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SmartScanNG

Generic User's Guide for Domestic Systems

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Because products evolve and system configurations change, this manual may not be an exact representation of the products and systems that you are using.

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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.

In this guide, the instructions for installing the track hardware work only in the northern hemisphere (that is, in countries north of the equator). Also, parts of the systems described in this guide are powered by VAC. Systems powered solely by VDC (like those powered by a bank of batteries charged by a solar array) aren't covered.

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.

Contents	3
Chapter 1 Introduction	9
1.1 Purpose of This Guide	9
1.2 SmartScanNG	10
1.3 Cautions	11
1.4 Disclaimers	11
1.5 How to Comment on This Guide	11
1.6 How to Order More Copies of This Guide	11
1.7 Standard Warranty	12
Chapter 2 Track Components	13
2.1 Scanners	13
2.1.1 Bearing Scanners	14
2.1.2 Wheel Scanners	18
2.3 Auxiliary-Alarm Detectors	23
2.4 Track Circuit	23
2.5 AEI Antennas	24
2.5.1 Sinclair SRL470 Antennas	24
2.5.2 Scala HP9-915 Parapanel Antennas	25
Chapter 3 Adjustment Components	27
3.1 Alignment Fixture (2066-000)	27
3.2 Calibrated Heat Source (2100-810NG)	30
3.2.1 Temperature Knob	33
3.2.2 Gating Switch	33
3.2.3 Temperature Meter	34
3.2.4 Function Connectors	34
3.2.5 Fuse	34
Chapter 4 Wayside Enclosure Components	35
4.1 SmartScanNG Enclosure	35
4.1.1 System-Interconnect Board (2300-106)	37
4.1.2 Controller Module (2300-502)	37
4.1.3 SOTC Board	55
4.1.4 Surge-Protection Panel	56
4.1.5 Relay Panel	57
4.1.6 Radio	57
4.1.7 Other Components	58
4.2 Power Subsystem	61
4.2.1 Battery	65
4.2.2 Battery Charger	65
4.2.3 DC Power Distribution	66

4.3	Shielded Temperature Probe (2090-100)	67
4.4	AEI Interface Module (2300-750)	68
4.4.1	Components on Outside of Module	69
4.4.2	Components on Amtech AR2200 Board	70
Chapter 5	Preparation	71
5.1	Selecting a Site	71
5.2	Preparing the Scanner Location	71
5.3	Preparing the AEI Antenna Masts	72
5.4	Preparing the Wayside Enclosure	73
5.5	Receiving Your System	75
5.6	Returning Damaged or Defective Hardware	75
5.7	Getting Help with the Installation	75
5.8	Identifying the Installation Tools	76
Chapter 6	Installing Track Components	77
6.1	Bearing Scanners	77
6.2	Transducers	85
6.3	Wheel Scanners	94
6.4	Track Circuit	99
6.5	AEI Antennas	99
Chapter 7	Aligning Scanners	103
7.1	Bearing Scanners	103
7.2	Wheel Scanners	107
Chapter 8	Installing Wayside Enclosure Components	111
8.1	Grounding System	111
8.2	SmartScanNG Enclosure	111
8.3	Battery Charger	113
8.4	Fuse Block	115
8.5	Rest of Power Subsystem	116
8.6	Bearing Scanners	122
8.7	Wheel Scanners	123
8.8	Gating Transducers	125
8.9	Advance Transducers	126
8.10	Dragging-Equipment Detector	127
8.11	Track Circuit	128
8.12	Telephone	129
8.13	Shielded Temperature Probe	129
8.14	Radio Antenna	132
8.15	AEI Interface Module	133
8.16	High-Wide Detector	134
Chapter 9	Placing a System into Service	135
9.1	Initial Activities	135
9.2	Calibrating Scanners	147
9.2.1	Bearing Scanners	147
9.2.2	Wheel Scanners	150

9.3	Checking the Broadcast	154
9.4	Checking the Speech Data	156
9.5	Generating Test Trains	158
9.6	Setting Transducer Gain	162
9.7	Final Activities	165
Chapter 10	Defect Detection	181
10.1	System Activation	181
10.2	System Deactivation	182
10.3	Speed Calculation	183
10.4	Train Direction	183
10.5	Transducer Pulse Processing	184
10.6	Axle Scanning	185
10.7	Hot Bearing Alarms	186
10.7.1	Bearing Scan Process	187
10.7.2	Referencing System	188
10.7.3	Pyrometer Linearity	188
10.8	Hotwheel Alarms	189
10.9	Auxiliary Alarms	190
Chapter 11	Serial Interface	193
11.1	Main Menu	194
11.2	Setup Menu	196
11.2.1	Date and Time	198
11.2.2	Milepost/Kilometer Post (MP/KP)	199
11.2.3	Track Number	200
11.2.4	Alarm Limits	202
11.2.5	Equipment	210
11.2.6	Messages	221
11.2.7	AEI Reader Parameters	233
11.2.8	Load Default Setup Parameters	235
11.2.9	Setup Password	236
11.2.10	COM1	237
11.2.11	COM2	239
11.2.12	COM3	239
11.2.13	COM4	240
11.3	System Functions Menu	241
11.4	Replay EOT Announcement	249
11.5	Enter Pass-Through Mode	250
Chapter 12	Producing Reports	253
12.1	Train Summary Report	255
12.2	Train Detail Report	259
12.3	Exception Summary Report	268
12.4	Extended Exception Detail Report	272
12.5	Abbreviated Exception Detail Report	281
12.6	System Status Report	284
12.7	Last Train Report	290
12.8	Last Test Train Report	291

12.9	AEI Diagnostic Detail Report	292
12.10	Event Log Report.....	297
Chapter 13	Radio Announcements	299
13.1	Arrival Messages	300
13.2	Real-Time Messages	301
13.3	Post-Train Messages	301
13.3.1	Nothing Detected	303
13.3.2	Only an Integrity Failure Detected	304
13.3.3	Only Exception Alarms Detected	305
13.3.4	Both Exception Alarms and an Integrity Failure Detected	310
Chapter 14	Scheduled Maintenance	313
Chapter 15	Customer Service.....	339
15.1	Reaching STC	339
15.2	Returning Equipment for Repair	339
15.3	Reporting Problems or Suggestions	340
15.4	Ordering Spare Parts	340
15.5	Checking on Shipments and Orders	340
Appendix A	System Alarms.....	341
A.1	Advance System Failure Alarm (No Approach Track Alarm)	341
A.2	Cold Rail Alarm (Cold Bearing Scanner Alarm).....	341
A.3	Cold Resistor Alarm	342
A.4	Cold Wheel Scanner Alarm	343
A.5	Cold Wheel Scanner Resistor Alarm	344
A.6	Highrange Transducer Miscounts Alarm	344
A.7	Integrity Failure Alarm	345
A.8	Low Battery Alarm	345
A.9	Midrange Transducer Miscounts Alarm.....	345
A.10	Reverse Direction Detected Alarm	345
A.11	Short Train Alarm	345
A.12	Stuck Dragger Recovered Alarm.....	346
A.13	Test Train Alarm.....	346
A.14	Unstable SOTC Alarm.....	346
A.15	Very Slow Train Alarm.....	346
Appendix B	Integrity Failures.....	347
B.1	Dead Battery Alarm	347
B.2	Dead Resistor Alarm	347
B.3	Dead Wheel Scanner Resistor Alarm.....	348
B.4	Highrange Transducer Miscounts Alarm	348
B.5	Stuck Dragger During Train Passage Alarm	349
B.6	Stuck Dragger Pretrain Alarm	349
B.7	Stuck High-Load Detector Pretrain Alarm	349
B.8	Stuck Wide-Load Detector Pretrain Alarm.....	349
B.9	Successive Cold Rails Exceeded Alarm	350
B.10	Successive Cold Resistors Exceeded Alarm	351

B.11	Successive Cold Wheels Exceeded Alarm.....	352
B.12	Successive Cold Wheel Resistors Exceeded Alarm.....	352
Appendix C	System Functions	353
C.1	Radio Test	354
C.2	Vocabulary Test	354
C.3	Ramp Function	355
C.4	Radio Inhibit	355
C.5	Manual Test Mode.....	355
C.6	1KHz Test Tone	355
C.7	Auto-Calibration.....	356
C.8	Reset the COP Counters.....	356
C.9	Remote System Reset	356
C.10	Delete All Stored Train Data.....	356
C.11	Clear Event Log.....	356
Appendix D	Replacement of Scanners	357
D.1	Bearing Scanners.....	357
D.2	Wheel Scanners	359
Appendix E	Calibration of Scanners	361
E.1	Bearing Scanners	361
E.2	Wheel Scanners	363
Appendix F	Predictive Gate Scanning	367
F.1	Overview.....	367
F.2	Scanning Process.....	368
F.3	Reporting the Pyrometer Saturation Alarm	369
Index	371

Chapter 1

Introduction

This chapter summarizes the purpose of this guide, describes the SmartScanNG system, tells how to comment on this guide, and tells how to order more copies of this guide. 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. This guide is for those who purchase, install, maintain, troubleshoot, manage, or use domestic systems installed in the USA. Another guide is for export systems installed in the southern hemisphere. The last guide is for export (non-USA) systems installed in the northern hemisphere.

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 submenu 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 and firmware are 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 milepost 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.

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 not allow metallic articles to contact the negative and positive terminals of a battery at the same time.

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

1.5 How to Comment on This Guide

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1.6 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 email@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.

Chapter 2

Track Components

The track components are:

- Scanners
- Transducers
- 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, 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 types of scanners. One type scans the temperature of axle bearings. The other scans the temperature of wheels. Except for the addition of a plastic attenuation plug on the wheel scanner cover, the bearing and 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 algorithms.

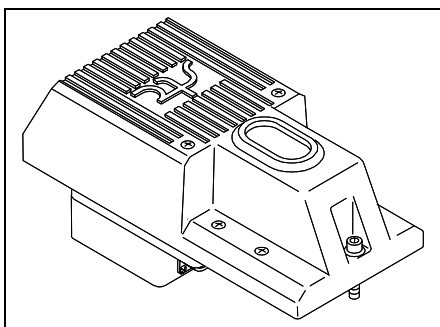
The dynamic-scan-rate algorithms assure collection of samples every 1/2 inch (1.27 centimeters) of axle travel regardless of train speed. The heat signal waveform will always be sampled 48 times between the gating transducers. It makes no difference what speed the train is going, as long as it is traveling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

