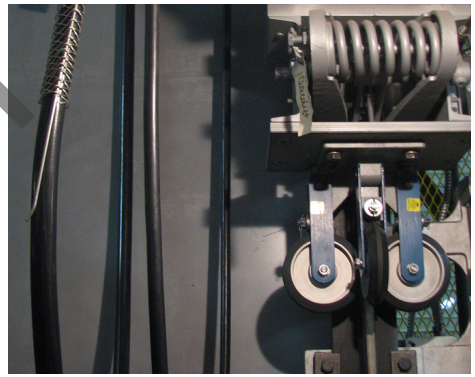
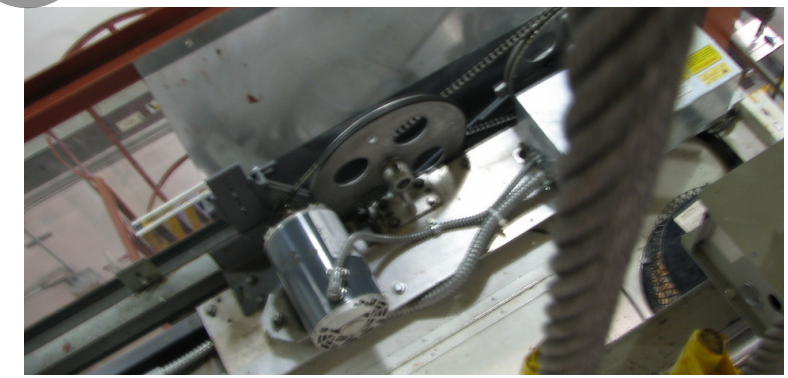
Instructor Guide





302: Advanced Electrical Printreading
Module 5: Troubleshooting Exercises

TRANSIT ELEVATOR/ESCALATOR CONSORTIUM

Table of Contents

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	30 Minutes
2	Block & Function-Block Diagrams	20 Minutes
3	Hydraulic Sequence of Operation	40 Minutes
4	Troubleshooting PLCs	20 Minutes
5	Troubleshooting Call Circuits	20 Minutes
6	Field Trip	120 Minutes
7	Summary	30 Minutes
	Total Time:	300 Minutes

Overview

Purpose The purpose of this module is to:

Provide the participant a means to further develop the craft of troubleshooting by reading electrical prints in order to troubleshoot escalator and elevator systems.

Objectives

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

- Explain block and function-block diagrams used for troubleshooting electrical problems.
- Troubleshoot hydraulic sequence of operation
- Troubleshoot a PLC problem using electrical diagrams
- Troubleshoot a safety circuit using electrical diagrams
- Troubleshoot a Call Circuit using electrical diagrams

Materials

Mandatory Make sure you have the following

- PowerPoint Presentation
- Coursebook
- Quizzes
- Pencils
- Handouts: Additional Troubleshooting Note Records for field trip

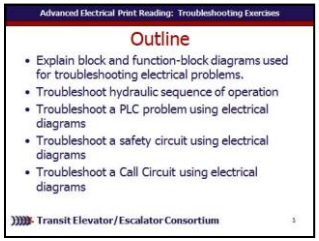
Optional You may also want the following for optional activities:

- Chalk board with chalk, large paper with marker, etc.
- Internet connection
- Lab, simulator or out of service elevator

Elevator-Escalator – Troubleshooting Exercises

Instructor's Guide

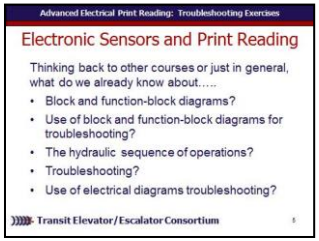
Module Length: 300 min Time remaining: 300 min This section: 30 min (7 slides) *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW module objectives **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Today we will • Explain block and function-block diagrams used for troubleshooting electrical problems. • Troubleshoot hydraulic sequence of operation • Troubleshoot a PLC problem using electrical diagrams • Troubleshoot a safety circuit using electrical diagrams • Troubleshoot a Call Circuit using electrical diagrams ***Advance***	✓PPT slide 3 

