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Process Control Automation Of Paper Pulp Using Plc

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ABSTRACT

Process control automation using PLC is the continuous process that takes over the task of controlling the required process variable parameters of conducting fluid i.e. paper pulp using PLC. The process variables that are controlled are level of the tank, temperature and flow rate of the fluid in the tank. All these variable parameters are continuously controlled using programmable logic controller [PLC]. Process control automation using PLC in a tank of automation plant is implemented by using ladder diagram. Desired set point is set by the user using Human Machine Interface [HMI]. All the operations will be programmed in ABB PLC and programming tool is ABB Automation builder.

Keywords : PLC, Paper pulp, Process variables, Process tank

I. INTRODUCTION

Over the years the demand for high quality, greater efficiency and automated machines has increased in the industrial sector of power plants. Power plants requires continuous monitoring and inspection at frequent intervals. There are possibilities of errors at measuring and various stages involved with human workers and also the lack of few features of microcontrollers.

Instrumentation is the art of measuring the value of some plant parameters like level, temperature, flow etc. Among the various parameters, control of liquid level, temperature, flow is a prime factor in many process stations such as pulp and paper industries, power plant, water treatment industries etc. The output signals are the standard signals and can then be processed by other equipment to provide indication.

The need for accurate and reliable level, temperature, flow measurement system is increased by the demands of advanced automated processing systems, more. stringent process control and strict regulatory requirements. By improving the accuracy of level, temperature, flow measurement, the variability in chemical processes can be reduced, which, in turn, helps to improve product quality and reduced costs and wastages. The purpose of a temperature controller unit is to heat up a particular solution to be desire temperature with minimum overshoot and quickest time constant. The system operates in a closed loop system to ensure that temperature will be obtained accurately.

II. METHODS AND MATERIAL

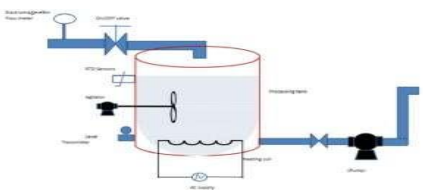


Figure 1. Block diagram of process control automation

The project is to implement the automation for the process tank to control the process variables like temperature, level and flow. PLC is used as controller for controlling action. All the signals from the sensors are given to the PLC as an input signal. According to set point mentioned in the PLC programming and the measured value from the process tank the controlling of process parameters take place. The conducting fluid (paper pulp) flows into the open process tank through the inlet valve where the flow meter is mounted across it and its flow rate is measured continuously. Accordingly, level is measured and once the level and flow reaches the set point the inlet valve gets closed. Then the temperature of the fluid is measured by using the head mounted RTD temperature sensor, if the measured value is less than the set point heater is turned on, at the same time agitator also turns on and continuous mixing of the of the fluid takes place for equal distribution of heat. Heater and agitator both contain induction motor with DOL starter with supply voltage 230V AC. Induction motor draws more current when it is started, so to prevent damage to the windings due to high current flow, the DOL starter is used. Once the fluid reaches desired temperature set point, fluid in the process tank is pumped out using the pump. To drive the pump induction motor with DOL starter is used. When level of the tank becomes zero, the pump and agitator gets off and as it's a batch process inlet valve gets open and next batch of fluid flows into the tank and controlling of process parameters takes place. All the above mentioned operations will be programmed in ABB PLC and programming tool is ABB Automation builder.

A. Hardware Used

1. Electromagnetic flow meter:

In an electromagnetic flowmeter, a magnetic field is generated and channelled to a fluid flowing through pipe. Following Faraday's law, flow of conductive fluid through the magnetic field will cause a voltage signal to be sensed by electrodes located on the flow tube. The paper pulp is conductive fluid hence electromagnetic flow meter is chosen for fluid measurement.

Model: AXF025G

Fluid temperature: 40 to 130 deg C Ambient temperature: 40 to 60 deg C Accuracy: 0.35% of rate Output signal: 4to 20 mA

2. Gauge type flange mounted level transmitter:

Gauge pressure transmitters are ideal for application ranging from high pressure measurement in boilers and fuel feeds to tank level measurement applications with relatively high process temperature.

Model: EJA210A

Accuracy: +/- 0.2%

Process temperature: -40 to 120 deg C Measurement range: 0-5000mm of water Output signal: 4 to 20 mA

3. Head mounted R To I RTD-PT100:

RTD is a temperature sensor that operates on the measurement principle that a material electrical resistance changes with temperature. Here Head Mounted R to I RTD is used in which resistance output from the RTD is converted into suitable current signal, the head mounted temperature transmitter converts the liberalized temperature to a 4 to 20 mA signal. Range: -200 to 850 deg C

Accuracy: +/- 0.05% of reading Output range: 4 to 20 mA Power supply: 10 to 30 V dc

Ambient operating range -40 to 85 deg C

4. Heater:

Heater contains an induction motor. Heater works on the principle of heating an electrically conducting object (usually a metal) by electromagnetic induction, through heat generated in the object by eddy currents. An induction heater consists of an electromagnet, and an electronic oscillator that passes a high-frequency alternating current (AC) through the electromagnet. The rapidly alternating magnetic field penetrates the object, generating electric currents inside the conductor called eddy currents. The eddy currents flowing through the resistance of the material heat it by Joule heating. The frequency of current used depends on the object

size, material type, coupling (between the work coil and the object to be heated) and the penetration depth.

