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The Application of PLC Control Technology in Electric Automation

Lu Zhou[1,a*], Yu Cui[2,b]

[1]School of Electrical and Information Engineering, Liaoning Institute of Science and Technology, Benxi 117004, Liaoning, China
[2]Siemens Ltd., China, Beijing, 110000, China
[a]346582905@qq.com, [b]64623184@qq.com
**Corresponding Author*

Abstract: *Automated production lines have very high requirements for electrical control design. In order to improve the quality of electronic control design and reduce the design time and cost, this article recommends a standard for electronic control design and applies it to the production line. Introduced the overview and rules of the belt conveyor electrical control system, the basic functions and precautions of the belt conveyor, with general guidance, and can provide hints for the implementation of the operation. Study the main applications from the selection of equipment of the belt conveyor control system to the selection of the master port and the slave port, and introduce the connection methods of various applications, and select the best communication method. By using the furnace lining batching packaging production line as an example, the total number of selected input and output modules is 33. All the electrical control modular design methods proposed in this article are applied, so that the time for electrical control design can be greatly shortened, and the electrical control design is like a "Building blocks" are general and very simple.*

Keywords: *PLC Control, Automated Production, Belt Conveyor Electrical, Electrical Control*

1. Introduction

Under the general trend of industrial development at home and abroad, facing the challenges of resource environment, environment, labor cost and fierce market competition, more and more companies are beginning to transform automated production technology to improve the degree of automation, integrity and reliability [1-2]. Be invincible in the ever-changing market, while bringing greater value to users and reducing overall costs [3]. Use computer technology and PLC control technology to design man-machine interface, realize real-time monitoring and dynamic analysis, combined with new mechatronics technology, adopt high-power soft-start technology and automatic tensioning device, real-time remote control and remote control of various parameters of each conveyor belt Monitoring significantly improves the efficiency of conveyor belt transportation [4-5].

Automated production is an important aspect of my country's economic development. Ghosh A proposed an automated tool called Manual Process Troubleshooting Tool (MPFDT), which can detect and identify errors and omissions in PLC control systems. MPFDT uses two independent process behavior models based on production system knowledge to achieve FADI goals. The basic idea is to identify the inconsistency between the model and the observation behavior of the production process. The first model is a PLC control process model based on final state control (DFA), which is used to determine whether the observed state change behavior of the PLC control process is consistent with the model state change behavior. The second model is a set of basic classic models based on synthetic neuron (ANN), which is used to determine whether there is a significant difference between the observed value of the construction system and the reference power system [6]. Sharma A proposed the design of a robotic work cell to quickly and reliably assemble electric vehicle battery modules on a large scale to reduce the gap between consumers' supply and demand for electric vehicles [7]. It is of practical significance to study the application of LC control technology in electrical automation.

The main content of this article is based on the original belt conveyor, using PLC as the host, to upgrade the original control system, to study the application and control technology of the PLC control system, to develop the system terminal for man-machine interaction, and the host man-machine interaction The software program, the man-machine interface, the operation is convenient, the

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operation is reliable and fast. Finally, a real-time monitoring system, high-performance, high-performance automatic transmission belt control system was developed.

2. Research on the Application of PLC Control Technology in Electric Automation

2.1 PLC Control System

PLC is the most widely used intelligent controller today. PLC technology has been greatly developed [8]. Unlike ordinary chips, microcomputers with chips are designed to fully comply with industry standards and can withstand high environments. Through such a rigid design, it can be ensured that it can operate normally in the company environment. Now PLC integrates many functions, such as AI module, DI module and so on. The integrated design enables PLC to be widely used in a variety of control environments, and the corresponding software functions are simple and can be used quickly [9-10].

According to the current classification of computers, PLC can be classified as a wide range of industrial computers. In essence, the performance of current personal computers is almost the same as that of PLCs. They are also designed as user interfaces by software, and applications provide the basis for software functions. So focus on software and hardware [11-12]. Under normal circumstances, it has more equipment, but every PLC will have the same basic equipment, especially these types. The first is the processor, the second is the input and output ports, and the third is the external circuit device. First of all, we need to pay attention to the basic knowledge of PLC: CPU, which is the data processing center of all PLCs. All work will be completed in stages through the process outlined here. It plays a role in the human brain to help PLC integrate and perform different tasks. Next, we need to define PLC data storage elements, commonly known as memory. Your performance is important. It has the settings necessary for the CPU to run and other data stored in the CUP. For example, the data collected during the mission will be stored in memory. However, the CPU system is stored in a specific area of the memory and cannot access external data. Another function that requires special information is the input and output functions of the PLC. The ports used by this service are often referred to as I/O ports. External information can be transmitted to the internal CPU through these ports. Similarly, internal information can also be transmitted to external devices through these ports.