Elevator-Escalator – Troubleshooting Exercises

Instructor's Guide

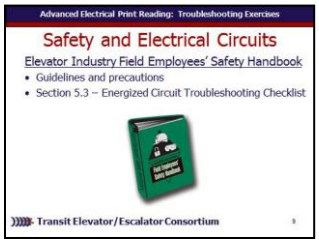
Module Length: 300 min Time remaining: 300 min This section: 30 min (7 slides) *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
ASK **SMALL GROUP ACTIVITY** **WRITE** **Instructor's Notes**	**In your own words:** Thinking back to other courses or just in general, what do we already know about….. • Block and function-block diagrams? • Use of block and function-block diagrams for troubleshooting? • The hydraulic sequence of operations? • Troubleshooting? • Use of electrical diagrams troubleshooting? ***Allow participants to think for a minute and perhaps discuss with a partner ideas as well as write down any ideas. Discuss participant responses and if possible list them on a chalk board or similar. Advance***	✓PPT slide 6  ✓ Paper ✓ Pencils or pens ✓ Larger paper , chalk board, or similar

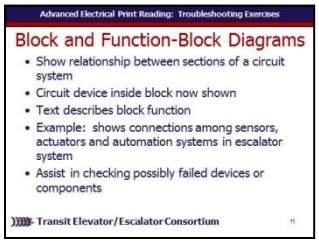
Module Length: 300 min Time remaining: 300 min This section: 30 min (7 slides) *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW slides **REFER** participants **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** ***REFER participants to the source section in the back of their course book.*** With the kind permission of several escalator and elevator manufacturers that work with our transit authorities, this module draws on practical examples in the transit field. These companies are cited in the Sources section at the end of this module. Each manufacturer provides procedures for troubleshooting, repairing, and replacing components should there be malfunctions. ***Advance***	✓PPT slide 7  Advanced Electrical Print Reading: Troubleshooting Exercises Sources • EECO. EECO Hydraulic Control Valve. 2003. Los Angeles, California. • MCE. Troubleshooting Seminar Manual. 2003. Motion Control Engineering Inc. Rancho Cordova, California. • Mazur, Glen A. and Weindorf, William J., Printreading for Installing and Troubleshooting Eelctrical Systems. 2009. American Technical Publishers, Homewood, Illinois. • Mazur, Glen A. and Proctor, Thomas E., Troubleshooting Electrical/Electronic Systems. 2010. American Technical Publishers, Homewood, Illinois. • Rosandich, Ryan G. Troubleshooting PLCs. Electrical Construction & Maintenance website, http://ecmweb.com/content/troubleshooting-plcs Transit Elevator/Escalator Consortium ✓ Course book

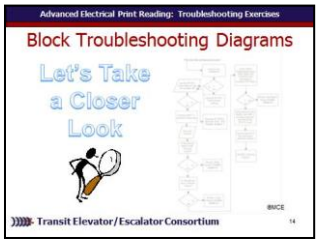
Module Length: 300 min | Time remaining: 270 min | This section: 20 min (3 slides) | *Section start time: _____* | *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW slides **REFER** participants **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** ***REFER participants to Section 5.3 of The Elevator Industry Field Employees' Safety Handbook*** The *Elevator Industry Field Employees' Safety Handbook* lists a number of guidelines for precautions when working around electrical circuits in Section 5.3, Energized Circuit Troubleshooting Checklist. ***Advance***	✓PPT slide 9  ✓ The Elevator Industry Field Employees' Safety Handbook

Module Length: 300 min Time remaining: 250 min This section: 40 min (13 slides) *Section start time:* _____ *Section End Time:* _____

