EUD-2012032-00

SmartScanNG

Generic User's Guide for Export Systems in Northern Hemisphere

1 February 2012

NOTICE

This is a generic guide. And, as such, contains information of a general nature. No one user has all the hardware components described in this guide. Nor does any one user have the exact same firmware that is described herein.

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, and maintaining the SmartScanNG system. Failure to do so could result in damage to the equipment or serious injury to you.

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Contents

This section lists the headings of this guide in sequential order with their page references.

Chapter 1
Introduction

This chapter summarizes the purpose of this guide, describes the SmartScanNG 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.

1.1 Purpose of This Guide

The technical staff at Southern Technologies Corporation (STC) created the SmartScanNG system. This guide describes that system.

The SmartScanNG system 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 SmartScanNG system 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 SmartScanNG system differ from railroad to railroad.

This is a generic guide. And, as such, contains information of a general nature. No one user has all the hardware components described in this guide. Nor does any one user have the exact same firmware that is described herein.

There are three SmartScanNG generic guides. One is for domestic systems installed in the USA. Another is for export systems installed in the southern hemisphere. <u>This guide</u> is for those who purchase, install, maintain, troubleshoot, manage, or use the generic <u>export</u> <u>system</u> (that is, a non-USA installed system) in the <u>northern</u> <u>hemisphere</u>.

Your menus and submenus may not match those shown in this guide. Some of the options shown may not appear on your menus and submenus. For example, Event Log doesn't appear on everybody's Main menu. Also, some options that appear on your menus and submenus may not apply to your system. For example, if you don't have an AEI subsystem attached to your SmartScanNG, the AEI option on the Equipment menu would not be applicable.

Because the shown menus and submenus may be different from what appears on your system, the letter that is associated with an option may be different from what appears on your system. So, where there is a difference, type the letter of the desired option as it appears on your menus and submenus.

1.2 SmartScanNG

The SmartScanNG system 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
- Exit speed of the train

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

When the SmartScanNG system 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 location of the reporting SmartScanNG system, 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.

There are three types of messages. Real-time messages are announced as the train is passing 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 SmartScanNG system. Arrival messages are announced as the train enters the site. However, this type of message isn't available on all systems. On those systems it is available on, it's optional. The content and use of these three message types are railroad specific. By using the **Primary Language option** on the Messages menu, you can specify if you want the messages announced in English, French, or Spanish.

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.

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 SmartScanNG system. 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 dispersion of casing fragments and corrosive liquid electrolyte. So, carefully follow manufacturer's instructions. Keep all sources of gas ignition away from the batteries and do <u>not</u> allow metallic articles to contact the negative and positive terminals of a battery at the same time.

Do <u>not</u> install any tower, pole, mast, or antenna on a wet or windy day. Do <u>not</u> 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 <u>not</u> 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

We want to hear from you. Tell us what you like or don't like about this guide. Send your comments to:

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

All comments become the sole property of STC and none will be returned.

1.6 How to Order More Copies of This Guide

When placing an order for more copies of this guide, refer to the order number shown on the cover of this guide. To request pricing and delivery, call 423-892-3029, fax 423-499-0045, or send email to stcemail@southern-tech.com. Electronic copies of this guide are also available.

1.7 Standard Warranty

Systems manufactured by Southern Technologies Corporation carry a 14-month warranty from 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 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 ***5.6 - 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 ***15.2 - 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
- Deflectors
- Auxiliary-alarm detectors
- Track Circuits
- AEI Antennas

This chapter describes most of these components. ***Chapter 6 - Installing Track Components*** tells how to install scanners, transducers, deflectors, 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 SmartScanNG system 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 **type2** wheel scanner cover, the **type2** bearing scanner and **type2** wheel scanner covers and modules are identical and can be used interchangeably. Except for different aluminum **filter frames** within the **type3** scanner module, the **type3** bearing scanner and **type3** 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 mean that fewer spare parts need to be kept on hand.

Within each scanner is a pyrometer that measures 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 SmartScanNG enclosure. It then passes through the System-Interconnect board to the 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 (DSR) algorithms.

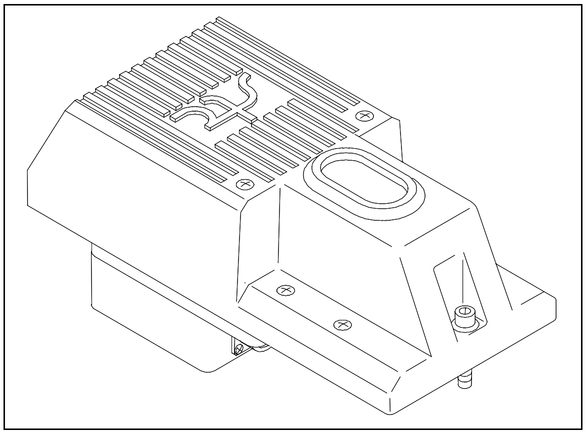
The Dynamic Scan Rate algorithms assure collection of samples every 1/2 inch (1.27 centimeters) of axle travel regardless of train speed. The heat signal waveform is always sampled 48 times between the gating transducers. It makes no difference what speed the train is going, as long as it is traveling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

A benefit to using these algorithms is the creation of a passive 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 passive filter for undesirable noise induced signals. In other words, use of these algorithms contributes to better detection of alarm conditions with fewer false readings.

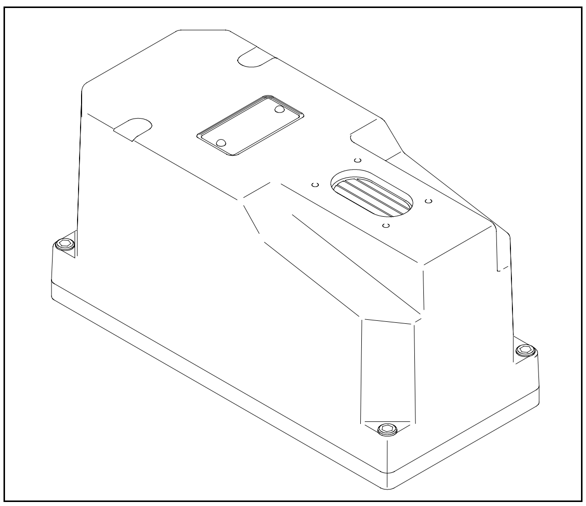
To avoid errant heat readings caused by moisture on the pyrometer lenses, the scanners have heaters built into them. The heaters are made active, for varying periods of time, when the ambient temperature is 80°F (26.7°C) or less.

2.1.1 Bearing Scanners

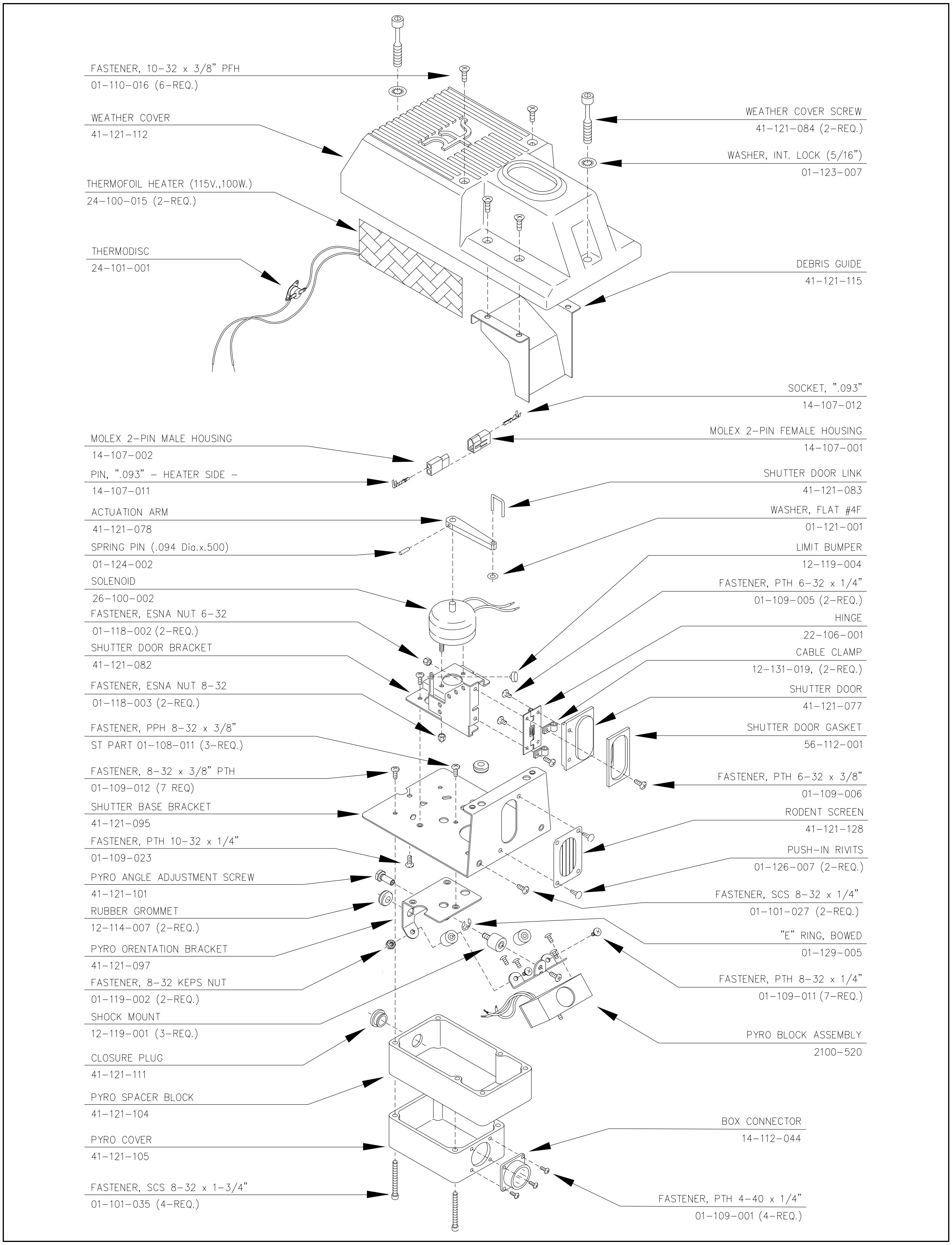
The figure below shows an assembled **type2** bearing scanner cover and module.



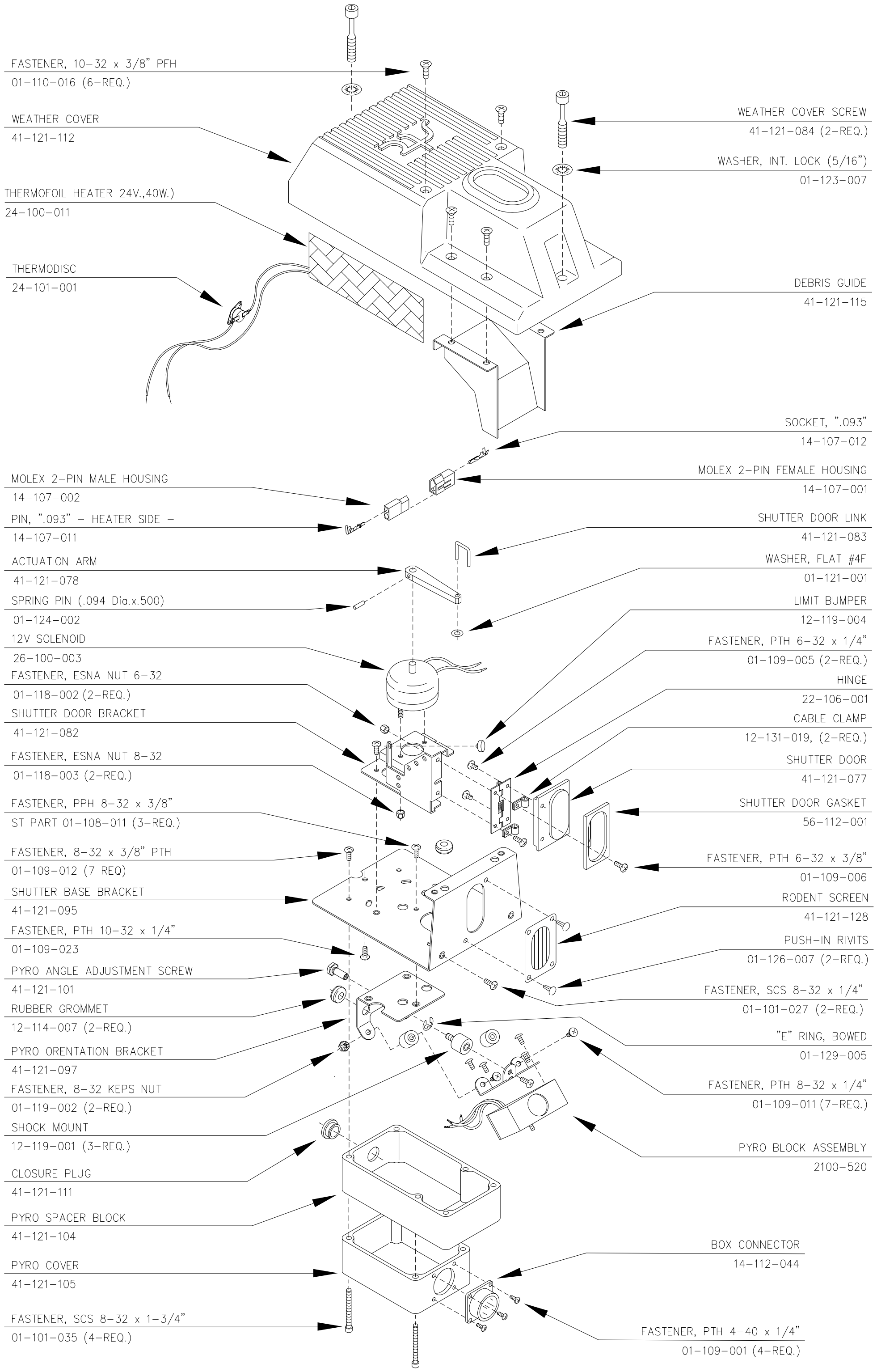
The figure below shows an assembled **type3** bearing scanner cover and module.



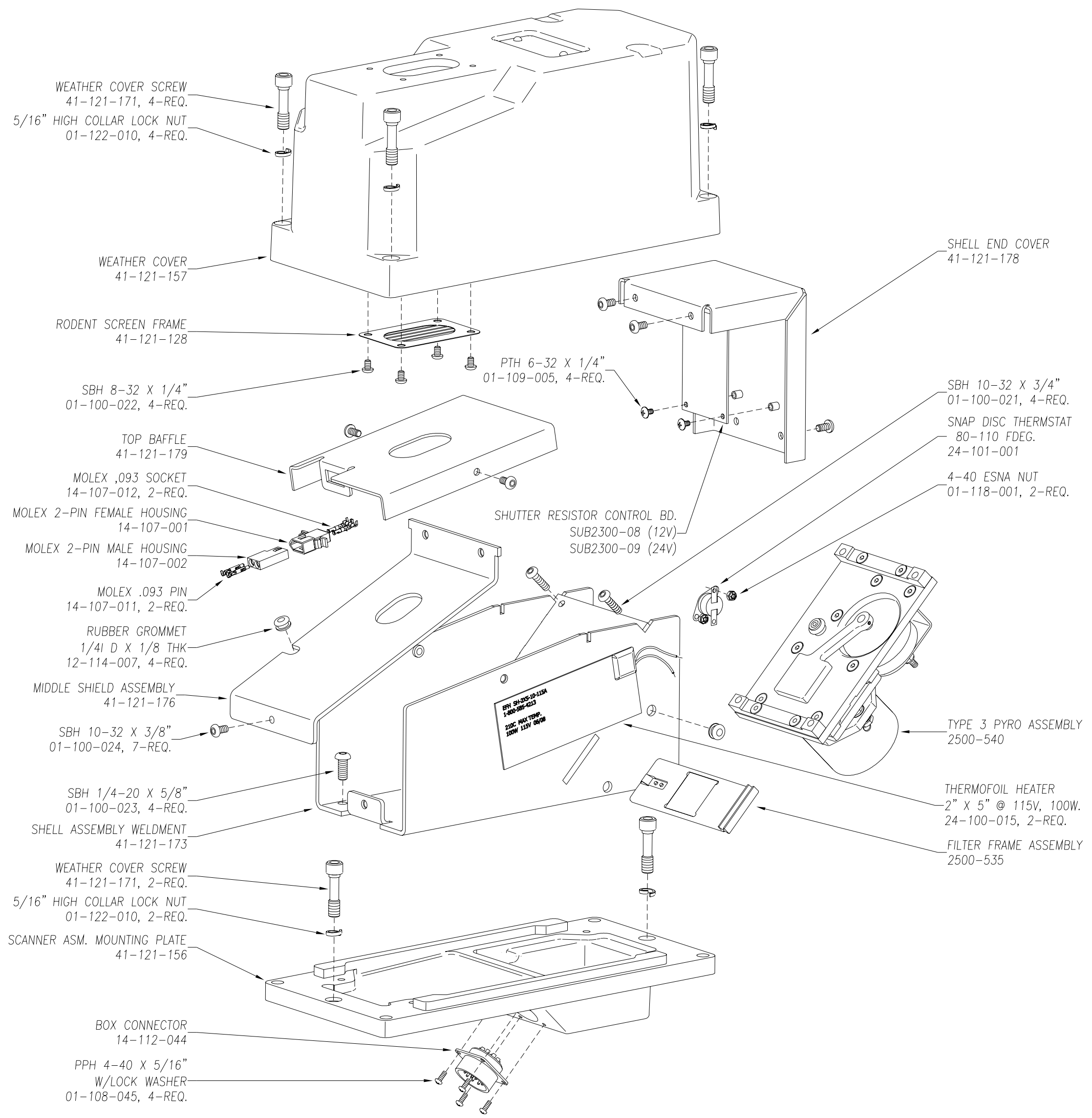
For a site that has a 120-volt 60 Hz power source, the figure below shows the parts of a **type2** bearing scanner cover-and-module assembly (2100-512**AC**).



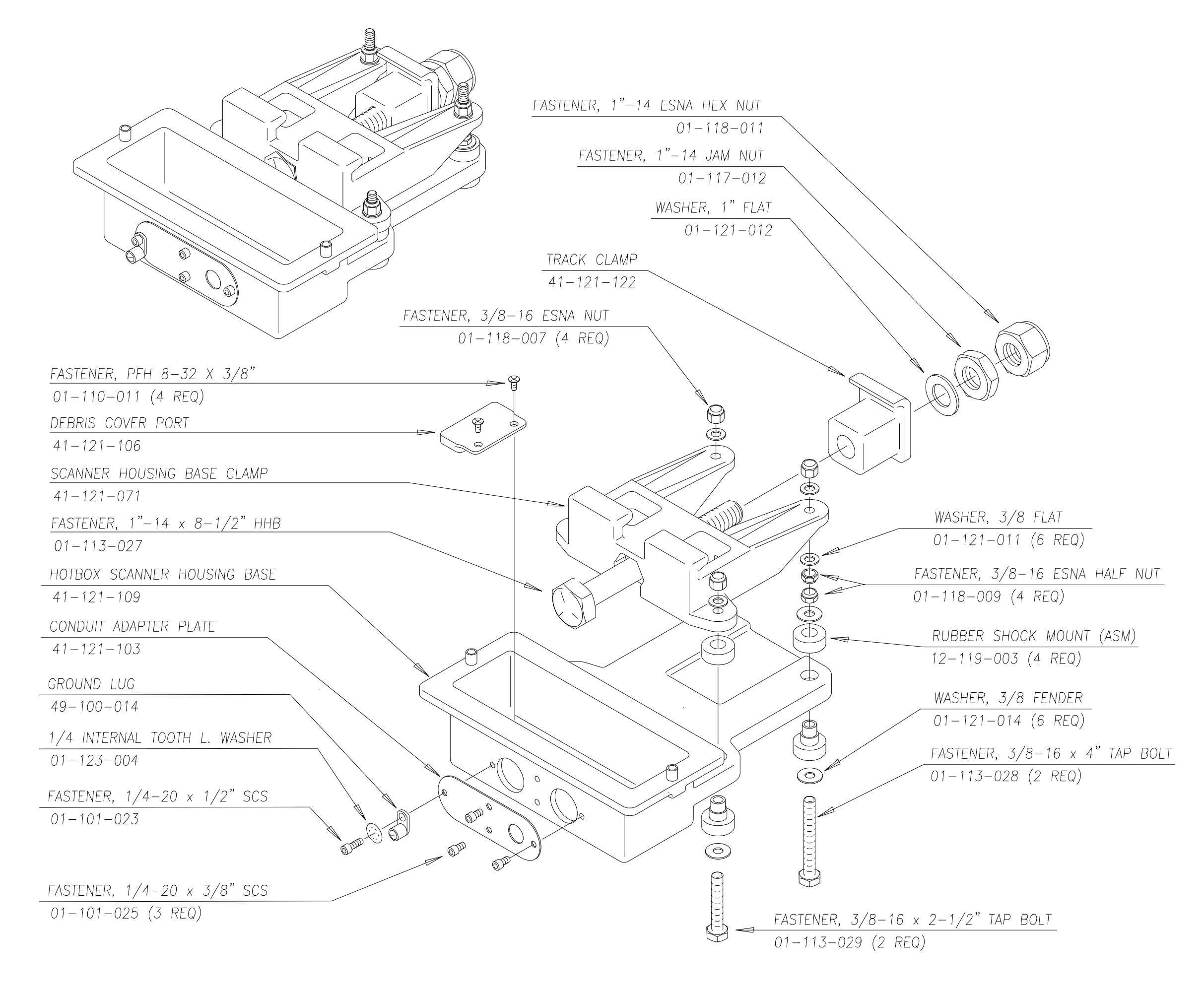
For a site that doesn't have a 120-volt 60 Hz power source, the figure below shows the parts of a **type2** bearing scanner cover-and-module assembly (2100-512**DC**).



The figure below shows the parts of a **<u>type3</u>** bearing scanner cover-and-module assembly (2500-512**AC**). The **<u>type3</u>** bearing scanner uses a **black filter frame**, which is shipped from the factory with it installed.



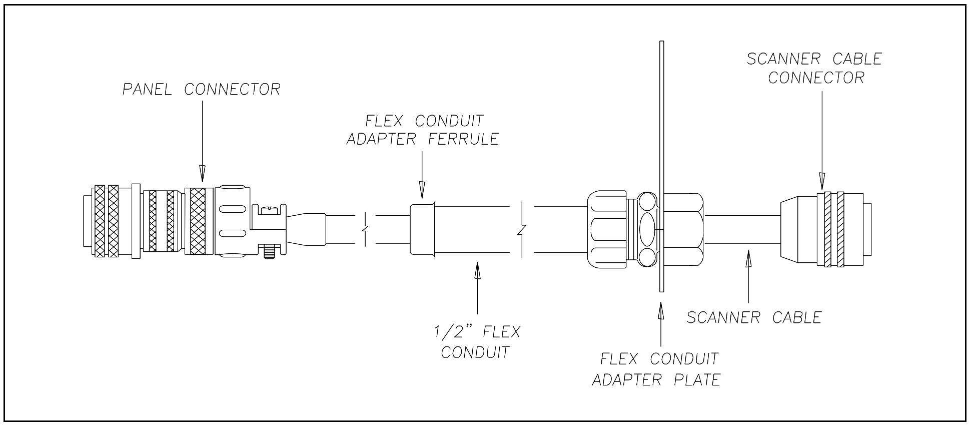
The figures below show a **type2/type3** bearing scanner mount (2100-501).



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 SmartScanNG enclosure.

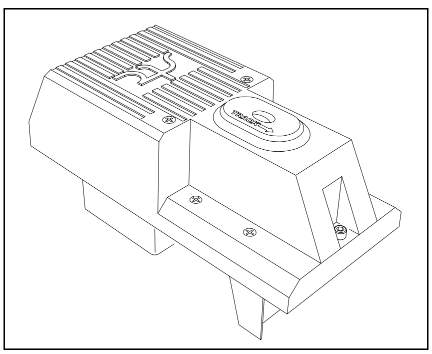
Single-track sites use two 65-foot (19.8-meter) bearing scanner cables. **Double-track sites** use two 65-foot bearing scanner cables for the track closest to the wayside enclosure (aka bungalow) and two 100-foot (30.5-meter) bearing scanner cables for the track farthest from the wayside enclosure.

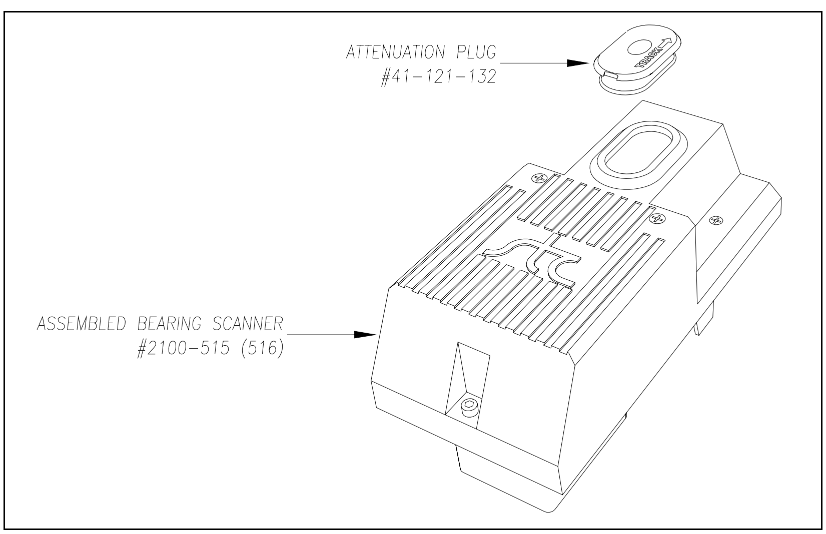
The figure below shows a bearing scanner cable. The part number for the 65-foot (19.8-meter) bearing scanner cable is 2058-260PM. For the 100-foot (30.5-meter) cable, it's 2058-265PM.



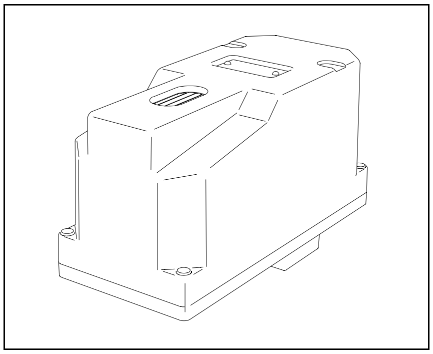
2.1.2 Wheel Scanners

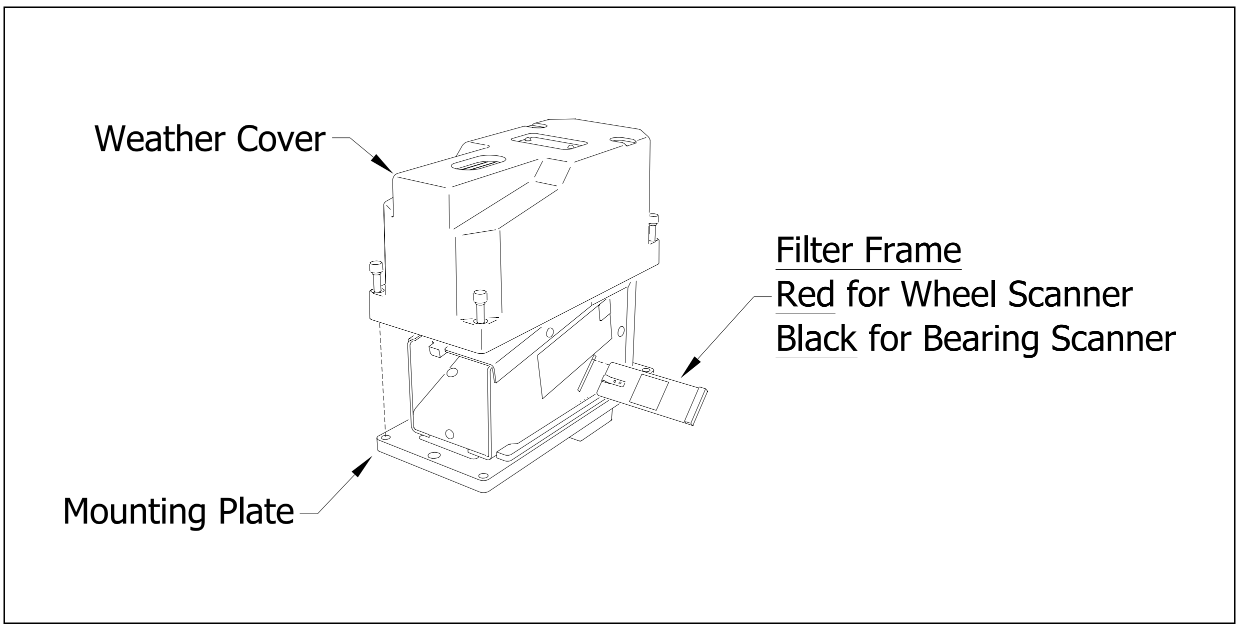
The figure below shows a **type2** wheel scanner cover-and-module assembly. The only difference between the **type2** wheel scanner cover-and-module assembly and the one for the **type2** bearing scanner is the addition of the plastic attenuation plug.



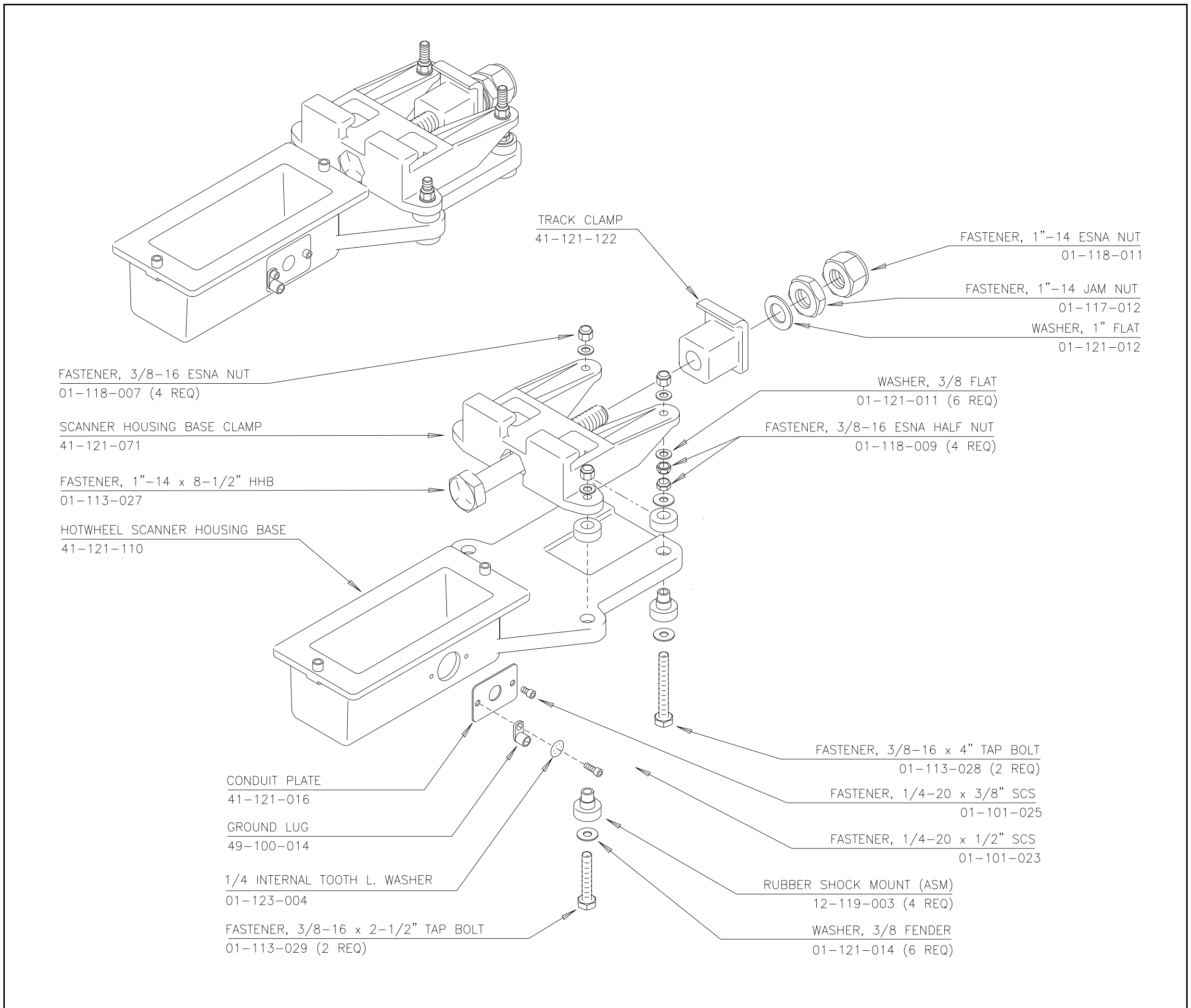


The figure below shows a **type3** wheel scanner cover-and-module assembly. The only difference between the **type3** wheel scanner cover-and-module assembly and the one for the **type3** bearing scanner is a change of filter frames. The **type3** wheel scanner uses a **red filter frame**. However, **type3** wheel scanners are shipped from the factory with black filter frames installed.

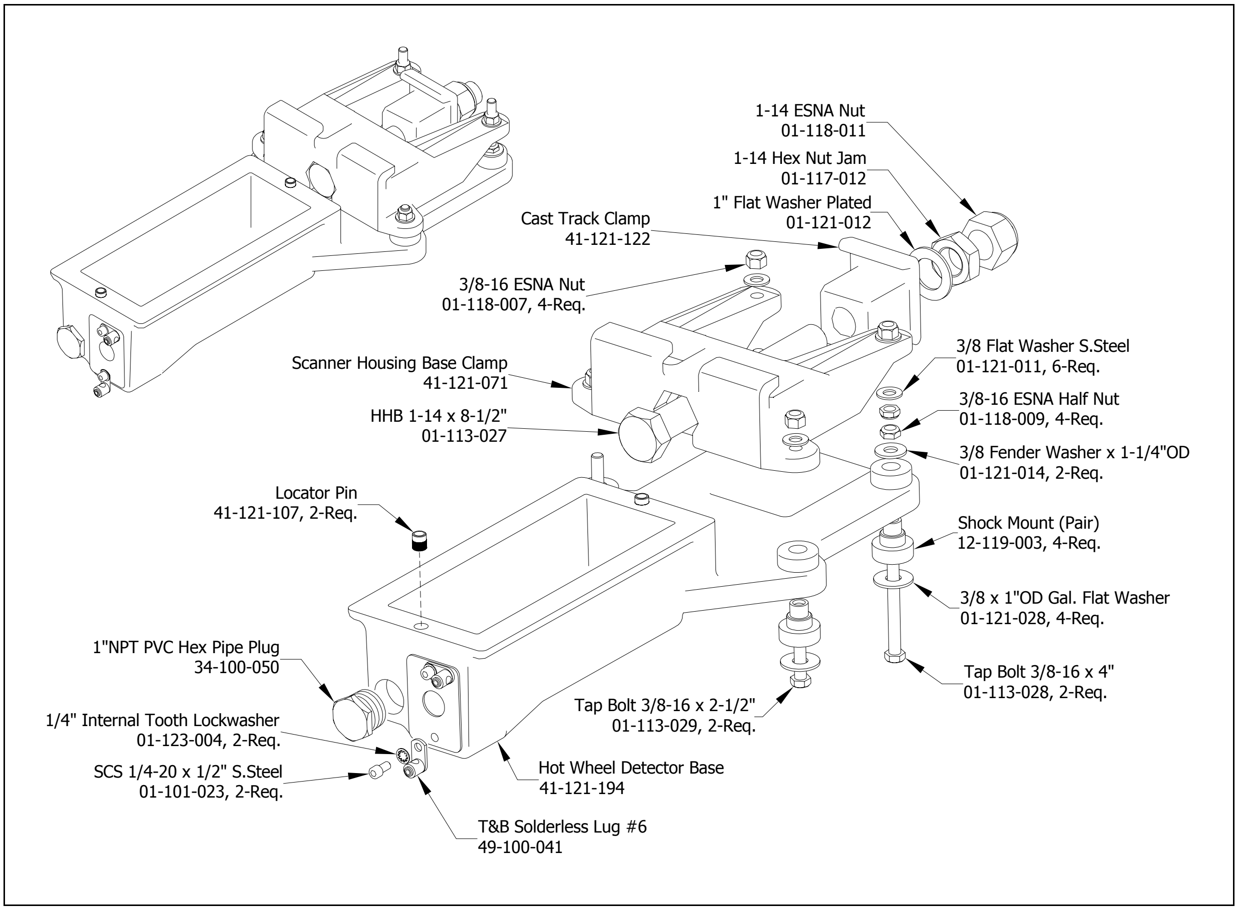




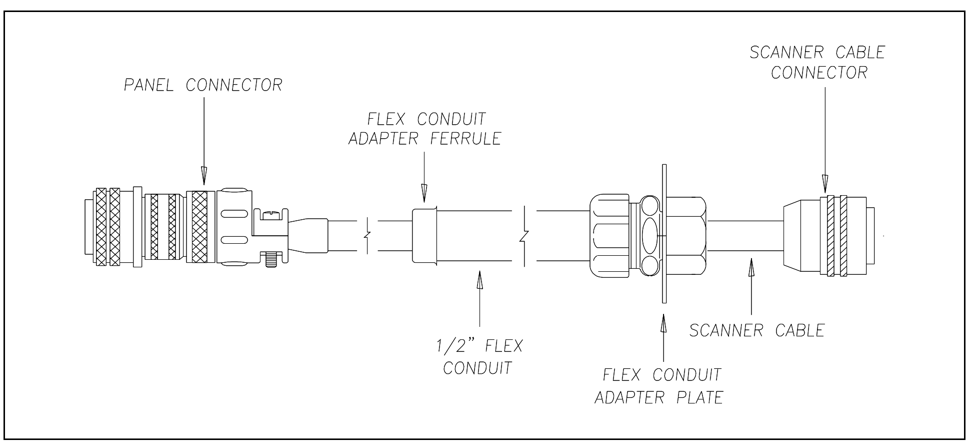
The figure below shows a **type2** wheel scanner mount (2100-701). Though not recommended, this mount can also be used for **type3** wheel scanners. However, this guide does not cover the use of this mount for **type3** wheel scanners.



The figure below shows a **type3** 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 100-foot (30.5-meter) cable, it's 2058-265HW.)



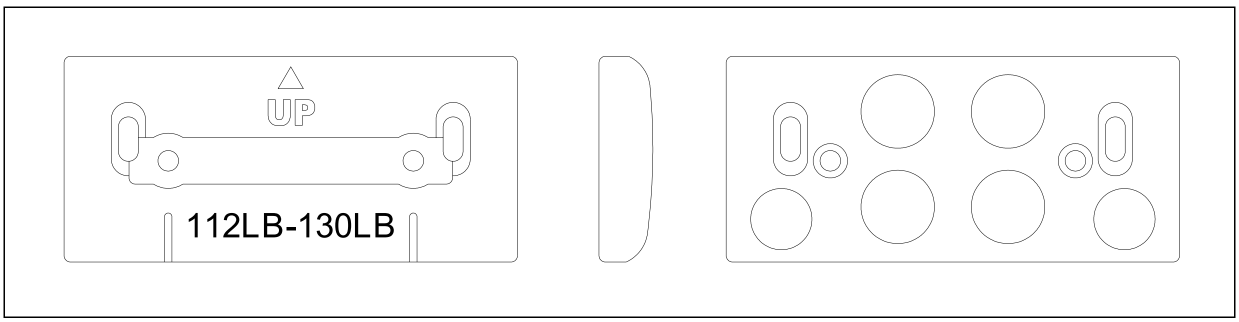
2.2 Transducers

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

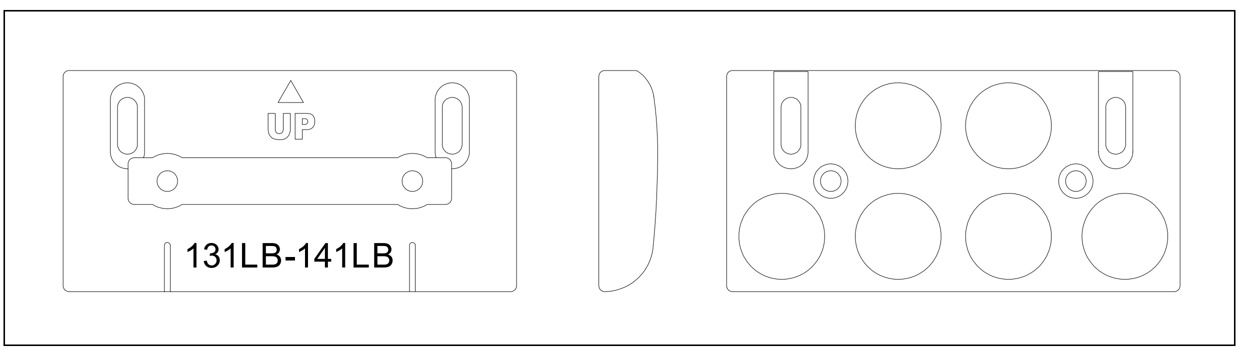
- Detect a train's presence
- Coordinate gating
- Determine a train's direction
- Calculate a train's exit speed
- Calculate a train's length
- Identify individual railcars and locomotives based on axle spacing patterns

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.

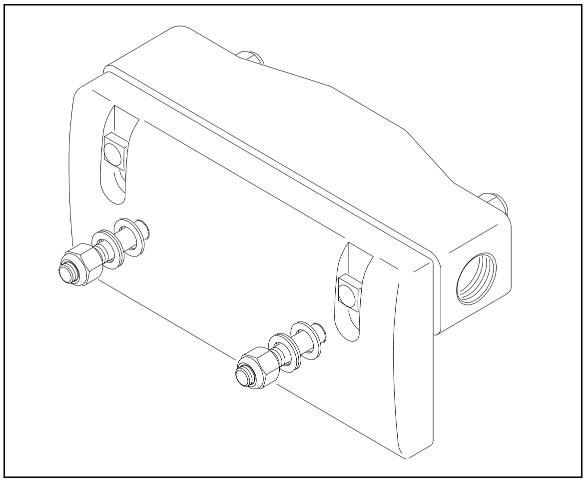
If your rail size were 112 to 130 pounds per yard (55.6 to 64.5 kilograms per meter), you would use the <u>smaller</u> mounting plate (2100-554) that looks like this.



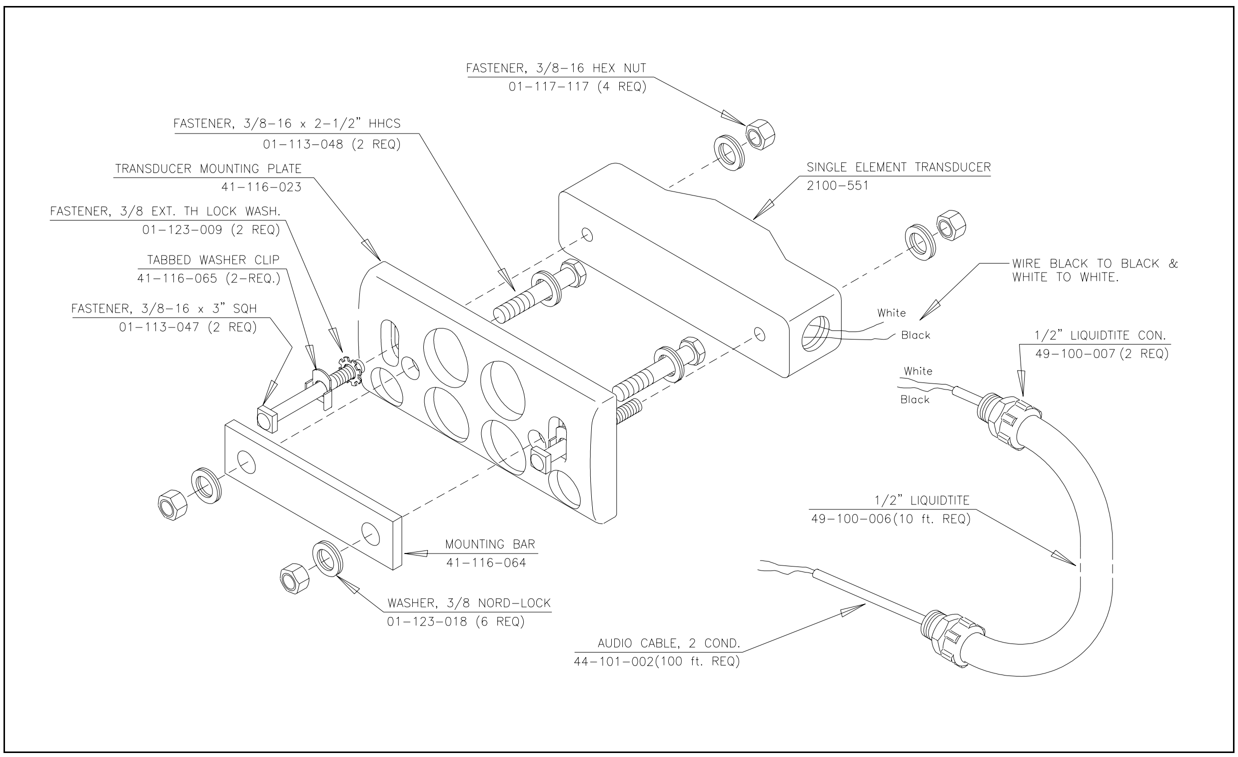
If your rail size were 131 to 141 pounds per yard (65.0 to 69.9 kilograms per meter), you would use the <u>larger</u> mounting plate (2100-552) that looks like this.



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**.

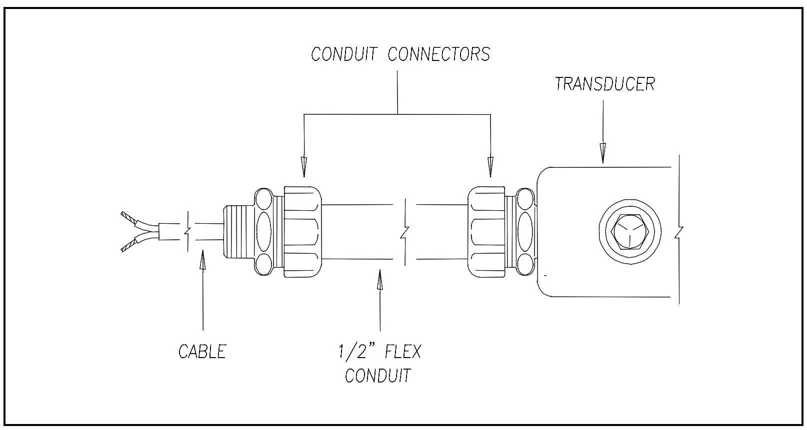


STC transducers consist of a horseshoe magnet with a tightly wound coil, encapsulated in a rigid epoxy potting compound. Each transducer is mounted 1-9/16 inches (3.97 centimeters) below the top of the rail. As the wheels of a railcar pass over the transducer, the wheel flange disturbs the flux field 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 SmartScanNG system 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. Instead of two advance transducers, train presence can be ascertained by using a track circuit.

All tracks use two rail-mounted gating transducers. On the rail nearest the 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 (labeled **ADV1** and **ADV2**). On the rail nearest the wayside enclosure, the two advance transducers 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.

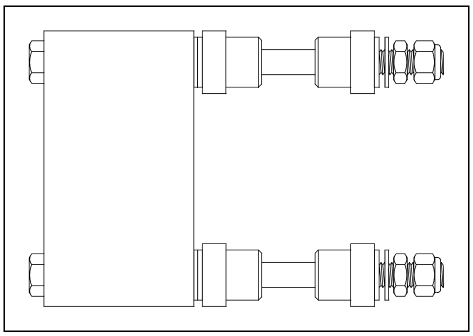
The figure below shows a transducer cable.

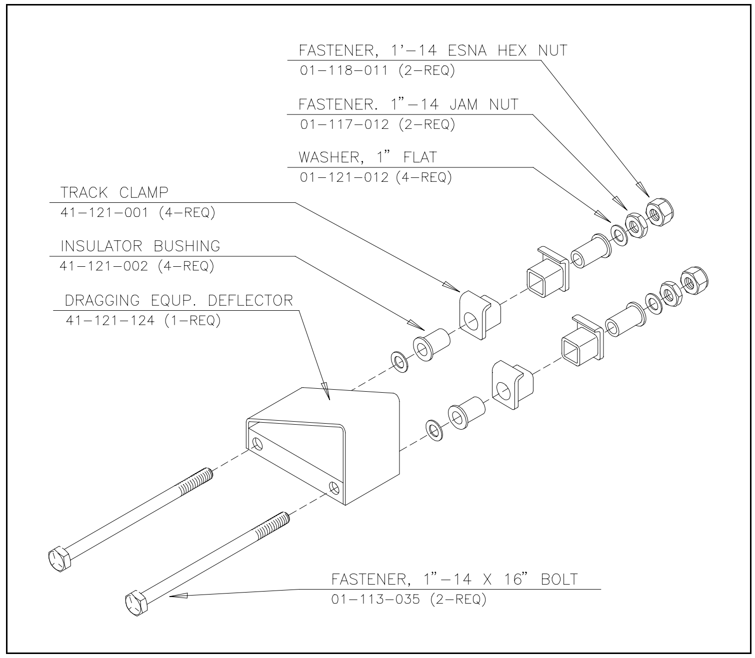


One end of the transducer cable comes attached to the transducer. The other end has two wires protruding from the conduit. These wires are black and white. They attach to a surge protector located on the surge-protection panel. There is one surge protector assigned to transducer TO1 and another to transducer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

2.3 Deflectors

Deflectors protect the scanners from being hit by dragging equipment. The figures below show a deflector.





2.4 Auxiliary-Alarm Detectors

The standard SmartScanNG system 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 SmartScanNG system 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.

2.5 Track Circuit

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

The track circuit combined with the SOTC board (described in ***Chapter 4 – Wayside Enclosure Components***) make up the presence subsystem. The track circuit is nothing more than two wires attached to the rails. One wire is attached to each rail. When the SOTC board senses a track shunt, it signals the SmartScanNG system that a train is present. The shunting zone is adjustable up to 150 feet (45.7 meters) on each side of the attached track-circuit wires.

The track circuit wires are attached to each rail directly opposite from the 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 by railroads. 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 three-terminal arrester mounted below the SmartScanNG 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.

2.6 AEI Antennas

Not all SmartScanNG systems use the AEI subsystem. If your SmartScanNG system does, the AEI subsystem consists of the AEI antennas, which are described below, and the AEI Interface module, which is described in ***Chapter 4 – Wayside Enclosure Components***.

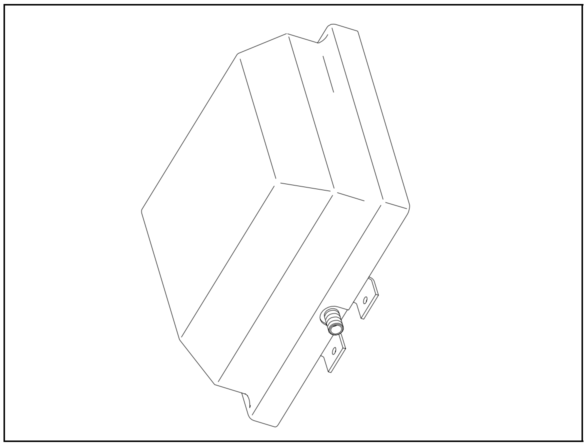
The SmartScanNG system supports two types of antennas.

- Sinclair SRL470 antennas
- Scala HP9-915 Parapanel antennas

These antennas are described below.

2.6.1 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.



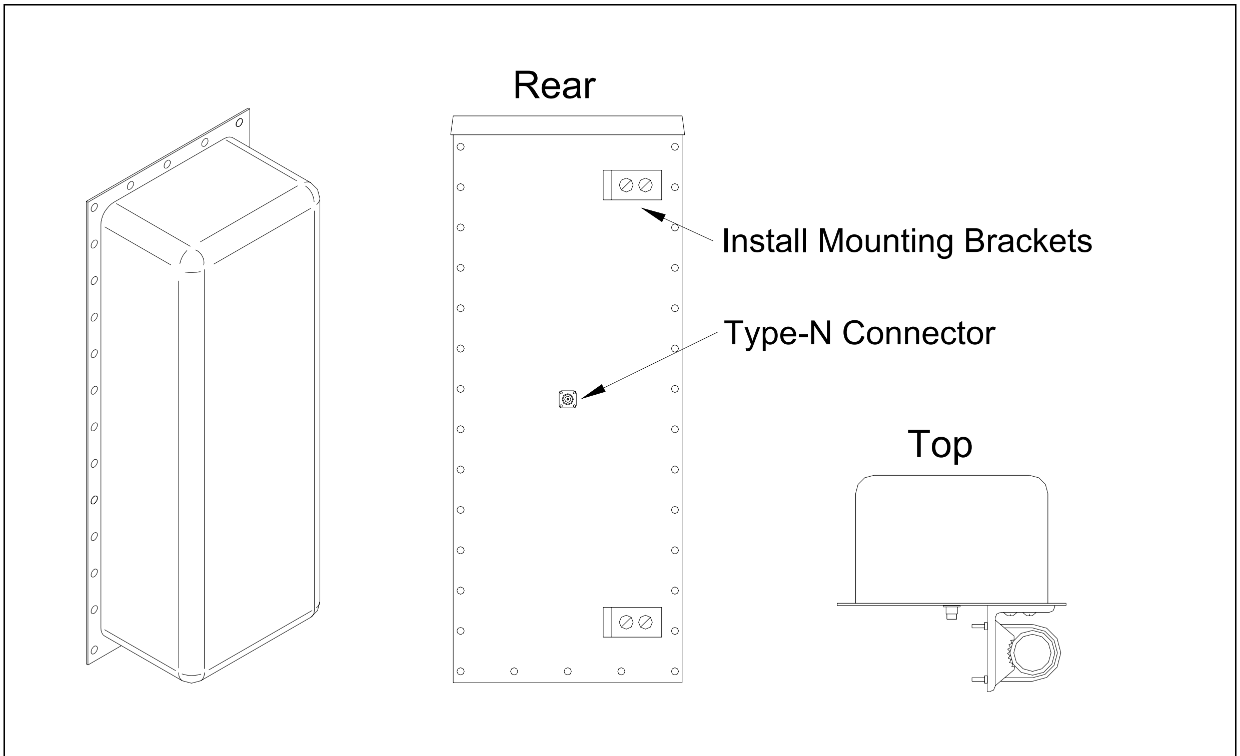
In reference to the track, **antenna0** is the northmost or eastmost antenna. **Antenna1** is the southmost or westmost antenna.

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 transducers
- Opposite each other

2.6.2 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, **antenna0** is the northmost or eastmost antenna. **Antenna1** is the southmost or westmost antenna.

Each HP9-915 antenna is installed:

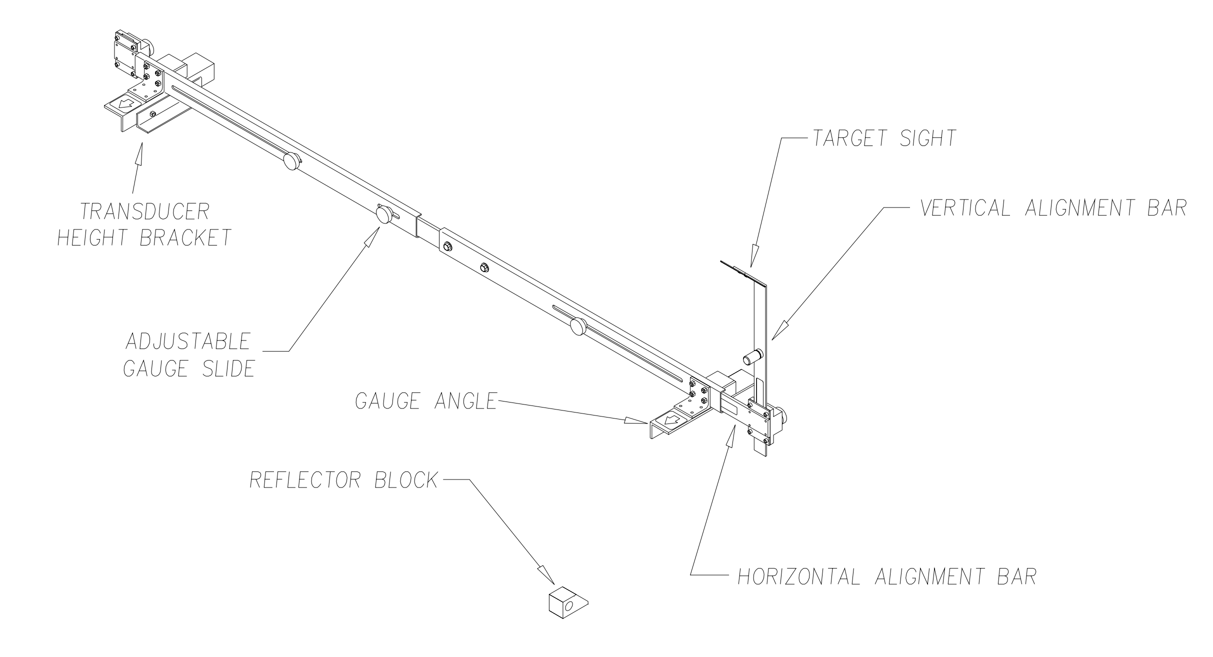
- Vertically with its face parallel to the rails
- 10 feet (3 meters) from the center of the track
- 3.5 feet (1.1 meters) above the top of the rails
- Centered between the transducers
- Opposite each other

Chapter 3
Adjustment Components

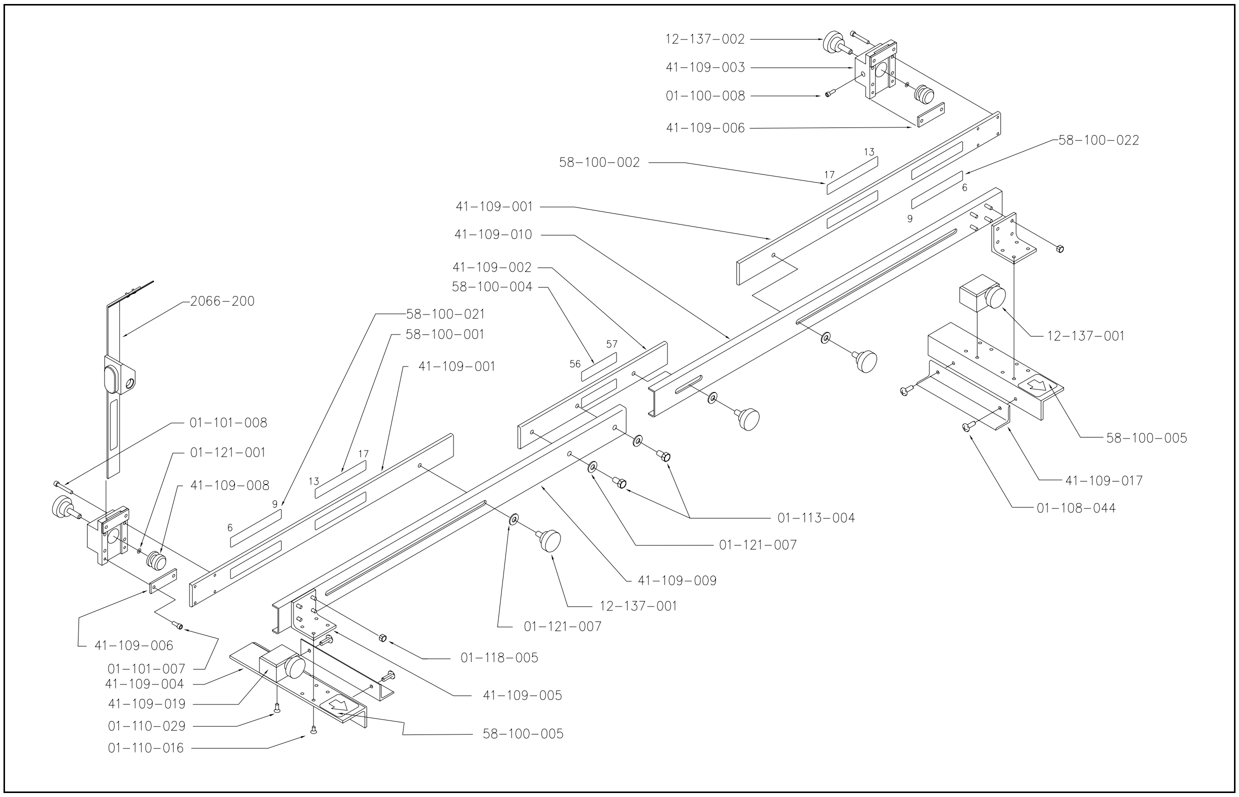
This chapter describes the components that are used during the adjustment process. Covered are the alignment fixture and the calibrated heat source. STC supplies one of each for each SmartScanNG site. ***Chapter 7 - Aligning Scanners*** and ***Chapter 9 - Placing a System into Service*** tell how to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

3.1 Alignment Fixture (2066-000)

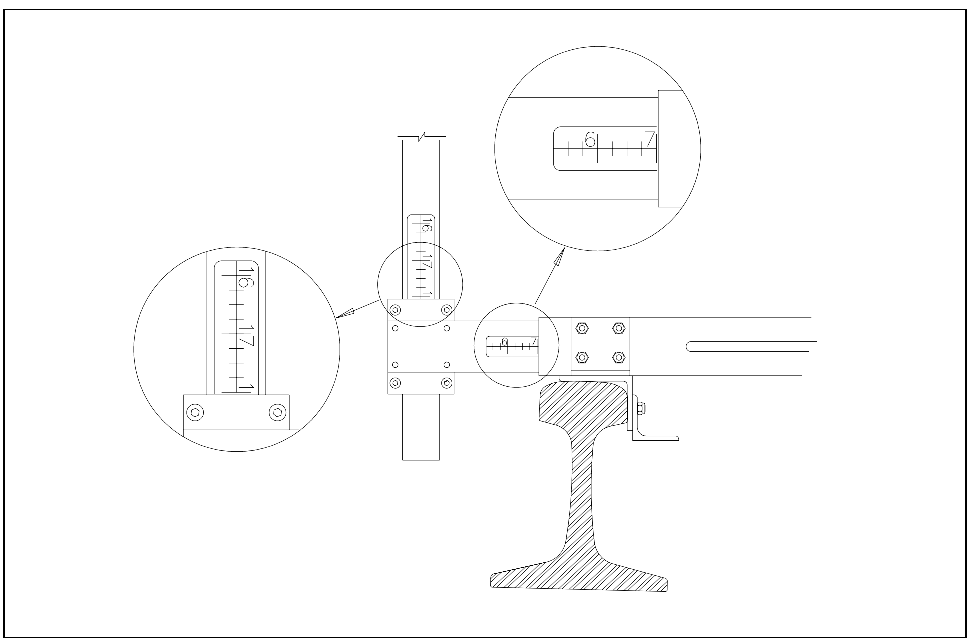
The figure below shows an assembled alignment fixture (2066-000).



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

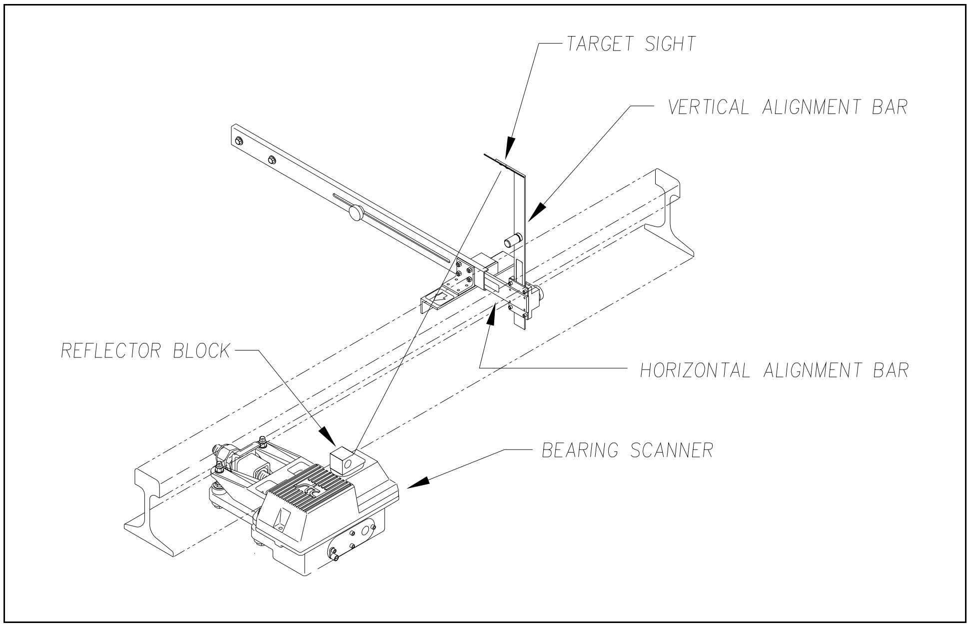


The alignment fixture is used to ensure that all scanners are aimed at the proper point above the rail. Each axis of the fixture is equipped with graduated scales that give indications relative to the top of the rail and the gauge.

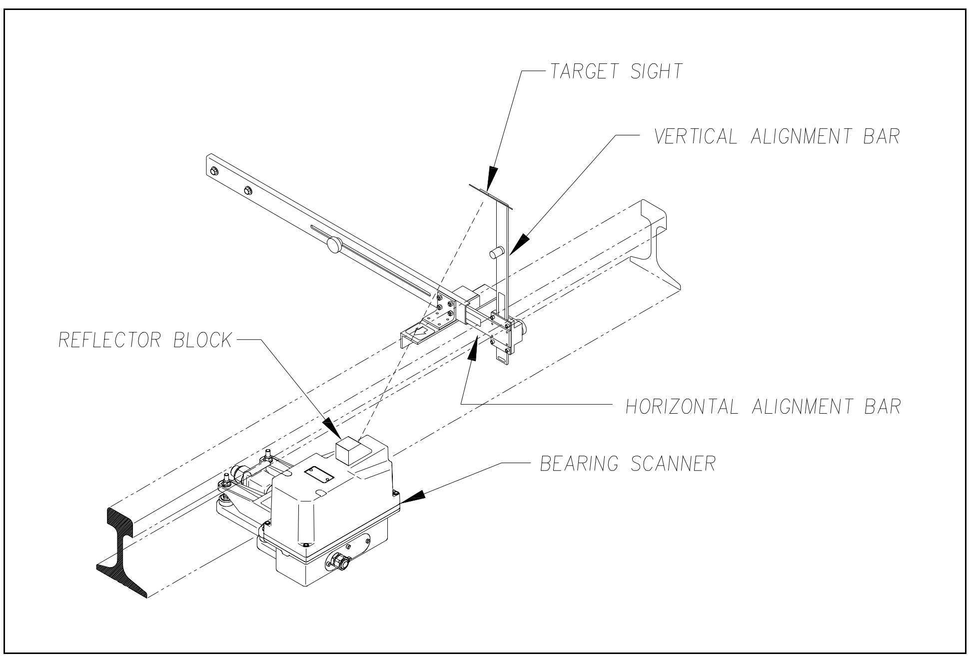


The fixture is used differently for bearing scanners and for wheel scanners. To align **type2/type3** bearing scanners, you use the optical system of the fixture. The key parts of this optical system are the target sight and the reflector block.

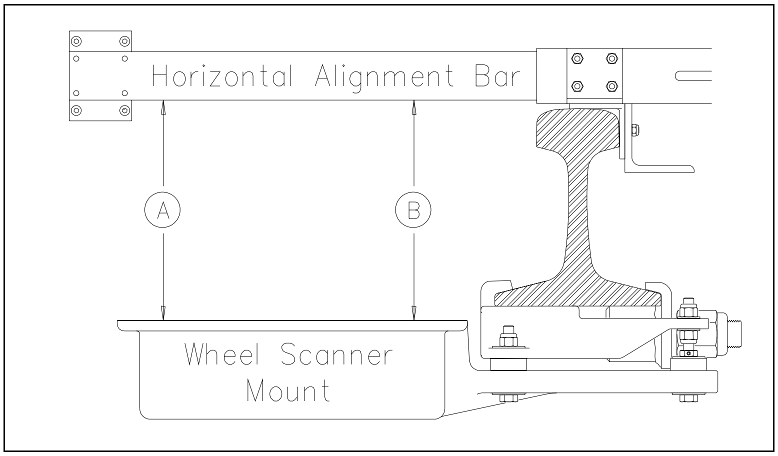
Shown below is alignment of a **type2** bearing scanner.



Shown below is alignment of a **type3** bearing scanner.

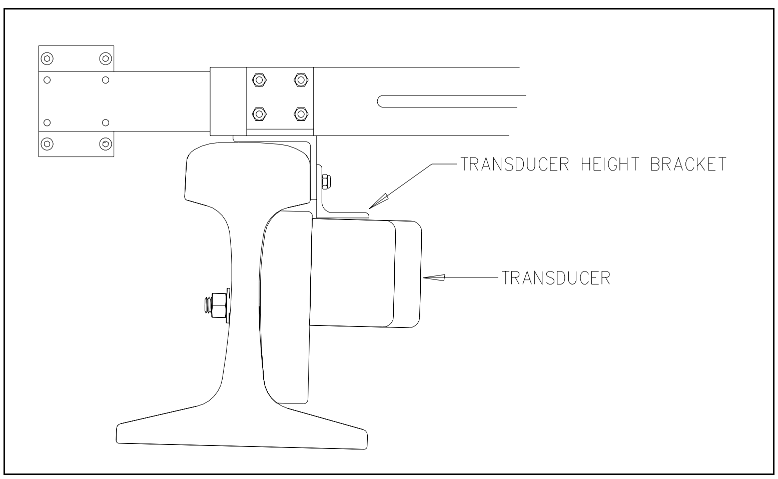


To align **type2/type3** wheel scanners, you use the horizontal alignment bar of the fixture. Alignment is done by measuring from the bottom of the extended bar to the top of both ends of the scanner mount. When both measurements are the same, alignment is correct. That is, as shown below, when distance **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 Calibrated Heat Source (2100-810NG)

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-foot (15-meter) 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.

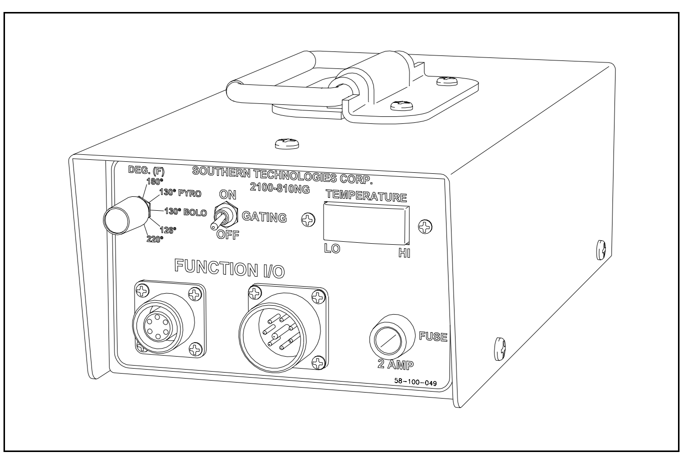
On the front of the calibrated heat source is a knob that lets you select one of five delta temperatures, ranging from 126°F to 220°F. The heat source contains a heat block that can reach a combined temperature of your delta temperature and the ambient temperature. It can maintain this temperature for 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.

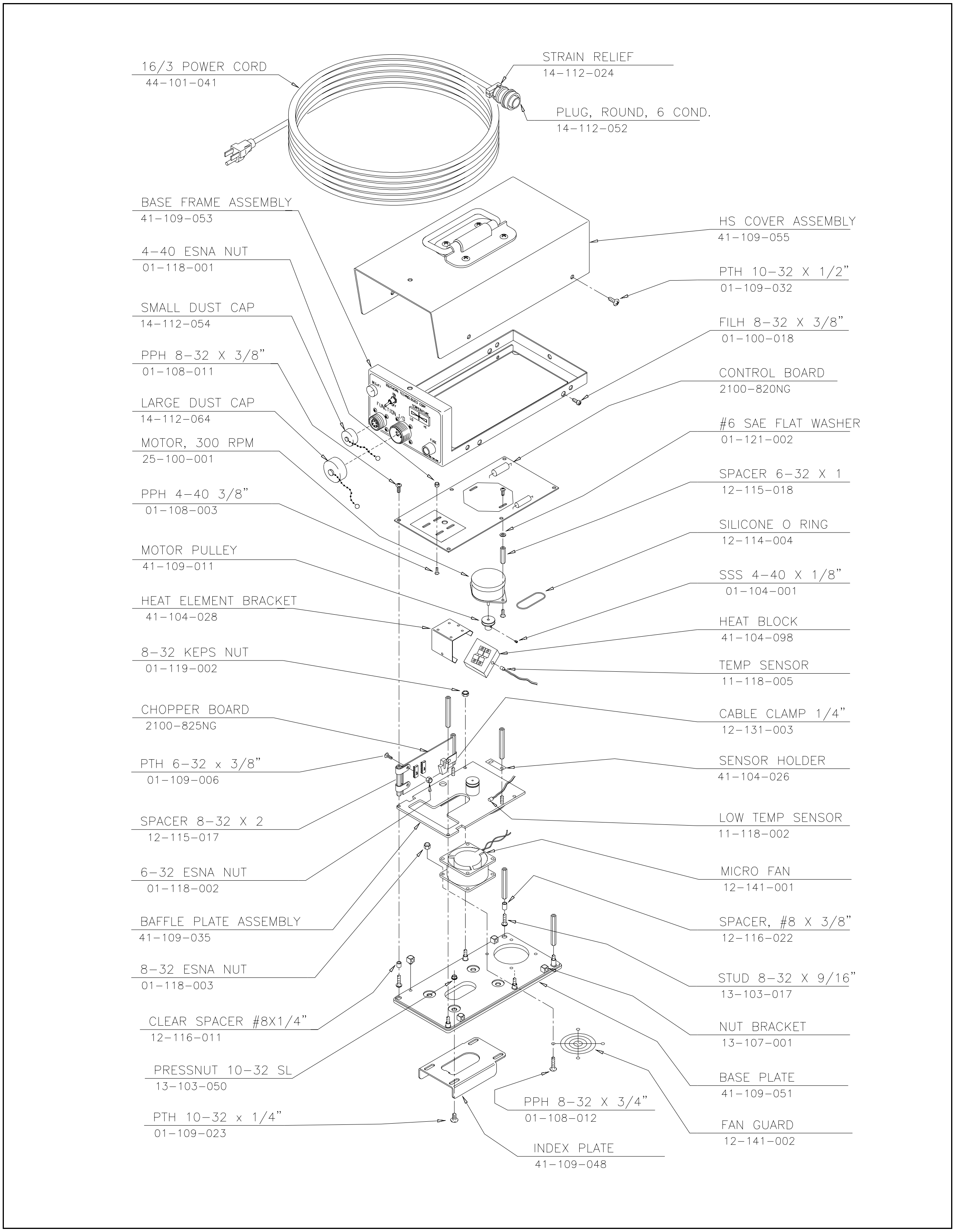
The calibrated heat source is placed over the opening of the scanner cover. With the heat source in place, it is then possible to calibrate the system at a precise value <u>above</u> ambient temperature.

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 set point, the heat source isn't operating properly.

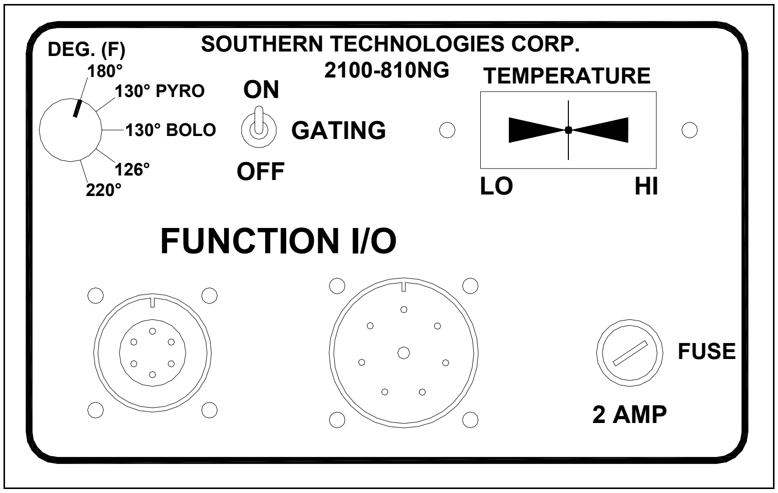
The figure below shows an assembled calibrated heat source (2100-810NG).



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 A-transducer) signal. The second signal sent is a simulated TO2 (aka B-transducer) 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 SmartScanNG system. The **Gating** switch may be left in the off position.

3.2.3 Temperature Meter

The temperature meter shows when heat block has reached the selected temperature setting and has stabilized within ± 2 degrees of set point. 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 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
Wayside Enclosure Components

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

Attached to the <u>inside</u> of most wayside enclosures is:

- One SmartScanNG enclosure per track
- One power subsystem per SmartScanNG enclosure

Attached to the <u>outside</u> of most wayside enclosures is:

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

This chapter describes these components. ***Chapter 8 - Installing Wayside Enclosure Components*** tells how to install them.

4.1 SmartScanNG Enclosure

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

As a minimum, most SmartScanNG enclosures contain:

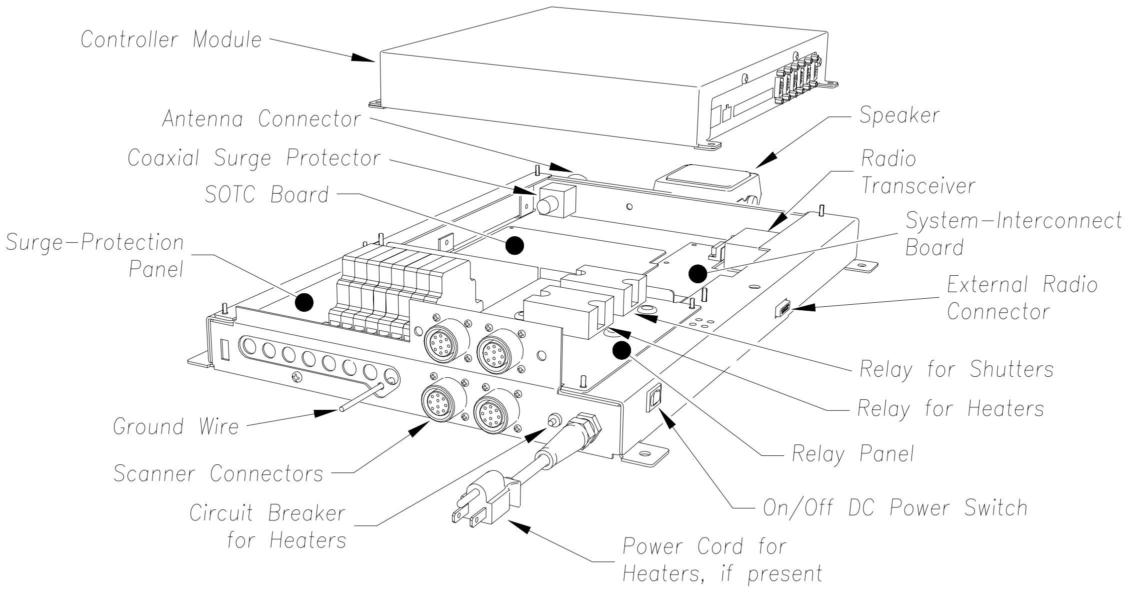
- System-Interconnect board
- Controller module, containing Processor, Interface, and Modem boards
- Surge-protection panel
- Relay panel

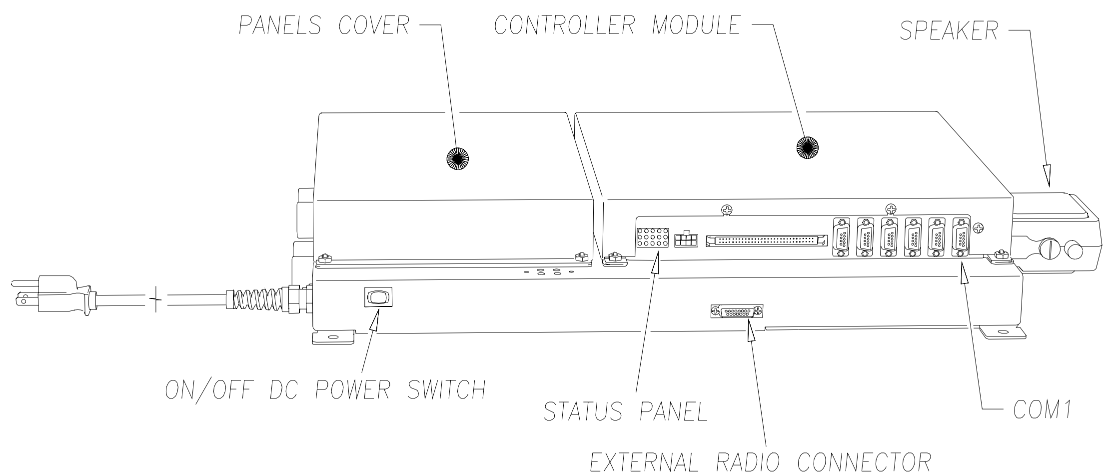
Additionally, most SmartScanNG enclosures usually contain:

- SOTC board (not present if <u>advance</u> <u>transducers</u> are used)
- Radio (aka RF transceiver) (normally an <u>external</u> <u>radio</u> is used)
- Other components

This guide covers all the hardware components listed above, even though your site may not have all of them.

The next two figures show the major parts of the SmartScanNG enclosure.





The power cord at the bottom of the SmartScanNG enclosure is used to power the heaters in the 2100-512**AC** scanner. This cord should be plugged into a grounded three-wire 120-volt outlet. Minimum operating voltage is 110 volts. **Plugging the cord into an outlet of more than 128 volts will severely damage your system.**

If 2100-512**DC** scanners are used, there usually isn't a power cord at the bottom of the enclosure. If one is present, don't plug it into an outlet, because the heaters in these scanners use 12 VDC.

4.1.1 System-Interconnect Board (2300-106)

The System-Interconnect board provides connection points for incoming and outgoing wiring. Most wiring to this board is from the surge-protection panel, which is the entry point for the transducers, auxiliary-alarm detectors, shielded temperature probe, telephone line, and DC power. Other wiring to this board is from the chassis-mounted connectors located on the SmartScanNG enclosure. These connectors are provided for the external speaker, external radio, bearing and wheel scanners, and radio antenna.

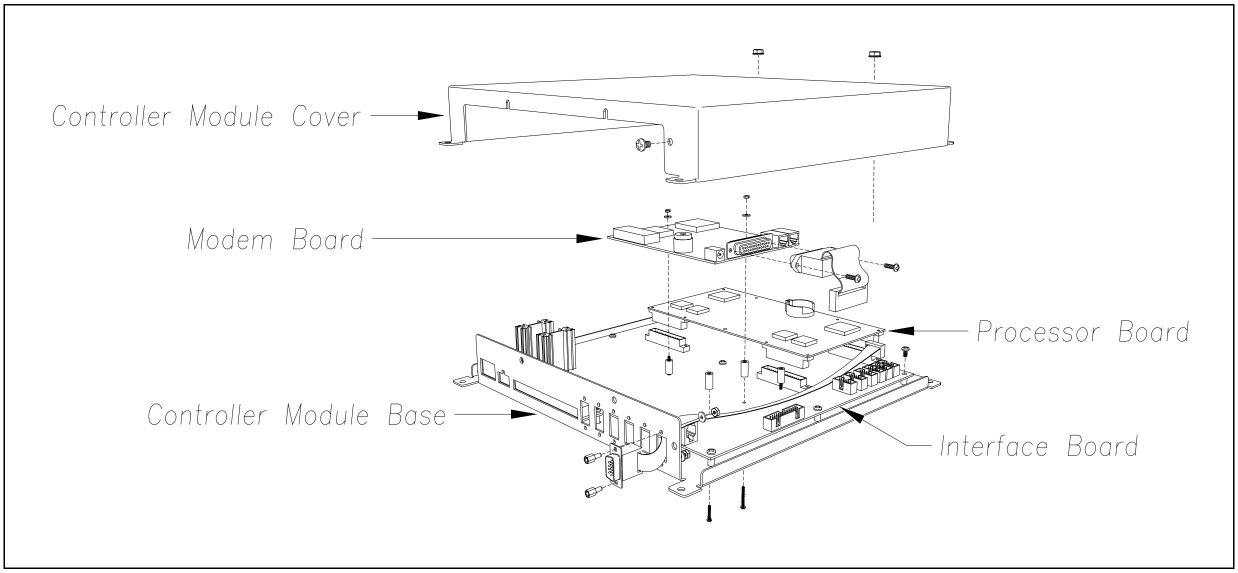
Only a few electronic components are located on the System-Interconnect board. Most of them are associated with power distribution. DC power from the System-Interconnect board is routed to the Interface board, shielded temperature probe, internal radio, SOTC board, and bearing and wheel scanners. Much of the DC power originates from a common source before branching out to various destinations. So, the board fuses each DC branch with a self-restoring fuse. This prevents a malfunction in a single device from bringing down a larger portion of the system. A tripped fuse remains in the tripped state until the overcurrent condition is corrected. There are 10 individually fused 12 VDC branches. Four provide power to the bearing and wheel scanner electronics. Four provide power to the bearing and wheel scanner protective-shutters. One provides power to the optional internal radio. One provides power to the optional SOTC board.

Scanners use three sources of power. The scanner circuitry uses 12 VDC, which is protected by one self-restoring fuse per scanner. The scanner shutters use 12 VDC, which is switched by a single solid-state relay (on the relay panel), protected by one self-restoring fuse per shutter, and indicated with signal activation LEDs. The heaters in the 2100-512**AC** scanners use 120 VAC, which is switched by a single solid-state relay (on the relay panel), protected by a circuit breaker on the bottom of the SmartScanNG enclosure, and indicated with signal activation LEDs. The heaters in the 2100-512**DC** scanners use 12 VDC, which is switched by a single solid-state relay (on the relay panel), protected by one circuit breaker, and indicated with a signal activation LED.

4.1.2 Controller Module (2300-502)

The Controller module contains the Interface board, the Processor board, and the Modem board. For ease of maintenance, the module detaches from the SmartScanNG enclosure as a separate unit. It is easily removed by first unplugging the Molex and ribbon cable connectors and then by removing the fasteners.

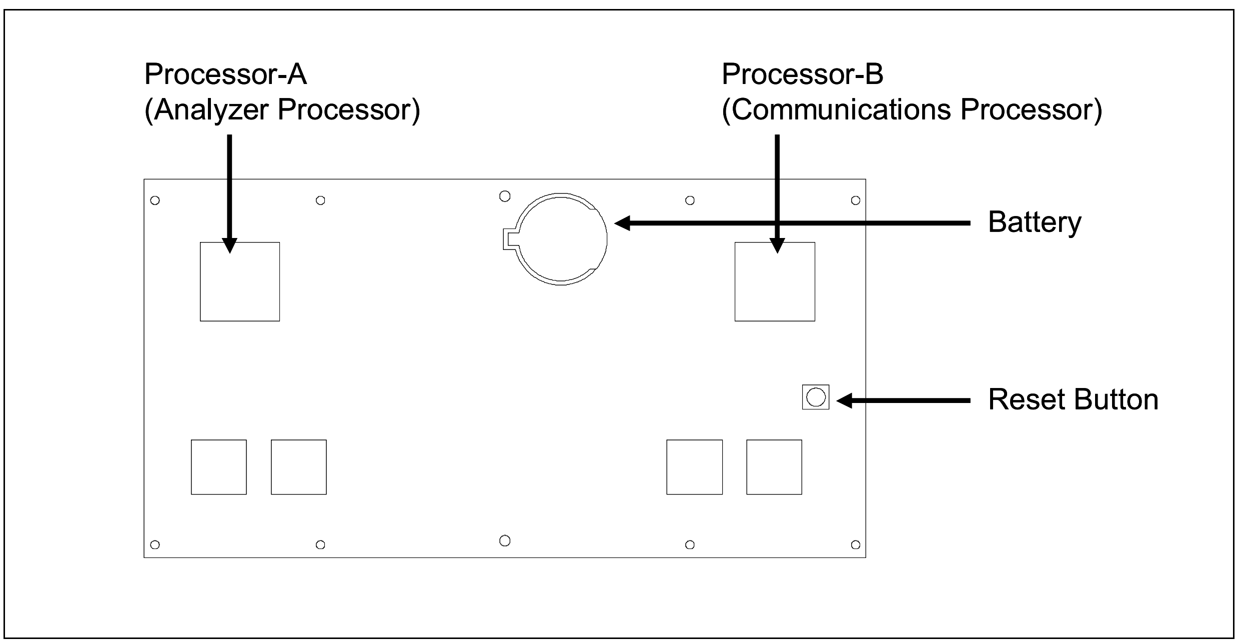
The figure below shows the major parts of the Controller module (2300-502).



4.1.2.1 Processor Board (2300-100)

The Processor board controls the entire SmartScanNG system. All signals to and from the external devices first pass through the System-Interconnect board and 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 SmartScanNG system.

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 external sources, such as the shielded temperature probe, scanners, transducers, and auxiliary devices. The CPU on the right (aka processor-B aka Communications Processor) is used to process and store the data retrieved by the other CPU. It then presents information to the user in the form of reports.

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 longterm storage. This SRAM contains:

- The Trains directory, which contains data on each new train that passes the site. The Train Summary report and Train Detail report get their data from this directory.
- The Exceptions directory, which contains data on each train that has one or more Exception Alarms or System Alarms. The Exception Summary report and Exception Detail report get their data from this directory.
- The Test Train (aka Ramp Train) directory, which contains data on the last test train. The Last Test Train report gets its 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 140,000 axles, but no more than 100 trains. The buffer for the Exceptions directory holds data on about 4,500 axles, but no more than 40 trains.

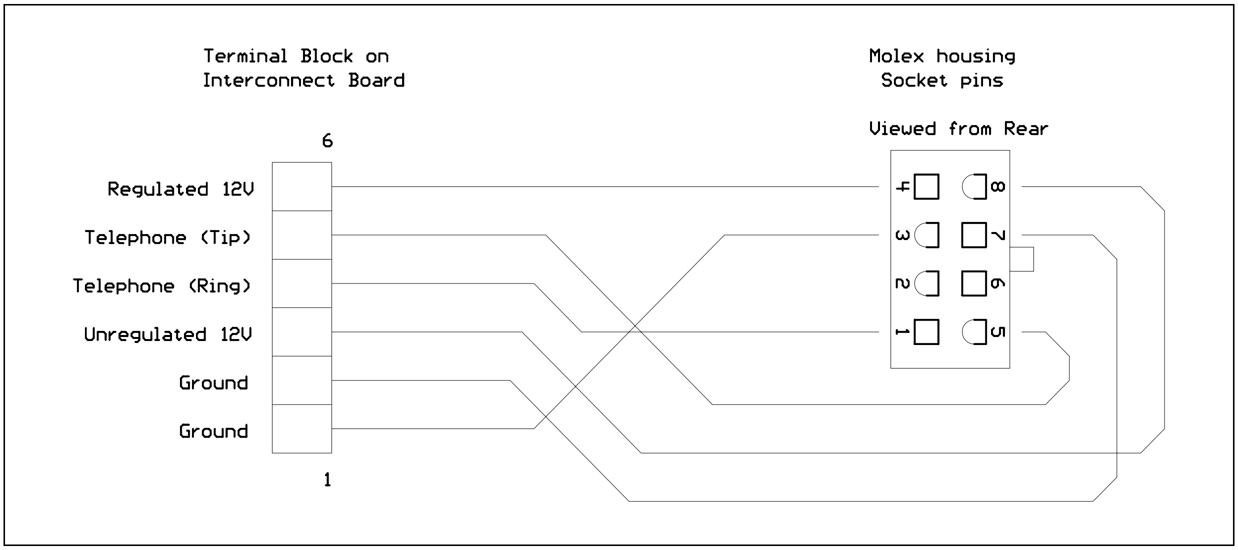
Under the CPU on the right is a white reset button. Pressing it causes a "hard reset" of the Processor board. (You can get the same results by toggling the on-off switch on the side of the SmartScanNG enclosure off, waiting 10 seconds, and toggling it back on.) As long as no train is present at the site, pressing the reset button doesn't affect the setup information or train data. However, if a train is present, pressing the reset button looses train data only for that train.

The Processor board requires regulated 5 VDC and regulated 12 VDC for operation. The input power is received from the 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 the battery is low or dead, the time, the date, and all train data will be lost.

