# Separation and Packaging Of Acidic And Basic Solution

## Automation and Drives

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*Abstract* — *Automation is the use of control system (such as numerical control, programmable logic control, and other industrial control systems), in contact with other applications of information technology to control industrial machinery and processes, reducing the need for human intervention. Whereas mechanization provides human operators with machinery to assist them with the physical requirements of work, automation greatly reduces the need for human sensory and mental requirements as well. Processes and system can also be automated. Automation is a discipline that has been into existence for the past ten to fifteen years. And this is the field that has been continuously explored by the experts for the betterment and ease of engineering industry. The title of our Research is "Separation and Packaging of Acidic and Basic Solution". This is the Research that we are doing under our esteemed faculty Mr. Dipesh shah. They were the source of guiding factor behind this Research. The automation of this Research is done using a PLC and the representation of the graphic user interface (GUI) might be done using SCADA.*

*Index Terms*—**Automation , Drives , PLC , Motors , PH Meter**

## I. INTRODUCTION

Automation is the use of control systems to reduce the need for human work in the production of goods and services. In the scope of industrialization, automation is a step beyond mechanization. Whereas mechanization provided human operators with machinery to assist them with the muscular requirements of work, automation greatly decreases the need for human sensory and mental requirements as well. Automation plays an increasingly important role in the world economy and in daily experience.

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In Industries, nowadays there is a trend of using automated machines and other equipment. Use of this machinery provides better accuracy, maintains good quality of product outcome, and reduces human effort.

Also cost of those machinery are high but as a long term installation, they are found to be less costly than labour.

In our Research, handling of various acids and base takes place. It might be danger for a person working over there. So we are trying to automate our process. It will reduce human effort as well as reduce contact of such persons with an acid and base.

### A. Problem Summery

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### B. What is Batching Process?

Batch processing is execution of a series of programs ("jobs") on a computer without manual intervention. Jobs are set up so they can be run to completion without manual intervention, so all input data are preselected through scripts, command-line parameters, or job control language. This is in contrast to "online" or interactive programs which prompt the user for such input. A program takes a set of data files as input, processes the data, and produces a set of output data files. This operating environment is termed as "batch processing" because the input data are collected into batches of files and are processed in batches by the program.

### C. Advatages

(1) It can shift the time of job processing to when the computing resources are less busy.
(2) It avoids idling the computing resources with minute-by-minute manual intervention and supervision.
(3) By keeping high overall rate of utilization, it better amortizes the cost of a computer, especially an expensive one.
(4) It allows the system to use different priorities for batch and interactive work.

## II. SYSTEM MODEL

### A. Basic Principle

Principle of our research is to separate the two solutions on the basis of "pH value".

The basic principle of the pH meter is to measure the concentration of hydrogen ions. Acids dissolve in water forming positively charged hydrogen ions (H+). The greater this concentration of hydrogen ions, the stronger the acid is. Similarly alkalis or bases dissolve in water forming negatively charged hydrogen ions (OH-). The stronger a base is the higher the concentration of negatively charged hydrogen ions there are. The amount of these hydrogen ions present solution is dissolved in some amount of water determines the pH.

