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Research on Electrical Automation Control System Based on PLC Technology

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Abstract: *Industrial enterprises use PLC control system to realize the recording and operation of system programmable control, and combine relay contact controller technology, cloud computing technology and PLC control system to solve the problems of complex internal wiring, low operation reliability and high energy consumption of traditional electrical control system. In the application process of PLC technology, the control effect can be analyzed in the application process of technology. In the application of PLC technology, we should control certain principles, and ensure its application to be more reasonable through effective analysis of its principles. The advantages of PLC technology in electrical automation control are more obvious, which can effectively improve the reliability and stability of the whole system, and also improve the running performance of the whole system. Therefore, this paper analyzes the electrical automation control and discusses the control design and implementation of the electrical automation control system based on PLC technology.*

Keywords: *PLC; Electrical automation; Automatic control*

1. Introduction

With the continuous improvement of industrial automation level in China, higher requirements are put forward for electrical automation control system, based on the continuous and rapid development of PLC technology. PLC technology effectively integrates traditional technology with modern science and technology, especially with the support of computer technology, it can be programmed according to actual production requirements, further improving production efficiency [1]. In addition, in the design of PLC technology, the process flow is expressed by means of program design, ladder diagram and statement table. However, combined with the specific application status of PLC technology in electrical engineering and its automation control, there are still problems in the actual application process, which affect the application effect of PLC technology [2]. Therefore, we should study and analyze how to apply PLC technology in electrical automation control to promote the development of electrical automation control, improve people's work efficiency and provide convenience for life.

2. Overview of PLC technology

PLC is a very advanced electronic system, which is mainly designed and developed for the electrical control of industrial production process. PLC can be regarded as a memory with programming ability, and its structure is shown in Figure 1.

Industrial enterprises use PLC control system to realize the recording and operation of system programmable control, and combine relay contact controller technology, cloud computing technology and PLC control system to solve the problems of complex internal wiring, low operation reliability and high energy consumption of traditional electrical control system [3-4]. The operating principle of this technology is to input the collected field data information into the system through the input module, and use the central processor to transmit the control signal to each module according to the program logic, so as to carry out intelligent control.

In electrical engineering and its automatic control, the application of PLC technology can significantly improve the anti-interference ability of the electrical system itself. Even in harsh environment, the system can still maintain safe operation and strengthen system control according to the specific needs of users. Compared with the previous programming procedures of electromechanical equipment, the programming difficulty of PLC technology is greatly reduced, and it can automatically identify a variety of signals and procedures, and can complete the command of the system without the

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operator inputting a large number of instructions [5]. In the application process of PLC technology, the control effect can be analyzed in the application process of technology. In the application of PLC technology, we should control certain principles, and ensure its application to be more reasonable through effective analysis of its principles.

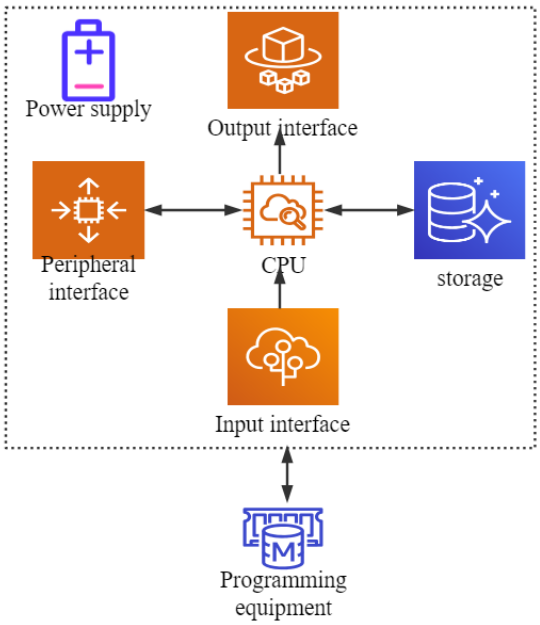

Figure 1: Schematic diagram of PLC structure

3. Design scheme of electrical automation control optimization system based on PLC technology

3.1. Design of communication mode

Communication system is an important part of electrical automation control system. In electrical automation control system, there are many terminal nodes, and the communication mode is complicated. Electric power units can realize communication by wired or wireless means. Ordinary radio communication is often used in load management and control, and its cost is very low, but its reliability is not very good, so it cannot be used in distribution terminals with high reliability standards [6]. It can freely select the routing function, also has the function of active reporting, and has good security, and can be used in distribution terminals with high reliability standards. But its cost is high.

