



Design and Fabrication of Bottom Fixture in Robot Soldering Machine

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ABSTRACT

The main purpose of this project is to design and manufacture of bottom fixture in Robo Soldering machine and inspect it with the image of the PCB captured through Vision Based system. Power supply has to be turned on to peripheral devices of the machine before turning on main supply. Status of DIO (Direct Input Output) power supply and field bus connection is diagnosed at the initialization process. When the product is kept on the table and if there is no power supply detected then there will be a alarm. The process mainly takes place with the help of PLC and Lab VIEW interfacing. VCC (Verify C-Compiler) program software is used .lab VIEW programming for automation purpose and process repetition and this acts as master and PLC as slave. The communication cable that is used is RS232. When the component is first placed on the fixture table, a sensor gives the feedback to the controller. The 4 digit, 7- segment LED display shows the controller status. An image of the board before soldering is captured. Create a position table and a program using the SEL (Services for Export and Language) programming language. Now according to the programming fed, the Robot takes the solder material and feed it on the points where the soldering has to be done on the PCB board based on X/Y/Z coordinate axes. After the soldering is done, an image is captured. If the soldering is done well with the appropriate feed on all pins then we get the inspection result as "Good" else the result will be "No Good". If the result is "Good" then it can be taken to the next level else the same procedure has to be repeated. The main advantage of this vision based inspection is that

it gives the details of even the person who did the process, in case if there is any issue regarding that product. This can be designed in such a way to be used for other applications also.

INTRODUCTION

Automation or Automatic control is the use of various control systems for operating equipment such as machinery, processes in factories, boilers and heat treating ovens, switching in telephone networks, steering and stabilization of ships, aircraft and other applications with minimal or reduced human interventions. 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. The term automation, inspired by the earlier word automatic (coming from automaton), was not widely used before 1947, when General Motors established the automation department. It was during this time that industry was rapidly adopting feedback controllers, which were introduced in 1930s. Automation has been achieved by various means including mechanical, hydraulic, pneumatic, electrical and electronic and computers, usually in combination. Complicated systems, modern factories, airplanes and ships typically use all these combined techniques.

LabVIEW (Laboratory Virtual Instrument Engineering Workbench) is a system design platform and development environment for a visual programming. National Instruments hardware and software connect your computer to the application to

offer the widest range of solutions for practically any measurement or automation application. PC based Machine vision system have the flexibility to address the needs of research, test and measurement, and industrial automation vision applications. With this application, any specification can be easily adjusted than with traditional tools. Machine vision system mainly needs camera to acquire the image.

The objective of the project is to develop a machine for automatic soldering of PCB (Printed Circuit Board) that is used in DIDs (Driver Information Display) with required amount of solder metal and to inspect it through Machine Vision system. The system has to integrate mechanical and electronics for a coordinated approach towards making the soldering process automatic. For the soldering to be done without any excess or poor flow, without any formation of solder balls and also without any overlap of solder metal. This design is developed using standard mechanical design methods of all components. The design is calculated to be safe and accurate.

The objective of this project work has been framed and the chapters required for the process development of the Automatic Robot Soldering machine and Vision Based Inspection has been organized. The photographs of the project are included in appendix. The work from the scratch i.e., selection of materials to the fabrication and completion of the project

PROBLEM IDENTIFICATION

In the robot soldering machine to develop a machine for automatic soldering of PCB (Printed Circuit Board) in the machine there is no proper fixture to hold the PCB in the robot soldering machine. Where there is a poor flow of soldering while the PCB and connector is soldering. The fixture is not available for the all dimensions of various PCB in the robot soldering machine. The fixture is arranged and it is designed for various dimensions of PCB and then the soldering to be done without any excess or poor flow, without any formation of solder balls and also without any overlap of solder metal. This design is developed using standard mechanical design methods of all components. The design is calculated to be safe and accurate.

