

# Pneumatic Pumping System

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**Abstract**— The project basically involves pneumatic pumping process. The main objective is to replace conventional motoring system with pneumatic pumping. The PLC used in the project is . SCADA system has been implemented so as to suit the operator with graphics of the processes being carried out. There are several advantages of automation in an industry or even in a company. Automation helps in saving the labor of the workers and thus it also saves a lot of time for the worker who can be then directed to some other work process. The greatest advantage of using automatic pneumatic pumping system is that it saves time and at the same time it also saves costs. Automation of sugar syrup pumping system (using pneumatic pumping system) is very efficient way to operate pumps in industries where requirement of high production rate with high quality is essential. This results in system which is synchronized to perform sequential operations.

**Key words:** Programmable Logic Controller (PLC), Power Supply(SMPS) Input-Output (I/O), Solenoid Output Valve (SOV), Push Button (PB)

## I. INTRODUCTION

With the increasing need of improved quality of products and efficient manufacturing, the focus is now on the automation of the Indian manufacturing lines. The automation of machines invariably involves Programmable Logic Controllers (PLC). PLC is a control and monitoring device, which controls the operations of a machine, process or a production line. PLCs find application in standalone machines as well as in complex interlinked process lines.

A Programmable Logic Controller (PLC) is an industrial computer that accepts inputs from switches and sensors, evaluates these in accordance with a stored program, and generates outputs to control machines and processes.

The programming device is a PC that enables the user to create, edit, monitor, upload and download ladder logic (program) to the PLC.

In this generation all the work is carried out automatically. Only few operations are done manually. The main reason for this evolution is to increase the production rate and decrease the human error. Many automation equipment's are being produced and one out of them is PLC i.e. Programmable Logic Control. A PLC is an electronic apparatus with programmable memory, inputs and outputs, and a power supply that executes user-entered instructions. In sugar industries many process are to be carried out and one of them is pumping sugar syrup. Realizing high quality and maintenance free Pumping Device Improving the operability and production efficiency. As the regulations governing the use of programmable controllers in safety systems, machine builders began to migrate from hardwired safety to some level of digital safety systems as their customers recognized the benefits and began pushing machine builder to get with it.

## II. RELATED WORK

After finalizing this project we studied how to work on PLC. We consulted our faculty members about the feasibility of this project. We found out information on various component required for the automation on internet. We took help of our external guide for learning the CoDeSys software. We got the basic idea about how the pumps work and how we can arrange different components for the automation of the machine

## III. BLOCK DIAGRAM

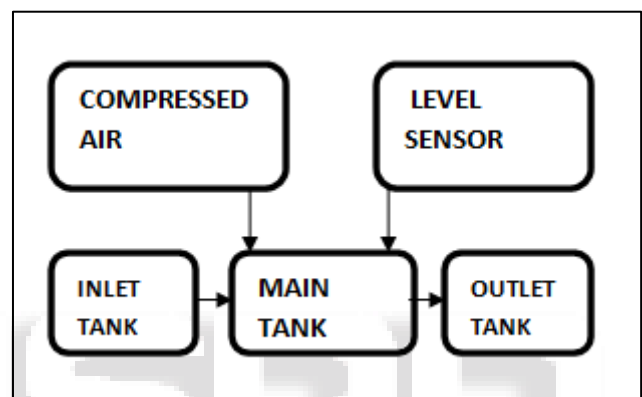


Fig. 1: Block Diagram

The block diagram consists of 5 blocks:

**Main Tank:**

This is the main part of the pumping system. All other parts connected to it. Main tank is storing device. There are two inlets and two outlets connected to main tank.

1) *Inlet:*

Liquid came from process is fed to main tank from inlet.

2) *Compressed Air Inlet:*

Compressed air from compressor is fed to the main tank from compressed air inlet valve. This compressed air force liquid to pump at a higher level.

3) *Air Outlet:*

While liquid is being fed to main tank air present in the tank is out from air outlet valve.

4) *Outlet:*

liquid outlet valve is non return valve. Compressed air pressurizes liquid to pump at a high level through this liquid outlet.