To realize the seamless connection between the field device layer and the enterprise management layer, Ethernet has long been the first choice of enterprise management network. Applying Ethernet to the control network of field devices can realize the integration of enterprise information network and control network and promote the integration of informatization of the whole enterprise. Optical fiber network has become the backbone network of Ethernet, and its good anti-noise performance makes Ethernet more suitable for real-time monitoring of high-noise equipment site environment [7-8]. The network bus cycle is divided into reserved time and non-reserved time, and IO data with strict time requirements are transmitted within the reserved time, thus ensuring the certainty and repeatability of real-time data transmission.

After the debugging of UDP communication between the embedded part and the PC is successful, the UDP application program of the PC part should be designed as a DLL (Dynamic Link Library), so that the visualization part can communicate by calling the interface function of the DLL.

Use Visual C++ to write a DLL for UDP communication, and the DLL is named dllUdp.dll. When writing the visualization part, you can easily interact with PLC by calling these custom functions and procedures.

3.2. Design of PLC circuit

Fieldbus is a data communication network that establishes the connection between the field devices

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and the system. The monitoring method based on Fieldbus technology enhances the openness, practicability and safety of the system design. As the most important control unit, PLC not only needs to meet its own power demand, but also has cables of different models and specifications to transmit control signals to each unit [9]. When processing data resources, PLC control system comprehensively optimizes transmission management, reasonably controls the transmission value of data resources, and ensures the safe mobilization of resources. According to the actual operation requirements of the control system, ensure that the PLC control system can efficiently adapt to the temperature adjustment requirements, and optimize the operating performance of the system in combination with the temperature characteristics.

Configuration module is mainly to describe the names of related modules, write rack slot numbers, and select appropriate matching methods. In the part of analog output and input, it needs to be measured according to the standard, and the indicators such as analog input type signal, offset, range, filtering time, etc. In software, instruction code is an important guarantee to ensure the processing quality. By grouping various simple instructions, functional blocks with input and output parameters, precision compensation, whole process simulation and automatic programming of standard parts are formed, and the machining quality is improved.

The PLC reads the corresponding operation instructions from the image register and the element data register, and generates a command to control the corresponding element to execute the program. When the command is executed, the system controls the output stage and reaches the output refresh stage. Full capacity design is to estimate the capacity of PLC input circuit and electrical automation control system, and the operating capacity shall not exceed 80% of the total capacity.

3.3. Software design of control system

To some extent, software refers to the aggregation of various types of data codes, and these codes represent related instructions in a specific order, which is an extension of hardware system functions and a method to achieve goals. The most important part of the system is the control system software, and Figure 2 shows the overall architecture of the software.

