

# A Review Approach on Manual Fixture Automation Using PLC

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**Abstract:** — a fixture is a mechanical setup that holds a job so that it will aid the industrial processes carried out on it with ease, in terms of accessibility and reach. The processes may include manipulation of a job like rotation, clamping, de-clamping and positioning. Fixtures can be handled manually to hold a job. But such manual process becomes tedious in complex processes which causes human fatigue as well as it is time consuming. Hence PLC (Programmable Logic controller) can be used to automate the industrial fixture, to reduce the complexity of the process. In our project we are trying to construct a PLC based control system to simulate the automation of an industrial fixture and analyzed it for safety and increase productivity which will be beneficial for manufacture industry.

**Key Words:** FRL Unit, Inductive Proximity Sensors, Ladder Logic, Miniature Circuit Breaker or MCB, Pneumatic Cylinders, Programmable logic controller, Reed Switches, Relays, Rslogix5000, Solenoid valves.

## I. INTRODUCTION

The automotive industry has pioneered the large scale use of robots. Long production runs of identical car bodies were the ideal field of application for early industrial robots, and spot welding lines with hundreds of robots have become a familiar sight. However, a lot of the production equipment is still based on hard automation, today's market is increasingly putting automobile manufactures under pressure to offer customers more choice of products within less time and variants with decreasing life cycle, while at the same time demanding lower production costs.

To respond to these increasing demands it is necessary to make the automotive body assembly without even stopping the production, making more and more units per day to increase the productivity. This can be achieved with replacing the present manual operated machine with the automated machine. Automating the machine will give the standardization, high accuracy of the job and will remove the faults. The machines again achieve their high flexibility through a rigorous utilization of robot technology, not only for handling and welding with robots but also for clamping and fixture systems.

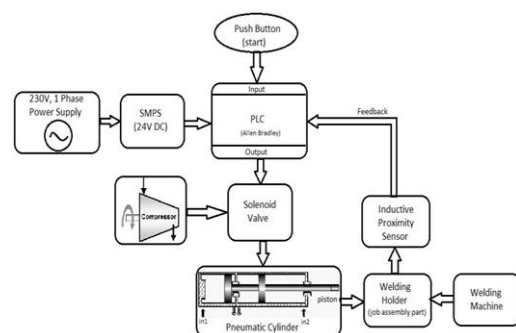
## II. SYSTEM DEVELOPMENT

The term automation, is inspired by the earlier word automatic (came from automation).

Automation or automatic control, is the use of various control system for operating equipment such as machinery, processes in factories, boilers and heat treating ovens, switching on telephone networks, steering and stabilization of ships, aircraft and other applications with minimal or reduced human intervention. Some processes have been completely automated.

The biggest benefit of automation is that it saves labor; however, it is also used to save energy and materials and to improve quality, accuracy and precision. Automation has been achieved by various means including mechanical, hydraulic, pneumatic, electrical, electronic devices and computers, usually in combination.

### 2.1. Block Diagram



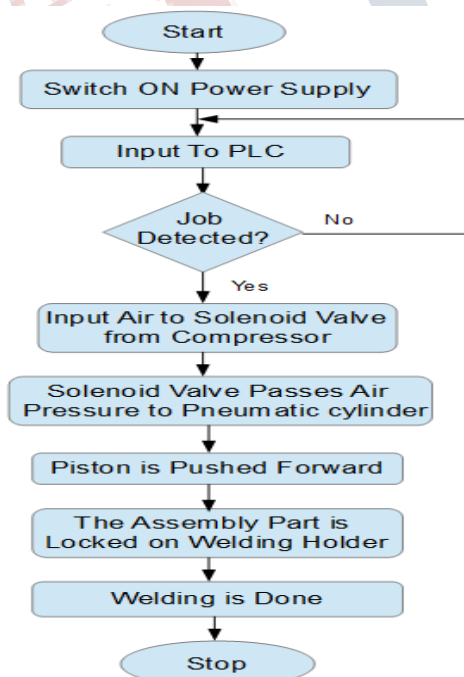
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Any industry has a power supply of 230VAC/1 $\phi$  available for fixtures but PLC requires a 24V DC input supply. Hence for this purpose SMPS is used to convert the AC power to DC.

