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Based on the PLC Technology Automation Design of On-board Pump Station Oil Temperature Control System

Liangyuan Shen[1]

Abstract

Vehicle hydraulic pump station, often work environment is poor, the environment temperature difference is very big, the nature of the hydraulic oil is affected by temperature is very big, a lot of damage, PLC automatic control scheme and design of pumping station, the oil temperature automatic control system realized the automation of the oil temperature control, greatly improving the pump station of the outdoor environment to adapt to the performance.

Keywords-Hydraulic power pack; Oil temperature control; Automatic control

Introduction

Vehicle hydraulic pump station work environment tend to be bad, the environment temperature difference is very big, and request to all-weather work. Is the working medium of hydraulic system of hydraulic oil, and the nature of the hydraulic oil is highly affected by the temperature, oil viscosity, leakage increases, the volume of the pump efficiency and the efficiency of the whole system will be significantly reduced. As a result of the oil viscosity is reduced, valve and other moving parts of the oil film thinning and cut broken, frictional resistance increases, lead to wear and tear. Make the deformation of rubber seals, accelerated aging failure, reduce the sealing performance and using life, cause leakage. Reduce oil separation of air pressure, air dissolved in transformer oil escape, produce cavitation, the working performance of hydraulic system. Temperature too low viscosity, seriously affecting transmission efficiency. Wild environment to adapt to the performance of pump station in order to improve the car, the design of pumping station, the oil temperature automatic control system to ensure that the vehicle hydraulic pump station in the use of different environmental performance.

The Oil Temperature Automatic Control System for the Overall Solution

The oil temperature automatic control system adopts PLC automatic control scheme, the main processing module, cooling temperature measurement module, PLC module, the heating module (figure 1). Temperature measurement module, real time detect important position of the hydraulic oil temperature of hydraulic pump station, the monitoring signal transmitted to the PLC processing module, judgment, processing and output control signals, control cooling or heating module, complete pump the oil temperature automatic control.

[1]Teaching and research department High-tech institute, Fan Gong-ting south street T on the 12th, Qing Zhou, China；Liangyuan_shen0731@126.com

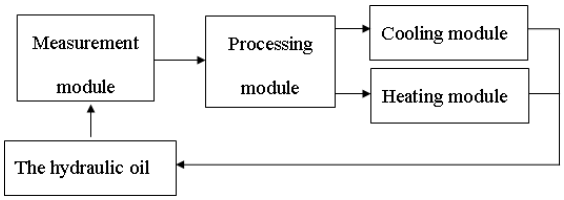

Figure 1. The oil temperature automatic control system for the overall scheme of the control block diagram.

Temperature measurement module

Sensitive element uses the heat resistance, temperature acquisition processing with extension resistance/thermocouple module. Place the thermal resistance respectively in the inlet, a group of oil outlet tank in the middle of two groups, the important part of the oil temperature detection. Choose SLC500 controller extension module has set temperature acquisition and data processing in one of the special intelligent temperature module thermal resistance/resistance (1746 - NR4) signal input module. In this module temperature simulation quantity to produce the corresponding 16-bit A/D digital value, the thermal resistance of transmitting temperature signal is about 1/8 degree, the resolution of the controller can be used directly in the numerical processing module conversion value, no level in the hardware circuit for other processing. The use of thermal resistance temperature module is very convenient, only need to heat resistance on the terminal of receiving module, does not require any external or peripheral circuit in the transmitter, temperature signal by the thermal resistance acquisition, conversion to electrical signals, after directly for the temperature in the module.

Processing module of PLC

The PLC processing module is composed of SLC500 controller, temperature display unit. SLC500 controller input channel of a thermal resistance module can meet four temperature thermal resistance temperature sensor. The temperature of the temperature measurement module testing signal is read, judgment, display and output control signals.

A. The control program

Control program including read subroutines, temperature display subroutine, determine output program.

Initialized first, scan read temperature measurement data, and temperature display, and then determine whether the temperature out of range, such as low temperature, according to the degree of low temperature, the control voltage, voltage regulator to control the heating power. Such as high temperature, signal cooling, control ac contactor action driven cooling motor work (Figure 2).

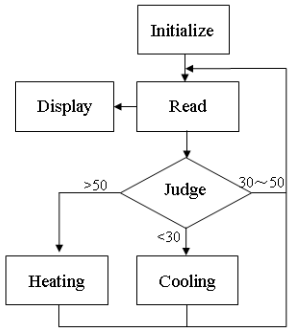

Figure 2. The control flow chart.

B. Temperature display unit

Temperature display unit using digital tube display, choose ZLG7289A chip, it with controller adopts 3 line serial interface, you just need to take up SLC500 three dots, can drive eight LED digital display tube, with a cascade can expand the number of digital display tube, realize the real-time temperature display. CS for the selected input, the foot as low electricity at ordinary times, can send instruction to the chip; CLK is a clock input, serial DATA input, DATA is in serial DATA clock CLK rise along the effective. Eight period of driving signal SEG after each segment of monitor, 8 bits DIG0 - driven signal DIG7 respectively display the common cathode of public land.

Cooling and heating module

Adopts the circulating water cooling module, when need to cooling, PLC signal alternating current AC contactor controlling, control of ac contactor action, drive cooling motor, drive the cooling water pump work, through the serpentine is recirculated cooling device, to absorb the oil heat, to achieve the purpose of cooling.

Heating module uses the voltage regulator control mode, when need heating, PLC control voltage regulator, so as to control the heating power module. Output channel for the analog output module (1746 nio4v), the output signal is a voltage signal, can be controlled by a voltage regulator power supply opening (that is, a week during the period of conduction ratio), to control the output power of the power supply. Temperature control system in the thermal resistance of analog input module voltage signal range is 0 ~ 4124, the SCP command whole it as engineering unit of 0 ~ 16383, its value in the PV (process variables) memory address N7:38, to control the output value in the N7:39. Finally the N7 with MOV instruction: 39 of the process variable is passed to the 1746 nio4v analog output module. Control effect is as follows:

(1) When the SP - PV≥ 50, a maximum output value is 32767, make the opening of the voltage regulator is the largest, maximum voltage power supply to heater, make the object being measured temperature rising fast. (2) when the SP - PV > - 30 and SP - PV < 50, the output of PID control output, the scope of this range of PID parameters adjustment. (3) when the SP - PV < - 30, the output value of the minimum value of 0, the opening of the voltage regulator is zero, namely stop heating.

Conclusion

The oil temperature automatic control system adopts PLC automatic control system. Signal acquisition module using special intelligent temperature thermal resistance/resistance signal input module, convenient wiring, save the external transmitter or peripheral circuit, heating output channel for the analog output module, the program control the heating power, high heat efficiency. Adopt AC contactor control cooling motor work, using circulating water cooling module, cooling effect is good. The system is a high degree of automation, effectively control the oil temperature, greatly improving the field to adapt to the performance of pump station.

References

[1] Zhi Li , “Hydraulic,” Shandong Machinery Industry School, Machinery Industry Press, August 2001.
[2] Shanjun Zhu, “Interface Technology and Application,” Tsinghua University Press, 2005.
[3] Wenzhi Sun. “Hydraulic control system” [M]. Beijing: National Defence Industry Press, 1985.