PRIMARY DEVELOPER: Glenn Wisniewski – HFC Industrial Trainer
Wes Bye – Mechatronics SME

Mechapracticum Outline

Capstone Project: Troubleshooting

Topic: Capstone Project-Troubleshooting

Estimated completion time: 120 hours.

Purpose:

This Mechapracticum is intended to enable the participant to demonstrate hands-on proficiency, using the training gained in this course of study, to safely implement a typical automation application, described in this document, that the Mechatronic Technician would expect to encounter in nearly any manufacturing facility.

Instructional Outcomes:

The participant will demonstrate the abilities to:

- Recognize situations, conditions, practices or material uses that may present actual or potential damage or injury to personnel, equipment, property, or the environment, and to act to communicate and resolve any unsafe condition or circumstance before proceeding.
- Design and draw electrical and pneumatic schematic diagrams that address the needs of a specific application.
- Design an electrical interface to connect a linear motion potentiometer to an analog input on a programmable logic controller.
- Design a mechanical detail or details to complete an automated mechanical device.
- Machine or fabricate a mechanical detail in order to complete an automated mechanical system.
- Design a ladder logic program to direct the operation of an automated mechanical system.
- Assemble mechanical, electrical and pneumatic details and components to create an automated mechanical system.
- Layout, drill, taps, assemble and wire an electrical control panel, terminal box and operator pushbutton station.
- Interconnect the various electrical devices on an automated mechanical system to the electrical control panel.

Mechapracticum Outline

Capstone Project: Troubleshooting

- Perform initial electrical and pneumatic power application to an automated mechanical system, verifying proper power consumption and correct interconnections of electrical and pneumatic devices and presetting actuators at an initial safe speed.
- Access programming software on a computer, establish communications between the computer and the programmable logic controller, and download the ladder logic program from the computer to the controller.
- Methodically verify that the program satisfies the needs of the automated mechanical system, editing the ladder logic program as needed.
- Accurately document and annotate the elements and logic flow of the ladder logic program.
- Troubleshoot introduced faults in the ladder logic program or on the automated mechanical system.
- Establish Ethernet communications between the controller and a central control system.
- Design, program and troubleshoot product flow and status reporting on a network.
- Reporting/Documentation…
- Perform orderly decommissioning/disassembly and disposition of reusable machine components and the disposal or recycling of obsolete or consumable material.

Instructions to Participants

1) By physical examination of an operating machine, and through operation of the manual controls, a sequence diagram will be developed [for each station(s)] which will indicate: each step in the sequence following a cycle start, the duration of the step, the output actuator controlling the action and the probable triggers for that step. Note: there will be two sequence diagrams for the AMTEC simulator to allow for the robot to be activated or bypassed.

2) By examination of the working drawings, assign and verify (on the integrated system) the PLC inputs and outputs associated with each input and output referenced in the sequence diagram. This information is to be added to the Sequence diagram generated in objective 1.

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Capstone Project: Troubleshooting

3) By evaluation of the PLC logic, verify the triggers recorded in the sequence diagram above. (Finalize the sequence diagram.)

4) By physical evaluation of the integrated system and the PLC logic, identify all permissives (signals or states) necessary to place the integrated system into automatic mode (awaiting cycle start). These will be noted on the bottom of the Sequence diagram.

5) Develop a flow chart on how to troubleshoot the integrated system without access to the PLC logic. Assuming that the machine was running and fault just occurred. Utilizes the sequence chart developed above.

6) Develop a flow chart on how to troubleshoot the integrated system with access to the PLC logic. Assuming that the machine was running and a fault just occurred. Utilizes the sequence chart developed above.

7) Develop a flow chart on how to trouble shoot the integrated system if it cannot be started at the beginning of a shift. (Assuming that work was performed on the system over the weekend.)

8) Given that the PLC logic is not available, identify a faulted component, wire, module, etc. when given an operator complaint. Manual operation can be attempted and common test equipment is available for use... (This assumes that the equipment was running production and just stopped operating.) Working Drawings are to be used along with any Fault messages available.

9) Given that the PLC logic is available, identify a faulted component, wire, module, etc. when given an operator complaint. Manual operation can be attempted and common test equipment is available for use… (This assumes that the equipment was running production and just stopped operating.) Working Drawings are to be used along with any Fault messages available.

Mechapracticum Outline

Capstone Project: Troubleshooting

10) Given that the PLC logic is not available, identify a faulted component, wire, module, etc. when given an operator complaint. Manual operation can be attempted and common test equipment is available for use... (This assumes that the equipment was running production and just stopped operating.) Working Drawings are to be used along with any Fault messages available.

11) Given that the PLC logic is available, identify a faulted component, wire, module, etc. when given an operator complaint. Manual operation can be attempted and common test equipment is available for use… (This assumes that the equipment was running production and just stopped operating.) Working Drawings are to be used along with any Fault messages available.

12) Given an operator complaint that the integrated system will not start in automatic, after week end maintenance, troubleshoot and repair the system and return to full automatic operation. This is to be completed under two scenarios, with and without access to the PLC logic.

13) Demonstrate proficiency in editing the Robot path and modification of the Robot program to include…. As specified by the instructor.

Instructions to Evaluator:

Training on systems troubleshooting is included in this section of the program. We will review some of the Basic principles covered in the first troubleshooting course 3 years ago. After completing the subsequent courses, the student is now prepared to utilize all the tools and skills needed to efficiently troubleshoot an integrated system.

Tools and Equipment-TBD

Rubric:-TBD

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