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SmartScanIS

User's Guide

for Union Pacific

26 September 2023

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CAUTION

Contact with electrically active parts could result in sparks, burns, and electric shock. Because of this, you should avoid all electrical hazards when installing, wiring, operating, maintaining, and using the SmartScanIS. Failure to do so could result in damage to the equipment or serious injury to you.

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Chapter 1

Introduction

This chapter summarizes the purpose of this guide, describes the SmartScan Integrated System, tells how to comment on this guide, tells how to order more copies of this guide, and covers STC's standard warranty. It also covers the cautions and disclaimers of which the customer should be aware of.

1.1 Purpose of This Guide

The technical staff at Southern Technologies Corporation (STC) created the SmartScan Integrated System (SmartScanIS). This guide describes that system.

The SmartScanIS monitors moving trains and reports certain conditions detected on these trains. Parts of the system, like the bearing scanners, are installed on the tracks. Other parts of the system, like the controller module, are installed near the tracks.

The SmartScanIS is modular and firmware-driven. Hardware and firmware can be changed to meet the unique needs of a given railroad. Thus, some of the components that make up a SmartScanIS differ from railroad to railroad.

This guide is for those who purchase, install, maintain, troubleshoot, manage, or use the SmartScanIS at Union Pacific.

1.2 SmartScanIS

The SmartScanIS is a full-featured detection and reporting system. It monitors moving trains, providing real-time detection of:

- Overheated bearings
- Overheated wheels, when wheel scanners are installed and enabled
- Dragging equipment, when dragging-equipment detectors are installed and enabled
- Shifted loads, when wide-load detectors are installed and enabled
- Oversized loads, when high-load detectors are installed and enabled
- Automatic Equipment Identification (AEI) tags, when AEI hardware is installed and enabled
- Direction of the train
- Arrival and exit speeds of the train

The SmartScanIS runs well in the harsh environments found along right of ways. It runs under the most adverse weather conditions, functioning over a temperature range of -40°F to +160°F (-40°C to +71°C). It runs in high vibration situations. It runs unattended, carrying out all tasks without human intervention.

The SmartScanIS monitors trains traveling from 7 to 90 mph (11.3 to 145 kph). It monitors trains heading in either direction on the track.

The SmartScanIS reports defects in three ways.

- Announcements made via the road channel
- Detailed defect information downloaded to a computer
- Communications sent to the Harriman Dispatch Center

When the SmartScanIS detects a defect, it informs the crew of the affected train. This is done by a voice transmission over an assigned radio channel. The voice is computer-generated from previously digitized human speech. It tells the crew the milepost of the reporting SmartScanIS, a warning that a defect has been detected, and other defect-related information. When no defect is detected, the voice tells the crew that the train was scanned and found free of defects. If you configure the system for "Talk On Defect" operation, it won't make any announcements for defect-free trains.

There are three types of messages. Real-time messages are announced as the train passes over the site. Post-train messages are announced after the train has left the site, and all the recorded train data has been processed by the SmartScanIS. When enabled, there are also arrival messages. Arrival messages are announced as the train enters the site. The content and use of these three message types are railroad-specific.

The results of train scans are also stored for later use. With this stored data, the system can create formatted reports. To get them at the site, you need a computer. With a modem and a computer, you can retrieve them remotely.

Some site preparation is needed before installing the SmartScanIS. Among the things to do is to supply the site with a stable AC power source of at least 110 volts at 20 amperes. This and other preparations are covered in **Chapter 5 - Preparation**. Also covered in that chapter is how to install the antenna masts, bungalow (aka wayside enclosure), and PVC pipes.

1.3 Cautions

Contact with electrically active parts could result in sparks, burns, and electric shock. Because of this, you should avoid all electrical hazards when installing, wiring, operating, and maintaining the SmartScanIS. Failure to do so could result in damage to the equipment or serious injury to you.

In operation, batteries generate and release flammable hydrogen gas, which, if ignited by a burning cigarette, naked flame, or spark, may cause battery explosion with a dispersion of casing fragments and corrosive liquid electrolyte. So, carefully follow the manufacturer's instructions. Keep all sources of gas ignition away from the batteries and do not allow metallic articles to contact the negative and positive terminals of a battery at the same time.

Do not install any tower, pole, mast, or antenna on a wet or windy day. Do not install them near any type of power line. Be sure all parts of the system are out of falling range of any overhead wires, including the lead to any building. Once installed, do not climb any tower, pole, or mast. Failure to follow these instructions could result in injury or death.

1.4 Disclaimers

The correct use of this guide, the environmental conditions at the time of installation, the method of installation itself, and the installation of customer-supplied components are beyond the control of STC. So too are the correct use and maintenance of all or part of the SmartScan system. Therefore, the installer, user, and maintainer must assume the risk of any injury that might occur during installation, use, and maintenance of all or part of the SmartScan system. STC assumes no risk, liability, or responsibility for errors and omissions on the part of the installer, user, or maintainer.

1.5 How to Comment on This Guide

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1.7 Standard Warranty

Systems manufactured by Southern Technologies Corporation carry a 14-month warranty from the date of shipment. Warranty is limited to repair or replacement at the sole discretion of STC, of any goods found to be defective in either materials or workmanship during the 14-month period following shipment. Warranty does not apply to a product with signs of obvious abuse, or product that has been improperly installed.

STC warrants that goods represented by this warranty statement have been designed and manufactured with all reasonable care and attention to appropriate regulatory documents. STC makes no representation that the goods covered by this warranty are suitable for the application they are used for. Application of the goods is at the sole discretion of the purchaser.

Purchaser is responsible for shipment of the defective product to STC. STC will pay the return shipping charges.

Products purchased from others but included in STC systems carry the original manufacturer's warranty, typically 12 months. Warranty claims for these products must be made directly to the original equipment manufacturer.

Section **5.7 - Returning Damaged or Defective Hardware** tells how to return any damaged or defective yet-to-be-installed hardware to STC for repair or replacement. Section **16.2 - Returning Equipment for Repair** tells how to return any damaged, defective, or malfunctioning already-installed equipment to STC for repair or replacement.

Chapter 2

Track Components

The track components are:

- Scanners
- Transducers
- Auxiliary-alarm detectors
- AEI antennas
- Track circuits

This chapter describes most of these components. **Chapter 6 - Installing the Track Components** tells how to install scanners, transducers, track circuits, and AEI antennas. The installation of dragging-equipment detectors and other auxiliary-alarm detectors isn't covered in this guide.

2.1 Scanners

STC scanners are the primary input devices of the system. Each has:

- A housing that protects the infrared sensor and associated optics.
- A shutter that prevents the entrance of contaminants during periods of inactivity.
- A heater that removes moisture from the infrared sensor assembly.
- A vibration-resistant connection between the scanner and the system electronics.

STC scanners are made up of covers, modules, and mounts. The external housing consists of the cover and mount. The internal module contains the infrared sensor and associated optics. The module and cover are tightly integrated and rarely should be taken apart.

The SmartScanIS uses two kinds of scanners. One kind scans the temperature of axle bearings. The other scans the temperature of wheels. Except for the addition of a plastic **attenuation plug** on the **Type II** wheel scanner cover, the **Type II** bearing scanner and **Type II** wheel scanner covers and modules are identical and can be used interchangeably. Except for different aluminum **filter frames** within the **Type III** scanner module, the **Type III** bearing scanner and **Type III** wheel scanner covers and modules are identical and can be used interchangeably.

Scanner mounts attach to the rail in a way that ensures that the scanners are:

- Correctly aimed
- Easily re-aimed, if necessary
- Isolated from as much shock and vibration as possible
- Electrically isolated from the rail

The scanner mounts can be installed on either rail, eliminating the need to maintain left-rail and right-rail models. However, bearing scanner mounts and wheel scanner mounts are different in design. They can't be directly interchanged. Nevertheless, they contain many common parts, which means that fewer spare parts need to be kept on hand.

Within each scanner is a pyrometer that measures the change in the amount of infrared radiation emanating from the point at which it is aimed. As the amount of infrared radiation increases, the output from the scanner increases proportionally. This increase is expressed as a positive-analog voltage.

The scanner generates a signal as it is exposed to a passing heat source, such as heat from a bearing or wheel. The ambient reference is obtained from the bottoms of the vehicles as they pass over. The waveform of the heat signal is an electrical representation of the heat generated by the passing bearing or wheel with respect to the ambient reference.

The heat signal travels from the scanner through the cable to the SmartScanIS enclosure. It then passes through the Scanner Interface board to the System Interface board. Here, the amplitude of the heat signal is scaled to represent an accurate representation of the temperature. Next, the heat signal passes to the Processor board, where it is digitized for use by STC's dynamic-scan-rate algorithms.

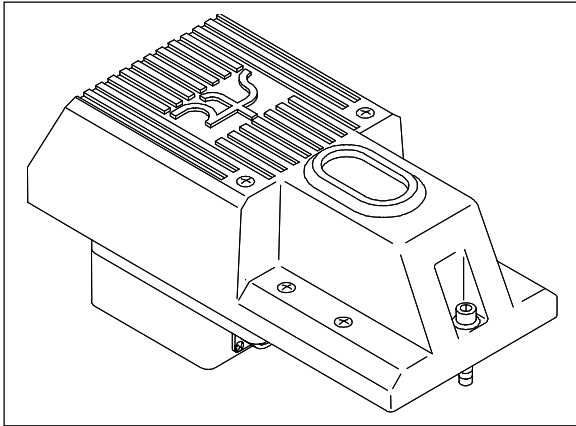
The dynamic-scan-rate algorithms assure the collection of samples every 1/2 inch (1.27 centimeters) of axle travel regardless of train speed. The heat signal waveform is always sampled 48 times between the gating transducers. It makes no difference what speed the train is going, as long as it is traveling from 7 to 90 mph (11.3 to 145 kph).

A benefit to using these algorithms is the creation of a digital filter within the firmware. Sampling every 1/2 inch (1.27 centimeters) assures that no valid heat is missed, but timing the sample rate creates relatively long periods when no samples are being taken at all. This period acts as a filter for undesirable noise-induced signals. In other words, the use of these algorithms contributes to better detection of alarm conditions with fewer false readings.

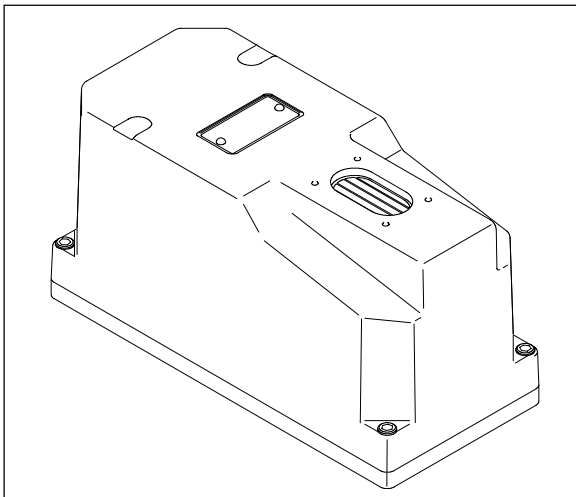
To avoid errant heat readings caused by moisture on the pyrometer lenses, the scanners have heaters built into them. The heaters are made active, for varying periods of time, when the ambient temperature is 80°F (26.7°C) or less.

2.1.1 Bearing Scanners

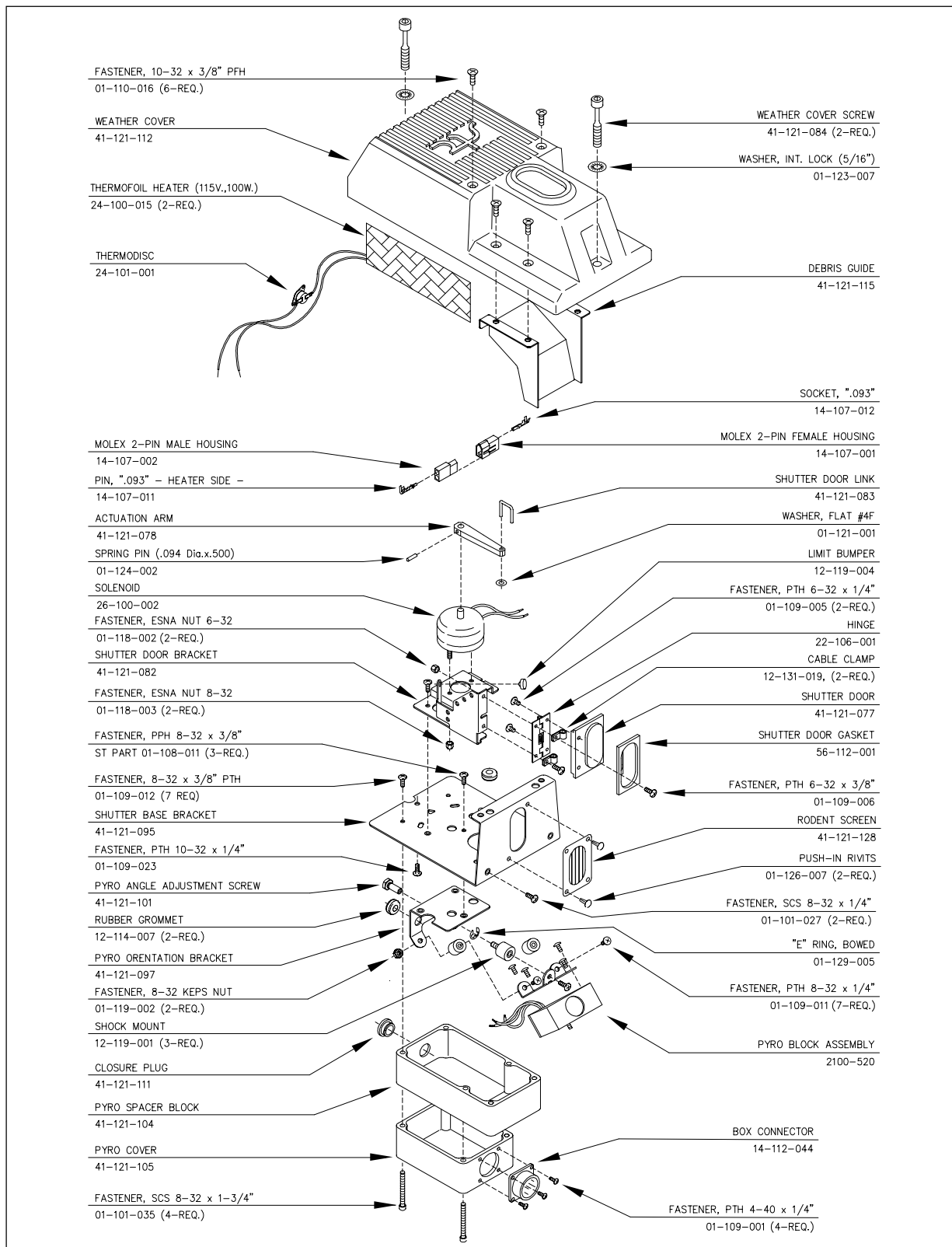
The figure below shows an assembled **Type II** bearing scanner cover and module.



The figure below shows an assembled **Type III** bearing scanner cover and module.



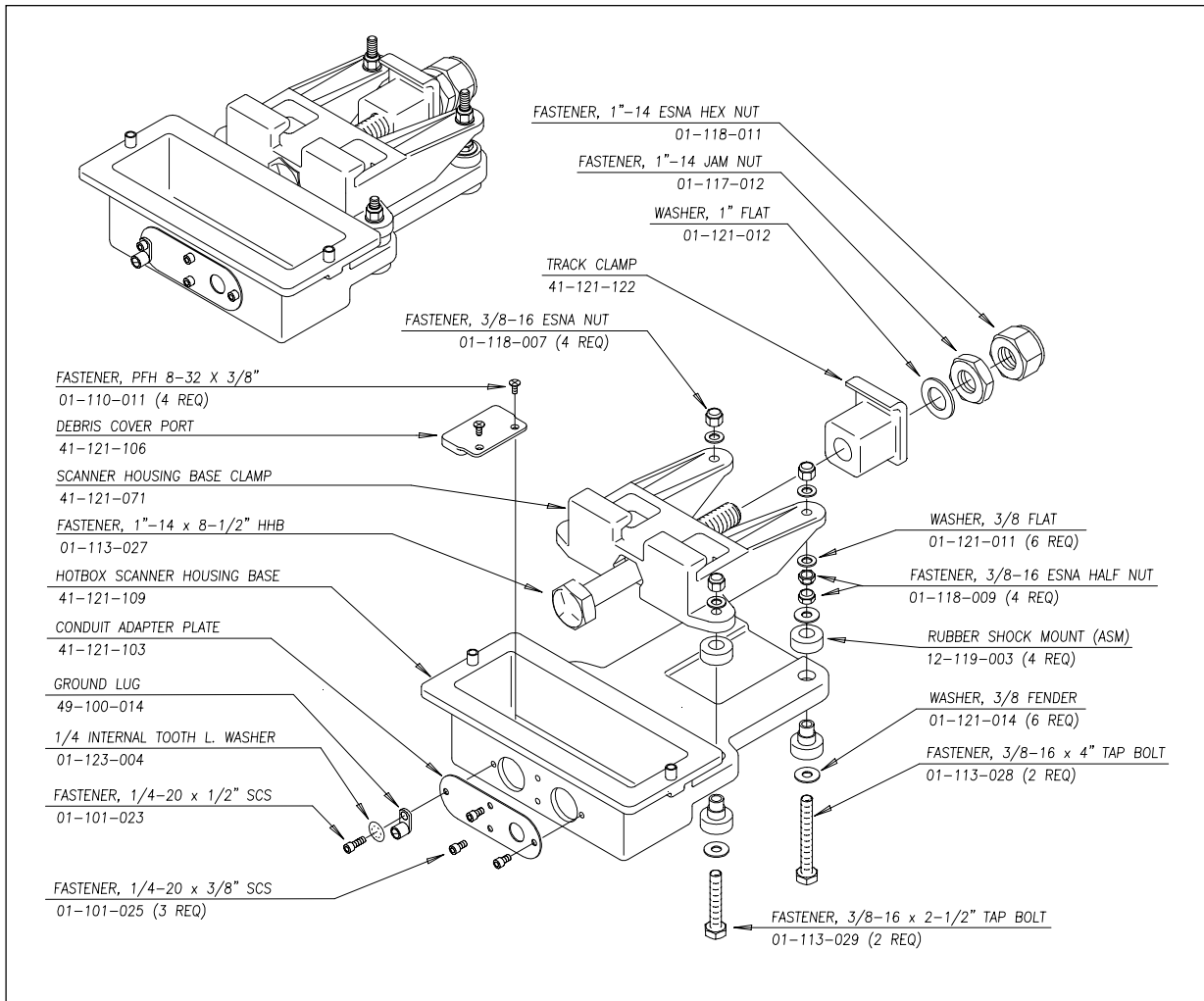
The figure below shows the parts of a **Type II** bearing scanner cover-and-module assembly (2100-510AC).



Exploded view diagram of a scanner assembly. The diagram shows the following components and their quantities:

- WEATHER COVER SCREW 41-121-171, 4-REQ.
- 5/16" HIGH COLLAR LOCK NUT 01-122-010, 4-REQ.
- WEATHER COVER 41-121-157
- RODENT SCREEN FRAME 41-121-128
- SBH 8-32 X 1/4" 01-100-022, 4-REQ.
- TOP BAFFLE 41-121-179
- MOLEX .093 SOCKET 14-107-012, 2-REQ.
- MOLEX 2-PIN FEMALE HOUSING 14-107-001
- MOLEX 2-PIN MALE HOUSING 14-107-002
- MOLEX .093 PIN 14-107-011, 2-REQ.
- RUBBER GROMMET 1/4" D X 1/8 THK 12-114-007, 4-REQ.
- MIDDLE SHIELD ASSEMBLY 41-121-176
- SBH 10-32 X 3/8" 01-100-024, 7-REQ.
- SBH 1/4-20 X 5/8" 01-100-023, 4-REQ.
- SHELL ASSEMBLY WELDMENT 41-121-173
- WEATHER COVER SCREW 41-121-171, 2-REQ.
- 5/16" HIGH COLLAR LOCK NUT 01-122-010, 2-REQ.
- SCANNER ASM. MOUNTING PLATE 41-121-156
- BOX CONNECTOR 14-112-044
- PPH 4-40 X 5/16" W/LOCK WASHER 01-108-045, 4-REQ.
- PTH 6-32 X 1/4" 01-109-005, 4-REQ.
- SHUTTER RESISTOR CONTROL BD. SUB2300-08 (12V) SUB2300-09 (24V)
- SHELL END COVER 41-121-178
- SBH 10-32 X 3/4" 01-100-021, 4-REQ.
- SNAP DISC THERMISTAT 80-110 FDEG. 24-101-001
- 4-40 ESNA NUT 01-118-001, 2-REQ.
- TYPE 3 PYRO ASSEMBLY 2500-540
- THERMOFOIL HEATER 2" X 5" @ 115V, 100W. 24-100-015, 2-REQ.
- FILTER FRAME ASSEMBLY 2500-535

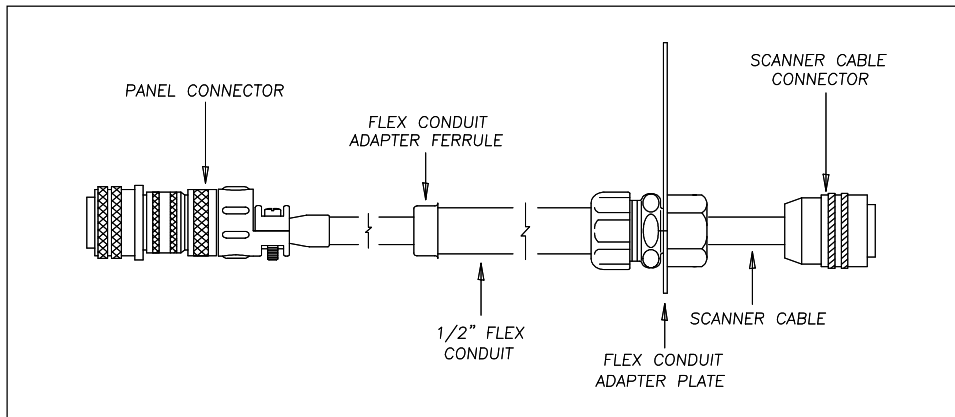
The figures below show a **Type II/Type III** bearing scanner mount (2100-501).



The bearing scanner cables are PVC jacketed with six individually shielded pairs of 20-gauge wire. Cable insulation is rated for 300-volt service. The bearing scanner cable has a potted connector for mating to the scanner and a circular connector at the SmartScanIS enclosure.

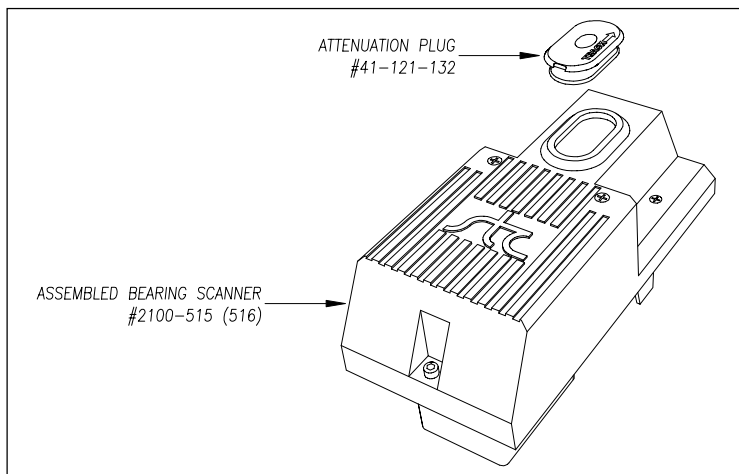
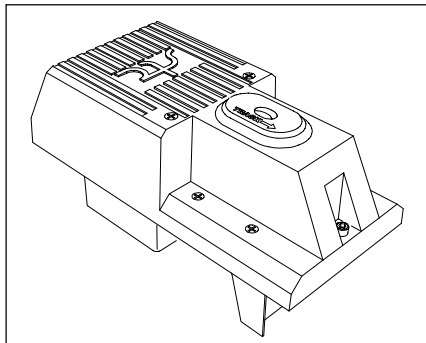
Single-track sites use two 65-foot (19.8-meter) bearing scanner cables. **Double-track sites** use two 65-foot bearing scanner cables for the track closest to the bungalow (aka wayside enclosure). For the track farthest from the bungalow, you have two 85-foot (25.9-meter) or two 100-foot (30.5-meter) bearing scanner cables.

The figure below shows a bearing scanner cable. The part number for the 65-foot (19.8-meter) bearing scanner cable is 2058-260 PM. For the 85-foot (25.9-meter) cable, it's 2058-268 PM. For the 100-foot (30.5-meter) cable, it's 2058-265 PM.

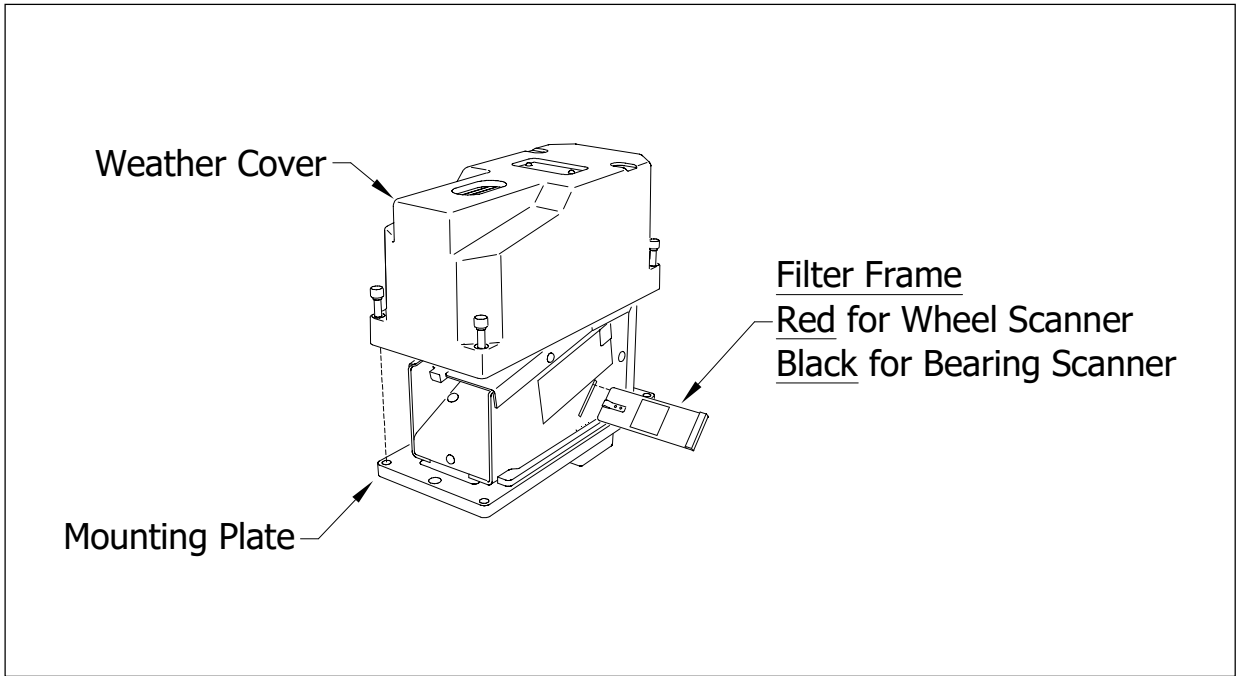
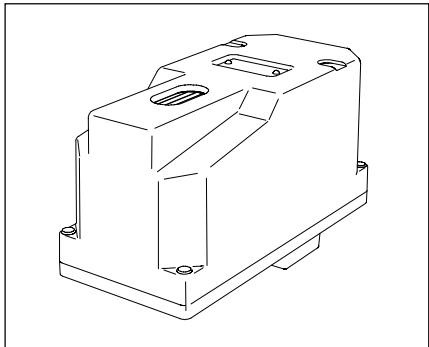


2.1.2 Wheel Scanners

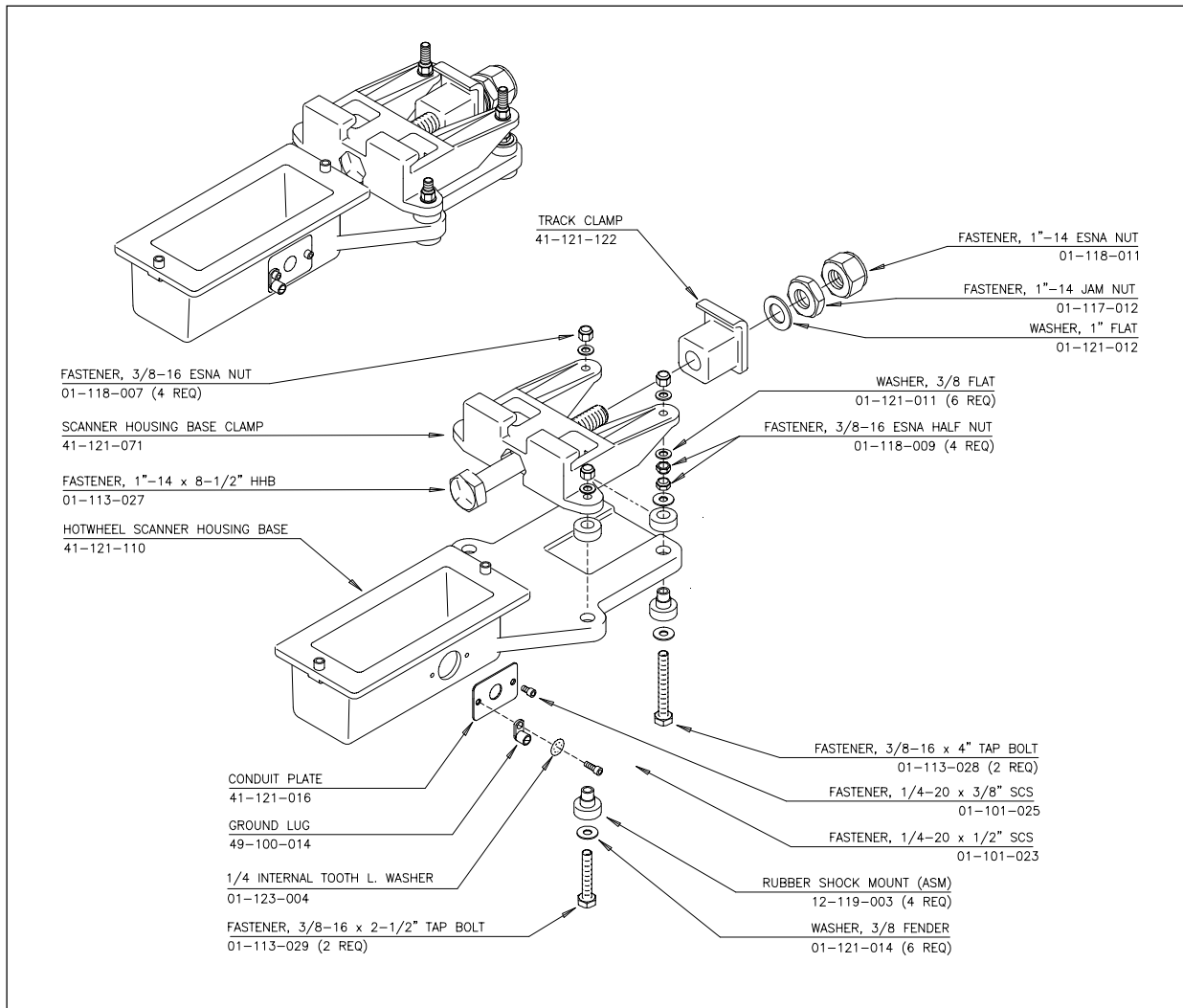
The figure below shows a **Type II** wheel scanner cover-and-module assembly. The only difference between the **Type II** wheel scanner cover-and-module assembly and the one for the **Type II** bearing scanner is the addition of the plastic attenuation plug.



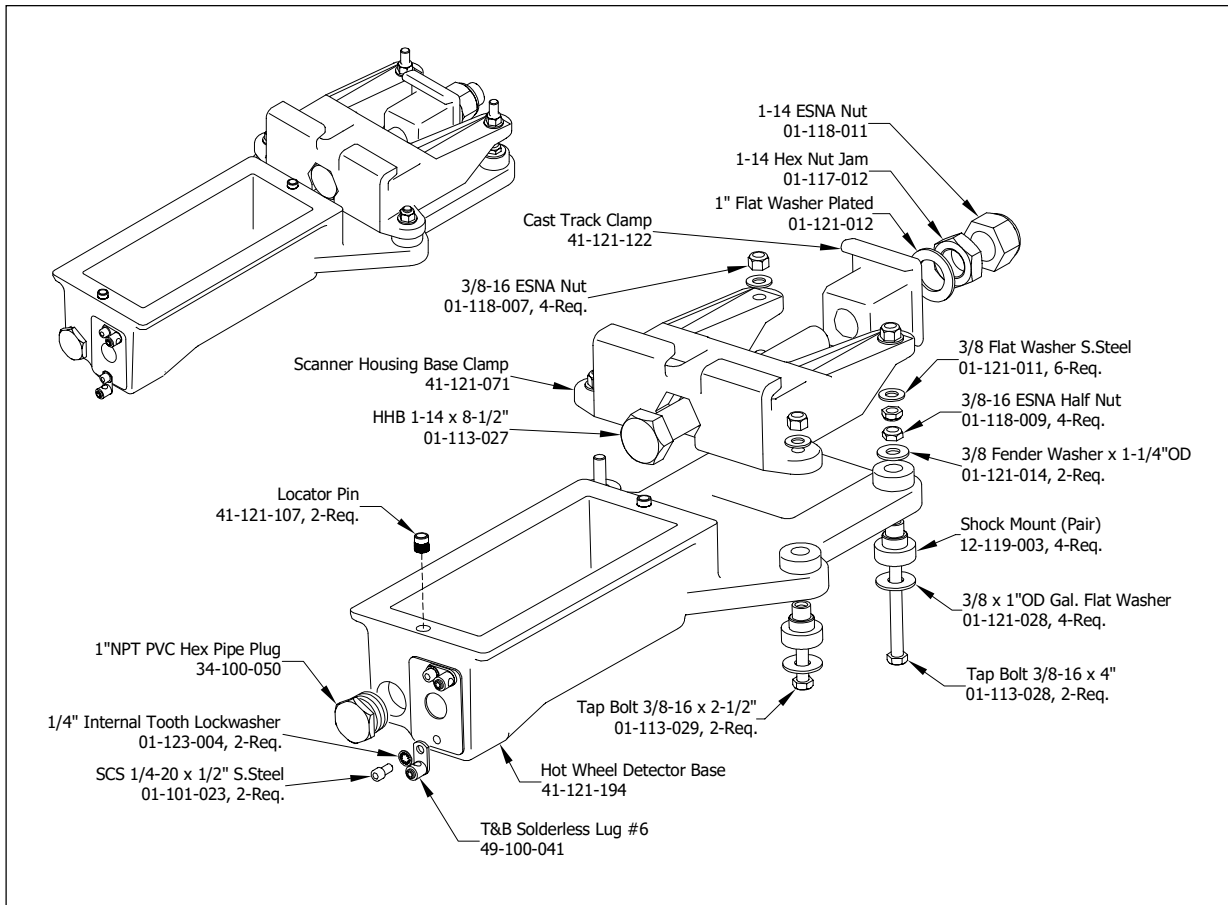
The figure below shows a **Type III** wheel scanner cover-and-module assembly. The only difference between the **Type III** wheel scanner cover-and-module assembly and the one for the **Type III** bearing scanner is a change of filter frames. The **Type III** wheel scanner uses a **red filter frame**. The bearing scanner uses a black one.



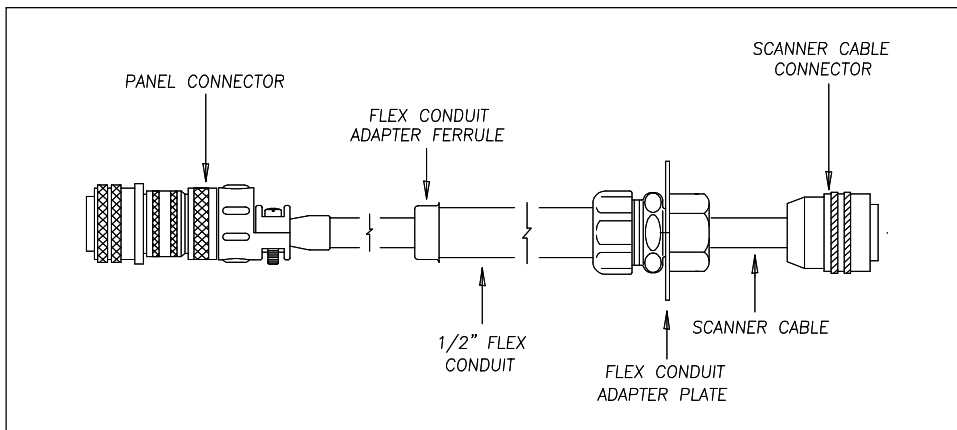
The figure below shows a **Type II** wheel scanner mount (2100-701). Though not recommended, this mount can also be used for **Type III** wheel scanners. However, this guide does not cover the use of this mount for **Type III** wheel scanners.



The figure below shows a **Type III** wheel scanner mount (2500-401).



The figure below shows the wheel scanner cable. The only difference between the bearing scanner cable and the wheel scanner cable is a different flex-conduit-adapter plate. The one for the wheel scanner is smaller. (The part number for the 65-foot (19.8-meter) wheel scanner cable is 2058-260HW. For the 85-foot (25.9-meter) cable, it's 2058-268HW. For the 100-foot (30.5-meter) cable, it's 2058-265HW.)



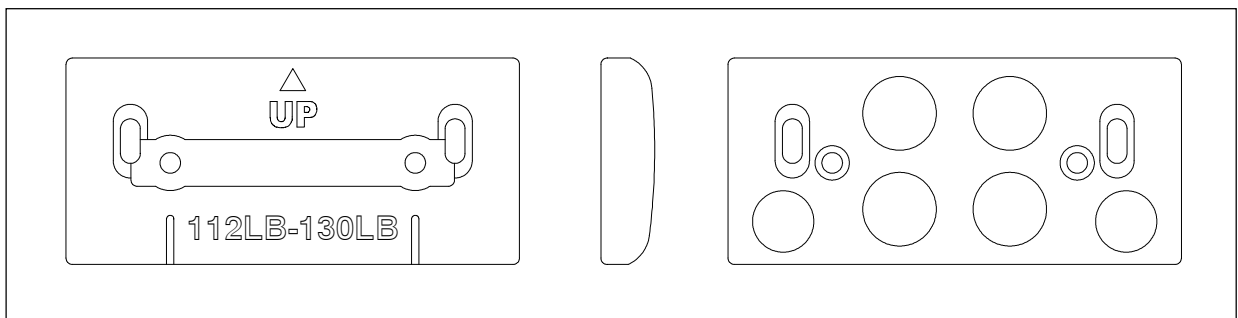
2.2 Transducers

Transducers are rail-mounted devices that provide the timing signals that allow the system to:

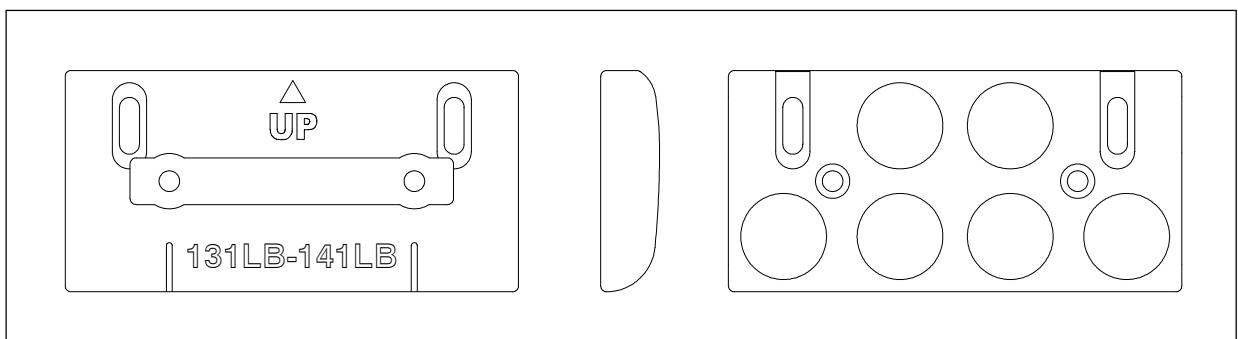
- Detect a train's presence
- Coordinate gating
- Determine a train's direction
- Calculate a train's arrival and exit speeds
- Calculate a train's length
- Identify individual railcars and locomotives based on axle spacing patterns

Two mounting plates are packaged with each transducer. The smaller one, which is labeled **112LB-130LB**, is used with lighter rails. The larger one, which is labeled **131LB-141LB**, is used with heavier rails.

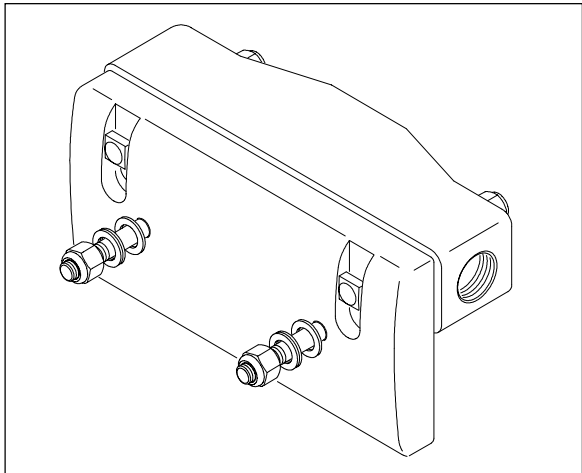
If your rail size were 112 to 130 pounds per yard (55.6 to 64.5 kilograms per meter), you would use the smaller mounting plate (2100-554) that looks like this.



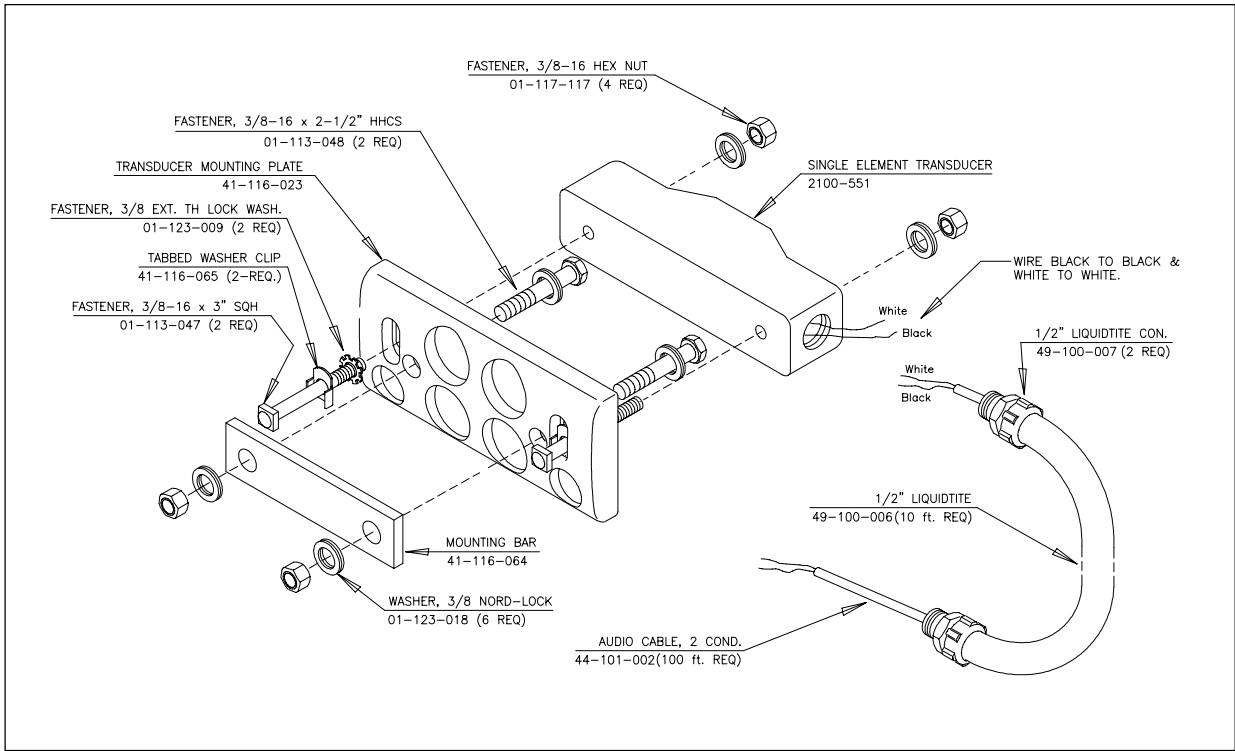
If your rail size were 131 to 141 pounds per yard (65.0 to 69.9 kilograms per meter), you would use the larger mounting plate (2100-552) that looks like this.



The figure below shows an assembled transducer with the **larger mounting plate**.



The figure below shows the parts of a transducer with the **smaller mounting plate**.

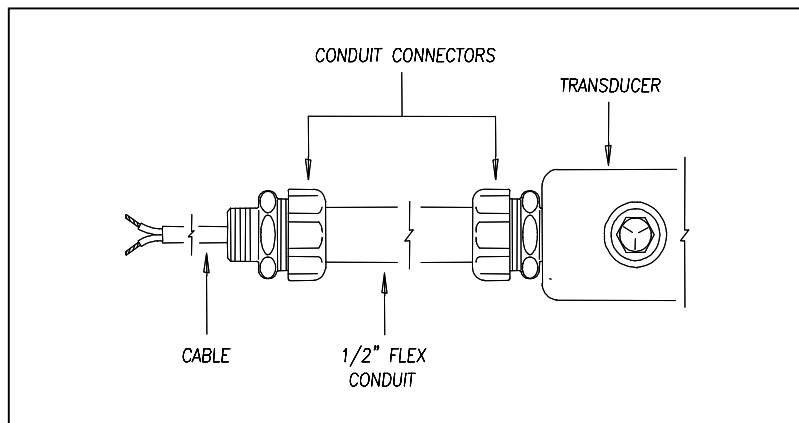


STC transducers consist of a horseshoe magnet with a tightly wound coil encapsulated in a rigid epoxy potting compound. Each transducer is mounted 1-9/16 inches (3.97 centimeters) below the top of the rail. As the wheels of a railcar pass over the transducer, the wheel flange disturbs the flux field of the magnet, causing the output of a sinusoidal waveform of varying amplitude. The depth of the flange and the speed at which the wheel is moving determines amplitude.

The SmartScanIS can use two types of STC magnetic transducers. Both are identical but are named differently, depending on their location and their function. One type is called gating transducer. The other is called advance transducer.

All tracks use two rail-mounted gating transducers. On the rail nearest the bungalow (aka wayside enclosure), these transducers (labeled **TO1** and **TO2**) are mounted near and to the north or east of the bearing scanner. They control scan timing and car recognition. Additionally, some tracks use rail-mounted advance transducers. On the rail nearest the bungalow, the two advance transducers (labeled **ADV1** and **ADV2**) are mounted about 32 feet (9.75 meters) on either side of the gating transducers. The first one encountered provides a signal that changes the state of an inactive system from idle to scan mode. (Instead of two advance transducers, train presence can be ascertained by using a track circuit.) Once mounted to the rail, the bodies of advance transducers and gating transducers can be moved up and down.

The figure below shows a transducer cable.



One end of the transducer cable comes attached to the transducer. The other end has two wires protruding from the conduit. These wires are black and white. They attach to a surge protector located on the surge-protection panel. There is one surge protector assigned to transducer TO1 and another to transducer TO2. These surge protectors protect the SmartScanIS from transients and surges, which can be induced onto external wiring by lightning.

2.3 Auxiliary-Alarm Detectors

The standard SmartScanIS can support input from as many as four external alarm devices. Any device that provides an open set of relay contacts upon alarm detection can be supported by the system. The system responds to an open contact by announcing the defect and the axle number nearest the defect. Alarm detection and announcement are in real-time. The SmartScanIS supports dragging equipment alarms, high-load alarms, and wide-load alarms. Other alarm devices require custom speech programming.

STC doesn't manufacture any auxiliary-alarm input devices. Therefore, their installation, use, and maintenance aren't covered in this manual.

2.4 AEI Antennas

Each AEI-configured SmartScanIS site requires two antennas, designated antenna1 and antenna2. The antennas are used in conjunction with the 2200-750 Reader, which is described in **Chapter 4 - Bungalow Components**.

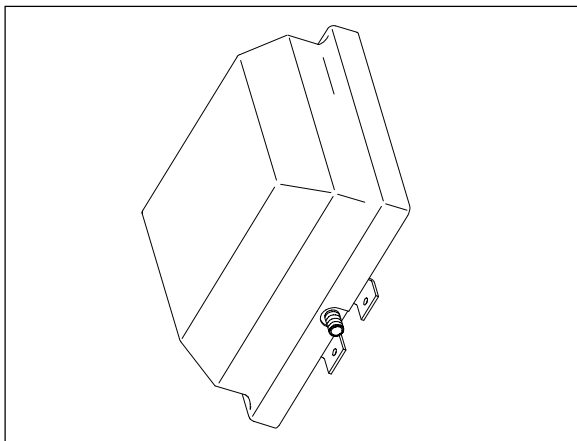
The SmartScanIS supports two types of antennas.

- Sinclair SRL470 antennas
- Scala HP9-915 Parapanel antennas

These antennas are described below.

2.4.1 Sinclair SRL470 Antennas

Two 100-watt Sinclair SRL470 antennas (or two Scala HP9-915 Parapanel antennas) are installed per track. The SRL470 is a directionally-pointed horizontally-polarized panel antenna. It is housed in a compact white enclosure that is made from materials that don't interfere with the transmission and reception of radio waves. It is suitable for pipe, tower, or wall mounting.



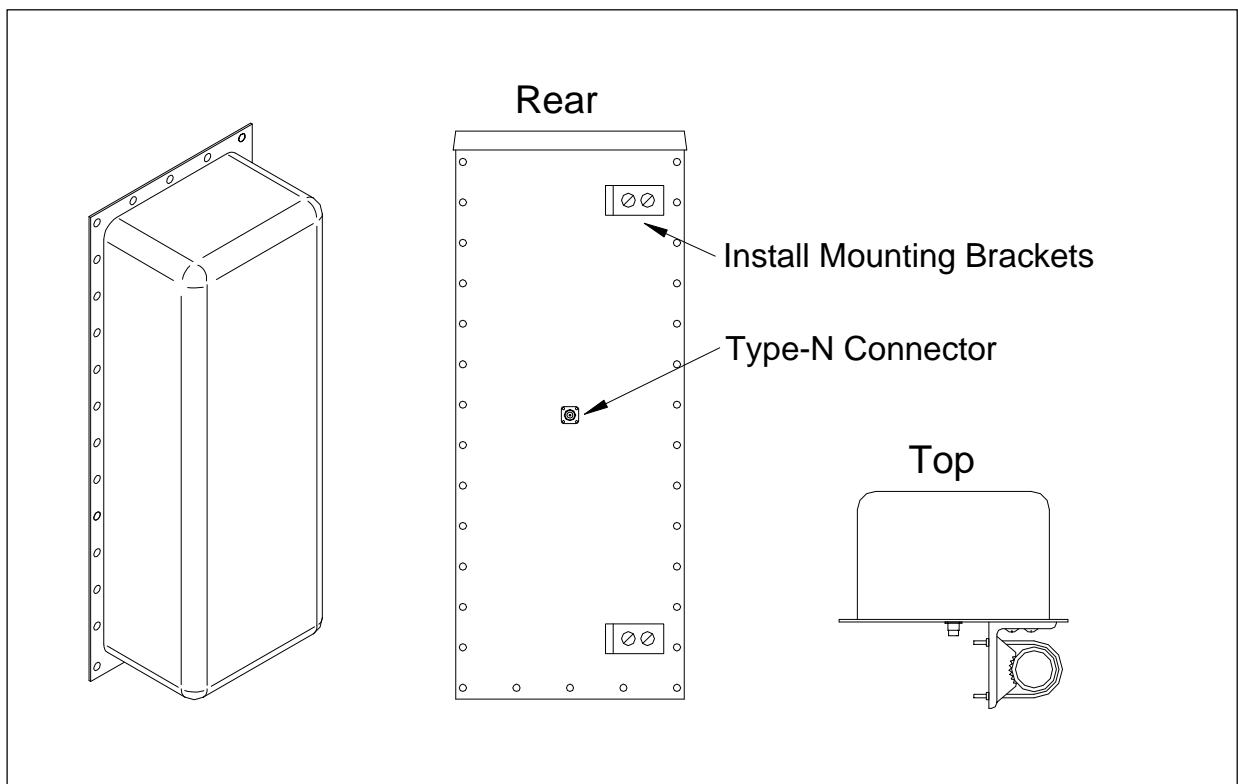
In reference to the track, **antenna1** is the northmost or eastmost antenna. **Antenna2** is the southmost or westmost antenna.

Each SRL470 antenna is installed:

- With its face parallel to the rails
- With its N-type socket pointing down
- 10 feet (3 meters) from the center of the track
- 3.5 feet (1.1 meters) above the top of the rails
- Centered between the gating transducers
- Opposite each other

2.4.2 Scala HP9-915 Parapanel Antennas

Two 100-watt Scala HP9-915 Parapanel antennas (or two Sinclair SRL470 antennas) are installed per track. The HP9-915 is a directionally-pointed horizontally-polarized panel antenna. It has a gain of 9.5 dBd. It is housed in a compact white enclosure that is made from materials that don't interfere with the transmission and reception of radio waves. It is suitable for either pipe or tower mounting.



In reference to the track, **antenna1** is the northmost or eastmost antenna. **Antenna2** is the southmost or westmost antenna.

Each HP9-915 antenna is installed:

- Vertically with its face parallel to the rails
- 10 feet (3 meters) from the center of the track
- 3.5 feet (1.1 meters) above the top of the rails
- Centered between the transducers
- Opposite each other

2.5 Track Circuit

Some SmartScanIS sites use a track circuit to detect train presence. Other sites use advance transducers for this purpose.

The track circuit is nothing more than two wires attached to the rails. One wire is attached to each rail. They are attached directly opposite each other, centered between the gating transducers. Connection to the rail can be made in one of two ways.

- **Bonding** – Cadweld manufactures a line of bond welding systems that are commonly used in the rail industry. The recommended practice is to weld a short length of bond strand to the web of each rail. Cadweld can provide these items as prepackaged kits, which include the bond strand (a 3/16-inch (4.8-millimeter) diameter strand is recommended) and the one-shot welding system. A reusable mold of the correct size is required.
- **Drilling** – The alternative to Cad-welding is to drill a 3/8-inch (9.5-millimeter) hole in the web of each rail at the neutral axis, and apply a bonding kit. The kit includes ready-made lengths of bond strand with "chicken heads" attached. The "chicken heads" are tapered solid metal inserts that can be driven into the 3/8-inch (9.5-millimeter) holes to establish a permanent connection to the rail.

Once the rail attachment is made, extend the connection to the Surge Protection Subassembly in the SmartScanIS enclosure. You do this by splicing a length of wire to each bond strand. Okonite Cable makes a twisted-pair cable (Okonite 113-12-3933) that is suitable for direct burial. The cable has two 6 AWG solid conductors and a very rugged insulation jacket. The cable should be attached to the bond strand using compression sleeves.

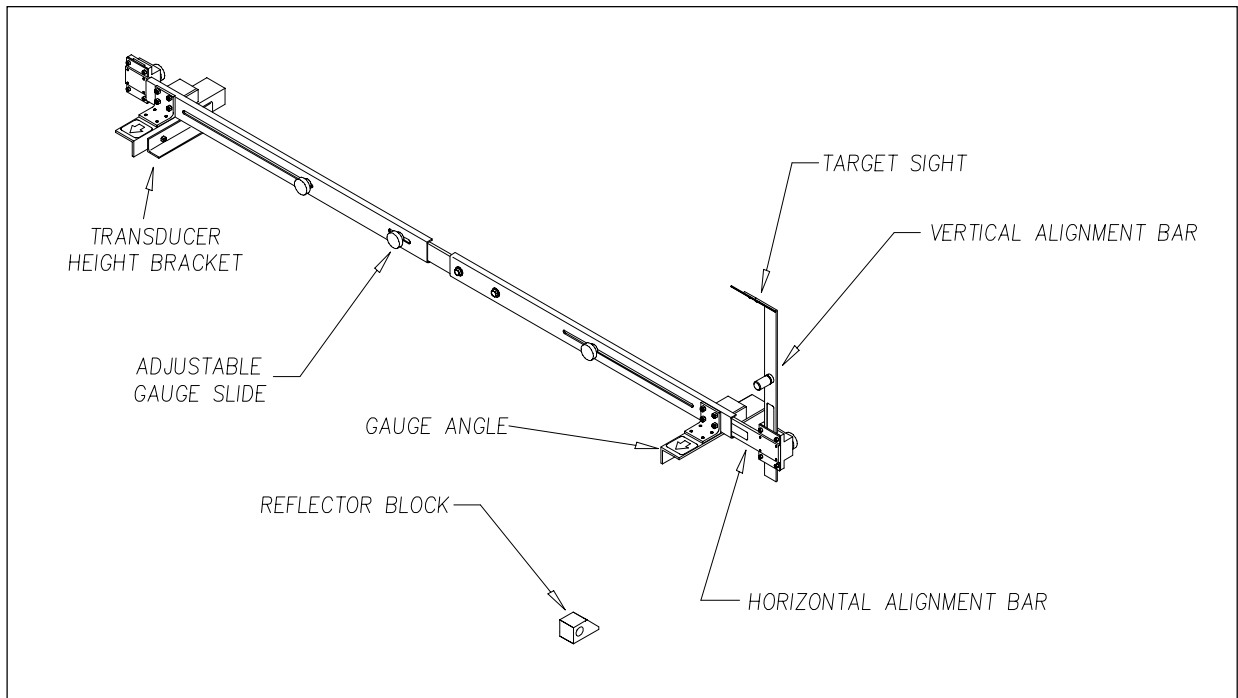
The track circuit is used in conjunction with the 2200-500 Presence Detector, which is described in **Chapter 4 - Bungalow Components**. This module continuously sends a signal down one of the wires of the track circuit. When the wheels-axle of a train (or any metal object) shunts the track, this completes the circuit, causing the signal to return to the 2200-500 Presence Detector via the other wire. At a certain distance from the track circuit, the amplitude of the signal is strong enough to trigger an active high, which indicates to the SmartScanIS that a train is present. This shunting zone is adjustable up to 150 feet (45.7 meters) on each side of the attached track-circuit wires.

Chapter 3 Adjustment Components

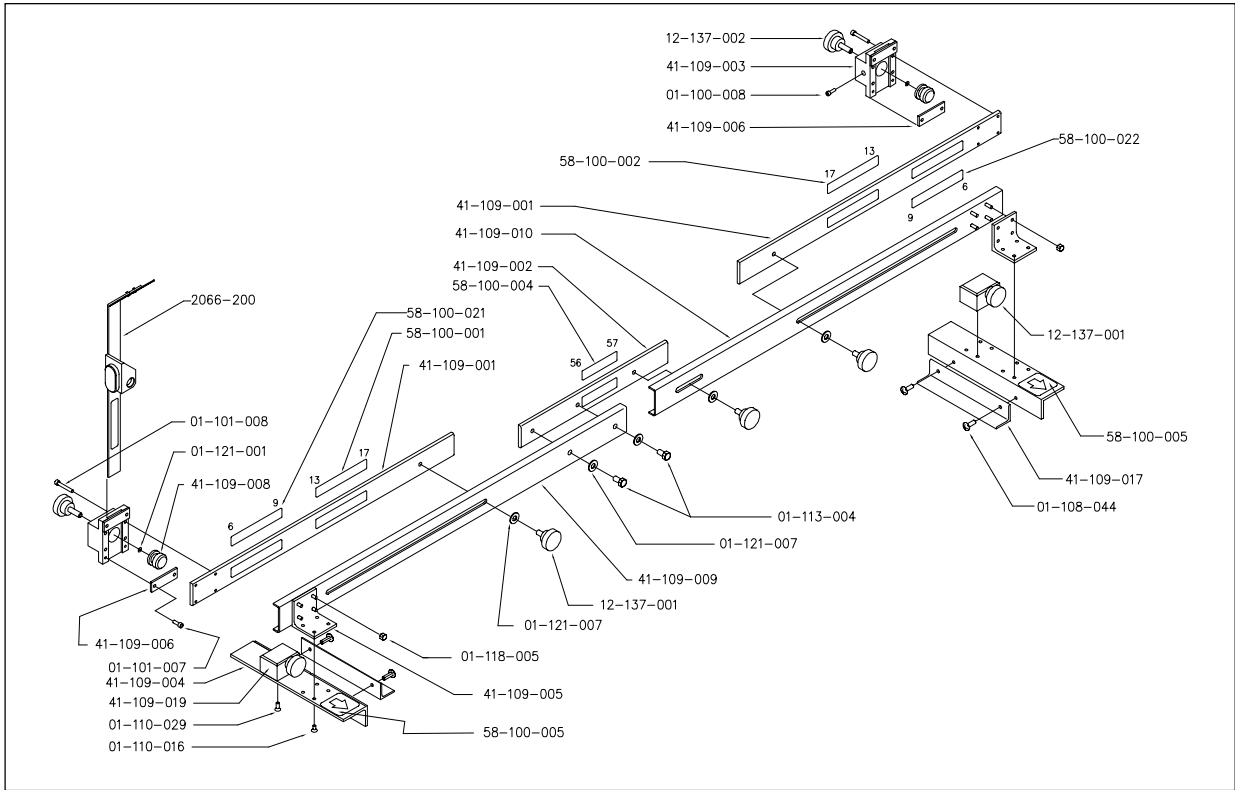
This chapter describes the components that are used during the adjustment process. Covered are the alignment fixture and the calibrated heat source. STC supplies one of each for each SmartScanIS site. **Chapter 7 - Adjusting the Track Components** and **Chapter 9 - Placing a System into Service** tell how to use these components to establish proper scanner alignment and to set and verify the heat values seen by the scanners.

3.1 2066-000 Alignment Fixture

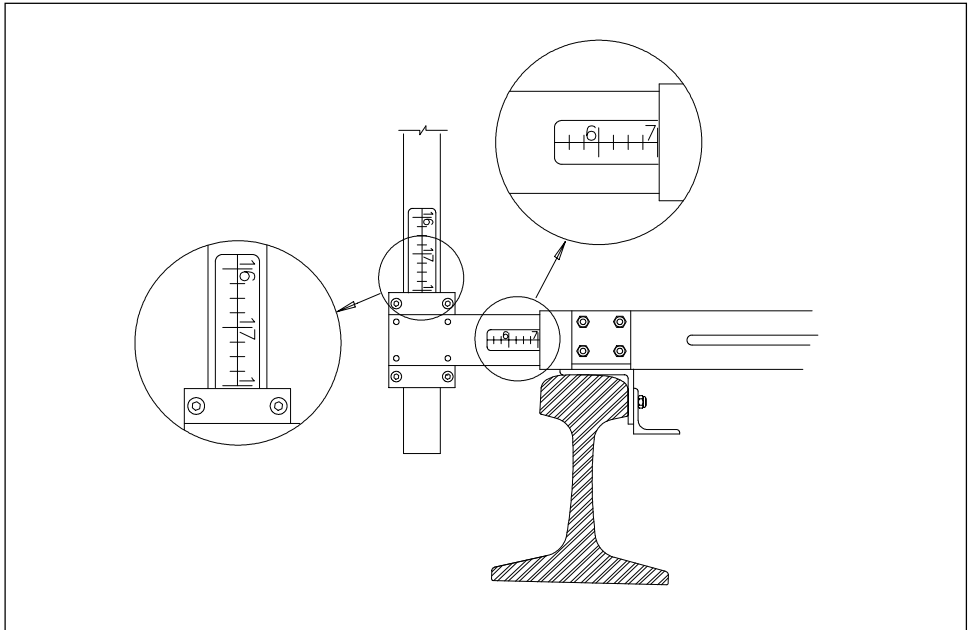
The figure below shows an assembled alignment fixture (2066-000).



The figure below shows the parts of an alignment fixture (2066-000).

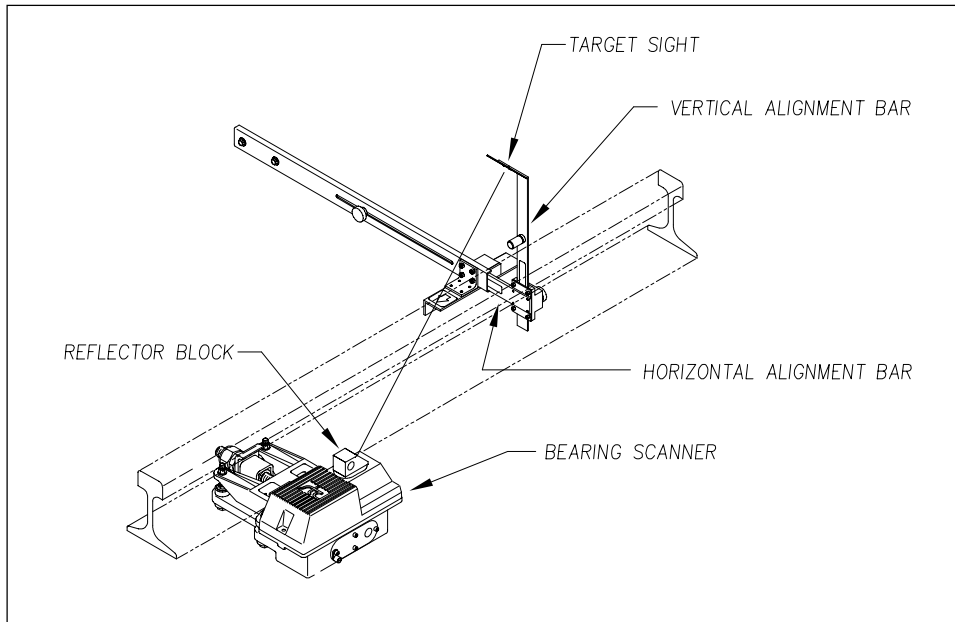


The alignment fixture is used to ensure that all scanners are aimed at the proper point above the rail. Each axis of the fixture is equipped with graduated scales that give indications relative to the top of the rail and the gauge.

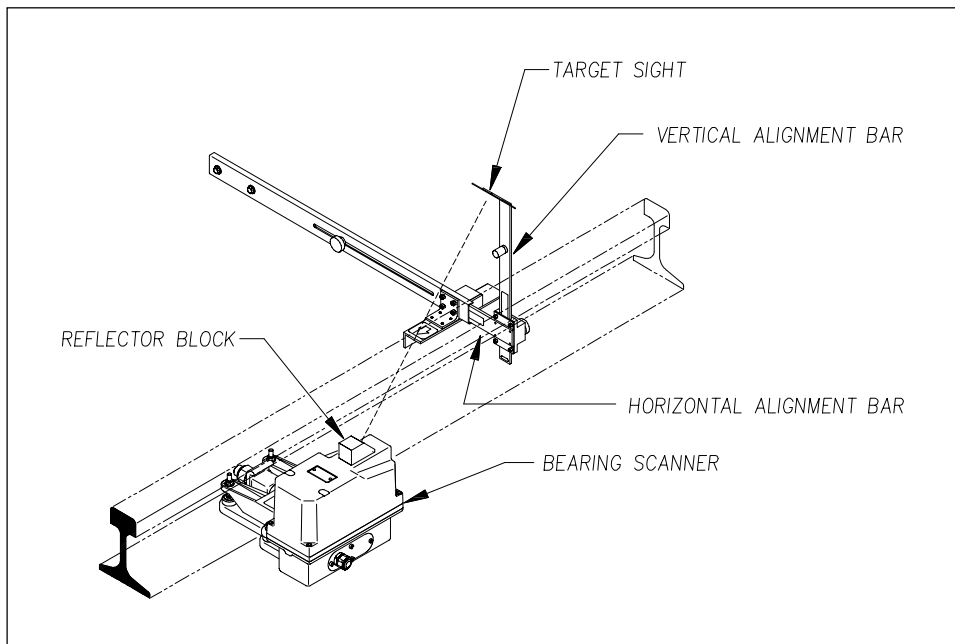


The fixture is used differently for bearing scanners and for wheel scanners. To align **Type II/Type III** bearing scanners, you use the optical system of the fixture. The key parts of this optical system are the target sight and the reflector block.

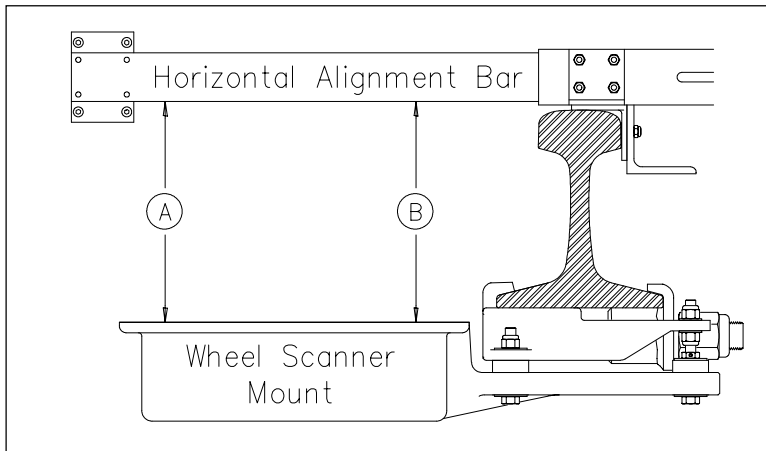
Shown below is the alignment of a **Type II** bearing scanner.



Shown below is the alignment of a **Type III** bearing scanner.

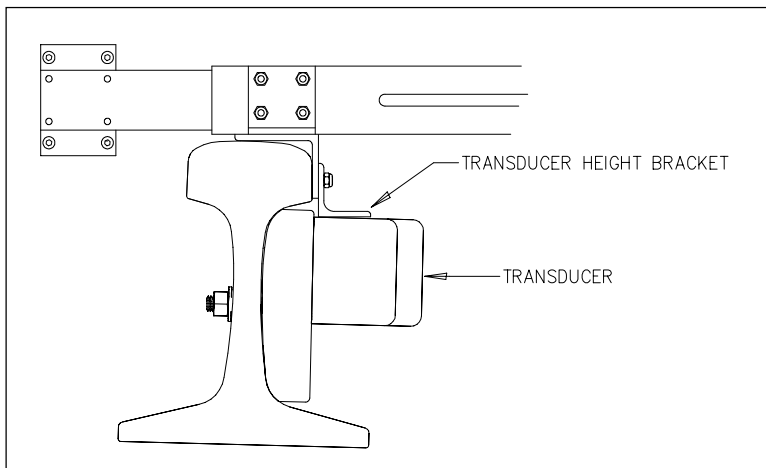


To align **Type II/Type III** wheel scanners, you use the horizontal alignment bar of the fixture. Alignment is done by measuring from the bottom of the extended bar to the top of both ends of the scanner mount. When both measurements are the same, alignment is correct. That is, as shown below, when distance **A** is equal to distance **B**, alignment is correct.



Alignment must be performed when a new scanner is installed. Thereafter, unless the scanner is damaged, it is unlikely that alignment will change once it has been set.

The transducer height bracket on the bottom of the alignment fixture can be used to ensure proper installation of the transducers. When the transducer body touches the bracket, the transducer body is 1-9/16 inches (3.97 centimeters) below the top of the rail and parallel to it.



3.2 2100-810NG Calibrated Heat Source

When a new scanner is installed, calibration is done. Thereafter, calibration usually is done only when needed or on a regular basis during scheduled maintenance.

The supplied calibrated heat source (2100-810NG) operates from a 120-volt 60 Hz power source. Minimum operating voltage is 105 volts. A frequency of 50 Hz won't work. The supplied 16-gauge orange power cable provides the necessary safety ground. This cable is 50 feet (15 meters) long. If you need to add an extension cord to this cable, make sure it is 16 gauge or larger thickness of wire.

For a site that doesn't have a 120-volt 60 Hz power source, the heat source should be powered from a true sine wave inverter capable of 250 watts with an output of at least 110 volts at 60 Hz. The inverter should operate from an input voltage of 10.5 VDC to 15 VDC. A 120-volt USA socket should be provided to match the heat source power cord. The inverter should be grounded according to the manufacturer's recommendations.

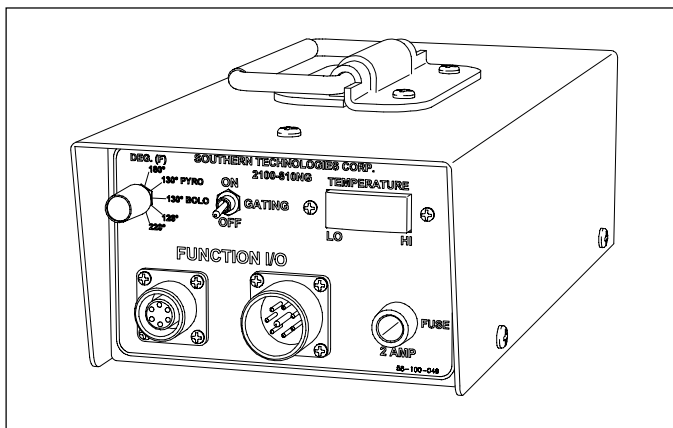
On the front of the calibrated heat source is a knob that lets you select one of five delta temperatures, ranging from 126°F to 220°F. The heat source contains a heat block that can reach a combined temperature of your delta temperature and the ambient temperature. It can maintain this temperature for extended periods. The heat block is controlled by a circuit that references both ambient temperature and the temperature of the heat block and maintains the selected differential. For example, if the ambient temperature were 85°F (29.4°C) and the knob were set to 180°F (100°C), the heat block would be maintained at 265°F (129.4°C).

Infrared scanners respond to rapid changes in infrared radiation. The calibrated heat source accomplishes the rapid changes by employing a rotating wheel with an aperture in one side. As the wheel turns, the infrared radiation from the heat block is shielded from the scanner until the aperture lines up with the opening in the bottom of the heat source case. The wheel rotates at 300 rpm.

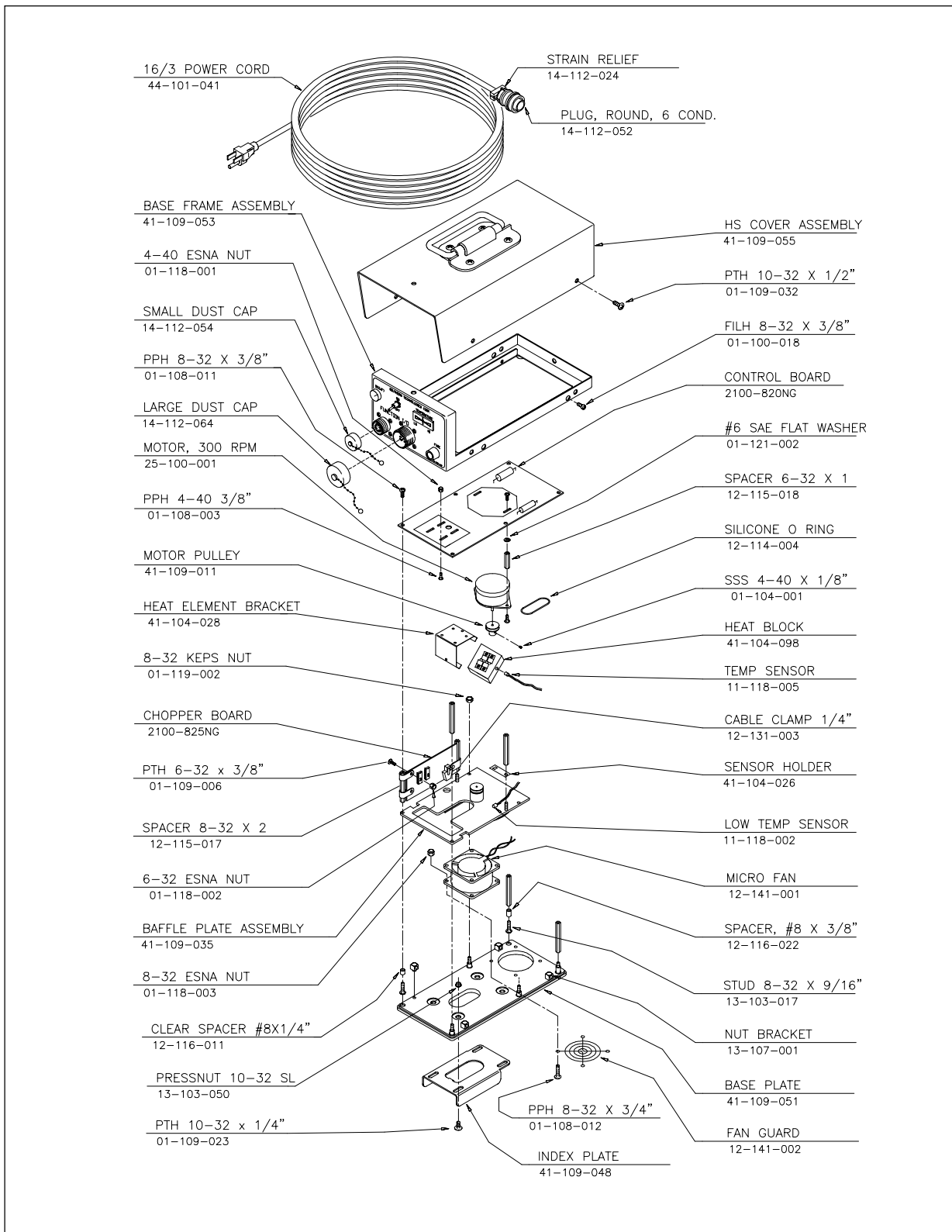
The calibrated heat source is placed over the opening of the scanner cover. With the heat source in place, it is then possible to calibrate the system at a precise value above ambient temperature.

STC recommends that you use the calibrated heat source (2100-810NG) only when the outside (ambient) temperature is above 0°F (-18°C) and below 90°F (32°C). If you must use it at other times, do so only when the needle is centered on the front of the temperature meter. If the needle isn't stabilized within ± 2 degrees of the setpoint, the heat source isn't operating properly.

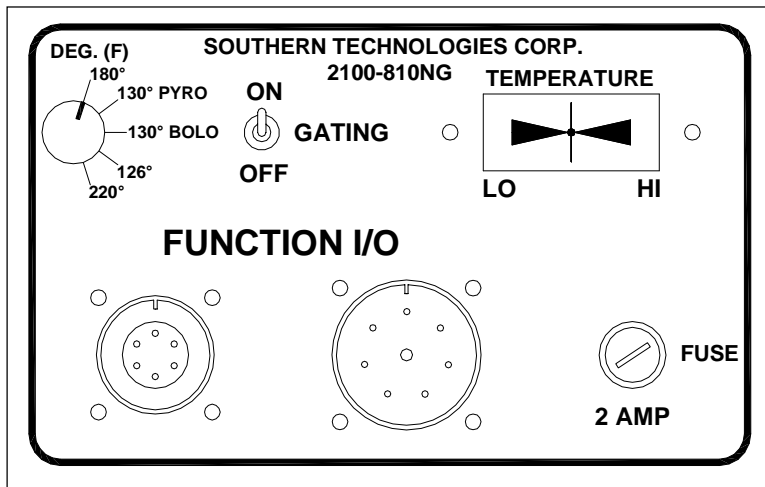
The figure below shows an assembled calibrated heat source (2100-810NG).



The figure below shows the parts of a calibrated heat source (2100-810NG).



The figure below shows the control panel that's on the front of a calibrated heat source (2100-810NG).



3.2.1 Temperature Knob

The temperature knob allows you to select one of five delta temperatures. The temperature label on each knob setting represents degrees Fahrenheit above ambient. The **180** setting is normally used with all STC scanners.

3.2.2 Gating Switch

On the front of the heat source is the **Gating** switch. Toggling it on causes gating signals to be sent to the Function I/O connectors. The first signal sent is a simulated TO1 (aka transducer-A) signal. The second signal sent is a simulated TO2 (aka transducer-B) signal. As long as this switch is toggled on, this sequence continues at a rate of 10 signals per second (five of them being TO1s and five of them being TO2s).

The gating signals aren't needed for calibration of the SmartScanIS. The **Gating** switch may be left in the off position.

3.2.3 Temperature Meter

The temperature meter shows when the heat block has reached the selected temperature setting and has stabilized within ± 2 degrees of the setpoint. From a cold start, this could take 5 to 8 minutes. The heat block is stabilized when the needle is centered.

3.2.4 Function Connectors

The function connectors provide the I/O lines to the heat source, including AC power in and gating signals out.

The six-contact circular connector (on the left side) is compatible with the power cord included with the system. One end of the supplied 2100-832 power cord is connected to the heat source. The other end is plugged into a stable, grounded three-wire AC outlet capable of at least 105 VAC at 15 amperes.

The table below shows the pin assignment for the six-contact connector.

Pin	Assignment
A	AC Neutral
B	AC Hot
C	AC Ground
D	TO1 (positive output pulse)
E	TO2 (positive output pulse)
F	Ground

The eight-contact circular connector (on the right side) isn't used when calibrating STC scanners. **For safety's sake, always cover this connector with the supplied dust cap.**

3.2.5 Fuse

On the front of the heat source is a 2-amp 250-volt fast-acting fuse. It protects the heat source from excessive current.

Chapter 4

Bungalow Components

In this guide, the structure alongside the track is called a "bungalow." This structure, which comes in many shapes and sizes, can be any appropriate waterproof enclosure. It goes by many other names, such as wayside enclosure, location case, apparatus housing, and equipment enclosure.

Attached to the inside of the bungalow is:

- One SmartScanIS enclosure per track
- One power subsystem per SmartScanIS enclosure

Attached to the outside of the bungalow is:

- One radio antenna per radio
- One shielded temperature probe per SmartScanIS enclosure

This chapter describes most of these components.

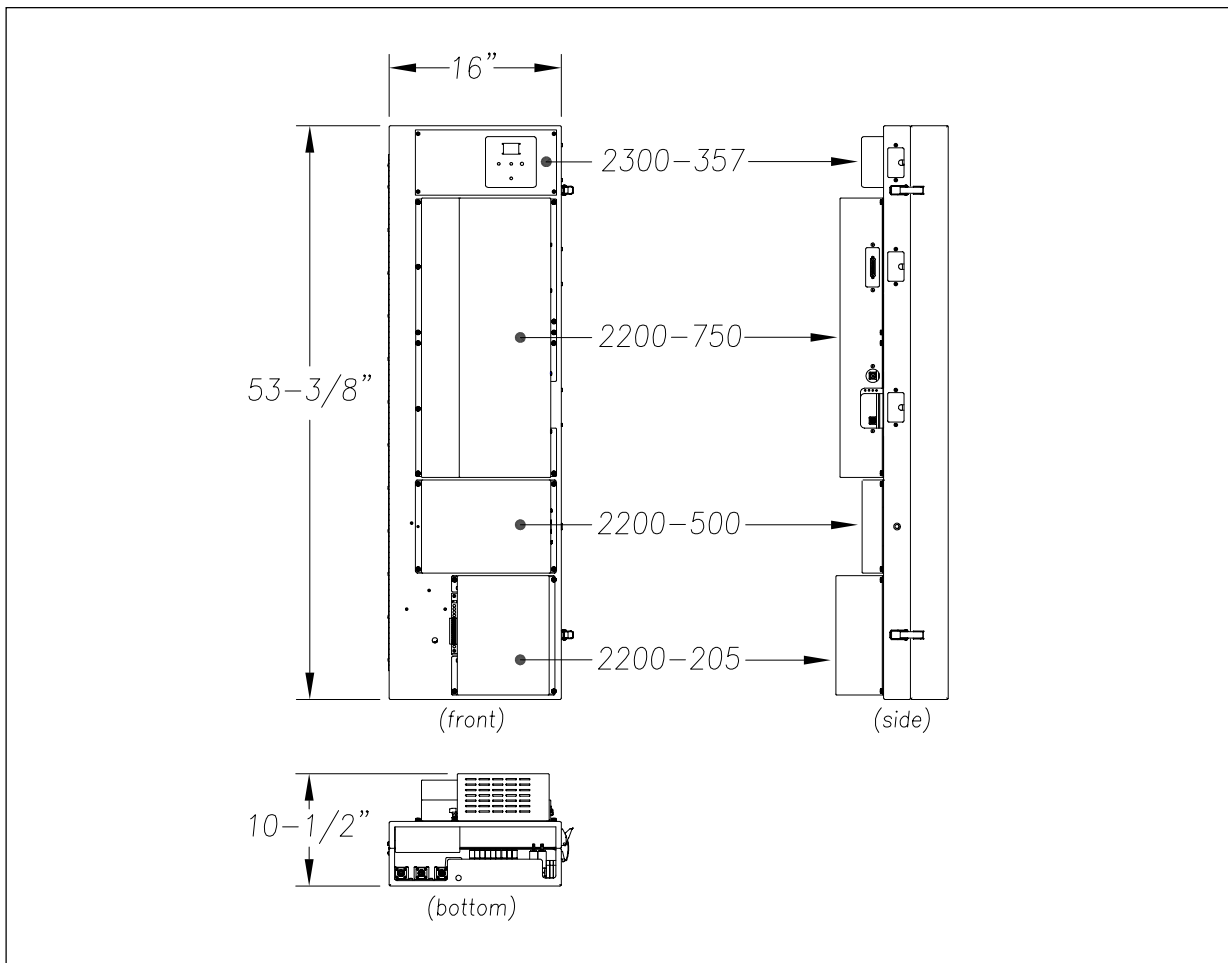
4.1 SmartScanIS Enclosure

There is one SmartScanIS enclosure per track. At double-track sites, the one on the left supports track1, and the one on the right supports track2.

The SmartScanIS enclosure is a wall-mounted system that provides mounting points and interconnections for the various modules that comprise a typical mainline AEI and non-AEI subsystem. The enclosure is designed for applications where trackside space isn't limited, and the user would prefer the SmartScanIS enclosure located in a bungalow.

The SmartScanIS enclosure is designed for easy installation inside the controlled environment of an equipment room or bungalow. The system provides a compact hinged assembly that bolts easily to a wall or other secure structure. The enclosure requires wall space measuring 16 inches (40.6 centimeters) wide by 53.4 inches (135.6 centimeters) high. Forward projection from the wall is 10.5 inches (26.7 centimeters) with the door closed and 18 inches (45.7 centimeters) with the door open.

The figure below shows the outside of the SmartScanIS enclosure.

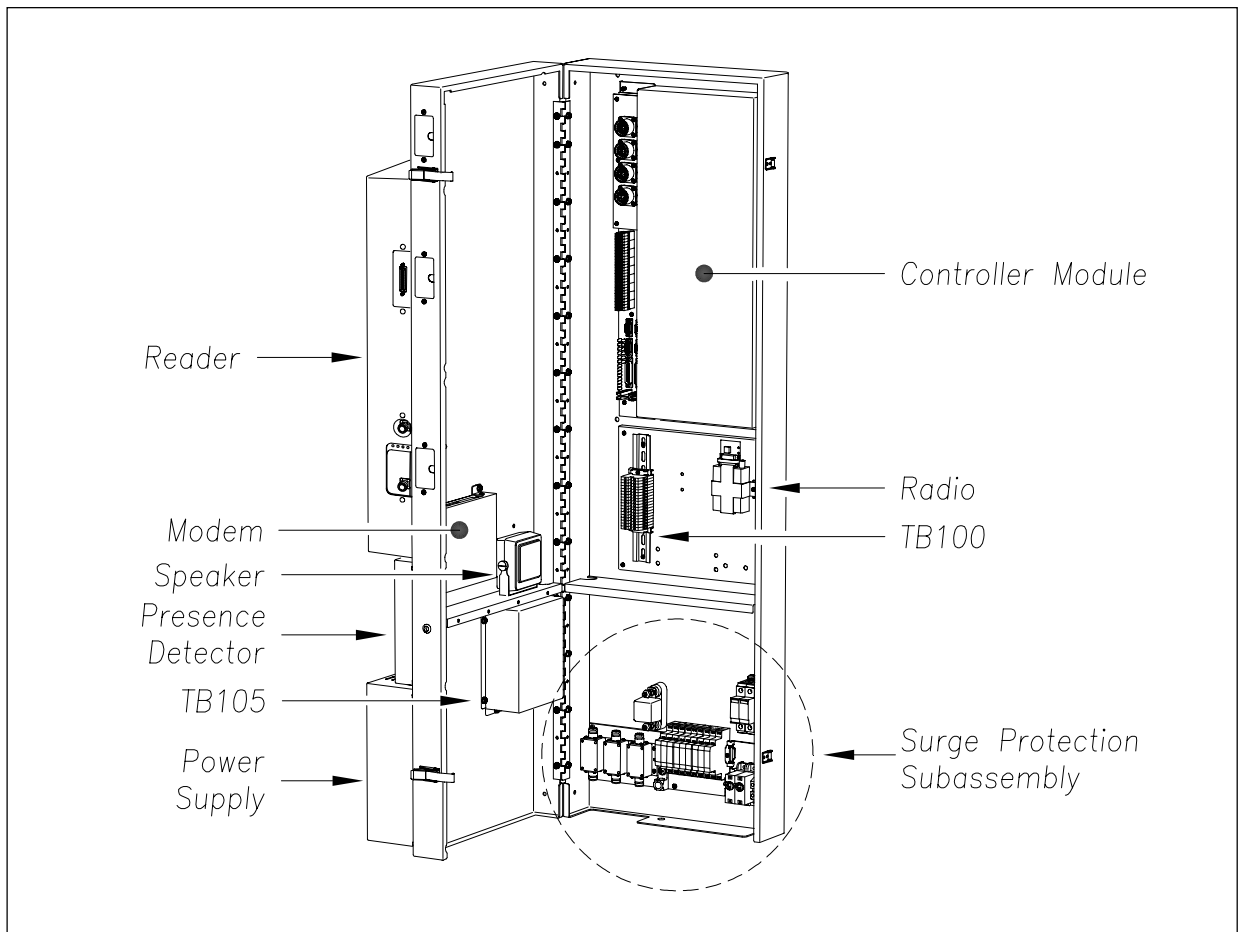


On the outside of the front panel shown above, mounting points are provided for up to four system modules. Beginning from the top of the panel, the modules are:

- Optional 2300-357 Efficiency Test panel
- Optional 2200-750 Reader module, which is used with both **antenna1** and **antenna2**
- Optional 2200-500 Presence Detector module
- Required 2200-205 Power Supply module

Each module is secured to the panel with four Keps-nuts. Serial cables provide interconnections to the System Interface board. The remaining connections are provided through a wire harness with appropriate connectors at the attachment points to the modules.

The figure below shows the inside of the SmartScanIS enclosure.



The SmartScanIS enclosure consists of two formed sheet-metal box panels that are joined by a continuous hinge and coated with a white polyester powder coat to provide a long-lasting finish. An enclosure can easily fit in a 4-ft x 4-ft signal bungalow. It is secured to a plywood backboard with six 1/4 x 1-inch lag screws. System modules are mounted inside and outside of the enclosure to reduce the size of the complete system.

On the inside of the front panel are these components.

- Speaker
- 2200-600 Modem module
- Terminal Block **TB105**

On the inside of the back panel are these components.

- Controller module
- Terminal Block **TB100**
- Radio
- Surge Protection Subassembly

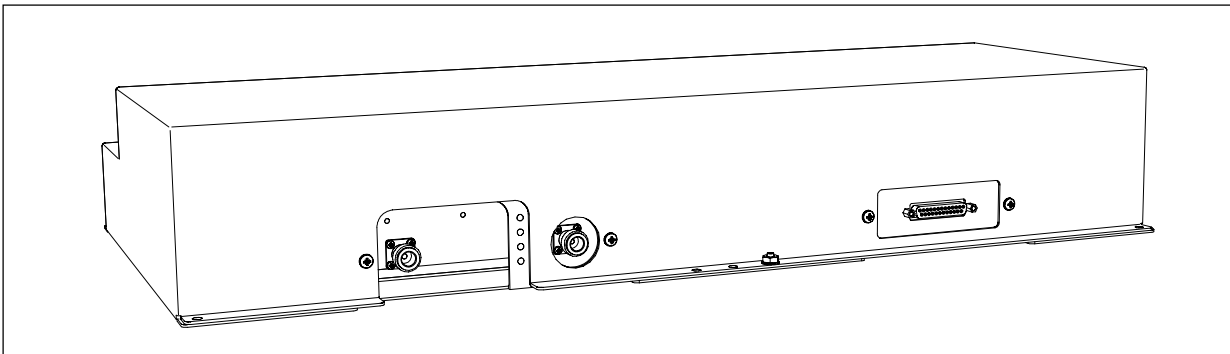
4.2 2200-750 Reader Module

The 2200-750 Reader multiplexes its RF output between two antennas. Normally, this reader is connected to DB25F socket **P5** on the System Interface board.

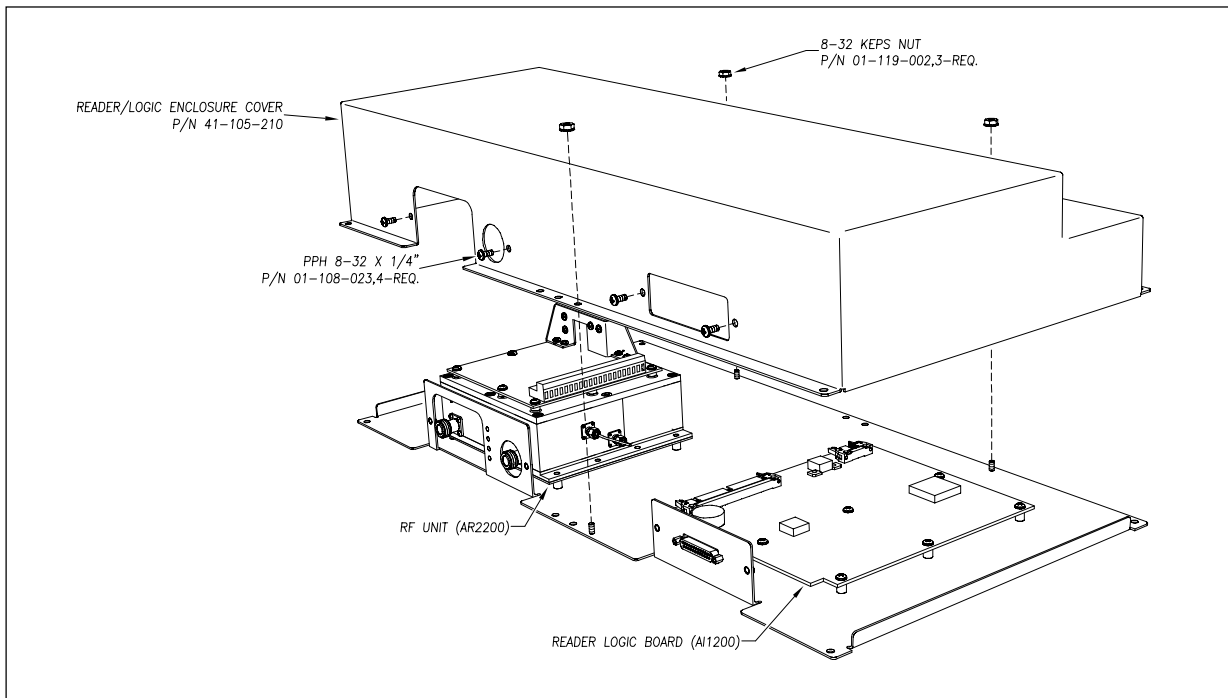
For single-track sites, the standard frequency is 911.5 MHz. For double-track sites, the standard frequency is 911.5 MHz for track1 and 918.5 MHz for track2.

4.2.1 Module Views

The figure below shows an assembled 2200-750 Reader.



The figure below shows the parts of a 2200-750 Reader, containing an RF unit (AR2200) and a Reader Logic board (AI1200).



4.2.2 Front Panel

The figure below shows the front panel of a 2200-750 Reader.



4.2.3 Pinout on AI1200

The table below shows the pinout of the DB25 socket on the front panel.

Pin #	Signal Name	Pin #	Signal Name
1	Ground (Power)	14	Ground (Power)
2	Rxd	15	Unused
3	Txd	16	Unused
4	CTS (clear to send)	17	Unused
5	RTS (request to send)	18	Unused
6	Unused	19	Unused
7	Signal Ground	20	Unused
8	Unused	21	Unused
9	Unused	22	Unused
10	Unused	23	Unused
11	Unused	24	Unused
12	Unused	25	+12 VDC
13	+12 VDC		

4.2.4 LEDs on AR2200

The table below describes what each lit LED, on the front panel, means.

LED Name	LED Color	Meaning When Lit
PWR	Green	Proper voltage is present. Stays lit as long as the AR2200 is powered up.
RF	Green	RF power is on.
RF0	Green	RF power to antenna1 is on. In reference to the track, antenna1 is the northmost or eastmost antenna.
RF1	Green	RF power to antenna2 is on. In reference to the track, antenna2 is the southmost or westmost antenna.

4.2.5 Operation

Commands are used to control the operation of the reader. Setup commands are sent from the Controller module at power startup to configure the reader.

In data mode, the reader reads RFID tags and transmits data messages, such as tag IDs and reports, to the Controller module. Reports provide information on input status changes (input0 and input1), a presence without tag report, and buffer overflow information. In data mode, the Controller module will only send Command 01, which changes the reader from data mode to command mode.

In command mode, the Controller module sends commands to the reader. These commands control the operation and configuration of the reader. After the reader receives a command, it sends an acknowledgment message. Typically, the acknowledgment message contains the word Error, the word Done, or data relating specifically to the command request. These messages may be of variable length since some commands require information as part of the message.

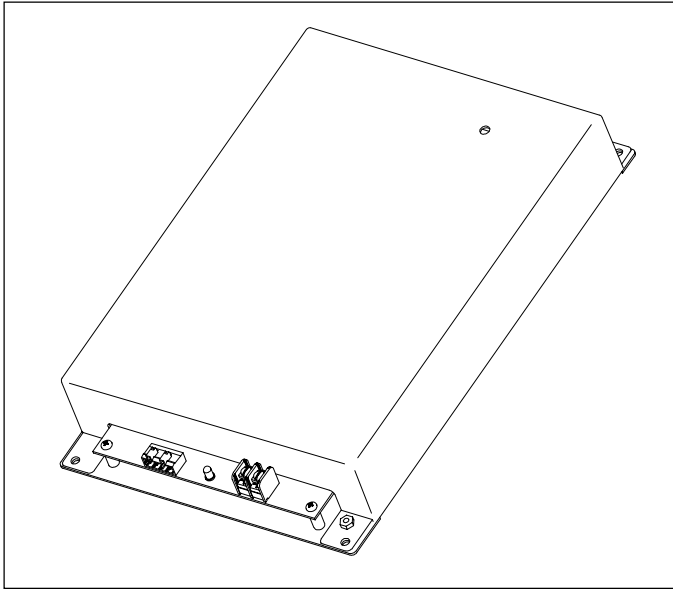
4.3 2200-500 Presence Detector Module

Most SmartScanIS sites use a track circuit. If your site does, it also needs a 2200-500 Presence Detector module, which activates the SmartScanIS when a train is present at the site. If your site is using two advance transducers instead of a track circuit, there is no 2200-500 Presence Detector.