2.2 Characteristics of Electrical Automation Control Technology

Electronic technology demonstrates the use of information control technology to use information through a variety of tools, while providing and determining the amount of information used in daily activities and project activities to improve efficiency. The company uses electronic technology to monitor the productivity, efficiency and reliability of operations. It saves people from planned terrorist activities and allows them to participate in creative activities. The electronic data acquisition system includes various types of sensors, such as flux sensors, water level, heat meters, energy meters, etc., which convert many signals into electrical signals and integrate them into the automation control system. The process of data processing and execution is a single circuit or intelligent system that collects, manages and processes the information in the received data. The main players in power technology are automobiles, solenoid valves, disk drives, etc. Through various activities, they completed various forms of power control, and successfully mastered the control of the industry. Whether it is electrical systems, power distribution engines or electrical technology, it is the basic requirement for the sustainable development of modern enterprises, technology and automation.

Electrical automation management technology marks a new stage of industrial development. Its main characteristics are as follows: (1) The development culture of automation control equipment is flexible. The factory's electronic automation technology is controlled by systems with different interfaces, reducing the human resources required by the system control center. (2) The application of electrical automation control technology is developing in the direction of distribution. Electronic automation control equipment mainly includes inverters, motor starters, serial cables, PLCs, remote I/O ports and computer systems. The operation information of the above-mentioned technical equipment is collected and stored in the central control center of the factory. The application control adopts a radial distribution system, which improves the efficiency of on-site material control. (3) The application of electrical automation control technology is developing in the direction of informatization. The application of electronic automation control technology in the industry is divided into two areas: horizontal and vertical. Horizontally, in the automation control system of the entire industry, it

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improves the system quality of the automation system, and vertically excavates the data of system automation to effectively retain the data of all parties. Be prepared with information.

3. Investigation and Research on the Application of PLC Control Technology in Electric Automation

3.1 Realization of Electrical Control System

The PLC programming of this system uses EasyLad software. EasyLad is a ladder diagram editing and monitoring environment designed for KC02 series PLCs. The software programming habits are similar to those of Mitsubishi PLCs in Japan. It uses a multi-document interface based on the WINDOWS operating system with a full Chinese kernel. , Use ladder diagram to compile, can quickly start, strong versatility, easy to operate, and the ladder diagram editing function is very powerful, save writing time to improve efficiency. It is a supporting programming software for intrinsically safe PLC. This system touch screen KC01 homepage design uses ExibI software, this software can be used on WINDOW, there are many examples for reference, and the screen is very beautiful, when designing the page, you can call other excellent page designs, which improves work efficiency. In the automation control software system, for PLC, a real-time operating system is used, and corresponding hardware drivers are also packaged at the same time. This PLC installs the operating system in the CF card, so we can easily see its operating system files.

3.2 Power Selection

The selection of PLC should be based on the working environment, control object, use occasion, cost, etc., so that it is economical and reasonable and meets the functional requirements. Generally speaking, one switch occupies one input point, and one intermediate relay or signal lamp occupies one output point. The estimation formula for the number of input points of the switch is:

$$DI = K \times \sum (A + B + C) \tag{1}$$

In the formula, DI is the total number of switch input points;

K is the reserved coefficient, A is the type parameter of a single system, B is the number of detection points of a single system, and C is the number of main control points, such as start-stop switches, detection switches, and interlock signals of control equipment;

The power of the selected motor is determined according to the needs of the production machinery. For a continuously running motor, first calculate the power of the production machine, and the rated power of the selected motor is equal to or greater than the power of the production machine:

$$P = \frac{\sigma_1}{\eta_1} = \frac{Fv}{1000 \times 60 \times \eta_1}(kw)$$

η_1 is the efficiency of the transmission mechanism. Short-term running motor power selection, short-term running motor power can allow the appropriate overload factor to be λ, then the rated power of the motor can be $1/\lambda$ of the power required by the production machinery.

