



# Troubleshooting and Repair of Track Circuits

## Course 301

### PARTICIPANT GUIDE



 SIGNALS TRAINING CONSORTIUM



Overview

# TRACK CIRCUITS TROUBLESHOOTING AND REPAIR

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## Participant Guide

Signals Maintenance Training Consortium

**COURSE 301**

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## How to Use the Participant Guide

### Purpose of the Course

The purpose of the *Track Circuits Troubleshooting and Repair* course is to assist the participant in gaining in troubleshooting and repairing track circuits and their associated components.

### Approach of the Book

Each course module begins with an outline, a statement of purpose and objectives, a list of key terms, and review exercises. 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 this module. *Review exercises* conclude each module to assist the participants in reviewing key information.

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# Module 1

## PRINCIPLES OF TROUBLESHOOTING

### Outline

- 1-1 Overview
- 1-2 Four Steps in Troubleshooting
- 1-3 Best Practices for Troubleshooting
- 1-4 Charts and Diagrams in Troubleshooting
- 1-5 Summary

### Purpose and Objectives

The purpose of this module is to provide an overview to troubleshooting signal systems equipment and machinery within the context of general troubleshooting and best practices.

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

- Examine the importance of troubleshooting
- Restate the troubleshooting process
- Identify troubleshooting steps
- Identify troubleshooting best practices
- Apply troubleshooting principles to some common signal systems problems and causes.

### Key Terms

- Root Cause Analysis (RCA)
- Root cause
- Four Ds: Define, Decide, Do, Document

## 1-1 OVERVIEW

Troubleshooting is an integral part of signal systems maintenance. The signal maintainer is guided through a process of troubleshooting in order to get to the heart of the reported signals problem so that solutions can be applied quickly and equipment can be safely returned to service in the most efficient way possible.

As part of the Signals Training Consortium series of courses, this course guides the participant through the troubleshooting process by identifying some general strategies, tips, pitfalls, and application procedures. In later courses the participant will apply this general approach while troubleshooting specific areas of the signals system such as track circuits, switches, interlockings, grade crossings, and power distribution by examining common failures and discussion examples.

## 1-2 THE PROCESS OF TROUBLESHOOTING

Troubleshooting may be defined as a systematic approach to finding the source of a problem in an effort to restore an operation. Troubleshooting is problem-solving in a methodical and organized manner. Sometimes troubleshooting a problem is simple. At other times it may be complex and problems may be difficult to diagnose. Whatever the level of complexity of a signals system, the approach to troubleshooting should be orderly and logical.

The focus of troubleshooting is to find the **root cause** of a problem: that which is initiating a problem. In order to get at the root cause, the troubleshooter would apply **Root Cause Analysis (RCA)** which is the collective term that describes the processes or procedures that help guide signal maintainers not only to discover and understand the initiating causes of a problem, but to determine what is needed to prevent recurrence.

In general, there is a series of steps in troubleshooting. There are many descriptions of these steps in the signals industry, but a simple approach involves four steps which we can refer to as the **Four Ds**. They are:

1. **Define**
2. **Decide**
3. **Do**
4. **Document**



## 1-3 FOUR STEPS IN TROUBLESHOOTING

Figure 1.1 illustrates the four-step method for troubleshooting. Some rail transit authorities may have additional or different steps in approaching troubleshooting but, in general, all the principles are captured in these four steps which can be followed when beginning to troubleshoot a problem within transit signal systems. This list is a basic approach or model that the participant can follow.



Figure 1.1 The Four Ds: Steps in Troubleshooting Signals Systems

### Step 1 - Define

#### Identify Symptoms, Investigate Situation, Isolate Problem



In order to define the problem, the Signal Maintainer needs to identify the symptoms of the trouble call by collecting as much information as possible on the reported problem. Some questions the Signal Maintainer may ask are:

- Who may have relevant knowledge about the problem?
- What other local equipment is having trouble? Look at broader, larger picture.
- Investigate initial complaints or situation, employ sensory inspection – check the problem out for yourself. Is there an environmental condition that is affecting the equipment performance? Have temperatures dropped too low? Is something overheated? Do you notice any unusual smells or sounds? Do any parts of the system seem unusual to the touch?
- Use your eyes, ears, nose, when possible to get a feel for the problem.
- Check log book for problems with the specific equipment – has the equipment displayed the same symptoms previously? Perhaps the symptoms have been treated but the problem not solved.