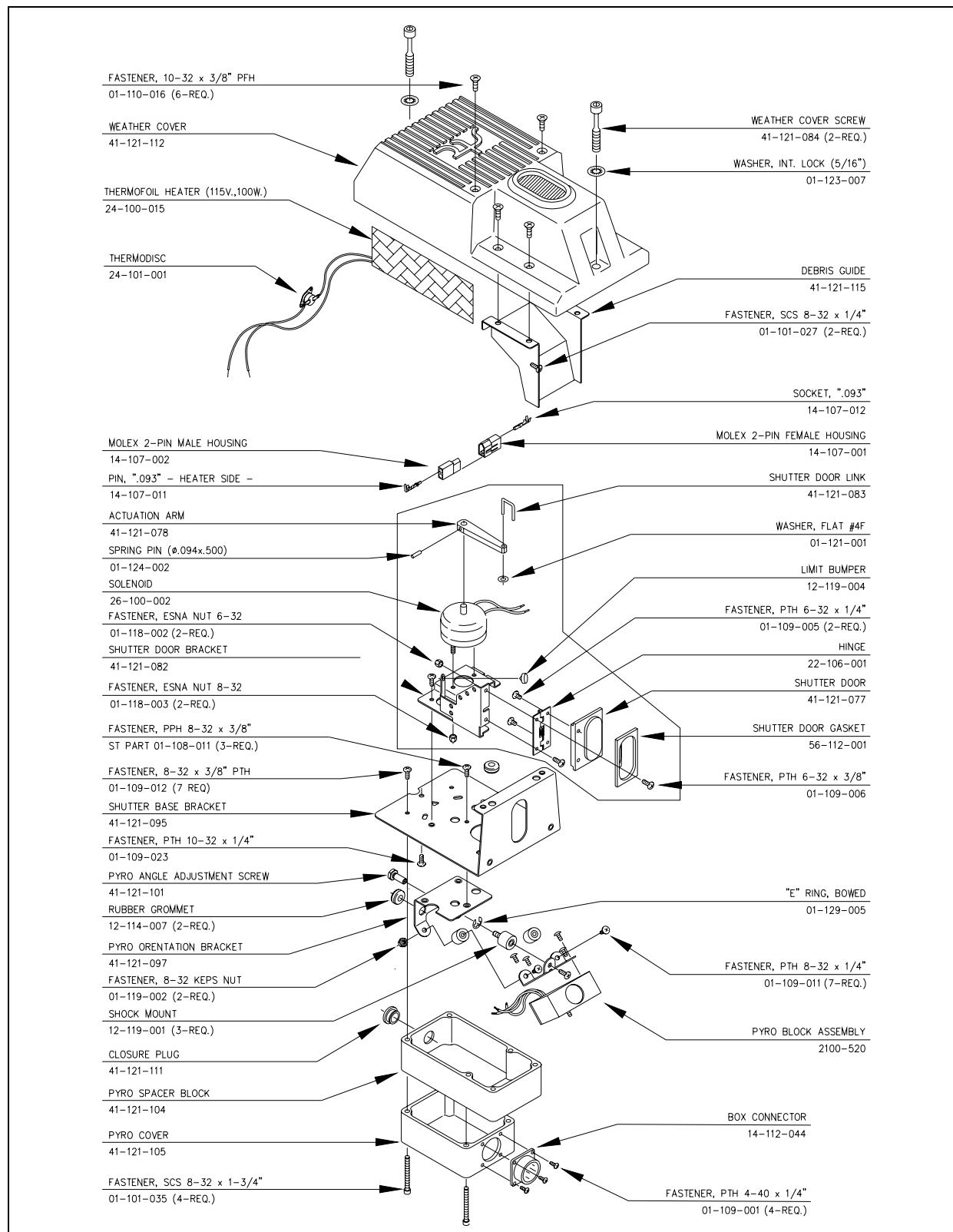
To avoid errant heat readings caused by moisture on the pyrometer lenses, the scanners have heaters built into them. The heaters are made active, for varying periods of time, when the ambient temperature is 80°F (26.7°C) or less.

2.1.1 Bearing Scanners

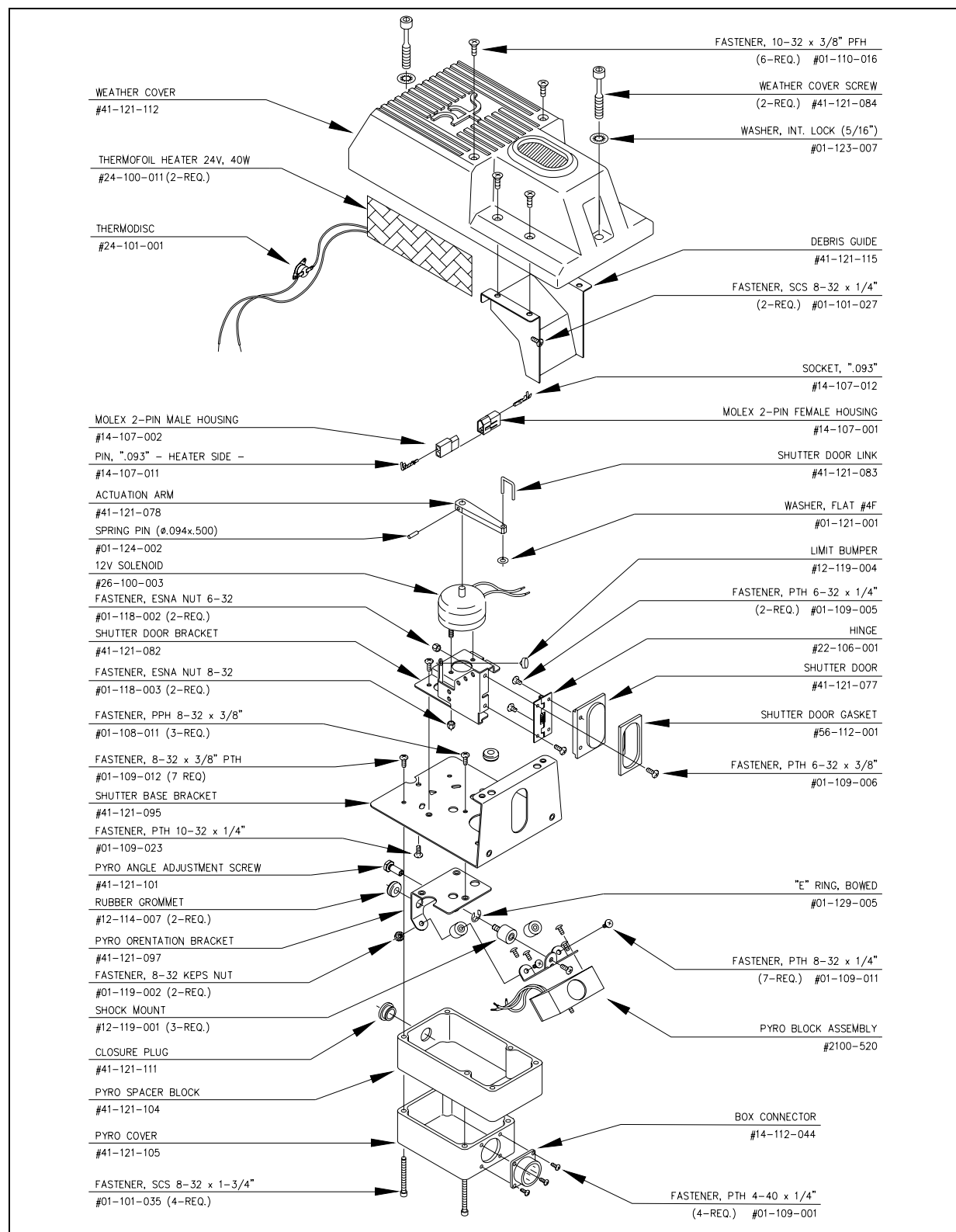
The figure below shows an assembled bearing scanner cover and module.



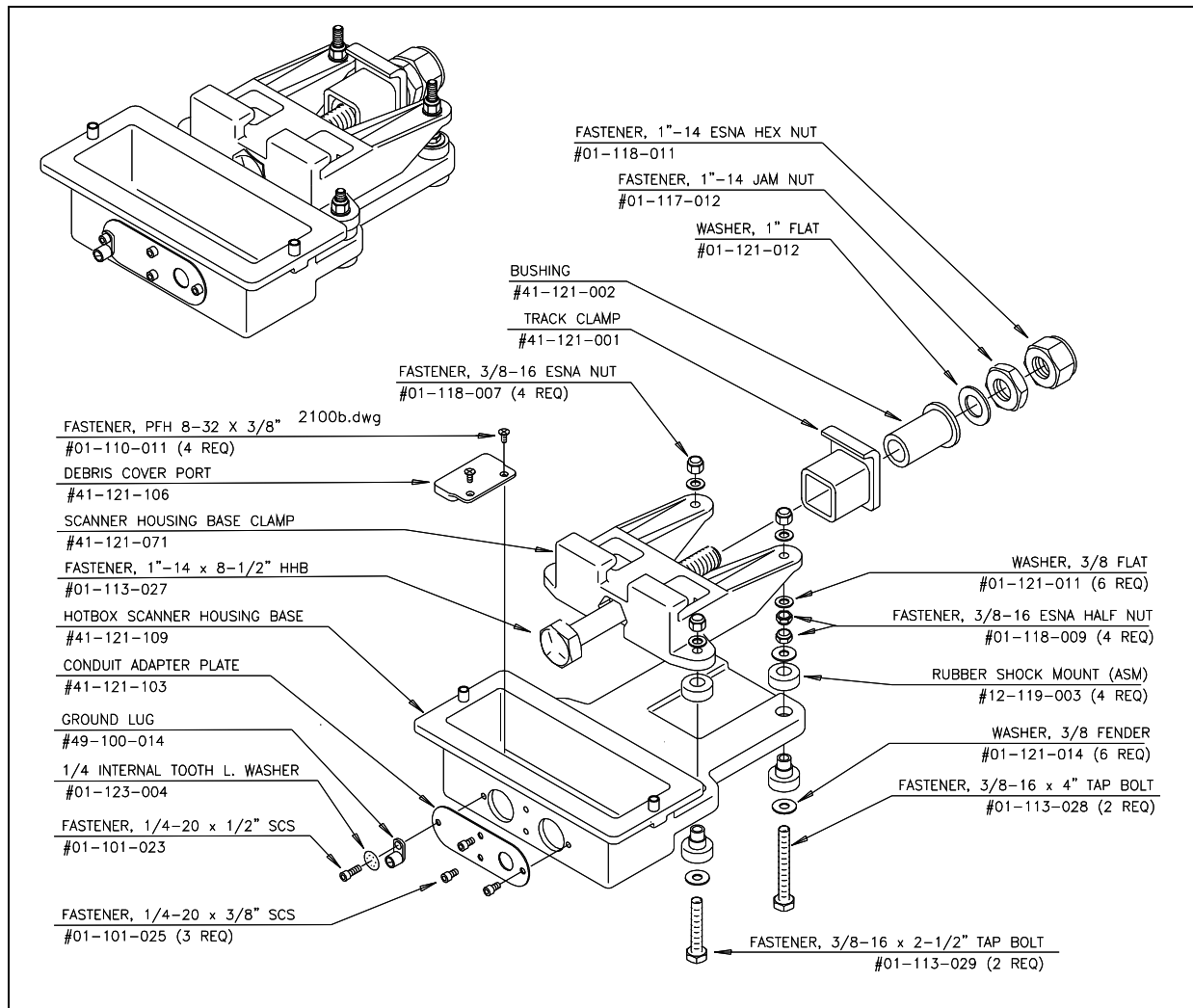
For a site that has a 120-volt 60 Hz power source, the figure below shows the parts of a bearing scanner cover and module (2100-512AC).



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



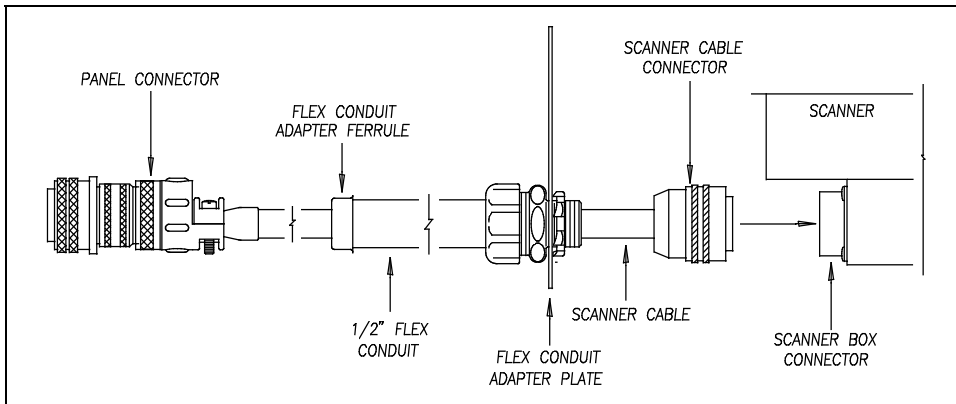
The figures below show a bearing scanner mount (2100-501).



