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Using the Pid Controller in PLC S7-300 to Stabilize the Oven Temperature

Duong Quynh Nga[1], Duong Quynh Nhat[2]
Department of Electrical Engineering, Thai Nguyen University of Technology, Vietnam

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ABSTRACT
Today, with the rapid development of science and technology, electronic devices are increasingly used in agricultural production, gradually replacing traditional production methods with low productivity and quality. One of those applications can be the problem of temperature stabilization for agricultural products that bring high productivity and quality. However, most of the current problems in stabilizing the temperature of agricultural products are controlling ON/OFF temperature, which may not be as accurate as desired. Therefore, researching solutions to stabilize temperature is an urgent requirement, especially for agricultural products that require absolutely accurate drying temperatures, so the project proposes a solution to stabilize temperature on the basis of drying temperature. PLC S7-300 PID controller application.
KEYWORDS: PLC, oven temperature

I. INTRODUCTION

Besides traditional heating furnaces with heat-providing fuels such as: coal, firewood, bark or stems of agricultural crops... Current automatic temperature-stabilizing heating devices are generally the most controlled methods. controlled by the central controller, taking feedback from the thermal sensors, then through the pre-installed control algorithm in the software, to output a signal to control the heating device to increase or decrease accordingly. actual requirements. Below are presented some models of heating equipment that have been and are being applied in practice.The heating model for drying agricultural products in agricultural production uses the PID controller in PLC S7300 with the following main features: Automatically stabilizes the drying oven temperature as required based on the PID algorithm. Set temperature and PID controller parameters can be set through WinCC monitoring software.

II. OVERVIEW OF SOME CURRENT HEATING SYSTEMS

For traditional heating solutions, the application of control techniques in heating devices is mostly only on-off heating (temperature control in a range corresponding to a range of input voltage). heating device), which makes the control algorithm simple. However, it will be limited to cases that require stable, precise and continuous heating. From there, the project proposes a solution to build a PID algorithm to smoothly control the voltage supplied to the heating device to ensure the temperature. The drying oven is always stable when influenced by external factors.

Technical requirements and equipment for the heating system include: Can measure and monitor the temperature of the agricultural drying chamber. The heating device used is a thermistor (or replaced by an incandescent lamp) powered by a 220VAC/50Hz source. The temperature can be set as required depending on the type of agricultural product. Use a temperature sensor to measure the temperature of the drying chamber. Feedback temperature signal through thermal sensor to central controller. Smoothly control the temperature in the drying chamber according to the set temperature even in the case of environmental influences. Working with voltage 220V/50 HZ. Ensures accurate, continuous operation for a long time.
Solution for selecting control devices for the project

a. Technology Solutions
- These devices are available on the market, have low prices, ensure working reliability, accuracy, continuity when working, and meet computing capacity...
- Software such as Step 7, WinCC explorer.
- Power supply for PLC 24VDC.
- Central controller uses PID module in PLC S7-300.
- Controller with input signal 0-10VDC, corresponding output signal 0-220VAC.

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- PT100 temperature sensor measures temperature range from 0 to 200^{0}C.
- 200W U-shaped MITSUBISHI thermistor, 220VAC power supply.
- Convection fan.

b. Design Solutions

- Simulation programming on Step 7 and Simulator.
- Design and run on real models to evaluate results.

