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Troubleshooting Rail Vehicle Communication Systems

Course 310



PARTICIPANT GUIDE

 RAIL CAR TRAINING CONSORTIUM

Rail Vehicle Communication Systems

Troubleshooting

Course 310

Participant Guide

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HOW TO USE THE PARTICIPANT GUIDE

Purpose of the Course

Course 310: Troubleshooting of Rail Vehicle Communication Systems provides participants with an overview to the troubleshooting procedures followed for the rail vehicle's communication system and its individual 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. *Exercises* are built in throughout the course materials to assist the participants in learning and reviewing key information.

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MODULE 1

Troubleshooting Rail Vehicle Communication System Components

Outline

- 1-1 Overview
- 1-2 Automatic vs. Manual Announcements
- 1-3 Public Address System
- 1-4 Public Address Components
- 1-5 Related Components
- 1-6 Scenario Based Learning Examples
- 1-7 Summary

Purpose and Objectives

The purpose of this Module is to provide participants with an understanding of common troubleshooting scenarios for the rail vehicle's communication system and its components.

Following the completion of this Module, the participant should be able to complete the objectives with an accuracy of 75% or greater:

- Demonstrate the ability to troubleshoot communication system components to include:
 - Centralized Communication Control Unit
 - Automatic Announcement Control Panel (AACP)
 - Microphone and Radio
 - Public Address System
 - Passenger Intercom Unit (PIU)
 - Speakers & Pre-Amp
 - Antennas
 - GPS

Key Terms

- Centralized Communication Control Unit (CCCU)
- Microphone
- Radio
- GPS
- Automatic Announcement Control Panel (AACP)
- Passenger Intercom Unit
- Speakers
- Manual Announcements
- Antennas
- Public Address System (PA System)
- Pre-Amp

1-1 OVERVIEW

In Course 300, Troubleshooting Principles, the participant was provided with an overview of the troubleshooting process along with related general strategies, tips and pitfalls. This course, Course 310, builds on the earlier troubleshooting course and focuses on commonly reported problems with the Communication System and its components.

Troubleshooting is a systematic approach to find the source of a problem in an effort to restore a component, operation or process. Because there are so many variances in rail car types and systems, this course cannot be a one-size-fits-all course on troubleshooting communication systems. The goal of this course is to identify common troubleshooting scenarios that the rail car technician can analyze and apply to similar situations in their role at their transportation agency.

This course will cover troubleshooting tips and strategies for:

- Incoming Data
- Outgoing Data
- Video Surveillance Data

Course 310 jumps right into troubleshooting communication system components. For each component discussed in this Module, a troubleshooting table is presented with three columns shown below.

| Symptom | Probable Cause | Corrective Action |
|---------|----------------|-------------------|
| | | |
| | | |
| | | |
| | | |

The tables presented are useful however, additional agency specific information may be needed. Therefore, participants are encouraged to add their notes and observations to these tables during training.

Preparing for troubleshooting is an important first step. Therefore, before you begin to troubleshoot equipment it is important to always:

- Wear proper clothing and footwear;
- Ground all equipment;
- Assemble all test equipment;
- Assemble all required documentation.

1-2 AUTOMATIC VS. MANUAL ANNOUNCEMENTS

When troubleshooting the Communication System, the technician first needs to discern if the problem is stemming from the automatic announcements or manual announcements. Although troubleshooting procedures will vary by agency, the following chart will help to identify where the problem is coming from. **Figure 1.1** identifies common problems associated with the **Automatic Announcements** of the Public Address System (PA System).