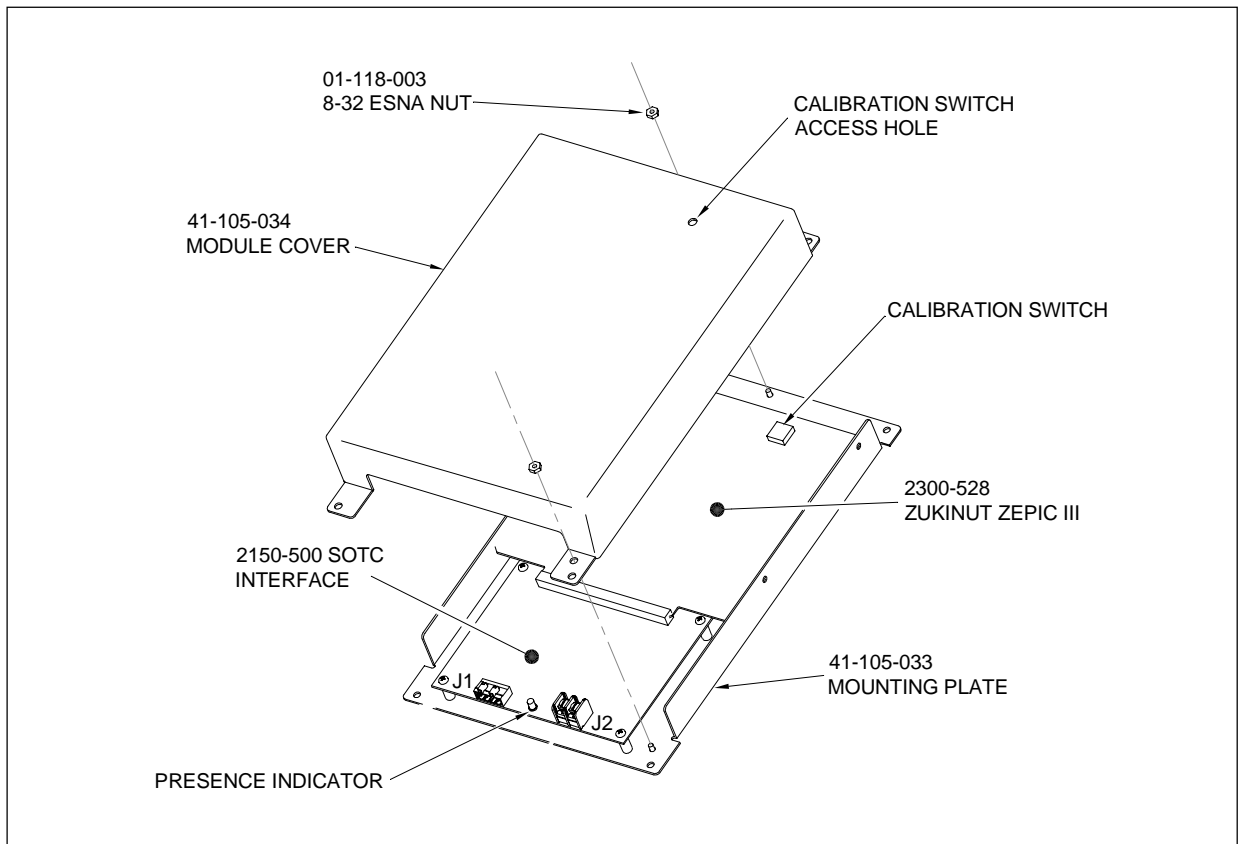
On the outside of the SmartScanIS enclosure, mounting studs are provided for the 2200-500 Presence Detector. Directly below the 2200-750 Reader, the Presence Detector is secured to the panel with four Keps-nuts. A cable connects the Presence Detector to terminal block **TB105** located inside the SmartScanIS enclosure. If your SmartScanIS was shipped in a bungalow, you'd need to install the Presence Detector. If it was shipped in a crate instead, the Presence Detector was already installed.

4.3.1 Module Views

The figure below shows an assembled 2200-500 Presence Detector.



The figure below shows the parts of a 2200-500 Presence Detector.



4.3.2 Pinout

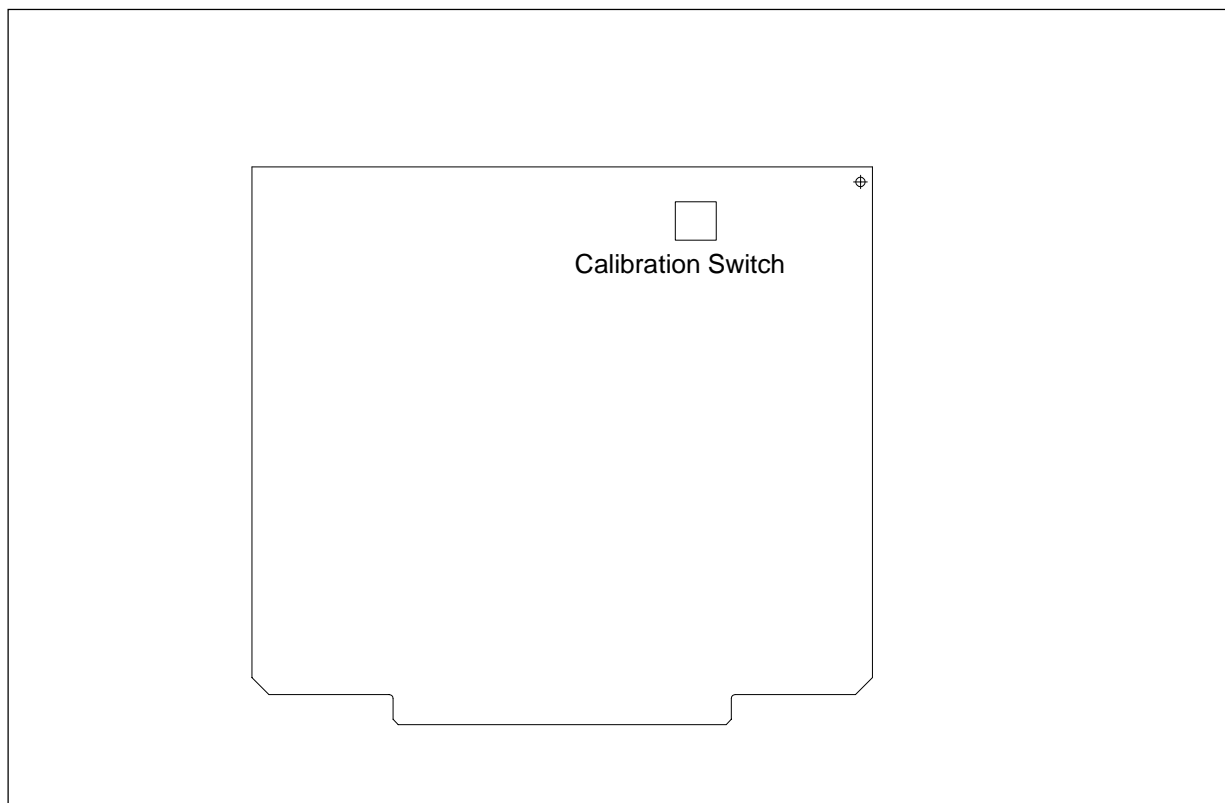
The J1 connector provides connections for module power and presence signal output. The table below shows the J1 pinout.

Pin #	Function
1	BATT+ (9 VDC to 28 VDC)
2	GND
3	PRES OUT
4	NC

The J2 terminal block is for the track circuit inputs. One rail is connected to terminal-1, the opposite rail to terminal-2. Polarity makes no difference.

4.3.3 2300-528 Zepic III Board

The Zepic III board (aka SOTC board) operates on a voltage range of 9 to 24 VDC. This board provides a consistent activation point independent of input voltage. The semiautomated track circuit setup feature makes calibration quick and easy. Just place a shunt and push a button.

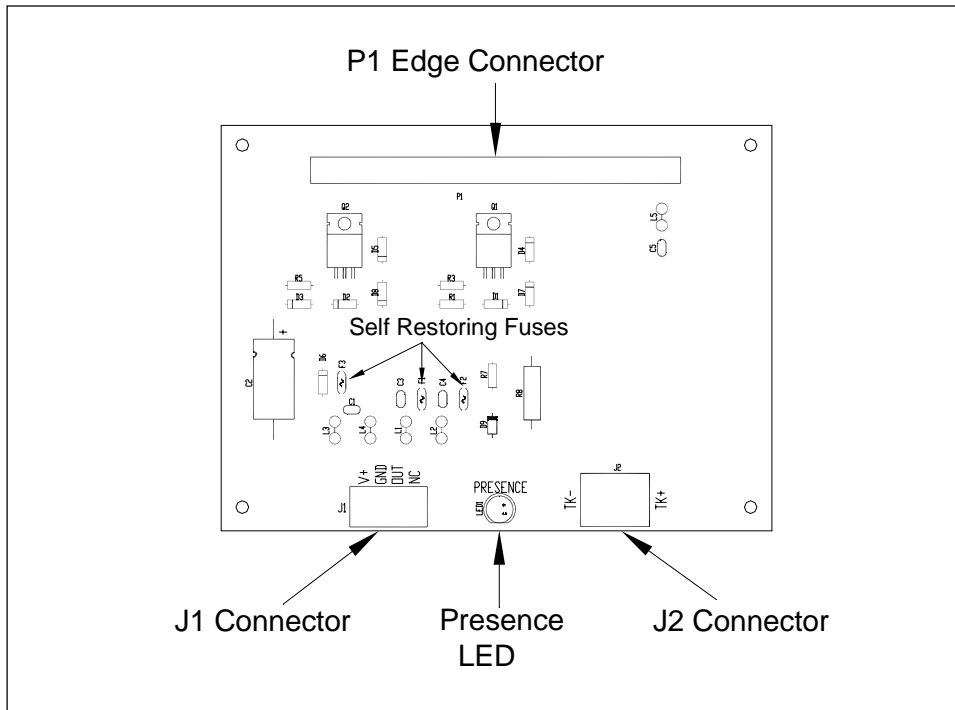


4.3.4 2150-500 SOTC Interface Board

Among other things, the 2150-500 SOTC Interface board provides:

- Connection points to the Zepic III board (aka SOTC board) and the rest of the system.
- Fusing for itself and the Zepic III board.

The figure below shows a 2150-500 SOTC Interface board.



The 2200-500 SOTC Interface board has one LED. If everything is functioning properly, a lit LED indicates that a train is present. An unlit LED indicates that no train is present. While in calibration mode, the LED flashes until calibration is complete. Also, the 28-pin edge connector connects the 2150-500 SOTC Interface board to the 2300-528 Zepic III board.

4.4 2200-205 Power Supply Module

The 2200-205 Power Supply module is a combination power supply and battery charger for the SmartScanIS. Two DC outputs are provided.

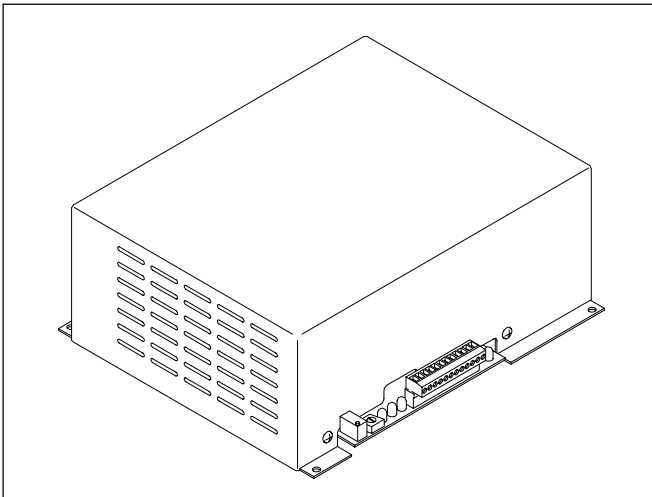
- A 24-volt output capable of charging batteries.
- A 12-volt (adjustable) 100-watt output capable of 8-amps maximum current.

AC powers the SmartScanIS. Input power is 104-127 VAC. The 2200-205 Power Supply converts the externally supplied AC to regulated DC power. When AC power fails, the 12 VDC output is supplied from the batteries through the 2200-205's DC-DC converter. LED indicators are provided for the two DC outputs, the AC input and an AC power fail condition. A relay contact closure is also provided for the AC power fail condition. All connections to the 2200-205 Power Supply are made through a pluggable terminal block **TB1**.

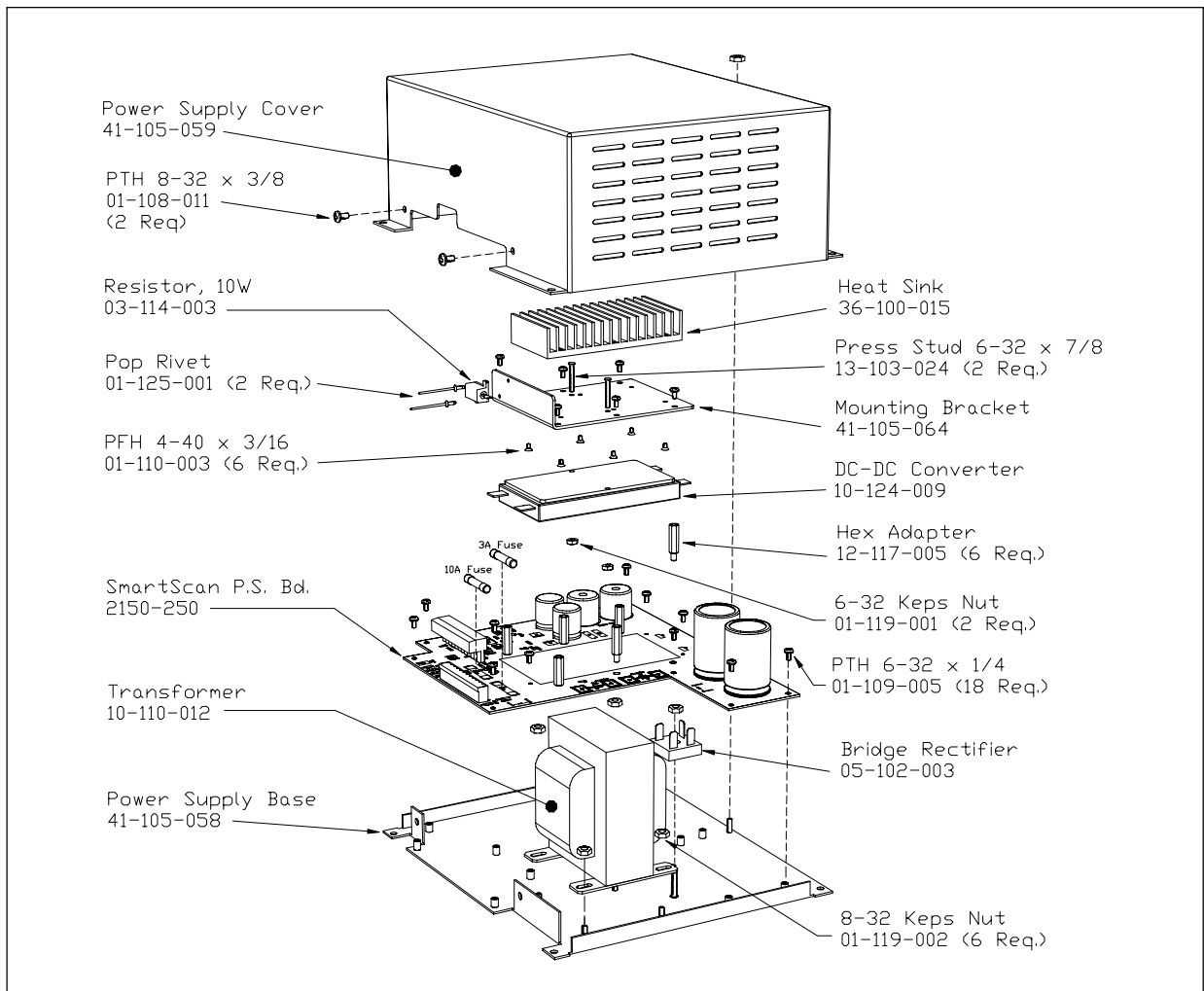
The 2200-205 Power Supply contains:

- Module cover
- Fuses
- Potentiometers
- Status LEDs
- Power converter and battery charger
- Power Supply board
- Module base

The figure below shows an assembled 2200-205 Power Supply.



The figure below shows the parts of a 2200-205 Power Supply.



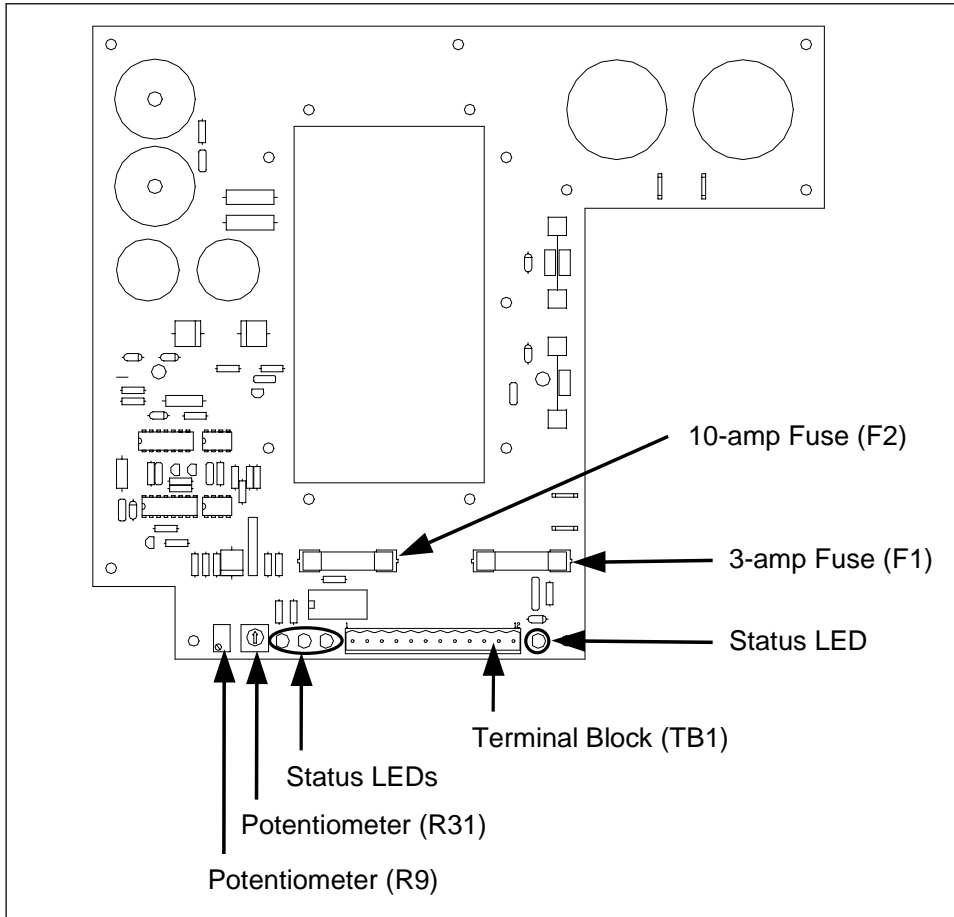
DANGER

When AC is present, there is a risk of shock inside and outside of the 2200-205 Power Supply. Some possible high-voltage danger areas are the transformer, bridge rectifier, AC fuse holder, and terminal block. Other dangerous areas also exist. So, when power is on, touching these areas could electrocute you.

4.4.1 Power Supply Board

The Power Supply board provides filtering and regulation of the DC voltages used by the SmartScanIS. It also provides LED indicators for the input and output voltages and a terminal block for connections to the barrier strip and the Fuse panel. Fuses are provided on the board for the AC input and 24-volt DC output.

The figure below shows a Power Supply board.



4.4.1.1 Potentiometer (R9)

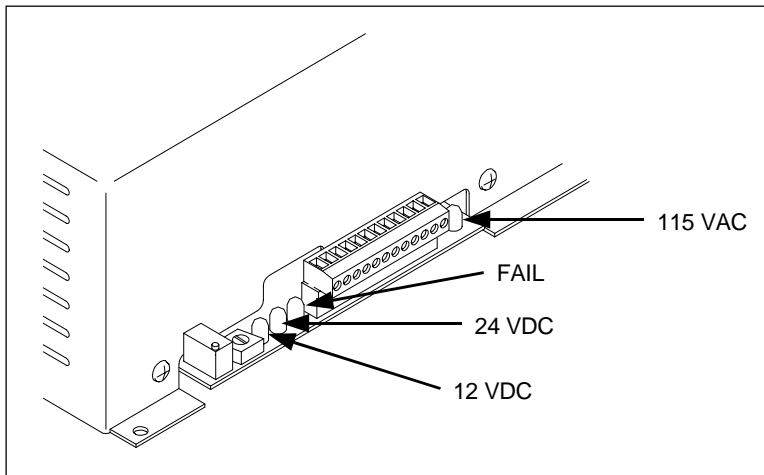
Potentiometer **R9** is used to adjust the battery float voltage. It was factory adjusted to 28 VDC. At the site, when the voltage is not between 27.8 and 28.2, adjust R9 until a multimeter shows 28 VDC at terminal 4 on **TB1**. You can do this by turning R9 clockwise to increase the voltage or counterclockwise to decrease the voltage. The batteries must be disconnected while setting the float voltage.

4.4.1.2 Potentiometers (R31)

Potentiometer **R31** is used to adjust the DC voltage that is present at terminal 8 on **TB1**. At the factory, it is adjusted for a value of 12.5 VDC. Turn R31 counterclockwise to increase the voltage. Turn it clockwise to decrease the voltage.

4.4.1.3 Status LEDs

On the edge of the Power Supply board are four status LEDs. The figure below shows the location of the LEDs.



The table below describes what each lit LED means.

LED Name	LED Color	Meaning When Lit
12 VDC	Green	Proper DC voltage is present at terminal 8 on TB1 . Stays lit as long as the system is powered up and 12 VDC is present.
24 VDC	Green	Proper DC voltage is present at terminal 4 on TB1 . Stays lit as long as the system is powered up and 24 VDC is present.
FAIL	Red	Proper AC voltage isn't present at terminal 10 on TB1 . Stays lit as long as the system is powered up, AC isn't present, and the system is running on battery backup.
115 VAC	Green	Proper AC voltage is present at terminal 10 on TB1 . Stays lit as long as the system is powered up and AC is present.

4.4.1.4 Fuses (F1, F2)

There are two fuses on the Power Supply board. Both are 3AG glass-body fast-acting fuses. The 3-amp fuse (F1) protects the 2200-205 Power Supply from excessive AC. The 10-amp fuse (F2) protects the rest of the SmartScanIS from excessive DC.

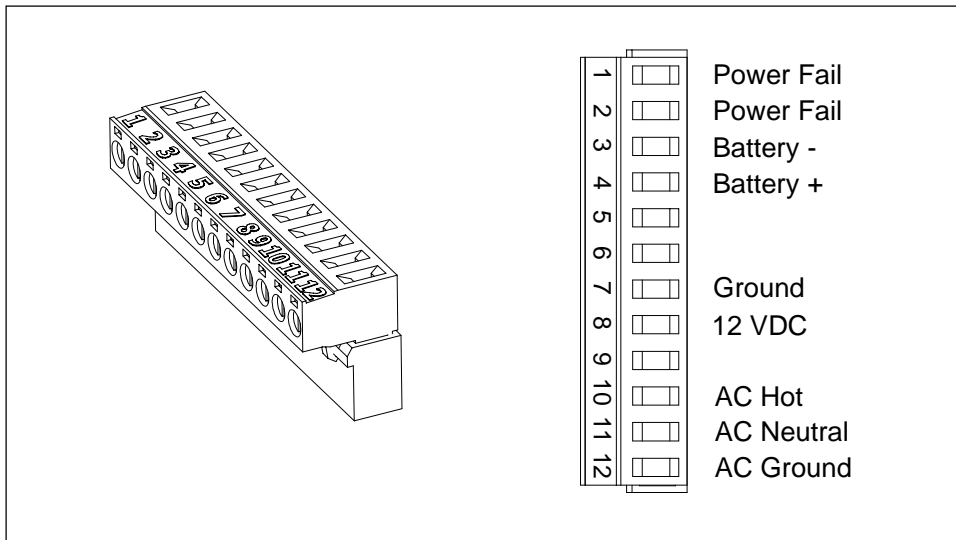
4.4.1.5 Terminal Block TB1

The 12-position terminal block **TB1** connects the Power Supply board to terminal block **TB105**, the Controller module, and the Surge Protection Subassembly.

DANGER

Do not touch the terminal block TB1 without the power shut off. If the power is on, the AC voltage present on part of this block could electrocute you.

The figure below shows what is wired to each terminal.



4.4.2 Power Converter and Battery Charger

Inside the module is the power converter and battery charger, consisting of these major parts.

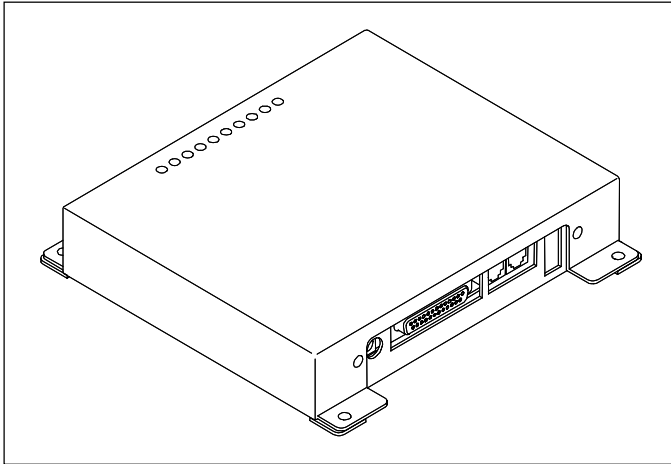
- Transformer
- Bridge rectifier
- Filter capacitors
- Regulators
- DC-DC converter

For the needs of the AC-powered system, the 2200-205 Power Supply converts the externally supplied 120 VAC to a regulated 12 VDC and 24 VDC. The regulated 24 VDC is also used to float charge the standby battery system. This allows continued system operation for about 100 hours when there is an interruption in the externally supplied 120 VAC.

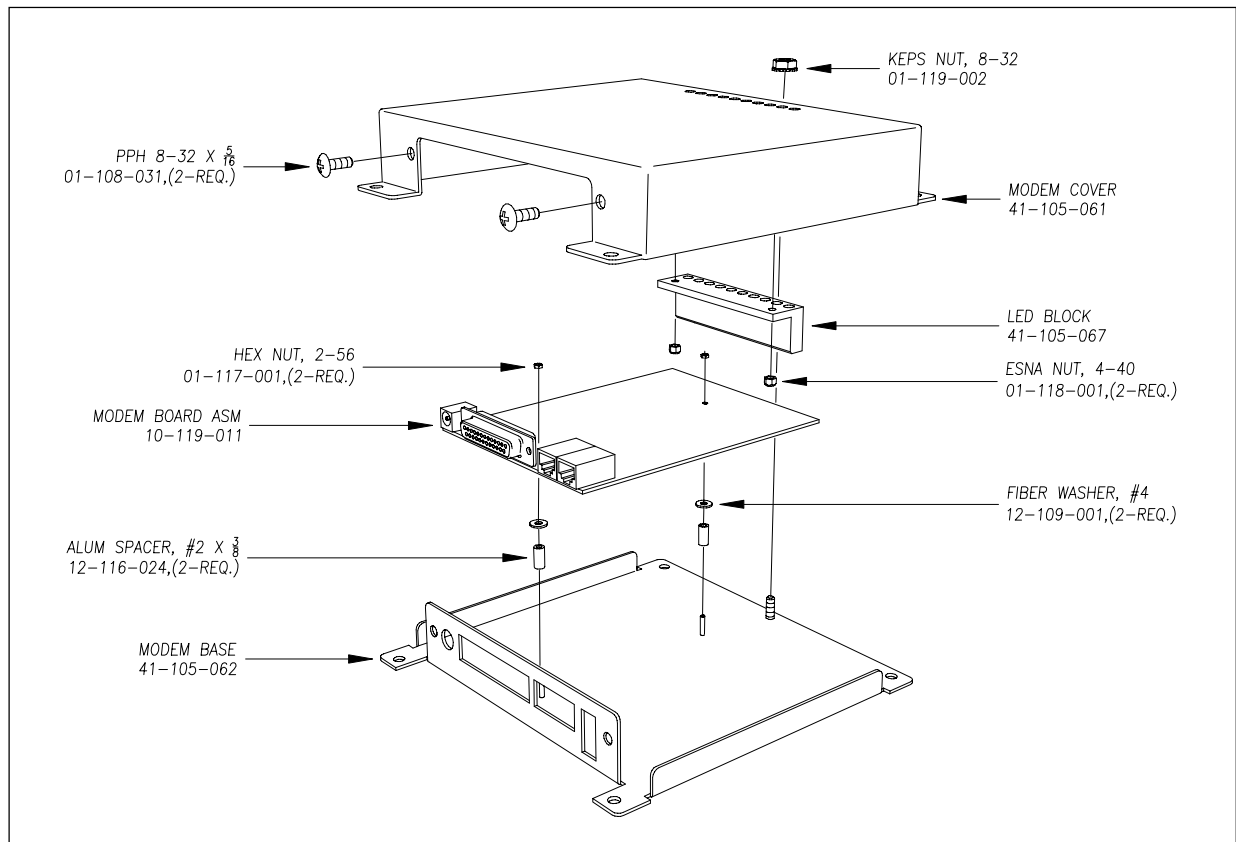
4.5 2200-600 Modem Module

The 2200-600 Modem module is a device that lets the system (at the site) communicate with a computer (away from the site) over the landline telephone system. Inside the 2200-600 Modem is a MultiTech Systems modem, either model MT1932ZDX or MT2834ZDXb.

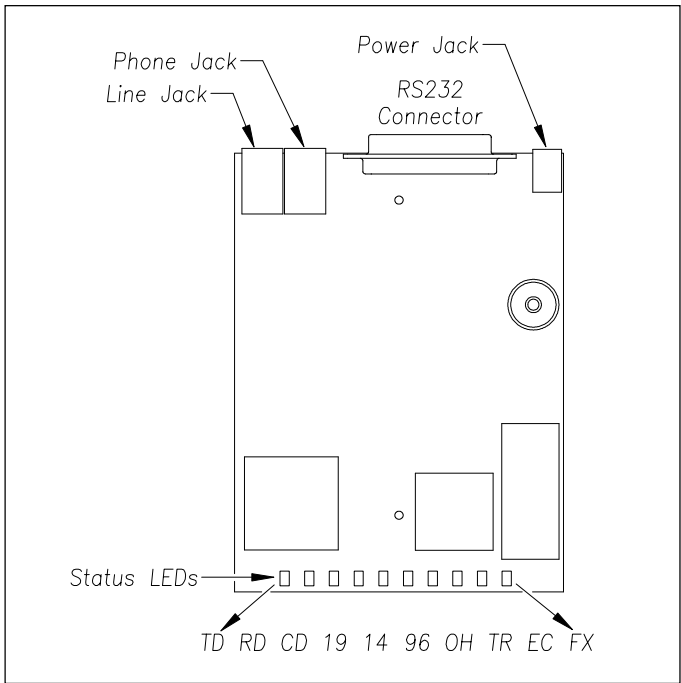
The figure below shows an assembled 2200-600 Modem.



The figure below shows the parts of a 2200-600 Modem.

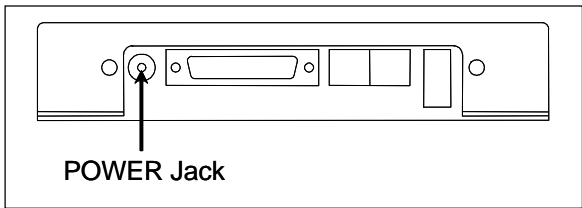


The figure below shows a Modem board.



4.5.1 Power Connection (Power Jack)

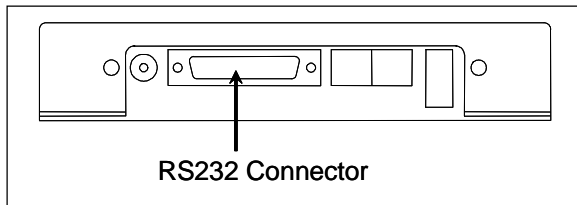
The POWER jack supplies low-voltage DC power to the modem.



At the factory, one end of a power cord was plugged into the power jack. The other end of the power cord was wired to terminal block **TB105**.

4.5.2 System Connection (RS232 Connector)

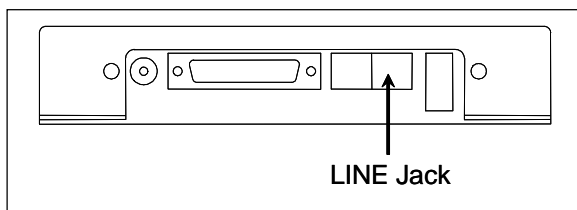
The RS232 connector connects the modem to the rest of the system.



At the factory, the 25-pin end of a standard modem cable was plugged into the RS232 connector on the Modem board. The other end is a 26-pin connector that is plugged into **COM3-P8** on the System Interface board.

4.5.3 Line Cable Connection (Line Jack)

The LINE jack connects the modem to the telephone system.



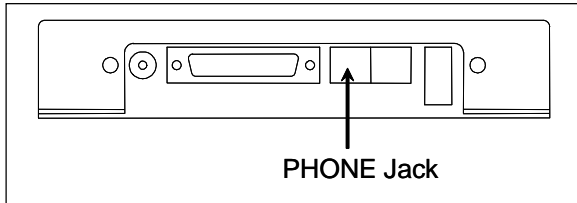
At the factory, one end of a telephone cord was plugged into the LINE jack (on the Modem module). The other end was wired to a universal transient barrier of the Surge Protection Subassembly. At the site, the customer finishes this wiring by supplying the site with normal telephone service, bringing the telephone line to a four-wire modular plug (type RJ11/14) in the bungalow, and wiring from the universal transient barrier to this modular plug.

CAUTION

The LINE jack and the PHONE jack aren't interchangeable. Therefore, don't plug the line cable into the PHONE jack. Doing so causes your modem not to work properly.

4.5.4 Telephone Connection (Phone Jack)

The PHONE jack is used to plug a telephone into the modem for voice communications. When you do so, the telephone shares the same telephone line as the modem. This jack is provided as a convenience. It is rarely used.



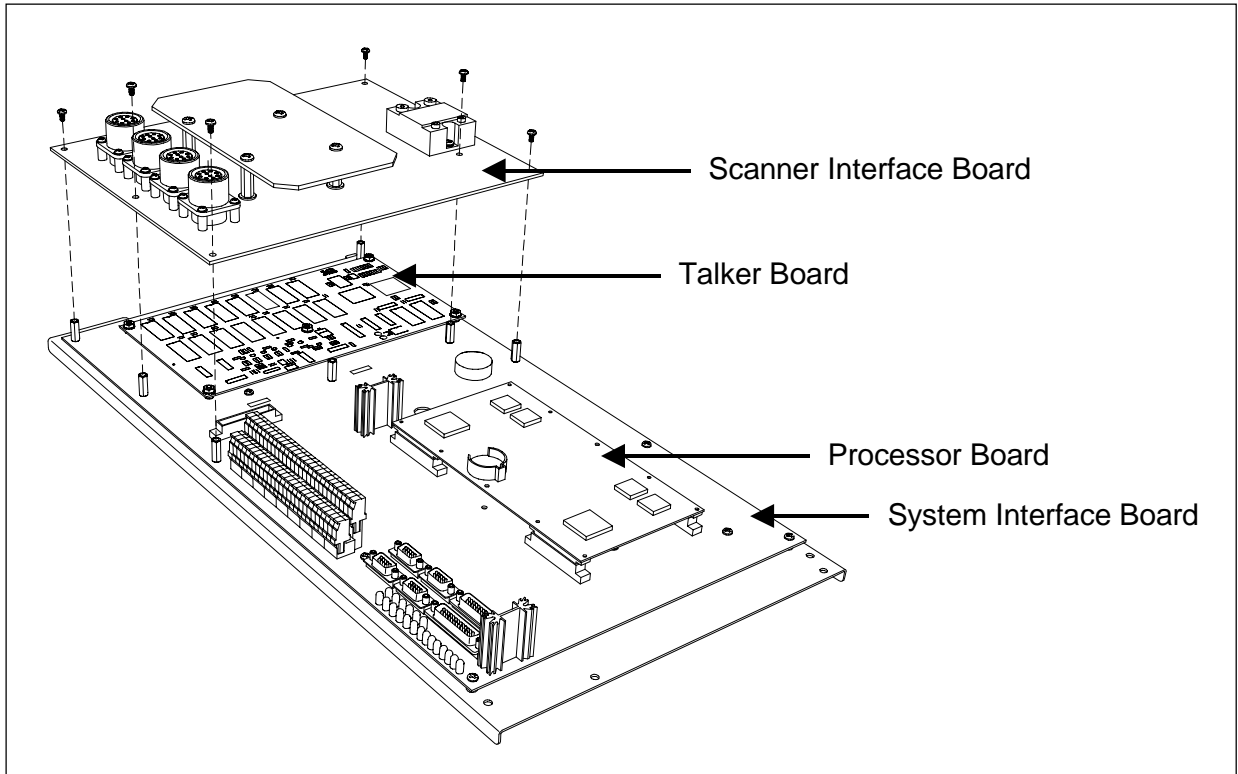
4.5.5 Status LEDs

On the module cover are 10 status LEDs. The table below describes what each lit LED means.

LED	Meaning When Lit
14	By itself, lights when the modem is operating at 14,400 bps. When lit with LED 19, the modem is operating at 16,800 bps. When lit with LED 96, the modem is operating at 12,000 bps.
19	By itself, lights when the modem is operating at 19,200 bps. When lit with LED 14, the modem is operating at 16,800 bps.
96	By itself, lights when the modem is operating at 9600 bps. When lit with LED 14, the modem is operating at 12,000 bps. If no speed LED lights, the modem is operating at less than 9600 bps.
CD	Lights when valid carrier signal from another modem is detected.
EC	Lights when the modem is in error-correction mode. Flashes when compression is activated.
FX	Lights when the modem is in fax mode.
OH	Lights when the phone line is off-hook, which occurs when the modem is dialing, online, or answering a call. Flashes when the modem is pulse dialing.
RD	Flashes when data is being received.
TD	Flashes when data is being transmitted.
TR	STC's firmware configures the modem to ignore this light. So, it is never lit.

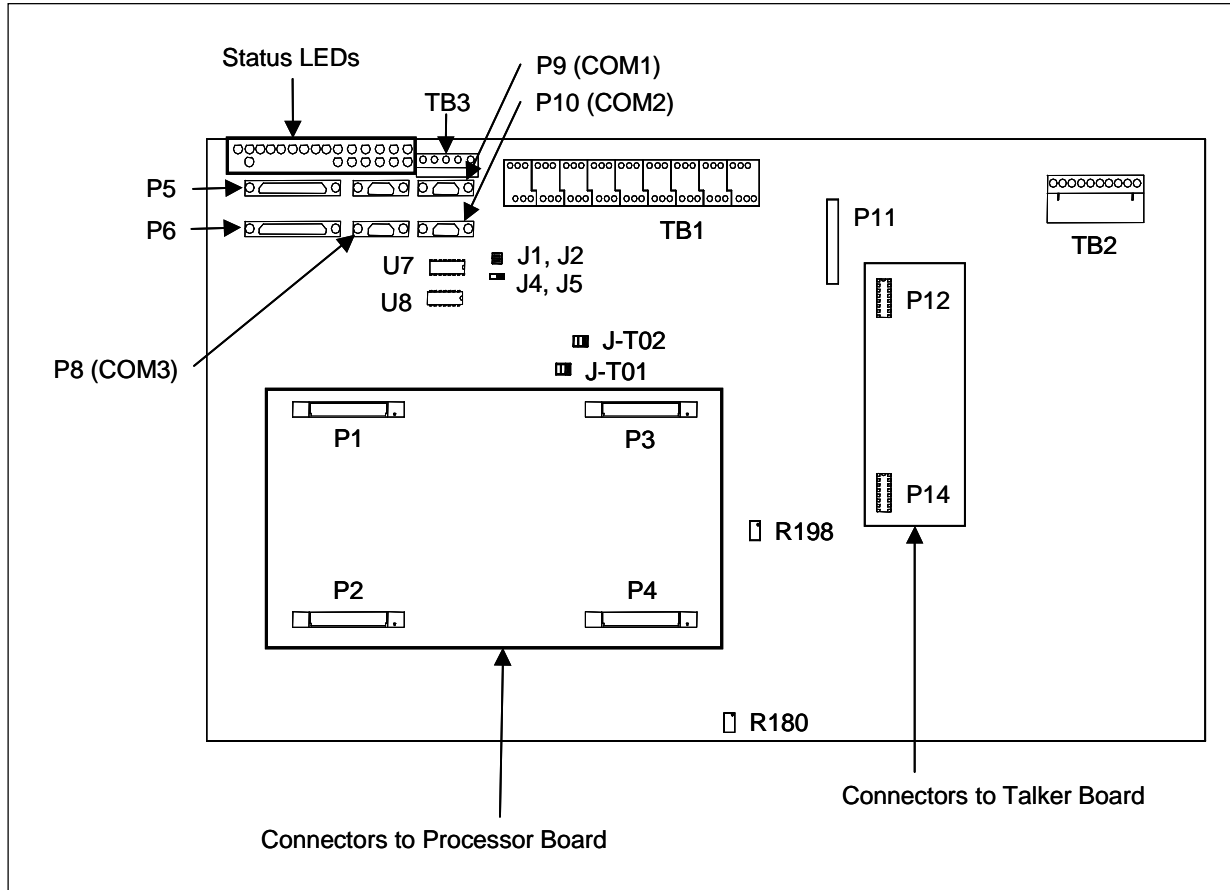
4.6 2300-350 Controller Module

The figure below shows the major parts of the 2300-350 Controller module.



4.6.1 2300-200 System Interface Board

As its name implies, all the interface and signal conditioning circuitry are located on the 2300-200 System Interface board. The figure below shows a System Interface board with some important components highlighted.



4.6.1.1 Terminal Block TB1

The 54-position terminal block **TB1** is the largest set of terminals on the System Interface board. Each screw terminal is numbered and has an associated label located on the circuit board. The labels indicate how a given terminal is used.

The table below describes the function of each terminal.

Function	Num	Num	Function
Ground – Power supply ground.	28	1	+12 VDC input.
Ground – Power supply ground.	29	2	+24 VDC input.
Output1 is the open collector sinking output of transistor Q3. Designed to supply a ground to drive a relay.	30	3	Normally closed relay contact.
Output2 is the open collector sinking output of transistor Q4. Designed to supply a ground to drive a relay.	31	4	Normally closed relay contact.
Input1 ground return. Associated with terminal 5.	32	5	Input1 signal. Contact closure to ground or to terminal 32 indicates presence of the AC power.
Input2 ground return. Associated with terminal 6.	33	6	Input2 signal. Contact closure to ground or to terminal 33 indicates the AC surge arrester is in working condition.
Input3 ground return. Associated with terminal 7.	34	7	Input3 signal. Ground this input to rebroadcast the last announcement.
High-load or high-wide ground return. Associated with terminal 8.	35	8	High-load or high-wide signal. Contact closure to ground or to terminal 35 indicates no high-load or high wide. Open contacts signify high-load or high-wide.
Dragging-equipment ground return. Associated with terminal 9.	36	9	Dragger signal. Contact closure to ground or to terminal 36 indicates no dragging equipment. Open contacts signify dragging equipment.
Wide-load-1 ground return. Associated with terminal 10.	37	10	Wide-load-1 signal. Contact closure to ground or to terminal 37 indicates no wide-load on the right-side of the track. Open contacts signify wide-load on the right-side of the track.
Wide-load-2 ground return. Associated with terminal 11.	38	11	Wide-load-2 signal. Contact closure to ground or to terminal 38 indicates no wide-load on the left-side of the track. Open contacts signify wide-load on the left-side of the track.
SOTC ground. Associated with terminal 12.	39	12	SOTC signal. +12 VDC applied here indicates train is present.
Number 1 zero-speed transducer ground return. Associated with terminal 13.	40	13	Number 1 zero-speed transducer signal. <i>Not used.</i>
Number 2 zero-speed transducer ground return. Associated with terminal 14.	41	14	Number 2 zero-speed transducer signal. <i>Not used.</i>
Number 3 zero-speed transducer ground return. Associated with terminal 15.	42	15	Number 3 zero-speed transducer signal. <i>Not used.</i>
Number 4 zero-speed transducer ground return. Associated with terminal 16.	43	16	Number 4 zero-speed transducer signal. <i>Not used.</i>

Function	Num	Num	Function
Number 5 zero-speed transducer ground return. Associated with terminal 17.	44	17	Number 5 zero-speed transducer signal. <i>Not used.</i>
Ground. Associated with terminal 18.	45	18	+12 VDC output. <i>Not used.</i>
TO1 magnetic transducer ground return. Associated with terminal 19.	46	19	TO1 magnetic transducer signal. Gating transducer connection.
TO2 magnetic transducer ground return. Associated with terminal 20.	47	20	TO2 magnetic transducer signal. Gating transducer connection.
Number 3 magnetic transducer ground return. Associated with terminal 21.	48	21	Number 3 magnetic transducer signal. Used to connect advance transducers.
Number 4 magnetic transducer ground return. Associated with terminal 22.	49	22	Number 4 magnetic transducer signal. <i>Not used.</i>
Number 5 magnetic transducer ground return. Associated with terminal 23.	50	23	Number 5 magnetic transducer signal. <i>Not used.</i>
Analog-to-digital converter channel7 ground return. Associated with terminal 24. <i>Not used.</i>	51	24	Signal from analog-to-digital converter channel7. <i>Not used.</i>
Analog-to-digital converter channel6 ground return. Associated with terminal 25. <i>Not used.</i>	52	25	Signal from analog-to-digital converter channel6. <i>Not used.</i>
Battery voltage ground return. Associated with terminal 26.	53	26	Battery Voltage Positive Input. Battery voltage is measured by the processor-A.
Ground return from shielded temperature probe. Associated with terminal 27.	54	27	Signal from shielded temperature probe. 0 to 5 VDC represents an outside air temperature of about -50° to +150°F (-45.6° to +65.6°C).

4.6.1.2 Terminal Block TB2

On the System Interface board, the 10-position terminal block **TB2** is used to connect to the radio and the speaker.

The table below describes the function of each terminal.

Terminal Name	Function
Speaker + Speaker -	Connect these terminals to the positive and negative 8-ohm speaker terminals.
Ground PTT (push to talk)	Connect these terminals to the radio's PTT and ground. Active low.
Ground Transmit Audio	Connect these terminals to the transmit-audio input of the radio.
Ground Hold-Off Out	This signal is not used. A low signal indicates the system is making an announcement.
Ground Hold-Off In	Connect these terminals to the radio's carrier-detect output and ground. Active low when the radio's squelch breaks. Indicates to the Talker board that the channel is busy.

4.6.1.3 Status LEDs

On the System Interface board, there are 22 status LEDs. The table below describes what each lit LED means.

		LED	Meaning When Lit
1	16	1	Lights when wide-load-2 input is active.
2	17	2	Lights when dragging-equipment input is active.
3	18	3	Lights when input3 is active. Dark when rebroadcast.
4	19	4	Lights when AC power to the system is off and the system is running on battery backup . This LED is unlit when AC power is present.
5	20	5	Lights when processor-A is operating properly. Slowly fading off and on indicates normal operation.
6	21	6	Lights when output1 is active. <i>Not used.</i>
7		7	Lights when transducer TO1 is active. Will flicker as each wheel passes over transducer TO1 during train passage.
8		8	Lights when transducer TO2 is active. Will flicker as each wheel passes over transducer TO2 during train passage.
9		9	Lights when either advance transducer is active. Will flicker as each wheel passes over either advance transducer during train passage.
10		10	Lights when transducer4 input is active. <i>Not used.</i>
11		11	Lights when transducer5 input is active. <i>Not used.</i>
12		12	Lights when voltage present at the +24 VDC input TB1 (terminal 2).
13		13	Lights when there is voltage from the +5-volt regulator U57. This regulator powers the 5-volt logic and processor circuitry.
14	22	14	Lights when there is voltage from the +5-volt regulator U59. This regulator powers the 2200-750 Reader. Plugged into P5.
15		15	Lights when voltage present at the +12 VDC input TB1 (terminal 1).
		16	Lights continuously when the track circuit indicates a train is present at the site.
		17	Lights when wide-load-1 input is active.
		18	Lights when the high-load input is active.
		19	Lights when AC surge protector should be replaced. Dark when AC surge arrestor is in working condition.
		20	Lights when processor-B is operating properly. Slowly fading off and on indicates normal operation.
		21	Lights when output2 is active. <i>Not used.</i>
		22	Lights when there is voltage from the +5-volt regulator U60. This regulator is currently not used .

4.6.1.4 Sockets P12 and P14

On the System Interface board, the two 14-pin sockets **P12** and **P14** are used to connect to the Talker board.

The table below shows the pinout of socket **P12**.

Pin 1	<i>Not Connected</i>	Pin 16	<i>Not Connected</i>
Pin 2	<i>Not Connected</i>	Pin 15	<i>Not Connected</i>
Pin 3	<i>Not Connected</i>	Pin 14	<i>Not Connected</i>
Pin 4	<i>Not Connected</i>	Pin 13	<i>Not Connected</i>
Pin 5	<i>Not Connected</i>	Pin 12	<i>Not Connected</i>
Pin 6	Active low reset signal from processor-A. Used to reset the Talker board.	Pin 11	Active low PTT signal to processor-A from Talker board.
Pin 7	Receive serial data to processor-A.	Pin 10	<i>Not Used</i>
Pin 8	Transmit serial data from processor-A.	Pin 9	Negative 12-volts to Talker board.

The table below shows the pinout of socket **P14**.

Pin 1	+12 VDC supply to Talker board.	Pin 16	TX audio to radio.
Pin 2	+12 VDC supply to Talker board.	Pin 15	Audio to System Interface board for amplification to drive speaker.
Pin 3	+12 VDC supply to Talker board.	Pin 14	Active low holdoff-out signal.
Pin 4	<i>Not Connected</i>	Pin 13	<i>Not Used</i>
Pin 5	<i>Not Connected</i>	Pin 12	Active low PTT signal from Talker to radio.
Pin 6	Ground	Pin 11	<i>Not Connected</i>
Pin 7	Ground	Pin 10	<i>Not Connected</i>
Pin 8	Ground	Pin 9	<i>Not Connected</i>

4.6.1.5 Connectors P1-P4

On the System Interface board, the four 32-pin connectors P1, P2, P3, and P4 are used to connect to the Processor board. These connectors are keyed so that the Processor board cannot be plugged in backward. Totaling 128 pins that carry power supply voltages, address lines, data lines, digital signals, and analog signals to and from the Processor board.

Be sure that the system is completely powered down before removing or installing the Processor board.

4.6.1.6 Connector P11

On the System Interface board, the 32-pin connector P11 contains power supply and control signals for the Scanner Interface board.

The table below shows the pinout of connector **P11**. If the track runs north and south, rail1 is the east rail, and rail2 is the west rail. If the track runs east and west, rail1 is the north rail, and rail2 is the south rail.

Pin 1	+5 VDC for heater relay.	Pin 2	Supplies a ground to activate the shutter relay.
Pin 3	Supplies a ground to activate the heater relay.	Pin 4	+5 VDC for shutter relay.
Pin 5	Ground.	Pin 6	Ground.
Pin 7	Ground return for the heat signal from bearing scanner on rail1.	Pin 8	Heat signal from bearing scanner on rail1.
Pin 9	Ground return for the heat signal from bearing scanner on rail2.	Pin 10	Heat signal from bearing scanner on rail2.
Pin 11	Ground return for the heat signal from wheel scanner on rail1.	Pin 12	Heat signal from wheel scanner on rail1.
Pin 13	Ground return for the heat signal from wheel scanner on rail2.	Pin 14	Heat signal from wheel scanner on rail2.
Pin 15	<i>Not Connected</i>	Pin 16	<i>Not Connected</i>
Pin 17	<i>Not Connected</i>	Pin 18	<i>Not Connected</i>
Pin 19	Ground.	Pin 20	Ground.
Pin 21	Ground.	Pin 22	Ground.
Pin 23	Ground.	Pin 24	Ground.
Pin 25	+12 VDC to the Scanner Interface board.	Pin 26	+12 VDC to the Scanner Interface board.
Pin 27	+12 VDC to the Scanner Interface board.	Pin 28	+12 VDC to the Scanner Interface board.
Pin 29	+12 VDC to the Scanner Interface board.	Pin 30	+12 VDC to the Scanner Interface board.
Pin 31	+12 VDC to the Scanner Interface board.	Pin 32	+12 VDC to the Scanner Interface board.

4.6.1.7 Socket P5

On the System Interface board, the DB25F socket **P5** is used to connect to the 2200-750 Reader. This 25-pin socket provides an RS232 communications interface, +5 VDC, and +12 VDC to power the 2200-750 Reader.

The table below shows the pinout of socket **P5**.

Pin 1	Ground	Pin 14	Ground
Pin 2	Transmit	Pin 15	Ground
Pin 3	Receive	Pin 16	<i>Not Connected</i>
Pin 4	RTS	Pin 17	<i>Not Connected</i>
Pin 5	CTS	Pin 18	<i>Not Connected</i>
Pin 6	<i>Not Connected</i>	Pin 19	<i>Not Connected</i>
Pin 7	Ground	Pin 20	+12 VDC
Pin 8	<i>Not Connected</i>	Pin 21	<i>Not Connected</i>
Pin 9	+5 VDC	Pin 22	<i>Not Connected</i>
Pin 10	+5 VDC	Pin 23	<i>Not Connected</i>
Pin 11	<i>Not Connected</i>	Pin 24	<i>Not Connected</i>
Pin 12	<i>Not Connected</i>	Pin 25	+12 VDC
Pin 13	+12 VDC		

4.6.1.8 Socket P6

On the System Interface board, the DB25F socket **P6** is **currently not used**.

The table below shows the pinout of socket **P6**.

Pin 1	Ground	Pin 14	Ground
Pin 2	Transmit	Pin 15	Ground
Pin 3	Receive	Pin 16	<i>Not Connected</i>
Pin 4	RTS	Pin 17	<i>Not Connected</i>
Pin 5	CTS	Pin 18	<i>Not Connected</i>
Pin 6	<i>Not Connected</i>	Pin 19	<i>Not Connected</i>
Pin 7	Ground	Pin 20	+12 VDC
Pin 8	<i>Not Connected</i>	Pin 21	<i>Not Connected</i>
Pin 9	+5 VDC	Pin 22	<i>Not Connected</i>
Pin 10	+5 VDC	Pin 23	<i>Not Connected</i>
Pin 11	<i>Not Connected</i>	Pin 24	<i>Not Connected</i>
Pin 12	<i>Not Connected</i>	Pin 25	+12 VDC
Pin 13	+12 VDC		

4.6.1.9 Plug P8 (COM3)

On the System Interface board, the DB9M plug P8 is an RS232 connector used to connect to the modem. This 9-pin plug is the only serial port that outputs information as the system boots up following a reset. Because COM1-P9 and COM2-P10 already have functions allocated to them, **STC recommends COM3-P8 as the only serial port for use with a laptop computer to access the serial interface.** It is necessary to use a null modem cable with the laptop. The default RS232 settings are 9600, N, 8, 1.

The table below shows the pinout of plug **P8**.

Pin 1	CD
Pin 2	RX
Pin 3	TX
Pin 4	DTR
Pin 5	Ground
Pin 6	DSR
Pin 7	RTS
Pin 8	CTS
Pin 9	RI

4.6.1.10 Plug P10 (COM2)

On the System Interface board, the DB9M plug P10 is dedicated to the Union Pacific's Polling System.

The table below shows the pinout of plug **P10**.

Pin 1	<i>Not Connected</i>
Pin 2	RX
Pin 3	TX
Pin 4	<i>Not Connected</i>
Pin 5	Ground
Pin 6	<i>Not Connected</i>
Pin 7	RTS
Pin 8	CTS
Pin 9	<i>Not Connected</i>

4.6.1.11 Plug P7 (COM4)

On the System Interface board, the DB9M plug P7 isn't for use by the customer. Rather, it is used at the factory to test the system. Since jumper J6 is associated with P7, do not short it.

4.6.1.12 Connector P16

The 10-pin connector P16 appears on System Interface boards. This connector allows access to eight optically isolated digital inputs. This connector is intended for future expansion.

4.6.1.13 Connector P17

The 10-pin connector P17 connects to the 2300-357 Efficiency Test panel. **Chapter 14 – Using the Efficiency Test Panel** tells how to arm and disarm the panel.

4.6.1.14 Terminal Block TB3

On the System Interface board, the 6-position terminal block **TB3** is used to connect to RS485 devices, such as wind speed and wind direction instrumentation.

Terminal Name	Function
12VDC	Protected with a 100mA self-restoring fuse. Used for powering external instrumentation.
TX	RS485 TX - (Connected to RX through J1)
TX	RS485 TX+ (Connected to RX through J2)
RX	RS485 RX - (Connected to TX through J1)
RX	RS485 RX+ (Connected to TX through J2)
GND	Used for powering external instrumentation.

4.6.1.15 Plug P9 (COM1)

On the System Interface board, the DB9M plug P9 can be configured in one of three different modes of communications, RS232, RS422, and RS485. The configuration in which the board ships from the factory is RS485. All modes are described in this section for reference.

For **RS232** communications:

- Install U8 (MAX489) chip
- Install U7 (MAX232) chip
- Ignore jumpers J1 and J2
- Short jumper J4
- Remove any communications wiring from terminal block **TB3**
- Connect null-modem communications cable to plug P9

For **RS422** four-wire communications:

- Install U8 (MAX489) chip
- Install U7 (MAX232) chip
- Short jumper J5
- Do not short jumpers J1 and J2
- Remove RS232 cable from plug P9
- Connect RS422 wiring to terminal block **TB3**

For **RS485** two-wire communications:

- Install U8 (MAX489) chip
- Install U7 (MAX232) chip
- Short jumper J5
- Short jumpers J1 and J2
- Remove RS232 cable from plug P9
- Connect RS485 wiring to terminal block **TB3**

The table below shows the pinout of plug **P9**.

Pin 1	<i>Not Used</i>
Pin 2	RX
Pin 3	TX
Pin 4	<i>Not Used</i>
Pin 5	Ground
Pin 6	<i>Not Used</i>
Pin 7	RTS
Pin 8	CTS
Pin 9	RI

4.6.1.16 Jumpers J1 and J2

When COM1-P9 is configured for **RS485**, both jumpers J1 and J2 should be shorted, which is how they come from the factory. For **RS422**, they should not be shorted. For **RS232**, jumpers J1 and J2 have no effect.

4.6.1.17 Jumpers J4 and J5

For **RS232** communications, short jumper J4 and don't short J5. For **RS422**, four-wire communication and for **RS485** two-wire communications, short jumper J5, and don't short J4.

4.6.1.18 Jumper J6

On the System Interface board, jumper J6 isn't for use by the customer. Rather, it is used at the factory along with plug P7 to test the system. Therefore, do not short jumper J6.

4.6.1.19 Jumpers J-TO1 and J-TO2

On the System Interface board, the jumpers J-TO1 and J-TO2 set the sensitivity of the gating transducers. Jumper J-TO1 is used to select the sensitivity value for gating transducer **TO1**. TO1 is the first gating transducer going north or east from the bearing scanner. It is the gating transducer closest to the bearing scanner. Jumper J-TO2 is used to select the sensitivity value for gating transducer **TO2**. TO2 is the second gating transducer going north or east from the bearing scanner. It is the gating transducer farthest from the bearing scanner.

Each jumper setting selects a different loading. From top to bottom, the selections are high (470 ohms), medium (220 ohms), and low (100 ohms) sensitivity. High is the most sensitive. Low is the least sensitive. Medium is somewhat between these sensitivities.

Transducer loading is the application of a parallel resistance to the magnetic wheel transducer for controlling sensitivity. The SmartScanIS uses jumpers on the circuit board to select a loading resistor for each gating transducer. The transducer's sensitivity lowers as the loading resistance value lowers. It becomes more sensitive as the loading resistance value increases.

Too much sensitivity can make the transducer susceptible to interference from external sources, such as radio transmitters and locomotive traction motors. In this case, the detector can misinterpret this noise as extra wheel pulses. Not enough sensitivity will result in missed wheel pulses.

Once the transducers are optimally loaded, the SmartScanIS operates over a relatively wide range of transducer signal strengths. This wide range is necessary because the signal level can vary greatly from one wheel to the next. This variation is largely due to wheel wear. For example, a newer wheel tends to generate a weaker transducer pulse than a worn wheel, which has a deeper flange that comes closer to the transducer. Track gauges that are out of tolerance also cause variations in signal strength, allowing the wheel flange to wander out near the lateral operating limitations of the transducer.

A relatively high sensitivity setting, in the 470-ohm range, works well at most sites, but not necessarily for all. It is difficult to define a value that works with 100% accuracy for all installations due to external variables unique to a given site. Many sites produce very little if any external interference, which allows a higher sensitivity setting resulting in the ability to scan slightly slower trains than normal. Others have various issues that require a lesser resistance value than the standard 470 ohms.

Generally, start with 470 ohms for maximum sensitivity. If you observe too many wheel pulses for a given train, reduce the loading to the center position of 220 ohms. If the SmartScanIS still counts too many pulses, reduce the loading to the bottom position.

4.6.1.20 Potentiometer R180

Potentiometer **R180** adjusts the audio level (loudness) into the on-board audio amplifier that drives the speaker inside the SmartScanIS enclosure. This factory adjustment is set for maximum loudness with minimal distortion. Once properly adjusted, the customer uses the volume control on the speaker to set its volume.

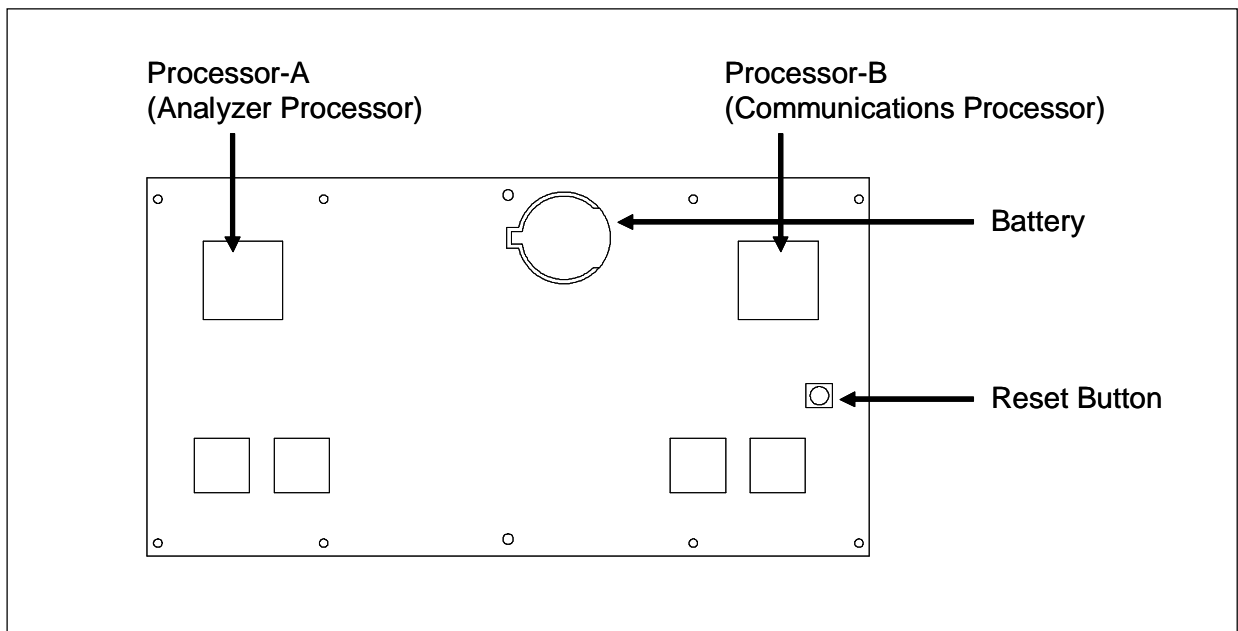
4.6.1.21 Potentiometer R198

Potentiometer **R198** adjusts the transmit audio level going to the radio. A misadjusted level will be distorted or very weak sounding. This adjustment is set at the factory to FCC specifications for 3 kHz FM deviation. Turn R198 clockwise to increase the audio level. Turn it counterclockwise to decrease the audio level.

4.6.2 2300-100 Processor Board

The 2300-100 Processor board controls the entire SmartScanIS. All signals to and from the external devices pass through the System Interface board on the way to their final destination, the Processor board. Running programs written by STC, the Processor board is the brains of the SmartScanIS.

The figure below shows a Processor board (2300-100).



The Processor board uses two independently operating central processing units (**CPUs**). The CPU on the left (aka processor-A aka Analyzer Processor) is responsible for data retrieval from most external sources, such as the shielded temperature probe, scanners, transducers, and dragging-equipment detectors. The CPU on the right (aka processor-B aka Communications Processor) is used to process and store the data retrieved by the other CPU. Also, the CPU on the right is responsible for data retrieval from the remaining external sources, such as the wind monitor. After the train data is stored, the system can send it to the user in the form of a report or through the polling system.

Processor-A initially stores train data in static random-access memory (SRAM) on the Processor board. After train passage, processor-B moves this data to a different SRAM for long-term storage. This SRAM contains:

- The Trains directory, which contains data on each new train that passes the site and each new generated gate-test train. The Train Summary report and Train Detail report get their data from this directory. The Last Train report, Range of Trains report, and T94 Train Detail report also get their data from this directory.
- The Exceptions directory, which contains data on each train that has one or more Exception Alarms or on a train where sliding wheels were detected. The Exception Summary report and Exception Detail report get their data from this directory.

Each directory is organized as a circular buffer. In this scheme, data is added to the directory until the directory is full. Once full, the oldest data in the directory is overwritten as new data is recorded. The buffer for the Trains directory holds data on about 88,000 axles but no more than 300 trains. The buffer for the Exceptions directory holds data on about 14,000 axles but no more than 30 trains. Per train, only information on the first 1,400 axles is stored. In the same SRAM as these directories is the Event Log, which also operates as a circular buffer.

Under the CPU on the right is a white **reset button**. Pressing it causes a "hard reset" of the Processor board. As long as no train is present at the site, pressing the reset button doesn't affect the setup information or train data. However, if a train is present, pressing the reset button only loses train data for that train.

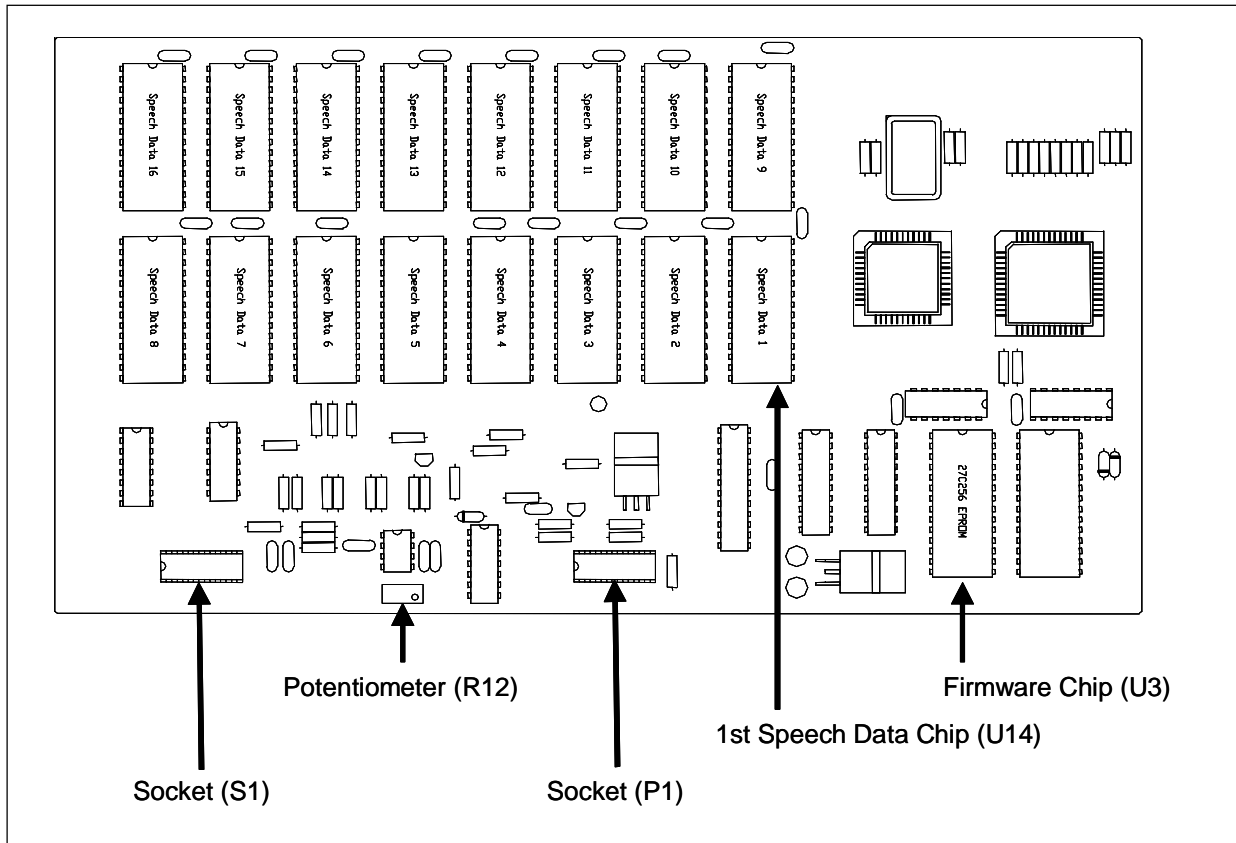
The Processor board requires regulated 5 VDC and regulated 12 VDC for operation. The input power is received from the System Interface board.

Between the two CPUs is a coin-cell **battery**. During a power interruption to the Processor board, this battery keeps the stored train data from being lost and the time/date accurate. If the battery is low or dead, there is no danger of losing train data unless the power to the system is lost. If you power down the system and remove the battery on the Processor board, the time, the date, and all train data will be lost.

4.6.3 2058-305 Talker Board

The 2058-305 Talker board transmits voice messages to the train crew. It receives various commands from processor-A (aka Analyzer Processor) on the Processor board during and after train passage. Processor-A decides what needs to be announced and sends high-level commands to the Talker board, which interprets these commands and constructs the appropriate messages. The Talker board also generates the audio and PTT signals necessary to control the radio.

The figure below shows a Talker board (2058-305).



4.6.3.1 Firmware Chip (U3)

On the Talker board, the firmware is in a single 27C256 or equivalent EPROM (erasable programmable read-only memory). If it becomes necessary to replace this chip, see **Chapter 15 – Replacing Chips**.

4.6.3.2 Socket (P1)

The 16-pin socket (labeled P1) connects the Talker board to the System Interface board.

4.6.3.3 Socket (S1)

The 16-pin socket (labeled S1) connects the Talker board to the Processor board by way of the System Interface board.

4.6.3.4 Speech Data Chips (U14-U29)

On the Talker board, the 16 sockets, labeled U14 through U29, are for 27C256, 27C512, or equivalent EPROMs. These chips contain the digitized words and phrases required for voice announcements. If it becomes necessary to replace one or more of these chips, see ***Chapter 15 – Replacing Chips***.

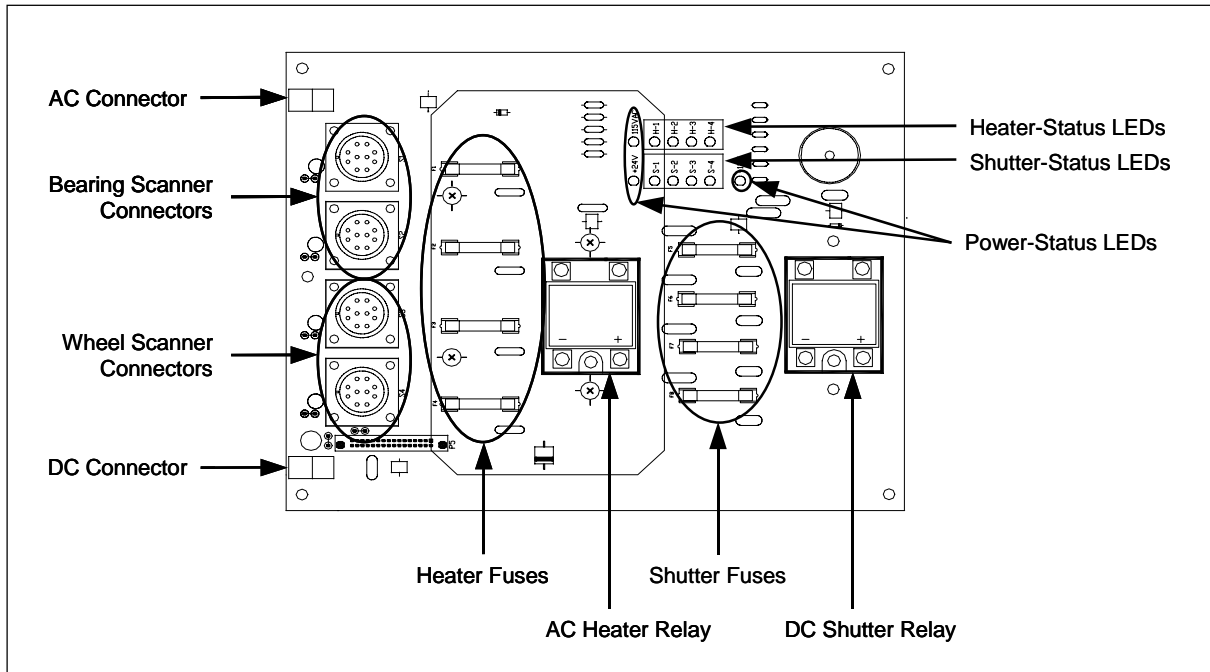
4.6.3.5 Potentiometer (R12)

Potentiometer **R12** should no longer be installed on the Talker board. If it is, fully turn it clockwise to allow maximum audio level output. Potentiometer **R198** on the System Interface board is used to adjust the signal level for transmit audio.

4.6.4 2300-300 Scanner Interface Board

The 2300-300 Scanner Interface board provides interface connections between the scanners and the System Interface board. The cables from both bearing and wheel scanners are terminated into their respective connectors on the Scanner Interface board. On-board relays are used to control scanner heaters and shutters. Status LEDs are provided to indicate the current state of the heaters, shutters, and supply voltages.

The figure below shows a Scanner Interface board (2300-300), with some important components highlighted.



4.6.4.1 Power Connectors

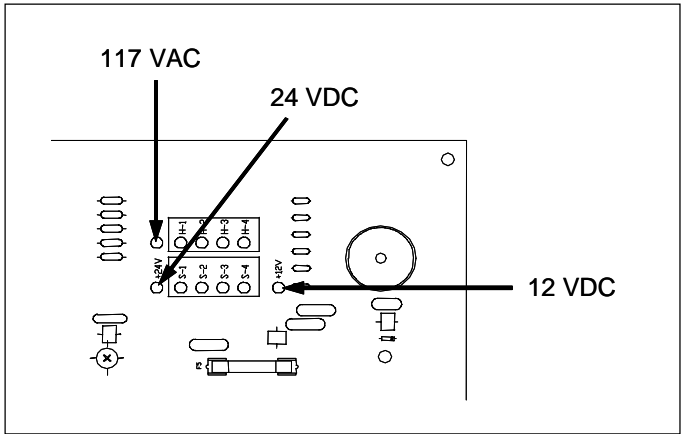
The two-position shrouded header located in the upper left-hand corner provides a termination point for the incoming 120 VAC wire harness. The two-position shrouded header located in the lower left-hand corner provides a connection for the 24 VDC supply. These connections are prewired at the factory.

4.6.4.2 Board-to-Board Connector

A 32-pin connector located on the underside of the Scanner Interface board provides board-to-board connections to the 2300-200 System Interface board.

4.6.4.3 Status LEDs

There are three **power-status** LEDs.



The table below describes what each lit LED means.

LED	Meaning When Lit
12VDC	12 VDC is present on Scanner Interface board.
24VDC	24 VDC is present on Scanner Interface board.
117VAC	120 VAC is present on Scanner Interface board.

There are four **heater-status** LEDs. The table below describes what each lit LED means.

LED	Meaning When Lit
H-1	Power is applied to activate heater on N/E bearing scanner.
H-2	Power is applied to activate heater on S/W bearing scanner.
H-3	Power is applied to activate heater on N/E wheel scanner.
H-4	Power is applied to activate heater on S/W wheel scanner.

There are four **shutter-status** LEDs. The table below describes what each lit LED means.

LED	Meaning When Lit
S-1	Power is applied to open shutter on N/E bearing scanner.
S-2	Power is applied to open shutter on S/W bearing scanner.
S-3	Power is applied to open shutter on n N/E wheel scanner.
S-4	Power is applied to open shutter on S/W wheel scanner.

4.6.4.4 Relays

The SmartScanIS uses optically isolated solid-state relays (SSRs) to eliminate electromagnetic radiation, which would otherwise be generated by arcing of mechanical relay contacts. There are two SSRs. One SSR is used to operate the scanner shutters. The other energizes the scanner heaters. The signals to activate the SSRs originate at the Processor board.

The power rating for each SSR is intentionally overrated to ensure long-lasting reliability. For example, the SSR associated with the scanner **shutters** is rated for 100 VDC at 12 amps, even though the shutters operate on 12 volts and require less than 2 amps each. Likewise, the SSR associated with the **heaters** in the 2100-510AC scanners is rated for 240 VAC at 25 amps of current, even though the heaters require only 120 VAC at 2.5 amps each.

4.6.4.5 Fuses

There are four **heater** fuses. All are 3AG glass-body 4-amp 250-volt fast-acting fuses. The table below describes what each fuse protects.

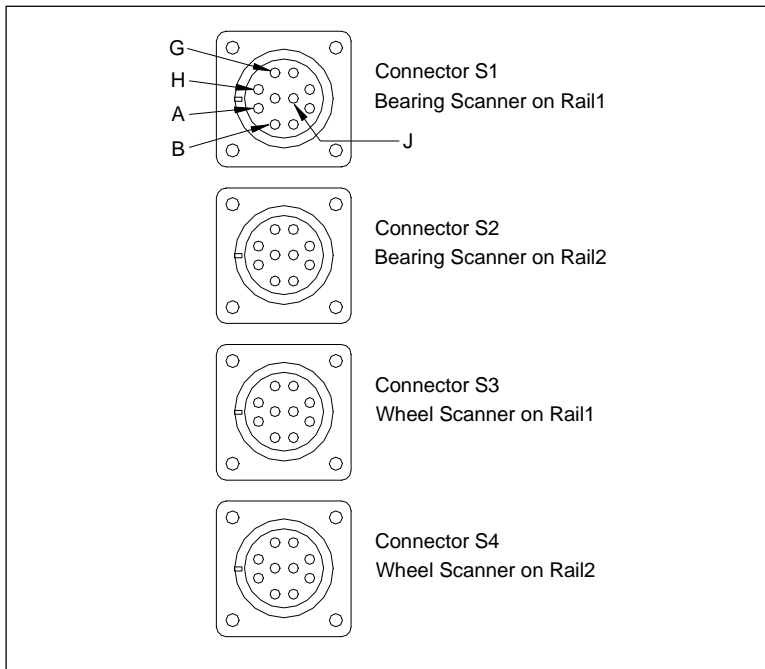
Fuse	Protects
F1	Heater for N/E bearing scanner.
F2	Heater for S/W bearing scanner.
F3	Heater for N/E wheel scanner.
F4	Heater for S/W wheel scanner.

There are four **shutter** fuses. All are 3AG glass-body 2-amp 250-volt fast-acting fuses. The table below describes what each fuse protects.

Fuse	Protects
F5	Shutter for N/E bearing scanner.
F6	Shutter for S/W bearing scanner.
F7	Shutter for N/E wheel scanner.
F8	Shutter for S/W wheel scanner.

4.6.4.6 Scanner Connectors

Mounted on the left side of the Scanner Interface board are four Amphenol connectors (97 series box receptacles). The top two, which are labeled S1 and S2, are for the bearing scanner cables. The bottom two, which are labeled S3 and S4, are for the wheel scanner cables.

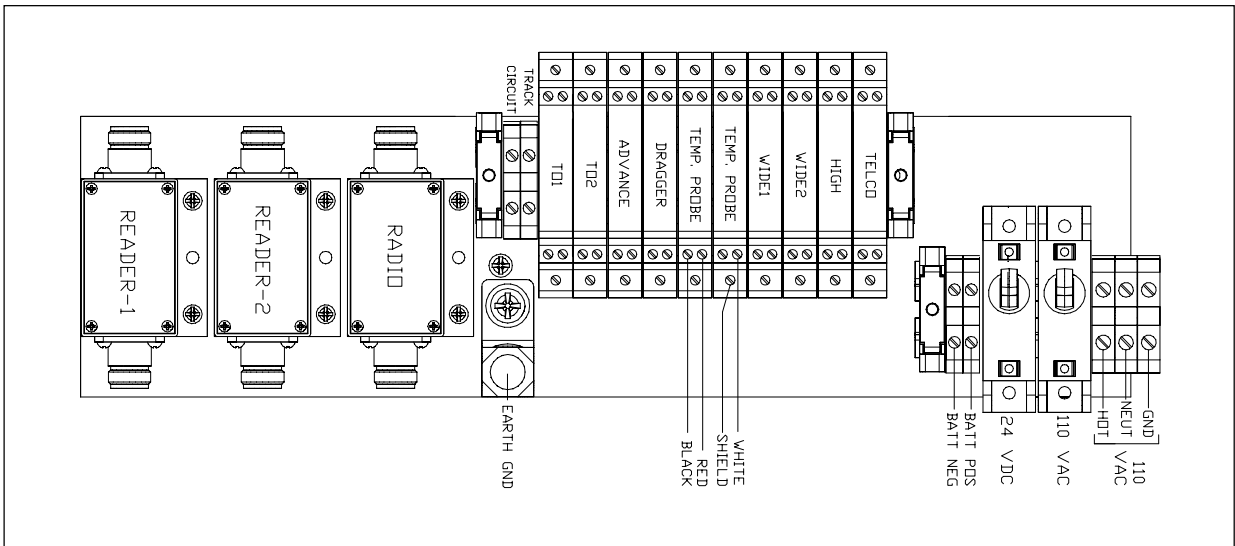
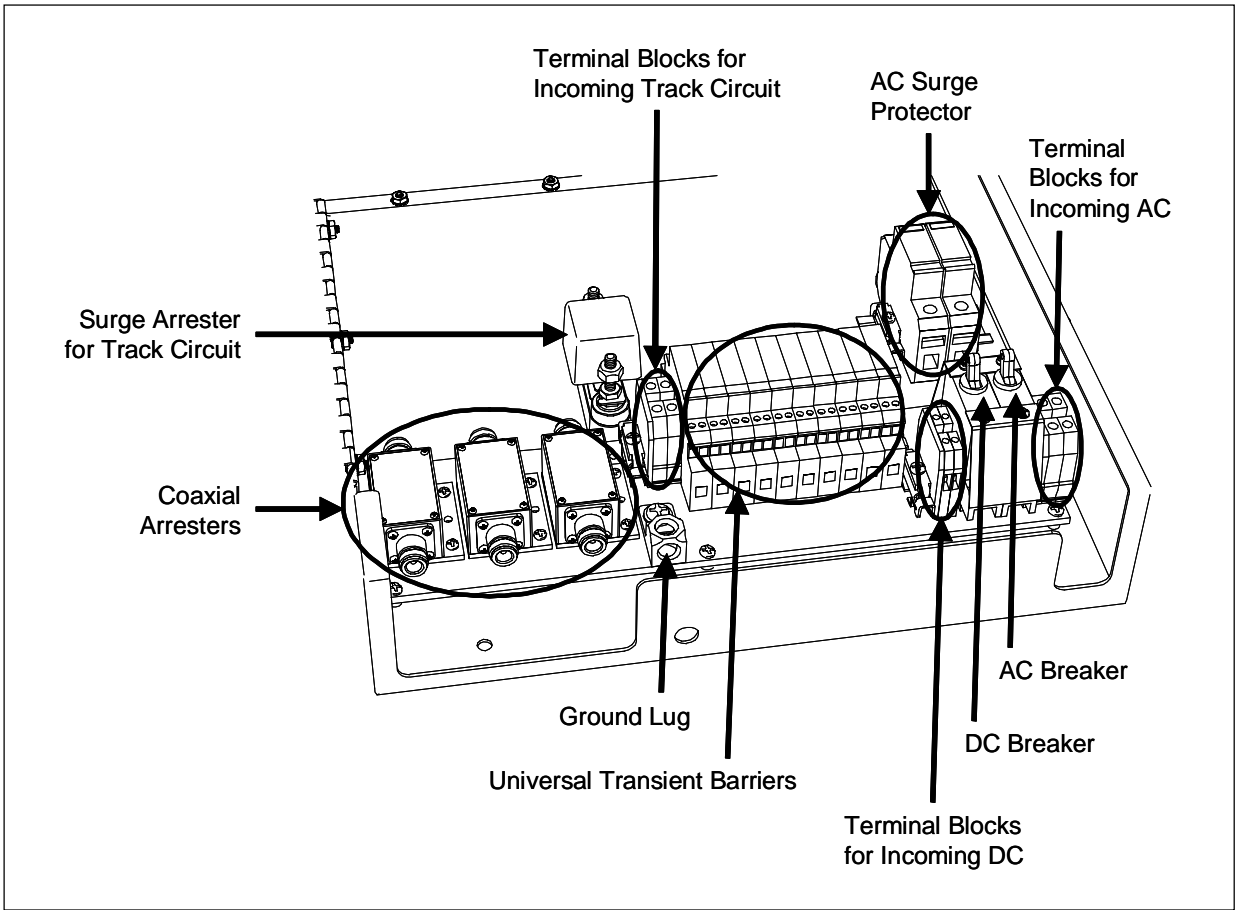


Connectors S1 through S4 on the Scanner Interface board each have the same printout. The table below shows this pinout.

Pin A	Ground
Pin B	Shield
Pin C	120 VAC (line voltage) that activates the scanner heaters. Fused at 4 amps.
Pin D	Neutral for heaters.
Pin E	<i>Not Used</i>
Pin F	+24 VDC (battery voltage) that activates the scanner shutter.
Pin G	Ground return for shutter solenoid.
Pin H	Heat signal from the scanner.
Pin I	Ground return for heat signal from the scanner.
Pin J	Scanner pyrometer power. Regulated +12 VDC fused at 100mA with a self-restoring fuse.

4.7 Surge Protection Subassembly

The figures below show the Surge Protection Subassembly, with some important components highlighted.



4.7.1 Ground Lug

In order for the Surge Protection Subassembly to function properly, the surge components must be properly grounded. To do this, a solderless copper lug has been provided as a termination point for the earth ground.

4.7.2 Coaxial Arresters

On the left side of the Surge Protection Subassembly are three Joslyn coaxial lightning arresters. At the factory, the top end of these arresters are wired to the radio and, if used, to the 2200-750 Reader.

During installation, the customer attaches antenna cables to the bottom end of these arresters. For SmartScanIS to work properly, the northmost or eastmost AEI antenna, **antenna1**, must be connected to the arrester labeled **Reader1**. The southmost or westmost AEI antenna, **antenna2**, must be connected to the arrester labeled **Reader2**.

4.7.3 Surge Arrester for Track Circuit

Above the rightmost coaxial arrester is a three-terminal arrester, which is used to protect the system from voltage surges from the track circuit.

4.7.4 Terminal Blocks for Incoming Track Circuit

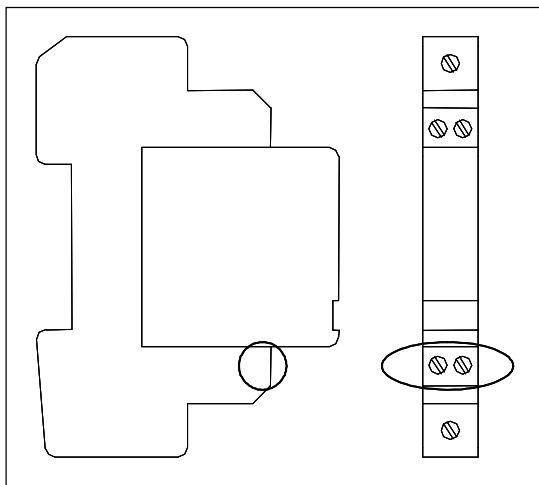
Two DIN-mounted terminal blocks are provided for the termination of track circuit wiring. Polarity doesn't matter when connecting the wires from the track circuit.

4.7.5 Universal Transient Barriers

On the DIN rail are industrial grade surge suppressors (aka universal transient barriers or UTBs). They protect the system from voltage surges from the shielded temperature probe, telephone, transducers, and dragging-equipment detector. At sites with wide-load, high-load, or high-wide detectors, the system will also be protected from voltage surges from these devices.

The UTBs are capable of suppressing damaging electrical transients and surges, which can be induced onto signal lines by lightning. Here is a list of signals that pass through the UTBs on the DIN rail before entering the rest of the SmartScanIS enclosure.

- Gating transducer **TO1**
- Gating transducer **TO2**
- Advance transducer **ADVANCE**, if used
- Dragging-equipment detector, **DRAGGER**
- Shielded temperature probe **TEMP PROBE**, which uses two UTBs
- High-load detector **HIGH**, if used
- Wide-load detector **WIDE1**, if used
- Wide-load detector **WIDE2**, if used
- Telephone line **TELCO**



Each UTB is mounted vertically on a DIN rail. Shown to the left are two views of the same UTB.

As you can see, there are two tiers of connectors (one above the other) on each side of the UTB. Starting from the top, the connectors on the first and fourth rows are lower than those on the second and third rows.

The equipment listed above is wired to the third row of connectors.

Also on the DIN rail, but not protected by UTBs, are connections for the track circuit. Before entering the rest of the SmartScanIS enclosure, the wiring from the track circuit is protected by a three-terminal arrester. Therefore, it doesn't need UTB protection.

4.7.6 AC Surge Protector

Two DEHNgard Model P-150 Surge Suppressors provide AC surge protection. The Model P-150 consists of a base with a replaceable plug-in MOV module, contacts for remote monitoring, and a red fault indicating flag window.

Even in the event of suppressor failure, AC line voltage is still provided to the system. This reduces the possibility of a total system shutdown. However, after a suppressor failure, you no longer have surge protection. When running firmware version 5.01 or later, the integrity of the Model P-150 is monitored by the system. Should the protection become compromised, the end-user is alerted via the System Status report and the Union Pacific's Polling System.

4.7.7 AC and DC Breakers

The AC and DC breakers provide overload and short-circuit protection for the SmartScanIS. The AC breaker protects the AC power input to the electronics enclosure. The DC breaker protects the 24 VDC (battery) connection. These circuit breakers also provide a convenient means to turn off power to the system. Both the AC breaker and the DC breaker must be toggled off to power down the SmartScanIS.

4.7.8 Terminal Blocks for Incoming AC

To the right of the AC breaker, three DIN mounted terminal blocks are provided as a termination point for incoming AC service. At the factory, a power cord is attached to these terminal blocks.

4.7.9 Terminal Blocks for Incoming DC

To the left of the DC breaker, two DIN mounted terminal blocks are provided as a termination point for the 24 VDC battery backup.

4.8 2300-357 Efficiency Test Panel

Not all SmartScanIS sites use the 2300-357 Efficiency Test panel, which is used to monitor train crew performance during a hotbox or dragging-equipment stop.

The Efficiency Test panel contains:

- Panel cover
- LED
- Side-selection switch
- Detector-selection switch
- Car-selection thumbwheels
- Radio test switch

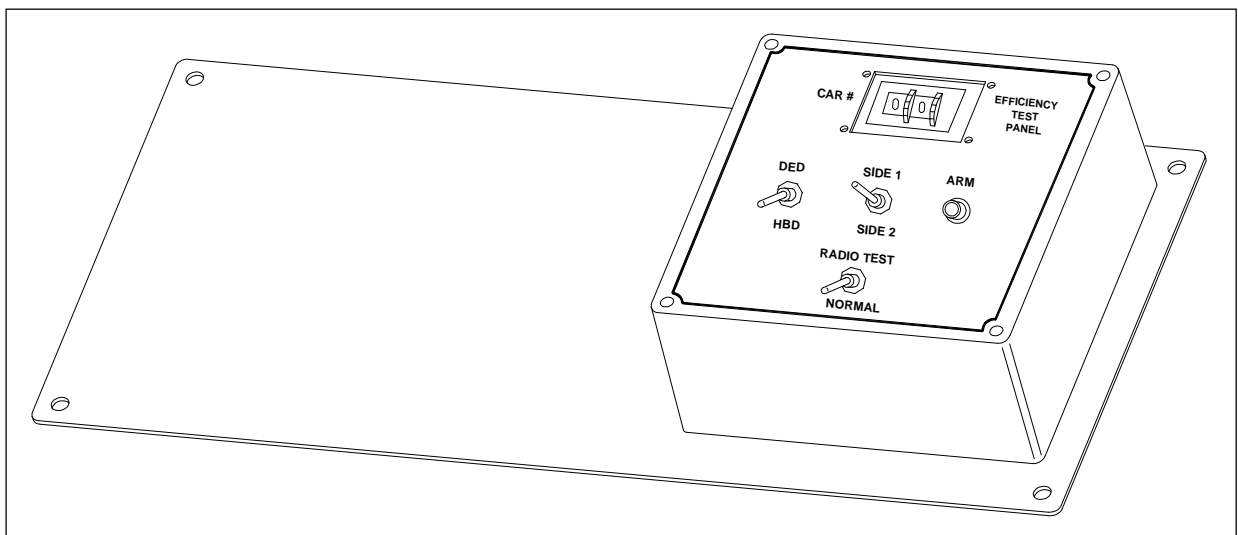
When armed, the panel causes the system to generate an alarm on the next train and at the car number specified by the panel.

CAUTION

Unless authorized to do so, do not arm this panel. Doing so will stop a train.

On the outside of the SmartScanIS enclosure, mounting studs are provided for the 2300-357 Efficiency Test panel. At the top edge of the enclosure, the 2300-357 Efficiency Test panel is secured with four Keps-nuts. A serial cable connects the test panel to the System Interface board. If your SmartScanIS enclosure was shipped in a bungalow, you'd need to install the test panel. If it was shipped in a crate instead, the test panel was already installed.

The figure below shows an assembled 2300-357 Efficiency Test panel.



4.8.1 Radio-Test Switch

On the front of the Efficiency Test panel is a two-position switch. With this switch, you can disable the PTT line to the radio. The up position is "Test," which prevents the radio from transmitting. The down position is "Normal" for normal operation.

4.8.2 LED

On the front of the Efficiency Test panel is a red LED labeled **ARM**. This LED is lit when the panel is armed.

4.8.3 Detector-Selection Switch

On the front of the Efficiency Test panel is a two-position switch. With this switch, you select either a Dragging-Equipment alarm or an absolute Hotbox alarm.

4.8.4 Side-Selection Switch

On the front of the Efficiency Test panel is a three-position switch. With this switch, you arm the panel and, in the case of a hotbox, you select the side on which the alarm occurs.

4.8.5 Car-Selection Thumbwheels

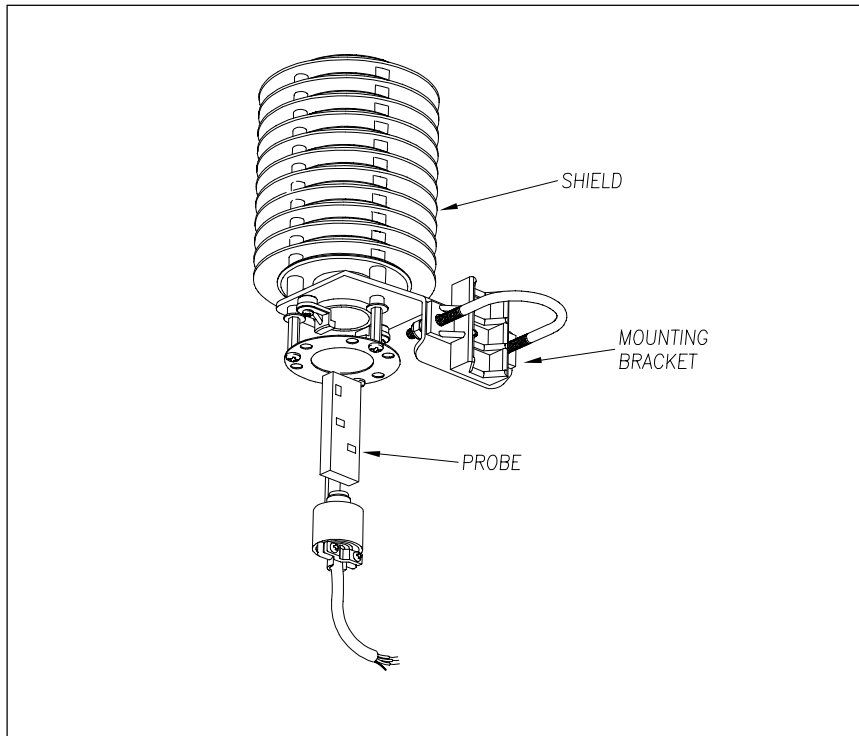
On the front of the Efficiency Test panel are two thumbwheels. With these wheels, you select the number of the car on which an alarm is to be generated.

For disarming the panel, select 00. For arming the panel, select a number from 01 through 99. ***Chapter 14 – Using the Efficiency Test Panel*** tells how to arm and disarm the panel.

4.9 Shielded Temperature Probe (2090-100)

The temperature probe is encased in a radiation shield that shields it from direct sunlight and allows ambient air to flow through and around it. The probe mounts to the outside wall of the bungalow (aka wayside enclosure) and provides accurate temperature indications over a range of -49°F to +149°F (-45°C to +65°C). Site ambient temperature (at the time the train passed the site) is included with most system reports. There is one shielded temperature probe per system.

The figure below shows the major parts of a shielded temperature probe (2090-100).



The SmartScanIS supplies 12 volts to the shielded temperature probe. The probe returns 0 to 5 volts. Zero volts indicate a -49°F (-45°C) reading. Five volts indicate a +149°F (+65°C) reading. During normal operation, you should probably never get either reading. Therefore, if you get a -49°F (-45°C) reading, the probe could be malfunctioning, the cable from the probe to the SmartScanIS enclosure could be cut, or the wiring to the System Interface board could be disconnected. If you get a +149°F (+65°C) reading, the probe could be malfunctioning or the ground wire from the probe to the SmartScanIS enclosure could be cut.

Chapter 8 - Installing the Bungalow Components tells how to install the shielded temperature probe.

Chapter 5

Preparation

The preparation phase starts with selecting the site. It ends with identifying the installation tools. Care taken during this phase can result in reduced maintenance and improved performance of the SmartScanIS.

This chapter covers what needs to be done before trackside hardware is installed. Contained herein is time-tested advice that is well worth following. Also covered is how to install the bungalow (aka wayside enclosure), antenna masts, and PVC pipes.

5.1 Selecting a Site

Locate the site:

- On level, well-drained ground (avoid low areas where flooding may occur)
- In an area that doesn't normally require heavy braking by passing trains
- At least 300 feet (91.4 meters) from the nearest road crossing
- Away from a track joint, a track switch, and a side track
- By a track that is on gauge (avoid placing track hardware in curves)
- By a roadbed that is tamped, stable, and well maintained
- Where trains usually travel more than 10 mph (16 kph)

5.2 Preparing the Scanner Location

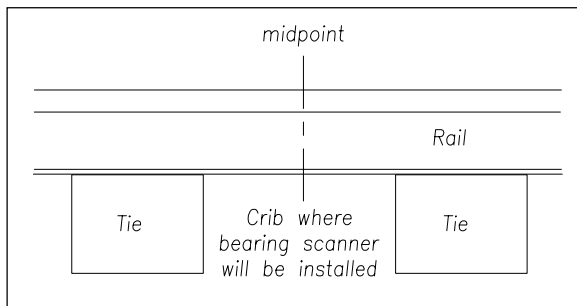
To ready the scanner location:

- 1 Select a location to install the bearing scanners.
- 2 Inspect the ties and tie plates in the area where the scanners are to be installed.
- 3 If the ties or tie plates aren't in good condition, fix this problem before proceeding.
- 4 If the ties aren't well tamped, fix this problem before proceeding.
- 5 Measure the distance between the ties.

