Instructor Guide



302: Advanced Electrical Printreading Module 4: PLC Prints

JUMP TRANSIT ELEVATOR/ESCALATOR CONSORTIUM

Elevator-Escalator – PLC Print Reading *Instructor's Guide*



Table of Contents

Overview	4
Principles of PLC Prints	8
Interpreting PLC Schematics & Diagrams	41
PLC Programming Precautions	51
Summarv	60

Elevator-Escalator – PLC Print Reading *Instructor's Guide*



Icons Used In This Guide

				Topic #	Topic Title	Duration
	REVIEW slides		INDIVIDUAL ACTIVITY	1	Overview	45 Minutes
				2	Principles of PLC Prints	90 Minutes
?	ASK		WRITE	3	Interpreting PLC Schematics	30 Minutes
	CLASSROOM ACTIVITY	Ē	Multimedia	4	PLC Programming Precautions	30 Minutes
				5	Summary	45 Minutes
	SMALL GROUP ACTIVITY		REFER participants to			
					Total Time:	240 Minutes
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Agenda

Elevator-Escalator – PLC Print Reading *Instructor's Guide*

Overview

Purpose The purpose of this module is to:

• Provide the participant with the background to reading electrical prints of the transit elevator and escalation programmable logic controller at an advanced apprenticeship level.

Objectives

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

- Review and discuss PLC principles
- Identify universal set of PLC symbols
- Discuss PLC programming design
- Interpret a ladder diagram
- Discuss function and location of all components with each command
- Identify input/output within each diagram
- Discuss precautions when dealing with PLC programming

Materials Mandatory

Optional

Make sure you have the following

- **PowerPoint Presentation**
- Coursebook
- Quizzes
- Pencils
- Handouts: PLC Nomenclature, Switches and Electrical Symbols, Sensor Cards
- 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

Elevator-Escalator – PLC Print Reading Instructor's Guide				
Module Length: 240 min Time remaining: 240	min This section: 45 min (5 slides) Section start time:	Section End Time:		
DO	SAY	Materials Needed		
Instructor's Notes	In your own words: Lets take a look at some of the key words we will be defining as move through this module: • Automatically operated switch • Block diagram • Central Processing Unit (CPU) • DeviceNet • Ladder Logic Diagrams • Manually operated switch • Schematic • XIO and XIC instructions	<section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header>		

Elevator-Escalator – PLC Print Reading				
Vodule Length: 240 min Time remaining: 195	min This section: 90 min (39 slides) Section start time:	Section End Time:		
DO	SAY	Materials Needed		
REVIEW slides	 In your own words: Ladder logic diagrams are used to program PLCs and, as the participant should recall from earlier courses, ladder logic diagrams resemble ladders with vertical rails and horizontal rungs. Advance A ladder logic diagram has four elements: A power source. An input device, such as a switch, that is represented as a symbol on the left side of the rung. An output device, such as a light, that is represented as a symbol on the right side of the rung. Interconnecting wires. Advance 	<section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><text><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></text></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header>		

Module Length: 240 min Time remaining: 195	min This section: 90 min (39 slides) Section start time:	Section End Time:
DO	SAY	Materials Needed
REVIEW slide REFER participants	In your own words: Automatically operated switches are those that are activated independent of a person or object. These are typically switches that measure temperature, fluid level, and pressure. Advance REFER participants to course book. You can see common electrical print symbols for automatically operated switches here in this chart. Review chart with participants. Advance	<section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header>

Elevator-Escalator – PLC F Instructor's Guide	Print Reading	
Module Length: 240 min Time remaining: 195	min This section: 90 min (39 slides) Section start time:	Section End Time:
DO	SAY	Materials Needed
ASK Instructor's Notes	In your own words: Lets see what we have learned so far: Henry does not know how a PLC works. What would you say to Henry to explain how a PLC works? Call on participants for answer Advance for the correct answer Advance for the correct answer Answer: Input terminals Interprets high and low logical states from sensors and switches (examples: hall call buttons, count magnetic switch) Output terminals Output high and low signals to on/off control devices (examples: power lights, solenoids, contactors, small motors) Advance	