4. Investigation and Analysis of the Application of PLC Control Technology in Electric Automation

4.1 PLC network Control Block Diagram Design

Because PLC integrates three power systems (electrical control, electrical instrumentation and telex), it has a powerful one-stop system. Therefore, it has relatively low requirements for the communication speed of the PLC network, and the amount of data that needs to be exchanged through the network is also relatively low.

The communication data of the PLC network control system based on the RS422 bus is mainly the start-stop control signal of the transmission line with low real-time and safety requirements and the

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error signal from the analog display. The main part of the system control is that the control of the sub-packing machine is self-made by PLC.

According to the requirements of PLC network control of the tape transmission line, the upper RS422 bus connection system is adopted. Adapter selection A: 3G2A9-AL004-E is connected to the host, B: 3G2A9-AL001-E is connected to the bus. The PLC communication method adopts the master-slave bus 1:N communication method.

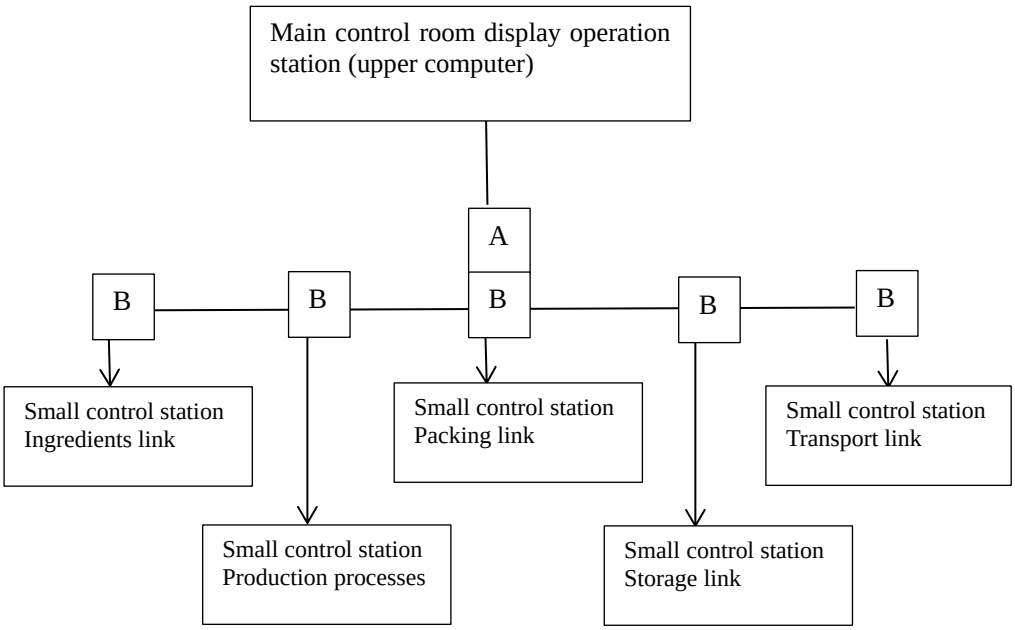

Figure 1: PLC network control block diagram

The PLC network control block diagram based on Rs422 bus is shown in Figure 1. There are five small control stations in the main control display operation station, which mainly control the batching link, the production link, the packaging link, the storage link and the transportation link. Among them, the PLC in the transmission link of the small control station selects OMRoNc series C60H, this machine has a Host Link interface, communicates with the upper computer through an adapter, and connects to the bus.

4.2 The Hardware Modular Design of the Lining Batching Packaging Production Line

We use EPLAN for hardware modular design. First, we load the prepared EPLAN modular standard template, build the project, and fill in the project information. Then, combined with the schematic diagram of the production line, modify the modular system topology. For the AC circuit, because there is no special, we can completely use our pre-designed hardware circuit cam switch module and air switch module. For safety circuits, this production line has no special requirements, just add a simple emergency stop module. For safety circuits, this production line has no special requirements, just add a simple emergency stop module. For the control loop, this production line needs The selected input and output modules are shown in Table 1, and the number to be selected is shown in Figure 2.