The scanners should be centered in the crib of two ties spaced at least 14 inches (35.6 centimeters) apart.

- 6 If the ties aren't spaced at least 14 inches (35.6 centimeters) apart, fix this problem before proceeding.

7 Mark the rail at the midpoint between the ties.



If you are going to install antenna masts, in addition to identifying where the bearing scanners will be installed, this midpoint mark will also be used later to locate where the holes for the mast bases are to be dug.

8 If your installation has wheel scanners:

- a** Select a location to install them.

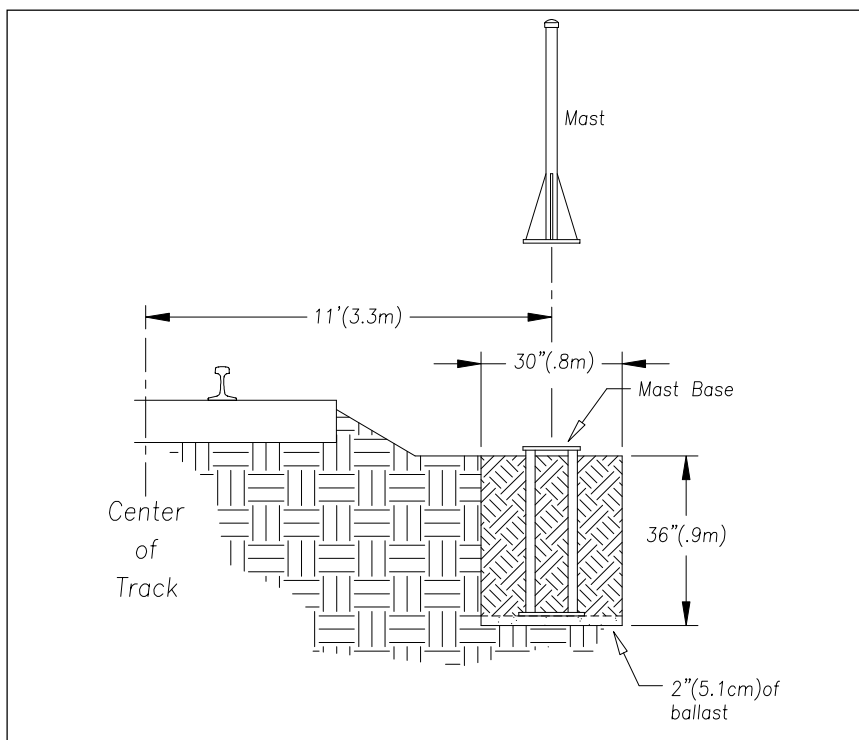
The wheel scanners should be centered in the crib of the two ties immediately ahead (and to the north or east) of the bearing scanners.

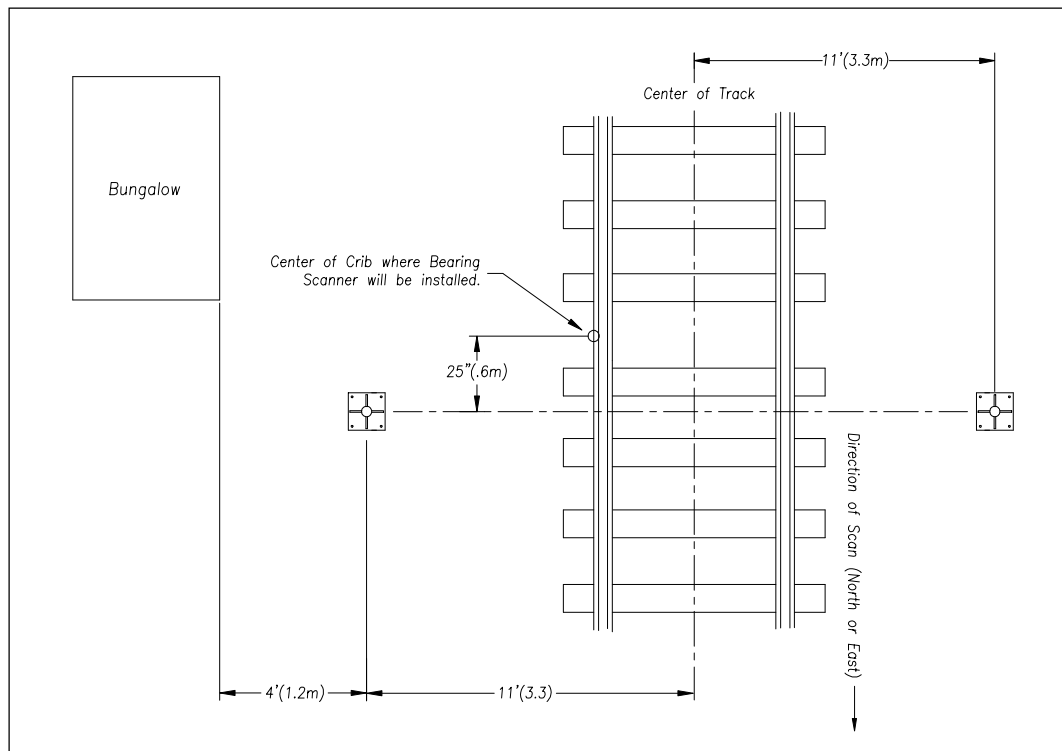
- b** Repeat steps 2 through 6.

5.3 Preparing the AEI Antenna Masts

If your **single-track site** uses AEI equipment, ready the two antenna masts (aka poles):

- 1** Using the dimensions below, dig two holes and add ballast.





- 2 Lower one metal mast base into each hole, rotating it until one edge of the base is parallel to the track.

Install each base so that it is plumb and so that its center is 11 feet (3.3 meters) from the center of the track and 25 inches (0.6 meters) from the center of the crib in which the bearing scanner will be installed. Both bases will be north or east of the crib.

- 3 With the supplied hardware, attach one mast to each base.
- 4 Plumb each mast.
- 5 Ground each mast.

When done, each mast should be level, grounded, attached to a base, and placed directly opposite the other mast.

5.4 Preparing the Bungalow

To ready the bungalow:

- 1 Place the bungalow on level, well-drained ground.
Face the door side of the bungalow toward the tracks. This side of the bungalow should be parallel to the track and 15 feet (4.6 meters) from the center of the track.
- 2 Level the bungalow.

- 3 On the side of the bungalow, drive at least one ground rod into the ground.

Ground rods should be 0.75-inch (1.9-centimeter) diameter copper-clad steel rods or 1-inch (2.5-centimeter) diameter zinc-coated steel rods. The minimum length of a ground rod is 8 feet (2.4 meters). Ground rods should be driven vertically for their full length, and the top of the ground rod should be located a minimum of 12 inches (30.5 centimeters) below the top of the subgrade at the toe of the ballast slope. The maximum allowable resistance of grounded rail or structures is 25 ohms.

Ground connectors with attached copper wire are welded to the underside of most bungalows.

- 4 Attach one end of the copper wire that is attached to the bungalow to the ground rod.

Telephone service is needed for you to access the system remotely. Telephone service is not needed to send information through the polling system.

- 5 If your site is not going to have telephone service, go to step 8.

- 6 Supply the site with normal telephone service.

- 7 Complying with all applicable codes and inspections, bring the telephone line into the bungalow and leave it coiled on the floor.

- 8 Supply the site with a stable AC power source of at least 110 volts at 20 amperes.

The incoming AC voltage is internally converted to the 24 VDC and 12 VDC supplies required by the SmartScanIS. Two 115 AH batteries provide backup power for the system.

- 9 Complying with all applicable codes and inspections, bring the outside power line to the circuit-breaker box inside the bungalow.

- 10 Toggle off all breakers in the circuit-breaker box.

- 11 Complying with all applicable codes and inspections, wire the power line to the circuit-breaker box.

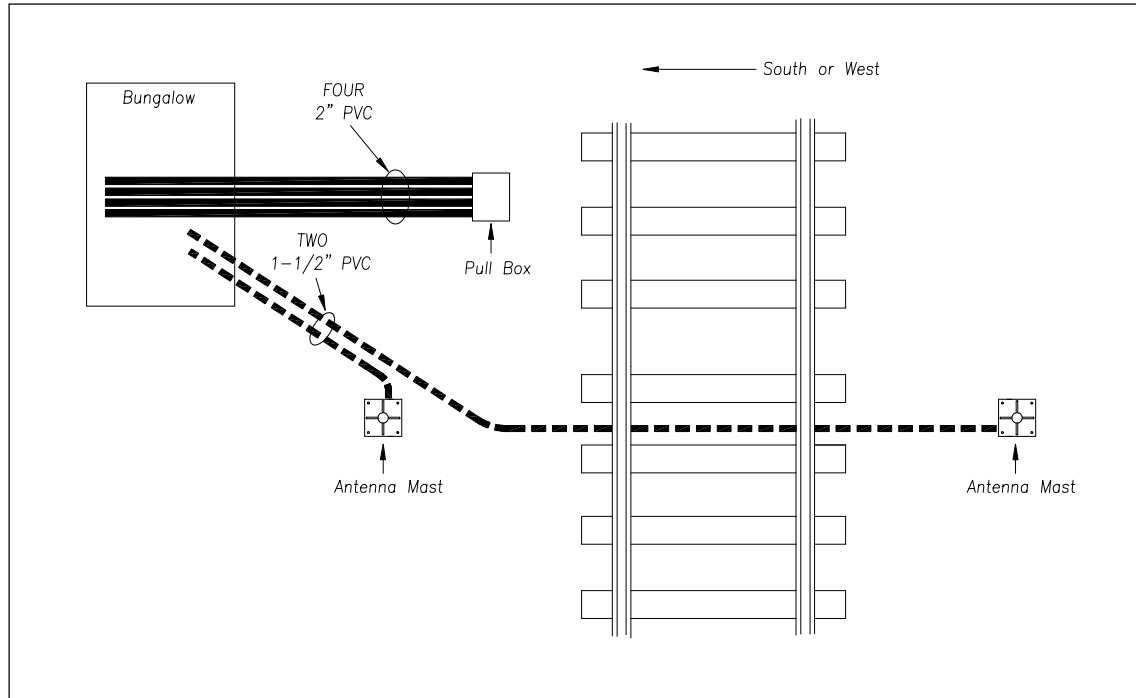
Some railroads wire the power line to a surge protector and then to the circuit-breaker box.

- 12 If not done already, wire from the circuit-breaker box to a grounded outlet.

5.5 Preparing the Pull Box and PVC Pipes

To ready the pull box and PVC pipes:

- 1 Using the figure below and following your company's standards, dig trenches for the pull box and the PVC pipes.



- 2 Install the pull box.
- 3 Lay four 2-inch PVC pipes from the pull box to the bungalow.
Later, these four pipes will contain cables from the scanners and transducers to the bungalow.
- 4 Lay two 1-1/2-inch PVC pipes from the mast bases to the bungalow.
Later, these two pipes will contain cables from the AEI antennas to the bungalow.

5.6 Receiving Your System

All the dragging-equipment detectors that a site needs are shipped on one pallet. All the components that make up one or more systems are shipped either in a crate or in a bungalow if one was ordered. The contents of this crate or bungalow are specific to the site and are detailed on the packing list.

When the packages arrive at the site, check them immediately for exterior damage. If there is any, notify STC.

5.7 Returning Damaged or Defective Hardware

Return any damaged or defective hardware to STC for repair or replacement. You don't need a return authorization number. You don't need to call first. Just ship it directly to:

Southern Technologies Corporation
Returns Department
6145 Preservation Drive
Chattanooga, Tennessee 37416-3638
USA

With the returned hardware, include:

- Complete address of where the hardware is to be returned.
- Name and telephone number of the person who should be contacted to answer questions about the hardware.
- A written explanation of the hardware damage or defect.

5.8 Getting Help with the Installation

If a part is missing or if you have any problems installing a part, telephone STC's engineering staff. Except on major holidays, you can reach them at 423-892-3029, Monday through Friday, from 8:00 a.m. until 5:00 p.m. Eastern time. After business hours, calls are answered by a machine. These calls are returned promptly the next business day.

When calling, state that you are calling about a SmartScanIS. Your call will then be directed to the right person.

Though slower and more cumbersome, solving your problems by email is also possible.

5.9 Identifying the Installation Tools

Besides the tools needed to install signal cases, underground cables, and power services, you need these to install your SmartScanIS.

- Laptop computer
- Track drill with 3/8-inch bit
- 1/2-inch drive ratchet with 9/16-inch deep well socket
- 3/4-inch drive ratchet with 1-7/16-inch socket
- 9/16-inch torque wrench
- 1/2-inch nutdriver
- 9/64-inch Allen wrench (if your site uses **Type II** scanners)
- Medium-size adjustable box wrench (aka crescent wrench)
- Carpenters level
- #2 Phillips head screwdriver
- Small slotted screwdriver (aka flathead screwdriver)
- 50-foot (15-meter) or longer tape measure
- Multimeter, reading at least 110-120 VAC, 0-50 VDC, and 0-1 megohm

In the box containing the bearing scanners are these tools.

- Short-handle 1-1/2-inch open-end wrench, which is used to install the scanner mounts
- T-handle 3/16-inch hex-wrench, which is used to install the flex-conduit-adaptor plates on the scanner mounts
- T-handle 1/4-inch hex-wrench, which is used to install the scanners on the scanner mounts
- Two combination 9/16-inch open-end box wrenches, which are used to install the transducers and align the scanners

When you finish using the supplied tools, store them in the bungalow, if possible. They are also used to maintain the system.

Chapter 6

Installing the Track Components

For purposes of this guide, track components are scanners, transducers, track circuits, auxiliary-alarm detectors, and AEI antennas. This chapter tells how to install scanners, transducers, track circuits, and AEI antennas. The installation of dragging-equipment detectors and other auxiliary-alarm detectors isn't covered in this guide.

All SmartScanIS sites have two bearing scanners per track. Some tracks also have two wheel scanners. All tracks have two gating transducers. Gating transducers are used to control scan timing and car recognition. All tracks have either two advance transducers or one track circuit. Advance transducers and track circuits are used to indicate train presence.

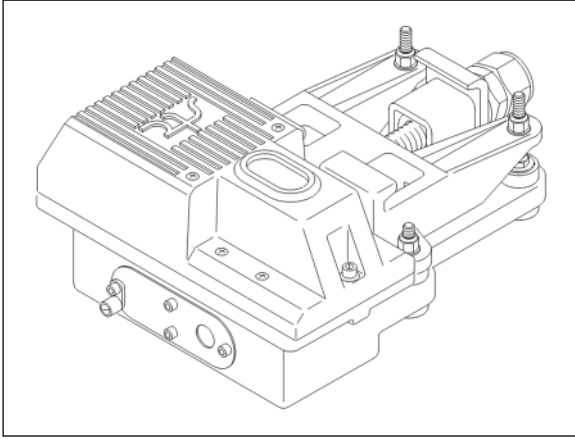
Track components are installed in this order.

- Bearing scanners and their cables
- Gating transducers and their cables
- When used, advance transducers and their cables
- When used, wheel scanners and their cables
- When used, the track circuit and its wires
- When used, AEI antennas and their cables
- When used, auxiliary-alarm detectors and their cables

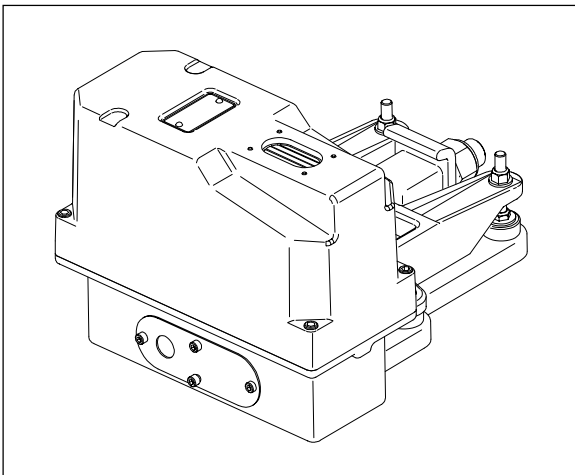
The instructions that follow **only work in the northern hemisphere**. If your site is south of the equator, skip the instructions in this chapter and call STC for help.

6.1 Bearing Scanners

An assembled **Type II** bearing scanner looks like this.



An assembled **Type III** bearing scanner looks like this.



To install the **Type II/Type III** bearing scanners:

- 1 Be sure that you have on hand two assembled bearing scanners.
- 2 Be sure that you have on hand a short-handle 1-1/2-inch open-end wrench, a T-handle 3/16-inch hex-wrench, a T-handle 1/4-inch hex-wrench, a #2 Phillips head screwdriver, and a 50-foot (15-meter) or longer tape measure.
- 3 Select a location to install the bearing scanners.

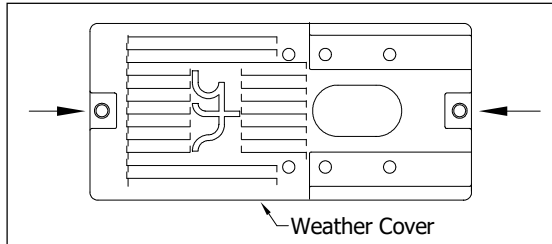
The bearing scanners should be centered in the crib of two ties spaced at least 14 inches (35.6 centimeters) apart.

- 4 Under both rails between the ties, remove the ballast to a depth of 4 inches (10.1 centimeters).

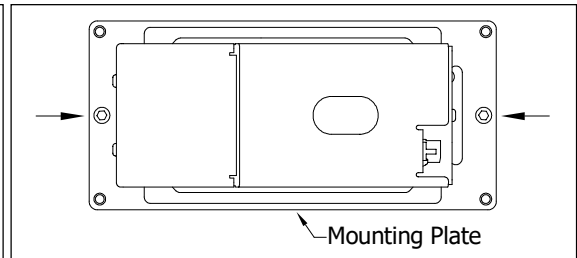
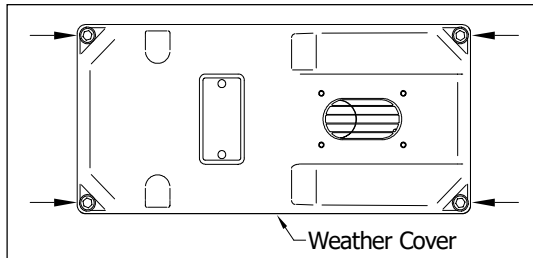
You'll next install the first bearing scanner.

- 5 Using a T-handle 1/4-inch hex-wrench, loosen the socket-head-cap screws on the cover of a not-yet-installed bearing scanner.

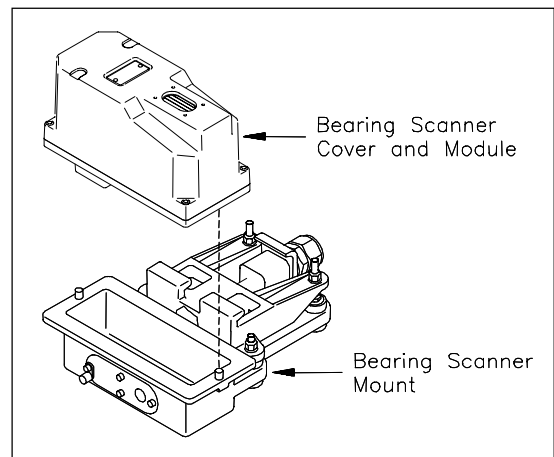
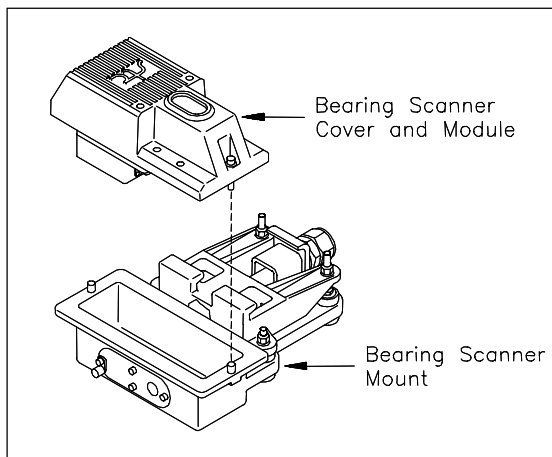
The **Type II** bearing scanner has two socket-head-cap screws that attach the weather cover to the mount.



The **Type III** bearing scanner has six. Four attach the weather cover to the mounting plate, and two attach the mounting plate to the mount.



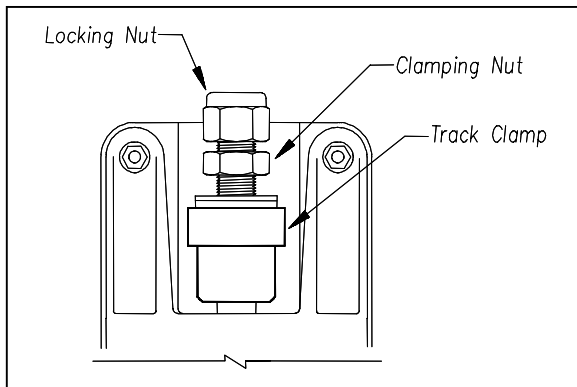
- 6 Separate the bearing scanner cover-and-module assembly from its mount.



- 7 If this is a **Type III** bearing scanner, disconnect the heater wiring plug.

- 8 Store the cover-and-module assembly in a safe place until you replace it.

In the steps that follow, the terms track clamp, clamping nut, and locking nut are used. Notice where they are on the mount.



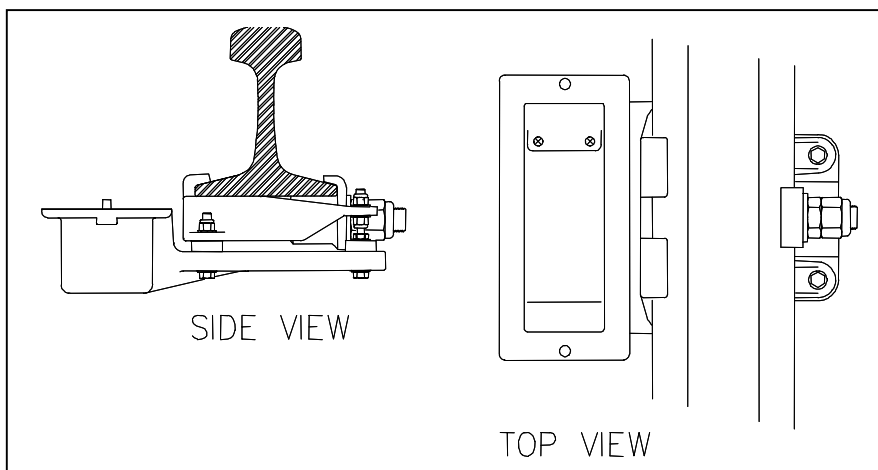
- 9 Centered between the ties and on the rail closest to the bungalow, place the mount so that the moveable track clamp extends under the rail and toward the center of the track.
- 10 Tighten the inner nut (that is, the clamping nut) by hand.
This should hold the mount in place.
- 11 Using a short-handle 1-1/2-inch wrench, tighten the clamping nut to a **torque of 48 to 50 foot-pounds (65.1 to 67.8 newton-meters)**.

Don't exceed a torque of 50 foot-pounds (67.8 newton-meters). Doing so can cause failure of the mount.

- 12 Using a short-handle 1-1/2-inch wrench, tighten the locking nut to a **torque of 48 to 50 foot-pounds (65.1 to 67.8 newton-meters)**.

Don't exceed a torque of 50 foot-pounds (67.8 newton-meters). Doing so can cause failure of the mount.

At this point, your work should look like this.

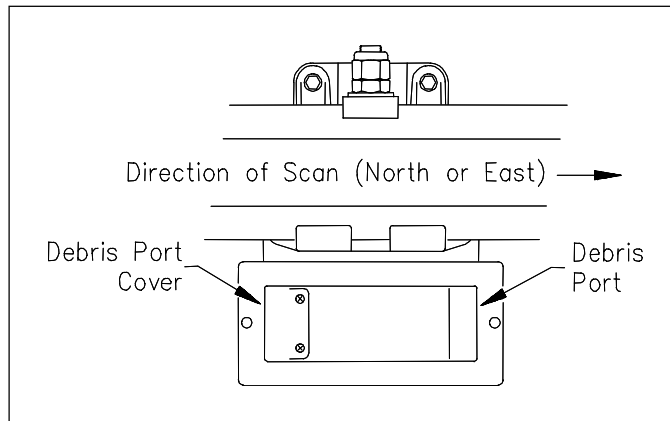


The next step is necessary to finish installing the bearing scanner mounts, to install the bearing scanners themselves, and to install the transducers.

13 Determine the direction of scan.

If the track runs north and south, both the oval hole in the top of the scanner and the rectangular hole in the bottom of the mount should be pointed north. If the track runs east and west, both holes should be pointed east. The goal of proper scanner orientation is to reduce the possibility of the scanners looking directly into the sun during scanning operations.

14 Examine the top of the mount.



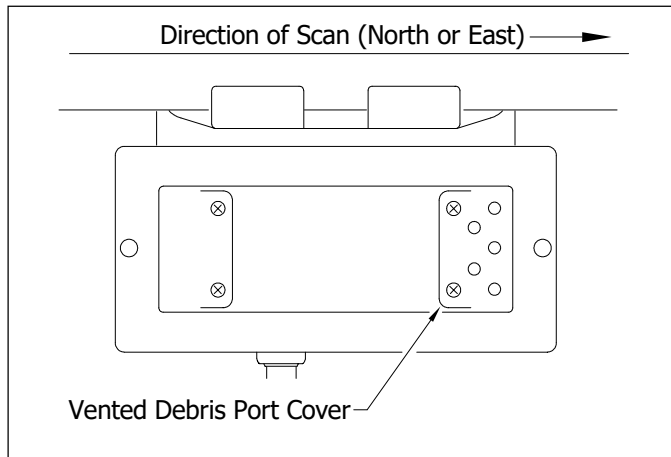
In the bottom of the mount are two rectangular holes called debris ports. One port is covered. One isn't. **Do the next step only if the uncovered debris port is at the southmost or westmost end of the mount.**

15 If the debris port cover isn't as shown above:

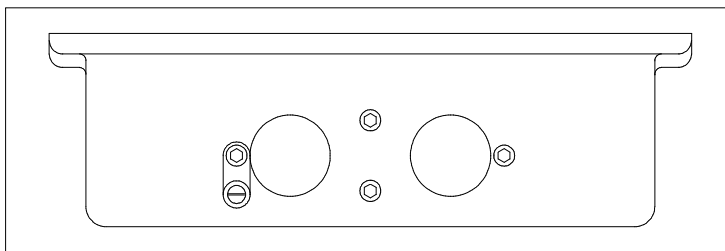
- a** Using a #2 Phillips head screwdriver, remove the two screws holding the debris port cover.
- b** Store the screws in a safe place until you replace them.
- c** With gentle pushing from underneath, remove the debris port cover.
- d** Place the debris port cover over the debris port on the other end of the mount.
- e** Using a #2 Phillips head screwdriver, replace the two screws through the debris port cover.

16 If you are installing a **Type III** bearing scanner:

- a** Place the vented debris port cover over the debris port.
- b** Using a #2 Phillips head screwdriver and the supplied two screws, secure to mount.



17 Examine the side of the mount farthest from the track.

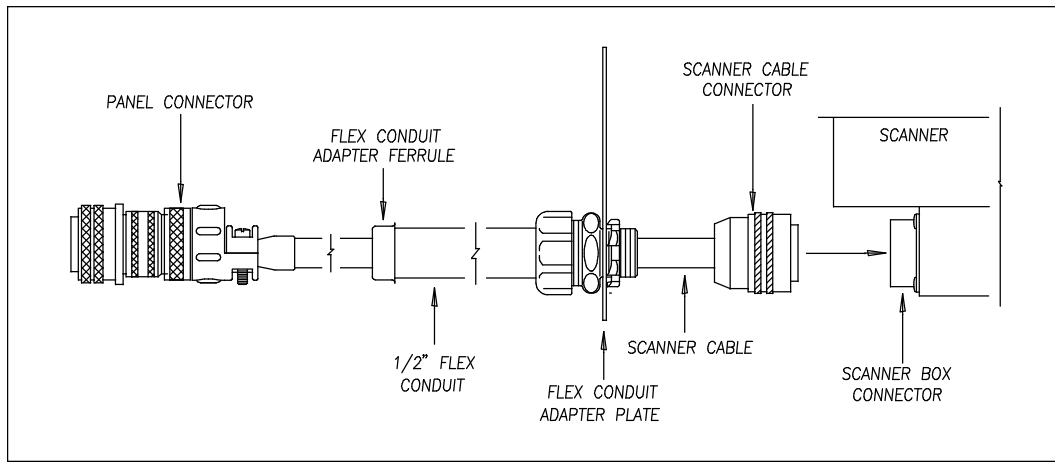


On the side of the mount are two large holes and four socket-head-cap screws. The longest screw is holding a ground lug and an internal-tooth washer.

18 Using a T-handle 3/16-inch hex-wrench, remove the four socket-head-cap screws.

- 19** Store the screws, washer, and lug in a safe place until you replace them.

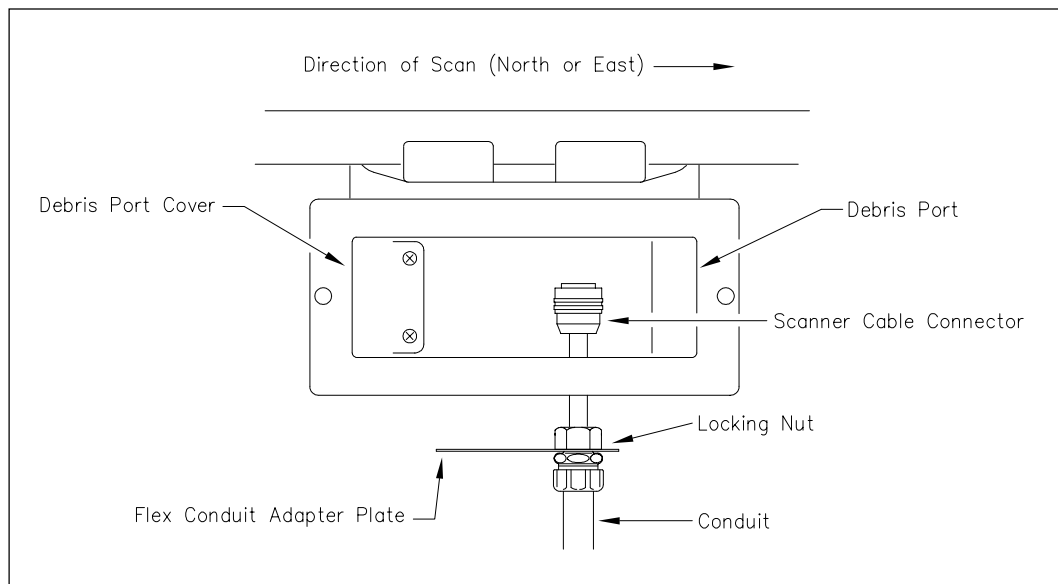
In the steps that follow, the terms scanner cable connector, panel connector, and flex-conduit-adapter plate are used. Notice where they are on a bearing scanner cable.



Single-track sites have two 65-foot (19.8-meter) bearing scanner cables.

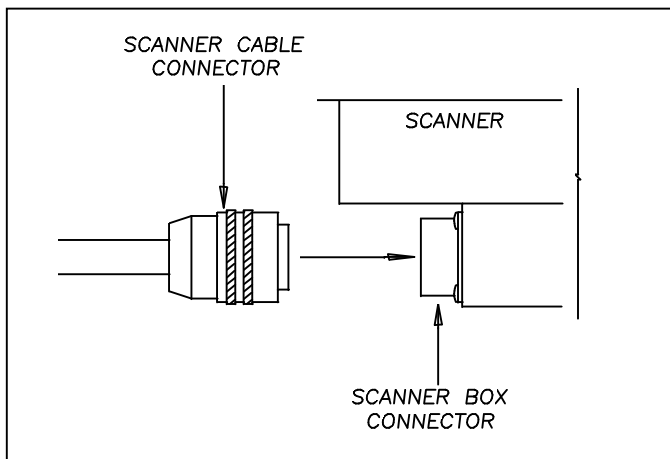
Double-track sites have two 65-foot bearing scanner cables for the track closest to the bungalow. For the track farthest from the bungalow, they have either two 85-foot (25.9-meter) or two 100-foot (30.5-meter) bearing scanner cables.

- 20** If this is a double-track site, select the correct length of cable.
- 21** Tighten the locking nut (on the conduit connector) until it is tight against the flex-conduit-adapter plate.

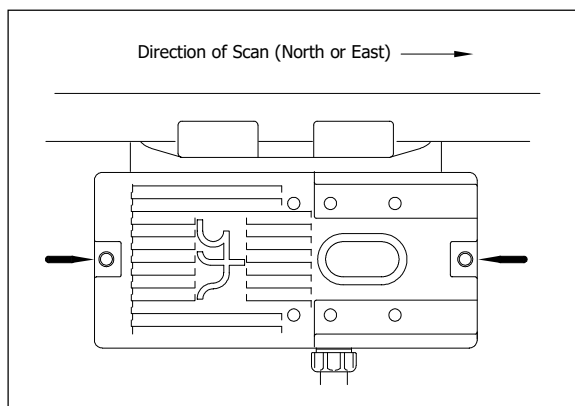


- 22** Put the scanner cable connector through the northmost or eastmost round hole in the side of the mount.

- 23 Align the screw holes in the flex-conduit adapter plate with the screw holes in the mount.
- 24 Replace the two center screws and tighten them by hand.
This should hold the flex-conduit-adapter plate in place.
- 25 Leave 6 inches (15.2 centimeters) of the bearing scanner cable in the mount.
- 26 In the screw hole closest to the cable, replace the screw and tighten it by hand.
- 27 In the screw hole farthest from the cable, replace the ground lug, internal-tooth washer, and screw.
- 28 Tighten by hand.
- 29 Using a T-handle 3/16-inch hex-wrench, tighten the four screws until they are completely tight.
- 30 Attach the bearing scanner cable connector to the scanner box connector.



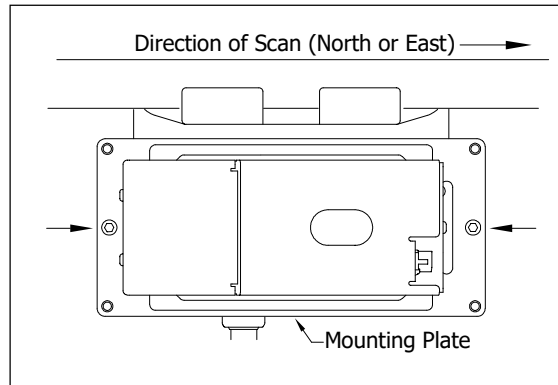
- 31 If this is a **Type II** bearing scanner:
 - a With the hole on top of the bearing scanner cover facing north or east, set the cover-and-module assembly onto its mount.



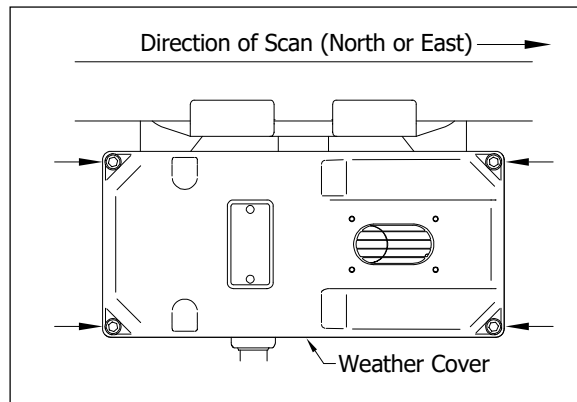
- b Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.

32 If this is a **Type III** bearing scanner:

- a** With the hole on top of the bearing scanner cover facing north or east, set the mounting plate back onto its scanner mount.



- b** Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.
- c** Reconnect the heater wiring plug.
- d** With the hole on top of the bearing scanner cover facing north or east, set the weather cover back onto its mounting plate.



- e** Using the T-handle 1/4-inch hex-wrench, uniformly tighten the four socket-head-cap screws.
- 33** If this is a single-track site, label the end of the cable that isn't attached to the bearing scanner **RAIL1** or **RAIL2**, whichever is appropriate.
- If the track runs north and south, RAIL1 is the east rail, and RAIL2 is the west rail. If the track runs east and west, RAIL1 is the north rail, and RAIL2 is the south rail.
- 34** If this is a double-track site, label the end of the cable that isn't attached to the bearing scanner **RAIL1-TRACK1**, **RAIL2-TRACK1**, **RAIL1-TRACK2**, or **RAIL2-TRACK2**, whichever is appropriate.

- 35 Extend the cable into the bungalow and leave it coiled on the floor.
- 36 Attach one end of an 8 AWG stranded copper wire to the ground lug on the flex-conduit-adapter plate and the other end to the ground connector on the ground rod.

The ground rod was driven into the ground beside the bungalow.

You'll next install the second bearing scanner on the opposite rail.

- 37 Using a T-handle 1/4-inch hex-wrench, loosen the socket-head-cap screws on the cover of the remaining not-yet-installed bearing scanner.

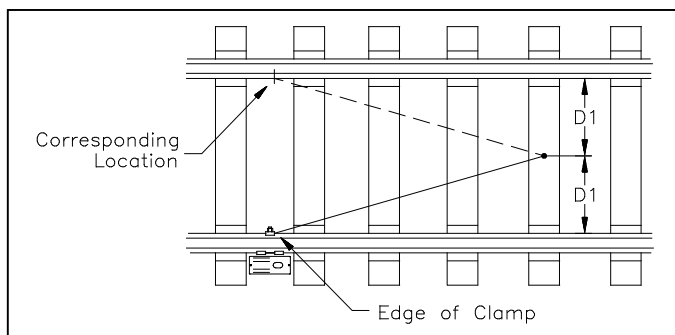
The **Type II** bearing scanner has two socket-head-cap screws that attach the weather cover to the mount. The **Type III** bearing scanner has six. Four attach the weather cover to the mounting plate, and two attach the mounting plate to the mount.

- 38 Separate the scanner cover-and-module assembly from its mount.
- 39 If this is a **Type III** bearing scanner, disconnect the heater wiring plug.
- 40 Store the cover-and-module assembly in a safe place until you replace it.

When installing the second bearing mount on the opposite rail, make sure that the two bearing mounts are squared with each other and directly opposite each other. The next step tells how to do this.

- 41 To locate the second mount on the opposite rail:

- a Mark the center of the fourth tie ahead of the just installed mount.
- b From this mark, measure to the edge of the track clamp on the just installed mount.
- c From the mark, measure the same distance on the opposite rail.



- d Mark this location on the rail.

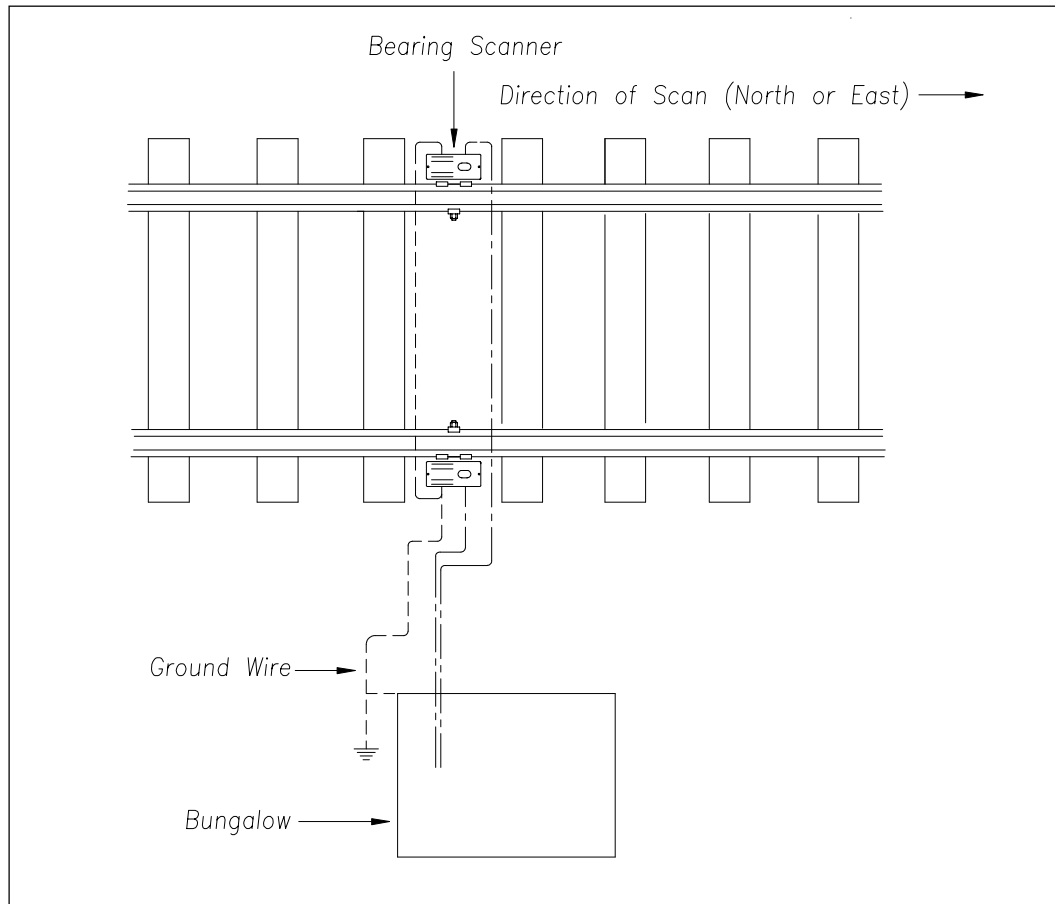
This mark will correspond to the edge of the track clamp on the opposite mount.

Use a permanent marker, magic marker, lumber crayon, or paint pen to mark the rail. Don't use a file or punch to mark the rail.

- 42 With the mark as a guide, place the second mount so that the moveable track clamp extends under the rail and toward the center of the track.
- 43 Repeat steps 10 through 35.

- 44** Attach one end of a 6 AWG stranded copper wire to the ground lug on the flex-conduit-adaptor plate and the other end to the ground lug on the other scanner mount.

Seen from above, your site would look something like this.



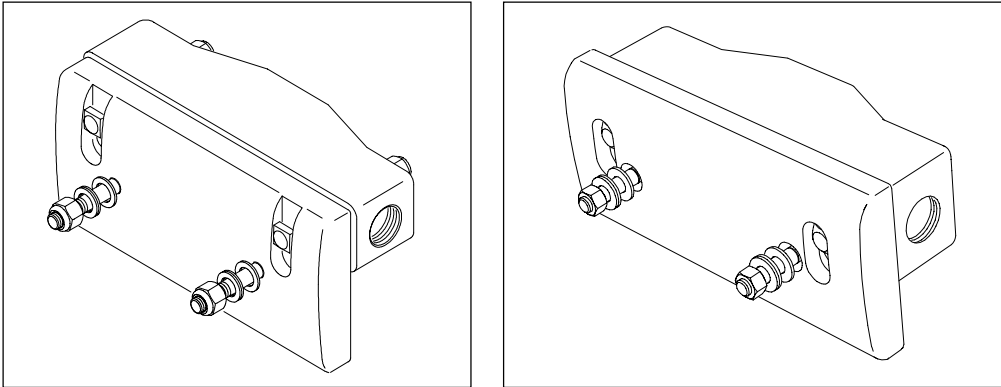
- 45** If this is a single-track site, go to **6.2 Transducers**.

- 46** If this is a double-track site:

- a** Repeat steps **1** through **44** on the second track.
- b** Go to **6.2 Transducers**.

6.2 Transducers

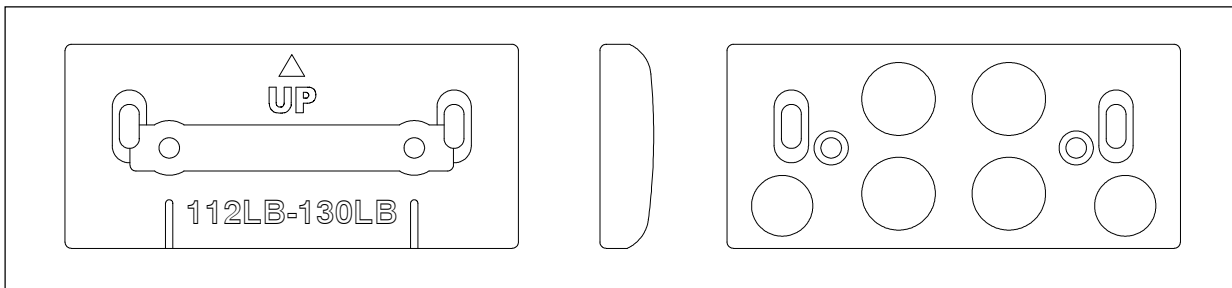
An assembled STC magnetic transducer looks like one of these.



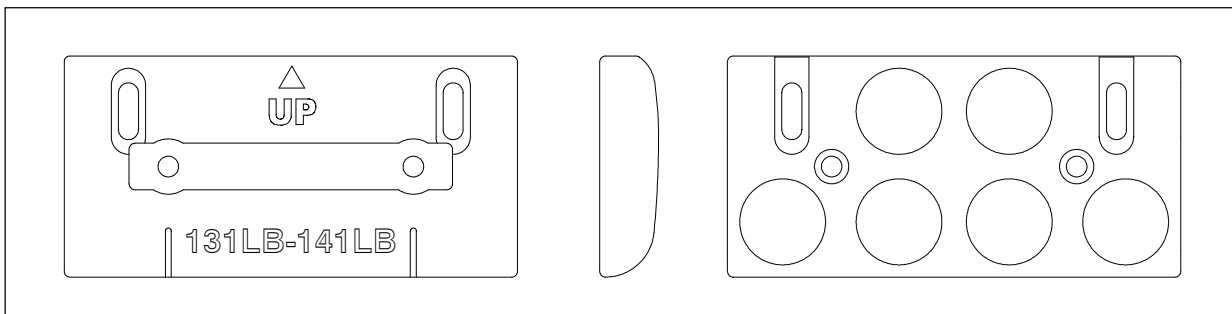
If your site uses transducers that don't look like either of the above, skip the instructions below and call STC for help. If your rail size isn't 115, 122, 127, 132, 136, or 141 pounds per yard (57.05, 60.52, 63.00, 65.48, 67.46, or 69.94 kilograms per meter), skip the instructions below and call STC for help.

Two mounting plates are packaged with each transducer. The smaller one, which is labeled **112LB-130LB**, is used with lighter rails. The larger one, which is labeled **131LB-141LB**, is used with heavier rails.

If your rail size is 112 to 130 pounds per yard (55.6 to 64.5 kilograms per meter), use the smaller mounting plate (2100-554) that looks like this.



If your rail size is 131 to 141 pounds per yard (65.0 to 69.9 kilograms per meter), use the larger mounting plate (2100-552) that looks like this.



To install the transducers with their correct mounting plate:

- 1 Be sure that you have on hand all the parts for two gating transducers and, if used, all the parts for two advance transducers.
- 2 Be sure that you have on hand a track drill, a 3/8-inch bit, a 9/16-inch wrench, and a 50-foot (15-meter) or longer tape measure.
- 3 Determine the size of the rail at your site.

If your rail size isn't 115, 122, 127, 132, 136, or 141 pounds per yard (57.05, 60.52, 63.00, 65.48, 67.46, or 69.94 kilograms per meter), call STC for help.

On the rail nearest to the bungalow, you'll next install the gating transducer nearest to the bearing scanner. This transducer is **TO1**.

- 4 Using one of the two tables below, note the distance for your rail size.

When using with **Type II** bearing scanners:

Rail Size pounds/yard	Rail Size kilograms/meter	Distance (DIM1), When Using With Type II Bearing Scanners
115	57.05	10-3/8 inches (26.35 centimeters)
122	60.52	10-1/2 inches (26.67 centimeters)
127	63.00	10-3/4 inches (27.31 centimeters)
132	65.48	10-7/8 inches (27.62 centimeters)
136	67.46	10-15/16 inches (27.78 centimeters)
141	69.94	11-3/16 inches (28.41 centimeters)

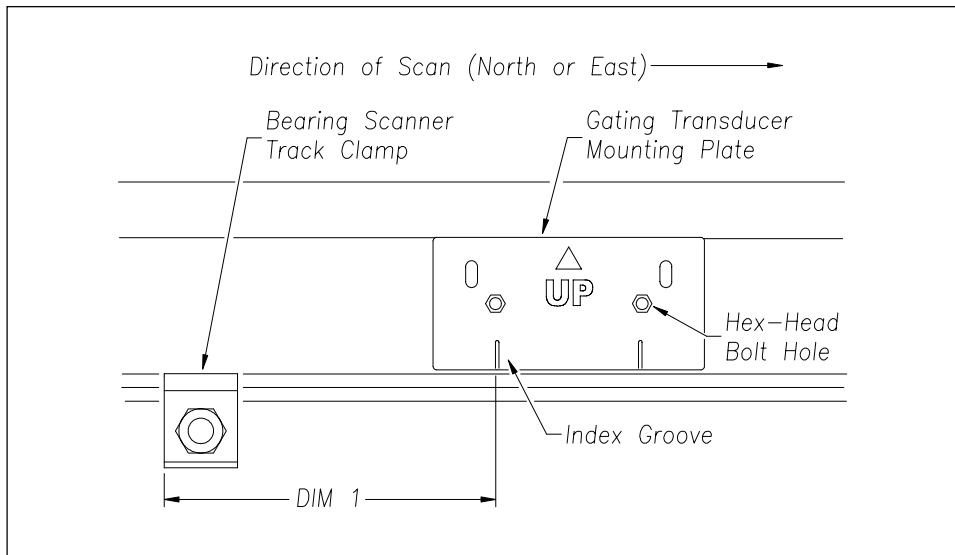
When using with **Type III** bearing scanners:

Rail Size pounds/yard	Rail Size kilograms/meter	Distance (DIM1), When Using With Type III Bearing Scanners
115	57.05	8-1/4 inches (20.96 centimeters)
122	60.52	8-7/16 inches (21.43 centimeters)
127	63.00	8-5/8 inches (21.91 centimeters)
132	65.48	8-3/4 inches (22.23 centimeters)
136	67.46	8-13/16 inches (22.39 centimeters)
141	69.94	9-1/16 inches (23.02 centimeters)

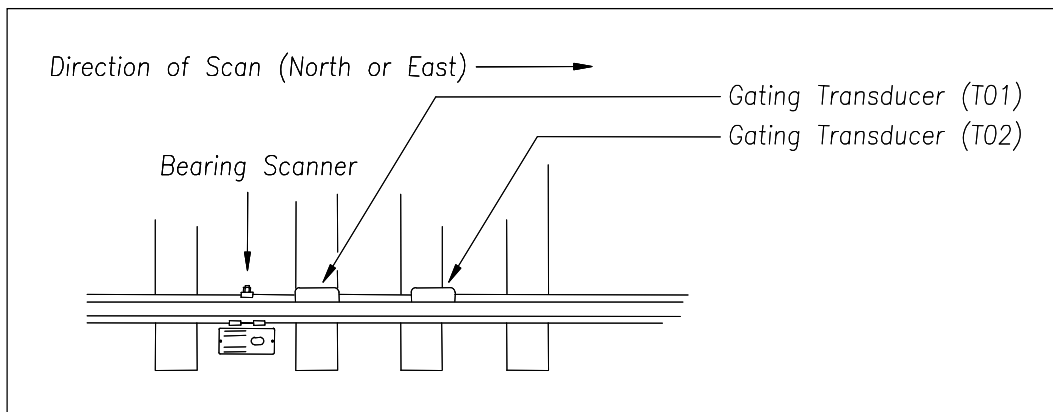
For example, when using with **Type II** bearing scanners, if your rail size is 132 pounds per yard (65.48 kilograms per meter), the distance is 10-7/8 inches (27.62 centimeters). This distance is **DIM1**.

- 5 Separate the fiberglass-reinforced polyester transducer body from the aluminum mounting plate.
- 6 With the arrow on the plate pointing up, place the mounting plate against the gauge side of the rail.

- 7 Going north or east from the far edge of the track clamp on the bearing scanner to the closest index groove on the mounting plate, measure the distance obtained in step 4.

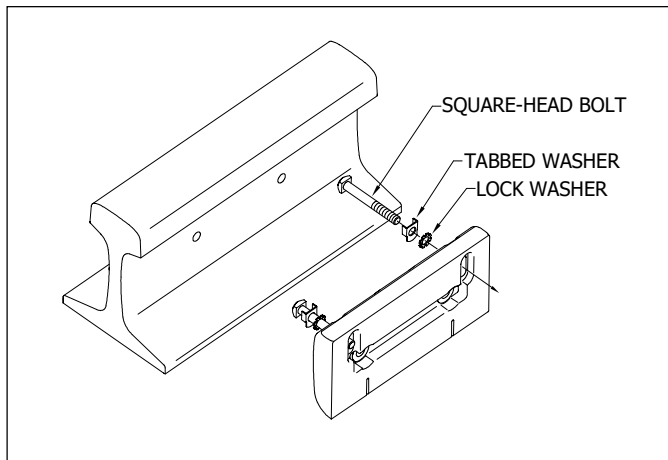


Note that the hole (on top of the bearing scanner cover) faces north or east. Note further that the gating transducers are mounted on the same side as where the bearing scanner is "looking."

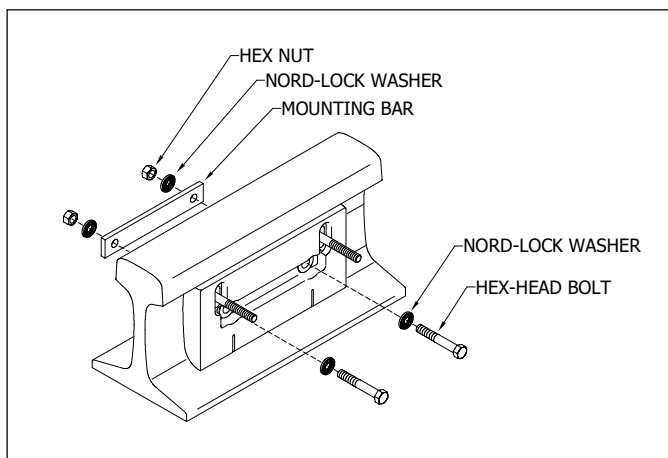


- 8 Hold the mounting plate against the rail and as high against the crown as possible.
- 9 Using the hex-head bolt holes as your guide, mark the two places on the rail where you'll later drill holes.
- 10 Remove the mounting plate.
- 11 Using a 3/8-inch bit, drill the two holes.
- 12 Place one tabbed washer and one external-tooth lock washer on each square-head bolt.

- 13 Insert the two square-head bolts with tabbed washers and external-tooth lock washers into the slotted holes of the mounting plate.



- 14 With the arrow on the plate pointing up and the heads of the bolts against the gauge side of the rail, align the hex-head bolt holes in the plate with the drilled holes in the rail.
- 15 Place one Nord-Lock washer on each hex-head bolt.
- 16 Insert the two hex-head bolts with Nord-Lock washers through the aligned holes.
- 17 Loosely place the mounting bar, Nord-Lock washers, and hex-lock nuts onto the hex-head bolts.

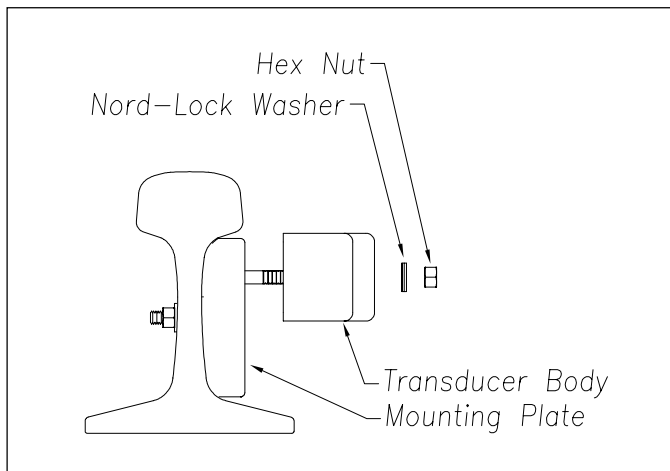


- 18 Tighten each hex-lock nut with a 9/16-inch torque wrench to a **torque of 12 to 15 foot-pounds (16.3 to 20.3 newton-meters)**.

Don't exceed a torque of 15 foot-pounds (20.3 newton-meters). Doing so can weaken or break a bolt, requiring the bolt to be replaced.

- 19 With the transducer body's magnetic side up (that is, with the arrow on the transducer body pointing up), slide it onto the square-head bolts.

- 20** Loosely place the Nord-Lock washers and hex-lock nuts onto the square-head bolts.

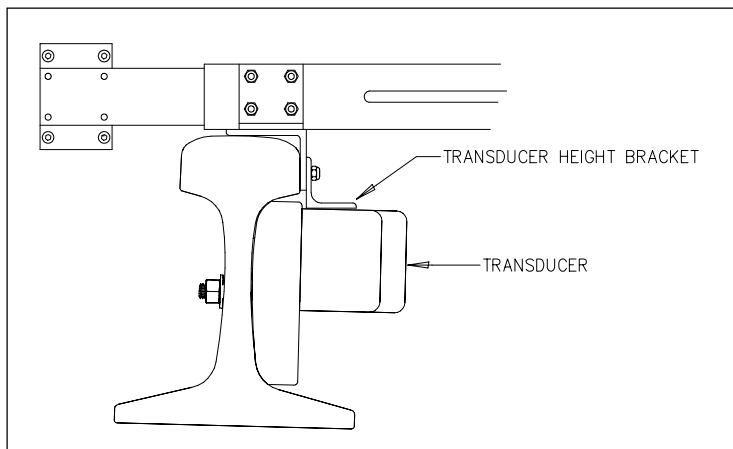


The installed transducer body should be 1-9/16 inches (3.97 centimeters) below the top of the rail and parallel to it. You can meet this requirement by using the transducer height bracket on the bottom of the alignment fixture.

- 21** Place the alignment fixture across both rails, centered over the transducer.

The fixture should be snug against the top and gauge of both rails.

- 22** Move the transducer body to where it just touches the height bracket.



- 23** Tighten each hex nut with a 9/16-inch torque wrench to a **torque of 12 to 15 foot-pounds (16.3 to 20.3 newton-meters).**

Don't exceed a torque of 15 foot-pounds (20.3 newton-meters). Doing so can weaken or break a bolt, requiring the bolt to be replaced.

The transducer body is now attached to the mounting plate.

- 24** If this is a single-track site, label the two-wire end of the cable **TO1**.
- 25** If this is a double-track site, label the two-wire end of the cable **TO1-TRACK1** or **TO1-TRACK2**, whichever is appropriate.
- 26** Extend the cable into the bungalow and leave it coiled on the floor.
- You'll next install the gating transducer farthest from the bearing scanner. This transducer is **TO2**.
- 27** Using another transducer, separate the body from the mounting plate.
- 28** Using one of the two tables below, note the distance for your rail size.

When using with **Type II** bearing scanners:

Rail Size pounds/yard	Rail Size kilograms/meter	Distance (DIM2), When Using With Type II Bearing Scanners
115	57.05	34-3/8 inches (87.31 centimeters)
122	60.52	34-1/2 inches (87.63 centimeters)
127	63.00	34-3/4 inches (88.27 centimeters)
132	65.48	34-7/8 inches (88.58 centimeters)
136	67.46	34-15/16 inches (88.74 centimeters)
141	69.94	35-3/16 inches (89.37 centimeters)

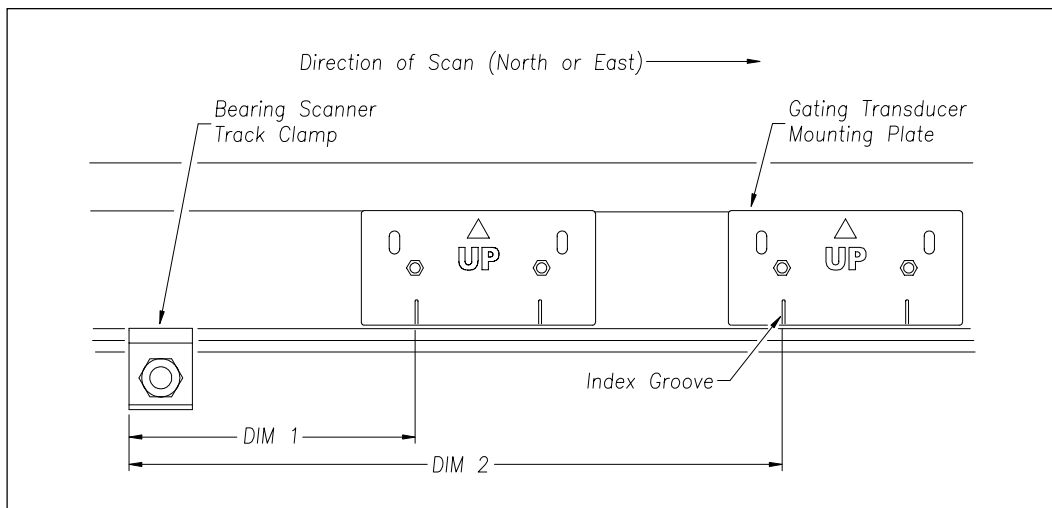
When using with **Type III** bearing scanners:

Rail Size pounds/yard	Rail Size kilograms/meter	Distance (DIM2), When Using With Type III Bearing Scanners
115	57.05	32-1/4 inches (81.92 centimeters)
122	60.52	32-7/16 inches (82.39 centimeters)
127	63.00	32-5/8 inches (82.87 centimeters)
132	65.48	32-3/4 inches (83.19 centimeters)
136	67.46	32-13/16 inches (83.35 centimeters)
141	69.94	33-1/16 inches (83.98 centimeters)

For example, when using with **Type II** bearing scanners, if your rail size is 132 pounds per yard (65.48 kilograms per meter), the distance is 34-7/8 inches (88.58 centimeters). This distance is **DIM2**.

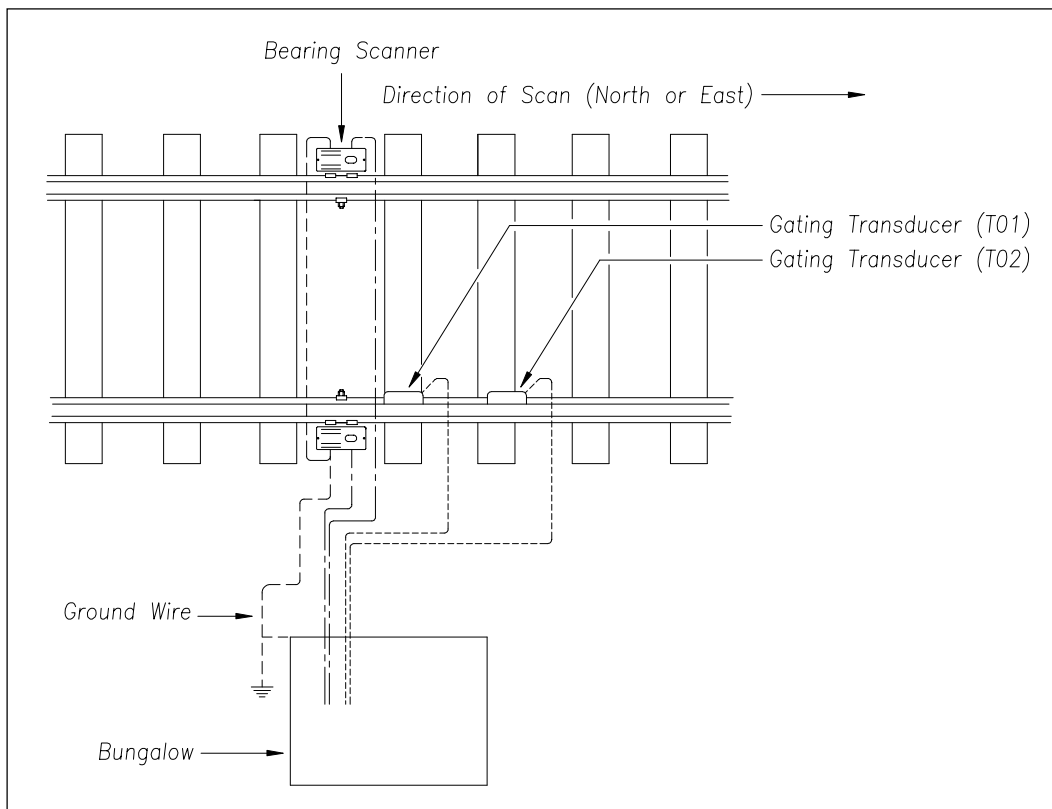
- 29** With the arrow on the plate pointing up, place the mounting plate against the gauge side of the rail.

- 30** Going north or east from the far edge of the track clamp on the bearing scanner to the closest index groove on the mounting plate, measure the distance obtained in step **28**.



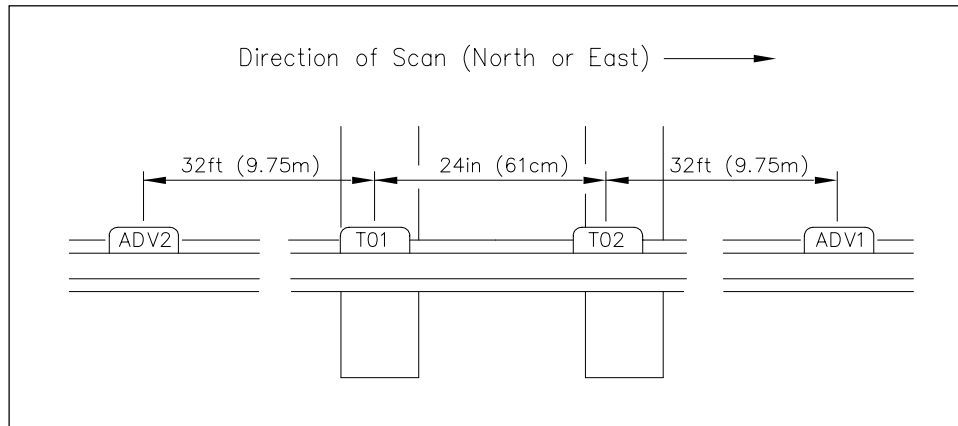
- 31** Repeat steps **8** through **23**.
- 32** If this is a single-track site, label the two-wire end of the cable **TO2**.
- 33** If this is a double-track site, label the two-wire end of the cable **TO2-TRACK1** or **TO2-TRACK2**, whichever is appropriate.
- 34** Extend the cable into the bungalow and leave it coiled on the floor.

Seen from above, your site would look something like this.



- 35** If this is a single-track site, go to step **37**.
- 36** If this is a double-track site, repeat steps **1** through **34** on the second track.
- 37** If you are going to install a track circuit instead of advance transducers:
- a** If your site has wheel scanners, go to **6.3 Wheel Scanners**.
 - b** Go to **6.4 Track Circuit**.

Do the remaining steps only if your site uses **advance transducers** instead of a track circuit. When used, the two advance transducers are located about 32 feet (9.75 meters) on either side of and on the same rail as the gating transducers. You'll next install advance transducer **ADV1** to the right of gating transducer **TO2**.

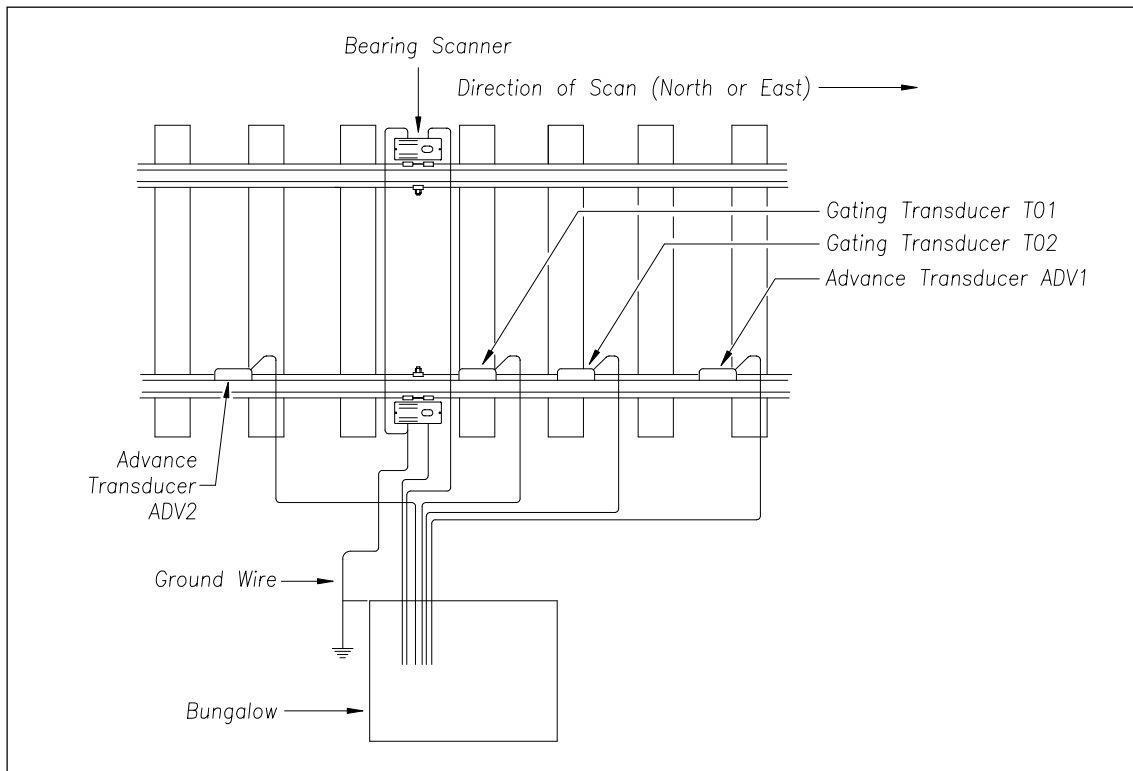


- 38** Using another transducer, separate the body from the mounting plate.
- 39** With the arrow on the plate pointing up, place the mounting plate against the gauge side of the rail.
- 40** Going right from the rightmost index groove of gating transducer **TO2**, measure 32 feet (9.75 meters) to the rightmost index groove on the new mounting plate.
- 41** Repeat steps **8** through **23**.
- 42** If this is a single-track site, label the two-wire end of the cable **ADV1**.
- 43** If this is a double-track site, label the two-wire end of the cable either **ADV1-TRACK1** or **ADV1-TRACK2**, whichever is appropriate.
- 44** Extend the transducer cable into the bungalow and leave it coiled on the floor.
- You'll next install advance transducer **ADV2** to the left of gating transducer **TO1**.
- 45** Using another transducer, separate the body from the mounting plate.
- 46** With the arrow on the plate pointing up, place the mounting plate against the gauge side of the rail.
- 47** Going left from the leftmost index groove of gating transducer **TO1**, measure 32 feet (9.75 meters) to the leftmost index groove on the new mounting plate.

48 Repeat steps **8** through **23**.

49 If this is a single-track site, label the two-wire end of the cable **ADV2**.

If this is a single-track site, you are done installing all the transducers. Seen from above, your site would look something like this.



50 If this is a double-track site, label the two-wire end of the cable either **ADV2-TRACK1** or **ADV2-TRACK2**, whichever is appropriate.

51 If this is a single-track site:

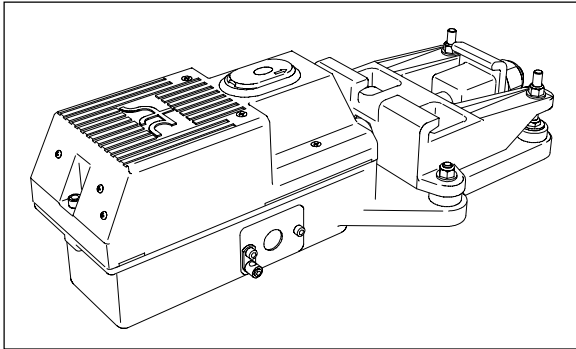
- a** If your site has wheel scanners, go to **6.3 Wheel Scanners**.
- b** Go to **6.5 AEI Antennas**.

52 If this is a double-track site:

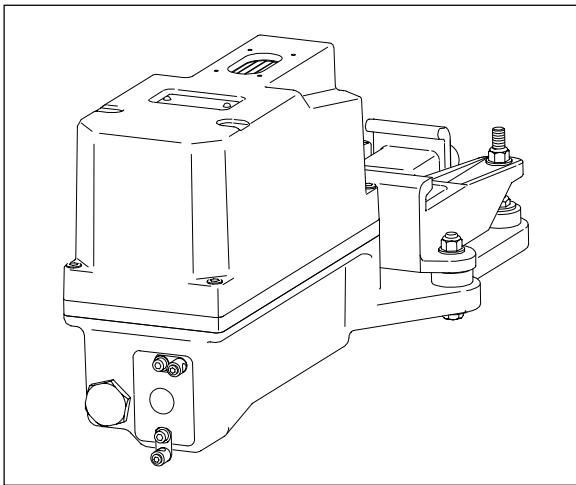
- a** Repeat steps **1** through **50** on the second track.
- b** If your site has wheel scanners, go to **6.3 Wheel Scanners**.
- c** Go to **6.5 AEI Antennas**.

6.3 Wheel Scanners

An assembled **Type II** wheel scanner looks like this.



An assembled **Type III** wheel scanner looks like this.



Not all sites use wheel scanners. If your site doesn't use them, skip the instructions below and go to **6.4 Track Circuit**.

To install the **Type II/Type III** wheel scanners:

- 1 Be sure that you have on hand two assembled wheel scanners.
- 2 Be sure that you have on hand a short-handle 1-1/2-inch open-end wrench, a T-handle 3/16-inch hex-wrench, a T-handle 1/4-inch hex wrench, and a 50-foot (15-meter) or longer tape measure.
- 3 If not done already, select a location to install the wheel scanners.

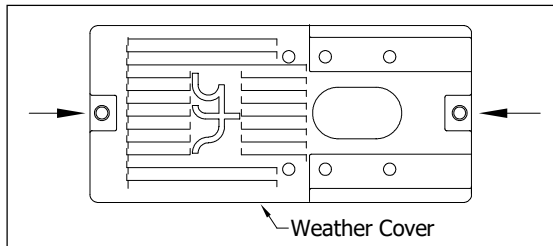
The wheel scanners should be centered in the crib of two ties spaced at least 14 inches (35.6 centimeters) apart. The crib of the two ties is the one immediately ahead (and to the north or east) of the bearing scanners. This places one wheel scanner between the two gating transducers. The other one is directly opposite, on the other rail of the track.

- 4 If not done already, remove ballast from under both rails between the ties.

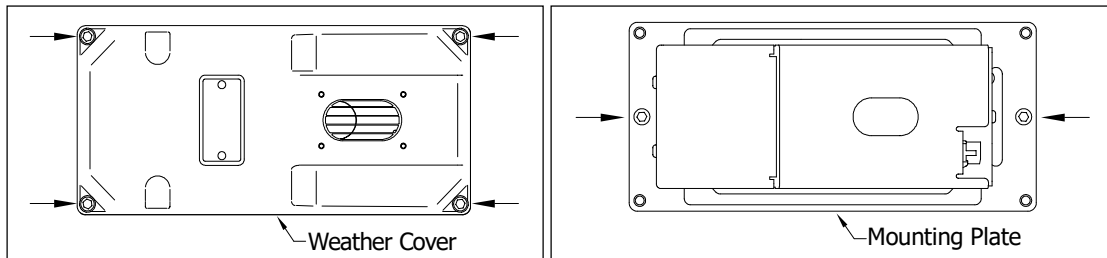
You'll next install the first wheel scanner.

- 5 Using a T-handle 1/4-inch hex-wrench, loosen the socket-head-cap screws on the cover of a not-yet-installed wheel scanner.

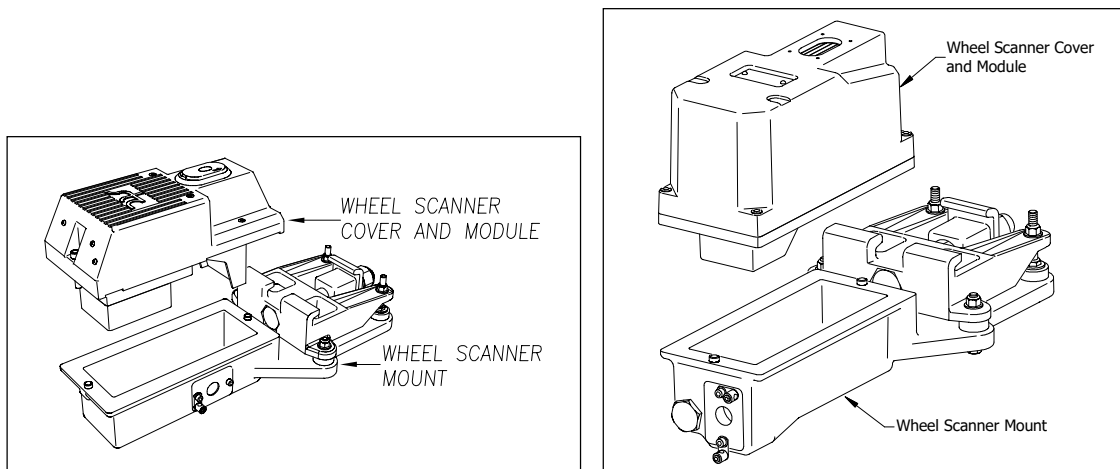
The **Type II** wheel scanner has two socket-head-cap screws that attach the weather cover to the mount.



The **Type III** wheel scanner has six. Four that attach the weather cover to the mounting plate and two that attach the mounting plate to the mount.



- 6 Separate the wheel scanner cover-and-module assembly from its mount.



- 7 If this is a **Type III** wheel scanner, disconnect the heater wiring plug.
- 8 Store the cover-and-module assembly in a safe place until you replace it.
- 9 Centered between the ties and on the rail closest to the bungalow (aka wayside enclosure), place the mount so that the moveable track clamp extends under the rail and toward the center of the track.

- 10 Tighten the inner nut (that is, the clamping nut) by hand.

This should hold the mount in place.

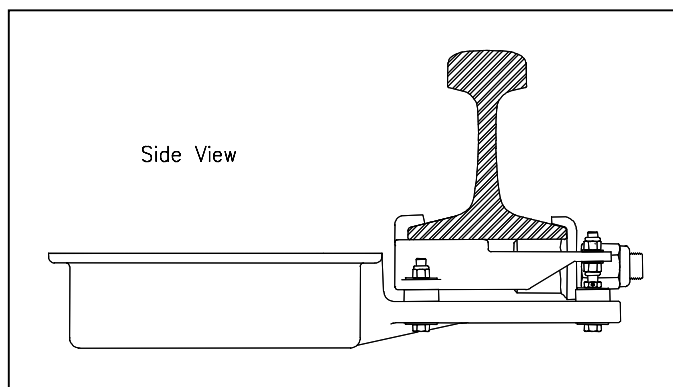
- 11 Using a short-handle 1-1/2-inch wrench, tighten the clamping nut to a **torque of 48 to 50 foot-pounds (65.1 to 67.8 newton-meters)**.

Don't exceed a torque of 50 foot-pounds (67.8 newton-meters). Doing so can cause failure of the mount.

- 12 Using a short-handle 1-1/2-inch wrench, tighten the locking nut to a **torque of 48 to 50 foot-pounds (65.1 to 67.8 newton-meters)**.

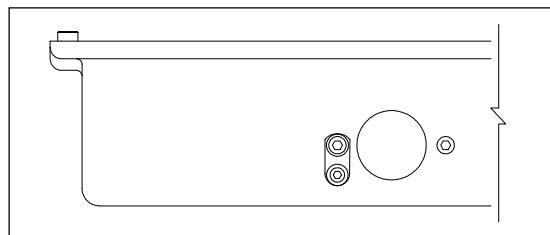
Don't exceed a torque of 50 foot-pounds (67.8 newton-meters). Doing so can cause failure of the mount.

At this point, your work should look like this.

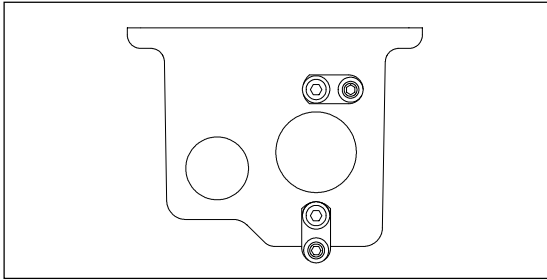


On the side of the mount are a large hole and two socket-head-cap screws. The longest screw is holding a ground lug and an internal-tooth washer.

For the **Type II** wheel scanner, the large hole is on the right side of the mount (2100-701) as you face the track.

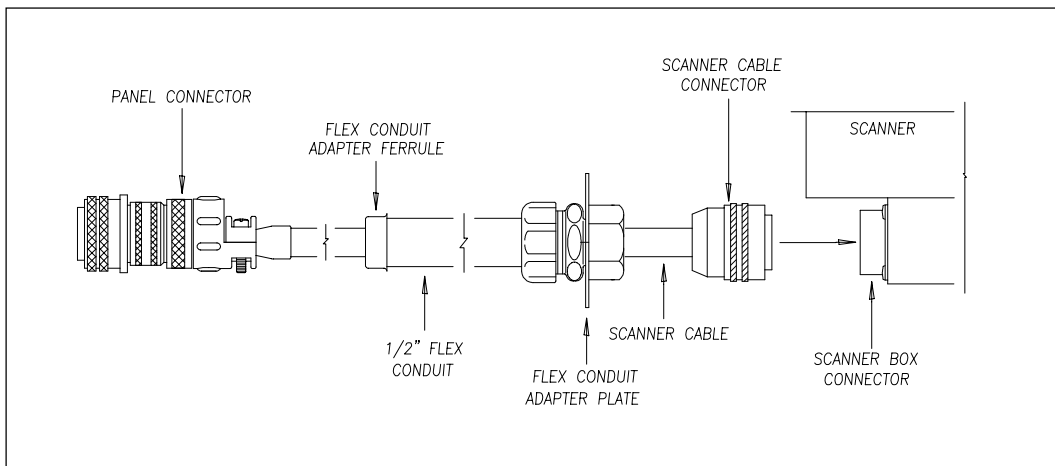


For the **Type III** wheel scanner, the large hole is on the side of the mount (2500-401) farthest from the track. Some of these scanners have two ground lugs, as shown below.



- 13 Using a T-handle 3/16-inch hex wrench, remove the two socket-head-cap screws.
- 14 Store the screws, washer, and ground lug (or ground lugs) in a safe place until you're ready to use them.

In the steps that follow, the terms scanner cable connector, panel connector, and flex-conduit-adapter plate are used. Notice where they are on a wheel scanner cable.



Single-track sites have two 65-foot (19.8-meter) wheel scanner cables. **Double-track sites** have two 65-foot wheel scanner cables for the track closest to the bungalow. For the track farthest from the bungalow, they have either two 85-foot (25.9-meter) or two 100-foot (30.5-meter) wheel scanner cables.

- 15 If this is a double-track site, select the correct length of cable.
- 16 Tighten the locking nut (on the conduit connector) until it is tight against the flex-conduit-adapter plate.
- 17 Put the scanner cable connector through the round hole in the side of the mount.
- 18 Align the screw holes in the flex-conduit adapter plate with the screw holes in the mount.

- 19 If you are installing a **Type II** wheel scanner:
- a In the screw hole closest to the rail, replace the screw.
 - b In the screw hole farthest from the rail, replace the ground lug, internal-tooth washer, and screw.
- 20 If you are installing a **Type III** wheel scanner:
- a If your wheel scanner uses only one ground lug, replace the screw into the top screw hole.
 - b If your wheel scanner uses two ground lugs, replace the ground lug, internal-tooth washer, and screw into the top screw hole.
 - c In the bottom screw hole, replace the ground lug, internal-tooth washer, and screw.
- 21 Tighten by hand.
- This should hold the flex-conduit-adapter plate in place.
- 22 Using a T-handle 3/16-inch hex-wrench, tighten the two socket-head-cap screws until they are completely tight.
- 23 Leave 6 inches (15.2 centimeters) of the scanner cable in the mount.
- 24 Attach the scanner cable connector to the scanner box connector.
- 25 If this is a **Type II** wheel scanner:
- a With the hole on top of the wheel scanner cover facing the center of the track, set the cover-and-module assembly onto its mount.
 - b Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.
- 26 If this is a **Type III** wheel scanner:
- a With the hole on top of the wheel scanner cover facing the center of the track, set the mounting plate back onto its scanner mount.
 - b Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.
 - c Reconnect the heater wiring plug.
 - d With the hole on top of the wheel scanner cover facing the center of the track, set the weather cover back onto its mounting plate.
 - e Using the T-handle 1/4-inch hex-wrench, uniformly tighten the four socket-head-cap screws.
- 27 If this is a single-track site, label the end of the cable that isn't attached to the wheel scanner **W-RAIL1** or **W-RAIL2**, whichever is appropriate.
- If the track runs north and south, RAIL1 is the east rail, and RAIL2 is the west rail. If the track runs east and west, RAIL1 is the north rail, and RAIL2 is the south rail.
- 28 If this is a double-track site, label the end of the cable that isn't attached to the wheel scanner **W-RAIL1-TRACK1**, **W-RAIL2-TRACK1**, **W-RAIL1-TRACK2**, or **W-RAIL2-TRACK2**, whichever is appropriate.

- 29** Extend the cable into the bungalow and leave it coiled on the floor.
- 30** Attach one end of an 8 AWG stranded copper wire to the ground lug on the flex-conduit-adaptor plate and the other end to the ground connector on the ground rod.

You'll next install the second wheel scanner on the opposite rail.

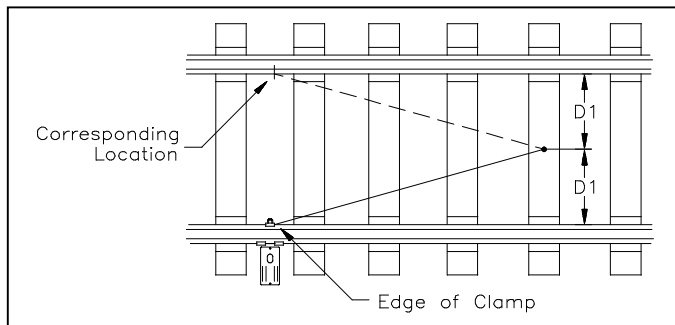
- 31** Using a T-handle 1/4-inch hex-wrench, loosen the socket-head-cap screws on the cover of the remaining not-yet-installed bearing scanner.

The **Type II** wheel scanner has two socket-head-cap screws that attach the weather cover to the mount. The **Type III** wheel scanner has six. Four attach the weather cover to the mounting plate, and two attach the mounting plate to the mount.

- 32** Separate the scanner cover-and-module assembly from its mount.
- 33** If this is a **Type III** wheel scanner, disconnect the heater wiring plug.
- 34** Store the cover-and-module assembly in a safe place until you replace it.

When installing the second wheel mount on the opposite rail, make sure that the two wheel mounts are squared with each other and directly opposite each other. The next step tells how to do this.

- 35** To locate the second mount on the opposite rail:
- a** Mark the center of the fourth tie ahead of the just installed mount.
 - b** From this mark, measure to the edge of the track clamp on the just installed mount.
 - c** From the mark, measure the same distance on the opposite rail.



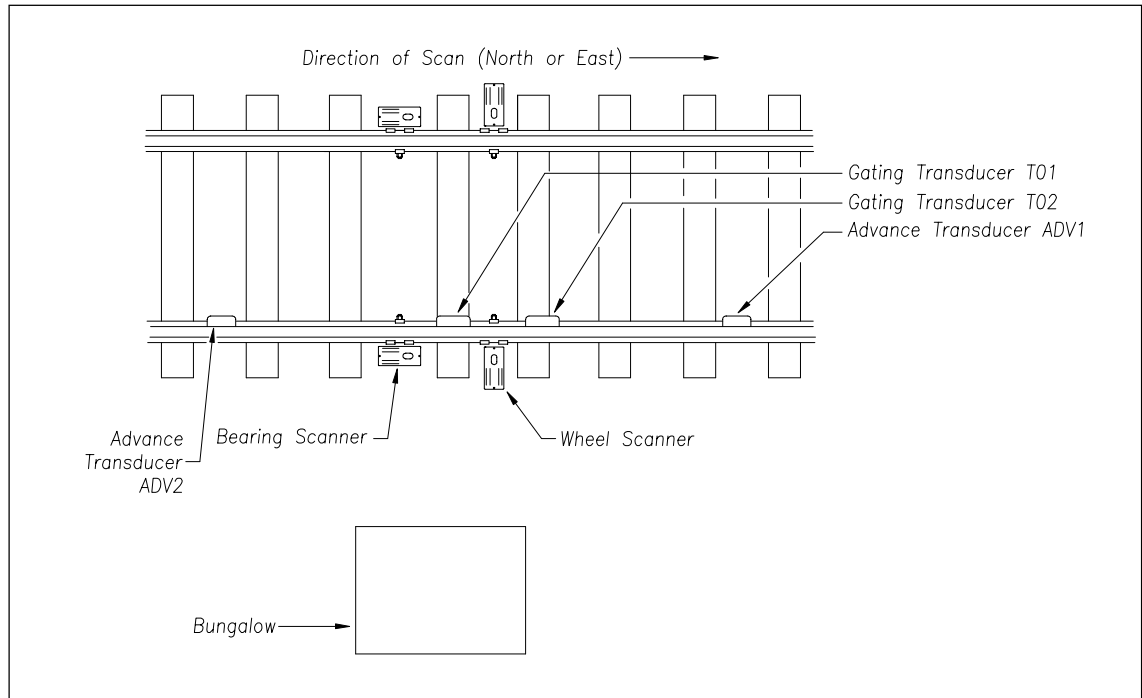
- d** Mark this location on the rail.

This mark will correspond to the edge of the track clamp on the opposite mount.

Use a permanent marker, magic marker, lumber crayon, or paint pen to mark the rail. Don't use a file or punch to mark the rail.

- 36 With the mark as a guide, place the second mount so that the moveable track clamp extends under the rail and toward the center of the track.
- 37 Repeat steps 9 through 29.
- 38 Attach one end of an 8 AWG stranded copper wire to the ground lug on the flex-conduit-adaptor plate and the other end to the ground lug on the other scanner mount.

Seen from above, your site would look something like this.



- 39 If this is a single-track site, go to **6.4 Track Circuit**.
- 40 If this is a double-track site:
 - a Repeat steps 1 through 38 on the second track.
 - b Go to **6.4 Track Circuit**.

6.4 Track Circuit

Not all sites use a track circuit. If your site doesn't use one, skip the instructions below and go to **6.5 AEI Antennas**.

Following the directions that came with your track circuit:

- 1 Mount both track-wire connectors.

Mount one connector on each rail, directly opposite each other. Mount them within 5 ft (1.5 meters) of the scanners. Connection to the rail can be made in one of two ways:

- **Bonding** – Cadweld manufactures a complete line of bond welding systems that are commonly used in the rail industry. The recommended practice is to weld a short length of bond strand to the web of each rail. Cadweld can provide these items as pre-packaged kits, which include the bond strand (*a 3/16"- diameter strand is recommended*), and the one-shot welding system. *Note: A reusable mold of the correct size, to be acquired by the distributor of your choice, is required.*
- **Drilling** – The alternative to "Cadwelding" is to drill a 3/8" hole in the web of each rail at the neutral axis and apply a bonding kit. The kit includes ready-made lengths of bond strand with "chicken heads" attached. The "chicken heads" are tapered solid metal inserts that can be driven into the 3/8" holes to establish a permanent connection to the rail.

- 2 Attach wires to the track-wire connectors.

Wires should be as short as practical. They should be 9 AWG (or larger) insulated copper wire. Total wire resistance shouldn't exceed 0.2 ohm.

- 3 If this is a single-track site, label the end of the wires that aren't attached to the track-wire connectors **TC**.
- 4 If this is a double-track site, label the end of the wires that aren't attached to the track-wire connectors **TC-TRACK1** or **TC-TRACK2**, whichever is appropriate.
- 5 Extend the wires into the bungalow and leave them coiled on the floor.
- 6 If this is a single-track site, go to **6.5 AEI Antennas**.
- 7 If this is a double-track site:
 - a Repeat steps 1 through 5 on the second track.
 - b Go to **6.5 AEI Antennas**.

6.5 AEI Antennas

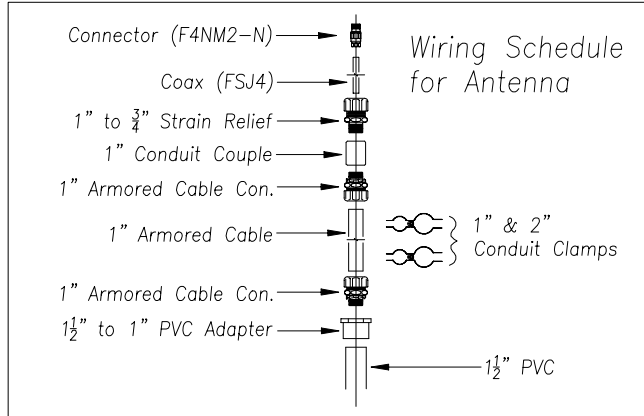
Not all sites use AEI antennas. If your site doesn't use them, skip the instructions below and go to the next chapter.

At each SmartScanIS site that uses AEI, two 100-watt Sinclair SRL470 antennas or two 100-watt Scala HP9-915 Parapanel antennas are installed per track. In reference to the track, **antenna1** is the northmost or eastmost antenna. **Antenna2** is the southmost or westmost antenna. (As a means of reference, transducer **TO1** is the first gating transducer going north or east from the bearing scanner. It is the gating transducer closest to the bearing scanner.)

The instructions below assume that the masts that the antennas will be attached to have already been installed. Their installation was described in **Chapter 5 - Preparation**.

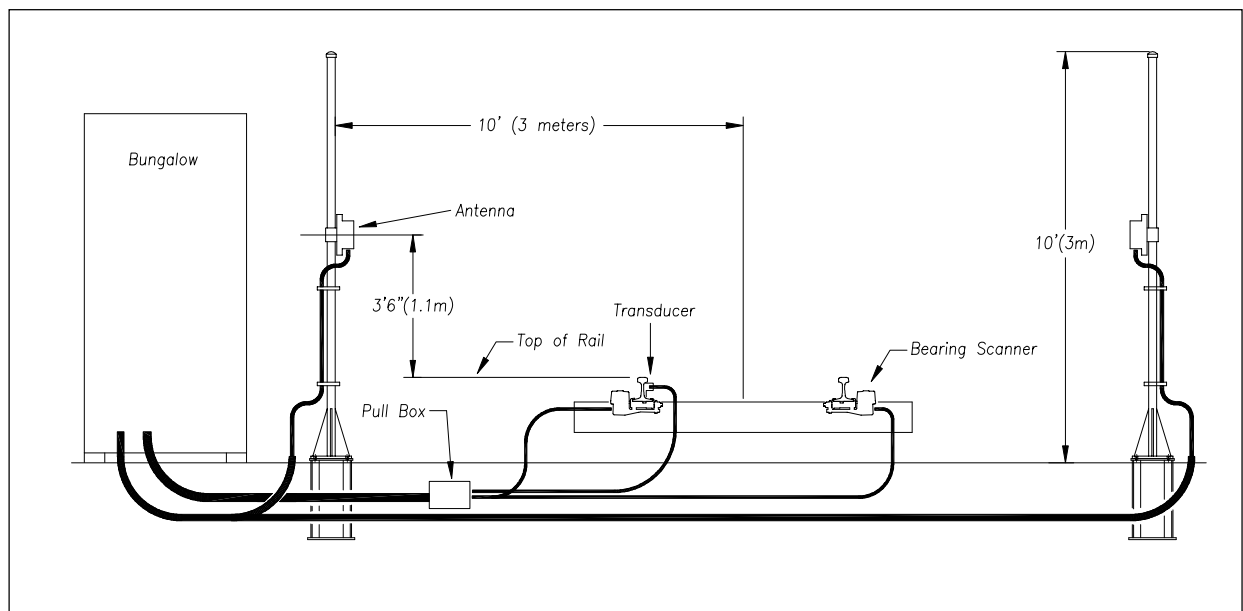
Only the installation of the SRL470 is covered below. The installation of the HP9-915 isn't covered in this guide.

Coaxial antenna cables (N-Type Male to N-Type Male) are cut to length and assembled **on-site**. **Antenna1** output is connected to the northmost or eastmost antenna. **Antenna2** is connected to the southmost or westmost antenna.



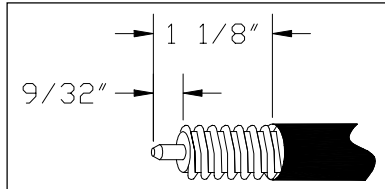
Each SRL470 antenna is installed:

- With its face parallel to the rails
- With its N-type socket pointing down
- 10 feet (3 meters) from the center of the track
- 3.5 feet (1.1 meters) above the top of the rails
- Centered between the gating transducers
- Opposite each other

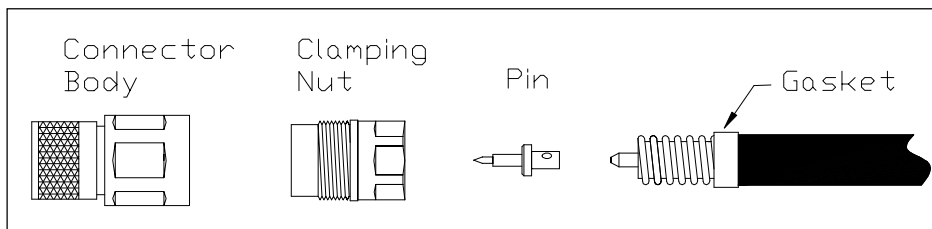


To install the antenna cables:

- 1 Run FSJ4 coaxial cable from each AEI antenna to the bottom of the SmartScanIS enclosure.
- 2 Cut each cable to the correct length.
- 3 In the bungalow, label the cable from the northmost or eastmost antenna **ANTENNA1**.
- 4 In the bungalow, label the other cable **ANTENNA2**.
- 5 Install an N-type connector on each end of each cable as follows:
 - a Trim the cable jacket on the FSJ4 back 1-1/8 inches (28.6 millimeters).



- b Remove 9/32 inches (7.1 millimeters) of the outer conductor.
- c Remove the foam and adhesive from inner conductor.
- d Taper the inner conductor.
- e Add a gasket.



- f Place the supplied heat shield over inner conductor, slide the pin on, and solder.
 - g Remove the heat shield and trim any excess solder from the pin.
 - h Add grease to the gasket and to the rubber O-ring (on the clamping nut).
 - i Thread the clamping nut onto cable until it stops.
 - j Attach the connector body to the clamping nut.
 - k Tighten the connector body with a wrench to a **torque of 20 to 22 foot-pounds (27.1 to 29.8 newton-meters)**.
 - l Apply heat-shrink tube to connector to provide weather seal.
- 6 Connect the N-type connector on the trackside end of a coaxial cable to the antenna to a **torque of 15 inch-pounds (1.7 newton-meters)**.

Later you'll attach the bungalow end of the coaxial cables to their respective Joslyn surge protectors on the Surge Protection Subassembly. **Antenna1** to the protector labeled **Reader1**. And, **antenna2** to the protector labeled **Reader2**.

