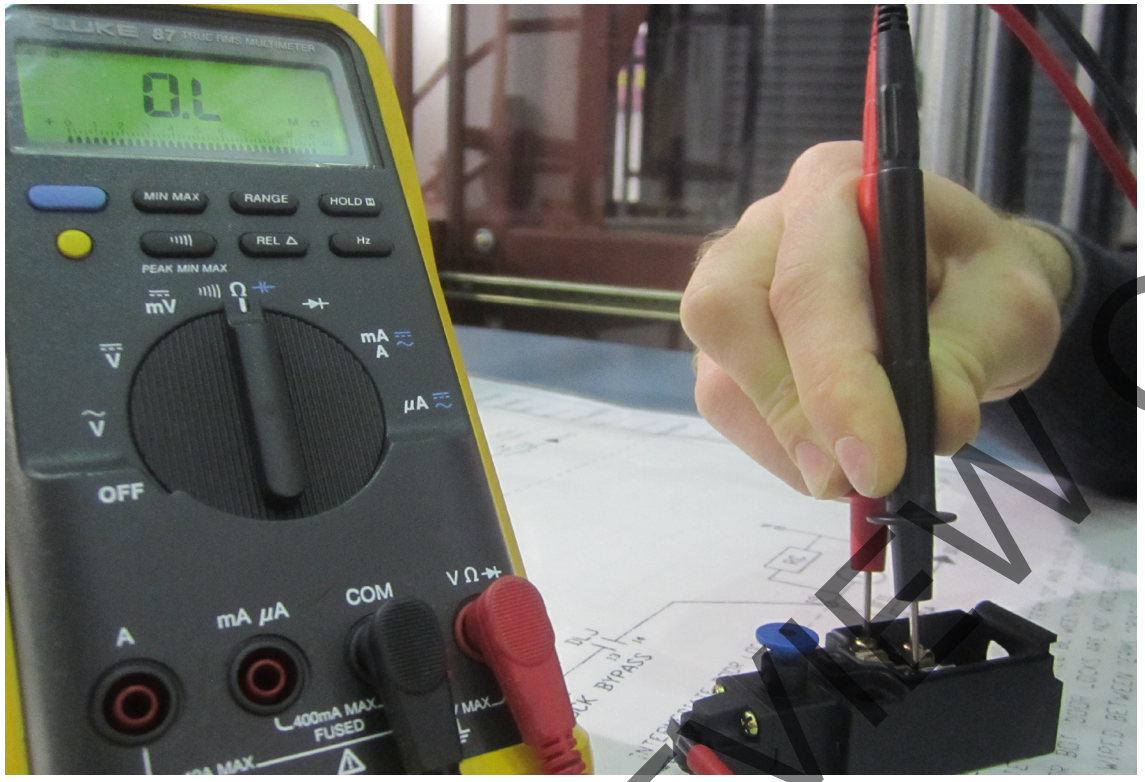
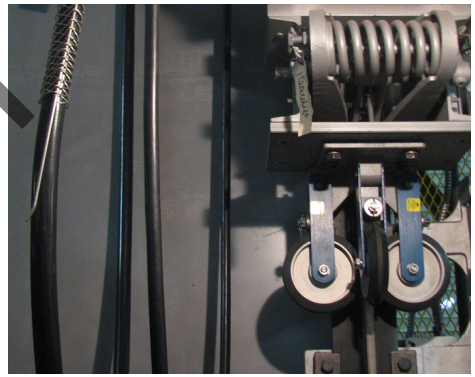
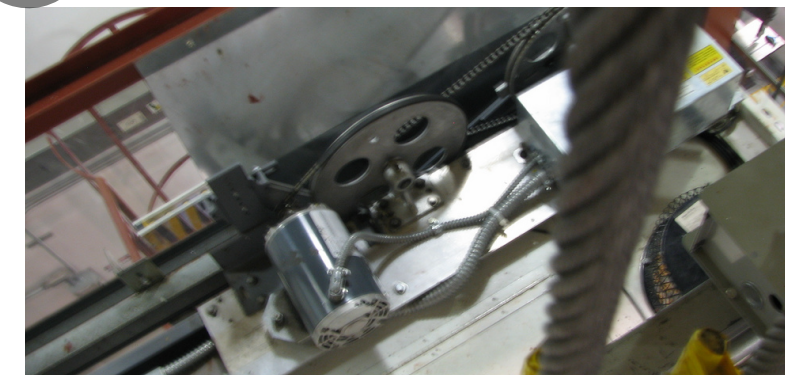
Instructor Guide