DO	SAY	Materials Needed
REVIEW slide **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** You probably may recall that block diagrams are electrical drawings that show the relationship between individual sections, or blocks, of a circuit or system. ***Advance*** The circuit device or component inside each block is not shown ***Advance*** and text describes the function of the block. Block diagrams show the circuit, device, or component. ***Advance*** For example, a block diagram of the network can show the connections among sensors, actuators and automation systems in an escalator system. ***Advance*** Block diagrams can help the mechanic check the devices or components that are under suspicion of failure. ***Advance***	✓PPT slide 11 

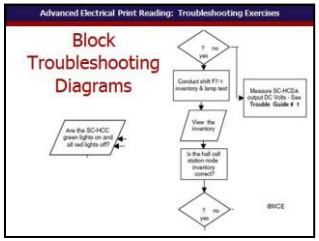
Module Length: 300 min | Time remaining: 250 min | This section: 40 min (13 slides) | *Section start time:* _____ | *Section End Time:* _____

DO	SAY	Materials Needed
REVIEW slides **REFER** participants **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** ***REFER participants to their course book to view close up diagrams of the following slides.*** Lets take a closer look at a block troubleshooting diagram. Figure 3 in your course book illustrates a troubleshooting flow chart for a hall call problem taking the mechanic from "This here hall call thing isn't working" through various fixes and possible solutions. When all options have been explored without a resolution, the mechanic will have to put in a support call with the manufacturer. ***Advance***	✓PPT slide 14  ✓Course Book

Elevator-Escalator – Troubleshooting Exercises

Instructor's Guide

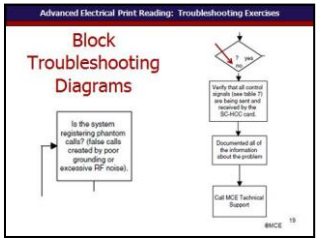
Module Length: 300 min Time remaining: 250 min This section: 40 min (13 slides) *Section start time:* _____ *Section End Time:* _____

DO	SAY	Materials Needed
REVIEW slides **REFER** participants **ASK** **Instructor's Notes**	**In your own words:** ***REFER participants to their course book to view close up diagrams of the following slides.*** If the answer to "Are the SC-HCC green lights on and all red lights off?" is no, then the suggestion is to measure SC-HCDA output DC volts and we have an additional instruction to see Trouble Guide #1. ***ASK*** If the answer to "Are the SC-HCC green lights on and all red lights off?" is yes, what does the chart suggest to do? ***Allow participants to share answer.*** Correct answer: Conduct shift F7-1 inventory & lamp test. View the inventory. This takes us to the next question, "Is the hall call station mode inventory correct?" ***Advance***	✓PPT slide 16  ✓Course Book

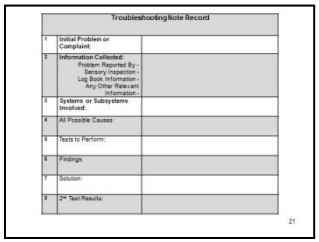
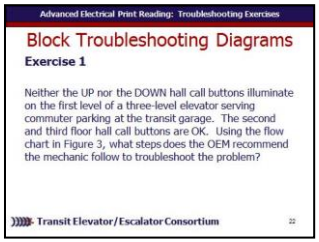
Elevator-Escalator – Troubleshooting Exercises

Instructor's Guide

Module Length: 300 min Time remaining: 250 min This section: 40 min (13 slides) *Section start time:* _____ *Section End Time:* _____

DO	SAY	Materials Needed
REVIEW slides **REFER** participants **ASK** **Instructor's Notes**	**In your own words:** ***REFER participants to their course book to view close up diagrams of the following slides.*** ***ASK*** If the answer no to the question, "Is the system registering phantom calls?", then what should the technician do? ***Allow participants to share answer.*** Correct answer: Verify that all control signals are being sent and received by the SC-HCC card, see table 7, document all information about the system, and then call MCE technical support. ***Advance***	✓PPT slide 19  ✓Course Book

