

Instructor Guide



401: Programmable Logic Controllers

Module 3: Troubleshooting I/O Devices and Controllers

Elevator – Escalator Programmable Logic Controllers

Instructor's Guide



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Summary.....

PREVIEW ONLY

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Icons Used In This Guide



REVIEW slides



INDIVIDUAL ACTIVITY



ASK



WRITE



CLASSROOM ACTIVITY



Multimedia



SMALL GROUP ACTIVITY



REFER participants to

Agenda

Topic #	Topic Title	Duration
1	Overview	20 Minutes
2	Preventative Maintenance	20 Minutes
3	Checking the CPU with LED Color Code	20 Minutes
4	Replace the CPU RAM-memory back-up Battery	20 Minutes
5	Checking the Input Modules of the PLC	20 Minutes
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8	Checking Communications Set Up	20 Minutes
9	Uploading and Loading an Existing Project	20 Minutes
10	Summary	20 Minutes
	Total Time:	200 Minutes

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Overview

Purpose The purpose of this module is to:
Provide the participant with a conceptual understanding of programmable logic controllers (PLC) for elevator and escalators.

Objectives

At the end of this lesson, the transit elevator/escalator trainee will be able to:

- Discuss safety and authority-specific procedures
- Discuss the safety integrity levels for control devices
- Describe ladder logic
- Identify the main components of a PLC
- Identify the principles of programming a PLC

Materials

Mandatory Make sure you have the following

- PowerPoint Presentation
- Lesson Plan
- Quizzes
- Pencils

Optional

You may also want the following for optional activities:

- Chalk board with chalk, large paper with marker, etc.
- Internet connection
- Lab, simulator or out of service elevator
- Specific transit authority related procedures and guidelines

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Module Length: 200 min Time remaining: 200 min This section: 20 min (4 slides) Section start time: _____ Section End Time: _____

DO



REVIEW introduction slides

Instructor's Notes

SAY

In your own words:
Welcome to the course on Programmable Logic Controllers
Advance

Materials Needed

✓ PPT slides 1



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Module Length: 200 min

Time remaining: 200 min

This section: 20 min (4 slides)

Section start time: _____

Section End Time: _____

DO	SAY	Materials Needed
<div> </div> <div> <p>REVIEW module objectives</p> </div> <div> <h3>Instructor's Notes</h3> </div> <hr/> <hr/> <hr/> <hr/> <hr/>	<div> <p>In your own words:</p> </div> <div> <p>Today we will discuss the:</p> <ul style="list-style-type: none"> -Preventative Maintenance -Checking the CPU Code with LED Color Code -Replacing the CPU RAM-memory back-up Battery -Checking the Input Modules of the PLC -Checking the Output Modules of the PLC -Basic Procedures for Checking Programming Problems -Checking Communications Set Up -Summary -Knowledge Check </div> <div> <p>Advance</p> </div>	<div> <p>✓ PPT slide 2</p> </div> <div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; font-size: small;">Programmable Logic Controllers</p> <p style="text-align: center; color: red; font-weight: bold;">Outline</p> <ul style="list-style-type: none"> ✓ Preventative Maintenance ✓ Checking the CPU Code with LED Color Code ✓ Replace the CPU RAM-memory back-up Battery ✓ Checking the Input Modules of the PLC ✓ Checking the Output Modules of the PLC ✓ Basic Procedures for Checking Programming Problems ✓ Checking Communications Set Up ✓ Summary ✓ Knowledge Check <p style="font-size: x-small;">Transit Elevator/Escalator Consortium</p> </div> </div>

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Module Length: 200 min

Time remaining: 200 min

This section: 20 min (4 slides)

Section start time: _____

Section End Time: _____

DO



REVIEW key terms

Instructor's Notes

SAY

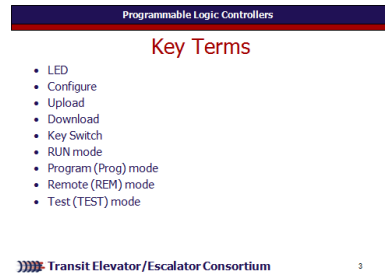
In your own words:

Lets take a look at some of the key words we will be defining as move through this module:

- LED
- Configure
- Upload
- Download
- Key Switch
- RUN mode
- Program (Prog) mode
- Remote (REM) mode
- Test (TEST) mode

Materials Needed

✓ PPT slide 3



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Module Length: 200 min Time remaining: 180 min This section: 20 min (3 slides) Section start time: _____ Section End Time: _____

DO

SAY

Materials Needed



REVIEW slide

In your own words:

Preventative Maintenance is important to keep the PLC functioning correctly.

- You should always follow your agency's procedures and recommendations for preventative maintenance procedures. Always refer to the manufacturer's manual for the specific PLC you are working on when you are encountering a problem. And last but not least, Always inform your supervisor before working on a PLC.