300: Input Output Control Equipment
Module 4: Testing and Troubleshooting

TRANSIT ELEVATOR/ESCALATOR CONSORTIUM

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Icons Used In This Guide

REVIEW slides

INDIVIDUAL ACTIVITY

ASK

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CLASSROOM ACTIVITY

Multimedia

SMALL GROUP ACTIVITY

REFER participants to

Agenda

Topic #	Topic Title	Duration
1	Overview	30 Minutes
2	Testing Switches	40 Minutes
3	Testing Dynamic Sensors	30 Minutes
4	Testing Solid State Switches	30 Minutes
5	Common Faults Solid State Switches	20 Minutes
6	Field Trip	180 Minutes
7	Summary	30 Minutes
	Total Time:	360 Minutes

Overview

Purpose The purpose of this module is to:

Provide participants with an overview of the electrical testing and troubleshooting that will be done with input/output equipment on transit elevators and escalators.

Objectives

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

- Identify the solid state switches (sensors) which can be tested
- Demonstrate the ability to electrically test switches for proper operation
- Demonstrate the ability to electrically test dynamic sensors for proper operation
- Demonstrate the ability to electrically test solid state switches for proper operation
- Given a certain solid state switch, identify problems that indicate that it is faulty

Materials

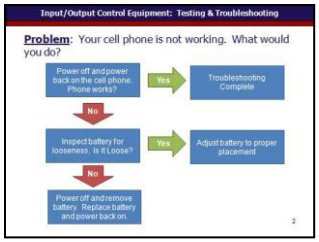
Mandatory Make sure you have the following

- PowerPoint Presentation
- Coursebook
- Quizzes
- Pencils
- Handouts: Solid State Switch Faults

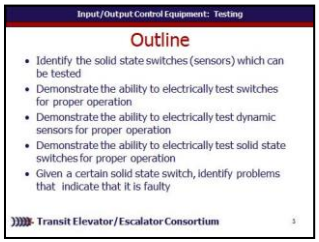
Optional You may also want the following for optional activities:

- Chalk board with chalk, large paper with marker, etc.
- Internet connection
- Lab, simulator or out of service elevator
- Course 300 Course book: Voltage Testing, final limit switch, handrail speed sensor
- QuickTime installed on computer displaying PowerPoint slides

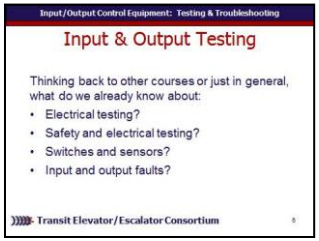
Module Length: 360 min Time remaining: 360 min This section: 30 min (9 slides) *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW introduction slides **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** These are all good ideas. Here is a sample troubleshooting chart that may illustrate steps to take including some of the ideas you may have already mentioned. First, you might try to power off and power back on the phone. ***Advance*** If that works, then troubleshooting is complete. ***Advance*** If that doesn't work, then you may inspect the battery for looseness. ***Advance*** If the battery is loose, then adjust the battery to correct placement. ***Advance*** If the battery is not loose….. ***Advance***	✓PPT slide 2 

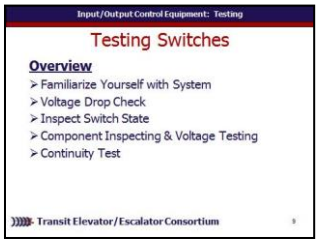
Module Length: 360 min Time remaining: 360 min This section: 30 min (9 slides) *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW module objectives **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** Today we will • Identify the solid state switches (sensors) which can be tested • Demonstrate the ability to electrically test switches for proper operation • Demonstrate the ability to electrically test dynamic sensors for proper operation • Demonstrate the ability to electrically test solid state switches for proper operation • Given a certain solid state switch, identify problems that indicate that it is faulty ***Advance***	✓PPT slide 3 