Chapter 7

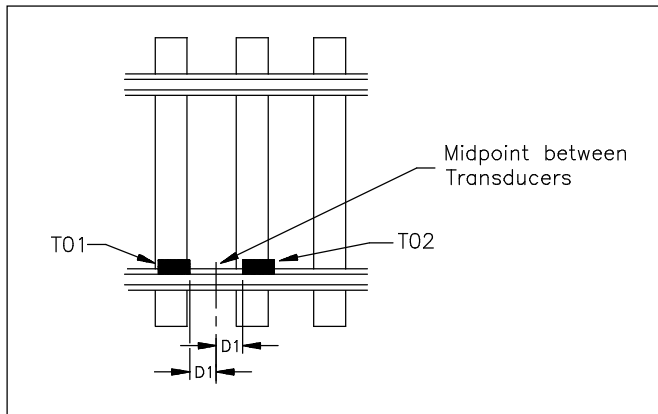
Adjusting the Track Components

This chapter tells how to adjust the scanners and transducers.

7.1 Bearing Scanners

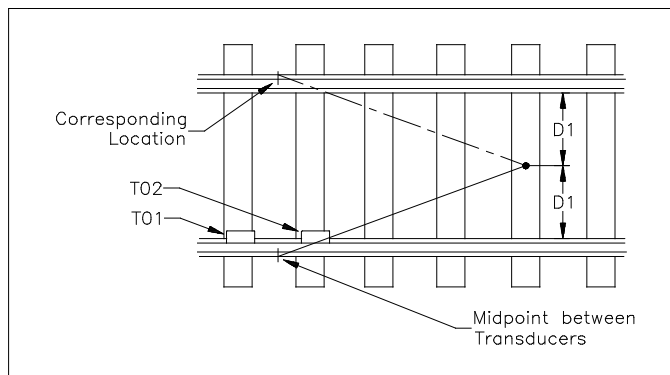
To align the **Type II/Type III** bearing scanners:

- 1 Be sure that you have on hand a short-handle 1-1/2-inch open-end wrench, a combination 9/16-inch open-end box wrench, and an STC alignment fixture.
- 2 Turn off all power to the scanners.
- 3 On the outside of the rail, mark the midpoint between TO1 and TO2.



Use a permanent marker, magic marker, lumber crayon, or paint pen to mark the rail. Don't use a file or punch to mark the rail.

- 4 Mark the center of the fourth tie ahead of this midpoint.
- 5 From this mark on the fourth tie, measure to the midpoint between the transducers.
- 6 From the mark on the fourth tie, measure the same distance on the opposite rail.

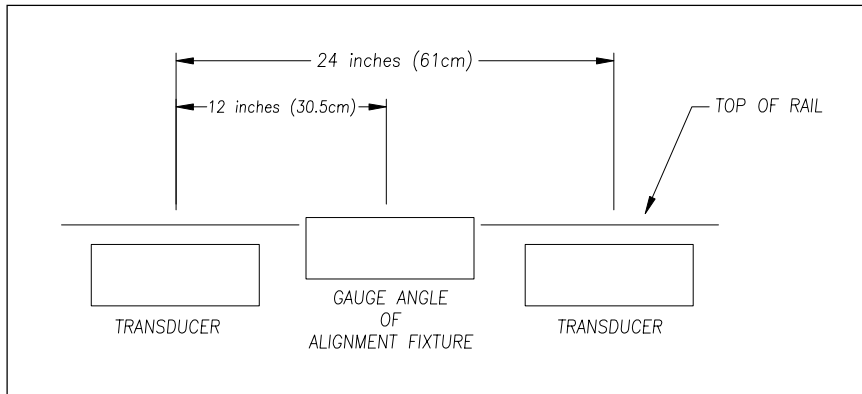


- 7 On the outside of the rail, mark this location.

This mark should correspond to the first mark on the opposite rail.

Use a permanent marker, magic marker, lumber crayon, or paint pen to mark the rail.
Don't use a file or punch to mark the rail.

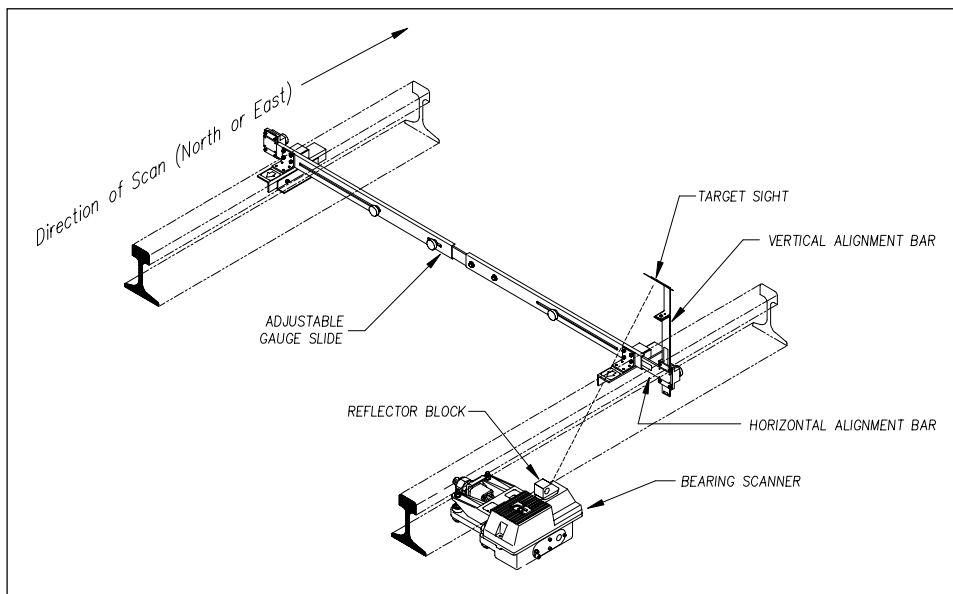
- 8 Place the alignment fixture across both rails and adjust it so that the north or east side of the adjustable gauge slide is even with the two rail marks.



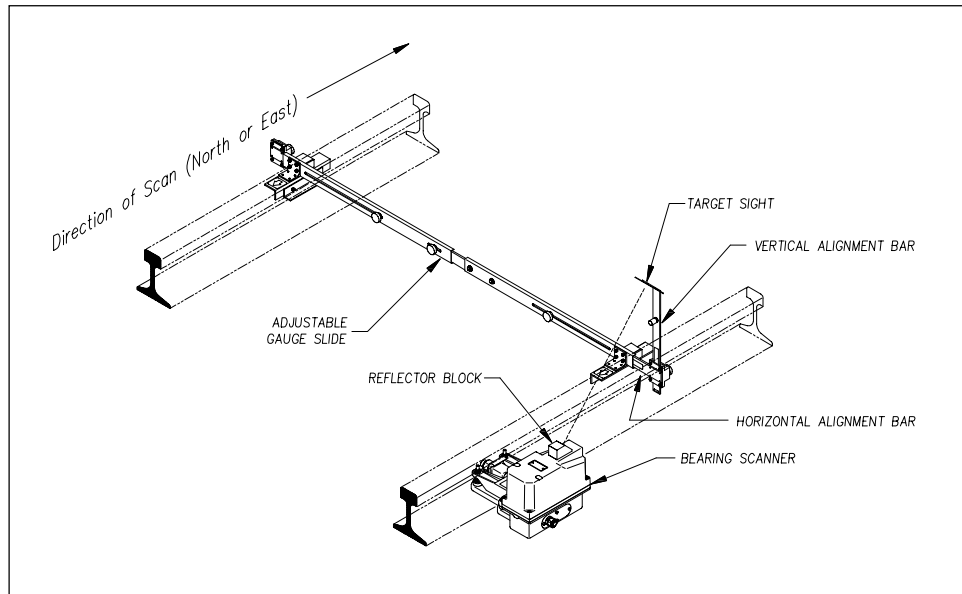
The fixture should be snug against the top and gauge of both rails.

- 9 Remove the reflector block from the vertical alignment bar.
- 10 Install the vertical alignment bar with the target sight tilted toward the bearing scanner.
- 11 Install the reflector block in the top of the scanner cover with the sloping surface facing the target.

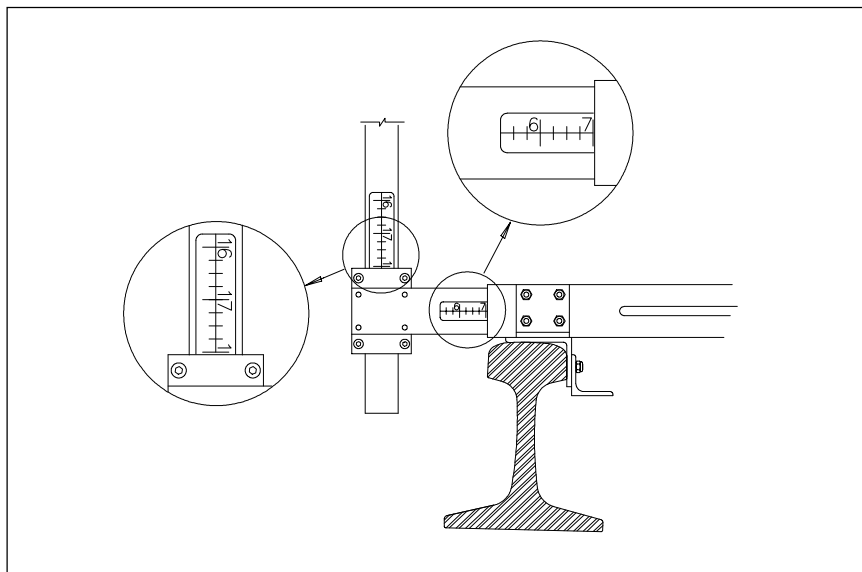
The setup for the **Type II** bearing scanner is shown below.



The setup for the **Type III** bearing scanner is shown below.



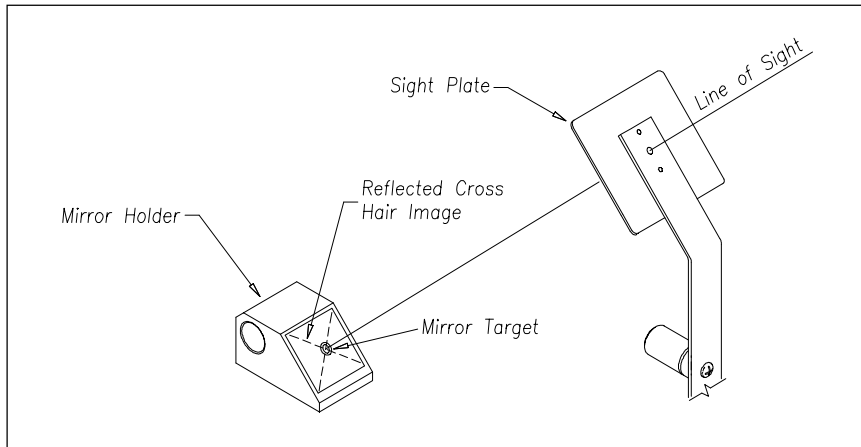
12 Extend the horizontal alignment bar to 7-1/4 inches \pm 1/4 inch on the scale.



13 Extend the vertical alignment bar to 18 inches \pm 1 inch on the scale.

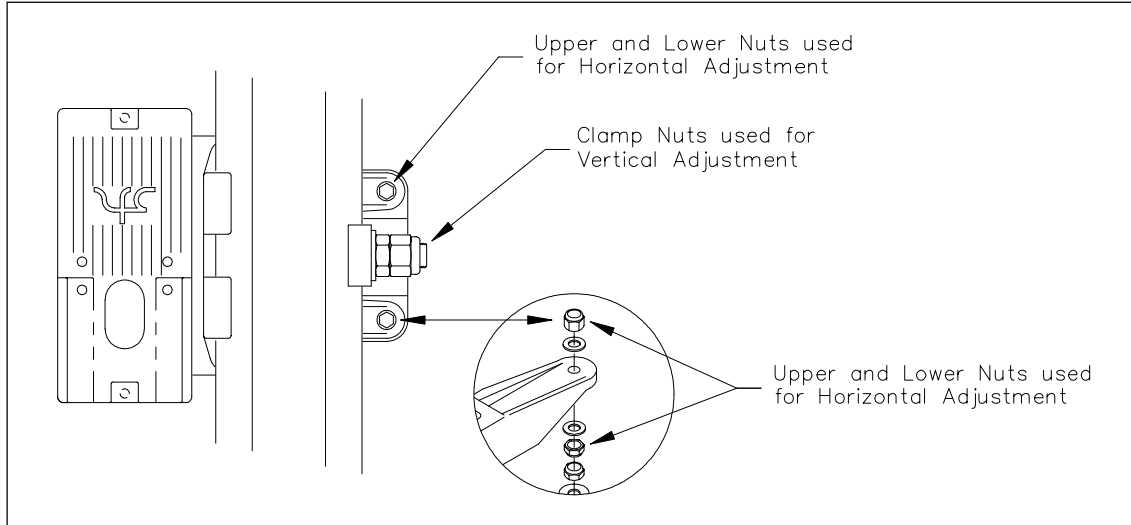
- 14** Look through the hole in the center of the target and note the relationship of the target crosshairs to the circle in the center of the reflector block.

When the crosshairs are centered on the circle, alignment is correct.



- 15** If the crosshairs are centered on the circle, go to step **19**.
- 16** If horizontal adjustment is necessary, adjust the upper and lower nuts on the edge of the arm of the bearing scanner mount.

Using a combination 9/16-inch open-end box wrench, turn both upper nuts the same number of turns. Turn both lower nuts the same number of turns. Adjusting these four nuts causes the scanner to pivot about the two shock mounts under the rail. This adjustment moves the crosshairs (on the circle) to the right or left.



17 If vertical adjustment is necessary:

a Using a short-handle 1-1/2-inch wrench, loosen both nuts on the side of the mount. The inner nut is the clamping nut. The outer nut is the locking nut.

b Slide the entire mount toward or away from the alignment fixture.

Sliding toward the fixture raises the crosshairs on the circle. Sliding away from the fixture lowers the crosshairs on the circle.

c Using a short-handle 1-1/2-inch wrench, tighten the clamping nut to a **torque of 48 to 50 foot-pounds (65.1 to 67.8 newton-meters)**.

Don't exceed a torque of 50 foot-pounds (67.8 newton-meters). Doing so can cause failure of the mount.

d Using a short-handle 1-1/2-inch wrench, tighten the locking nut to a **torque of 48 to 50 foot-pounds (65.1 to 67.8 newton-meters)**.

Don't exceed a torque of 50 foot-pounds (67.8 newton-meters). Doing so can cause failure of the mount.

18 Until the crosshairs are centered on the circle, repeat steps **16** and **17**.

19 Remove the vertical alignment bar, target sight, and reflector block.

20 Repeat steps **10** through **18** for the bearing scanner on the opposite rail.

21 Remove the alignment fixture from the track.

22 If this is a single-track site:

a If your site has wheel scanners, go to **7.2 Wheel Scanners**.

b Store the alignment fixture in the bungalow.

c If your site doesn't have wheel scanners, go to the next chapter.

23 If this is a double-track site:

a Repeat steps **1** through **21** for the second track.

b If your site has wheel scanners, go to **7.2 Wheel Scanners**.

c Store the alignment fixture in the bungalow.

d If your site doesn't have wheel scanners, go to the next chapter.

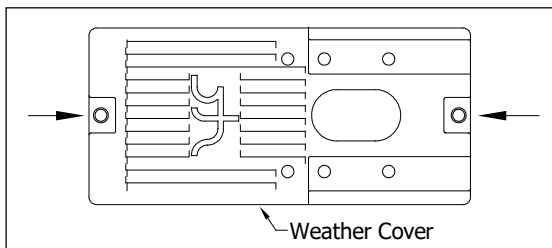
7.2 Wheel Scanners

Not all sites use wheel scanners. If your site doesn't use them, skip the instructions below and go to the next chapter.

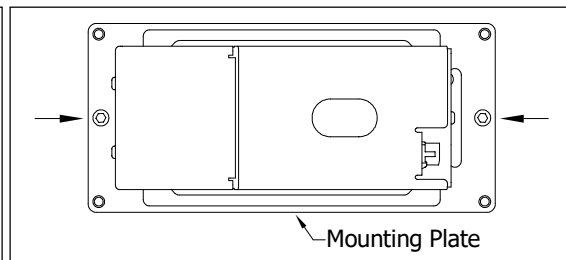
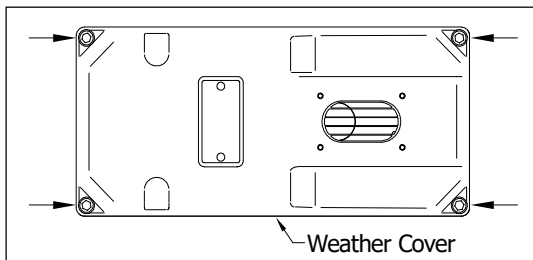
To align the **Type II/Type III** wheel scanners:

- 1 Be sure that you have on hand a T-handle 1/4-inch hex-wrench, a combination 9/16-inch open-end box wrench, and an STC alignment fixture.
- 2 Turn off all power to the scanners.
- 3 Using a T-handle 1/4-inch hex-wrench, loosen the socket-head-cap screws on the cover of a wheel scanner.

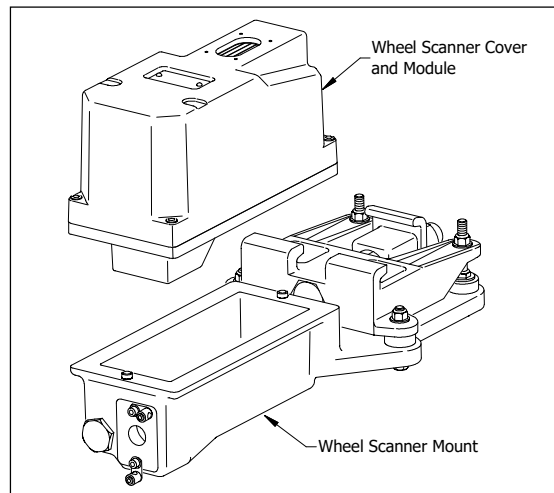
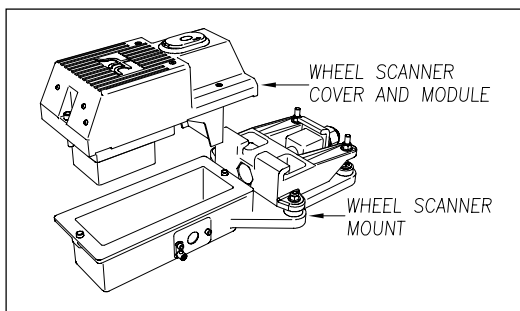
The **Type II** wheel scanner has two socket-head-cap screws that attach the weather cover to the mount.



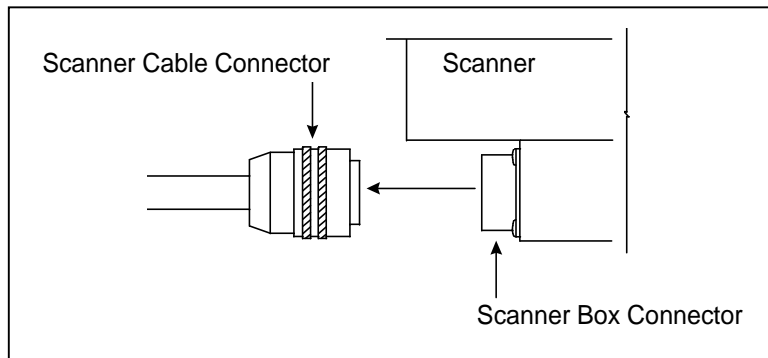
The **Type III** wheel scanner has six. Four attach the weather cover to the mounting plate, and two attach the mounting plate to the mount.



- 4 Separate the wheel scanner cover-and-module assembly from its mount.

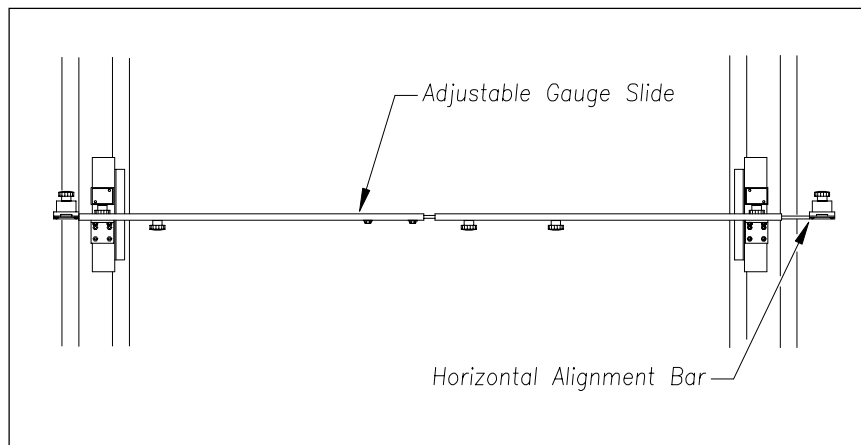


- 5 If this is a **Type III** wheel scanner, disconnect the heater wiring plug.
- 6 Disconnect the scanner cable connector from the scanner box connector.



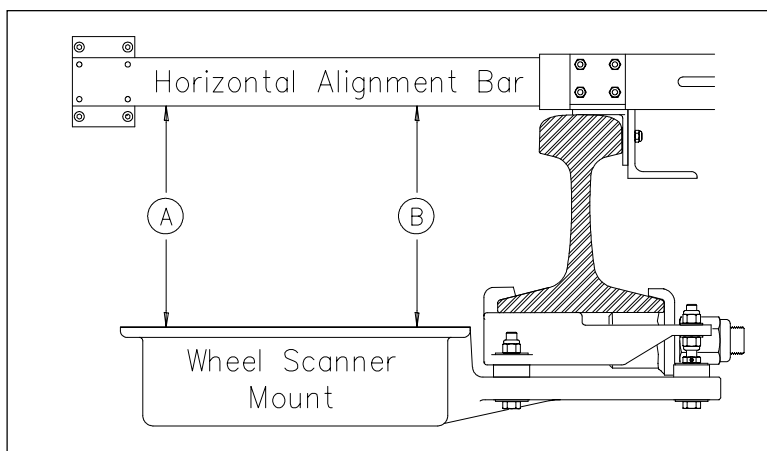
- 7 Store the cover-and-module assembly in a safe place until you replace it.
- 8 If not done already, place the alignment fixture on the rails so that the adjustable gauge slide is over both wheel scanners.

The fixture should be snug against the top and gauge of both rails.



- 9 Over the scanner mount, extend the horizontal alignment bar of the fixture as far as it will go.
- 10 Tighten the extended bar.

- 11** At both ends of the scanner mount, measure from the bottom of the extended bar to the top surface of the mount.

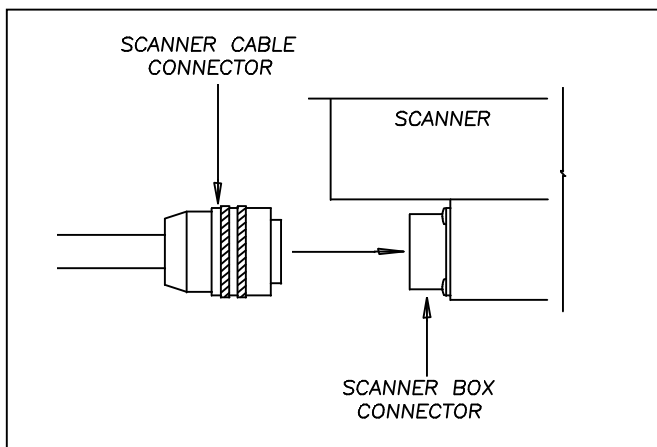


When both measurements are the same, alignment is correct. That is, as shown above, when distance **A** is equal to distance **B**, alignment is correct.

- 12** If adjustment is necessary, adjust the upper and lower nuts on the edge of the wheel scanner mount's arm.

Using a combination 9/16-inch open-end box wrench, turn both upper nuts the same number of turns. Turn both lower nuts the same number of turns. Adjusting these four nuts causes the scanner to pivot about the two shock mounts under the rail.

- 13** Until both measurements are the same, repeat steps **11** and **12**.
14 Retract the horizontal alignment bar as far as it will go.
15 Attach the scanner cable connector to the scanner box connector.



16 If this is a **Type II** wheel scanner:

- a** With the hole on top of the wheel scanner cover facing the center of the track, set the cover-and-module assembly onto its mount.
- b** Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.

17 If this is a **Type III** wheel scanner:

- a** With the hole on top of the wheel scanner cover facing the center of the track, set the mounting plate back onto its scanner mount.
- b** Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.
- c** Reconnect the heater wiring plug.
- d** With the hole on top of the wheel scanner cover facing the center of the track, set the weather cover back onto its mounting plate.
- e** Using the T-handle 1/4-inch hex-wrench, uniformly tighten the four socket-head-cap screws.

18 Repeat steps **3** through **17** for the wheel scanner on the opposite rail.

19 Remove the alignment fixture from the track.

20 If this is a single-track site:

- a** Store the alignment fixture in the bungalow.
- b** Go to the next chapter.

21 If this is a double-track site:

- a** Repeat steps **1** through **19** for the second track.
- b** Store the alignment fixture in the bungalow.
- c** Go to the next chapter.

Chapter 8

Installing the Bungalow Components

This chapter tells how to do the final installation of most of the bungalow components. If you are having problems with or have questions about installing any components, call STC for help. Though slower and more cumbersome, solving your problems and answering your questions by email is also possible.

8.1 Grounding System

The SmartScanIS is equipped with components for surge and lightning protection of the equipment attached to it. However, if the attachment to the earth grounding system isn't made correctly, the surge protection equipment may not work as designed, resulting in damaged or destroyed system components.

Ground rods should be 0.75-inch (1.9-centimeter) diameter copper-clad steel rods or 1-inch (2.5-centimeter) diameter zinc-coated steel rods. The minimum length of a ground rod is 8 feet (2.4 meters). Ground rods should be driven vertically for their full length, and the top of the ground rod should be located a minimum of 12 inches (30.5 centimeters) below the top of the subgrade at the toe of the ballast slope. The maximum allowable resistance of grounded rail or structures is 25 ohms.

Two driven ground rods should be installed at opposite corners of the bungalow in which the SmartScanIS enclosure is installed. **A third driven ground** should be installed at the power pole to which the AC power connection is made. All three ground rods should be interconnected and exothermically bonded with a 2 AWG bare stranded copper wire. Two 2 AWG copper transitions welded to the skin of the bungalow should be exothermically bonded to the driven grounds at its corners.

An exothermically bonded pigtail should be run through the floor of the bungalow and terminated at a properly installed **ground bus** inside the bungalow. There should be one ground bus per bungalow.

8.2 SmartScanIS Enclosure

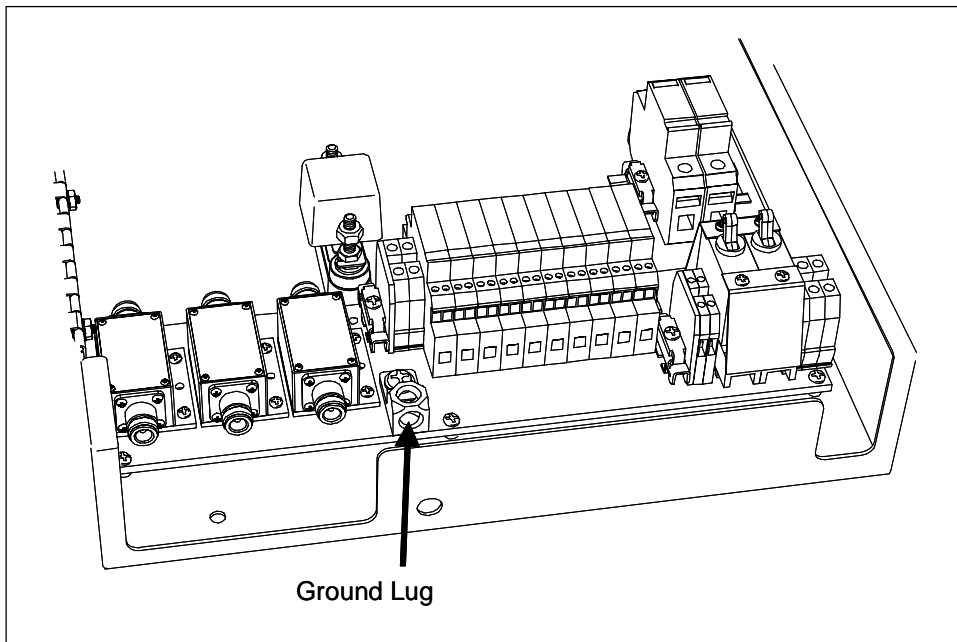
There is one SmartScanIS enclosure per track. At double-track sites, the leftmost enclosure supports track1, and the rightmost one supports track2.

The SmartScanIS enclosure can be mounted to any flat wooden surface. A 3/4-inch (1.9 centimeters) or thicker plywood works well. Other flat wooden surfaces may work just as well. The SmartScanIS enclosure can also be rack-mounted.

Mount the SmartScanIS enclosure about 2 feet (61 centimeters) above the floor. Doing so positions the enclosure at a convenient height for installation and servicing. Mounting it at this height also allows you to install the batteries below it.

Mount the SmartScanIS enclosure within 4 feet (1.2 meters) of a grounded three-wire 110-120 VAC outlet. The enclosure is provided with a 5-foot (1.5-meters) power cord. Level the enclosure.

To ground the SmartScanIS enclosure, attach one end of a 6 AWG stranded copper wire to the ground bus and the other end to the copper **ground lug** on the Surge Protection Subassembly (in the SmartScanIS enclosure). At double-track sites, each SmartScanIS enclosure must be grounded.



8.3 Bearing Scanners

There are two bearing scanners per track.

At double-track sites, the cables from the bearing scanners on track1 are connected to the box connectors in the leftmost SmartScanIS enclosure. The cables from track2 are connected to the box connectors in the rightmost SmartScanIS enclosure.

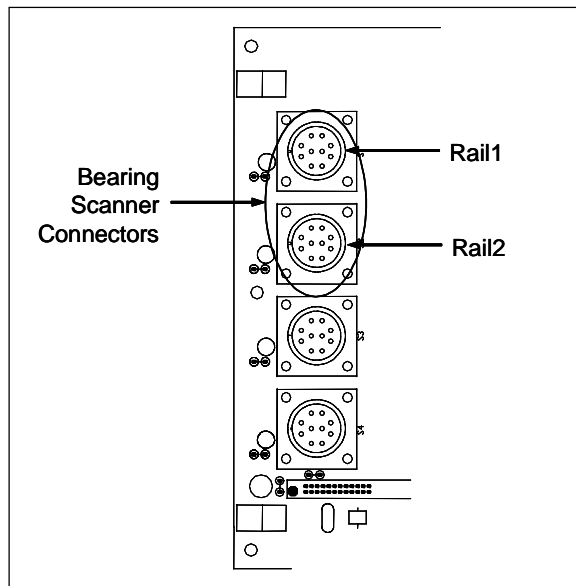
To connect the **Type II/Type III** bearing scanners to the SmartScanIS enclosure:

- 1 Be sure that both bearing scanners are installed on the track.

At a single-track site, the cable from the bearing scanner on rail1 should be labeled **RAIL1**. The cable from the bearing scanner on rail2 should be labeled **RAIL2**. If the track runs north and south, RAIL1 is the east rail, and RAIL2 is the west rail. If the track runs east and west, RAIL1 is the north rail, and RAIL2 is the south rail.

At a double-track site, they're labeled **RAIL1-TRACK1**, **RAIL2-TRACK1**, **RAIL1-TRACK2**, or **RAIL2-TRACK2**, whichever is appropriate.

- 2 Plug the connector from the bearing scanner on rail1 (that is, from the north or east rail) into the first (top) box connector on the Scanner Interface board.



- 3 Plug the connector from the bearing scanner on rail2 (that is, from the south or west rail) into the second box connector on the Scanner Interface board.
- 4 If this is a single-track site:
 - a If your site has wheel scanners, go to **8.4 Wheel Scanners**.
 - b Go to **8.5 Gating Transducers**.
- 5 If this is a double-track site:
 - a Repeat steps 1 through 3 on the second track.

The cables from track2 are connected to the rightmost SmartScanIS enclosure.
 - b If your site has wheel scanners, go to **8.4 Wheel Scanners**.
 - c Go to **8.5 Gating Transducers**.

8.4 Wheel Scanners

Not all sites use wheel scanners. If your site doesn't use them, skip the instructions below and go to **8.5 Gating Transducers**.

If your site uses them, there are two wheel scanners per track.

At double-track sites, the cables from the wheel scanners on track1 are connected to the box connectors in the leftmost SmartScanIS enclosure. The cables from track2 are connected to the box connectors in the rightmost SmartScanIS enclosure.

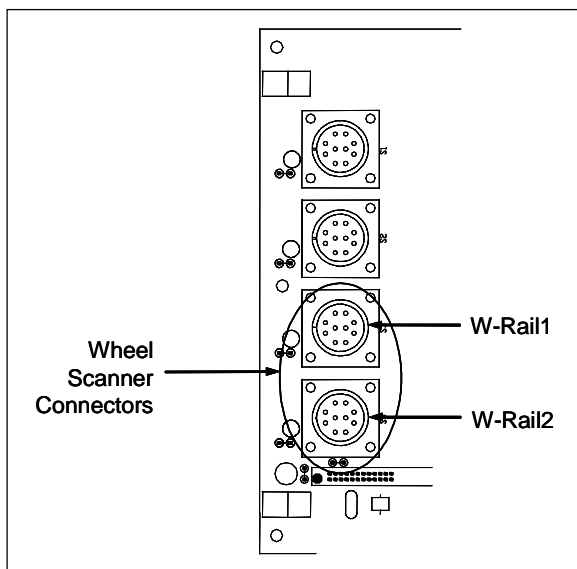
To connect the **Type II/Type III** wheel scanners to the SmartScanIS enclosure:

- 1 Be sure that both wheel scanners are installed on the track.

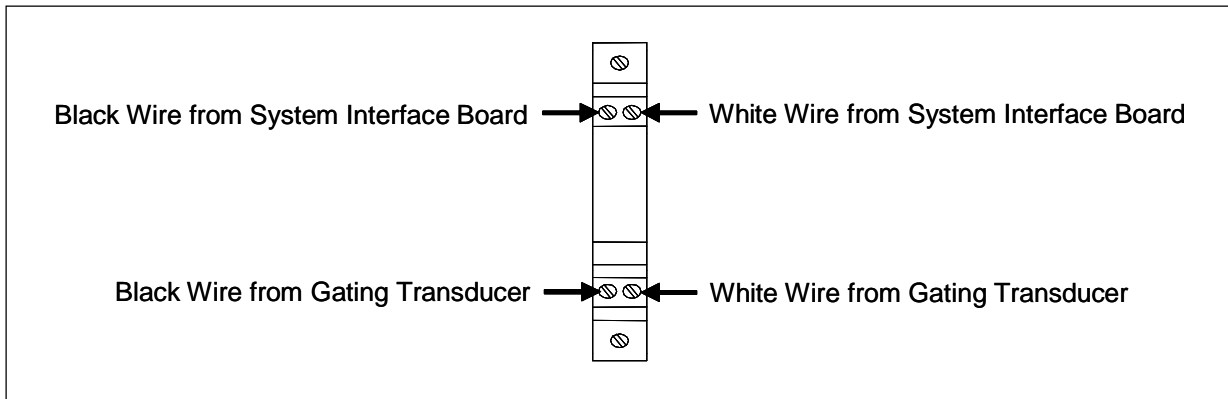
At a single-track site, the cable from the wheel scanner on rail1 should be labeled **W-RAIL1**. The cable from the wheel scanner on rail2 should be labeled **W-RAIL2**. If the track runs north and south, RAIL1 is the east rail, and RAIL2 is the west rail. If the track runs east and west, RAIL1 is the north rail, and RAIL2 is the south rail.

At a double-track site, they're labeled **W-RAIL1-TRACK1**, **W-RAIL2-TRACK1**, **W-RAIL1-TRACK2**, or **W-RAIL2-TRACK2**, whichever is appropriate.

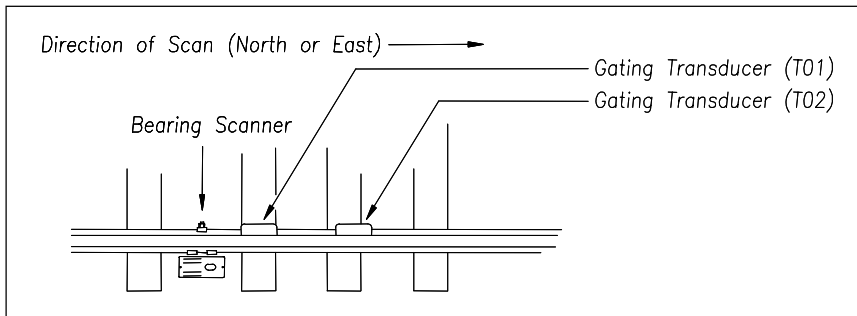
- 2 Plug the connector from the wheel scanner on rail1 (that is, from the north or east rail) into the third box connector on the Scanner Interface board.



- 3 Plug the connector from the wheel scanner on rail2 (that is, from the south or west rail) into the fourth (bottom) box connector on the Scanner Interface board.
- 4 If this is a single-track site, go to **8.5 Gating Transducers**.
- 5 If this is a double-track site, repeat steps 1 through 3 on the second track and then go to **8.5 Gating Transducers**.



Observe correct polarity when you connect the wires from the transducers. The polarity is correct when the transducer's white wire is connected directly under the existing white wire at row two of the UTB, and the transducer's black wire is connected directly under the existing black wire at row two of the UTB. Connect **T01** first and **T02** second. **T01** is the gating transducer closest to the bearing scanner. **T02** is the one farthest from the bearing scanner.



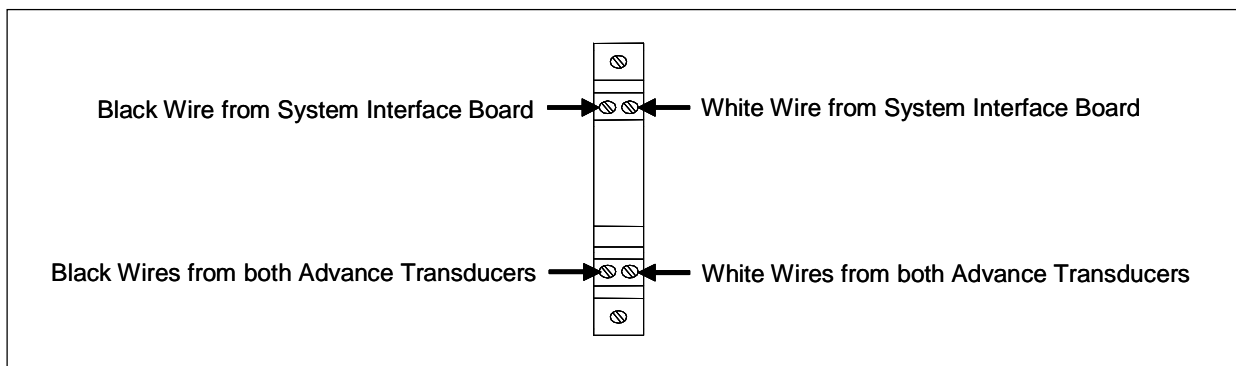
8.6 Advance Transducers

All tracks have either two advance transducers or one track circuit. If your site uses track circuits, skip the instructions below and go to **8.7 Dragging-Equipment Detector**.

When used, there are two advance transducers per track, each having two wires. One black wire and one white wire. At a single-track site, the cables from the advance transducers should be labeled **ADV1** and **ADV2**.

At a double-track site, they're labeled **ADV1-TRACK1**, **ADV2-TRACK1**, **ADV1-TRACK2**, or **ADV2-TRACK2**, whichever is appropriate. At double-track sites, the cables from the advance transducers on track1 are connected inside the leftmost SmartScanIS enclosure. The cables from track2 are connected inside the rightmost SmartScanIS enclosure.

On the Surge Protection Subassembly (in the SmartScanIS enclosure), there is one UTB assigned to both advance transducers. This UTB protects the SmartScanIS from transients and surges, which can be induced onto external wiring by lightning. This UTB, which is labeled **Advance**, has four rows of connectors. The wires from both advance transducers are terminated at the third row of connectors from the top. The second row from the top is wired at the factory to terminal block **TB1** on the System Interface board.



Observe correct polarity when you connect the wires from the transducers. The polarity is correct when the transducers' white wires are connected directly below the existing white wire at row two of the UTB, and the transducers' black wires are connected directly below the existing black wire at row two of the UTB.

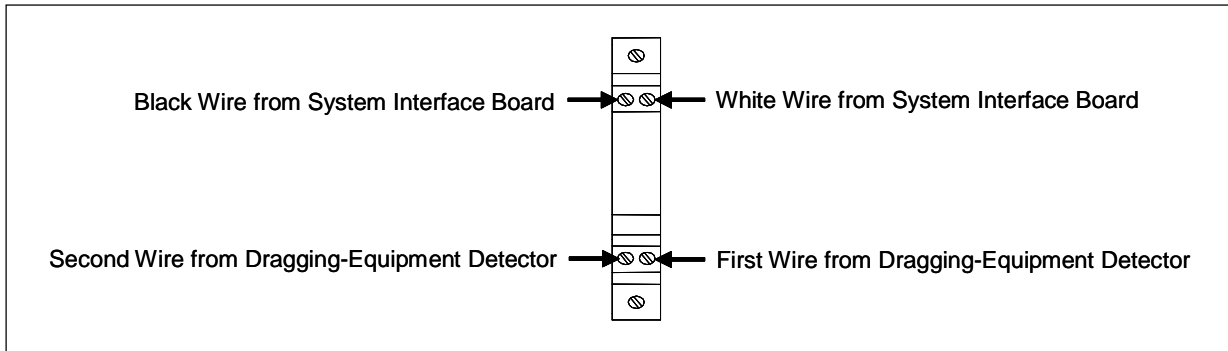
8.7 Dragging-Equipment Detector

Most, but not all, systems use dragging-equipment detectors. If your site doesn't use them, skip the instructions below and go to **8.8 Track Circuit**.

When used, there is one dragging-equipment detector per track, each having two wires. Usually, one black wire and one white wire. The color of your wires may be different.

At double-track sites, the wires from the dragging-equipment detector on track1 are connected inside the leftmost SmartScanIS enclosure. The wires from track2 are connected inside the rightmost SmartScanIS enclosure.

On the Surge Protection Subassembly (in the SmartScanIS enclosure), the UTB labeled **Dragger** is for the dragging-equipment detector. This UTB protects the SmartScanIS from transients and surges, which can be induced onto external wiring by lightning. The UTB has four rows of connectors. The wires from the dragging-equipment detector are terminated at the third row of connectors from the top. The second row from the top is wired at the factory to terminal block **TB1** on the System Interface board.



Correct polarity need not be observed when connecting the wires from the detector. One wire from the detector should be connected directly below the existing white wire at row two of the UTB, and the other wire should be connected directly below the existing black wire at row two of the UTB.

8.8 Track Circuit

Not all systems use a track circuit. When present, there is one track circuit per track. If your site doesn't use a track circuit, skip the instructions below and go to **8.9 Telephone**.

To connect the track circuit to the SmartScanIS enclosure:

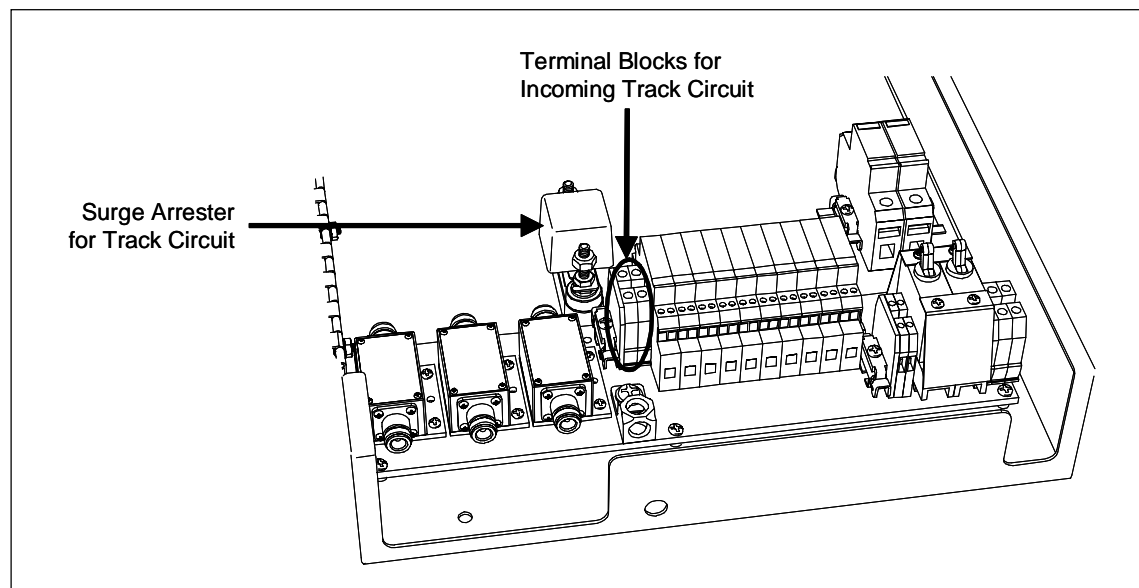
- 1 Be sure that the track circuit is installed on the track.
- 2 Be sure that you have on hand a wire stripper, a pliers-type crimping tool, and a midsize slotted screwdriver.
- 3 Mount a terminal block below the SmartScanIS enclosure.

At a single-track site, the cable from the track circuit should be labeled **TC**. At a double-track site, they're labeled **TC-TRACK1** or **TC-TRACK2**, whichever is appropriate.

At a double-track site, the cable from track1 is connected to the leftmost SmartScanIS enclosure.

- 4 Cut the track-circuit cable to the proper length.
- 5 Using a wire stripper, remove 1/4 inches (6.4 millimeters) of insulation from the ends of both wires coming from the track circuit.
- 6 Using a pliers-type crimping tool, crimp one ring terminal to the end of each of these two wires.
- 7 Fasten one ring terminal to the left side of the terminal block.
- 8 Fasten the other ring terminal to the right side of the terminal block.

On the Surge Protection Subassembly (in the SmartScanIS enclosure) are two terminal blocks (labeled **SOTC**). One is red, and the other is black.



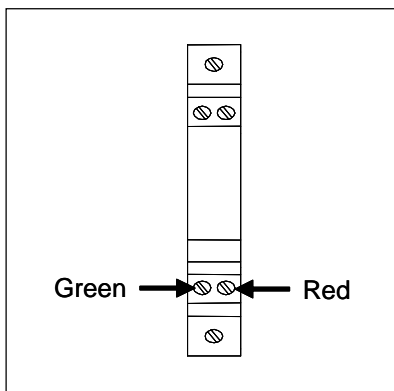
- 9 Wire from the terminal block to the appropriate terminal blocks on the Surge Protection Subassembly.
- 10 If this is a single-track site, go to **8.9 Telephone**.
- 11 If this is a double-track site:
 - a Repeat steps 1 through 9 on the second track.
The wires from track2 are connected to the rightmost SmartScanIS enclosure.
 - b Go to **8.9 Telephone**.

8.9 Telephone

Not all sites have telephone service. When present, there is one telephone line per site. If your site doesn't have telephone service, skip this section and go to **8.10 Shielded Temperature Probe**.

The telephone service provider should terminate their drop on a lightning arrester terminal on the service pole. From the lightning arrester block, run a four-wire service cord to the bungalow and route it to the Surge Protection Subassembly (in the SmartScanIS enclosure). At double-track sites, the service cord is routed to the leftmost SmartScanIS enclosure.

On the Surge Protection Subassembly (in the SmartScanIS enclosure), the UTB labeled **TelCo** is for the telephone line. This UTB protects the SmartScanIS from transients and surges, which can be induced onto external wiring by lightning. The UTB has four rows of connectors. The wires from the incoming telephone line are terminated at the third row of connectors from the top. The second row from the top is wired at the factory. The green wire of the incoming telephone line is terminated on the left. The red wire is terminated on the right. The other two telephone wires (yellow and black) aren't required for the SmartScanIS.



At double-track sites, a telephone line is connected to just one SmartScanIS enclosure. That means that only the SmartScanIS enclosure connected to the phone line can be communicated with remotely. However, each SmartScanIS enclosure can still be communicated with locally.

8.10 Shielded Temperature Probe

The temperature probe is encased in a radiation shield that shields it from direct sunlight and allows ambient air to flow through and around it. The probe mounts to the outside wall of the wayside enclosure and provides accurate temperature indications over a range of -49°F to +149°F (-45°C to +65°C). Site ambient temperature (at the time the train passed the site) is included with most system reports.

The system supplies 12 volts to the shielded temperature probe. The probe returns 0 to 5 volts. Zero volts indicate a -49°F (-45°C) reading. Five volts indicate a +149°F (+65°C) reading. During normal operation, you should probably never get either reading. Therefore, if you get a -49°F (-45°C) reading, the probe could be malfunctioning, the cable from the probe to the system could be cut, or the wiring to the terminal block on the System Interface board could be disconnected. If you get a +149°F (+65°C) reading, the probe could be malfunctioning, or the ground wire from the probe to the system could be cut.

There is one shielded temperature probe per system. To install this probe:

- 1 Be sure that you have on hand the customer-supplied fasteners needed to attach the shielded temperature probe to the outside of the bungalow; a wire stripper; and the fasteners needed to attach the RF-filter assembly to the inside of the bungalow.
- 2 If you haven't done so already, remove the shielded temperature probe and the RF-filter assembly from its box.
- 3 Mount the probe onto the outside of the bungalow, preferably on the side of the enclosure where the SmartScanIS enclosure is mounted.

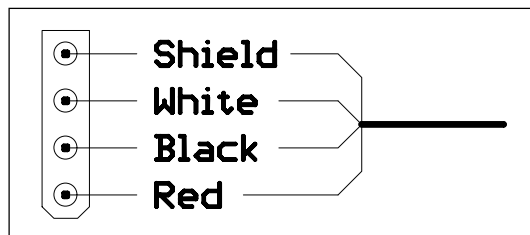
No matter where it is mounted, make sure the whole shielded temperature probe is in the top third of the bungalow **or** above the roof of the bungalow.

- 4 Route the cable from the probe to the SmartScanIS enclosure.

In sheet metal, use a rubber grommet in every hole through which you route the cable.

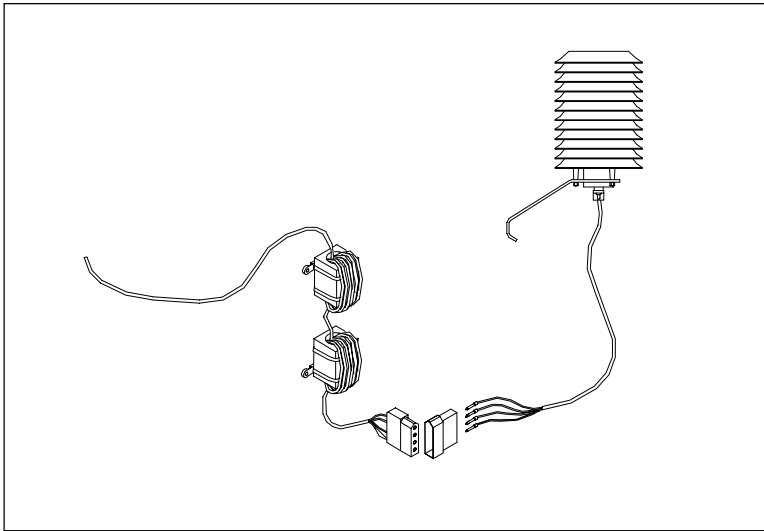
At a single-track site, the cable is routed to the bottom of the SmartScanIS enclosure. At a double-track site, the cable is routed to the bottom of the leftmost SmartScanIS enclosure.

- 5 As shown below, insert the four Molex pins (on the end of the cable of the probe) into the supplied Molex housing.



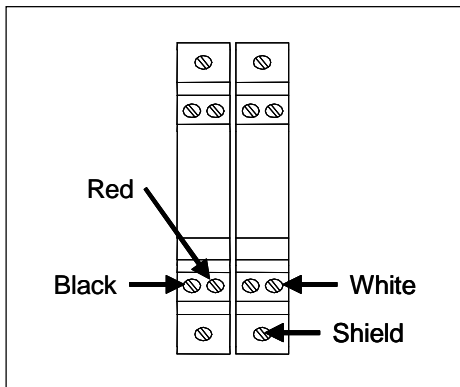
The red wire supplies 12 VDC to the shielded temperature probe.

- 6 Mate the Molex housing (on the end of the cable of the probe) to the factory-wired Molex socket on the end of the RF-filter assembly.



- 7 Using a wire stripper, remove 1/4 inches (6.4 millimeters) of insulation from the ends of the four wires coming from the other end of the RF-filter assembly.

On the Surge Protection Subassembly (in the SmartScanIS enclosure), the two UTBs labeled **TempProbe** are for the shielded temperature probe. Each UTB has four rows of connectors. As shown below, the wires from the shielded temperature probe are terminated at the third row and fourth row of connectors from the top. The other connectors on these UTBs are prewired at the factory and need no further wiring.



- 8 As shown above, terminate the wires from the end of the RF-filter assembly.
- 9 Mount the two filters of the RF-filter assembly onto the inside of the bungalow.

8.11 Radio Antenna

There is one radio per track. For a radio to work properly, it needs an antenna.

When installing the radio antenna, follow the directions that came with your antenna and:

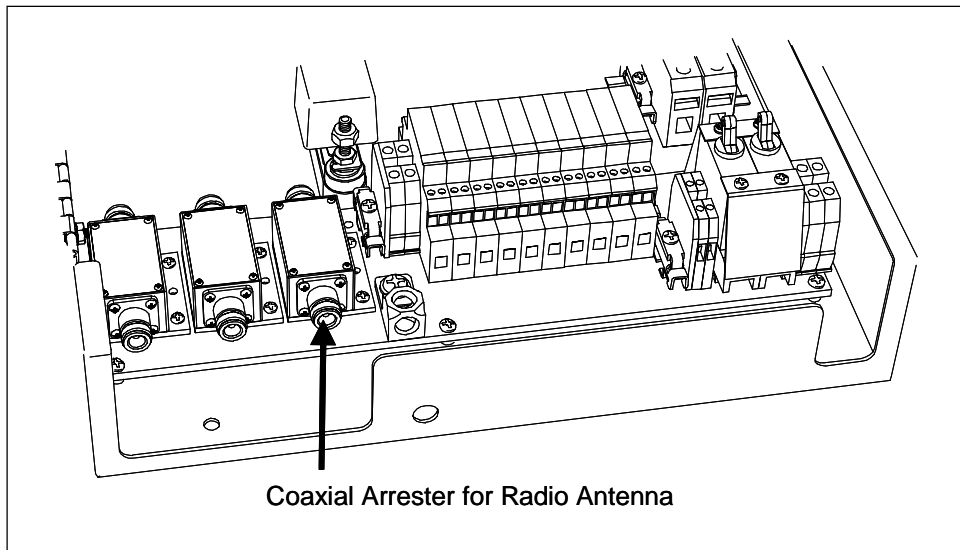
- 1 Mount the antenna onto the outside of the bungalow, preferably on the roof of the bungalow.

If you mount it on the side of the bungalow, make sure the entire antenna is above the roofline.

- 2 Route the coaxial cable from the antenna-mounting base to the SmartScanIS enclosure.

In sheet metal, use a rubber grommet in every hole through which you route the cable.

- 3 Install an N-type plug onto the end of the cable.
- 4 Connect this plug to the coaxial arrester on the Surge Protection Subassembly (in the SmartScanIS enclosure).

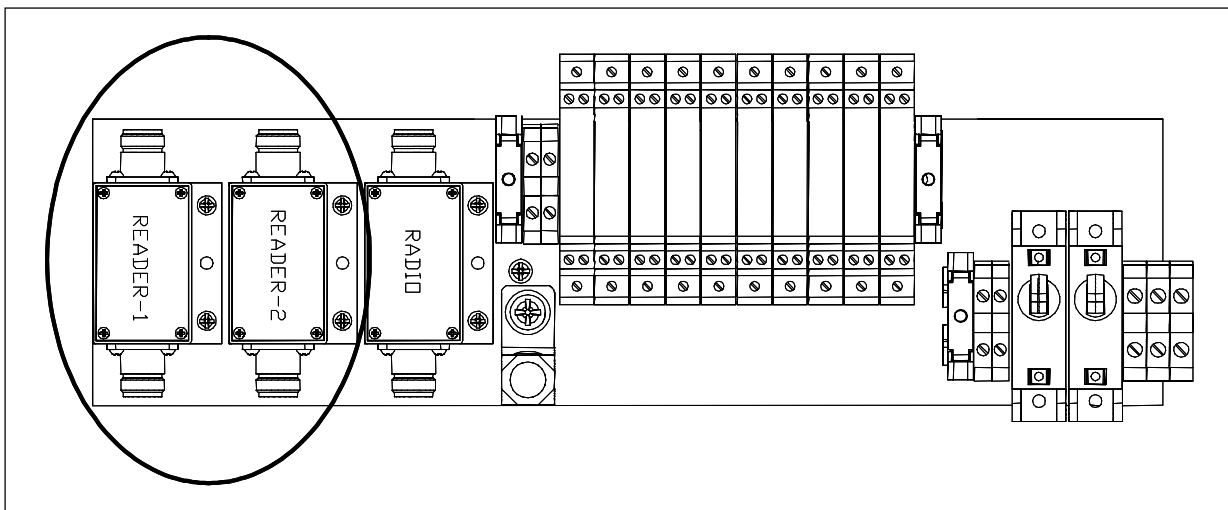
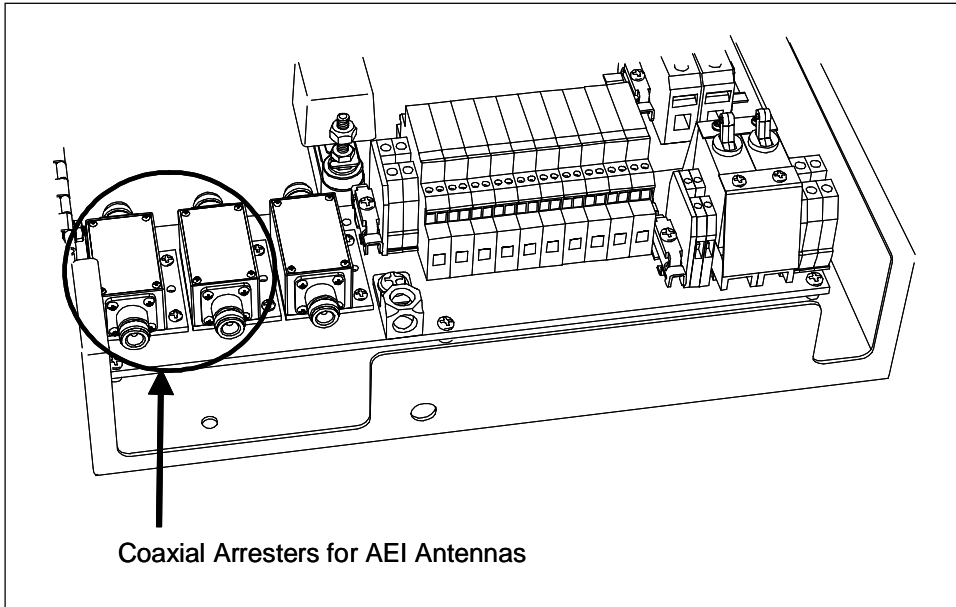


- 5 If this is a single-track site, go to **8.12 AEI Antennas**.
- 6 If this is a double-track site:
 - a Repeat steps 1 through 4 for the radio in the other SmartScanIS enclosure.
 - b Go to **8.12 AEI Antennas**.

8.12 AEI Antennas

Not all sites have AEI antennas. When present, there are two AEI antennas per track. If your site doesn't have AEI antennas, skip this section and go to **8.13 Batteries**.

Connect the cable from each AEI antenna to its respective coaxial arrester on the Surge Protection Subassembly (in the SmartScanIS enclosure). The northmost or eastmost antenna, **antenna1**, connects to the arrester labeled **Reader1**. The southmost or westmost antenna, **antenna2**, connects to the arrester labeled **Reader2**. This standard must be adhered to for the SmartScanIS to function properly.



8.13 Batteries

The battery subsystem is usually made up of two 12-volt 115-ampere-hour batteries. These batteries should be wired in a series arrangement so that they supply 24 volts with a capacity of 115 ampere-hours. The use of smaller batteries reduces the amount of time that the system can continue to operate after AC power is removed. The use of larger batteries or more than two batteries may exceed the charging capacity of the Power Supply module and could result in its failure.

WARNING

Battery posts, terminals, and related accessories contain lead and lead components, chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm. So, as a minimum, wash your hands after handling batteries.

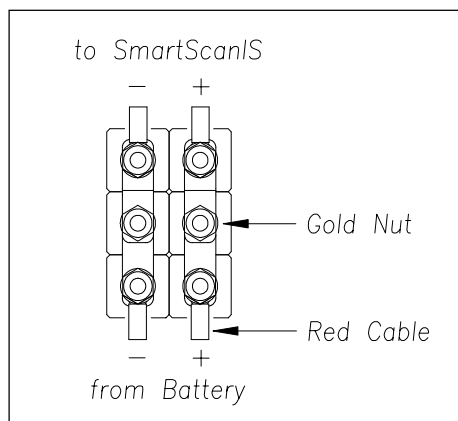
WARNING

Once the batteries are attached to the battery block, touching the terminals of the battery block with a piece of metal could short both batteries. Shorting takes place when you touch any right-sided terminal and any left-sided terminal at the same time. So be careful when using uninsulated tools around the battery block.

The following instructions assume that the batteries, wiring, and optional battery block are supplied by STC. The customer may supply those materials. In that case, the connections may be different, but these instructions should still serve as a guide.

There are two batteries per system. To install the batteries on a system using a battery block:

- 1 Be sure you have on hand a 9/16-inch open-end wrench, a 1/2-inch insulated socket wrench, a wire cutter, a wire stripper, a pliers-type crimping tool, a 1/2-inch nutdriver, a midsize slotted screwdriver, two batteries, the optional six-terminal battery block, wiring, and six ring terminals.
- 2 Using a 1/2-inch insulated socket wrench, loosen the middle gold nut on the right side (that is, the side with the red cables) of the battery block.



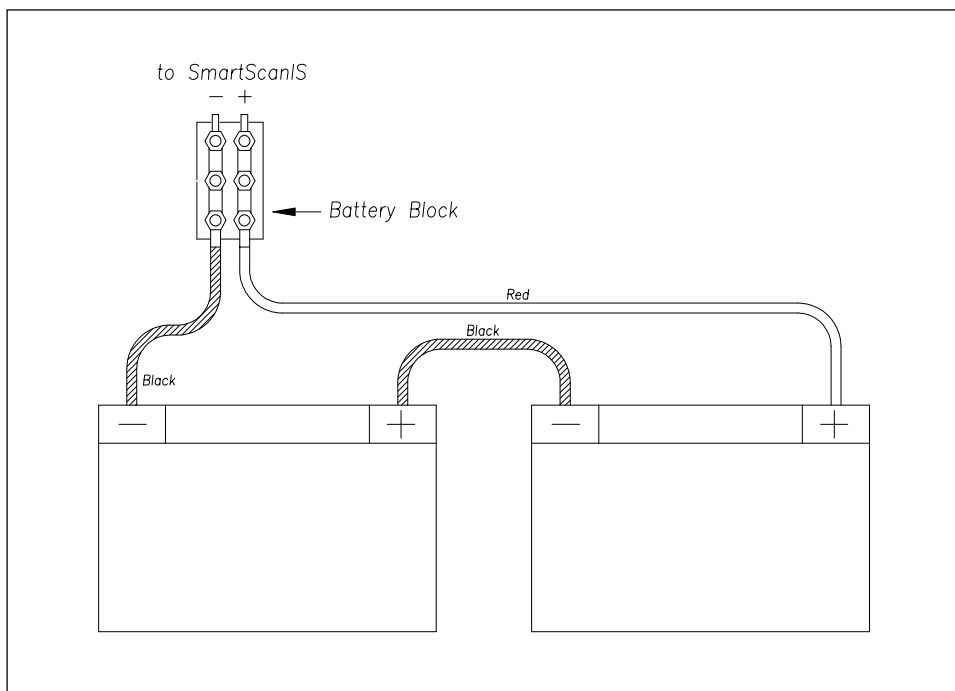
- 3 Cut a red-black 10 AWG 2-conductor wire to fit **between the battery and the battery block**.

- 4 Using a wire stripper, remove 1/4 inches (6.4 millimeters) of insulation from both ends of both conductors.
- 5 Using a pliers-type crimping tool, crimp one ring terminal to the end of each of these four conductors.
- 6 If you haven't done so already, remove the two batteries from their boxes.
- 7 Place the batteries on the floor below the battery block.

To prevent damage to the system, attach the red wire before the black wires.

- 8 Using a 1/2-inch nutdriver, connect the red wire from the positive battery post to the left side of the battery block.
- 9 Using a 1/2-inch nutdriver, connect the black wire from the negative battery post to the right side of the battery block.

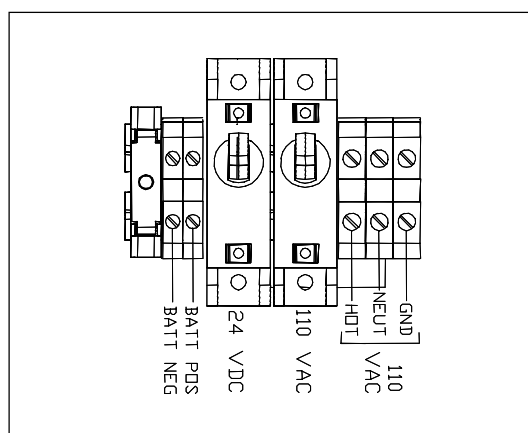
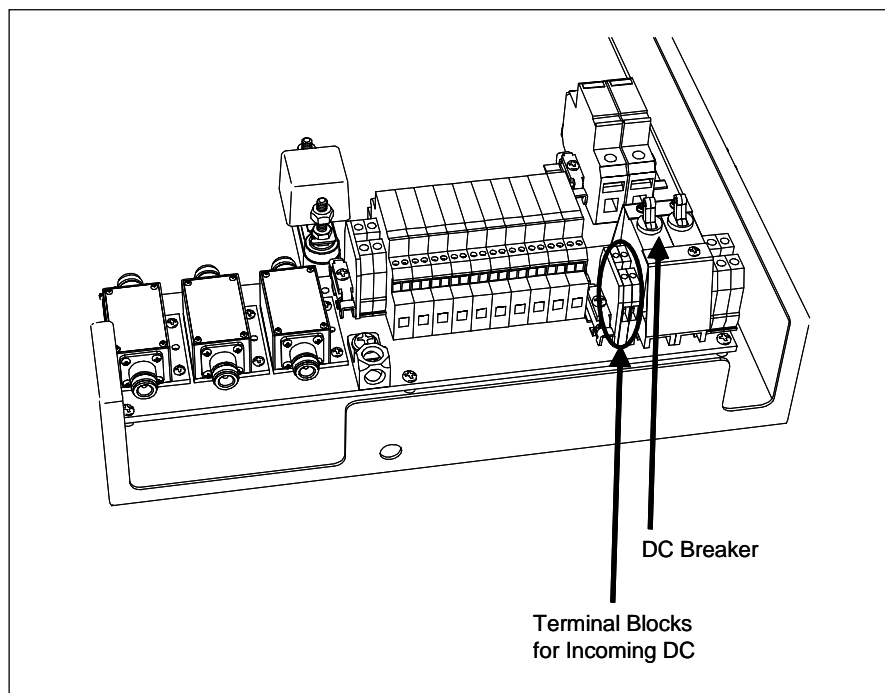
Your connections should now look like this.



- 10 Cut a red-black 10 AWG 2-conductor wire to fit **between the battery block and the SmartScanIS enclosure.**
- 11 Using a wire stripper, remove 1/4 inches (6.4 millimeters) of insulation from both ends of both conductors.
- 12 Using a pliers-type crimping tool, crimp a ring terminal to the end of the red conductor and another ring terminal to the same end of the black conductor.

The end with the ring terminals attaches to the battery block. The other end attaches to the terminal blocks in the SmartScanIS enclosure. The red conductor (positive) is attached to the red terminal block and the black conductor (negative) to the black terminal.

The figures below show the location of the terminal blocks for incoming DC.

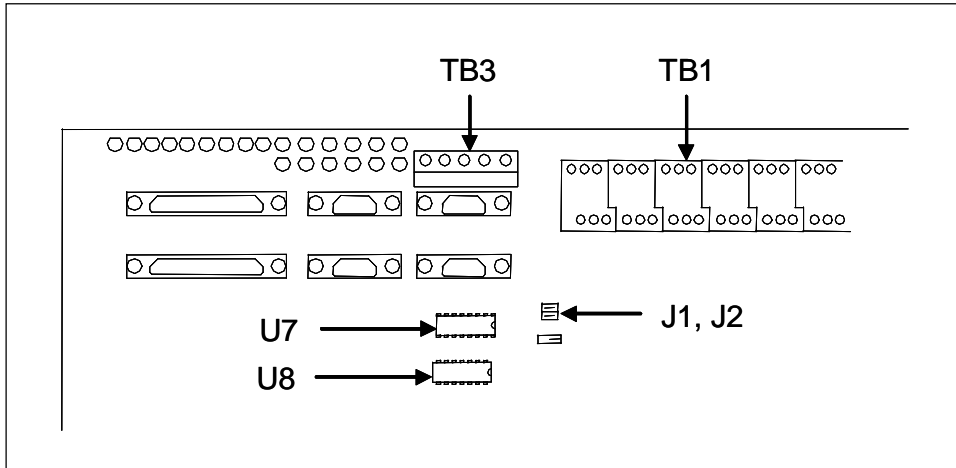


- 13 Using a 1/2-inch nutdriver, connect the red wire from the positive terminal block to the left side of the battery block.
- 14 Using a 1/2-inch nutdriver, connect the black wire from the negative terminal block to the right side of the battery block.
- 15 If this is a single-track site, go to **8.14 Wind Monitor**.
- 16 If this is a double-track site:
 - a Repeat steps 1 through 14 for the batteries that power the other SmartScanIS enclosure.
 - b Go to **8.14 Wind Monitor**.

8.14 Wind Monitor

Not all sites have a wind monitor. When present, there is one wind monitor per site. If your site doesn't have a wind monitor, skip this section and go to the next chapter.

The R.M. Young Model 09101 Wind Monitor communicates via an RS485 connection, which the SmartScanIS supplies through the communication port provided by terminal block **TB3** on the System Interface board.



Using the wind monitor involves configuring the SmartScanIS and connecting the wind-monitor hardware.

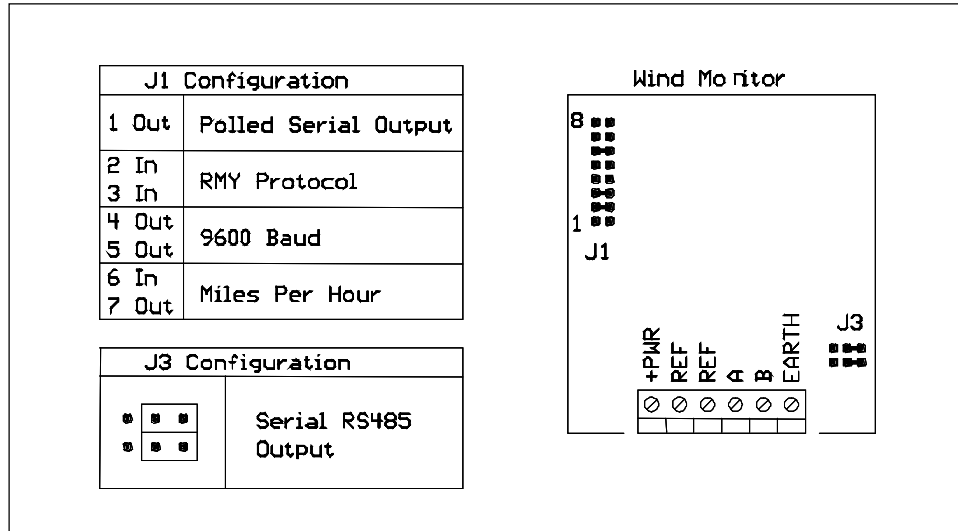
8.14.1 Configuring the SmartScanIS for RS485 Communication

- The baud rate used by the RS485 port must match the baud rate used by the wind monitor. Currently, the RS485 port defaults to 9600 baud.
- Headers must be installed onto the **J1** and **J2** jumpers. These headers should run vertically (that is, one header should connect the upper-left and lower-left pins and one header should connect the upper-right and lower-right pins). SmartScanIS units ship from STC in this configuration.
- The System Interface boards contain a jumper for selecting between RS232 and RS485 on COM1.
- Because the SmartScanIS hardware and firmware support RS485 communication, no RS232/RS485 converter is needed.

8.14.2 Connecting the Wind-Monitor Hardware

Attaching the wind monitor to the SmartScanIS involves four wires and two resistors. Making the RS485 connection to the SmartScanIS involves using two of its **TB3** terminals. One terminal is labeled RX, and the other one is labeled RX with a bar over it. In the bulleted list below, they are referred to as RX and RX-BAR, respectively.

- Connect the wind monitor's **EARTH** terminal to earth ground.
- Connect the wind monitor's **+PWR** terminal to a 12-volt power source.
- Connect the wind monitor's leftmost **REF** terminal to ground.



- Connect the wind monitor's **A** terminal to the SmartScanIS **RX** terminal.
- Connect the wind monitor's **B** terminal to the SmartScanIS **RX-BAR** terminal.

The firmware doesn't poll the wind monitor while the user is using the serial interface. Otherwise, the firmware polls the wind monitor every 15 seconds.

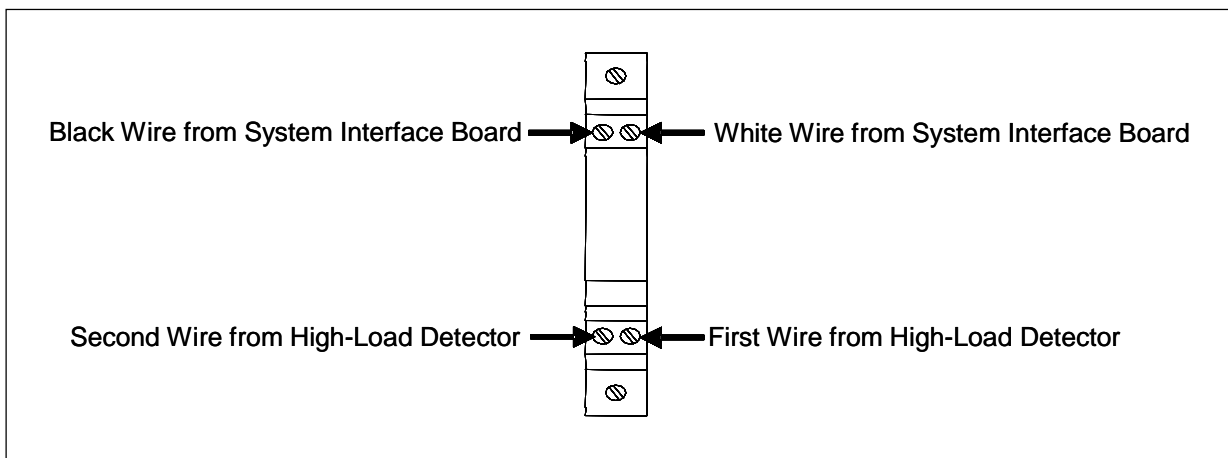
8.15 High-Load Detector

Some systems use high-load detectors. If your site doesn't use them, skip the instructions below and go to the next chapter.

When used, there is one high-load detector per track, each having two wires.

At double-track sites, the wires from the high-load detector on track1 are connected inside the leftmost SmartScanIS enclosure. The wires from track2 are connected inside the rightmost SmartScanIS enclosure.

On the Surge Protection Subassembly (in the SmartScanIS enclosure), the UTB labeled **HIGH** is for the high-load detector. This UTB protects the SmartScanIS from transients and surges, which can be induced onto external wiring by lightning. The UTB has four rows of connectors. The wires from the high-load detector are terminated at the third row of connectors from the top. The second row from the top is wired at the factory to terminal block **TB1** on the System Interface board.



Correct polarity need not be observed when connecting the wires from the high-load detector. One wire from the detector should be connected directly below the existing white wire at row two of the UTB, and the other wire should be connected directly below the existing black wire at row two of the UTB.

Chapter 9

Placing a System into Service

This chapter describes some of the final things that need to be done before placing a SmartScanIS into service.

9.1 Checking the Trackside Components

To check the correctness of the installation of the trackside components:

- 1 Be sure that you have on hand a tape measure, a 9/16-inch torque wrench, and the alignment fixture.
- 2 At trackside, check track conditions on all tracks.
- 3 If any track is pumping (vertical displacement of the rails) or running (lateral displacement of the rails) more than 2 inches (5 centimeters), have it repaired before proceeding.
- 4 At trackside, check that all the track-mounted hardware has been installed properly.
- 5 If any piece of the track-mounted hardware isn't installed or isn't installed properly, install it properly before proceeding.

Chapter 6 - Installing the Track Components tells how to install the scanners, transducers, a track circuit, and AEI antennas. Trackside installation of dragging-equipment detectors and other auxiliary-alarm detectors isn't covered in this guide.

- 6 At trackside, check all transducer-mounting bolts on all tracks to make sure that all transducers are snug against the rail.

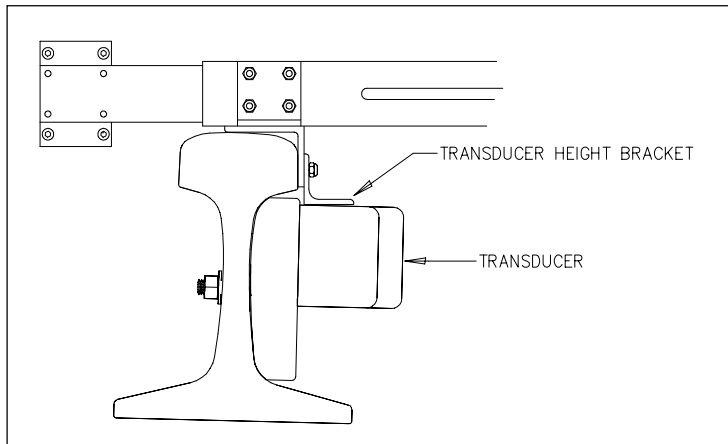
Four bolts are needed to hold the transducer in place. Two square-head bolts go through the mounting plate and transducer body. Two hex-head bolts go through the mounting plate and rail. If any of these bolts are sheared or missing, they must be replaced with the correct replacement bolt. Also, if any washers or nuts are missing, they must be replaced.

- 7 If all transducers aren't snug against the rail, fix this problem before proceeding.

Each installed transducer body should be 1-9/16 inches (3.97 centimeters) below the top of the rail and parallel to it. You can meet this requirement by using the transducer height bracket on the bottom of the alignment fixture.

- 8 Place the alignment fixture across both rails, centered over each transducer in turn.

- 9 Check if each transducer body just touches the bracket.



The fixture should be snug against the top and gauge of both rails. This may be impossible if the transducer body is less than 1-9/16 inches (3.97 centimeters) below the top of the rail or if the transducer body isn't parallel to the top of the rail.

- 10 If a transducer body doesn't just touch the bracket:

- a Loosen the nuts holding the transducer body to its mounting plate.
- b By sliding it up and down, adjust the transducer body to the proper height.
- c Tighten each hex nut with a 9/16-inch torque wrench to a **torque of 12 to 15 foot-pounds (16.3 to 20.3 newton-meters)**.

Don't exceed a torque of 15 foot-pounds (20.3 newton-meters). Doing so can weaken or break a bolt, requiring the bolt to be replaced.

- 11 At the trackside, check all scanner-mounting bolts on all tracks.

- 12 If all scanner mounts aren't snug against the gauge side of the rail, fix this problem before proceeding.

If you need to tighten a scanner's clamping nut or locking nut, don't exceed a torque of 50 foot-pounds (67.8 newton-meters). Doing so can cause failure of the mount.

- 13 From under all scanners, remove ballast that could damage the scanners during train passage.

- 14 Remove all obstructions to the scan path of each scanner.

9.2 Checking the Bungalow Components

To check the correctness of the installation of the bungalow components:

- 1 If the radio antenna and the shielded temperature probe haven't been mounted to the outside of the bungalow, mount them.

Chapter 8 - Installing the Bungalow Components tells how to install the radio antenna and the shielded temperature probe.

- 2 If the bungalow isn't attached to a properly installed outside grounding system, fix this problem before proceeding.

Chapter 8 - Installing the Bungalow Components tells how to ground the SmartScanIS.

- 3 If there isn't a **ground bus** inside the bungalow that has been attached to a properly installed outside grounding system, fix this problem before proceeding.
- 4 Check that all bungalow components have been installed properly.
- 5 If any component of the bungalow isn't installed or isn't installed properly, install it properly before proceeding.

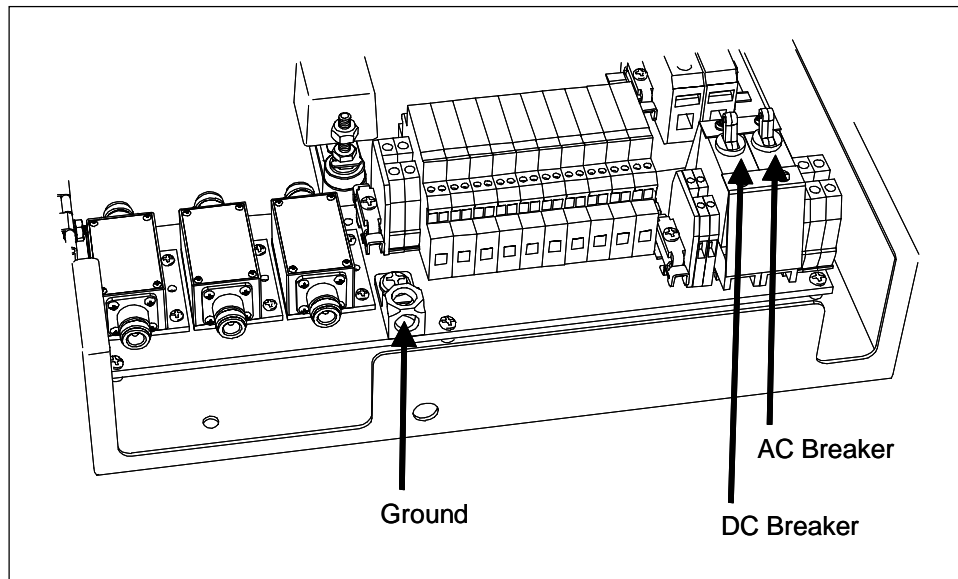
Chapter 8 - Installing the Bungalow Components tells how to install the bungalow components.

- 6 Inside the bungalow, check that there are no loose wires or cables.
- 7 If there are any loose wires or cables, fix this problem before proceeding.

9.3 Powering-up the SmartScanIS

To power up the SmartScanIS:

- 1 Be sure that you have on hand a multimeter and a 1/2-inch insulated socket wrench.
- 2 Open the door on the SmartScanIS enclosure.
- 3 On the Surge Protection Subassembly, toggle off both breakers.



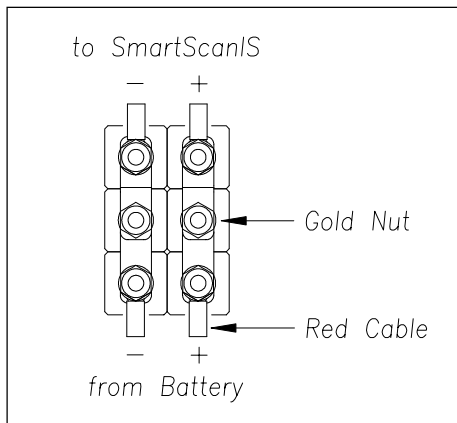
- 4 If the SmartScanIS enclosure hasn't been properly grounded, fix this problem before proceeding.
- 5 Switch on the AC power to the bungalow.

- 6 At all outlets, verify that the AC power is stable and at least 110 volts at 20 amperes.
- 7 If the AC power isn't stable or if it isn't at least 110 volts at 20 amperes, fix this problem before proceeding.
- 8 Plug in the SmartScanIS enclosure.

WARNING

Plugging the power cord at the bottom of the SmartScanIS enclosure into an outlet of more than 128 volts will severely damage your system.

- 9 Using a 1/2-inch insulated socket wrench, tighten the middle gold nut on the right side (that is, the side with the red cables) of the battery block, which is usually mounted below the SmartScanIS enclosure.



WARNING

In operation, batteries generate and release flammable hydrogen gas, which, if ignited by a burning cigarette, naked flame, or spark, may cause battery explosion with a dispersion of casing fragments and corrosive liquid electrolyte. So, carefully follow the manufacturer's instructions for installation and service. Keep all sources of gas ignition away from the batteries and do not allow metallic articles to contact the negative and positive terminals of a battery at the same time.

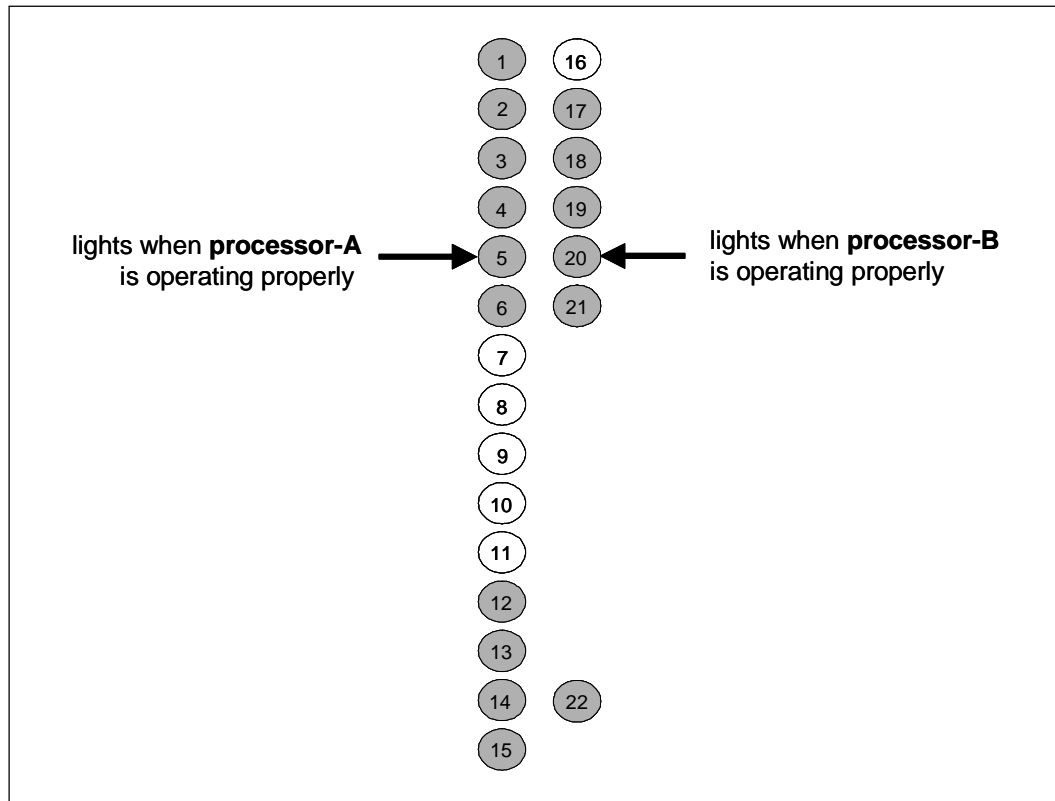
WARNING

A damaged or aged battery, in combination with the connected battery charger, can pose a serious health threat. The battery can produce hydrogen sulfide gas, which is characterized by its unique "rotten egg" smell. So, when a strong sulfurous odor is detected, remove power to the battery charger and check the battery for excessive heating. Do not inhale the fumes.

10 On the Surge Protection Subassembly, toggle on both breakers.

11 Observe the bank of status LEDs on the System Interface board.

On or before 10 seconds, LEDs 5 and 20 should begin to fade slowly off and on.

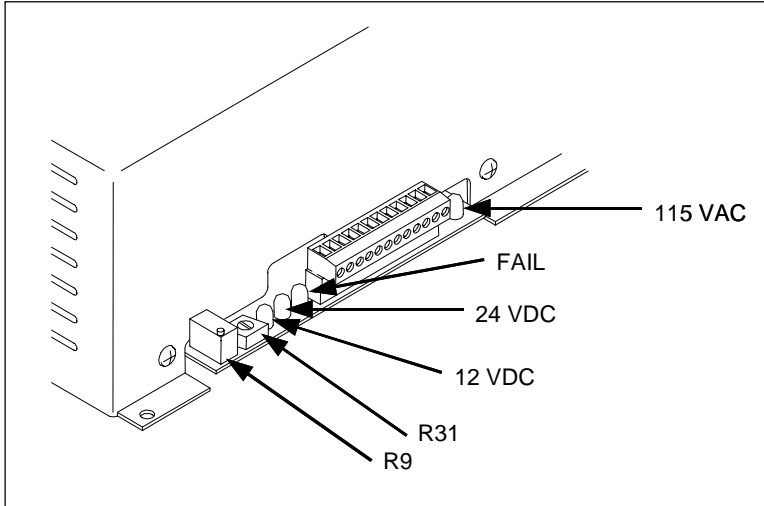


12 After 10 seconds, if LEDs 5 and 20 aren't fading off and on, call STC for help in isolating and fixing the underlining problem.

13 Close the door on the SmartScanIS enclosure.

9.4 Adjusting the Battery Float Voltage

On the front of the 2200-205 Power Supply, potentiometer **R9** is used to adjust the battery float voltage. It was factory adjusted to 28 VDC. At the site, when the voltage is not between 27.8 and 28.2, adjust R9 until a multimeter shows 28 VDC at terminal 4 on **TB1** on the Power Supply module. You can do this by turning R9 clockwise to increase the voltage or counterclockwise to decrease the voltage. The batteries must be disconnected while setting the float voltage.



To adjust the battery float voltage:

- 1 Be sure that you have on hand a multimeter.
- 2 If the **115 VAC** and **24 VDC** LEDs on the edge of the 2200-205 Power Supply module aren't lit, fix this problem before continuing.
- 3 Toggle off the DC breaker.
- 4 Switch the multimeter to the DC volts scale.
- 5 Touch the black lead of the multimeter to terminal 3 on the Power Supply module.
- 6 Touch the red lead to terminal 4 on the Power Supply module.
- 7 If the voltage isn't between 27.8 and 28.2, adjust the potentiometer **R9** (on the Power Supply module) until the multimeter shows 28 VDC.
Turn R9 clockwise to increase voltage. Turn it counterclockwise to decrease voltage.
- 8 Toggle on the DC breaker.

9.5 Adjusting the Track Circuit

Most SmartScanIS sites use a track circuit. If your site does, it also needs a 2200-500 Presence Detector module, which activates the SmartScanIS when a train is present at the site. If your site is using two advance transducers instead of a track circuit, there is no 2200-500 Presence Detector.

To check the operation of the SOTC and adjust it:

- 1 If your site uses **advance transducers**, go to **9.6 Checking the Scanner Shutters**.

Do the next steps only if your site uses a **track circuit**.

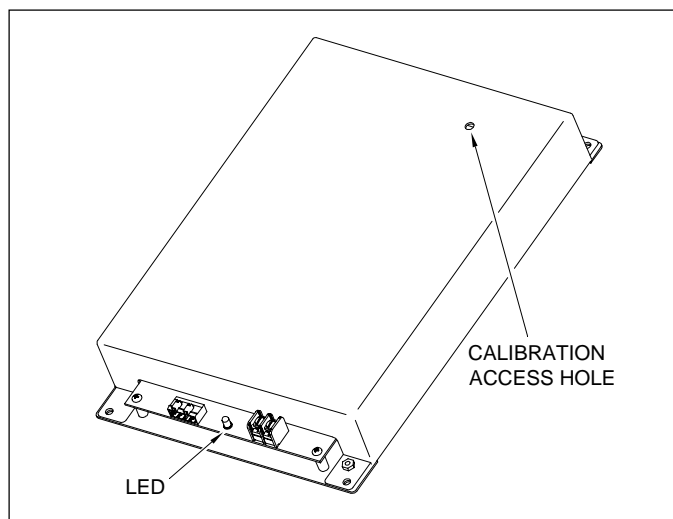
- 2 From the center of the gating transducer farthest from the track circuit, measure the shortest distance you want the track circuit to pick up the presence of a train.

The distance must be at least 25 feet (4.6 meters) and no more than 150 feet (45.7 meters). You'll next shunt the track. The track must be shunted before the blue calibration switch on the Zepic III board (aka SOTC board) can be pressed, and calibration can begin.

Shunting a track circuit could adversely affect adjacent signal-system track circuits or crossing warning systems. Ensure the proper protection is in place before shunting any track.

- 3 At the point just measured, place a 0.06-ohm shunt across both rails.

Part of the 2150-500 SOTC Interface board appears at the front of the 2200-500 Presence Detector module. On this exposed section of the board are two connectors and a LED. When lit, this LED indicates a received pulse from the track circuit.



- 4 Locate the calibration access hole on the cover of the Presence Detector module.
- 5 Insert a nonmetal, nonconductive stick through the hole, gently pressing and holding down the blue calibration switch on the Zepic III board until the LED starts blinking.

- 6 Release the blue calibration switch on the Zepic III board.

The LED (on the front of the Presence Detector module) will stop blinking, and the system will automatically begin the calibration process. The track shunt must remain in place during the calibration process.

When the unit has successfully been calibrated, the LED (on the front of the Presence Detector module) will light again. This process can take up to 45 seconds to complete.

- 7 Remove the 0.06-ohm shunt.

The LED (on the front of the Presence Detector module) should go out.

- 8 Place the 0.06-ohm shunt across both rails at the point 5 feet (1.5 meters) beyond the measured point (that is, 5 feet farther from the gating transducer).

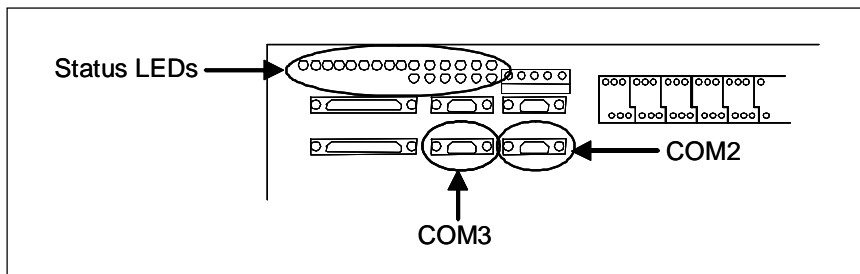
- 9 If the LED (on the front of the Presence Detector module) lights, return to step 1.

- 10 Remove the 0.06-ohm shunt.

9.6 Checking the Scanner Shutters

To check the operation of the scanner shutters:

- 1 To use the serial interface to open the scanner shutters:
 - a If COM3 has nothing plugged in it, plug your computer into it.



- b If COM3 has something plugged into it, unplug what is connected to COM3 and plug your computer into it.
 - c Turn on your computer.
 - d Be sure that your computer has installed communications software, that it is set to use full-duplex, and that the baud rate is set to 9,600.

The baud rate of your computer must match the baud rate of the selected serial port because they are in direct, one-to-one communication with one another. For example, the baud rate for COM3 was set to 9600 at the factory. If the customer changes this baud rate, your computer must be set to the changed value.

Use your communications software to open a LOG file and capture the whole session to the file. When your session is complete, you may then view what you have done with an editor, print it with a printer, or store it for later retrieval.

- e On your computer, open a LOG file.
- f Using the serial interface, display the Main menu.

Chapter 11 - Serial Interface tells how to display the Main menu. The Main menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
Main Menu
-----
      .
      .
      .
H) Event Log
I) Setup Menu
J) T94 Train Detail
X) Exit Menu
```

- g Select **Setup menu**.
This prompt appears.

```
Enter Password:
```

- h At the password prompt, type **uptest**
The password isn't case-sensitive. Entering an incorrect password produces the "Password Incorrect!" message and returns to the Main menu. Pressing **[Esc]** or allowing the entry routine to time out (one minute) returns to the Main menu.
Typing the correct password displays the Setup menu.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
Setup Menu
-----
      .
      .
      .
G) -For Future Use-
H) System Functions
I) Polling System
      .
      .
      .
```

i Select **System Functions**.

The System Functions menu appears.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
System Functions Menu
-----
A) Radio Test
B) Vocabulary Test
C) Gate Test
D) 1KHz Test Tone
E) Auto-Calibration
F) Reset the COP Counters
      .
      .
      .
```

j Select the **Auto-Calibration** option to open the shutters.

The protective shutters in all scanners should open and stay open for three minutes. If this isn't enough time to check the shutters and optics, select the option again.

- 2 In each scanner, check if its shutter opened.
- 3 If any shutter didn't open, fix this problem before proceeding.
- 4 In each scanner, check the optics.
- 5 If dirty, clean the scanner optics.

Appendix F - Lens Cleaning of Scanners tells how to clean the scanner optics.

- 6 If the date and time displayed on the top of the System Functions menu are incorrect, fix them before proceeding.

Chapter 11 - Serial Interface tells how to change the date and time.

- 7 To return to the Setup menu, type **x**
- 8 To return to the Main menu, type **x**
- 9 To exit the serial interface and return the system to normal operation, type **x**
- 10 If this is a double-track site, repeat steps **1** through **8** for the other SmartScanIS.

9.7 Calibrating the Scanners

The SmartScanIS self-calibrates its pyrometer interface circuitry. You need only put a preheated calibrated heat source on a scanner and place the system in autocalibration mode. The system then scans all pyrometer inputs until the signal from the calibrated heat source is located. The necessary adjustments to the related interface circuitry are automatically made while the system monitors its own progress by analyzing changes in the heat signals. Once the procedure has been completed, autocalibration mode is disengaged, and the calibration results are displayed on your computer. The next two sections contain details for calibrating the bearing scanners and the wheel scanners.

9.7.1 Bearing Scanners

STC recommends that you use the calibrated heat source (2100-810NG) only when the outside (ambient) temperature is above 0°F (-18°C) and below 90°F (32°C). If you must use it at other times, do so only when the needle is centered on the front of the temperature meter. If the needle isn't stabilized within ± 2 degrees of the set point, the heat source isn't operating properly.

To calibrate the **Type II/Type III** bearing scanners:

- 1 Be sure that you have on hand an STC calibrated heat source (2100-810NG) and a laptop computer.
- 2 On the control panel of the calibrated heat source, toggle the **Gating** switch off.
- 3 Plug the proper end of the supplied 50-foot (15-meter) power cord into the **six**-contact circular connector on the front of the calibrated heat source.

Sixty Hz is critical for proper operation. For a site that doesn't have a 120-volt 60 Hz power source, the heat source should be powered from a true sine wave inverter capable of 250 watts with an output of at least 110 volts at 60 Hz. The inverter should operate from an input voltage of 10.5 VDC to 15 VDC. A 120-volt USA socket should be provided to match the heat source power cord. The inverter should be grounded according to the manufacturer's recommendations.

WARNING

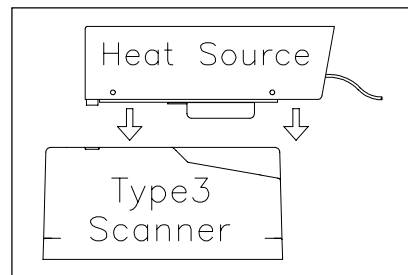
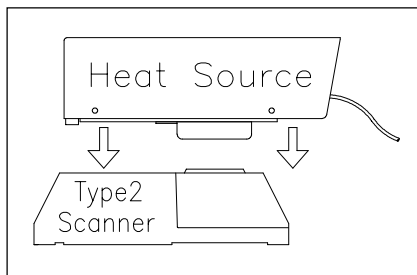
Once plugged in, both function connectors will have live AC present.

- 4 Using the supplied dust cap, cover the function connector that isn't being used.
- 5 Plug the other end of the power cord into the 120-volt USA socket.
- 6 On the control panel of the calibrated heat source, turn the temperature knob to **180**.
- 7 Put the heat source in a shady area, out of direct sunlight and out of the wind.
- 8 Wait about 8 minutes for the heat source to reach operating temperature and stabilize.

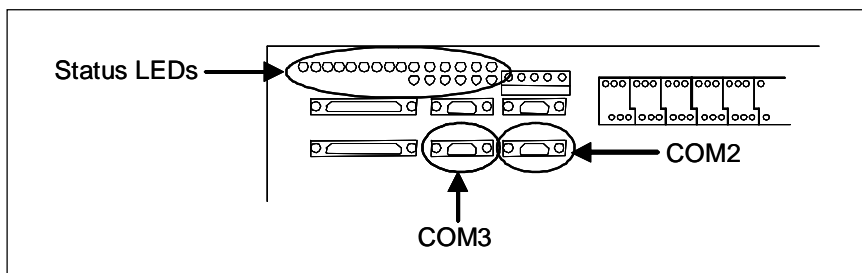
The heat source has reached operating temperature and stabilized when the temperature meter needle remains centered.

Once the temperature stabilizes, calibration may begin. Once stabilized, the temperature will change less than plus-or-minus one degree Fahrenheit.

- 9 Take the calibrated heat source to the bearing scanner on the north or east rail.
- 10 With the power cord to the front of the scanner, place the calibrated heat source on the bearing scanner.



- 11 If COM3 has nothing plugged in it, plug your computer into it.



- 12 If COM3 has something plugged into it, unplug what is connected to COM3 and plug your computer into it.
- 13 Be sure that the laptop computer is turned on, that it has appropriate communications software installed, that the communications software is set to use full duplex, that the baud rate is set to 9600, and that a LOG file is opened.

The baud rate of your computer must match the baud rate of the selected serial port because they are in direct, one-to-one, communication with one another. For example, the baud rate for COM3 was set to 9600 at the factory. If the customer changed this baud rate, your computer must be set to the changed value.

- 14 Using the serial interface, display the Main menu.

Chapter 11 - Serial Interface tells how to display the Main menu. The Main menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
Main Menu
-----
      .
      .
      .
H) Event Log
I) Setup Menu
J) T94 Train Detail
X) Exit Menu
```

- 15 Select the **Setup menu**.

