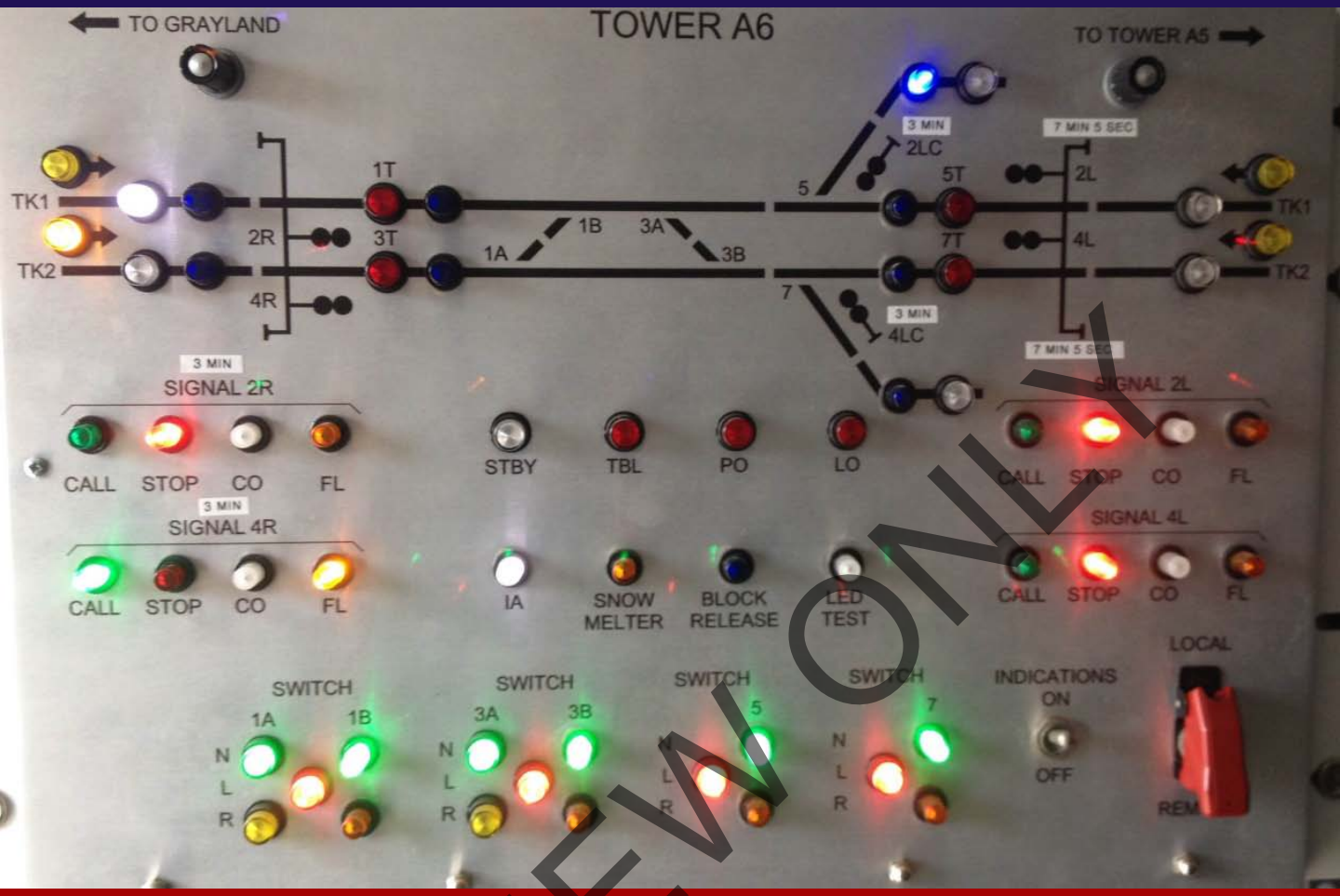

Inspection and Maintenance of Control Panels

Course 208

PARTICIPANT GUIDE

SIGNALS TRAINING CONSORTIUM

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How to Use the Participant Guide

Purpose of the Course

The purpose of the *Inspection and Maintenance of Control Panels* course is to assist the participant in gaining knowledge about how to inspect, test and maintain control panels and their use in the maintenance of interlockings.