4.1.2.2 Interface Board (2300-105)

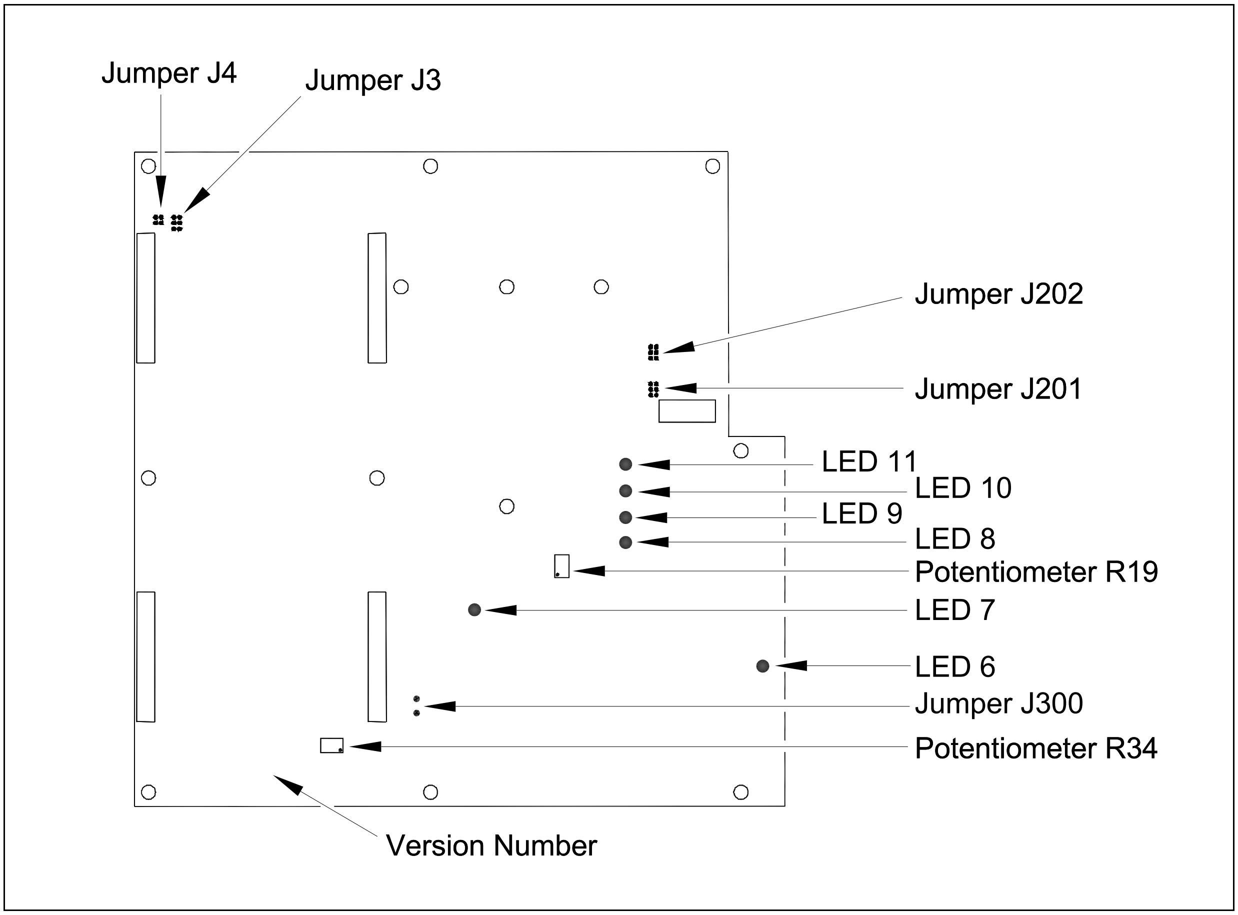
As its name implies, all of the interface and signal conditioning circuitry is located on the Interface board. This board connects to the System-Interconnect board with a 60-position ribbon connector and an 8-position Molex connector, which is shown below.



The board requires unregulated 12 VDC (battery voltage) to operate. The 12 VDC input power circuitry includes radio-frequency interference suppression, voltage surge protection, open fuse LED indicator, a self-restoring fuse, crowbar overvoltage protection, and reverse polarity protection. The board produces regulated -5 VDC, regulated +5 VDC, unregulated +9 VDC, regulated +12 VDC, and regulated +15 VDC to power the on-board circuitry, modem, and external scanner circuitry.

This guide only covers Interface board versions 1.21, 1.22, 1.30, and 1.40. Although like these latest versions of the board, earlier versions aren't covered in this guide.

The figure below shows part of the Interface board (2300-105). The board is shown as one would see it in service, which is the normal orientation for the board on a properly installed system.

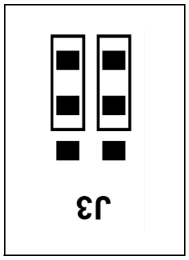


Jumper J3

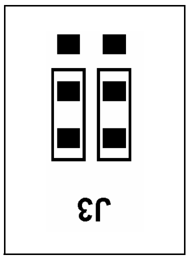
Jumper J3 selects either RS422 or RS485 mode.

DB9 connector pin-out for **RS422** is:	DB9 connector pin-out for **RS485** is:
1) Ground	1) Ground
2) Not Used	2) Not Used
3) RX-	3) Tx-/Rx-
4) Not Used	4) Not Used
5) TX-	5) Tx-/Rx-
6) Not Used	6) Not Used
7) RX+	7) Tx+/Rx+
8) Not Used	8) Not Used
9) TX+	9) Tx+/Rx+

If you want a RS485 connection, connect pins 7 and 9 together and pins 3 and 5 together. If you want a RS422 connection, do nothing.



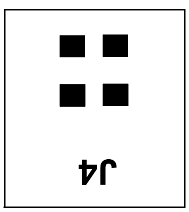
This is the jumper configuration for four-wire RS422 mode.



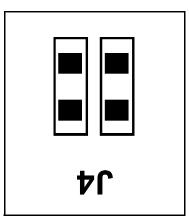
This is the jumper configuration for two-wire RS485 mode.

Jumper J4

Use jumper J4 (in conjunction with jumper 3) to switch the output from the bottommost connector (on the Controller module) between RS422 and RS485 mode.



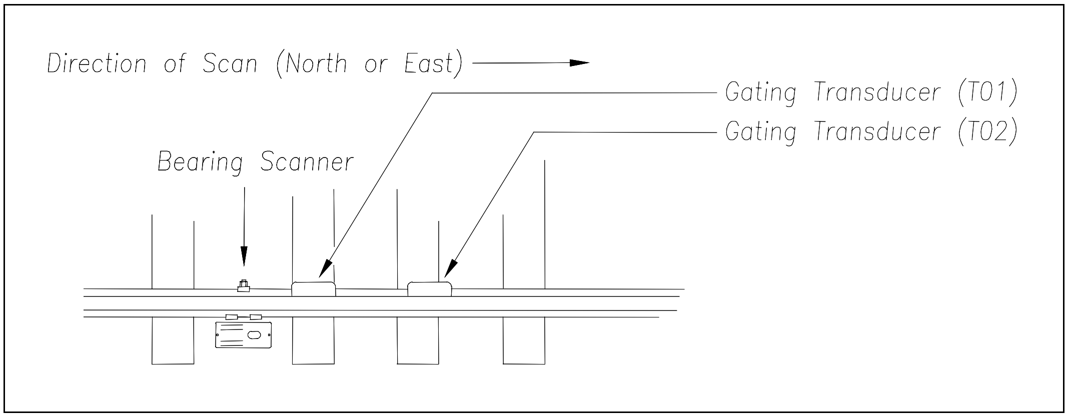
This is the jumper configuration for four-wire RS422 mode. Both transmit and receive are on continuously.



This is the jumper configuration for two-wire RS485 mode. The processor controls transmit and receive.

Jumper J201

Jumper J201 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.

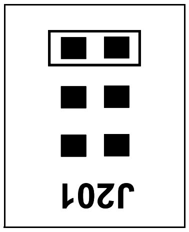


The table below lists the highest, middle, and lowest sensitivity for transducer loading for current board versions. Highest is the most sensitive. Lowest is the least sensitive. Middle is somewhat between these sensitivities.

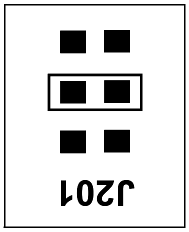
J201 Jumper Position	Version 1.21 and 1.22 and 1.30 and 1.40 Board
Top	Lowest Sensitivity
Center	Middle Sensitivity
Bottom	Highest Sensitivity

This table above only covers board versions 1.21, 1.22, 1.30, and 1.40. Earlier versions of the board have different jumper positions for each sensitivity level. That is, the available loading sensitivities vary depending on which version of Interface board you have, whether the board was modified, and whether resistors are attached to the jumpers. The version number is printed on the lower-left edge of the board.

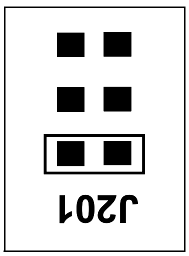
At the factory, J201 was set for optimal transducer loading. If you're having transducer miscounts, you can change this setting. However, this setting rarely needs changing. And, if changed, rarely needs to be changed again. Changes to the jumpers should be made only after all external conditions that cause transducer miscounts have been corrected. Some of these external conditions are improperly installed transducers, loose transducer bolts, incorrect transducer heights, damaged transducers, damaged transducer cables, and loose wiring connections.



The **top position** of J201 selects the lowest sensitivity for transducer loading. This position is the jumper position closest to the speaker. The figure to the left shows the top position of J201 being selected.



The **center position** of J201 selects the middle sensitivity for transducer loading. The figure to the left shows the center position of J201 being selected.



The **bottom position** of J201 selects the highest sensitivity for transducer loading. The figure to the left shows the bottom position of J201 being selected.

Jumper J202

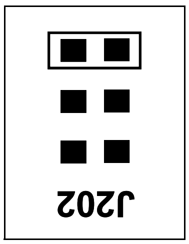
Jumper J202 is used to select the sensitivity value for gating transducer TO2. TO2 is the second gating transducer going north or east from the bearing scanner. It is the gating transducer farthest from the bearing scanner.

The table below lists the highest, middle, and lowest sensitivity for transducer loading for current board versions. Highest is the most sensitive. Lowest is the least sensitive. Middle is somewhat between these sensitivities.

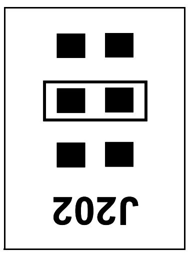
J202 Jumper Position	Version 1.21 and 1.22 and 1.30 and 1.40 Board
Top	Lowest Sensitivity
Center	Middle Sensitivity
Bottom	Highest Sensitivity

This table above only covers board versions 1.21, 1.22, 1.30, and 1.40. Earlier versions of the board have different jumper positions for each sensitivity level. That is, the available loading sensitivities vary depending on which version of Interface board you have, whether the board was modified, and whether resistors are attached to the jumpers. The version number is printed on the lower-left edge of the board.

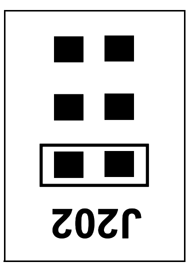
At the factory, J202 was set for optimal transducer loading. If you're having transducer miscounts, you can change this setting. However, this setting rarely needs changing. And, if changed, rarely needs to be changed again. Changes to the jumpers should be made only after all external conditions that cause transducer miscounts have been corrected. Some of these external conditions are improperly installed transducers, loose transducer bolts, incorrect transducer heights, damaged transducers, damaged transducer cables, and loose wiring connections.



The **top position** of J202 selects the lowest sensitivity for transducer loading. This position is the jumper position closest to the speaker. The figure to the left shows the top position of J202 being selected.



The **center position** of J202 selects the middle sensitivity for transducer loading. The figure to the left shows the center position of J202 being selected.



The **bottom position** of J202 selects the highest sensitivity for transducer loading. The figure to the left shows the bottom position of J202 being selected.

Jumper J300

Versions 1.30 and 1.40 of the Interface board (2300-105) have an additional safety feature associated with autocalibration. The system applies a safety to the digital potentiometers when it isn't doing autocalibration. This secures the potentiometer settings in the improbable event of hardware or firmware failure. Jumper J300 provides the ability to override this safety feature. A shorting block placed on jumper J300 disables the safety, thus removing the safety feature from this board. Leave this jumper off (that is, not shorted) unless you are troubleshooting the board.

Potentiometer R19

Potentiometer R19 adjusts the incoming touchtone volume. It is set at the factory and should not be changed by the customer.

Potentiometer R34

Potentiometer R34 adjusts the audio level (modulation) going to the radio. A misadjusted level will be distorted or very weak sounding. This adjustment is set at the factory to FCC specifications. Turn R34 clockwise to increase the audio level. Turn it counterclockwise to decrease the audio level.

LED 6

The Interface board (2300-105) has a red LED labeled **F1 Open** (also labeled **LED6**) on it. This LED lights when the self-restoring fuse F1 opens due to an overcurrent condition on the +12 VDC supply voltage input. A possible reason for this LED to be lit is that the crowbar circuit was triggered due to an overvoltage condition. In this case, power cycling the unit will reset the crowbar circuit.

LED 7

Versions 1.30 and 1.40 of the Interface board (2300-105) have a red LED labeled **Valid DTMF** (also labeled **LED7**) on it. If R19 is adjusted properly, this LED lights as valid touchtones are received from the radio.

LED 8

Version 1.40 of the Interface board (2300-105) has a red LED labeled **DR** (also labeled **LED8**) on it. This LED lights when the dragger (aka dragging-equipment detector) input activates.

LED 9

Version 1.40 of the Interface board (2300-105) has a red LED labeled **HL** (also labeled **LED9**) on it. This LED lights when the high-load input activates.

LED 10

Version 1.40 of the Interface board (2300-105) has a red LED labeled **W1** (also labeled **LED10**) on it. This LED lights when the wide-load-1 input activates.

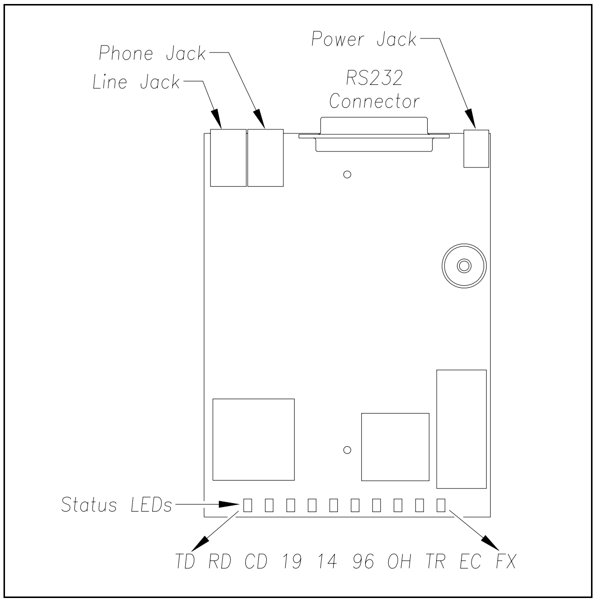
LED 11

Version 1.40 of the Interface board (2300-105) has a red LED labeled **W2** (also labeled **LED11**) on it. This LED lights when the wide-load-2 input activates.

4.1.2.3 Modem Board

The Modem board lets the system (at the site) communicate with a computer (away from the site) over the telephone system. The Modem board is a MultiTech Systems MT5634ZBA modem. If your site doesn't have telephone service, you cannot communicate with the system remotely (that is, when you are away from the site).

The figure below shows a Modem board.



Power Jack

The power jack is used to supply 9 VDC 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 P13 on the Interface board.

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 P14 on the Interface board.

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. The other end was plugged into MJ1 on the Interface board. At the site, the customer finishes this wiring by supplying the site with normal telephone service, bringing the telephone line to the SmartScanNG enclosure, and wiring the tip (green) and ring (red) wires to the telephone-line surge suppressor on the surge-suppressor panel.

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.

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.

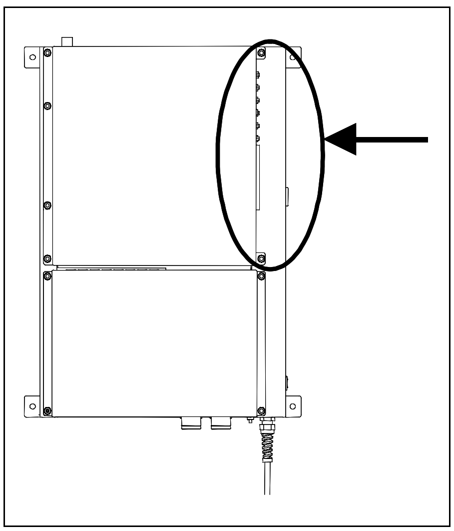
Status LEDs

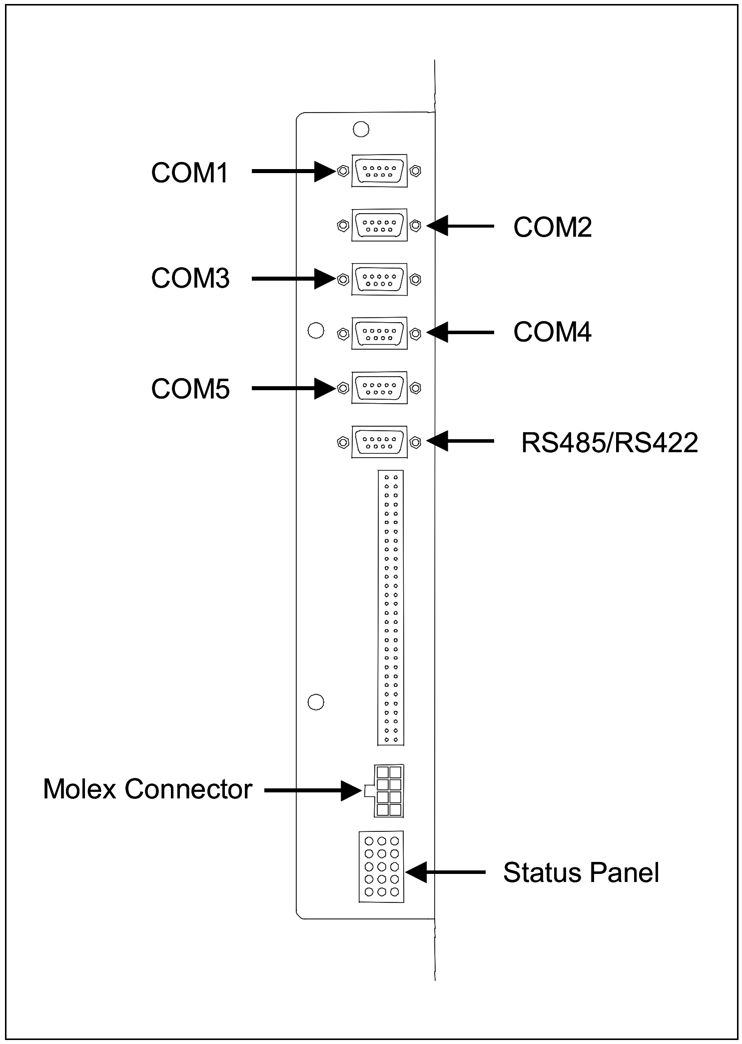
On the Modem board are 10 status LEDs. The table below describes what each lit LED means.

LED	Meaning When Lit
14	Lights when the modem connects using the V.32bis protocol. In V.32bis mode, the modem operates at 7,200-14,400 bps.
33	Lights when the modem connects using the V.34 protocol. In V.34 mode, the modem operates at 2,400-33,600 bps.
56	Lights when the modem connects using the V.90 or V.92 protocol. In 56K mode, the modem operates at 28,400-56,400 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 telephone 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 LED. So, it is never lit.

4.1.3 Side of Controller Module

On the right side of a mounted Controller module (2300-502) are a group of connectors and LEDs, as shown below.





4.1.3.1 Serial Ports

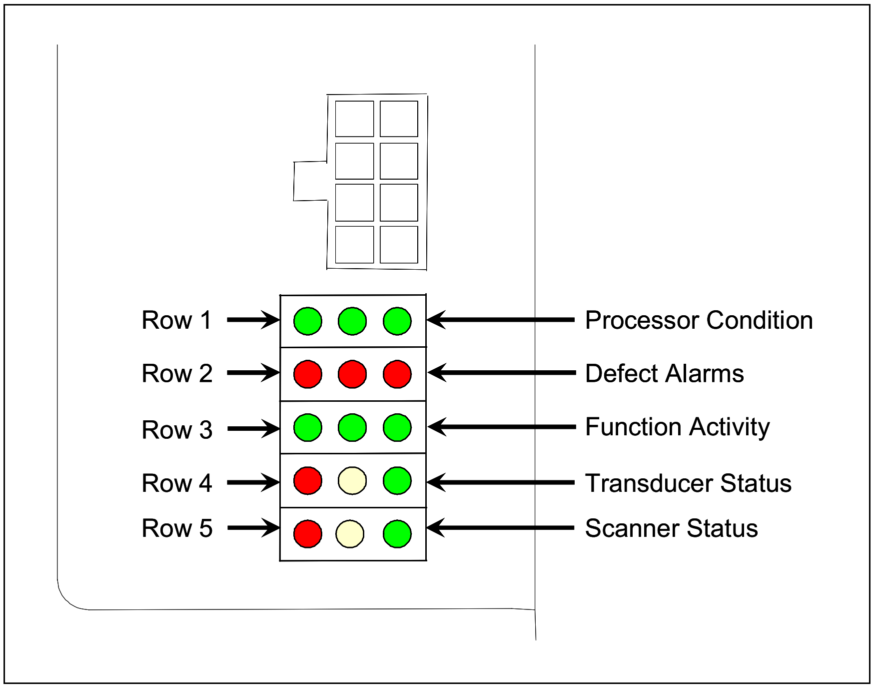
On the right side of a mounted Controller module are six external serial ports. They are labeled COM1, COM2, COM3, COM4, COM5, and RS485/RS422.

The table below describes the use of each external serial port and where on the Interface board (2300-105) it is attached to.

Port	Use
COM1	Used to communicate with a customer-provided external device. At single-track sites, a computer is normally connected here. At double-track sites, a serial cable is attached from **COM4 of system1** (that is, the system with an installed modem) to **COM1 of system2** (that is, the system without an installed modem). COM1 is connected to **P6** on the Interface board.
COM2	Used to communicate with a customer-provided external device. COM2 is connected to **P9** on the Interface board.
COM3	COM3 is connected to **P7** on the Interface board. If an **internal** modem is being used, do not use this serial port. If an **external** modem is being used, plug it into this serial port. However, do not use COM3 for an external modem until the internal modem has been disconnected.
COM4	At double-track sites, a serial cable is attached from **COM4 of system1** (that is, the system with an installed modem) to **COM1 of system2** (that is, the system without an installed modem). COM4 is connected to **P5** on the Interface board.
COM5	Used to connect AEI Interface module (2300-750) to the SmartScanNG system. COM5 is connected to **P8** on the Interface board.
RS485 RS422	Used to communicate with a customer-provided external device. RS485/RS422 is connected to **P10** on the Interface board. Jumper J3 on the Interface board (2300-105) selects either RS422 or RS485 mode.

4.1.3.2 Status Panel

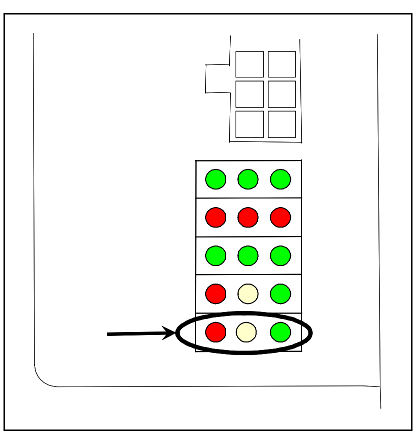
The status panel consists of 15 LEDs in 5 rows of LEDs, as shown below. The LEDs are shown as one would see them in service, which is their normal orientation on a properly installed system.

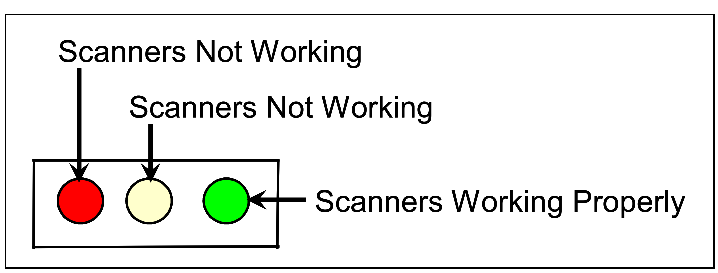


The information that is used to control rows 4 and 5 is contained in a log of the last 20 trains to pass the site. A separate log of the last 40 trains controls the LEDs in row 2. Both of these logs clear at power-up or reset.

Scanner Status

On a mounted Controller module, the <u>bottom</u> <u>row</u> (aka fifth row) of LEDs indicates the operational condition of the scanners when the system is at rest (that is, when a train isn't present at the site). Several conditions are monitored and logged.





The leftmost red LED indicates whether the integrity check passed or failed. If a scanner failed integrity on any of the last 20 trains, this LED lights and remains lit until all trains with integrity failures are flushed from the log. Conditions that would trigger the lighting of this LED are:

- Insufficient heat from one or both bearing scanners or from one or both wheel scanners was detected. If either bearing scanner records less than 5°F (2.8°C) for an entire train or if either wheel scanner records less than 15°F (8.3°C) for an entire train.
- Shutter resistor check failed. The minimum value expected for the temperature of the resistor wasn't met. To cause the LED to light, this minimum value must be greater than the target resistor heat value that is calculated for each train. These requirements for lighting the LED are the same as for generating a Cold Bearing Scanner Resistor alarm (on some systems, called the Cold Resistor alarm).
- For any five consecutive trains, the difference between the average recorded temperatures for both bearing scanners was more than a delta temperature of 20°F (11.1°C) or the difference between the average recorded temperatures for both wheel scanners was more than a delta temperature of 120°F (66.7°C).

If all of the last 20 trains have passed integrity, the red LED isn't lit. In the last 20 trains, if both bearing scanners or both wheel scanners failed the integrity check, this LED is lit solid. In the last 20 trains, if just one bearing scanner or one wheel scanner failed the integrity check, this LED flashes. The rate and pattern of flashing is different for which rail the scanner was on. For a scanner on the north or east rail, the repeated pattern is on for a half second, off for a full second. For a scanner on the south or west rail, the repeated pattern is on for a half second, off for a half second, on for a half second, off for two seconds.

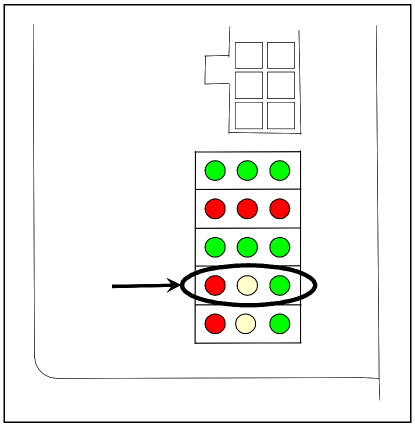
The middle yellow LED flashes when the difference between the average temperatures (recorded by the two bearing scanners or recorded by the two wheel scanners) isn't within acceptable balance limits for 20 consecutive trains. These limits are different for bearing and wheel scanners. For the bearing scanners this limit is 5°F (2.8°C) and for wheel scanners is 15°F (8.3°C). If the averages fall below these balance limits, the yellow LED will flash continuously until less than 20 consecutive trains have a temperature imbalance between the two bearing or the two wheel scanners.

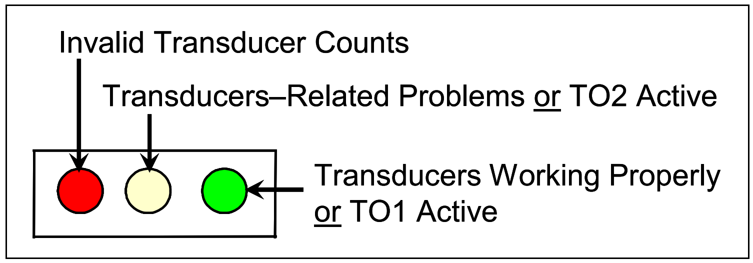
Within the scanner pairs, the scanner with the lower temperatures is considered the problem scanner. Its identity is revealed by the rate and pattern of flashing of the LED. For a scanner on the north or east rail, the repeated pattern is on for a half second, off for a full second. For a scanner on the south or west rail, the repeated pattern is on for a half second, off for a half second, on for a half second, off for two seconds. Since this LED makes no distinction between bearing and wheel scanners, the flashing LED can indicate a problem with either the bearing or the wheel scanner on the indicated rail or a problem with both of them.

The rightmost green LED flashes when all of the bearing and wheel scanners worked properly during passage of the last 20 trains. It's off when one or more scanners aren't performing as they should be. It's never lit solid.

Transducer Status

On a mounted Controller module, the fourth row of LEDs operates differently when a train is at the site and when it isn't.





When a train is present at the site, this row indicates the operational status of the gating transducers for the current train. The rightmost green LED will flash as a wheel travels over transducer TO1. The center yellow LED will flash when a wheel travels over transducer TO2. The leftmost red LED doesn't light during train passage, except when both transducers fail integrity tests.

When a train isn't present at the site, this row indicates the operational status of the gating transducers for the last 20 trains. The leftmost red LED is lit when all the following conditions befall any given train.

- The count between TO1 and TO2 varies by four or more.
- The speed of the train remains above 10 mph (16 kph).
- The train has an odd axle count.

In the last 20 trains, if all three fault conditions don't exist on each given train, the red LED is not lit. In the last 20 trains, if there's a possible fault with TO1 on one train and TO2 on another train, this LED is lit solid. In the last 20 trains, if there's a possible fault with just one gating transducer on a given train, this LED flashes. The gating transducer with fewer hits is considered the bad one. The rate and pattern of flashing is different for each transducer. For TO1, the repeated pattern is on for a half second, off for a full second. For TO2, the repeated pattern is on for a half second, off for a half second, on for a half second, off for two seconds.

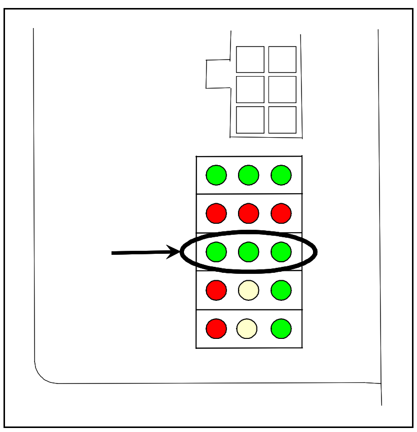
When a train isn't present at the site, the middle yellow LED is lit when:

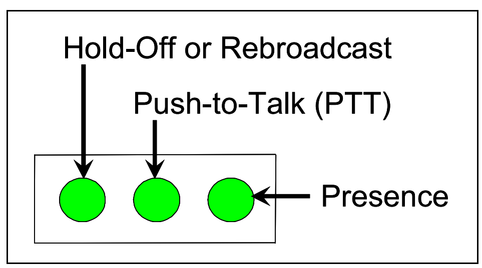
- A gating transducer experiences more than 20 filtered pulses on a train. In other words, a gating transducer experiences more than 20 pulses on a train that the SmartScanNG system considers noise.
- The gating transducers are activating the system.

When a train isn't present at the site, the rightmost green LED flashes when the count between TO1 and TO2 varies by three or less. Under those conditions, this LED will still flash even when the axle count is odd or the train speed falls below 10 mph (16 kph).

Function Activity

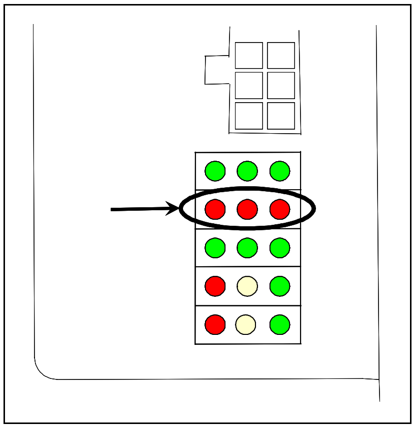
On a mounted Controller module, the middle row of green LEDs indicates system activities, system activities, including train presence, push-to-talk (PTT), and hold-off or rebroadcast. Each LED lights while its function is active. The hold-off LED lights during the reception of radio traffic. It will blink when there is radio traffic and the system is waiting to make an announcement. The PTT LED lights during radio transmissions made by the system. The train presence LED lights when the system senses the presence of a train. It turns off after the train leaves the site.

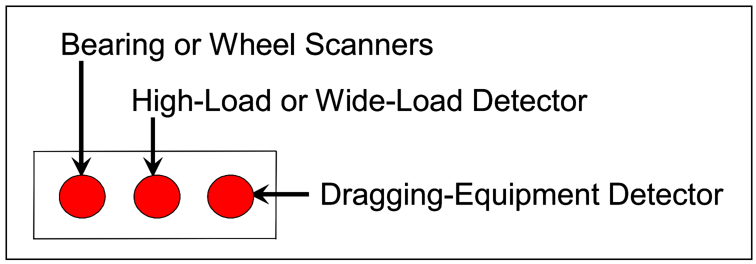




Defect Alarms

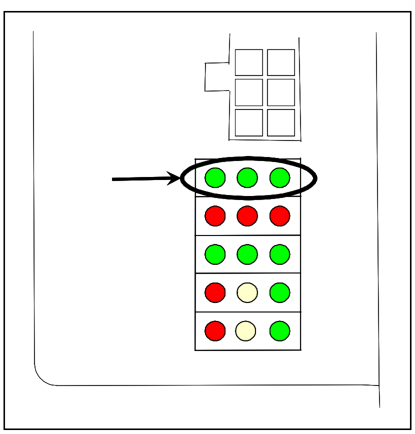
On a mounted Controller module, the second row of red LEDs indicates stored defect alarms, including those for bearing scanners, wheel scanners, dragging-equipment detectors, high-load detectors, and wide-load detectors. These LEDs are lit when a defect alarm (associated with one of those pieces of equipment) has been recorded in any of the last 40 trains. Each LED remains lit until there isn't a recorded defect alarm (for the equipment associated with it) in any of the last 40 trains.

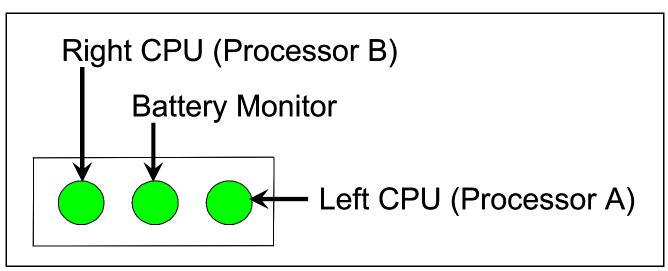




Processor Condition

On a mounted Controller module, the top row (aka first row) of green LEDs indicates the condition of the CPUs and the battery on the Processor board. If both CPUs are running their programs correctly, their LEDs pulsate (that is, repeat the cycle off, dim, bright, dim). If a program isn't operating as expected, the LED for the affected CPU blinks on and off, is lit solid, or isn't lit at all.

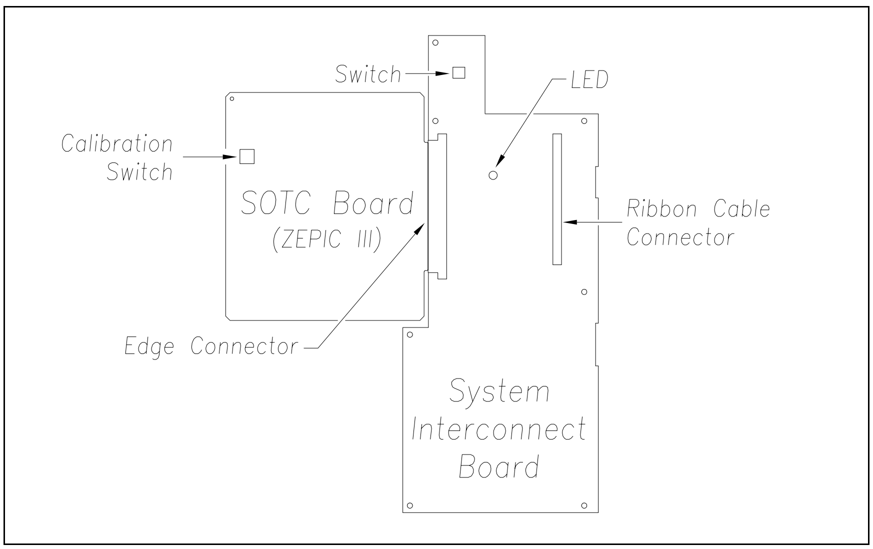




If the on-board coin-cell battery is low or dead, the **middle LED** is lit. Otherwise, it isn't lit. During a power interruption to the Processor board, this battery keeps the stored train data from being lost and the time/date accurate. If the battery is low, there is no danger of losing train data unless the power to the system is lost. When the **middle LED** is lit, the battery should be replaced. If care is taken, this can be done with the system powered up. Otherwise, **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**. Some Processor boards have a permanently installed battery. Those Processor boards should be returned to STC for battery replacement.

4.1.4   SOTC Board

The SOTC board tells the system when a train is present at the site. On the board is the blue calibration switch, which is used to adjust the gain control of the track circuit.



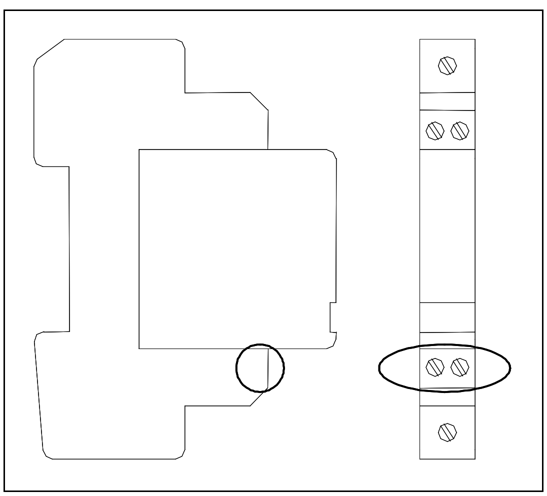
The SmartScanNG enclosure only has a SOTC board if the site is using a track circuit. If the site is using two advance transducers, there is no SOTC board.

4.1.5 Surge-Protection Panel

Along with the surge suppressors found on the Interface board, the SmartScanNG system employs a primary layer of surge suppression, which is located on the surge-suppression panel. This section of the SmartScanNG enclosure forms a Faraday shield (that is, a grounded conducting enclosure). The purpose of the Faraday shield is to contain electromagnetic radiation.

Located inside are industrial grade surge suppressors (aka universal transient barriers or UTBs). They 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 surge-suppressor panel before entering the rest of the SmartScanNG enclosure.

- Gating transducer **TO1**
- Gating transducer **TO2**
- Advance transducer **ADV1**, if used
- Advance transducer **ADV2**, if used
- Dragging-equipment detector **DED**
- High-load detector **HIGH**, if used
- Wide-load detector **WIDE1**, if used
- Wide-load detector **WIDE2**, if used
- Shielded temperature probe **TempProbe**, which uses two UTBs
- Telephone line **TelCo**



Each UTB is mounted horizontally 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 surge-protection panel, but not protected by UTBs, are connections for the track circuit (labeled **SOTC**), if used; the incoming DC (labeled **12 VDC**); and the incoming ground. Before entering the SmartScanNG enclosure, the incoming DC is protected by the components on the fuse block <u>and</u> the wiring from the track circuit is protected by a three-terminal arrester. Therefore, neither needs UTB protection.

4.1.6 Relay Panel

The SmartScanNG system 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 mounted to the relay panel. One SSR operates 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 <u>less</u> <u>than</u> 2 amps each. Likewise, the SSR associated with the **heaters** in the 2100-512**DC** scanners is rated for 100 VDC at 12 amps, even though the heaters operate on 12 volts and require <u>less</u> <u>than</u> 1 amp each. The SSR associated with the **heaters** in the 2100-512**AC** scanners is rated for 240 VAC at 25 amps of current, even though the heaters require only 120 VAC at 1.6 amps each.

4.1.7 Radio

Radios (aka RF transceivers) can be installed either internally or externally. Radios that are installed internally at the factory are usually Ritron synthesized VHF transceivers.

At double-track sites, there is usually one radio per track. This is the case when internal radios are used, but not always the case when external radios are used. When external radios are used, the components supporting **track2** don't have to have their own radio. Instead, they can use the radio that supports **track1**. (Using only one radio at a double-track site isn't covered in this guide. Call STC for help in doing this.)

The SmartScanNG system provides the following connections to the radio.

- Regulated 11.5 VDC power supply, which is internally fused with a self-restoring fuse at 2.5 amps
- PTT signal to the radio, which allows the SmartScanNG system to key the radio before transmission
- Adjustable audio level to the radio for verbal messages to the train crew
- Adjustable audio level from the radio for DTMF detection, which allows the train crew to request rebroadcasts
- Hold-off signal (carrier detect) from the radio, which prevents transmissions while the channel is busy
- Channel select to the radio, which allows firmware control channel selection of two channels
- Eight channel selector switch located on the System-Interconnect board
- Coaxial surge arrester for the antenna connection, which is located inside the SmartScanNG enclosure

4.1.8 Other Components

On the outside of the SmartScanNG enclosure are connectors, LEDs, and other components.

On the **top edge** of the enclosure are:

- Antenna connector, when applicable
- Speaker with volume control
- Speaker jack

On the **bottom edge** of the enclosure are:

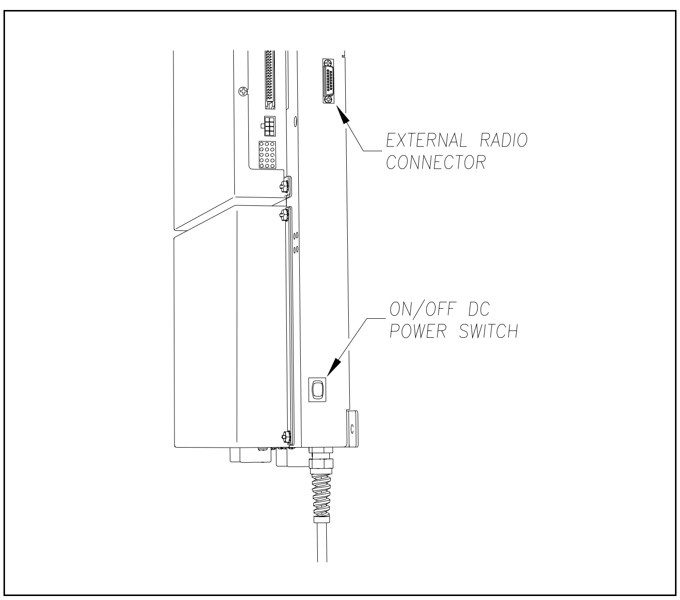
- Four scanner connectors
- AC power cord for powering the scanner heaters, when applicable
- Circuit breaker for scanner heaters

On the **right-side edge** of the enclosure are:

- On/off DC power switch
- External radio connector
- Chassis mounted LEDs

4.1.8.1 DC Power Switch

The SmartScanNG enclosure doesn't have an AC power switch and needs to be disconnected from its AC power source to stop AC from entering the enclosure. However, it does have a DC power switch on the right-side edge of the enclosure. When it is toggled off, all DC power to the SmartScanNG enclosure is stopped.



4.1.8.2 External Radio Connector

The external radio connector is a DB15 connector. The signals that are used have the same pin-out as the internal radio connector. Located on the System-Interconnect board is an 8-position channel selector switch, which controls pins 1-3 in a binary fashion. Pin-5 and pin-1 are the same electrical connection, which also connects to a digital output from the Processor board. When channel zero is selected with the channel selector switch, the processor can select either channel-0 or channel-1. Software that supports processor controlled channel selection is optional.

Pin-6 provides regulated 11.5 volts at 2.5 amps. This is appropriate for the Ritron radio, but not for larger radios requiring more power. It is advisable to use another means to power such radios.

Pin-7 provides audio output from the SmartScanNG system to an external radio. The audio level is adjustable using potentiometer R34, which is located on the Interface board. Pin-12 provides audio input to the SmartScanNG system (from the external radio) when the rebroadcast function is used.

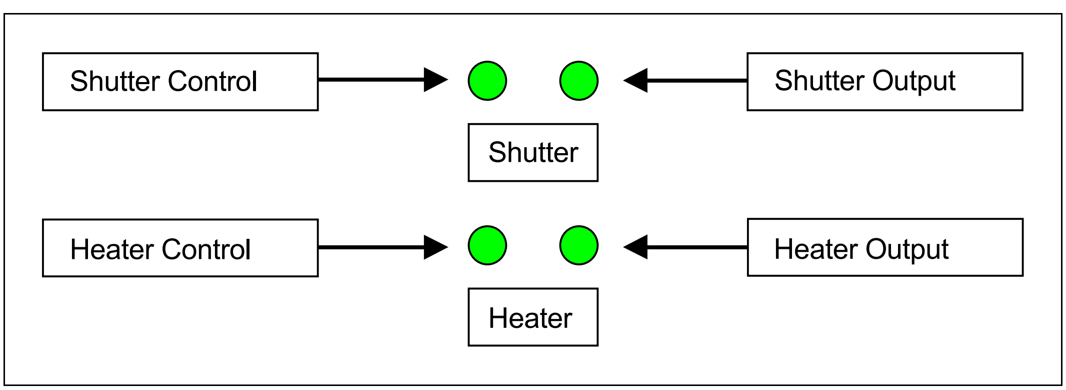
Pin-13 is the carrier-detect input to the SmartScanNG system. This signal is internally pulled high. A low level prevents the SmartScanNG system from initiating a voice transmission.

Pin-14 is the PTT output from the SmartScanNG system. This is an open-collector, active low signal, which is grounded while the SmartScanNG system is transmitting.

Pin-15 is ground. Pins 4, 8, 9, 10, and 11 aren't used.

4.1.8.3 Chassis Mounted LEDs

There is a group of four status LEDs on the lower right side of the chassis. These LEDs show the operation of the solid-state relays used to control the scanner shutters and heaters. They can also indicate problems with the relays if they fail to operate. All four of these LEDs are green. Two of the LEDs are wired directly to the relays input terminals to indicate when a control signal has been sent from the controller. The other two LEDs are wired to the relay output to indicate when power is being applied to the scanner.



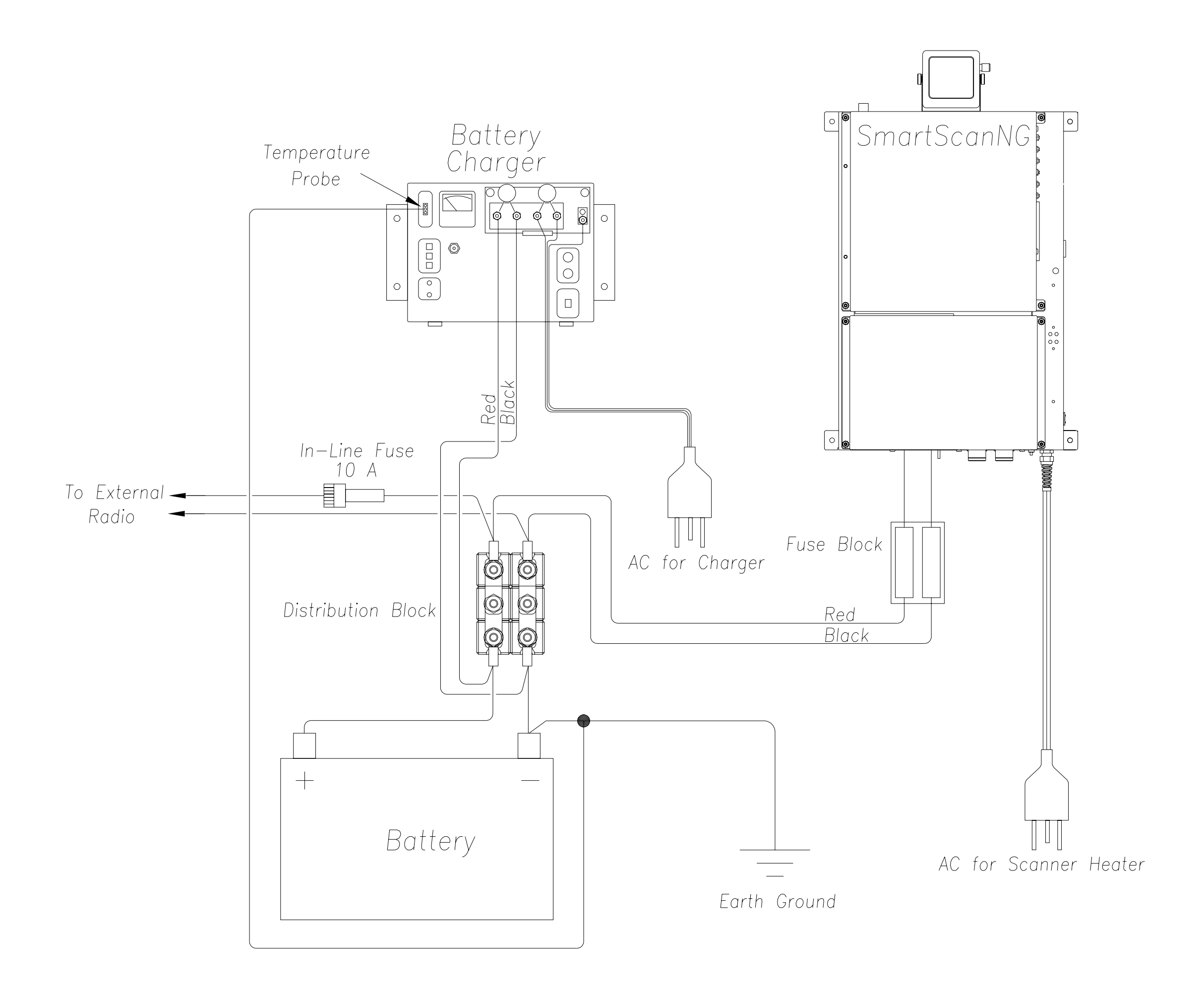
Not all four LEDs can be lit at the same time. Anytime the shutters are open, the heaters should be off. Under normal conditions, the top two LEDs (shutters) should only be lit when the heaters are off. Conversely, under normal conditions, the bottom two LEDs (heaters) should only be lit when the shutters are closed. In other words, when the system is working, only the top two LEDs are lit when a train is rolling through the site. When no train is present, only the bottom two LEDs may be lit.

The LEDs can indicate that the relay has failed to activate when a control signal is applied, as shown in the table below. In the table, a shaded area means that an LED is lit. An unshaded area means that an LED isn't lit. Only seven of the possible combinations of lit LEDs are listed below. All other combinations are invalid and indicate a system problem.

Shutter Control LED (Top Right)	**Shutter Output LED (Top Left)**	**Heater Control LED (Bottom Right)**	**Heater Output LED (Bottom Left)**	**Explanation**
On	Off	Off	Off	Invalid. The shutters are being commanded to open, but the relay isn't responding with shutter voltage.
On	On	Off	Off	Normal if a train is present. Invalid if a train isn't present.
Off	On	Off	Off	Invalid. No shutter signal, but shutter voltage is present.
Off	Off	On	On	Normal if a train isn't present and the outside temperature is cold. Invalid if a train is present or if the outside temperature is warm.
Off	Off	On	Off	Invalid. The heaters are being commanded to turn on, but the relay isn't responding with heater voltage.
Off	Off	Off	On	Invalid. No heater signal, but heater voltage is present.
Off	Off	Off	Off	Normal if a train isn't present and the outside temperature is warm. Invalid if a train is present or if the outside temperature is cold.

4.2 Power Subsystem

The figure below shows the major parts of the power subsystem powered from an AC power source.



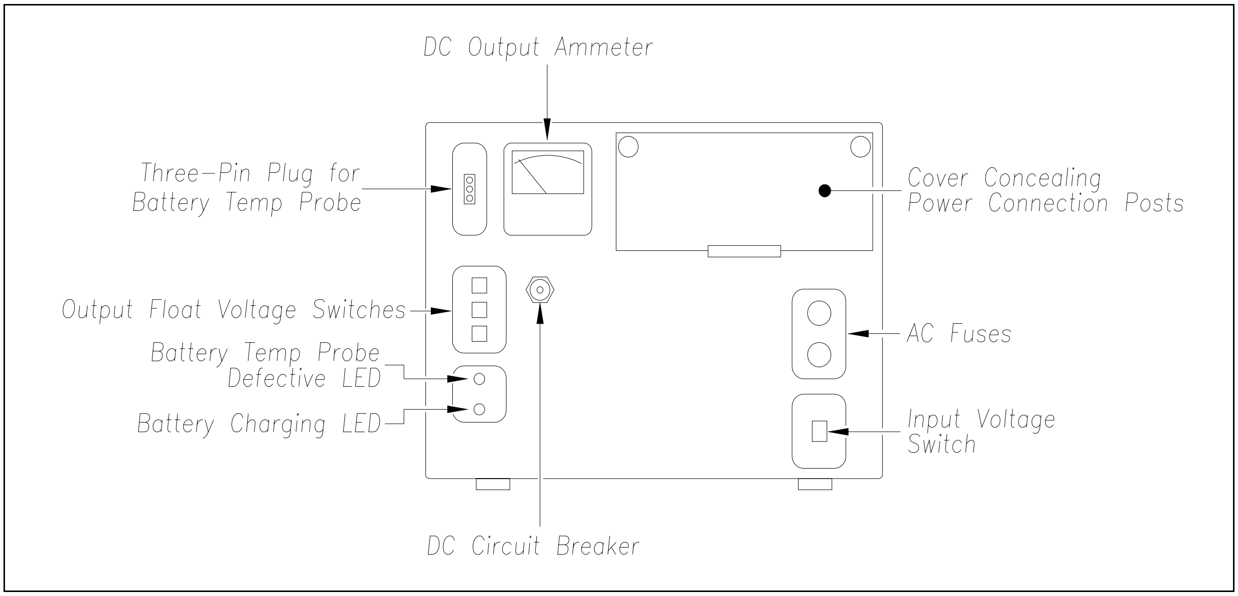
There is one SmartScanNG enclosure per track. One power subsystem per SmartScanNG enclosure. One battery per power subsystem. One battery charger per battery.

4.2.1 Battery

Each SmartScanNG enclosure uses one 12-volt 115-ampere-hour battery. The use of a smaller battery reduces the amount of time that the SmartScanNG system can continue to operate after AC power is removed.

4.2.2 Battery Charger

The figure below shows the front of a NRS ELC-12/20-D battery charger.



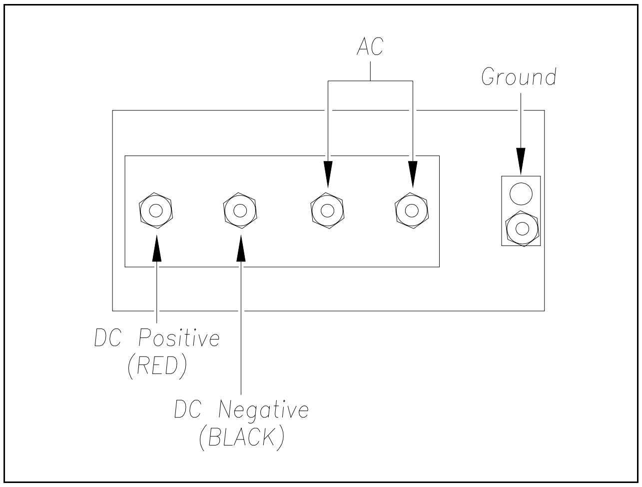
The input voltage switch can be set to 115 VAC or 230 VAC. Use 115 for input voltages between 108 and 128. Use 230 for input voltages between 216 and 256.

The output float voltage switches can be set so that a battery is charged within the range 10.00 VDC and 17.00 VDC. The **factory default is 14.00 VDC**. To reset the switches, use a small slotted screwdriver to turn each switch to the desired number. Be sure that each switch is set on a number and not between numbers. The ten's digit is always 1 and can't be changed. The top switch controls the unit's digit. The middle switch controls the tenth's digit. The bottom switch controls the hundredth's digit. Thus, to select 13.68 VDC, turn the top switch to 3, the middle switch to 6, and the bottom switch to 8.

If the battery temperature probe is defective or not installed, the red defective LED is lit. If the battery is charging properly, the yellow battery-charging LED is lit. If one or more of the output float voltage switches is set between numbers, the yellow battery-charging LED flashes.

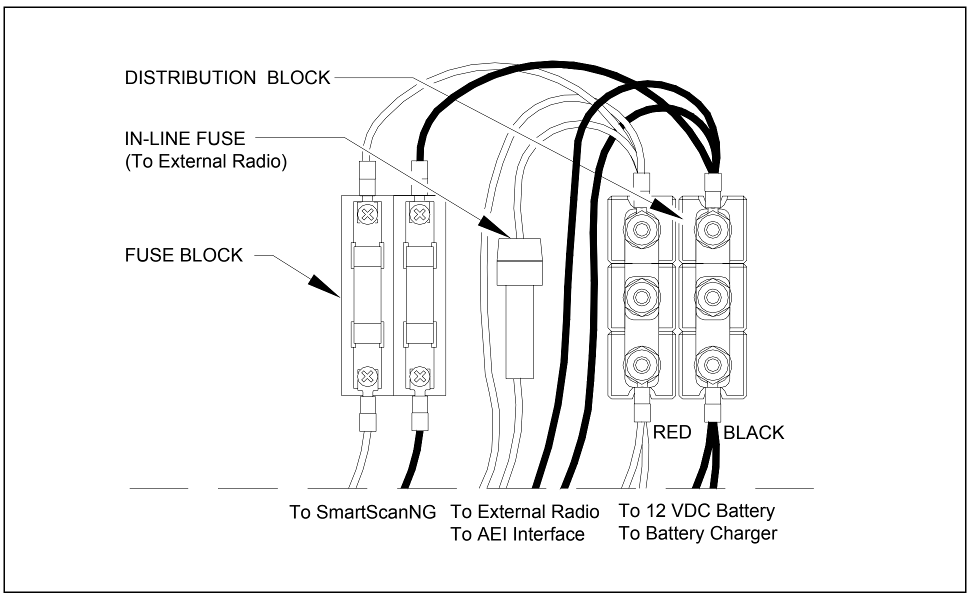
Above the input voltage switch are two 4-amp 250-volt fast-acting fuses. They protect the battery charger from excessive AC. To the right of the output float voltage switches is a circuit breaker. It protects the battery charger from excessive DC.

You can open the small door on the front of the charger by pulling out the push tabs. Doing so reveals the power connection posts, as shown below.



4.2.3 DC Power Distribution

DC power distribution consists of a distribution block and a fuse block, which is shown below. There is one of each of these components per SmartScanNG enclosure.



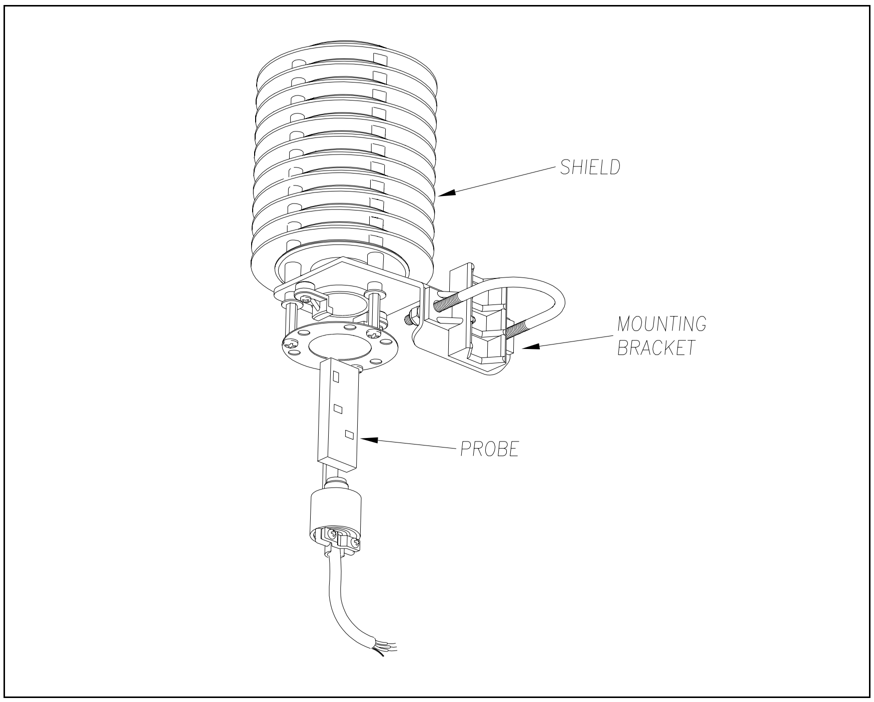
The **distribution block** contains six terminals. Loosening the middle gold nuts will disconnect DC power to the rest of the system. Wires from the <u>bottom</u> of the distribution block go to the 12V battery and to the battery charger. Wires from its <u>top</u> go to the fuse block, to the AEI Interface, and to the external radio.

The **fuse block** contains two fuses. These fuses are standard 13/32x1-1/2-inch, 25-amp, fast blow fuses. The fuses provide overload protection for the SmartScanNG enclosure. Wires from the equipment side of the fuse block go to the surge-suppression panel inside the SmartScanNG enclosure. Wires from the battery side of the fuse block go to the battery via the distribution block.

4.3 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 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 SmartScanNG 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 SmartScanNG enclosure could be cut, or the wiring to the System-Interconnect 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 SmartScanNG enclosure could be cut.

The system comes with a partially installed shielded temperature probe. ***Chapter 8 - Installing Wayside Enclosure Components*** tells how to finish installing it.

4.4 AEI Interface Module (2300-750)

Not all SmartScanNG systems use the AEI subsystem. If your SmartScanNG system does, the AEI subsystem will consist of two AEI antennas, which were described in a prior chapter, and the AEI Interface module, which is described below.

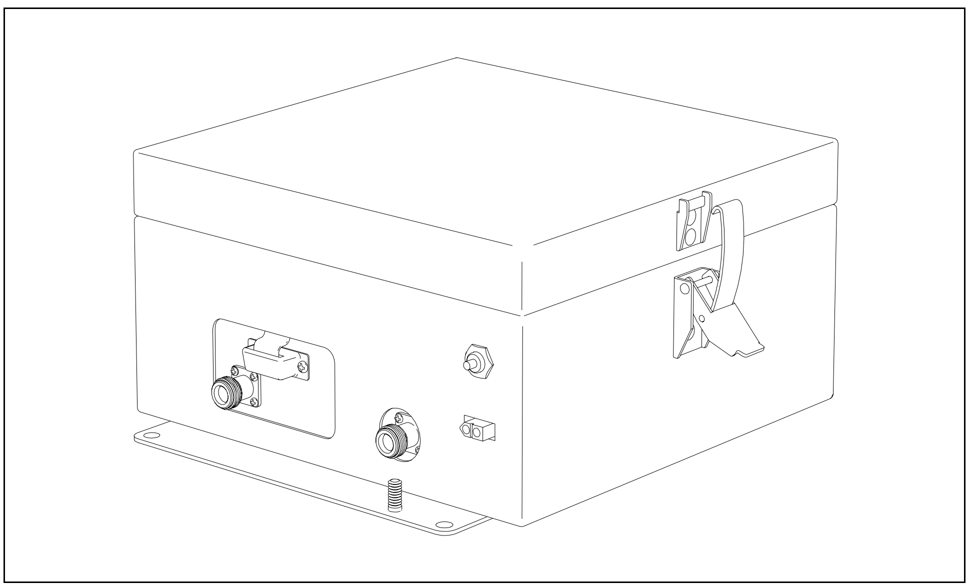
The AEI Interface module contains an Amtech AR2200 RF unit and an Amtech AI1200 Reader Logic board. The AR2200 has a single RF output that is multiplexed between two antenna connections (ant0 and ant1). One or both antennas can be enabled via setup commands.

The AEI Interface module reads and reports Radio Frequency Identification (RFID) tags in the original programmed format. It can also decode owner's initials, equipment number, and side indicator of tags that are in the Association of American Railroads (AAR), International Standardization Organization (ISO), or American Trucking Association (ATA) data format.

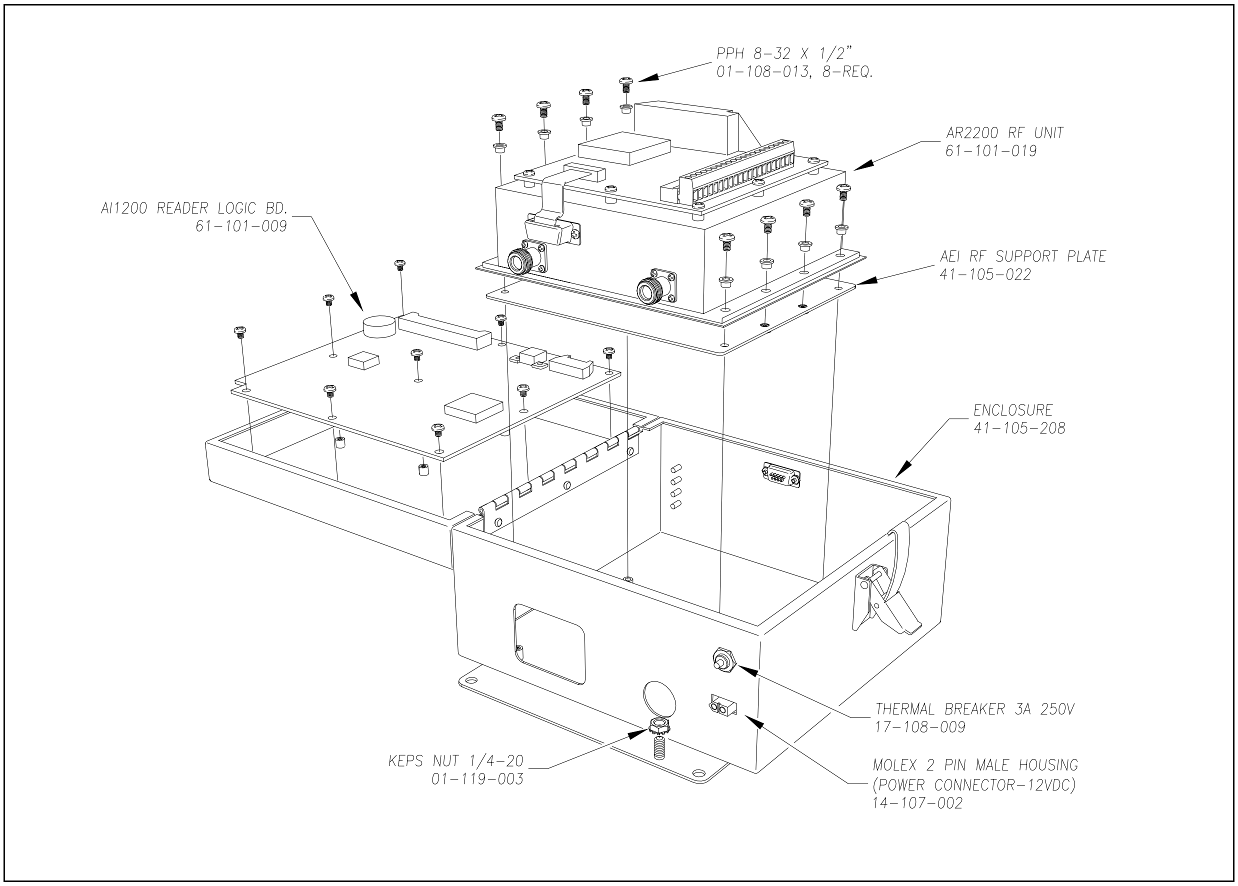
Commands are used to control the operation of the AEI Interface module. Setup commands are sent from the Processor board (2300-100) at power startup to configure the operating parameters of the AEI Interface module. When a train arrives at the site, the AEI Interface module "wakes up." It then starts reading AEI tags from the passing train. The information from these tags is sent to the Processor board as the tags are read. The AEI Interface module appends a timestamp to each tag record that indicates when the tag was read. After a train has left the site, the timestamp is used to match each tag to a vehicle in the train's consist.

The Train Detail report displays the AEI information of each vehicle in the train's consist from which a tag was read. The Train Summary report displays a total tag count for each train.

The figure below shows an assembled AEI Interface module (2300-750).



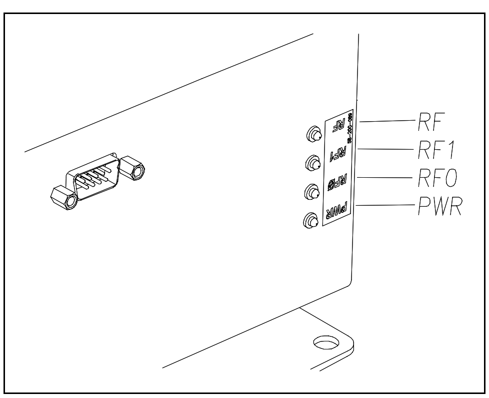
The figure below shows the major parts of an AEI Interface module (2300-750).



4.4.1 Components on Outside of Module

On one side of the AEI Interface module are two N-type antenna connectors, a 2-pin 12 VDC connector, a 3-amp 250-volt thermal breaker, and a ground connector. On other side are four LED status indicators and a serial communications port (Dsub9 connector), which connects to the COM5 of the Controller module (2300-502).

The figure below shows the location of the LEDs.



The table below describes what each lit LED means.

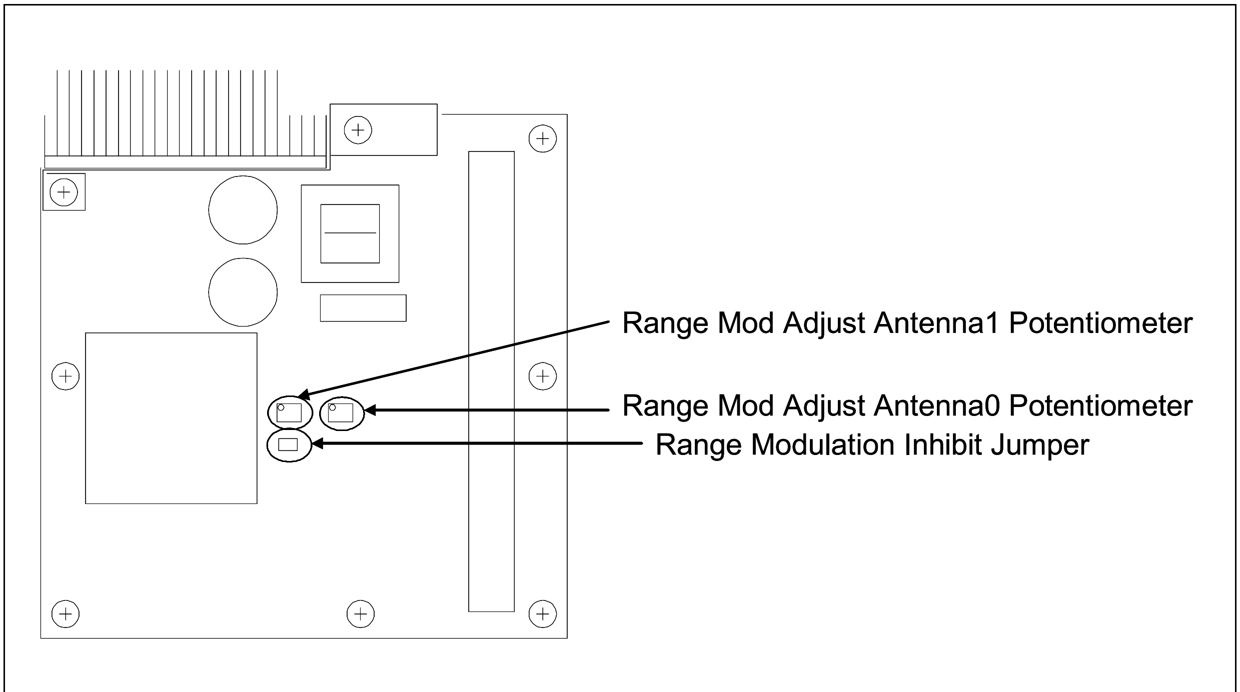
LED Name	LED Color	Meaning When Lit
PWR	Green	Proper voltage is present. Stays lit as long as the AEI Interface module is powered up.
RF	Green	RF power is "ON."
RF0	Green	RF power to antenna0 is "ON."
RF1	Green	RF power to antenna1 is "ON."

4.4.2 Components on Amtech AR2200 Board

The AR2200 provides a range-sensitivity adjustment feature that allows unwanted tag signals to be screened without decreasing RF power. Potentiometers "Range Mod Adjust Antenna0" and "Range Mod Adjust Antenna1" are used to desensitize the read range of antenna0 and antenna1 respectively. Jumper J3, when shorted, inhibits range adjust potentiometers.

For some installations, it may be necessary to attenuate RF power in conjunction with range-sensitivity adjustment in order to achieve the optimal read range.

The figure below shows the user-changeable components on an Amtech AR2200 board.



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 SmartScanNG system.

This chapter covers what needs to be done before installation begins. Contained herein is time-tested advice that is well worth following. Also covered is how to install the wayside enclosure (aka bungalow) and, for those using AEI equipment, antenna masts. Installation of the solar panels isn't covered in this guide.

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 at <u>more</u> <u>than</u> 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 (aka sleepers) and tie plates (aka sleeper 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.

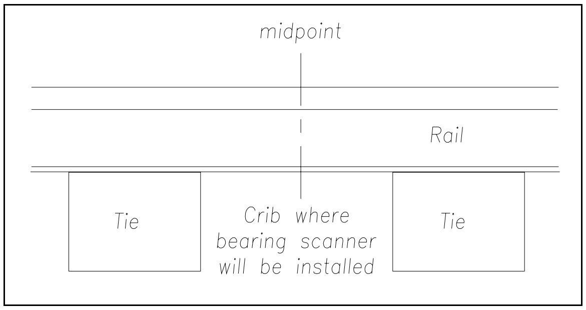
4 If the ties aren't well tamped, fix this problem before proceeding.

5 Measure the distance between the ties.

The scanners should be <u>centered</u> 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.

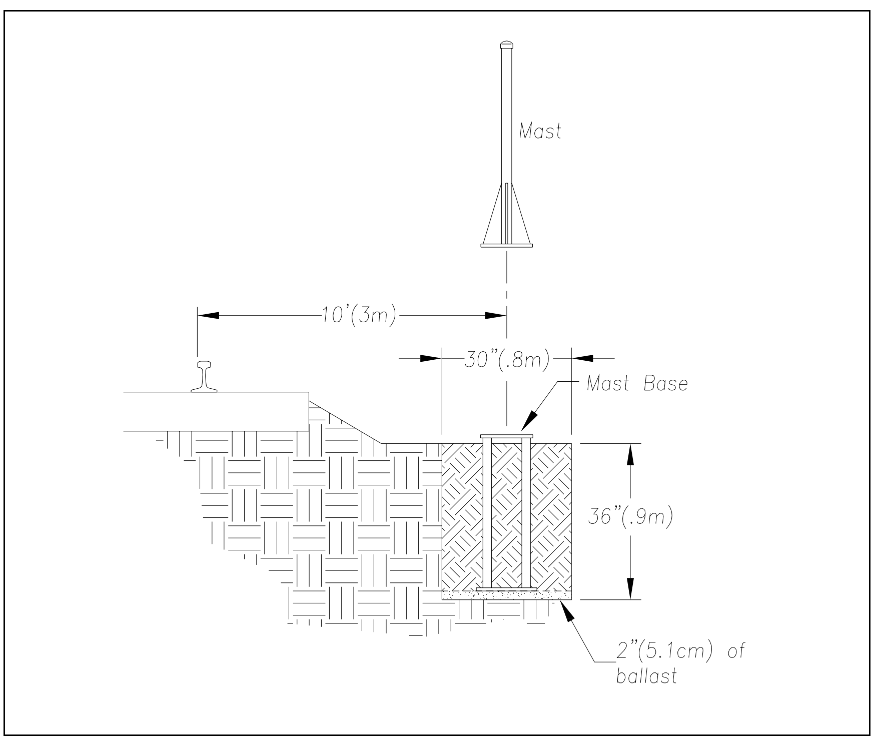
      The wheel scanners should be centered in the crib of the two ties immediately ahead (and to the north or east) of the bearing scanners.

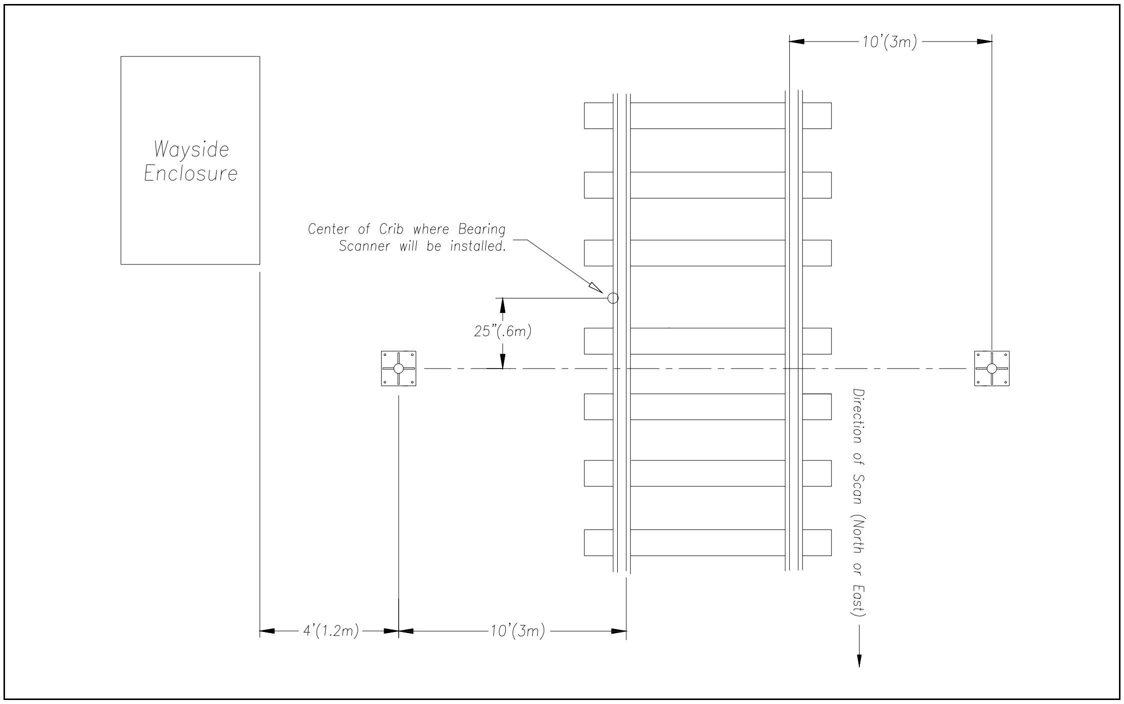
   b Repeat steps **2** through **6**.

5.3 Preparing the AEI Antenna Masts

If your **single-track site** uses AEI equipment, to ready the 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's plumb and so that its center is 10 feet (3 meters) from the gauge side of the closest rail 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 Wayside Enclosure

To ready the wayside enclosure:

1 Place the wayside enclosure on level, well-drained ground.

Face the door side (of the wayside enclosure) toward the tracks.

2 Level the wayside enclosure.

3 As a minimum, install two ground rods at opposite corners of the wayside enclosure.

Ground rods should be at least 5/8-inch (1.59-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 wayside enclosures.

4 Attach one end of the copper wire that is attached to the wayside enclosure to the ground rod.

Telephone service is needed for you to access the system remotely.

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 wayside enclosure and leave it coiled on the floor.

In a later chapter, this telephone line will be wired to a surge protector in the SmartScanNG enclosure.

8 Supply the site with a stable AC power source of at least 110 volts at 20 amperes or a stable DC power source of 11.5 through 15 volts at 15 amperes.

9 If your site is going to use a **DC power source**:

- **a** Complying with all applicable codes and inspections, bring the DC power source to the fuse block inside the wayside enclosure.

  Though not described in detail in this guide, you'll later attach the wires from the DC power source to the fuse block. Until then, be sure that the wires from the DC power source are dead (that is, there is be sure that currently no current is coming from the DC power source).

- **b** Skip the remaining steps.

10 Complying with all applicable codes and inspections, bring the outside **AC power line** to the circuit-breaker box inside the wayside enclosure.

The next step will remove power from the circuit-breaker box to the rest of the wayside enclosure.

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

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

You can also wire the power line to a surge protector and then to the circuit-breaker box.

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

In a later chapter, the SmartScanNG enclosure and the battery charger will be plugged into this outlet. Don't plug it in now.

5.5 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 SmartScanNG systems are shipped either in a crate or in a wayside enclosure, if one was ordered. The contents of this crate or wayside enclosure 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.

5.6 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
Repair 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.
- Written explanation of the hardware damage or defect.

5.7 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 machine. These calls are returned promptly the next business day.

When calling, state that you are calling about a SmartScanNG system. Your call will then be directed to the appropriate person.

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

5.8 Identifying the Installation Tools

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

- Laptop computer
- Track drill with 3/8-inch bit
- 1/2-inch drive socket with 9/16-inch deep well socket
- 3/4-inch drive socket with 1-7/16-inch socket
- 9/16-inch torque wrench
- 9/64-inch Allen wrench (if your site uses **type2** scanners)
- Medium size adjustable box wrench (aka crescent wrench)
- Carpenters level
- 1/2-inch nutdriver
- 11/32-inch nutdriver
- #2 Phillips head screwdriver
- Small slotted screwdriver (aka flathead screwdriver)
- 50-foot (15-meter) or longer tape measure
- Multimeter, reading at least 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-adapter 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 wayside enclosure, if possible. They are also used to maintain the system.

Chapter 6
Installing Track Components

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

All SmartScanNG 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.

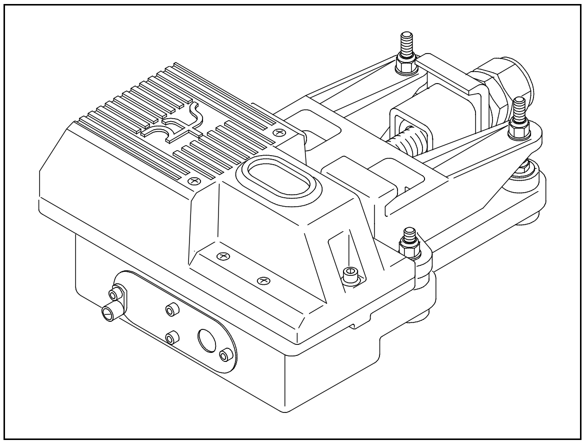
Track components are installed in this order.

- 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, deflectors
- When used, the track circuit and its wires
- When used, AEI antennas and their cables
- When used, auxiliary-alarm detectors and their cables

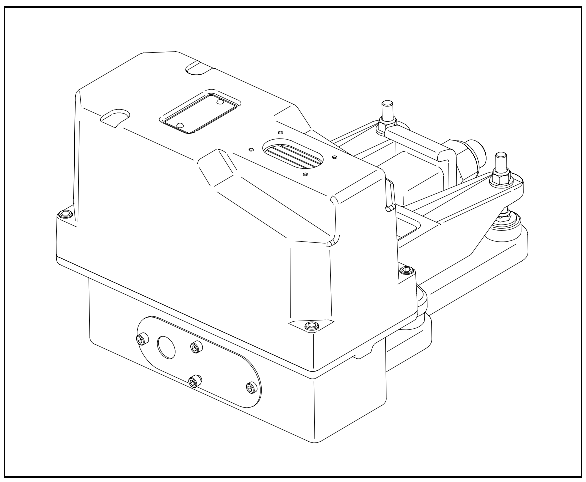
The instructions that follow **only work in the northern hemisphere**. If your site is south of the equator, skip the instructions in this chapter and call STC for help.

6.1 Bearing Scanners

An assembled **type2** bearing scanner looks like this.



An assembled **type3** bearing scanner looks like this.



To install the **type2/type3** 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.

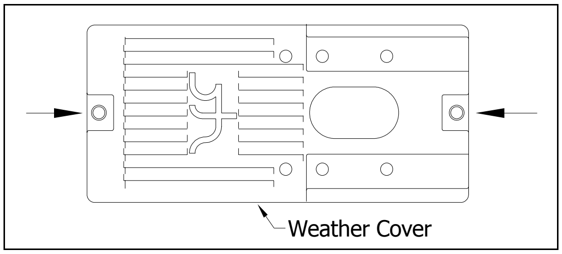
The bearing scanners should be centered in the crib of two ties (aka sleepers) spaced at least 14 inches (35.6 centimeters) apart.

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

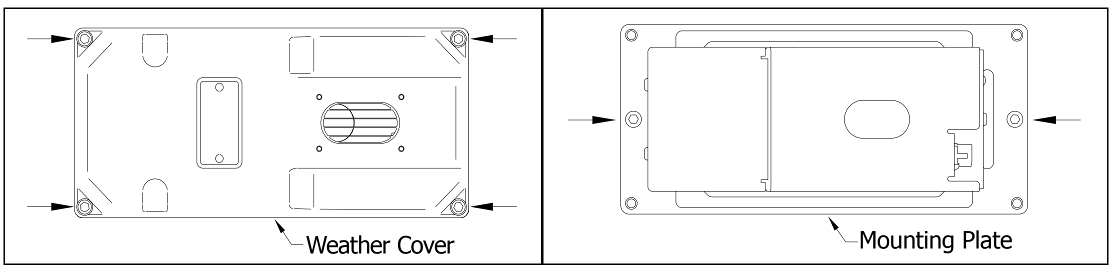
You'll next install the first bearing scanner.

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.

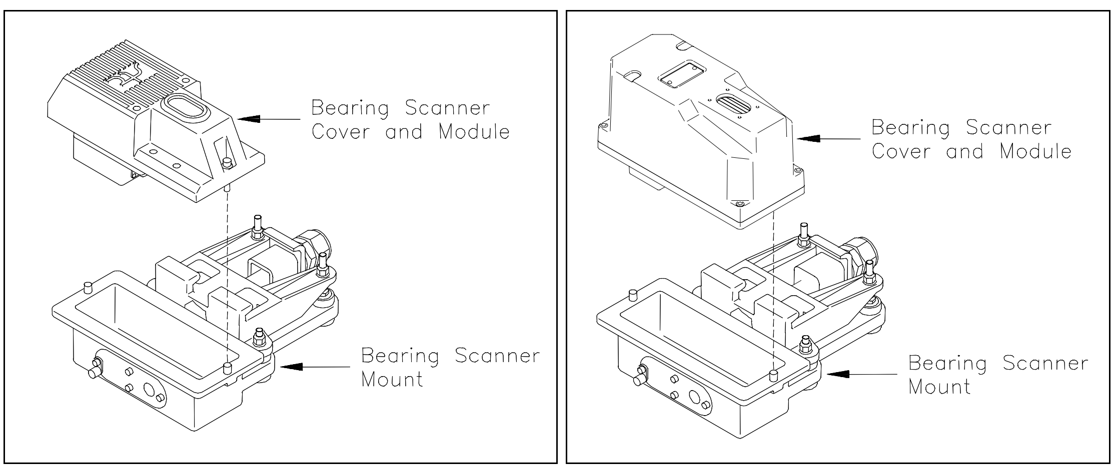
The **type2** bearing scanner has two socket-head-cap screws that attach the weather cover to the mount.



The **type3** bearing scanner has six. Four that attach the weather cover to the mounting plate and two that attach the mounting plate to the mount.



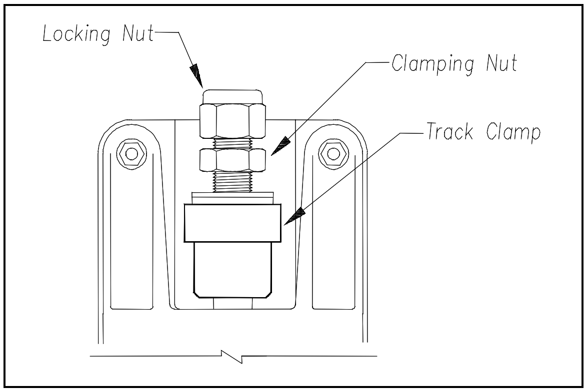
6 Separate the bearing scanner cover-and-module assembly from its mount.



7 If this is a **type3** 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 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.

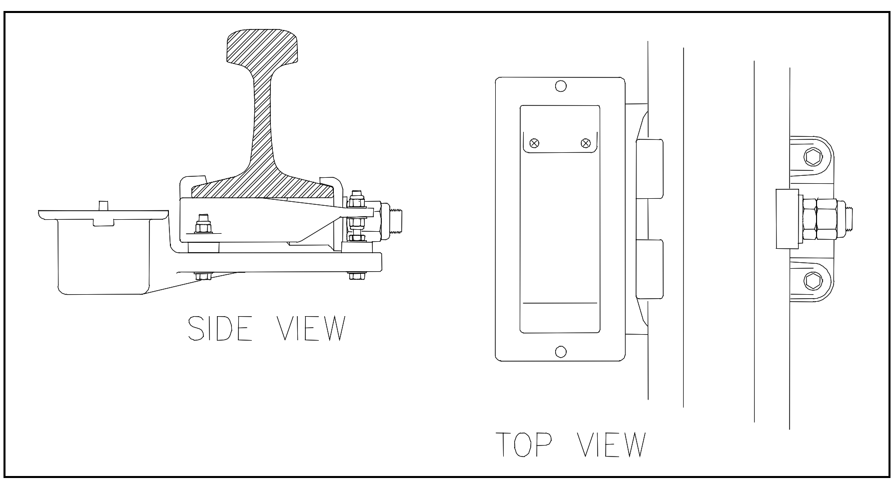
11 Using a short-handle 1-1/2-inch wrench, tighten the clamping nut to a **torque of 48 to 50 foot-pounds (65.1 to 67.8 newton-meters)**.

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.

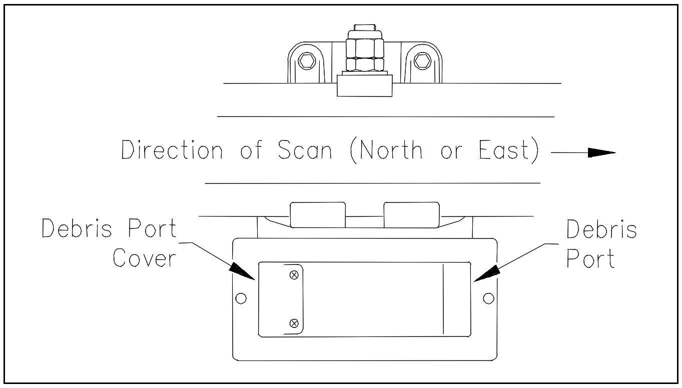


The next step is necessary to finish installing the bearing scanner mounts, to install the bearing scanners themselves, and to install the transducers.

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 <u>uncovered</u> debris port is at the southmost or westmost end of the mount.**

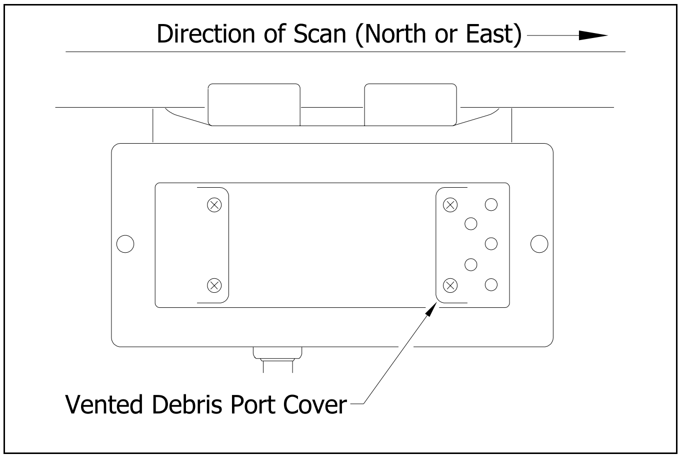
15 If the debris port cover isn't as shown above:

- **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.

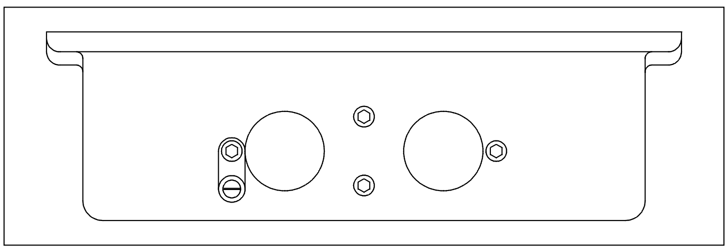
16 If you are installing a **type3** bearing scanner:

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.

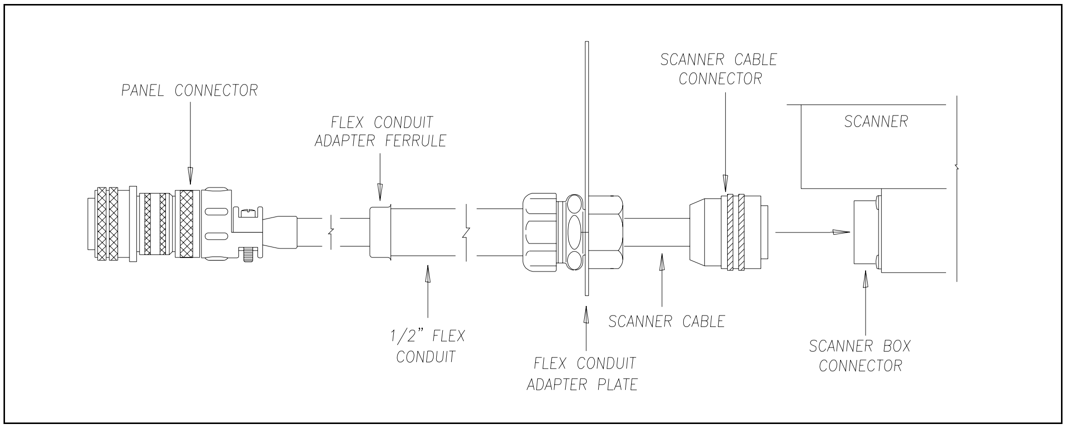


On the side of the mount are two large holes and four socket-head-cap screws. The longest screw is holding a ground lug and an internal-tooth washer.

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.

