K-06b

ELECTRICIAN TRAINING

SKILL DEVELOPMENT GUIDE

DUTY K: PLC (Modicon)
K-06b: Troubleshoot I/O Module

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Task Preview

Troubleshoot I/O Module

At Caterpillar, some PLC problems are cued by a device that is not working correctly. Often the problem is with the input or output (I/O) module and not with the device. Troubleshooting the input or output module often eliminates potential problems within the system. The individual performing the task must exercise extreme caution when troubleshooting an I/O module. The machine must be in the manual mode and must have stopped before any troubleshooting takes place. Failure to stop the machine could result in unexpected movement of the machinery, which could cause injury to personnel or damage to a part.

How your skills will be checked

The Skill Check will require you to troubleshoot an I/O module. 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 notification of a machine device communication problem, troubleshoot the I/O module.

Task Standards

1. You identify the problem and suggest a corrective action.

2. Corrective action results in the machine performing according to specification.

What You Will Need

This section contains the safety information, tools, and resources you will need before troubleshooting an I/O module.

- Follow all Caterpillar Facility Safety Standards when performing this task in the plant.
- 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.
- Wear safety glasses and hearing protection in assembly and production areas.

- P190 programmer (Typically used with the 184, 384, 484, 584, 884, and 984 processors.)
- P230 programmer (Used with the 984 processor and the 184, 384, 484, 584, and 884 processors in the P190 emulator mode.)
- PLC communication cable
- Tape Loader Tape (P190 only)
- Program Loader Tape (P190 only)
- Modicon Bus Plus (Used with all processors.)
- Wiggy Voltage Tester

- Basic Help Keys, available on programmer software
- Modsoft Programmer User's Manual (GM-MSFT-001 Rev. F)
- Modicon P230 Quick Key reference card
- Ladder Diagram printout
- Modbus Plus Data Highway Chart
- Machine Print

Task Steps

Troubleshoot I/O Module

1. **Identify the problem device type.**

   - Determine if it is an output device or an input device. Examples of output devices include coils, starters, lights, and relays. Examples of input devices include push buttons, limit switches, and proximity switches.

2. **Stop the machine.**

WARNING: Before performing any troubleshooting, put the machine into manual mode and verify that the machine cannot move. Failure to stop the machine could result in unexpected movement of the machinery which could cause injury to personnel or damage to a part.

3. **Locate the device on the machine print.**

   - After determining whether the device is an input or an output device, locate the device on the machine print to determine the corresponding communication light on the input or output module.

4. **If the device is an output device, then proceed to the next step. If the device is an input device, then proceed to step 7.**

5. **Verify that the output module communication light is illuminated.**

   - If the light is illuminated, then check the voltage. Check the voltage on the corresponding terminal point and either the white neutral line or the ground wire.
   - If the voltage check results in no voltage, then you need to replace the output module.
   - If the voltage check on the output module reads 110v, then check the fuse. Read the wire number on the corresponding red wire from the output module. Follow the wire number and locate the corresponding fuse.

- To test the fuse, place one lead from the voltmeter to one end of the fuse and place the other lead to either the neutral white wire or a ground location. Repeat for the other side of the fuse.
- If the fuse fails to read voltage, then replace the fuse.
- If the fuse is good, then there may be a problem with the output device.

6. If the communication light is not illuminated on the output module, then enter the PLC Ladder Diagram from the programmer.

- Call up the coil that device is using. This is the location that you found in step 3.
- If the coil is turned on in the Ladder Diagram but the corresponding output light is not illuminated, you need to replace the output module.
- Replace the module and then verify that the device operates.

7. Verify that the input module light is illuminated.

- If the light is illuminated, then check the voltage on the corresponding red wire and either the white neutral line or the ground wire.
- If the light is illuminated on the input module and the voltage test verifies there is power coming to the unit, then enter the Ladder Diagram for this machine.
- Call up the input that the device is using. This is the location that you found in step 3.
- If the input device is not activated in the Ladder Diagram but the corresponding input light is illuminated, then you need to replace the input module.
- Replace the module and verify that the device operates correctly.

8. If the light is off, then use an assistant to manually operate the input device off and on.

- Watch the input module while the assistant operates the device to see if the light illuminates and extinguishes. If the light does not flash when the device is opened and closed, then the device may be faulty.
- If the light does flash when the device is opened and closed, then enter the Ladder Diagram for this machine.
- Activate the coil that the device is using. This is the location that you found in step 3.

- If the input is off in the Ladder Diagram but the corresponding input light is illuminated, then you need to replace the input module.
- Replace the module and verify the device operation.

9. If after replacing the input/output module with a known working module there is still a problem, then the problem may be due to a bad rack. Replace the rack and verify that the device is functioning. If you replace an I/O module and the rack, and the problem still exists, call an Engineer for assistance.

Concept Check

Troubleshoot I/O Module

Answer the following questions to check your understanding of troubleshooting an I/O module. 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. Typical output devices on a PLC include push buttons, limit switches, and proximity switches.

    a. True

    b. False

2. After determining whether a device is an input or an output device, you should locate the device on the

    a. Ladder printout.

    b. Ladder Diagram printout.

    c. Machine print.

    d. Modbus Plus Data Highway Chart.

3. When troubleshooting an output module, what should you do if the coil is activated in the Ladder Diagram but the corresponding output light is not illuminated?

    a. Replace the fuse.

    b. Deactivate the coil.

    c. Replace the output module.

    d. Replace the output device.

4. After replacing an I/O module with a known working module and there is still a problem, then to what might the problem be related?

    a. A bad rack

    b. Coil not activated

    c. No power supply

    d. A bad device

5. If the input device is not activated in the Ladder Diagram but the corresponding input module communication light is illuminated, then you should replace the input module.

    a. True

    b. False

Answers: (1. b 2. c 3. c 4. a 5. a)

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

Practice troubleshooting an output board that has failed. Your Trainer should set up this practice activity for you. Perform the troubleshooting steps for output modules and determine the cause for the output board failure.

Practice Objective 1

You should perform all of the troubleshooting steps, in sequence, and determine the cause for the output board failure. You should be able to determine that the output board has been deactivated in the Ladder Diagram.

Practice 2

Identify a device on a machine that your trainer has specified for your practice. Locate that device on the electrical print. Enter the Ladder Diagram for that machine. Practice turning specific devices off and on in the Ladder diagram. Observe the I/O module communication lights that correspond with that device. Be prepared to discuss safe work practices associated with troubleshooting an I/O module.

Practice Objective 2

You should be able to enter a network and force a device to turn on and off. With your Trainer's supervision, practice "forcing" an open coil closed and opening a closed coil. Point out the corresponding I/O board communication light as it opens and closes. You should discuss various safe work practices, including putting the machine in the manual mode and verifying that the machine has stopped before troubleshooting an I/O module.

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.