International Journal For Technological Research In Engineering
Volume 1, Issue 8, April-2014 ISSN (Online): 2347 - 4718

PLC BASED CLEAN IN PLACE SYSTEM FOR DUCT AND FOOD PROCESSING PLANT

Mr. N.A.Bhujbal[1], F.N.Shaikh[2], Mr.S.C.Rajgade[3]
[1,2]BE Instrumentation Engg. [3]Assistanant Prof. of Instrumentation Department.
Department of Instrumentation and Control
AISSMS Institute of Information Technology
Pune, India.

***Abstract*—Our project is Clean In Place system Using PLC. In this project we are using PLC instead of microcontroller. Now a day's automation process system is heart of industries. Clean-In-Place (CIP) is a method of cleaning the interior surfaces pipes, vessels, process equipment, filters and associate fittings, without disassembly. In our project we are using tanks , pipes, valves, pumps, sensors, relays ,heater and scada software to design CIP system using PLC Our project shows how CIP system will not only save money in terms of higher plant utilization but also in terms of significant saving in CIP detergent and man-hours. The cleaning of complete items of plant or pipeline circuits without dismantling or opening of the equipment, and with little or no manual involvement on the part of the operator. The process involves the jetting or spraying of surfaces or circulation of cleaning solutions through the plant.**

***Index Terms*—Solenoid valve, SCADA, PLC.**

I. INTRODUCTION

Clean-in-Place (CIP) is a method of cleaning the interior surfaces of pipes, vessels, process equipment, filters and associated fittings, without disassembly. Up to the 1950s, closed systems were disassembled and cleaned manually. The advent of CIP was a boon to industries that needed frequent internal cleaning of their processes. Industries that rely heavily on CIP are those requiring high levels of hygiene and include: pharmaceutical, cosmetics, biotechnology, beverage, and brewing, dairy, processed foods.

The definition of CIP is as follows:

"The cleaning of complete items of plant or pipeline circuits without dismantling or opening of the equipment, and with little or no manual involvement on the part of the operator. The process involves the jetting or spraying of surfaces or circulation of cleaning solutions through the plant under conditions of increased turbulence and flow velocity."

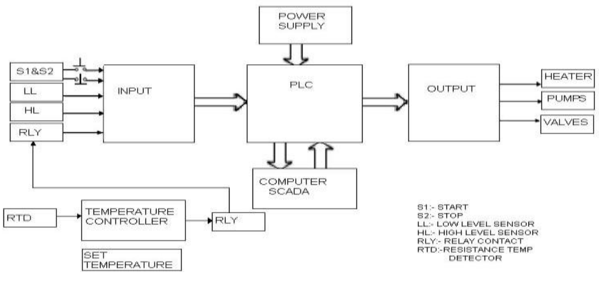


Fig. 1. Block dia. of a CIP System

The benefit to industries that use CIP is that the cleaning is faster, less labor intensive and more repeatable, and poses less of a chemical exposure risk to people.

II. SYSTEM DESCRIPTION

The system description is as shown in figure 1.

III. COMPONENT DESCRIPTION

A. Solenoid Valve

A solenoid valve is electromechanically operated valve. The valve is controlled by an electric current through a solenoid. In our case we are using one input and one output type solenoid valve. it is 24VDC operated valve. Solenoid valve is the most frequently used control element in fluidics. This are used to shut off, release, dose, distribute or mix a fluids. This are found in many application area. Solenoid valve have a fast and safe switching, high reliability, long service life, good medium compatibility of the material and low control power and compact design. In this project we are using a plunger type actuator.

B. Capacitive Proximity Sensor

Capacitive proximity sensors are designed to operate by generating an Electrostatic field and detecting Changes in this field caused when a target approaches the sensing face. The sensor's internal workings consist of a capacitive probe, an oscillator, a signal rectifier, a filter circuit and an Output circuit. In the absence of a target, the oscillations in active. As a target approaches, it raises the capacitance of the probe System. When the capacitance reaches a specified threshold, the oscillator is activated which triggers the output circuit to change between "on" and "off." The capacitance of the probe system is determined by the target's size, Dielectric constant and distance from the probe. The larger the size and dielectric constant of a target, the more it increases capacitance. The shorter the distance between target and probe, the more the target increases capacitance.