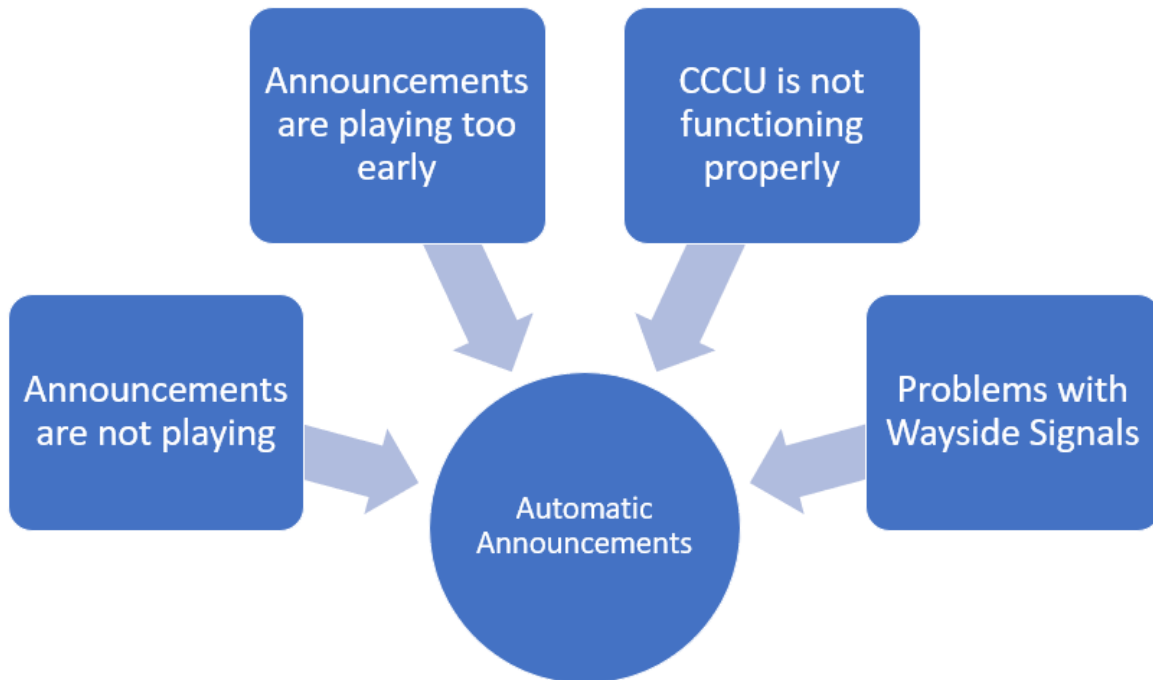


Figure 1.1 Automatic Announcement Troubleshooting Problems

Figure 1.2 identifies when common problems that are associated with the **Manual Announcements** of the PA System.

