CONTROLLING BY THE HELP OF PLC AND OPERATOR PANEL OF WATER TANK FILLING SYSTEM

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Absract

Together with the developing technology, the production that is based on the human force has been realized by the machines in recent times. The automation and machinery technologies have enabled fast and reliable production qualities too. As that is the case, machines and processes that find a life by the microchip-based control methods have started to be an undeniable part of the industry.

In this paper, the aim is to control the water tank filling system through the PLC and Operator Panel. There are dc motor, valve, heater etc. devices in system. This system is controlled on operator panel via developed plc ladder diagram.

Key Words: PLC, Operator Panel, Pwm control

1. Introduction

The automation and machinery technologies have enabled fast and reliable production qualities too. As that is the case, machines and processes that find a life by the microchip-based control methods have started to be an undeniable part of the industry [1].

Industrial automation is an essential fact for the high efficiency and qualified production in our recent technology. Those systems improve day by day. PLSs has an important place in the development of the industrial automation systems.

Programmable Logic Controllers (PLC's) are used by most Flexible Manufacturing Systems (FMS's) as their process controllers because they are adaptable, modular, user-friendly and acquired at low cost. For a sophisticated FMS, however, the PLC's capability in fault detection is limited because of its inflexible programming system [2,3].

In this study, tank filling system was controlled by a programmable logic controller (PLC) and the ability of intervening to the operator panel system was obtained.

2. The Work-Principle of The System

In the system that is shown in Figure 1, the water of the water tank was made reach to the tank by a speed control of DC motor and with the Pals With Modulation and also by pumping it. The water can also be carried when the by-pass (Valve1) is closed and when the water goes above the cooler if it is desired by-pass. The water that reaches to the water tank is heated by the water dimmer circuit and an temperature-changeable electrical resistance by which the desires temperature set value is obtained. In order to enable the homorganic temperature distribution in the water, the mixer motor is controlled in the on/off mode. Those processes are carried out by the information that is sent to PLC and their interpretation of the program that is written in the PLC, and the arrangement of the feedbacks accordingly.

The control of the valves and pumps in the system can be realized by via an operator panel. Additionally, tank temperature and the liquid level can be observed over the panel.

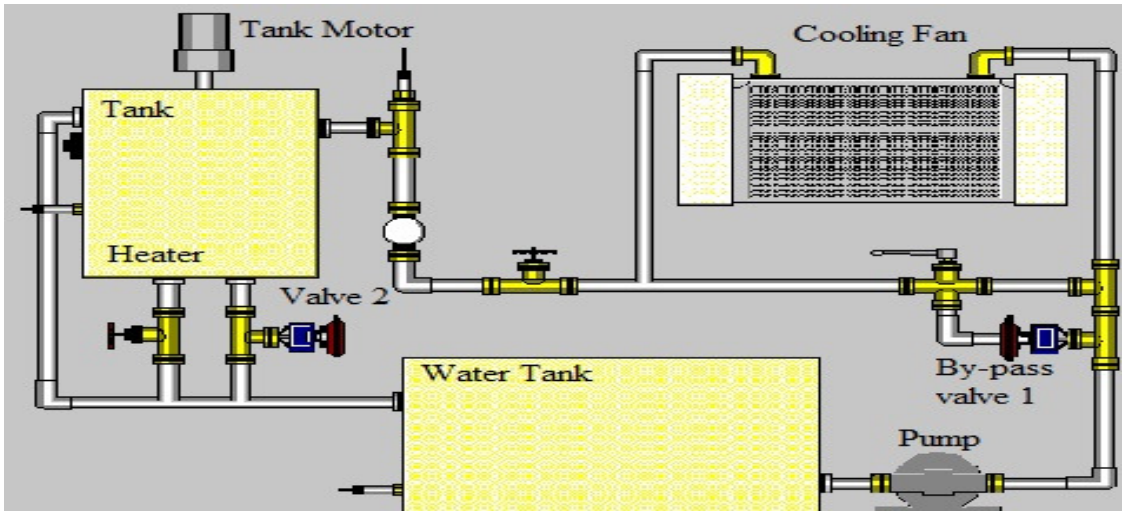

Figure 1 The process period of the water tank filling system

3. Plc Programming

PLC, in a short sense, is a computer that is designed for the industry that can maintain the functions such as timing, counting, control in a raw, doing arithmetic's, data channeling, communication etc by a program that is situated written inside. PLC's that were formerly designed to take the function of relay, Timer Relay etc within the classical control panels are available to be used currently for realizing the complex control procedures[4].

PLCs are generally used in the industrial process applications and production. The basic advantage of the PLC is that it helps to enable flexible, reliable and simple system configuration and it has lower cost of care therefore complex systems moves toward PLC control systems [5].