A pH value of 7 indicates a neutral solution. Pure water should have a pH value of 7. Now pH values less than 7 indicate an acidic solution while a pH value greater than 7 will indicate an alkaline solution. A solution with pH value of 1 is highly acidic and a solution of pH value of 14 is highly alkaline. Both of these types of solutions can cause serious burns if they come in contact with skin.
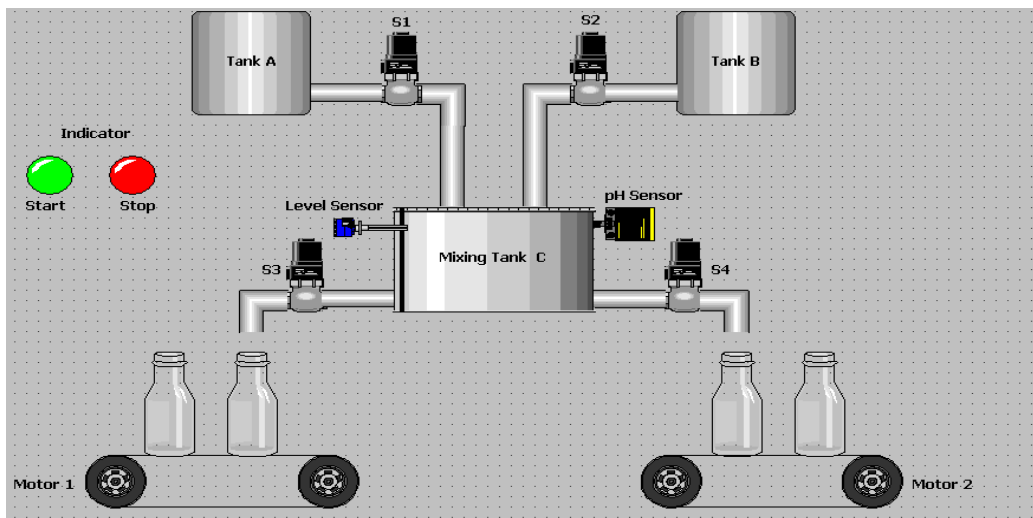
### B. Block Diagram



Figure 2.1 Block Diagram

### C. Working

Two different solutions will be placed in two different tanks. Mixing of those two solutions will be controlled by solenoid valves. Solenoid valve will react i.e. open/close , according to the timing stored in PLC.

PLC will control the whole automation of the research.

Tank A and Tank B contains two solutions. Mixing of this solution will be carried out in Tank C. In Tank C measuring of pH value and level of the liquid will be done.

Solution will flow from both tanks till the level/limit switch is activated. As soon as the activation of limit switch takes place, solenoid valves S1 and S2 will be closed and then sensing of pH takes place.

After the value is decided, then it will show that the solution is acidic or basic. If the solution will be acidic then solenoid valve S3 will be activated. And if the solution will be basic then solenoid valve S4 will be activated. Thus packaging of those solutions will be carried out through containers and conveyer mechanism.

Conveyer mechanism will work on DC Motor and filling of containers will be done through sensors. According to sensor the mechanism will work and also solenoid valve S3 and S4.

Also on-line monitoring will be done through SCADA software.

## III. HARDWARE DESCRIPTION

The main components of our research are:
1. PLC- Allen Bradley Micrologix 1000
2. Solenoid Valve
3. DC motor
4. Proximity Sensor
5. Limit Switch
6. SCADA Software

*A. PLC- Allen Bradley Micrologix 1000 Specification*



Figure 3.8 Allen Bradley Micrologix 1000

| Output | O | 0 | 8 |
|---|---|---|---|
| Input | I | 1 | 16/32 |
| Status | S | 2 | Status Files |
| Binary | B | 3 | B2:0 to B2;255 |
| Timer | T | 4 | T4:0 to  T4;255 |
| Counters | C | 5 | C5:0 to  C5;255 |
| Control | C | 6 | R6:0 to R6;255 |
| Integer | N | 7 | N7:0 to N7;255 |
| Floating | F | 8 | F8:0 to F8;255 |

| SCAN TIME | 10 MILLISECOND |
|---|---|
| Software | Rs Logix 500 |
| Driver | RsLinx |
| Communication | RS-232 |
| Supply | 230 Vac |
| I/O Module | 1 Module with power supply and cpu |
| Total Instruction | 128 |
| Total Ladder | 225 with subroutine and sub ladder |

Table 3.1 Specification of Micrologix 1000 Reference[2]

*B. Solenoid Valve*

A Solenoid valve is an electromechanically operated valve. The valve is controlled by an electri current through a solenoid: in the case of a two-port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports. Multiple solenoid valves can be placed together on a manifold. Reference[1]



Figure 3.9 Solenpod Valve

Solenoid valves are the most frequently used control elements in fluidics. Their tasks are to shut off, release, dose, distribute or mix fluids. They are found in many application areas. Solenoids offer fast and safe switching, high reliability, long service life, good medium compatibility of the materials used, low control power and compact design.

