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DESIGN AND IMPLEMENTATION OF POWER SUPPLY CONTROL SYSTEM ON HI-13

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Abstract

On the HI-13 tandem accelerator, steer power supply and quadrupole lens power supply provides three different types of control interface, Remote control system of these power supplies implemented by using Siemens S7 series PLC, serial server, OPC server and WINCC, Long-time operation show that the control system is easy to be operated and its performance is reliable.
Keywords:HI-13, power supply control system, WINCC

INTRODUCTION

The beam must be focused by multiply quadrupole lens and the steers during transmission process for reasons of beam dispersion and deviation. Power supplies build an electrical or magnetic field by output changeable voltage or current. The new remote control system based on PLC and WINCC implement an totally upgrading of the old control mode which was dependent on manual adjustment of the mechanical potentiometer and step motors and facilitates convenient operation, intuitional display and precision improvement.

CONTROL DESIGN SCHEME

The bottom control built with SIEMENS S7PLC and programming is complete with STEP7 ladder diagram language. The interface based WINCC establish a connection with the PLC via the visual graphics, essential monitoring status of power supply could be clearly shown on the interface. Otherwise, different user authority be distributed and browser authority or program changing authority was definite for different users.

Steer Power Supply Control

In the HI-13, there are two kinds of steer power supply, one is the electrostatic steer power supply, the other is the magnetic steer power supply.

Electrostatic Steer Power Control The electrostatic steer power supply provides voltage output for the electrostatic steer, and its output is 0 ~ ± 7.5KV and 0 ~ ± 1KV, with ripple of 0.05% and stability of 0.05%.

8 Electrostatic steer power supply provide power for low energy terminal steers and high energy terminal steers respectively. Each power supply provides a DB9 interface, using analog method, whose definition is shown in Figure 1.

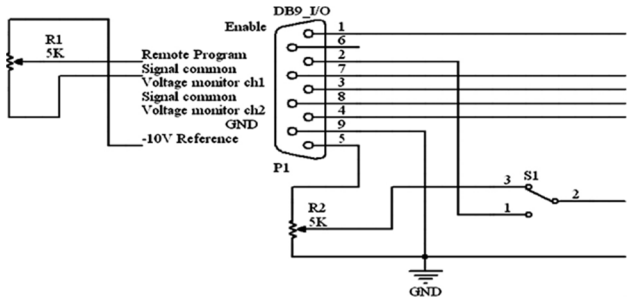

Figure 1: DB9.

Among them, pin 2 provides a remote voltage (0 ~ 10V) control mode, Pins 3 and 4 provide the voltage output return value (0 to 10V) for channels 1 and 2, pin 5 provides a 10V voltage reference, and when it is greater than 10V, it indicates that a fault has occurred. In this case, To disable the power supply to no longer work. The group of power control system use Siemens S7-300 series PLC, all input and output are connected through the IO module. The PLC hardware consists of three analog input modules (SM331), one analog output module (SM332), one digital output module (SM322), one CPU module (CPU315-2DP) and one communication module (CP343) [1].

The WINCC driver uses the SIMATIC S7 Protocol Suite-> TCP / IP [2].

Magnetic Steer Power Control The magnetic steer power supply provides a current output for the magnetic steer with an output of -2A to + 2A.

There are 4 power supply in total, the bottom data is transmitted through RS485 protocol, with communication speed is 57600bps, the starting position is 1, the data bit is 8, the stop bit is 1, the parity is: even check, the hardware connector is RJ45, Interface, PIN1: TX +, PIN2: TX-, PIN4: GND.

The four power supplies are connected to the MOXA 5430 serial server via a network cable, MOXA 5430 is a 4-port communication device that allows control of four RS485 serial devices via TCP / IP based Ethernet. Before using it, you need to set the mode of each port to Server mode, and set the communication parameters of each serial port such as rate, start bit, data bits and so on.

PLC use Siemens S7 1500 series, CPU is 1515-2 DP, and its IP address is in the same network segment with MOXA 5430. In STEP7 programming [3], using the open communication library TCON function module to connect the CPU as the client with MOXA 5430, the TSEND function module to send the control word, and the TRCV function module to receive the return information. In order

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to monitor the power output status in real time, a 2S oscillation logic was programmed with the timer.

The WINCC driver uses the SIMATIC S7-1200, S7-1500 Channel [2].

Quadrupole Lens Power Supply Control

The quadrupole lens power with output current of 0 ~ 50A.

This type of power supply is 10, providing current for different lenses in the beam line. Each device is controlled by a set ofS7 Smart 200 PLCs, providing an Ethernet control interface, and providing over-current, over-voltage, temperature and other status monitoring.

Since the WINCC configuration software does not support direct communication with the S7 200 PLC, the OPC server is required. Siemens SIMATIC NET OPC server is used. OPC (OLE for Process Control) the basic principle is: OPC client application communicate with OPC server through a standard, open multi-vendor interface. OPC server needs to be configured to work. After the configuration is complete, the OPC SCOUT tool in the SIMATIC NET software is used for the OPC configuration. The generated OPC groups and terms are used for communication between PLC and WINCC configuration software. SCOUT is also to test the data communication between the OPC server and the PLC.

The WINCC driver uses OPC / OPC GROUP (OPC HN UNIT # 1) [2].

CONCLUSION

The power supply control system has been successfully applied in the operation control of HI-13 tandem accelerator, it completely changed the original traditional control mode and greatly improving the level of automation, intelligence and system operation reliability. The intuitive clear graphical interface of the host computer brings convenience to operators, which saves the adjustment time. A long period of running test shows that the control system is user-friendly and stable, in the same time, it also shows the advantages of simplicity and flexibility.

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