These devices were designed to replace relay logic circuits and the basic programming language, ladder diagram, resembles relay logic schematics[6].

In the system, the PLC equipment with the model of CPU224 that belongs to the Siemens S7-200 family was used. There are 14 digital input (DI) and 10 output(DQ) terminals located in the system with 2 analog inputs 1 analog output. The program prepared by STEP7 Micro/Win4.0 software was installed to PLC by the RS232-RS485 PC/PPI wire.

There are different programs for programmable logic controllers.. In the early 1990s the International Electrotechnical Commission IEC standard was created. The IEC Standard recommends the structure for five programming languages, which includes ladder diagram, instruction list, function block diagram, sequential function charts, and structured text [6,7]. Ladder-LAD was chosen as the programming language

Siemens TD-200 model that works in accordance with s7-200 PLC was chosen as the operator panel. The programming of the TD-200 operator panel was obtained by the help of microWIN program.

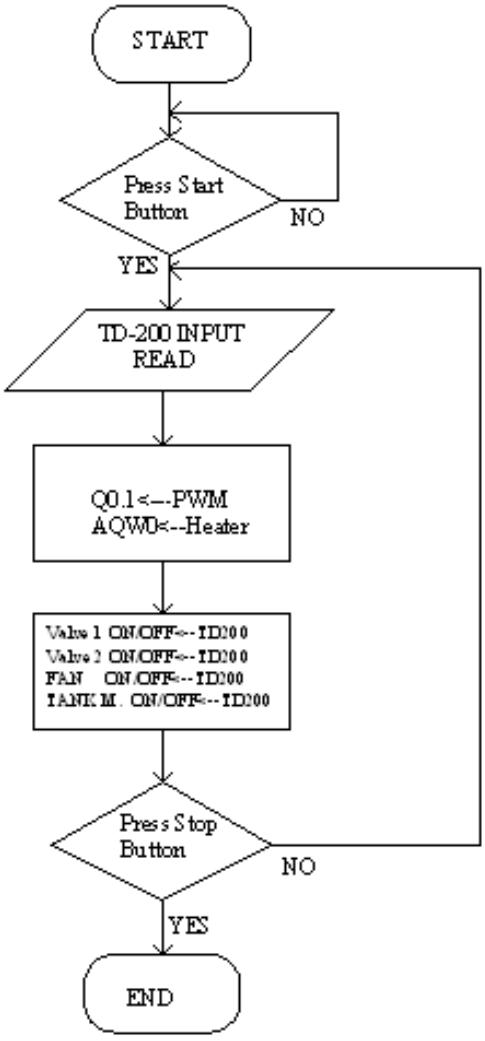

Figure 2 PLC Flow Chart

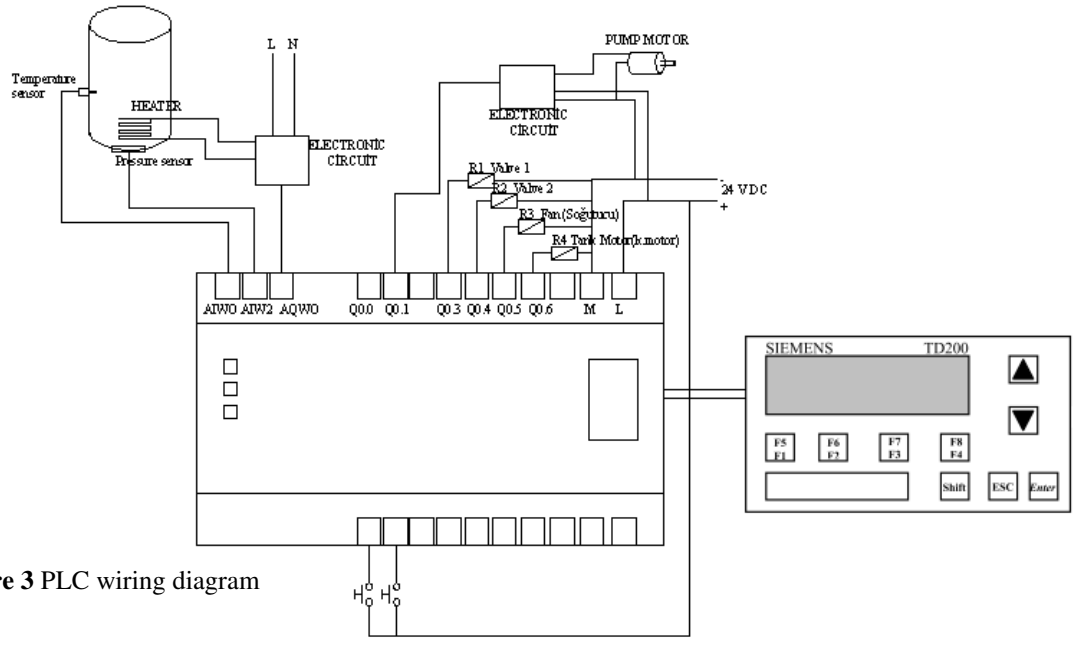

Figure 3 PLC wiring diagram

4. PWM DC Motor Control

PWM(Pulse Width Modulation), as it applies to motor control, is a way of delivering energy through a succession of pulses rather than a continuously varying (analog) signal. The Model of S7-200 PLC has built-in functions to generate the PWM. S7-200 PLC has two PWM output pin (Q0.0 and Q0.1).

The important point in PLC selection is to use PLC with transistor output, because high frequency switching is required

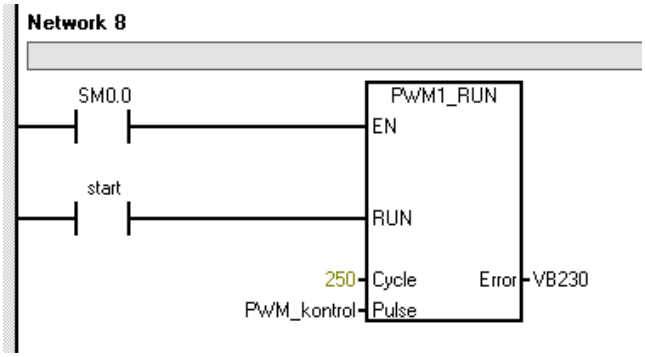

Figure 4 PWM control with PLC

Table 1 Analog voltage that corresponds to the output pulse

Cycle	Pulse	Analog Output
250	250	24 V
250	200	22.1 V
250	150	19,2 V
250	125	17,3 V
250	75	13,1 V
250	25	7.8 V
250	0	0 V

5. Operator Panel

