



## Introduction and Overview to Train Stops

### Course 103

#### PARTICIPANT GUIDE

)))))) SIGNALS TRAINING CONSORTIUM

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# Introduction and Overview to Train Stops

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## Participant Guide

Signals Maintenance Training Consortium

COURSE 103

*April 2014 Draft*

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## How to Use the Participant Guide

### Purpose of the Course

The purpose of the *Introduction and Overview to Train Stops* course is to assist the participant in demonstrating proper safety procedures and gaining an overview the functions of 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.

# INTRODUCTION AND OVERVIEW TO TRAIN STOPS

## Outline

- 1-1 Overview
- 1-2 Train stops
- 1-3 Other Train Stops
- 1-4 Summary

## Purpose and Objectives:

The purpose of this module is to provide an overview of the purpose, principles of operation and various configurations of train stops that are present in transit and commuter rail systems.

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

- Describe principles of operation and purpose of train stops
- Differentiate between pneumatic and electric train stops
- Identify and describe different types of train stops
- Identify and describe the purpose of a dragging equipment detector (DED) trip vane device

## Key Terms

- |                                       |                                     |                        |
|---------------------------------------|-------------------------------------|------------------------|
| • Aspect                              | • Circuit controller                | • Resistor             |
| • Automatic braking application (ATO) | • Dragging Equipment Detector (DED) | • Retaining pins       |
| • Automatic train protection (ATP)    | • DED trip vane device              | • Rocker arm           |
| • Automatic train stop                | • Fingers                           | • Rocker shaft         |
| • Bearing strap                       | • Fixed train stop                  | • Skate                |
| • Birthing marker                     | • Head                              | • Station stop trigger |
| • Bumper post                         | • Identification tag                | • Stop box             |
| • Bumpers                             | • Magnet                            | • Tension members      |
| • Capacitor                           | • Magnetic sensor                   | • Timed train stop     |
| • Central Instrument Location (CIL)   | • Magnetic train stop               | • Transceiver          |
| • Compression members                 | • Motor                             | • Trip arm             |
| • Contacts                            | • Paddle dragger                    | • Trip cock            |
|                                       | • Portable train stop               | • Trip stop            |
|                                       |                                     | • Tripping             |



## 1-1 Overview

A train stop is a safety device that ensures that trains are stopped if they are moving within a block of track that they should not be and/or if they are moving too quickly.

There are many different types of train stops including the following. Each will be covered in detail in the next section. Pictures of each (Figures 1-6) are found on the following page:

1. **Train Stop** (Figure 103. 1) also known as *Trip Stop*, *Automatic Train Stop* or *Stop Box* – ensures a train does not continue moving if a restrictive wayside signal is ignored. This type of train stop will be covered most in depth in this module.
2. **Dragging Equipment Detector (DED)** (Figure 103. 2) also known as *Automatic Train Protection (ATP)* or *paddle draggers* – detects if there is something under the body of the rail car which is dragging on, or near to, the track in between the rails.
3. **Timed Train Stop** (Figure 103. 3) also known as *birthing markers* or *station stop triggers* – measures the speed at which the train is traveling by use of magnetic sensors placed both on the track and on the train.
4. **Portable Train Stop** (Figure 103. 4) – a movable train stop used for emergencies or re-routing for maintenance and/or installation purposes.
5. **Fixed Train Stop** (Figure 103. 5) – a stationary train stop at the end of the line to stop the rail vehicle from going off the end of the track. Comes in two types:
  - a. One where the arm is permanently in a raised position.
  - b. A **bumper post** – a rudimentary mechanical stop at the end of a line.
6. **Skate** (Figure 103. 6) – mechanical stop applied to the head of the rail, especially on inclines.

Train stops are generally mechanical. There are some **magnetic train stops** in use but their use is limited; these are often suitable for embedded track applications. Of the mechanical train stops, there are two types: electric and electro-pneumatic.

