The Control system of Automatic Washing machine Based on LOGO!

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Abstract
In this paper, design and analysis of the control system of automatic washing machine based on LOGO! is introduced. By the system, the different modes of laundry can be implemented and the smooth dehydration process can be taken by the use of frequency converter on the dehydration rate adjustment. By simulating and debugging the control system, it shows that the LOGO! Can realize all kinds of control functions of automatic washing machine.

Keywords
LOGO!, automatic washing machine, control system

1. Introduction
At present a lot of automatic washing machine control system by single chip microcomputer. This kind of control system, programming is more complex, and needs a lot of kinds of drive circuit and protection devices. So the control system has the problem of high complexity and hard to maintain if it got wrong. If the automatic washing machine control system adopts PLC to control, these defects will be able to overcome. But the cost general PLC is high, So it is no widely adopted. LOGO! is a miniature PLC product by Siemens company, which has the function of programming, display and control. It has advantages of small volume, strong function and high cost performance. Automatic Washing machine controlled by LOGO! can realize forward, pause, inversion, suspended alternating washing. It can perfect the function of the washing machine.

2. Control requirements
Automatic washing machine has different mode of laundry. Different fabrics with different patterns of washing. As well, Washing machine should have laundry mode such as single wash, rinse and dehydration. The operator can choose the washing mode and the temperature of the water on the control panel. When the start button is Pressed, the temperature sensor automatically detects temperature of the water. If the temperature is not reached set value, the heating solenoid valve is opened to heat the water. When the water is heat, the washing machine start to fill water. The water level is detected by the sensor. According to the selected mode of laundry, the machine can adjust the water level. Wash, rinse and dehydration would be automatically processed. If stop button was pressed midway, washing machine would stop working. In the process of washing, the washing process is indicated by light indicator.

3. Equipment selection
According to the input and output points, as well as power supply, to select the model of LOGO! The system has eight digital quantity input: start button, stop button, and six washing mode function selector switch. Two analog input: temperature detection, water level detection; Eight digital output: solenoid valve, the water drainage solenoid valve control, washing motor forward, reverse washing motor, washing/rinse light, 2 dehydration speed control and heating solenoid valve control. The voltage supply of the system is ac 220 V
The LOGO! 230 RCE, which has eight input and four digital output, four input can be used as digital quantity input. Which also can use as analog input. Digital input and output of controller is not enough, so expand extension module should be choose. LOGO! 230 DM8 which can provide four digital quantity input, and four digital output is selected.

4. Program flow

Generally the working process of the automatic washing machine is divided into three stages: washing, rinsing, and dehydration.

First of all, the laundry mode is selected, then the start button is pressed, the system enter the stage of washing. After water is heated to set temperature, feed water electromagnetic valve is opened. the washing water level is adjusted according to the mode. At the same time, the motor forward, pause, inversion, suspend alternates to wash clothes automatically.

After washing time, the system comes into rinse stage. The drainage solenoid valve is opened, and the washing machine began to drainage. When the water level is lower than the low water level, washing machine began to short-term dehydration. Short-term dehydration timer is started. After dehydration time, the system stopped the dehydration, the drainage solenoid valve was closed at the same time. Rinse process is similar to the washing process. The motor also alternates forward, pause, inversion, suspend to rinse clothes.

The stage of dehydration is after Rinse stage. In order to guarantee the smooth dehydration process, first the turning speed of the motor is controlled with higher than 60 r/min is about 1 min, to make clothes even attached on the inner wall of the washing machine drum; After completion of drainage, medium speed is about 400 r/min about 1 min. Then entered the stage of 800 r/min of high-speed dehydration, lasts about 5 min; And then transition to speed dehydration stage lasts about 1 min. Motor speed is regulated by the frequency converter which is controlled by LOGO! When dehydration time is up, the drainage solenoid valve is closed at the same time. The motor also alternates forward, pause, inversion, suspend to rinse clothes.

In addition, in the process of washing machine is working, press the stop button, close all the electromagnetic valve and motor, washing machine stop working.

5. Conclusion

Automatic washing machine is normally controlled by micro-controller unit, which is complicated in programming and hardware, and is difficult to maintain. If automatic washing machine is controlled by PLC, cost is increased. In order to cut costs, simplify programming and maintain convienently, LOGO! controller of SIEMENS was applied in the automatic washing machine. Control system of automatic washing machine is analyzed and designed. The software programs was compiled to implement the control in different laundry modes for bafa, chemical fiber, wool fabric at different temperature, and in the modes of single washing, single rinse and dehydration. Frequency converter was used to adjust the speed of dehydration to make the process smooth and steady. The simulation debugging and validation on the control system were made. The results show that the LOGO! can realize all kinds of control functions of automatic washing machine.

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