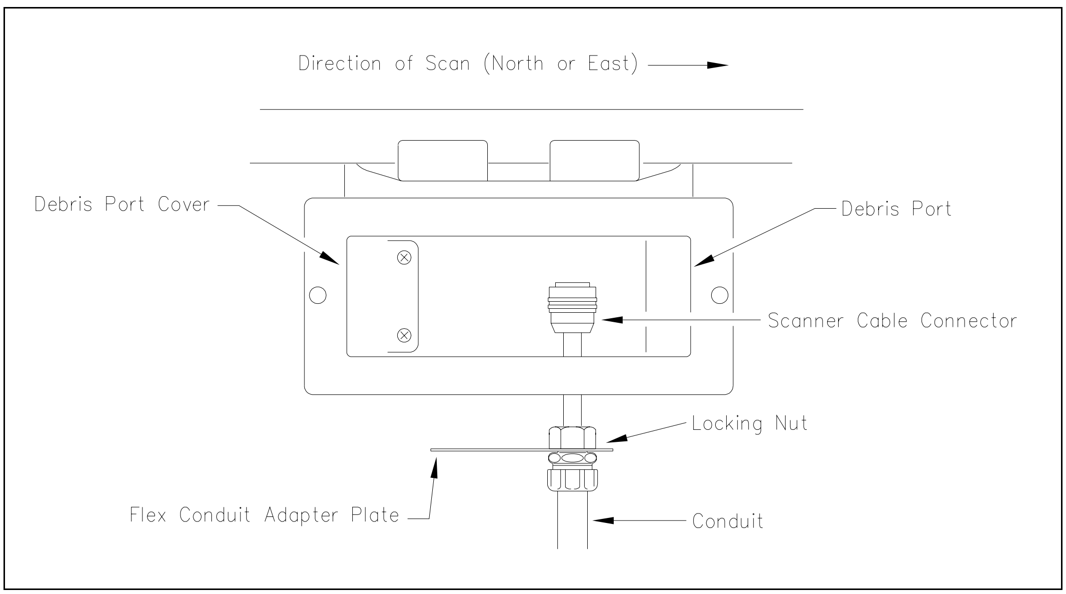
In the steps that follow, the terms scanner cable connector, panel connector, and flex-conduit-adapter plate are used. Notice where they are on a bearing scanner cable.



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 wayside enclosure and two 100-foot (30.5-meter) bearing scanner cables for the track farthest from the wayside enclosure.

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 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.

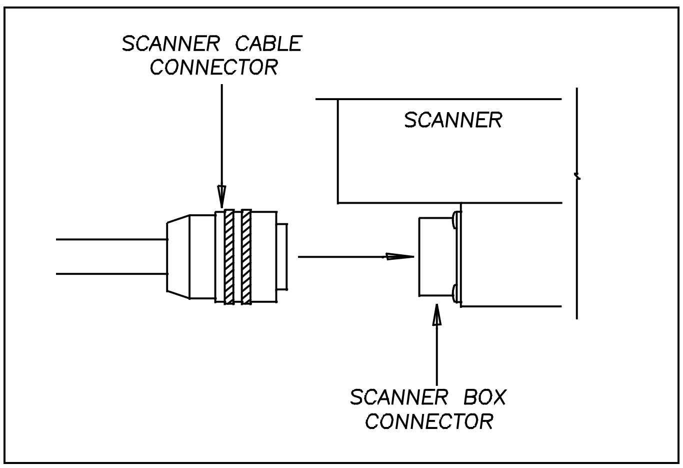
26 In the screw hole closest to the cable, replace the screw and tighten by hand.

27 In the screw hole farthest from the cable, replace the ground lug, internal-tooth washer, and screw.

28 Tighten by hand.

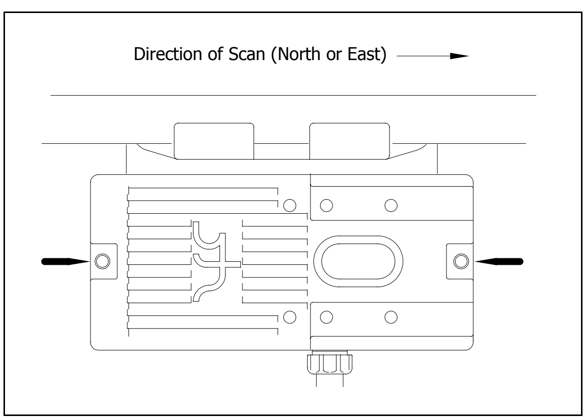
29 Using a T-handle 3/16-inch hex-wrench, tighten the four screws until they are completely tight.

30 Attach the bearing scanner cable connector to the scanner box connector.



31 If this is a **type2** bearing scanner:

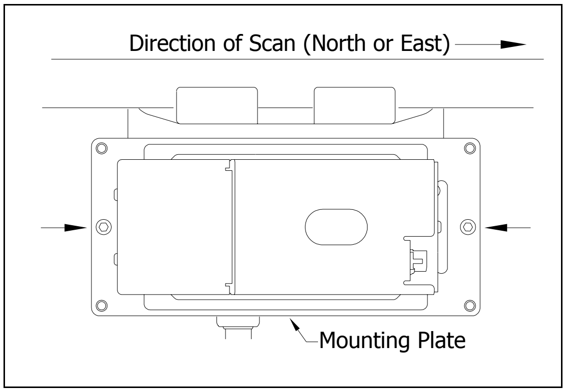
a With the hole on top of the bearing scanner cover facing north or east, set the cover-and-module assembly onto its mount.



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

32 If this is a **type3** bearing scanner:

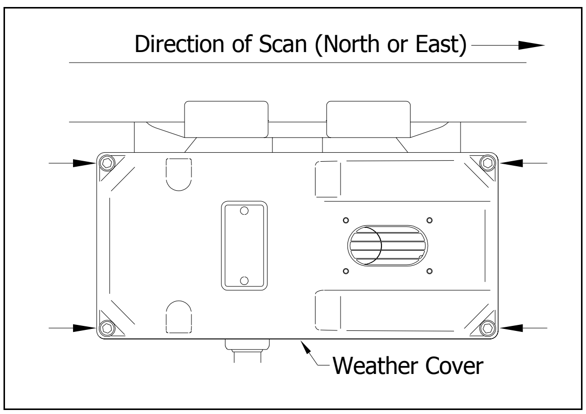
a With the hole on top of the bearing scanner cover facing north or east, set the mounting plate back onto its scanner mount.



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

c Connect 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 wayside enclosure <u>and</u> 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 wayside enclosure.

You'll next install the <u>second</u> 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 **<u>type2</u>** bearing scanner has <u>two</u> socket-head-cap screws that attach the weather cover to the mount. The **<u>type3</u>** bearing scanner has six. <u>Four</u> that attach the weather cover to the mounting plate and <u>two</u> that attach the mounting plate to the mount.

38 Separate the scanner cover, which contains an attached scanner module, from its mount.

39 If this is a **<u>type3</u>** bearing scanner, disconnect the heater wiring plug.

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

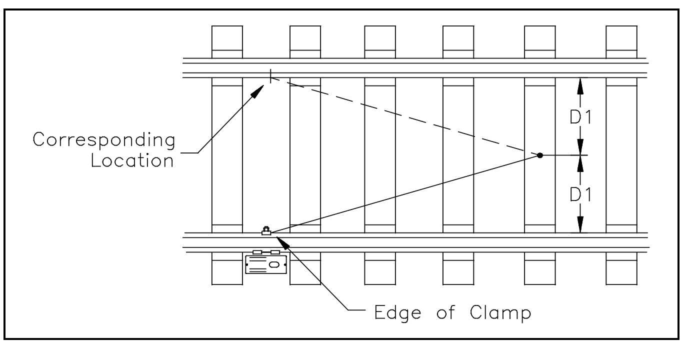
When installing the second bearing mount on the opposite rail, make sure that the two bearing mounts are squared with each other and directly opposite each other. The next step tells how to do this.

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.

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

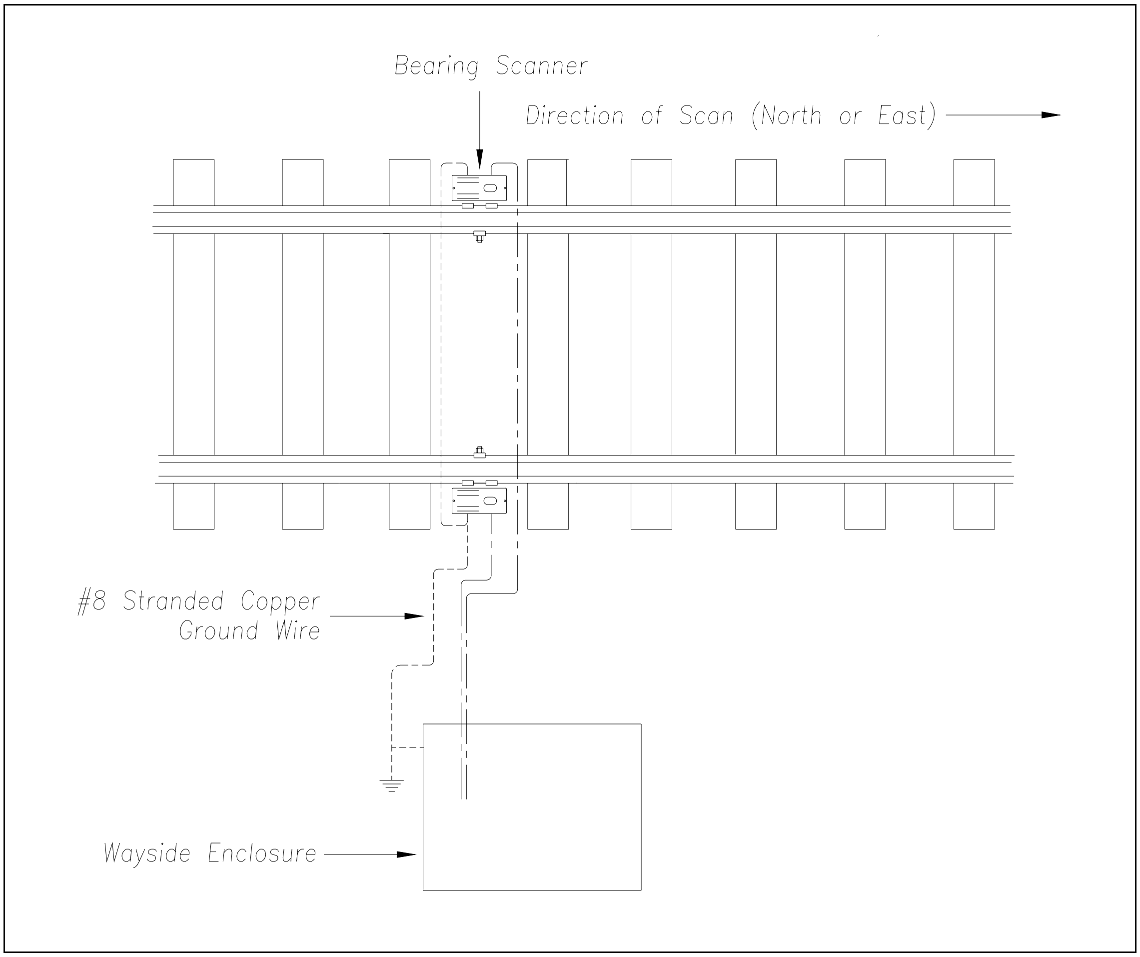
Use a permanent marker, magic marker, lumber crayon, or paint pen to mark the rail. Don't use a file or punch to mark the rail.

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 an 8 AWG stranded copper wire to the ground lug on the flex-conduit-adapter plate and the other end to the ground lug on the other scanner mount.

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



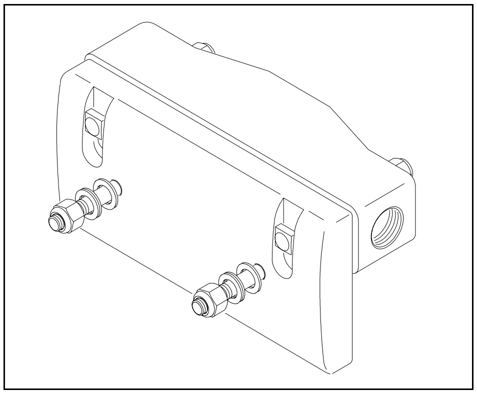
45 If this is a single-track site, go to ***6.2 Transducers***.

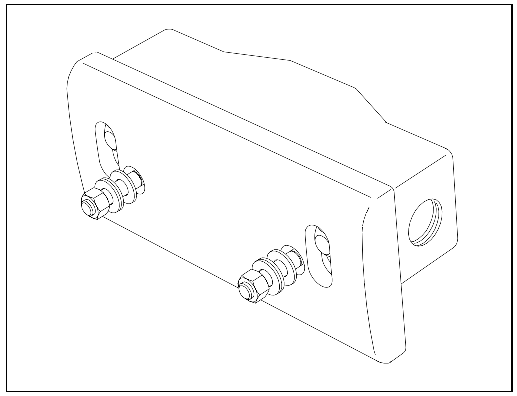
46 If this is a double-track site:

- **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.

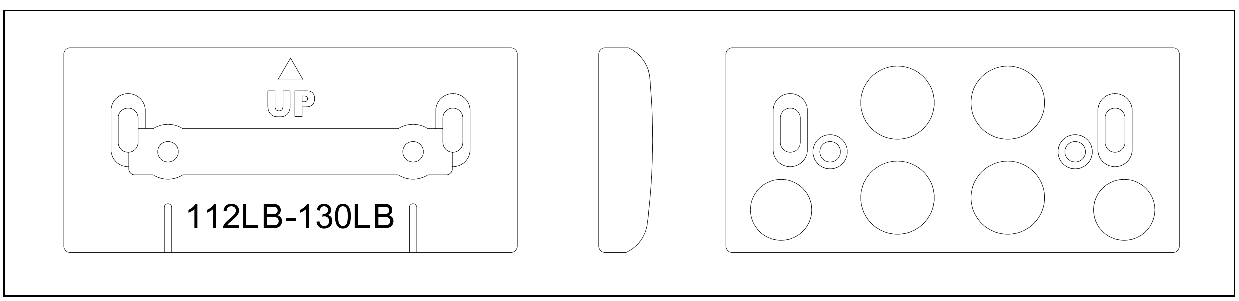




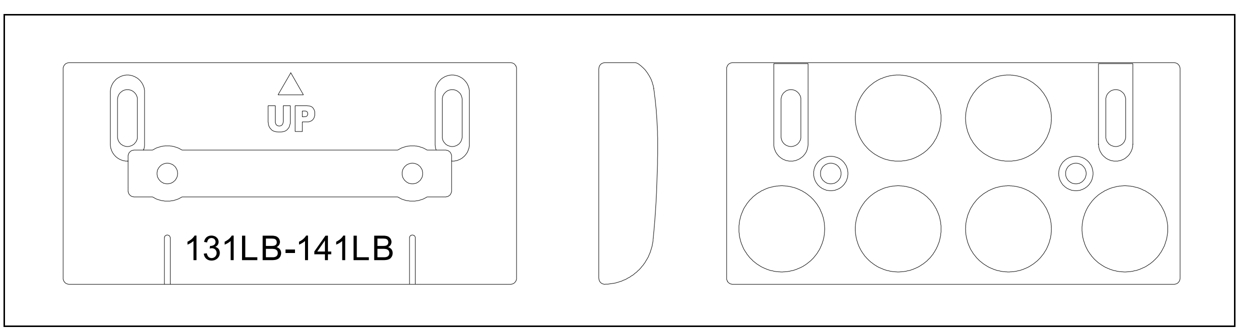
If your site uses transducers that don't look like either of the above, skip the instructions below and call STC for help. If your rail size isn't 115, 122, 127, 132, 136, or 141 pounds per yard (57.05, 60.52, 63.00, 65.48, 67.46, or 69.94 kilograms per meter), skip the instructions below and call STC 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 torque wrench, a 50-foot (15-meter) or longer tape measure, and the alignment fixture.

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 wayside enclosure, 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 **type2** bearing scanners:

Rail Size pounds/yard	Rail Size kilograms/meter	Distance (DIM1), When Using With Type2 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	11-1/16 inches (28.09 centimeters)
141	69.94	11-3/16 inches (28.41 centimeters)

When using with **type3** bearing scanners:

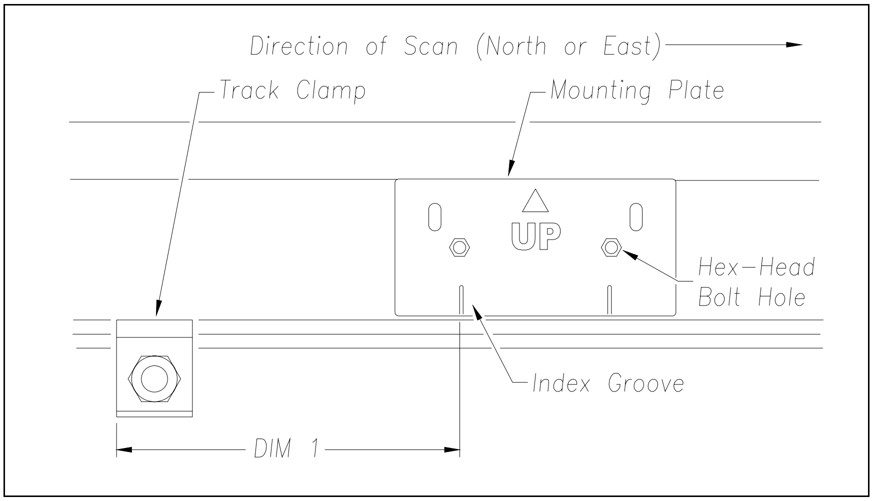
Rail Size pounds/yard	Rail Size kilograms/meter	Distance (DIM1), When Using With Type3 Bearing Scanners
115	57.05	8-1/4 inches (20.96 centimeters)
122	60.52	8-7/16 inches (21.43 centimeters)
127	63.00	8-5/8 inches (21.91 centimeters)
132	65.48	8-3/4 inches (22.23 centimeters)
136	67.46	8-15/16 inches (22.70 centimeters)
141	69.94	9-1/16 inches (23.02 centimeters)

For example, when using with **type2** 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**.

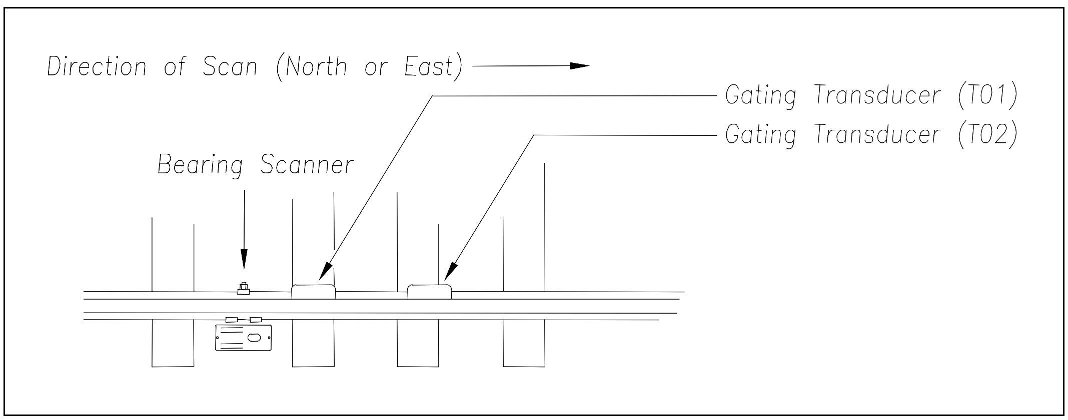
5 Separate the fiberglass-reinforced polyester transducer body from the aluminum mounting plate.

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.

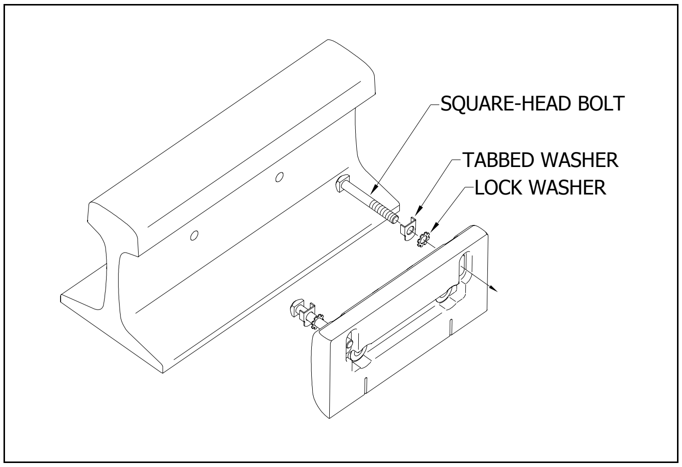
9 Using the hex-head bolt holes as your guide, mark the two places on the rail where you'll later drill holes.

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.

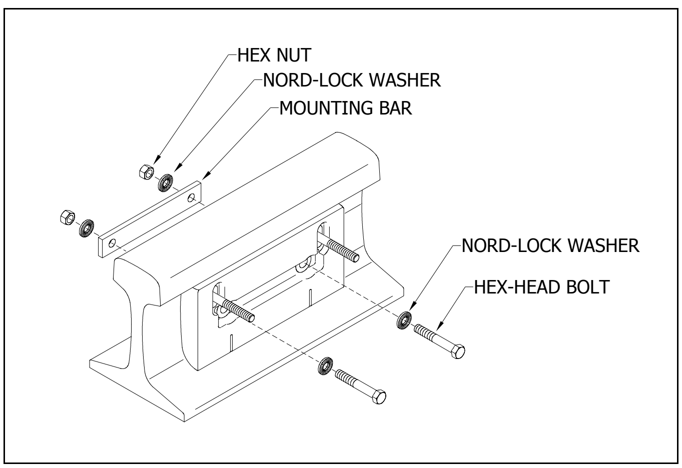


14 With the arrow on the plate pointing up and the heads of the bolts against the gauge side of the rail, align the hex-head bolt holes in the plate with the drilled holes in the rail.

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.

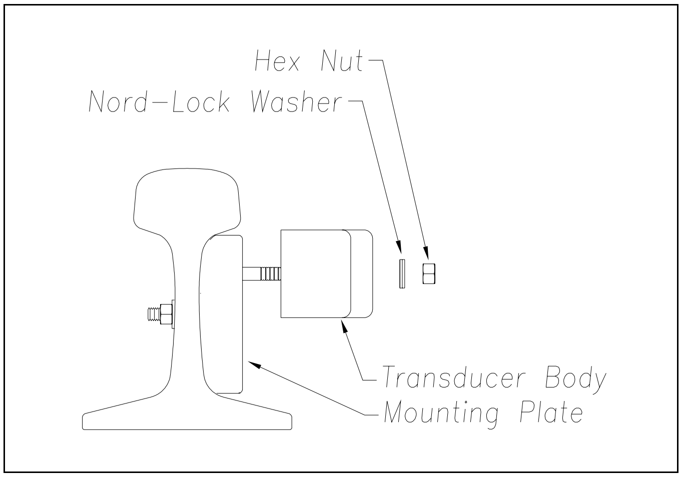


18 Tighten each hex-lock nut with a 9/16-inch torque wrench to a **torque of 12 to 15 foot-pounds (16.3 to 20.3 newton-meters)**.

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.

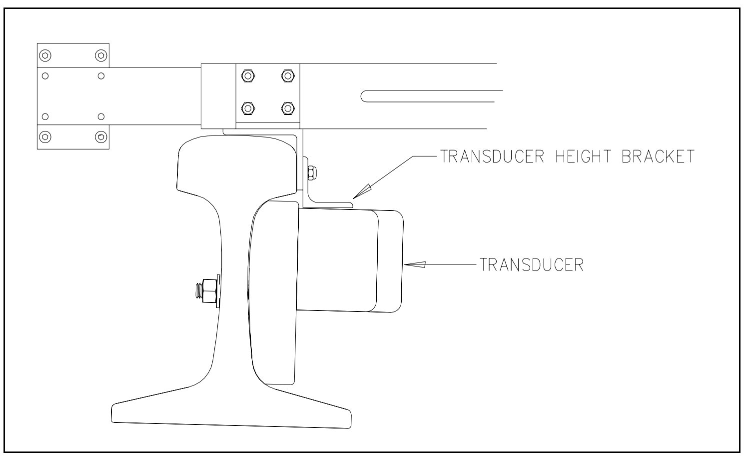


The installed transducer body should be 1-9/16 inches (3.97 centimeters) below the top of the rail and parallel to it. You can meet this requirement by using the transducer height bracket on the bottom of the alignment fixture.

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 wayside enclosure 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 **type2** bearing scanners:

Rail Size pounds/yard	Rail Size kilograms/meter	Distance (DIM2), When Using With Type2 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	35-1/16 inches (89.06 centimeters)
141	69.94	35-3/16 inches (89.37 centimeters)

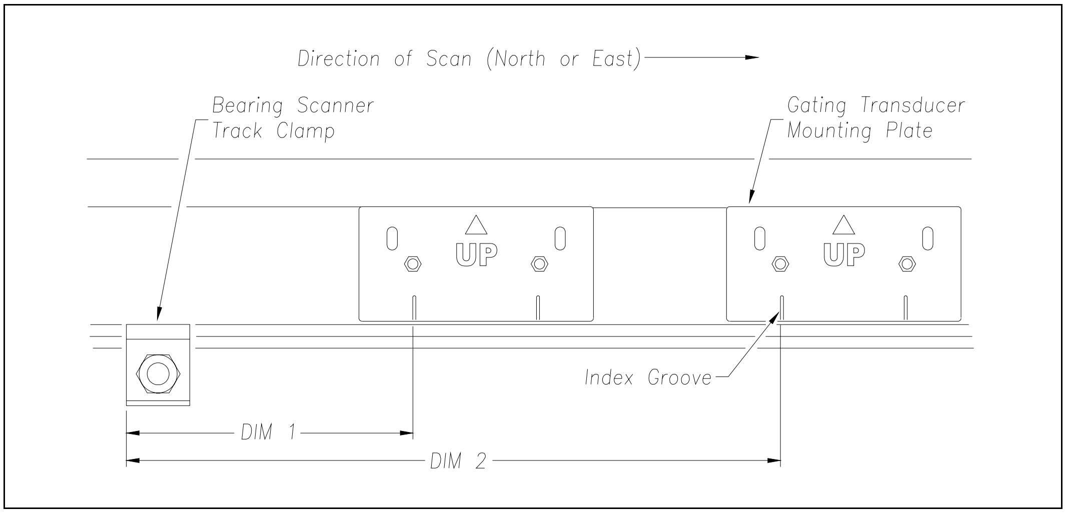
When using with **type3** bearing scanners:

Rail Size pounds/yard	Rail Size kilograms/meter	Distance (DIM2), When Using With Type3 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	32-15/16 inches (83.66 centimeters)
141	69.94	33-1/16 inches (83.98 centimeters)

For example, when using with **type2** 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**.



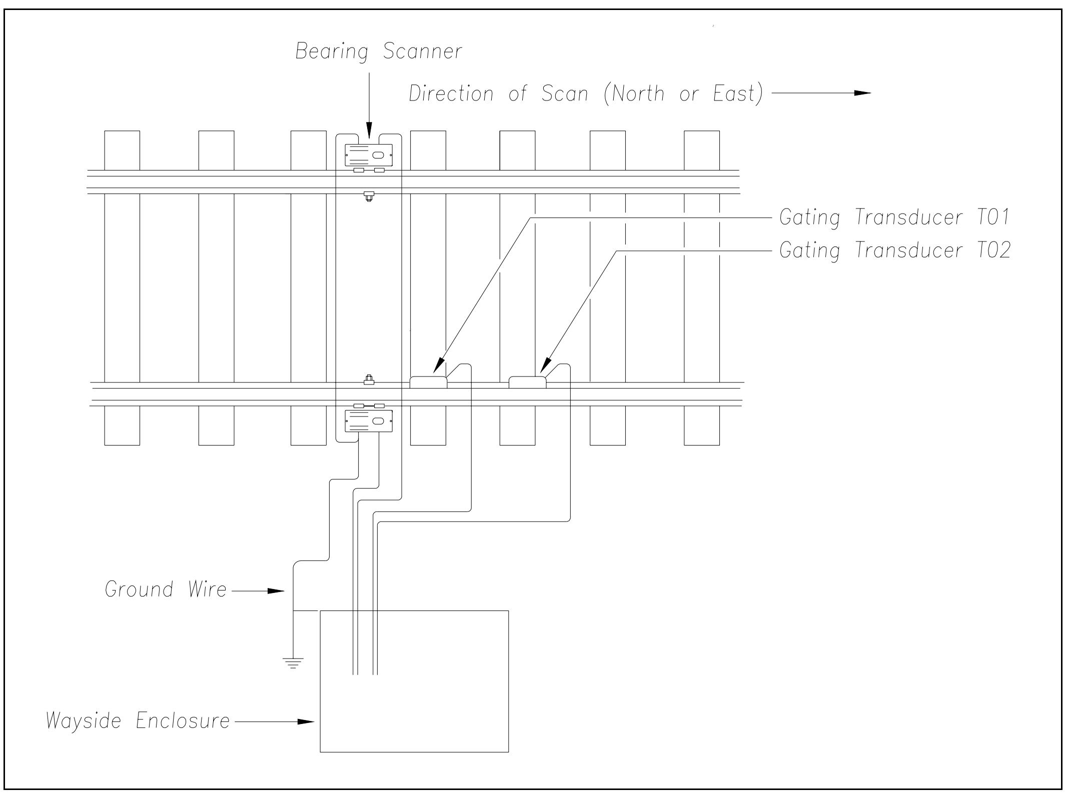
31 Repeat steps **8** through **23**.

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 wayside enclosure <u>and</u> leave it coiled on the floor.

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



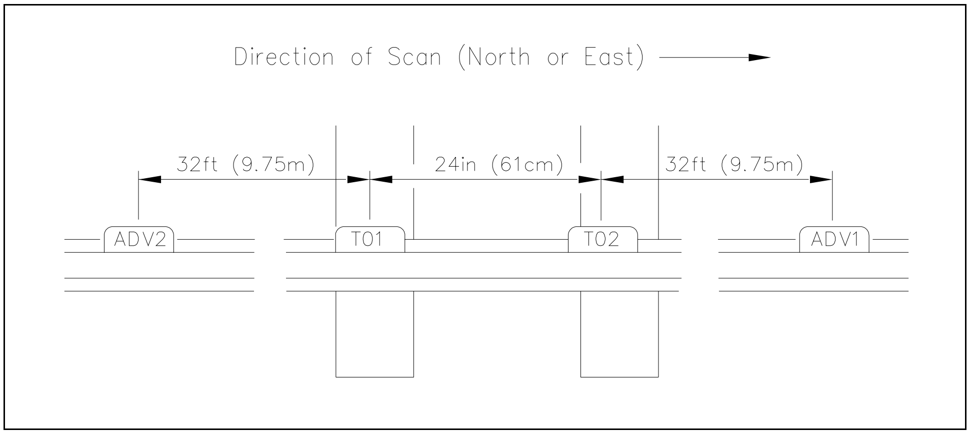
35 If this is a single-track site, go to step **37**.

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 Deflectors***.

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 <u>and</u> on the same rail as the gating transducers. You'll next install advance transducer **ADV1** to the <u>right</u> 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 <u>right</u> from the <u>rightmost</u> index groove of gating transducer **TO2**, measure 32 feet (9.75 meters) to the <u>rightmost</u> 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 wayside enclosure <u>and</u> leave it coiled on the floor.

You'll next install advance transducer **ADV2** to the <u>left</u> of gating transducer **TO1**.

45 Using another transducer, separate the body from the mounting plate.

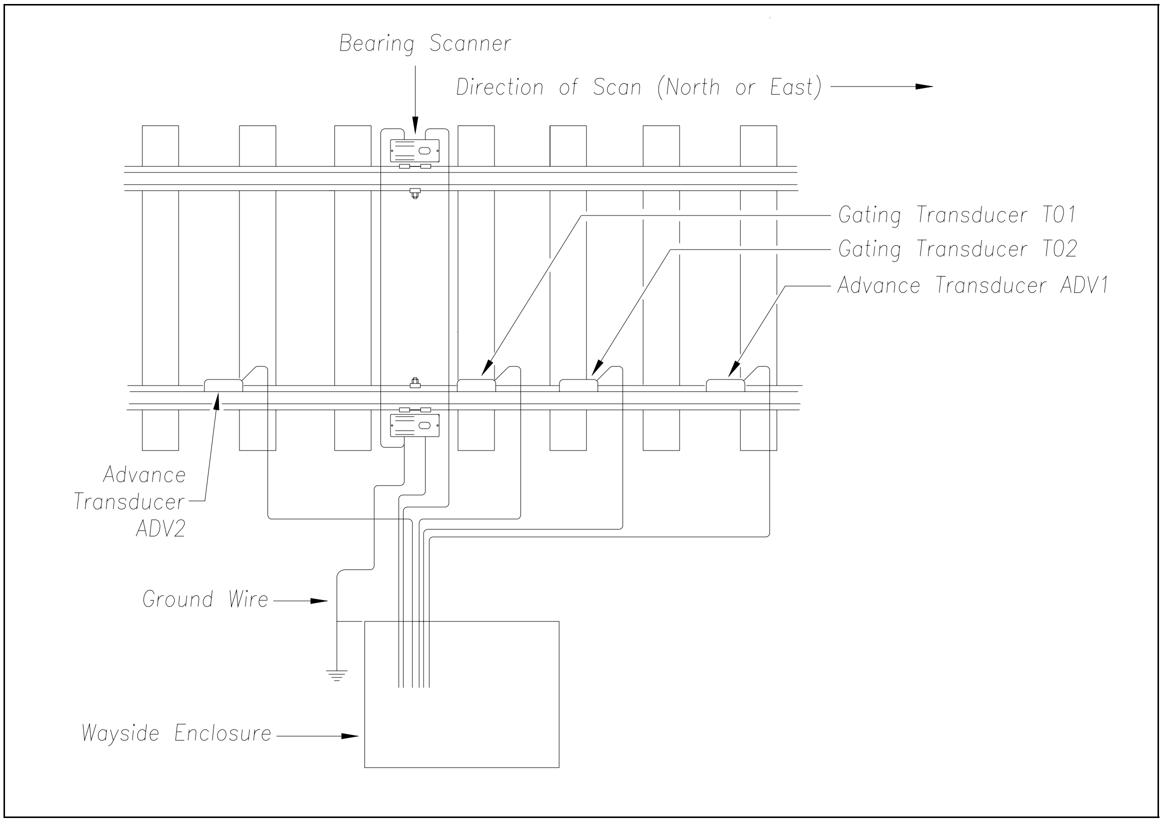
46 With the arrow on the plate pointing up, place the mounting plate against the gauge side of the rail.

47 Going <u>left</u> from the <u>leftmost</u> index groove of gating transducer **TO1**, measure 32 feet (9.75 meters) to the <u>leftmost</u> 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:

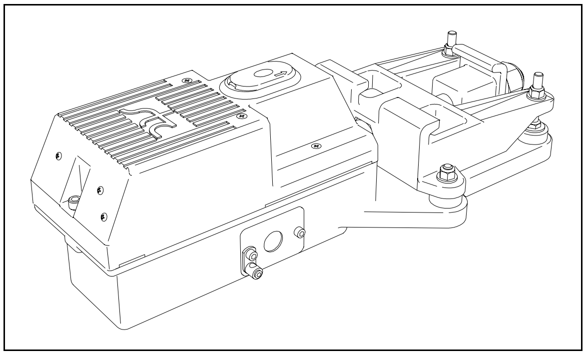
- **a** If your site has wheel scanners, go to ***6.3 Wheel Scanners***.
- **b** Go to ***6.4 Deflectors***.

52 If this is a double-track site:

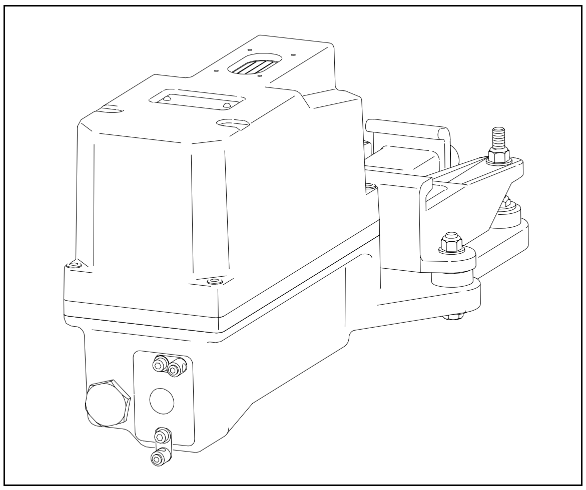
- **a** Repeat steps **1** through **50** on the second track.
- **b** If your site has wheel scanners, go to ***6.3 Wheel Scanners***.
- **c** Go to ***6.4 Deflectors***.

6.3 Wheel Scanners

An assembled **type2** wheel scanner looks like this.



An assembled **type3** 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 Deflectors***.

To <u>install</u> the **type2/type3** 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.

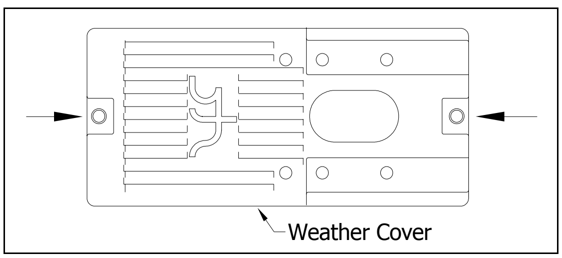
The wheel scanners should be centered in the crib of two ties spaced at least 14 inches (35.6 centimeters) apart. The crib of the two ties is the one immediately ahead (and to the north or east) of the bearing scanners. This places one wheel scanner between the two gating transducers. The other one is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

4 If not done already, remove ballast from under <u>both</u> rails between the ties.

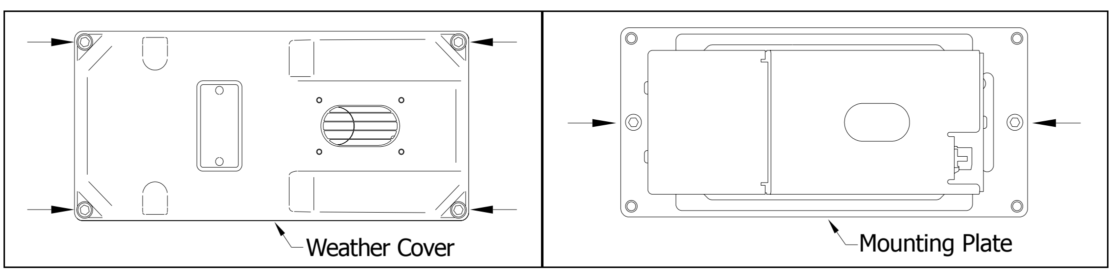
You'll next install the <u>first</u> wheel scanner.

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.

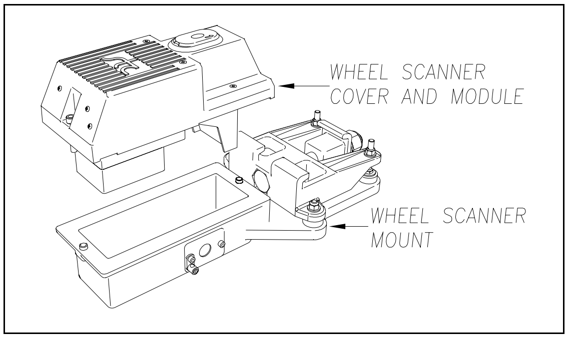
The <u>**type2**</u> wheel scanner has <u>two</u> socket-head-cap screws that attach the weather cover to the mount.

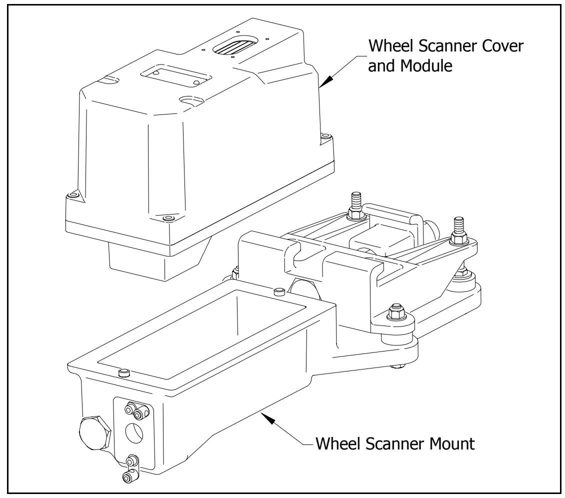


The <u>**type3**</u> wheel scanner has six. <u>Four</u> that attach the weather cover to the mounting plate and <u>two</u> that attach the mounting plate to the mount.



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





7 If this is a **type3** 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 the 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.

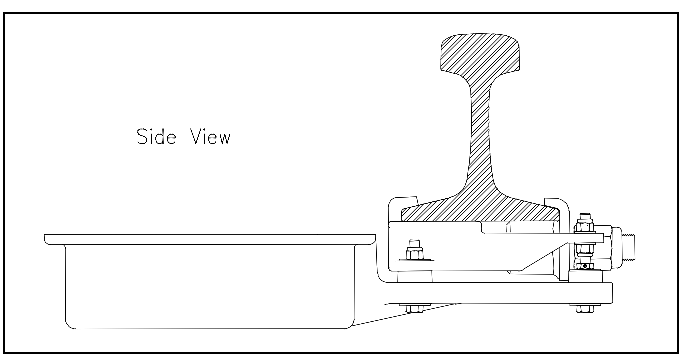
11 Using a short-handle 1-1/2-inch wrench, tighten the clamping nut to a **torque of 48 to 50 foot-pounds (65.1 to 67.8 newton-meters)**.

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)**.

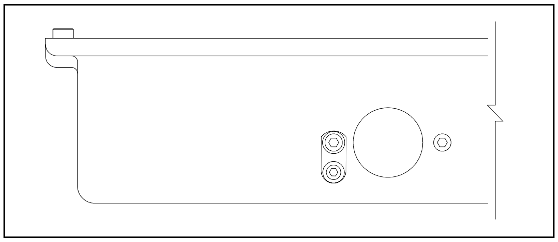
Don't exceed a torque of 50 foot-pounds (67.8 newton-meters). Doing so can cause failure of the mount.

At this point, your work should look like this.

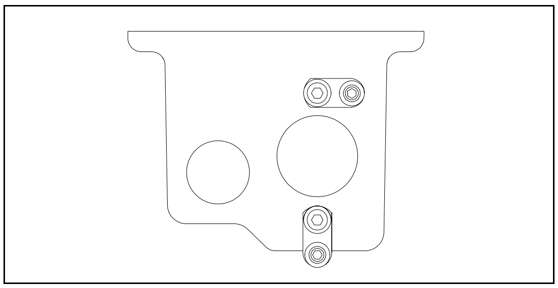


On the side of the mount are a large hole and two socket-head-cap screws. The longest screw is holding a ground lug and an internal-tooth washer.

For the **type2** wheel scanner, the large hole is on the right side of the mount (2100-701) as you face the track.



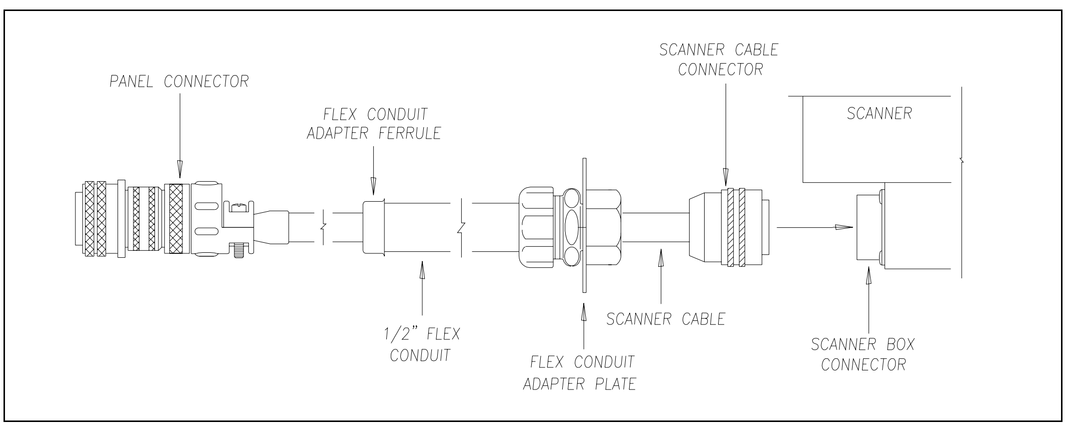
For the **type3** wheel scanner, the large hole is on the side of the mount (2500-401) farthest from the track. Some of these scanners have two ground lugs, as shown below.



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 (19.8-meter) wheel scanner cables for the track closest to the enclosure and two 100-foot (30.5-meter) wheel scanner cables for the track farthest from the enclosure.

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 f you are installing a **type2** 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 **type3** 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.

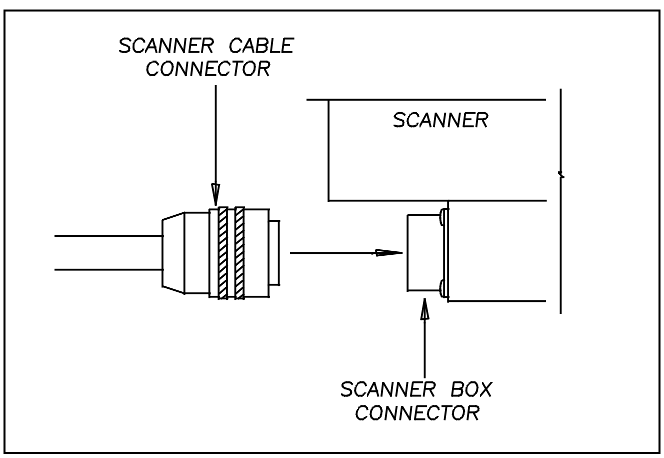
21 Tighten by hand.

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 **type2** 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 **type3** 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 wayside enclosure 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-adapter 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 **type2** wheel scanner has two socket-head-cap screws that attach the weather cover to the mount. The **type3** wheel scanner has six. Four that attach the weather cover to the mounting plate and two that attach the mounting plate to the mount.

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

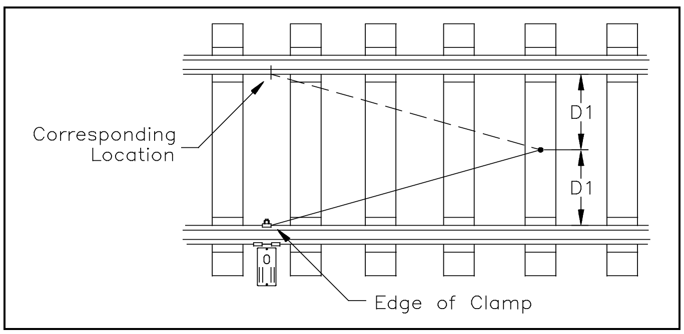
33 If this is a **type3** wheel scanner, disconnect the heater wiring plug.

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.

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

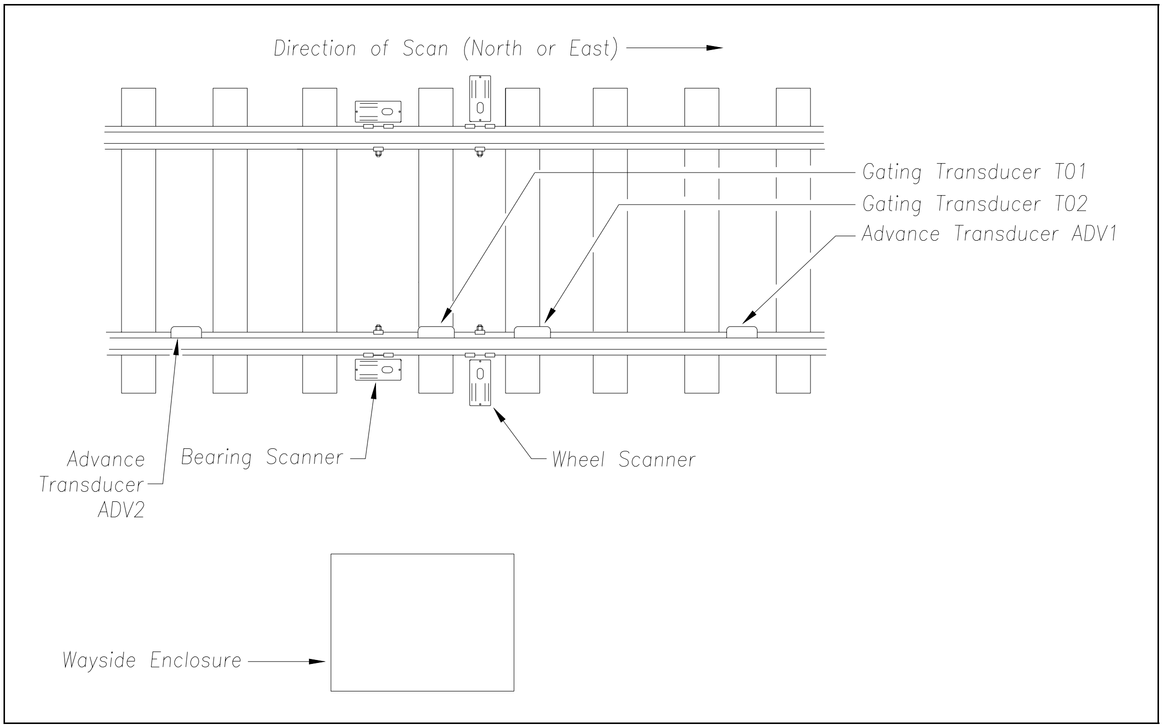
  Use a permanent marker, magic marker, lumber crayon, or paint pen to mark the rail. Don't use a file or punch to mark the rail.

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-adapter 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 Deflectors***.

40 If this is a double-track site:

a Repeat steps **1** through **38** on the second track.

b Go to ***6.4 Deflectors***.

6.4 Deflectors

Not all sites use deflectors. If your site doesn't use them, skip the instructions below and go to ***6.5 Track Circuit***.

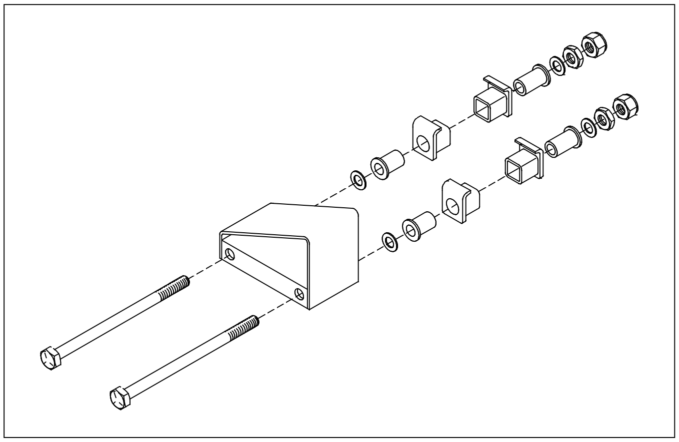
To assemble the deflectors:

1 Be sure that you have on hand all the parts for four deflectors.

You'll next put together two **left-hand deflectors**.

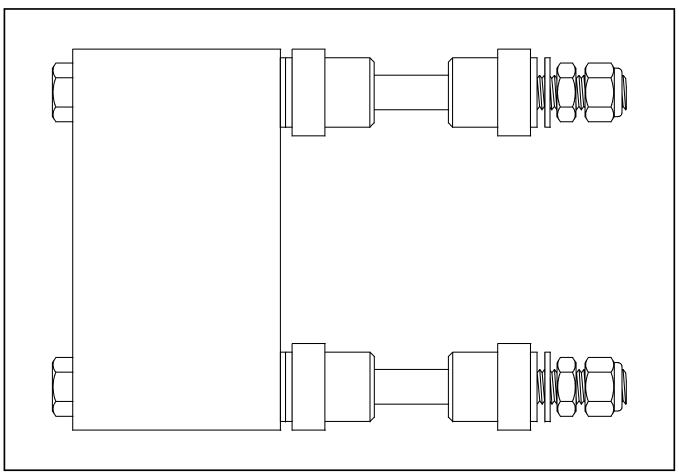
2 On a clean, flat surface, place a deflector ramp with its peak side toward you.

3 As shown below, place two bolts to the left and the rest of the needed parts to the right.



4 Assemble the parts, loosely putting on the final two nuts.

Your assembled deflector should look like this.



5 Put the deflector aside.

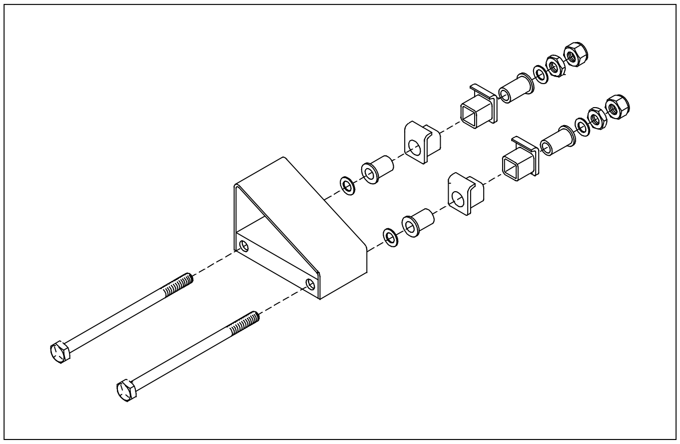
6 If you have only assembled one left-hand deflector, repeat steps **2** through **5**.

You now have two assembled left-hand deflectors. One will be installed to the left of the leftmost scanner on one rail. The other will be installed to the left of the leftmost scanner on the opposite rail. The peak side of the deflector ramps will always be the ones closest to the scanner.

You'll next put together two **right-hand deflectors**.

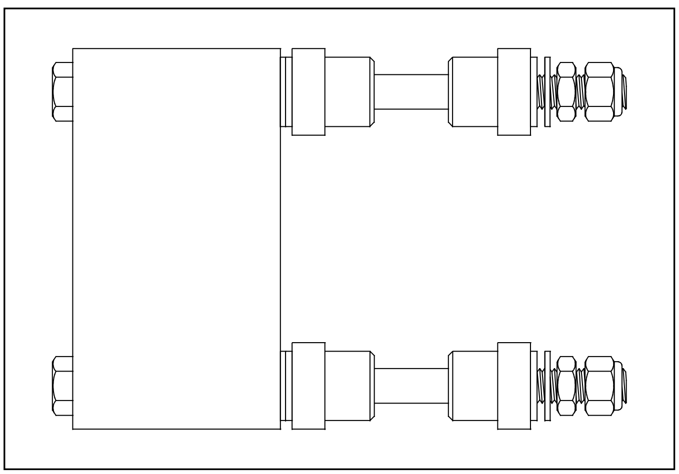
7 On a clean, flat surface, place a deflector ramp with its peak side away from you.

8 As shown below, place two bolts to the left and the rest of the needed parts to the right.



9 Assemble the parts, loosely putting on the final two nuts.

Your assembled deflector should look like this.



10 Put the deflector aside.

11 If you have only assembled one right-hand deflector, repeat steps **7** through **10**.

You now have two more assembled right-hand deflectors. One will be installed to the right of the rightmost scanner on one rail. The other will be installed to the right of the rightmost scanner on the opposite rail. The peak side of the deflector ramps will always be the ones closest to the scanner.

You're now ready to install the deflectors.

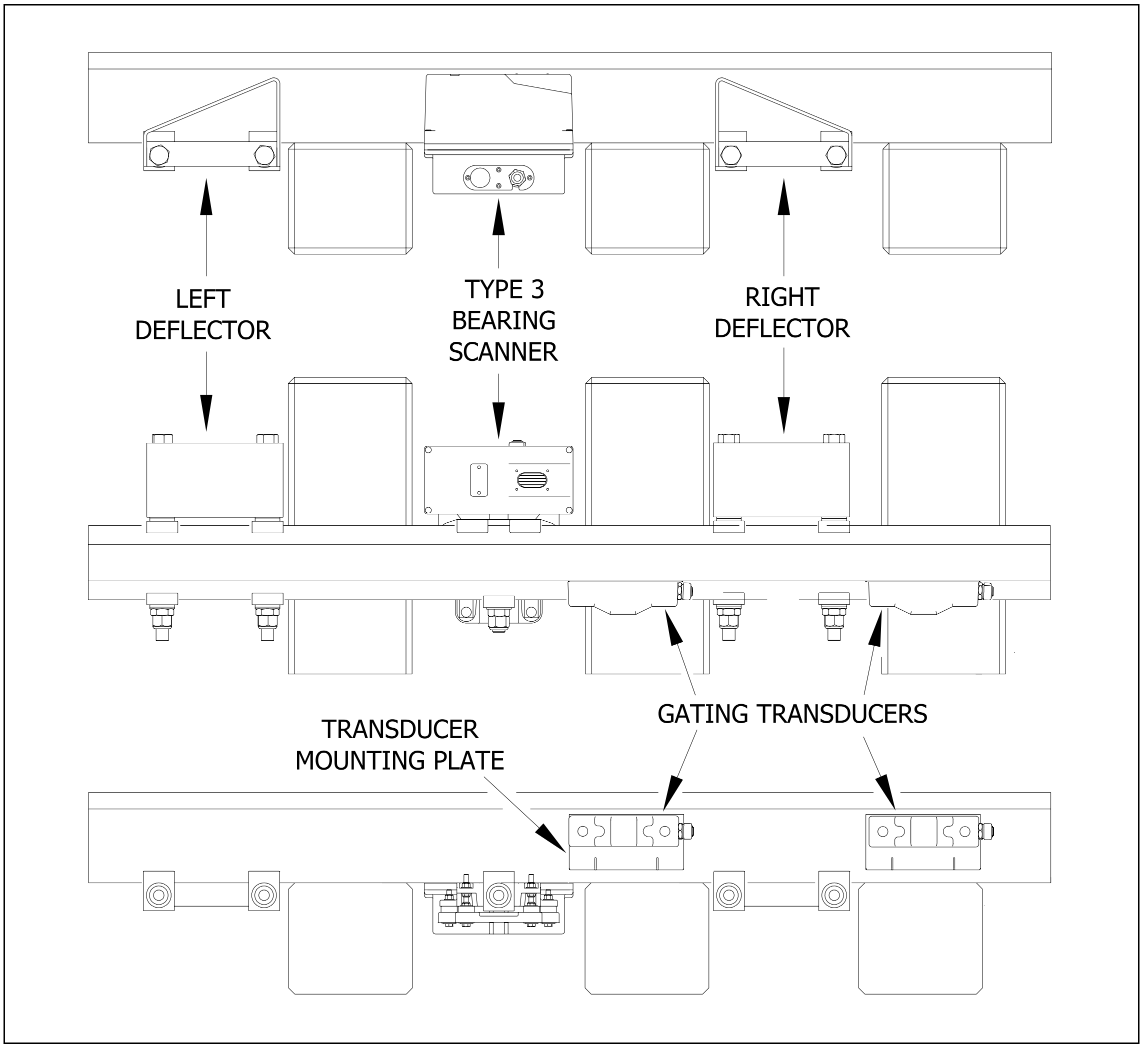
To <u>install</u> the deflectors:

1 Be sure that you have on hand four assembled deflectors.

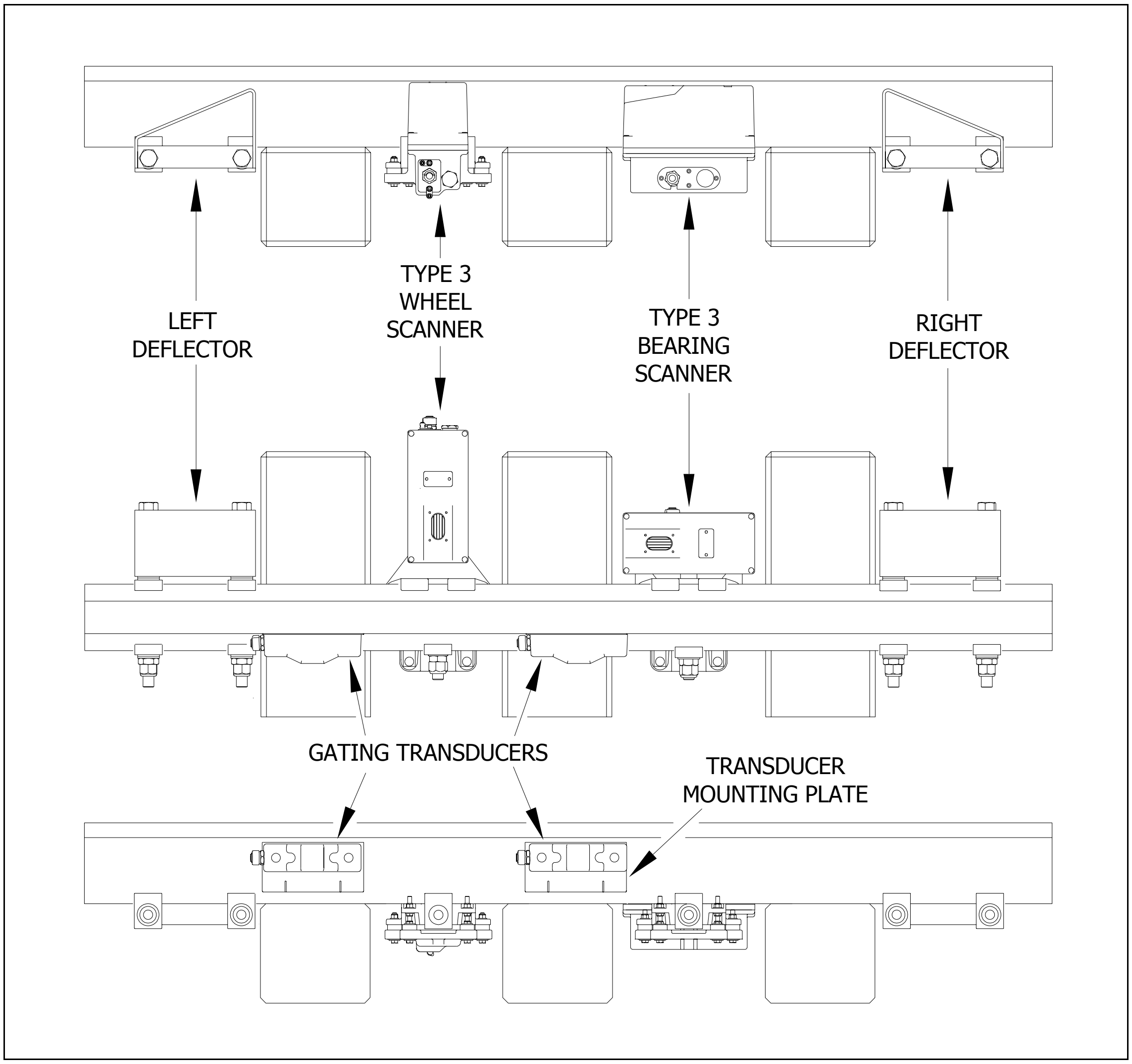
2 Be sure that you have on hand a short-handle 1-1/2-inch wrench.

3 As shown below, note where the deflectors are placed.

If your site has just bearing scanners, one installation will look like this.



If your site has both bearing scanners and wheel scanners, one installation will look like this.



4 Under both rails between both ties, remove the ballast to a depth of 4 inches (10 centimeters).

5 To the right of the rightmost scanner and flush against the tie closest to it, place a right-hand deflector on the rail so that the bolts with the moveable clamps extend under the rail and toward the center of the track.

6 Tighten each inner nut (that is, each clamping nut) by hand.

This should hold the deflector in place.

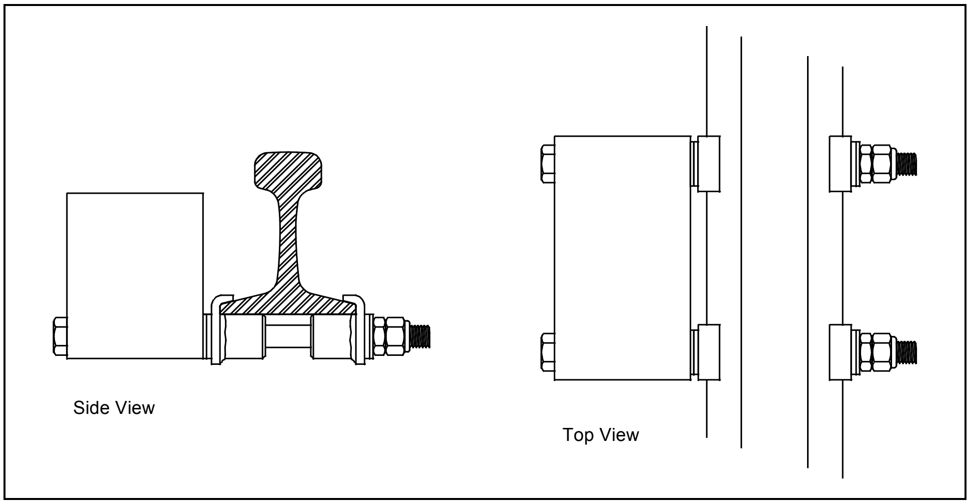
7 Using a short-handle 1-1/2-inch wrench, tighten the clamping nut to a **torque of 48 to 50 foot-pounds (65.1 to 67.8 newton-meters)**.

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

8 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.

You're done installing the first deflector. Your work should look like this.



You're now ready to install the deflector on the other side of the scanner mount.

9 To the left of the leftmost scanner and flush against the tie closest to it, place a left-hand deflector on the rail so that the bolts with the moveable clamps extend under the rail and toward the center of the track.

10 Tighten each clamping nut by hand.

This should hold the deflector 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.

You're done installing the second deflector on the first rail.

13 To install the other two deflectors on the opposite rail, repeat steps **5** through **12**.

14 If this is a single-track site, go to ***6.5 Track Circuit***.

15 If this is a double-track site:

a Repeat steps **1** through **13** on the second track.

b Go to ***6.5 Track Circuit***.

6.5 Track Circuit

Not all sites use a track circuit. If your site doesn't use one, skip the instructions below and go to ***6.6 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 feet (1.5 meters) of the scanners.

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 wayside enclosure and leave them coiled on the floor.

6 If this is a single-track site, go to ***6.6 AEI Antennas***.

7 If this is a double-track site:

- **a** Repeat steps **1** through **5** on the second track.
- **b** Go to ***6.6 AEI Antennas***.

6.6 AEI Antennas

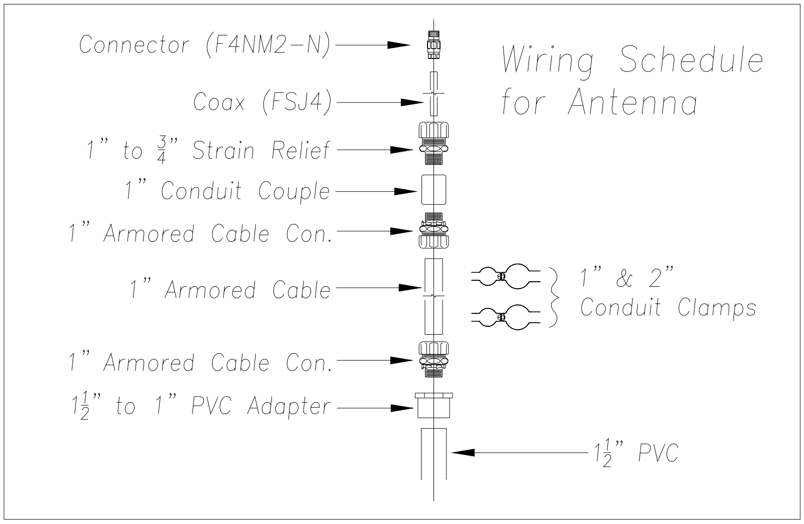
Not all sites use AEI antennas. If your site doesn't use them, skip the instructions below and go to the next chapter.

At each SmartScanNG site that uses AEI, two 100-watt Sinclair SRL470 antennas <u>or</u> two 100-watt Scala HP9-915 Parapanel antennas are installed per track. In reference to the track, **antenna0** is the northmost or eastmost antenna. **Antenna1** 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 <u>closest</u> <u>to</u> 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***.

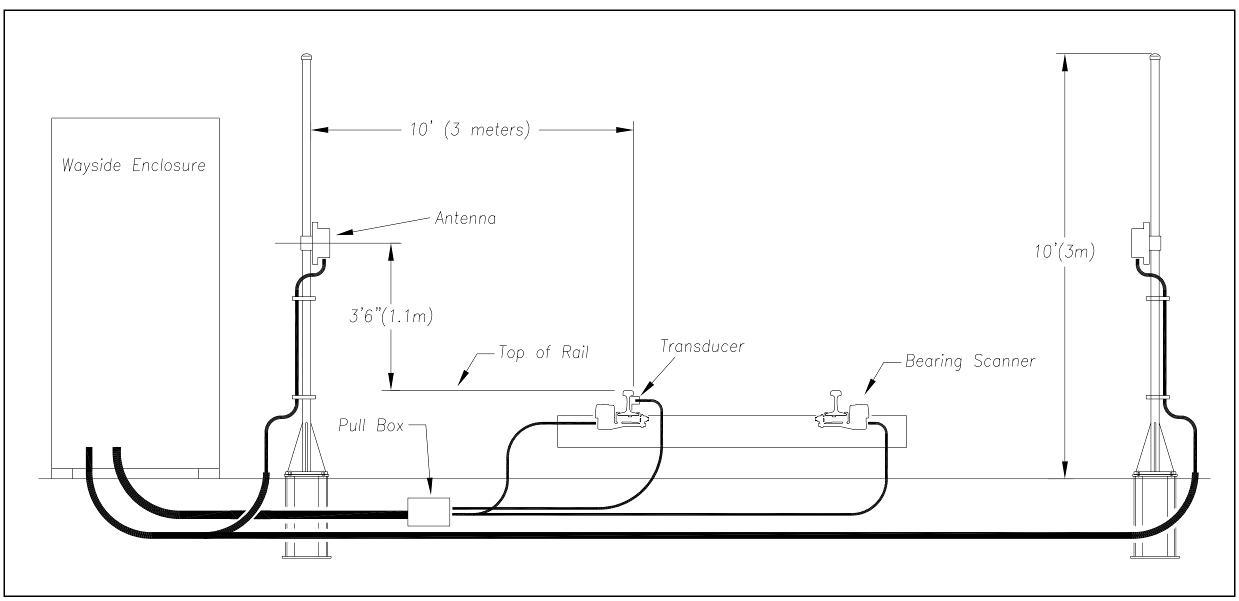
Only the installation of the SRL470 is covered below. The installation of the HP9-915 isn't covered in this guide.

Coaxial antenna cables (N-Type Male to N-Type Male) are cut to length and assembled **on-site**. **Antenna0** (RF0) output is connected to the northmost or eastmost antenna. **Antenna1** (RF1) 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 SmartScanNG enclosure.

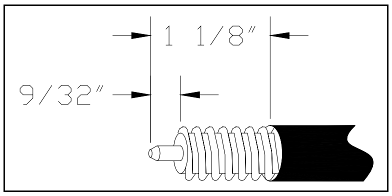
2 Cut each cable to the correct length.

3 In the wayside enclosure, label the cable from the northmost or eastmost antenna **ANTENNA0**.

4 In the wayside enclosure, label the other cable **ANTENNA1**.

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).

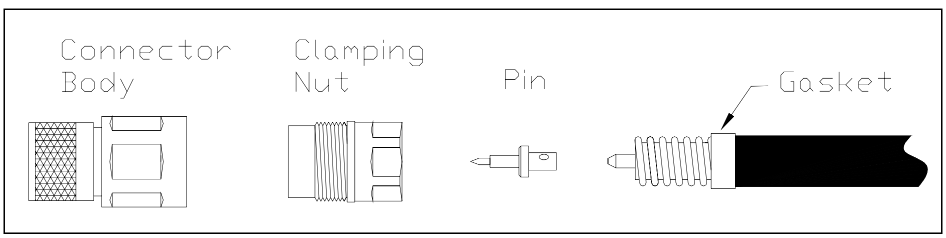


b Remove 9/32 inches (7.1 millimeters) of outer conductor.

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)**.

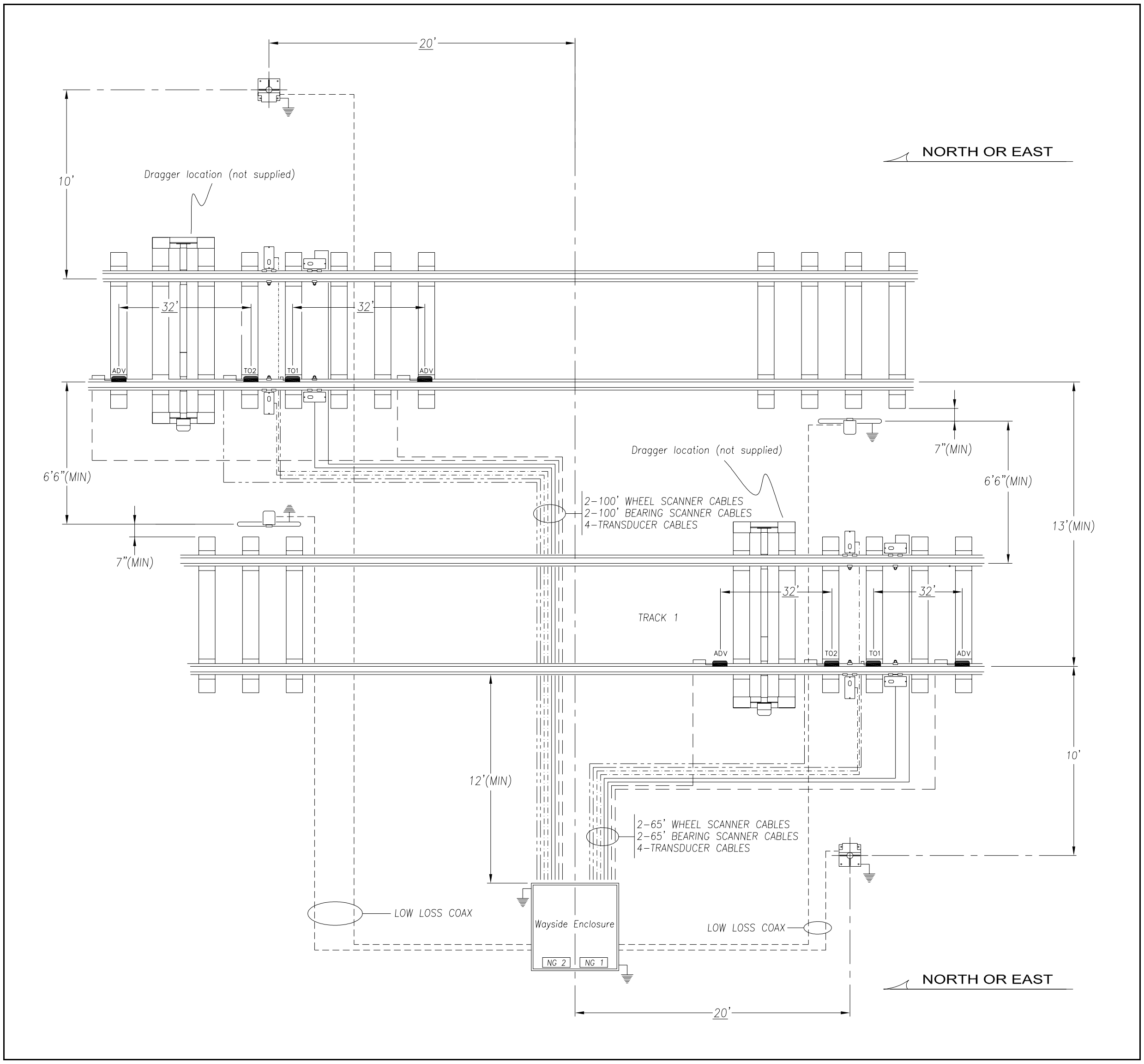
l Apply heat-shrink tube to connector to provide weather seal.

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 wayside-enclosure end of the coaxial cables to their respective Joslyn surge protectors (aka Joslyn coaxial lightning arresters). The other end of the surge protectors is then attached to the AEI Interface module (2300-750).

6.7 Installation Diagrams

Seen from above, the layout of your **double-track site** would look something like this.

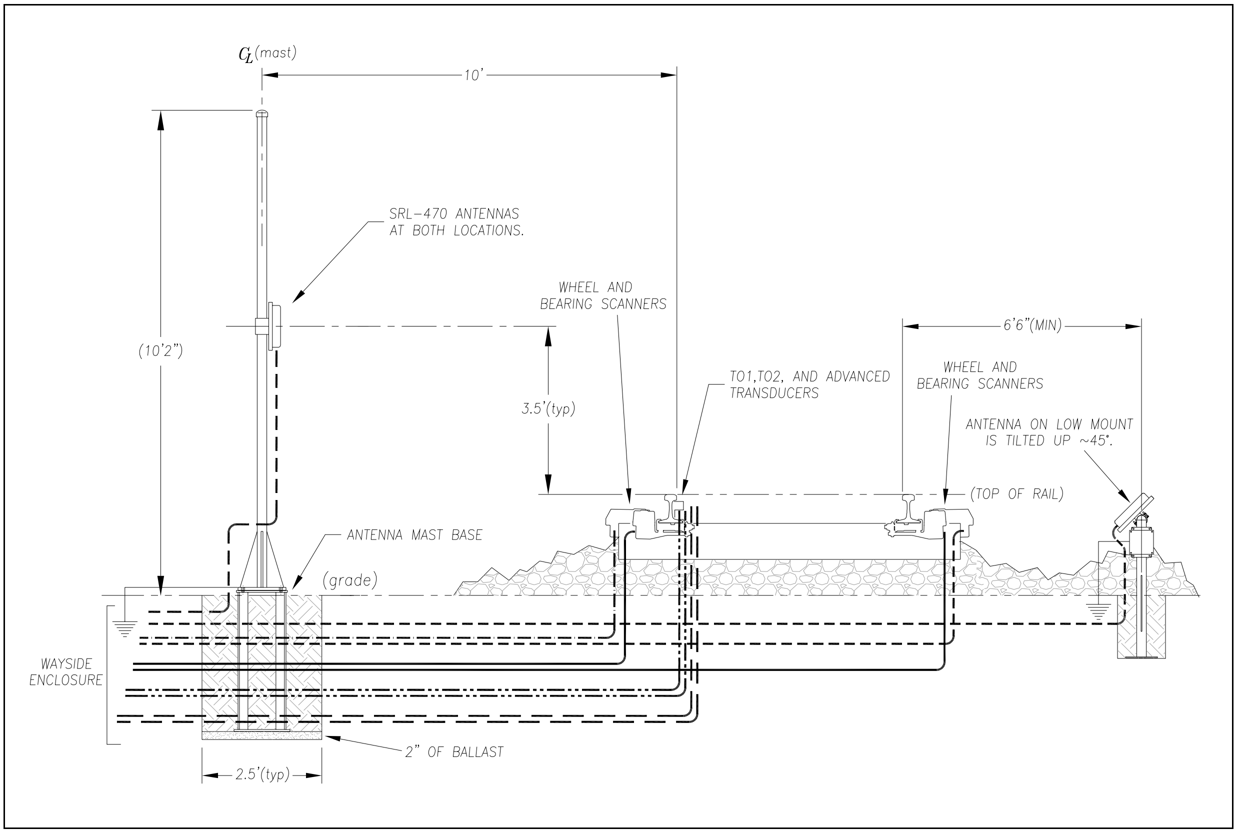


The minimum distance between the gauge of the closest rail and the center of the low antenna mount should be 6.5 feet (2 meters). The low antenna should be positioned at the end of the ties and centered between the two gating transducers.

Be sure to provide one continuous ground between the antennas, scanners, and the wayside enclosure. See ***Chapter 8 - Installing Wayside Enclosure Components*** for more information about the grounding system.

Be sure that the hole on top of the bearing scanner cover is facing north or east and facing the two gating transducers.

Seen from the side, the layout of your **track1** of a **double-track site** would look something like this. An installed dragger (aka dragging-equipment detector) is not shown in the figure below.



Shown in the figure above are two 100-watt Sinclair antennas. The SRL470 is pole mounted and the SP470 is low mounted.

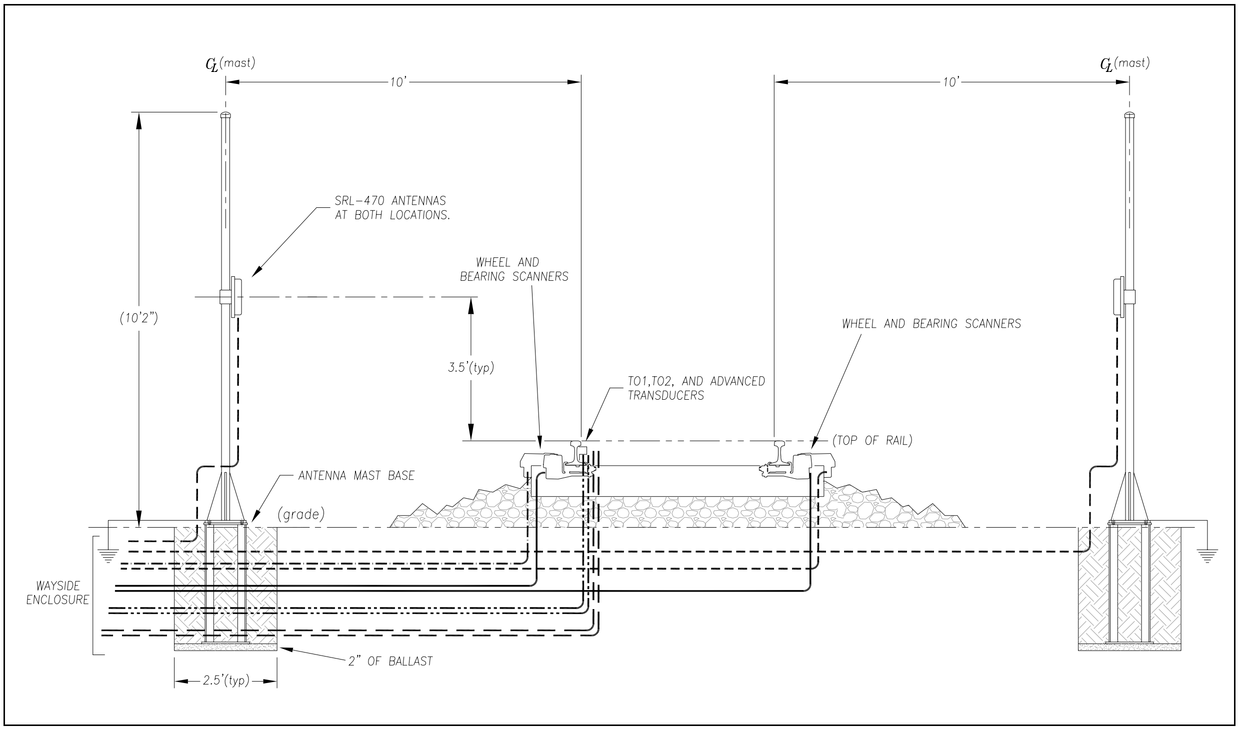
Install the AEI antennas centered between the two pairs of gating transducers and directly opposite each other. Mount them with their N-type socket pointing down.

For the **pole-mounted antenna**, install it with its face parallel to the rails, 3.5 feet (1.1 meters) above the top of the rails. Be sure that the pole's base is plumb and that its center is 10 feet (3 meters) from the gauge side of the closest rail. Be sure that each pole is level, grounded, and properly attached to a base.

For the **low-mounted antenna**, install it at a minimum distance of 6.5 feet (2 meters) between the gauge of the closest rail and the center of the low antenna mount. Be sure that it is positioned at the end of the ties and pointed so it will be able to read an AEI tag on a train.

Do not install any 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 pole or mast. Failure to follow these instructions could result in injury or death.

Seen from the side, the layout of your **single-track site** would look something like this. An installed dragger (aka dragging-equipment detector) is not shown in the figure below.



Shown in the figure above are two 100-watt Sinclair SRL470 pole-mounted antennas.

Install the AEI antennas centered between the two pairs of gating transducers and directly opposite each other. Mount them with their N-type socket pointing down. Install each antenna with its face parallel to the rails, 3.5 feet (1.1 meters) above the top of the rails.

Be sure that the pole's base is plumb and that its center is 10 feet (3 meters) from the gauge side of the closest rail. Be sure that each pole is level, grounded, and properly attached to a base.

See ***Chapter 5 - Preparation*** for more information on installing the pole and its base.

Do not install any 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 pole or mast. Failure to follow these instructions could result in injury or death.

Chapter 7
Aligning Scanners

This chapter tells how to align the scanners so that the SmartScanNG system can use them.

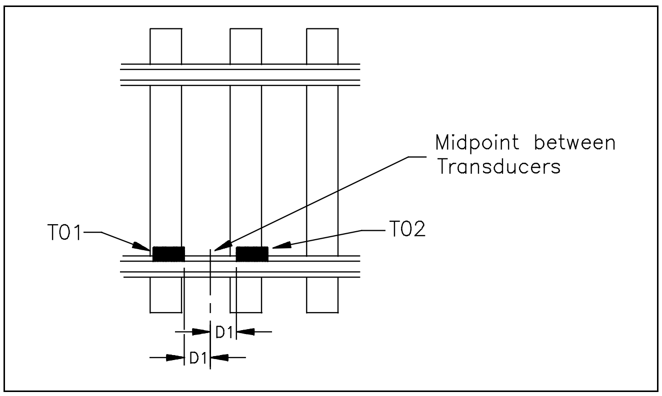
7.1 Bearing Scanners

To align the **type2/type3** 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 a 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.

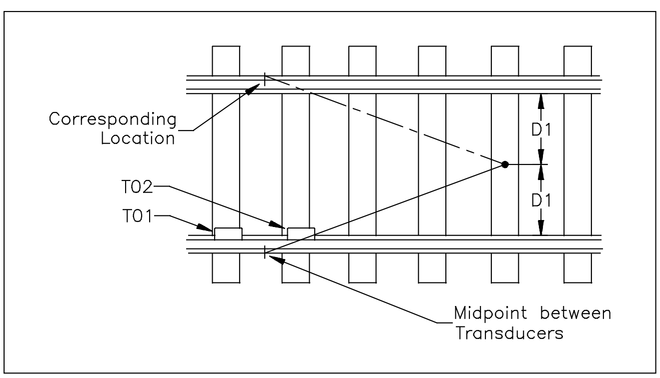


Use a permanent marker, magic marker, lumber crayon, or paint pen to mark the rail. Don't use a file or punch to mark the rail.

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.

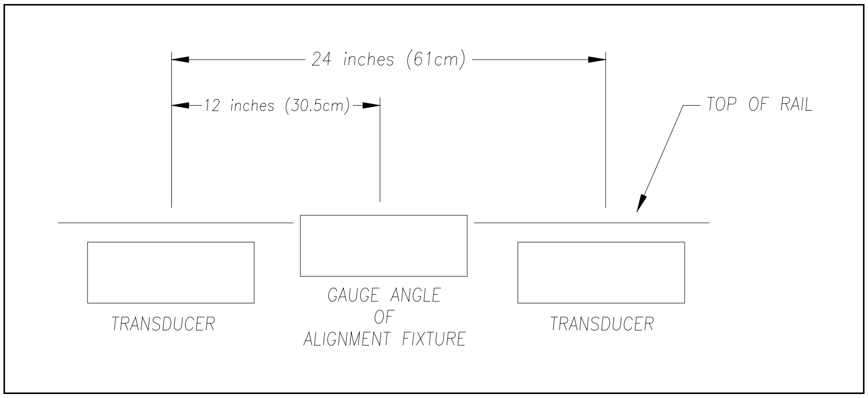


7 On the outside of the rail, mark this location.

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.



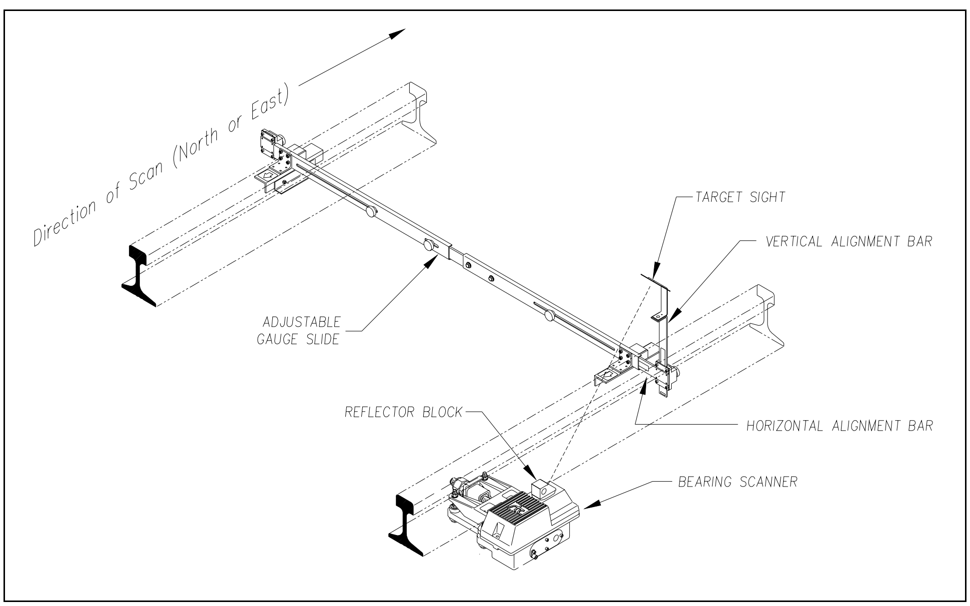
The fixture should be snug against the top and gauge of both rails.

9 Remove the reflector block from the vertical alignment bar.

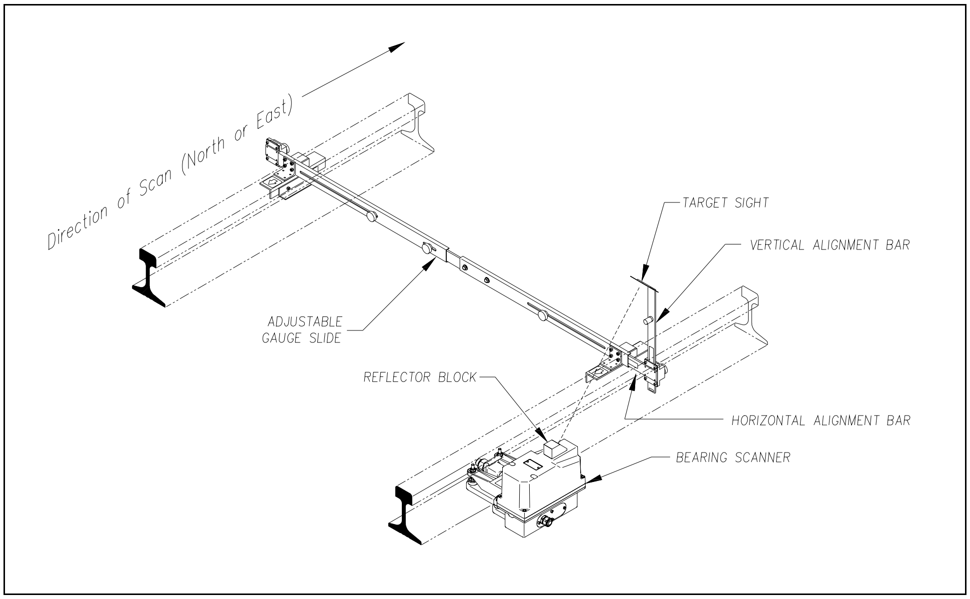
10 Install the vertical alignment bar with the target sight tilted toward the bearing scanner.

11 Install the reflector block in the top of the scanner cover with the sloping surface facing the target.

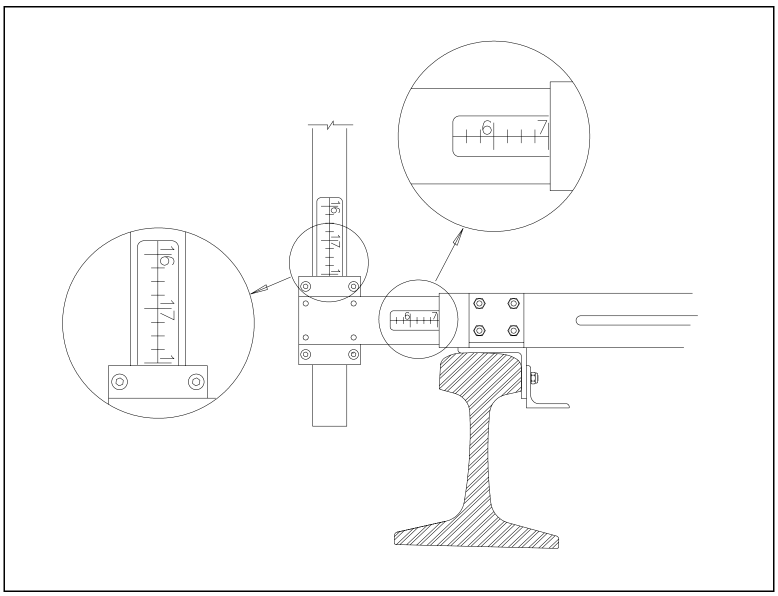
The setup for the **type2** bearing scanner is shown below.



The setup for the **type3** bearing scanner is shown below.



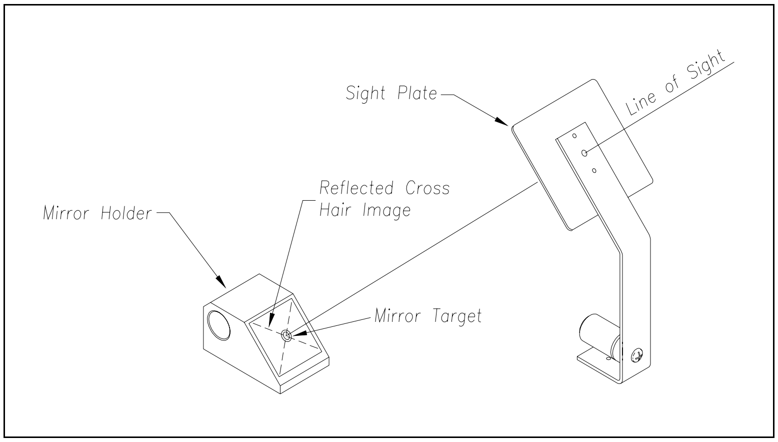
12 Extend the horizontal alignment bar to 7-1/4 inches ± 1/4 inch on the scale.



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

14 Look through the hole in the center of the target and note the relationship of the target cross hairs to the circle in the center of the reflector block.

