Design of Intelligent Detection System for Diesel Engine Main Oil Duct Hole Based on S7-300 Control

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Abstract. The main oil channel of diesel engine cylinder block is the channel of lubricating oil. Whether they are smooth directly affects the working performance of diesel engine. This paper designs an intelligent detection system with programmable controller S7-300 as the control core, which mainly uses programmable control technology, photoelectric sensor technology and touch screen technology to complete the detection of cylinder main oil channel hole. The detection time is controlled within 38 s. This paper introduces the system composition and circuit working principle of detection system, and expounds the design scheme of PLC control system with S7-300 as the core. The design improves the detection speed, eliminates the missed inspection and false inspection, and provides the basic guarantee for the diesel engine to serve industry and agriculture efficiently.

1. Introduction
With the rapid development of industrial and agricultural economy, diesel engine is widely used in construction machinery, agricultural machinery and irrigation. Whether it can work normally affects the economic development of various industries, and whether the main oil channel hole of diesel engine block is smooth directly affects the function of diesel engine. The main oil channel hole of diesel engine cylinder block belongs to the deep hole which is difficult to process precisely. It will be blocked because it is not processed into a through hole or into a foreign body in the oil channel hole, which will lead to the impassable passage of lubricating oil and mechanical accident. Intelligent detection system of main oil channel hole of diesel engine based on s7-300 control. The design is discussed from the aspects of working principle analysis and control system design. The detection time is controlled within 38 s, which can complete the detection task with high quality, eliminate the phenomenon of missed inspection and false inspection, and provide guarantee for diesel engine to serve industry and agriculture efficiently.

2. Composition and Working Principle of Intelligent Detection System

2.1. Composition of the Intelligent Detection System
The composition of the intelligent detection system includes the detection cylinder, the block cylinder, the sensor mounting frame, the sensor, the Kun Road, the cylinder support, the controller and so on. The detection device is about 0.96 meters long, 0.43 meters wide and 0.65 meters high. The overall structure diagram is shown in figure 1. The figure 2 is the detection cylinder support, 4 is the detection cylinder, 5 is the piston rod, 6 is the sensor mounting frame, 7 is the sensor, 8 is the bolt M10×45, 9 is the nut M10, 10 is the bolt 2-M10×20, 11 is the bolt 3-M12M10×25, 12 is the bolt 4-M5M10×10, 13 is...
the cylinder block main oil hole ,14 is the nut ,15 is the nut ,16 is the block material ,17 is the block cylinder ,18 is the Kun Road.

![Figure 1. General Structure Chart of Intelligent Detection System]

2.2. Working Principle of Intelligent Detection
The automatic detection is completed by the control system with S7-300PLC as the core. According to the PLC program, click the touch screen automatic button and enter the automatic running state. After the roller stops running, the cylinder drives the sensor mounting frame down and detects the main oil channel hole.

If the detection passes, the detection cylinder drives the sensor mounting frame up, after receiving the feed signal, the block cylinder drops, the roller motor rotates, the detected workpiece is sent to the next station, and the sensor detects no workpiece. If the main oil channel hole of the cylinder block is impassable, the system sends out the buzzer alarm sound, the fault indicator light becomes red, chooses to release the alarm through the touch screen, and completes the related operation.

3. PLC Control System Design with S7-300 as the Core

3.1. System Hardware Composition
The hardware of this design system mainly includes 24 V power supply module, Siemens S7-300 series PLC, Siemens touch screen MP277, OMRON 0 photoelectric sensor. Among them, s7-300 series of photoelectric sensors have the characteristics of short cycle period, high processing speed, modular structure and so on.

3.2. PLC Selection
To meet the requirements of circuit function, according to the principle of selection, s7-300 series of CPU315-2PN/DP (315-2E14-0AB0) is selected as its controller. The digital input module selects 321-1 with 16 digital points BH81-0AA0, the digital output module selects 322-1 BH81-0AA0, with 16 number points. The input and output points are determined according to the action requirements and
principles of the detection system design, and the input and output port allocation table is made. The I0.0-I0.5, I1.0-I1.4 in the table is input, Q1.1-Q1.7 is output, as shown in Table 1.

| address | function declaration | address | function declaration | address | function declaration |
|---------|----------------------|---------|----------------------|---------|----------------------|
| I0.0    | Workpiece in place detection | I1.2    | Receiving signals | Q1.3    | Detection of cylinder rise |
| I0.2    | Check that the cylinder rises in place | I1.3    | automatic          | Q1.4    | Detection of cylinder descent |
| I0.3    | Check that the cylinder drops to the right position | I1.4    | Manual             | Q1.5    | alarm lamp |
| I0.4    | The blocking cylinder rises in place | Q1.1    | Block cylinder Rising | Q1.6    | Alarm beep |
| I0.5    | Stop cylinder lowered to position | Q1.2    | Block cylinder Decline | Q1.7    | Roller motor |
| I1.0    | Pre-station release |  |  |  |  |

3.3. PLC Hardware Wiring Diagrams
Hardware wiring diagram PLC intelligent detection system is shown in figure 2.

![Figure 2. Hardware wiring diagram PLC intelligent detection system](image)

4. Work Analysis of Touch Screen
This system selects siemens touch screen MP277, the touch screen is designed with motor start, motor stop, block rise, block fall, cylinder rise, cylinder fall, manual button, automatic button, in-situ indicator light, fault reset and other buttons. Motor start, motor stop button is to control Roller motor,
for the operator needs to run the workpiece to the detection station. Or release to the next station. The rising and falling buttons are the action of the cylinder, and the rising and falling buttons are the action buttons to detect the cylinder. When the cylinder rises, the workpiece can be released from the upper process to the detection station or from the detection station to the next station.

Touch screen can be used for manual operation after fault alarm or manual detection, mainly for handling after alarm. If the automatic detection system alarm, press the "fault reset" button, buzzer end, press the "manual button " , manual operation, select "cylinder rise ", so that the detection cylinder drive sensor mounting frame up, after rising in place, press the "block drop" button, press the "motor start" button, roll rotation, send the detection workpiece out of the system detection station, then select the "motor stop" button, roll stop rotation, press "block rise ", block cylinder drive up in place, after operation, press" automatic button ", The detection device enters automatic detection and begins to detect the workpiece to be detected behind.

5. Epilogue

High thermal efficiency and low fuel consumption are the remarkable advantages of diesel engine, which determine its position in construction machinery and other fields. This design combines Siemens S7-300, touch screen technology, sensor technology and so on. The structure is rigorous and the operation is simple.

For practical application, the detection time of the intelligent detection system can be controlled within 38S, which can shorten the detection time, save the cost and reduce the failure rate, and has a wide application prospect in enterprises.

6. Reference Documentation

[1] Pastoral, Pei Jie, Zhang Xin. Production line design [J.] of filling and labeling based on S7-200smartPLC control Southern Agricultural Machinery ,2020(19):23-24 27.
[2] Li Li. Research on PLC Automation Application in Electrical Control Based on J]. Technology and Markets, 2020(10):99 101.
[3] Zhang Qin, Feng Jinbing, Yin Hongmei. The Design [J.] of Automatic Control System for Vegetable Binders Based on PLC Electrical and Mechanical Information ,2020(27):105-106.
[4] Yao New Year. The role of PLC in fault maintenance of electromechanical control system Electronic Testing, 2020(18):108-109.
[5] Kong Qinglong, Guan Baojin, Wang Yanyu. System Design [J.] of Wheat Automatic Packaging Machine Based on PLC Control Science and Technology Innovation ,2020(20):89-90.