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.

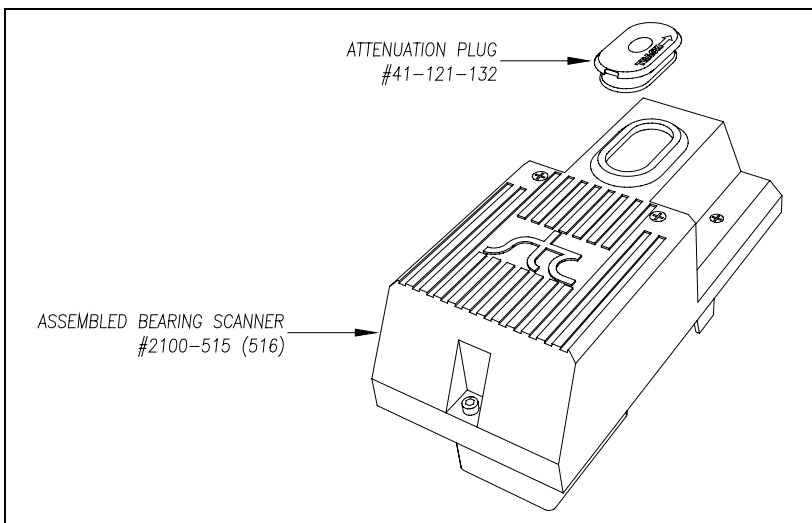
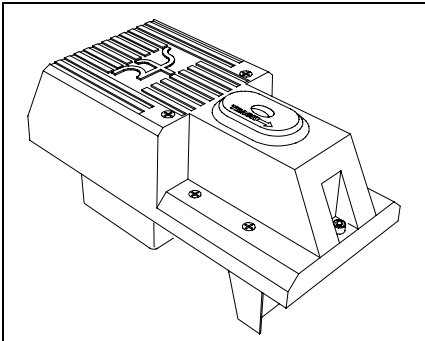
Single-track sites use two 65-foot (19.8-meter) bearing scanner cables. **Double-track sites** use two 65-foot bearing scanner cables for the track closest to the wayside enclosure and two 100-foot (30.5-meter) bearing scanner cables for the track farthest from the wayside enclosure. **Triple-track sites** use two 65-foot cables, two 100-foot cables, and two 130-foot (39.6-meter) cables.

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. For the 130-foot (39.6-meter) cable, it's 2058-267PM.

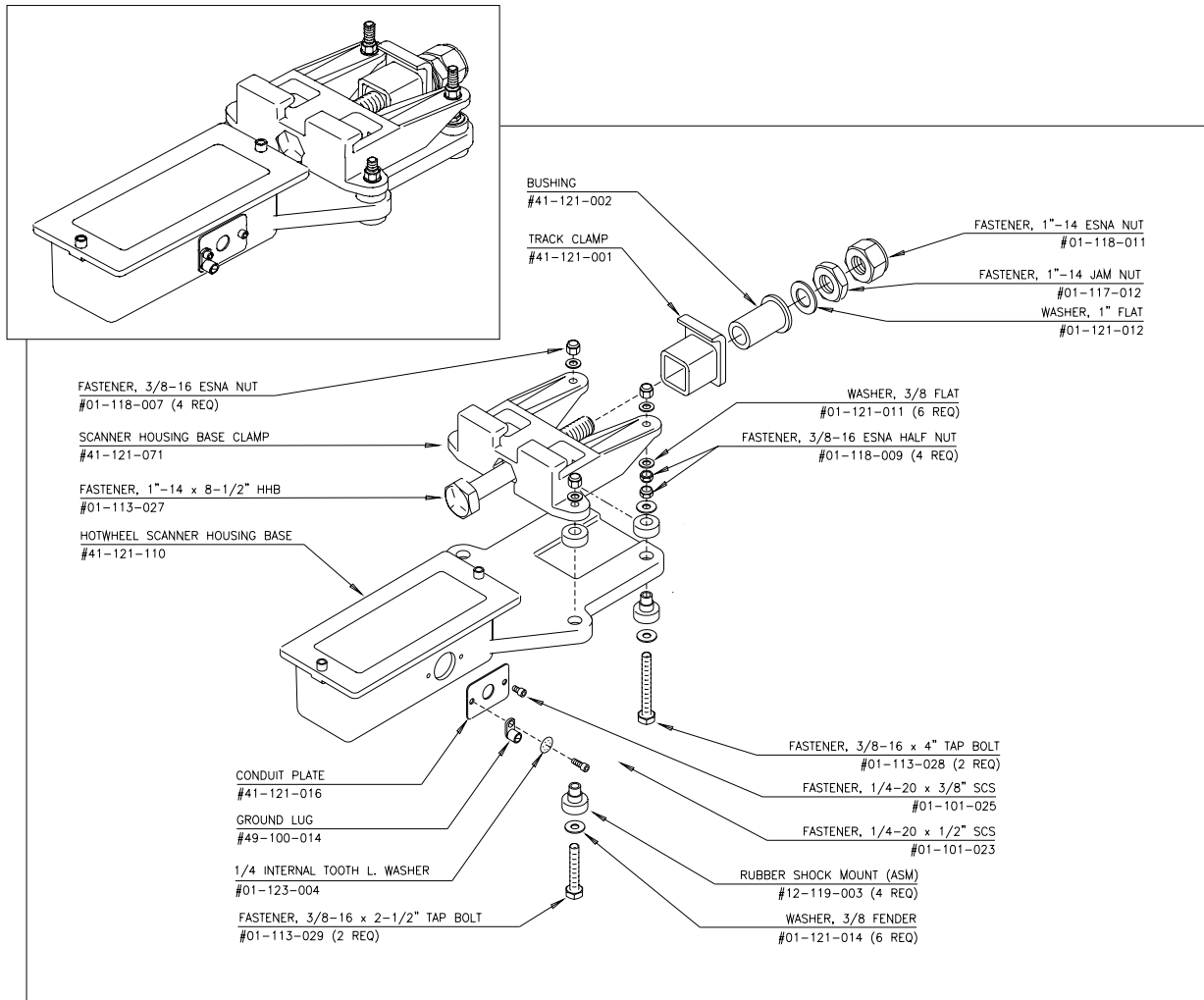


2.1.2 Wheel Scanners

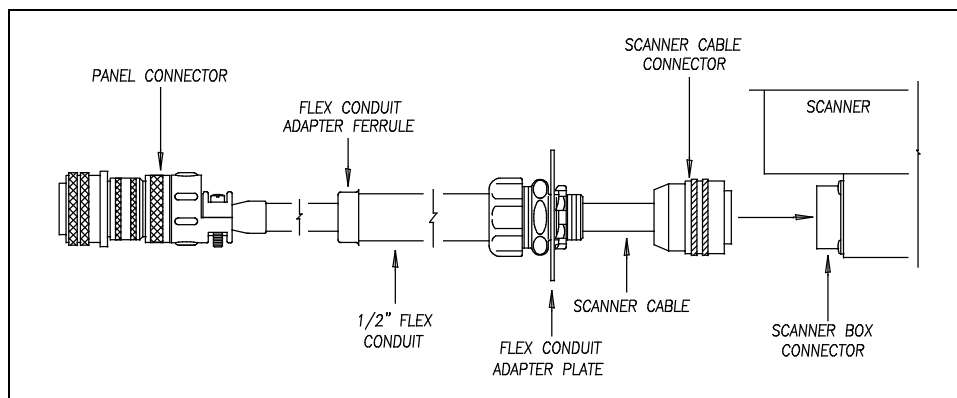
The figure below shows a wheel scanner cover and module. The only difference between the wheel scanner cover-and-module assembly and the one for the bearing scanner is the addition of the plastic attenuation plug.



The figures below show a wheel scanner mount (2100-701).



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-footer (30.5-meter), it's 2058-265HW. For the 130-foot (39.6-meter) cable, it's 2058-267HW.)



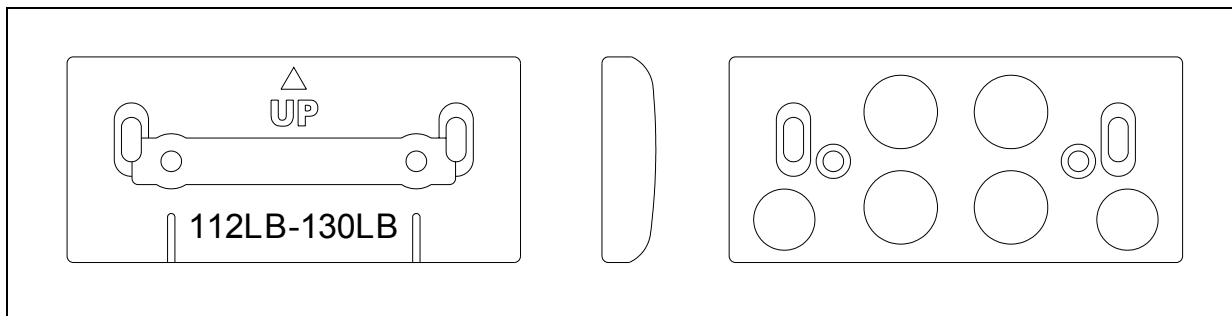
2.2 Transducers

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

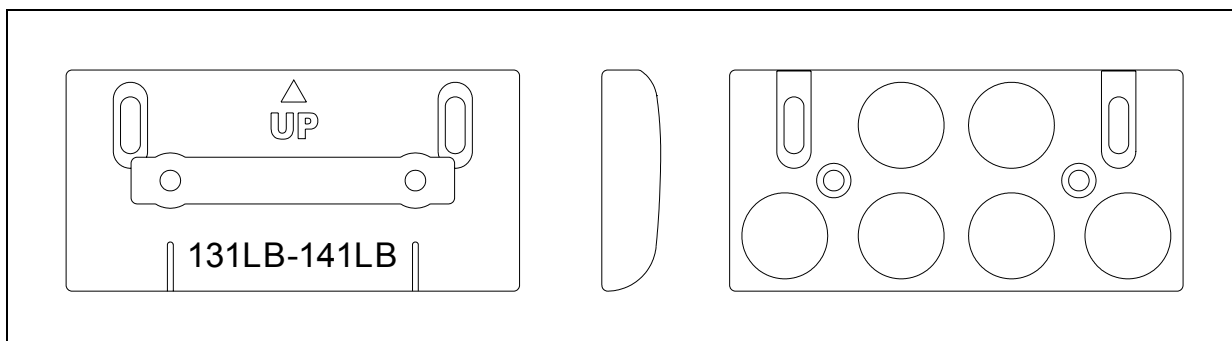
- Detect a train's presence
- Coordinate gating
- Determine a train's direction
- Calculate a train's exit speed
- Calculate a train's length
- Identify individual railcars and locomotives based on axle spacing patterns

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.

