high reliability and strong anti-interference ability, PLC technology can be used in the electrical automatic control to improve the system operation efficiency and safety.

### 5. Conclusions

In this paper, The application of PCL technology in electrical automatic control optimizes the logic of the relay. Furthermore, it improves the reliability and safety of the system and optimizes the structure as well, which can promote the system convenience of the use and maintenance, thus it plays an important role in the operation and maintenance for the staff. Therefore, in the process of continuous development of electrical automation technology, it is necessary to optimize the system in time and to
use the PCL technology optimization system. What’s more, we should constantly develop and improve the PCL technology in the application process. Only in this way can we improve the reliability and safety of the system, complete the electrical automatic control in production requirements, and realize the important meaning of electrical automatic control.

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