

Design and implementation of automatic packing machine system based on PLC

Dan Luo

Shenyang Institute of Technology, Fushun, Liaoning 113122, China

Abstract: In the commodity industry, the commodity packaging machinery products are rich in variety, the shape, nature, packaging requirements of the commodity are very different, and the output is large. In view of the urgent needs of domestic commodity enterprises for all kinds of automatic packaging machines, we design a commodity packaging machine control system to solve the problem. The software system of an automatic packing machine based on PLC is designed in order to improve the automation of the equipment and improve its production efficiency. PLC software control system has greatly improved the production capacity of the equipment, and can ensure the stability of the equipment. In terms of human-computer interaction, it adopts a more intuitive touch screen technology, which makes human-computer interaction more convenient and intuitive, so that workers can better understand the operation of the equipment. The equipment designed by this software system has good stability, convenient and intuitive operating platform, which improves the working performance and efficiency of the packaging machine.

Keywords: Enter key words or phrases in alphabetical order; Separated by commas.

1. System scheme design

Automatic packaging machine technology is a interdisciplinary comprehensive technology involving many fields, in recent years, the development of automatic packaging machine is increasing rapidly, electronic technology, computer technology, sensor technology and some of the latest technology in the automatic packaging machine has been applied. The use of fully automatic packaging machine technology is an important part of our industrial development. The upper computer is the main operating interface of the control system and has the function of data query. We choose Siemens Industrial computer as the upper computer and install programming software on it as the development system of the upper computer. The function of the industrial computer is almost the same as that of the ordinary home computer, but it is a computer type specially designed for industrial production. Although the configuration is often relatively low, the stability of each system is far greater than that of the home computer, which can adapt to the harsh environment such as strong noise and dust in industrial production [1].

This design uses Siemens S7-1200 series PLC, S7-1200 hardware composition has a high degree of flexibility, users can determine the structure of PLC according to their own needs, the system is very convenient to expand. This design uses automatic control of the conveyor belt, push rod, sucker, packing machine, baler start and stop, qualified testing of finished bottles, packaging, packaging, so as to achieve the function of automatic packaging machine. In order to ensure that the automatic packing machine control system can work in all possible environments, the system should have the ability to work normally in all kinds of external environments.

In order to achieve the desired function, the system is mainly divided into 5 modules, which are respectively push-bottle module, upper cover module, packing detection module, push-bottle mechanism and finished product counting module. Push-bottle module mainly has inductance sensor to detect whether the length and width of the bottle is qualified; The

packing module is measured by the photoelectric sensor. When the bottle reaches the specified position, the photoelectric sensor sends a signal to the PLC, and the PLC controls the belt to stop, and the machine starts packing; The push-bottle module is measured by the photoelectric sensor. When the bottle reaches the specified position, the photoelectric sensor sends a signal to the PLC, and the PLC controls the belt to stop and the machine starts packing; The quality detection module is mainly measured by the inductance sensor. If unqualified, the sensor sends a signal to the PLC, and then the PLC controls to send the unqualified bottle to the waste recycling area. Bottling counting, the upper cover module by the photoelectric sensor to count, and detect the object level, when the bottle reaches the designated position of the push rod, PLC control belt to stop and start the push rod, when the specified count number, stop the outward push rod, a period of time after the motor starts the belt operation. Control system motor schematic diagram, as shown in Figure 1.

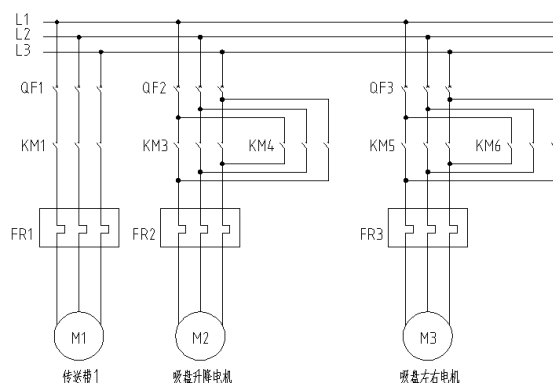


Figure 1. Automatic packing machine system main circuit diagram

2. Hardware selection of automatic packaging machine system

This system uses Siemens PLC S7-1200 as controller S7-1200 is mainly composed of CPU module (CPU for short),

signal board, signal template, communication template and programming software. The CPU module is 1214C DC/DC/DC.S7-1200 hardware composition has a high degree of flexibility, the user can determine the PLC structure according to their own needs, the system is very convenient to expand. PLC controller by relay control technology, computer technology and other development, now has been used in a very wide range of applications in various fields. Its core component is the microprocessor, through the editing program to achieve the control of the machine, counting and other functions, but also can change the input/output mode to control the mechanical manufacturing process of each link.

In PLC each I/O interface is relatively independent, there are corresponding anti-interference shielding measures between each module, the parts used by PLC are through strict screening, and has a good self-diagnosis ability, once the operation of abnormal, the CPU will immediately take relevant control measures to prevent the further expansion of the fault; The multi-CPU structure is also used in some high demand occasions, so that the stability of the device is more reliable. Automatic packaging machine control system is realized by controlling PLC and processing the peripheral circuit, the external circuit will be the system of signal transmission to the PLC control system, and then through the processing of output control requirements. PLC control wiring schematic diagram, as shown in Figure 2.