This prompt appears.

```
Enter Password:
```

16 At the password prompt, type **uptest**

The password isn't case-sensitive. Entering an incorrect password produces the "Password Incorrect!" message and returns to the Main menu. Pressing **[Esc]** or allowing the entry routine to time out (one minute) returns to the Main menu.

Typing the correct password displays the Setup menu.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
Setup Menu
-----
      .
      .
      .
G) -For Future Use-
H) System Functions
I) Polling System
      .
      .
      .
```

17 Select **System Functions**.

The System Functions menu appears.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
System Functions Menu
-----
A) Radio Test
B) Vocabulary Test
C) Gate Test
D) 1KHz Test Tone
E) Auto-Calibration
F) Reset the COP Counters
      .
      .
      .
```

The **Auto-Calibration** option is used to calibrate the system's pyrometer interface circuitry.

18 Select Auto-Calibration.

The SmartScanIS will now calibrate itself. **Follow along on your computer screen until you see "Auto-Calibration Disengaged."** This message is an indication that the system is done with the calibration procedure. To abort the process, press **[Esc]** on your computer or remove the heat source from the bearing scanner.

On your computer screen, an acceptable calibration looks like this. Your values will be different.

```
Auto Calibration Selected

Signal levels in millivolts with closed shutters
  Rail1      Rail2      Wheel1      Wheel2
Min/Max/Average  Min/Max/Average  Min/Max/Average  Min/Max/Average
0  80  20  0  60  20  0  60  20  20  80  40

Opening the shutters.
Scanning for heat source. Press the 'Esc' key to abort.
Located 187F heat source at Rail1. Auto-calibration beginning in 0 secs.

.....Auto-Calibration Engaged.....

Testing Digital-Pot U-19. Stand by.
Digital-pot checks OK.
Previous calibrated digital-pot. setting was 38.
Adjusting digital-pot.
Temp = 225F Pot = 59 Sec = 1 Pot. decremented by 1 step.
Temp = 224F Pot = 58 Sec = 1 Pot. decremented by 1 step.
Temp = 221F Pot = 57 Sec = 2 Pot. decremented by 1 step.
Temp = 219F Pot = 56 Sec = 3 Pot. decremented by 1 step.
.
.
.
Temp = 183F Pot = 35 Sec = 15 Pot. decremented by 1 step.
Temp = 182F Pot = 34 Sec = 18 Pot. decremented by 1 step.
Temp = 181F Pot = 33 Sec = 29 Pot. decremented by 1 step.
Temp = 179F Pot = 33 Sec = 93 Monitoring heat source temperature.
Rail1 digital-pot setting of 33 was stored in EEPROM.
East Rail Scanner Calibration complete.
The setpoint is 180F. The calibrated temp. is 179F.
Closing the shutters.

.....Auto-Calibration Disengaged.....
```

Before the shutters are opened, if you get a signal level, greater than 200 millivolts, it usually means that there is noise on the scanner inputs, which most times is caused by an electrical problem with the scanner. If you cannot isolate and fix the cause of this problem, call STC for help.

Auto Calibration Selected											
Signal levels in millivolts with closed shutters											
Rail1			Rail2			Wheel1			Wheel2		
Min/Max/Average			Min/Max/Average			Min/Max/Average			Min/Max/Average		
210	250	210	0	60	20	0	60	20	20	80	40
•											
•											
•											

Before the shutters are closed, if you don't get a calibrated temperature in the range 178F to 182F, it means that the scanner wasn't calibrated. If cleaning the optics doesn't solve your problem, replace the scanner cover-and-module assembly. If this doesn't solve your problem, call STC for help in fixing the problem.

- 19 When "Auto-Calibration Disengaged" is displayed on your computer, remove the calibrated heat source.
- 20 Take the calibrated heat source to the bearing scanner on the south or west rail.
- 21 With the power cord to the front of the scanner, place the calibrated heat source on the bearing scanner.
- 22 Repeat steps 18 through 19.
- 23 To return to the Setup menu, type **x**
- 24 To return to the Main menu, type **x**
- 25 To exit the serial interface and return the system to normal operation, type **x**
- 26 If this is a single-track site:
 - a If your site has wheel scanners, go to **9.7.2 Wheel Scanners**.
 - b Store the calibrated heat source and its power cord in the bungalow.
 - c Go to **9.8 Checking the Broadcast**.
- 27 If this is a double-track site:
 - a Repeat steps 1 through 25 for the second track.
 - b If your site has wheel scanners, go to **9.7.2 Wheel Scanners**.
 - c Store the calibrated heat source and its power cord in the bungalow.
 - d Go to **9.8 Checking the Broadcast**.

9.7.2 Wheel Scanners

Not all sites use wheel scanners. If your site doesn't use them, skip the instructions below and go to **9.8 Checking the Broadcast**.

STC recommends that you use the calibrated heat source (2100-810NG) only when the outside (ambient) temperature is above 0°F (-18°C) and below 90°F (32°C). If you must use it at other times, do so only when the needle is centered on the front of the temperature meter. If the needle isn't stabilized within ± 2 degrees of set point, the heat source isn't operating properly.

To calibrate the **Type II/Type III** wheel scanners:

- 1 Be sure that you have on hand an STC calibrated heat source (2100-810NG) and a laptop computer.
- 2 If the calibrated heat source is already plugged in and functioning properly, go to step **10**.
- 3 On the control panel of the calibrated heat source, toggle the **Gating** switch off.
- 4 Plug the proper end of the supplied 50-foot (15-meter) power cord into the **six**-contact circular connector on the front of the calibrated heat source.

Sixty Hz is critical for proper operation. For a site that doesn't have a 120-volt 60 Hz power source, the heat source should be powered from a true sine wave inverter capable of 250 watts with an output of at least 110 volts at 60 Hz. The inverter should operate from an input voltage of 10.5 VDC to 15 VDC. A 120-volt USA socket should be provided to match the heat source power cord. The inverter should be grounded according to the manufacturer's recommendations.

WARNING

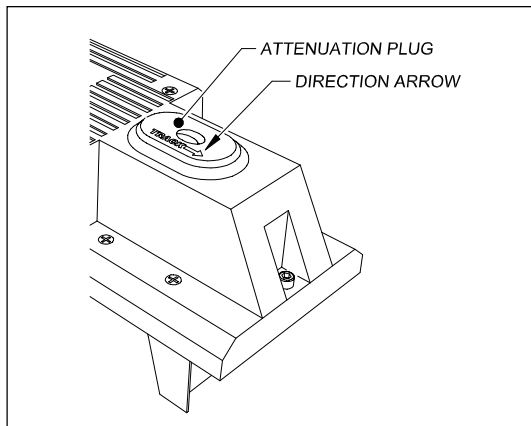
Once plugged in, both function connectors will have live AC present.

- 5 Using the supplied dust cap, cover the function connector that isn't being used.
- 6 Plug the other end of the power cord into the 120-volt USA socket.
- 7 On the control panel of the calibrated heat source, turn the temperature knob to **180**.
- 8 Put the heat source in a shady area, out of direct sunlight and out of the wind.
- 9 Wait about 8 minutes for the heat source to reach operating temperature and stabilize.

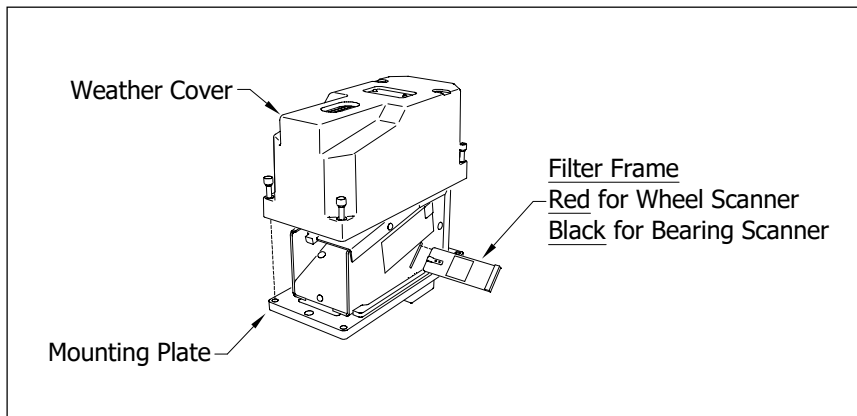
The heat source has reached operating temperature and stabilized when the temperature meter needle remains centered.

Once the temperature stabilizes, calibration may begin. Once stabilized, the temperature will change less than plus-or-minus one degree Fahrenheit.

- 10** If you are calibrating **Type II** wheel scanners, remove the attenuation plug from the weather cover on both scanners.

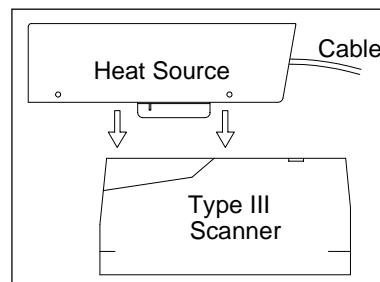
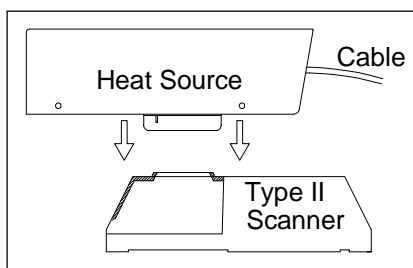


- 11** If you are calibrating **Type III** wheel scanners, be sure that a black filter frame is still installed in each scanner.



You'll need to remove the weather cover before you can check the color of the filter frame. Four socket-head-cap screws attach the weather cover to the mounting plate. Before continuing, be sure that the black filter frame is securely in place and that the four socket-head-cap screws on the weather cover are completely tight.

- 12** Take the calibrated heat source to the wheel scanner on the north or east rail.
- 13** With the power cord to the front of the scanner, place the calibrated heat source on the wheel scanner.



- 14 Using the serial interface, display the Main menu.

Chapter 11 - Serial Interface tells how to display the Main menu.

- 15 Select **Setup menu**.

- 16 At the password prompt, type **uptest**

- 17 Select **System Functions** menu.

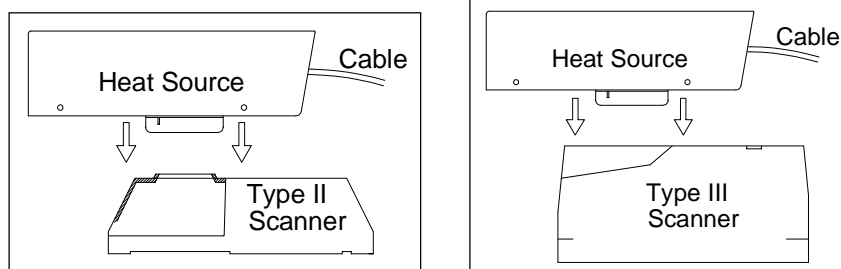
- 18 Select **Auto-Calibration**.

The SmartScanIS will now calibrate itself. **Follow along on your computer screen until you see "Auto-Calibration Disengaged."** This message is an indication that the system is done with the calibration procedure. To abort the process, press **[Esc]** on your computer or remove the heat source from the wheel scanner.

Before the shutters are opened, if you get a signal level greater than 200 millivolts, it usually means that there is noise on the scanner inputs, which most times is caused by an electrical problem with the scanner. If you cannot isolate and fix the cause of this problem, call STC for help.

Before the shutters are closed, if you don't get a calibrated temperature in the range $540^{\circ}\text{F} \pm 6^{\circ}\text{F}$, it means that the scanner wasn't calibrated. If cleaning the optics doesn't solve your problem, replace the scanner cover-and-module assembly. If this doesn't solve your problem, call STC for help in fixing the problem.

- 19 When "Auto-Calibration Disengaged" is displayed on your computer, remove the calibrated heat source.
- 20 Take the calibrated heat source to the wheel scanner on the south or west rail.
- 21 With the power cord to the front of the scanner, place the calibrated heat source on the scanner.



- 22 Repeat steps **18** and **19**.
- 23 To return to the Setup menu, type **x**
- 24 To return to the Main menu, type **x**
- 25 To exit the serial interface and return the system to normal operation, type **x**

- 26** If you just calibrated **Type II** wheel scanners, replace the attenuation plug on both scanners.

The attenuation plug has a direction arrow molded into the top of the plug. This arrow should be pointing toward the rail.

- 27** If you just calibrated **Type III** wheel scanners, immediately replace the black filter frame with the red one in both wheel scanners.

Before continuing, be sure that for each wheel scanner that the red filter frame is securely in place, that the hole on top of the wheel scanner cover is facing the center of the track, and that the four socket-head-cap screws on the weather cover are completely tight.

- 28** If this is a single-track site:

- a** Store the calibrated heat source and its power cord in the bungalow.
- b** Go to **9.8 Checking the Broadcast**.

- 29** If this is a double-track site:

- a** Repeat steps **1** through **27** for the second track.
- b** Store the calibrated heat source and its power cord in the bungalow.
- c** Go to **9.8 Checking the Broadcast**.

9.8 Checking the Broadcast

The **Radio Test option** is used to broadcast a short message through the speaker (inside the SmartScanIS enclosure) **and** through the radio. Similarly, the **1KHz Test Tone option** is used to generate a continuous tone for about 15 seconds through the speaker and the radio. Using either of these options will let you verify that the speaker and radio are working properly.

At single-track sites, the text of the message is "Testing, U-P detector, milepost (milepost number), testing, one, two, three, four, five, four, three, two, one, testing detector-out." At double-track sites, the text of the message is "Testing, UP detector, milepost (milepost number), track (track designation), testing, one, two, three, four, five, four, three, two, one, testing, detector-out."

To check the operation of the speaker and the radio:

- 1 Be sure that the speaker (inside the SmartScanIS enclosure) is plugged in and that its volume knob is turned to the middle position.
- 2 Using the serial interface, display the Main menu.

Chapter 11 - Serial Interface tells how to display the Main menu.

- 3 Select **Setup Menu**.
- 4 At the password prompt, type **uptest**
- 5 Select **System Functions** menu.

The System Functions menu appears.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
System Functions
-----
A) Radio Test
B) Vocabulary Test
C) Gate Test
D) 1KHz Test Tone
E) Auto-Calibration
    .
    .
    .
```

- 6 Select an option to start outputting either the phrases or the tones.
If the system isn't currently making any other voice announcements, it begins the message or tone. If the system is currently making a voice announcement, the firmware waits until it is done to begin the message or tone.
- 7 If you hear nothing or the speech is too garbled to understand, call STC for help in fixing this problem.
- 8 To return to the Setup menu, type **x**
- 9 To return to the Main menu, type **x**
- 10 To exit the serial interface and return the system to normal operation, type **x**
- 11 If this is a double-track site, repeat steps **1** through **10** for the other track (that is, for the other SmartScanIS).

9.9 Checking the Speech Data

The **Vocabulary Test option** is used to enunciate all of the stored speech phrases. This announcement is broadcast through the speaker (inside the SmartScanIS enclosure), but not through the radio.

Below is a list of the phrases that are announced. The phrases are grouped by chip number.

Chip	Announced Phrases
1	Zero, One, Two, Three, Four, Five
2	Six, Seven, Eight, Nine, No-Defects
3	Detector-Malfunction, Point, Hotwheel, Testing
4	Axle, Dragging-Equipment-Near, North, Rail
5	South, East, West, Track, Hotbox
6	Defect-Detected, M-P-H, Fifth
7	Integrity-Failure, Detector-Out, Sixth
8	No Rebroadcast, Minutes, Train-Too-Slow, Total-Axles, Speed
9	A, B, C, D, E, Temperature, Length, Minus, First, Second
10	F, G, H, I, J, Third, Fourth, Left-Side, Right-Side, <i>beep</i>
11	K, L, M, N, O, High-Load, Wide-Load, On, Seventh, Eighth
12	P, Q, R, S, T, S-P-Detector, Milepost, Detector-Working
13	U, V, W, X, Y, Stop-Your-Train, U-P-Detector, Ninth
14	Z, Sliding-Wheel, Car-I-D, From-Head-of-Train, Degrees, Number
15	Multiple-Hot-Journal-and-Dragging-Equipment, Power-Off, High-Wide-Near
16	Detected-From-Axle, To-End-of-Train, Miles-Per-Hour, Multiple-Dragging-Equipment

To check the integrity of the speech data:

- 1 Be sure that the speaker (inside the SmartScanIS enclosure) is plugged in and that its volume knob is turned to the middle position.
- 2 Using the serial interface, display the Main menu.
Chapter 11 - Serial Interface tells how to display the Main menu.
- 3 Select the **Setup Menu**.
- 4 At the password prompt, type **uptest**

5 Select **System Functions**.

The System Functions menu appears.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
System Functions
-----
A) Radio Test
B) Vocabulary Test
C) Gate Test
      .
      .
      .
```

6 Select **Vocabulary Test** from the System Functions menu.

If the system isn't currently making any other voice announcements, it begins the vocabulary-test announcement. If the system is currently making a voice announcement, the firmware waits until it is done to begin the vocabulary-test announcement.

- 7 If you hear nothing or the speech is too garbled to understand, call STC for help in fixing this problem.
- 8 To return to the Setup menu, type **x**
- 9 To return to the Main menu, type **x**
- 10 To exit the serial interface and return the system to normal operation, type **x**
- 11 If this is a double-track site, repeat steps **1** through **10** for the other track (that is, for the other SmartScanIS).

9.10 Checking the Number of Axles

To generate a test train to check the number of axles:

- 1 Quickly stroke the top of each gating transducer with a metal wrench, alternating between TO1 and TO2 for a total of **ten** simulated axles.
- 2 Wait for the system to time out and the shutters to close.
- 3 Produce a Last Train report.

Chapter 12 - Producing Reports tells how to produce this report. From the Main menu, you would select **Last Train**.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single  
05/31/2013  9:35  
Main Menu
```

```
-----  
A) Train Summary  
B) Train Detail  
C) Exception Summary  
D) Exception Detail  
E) System Status  
F) Last Train  
G) Range of Trains
```

```
•  
•  
•
```

The Last Train report is identical to the Train Detail report. There is a difference in the way you specify the train on which you want a report. For this report, you don't specify a train. A report on the most current train is produced.

- 4 On the report, check that the number of axles agrees with the number of times that you stroked the gating transducers.
- 5 On the report, if the number of axles doesn't agree with the number of times that you stroked the gating transducers, call STC for help in fixing this problem.
- 6 If this is a double-track site, repeat steps 1 through 5 for the other track (that is, for the other SmartScanIS).

9.11 Checking for Hot Bearing

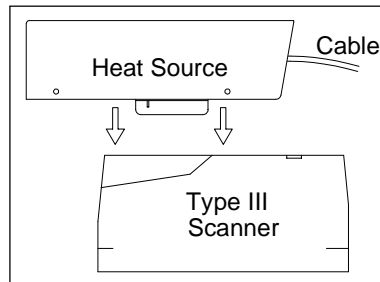
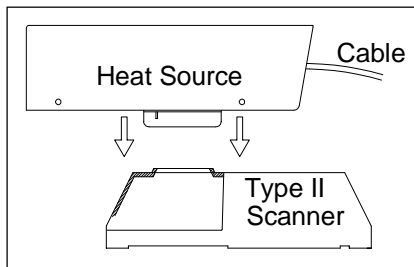
To generate a test train to check for hot bearings:

STC recommends that you use the calibrated heat source (2100-810NG) only when the outside (ambient) temperature is above 0°F (-18°C) and below 90°F (32°C). If you must use it at other times, do so only when the needle is centered on the front of the temperature meter. If the needle isn't stabilized within ± 2 degrees of set point, the heat source isn't operating properly.

- 1 Ready the calibrated heat source.

After powering it up, let the heat source sit in the shade and out of the wind for at least 8 minutes to stabilize. The heat source has reached operating temperature and stabilized when the temperature meter needle remains centered.

- 2 Stroke both gating transducers four times with a metal wrench, starting with TO1.
- 3 Stroke TO1 one more time with a metal wrench.
- 4 With the power cord to the front of the scanner, place the calibrated heat source on the bearing scanner that is on the rail with the gating transducers.



- 5 Stroke TO2 with a metal wrench.

You should hear the real-time defect message from the radio.

- 6 Wait for the system to time out, which normally takes about 10 seconds.

You should hear an end-of-train message with one Hotbox alarm.

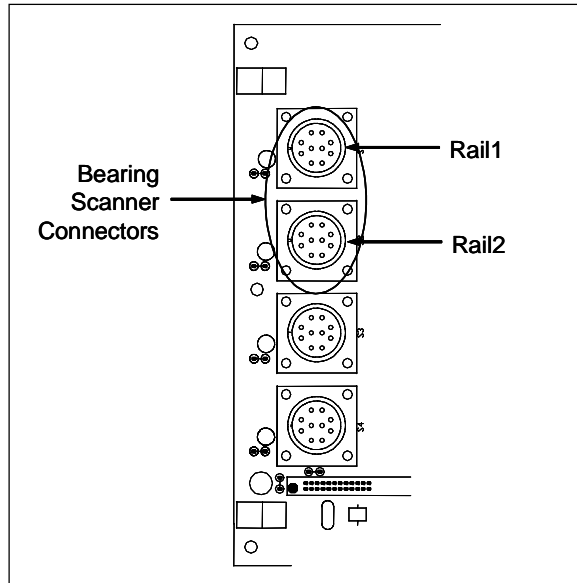
- 7 Listen to be sure that the Hotbox alarm was announced on the correct side and on axle five.

If you don't hear anything, no alarm-level heat was recorded. No measurable heat from a bearing scanner may be due to loose connections, a scanner not being connected on the Scanner Interface board, a defective shutter motor in the scanner, or a damaged scanner.

- 8 If you don't hear a Hotbox alarm being announced, fix this problem before proceeding.

- 9 If the Hotbox alarm is announced for the wrong side, switch the bearing scanner connections on the Scanner Interface board.

Plug the connector from the bearing scanner on rail1 (that is, from the north or east rail) into the first (top) box connector on the Scanner Interface board. Plug the connector from the bearing scanner on rail2 (that is, from the south or west rail) into the second box connector on the Scanner Interface board.



- 10 Repeat the test, this time placing the calibrated heat source on the bearing scanner on the opposite rail.
- 11 Verify the results as before.
If the results are correct, your system should function properly when scanning the bearings of real trains.
- 12 Remove the calibrated heat source.
- 13 If this is a double-track site, repeat steps 1 through 12 for the other track (that is, for the other SmartScanIS).
- 14 Store the calibrated heat source and its cable in the bungalow.

9.12 Checking Communication with Harriman Dispatch Center

To check communication with the Harriman Dispatch Center:

- 1 Using the serial interface, display the Main menu.
Chapter 11 - Serial Interface tells how to display the Main menu.
- 2 Select **Setup Menu**.
- 3 At the password prompt, type **uptest**

4 Select **System Functions**.

The System Functions menu appears.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
System Functions
-----
      .
      .
      .

I) Clear Event Log
J) Send JC Message
K) Send JM Message
L) Send JP Message
M) Send JS Message
N) Real-Time Diagnostics
X) Exit Menu
```

- 5 If the Harriman Dispatch Center requests that the site send a Continuous Carrier signal for 15 seconds, select **Send JC Message**.
- 6 If the Harriman Dispatch Center requests that the site send a Continuous Mark signal for 15 seconds, select **Send JM Message**.
- 7 If the Harriman Dispatch Center requests that the site send a Mark-Space pattern for 15 seconds, select **Send JP Message**.
- 8 If the Harriman Dispatch Center requests that the site send a Continuous Space signal for 15 seconds, select **Send JS Message**.
- 9 To return to the Setup menu, type **x**
- 10 To return to the Main menu, type **x**
- 11 To exit the serial interface and return the system to normal operation, type **x**
- 12 If this is a double-track site, repeat steps 1 through 11 for the other track (that is, for the other SmartScanIS).

9.13 Checking a Train Summary Report

To check a Train Summary report:

- 1 Be sure that at least three trains have passed over the site.

You aren't done (that is, you have not placed the system in service) until all the steps below are done.

2 Produce a Train Summary report.

Chapter 12 - Producing Reports tells how to produce this report. From the Main menu, you would select **Train Summary**.

STC Integrated Detector System, Milepost-0501.2, Track:Single 05/31/2013 9:35 Main Menu ----- A) Train Summary B) Train Detail C) Exception Summary . . .
--

The Train Summary report lists all trains currently stored in the Trains directory. A line of information is shown for each train entry. The report is divided into a header section and a detail section. The header section contains general information about the site. The detail section contains summary information on each train that passed the site.

3 On the Train Summary report, check the **Avg Bearing** heading.

Under this heading are two columns, one for each rail, containing the average temperature read by the bearing scanners. If track orientation is east and west, rails are north and south. If track orientation is north and south, rails are east and west.

4 If the columns aren't within four degrees, realign and recalibrate the bearing scanners.

Chapter 7 - Adjusting the Track Components tells how to align the scanners.
Appendix E- Calibration of Scanners tells how to calibrate the scanners.

5 If you don't have wheel scanners installed at your site, go to step 8.

6 On the Train Summary report, check the **Avg Wheel** heading.

This heading appears only when Hotwheel alarm reporting is enabled. Under it are two columns, one for each rail, containing the average temperature read by the wheel scanners. If track orientation is east and west, rails are north and south. If track orientation is north and south, rails are east and west.

7 If the columns aren't within four degrees, realign and recalibrate the wheel scanners.

Chapter 7 - Adjusting the Track Components tells how to align the scanners.
Appendix E- Calibration of Scanners tells how to calibrate the scanners.

8 On the Train Summary report, check the **Axles** column.

Axle count should be an even number. Odd-numbered axle counts are possible indications of gating transducer problems.

9 If there is an even axle count and the values under "Axles," "T01," and "TO2" are the same, skip the remaining steps.

If things are working correctly, all three values for a given train should be equal.

- 10 At trackside, check all transducer-mounting bolts on all tracks to make sure that all transducers are snug against the rail.

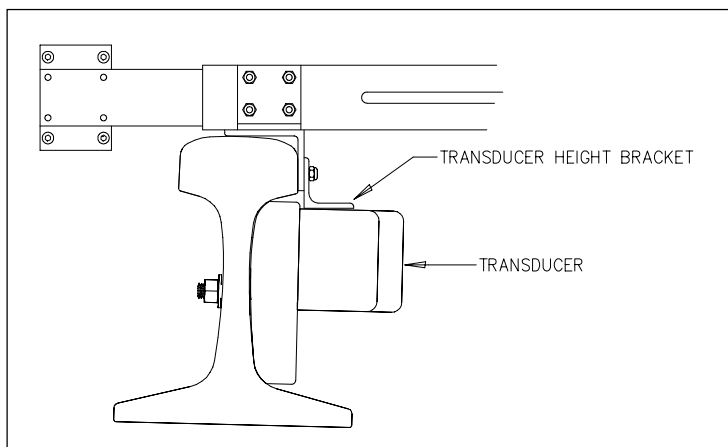
Four bolts are needed to hold the transducer in place. Two square-head bolts go through the mounting plate and transducer body. Two hex-head bolts go through the mounting plate and rail. If any of these bolts are sheared or missing, they must be replaced with the correct replacement bolt. Also, if any washers or nuts are missing, they must be replaced.

- 11 If all transducers aren't snug against the rail, fix this problem before proceeding.

Each installed transducer body should be 1-9/16 inches (3.97 centimeters) below the top of the rail and parallel to it. Checking for these characteristics should be done with the transducer height bracket on the bottom of the alignment fixture.

- 12 Place the alignment fixture across both rails, centered over each transducer in turn.

- 13 Check if each transducer body just touches the bracket.



The fixture should be snug against the top and gauge of both rails. This may be impossible if the transducer body is less than 1-9/16 inches (3.97 centimeters) below the top of the rail or if the transducer body is not parallel to the top of the rail.

- 14 If a transducer body doesn't just touch the bracket:

- a Loosen the nuts holding the transducer body to its mounting plate.
- b By sliding it up and down, adjust the transducer body to the proper height.
- c Tighten each hex nut with a 9/16-inch torque wrench to a **torque of 12 to 15 foot-pounds (16.3 to 20.3 newton-meters)**.

Don't exceed a torque of 15 foot-pounds (20.3 newton-meters). Doing so can weaken or break a bolt, requiring the bolt to be replaced.

- d Wait until three more trains have passed over the site and then return to step 1.

- 15 If a transducer body just touches the bracket, call STC for help in fixing the problem that caused the values under "Axles," "T01," and "TO2" to be uneven.

Chapter 10

Defect Detection

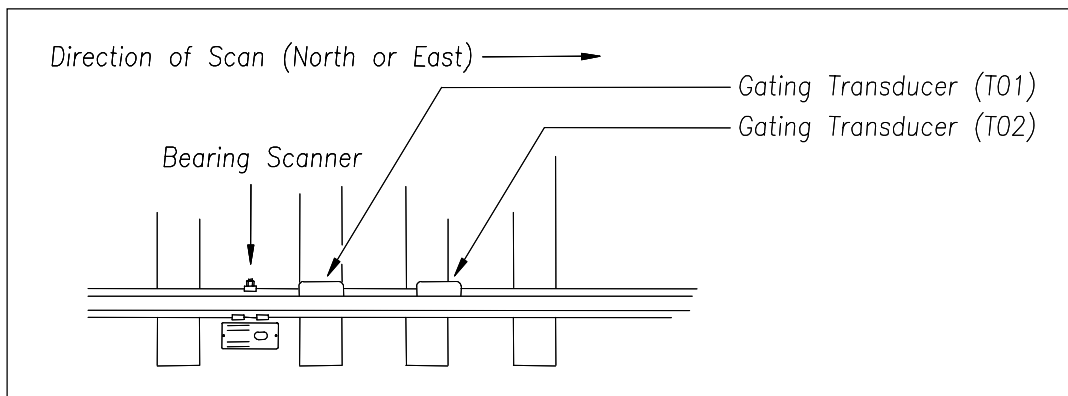
This chapter describes the Exception Alarms (aka Defect Alarms and Train Alarms) and how they are detected. Miscellaneous train scanning features are also covered.

10.1 System Activation

System activation is the process used to detect train presence and to prepare for train scanning. It is during the scanning process that the system checks for defects.

The SmartScanIS is equipped with one of two primary means of train arrival detection, which are the track circuit or the advance transducers. In case of a failure in the primary detection method, the gating transducers act as a backup to detect train arrival. Once the system senses a train's presence, it enters scanning mode. In other words, the system has activated. It then opens the scanner's shutters and disables their heaters. It then waits for further evidence of a train at the site in the form of gating transducer activity.

Once the system is active, it reads pulses from the two rail-mounted gating transducers, which are designated TO1 and TO2. On the rail nearest the bungalow (aka wayside enclosure), these transducers are mounted near and to the north or east of the bearing scanners. **TO1** is the gating transducer closest to the bearing scanner. **TO2** is the one farthest from the bearing scanner.



The signals from these gating transducers indicate to the system that passing wheels are in view of the scanners. Furthermore, the speed of the train is determined by using the known distance between TO1 and TO2 versus the time required for a given wheel to pass over them.

Under normal circumstances, four axles must pass over the gating transducers for the system to consider the event a valid train. This prevents maintenance equipment from generating alarms and causing unwanted voice messages on the road channel. An exception occurs when a catastrophic transducer failure combines with an auxiliary alarm. If the detector, before recording four axles, records more than ten spikes from a gating transducer and detects an auxiliary alarm, it records a train of less than four axles. The detector treats these trains like any other, making all of the applicable announcements, storing them in long-term storage, and transmitting them to Harriman.

10.2 System Deactivation

System deactivation is the process used to detect the moment that the train exits the site. This happens in one of two ways, which is dependent upon whether the track circuit or one of the transducers has activated the system.

If the track circuit activated the system, the system waits for the track-circuit signal to be absent for ten seconds before deactivating. Likewise, if a transducer activates the system, the system waits for ten seconds of inactivity from the gating transducers before deactivating.

10.3 Speed Calculation

A train's arrival speed and its exit speed are calculated. The exit speed is the speed shown on generated reports. Union Pacific's Central Reporting System uses the arrival and exit speeds. The arrival speed is calculated based on the on times of the first eight axles. The exit speed is calculated based on the on times of the last eight axles. Calculated speeds over 99 mph (159 kph) are reported as 99 mph. If a train has fewer than eight axles, its speed is reported as 0 mph.

A train is called "slow" if its exit speed is 6 mph (9.7 kph). It is called "very slow" if its exit speed is less than 6 mph. Trains having an exit speed of 6 mph (9.7 kph) or less generate an Integrity Failure announcement. They also display an Integrity Failure message and either a "Slow Train" or a "Very Slow Train" message, under the System Alarms heading on the Train Detail and Exception Detail reports. However, if a Dragging-Equipment alarm is detected on a Slow or Very Slow train, no Integrity Failure announcement is made, and neither the "Slow Train" nor "Very Slow Train" message appears under the System Alarms heading. Messages generated by any additional Integrity Failures found on such a train will still appear in the System Alarms section of the report header.

The report fragment below, from the header section of a Train Detail report, shows the location of the "Slow Train" and "Very Slow Train" messages. For a given train, only one of these conditions will be flagged and appear on the report. A train won't be both slow and very slow.

Southern Technologies Corporation	
Integrated Detector System	
Union Pacific Railroad	
TRAIN DETAIL	
=====	
System Alarms	•

Slow Train	
Very Slow Train	•

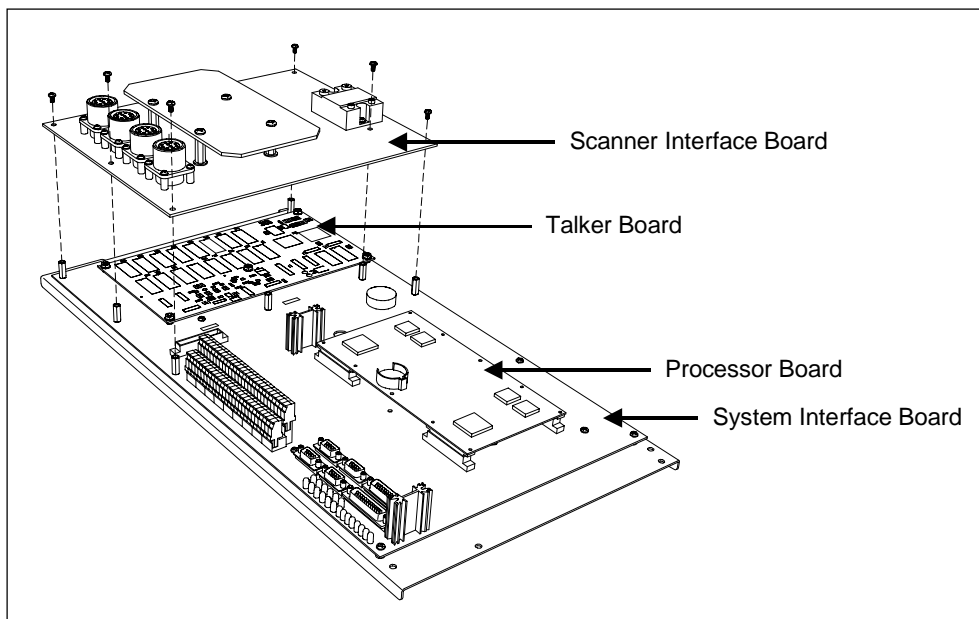
10.4 Train Direction

Train direction is based on whether TO1 or TO2 generated the first gating transducer pulse.

10.5 Transducer Pulse Processing

As a wheel enters the sensing range of a transducer, the transducer should respond with a positive-going pulse. The polarization of the two wires from the transducer determines if this pulse is positive or negative.

On the System Interface board (in the Controller module), the transducer signals undergo RF filtering and amplification with a gain of 30. For validation, the amplified signals are fed into comparators, which create 5-VDC pulses lasting the period of time that the amplified signals remain above 620 millivolts. Processor-A (on the Processor board) receives these 5-VDC pulses through ports PA0 (TO1) and PA1 (TO2).



A firmware-controlled feature of the comparator circuit allows adjustment of the threshold voltage based on the speed of the train. Trains traveling less than 20 mph (32 kph) use the 620-millivolt threshold setting for maximum sensitivity. However, faster trains will cause the transducers to generate a higher signal voltage, which allows the system to increase the threshold voltage. This improves the signal-to-noise ratio resulting in better signal validation.

Processor-A (on the Processor board) internally generates interrupts on the positive-going and negative-going edges of each transducer pulse coming from the comparator. The positive edge of each comparator pulse starts a timer. The timer stops with the detection of a negative-going edge. The width of each pulse is a determining factor of signal validity. The **Minimum Transducer Pulse Width option** on the Equipment submenu lets you set the minimum pulse width. Five-milliseconds is the default. Rejected pulses don't increment the transducer counters.

In normal operation, the gating transducers fire in sequence, first one then the other. With 24-inch (61-centimeter) gating-transducer spacing, a wheel passes over both gating transducers before the next wheel passes over a gating transducer. Therefore, two consecutive pulses on the same gating transducer aren't physically possible. However, in the unlikely event that a gating transducer is ever caused to fire by another source, such as electrical interference from a locomotive's traction motor, a spike-counter for the gating transducer that misfired will be incremented by one. To increment the axle counter, one pulse from each gating transducer must occur in sequence.

10.6 Axle Scanning

When the train first enters the site, the SmartScanIS begins reading the scanners for a heat signal when the wheel is at the center of the first gating transducer. Thereafter, it starts reading the scanners 20 inches (50.8 centimeters) before the center of the first gating transducer. (See **Appendix G - Predictive Gate Scanning** for more information about this 20-inch (50.8-centimeter) pre-gate scanning.) The system continues reading until the wheel is at the center of the second gating transducer. This is the period that the axle is in view of the scanner. A negative-going edge of a transducer signal is an indication that the wheel is in the center of that transducer.

The firmware uses Dynamic Scan Rate sampling between the centers of the two transducers (that is, between the gate), which means that heat readings taken every 1/2 inch (1.27 centimeters) of wheel movement are used to detect alarms, regardless of the speed of the train. As a result, the system takes 48 evenly spaced samples as the wheel rolls through the 24-inch (61-centimeter) detection zone that is established by the distance between the gating transducers.

10.7 Hot Bearing Alarms

The SmartScanIS checks for hot bearings during the scanning process. The four types of hot bearing alarms (aka Hotbox alarms) are:

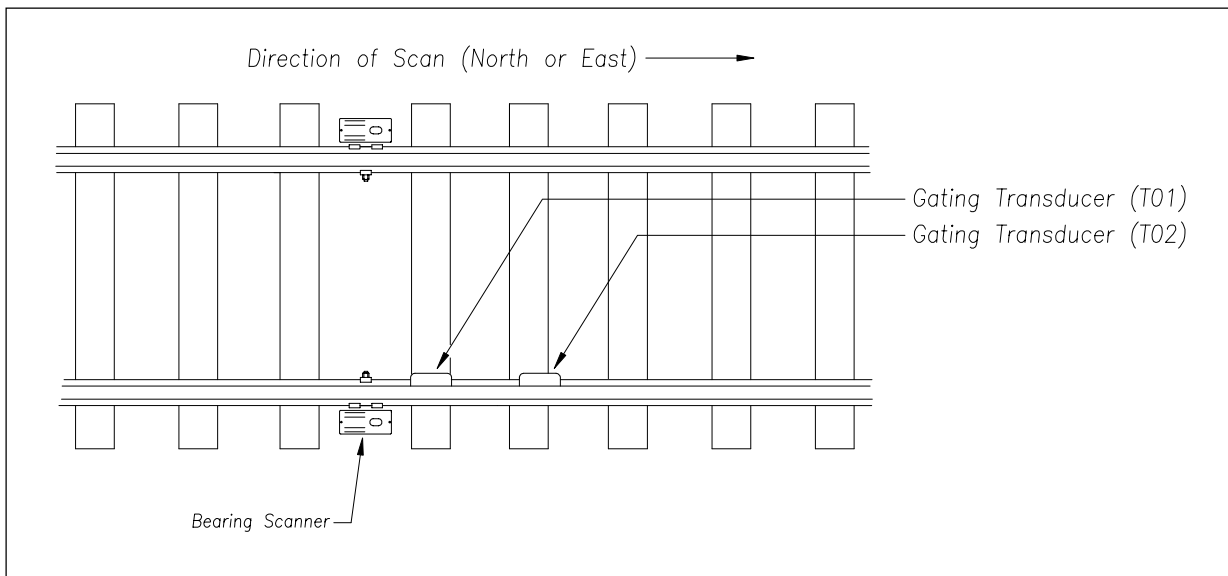
- **Absolute.** To trigger an Absolute alarm, a bearing temperature must exceed the limit that was established using the **Absolute option** on the Alarm Limits submenu. This alarm limit is an offset, in degrees Fahrenheit, above the ambient temperature.
- **Differential.** To trigger a Differential alarm, a bearing temperature must exceed the opposite side bearing temperature of the same axle by a differential amount established using the **Differential option** on the Alarm Limits submenu. A Differential alarm doesn't appear on an axle that already contains an Absolute alarm.
- **Pyrometer Saturation.** To trigger a Pyrometer Saturation alarm, an interaxle bearing temperature must exceed the limit that was established using the **Absolute option** on the Alarm Limits submenu. If an Absolute alarm or a Differential alarm has already been triggered for the axle, a Pyrometer Saturation alarm isn't generated. For more details on the Pyrometer Saturation alarm, see **Appendix G - Predictive Gate Scanning**.
- **Carside Slope.** To trigger a Carside Slope alarm, a bearing temperature must meet or exceed a calculated alarm level and a minimum heat value. The bearing temperature must also be at least twice the opposite bearing's temperature. If an Absolute alarm or a Differential alarm has already been triggered for the axle, a Carside Slope alarm isn't generated. The minimum heat value is established using the **Carside Minimum option**.

Absolute alarms, Differential alarms, and Pyrometer Saturation alarms are always checked for by the system. In order for Carside Slope alarms to be processed, they must be enabled using the **Carside Slope option** on the Equipment submenu.

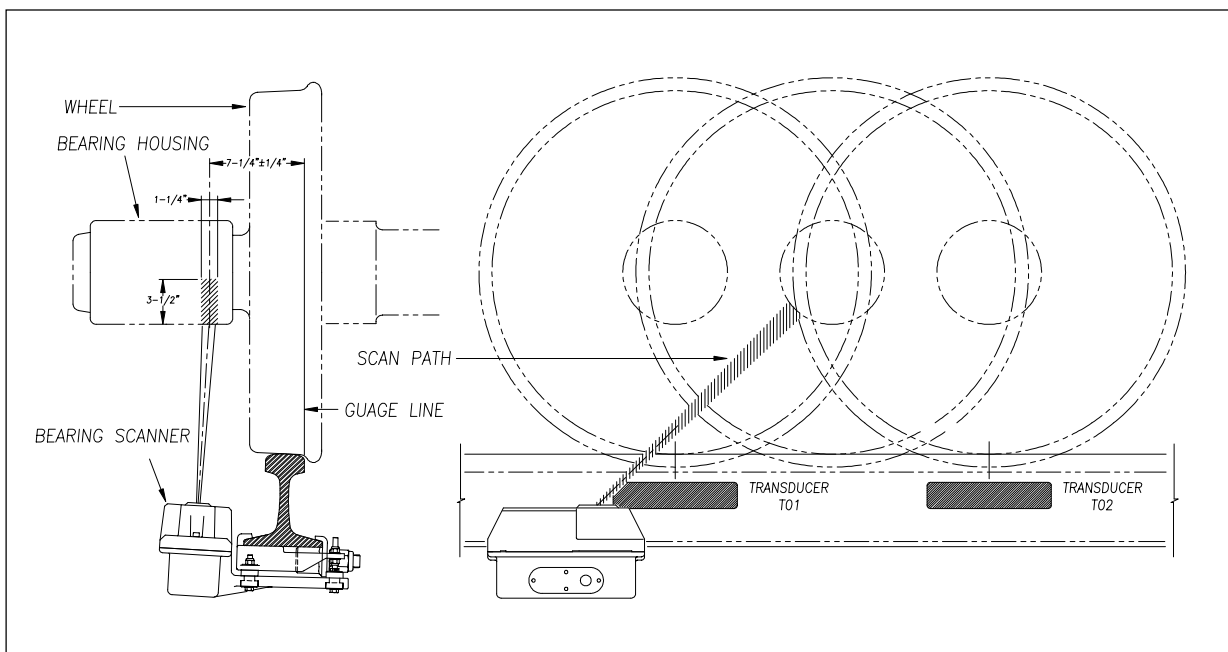
The SmartScanIS detects and records every Hotbox alarm that occurs. However, it is physically impossible to have more than one Hotbox alarm per axle per rail.

10.7.1 Bearing Scan Process

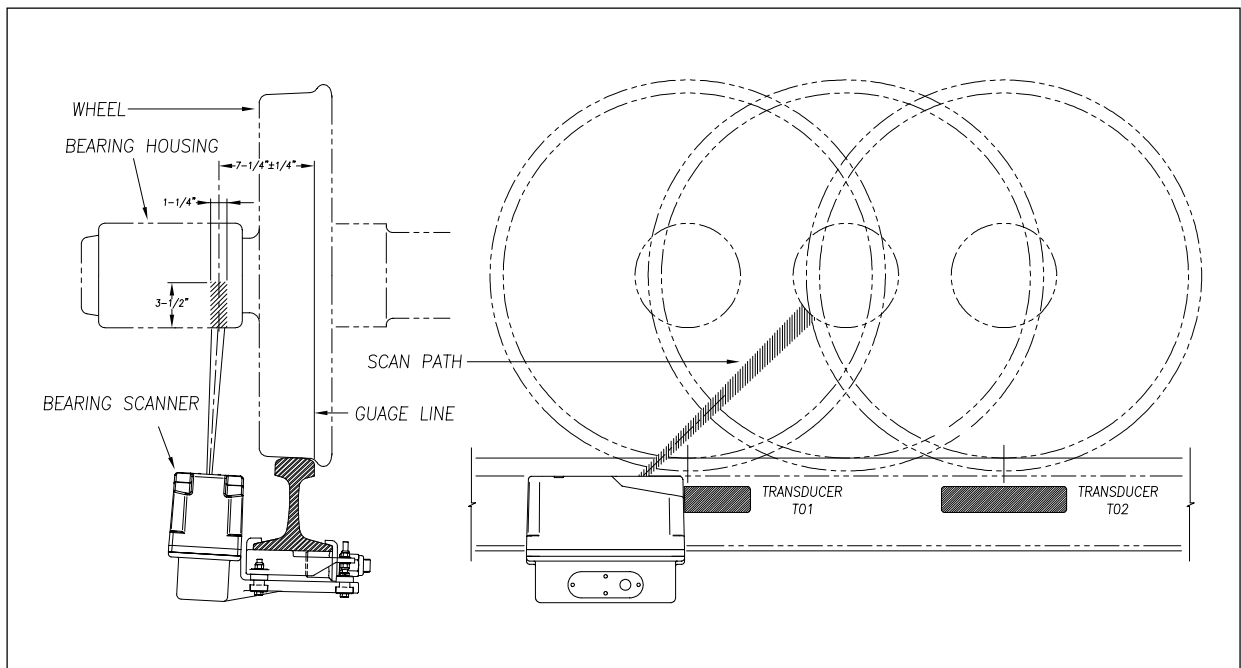
Bearing scanners are mounted in the center of the crib of two ties spaced at least 14 inches (35.6 centimeters) apart. Both bearing scanners are mounted in the crib immediately ahead of the gating transducers (that is, in the crib immediately to the south or west of the gating transducers). They are mounted directly opposite each other, one on each rail of the track. The hole on the top of the scanner covers faces north or east.



The **Type II** bearing scanners are aligned to scan the bottom 3.5 inches (8.9 centimeters) of the bearing housing, about 7.25 inches (18.4 centimeters) from the gauge line.



The **Type III** bearing scanners are aligned to scan the bottom 3.5 inches (8.9 centimeters) of the bearing housing, about 7.25 inches (18.4 centimeters) from the gauge line.



Bearing temperatures are sampled for a short period before the gate opens to support detection of Pyrometer Saturation alarms, and while the gate is open

10.7.2 Referencing System

Pyrometers measure rapid changes in infrared energy emitted from objects passing through their field of view. The rail-mounted scanners are aligned to take advantage of this characteristic.

When no axle is present between the gating transducers, the scanner typically sees only the undersides of the cars passing over the site. The undersides of the cars are at or near ambient temperature, thus establishing the reference from which the elevated temperatures of bearings are measured. The pyrometers normalize during this time, producing a zero-level signal.

Occasionally, the scanners are exposed to infrared emissions that are colder than the underside of the cars. Typically, this occurs in the gaps between cars when the scanners may reference on clear sky. This could present an erroneous reference if a bearing was scanned immediately following a sky shot, resulting in an abnormally high reading for the bearing. The pyrometers have internal circuitry to prevent the reference from shifting below the established zero reference.

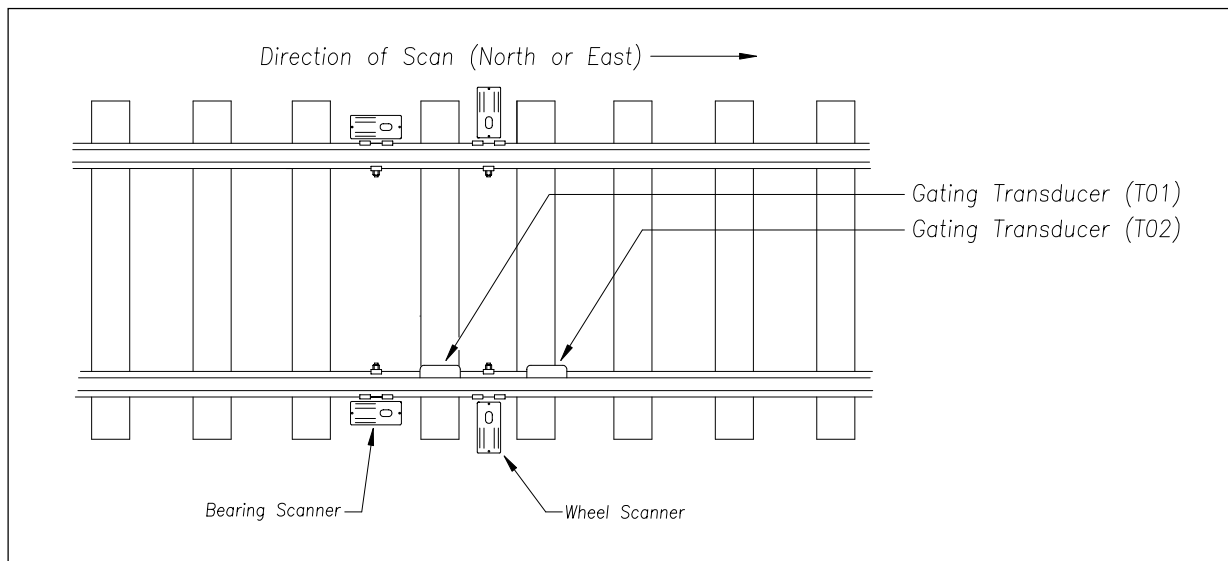
When a bearing passes through the field of view of the scanner, a rapid change in temperature is presented to the internal lithium tantalite crystal. This causes the signal level from the pyrometer to increase proportionally to the amount of exposed infrared energy. When an axle is between the gating transducers, the pyrometer signal is sampled at every 1/2 inch (1.27 centimeters) of wheel movement for a total of 48 samples, and the maximum signal level is stored. This signal level, measured in volts, is converted to a digital value and expressed in degrees Fahrenheit above ambient temperature. This value is the basis for the alarm analysis done by the system.

10.7.3 Pyrometer Linearity

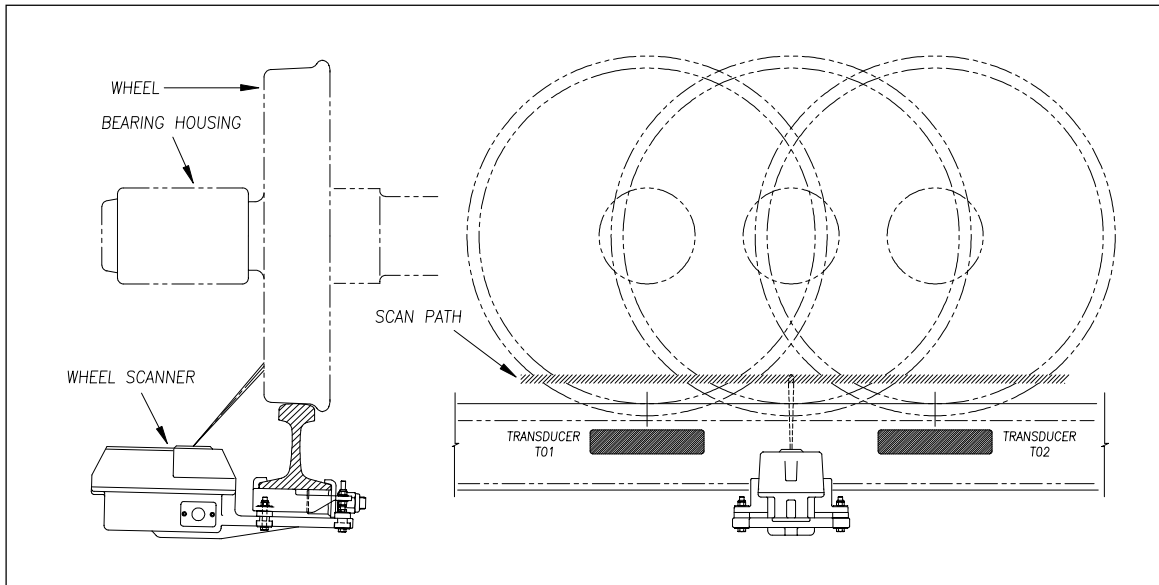
The output of the pyrometers is linear across most of the operating speed range of the system. However, the output of the pyrometers is nonlinear at either end of the operating speed range. To compensate for this nonlinear output, the firmware applies a correction factor to the sampled heat value. The correction factor applied to each bearing sample is based on the speed of the bearing (axle's on time) as it passed through the gate and on the actual value read by the pyrometer. The correction factor is derived from a table that is keyed by the axle's on time and heat value. Due to the fast nature of this lookup table, linearity compensation is done in real-time so that detected alarms reflect the heat value after the linearity step has been done.

10.8 Hotwheel Alarms

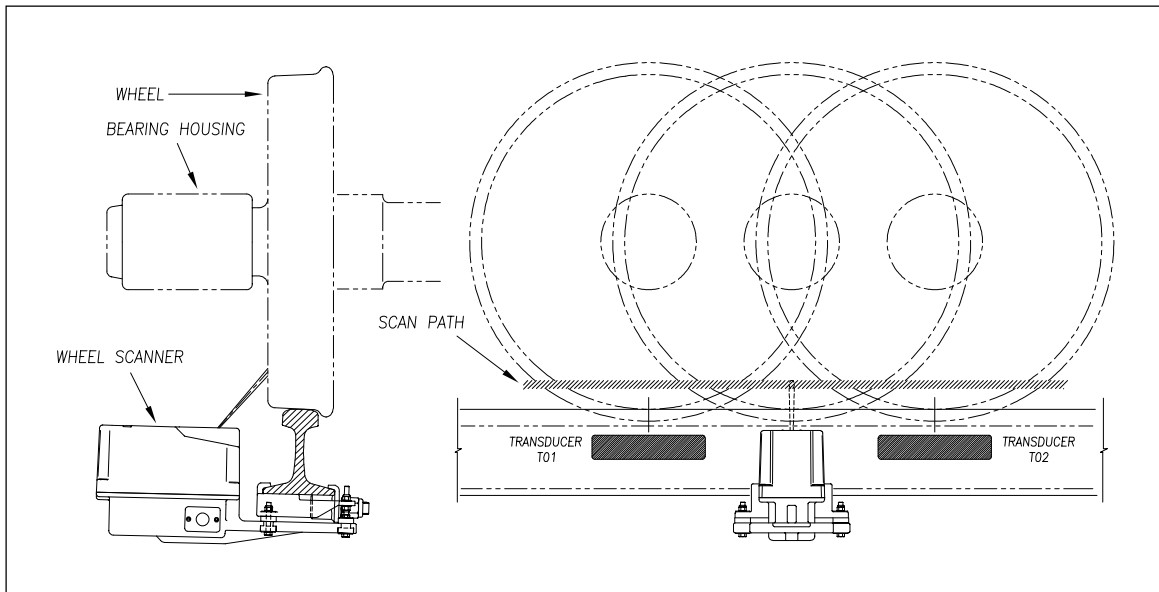
When used, wheel scanners are mounted in the center of the crib of two ties spaced at least 14 inches (35.6 centimeters) apart. Both wheel scanners are mounted in the crib between the two gating transducers. They are mounted directly opposite each other, one on each rail of the track. The hole on the top of the scanner covers faces the center of the track.



The **Type II** wheel scanners are aligned to scan about 4 inches (10.2 centimeters) above the rail.



The **Type III** wheel scanners are aligned to scan about 4 inches (10.2 centimeters) above the rail.



The SmartScanIS checks for hotwheels during the scanning process. Scan timing is controlled the same as for the bearing scanners.

Wheel scanning alarms are limited to absolute only. To trigger a Hotwheel alarm, wheel scanners must be properly installed, hotwheel detection must be enabled, and a wheel temperature must exceed the limit that was established using the **Hotwheel option** on the Alarm Limits submenu. This alarm limit is an offset, in degrees Fahrenheit, above the ambient temperature. Hotwheel detection is enabled/disabled using the **Hotwheel option** on the Equipment submenu. When enabled, the SmartScanIS detects and records every Hotwheel alarm that occurs.

10.9 Auxiliary Alarms

The SmartScanIS can support input from as many as four external alarm devices. Any device that provides an open relay contact upon alarm detection can be supported by the system.

Auxiliary alarms supported by the SmartScanIS are:

- **Dragging Equipment.** To trigger a Dragging-Equipment alarm, a dragging-equipment detector must be properly installed, dragging-equipment detection must be enabled, and the SmartScanIS must sense an open relay contact from the dragging-equipment detector. Dragging-equipment detection is enabled/disabled using the **Dragger option** on the Equipment submenu. When enabled, the SmartScanIS detects and records every Dragging-Equipment alarm that occurs on a given train.

When the SmartScanIS finds a pretrain Dragging-Equipment alarm, the system flags the pretrain condition as an integrity failure, disables dragging-equipment scanning for the remainder of the train, and doesn't assign a dragging-equipment condition to any of the axles.

- **High Load** (aka oversized load). To trigger a High-Load alarm, a high-load detector must be properly installed, high-load detection must be enabled, and the SmartScanIS must sense an open relay contact from the high-load detector. High-load detection is enabled/disabled using the **High-Load option** on the Equipment submenu.
- The firmware's high-load logic is configured for use with a light-beam or trip-wire type of high-load detector. Since Union Pacific uses the trip-wire type of high-load detector, their devices generate the proper alarm signal when something breaks the connected wire. Because a wire can only break once, the firmware only records one High-Load alarm per train, regardless of the high-load status.

When the SmartScanIS finds a pretrain High-Load alarm, the system flags the pretrain condition as an integrity failure, disables high-load scanning for the remainder of the train, and doesn't assign a high-load condition to any of the axles.

- **Wide Load** (aka shifted load). To trigger a Wide-Load alarm, two wide-load detectors (one on each side of the track) must be properly installed, wide-load detection must be enabled, and the SmartScanIS must sense an open relay contact from either of the wide-load detectors. Wide-load detection is enabled/disabled using the **Wide-Load option** on the Equipment submenu.

The firmware's wide-load logic is configured for use with a light-beam or trip-wire type of wide-load detector. Since Union Pacific uses the trip-wire type of wide-load detector, their devices generate the proper alarm signal when something breaks the connected wire. Because a wire can only break once, the firmware only records one Wide-Load alarm per train, regardless of the wide-load status.

When the SmartScanIS finds a pretrain Wide-Load alarm, the system flags the pretrain condition as an integrity failure, disables wide-load scanning for the remainder of the train, and doesn't assign a wide-load condition to any of the axles.

10.10 Cold Wheel Alarms

The Cold Wheel alarm indicates that the specified minimum acceptable wheel temperature wasn't reached on a given axle.

Cold Wheel alarm detection is enabled/disabled using the **Cold Wheel option** on the Equipment submenu. The Cold Wheel function is intended to be used where trains are expected to be braking as they approach a site and to identify axles whose brakes have failed.

The **Cold Wheel option** on the Alarm Limits submenu is used to specify the minimum acceptable wheel temperature. A wheel found with temperature less than this limit will be flagged with a Cold Wheel alarm. Alarms of this type will not produce a voice message, but will be included in the data sent to the Harriman Dispatch Center.

10.11 Sliding Wheel Alarms

The Sliding Wheel alarm indicates that a combination of very low bearing and wheel temperatures were found on a given axle in conjunction with high wheel temperatures recorded on the remaining axles of a car. This condition could mean that the wheels on the affected axle were sliding, rather than rolling, on the rail.

The Sliding Wheel alarm is both an Exception Alarm and a System Alarm. Sliding Wheel alarm detection is enabled/disabled using the **Sliding Wheel option** on the Equipment submenu. The Sliding Wheel function requires that both bearing and wheel scanners be installed and in operation at a site. The Sliding Wheel detection algorithm is intended to be used where trains travel down a long grade before reaching the site. The algorithm calculates average wheel and bearing heat per train side and per car and attempts to isolate those axles that have extremely low bearing and wheel temperatures in comparison.

The **Sliding Wheel Ratio option** on the Alarm Limits submenu is used to specify the ratio that is applied when evaluating wheel and bearing temperatures to identify sliding wheels. This ratio is applied to calculated average temperatures to establish minimum acceptable wheel and bearing temperatures that are in turn used to identify sliding wheels.

Chapter 11

Serial Interface

The serial interface allows **on-site** and **off-site** communication with the system. Using this interface is the only way to view reports and to change system parameters. If your site doesn't have telephone service, you cannot communicate with the system remotely (that is, **off-site**).

To use the interface **locally**, you need:

- A computer
- Communications software, which is installed on the computer
- A cable from the computer to a communications port on the System Interface board

To use the interface **remotely**, you need:

- A computer
- Communications software, which is installed on the computer
- A modem, which is connected to the computer
- A nonswitched analog telephone line, which is connected to the computer's modem
- Another modem, which is connected to a communications port on the System Interface board
- Another nonswitched analog telephone line, which is connected to the modem in the SmartScanIS enclosure

This chapter describes the serial interface for the SmartScanIS. It covers how to enter or change the system parameters. The next chapter tells how to use the serial interface to produce reports.

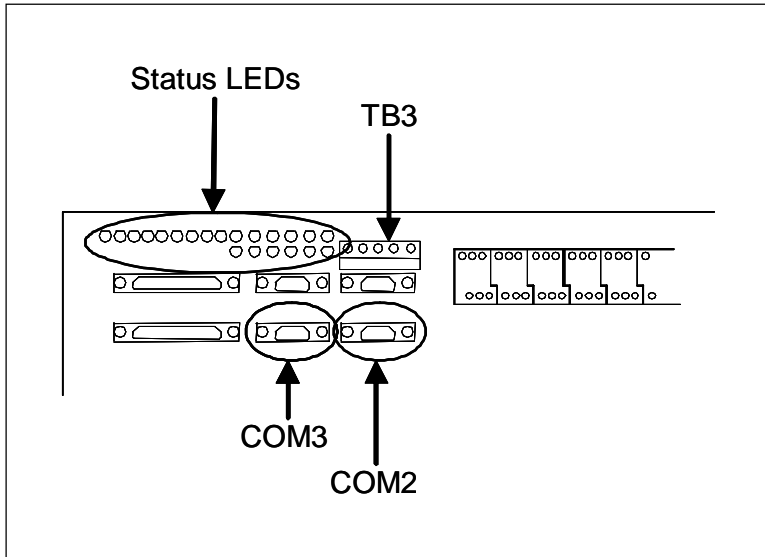
It is necessary to go through a complete setup the first time a SmartScanIS is installed at a new site. (If this is a double-track site, you need to do this for the other SmartScanIS.) After that, the Processor board (in the Controller module) retains the setup information. During a power outage, no setup information is lost if the battery on the Processor board is operative. If this battery isn't operative during the power outage, the only setup information that is lost is the date and time.

11.1 Serial Ports; RS232 Devices

There are two serial ports on the System Interface board that connect the SmartScanIS to RS232 devices. They are labeled P8 and P10 on the board. P10 is COM2 and P8 is COM3.

COM1 functions as the conduit for communications with RS485 devices and is configured for this protocol when systems are shipped. If anything is connected to this port, you can't just unplug it to free up a spot for your laptop. Other modifications have to be made to the system to let COM1 connect to RS232 devices.

The figure below shows the location of COM2 and COM3.



The table below lists the normal functions for which each of these COM ports is used.

Port	Use
COM2	Union Pacific's Polling System
COM3	Laptop Computer

The table below lists what is normally plugged into each of these COM ports.

Type of Polling System	COM2	COM3
No Polling System	<i>nothing</i>	Modem
RFL Polling System	RFL	Modem
Dialup Polling System	Modem	<i>nothing</i>

COM2 is dedicated to Union Pacific's Polling System. If your site communicates with the Harriman Dispatch Center over the RFL network, you can't disconnect that link without first obtaining permission from the Harriman Dispatch Center. If your site uses a modem to communicate with the Harriman Dispatch Center, COM3 is unused and available for your laptop.

COM3 is the only port that displays anything as the system boots up. Consequently, you must use it if you want to see what's happening following a power-up or reset. Because COM1 and COM2 already have functions allocated to them, **STC recommends COM3 as the only serial port for use with the serial interface.**

11.2 Main Menu

To display the Main menu:

- 1 If **on-site**:
 - a If COM3 has nothing plugged in it, plug your computer into it.
 - b If COM3 has something plugged into it, unplug what is connected to COM3 and plug your computer into it.
- 2 If **off-site**, plug your computer into a modem that is plugged into a nonswitched analog telephone line.
- 3 Turn on your computer.
- 4 Be sure that your computer has installed communications software, that it is set to use full-duplex, and that the baud rate is set correctly.

If **on-site**, the baud rate of your computer must match the baud rate of the selected serial port because they are in direct, one-to-one communication with one another. For example, the baud rate for COM3 was set to 9600 at the factory. If the customer changes this baud rate, your computer must be set to the changed value.

For **off-site** connections, the baud rate of your computer doesn't have to match the baud rate of the selected serial port because the telephone network between the two modems breaks this direct physical connection. In an **off-site** setup, your computer and its modem have a direct connection, the two modems have a direct connection, and the detector and its modem have a direct connection. Each of these individual direct connections must have matching baud rates. However, the different connection "types" (user computer to modem, modem to modem, detector to modem) don't have to share a common baud rate (although it's simpler if they do).

Use your communications software to open a LOG file and capture the whole session to the file. When your session is complete, you may then view what you have done with an editor, print it with a printer, or store it for later retrieval.

- 5 On your computer, open a LOG file.

6 If off-site:

- a** From your computer, dial and connect to the modem at the site to which you want to communicate.
- b** Wait for the "connect" message from your modem.

7 To get the serial interface to come up, press **[Esc]**.

The Main menu appears.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
Main Menu
-----
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
F) Last Train
G) Range of Trains
H) Event Log
I) Setup Menu
J) T94 Train Detail
X) Exit Menu
```

At the above prompt, you can:

- Produce one of the listed reports by selecting the appropriate option. This is explained in the next chapter.
- Access the **Setup Menu**. This is explained below. It is from the Setup menu that you can set system parameters.

8 When done, close the LOG file.

9 To exit the serial interface and return the SmartScanIS to normal operation, type **x**

When a session ends, if a modem was used, the system sends various commands to the modem to prepare it for future use. If at any time during the disconnect procedure, lines such as "+++ATH0" appear on your screen, these are merely commands preparing the modem for further use. They shouldn't be construed as anything that is meant for the user.

10 If **on-site** and if you unplugged a device from COM3, plug the device back in after unplugging your computer.

11.3 Setup Menu

To display the Setup menu:

- 1 Be sure that the Main menu is displayed.
- 2 Select **Setup Menu**.

This prompt appears.

```
Enter Password:
```

- 3 At the password prompt, type **uptest**

The password isn't case-sensitive. Entering an incorrect password produces the "Password Incorrect!" message and returns to the Main menu. Pressing **[Esc]** or allowing the entry routine to time out (one minute) returns to the Main menu.

Entering the correct password accesses the Setup menu. After entering the correct password, a menu and prompt like this one appears. To access any of the Setup menu options, type the letter that corresponds to the desired menu option.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
Setup Menu
-----
A) Set Date and Time
B) Milepost
C) Track Number
D) Alarm Limits
E) Equipment
F) Messages
G) -For Future Use-
H) System Functions
I) Polling System
J) Serial Ports
K) Amtech Reader Parameters
L) Modem Setup
X) Exit Menu
```

At any prompt, a timeout mechanism is in place to prevent the system from remaining in that state indefinitely. When a timeout occurs, the serial interface regresses to the previous menu. For example, if a timeout occurs in the Equipment submenu, the system reverts to the Setup menu. If this menu times out, the system reverts to the Main menu. If this menu times out, the system disconnects the modem connection and resumes normal operation. At the Main menu, the timeout is set for five minutes. For all other prompts, the system uses several different timeout values.

- 4 To return to the Main menu, type **x**

Changes to the system parameters aren't reflected until after you have logged out of the serial interface.

11.3.1 Date and Time

To set or change the **date** setting, the **time** setting, or both settings:

- 1 Be sure that the Setup menu is displayed.

The top part of the Setup menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
Setup Menu
-----
A) Set Date and Time
B) Milepost
C) Track Number
    .
    .
    .
```

- 2 Select **Set Date and Time**.

A prompt like this appears.

```
Current date is: 05/31/2013
Enter new date:
```

Dates are in **mm/dd/yyyy** format, where **mm** is month, **dd** is day, and **yyyy** is year. You only type the last two digits of the year. The system automatically inserts the slashes and the first two digits of the year. For days, for months, or for the last two digits of years from 1 through 9, type leading zeros. Thus, for 31 May 2013, type **053113**.

If you want to keep the displayed date, press **[Enter]**. If you don't want to keep the displayed date, type a new date. If you start typing the date and press **[Enter]** before finishing, you will get this message and will be returned to the Setup menu. You'll also get this message if the typed value is outside the limits of the validity check.

```
Invalid date.  Date and Time will not be changed!
```

- 3 Type a new date or press **[Enter]**.

A prompt like this appears.

```
Current time is: 09:35:00
Enter new time:
```

Time is in 24-hour **hh:mm:ss** format, where 8 a.m. is 08:00:00, noon is 12:00:00, 8 p.m. is 20:00:00, and midnight is 00:00:00. Thus, for 17 seconds past 3:42 p.m., type **154217**. The system automatically inserts the colons. For hours, minutes, and seconds from 0 through 9, type leading zeros.

If you want to keep the displayed time, press **[Enter]**. If you don't want to keep the displayed time, type a new time. If you start typing the time and press **[Enter]** before finishing, the remaining untyped digits will be changed to zeros. For example, if you just type **11** and they press **[Enter]**, the time that is recorded will be 11:00:00.

This message will appear if the typed value is outside the limits of the validity check.

```
Invalid Time. Date and Time will not be changed!
```

- 4 Type a new time or press **[Enter]**.

The Setup menu reappears.

11.3.2 Milepost

To set or change the **milepost** setting:

- 1 Be sure that the Setup menu is displayed.

The top part of the Setup menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
Setup Menu
-----
A) Set Date and Time
B) Milepost
C) Track Number
      .
      .
      .
```

- 2 Select **Milepost**.

A prompt like this appears.

```
Milepost: 0501.2
New Milepost:
```

Milepost is in **nnnn.n** format. If the desired milepost has less than five digits, type leading zeros. If the desired milepost is an integer, type a trailing zero. Thus, for milepost 30, type **00300**. The system automatically inserts the decimal point.

- 3 To keep the displayed milepost, press **[Enter]**.

The Setup menu reappears.

- 4 Type the five-digit milepost.

A prompt like this appears.

```
Milepost: 0501.2
New Milepost: 1234.5
Is this correct ?
```

At this point, type either **y** (yes) or **n** (no).

- 5 If the milepost is incorrect:

- a Type **n**

- b Return to step 4.

- 6 If the milepost is correct, type **y**

The Setup menu reappears.

11.3.3 Track Number

To set or change the **track-number** setting:

- 1 Be sure that the Setup menu is displayed.

The top part of the Setup menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
Setup Menu
-----
```

```
A) Set Date and Time
B) Milepost
C) Track Number
D) Alarm Limits
```

```
•
•
•
```

2 Select Track Number.

A prompt like this appears.

```
Track Direction is North/South, is this OK (Y/N)?
```

At this point, type either **y** (yes) or **n** (no). If North/South is displayed (as it is above), typing **n** changes it to East/West. Typing **y** keeps it North/South. If East/West is displayed, typing **n** changes it to North/South. Typing **y** keeps it East/West.

3 To keep the displayed track direction:

a Type y

This prompt appears.

```
Is this a multi-track site (Y/N)?
```

At this point, type either **y** (yes) or **n** (no).

b Go to step 5.

4 To set or change the **track-direction setting:**

a Type n

The track direction toggles between east/west and north/south.

b If the track direction is incorrect, return to step a.

c If the track direction is correct, type y

This prompt appears.

```
Is this a multi-track site (Y/N)?
```

At this point, type either **y** (yes) or **n** (no).

5 If you have only one track at this site:

a Type n

The Setup menu reappears.

b Skip the remaining steps.

6 If you have two or more tracks at this site, type y

This prompt appears.

```
Enter track number (1-6):
```

7 Type the track number you want.

If you type a digit from 1 through 6, the Setup menu reappears.

If you type an incorrect character, the message below appears followed by the above prompt. If this happens, type a valid track number.

```
Minimum valid value is 1, Maximum valid value is 6
```

11.3.4 Alarm Limits

To set or change one or more of the alarm limits:

- 1 Be sure that the Setup menu is displayed.

The top part of the Setup menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
Setup Menu
-----
A) Set Date and Time
B) Milepost
C) Track Number
D) Alarm Limits
E) Equipment
      .
      .
      .
```

- 2 Select **Alarm Limits**.

A menu and prompt like this appears.

```
Milepost-0501.2, Track:Single
Alarm Limits
-----
A) Absolute..... 180°
B) Differential..... 90°
C) Hot Wheel..... 540°
D) Cold Wheel..... 30°
E) CS Slope..... 0.32
F) CS Minimum..... 37°
G) Cold Journal..... 10°
H) Cold Wheel Scanner..... 30°
I) Cold Trains..... 3
J) Sliding Wheel Ratio..... 50%
K) Max Alarms..... 6

Alarm to change or Esc to quit?
```

This menu option allows you to change the various alarm limits that affect system operations. The current setting for each limit is displayed. To change one of the alarm limit settings, start by typing the letter corresponding to the desired option.

3 To leave the Alarm Limits submenu and return to the Setup menu:

a Press **[Esc]**.

The Setup menu reappears.

b Skip the remaining steps.

4 To set or change the **absolute-alarm limit** :

The number after the word Absolute (on the Alarm Limits submenu) is an offset in degrees Fahrenheit above ambient temperature. When a bearing temperature exceeds this value, the system generates an Absolute alarm.

```
Milepost-0501.2, Track:Single
Alarm Limits
-----
A) Absolute..... 180°
B) Differential..... 90°
C) Hot Wheel..... 540°
      .
      .
      .
```

a Select the **Absolute** submenu.

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, you can type leading zeros to make it three digits long or you can press **[Enter]** after typing one or two digits.

b To not change the value, press **[Esc]** and return to step 3.

c Type the new limit.

A prompt like this appears. All typed nondigits are ignored.

```
New Value ? 200
Is this correct ?
```

At this point, type either **y** (yes) or **n** (no).

d If the new limit is incorrect, type **n** and return to step b.

- e If the new limit is correct, type **y**

If you type zero or a value greater than 300, this error message and prompt appears.

```
Minimum valid value is 1, Maximum valid value is 300
New Value ?
```

If you type an acceptable value, the **Absolute option** on the Alarm Limits submenu changes, and the Alarm Limits submenu reappears.

- f If you get an error message, return to step **b**.
g If you don't get an error message, return to step **3**.

5 To set or change the **differential-alarm limit:**

The number after the word Differential (on the Alarm Limits submenu) is an offset in degrees Fahrenheit between rail1 and rail2. A bearing temperature is compared to the bearing temperature on the opposite end of the same axle. When the difference in temperatures exceeds the value on the screen, the system generates a Differential alarm.

```
Milepost-0501.2, Track:Single
Alarm Limits
-----
A) Absolute..... 180°
B) Differential..... 90°
C) Hot Wheel..... 540°
      .
      .
      .
```

- a From the Alarm Limits submenu, select **Differential**.

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, you can type leading zeros to make it three digits long or you can press **[Enter]** after typing one or two digits.

- b To not change the value, press **[Esc]** and return to step **3**.
c Type the new limit.

A prompt like this appears. All typed nondigits are ignored.

```
New Value ? 110
Is this correct ?
```

At this point, type either **y** (yes) or **n** (no).

d If the new limit is incorrect, type **n** and return to step **b**.

e If the new limit is correct, type **y**

If you type zero or a value greater than 300, this error message and prompt appears.

```
Minimum valid value is 1, Maximum valid value is 300
New Value ?
```

If you type an acceptable value, the **Differential option** on the Alarm Limits submenu changes and the Alarm Limits submenu reappears.

f If you get an error message, return to step **b**.

g If you don't get an error message, return to step **3**.

6 To set or change the **hotwheel-alarm limit**:

The number after the words Hot Wheel (on the Alarm Limits submenu) is an offset in degrees Fahrenheit above ambient temperature. When a wheel temperature exceeds this value, the system generates a Hotwheel alarm. In order for Hotwheel Alarm Limits to be processed, they must be enabled using the Carside Slope option on the Equipment submenu.

```
Milepost-0501.2, Track:Single
Alarm Limits
-----
A) Absolute..... 180°
B) Differential..... 90°
C) Hot Wheel..... 540°
D) Cold Wheel..... 30°

      .
      .
      .
```

a From the Alarm Limits submenu, select **Hot Wheel**.

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, you can type leading zeros to make it three digits long or you can press **[Enter]** after typing one or two digits.

b To not change the value, press **[Esc]** and return to step **3**.

c Type the new limit.

A prompt like this appears. All typed nondigits are ignored.

```
New Value ? 650
Is this correct ?
```

At this point, type either **y** (yes) or **n** (no).

d If the new limit is incorrect, type **n** and return to step **b**.

e If the new limit is correct, type **y**

If you type zero or a value greater than 900, this error message and prompt appears.

```
Minimum valid value is 1, Maximum valid value is 900
New Value ?
```

If you type an acceptable value, the **Hotwheel option** on the Alarm Limits submenu changes and the Alarm Limits submenu reappears.

f If you get an error message, return to step **b**.

g If you don't get an error message, return to step **3**.

7 To set or change the **cold-wheel limit**:

The number after the words Cold Wheel (on the Alarm Limits submenu) is an offset in degrees Fahrenheit above ambient temperature. When a wheel is found with a temperature less than this value, the system generates a Cold Wheel alarm. Alarms of this type don't produce a radio message, but are included in the data sent to the Harriman Dispatch Center. In order for Cold Wheel alarms to be processed, both the Cold Wheel option and the Hotwheel option on the Equipment submenu must be enabled

```
Milepost-0501.2, Track:Single
Alarm Limits
-----
A) Absolute..... 180°
B) Differential..... 90°
C) Hot Wheel..... 540°
D) Cold Wheel..... 30°
E) CS Slope..... 0.32
```

•
•
•

a From the Alarm Limits submenu, select **Cold Wheel**.

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, you can type leading zeros to make it three digits long, or you can press **[Enter]** after typing one or two digits.

b To not change the value, press **[Esc]** and return to step **3**.

- c Type the new limit.

A prompt like this appears. All typed nondigits are ignored.

```
New Value ? 040
Is this correct ?
```

At this point, type either **y** (yes) or **n** (no).

- d If the new limit is incorrect, type **n** and return to step b.

- e If the new limit is correct, type **y**

If you type zero or a value greater than 100, this error message and the prompt appears.

```
Minimum valid value is 1, Maximum valid value is 100
New Value ?
```

If you type an acceptable value, the **Cold Wheel option** on the Alarm Limits submenu changes, and the Alarm Limits submenu reappears.

- f If you get an error message, return to step b.

- g If you don't get an error message, return to step 3.

8 To set or change the **carside-slope value**:

The number after the words CS Slope on the Alarm Limits submenu is the slope value used when doing carside-slope analysis. **Chapter 10 - Defect Detection** describes the Carside Slope alarm process. In order for Carside Slope alarms to be processed, they must be enabled using the **Carside Slope option** on the Equipment submenu.

```
Milepost-0501.2, Track:Single
Alarm Limits
-----
A) Absolute..... 180°
B) Differential..... 90°
C) Hot Wheel..... 540°
D) Cold Wheel..... 30°
E) CS Slope..... 0.32
F) CS Minimum..... 37°
```

•
•
•

- a** From the Alarm Limits submenu, select **CS Slope**.

This prompt appears.

```
New Value ?
```

Slope value is in **n.nn** format. The system automatically inserts a decimal point between the first and second digits. If the new value has less than three digits, type leading zeros, trailing zeros, or both. Thus, for .98, type **098**. For 1.2, type **120**.

- b** To not change the value, press **[Esc]** and return to step **3**.

- c** Type the new limit.

A prompt like this appears.

```
New Value ? 1.40  
Is this correct ?
```

At this point, type either **y** (yes) or **n** (no).

- d** If the new limit is incorrect, type **n** and return to step **b**.

- e** If the new value is correct, type **y**

If you type zero or a value greater than 2.55, this error message and prompt appears.

```
Minimum valid value is 0.01, Maximum valid value is 2.55  
New Value ?
```

If you type an acceptable value, the **Carside Slope option** on the Alarm Limits submenu changes, and the Alarm Limits submenu reappears.

- f** If you get an error message, return to step **b**.
g If you don't get an error message, return to step **3**.

9 To set or change the **carside-minimum-heat value:**

The number after the words CS Minimum on the Alarm Limits submenu is an offset in degrees Fahrenheit used when doing carside-slope analysis. **Chapter 10 - Defect Detection** describes the Carside Slope alarm process. In order for Carside Slope alarms to be processed, they must be enabled using the Carside Slope option on the Equipment submenu.

```
Milepost-0501.2, Track:Single
Alarm Limits
-----
A) Absolute..... 180°
B) Differential..... 90°
C) Hot Wheel..... 540°
D) Cold Wheel..... 30°
E) CS Slope..... 0.32
F) CS Minimum..... 37°
G) Cold Journal..... 10°
```

•
•
•

- a** From the Alarm Limits submenu, select **CS Minimum**.

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, you can type leading zeros to make it three digits long or you can press **[Enter]** after typing one or two digits.

- b** To not change the value, press **[Esc]** and return to step **3**.
c Type the new limit.

A prompt like this appears. All typed nondigits are ignored.

```
New Value ? 255
Is this correct ?
```

At this point, type either **y** (yes) or **n** (no).

- d** If the new limit is incorrect, type **n** and return to step **b**.
e If the new limit is correct, type **y**

If you type zero or a value greater than 300, this error message and the prompt appears.

```
Minimum valid value is 1, Maximum valid value is 300
New Value ?
```

If you type an acceptable value, the **Carside Minimum option** on the Alarm Limits submenu changes, and the Alarm Limits submenu reappears.

- f If you get an error message, return to step **b**.
- g If you don't get an error message, return to step **3**.

10 To set or change the **cold-journal value**:

The number after the words Cold Journal (on the Alarm Limits submenu) is an offset in degrees Fahrenheit above the ambient temperature. This value pertains to the post-train examination of the maximum heats recorded by the bearing scanners. When no bearing on a given rail generates a delta temperature reading greater than this value, the system generates a Cold Rail alarm for the given rail.

```

Milepost-0501.2, Track:Single
Alarm Limits
-----
A) Absolute..... 180°
B) Differential..... 90°
C) Hot Wheel..... 540°
D) Cold Wheel..... 30°
E) CS Slope..... 0.32
F) CS Minimum..... 37°
G) Cold Journal..... 10°
H) Cold Wheel Scanner..... 30°
I) Cold Trains..... 3
J) Sliding Wheel Ratio..... 50%
K) Max Alarms..... 6

Alarm to change or Esc to quit?

```

- a From the Alarm Limits submenu, select **Cold Journal**.

This prompt appears.

```

New Value ?

```

If the new limit has less than three digits, you can type leading zeros to make it three digits long or you can press **[Enter]** after typing one or two digits.

- b To not change the value, press **[Esc]** and return to step **3**.
- c Type the new limit.

A prompt like this appears. All typed nondigits are ignored.

```

New Value ? 12
Is this correct ?

```

At this point, type either **y** (yes) or **n** (no).

- d If the new limit is incorrect, type **n** and return to step **b**.

- e If the new limit is correct, type **y**
 If you type zero or a value greater than 30, this error message and prompt appears.

```
Minimum valid value is 1, Maximum valid value is 30
New Value ?
```

If you type an acceptable value, the **Cold Journal option** on the Alarm Limits submenu changes, and the Alarm Limits submenu reappears.

- f If you get an error message, return to step **b**.
 g If you don't get an error message, return to step **3**.

11 To set or change the **cold-wheel-scanner value:**

The number after the words Cold Wheel Scanner (on the Alarm Limits submenu) is an offset in degrees Fahrenheit above the ambient temperature. This value pertains to post-train examination of the maximum heats recorded by the wheel scanners. When no wheel on a given rail generates a delta temperature reading greater than this value, the system generates a Cold Wheel Scanner alarm for the given rail.

```

      •
      •
      •

G) Cold Journal..... 10°
H) Cold Wheel Scanner..... 30°
I) Cold Trains..... 3
J) Sliding Wheel Ratio..... 50%
K) Max Alarms..... 6

Alarm to change or Esc to quit?
```

- a From the Alarm Limits submenu, select **Cold Wheel Scanner**.

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, you can type leading zeros to make it three digits long, or you can press **[Enter]** after typing one or two digits.

- b To not change the value, press **[Esc]** and return to step **3**.
 c Type the new limit.

A prompt like this appears. All typed nondigits are ignored.

```
New Value ? 32
Is this correct ?
```

At this point, type either **y** (yes) or **n** (no).

- d If the new limit is incorrect, type **n** and return to step **b**.

- e If the new limit is correct, type **y**

If you type zero or a value greater than 100, this error message and prompt appears.

```
Minimum valid value is 1, Maximum valid value is 100
New Value ?
```

If you type an acceptable value, the **Cold Wheel Scanner option** on the Alarm Limits submenu changes and the Alarm Limits submenu reappears.

- f If you get an error message, return to step **b**.
g If you don't get an error message, return to step **3**.

12 To set or change the **cold-trains value:**

The number after the words Cold Trains (on the Alarm Limits submenu) is the maximum number (per railside) of consecutive trains, having Cold Rail alarms or Cold Resistor alarms required to generate an Integrity Failure alarm. The Cold Wheel Scanner alarms, Cold Wheel Scanner Resistor alarms, and Equal Heats Test Failed alarm also use this value to determine when they become Successive Cold Wheels Exceeded, Successive Cold Wheel Resistors Exceeded, and Max Equal Heat Test Failures Exceeded alarms. **Appendix A - System Alarms** describes the conditions and events that the system flags as System Alarms. **Appendix B - Integrity Failures** describes the conditions and events that the system flags as Integrity Failures.

```
      .
      .
      .

H) Cold Wheel Scanner..... 30°
I) Cold Trains..... 3
J) Sliding Wheel Ratio..... 50%
K) Max Alarms..... 6

Alarm to change or Esc to quit?
```

- a From the Alarm Limits submenu, select **Cold Trains**.

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, you can type leading zeros to make it three digits long, or you can press **[Enter]** after typing one or two digits.

- b To not change the value, press **[Esc]** and return to step **3**.

- c Type the new limit.

A prompt like this appears. All typed nondigits are ignored.

```
New Value ? 4
Is this correct ?
```

At this point, type either **y** (yes) or **n** (no).

- d If the new limit is incorrect, type **n** and return to step b.

- e If the new limit is correct, type **y**

If you type zero or a value greater than 9, this error message and prompt appear.

```
Minimum valid value is 1, Maximum valid value is 9
New Value ?
```

If you type an acceptable value, the **Cold Trains option** on the Alarm Limits submenu changes, and the Alarm Limits submenu reappears.

- f If you get an error message, return to step b.

- g If you don't get an error message, return to step 3.

13 To set or change the **sliding-wheel ratio:**

The number after the words Sliding Wheel Ratio (on the Alarm Limits submenu) is the ratio to be applied while evaluating wheel and bearing temperatures to identify sliding wheels. The Sliding Wheel Ratio is applied to calculated average temperatures to establish minimum acceptable wheel and bearing temperatures that are in turn used to identify sliding wheels. In order for Sliding Wheel alarms to be processed, both the Hotwheel option and the Sliding Wheel option on the Equipment submenu must be enabled.

```
      •
      •
      •

I) Cold Trains..... 3
J) Sliding Wheel Ratio..... 50%
K) Max Alarms..... 6

Alarm to change or Esc to quit?
```

- a From the Alarm Limits submenu, select **Sliding Wheel Ratio**.

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, you can type leading zeros to make it three digits long, or you can press **[Enter]** after typing one or two digits.

- b To not change the value, press **[Esc]** and return to step 3.

- c Type the new limit.

A prompt like this appears. All typed nondigits are ignored.

```
New Value ? 40
Is this correct ?
```

At this point, type either **y** (yes) or **n** (no).

- d If the new limit is incorrect, type **n** and return to step b.

- e If the new limit is correct, type **y**

If you type a value less than 10 or a value greater than 100, this error message and prompt appears.

```
Minimum valid value is 10, Maximum valid value is 100
New Value ?
```

If you type an acceptable value, the **Sliding Wheel Ratio option** on the Alarm Limits submenu changes and the Alarm Limits submenu reappears.

- f If you get an error message, return to step b.
- g If you don't get an error message, return to step 3.

14 To set or change the **maximum-alarms limit:**

The number after the words Max Alarms (on the Alarm Limits submenu) is the maximum number of Exception Alarms allowed on a train before generating an Integrity Failure alarm. This limit also controls assignment of the Stuck Dragger alarm. **Appendix A - System Alarms** describes the conditions and events that the system flags as System Alarms. **Appendix B - Integrity Failures** describes the conditions and events that the system flags as Integrity Failures.

The 10 Exception Alarms are the Absolute, Carside Slope, Differential, Cold Wheel, Dragging-Equipment, High-Load, Hotwheel, Pyrometer Saturation, Wide-Load, and Sliding Wheel alarms.

The Maximum Exception Alarms Exceeded alarm is generated when the maximum number of Exception Alarms (defined by the **Maximum Alarms option**) is exceeded on a single train. The Stuck Dragger alarm is generated when the maximum number of consecutive axles (defined by the **Maximum Alarms option**) had Dragging-Equipment alarms during train passage.

Real-time messages are announced using a 1000-hertz tone. When the first alarm is detected, the tone is issued, followed by the words "defect detected." All subsequent alarm announcements only use the tone. One tone is issued for each alarm detected up to and including twice the maximum number of alarms specified using the **Maximum Alarms option**.

```

      •
      •
      •

I) Cold Trains.....      3
J) Sliding Wheel Ratio..... 50%
K) Max Alarms.....      6

```

Alarm to change or Esc to quit?

- a** From the Alarm Limits submenu, select **Max Alarms**.

This prompt appears.

```

New Value ?

```

If the new limit has less than three digits, you can type leading zeros to make it three digits long, or you can press **[Enter]** after typing one or two digits.

- b** To not change the value, press **[Esc]** and return to step **3**.

- c** Type the new limit.

A prompt like this appears. All typed nondigits are ignored.

```

New Value ? 4
Is this correct ?

```

At this point, type either **y** (yes) or **n** (no).

- d** If the new limit is incorrect, type **n** and return to step **b**.

- e** If the new limit is correct, type **y**

If you type zero or a value greater than 11, this error message and prompt appears.

```

Minimum valid value is 1, Maximum valid value is 11
New Value ?

```

If you type an acceptable value, the **Maximum Alarms option** on the Alarm Limits submenu changes, and the Alarm Limits submenu reappears.

- f** If you get an error message, return to step **b**.

- g** If you don't get an error message, return to step **3**.

11.3.5 Equipment

To set or change one or more of the equipment parameters:

- 1 Be sure that the Setup menu is displayed.

The top part of the Setup menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
Setup Menu
-----
A) Set Date and Time
B) Milepost
C) Track Number
D) Alarm Limits
E) Equipment
F) Messages
.
.
.
```

- 2 To go to the Equipment submenu, select **Equipment**.

A menu and prompt like this appears.

```
Milepost-0501.2, Track:Single
Equipment
-----
A) Dragger..... NO
B) Hot Wheel..... NO
C) High Load..... NO
D) Wide Load..... NO
E) Carside Slope..... NO
F) Talker Mode..... Talk Freely
G) Snow Cycle..... NO
H) AEI..... NO
I) Sliding Wheel..... NO
J) Gate Distance..... 24.0 inches
K) Cold Wheel..... NO
L) Resistor Integ. Test.... Enabled
M) Modem Type:..... Analog
N) Min. Transducer Pulse Width. 3mS
O) Cold Rail Test..... All Trains

Equipment to change or Esc to quit?
```

The current setting for each menu option is displayed. For example, the screen above shows that Wide-Load alarm detection is disabled (NO). To change one of the settings, press the letter corresponding to the desired option. Except for the **Gate Width option**, the **Minimum Transducer Pulse Width option**, and the **Snow Cycle option**, which require value entries, all the other options toggle between two or more settings.

- 3 To leave the Equipment submenu and return to the Setup menu:

- a Press **[Esc]**.

The Setup menu reappears.

- b Skip the remaining steps.

- 4 To set or change the **dragger** (aka dragging-equipment) setting:

The Equipment submenu shows whether Dragging-Equipment alarm detection is enabled (YES) or disabled (NO). When enabled, Dragging-Equipment alarms will be announced and stored.

In the presence of a continuous dragger signal, the system alarms consecutive axles. The **Maximum Alarms option** on the Alarm Limits submenu shows the number of consecutive dragger-alarmed axles flagging a stuck-dragger condition.

Milepost-0501.2, Track:Single	
Equipment	

A) Dragger.....	NO
B) Hot Wheel.....	NO
C) High Load.....	NO
•	
•	
•	

- a From the Equipment submenu, select **Dragger**.

The dragging-equipment setting toggles between enabled (YES) and disabled (NO). The **Dragger option** on the Equipment submenu changes. The Equipment submenu reappears.

If you want Dragging-Equipment alarm detection to occur, be sure that YES appears after the word Dragger on the Equipment submenu.

- b Return to step 3.

5 To set or change the **hotwheel** setting:

The Equipment submenu shows whether Hotwheel alarm detection is enabled (YES) or disabled (NO). When enabled, hotwheel alarms will be announced and stored.

```
Milepost-0501.2, Track:Single
Equipment
-----
A) Dragger..... NO
B) Hot Wheel..... NO
C) High Load..... NO
      .
      .
      .
```

- a From the Equipment submenu, select **Hot Wheel**.

The hotwheel setting toggles between enabled (YES) and disabled (NO). The **Hotwheel option** on the Equipment submenu changes. The Equipment submenu reappears.

If you want Hotwheel alarm detection to occur, be sure that YES appears after the words Hot Wheel on the Equipment submenu.

- b Return to step 3.

6 To set or change the **high-load** setting:

The Equipment submenu shows whether High-Load alarm detection is enabled (YES) or disabled (NO). When enabled, high-load alarms will be announced and stored. To announce High-Load alarms, YES must appear after the words High Load on the Equipment submenu, and NO must appear after the word HiWide on the Messages submenu. To announce High-Wide alarms, YES must appear after the words High Load on the Equipment submenu and YES must appear after the word HiWide on the Messages submenu.

```
Milepost-0501.2, Track:Single
Equipment
-----
A) Dragger..... NO
B) Hot Wheel..... NO
C) High Load..... NO
D) Wide Load..... NO
      .
      .
      .
```


- a** From the Equipment submenu, select **High Load**.

The high-load setting toggles between enabled (YES) and disabled (NO). The **High-Load option** on the Equipment submenu changes. The Equipment submenu reappears.

If you want High-Load alarm detection to occur, be sure that YES appears after the words High Load on the Equipment submenu.

- b** Return to step 3.

7 To set or change the **wide-load** setting:

The Equipment submenu shows whether Wide-Load alarm detection is enabled (YES) or disabled (NO). When enabled, wide-load alarms will be announced and stored.