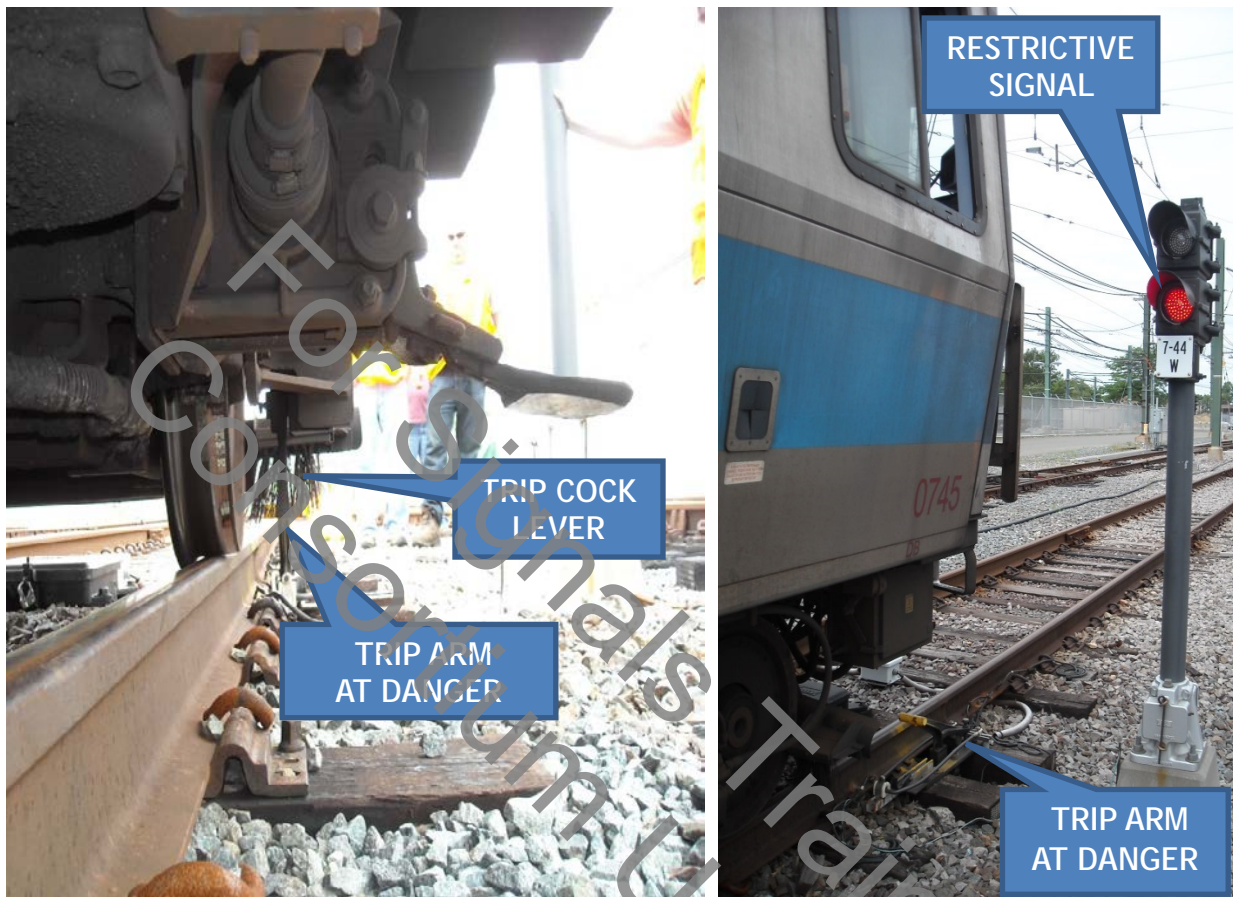
Future train stop modules, specifically Course 203, will focus on the inspection and maintenance of train stops and DEDs.



### Warning: Safety Precautions!

As with all work on train tracks, the signal maintainer must strictly adhere to the worker safety policies of the transportation agency.

Figure 103.9 provides a close-up view of the location and position of two key components, the trip arm adjacent to the running rail and the trip cock on the underside of the train, when a train is in an area of track with a restrictive signal.



**Figure 103. 8 Relationship of the trip arm in the up position (at danger) with the trip cock lever and a restrictive signal - Courtesy MBTA**

As mentioned above, the trip arm is moved into the correct position depending on the signal on the track. An electrical trip stop utilizes a **motor** that is housed inside the stop box to move the arm into the correct position. On an electro-pneumatic trip stop this is achieved by energizing a **magnet valve** which allows air to flow and therefore raises the trip arm. All train stops basically function in the same way, except that there is some variation in the value of the **capacitor**.

Note that inside the stop box are numerous **controllers**. These controllers communicate with the **central instrument location (CIL)**, also known as the *central instrument house (CIH)*, and change the trip arm position and **aspect** accordingly. This is done through a series of **contacts**, also known as **fingers**. These contacts whether they are made (closed) or not made (opened) communicate with the CIL. These connections (or lack thereof) determine the aspect of the signal. This information, as well as the positioning of the arm, is relayed back to the CIL. Signals from the CIL are determined by track circuits and the location of the train(s). This communications process between field equipment and the CIL via the stop box is depicted in Figure 103. 10 below. Note that all these communications happen in “real-time.”

## Electric Train Stops

The vast majority of train stops that will be encountered will be electric. For our purposes here, and moving forward in these courses, the **Twincos PS-1** (Figure 103. 14 and Figure 103. 15 ) will be used as the example for an electric train stop as it is most common amongst transportation authorities. Other common electric train stops include the Alstom P5014B P12 and Ansaldo EM-1. All of these train stops basically function in the same way.