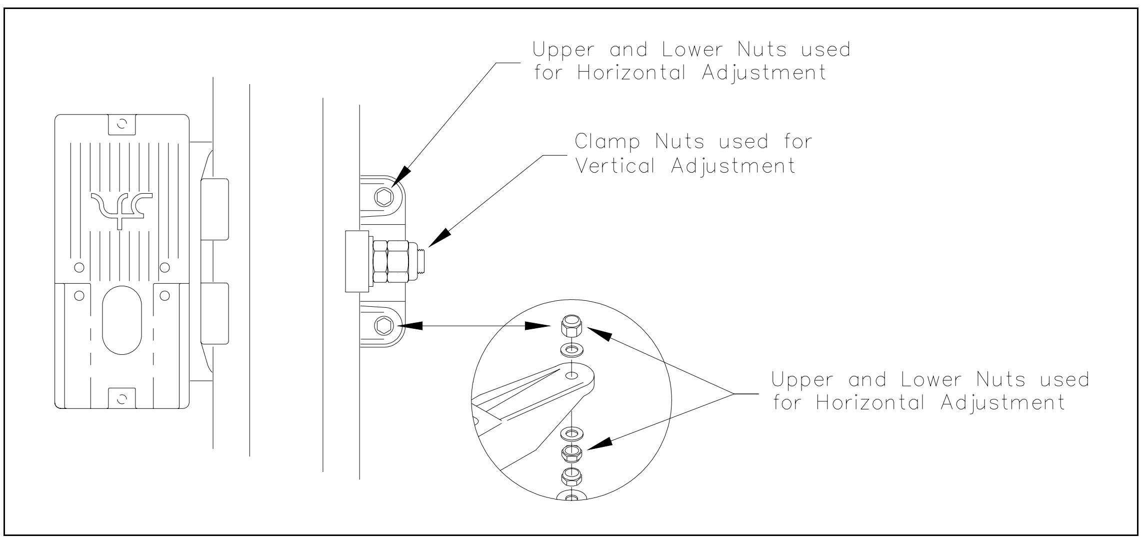
When the cross hairs are centered on the circle, alignment is correct.



15 If the cross hairs 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 cross hairs (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 cross hairs on the circle. Sliding away from the fixture lowers the cross hairs 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 cross hairs 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 wayside enclosure.

c 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 wayside enclosure.

d Go to the next chapter.

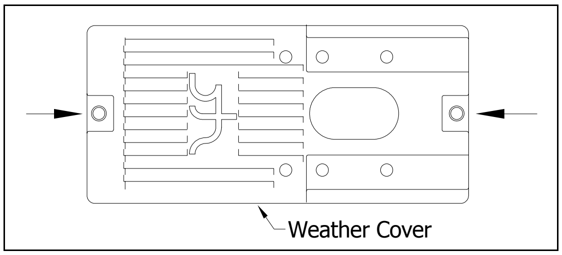
7.2 Wheel Scanners

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

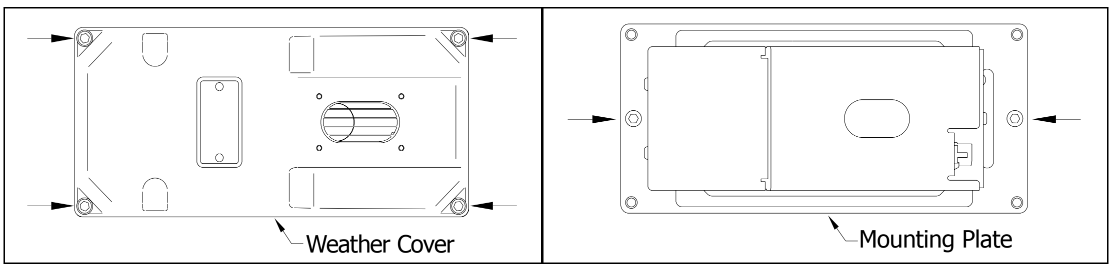
To align the **type2/type3** wheel scanners:

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 a 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.

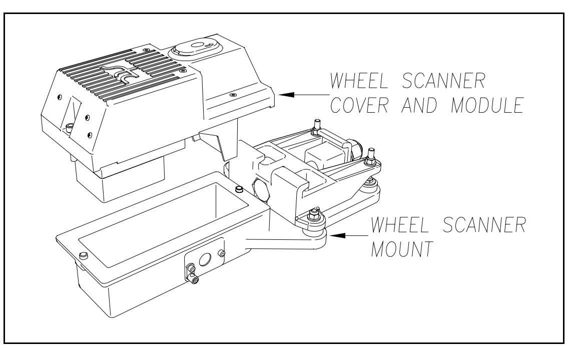
   The **type2** wheel scanner has two socket-head-cap screws that attach the weather cover to the mount.

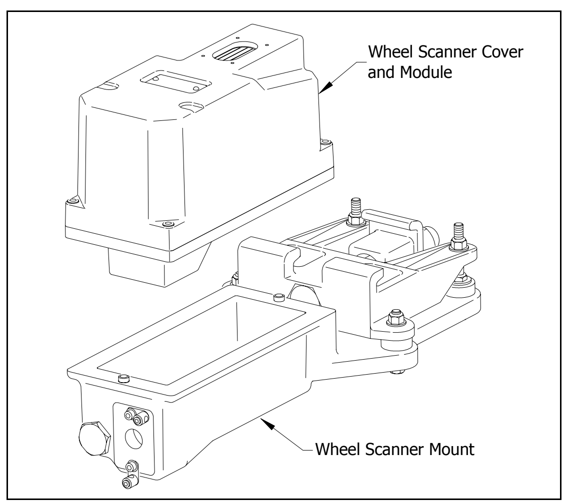


   The **type3** wheel scanner has six. Four that attach the weather cover to the mounting plate and two that attach the mounting plate to the mount.



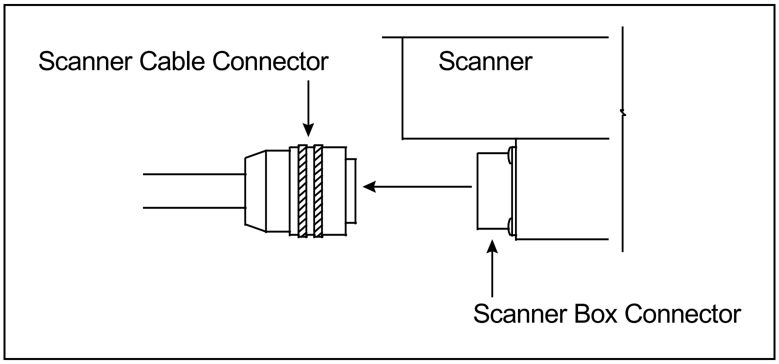
4. Separate the wheel scanner cover-and-module assembly from its mount.





5 If this is a **type3** wheel scanner, disconnect the heater wiring plug.

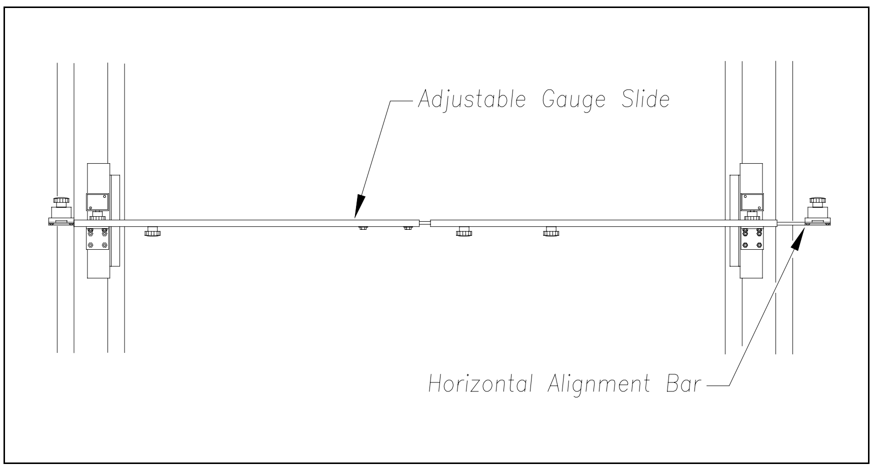
6 Disconnect the scanner cable connector from the scanner box connector.



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.

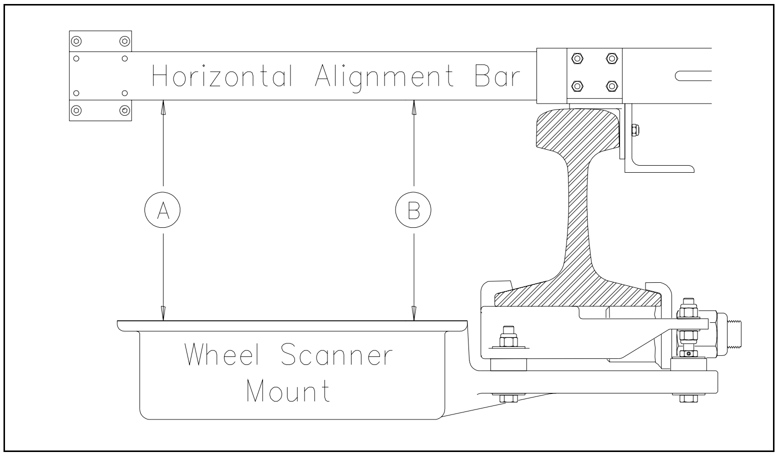
The fixture should be snug against the top and gauge of both rails.



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.

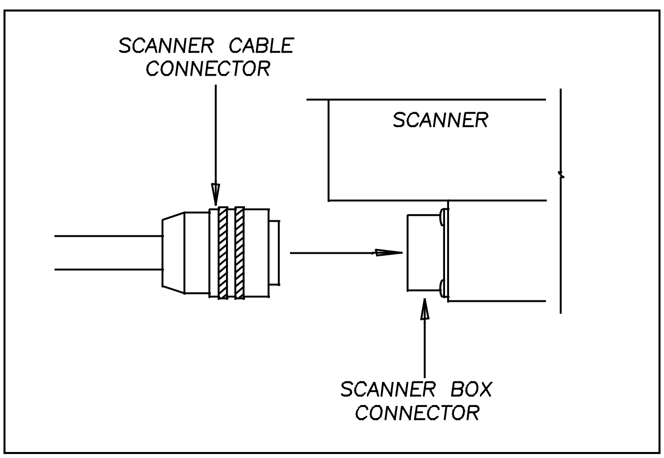
12 If adjustment is necessary, adjust the upper and lower nuts on the edge of the wheel scanner mount's arm.

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 **<u>type2</u>** 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 <u>two</u> socket-head-cap screws.

17 If this is a **<u>type3</u>** 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 <u>two</u> 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 <u>four</u> 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 wayside enclosure.
- **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 wayside enclosure.
- **c** Go to the next chapter.

Chapter 8
Installing Wayside Enclosure Components

This chapter tells how to do the final installation of the wayside enclosure components.

8.1 Grounding System

The SmartScanNG system 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 at least 5/8-inch (1.59-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.

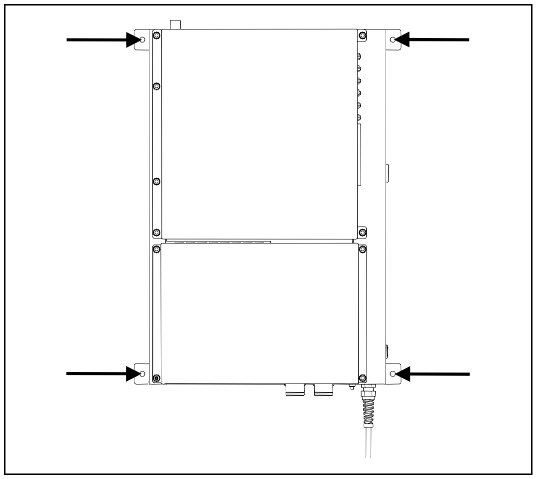
As a minimum, **two driven ground rods** should be installed at opposite corners of the wayside enclosure (aka bungalow) in which the SmartScanNG enclosure is installed. **A third driven ground rod** should be installed at the power pole to which the AC power connection is made. All three ground rods 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 wayside enclosure should be exothermically bonded to the driven grounds at its corners.

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

8.2 SmartScanNG Enclosure

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

The SmartScanNG enclosure has four symmetrically placed 5/16-inch (7.9-millimeter) holes on the outside of the enclosure. Using these holes, four 1/4-inch x 1-inch lag screws, and four 1/4-inch flat washers, the enclosure can be mounted to any flat wooden surface. A 3/4-inch (1.9-centimeter) or thicker plywood works well. Other flat wooden surfaces may work just as well.



Mount the SmartScanNG enclosure about 4 feet (1.2 meters) 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 power subsystem below it.

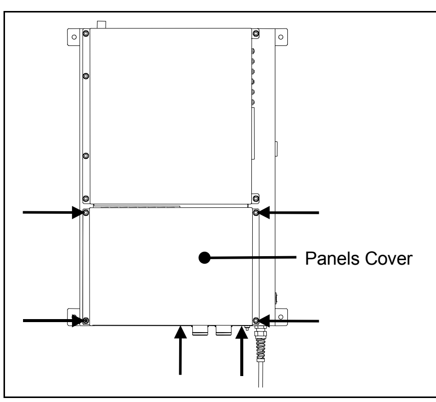
Mount the SmartScanNG enclosure within 4 feet (1.2 meters) of a grounded three-wire 110-120 VAC outlet. The enclosure is provided with a 5-foot (1.5-meter) power cord. Be sure that the enclosure is level with the speaker on the top and the scanner connectors on the bottom.

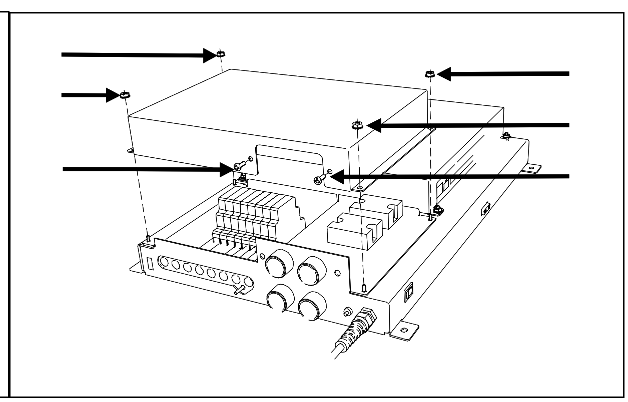
To ground the SmartScanNG enclosure:

1 Be sure that you have on hand an 11/32-inch nutdriver, a #2 Phillips head screwdriver, and a midsize slotted screwdriver.

2 Remove all power to the system.

3 Using a #2 Phillips head screwdriver and an 11/32-inch nutdriver, remove the two screws and four nuts securing the panels cover to the rest of the SmartScanNG enclosure.





4 Separate the panels cover from the SmartScanNG enclosure.

5 Store the cover, screws, and nuts in a safe place until you replace them.

6 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 bottom right of the surge-suppression panel (in the SmartScanNG enclosure).

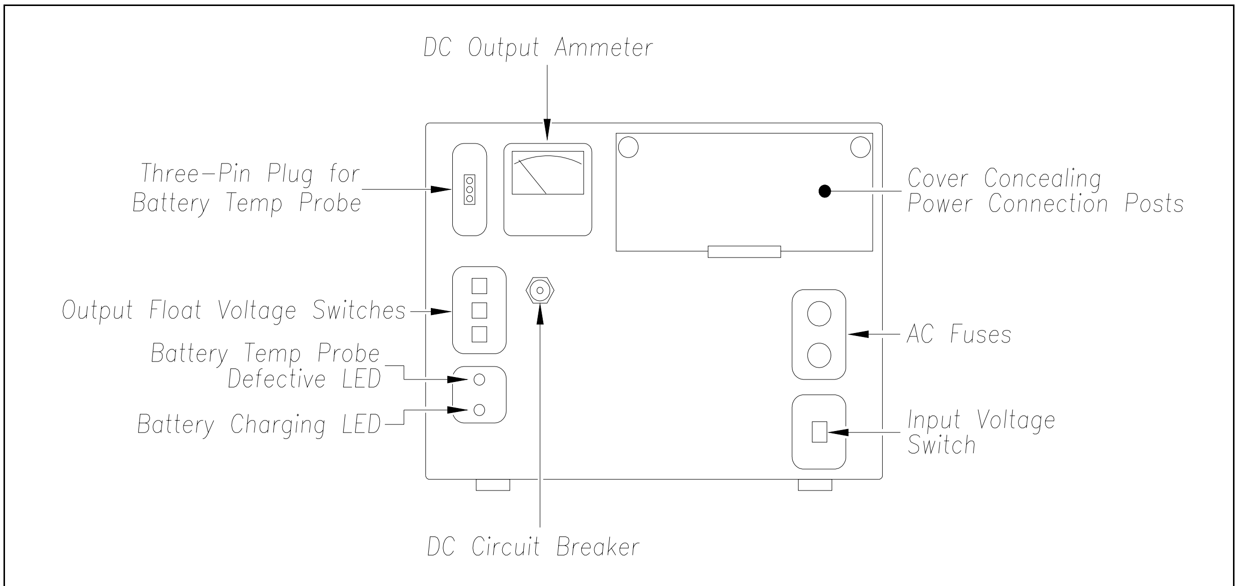
8.3 Battery Charger

The NRS ELC-12/20-D battery charger has four symmetrically placed 5/16-inch (7.9-millimeter) holes on the outside of the enclosure. Using these holes, four 1/4-inch x 1-inch lag screws, and four 1/4-inch flat washers, the enclosure can be mounted to any flat wooden surface. A 3/4-inch (1.9-centimeter) or thicker plywood works well. Other flat wooden surfaces may work just as well.

Normally the battery charger is mounted about 1 foot (30 centimeters) above the floor **and** within 2 feet (61 centimeters) of the bottom of the SmartScanNG enclosure. If this is inconvenient for you, mount it at any height between 1 foot (30 centimeters) and 4 feet (1.2 meters) above the floor **and** within 2 feet (61 centimeters) of the SmartScanNG enclosure.

Be sure that the charger is level.

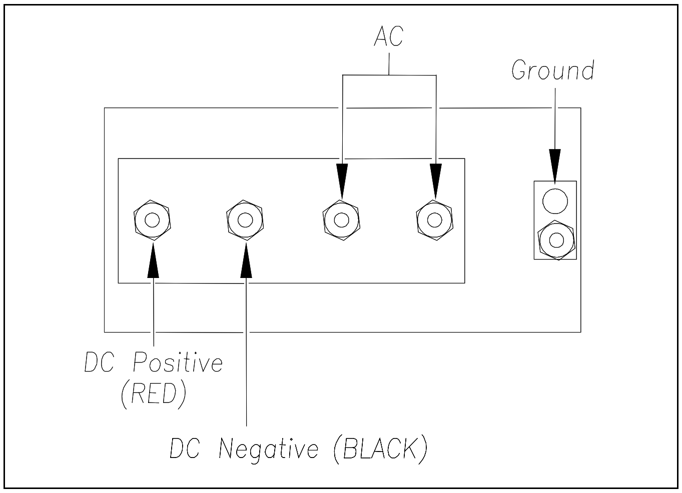
The figure below shows the front of a NRS ELC-12/20-D battery charger. (Solar-powered systems don't use this charger.)



The input voltage switch can be set to 115 VAC or 230 VAC. Use 115 for input voltages between 108 and 128. Use 230 for input voltages between 216 and 256.

To ground the battery charger:

1 Be sure that you have on hand a midsize slotted screwdriver.
2 Remove all power to the system.
3 Open the small door on the front of the charger by pulling out the push tabs.



4 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 right of the power connection posts.

To attach the power cord to the battery charger:

1 Be sure that you have on hand a wire stripper, a pliers-type crimping tool, a 1/2-inch nutdriver, and a midsize slotted screwdriver.
2 Remove all power to the system.

  Be sure that the power cord isn't plugged into an outlet or in any other way attached to a power source.
3 Using a wire stripper, remove 1/4 inches (6.4 millimeters) of insulation from the ends of the three wires coming from the supplied power cord.
4 Connect the green wire to the copper ground lug to the right of the power connection posts.

  The green wire shares the ground lug with the wire from the ground bus.
5 Using a pliers-type crimping tool, crimp a ring terminal to the end of the white wire and another ring terminal to the end of the black wire.
6 Using a 1/2-inch nutdriver, connect these ring terminals to the two rightmost binding posts, as marked on the panel behind the posts.

  Two 320-volt varistors (round disks with ring terminals) were shipped with the charger.
7 Using a 1/2-inch nutdriver, connect one 320-volt varistor to the binding posts to which you just connected the white and black wires.
8 At this time, do not plug the just-wired power cord into an outlet or other power source.

8.4 Fuse Block

There is one fuse block per SmartScanNG enclosure. To mount the fuse block and wire it to the SmartScanNG enclosure:

1. Be sure that you have on hand a wire cutter, a wire stripper, a pliers-type crimping tool, and a midsize slotted screwdriver.
2. Remove all power to the SmartScanNG enclosure.
3. Remove the fuses from the fuse block.
4. Store the fuses in a safe place until you replace them in the next chapter.
5. Using the supplied screws, mount the fuse block between the distribution block and the SmartScanNG enclosure.

   Be sure that there is enough room above and below the block to make all connections.

   STC supplies each system with 15 feet (4.6 meters) of red-black 10 AWG 2-conductor zip wire. You must cut this zip wire to four correctly sized lengths, which is dependent upon the location of various components in the wayside enclosure. These cut lengths of wire are used between:

   - The fuse block and the SmartScanNG enclosure
   - The fuse block and the distribution block
   - The battery charger and the distribution block
   - The battery and the distribution block

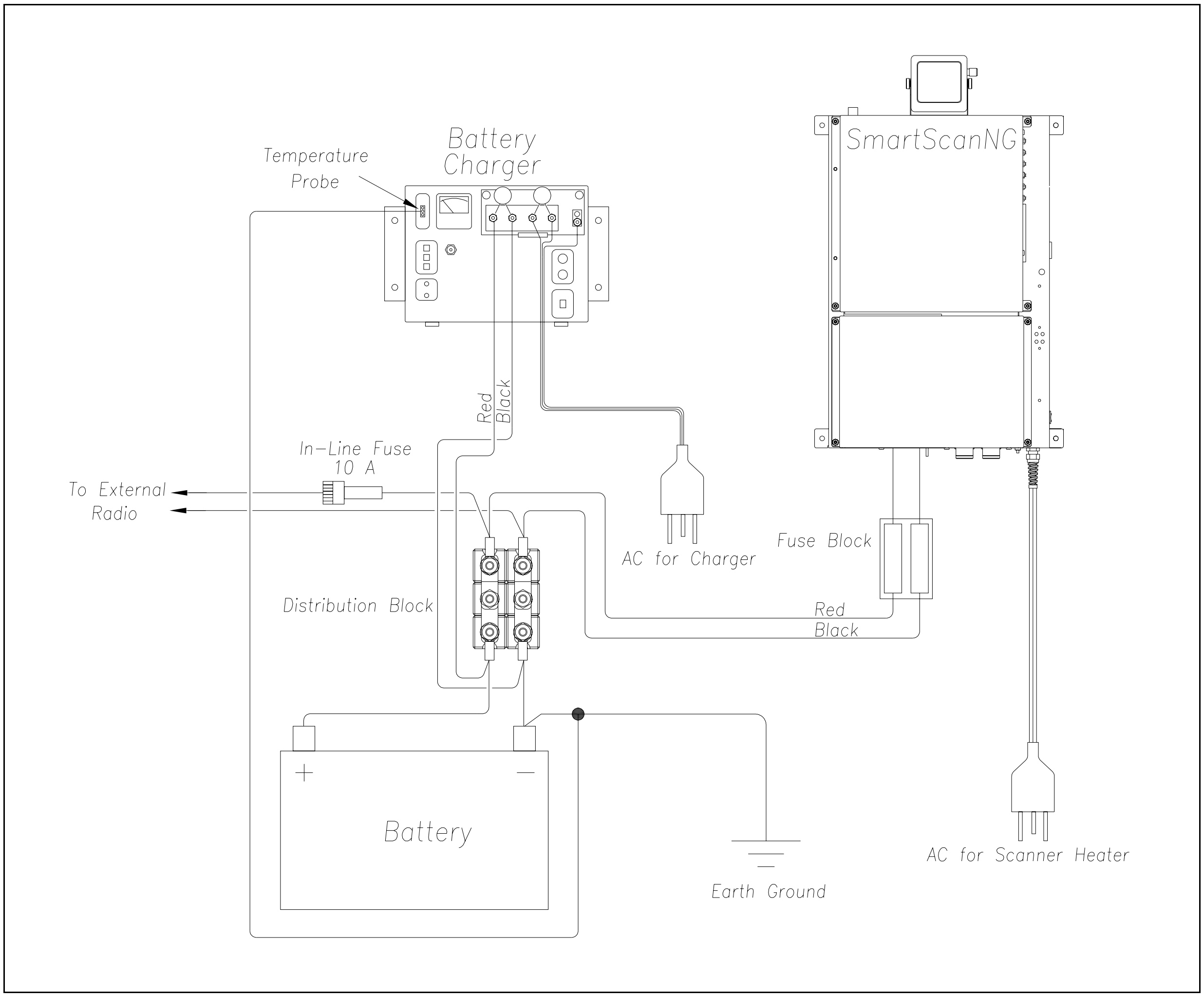
   It may not be necessary to use all 15 feet (4.6 meters) of this zip wire. You should cut it to the shortest lengths that will do the job.

   On the surge-suppression panel (in the SmartScanNG enclosure) is a DIN rail. On the right side of this DIN rail are two terminal blocks. One is red and the other is black.
6. Cut the red-black 10 AWG 2-conductor zip wire to fit **between the top edge of the fuse block and the terminal blocks on the DIN rail**.
7. Using a wire stripper, remove 1/4 inches (6.4 millimeters) of insulation from both ends of both conductors.
8. Using a pliers-type crimping tool, crimp a spade terminal to the end of the red conductor and another spade terminal to the same end of the black conductor.

   The end with the spade terminals attaches to the fuse block. The other end attaches to the terminal blocks in the SmartScanNG enclosure. The red conductor (positive) is attached to the red terminal block and the black conductor (negative) to the black terminal.
9. Wire from the top edge of the fuse block to the terminal blocks on the DIN rail.
10. If this is a double-track site, repeat steps **2** through **9** on the other system.

8.5 Rest of Power Subsystem

The figure below shows the major parts of the power subsystem powered from an AC power source at a **single-track site**.



To finish installing the power subsystem:

1 Be sure that you have on hand a wire cutter, a wire stripper, a pliers-type crimping tool, a 1/2-inch nutdriver, and a midsize slotted screwdriver.

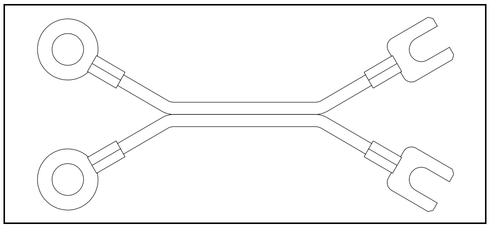
2 Remove all power to the system.

Be sure that the SmartScanNG enclosure and the battery charger aren't plugged into an outlet or in any other way attached to a power source.

3 Cut the red-black 10 AWG 2-conductor zip wire to fit **between the bottom edge of the fuse block and the top edge of the distribution 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 a ring terminal to one end and a spade terminal to the other end of each of these conductors.

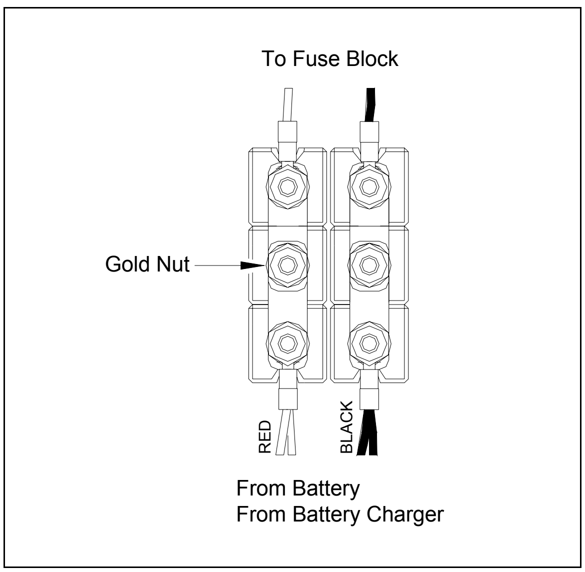


6 Using a midsize slotted screwdriver, connect the spade terminal ends to the bottom of the fuse block.

Be sure that the red conductor (positive) is attached to the left terminal block and the black conductor (negative) to the right terminal. When done, both conductors on the left should be red. That is, the leftmost conductor from the top of the fuse block and leftmost conductor from the bottom of the fuse block should be red. Those on the other side should both be black.

The fuse block isn't wired directly to either the battery or the battery charger. It is wired directly to the distribution block. The distribution block contains six nuts. Loosening the middle gold nuts disconnects the connection between the incoming DC power and the rest of the system.

7 If tight, loosen the middle gold nuts on the distribution block.



8 Using a 1/2-inch nutdriver, connect the ring terminal ends to the top of the distribution block.

9 Cut the red-black 10 AWG 2-conductor zip wire to fit **between the battery charger and the bottom edge of the distribution block**.

10 Using a wire stripper, remove 1/4 inches (6.4 millimeters) of insulation from both ends of both conductors.

11 Using a pliers-type crimping tool, crimp one ring terminal to the end of each of these four conductors.

12 Using a 1/2-inch nutdriver, connect one ring terminal on the red conductor and one on the black conductor to the two leftmost binding posts (of the battery charger), as marked on the panel behind the posts.

Be sure that the red conductor (positive) is attached to the leftmost binding post and the black conductor (negative) to the right of it.

Two 320-volt varistors (round disks with ring terminals) were shipped with the charger.

13 Using a 1/2-inch nutdriver, connect one 320-volt varistor to the binding posts to which you just connected the red and black wires.

14 Cut the red-black 10 AWG 2-conductor zip wire to fit **between the battery and the bottom edge of the distribution block**.

15 Using a wire stripper, remove 1/4 inches (6.4 millimeters) of insulation from both ends of both conductors.

16 Using a pliers-type crimping tool, crimp one ring terminal to the end of each of these four conductors.

> **WARNING**
> Wear appropriate eye and skin protective equipment when servicing batteries.

17 Using a 1/2-inch nutdriver, connect the battery temperature probe (from the battery charger) to the negative battery post.

18 Plug the other end of the battery temperature probe into the receptacle labeled **TempProbe** on the front of the charger.

19 Using a 1/2-inch nutdriver, connect the red wires from the battery charger and from the positive battery post to the left side of the bottom edge of the distribution block.

20 Using a 1/2-inch nutdriver, connect the black wires from the battery charger and from the negative battery post to the right side of the bottom edge of the distribution block.

> **WARNING**
> Once the battery is installed, touching any right-sided terminal and any left-sided terminal on the distribution block simultaneously with a metal object will short the battery.

21 If this is a single-track site, go to ***8.6 Bearing Scanners***.

22 If this is a double-track site:

   a Repeat steps **1** through **20** on the second track.

   b Go to ***8.6 Bearing Scanners***.

8.6 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 bottom of the leftmost SmartScanNG enclosure. The cables from track2 are connected to the bottom of the rightmost SmartScanNG enclosure.

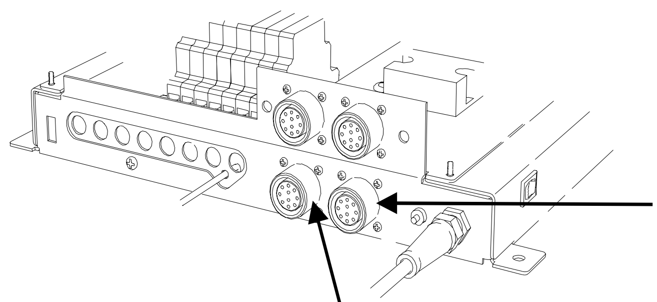
To connect the **type2/type3** bearing scanners to the SmartScanNG enclosure:

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 rightmost box connector on the backmost part of the bottom of the SmartScanNG enclosure.



3 Plug the connector from the bearing scanner on rail2 (that is, from the south or west rail) into the leftmost box connector on the backmost part of the bottom of the SmartScanNG enclosure.

4 If this is a single-track site:

a If your site has wheel scanners, go to ***8.7 Wheel Scanners***.

b Go to ***8.8 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 SmartScanNG enclosure.

b If your site has wheel scanners, go to ***8.7 Wheel Scanners***.

c Go to ***8.8 Gating Transducers***.

8.7 Wheel Scanners

Not all sites use wheel scanners. If your site doesn't use them, skip the instructions below and go to ***8.8 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 bottom of the leftmost SmartScanNG enclosure. The cables from track2 are connected to the bottom of the rightmost SmartScanNG enclosure.

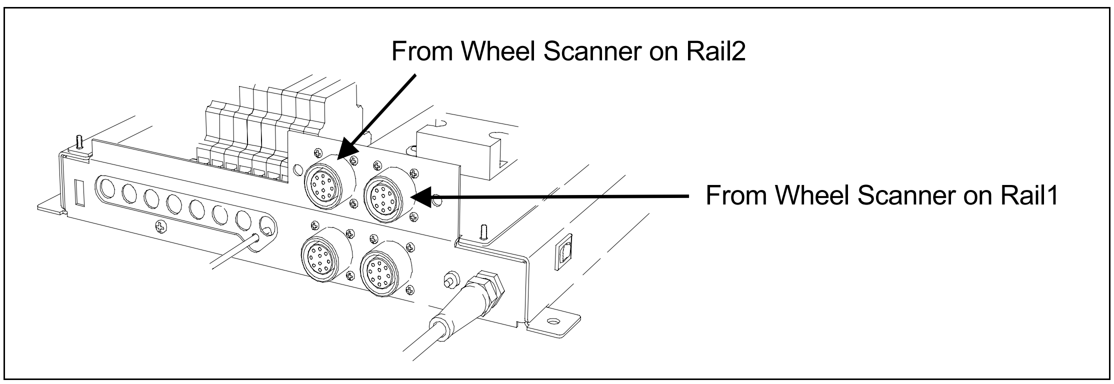
To connect the **type2/type3** wheel scanners to the SmartScanNG enclosure:

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 rightmost box connector on the frontmost part of the bottom of the SmartScanNG enclosure.



3 Plug the connector from the wheel scanner on rail2 (that is, from the south or west rail) into the leftmost box connector on the frontmost part of the bottom of the SmartScanNG enclosure.

4 If this is a single-track site, go to ***8.8 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 SmartScanNG enclosure.

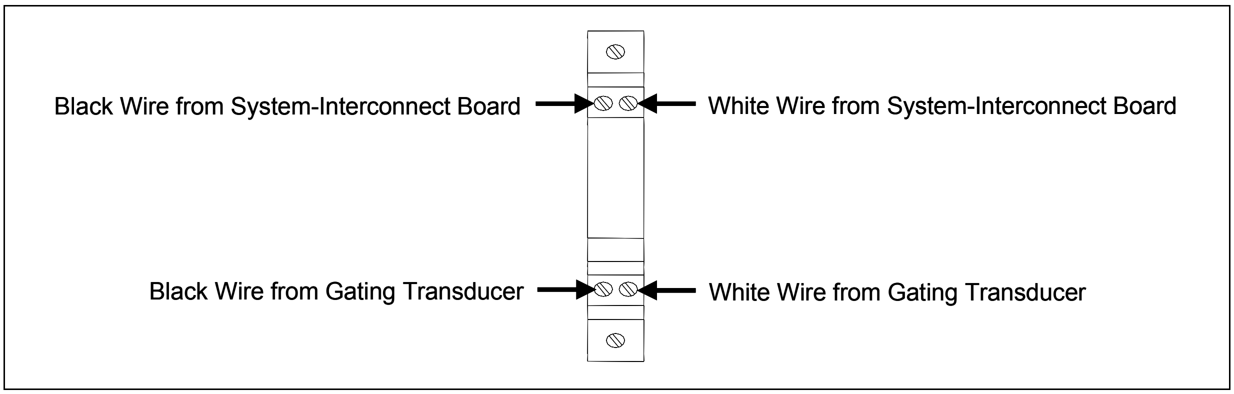
b Go to ***8.8 Gating Transducers***.

8.8 Gating Transducers

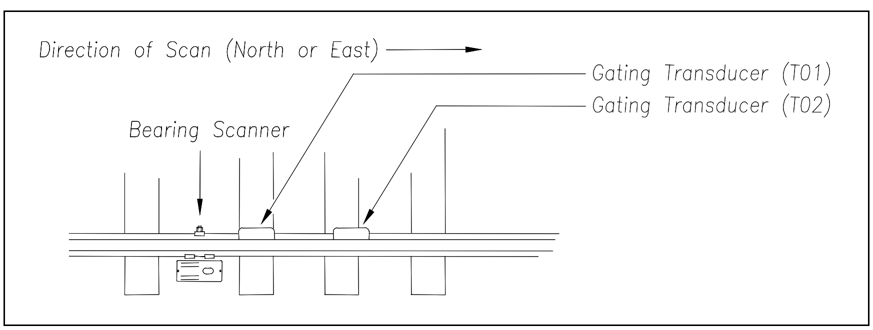
There are two gating transducers per track, each having two wires. One black wire and one white wire. At a single-track site, the wires from gating transducer TO1 should be labeled **TO1**. The wires from gating transducer TO2 should be labeled **TO2**.

At a double-track site, they should be labeled **TO1-TRACK1**, **TO2-TRACK1**, **TO1-TRACK2**, or **TO2-TRACK2**, whichever is appropriate. At double-track sites, the wires from the gating transducers on track1 are connected inside the leftmost SmartScanNG enclosure. The wires from track2 are connected inside the rightmost SmartScanNG enclosure.

On each surge-suppression panel, there is one UTB (universal transient barrier) assigned to transducer **TO1** and another to transducer **TO2**. These UTBs protect the SmartScanNG system from transients and surges, which can be induced onto external wiring by lightning. Each UTB has four rows of connectors. The wires from one gating transducer are terminated at the third row of connectors from the top. The second row from the top is wired at the factory to TS3 on the System-Interconnect board.



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 **TO1** first and **TO2** second. **TO1** is the gating transducer closest to the bearing scanner. **TO2** is the one farthest from the bearing scanner.



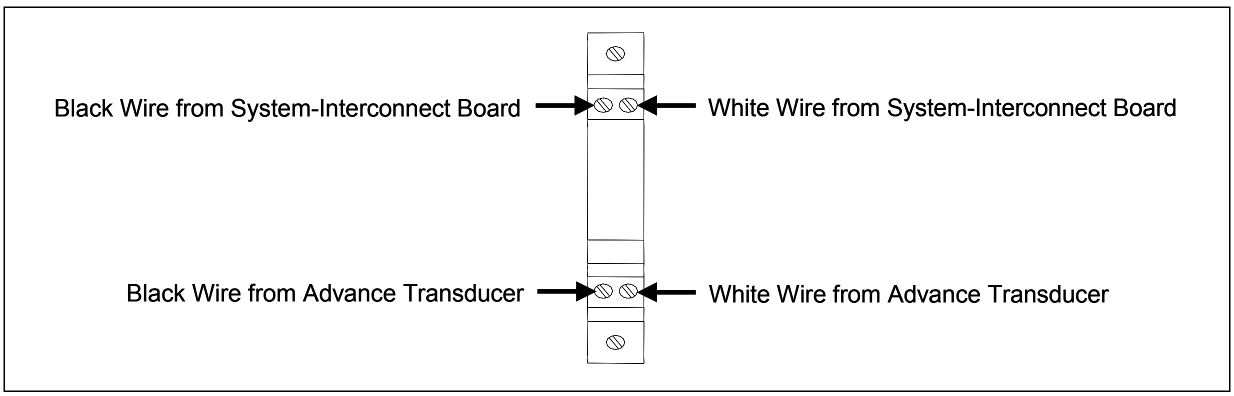
8.9 Advance Transducers

All tracks have either two advance transducers or one track circuit. If your site uses track circuits, skip the instructions below and go to ***8.10 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 wires from advance transducer ADV1 should be labeled **ADV1**. The wires from advance transducer ADV2 should be labeled **ADV2**.

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

On each surge-suppression panel, there is one UTB assigned to transducer **ADV1** and another to transducer **ADV2**. These UTBs protect the SmartScanNG system from transients and surges, which can be induced onto external wiring by lightning. Each UTB has four rows of connectors. The wires from one advance transducer are terminated at the third row of connectors from the top. The second row from the top is wired at the factory to TS3 on the System-Interconnect board.



Observe correct polarity when you connect the wires from the transducers. The polarity is correct when the transducer's white wire is connected directly below the existing white wire at row two of the UTB, and the transducer's black wire is connected directly below the existing black wire at row two of the UTB. Connect **ADV1** first and **ADV2** second. **ADV1** is the advance transducer to the right of gating transducer **TO2**. **ADV2** is the one to the left of gating transducer **TO1**.

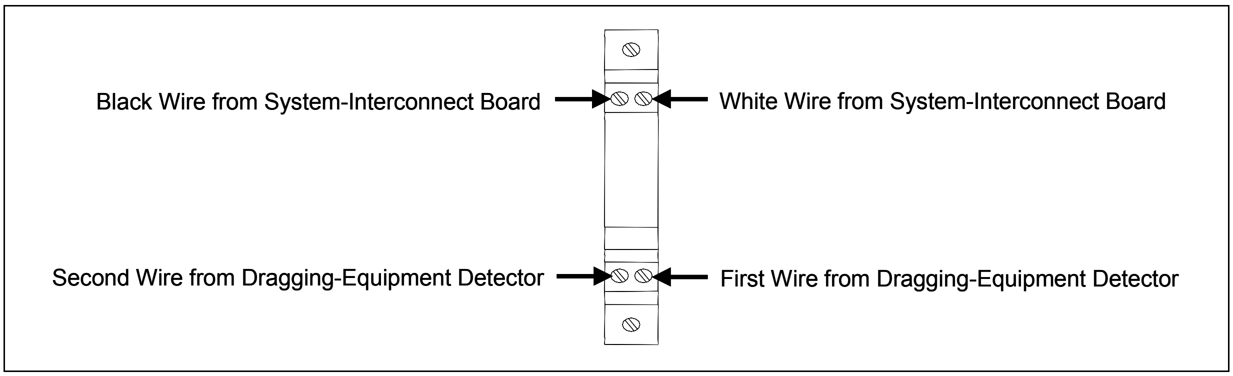
8.10 Dragging-Equipment Detector

Most, but not all, systems use dragging-equipment detectors. If your site doesn't use them, skip the instructions below and go to ***8.11 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 SmartScanNG enclosure. The wires from track2 are connected inside the rightmost SmartScanNG enclosure.

On the DIN rail assembly, the UTB labeled **DED** is for the dragging-equipment detector. This UTB protects the SmartScanNG system 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 TS4 on the System-Interconnect 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.

8.11 Track Circuit

Not all systems use a track circuit. When present, there is one track circuit line per track. If your site doesn't use a track circuit, skip the instructions below and go to ***8.12 Telephone***.

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

To connect the track circuit to the SmartScanNG 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 Using the supplied screws, mount the three-terminal arrester below the SmartScanNG enclosure.

4 Connect the black ground wire from the three-terminal arrester to earth ground.

5 Cut the track-circuit wires to the proper length.

6 Using a wire stripper, remove 1/4 inches (6.4 millimeters) of insulation from the ends of both wires coming from the track circuit.

7 Using a pliers-type crimping tool, crimp one ring terminal to the end of each of these two wires.

8 Fasten one ring terminal to the left side of the three-terminal arrester.

9 Fasten the other ring terminal to the right side of the three-terminal arrester.

On the surge-suppression panel (in the SmartScanNG enclosure) is a DIN rail. On the middle of this DIN rail are two terminal blocks (labeled **SOTC**). One is red and the other is black.

10 Wire from the three-terminal arrester to the appropriate terminal blocks on the DIN rail.

11 If this is a single-track site, go to ***8.12 Telephone***.

12 If this is a double-track site:

a Repeat steps **1** through **10** on the second track.

The wires from track2 are connected to the rightmost SmartScanNG enclosure.

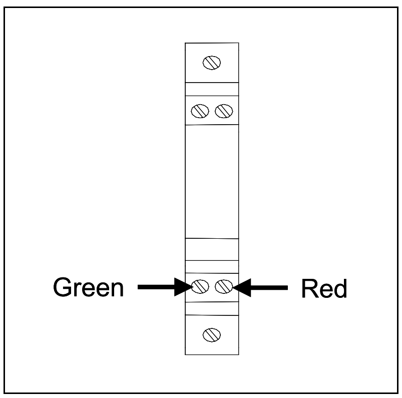
b Go to ***8.12 Telephone***.

8.12 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 ***8.13 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 wayside enclosure and route it to the DIN rail assembly on the surge-suppression panel (in the SmartScanNG enclosure). At double-track sites, the service cord is routed to the DIN rail assembly in the leftmost SmartScanNG enclosure.

On the DIN rail assembly, the UTB labeled **TelCo** is for the telephone line. This UTB protects the SmartScanNG system 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 a SmartScanNG system.



At double-track sites, the telephone line is connected to only one SmartScanNG enclosure (that is, the leftmost enclosure). System1 is the one with the telephone line attached and the modem installed. To communicate remotely with another SmartScanNG enclosure at the same site, you would start by using the **Enter Pass-Thru Mode option** on the Main menu of system1. At double-track sites, attach a serial cable from **COM4 of system1** to **COM1 of system2**.

8.13 Shielded Temperature Probe

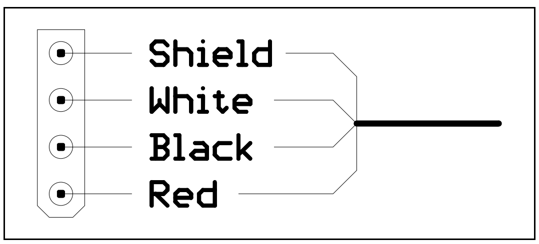
The temperature probe is encased in a radiation shield that shields it from direct sunlight and allows ambient air to flow through and around it. The probe mounts to the outside wall of the wayside enclosure and provides accurate temperature indications over a range of -49°F to +149°F (-45°C to +65°C).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

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

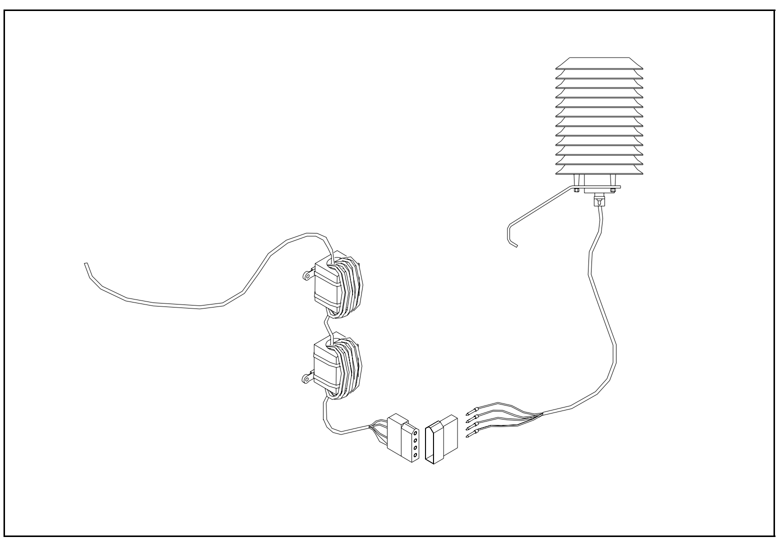
1. Be sure that you have on hand the customer-supplied fasteners needed to attach the shielded temperature probe to the outside of the wayside enclosure; a wire stripper; and the fasteners needed to attach the RF-filter assembly to the inside of the wayside enclosure.
2. If you haven't done so already,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

   The probe should be mounted on the side of the wayside enclosure furthest from the track. This should be the side of the enclosure where the SmartScanNG enclosure is mounted. No matter where it is mounted, make sure the entire shielded temperature probe is in the top third of the enclosure **or** above the roof of the enclosure.
4. Route the cable from the probe to the bottom of the SmartScanNG enclosure that it is associated with.

   In sheet metal, use a rubber grommet in every hole through which you route the cable.
5. As shown below, insert the four Molex pins (on the end of the cable of the probe) into the supplied Molex housing.

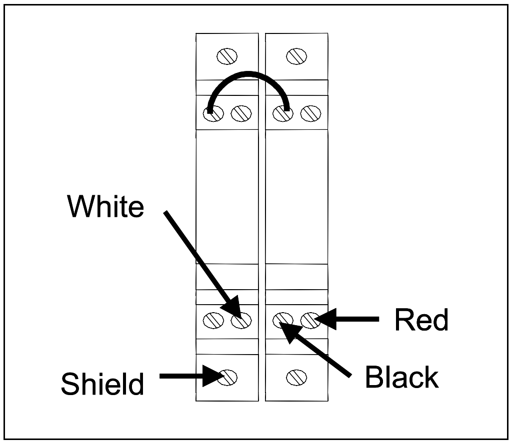
   

   The red wire supplies 12 VDC to the shielded temperature probe.
6. Mate the Molex housing (on the end of the cable of the probe) to the factory-wired Molex socket on the end of the RF-filter assembly.

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 DIN rail assembly, 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 top 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 wayside enclosure.

10 Go to ***8.14 Radio Antenna***.

8.14 Radio Antenna

At double-track sites, there is usually one radio per track. This is the case when internal radios are used, but not always the case when external radios are used. When external radios are used, the components supporting track2 don't need to have their own radio. Instead, they can use the radio that supports track1. Using only one radio at a double-track site isn't covered in this guide. Call STC for help in doing this.

For the radio to function properly, it needs an antenna. However, STC doesn't supply the antenna or the hardware to install it.

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

1 Mount the antenna onto the outside of the wayside enclosure, preferably on the roof of the enclosure.

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

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

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

3 If needed, install a PL-259 UHF or a type-N plug onto the end of the cable.

4 Connect this plug to the type-N jack on the top of the SmartScanNG enclosure.

The enclosure is equipped with a type-N jack. For those using a PL-259 UHF plug, a UHF-to-type-N adapter is shipped with the SmartScanNG enclosure.

5 If this is a single-track site, go to ***8.15 AEI Interface Module***.

There is an antenna for each radio.

6 If this is a double-track site:

a Repeat steps **1** through **4** for the radio in the other SmartScanNG enclosure.

b Go to ***8.15 AEI Interface Module***.

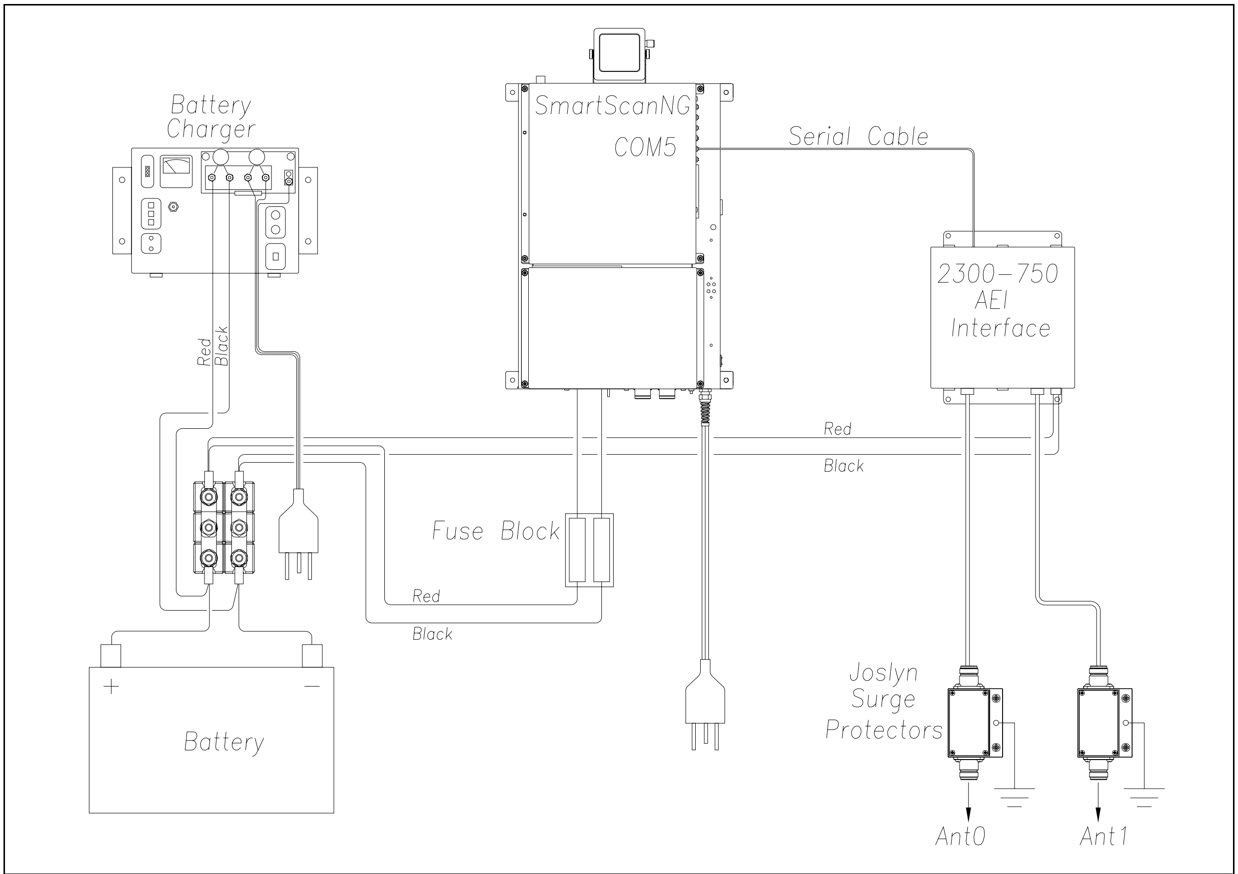
8.15 AEI Interface Module

Not all sites use an AEI Interface module. If your site doesn't use one, skip the instructions below and go to ***8.16 High-Load/High-Wide Detector***.

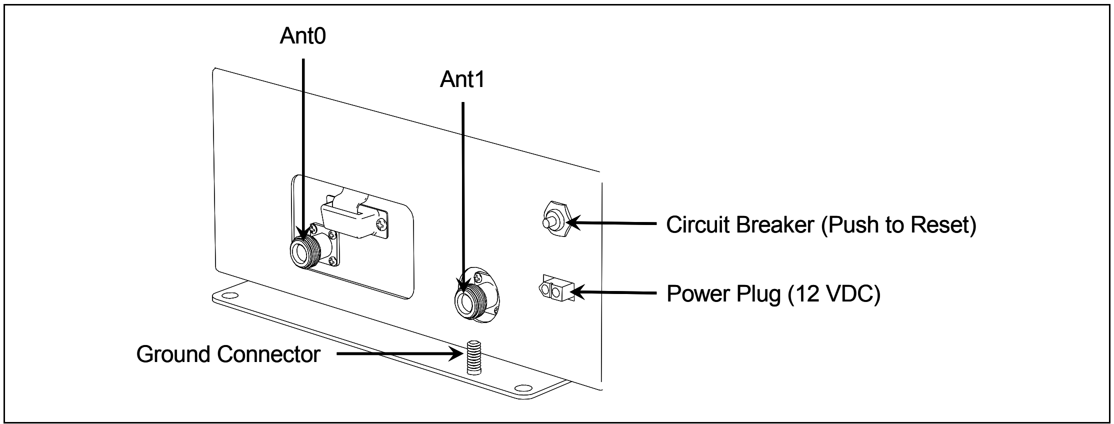
Mount the AEI Interface module (2300-750) next to the SmartScanNG enclosure. Under the AEI Interface module, mount two Joslyn surge protectors (aka Joslyn coaxial lightning arresters).

Attach the power cable from AEI Interface module to the top edge of the distribution block. Attach the serial communications cable (Dsub9F to Dsub9F null) to **COM5** of the Controller module (2300-502).

Attach the coaxial cables, coming from the AEI antennas, to their respective Joslyn surge protectors (aka Joslyn coaxial lightning arresters). Attach the other end of the grounded surge protectors to the AEI Interface module (2300-750).



The AEI Interface module (2300-750) chassis should be tied to earth ground. To do this, connect a ground wire to the ground connector on the mounting tab on the AEI Interface module. Any size copper wire can be used for grounding. Instead of wrapping the wire around the ground connector, either crimp a ring terminal to the grounding wire before slipping it onto the ground connector or slip a copper ground lug onto the ground connector and use it to hold the grounding wire.



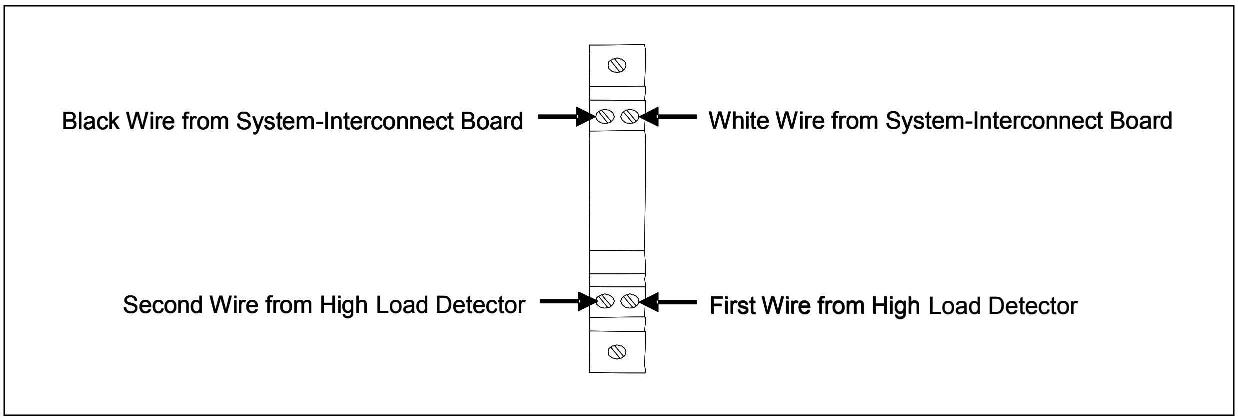
8.16 High-Wide Detector

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

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

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

On the DIN rail assembly, the UTB labeled **HIGH** is either for the high-wide detector or the high-load detector. This UTB protects the SmartScanNG system 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/high-wide detector are terminated at the third row of connectors from the top. The second row from the top is wired at the factory to TS4 on the System-Interconnect board.



Correct polarity need not be observed when connecting the wires from the high-load/high-wide 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.

To designate High-Load alarms, YES must appear after the words High Load on the Equipment menu and Separate must appear after the words Clearance Mode on the Equipment menu. **To designate High-Wide alarms**, YES must appear after the words High Load on the Equipment menu and Multiplexed must appear after the words Clearance Mode on the on the Equipment menu.

Chapter 9
Placing a System into Service

This chapter describes all the things that need to be done before placing a SmartScanNG system 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 #2 Phillips head screwdriver, a small slotted screwdriver, a 9/16-inch torque wrench, a laptop computer, a multimeter, 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 Track Components tells how to install the scanners, transducers, deflectors, 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.

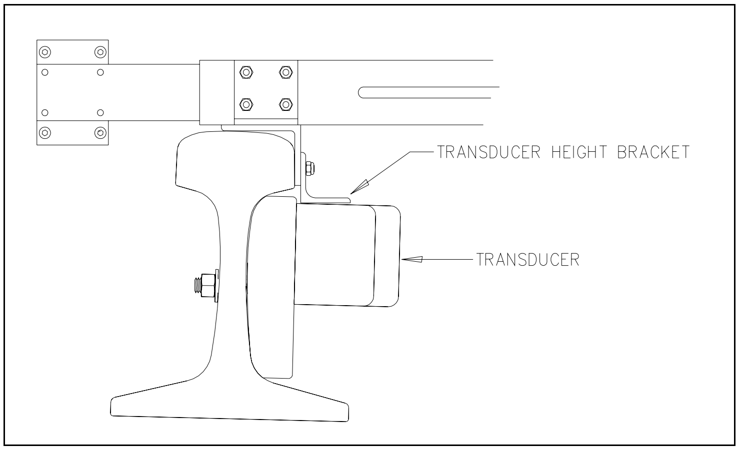
Four bolts are needed to hold the transducer in place. Two square-head bolts go through the mounting plate and transducer body. Two hex-head bolts go through the mounting plate and rail. If any of these bolts are sheared or missing, they must be replaced with the correct replacement bolt. Also, if any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

To check the correctness of the installation of the wayside enclosure components:

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

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

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

Chapter 8 - Installing Wayside Enclosure Components tells how to ground the SmartScanNG system.

3 If there isn't a **ground bus** inside the wayside enclosure that has been attached to a properly installed outside grounding system, fix this problem before proceeding.

4 Check that all wayside enclosure components have been installed properly.

5 If any component of the wayside enclosure isn't installed or isn't installed properly, install it properly before proceeding.

Chapter 8 - Installing Wayside Enclosure Components tells how to install the wayside enclosure components.

6 Inside the wayside enclosure, 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 SmartScanNG System

To power-up the SmartScanNG system:

1 If this is a **solar-powered system**, go to step **25**.

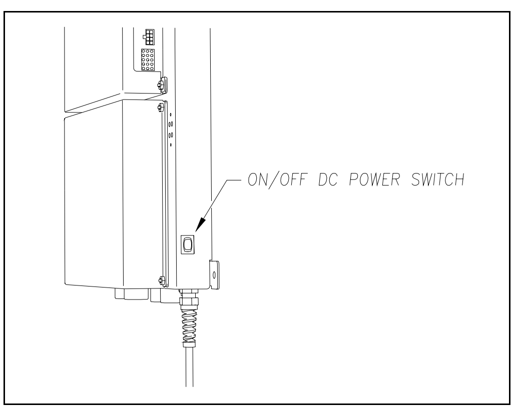
Do steps **2** through **24** only if this is an **AC-powered system**.

2 If plugged in, unplug the SmartScanNG enclosure and the battery charger.

The NRS ELC-12/20-D battery charger doesn't have a power switch. To turn it off, you need to disconnect it from its power source. Even after AC and DC are disconnected, a voltage is still present on the DC terminals because of the energy stored in the capacitor.

The SmartScanNG enclosure doesn't have an AC power switch and needs to be disconnected from its AC power source to stop AC from entering the enclosure. However, it does have a DC power switch.

3 If toggled on, toggle off the DC power switch on the right edge of the SmartScanNG enclosure.



4 Toggle on the AC circuit breaker in the circuit-breaker box.

The next two steps assume your site uses 110-120 VAC. If your site uses 220-250 VAC, skip the next two steps. If your site uses any other AC voltage, skip all the steps below and call STC for help.

5 At all outlets, check if the AC power is stable and at least 110 volts at 20 amperes.

6 If the AC power isn't stable or if it isn't at least 110 volts at 20 amperes, fix this problem before proceeding.

7 If the battery charger hasn't been properly grounded to the ground bus, fix this problem before proceeding.

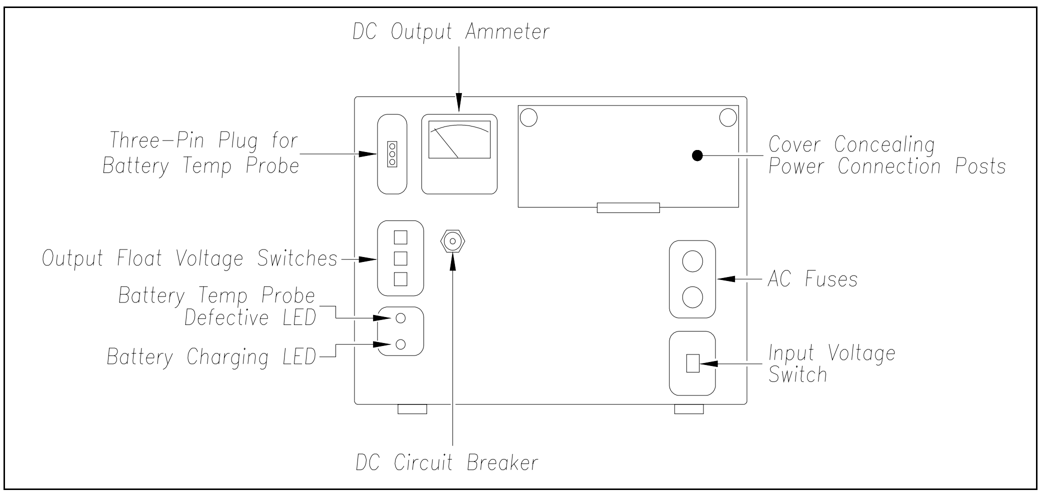
8 If the SmartScanNG enclosure hasn't been properly grounded to the ground bus, fix this problem before proceeding.

9 Remove anything that is blocking the vents on the battery charger.

There are vents on the top, bottom, and sides of the charger. Blocking any of these vents could result in damage to the charger or battery.

10 On the front of the unplugged battery charger:

a Check the setting of the input voltage switch on the bottom-right corner.



b If the input voltage switch isn't set properly, fix this problem before proceeding.

The input voltage switch can be set to 115 VAC or 230 VAC. Use 115 for input voltages between 108 and 128. Use 230 for input voltages between 216 and 256.

c Check the output float voltage switches on the center-left edge.

d Be sure each switch is set on a number and not between numbers.

e If the switches aren't set within the range 12.70 through 14.50 VDC, reset them to 14.00 VDC.

To reset the switches, use a small slotted screwdriver to turn each switch to the desired number. The ten's digit is always 1 and can't be changed. The top switch controls the unit's digit. The middle switch controls the tenth's digit. The bottom switch controls the hundredth's digit. The factory default is **14.00 VDC**, which is the **recommended setting**. To select 14.00 VDC, turn the top switch to 4, the middle switch to 0, and the bottom switch to 0.

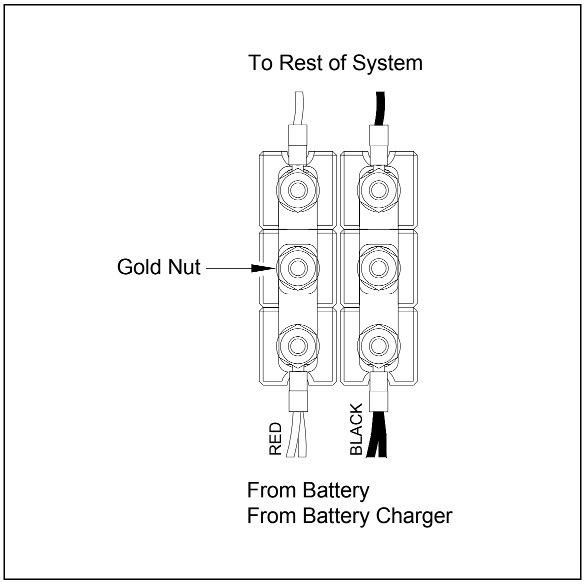
f Open the small door cover on the top-right corner.

g Check that all binding posts nuts are tight and that all wiring is correct.

h If the binding posts nuts aren't tight, tighten them.

i If the wiring isn't correct, correct it.

11 If loose, tighten the middle gold nuts on the distribution block.



12 Plug in the SmartScanNG enclosure and the battery charger.

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

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 dispersion of casing fragments and corrosive liquid electrolyte. So, carefully follow 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 <u>not</u> inhale the fumes.

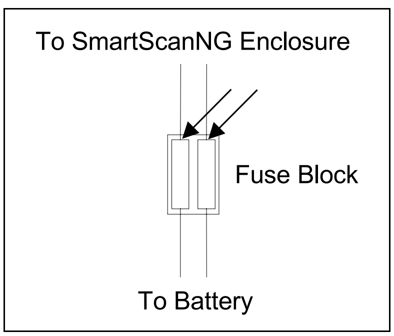
One end of the battery temperature probe cable has a three-pin plug, which plugs into a receptacle on the front of the battery charger. The other end, which has a temperature sensor sealed in it, should be attached to the negative battery post. If the battery temperature probe is defective or not installed, the red defective LED is lit.

13 On the front of the battery charger, if the red defective-temperature-probe LED is lit, fix the underlying problem before proceeding.

14 Switch the multimeter to the DC volts scale.

The **equipment side** of the fuse block is directly wired to the SmartScanNG enclosure. The **battery side** of the fuse block is wired to the battery via the distribution block.

15 Touch the leads from the multimeter to the terminals on the equipment side of the fuse block.



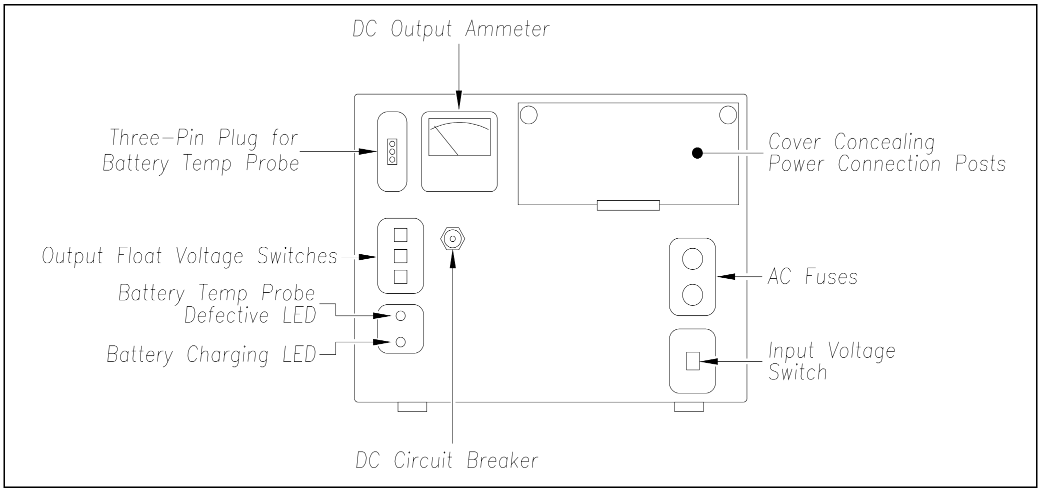
16 If voltage (on the equipment side of the fuse block) is 12.7 through 14.5 VDC, go to step **20**.

17 If voltage (on the equipment side of the fuse block) is 0 VDC:

- **a** Touch the leads to the terminals on the battery side of the fuse block.
- **b** If voltage (on the battery side of the fuse block) is greater than 0 VDC, replace each fuse in the fuse block with a BAF-25 (25-amp 250-volt) fast-acting fuse and return to step **15**.
- **c** If voltage (on the battery side of the fuse block) is 0 VDC, fix any wiring problems between the fuse block, the distribution block, the battery, and the charger.
- **d** Return to step **15**.

18 If voltage is less than 12.7 VDC:

a On the battery charger, check the AC fuses to see if either is blown.



b If need be, replace with 4-amp 250-volt fast-acting fuses.

c On the battery charger, check the DC circuit breaker to see if it is open (tripped).

When closed, about 0.09 inch (0.23 centimeters) of the breaker's button is seen. When open, the button is popped out, showing about 0.25 inch (0.64 centimeters).

d If open (tripped), push the breaker's button in to reset the DC circuit breaker.

e Check to see if the battery charger is plugged in.

f If the battery charger isn't plugged in, plug it in.

g On the battery charger, check the battery-charging LED.

If the battery is charging properly, the yellow battery-charging LED is lit solid. If one or more of the output float voltage switches are set between numbers, the yellow battery-charging LED flashes.

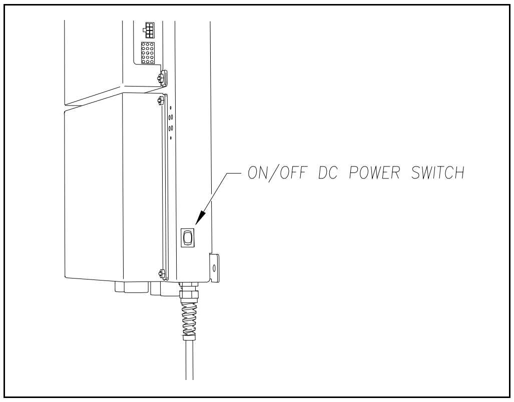
h If the yellow battery-charging LED isn't lit, call STC for help in fixing this problem.

i If the yellow battery-charging LED is lit solid, monitor the voltage for ten minutes.

If the voltage is gradually increasing, the battery is probably charging. After the battery has charged for five hours, the battery voltage should be very near the float voltage setting. If the voltage isn't gradually increasing, the battery is probably not charging. This may indicate that the battery is defective and should be replaced.

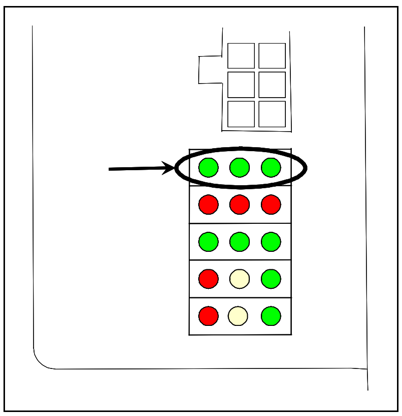
19 If voltage is greater than 14.5 VDC, cut all power to the SmartScanNG system and call STC for help in fixing this problem.

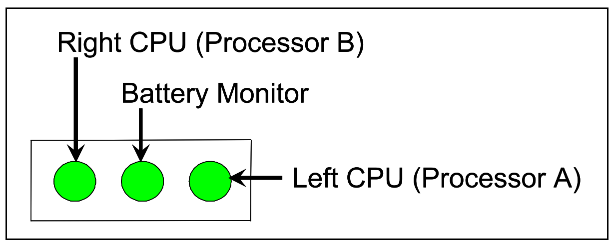
20 Toggle on the DC power switch on the right edge of the SmartScanNG enclosure.



21 Wait 30 seconds.

22 On the status panel, look at the top row of LEDs.





The top row of green LEDs indicates the condition of the CPUs and the battery on the Processor board. If both CPUs are running their programs correctly, their LEDs pulsate (that is, repeat the cycle off, dim, bright, dim). If a program isn't operating as expected, the LED for the affected CPU blinks on and off, is lit solid, or isn't lit at all.

If the on-board coin cell battery is low or dead, the **middle LED** is lit. Otherwise, it isn't lit. 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, there is no danger of losing train data unless the power to the system is lost. When the **middle LED** is lit, the battery should be replaced. If care is taken, this can be done with the system powered up. Otherwise, **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**. Some Processor boards have a permanently installed battery. Those Processor boards should be returned to STC for battery replacement.

23 If either or both of the **rightmost** and **leftmost LEDs** (on the top row) blinks on and off, is lit solid, or isn't lit at all, call STC for help in fixing this problem.

24 Go to ***9.4 Adjusting the Track Circuit***.

Do steps **25** through **36** only if this is a **solar-powered system**.

25 Check if the SmartScanNG enclosure is supplied with a stable DC power source of 11.5 through 15 volts at 15 amperes.

26 If the DC power isn't stable <u>or</u> if it isn't 11.5 through 15 volts at 15 amperes, fix this problem before proceeding.

27 Check all batteries.

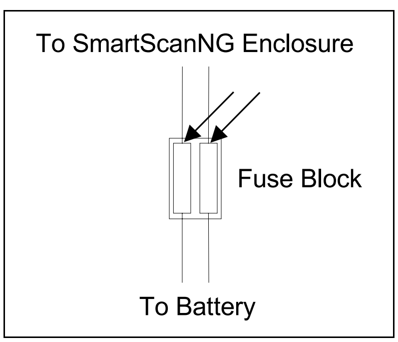
28 If any battery is dead, damaged, or emitting a strong sulfurous odor, replace it before proceeding.

> **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 dispersion of casing fragments and corrosive liquid electrolyte. So, carefully follow manufacturer's instructions for installation and service. Keep all sources of gas ignition away from the batteries and do <u>not</u> 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 <u>not</u> inhale the fumes.

29 Switch the multimeter to the <u>DC</u> <u>volts</u> scale.

30 Touch the leads from the multimeter to the terminals on the <u>top</u> of the fuse block.



31 If voltage on the <u>top</u> of the fuse block is 11.5 through 15 VDC, return to step **22**.

32 If voltage on the <u>top</u> of the fuse block is <u>greater</u> <u>than</u> 0 VDC and <u>less</u> <u>than</u> 11.5 VDC:

- **a** Fix this problem before proceeding.
- **b** Return to step **22**.

33 If voltage on the <u>top</u> of the fuse block is 0 VDC, touch the leads to the terminals on the <u>bottom</u> of the fuse block.

34 If voltage on the bottom of the fuse block is greater than 0 VDC:

  a Replace each fuse in the fuse block with a BAF-25 (25-amp 250-volt) fast-acting fuse.

  b Return to step **30**.

35 If voltage on the bottom of the fuse block is 0 VDC:

  a Correct any wiring problems from the fuse block through the solar subsystem.

  b Correct any problems with the batteries not charging properly.

  c Return to step **30**.

36 If this is a double-track site **with solar-powered systems**, repeat steps **25** through **35** for the other SmartScanNG system.

37 Go to ***9.4 Adjusting the Track Circuit***.

9.4 Adjusting the Track Circuit

Some SmartScanNG sites use a track circuit to detect train presence. Other sites use two advance transducers for this purpose. The SmartScanNG enclosure only has a SOTC board if the site is using a track circuit. If the site is using advance transducers, there is no SOTC board.

To check the operation of the SOTC and adjust it:

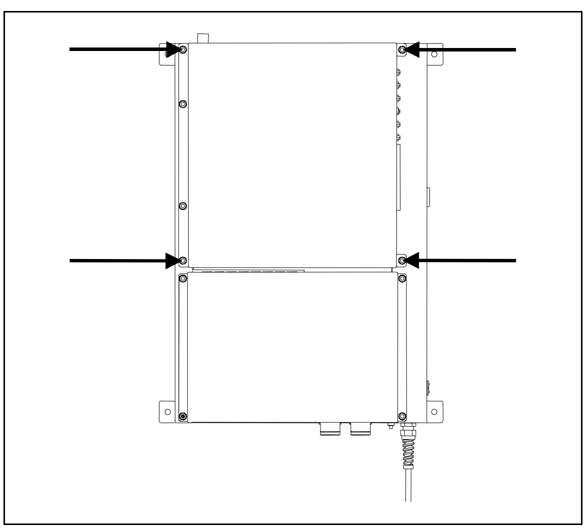
1 If your site uses **advance transducers**, go to ***9.5 Checking the Scanner Shutters***.

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

2 Toggle off the DC power switch on the right edge of the SmartScanNG enclosure.

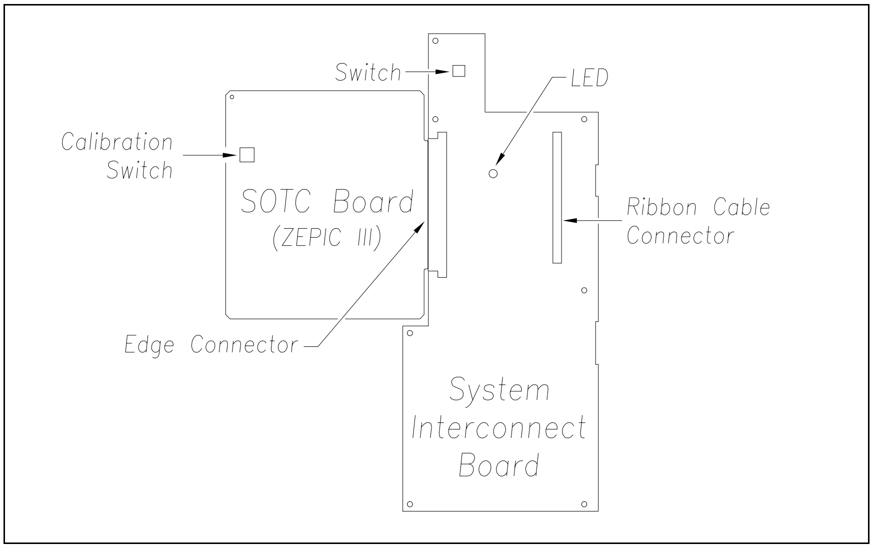
3 Unplug the Molex and ribbon cables from the Controller module.

4 Remove the four nuts that hold the Controller module to the rest of the SmartScanNG enclosure.



5 Detach the Controller module from the rest of the SmartScanNG enclosure.

The SOTC board and the System-Interconnect board are now visible. On some System-Interconnect boards, the LED is to the right of the ribbon cable connector.



6 Store the removed Controller module and nuts in a safe place until you replace them.

7 Toggle <u>on</u> the DC power switch on the right edge of the SmartScanNG enclosure.

8 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 15 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 SOTC board can be pressed and calibration can begin.

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

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

When lit, the LED on the System-Interconnect board indicates a received signal from the track circuit.

10 Press and hold down the blue calibration switch on the SOTC board until the LED on the System-Interconnect board starts blinking.

11 Release the blue calibration switch on the SOTC board.

The LED on the System-Interconnect board 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 System-Interconnect board will light again. This process can take up to 45 seconds to complete.

12 Remove the 0.06 ohm shunt.

The LED on the System-Interconnect board should go out.

13 Place the 0.06 ohm shunt across both rails at the point 10 feet (3 meters) beyond the measured point (that is, 10 feet farther from the gating transducer).

14 If the LED on the System-Interconnect board lights, return to step **8**.

15 Remove the 0.06 ohm shunt.

16 Toggle <u>off</u> the DC power switch on the right edge of the SmartScanNG enclosure.

17 Reattach the Controller module to the rest of the SmartScanNG enclosure.

18 Plug the Molex and ribbon cables into the Controller module.

19 Toggle <u>on</u> the DC power switch on the right edge of the SmartScanNG enclosure.

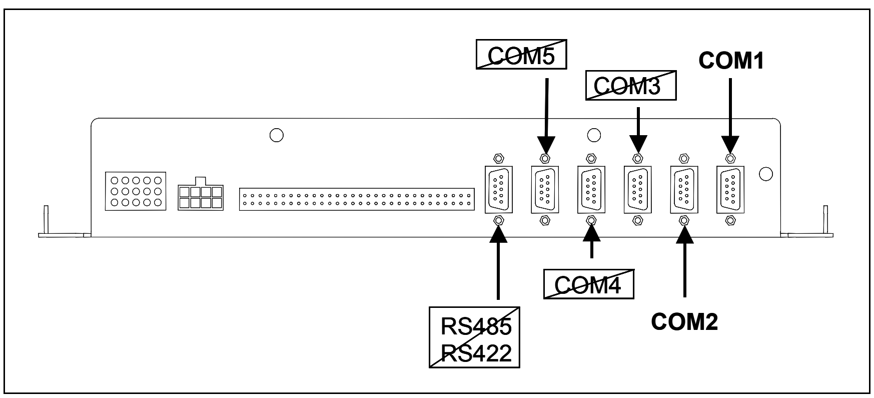
20 If this is a double-track site, repeat steps **2** through **19** for the second track (that is, for the other SmartScanNG system).

9.5 Checking the Scanner Shutters

To <u>check</u> the operation of the scanner shutters:

1 To use the serial interface to open the scanner shutters:

a Plug your computer into COM1 or COM2 (whichever is available) using a crossover (null-modem) cable.



b Turn on your computer.

c Be sure that your computer has installed communications software, that it is set to use full duplex, <u>and</u> that the baud rate is set to 19,200.

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.

d On your computer, open a LOG file.

e To get the serial interface to come up, press **[Esc]**.

This prompt appears.

```
Enter "SmartSCAN" To Proceed:
```

f Type **SmartSCAN**

The entry of this word is case sensitive.

g To get the serial interface to come up, press **[Enter]**.

The Main menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Main Menu
-------------------------------------------------
              .
              .
              .

  K) Enter Pass-Thru Mode for COM 2
  L) System Functions
  M) Event Log
  X) Exit
```

h To go to the System Functions menu, type **L**

The System Functions menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
System Functions Menu
-------------------------------------------------
              .
              .
              .

  F) 1KHz Test Tone
  G) Auto-Calibration
  H) Reset the COP Counters
  I) Remote System RESET
  J) Delete All Stored Train Data
  K) Clear Event Log
  X) Exit
```

i To open the shutters by starting autocalibration, type **G**

The protective shutters in all scanners should open and stay open for three minutes. If it isn't enough time to check the shutters and optics, type **G** 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 for dirty 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 Main menu, type **X**

8 To exit the serial interface <u>and</u> return the system to normal operation, type **X**

9 If this is a double-track site, repeat steps **1** through **8** for the other SmartScanNG system.

9.6 Calibrating Scanners

The SmartScanNG system 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.

9.6.1 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 set point, the heat source isn't operating properly.

To <u>calibrate</u> the **type2/type3** bearing scanners:

1 Be sure that you have on hand a 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.

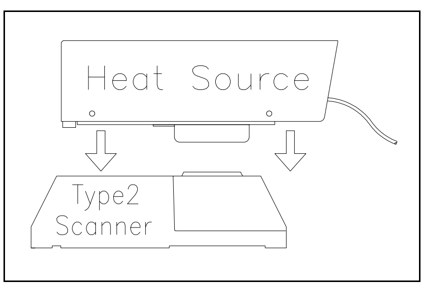
8 Wait about 8 minutes for the heat source to reach operating temperature and stabilize.

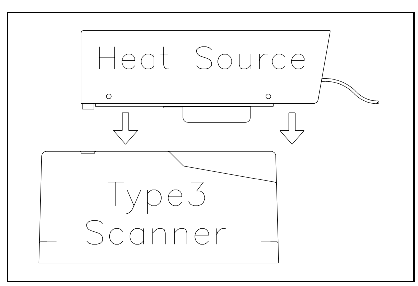
The heat source has reached operating temperature and stabilized when the temperature meter needle remains centered.

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 To prepare your computer:

a Plug your computer into COM1 or COM2 (whichever is available) using a crossover (null-modem) cable.

b Turn on your computer.

c 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 19,200.

d On your computer, open a LOG file.

12 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 SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Main Menu
-------------------------------------------------
               .
               .
               .
  K) Enter Pass-Thru Mode for COM 2
  L) System Functions
  M) Event Log
  X) Exit
```

13 To go to the System Functions menu, type **L**

The System Functions menu appears.

```
               .
               .
               .
  F) 1KHz Test Tone
  G) Auto-Calibration
  H) Reset the COP Counters
  I) Remote System RESET
  J) Delete All Stored Train Data
  K) Clear Event Log
  X) Exit
```

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

14 To start autocalibration, type **G**

The SmartScanNG system 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 <u>or</u> remove the heat source from the bearing scanner.

On your computer screen, an <u>acceptable</u> <u>calibration</u> 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-306. 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.
Resistor test pending.

.......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.

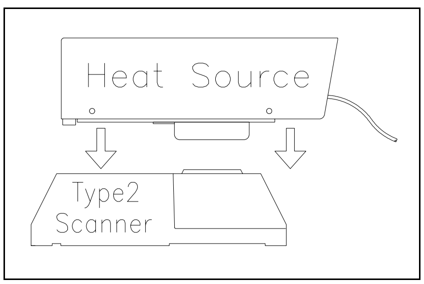
```
Auto Calibration Selected

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
             .
             .
             .
```

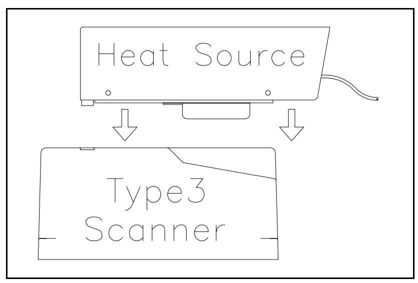
Before the shutters are closed, if you don't get a calibrated temperature in the range 178F to 182F, it means that the scanner wasn't calibrated. If cleaning the optics doesn't solve your problem, replace the scanner cover-and-module assembly. If this doesn't solve your problem, call STC for help in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

15 When "Auto-Calibration Disengaged" is displayed on your computer, remove the calibrated heat source.

16 Take the calibrated heat source to the bearing scanner on the south or west rail.

17 With the power cord to the front of the scanner, place the calibrated heat source on the bearing scanner.





18 Repeat steps **14** through **15**.

19 To return to the Main menu, type **X**

20 To exit the serial interface and return the system to normal operation, type **X**

21 If this is a single-track site:

  a If your site has wheel scanners, go to ***9.6.2 Wheel Scanners***.

  b Store the calibrated heat source and its power cord in the wayside enclosure.

  c Go to ***9.7 Checking the Broadcast***.

22 If this is a double-track site:

  a Repeat steps **1** through **20** for the second track.

  b If your site has wheel scanners, go to ***9.6.2 Wheel Scanners***.

  c Store the calibrated heat source and its power cord in the wayside enclosure.

  d Go to ***9.7 Checking the Broadcast***.

9.6.2 Wheel Scanners

Not all sites use wheel scanners. If your site doesn't use them, skip the instructions below and go to ***9.7 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 **type2/type3** wheel scanners:

1 Be sure that you have on hand a 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**.

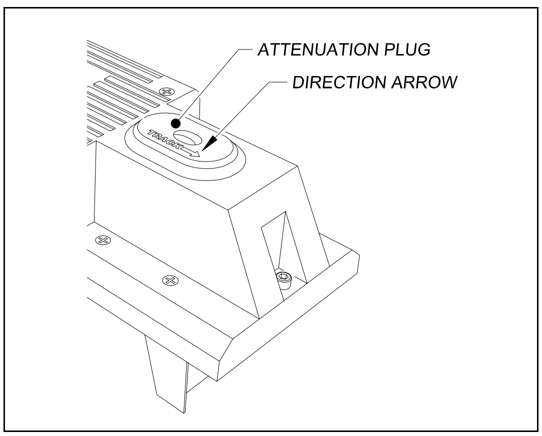
8 Put the heat source in a shady area, out of direct sunlight and out of the wind.

9 Wait about 8 minutes for the heat source to reach operating temperature and stabilize.

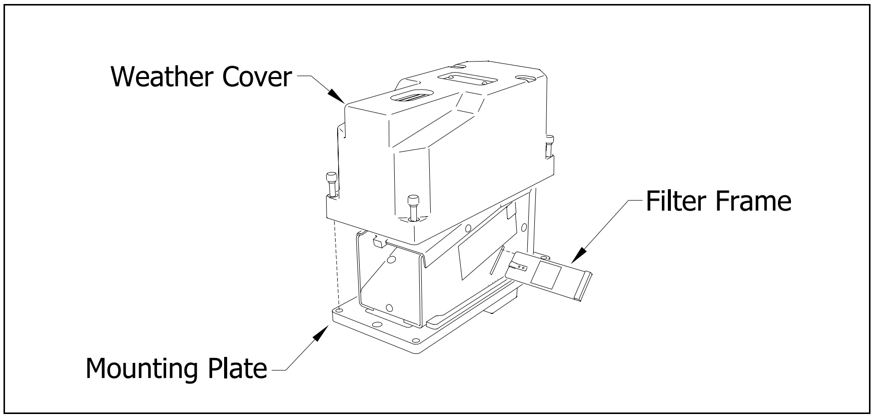
The heat source has reached operating temperature and stabilized when the temperature meter needle remains centered.

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 **type2** wheel scanners, remove the attenuation plug from the weather cover on both scanners.



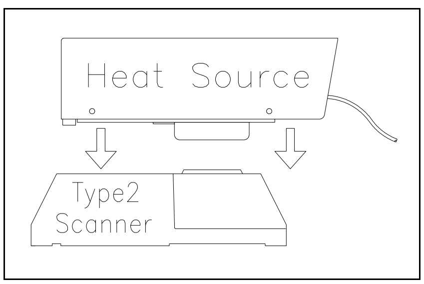
11 If you are calibrating **type3** wheel scanners, be sure that a black filter frame is still installed in each scanner.

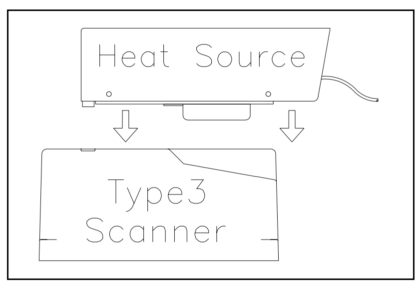


You'll need to remove the weather cover before you can check the color of the filter frame. Four socket-head-cap screws attach the weather cover to the mounting plate. Before continuing, be sure that the black filter frame is securely in place and that the four socket-head-cap screws on the weather cover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

- **a** Plug your computer into COM1 or COM2 (whichever is available) using a crossover (null-modem) cable.
- **b** Turn on your computer.
- **c** 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 19,200.
- **d** On your computer, open a LOG file.

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 SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Main Menu
-------------------------------------------------
               .
               .
               .

  K) Enter Pass-Thru Mode for COM 2
  L) System Functions
  M) Event Log
  X) Exit
```

16 To go to the System Functions menu, type **L**

The System Functions menu appears.

```
               .
               .
               .

  F) 1KHz Test Tone
  G) Auto-Calibration
  H) Reset the COP Counters
               .
               .
               .
```

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

17 To start autocalibration, type **G**

The SmartScanNG system 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.

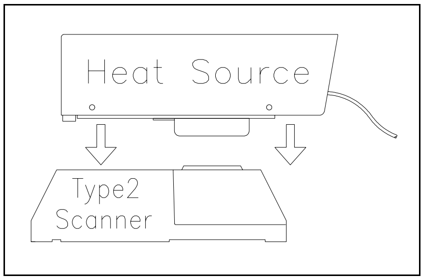
Before the shutters are opened, if you get a signal level greater than 200 millivolts, it usually means that there is noise on the scanner inputs, which most times is caused by an electrical problem with the scanner. If you cannot isolate and fix the cause of this problem, call STC for help.