1. DESIGN

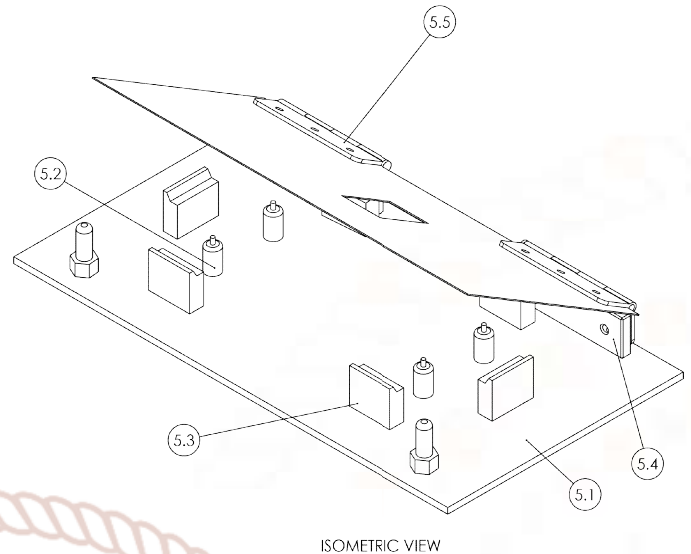
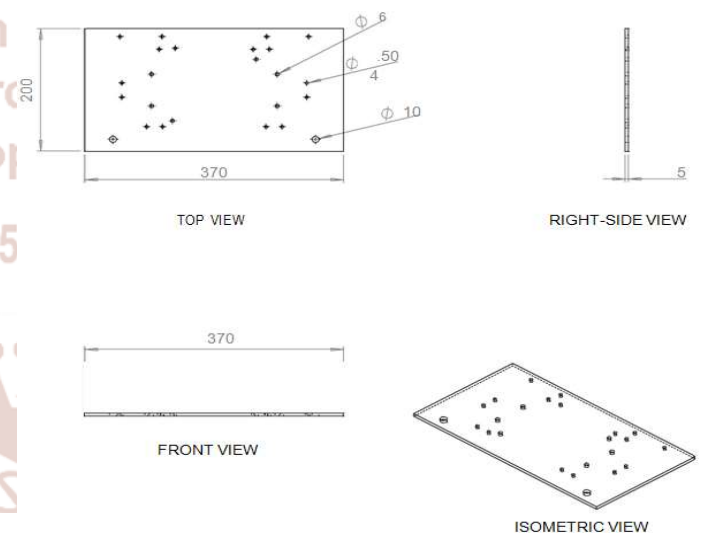


Fig 1: Isometric view of overall design

DETAILED DRAWING OF COMPONENTS

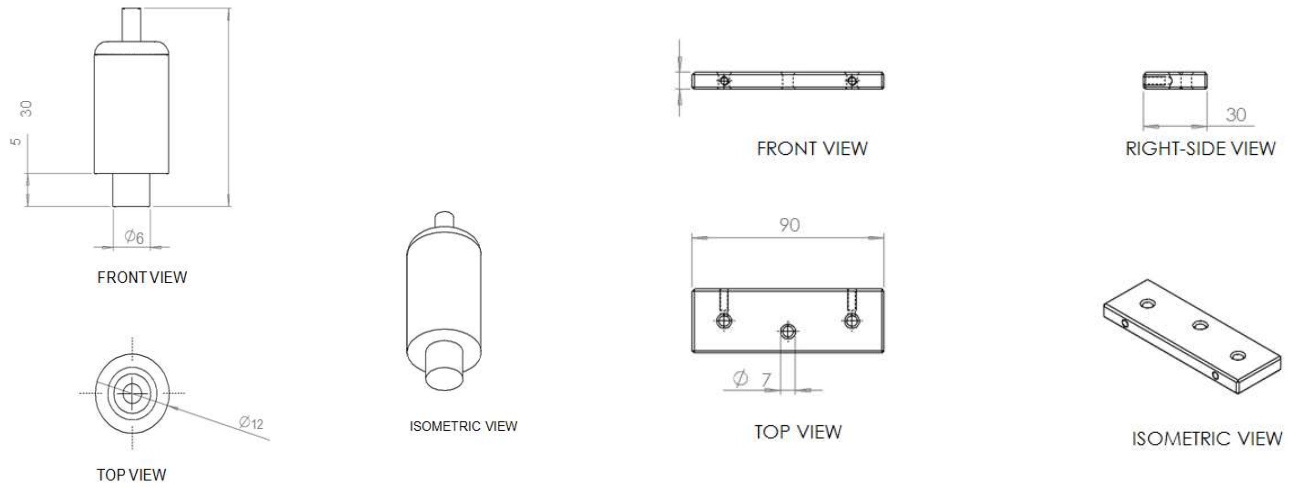
Fixture base plate:

The frame is the structural portion which the machine above the table and support it.



Push rod:

The Push rod is placed above the fixture base plate. The push rod is used to support the PCB while the soldering process takes in the printer circuit board. The robo soldering machine is applied the soldering paste to the PCB with connectors the board will act deform and it may causes damage in the PCB so the push rod is used to support the PCB in the fixture.