Approach of the Book

Each course module begins with an outline, a statement of purpose and objectives, and a list of key terms. The *outline* will discuss the main topics to be addressed in the module. *Learning objectives* define the basic skills, knowledge, and abilities course participants should be able to demonstrate to show that they have learned the material presented in the module. A list of *key terms* identifies important terminology that will be introduced in each course module. *Review exercises* conclude each module to assist the participants in reviewing key information.

INSPECTION AND MAINTENANCE OF CONTROL PANELS

Outline

1-1 Overview
1-2 Tools and Materials
1-3 General Inspection Procedures
1-4 Testing Interlockings
1-5 Documentation
1-6 Summary

Purpose and Objectives

The purpose of this module is to provide a review of the inspection, testing and maintenance of control panels to verify they are operating as designed.

Following the completion of this module, the participant should be able to complete the exercises with an accuracy of 70% or greater:

- List tools and materials used in the inspection, testing and maintenance of control panels
- Describe inspection and maintenance procedures as per location and regulating authority of non-vital components of the control panel
    - Lamp Test
    - Replace burned out lamps
    - Functionality of Switches, i.e. push buttons, toggle, wafer …
    - Alarms
- Describe basic inspection and maintenance procedures as per industry standards
- Describe control panel functions when testing specific type of interlockings
- Identify agency specific schedules, if applicable, for control panel inspection and maintenance
- Describe inspection, maintenance and testing documentation for reporting as per agency regulations

Key Terms

- Block release
- Bulb extractor
- Interlockings
- Interlocking control panel
- Intrusion alarm
- Lamp or LED Test
- Solderless terminal
- Track blocks
- Vital Microprocessor Interlocking Graphical User Interface

1-1 OVERVIEW

The participant was introduced to control panels and their basic functions previously in *Course 108 Overview and Introduction to Control Panels* and in earlier Interlockings courses, specifically *Course 106 Overview and Introduction to Interlockings and Course 206 Inspection and Maintenance of Interlockings*. These courses emphasized the interconnection between control panels and **interlockings** – a complex segment of the signal system that arranges signals and signal appliances so that their interconnected movements must succeed each other in a proper sequence to ensure the safe movement of rail traffic. This course on the inspection and maintenance of control panels will reference these earlier courses often and where appropriate will closely review concepts covered therein, since the control panel is a required tool used in the testing, inspection and maintenance of interlockings. This course will also focus on the inspection and maintenance of control panel components. Most transit authorities require signal maintainers to replace switches, blown fuses or indicator lights on the control panel.

The course content here is based in part on American Public Transportation Association (APTA) standards. It was developed by a consortium of signal specialists from several rail transportation authorities that, on the federal level, are governed by the Federal Railroad Administration (FRA) or the Federal Transit Administration (FTA). Each signal maintainer should refer to the rail transit authority's SOP for applicable testing and maintenance. The FRA guidelines also prescribe standards to ensure that personnel working with, and affected by, safety-critical train control system related products receive appropriate training and testing.

As noted in prior courses, it is imperative that when signal maintainers perform testing, inspection and maintenance, they should use their authorities' safety procedures and practices. Also, the principles of safety covered in your orientation and in Course 100 of this series of courses, particularly the module on *Signal Maintainer Worker Safety*, should be followed. Safety extends to the proper use of tools when inspecting and maintaining control panels. This course will cover specific tools signal maintainer can expect to use when working on control panels and interlockings.

Every transportation authority adheres to mandatory record-keeping and timetables for inspection and maintenance in order to ensure the safety of passengers and personnel. This module also will remind participants of the importance of maintenance record keeping.

Warning: Safety Precautions!

As with all work on or near the wayside, the signal maintainers must strictly adhere to their authority-specific worker safety policies.