Table 1: Liners input and output modules

Serial number	Module name	Quantity	Introduce
1	KL1408	9	Digital input module
2	KL2408	8	Digital output module
3	KL3102	3	Analog input module (-10V~+10V)
4	KL2791	4	AC motor speed control module
5	KL6001	3	RS232 communication module
6	KL3351	6	Resistance bridge terminal module (strain gauge)

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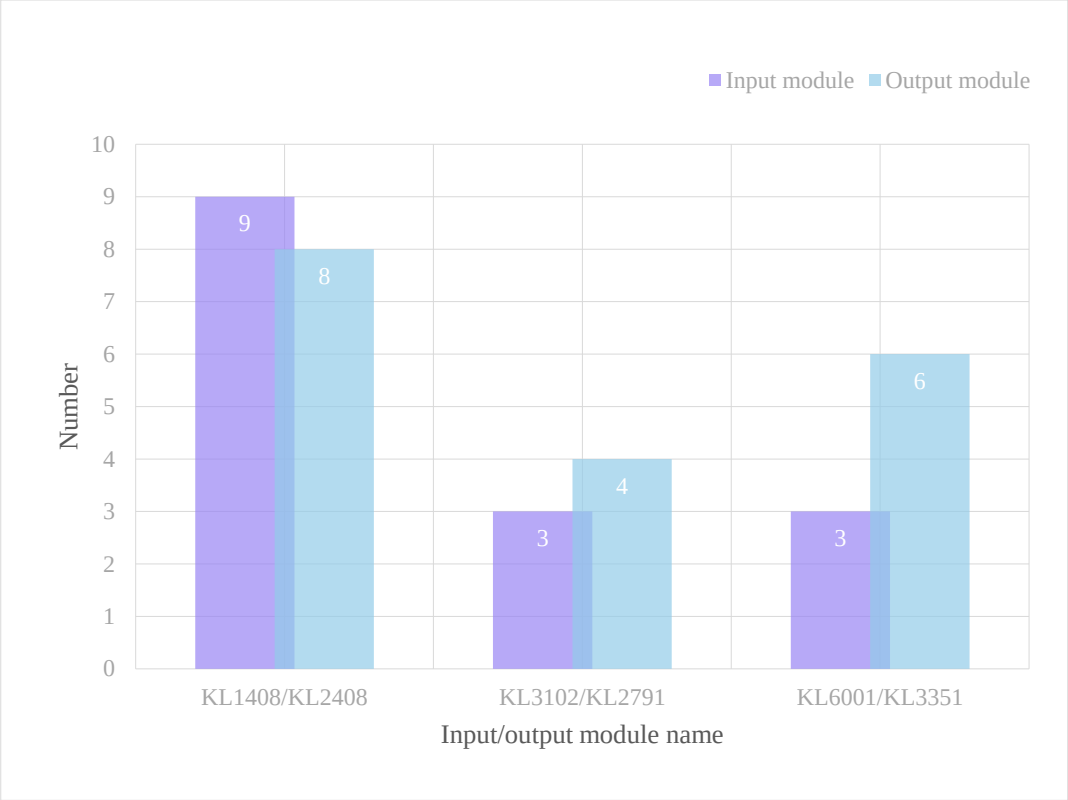

Figure 2: The number of modules that need to be selected for the production line

Open the input and output file of the lining ingredient packaging production line generated by EPLAN. This file is automatically exported by EPLAN through a macro. Use Excel to open this file and click on the macro to automatically generate the input and output hardware mapping program IO.EXP of the PLC program, and then import this program into the PLC programming. Since the hardware design follows a fixed modular naming method, for example, the total alarm signal light of the packaging line is "P900", so "P900" is directly mapped to the standard program variable "Main—Alarm—Light" in the generated program.

5. Conclusions

The electrical control system is a system that combines a variety of controls and system ideas. It has great use value. Research and product development must combine the industrial structure with the development of the modern market in order to make products have available technologies and add and play their required industrial functions. In this paper, based on the application research of the electrical control system of the mine belt conveyor based on PLC, it carries out the functional realization and innovative development of the electrical control system of the belt conveyor, and makes an in-depth analysis of the functional realization of the electrical control system of the belt conveyor. The electrical control system of the belt conveyor knows its advantages and disadvantages. While transplanting its advantages, it optimizes its disadvantages. Starting from the overall electrical control system, from the selection of hardware to the realization of software functions, analysis and comparison are made, and the best plan is finally selected, and the system is perfected through repeated debugging.

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