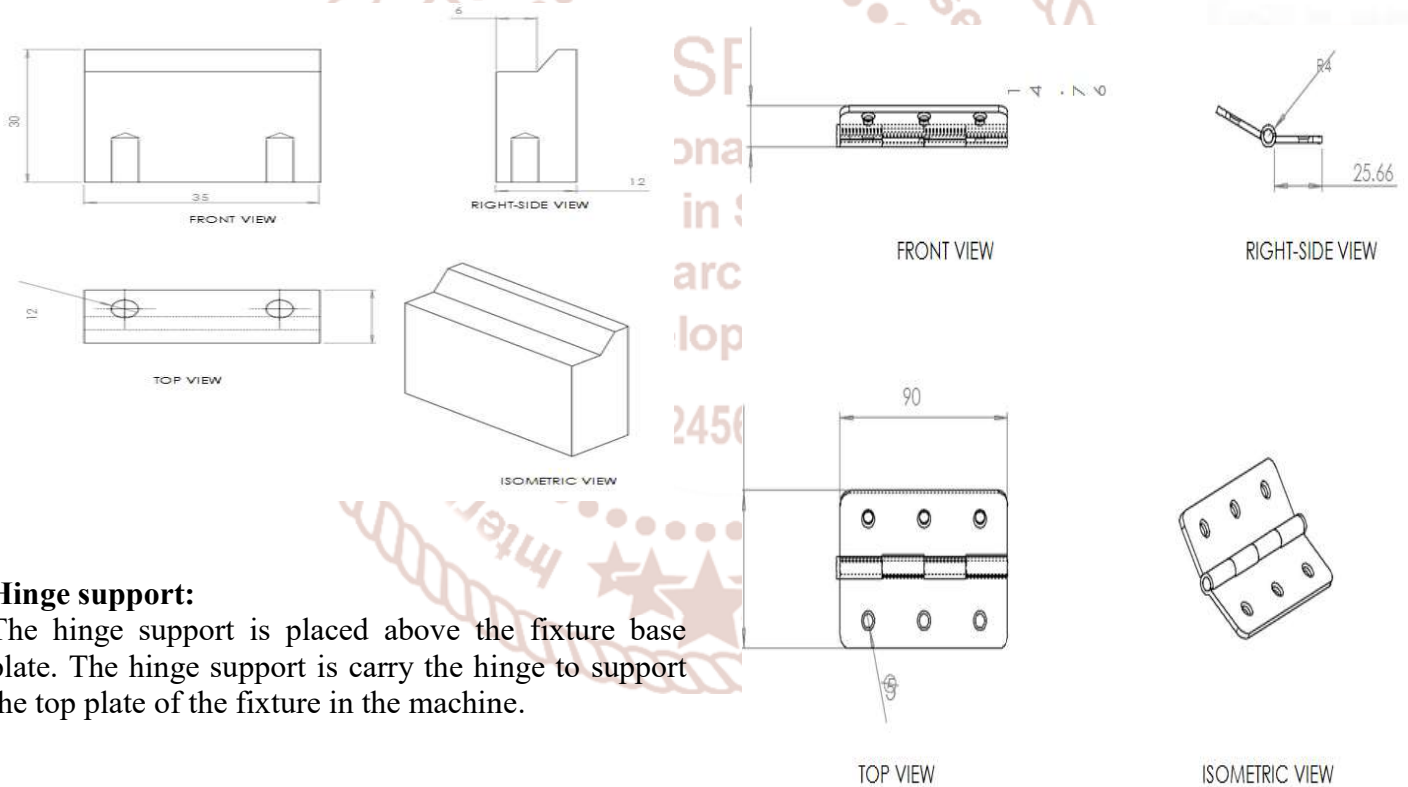


PCB Side Support:

The PCB side support is placed above the fixture base plate. The side support is used to carry the PCB in the fixture plate for the soldering process of connector and printer circuit board.

Hinge:

The hinge is placed with the hinge support in the machine. The hinge is fixed with the top plate of fixture and hinge support for the opening and closing of top plate of fixture.



Hinge support:

The hinge support is placed above the fixture base plate. The hinge support is carry the hinge to support the top plate of the fixture in the machine.

OPERATION

The Printer Circuit Board is placed on the fixture. The fixture is arranged and it is designed to hold the Printer Circuit Board in the robo soldering machine. The top plate of the fixture is closed after the board is placed in the fixture. Then the soldering machine is ON and the base plate of fixture is moved to the machine for soldering work. The robo is started to

soldering the printer circuit board with connector and LED. After completing the soldering work in the machining process the base plate of the fixture is moved out to the original position then the top plate of fixture is open and the solder printer circuit board with connectors and LED is removed from the fixture.

ADVANTAGE

- It reduces labour power
- Required less time
- Eye protection due to automation.
- It protects PCB board during soldering process.
- Joint soldering should be avoided.
- More accuracy compare to manual

CONCLUSION

Thus the simultaneous soldering of the accurate position where the soldering has to be done proves not only efficient but also ensures accurate and also customer's requirement can be met easily. Accuracy mainly comes from the inspection that is done after the soldering. Thus the objective of the project to develop an bottom fixture to hold the PCB in Robo Soldering machine is achieved.

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