```
Milepost-0501.2, Track:Single
Equipment
-----
A) Dragger..... NO
B) Hot Wheel..... NO
C) High Load..... NO
D) Wide Load..... NO
E) Carside Slope..... NO
```

•
•
•

- a** From the Equipment submenu, select **Wide Load**.

The wide-load setting toggles between enabled (YES) and disabled (NO). The **Wide-Load option** on the Equipment submenu changes. The Equipment submenu reappears.

If you want Wide-Load alarm detection to occur, be sure that YES appears after the words Wide Load on the Equipment submenu.

- b** Return to step 3.

8 To set or change the **carside-slope** setting:

The Equipment submenu shows whether Carside Slope alarm detection is enabled (YES) or disabled (NO). When enabled, carside-slope alarms will be announced and stored.

Milepost-0501.2, Track:Single
Equipment

A) Dragger..... NO

B) Hot Wheel..... NO

C) High Load..... NO

D) Wide Load..... NO

E) Carside Slope..... NO

F) Talker Mode..... Talk Freely

•

•

•

- a From the Equipment submenu, select **Carside Slope**.

The carside-slope setting toggles between enabled (YES) and disabled (NO). The **Carside Slope option** on the Equipment submenu changes. The Equipment submenu reappears.

- b Return to step 3.

9 To set or change the **talker-mode** setting:

The **Talker Mode option** lets you select when announcements are given during and after train passage. The talk-freely mode is the normal talker mode. In this mode, the system makes announcements even when defects aren't detected. In talk-on-defect mode, the system makes announcements only when a defect is detected. If you don't select a talker mode, it defaults to talk-freely.

If a SmartScanIS is in Poll/Standalone mode and doesn't receive a valid poll for five minutes, Talker Mode changes to talk-freely mode. No change occurs when the system already operates in talk-freely mode. The next time a valid poll is received, Talker Mode reverts to the mode that was active before it was changed. If another valid poll isn't received, the system stays in talk-freely mode.

While in Poll/Standalone mode, changing to talk-freely mode also occurs when a ZA or ZU message, sent by the SmartScanIS to the Harriman Dispatch Center, isn't acknowledged after five transmissions. When message acknowledgments are restored, Talker Mode reverts to the mode that was active before it was changed. If a message non-acknowledgment is followed by five minutes of no valid polls, both the acknowledgment failure and the five-minute timeout must be resolved before Talker Mode reverts to the mode that was active before it was changed to talk-freely mode.

```
Milepost-0501.2, Track:Single
Equipment
-----
A) Dragger..... NO
B) Hot Wheel..... NO
C) High Load..... NO
D) Wide Load..... NO
E) Carside Slope..... NO
F) Talker Mode..... Talk Freely
G) Snow Cycle..... NO

      .
      .
      .
```

- a** From the Equipment submenu, select **Talker Mode**.

The talker-mode setting toggles between Talk Freely and Talk On Defect. The **Talker Mode option** on the Equipment submenu changes. The Equipment submenu reappears.

- b** Return to step 3.

10 To set or change the **snow-cycle** setting:

The Equipment submenu shows whether the snow-cycle feature is enabled (YES) or disabled (NO). To avoid errant heat readings caused by moisture on the pyrometer lenses, the scanners have heaters built into them. These heaters are made active for varying periods of time, depending on the ambient temperature.

The table below lists the heater activation times for both normal and snow-cycle operation, grouped by ambient temperature.

Temperature Range in degrees Fahrenheit		Out of every ten seconds, the number of seconds scanner heaters are active	
Low	High	Snow Cycle Off	Snow Cycle On
--	32	10 (Always On)	10 (Always On)
33	35	3	8
36	51	2	2
52	80	1	1
80	--	Off	Off

Note that the duty cycle for the scanner heaters now runs the heaters continuously at ambient temperatures of 32 degrees Fahrenheit or lower.

```
Milepost-0501.2, Track:Single
Equipment
-----
A) Dragger..... NO
B) Hot Wheel..... NO
C) High Load..... NO
D) Wide Load..... NO
E) Carside Slope..... NO
F) Talker Mode..... Talk Freely
G) Snow Cycle..... NO
H) AEI..... YES

      •
      •
      •
```

a From the Equipment submenu, select **Snow Cycle**.

The snow-cycle setting toggles between enabled (YES) and disabled (NO). The **Snow Cycle option** on the Equipment submenu changes.

If you disabled the snow-cycle setting, the Equipment submenu reappears. If you enabled the snow-cycle setting, this prompt appears.

```
Enter Start Month (1-12)
```

If the new start value is one digit long, you can type a leading zero to make it two digits long, or you can press **[Enter]** after typing one digit.

b If you disabled the snow-cycle setting, skip the steps below and return to step **3**.

c To not change the starting and ending values, press **[Esc]** and return to step **3**.

d Type the new starting value.

If you type zero or a value greater than 12, this error message and prompt appears.

```
Minimum valid value is 1, Maximum valid value is 12
Enter Start Month (1-12)
```

If you type an acceptable value, this prompt appears.

```
Enter End Month (1-12)
```

e If you get an error message, return to step **c**.

f To not change the ending value, press **[Esc]** and return to step **3**.

g Type the new ending value.

If you type zero or a value greater than 12, this error message and prompt appears.

```
Minimum valid value is 1, Maximum valid value is 12
Enter End Month (1-12)
```

If you type an acceptable value, the Equipment submenu reappears, displaying the start and end months that the snow cycle is enabled. For example, if you typed 11 for the start month and 01 for the end month, you'll see a line like this.

```
      .
      .
      .
G) Snow Cycle..... (Nov - Jan) YES
      .
      .
      .
```

If you entered the same value (that is, the same month) for both start and end months, the heaters are enabled year-round. For example, if the start month is 12 and the end month is 12, the heaters are enabled year-round. If the start month is 12 and the end month is 11, the heaters are also enabled year-round. If the start month is 11 and the end month is 12, the heaters are only enabled for November and December.

h If you get an error message, return to step **f**.

i Return to step **3**.

11 To set or change the **AEI** setting:

The Equipment submenu shows whether the AEI subsystem is enabled (YES) or disabled (NO). When the 2200-750 Reader and attendant antennas and cabling are present, this parameter should be set to YES, so that the system knows to configure the 2200-750 Reader and to use the AEI data transmitted from it. When there is no installed AEI subsystem attached to the SmartScanIS, this parameter should be set to NO.

```
      .
      .
      .
G) Snow Cycle..... NO
H) AEI..... YES
I) Sliding Wheel..... YES
J) Gate Distance..... 24.0 inches
K) Cold Wheel..... YES
L) Resistor Integ. Test.... Enabled

Equipment to change or Esc to quit?
```

- a From the Equipment submenu, select **AEI**.

The AEI setting toggles between enabled (YES) and disabled (NO). The **AEI option** on the Equipment submenu changes. The Equipment submenu reappears.

- b Return to step 3.

12 To set or change the **sliding-wheel** setting:

The Equipment submenu shows whether Sliding Wheel detection is enabled (YES) or disabled (NO). In order for Sliding Wheel alarms to be processed, both the Hotwheel option and the Sliding Wheel option on the Equipment submenu must be enabled. The Sliding Wheel function requires that bearing and wheel scanners be installed and in operation at a site. The Sliding Wheel detection algorithm is intended to be used where trains travel down a long grade before reaching the site. The algorithm calculates average wheel and bearing heat per train side and per car and attempts to isolate those axles that have extremely low bearing and wheel temperatures.

•
•
•

H) AEI.....	YES
I) Sliding Wheel.....	YES
J) Gate Distance.....	24.0 inches
K) Cold Wheel.....	YES
L) Resistor Integ. Test....	Enabled
M) Modem Type:.....	Analog
N) Min. Transducer Pulse Width.	3mS
O) Cold Rail Test.....	All Trains

Equipment to change or Esc to quit?

- a From the Equipment submenu, select **Sliding Wheel**.

The sliding-wheel setting toggles between enabled (YES) and disabled (NO). The **Sliding Wheel option** on the Equipment submenu changes. The Equipment submenu reappears.

- b Return to step 3.

13 To set or change the **gate distance** (aka gate width) value:

The Equipment submenu shows the number of inches between the centers of the gating transducers.

```
      .
      .
      .

I) Sliding Wheel..... YES
J) Gate Distance..... 24.0 inches
K) Cold Wheel..... YES
L) Resistor Integ. Test.... Enabled
M) Modem Type:..... Analog
N) Min. Transducer Pulse Width. 3mS
O) Cold Rail Test..... All Trains

Equipment to change or Esc to quit?
```

- a** From the Equipment submenu, select **Gate Distance**.

This prompt appears.

```
Gate Distance:
```

The format for gate width (gate distance) is **nn.n**. If the new value has less than three digits, type leading zeros, trailing zeros, or both. Thus, for 2, type **020**. The system inserts the decimal point for you. The gate width (it is usually 24.0) can be recorded in 1/10-inch increments to reflect the actual transducer spacing. Accurate gating-transducer spacing results in accurate speed calculations.

- b** Enter the three-digit number.

The **Gate Width option** on the Equipment submenu changes. The Equipment submenu reappears.

- c** Return to step **3**.

14 To set or change the **cold-wheel** setting:

The Equipment submenu shows whether Cold Wheel alarm detection is enabled (YES) or disabled (NO). The Cold Wheel function requires that wheel scanners be installed and hotwheel scanning be enabled. The Cold Wheel function is intended to be used where trains are expected to be braking as they approach a site and to identify axles whose brakes have failed.

•
•
•

J) Gate Distance..... 24.0 inches
K) Cold Wheel..... YES
L) Resistor Integ. Test.... Enabled
M) Modem Type:..... Analog
N) Min. Transducer Pulse Width. 3mS
O) Cold Rail Test..... All Trains

Equipment to change or Esc to quit?

- a** From the Equipment submenu, select **Cold Wheel**.

The cold-wheel setting toggles between enabled (YES) and disabled (NO). The **Cold Wheel option** on the Equipment submenu changes. The Equipment submenu reappears.

- b** Return to step **3**.

15 To set or change the **resistor-integrity-test** setting:

The Equipment submenu shows whether the resistor-integrity-test setting is enabled, reduced, or disabled.

After a train clears a site, the system does an integrity test to verify that the scanners are operational and that the system can read alarm level heat. This test consists of reading the temperature of power resistors mounted to the back of the scanner shutters, after the shutters close. The recorded temperature of the shutter resistors is compared against expected values, which are calculated using the amount of time the shutters were open.

A site can be set up to perform the resistor integrity test in one of three modes. When the resistor integrity test is in enabled mode, the existing algorithm is used to determine the minimum acceptable resistor temperature values for a given train. When in reduced mode, the existing acceptable resistor values are reduced by 15% before the comparison is made to the temperature values read from the resistors. The third mode, disabled, prevents the resistor integrity test from being performed at all.

For a given train duration, the resistor heats expected by both the enabled and reduced modes are as follows.

Train Duration (in seconds)	Expected Resistor Temperatures for Reduced Mode	Expected Resistor Temperatures for Enabled Mode
10 or less	No Test Occurs	No Test Occurs
11 - 19	32°F (0°C)	40°F (4.4°C)
20 - 29	67°F (19.4°C)	80°F (26.7°C)
30 - 39	101°F (38.3°C)	120°F (48.9°C)
40 or more	135°F (57.2°C)	160°F (71.1°C)

Selecting the **Resistor Integ. Test** option toggles from one resistor test mode to another.

```

      •
      •
      •

K) Cold Wheel..... YES
L) Resistor Integ. Test.... Enabled
M) Modem Type:..... Analog
N) Min. Transducer Pulse Width. 3mS
O) Cold Rail Test..... All Trains

Equipment to change or Esc to quit?

```

- a** From the Equipment submenu, select **Resistor Integ. Test**.

The resistor-integrity-test setting toggles from enabled to disabled, from disabled to reduced, or from reduced to enabled. The **Resistor Integrity Test Mode option** on the Equipment submenu changes. The Equipment submenu reappears.

- b** Return to step **3**.

16 To set or change the **modem-type setting:**

The Equipment submenu shows the modem type. You should choose Analog when the system uses the MultiTech ZDX modem supplied by STC. Choose Cellular when the system uses a modem that communicates over a cellular network.

```
      •
      •
      •

L) Resistor Integ. Test.... Enabled
M) Modem Type:..... Analog
N) Min. Transducer Pulse Width. 3mS
O) Cold Rail Test..... All Trains

Equipment to change or Esc to quit?
```

- a** From the Equipment submenu, select **Modem Type**.

The modem-type setting toggles between Analog and Cellular. The **Modem Type option** on the Equipment submenu changes. The Equipment submenu reappears.

- b** Return to step 3.

17 To set or change the **minimum-pulse-width setting:**

The Equipment submenu shows the minimum pulse width required of gating transducer signals.

Unless a site exhibits transducer miscounts in conjunction with most, if not all, trains traveling at or below 7 mph (11.3 kph), the minimum transducer pulse width setting should be **5mS**. Entering a lower value can result in extra transducer hits. Entering a value of 0mS disables the filter altogether.

```
      •
      •
      •

M) Modem Type:..... Analog
N) Min. Transducer Pulse Width. 3mS
O) Cold Rail Test..... All Trains

Equipment to change or Esc to quit?
```

- a** From the Equipment submenu, select **Min. Transducer Pulse Width**.

This prompt appears.

```
New Value ?
```

- b** To not change the value, press **[Esc]** and return to step 3.
- c** Type the new value.

If you type a value greater than 5, this error message and prompt appears.

```
Minimum valid value is 0, Maximum valid value is 5
New Value ?
```

If you type an acceptable value, the **Minimum Transducer Pulse Width option** on the Equipment submenu changes. The Equipment submenu reappears.

- d** If you get an error message, return to step **b**.
- e** If you don't get an error message, return to step **3**

18 To set or change the **cold-rail-test** setting:

The Equipment submenu shows whether the user disabled the post-train cold-rail and equal-heat tests for trains having fewer than 50 axles (that is, short trains). You should choose All Trains when you want the system to run post-train cold-rail and equal-heat tests on all trains passing over the site. Choosing Long Trains Only does not perform cold-rail or equal-heat tests on trains having fewer than 50 axles.

```

      •
      •
      •

M) Modem Type:..... Analog
N) Min. Transducer Pulse Width. 3mS
O) Cold Rail Test..... All Trains

Equipment to change or Esc to quit?
```

- a** From the Equipment submenu, select **Cold Rail Test**.

The cold-rail-test setting toggles between All Trains and Long Trains Only. The **Cold Rail Test option** on the Equipment submenu changes. The Equipment submenu reappears.

- b** Return to step **3**.

11.3.6 Messages

To set or change one or more of the message parameters:

- 1 Be sure that the Setup menu is displayed.

The top part of the Setup menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
Setup Menu
-----
A) Set Date and Time
B) Milepost
C) Track Number
D) Alarm Limits
E) Equipment
F) Messages
G) -For Future Use-
      .
      .
```

- 2 Select the **Messages** submenu.

A menu and prompt like this appears. The options on the Messages submenu are used to affect the phrases broadcast to a passing train.

```
Milepost-0125.0, Track:3
Messages
-----
A) Axles..... YES
B) Arrival..... YES
C) Speed..... YES
D) Length..... YES
E) Temperature..... YES
F) Power Off..... YES
G) HiWide..... YES
H) Car ID..... YES
I) No Defects..... 1
J) Rebroadcast Time Limit. 10 min.

Message to change or Esc to quit?
```

- 3 To leave the Messages submenu and return to the Setup menu:

- a Press **[Esc]**.

The Setup menu reappears.

- b Skip the remaining steps.

4 To set or change the **announce-axles** setting:

The Messages submenu shows whether the total axle count is to be announced (YES) or not announced (NO).

Milepost-0501.2, Track:3	
Messages	

A) Axles.....	YES
B) Arrival.....	YES
C) Speed.....	YES
•	
•	
•	

a From the Messages submenu, select **Axles**.

The announce-axles setting toggles between announce (YES) or not announce (NO). The **Announce Axles option** on the Messages submenu changes. The Messages submenu reappears.

b Return to step 3.

5 To set or change the **announce-arrival-message** setting:

The Messages submenu shows whether the train-arrival message is to be announced (YES) or not announced (NO).

Milepost-0501.2, Track:3	
Messages	

A) Axles.....	YES
B) Arrival.....	YES
C) Speed.....	YES
•	
•	
•	

a From the Messages submenu, select **Arrival**.

The announce-arrival-message setting toggles between announce (YES) or not announce (NO). The **Announce Arrival Message option** on the Messages submenu changes. The Messages submenu reappears.

b Return to step 3.

6 To set or change the **announce-speed** setting:

The Messages submenu shows whether the exit speed of the train is to be announced (YES) or not announced (NO).

```
Milepost-0501.2, Track:3
Messages
-----
A) Axles..... YES
B) Arrival..... YES
C) Speed..... YES
D) Length..... YES
      .
      .
      .
```

- a** From the Messages submenu, select **Speed**.

The announce-speed setting toggles between announce (YES) or not announce (NO). The **Announce Speed option** on the Messages submenu changes. The Messages submenu reappears.

- b** Return to step 3.

7 To set or change the **announce-train-length** setting:

The Messages submenu shows whether the train length is to be announced (YES) or not announced (NO).

```
Milepost-0501.2, Track:3
Messages
-----
A) Axles..... YES
B) Arrival..... YES
C) Speed..... YES
D) Length..... YES
E) Temperature..... YES
      .
      .
      .
```

- a** From the Messages submenu, select **Length**.

The announce-train-length setting toggles between announce (YES) or not announce (NO). The **Announce Train Length option** on the Messages submenu changes. The Messages submenu reappears.

- b** Return to step 3.

8 To set or change the **announce-temperature** setting:

The Messages submenu shows whether the ambient temperature (taken at the site by the shielded temperature probe as the train leaves the site) is to be announced (YES) or not announced (NO).

```
Milepost-0501.2, Track:3
Messages
-----
A) Axles..... YES
B) Arrival..... YES
C) Speed..... YES
D) Length..... YES
E) Temperature..... YES
F) Power Off..... YES

      •
      •
      •
```

a From the Messages submenu, select **Temperature**.

The announce-temperature setting toggles between announce (YES) or not announce (NO). The **Announce Temperature option** on the Messages submenu changes. The Messages submenu reappears.

b Return to step 3.

9 To set or change the **announce-power-off** setting:

The Messages submenu shows whether the power-off message is to be announced (YES) or not announced (NO). This message is generated whenever the battery voltage is at least 18 VDC, but less than 22 VDC. AC power need never have been off to cause this to happen. However, most times, it does indicate that AC power has been off, causing the battery to be drained. This message is also generated whenever AC power wasn't on during the end-of-train processing.

```
      •
      •
      •

E) Temperature..... YES
F) Power Off..... YES
G) HiWide..... YES
H) Car ID..... YES
I) No Defects..... 1
J) Rebroadcast Time Limit. 10 min.

Message to change or Esc to quit?
```

- The announce-power-off setting toggles between enabled (YES) and disabled (NO). The **Announce Power Off option** on the Messages submenu changes. The Messages submenu reappears.

- 10** To set or change the **announce-high-wide** setting:

The Messages submenu shows whether the high-wide message is to be announced (YES) or not announced (NO). Select YES when a single tripwire is used for both high-load and wide-load detection. Doing so will announce high-wide for either a high-load condition or a wide-load condition. Select NO when each high-load and wide-load detector has its own tripwire. Doing so will announce high-load for a high-load condition and wide-load for a wide-load condition.

To announce High-Load alarms, YES must appear after the words High Load on the Equipment submenu, and NO must appear after the word HiWide on the Messages submenu. To announce High-Wide alarms, YES must appear after the words High Load on the Equipment submenu, and YES must appear after the word HiWide on the Messages submenu.

```

      •
      •
      •

F) Power Off..... YES
G) HiWide..... YES
H) Car ID..... YES
I) No Defects..... 1
J) Rebroadcast Time Limit. 10 min.

Message to change or Esc to quit?

```

- The announce-high-wide setting toggles between enabled (YES) and disabled (NO). The **Announce High-Wide** option on the Messages submenu changes. The Messages submenu reappears.

- 26 September 2023, SmartScanIS User's Guide for Union Pacific, EUD-2016026-00 Rev.3

11 To set or change the **announce-car-identification setting:**

The Messages submenu shows whether the car-identification message is to be announced (YES) or not announced (NO). When this option is set to YES and the AEI option is enabled on the Equipment submenu, the AEI car identification will be included in the post-train announcement of the detected alarm.

```
      •
      •
      •

G) HiWide..... YES
H) Car ID..... YES
I) No Defects..... 1
J) Rebroadcast Time Limit. 10 min.

Message to change or Esc to quit?
```

a From the Messages submenu, select **Car ID**.

The announce-car-identification setting toggles between enabled (YES) and disabled (NO). The **Announce Car Identification option** on the Messages submenu changes. The Messages submenu reappears.

b Return to step 3.

12 To set or change the **no-defects setting:**

The Messages submenu shows how many times the system makes the no-defects announcement for trains with no Exception Alarms and no Integrity Failures. If set to a value other than 1, a pause of roughly three seconds occurs between each of the no-defects messages. The detector-out message occurs only once and follows the final no-defects announcement. A three-second pause doesn't occur between the final no-defects message and the detector-out message.

```
      •
      •
      •

H) Car ID..... YES
I) No Defects..... 1
J) Rebroadcast Time Limit. 10 min.

Message to change or Esc to quit?
```

- a From the Messages submenu, select **No Defects**.

This prompt appears.

```
New Value ?
```

- b To not change the value, press **[Esc]** and return to step 3.

- c Type the new limit.

If you type zero or a value greater than 3, this error message and prompt appears.

```
Minimum valid value is 1, Maximum valid value is 3  
New Value ?
```

If you type an acceptable value, the **No Defects option** on the Messages submenu changes, and the Messages submenu reappears.

- d If you get an error message, return to step b.
e If you don't get an error message, return to step 3.

13 To set or change the **rebroadcast-time-limit setting:**

Post-train (that is, end-of-train) announcements resulting from site events of four or more axles (that is, normal train traffic) are saved for rebroadcast. Post-train announcements resulting from spike events (that is, those with less than four axles recorded and the TO1 and/or TO2 spike count exceeds four) or from a catastrophic transducer failure occurring in conjunction with an auxiliary alarm are also saved for rebroadcast. All other site events of less than four axles do not generate a post-train announcement and are therefore not saved for rebroadcast.

The entry routine accommodates up to 3 digits and enforces a minimum value of 0 and a maximum value of 240, which is 240 minutes (that is, 4 hours). Entering a 0 configures the system for infinite rebroadcast, meaning that the last passing train's post-train announcements are available for rebroadcast indefinitely.

Enabling or disabling various ancillary messaging options has no effect on the message that is rebroadcast. A system's Talker Mode setting has no effect on the rebroadcast.

```
•  
•  
•  
  
H) Car ID..... YES  
I) No Defects..... 1  
J) Rebroadcast Time Limit. 10 min.
```

```
Message to change or Esc to quit?
```

- a** From the Messages submenu, select **Rebroadcast Time Limit**.

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, you can type leading zeros to make it three digits long or you can press **[Enter]** after typing one or two digits.

- b** To not change the value, press **[Esc]** and return to step **3**.

- c** Type the new value.

If you type a value greater than 240, this error message and prompt appears.

```
Minimum valid value is 0, Maximum valid value is 240
New Value ?
```

If you type an acceptable value, the **Rebroadcast Time Limit option** on the Messages submenu changes. The Messages submenu reappears.

- d** If you get an error message, return to step **b**.
e If you don't get an error message, return to step **3**

11.3.7 System Functions

To execute any of the system functions:

- 1** Be sure that the Setup menu is displayed.

The top part of the Setup menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
Setup Menu
-----
```

```
A) Set Date and Time
B) Milepost
C) Track Number
D) Alarm Limits
E) Equipment
F) Messages
G) -For Future Use-
H) System Functions
I) Polling System
```

```
•
•
•
```

2 Select the **System Functions** menu.

The System Functions menu appears.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
System Functions
-----
```

```
A) Radio Test
B) Vocabulary Test
C) Gate Test
D) 1KHz Test Tone
E) Auto-Calibration
F) Reset the COP Counters
G) Remote System RESET
H) Clear All Stored Train Data
I) Clear Event Log
J) Send JC Message
K) Send JM Message
L) Send JP Message
M) Send JS Message
N) Real-Time Diagnostics
X) Exit Menu
```

3 To leave the System Functions menu and return to the Setup menu:

a Press **[Esc]**.

The Setup menu reappears.

b Skip the remaining steps.

4 To execute the radio test:

Selection of the **Radio Test option** broadcasts a short message through the speaker and through the radio. At single-track sites, the text of the message is "Testing, U-P detector, milepost (milepost number), testing, one, two, three, four, five, four, three, two, one, testing detector-out." At multitrack sites, the text of the message is "Testing, UP detector, milepost (milepost number), track (track designation), testing, one, two, three, four, five, four, three, two, one, testing, detector-out."

a Be sure that the speaker (inside the SmartScanIS enclosure) is plugged in and that its volume knob is turned to the middle position.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
System Functions
-----
```

```
A) Radio Test
B) Vocabulary Test
C) Gate Test
```

```
•
•
•
```

- b** From the System Functions menu, select **Radio Test**.

If the system isn't currently making any other voice announcements, it begins the message. If the system is currently making a voice announcement, the firmware waits until it is done to begin the message.

- c** If you hear nothing or the speech is too garbled to understand, call STC for help in fixing this problem.

- d** Return to step 3.

5 To execute the vocabulary test:

Selection of the **Vocabulary Test option** enunciates all of the stored speech phrases. This announcement is broadcast through the speaker but not through the radio.

Below is a list of the phrases that are announced. The phrases are grouped by chip number.

Chip	Announced Phrases
1	Zero, One, Two, Three, Four, Five
2	Six, Seven, Eight, Nine, No-Defects
3	Detector-Malfunction, Point, Hotwheel, Testing
4	Axle, Dragging-Equipment-Near, North, Rail
5	South, East, West, Track, Hotbox
6	Defect-Detected, M-P-H, Fifth
7	Integrity-Failure, Detector-Out, Sixth
8	No Rebroadcast, Minutes, Train-Too-Slow, Total-Axles, Speed
9	A, B, C, D, E, Temperature, Length, Minus, First, Second
10	F, G, H, I, J, Third, Fourth, Left-Side, Right-Side, <i>beep</i>
11	K, L, M, N, O, High-Load, Wide-Load, On, Seventh, Eighth
12	P, Q, R, S, T, S-P-Detector, Milepost, Detector-Working
13	U, V, W, X, Y, Stop-Your-Train, U-P-Detector, Ninth
14	Z, Sliding-Wheel, Car-I-D, From-Head-of-Train, Degrees, Number
15	Multiple-Hot-Journal-and-Dragging-Equipment, Power-Off, High-Wide-Near
16	Detected-From-Axle, To-End-of-Train, Miles-Per-Hour, Multiple-Dragging-Equipment

- a** Be sure that the speaker (inside the SmartScanIS enclosure) is plugged in and that its volume knob is turned to the middle position.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
System Functions
-----
A) Radio Test
B) Vocabulary Test
C) Gate Test
      .
      .
      .
```

- b** From the System Functions menu, select **Vocabulary Test**.

If the system isn't currently making any other voice announcements, it begins the vocabulary-test announcement. If the system is currently making a voice announcement, the firmware waits until it is done to begin the vocabulary-test announcement.

- c** If you hear nothing or the speech is too garbled to understand, call STC for help in fixing this problem.
- d** Return to step 3.

6 To execute the gate test:

Selection of the **Gate Test option** opens the scanner shutters and simulates a passing train. While in this mode, you can simulate alarms by placing a heat source on a scanner or by opening an auxiliary alarm detector's contacts.

You can stop the gate test by pressing **[Esc]**. If you don't press **[Esc]**, the test continues until 486 axles are simulated. The firmware pauses between railcars and scans for a pressed **[Esc]**. Consequently, the gate test may not terminate immediately after **[Esc]** is pressed. It may need to finish the current car's axles. Pressing keys before pressing **[Esc]** results in the generation of additional cars of axles before aborting. There will be one additional car of axles for each key pressed before pressing **[Esc]**.

After pressing **[Y]** to begin the gate test, the "Running Gate Test..." message appears followed by a four-second pause.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
System Functions
-----
A) Radio Test
B) Vocabulary Test
C) Gate Test
D) 1KHz Test Tone
      .
      .
      .
```

- a** From the System Functions menu, select **Gate Test**.

This prompt appears.

```
Start Gate Test?
```

- b** To not start the gate test:

- Type **n**

The System Functions menu reappears.

- Return to step **3**.

- c** To start the gate test, type **y**

This message appears.

```
Running Gate Test...
```

When finished, this message appears followed by the System Functions menu.

```
Running Gate Test...Gate Test Complete
```

- d** Return to step **3**.

7 To execute the one-kilohertz Test Tone:

Selection of the **1KHz Test Tone option** generates a continuous one-kilohertz tone for 15 seconds. This tone is broadcast through the speaker and through the radio.

- a** Be sure that the speaker (inside the SmartScanIS enclosure) is plugged in and that its volume knob is turned to the middle position.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
System Functions
-----
A) Radio Test
B) Vocabulary Test
C) Gate Test
D) 1KHz Test Tone
E) Auto-Calibration
      .
      .
      .
```

- b** From the System Functions menu, select **1KHz Test Tone**.

If the system isn't currently making any other voice announcements, it begins the tone. If the system is currently making a voice announcement, the firmware waits until it is done to begin the tone.

- c** If you hear nothing, call STC for help in fixing this problem.

- d** Return to step **3**.

8 To start autocalibration:

Selection of the **Auto-Calibration option** places the system in autocalibration mode.

The SmartScanIS self-calibrates its pyrometer interface circuitry. You need only put a preheated calibrated heat source on a scanner and place the system in autocalibration mode. The system then scans all pyrometer inputs until the signal from the calibrated heat source is located. The necessary adjustments to the related interface circuitry are automatically made while the system monitors its own progress by analyzing changes in the heat signals. Once the procedure has been completed, autocalibration mode is disengaged, and the calibration results are displayed on your computer.

- a** Place a preheated calibrated heat source on the scanner to be calibrated.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
System Functions
-----
A) Radio Test
B) Vocabulary Test
C) Gate Test
D) 1KHz Test Tone
E) Auto-Calibration
F) Reset the COP Counters

      •
      •
      •
```

- b** From the System Functions menu, select **Auto-Calibration**.

The SmartScanIS will now calibrate itself. **Follow along on the user computer screen until you see "Auto-Calibration Disengaged."** This message is an indication that the system is finished with the calibration procedure. To abort the process, press **[Esc]** (on your computer) or remove the heat source (from the scanner).

- c** When "Auto-Calibration Disengaged" is displayed on your computer, remove the calibrated heat source.

- d** Return to step **3**.

- 9** To reset the COP counters:

Built into each microprocessor on the Processor board is a Computer Operating Properly (COP) monitor. This feature gives the processor the ability to monitor its own operation and, in the presence of abnormal operating conditions, automatically trigger a system reset. The SmartScanIS maintains a count of these system resets (until 255 is reached), whether initiated automatically by the system or manually by the user via the **Remote System Reset option** on the System Functions menu. These counters are used for diagnostic purposes only. The current value of these counters appears on the System Status report.

Selection of the **Reset the COP Counters option** resets each COP counter to zero.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013  9:35
System Functions
-----
```

- A) Radio Test
- B) Vocabulary Test
- C) Gate Test
- D) 1KHz Test Tone
- E) Auto-Calibration
- F) Reset the COP Counters
- G) Remote System RESET

•
•
•

- a** From the System Functions menu, select **Reset the COP Counters**.

The firmware clears the COP counter for both microprocessors.

The System Functions menu reappears.

- b** Return to step 3.

10 To force a system reset:

Selection of the **Remote System Reset option** forces a system reset through a remote connection. It can also be used locally.

- ```
•
•
•

F) Reset the COP Counters
G) Remote System RESET
H) Clear All Stored Train Data
```

•  
•  
•

- a** From the System Functions menu, select **Remote System RESET**.

This prompt appears.

```
Are You Sure?
```

- b** To not reset the system:

- Type **n**

The System Functions menu reappears.

- Return to step 3.

- c** To reset the system, type **y**

This message appears.

```
Will RESET 5 seconds after exit from Serial Interface!
```

The System Functions menu reappears.

- d** Return to step **3**.

**11** To delete all stored train data:

Selection of the **Clear All Stored Train Data option** erases all of the stored train data. This encompasses all of the trains in the Trains and Exceptions directories. After deleting all train data, there isn't any way of regenerating it. The data is gone forever.

```
 •
 •
 •
G) Remote System RESET
H) Clear All Stored Train Data
I) Clear Event Log
 •
 •
 •
```

- a** From the System Functions menu, select **Clear All Stored Train Data**.

This prompt appears.

```
Are You Sure?
```

- b** To not delete all stored train data:

- Type **n**

The System Functions menu reappears.

- Return to step **3**.

- c** To delete all stored train data, type **y**

This message appears.

```
Clearing Stored Train Data...
```

Clearing the train data takes about two seconds. When finished, this message appears followed by the System Functions menu.

```
Clearing Stored Train Data...Done
```

- d** Return to step **3**.

**12** To delete all of the events stored in the Event Log:

Selection of the **Clear Event Log option** erases all of the events stored in the Event Log and displayed on the Event Log report. After deleting the log, there isn't any way of regenerating it. The data is gone forever.

```
 •
 •
 •
H) Clear All Stored Train Data
I) Clear Event Log
J) Send JC Message
 •
 •
 •
```

- a** From the System Functions menu, select **Clear Event Log**.

This prompt appears.

```
Are You Sure?
```

- b** To not delete all of the events stored in the Event Log:

- Type **n**

The System Functions menu reappears.

- Return to step **3**.

- c** To delete all of the events stored in the Event Log, type **y**

The System Functions menu reappears.

- d** Return to step **3**.

**13** To send a Continuous Carrier signal to the Harriman Dispatch Center:

Selection of the **Send JC Message option** sends a Continuous Carrier signal for 15 seconds to the Harriman Dispatch Center.

```
 •
 •
I) Clear Event Log
J) Send JC Message
K) Send JM Message
L) Send JP Message
M) Send JS Message
N) Real-Time Diagnostics
X) Exit Menu
```

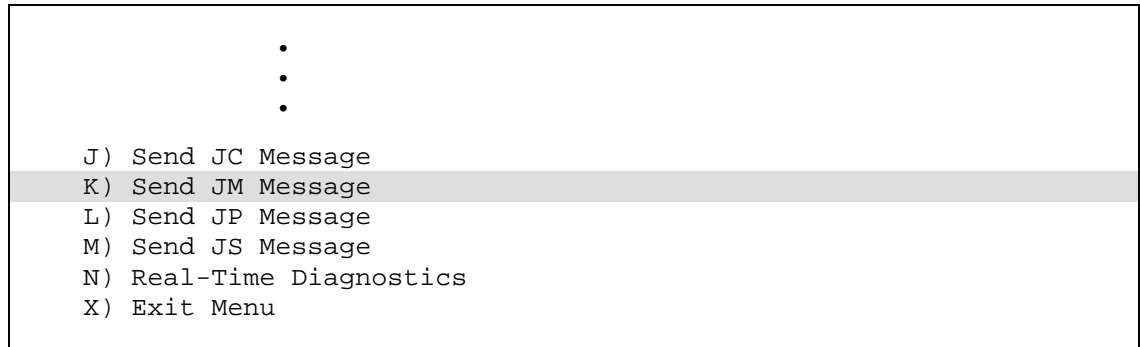
- a** From the System Functions menu, select **Send JC Message**.

After 15 seconds, the System Functions menu reappears.

- b** Return to step **3**.

**14** To send a Continuous Mark signal to the Harriman Dispatch Center:

Selection of the **Send JM Message option** sends a Continuous Mark signal for 15 seconds to the Harriman Dispatch Center.



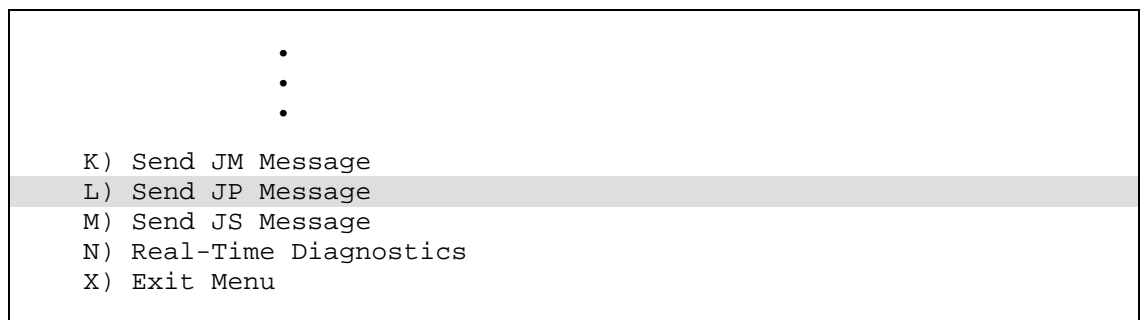
**a** From the System Functions menu, select **Send JM Message**.

After 15 seconds, the System Functions menu reappears.

**b** Return to step 3.

**15** To send a Mark-Space pattern to the Harriman Dispatch Center:

Selection of the **Send JP Message option** sends a Mark-Space pattern for 15 seconds to the Harriman Dispatch Center.



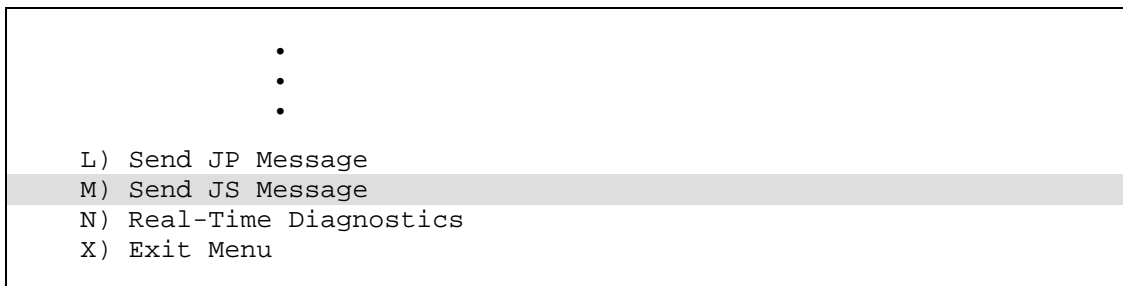
**a** From the System Functions menu, select **Send JP Message**.

After 15 seconds, the System Functions menu reappears.

**b** Return to step 3.

**16** To send a Continuous Space signal to the Harriman Dispatch Center:

Selection of the **Send JS Message option** sends a Continuous Space signal for 15 seconds to the Harriman Dispatch Center.



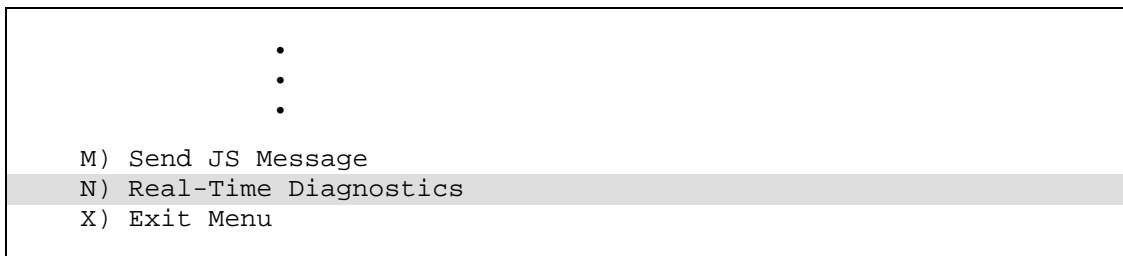
- a** From the System Functions menu, select **Send JS Message**.

After 15 seconds, the System Functions menu reappears.

- b** Return to step **3**.

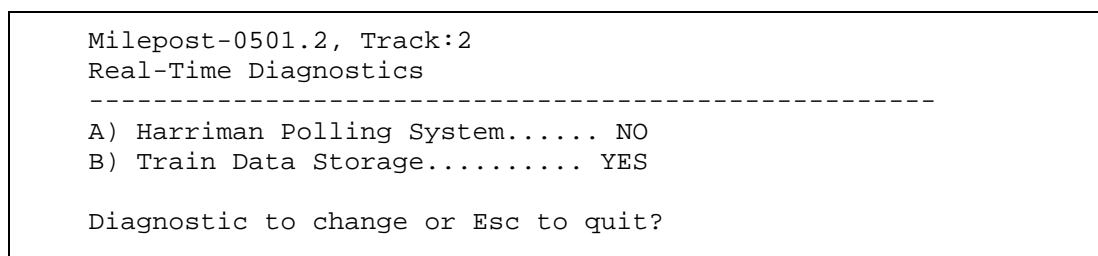
**17** To enable/disable real-time diagnostics:

Selection of the Real-Time Diagnostics submenu enables and disables various diagnostic messages. These messages aren't meant for general-purpose use and should only be enabled in consultation with STC personnel.



- a** From the System Functions menu, select **Real-Time Diagnostics**.

A message like this appears.



Typing the option letter toggles the diagnostics between enabled (YES) and disabled (NO).

- b** Select **Harriman Polling System** to change the setting for Harriman diagnostics.
- c** Select **Train Data Storage** to change the setting for train diagnostics.
- d** Press **[Esc]**.
- The System Functions menu reappears.
- e** Return to step **3**.

### 11.3.8 Polling System

The Polling System submenu is the gateway to creating a polling address so that the SmartScanIS can participate in the Central Reporting System. To participate in the Central Reporting System, each SmartScanIS must have a polling address. What that address is depends on which mode you're in. In Poll/Standalone mode, the address is based on a single alpha character designator. In Dialup mode, the address is based on the site name. Detectors operating in Dialup mode also require the entry of at least one telephone number.

To set or change any of the polling-system settings:

- 1 Be sure that the Setup menu is displayed.

The top part of the Setup menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
Setup Menu

A) Set Date and Time
B) Milepost
C) Track Number
D) Alarm Limits
E) Equipment
F) Messages
G) -For Future Use-
H) System Functions
I) Polling System
J) Serial Ports

 .
 .
 .
```

- 2 Select the **Polling System** submenu.

This prompt

```
Polling Mode is Dialup, is this OK (Y/N)?
```

or this one appears.

```
Polling Mode is Poll/Standalone, is this OK (Y/N)?
```

You can configure the SmartScanIS for either dialup mode or poll/standalone mode operation. **Dialup mode** should be chosen for systems that will be connected to the Harriman Dispatch Center via an external modem. **Poll/Standalone mode** should be chosen for systems that will be either connected to Harriman via a hardwired microwave connection or not connected to Harriman at all.

Typing **n** toggles between dialup mode and poll/standalone mode. When the correct operating mode is displayed, type **y**.

- 3 If the displayed operating mode is incorrect, type **n**

The operating-mode setting toggles between dialup and poll/standalone.

- 4 If the displayed operating mode is correct, type **y**

If you selected **dialup mode**, this prompt appears.

```
Milepost-0501.2, Track:2
Polling System - Dialup Mode

A) Primary Phone#..... Disabled
B) Secondary Phone#..... Disabled
C) Site ID..... UP123
D) Calibration Temp..... 180°
E) Wind Monitor..... Disabled
F) Rail Stress Monitor..... NO
G) High Wind Alarm..... 32mph
H) Rail Stress Lim. Low:-40 Hi:+40

Parameter to change or Esc to quit?
```

If you selected **poll/standalone mode**, this prompt appears.

```
Milepost-0501.2, Track:2
Polling System - Poll/Standalone Mode

A) Poll Address..... A
B) RFL Delay..... 200
C) Site ID..... UP123
D) Calibration Temp..... 180°
E) Wind Monitor..... Disabled
F) Rail Stress Monitor..... NO
G) High Wind Alarm..... 32mph
H) Rail Stress Lim. Low:-40 Hi:+40

Parameter to change or Esc to quit?
```

Currently, the rail stress monitor and rail stress limit options aren't supported in the firmware. Therefore, they won't be discussed below.

- 5 If you selected Dialup mode:

- a If you want to change the primary telephone number, select the **Primary Phone#** option and and then type in the desired phone number.

Dialup mode lets you enter up to two telephone numbers, which the SmartScanIS will use to initiate contact with the Harriman Dispatch Center. You can type up to 18 appropriate characters, or you can press **[Enter]** to cause the phone number to be disabled.

A comma is interpreted by most modems to represent a pause in the dialing process, such as the pause between dialing a number to obtain an outside line and then proceeding to dial the actual telephone number. The amount of time that the modem pauses when encountering a comma is a function of the modem's setup parameters.



- b If you want to disable the primary telephone number, select **Primary Phone#** and then press **[Enter]**.
  - c If you want to change the secondary telephone number, select **Secondary Phone#** and then type in the desired phone number.
  - d If you want to disable the secondary telephone number, select **Secondary Phone#** and then press **[Enter]**.
  - e Go to step 7.
- 6 If you selected Poll/Standalone mode:
- a If you want to change the **Poll Address** select the **Poll Address** option and then type in a letter.  
 Poll/Standalone mode lets you select an address letter. Any letter may be typed. If you don't input a poll address, it defaults to the letter **A**.
  - b If you want to change the **RFL Delay**, select the **Poll Delay** option and then type in a number from 200 through 500.  
 The number after the words RFL Delay is the amount of delay, in milliseconds, between the system keying of the polling-system radio and the time that the radio is ready to accurately transmit data. If you don't input a value for the RFL delay, it defaults to 200 milliseconds.
- 7 If you want to change the **Site ID**, select the **Site ID** option and then type in six or less digits, letters, or both digits and letters.  
 If you don't input a value for the site name, it defaults to *NONAME*.
- 8 If you want to change the **Calibration Temp**, select the **Calibration Temp** option and then type in a number from 100 through 250.  
 This option lets you enter the calibration temperature in degrees Fahrenheit. Once entered, this value is used for display purposes only. It is not an alarm limit. (This parameter defaults to 180.)
- 9 If you want to disable/enable the **Wind Monitor**  
 This option shows whether the wind-monitor feature is enabled (YES) or disabled (NO). It doesn't show whether the wind-monitor hardware was installed or not. Selecting the **Wind Monitor** option toggles enabled and disabled.
- 10 If you want to change the **High Wind Alarm** limit, select the **High Wind Alarm** option and then type in a number from 30 through 100.  
 This option lets you enter a wind speed in miles per hour. When the wind monitor records a wind speed that matches or exceeds this alarm limit, the detector flags a high wind condition and queues a WX message for transmission to the Harriman Dispatch Center. (This parameter defaults to 50.)
- 11 To leave the Polling System submenu and return to the Setup menu, press **[Esc]**.  
 The Setup menu reappears.

## 11.3.9 Serial Ports

To set or change any of the serial-ports settings:

- 1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
Setup Menu

A) Set Date and Time
B) Milepost
C) Track Number
D) Alarm Limits
E) Equipment
F) Messages
G) -For Future Use-
H) System Functions
I) Polling System
J) Serial Ports
K) Amtech Reader Parameters
L) Modem Setup
X) Exit Menu
```

- 2 Select **Serial Ports** option to display the submenu.

A prompt like this appears.

```
Milepost-0501.2, Track:2
Serial Ports

Port Tx Rx Line Setting

A) COM1-P9 9600 9600 N-8-1
B) COM2-P10 9600 9600 N-8-1
C) COM3-P8 9600 9600 N-8-1

Port to change or Esc to quit?
```

When using the Serial Ports submenu to alter the serial port parameters, pressing **[Esc]** saves any parameter changes made by the user.

**3** Select **COM1-P9** to modify the COM1 serial port's parameters.

A prompt like this appears.

```
Milepost-0501.2, Track:2
Serial Ports
COM1-P9 Tx-9600/Rx-9600 N-8-1

A) Increase Tx Baud Rate
B) Decrease Tx Baud Rate
C) Increase Rx Baud Rate
D) Decrease Rx Baud Rate
X) Exit Menu

Parameter to change or Esc to quit?
```

Select the appropriate option to either increase or decrease the transmit or receive baud rate for COM1. Depending on which letter you type and what baud rate was displayed when you typed it, the baud rate changes to either the next or the prior value from these values: 150, 300, 600, 1200, 2400, 4800, 9600, and 19200. You can't change the line setting of N-8-1.

**a** Type the letter of what you want to change.

The prompt reappears.

**b** If you aren't done changing the parameters for COM1, return to step **a**.

**c** If you are done changing the parameters for COM1, type **x**

**4** Select **COM2-P10** to modify the COM2 serial port's parameters.

A prompt like this appears.

```
Milepost-0501.2, Track:2
Serial Ports
COM2-P10 Tx-9600/Rx-9600 N-8-1

A) Increase Tx Baud Rate
B) Decrease Tx Baud Rate
C) Increase Rx Baud Rate
D) Decrease Rx Baud Rate
E) N-8-1
F) E-7-1
X) Exit Menu

Parameter to change or Esc to quit?
```

Select the appropriate option to increase or decrease the transmit or receive baud rate for COM2. Depending on which letter you type and what baud rate was displayed when you typed it, the baud rate changes to either the next or the prior value from these values: 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200. Select **N-8-1** for no parity bit, 8 data bits, and 1 stop bit. Select **E-7-1** for even parity bit, 7 data bits, and 1 stop bit.

**a** Type the letter of what you want to change.

The prompt reappears.

**b** If you aren't done changing the parameters for COM2, return to step **a**.

**c** If you are done changing the parameters for COM2, type **x**

**5** Select **COM3-P8** to modify the COM3 serial port's parameters.

A prompt like this appears.

```
Milepost-0501.2, Track:2
Serial Ports
COM3-P8 Tx-9600/Rx-9600 N-8-1

A) Increase Tx Baud Rate
B) Decrease Tx Baud Rate
C) Increase Rx Baud Rate
D) Decrease Rx Baud Rate
E) N-8-1
F) E-7-1
X) Exit Menu

Parameter to change or Esc to quit?
```

Select the appropriate option to either increase or decrease the transmit or receive baud rate for COM3. Depending on which letter you type and what baud rate was displayed when you typed it, the baud rate changes to either the next or the prior value from these values: 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200. Select **N-8-1** for no parity bit, 8 data bits, and 1 stop bit. Select **E-7-1** for even parity bit, 7 data bits, and 1 stop bit.

**a** Type the letter of what you want to change.

The prompt reappears.

**b** If you aren't done changing the parameters for COM3, return to step **a**.

**c** If you are done changing the parameters for COM3, type **x**

**6** To leave the Serial Ports submenu and return to the Setup menu, press **[Esc]**.

Pressing **[Esc]** now saves any parameter changes made by the user. The Setup menu reappears.

### 11.3.10 Amtech Reader Parameters

The AEI reader parameters directly affect how the 2200-750 Reader operates to acquire tags while a train is passing the site.

To set or change any of the reader parameters:

- 1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
Setup Menu

A) Set Date and Time
B) Milepost
C) Track Number
D) Alarm Limits
E) Equipment
F) Messages
G) -For Future Use-
H) System Functions
I) Polling System
J) Serial Ports
K) Amtech Reader Parameters
L) Modem Setup
X) Exit Menu
```

- 2 Select **Amtech Reader Parameters** to display the submenu.

A prompt like this appears.

```
Milepost-0501.2, Track:2
Amtech Reader Parameters - Reader1: AI1200 Reader2: None

A) ID Separation..... 2
B) Consecutive Reads..... 2
C) Uniqueness Timeout..... 120 Sec

Parameter to change or Esc to quit?
```

Shown above are the parameters currently defined in the system.

- ID Separation specifies the number of intervening tags that must be read and reported before a given tag is reported again. Valid values are 1, 2, 3, and 4. The default is 2.
- Consecutive Reads specifies the number of times that a tag must be read before it is considered a valid (reportable) tag. Valid values are 1, 2, 3, and 4. The default is 2.
- Uniqueness Timeout specifies the number of seconds that the ID Separation parameter is in effect for a given tag. When a 2200-750 Reader is attached to the system, the Uniqueness Timeout parameter is automatically set to 120 seconds. For a 2200-750 Reader, this value cannot be changed.

- 3 Select **ID Separation** to modify the parameter.

A prompt like this appears.

```
Current ID Separation: 2
Modify ? (Y/N):
```

- a Type **y** until the value you want is shown.

Typing the letter **y** cycles the displayed value from 1 through 4.

- b Type **n**

- 4 Select **Consecutive Reads** to modify the parameter.

A prompt like this appears.

```
Current Consecutive Reads: 2
Modify ? (Y/N):
```

- a Type **y** until the value you want is shown.

Typing the letter **y** cycles the displayed value from 1 through 4.

- b Type **n**

- 5 Select **Uniqueness Timeout** to modify the parameter.

A prompt like this appears.

```
Current Uniqueness Timeout: 120 Seconds
Modify ? (Y/N):
```

- a Type **y** until the value you want is shown.

Typing the letter **y** switches from 15 to 30, from 30 to 120, or from 120 to 15.

When a 2200-750 Reader is attached to the system, the Uniqueness Timeout parameter is automatically set to 120 seconds. For a 2200-750 Reader, this value cannot be changed.

- b Type **n**

- 6 To leave the Amtech Reader Parameters submenu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

### 11.3.11 Modem Setup

To set or change any of the modem-setup settings:

- 1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
Setup Menu

A) Set Date and Time
B) Milepost
C) Track Number
D) Alarm Limits
E) Equipment
F) Messages
G) -For Future Use-
H) System Functions
I) Polling System
J) Serial Ports
K) Amtech Reader Parameters
L) Modem Setup
X) Exit Menu
```

- 2 Select **Modem Setup** to display the submenu.

A prompt like this appears.

```
Milepost-0501.2, Track:2
Modem Setup

A) Modem Setup Line 1 = AT&F
B) Modem Setup Line 2 = ATV0 S0=2 &D0 &Q1
C) Modem Setup Line 3 = ATX4 E0 &E3
D) Modem Setup Line 4 = Empty
E) Modem Setup Line 5 = AT&W0

The Default modem is selected, is this OK (Y/N)?
```

Lines like this appear. These lines show the current modem configuration. Support exists in the firmware for two modem types. The "default" modem type provides a preset series of modem configuration commands. These commands cannot be altered. The "alternate" modem type provides the ability to edit and customize the modem setup commands. This submenu also provides a method for forcing the initialization of the modem.

Below the current modem configuration, this prompt

```
The Default modem is selected, is this OK (Y/N)?
```

or this one appears.

```
The Alternate modem is selected, is this OK (Y/N)?
```

Typing **n** toggles between default modem and alternate modem. When the correct modem type is displayed, type **y**.

- 3** If the displayed modem type is incorrect, type **n**

The modem-selection setting toggles between default and alternate.

- 4** If the displayed modem type is correct, type **y**

If you selected Default, the system reverts to the default modem configuration and this prompt appears.

```
Do you want to initialize the modem now (Y/N)?
```

- 5** If the selected modem type is Default, go to step **9**.

- 6** If the selected modem type is Alternate, this prompt appears.

```
Modem Setup - Alternate Modem Initialization Selected

Modem Setup Line 1 = ATVS0=2$MB9600
Modem Setup Line 2 = Empty
Modem Setup Line 3 = Empty
Modem Setup Line 4 = Empty
Modem Setup Line 5 = Empty
Are the setup commands OK (Y/N)?
```



- 7 If you need to modify one or more of the five displayed lines of modem setup commands, type **n**

This prompt appears.

```
Enter line number to change (1-5):
```

There are five available lines for setup command data, each line having a maximum of 25 characters of data. Entry of a line number is followed by a prompt for entry of the new modem setup data for the selected line number. Type in the desired modem commands, pressing **[Enter]** when done. If an entered command consumes the entire 25 characters of a line, the newly entered data is automatically saved upon entry of the 25th character. The contents of a line can be removed entirely by immediately pressing **[Enter]** when prompted for the new setup data. On the Modem Setup submenu and on the System Status report, lines that have been cleared of data this way will show the word Empty.

This screen fragment shows an example of erasing the fifth line of setup data. Pressing **[Enter]** to clear the fifth line is shown by **[Enter]** in the example.

```
Are the setup commands OK (Y/N)?n
Enter line number to change (1-5):5
Enter new setup commands (25 characters max):[Enter]
Are the setup commands OK (Y/N)?
```

- 8 If you don't need to correct any of the five displayed lines of modem setup commands, type **y**

This prompt appears.

```
Do you want to initialize the modem now (Y/N)?
```

- 9 If you want to initialize the modem now, type **y**

The modem initialization routine uses the current modem setup data. A one-second pause is placed between each line of setup commands as they are output to the modem. Empty setup command lines aren't outputted to the modem. After the modem is initialized, the Modem Setup submenu reappears.

- 10 If you don't want to initialize the modem now, type **n**

The Modem Setup submenu reappears.

- 11 To leave the Modem Setup submenu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.



## Chapter 12

# Producing Reports

---

The SmartScanIS provides:

- Train Summary report
- Train Detail report
- Exception Summary report
- Exception Detail report (extended)
- Exception Detail report (abbreviated)
- System Status report
- Last Train report
- Range of Trains report
- Event Log report
- T94 Train Detail

After plugging a laptop computer into the system, you can produce any of these 10 reports by using the serial interface.

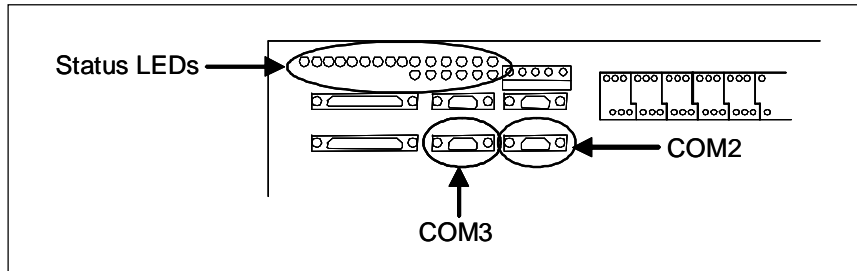
When using a computer, use your communications software to open a LOG file and capture the reports to the file. (You need to do this because reports don't contain logic to pause when the screen is filled.) When your session is complete, you may then view the recorded reports with an editor or print them with a printer.

This chapter shows a sample of each report with instructions on how to use the serial interface to produce it. The content of each field on each report is also covered. In the sample reports, do not interpret the displayed data as representing real-world conditions or activity. The examples are meant to illustrate the general appearance of a given report and provide a reference for the location of relevant data.

This chapter also lists step-by-step instructions on producing each report both **on-site** and **off-site**. The instructions for each report start with you being at the Main menu, which is described below.

**1 If on-site:**

- a** If COM3 has nothing plugged in it, plug your computer into it.



- b** If COM3 has something plugged into it, unplug what is connected to COM3 and plug your computer into it.
- 2** If **off-site**, plug your computer into a modem that is plugged into a nonswitched analog telephone line.
- 3** Turn on your computer.
- 4** Be sure that your computer has installed communications software, that it is set to use full-duplex, and that the baud rate is set correctly.

If **on-site**, the baud rate of your computer must match the baud rate of the selected serial port because they are in direct, one-to-one communication with one another. For example, the baud rate for COM3 was set to 9600 at the factory. If the customer changes this baud rate, your computer must be set to the changed value.

For **off-site** connections, the baud rate of your computer doesn't have to match the baud rate of the selected serial port because the telephone network between the two modems breaks this direct physical connection. In an **off-site** setup, your computer and its modem have a direct connection, the two modems have a direct connection, and the detector and its modem have a direct connection. Each of these individual direct connections must have matching baud rates. However, the different connection "types" (user computer to modem, modem to modem, detector to modem) don't have to share a common baud rate (although it's simpler if they do).

Opening a LOG file captures the whole session to the file. Then, when your session is done, you can view what you have done with an editor, print it with a printer, or store it for later retrieval.

- 5** On your computer, open a LOG file.

**6 If off-site:**

- a** From your computer, dial and connect to the modem at the site to which you want to communicate.
- b** Wait for the "connect" message from your modem.

- 7 To get the serial interface to come up, press **[Esc]**.

The Main menu appears.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
Main Menu

A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
F) Last Train
G) Range of Trains
H) Event Log
I) Setup Menu
J) T94 Train Detail
X) Exit Menu
```

At the above prompt, you can produce one of the listed reports by selecting the appropriate option.

- 8 When done, close the LOG file.

- 9 To exit the serial interface and return the SmartScanIS to normal operation, type **x**

When a session ends, if a modem was used, the system sends various commands to the modem to prepare it for future use. If at any time during the disconnect procedure, lines such as “+++ATH0” appear on your screen, these are merely commands preparing the modem for further use. They shouldn’t be construed as anything that is meant for the user.

- 10 If **on-site** and if you unplugged a device from COM3, plug the device back in after unplugging your computer.

## 12.1 Train Summary Report

The Train Summary report lists all trains currently stored in the Trains directory. A train number is shown for each train entry so that a Train Detail report may easily be produced for any train listed on the summary.

Below is a sample of part of a Train Summary report when Hotwheel alarm reporting is disabled using the **Hotwheel option** on the Equipment submenu. The contents of your report will be different. The version information in the sample below is for illustrative purposes only. It doesn't represent any real release of the firmware.

|                                                                                                                                 |      |                    |       |                 |            |     |     |                  |       |    |     |         |      |         |      |         |         |         |     |
|---------------------------------------------------------------------------------------------------------------------------------|------|--------------------|-------|-----------------|------------|-----|-----|------------------|-------|----|-----|---------|------|---------|------|---------|---------|---------|-----|
| Southern Technologies Corporation<br>Integrated Detector System<br>Union Pacific Railroad<br><b>TRAIN SUMMARY</b><br>06/23/2013 |      |                    |       |                 |            |     |     |                  |       |    |     |         |      |         |      |         |         |         |     |
| =====                                                                                                                           |      |                    |       |                 |            |     |     |                  |       |    |     |         |      |         |      |         |         |         |     |
| Version Info....                                                                                                                |      | Analyzer:          | 1.01  | 01/10/2013      |            |     |     | Milepost: 0501.2 |       |    |     |         |      |         |      |         |         |         |     |
|                                                                                                                                 |      | Talker:            | 2.02  | 02/20/2013      |            |     |     | Track: Single    |       |    |     |         |      |         |      |         |         |         |     |
|                                                                                                                                 |      | Communicator:      | 3.03  | 03/30/2013      |            |     |     | SiteID: NONAME   |       |    |     |         |      |         |      |         |         |         |     |
| -----                                                                                                                           |      |                    |       |                 |            |     |     |                  |       |    |     |         |      |         |      |         |         |         |     |
| Alarm Limits..                                                                                                                  |      | Absolute: 200°     |       | CS Minimum: 245 |            |     |     |                  |       |    |     |         |      |         |      |         |         |         |     |
|                                                                                                                                 |      | Differential: 150° |       | CS Slope: 2.34  |            |     |     |                  |       |    |     |         |      |         |      |         |         |         |     |
| -----                                                                                                                           |      |                    |       |                 |            |     |     |                  |       |    |     |         |      |         |      |         |         |         |     |
| D                                                                                                                               |      |                    |       |                 |            |     |     |                  |       |    |     |         |      |         |      |         |         |         |     |
| Train#                                                                                                                          | Date | Time               | Cars  | Axles           | Txd Counts |     | Txd | Spikes           | Speed | i  | Max | Bearing | Avg  | Bearing | Tags | Battery | T01Hits | T02Hits |     |
| -----                                                                                                                           |      |                    |       |                 |            |     |     |                  |       |    |     |         |      |         |      |         |         |         |     |
| I                                                                                                                               | 177  | 06/21/13           | 08:32 | 18              | 78         | 78  | 78  | 0                | 0     | 57 | E   | 37°     | 38°  | 36°     | 37°  | 0       | 27.2v   | 156     | 156 |
|                                                                                                                                 | 176  | 06/21/13           | 07:40 | 10              | 46         | 46  | 46  | 0                | 0     | 57 | E   | 150°    | 8°   | 43°     | 7°   | 0       | 27.2v   | 92      | 92  |
|                                                                                                                                 | 175  | 06/21/13           | 06:28 | 14              | 62         | 62  | 62  | 0                | 0     | 57 | E   | 37°     | 38°  | 36°     | 37°  | 0       | 27.2v   | 124     | 124 |
| -----                                                                                                                           |      |                    |       |                 |            |     |     |                  |       |    |     |         |      |         |      |         |         |         |     |
| I                                                                                                                               | 174  | 06/20/13           | 11:32 | 18              | 78         | 78  | 78  | 1                | 0     | 53 | E   | 56°     | 56°  | 55°     | 55°  | 0       | 27.1v   | 158     | 156 |
|                                                                                                                                 | 173  | 06/20/13           | 01:19 | 18              | 78         | 78  | 78  | 0                | 0     | 55 | E   | 126°    | 126° | 58°     | 20°  | 0       | 26.7v   | 156     | 156 |
| -----                                                                                                                           |      |                    |       |                 |            |     |     |                  |       |    |     |         |      |         |      |         |         |         |     |
| I                                                                                                                               | 172  | 06/19/13           | 11:24 | 53              | 218        | 218 | 218 | 0                | 0     | 49 | E   | 116°    | 116° | 54°     | 18°  | 0       | 27.1v   | 436     | 436 |
| I                                                                                                                               | 171  | 06/19/13           | 01:22 | 8               | 38         | 38  | 38  | 0                | 0     | 53 | E   | 120°    | 120° | 55°     | 18°  | 0       | 27.1v   | 76      | 76  |
| -----                                                                                                                           |      |                    |       |                 |            |     |     |                  |       |    |     |         |      |         |      |         |         |         |     |
| .                                                                                                                               |      |                    |       |                 |            |     |     |                  |       |    |     |         |      |         |      |         |         |         |     |
| .                                                                                                                               |      |                    |       |                 |            |     |     |                  |       |    |     |         |      |         |      |         |         |         |     |
| .                                                                                                                               |      |                    |       |                 |            |     |     |                  |       |    |     |         |      |         |      |         |         |         |     |

Below is a sample of part of a Train Summary report when Hotwheel alarm reporting is enabled using the **Hotwheel option** on the Equipment submenu. The contents of your report will be different.

|                |  |                    |      |      |       |                |     |            |     |       |   |             |       |             |       |           |       |           |       |
|----------------|--|--------------------|------|------|-------|----------------|-----|------------|-----|-------|---|-------------|-------|-------------|-------|-----------|-------|-----------|-------|
| .              |  |                    |      |      |       |                |     |            |     |       |   |             |       |             |       |           |       |           |       |
| .              |  |                    |      |      |       |                |     |            |     |       |   |             |       |             |       |           |       |           |       |
| .              |  |                    |      |      |       |                |     |            |     |       |   |             |       |             |       |           |       |           |       |
| Alarm Limits.. |  | Absolute: 180°     |      |      |       | CS Minimum: 60 |     |            |     |       |   |             |       |             |       |           |       |           |       |
|                |  | Differential: 120° |      |      |       | CS Slope: 0.75 |     |            |     |       |   |             |       |             |       |           |       |           |       |
|                |  | Hot Wheel: 540°    |      |      |       |                |     |            |     |       |   |             |       |             |       |           |       |           |       |
| -----          |  |                    |      |      |       |                |     |            |     |       |   |             |       |             |       |           |       |           |       |
| D              |  |                    |      |      |       |                |     |            |     |       |   |             |       |             |       |           |       |           |       |
| Train#         |  | Date               | Time | Cars | Axles | Txd Counts     |     | Txd Spikes |     | Speed | i | Max Bearing |       | Avg Bearing |       | Max Wheel |       | Avg Wheel |       |
|                |  |                    |      |      |       | T01            | T02 | T01        | T02 | (mph) | r | North       | South | North       | South | North     | South | North     | South |
|                |  |                    |      |      |       |                |     |            |     |       |   |             |       |             |       |           |       |           |       |
| -----          |  |                    |      |      |       |                |     |            |     |       |   |             |       |             |       |           |       |           |       |
| .              |  |                    |      |      |       |                |     |            |     |       |   |             |       |             |       |           |       |           |       |
| .              |  |                    |      |      |       |                |     |            |     |       |   |             |       |             |       |           |       |           |       |
| .              |  |                    |      |      |       |                |     |            |     |       |   |             |       |             |       |           |       |           |       |

The Train Summary report is divided into a header section and a detail section. The header section contains general information about the site. The detail section contains summary information on each train that passed the site.

The SmartScanIS calculates a checksum for each train. This checksum is stored with the train data. Later, when the system retrieves this data, it recalculates the checksum. If the two checksums don't match, the Train Summary report so states in the detail section. Therefore, instead of getting a train record, you'll get a checksum-error line, as shown below.

|                                                             |      |                                                 |       |       |     |     |     |     |       |    |       |       |       |       |      |         |         |         |     |
|-------------------------------------------------------------|------|-------------------------------------------------|-------|-------|-----|-----|-----|-----|-------|----|-------|-------|-------|-------|------|---------|---------|---------|-----|
| Southern Technologies Corporation                           |      |                                                 |       |       |     |     |     |     |       |    |       |       |       |       |      |         |         |         |     |
| Integrated Detector System                                  |      |                                                 |       |       |     |     |     |     |       |    |       |       |       |       |      |         |         |         |     |
| Union Pacific Railroad                                      |      |                                                 |       |       |     |     |     |     |       |    |       |       |       |       |      |         |         |         |     |
| TRAIN SUMMARY                                               |      |                                                 |       |       |     |     |     |     |       |    |       |       |       |       |      |         |         |         |     |
| 06/23/2013                                                  |      |                                                 |       |       |     |     |     |     |       |    |       |       |       |       |      |         |         |         |     |
| =====                                                       |      |                                                 |       |       |     |     |     |     |       |    |       |       |       |       |      |         |         |         |     |
| Version Info.... Analyzer: 1.01 01/10/2013 Milepost: 0501.2 |      |                                                 |       |       |     |     |     |     |       |    |       |       |       |       |      |         |         |         |     |
| Talker: 2.02 02/20/2013 Track: Single                       |      |                                                 |       |       |     |     |     |     |       |    |       |       |       |       |      |         |         |         |     |
| Communicator: 3.03 03/30/2013 SiteID: NONAME                |      |                                                 |       |       |     |     |     |     |       |    |       |       |       |       |      |         |         |         |     |
| Alarm Limits.. Absolute: 200° CS Minimum: 245               |      |                                                 |       |       |     |     |     |     |       |    |       |       |       |       |      |         |         |         |     |
| Differential: 150° CS Slope: 2.34                           |      |                                                 |       |       |     |     |     |     |       |    |       |       |       |       |      |         |         |         |     |
| -----                                                       |      |                                                 |       |       |     |     |     |     |       |    |       |       |       |       |      |         |         |         |     |
| D                                                           |      |                                                 |       |       |     |     |     |     |       |    |       |       |       |       |      |         |         |         |     |
| Txd Counts Txd Spikes Speed i Max Bearing Avg Bearing       |      |                                                 |       |       |     |     |     |     |       |    |       |       |       |       |      |         |         |         |     |
| Train#                                                      | Date | Time                                            | Cars  | Axles | T01 | T02 | T01 | T02 | (mph) | r  | North | South | North | South | Tags | Battery | T01Hits | T02Hits |     |
| -----                                                       |      |                                                 |       |       |     |     |     |     |       |    |       |       |       |       |      |         |         |         |     |
| M                                                           | 178  | 06/22/13                                        | 15:47 | 18    | 78  | 78  | 78  | 0   | 0     | 53 | E     | 16°   | 16°   | 56°   | 21°  | 0       | 27.1v   | 156     | 156 |
|                                                             | 177  | CHECKSUM ERROR: StartAddr 134879 EndAddr 134930 |       |       |     |     |     |     |       |    |       |       |       |       |      |         |         |         |     |
| I                                                           | 176  | 06/21/13                                        | 07:40 | 10    | 46  | 46  | 46  | 0   | 0     | 57 | E     | 150°  | 8°    | 43°   | 7°   | 0       | 27.2v   | 92      | 92  |
|                                                             | 175  | 06/21/13                                        | 06:28 | 14    | 62  | 62  | 62  | 0   | 0     | 57 | E     | 37°   | 38°   | 36°   | 37°  | 0       | 27.2v   | 124     | 124 |
| .                                                           |      |                                                 |       |       |     |     |     |     |       |    |       |       |       |       |      |         |         |         |     |
| .                                                           |      |                                                 |       |       |     |     |     |     |       |    |       |       |       |       |      |         |         |         |     |
| .                                                           |      |                                                 |       |       |     |     |     |     |       |    |       |       |       |       |      |         |         |         |     |

The table below lists the fields from the header section and the content of each field.

| Heading      | Contents of Field                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Version Info | Software version numbers and release dates for the firmware. "Analyzer" is the firmware chip (in socket <b>U2</b> ) on the Processor board that is run by processor-A (in socket <b>U1</b> ). "Talker" is the firmware chip (in socket <b>U3</b> ) on the Talker board that is run by the processor in socket <b>U1</b> . "Communicator" is the firmware chip (in socket <b>U12</b> ) on the Processor board that is run by processor-B (in socket <b>U11</b> ). |
| Milepost     | The five-digit milepost of the site. <b>Chapter 11 - Serial Interface</b> tells how to set this value using the Milepost submenu.                                                                                                                                                                                                                                                                                                                                |
| Track        | The track designator of the site. For single-track sites, the value is Single. For multitrack sites, valid values are 1, 2, 3, 4, 5, and 6. <b>Chapter 11 - Serial Interface</b> tells how to set this value using the Track Number submenu.                                                                                                                                                                                                                     |

| Heading      | Contents of Field                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SiteID       | The name of the site. This can be supplied either by the Harriman Dispatch Center via the Polling System <u>or</u> by the <b>Site ID option</b> on the Polling System submenu. The default is <i>NONAME</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Alarm Limits | <p>These are the alarm parameters currently defined in the system setup. These values were in place at the time this report was run and were set using the serial interface.</p> <ul style="list-style-type: none"> <li>• The value after Absolute is set by the <b>Absolute option</b> on the Alarm Limits submenu.</li> <li>• The value after Differential is set by the <b>Differential option</b> on the Alarm Limits submenu.</li> <li>• The heading Hot Wheel only appears if Hotwheel alarm reporting is enabled. The value after Hot Wheel is set by the <b>Hotwheel option</b> on the Alarm Limits submenu.</li> <li>• The value after CS Minimum is set by the <b>Carside Minimum option</b> on the Alarm Limits submenu.</li> <li>• The value after CS Slope is set by the <b>Carside Slope option</b> on the Alarm Limits submenu.</li> </ul> <p><b>Chapter 11 - Serial Interface</b> tells how to set these values.</p> |

The table below lists the fields from the detail section and the contents of each field.

| Heading     | Contents of Field                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Train#      | The number that identifies the train in the Trains directory. If the letter <b>E</b> precedes this number, one or more Exception Alarms were detected on the train. If the letter <b>S</b> precedes, one or more System Alarms were detected. If the letter <b>I</b> precedes, one or more Integrity Failures <u>or</u> both Integrity Failures and System Alarms were detected. If the letter <b>M</b> precedes, both an Exception Alarm and either an Integrity Failure, a System Alarm, or both were detected. If the letter <b>L</b> follows one of the above letters, a Sliding Wheel alarm was found on the train. |
| Date        | The date the train arrived at the site. Date is in <b>mm/dd/yy</b> format.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Time        | The time the train arrived at the site. Time is in 24-hour <b>hh:mm</b> format, where 8 a.m. is 08:00, noon is 12:00, 8 p.m. is 20:00, and midnight is 00:00.                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Cars        | The total number of cars counted by the SmartScanIS.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Axles       | The total number of axles counted by the SmartScanIS.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Txd Counts  | Under this heading are two columns, one for each gating transducer, containing the number of hits counted by the gating transducers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Txd Spikes  | Under this heading are two columns, one for each gating transducer, containing the number of spikes detected by the gating transducers. (Note: Spikes are ignored for a train's first thirty-six axles and for all subsequent six-axle vehicles.)                                                                                                                                                                                                                                                                                                                                                                        |
| Speed (mph) | The train's exit speed in miles per hour.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Dir         | The direction the train was traveling. Valid values are N, S, E, and W.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |



| Heading     | Contents of Field                                                                                                                                                                                                                                                                                   |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Max Bearing | Under this heading are two columns, one for each rail, containing the <u>maximum</u> temperature read by the <u>bearing scanners</u> for each railside. If the track orientation is east and west, rails are north and south. If the track orientation is north and south, rails are east and west. |
| Avg Bearing | Under this heading are two columns, one for each rail, containing the <u>average</u> temperature read by the <u>bearing scanners</u> for each railside.                                                                                                                                             |
| Max Wheel   | Under this heading are two columns, one for each rail, containing the <u>maximum</u> temperature read by the <u>wheel scanners</u> for each railside. This heading appears only when Hotwheel alarm reporting is enabled using the <b>Hotwheel option</b> on the Equipment submenu.                 |
| Avg Wheel   | Under this heading are two columns, one for each rail, containing the <u>average</u> temperature read by the <u>wheel scanners</u> for each railside. This heading appears only when Hotwheel alarm reporting is enabled using the <b>Hotwheel option</b> on the Equipment submenu.                 |
| Tags        | The total number of AEI tags stored (that is, the number of tag pairs found plus those single tags that lack a match). This heading always appears, even if the AEI subsystem is disabled using the <b>AEI option</b> on the Equipment submenu.                                                     |
| Battery     | The backup battery voltage at the time the train passed the site.                                                                                                                                                                                                                                   |
| TO1Hits     | The total number (for a given train) of interrupt firings for gating transducer TO1. Since each interrupt fires once on a signal's rising-edge and once on a signal's falling-edge, this value should be double the train's Txd Count for gating transducer TO1.                                    |
| TO2Hits     | The total number (for a given train) of interrupt firings for gating transducer TO2. Since each interrupt fires once on a signal's rising-edge and once on a signal's falling-edge, this value should be double the train's Txd Count for gating transducer TO2.                                    |

To produce a Train Summary report:

- 1 Using the serial interface, display the Main menu.

The Main menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
Main Menu

A) Train Summary
B) Train Detail
C) Exception Summary
 .
 .
 .
```

- 2 Select **Train Summary**.

At this time, you can produce another report by selecting the appropriate option.

- 3 When done, close the LOG file.
- 4 To exit the serial interface and return the SmartScanIS to normal operation, type **x**
- 5 If **on-site** and if you unplugged a device from COM3, plug the device back in after unplugging your computer.

## 12.2 Train Detail Report

The Train Detail report provides detailed information on a single train. When choosing this report, you'll be prompted for a train number. When prompted, type a train number from the Train Summary report. The train number appears under the column titled "Train#" in the detail section of that report.

Below is a sample of part of a Train Detail report when Hotwheel alarm reporting is disabled, and the AEI subsystem is disabled at the time the report was requested. The contents of your report will be different. The version information in the sample below is for illustrative purposes only. It doesn't represent any real release of the firmware.

Southern Technologies Corporation  
Integrated Detector System  
Union Pacific Railroad  
**TRAIN DETAIL**

```
=====
Train#: 5 Speed: 43 Milepost: 0501.2
Date: 05/01/2013 Axles: 194 Track: Single
Time: 12:55 Direction: East Temperature: +51°
SiteID: NONAME Battery: 27.7v
=====
```

| Rail  | Max  | Avg | Resistor |      | Transducer |        | Alarm | Limit        | CS Slope | Parms          |
|-------|------|-----|----------|------|------------|--------|-------|--------------|----------|----------------|
|       |      |     | Read     | Req  | Count      | Spikes |       |              |          |                |
| North | 186° | 77° | 142°     | 160° | T01:       | 194    | 0     | Absolute     | 180°     | CS Min: 60     |
| South | 181° | 68° | 99°      | 160° | T02:       | 194    | 0     | Differential | 100°     | CS Slope: 0.75 |
|       |      |     |          |      |            |        |       | Hot Wheel    | 556°     |                |

Resistor Integ. Test: Enabled  
Cold Rail Test: All Trains

System Alarms

-----  
Cold North Resistor  
Cold South Resistor  
System Integrity Check Passed!

Train Alarms: 5

-----  
Axle 46 South Rail Absolute  
Axle 77 South Rail Differential  
Axle 193 North Rail Absolute  
Axle 193 South Rail Absolute  
Axle 194 North Rail Absolute

Firmware Versions

-----  
Analyzer: 1.01 01/10/2013    Talker: 2.02 02/20/2013    ComBoard: 3.03 03/30/2013

| Car | Axle | Rail  |       | ON | OFF | PW1 | PW2 | TxdHits |     | Alarms              |
|-----|------|-------|-------|----|-----|-----|-----|---------|-----|---------------------|
|     |      | North | South |    |     |     |     | T01     | T02 |                     |
| 1   | 1    | 56°   | 21°   | 25 | 0   | 8   | 8   | 2       | 2   |                     |
|     | 2    | 57°   | 21°   | 25 | 59  | 5   | 5   | 2       | 2   |                     |
|     | 3    | 56°   | 21°   | 25 | 59  | 5   | 5   | 2       | 2   |                     |
|     | 4    | 56°   | 21°   | 25 | 362 | 5   | 5   | 2       | 2   |                     |
|     | 5    | 56°   | 21°   | 25 | 59  | 5   | 5   | 2       | 2   |                     |
|     | 6    | 56°   | 21°   | 25 | 59  | 4   | 5   | 2       | 2   |                     |
| 2   | 7    | 56°   | 20°   | 25 | 162 | 5   | 5   | 2       | 2   |                     |
|     | 8    | 56°   | 21°   | 25 | 59  | 5   | 5   | 2       | 2   |                     |
|     |      |       |       |    | .   |     |     |         |     |                     |
|     |      |       |       |    | .   |     |     |         |     |                     |
|     |      |       |       |    | .   |     |     |         |     |                     |
|     | 193  | 186°  | 181°  | 25 | 59  | 5   | 5   | 2       | 2   | North Rail Absolute |
|     |      |       |       |    |     |     |     |         |     | South Rail Absolute |
|     | 194  | 183°  | 170°  | 25 | 641 | 5   | 5   | 2       | 2   | North Rail Absolute |
|     |      |       |       |    | .   |     |     |         |     |                     |
|     |      |       |       |    | .   |     |     |         |     |                     |
|     |      |       |       |    | .   |     |     |         |     |                     |

Below is a sample of part of a Train Detail report when both the **AEI option** and **Hotwheel option** are enabled at the time the report was requested. Also, both the **AEI option** and **Hotwheel option** had to be enabled while the specified train was passing the site. The contents of your report will be different.

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Below is a sample of part of a Train Detail report when the AEI subsystem is enabled but no AEI equipment is installed. You'll also get this if the AEI equipment is installed but the **AEI option** was disabled during train passage.

```

 .
 .
 .

=====
AEI System Data

Tags Read Tags Stored: 0

Reader 1: 0 []
Reader 2: 0 []
=====

 .
 .
 .

```

The SmartScanIS calculates a checksum for each train. This checksum is stored with the train data. Later, when the system retrieves this data, it recalculates the checksum. If the two checksums don't match, the Train Detail report so states, as shown below.

```

Southern Technologies Corporation
Integrated Detector System
Union Pacific Railroad
TRAIN DETAIL
=====
CHECKSUM ERROR: StartAddr 134879 EndAddr 134930

```

In addition, each axle has a checksum associated with it. If an axle is determined to have an invalid checksum, the Train Detail report so states in the associated axle's row (as shown below).

|                                   |      |                                                 |       |    |     |         |                  |     |     |        |
|-----------------------------------|------|-------------------------------------------------|-------|----|-----|---------|------------------|-----|-----|--------|
| Southern Technologies Corporation |      |                                                 |       |    |     |         |                  |     |     |        |
| Integrated Detector System        |      |                                                 |       |    |     |         |                  |     |     |        |
| Union Pacific Railroad            |      |                                                 |       |    |     |         |                  |     |     |        |
| TRAIN DETAIL                      |      |                                                 |       |    |     |         |                  |     |     |        |
| =====                             |      |                                                 |       |    |     |         |                  |     |     |        |
| Train#:                           | 5    | Speed: 43                                       |       |    |     |         | Milepost: 0501.2 |     |     |        |
| .                                 |      |                                                 |       |    |     |         |                  |     |     |        |
| .                                 |      |                                                 |       |    |     |         |                  |     |     |        |
| .                                 |      |                                                 |       |    |     |         |                  |     |     |        |
|                                   |      | Rail                                            |       |    |     | TxdHits |                  |     |     |        |
| Car                               | Axle | North                                           | South | ON | OFF | PW1     | PW2              | TO1 | TO2 | Alarms |
| -----                             |      |                                                 |       |    |     |         |                  |     |     |        |
| 1                                 | 1    | 56°                                             | 21°   | 25 | 0   | 8       | 8                | 2   | 2   |        |
|                                   | 2    | 57°                                             | 21°   | 25 | 59  | 5       | 5                | 2   | 2   |        |
|                                   | 3    | 56°                                             | 21°   | 25 | 59  | 5       | 5                | 2   | 2   |        |
|                                   | 4    | CHECKSUM ERROR: StartAddr 136416 EndAddr 136427 |       |    |     |         |                  |     |     |        |
|                                   | 5    | 56°                                             | 21°   | 25 | 59  | 5       | 5                | 2   | 2   |        |
|                                   | 6    | 56°                                             | 21°   | 25 | 59  | 4       | 5                | 2   | 2   |        |
| 2                                 | 7    | 56°                                             | 20°   | 25 | 162 | 5       | 5                | 2   | 2   |        |
|                                   | 8    | 56°                                             | 21°   | 25 | 59  | 5       | 5                | 2   | 2   |        |
| .                                 |      |                                                 |       |    |     |         |                  |     |     |        |
| .                                 |      |                                                 |       |    |     |         |                  |     |     |        |
| .                                 |      |                                                 |       |    |     |         |                  |     |     |        |

The Train Detail report is divided into a header section and a detail section. The header section contains general information about the site (like milepost) and some detail information about the specific train (like train's exit speed) that passed the site. The detail section contains more detailed information (like car number) about the specific train.

The table below lists the fields from the header section and the contents of each field.

| Heading | Contents of Field                                                                                                                                                                                             |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Train#  | The number that identifies the train in the Trains directory.                                                                                                                                                 |
| Date    | The date the train arrived at the site. Date is in <b>mm/dd/yy</b> format.                                                                                                                                    |
| Time    | The time the train arrived at the site. Time is in 24-hour <b>hh:mm</b> format, where 8 a.m. is 08:00, noon is 12:00, 8 p.m. is 20:00, and midnight is 00:00.                                                 |
| SiteID  | The name of the site. This can be supplied either by the Harriman Dispatch Center via the Polling System <u>or</u> by the <b>Site ID option</b> on the Polling System submenu. The default is <i>NONAME</i> . |
| Speed   | The train's exit speed in miles per hour.                                                                                                                                                                     |
| Axles   | The total number of axles counted by the SmartScanIS.                                                                                                                                                         |

| Heading           | Contents of Field                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Direction         | The direction the train was traveling. Valid values are North, South, East, and West.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Milepost          | The five-digit milepost of the site. <b>Chapter 11 - Serial Interface</b> tells how to set this value using the Milepost submenu.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Track             | The track designator of the site. For single-track sites, the value is Single. For multitrack sites, valid values are 1, 2, 3, 4, 5, and 6. <b>Chapter 11 - Serial Interface</b> tells how to set this value using the Track Number submenu.                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Temperature       | The ambient temperature, in degrees Fahrenheit, at the time the train passed the site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Battery           | The backup battery voltage at the time the train passed the site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Rail              | Rail orientation for each side of the train. If the track orientation is east and west, rails are north and south. If the track orientation is north and south, rails are east and west.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Max               | The maximum temperature (above ambient), in degrees Fahrenheit, recorded by the bearing scanner on a given railside.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Avg               | The average temperature (above ambient), in degrees Fahrenheit, calculated from all recorded temperatures from the bearing scanner on a given railside.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Resistor Read     | The scanner resistor temperature (read after train passage), in degrees Fahrenheit, recorded by the bearing scanner on a given railside.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Resistor Req      | The resistor temperature, in degrees Fahrenheit, required by the bearing scanner on a given railside to avoid a Cold Resistor alarm. This value was calculated using the amount of time the shutters were open and the Resistor Integrity Test Mode in effect at the time the train passed the site. If the <b>Resistor Integrity Test Mode option</b> is disabled, a zero appears in this field.                                                                                                                                                                                                                                                                                           |
| Transducer Counts | The gating transducer designator (either TO1 or TO2) followed by the total number of hits on that transducer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Transducer Spikes | The gating transducer designator (either TO1 or TO2) followed by the total number of spikes on that transducer. (Note: Spikes are ignored for a train's first thirty-six axles and for all subsequent six-axle vehicles.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Alarm Limit       | <p>The Hotwheel alarm level and Hotbox alarm levels for Absolute and Differential. These values were in place at the time the train passed the site.</p> <ul style="list-style-type: none"> <li>• The value after Absolute is set by the <b>Absolute option</b> on the Alarm Limits submenu.</li> <li>• The value after Differential is set by the <b>Differential option</b> on the Alarm Limits submenu.</li> <li>• The Hot Wheel heading always appears, even if Hotwheel alarm reporting is disabled. The value after Hot Wheel is set by the <b>Hotwheel option</b> on the Alarm Limits submenu.</li> </ul> <p><b>Chapter 11 - Serial Interface</b> tells how to set these values.</p> |

| Heading           | Contents of Field                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CS Slope<br>Parms | <p>These are the Carside Slope alarm parameters currently defined in the system setup. These values were in place at the time the train passed the site.</p> <ul style="list-style-type: none"> <li>• The value after CS Min is set by the <b>Carside Minimum option</b> on the Alarm Limits submenu.</li> <li>• The value after CS Slope is set by the <b>Carside Slope option</b> on the Alarm Limits submenu.</li> </ul> <p><b>Chapter 11 - Serial Interface</b> tells how to set these values.</p>                                           |
| Wheel             | Rail orientation for each side of the train. If the track orientation is east and west, rails are north and south. If the track orientation is north and south, rails are east and west. This field only appears when Hotwheel alarm reporting is enabled using the <b>Hotwheel option</b> on the Equipment submenu.                                                                                                                                                                                                                             |
| Max               | The maximum temperature (above ambient), in degrees Fahrenheit, recorded by the wheel scanner on a given railside. This field only appears when Hotwheel alarm reporting is enabled using the <b>Hotwheel option</b> on the Equipment submenu.                                                                                                                                                                                                                                                                                                   |
| Avg               | The average temperature (above ambient), in degrees Fahrenheit, calculated from all recorded temperatures from the wheel scanner on a given railside. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the <b>Hotwheel option</b> on the Equipment submenu.                                                                                                                                                                                                                                                         |
| Resistor<br>Read  | The scanner resistor temperature (read after train passage), in degrees Fahrenheit, recorded by the wheel scanner on a given railside. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the <b>Hotwheel option</b> on the Equipment submenu.                                                                                                                                                                                                                                                                        |
| Resistor<br>Req   | The resistor temperature, in degrees Fahrenheit, required by the wheel scanner on a given railside to avoid a Cold Wheel Scanner Resistor alarm. This value was calculated using the amount of time the shutters were open and the Resistor Integrity Test Mode in effect at the time the train passed the site. If the <b>Resistor Integrity Test Mode option</b> is disabled, a zero appears in this field. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the <b>Hotwheel option</b> on the Equipment submenu. |



| Heading                 | Contents of Field                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Resistor Integrity Test | Status of the post-train resistor integrity test at the time the train passed the site. Valid values are Enabled, Reduced, and Disabled. <b>Chapter 11 - Serial Interface</b> tells how to set this value using the <b>Resistor Integrity Test Mode option</b> on the Equipment submenu.                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Cold Rail Test          | Status of the cold-rail test at the time the train passed the site. Valid values are All Trains and Long Trains Only. <b>Chapter 11 - Serial Interface</b> tells how to set this value using the <b>Cold Rail Test Mode option</b> on the Equipment submenu.                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| AEI System Data         | The number of AEI tags read (by antenna1 and antenna2) and the total number of tags stored for the train. Where both tags of a tag pair are operational, each antenna will read one tag of the pair. The total number of tags stored represents the number of tag pairs found plus those single tags that lack a match. This heading and the columns under it appear only when the AEI subsystem is enabled using the <b>AEI option</b> on the Equipment submenu.                                                                                                                                                                                                                                             |
| System Alarms           | At least one text message, which can be either: <ul style="list-style-type: none"> <li>• "System Integrity Check Passed!" only</li> <li>• One or more System Alarm descriptions followed by "System Integrity Check Passed!"</li> <li>• "Integrity Failure" followed by one or more Integrity Failure descriptions</li> <li>• One or more System Alarm descriptions, followed by "Integrity Failure," followed by one or more Integrity Failure descriptions</li> </ul> <b>Appendix A - System Alarms</b> describes the conditions and events that the system flags as System Alarms. <b>Appendix B - Integrity Failures</b> describes the conditions and events that the system flags as Integrity Failures. |
| Train Alarms            | The number of Exception Alarms found on the train. This is followed by a list of each Exception Alarm found and the axle on which it was found.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Firmware Versions       | Software version numbers and release dates for the firmware. "Analyzer" is the firmware chip (in socket <b>U2</b> ) on the Processor board that is run by processor-A (in socket <b>U1</b> ). "Talker" is the firmware chip (in socket <b>U3</b> ) on the Talker board that is run by the processor in socket <b>U1</b> . "ComBoard" is the firmware chip (in socket <b>U12</b> ) on the Processor board that is run by processor-B (in socket <b>U11</b> ).                                                                                                                                                                                                                                                  |

The table below lists the fields from the detail section and the contents of each field.

| Heading     | Contents of Field                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Car         | The car number as determined by the firmware.                                                                                                                                                                                                                                                                                                                                                             |
| Axle        | The axle number.                                                                                                                                                                                                                                                                                                                                                                                          |
| Rail        | Under it are two columns, one for each rail, containing the temperature read by the bearing scanners. If the track orientation is east and west, rails are north and south. If the track orientation is north and south, rails are east and west.                                                                                                                                                         |
| Wheel       | Under it are two columns, one for each rail, containing the temperature read by the wheel scanners. If the track orientation is east and west, rails are north and south. If the track orientation is north and south, rails are east and west. This heading and the two columns under it appear only when Hotwheel alarm reporting is enabled using the <b>Hotwheel option</b> on the Equipment submenu. |
| ON          | The number of milliseconds a bearing was scanned.                                                                                                                                                                                                                                                                                                                                                         |
| OFF         | The number of milliseconds between bearings (when no bearing was between the gating transducers).                                                                                                                                                                                                                                                                                                         |
| PW1         | The recorded pulse width generated by gating transducer TO1. There is no fixed value for the pulse widths. Slower trains generate wider pulse widths (that is, they generate larger values) than faster moving trains.                                                                                                                                                                                    |
| PW2         | The recorded pulse width generated by gating transducer TO2. There is no fixed value for the pulse widths. Slower trains generate wider pulse widths (that is, they generate larger values) than faster moving trains.                                                                                                                                                                                    |
| TxdHits TO1 | The total number (for a given axle) of interrupt firings for gating transducer TO1. Since each interrupt fires once on a signal's rising-edge and once on a signal's falling-edge, this value should be two. Values higher than two can indicate additional interrupt firings, possibly from a transducer spike, or a missed axle on the opposite transducer.                                             |
| TxdHits TO2 | The total number (for a given axle) of interrupt firings for gating transducer TO2. Since each interrupt fires once on a signal's rising-edge and once on a signal's falling-edge, this value should be two. Values higher than two can indicate additional interrupt firings, possibly from a transducer spike or a missed axle on the opposite transducer.                                              |
| Alarms      | Any Exception Alarm found on the given axle.                                                                                                                                                                                                                                                                                                                                                              |

To produce a Train Detail report:

- 1 Using the serial interface, display the Main menu.

The Main menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
Main Menu

A) Train Summary
B) Train Detail
C) Exception Summary
 .
 .
 .
```

- 2 Select **Train Detail**.

This prompt appears.

```
Train Number ?
```

- 3 Type the train number.

If you typed a four-digit valid train number, a report for that train is produced. If the typed train number is invalid, the Main menu reappears.

- 4 If you typed one, two, or three digits, press **[Enter]**.

If the typed train number is valid, pressing **[Enter]** produces a report for it. If the typed train number is invalid, the Main menu reappears.

At this time, you can produce another report by selecting the appropriate menu option.

- 5 When done, close the LOG file.
- 6 To exit the serial interface and return the SmartScanIS to normal operation, type **x**
- 7 If **on-site** and if you unplugged a device from COM3, plug the device back in after unplugging your computer.

## 12.3 Exception Summary Report

The Exception Summary report lists all trains currently stored in the Exceptions directory. A train number is shown for each train entry so that an Exception Detail report may easily be produced for any train listed on the summary.



The Exception Summary report is divided into a header section and a detail section. The header section contains general information about the site. The detail section contains summary information on each exception train (that is, each train having one or more Exception Alarms) that passed the site.

The SmartScanIS calculates a checksum for each train. This checksum is stored with the train data. Later, when the system retrieves this data, it recalculates the checksum. If the two checksums don't match, the Exception Summary report so states in the detail section. Therefore, instead of getting a train record, you'll get a checksum-error line, as shown below.

|                                                                                                                                                                             |                                                        |          |            |             |       |           |                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|----------|------------|-------------|-------|-----------|---------------------|
| <p style="text-align: center;">Southern Technologies Corporation<br/>Integrated Detector System<br/>Union Pacific Railroad<br/><b>EXCEPTIONS SUMMARY</b><br/>05/23/2013</p> |                                                        |          |            |             |       |           |                     |
| =====                                                                                                                                                                       |                                                        |          |            |             |       |           |                     |
| Version Info....                                                                                                                                                            | Analyzer:                                              | 1.01     | 01/10/2013 |             |       | Milepost: | 0501.2              |
|                                                                                                                                                                             | Talker:                                                | 2.02     | 02/20/2013 |             |       | Track:    | Single              |
|                                                                                                                                                                             | Communicator:                                          | 3.03     | 03/30/2013 |             |       | SiteID:   | NONAME              |
|                                                                                                                                                                             |                                                        |          |            |             |       |           |                     |
| Alarm Limits..                                                                                                                                                              | Absolute:                                              | 200°     |            | CS Minimum: | 245   |           |                     |
|                                                                                                                                                                             | Differential:                                          | 150°     |            | CS Slope:   | 2.34  |           |                     |
| -----                                                                                                                                                                       |                                                        |          |            |             |       |           |                     |
|                                                                                                                                                                             |                                                        |          |            | Speed       |       |           |                     |
| Train#                                                                                                                                                                      | Ref#                                                   | Date     | Time       | Axles       | (mph) | Dir       | Alarms              |
| -----                                                                                                                                                                       |                                                        |          |            |             |       |           |                     |
| 15                                                                                                                                                                          | 422                                                    | 07/06/13 | 04:44      | 78          | 53    | E         | Dragging Equipment  |
| 14                                                                                                                                                                          | 421                                                    | 07/06/13 | 03:03      | 122         | 44    | E         | Dragging Equipment  |
| 13                                                                                                                                                                          | 420                                                    | 07/06/13 | 01:55      | 64          | 55    | E         | Dragging Equipment  |
| 12                                                                                                                                                                          | <b>CHECKSUM ERROR: StartAddr 134879 EndAddr 134930</b> |          |            |             |       |           |                     |
| 11                                                                                                                                                                          | 366                                                    | 06/01/13 | 01:30      | 96          | 57    | E         | North Rail Absolute |
| 10                                                                                                                                                                          | 284                                                    | 04/17/13 | 01:26      | 50          | 57    | E         | North Rail Absolute |
|                                                                                                                                                                             |                                                        |          |            |             |       |           |                     |
|                                                                                                                                                                             |                                                        |          |            |             |       |           |                     |
|                                                                                                                                                                             |                                                        |          |            |             |       |           |                     |
|                                                                                                                                                                             |                                                        |          |            |             |       |           |                     |

The table below lists the fields from the header section and the contents of each field.

| Heading      | Contents of Field                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Version Info | Software version numbers and release dates for the firmware. "Analyzer" is the firmware chip (in socket <b>U2</b> ) on the Processor board that is run by processor-A (in socket <b>U1</b> ). "Talker" is the firmware chip (in socket <b>U3</b> ) on the Talker board that is run by the processor in socket <b>U1</b> . "Communicator" is the firmware chip (in socket <b>U12</b> ) on the Processor board that is run by processor-B (in socket <b>U11</b> ). |
| Milepost     | The five-digit milepost of the site. <b>Chapter 11 - Serial Interface</b> tells how to set this value using the Milepost submenu.                                                                                                                                                                                                                                                                                                                                |
| Track        | The track designator of the site. For single-track sites, the value is Single. For multitrack sites, valid values are 1, 2, 3, 4, 5, and 6. <b>Chapter 11 - Serial Interface</b> tells how to set this value using the Track Number submenu.                                                                                                                                                                                                                     |

| Heading      | Contents of Field                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SiteID       | The name of the site. This can be supplied either by the Harriman Dispatch Center via the Polling System <u>or</u> by the <b>Site ID option</b> on the Polling System submenu. The default is <i>NONAME</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Alarm Limits | <p>These are the alarm parameters currently defined in the system setup. These values were in place at the time this report was run and were set using the serial interface.</p> <ul style="list-style-type: none"> <li>• The value after Absolute is set by the <b>Absolute option</b> on the Alarm Limits submenu.</li> <li>• The value after Differential is set by the <b>Differential option</b> on the Alarm Limits submenu.</li> <li>• The heading Hot Wheel only appears if Hotwheel alarm reporting is enabled. The value after Hot Wheel is set by the <b>Hotwheel option</b> on the Alarm Limits submenu.</li> <li>• The value after CS Minimum is set by the <b>Carside Minimum option</b> on the Alarm Limits submenu.</li> <li>• The value after CS Slope is set by the <b>Carside Slope option</b> on the Alarm Limits submenu.</li> </ul> <p><b>Chapter 11 - Serial Interface</b> tells how to set these values.</p> |

The table below lists the fields from the detail section and the contents of each field.

| Heading     | Contents of Field                                                                                                                                             |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Train#      | The number that identifies the train in the Exceptions directory.                                                                                             |
| Ref#        | The number that identifies the train in the Trains directory.                                                                                                 |
| Date        | The date the train arrived at the site. Date is in <b>mm/dd/yy</b> format.                                                                                    |
| Time        | The time the train arrived at the site. Time is in 24-hour <b>hh:mm</b> format, where 8 a.m. is 08:00, noon is 12:00, 8 p.m. is 20:00, and midnight is 00:00. |
| Axles       | The total number of axles counted by the SmartScanIS.                                                                                                         |
| Speed (mph) | The train's exit speed in miles per hour.                                                                                                                     |
| Dir         | The direction the train was traveling. Valid values are N, S, E, and W.                                                                                       |
| Alarms      | A description of the alarms that were detected for the current train.                                                                                         |

To produce an Exception Summary report:

- 1 Using the serial interface, display the Main menu.

The Main menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
Main Menu

```

```
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
```

```
•
•
•
```

- 2 Select **Exception Summary**.