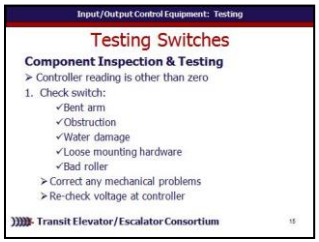
Module Length: 360 min Time remaining: 360 min This section: 30 min (9 slides) *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
ASK participants **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: • Electrical testing? • Safety and electrical testing? • Switches and sensors? • Input and output faults? ***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

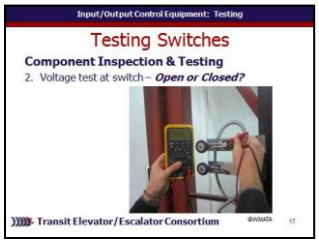
Module Length: 360 min Time remaining: 330 min This section: 40 min (22 slides) *Section start time:* _____ *Section End Time:* _____

DO	SAY	Materials Needed
REVIEW slide **ASK** **Instructor's Notes**	**In your own words:** As an example of a common switch in transit elevators/escalators we'll use the example of a **final limit switch** to illustrate how to electrically test a switch. ***ASK:*** Who can tell us about a final limit switch? ***Allow participants to discuss possible answers.*** A summary of the steps to take when testing a limit switch can be found in the troubleshooting decision tree in Figure 7 in your course book, we will look at this later. For now, here is a list of the general steps for testing switches. ***Advance*** Familiarize yourself with the system ***Advance*** Complete a voltage drop check ***Advance***	✓PPT slide 10 

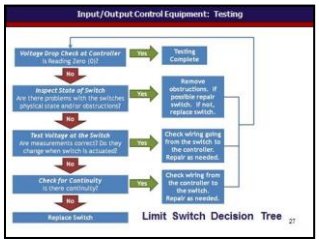
Module Length: 360 min Time remaining: 330 min This section: 40 min (22 slides) *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW slide **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** **Inspecting and Voltage Testing the Component in the Field** If the reading at the controller is anything other than zero, the next step is to inspect the state of the switch itself. Go to the switch and check for any physical problems including: ***Advance*** Bent arm on the switch An obstruction Water Damage Loose Mounting Hardware Bad Roller ***Advance*** If there is any sort of mechanical problem, repair the problem and go back to do the voltage drop check at the controller. ***Advance***	✓PPT slide 16 

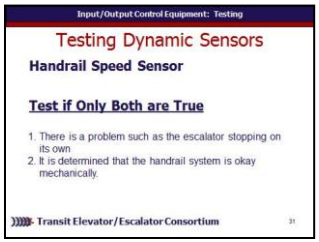
Module Length: 360 min Time remaining: 330 min This section: 40 min (22 slides) *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW slides **ASK** **REFER** participants **Instructor's Notes**	**In your own words:** ***ASK:*** In this photo of voltage testing, is the switch open or closed? ***Allow participants to answer.*** ***REFER participants to course book.*** ***Advance*** ***Discuss answer.*** Answer: Closed because the reading is less than 1 volt. ***Advance***	✓PPT slide 18  ✓ Course book

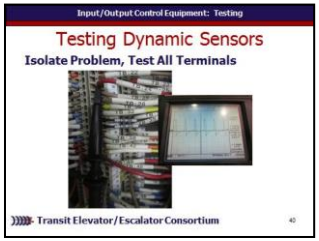
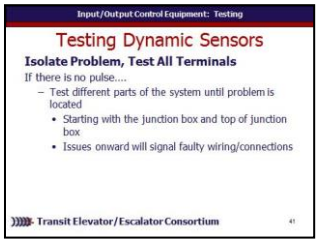
Module Length: 360 min Time remaining: 330 min This section: 40 min (22 slides) *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW slide **ASK** **REFER** participants **Instructor's Notes**	**In your own words:** ***REFER participants to course book.*** Here is the decision tree for limit switch testing mentioned earlier. ***ASK:*** What is the first thing we do to test a switch not listed here? ***Allow participants to answer.*** Always familiarize yourself with the system. ***Review chart with participants.*** ***Advance***	✓PPT slide 28  ✓ Course book