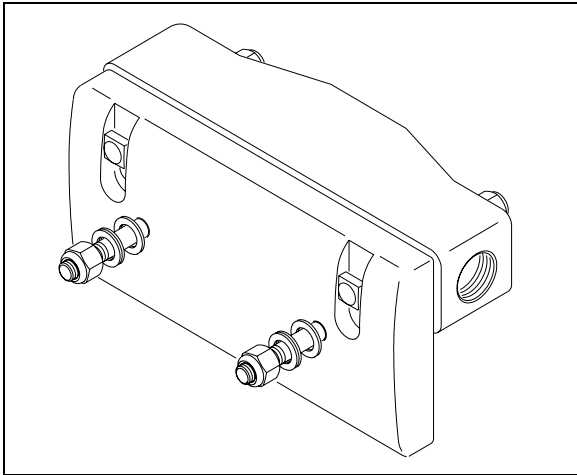
If your rail size were 112 to 130 pounds per yard (55.6 to 64.5 kilograms per meter), use the smaller mounting plate (2100-554) that looks like this.



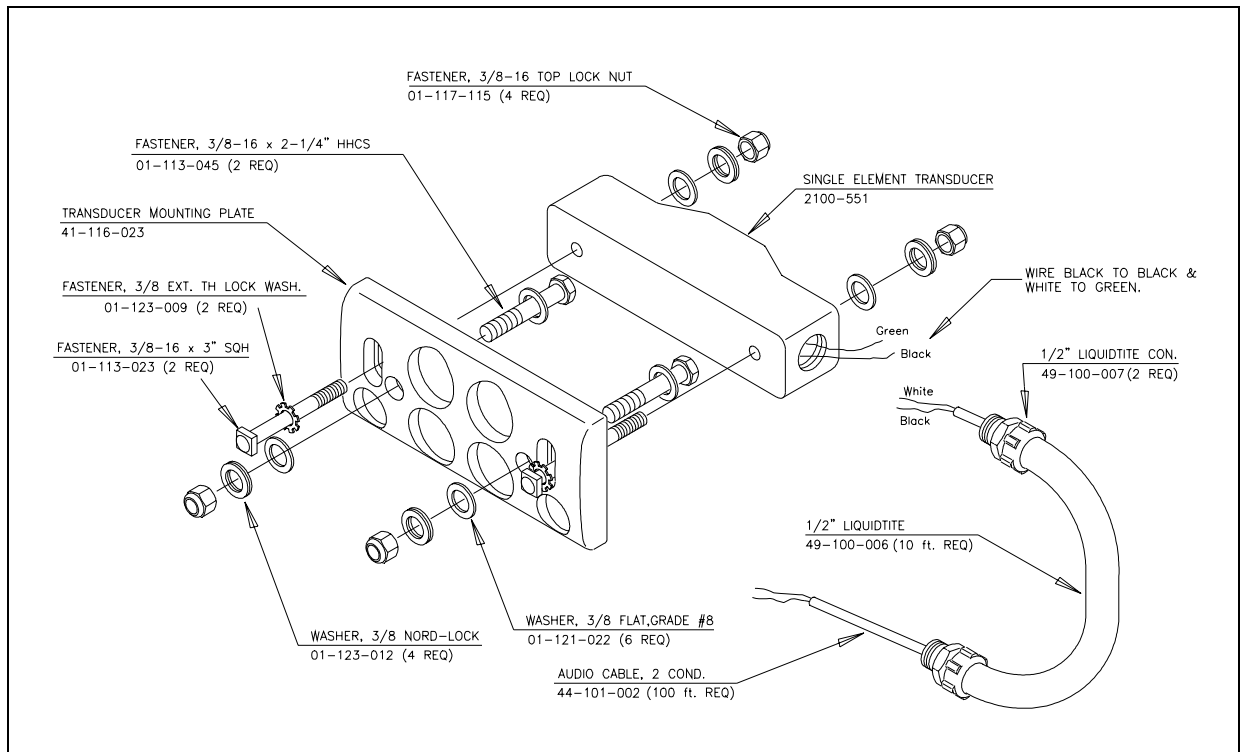
If your rail size were 131 to 141 pounds per yard (65.0 to 69.9 kilograms per meter), use the larger mounting plate (2100-552) that looks like this.



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



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

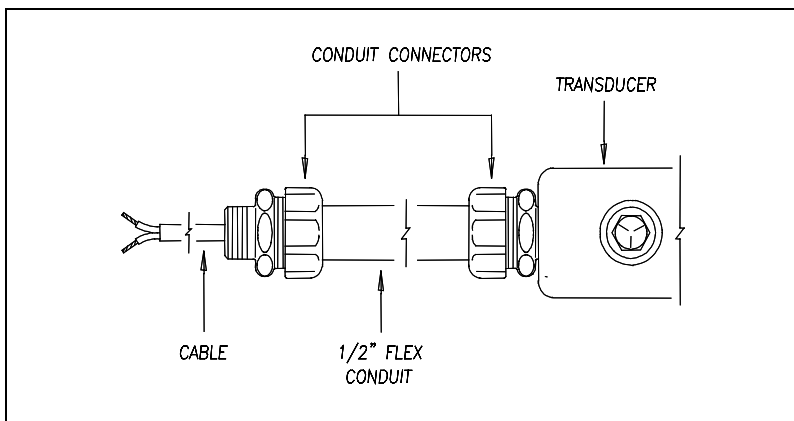


STC transducers consist of a horseshoe magnet with a tightly wound coil, encapsulated in a rigid epoxy potting compound. Each transducer is mounted 1-9/16 inches (3.97 centimeters) below the top of the rail. As the wheels of a railcar pass over the transducer, the wheel flange disturbs the flux field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

The 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, most sites use 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. 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. 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 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, high-load, and wide-load alarms. Other alarm devices require custom speech programming.

STC doesn't manufacture any auxiliary-alarm input devices. However, they do supply some sites with dragging-equipment detectors.

2.4 Track Circuit

Most 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**) makes up the presence subsystem. The track circuit is nothing more than two wires attached to the rails. One wire is attached to each rail. The SOTC board continuously sends a signal down one of the wires of the track circuit. When the wheels-axle of a train (or any metal object) shunts the track, this completes the circuit, causing the signal to return to the SOTC board via the other wire. At a certain distance from the track circuit, the amplitude of the signal is strong enough to trigger an active high output, which indicates to the SmartScanNG system that a train is present. This shunting zone is adjustable up to 150 feet (45.7 meters) on each side of the attached track-circuit wires.

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.

2.5 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 a later chapter.

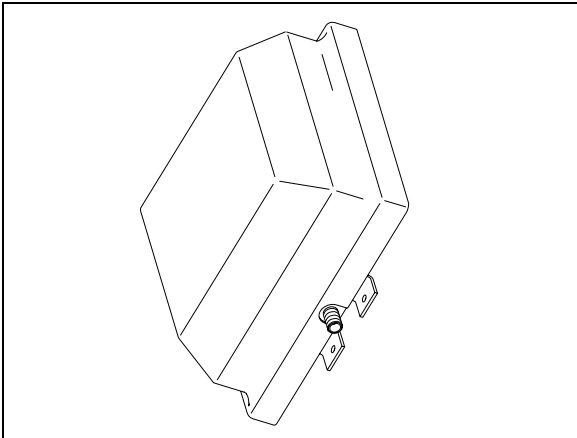
The SmartScanNG system supports two types of antennas.

- Sinclair SRL470 antennas
- Scala HP9-915 Parapanel antennas

These antennas are described below.

2.5.1 Sinclair SRL470 Antennas

When AEI is used, 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.



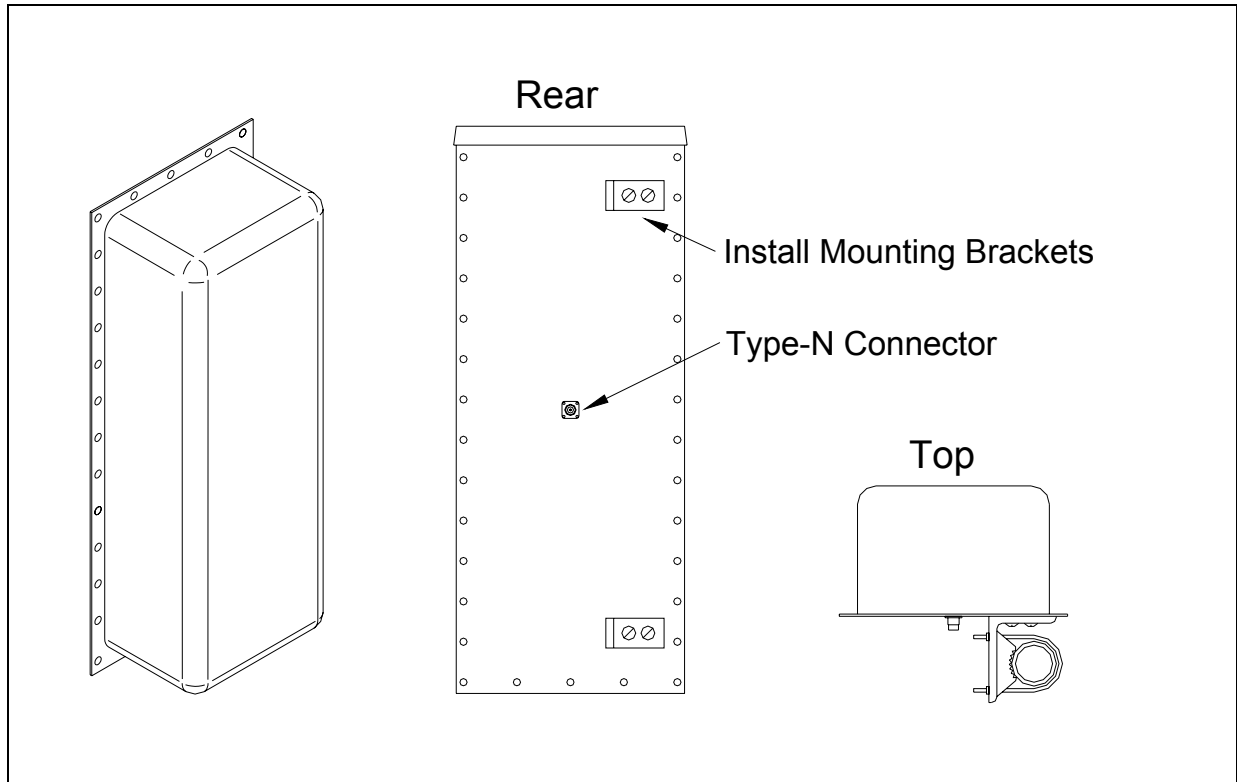
In reference to the track, **antenna0** is the northmost or eastmost antenna. **Antenna1** is the southmost or westmost antenna.