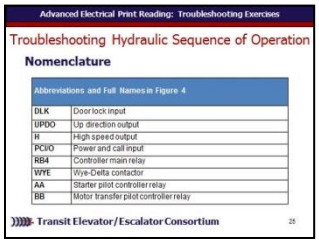
Module Length: 300 min | Time remaining: 250 min | This section: 40 min (13 slides) | *Section start time:* _____ | *Section End Time:* _____

DO	SAY	Materials Needed
ASK **CLASSROOM ACTIVITY** **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Please feel free to use this or similar format in your own notes and records when you are troubleshooting. ***You may Direct participants to record notes in their course book as they work through the activity as a class.*** ***Advance*** ***ASK*** Neither the UP nor the DOWN hall call buttons illuminate on the first level of a three-level elevator serving commuter parking at the transit garage. The second and third floor hall call buttons are OK. Using the flow chart in Figure 3, what steps does the OEM recommend the mechanic follow to troubleshoot the problem? ***Advance***	✓PPT slides 21, 22   ✓Appendix 1 ✓Course Book, Troubleshooting Note Record

Elevator-Escalator – Troubleshooting Exercises

Instructor's Guide

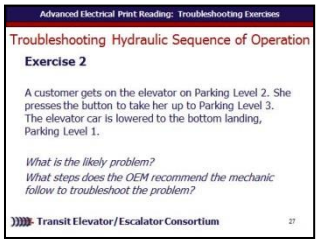
Module Length: 300 min | Time remaining: 210 min | This section: 20 min (6 slides) | *Section start time:* _____ | *Section End Time:* _____

DO	SAY	Materials Needed
REVIEW slides **REFER** participants **ASK** **Instructor's Notes**	**In your own words:** ***ASK:*** What is nomenclature? ***Allow participants to discuss possible answers.*** ***Advance*** Nomenclature is a standardized set of terms or symbols. For the following sequence of operation we will look at, this is the nomenclature we will use. ***REFER participants to their course book.*** DLK – Door lock input UPDO – Up direction output H – High speed output PCI/O – Power and call input RB4 – Controller main relay WYE – Wye-Delta contactor AA – Starter pilot controller relay BB – Motor transfer pilot controller relay ***Advance***	✓PPT slide 25  Advanced Electrical Print Reading: Troubleshooting Exercises Troubleshooting Hydraulic Sequence of Operation Nomenclature Abbreviations and Full Names in Figure 4 DLK Door lock input UPDO Up direction output H High speed output PCI/O Power and call input RB4 Controller main relay WYE Wye-Delta contactor AA Starter pilot controller relay BB Motor transfer pilot controller relay Transit Elevator/Escalator Consortium 25 ✓Course Book

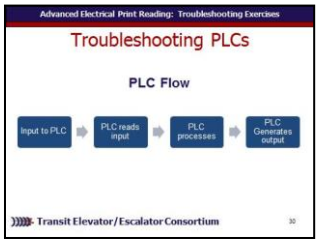
Elevator-Escalator – Troubleshooting Exercises

Instructor's Guide

Module Length: 300 min | Time remaining: 210 min | This section: 20 min (6 slides) | *Section start time:* _____ | *Section End Time:* _____

DO	SAY	Materials Needed
ASK **CLASSROOM ACTIVITY** **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Lets take a look at another example of a problem for troubleshooting. A customer gets on the elevator on Parking Level 2. She presses the button to take her up to Parking Level 3. The elevator car is lowered to the bottom landing, Parking Level 1. What is the likely problem? ***Advance*** What is the likely problem? ***Advance*** What steps does the OEM recommend the mechanic follow to troubleshoot the problem? ***Advance***	✓PPT slides 27  Advanced Electrical Print Reading: Troubleshooting Exercises Troubleshooting Hydraulic Sequence of Operation Exercise 2 A customer gets on the elevator on Parking Level 2. She presses the button to take her up to Parking Level 3. The elevator car is lowered to the bottom landing, Parking Level 1. *What is the likely problem?* *What steps does the OEM recommend the mechanic follow to troubleshoot the problem?* Transit Elevator/Escalator Consortium 27 ✓Appendix 1 ✓Course Book, Troubleshooting Note Record