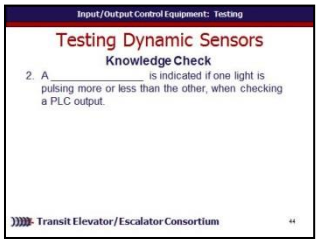
DO	SAY	Materials Needed
REVIEW slide **ASK** **Instructor's Notes**	**In your own words:** As an example of a common dynamic sensor in transit elevators/escalators we'll use the example of a handrail speed sensor to illustrate how to electrically test a dynamic sensor. ***ASK:*** Who can tell us about a handrail speed sensor? ***Allow participants to discuss possible answers.*** A summary of the steps to take when testing a handrail speed sensor can be found in the troubleshooting decision tree later in your course book. ***Advance***	✓PPT slide 32



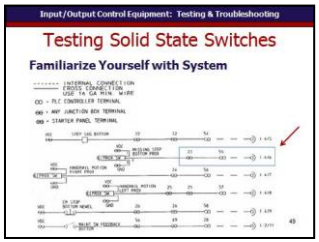
Module Length: 360 min Time remaining: 290 min This section: 30 min (15 slides) *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW slide **REFER** participants **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** ***REFER participants to course book.*** Here is a photo showing the testing terminals with an Oscilloscope - photo courtesy of WMATA. ***Advance*** If there is no pulse, the same sort of testing should take place at different parts of the system until the problem area is located. ***Advance*** The next place to check would be the junction box and then the top junction box. From this point onward, any issues encountered will be a sign of faulty wiring and/or connections. ***Advance***	✓PPT slides 41, 42   ✓ Course book

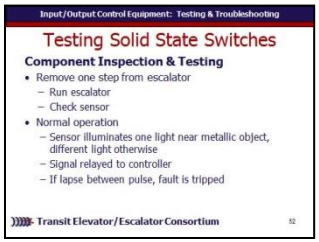
Module Length: 360 min Time remaining: 290 min This section: 30 min (15 slides) *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
ASK **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** A _____ is indicated if one light is pulsing more or less than the other, when checking a PLC output. ***Call on participants for answer*** ***Advance for the correct answer*** Answer: wire or sensor problem ***Advance***	✓PPT slide 45 

Module Length: 360 min Time remaining: 260 min This section: 30 min (14 slides) *Section start time: _____* *Section End Time: _____*

DO	SAY	Materials Needed
REVIEW slide **REFER** participants **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** ***REFER participants to course book.*** Again, familiarize yourself with the system. As with any troubleshooting, the first step in testing/troubleshooting a system is to understand it. From the prints on this specific system, you'll see that the missing step detector is on terminal 23 on any junction box and terminal 55 at the controller. The PLC input card signal is six. ***Advance***	✓PPT slides 49  Input/Output Control Equipment: Testing & Troubleshooting Testing Solid State Switches Familiarize Yourself with System ✓ Course book

Module Length: 360 min Time remaining: 260 min This section: 30 min (14 slides) *Section start time:* _____ *Section End Time:* _____

DO	SAY	Materials Needed
REVIEW slide **Instructor's Notes** _____ _____ _____ _____ _____	**In your own words:** **Next, Inspecting the Component in the Field** In this case the missing step detector is a proximity sensor that senses when a metallic material comes in proximity to it. The easiest way to make sure that the missing step detector is working correctly is to remove one step from the escalator, run the escalator and check that the sensor itself is in working order. ***Advance*** Under normal operation, the sensor will illuminate one light when a metallic object (in this case the step) is in proximity and a different light when it is not. These signals will be relayed to the controller. If there is too long of a lapse between pulses A fault will trip in the controller for the missing step. ***Advance***	✓PPT slide 52 

Module Length: 360 min | Time remaining: 230 min | This section: 20 min (2 slides) | *Section start time: _____* | *Section End Time: _____*

DO	SAY	Materials Needed
ASK participants **INDIVIDUAL ACTIVITY** **WRITE** **Instructor's Notes**	**In your own words:** ***DISTRIBUTE: Handout for Solid State Switch Faults.*** ***Direct participants to complete using their course book.*** ***Allow 5 minutes to complete.*** ***With the course book as a guide, review correct answers with participants.*** ***Advance***	✓PPT slide 62  ✓ **Handout:** Solid State Switch Faults

Module Length: 360 min | Time remaining: 30 min | This section: 30 min (4 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 67 ✓Quizzes ✓ Pencils