5. Agitator:

The agitation is achieved by movement of the heterogeneous mass (liquid-solid phase), to the impeller. This is due to mechanical agitators, to the rotation of an impeller. The bulk can be composed of different substances and the aim of the operation is to blend it or to improve the efficiency of a reaction by a better contact between reactive products. Or the bulk is already blended and the aim of agitation is to increase a heat transfer or to maintain particles in suspension to avoid any deposit.

6. Pump:

A pump is a device or an apparatus used for conveying a fluid from one point to other, usually through a pipe. A pump may, therefore, be defined as a mechanical device which translates the mechanical energy imparted to it from an external source (electric motor, diesel engine or even manual energy) into hydraulic energy in the fluid handled by it. As a consequence, the energy level of fluid handled by the pump or flowing through the pump is augmented, making it possible for the fluid to move from a lower level to a higher level, against gravity and friction.

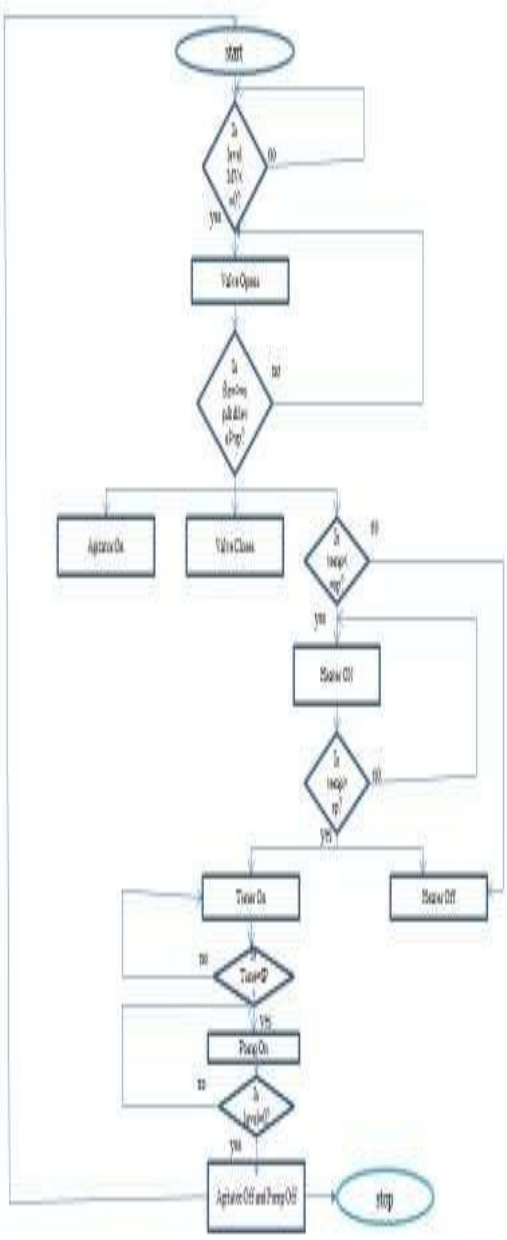
B. **Software Used**:

ABB PLC:

PLC introduces a better solution in accurate level and temperature measurements. Not only that, smooth transition of level control can be controlled by the PLC. PLC is more suitable for real time applications. With the AC500 PLC a reliable and powerful platform to design and create scalable, cost-effective and flexible automation solutions. The scalability of the AC500 PLCs is achieved by offering a large variety of devices to design and implement configurations suitable for simple control tasks or complex automation solutions.

The AC500 PLC provides action flexibility with one integrated software.

Flow of the Program:



III. RESULT AND DISCUSSION

We have implemented automation builder to the process tank consisting of paper pulp where its process variable parameters i.e. level, temperature and flow have been controlled and measured according to the user requirement using ABB PLC.

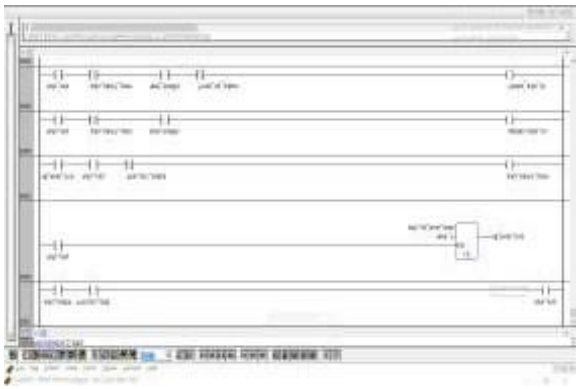


Figure 2

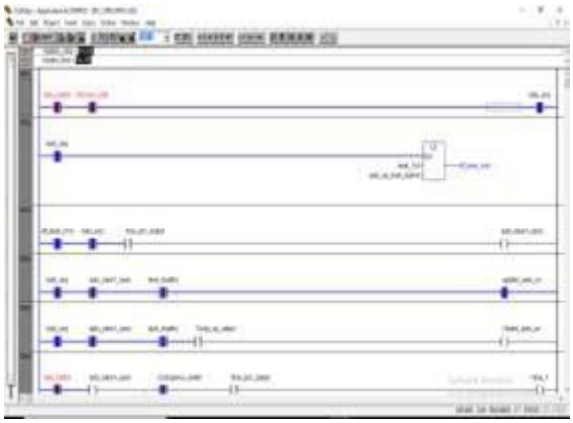


Figure 3

IV. CONCLUSION

In this paper, a PLC based automation control system is proposed and implemented. The proposed architecture utilizes a HMI communications and the data can be processed in the PLC. The resulting output helps in controlling of process parameters i.e. flow, level and temperature according to the user requirements.

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