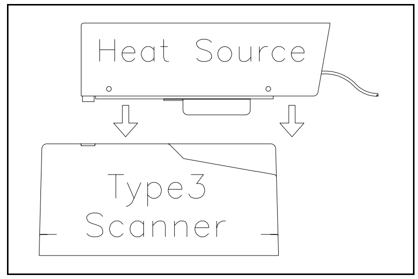
Before the shutters are closed, if you don't get a calibrated temperature in the range 178F to 182F, it means that the scanner wasn't calibrated. If cleaning the optics doesn't solve your problem, replace the scanner cover-and-module assembly. If this doesn't solve your problem, call STC for help in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

18 When "Auto-Calibration Disengaged" is displayed on your computer, remove the calibrated heat source.

19 Take the calibrated heat source to the wheel scanner on the south or west rail.

20 With the power cord to the front of the scanner, place the calibrated heat source on the wheel scanner.





21 Repeat steps **17** through **18**.

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 **type2** 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.

25 If you just calibrated **type3** wheel scanners, replace the black filter frame with the red one in both 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.

26 If this is a single-track site:

a Store the calibrated heat source and its power cord in the wayside enclosure.

b Go to ***9.7 Checking the Broadcast***.

27 If this is a double-track site:

a Repeat steps **1** through **25** for the second track.

b Store the calibrated heat source and its power cord in the wayside enclosure.

c Go to ***9.7 Checking the Broadcast***.

9.7 Checking the Broadcast

The **Radio Test option** is used to broadcast a short message through the speaker (on top of the SmartScanNG enclosure) **and** through the radio. Similarly, the **1KHz Test Tone option** is used to generate a continuous tone for about 10 seconds through the speaker and through the radio. Using either of these options lets you verify that the speaker and radio are working properly.

To check the operation of the speaker and the radio:

1. Be sure that the speaker (on top of the SmartScanNG enclosure) is plugged in and 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. The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Main Menu
-------------------------------------------------
                .
                .
                .
  K) Enter Pass-Thru Mode for COM 2
  L) System Functions
  M) Event Log
  X) Exit
```

3. To go to the System Functions menu, type **L**

   The System Functions menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
System Functions Menu
-------------------------------------------------
  A) Radio Test
  B) Vocabulary Test
  C) Ramp Function
  D) Radio Inhibit
  E) Manual Test Mode
  F) 1KHz Test Tone
  G) Auto-Calibration
  H) Reset the COP Counters
  I) Remote System RESET
  J) Delete All Stored Train Data
  K) Clear Event Log
  X) Exit
```

4 To start outputting either the phrases or the tones, type either **A** or **F**

If you typed **A**, this message appears.

```
Starting Radio Test
```

If you typed **F**, this message appears.

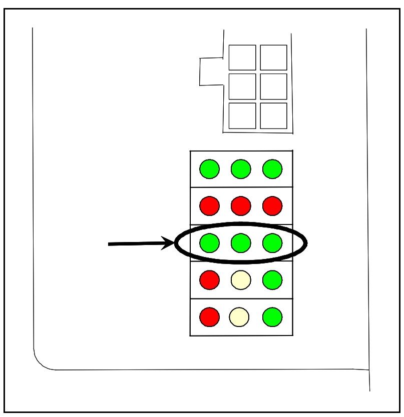
```
Starting 1kHz Test Tone
```

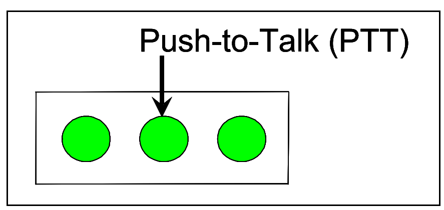
If the system isn't currently making any other voice announcements, it begins the message or tone. After the message or tone finishes, the System Functions menu reappears.

If the system is currently making a voice announcement, the firmware displays the message "System Is Currently Making Voice Announcements! Try Again Later" and redisplays the System Functions menu.

5 While listening to the message or tone, look at the **third row of LEDs** on the status panel.

The **middle green LED** should be lit.





If this LED isn't lit, the system's ability to send a message or tone to the radio might be inhibited. This can happen when one uses the **Radio Inhibit option** on the System Functions menu. If the radio is inhibited, the results of this check are invalid.

The **Radio Inhibit option** prevents radio activation for three minutes. During this time, any announcements generated by the system are broadcast through the speaker, but not through the radio.

6 If the **middle green LED** (on the third row) isn't lit and the radio is inhibited, wait three minutes and return to step **4**.

7 If the **middle green LED** (on the third row) isn't lit and the radio isn't inhibited, call STC for help in fixing this problem.

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 **9** for the other SmartScanNG system.

9.8 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 (on top of the SmartScanNG enclosure), but not through the radio. Therefore, it isn't affected by the **Radio Inhibit option** being enabled.

To check the integrity of the speech data:

1 Be sure that the speaker (on top of the SmartScanNG enclosure) is plugged in and 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.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Main Menu
-------------------------------------------------
               .
               .
               .

  K) Enter Pass-Thru Mode for COM 2
  L) System Functions
  M) Event Log
  X) Exit
```

3 To go to the System Functions menu, type **L**

The System Functions menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
System Functions Menu
-------------------------------------------------
  A) Radio Test
  B) Vocabulary Test
  C) Ramp Function
           .
           .
           .
```

4 From the System Functions menu, type **B**

This message appears.

```
Starting Vocabulary Test
```

If the system isn't currently making any other voice announcements, it begins the vocabulary-test announcement. After the announcement finishes, the System Functions menu reappears.

If the system is currently making a voice announcement, the firmware displays the "System Is Currently Making Voice Announcements! Try Again Later" message and the System Functions menu reappears.

5 If you hear nothing or speech that is too garbled to understand, call STC for help in fixing this problem.

6 To return to the Main menu, type **X**

7 To exit the serial interface and return the system to normal operation, type **X**

8 If this is a double-track site, repeat steps **1** through **7** for the other SmartScanNG system.

9.9 Generating Test Trains

To generate a test train to check simulated alarms:

1 Using the serial interface, display the Main menu.

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

2 To go to the System Functions menu, type **L**

The System Functions menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
System Functions Menu
-------------------------------------------------
  A) Radio Test
  B) Vocabulary Test
  C) Ramp Function
  D) Radio Inhibit
           .
           .
           .
```

3 From the System Functions menu, type **C**

This prompt appears.

```
Start Ramp Function?
```

The **Ramp Function option** is used to generate a test train. It simulates two Absolute alarms, two Differential alarms, and two Hotwheel alarms. It doesn't simulate any Carside Slope alarms. It simulates the Hotwheel alarms even if detection for those alarms is disabled in the Equipment menu. However, disabled alarms don't appear on the Last Test Train report.

4 To start the ramp function, type **Y**

This message appears.

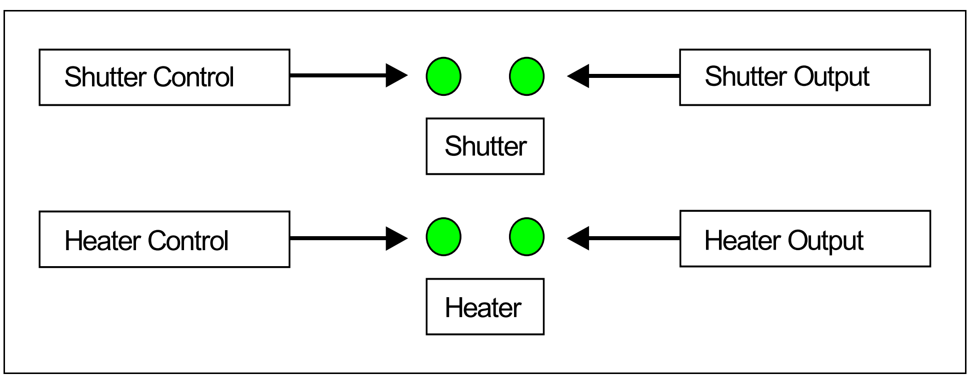
```
Running Ramp Function...
```

The advance input is made active, gating transducer signals are simulated, and heat values are ramped up (increased) and ramped down (decreased) in a predictable sequence to simulate eight Exception Alarms. **This may take a few minutes.** You cannot stop the ramp function by pressing **[Esc]**. When finished, this message appears followed by the System Functions menu.

```
Running Ramp Function...Ramp Function Complete
```

5 Wait until the two LEDs labeled **Shutter** go out.

There is a group of four status LEDs on the lower right side of the chassis. These LEDs show the operation of the solid-state relays used to control the scanner shutters and heaters. The top two are the LEDs labeled **Shutter**.



6 Produce a Last Test Train report.

__Chapter 12 - Producing Reports__ tells how to produce this report. From the Main menu, type **G**.

```
            .
            .
            .
F) Last Train
G) Last Test Train
H) AEI Diagnostic Detail
            .
            .
            .
```

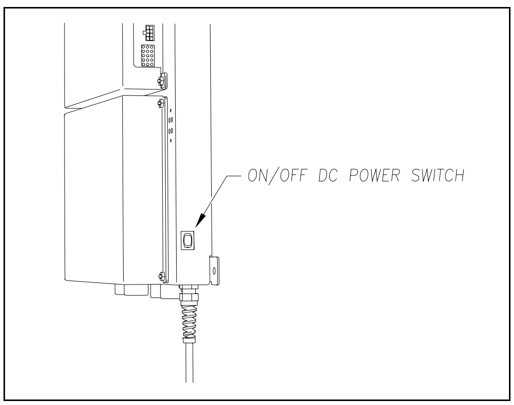
The Last Test Train report is identical to the Train Detail report. There is a difference in the way you specify the train on which you want a report. For this report, you don't specify a train. The most current test train (aka ramp train) is produced.

7 On the Last Test Train report, check for two Absolute alarms and two Differential alarms.

8 If your report doesn't show two Absolute alarms and two Differential alarms, call STC for help in fixing this problem.

9 To purge the system of the test train data:

a Toggle off the DC power switch on the right edge of the SmartScanNG enclosure.



b Wait 10 seconds.

c Toggle on the DC power switch on the right edge of the SmartScanNG enclosure.

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 SmartScanNG system.

To generate a test train to check 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, type **F**.

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 SmartScanNG system.

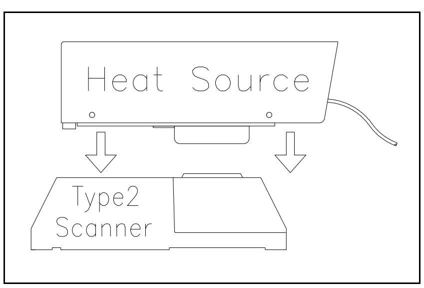
To generate a test train to check hot bearings:

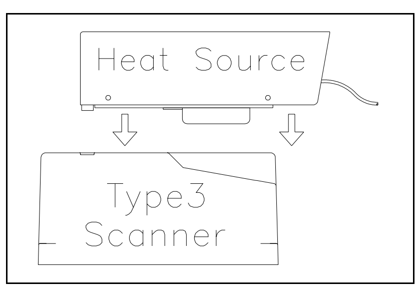
STC recommends that you use the calibrated heat source (2100-810NG) only when the outside (ambient) temperature is above 0°F (-18°C) and below 90°F (32°C). If you must use it at other times, do so only when the needle is centered on the front of the temperature meter. If the needle isn't stabilized within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





3 Quickly stroke the top of each gating transducer with a metal wrench, alternating between TO1 and TO2 for a total of **six** simulated axles.

You should hear the real-time defect message. No matter how many defects are found, the real-time defect message is only announced once.

4 Wait for the system to time out, which normally takes about 10 seconds.

   You should hear an end-of-train message with four Hotbox alarms. Per train, the system only announces the first four Hotbox alarms.

5 Listen to be sure that the Hotbox alarms are announced and that they are announced for the correct side.

   If you do not 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 to the bottom of the SmartScanNG enclosure, a defective shutter motor in the scanner, or a damaged scanner.

6 If you do not hear any Hotbox alarms being announced, fix this problem before proceeding.

7 If the Hotbox alarms are announced for the wrong side, switch the bearing scanner connections on the bottom of the SmartScanNG enclosure.

8 Repeat the test, this time placing the calibrated heat source on the bearing scanner on the opposite rail.

9 Verify the results as before.

   If the results are correct, your system should function properly when scanning the bearings of real trains.

10 Remove the calibrated heat source.

11 If this is a double-track site, repeat steps **1** through **10** for the other SmartScanNG system.

12 Store the calibrated heat source and its power cord in the wayside enclosure.

9.10 Setting Transducer Gain

The Equipment menu shows whether the transducer-gain setting is normal or high. Regardless of the setting, the SmartScanNG system starts every train with the transducer input comparator set to high mode. Then, if the train is traveling 20 mph (32 kph) or more and if the transducer gain was set to normal mode, the transducer input comparator switches to normal mode. This means that it is rarely necessary to set this option to high. **Normal is the recommended starting position.**

When the comparator is in high mode, the comparator converts lower voltage pulses from the transducer into output pulses. This causes the system to be more sensitive to transducer output. When the comparator is in normal mode, the comparator has a better chance of filtering transducer pulses not caused by a wheel.

To set the transducer-gain setting to normal:

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.

```
              .
              .
              .
I) Replay EOT Announcement
J) Setup
K) Enter Pass-Thru Mode for COM 2
              .
              .
              .
```

2 To go to the Setup menu, type **J**

If the Setup menu is password protected, this prompt appears.

```
Enter Setup Password:
```

You are given three chances to type the correct password. When you don't type the correct password in three tries, the system returns to the Main menu.

Each time you incorrectly type the password, this error message appears.

```
Password Incorrect
```

If the password is less than 11 characters long, press **[Enter]** after typing the last character. If the password is the full 11 characters in length, pressing **[Enter]** isn't necessary.

The entry of the password is case sensitive. For example, the password "abc123" cannot be entered "ABC123."

Chapter 11 - Serial Interface tells how to create or change the password using the Setup Password submenu on the Setup menu.

If the Setup menu is not password protected, the Setup menu appears. Also, after you type the password correctly for a password protected Setup menu, the Setup menu appears.

```
              .
              .
              .
D) Alarm Limits
E) Equipment
F) Messages
              .
              .
              .
```

3 To go to the Equipment menu, type **E**

```
Equipment, MP/KP-1794.5, Track:Single
--------------------------------------------------------
           .
           .
           .
H  Winter Cycle........ YES
I  Transducer Gain..... Normal
J  AEI................. YES
           .
           .
           .
```

The Equipment menu shows whether the transducer-gain setting is normal or high. Regardless of the setting, the SmartScanNG system starts every train with the transducer input comparator set to high mode. Then, if the train is traveling 20 mph (32 kph) or more and if the transducer gain was set to normal mode, the transducer input comparator switches to normal mode. This means that it is rarely necessary to set this option to high. **Normal is the recommended starting position**.

When the comparator is in high mode, the comparator converts lower voltage pulses from the transducer into output pulses. This causes the system to be more sensitive to transducer output. When the comparator is in normal mode, the comparator has a better chance of filtering transducer pulses not caused by a wheel.

4 If the **Transducer Gain option** on the Equipment menu is set to Normal, go to step **6**.

5 If the **Transducer Gain option** on the Equipment menu is set to High, type **I**

The transducer-gain setting toggles from high to normal. The **Transducer Gain option** on the Equipment menu changes and the Equipment menu reappears.

6 To leave the Equipment menu and return to the Setup menu, press **[Esc]**.

7 To leave the Setup menu and return to the Main menu, type **X**

Changes to the system parameters aren't reflected until after you have exited the Setup menu.

8 To exit the serial interface and return the system to normal operation, type **X**

9 Leave the SmartScanNG enclosure and the battery charger plugged in, powered, and turned on.

10 If this is a double-track site, repeat steps **1** through **9** for the other SmartScanNG system.

11 Wait until 20 or more trains have passed over the site.

Do the steps that follow after 20 or more trains have passed over the site.

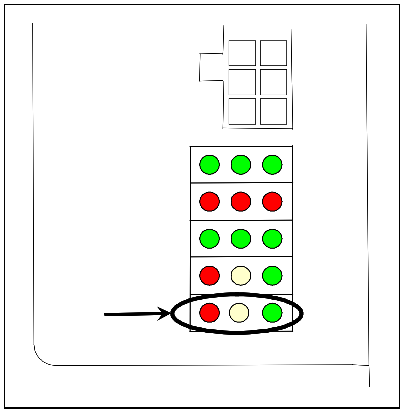
9.11 Doing the Final Activities

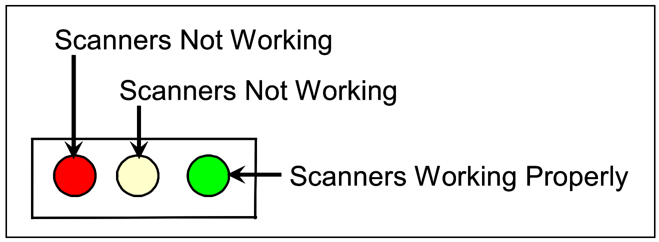
To do the final activities:

1. **Be sure that at least 20 trains have passed over the site.**

   You are not done (that is, you have not placed the system in service) until all the steps below are done.

2. On the status panel, look at the bottom row of LEDs.

   The bottom row of LEDs indicates the operational condition of the bearing and wheel scanners when the system is at rest (that is, when a train isn't present at the site). Several conditions are monitored and logged.

   The **leftmost red LED** indicates whether the integrity check passed or failed. If a scanner failed integrity on any of the last 20 trains, this LED lights and remains lit until all trains with integrity failures are flushed from the log. Conditions that would trigger the lighting of this LED are:

   - Insufficient heat from one or both bearing scanners or from one or both wheel scanners was detected. If either bearing scanner records less than 5°F (2.8°C) for an entire train or if either wheel scanner records less than 15°F (8.3°C) for an entire train.
   - Shutter resistor check failed. The minimum value expected for the temperature of the resistor wasn't met. To cause the LED to light, this minimum value must be greater than the target resistor heat value that is calculated for each train. These requirements for lighting the LED are the same as for generating a Cold Bearing Scanner Resistor alarm (on some systems, called the Cold Resistor alarm).
   - For any five consecutive trains, the difference between the average recorded temperatures for both bearing scanners was more than a delta temperature of 20°F (11.1°C) or the difference between the average recorded temperatures for both wheel scanners was more than a delta temperature of 120°F (66.7°C).

If all of the last 20 trains have passed integrity, the red LED isn't lit. In the last 20 trains, if both bearing scanners or both wheel scanners failed the integrity check, this LED is lit solid. In the last 20 trains, if just one bearing scanner or one wheel scanner failed the integrity check, this LED flashes. The rate and pattern of flashing is different for which rail the scanner was on. For a scanner on the north or east rail, the repeated pattern is on for a half second, off for a full second. For a scanner on the south or west rail, the repeated pattern is on for a half second, off for a half second, on for a half second, off for two seconds.

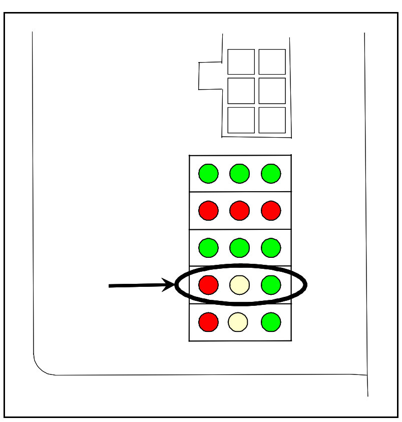
The **middle yellow LED** flashes when the difference between the average temperatures (recorded by the two bearing scanners or recorded by the two wheel scanners) isn't within acceptable balance limits for 20 consecutive trains. These limits are different for bearing and wheel scanners. For the bearing scanners this limit is 5°F (2.8°C) and for wheel scanners is 15°F (8.3°C). If the averages fall below these balance limits, the yellow LED flashes continuously until less than 20 consecutive trains have a temperature imbalance between the two bearing or the two wheel scanners.

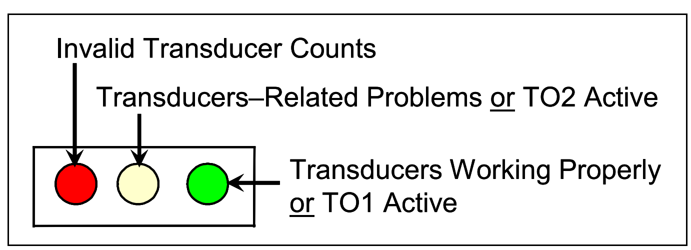
Within the scanner pairs, the scanner with the lower temperatures is considered the problem scanner. Its identity is revealed by the rate and pattern of flashing of the LED. For a scanner on the north or east rail, the repeated pattern is on for a half second, off for a full second. For a scanner on the south or west rail, the repeated pattern is on for a half second, off for a half second, on for a half second, off for two seconds. Since this LED makes no distinction between bearing and wheel scanners, the flashing LED can indicate a problem with either the bearing or the wheel scanner on the indicated rail or a problem with both of them.

The **rightmost green LED** flashes when all of the bearing and wheel scanners worked properly during passage of the last 20 trains. It's off when one or more scanners aren't performing as they should be. It's never lit solid.

3 If the **rightmost green LED** (on the bottom row) isn't flashing, call STC for help in fixing this problem.

4 On the status panel, look at the fourth row of LEDs when no train is present.





The fourth row of LEDs operates differently when a train is at the site and when it isn't.

When a train is present at the site, this row indicates the operational status of the gating transducers for the current train. The **rightmost green LED** will flash as a wheel travels over transducer TO1. The center yellow LED will flash when a wheel travels over transducer TO2. The **leftmost red LED** doesn't light during train passage.

When a train isn't present at the site, this row indicates the operational status of the gating transducers for the last 20 trains. The **leftmost red LED** is lit when all the following conditions befall any given train.

- The count between TO1 and TO2 varies by four or more.
- The speed of the train remains above 10 mph (16 kph).
- The train has an odd axle count.

In the last 20 trains, if not all three fault conditions exist on each given train, the red LED is not lit. In the last 20 trains, if there's a possible fault with TO1 on one train and TO2 on another train, this LED is lit solid. In the last 20 trains, if there's a possible fault with just one gating transducer on a given train, this LED flashes. The gating transducer with fewer hits is considered the bad one. The rate and pattern of flashing is different for each transducer. For TO1, the repeated pattern is on for a half second, off for a full second. For TO2, the repeated pattern is on for a half second, off for a half second, on for a half second, off for two seconds.

When a train isn't present at the site, the **middle yellow LED** is lit when:

- A gating transducer experiences more than 20 filtered pulses on a train. In other words, a gating transducer experiences more than 20 pulses on a train that the SmartScanNG system considers noise.
- The gating transducers are activating the system.

When a train isn't present at the site, the **rightmost green LED** flashes when the count between TO1 and TO2 varies by three or less. Under those conditions, this LED will still flash even when the axle count is odd or the train speed falls below 10 mph (16 kph).

The gating transducers are probably functioning properly when the **rightmost green LED** flashes, the **leftmost red LED** isn't lit, and the **middle yellow LED** isn't lit. But, to be sure, you still need to examine a Train Summary report.

5 When a train isn't present at the site, if the **middle yellow LED** (on the fourth row) isn't lit, go to step **7**.

6 To see if the system is being activated by the gating transducers:

a Produce a Last Train report.

Chapter 12 - Producing Reports tells how to produce this report. From the Main menu, type **F**.

```
            .
            .
            .

E) System Status
F) Last Train
G) Last Test Train
            .
            .
            .
```

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.

b On the Last Train report, check under the System Alarms section of the report for the words "No Approach Track."

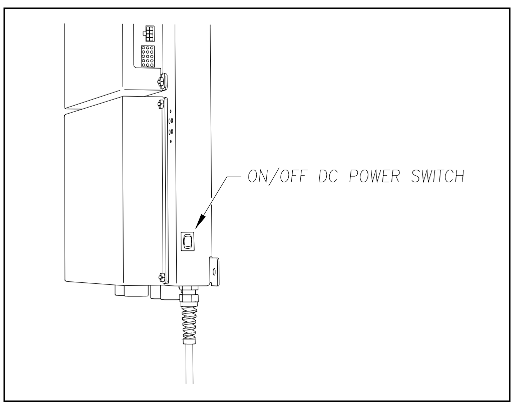
The No Approach Track alarm indicates that the system presence detection system (that is, the track circuit or the advance transducers) didn't detect the arrival of the train at the site. Instead, the system started the train scanning process when a gating transducer sensed the train.

c If the words "No Approach Track" don't appear, go to step **10**.

7 If your system uses advance transducers, go to step **9**.

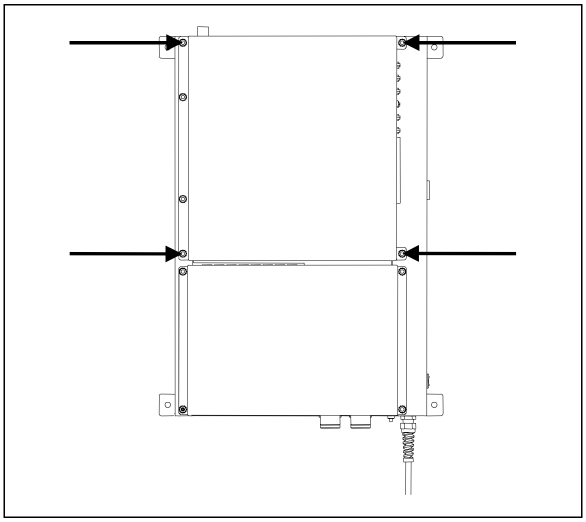
8 If your system uses a track circuit:

a Toggle off the DC power switch on the right edge of the SmartScanNG enclosure.



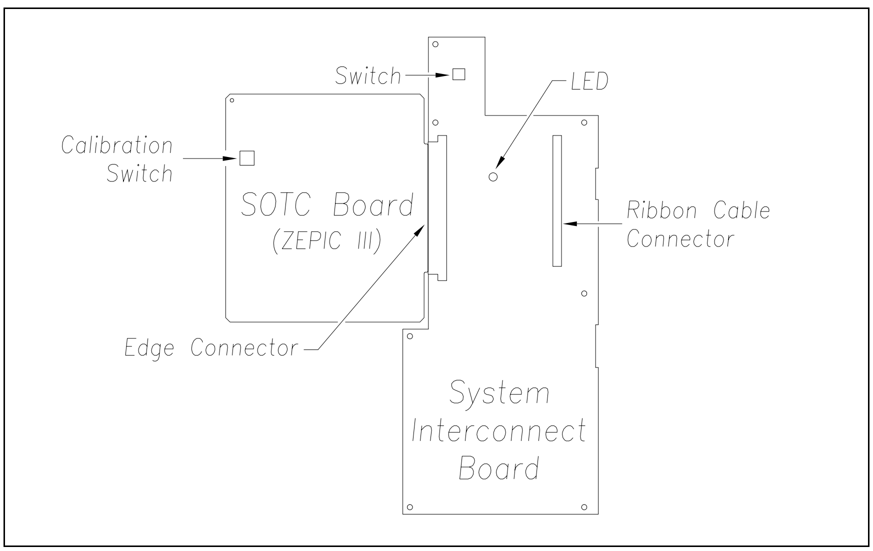
b Unplug the Molex and ribbon cables from the Controller module.

c Remove the four nuts that hold the Controller module to the rest of the SmartScanNG enclosure.



d Detach the Controller module from the rest of the SmartScanNG enclosure.

The SOTC board and the System-Interconnect board are now visible. On some System-Interconnect boards, the LED is to the right of the ribbon cable connector.



e Store the removed Controller module and nuts in a safe place until you replace them.

f Toggle <u>on</u> the DC power switch on the right edge of the SmartScanNG enclosure.

g 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 15 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 SOTC board can be pressed and calibration can begin.

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

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

When lit, the LED on the System-Interconnect board indicates a received signal from the track circuit.

i Press and hold down the blue calibration switch on the SOTC board until the LED on the System-Interconnect board starts blinking.

j Release the blue calibration switch on the SOTC board.

The LED on the System-Interconnect board 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 System-Interconnect board will light again. This process can take up to 45 seconds to complete.

k Remove the 0.06 ohm shunt.

The LED on the System-Interconnect board should go out.

l Place the 0.06 ohm shunt across both rails at the point 10 feet (3 meters) beyond the measured point (that is, 10 feet farther from the gating transducer).

m If the LED on the System-Interconnect board lights, return to step **j**.

n Remove the 0.06 ohm shunt.

o Toggle <u>off</u> the DC power switch on the right edge of the SmartScanNG enclosure.

p Reattach the Controller module to the rest of the SmartScanNG enclosure.

q Plug the Molex and ribbon cables into the Controller module.

r Toggle <u>on</u> the DC power switch on the right edge of the SmartScanNG enclosure.

s Go to step **10**.

9 If your system uses advance transducers:

You'll next verify that that each advance transducer is functional.

a Using a metal wrench, stroke the top of one of the advance transducers.

The scanner shutters should open completely for 10 seconds.

b On one of the bearing scanners, check to see if the shutter opens.

c If the shutter didn't open, fix this problem before proceeding.

d Using a metal wrench, stroke the top of the other advance transducer.

The scanner shutters should open completely for 10 seconds.

e On one of the bearing scanners, check to see if the shutter opens.

f If the shutter didn't open, fix this problem before proceeding.

10 Produce a Train Summary report.

Chapter 12 - Producing Reports tells how to produce this report. From the Main menu, type **A**.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
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.

11 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.

12 If there is an odd axle count and if train speed was always above 7 mph (11.3 kph), go to step **14**.

If at any time during train passage the train speed was less than or equal to 7 mph (11.3 kph), gating transducer problems probably don't exist. If the train speed was always above 7 mph (11.3 kph), gating transducer problems probably do exist.

The Very Slow Train alarm indicates that, at some point during train passage, four consecutive axles crossed the gating transducers at a speed of 7 mph (11.3 kph) or less. This alarm appears on a Train Detail report.

If there are many very slow trains (that is, many trains traveling less than 7 mph (11.3 kph)) at this site, it may be necessary to relocate the scanners and other track hardware to a better location. Deciding to do this should be made in consultation with STC. Relocating a site is beyond the scope of this document.

13 If there is an even axle count and the values under "Axles," "TO1," and "TO2" are the same, go to step **22**.

If things are working correctly, all three values for a given train should be equal. Do the next step only if things aren't working correctly.

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

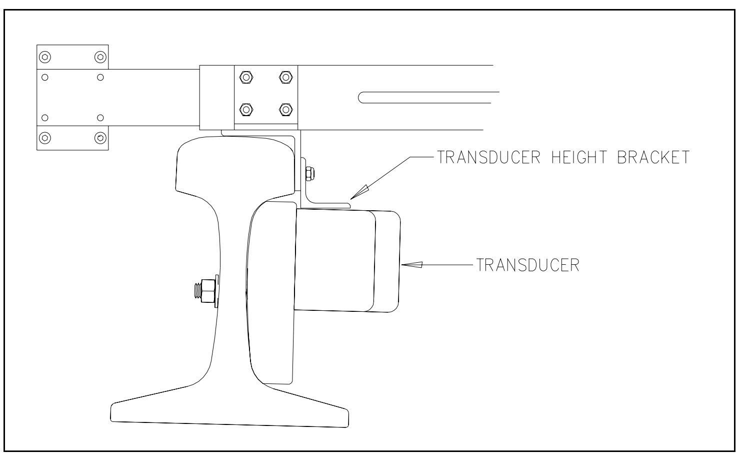
Four bolts are needed to hold the transducer in place. Two square-head bolts go through the mounting plate and transducer body. Two hex-head bolts go through the mounting plate and rail. If any of these bolts are sheared or missing, they must be replaced with the correct replacement bolt. Also, if any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

15 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.

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

17 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.

18 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 20 more trains have passed over the site and then return to step **1**.

19 Determine which gating transducer is recording incorrect information.

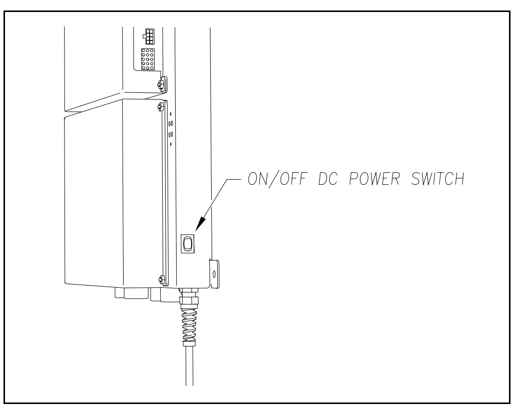
Determine which gating transducer is recording incorrect axle counts and whether it isn't counting all axles or counting extra ones. You may not be able to do this by just looking at the values under the Axles, TO1, and TO2 columns of the Train Summary report. Sometimes, a transducer problem causes the number in the Axles column to be incorrect. Therefore, the true axle count may have to be determined from an alternate source such as the next detector system that encounters the train with the transducer-count imbalance.

After you determine which gating transducer is miscounting, you'll need to change a jumper setting on the Interface board. If TO1 is the problem, you'll change the setting for J201. If TO2 is the problem, you'll change the setting for J202. If both TO1 and TO2 have a problem, both jumpers will need to be changed. Changes to the jumpers should be made only after all external conditions that cause transducer miscounts have been corrected. Some of these external conditions are improperly installed transducers, loose transducer bolts, incorrect transducer heights, damaged transducers, damaged transducer cables, and loose wiring connections.

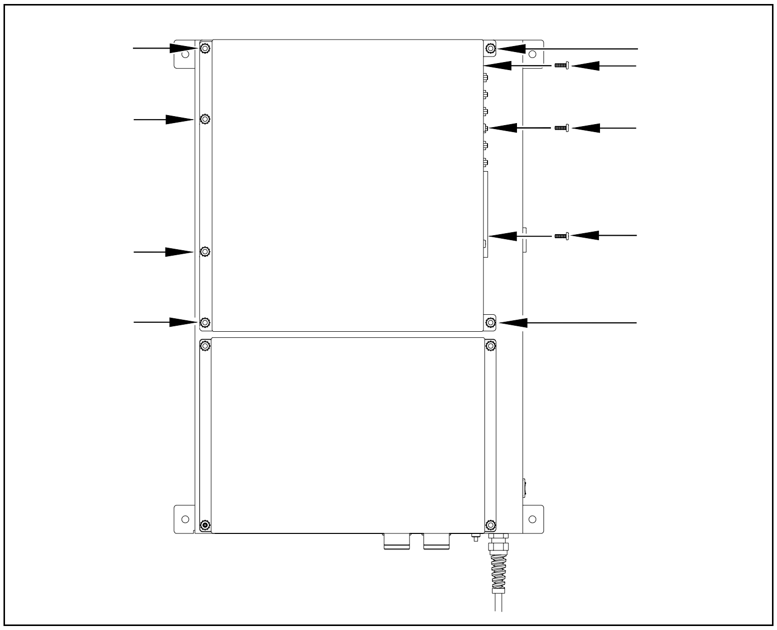
The process of adjusting the transducer loading is trail and error. Generally, if you are having too many transducer counts, lower the loading resistance to make the transducer less sensitive. Likewise, too few counts suggest that the transducer isn't sensitive enough, so you would select a loading value with more resistance.

20 If the selected gating transducer appears to be missing axles (that is, the transducer that is showing a number of hits less than the true axle count):

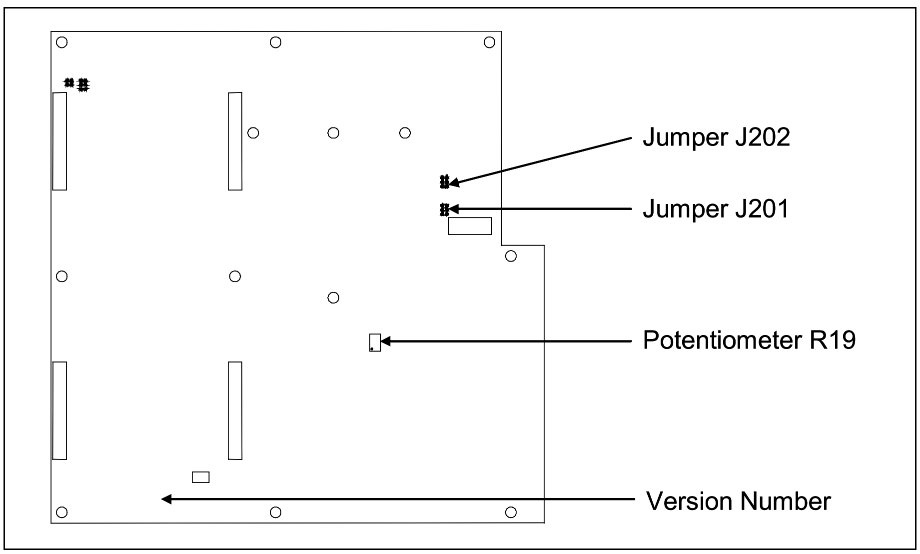
a Toggle off the DC power switch on the right edge of the SmartScanNG enclosure.



b Remove the six nuts and three screws holding the cover over the Interface board.



The Interface board is now visible.



c To prevent the base assembly from falling, replace two of the just removed nuts onto the top two mounting studs on the SmartScanNG enclosure.

d Store the removed cover, three screws, and remaining four nuts in a safe place until you replace them.

The available loading sensitivities vary depending on which version of Interface board you have and whether resistors are attached to the jumpers or not. The version number is printed on the lower-left edge of the board.

e Note the version number of your Interface board.

The table below lists the highest, middle, and lowest sensitivity for transducer loading for current board versions. Highest is the most sensitive. The jumper's top position is the one closest to the external speaker.

J201 or J202 Jumper Position	Version 1.21 and 1.22 and 1.30 and 1.40 Board
Top	Lowest Sensitivity
Center	Middle Sensitivity
Bottom	Highest Sensitivity

This table above only covers board versions 1.21, 1.22, 1.30, and 1.40. Earlier versions of the board have different jumper positions for each sensitivity level. That is, the available loading sensitivities vary depending on which version of Interface board you have, whether the board was modified, and whether resistors are attached to the jumpers. The version number is printed on the lower-left edge of the board.

f If TO1 is the selected gating transducer and the J201 jumper is currently on the lowest sensitivity position, move it to the middle sensitivity position.

g If TO1 is the selected gating transducer and the J201 jumper is currently on the middle sensitivity position, move it to the highest sensitivity position.

h If TO1 is the selected gating transducer and the J201 jumper is currently on the highest sensitivity position, call STC for help in fixing this problem.

i If TO2 is the selected gating transducer and the J202 jumper is currently on the lowest sensitivity position, move it to the middle sensitivity position.

j If TO2 is the selected gating transducer and the J202 jumper is currently on the middle sensitivity position, move it to the highest sensitivity position.

k If TO2 is the selected gating transducer and the J202 jumper is currently on the highest sensitivity position, call STC for help in fixing this problem.

l Remove the two nuts holding the base assembly to the SmartScanNG enclosure.

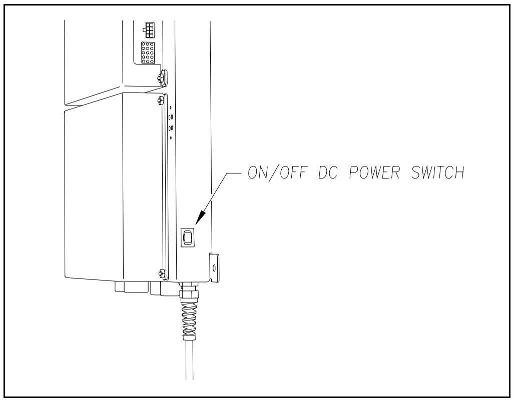
m Using the saved six nuts and three screws, reattach the cover over the Interface board.

n Toggle on the DC power switch on the right edge of the SmartScanNG enclosure.

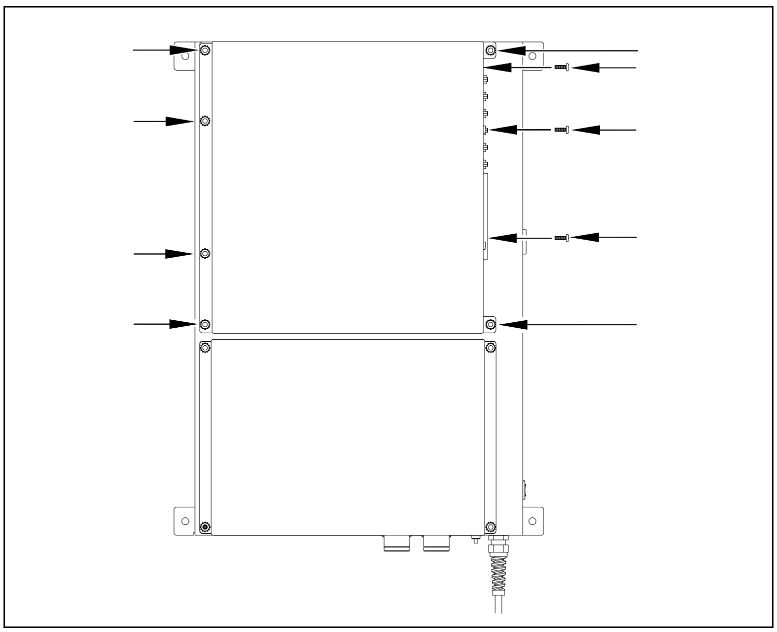
o Wait until 20 more trains have passed over the site and then return to step **1**.

21 If the selected gating transducer appears to be counting extra axles (that is, the transducer that is showing a number of hits more than the true axle count):

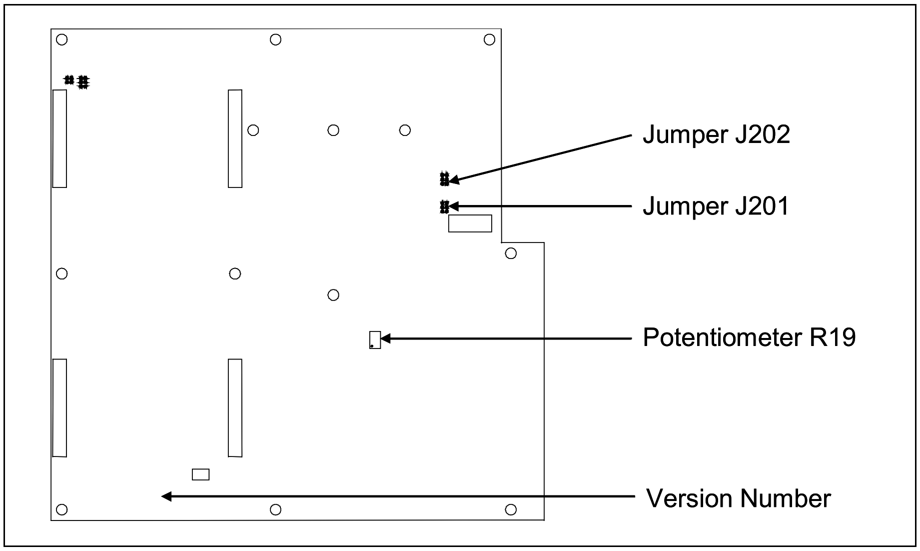
a Toggle off the DC power switch on the right edge of the SmartScanNG enclosure.



b Remove the six nuts and three screws holding the cover over the Interface board.



The Interface board is now visible.



c To prevent the base assembly from falling, replace two of the just removed nuts onto the top two mounting studs on the SmartScanNG enclosure.

d Store the removed cover, three screws, and remaining four nuts in a safe place until you replace them.

The available loading sensitivities vary depending on which version of Interface board you have and whether resistors are attached to the jumpers or not. The version number is printed on the lower-left edge of the board.

e Note the version number of your Interface board.

The table below lists the highest, middle, and lowest sensitivity for transducer loading for current board versions. Highest is the most sensitive. The jumper's top position is the one closest to the external speaker.

J201 or J202 Jumper Position	Version 1.21 and 1.22 and 1.30 and 1.40 Board
Top	Lowest Sensitivity
Center	Middle Sensitivity
Bottom	Highest Sensitivity

This table above only covers board versions 1.21, 1.22, 1.30, and 1.40. Earlier versions of the board have different jumper positions for each sensitivity level. That is, the available loading sensitivities vary depending on which version of Interface board you have, whether the board was modified, and whether resistors are attached to the jumpers. The version number is printed on the lower-left edge of the board.

f If TO1 is the selected gating transducer and the J201 jumper is currently on the highest sensitivity position, move it to the middle sensitivity position.

g If TO1 is the selected gating transducer and the J201 jumper is currently on the middle sensitivity position, move it to the lowest sensitivity position.

- **h** If TO1 is the selected gating transducer and the J201 jumper is currently on the lowest sensitivity position, call STC for help in fixing this problem.
- **i** If TO2 is the selected gating transducer and the J202 jumper is currently on the highest sensitivity position, move it to the middle sensitivity position.
- **j** If TO2 is the selected gating transducer and the J202 jumper is currently on the middle sensitivity position, move it to the lowest sensitivity position.
- **k** If TO2 is the selected gating transducer and the J202 jumper is currently on the lowest sensitivity position, call STC for help in fixing this problem.
- **l** Remove the two nuts holding the base assembly to the SmartScanNG enclosure.
- **m** Using the saved six nuts and three screws, reattach the cover over the Interface board.
- **n** Toggle on the DC power switch on the right edge of the SmartScanNG enclosure.
- **o** Wait until 20 more trains have passed over the site and then return to step **1**.

22 On the Train Summary report, check the column marked "Average."

For each train, the values in the two columns under this heading should be within four degrees of each other.

23 If the columns aren't within four degrees and if the scanner optics are clean, recalibrate and realign the scanner.

Chapter 7 - Aligning Scanners tells how to align the scanners. ***Appendix E - Calibration of Scanners*** tells how to calibrate the scanners.

24 On the Train Summary report, check the last column of the report.

The last column shows the system battery voltage at the time each train passed the site. It should show values between 12.7 and 14.5 volts.

If this is an **AC-powered system**, values outside this range may be caused by:

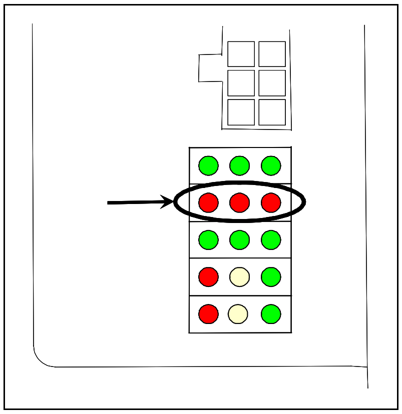
- No AC power for an extended period
- Improperly adjusted float voltage
- Defective battery
- Blown fuses
- Defective battery charger

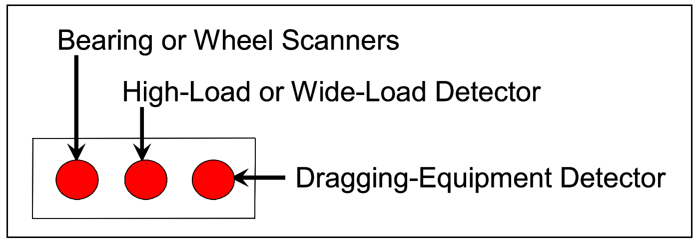
If this is a **solar-powered system**, values outside this range may be caused by:

- Defective battery
- Blown fuses
- Defective solar subsystem

25 If the most recent value isn't between 12.7 and 14.5 volts., investigate and fix any problems before proceeding.

26 On the status panel, look at the second row of LEDs.





The second row of red LEDs indicates stored defect alarms, including those for bearing/wheel scanners, dragging equipment, and clearance equipment. These LEDs are lit when a defect alarm (associated with one of those pieces of equipment) has been recorded in any of the last 40 trains. Each LED remains lit until there isn't a recorded defect alarm (for the equipment associated with it) in any of the last 40 trains. Note, however, since this is a new installation, you might have less than 40 trains listed on the Exception Summary report. Or, you might have no trains listed. Also, you could have a lit LED and no trains listed if you ran a test train and didn't clear the results.

27 If any LED (on the second row) is lit:

a Produce an Exception Summary report.

Chapter 12 - Producing Reports tells how to produce this report. From the Main menu, type **C**.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Main Menu
-------------------------------------------------
  A) Train Summary
  B) Train Detail
  C) Exception Summary
  D) Exception Detail
           .
           .
           .
```

The Exception Summary report lists all trains currently stored in the Exceptions directory. A train is stored in the Exceptions directory if either an Exception Alarm or an Integrity Failure was detected on it as it passed the site. A line of information is shown for each train entry.

b If any red LED (on the second row) is lit and there are no train entries on the Exception Summary report, call STC for help in fixing this problem.

- **c** Produce an <u>extended</u> <u>Exception</u> <u>Detail</u> <u>report</u> for each train that is listed on the Exception Summary report, up to and including the most current 40 trains.

  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, enter a train number from the Exception Summary report. The train number appears under the column titled "Train#" in the <u>detail</u> section of the Exception Summary report.

- **d** Looking in the <u>detail</u> section of each of the produced Exception Detail reports, note every recorded defect alarm.
- **e** If a red LED (on the second row) is lit <u>and</u> there is no corresponding recorded defect alarm on any of the produced Exception Detail reports, call STC for help in fixing this problem.
- **f** If a red LED (on the second row) is lit <u>and</u> there are one or more corresponding recorded defect alarms on half or less <u>and</u> not on the most current five of the produced Exception Detail reports, go to step **28**.
- **g** If a red LED (on the second row) is lit <u>and</u> there are one or more corresponding recorded defect alarms on more than half <u>or</u> on the most current five of the produced Exception Detail reports, check the track hardware and the wiring to the wayside enclosure.
- **h** If problems are found with the hardware, wiring, or both, fix the problems and then go to step **28**.
- **i** If no problems are found with the hardware and wiring, call STC for help in fixing this problem.

28 If this is an **AC-powered system**, leave the SmartScanNG enclosure <u>and</u> the battery charger plugged in, powered, <u>and</u> turned on.

29 If this is a **solar-powered system**, leave the SmartScanNG enclosure plugged in, powered, <u>and</u> turned on.

30 If this is a double-track site, repeat steps **1** through **29** for the other track (that is, for the other SmartScanNG system).

Chapter 10
Defect Detection

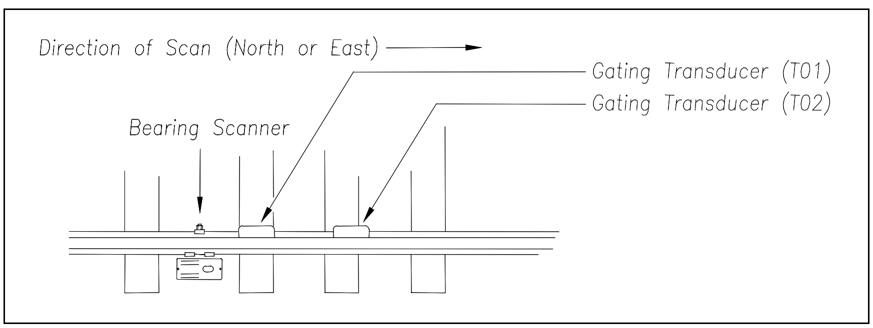
This chapter describes the Exception Alarms (aka defect alarms aka train alarms) and how they are detected. Miscellaneous train scanning features are also covered.

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 SmartScanNG system is equipped with one of two primary means of train arrival detection, which are the track circuit or 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 wayside enclosure, these transducers are mounted near and to the north or east of the bearing scanners. **TO1** is the gating transducer <u>closest</u> <u>to</u> the bearing scanner. **TO2** is the one <u>farthest</u> <u>from</u> 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.

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.

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 activated the system, the system waits for ten seconds of inactivity from the gating transducers before deactivating.

10.3 Speed Calculation

A train's exit speed is the speed shown on the reports. The system calculates this speed by using timing from the last eight axles as provided by the gating transducers. The system calculates the speed by knowing the distance between the two transducers versus the time that it takes a given wheel to pass over them. Calculated speeds over 99 mph (159 kph) are reported as 99 mph (159 kph). If a train has fewer than eight axles, its speed is reported as 0 mph (0 kph).

Trains traveling at less than 7 mph (11.3 kph) are considered "very slow." If a passing train drops below this speed threshold, the detection of Differential alarms, Pyrometer Saturation alarms, and Carside Slope alarms isn't performed. After passage of these trains, the phrase "train too slow" is appended to the post-train message (when the **Announce Slow Train option** is enabled) and a diagnostic message is noted on the Train Detail and Exception Detail reports. Also, after passage of these trains, axle count, exit speed, length of train, and total number of cars isn't announced. This is true even when the **Announce Axles option, Announce Speed option**, **Announce Train Length option**, and **Announce Number of Cars option** are enabled.

The report fragment below, from the header section of a Train Detail report, shows the location of this message.

```
                    Southern Technologies Corporation
                     Next Generation Detector System
                               TRAIN DETAIL
========================================================================
                            •
                            •
System Alarms
-------------------------------------
VERY Slow Train
                            •
                            •
```

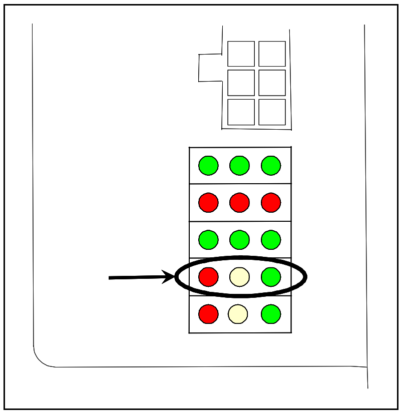
10.4 Train Direction

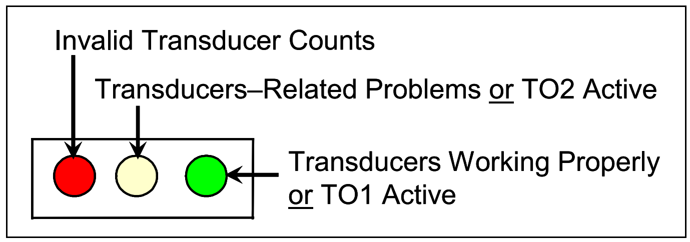
Train direction is based on whether TO1 or TO2 generated the first gating transducer pulse.

10.5 Transducer Pulse Processing

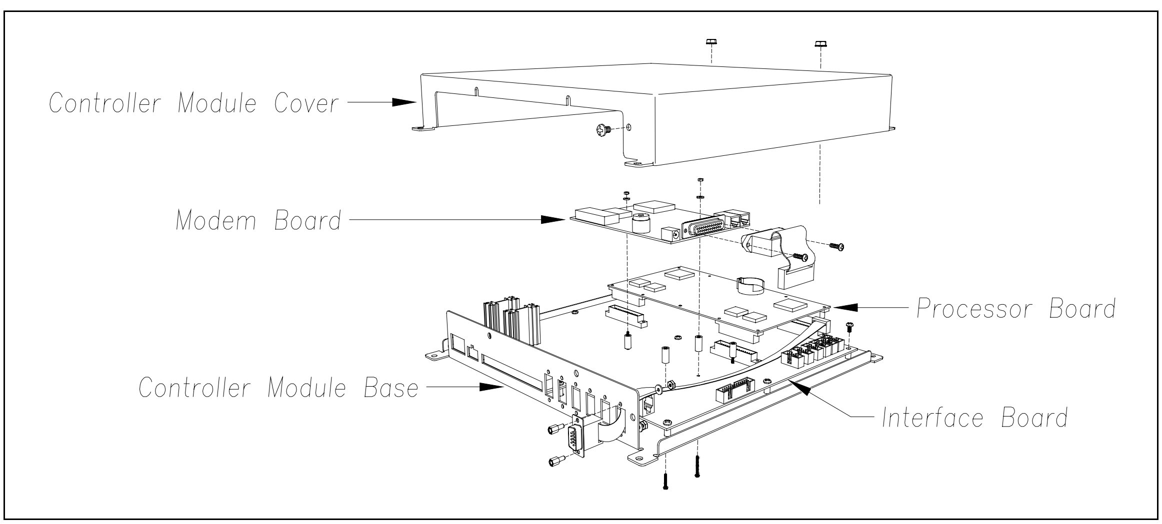
As a wheel enters the sensing range of a transducer, the transducer should respond with a positive going pulse. The polarization of the two wires from the transducer determines if this pulse is positive or negative.

Here is a simple test that you can use to verify the correct polarization of the gating transducers. While watching the TO1 and TO2 LEDs in row four on the status panel, have someone lay a metal wrench on one of the gating transducers. The corresponding LED should briefly light as the wrench touches the transducer. Then lift the wrench up. The LED shouldn't light as the wrench is lifted away. Repeat the test for the other transducer.





On the 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 remains 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 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. Three milliseconds or greater is considered to be a valid signal. The firmware rejects any pulse width shorter than 3-milliseconds. 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 SmartScanNG system begins reading the scanners for a heat signal when the wheel is at the center of the first gating transducer. There after, it starts reading the scanners 16 inches (40.6 centimeters) before the center of the first gating transducer. (See ***Appendix G - Predictive Gate Scanning*** for more information about this 16-inch (40.6 centimeter) pregate 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 (DSR) 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 SmartScanNG system checks for hot bearings during the scanning process. It detects and records every Hotbox alarm that occurs. However, it only announces a maximum of four per train. For example, if a train contains seven Hotbox alarms, the Train Detail report will show all seven, but only the first four are announced.

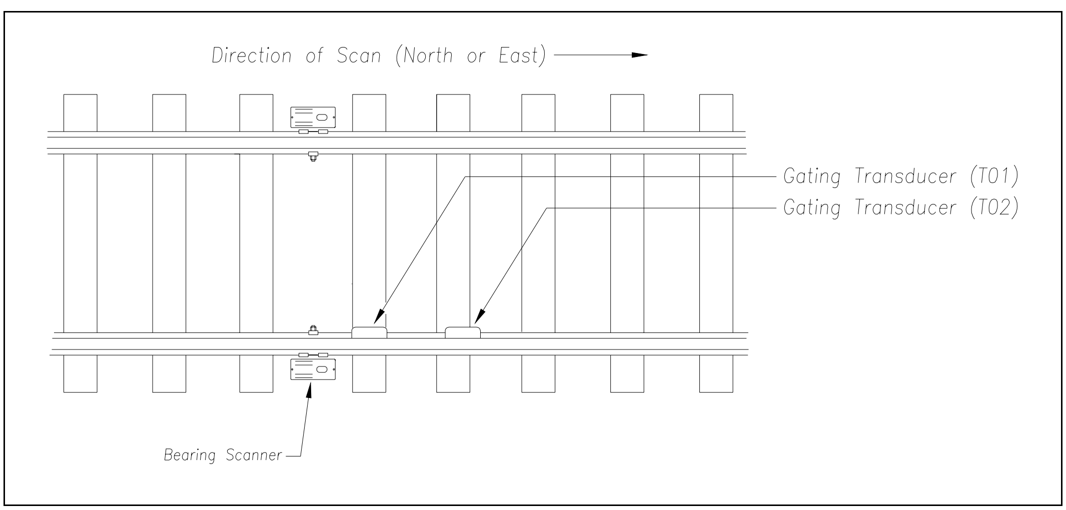
There are four types of Hotbox alarms.

- **Absolute**. To trigger an Absolute alarm, a bearing temperature must exceed the limit that was established using the **Absolute option** on the Alarm Settings menu. 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 Settings menu.
- **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 Settings menu. If an Absolute alarm or a Differential alarm has already been triggered for the axle, a Pyrometer Saturation alarm isn't generated.
- **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** on the Alarm Settings menu.

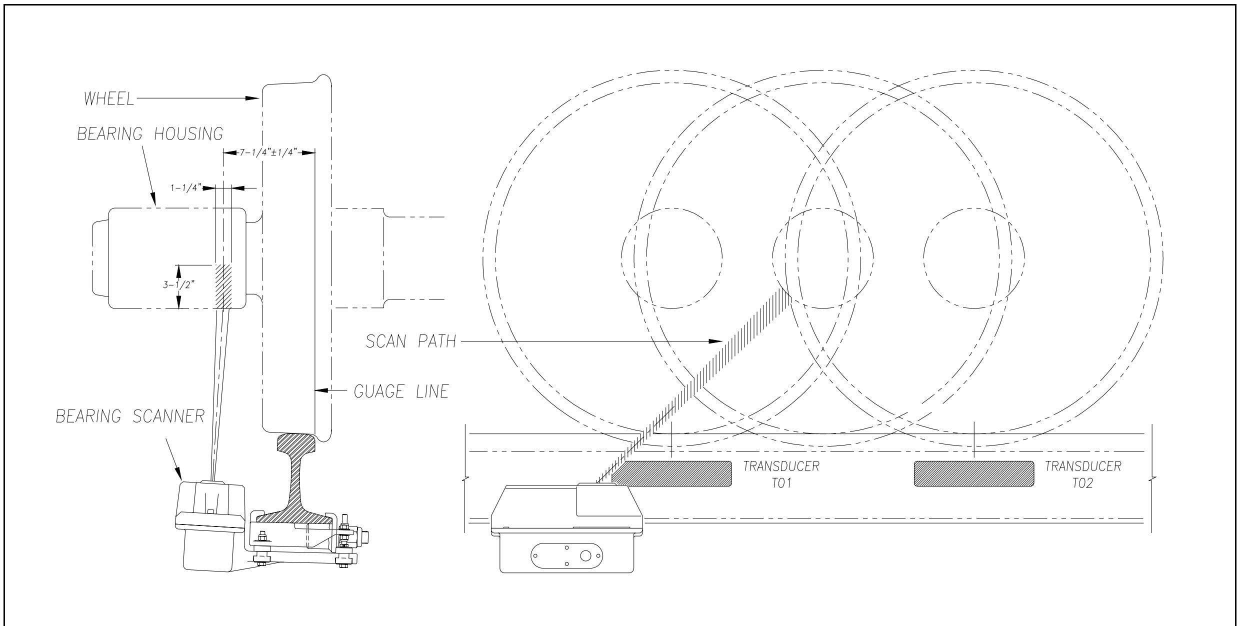
The system always checks for Absolute alarms. The system also checks for Differential alarms and Pyrometer Saturation alarms. However, their detection stops when the speed of the train drops below 7 mph (11.3 kph). In order for Carside Slope alarms to be processed, they must be enabled using the **Carside Slope option** on the Equipment menu. The detection of Carside Slope alarms also stops when the speed of the train drops below 7 mph (11.3 kph).

10.7.1 Bearing Scan Process

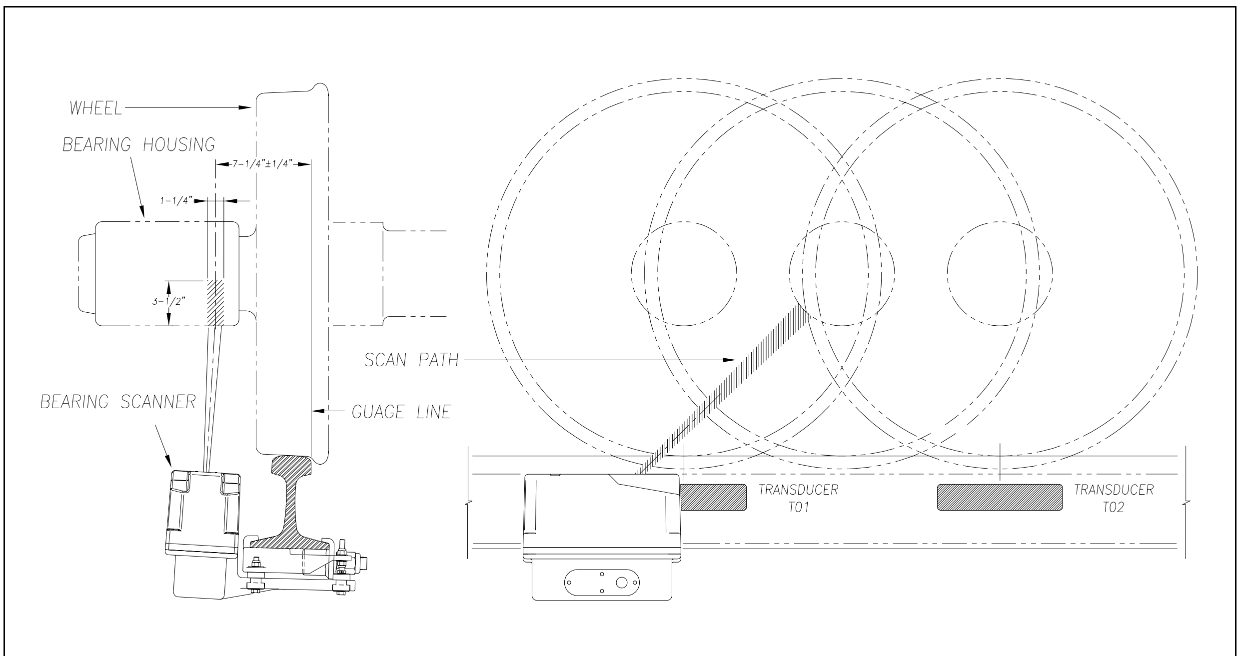
Bearing scanners are mounted in the center of the crib of two ties spaced at least 14 inches (35.6 centimeters) apart. Both bearing scanners are mounted in the crib immediately ahead of the gating transducers (that is, in the crib immediately to the south or west of the gating transducers). They are 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 **type2** 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 **type3** 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.

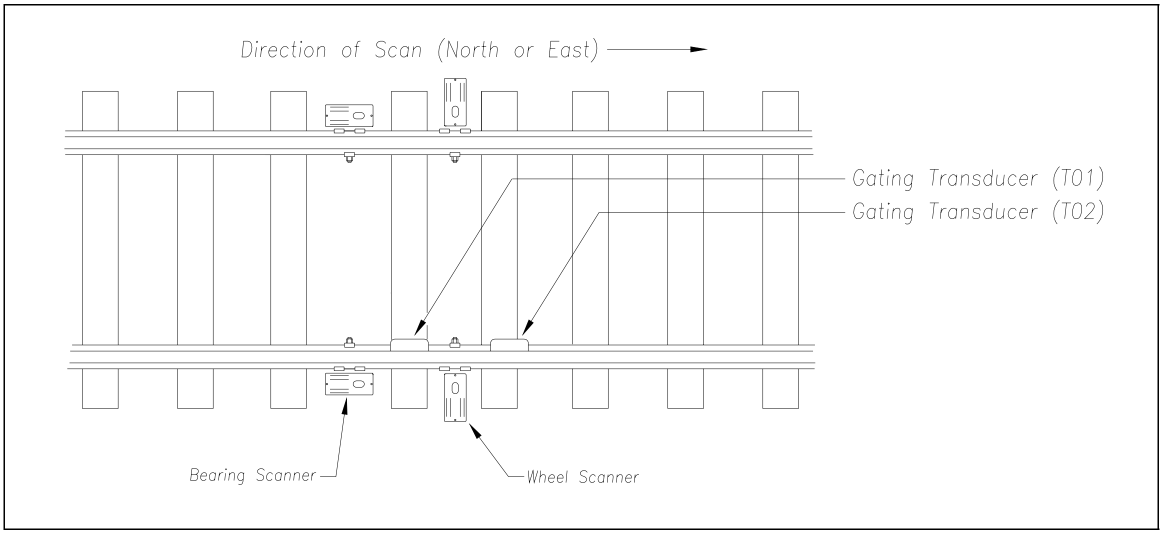
When a bearing passes through the field of view of the scanner, a rapid change in temperature is presented to the internal lithium tantalite crystal. This causes the signal level from the pyrometer to increase proportionally to the amount of exposed infrared energy. When an axle is between the gating 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

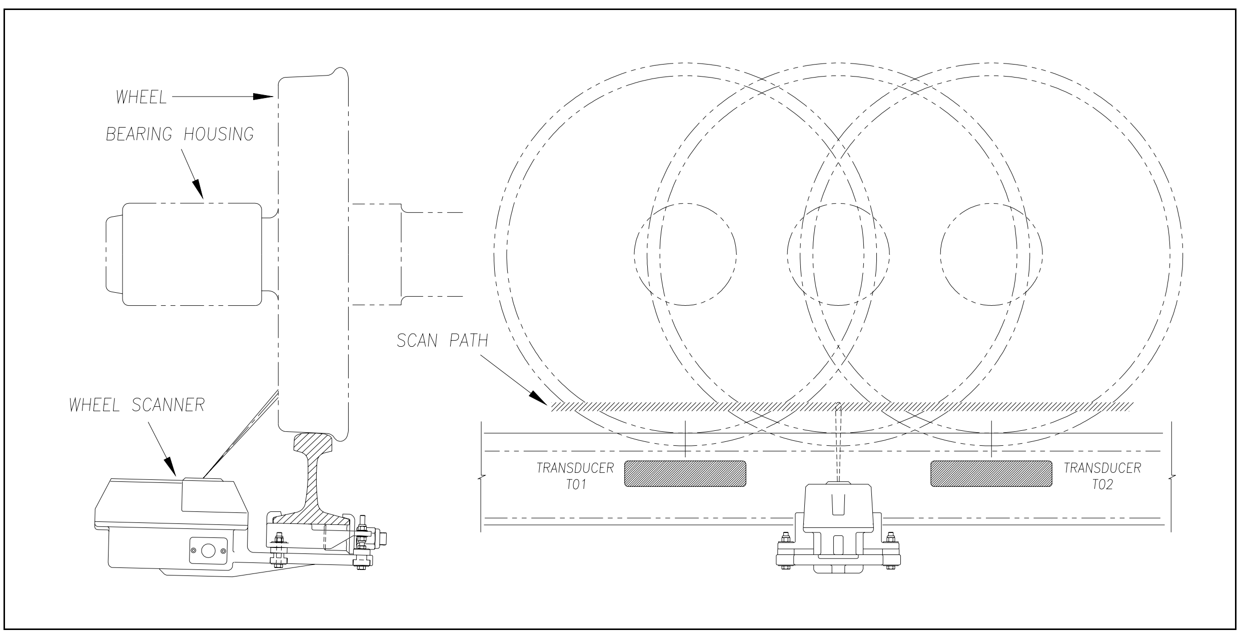
The output of the pyrometers is linear across most of the operating speed range of the system. However, the output of the pyrometers is nonlinear at either end of the operating speed range. To compensate for this nonlinear output, the firmware applies a correction factor to the sampled heat value. The 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 real-time so that detected alarms reflect the heat value after the linearity step has been done.

10.8 Hotwheel Alarms

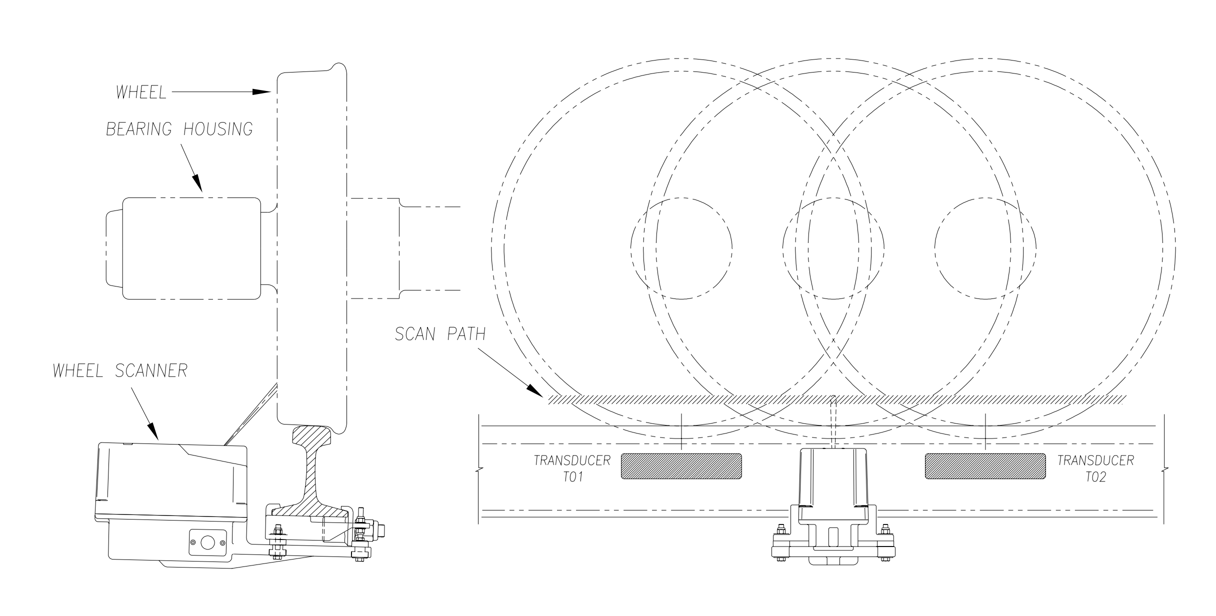
When used, wheel scanners are mounted in the center of the crib of two ties spaced at least 14 inches (35.6 centimeters) apart. Both wheel scanners are mounted in the crib between the two gating transducers. They are mounted directly opposite each other, one on each rail of the track. The hole on the top of the scanner covers faces the center of the track.



The **type2** wheel scanners are aligned to scan about 4 inches (10.2 centimeters) above the rail.



The **type3** wheel scanners are aligned to scan about 4 inches (10.2 centimeters) above the rail.



The SmartScanNG system 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 Settings menu. This alarm limit is an offset, in degrees Fahrenheit, above the ambient temperature. Hotwheel detection is enabled using the **Hotwheel option** on the Equipment menu. When enabled, the SmartScanNG system detects and records every Hotwheel alarm that occurs. However, it only announces a maximum of four per train. For example, if a train contains nine Hotwheel alarms, the Train Detail report will show all nine, but only the first four are announced.

10.9 Auxiliary Alarms

The SmartScanNG system 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 SmartScanNG system 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 SmartScanNG system must sense an open relay contact from the dragging-equipment detector. Dragging-equipment detection is enabled using the **Dragger option** on the Equipment menu. When enabled, the SmartScanNG system detects and records every Dragging-Equipment alarm that occurs on a given train. However, the system only announces the first two.

- **High Load** (oversized loads). To trigger a High-Load alarm, a high-load detector must be properly installed, high-load detection must be enabled, and the SmartScanNG system must sense an open relay contact from the high-load detector. High-load detection is enabled using the **High-Load option** on the Equipment menu.

  When a high-load detector is configured for trip-wire operation, the SmartScanNG system only records one High-Load alarm, regardless of the high-load signal status. This is because you can only break a wire once.

  When a high-load detector is configured for light-beam operation, the SmartScanNG system records every High-Load alarm that occurs. However, the system won't flag High-Load alarms on consecutive axles. At least one unalarmed axle must separate the alarmed axles. Regardless of the number of detected High-Load alarms, it only announces a maximum of two.

  The mode of operation (light beam or trip wire) isn't relevant when the SmartScanNG system finds a Stuck High-Load Detector Pretrain alarm. When this occurs, 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** (shifted loads). 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 SmartScanNG system must sense an open relay contact from either of the wide-load detectors. Wide-load detection is enabled using the **Wide-Load option** on the Equipment menu.

  When a wide-load detector is configured for trip-wire operation, the SmartScanNG system only records one Wide-Load alarm, regardless of the wide-load signal status. This is because you can only break a wire once.

  When a wide-load detector is configured for light-beam operation, the SmartScanNG system records every Wide-Load alarm that occurs. However, the system won't flag Wide-Load alarms on consecutive axles. At least one unalarmed axle must separate the alarmed axles. Regardless of the number of detected Wide-Load alarms, it only announces a maximum of two.

  The mode of operation (light beam or trip wire) isn't relevant when the SmartScanNG system finds a Stuck Wide-Load Detector Pretrain alarm. When this occurs, 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.

<u>Both</u> high-load detectors and wide-load detectors must be <u>either</u> trip-wire detectors or light-beam detectors. The selection of trip wire or light beam is done using the **Clearance Type option** on the Equipment menu.

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 Controller module

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 COM3 on the Interface board (internally) or COM3 on the Controller module (externally)
- Another nonswitched analog telephone line, which is connected to the SmartScanNG's modem

This chapter describes the serial interface for the SmartScanNG system. It covers how to enter or change the system parameters. The next chapter tells how to use the serial interface to produce reports.

Your menus and submenus may not match those shown in this guide. Some of the options shown may not appear on your menus and submenus. For example, Event Log doesn't appear on everybody's Main menu. Also, some options that appear on your menus and submenus may not apply to your system. For example, if you don't have an AEI subsystem attached to your SmartScanNG, the AEI option on the Equipment menu would not be applicable.

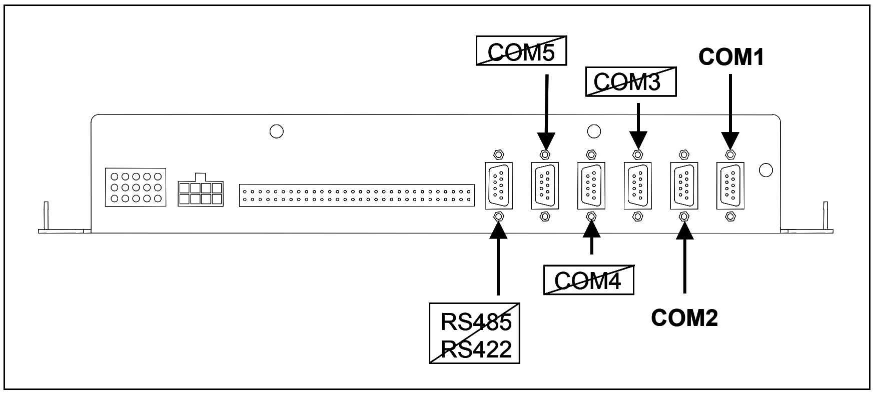
Because the shown menus and submenus may be different from what appears on your system, the letter that is associated with an option may be different from what appears on your system. So, where there is a difference, type the letter of the desired option as it appears on your menus and submenus.

It is necessary to go through a complete setup the first time a SmartScanNG system is installed at a new site. (If this is a double-track site, you need to do this for each SmartScanNG system.) 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 Main Menu

To display the Main menu:

1 If **on-site**, plug your computer into COM1 or COM2 (whichever is available) using a crossover (null-modem) cable.



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 to 19,200.

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]**.

This prompt appears.

```
Enter "SmartSCAN" To Proceed:
```

8 Type **SmartSCAN**

The entry of this word is case sensitive.

9 To get the serial interface to come up, press **[Enter]**.

The Main menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Main Menu
-------------------------------------------------
  A) Train Summary
  B) Train Detail
  C) Exception Summary
  D) Exception Detail
  E) System Status
  F) Last Train
  G) Last Test Train
  H) AEI Diagnostic Detail
  I) Replay EOT Announcement
  J) Setup
  K) Enter Pass-Thru Mode for COM 2
  L) System Functions
  M) Event Log
  X) Exit
```

At the above prompt, you can:

- Produce one of the listed reports by typing one of the letters **A** through **H** or **M**. This is explained in the next chapter. Not all systems have the **Event Log option**.
- Replay an EOT announcement by typing **I**. This is explained below.
- Access the Setup menu by typing **J**. This is explained below. It is from the Setup menu that you can set system parameters.
- Enter pass-through mode by typing **K**. This is explained below. Pass-through mode allows you to access two SmartScanNG systems with one modem.
- Access the System Functions menu by typing **L**. This is explained below.

If a train is at the site when the Main menu is generated, "*** Train Is Present ***" is displayed just above the menu header for the Main menu and for every other menu.

10 When done, close the LOG file.

11 To exit the serial interface <u>and</u> return the system 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.

11.2 Setup Menu

To display the Setup menu:

1 Be sure that the Main menu is displayed.

The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Main Menu
-------------------------------------------------
  A) Train Summary
  B) Train Detail
  C) Exception Summary
  D) Exception Detail
  E) System Status
  F) Last Train
  G) Last Test Train
  H) AEI Diagnostic Detail
  I) Replay EOT Announcement
  J) Setup
  K) Enter Pass-Thru Mode for COM 2
  L) System Functions
  M) Event Log
  X) Exit
```

2 To go to the Setup menu, type **J**

If the Setup menu is password protected, this prompt appears.

```
Enter Setup Password:
```

You are given three chances to type the correct password. When you don't type the correct password in three tries, the system returns to the Main menu.

Each time you incorrectly type the password, this error message appears.

```
Password Incorrect
```

If the password is less than 11 characters long, press **[Enter]** after typing the last character. If the password is the full 11 characters in length, pressing **[Enter]** isn't necessary.

The entry of the password is case sensitive. For example, the password "abc123" cannot be entered "ABC123."

This chapter tells how to create or change the password using the Setup Password submenu on the Setup menu.

If the Setup menu is not password protected, the Setup menu appears. Also, after you type the password correctly for a password protected Setup menu, the Setup menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Setup Menu
-------------------------------------------------
  A) Date and Time
  B) MP/KP
  C) Track Number
  D) Alarm Limits
  E) Equipment
  F) Messages
  G) AEI Reader Parameters
  H) Load Default Setup Parameters
  I) Units of Measure
  J) DCS Parameters
  K) COM1  Tx 19200 / Rx 19200   N-8-1
  L) COM2  Tx 19200 / Rx 19200   N-8-1
  M) COM3  Tx 19200 / Rx 19200   N-8-1
  N) COM4  Tx 19200 / Rx 19200   N-8-1
  O) Setup Password
  X) Exit
```

To access any of the Setup menu options, type the letter that corresponds to the desired menu option.

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 menu, 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.

If a train is at the site when the Setup menu is generated, "*** Train Is Present ***" is displayed just above the menu header for the Setup menu.

3 To return to the Main menu, type **X**

Changes to the system parameters aren't reflected until after you have exited the Setup menu.

11.2.1 Date and Time

To set or change the date, the time, or both:

1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Setup Menu
-------------------------------------------------
  A) Date and Time
  B) MP/KP
  C) Track Number
           .
           .
           .
```

2 To go to the Date and Time submenu, type **A**

A prompt like this appears.

```
Current date is: 11/07/2011
Enter new date:
```

Depending on what was set by the **Date Format option** on the Units of Measure submenu, dates are in either **mm/dd/yyyy** or **dd/mm/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 8 April 2011, type **040811** when in **mm/dd/yyyy** format and **080411** when in **dd/mm/yyyy** format.

If you want to keep the displayed date, press **[Enter]**. If you don't, type a new date.

3 Type a new date <u>or</u> press **[Enter]**.

A prompt like this appears.

```
Current time is: 21:57:34
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, type a new time.

4 Type a new time or press **[Enter]**.

Information like this appears. This is followed by the reappearance of the Setup menu.

```
Time is: 11/07/2011  21:39:00
```

11.2.2 Milepost/Kilometer Post (MP/KP)

To set or change the milepost/kilometer post (MP/KP) setting:

1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Setup Menu
--------------------------------------------------
  A) Date and Time
  B) MP/KP
  C) Track Number
             .
             .
             .
```

2 To go to the MP/KP submenu, type **B**

A prompt like this appears.

```
MP/KP: 1794.5
New MP/KP:
```

MP/KP is in **nnnn.n** format. If the desired MP/KP has less than five digits, type leading zeros. If the desired MP/KP is an integer, type a trailing zero. Thus, for MP/KP 30, type **00300**. The system automatically inserts the decimal point.

3 To keep the displayed MP/KP:

a Press **[Enter]**.

The Setup menu reappears.

b Skip the remaining steps.

4 To change the displayed MP/KP, type the new five-digit MP/KP.

This prompt appears.

```
Is this correct ?
```

At this point, type either **Y** (yes) or **N** (no).

5 If the MP/KP is incorrect:

a Type **N**

This prompt reappears.

```
New MP/KP:
```

b Return to step **4**.

6 If the MP/KP is correct, type **Y**

The Setup menu reappears.

11.2.3 Track Number

To set or change the track number:

1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Setup Menu
-------------------------------------------------
  A) Date and Time
  B) MP/KP
  C) Track Number
  D) Alarm Limits
              .
              .
              .
```

2 To go to the Track Number submenu, type **C**

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 change the displayed track direction:

a Type **N**

The track direction toggles between east/west and north/south.

b If the track direction is incorrect, go 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.

```
1 = NORTH
2 = SOUTH
3 = EAST
4 = WEST
5 = MIDDLE
6 = MAIN1
7 = MAIN2
8 = MAIN3

Enter number:
```

7 To not change the value, press **[Esc]** and skip the next step.

The Setup menu reappears.

8 Type the digit that corresponds to the track designator you want.

If you typed a digit from 1 through 8, the Setup menu reappears.

If you typed something else, the message below appears followed by the above prompt. If this happens, retype the digit that corresponds to the track designator you want.

```
That was not one of the valid choices.
```

11.2.4 Alarm Limits

To set or change one or more of the alarm limits:

1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
               .
               .
               .

  C) Track Number
  D) Alarm Limits
  E) Equipment
               .
               .
               .
```

2 To go to the Alarm Settings menu, type **D**

A menu and prompt like this appears.

```
Alarm Settings, MP/KP-1794.5, Track:Single
-------------------------------------------------
A  Absolute.......... 180
B  Differential...... 130
C  Warm Bearing......  80
D  Blocked Scanner...   9
E  Hot Wheel......... 650
F  Carside Slope..... 1.60
G  Carside Minimum... 155
H  Cold Bearings.....  1
I  Cold Bearing Temp. 10

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 Settings menu and return to the Setup menu:

a Press **[Esc]**.

The Setup menu reappears.

b Skip the remaining steps.

4 To change the displayed **absolute-alarm limit**:

The number after the word Absolute on the Alarm Settings menu is an offset in degrees Fahrenheit above the ambient temperature. When a bearing temperature exceeds this value, the system generates an Absolute alarm.

```
Alarm Settings, MP/KP-1794.5, Track:Single
-------------------------------------------------
A  Absolute.......... 180
B  Differential...... 130
C  Warm Bearing......  80
             .
             .
             .
```

a From the Alarm Settings menu, type **A**

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, type leading zeros to make it three digits long or press **[Enter]** after typing one or two digits.

b To not change the limit, 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 appear.

```
Minimum valid value is 1, Maximum valid value is 300
New Value ?
```

If you type an acceptable value, the **Absolute option** on the Alarm Settings menu changes and the Alarm Settings menu reappears.

f If you get an error message, return to step **b**.

g To leave the Alarm Settings menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

5 To change the displayed **differential-alarm limit**:

The number after the word Differential on the Alarm Settings menu is an offset in degrees Fahrenheit between that bearing temperature that is read by one bearing scanner and the one read by the other bearing scanner. One bearing temperature is compared to the other 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. Checking for Differential alarms stops when the speed of the train drops below 7 mph (11.3 kph).

```
Alarm Settings, MP/KP-1794.5, Track:Single
-------------------------------------------------
A  Absolute.......... 180
B  Differential...... 130
C  Warm Bearing......  80
                .
                .
                .
```

a From the Alarm Settings menu, type **B**

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, type leading zeros to make it three digits long or press **[Enter]** after typing one or two digits.

b To not change the limit, 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 appear.

```
Minimum valid value is 1, Maximum valid value is 300
New Value ?
```

If you type an acceptable value, the **Differential option** on the Alarm Settings menu changes and the Alarm Settings menu reappears.

f If you get an error message, return to step **b**.

g To leave the Alarm Settings menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

6 To change the displayed **warn-bearing-alarm limit**:

The number after the words Warm Bearing on the Alarm Settings menu is an offset in degrees Fahrenheit above ambient temperature. When a bearing temperature exceeds this value, the system generates a Warm Bearing alarm. If the value after the word Warm Bearing on the Alarm Settings menu is greater than the value after the word Absolute on the Alarm Settings menu, you will never get a Warm Bearing alarm.

Bearings found to be warmer than this value (that is, a bearing that is hotter than expected, but not yet hot enough to exceed the Absolute alarm limits or the Differential alarm limits) will be flagged as such on the Train Detail and Exception Detail reports. Where a Data Collection System (DCS) is in place and active, the real-time alarm messaging could flag a warm bearing occurrence. No alarm announcement is generated by the detection of a warm bearing.

```
Alarm Settings, MP/KP-1794.5, Track:Single
-------------------------------------------------
A  Absolute.......... 180
B  Differential...... 130
C  Warm Bearing......  80
D  Blocked Scanner...   9
             .
             .
             .
```

a From the Alarm Settings menu, type **C**

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, type leading zeros to make it three digits long or press **[Enter]** after typing one or two digits.

b To not change the limit, 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 appear.

```
Minimum valid value is 1, Maximum valid value is 300
New Value ?
```

If you type an acceptable value, the **Warm Bearing option** on the Alarm Settings menu changes and the Alarm Settings menu reappears.

f If you get an error message, return to step **b**.

g To leave the Alarm Settings menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

7 To change the displayed **blocked-scanner** limit:

The number after the words Blocked Scanner on the Alarm Settings menu is a value used in determining the proper functioning of the scanners.

When all the **bearings** on a given rail generate a average temperature reading less than or equal to the average temperature set by the **Blocked Scanner option** on the Alarm Settings menu, the system generates a **Blocked Bearing Scanner alarm**. The Blocked Bearing Scanner alarm indicates that a bearing scanner is not functioning properly, which is usually caused by something (like snow) covering the top of the scanner.

When all the **wheels** on a given rail generate a average temperature reading less than or equal to the average temperature set by the **Blocked Scanner option** on the Alarm Settings menu, the system generates a **Blocked Wheel Scanner alarm**. The Blocked Wheel Scanner alarm indicates that a wheel scanner is not functioning properly, which is usually caused by something (like snow) covering the top of the scanner.

```
Alarm Settings, MP/KP-1794.5, Track:Single
-------------------------------------------------
A  Absolute.......... 180
B  Differential...... 130
C  Warm Bearing......  80
D  Blocked Scanner...   9
E  Hot Wheel......... 650
             .
             .
             .
```

a From the Alarm Settings menu, type **D**

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, type leading zeros to make it three digits long or press **[Enter]** after typing one or two digits.

b To not change the limit, press **[Esc]** and return to step **3**.

c Type the new limit.

A prompt like this appears. All typed nondigits are ignored.

```
New Value ? 004
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 3 or a value greater than 9, this error message and prompt appear.

```
Minimum valid value is 3, Maximum valid value is 9
New Value ?
```

If you type an acceptable value, the **Blocked Scanner option** on the Alarm Settings menu changes and the Alarm Settings menu reappears.

f If you get an error message, return to step **b**.

g To leave the Alarm Settings menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

8 To change the displayed **hotwheel-alarm limit**:

The number after the words Hot Wheel on the Alarm Settings menu is an offset in degrees Fahrenheit above the ambient temperature. When a wheel temperature exceeds this value, the system generates a Hotwheel alarm. However, when the **Hotwheel option** on the Equipment menu is disabled, Hotwheel alarms aren't generated.

```
Alarm Settings, MP/KP-1794.5, Track:Single
-------------------------------------------------
A  Absolute.......... 180
B  Differential...... 130
C  Warm Bearing......  80
D  Blocked Scanner...   9
E  Hot Wheel......... 650
F  Carside Slope..... 1.60
                .
                .
                .
```

a From the Alarm Settings menu, type **E**

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, type leading zeros to make it three digits long or press **[Enter]** after typing one or two digits.

b To not change the limit, press **[Esc]** and return to step **3**.

c Type the new limit.

A prompt like this appears. All typed nondigits are ignored.

```
New Value ? 660
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 appear.

```
Minimum valid value is 1, Maximum valid value is 900
New Value ?
```

If you type an acceptable value, the **Hotwheel option** on the Alarm Settings menu changes and the Alarm Settings menu reappears.

f If you get an error message, return to step **b**.

g To leave the Alarm Settings menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

9 To change the displayed **carside slope value**:

The number after the words Carside Slope on the Alarm Settings menu 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 menu. The detection of Carside Slope alarms stops if the speed of the train drops below 7 mph (11.3 kph).

```
              .
              .
              .

E  Hot Wheel......... 650
F  Carside Slope..... 1.60
G  Carside Minimum... 155
              .
              .
              .
```

a From the Alarm Settings menu, type **F**

This prompt appears.

```
New Value ?
```

Slope value is in **n.nn** format. 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**. The system automatically inserts a decimal point between the first and second digits.

b To not change the value, press **[Esc]** and return to step **3**.

c Type the new value.

A prompt like this appears. All typed nondigits are ignored.

```
New Value ? 1.40
Is this correct ?
```

At this point, type either **Y** (yes) or **N** (no).

d If the new value 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 appear.

```
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 Settings menu changes and the Alarm Settings menu reappears.

f If you get an error message, return to step **b**.

g To leave the Alarm Settings menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

10 To change the displayed **carside minimum heat value**:

The number after the words Carside Minimum on the Alarm Settings menu is a minimum offset (in degrees Fahrenheit) used when doing carside-slope calculation/analysis. If the **Carside Slope option** on the Equipment menu is disabled during train passage, no carside-slope calculation/analysis is done and, thus, no Carside Slope alarms are generated. If the **Carside Slope option** on the Equipment menu is disabled when a Train Detail report is requested, no carside-slope calculation is done and, thus, no carside-slope alarm-limit lines are generated. ***Chapter 10 - Defect Detection*** describes the Carside Slope alarm process. The detection of Carside Slope alarms stops if the speed of the train drops below 7 mph (11.3 kph).

```
             .
             .
             .

F  Carside Slope..... 1.60
G  Carside Minimum... 155
H  Cold Bearings.....  1
I  Cold Bearing Temp. 10

Alarm to change or Esc to quit?
```

a From the Alarm Settings menu, type **G**

This prompt appears.

```
New Value ?
```

If the new value has less than three digits, type leading zeros to make it three digits long or 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.

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 value 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 300, this error message and prompt appear.

```
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 Settings menu changes and the Alarm Settings menu reappears.

f If you get an error message, return to step **b**.

g To leave the Alarm Settings menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

11 To change the displayed **number of allowed consecutive cold bearings**:

The number after the words Cold Bearings on the Alarm Settings menu is the maximum number (per railside) of consecutive trains having:

- Cold Bearing Scanner alarms (on some systems, called the Cold Rail alarms) needed to generate a Successive Cold Rails Exceeded alarm.
- Cold Bearing Scanner Resistor alarms (on some systems, called the Cold Resistor alarms) needed to generate a Successive Cold Resistors Exceeded alarm.
- Cold Wheel Scanner alarms needed to generate a Successive Cold Wheels Exceeded alarm.
- Cold Wheel Scanner Resistor alarms needed to generate a Successive Cold Wheel Resistors Exceeded alarm.