- In addition, always follow the Lock-Out/Tag-Out procedures before working on the PLC and all ancillary equipment. Remember to de-energize all power sources (electrical, hydraulic, and mechanical).

- Check to ensure that the electrical power and the main disconnect switch and all ancillary power switches are in the proper positions and providing the proper amperage & voltage per the manufacturers specifications.

Advance

✓ PPT slide 5

Programmable Logic Controllers

Preventative Maintenance

- Always follow your agency's procedures & the manufacturer's recommendations for preventative maintenance procedures
- Refer to the manufacturer's manual for the specific PLC you are working on
- Always inform your supervisor before working on a PLC
- Follow all Lock-Out/Tag-Out procedures
- Make sure the main electrical disconnect switch, and all ancillary power switches are in the proper positions
- Check that all switches are providing the proper amount of voltage and amperage per the manufacturer's specifications

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Module Length: 200 min

Time remaining: 180 min

This section: 20 min (3 slides)

Section start time: _____

Section End Time: _____

DO



REVIEW slide

Instructor's Notes

SAY

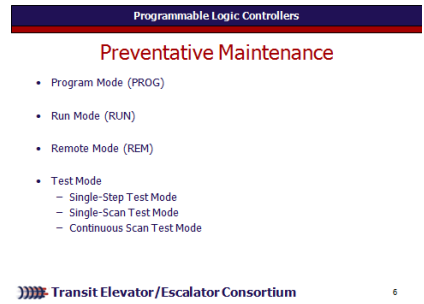
In your own words:

As mentioned previously, SLC500 processors operate in different modes. Some of the different modes are:

- Program mode (PROG) – this mode is used to enter a new program. It allows for the existing program to be edited or updated. When the PLC is in this mode all outputs from the PLC are forced to the OFF position regardless of their rung logic status. This means that the Input/Output Scan sequence is halted and all input and output devices are stopped and disabled.
- Run Mode (RUN) – this is used for execution of the program. All input and output devices are energized and monitored during this mode.
- Remote Mode (REM) – some PLCs will have a three (3) position switch that allows the PLC to remotely change its status between Run and Program Modes. This mode is activated by a personal computer, phone, or tablet.

Materials Needed

✓ PPT slide 6



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Module Length: 200 min

Time remaining: 180 min

This section: 20 min (3 slides)

Section start time: _____

Section End Time: _____

DO

SAY

Materials Needed



REVIEW slide

In your own words:

- Ensure that the PLC is never mounted too close to heat sources (such as furnaces, electrical heaters, etc.) or air discharging units (air conditioners, condensers, output vents) as the heat can damage electrical components
- Inspect the condition of the battery (if the unit has a battery) that provides back up power for the RAM memory every time preventative maintenance is performed. Check the LED status (battery voltage level)
- Keep the master discs or USB flash drives with software programs and operating programs in a safe location. They should be properly marked with specific PLC, location, and date of last version.

Advance

✓ PPT slide 7

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Preventative Maintenance

- Clean and replace the air filtering on a regular basis
- Clean all dust and debris from all PLC circuit boards
- Ensure that all connections are installed properly and secured
- Inspect all input and output modules for proper calibration
- Ensure the PLC is never mounted too close to heat sources or air discharging units
- Inspect the battery LED every time the PLC is inspected (if the unit contains a battery)
- Keep the master discs or USB flash drives with the software program in a safe location (controlled environment).

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Module Length: 200 min Time remaining: 140 min This section: 20 min (1 slides) Section start time: _____ Section End Time: _____

DO	SAY	Materials Needed
<div> </div> <p>REVIEW slide</p> <p>Instructor's Notes</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<p>In your own words:</p> <ul style="list-style-type: none"> • Note the wiring connections of the battery then unplug the battery power wiring connections from the wire socket and retaining clips. • Insert the new battery into the battery retaining clips and plug the battery wiring connections into the proper wiring socket. • Insert the processor into the chassis and restore the power after checking all wiring and ensuring that battery and processor are securely mounted. • Check that the BATT LED is not illuminating. • Follow your agency's procedures and manufacturer's recommendations on proper handling, storing, transporting, and disposing of old battery. <p>As a side note, the Allen Bradley Model 5573 does NOT contain a battery; it uses a capacitor and an SD card.</p> <p>Advance</p>	<p>✓ PPT slide 9</p> <div> <p style="text-align: center; border: 1px solid black; padding: 2px;">Programmable Logic Controllers</p> <p style="text-align: center; color: red;">Replace the CPU RAM-memory back-up Battery</p> <ul style="list-style-type: none"> • Replacing the battery <ul style="list-style-type: none"> – Remove the main power and all ancillary power – Slide the processor out – Unplug the battery power wiring connections – Insert the new battery – Check the BATT LED – Follow your agency's procedures and the manufacturers recommendations for disposal of old battery </div> <p>Transit Elevator/ Escalator Consortium</p>

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Module Length: 200 min

Time remaining: 100 min

This section: 20 min (1 slides)

Section start time: _____

Section End Time: _____

DO

SAY

Materials Needed



REVIEW slide

In your own words:

If the controller is operating in the RUN mode but the output devices are not working properly, the fault could be any of the following:

• Blown fuse. When an output module or device does not energize, first check the LED status on the Output module. Inspect for the blown fuse LED on the module or the LED indicator for power. The blown fuse LED indicator indicates the condition of the fuse protecting the output circuits and is normally located on the far right side of the LED status indicators (on the Output LED indicators section of the module). On some modules, they will be marked FUSE or EFUSE. If this light is illuminated then it means that there is a blown fuse at one of the output devices.