1-2 TOOLS AND MATERIALS

Signal maintainers have a set of authority-approved tools when performing tests, inspection and maintenance. During the inspection and maintenance of control panels, the tools (Figure 1) listed here may be used. Note that the use of these tools and others may vary among rail transit agencies. A commonly used tool is a **bulb extractor** (
Figure 2) which is a device used to remove a bulb from a recessed area of a model board or control panel.

- Allen keys
- Bulb extractor
- Multi-meter (calibrated according to OEM and agency specific guidelines)
- Soldering iron
- Wire working tools: cutters, crimpers, etc.
- Terminal nut wrench
- Nut Drivers
- Precision Screwdrivers
- Portable radio

Figure 1 Interlocking Control Panel Tools

Figure 2 Bulb Extractor

In addition to the tools listed above, the following materials are recommended for inspecting and maintaining control panels:

- Appropriate bulbs or LEDs
- Assorted solderless terminals
- Lint-free cloths
- ESD safe vacuum
- Aerosol duster
- Authority-specified contact cleaner

Solderless terminals are devices that establish a connection between two or more electric conductors, or between one or more conductors and a terminal, by means of mechanical pressure and without the use of solder.

A partial list of tools and materials recommended for troubleshooting control panels is listed below in the following classroom activity.

Classroom Activity

Review the tools and materials listed on the table below which represents a partial list of those needed for inspecting and maintaining control panels. Complete the following:

- Place a checkmark beside those tools and materials used by your authority.
- In the appropriate column, give an example of the primary function of the tool or material when maintaining a control panel.
- Draw a line through those not required by your authority.
- Add any other tools and their function not listed here that are required by either your authority or OEM.

Tool or Material	Authority Specific [Check √ if used]	Example of Primary Function
Allen keys		
Bulb extractor		
Multi-meter		
Soldering iron		
Wire cutters/crimpers		
Terminal nut wrench		
Nut Drivers		
Precision Screwdrivers		
Portable radio		
Bulbs or LEDs		
Assorted solderless terminals		
ESD safe vacuum		
Aerosol duster		
Contact cleaner		

Table 1 Location Specific Information on Tools and Materials

Before concluding your inspection, be sure all covers and locks are in place and secured. As always, perform any additional agency-specific tests. Complete the inspection and maintenance procedures by notifying the OCC and/or other authorities when all activities are complete. Verify proper remote operation once OCC resumes control. Ask them to exercise or manipulate a device while you are present in the location.

Remember that any deficiencies identified during any inspection must be corrected and documented in accordance with OEM and/or your rail authority's requirements.

Frequency of Inspection

The inspection procedures outlined by APTA standards must be performed when control panels are placed in service, when they are modified, repaired, or disarranged, or as otherwise deemed necessary by the rail transit authority. Additional details regarding the use of control panels during the inspection and testing of control panels will be discussed in the next section.

Classroom Activity

With assistance from your instructor, describe your agency-specific schedule for the inspection and maintenance of control panels, if applicable.

NOTES

1-4 TESTING

As stated in the Course 108, signaling is a way of ensuring that trains are operating in a safe and efficient manner. Signal maintainers and other rail personnel are able to accomplish this is by using individual local control panels. Remember that since local control panel operation effects train movement, qualified personnel should only take control after receiving proper authority from OCC. As noted, one major function of control panels is to test interlockings. A detailed description of interlocking tests that specifically involve control panels can be found in *Course 206 Inspection and Maintenance of Interlockings.*

FRA Testing

Under the U.S. Department of Transportation, the FRA governs interlockings. Most railroad agencies must follow the FRA guidelines. Interlockings are covered in ***The Code of Federal Regulations (CFR) Title 49: Transportation*** ***Part 236, Subpart C– Interlocking***. The FRA provides standards that govern interlockings for both railroad and transit. While transit agencies are not mandated to follow FRA guidelines, many follow them as a matter of practice. As always, refer to your specific transit organization for these guidelines.