Module Length: 300 min | Time remaining: 190 min | This section: 20 min (5 slides) | *Section start time: _____* | *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW slide **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** You may recall the PLC reads inputs, processes them through a program, and generates outputs. The PLC is often the first place for a mechanic to begin troubleshooting, especially if the problem resides in the PLC itself. In the previous module to this course, the participant examined PLC logic using software for training purposes only. The participant also examined schematics and diagrams that identified input/output within each diagram in order to troubleshoot a problem with the transit escalator or elevator. This section follows up on the previous module in this course by outlining some PLC troubleshooting methods which may be helpful to the elevator-escalator transit technician. ***Advance***	✓PPT slide 30 

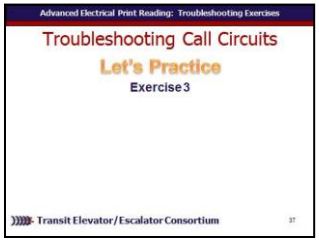
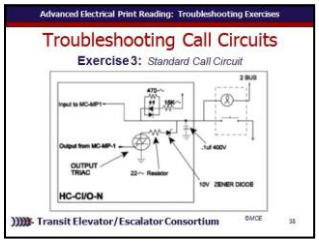
Module Length: 300 min | Time remaining: 190 min | This section: 20 min (5 slides) | *Section start time: _____* | *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW slide **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Hardware component problem: Visually inspect all LED lights in each of the I/O slots, ensure they are lit. If some lights on a card are out went they should be lit, or all lights on a card are out, then replace the card or cards. If all lights are out starting from the memory card to the end of the I/O slots, then test the PLC power supply using a DMM. Test for incoming voltage —120VAC at the input terminals and the output voltage and 240 VDC at the output terminals. If input voltage is present, but output voltage is not, then test the power supply fuse. If the fuse is good, then it is likely that the power supply is defective and should be replaced. I think this should be 240 and not 24 VDC – unless Alex said differently. ***Advance***	✓PPT slide 32 

Elevator-Escalator – Troubleshooting Exercises

Instructor's Guide

Module Length: 300 min Time remaining: 170 min This section: 20 min (5 slides) *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW slides **REFER** participants **Instructor's Notes**	**In your own words:** ***REFER participants to their course book.*** Lets take a look at Exercise 3. ***Advance*** The call circuit is a combination Input/Output circuit. In the call circuit below, the call terminal stays about 10 volts above ground when activated. Why? ***Allow participants to discuss possible answers.*** ***Advance***	✓PPT slides 37, 38   ✓Course Book

Elevator-Escalator – Troubleshooting Exercises

Instructor's Guide

Module Length: 300 min | Time remaining: 150 min | This section: 120 min | *Section start time: _____* | *Section End Time: _____*

DO	SAY	Materials Needed
ASK **CLASSROOM ACTIVITY** **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** ***At instructor's discretion, take time to visit the field and practice one or more of the following:*** • **Troubleshoot hydraulic sequence of operation** • **Troubleshoot a PLC problem using electrical diagrams** • **Troubleshoot a safety circuit using electrical diagrams** • **Troubleshoot a Call Circuit using electrical diagrams** ***Advance***	✓PPT slide 40 

Elevator-Escalator – Troubleshooting Exercises

Instructor's Guide

Module Length: 300 min | Time remaining: 30 min | This section: 30 min (3 slides) | *Section start time: _____* | *Section End Time: _____*

DO	SAY	Materials Needed
CLASSROOM ACTIVITY **INDIVIDUAL ACTIVITY** **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** ***Administer quizzes.***	✓PPT slides 43 ✓Quizzes ✓ Pencils