

Application of S7-200plc Technology in Automatic Mixing and Dough Mixer

Huanxia Shao, Wenli Jiang

School of Food Science and Engineering, Qingdao Agricultural University, Qingdao, 266109, China

Keywords: S7-200plc Technology; Fully Automatic Mixing and Dough Machine; Mm420 Inverter

Abstract: In order to further improve the efficiency of surface production, this paper combines the technical advantages of s7-200plc to complete the design of automatic mixing and noodle machine, and realizes the automatic operation of adding water, adding surface, stirring and forming, reducing the correlation. Through the application of Siemens mm420 inverter, the adjustment of the motor speed is realized, and the application effect of the dough mixer is further optimized.

1. Introduction

At this stage, due to the continuous improvement of technology, the actual production is moving towards automation. Among them, the s7-200plc technology is mainly controlled by plc, which can better realize the automation of the whole process of production. Based on this advantage, the author designed a fully automatic mixing and dough machine using s7-200plc technology, which realized the automatic operation of adding water, adding surface, stirring and forming, and reduced the workload of related personnel. Compared with the traditional dough mixer, the automatic mixing and mixer is more efficient, and can automatically adjust the water volume, which has better use advantages, so it has a high practical significance for its design.

2. S7-200plc Technical Advantage Analysis

2.1. S7-200plc instruction type

S7-200plc is the smallest plc currently developed and produced by Siemens. It has high advantages in hardware characteristics, volume, weight, performance, running speed and command system. Compared with the past plc, A comprehensive upgrade of performance and other aspects[1] has been achieved. In the s7-200plc, the instruction system can be divided into the following nine types: basic logic instructions, including Boolean operations, data comparison, edge capture, timing count instructions, including timers (supporting variable timing), counters (supporting variable counting), and loops. Displacement instructions, including loop instructions and shift instructions; data operation instructions, including addition, subtraction, multiplication, division, square root, logic operations; data conversion instructions, including type conversion (integer to real, real to integer), code conversion; Table processing instructions, including fifo, lifo, att, fnd=, etc.; program control instructions, including mark segments, jump instructions, subroutine instructions, other (end, wdr, stop, nop, etc.); special instructions, including encoding Instructions, direct operation instructions, clock read/write instructions, network read/write instructions, communication instructions, interrupt program instructions, high-speed port instructions, pid instructions.

It can be seen that the instructions in the s7-200plc basically contain all the basic instructions that the computer has, and the execution speed is relatively fast, so it has a high technical advantage.

2.2. Features of 1.2s7-200plc technology

In the technology, the data is stored in the same manner as the computer stores the information. Specifically, the data information is stored by using bits, words, bytes, and double words. Due to the wide range of applications, this data storage method is easier to accept and master, and improves the understanding speed and effect of s7-200plc data storage.

Since the s7-200plc uses the same data information storage method as a computer, its addressing

is more diverse. The addressing mode can be divided into direct addressing, indirect addressing, and immediate addressing[2] depending on the memory area. Compared with other small plc, the s7-200plc's instructions are more flexible and have higher application advantages.

3. Fully Automatic Mixing and Dough Machine Hardware Design Based on S7-200plc Technology

3.1. Mechanical structure design

In the automatic mixing and dough machine based on s7-200plc technology, the application of plc control technology, pneumatic technology, mechanical transmission technology, etc., mainly achieves the improvement of the surface efficiency, which significantly reduces the workload of the relevant personnel. For the process of adding water, adding dough, stirring and forming, the machine realizes the automatic control of the whole process and has higher use advantages.

For the automatic stirring and noodle machine based on S7-200PLC technology, the main structure has water injection port, noodle port, stirring motor, mixing box, bottom water tank and push-out cylinder. Before the actual operation, the water injection valve should be opened. And put the flour in the noodles. At this time, when the switch is turned on, the mixer can automatically complete the agitation and the dough. The specific parameters are set as follows: the speed is 40r·min⁻¹, the capacity is 20L, the power is 1.6kW, the power supply is 220-380V, the surface volume is 16kg, and the working time is 10min.