```
             .
             .
             .

G  Carside Minimum... 155
H  Cold Bearings.....  1
I  Cold Bearing Temp. 10

Alarm to change or Esc to quit?
```

a From the Alarm Settings menu, type **H**

This prompt appears.

```
New Value ?
```

If the new value has less than three digits, type leading zeros to make it three digits long or 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.

A prompt like this appears. All typed nondigits are ignored.

```
New Value ? 006
Is this correct ?
```

At this point, type either **Y** (yes) or **N** (no).

d If the new value 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 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 Bearings option** on the Alarm Settings menu changes and the Alarm Settings menu reappears.

f If you get an error message, return to step **b**.

g To leave the Alarm Settings menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

12 To change the displayed **cold bearing temperature**:

The number after the words Cold Bearing Temp on the Alarm Settings menu is an offset, in degrees Fahrenheit, above the ambient temperature. When no bearing on a given rail generates a delta temperature reading greater than or equal to this value, the system generates a Cold Bearing Scanner alarm (on some systems, called the Cold Rail alarm) for the given rail. There is a different Cold Bearing Scanner alarm for each rail. That is, there is a Cold North Bearing alarm and a Cold South Bearing alarm (or, depending on track direction, a Cold East Bearing alarm and a Cold West Bearing alarm).

```
             .
             .
             .
H  Cold Bearings.....  1
I  Cold Bearing Temp. 10

Alarm to change or Esc to quit?
```

a From the Alarm Settings menu, type **I**

This prompt appears.

```
New Value ?
```

If the new value has less than three digits, type leading zeros to make it three digits long or 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.

A prompt like this appears. All typed nondigits are ignored.

```
New Value ? 015
Is this correct ?
```

At this point, type either **Y** (yes) or **N** (no).

d If the new value is incorrect, type **N** and return to step **b**.

e If the new value is correct, type **Y**

If you type a number less than 10 or greater than 30, this error message and prompt appears.

```
Minimum valid value is 10, Maximum valid value is 30
New Value ?
```

If you type an acceptable value, the **Cold Bearing Temperature option** on the Alarm Settings menu changes and the Alarm Settings menu reappears.

f If you get an error message, return to step **b**.

g To leave the Alarm Settings menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

11.2.5 Equipment

To set or change one or more of the equipment parameters:

1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
                  .
                  .
                  .
     D) Alarm Limits
     E) Equipment
     F) Messages
                  .
                  .
                  .
```

2 To go to the Equipment menu, type **E**

A menu and prompt like this appears.

```
Equipment, MP/KP-1794.5, Track:Single
--------------------------------------------------------
A  Dragger............. YES
B  High Load........... NO
C  Wide Load........... NO
D  Carside Slope....... YES
E  Hot Wheel........... NO
F  Clearance Type...... Trip Wire
G  Clearance Mode...... Multiplexed
H  Winter Cycle........ YES
I  Transducer Gain..... Normal
J  AEI................. NO
K  Gate Distance....... 24.0 inches
L  Selected Modem...... Default
     Modem Setup Line 1 = +++
     Modem Setup Line 2 = AT&F
     Modem Setup Line 3 = AT&D0&E1&E15S0=1V0&Q1
     Modem Setup Line 4 = AT E0 X4 &Q1 $SB19200
     Modem Setup Line 5 = AT &W0
M  Solar Powered....... NO
N  Resistor Test....... Enabled
O  Car Breakout........ Intermodal

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 inactive (NO). To change one of the settings, press the letter corresponding to the desired option. Except for the **Gate Distance option**, which requires a value entry, all the options toggle between two or three settings. If you choose Alternate for the Selected Modem type, you can change any of the five available lines of modem setup commands.

3 To <u>leave</u> the Equipment menu <u>and</u> return to the Setup menu:

a Press **[Esc]**.

The Setup menu reappears.

b Skip the remaining steps.

4 To <u>change</u> the current **dragger** (aka dragging-equipment detector) setting:

The Equipment menu shows whether Dragging-Equipment alarm detection is enabled (YES) or disabled (NO). When disabled, Dragging-Equipment alarms won't be announced nor stored. Since they aren't stored, they can't be printed. When enabled, Dragging-Equipment alarms are announced and stored. Since they are stored, they can be printed. In the presence of a continuous Dragger signal, the system alarms consecutive axles. When the system reaches the fifth consecutive Dragger alarmed axle, it flags the Stuck Dragger condition.

```
Equipment, MP/KP-1794.5, Track:Single
--------------------------------------------------------
A  Dragger............. YES
B  High Load........... NO
C  Wide Load........... NO
                     .
                     .
                     .
```

a From the Equipment menu, type **A**

The dragging-equipment setting toggles between active (YES) and inactive (NO). The **Dragger option** on the Equipment menu changes. The Equipment menu reappears.

If you want Dragging-Equipment alarm detection to occur, YES must appear after the word Dragger on the Equipment menu.

b To <u>leave</u> the Equipment menu <u>and</u> return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

5 To <u>change</u> the current **high-load** setting:

The Equipment menu shows whether High-Load alarm detection is active (YES) or inactive (NO). **To designate High-Load alarms**, YES must appear after the words High Load on the Equipment menu <u>and</u> Separate must appear after the words Clearance Mode on the Equipment menu. **To designate High-Wide alarms**, YES must appear after the words High Load on the Equipment menu <u>and</u> Multiplexed must appear after the words Clearance Mode on the on the Equipment menu.

```
Equipment, MP/KP-1794.5, Track:Single
--------------------------------------------------------
A  Dragger............. YES
B  High Load........... NO
C  Wide Load........... NO
                  .
                  .
                  .
```

a From the Equipment menu, type **B**

The high-load setting toggles between active (YES) and inactive (NO). The **High-Load option** on the Equipment menu changes. The Equipment menu reappears.

If you want High-Load alarm detection to occur, be sure that YES appears after the word High-Load on the Equipment menu.

b To <u>leave</u> the Equipment menu <u>and</u> return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

6 To <u>change</u> the current **wide-load** setting:

The Equipment menu shows whether Wide-Load alarm detection is active (YES) or inactive (NO).

```
Equipment, MP/KP-1794.5, Track:Single
--------------------------------------------------------
A  Dragger............. YES
B  High Load........... NO
C  Wide Load........... NO
D  Carside Slope....... YES
                  .
                  .
                  .
```

a From the Equipment menu, type **C**

The wide-load setting toggles between active (YES) and inactive (NO). The **Wide-Load option** on the Equipment menu changes. The Equipment menu reappears.

If you want Wide-Load alarm detection to occur, be sure that YES appears after the word Wide-Load on the Equipment menu.

b To leave the Equipment menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

7 To change the current **carside-slope** setting:

The Equipment menu shows whether Carside Slope alarm detection is enabled (YES) or disabled (NO). If disabled (NO) during train passage, no carside-slope calculation/analysis is done and, thus, no Carside Slope alarms are generated. If disabled (NO) when a Train Detail report is requested, no carside-slope calculation is done and, thus, no carside-slope alarm-limit lines are generated.

```
Equipment, MP/KP-1794.5, Track:Single
--------------------------------------------------------
A  Dragger............. YES
B  High Load........... NO
C  Wide Load........... NO
D  Carside Slope....... YES
E  Hot Wheel........... NO
                  .
                  .
                  .
```

a From the Equipment menu, type **D**

The carside-slope setting toggles between active (YES) and inactive (NO). The **Carside Slope option** on the Equipment menu changes. The Equipment menu reappears.

b To leave the Equipment menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

8 To <u>change</u> the current **hotwheel** setting:

The Equipment menu shows whether Hotwheel alarm detection is enabled (YES) or disabled (NO). When disabled, Hotwheel alarms won't be announced nor stored. Since they aren't stored, they can't be printed. When enabled, Hotwheel alarms are announced and stored. Since they are stored, they can be printed.

```
              .
              .
              .

D  Carside Slope....... YES
E  Hot Wheel........... NO
F  Clearance Type...... Trip Wire
              .
              .
              .
```

a From the Equipment menu, type **E**

The hotwheel setting toggles between active (YES) and inactive (NO). The **Hotwheel option** on the Equipment menu changes. The Equipment menu reappears.

b To <u>leave</u> the Equipment menu <u>and</u> return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

9 To <u>change</u> the current **clearance-type** setting:

The Equipment menu shows whether clearance type is trip wire or light beam. This option is only used for high-load detectors and wide-load detectors. <u>Both</u> high-load detectors and wide-load detectors must be <u>either</u> trip-wire detectors or light-beam detectors.

```
              .
              .
              .

E  Hot Wheel........... NO
F  Clearance Type...... Trip Wire
G  Clearance Mode...... Multiplexed
              .
              .
              .
```

a From the Equipment menu, type **F**

The clearance-type setting toggles between **trip wire** and **light beam**. The **Clearance Type option** on the Equipment menu changes. The Equipment menu reappears.

b To <u>leave</u> the Equipment menu <u>and</u> return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

10 To <u>change</u> the current **clearance-mode** setting:

The Equipment menu shows whether clearance mode is separate or multiplexed. This option is only used for high-load detectors and wide-load detectors. When set to <u>separate</u>, the alarms coming from the high-load detectors are announced as High-Load alarms <u>and</u> the alarms coming from the wide-load detectors are announced as Wide-Load alarms. When set to <u>multiplexed</u>, the alarms coming from the high-load detectors <u>and</u> wide-load detectors are announced as High-Wide alarms.

```
              .
              .
              .
F  Clearance Type...... Trip Wire
G  Clearance Mode...... Multiplexed
H  Winter Cycle........ YES
              .
              .
              .
```

a From the Equipment menu, type **G**

The clearance-mode setting toggles between **separate** and **multiplexed**. The **Clearance Mode option** on the Equipment menu changes. The Equipment menu reappears.

b To <u>leave</u> the Equipment menu <u>and</u> return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

11 To <u>change</u> the current **winter-cycle** setting:

The Equipment menu shows whether the winter-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. The heaters are made active, for varying periods of time, depending on an ambient temperature of 80°F (26.7°C) or less.

The table below lists the heater activation times for both normal and winter-cycle operation, grouped by ambient temperature.

Temperature Range in degrees Fahrenheit		Out of every ten seconds, the number of seconds the scanner heaters are active	
Low	**High**	**Winter Cycle Disabled**	**Winter Cycle Enabled**
--	16	4	8
17	35	3	7
36	51	2	2
52	80	1	1
80	--	Off	Off

The normal heater activation times aren't suitable for extremely cold climates, so the winter-cycle feature compensates for this. When this feature is disabled, the heater controls function normally. When enabled, the system increases the normal running time for the scanner heaters. The winter-cycle feature doesn't affect all the temperature ranges that the scanner heaters will activate on. It affects just the ones that are considered extremely cold.

```
              .
              .
              .

  G  Clearance Mode...... Multiplexed
  H  Winter Cycle........ YES
  I  Transducer Gain..... Normal
              .
              .
              .
```

a From the Equipment menu, type **H**

The winter-cycle setting toggles between enabled (YES) and disabled (NO). The **Winter Cycle option** on the Equipment menu changes. The Equipment menu reappears.

b To leave the Equipment menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

12 To change the current **transducer-gain** setting:

The Equipment menu shows whether the transducer-gain setting is normal or high. Regardless of the setting, the SmartScanNG system starts every train with the transducer input comparator set to high mode. Then, if the train is traveling 20 mph (32 kph) or more and if the transducer gain was set to normal mode, the transducer input comparator switches to normal mode. This means that it is rarely necessary to set this option to high.

When the comparator is in high mode, the comparator converts lower voltage pulses from the transducer into output pulses. This causes the system to be more sensitive to transducer output. When the comparator is in normal mode, the comparator has a better chance of filtering transducer pulses not caused by a wheel.

```
              .
              .
              .

   H  Winter Cycle........ YES
   I  Transducer Gain..... Normal
   J  AEI................. YES
              .
              .
              .
```

a From the Equipment menu, type **I**

The status of the transducer-gain setting toggles from **normal** to **high** or from high to normal, depending upon the current status of the option. The **Transducer Gain option** on the Equipment menu changes. The Equipment menu reappears.

b To leave the Equipment menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

13 To change the current **AEI** setting:

The Equipment menu shows whether the AEI subsystem is enabled (YES) or disabled (NO). When tag readers and attendant antennas and cabling are present, this parameter should be set to YES, so that the system knows to configure the readers and to use the AEI data transmitted from them. When there is no installed AEI subsystem attached to the SmartScanNG system, this parameter should be set to NO.

```
              .
              .
              .

   I  Transducer Gain..... Normal
   J  AEI................. YES
   K  Gate Distance....... 24.0 inches

              .
              .
              .
```

a From the Equipment menu, type **J**

The status of the AEI setting toggles from YES (active) to NO (inactive) or from NO to YES, depending upon the current status of the option. The **AEI option** on the Equipment menu changes. The Equipment menu reappears.

b To leave the Equipment menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

14 To change the current value for **gate distance** (aka gate width):

The Equipment menu shows the number of inches between the centers of the gating transducers.

```
                  .
                  .
                  .
J  AEI................. YES
K  Gate Distance....... 24.0 inches
L  Selected Modem...... Default
     Modem Setup Line 1 = +++
     Modem Setup Line 2 = AT&F
     Modem Setup Line 3 = AT&D0&E1&E15S0=1V0&Q1
     Modem Setup Line 4 = AT E0 X4 &Q1 $SB19200
     Modem Setup Line 5 = AT &W0
M  Solar Powered....... NO
N  Resistor Test....... Enabled
O  Car Breakout........ Intermodal

Equipment to change or Esc to quit ?
```

a From the Equipment menu, type **K**

This prompt appears.

```
Gate Distance:
```

The gate distance (aka gate width) is in **nn.n** format. 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 distance (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. All typed nondigits are ignored.

b To not change the value that appears on the Equipment menu, press **[Esc]** and return to step **3**.

c Type the new three-digit number.

The **Gate Distance option** on the Equipment menu changes. The Equipment menu reappears.

d To leave the Equipment menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

15 To change the **modem-configuration** setting:

The Equipment menu shows the current modem configuration. Support exists in the firmware for two modem types. Default provides a preset series of modem configuration commands. These commands cannot be altered. Alternate provides the ability to edit and customize the modem setup commands. This submenu also provides a method for forcing the initialization of the modem.

```
                 .
                 .
                 .
K  Gate Distance....... 24.0 inches
L  Selected Modem...... Default
     Modem Setup Line 1 = +++
     Modem Setup Line 2 = AT&F
     Modem Setup Line 3 = AT&D0&E1&E15S0=1V0&Q1
     Modem Setup Line 4 = AT E0 X4 &Q1 $SB19200
     Modem Setup Line 5 = AT &W0
M  Solar Powered....... NO
N  Resistor Test....... Enabled
O  Car Breakout........ Intermodal

Equipment to change or Esc to quit ?
```

a From the Equipment menu, type **L**

A prompt like this

```
The Default modem is selected, is this OK (Y/N)?
```

or like this appears.

```
The Alternate modem is selected, is this OK (Y/N)?
```

b If the selected modem type is incorrect, type **N**

The modem-configuration setting toggles between **default** and **alternate**. The **Modem Type option** on the Equipment menu changes.

c If the selected modem type is correct, type **Y**

If you select Default, the system reverts to the default modem configuration.

d If the selected modem type is Default, go to step **h**.

e If the selected modem type is Alternate, this prompt appears.

```
Are the setup commands OK (Y/N)?
```

f 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 Equipment menu <u>and</u> on the System Status report, lines that have been cleared of data this way are left blank.

This screen fragment shows an example of changing the default baud rates, in the third line of setup data, from 9600 to 1200, and then erasing the fifth line of setup data. Pressing **[Enter]** to clear the fifth line is shown by **[Enter]** in the example.

```
Enter line number to change (1-5):3
Enter new setup commands (25 characters max):AT E0 X0 $SB1200 $MB1200
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)?
```

g If you don't need to correct any of the five displayed lines of modem setup commands, type **Y**

If you plugged your computer into a serial port other than COM3 (the modem port), this prompt appears.

```
Do you want to initialize the modem now (Y/N)?
```

If you plugged into COM3 or have an **off-site** connection, this message appears.

```
The modem will initialize upon exiting the Main Menu.
```

h If you plugged into COM3 or have an **off-site** connection, return to step **3**.

i 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 outputted to the modem. Empty setup command lines aren't outputted to the modem. After the modem is initialized, the Equipment menu reappears.

j If you don't want to initialize the modem now, type **N**

The Equipment menu reappears.

k To <u>leave</u> the Equipment menu <u>and</u> return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

16 To <u>change</u> the current **solar-powered** setting:

The Equipment menu shows whether the solar-powered feature is enabled (YES) or disabled (NO). If this SmartScanNG is powered by solar, this feature should be enabled. If this SmartScanNG isn't powered by solar, this feature should be disabled.

```
                    .
                    .
                    .
L  Selected Modem...... Default
     Modem Setup Line 1 = +++
     Modem Setup Line 2 = AT&F
     Modem Setup Line 3 = AT&D0&E1&E15S0=1V0&Q1
     Modem Setup Line 4 = AT E0 X4 &Q1 $SB19200
     Modem Setup Line 5 = AT &W0
M  Solar Powered....... NO
N  Resistor Test....... Enabled
O  Car Breakout........ Intermodal

Equipment to change or Esc to quit ?
```

a From the Equipment menu, type **M**

The solar-powered setting toggles between enabled (YES) and disabled (NO). The **Solar Powered option** on the Equipment menu changes.

The Equipment menu reappears.

b To <u>leave</u> the Equipment menu <u>and</u> return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

17 To change the current **resistor-test** setting:

The Equipment menu shows whether the resistor-test setting is enabled, reduced, or enabled.

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 a combination of the amount of time the shutters were open and the system battery voltage.

A site can be setup 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.

The minimum required resistor temperatures for a given train are determined by the train's duration at the site and the resistor temperature baseline profile. This profile is established 20 minutes after the user calibrates the scanners with the autocalibration function. Twenty minutes is the cooling period required to allow the resistors to return to ambient temperature after autocalibration.

Typing the letter **N** toggles from one resistor test mode to another.

```
                  .
                  .
                  .

M  Solar Powered....... NO
N  Resistor Test....... Enabled
O  Car Breakout........ Intermodal

Equipment to change or Esc to quit ?
```

a From the Equipment menu, type **N**

The resistor-test setting toggles from enabled to reduced, from reduced to disabled, or from disabled to enabled. The **Resistor Test Mode option** on the Equipment menu changes. The Equipment menu reappears.

b If the resistor-test mode isn't correct, return to step **a.**

c To leave the Equipment menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

18 To change the current **car-breakout** setting:

The Equipment menu shows whether the car-breakout setting is default or intermodal. This setting is used to specify the SmartScanNG system's approach to breaking axle patterns out into cars. Where multi-platform vehicles (such as those used in North American freight consists) are common, intermodal is appropriate. For all other traffic (that is, for captured fleets, ore car operations, and the like), default is appropriate.

```
                    .
                    .
                    .

M  Solar Powered....... NO
N  Resistor Test....... Enabled
O  Car Breakout........ Intermodal

Equipment to change or Esc to quit ?
```

a From the Equipment menu, type **O**

The status of the **car-breakout** setting toggles from **default** to **intermodal** or from intermodal to default, depending upon the current status of the option. The **Car Breakout option** on the Equipment menu changes. The Equipment menu reappears.

b To leave the Equipment menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

11.2.6 Messages

To set or change any of the message parameters:

1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
                    .
                    .
                    .

E) Equipment
F) Messages
G) AEI Reader Parameters
                    .
                    .
                    .
```

2 To go to the Messages menu, type **F**

A menu and prompt like this appears. The options on the Messages menu are used to affect the phrases broadcast to a passing train or are used to modify the parameters associated with the rebroadcast function. Not all systems have the last two options on the menu below.

```
Messages, MP/KP-1234.5, Track:Single
------------------------------------------------------------
  A  Axles...................  YES
  B  Speed...................  NO
  C  Temperature.............  YES
  D  Length..................  NO
  E  Slow....................  YES
  F  Power Off...............  YES
  G  Repeat No Defects........  YES
  H  Cars....................  NO
  I  Primary Language.........  English
  J  Secondary Language.......  NONE
  K  Request EOT Timer........  10
  L  Rebroad DTMF Code........  001
  M  Car ID With Alarm........  NO
  N  Customer Name............  YES
  O  Arrival Message..........  YES

Message to change or Esc to quit ?
```

Enabling one or more of these options generates the ancillary messages: A (axle count), B (train speed), C (site ambient temperature), D (train length), E (slow train), F (power off), and H (number of cars). The other options of the Messages menu aren't used to generate ancillary messages.

3 To leave the Messages menu and return to the Setup menu:

a Press **[Esc]**.

The Setup menu reappears.

b Skip the remaining steps.

4 To change the **announce-axles** setting:

The **Announce Axles option** on the Messages menu shows whether the total axle count is to be part of (YES) or not part of (NO) post-train announcements. When the Highrange Transducer Miscounts alarm or the Very Slow Train alarm occurs, the system won't announce axle count, even even when this option is enabled. Typing **A** toggles between what is shown and its opposite.

```
Messages, MP/KP-1234.5, Track:Single
------------------------------------------------------------
  A  Axles....................  YES
  B  Speed....................  NO
  C  Temperature..............  YES
                 .
                 .
                 .
```

a From the Messages menu, type **A**

The announce-axles setting toggles between announce (YES) or not announce (NO). The **Announce Axles option** on the Messages menu changes. The Messages menu reappears.

b To leave the Messages menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

5 To change the **announce-speed** setting:

The **Announce Speed option** on the Messages menu shows whether the exit speed of the train is to be part of (YES) or not part of (NO) post-train announcements. Typing **B** toggles between what is shown and its opposite.

Furthermore, if you selected mph with the **Speed Format option** on the Units of Measure submenu and the **Announce Speed option** on the Messages menu is enabled, the speed of the train will be announced in miles per hour. If you selected kph with the **Speed Format option** and the **Announce Speed option** is enabled, the speed of the train will be announced in kilometers per hour.

```
Messages, MP/KP-1234.5, Track:Single
------------------------------------------------------------
  A  Axles....................  YES
  B  Speed....................  NO
  C  Temperature..............  YES
                 .
                 .
                 .
```

a From the Messages menu, type **B**

The announce-speed setting toggles between announce (YES) or not announce (NO). The **Announce Speed option** on the Messages menu changes. The Messages menu reappears.

b To leave the Messages menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

6 To change the **announce-temperature** setting:

The **Announce Temperature option** on the Messages menu shows whether the ambient temperature (taken at the site by the shielded temperature probe as the train leaves the site) is to be part of (YES) or not part of (NO) post-train announcements. Typing **C** toggles between what is shown and its opposite.

Furthermore, if you selected Celsius with the **Temperature Format option** on the Units of Measure submenu and the **Announce Temperature option** on the Messages menu is enabled, the ambient temperature will be announced in Celsius. If you selected Fahrenheit with the **Temperature Format option** and the **Announce Temperature option** is enabled, the ambient temperature will be announced in Fahrenheit.

```
Messages, MP/KP-1234.5, Track:Single
------------------------------------------------------------
  A  Axles...................  YES
  B  Speed...................  NO
  C  Temperature.............  YES
  D  Length..................  NO
                    .
                    .
                    .
```

a From the Messages menu, type **C**

The announce-temperature setting toggles between announce (YES) or not announce (NO). The **Announce Temperature option** on the Messages menu changes. The Messages menu reappears.

b To leave the Messages menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

7 To change the **announce-train-length** setting:

The **Announce Train Length option** on the Messages menu shows whether the train length is to be part of (NO) post-train announcements. When the Highrange Transducer Miscounts alarm or the Very Slow Train alarm occurs, the system won't announce length of train, even when this option is enabled. Typing **D** toggles between what is shown and its opposite.

```
                  .
                  .
                  .
   C  Temperature.............  YES
   D  Length..................  NO
   E  Slow....................  YES
                  .
                  .
                  .
```

a From the Messages menu, type **D**

The announce-train-length setting toggles between announce (YES) or not announce (NO). The **Announce Train Length option** on the Messages menu changes. The Messages menu reappears.

b To leave the Messages menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

8 To change the **announce-slow-trains** setting:

The **Announce Slow Train option** on the Messages menu shows whether a message indicating a slow train (one going 7 mph (11.3 kph) or slower) is to be part of (YES) or not part of (NO) post-train announcements. Typing **E** toggles between what is shown and its opposite.

```
                  .
                  .
                  .
   D  Length..................  NO
   E  Slow....................  YES
   F  Power Off...............  YES
                  .
                  .
                  .
```

a From the Messages menu, type **E**

The announce-slow-trains setting toggles between announce (YES) or not announce (NO). The **Announce Slow Train option** on the Messages menu changes. The Messages menu reappears.

b To leave the Messages menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

9 To change the **announce-power-off** setting:

The **Announce Power Off option** on the Messages menu shows whether the power-off message is to be part of (YES) or not part of (NO) post-train announcements. The generation of this message depends on battery voltage, not AC power. It is generated whenever the voltage coming from the battery is less than 12.6 VDC (on a solar-powered system its 11.5 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. Typing **F** toggles between what is shown and its opposite.

```
                .
                .
                .

E  Slow....................  YES
F  Power Off...............  YES
G  Repeat No Defects........  YES
                .
                .
                .
```

a From the Messages menu, type **F**

The announce-power-off setting toggles between announce (YES) and not announce (NO). The **Announce Power Off option** on the Messages menu changes. The Messages menu reappears.

b To leave the Messages menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

10 To change the **repeat-no-defect-message** setting:

The **Repeat No Defects option** on the Messages menu shows whether the no-defect message is to be repeated (YES) or not repeated (NO). Typing **G** toggles between what is shown and its opposite.

```
                 .
                 .
                 .
    F  Power Off................  YES
    G  Repeat No Defects........  YES
    H  Cars.....................  NO
                 .
                 .
                 .
```

a From the Messages menu, type **G**

The repeat-no-defect-message setting toggles between enabled (YES) and disabled (NO). The **Repeat No Defects option** on the Messages menu changes. The Messages menu reappears.

b To leave the Messages menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

11 To change the **announce-number-of-cars** setting:

The **Announce Number of Cars option** on the Messages menu shows whether the number of cars is to be part of (YES) or not part of (NO) post-train announcements. Typing **H** toggles between what is shown and its opposite.

```
                 .
                 .
                 .
    G  Repeat No Defects........  YES
    H  Cars.....................  NO
    I  Primary Language.........  English
                 .
                 .
                 .
```

a From the Messages menu, type **H**

The announce-number-of-cars setting toggles between announce (YES) and not announce (NO). The **Announce Number of Cars option** on the Messages menu changes. The Messages menu reappears.

b To leave the Messages menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

12 To change the **primary-language** setting:

The **Primary Language option** on the Messages menu shows whether the **primary-language** (that is, the one that will be spoken first) setting is English, Spanish, or French. For some systems, no matter what you select will result in English being spoken. In other words, all announcements will be in English.

```
                   .
                   .
                   .

H  Cars....................  NO
I  Primary Language.........  English
J  Secondary Language.......  NONE
                   .
                   .
                   .
```

a From the Messages menu, type **I**

This prompt appears.

```
1 = English
2 = Spanish
3 = French
Enter number:
```

b Type the digit that corresponds to the language you want to be spoken first or press **[Esc]**.

If you typed a digit from 1 through 3 or pressed **[Esc]**, the Messages menu reappears. If you selected a different language then the one that was previously displayed, the **Primary Language option** on the Messages menu changes to the one you just selected.

If you pressed something other than **[1]**, **[2]**, **[3]**, or **[Esc]**, the message below appears followed by the above prompt. If this happens, retype the digit that corresponds to the language you want.

```
That was not one of the valid choices.
```

c To leave the Messages menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

13 To change the **secondary-language** setting:

The **Secondary Language option** on the Messages menu shows whether the **secondary-language** (that is, the one that will be spoken second) setting is English, Spanish, or French. For some systems, no matter what you select will result in English being spoken. In other words, all announcements will be in English.

```
                 .
                 .
                 .

    I  Primary Language.........  English
    J  Secondary Language.......  NONE
    K  Request EOT Timer........  10
                 .
                 .
                 .
```

a From the Messages menu, type **J**

This prompt appears.

```
1 = English
2 = Spanish
3 = French
Enter number:
```

b Type the digit that corresponds to the language you want to be spoken second or press **[Esc]**.

If you typed a digit from 1 through 3 or pressed **[Esc]**, the Messages menu reappears. If you selected a different language then the one that was previously displayed, the **Secondary Language option** on the Messages menu changes to the one you just selected.

If you pressed something other than **[1]**, **[2]**, **[3]**, or **[Esc]**, the message below appears followed by the above prompt. If this happens, retype the digit that corresponds to the language you want.

```
That was not one of the valid choices.
```

c To leave the Messages menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

14 To change the **repeat-EOT-message-timeout-period** setting:

The **Repeat Timeout Period option** on the Messages menu shows a value for the repeat-timeout-period setting. If a nonzero value is shown, the value is the number of minutes that you have to request a repeat of the last end-of-train (EOT) message. If zero is shown, the last EOT message is always available for rebroadcast. The train crew makes the actual request for rebroadcast. The repeated message has the word "rebroadcast" at the beginning and ending of the message.

```
                 .
                 .
                 .
J  Secondary Language.......  NONE
K  Request EOT Timer........  10
L  Rebroad DTMF Code........  001
                 .
                 .
                 .
```

a From the Messages menu, type **K**

This prompt appears.

```
Request EOT Timer:
```

If the new limit has less than three digits, type leading zeros.

b Type the three-digit value.

If you type 000, the last EOT message is always available for rebroadcast. If you type 240, the train crew has four hours (that is, 240 minutes) to request a repeat of the last EOT message.

If you type a value greater than 240, this error message and prompt appear.

```
Value must be less than 241 minutes.
Request EOT Timer:
```

If you type an acceptable value, the **Repeat Timeout Period option** on the Messages menu changes and the Messages menu reappears.

c If you get an error message, return to step **b**.

d If you don't get an error message, press **[Esc]**.

The Setup menu reappears.

15 To <u>change</u> the **rebroadcast-DTMF-code** setting:

The **Rebroadcast DTMF Code option** on the Messages menu shows the rebroadcast-DTMF-code setting. The stored DTMF code is the touchtone digits that trigger a rebroadcast. Up to three digits may be typed into this setup parameter. The SmartScanNG system monitors radio traffic. When it receives the proper DTMF code, it rebroadcasts the last end-of-train message, provided the request EOT timer hasn't expired.

```
                .
                .
                .
K  Request EOT Timer........  10
L  Rebroad DTMF Code........  001
M  Car ID With Alarm........  NO
                .
                .
                .
```

a From the Messages menu, type **L**

This prompt appears.

```
Rebroadcast DTMF Code:
```

b Type the new DTMF code <u>or</u> press **[Esc]**.

c If you typed one or two digits, press **[Enter]**.

The **Rebroadcast DTMF Code option** on the Messages menu changes <u>and</u> the Messages menu reappears. If you typed only nondigits <u>and</u> then pressed **[Enter]**, the rebroadcast function would be turned off (that is, disabled). Blanks after the words "Rebroad DTMF Code" mean that it is disabled.

d To <u>leave</u> the Messages menu <u>and</u> return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

16 To change the **announce-car-identification** setting:

The **Announce Car Identification option** on the Messages menu shows whether the car-identification message is to be announced (YES) or not announced (NO). When this option is set to YES and an Exception Alarm is found on a car, the car-identification information is included in the post-train announcement for the train having the Exception Alarm. This, of course, will only happen if the **AEI option** on the Equipment menu is enabled (YES) and the AEI subsystem is functioning properly during train passage. Typing **M** toggles between what is shown and its opposite.

```
                    .
                    .
                    .

  L  Rebroad DTMF Code........  001
  M  Car ID With Alarm........  NO
  N  Customer Name............  YES
                    .
                    .
                    .
```

a From the Messages menu, type **M**

The announce-car-identification setting toggles between announce (YES) and not announce (NO). The **Announce Car Identification option** on the Messages menu changes. The Messages menu reappears.

b To leave the Messages menu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

17 To change the **announce-customer-name** setting:

The **Announce Customer Name option** on the Messages menu shows whether the customer's railroad name is to be part of (YES) or not part of (NO) post-train announcements. Typing **N** toggles between what is shown and its opposite. Not all systems have this option.

```
                    .
                    .
                    .

  M  Car ID With Alarm........  NO
  N  Customer Name............  YES
  O  Arrival Message..........  YES

Message to change or Esc to quit ?
```

a From the Messages menu, type **N**

The announce-customer-name setting toggles between announce (YES) and not announce (NO). The **Announce Customer Name option** on the Messages menu changes. The Messages menu reappears.

b To <u>leave</u> the Messages menu <u>and</u> return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

18 To <u>change</u> the **announce-arrival-message** setting:

The **Announce Arrival Message option** on the Messages menu shows whether the train-arrival message is to be announced (YES) or not announced (NO). Typing **O** toggles between what is shown and its opposite. Not all systems have this option.

```
                 .
                 .
                 .

    N  Customer Name............  YES
    O  Arrival Message..........  YES

  Message to change or Esc to quit ?
```

a From the Messages menu, type **O**

The announce-arrival-message setting toggles between announce (YES) and not announce (NO). The **Announce Arrival Message option** on the Messages menu changes. The Messages menu reappears.

b To <u>leave</u> the Messages menu <u>and</u> return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

11.2.7 AEI Reader Parameters

The AEI reader parameters directly affect how the AEI readers operate to acquire tags while a train is passing the site.

To set or change any of the AEI reader parameters:

1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
                  .
                  .
                  .
    F) Messages
    G) AEI Reader Parameters
    H) Load Default Setup Parameters
                  .
                  .
                  .
```

2 To display the AEI Reader Parameters menu, type **G**

A prompt like this appears.

```
AEI Reader Parameter Menu
------------------------------------------------------------
A  ID Separation.......  2 ID's
B  Consecutive Reads...  2 Reads
C  Decode As ASCII Tags  Disabled
D  AEI Reader Interface

Parm 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.
- **Decode as ASCII Tags** specifies whether the tag data is to be interpreted as ASCII characters or in the encoded format.

3 To change the **ID-separation** parameter, type **A**

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** toggles from 1 to 2, from 2 to 3, from 3 to 4, or from 4 to 1.

b Type **N**

4 To change the **consecutive-reads** parameter, type **B**

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** toggles from 1 to 2, from 2 to 3, from 3 to 4, or from 4 to 1.

b Type **N**

5 To change the **decode-as-ASCII-tags** setting, type **C**

The decode-as-ASCII-tags setting toggles between enabled (YES) and disabled (NO). The AEI Reader Parameters menu reappears.

6 To enter the **AEI reader interface**, type **D**

This message appears.

```
Entering AEI Reader Interface
<Type EXIT to quit>
```

7 To leave the AEI reader interface:

a Type **EXIT**

b Press **[Enter]**.

8 To leave the AEI Reader Parameters menu and return to the Setup menu, press **[Esc]**.

This prompt appears.

```
Initialize Reader now (Y/N)
```

9 To initialize the reader, type **Y**

The Setup menu reappears.

10 To not initialize the reader, type **N**

The Setup menu reappears.

11.2.8 Load Default Setup Parameters

An option to load default setup parameters is included to assist installers in setting up a new system. When this menu item is selected, the parameters listed below are assigned the values listed below. A "yes" after a parameter means that it is "enabled." A "no" means that it is "disabled." Blanks after "Rebroad DTMF Code" mean that it is disabled.

Alarms:

Absolute	180
Blocked Scanner	5
Carside Minimum	155
Carside Slope	1.60
Cold Bearing	1
Cold Bearing Temp	10
Differential	130
Hotwheel	650
Warm Bearing	80

Units Of Measure:

Ambient Temp	Celsius
Date	dd/mm/yyyy
Length	Meters
Speed	KPH

Equipment:

AEI	No
Car Breakout	Intermodal
Carside Slope	No
Clearance Mode	Multiplexed
Clearance Type	Trip Wire
Dragger	Yes
Gate Distance	24.0 inches
High Load	No
Hotwheel	No
Resistor Test	Enabled
Solar Powered	No
Transducer Gain	Normal
Wide Load	No
Winter Cycle	No

Messages:

Axles	Yes
Car ID With Alarm	No
Cars	No
Length	No
Power Off	Yes
Primary Language	English
Rebroad DTMF Code	
Repeat No Defects	Yes
Request EOT Timer	10
Secondary Language	None
Slow Train	Yes
Speed	No
Temperature	Yes

To load the default setup parameters:

1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
        .
        .
        .
G) AEI Reader Parameters
H) Load Default Setup Parameters
I) Units of Measure
        .
        .
        .
```

2 Type **H**

This prompt appears.

```
Load Default Setup Parameters?
```

3 To not load default setup parameters:

a Type **N**

This message appears followed by the Setup menu.

```
Default Setup Parameters Not Loaded...
```

b Return to step **1**.

4 To load default setup parameters:

a Type **Y**

This message appears followed by the Setup menu.

```
Loading Default Setup Parameters...
```

Loading takes a few seconds. When finished, the Setup menu reappears.

b Return to step **1**.

11.2.9 Units of Measure

To set or change any of the units-of-measure parameters:

1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
                  .
                  .
                  .
    H) Load Default Setup Parameters
    I) Units of Measure
    J) DCS Parameters
                  .
                  .
                  .
```

2 To display the Units of Measure submenu, type **I**

A prompt like this appears.

```
Units of Measure, MP/KP-1234.5, Track:Single
------------------------------------------------------------
A  Date.................  mm/dd/yyyy
B  Ambient Temperature...  Celsius
C  Speed................  KPH
D  Length...............  Meters

Unit of Measure to change or Esc to quit? a
```

Shown above are the parameters currently defined in the system. They define how the system will show the date, ambient temperature, speed, and length of train <u>in the reports</u> and how voice announcements are made.

Date is reported in either **dd/mm/yyyy** or **mm/dd/yyyy** format. Typing **A** toggles between what is shown and its other possibility. This parameter doesn't affect the announcement of messages, but it does affect the format of the date shown on menus.

Ambient temperature is reported in either degrees **Celsius** (C) or degrees **Fahrenheit** (F). Typing **B** toggles between what is shown and its other possibility. If you selected <u>Celsius</u>, the ambient temperature will be announced in Celsius. If you selected <u>Fahrenheit</u>, the ambient temperature will be announced in Fahrenheit.

Speed is reported in either miles per hour (**mph**) or kilometers per hour (**kph**). Typing **C** toggles between what is shown and its other possibility. If you selected <u>mph</u>, the word "milepost" will be announced <u>and</u> the speed of the train will be announced in miles per hour. If you selected <u>kph</u>, the words "kilometer post" will be announced <u>and</u> the speed of the train will be announced in kilometers per hour.

Length of train is reported in either **feet** (ft) or **meters** (m). Typing **D** toggles between what is shown and its other possibility. If you selected <u>feet</u>, the length of the train will be announced in feet. If you selected <u>meters</u>, the length of the train will be announced in meters.

3 To <u>change</u> the **date format**, type **A**

The **Date Format option** changes <u>and</u> the Units of Measure submenu reappears.

4 To <u>change</u> the **temperature format**, type **B**.

The **Temperature Format option** changes <u>and</u> the Units of Measure submenu reappears.

5 To <u>change</u> the **speed format**, type **C**.

The **Speed Format option** changes <u>and</u> the Units of Measure submenu reappears.

6 To <u>change</u> the **length format**, type **D**.

The **Length Format option** changes <u>and</u> the Units of Measure submenu reappears.

7 To <u>leave</u> the Units of Measure submenu <u>and</u> return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

11.2.10 DCS Parameters

The SmartScanNG firmware can call a host computer and transfer a report for each train on which an Exception Alarm has been detected. In order for this transfer to take place, the SmartScanNG system must have several parameters populated by the user. The DCS (Data Collection System) Parameters menu, which is described below, lets you do this. The current values for these parameters are listed under the DCS Parameters heading of the System Status report. ***Chapter 12 - Producing Reports*** tells how to produce this report.

To set or change any of the DCS parameters:

1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
                 .
                 .
                 .

  I) Units of Measure
  J) DCS Parameters
  K) COM1  Tx 19200 / Rx 19200   N-8-1
                 .
                 .
                 .
```

2 To display the DCS Parameters menu, type **J**

A prompt like this appears.

```
DCS Parameters Menu
------------------------------------------------
A) Poll ID...................  128
B) Connection Mode...........  Direct
C) Retry Attempts............    0
D) Retry Delay...............  255
E) Phone #1.................. None
F) Phone #2.................. None
G) Phone #3.................. None

Parameter to change or Esc to quit?
```

Shown above are the parameters currently defined in the system.

- **Poll ID** is the user-specified poll identifier.
- **Connection Mode** is the method used to connect the SmartScanNG system to a host computer for the purpose of systematically transferring train data to the host. The connection can either be a direct (always-on) connection or a dial-up (via modem) connection.
- **Retry Attempts** is the number of retry attempts that the SmartScanNG system makes if a transfer fails. If the value is 0, the transfer is attempted one time with no retries if the initial attempt fails.

- **Retry Delay** is the number of seconds that the SmartScanNG system waits between transfer attempts.
- **Phone #1** is the first phone number that is dialed in an attempt to transfer a report for a given train. If there isn't any phone that can be called, this header is followed by the word "none."
- **Phone #2** is the second phone number that is dialed in an attempt to transfer a report for a given train. This happens if the SmartScanNG system fails to transfer the report to the host system at "Phone #1." If there isn't a second phone that can be called, this header is followed by the word "none."
- **Phone #3** is the third phone number that is dialed in an attempt to transfer a report for a given train. This happens if the SmartScanNG system fails to transfer the report to the host system at "Phone #1" and "Phone #2." If there isn't a third phone that can be called, this header is followed by the word "none."

3 To change the displayed poll identifier, type **A**

This prompt appears.

```
New Value ?
```

This prompt allows you to enter a poll identifier, which consists of three digits from 128 through 255. If you type a value outside this range, you'll get an error message. If you type no characters and just press **[Enter]**, the field will be filled with blanks.

a Type a three-digit value.

A prompt like this appears.

```
New Value ? 246
Is this correct ?
```

At this point, type either **Y** (yes) or **N** (no).

b If the new value is incorrect, type **N** and return to step **a**.

c If the new value is correct, type **Y**

If you type a value less than 128 or greater than 255, this error message and prompt appears.

```
Minimum valid value is 128, Maximum valid value is 255
New Value ?
```

If you type an acceptable value, the **Poll Identifier option** on the DCS Parameters menu changes and the DCS Parameters menu reappears.

d If you get an error message, return to step **a**.

4 To change the connection (operational) mode setting, type **B**

The Connection Mode setting toggles between Direct and Dial Up. The **Connection Mode option** on the DCS Parameters menu changes and the DCS Parameters menu reappears.

5 To change the number of retry attempts that the SmartScanNG system makes if a transfer fails, type **C**

This prompt appears.

```
New Value ?
```

If the new value has less than two digits, type leading zeros.

a Type a two-digit value.

A prompt like this appears.

```
New Value ? 12
Is this correct ?
```

At this point, type either **Y** (yes) or **N** (no).

b If the new value is incorrect, type **N** and return to step **a**.

c If the new value is correct, type **Y**

If you type a value greater than 20, this error message and prompt appears.

```
Minimum valid value is 0, Maximum valid value is 20
New Value ?
```

If you type an acceptable value, the **Retry Attempts option** on the DCS Parameters menu changes and the DCS Parameters menu reappears.

d If you get an error message, return to step **a**.

6 To change the number of seconds that the SmartScanNG system waits between transfer attempts, type **D**

This prompt appears.

```
New Value ?
```

If the new value has less than four digits, type leading zeros.

a Type a four-digit value.

A prompt like this appears.

```
New Value ? 200
Is this correct ?
```

At this point, type either **Y** (yes) or **N** (no).

b If the new value is incorrect, type **N** and return to step **a**.

c If the new value is correct, type **Y**

If you type a value less than 10 or greater than 1200, this error message and prompt appears.

```
Minimum valid value is 10, Maximum valid value is 1200
New Value ?
```

If you type an acceptable value, the **Retry Delay option** on the DCS Parameters menu changes and the DCS Parameters menu reappears.

d If you get an error message, return to step **a**.

7 To change the primary telephone number, type **E**

This prompt appears.

```
Current: NONE
Enter New: Current:
```

This prompt allows you to enter the telephone number of the primary host computer, which can consist of from 1 to 20 characters. If it is less than 20 characters long, press **[Enter]** after typing the last character. If it is the full 20 characters long, pressing **[Enter]** isn't necessary. If you type no characters and just press **[Enter]**, the field will show the word "none."

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 modems setup parameters.

a Type the primary telephone number.

b If the primary telephone number is less than 20 characters, press **[Enter]**.

The **Primary Phone Number option** on the DCS Parameters menu changes and the DCS Parameters menu reappears.

8 To change the secondary telephone number, type **F**

This prompt appears.

```
Current: NONE
Enter New: Current:
```

This prompt allows you to enter the telephone number of the secondary host computer, which can consist of from 1 to 20 characters. If it is less than 20 characters long, press **[Enter]** after typing the last character. If it is the full 20 characters long, pressing **[Enter]** isn't necessary. If you type no characters and just press **[Enter]**, the field will show the word "none."

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 modems setup parameters.

a Type the secondary telephone number.

b If the secondary telephone number is less than 20 characters, press **[Enter]**.

The **Secondary Phone Number option** on the DCS Parameters menu changes and the DCS Parameters menu reappears.

9 To change the tertiary telephone number, type **G**

This prompt appears.

```
Current: NONE
Enter New: Current:
```

This prompt allows you to enter the telephone number of the tertiary host computer, which can consist of from 1 to 20 characters. If it is less than 20 characters long, press **[Enter]** after typing the last character. If it is the full 20 characters long, pressing **[Enter]** isn't necessary. If you type no characters and just press **[Enter]**, the field will show the word "none."

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 modems setup parameters.

a Type the tertiary telephone number.

b If the tertiary telephone number is less than 20 characters, press **[Enter]**.

The **Tertiary Phone Number option** on the DCS Parameters menu changes and the DCS Parameters menu reappears.

10 To leave the DCS Parameters menu and return to the Setup menu, press **[Esc]**.

11.2.11 COM1

When **on-site**, you would normally plug your computer into COM1 or COM2 (whichever is available) using a crossover (null-modem) cable. You would normally not plug it into any other serial port.

To change the parameters for serial port COM1:

1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
                  .
                  .
                  .
   J) DCS Parameters
   K) COM1  Tx 19200 / Rx 19200   N-8-1
   L) COM2  Tx 19200 / Rx 19200   N-8-1
   M) COM3  Tx 19200 / Rx 19200   N-8-1
   N) COM4  Tx 19200 / Rx 19200   N-8-1
   O) Setup Password
   X) Exit
```

2 To go to the COM1 submenu, type **K**

If COM1 is currently being used, this message appears.

```
Editing the settings of the port currently in use is not allowed.
```

If COM1 is currently not being used, the COM1 submenu appears.

```
STC SmartScanNG, MP/KP-1234.5, Track:Single
11/07/2011 21:57
COM1   Tx-19200/Rx-19200   N-8-1
-------------------------------------------------
  A) Increase Tx Baud
  B) Decrease Tx Baud
  C) Increase Rx Baud
  D) Decrease Rx Baud
  E) N-8-1
  F) E-7-1
  X) Exit
```

Type either **A** to increase or **B** to decrease the outgoing (aka transmit) baud rate for COM1. Type either **C** to increase or **D** to decrease the incoming (aka 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, 19200, 38400, 57600, and 115200. Type **E** for no parity bit, 8 data bits, and 1 stop bit. Type **F** for even parity bit, 7 data bits, and 1 stop bit.

3 Type the letter of what you want to change.

The COM1 submenu reappears.

4 If you aren't done changing the parameters for COM1, return to step **3**.

5 If you are done changing the parameters for COM1, type **X**

The Setup menu reappears.

11.2.12 COM2

When **on-site**, you would normally plug your computer into COM1 or COM2 (whichever is available) using a crossover (null-modem) cable. You would normally not plug it into any other serial port.

To change the parameters for serial port COM2:

1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
                 .
                 .
                 .
    K) COM1  Tx 19200 / Rx 19200   N-8-1
    L) COM2  Tx 19200 / Rx 19200   N-8-1
    M) COM3  Tx 19200 / Rx 19200   N-8-1
    N) COM4  Tx 19200 / Rx 19200   N-8-1
    O) Setup Password
    X) Exit
```

2 To go to the COM2 submenu, type **L**

If COM2 is currently being used, this message appears.

```
Editing the settings of the port currently in use is not allowed.
```

If COM2 is currently not being used, the COM2 submenu appears.

```
STC SmartScanNG, MP/KP-1234.5, Track:Single
11/07/2011 21:57
COM2   Tx-19200/Rx-19200   N-8-1
-------------------------------------------------
  A) Increase Tx Baud
  B) Decrease Tx Baud
  C) Increase Rx Baud
  D) Decrease Rx Baud
  E) N-8-1
  F) E-7-1
  X) Exit
```

Type either **A** to increase or **B** to decrease the outgoing (aka transmit) baud rate for COM2. Type either **C** to increase or **D** to decrease the incoming (aka 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. Type **E** for no parity bit, 8 data bits, and 1 stop bit. Type **F** for even parity bit, 7 data bits, and 1 stop bit.

3 Type the letter of what you want to change.

The COM2 submenu reappears.

4 If you aren't done changing the parameters for COM2, return to step **3**.

5 If you are done changing the parameters for COM2, type **X**

The Setup menu reappears.

11.2.13 COM3

If an internal modem is installed, COM3 won't be available externally and these parameters will only affect communications between the SmartScanNG and the internal modem. If no internal modem is installed, these parameters will affect the external COM3 serial port on the right side of a mounted Controller module (2300-502)

To <u>change</u> the parameters for serial port COM3:

1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
                    .
                    .
                    .

  L) COM2  Tx 19200 / Rx 19200   N-8-1
  M) COM3  Tx 19200 / Rx 19200   N-8-1
  N) COM4  Tx 19200 / Rx 19200   N-8-1
  O) Setup Password
  X) Exit
```

2 To go to the COM3 submenu, type **N**

If COM3 is currently being used, this message appears.

```
Editing the settings of the port currently in use is not allowed.
```

If COM3 is currently not being used, the COM3 submenu appears.

```
STC SmartScanNG, MP/KP-1234.5, Track:Single
11/07/2011 21:57
COM3   Tx-19200/Rx-19200   N-8-1
-------------------------------------------------
  A) Increase Tx Baud
  B) Decrease Tx Baud
  C) Increase Rx Baud
  D) Decrease Rx Baud
  E) N-8-1
  F) E-7-1
  X) Exit
```

Type either **A** to increase or **B** to decrease the outgoing (aka transmit) baud rate for COM3. Type either **C** to increase or **D** to decrease the incoming (aka 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. Type **E** for no parity bit, 8 data bits, and 1 stop bit. Type **F** for even parity bit, 7 data bits, and 1 stop bit.

3 Type the letter of what you want to change.

The COM3 submenu reappears.

4 If you aren't done changing the parameters for COM3, return to step **3**.

5 If you are done changing the parameters for COM3, type **X**

The Setup menu reappears.

11.2.14 COM4

To change the parameters for serial port COM4:

1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
                 .
                 .
                 .
  M) COM3  Tx 19200 / Rx 19200   N-8-1
  N) COM4  Tx 19200 / Rx 19200   N-8-1
  O) Setup Password
  X) Exit
```

2 To go to the COM4 submenu, type **N**

If COM4 is currently being used, this message appears.

```
Editing the settings of the port currently in use is not allowed.
```

If COM4 is currently not being used, the COM4 submenu appears.

```
STC SmartScanNG, MP/KP-1234.5, Track:Single
11/07/2011 21:57
COM4   Tx-19200/Rx-19200   N-8-1
-------------------------------------------------
  A) Increase Tx Baud
  B) Decrease Tx Baud
  C) Increase Rx Baud
  D) Decrease Rx Baud
  E) N-8-1
  F) E-7-1
  X) Exit
```

Type either **A** to increase or **B** to decrease the outgoing (aka transmit) baud rate for COM4. Type either **C** to increase or **D** to decrease the incoming (aka receive) baud rate for COM4. 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. Type **E** for no parity bit, 8 data bits, and 1 stop bit. Type **F** for even parity bit, 7 data bits, and 1 stop bit.

3 Type the letter of what you want to change.

The COM4 submenu reappears.

4 If you aren't done changing the parameters for COM4, return to step **3**.

5 If you are done changing the parameters for COM4, type **X**

The Setup menu reappears.

11.2.15 Setup Password

You can password protect the Setup menu on most systems. However, not all systems have this option.

To set or change the password needed to enter the Setup menu:

1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Setup Menu
-------------------------------------------------
                  .
                  .
                  .

  N) COM4  Tx 19200 / Rx 19200   N-8-1
  O) Setup Password
  X) Exit
```

2 To go to the Setup Password submenu, type **O**

A prompt like this appears.

```
Enter Setup Password:
```

This prompt allows you to enter a password into the system. A password can consist of from 1 to 11 characters. If it is less than 11 characters long, press **[Enter]** after typing the last character. If it is the full 11 characters long, pressing **[Enter]** isn't necessary. If you type no characters and just press **[Enter]**, the password function would be turned off. There would be no password required to access the Setup menu.

The entry of the password is case sensitive. For example, the password "abc123" cannot be entered "ABC123."

3 Type the password.

4 If the password is less than 11 characters, press **[Enter]**.

The Setup menu reappears.

11.3 System Functions Menu

To execute one or more system functions:

1 Be sure that the Main menu is displayed.

The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Main Menu
-------------------------------------------------
               .
               .
               .
  K) Enter Pass-Thru Mode for COM 2
  L) System Functions
  M) Event Log
  X) Exit
```

2 To display the System Functions menu, type **L**

A menu and prompt like this appears. To access any of the System Functions menu options, type the letter that corresponds to the desired menu option.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
System Functions Menu
-------------------------------------------------
  A) Radio Test
  B) Vocabulary Test
  C) Ramp Function
  D) Radio Inhibit
  E) Manual Test Mode
  F) 1KHz Test Tone
  G) Auto-Calibration
  H) Reset the COP Counters
  I) Remote System RESET
  J) Delete All Stored Train Data
  K) Clear Event Log
  X) Exit
```

If a train is at the site when the System Functions menu is generated, "*** **Train Is Present** ***" is displayed just above the menu header for the System Functions menu. During that time, if you select any item on the System Functions menu, you'll be prompted with "**Train Is Present. Continue?**" You must type **Y** to continue. Note that most items on the Systems Functions menu should not be performed while a train is present at the site.

3 To leave the System Functions menu and return to the Main menu:

a Type **X**

The Main menu reappears.

b Skip the remaining steps.

4 To execute the **radio test**:

The **Radio Test option** on the System Functions menu is used to broadcast a short message through the speaker (on top of the SmartScanNG enclosure) and through the radio. Using this option lets you verify that the speaker and radio are working properly.

At single-track sites, the English text of the message is usually "Testing, detector at kilometer post (kilometer-post number), testing, one, two, three, four, five, four, three, two, one, testing." At double-track sites, the English text of the message is usually "Testing, detector at kilometer post (kilometer-post number), track (track designation), testing, one, two, three, four, five, four, three, two, one, testing."

Some systems let you choose both a **Primary Language option** and a **Secondary Language option**. If your system does, the radio test is broadcast first in the primary language you chose and then in the secondary language you chose.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
System Functions Menu
-------------------------------------------------
  A) Radio Test
  B) Vocabulary Test
  C) Ramp Function
            .
            .
            .
```

a Be sure that the speaker (on top of the SmartScanNG enclosure) is plugged in and its volume knob is turned to the middle position.

b From the System Functions menu, type **A**

This message appears.

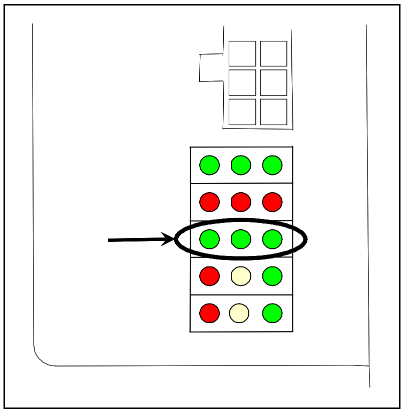
```
Starting Radio Test
```

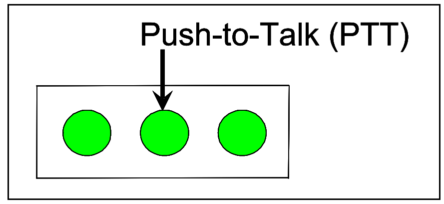
If the system isn't currently making any other voice announcements, it begins the Radio Test announcement. After the announcement finishes, the System Functions menu reappears.

If the system is currently making a voice announcement, the firmware displays the message "System Is Currently Making Voice Announcements! Try Again Later" and redisplays the System Functions menu.

c While listening to the message, look at the **third row of LEDs** on the status panel.

The **middle green LED** should be lit.





If this LED isn't lit, the system's ability to send a message to the radio might be inhibited by the **Radio Inhibit option** on the System Functions menu. If the radio is inhibited, the results of this check are invalid.

d Return to step **3**.

5 To execute the **vocabulary test**:

The **Vocabulary Test option** on the System Functions menu is used to enunciate all of the stored speech phrases. This announcement is broadcast <u>through</u> the speaker (on top of the SmartScanNG enclosure), but <u>not</u> <u>through</u> the radio. Therefore, it isn't affected by the **Radio Inhibit option** being enabled.

The English text of the message is usually "zero, one, two, three, four, five, six, seven, eight, nine, integrity-failure, *beep*, detector-at, milepost, kilometer-post, main-3, system-working, no-defects, main-1, main-2, rebroadcast, hotwheel, defect, axle, dragging-equipment-near, north, south, rail, east, west, track, car-I-D, no, hotbox, high-wide-near, you-have-a-defect, testing, train too slow, total axles, speed, temperature, length, minus, point, middle, high-load, wide-load, power-off, excess-alarms, repeat, total-cars, detector-out, A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z." Not all systems broadcast the letters A through Z.

Some systems let you choose both a **Primary Language option** and a **Secondary Language option**. If your system does, the vocabulary test is broadcast first in the primary language you chose and then in the secondary language you chose.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
System Functions Menu
-------------------------------------------------
  A) Radio Test
  B) Vocabulary Test
  C) Ramp Function
           .
           .
           .
```

a Be sure that the speaker (on top of the SmartScanNG enclosure) is plugged in and its volume knob is turned to the middle position.

b From the System Functions menu, type **B**

This message appears.

```
Starting Vocabulary Test.
```

If the system isn't currently making any other voice announcements, it begins the Vocabulary Test announcement. After the announcement finishes, the System Functions menu reappears.

If the system is currently making a voice announcement, the firmware displays the "System Is Currently Making Voice Announcements! Try Again Later" message and the System Functions menu reappears.

c Return to step **3**.

6 To execute the **ramp function**:

The **Ramp Function option** on the System Functions menu is used to generate a test train. It simulates two Absolute alarms, two Differential alarms, and two Hotwheel alarms. It simulates the Hotwheel alarms even if detection for those alarms is disabled in the Equipment menu. However, disabled alarms don't appear on the Last Test Train report.

The data generated for this test train is stored in the Test Train directory, which contains data on the last test train only. The Last Test Train report gets its data from this directory.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
System Functions Menu
-------------------------------------------------
  A) Radio Test
  B) Vocabulary Test
  C) Ramp Function
  D) Radio Inhibit
           .
           .
           .
```

a From the System Functions menu, type **C**

This prompt appears.

```
Start Ramp Function?
```

b To not start the ramp function:

- Type **N**

  The System Functions menu reappears.

- Return to step **3**.

c To start the ramp function, type **Y**

This message appears.

```
Running Ramp Function...
```

The advance input is made active, gating transducer signals are simulated, and heat values are ramped up (increased) and ramped down (decreased) in a predictable sequence to simulate eight Exception Alarms. **This may take a few minutes.** You cannot stop the ramp function by pressing **[Esc]**. When finished, this message appears followed by the System Functions menu.

```
Running Ramp Function...Ramp Function Complete
```

d Return to step **3**.

7 To execute the **radio inhibit**:

The **Radio Inhibit option** on the System Functions menu is used to prevent radio activation for three minutes. During this time, any announcements generated by the system are broadcast through the speaker (on top of the SmartScanNG enclosure), but not through the radio. This feature may be overridden by recalling this submenu and then typing **N**.

```
           .
           .
           .

  C) Ramp Function
  D) Radio Inhibit
  E) Manual Test Mode

           .
           .
           .
```

a From the System Functions menu, type **D**

This prompt appears.

```
Inhibit Radio?
```

If you want to inhibit the radio (that is, you want to disable road channel broadcasts), type **Y**. If you don't want to inhibit the radio (that is, you want to enable road channel broadcasts), type **N**.

b To disable road channel broadcasts:

- Type **Y**

  The System Functions menu reappears.

- Return to step **3**.

c To enable road channel broadcasts, type **N**

The System Functions menu reappears.

d Return to step **3**.

8 To initiate the **manual test mode**:

The **Manual Test Mode option** on the System Functions menu is used to have the system open all the shutters and simulate transducer pulses for about two minutes. During this time, a person can check various aspects of the installed components. In this mode, the system runs the ramp function without generating heats. The train is marked as a test train. There won't be any voltage applied to the scanner inputs.

The test continues until 486 axles are simulated. You cannot stop this test by pressing **[Esc]**.

The data generated for this test train is stored in the Test Train directory, which contains data on the last test train only. The Last Test Train report gets its data from this directory.

```
          .
          .
          .
D) Radio Inhibit
E) Manual Test Mode
F) 1KHz Test Tone
          .
          .
          .
```

a From the System Functions menu, type **E**

This prompt appears.

```
Start Manual Test Mode?
```

If you want to start manual test mode, type **Y**. If you don't want to start manual test mode, type **N**.

b To <u>not</u> start manual test mode:

- Type **N**

  The System Functions menu reappears.

- Return to step **3**.

c To start manual test mode, type **Y**

This message appears.

```
Entering Manual Test Mode
You have about two minutes
```

After two minutes, this message appears followed by the System Functions menu.

```
Manual Test Mode Complete
```

d Return to step **3**.

9 To generate the **1KHz test tone**:

The **1KHz Test Tone option** on the System Functions menu is used to generate a continuous 1KHz tone for about 10 seconds. This test tone is to broadcast through the speaker (on top of the SmartScanNG enclosure) and through the radio.

```
          .
          .
          .

E) Manual Test Mode
F) 1KHz Test Tone
G) Auto-Calibration
          .
          .
          .
```

a Be sure that the speaker (on top of the SmartScanNG enclosure) is plugged in and its volume knob is turned to the middle position.

b From the System Functions menu, type **F**

This message appears.

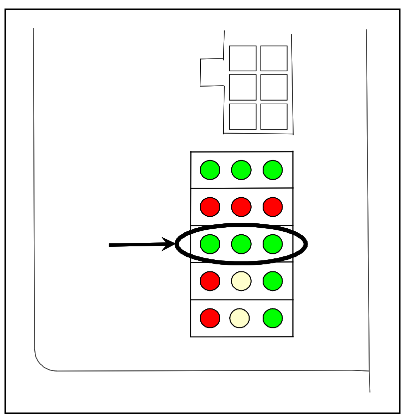
```
Starting 1kHz Test Tone
```

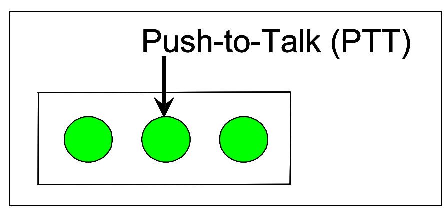
If the system isn't currently making any other voice announcements, it begins the tone. After the tone finishes, the System Functions menu reappears.

If the system is currently making a voice announcement, the firmware displays the message "System Is Currently Making Voice Announcements! Try Again Later" and redisplays the System Functions menu.

c While listening to the tone, look at the **third row of LEDs** on the status panel.

The **middle green LED** should be lit.





If this LED isn't lit, the system's ability to send a tone to the radio might be inhibited by the **Radio Inhibit option** on the System Functions menu. If the radio is inhibited, the results of this check are invalid.

d Return to step **3**.

10 To start **autocalibration**:

The SmartScanNG system 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 by using the **Auto-Calibration option** on the System Functions menu. 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***.

a Place a preheated calibrated heat source on the scanner to be calibrated.

b From the System Functions menu, type **G**

The SmartScanNG system will now calibrate the channel associated with the scanner on which the heat source has been placed. 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 scanner.

c When "Auto-Calibration Disengaged" is displayed on your computer, remove the calibrated heat source.

Upon completion of autocalibration, the system acquires the scanner resistor temperature baseline values. The process begins with a 20-minute wait period in which the resistors are allowed to cool down. The system counts down during this period, sounding a tone each minute. After the 20-minute cool down period, the system opens and closes the shutters for a period of 8 minutes.

d Return to step **3**.

11 To reset the **COP counters**:

Associated with each microprocessor on the Processor board is a Computer Operating Properly (COP) counter. The SmartScanNG system uses these counters to keep track of every time the system automatically resets itself or the customer manually resets it, 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. Selecting the **Reset the COP Counters option** resets each COP counter to zero.

a From the System Functions menu, type **H**

The firmware clears the COP counter for both microprocessors.

The System Functions menu reappears.

b Return to step **3**.

12 To force a **system reset**:

The **Remote System Reset option** on the System Functions menu allows you to force a system reset through a remote connection. It can also be used locally.

a From the System Functions menu, type **I**

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.

```
System RESET will occur 5 seconds after exiting from
the Serial Interface!
```

After three seconds, the System Functions menu reappears.

d Return to step **3**.

13 To **delete all stored train data**:

The **Delete All Stored Train Data option** on the System Functions menu allows you to erase all of the stored train data. This encompasses all of the data on the trains in the Trains directory, Exceptions directory, and Test Train directory. After deleting all train data, there isn't any way of regenerating it. The data is gone forever.

```
           .
           .
           .

I) Remote System RESET
J) Delete All Stored Train Data
K) Clear Event Log
X) Exit
```

a From the System Functions menu, type **J**

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**.

14 To **delete all of the events stored in the Event Log**:

The **Clear Event Log option** on the System Functions menu is used to erase 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. Not all systems have the **Clear Event Log option**. Only those that have the Event Log option on Main menu do.

```
           .
           .
           .
J) Delete All Stored Train Data
K) Clear Event Log
X) Exit
```

a From the System Functions menu, type **K**

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**.

11.4 Replay EOT Announcement

The EOT message for every train that is stored in longterm memory can be replayed through the local speaker. The replaying of the EOT message doesn't activate the PTT so it isn't broadcast over the radio.

To replay the EOT announcement for a given train:

1 Be sure that the Main menu is displayed.

The Main menu looks like this.

```
          .
          .
          .

H) AEI Diagnostic Detail
I) Replay EOT Announcement
J) Setup
K) Enter Pass-Thru Mode for COM 2
L) System Functions
M) Event Log
X) Exit
```

2 From the Main menu, type **I**

This prompt appears.

```
Train Number ?
```

3 Type the train number.

If you typed a three-digit valid train number, you'll hear the EOT announcement through the speaker.

4 If you typed one or two digits, press **[Enter]**.

If the typed train number is valid, pressing **[Enter]** produces the announcement.

11.5 Enter Pass-Through Mode

Pass-through mode allows you to access two or more SmartScanNG systems with one modem. To make this happen:

- At double-track sites without AEI, attach a serial cable from **COM5** of system1 to COM1 of system2. At double-track sites with AEI, attach a serial cable from **COM4** of system1 to COM1 of system2.
- System1 is the one with the telephone line attached and the modem installed.
- Dial into system1.
- Keep selecting pass-through mode from the Main menus, until the system you want to communicate with is reached.

Pass-through mode is not available on SmartScanNG systems that have AEI and who communicate with a host computer over a distributed communication network.

To use pass-through mode at a double-track site:

1 Be sure that the Main menu for system1 is displayed.

The Main menu looks like this.

```
          .
          .
          .

J) Setup
K) Enter Pass-Thru Mode for COM 2
L) System Functions
M) Event Log
X) Exit
```

2 To enter pass-through mode, type **J**

If there is a response from the SmartScanNG system on COM5 within five seconds, this message appears.

```
Entering Pass-Thru Mode.
```

If there isn't a response from the SmartScanNG system on COM5 within five seconds, this message appears followed by the reappearance of the Main menu.

```
COM5 does not have a detector attached serially!
```

3 After receiving the "entering pass-thru mode" message, press **[Esc]** to display the Main menu for system2.

You can now communicate with system2.

4 To return to system1, from the Main menu, type **X**

Upon leaving system2, this message appears followed by the Main menu for system1.

```
Leaving Pass-Thru Mode.
```

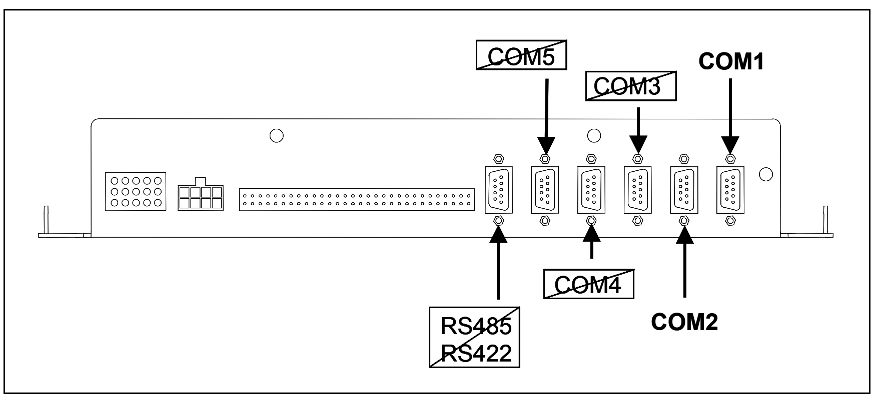
Chapter 12
Producing Reports

The SmartScanNG system provides:

- Train Summary report
- Train Detail report
- Exception Summary report
- extended Exception Detail report
- abbreviated Exception Detail report
- System Status report
- Last Train report
- Last Test Train report
- AEI Diagnostic Detail report
- Event Log report

This chapter shows a sample of each report with a description of each field. It 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**, plug your computer into COM1 or COM2 (whichever is available) using a crossover (null-modem) cable.



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 to 19,200.

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]**.

This prompt appears.

```
Enter "SmartSCAN" To Proceed:
```

8 Type **SmartSCAN**

The entry of this word is case sensitive.

9 To get the serial interface to come up, press **[Enter]**.

The Main menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Main Menu
-------------------------------------------------
  A) Train Summary
  B) Train Detail
  C) Exception Summary
  D) Exception Detail
  E) System Status
  F) Last Train
  G) Last Test Train
  H) AEI Diagnostic Detail
  I) Replay EOT Announcement
  J) Setup
  K) Enter Pass-Thru Mode for COM 2
  L) System Functions
  M) Event Log
  X) Exit
```

At the above prompt, you can produce one of the listed reports by typing one of the letters **A** through **H** or **M**. Not all systems have the **Event Log option**.

If a train is at the site when the Main menu is generated, "*** Train Is Present ***" is displayed just above the menu header for the Main menu.

10 When done, close the LOG file.

11 To exit the serial interface and return the system 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.

Your menus and submenus may not match those shown in this guide. Some of the options shown may not appear on your menus and submenus. For example, Event Log doesn't appear on everybody's Main menu. Also, some options that appear on your menus and submenus may not apply to your system. For example, if you don't have an AEI subsystem attached to your SmartScanNG, the AEI option on the Equipment menu would not be applicable.

Because the shown menus and submenus may be different from what appears on your system, the letter that is associated with an option may be different from what appears on your system. So, where there is a difference, type the letter of the desired option as it appears on your menus and submenus.

Also, the headings in your reports may not match those shown in this guide. The contents of your report will be different from what is shown. The version information that is shown doesn't represent any real release of the firmware.

12.1 Train Summary Report

The Train Summary report lists all trains currently stored in the Trains directory. The buffer for the Trains directory holds data on about 140,000 axles, but no more than 100 trains. 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.

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.

The SmartScanNG system 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. So, instead of getting a train record, you'll get a checksum-error line.

Below is a sample of part of a Train Summary report when Hotwheel alarm detection was disabled during report processing and when the AEI subsystem was disabled during train passage. (When the report is run, if the **Hotwheel option** on the Equipment menu is disabled, the hotwheel information is hidden. When the report is run, if the **AEI option** is disabled, the tag information isn't hidden.) 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. Not all systems display the version number of the speech data.

```
                       Southern Technologies Corporation
                        Next Generation Detector System
                                TRAIN SUMMARY
===============================================================================
Version Info.... Analyzer:  XYZ1.11-B 05/11/11                    MP/KP: 1234.5
             Communicator:  XYZ1.22-B 05/22/11                    Track: Single
                   Speech:  XYZ1.33

Alarm Limits..     Absolute: 180         Carside Slope... 1.60
               Differential: 130               Minimum... 155
                                        Cool Wheel Temp..  10
-------------------------------------------------------------------------------
                                                 D   Bearing
                                        AEI Speed i   Average      Amb
Train#   Date   Time   Cars Axles TO1 TO2 Tags (MPH) r  North South  Temp   Bat
-------------------------------------------------------------------------------
 178   06/22/11 15:47   18   78   78  78    0   53  W    56    21   +77F  14.0v

 177 A 06/21/11 08:32   20   86   86  86    0   56  E    36    37   +68F  14.0v
 176 I 06/21/11 07:40   10   46   46  46    0   57  E    43     7   +66F  14.0v
 175 B 06/21/11 06:28   14   62   62  62    0   57  E    36    37   +60F  13.8v

 174   06/20/11 11:33   18   78   78  78    0   53  W    55    55   +73F  14.0v
 173   CHECKSUM ERROR: StartAddr 134879 EndAddr 134930
 172   06/20/11 01:19   18   78   78  78    0   55  E    58    20   +59F  14.0v

 171   06/19/11 11:24   53  218  218 218    0   49  E    54    18   +72F  14.0v
 170 I 06/19/11 01:22    8   38   38  38    0   53  E    55    18   +60F  14.0v
              •
              •
              •

END OF REPORT - Press any key...
```

Below is a sample of part of a Train Summary report when the **Hotwheel option** on the Equipment menu is enabled. The contents of your report will be different.

```
                                  .
                                  .
                                  .

Alarm Limits..     Absolute: 180         Carside Slope... 1.60
               Differential: 130               Minimum... 155
                  Hot Wheel: 652        Cool Wheel Temp..  10
-------------------------------------------------------------------------------
                                                  D  Bearing      Wheel
                                          AEI Speed i  Average     Average     Amb
Train#   Date   Time Cars Axles TO1  TO2 Tags (KPH) r East  West  East  West  Temp   Bat
-----------------------------------------------------------------------------------------
                                  .
                                  .
                                  .
```

The table below lists the fields from the header section and the contents of each field.

Heading	Contents of Field
Version Info	For Analyzer and Comm, the version numbers of the firmware and their release dates, which are in **mm/dd/yy** format. This firmware resides on the Processor board (2300-100). For Speech, the version number of the speech data. This data resides on the Interface board (2300-105). Not all systems display the version number of the speech data.
MP/KP	The five-digit milepost/kilometer post of the site. ***Chapter 11 - Serial Interface*** tells how to change this value using the MP/KP submenu on the Setup menu.
Track	The track designator of the site. For single-track sites, the value is Single. For double-track sites, valid values are North, South, East, West, Main 1, Main 2, Main 3, and Middle. ***Chapter 11 - Serial Interface*** tells how to set this value using the Track Number submenu on the Setup menu.

Heading	Contents of Field
Alarm Limits	These are the alarm parameters currently defined in the system setup. These values were in place when this report was run. • The value after Absolute is set by the **Absolute option** on the Alarm Settings menu. • The value after Differential is set by the **Differential option** on the Alarm Settings menu. • The heading Hot Wheel only appears if the **Hotwheel option** on the Equipment menu is enabled. The value after Hot Wheel is set by the **Hotwheel option** on the Alarm Settings menu. • The value after Carside Slope is set by the **Carside Slope option** on the Alarm Settings menu. • The value after Minimum is set by the **Carside Minimum option** on the Alarm Settings menu. • The value after Cool Wheel Temp is set by the **Cold Bearing Temperature option** on the Alarm Settings menu. ***Chapter 11 - Serial Interface*** tells how to set these values.

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.
	There is one unlabeled columns between those labeled "Train#" and "Date." This column can contain **A**, **B**, **I**, or nothing. If "A," an Exception Alarm was detected on the train. If "I," a System Alarm was detected. If "B," both an Exception Alarm and a System Alarm were detected. If blank, no Exception Alarm or System Alarm was detected.
Date	The date the train arrived at the site. Date is in either **dd/mm/yy** or **mm/dd/yy** format, depending on what was set by the **Date Format option** on the Units of Measure submenu. ***Chapter 11 - Serial Interface*** tells how to select the format. ***Chapter 11 - Serial Interface*** also tells how to change the date using the Date and Time submenu on the Setup menu.
Time	The time the train arrived at the site. Time is in 24-hour **hh:mm** format, where 8 a.m. is 08:00, noon is 12:00, 8 p.m. is 20:00, and midnight is 00:00. ***Chapter 11 - Serial Interface*** tells how to change the time using the Date and Time submenu on the Setup menu.
Cars	The total number of cars counted by the SmartScanNG system.
Axles	The total number of axles counted by the SmartScanNG system.

Heading	Contents of Field
TO1	The total number of hits counted by 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.
TO2	The total number of hits counted by 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.
AEI Tags	The total number of AEI tags stored. 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 **AEI option** on the Equipment menu.
Speed	The train's exit speed. Speed is in either miles per hour (**mph**) or kilometers per hour (**kph**), depending on what was set by the **Speed Format option** on the Units of Measure submenu. ***Chapter 11 - Serial Interface*** tells how to select the setting.
Dir	The direction the train was traveling. Valid values are N, S, E, and W.
Bearing Average	Under this heading are two columns, one for each bearing scanner, containing the average temperature read by the bearing scanners. If the track orientation is east and west, the bearing scanners are labeled north and south. If the track orientation is north and south, they are labeled east and west.
Wheel Average	Under this heading are two columns, one for each wheel scanner, containing the average temperature read by the wheel scanners. If the track orientation is east and west, the wheel scanners are labeled north and south. If the track orientation is north and south, they are labeled east and west. This field appears only when the **Hotwheel option** on the Equipment menu is enabled.
Amb Temp	The ambient temperature when the train arrived at the site. Temperature is in either degrees Celsius (**C**) or degrees Fahrenheit (**F**), depending on what was set by the Units of Measure submenu on the Setup menu. ***Chapter 11 - Serial Interface*** tells how to select the setting.
Bat	The system battery voltage when the train arrived at the site.

To produce a Train Summary report:

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 SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Main Menu
-----------------------------------
 A) Train Summary
 B) Train Detail
 C) Exception Summary
           .
           .
           .
```

2 To produce the Train Summary report, type **A**

The last line of the report reads: "END OF REPORT - Press any key..."

3 To return to the Main menu, press any key.

At this time, you can produce another report by typing one of the letters **A** through **H** or **M**.

4 When done, close the LOG file.

5 To exit the serial interface and return the SmartScanNG system to normal operation, type **X**

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, enter a train number from the Train Summary report. The train number appears under the column titled "Train#" in the detail section of the Train Summary report.

Carside Slope alarm detection is enabled/disabled using the **Carside Slope option** on the Equipment menu. Hotwheel alarm reporting is enabled/disabled using the **Hotwheel option** on the Equipment menu. The AEI subsystem is enabled/disabled using the **AEI option** on the Equipment menu.

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 during train passage, no AEI information is recorded. If the **Carside Slope option** is disabled during train passage, no Carside Slope alarms are generated. But, if it is enabled when a report is requested, a carside-slope alarm-limit line is generated for each car of the train.

Below is a sample of part of a Train Detail report when both the **AEI option** and the **Hotwheel option** were disabled when the report was requested. The **Carside Slope option** was enabled. 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. Not all systems display the version number of the speech data.

```
                    Southern Technologies Corporation
                     Next Generation Detector System
                               TRAIN DETAIL
================================================================================
Train#: 222                  Speed:  30 KPH              MP/KP: 0611.1
  Date: 08/12/11             Axles:  31                  Track: Single
  Time: 13:55            Direction: South          Temperature: + 62F
Length:   160 m      Shutters Open:   16 sec           Battery: 13.6V
================================================================================
              Resistor              Filters
Brng  Max Avg Read Req   Txdr Count   A   B  Alarm        Limit  Carside Parms
-----------------------  -------------------  -------------------  -------------
East   63  62    2  68I   TO1  86      0   0  Absolute       180    Slope: 1.60
West  232  64    2  68I   TO2  86      0   0  Differential   130  Minimum: 155
                                              Hot Wheel      652
Resistor Test Mode: Disabled                  Cold Rail Temp  10

Car Breakout      : Intermodal
================================================================================

Firmware Versions
-----------------
Analyzer: XYZ1.11-B 05/11/11   Comm: XYZ1.22-B 05/22/11   Speech: XYZ1.33
--------------------------------------------------------------------------------

System Alarms
--------------------------------------------------------------------------------
Cold East Bearing Scanner
Cold West Bearing Scanner
Successive Cold Rails Exceeded
Short Train
Reverse Direction Detected
No Approach Track

Axle Alarm Summary
--------------------------------------------------------------------------------
  13  Dragging Equipment

--------------------------------------------------------------------------------
Car  Axle Trk East     West    ON   OFF PW1 PW2  Alarms
  1     1   0    4        4    95     0  77 102
        2   0    4        4    88   104  78  93
        3   0    4        4    88   102  72  89
        4   0    4        4    99    96  91  82
        5   0    3        3   195    96  92  77
        6   0    4        4    89    88  79  70
        7   0    3        3   190    88  65  86
        8   0    4        4    96    93  84  76
        9   0    3        3   187    93  78  77
       10   0    4        4    77   111  63  97
       11   0    4        4    97   124  88 103

  2    12   1    4        4    92   103  86  84
       13   1    4        4   140   115  58  85  Dragging Equipment
       14   1    3        3   183   115  69  92
       15   1    4        4    87    96  76  71
                            •
                            •
                            •

END OF REPORT - Press any key...
```

Below is a sample of part of a Train Detail report when both the **AEI option** and the **Hotwheel option** on the Equipment menu were enabled when the report was requested. The **Carside Slope option** on the Equipment menu was disabled. Also, both the **AEI option** and the **Hotwheel option** were enabled while the specified train was passing the site. 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. Not all systems display the version number of the speech data.

```
                         Southern Technologies Corporation
                          Next Generation Detector System
                                   TRAIN DETAIL
==============================================================================
Train#: 321                  Speed:  48 KPH              MP/KP: 1234.5
  Date: 08/04/11             Axles:  52                  Track: Single
  Time: 08:26            Direction: South          Temperature: + 21C
Length:  1013 m      Shutters Open:   36 sec           Battery: 14.2v
===============================================================================
              Resistor               Filters
Brng  Max Avg Read Req   Txdr Count   A   B  Alarm        Limit  Carside Parms
-----------------------  ------------------  ------------------  -------------
East   63  62    2  68I   TO1  86     0   0  Absolute       180    Slope: 1.60
West  232  64    2  68I   TO2  86     0   0  Differential   130  Minimum: 155
                                             Hot Wheel      652
Resistor Test Mode: Disabled                 Cold Rail Temp  10

Car Breakout      : Intermodal

              Resistor
Wheel Max Avg Read Req
-----------------------
East   10  10   49  58I
West   14  14   48  58I
===============================================================================
AEI System Data

Tags Read          Tags Stored: 11
--------------
Antenna 0:  12
Antenna 1:   0
===============================================================================
Firmware Versions
-----------------
Analyzer: XYZ1.11-B 05/11/11   Comm: XYZ1.22-B 05/22/11   Speech: XYZ1.33
-------------------------------------------------------------------------------

System Alarms
----------------------------------------
Cold East Bearing Scanner Resistor
Cold West Bearing Scanner Resistor
Successive Cold Resistors Exceeded

Axle Alarm Summary
-------------------------------------------------------------------------------
  14  East Rail Absolute TTEX 354063 R2, B End Leading
  16  West Rail Absolute TTEX 354063 L4, B End Leading

-------------------------------------------------------------------------------
          Bearing      Wheel
Car Axle East  West  East  West   ON   OFF PW1 PW2  Alarms

  1    1    4     4    10    14  104     0 133  86  XYZ  8440 B End Leading
       2    4     4    10    14  100   103  82  84
                              .
                              .
                              .
```

The Train Detail report is divided into three sections. The header section contains general information about the site (like the MP/KP) and some detail information about the specific train (like the train's exit speed) that passed the site. The detail section contains more detailed information (like the car number) about the specific train. In between these two sections is the system-events section, which contains all System Alarms and Exception Alarms associated with the train.

The SmartScanNG system 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
                       Next Generation Detector System
                                 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
                       Next Generation Detector System
                                 TRAIN DETAIL
==============================================================================
Train#: 135                  Speed:  30 KPH                MP/KP: 0246.8
                              .
                              .
                              .
-------------------------------------------------------------------------------
Car  Axle Trk  East   West    ON   OFF   PW1 PW2  Alarms
------------------------------------------------------------------------------
  1     1   0    56     21    25     0     9   9
        2   0    57     21    25    59     9   9
        3   0    56     21    25    59     9   9
        4     CHECKSUM ERROR: StartAddr 136416 EndAddr 136427
        5   0    56     21    25    59     9   9
        6   0    56     21    25    59     9   9

  2     7   0    56     20    25   162     9   9
        8   0    56     21    25    59     9   9
                              .
                              .
                              .
END OF REPORT - Press any key...
```

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 either **dd/mm/yy** or **mm/dd/yy** format, depending on what was set by the **Date Format option** on the Units of Measure submenu. ***Chapter 11 - Serial Interface*** tells how to select the format. ***Chapter 11 - Serial Interface*** also tells how to change the date using the Date and Time submenu on the Setup menu.
Time	The time the train arrived at the site. Time is in 24-hour **hh:mm** format, where 8 a.m. is 08:00, noon is 12:00, 8 p.m. is 20:00, and midnight is 00:00. ***Chapter 11 - Serial Interface*** tells how to change the time using the Date and Time submenu on the Setup menu.
Length	Length of train. Length is in either feet (**ft**) or meters (**m**), depending on what was set by the Units of Measure submenu on the Setup menu. ***Chapter 11 - Serial Interface*** tells how to select the setting.
Speed	The train's exit speed. Speed is in either miles per hour (**mph**) or kilometers per hour (**kph**), depending on what was set by the **Speed Format option** on the Units of Measure submenu. ***Chapter 11 - Serial Interface*** tells how to select the setting.
Axles	The total number of axles counted by the SmartScanNG system.
Direction	The direction the train was traveling. Valid values are North, South, East, and West.
Shutters Open	The number of seconds it took the train to pass over the site.
MP/KP	The five-digit milepost/kilometer post of the site. ***Chapter 11 - Serial Interface*** tells how to change this value using the MP/KP submenu on the Setup menu.
Track	The track designator of the site. For single-track sites, the value is Single. For double-track sites, valid values are North, South, East, West, Main 1, Main 2, Main 3, and Middle. ***Chapter 11 - Serial Interface*** tells how to set this value using the Track Number submenu on the Setup menu.
Temperature	The ambient temperature when the train arrived at the site. Temperature is in either degrees Celsius (**C**) or degrees Fahrenheit (**F**), depending on what was set by the Units of Measure submenu on the Setup menu. ***Chapter 11 - Serial Interface*** tells how to select the setting.
Battery	The system battery voltage when the train arrived at the site.
Brng	Location of the bearing scanners. If the track orientation is east and west, the bearing scanners are labeled north and south. If the track orientation is north and south, they are labeled east and west
Max	The maximum temperature, above the ambient temperature in degrees Fahrenheit, recorded by the bearing scanner on a given railside. For example, if the ambient temperature (when the train arrived at the site) is 77°F (25°C) and the value in this field is 112, the maximum temperature would be 189°F (87.2°C).

Heading	Contents of Field
Avg	The average temperature, above the ambient temperature in degrees Fahrenheit, calculated from all recorded temperatures from the bearing scanner on a given railside. For example, if the ambient temperature (when the train arrived at the site) is 86°F (30°C) and the value in this field is 55, the average temperature would be 141°F (60.6°C).
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 Bearing Scanner Resistor alarm (on some systems, called the Cold Resistor alarm). This value was calculated using the amount of time the shutters were open and the **Resistor Test Mode option** in effect when the train exits the site. If the **Resistor Test Mode option** is disabled, a zero appears in this field.
	One of five uppercase letters follows the Resistor Req temperature. **B** The baseline resistor integrity test method was used for this train. **D** The resistor integrity test (that is, the **Resistor Test Mode option**) was disabled by the user. **I** The interim resistor integrity test method was used for this train. **T** For this train, the shutters were open for less than 30 seconds. **V** For this train, the battery voltage (measured with the shutters open) was less than 13 volts. For **D**, **T**, and **V**, the required resistor heat is set to zero (that is, a zero appears in the Resistor Read field). A **T** or **V** indicates that the integrity test was not performed due to low voltage or insufficient shutter open time, which could result in an invalid resistor integrity test if it was performed.
Txdr Count	The gating transducer designator (either TO1 or TO2) followed by the total number of hits on that transducer.
Filter A	The number of transducer pulses that were filtered by the pulse width filter (that is, those that were smaller than 3 milliseconds).
Filter B	The number of transducer pulses that were within 300 milliseconds of the previous transducer pulse.
Alarm Limit	The Hotwheel alarm level; the Hotbox alarm levels for Absolute and Differential; and the Cold Bearing Temperature offset. These values were in place when the train arrived at the site. • The value after Absolute is set by the **Absolute option** on the Alarm Settings menu. • The value after Differential is set by the **Differential option** on the Alarm Settings menu. • The value after Hot Wheel is set by the **Hotwheel option** on the Alarm Settings menu. • The value after Cold Rail Temp is set by the **Cold Bearing Temperature option** on the Alarm Settings menu. ***Chapter 11 - Serial Interface*** tells how to set these values.

Heading	Contents of Field
Carside Parms	The Carside Slope alarm parameter values that were in place when the train arrived at the site. • The value after Carside Slope is set by the **Carside Slope option** on the Alarm Settings menu. • The value after Minimum is set by the **Carside Minimum option** on the Alarm Settings menu. ***Chapter 11 - Serial Interface*** tells how to set these values.
Resistor Test Mode	The status of the post-train resistor integrity test when the train arrived at the site. Valid values (aka modes) are Enabled, Reduced, and Disabled. ***Chapter 11 - Serial Interface*** tells how to set this value using the **Resistor Test Mode option** on the Equipment menu.
Car Breakout	Approach to breaking axle patterns out into cars. Valid values are Default and Intermodal. Intermodal is used where multi-platform vehicles normally pass the site. Default is used where other traffic normally pass the site.
Wheel	Location of the wheel scanners. If the track orientation is east and west, the wheel scanners are labeled north and south. If the track orientation is north and south, they are labeled east and west. This field only appears when Hotwheel alarm reporting is enabled using the **Hotwheel option** on the Equipment menu.
Max	The maximum temperature, above the ambient temperature in degrees Fahrenheit, recorded by the wheel scanner on a given railside. This field only appears when Hotwheel alarm reporting is enabled using the **Hotwheel option** on the Equipment menu.
Avg	The average temperature, above the ambient temperature 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 **Hotwheel option** on the Equipment menu.
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 **Hotwheel option** on the Equipment menu.
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 Test Mode option** in effect when the train exits the site. If the **Resistor Test Mode option** is disabled, a zero appears in this field. This field only appears when Hotwheel alarm reporting is enabled using the **Hotwheel option** on the Equipment menu.

Heading	Contents of Field
	One of five uppercase letters follows the Resistor Req temperature. **B** The baseline resistor integrity test method was used for this train. **D** The resistor integrity test (that is, the **Resistor Test Mode option**) was disabled by the user. **I** The interim resistor integrity test method was used for this train. **T** For this train, the shutters were open for less than 30 seconds. **V** For this train, the battery voltage (measured with the shutters open) was less than 13 volts. For **D**, **T**, and **V**, the required resistor heat is set to zero (that is, a zero appears in the Resistor Read field). A **T** or **V** indicates that the integrity test was not performed due to low voltage or insufficient shutter open time, which could result in an invalid resistor integrity test if it was performed.
AEI System Data	The number of AEI tags read (by antenna0 and antenna1) 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 **AEI option** on the Equipment menu.
Firmware Versions	For Analyzer and Comm, the version numbers of the firmware and their release dates, which are in **mm/dd/yy** format. This firmware resides on the Processor board (2300-100). For Speech, the version number of the speech data. This data resides on the Interface board (2300-105). Not all systems display the version number of the speech data.

The table below lists the fields from the system-events section and the contents of each field.

Heading	Contents of Field
System Alarms	Lists each condition that could affect the ability of the system to scan trains properly for defects. If none of these conditions were encountered, this header is followed by the word "none." ***Appendix A - System Alarms*** describes the conditions that the system flags as System Alarms.
Axle Alarm Summary	Lists each Exception Alarm found on the train and the axle on which it was found. If none were found, this header is followed by the word "none."