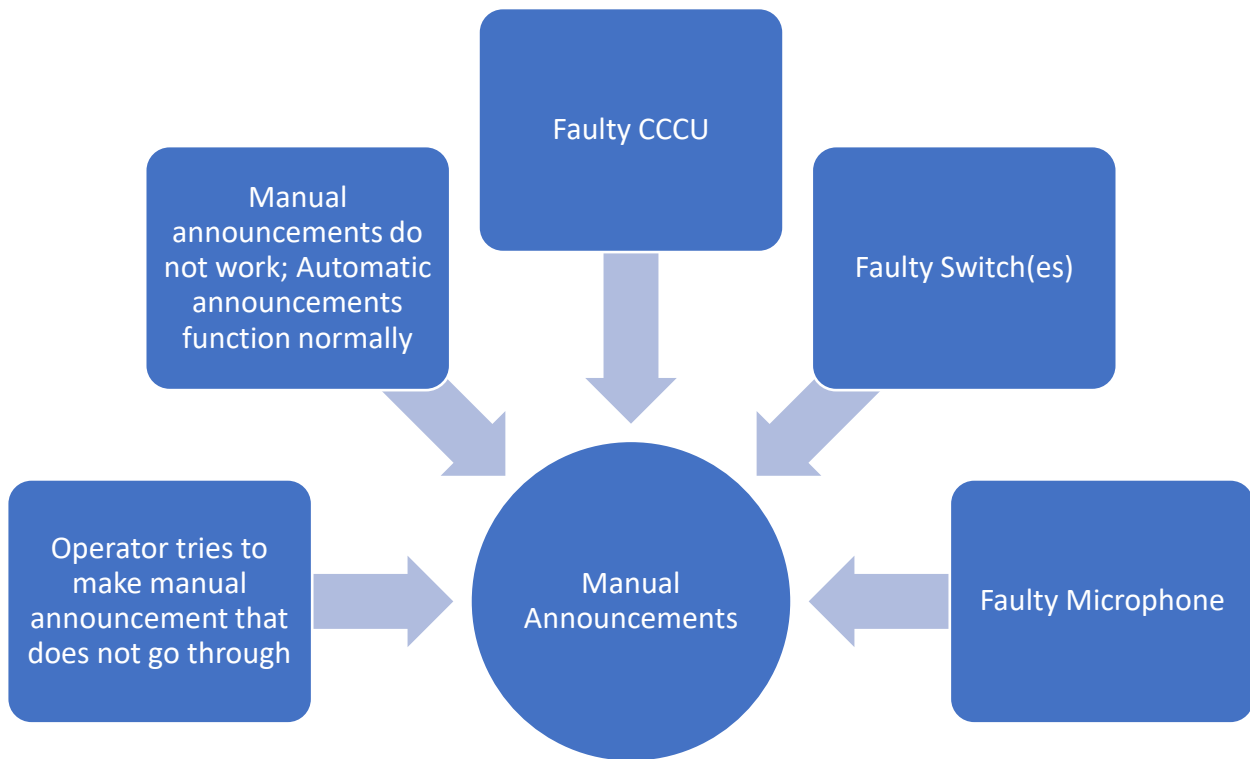


Figure 1.2 Manual Announcement Troubleshooting Problems

Determining whether the communication system failures are associated with the automatic or manual announcements, will better help the technician to troubleshoot and determine a solution to the problem.

1-3 PUBLIC ADDRESS SYSTEM (PA SYSTEM)

The following chart identifies common troubleshooting problems with the PA System.

| SYMPTOM | PROBABLE CAUSE | CORRECTIVE ACTION |
|---|---|---|
| PA pushbutton is pressed and nothing happens | <ul style="list-style-type: none"> Power supply unit issue | <ul style="list-style-type: none"> PA console replaced* |
| PA pushbutton light does not light when button is pressed | <ul style="list-style-type: none"> Networking cable issue | <ul style="list-style-type: none"> Free-up or replace PA push button |
| PA announcement is not played on all speakers | <ul style="list-style-type: none"> Debris Defective push button | |

| | | |
|-------------------------|--|--|
| | <ul style="list-style-type: none"> Operator error | |
| Agency Specific: | | |

In addition to the examples above, some agencies are able to use a PTU to troubleshoot the PA system. Using a PTU device, the technician can use a web browser to determine if the network connection for the PA system is working.

**When the PA console is removed and replaced, the entire unit is replaced; individual pieces of equipment are not replaced. The entire console is then sent to the electronics shop to be repaired and used at a later time.*

Passenger Intercom Unit (PIU)

The Passenger Intercom Unit troubleshooting chart is provided below. In situations where “Replace PIU” is identified as the corrective action, the entire PIU unit is replaced, as opposed to individual pieces.

| SYMPTOM | PROBABLE CAUSE | CORRECTIVE ACTION |
|---|---|-------------------------------------|
| Call button pressed and nothing happens on PIU unit | Loose connection | Re torque connections |
| | Defective PIU pushbutton | Replace PIU |
| LED does not illuminate when PIU pushbutton is pressed | Defective LED | Replace LED |
| Chime is not heard on PIU when pushbutton is pressed | Defective speaker | Perform a speaker PIU diagnostic |
| | | Replace PIU |
| Passenger cannot hear operator voice when pushbutton is pressed | <ul style="list-style-type: none"> Defective microphone | Perform a microphone PIU diagnostic |
| | <ul style="list-style-type: none"> Volume control adjusted incorrectly | Replace PIU |
| Operator does not receive PIU call from passenger | <ul style="list-style-type: none"> Wiring, harness PIU defective | Repair wiring or change harness |
| | <ul style="list-style-type: none"> Network problem | Replace PIU |

| | | |
|-------------------------|--|--|
| Agency Specific: | | |
|-------------------------|--|--|

PIU Console

General PIU Console troubleshooting examples are provided below. If the symptoms and probable causes indicate the PIU console should be replaced, it is sent the overhaul shop. Technicians will then repair the faulty PIU console to be used at a later time.