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

2.5.2 Scala HP9-915 Parapanel Antennas

When AEI is used, 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

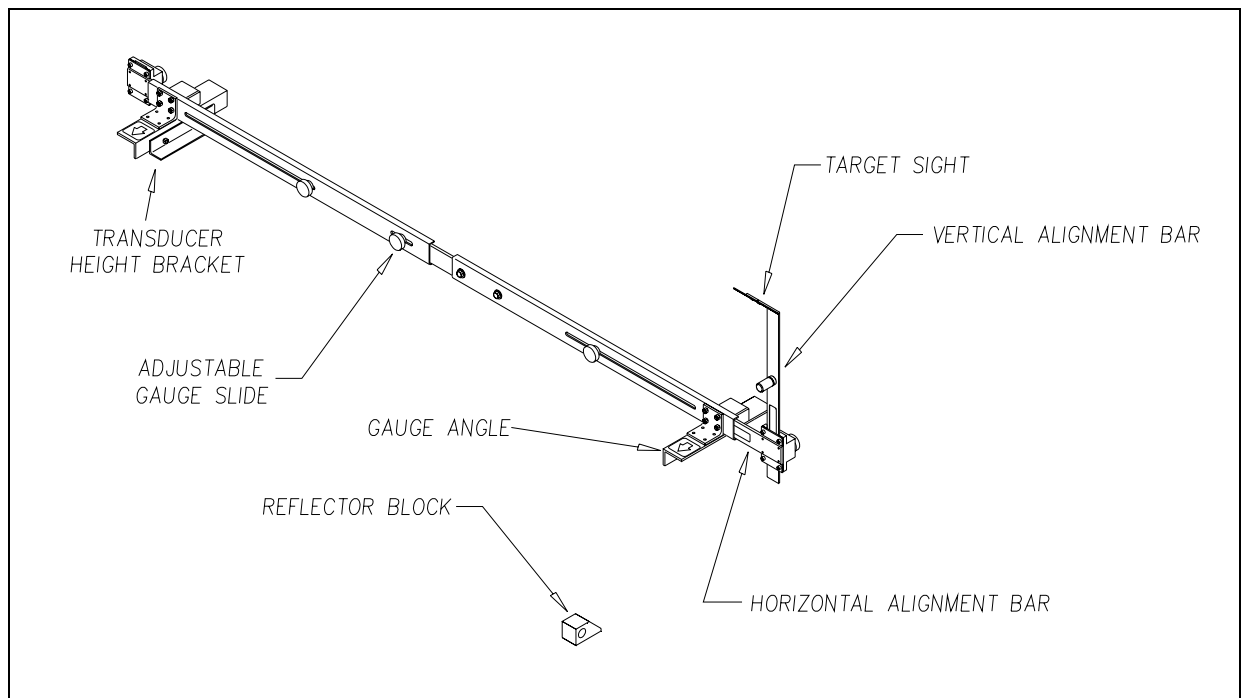
Chapter 3

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).



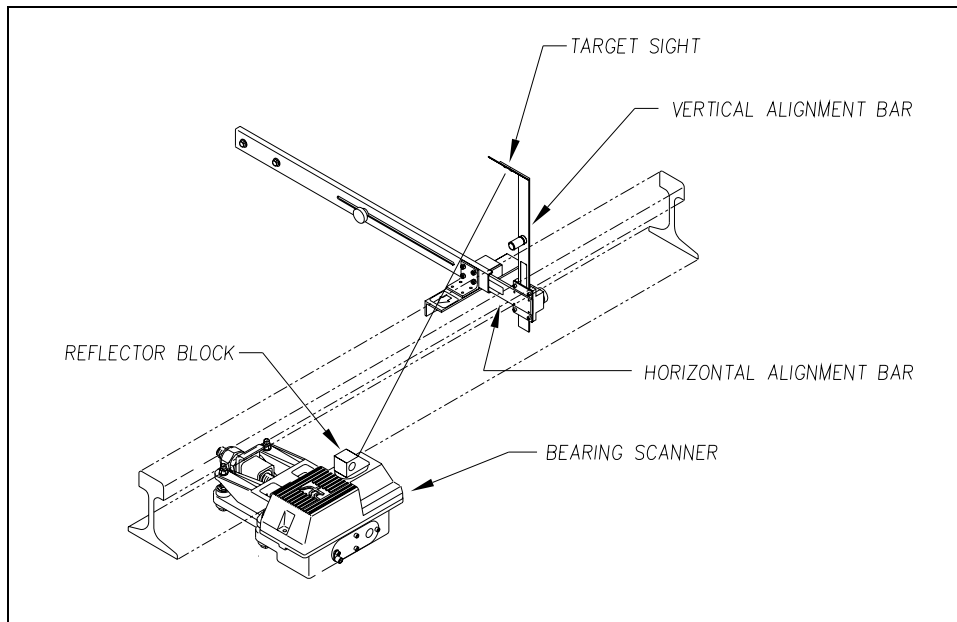
This diagram illustrates the exploded view of a mechanical assembly, likely a conveyor system component. The assembly consists of several main structural elements and various fasteners. Key components include:

- Structural Members:**
 - Long horizontal beams (e.g., 41-109-001, 41-109-010, 41-109-002, 41-109-004).
 - Vertical support rails (e.g., 2066-200, 01-101-008).
 - End brackets and mounting plates (e.g., 12-137-001, 12-137-005).
- Fasteners and Hardware:**
 - Bolts and nuts (e.g., 01-100-008, 01-113-004, 01-121-007).
 - Washers and spacers (e.g., 01-110-029, 01-110-016).
 - Rollers or guides (e.g., 58-100-002, 58-100-021, 58-100-001).
- Identification:** Each part is labeled with a unique alphanumeric code, such as 41-109-006, 58-100-005, and 01-108-044, for inventory and assembly tracking.

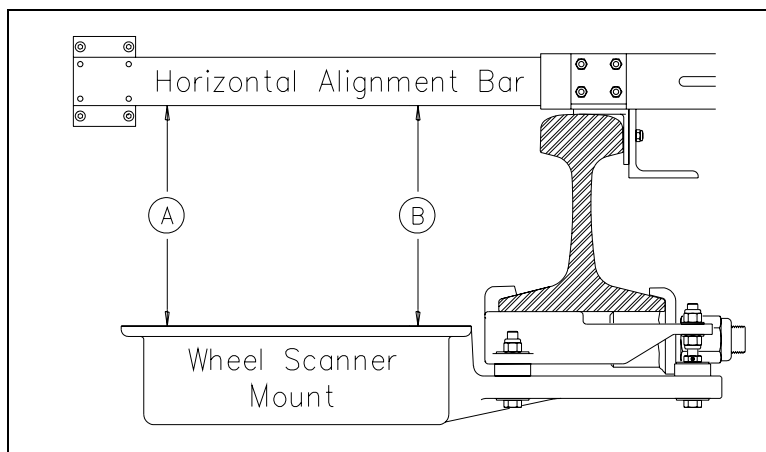
The drawing shows a mechanical assembly with a base and a vertical component. Three circular callouts provide detailed views of a scale on the vertical component:

- Top Callout:** Shows a scale with markings from 6 to 7. The scale is oriented horizontally.
- Bottom Callout:** Shows a scale with markings from 1 to 2. The scale is oriented vertically.
- Left Callout:** Shows a scale with markings from 1 to 2. The scale is oriented vertically.

The fixture is used differently for bearing scanners and for wheel scanners. To align 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.

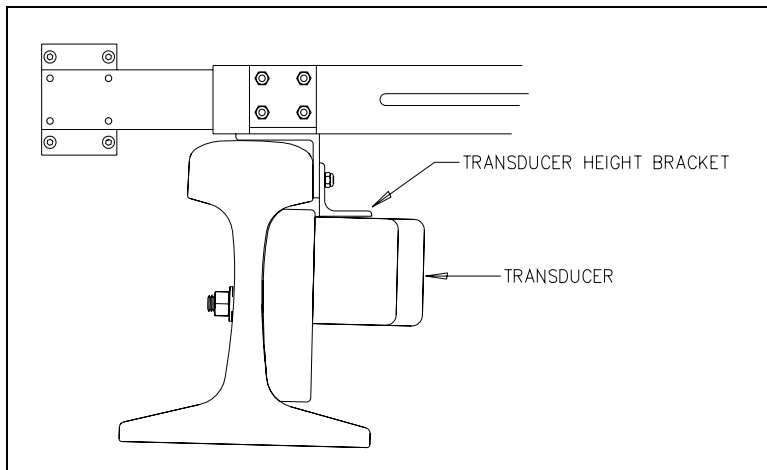


To align wheel scanners, you use the horizontal alignment bar of the fixture. Alignment is done by measuring from the bottom of the extended bar to the top of both ends of the scanner mount. When both measurements are the same, alignment is correct. That is, as shown below, when distance **A** is equal 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 feet (15 meters) long. If you need to add an extension cord to this cable, make sure it is 16 gauge or larger thickness of wire.

For solar powered DC systems, the heat source should be powered from a true sine wave inverter capable of 250 watts with an output of at least 110 volts at 60 Hz. The inverter should operate from an input voltage of 10.5 VDC to 15 VDC. A 120-volt USA socket should be provided to match the heat source power cord. The inverter should be grounded according to the manufacturer's recommendations.

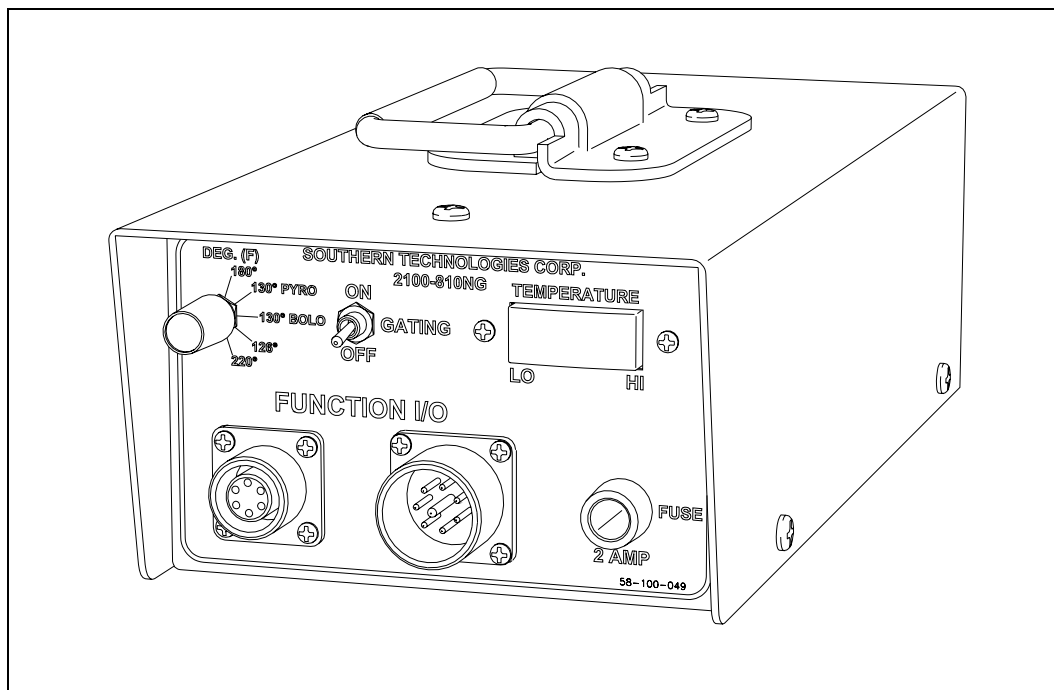
On the front of the calibrated heat source is a knob that lets you select one of five delta temperatures, ranging from 126°F to 220°F. The heat source contains a heat block that can reach a combined temperature of your delta temperature and the ambient temperature. It can maintain this temperature for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