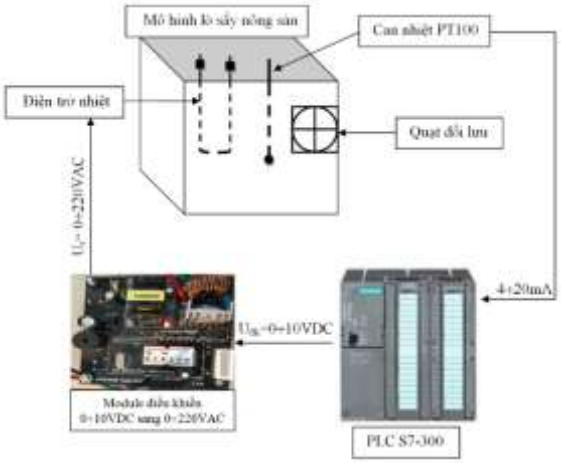

Figure 1. Temperature control model of agricultural drying oven

III. FORMULATE PROBLEMS AND PROPOSE CONTROL SOLUTIONS

Control the temperature of the agricultural drying oven according to the preset temperature for each type of agricultural product. The PT100 thermocouple will measure the oven temperature and then respond with a 4-20mA signal to the PLC, through the program code programmed for the PID control module, outputting a signal from 0-10VDC to the module. Controls DC voltage to AC voltage from 0-220VAC. This voltage supplies power to the thermistor to heat the oven, ensuring that the oven temperature meets the pre-set temperature requirements.