The automatic mixing and dough machine based on the s7-200plc technology is as follows: In the noodle, the flour will enter the mixing tank. At this time, the water injection port of the dough mixer will start to inject water at the same time. The water injection amount is from the previous stage. The soft and hard parameters of the dough prepared in plc are determined; when the height of the mixture of water and flour in the mixing tank reaches a predetermined value, after a delay of 5 seconds, the stirring motor will automatically start running and start the stirring operation, at this time, stirring The rotating blades in the box will rotate at the same time. The stirring time is determined by the time parameter set in the previous period. In the actual mixing process, the motor speed can be adjusted with the Siemens mm420 inverter to ensure the softness and hardness of the dough reach the desired level. At this point, the sensor detection is completed by the torque sensor; when the agitation and surface operations are completed, the agitator motor in the machine will stop running. After a delay of 5 seconds, the cylinder has no rod cavity and injected with compressed air to ensure that the agitator is open. Rotate in the direction and finally stir the dough everywhere.

Combined with the above workflow, it can be seen that this process is more automated and faster. In order to ensure the quality of the fully automatic mixing and mixer, the author used 304 food grade stainless steel plate with better heat resistance, corrosion resistance and low temperature strength, and applied a curved cold rolling forming technology to complete the production; Double-acting cylinder with low pollution and no residue[3].With the support of this dough mixer, the actual water addition can be adjusted according to the user's needs, and has a higher use advantage. In order to ensure the stability of the automatic mixing and dough machine operation, the author uses a plurality of sensors to form a detection device, and can automatically issue an alarm once an operational problem is found.

3.2. Pneumatic circuit design

When designing the pneumatic circuit in the automatic mixing and dough machine based on s7-200plc technology, the author mainly applied the double-piston silent air compressor to form the power system of the circuit. At the same time, in order to guarantee the performance of the fully automatic mixing and dough machine, the author designed a backup system, the main actuators of which are composed of three double-acting cylinders installed side by side. These three double-acting cylinders are connected to the manifold and are ultimately connected to the air source (air compressor).At this time, the compressed air blown by the air source (air compressor) is respectively transported to the rodless cavity of three different double-acting cylinders through the

manifold, and it is estimated that the piston rod completes the extending action, and finally the ejector is present in the stirring box.

In actual use, the valves of the other two double-acting cylinders can also be closed, and only one cylinder can be used to eject the dough. If there is a problem that the cylinder pushing speed is too fast, the control can be completed by adjusting the opening size of the one-way throttle valve to ensure the smoothness and reliability of the dough pushing process.

4. Fully Automatic Mixing and Noodle Program Design Based on S7-200plc Technology

4.1. Parameter design of the inverter

In the above design, in order to achieve effective adjustment of the motor speed, the author added Siemens mm420 inverter in the automatic mixing and dough machine based on s7-200plc technology. For the inverter, it has thousands of parameters, so in order to achieve rapid access and adjustment of the parameters, the author applied the bop panel to complete the quick debugging of the inverter, the specific parameters are designed as follows: p0003 parameter setting value For 1, p0010 parameter setting value is 0, p0100 parameter setting value is 0, p0304 parameter setting value is 400, p0305 parameter setting value is 1.90, p0307 parameter setting value is 0.75, p0310 parameter setting value is 50, p0311 parameter setting value is p0311 parameter setting value 1395.

4.2. Plc program design

In the fully automatic mixing and mixer based on s7-200plc technology, plc has many functions. For example, when the setting of the plc program is performed, when the water and flour mixture in the stirring tank reaches a predetermined value, the stirring motor is automatically started for 5 seconds, and the rotating blades in the stirring box are simultaneously rotated and the like.

5. Conclusion

In summary, s7-200plc has a higher technical advantage, its application and automatic stirring and noodle machine settings, combined with Siemens mm420 frequency converter, to achieve automatic addition of water, adding surface, mixing, forming Control has improved the efficiency and effect of dough production and has high application value.

References

- [1] Liu Xiaopeng, Wang Wei. Sequential control design method programming of s7-200plc for motor start control. *Times Agricultural Machinery*, 2019(1):101-105.
- [2] Liao Changchu. Technical characteristics of s7-200 smart plc. *Electric World*, 2016, 57(7):1-4.
- [3] Jiang Xin. Design and control of automatic mixing and mixer based on s7-200plc. *Packaging and Food Machinery*, 2015, 33(4):48-49.