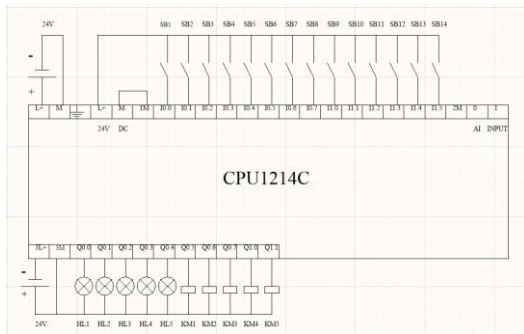


Figure 2. Automatic packing machine system schematic

3. Automatic packing machine system control program design

This system uses the new generation of Siemens modular small PLC S7-1200 as the controller. The CPU module is 1214C DC/DC/DC. After the preparation of the ladder diagram is completed, simulation is carried out to check the running status of the ladder diagram, check whether the program operation meets the design requirements of the automatic packaging system, whether there are obvious errors during the program operation, and whether the control process meets the requirements. The main program mainly completes the initialization task of the system, here is mainly for PLC I/O port, serial port, interrupt allowed initialization, and then according to the control command, call the corresponding function module, complete certain tasks.

I0.1 and I0.1 are the start switch and stop switch of the automatic packaging machine system respectively, and their corresponding running indicators of the automatic packaging machine system are respectively, generating power and self-locking. Automatic packaging machine equipment and protection system starting program, as shown in Figure 3.



Figure 3. System startup program segment

After the start button I0.0 is pressed, and the "Automatic mode" I0.3 is pressed, the manual mode will be closed, the automatic indicator will light up, and the system will enter the automatic mode; When the button "Manual mode" I0.2 is pressed, the automatic mode will be closed, the manual indicator will be on, and the system will enter the manual mode. Automatic packaging machine system call automatic and manual subroutine ladder diagram, as shown in Figure 4.

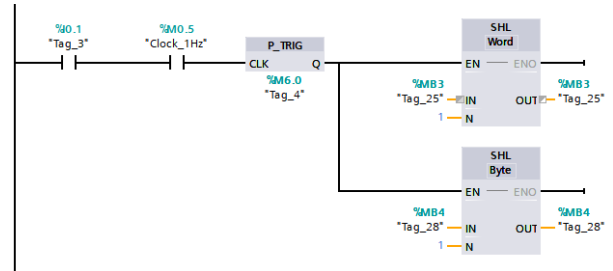


Figure 4. System manual and automatic mode program segment

Press the automatic mode, the automatic indicator lights up, the conveyor belt 1 starts, the finished bottles are sent forward, the quality inspection is carried out after reaching the sorting area, the qualified bottles will continue to move forward, the unqualified bottles will start the push rod to push the bottles to the waste recycling area, the qualified bottles will move to the sorting platform, when the number reaches 12 bottles, the suction cup handling machine will start, first drop to the lower limit, the suction cup will suck. Hold the bottle and move it to the packing box. Lower the bottle and place it in the packing box. Release the suction cup conveyor and move it to the left to return to the origin. The packing machine starts for 5S to complete the packaging, conveyor belt 2 starts, moves the bottle to the baler, the baler starts for 5S, finishes packing the packing box and then starts conveyor belt 2 again to send the packaged products to the finished product area. Automatic packaging machine inspection program segment is shown in Figure 5.

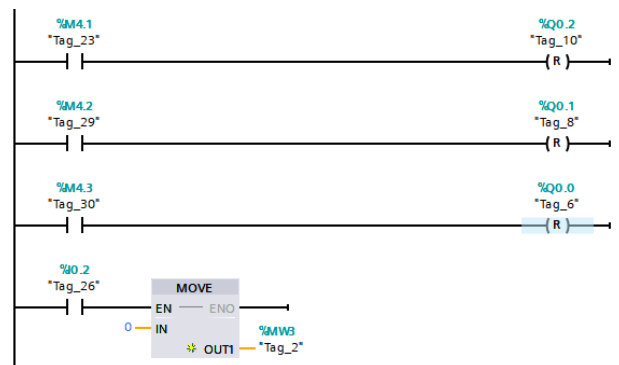


Figure 5. Automatic packaging machine inspection program segment

4. Summary

The design and implementation of automatic packing machine control system is based on the design of Siemens S7-1200. The program is controlled by PLC chip to realize the start and stop of peripheral equipment. Automatic packing machine control system based on PLC is a system that can

control automatic packing machine by direct operation of configuration interface.

The design, complete the automatic packaging machine control system design system composition, the most basic part of the controller, the regulator, the controlled object and so on, and in the practical control engineering application, a good combination of theory and practice. In general, the following steps are required: cognition of the controlled object, design of control scheme, selection of control law, selection of process instrument, selection of process module, design of system flow chart and configuration diagram, design of configuration screen, design of data dictionary, etc., until the final program, hardware, configuration of these functions are successfully connected and run, and meet the control requirements.

References

- [1] Peng Chuansheng. Computer Simulation of Container Terminal Planning and Design [J]. Traffic and Transportation Engineering, 2017, (6) : 66-70.
- [2] Dai Lihua. Simulation Study on Berth Handling System for Export Bulk grain. Port Engineering, 2015, (6): 27-31.
- [3] Wang Xuechen. Research on Risk Assessment and Early warning System of Coal mine Production Safety [D]. Wuhan University of Technology, 2017.
- [4] Shi Zhijun, Yao Ke, Liu Fei. Development and Prospect of underground tunnel drilling Technology and Equipment in Coal mine for 40 Years [J]. Coal Science and Technology, 2020, 48(04): 1-34.
- [5] Xu Zhen, Zhou Xiaojun, WANG Liming. Research Progress of Key Technologies of PLC attack and Defense [J]. Journal of Information Security, 2019, 4(03): 48-69.