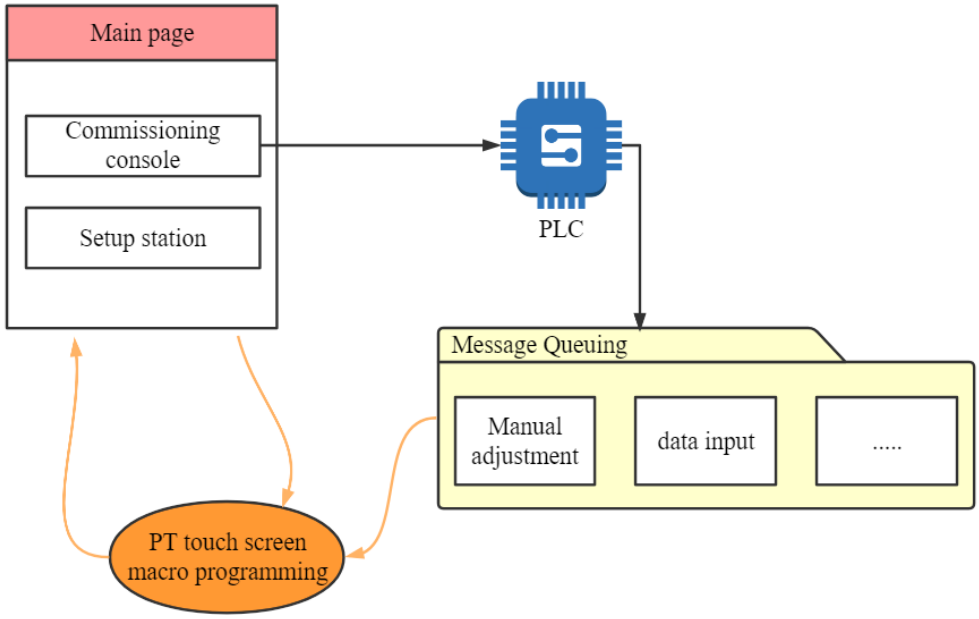

Figure 2: Software overall structure diagram

The input adopts touch screen, and the operation interface and the main interface form a man-machine interaction interface. The host adopts touch screen macro programming for PLC, and PLC main program calls subroutine module to realize the ladder diagram of each program according to different functions. Data are edited by office software, stored in CF card as BIN data type, inserted into the touch screen, and data are input into W1-2000 address by macro instruction operation of the touch screen.

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4. Debugging of PLC electrical automation control system

The program design of the system mainly includes decentralized process control level, centralized operation monitoring level and comprehensive information management level. The distributed process control level program mainly uses PLC programming software to compile PLC application programs through ladder diagram, statement table or function block diagram to complete the detection of equipment parameters.

The basic step of PLC programming is to draw the system control flow chart for the more complex control system, which can clearly show the sequence and conditions of actions. Designing a ladder diagram or writing a program in other languages is a key and difficult step in program design. Debug and modify the program until it meets the functional requirements; Preparation and delivery of technical documents [10].

The motion control of PLC mainly adopts trajectory control mode, and the stepper motor and servo motor are operated to control the position of single axis and multi-axis according to the operation requirements, so as to meet the requirements of acceleration and make the system have high control accuracy. In chemical production, the automatic control of each chemical device is realized by means of PLC control system technology, which makes the automatic control of chemical devices more reliable. Combined with the characteristics of switch control PLC control system, with the help of PLC control system, the application of passing electrical equipment is optimized, the control interval is shortened, and the reliability of switch control is ensured.

The advantages of remote monitoring of electrical automation control system are that it can reduce the cost, reduce the cable utilization rate, and it is more convenient to install, and the cost generated during installation is also lower, and it also has flexibility and higher security. The automatic PLC rack equipment includes: Expansion rack, configuration rack and other parts, in which the main rack part is distributed according to the standard of each module on the rack, and then right-click the mouse backboard to add modules one by one. In the configuration rack expansion, it includes remote configuration of IO cabinet, network configuration and equipment pendant configuration. The application of PLC technology in analog control can improve the control of analog module to a great extent, so as to realize good signal conversion of analog control module and improve the control function of the whole system.

In general, one person is responsible for designing PLC control program, one person is responsible for designing WinCC monitoring program, and one person is responsible for designing and simulating the controlled object program. After the initial debugging, download it to the actual PLC, simulate the mode of the controlled object with hardware PLC+ software and hardware, debug the PLC program, and observe whether the controlled object runs according to the correct process flow. Finally, hardware PLC+WinCC monitoring+software and hardware simulation are used to debug the controlled object, thus achieving the effect basically consistent with the actual control system debugging.

5. Conclusions

PLC is the core of electrical automation control system with powerful functions, and there are various control logic problems. PLC technology effectively integrates traditional technology with modern science and technology, especially with the support of computer technology, it can be programmed according to actual production requirements, further improving production efficiency. Therefore, we should study and analyze how to apply PLC technology in electrical automation control to promote the development of electrical automation control, improve people's work efficiency and provide convenience for life. The application of PLC technology has great advantages in electrical automation control, which can obviously improve the level of electrical automation control, promote the maintenance of workers and improve the working efficiency of machinery, and ensure the working life of machines. Therefore, relevant departments must strengthen the innovation and research of distribution system in power enterprises, so as to realize the automation of distribution system as soon as possible and provide more convenient and reliable electricity service for people's production and life.

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