Research on Design of Temperature Control System based on PLC

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Abstract: In many fields of scientific research and production practice, the temperature control occupies a very important position, especially with a pivotal role in the industrial and agricultural production. With the development of electronic and computer technology, PLC from the original amount of simple logic control, and gradually have the function of a computer control system, since the computing power, anti-jamming capability, response speed, communications networking capability, flexibility, and maintainability many advantages aspects, PLC has been extensive use of temperature control system, the author designed temperature control system based on PLC. In the industry control equipment, temperature control absolutely decides product quality. Introduces a temperature control system based on EJ1 temperature control module that product by OMRON company, industry control computer communicates with PLC through Ethernet. And program on the VC++ flat, establishes man-machine friendly intercommunion interface, sets the temperature of each temperature and realize Real-time monitoring.

Theoretical Introduction of PLC

PLC software provides both manufacturers, but also user-developed applications. The system program for the development of the user program provides the movement platform, also necessary for the reliable operation and the signal processing and information into the PLC program. The user program by the user according to the specific requirements for the design of control systems mentioned here PLC software design which means the user-developed applications.

PLC has strong function, high performance and low cost, can achieve very complex control functions. Compared with the same functions as a relay high price system, through the communication network, PLC can achieve decentralized control, centralized management. High reliability, strong anti-interference ability: PLC using a range of hardware and software anti-jamming measures, has a strong anti-interference ability, MTBF of more than tens of thousands of hours, there is a strong interference can be directly used for industrial production site , PLC has been recognized as one of the majority of users the most reliable industrial control equipment [1].

Temperature control system is a typical process control compared with other control systems, temperature control system has its particularity, obviously nonlinear, time-varying, distribution and the time lag. In industrial control, temperature control is used in many devices. This article describes the temperature control system is based on solar cells as a model press drying furnace, installing the heating pipe in the device in a closed environment, the use of a thermocouple for temperature detection and the detected temperature and set temperature contrast, the control algorithm temperature regulation. This enables closed-loop temperature control, temperature control is a big lag in the process, we require five thousandths precision temperature control equipment, and real-time temperature data acquisition, and draw the temperature curve.

Structure and Composition of PLC System

Computers connected via Ethernet port and PLC, use FinsGate W ay command to send commands to the communication PLC, realize the communication of computer and PLC. First provided by OMRON distribution network software for Ethernet communications network settings, PLC via

Ethernet connection, and PLC hardware DIP switch, node number, unit number is set, then the PLC distribution network. After using PLC as the control core, temperature variation through temperature sensor (temperature transmitters) collection, then after A / D conversion module converts PLC readable data> PLC will compare it with the set value, and press some control law of error calculation, drive actuators, closed-loop control of the temperature [2]. Fig.1 shows the hardware structure of systems.

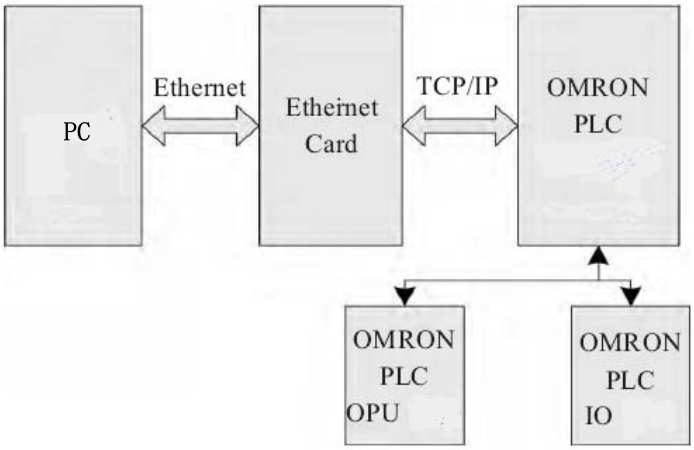

Fig. 1.The hardware structure of systems

The main aspects should select PLC type, capacity, I / O module, power modules, special function modules, communications networking capability to be considered. Mitsubishi temperature control system selects the PLC system main relay output unit outputs, 24 inputs and 24 outputs. Temperature Sensor is selection Pt100 platinum resistance sensor. Platinum resistance is the most commonly used low-temperature zone temperature detector, its main feature is high accuracy, stable performance, in which platinum RTD measurement accuracy is the highest. Analog Input Module Pt100 platinum resistance temperature sensor is detected by the analog resistive output signal, and PLC can handle a digital signal, and therefore need to select the analog input module.

We will use an electric heater tube as a member of the system, having life's, good oxidation resistance, high resistance, the advantages of cheap. The choice of heating drive control system effectiveness, reliability and service life have a greater impact. Currently, there are more contacts, SCR, solid state relays, using relay output, use solid state relays drive control device. Using the touch screen to control the system to start, stop I}, enter the temperature setting, real-time monitoring of temperature changes, temporary change P1D of the data and other operations, make the operation more convenient, and saves 1/0 PLC input [3].

The Software Implementation

Start and stop the system, instead of using an internal auxiliary relay switch input, you can click Start, Stop on the touch screen, saving I / O input. In the conventional temperature control, PID temperature control algorithm commonly used in PID control and improved on the basis of the control algorithm, now more and more intelligent control algorithm is applied to temperature control, such as integrated fuzzy control, fuzzy adaptive control, neural fuzzy control, fuzzy PID control algorithm for nonlinear characteristics of this system, large time delay, time-varying and strongly associated fuzzy parameter self-tuning PID control algorithm [4].

