



Troubleshooting and Repair of Train Stops

Course 303

PARTICIPANT GUIDE



 **SIGNALS TRAINING CONSORTIUM**



Troubleshooting and Repair of Train Stops

Participant Guide

Signals Maintenance Training Consortium

COURSE 303

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For Signals Training
Consortium Use Only

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How to Use the Participant Guide

Purpose of the Course

The purpose of the *Troubleshooting and Repair of Train Stops* course is to assist the participant in demonstrating safely troubleshooting train stops and their associated components.

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. A list of *key terms* identifies important terminology that will be introduced in this 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.

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

- Four Ds
- Root Cause
- Root Cause Analysis (RCA)

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.

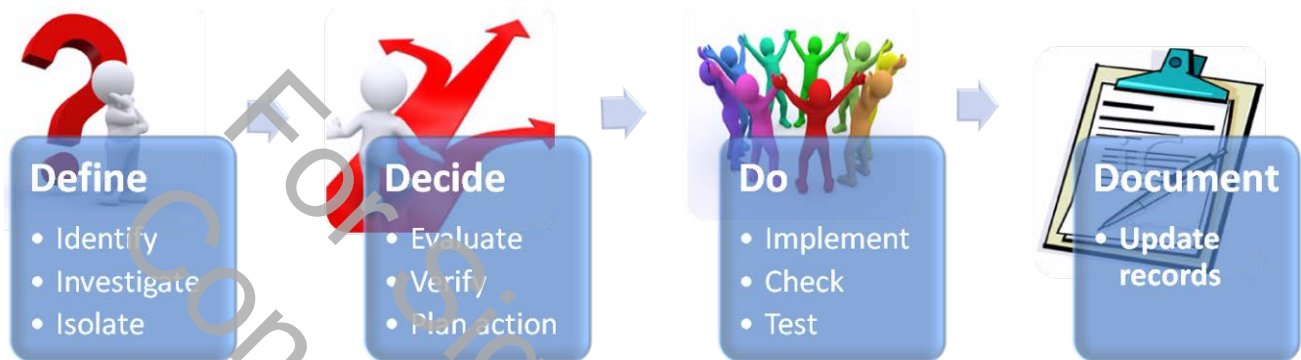


Figure 1.1 The Four Ds: Steps in Troubleshooting Signals Systems

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.
- What kinds of historical problems have there been with the generic equipment (routine breaks) – check for general problems with this

Module 2

OVERVIEW TO TROUBLESHOOTING AND REPAIR OF TRAIN STOPS

Outline

- 2-1 Overview
- 2-2 Safety Procedures when Troubleshooting Train Stops
- 2-3 Documenting Procedures
- 2-4 Types of Malfunctions
- 2-5 Summary

Purpose and Objectives

The purpose of this module is to provide the participant with an overview for troubleshooting and repair of train stops.

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

- Describe safety practices and processes as related to troubleshooting and repair of train stops
- Describe agency specific documentation procedures
- Describe types of malfunctions for train stops
- Explain process for when a train stop cannot be repaired promptly
- Describe specialized test equipment used for troubleshooting train stops

Key Terms

- Delayed Repairs
- Documentation Procedures
- Hazards
- Job Site Analysis (JSA)
- Malfunctions
- Repair
- Right of Way
- Safety
- Scenario-Based Troubleshooting Problems
- Test Equipment
- Troubleshooting

2-1 OVERVIEW

While general troubleshooting is covered in the earlier module, troubleshooting train stops may present special circumstances and situations. This module will basic definitions and specialized tools that are sometimes required for the troubleshooting and repair of train stops.

2-2 SAFETY PROCEDURES WHEN TROUBLESHOOTING TRAIN STOPS

Analysis and Effective Response

From the first notice of a train stop related problem, a signal maintainer should begin analysis. This should continue until the problem is corrected, and the train stop is tested and returned to service. Analysis can be defined as a “careful study of something to learn about its parts, what they do, and how they are related to each other.” With this in mind, this section will look at the various facets of analysis for troubleshooting train stops.

Initial Notice of Problem

Often, a signal maintainer first learns of a train stop before they are ever on site. Consequently and to prepare for the work ahead, a signal maintainer must determine as much as possible about the nature of the problem and begin the critical process of communication prior to their arrival at the train stop location. This communication consists of alerting and asking questions to the appropriate personnel and departments. When there is a malfunction of a train stop, it is critical that the larger rail system be alerted and signal maintainer safety established by means of proper communication as determined by your agency. This important first step, and when done correctly, will help to begin restoration the train stop in the safest and fastest way possible.

Upon first learning of a train stop problem, a signal maintainer should complete the following:

1. Determine the nature of the problem
2. Predict hazard related to the problem
3. Decide how to respond

Determine the Nature of Problem

In determining the nature of the problem, a signal maintainer should identify the location of the train stop and what affects the problem will have on traffic and the overall signal system.

Properly determining the nature of the problem can make the troubleshooting process safer and more efficient.

Predict Hazards Related to the Problem

From the initial set of information, a signal maintainer must predict what potential hazards. This initial set of problem data collection also begins a “Job Hazard Analysis.”

Module 4

ELECTRO-PNEUMATIC TRAIN STOPS

Outline

- 4-1 Overview**
- 4-2 Troubleshooting Electro-Pneumatic Train Stops**
- 4-3 Scenario-based Sample Problems**
- 4-4 Component Specific Repair / Replacement**
- 4-5 Summary**

Purpose and Objectives

The purpose of this module is to provide an overview of troubleshooting procedures to be performed during the maintenance of electro-pneumatic train stops.

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

- List common failures in electro-pneumatic train stops
- Describe types of train stop malfunctions
- Identify symptoms of train stop malfunctions and possible causes
- Given a train stop problem and cause, describe possible solutions and/or necessary repair
- Demonstrate ability to troubleshoot and repair train stops using authority specifications and OEM manuals.
- Test, troubleshoot, adjust or repair specific train stop components, including heaters/snow melters, if applicable

Key Terms

- Contacts
- Gland
- Return spring
- Return spring cylinder