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.
Trk	The truck number. Each railroad vehicle has two or more trucks (that is, wheel assemblies). The trucks are numbered, starting with 0, and increasing from the beginning of the train to the end. Each axle record is associated with one of these trucks. The axles are assigned the number of the truck with which they've been associated. These assigned truck numbers appear in this field. If the **Hotwheel option** on the Equipment menu is enabled, this field doesn't appear.
Bearing	Under this heading are two columns, one for each bearing scanner, containing the temperature read by the bearing scanners. If the track orientation is east and west, the bearing scanners are labeled north and south. If the track orientation is north and south, they are labeled east and west. If the **Hotwheel option** on the Equipment menu is disabled, the word "Bearing" doesn't appear, but the two columns do.
Wheel	Under this heading are two columns, one for each wheel scanner, containing the temperature read by the wheel scanners. If the track orientation is east and west, the wheel scanners are labeled north and south. If the track orientation is north and south, they are labeled east and west. This heading and the two columns under it appear only when the **Hotwheel option** on the Equipment menu is enabled.
ON	The number of milliseconds a bearing was scanned.
OFF	The number of milliseconds between axles (when no axle was between the gating transducers).
PW1	The recorded width of the pulse 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 width of the pulse 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.
Alarms	Any Exception Alarm found on the given axle.

To produce a Train Detail report:

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 SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Main Menu
-----------------------------------
 A) Train Summary
 B) Train Detail
 C) Exception Summary
          .
          .
          .
```

2 To produce the Train Detail report, type **B**

This prompt appears.

```
Train Number ?
```

3 Type the train number.

If you typed a three-digit invalid train number, the Main menu reappears. If you typed a three-digit valid train number, a report for that train is produced. The last line of the report reads: "END OF REPORT - Press any key..."

4 If you typed one or two digits, press **[Enter]**.

If you typed an invalid train number, pressing **[Enter]** causes the Main menu to reappear. If the typed train number is valid, pressing **[Enter]** produces a report for it. The last line of the report reads: "END OF REPORT - Press any key..."

5 To return to the Main menu after a report is produced, press any key.

At this time, you can produce another report by typing one of the letters **A** through **H** or **M**.

6 When done, close the LOG file.

7 To exit the serial interface and return the SmartScanNG system to normal operation, type **X**

12.3 Exception Summary Report

The Exception Summary report lists all trains currently stored in the Exceptions directory. The buffer for the Exceptions directory holds data on about 4,500 axles, but no more than 40 trains. A train is stored in the Exceptions directory if either an Exception Alarm or a System Alarm was detected on it as it passed the site. 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.

Below is a sample of part of an Exception Summary report when Hotwheel alarm detection was disabled during report processing and when the AEI subsystem was disabled during train passage. (When the report is run, if the **Hotwheel option** on the Equipment menu is disabled, the hotwheel information is hidden. When the report is run, if the **AEI option** is disabled, the tag information isn't hidden.) 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. Not all systems display the version number of the speech data.

```
                          Southern Technologies Corporation
                           Next Generation Detector System
                                 EXCEPTIONS SUMMARY
===============================================================================
Version Info.... Analyzer:  XYZ1.11-B 05/11/11                    MP/KP: 1234.5
             Communicator:  XYZ1.22-B 05/22/11                    Track: Single
                   Speech:  XYZ1.33

Alarm Limits..     Absolute: 180          Carside Slope... 1.60
               Differential: 130                Minimum... 155
                                         Cool Wheel Temp..  10
-------------------------------------------------------------------------------
                                                     D   Bearing
                                          AEI Speed i  Average      Amb
Train#   Date    Time  Cars Axles TO1 TO2 Tags (MPH) r  North South  Temp   Bat
-------------------------------------------------------------------------------
 177 A 06/21/11 08:32   20   86   86  86    0   56  E    36    37   +68F  14.0v
 176 I 06/21/11 07:40   10   46   46  46    0   57  E    43     7   +66F  14.0v
 175 B 06/21/11 06:28   14   62   62  62    0   57  E    36    37   +60F  13.8v
 170 I 06/19/11 01:22    8   38   38  38    0   53  E    55    18   +60F  14.0v
              .
              .
              .

END OF REPORT - Press any key...
```

Below is a sample of part of an Exception Summary report when the **Hotwheel option** on the Equipment menu is enabled. The contents of your report will be different.

```
                                        .
                                        .
                                        .

Alarm Limits..     Absolute: 180          Carside Slope... 1.60
               Differential: 130                Minimum... 155
                  Hot Wheel: 652         Cool Wheel Temp..  10
-------------------------------------------------------------------------------
                                                     D  Bearing      Wheel
                                          AEI Speed i  Average     Average     Amb
Train#   Date    Time Cars Axles TO1  TO2 Tags (KPH) r East  West  East  West  Temp   Bat
-----------------------------------------------------------------------------------------
                                        .
                                        .
                                        .
```

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 exception train (that is, a train having an Exception Alarm, a System Alarm, or both) that passed the site.

The SmartScanNG system 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. So, instead of getting a train record, you'll get a checksum-error line.

The table below lists the fields from the header section and the contents of each field.

Heading	Contents of Field
Version Info	For Analyzer and Comm, the version numbers of the firmware and their release dates, which are in **mm/dd/yy** format. This firmware resides on the Processor board (2300-100). For Speech, the version number of the speech data. This data resides on the Interface board (2300-105). Not all systems display the version number of the speech data.
MP/KP	The five-digit milepost/kilometer post of the site. ***Chapter 11 - Serial Interface*** tells how to change this value using the MP/KP submenu on the Setup menu.
Track	The track designator of the site. For single-track sites, the value is Single. For double-track sites, valid values are North, South, East, West, Main 1, Main 2, Main 3, and Middle. ***Chapter 11 - Serial Interface*** tells how to set this value using the Track Number submenu on the Setup menu.
Alarm Limits	These are the alarm parameters currently defined in the system setup. These values were in place when this report was run. • The value after Absolute is set by the **Absolute option** on the Alarm Settings menu. • The value after Differential is set by the **Differential option** on the Alarm Settings menu. • The heading Hot Wheel only appears if Hotwheel alarm detection is enabled. The value after Hot Wheel is set by the **Hotwheel option** on the Alarm Settings menu. • The value after Carside Slope is set by the **Carside Slope option** on the Alarm Settings menu. • The value after Minimum is set by the **Carside Minimum option** on the Alarm Settings menu. • The value after Cool Wheel Temp is set by the **Cold Bearing Temperature option** on the Alarm Settings menu. ***Chapter 11 - Serial Interface*** tells how to set these values.

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.
	There is one unlabeled columns between those labeled "Train#" and "Date." This column can contain **A**, **B**, **I**, or nothing. If "A," an Exception Alarm was detected on the train. If "I," a System Alarm was detected. If "B," both an Exception Alarm and a System Alarm were detected. If blank, no Exception Alarm or System Alarm was detected.
Date	The date the train arrived at the site. Date is in either **dd/mm/yy** or **mm/dd/yy** format, depending on what was set by the **Date Format option** on the Units of Measure submenu. ***Chapter 11 - Serial Interface*** tells how to select the format. ***Chapter 11 - Serial Interface*** also tells how to change the date using the Date and Time submenu of the Setup menu.
Time	The time the train arrived at the site. Time is in 24-hour **hh:mm** format, where 8 a.m. is 08:00, noon is 12:00, 8 p.m. is 20:00, and midnight is 00:00. ***Chapter 11 - Serial Interface*** tells how to change the time using the Date and Time submenu on the Setup menu.
Cars	The total number of cars counted by the SmartScanNG system.
Axles	The total number of axles counted by the SmartScanNG system.
TO1	The total number of hits counted by 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.
TO2	The total number of hits counted by 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.
AEI Tags	The total number of AEI tags stored. 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 **AEI option** on the Equipment menu.
Speed	The train's exit speed. Speed is in either miles per hour (**mph**) or kilometers per hour (**kph**), depending on what was set by the **Speed Format option** on the Units of Measure submenu. ***Chapter 11 - Serial Interface*** tells how to select the setting.
Dir	The direction the train was traveling. Valid values are N, S, E, and W.
Bearing Average	Under this heading are two columns, one for each bearing scanner, containing the average temperature read by the bearing scanners. If the track orientation is east and west, the bearing scanners are labeled north and south. If the track orientation is north and south, they are labeled east and west.
Wheel Average	Under this heading are two columns, one for each wheel scanner, containing the average temperature read by the wheel scanners. If the track orientation is east and west, the wheel scanners are labeled north and south. If the track orientation is north and south, they are labeled east and west. This field appears only when the **Hotwheel option** on the Equipment menu is enabled.

Heading	Contents of Field
Amb Temp	The ambient temperature when the train arrived at the site. Temperature is in either degrees Celsius (**C**) or degrees Fahrenheit (**F**), depending on what was set by the Units of Measure submenu on the Setup menu. ***Chapter 11 - Serial Interface*** tells how to select the setting.
Bat	The system battery voltage when the train arrived at the site.

To produce an Exception Summary report:

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 SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Main Menu
-----------------------------------
 A) Train Summary
 B) Train Detail
 C) Exception Summary
 D) Exception Detail
           .
           .
           .
```

2 To produce the Exception Summary report, type **C**

The last line of the report reads: "END OF REPORT - Press any key..."

3 To return to the Main menu, press any key.

At this time, you can produce another report by typing one of the letters **A** through **H** or **M**.

4 When done, close the LOG file.

5 To exit the serial interface and return the SmartScanNG system to normal operation, type **X**

12.4 Extended Exception Detail Report

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, enter a train number from the Exception Summary report. The train number appears under the column titled "Train#" in the detail section of the Exception Summary report.

Below is a sample of part of an extended Exception Detail report when Hotwheel alarm detection is disabled. 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. Not all systems display the version number of the speech data.

```
                         Southern Technologies Corporation
                          Next Generation Detector System
                                 EXCEPTION DETAIL
===============================================================================
Train#: 232                  Speed:  30 KPH                MP/KP: 0611.1
  Date: 09/09/11             Axles:  31                    Track: Single
  Time: 13:55            Direction: South            Temperature: + 51F
Length:   160 m      Shutters Open:   16 sec             Battery: 13.6V
===============================================================================
              Resistor            Filters
Brng  Max Avg Read Req   Txdr Count   A   B  Alarm        Limit  Carside Parms
-----------------------  ------------------  ------------------  -------------
East   63  62    2  68I   TO1  86     0   0  Absolute       180    Slope: 1.60
West  232  64    2  68I   TO2  86     0   0  Differential   130  Minimum: 155
                                             Hot Wheel      652
Resistor Test Mode: Disabled                 Cold Rail Temp  10

Car Breakout      : Intermodal
===============================================================================

Firmware Versions
-----------------
Analyzer: XYZ1.11-B 05/11/11   Comm: XYZ1.22-B 05/22/11   Speech: XYZ1.33
-------------------------------------------------------------------------------

System Alarms
-------------------------------------------------------------------------------
Cold East Bearing Scanner
Cold West Bearing Scanner
Successive Cold Rails Exceeded
Cold East Bearing Scanner Resistor
Cold West Bearing Scanner Resistor

Axle Alarm Summary
-------------------------------------------------------------------------------
 46  South Rail Absolute
 77  South Rail Differential
193  North Rail Absolute
193  South Rail Absolute
194  North Rail Absolute

-------------------------------------------------------------------------------
Car  Axle Trk East     West    ON   OFF PW1 PW2  Alarms

  1     1   0    4        4    95     0  77 102
        2   0    4        4    88   104  78  93
        3   0    4        4    88   102  72  89
        4   0    4        4    99    96  91  82
        5   0    3        3   195    96  92  77
        6   0    4        4    89    88  79  70

  2     7   0    3        3   190    88  65  86
        8   0    4        4    96    93  84  76
        9   0    3        3   187    93  78  77
       10   0    4        4    77   111  63  97
                              .
                              .
                              .
```

Below is a sample of part of an extended Exception Detail report when both the **AEI option** and the **Hotwheel option** are enabled when the report was requested. Also, both the **AEI option** and the **Hotwheel option** were enabled while the specified train was passing the site. 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. Not all systems display the version number of the speech data.

```
                      Southern Technologies Corporation
                       Next Generation Detector System
                               EXCEPTION DETAIL
==============================================================================
Train#: 321                 Speed:  48 KPH              MP/KP: 1234.5
  Date: 08/04/11            Axles:  52                  Track: Single
  Time: 08:26           Direction: South          Temperature: + 21C
Length:  1013 m      Shutters Open:   36 sec            Battery: 14.2v
===============================================================================
              Resistor             Filters
Brng  Max Avg Read Req   Txdr Count   A   B  Alarm        Limit  Carside Parms
-----------------------  ------------------  ------------------  -------------
East   63  62    2  68I   TO1  86     0   0  Absolute       180    Slope: 1.60
West  232  64    2  68I   TO2  86     0   0  Differential   130  Minimum: 155
                                             Hot Wheel      652
Resistor Test Mode: Disabled                 Cold Rail Temp  10

Car Breakout      : Intermodal

              Resistor
Wheel Max Avg Read Req
-----------------------
East   10  10   49  58I
West   14  14   48  58I
===============================================================================
AEI System Data

Tags Read          Tags Stored: 11
--------------
Antenna 0:  12
Antenna 1:   0
===============================================================================
Firmware Versions
-----------------
Analyzer: XYZ1.11-B 05/11/11   Comm: XYZ1.22-B 05/22/11   Speech: XYZ1.33
-------------------------------------------------------------------------------

System Alarms
----------------------------------------
Cold East Bearing Scanner Resistor
Cold West Bearing Scanner Resistor
Successive Cold Resistors Exceeded

Axle Alarm Summary
-------------------------------------------------------------------------------
  14  East Rail Absolute TTEX 354063 R2, B End Leading
  16  West Rail Absolute TTEX 354063 L4, B End Leading

-------------------------------------------------------------------------------
          Bearing      Wheel
Car Axle East  West  East  West   ON   OFF PW1 PW2  Alarms

  1    1    4     4    10    14  104     0 133  86  XYZ  8440 B End Leading
       2    4     4    10    14  100   103  82  84
       3    4     4    10    14   99    95  72  83
                          .
                          .
                          .
```

The extended Exception Detail report is divided into three sections. The header section contains general information about the site (like the MP/KP) and some detail information about the specific train (like the train's exit speed) that passed the site. The detail section contains more detailed information (like the car number) about the specific train. In between these two sections is the system-events section, which contains all System Alarms and Exception Alarms associated with the train.

The SmartScanNG system 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
                          Next Generation Detector System
                                  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
                          Next Generation Detector System
                                  EXCEPTION DETAIL
==============================================================================
Train#: 135                  Speed:  30 KPH               MP/KP: 0246.8
                            .
                            .
                            .

-------------------------------------------------------------------------------
Car  Axle Trk  East   West    ON   OFF   PW1 PW2  Alarms
------------------------------------------------------------------------------
  1     1   0    56     21    25     0     9   9
        2   0    57     21    25    59     9   9
        3   0    56     21    25    59     9   9
        4     CHECKSUM ERROR: StartAddr 136416 EndAddr 136427
        5   0    56     21    25    59     9   9
        6   0    56     21    25    59     9   9

  2     7   0    56     20    25   162     9   9
        8   0    56     21    25    59     9   9
                            .
                            .
                            .
```

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 either **dd/mm/yy** or **mm/dd/yy** format, depending on what was set by the **Date Format option** on the Units of Measure submenu. ***Chapter 11 - Serial Interface*** tells how to select the format.
Time	The time the train arrived at the site. Time is in 24-hour **hh:mm** format, where 8 a.m. is 08:00, noon is 12:00, 8 p.m. is 20:00, and midnight is 00:00. ***Chapter 11 - Serial Interface*** tells how to change the time using the Date and Time submenu on the Setup menu.
Length	Length of train. Length is in either feet (**ft**) or meters (**m**), depending on what was set by the Units of Measure submenu on the Setup menu. ***Chapter 11 - Serial Interface*** tells how to select the setting.
Speed	The train's exit speed. Speed is in either miles per hour (**mph**) or kilometers per hour (**kph**), depending on what was set by the **Speed Format option** on the Units of Measure submenu. ***Chapter 11 - Serial Interface*** tells how to select the setting.
Axles	The total number of axles counted by the SmartScanNG system.
Direction	The direction the train was traveling. Valid values are North, South, East, and West.
Shutters Open	Number of seconds it took the train to pass over the site.
MP/KP	The five-digit milepost/kilometer post of the site. ***Chapter 11 - Serial Interface*** tells how to change this value using the MP/KP submenu on the Setup menu.
Track	The track designator of the site. For single-track sites, the value is Single. For double-track sites, valid values are North, South, East, West, Main 1, Main 2, Main 3, and Middle. ***Chapter 11 - Serial Interface*** tells how to set this value using the Track Number submenu on the Setup menu.
Temperature	The ambient temperature when the train arrived at the site. Temperature is in either degrees Celsius (**C**) or degrees Fahrenheit (**F**), depending on what was set by the Units of Measure submenu on the Setup menu. ***Chapter 11 - Serial Interface*** tells how to select the setting.
Battery	The system battery voltage when the train arrived at the site.
Brng	Location of the bearing scanners. If the track orientation is east and west, the bearing scanners are labeled north and south. If the track orientation is north and south, they are labeled east and west
Max	The maximum temperature, above the ambient temperature in degrees Fahrenheit, recorded by the bearing scanner on a given railside. For example, if the ambient temperature (when the train arrived at the site) is 77°F (25°C) and the value in this field is 112, the maximum temperature would be 189°F (87.2°C).

Heading	Contents of Field
Avg	The average temperature, above the ambient temperature in degrees Fahrenheit, calculated from all recorded temperatures from the bearing scanner on a given railside. For example, if the ambient temperature (when the train arrived at the site) is 86°F (30°C) and the value in this field is 55, the average temperature would be 141°F (60.6°C).
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 Bearing Scanner Resistor alarm (on some systems, called the Cold Resistor alarm). This value was calculated using the amount of time the shutters were open and the **Resistor Test Mode option** in effect when the train exits the site. If the **Resistor Test Mode option** is disabled, a zero appears in this field.
	One of five uppercase letters follows the Resistor Req temperature. **B** The baseline resistor integrity test method was used for this train. **D** The resistor integrity test (that is, the **Resistor Test Mode option**) was disabled by the user. **I** The interim resistor integrity test method was used for this train. **T** For this train, the shutters were open for less than 30 seconds. **V** For this train, the battery voltage (measured with the shutters open) was less than 13 volts. For **D**, **T**, and **V**, the required resistor heat is set to zero (that is, a zero appears in the Resistor Read field). A **T** or **V** indicates that the integrity test was not performed due to low voltage or insufficient shutter open time, which could result in an invalid resistor integrity test if it was performed.
Txdr Count	The gating transducer designator (either TO1 or TO2) followed by the total number of hits on that transducer.
Filter A	The number of transducer pulses that were filtered by the pulse width filter (that is, those that were smaller than 3 milliseconds).
Filter B	The number of transducer pulses that were within 300 milliseconds of the previous transducer pulse.
Alarm Limit	The Hotwheel alarm level; the Hotbox alarm levels for Absolute and Differential; and the Cold Bearing Temperature offset. These values were in place when the train arrived at the site. • The value after Absolute is set by the **Absolute option** on the Alarm Settings menu. • The value after Differential is set by the **Differential option** on the Alarm Settings menu. • The value after Hot Wheel is set by the **Hotwheel option** on the Alarm Settings menu. • The value after Cold Rail Temp is set by the **Cold Bearing Temperature option** on the Alarm Settings menu. ***Chapter 11 - Serial Interface*** tells how to set these values.

Heading	Contents of Field
Carside Parms	The Carside Slope alarm parameter values that were in place when the train arrived at the site. • The value after Carside Slope is set by the **Carside Slope option** on the Alarm Settings menu. • The value after Minimum is set by the **Carside Minimum option** on the Alarm Settings menu. ***Chapter 11 - Serial Interface*** tells how to set these values.
Resistor Test Mode	The status of the post-train resistor integrity test when the train arrived at the site. Valid values (aka modes) are Enabled, Reduced, and Disabled. Chapter 11 - Serial Interface tells how to set this value using the **Resistor Test Mode option** on the Equipment menu.
Car Breakout	Approach to breaking axle patterns out into cars. Valid values are Default and Intermodal. Intermodal is used where multi-platform vehicles normally pass the site. Default is used where other traffic normally pass the site.
Wheel	Location of the wheel scanners. If the track orientation is east and west, the wheel scanners are labeled north and south. If the track orientation is north and south, they are labeled east and west. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the **Hotwheel option** on the Equipment menu.
Max	The maximum temperature, above the ambient temperature 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 **Hotwheel option** on the Equipment menu.
Avg	The average temperature, above the ambient temperature 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 **Hotwheel option** on the Equipment menu.
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 <u>enabled</u> using the **Hotwheel option** on the Equipment menu.

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 Test Mode option** in effect when the train exits the site. If the **Resistor Test Mode option** is disabled, a zero appears in this field. This field only appears when Hotwheel alarm reporting is enabled using the **Hotwheel option** on the Equipment menu.
	One of five uppercase letters follows the Resistor Req temperature. **B** The baseline resistor integrity test method was used for this train. **D** The resistor integrity test (that is, the **Resistor Test Mode option**) was disabled by the user. **I** The interim resistor integrity test method was used for this train. **T** For this train, the shutters were open for less than 30 seconds. **V** For this train, the battery voltage (measured with the shutters open) was less than 13 volts. For **D**, **T**, and **V**, the required resistor heat is set to zero (that is, a zero appears in the Resistor Read field). A **T** or **V** indicates that the integrity test was not performed due to low voltage or insufficient shutter open time, which could result in an invalid resistor integrity test if it was performed.
AEI System Data	The number of AEI tags read (by antenna0 and antenna1) 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 **AEI option** on the Equipment menu.
Firmware Versions	For Analyzer and Comm, the version numbers of the firmware and their release dates, which are in **mm/dd/yy** format. This firmware resides on the Processor board (2300-100). For Speech, the version number of the speech data. This data resides on the Interface board (2300-105). Not all systems display the version number of the speech data.

The table below lists the fields from the system-events section and the contents of each field.

Heading	Contents of Field
System Alarms	Lists each condition that could affect the ability of the system to scan trains properly for defects. If none of these conditions were encountered, this header is followed by the word "none." ***Appendix A - System Alarms*** describes the conditions that the system flags as System Alarms.
Axle Alarm Summary	Lists each Exception Alarm found on the train and the axle on which it was found. If none were found, this header is followed by the word "none."

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.
Trk	The truck number. Each railroad vehicle has two or more trucks (that is, wheel assemblies). The trucks are numbered, starting with 0, and increasing from the beginning of the train to the end. Each axle record is associated with one of these trucks. The axles are assigned the number of the truck with which they've been associated. These assigned truck numbers appear in this field. If the **Hotwheel optio**n on the Equipment menu is enabled, this field doesn't appear.
Bearing	Under this heading are two columns, one for each bearing scanner, containing the temperature read by the bearing scanners. If the track orientation is east and west, the bearing scanners are labeled north and south. If the track orientation is north and south, they are labeled east and west. If the **Hotwheel optio**n on the Equipment menu is disabled, the word "Bearing" doesn't appear, but the two columns do.
Wheel	Under this heading are two columns, one for each wheel scanner, containing the temperature read by the wheel scanners. If the track orientation is east and west, the wheel scanners are labeled north and south. If the track orientation is north and south, they are labeled east and west. This heading and the two columns under it appear only when the **Hotwheel optio**n on the Equipment menu is enabled.
ON	The number of milliseconds a bearing was scanned.
OFF	The number of milliseconds between axles (when no axle was between the gating transducers).
PW1	The recorded width of the pulse 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 width of the pulse 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.
Alarms	Any Exception Alarm found on the given axle.

To produce the extended Exception Detail report:

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 SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Main Menu
-----------------------------------
 A) Train Summary
 B) Train Detail
 C) Exception Summary
 D) Exception Detail
 E) System Status
           .
           .
           .
```

2. To select the Exception Detail report, type **D**

   This prompt appears.

```
Train Number ?
```

3. Type the train number.

   If you typed a three-digit invalid train number, the Main menu reappears. If you typed a three-digit valid train number, the prompt below appears.

4. If you typed one or two digits, press **[Enter]**.

   If you typed an invalid train number, the Main menu reappears. If you typed a valid train number, this prompt appears.

```
Abbreviated Listing ?
```

5. To produce the extended Exception Detail report, type **N**

   If you typed an invalid train number, the Main menu reappears. If the typed train number is valid, a report for that train is produced. The last line of the report reads: "END OF REPORT - Press any key..."

6 To return to the Main menu after a report is produced, press any key.

   At this time, you can produce another report by typing one of the letters **A** through **H** or **M**.

7 When done, close the LOG file.

8 To exit the serial interface and return the SmartScanNG system to normal operation, type **X**

12.5 Abbreviated Exception Detail Report

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 immediately before and immediately after them.

Like the extended Exception Detail report, the abbreviated Exception Detail report is divided into three sections. The header section contains general information about the site (like the MP/KP) and some detail information about the specific train (like the train's exit speed) that passed the site. The detail section contains more detailed information (like the car number) about the specific train. In between these two sections is the system-events section, which contains all System Alarms and Exception Alarms associated with the train.

Below is a sample of part of an abbreviated Exception Detail report when the **AEI option**, the **Carside Slope option**, and the **Hotwheel option** were all disabled when the report was requested. The contents of your report will be different.

```
                         Southern Technologies Corporation
                          Next Generation Detector System
                           EXCEPTION DETAIL - ABBREVIATED
==============================================================================
Train#: 232                  Speed:  30 KPH                 MP/KP: 0611.1
  Date: 09/09/11             Axles:  31                     Track: Single
  Time: 13:55            Direction: South             Temperature: + 77F
Length:   160 m      Shutters Open:   16 sec              Battery: 13.6V
==============================================================================
                            .
                            .
                            .

System Alarms
-------------------------------------------------------------------------------
Cold North Bearing Scanner Resistor

Axle Alarm Summary
-------------------------------------------------------------------------------
  6  North Rail Absolute
 27  Dragging Equipment
 28  Dragging Equipment
 37  North Rail Absolute
105  North Rail Differential

------------------------------------------------------------------------------
Car  Axle  Trk  North  South    ON   OFF   PW1 PW2   Alarms
------------------------------------------------------------------------------

  1     1    0    56     21     25     0    10  11
        2    0    57     21     25    59     9   9
        3    0    57     22     25    59     9   9
        4    0    57     22     25   562     9   9

  2     5    0    56     22     25   162     9   9
        6    0   189    110     25   641     9   9   North Rail Absolute
        7    0    57     22     25    59     8   9
        8    0    57     22     25   562     9   9

  3     9    0    56    113     25   162     9   9
       10    0    57     23     25    59     9   9
       11    0    57     24     25    59     9   9
       12    0    57     23     25   562     9   9

  6    21    0    56     23     25   162     9   9
       22    0    57     23     26    58     9   9
       23    0    57     23     26   561     9   9
       24    0    57     22     26    58     9   9

  7    25    0    56     22     25   162     9   9
       26    0    57     21     26    58     9   9
       27    0    57     22     26   561     9   9   Dragging Equipment
       28    0    57     23     26    58     9   9   Dragging Equipment

  8    29    0   56      22     25   162     9   9
       30    0   57      22     26    58     9   9
                            .
                            .
                            .
```

To produce the abbreviated Exception Detail report:

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 SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Main Menu
-----------------------------------
 A) Train Summary
 B) Train Detail
 C) Exception Summary
 D) Exception Detail
 E) System Status
              .
              .
              .
```

2 To select the Exception Detail report, type **D**

This prompt appears.

```
Train Number ?
```

3 Type the train number.

If you typed a three-digit invalid train number, the Main menu reappears. If you typed a three-digit valid train number, the prompt below appears.

4 If you typed one or two digits, press **[Enter]**.

If you typed an invalid train number, the Main menu reappears. If you typed a valid train number, this prompt appears.

```
Abbreviated Listing ?
```

5 To produce the abbreviated Exception Detail report, type **Y**

If you typed an invalid train number, the Main menu reappears. If the typed train number is valid, a report for that train is produced. The last line of the report reads: "END OF REPORT - Press any key..."

6 To return to the Main menu after a report is produced, press any key.

At this time, you can produce another report by typing one of the letters **A** through **H** or **M**.

7 When done, close the LOG file.

8 To exit the serial interface and return the SmartScanNG system to normal operation, type **X**

12.6 System Status Report

The System Status report contains the system's current setup configuration. Once a SmartScanNG system is set up properly, print this report and keep it in the wayside enclosure for future reference. Should you ever need to set up the system again, you'll have most of the information you'll need 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
                        Next Generation Detector System
                             SYSTEM STATUS REPORT
===============================================================================
  Date: 13/12/11      Time: 19:35      Battery: 14.2V      Ambient Temp.: +73F
-------------------------------------------------------------------------------

   MP/KP....... 1234.5    Track Dir... N/S   Track....... Single

   Alarm Settings
   ------------------------------------------------------------
     Absolute........  180       Carside Slope...... 1.60
     Differential....  130               Minimum....  155
     Warm Bearing....   80       Cold Bearings......    1
     Blocked Scanner.    5       Cold Bearing Temp..   10
     Hot Wheel.......  650

   Equipment
   ------------------------------------------------------------
     Dragger.........  YES      Gate Distance.... 24.0 inches
     High Load.......  NO       Clearance Type... Trip Wire
     Wide Load.......  NO       Clearance Mode... Multiplexed
     Carside Slope...  NO       Winter Cycle..... NO
     Hot Wheel.......  NO       Transducer Gain.. Normal
     AEI.............  NO       Solar Powered.... NO
     Resistor Test...  Enabled  Car Breakout..... Intermodal

   Selected Modem............. Default
        Modem Setup Line 1 = +++
        Modem Setup Line 2 = AT&F
        Modem Setup Line 3 = AT &D0 &E1 &E15 S0=1 V0
        Modem Setup Line 4 = AT E0 X4 $SB19200
        Modem Setup Line 5 = AT &W0

   Messages
   ------------------------------------------------------------
     Axles............  YES       Speed............  NO
     Temperature......  YES       Length...........  NO
     Slow.............  YES       Power Off........  YES
     Repeat No Defects. YES       Cars.............  NO
     Car ID With Alarm. NO        Rebroad DTMF Code. 001
     Primary Language.. English   Request EOT Timer.   10
     Secondary Language NONE

   Units Of Measure
   ------------------------------------------------------------
     Date.....  dd/mm/yyyy   Ambient Temperature...  Fahrenheit
     Speed....  KPH          Length................  Meters
                            .
                            .
                            .
```

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. Not all systems display the version number of the speech data.

```
                          .
                          .
                          .

   Scanner Calibration Date / Digital Potentiometer Settings
   -----------------------------------------------------------------
     Rail1...05/30/2011 03:57 / 43    Rail2...05/30/2011 04:01 / 41
     Wheel1..05/30/2011 04:05 / 40    Wheel2..05/30/2011 04:09 / 42

   Port Settings
   ------------------------------------------------------------
     COM1 Tx/Rx Baud 19200/19200 N-8-1
     COM2 Tx/Rx Baud 19200/19200 N-8-1
     COM3 Tx/Rx Baud 19200/19200 N-8-1
     COM4 Tx/Rx Baud 19200/19200 N-8-1

   DCS Parameters
   ------------------------------------------------------------
     Poll ID....................  246
     Connection Mode..........  Direct
     Retry Attempts.............    0
     Retry Delay................  255
     Phone #1................... None
     Phone #2................... None
     Phone #3..... ............. None

   AEI Reader Parameter Menu
   ------------------------------------------------------------
     ID Separation.......  2 ID's
     Consecutive Reads...  2 Reads
     Decode As ASCII Tags  Disabled

                               COP
   Software Versions           Resets   Flags
   ------------------------------------------------------------
     Analyzer:  XYZ1.11-B 01/13/11   0
     Comm    :  XYZ1.22-B 01/13/11   2
     Speech  :  XYZ1.33

   Hardware
   ------------------------------------------------------------
     EPCC 02/04/11  S/N: 410304            SICM Version 1.3

   Resistor Data
------------------------------------------------------------------------------
VOLTS  DATE     TIME    30   40   50   60   70   80   90  100  110  120 STATUS
------------------------------------------------------------------------------
Rail 1
13.8  06/04/11  09:20   37,   9, 300, 297,   3, 180,   5, 300, 300, 300 VALID
Rail 2
13.8  06/04/11  09:30  300, 300, 300, 300, 300, 300, 300, 300, 300, 300 VALID
Wheel 1
13.8  06/04/11  09:40  300, 300, 300, 300, 300, 300, 300, 300, 300, 300 VALID
Wheel 2
13.8  06/04/11  09:50  300, 300, 300, 300, 300, 300, 300, 300, 300, 300 VALID

===============================================================================

END OF REPORT - Press any key...
```

The table below lists the fields on the System Status report and the contents of each field.

Heading	Contents of Field
Date	The date when this report was generated. Date is in either **dd/mm/yy** or **mm/dd/yy** format, depending on what was set by the **Date Format option** on the Units of Measure submenu. ***Chapter 11 - Serial Interface*** tells how to select the format.
Time	The time when this report was generated. Time is in 24-hour **hh:mm** format, where 8 a.m. is 08:00, noon is 12:00, 8 p.m. is 20:00, and midnight is 00:00. ***Chapter 11 - Serial Interface*** tells how to change this value using the Date and Time submenu on the Setup menu.
Battery	The system battery voltage when this report was generated.
Ambient Temp	The ambient temperature when this report was generated. Temperature is expressed in either degrees Fahrenheit or degrees Celsius, depending on what was set by the Units of Measure submenu. ***Chapter 11 - Serial Interface*** tells how to select the expression.
MP/KP	The five-digit milepost/kilometer post of the site. ***Chapter 11 - Serial Interface*** tells how to change this value using the MP/KP submenu.
Track Dir	The track direction of the site. Valid values are N/S (for north/south) and E/W (for east/west). ***Chapter 11 - Serial Interface*** tells how to change this value using the Track Number submenu.
Track	The track designator of the site. For single-track sites, the value is Single. For double-track sites, valid values are North, South, East, West, Main 1, Main 2, Main 3, and Middle. ***Chapter 11 - Serial Interface*** tells how to change this value using the Track Number submenu.
Alarm Settings	The alarm parameters and limits as they are currently defined in the system setup. ***Chapter 11 - Serial Interface*** tells how to change these parameters and limits using the Alarm Settings menu.
Equipment	Equipment configuration as currently defined in system setup. ***Chapter 11 - Serial Interface*** tells how to change this configuration using the Equipment menu.
Messages	Message configuration as currently defined in system setup. ***Chapter 11 - Serial Interface*** tells how to change this configuration using the Messages menu.
Units of Measure	How the system reports the date, ambient temperature, speed, and length of train. ***Chapter 11 - Serial Interface*** tells how to change this configuration using the Units of Measure submenu.

Heading	Contents of Field
Scanner Calibration Date	Date and time each scanner was last calibrated. The autocalibration function maintains these fields.
Digital Potentiometer Settings	The settings of the digital potentiometers that the reader processor adjusts when calibrating the bearing and wheel scanners. Typical settings are in the 30 to 40 range.
Port Settings	Communications port parameter settings as currently defined in system setup. These parameters reflect the baud rate and parity settings for each communications port. ***Chapter 11 - Serial Interface*** tells how to change these parameter settings using the Setup menu.
DCS Parameters	Below are the DCS Parameters currently defined in the system setup. These values were in place when this report was run. • **Poll ID** is the user-specified poll identifier. • **Connection Mode** is the method used to connect the SmartScanNG system to a host computer for the purpose of systematically transferring train data to the host. The connection can either be a direct (always-on) connection or a dial-up (via modem) connection. • **Retry Attempts** is the number of retry attempts that the SmartScanNG system makes if a transfer fails. If the value is 0, the transfer is attempted one time with no retries if the initial attempt fails. • **Retry Delay** is the number of seconds that the SmartScanNG system waits between transfer attempts. • **Phone #1** is the first phone number that is dialed in an attempt to transfer a report for a given train. If there isn't any phone that can be called, this header is followed by the word "none." • **Phone #2** is the second phone number that is dialed in an attempt to transfer a report for a given train. This happens if the SmartScanNG system fails to transfer the report to the host system at "Phone #1." If there isn't a second phone that can be called, this header is followed by the word "none." • **Phone #3** is the third phone number that is dialed in an attempt to transfer a report for a given train. This happens if the SmartScanNG system fails to transfer the report to the host system at "Phone #1" and "Phone #2." If there isn't a third phone that can be called, this header is followed by the word "none." ***Chapter 11 - Serial Interface*** tells how to change these parameter settings using the DCS Parameters menu.

Heading	Contents of Field
AEI Reader Parameters Menu	This heading always appears, even if the AEI subsystem is disabled using the **AEI option** on the Equipment menu. Below are the AEI Reader Parameters currently defined in the system setup. These values were in place when this report was run. • **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. • **Decode as ASCII Tags** specifies whether the tag data is to be interpreted as ASCII characters or in the encoded format. ***Chapter 11 - Serial Interface*** tells how to set these values using the AEI Reader Parameters menu on the Setup menu.
Software Versions	For Analyzer and Comm, the version numbers of the firmware and their release dates, which are in **mm/dd/yy** format. This firmware resides on the Processor board (2300-100). For Speech, the version number of the speech data. This data resides on the Interface board (2300-105). Not all systems display the version number of the speech data.
COP Resets	Number of COP resets occurring since the last time the counters were cleared. The top value is for processor-A (aka Analyzer Processor) on the Processor board (2300-100). The middle value is for processor-B (aka Communications Processor) on the same board. ***Chapter 11 - Serial Interface*** tells how to clear the counters using the System Functions menu.
Hardware	For **EPCC**, the date tested and serial number of the Processor board (2300-100). An automated testing station at STC tested this board. It is possible to have a board that was manufactured and tested before STC implemented automated testing. When this is the case, some obvious incorrect values, such as "255/255/255 S/N:255255," are usually displayed. These incorrect values are harmless and can be ignored. For **SICM**, the version number of the Interface board (2300-105). If your board is a version earlier than 1.3, this header and following number won't appear on the System Status report. Not all systems display the version number of the SICM.
Resistor Data	**See explanation below.**

For the resistor integrity test that is performed after train passage, there are two methods used to calculate the expected resistor temperature. The baseline resistor integrity test method requires the prerequisite of valid resistor baseline data to be stored in nonvolatile memory. Until the system acquires this data, it applies the interim resistor integrity test method to each train. The resistor data used in the baseline resistor integrity test method appears at the bottom of the System Status report, as shown below.

```
      Resistor Data
-----------------------------------------------------------------------------
VOLTS  DATE     TIME    30   40   50   60   70   80   90  100  110  120 STATUS
-----------------------------------------------------------------------------
RAIL 1
13.4  03/08/11  13:39  103, 130, 152, 168, 183, 195, 204, 211, 217, 223 VALID

RAIL 2
13.5  03/09/11  08:50   76,  92, 104, 111, 118, 123, 127, 130, 132, 134 VALID
```

Included in the data above is a resistor heat profile of each scanner resistor, which covers a period of 30 to 120 seconds, in 10-second intervals. The differences in resistor heat between the two scanners are due to the cable lengths used in this example. A 65-foot (19.8-meter) cable for the rail-1 bearing scanner and a 100-foot (30.5-meter) cable for the rail-2 bearing scanner. Additional items in the data are the battery voltage measured with the shutters open, the date and time of the data acquisition, and the status of the heat profile data.

In this example, the status of both sets of resistor data is valid. Meaning they are being used in the baseline integrity test for each train. There are two other possibilities for status, pending and invalid. If the word PENDING appears in the status column, the system is waiting for the resistors to cool before acquiring resistor data or for the battery to charge to 13 volts. INVALID indicates that the system has tried twice and could not acquire valid resistor data. In either case, the system applies the interim integrity test to passing trains, which doesn't require resistor baseline data.

The system acquires the resistor data 20 minutes after the user calibrates the scanners with the autocalibration function. The resistor data acquisition runs unattended. Twenty minutes is the cooling period required to allow the resistors to return to ambient temperature after autocalibration. If a train should interrupt the cooling period, the resistor data acquisition runs 20 minutes after the shutters close following the passage of the train.

During the resistor-cooling period, the system announces through the speaker the following. These announcements aren't broadcast over the radio.

- A beep sounds once per minute until two minutes before the resistor test.
- At two minutes until the test, "Scanner resistor test beginning in 2 minutes" is voiced.
- At one minute until the test, "Scanner resistor test beginning in 1 minute" is voiced.

After the resistor cooling period:

- As the test begins, "Testing" is voiced. During this time, the word PENDING appears in the status column of the Resistor Data section.
- If the test was successful, "System working" is voiced. The word VALID appears in the status column of the Resistor Data section, signifying that the baseline test applies to each passing train.
- If the test wasn't successful, "Scanner resistor test beginning in two-zero minutes" is voiced, meaning that the system will try once more after 20 minutes to acquire an accurate resistor heat profile. During this time, the word PENDING appears in the status column of the Resistor Data section. If the test fails a second time, the word INVALID appears in the same column. The system applies the interim integrity test to each passing train while either PENDING or INVALID appears.

To produce a System Status report:

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.

```
          .
          .
          .

  D) Exception Detail
  E) System Status
  F) Last Train
          .
          .
          .
```

2 To produce the System Status report, type **E**

The last line of the report reads: "END OF REPORT - Press any key..."

3 To return to the Main menu, press any key.

At this time, you can produce another report by typing one of the letters **A** through **H** or **M**.

4 When done, close the LOG file.

5 To exit the serial interface and return the SmartScanNG system to normal operation, type **X**

12.7 Last Train Report

The Last Train report is identical to the Train Detail report. There is a difference in the way you specify the train for which you want a report. For this report, you don't specify a train. A report on the most current train is produced.

To produce a Last Train report:

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.

   ```
             .
             .
             .
   E) System Status
   F) Last Train
   G) Last Test Train
             .
             .
             .
   ```

2. To produce the Last Train report, type **F**

   The last line of the report reads: "END OF REPORT - Press any key..."

3. To return to the Main menu, press any key.

   At this time, you can produce another report by typing one of the letters **A** through **H** or **M**.

4. When done, close the LOG file.

5. To exit the serial interface and return the SmartScanNG system to normal operation, type **X**

12.8 Last Test Train Report

The Last Test 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 ramp train (aka test train) is produced.

To produce a Last Test Train report:

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.

```
              .
              .
              .

     F) Last Train
     G) Last Test Train
     H) AEI Diagnostic Detail
              .
              .
              .
```

2 To produce the Last Test Train report, type **G**

  The last line of the report reads: "END OF REPORT - Press any key..."

3 To return to the Main menu, press any key.

  At this time, you can produce another report by typing one of the letters **A** through **H** or **M**.

4 When done, close the LOG file.

5 To exit the serial interface and return the SmartScanNG system to normal operation, type **X**

12.9 AEI Diagnostic Detail Report

The AEI Diagnostic 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 menu. The AEI subsystem is enabled/disabled using the **AEI option** on the Equipment menu. 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 an AEI Diagnostic Detail report when both the **AEI option** and the **Hotwheel option** are enabled when the report was requested. Also, both the **AEI option** and the **Hotwheel option** where enabled while the specified train was passing the site. 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
                         Next Generation Detector System
                                  TRAIN DETAIL
===============================================================================
Train#: 321                  Speed:  48 KPH                 MP/KP: 1234.5
  Date: 08/04/11             Axles:  52                     Track: Single
  Time: 08:26            Direction: South             Temperature: + 21C
Length:  1013 m      Shutters Open:   36 sec              Battery: 14.2v
===============================================================================
              Resistor                 Filters
Brng  Max Avg Read Req   Txdr Count   A   B  Alarm        Limit  Carside Parms
-----------------------  ------------------  ------------------  -------------
East   63  62    2  68I   TO1  86     0   0  Absolute       180    Slope: 1.60
West  232  64    2  68I   TO2  86     0   0  Differential   130  Minimum: 155
                                             Hot Wheel      652
Resistor Test Mode: Disabled                 Cold Rail Temp  10

Car Breakout      : Intermodal

              Resistor
Wheel Max Avg Read Req
-----------------------
East   10  10   49  58I
West   14  14   48  58I
===============================================================================
AEI System Data

Tags Read          Tags Stored: 11
--------------
Antenna 0:  12
Antenna 1:   0
===============================================================================
Firmware Versions
-----------------
Analyzer: XYZ1.11-B 05/11/11   Comm: XYZ1.22-B 05/22/11   Speech: XYZ1.33
-------------------------------------------------------------------------------

System Alarms
----------------------------------------
Cold East Bearing Scanner Resistor
Cold West Bearing Scanner Resistor
Successive Cold Resistors Exceeded

Axle Alarm Summary
-------------------------------------------------------------------------------
  14  East Rail Absolute TTEX 354063 R2, B End Leading
  16  West Rail Absolute TTEX 354063 L4, B End Leading

-------------------------------------------------------------------------------
          Bearing      Wheel
Car Axle East  West  East  West   ON   OFF PW1 PW2  Alarms

  1  6  1 B   0  0  0   0  0 E  ST:000985 ET:001713       0
     6 L?  5 XYZ     8440   0 P0  001568|000000 001|000  70

  1    1    4     4    10    14  104     0 133  86  XYZ  8440 B End Leading
       2    4     4    10    14  100   103  82  84
       3    4     4    10    14   99    95  72  83
       4    5     5    10    14  101    95  79  83
       5    4     4    10    14   95    99  77  81
       6    4     4    10    14  110    94  96  74

  2  6  1 B   0  0  0   0  0 S  ST:002855 ET:005041       0
     6 L?  5 XYZ     6064   0 P0  004652|000000 001|000  70

  2    7    4     4    10    14  101   108  84  88  XYZ  6064 A End Leading
       8    4     4    10    14  100   102  83  85

              .
              .
              .
```

Like the Train Detail report, the AEI Diagnostic Detail report is divided into three sections. The header section contains general information about the site (like the MP/KP) and some detail information about the specific train (like the train's exit speed) that passed the site. The detail section contains more detailed information (like the car number) about the specific train. In between these two sections is the system-events section, which contains all System Alarms and Exception Alarms associated with the train.

Unlike the Train Detail report, the AEI Diagnostic Detail report has an additional two lines per car. Below is part of the sample AEI Diagnostic Detail report that dealt specifically with AEI diagnostic data. These two lines are representative of similar lines added for each vehicle in the train's consist.

```
1   6   1 B    0  0  0    0  0 E  ST:000985 ET:001713       0  <-Vehicle related data
    6 L?  5 XYZ      8440    0 P0  001568|000000 001|000  70  <-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	AAR Format Only
1	Vehicle number – the standing order number of the associated vehicle in relation to the train's consist.	No
6	Axle count – the number of axles recorded for the vehicle.	No
1	Tag count – the number of AEI tag records associated with the vehicle.	No
B	The orientation of the vehicle in the train's consist – **A**-end or **B**-end forward.	Yes
0 0 0 0 0	*Reserved for future diagnostics development.*	-----
E	The direction the vehicle traveled.	No
ST:000985	Vehicle starting timestamp – the timer starts when train presence is detected.	No
ET:001713	Vehicle ending timestamp.	No

The table below defines the relevant fields in line two (tag related data). For those items that contain "Yes" in the last column, when ASCII format AEI tags are being used, these fields aren't available from the tags or cannot be determined due to unavailable tag data. In reference to the track, **antenna0** is the northmost or eastmost antenna. **Antenna1** is the southmost or westmost antenna.

Field Value	**Field Definition**	**AAR Format Only**
6	Axle count – from tag data.	Yes
L	Tag pair read indicator – **L** = left tag missing, **R** = right tag missing **G** = both tags present.	Yes
?	*Reserved for future diagnostics development.*	-----
5	Equipment Group Code from tag data.	Yes
XYZ 8440	AEI vehicle identification.	No
0	*Reserved for future diagnostics development.*	-----
P0	Platform code – from tag data.	Yes
001568	Antenna0 tag read timestamp – in milliseconds from start of train.	No
000000	Antenna1 tag read timestamp – in milliseconds from start of train.	No
001	Antenna0 tag read "handshakes" – the number of times a tag was read.	No
000	Antenna1 tag read "handshakes" – the number of times a tag was read.	No
70	Vehicle length – from tag data.	Yes

To produce an AEI Diagnostic Detail report:

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.

```
            .
            .
            .

    G) Last Test Train
    H) AEI Diagnostic Detail
    I) Replay EOT Announcement
            .
            .
            .
```

2 To produce the AEI Diagnostic Detail report, type **L**

This prompt appears.

```
  Train Number ?
```

3 Type the train number.

If you typed a three-digit invalid train number, the Main menu reappears. If you typed a three-digit valid train number, a report for that train is produced. The last line of the report reads: "END OF REPORT - Press any key..."

4 If you typed one or two digits, press **[Enter]**.

If you typed an invalid train number, pressing **[Enter]** causes the Main menu to reappear. If the typed train number is valid, pressing **[Enter]** produces a report for it. The last line of the report reads: "END OF REPORT - Press any key..."

5 To return to the Main menu after a report is produced, press any key.

At this time, you can produce another report by typing one of the letters **A** through **H** or **M**.

6 When done, close the LOG file.

7 To exit the serial interface and return the SmartScanNG system to normal operation, type **X**

12.10 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 300 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 power outage, but can be deleted with the **Clear Event Log option** on 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.

Below is a sample of an Event Log report containing no events. The date/time at the top of the report is the system date/time when this report was generated. The contents of your report may be different.

```
Southern Technologies Corporation                                Event Log

                               09/07/2011
                                13:39:02
==============================================================================
No Events!

--------------------------------  End of Report  ------------------------------
```

Below is a sample of part 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 when this 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 (date is in mm/dd/yy format)
- The time at which the event was recorded (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)
- The event description

```
Southern Technologies Corporation                                Event Log

                               09/07/2011
                                10:08:02
==============================================================================
  42 09/05/11 13:36:20 <Train Stored>
  41 09/05/11 13:36:17 <Store Train #118>
  40 09/30/11 19:18:47 <Excep. Train Stored>
  49 09/30/11 19:18:43 <Store Excep. Train #105>
                             .
                             .
                             .

--------------------------------  End of Report  ------------------------------
```

To produce an Event Log report:

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.

```
              .
              .
              .

    L) System Functions
    M) Event Log
    X) Exit
```

2 To produce the Event Log report, type **M**

The last line of the report reads: "END OF REPORT - Press any key..."

3 To return to the Main menu, press any key.

At this time, you can produce another report by typing one of the letters **A** through **H** or **M**.

4 When done, close the LOG file.

5 To exit the serial interface and return the SmartScanNG system to normal operation, type **X**

Chapter 13
Radio Announcements

Currently, the two ways of reporting defects are:

- Announcements made via the road channel
- Reports, which may be printed to provide detailed defect information

This chapter describes radio announcements. The prior chapter described reports.

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. They are shown in English. By using the **Primary Language option** on the Messages menu, you can specify if you want the messages announced in English, French, or Spanish. Instead of just the **Primary Language option**, some systems let you choose both a **Primary Language option** and a **Secondary Language option**. If your system does, the radio announcement is broadcast first in the primary language you chose and then in the secondary language you chose.

In the examples that follow, the use of the abbreviation SITE is for example purposes only. There is no railroad named SITE. In the actual announcement, SITE will normally be replaced with the customer's railroad name. In the examples that follow, the message "S-I-T-E Detector" is announced because it was enabled using the **Announce Customer Name option** on the Messages menu. Not all systems have this option. If your system doesn't have it, sometimes just the word "Detector" is announced instead of a customer's railroad name.

Each SmartScanNG system has a priority level assigned to it, based on the setting of the Track Number submenu on the Setup menu. Associated with these priorities are two timers, as shown below.

Track Designator	Priority	Broadcast Delay	Maximum Holdoff
Single	1	3 sec	50 sec
Main 1	1	3 sec	50 sec
Main 2	2	5 sec	60 sec
Main 3	3	7 sec	70 sec
North	4	9 sec	80 sec
East	4	9 sec	80 sec
South	5	11 sec	90 sec
West	5	11 sec	90 sec
Middle	6	13 sec	100 sec

Broadcast Delay is the amount of time a given SmartScanNG system delays the broadcasting of a message, after it has detected an inactive Holdoff input. **Maximum Holdoff** is the maximum amount of time a given SmartScanNG system delays broadcasting a message while waiting for the holdoff input to clear. If this timeout period expires and the holdoff input remains active, the detector will broadcast its pending message anyway.

Anytime a message needs to be announced, the expanded holdoff logic kicks in, and the process is as follows:

1. Start the Broadcast Delay timer and wait until it expires.

   The Holdoff line is enabled when the road channel is busy.

2. Check the Holdoff line.
3. If the Holdoff line is free, announce your messages and skip the remaining steps.
4. If the Holdoff line is currently in use, start the Holdoff timer and begin monitoring the Holdoff line.
5. If the Holdoff line becomes free (that is, if the Holdoff line frees up before the Holdoff timer expires), return to step **1**.
6. If the Holdoff timer expires (that is, if the Holdoff timer expires without the Holdoff line ever becoming free), announce your messages.

13.1 Arrival Messages

The arrival message is used to announce train arrival at the site. This message isn't available on all systems. On those systems on which it is available, it's optional. If it were available on your system, you would enable or disable it using the **Announce Arrival Message option** on the Messages menu.

If you selected mph with the **Speed Format option** on the Units of Measure submenu, the word "milepost" will be announced. If you selected kph with the **Speed Format option** on the Units of Measure submenu, the words "kilometer post" will be announced instead.

If mph was selected, the format of this announcement is:

[customer name] milepost (milepost number) [track indicator]

If kph was selected, the format of this announcement is:

[customer name] kilometer post (kilometer-post number) [track indicator]

At a double-track site, "track indicator" represents the position in the message text that the track designator (such as "East Track") is inserted into the announcements. At a single-track site, no message text is inserted for track indicator.

For example, at a single-track site with mph selected, the announcement is like this. In this example, milepost 359.4 was used.

S-I-T-E Detector
Milepost 3-5-9 point 4

At a double-track site with kph selected, the announcement is like this. In this example, kilometer post 291.1 was used.

S-I-T-E Detector
Kilometer Post 2-9-7 Point 1
South Track

The arrival message is only announced once per train.

13.2 Real-Time Messages

Real-time messages consist of announcements that occur as the train is passing over the site. No matter what kind of defect was detected, there is only one general format for this announcement.

If mph was selected, the format of this announcement is:

[customer name] milepost (milepost number) [track indicator]
You Have A Defect

If kph was selected, the format of this announcement is:

[customer name] kilometer post (kilometer-post number) [track indicator]
You Have A Defect

For example, at a single-track site with mph selected, the announcement is like this. In this example, milepost 321.4 was used.

S-I-T-E Detector
Milepost 3-2-1 Point 4
You Have A Defect

At a double-track site with mph selected, the announcement is like this. In this example, milepost 72.9 was used.

S-I-T-E Detector
Milepost 7-2 Point 9
South Track
You Have A Defect

No matter how many defects are found, the real-time message is only announced once per train.

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 SmartScanNG system.

These messages consist of four 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 and Integrity Failures not detected
- Exception Alarms detected and Integrity Failures detected

Exception Alarms are associated with axles. When the **Clearance Mode option** on the Messages menu is set to separate, there are eight Exception Alarms. They are the Absolute, Carside Slope, Differential, Dragging-Equipment, **High-Load**, Hotwheel, Pyrometer Saturation, and **Wide-Load** alarms. When the **Clearance Mode option** is set to multiplexed, there are seven Exception Alarms. They are the Absolute, Carside Slope, Differential, Dragging-Equipment, **High-Wide**, Hotwheel, and Pyrometer Saturation alarms.

The four types of Hotbox 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 only announces Dragging-Equipment, High-Load, High-Wide, Hotbox, Hotwheel, and Wide-Load.

Integrity Failures are the Dead Battery, Dead Resistor, Dead Wheel Scanner Resistor, Stuck Dragger During Train Passage, Stuck Dragger Pretrain, Stuck High-Load Detector Pretrain, Stuck Wide-Load Detector Pretrain, Successive Cold Rails Exceeded, Successive Cold Resistors Exceeded, Successive Cold Wheel Resistors Exceeded, Successive Cold Wheels Exceeded, and sometimes Highrange Transducer Miscounts alarms.

The Highrange Transducer Miscounts alarm can be either a System Alarm or an Integrity Failure, depending on the presence of a Very Slow Train alarm. If a highrange transducer miscount occurs on a train that also contains a Very Slow Train alarm, the firmware treats the miscount condition as a System Alarm. If a highrange transducer miscount occurs on a train traveling faster than 7 mph (11.3 kph), the firmware treats the miscount condition as an Integrity Failure.

Below is the Messages menu. 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.

```
Messages, MP/KP-1234.5, Track:Single
------------------------------------------------------------
  A  Axles...................  YES
  B  Speed...................  NO
  C  Temperature.............  YES
  D  Length..................  NO
  E  Slow....................  YES
  F  Power Off...............  YES
  G  Repeat No Defects........  YES
  H  Cars....................  NO
  I  Primary Language.........  English
  J  Secondary Language.......  NONE
  K  Request EOT Timer........  10
  L  Rebroad DTMF Code........  001
  M  Car ID With Alarm........  NO
  N  Customer Name............  YES
  O  Arrival Message..........  YES

Message to change or Esc to quit ?
```

Enabling one or more of these options generates the ancillary messages: A (axle count), B (train speed), C (site ambient temperature), D (train length), E (slow train), F (power off), and H (number of cars). The other options of the Messages menu aren't used to generate ancillary messages.

In the examples that follow, not all ancillary messages are shown. This is because only axle count and train speed were enabled. That is, only the **Announce Axles option** on the Messages menu and the **Announce Speed option** on the Messages menu were enabled.

If you selected mph with the **Speed Format option** on the Units of Measure submenu and the **Announce Speed option** on the Messages menu is enabled, the speed of the train will be announced in miles per hour. If you selected kph, the speed of the train will be announced in kilometers per hour.

Site ambient temperature, train length, number of cars, power off, and slow train were disabled. ***Chapter 11 - Serial Interface*** tells how to enable and disable these messages using the Messages menu on the Setup menu.

If you selected Celsius with the **Temperature Format option** on the Units of Measure submenu and the **Announce Temperature option** on the Messages menu is enabled, the ambient temperature will be announced in Celsius. If you selected Fahrenheit, the ambient temperature will be announced in Fahrenheit. Neither the word Celsius nor the word Fahrenheit is announced.

If you selected feet with the **Length Format option** on the Units of Measure submenu and the **Announce Train Length option** on the Messages menu is enabled, the length of the train will be announced in feet. If you selected meters, the length of the train will be announced in meters. Neither the word feet nor the word meters is announced.

When the Highrange Transducer Miscounts alarm or Very Slow Train alarm occurs, the system won't announce axle count, train speed, train length, or number of cars (even if these messages are enabled).

In the examples that follow, the **Speed Format option** on the Units of Measure submenu is set to mph.

13.3.1 Nothing Detected

When neither an Exception Alarm nor an Integrity Failure is detected, the no-defect message is announced. The format of this announcement is:

If the **Repeat No Defects option** on the Messages menu is disabled, the format of this announcement is:

[customer name] milepost (milepost number) [track indicator] [speed indicator]
No Defects
[other ancillary messages] Detector Out

If the **Repeat No Defects option** is enabled, the format of this announcement is:

[customer name] milepost (milepost number) [track indicator] [speed indicator]
No Defects
Repeat No Defects
[other ancillary messages] Detector Out

For example, at a single-track site when the **Repeat No Defects option** is disabled, the announcement is like this.

S-I-T-E Detector
Milepost 3-2-1 Point 4
Speed 4-5
No Defects
Total Axles 9-8
Detector Out

At a single-track site when the **Repeat No Defects option** is enabled, the announcement is like this.

S-I-T-E Detector
Milepost 3-2-1 Point 4
Speed 4-5
No Defects
Repeat No Defects
Total Axles 9-8
Detector Out

At a double-track site when the **Repeat No Defects option** is enabled, the announcement is like this.

S-I-T-E Detector
Milepost 3-9-9 Point 1
South Track
Speed 5-3
No Defects
Repeat No Defects
Total Axles 1-6-2
Detector Out

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 train stoppage, later maintenance, or both. Integrity failures appear in the header of Train Detail reports and Exception Detail reports. ***Chapter 12 - Producing Reports*** tells how to produce these reports. ***Appendix B - Integrity Failures*** describes the conditions and events that the SmartScanNG system flags as Integrity Failures.

When no Exception Alarms are detected but an Integrity Failure is detected, Integrity Failure is announced.

The format of this announcement is:

[customer name] milepost (milepost number) [track indicator]
[ancillary messages] Integrity Failure
(a pause)
[customer name] milepost (milepost number) [track indicator]
[ancillary messages] Integrity Failure Detector Out

For example, at a double-track site, the announcement is like this.

S-I-T-E Detector
Milepost 3-9-9 Point 1
South Track
Speed 5-3
Total Axles 9-2
Integrity Failure
(a pause)
S-I-T-E Detector
Milepost 3-9-9 Point 1
South Track
Speed 5-3
Total Axles 9-2
Integrity Failure
Detector Out

13.3.3 Only Exception Alarms Detected

When one or more Exception Alarms are detected and an Integrity Failure isn't detected, the alarms are announced. The format of this announcement is:

[customer name] milepost (milepost number) [track indicator] [speed indicator]
[alarm announcements] [other ancillary messages] [excessive-alarms indicator]
(a pause)
[customer name] milepost (milepost number) [track indicator] [speed indicator]
[alarm announcements] [other ancillary messages] [excessive-alarms indicator]
Detector Out

Per train, only the first four Hotbox alarms and first four Hotwheel alarms are ever announced. Per train, only the first eight alarms are announced. When Excessive Alarms is announced, the train had more than four Hotbox alarms, more than four Hotwheel alarms, or more than eight Exception Alarms. When a system broadcasts the "Excessive Alarms" phrase for a train, the Excessive Alarms alarm will appear on a detail report for that train.

Hotwheel alarms use the same general format as Hotbox alarms. High-Load, High-Wide, and Wide-Load alarms use the same general format as Dragging-Equipment alarms.

The **Clearance Type option** on the Equipment menu is either trip wire or light beam. This option is only used for high-load detectors and wide-load detectors. Both high-load detectors and wide-load detectors must be either trip-wire detectors or light-beam detectors.

When a wide-load detector is configured for trip-wire operation, the system only records one Wide-Load alarm, regardless of the wide-load signal status. This is because you can only break a wire once.

When it is configured for light-beam operation, the system records every Wide-Load alarm that occurs. However, the system won't flag Wide-Load alarms on consecutive axles. At least one unalarmed axle must separate the alarmed axles. Regardless of the number of detected Wide-Load alarms, the system only announces a maximum of two.

When a high-load detector is configured for trip-wire operation, the system only records one High-Load alarm, regardless of the high-load signal status. This is because you can only break a wire once.

When it is configured for light-beam operation, the system records every High-Load alarm that occurs. However, the system won't flag High-Load alarms on consecutive axles. At least one unalarmed axle must separate the alarmed axles. Regardless of the number of detected High-Load alarms, the system only announces a maximum of two.

The **Clearance Mode option** on the Equipment menu is either separate or multiplexed. This option is only used for high-load detectors and wide-load detectors. When this option is set to separate, the alarms coming from the high-load detectors are announced as High-Load alarms and the alarms coming from the wide-load detectors are announced as Wide-Load alarms. When this option is set to multiplexed, the alarms coming from the high-load detectors and wide-load detectors are announced as High-Wide alarms.

The **Announce Car Identification option** on the Messages menu shows whether car-identification information is to be announced (YES) or not announced (NO). When this option is set to YES and an Exception Alarm is found on a car, the car-identification information is announced right after the Exception Alarm is announced during the second pass through the end-of-train message. This, of course, will only happen if the **AEI option** on the Equipment menu is enabled (YES) and the AEI subsystem is functioning properly during train passage. The "near-axle number" gets broadcast, even when the car-identification information is broadcast. In the examples that follow, the **Announce Car Identification option** was set to NO.

For example, at a single-track site having one Hotbox alarm and no Integrity Failure, the announcement is like this.

S-I-T-E Detector
Milepost 3-2-1 Point 4
Speed 4-5
Hotbox North-Rail Axle-7-5
Total Axles 9-8
(a pause)
S-I-T-E Detector
Milepost 3-2-1 Point 4
Speed 4-5
Hotbox North-Rail Axle-7-5
Total Axles 9-8
Detector Out

At a double-track site having one Dragging-Equipment alarm and no Integrity Failure, the announcement is like this.

S-I-T-E Detector
Milepost 3-9-9 Point 1
South Track
Speed 4-5
Dragging-Equipment Near-Axle-8-4
Total Axles 8-8
(a pause)
S-I-T-E Detector
Milepost 3-9-9 Point 1
South Track
Speed 4-5
Dragging-Equipment Near-Axle-8-4
Total Axles 8-8
Detector Out

At a single-track site having two Hotbox alarms and no Integrity Failure, the announcement is like this.

S-I-T-E Detector
Milepost 3-2-1 Point 4
Speed 4-5
First-Hotbox North-Rail Axle-7-5
Second-Hotbox North-Rail Axle-8-0
Total Axles 9-0
(a pause)
S-I-T-E Detector
Milepost 3-2-1 Point 4
Speed 4-5
First-Hotbox North-Rail Axle-7-5
Second-Hotbox North-Rail Axle-8-0
Total Axles 9-0
Detector Out

The post-train announcement for a detected Hotwheel alarm uses the same general format: "First-Hotwheel North-Rail Axle-7-5."

At a single-track site having two Dragging-Equipment alarms and no Integrity Failure, the announcement is like this.

S-I-T-E Detector
Milepost 3-2-1 Point 4
Speed 5-7
First-Dragging-Equipment Near-Axle-8-4
Second-Dragging-Equipment Near-Axle-8-8
Total Axles 1-0-8
(a pause)
S-I-T-E Detector
Milepost 3-2-1 Point 4
Speed 5-7
First-Dragging-Equipment Near-Axle-8-4
Second-Dragging-Equipment Near-Axle-8-8
Total Axles 1-0-8
Detector Out

At a <u>single</u>-<u>track</u> <u>site</u> having <u>one</u> Hotbox alarm, <u>one</u> Dragging-Equipment alarm, and no Integrity Failure, the announcement is like this.

S-I-T-E Detector
Kilometer Post 3-2-1 Point 4
Speed 4-5
Hotbox North-Rail Axle-7-5
Dragging-Equipment Near-Axle-8-4
Total Axles 9-8
(a pause)
S-I-T-E Detector
Kilometer Post 3-2-1 Point 4
Speed 4-5
Hotbox North-Rail Axle-7-5
Dragging-Equipment Near-Axle-8-4
Total Axles 9-8
Detector Out

At a <u>single</u>-<u>track</u> <u>site</u> having <u>three</u> <u>or</u> <u>more</u> Dragging-Equipment alarms and no Integrity Failure, the announcement is like this.

S-I-T-E Detector
Kilometer Post 3-2-1 Point 4
Speed 4-5
First-Dragging-Equipment Near-Axle-1-2
Second-Dragging-Equipment Near-Axle-3-4
Total Axles 9-8
Excessive Alarms
(a pause)
S-I-T-E Detector
Kilometer Post 3-2-1 Point 4
Speed 4-5
First-Dragging-Equipment Near-Axle-1-2
Second-Dragging-Equipment Near-Axle-3-4
Total Axles 9-8
Excessive Alarms
Detector Out

Per train, only the first two Dragging-Equipment alarms are ever announced. Per train, only the first four Hotbox alarms or Hotwheel alarms are ever announced.

13.3.4 Both Exception Alarms and 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 train stoppage, later maintenance, or both. Integrity failures appear in the header of Train Detail reports and Exception Detail reports. ***Chapter 12 - Producing Reports*** tells how to produce these reports. ***Appendix B - Integrity Failures*** describes the conditions and events that the SmartScanNG system flags as Integrity Failures.

When one or more alarm conditions and an Integrity Failure are detected, the format of this announcement is:

[customer name] milepost (milepost number) [track indicator] [speed indicator]
[alarm announcements] [other ancillary messages]
[excessive-alarms indicator] Integrity Failure
(a pause)
[customer name] milepost (milepost number) [track indicator] [speed indicator]
[alarm announcements] [other ancillary messages]
[excessive-alarms indicator] Integrity Failure Detector Out

For the rest of the examples in this chapter, the **Announce Car Identification option** was set to NO. ***Chapter 11 - Serial Interface*** tells how to change this option.

For example, at a single-track site having one Hotbox alarm and an Integrity Failure, the announcement is like this.

S-I-T-E Detector
Kilometer Post 3-2-1 Point 4
Speed 6-0
Hotbox North-Rail Axle-7-5
Total Axles 9-8
Integrity Failure
(a pause)
S-I-T-E Detector
Kilometer Post 3-2-1 Point 4
Speed 6-0
Hotbox North-Rail Axle-7-5
Total Axles 9-8
Integrity Failure
Detector Out

At a double-track site having one Dragging-Equipment alarm and an Integrity Failure, the announcement is like this.

S-I-T-E Detector
Kilometer Post 3-9-9 Point 1
North Track
Speed 5-7
Dragging-Equipment Near-Axle-2-4
Total Axles 8-6
Integrity Failure
(a pause)
S-I-T-E Detector
Kilometer Post 3-9-9 Point 1
North Track
Speed 5-7
Dragging-Equipment Near-Axle-2-4
Total Axles 8-6
Integrity Failure
Detector Out

At a single-track site having three or more Dragging-Equipment alarms and an Integrity Failure, the announcement is like this.

S-I-T-E Detector
Kilometer Post 3-2-1 Point 4
Speed 4-5
First-Dragging-Equipment Near-Axle-1-2
Second-Dragging-Equipment Near-Axle-3-4
Total Axles 9-8
Integrity Failure
Excessive Alarms
(a pause)
S-I-T-E Detector
Kilometer Post 3-2-1 Point 4
Speed 4-5
First-Dragging-Equipment Near-Axle-1-2
Second-Dragging-Equipment Near-Axle-3-4
Total Axles 9-8
Integrity Failure
Excessive Alarms
Detector Out

At a single-track site having one Hotbox alarm, six Dragging-Equipment alarms, and an Integrity Failure, the announcement is like this.

S-I-T-E Detector
Kilometer Post 3-2-1 Point 4
Speed 5-4
First-Dragging-Equipment Near-Axle-2-1
Second-Dragging-Equipment Near-Axle-2-9
Hotbox North-Rail Axle-7-5
Total Axles 1-0-8
Integrity Failure
Excessive Alarms
(a pause)
S-I-T-E Detector
Kilometer Post 3-2-1 Point 4
Speed 5-4
First-Dragging-Equipment Near-Axle-2-1
Second-Dragging-Equipment Near-Axle-2-9
Hotbox North-Rail Axle-7-5
Total Axles 1-0-8
Integrity Failure
Excessive Alarms
Detector Out

Chapter 14
Scheduled Maintenance

This chapter lists the items that STC recommends be done during scheduled maintenance.

An up-and-running SmartScanNG system needs to be visited from time to time to do scheduled maintenance. The frequency of these visits is up to the customer. STC recommends visits every 30 to 90 days. Maintenance requirements change with environmental conditions. For example, if the system is installed in a damp or a dusty environment, it may be necessary to visit the location more frequently to clean the optics. The optical system is the item most likely to need periodic maintenance. If moisture or dust isn't a problem, you may not need to do scheduled maintenance more often than every 90 days.

What is done during a maintenance visit is up to the customer. However, STC does have some recommendations. For normal scheduled maintenance, STC recommends these steps.

1 Be sure that you have on hand a tape measure, a #2 Phillips head screwdriver, a small slotted screwdriver, a 9/16-inch torque wrench, a laptop computer, a multimeter, 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 for damaged transducers, damaged transducer cables, and other damaged components.

5 If you find any damaged components, repair or replace them before proceeding.

STC transducers don't require a lot of care and attention. Once installed correctly, you don't need to remove them from the rail for cleaning or readjustment.

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

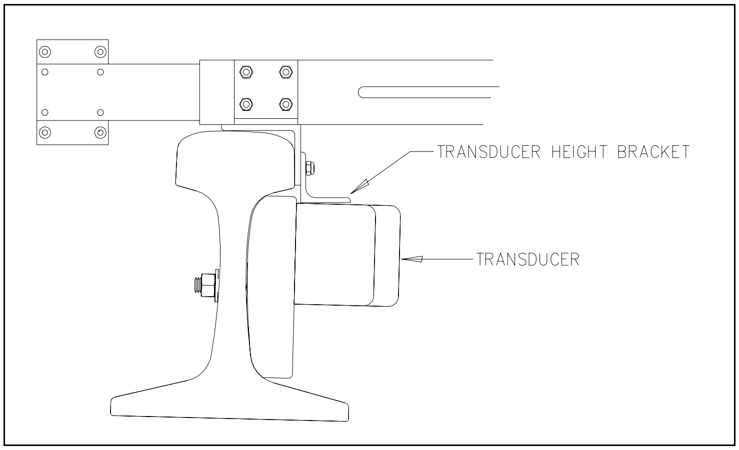
Four bolts are needed to hold the transducer in place. Two square-head bolts go through the mounting plate and transducer body. Two hex-head bolts go through the mounting plate and rail. If any of these bolts are sheared or missing, they must be replaced with the correct replacement bolt. Also, if any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

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

15 If the wayside enclosure isn't attached to a properly installed outside grounding system, fix this problem before proceeding.

16 If there isn't a **ground bus** inside the wayside enclosure that has been attached to a properly installed outside grounding system, fix this problem before proceeding.

17 If the battery is dead, damaged, or emitting a strong sulfurous odor, replace it before proceeding.

> **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 dispersion of casing fragments and corrosive liquid electrolyte. So, carefully follow 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.

18 If the battery charger hasn't been properly grounded to the ground bus, fix this problem before proceeding.

19 If the SmartScanNG enclosure hasn't been properly grounded to the ground bus, fix this problem before proceeding.

20 If this is a **DC-powered system**:

a Check if the SmartScanNG enclosure is supplied with a stable DC power source of 11.5 through 15 volts at 15 amperes.

b If the DC power isn't stable or if it isn't 11.5 through 15 volts at 15 amperes, fix this problem before proceeding.

c Go to step **30**.

21 If this is an **AC-powered system**:

The next two steps assume your site uses 110-120 VAC. If your site uses 220-250 VAC, skip the next two steps and go to step **22**. If your site uses any other AC voltage, skip all the steps below and call STC for help.

a At all outlets, check if the AC power is stable and at least 110 volts at 20 amperes.

b If the AC power isn't stable or if it isn't at least 110 volts at 20 amperes, fix this problem before proceeding.

There are vents on the top, bottom, and sides of the charger. Blocking any of these vents could result in damage to the charger or battery.

22 Remove anything that is blocking the vents on the battery charger.

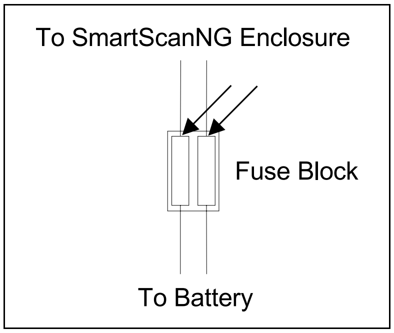
One end of the battery temperature probe cable has a three-pin plug, which plugs into a receptacle on the front of the battery charger. The other end, which has a temperature sensor sealed in it, should be attached to the negative battery post. If the battery temperature probe is defective or not installed, the red defective LED is lit.

23 On the front of the battery charger, if the red defective-temperature-probe LED is lit, fix the underlying problem before proceeding.

24 Switch the multimeter to the DC volts scale.

The **equipment side** of the fuse block is directly wired to the SmartScanNG enclosure. The **battery side** of the fuse block is wired to the battery via the distribution block.

25 Touch the leads from the multimeter to the terminals on the equipment side of the fuse block.



26 If voltage (on the equipment side of the fuse block) is 12.7 through 14.5 VDC, go to step **30**.

27 If voltage (on the equipment side of the fuse block) is 0 VDC:

a Touch the leads to the terminals on the battery side of the fuse block.

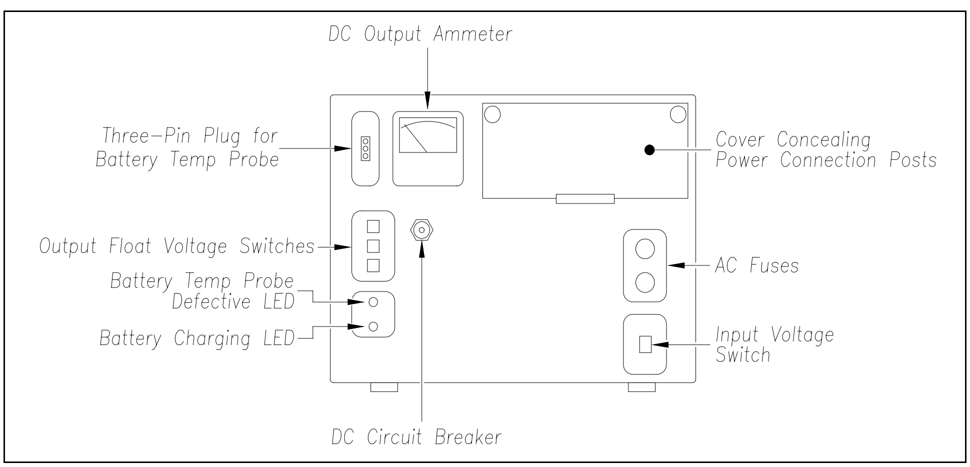
b If voltage (on the battery side of the fuse block) is greater than 0 VDC, replace each fuse in the fuse block with a BAF-25 (25-amp 250-volt) fast-acting fuse and return to step **25**.

c If voltage (on the battery side of the fuse block) is 0 VDC, fix any wiring problems between the fuse block, the distribution block, the battery, and the charger.

d Return to step **25**.

28 If voltage is less than 12.7 VDC:

a On the battery charger, check the input voltage switch for proper setting.



The input voltage switch can be set to 115 VAC or 230 VAC. Use 115 for input voltages between 108 and 128. Use 230 for input voltages between 216 and 256.

b On the battery charger, check the output float voltage switches.

c If the switches are set lower than 12.70 VDC, reset them to 14.00 VDC.

To reset the switches, use a small slotted screwdriver to turn each switch to the desired number. The ten's digit is always 1 and can't be changed. The top switch controls the unit's digit. The middle switch controls the tenth's digit. The bottom switch controls the hundredth's digit. The factory default is **14.00 VDC**, which is the **recommended setting**. To select 14.00 VDC, turn the top switch to 4, the middle switch to 0, and the bottom switch to 0.

d Open the small door cover on the top-right corner of the front of the charger.

Do not touch the uninsulated parts of the wires or the charger's binding posts. Doing so could result in sparks, burns, or electric shock.

e Check that all binding posts nuts are tight and that all wiring is correct.

f On the battery charger, check the AC fuses to see if either is blown.

g If need be, replace with 4-amp 250-volt fast-acting fuses.

h On the battery charger, check the DC circuit breaker to see if it is open (tripped).

When closed, about 0.09 inch (0.23 centimeters) of the breaker's button is seen. When open, the button is popped out, showing about 0.25 inch (0.64 centimeters).

i If open (tripped), push the breaker's button in to reset the DC circuit breaker.

j Check to see if the battery charger is plugged in.

k If the battery charger isn't plugged in, plug it in.

l Check the battery-charging LED.

If the battery is charging properly, the yellow battery-charging LED is lit solid. If one or more of the output float voltage switches are set between numbers, the yellow battery-charging LED flashes.

m If the yellow battery-charging LED isn't lit, call STC for help in fixing this problem.

n If the yellow battery-charging LED is lit solid, monitor the voltage for ten minutes.

If the voltage is gradually increasing, the battery is probably charging. After the battery has charged for five hours, the battery voltage should be very near the float voltage setting. If the voltage isn't gradually increasing, the battery is probably not charging. This may indicate that the battery is defective and should be replaced.

29 If voltage is greater than 14.5 VDC:

a Check the output float voltage switches on the center-left edge of the battery charger.

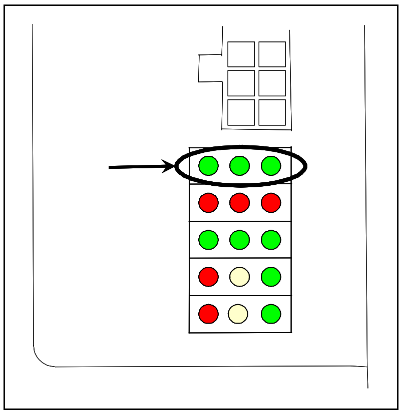
b Be sure each switch is set on a number and not between numbers.

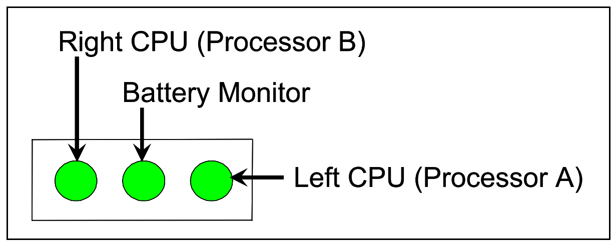
c If the switches are set to 14.00 VDC or less, cut all power to the SmartScanNG system and call STC for help in fixing this problem.

d If the switches are set higher than 14.50 VDC, reset them to 14.00 VDC and return to step **25**.

To reset the switches, use a small slotted screwdriver to turn each switch to the desired number. The ten's digit is always 1 and can't be changed. The top switch controls the unit's digit. The middle switch controls the tenth's digit. The bottom switch controls the hundredth's digit. The factory default is **14.00 VDC**, which is the **recommended setting**. To select 14.00 VDC, turn the top switch to 4, the middle switch to 0, and the bottom switch to 0.

30 On the status panel, look at the top row (aka first row) of LEDs.





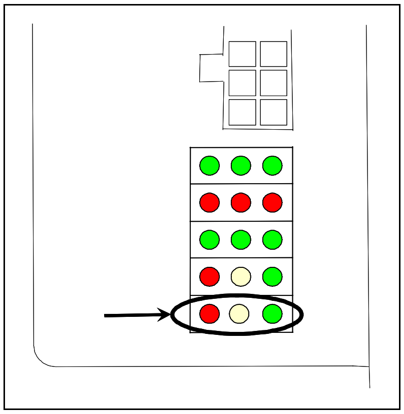
The top row of green LEDs indicates the condition of the CPUs and the battery on the Processor board. If both CPUs are running their programs correctly, their LEDs pulsate (that is, repeat the cycle off, dim, bright, dim). If a program isn't operating as expected, the LED for the affected CPU blinks on and off, is lit solid, or isn't lit at all.

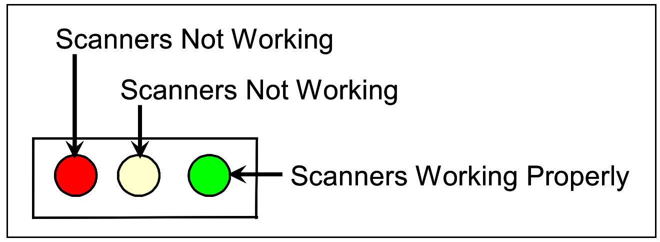
If the on-board coin cell battery is low or dead, the **middle LED** is lit. Otherwise, it isn't lit. During a power interruption to the Processor board, this battery keeps the stored train data from being lost and the time/date accurate. If the battery is low, there is no danger of losing train data unless the power to the system is lost. When the **middle LED** is lit, the battery should be replaced. If care is taken, this can be done with the system powered up. Otherwise, **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**. Some Processor boards have a permanently installed battery. Those Processor boards should be returned to STC for battery replacement.

31 If either or both of the **rightmost** and **leftmost LEDs** (on the top row) blinks on and off, is lit solid, or isn't lit at all, call STC for help in fixing this problem.

32 If the **middle LED** (on the top row) is lit, replace the battery on the Processor board.

33 On the status panel, look at the bottom row (aka fifth row) of LEDs.





The bottom row of LEDs indicates the operational condition of the bearing and wheel scanners when the system is at rest (that is, when a train isn't present at the site). Several conditions are monitored and logged.

The **leftmost red LED** indicates whether the integrity check passed or failed. If a scanner failed integrity on any of the last 20 trains, this LED lights and remains lit until all trains with integrity failures are flushed from the log. Conditions that would trigger the lighting of this LED are:

- Insufficient heat from one or both bearing scanners or from one or both wheel scanners was detected. If either bearing scanner records less than 5°F (2.8°C) for an entire train or if either wheel scanner records less than 15°F (8.3°C) for an entire train.
- Shutter resistor check failed. The minimum value expected for the temperature of the resistor wasn't met. To cause the LED to light, this minimum value must be greater than the target resistor heat value that is calculated for each train. These requirements for lighting the LED are the same as for generating a Cold Bearing Scanner Resistor alarm (on some systems, called the Cold Resistor alarm).
- For any five consecutive trains, the difference between the average recorded temperatures for both bearing scanners was more than a delta temperature of 20°F (11.1°C) or the difference between the average recorded temperatures for both wheel scanners was more than a delta temperature of 120°F (66.7°C).

If all of the last 20 trains have passed integrity, the **leftmost red LED** isn't lit. In the last 20 trains, if both bearing scanners or both wheel scanners failed the integrity check, this LED is lit solid. In the last 20 trains, if just one bearing scanner or one wheel scanner failed the integrity check, this LED flashes. The rate and pattern of flashing is different for which rail the scanner was on. For a scanner on the north or east rail, the repeated pattern is on for a half second, off for a full second. For a scanner on the south or west rail, the repeated pattern is on for a half second, off for a half second, on for a half second, off for two seconds.

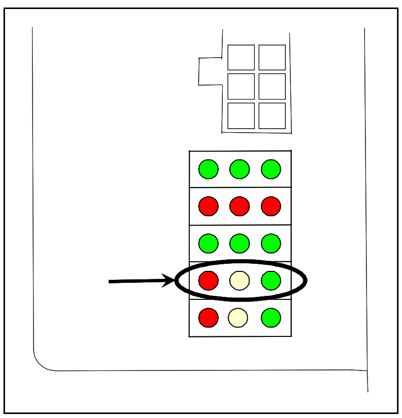
The **middle yellow LED** flashes when the difference between the average temperatures (recorded by the two bearing scanners or recorded by the two wheel scanners) isn't within acceptable balance limits for 20 consecutive trains. These limits are different for bearing and wheel scanners. For the bearing scanners this limit is 5°F (2.8°C) and for wheel scanners is 15°F (8.3°C). If the averages fall below these balance limits, the **middle yellow LED** will flash continuously until less than 20 consecutive trains have a temperature imbalance between the two bearing or the two wheel scanners.

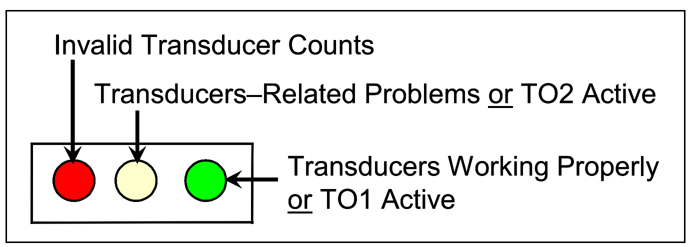
Within the scanner pairs, the scanner with the lower temperatures is considered the problem scanner. Its identity is revealed by the rate and pattern of flashing of the **middle yellow LED**. For a scanner on the north or east rail, the repeated pattern is on for a half second, off for a full second. For a scanner on the south or west rail, the repeated pattern is on for a half second, off for a half second, on for a half second, off for two seconds. Since this LED makes no distinction between bearing and wheel scanners, the flashing LED can indicate a problem with either the bearing or the wheel scanner on the indicated rail or a problem with both of them.

The **rightmost green LED** flashes when all of the bearing and wheel scanners worked properly during passage of the last 20 trains. It's off when one or more scanners aren't performing as they should be. It's never lit solid.

34 If the **rightmost green LED** (on the bottom row) isn't flashing, call STC for help in fixing this problem.

35 On the status panel, look at the fourth row of LEDs when no train is present.





The fourth row of LEDs operates differently when a train is at the site and when it isn't.

When a train is present at the site, this row indicates the operational status of the gating transducers for the current train. The **rightmost green LED** will flash as a wheel travels over transducer TO1. The center yellow LED will flash when a wheel travels over transducer TO2. The **leftmost red LED** doesn't light during train passage.

When a train isn't present at the site, this row indicates the operational status of the gating transducers for the last 20 trains. The **leftmost red LED** is lit when all the following conditions befall any given train.

- The count between TO1 and TO2 varies by four or more.
- The speed of the train remains above 10 mph (16 kph).
- The train has an odd axle count.

In the last 20 trains, if not all three fault conditions exist on each given train, the red LED is not lit. In the last 20 trains, if there's a possible fault with TO1 on one train and TO2 on another train, this LED is lit solid. In the last 20 trains, if there's a possible fault with just one gating transducer on a given train, this LED flashes. The gating transducer with fewer hits is considered the bad one. The rate and pattern of flashing is different for each transducer. For TO1, the repeated pattern is on for a half second, off for a full second. For TO2, the repeated pattern is on for a half second, off for a half second, on for a half second, off for two seconds.

When a train isn't present at the site, the **middle yellow LED** is lit when:

- A gating transducer experiences more than 20 filtered pulses on a train. In other words, a gating transducer experiences more than 20 pulses on a train that the SmartScanNG system considers noise.
- The gating transducers are activating the system.

When a train isn't present at the site, the **rightmost green LED** flashes when the count between TO1 and TO2 varies by three or less. Under those conditions, this LED will still flash even when the axle count is odd or the train speed falls below 10 mph (16 kph).

The gating transducers are probably functioning properly when the **rightmost green LED** flashes, the **leftmost red LED** isn't lit, and the **middle yellow LED** isn't lit. But, to be sure, you still need to examine a Train Summary report.

36 When a train isn't present at the site, if the **middle yellow LED** (on the fourth row) isn't lit, go to step **41**.

37 To see if the system is being activated by the gating transducers:

a Produce a Last Train report.

Chapter 12 - Producing Reports tells how to produce this report. From the Main menu, type **F**.

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.

b On the Last Train report, check under the System Alarms section of the report for the words "No Approach Track."

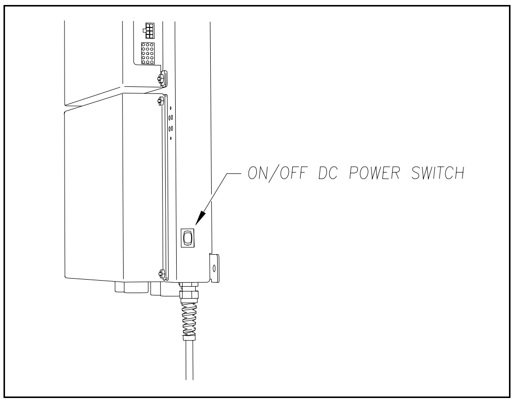
The No Approach Track alarm indicates that the system presence detection system (that is, the track circuit or the advance transducers) didn't detect the arrival of the train at the site. Instead, the system started the train scanning process when a gating transducer sensed the train.

c If the words "No Approach Track" don't appear, go to step **41**.

38 If your system uses advance transducers, go to step **40**.

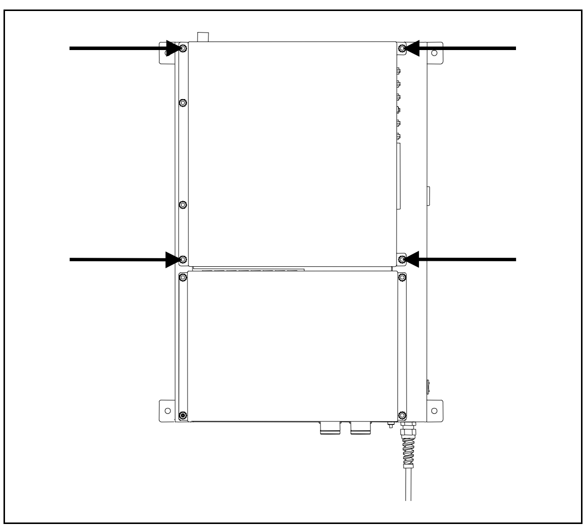
39 If your system uses a track circuit:

a Toggle off the DC power switch on the right edge of the SmartScanNG enclosure.



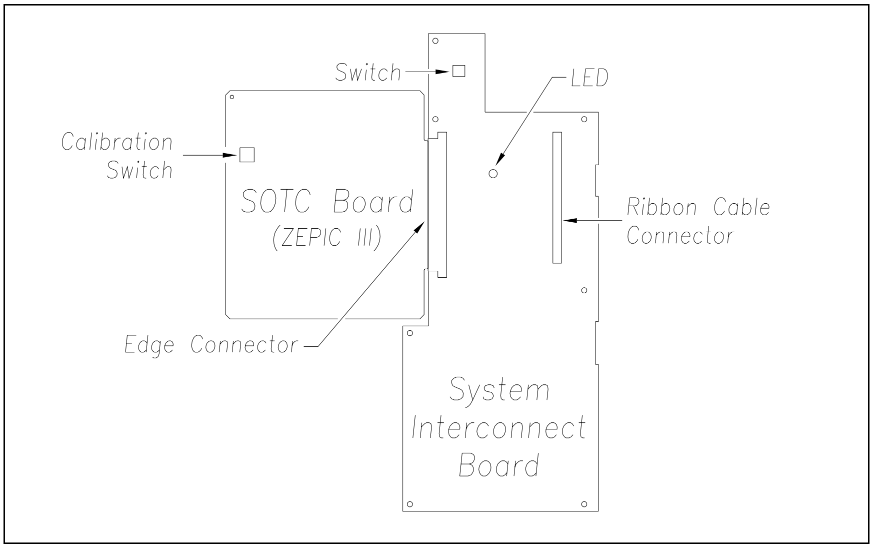
b Unplug the Molex and ribbon cables from the Controller module.

c Remove the four nuts that hold the Controller module to the rest of the SmartScanNG enclosure.



d Detach the Controller module from the rest of the SmartScanNG enclosure.