A push button is used as input to PLC which turns on PLC on a single push. As soon as the PLC is turn on it starts executing the program which is there in its memory. Another input to PLC is feedback from Inductive Proximity Sensor which senses if the part of job is placed on the welding holder arm or not. If the job is detected, input command is given accordingly and output from PLC is generated and given to Solenoid Valve. A solenoid valve gets open and allows the air from Compressor to pass through. The pressure of compressed air gives a forward stroke to Piston in Pneumatic Cylinder. This pushes the welding holder and locks the part tightly on it, the process is known as Clamping. Once a part is perfectly clamped, a spot welding is done by welding gun (either manually or automatically).

After welding, an exactly reverse process of unlocking the part out of welding holder, called as De-clamping is done by moving the Piston in reverse direction by giving it a backward stroke by allowing air to pass through another port.

### 2.2 Flowchart



### 2.3. Major Blocks of System

#### 2.3.1. Programmable Logic Controller

A programmable logic controller, PLC, or programmable controller is a digital computer used for automation of typically industrial electromechanical processes, such as control of machinery on factory assembly lines, amusement rides, or light fixtures. PLC's are used in many machines, in many industries. The program is written on a computer and is downloaded to the PLC via cable. These loaded programs are stored in non-volatile memory of the PLC. During the transition of the relay control panel to PLC, the hard wired relay logic was exchanged for the program fed by the user. A visual programming language known as the Ladder Logic was created to program the PLC. The PLC which we are using in the system is Allen Bradley.

#### 2.3.2. Solenoid Valve

A solenoid valve is an electromechanically operated valve. The valve is controlled by an electric current through a solenoid. 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.

#### 2.3.3 Pneumatic Cylinder

Pneumatic cylinder (air cylinders) are mechanical device which use the power of compressed gas to produce a force in a reciprocating linear motion.

Air from Compressor forces a piston to move in the desired direction. The piston is a disc or cylinder, and the piston rod transfers the force it develops to the object to be moved. We have selected pneumatics because they are quieter, cleaner, and do not require large amounts of space for fluid storage. Also operating fluid is a gas, leakage from a pneumatic cylinder will not drip out and contaminate the surroundings, making pneumatics more desirable where cleanliness is a requirement.

There are 3 types of pneumatic cylinders:

- Single-acting
- Double-acting (used in project)
- Multistage, Telescoping

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### 2.3.4 Reed Switches

The reed switch is an electrical switch operated by an applied magnetic field. These are used as sensor to sense the position of Piston inside the cylinder and send the signal to PLC when to send clamp or declamp instruction. The contacts may be normally open, closing when a magnetic field is present, or normally closed and opening when a magnetic field is applied. The switch may be actuated by a coil, making a reed relay. or by bringing a magnet near to the switch. Once the magnet is pulled away from the switch, the reed switch will go back to its original position.

### 2.3.5 Inductive Proximity Sensor

An inductive proximity sensor is a type of non- contact electronic proximity sensor that is used to detect the position of metal objects. An inductive proximity sensor measures the absence or presence of a target. It has an induction loop. Electric current generates a magnetic field. The inductance of the loop changes when any metal material comes in its field and since metals are much more effective inductors than other materials the presence of metal increases the current flowing through the loop. This change can be detected by sensing circuitry, which can signal to some other device whenever metal is detected.

When a job is sensed by sensor, output is given to PLC as a feedback.

### III.ADVANTAGES

- Makes working faster hence less time consume
- Increases No. of units produced per day
- Decreases Operator's Fatigue
- Efficient
- Decreasing life cycle of making process
- Standardization of machine
- High accuracy of the job and perfection of spot shape

### IV.APPLICATIONS

Fixture automation is useful in many industries to replace the manually operated system such as-

- Bottle filling station
- Simple manipulator fixture
- Hydraulic clamping and de-clamping fixture

### V. FUTURE SCOPE

- Automate the Placing of parts and taking off the job assembly.
- System may include robotic fixture
- Modify a system to invert a part i.e. rotation up to certain angle
- Robots or conveyors to move the assembled job.
- Reduce the cycle time further for each job.

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