• If the Led indicator light is not illuminating then the fused device and corresponding circuit is not operating properly. The device and the circuit should be checked for a problem such as a possible overcurrent or short-circuit condition.

✓ PPT slide 12

Programmable Logic Controllers

Checking the Output Modules of the PLC

- If the output devices are not operating properly, the fault could be:
 - Blown fuse
 - Wiring and/or terminal connections
 - Output Module
 - Processor Problems

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Module Length: 200 min Time remaining: 100 min This section: 20 min (1 slides) Section start time: _____ Section End Time: _____

DO	SAY	Materials Needed
 REVIEW slide Instructor's Notes _____ _____ _____ _____ _____	<p>In your own words:</p> <ul style="list-style-type: none">• If the module LED status indicator is OFF but the output device is commanded to turn ON, then the problem is the output device, the processor, the power supply, or wiring. Always ensure that the processor is properly mounted on the chassis.• Follow the manufacturer's troubleshooting guides in their manual (maintenance or operating) for typical output problems. <p>Advance</p>	<p>✓ PPT slide 12</p> <div><p>Programmable Logic Controllers</p><p>Checking the Output Modules of the PLC</p><ul style="list-style-type: none">• If the output devices are not operating properly, the fault could be:<ul style="list-style-type: none">– Blown fuse– Wiring and/or terminal connections– Output Module– Processor Problems<p>Transit Elevator/Escalator Consortium 12</p></div>

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Module Length: 200 min

Time remaining: 80 min

This section: 20 min (2 slides)

Section start time: _____

Section End Time: _____

DO

SAY

Materials Needed



REVIEW slide

In your own words:

- Select the proper subprogram to be used for program error verification and to check the ladder logic programming for error messages.
- If necessary, force ON and OFF instructions that allow specific bits to be turned ON and OFF for testing purposes.

Advance

Instructor's Notes

✓ PPT slides 15

Programmable Logic Controllers

Basic Procedures for Checking Programming Problems

- Use the diagnostic tools (cont)
 - Use the diagnostic instructions included in the PLC's instructional programming
 - Select the proper subprogram to check ladder logic programming
 - If necessary, force ON and force OFF instructions for testing purposes

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Module Length: 200 min

Time remaining: 40 min

This section: 20 min (1 slides)

Section start time: _____

Section End Time: _____

DO

SAY

Materials Needed



REVIEW slide

Instructor's Notes

In your own words:

- The back-up battery for a PLC normally has a two year life cycle. Newer Allen Bradleys may not have a battery, they may only have a capacitor and a SD card.
- If there is a problem suspected with an Input or Output device, first compare the two LED status indicators.
- If the Blown Fuse LED indicator is not illuminated, there is a problem with the fuse.
- If the LED module status is illuminated, then that means the module's logic circuitry is operating properly and recognizing the commands from the processor.

Advance

Some key terms that are used in discussing the programming of PLCs are: Configure, Download, and Upload.

✓ PPT slides 19, 20

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Summary

- If the CPU FLT Led indicator is illuminated, that means there is a fault.
- The back-up battery for the CPU RAM normally has a 2 year life cycle. Newer Allen Bradley's may not have batteries; they have a capacitor and a SD card.
- Compare the two LED status indicators on an Input and Output device when a problem is suspected.
- If the Blown Fuse indicator is not illuminated, there is a problem with the fuse
- If the Led module status indicator is illuminated, it is operating properly.

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Summary

- Key Definitions
 - Configure
 - Upload
 - Download

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Module Length: 430 min

Time remaining: 20 min

This section: 20 min (2 slides)

Section start time: _____

Section End Time: _____

DO

SAY

Materials Needed



ASK



SMALL GROUP ACTIVITY

Instructor's Notes

In your own words:

Now lets see what you can remember.

Ask

Which of the following is NOT a reason the output devices are not working properly for an input malfunction?

- a. Processor problems
- b. Output Actuators
- c. Wiring Problems
- d. The BATT LED is not illuminating

Advance

The correct answer is d. The BATT LED light not illuminating means that the Battery is functioning properly.

✓ PPT slide 22



Knowledge Check

Which of the following is NOT a reason the output devices are not working properly for an input malfunction:

- a. Processor problems
- b. Output Actuators
- c. Wiring problems
- d. The BATT LED is not illuminating

Answer: d the BATT LED is not illuminating

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