Upper and lower Internet communications need to meet specific communication interfaces, communication media or drivers condition is easy to control in serial, Ethernet, OPC, boards, virtual equipment and other fieldbus passage ways to communicate with field devices, field devices communicate through channels and is easy to control, easy to control by connecting multiple devices on one channel to achieve simultaneous communication with multiple devices. Easy to control the wealth of integrated communication programs, support most automation equipment, simply select the desired device in the configuration process to communicate and to do basic

configuration parameters. Fig.2 shows the real-time temperature curve.

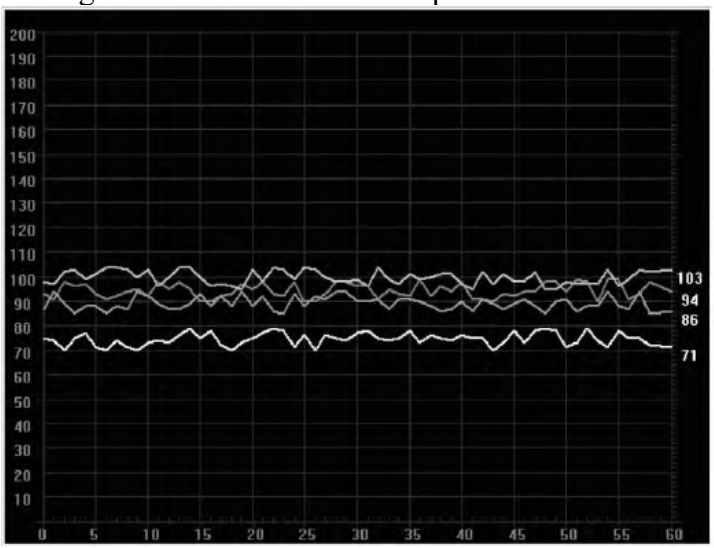

Fig. 2 .The real-time temperature curve

In VC ++ programming platform, written in Ethernet communications program, open real-time temperature value of the thread to read and write in four temperature zones, and the temperature data is written to the memory area, and then draw real-time curve for user reference temperature, set temperature and real-time comparison the difference between the value and the actual value of the temperature, so the difference is too large, resulting in product process failure, if outside the set range, the pop-up dialog box to remind the user, automatically disconnected heating.

The Anti-jamming of PLC Systems

Programmable Logic Controller (PLC) in industrial control has been widely applied in the process industry and PLC control, where the working environment is very complex, the various interference impact are not conducive to the stable operation of the PLC system, the entire system anti-jamming capability is directly related to the PLC to the stability and safe operation. PLC control system interference is a very complex issue, and therefore anti-jamming design should be considered various factors, rational and effective interference suppression, interference of some specific analysis needs to be done in order to make the PLC control system to work [5].

Various types of signal transmission lines connected to the system with the PLC, in addition to the effective transmission of various types of information, there will always be external interference signal intrusion. This interference There are two main ways: first, through the grid disturbance transmitter power supply or shared power supply fleeing into the signal meter, which is often neglected; the second is the interference signal line space by electromagnetic radiation, which signal line external inductive interference, which is very serious. Interference from within the system mainly mutual electromagnetic radiation generated by the internal components and between circuits, such as: a logic circuit mutual radiation and its effects on analog circuits, analog and logic to each other and the mutual influence between the components do not match use.

Consider several external interferences suppression measures. The main contents include: the PLC system and the external lead shielding to prevent electromagnetic radiation interference space; pair of external leads isolation, filtering, especially in the power cable, layered arrangement to prevent the introduction of conducted electromagnetic interference by external lead; properly designed access Location and grounding means perfect grounding system. It also can take advantage of digital filtering means to further improve the reliability of system operation. Signal before connecting PLC, between the signal line and ground and connected capacitors to reduce common mode interference; between the signal poles to install filters to reduce the differential mode interference. Some commonly used measures are: digital filtering, setting software traps and other methods. Fig.3 shows the anti-jamming measures of PLC systems.

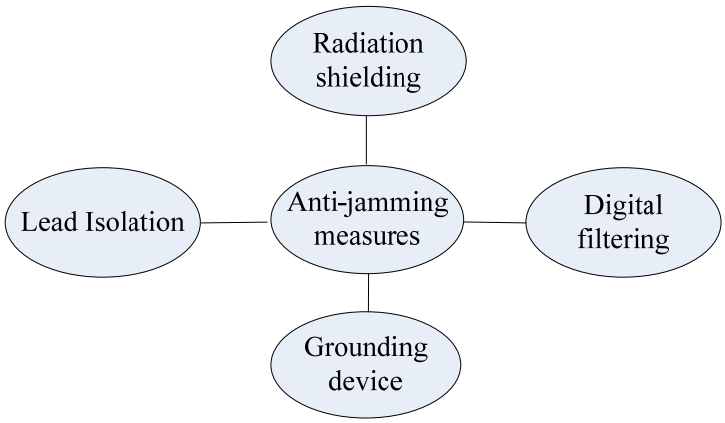

Fig. 3 .The anti-jamming measures of PLC systems

Conclusions

This paper describes the PLC-based temperature control system software and hardware design, the proposed temperature control module to establish communications through the thermostat module for design four-zone temperature control has been verified, with a clear structure, high real-time, high precision, easy to use, and easy to expand, It can be used for industrial control equipment temperature control. Higher precision control; using the PWM pulse width modulation instruction, to further improve the control precision; using the touch screen as the user interface, the control system to start, stop, enter the temperature setting, real-time monitoring of temperature changes, the temporary change of each P1D You do not change the data item has been ladder, you can change the temperature set points and other data, make the operation more convenient. PLC-based temperature control system is simple, stable, easy to maintain.

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