The SOTC board and the System-Interconnect board are now visible. On some System-Interconnect boards, the LED is to the right of the ribbon cable connector.



e Store the removed Controller module and nuts in a safe place until you replace them.

f Toggle <u>on</u> the DC power switch on the right edge of the SmartScanNG enclosure.

g 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 15 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 SOTC board can be pressed and calibration can begin.

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

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

When lit, the LED on the System-Interconnect board indicates a received signal from the track circuit.

i Press and hold down the blue calibration switch on the SOTC board until the LED on the System-Interconnect board starts blinking.

j Release the blue calibration switch on the SOTC board.

The LED on the System-Interconnect board 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 System-Interconnect board will light again. This process can take up to 45 seconds to complete.

k Remove the 0.06 ohm shunt.

The LED on the System-Interconnect board should go out.

l Place the 0.06 ohm shunt across both rails at the point 10 feet (3 meters) beyond the measured point (that is, 10 feet farther from the gating transducer).

m If the LED on the System-Interconnect board lights, return to step **j**.

n Remove the 0.06 ohm shunt.

o Toggle off the DC power switch on the right edge of the SmartScanNG enclosure.

p Reattach the Controller module to the rest of the SmartScanNG enclosure.

q Plug the Molex and ribbon cables into the Controller module.

r Toggle on the DC power switch on the right edge of the SmartScanNG enclosure.

s Go to step **41**.

40 If your system uses advance transducers:

You'll next verify that that each advance transducer is functional.

a Using a metal wrench, stroke the top of one of the advance transducers.

The scanner shutters should open completely for 10 seconds.

b On one of the bearing scanners, check to see if the shutter opens.

c If the shutter didn't open, fix this problem before proceeding.

d Using a metal wrench, stroke the top of the other advance transducer.

The scanner shutters should open completely for 10 seconds.

e On one of the bearing scanners, check to see if the shutter opens.

f If the shutter didn't open, fix this problem before proceeding.

41 Produce a Train Summary report.

Chapter 12 - Producing Reports tells how to produce this report. From the Main menu, type **A**.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
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.

42 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.

43 If there is an odd axle count and if train speed was always above 7 mph (11.3 kph), go to step **45**.

If at any time during train passage the train speed was less than or equal to 7 mph (11.3 kph), gating transducer problems probably don't exist. If the train speed was always above 7 mph (11.3 kph), gating transducer problems probably do exist.

The Very Slow Train alarm indicates that, at some point during train passage, four consecutive axles crossed the gating transducers at a speed of 7 mph (11.3 kph) or less. This alarm appears on a Train Detail report.

If there are many very slow trains (that is, many trains traveling less than 7 mph (11.3 kph)) at this site, it may be necessary to relocate the scanners and other track hardware to a better location. Deciding to do this should be made in consultation with STC. Relocating a site is beyond the scope of this document.

44 If there is an even axle count and the values under "Axles," "TO1," and "TO2" are the same, go to step **49**.

If things are working correctly, all three values for a given train should be equal. Do the next step only if things aren't working correctly.

45 Determine which gating transducer is recording incorrect information.

Determine which gating transducer is recording incorrect axle counts and whether it isn't counting all axles or counting extra ones. You may not be able to do this by just looking at the values under the Axles, TO1, and TO2 columns of the Train Summary report. Sometimes, a transducer problem causes the number in the Axles column to be incorrect. Therefore, the true axle count may have to be determined from an alternate source such as the next detector the train with the transducer-count imbalance encountered.

After you determine which gating transducer is miscounting, you'll need to change a jumper setting on the Interface board. If TO1 is the problem, you'll change the setting for J201. If TO2 is the problem, you'll change the setting for J202. If both TO1 and TO2 have a problem, both jumpers will need to be changed.

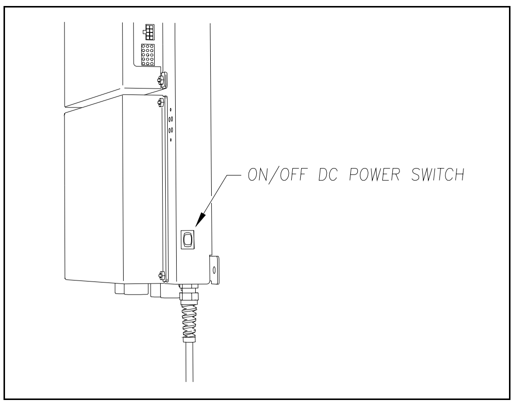
Changes to the jumpers should be made only after all external conditions that cause transducer miscounts have been corrected. Some of these external conditions are improperly installed transducers, loose transducer bolts, incorrect transducer heights, damaged transducers, damaged transducer cables, and loose wiring connections. You should have already checked and corrected for these external conditions in steps **4** through **10** above. If you think the corrections you made in those steps fixes gating transducer miscounting, you can skip some of the steps below.

The process of adjusting the transducer loading is trail and error. Generally, if you are having too many transducer counts, lower the loading resistance to make the transducer less sensitive. Likewise, too few counts suggest that the transducer isn't sensitive enough, so you would select a loading value with more resistance.

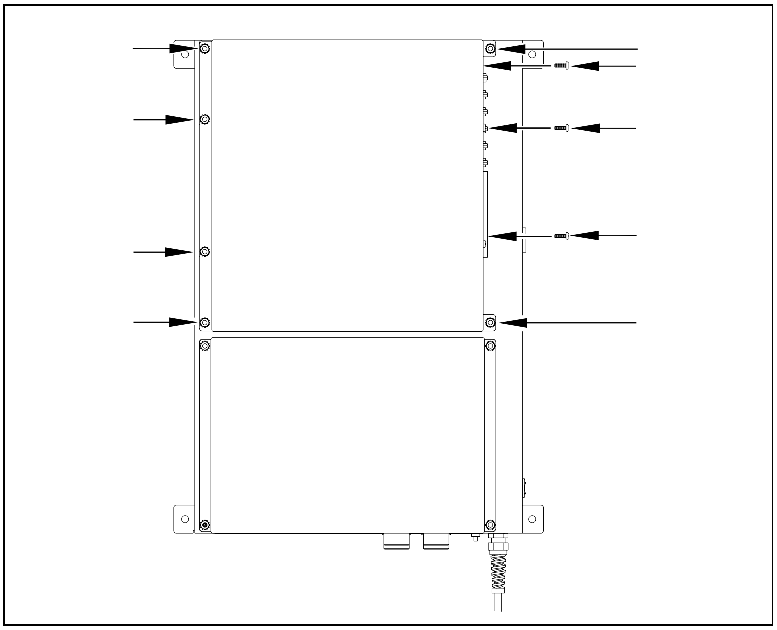
46 If you corrected all external conditions that negatively affect gating transducers and you think this fixes gating transducer miscounting, go to step **49**.

47 If the selected gating transducer appears to be missing axles (that is, the transducer that is showing a number of hits less than the true axle count):

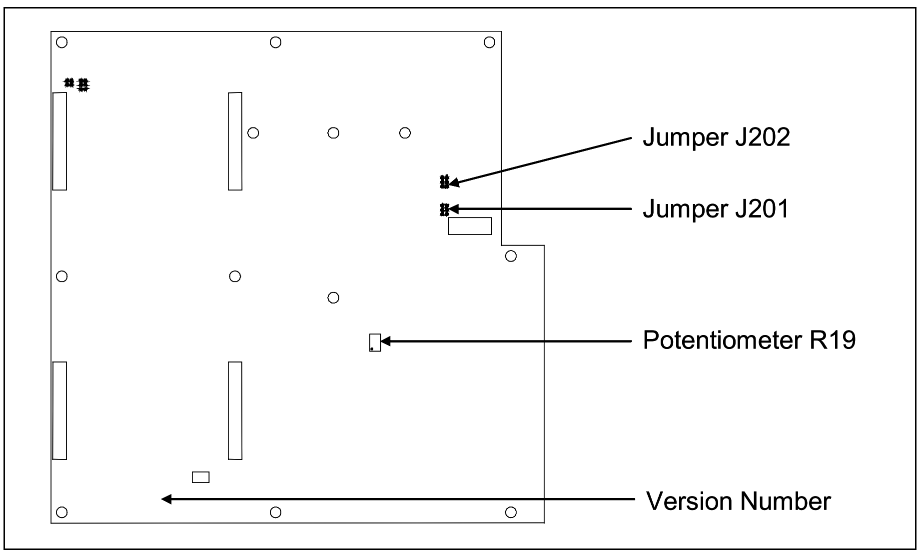
a Toggle off the DC power switch on the right edge of the SmartScanNG enclosure.



b Remove the six nuts and three screws holding the cover over the Interface board.



The Interface board is now visible.



c To prevent the base assembly from falling, replace two of the just removed nuts onto the top two mounting studs on the SmartScanNG enclosure.

d Store the removed cover, three screws, and remaining four nuts in a safe place until you replace them.

The available loading sensitivities vary depending on which version of Interface board you have <u>and</u> whether resistors are attached to the jumpers or not. The version number is printed on the lower-left edge of the board.

e Note the version number of your Interface board.

The table below lists the highest, middle, and lowest sensitivity for transducer loading for current board versions. Highest is the most sensitive. The jumper's top position is the one closest to the external speaker.

J201 or J202 Jumper Position	Version 1.21 and 1.22 and 1.30 and 1.40 Board
Top	Lowest Sensitivity
Center	Middle Sensitivity
Bottom	Highest Sensitivity

This table above only covers board versions 1.21, 1.22, 1.30, and 1.40. Earlier versions of the board have different jumper positions for each sensitivity level. That is, the available loading sensitivities vary depending on which version of Interface board you have, whether the board was modified, and whether resistors are attached to the jumpers. The version number is printed on the lower-left edge of the board.

f If TO1 is the selected gating transducer and the J201 jumper is currently on the lowest sensitivity position, move it to the middle sensitivity position.

g If TO1 is the selected gating transducer and the J201 jumper is currently on the middle sensitivity position, move it to the highest sensitivity position.

h If TO1 is the selected gating transducer and the J201 jumper is currently on the highest sensitivity position, call STC for help in fixing this problem.

i If TO2 is the selected gating transducer and the J202 jumper is currently on the lowest sensitivity position, move it to the middle sensitivity position.

j If TO2 is the selected gating transducer and the J202 jumper is currently on the middle sensitivity position, move it to the highest sensitivity position.

k If TO2 is the selected gating transducer and the J202 jumper is currently on the highest sensitivity position, call STC for help in fixing this problem.

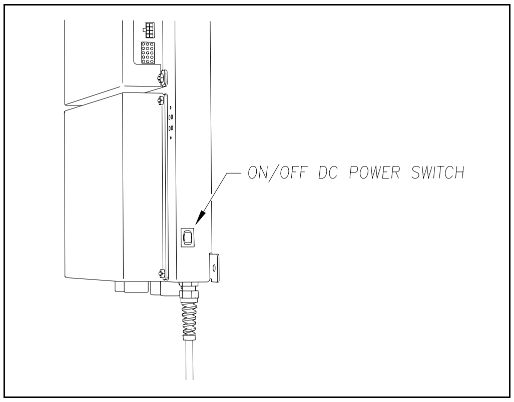
l Remove the two nuts holding the base assembly to the SmartScanNG enclosure.

m Using the saved six nuts and three screws, reattach the cover over the Interface board.

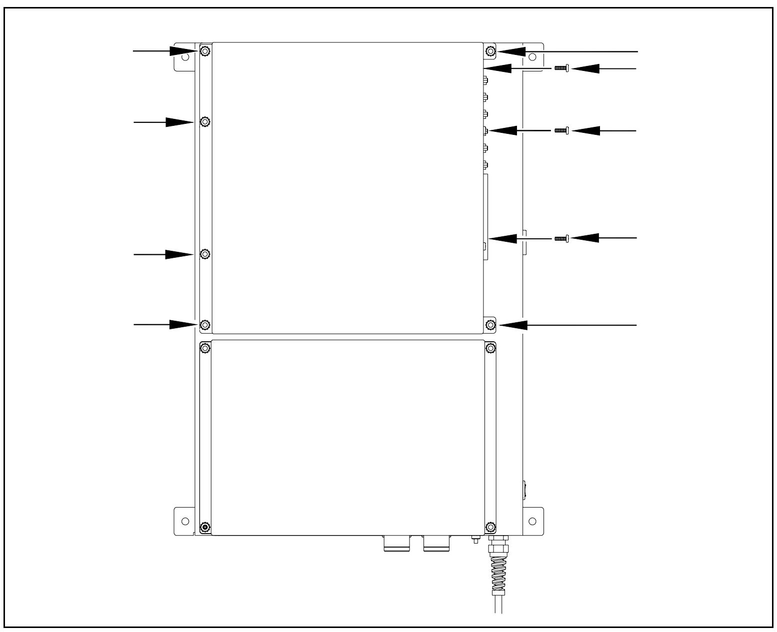
n Toggle on the DC power switch on the right edge of the SmartScanNG enclosure.

48 If the selected gating transducer appears to be counting extra axles (that is, the transducer that is showing a number of hits more than the true axle count):

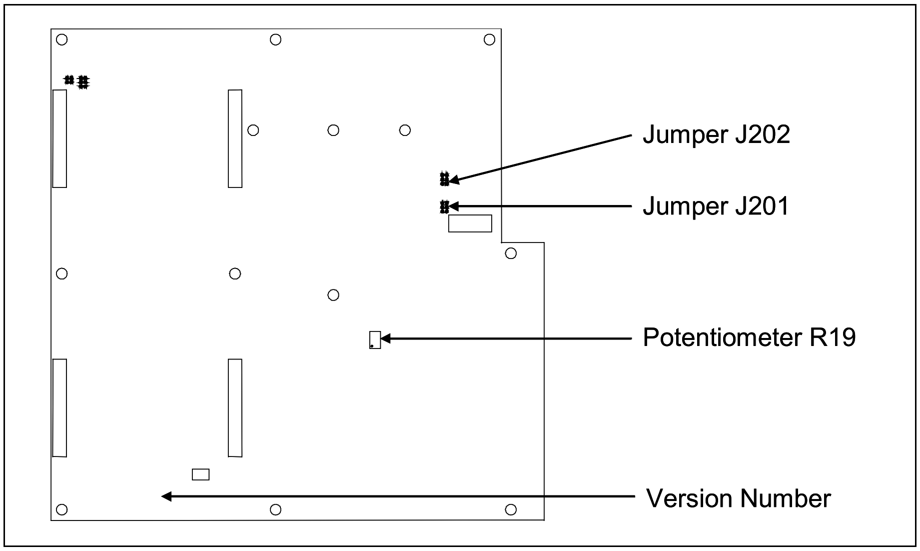
a Toggle off the DC power switch on the right edge of the SmartScanNG enclosure.



b Remove the six nuts and three screws holding the cover over the Interface board.



The Interface board is now visible.



c To prevent the base assembly from falling, replace two of the just removed nuts onto the top two mounting studs on the SmartScanNG enclosure.

d Store the removed cover, three screws, and remaining four nuts in a safe place until you replace them.

The available loading sensitivities vary depending on which version of Interface board you have and whether resistors are attached to the jumpers or not. The version number is printed on the lower-left edge of the board.

e Note the version number of your Interface board.

The table below lists the highest, middle, and lowest sensitivity for transducer loading for current board versions. Highest is the most sensitive. The jumper's top position is the one closest to the external speaker.

J201 or J202 Jumper Position	Version 1.21 and 1.22 and 1.30 and 1.40 Board
Top	Lowest Sensitivity
Center	Middle Sensitivity
Bottom	Highest Sensitivity

This table above only covers board versions 1.21, 1.22, 1.30, and 1.40. Earlier versions of the board have different jumper positions for each sensitivity level. That is, the available loading sensitivities vary depending on which version of Interface board you have, whether the board was modified, and whether resistors are attached to the jumpers. The version number is printed on the lower-left edge of the board.

- **f** If TO1 is the selected gating transducer and the J201 jumper is currently on the highest sensitivity position, move it to the middle sensitivity position.
- **g** If TO1 is the selected gating transducer and the J201 jumper is currently on the middle sensitivity position, move it to the lowest sensitivity position.
- **h** If TO1 is the selected gating transducer and the J201 jumper is currently on the lowest sensitivity position, call STC for help in fixing this problem.
- **i** If TO2 is the selected gating transducer and the J202 jumper is currently on the highest sensitivity position, move it to the middle sensitivity position.
- **j** If TO2 is the selected gating transducer and the J202 jumper is currently on the middle sensitivity position, move it to the lowest sensitivity position.
- **k** If TO2 is the selected gating transducer and the J202 jumper is currently on the lowest sensitivity position, call STC for help in fixing this problem.
- **l** Remove the two nuts holding the base assembly to the SmartScanNG enclosure.
- **m** Using the saved six nuts and three screws, reattach the cover over the Interface board.
- **n** Toggle on the DC power switch on the right edge of the SmartScanNG enclosure.

49 To use the serial interface to open the scanner shutters:

- **a** Using the serial interface, display the Main menu.

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

- **b** To go to the System Functions menu, type **L**

  The System Functions menu appears.

- **c** To open the shutters by starting autocalibration, type **G**

  The protective shutters in all scanners should open and stay open for three minutes. If it isn't enough time to check the shutters and optics, type **G** again.

50 In each scanner, check if its shutter opened.

51 If any shutter didn't open, fix this problem before proceeding.

52 In each scanner, check for dirty optics.

53 If dirty, clean the scanner optics.

Appendix F - Lens Cleaning of Type2/Type3 Scanners tells how to clean the scanner optics.

54 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.

55 To <u>check</u> the operation of the speaker and the radio:

The **Radio Test option** on the System Functions menu is used to broadcast a short message through the speaker (on top of the SmartScanNG enclosure) and through the radio. Similarly, the **1KHz Test Tone option** on the System Functions menu is used to generate a continuous tone for about 10 seconds through the speaker and the radio. Using either of these options will let you verify that the speaker and radio are working properly.

a Be sure that the speaker (on top of the SmartScanNG enclosure) is plugged in <u>and</u> its volume knob is turned to the middle position.

b From the System Functions menu, type <u>either</u> **A** <u>or</u> **F**

If you typed **A**, this message appears.

```
Starting Radio Test
```

If you typed **F**, this message appears.

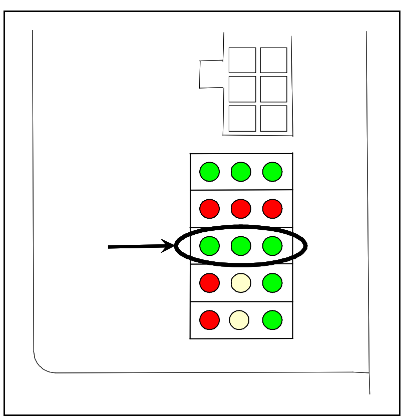
```
Starting 1kHz Test Tone
```

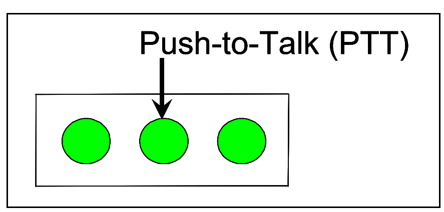
If the system isn't currently making any other voice announcements, it begins the message or tone. After the message or tone finishes, the System Functions menu reappears.

If the system is currently making a voice announcement, the firmware displays the message "System Is Currently Making Voice Announcements! Try Again Later" and redisplays the System Functions menu.

c While listening to the message or tone, look at the **third row of LEDs** on the status panel.

The **middle green LED** should be lit.





If this LED isn't lit, the system's ability to send a message or tone to the radio might be inhibited. This can happen when one uses the **Radio Inhibit option** on the System Functions menu. If the radio is inhibited, the results of this check are invalid.

The **Radio Inhibit option** prevents radio activation for three minutes. During this time, any announcements generated by the system are broadcast through the speaker, but not through the radio.

d If the **middle green LED** (on the third row) isn't lit and the radio isn't inhibited, call STC for help in fixing this problem.

56 To check the integrity of the speech data:

The **Vocabulary Test option** on the System Functions menu is used to enunciate all of the stored speech phrases. This announcement is broadcast through the speaker (on top of the SmartScanNG enclosure), but not through the radio. Therefore, it isn't affected by the **Radio Inhibit option** being enabled.

a Be sure that the speaker (on top of the SmartScanNG enclosure) is plugged in and its volume knob is turned to the middle position.

b Using the serial interface, display the Main menu.

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

c To go to the System Functions menu, type **L**

The System Functions menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
System Functions Menu
--------------------------------------------------
  A) Radio Test
  B) Vocabulary Test
  C) Ramp Function
           .
           .
           .
```

d From the System Functions menu, type **B**

This message appears.

```
Starting Vocabulary Test
```

If the system isn't currently making any other voice announcements, it begins the Vocabulary Test announcement. The SmartScanNG system outputs phrases through the speaker (on the top of the SmartScanNG enclosure), but not through the radio. After the announcement finishes, the System Functions menu reappears.

If the system is currently making a voice announcement, the firmware displays the "System Is Currently Making Voice Announcements! Try Again Later" message and the System Functions menu reappears.

e If you hear nothing or the speech is too garbled to understand, call STC for help in fixing this problem.

57 To generate a test train to check <u>simulated</u> <u>alarms</u>:

a From the System Functions menu, type **C**

This prompt appears.

```
Start Ramp Function?
```

b Type **Y**

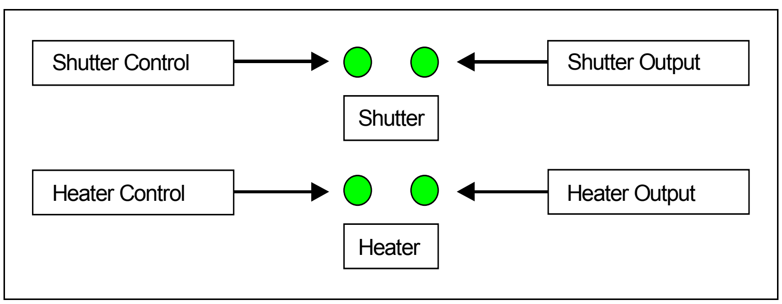
The advance input is made active, gating transducer signals are simulated, and heat values are ramped up (increased) and ramped down (decreased) in a predictable sequence to simulate eight Exception Alarms. **This may take a few minutes.** You <u>cannot</u> stop the ramp function by pressing **[Esc]**. When finished, this message appears followed by the System Functions menu.

```
Running Ramp Function...Ramp Function Complete
```

The ramp function simulates two Absolute alarms, two Differential alarms, and two Hotwheel alarms. It simulates the Hotwheel alarms even if detection for those alarms is disabled in the Equipment menu. However, disabled alarms don't appear on the Last Test Train report.

c Wait until the two LEDs labeled **Shutter** go out.

There is a group of four status LEDs on the lower right side of the chassis. These LEDs show the operation of the solid-state relays used to control the scanner shutters and heaters. The top two are the LEDs labeled **Shutter**.



d Produce a Last Test Train report.

Chapter 12 - Producing Reports tells how to produce this report. From the Main menu, type **G**.

The Last Test Train report is identical to the Train Detail report. There is a difference in the way you specify which train you want reported. In this version of the report, you don't specify a train. The most current ramp train is produced.

e On the report, check for two Absolute alarms and two Differential alarms.

f If your report doesn't show two Absolute alarms and two Differential alarms, call STC for help in fixing this problem.

58 To generate a test train to check number of axles:

a Quickly stroke the top of each gating transducer with a metal wrench, alternating between TO1 and TO2.

b Repeat step **a** nine more times, for a total of **ten** simulated axles.

c Wait for the system to time out and the shutters to close.

d Produce a Last Train report.

Chapter 12 - Producing Reports tells how to produce this report. From the Main menu, type **F**.

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.

e On the report, check that the number of axles agrees with the number of times that you stroked the gating transducers.

f 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.

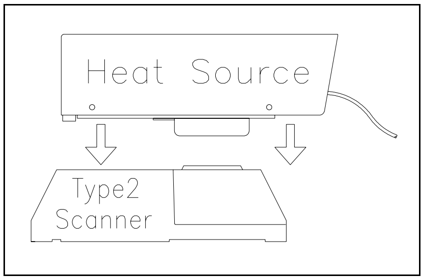
59 To generate a test train to check hot bearings:

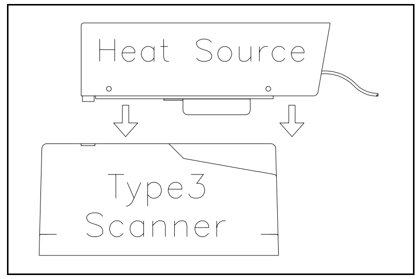
STC recommends that you use the calibrated heat source (2100-810NG) only when the outside (ambient) temperature is above 0°F (-18°C) and below 90°F (32°C). If you must use it at other times, do so only when the needle is centered on the front of the temperature meter. If the needle isn't stabilized within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

a 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.

b 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.





c Quickly stroke the top of each gating transducer with a metal wrench, alternating between TO1 and TO2 for a total of **six** simulated axles.

You should hear the real-time defect message. No matter how many defects are found, the real-time defect message is only announced once.

d Wait for the system to time out, which normally takes about 10 seconds.

You should hear an end-of-train message with three Hotbox alarms. Per train, only the first three Hotbox alarms are ever announced.

e Listen to be sure that the Hotbox alarms are announced and that they are announced for the correct side.

If you do not 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 to the bottom of the SmartScanNG enclosure, a defective shutter motor in the scanner, or a damaged scanner.

f If you do not hear any Hotbox alarms being announced, fix this problem before proceeding.

g If the Hotbox alarms are announced for the wrong side, switch the bearing scanner connections on the bottom of the SmartScanNG enclosure.

h Repeat the test, this time placing the calibrated heat source on the bearing scanner on the opposite rail.

i Verify the results as before.

If the results are correct, your system should function properly when scanning the bearings of real trains.

j Remove the calibrated heat source.

k Store the calibrated heat source and its power cord in the wayside enclosure.

60 On the Train Summary report, check the column marked "Average."

For each train, the values in the two columns under this heading should be within four degrees of each other.

61 If the columns aren't within four degrees <u>and</u> if the scanner optics are clean, recalibrate and realign the scanner.

Chapter 7 - Aligning Scanners tells how to align the scanners. ***Appendix E - Calibration of Scanners*** tells how to calibrate the scanners.

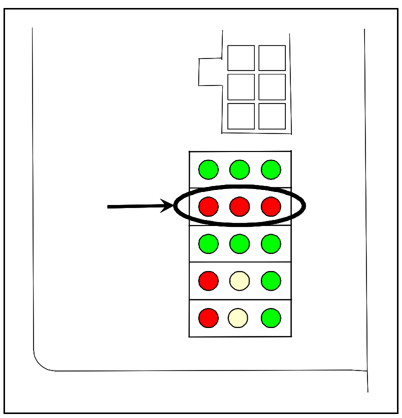
62 On the Train Summary report, check the last column of the report.

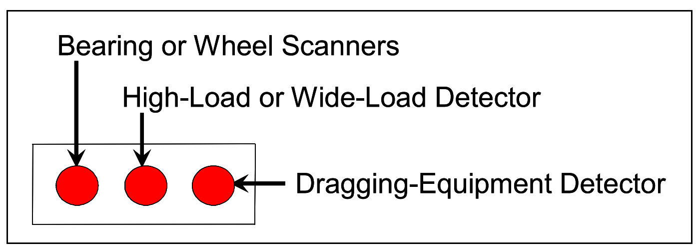
The last column shows the battery voltage when each train passed the site. It should show values between 12.7 and 14.5 volts. Values outside this range may be caused by:

- No AC power for an extended period
- Improperly adjusted float voltage
- Defective battery
- Blown fuses
- Defective battery charger

63 If the most recent value isn't between 12.7 and 14.5 volts, investigate and fix any problems before proceeding.

64 On the status panel, look at the second row of LEDs.





The second row of red LEDs indicates stored defect alarms, including those for bearing/wheel scanners, dragging equipment, and clearance equipment. These LEDs are lit when a defect alarm (associated with one of those pieces of equipment) has been recorded in any of the last 40 trains. Each LED remains lit until there isn't a recorded defect alarm (for the equipment associated with it) in any of the last 40 trains. Note, however, since this is a new installation, you might have <u>less</u> <u>than</u> 40 trains listed on the Exception Summary report. Or, you might have no trains listed. Also, you could have a lit LED and no trains listed if you ran a test train and didn't clear the results.

65 If any LED (on the second row) is lit:

a Produce an Exception Summary report.

Chapter 12 - Producing Reports tells how to produce this report. From the Main menu, type **C**.

The Exception Summary report lists all trains currently stored in the Exceptions directory. A train is stored in the Exceptions directory if either an Exception Alarm or an Integrity Failure was detected on it as it passed the site. A line of information is shown for each train entry.

b If any red LED (on the second row) is lit and there are no train entries on the Exception Summary report, call STC for help in fixing this problem.

c Produce an extended Exception Detail report for each train that is listed on the Exception Summary report, up to and including the most current 40 trains.

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, enter a train number from the Exception Summary report. The train number appears under the column titled "Train#" in the detail section of the Exception Summary report.

d Looking in the detail section of each of the produced Exception Detail reports, note every recorded defect alarm.

e If a red LED (on the second row) is lit and there is no corresponding recorded defect alarm on any of the produced Exception Detail reports, call STC for help in fixing this problem.

f If a red LED (on the second row) is lit and there are one or more corresponding recorded defect alarms on half or less and not on the most current five of the produced Exception Detail reports, go to step **66**.

g If a red LED (on the second row) is lit and there are one or more corresponding recorded defect alarms on more than half or on the most current five of the produced Exception Detail reports, check the track hardware and the wiring to the wayside enclosure.

h If problems are found with the hardware, wiring, or both, fix the problems and then go to step **66**.

i If no problems are found with the hardware and wiring, call STC for help in fixing this problem.

66 If this is a double-track site, repeat steps **18** through **65** for the other track.

Chapter 15
Customer Service

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.

15.1 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 usually takes 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. Email is replied to as soon as possible, normally within one working day.

15.2 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 of where the equipment is to be returned.
- Name and telephone number of person who should be contacted to answer questions about the equipment.
- Written explanation of the equipment defect or malfunction.
- Any reports or other data that would be helpful in diagnosing the problem.
- If out of warranty, If out of warranty, Purchase Order Number for the order or credit card number (to be charged) with its expiration date.

15.3 Reporting Problems or Suggestions

If you have any problems, suggestions, or questions related to STC equipment, telephone the **Engineering Department** at the telephone number above. When calling, state the equipment you're calling about. Your call will then be directed to the right person.

15.4 Ordering Spare Parts

If you need any spare parts to support STC equipment, telephone or fax the **Sales Department** at the telephone numbers above.

When calling, state that you're 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 obtain 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.

15.5 Checking on Shipments and Orders

If you need to check on the status of any shipment or order, telephone or fax the **Sales Department** at the telephone numbers above.

When calling, state that you're 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 locate your order number 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

This appendix describes the conditions and events that the SmartScanNG system flags as System Alarms. These alarms provide data about passing trains and system status. These alarms are listed under the System Alarms section of the Train Detail and Exception Detail reports. ***Chapter 12 - Producing Reports*** tells how to produce these reports.

A.1 Blocked Bearing Scanner Alarm

The Blocked Bearing Scanner alarm indicates that a bearing scanner is not functioning properly, which is usually caused by something (like snow) covering the top of the scanner.

This function considers the average temperature of all of the bearings recorded by a given bearing scanner for a given train passage. When all the bearings on a given rail generate an average temperature reading less than or equal to the average temperature set by the **Blocked Scanner option** on the Alarm Settings menu, the system generates a Blocked Bearing Scanner alarm. ***Chapter 11 - Serial Interface*** tells how to view or change the **Blocked Scanner option**. Valid values for this option are in the range from 3 to 9 degrees Fahrenheit, inclusive.

```
Alarm Settings, MP/KP-1794.5, Track:Single
-------------------------------------------------
A  Absolute.......... 180
B  Differential...... 130
C  Warm Bearing......  80
D  Blocked Scanner...   9
E  Hot Wheel......... 650
                  •
                  •
                  •
```

There is a different Blocked Bearing Scanner alarm for each rail. That is, there is a Blocked North Bearing Scanner alarm and a Blocked South Bearing Scanner alarm (or, depending on track direction, a Blocked East Bearing Scanner alarm and a Blocked West Bearing Scanner alarm).

A.2 Blocked Wheel Scanner Alarm

The Blocked Wheel Scanner alarm indicates that a wheel scanner is not functioning properly, which is usually caused by something (like snow) covering the top of the scanner.

This function considers the average temperature of all of the wheels recorded by a given wheel scanner for a given train passage. When all the wheels on a given rail generate an average temperature reading less than or equal to the average temperature set by the **Blocked Scanner option** on the Alarm Settings menu, the system generates a Blocked Wheel Scanner alarm. ***Chapter 11 - Serial Interface*** tells how to view or change the **Blocked Scanner option**. Valid values for this option are in the range from 3 to 9 degrees Fahrenheit, inclusive.

```
Alarm Settings, MP/KP-1794.5, Track:Single
-------------------------------------------------
A  Absolute.......... 180
B  Differential...... 130
C  Warm Bearing......  80
D  Blocked Scanner...   9
E  Hot Wheel......... 650
                 •
                 •
                 •
```

There is a different Blocked Wheel Scanner alarm for each rail. That is, there is a Blocked North Wheel Scanner alarm and a Blocked South Wheel Scanner alarm (or, depending on track direction, a Blocked East Wheel Scanner alarm and a Blocked West Wheel Scanner alarm).

A.3 Cold Bearing Scanner Alarm

The Cold Bearing Scanner alarm (on some systems, called the Cold Rail alarm) indicates that the temperatures of all bearings (of the train) on the designated rail were below a given temperature. When no bearing on a given rail generates a delta temperature reading greater than or equal to the temperature set by the **Cold Bearing Temperature option** on the Alarm Settings menu, the system generates a Cold Bearing Scanner alarm. ***Chapter 11 - Serial Interface*** tells how to view or change the **Cold Bearing Temperature option**.

```
Alarm Settings, MP/KP-1794.5, Track:Single
-------------------------------------------------
A  Absolute.......... 180
B  Differential...... 130
C  Warm Bearing......  80
D  Blocked Scanner...   9
E  Hot Wheel......... 650
F  Carside Slope..... 1.60
G  Carside Minimum... 155
H  Cold Bearings.....  1
I  Cold Bearing Temp. 10

Alarm to change or Esc to quit?
```

There is a different Cold Bearing Scanner alarm for each rail. That is, there is a Cold North Bearing Scanner alarm and a Cold South Bearing Scanner alarm (or, depending on track direction, a Cold East Bearing Scanner alarm and a Cold West Bearing Scanner alarm).

The maximum number (per railside) of consecutive trains, having Cold Bearing Scanner alarms, allowed before generating a Successive Cold Rails Exceeded alarm is set by the **Cold Bearings option** on the Alarm Settings menu. Successive Cold Rails Exceeded alarms are covered in the next appendix. ***Chapter 11 - Serial Interface*** tells how to view or change the **Cold Bearings option**.

```
             .
             .
             .

G  Carside Minimum... 155
H  Cold Bearings.....  1
I  Cold Bearing Temp. 10

Alarm to change or Esc to quit?
```

A.4 Cold Bearing Scanner 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 a site and the shutters have closed, the temperature of the resistor is read by the scanner pyrometer. In this way, a check of the system's ability to read heat correctly is made.

The Cold Bearing Scanner Resistor alarm (on some systems, called 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** wasn't met, a second check compares the recorded resistor temperature against the limit that was established using the **Absolute option** on the Alarm Settings menu. (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 Bearing Scanner Resistor alarms. ***Chapter 11 - Serial Interface*** tells how to view or change the **Absolute option**.

```
Alarm Settings, MP/KP-1794.5, Track:Single
--------------------------------
A  Absolute.......... 180
B  Differential...... 130
C  Warm Bearing......  80
                 •
                 •
                 •
```

There is a different Cold Bearing Scanner Resistor alarm for each rail. That is, there is a Cold North Bearing Scanner Resistor alarm and a Cold South Bearing Scanner Resistor alarm (or, depending on track direction, a Cold East Bearing Scanner Resistor alarm and a Cold West Bearing Scanner Resistor alarm).

The **maximum number** (per railside) of consecutive trains, having Cold Bearing Scanner Resistor alarms, allowed before generating a Successive Cold Resistors Exceeded alarm is set by the **Cold Bearings option** on the Alarm Settings menu. Successive Cold Resistors Exceeded alarms are covered in the next appendix. ***Chapter 11 - Serial Interface*** tells how to view or change the **Cold Bearings option**.

```
             .
             .
             .

G  Carside Minimum... 155
H  Cold Bearings.....  1
I  Cold Bearing Temp. 10

Alarm to change or Esc to quit?
```

A.5 Cold Wheel Scanner Alarm

The Cold Wheel Scanner alarm represents the wheel scanner's equivalent of the bearing scanner's Cold Bearing Scanner alarm (on some systems, called the Cold Rail alarm). When no wheel on a given rail generates a delta temperature reading greater than or equal to a preset minimum, the system generates a Cold Wheel Scanner alarm. The preset minimum temperature is determined by the firmware and is currently 5°C above ambient (9°F above ambient). The customer can't change this value. Just like Cold Bearing Scanner alarms, separate Cold Wheel Scanner alarms exist for each railside.

The **maximum number** (per railside) of consecutive trains, having Cold Wheel Scanner alarms, allowed before generating a Successive Cold Wheels Exceeded alarm is set by the **Cold Bearings option** on the Alarm Settings menu. Successive Cold Wheels Exceeded alarms are covered in the next appendix. ***Chapter 11 - Serial Interface*** tells how to view or change the **Cold Bearings option**.

```
             .
             .
             .

G  Carside Minimum... 155
H  Cold Bearings.....  1
I  Cold Bearing Temp. 10

Alarm to change or Esc to quit?
```

A.6 Cold Wheel Scanner Resistor Alarm

The Cold Wheel Scanner Resistor alarm represents the wheel scanner's equivalent of the bearing scanner's Cold Bearing Scanner Resistor alarm (on some systems, called the 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 Bearing Scanner 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 Bearing Scanner 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 Bearings option** on the Alarm Settings menu. Successive Cold Wheel Resistors Exceeded alarms are covered in the next appendix. ***Chapter 11 - Serial Interface*** tells how to view or change the **Cold Bearings option**.

```
              .
              .
              .

G  Carside Minimum... 155
H  Cold Bearings.....  1
I  Cold Bearing Temp. 10

Alarm to change or Esc to quit?
```

A.7 Highrange Transducer Miscounts Alarm

The Highrange Transducer Miscounts alarm indicates that the transducer counts for TO1 and TO2 differ by seven or more. This calculation is made after each axle crosses both gating transducers. When this alarm occurs, the system won't announce axle count, exit speed, length of train, or total number of cars (even if these messages are enabled).

The Highrange Transducer Miscounts alarm <u>can</u> <u>be</u> <u>either</u> a System Alarm or an Integrity Failure, depending on the presence of a Very Slow Train alarm. If a highrange transducer miscount occurs on a train that also contains a Very Slow Train alarm, the firmware treats the miscount condition as a System Alarm. This logic assumes that the train's slow rate of travel likely caused the transducer miscount condition. If a highrange transducer miscount occurs on a train traveling faster than 7 mph (11.3 kph), the firmware treats the miscount condition as an Integrity Failure.

A.8 Integrity Failure Alarm

The Integrity Failure alarm indicates that the SmartScanNG system 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 accurately to record train data, may be compromised. These unusual conditions, called Integrity Failures, may require train stoppage, later maintenance, or both. They are covered in the next appendix.

A.9 Low Battery Alarm

The **Low Battery alarm** indicates a float voltage of at least 11.5 volts, but less than 12.6 volts, on the standby battery. (The **Dead Battery alarm** indicates a float voltage of less than 11.5 volts on the standby battery.) On a solar-powered system, it indicates a voltage of at least 10.5 volts, but less than 11.5 volts, from the solar subsystem.

A.10 Midrange Transducer Miscounts Alarm

The Midrange Transducer Miscounts alarm indicates that the transducer counts for TO1 and TO2 differ by five or six. This calculation is made after each axle crosses both gating transducers.

A.11 No Approach Track Alarm

The No Approach Track alarm (on some systems, called the Advance System Failure alarm) indicates that the system presence detection system (that is, the track circuit or the advance transducers) didn't detect the arrival of the train at the site. Instead, the system started the train scanning process when a gating transducer sensed the train.

A.12 Pyrometer Noise Filtered Rail Alarm

The Pyrometer Noise Filtered Rail alarm indicates that a pyrometer in a bearing scanner might be becoming unreliable. This alarm isn't considered an Integrity Failure and therefore won't result in “Not Working” being part of the post-train announcement.

There is a different Pyrometer Noise Filtered Rail alarm for each rail. That is, there is a Pyrometer Noise Filtered North Rail alarm and a Pyrometer Noise Filtered South Rail alarm (or, depending on track direction, a Pyrometer Noise Filtered East Rail alarm and a Pyrometer Noise Filtered West Rail alarm).

Not all systems have the Pyrometer Noise Filtered Rail alarm.

A.13 Pyrometer Noise Filtered Wheel Alarm

The Pyrometer Noise Filtered Wheel alarm indicates that a pyrometer in a wheel scanner might be becoming unreliable. This alarm isn't considered an Integrity Failure and therefore won't result in “Not Working” being part of the post-train announcement.

There is a different Pyrometer Noise Filtered Wheel alarm for each rail. That is, there is a Pyrometer Noise Filtered North Wheel alarm and a Pyrometer Noise Filtered South Wheel alarm (or, depending on track direction, a Pyrometer Noise Filtered East Wheel alarm and a Pyrometer Noise Filtered West Wheel alarm).

Not all systems have the Pyrometer Noise Filtered Wheel alarm.

A.14 Reverse Direction Detected Alarm

Trains that are being scanned correctly will have axles whose <u>on</u> <u>times</u> (that is, the time during which an axle passed between the gating transducers) are <u>less</u> <u>than</u> their <u>off</u> <u>times</u> (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 <u>greater</u> <u>than</u> the off time. If the axle's on time is <u>greater</u> <u>than</u> its off time, the system reverses the direction locked-in by the first gating pulse, reverses the opening and closing gate assignment for TO1 and TO2, and generates a false transducer pulse. The system considers the gate active for the next axle at the time it determines the current axle's opening gate pulse was missed.

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.15 Short Train Alarm

The Short Train alarm indicates that a train had fewer than 50 axles.

A.16 Stuck Dragger Recovered Alarm

The Stuck Dragger Recovered alarm indicates that a stuck dragger was detected during train passage and, at some point later, the dragging-equipment detector returned to its neutral position. After returning to its neutral position, the firmware must scan at least eight consecutive Dragger free axles before flagging this condition again.

A.17 Stuck SOTC Alarm

The Stuck SOTC alarm indicates that the track circuit is active when it shouldn't be. That is, it is active when no train is present at the site. Or, when a train is moving through the site and both transducers are inactive. Not all systems have the Stuck SOTC alarm.

A.18 Test Train Alarm

The Test Train alarm indicates that a given train was generated by the SmartScanNG system. These trains are used for testing purposes and don't represent actual trains passing the site.

A.19 Very Slow Train Alarm

The Very Slow Train alarm indicates that, at some point during train passage, four consecutive axles crossed the gating transducers at a speed of 7 mph (11.3 kph) or less. When this alarm occurs, the system won't announce axle count, exit speed, length of train, and total number of cars (even if these messages are enabled).

Appendix B
Integrity Failures

This appendix describes the conditions and events that the SmartScanNG system 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 under 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 11.5 volts on the standby battery. (The **Low Battery alarm** indicates a float voltage of at least 11.5 volts, but less than 12.6 volts, on the standby battery.) On a solar-powered system, it indicates a voltage of less than 10.5 volts from the solar subsystem.

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 Bearing Scanner alarm (on some systems, called the Cold Rail alarm) on a given rail. Second, the recorded temperature for the bearing scanner's resistor on that rail must fall below the value set by the **Cold Bearing Temperature option** on the Alarm Settings menu. ***Chapter 11 - Serial Interface*** tells how to view or change this value.

```
              .
              .
              .

G  Carside Minimum... 155
H  Cold Bearings.....  1
I  Cold Bearing Temp. 10

Alarm to change or Esc to quit?
```

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 Dead Wheel Scanner Resistor Alarm

The wheel scanner's 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 wheel scanner's resistor on that rail must fall below the value set by the **Cold Bearing Temperature option** on the Alarm Settings menu. ***Chapter 11 - Serial Interface*** tells how to view or change this value.

```
             .
             .
             .

G  Carside Minimum... 155
H  Cold Bearings.....  1
I  Cold Bearing Temp. 10

Alarm to change or Esc to quit?
```

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).

B.4 Highrange Transducer Miscounts Alarm

The Highrange Transducer Miscounts alarm indicates that the transducer counts for TO1 and TO2 differ by seven or more. This calculation is made after each axle crosses both gating transducers. When this alarm occurs, the system won't announce axle count, exit speed, length of train, or total number of cars (even if these messages are enabled).

The Highrange Transducer Miscounts alarm can be either a System Alarm or an Integrity Failure, depending on the presence of a Very Slow Train alarm. If a highrange transducer miscount occurs on a train that also contains a Very Slow Train alarm, the firmware treats the miscount condition as a System Alarm. This logic assumes that the train's slow rate of travel likely caused the transducer miscount condition. If a highrange transducer miscount occurs on a train traveling faster than 7 mph (11.3 kph), the firmware treats the miscount condition as an Integrity Failure.

B.5 Stuck Dragger During Train Passage Alarm

The Stuck Dragger During Train Passage alarm indicates that the preset maximum number of consecutive axles have had Dragging-Equipment alarms during train passage. The maximum number is determined by the firmware and is currently five.

B.6 Stuck Dragger Pretrain Alarm

The Stuck Dragger Pretrain alarm indicates that the dragging-equipment detector was stuck before the scanners started scanning. That is, between the time of first receiving a pulse from the track circuit (or the advance transducers) and the time of first receiving a pulse from either gating transducer, the SmartScanNG system detected an open circuit from the dragging-equipment detector.

B.7 Stuck High-Load Detector Pretrain Alarm

The Stuck High-Load Detector Pretrain alarm indicates that, before the scanners started scanning, the high-load detector was stuck. That is, between the time of first receiving a pulse from the track circuit (or the advance transducers) and the time of first receiving a pulse from either gating transducer, the SmartScanNG system detected an open circuit from the high-load detector.

B.8 Stuck Wide-Load Detector Pretrain Alarm

The Stuck Wide-Load Detector Pretrain alarm indicates that, before the scanners started scanning, the wide-load detector was stuck. That is, between the time of first receiving a pulse from the track circuit (or the advance transducers) and the time of first receiving a pulse from either gating transducer, the SmartScanNG system detected an open circuit from the wide-load detector.

There is a different Stuck Wide-Load Detector Pretrain alarm for each rail. That is, there is a Stuck Wide-Load Detector Pretrain North Side alarm and a Stuck Wide-Load Detector Pretrain South Side alarm (or, depending on track direction, a Stuck Wide-Load Detector Pretrain East Side alarm and a Stuck Wide-Load Detector Pretrain West Side alarm).

B.9 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 Bearing Scanner alarms (on some systems, called the Cold Rail alarms) on the same railside, have passed a site. The maximum number (per railside) of consecutive trains having Cold Bearing Scanner alarms allowed before generating an Integrity Failure alarm is set by the **Cold Bearings option** on the Alarm Settings menu. ***Chapter 11 - Serial Interface*** tells how to view or change this value.

```
              .
              .
              .

G  Carside Minimum... 155
H  Cold Bearings.....  1
I  Cold Bearing Temp. 10

Alarm to change or Esc to quit?
```

Under normal circumstances, Cold Rail conditions represent System Alarms, not Integrity Failures. However, if the number of consecutive trains bearing identical Cold Bearing Scanner alarms <u>equals</u> <u>or</u> <u>exceeds</u> the **Cold Bearings option** on the Alarm Settings menu, 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.10 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 Bearing Scanner Resistor alarms (on some systems, called the Cold Resistor alarms) on the same railside, have passed a site. The maximum number (per railside) of consecutive trains having Cold Bearing Scanner Resistor alarms allowed before generating an Integrity Failure alarm is set by the **Cold Bearings option** on the Alarm Settings menu. ***Chapter 11 - Serial Interface*** tells how to view or change this value.

```
              .
              .
              .

G  Carside Minimum... 155
H  Cold Bearings.....  1
I  Cold Bearing Temp. 10

Alarm to change or Esc to quit?
```

Under normal circumstances, Cold Resistor conditions represent System Alarms, not Integrity Failures. However, if the number of consecutive trains bearing identical Cold Bearing Scanner Resistor alarms equals or exceeds the **Cold Bearings option** on the Alarm Settings menu, 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.11 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 user determines the number of consecutive trains used in the comparison through the **Cold Bearings option** on the Alarm Settings menu. ***Chapter 11 - Serial Interface*** tells how to view or change this value.

```
             .
             .
             .

G  Carside Minimum... 155
H  Cold Bearings.....  1
I  Cold Bearing Temp. 10

Alarm to change or Esc to quit?
```

Under normal circumstances, cold-wheel conditions represent System Alarms, not Integrity Failures. However, if the number of consecutive trains bearing identical Cold Wheel Scanner alarms equals or exceeds the **Cold Bearings option** on the Alarm Settings menu, 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 Wheels Exceeded."

B.12 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 user determines the number of consecutive trains used in the comparison through the **Cold Bearings option** on the Alarm Settings menu. ***Chapter 11 - Serial Interface*** tells how to view or change this value.

Under normal circumstances, cold-wheel-resistor conditions represent System Alarms, not Integrity Failures. However, if the number of consecutive trains bearing identical Cold Wheel Scanner Resistor alarms equals or exceeds the **Cold Bearings option** on the Alarm Settings menu, 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 Wheel Resistors Exceeded."

Appendix C
System Functions

This appendix lists the system functions provided by the SmartScanNG system.

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 SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Main Menu
-------------------------------------------------
  A) Train Summary
  B) Train Detail
  C) Exception Summary
  D) Exception Detail
  E) System Status
  F) Last Train
  G) Last Test Train
  H) AEI Diagnostic Detail
  I) Replay EOT Announcement
  J) Setup
  K) Enter Pass-Thru Mode for COM 2
  L) System Functions
  M) Event Log
  X) Exit
```

2 To go to the System Functions menu, type **L**

The System Functions menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
System Functions Menu
-------------------------------------------------
  A) Radio Test
  B) Vocabulary Test
  C) Ramp Function
  D) Radio Inhibit
  E) Manual Test Mode
  F) 1KHz Test Tone
  G) Auto-Calibration
  H) Reset the COP Counters
  I) Remote System RESET
  J) Delete All Stored Train Data
  K) Clear Event Log
  X) Exit
```

No password is needed to select or run any of the above functions. Not all systems have the **Clear Event Log option**.

C.1 Radio Test

Selection of the **Radio Test option** broadcasts a short message through the speaker (on top of the SmartScanNG enclosure) and through the radio. Using this option lets you verify that the speaker and radio are working properly.

At single-track sites, if English was selected with the **Primary Language option** and kph was selected with the **Speed Format option**, the text of the message is usually "Testing, detector at kilometer post (kilometer-post number), testing, one, two, three, four, five, four, three, two, one, testing." At double-track sites, if English was selected with the **Primary Language option** and kph was selected with the **Speed Format option**, the text of the message is usually "Testing, detector at kilometer post (kilometer-post number), track (track designation), testing, one, two, three, four, five, four, three, two, one, testing."

By using the **Primary Language option** on the Messages menu, you can specify if you want the message broadcast in English, French, or Spanish. Instead of just the **Primary Language option**, some systems let you choose both a **Primary Language option** and a **Secondary Language option**. If your system does, the radio test is broadcast first in the primary language you chose and then in the secondary language you chose.

If you selected mph with the **Speed Format option** on the Units of Measure submenu and English, the word "milepost" will be announced. If you selected kph with the **Speed Format option** and English, the words "kilometer post" will be announced instead.

C.2 Vocabulary Test

Selection of the **Vocabulary Test option** enunciates all of the stored speech phrases. This announcement is broadcast through the speaker (on top of the SmartScanNG enclosure), but not through the radio. Therefore, it isn't affected by the **Radio Inhibit option** being enabled.

The English text of the message is usually "zero, one, two, three, four, five, six, seven, eight, nine, integrity-failure, *beep*, detector-at, milepost, kilometer-post, main-3, system-working, no-defects, main-1, main-2, rebroadcast, hotwheel, defect, axle, dragging-equipment-near, north, south, rail, east, west, track, car-I-D, no, hotbox, high-wide-near, you-have-a-defect, testing, train too slow, total axles, speed, temperature, length, minus, point, middle, high-load, wide-load, power-off, excess-alarms, repeat, total-cars, detector-out, A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z." Not all systems broadcast the letters A through Z.

By using the **Primary Language option** on the Messages menu, you can specify if you want the message broadcast in English, French, or Spanish. Instead of just the **Primary Language option**, some systems let you choose both a **Primary Language option** and a **Secondary Language option**. If your system does, the radio test is broadcast first in the primary language you chose and then in the secondary language you chose.

C.3 Ramp Function

Selection of the **Ramp Function option** generates a test train. It simulates two Absolute alarms, two Differential alarms, and two Hotwheel alarms. It doesn't simulate any Carside Slope alarms. It simulates the Hotwheel alarms even if detection for those alarms is disabled in the Equipment menu. However, disabled alarms don't appear on the Last Test Train report.

You cannot stop the ramp function by pressing **[Esc]**.

The data generated for this test train is stored in the Test Train directory, which contains data on the last test train only. The Last Test Train report gets its data from this directory.

C.4 Radio Inhibit

Selection of the **Radio Inhibit option** prevents radio activation for three minutes. During this time, any announcements generated by the system are broadcast through the speaker (on top of the SmartScanNG enclosure), but not through the radio. This feature may be overridden by recalling this submenu and then typing **N**.

C.5 Manual Test Mode

Selection of the **Manual Test Mode option** opens all the shutters and simulates transducer pulses for about one minute. During this time, a person can check various aspects of the installed components. In this mode, the system runs the ramp function without generating heats. The train is marked as a test train. There won't be any voltage applied to the scanner inputs.

The test continues until 486 axles are simulated. You <u>cannot</u> stop this test by pressing **[Esc]**.

The data generated for this test train is stored in the Test Train directory, which contains data on the last test train only. The Last Test Train report gets its data from this directory.

C.6 1KHz Test Tone

Selection of the **1KHz Test Tone option** generates a continuous one-kilohertz tone for about 10 seconds through the speaker and the radio. This tone is broadcast <u>through</u> <u>the</u> <u>speaker</u> and <u>through</u> <u>the</u> <u>radio</u>. Using this option lets you verify that the speaker and radio are working properly.

C.7 Auto-Calibration

Selection of the **Auto-Calibration option** places the system in autocalibration mode.

The SmartScanNG system 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.8 Reset the COP Counters

Selection of the **Reset the COP Counters option** resets each COP counter to zero.

Associated with each microprocessor on the Processor board is a Computer Operating Properly (COP) counter. The SmartScanNG system uses these counters to keep track of every time the system automatically resets itself or the customer manually resets it, 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.

No password is needed before this function can be activated.

C.9 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.

No password is needed before this function can be activated.

C.10 Delete All Stored Train Data

Selection of the **Delete All Stored Train Data option** erases all of the stored train data. This encompasses all of the data on the trains in the Trains directory, Exceptions directory, and Test Train directory. After deleting all the train data, there isn't any way of regenerating it. The data is gone forever.

No password is needed before this function can be activated.

C.11 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.

No password is needed before this function can be activated. Not all systems have this option.

Appendix D
Replacement of Scanner Cover-and-Module Assemblies

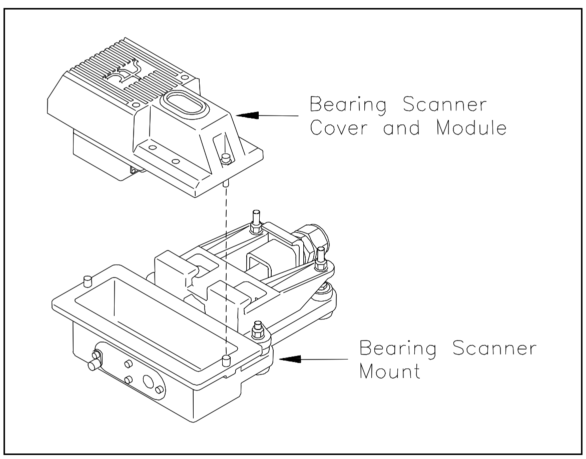
There are **type2** bearing scanners and **type2** wheel scanners. Both contain two major parts. The top part is the cover-and-module assembly. The module and its protective cover are tightly integrated and rarely should be taken apart. Except for the addition of a **plastic attenuation plug** on the 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 **type3** bearing scanners and **type3** 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.

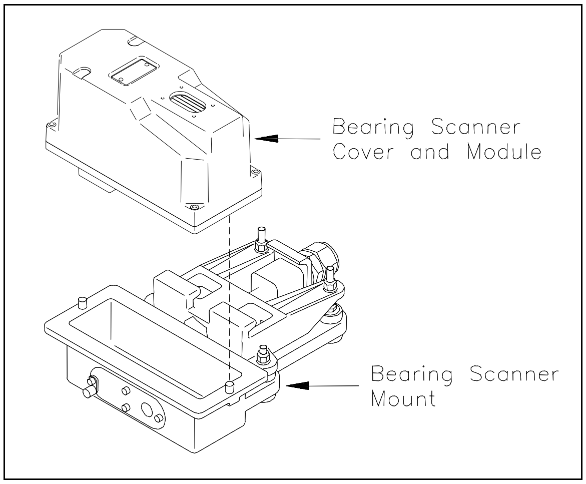
This appendix tells how to replace scanner cover-and-module assemblies. Replacement of scanner mounts isn't covered in this guide.

D.1 Bearing Scanners

The figure below shows the major parts of a **type2** bearing scanner.



The figure below shows the major parts of a **type3** bearing scanner.



To replace a **type2/type3** bearing scanner cover-and-module assembly:

1 Be sure that you have on hand a new scanner cover-and-module assembly.

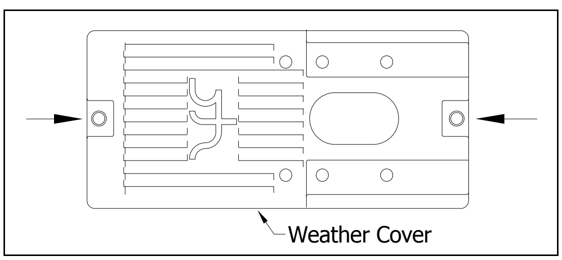
2 Be sure that you have on hand a T-handle 1/4-inch hex-wrench.

3 Turn off all power to the scanners.

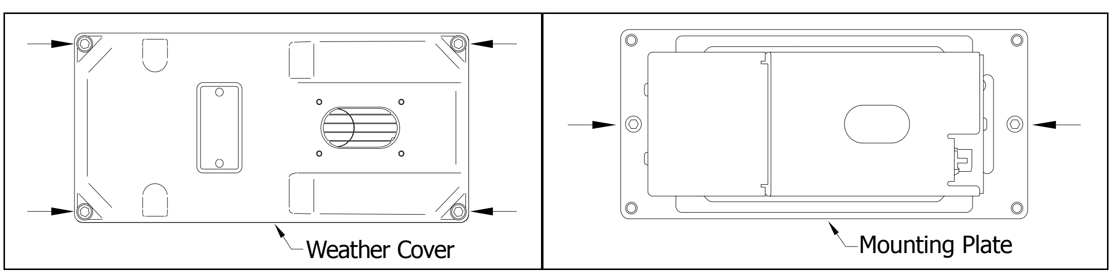
This requires turning off the DC power switch on the SmartScanNG enclosure and unplugging the AC power cord on the bottom of the SmartScanNG enclosure.

4 Using a T-handle 1/4-inch hex-wrench, loosen the socket-head-cap screws on the cover of the bearing scanner.

The **type2** bearing scanner has two socket-head-cap screws that attach the weather cover to the mount.



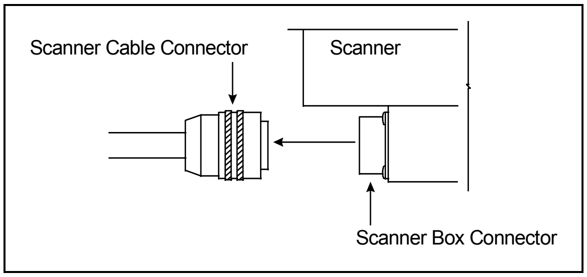
The **type3** bearing scanner has six. Four that attach the weather cover to the mounting plate and two that attach the mounting plate to the mount.



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

6 If this is a **type3** 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.

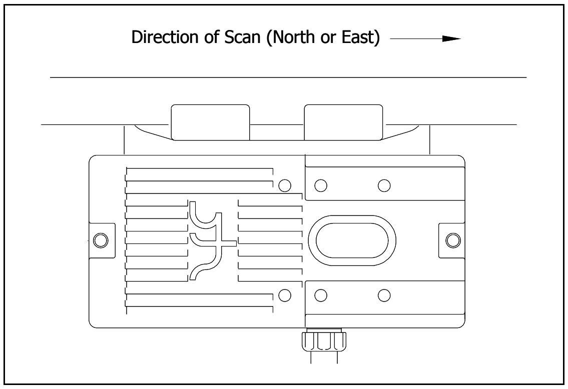
10 If this is a **type2** bearing scanner:

- 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.

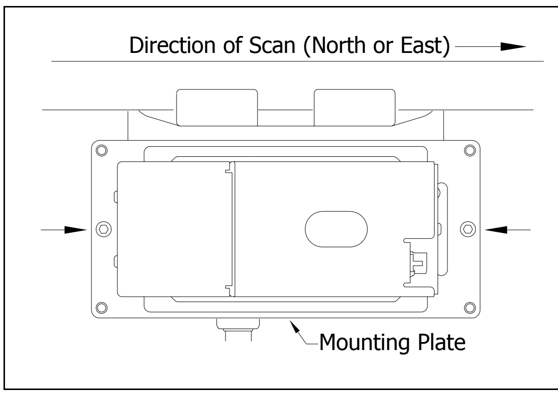
11 If this is a **type3** bearing scanner:

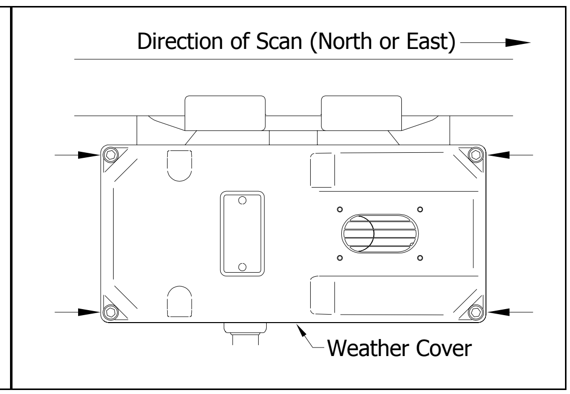
- a With the hole on top of the bearing scanner cover facing north or east, set the mounting plate back onto its scanner mount.
- b Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.
- c Reconnect the heater wiring plug.
- d With the hole on top of the bearing scanner 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 **type2** bearing scanner weather cover is shown below.



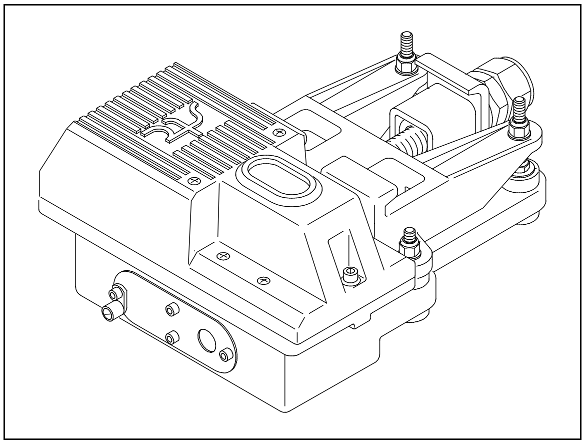
The top view of the **type3** bearing scanner mounting plate and weather cover are shown below.



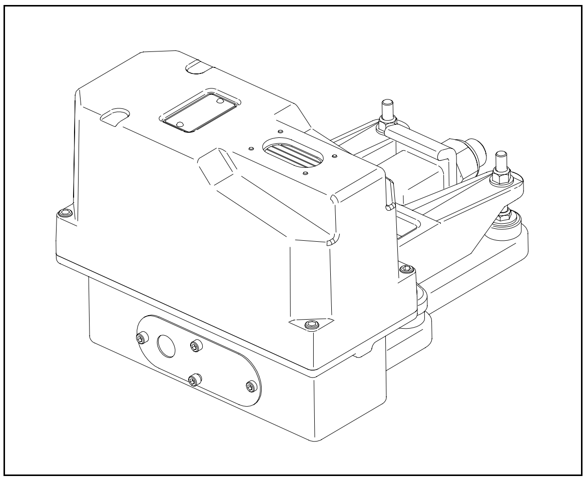


12 Turn on power to the scanners.

An assembled **type2** bearing scanner looks like this.

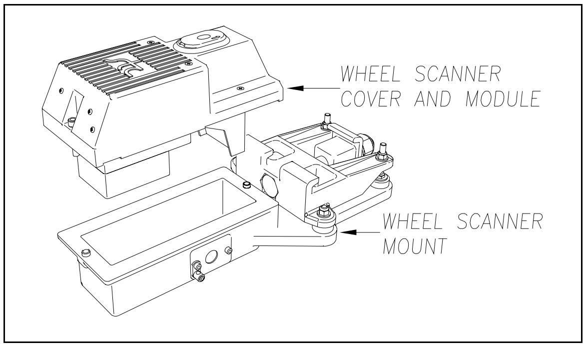


An assembled **type3** bearing scanner looks like this.

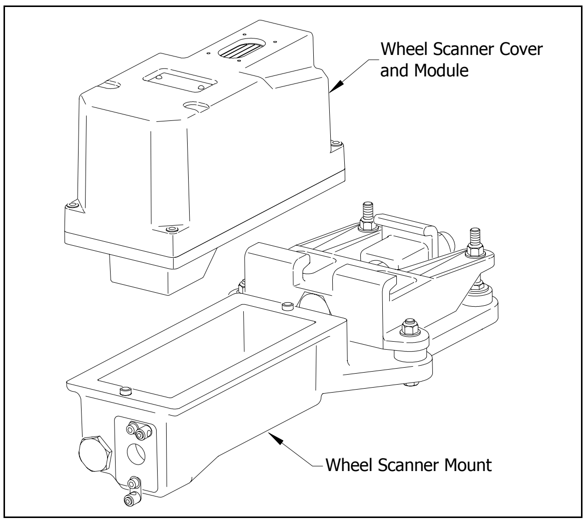


D.2 Wheel Scanners

The figure below shows the major parts of a **type2** wheel scanner.



The figure below shows the major parts of a **type3** wheel scanner.



To replace a **type2/type3** wheel scanner cover-and-module assembly:

1 Be sure that you have on hand a new scanner cover-and-module assembly.

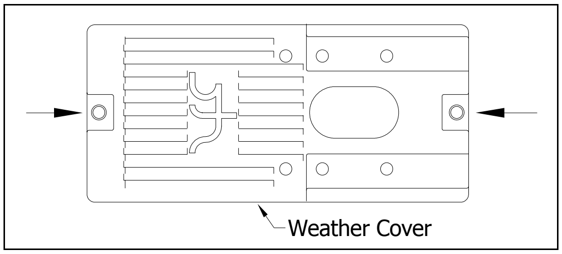
2 Be sure that you have on hand a T-handle 1/4-inch hex-wrench.

3 Turn off all power to the scanners.

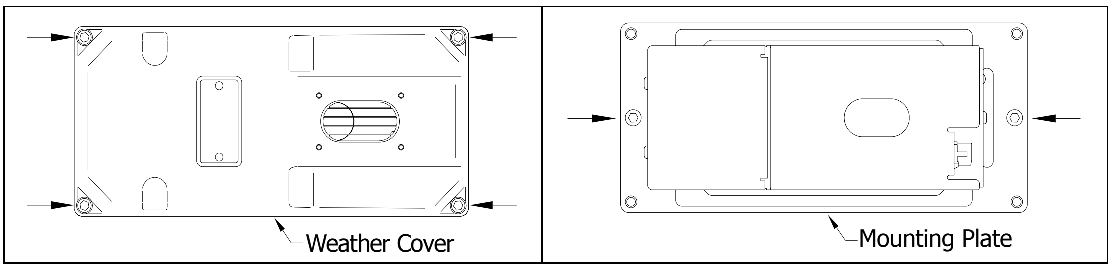
This requires turning off the DC power switch on the SmartScanNG enclosure and unplugging the AC power cord on the bottom of the SmartScanNG enclosure.

4 Using a T-handle 1/4-inch hex-wrench, loosen the socket-head-cap screws on the cover of the wheel scanner.

The **type2** wheel scanner has two socket-head-cap screws that attach the weather cover to the mount.



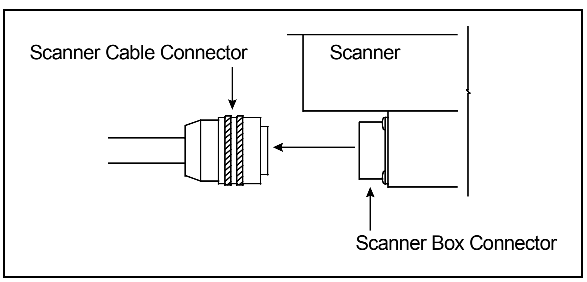
The **type3** wheel scanner has six. Four that attach the weather cover to the mounting plate and two that attach the mounting plate to the mount.



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

6 If this is a **type3** 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 **type2** 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 **type3** 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.

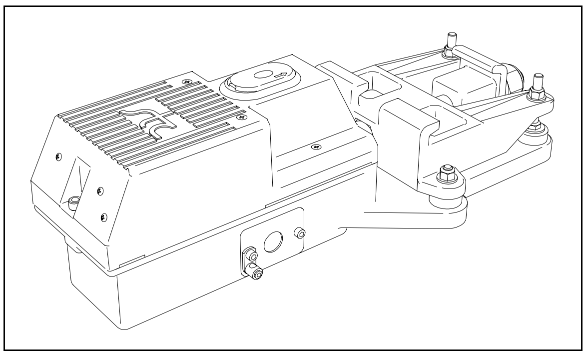
  c Reconnect the heater wiring plug.

  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.

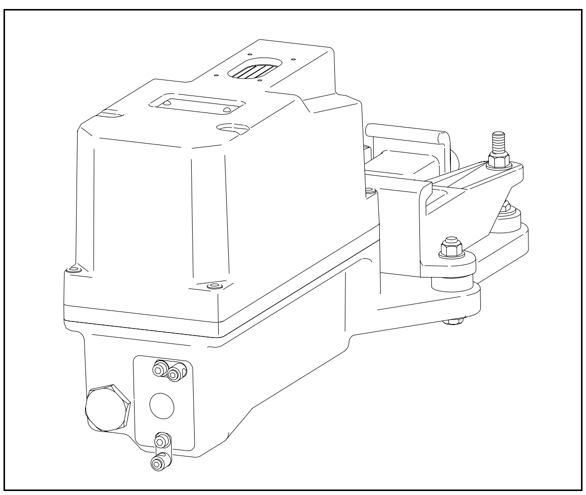
  e Using the T-handle 1/4-inch hex-wrench, uniformly tighten the four socket-head-cap screws.

12 Turn on power to the scanners.

An assembled **type2** wheel scanner looks like this.



An assembled **type3** wheel scanner looks like this.



Appendix E
Calibration of Scanners

The SmartScanNG system 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 ± 2 degrees of set point, the heat source isn't operating properly.

To calibrate a **type2/type3** bearing scanner:

1 Be sure that you have on hand a 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**.

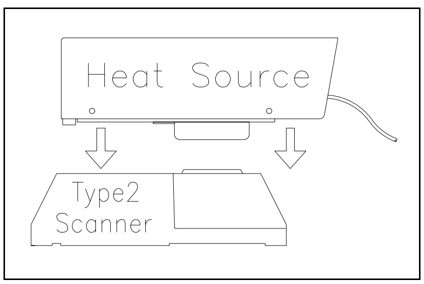
7 Put the heat source in a shady area, out of direct sunlight and out of the wind.

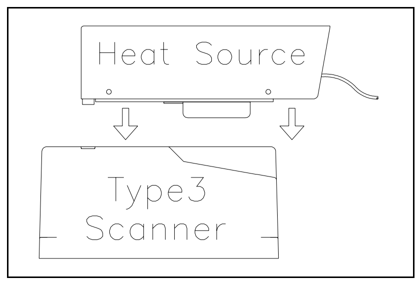
8 Wait about 8 minutes for the heat source to reach operating temperature and stabilize.

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 To prepare your computer:

a Plug your computer into COM1 or COM2 (whichever is available) using a crossover (null-modem) cable.

b Turn on your computer.

c 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 19,200.

d On your computer, open a LOG file.

11 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.

```
                .
                .
                .

    K) Enter Pass-Thru Mode for COM 2
    L) System Functions
    M) Event Log
    X) Exit
```

12 To go to the System Functions menu, type **L**

The System Functions menu appears.

```
STC SmartScanNG, MP/KP-1111.1, Track:South
11/07/2011 21:57
System Functions Menu
-------------------------------------------------
  A) Radio Test
  B) Vocabulary Test
  C) Ramp Function
  D) Radio Inhibit
  E) Manual Test Mode
  F) 1KHz Test Tone
  G) Auto-Calibration
  H) Reset the COP Counters
  I) Remote System RESET
  J) Delete All Stored Train Data
  K) Clear Event Log
  X) Exit
```

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

13 To start autocalibration, type **G**

The SmartScanNG system 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-306. 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.
Resistor test pending.

.......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.

14 When "Auto-Calibration Disengaged" is displayed on your computer, remove the calibrated heat source.

Upon completion of autocalibration, the system acquires the scanner resistor temperature baseline values. The process begins with a 20-minute wait period in which the resistors are allowed to cool down. The system counts down during this period, sounding a tone each minute. After the 20-minute cool down period, the system opens and closes the shutters for a period of 8 minutes.

15 To return to the Main menu, type **X**

16 To exit the serial interface and return the system to normal operation, type **X**

17 Store the calibrated heat source and its power cord in the 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 ± 2 degrees of set point, the heat source isn't operating properly.

To calibrate a **type2/type3** wheel scanner:

1 Be sure that you have on hand a 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**.

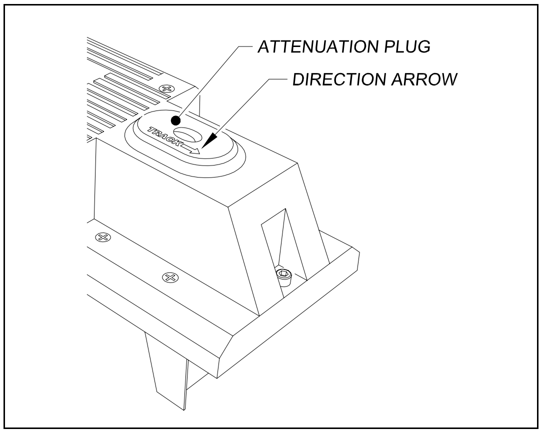
7 Put the heat source in a shady area, out of direct sunlight and out of the wind.

8 Wait about 8 minutes for the heat source to reach operating temperature and stabilize.

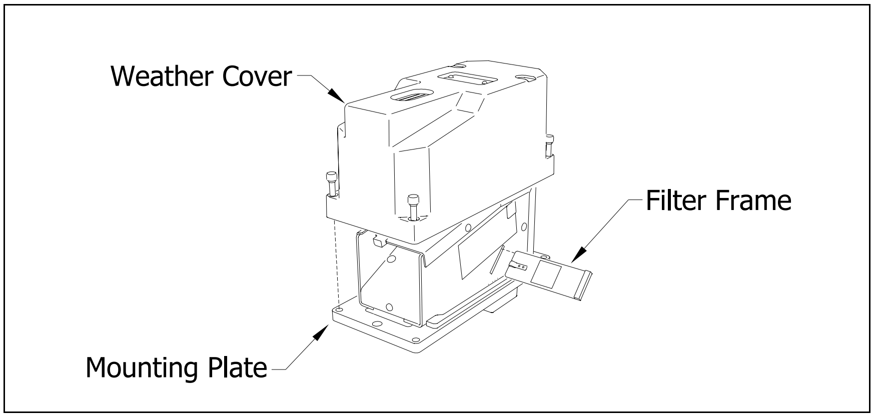
The heat source has reached operating temperature and stabilized when the temperature meter needle remains centered.

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 **type2** wheel scanner, remove the attenuation plug from the weather cover.

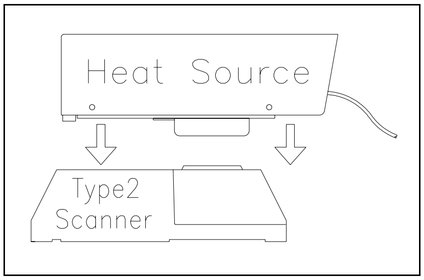


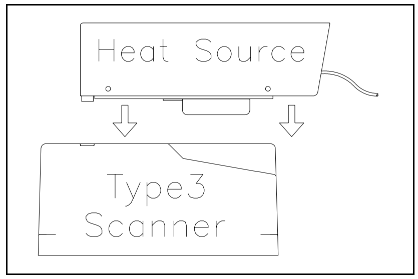
10 If you are calibrating a **type3** wheel scanner, replace the red filter frame with the black one.



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 To prepare your computer:

a Plug your computer into COM1 or COM2 (whichever is available) using a crossover (null-modem) cable.

b Turn on your computer.

c 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 19,200.

d On your computer, open a LOG file.

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 SmartScanNG, MP/KP-1794.5, Track:Single
11/07/2011 21:57
Main Menu
-------------------------------------------------
               .
               .
               .

  K) Enter Pass-Thru Mode for COM 2
  L) System Functions
  M) Event Log
  X) Exit
```

14 To go to the System Functions menu, type **L**

The System Functions menu appears.

```
STC SmartScanNG, MP/KP-1111.1, Track:South
11/07/2011 21:57
System Functions Menu
-------------------------------------------------
  A) Radio Test
  B) Vocabulary Test
  C) Ramp Function
  D) Radio Inhibit
  E) Manual Test Mode
  F) 1KHz Test Tone
  G) Auto-Calibration
  H) Reset the COP Counters
  I) Remote System RESET
  J) Delete All Stored Train Data
  K) Clear Event Log
  X) Exit
```

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

15 To start autocalibration, type **G**

The SmartScanNG system 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 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.

16 When "Auto-Calibration Disengaged" is displayed on your computer, remove the calibrated heat source.

Upon completion of autocalibration, the system acquires the scanner resistor temperature baseline values. The process begins with a 20-minute wait period in which the resistors are allowed to cool down. The system counts down during this period, sounding a tone each minute. After the 20-minute cool down period, the system opens and closes the shutters for a period of 8 minutes.

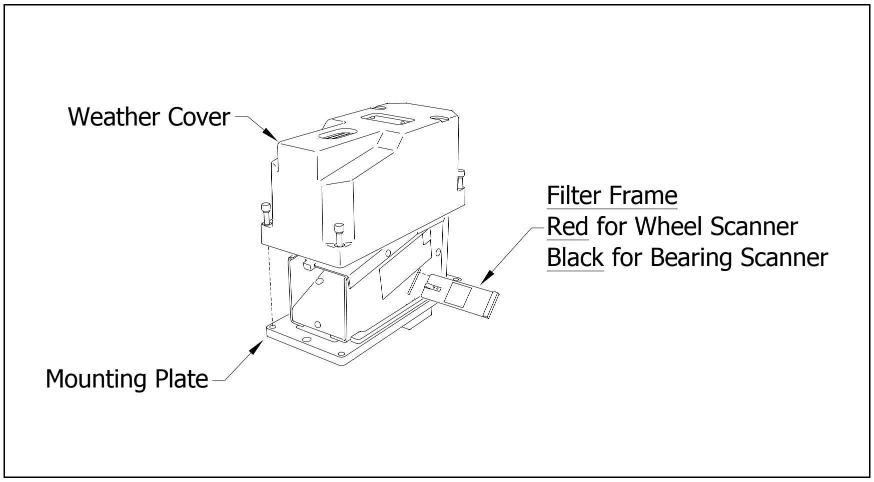
17 To return to the Main menu, type **X**

18 To exit the serial interface and return the system to normal operation, type **X**

19 If you just calibrated a **type2** 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.

20 If you just calibrated a **type3** wheel scanner, 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.

21 Store the calibrated heat source and its power cord in the wayside enclosure.

Appendix F
Lens Cleaning of Scanners

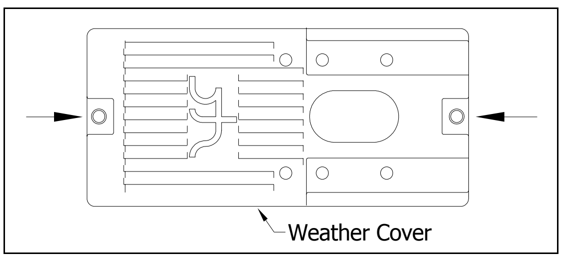
This appendix tells how to clean the optics in the scanners.

F.1 Type2 Scanners

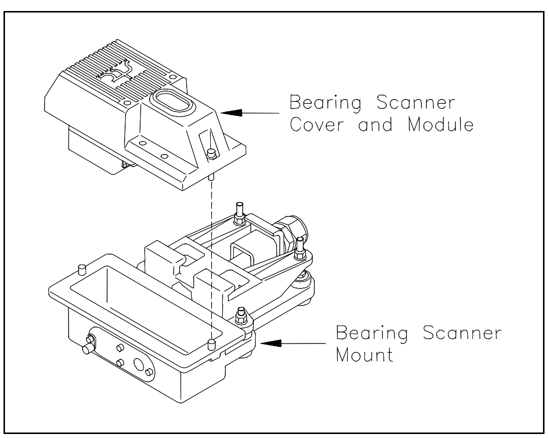
To clean the optics in the **type2** scanners:

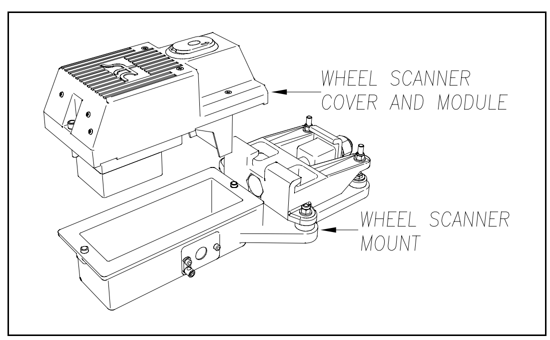
1. Be sure that you have on hand a T-handle 1/4-inch hex-wrench and a 9/64-inch Allen wrench.
2. Turn off all power to the scanners.

   This requires turning off the DC power switch on the SmartScanNG enclosure and unplugging the AC power cord on the bottom of the SmartScanNG enclosure.
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.

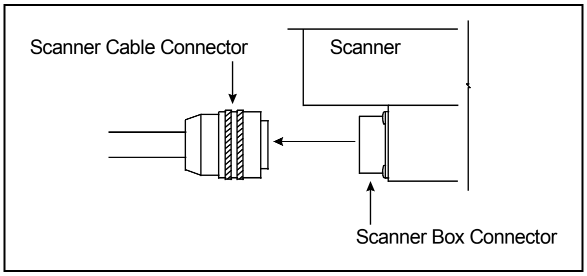


4. Separate the scanner cover-and-module assembly from its mount.



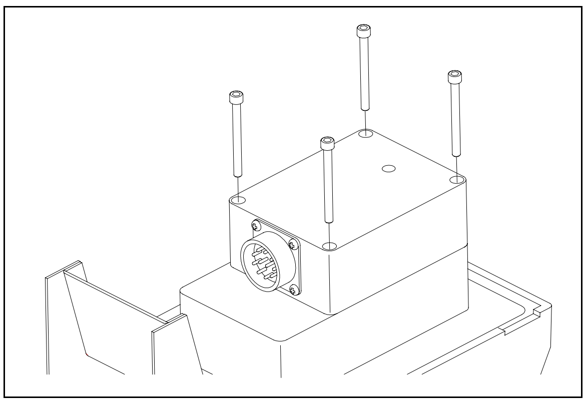


5 Disconnect the scanner cable connector from the scanner box connector.



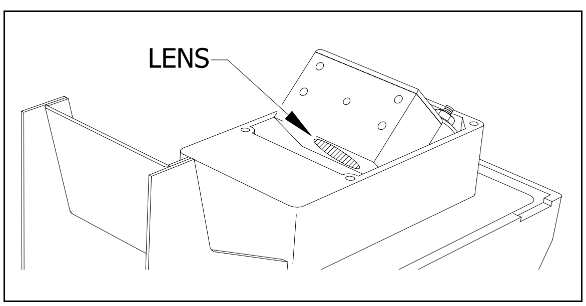
6 Turn the cover-and-module assembly upside down.

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 a 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 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 **type2 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 **type2 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 Type3 Scanners

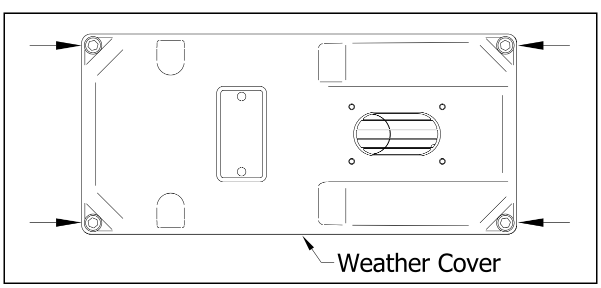
To clean the optics in the **type3** scanners:

1 Be sure that you have on hand a T-handle 1/4-inch hex-wrench.

2 Turn off all power to the scanners.

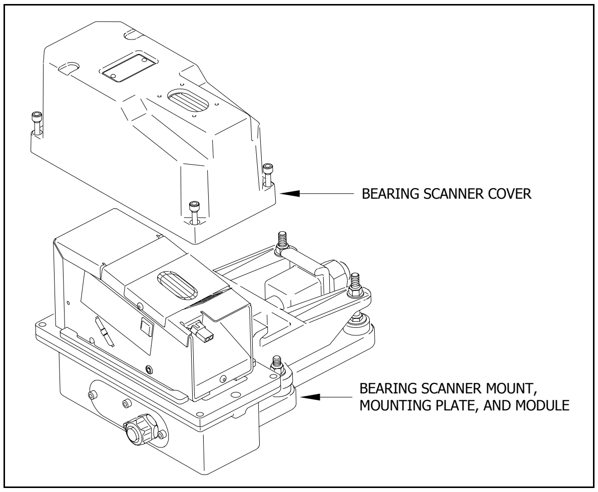
This requires turning off the DC power switch on the SmartScanNG enclosure and unplugging the AC power cord on the bottom of the SmartScanNG enclosure.

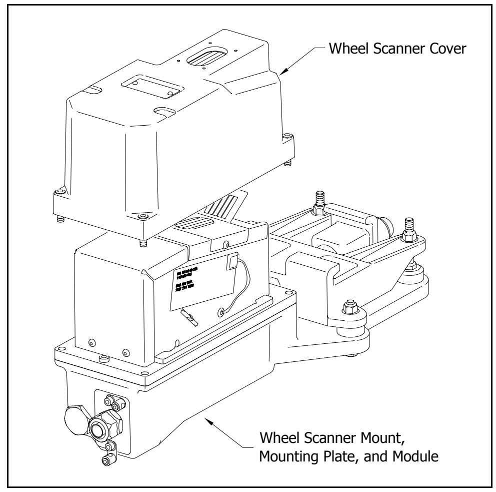
3 Using the T-handle 1/4-inch hex-wrench, loosen the four socket-head-cap screws that attach the weather cover to the mounting plate.



4 Remove the weather cover from its mounting plate.

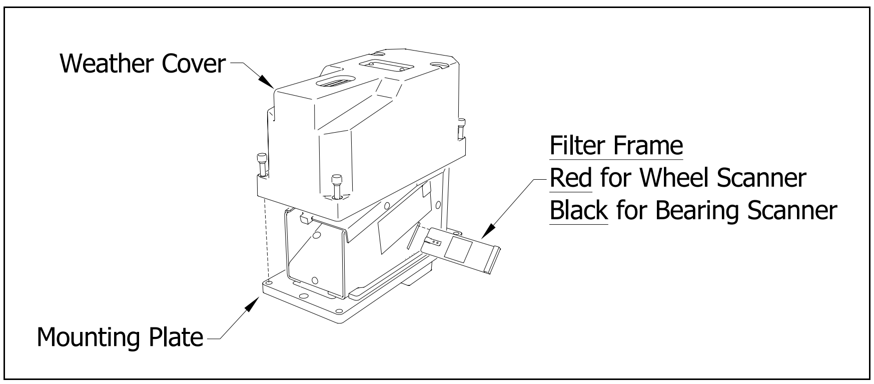
Be careful not to damage the electrical connection for the cover heaters.





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 a soft dry cloth, remove any accumulated dirt or grit.

Be careful not to abrade or scratch the surface of the lens.

8 Using a soft clean cloth, apply a mild cleaning solution such a Vallen V8L or any similar solution that would typically be used for cleaning eyeglasses.

9 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.

10 To restore a uniform surface, gently polish the lens surface with a clean dry cloth.

11 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.

12 Reconnect the heater wiring plug.

13 If this is a **type3 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.

14 If this is a **type3 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.

15 Turn on power to the scanners.

Appendix G
Predictive Gate Scanning

This appendix describes predictive gate scanning of bearings.

G.1 Overview

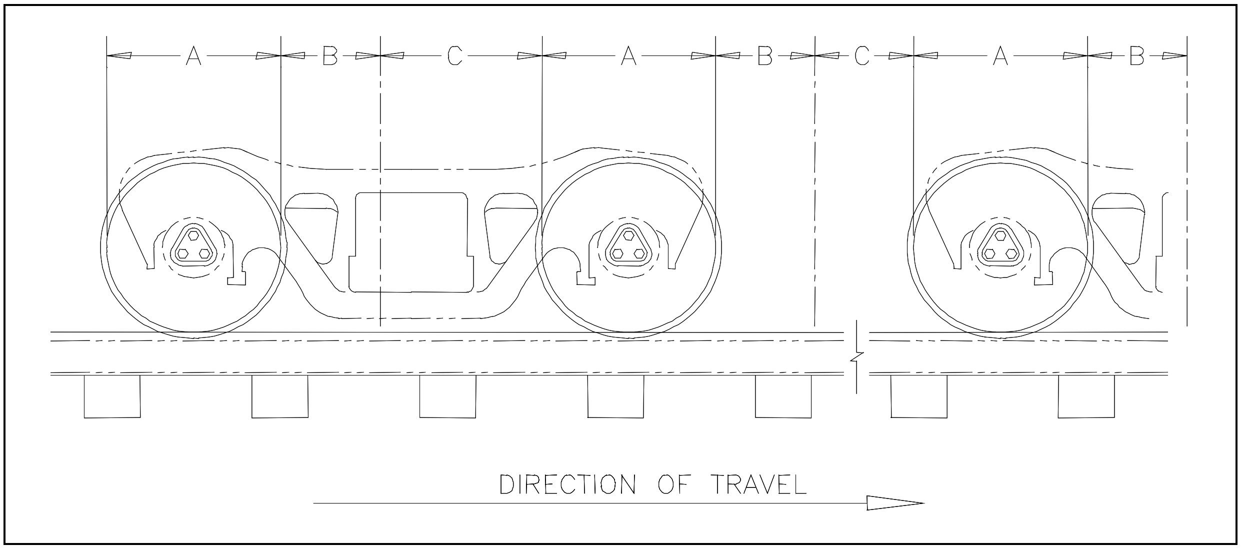
If a pyrometer is exposed to extreme infrared energy emission, the device itself can be driven into a saturated state. When this happens, it is blinded to subsequent changes in infrared energy emission. This blinded state can last up to 1-1/2 seconds.

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 SmartScanNG system 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 16 inches (40.6 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 16 inches (40.6 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 16 inches (40.6 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. 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 meet or exceed the Absolute alarm threshold are ignored. Values that meet or exceed the Absolute alarm threshold are handled as follows:

- If the interval-A heat value meets or 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 meet or 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.

The Very Slow Train alarm indicates that, at some point during train passage, four consecutive axles crossed the gating transducers at a speed of 7 mph (11.3 kph) or less. The firmware doesn't check for Pyrometer Saturation alarms if the train has been flagged with a Very Slow Train alarm.

G.3 Reporting the Pyrometer Saturation Alarm

If a Pyrometer Saturation alarm is detected and assigned to an axle, a printed message will appear on Detail reports.

The figure below shows part of a Train Detail report with a Pyrometer Saturation alarm. The contents of your report will be different.

```
                          Southern Technologies Corporation
                           Next Generation Detector System
                                     TRAIN DETAIL
==============================================================================
                                   .
                                   .
                                   .

-----------------------------------------------------------------------------

Car  Axle Trk  East  West  East  West   ON OFF PW1 PW2  Alarms
               Rail  Rail  Wheel Wheel
  1     1   0    58    22    176   154  25   0  15  15
        2   0    58    22    176   186  25  59  13  13
        3   0   210    22    176   186  25  59  13  13  East Rail Pyro Saturation Alarm
        4   1    58    22    186   176  25 562  13  13
        5   1    58    22    186   172  25  60  13  13
        6   1    58    22    186   176  25  59  13  13

  2     7   2    60    22    172   186  25 162  13  13
        8   2    58    22    176   186  25  59  13  13
                                   .
                                   .
                                   .
```

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