Elevator-Escalator – PLC Print Reading				
Module Length: 240 min Time remaining: 195	min This section: 90 min (39 slides) Section start time:	Section End Time:		
DO	SAY	Materials Needed		
REVIEW slide	In your own words: Many times well-meaning PLC trainers make the mistake of explaining that the XIO and XIC instructions represent actual "switches" in the field. This is unfortunate and often leads to more confusion down the road. It is much better to consider the XIC and the XIO to be <i>instructions to the processor.</i> Advance Essentially, the XIC instruction tells the processor to: Look in a bit or box for a "1" The processor will either find a "1" (and be true) or it will not find a "1" (and be false). Advance Similarly, the XIO instruction tells the processor to: Look in a bit/box for a "0" The processor will either find a "0" (and be true) or it will not find a "0" (and be true) or it will not find a "0" (and be false) Advance	<section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header>		

Elevator-Escalator – PLC Print Reading Instructor's Guide				
Module Length: 240 min Time remaining: 195	min This section: 90 min (39 slides) Section start time:	Section End Time:		
DO	SAY	Materials Needed		
REVIEW slide	In your own words: One shot is a program control instruction that causes an event to happen for only one scan. OSR, one shot rising, is a programming instruction that causes an event to happen when the rising odds of a signal gass from a	✓ PPT slide 33 Advanced Detrical Post Reading: PLC Points PLC Programming Design OSR Instructions • One short, causes event for one scan • Causes event • Causes event		
Instructor's Notes	 When the fising edge of a signal goes from a low value to a high value. ASK: What do you predict OSF to mean? Allow participants to share. Advance for answers. Similarly, OSF is the abbreviation for one shot falling which is an instruction that causes an event to happen when the falling edge of a 	- Causes event - Falling edge of signal moves from high to low 3000-Transit Elevator/Escalator Consortium		
	signal goes from a high value to a low value.			

Elevator-Escalator – PLC Print Reading			
Module Length: 240 min Time remaining: 195	min This section: 90 min (39 slides) Section start time:	Section End Time:	
DO	SAY	Materials Needed	
ASK Instructor's Notes	In your own words: Lets see what we have learned so far: The idea of using a PLC is new to Mike. What would you say to Mike to help him understand the advantages of using a PLC? <i>Call on participants for answer</i> <i>Advance for the correct answer</i> <i>Advance for the correct answer</i> <i>Answer</i> : Since the PLC is a programmable device, we can alter its behavior by changing the commands we give it, without having to reconfigure the electrical components connected to it. <i>Advance</i>	<section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><text><section-header><text><text></text></text></section-header></text></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header>	

Elevator-Escalator – PLC Print Reading				
Module Length: 240 min Time remaining: 105	min This section: 30 min (15 slides) Section start time:	Section End Time:		
DO	SAY	Materials Needed		
REVIEW slides REFER participants ASK	In your own words: <i>ASK:</i> According to the course book, what devices are controlled and monitored by the PLC in this escalator system <i>REFER participants to their course book.</i> <i>Allow participants to share several of the</i> <i>devices listed in their course book.</i>	✓ PPT slide 47 Artaneot Electrical Prict Reading: PLC Printie PLC Schematics & Diagrams Case Study What devices are controlled and monitored by the PLC in this escalator?		
Instructor's Notes	Advance to review the first set of the devices. Advance to review the second set of devices. Advance	✓ Course Book		