## IV. PLC SPECIFICATIONS

GE – FANUC 14 PNT MICRO PLC

<b>Weight</b>	<b>300 grams</b>
<b>Module Dimensions</b>	Height: 97 mm
	Depth: 58 mm
	Width: 118 mm
<b>Typical</b>	7.5 ms/K of logic

scan rate	
Real time clock accuracy	+/- 0.5 %
Inputs	Eight 24 VDC positive/negative logic input circuits.
Outputs	Six normally open 2 A relay circuits.
High speed counters	Up to four Type A or one Type A and one Type B
Output Power supplies	24 VDC for input circuits

Table 1:

#### V. PROCESS DIAGRAM

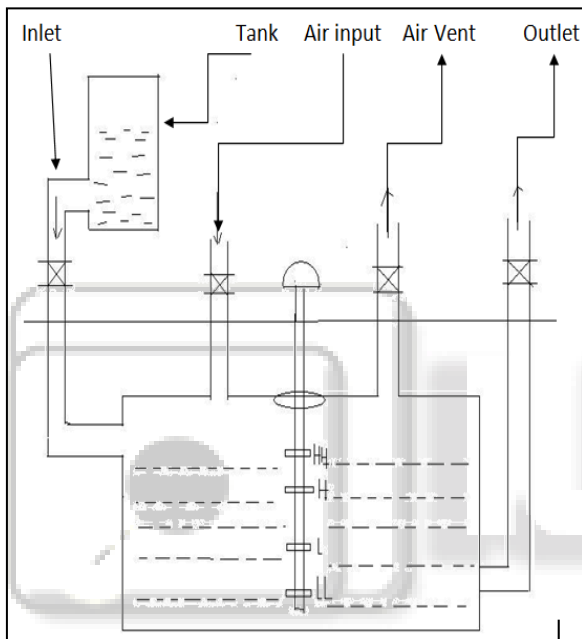


Fig. 2: Process Diagram

#### VI. PANEL SPECIFICATIONS

- 1) Vent open
- 2) Inlet open
- 3) Outlet open
- 4) Air pressure open
- 5) Water supply open
- 6) Hooter On
- 7) High-high level
- 8) High level
- 9) Medium level
- 10) Low-low level
- 11) Low level

#### VII. PROCESS

Viscosity of the sugarcane syrup is quite large and it solidifies as it cools. This is the main problem in sugarcane industries. Hence it is required to provide a pumping system which can pump sugarcane syrup at desired head, within specific period (before syrup get solidify), automatic, with less maintenance.

Old conventional system with centrifugal pumps creates lot many problems such as noisy operation,

maintenance cost is quite high, space required is large, it get stuck in its rotating parts and get solidify so frequent maintenance is required.

Best solution for above problem is 'Pneumatic Pumping System'. With pneumatic pumping system we can pump sugarcane syrup at desired head and within specific time. It is automatic, maintenance free and compact system.

#### VIII. OPERATION

Firstly sugarcane syrup from processing is being fed to the main tank from sugar inlet valve. At this time syrup outlet valve and compressed air inlet valve are closed, Air outlet valve is open. As the level in the tank increases the level magnetic level sensors actuates as per the level of sugar syrup in the tank and gives signals to the PLC. When level sensors gives high level signal to the PLC, syrup inlet valve close as well as it will close air outlet valve. Then syrup outlet valve is open and compressed air inlet valve opens. It fed compressed air in the tank and pressurizes the sugarcane syrup to pump at higher levels. As the syrup level decreases in tank, level sensors gives indications according to the syrup level in the tank. As level sensors gives low level indication to PLC it will close compressed air inlet valve. Then it will close syrup outlet valve. Then cycle repeats again and again.

#### IX. CONCLUSION

In this paper, a system has been successfully designed that should prove very useful in the field of technology. Based on actual tests and evaluations, we believe the use automation of pumping system (using pneumatic pumping system) is very efficient way to operate pumps in industries where requirement of high protection rate with high quality is essential. This results in system which is synchronized to perform sequential operations.

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