PID Control of Heating Tank using PLC & SCADA

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Abstract: ***The paper presents an automatic temperature control system using PLC and SCADA based on proportional-integral-derivative (PID) algorithm to maintain a temperature of a machine that uses a closed loop process control where the box temperature control can be achieved. In this system reactor/tank is heated using heating coil and its temperature is measured by RTD temperature sensor. The accurate control of temperature is the realistic feature of this system .The PLC & SCADA control process parameters with efficient accuracy and the results are found to be satisfactorily.***

Keywords: PID, PLC, SCADA, RTD, Temperature

1. Introduction

A Temperature Controlled System is a type of control system that automatically controls the temperature of an object or an area. These control systems are used in most of the manufacturing industries like chemical, process engineering, textile mill, pharmaceutical industry, oil refinery etc. The temperature controllers are used to maintain constant temperature of process or plant or any material. In order to implement a temperature control system, we need a temperature sensor and a controller.

In this project, we have implemented a simple Temperature control system using PLC & SCADA with PID control. The aim of this project is to automatically maintaining the temperature of the system by detecting the surrounding temperature using a temperature sensor.

PID controller provides proportional with integral and derivative control. It has the effect of slowing down the heater so that it will not overshoot the setpoint, but will approach the setpoint and maintain a stable temperature. PID uses feedback mechanism to control the process, it uses topology to calculate error value in system by differing the measured value & the set point value.PID tuning is the process for adjustment of control parameters like P, I and D control to obtain control desired output.

2. Block Diagram

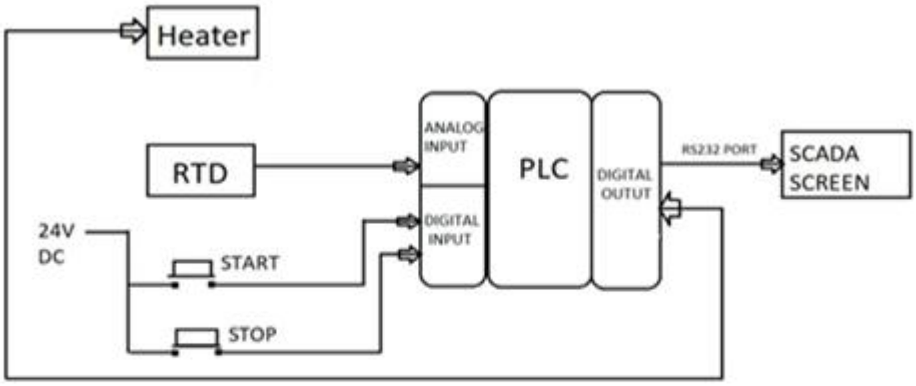

Figure: Block diagram of proposed system

Specification for each individual unit present in this system as present below:
1) Programmable logic controller (PLC)-Allen Bradley MicroLogix 1400A, 120/240AC, 24V DC,10Kb RAM,20 digital input, (12 fast ,8 Normal),12 digital output, 2 analog input, 2 analog outputs.
2) SCADA system-RS Logix 500
3) Temperature sensor-RTD PT-(100)
4) Proportional, derivative and integral (PID)

3. Methodology

1) The topic was chosen by doing a research on the existing automation system. The shortcomings of the current methods were listed down. A brain storming session was conducted to find ways to overcome the shortcomings and improve the current method.
2) The SCADA interface is designed to be user friendly while also providing the user with all relevant information needed to monitor the process and manually override control if needed.
3) PID is implemented using a PLC module and tuned using the trial-and-error method.
4) Ladder Diagram is planned and implemented on RsLogix500 software to incorporate the use of PID module and timer along with the temperature monitoring system.

5) Entire process is simulated using FactoryTalk ViewStudio and expected results are confirmed.

Step wise procedure of the system's working

1) Temperature Sensing using RTD
2) Converting Analog values to Digital for PID using Scale with Parameter (SCP)
3) Taking Setpoint value from the user and converting its value using SCP
4) Controlling the Output Heating Element using PID as per the gain set
5) Converting the PID output control power from Digital to Analog using SCP

4. Conclusion

In this paper we have developed a real time programmable logic controller (PLC) ad supervisory control and data acquisition (SCADA) based monitoring system. In this system PLC receives information from sensor then information is processed, analyzed and executed with custom program instructions and the data is stored in PLC memory. The PLC shares the information to SCADA system via RS 232 communication protocol, in SCADA system received digital data is displayed like minimum and maximum temperature. Through this in automation industries like chemical reaction and process engineering, a precise temperature control application with decisive influence on production output quality and process reliability at higher accuracy can be achieved.

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