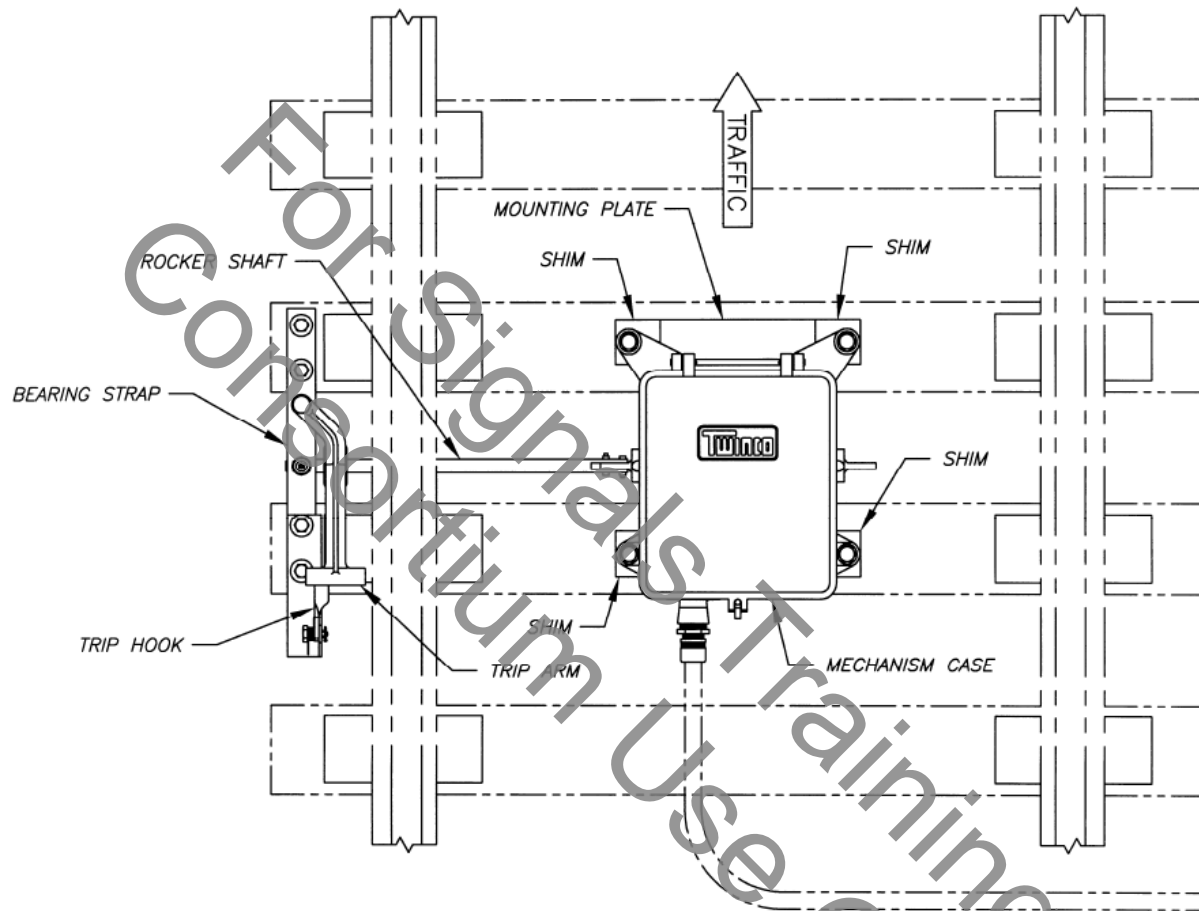


Figure 103. 13 Typical Train Stop Layout © Twincos

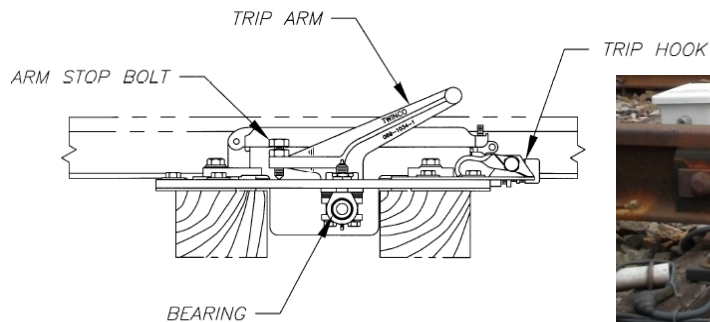


Figure 103. 14 Trip Arm in Tripping Position: Layout ©Twincos and Photo - Courtesy MBTA