FRA testing is done with the local control panel. The overall flexibility of operations as well as all remote operation, both controls and indications, must be verified by testing coordinated with the proper authority.

Follow Agency Specific Guidelines!

Always refer to your organization for specific guidelines and regulations.

Testing and Inspection of Typical Local Control Panel

As explained in earlier interlocking courses, an **interlocking control panel** displays a line diagram of the tracks in and near a particular interlocking or group of interlockings, and is equipped with various push buttons, electric switches, indicator lights and audible alarms to allow control and monitoring of a section of track. Further, as with all control panels, the primary functions include, monitoring normal train movement and wayside activities, providing status details for troubleshooting and testing interlockings as well as providing the ability for an emergency take over.

The following instructions are for the testing and inspection of the typical local control panel depicted in Figure 3. They are provided here courtesy of one rail transit authority. Note that there may be different instructions due to variations of the equipment or systems found in different rail transit authorities. Terminology also may vary as well. As always, follow your specific transit organization's guidelines and instructions.

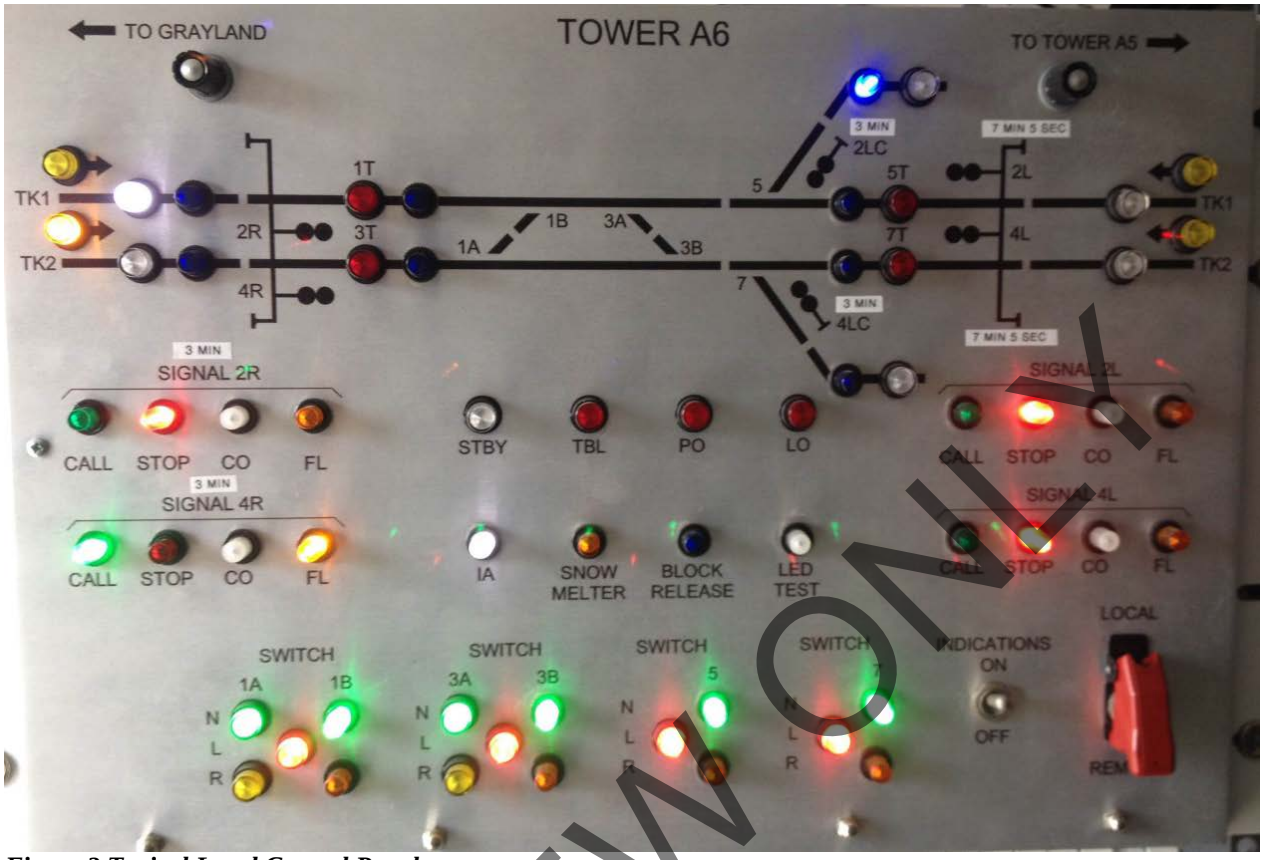

Figure 3 Typical Local Control Panel

Local Control Panel Controls

When the local control panel is in local operation the Dispatcher or Train Controller is prevented from sending out controls but allows indications to be sent to the Dispatcher or Train Controller. The appropriate operation occurs by switching the Local/Remote switch (Figure 4).

Switches