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

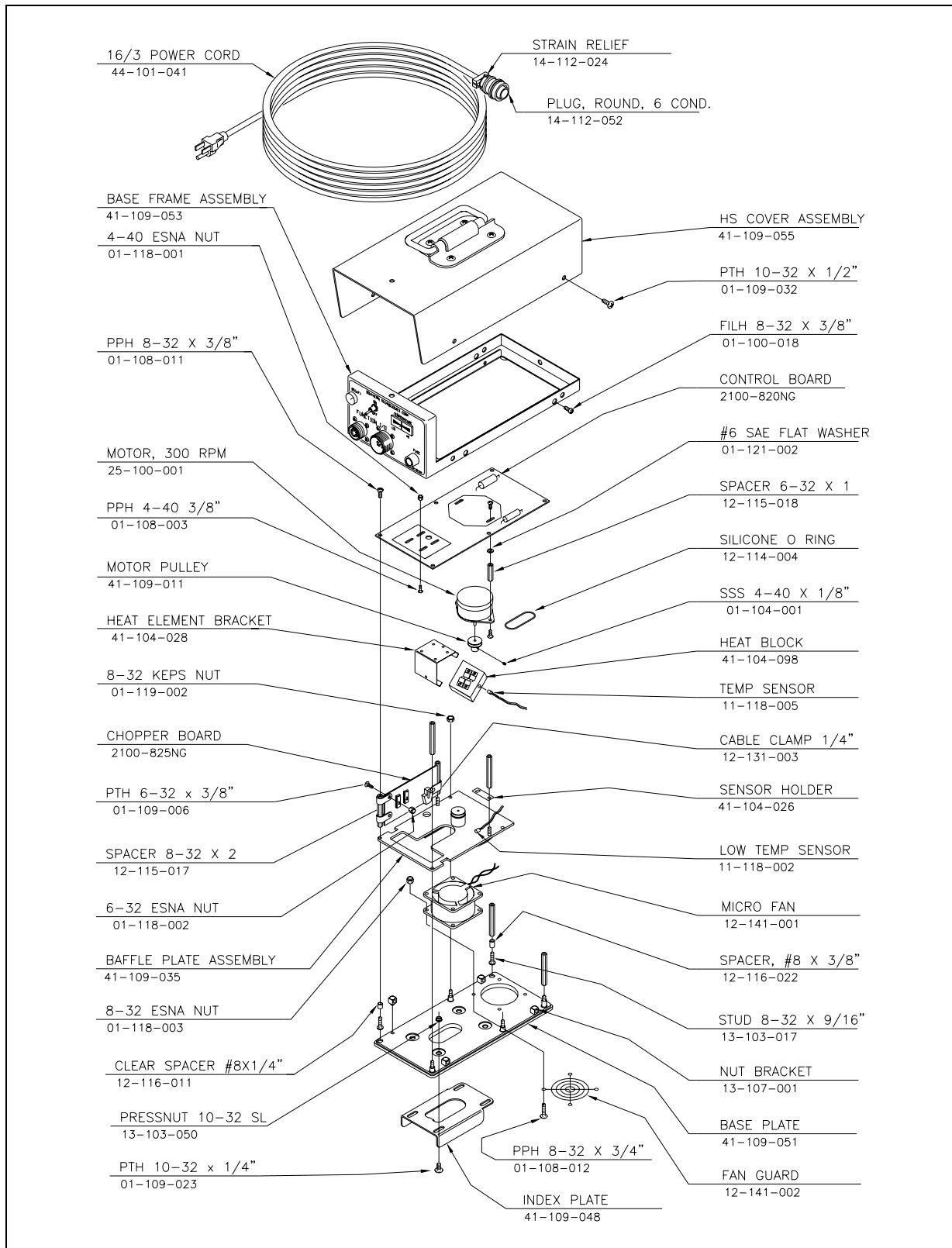
The calibrated heat source is placed over the opening of the scanner cover. With the heat source in place, it is then possible to calibrate the system at a precise value above ambient temperature.

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

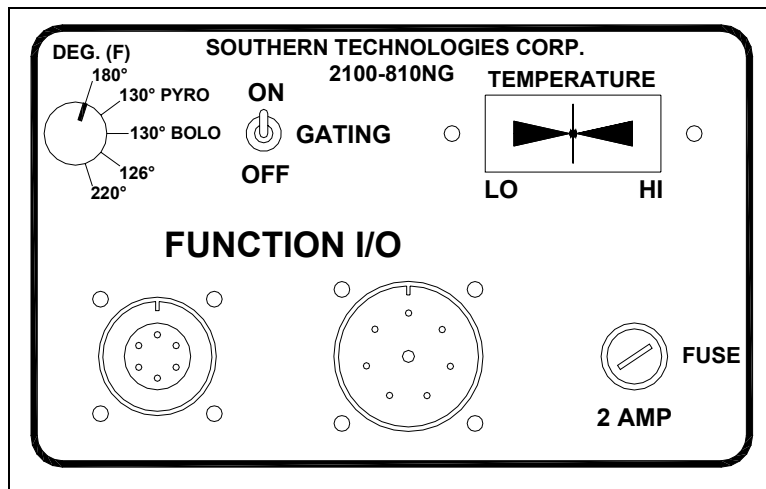
The figure below shows an assembled calibrated heat source (2100-810NG).



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.

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 inside of the wayside enclosure is:

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

Attached to the outside of the wayside enclosure is:

- One radio 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. At **triple-track sites**, the leftmost one supports track1, the middle one supports track2, and the rightmost one supports track3.

As a minimum, most SmartScanNG enclosures contain:

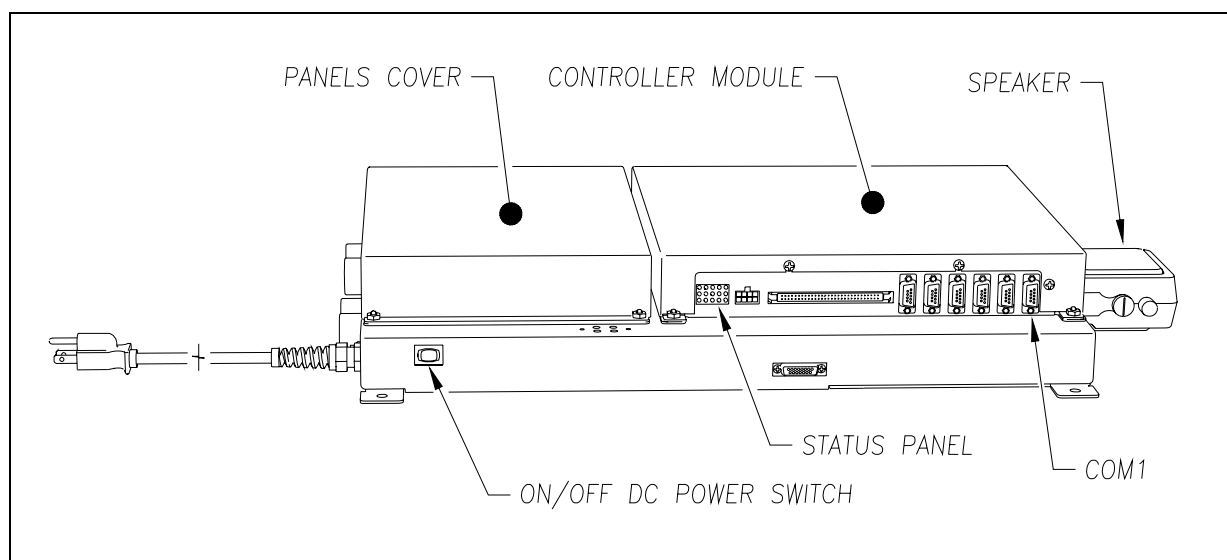
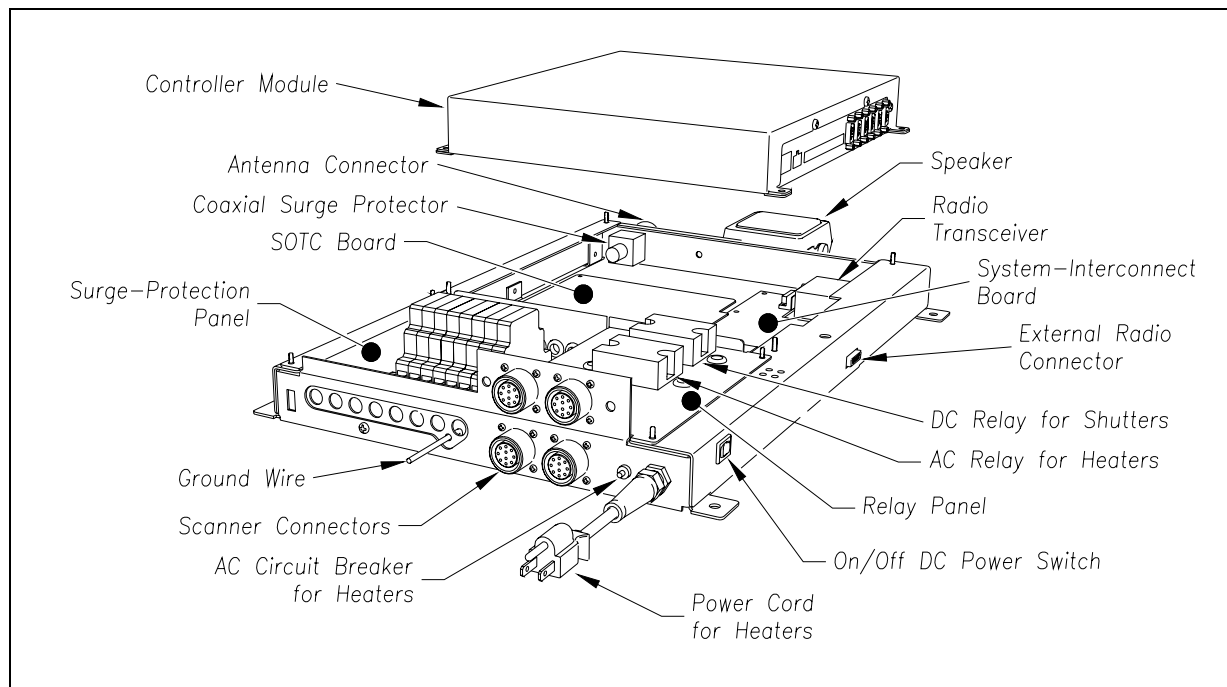
- System-Interconnect board
- Controller module, containing Processor, Interface, and Modem boards
- Surge-protection panel
- Relay panel

Additionally, most SmartScanNG enclosures usually contain:

- SOTC board (optional; not present if advance transducers are used)
- Radio (aka RF transceiver)
- 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.

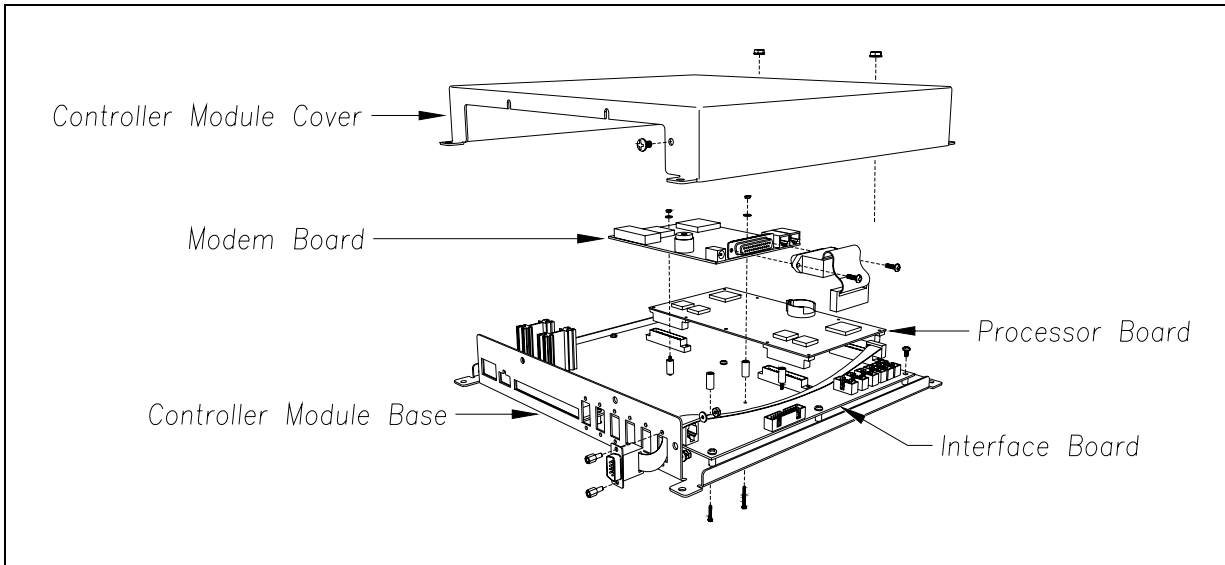
Only a few electronic components are located on the System-Interconnect board. Most of them are associated with power distribution. DC power from the System-Interconnect board is routed to the Interface board, shielded temperature probe, internal radio, SOTC board, and bearing and wheel scanners. Much 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.