C. Shielded vs. Unshielded Capacitive Proximity sensors

Shielded capacitive proximity sensors are best suited for sensing low dielectric constant (difficult to sense) materials due to their highly concentrated electrostatic fields. This allows them to detect targets which unshielded sensors cannot. However, this also more susceptible to false triggers due to the accumulation of dirt or moisture on the sensor face. The electrostatic field of an unshielded sensor is less concentrated than that of a shielded model. This makes them well suited for detecting high dielectric constant (easy to sense) materials or for differentiating between materials with high and low constants. For target materials, unshielded capacitive proximity sensors have longer sensing distances than shield versions. Unshielded capacitive sensors are also more suitable than shielded types for use with plastic sensor wells, an accessory designed for liquid level applications. The well is mounted through a hole in a tank and the sensor is slipped into the well's receptacle. The sensor detects the liquid in the tank through the wall of the sensor well. This allows the well to serve both as a plug for the hole and a mount for the sensor.

D. Conductivity sensor

In industrial environments water conductivity measurements are generally used to measure the concentration of ionized chemicals in water. For water quality assessment, conductivity measurement can be non-selective in the sense that it doesn't distinguish individual concentrations of different ionic chemicals mixed in water. Nevertheless conductivity measurements are of paramount importance in water quality assessment systems since high or low conductivity levels, relatively to its nominal value, can be used to detect environmental changes and pollution events. In our project we are using signet 2850 conductivity sensor.

Specifications and Features:

- High sensitivity and wide range ability
- Operating temperature -10 to 85°C
- Power require- 12 to 24 VDC

E. PLC

Programmable Logic Controller or PLC is an intelligent System of modules, which was introduced in the control, & instrumentation industry for replacing relay based logic. The PLC controls the final control elements. The main function of the PLC is acquire the digital and analog data from input module and vary the output of the system as the input conditions change, this is necessary as the system designed is a real time system. The PLC is programmed such that it will vary the output of the system if there is any change in the input quantity. Over a period of time, better I/O handling capabilities and more programming elements have been added along with improvement in communication. Basics of a PLC function are continual scanning of a program.

The scanning process involves three basic steps.

Step 1: Testing input status

First the PLC checks each of its input with intention to see which one has status on or off. In other words it checks whether a switch or a sensor etc., is activated or not. The information that the processor thus obtains through this step is stored in memory in order to be used in the following steps.

Step 2: Programming execution

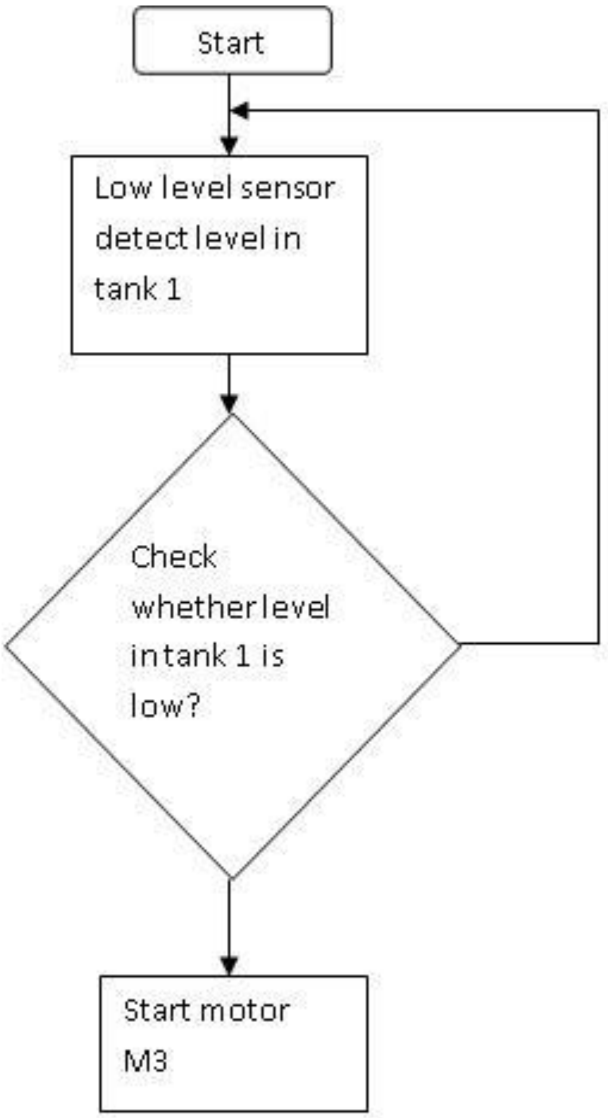
Here a PLC executes a program instruction by instruction based on the program and based on the status of the input has obtained in the preceding step, and appropriate action is taken. The action might be activation of certain outputs and the results can be put off and stored in memory to be retrieved later in the following steps.