Switches (Figure 4) are controlled by illuminated push buttons located on the panel. The buttons are labeled N (Normal) and R (Reverse). There is also a light labeled L (Locked). When a Reverse request is pressed, the Normal extinguishes and the Reverse button flashes to show that a request has been made. When the switch has completed its throw and indicated the Reverse button will light steady. Both ends of crossovers are thrown with one request, but the ends indicate individually.

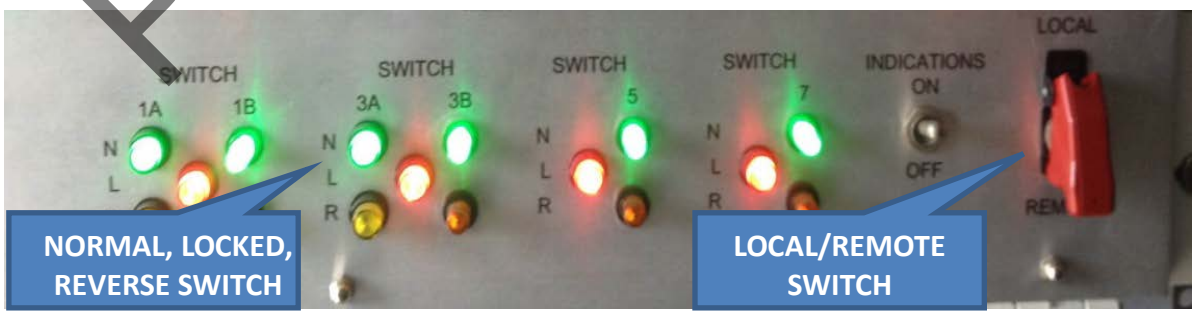

Figure 4 Switches controlled by illuminated push buttons

GLOSSARY

Block release: On a control panel, a type of push button used to release a track block

Bulb Extractor: A device used to remove a bulb from a recessed area of a model board or control panel

Interlockings: An arrangement of signals and signal appliances so interconnected that their movements must succeed each other in a proper sequence and for which interlocking rules are in effect.

Interlocking Control Panel: Also known as a control panel or local control panel. A device which monitors the normal train movement and wayside activities, provide status details for troubleshooting, test interlockings and provide an emergency take over. It displays a line diagram of the tracks in and near a particular interlocking or group of interlockings, and is equipped with various push buttons, electric switches, indicator lights and audible alarms to allow control and monitoring of a section of track.

Intrusion alarm: On a control panel, a type of door open alarm

Lamp or LED Test: On a control panel, a type of push button used to test illumination of all lamps or LEDs

Solderless terminal: A device which establishes a connection between two or more electric conductors, or between one or more conductors and a terminal, by means of mechanical pressure and without the use of solder

Track blocks: A block prohibiting signals from being lined or cleared over a certain track section.

Vital Microprocessor Interlocking Graphical User Interface: In a vital microprocessor interlocking, a graphical user interface is the result of processed user input and is usually the primary interface for human-machine interaction, displayed on a computer screen