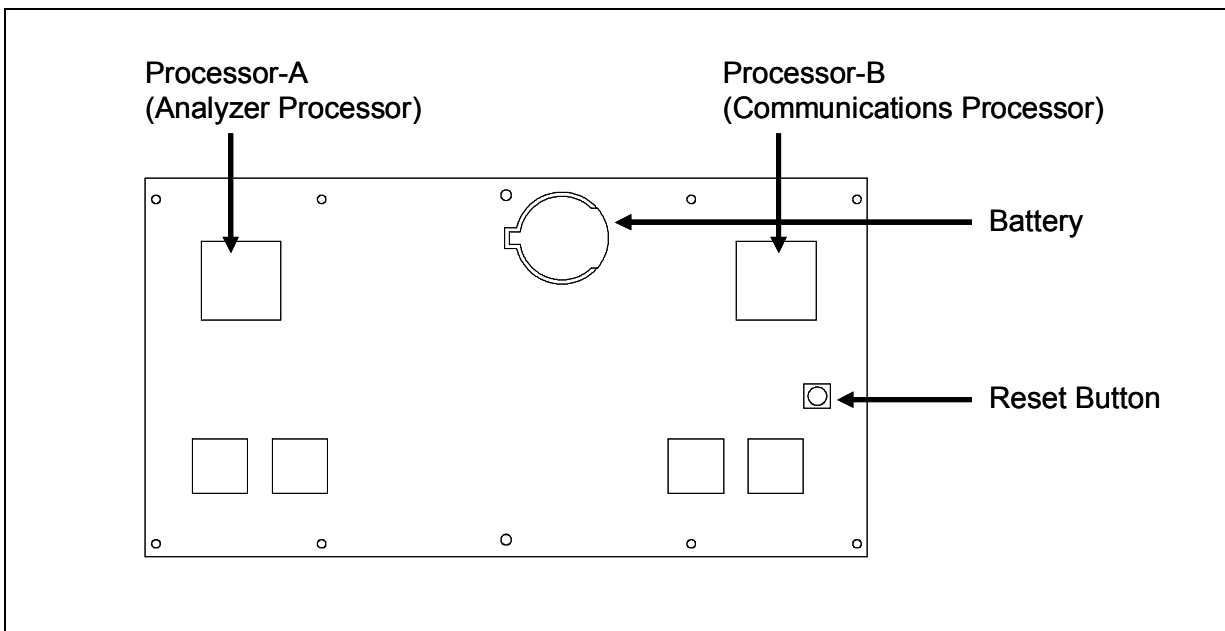
The figure below shows the major parts of the Controller module (2300-502).



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. The buffer for the Exceptions directory holds data on about 4,500 axles.

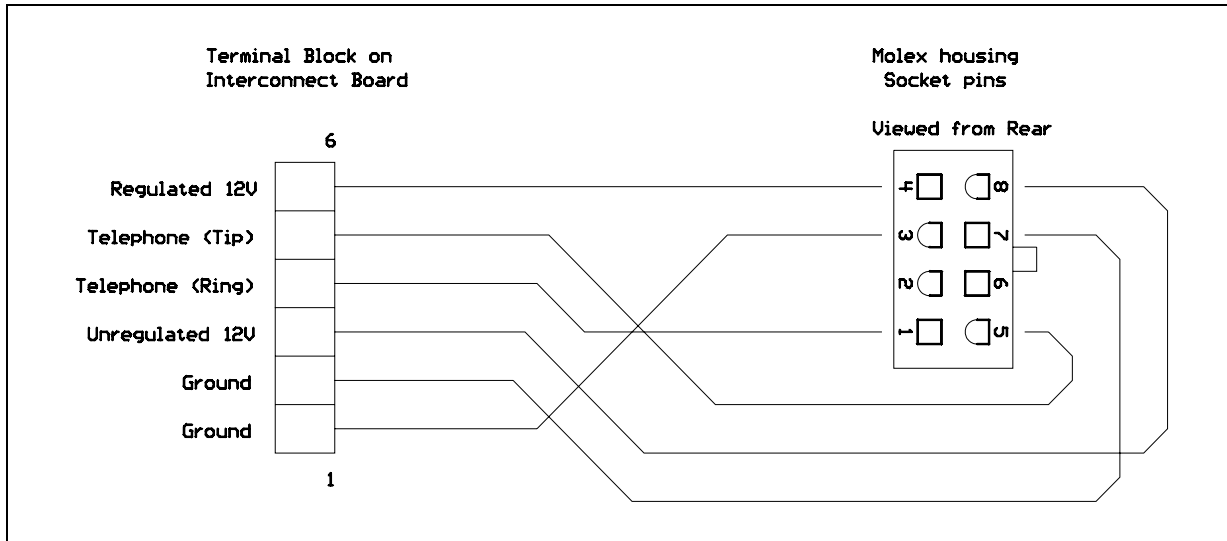
Under the CPU on the right is a white reset button. Pressing it causes a "hard reset" of the Processor board. (You can get the same results by toggling the on-off switch on the side of the SmartScanNG enclosure off, waiting 10 seconds, and toggling it back on.) As long as no train is present at the site,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

4.1.2.2 Interface Board (2300-105)

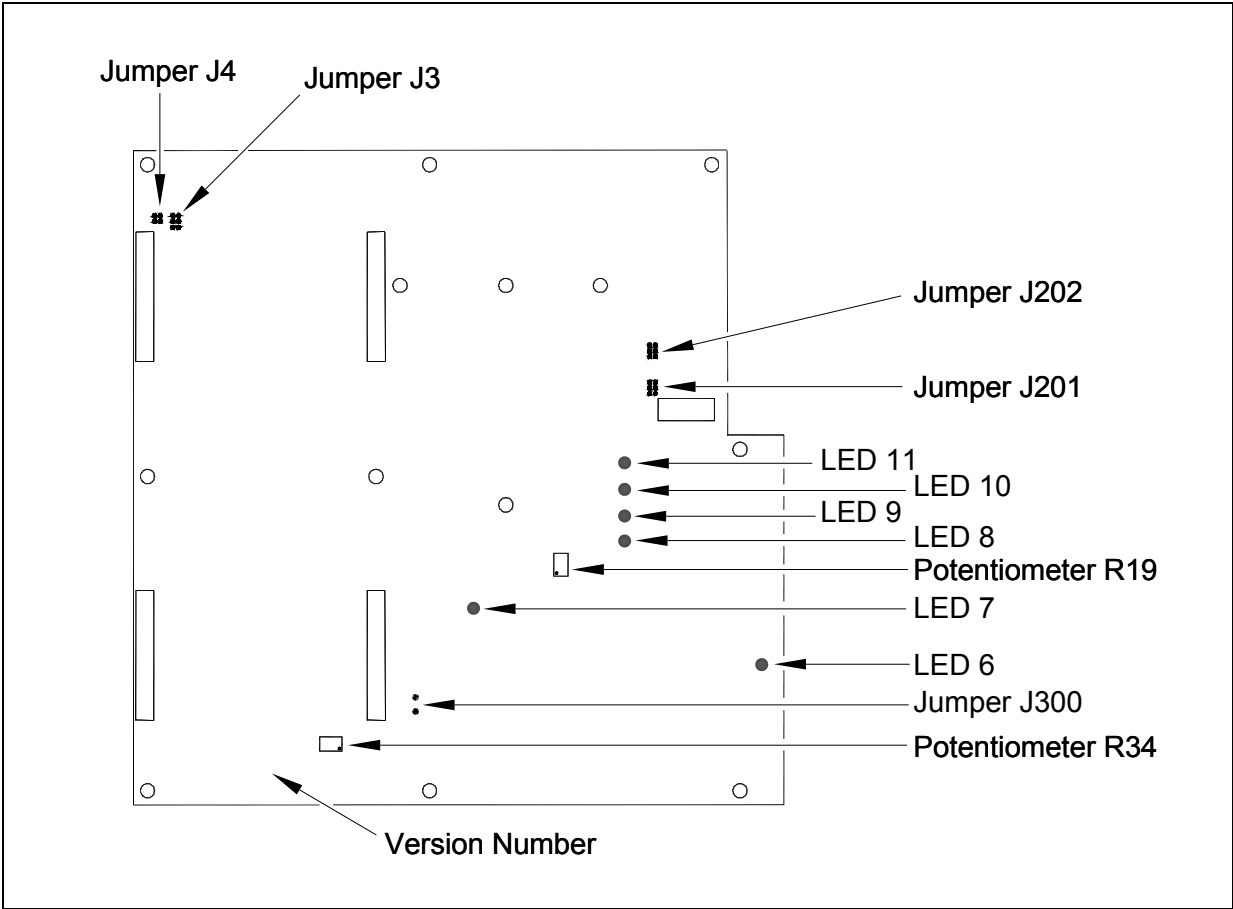
As its name implies, all of the interface and signal conditioning circuitry is located on the Interface board. This board connects to the System-Interconnect board with a sixty-position ribbon connector and an eight-position Molex connector, which is shown below.



The board requires unregulated 12 VDC (battery voltage) to operate. The 12 VDC input power circuitry includes 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.

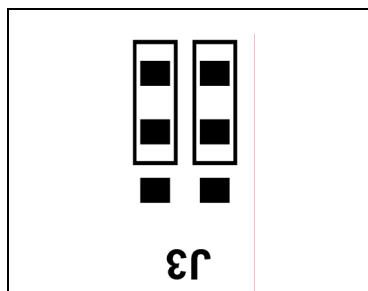


Jumper J3

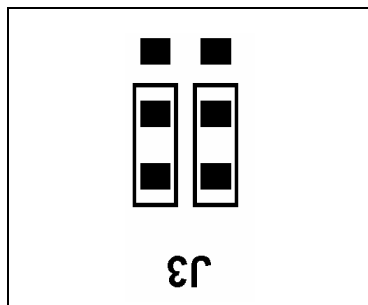
Jumper J3 selects either RS422 or RS485 mode.

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.



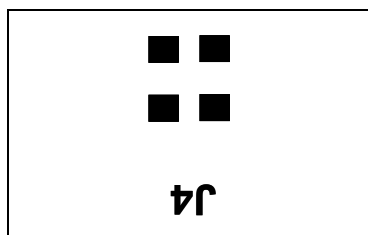
This is the jumper configuration for four-wire RS422 mode.



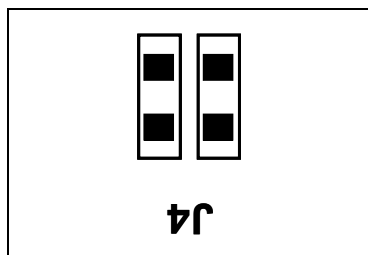
This is the jumper configuration for two-wire RS485 mode.

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.