Elevator-Escalator – PLC Print Reading Instructor's Guide Module Length: 240 min Time remaining: 105 min This section: 30 min (15 slides) Section start time: Section End Time:				
DO	SAY	Materials Needed		
REVIEW slides	In your own words: The CPU communicates with the device components using DeviceNet, a communication system originally developed by the Allen-Bradley company which is technology openly shared with third party vendors. DeviceNet is used widely in the automation industry to interconnect control devices for data exchange and is the standard for device-level communication. Much more than a sensor network, DeviceNet accommodates a range of devices from drives to pushbutton stations, PLC controllers to pneumatics.	<section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header>		
	Advance			

Elevator-Escalator – PLC F Instructor's Guide	Print Reading	Section End Time:
Module Length. 240 min mine remaining. 100		
DO	SAY	Materials Needed
ASK CLASSROOM ACTIVITY Instructor's Notes	In your own words: Advance. Let's practice. DIRECTIONS: I am going to distribute a set of cards. You will need to organize the cards into three groups of sensors according to location. You may not start until I say begin. You may use your course book if needed. You will have 3 minutes to complete. Once cards are distributed, say "Begin." Allow participants about 3 minutes to organize the card. Advance to show the groupings on the slide. Instruct participants to compare their organized list to that on the screen. Advance	

Elevator-Escalator – PLC F Instructor's Guide	Print Reading	
Module Length: 240 min Time remaining: 75 m	in This section: 30 min (6 slides) Section start time:	Section End Time:
DO	SAY	Materials Needed
REVIEW slides REFER participants ASK Instructor's Notes	In your own words: <i>REFER participants to course book.</i> <i>ASK</i> : What does liveness mean? <i>Allow a participant to answer.</i> <i>Advance for correct answer.</i> It is necessary to provide the PLC programmer with verification methods that ensure the safety and liveness of the control system. One way is to ensure the safety of PLC programs by using safety "framework" while programming. For example the IEC61131 standard improves the reusability and the quality of the programs thanks to PLC manufacturer-independent modular and structuring languages. Nevertheless, having common elements for all programming languages is not sufficient to ensure the quality of the programs and this standard lacks practical verification methods. <i>Continued</i>	<section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header>

Module Length: 240 min Time remaining: 75 min This section: 30 min (6 slides) Section start time: Section End Time: Image: Comparison of the participants Image: Comparison of the participants Materials Needed Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Comparison of the participants Image: Compart of the participants Image: Comparticip	levator-Escalator – PLC F	Print Reading	
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 REVIEW slides REFER participants REFER participants REFER participants ASK ASK In your own working with the PLC the mechanic should take the following precautions: When working with the PLC the mechanic should take the following precautions: 	DO	SAY Mat	terials Needed
Advance 1. Follow the safety recommendations of the PLC manufacturer and the transit agency. Many times they require the technician to use a grounding strap and gloves when working on the PLC components. Advance 2. Use the PLC in an environment that meets the general specification of the manufacturer.	REVIEW slides REFER participants ASK nstructor's Notes	In your own words: <i>REFER participants to course book.</i> <i>ASK</i> : What are precautions the mechanic should take when working on the PLC? <i>Allow participants to share answers.</i> <i>Advance for a review of the general list</i> <i>summarizing the course book.</i> When working with the PLC the mechanic should take the following precautions: <i>Advance</i> 1. Follow the safety recommendations of the PLC manufacturer and the transit agency. Many times they require the technician to use a grounding strap and gloves when working on the PLC components. <i>Advance</i> 2. Use the PLC in an environment that meets the general specification of the manufacturer.	<section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header>

Elevator-Escalator – PLC F Instructor's Guide	Print Reading	
Module Length: 240 min Time remaining: 75 m	hin This section: 30 min (6 slides) Section start time:	Section End Time:
DO	SAY	Materials Needed
ASK Instructor's Notes	In your own words: Lets see what we have learned so far: Programming a PLC will affect (check all that apply) a. Safety of equipment b. Optimal maintenance c. Look of the elevator d. Safety of passengers Call on participants for answer Advance once given the correct answer Answer: a., b., d. Advance	