| SYMPTOM | PROBABLE CAUSE | CORRECTIVE ACTION |
|-------------------------|--|--|
| No power to PIU Console | Converter issue, CCU issue, loose wiring | Diagnose by following schematics |
| | Faulty button | Replace button |
| Bad Signal | Faulty PIU, loose connections | Replace PIU, tighten loose connections |
| Agency Specific: | | |

1-4 PUBLIC ADDRESS SYSTEM COMPONENTS

Centralized Communication Control Unit (CCCU)

Rail vehicles may have one CCCU, while others may have two; one on the A end and the other on the B end of the vehicle.

If the CCCU is replaced, the defective equipment is brought back to the shop where it is repaired and used at a later date.

| SYMPTOM | PROBABLE CAUSE | CORRECTIVE ACTION |
|------------------------------------|------------------------|---|
| Internal failure; issue with power | Undervoltage condition | Check circuit breaker, fuses, power supply and inverter |
| | Loose wiring | Replace CCCU |

| | | |
|-------------------------|------------------|----------------|
| | Corrupt software | Reprogram CCCU |
| Agency Specific: | | |

Automatic Announcement Control Panel (AACP)

The Automatic Announcement Control Panel (AACP) may also be referred to as the Console Control Head or Train Operation Touch Screen (TOTS). Similar to other communication system components, a Portable Test Unit (PTU) can perform diagnostic tests and troubleshoot the AACP. The PTU can connect to a web browser to check the network connection of the AACP. Additionally, like a cell phone, many times the AACP simply needs to be turned off and powered back on to resolve issues.

| SYMPTOM | PROBABLE CAUSE | CORRECTIVE ACTION |
|---|-------------------------|----------------------|
| AACP does not work; sound is not heard and display is inoperative | Loose connections | Tighten connections |
| | Defective AACP | Replace AACP |
| Incorrect announcement is played on AACP | Database is out of date | Update database |
| | Defective Tag Reader | Inspect Tag Reader |
| | Incorrect wheel size | Replace train wheels |
| Agency Specific: | | |

Microphone and Radio

Troubleshooting the cab's microphone and radio is fairly limited. Typically, both the microphone and radio are replaced if there are problems. Procedures do vary by agency and OEM and therefore, it is important to refer to your agency's specific troubleshooting procedures. Space is provided for additional scenarios to be noted.

| SYMPTOM | PROBABLE CAUSE | CORRECTIVE ACTION |
|--|----------------|-------------------|
| Broken gooseneck; microphone can't stand | Wear and Tear | Replaced |

| | | |
|---|---------------|----------|
| Hand-held set; mechanism that activates talk buttons has problems | Defective set | Replaced |
| Agency Specific: | | |

Pre-Amp and Amplifier

As discussed in Course 110, the Communication System’s amplifiers help to adjust speaker volume in relation to ambient noise. A pre-amp is a signal that is filtered before being sent to the amplifier. Common amplifier troubleshooting examples are provided below. Use the space provided for additional agency specific examples.

| SYMPTOM | PROBABLE CAUSE | CORRECTIVE ACTION |
|-------------------------------|--|---|
| Multiple speakers not working | <ul style="list-style-type: none"> • Network issue • Power issue • Functional issue • Gum/debris over microphone | <ul style="list-style-type: none"> • Check wiring • Check harness • Replace amplifier |
| Output level is too high/low | Ambient noise sensing microphone/knob is not set correctly | <ul style="list-style-type: none"> • Check wiring • Check ambient noise mic • Replace mic • Turn volume louder • Inspect Pre-amp |
| | Software issue | Update software |
| Agency Specific: | | |

Speakers

Below are common speaker troubleshooting examples. It should be noted that speakers are not rebuilt.

| SYMPTOM | PROBABLE CAUSE | CORRECTIVE ACTION |
|-------------------------|---|--|
| Noisy speakers | Cracked webbing | Speaker replaced |
| Inoperative speakers | <ul style="list-style-type: none"> • Speaker not “ON” • Wiring, connector | <ul style="list-style-type: none"> • Check speaker control knob and power • Speaker replaced |
| Speaker blown | Amplifier sending too much power | <ul style="list-style-type: none"> • Speaker replaced. • Inspect pre-amp and amplifier for defects |
| Agency Specific: | | |