Step 3: Checking and Correction of output status

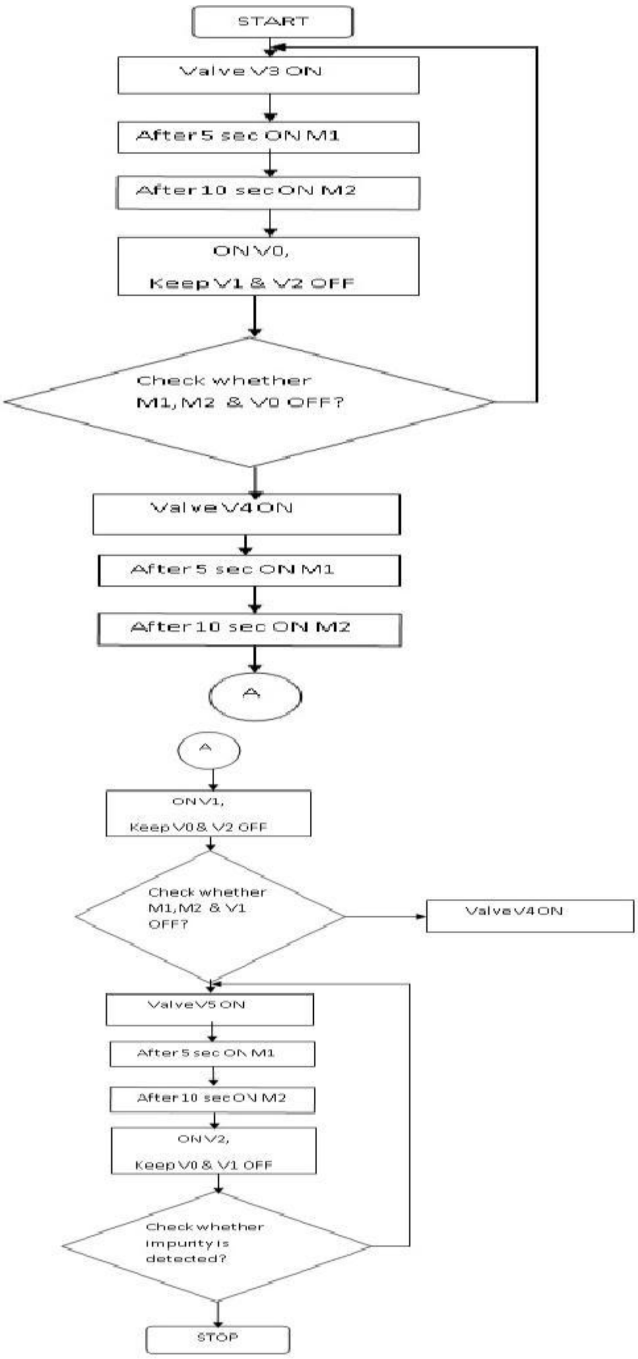
Finally, a PLC checks up output signals and adjust it has needed. Changes are performed based on the input status that had been read during the first step and based on the result of the program execution in step two? Following execution of step three PLC returns a beginning of the cycle and continually repeats these steps. Scanning time = Time for performing step 1+ Time for performing step 2+ Time for performing step 3.

FLOWCHART:

Initial Stage:



CIP Cycle:



F. RTD

Resistance thermometers, also called resistance temperature detectors (RTDs), are sensors used to measure temperature by correlating the resistance of the RTD element with temperature. Most RTD elements consist of a length of fine coiled wire wrapped around a ceramic or glass core. The element is usually quite fragile, so it is often placed inside a sheathed probe to protect it. The RTD element is made from a pure material whose resistance at various temperatures has been documented. The material has a predictable change in resistance as the temperature changes; it is this predictable change that is used to determine temperature. As they are almost invariably made of platinum, they are often called platinum resistance thermometers (PRTs). They are slowly replacing the use of thermocouples in many industrial applications below 600 °C, due to higher accuracy and repeatability. Common RTD sensing elements constructed of platinum, copper or nickel have a unique, and repeatable and predictable resistance versus temperature relationship and operating temperature

IV. CONCLUSION

The objective of the present invention is to provide an automated system for cleaning of duct and tank in food industries. In this project we are controlling high and low level of liquid, and the temperature of liquid using RTD. By using conductivity sensor we can measure the impurity of acid .In this way we are implementing CIP system using PLC which is very good option in number of industries and we are very confident that our project will take good position in the market. This system can also use in pharmaceutical and chemical industry

REFERENCES

[1] C.D Johnson, Process Control Instrumentation Technology, John Wiley & Sons Inc.; 3rd edition, 1998.
[2] Jon Webb, Programmable Logic Controllers: Principle and Application, Merrill, 1992.
[3] ‘Introduction to Programmable Logic Controllers’, third edition, by Gary Dunning.
[4] Bradley Rockwell Automation.
[5] www.massey.ac.nz/ychisti/CIP.pdf
[6] www.Milkquality.wise.edu/wpcontent/uploads/2011/10/CIP-processes.pdf
[7] www.wikipedia.org.