At this time, you can produce another report by selecting the appropriate menu option.

- 3 When done, close the LOG file.
- 4 To exit the serial interface and return the SmartScanIS to normal operation, type **x**
- 5 If **on-site** and if you unplugged a device from COM3, plug the device back in after unplugging your computer.

## 12.4 Exception Detail Report (extended)

The extended Exception Detail report provides detailed information on a single train. When choosing this report, you'll be prompted for a train number. When prompted, type a train number from the Exception Summary report. The train number appears under the column titled "Train#" in the detail section of that report.

Below is a sample of part of an extended Exception Detail report when Hotwheel alarm reporting is disabled and the AEI subsystem is disabled at the time the report was requested. The contents of your report will be different. The version information in the sample below is for illustrative purposes only. It doesn't represent any real release of the firmware.

Southern Technologies Corporation  
Integrated Detector System  
Union Pacific Railroad

**EXCEPTION DETAIL**

```
=====
Train#: 5 Speed: 43 Milepost: 0501.2
Date: 05/01/2013 Axles: 194 Track: Single
Time: 12:55 Direction: East Temperature: +51°
SiteID: NONAME Battery: 27.7v
=====
```

| Rail       | Max | Avg  | Resistor |      | Transducer |        | Alarm        | Limit | CS Slope  | Parms |
|------------|-----|------|----------|------|------------|--------|--------------|-------|-----------|-------|
|            |     |      | Read     | Req  | Count      | Spikes |              |       |           |       |
| North 186° | 77° | 142° | 160°     | T01: | 194        | 0      | Absolute     | 180°  | CS Min:   | 60    |
| South 181° | 68° | 99°  | 160°     | T02: | 194        | 0      | Differential | 100°  | CS Slope: | 0.75  |
|            |     |      |          |      |            |        | Hot Wheel    | 556°  |           |       |

Resistor Integ. Test: Enabled  
Cold Rail Test: All Trains

System Alarms

-----  
Cold North Resistor  
Cold South Resistor  
System Integrity Check Passed!

Train Alarms: 5

-----  
Axle 46 South Rail Absolute  
Axle 77 South Rail Differential  
Axle 193 North Rail Absolute  
Axle 193 South Rail Absolute  
Axle 194 North Rail Absolute

Firmware Versions

-----  
Analyzer: 1.01 01/10/2013    Talker: 2.02 02/20/2013    ComBoard: 3.03 03/30/2013

| Car | Axle | Rail  |       | ON | OFF | PW1 | PW2 | TxdHits |     | Alarms              |
|-----|------|-------|-------|----|-----|-----|-----|---------|-----|---------------------|
|     |      | North | South |    |     |     |     | T01     | T02 |                     |
| 1   | 1    | 56°   | 21°   | 25 | 0   | 8   | 8   | 2       | 2   |                     |
|     | 2    | 57°   | 21°   | 25 | 59  | 5   | 5   | 2       | 2   |                     |
|     | 3    | 56°   | 21°   | 25 | 59  | 5   | 5   | 2       | 2   |                     |
|     | 4    | 56°   | 21°   | 25 | 362 | 5   | 5   | 2       | 2   |                     |
|     | 5    | 56°   | 21°   | 25 | 59  | 5   | 5   | 2       | 2   |                     |
|     | 6    | 56°   | 21°   | 25 | 59  | 4   | 5   | 2       | 2   |                     |
| 2   | 7    | 56°   | 20°   | 25 | 162 | 5   | 5   | 2       | 2   |                     |
|     | 8    | 56°   | 21°   | 25 | 59  | 5   | 5   | 2       | 2   |                     |
|     |      |       |       | .  |     |     |     |         |     |                     |
|     |      |       |       | .  |     |     |     |         |     |                     |
|     |      |       |       | .  |     |     |     |         |     |                     |
|     | 193  | 186°  | 181°  | 25 | 59  | 5   | 5   | 2       | 2   | North Rail Absolute |
|     |      |       |       |    |     |     |     |         |     | South Rail Absolute |
|     | 194  | 183°  | 170°  | 25 | 641 | 5   | 5   | 2       | 2   | North Rail Absolute |
|     |      |       |       | .  |     |     |     |         |     |                     |
|     |      |       |       | .  |     |     |     |         |     |                     |
|     |      |       |       | .  |     |     |     |         |     |                     |



Below is a sample of part of an extended Exception Detail report when both the **AEI option** and **Hotwheel option** are enabled at the time the report was requested. Also, both the **AEI option** and **Hotwheel option** had to be enabled while the specified train was passing the site. The contents of your report will be different.

```

 .
 .
 .
=====
Rail Max Avg Resistor Transducer Alarm Limit CS Slope Parm
Read Req Count Spikes

North 167° 35° 275° 160° T01: 194 0 Absolute 180° CS Min: 60
South 181° 68° 202° 160° T02: 194 0 Differential 100° CS Slope: 0.75
Hot Wheel 556°

Wheel Max Avg Resistor
Read Req

North 566° 98° 60° 160°
South 587° 94° 67° 160°

Resistor Integ. Test: Enabled
Cold Rail Test: All Trains
=====
AEI System Data

Tags Read Tags Stored: 15

Reader 1: 16 [#00:00:32.80 07/04/93]
=====

System Alarms

Cold North Wheel Scanner Resistor
Cold South Wheel Scanner Resistor
Integrity Failure
Successive Cold Wheel Resistors Exceeded

Train Alarms: 5

Axle 97 North Hot Wheel
Axle 98 South Hot Wheel

 .
 .
 .

Rail Wheel TxdHits
Car Axle North South North South ON OFF PW1 PW2 T01 T02 Alarms

```

The SmartScanIS calculates a checksum for each train. This checksum is stored with the train data. Later, when the system retrieves this data, it recalculates the checksum. If the two checksums don't match, the extended Exception Detail report so states, as shown below.

|                                                 |  |
|-------------------------------------------------|--|
| Southern Technologies Corporation               |  |
| Integrated Detector System                      |  |
| Union Pacific Railroad                          |  |
| EXCEPTION DETAIL                                |  |
| =====                                           |  |
| CHECKSUM ERROR: StartAddr 134879 EndAddr 134930 |  |

In addition, each axle has a checksum associated with it. If an axle is determined to have an invalid checksum, the extended Exception Detail report so states in the associated axle's row, as shown below.

|                                   |                                                 |
|-----------------------------------|-------------------------------------------------|
| Southern Technologies Corporation |                                                 |
| Integrated Detector System        |                                                 |
| Union Pacific Railroad            |                                                 |
| EXCEPTION DETAIL                  |                                                 |
| =====                             |                                                 |
| Train#:                           | 5                                               |
| Speed:                            | 43                                              |
| Milepost:                         | 0501.2                                          |
| .                                 |                                                 |
| .                                 |                                                 |
| .                                 |                                                 |
| -----                             |                                                 |
| Car                               | 1                                               |
| Axle                              | 1                                               |
| North                             | 56°                                             |
| South                             | 21°                                             |
| ON                                | 25                                              |
| OFF                               | 0                                               |
| PW1                               | 8                                               |
| PW2                               | 8                                               |
| TO1                               | 2                                               |
| TO2                               | 2                                               |
| Alarms                            |                                                 |
| 2                                 | 57°                                             |
| 3                                 | 56°                                             |
| 4                                 | CHECKSUM ERROR: StartAddr 136416 EndAddr 136427 |
| 5                                 | 56°                                             |
| 6                                 | 56°                                             |
| 7                                 | 56°                                             |
| 8                                 | 56°                                             |
| 20°                               | 20°                                             |
| 21°                               | 21°                                             |
| 25                                | 25                                              |
| 162                               | 162                                             |
| 5                                 | 5                                               |
| 5                                 | 5                                               |
| 2                                 | 2                                               |
| 2                                 | 2                                               |
| .                                 |                                                 |
| .                                 |                                                 |
| .                                 |                                                 |

The extended Exception Detail report is divided into a header section and a detail section. The header section contains general information about the site (like milepost) and some detail information about the exception train (like train's exit speed) that passed the site. The detail section contains more detailed information (like car number) about the train.

The table below lists the fields from the header section and the contents of each field.

| Heading     | Contents of Field                                                                                                                                                                                                                            |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Train#      | The number that identifies the train in the Exceptions directory.                                                                                                                                                                            |
| Date        | The date the train arrived at the site. Date is in <b>mm/dd/yy</b> format.                                                                                                                                                                   |
| Time        | The time the train arrived at the site. Time is in 24-hour <b>hh:mm</b> format, where 8 a.m. is 08:00, noon is 12:00, 8 p.m. is 20:00, and midnight is 00:00.                                                                                |
| SiteID      | The name of the site. This can be supplied either by the Harriman Dispatch Center via the Polling System <u>or</u> by the <b>Site ID option</b> on the Polling System submenu. The default is <i>NONAME</i> .                                |
| Speed       | The train's exit speed in miles per hour.                                                                                                                                                                                                    |
| Axles       | The total number of axles counted by the SmartScanIS.                                                                                                                                                                                        |
| Direction   | The direction the train was traveling. Valid values are North, South, East, and West.                                                                                                                                                        |
| Milepost    | The five-digit milepost of the site. <b>Chapter 11 - Serial Interface</b> tells how to set this value using the Milepost submenu.                                                                                                            |
| Track       | The track designator of the site. For single-track sites, the value is Single. For multitrack sites, valid values are 1, 2, 3, 4, 5, and 6. <b>Chapter 11 - Serial Interface</b> tells how to set this value using the Track Number submenu. |
| Temperature | The ambient temperature, in degrees Fahrenheit, at the time the train passed the site.                                                                                                                                                       |
| Battery     | The backup battery voltage at the time the train passed the site.                                                                                                                                                                            |
| Rail        | Rail orientation for each side of the train. If the track orientation is east and west, rails are north and south. If the track orientation is north and south, rails are east and west.                                                     |
| Max         | The maximum temperature (above ambient), in degrees Fahrenheit, recorded by the bearing scanner on a given railside.                                                                                                                         |
| Avg         | The average temperature (above ambient), in degrees Fahrenheit, calculated from all recorded temperatures from the bearing scanner on a given railside.                                                                                      |

| Heading           | Contents of Field                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Resistor Read     | The scanner resistor temperature (read after train passage), in degrees Fahrenheit, recorded by the bearing scanner on a given railside.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Resistor Req      | The resistor temperature, in degrees Fahrenheit, required by the bearing scanner on a given railside to avoid a Cold Resistor alarm. This value was calculated using the amount of time the shutters were open and the Resistor Integrity Test Mode in effect at the time the train passed the site. If the <b>Resistor Integrity Test Mode option</b> is disabled, a zero appears in this field.                                                                                                                                                                                                                                                                                     |
| Transducer Count  | The gating transducer designator (either TO1 or TO2) followed by the total number of hits on that transducer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Transducer Spikes | The gating transducer designator (either TO1 or TO2) followed by the total number of spikes on that transducer. (Note: Spikes are ignored for a train's first thirty-six axles and for all subsequent six-axle vehicles.)                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Alarm Limit       | <p>The Hotwheel alarm level and Hotbox alarm levels for Absolute and Differential. These values were in place at the time the train passed the site.</p> <ul style="list-style-type: none"> <li>The value after Absolute is set by the <b>Absolute option</b> on the Alarm Limits submenu.</li> <li>The value after Differential is set by the <b>Differential option</b> on the Alarm Limits submenu.</li> <li>The Hot Wheel heading always appears, even if Hotwheel alarm reporting is disabled. The value after Hot Wheel is set by the <b>Hotwheel option</b> on the Alarm Limits submenu.</li> </ul> <p><b>Chapter 11 - Serial Interface</b> tells how to set these values.</p> |
| CS Slope Parm     | <p>These are the Carside Slope alarm parameters currently defined in the system setup. These values were in place at the time the train passed the site.</p> <ul style="list-style-type: none"> <li>The value after CS Min is set by the <b>Carside Minimum option</b> on the Alarm Limits submenu.</li> <li>The value after CS Slope is set by the <b>Carside Slope option</b> on the Alarm Limits submenu.</li> </ul>                                                                                                                                                                                                                                                               |
| Wheel             | Rail orientation for each side of the train. If the track orientation is east and west, rails are north and south. If the track orientation is north and south, rails are east and west. This field only appears when Hotwheel alarm reporting is enabled using the <b>Hotwheel option</b> on the Equipment submenu.                                                                                                                                                                                                                                                                                                                                                                  |
| Max               | The maximum temperature (above ambient), in degrees Fahrenheit, recorded by the wheel scanner on a given railside. This field only appears when Hotwheel alarm reporting is enabled using the <b>Hotwheel option</b> on the Equipment submenu.                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Avg               | The average temperature (above ambient), in degrees Fahrenheit, calculated from all recorded temperatures from the wheel scanner on a given railside. This field only appears when Hotwheel alarm reporting is enabled using the <b>Hotwheel option</b> on the Equipment submenu.                                                                                                                                                                                                                                                                                                                                                                                                     |
| Resistor Read     | The scanner resistor temperature (read after train passage), in degrees Fahrenheit, recorded by the wheel scanner on a given railside. This field only appears when Hotwheel alarm reporting is enabled using the <b>Hotwheel option</b> on the Equipment submenu.                                                                                                                                                                                                                                                                                                                                                                                                                    |

| Heading                 | Contents of Field                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Resistor Req            | The resistor temperature, in degrees Fahrenheit, required by the wheel scanner on a given raiiside to avoid a Cold Wheel Scanner Resistor alarm. This value was calculated using the amount of time the shutters were open and the Resistor Integrity Test Mode in effect at the time the train passed the site. If the <b>Resistor Integrity Test Mode option</b> is disabled, a zero appears in this field. This field only appears when Hotwheel alarm reporting is enabled using the <b>Hotwheel option</b> on the Equipment submenu.                                                                                                                                                                     |
| Resistor Integrity Test | Status of the post-train resistor integrity test at the time the train passed the site. Valid values (aka modes) are Enabled, Reduced, and Disabled. <b>Chapter 11 - Serial Interface</b> tells how to set this value using the <b>Resistor Integrity Test Mode option</b> on the Equipment submenu.                                                                                                                                                                                                                                                                                                                                                                                                          |
| Cold Rail Test          | Status of the cold-rail test at the time the train passed the site. Valid values (aka modes) are All Trains and Long Trains Only. <b>Chapter 11 - Serial Interface</b> tells how to set this value using the <b>Cold Rail Test Mode option</b> on the Equipment submenu.                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| AEI System Data         | The number of AEI tags read (by antenna1 and antenna2) and the total number of tags stored for the train. Where both tags of a tag pair are operational, each antenna will read one tag of the pair. The total number of tags stored represents the number of tag pairs found plus those single tags that lack a match. This heading and the columns under it appear only when the AEI subsystem is enabled using the <b>AEI option</b> on the Equipment submenu.                                                                                                                                                                                                                                             |
| System Alarms           | At least one text message, which can be either: <ul style="list-style-type: none"> <li>• "System Integrity Check Passed!" only</li> <li>• One or more System Alarm descriptions followed by "System Integrity Check Passed!"</li> <li>• "Integrity Failure" followed by one or more Integrity Failure descriptions</li> <li>• One or more System Alarm descriptions, followed by "Integrity Failure," followed by one or more Integrity Failure descriptions</li> </ul> <b>Appendix A - System Alarms</b> describes the conditions and events that the system flags as System Alarms. <b>Appendix B - Integrity Failures</b> describes the conditions and events that the system flags as Integrity Failures. |
| Train Alarms            | The number of Exception Alarms found on the train. This is followed by a list of each Exception Alarm found and the axle on which it was found.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Firmware Versions       | Software version numbers and release dates for the firmware. "Analyzer" is the firmware chip (in socket <b>U2</b> ) on the Processor board that is run by processor-A (in socket <b>U1</b> ). "Talker" is the firmware chip (in socket <b>U3</b> ) on the Talker board that is run by the processor in socket <b>U1</b> . "ComBoard" is the firmware chip (in socket <b>U12</b> ) on the Processor board that is run by processor-B (in socket <b>U11</b> ).                                                                                                                                                                                                                                                  |

The table below lists the fields from the detail section and the contents of each field.

| Heading     | Contents of Field                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Car         | The car number as determined by the firmware.                                                                                                                                                                                                                                                                                                                                                             |
| Axle        | The axle number.                                                                                                                                                                                                                                                                                                                                                                                          |
| Rail        | Under it are two columns, one for each rail, containing the temperature read by the bearing scanners. If the track orientation is east and west, rails are north and south. If the track orientation is north and south, rails are east and west.                                                                                                                                                         |
| Wheel       | Under it are two columns, one for each rail, containing the temperature read by the wheel scanners. If the track orientation is east and west, rails are north and south. If the track orientation is north and south, rails are east and west. This heading and the two columns under it appear only when Hotwheel alarm reporting is enabled using the <b>Hotwheel option</b> on the Equipment submenu. |
| ON          | The number of milliseconds a bearing was scanned.                                                                                                                                                                                                                                                                                                                                                         |
| OFF         | The number of milliseconds between bearings (when no bearing was between the gating transducers).                                                                                                                                                                                                                                                                                                         |
| PW1         | The recorded pulse width generated by gating transducer TO1. There is no fixed value for the pulse widths. Slower trains generate wider pulse widths (that is, they generate larger values) than faster moving trains.                                                                                                                                                                                    |
| PW2         | The recorded pulse width generated by gating transducer TO2. There is no fixed value for the pulse widths. Slower trains generate wider pulse widths (that is, they generate larger values) than faster moving trains.                                                                                                                                                                                    |
| TxdHits TO1 | The total number (for a given axle) of interrupt firings for gating transducer TO1. Since each interrupt fires once on a signal's rising-edge and once on a signal's falling-edge, this value should be two. Values higher than two can indicate additional interrupt firings, possibly from a transducer spike, or a missed axle on the opposite transducer.                                             |
| TxdHits TO2 | The total number (for a given train) of interrupt firings for gating transducer TO2. Since each interrupt fires once on a signal's rising-edge and once on a signal's falling-edge, this value should be two. Values higher than two can indicate additional interrupt firings, possibly from a transducer spike, or a missed axle on the opposite transducer.                                            |
| Alarms      | Any Exception Alarm found on the given axle.                                                                                                                                                                                                                                                                                                                                                              |

To produce an extended Exception Detail report:

- 1 Using the serial interface, display the Main menu.

The Main menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
Main Menu

A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
```

- 2 Select **Exception Detail**.

This prompt appears.

```
Train Number ?
```

- 3 Type the train number.

If you typed four digits, the prompt below appears.

- 4 If you typed one, two, or three digits, press **[Enter]**.

This prompt appears.

```
Abbreviated Listing ?
```

- 5 To produce the extended Exception Detail report, type **n**

If you typed a valid train number, a report for that train is produced. If the typed train number is invalid, the Main menu reappears.

At this time, you can produce another report by selecting the appropriate menu option.

- 6 When done, close the LOG file.
- 7 To exit the serial interface and return the SmartScanIS to normal operation, type **x**
- 8 If **on-site** and if you unplugged a device from COM3, plug the device back in after unplugging your computer.

## 12.5 Exception Detail Report (abbreviated)

The abbreviated Exception Detail report is like the extended Exception Detail report. However, the abbreviated report doesn't display all the recorded axle data. It only displays axle data for:

- The car immediately preceding a car with an alarmed axle.
- The car containing the alarmed axle.
- The car immediately following the car with the alarmed axle.

For example, assume that a train consisted of 3 locomotives and 20 cars, and Exception Alarms were found on cars 3, 10, 15, and 17. The abbreviated Exception Detail report for this train would only list axle data for cars 2, 3, 4, 9, 10, 11, 14, 15, 16, 17, and 18. These car numbers comprise the alarmed cars themselves and all cars just before and just after them.

Below is a sample of part of an abbreviated Exception Detail report when Hotwheel alarm reporting is disabled and the AEI subsystem is disabled at the time the report was requested. The contents of your report will be different. The version information in the sample below is for illustrative purposes only. It doesn't represent any real release of the firmware



Southern Technologies Corporation  
Integrated Detector System  
Union Pacific Railroad  
**EXCEPTION DETAIL - ABBREVIATED**

=====

|             |           |                  |
|-------------|-----------|------------------|
| Train#: 172 | Speed: 48 | Milepost: 0501.2 |
|-------------|-----------|------------------|

•  
•  
•

System Alarms

-----

Cold North Resistor

Train Alarms: 6

-----

|      |     |                         |
|------|-----|-------------------------|
| Axle | 6   | North Rail Absolute     |
| Axle | 27  | Dragging Equipment      |
| Axle | 28  | Dragging Equipment      |
| Axle | 37  | North Rail Absolute     |
| Axle | 105 | North Rail Differential |
| Axle | 106 | North Rail Differential |

Firmware Versions

-----

Analyzer: 1.01 01/10/2013    Talker: 2.02 02/20/2013    ComBoard: 3.03 03/30/2013

| Car   | Axle | Rail  |       | ON | OFF | TxdHits |     |     |     | Alarms              |
|-------|------|-------|-------|----|-----|---------|-----|-----|-----|---------------------|
|       |      | North | South |    |     | PW1     | PW2 | TO1 | TO2 |                     |
| ----- |      |       |       |    |     |         |     |     |     |                     |
| 1     | 1    | 56°   | 21°   | 25 | 0   | 8       | 8   | 2   | 2   | North Rail Absolute |
|       | 2    | 57°   | 21°   | 25 | 59  | 5       | 5   | 2   | 2   |                     |
|       | 3    | 57°   | 22°   | 25 | 59  | 5       | 5   | 2   | 2   |                     |
|       | 4    | 57°   | 22°   | 25 | 562 | 5       | 5   | 2   | 2   |                     |
| 2     | 5    | 56°   | 22°   | 25 | 162 | 5       | 5   | 2   | 2   |                     |
|       | 6    | 189°  | 110°  | 25 | 641 | 5       | 5   | 2   | 2   |                     |
|       | 7    | 57°   | 22°   | 25 | 59  | 5       | 5   | 2   | 2   |                     |
|       | 8    | 57°   | 22°   | 25 | 562 | 5       | 5   | 2   | 2   |                     |
| 3     | 9    | 56°   | 113°  | 25 | 162 | 5       | 5   | 2   | 2   |                     |
|       | 10   | 57°   | 23°   | 25 | 59  | 5       | 5   | 2   | 2   |                     |
|       | 11   | 57°   | 24°   | 25 | 59  | 5       | 5   | 2   | 2   |                     |
|       | 12   | 57°   | 23°   | 25 | 562 | 5       | 4   | 2   | 2   |                     |
| 6     | 21   | 56°   | 23°   | 25 | 162 | 5       | 5   | 2   | 2   |                     |
|       | 22   | 57°   | 23°   | 26 | 58  | 5       | 5   | 2   | 2   |                     |
|       | 23   | 57°   | 23°   | 26 | 561 | 5       | 5   | 2   | 2   |                     |
|       | 24   | 57°   | 22°   | 26 | 58  | 5       | 5   | 2   | 2   |                     |
| 7     | 25   | 56°   | 22°   | 25 | 162 | 5       | 5   | 2   | 2   |                     |
|       | 26   | 57°   | 21°   | 26 | 58  | 5       | 5   | 2   | 2   |                     |
|       | 27   | 57°   | 22°   | 26 | 561 | 5       | 5   | 2   | 2   |                     |
|       | 28   | 57°   | 23°   | 26 | 58  | 5       | 5   | 2   | 2   |                     |
| 8     | 29   | 56°   | 22°   | 25 | 162 | 5       | 5   | 2   | 2   |                     |
|       | 30   | 57°   | 22°   | 26 | 58  | 5       | 5   | 2   | 2   |                     |
|       |      |       |       |    |     |         |     |     |     | Dragging Equipment  |
|       |      |       |       |    |     |         |     |     |     | Dragging Equipment  |

•  
•  
•

To produce an abbreviated Exception Detail report:

- 1 Using the serial interface, display the Main menu.

The Main menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
Main Menu

A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
 .
 .
 .
```

- 2 Select **Exception Detail**.

This prompt appears.

```
Train Number ?
```

- 3 Type the train number.

If you typed four digits, the prompt below appears.

- 4 If you typed one, two, or three digits, press **[Enter]**.

This prompt appears.

```
Abbreviated Listing ?
```

- 5 To produce the abbreviated Exception Detail report, type **y**

If you typed a valid train number, a report for that train is produced. If the typed train number is invalid, the Main menu reappears.

At this time, you can produce another report by selecting the appropriate menu option.

- 6 When done, close the LOG file.
- 7 To exit the serial interface and return the SmartScanIS to normal operation, type **x**
- 8 If **on-site** and if you unplugged a device from COM3, plug the device back in after unplugging your computer.

## 12.6 System Status Report

The System Status report contains the system's current setup configuration. Once the SmartScanIS is set up properly, print this report and keep it in the bungalow for future reference. Should you ever need to set up the system again, you'll have most of the information on this report.

Below is a sample of the top half of a System Status report. The contents of your report will be different.

|                                                                                                                                                                                       |                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| Southern Technologies Corporation<br>Integrated Detector System<br>Union Pacific Railroad<br><b>SYSTEM STATUS REPORT</b><br>05/23/2013                                                |                                     |
| =====                                                                                                                                                                                 |                                     |
| Milepost.... 0501.2    Rail....E/W    Track....4    SiteID....NONAME<br>Ambient Temp: + 67ø    AC:Off ( 0:43)    Battery Voltage: 27.4V<br>AC Surge Suppressor:Blown 05/16/2013 10:52 |                                     |
| =====                                                                                                                                                                                 |                                     |
| Alarm Limits                                                                                                                                                                          |                                     |
| -----                                                                                                                                                                                 |                                     |
| Absolute..... 180°                                                                                                                                                                    | Differential..... 90°               |
| Hot Wheel..... 540°                                                                                                                                                                   | Cold Wheel..... 30°                 |
| CS Slope..... 0.32                                                                                                                                                                    | CS Minimum..... 37°                 |
| Cold Journal..... 10°                                                                                                                                                                 | Cold Wheel Scanner..... 30°         |
| Cold Trains..... 3                                                                                                                                                                    | Sliding Wheel Ratio..... 50%        |
| Max Alarms..... 6                                                                                                                                                                     |                                     |
| Equipment                                                                                                                                                                             |                                     |
| -----                                                                                                                                                                                 |                                     |
| Dragger..... NO                                                                                                                                                                       | Hot Wheel..... YES                  |
| High Load..... NO                                                                                                                                                                     | Wide Load..... NO                   |
| Carside Slope..... NO                                                                                                                                                                 | Talker Mode..... Talk Freely        |
| Snow Cycle..... NO                                                                                                                                                                    | AEI..... NO                         |
| Sliding Wheel..... NO                                                                                                                                                                 | Gate Distance..... 24.0 inches      |
| Cold Wheel..... NO                                                                                                                                                                    | Resistor Integ. Test..... Enabled   |
| Modem Type:..... Analog                                                                                                                                                               | Min. Transducer Pulse Width.... 3mS |
| Cold Rail Test..... All Trains                                                                                                                                                        |                                     |
| Messages                                                                                                                                                                              |                                     |
| -----                                                                                                                                                                                 |                                     |
| Axles..... NO                                                                                                                                                                         | Arrival..... NO                     |
| Speed..... NO                                                                                                                                                                         | Length..... NO                      |
| Temperature..... NO                                                                                                                                                                   | Power Off..... NO                   |
| HiWide..... YES                                                                                                                                                                       | Car ID..... NO                      |
| No Defects..... 1                                                                                                                                                                     | Rebroadcast Time Limit.... 10 min.  |
| .                                                                                                                                                                                     |                                     |
| .                                                                                                                                                                                     |                                     |
| .                                                                                                                                                                                     |                                     |

Below is a sample of the bottom half of a System Status report. The contents of your report will be different. The version information in the sample below is for illustrative purposes only. It doesn't represent any real release of the firmware.

```

 .
 .
 .

Polling System - Poll/Standalone Mode

Poll Address..... A
RFL Delay..... 200
Site ID..... NONAME
Calibration Temp..... 180°
Wind Monitor..... Disabled
Rail Stress Monitor..... NO
High Wind Alarm..... 32mph
Rail Stress Lim.... Low:-40 Hi:+40

Modem Setup - Default Modem Selected

Modem Setup Line 1 = AT&F
Modem Setup Line 2 = ATV0 S0=2 &D0 &Q1
Modem Setup Line 3 = ATX4 E0 &E3
Modem Setup Line 4 = Empty
Modem Setup Line 5 = AT&W0

Serial Ports

 Port Tx Rx Line Settings

COM1-P9 9600 9600 N-8-1
COM2-P10 9600 9600 N-8-1
COM3-P8 9600 9600 N-8-1

Amtech Reader Parameters - Reader1: AI1200 Reader2: None

ID Separation..... 2
Consecutive Reads..... 2
Uniqueness Timeout..... 120 Sec

Real-Time Diagnostics

Harriman Polling System..... YES Train Data Storage..... YES

Scanner Calibration Date

Rail1...00/00/2000 00:00 Rail2...00/00/2000 00:00
Wheel1...00/00/2000 00:00 Wheel2...00/00/2000 00:00

Software Versions COP Resets

Analyzer..... 1.01 01/10/2013 4
Talker..... 2.02 02/20/2013 N/A
Com Board..... 3.03 03/30/2013 0

Stack Min: 32471 EEMin: 75
```

The Polling System section, which is shown above, changes appearance slightly when the system is configured for Dialup operation instead of Poll/Standalone operation.

```

 .
 .
 .

Polling System - Dialup Mode

Primary Phone# [A,01] 18002345678
Secondary Phone#..... Disabled
Site ID..... NONAME
Calibration Temp..... 180°
Wind Monitor..... Disabled
Rail Stress Monitor..... NO
High Wind Alarm..... 32mph
Rail Stress Lim.... Low:-40 Hi:+40

 .
 .
 .

```

The System Status report displays the **health-check interval** assigned to the enabled telephone numbers. In the absence of communication with the Harriman Dispatch Center, this interval defines the number of hours (up to 23 hours) allowed to pass before the system initiates a dialup communication with Harriman. The letter in the bracket is either A for "all passing trains" or D for "defect trains only." If 00 follows the letter, the health check is disabled.

The table below lists the fields on the System Status report and the contents of each field.

| Heading         | Contents of Field                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Milepost        | The five-digit milepost of the site. <b>Chapter 11 - Serial Interface</b> tells how to set this value using the Milepost submenu.                                                                                                                                                                                                                                                                                                                                |
| Rail            | Rail orientation. Tracks running north/south have east/west rails. Tracks running east/west have north/south rails. Valid values are N/S and E/W.                                                                                                                                                                                                                                                                                                                |
| Track           | The track designator of the site. For single-track sites, the value is Single. For multitrack sites, valid values are 1, 2, 3, 4, 5, and 6. <b>Chapter 11 - Serial Interface</b> tells how to set this value using the Track Number submenu.                                                                                                                                                                                                                     |
| SiteID          | The name of the site. This can be supplied either by the Harriman Dispatch Center via the Polling System <u>or</u> by the <b>Site ID option</b> on the Polling System submenu. The default is <i>NONAME</i> .                                                                                                                                                                                                                                                    |
| Ambient Temp    | The ambient temperature, in degrees Fahrenheit, at the time this report was generated.                                                                                                                                                                                                                                                                                                                                                                           |
| AC              | The AC signal status, taking the form "AC:xxx (nnn:nn)." The word "Off" or "On" takes the place of the characters "xxx." This is followed by the amount of time, in hours and minutes, that the AC signal has been lost. A display of "AC:Off (123:45)" indicates that AC power is off and that it has been off for 123 hours and 45 minutes (just over 5 days). If the AC signal is present, the item appears as "AC:On (0:00)" and shows a time value of zero. |
| Battery Voltage | The battery voltage at the time this report was generated.                                                                                                                                                                                                                                                                                                                                                                                                       |

| Heading                  | Contents of Field                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AC Surge Suppressor      | The AC surge suppressor status. When the firmware detects a properly operating surge suppressor, the message "AC Surge Suppressor:OK" appears. When something occurs to blow the surge suppressor, the message "AC Surge Suppressor:Blown <b>mm/dd/yyyy hh:mm</b> " appears, showing the date/time that the failure occurred. For instance, a surge suppressor failure occurring at 12:34 on 27 October 2012, gives an "AC Surge Suppressor:Blown 10/27/2012 12:34" message.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Alarm Limits             | The alarm parameters and limits as they are currently defined in the system setup. You change these parameters and limits using the Alarm Limits submenu. <b>Chapter 11 - Serial Interface</b> tells how to set these values.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Equipment                | Equipment configuration as currently defined in the system setup. You change this configuration using the Equipment submenu. <b>Chapter 11 - Serial Interface</b> tells how to set these values.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Messages                 | Message configuration as currently defined in the system setup. You change this configuration using the Messages submenu. <b>Chapter 11 - Serial Interface</b> tells how to set these values.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Polling System           | Polling system configuration as currently defined in the system setup. You change this configuration using the Polling System submenu. Information dealing with the wind monitor and the rail-stress monitor is also displayed here.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Modem Setup              | The active modem configuration commands and which modem (default or alternate) is currently selected. You change this configuration using the Modem Setup submenu. <b>Chapter 11 - Serial Interface</b> tells how to set these values.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Serial Ports             | Communications port configurations, for COM1, COM2, and COM3, as currently defined in the system setup. You change this configuration using the Serial Ports submenu.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Amtech Reader Parameters | <p>This heading always appears, even if the AEI subsystem is disabled using the <b>AEI option</b> on the Equipment submenu. After Reader1 can be either AI1200 <u>or</u> None. (In this case, AI1200 means the 2200-750 Reader.) After Reader2 is only None.</p> <p>Below are the AEI Reader Parameters currently defined in the system setup. These values were in place at the time this report was run.</p> <ul style="list-style-type: none"> <li>• ID Separation specifies the number of intervening tags that must be read and reported before a given tag is reported again. Valid values are 1, 2, 3, and 4. The default is 2.</li> <li>• Consecutive Reads specifies the number of times that a tag must be read before it is considered a valid (reportable) tag. Valid values are 1, 2, 3, and 4. The default is 2.</li> <li>• Uniqueness Timeout specifies the number of seconds that the ID Separation parameter is in effect for a given tag. When a 2200-750 Reader is attached to the system, the Uniqueness Timeout parameter is automatically set to 120 seconds. For a 2200-750 Reader, this value cannot be changed.</li> </ul> <p><b>Chapter 11 - Serial Interface</b> tells how to set these values using the Amtech Reader Parameters submenu.</p> |

| Heading                  | Contents of Field                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Real-Time Diagnostics    | This is STC diagnostic information. It isn't meant for general-purpose use and should only be interpreted in consultation with STC personnel.                                                                                                                                                                                                                                                                                                                 |
| Scanner Calibration Date | Date and time each scanner was last calibrated. The autocalibration function maintains these fields. A default date and time of "00/00/2000 00:00" appears when the system has never calibrated a given scanner.                                                                                                                                                                                                                                              |
| Software Versions        | Software version numbers and release dates for the firmware. "Analyzer" is the firmware chip (in socket <b>U2</b> ) on the Processor board that is run by processor-A (in socket <b>U1</b> ). "Talker" is the firmware chip (in socket <b>U3</b> ) on the Talker board that is run by the processor in socket <b>U1</b> . "Com Board" is the firmware chip (in socket <b>U12</b> ) on the Processor board that is run by processor-B (in socket <b>U11</b> ). |
| COP Resets               | Number of COP resets, for each processor, occurring since the last time the counters were cleared.                                                                                                                                                                                                                                                                                                                                                            |
| Stack Min EEMin          | This is STC diagnostic information. It isn't meant for general-purpose use and should only be interpreted in consultation with STC personnel.                                                                                                                                                                                                                                                                                                                 |

To produce a System Status report:

- 1 Using the serial interface, display the Main menu.

The Main menu looks like this.

```

STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
Main Menu

A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
F) Last Train

 •
 •
 •

```

- 2 Select **System Status**.

At this time, you can produce another report by selecting the appropriate menu option.

- 3 When done, close the LOG file.
- 4 To exit the serial interface and return the SmartScanIS to normal operation, type **x**
- 5 If **on-site** and if you unplugged a device from COM3, plug the device back in after unplugging your computer.

## 12.7 Last Train Report

The Last Train report is identical to the Train Detail report except that it isn't necessary to specify a train to report, a report on the most current train is produced.

To produce a Last Train report:

- 1 Using the serial interface, display the Main menu.

The Main menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
Main Menu

A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
F) Last Train
G) Range of Trains
 .
 .
 .
```

- 2 Select **Last Train**.

At this time, you can produce another report by selecting the appropriate menu option.

- 3 When done, close the LOG file.
- 4 To exit the serial interface and return the SmartScanIS to normal operation, type **x**
- 5 If **on-site** and if you unplugged a device from COM3, plug the device back in after unplugging your computer.

## 12.8 Range of Trains Report

The Range of Trains report is a set of Train Detail reports for a range of train numbers. The Train Summary report can be used to get a list of train numbers for trains that are currently stored in the detector.



Below is a sample of part of a Range of Trains report. The contents of your report will be different.

|                                                                                                                            |           |                |
|----------------------------------------------------------------------------------------------------------------------------|-----------|----------------|
| Southern Technologies Corporation<br>Integrated Detector System<br>Union Pacific Railroad<br><b>RANGE OF TRAINS REPORT</b> |           |                |
| -----                                                                                                                      |           |                |
| TRAIN NUMBERS 3 THROUGH 8                                                                                                  |           |                |
| =====                                                                                                                      |           |                |
| Southern Technologies Corporation<br>Integrated Detector System<br>Union Pacific Railroad<br><b>TRAIN DETAIL</b>           |           |                |
| =====                                                                                                                      |           |                |
| Train#: 3                                                                                                                  | Speed: 56 | Milepost: 0059 |
|                                                                                                                            | .         |                |
|                                                                                                                            | .         |                |
|                                                                                                                            | .         |                |
| Southern Technologies Corporation<br>Integrated Detector System<br>Union Pacific Railroad<br><b>TRAIN DETAIL</b>           |           |                |
| =====                                                                                                                      |           |                |
| Train#: 8                                                                                                                  | Speed: 51 | Milepost: 0059 |
|                                                                                                                            | .         |                |
|                                                                                                                            | .         |                |
|                                                                                                                            | .         |                |

To produce a Range of Trains report:

- 1 Using the serial interface, display the Main menu.

The Main menu looks like this.

|                                                                                                        |  |
|--------------------------------------------------------------------------------------------------------|--|
| STC Integrated Detector System, Milepost-0501.2, Track:Single<br>05/31/2013 9:35<br>Main Menu<br>----- |  |
| A) Train Summary                                                                                       |  |
| B) Train Detail                                                                                        |  |
| C) Exception Summary                                                                                   |  |
| D) Exception Detail                                                                                    |  |
| E) System Status                                                                                       |  |
| F) Last Train                                                                                          |  |
| G) Range of Trains                                                                                     |  |
| H) Event Log                                                                                           |  |
| I) Setup Menu                                                                                          |  |
| J) T94 Train Detail                                                                                    |  |
| X) Exit Menu                                                                                           |  |

- 2 Select **Range of Trains**.

This prompt appears.

|                 |
|-----------------|
| Starting Train# |
|-----------------|

If you press **[Enter]** at the above prompt (without typing anything), the firmware automatically sets the starting train number to the oldest stored train.

- 3 Type the starting train number.  
If you typed four digits, the prompt below appears.
- 4 If you typed one, two, or three digits, press **[Enter]**.  
This prompt appears.

```
Ending Train#
```

If you press **[Enter]** at the above prompt (without typing anything), the firmware automatically sets the ending train number to the newest stored train.

- 5 Type the ending train number.  
If you typed a valid four-digit train number, a Range of Trains report is produced, oldest train first. If either of the typed train numbers is invalid, a message like this appears.

```
Train number not in range of currently stored trains.
Current range is: Oldest Train = 11 Newest Train = 234
```

At this time, you can produce another report by selecting the appropriate menu option.

- 6 If you typed one, two, or three digits, press **[Enter]**.  
If you typed a valid train number, a Range of Trains report is produced, oldest train first. If either of the typed train numbers is invalid, a message like this appears.

```
Train number not in range of currently stored trains.
Current range is: Oldest Train = 11 Newest Train = 234
```

At this time, you can produce another report by selecting the appropriate menu option.

- 7 When done, close the LOG file.
- 8 To exit the serial interface and return the SmartScanIS to normal operation, type **x**
- 9 If **on-site** and if you unplugged a device from COM3, plug the device back in after unplugging your computer.

## 12.9 Event Log Report

The Event Log report is used for diagnostics. As certain system events occur, entries are posted into the event log. Each time an entry is made into this log, it receives an event number, the date and time that the event was recorded, and an event description.

The entries are stored in a section of SRAM that can hold up to 900 separate entries. Each time an event is recorded which exceeds this maximum, the new one overwrites the oldest recorded event. The entries are saved during a power outage, but can be deleted with the **Clear Event Log option** on the System Functions menu. Producing the report at this time produces a "No Events" message. If events have been recorded and not cleared, they're listed in chronological order, beginning with the most recently recorded event.

Listed below are many of the system events that are currently available for recording. Not all of the available system events are listed. (Note that on the 2300-100 Processor board are two processors, the Analyzer Processor (aka processor-A) and the Communications Processor (aka processor-B). The Communications Processor has a hardware clock. The Analyzer Processor has a firmware clock.)

- **Comm Sending Setup:(TimDat)** is recorded when the Communications Processor sends the Analyzer Processor the time and date. This happens every time the customer changes these values and every morning at 01:00 a.m.
- **COP RESET Forced** is recorded when the user forces a system RESET through the **Remote System Reset option** on the System Functions menu.
- **Date/Time Transmission:Error** is recorded when a date-and-time transmission results in a checksum failure. Each failure posts a separate message. Therefore, if the Communications Processor makes five transmissions before succeeding, four error messages appear in the Event Log, followed by a **Date/Time Transmission:OK** message marking the success.
- **Date/Time Transmission:OK** is recorded when a date-and-time transmission succeeds.
- **Date/Time Transmission:Timeout** is recorded when a date-and-time transmission times out without receiving an Analyzer Processor response. Each timeout posts a separate message. Therefore, if the Communications Processor makes five transmissions before the Analyzer Processor responds, four timeout messages appear in the Event Log, followed by a **Date/Time Transmission:OK** message marking the success
- **Excep. Train Stored** is recorded each time the system scans and records a passing exception train. This entry is recorded just before the **Train Stored** entry for the same train is recorded.
- **Incoming Train Data: Re-Requested** is recorded each time processor-B's (aka Communications Processor's) checksum comparison fails and it asks processor-A (aka Analyzer Processor) to repeat the train data transmission.
- **Rebroadcast Request** is recorded when the system recognizes and handles a rebroadcast request.

- **Setup Data Request:Error** is recorded when a setup data request results in a checksum failure. Each failure posts a separate message. Therefore, if the Communications Processor makes five transmissions before succeeding, four error messages appear in the Event Log, followed by a **Setup Data Request:OK** message marking the success.
- **Setup Data Request:OK** is recorded when a setup data request succeeds.
- **Setup Data Request:Timeout** is recorded when the Communications Processor times out without receiving a response. Because a timeout cancels the request attempts, this message appears only once.
- **Setup Data Transmission:Error** is recorded when a setup data transmission results in a checksum failure. Each failure posts a separate message. Therefore, if the Communications Processor makes five transmissions before succeeding, four error messages appear in the Event Log, followed by a **Setup Data Transmission:OK** message marking the success.
- **Setup Data Transmission:OK** is recorded when a setup data transmission succeeds.
- **Setup Data Transmission:Timeout** is recorded when a setup data transmission times out without receiving an Analyzer Processor response. Each timeout posts a separate message. Therefore, if the Communications Processor makes five transmissions before the Analyzer Processor responds, four timeout messages appear in the Event Log, followed by a **Setup Data Transmission:OK** message marking the success.
- **System Accessed** is recorded each time the user enters the serial interface. This entry records the serial port used to access the serial interface. For example, accessing the serial interface through the P10 serial port creates a "System Accessed[P10]" entry in the Event Log. Valid port designations are P8, P9, and P10. To delimit any abnormal or error condition, the entry records a designation of P255.
- **System Exited** is recorded each time the user exits from the serial interface.
- **System Restart** is recorded each time the system is powered-up or reset.
- **Train Arrival** is recorded each time a train passes the site. To support transmitting ZA messages in real-time for systems operating in Poll/Standalone mode, processor-A (aka Analyzer Processor) alerts processor-B (aka Communications Processor) when a train enters the site. After processor-B receives and processes the alert, it records this entry.
- **Train Stored** is recorded each time the system scans and records a passing train and each time the system generates a gate-test train. In other words, every train gets this entry recorded.
- **Talker Mode:Error-NAK occurred** is recorded, for systems operating in Poll/Standalone mode, when at least five consecutive ZA or ZU polling system messages were sent to the Harriman Dispatch Center without being acknowledged. This entry appears each time the talker-mode setting automatically changes due to an unacknowledged ZA or ZU message transmission. If the talker-mode setting is talk-on-defect, it changes to talk-freely. If the setting is already talk-freely, it stays talk-freely.

- **Talker Mode:Error-Timeout occurred** is recorded, for systems operating in Poll/Standalone mode, when five minutes goes by without the system receiving a valid poll from the Harriman Dispatch Center. This message is also recorded for systems not connected to Harriman. This entry appears each time the talker-mode setting automatically changes due to a loss of communications with Harriman. If the talker-mode setting is talk-on-defect, it changes to talk-freely. If the setting is already talk-freely, it stays talk-freely.
- **Talker Mode:Timeout condition corrected** is recorded when a valid poll is received after a prior **Talker Mode:Error-Timeout occurred** event was recorded. This entry appears each time the system restores its prior talker-mode setting as a result of reestablishing communications with the Harriman Dispatch Center. The talker-mode setting that is restored is the one in existence just before the **Talker Mode:Error-Timeout occurred** event was recorded.
- **Talker Mode:NAK condition corrected** is recorded when a ZA or ZU message transmission is acknowledged by the Harriman Dispatch Center after a prior **Talker Mode:Error-NAK occurred** event was recorded. This entry appears each time the system restores its prior talker-mode setting as a result of processing an acknowledged ZA or ZU message transmission. The talker-mode setting that is restored is the one in existence just before the **Talker Mode:Error-NAK occurred** event was recorded.
- **Wind Monitor:Error-Direction suspicious** is recorded when the wind monitor reports a constant wind-direction reading for at least 30 minutes.
- **Wind Monitor:Direction restored** is recorded when the wind monitor reports a different wind-direction reading than the last reported one after a prior **Wind Monitor:Error-Direction suspicious** event was recorded.
- **Wind Monitor:Error-Speed suspicious** is recorded when the wind monitor reports a constant wind-speed reading for at least 30 minutes.
- **Wind Monitor:Speed restored** is recorded when the wind monitor reports a different wind-speed reading than the last reported one after a prior **Wind Monitor:Error-Speed suspicious** event was recorded.
- **Wind Monitor:Error-Loss of communications** is recorded when the wind-monitor hardware fails to produce a valid response for at least two minutes.
- **Wind Monitor:Communications restored** is recorded when the wind monitor correctly responds to a system poll after a prior **Wind Monitor:Error-Loss of communications** event was recorded.

Wind-monitor support must be enabled in order for the system to post any of the wind-monitor events. You can enable wind-monitor support by using the Polling System submenu of the Setup menu. **Chapter 11 - Serial Interface** tells how to set this value.

Below is a sample of an Event Log report containing some events. The contents of your report will be different. The date/time at the top of the report is the system date/time at the time the report was generated. Each line of text (that is, each event) contains these fields.

- The sequential number assigned to the event as it was generated
- The date at which the event was recorded
- The time at which the event was recorded
- The event description

```

Southern Technologies Corporation
Integrated Detector System
Union Pacific Railroad
Event Log
05/31/2013 09:45:11
=====
152 05/17/13 09:40 <Wind Monitor:Error -- Loss of communications>
151 05/15/13 08:59 <Talker Mode :Error -- Timeout occurred>
.
.
.
----- End of Report -----
```

Below is a sample of an Event Log report containing no events.

```

Southern Technologies Corporation
Integrated Detector System
Union Pacific Railroad
Event Log
05/31/2013 09:45:11
=====
No Entries!
----- End of Report -----
```

To produce an Event Log report:

- 1 Using the serial interface, display the Main menu.

The Main menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
Main Menu

A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
F) Last Train
G) Range of Trains
H) Event Log
I) Setup Menu
J) T94 Train Detail
X) Exit Menu
```

- 2 Select **Event Log**.

At this time, you can produce another report by selecting the appropriate menu option.

- 3 When done, close the LOG file.
- 4 To exit the serial interface and return the SmartScanIS to normal operation, type **x**
- 5 If **on-site** and if you unplugged a device from COM3, plug the device back in after unplugging your computer.

## 12.10 T94 Train Detail Report

The T94 Train Detail report provides detailed information on a single train. It contains information that can be useful in troubleshooting AEI related problems. When choosing this report, you'll be prompted for a train number. When prompted, type a train number from the Train Summary report. The train number appears under the column titled "Train#" in the detail section of that report.

Hotwheel alarm reporting is enabled/disabled using the **Hotwheel option** on the Equipment submenu. The AEI subsystem is enabled/disabled using the **AEI option** on the Equipment submenu. Where wheel scanners are properly installed, wheel temperatures are always recorded, even if the **Hotwheel option** is disabled. On the other hand, if the **AEI option** is disabled, no AEI information is recorded.

Below is a sample of part of a T94 Train Detail report when both the **AEI option** and **Hotwheel option** are enabled at the time the report was requested. Also, both the **AEI option** and **Hotwheel option** had to be enabled while the specified train was passing the site. The contents of your report will be different.

Southern Technologies Corporation  
Integrated Detector System  
Union Pacific Railroad

**TRAIN DETAIL**

```
=====
Train#: 16 Speed: 43 Milepost: 0501.2
Date: 05/01/2013 Axles: 194 Track: Single
Time: 12:55 Direction: East Temperature: +51°
SiteID: NONAME Battery: 27.7v
=====
```

| Rail  | Max  | Avg | Resistor<br>Read Req | Transducer<br>Count Spikes | Alarm        | Limit | CS Slope  | Parms |
|-------|------|-----|----------------------|----------------------------|--------------|-------|-----------|-------|
| North | 167° | 35° | 275° 160°            | T01 194 0                  | Absolute     | 180°  | CS Min:   | 60    |
| South | 181° | 68° | 202° 160°            | T02 194 0                  | Differential | 100°  | CS Slope: | 0.75  |
|       |      |     |                      |                            | Hot Wheel    | 556°  |           |       |

| Wheel | Max  | Avg | Resistor<br>Read Req |
|-------|------|-----|----------------------|
| North | 566° | 98° | 60° 160°             |
| South | 587° | 94° | 67° 160°             |

Resistor Integ. Test: Enabled  
Cold Rail Test: All Trains

=====

AEI System Data

Tags Read                      Tags Stored: 15

-----

Reader 1: 16 [#00:00:32.80 07/04/93]

=====

System Alarms

-----

Cold North Wheel Scanner Resistor

Cold South Wheel Scanner Resistor

.

.

.

| Car | Axle | Rail    |       | Wheel |       | ON   | OFF | TxdHits |          | Alarms |     |      |       |      |       |      |    |         |
|-----|------|---------|-------|-------|-------|------|-----|---------|----------|--------|-----|------|-------|------|-------|------|----|---------|
|     |      | North   | South | North | South |      |     | PW1     | PW2      |        | T01 | T02  |       |      |       |      |    |         |
| 1   | 6    | 1       | B     | 0     | 0     | 0    | 0   | 2       | 0        | E      | A   | 0    | ST    | 985  | ET    | 1733 | -  | 0       |
|     |      | Lead-T: |       | 0     | S:    | 985  | E:  | 1178    | Trail-T: |        | 1   | S:   | 1540  | E:   | 1733  |      |    |         |
|     |      | 6       | L?    | 19    | NS    | 8572 | 0   | P       | 0        | 1568   |     | 2238 | 6539  |      | 7137  | 106  | 98 | 70 0000 |
| 1   | 1    | 56°     | 21°   | 16°   | 16°   | 25   | 0   | 8       | 8        | 2      | 2   |      |       |      |       |      |    |         |
|     | 2    | 57°     | 21°   | 20°   | 20°   | 25   | 59  | 5       | 5        | 2      | 2   |      |       |      |       |      |    |         |
|     | 3    | 56°     | 21°   | 14°   | 10°   | 25   | 59  | 5       | 5        | 2      | 2   |      |       |      |       |      |    |         |
|     | 4    | 56°     | 21°   | 10°   | 10°   | 25   | 362 | 5       | 5        | 2      | 2   |      |       |      |       |      |    |         |
|     | 5    | 56°     | 21°   | 34°   | 16°   | 25   | 59  | 5       | 5        | 2      | 2   |      |       |      |       |      |    |         |
|     | 6    | 56°     | 21°   | 16°   | 14°   | 25   | 59  | 4       | 5        | 2      | 2   |      |       |      |       |      |    |         |
| 2   | 6    | 1       | B     | 0     | 0     | 0    | 0   | 0       | 0        | E      | A   | 0    | ST    | 1733 | ET    | 2566 |    | 0       |
|     |      | Lead-T: |       | 0     | S:    | 1895 | E:  | 2088    | Trail-T: |        | 1   | S:   | 2373  | E:   | 2566  |      |    |         |
|     |      | 6       | L?    | 19    | NS    | 8711 | 0   | P       | 0        | 2428   |     | 3330 | 15589 |      | 16174 | 97   | 96 | 70 0000 |
| 2   | 7    | 56°     | 20°   | 16°   | 16°   | 25   | 162 | 5       | 5        | 2      | 2   |      |       |      |       |      |    |         |
|     | 8    | 56°     | 21°   | 16°   | 16°   | 25   | 59  | 5       | 5        | 2      | 2   |      |       |      |       |      |    |         |

.

.

.



Below is part of the T94 Train Detail report that deals specifically with AEI diagnostic data. These three lines are representative of similar lines added for each vehicle in the train's consist.

|         |   |   |   |    |    |   |   |   |     |      |   |   |    |      |          |      |   |   |                         |      |  |  |  |      |      |  |  |  |      |                      |  |  |  |      |  |  |  |     |  |    |    |  |  |  |      |                     |
|---------|---|---|---|----|----|---|---|---|-----|------|---|---|----|------|----------|------|---|---|-------------------------|------|--|--|--|------|------|--|--|--|------|----------------------|--|--|--|------|--|--|--|-----|--|----|----|--|--|--|------|---------------------|
| 1       | 6 | 1 | B | 0  | 0  | 0 | 0 | 2 | 0   | E    | A | 0 | ST | 985  | ET       | 1733 | - | 0 | <- Vehicle-related data |      |  |  |  |      |      |  |  |  |      |                      |  |  |  |      |  |  |  |     |  |    |    |  |  |  |      |                     |
| Lead-T: |   |   |   | 0  | S: |   |   |   | 985 | E:   |   |   |    | 1178 | Trail-T: |      |   |   | 1                       | S:   |  |  |  | 1540 | E:   |  |  |  | 1733 | <- Truck-timing data |  |  |  |      |  |  |  |     |  |    |    |  |  |  |      |                     |
| 6       |   |   |   | L? | 19 |   |   |   | NS  | 8572 |   |   |    | 0    | P        |      |   |   | 0                       | 1568 |  |  |  |      | 2238 |  |  |  | 6539 |                      |  |  |  | 7137 |  |  |  | 106 |  | 98 | 70 |  |  |  | 0000 | <- Tag-related data |

The first line above contains data that is associated with the vehicle that consists of the axle records that follow. The second line shown contains data that is related to an AEI tag that has been associated with the vehicle.

The table below defines the relevant fields in line one (vehicle related data).

| Field Value | Field Definition                                                                                                                                                                                             |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1           | Vehicle number – the standing order number of the associated vehicle in relation to the train's consist.                                                                                                     |
| 6           | Axle count – the number of axles recorded for the vehicle.                                                                                                                                                   |
| 1           | Tag count – the number of AEI tag records associated with the vehicle.                                                                                                                                       |
| B           | Orientation of vehicle, where:<br>A = A-end of the vehicle<br>B = B-end (the brake-end) of the vehicle<br>In the above example, the vehicle was oriented with the brake-end of the vehicle pointing forward. |
| 0 0 0 0     | <i>Reserved for future diagnostics development.</i>                                                                                                                                                          |
| 2           | The number of trucks detected on the vehicle.                                                                                                                                                                |
| 0           | Reserved for future diagnostics development.                                                                                                                                                                 |
| E           | The direction the vehicle traveled.                                                                                                                                                                          |
| A           | Reserved for future diagnostics development                                                                                                                                                                  |
| 0           | Reserved for future diagnostics development                                                                                                                                                                  |
| ST 985      | Vehicle starting timestamp – the timer starts when train presence is detected.                                                                                                                               |
| ET 1733     | Vehicle ending timestamp.                                                                                                                                                                                    |
| -           | Reserved for future diagnostics development                                                                                                                                                                  |
| 0           | Reserved for future diagnostics development                                                                                                                                                                  |

The table below defines the relevant fields in line two (truck timing data). This line appears only when the train was scanned at a multi-track site.

| Field Value | Field Definition                                                                                                                                           |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Lead-T: 0   | The lead truck of the vehicle is labeled the #0 truck on the train.                                                                                        |
| S: 985      | The start time for the car's lead truck. This is the elapsed time (in milliseconds) at which the lead axle of the truck crossed the first transducer.      |
| E: 1178     | The end time for the car's lead truck. This is the elapsed time (in milliseconds) at which the trailing axle of the truck crossed the last transducer.     |
| Trail-T: 1  | The trailing truck of the vehicle is labeled the #1 truck on the train.                                                                                    |
| S: 1540     | The start time for the car's trailing truck. This is the elapsed time (in milliseconds) at which the lead axle of the truck crossed the first transducer.  |
| E: 1733     | The end time for the car's trailing truck. This is the elapsed time (in milliseconds) at which the trailing axle of the truck crossed the last transducer. |

The table below defines the relevant fields in line three (tag related data). If more than one AEI tag is associated with a particular car, there will be a subsequent line of tag related data for each tag. In reference to the track, **antenna1** is the northmost or eastmost antenna. **Antenna2** is the southmost or westmost antenna.

| Field Value | Field Definition                                                                                                                                                                                                                                                                                |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (space)     | Dynamic locomotive tag indication, where:<br>d = dynamic locomotive, tag is one of the two tags expected on vehicle<br>D = dynamic locomotive, tag is a third tag on vehicle<br>(space)= tag is not a dynamic locomotive tag<br>In the above example, the tag was not a dynamic locomotive tag. |
| (space)     | Data format code error indication, where:<br>F = Indicates the tag's data format code field was in error.<br>(space) = tag's data format code field was correct.<br>In the above example, the tag's data format code field was correct.                                                         |
| 6           | Axle count from tag data.                                                                                                                                                                                                                                                                       |
| (space)     | Tag reporting status, where:<br>- = Indicates the tag will not appear on the train's T94 report.<br>(space) = Indicates the tag will appear on the train's T94 report.<br>In the above example, the tag will appear on the train's T94 report.                                                  |
| L           | Indicates worthiness of tag pair read, where:<br>G = Good read of tag pair<br>L = Left tag missing<br>M = Mismatched tags<br>N = No tag read<br>R = Right tag missing<br>? = Other                                                                                                              |
| ?           | <i>Reserved for future diagnostics development.</i>                                                                                                                                                                                                                                             |
| 19          | Equipment Group Code from tag data.                                                                                                                                                                                                                                                             |
| NS 8572     | AEI vehicle identification.                                                                                                                                                                                                                                                                     |
| 0           | <i>Reserved for future diagnostics development.</i>                                                                                                                                                                                                                                             |
| P 0         | Platform code from tag data.                                                                                                                                                                                                                                                                    |
| 1568        | <b>Antenna1</b> tag read timestamp – in milliseconds from start of train.                                                                                                                                                                                                                       |
| 2238        | <b>Antenna1</b> lock time adjusted using the handshakes field.                                                                                                                                                                                                                                  |
| 6539        | <b>Antenna2</b> tag read timestamp – in milliseconds from start of train.                                                                                                                                                                                                                       |
| 7137        | <b>Antenna2</b> lock time adjusted using the handshakes field.                                                                                                                                                                                                                                  |
| 106         | <b>Antenna1</b> tag read "handshakes." The number of times <b>antenna1</b> read the tag as it passed.                                                                                                                                                                                           |
| 98          | <b>Antenna2</b> tag read "handshakes." The number of times <b>antenna2</b> read the tag as it passed.                                                                                                                                                                                           |
| 70          | Vehicle length (in feet) from the tag data.                                                                                                                                                                                                                                                     |
| 0000        | Diagnostic code used by STC.                                                                                                                                                                                                                                                                    |

The Train Detail report is divided into a header section and a detail section. The header section contains general information about the site (like milepost) and some detail information about the specific train (like train's exit speed) that passed the site. The detail section contains more detailed information (like car number) about the specific train and the AEI related information described above.

The table below lists the fields from the header section and the contents of each field.

| Heading     | Contents of Field                                                                                                                                                                                                                            |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Train#      | The number that identifies the train in the Trains directory.                                                                                                                                                                                |
| Date        | The date the train arrived at the site. Date is in <b>mm/dd/yy</b> format.                                                                                                                                                                   |
| Time        | The time the train arrived at the site. Time is in 24-hour <b>hh:mm</b> format, where 8 a.m. is 08:00, noon is 12:00, 8 p.m. is 20:00, and midnight is 00:00.                                                                                |
| SiteID      | The name of the site. This can be supplied either by the Harriman Dispatch Center via the Polling System <u>or</u> by the <b>Site ID option</b> on the Polling System submenu. The default is <i>NONAME</i> .                                |
| Speed       | The train's exit speed in miles per hour.                                                                                                                                                                                                    |
| Axles       | The total number of axles counted by the SmartScanIS.                                                                                                                                                                                        |
| Direction   | The direction the train was traveling. Valid values are North, South, East, and West.                                                                                                                                                        |
| Milepost    | The five-digit milepost of the site. <b>Chapter 11 - Serial Interface</b> tells how to set this value using the Milepost submenu.                                                                                                            |
| Track       | The track designator of the site. For single-track sites, the value is Single. For multitrack sites, valid values are 1, 2, 3, 4, 5, and 6. <b>Chapter 11 - Serial Interface</b> tells how to set this value using the Track Number submenu. |
| Temperature | The ambient temperature, in degrees Fahrenheit, at the time the train passed the site.                                                                                                                                                       |
| Battery     | The backup battery voltage at the time the train passed the site.                                                                                                                                                                            |
| Rail        | Rail orientation for each side of the train. If the track orientation is east and west, rails are north and south. If the track orientation is north and south, rails are east and west.                                                     |
| Max         | The maximum temperature (above ambient), in degrees Fahrenheit, recorded by the bearing scanner on a given railside.                                                                                                                         |
| Avg         | The average temperature (above ambient), in degrees Fahrenheit, calculated from all recorded temperatures from the bearing scanner on a given railside.                                                                                      |

| Heading           | Contents of Field                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Resistor Read     | The scanner resistor temperature (read after train passage), in degrees Fahrenheit, recorded by the bearing scanner on a given railside.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Resistor Req      | The resistor temperature, in degrees Fahrenheit, required by the bearing scanner on a given railside to avoid a Cold Resistor alarm. This value was calculated using the amount of time the shutters were open and the Resistor Integrity Test Mode in effect at the time the train passed the site. If the <b>Resistor Integrity Test Mode option</b> is disabled, a zero appears in this field.                                                                                                                                                                                                                                                                                           |
| Transducer Counts | The gating transducer designator (either TO1 or TO2) followed by the total number of hits on that transducer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Transducer Spikes | The gating transducer designator (either TO1 or TO2) followed by the total number of spikes on that transducer. (Note: Spikes are ignored for a train's first thirty-six axles and for all subsequent six-axle vehicles.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Alarm Limit       | <p>The Hotwheel alarm level and Hotbox alarm levels for Absolute and Differential. These values were in place at the time the train passed the site.</p> <ul style="list-style-type: none"> <li>• The value after Absolute is set by the <b>Absolute option</b> on the Alarm Limits submenu.</li> <li>• The value after Differential is set by the <b>Differential option</b> on the Alarm Limits submenu.</li> <li>• The Hot Wheel heading always appears, even if Hotwheel alarm reporting is disabled. The value after Hot Wheel is set by the <b>Hotwheel option</b> on the Alarm Limits submenu.</li> </ul> <p><b>Chapter 11 - Serial Interface</b> tells how to set these values.</p> |
| CS Slope Parm     | <p>These are the Carside Slope alarm parameters currently defined in the system setup. These values were in place at the time the train passed the site.</p> <ul style="list-style-type: none"> <li>• The value after CS Min is set by the <b>Carside Minimum option</b> on the Alarm Limits submenu.</li> <li>• The value after CS Slope is set by the <b>Carside Slope option</b> on the Alarm Limits submenu.</li> </ul>                                                                                                                                                                                                                                                                 |
| Wheel             | Rail orientation for each side of the train. If the track orientation is east and west, rails are north and south. If the track orientation is north and south, rails are east and west. This field only appears when Hotwheel alarm reporting is enabled using the <b>Hotwheel option</b> on the Equipment submenu.                                                                                                                                                                                                                                                                                                                                                                        |
| Max               | The maximum temperature (above ambient), in degrees Fahrenheit, recorded by the wheel scanner on a given railside. This field only appears when Hotwheel alarm reporting is enabled using the <b>Hotwheel option</b> on the Equipment submenu.                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Avg               | The average temperature (above ambient), in degrees Fahrenheit, calculated from all recorded temperatures from the wheel scanner on a given railside. This field only appears when Hotwheel alarm reporting is enabled using the <b>Hotwheel option</b> on the Equipment submenu.                                                                                                                                                                                                                                                                                                                                                                                                           |
| Resistor Read     | The scanner resistor temperature (read after train passage), in degrees Fahrenheit, recorded by the wheel scanner on a given railside. This field only appears when Hotwheel alarm reporting is enabled using the <b>Hotwheel option</b> on the Equipment submenu.                                                                                                                                                                                                                                                                                                                                                                                                                          |

| Heading                 | Contents of Field                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Resistor Req            | The resistor temperature, in degrees Fahrenheit, required by the wheel scanner on a given railside to avoid a Cold Wheel Scanner Resistor alarm. This value was calculated using the amount of time the shutters were open and the Resistor Integrity Test Mode in effect at the time the train passed the site. If the <b>Resistor Integrity Test Mode option</b> is disabled, a zero appears in this field. This field only appears when Hotwheel alarm reporting is enabled using the <b>Hotwheel option</b> on the Equipment submenu.                                                                                                                                                                     |
| Resistor Integrity Test | Status of the post-train resistor integrity test at the time the train passed the site. Valid values are Enabled, Reduced, and Disabled. <b>Chapter 11 - Serial Interface</b> tells how to set this value using the <b>Resistor Integrity Test Mode option</b> on the Equipment submenu.                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Cold Rail Test          | Status of the cold-rail test at the time the train passed the site. Valid values are All Trains and Long Trains Only. <b>Chapter 11 - Serial Interface</b> tells how to set this value using the <b>Cold Rail Test Mode option</b> on the Equipment submenu.                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| AEI System Data         | The number of AEI tags read (by antenna1 and antenna2) and the total number of tags stored for the train. Where both tags of a tag pair are operational, each antenna will read one tag of the pair. The total number of tags stored represents the number of tag pairs found plus those single tags that lack a match. This heading and the columns under it appear only when the AEI subsystem is enabled using the <b>AEI option</b> on the Equipment submenu.                                                                                                                                                                                                                                             |
| System Alarms           | At least one text message, which can be either: <ul style="list-style-type: none"> <li>• "System Integrity Check Passed!" only</li> <li>• One or more System Alarm descriptions followed by "System Integrity Check Passed!"</li> <li>• "Integrity Failure" followed by one or more Integrity Failure descriptions</li> <li>• One or more System Alarm descriptions, followed by "Integrity Failure," followed by one or more Integrity Failure descriptions</li> </ul> <b>Appendix A - System Alarms</b> describes the conditions and events that the system flags as System Alarms. <b>Appendix B - Integrity Failures</b> describes the conditions and events that the system flags as Integrity Failures. |
| Train Alarms            | The number of Exception Alarms found on the train. This is followed by a list of each Exception Alarm found and the axle on which it was found.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Firmware Versions       | Software version numbers and release dates for the firmware. "Analyzer" is the firmware chip (in socket <b>U2</b> ) on the Processor board that is run by processor-A (in socket <b>U1</b> ). "Talker" is the firmware chip (in socket <b>U3</b> ) on the Talker board that is run by the processor in socket <b>U1</b> . "ComBoard" is the firmware chip (in socket <b>U12</b> ) on the Processor board that is run by processor-B (in socket <b>U11</b> ).                                                                                                                                                                                                                                                  |

The table below lists the fields from the detail section and the contents of each field.

| Heading     | Contents of Field                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Car         | The car number as determined by the firmware.                                                                                                                                                                                                                                                                                                                                                             |
| Axle        | The axle number.                                                                                                                                                                                                                                                                                                                                                                                          |
| Rail        | Under it are two columns, one for each rail, containing the temperature read by the bearing scanners. If the track orientation is east and west, rails are north and south. If the track orientation is north and south, rails are east and west.                                                                                                                                                         |
| Wheel       | Under it are two columns, one for each rail, containing the temperature read by the wheel scanners. If the track orientation is east and west, rails are north and south. If the track orientation is north and south, rails are east and west. This heading and the two columns under it appear only when Hotwheel alarm reporting is enabled using the <b>Hotwheel option</b> on the Equipment submenu. |
| ON          | The number of milliseconds a bearing was scanned.                                                                                                                                                                                                                                                                                                                                                         |
| OFF         | The number of milliseconds between bearings (when no bearing was between the gating transducers).                                                                                                                                                                                                                                                                                                         |
| PW1         | The recorded pulse width generated by gating transducer TO1. There is no fixed value for the pulse widths. Slower trains generate wider pulse widths (that is, they generate larger values) than faster moving trains.                                                                                                                                                                                    |
| PW2         | The recorded pulse width generated by gating transducer TO2. There is no fixed value for the pulse widths. Slower trains generate wider pulse widths (that is, they generate larger values) than faster moving trains.                                                                                                                                                                                    |
| TxdHits TO1 | The total number (for a given axle) of interrupt firings for gating transducer TO1. Since each interrupt fires once on a signal's rising-edge and once on a signal's falling-edge, this value should be two. Values higher than two can indicate additional interrupt firings, possibly from a transducer spike, or a missed axle on the opposite transducer.                                             |
| TxdHits TO2 | The total number (for a given train) of interrupt firings for gating transducer TO2. Since each interrupt fires once on a signal's rising-edge and once on a signal's falling-edge, this value should be two. Values higher than two can indicate additional interrupt firings, possibly from a transducer spike, or a missed axle on the opposite transducer.                                            |
| Alarms      | Any Exception Alarm found on the given axle.                                                                                                                                                                                                                                                                                                                                                              |

To produce a T94 Train Detail report:

- 1 Using the serial interface, display the Main menu.

The Main menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
Main Menu

A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
F) Last Train
G) Range of Trains
H) Event Log
I) Setup Menu
J) T94 Train Detail
X) Exit Menu
```

- 2 Select **T94 Train Detail**.

This prompt appears.

```
Train Number ?
```

- 3 Type the train number.

If you typed a four-digit valid train number, a report for that train is produced. If the typed train number is invalid, the Main menu reappears.

- 4 If you typed one, two, or three digits, press **[Enter]**.

If the typed train number is valid, pressing **[Enter]** produces a report for it. If the typed train number is invalid, the Main menu reappears.

At this time, you can produce another report by selecting the appropriate menu option.

- 5 When done, close the LOG file.
- 6 To exit the serial interface and return the SmartScanIS to normal operation, type **x**
- 7 If **on-site** and if you unplugged a device from COM3, plug the device back in after unplugging your computer.



# Chapter 13

## Radio Announcements

---

This chapter describes the use of radio announcements to report defects to affected train crews via the road channel.

Radio announcements consist of a set of predefined spoken messages with each message triggered by a particular event or set of events. The message formats and announcement criteria are covered below.

Anytime a message needs to be announced, the system's holdoff logic kicks in, and the process is as follows:

- 1 Check the Holdoff line.  
The Holdoff line is active when the road channel is busy and inactive when the road channel is clear.
- 2 If the Holdoff line is inactive, announce your messages and skip the remaining steps.
- 3 If the Holdoff line is active, start the Holdoff timer and begin monitoring the Holdoff line.  
The maximum amount of time the system delays spoken announcements while waiting for a busy radio channel to clear, is 40 seconds.
- 4 If the Holdoff line becomes inactive before the Holdoff timer expires, announce your messages.
- 5 If the Holdoff timer expires without the Holdoff line ever becoming inactive, announce your messages.

### 13.1 Arrival Messages

The arrival message is used to announce train arrival at the site. This message is an option and is enabled or disabled using the **Announce Arrival Message option** on the Messages submenu. (In addition to having the message enabled, the system must recognize a passing train before giving the arrival announcement.) The format of this announcement is:

U-P Detector Milepost (mile) [track indicator]

For example, the announcement is like this.

U-P Detector  
Milepost 3-5-9 point 4

## 13.2 Real-Time Messages

Real-time messages are announcements that occur as the train is passing over the site. They are announced using a 1000-hertz tone. When the first alarm is detected, the tone is issued followed by the words "defect detected." All subsequent alarm announcements only use the tone. One tone is issued for each alarm detected up to and including twice the maximum number of alarms specified using the **Max Alarms option** on the Alarm Limits submenu.

For example, at a site having five alarms, the announcement is like this. For this example, the maximum number of alarms was set to a value greater than two.

(tone)  
Defect Detected  
(tone)  
(tone)  
(tone)  
(tone)

When Dragging Equipment, High Load, or Wide Load detector outputs are active as a train enters the site, "Detector Malfunction" messages appear in the real-time announcements, preceding any real-time announcements for alarms associated with an axle. A separate message appears for each active alarm type. If both Wide-Load outputs are active as a train enters a site, only one "Wide-Load Detector Malfunction" message is announced.

For example at a single-track site with the Dragging-Equipment detector active as the train arrives, the announcement is like this.

(tone)  
Dragging Equipment Detector Malfunction

At a single-track site with the High-Load and one or both Wide-Load detectors active as the train arrives, the announcement is like this.

(tone)  
High-Load Detector Malfunction  
(tone)  
Wide-Load Detector Malfunction

At a single-track site having three Hotbox alarms, and with the Dragging-Equipment, High-Load, and one or both Wide-Load detectors active as the train arrives, the announcement is like this.

(tone)  
Dragging Equipment Detector Malfunction  
(tone)  
High Load Detector Malfunction  
(tone)  
Wide Load Detector Malfunction  
(tone)  
Defect Detected  
(tone)  
(tone)

### 13.3 Post-Train Messages

Post-train (that is, end-of-train) announcements are given after the train has left the site and all the recorded train data has been processed by the SmartScanIS.

These messages consist of three distinct scenarios, each with its own spoken message. The scenarios are:

Exception Alarms not detected and Integrity Failures not detected

Exception Alarms not detected and Integrity Failures detected

Exception Alarms detected

**Exception Alarms** are associated with axles. There are 10 of them. They are the Absolute, Carside Slope, Differential, Dragging-Equipment, High-Load, Hotwheel, Pyrometer Saturation, Wide-Load, Cold Wheel, and Sliding Wheel alarms.

The four types of **Hotbox alarms** (aka hot bearing alarms) are Absolute alarms, Differential alarms, Pyrometer Saturation alarms, and Carside Slope alarms. When one of these four alarms occurs, a Hotbox alarm is announced. The system doesn't announce Cold Wheel alarms.

**Integrity Failures** are Dead Resistor, Slow Train, Very Slow Train, Successive Cold Rails Exceeded, Successive Cold Resistors Exceeded, Maximum Transducer Spikes Exceeded, Maximum Exception Alarms Exceeded, Max Equal Heat Test Failures Exceeded, Pretrain Stuck HiLoad, Pretrain Stuck WideLoad, Pretrain Stuck Dragger, and Dead Battery.

Below is the Messages submenu. The options on this submenu affect the phrases broadcast to a passing train or are used to modify the parameters associated with the rebroadcast function.

```
Milepost-0125.0, Track:3
Messages

A) Axles..... YES
B) Arrival..... YES
C) Speed..... YES
D) Length..... YES
E) Temperature..... YES
F) Power Off..... YES
G) HiWide..... YES
H) Car ID..... YES
I) No Defects..... 1
J) Rebroadcast Time Limit. 10 min.

Message to change or Esc to quit?
```

The above highlighted options on the Messages submenu are used to affect the phrases broadcast to a passing train. Enabling one or more of these options generates the ancillary messages: axle count, train speed, train length, site ambient temperature, and power off. The other options of the Messages submenu aren't used to generate ancillary messages.

In the examples that follow, not all ancillary messages are shown. This is because only total axle count and train speed were enabled. Site ambient temperature, train length, and power off were disabled. **Chapter 11 - Serial Interface** tells how to enable and disable these messages using the Messages submenu.

### 13.3.1 Nothing Detected

When neither an Exception Alarm nor an Integrity Failure is detected, the no-defects message is announced. The format of this announcement is:

[U-P Detector Milepost (mile) [track indicator] No Defects (3-second pause)]  
[U-P Detector Milepost (mile) [track indicator] No Defects (3-second pause)]  
U-P Detector Milepost (mile) [track indicator] No Defects  
[ancillary messages]  
Detector Out

By using the **No Defects option** on the Messages submenu, you can customize the number of times the detector makes the no-defects announcement. If the **No Defects option** was set to 2 or 3, a pause of roughly three seconds occurs between each of the no-defects messages. Any ancillary messages and the detector-out message occur only once and follow the final no-defects announcement.

For example, at a single-track site with the **No Defects option** set to one, the announcement is like this.

U-P Detector  
Milepost 3-2-1 point 4  
No Defects  
Total Axles 1-0-0  
Train Speed 4-5-m-p-h  
Detector Out

At a single-track site with the **No Defects option** set to three, the announcement is like this.

U-P Detector  
Milepost 1-7-9 point 5  
No Defects  
(3-second pause)  
U-P Detector  
Milepost 1-7-9 point 5  
No Defects  
(3-second pause)  
U-P Detector  
Milepost 1-7-9 point 5  
No Defects  
Total Axles 1-0-2  
Train Speed 5-3-m-p-h  
Detector Out

At a double-track site with the **No Defects option** set to one, the announcement is like this.

U-P Detector  
Milepost 2-5-4 point 5  
Track-1  
No Defects  
Total Axles 1-0-0  
Train Speed 4-5-m-p-h  
Detector Out

If the system's milepost setting is "0000.0," the firmware eliminates both the word "milepost" and the milepost number from the message. The rest of the message announces as shown above.

### 13.3.2 Only an Integrity Failure Detected

Integrity failures are caused when the system determines that a condition exists that could prevent proper scanning of a train. They indicate an unusual operating condition that may require maintenance. Integrity failures appear in the header of Train Detail reports and Exception Detail reports.

When no Exception Alarms are detected, but an Integrity Failure is detected, only Integrity Failure is announced. The format of this announcement is:

U-P Detector Milepost (mile) [track indicator] Integrity Failure  
U-P Detector Milepost (mile) [track indicator] Integrity Failure [ancillary messages]  
Detector Out

For example, at a double-track site, the announcement is like this.

U-P Detector  
Milepost 2-5-4 point 5  
Track-1  
Integrity Failure  
U-P Detector  
Milepost 2-5-4 point 5  
Track-1  
Integrity Failure  
Total Axles 1-2-4  
Train Speed 4-8-m-p-h  
Detector Out

If the system's milepost setting is "0000.0," the firmware eliminates both the word "milepost" and the milepost number from the message. The rest of the message announces as shown above.

### 13.3.3 Exception Alarms Detected

When one or more Exception Alarms are detected, the alarms are announced. The format of this announcement is:

U-P Detector Milepost (mile) [track indicator] [alarm announcements]  
U-P Detector Milepost (mile) [track indicator] [alarm announcements] [ancillary messages]  
Detector Out

For example, at a single-track site having one Hotbox alarm, the announcement is like this.

U-P Detector  
Milepost 3-2-1 point 4  
First-Hotbox West-Rail Axle-7-5 From-Head-of-Train  
U-P Detector  
Milepost 3-2-1 point 4  
First-Hotbox West-Rail Axle-7-5 From-Head-of-Train  
Total Axles 1-0-0  
Train Speed 4-5-m-p-h  
Detector Out

At a single-track site having one Hotwheel alarm, the announcement is like this.

U-P Detector  
Milepost 3-2-1 point 4  
First-Hotwheel West-Rail Axle-7-5 From-Head-of-Train  
U-P Detector  
Milepost 3-2-1 point 4  
First-Hotwheel West-Rail Axle-7-5 From-Head-of-Train  
Total Axles 1-0-0  
Train Speed 4-5-m-p-h  
Detector Out

At a single-track site having two Hotbox alarms, the announcement is like this.

U-P Detector  
Milepost 3-2-1 point 4  
First-Hotbox West-Rail Axle-7-5 From-Head-of-Train  
Second-Hotbox East-Rail Axle-8-0  
U-P Detector  
Milepost 3-2-1 point 4  
First-Hotbox West-Rail Axle-7-5 From-Head-of-Train  
Second-Hotbox East-Rail Axle-8-0  
Total Axles 1-0-0  
Train Speed 4-5-m-p-h  
Detector Out

At a single-track site having one Hotbox alarm and one Dragging-Equipment alarm, the announcement is like this.

U-P Detector  
Milepost 3-2-1 point 4  
First-Hotbox West-Rail Axle-7-5 From-Head-of-Train  
First-Dragging-Equipment Near-Axle-8-4  
U-P Detector  
Milepost 3-2-1 point 4  
First-Hotbox West-Rail Axle-7-5 From-Head-of-Train  
First-Dragging-Equipment Near-Axle-8-4  
Total Axles 1-0-0  
Train Speed 4-5-m-p-h  
Detector Out

When the number of detected alarms exceeds the **Maximum Alarms option** on the Alarm Limits submenu, a “Multiple ... Detected From Axle... To End of Train” message follows the alarm announcements.

At a single-track site having more Dragging-Equipment alarms than the maximum alarm setting and a detected Integrity Failure, the announcement is like this. For this example, the maximum number of alarms was set to two.

U-P Detector  
Milepost 3-2-1 point 4  
First-Dragging-Equipment Near-Axle-1-2 From-Head-of-Train  
Second-Dragging-Equipment Near-Axle-1-4  
Multiple-Dragging-Equipment Detected From-Axle-1-8 To-End-of-Train  
U-P Detector  
Milepost 3-2-1 point 4  
First-Dragging-Equipment Near-Axle-1-2 From-Head-of-Train  
Second-Dragging-Equipment Near-Axle-1-4  
Multiple-Dragging-Equipment Detected From-Axle-1-8 To-End-of-Train  
Total Axles 1-0-0  
Train Speed 4-5-m-p-h  
Detector Out

At a single-track site having a combined number of Hotbox, High-Load, and Wide-Load alarms greater than the maximum alarm setting, the announcement is like this. For this example, the maximum number of alarms was set to three.

U-P Detector  
Milepost 3-2-1 point 4  
First-High-Load Axle-1-2 From-Head-of-Train  
First-Wide-Load East-Rail-Near Axle-1-4  
First-Hotbox West-Rail Axle-2-5  
Multiple-Hotbox High-Load and Wide-Load Detected From-Axle-2-8 To-End-of-Train  
U-P Detector  
Milepost 3-2-1 point 4  
First-High-Load Axle-1-2 From-Head-of-Train  
First-Wide-Load East-Rail-Near Axle-1-4

First-Hotbox West-Rail Axle-2-5  
Multiple-Hotbox High-Load and Wide-Load Detected From-Axle-2-8 To-End-of-Train  
Total Axles 1-0-0  
Train Speed 4-5-m-p-h  
Detector Out

When Dragging Equipment, High Load, or Wide Load detector outputs are active as a train enters the site, “Detector Malfunction” messages appear in the post-train announcements, preceding any announcements for alarms associated with an axle. A separate message appears for each active alarm type. If both Wide-Load outputs are active as a train enters a site, only one “Wide-Load Detector Malfunction” message is announced.

For example at a single-track site with the Dragging-Equipment detector active as the train arrives, the announcement is like this.

U-P Detector  
Milepost 3-2-1 point 4  
Dragging Equipment Detector Malfunction  
U-P Detector  
Milepost 3-2-1 point 4  
Dragging Equipment Detector Malfunction  
Total Axles 1-0-0  
Train Speed 4-5-m-p-h  
Detector Out

At a single-track site with the High-Load and one or both Wide-Load detectors active as the train arrives, the announcement is like this.

U-P Detector  
Milepost 3-2-1 point 4  
High-Load Detector Malfunction  
Wide-Load Detector Malfunction  
U-P Detector  
Milepost 3-2-1 point 4  
High-Load Detector Malfunction  
Wide-Load Detector Malfunction  
Total Axles 1-0-0  
Train Speed 4-5-m-p-h  
Detector Out

At a single-track site having three Hotbox alarms, and with the Dragging-Equipment, High-Load, and one or both Wide-Load detectors active as the train arrives, the announcement is like this.

U-P Detector  
Milepost 3-2-1 point 4  
Dragging Equipment Detector Malfunction  
High-Load Detector Malfunction  
Wide-Load Detector Malfunction  
First-Hotbox East-Rail Axle-1-2



From-Head-of-Train  
Second-Hotbox West-Rail Axle-1-4  
Third-Hotbox East-Rail Axle-1-6  
U-P Detector  
Milepost 3-2-1 point 4  
Dragging Equipment Detector Malfunction  
High-Load Detector Malfunction  
Wide-Load Detector Malfunction  
First-Hotbox East-Rail Axle-1-2  
From-Head-of-Train  
Second-Hotbox West-Rail Axle-1-4  
Third-Hotbox East-Rail Axle-1-6  
Total Axles 1-0-0  
Train Speed 4-5-m-p-h  
Detector Out

When a catastrophic transducer failure occurs in conjunction with an auxiliary alarm, alarm announcements omit the alarm sequence numbers (that is, “first,” “second,” ... “ninth”), the axle numbers, and the phrase “From Head Of Train.” If announcing a “Multiple ... Detected From Axle... To End of Train” message, “From Axle... To End of Train” does not announce.

For example, at a single-track site with a malfunctioning TO1 transducer, an active Dragging Equipment output within the first three recorded axles, and a Hotbox alarm, the announcement is like this.

U-P Detector  
Milepost 3-2-1 point 4  
Dragging Equipment Detected  
Hotbox Detected East-Rail  
U-P Detector  
Milepost 3-2-1 point 4  
Dragging Equipment Detected  
Hotbox Detected East-Rail  
Total Axles 1-0-0  
Train Speed 4-5-m-p-h  
Detector Out

At a single-track site with a malfunctioning TO2 transducer, an active High-Load output within the first three recorded axles, a Wide-Load alarm, and a Hotwheel alarm, the announcement is like this.

U-P Detector  
Milepost 3-2-1 point 4  
High-Load Detected  
Hot Wheel Detected West-Rail  
Wide-Load Detected East-Rail  
U-P Detector  
Milepost 3-2-1 point 4  
High-Load Detected  
Hot Wheel Detected West-Rail

Wide-Load Detected East-Rail  
Total Axles 1-0-0  
Train Speed 4-5-m-p-h  
Detector Out

At a single-track site with a malfunctioning TO2 transducer, an active High-Load output within the first three recorded axles, a Wide-Load alarm, and a Hotwheel alarm, the announcement is like this. For this example, the maximum number of alarms was set to two.

U-P Detector  
Milepost 3-2-1 point 4  
High-Load Detected  
Multiple-High-Load Wide-Load and Hot Wheel Detected  
U-P Detector  
Milepost 3-2-1 point 4  
High-Load Detected  
Multiple-High-Load Wide-Load and Hot Wheel Detected  
Total Axles 1-0-0  
Train Speed 4-5-m-p-h  
Detector Out

If the system's milepost setting is "0000.0," the firmware eliminates both the word "milepost" and the milepost number from the message. The rest of the message announces as shown above.

The **Announce High-Wide option** on the Messages submenu lets you pick how you want a clearance alarm to be announced. Select YES when a single tripwire is used for both high-load and wide-load detection. Select NO when each high-load and wide-load detector has its own tripwire.

In the next example, each high-load and wide-load detector is wired individually to its input. The **Announce High-Wide option** was set to NO. And, one High-Load alarm is the only Exception Alarm that was encountered at this single-track site.

U-P Detector  
Milepost 3-2-1 point 4  
First-High-Load Axle-7-5 From-Head-of-Train  
U-P Detector  
Milepost 3-2-1 point 4  
First-High-Load Axle-7-5 From-Head-of-Train  
Total Axles 1-0-0  
Train Speed 4-5-m-p-h  
Detector Out

In the next example, a single tripwire is used for both high load and wide load detection. The **Announce High-Wide option** was set to YES. And, one High-Load alarm is the only Exception Alarm that was encountered at this single-track site.

U-P Detector  
Milepost 3-2-1 point 4  
First-High-Wide Near Axle-7-5 From-Head-of-Train  
U-P Detector Milepost 3-2-1 point 4  
First-High-Wide Near Axle-7-5 From-Head-of-Train  
Total Axles 1-0-0  
Train Speed 4-5-m-p-h  
Detector Out

## 13.4 Rebroadcasting Post-Train Messages

The **Rebroadcast Time Limit option** on the Messages submenu defines the amount of time that, following a train passing over the site, its post-train (that is, end-of-train) announcements are available for rebroadcast. To request a rebroadcast of the last train a 2300-356 DTMF Decoder board must be installed and working properly.

Following train passage, recorded post-train announcements are available for rebroadcast until the time period defined by the **Rebroadcast Time Limit option** expires. Recorded messages are available indefinitely if this value is zero.

When rebroadcasting a recorded post-train announcement, the format used is:

Rebroadcast  
(train messages) [ancillary messages]  
Rebroadcast  
Detector Out

For example, if the **No Defects option** on the Messages submenu is set to 2 and neither an Exception Alarm nor an Integrity Failure is detected on the last train, the format of the rebroadcast message is:

Rebroadcast  
U-P Detector Milepost (mile) [track indicator] No Defects  
(3-second pause)  
U-P Detector Milepost (mile) [track indicator] No Defects [ancillary messages]  
Rebroadcast  
Detector Out

When no Exception Alarms are detected but an Integrity Failure is detected on the last train, the format of the rebroadcast message is:

Rebroadcast

U-P Detector Milepost (mile) [track indicator] Integrity Failure

U-P Detector Milepost (mile) [track indicator] Integrity Failure [ancillary messages]

Rebroadcast

Detector Out

When one or more Exception Alarms are detected on the last train, the format of the rebroadcast message is:

Rebroadcast

U-P Detector Milepost (mile) [track indicator] [alarm announcements]

U-P Detector Milepost (mile) [track indicator] [alarm announcements] [ancillary messages]

Rebroadcast

Detector Out

When no recorded post-train announcement exists, the system announces a default message. The format of this message is:

Rebroadcast

U-P Detector Milepost (mile) [track indicator]

No Rebroadcast

Detector Out

Only a train's post-train announcements are recorded. Arrival messages and real-time messages are ignored. Any changes the customer makes to the ancillary announcement options or any dynamic change of the Talker Mode has no effect on the rebroadcast message. It plays whatever the last passing train heard, regardless of the current system settings.

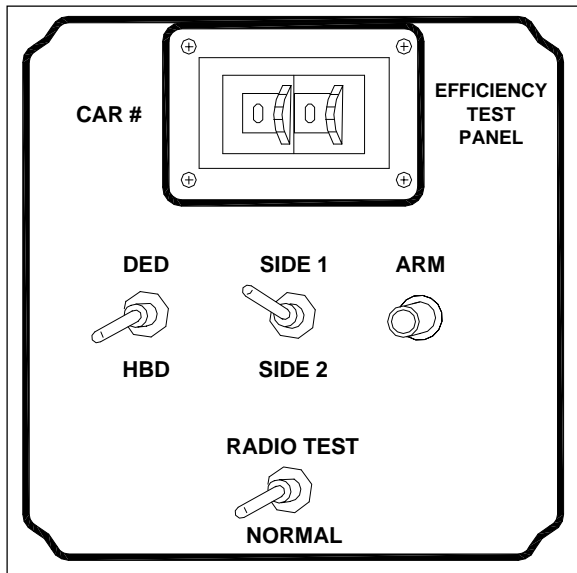
## Chapter 14

# Using the Efficiency Test Panel

---

This chapter tells how to arm and disarm the Efficiency Test panel.

The figure below shows the part of the Efficiency Test panel that is used for arming and disarming the panel.



### 14.1 Arming the Efficiency Test Panel

To arm the Efficiency Test panel:

- 1 Using the thumbwheels, select the number of the car on which the alarm is to be generated.

Pick a number from 01 through 99. When that car is sensed, an alarm (on the first axle of that car) is generated. If that car isn't reached, no alarm is generated and the panel is disarmed at train exit.

- 2 Using the two-position detector-selection switch, select the type of alarm you want to be generated.

If you want an absolute Hotbox alarm, toggle HBD. If you want a Dragging-Equipment alarm, toggle DED. If DED is selected, the appropriate alarm is generated only when the **Dragger option** on the Equipment submenu is enabled.

- 3 Using the three-position side-selection switch, select the side of the car on which the alarm is to be generated.

Either side can be picked for either alarm. If you want side one (that is, the north or east rail), move the switch up. If you want side two (that is, the south or west rail), move the switch down.

After the switch is pressed, the panel is armed and the LED labeled **ARM** lights. The panel stays armed until the next train exits or until you manually disarm the panel.

## 14.2 Disarming the Efficiency Test Panel

As long as the LED labeled **ARM** (on the Efficiency Test panel) is lit, the Efficiency Test panel is armed. While armed, changing the wheels or switches doesn't change the settings. The only way to change the settings is to disarm the panel first. For example, if you armed the panel with car number set to 23, the only way to change it to 27 is to disarm the panel first. Or, if you armed the panel with type of alarm set to DED, the only way to change it to HBD is to disarm the panel first.

To disarm the Efficiency Test panel:

- 1 Using the thumbwheels, select 00.
- 2 Using the three-way side-selection switch, select either side.

The LED labeled **ARM** ceases to be lit.

# Chapter 15

## Replacing Chips

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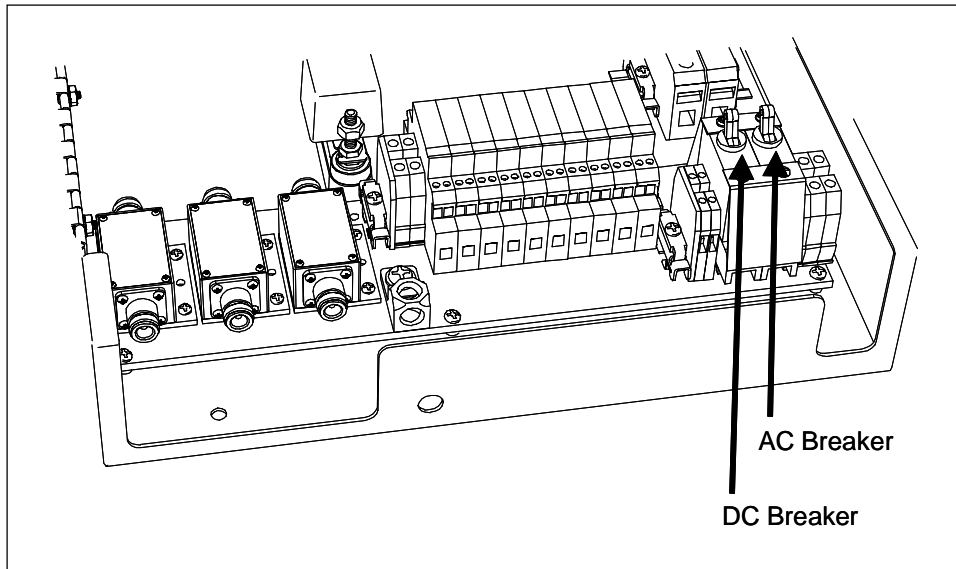
This chapter tells how to replace the firmware chip and the speech data chips on the 2058-305 Talker board.

### 15.1 Replacing Firmware Chip on Talker Board

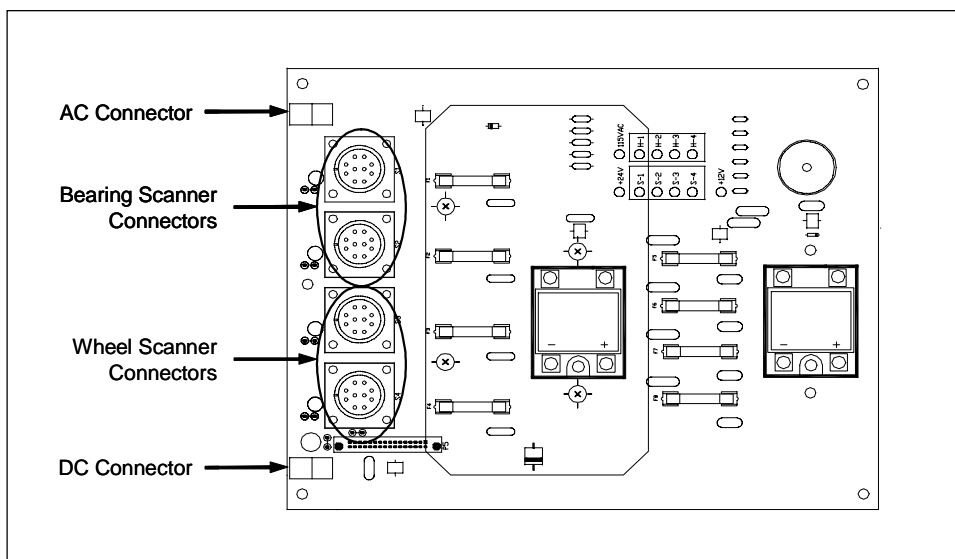
On the Talker board, the firmware is in a 27C256 or equivalent EPROM.

To replace the firmware chip (in socket **U3**) on the Talker board:

- 1 Be sure you have on hand a chip removal tool (or small slotted screwdriver) and a #2 Phillips head screwdriver.
- 2 Open the door on the SmartScanIS enclosure.  
Doing the next step powers down the system.
- 3 On the Surge Protection Subassembly, toggle off both breakers.

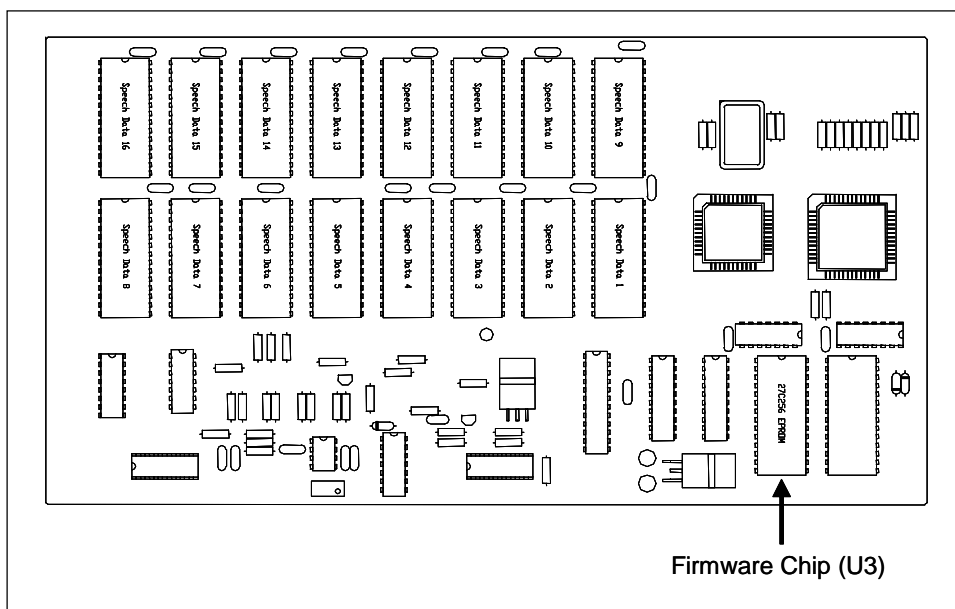


- 4 Note the location of all cables before unplugging them from the Scanner Interface board.



- 5 Disconnect all cables from the Scanner Interface board.
- 6 Using a #2 Phillips head screwdriver, remove the six screws that hold the Scanner Interface board to the System Interface board.
- 7 Store the screws in a safe place until you replace them.
- 8 Gently remove the Scanner Interface board from the System Interface board.

The Talker board is the board with the components in view.



- 9 Store the Scanner Interface board in a safe place until you replace it.



- 10 Using a chip removal tool or small slotted screwdriver, lift the EPROM from U3 by prying gently, one end at a time, until the pins are free of the socket.
- 11 To insert the new EPROM in U3:
  - a Orient the notch on the chip to the notch on the socket.  
**Putting the chip in backward or bending one or more of the pins may damage the SmartScanIS.**
  - b Line up the pins with the socket contacts.
  - c With a firm rocking motion, press the EPROM into the socket.
- 12 Gently replace the Scanner Interface board onto the System Interface board.
- 13 Using a #2 Phillips head screwdriver, replace the six screws that hold the Scanner Interface board to the System Interface board.
- 14 Check the orientation of all cables before plugging them into the Scanner Interface board.
- 15 Reconnect all cables to the Scanner Interface board.  
Doing the next step powers up the system.
- 16 On the Surge Protection Subassembly, toggle on both breakers.
- 17 Close the door on the SmartScanIS enclosure.

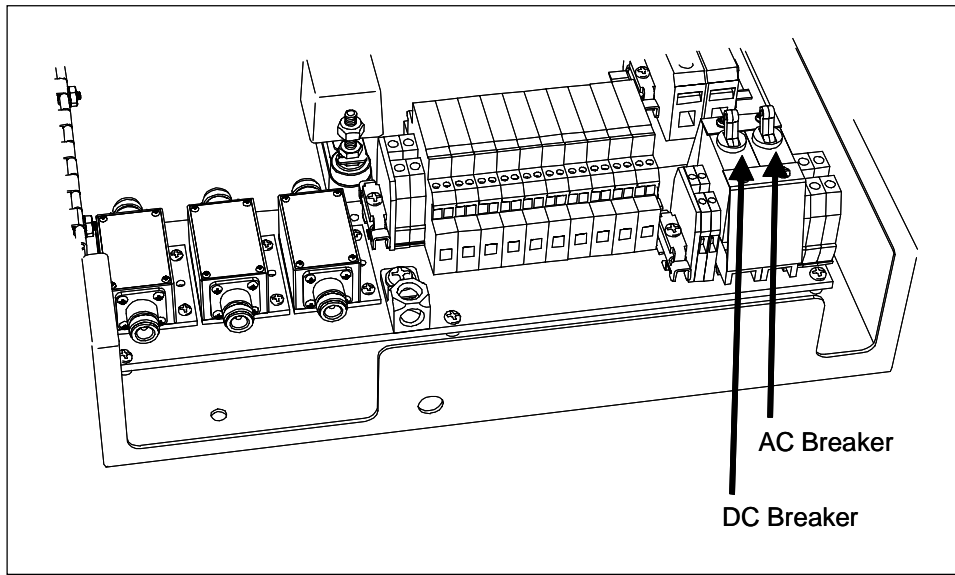
## 15.2 Replacing Speech Data Chips on Talker Board

On the Talker board, the 16 sockets, labeled **U14** through **U29**, are for 27C256, 27C512, or equivalent EPROMs. These chips contain the digitized words and phrases required for voice announcements.

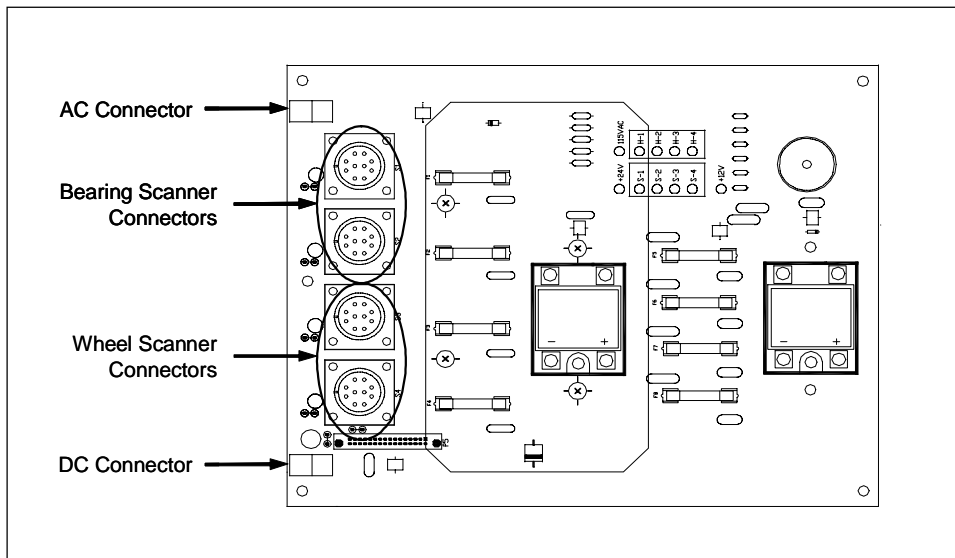
To replace one or more of the speech data chips (in the sockets labeled **U14** through **U29**) on the Talker board:

- 1 Be sure you have on hand a chip removal tool (or small slotted screwdriver) and a #2 Phillips head screwdriver.
- 2 Open the door on the SmartScanIS enclosure.  
Doing the next step powers down the system.

- 3 On the Surge Protection Subassembly, toggle off both breakers.

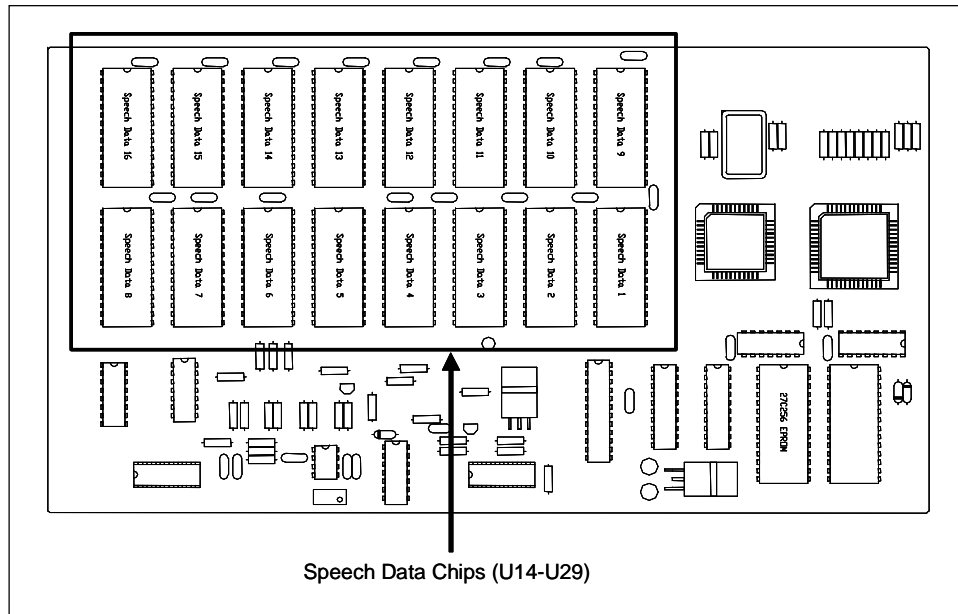


- 4 Note the location of all cables before unplugging them from the Scanner Interface board.



- 5 Disconnect all cables from the Scanner Interface board.
- 6 Using a #2 Phillips head screwdriver, remove the six screws that hold the Scanner Interface board to the System Interface board.
- 7 Store the screws in a safe place until you replace them.

- 8 Gently remove the Scanner Interface board from the System Interface board.  
The Talker board is the board with the components in view.



- 9 Store the Scanner Interface board in a safe place until you replace it.  
**If you're replacing all the speech data chips, start with the chip in U14, replacing one chip at a time, until you replace the chip in U29.** (On top of the chip that goes into U14 is the wording "SPEECH #01," on top of the chip that goes into U15 is the wording "SPEECH #02," and so on.)
- 10 Using a chip removal tool or small slotted screwdriver, lift the EPROM from its socket by prying gently, one end at a time, until the pins are free of the socket.
- 11 To insert the new EPROM in its socket:
  - a Orient the notch on the chip to the notch on the socket.  
**Putting the chip in backward or bending one or more of the pins may damage the SmartScanIS.**
  - b Line up the pins with the socket contacts.
  - c With a firm rocking motion, press the EPROM into the socket.
- 12 Repeat steps 10 and 11 until all the speech data chips that are to be replaced are replaced.
- 13 Gently replace the Scanner Interface board onto the System Interface board.
- 14 Using a #2 Phillips head screwdriver, replace the six screws that hold the Scanner Interface board to the System Interface board.

- 15** Check the orientation of all cables before plugging them into the Scanner Interface board.
- 16** Reconnect all cables to the Scanner Interface board.  
Doing the next step powers up the system.
- 17** On the Surge Protection Subassembly, toggle on both breakers.
- 18** Close the door on the SmartScanIS enclosure.

## Chapter 16

# Customer Service

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At STC, the customer is number one. STC is committed to products that work and customers that are satisfied. Nothing less is acceptable. This chapter tells how to get answers for questions, fixes for problems, and parts for spares.

### 16.1 Reaching STC

You can reach STC by mail, telephone, fax, and email. By mail, you can reach STC at:

Southern Technologies Corporation  
6145 Preservation Drive  
Chattanooga, Tennessee 37416-3638  
USA

Mail and shipments are replied to as soon as possible, normally within one working day. Equipment repair may take longer.

By telephone, except on major holidays, you can reach STC at 423-892-3029, Monday through Friday, from 8:00 a.m. until 5:00 p.m. Eastern time. After business hours, a machine answers the calls. These calls are returned promptly the next business day. By fax, you can reach STC at 423-499-0045. The fax machine can receive faxes at all times. Faxes are replied to as soon as possible, normally within one working day. By email, you can reach STC at [stcemail@southern-tech.com](mailto:stcemail@southern-tech.com). Email is replied to as soon as possible, normally within one working day.

### 16.2 Returning Equipment for Repair

Return any damaged, defective, or malfunctioning equipment to STC for repair or replacement. You don't need a return authorization number. You don't even need to make a telephone call first. Just ship it directly to the **Repair Department** at the address above.

With the returned equipment, include:

- Complete address where the equipment is to be returned.
- Name and telephone number of the person who should be contacted to answer questions about the equipment.
- A written explanation of the equipment defect or malfunction.
- Any reports or other data that would help in diagnosing the problem.
- If out of warranty, credit card number (to be charged) with its expiration date.

## 16.3 Reporting Problems or Suggestions

If you have any problems, suggestions, or questions related to STC equipment, phone the **Engineering Department** at the telephone number above. When calling, state the equipment about which you are calling. Your call will then be directed to the right person.

## 16.4 Ordering Spare Parts

If you need any spare parts to support STC equipment, phone or fax the **Sales Department** at the telephone numbers above.

When calling, state that you are calling to order parts. Your call will then be directed to the right person. When placing the order, reference the STC part numbers listed in this guide. However, if you don't have the part numbers, the sales staff can get them for you and provide you with current pricing and availability.

When faxing, include:

- Purchase Order Number for the order or credit card number (to be charged) with its expiration date.
- Complete address where the parts are to be shipped.
- Complete address where the invoice is to be mailed.
- Name and telephone number of the person who should be contacted to answer questions about the order.
- Your fax number, if available.
- For each item ordered, part number, complete description, and quantity needed.

## 16.5 Checking on Shipments and Orders

If you need to check on the status of any shipment or order, phone or fax the **Sales Department** at the telephone numbers above.

When calling, state that you are checking the status of a shipment or order. Your call will then be directed to the right person. Have your Purchase Order Number ready when you call. However, if you don't have the order number, the sales staff can get it for you and provide you with the status of the shipment or order.

When faxing, include:

- Purchase Order Number for the shipment or order being checked.
- Name and telephone number of the person who should be contacted after the order status is checked.
- Your fax number, if available.

# Appendix A

## System Alarms

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This appendix describes the conditions and events that the SmartScanIS flags as System Alarms. These alarms provide data about passing trains and system status. These alarms are listed in the System Alarms section of the Train Detail and Exception Detail reports.

**Chapter 12 - Producing Reports** tells how to produce these reports.

Regardless of the train's condition, the System Alarms header appears on the report, followed by at least one text message, which can be either:

- "System Integrity Check Passed!" only
- One or more System Alarm descriptions followed by "System Integrity Check Passed!"
- "Integrity Failure" followed by one or more Integrity Failure descriptions
- One or more System Alarm descriptions, followed by "Integrity Failure," followed by one or more Integrity Failure descriptions

### A.1 AC Power Is Off! Alarm

The AC Power Is Off! alarm indicates that AC power wasn't on when it was checked during the end-of-train processing. This alarm doesn't say anything about any lack of power during train passage.

### A.2 Advance Turn-On Failure Alarm

All tracks use two gating transducers. Some tracks also use two advance transducers or a track circuit. If the advance transducers or the track circuit fail to activate the system, the first hit on a gating transducer automatically activates it.

The Advance Turn-On Failure alarm indicates that this has happened and that the arrival speed of the train was at least 10 mph (16 kph).

### A.3 Basetime Error Reader 1 Alarm

The Basetime Error Reader 1 alarm indicates that a timestamp message was received from the 2200-750 Reader, but that the message was corrupt. This could mean that communications between the Processor board and the reader were temporarily out of synch. If the problem is flagged on many trains, it most likely indicates that the serial communications channel between the reader and the Processor board is breaking down.

## A.4 Basetime Error Reader 2 Alarm

There isn't a Basetime Error Reader 2 alarm when a 2200-750 Reader is attached to the system. This alarm only appeared under an earlier version of the system, one that used a 2200-504TB Reader.

## A.5 Blind Pyro Alarm

The Blind Pyro alarm indicates that an object may have blocked a scanner for at least 30 axles during train passage. If 30 or more consecutive axles have a bearing temperature of less than 3°F (1.6°C) on one side and greater than 19°F (10°C) on the opposite side, the scanner on the 3°F side is declared as having a "blind" pyrometer.

There is a different Blind Pyro alarm for each rail. That is, there is a Blind North Pyro alarm and a Blind South Pyro alarm (or, depending on track direction, a Blind East Pyro alarm and a Blind West Pyro alarm).

## A.6 Cold Rail Alarm

The Cold Rail alarm indicates that the temperatures of all bearings (of the train) on the designated rail were at or below a given temperature. When no bearing on a given rail generates a delta temperature reading greater than the temperature set by the **Cold Journal option** on the Alarm Limits submenu, the system generates a Cold Rail alarm for the given rail. **Chapter 11 - Serial Interface** tells how to view or change the **Cold Journal option**.