| Working Voltage | DC 12V |
|---|---|
| Maximum Current | 450 Ma |
| Operation mode | Normally-Closed (Valve opens when energized) |
| Inlet/Outlet Ports | External-diameter 3/4"(19mm) |
| Weight | 103 g |
| Valve Response Time | Fast Acting |
| Temperature Limitation | Maximum- Fluid Temprature 120°C |

Table 3.2 Specification of Solenoid Valve

*C. DC Motor*
Repeated scanning of the display is must for continuous vision, so this task is achieved by using circular rotation of the DC Motor along with whole circuit assembly. So, we used a DC motor as the prime mover



Figure 3.10 DC Motor

A DC motor is an electric motor that runs on direct current (DC) electricity. DC motors were used to run machinery, often eliminating the need for a local steam engine or internal combustion engine. DC motors can operate directly from rechargeable batteries, providing the motive power for the first electric vehicles. Today DC motors are still found in applications as small as toys and disk drives, or in large sizes to operate steel rolling mills and paper machines. Modern DC motors are nearly always operated in conjunction with power electronic device.

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion. Reference[1]

*D. Proximity Sensor*
Capacitive proximity sensors are similar to inductive proximity sensors. The main difference between the two types is that capacitive proximity sensors produce an electrostatic field instead of an electromagnetic field. Capacitive proximity switches will sense metal as well as nonmetallic materials such as paper, glass, liquids and cloth.
Proximity sensors can have a high reliability and long functional life because of the absence of mechanical parts and lack of physical contact between sensor and the sensed object.

Figure 3.11 Proximity Sensor

| Sensor Type | Capasitive |
|---|---|
| Sensityvity | Adjustable |
| Supply Voltage | 20-250V AC, 50-60Hz C/DC |
| Current Consuption | ≤2.5 mA max @240V AC |

Table 3.3 Specification of Proximity Sensor

*E. Limit Switch*

A Limit Switch regulates the operations of machines that are equipped with moving parts connected to a switching action mechanism. A wide range of industrial machinery uses limit switches to control the movement of devices performing on a production line, but these switches are also found in non-industrial applications, such as electric motor operation and garage door opener units.



Figure 3.12 Limit Switch

The limit switch triggers are very sensitive, and can be effected by induced electrical signals in the wires alone.

## IV. TROUBLE SHOOTING

*1. PLC MANUAL TESTING*
  1. Check the entire AC isolation switch with main AC supply switch
  2. Check all the phase and neutral of power supply

*2. DC motor is not rotating.*
  1. Check the current flowing through the motor. If it reaches above 750mA, then the motor is short, Replace it.
  2. In case of jamming, try to grease the bearing and shaft.

*3. PH Meter*
  1. Use fresh (< 1 week), room temperature buffers. They are stored in the refrigerator and Should be taken out in time to reach room temperature. The pH meter does display temperature, which should be taken into account when using the buffers.
  2. The buffers should be stirred using a stir plate and magnetic stirrer while they are being measured for calibration.

## V. FUTURE SCOPE AND APPLICATIONS

1. Chemical industry
2. Pesticides
3. Pharmaceutical

4. Food / Beverages

## VI. CONCLUSION

We conclude from our research with the help of PLC and SCADA will help an individual to get the objective easily and rapidly saving time consumption and increasing the production.

We also conclude from this research that the automation system is inevitable in every type of industry and should be established for the decrement of human resources and labor thereby is cost-effective.

Through this research, we became familiar with the use of the PLC and its programming as per the requirement and how it is very important to develop and automation system in any industry. The automation processes going on in the industry can be easily monitored and supervised with the help of SCADA.

## VII. ACKNOWLEDGEMENT

## VIII. REFERENCES

[1] Programmable Logic Controllers , 5th Edition by Ronald.A reis and john w. webb publition 2009 , phi publication
[2] Allen Bradley-Training Manual for Software RSLogix 500 by allen Bradley