K-11b

ELECTRICIAN TRAINING

SKILL DEVELOPMENT GUIDE

PLC (Modicon)
K-11b: Troubleshoot PLC-Controlled Machine
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Task Preview

Troubleshoot PLC-Controlled Machine

Learners must exercise extreme caution when troubleshooting a PLC-controlled machine. Modifying ladder logic incorrectly could result in unexpected movement of machinery or damage to a part.

The first step in troubleshooting is to talk with the Operator to determine where in the machine cycle the machine stopped. Learners must examine the machine to make sure there is no physical problem present such as a clamping problem, or an interference problem with an axis or part. The Learner must verify that the problem is not power-related or caused by a blown fuse. After this determination, he or she must use the online ladder file, Electrical Schematics, and Ladder Diagram printout for locating and monitoring inputs and outputs.

How your skills will be checked

The Skill Check will require you to (Task Statement). All tools, materials, and resources will be available. The Evaluator will verify that your demonstration meets the skill objective by observing or measuring each task standard. You must demonstrate safe work practices during the Skill Check. Contact your Evaluator whenever you are ready for the Skill Check.

Skill Objective

Upon receiving a request from an Operator, Electrical Technician, or Electrical Engineer to troubleshoot a PLC-controlled machine, troubleshoot the machine.

Task Standards

1. The problem device is identified.

2. The appropriate corrective actions are recommended.

What You Will Need

This section contains the safety information, tools, and resources you will need before troubleshoot PLC-controlled machine.

- Follow all Caterpillar Facility Safety Standards when performing this task in the plant.
- You will perform this task online. Perform the steps carefully; mistakes could result in injury to personnel or damage to the equipment.
- Visually check to ensure no physical problems are present before attempting to cycle the machine.
- Use caution when working around the PLC; high voltage is present on the inside of the PLC cabinet door and near the I/O chassis.
- Be careful when working near moving or rotating machinery.
- Wear safety glasses and hearing protection in assembly and production areas.

- PC equipped with PLC software
- Interconnect cable
- Basic electrical hand tools
- Voltmeter
- PLC location

- Electrical Schematics
- Ladder Diagram printout
- Diagnostic screens (Marquee, Display)
- Safe Job Procedures

Task Steps

Troubleshoot PLC-Controlled Machine

1. **Read the diagnostic display (if available) to see if the problem is identified.**

2. **Ask the Operator for information about where the machine stopped in the machine cycle.**

3. **Visually inspect the area where the problem occurred.**

   - In the event there is a physical problem with the machine, you do not want to activate an output, which could result in damage to the equipment or to a part. If the machine has stopped and no physical problem is present, you need to locate the output that will complete the machine cycle.

4. **Locate the output needed to complete the machine cycle.**

   - Ask the Operator for information about the next event in the machine cycle. Check the information against the Ladder Diagram to ensure that it is correct. If you know what the next event is, use the Electrical Schematics to locate the output number.

5. **Check the output module's power and fuses.**

   - Locate the output module in the PLC cabinet.
   - Verify that the output module is on by checking the "active" indicator.
   - Verify that the fuse indicator (if present) is not illuminated. If it is illuminated, the fuse is blown. Replace the fuse. If the problem is not corrected, proceed to step 6.

6. **Go online.**

   - Connect the PC to the PLC communication port, using the interconnect cable.
   - Open the PLC software.
   - Press the <Online Program> function key.

WARNING! YOU ARE ONLINE. INCORRECT ACTIONS COULD RESULT IN DAMAGE TO EQUIPMENT OR INJURY TO PERSONNEL.

7. Monitor the ladder file.

- Using the arrow keys, select the PLC file to be monitored.
- The ladder file displays; the first rung of the ladder logic is displayed at the top of the screen.

8. Locate the network and rung number.

- Refer to the Cross Reference section of the Ladder Diagram printout for the network and rung number where the output is located.
- Use the online cross reference to be sure of the updated locations. Regenerate a cross reference, if necessary.

9. Using the PLC software, locate the rung number of the instruction you need to find.

- Use the arrow keys to move through the rungs of the ladder network; or type the network number on the command line and then press <Enter>.
- You can also use the <Search> function to locate an instruction.

10. Observe the rung for instructions that are not intensified.

- If the problem is an input addressed instruction, this could be the possible cause for the output not being energized. Determine if the input device or input card is faulty.
- If the problem is an input, go to the next step. If no problem exists with the input addressed instruction, look at the other addressed instructions.

11. Determine the type of input device and the device location.

- Refer to the Electrical Schematic for device type and location.

12. Check the voltage to the input device, using the VOM.

- If voltage is not present, a problem could exist with the device, machine, or wiring.

13. If the other addressed instructions are not intensified, search for their output instruction rung.

- Use the <Search> function to locate the coil number or refer to the Cross Reference section of the Ladder Diagram printout.

14. Repeat steps 8-13 until you identify the problem.

15. Exit the Modsoft software.

- Press the <ESC> key.
- Repeat until the software prompts you for a (Y / N). Do you want to exit?

16. Disconnect the PC from the PLC processor.

- Power down the PC.
- Remove the interconnect cable from the PLC communication port.

Concept Check

Troubleshoot PLC-Controlled Machine

Answer the following questions to check your understanding of troubleshooting a PLC-controlled machine. Circle the correct answer in each question. Then compare your responses with the answers at the bottom of this page. Some of the questions may have more than one correct answer. If you have difficulty answering a question, review the Skill Development Guide or ask your Trainer for assistance.

1. The first step when troubleshooting a PLC-controlled machine problem is to

    a. look at the Ladder Diagram printout to determine the location of the device.

    b. talk with the Operator to find out where in the machine cycle the machine stopped.

    c. observe the area around the machine where the problem occurred.

    d. monitor the ladder file.

2. If the problem is an input device (limit switch, proximity switch, etc.), the next step is to determine if the problem is with the input device or the input card.

    a. True

    b. False

3. Locate output coils using the

    a. Electrical Schematics.

    b. online ladder file.

    c. Cross Reference section of the Ladder Diagram printout.

    d. SEARCH function in the software.

4. After locating the output needed to complete the machine cycle,

   a. go online and monitor the program.

   b. locate the rung number where the output is located.

   c. locate the output in the Cross Reference section of the Ladder Diagram printout.

   d. verify that the Output Module is on and that the fuse is not blown.

Answers: (1. b 2. a 3. a, c, d 4. d)

Next Step

If you are ready to demonstrate the task now, ask your Evaluator or Trainer to schedule the Skill Check. However, if you need to practice some of the steps first, continue to the next section.

Practice

The following practice will help prepare you for the Skill Check. Ask your Trainer to set up the practice for you. After you complete a practice, ask your Trainer to check your work.

Practice 1

Your Trainer will point out an input device on a rung in the ladder file. Practice using the Ladder Diagram printout and Electrical Schematics to determine what the device is (limit switch, up counter, timer) and where the device is located.

Practice Objective 1

Using the Electrical Schematics and the Ladder Diagram printout, you should identify the device causing the problem.

Practice 2

Your Trainer will designate a PLC-controlled machine for you to troubleshoot. The Trainer will have set up a hardware or software (program) problem for the troubleshooting task. While your Trainer observes, demonstrate and explain the steps for locating and monitoring inputs and outputs. Identify the problem and recommend the corrective action(s).

Practice Objective 2

You should have identified the problem and recommended the appropriate corrective action(s).

Next Step

Continue to practice until you are ready for the Skill Check. When you are ready to demonstrate the task, ask your Evaluator or Trainer to schedule the Skill Check.