GPS

Troubleshooting is relatively limited for the GPS. If it is determined the GPS is not working, the technician should first check for a signal. If there is no signal, and the train was indoors, the technician should move the train outdoors. If there continues to be no signal, the next troubleshooting step is to check the antenna. While examining the antenna, questions to ask yourself include, “*Is the antenna ripped off? Are there any cracks in the Antenna?*” After assessing the condition of the antenna, if there is still no GPS signal, the cabling going to the antenna should be checked for cracks or rips. If there is a faulty antenna or cable, they are replaced.

Rail Vehicle Signs; Interior and Exterior

The scope of the rail car technician’s troubleshooting will be limited with regards to Destination, Run and Side signs. At some agencies, the operator is responsible for setting the destination signs. At other agencies, the sign settings are preset before the operator leaves the yard. In this situation, the Operator has to key in his Operator ID, then route (block) number. This will populate information such as train destination, station times of arrival, views of next stops. This information is tied into automatic voice announcements and is all tracked and stored in an on-vehicle database.

1-5 RELATED COMPONENTS

Antennas

Troubleshooting antennas is relatively limited. Minor problems, such as cracks and loose connections, are replaced. Issues beyond those are outsourced to a different department within the rail agency.

| SYMPTOM | PROBABLE CAUSE | CORRECTIVE ACTION |
|---------------------------|-------------------|------------------------|
| Signal not being received | Check connections | Repair/replace antenna |
| Cracked/broken antenna | Wear and tear | Replace antenna |
| Agency Specific: | | |

Video and Camera System

Troubleshooting the video and camera is extremely limited for the rail car technician. At most agencies, rail car technicians will only replace a camera that isn't functioning properly. Typically, agencies have a separate video and camera crew that is responsible for maintenance and troubleshooting of the video and camera system. Additionally, some rail car maintenance supervisors will have access to remove DVRs from the vehicle in the event of an emergency event and investigation. The video/camera system will bookmark whenever any of the PIU buttons are pressed. This is to document activities that are happening in a rail car to be viewed at a later date by law enforcement or the rail agency, if necessary.

Communication System Dead Areas

Operators are likely to experience dead areas in areas such as, tunnels, hilly areas, and certain parts of underground tracks, where the communication equipment does not work. Operators are typically well aware of these dead zones. In the event of an emergency underground, and while the rail vehicle is in a communication dead zone, there are emergency telephone systems (ETS). The emergency telephones systems are usually identified by a special colored light or by signage located sporadically throughout the underground area. In this type of situation, the operator will locate an emergency phone and stop the train to make an emergency communication call to central control. In San Francisco, for example, the hilly terrain provides plenty of dead zones for operators. Operators are unable to use a cell phone while in the operator's cab. In the event of an emergency, the operator will have to stop the train and get out of the cab to use their cell phone and make an emergency call.

1-6 SCENARIO BASED LEARNING EXAMPLES



Learning Application 1.1 – Scenario Based Learning

The two scenarios below are examples of field problems in troubleshooting the Communication system. These scenarios are based on real situations.

When reading each scenario, consider the problem and determine:

1. What part of the communication system/equipment is involved?
2. What are the likely probable causes?
3. What are possible corrective actions

Your instructor will have the solutions to these problems (Learning Application 1.1 Answers – Appendix A) to verify your ideas when you are finished.

Scenario 1

A patron has tried to make a call over the PIU. The Operator receives the message however, it is coming in gargled.

Scenario 2

A patron has made a call on a PIU. The Operator receives the call and when he responds, his message is coming in gargled to the patron.

1-7 SUMMARY

This Course provided the learner with common troubleshooting scenarios for troubleshooting the rail vehicle's communication system and its components. Learners were provided with common symptoms, probable causes and corrective actions. Finally, scenario-based problems were provided to put the content into real life context. As always, refer to your agency for specific troubleshooting information and procedures,