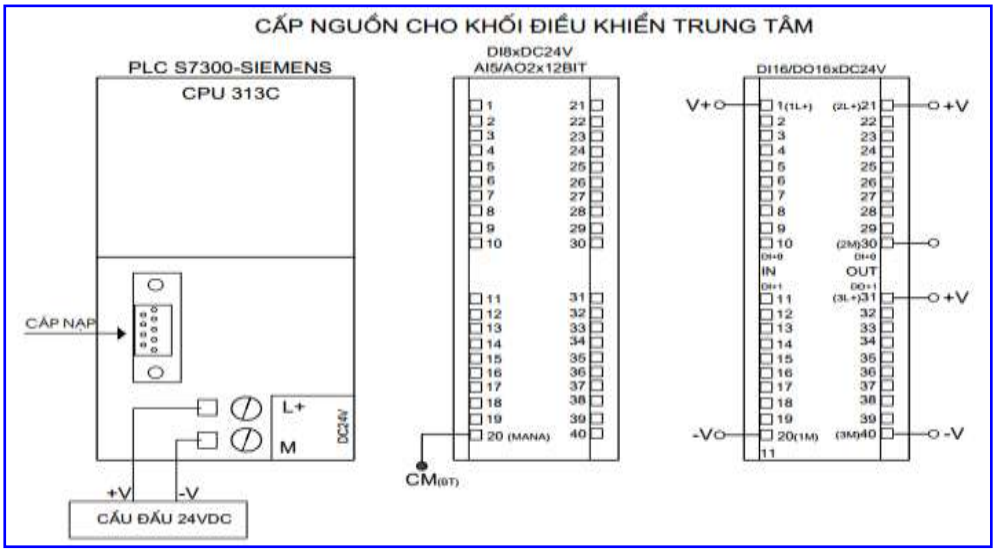

Figure 2. Signal circuit diagram

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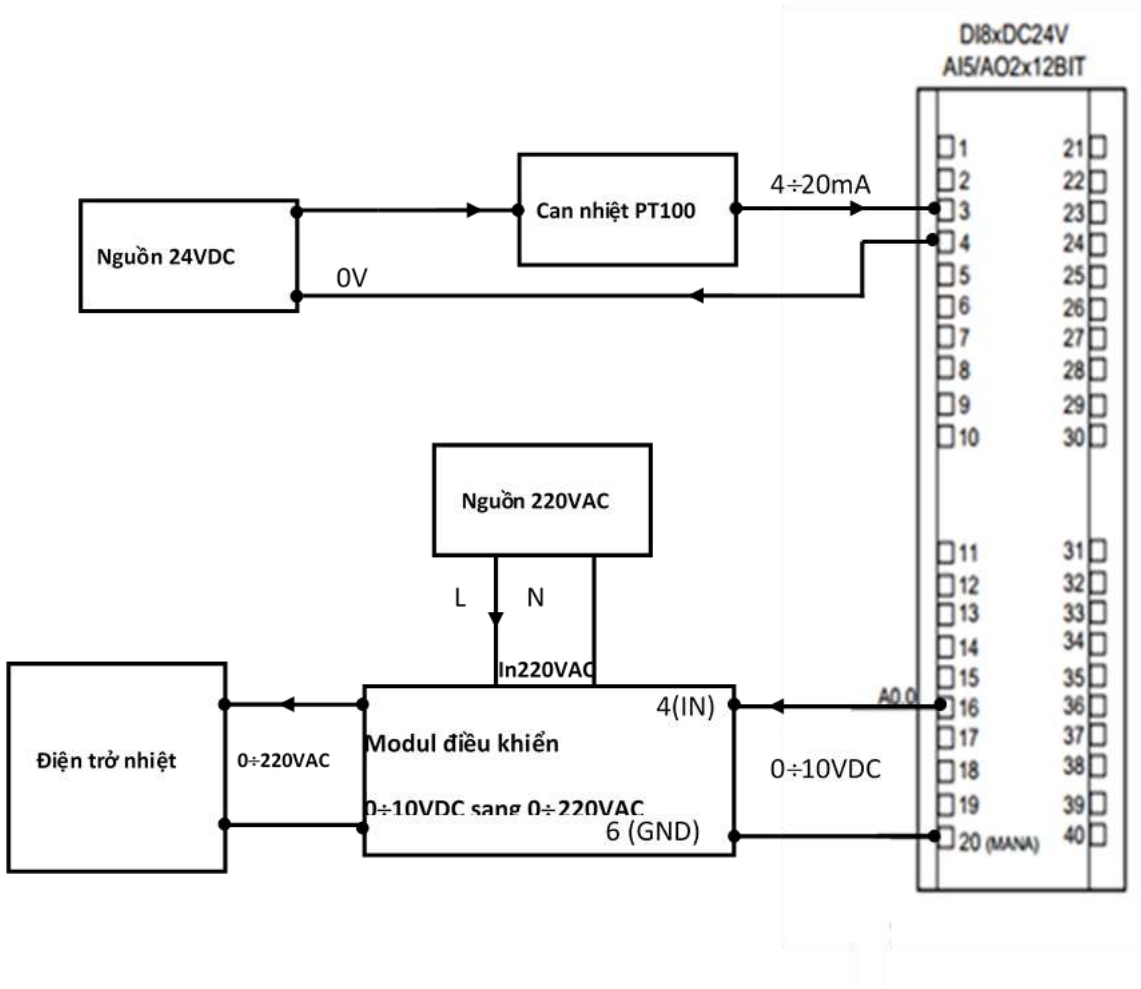

Figure 3. Power circuit diagram

Operating principle of the system:

- On-site mode: Place the rotary switch in the "LOT" position, the on-site mode indicator light is on. Press the START button → the running indicator lights up. At this point, we set the temperature on the wincc screen, after a transient period (according to actual observations, the transient time is approximately 5 minutes), we obtain a family of characteristic curves with 2 thermal curves closely following each other. Suppose during work there is a problem with the thermal signal wire breaking, then the Yellow light will immediately light up to signal a loss of signal and will turn off when the problem has been fixed. Press the STOP button and the system will stop operating when the Red light lights up and the Green light turns off
- Remote mode: Place the rotary switch in the "REMOTE" position, the remote mode indicator light is on, the system operates similarly to the local mode but the system control will be operated on the interface. WinCC interface on the computer screen.
-Monitoring screen interface via. WinCC

IV. RESULTS AND DISCUSSION

Through experiments, the results are as follows:

The designed drying oven model automatically stabilizes the temperature according to the set amount using a PID controller. When the set temperature of the drying oven changes, the controller will control the drying oven temperature to change according to the set amount. And the simulation results show that the oven temperature has adhered to the set temperature. The topic has learned about PLC S7-300 structure and PLC S7-300 programming language. Especially know how to program on step7- SIMATIC Manager software and run simulations to monitor system operations. However, the mechanical structure has not achieved high accuracy, so during operation there

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may be certain shortcomings, the product may operate less accurately than calculated.

Figure 4. The image of the system after complete

V. CONCLUSION

The use of PID controller in PLC S7-300 shows clear effectiveness in stabilizing the temperature of agricultural drying ovens. Results are simulated and monitored via WINCC FLEXIBLE software. Although the connection mechanism is still limited, there is a small error. However, the results were acceptable and will be improved during further research.

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