The operator panel provide the communication between the operators and machines. In the past, the communication between the operators and the machines was realized by the buttons that send the information and the signal lambs taking the message. After the usage of the PLCs as a control unit, the numbers of buttons and lambs used have increased therefore the complicatedness of the machines has increased accordingly. Each unit that will enable the communication between the button, lamb, the machine and the operator needed new holes to be perforated and new cable connections however this has both increased the cost and made the usage of the machines by the operators harder. Moreover, any change of these machines with this type of technology is highly difficult. An addition of even one button can result in a change of the whole control panel, reperforation of the whole holes and new cable connections. This process is highly pricy. The presentation of those information to the operator on a screen and conveying of this information to the production line via this screen is the biggest advantage of the usage of an operator panel[8].

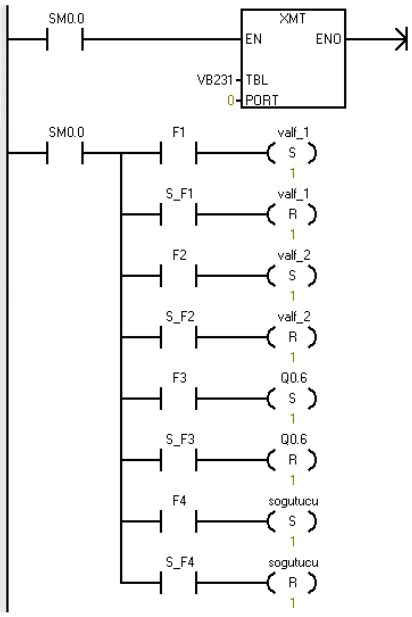

Table 2 Address lists of TD-200

Symbol	Address	Comment
F1	V306.0	Symbol for keypad button 'F1' pressed
F2	V306.1	Symbol for keypad button 'F2' pressed
F3	V306.2	Symbol for keypad button 'F3' pressed
F4	V306.3	Symbol for keypad button 'F4' pressed
S_F1	V308.4	Symbol for keypad button 'SHIFT+F1' pressed
S_F2	V308.5	Symbol for keypad button 'SHIFT+F2' pressed
S_F3	V308.6	Symbol for keypad button 'SHIFT+F3' pressed
S_F4	V308.7	Symbol for keypad button 'SHIFT+F4' pressed
sogutucu	Q0.5	
valf_1	Q0.3	
valf_2	Q0.4	

6. Conclusion

In this study, an appropriate PROGRAMMABLE LOJIK CONTROL (PLC) ladder diagram for a water tank filling system automation was created. PLC used belongs to the siemens family with the S7-200 brand.

Additionally, the communication between the operator, motor, heater and valves is obtained by the help of an operator panel. The operator panel used is TD-200 model that Works in accordance with siemens S7-200.

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