```
Milepost-0081.2, Track:Single
Alarm Limits
```

```

A) Absolute..... 180°
B) Differential..... 90°
C) Hot Wheel..... 540°
D) Cold Wheel..... 30°
E) CS Slope..... 0.32
F) CS Minimum..... 37°
G) Cold Journal..... 10°
H) Cold Wheel Scanner..... 30°
I) Cold Trains..... 3
J) Sliding Wheel Ratio..... 50%
K) Max Alarms..... 6
```

```
Alarm to change or Esc to quit?
```

There is a different Cold Rail alarm for each rail. That is, there is a Cold North Rail alarm and a Cold South Rail alarm (or, depending on track direction, a Cold East Rail alarm, and a Cold West Rail alarm).



The **maximum number** (per rai1side) of consecutive trains, having Cold Rail alarms, allowed before generating a Successive Cold Rails Exceeded alarm is set by the **Cold Trains option** on the Alarm Limits submenu. If the number of consecutive trains bearing identical Cold Rail alarms equals or exceeds the cold-trains-alarm limit, the System Alarms section of the Train Detail and Exception Detail reports displays the message "Successive Cold Rails Exceeded." Successive Cold Rails Exceeded alarms are covered in the next appendix. **Chapter 11 - Serial Interface** tells how to view or change the **Cold Trains option**.

### A.7 Cold Resistor Alarm

A resistor is mounted to the inside of the bearing scanner's shutter. A voltage is applied to this resistor while the shutter is open, causing it to heat up. After a train has left the site and the shutters have closed, the temperature of the resistor is read by the scanner pyrometer. In this way, a check is made of the system's ability to read heat correctly. The Cold Resistor alarm indicates that the **minimum value** expected for the temperature of the resistor wasn't met. This minimum value is determined by the firmware and is dependent upon the time it takes a train to pass a site.

If the **minimum value** was not met, a second check compares the recorded resistor temperature against the limit that was established using the **Absolute option** on the Alarm Limits submenu. (This alarm limit is an offset, in degrees Fahrenheit, above the ambient temperature.) If the recorded resistor temperature meets or exceeds the absolute-alarm limit, the firmware cancels any previously flagged Cold Resistor alarms. **Chapter 11 - Serial Interface** tells how to view or change the **Absolute option**.

|                               |      |
|-------------------------------|------|
| Milepost-0081.2, Track:Single |      |
| Alarm Limits                  |      |
| -----                         |      |
| A) Absolute.....              | 180° |
| B) Differential.....          | 90°  |
| C) Hot Wheel.....             | 540° |
| .                             |      |
| .                             |      |
| .                             |      |

There is a different Cold Resistor alarm for each rail. That is, there is a Cold North Resistor alarm and a Cold South Resistor alarm (or, depending on track direction, a Cold East Resistor alarm and a Cold West Resistor alarm).

The **maximum number** (per rai1side) of consecutive trains, having Cold Resistor alarms, allowed before generating a Successive Cold Resistors Exceeded alarm is set by the **Cold Trains option** on the Alarm Limits submenu. Successive Cold Resistors Exceeded alarms are covered in the next appendix. **Chapter 11 - Serial Interface** tells how to view or change the **Cold Trains option**.

### A.8 Cold Wheel Scanner Alarm

The Cold Wheel Scanner alarm represents the wheel scanner's equivalent of the bearing scanner's Cold Rail alarm. When no wheel on a given rail generates a delta temperature reading greater than the temperature set by the **Cold Wheel Scanner option** on the Alarm Limits submenu, the system generates a Cold Wheel Scanner alarm. Just like Cold Rail alarms, separate Cold Wheel Scanner alarms exist for each rai1side. **Chapter 11 - Serial Interface** tells how to view or change the **Cold Wheel Scanner option**.

|                                 |      |
|---------------------------------|------|
| Milepost-0081.2, Track:Single   |      |
| Alarm Limits                    |      |
| -----                           |      |
| A) Absolute.....                | 180° |
| B) Differential.....            | 90°  |
| C) Hot Wheel.....               | 540° |
| D) Cold Wheel.....              | 30°  |
| E) CS Slope.....                | 0.32 |
| F) CS Minimum.....              | 37°  |
| G) Cold Journal.....            | 10°  |
| H) Cold Wheel Scanner.....      | 30°  |
| I) Cold Trains.....             | 3    |
| J) Sliding Wheel Ratio.....     | 50%  |
| K) Max Alarms.....              | 6    |
| Alarm to change or Esc to quit? |      |

The **maximum number** (per rai1side) of consecutive trains, having Cold Wheel Scanner alarms, allowed before generating a Successive Cold Wheels Exceeded alarm is set by the **Cold Trains option** on the Alarm Limits submenu. Successive Cold Wheels Exceeded alarms are covered in the next appendix. **Chapter 11 - Serial Interface** tells how to view or change the **Cold Trains option**.

# A.9 Cold Wheel Scanner Resistor Alarm

The Cold Wheel Scanner Resistor alarm represents the wheel scanner's equivalent of the bearing scanner's Cold Resistor alarm. Evaluation of Cold Wheel Scanner Resistor alarm occurs in two stages. The first stage mimics the same logic used in the evaluation of Cold Resistor alarms. After finishing this check, and possibly flagging a Cold Wheel Scanner Resistor alarm, the firmware compares the recorded resistor temperature against a value of one-third the hot wheel alarm limit. If the recorded resistor temperature meets or exceeds this value, the firmware cancels any previously flagged Cold Wheel Scanner Resistor alarm. In this way, the system confirms the scanner's ability to read alarm level heat. Just like Cold Resistor alarms, separate Cold Wheel Scanner Resistor alarms exist for each railside.

The **maximum number** (per railside) of consecutive trains, having Cold Wheel Scanner Resistor alarms, allowed before generating a Successive Cold Wheel Resistors Exceeded alarm is set by the **Cold Trains option** on the Alarm Limits submenu. Successive Cold Wheel Resistors Exceeded alarms are covered in the next appendix.

```
Milepost-0081.2, Track:Single
Alarm Limits

 .
 .
 .
H) Cold Wheel Scanner..... 30°
I) Cold Trains..... 3
J) Sliding Wheel Ratio..... 50%
 .
 .
 .
```

# A.10 Dead Wheel Scanner Resistor Alarm

The Dead Wheel Scanner Resistor alarm indicates the presence of two separate conditions. First, the train must contain a Cold Wheel Scanner alarm on a given rail. Second, the recorded temperature for the resistor on that rail must fall below the value set by the **Cold Journal option** on the Alarm Limits submenu. **Chapter 11 - Serial Interface** tells how to view or change the **Cold Journal option**.

There is a different Dead Wheel Scanner Resistor alarm for each rail. That is, there is a Dead North Wheel Scanner Resistor alarm and a Dead South Wheel Scanner Resistor alarm (or, depending on track direction, a Dead East Wheel Scanner Resistor alarm and a Dead West Wheel Scanner Resistor alarm).

## A.11 Efficiency Test Panel in Use Alarm

The Efficiency Test Panel in Use alarm indicates that someone used the Efficiency Test panel to generate a train alarm.

## A.12 Equal Heats Test Failed Alarm

The Equal Heats Test Failed alarm indicates lower than expected heat readings from one railside. The firmware uses the average temperatures for rail1 and rail2 and calculates a percentage difference between them, flagging an alarm if this difference exceeds a predetermined alarm limit. The percentage difference between the two average rail temperatures is calculated using the formula  $(b-a)/a*100$ , where the variable 'a' represents the lower average rail temperature, and the variable 'b' represents the higher average rail temperature. As an example, for recorded average rail temperatures of 40 and 60 degrees, the calculated percentage difference would be 50% ( $60-40=20$ ,  $20/40*100=50$ ). The alarm limit is 100%, is hardcoded into the firmware, and isn't user-configurable.

The **maximum number** of consecutive trains, having Equal Heats Test Failed alarms, allowed before generating a Max Equal Heat Test Failures Exceeded alarm is set by the **Cold Trains option** on the Alarm Limits submenu. Max Equal Heat Test Failures Exceeded alarms are covered in the next appendix.

## A.13 Integrity Failure Alarm

The Integrity Failure alarm indicates that the firmware determined that a condition exists that could prevent proper scanning of a train. In other words, this alarm indicates the existence of one or more conditions in which the integrity of the system, and its ability to record train data accurately, may be compromised. These unusual conditions, called Integrity Failures, may require train stoppage, site maintenance, or both. They are covered in the next appendix.

## A.14 Low Battery Alarm

The **Low Battery alarm** indicates a float voltage of at least 18 volts, but less than 22 volts, on the standby batteries. (The **Dead Battery alarm** indicates a float voltage of less than 18 volts on the standby batteries.)

## A.15 No Basetime Reader 1 Alarm

The No Basetime Reader 1 alarm indicates that the timestamp message expected from the 2200-750 Reader wasn't received upon train arrival. This means that either the reader isn't functioning properly or the serial communications channel between the reader and the Processor board has broken down.

## **A.16 No Basetime Reader 2 Alarm**

There isn't a No Basetime Reader 2 alarm when a 2200-750 Reader is attached to the system. This alarm only appeared under an earlier version of the system, one that used a 2200-504TB Reader.

## **A.17 Reverse Direction Detected Alarm**

Trains that are being scanned correctly will have axles whose on times (that is, the time during which an axle passed between the gating transducers) are less than their off times (that is, the time during which no axle passed between the gating transducers). For each axle of a passing train (except for the first axle), the system checks for an on-time that is greater than the off-time. If the axle's on time is greater than its off time, the system reverses the opening and closing gate assignment for TO1 and TO2. If this occurs on the second or third axle of the train, the system reverses the direction locked in by the first gating pulse.

The Reverse Direction Detected alarm indicates that the system entered a state where it is scanning for bearing temperatures when the axles are outside the scanning gate. In this state, the transducer that should be opening the scanning gate is considered by the system to be the transducer that is closing the gate. Likewise, the transducer that should be closing the scanning gate is considered the transducer that is opening the gate.

## **A.18 Short Train Alarm**

The Short Train alarm indicates that a train had fewer than 50 axles.

## **A.19 Sliding Wheel Alarm**

The Sliding Wheel alarm indicates that a combination of very low bearing and wheel temperatures were found on a given axle in conjunction with high wheel temperatures recorded on the remaining axles of a car. This condition could mean that the wheels on the affected axle were sliding, rather than rolling, on the rail.

The Sliding Wheel alarm is both an Exception Alarm and a System Alarm.

# A.20 Stuck Dragger Alarm

The Stuck Dragger alarm indicates that the **maximum number** of consecutive axles had Dragging-Equipment alarms during train passage. You can view or change this value using the **Max Alarms option** on the Alarm Limits submenu.

Milepost-0081.2, Track:Single

Alarm Limits

-----

•

•

•

I) Cold Trains.....

3

J) Sliding Wheel Ratio.....

50%

K) Max Alarms.....

6

Alarm to change or Esc to quit?

# A.21 Successive Cold Wheels Exceeded Alarm

The Successive Cold Wheels Exceeded alarm indicates that at least a preset **maximum number** of consecutive trains, all having Cold Wheel Scanner alarms on the same railside, have passed a site. The **maximum number** (per railside) of consecutive trains, having Cold Wheel Scanner alarms, allowed before generating this alarm is set by the **Cold Trains option** on the Alarm Limits submenu.

# A.22 Successive Cold Wheel Resistors Exceeded Alarm

The Successive Cold Wheel Resistors Exceeded alarm indicates that at least a preset **maximum number** of consecutive trains, all having Cold Wheel Scanner Resistor alarms on the same railside, have passed a site. The **maximum number** (per railside) of consecutive trains, having Cold Wheel Scanner Resistor alarms, allowed before generating this alarm is set by the **Cold Trains option** on the Alarm Limits submenu.

# A.23 Test Train Alarm

The Test Train alarm indicates that a given train was generated by the firmware. These trains are used for testing purposes and don't represent actual trains passing the site.

## Appendix B

# Integrity Failures

---

This appendix describes the conditions and events that the SmartScanIS flags as Integrity Failures. These alarms indicate conditions in which the integrity of the system, and its ability to record train data accurately, may be compromised. These alarms are listed in the System Alarms section of the Train Detail and Exception Detail reports. **Chapter 12 - Producing Reports** tells how to produce these reports.

### B.1 Dead Battery Alarm

The **Dead Battery alarm** indicates a float voltage of less than 18 volts on the standby batteries. (The Low Battery **alarm** indicates a float voltage of at least 18 volts, but less than 22 volts, on the standby batteries.)

### B.2 Dead Resistor Alarm

The bearing scanner's Dead Resistor alarm indicates the presence of two separate conditions. First, the train must contain a Cold Rail alarm on a given rail. Second, the recorded temperature for the resistor on that rail must fall below the value set by the **Cold Journal option** on the Alarm Limits submenu. **Chapter 11 - Serial Interface** tells how to view or change the **Cold Journal option**.

```
Milepost-0081.2, Track:Single
Alarm Limits
```

```

 •
 •
 •

F) CS Minimum..... 37°
G) Cold Journal..... 10°
H) Cold Wheel Scanner..... 30°

 •
 •
 •
```

There is a different Dead Resistor alarm for each rail. That is, there is a Dead North Resistor alarm and a Dead South Resistor alarm (or, depending on track direction, a Dead East Resistor alarm and a Dead West Resistor alarm).

### B.3 Max Equal Heat Test Failures Exceeded Alarm

The Max Equal Heat Test Failures Exceeded alarm indicates that at least a preset **maximum number** of consecutive trains, all having Equal Heats Test Failed alarms, have passed a site. The **maximum number** of consecutive trains, having Equal Heats Test Failed alarms, allowed before generating an Integrity Failure alarm is set by the **Cold Trains option** on the Alarm Limits submenu.

```
Milepost-0081.2, Track:Single
Alarm Limits

 •
 •
 •
H) Cold Wheel Scanner..... 30°
I) Cold Trains..... 3
J) Sliding Wheel Ratio..... 50%
 •
 •
 •
```

### B.4 Maximum Exception Alarms Exceeded Alarm

Exception Alarms are associated with axles. There are 10 of them. They are the Absolute, Carside Slope, Differential, Dragging-Equipment, High-Load, Hotwheel, Pyrometer Saturation, Wide-Load, Cold Wheel, and Sliding Wheel alarms.

The Maximum Exception Alarms Exceeded alarm is generated when the maximum number of Exception Alarms is exceeded on a single train. This maximum number is defined by the **Max Alarms option** on the Alarm Limits submenu.

```
Milepost-0081.2, Track:Single
Alarm Limits

 •
 •
 •
I) Cold Trains..... 3
J) Sliding Wheel Ratio..... 50%
K) Max Alarms..... 6
Alarm to change or Esc to quit?
```



## **B.5 Maximum Transducer Spikes Exceeded Alarm**

The Maximum Transducer Spikes Exceeded alarm is generated when more than five transducer spikes are recorded for a given railside.

## **B.6 Pretrain Stuck Dragger Alarm**

The Pretrain Stuck Dragger alarm indicates that the dragging-equipment detector was active before the scanners started scanning. That is, between the time of first receiving a signal from the track circuit (or the advance transducers) and the time of first receiving a signal from either gating transducer, the SmartScanIS detected an open circuit from the dragging-equipment detector.

## **B.7 Pretrain Stuck HiLoad Alarm**

The Pretrain Stuck HiLoad alarm indicates that the high-load detector was active before the scanners started scanning. That is, between the time of first receiving a signal from the track circuit (or the advance transducers) and the time of first receiving a signal from either gating transducer, the SmartScanIS detected an open circuit from the high-load detector.

## **B.8 Pretrain Stuck WideLoad Alarm**

The Pretrain Stuck WideLoad alarm indicates that the wide-load detector was active before the scanners started scanning. That is, between the time of first receiving a signal from the track circuit (or the advance transducers) and the time of first receiving a signal from either gating transducer, the SmartScanIS detected an open circuit from the wide-load detector.

There is a different Pretrain Stuck WideLoad alarm for each rail. That is, there is a Pretrain Stuck WideLoad North Side alarm and a Pretrain Stuck WideLoad South Side alarm (or, depending on track direction, a Pretrain Stuck WideLoad East Side alarm and a Pretrain Stuck WideLoad West Side alarm).

## **B.9 Slow Train Alarm**

The Slow Train alarm is generated when a train has an exit speed of 6 mph (9.7 kph). When this happens, the firmware will generate an "Integrity Failure" announcement and will display "Integrity Failure" and "Slow Train" in the System Alarms section of Train Detail and Exception Detail reports. If a Dragging-Equipment alarm is detected on a slow train, no "Integrity Failure" announcement will be made, and no "Slow Train" message will appear in the System Alarms section. However, messages generated by any additional Integrity Failures found on such a train will still appear in the System Alarms section.

## B.10 Successive Cold Rails Exceeded Alarm

The Successive Cold Rails Exceeded alarm indicates that at least a preset maximum number of consecutive trains, all having Cold Rail alarms on the same railside, have passed a site. The maximum number (per railside) of consecutive trains, having Cold Rail alarms, allowed before generating an Integrity Failure alarm is set by the **Cold Trains option** on the Alarm Limits submenu.

Under normal circumstances, Cold Rail conditions represent System Alarms, not Integrity Failures. However, if the number of consecutive trains bearing the same Cold Rail alarm equals or exceeds the preset maximum, this condition becomes an Integrity Failure. When this happens, the System Alarms section of the Train Detail and Exception Detail reports displays the message "Successive Cold Rails Exceeded."

## B.11 Successive Cold Resistors Exceeded Alarm

The Successive Cold Resistors Exceeded alarm indicates that at least a preset maximum number of consecutive trains, all having Cold Resistor alarms on the same railside, have passed a site. The maximum number (per railside) of consecutive trains, having Cold Resistor alarms, allowed before generating an Integrity Failure alarm is set by the **Cold Trains option** on the Alarm Limits submenu.

Under normal circumstances, Cold Resistor conditions represent System Alarms, not Integrity Failures. However, if the number of consecutive trains bearing the same Cold Resistor alarm equals or exceeds the preset maximum, this condition becomes an Integrity Failure. When this happens, the System Alarms section of the Train Detail and Exception Detail reports displays the message "Successive Cold Resistors Exceeded."

## B.12 Very Slow Train Alarm

The Very Slow Train alarm is generated when a train has an exit speed of less than 6 mph (9.7 kph). When this happens, the firmware will generate an "Integrity Failure" announcement and will display "Integrity Failure" and "Very Slow Train" in the System Alarms section of Train Detail and Exception Detail reports. If a Dragging-Equipment alarm is detected on a very slow train, no "Integrity Failure" announcement will be made, and no "Very Slow Train" message will appear in the System Alarms section. However, messages generated by any additional Integrity Failures found on such a train will still appear in the System Alarms section.

# Appendix C

## System Functions

---

This appendix lists the system functions provided by the SmartScanIS.

To access the system functions:

- 1 Using the serial interface, display the Main menu.

**Chapter 11 - Serial Interface** tells how to display the Main menu. The Main menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
Main Menu

A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
F) Last Train
G) Range of Trains
H) Event Log
I) Setup Menu
J) T94 Train Detail
X) Exit Menu
```

- 2 Select **Setup menu**

This prompt appears.

```
Enter Password:
```

### 3 At the password prompt, type **uptest**

The Setup menu appears.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
Setup Menu
```

- 
- A) Set Date and Time
- B) Milepost
- C) Track Number
- D) Alarm Limits
- E) Equipment
- F) Messages
- G) -For Future Use-
- H) System Functions
- I) Polling System
- J) Serial Ports
- K) Amtech Reader Parameters
- L) Modem Setup
- X) Exit Menu

### 4 Select the **System Functions** menu.

The System Functions menu appears.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
System Functions
```

- 
- A) Radio Test
- B) Vocabulary Test
- C) Gate Test
- D) 1KHz Test Tone
- E) Auto-Calibration
- F) Reset the COP Counters
- G) Remote System RESET
- H) Clear All Stored Train Data
- I) Clear Event Log
- J) Send JC Message
- K) Send JM Message
- L) Send JP Message
- M) Send JS Message
- N) Real-Time Diagnostics
- X) Exit Menu

## C.1 Radio Test

Selection of the **Radio Test option** broadcasts a short message through the speaker and through the radio. Using this option lets you verify that the speaker and radio are working properly.

At single-track sites, the text of the message is "Testing, U-P detector, milepost (milepost number), testing, one, two, three, four, five, four, three, two, one, testing detector-out." At multitrack sites, the text of the message is "Testing, UP detector, milepost (milepost number), track (track designation), testing, one, two, three, four, five, four, three, two, one, testing, detector-out."

## C.2 Vocabulary Test

Selection of the **Vocabulary Test option** enunciates all of the stored speech phrases. This announcement is broadcast through the speaker, but not through the radio.

Below is a list of the phrases announced by the **Vocabulary Test option**. The phrases are grouped by chip number.

| Chip | Announced Phrases                                                                |
|------|----------------------------------------------------------------------------------|
| 1    | Zero, One, Two, Three, Four, Five                                                |
| 2    | Six, Seven, Eight, Nine, No-Defects                                              |
| 3    | Detector-Malfunction, Point, Hotwheel, Testing                                   |
| 4    | Axle, Dragging-Equipment-Near, North, Rail                                       |
| 5    | South, East, West, Track, Hotbox                                                 |
| 6    | Defect-Detected, M-P-H, Fifth                                                    |
| 7    | Integrity-Failure, Detector-Out, Sixth                                           |
| 8    | No Rebroadcast, Minutes, Train-Too-Slow, Total-Axles, Speed                      |
| 9    | A, B, C, D, E, Temperature, Length, Minus, First, Second                         |
| 10   | F, G, H, I, J, Third, Fourth, Left-Side, Right-Side, <i>beep</i>                 |
| 11   | K, L, M, N, O, High-Load, Wide-Load, On, Seventh, Eighth                         |
| 12   | P, Q, R, S, T, S-P-Detector, Milepost, Detector-Working                          |
| 13   | U, V, W, X, Y, Stop-Your-Train, U-P-Detector, Ninth                              |
| 14   | Z, Sliding-Wheel, Car-I-D, From-Head-of-Train, Degrees, Number                   |
| 15   | Multiple-Hot-Journal-and-Dragging-Equipment, Power-Off, High-Wide-Near           |
| 16   | Detected-From-Axle, To-End-of-Train, Miles-Per-Hour, Multiple-Dragging-Equipment |

## C.3 Gate Test

Selection of the **Gate Test option** opens the scanner shutters and simulates a passing train. While in this mode, you can simulate alarms by placing a heat source on a scanner or by opening an auxiliary alarm detector's contacts.

You can stop the gate test by pressing **[Esc]**. If you don't press **[Esc]**, the test continues until 486 axles are simulated. The firmware pauses between railcars and scans for a pressed **[Esc]**. Consequently, the gate test may not terminate immediately after **[Esc]** is pressed. It may need to finish the current car's axles. Pressing keys before pressing **[Esc]** results in the generation of additional cars of axles before aborting. There will be one additional car of axles for each key pressed before pressing **[Esc]**.

After pressing **[Y]** to begin the gate test, the "Running Gate Test..." message appears, followed by a four-second pause.

## C.4 1KHz Test Tone

Selection of the **1KHz Test Tone option** generates a continuous one-kilohertz tone for 15 seconds. This tone is broadcast through the speaker and through the radio. Using this option lets you verify that the speaker and radio are working properly.

## C.5 Auto-Calibration

Selection of the **Auto-Calibration option** places the system in autocalibration mode.

The SmartScanIS self-calibrates its pyrometer interface circuitry. You need only put a preheated calibrated heat source on a scanner and place the system in autocalibration mode. The system then scans all pyrometer inputs until the signal from the calibrated heat source is located. The necessary adjustments to the related interface circuitry are automatically made while the system monitors its own progress by analyzing changes in the heat signals. Once the procedure has been completed, autocalibration mode is disengaged, and the calibration results are displayed on your computer. For more details, see **Appendix E - Calibration of Scanners**.

## C.6 Reset the COP Counters

Selection of the **Reset the COP Counters option** resets each COP counter to zero.

Built into each microprocessor on the Processor board is a Computer Operating Properly (COP) monitor. This feature gives the processor the ability to monitor its own operation and, in the presence of abnormal operating conditions, automatically trigger a system reset. The SmartScanIS maintains a count of these system resets (until 255 is reached), whether initiated automatically by the system or manually by the user via the **Remote System Reset option** on the System Functions menu. These counters are used for diagnostic purposes only. The current value of these counters appears on the System Status report.

## C.7 Remote System Reset

Selection of the **Remote System Reset option** forces a system reset through a remote connection. It can also be used locally. If a train is present at the site when this function is selected, some train data will be lost.

## C.8 Clear All Stored Train Data

Selection of the **Clear All Stored Train Data option** erases all of the stored train data. This encompasses all of the trains in the Trains directory and Exceptions directory. After deleting all train data, there isn't any way of regenerating it. The data is gone forever.

## C.9 Clear Event Log

Selection of the **Clear Event Log option** erases all of the events stored in the Event Log and displayed on the Event Log report. After deleting the log, there isn't any way of regenerating it. The data is gone forever.

## C.10 Send JC Message

Selection of the **Send JC Message option** sends a Continuous Carrier signal for 15 seconds to the Harriman Dispatch Center.

## C.11 Send JM Message

Selection of the **Send JM Message option** sends a Continuous Mark signal for 15 seconds to the Harriman Dispatch Center.

## **C.12 Send JP Message**

Selection of the **Send JP Message option** sends a Mark-Space pattern for 15 seconds to the Harriman Dispatch Center.

## **C.13 Send JS Message**

Selection of the **Send JS Message option** sends a Continuous Space signal for 15 seconds to the Harriman Dispatch Center.

## **C.14 Real-Time Diagnostics**

Selection of the Real-Time Diagnostics submenu enables and disables various diagnostic messages. These messages aren't meant for general-purpose use and should only be enabled in consultation with STC personnel.



## Appendix D

# Replacing Scanner Cover-and-Module Assemblies

---

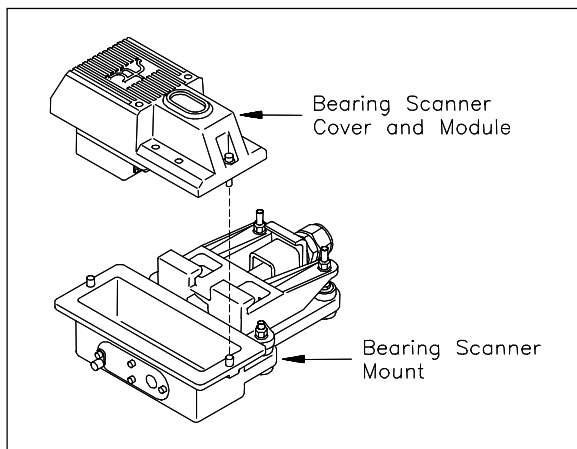
There are **Type II** bearing scanners and **Type II** wheel scanners. Both contain two major parts. The top part is the cover-and-module assembly. The module and its protective cover are tightly integrated and rarely should be taken apart. Except for the addition of a **plastic attenuation plug** on the wheel scanner cover, both types of cover-and-module assemblies are identical and can be used interchangeably. The bottom part is the mount. Bearing scanner mounts and wheel scanner mounts are different in design. They can't be interchanged.

There are also **Type III** bearing scanners and **Type III** wheel scanners. Both contain two major parts. The top part is the cover-and-module assembly. The module and its protective cover are tightly integrated and rarely should be taken apart. Except for the change of **filter frames** in the wheel scanner module, both types of cover-and-module assemblies are identical and can be used interchangeably. The bottom part is the mount. Bearing scanner mounts and wheel scanner mounts are different in design. They can't be interchanged.

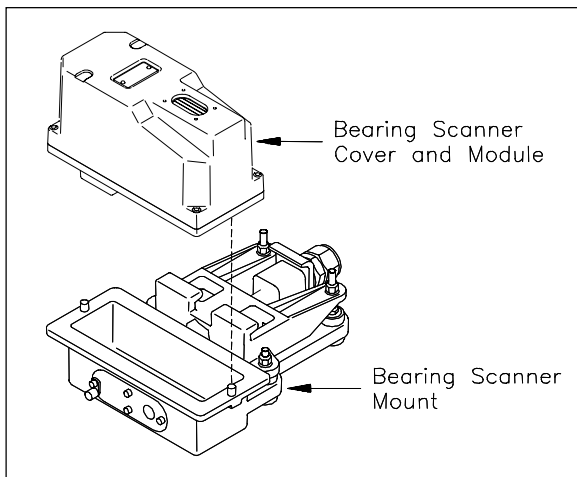
This appendix tells how to replace scanner cover-and-module assemblies. The replacement of scanner mounts isn't covered in this guide.

### D.1 Bearing Scanners

The figure below shows the major parts of a **Type II** bearing scanner.



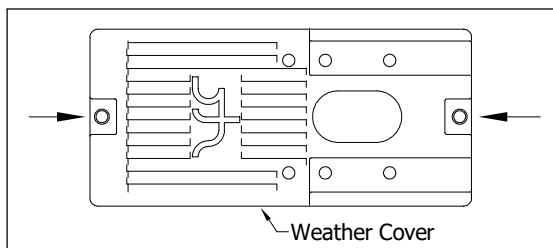
The figure below shows the major parts of a **Type III** bearing scanner.



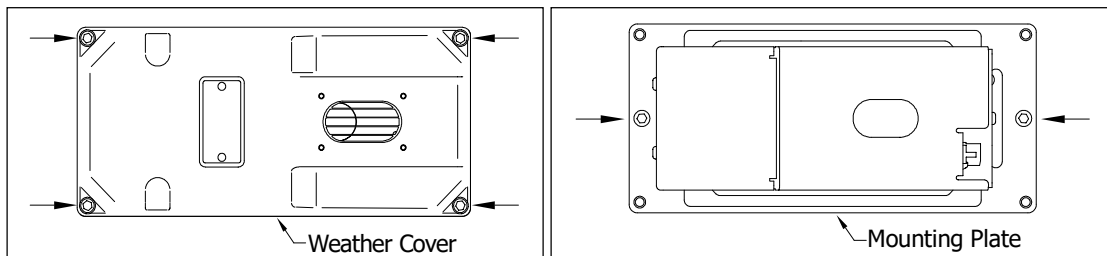
To replace a **Type II/Type III** bearing scanner cover-and-module assembly:

- 1 Be sure that you have on hand a new scanner cover-and-module assembly.
- 2 Be sure that you have on hand a T-handle 1/4-inch hex-wrench.
- 3 Turn off all power to the scanners.
- 4 Using a T-handle 1/4-inch hex-wrench, loosen the socket-head-cap screws on the cover of the bearing scanner.

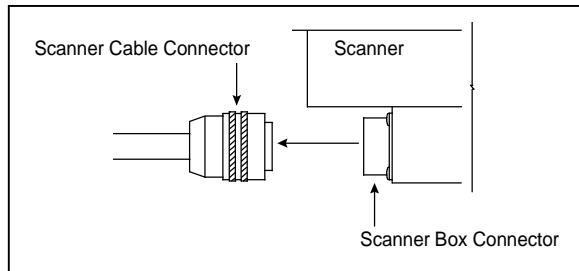
The **Type II** bearing scanner has two socket-head-cap screws that attach the weather cover to the mount.



The **Type III** bearing scanner has six. Four attach the weather cover to the mounting plate, and two attach the mounting plate to the mount.

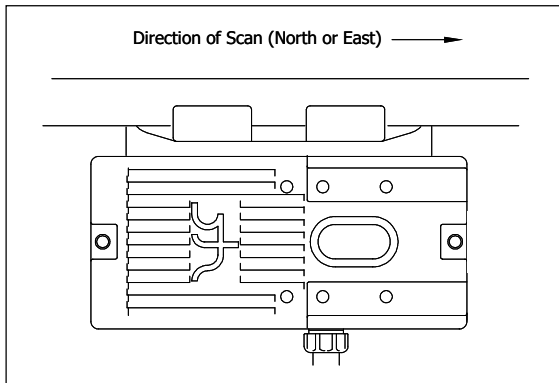


- 5 Separate the bearing scanner cover-and-module assembly from its mount.
- 6 If this is a **Type III** bearing scanner, disconnect the heater wiring plug.
- 7 Disconnect the scanner cable connector from the scanner box connector.

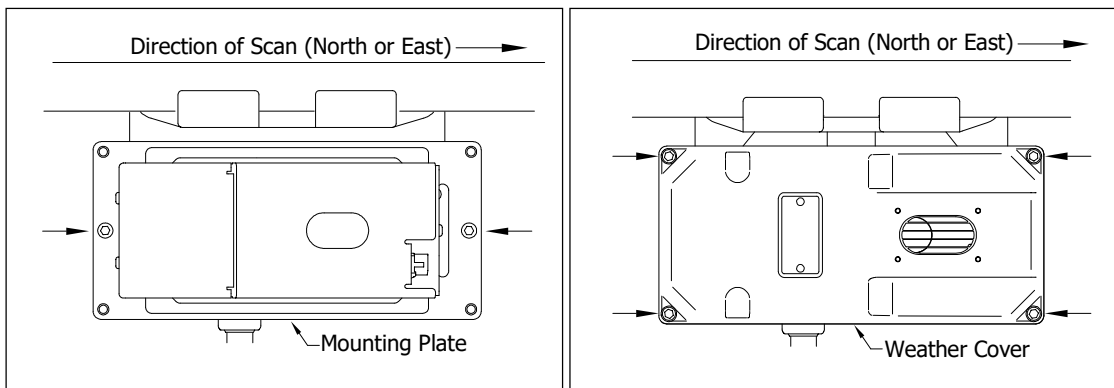


- 8 Store the removed scanner cover-and-module assembly in a safe place until you return it to STC for repair.
- 9 Attach the scanner cable connector to the scanner box connector of the new scanner cover-and-module assembly.
- 10 If this is a **Type II** bearing scanner:
  - a With the hole on top of the bearing scanner cover facing north or east, set the cover-and-module assembly onto its mount.
  - b Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.
- 11 If this is a **Type III** bearing scanner:
  - a With the hole on top of the bearing scanner cover facing north or east, set the mounting plate back onto its scanner mount.
  - b Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.
  - c Reconnect the heater wiring plug.
  - d With the hole on top of the bearing scanner cover facing north or east, set the weather cover back onto its mounting plate.
  - e Using the T-handle 1/4-inch hex-wrench, uniformly tighten the four socket-head-cap screws.

The top view of the **Type II** bearing scanner weather cover is shown below.

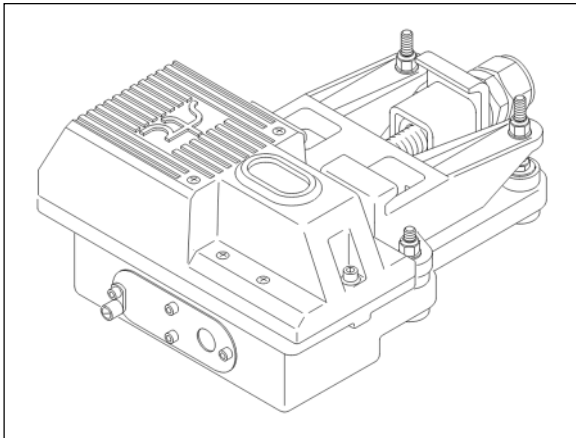


The top view of the **Type III** bearing scanner mounting plate and weather cover are shown below.

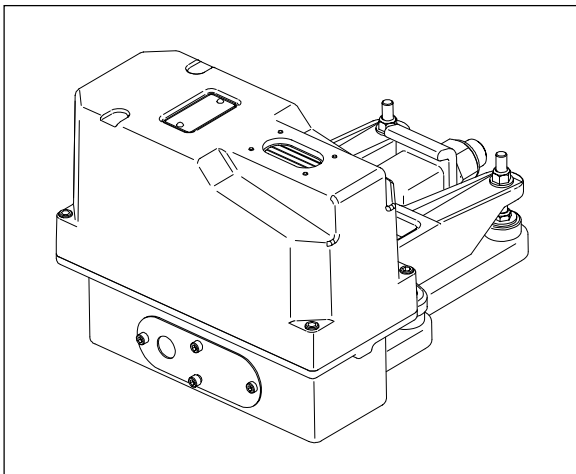


**12** Turn on power to the scanners.

An assembled **Type II** bearing scanner looks like this.

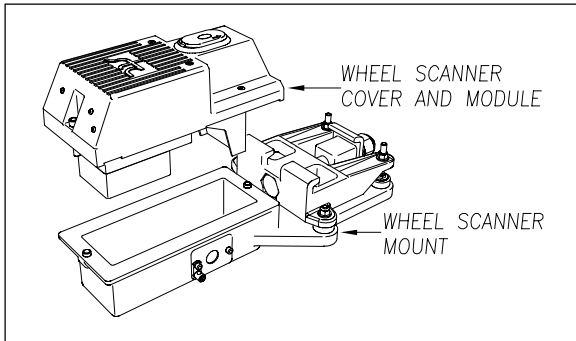


An assembled **Type III** bearing scanner looks like this.

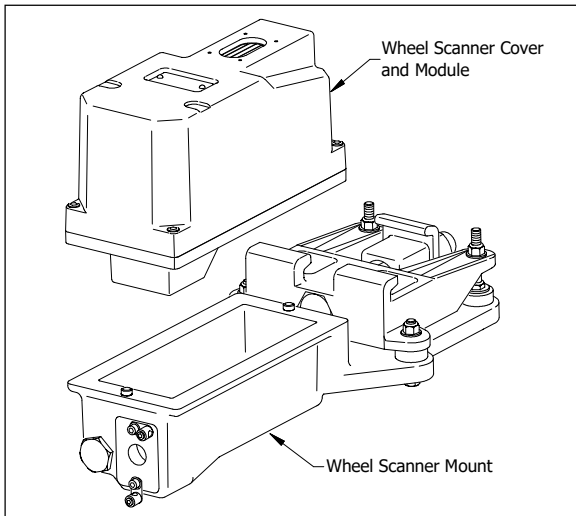


## D.2 Wheel Scanners

The figure below shows the major parts of a **Type II** wheel scanner.



The figure below shows the major parts of a **Type III** wheel scanner.

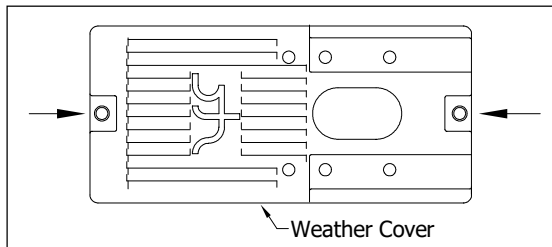


To replace a **Type II/Type III** wheel scanner cover-and-module assembly:

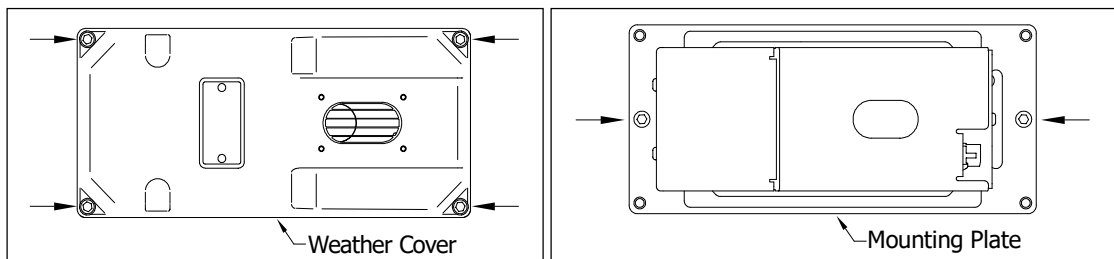
- 1 Be sure that you have on hand a new scanner cover-and-module assembly.
- 2 Be sure that you have on hand a T-handle 1/4-inch hex-wrench.
- 3 Turn off all power to the scanners.

- 4 Using a T-handle 1/4-inch hex-wrench, loosen the socket-head-cap screws on the cover of the wheel scanner.

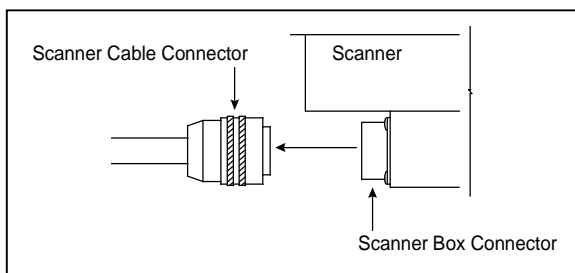
The **Type II** wheel scanner has two socket-head-cap screws that attach the weather cover to the mount.



The **Type III** wheel scanner has six. Four attach the weather cover to the mounting plate, and two attach the mounting plate to the mount.



- 5 Separate the wheel scanner cover-and-module assembly from its mount.
- 6 If this is a **Type III** wheel scanner, disconnect the heater wiring plug.
- 7 Disconnect the scanner cable connector from the scanner box connector.



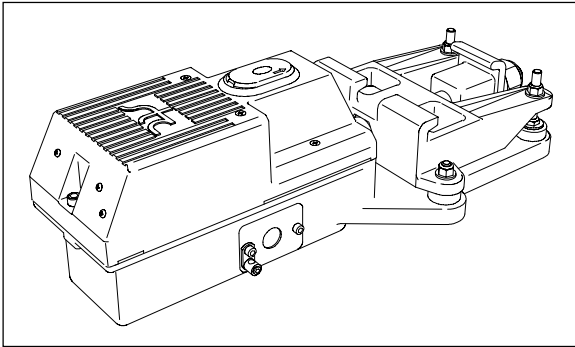
- 8 Store the removed scanner cover-and-module assembly in a safe place until you return it to STC for repair.
- 9 Attach the scanner cable connector to the scanner box connector (on the new scanner cover-and-module assembly).
- 10 If this is a **Type II** wheel scanner:
- a With the hole on top of the wheel scanner cover facing the center of the track, set the cover-and-module assembly onto its mount.
  - b Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.

**11** If this is a **Type III** wheel scanner:

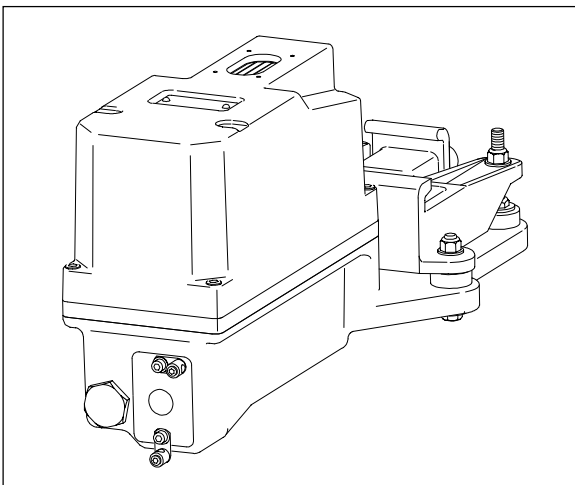
- a** With the hole on top of the wheel scanner cover facing the center of the track, set the mounting plate back onto its scanner mount.
- b** Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.
- c** Reconnect the heater wiring plug.
- d** With the hole on top of the wheel scanner cover facing the center of the track, set the weather cover back onto its mounting plate.
- e** Using the T-handle 1/4-inch hex-wrench, uniformly tighten the four socket-head-cap screws.

**12** Turn on power to the scanners.

An assembled **Type II** wheel scanner looks like this.



An assembled **Type III** wheel scanner looks like this.





## Appendix E

### Calibration of Scanners

---

The SmartScanIS self-calibrates its pyrometer interface circuitry. You need only put a preheated calibrated heat source on a scanner and place the system in autocalibration mode. The system then scans all pyrometer inputs until the signal from the calibrated heat source is located. The necessary adjustments to the related interface circuitry are automatically made while the system monitors its own progress by analyzing changes in the heat signals. Once the procedure has been completed, autocalibration mode is disengaged, and the calibration results are displayed on your computer.

This appendix tells how to use the calibrated heat source to calibrate the scanners.

#### E.1 Bearing Scanners

**STC recommends that you use the calibrated heat source (2100-810NG) only when the outside (ambient) temperature is above 0°F (-18°C) and below 90°F (32°C).** If you must use it at other times, do so only when the needle is centered on the front of the temperature meter. If the needle isn't stabilized within  $\pm 2$  degrees of the set point, the heat source isn't operating properly.

To calibrate a **Type II/Type III** bearing scanner:

- 1 Be sure that you have on hand an STC calibrated heat source (2100-810NG) and a laptop computer.
- 2 On the control panel of the calibrated heat source, toggle the **Gating** switch off.
- 3 Plug the proper end of the supplied 50-foot (15-meter) power cord into the **six**-contact circular connector on the front of the calibrated heat source.

**Sixty Hz is critical for proper operation.** For a site that doesn't have a 120-volt 60 Hz power source, the heat source should be powered from a true sine wave inverter capable of 250 watts with an output of at least 110 volts at 60 Hz. The inverter should operate from an input voltage of 10.5 VDC to 15 VDC. A 120-volt USA socket should be provided to match the heat source power cord. The inverter should be grounded according to the manufacturer's recommendations.

#### WARNING

Once plugged in, both function connectors will have live AC present.

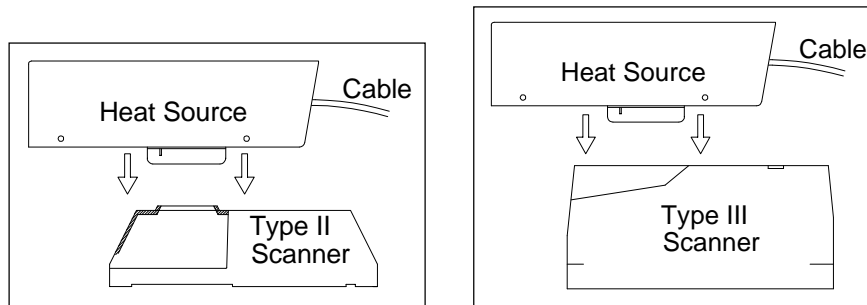
- 4 Using the supplied dust cap, cover the function connector that isn't being used.
- 5 Plug the other end of the power cord into the 120-volt USA socket.
- 6 On the control panel of the calibrated heat source, turn the temperature knob to **180**.

- 7 Put the heat source in a shady area, out of direct sunlight and out of the wind.
- 8 Wait about 8 minutes for the heat source to reach operating temperature and stabilize.

The heat source has reached operating temperature and stabilized when the temperature meter needle remains centered.

Once the temperature stabilizes, calibration may begin. Once stabilized, the temperature will change less than plus-or-minus one degree Fahrenheit.

- 9 With the power cord to the front of the scanner, place the calibrated heat source on the bearing scanner.



- 10 Plug your computer into COM3.
- 11 Turn on your computer.
- 12 Be sure that your computer has installed communications software, that it is set to use full duplex, and that the baud rate is set to 9,600.

The baud rate of your computer must match the baud rate of the selected serial port because they are in direct, one-to-one, communication with one another. For example, the baud rate for COM3 was set to 9600 at the factory. If the customer changed this baud rate, your computer must be set to the changed value.

- 13 Using the serial interface, display the Main menu.

**Chapter 11 - Serial Interface** tells how to display the Main menu. The Main menu looks like this.

```

STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
Main Menu

 .
 .
 .
H) Event Log
I) Setup Menu
J) T94 Train Detail
X) Exit Menu

```

#### 14 Select **Setup** menu

This prompt appears.

```
Enter Password:
```

#### 15 At the password prompt, type **uptest**

The password isn't case-sensitive. Entering an incorrect password produces the "Password Incorrect!" message and returns to the Main menu. Pressing **[Esc]** or allowing the entry routine to time out (one minute) returns to the Main menu.

Typing the correct password displays the Setup menu.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
Setup Menu

```

- A) Set Date and Time
- B) Milepost
- C) Track Number
- D) Alarm Limits
- E) Equipment
- F) Messages
- G) -For Future Use-
- H) System Functions
- I) Polling System

```
•
•
•
```

#### 16 Select the **System Functions** menu.

The System Functions menu appears.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
System Functions Menu

```

- A) Radio Test
- B) Vocabulary Test
- C) Gate Test
- D) 1KHz Test Tone
- E) Auto-Calibration
- F) Reset the COP Counters

```
•
•
•
```

The **Auto-Calibration** option is used to calibrate the system's pyrometer interface circuitry.

**17 Select Auto-Calibration** to initiate process.

The SmartScanIS will now calibrate itself. **Follow along on your computer screen until you see "Auto-Calibration Disengaged."** This message is an indication that the system is done with the calibration procedure. To abort the process, press **[Esc]** on your computer or remove the heat source from the bearing scanner.

On your computer screen, an acceptable calibration looks like this. Your values will be different.

```
Auto Calibration Selected

Signal levels in millivolts with closed shutters
 Rail1 Rail2 Wheel1 Wheel2
Min/Max/Average Min/Max/Average Min/Max/Average Min/Max/Average
0 80 20 0 60 20 0 60 20 20 80 40

Opening the shutters.
Scanning for heat source. Press the 'Esc' key to abort.
Located 187F heat source at Rail1. Auto-calibration beginning in 0 secs.

.....Auto-Calibration Engaged.....

Testing Digital-Pot U-19. Stand by.
Digital-pot checks OK.
Previous calibrated digital-pot. setting was 38.
Adjusting digital-pot.
Temp = 225F Pot = 59 Sec = 1 Pot. decremented by 1 step.
Temp = 224F Pot = 58 Sec = 1 Pot. decremented by 1 step.
Temp = 221F Pot = 57 Sec = 2 Pot. decremented by 1 step.
Temp = 219F Pot = 56 Sec = 3 Pot. decremented by 1 step.
.
.
.
Temp = 183F Pot = 35 Sec = 15 Pot. decremented by 1 step.
Temp = 182F Pot = 34 Sec = 18 Pot. decremented by 1 step.
Temp = 181F Pot = 33 Sec = 29 Pot. decremented by 1 step.
Temp = 179F Pot = 33 Sec = 93 Monitoring heat source temperature.
Rail1 digital-pot setting of 33 was stored in EEPROM.
East Rail Scanner Calibration complete.
The setpoint is 180F. The calibrated temp. is 179F.
Closing the shutters.

.....Auto-Calibration Disengaged.....
```

Before the shutters are opened, if you get a signal level greater than 200 millivolts, it usually means that there is noise on the scanner inputs, which most times is caused by an electrical problem with the scanner. If you cannot isolate and fix the cause of this problem, call STC for help.

|                                                  |     |     |                 |    |    |                 |    |    |                 |    |    |
|--------------------------------------------------|-----|-----|-----------------|----|----|-----------------|----|----|-----------------|----|----|
| Auto Calibration Selected                        |     |     |                 |    |    |                 |    |    |                 |    |    |
| Signal levels in millivolts with closed shutters |     |     |                 |    |    |                 |    |    |                 |    |    |
| Rail1                                            |     |     | Rail2           |    |    | Wheel1          |    |    | Wheel2          |    |    |
| Min/Max/Average                                  |     |     | Min/Max/Average |    |    | Min/Max/Average |    |    | Min/Max/Average |    |    |
| 210                                              | 250 | 210 | 0               | 60 | 20 | 0               | 60 | 20 | 20              | 80 | 40 |
| •                                                |     |     |                 |    |    |                 |    |    |                 |    |    |
| •                                                |     |     |                 |    |    |                 |    |    |                 |    |    |
| •                                                |     |     |                 |    |    |                 |    |    |                 |    |    |

Before the shutters are closed, if you don't get a calibrated temperature in the range 178F to 182F, it means that the scanner wasn't calibrated. If cleaning the optics doesn't solve your problem, replace the scanner cover-and-module assembly. If this doesn't solve your problem, call STC for help in fixing the problem.

- 18** When "Auto-Calibration Disengaged" is displayed on your computer, remove the calibrated heat source.
- 19** To return to the Setup menu, type **x**
- 20** To return to the Main menu, type **x**
- 21** To exit the serial interface and return the system to normal operation, type **x**
- 22** Store the calibrated heat source and its power cord in the bungalow (aka wayside enclosure).

## E.2 Wheel Scanners

STC recommends that you use the calibrated heat source (2100-810NG) only when the outside (ambient) temperature is above 0°F (-18°C) and below 90°F (32°C). If you must use it at other times, do so only when the needle is centered on the front of the temperature meter. If the needle isn't stabilized within  $\pm 2$  degrees of the set point, the heat source isn't operating properly.

To calibrate a **Type II/Type III** wheel scanner:

- 1 Be sure that you have on hand an STC calibrated heat source (2100-810NG) and a laptop computer.
- 2 On the control panel of the calibrated heat source, toggle the **Gating** switch off.
- 3 Plug the proper end of the supplied 50-foot (15-meter) power cord into the **six**-contact circular connector on the front of the calibrated heat source.

**Sixty Hz is critical for proper operation.** For a site that doesn't have a 120-volt 60 Hz power source, the heat source should be powered from a true sine wave inverter capable of 250 watts with an output of at least 110 volts at 60 Hz. The inverter should operate from an input voltage of 10.5 VDC to 15 VDC. A 120-volt USA socket should be provided to match the heat source power cord. The inverter should be grounded according to the manufacturer's recommendations.

### WARNING

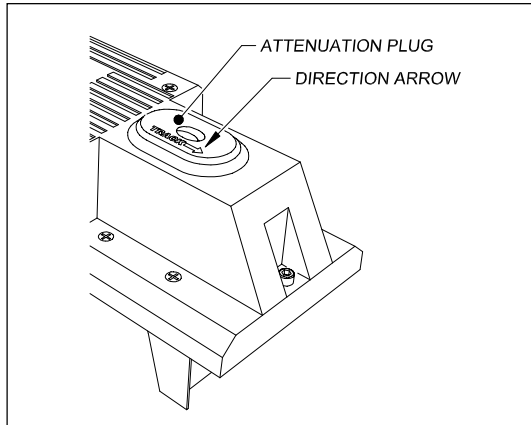
Once plugged in, both function connectors will have live AC present.

- 4 Using the supplied dust cap, cover the function connector that isn't being used.
- 5 Plug the other end of the power cord into the 120-volt USA socket.
- 6 On the control panel of the calibrated heat source, turn the temperature knob to **180**.
- 7 Put the heat source in a shady area, out of direct sunlight and out of the wind.
- 8 Wait about 8 minutes for the heat source to reach operating temperature and stabilize.

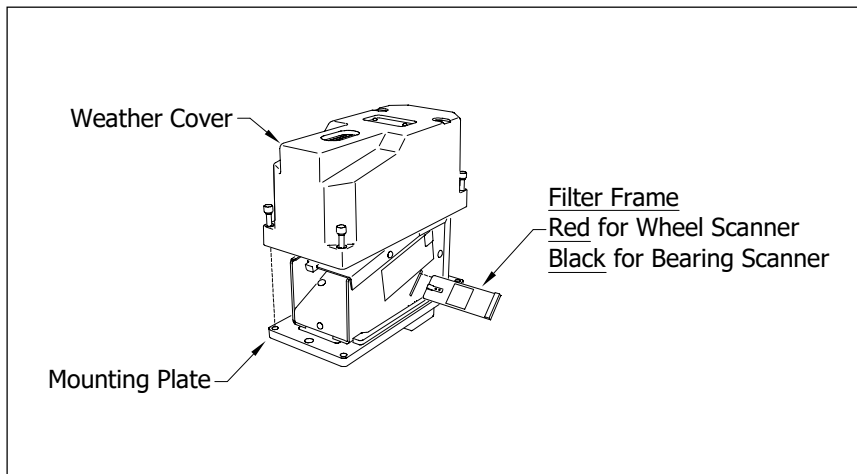
The heat source has reached operating temperature and stabilized when the temperature meter needle remains centered.

Once the temperature stabilizes, calibration may begin. Once stabilized, the temperature will change less than plus-or-minus one degree Fahrenheit.

- 9 If you are calibrating a **Type II** wheel scanner, remove the attenuation plug from the weather cover.

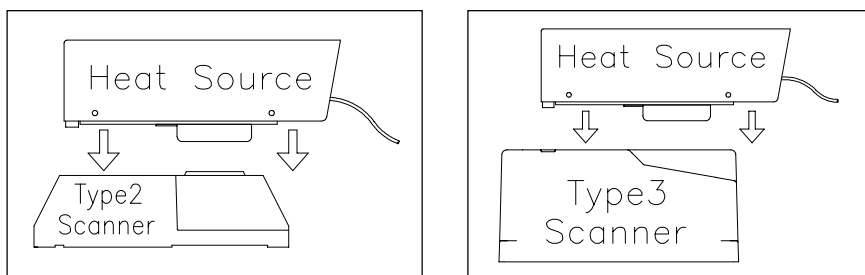


- 10 If you are calibrating a **Type III** wheel scanner, replace the red filter frame with the black one.



You'll need to remove the weather cover before you can replace the filter frame. Four socket-head-cap screws attach the weather cover to the mounting plate. Before continuing, be sure that the black filter frame is securely in place and that the four socket-head-cap screws on the weather cover are completely tight.

- 11 With the power cord to the front of the scanner, place the calibrated heat source on the wheel scanner.



- 12 Plug your computer into COM3.
- 13 Turn on your computer.
- 14 Be sure that your computer has installed communications software, that it is set to use full duplex, and that the baud rate is set to 9,600.
- The baud rate of your computer must match the baud rate of the selected serial port because they are in direct, one-to-one, communication with one another. For example, the baud rate for COM3 was set to 9600 at the factory. If the customer changed this baud rate, your computer must be set to the changed value.
- 15 Using the serial interface, display the Main menu.

**Chapter 11 - Serial Interface** tells how to display the Main menu. The Main menu looks like this.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
Main Menu

 .
 .
 .
H) Event Log
I) Setup Menu
J) T94 Train Detail
X) Exit Menu
```



## 16 Select **Setup** menu

This prompt appears.

```
Enter Password:
```

## 17 At the password prompt, type **uptest**

The password isn't case-sensitive. Entering an incorrect password produces the "Password Incorrect!" message and returns to the Main menu. Pressing **[Esc]** or allowing the entry routine to time out (one minute) returns to the Main menu.

Typing the correct password displays the Setup menu.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
Setup Menu

A) Set Date and Time
B) Milepost
C) Track Number
D) Alarm Limits
E) Equipment
F) Messages
G) -For Future Use-
H) System Functions
I) Polling System
.
.
.
```

## 18 Select the **System Functions** menu.

The System Functions menu appears.

```
STC Integrated Detector System, Milepost-0501.2, Track:Single
05/31/2013 9:35
System Functions Menu

A) Radio Test
B) Vocabulary Test
C) Gate Test
D) 1KHz Test Tone
E) Auto-Calibration
F) Reset the COP Counters
.
.
.
```

The **Auto-Calibration** option is used to calibrate the system's pyrometer interface circuitry.

- 19** Select **Auto-Calibration** to begin process.

The SmartScanIS will now calibrate itself. **Follow along on your computer screen until you see "Auto-Calibration Disengaged."** This message is an indication that the system is done with the calibration procedure. To abort the process, press **[Esc]** on your computer or remove the heat source from the wheel scanner.

Before the shutters are opened, if you get a signal level greater than 200 millivolts, it usually means that there is noise on the scanner inputs, which most times is caused by an electrical problem with the scanner. If you cannot isolate and fix the cause of this problem, call STC for help.

Before the shutters are closed, if you don't get a calibrated temperature in the range  $540^{\circ}\text{F} \pm 6^{\circ}\text{F}$ , it means that the scanner wasn't calibrated. If cleaning the optics doesn't solve your problem, replace the scanner cover-and-module assembly. If this doesn't solve your problem, call STC for help in fixing the problem.

- 20** When "Auto-Calibration Disengaged" is displayed on your computer, remove the calibrated heat source.

- 21** To return to the Setup menu, type **x**

- 22** To return to the Main menu, type **x**

- 23** To exit the serial interface and return the system to normal operation, type **x**

- 24** If you just calibrated a **Type II** wheel scanner, replace the attenuation plug.

The attenuation plug has a direction arrow molded into the top of the plug. This arrow should be pointing toward the rail.

- 25** If you just calibrated a **Type III** wheel scanner, immediately replace the black filter frame with the red one.

Before continuing, be sure that the red filter frame is securely in place and that the four socket-head-cap screws on the weather cover are completely tight.

- 26** Store the calibrated heat source and its power cord in the bungalow (aka wayside enclosure).

## Appendix F

### Lens Cleaning of Scanners

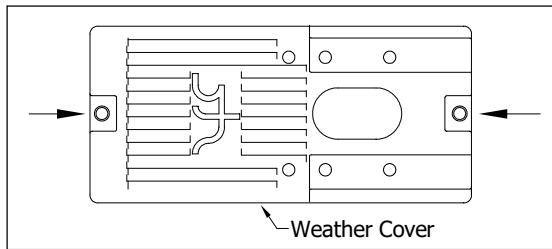
---

This appendix tells how to clean the optics in the scanners.

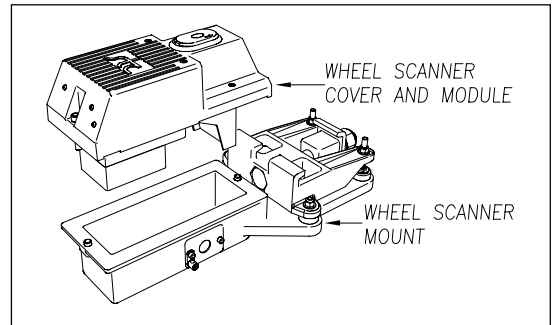
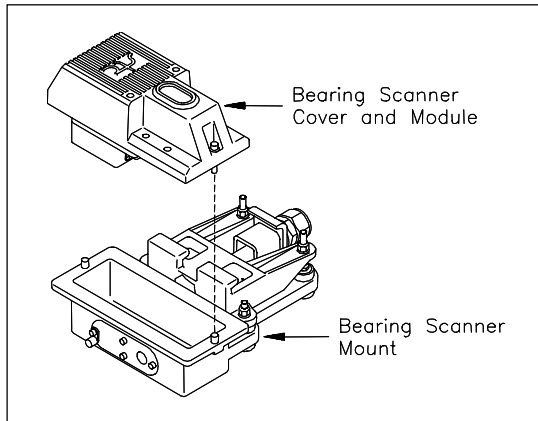
#### F.1 Type II Scanners

To clean the optics in the **Type II** scanners:

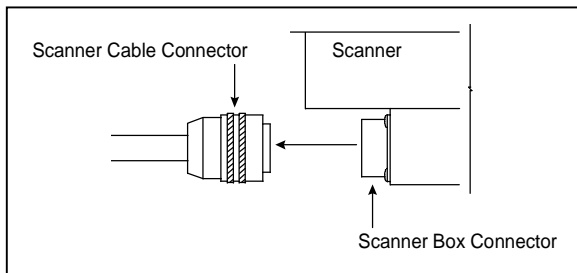
- 1 Be sure that you have on hand a T-handle 1/4-inch hex-wrench and a 9/64-inch Allen wrench.
- 2 Turn off all power to the scanners.
- 3 Using the T-handle 1/4-inch hex-wrench, loosen the two socket-head-cap screws that attach the weather cover to the mount.



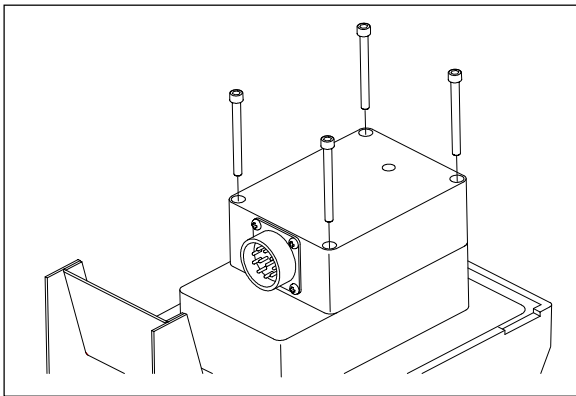
- 4 Separate the scanner cover-and-module assembly from its mount.



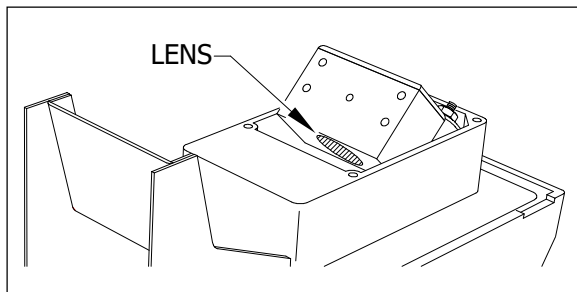
- 5 Disconnect the scanner cable connector from the scanner box connector.



- 6 Turn the cover-and-module assembly upside down.
- 7 Using the 9/64-inch Allen wrench, remove the four socket-head-cap screws from the bottom panel.



- 8 Store the socket-head-cap screws in a safe place until you replace it.
- 9 To expose the internal scanner module and lens assembly, separate the bottom panel of the scanner from the main body.



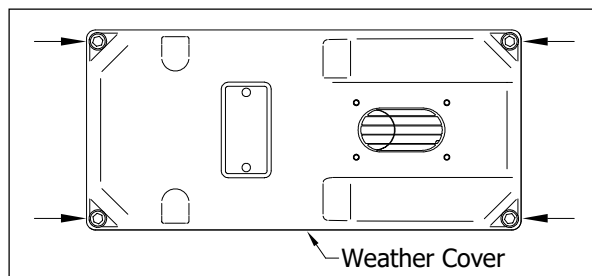
- 10 Using a soft dry cloth, remove any accumulated dirt or grit.  
Be careful not to abrade or scratch the surface of the lens.
- 11 Using a soft clean cloth, apply a mild cleaning solution such as Vallen V8L or any similar solution that would typically be used for cleaning eyeglasses.
- 12 Gently wipe the lens surface.  
Pay close attention to the area around the perimeter of the lens. It is important that the entire surface of the lens is clean.

- 13 To restore a uniform surface, gently polish the lens surface with a clean, dry cloth.
- 14 Reposition the bottom panel.
- 15 Replace the four socket-head-cap screws and tighten them by hand.
- 16 Using the 9/64-inch Allen wrench, tighten the four socket-head-cap screws until they are completely tight.  
Be sure that the screws are uniformly tightened.
- 17 Attach the scanner cable connector to the scanner box connector.
- 18 If this is a **Type II bearing scanner**:
  - a With the hole on top of the bearing scanner cover facing north or east, set the cover-and-module assembly onto its mount.
  - b Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.
- 19 If this is a **Type II wheel scanner**:
  - a With the hole on top of the wheel scanner cover facing the center of the track, set the cover-and-module assembly onto its mount.
  - b Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.
- 20 Turn on power to the scanners.

## F.2 Type III Scanners

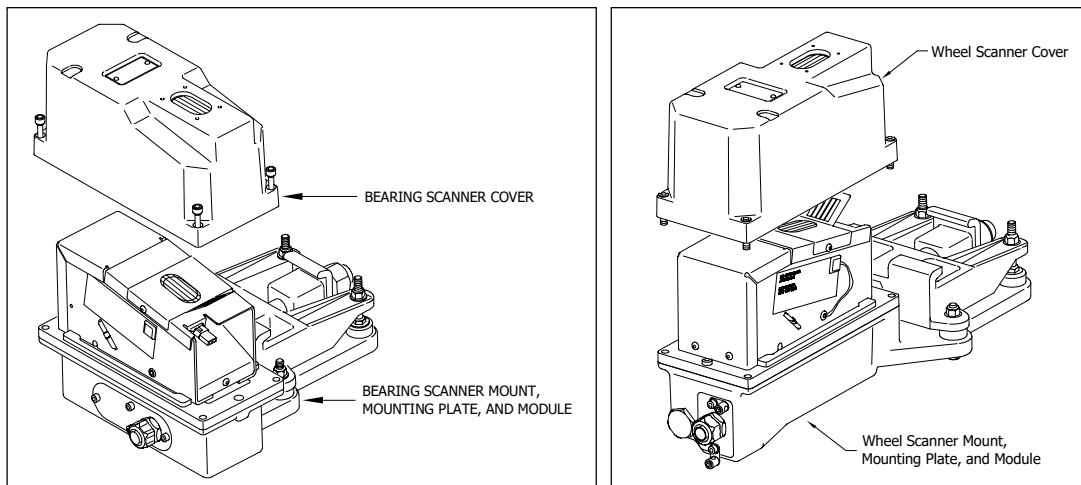
To clean the optics in the **Type III** scanners:

- 1 Be sure that you have on hand a T-handle 1/4-inch hex-wrench.
- 2 Turn off all power to the scanners.
- 3 Using the T-handle 1/4-inch hex-wrench, loosen the four socket-head-cap screws that attach the weather cover to the mounting plate.



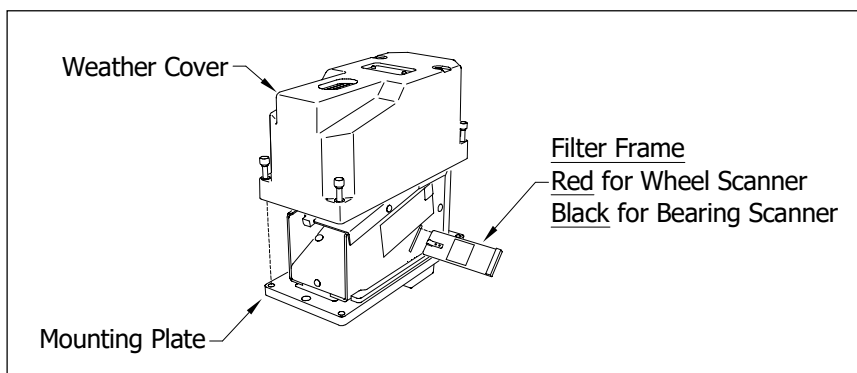
- 4 Remove the weather cover from its mounting plate.

Be careful not to damage the electrical connection for the cover heaters.



- 5 Disconnect the heater wiring plug.

On the side of the scanner module, you'll find a metal tab that protrudes about 1/4 inch outside the module.



- 6 Grasp the tab and pull the filter frame out of the scanner module.
- 7 Using the brush supplied with the tool kit, lightly dust the filter frame glass to remove any accumulated dirt or grit.

Be careful not to abrade or scratch the surface of the lens.

- 8 Apply a small amount of Vallen V8L cleaning solution (included in the tool kit) directly to the glass filter to loosen any remaining contamination.
- 9 Gently polish the reflective glass surface with a chamois pad.

Pay close attention to the area around the perimeter of the lens. It is important that the entire surface of the lens is clean.

- 10 Open the shutter by stroking one of the gating transducers with a piece of ferrous metal.
- 11 If the lens surface appears to have any dust on it, insert the brush from the tool kit through the baffle plates until it contacts the lens surface and apply a twisting motion to dislodge any accumulated dust.
- 12 Remove the brush and visually inspect the lens for cleanliness.
- 13 Insert the filter frame back in its receptacle.

Be sure that the frame is inserted correctly. To assure proper insertion, look at the glass portion of the filter. The reflective side should be facing toward the opening in the top of the module.
- 14 Reconnect the heater wiring plug.
- 15 If this is a **Type III bearing scanner**:
  - a With the hole on top of the bearing scanner cover facing north or east, set the weather cover back onto its mounting plate.
  - b Using the T-handle 1/4-inch hex-wrench, uniformly tighten the four socket-head-cap screws.
- 16 If this is a **Type III wheel scanner**:
  - a With the hole on top of the wheel scanner cover facing the center of the track, set the weather cover back onto its mounting plate.
  - b Using the T-handle 1/4-inch hex-wrench, uniformly tighten the four socket-head-cap screws.
- 17 Turn on power to the scanners.





# Appendix G

## Predictive Gate Scanning

---

This appendix describes predictive gate scanning of bearings.

### G.1 Overview

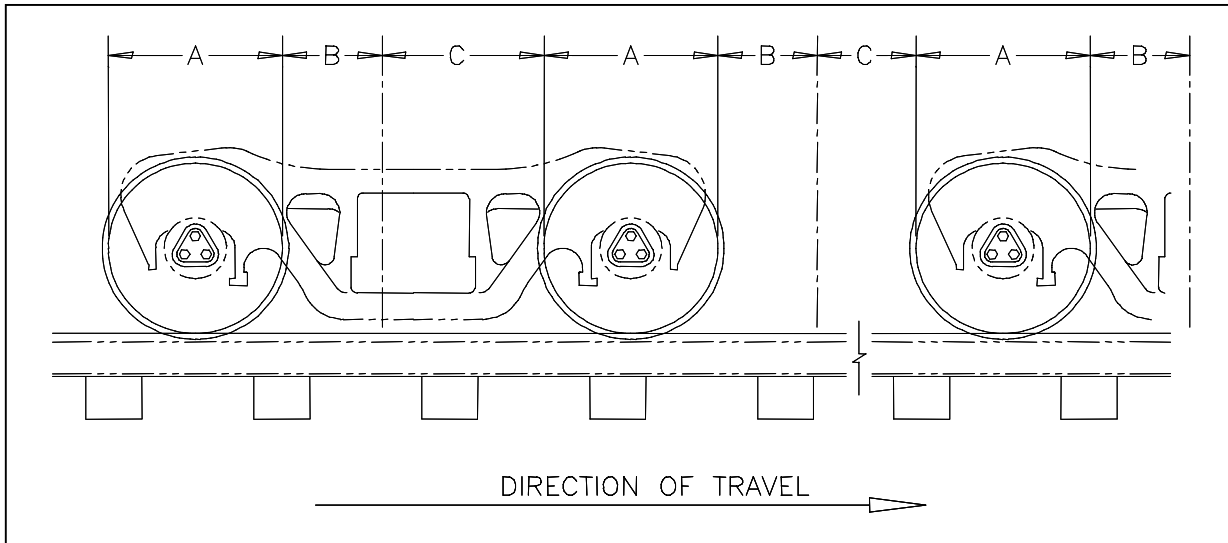
If a pyrometer is exposed to extreme infrared energy emission, the device itself can be driven into a saturated state. When this happens, it is blinded to subsequent changes in infrared energy emission. This blinded state can last up to 1-1/2 seconds.

Under certain circumstances, a pyrometer may be driven into saturation before the opening of the gate for a given axle. If the open-gate period was the only time during which pyrometer readings were sampled and processed, the system might miss an overheated bearing due to a device that was blinded before the opening of the gate. This can happen when a bearing is so overheated that it gives off infrared energy that can be seen by the pyrometer long before the bearing enters the pyrometer's field of view.

To compensate for this, the SmartScanIS includes special logic for processing heat seen by the pyrometers as they scan between the axle gates. The interval between axles has been divided into two parts.

The first part of this interval is the 20 inches (50.8 centimeters) that immediately precede the axle as it approaches the bearing scanners. This interval is treated as a "predictive gate" region in which the actual gate period (the time a bearing is physically in the pyrometer's field of view) is extended by 20 inches (50.8 centimeters). The remainder of the "between-gate" interval forms the second part. Heat values read during this second interval are ignored.

The figure below depicts the three distinct scanning intervals (the in-gate period plus the two between-gate intervals).



The table below defines the intervals.

| Interval | Description                                                                                                    |
|----------|----------------------------------------------------------------------------------------------------------------|
| A        | The normal bearing scanning interval of about 24 inches (61 centimeters), depending on the transducer spacing. |
| B        | A distance of about 20 inches (50.8 centimeters) before a given wheel.                                         |
| C        | The distance between wheels that doesn't fall within interval-B.                                               |

## G.2 Scanning Process

Interval-A is the normal bearing scanning interval. Interval-B is an extension of interval-A. That is, the greatest value read in either of these two intervals is recorded as the temperature for the axle. This value is checked for alarm levels in the same manner that scanned bearing temperatures are normally handled.

For interval-A: Heat values read during interval-A are processed normally.

For interval-B: Heat values read during interval-B that don't exceed the Absolute alarm threshold are ignored. Values that exceed the Absolute alarm threshold are handled as follows:

- If the interval-A heat value exceeds the Absolute alarm threshold, it is processed normally, and the interval-B heat reading is ignored.
- If the interval-A heat value doesn't exceed the Absolute alarm threshold, but interval-B heat value does, a Pyrometer Saturation alarm is flagged and the interval-B heat value is stored and reported for the alarmed axle.

For interval-C: Heat values read during interval-C are ignored.





# Appendix H

## Central Reporting System

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This appendix describes the part the SmartScanIS plays in Union Pacific's Central Reporting System (aka Automated Detector Monitoring System). Covered are the messages sent to and received from their host computer.

For a complete description of the Central Reporting System, refer to Union Pacific documentation. This appendix is only an overview.

### H.1 Overview

Union Pacific's Central Reporting System consists of three basic layers. The first layer consists of the trackside detectors. The second layer is the distributed communication network, consisting of the railroad's communication lines, commercial circuits, or a combination of both. The third layer contains the host computer that communicates with each site, processing and storing the data received.

The SmartScanIS provides support for the Central Reporting System. It sends messages to and receives messages from the host computer.

### H.2 Polling Port (COM2)

On the System Interface board, the DB9M plug P10 (COM2) is dedicated to the Union Pacific's Polling System. This port supports split baud rate communications providing a Receive baud rate of 150 to 115200 and a Transmit baud rate of 150 to 115200.

You change the parameters for port COM2 by using the COM2-P10 submenu of the Serial Ports menu. You can pick a baud rate of 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200. You can pick either no parity bit, 8 data bits, and 1 stop bit or even parity bit, 7 data bits, and 1 stop bit.

## H.3 Polling Address

To participate in the Central Reporting System, each SmartScanIS must have a polling address. What the address is depends on which mode you're in. In Poll/Standalone mode, the address is based on a single alpha character designator. In Dialup mode, the address is based on the site name.

## H.4 Messages

All messages sent between the SmartScanIS and the Central Reporting System use a fixed format. Each has a 10-byte header, followed by the text data, if any, and end with a linefeed character.

## H.5 Supported Message Types from Union Pacific

The SmartScanIS responds to the following two-byte message types received from the host computer at the Harriman Dispatch Center.

| Type | Function                                                                                 |
|------|------------------------------------------------------------------------------------------|
| IC   | Initialize - cold start                                                                  |
| IW   | Initialize - warm start                                                                  |
| JC   | Test mode - send continuous carrier for 15 seconds                                       |
| JM   | Test mode - send continuous mark for 15 seconds                                          |
| JP   | Test mode - send mark/space pattern for 15 seconds                                       |
| JS   | Test mode - send continuous space for 15 seconds                                         |
| LD   | Request list of defective trains                                                         |
| LT   | Request list of all trains                                                               |
| RA   | Resend train data all the train data for a specified train                               |
| RB   | Send digitized heat information for a specified car                                      |
| SL   | Set location name                                                                        |
| SM   | Set health-check interval, trigger values, and other modem parameters for dialup systems |
| SQ   | Set hot bearing alarm levels                                                             |
| SR   | Request data from Rail Stress Module                                                     |
| SX   | Request parameter value upload                                                           |
| TR   | Time read - send back current time and temperature                                       |
| TS   | Set time and date                                                                        |
| TT   | Start a test train at the site                                                           |
| WR   | Weather read - send back current weather                                                 |

## H.6 Unsupported Message Types from Union Pacific

The SmartScanIS doesn't support all two-byte message types in the Central Reporting System. Some are manufacturer-specific, while others don't apply to the SmartScanIS. Thus, the SmartScanIS doesn't respond to the following message types received from the host computer.

| Type | Function                                                           |
|------|--------------------------------------------------------------------|
| HW   | High-Wide measurement alarm                                        |
| MR   | Memory read                                                        |
| PR   | Port read                                                          |
| PW   | Port write                                                         |
| RB   | Send the digitized heat information for a specific axle in a train |
| SN   | Set train sequence number                                          |
| SR   | Request current data from the rail stress modules                  |
| TO   | Time-out/Lockup message                                            |
| TT   | Start a test train at the site                                     |

## H.7 Supported Message Types to Union Pacific

The SmartScanIS sends the following two-byte message types to the host computer at the Harriman Dispatch Center:

| Type | Function                                                               |
|------|------------------------------------------------------------------------|
| DL   | List of the defective trains archived at the field                     |
| IP   | Power-up initialization has occurred at the SmartScanIS                |
| SZ   | Parameter value upload response                                        |
| TD   | Time-of-day and air-temperature report                                 |
| TL   | List of trains archived at the site                                    |
| WD   | Wind speed, wind direction, and air temperature                        |
| WM   | Problem with wind indication equipment                                 |
| WX   | High wind limit exceeded                                               |
| XA   | Host command accepted                                                  |
| XR   | Host command rejected                                                  |
| XX   | Self-test compete                                                      |
| ZA   | Start-of-train message                                                 |
| ZB   | Axle interval and heat data                                            |
| ZC   | Wheel heat data for up to 40 axles of a train (sent after ZB message)  |
| ZD   | Dragging-equipment alarm                                               |
| ZE   | Digitized heat information (sent in response to the RB message)        |
| ZH   | Hot bearing detected                                                   |
| ZU   | End-of-train message                                                   |
| ZW   | Wheel temperature is outside the preset high or low temperature limits |
| ZX   | Auxiliary alarms                                                       |
| ZZ   | Final message (all train data sent)                                    |

## H.8 Modification of Talker Mode

If a SmartScanIS, which is in Poll/Standalone mode, doesn't receive a valid poll for five minutes, Talker Mode changes to talk-freely mode. (In this mode, the system makes announcements even when defects aren't detected.) No change occurs when the system already operates in talk-freely mode. The next time a valid poll is received, Talker Mode reverts to the mode that was active before it was changed.

While in Poll/Standalone mode, changing to talk-freely mode also occurs when a ZA or ZU message, sent by the SmartScanIS to the Harriman Dispatch Center, isn't acknowledged after five transmissions. When message acknowledgments are restored, Talker Mode reverts to the mode that was active before it was changed. If a message non-acknowledgment is followed by five minutes of no valid polls, both the acknowledgment failure and the five-minute timeout must be resolved before Talker Mode reverts to the mode that was active before it was changed to talk-freely mode.



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