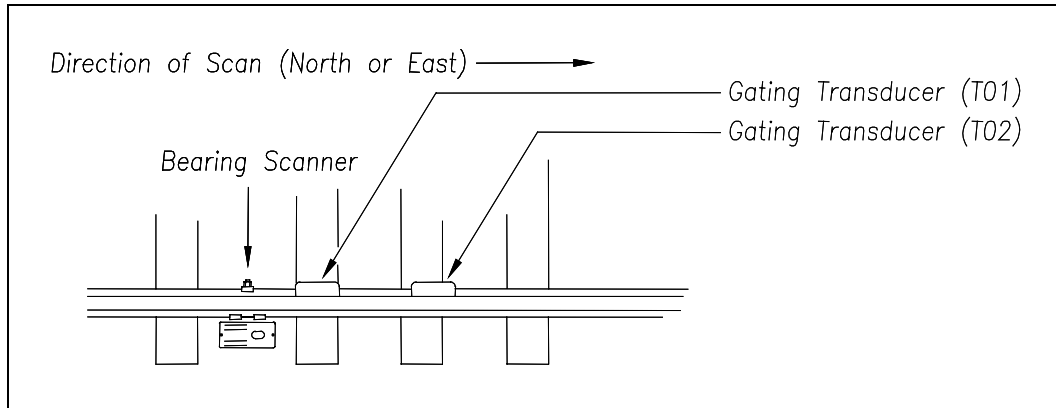
This is the jumper configuration for four-wire RS422 mode. Both transmit and receive are on continuously.



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.



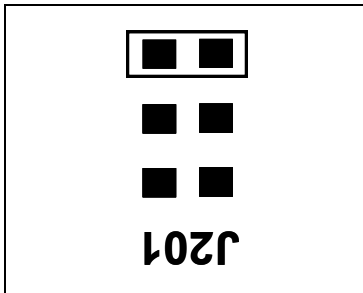
The table below lists the highest, middle, and lowest sensitivity for transducer loading for current board versions. Highest is the most sensitive. Lowest is the least sensitive. Middle is somewhat between these sensitivities.

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

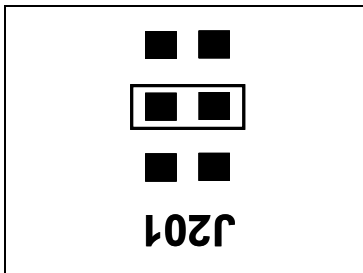
This table above only covers board versions 1.21, 1.22, 1.30, and 1.40. Earlier versions of the board have different jumper positions for each sensitivity level. That is, the available loading sensitivities vary depending on which version of Interface board you have, whether the board was modified, and 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.

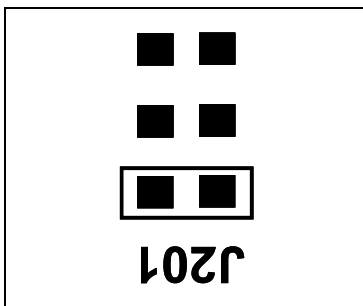
The figure below shows the **top position** of J201 being selected. The top position is the jumper position closest to the speaker. This position selects the lowest sensitivity for transducer loading.



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



The bottom position selects the highest sensitivity for transducer loading. The figure below 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.

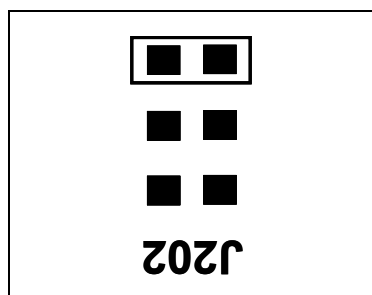
The table below lists the highest, middle, and lowest sensitivity for transducer loading for current board versions. Highest is the most sensitive. Lowest is the least sensitive. Middle is somewhat between these sensitivities.

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

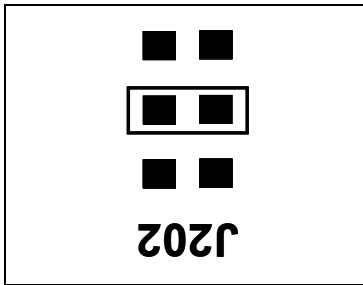
This table above only covers board versions 1.21, 1.22, 1.30, and 1.40. Earlier versions of the board have different jumper positions for each sensitivity level. That is, the available loading sensitivities vary depending on which version of Interface board you have, whether the board was modified, and 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.

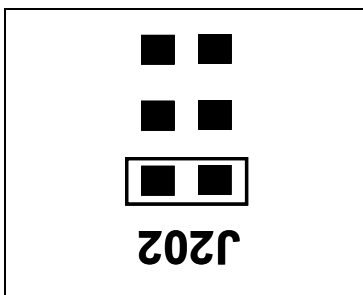
The top position selects the lowest sensitivity for transducer loading. The figure below shows the **top position** of J202 being selected. The top position is the jumper position closest to the speaker.



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



The bottom position selects the highest sensitivity for transducer loading. The figure below 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 is not 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) 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.

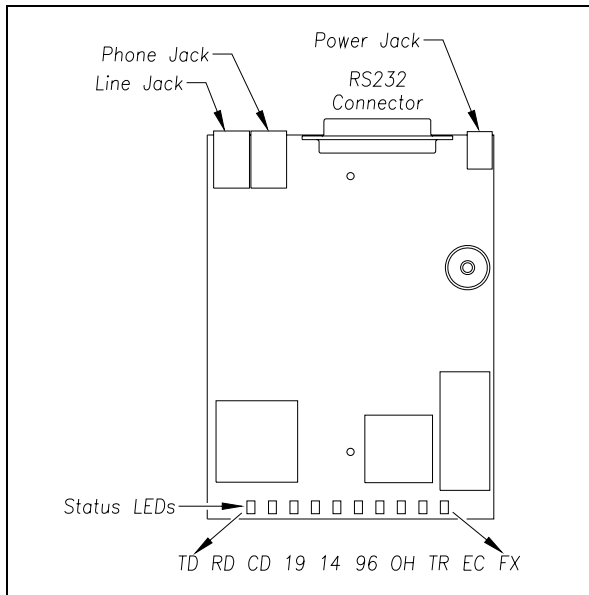
LED 11

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 is used to connect 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 is used to connect 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.

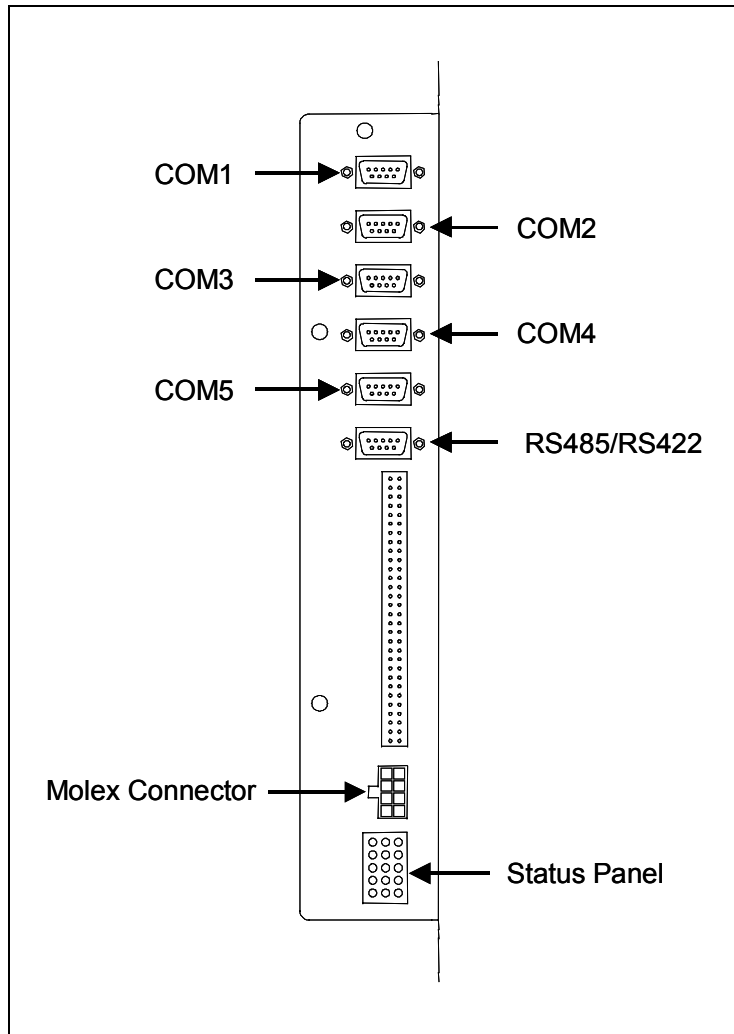
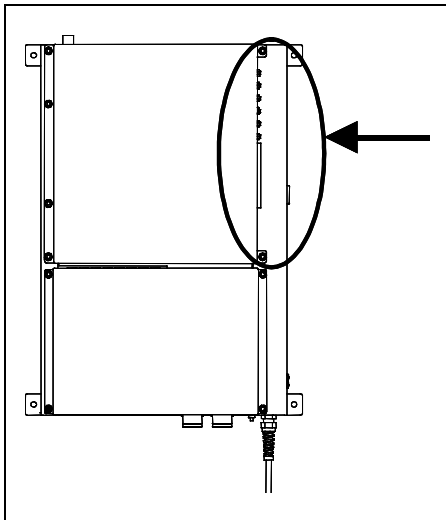
Status LEDs

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

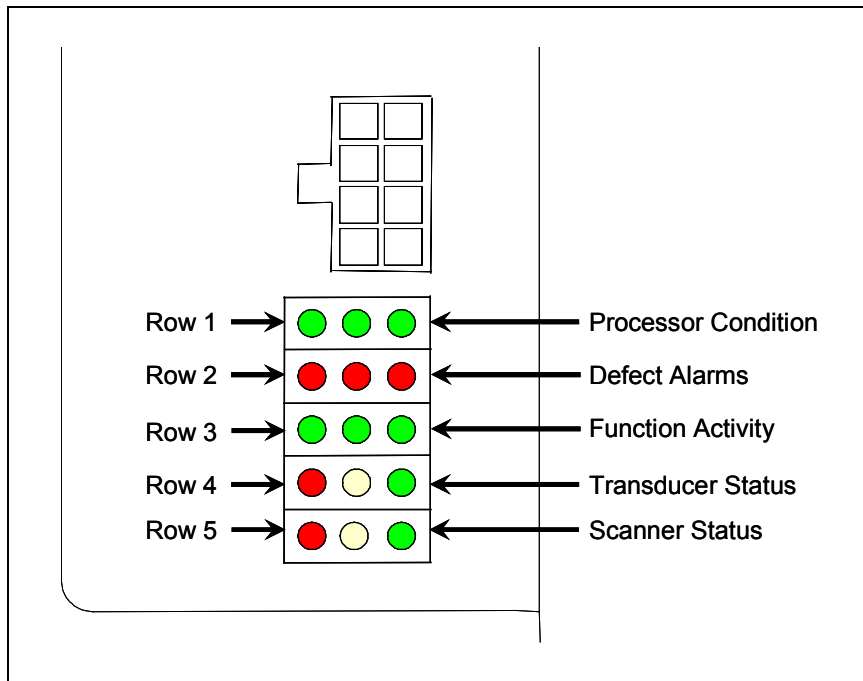
LED	Meaning When Lit
14	Lights when the modem connects using the V.32bis protocol. In V.32bis mode, the modem operates at 7,200-14,400 bps.
33	Lights when the modem connects using the V.34 protocol. In V.34 mode, the modem operates at 2,400-33,600 bps.
56	Lights when the modem connects using the V.90 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 V.42 error-correction mode. Flashes when compression is activated.
FX	Lights when the modem is in fax mode.
OH	Lights when the modem 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.

4.1.2.4 Status Panel

On the right side of a mounted Controller module are a group of connectors and LEDs, as shown below.



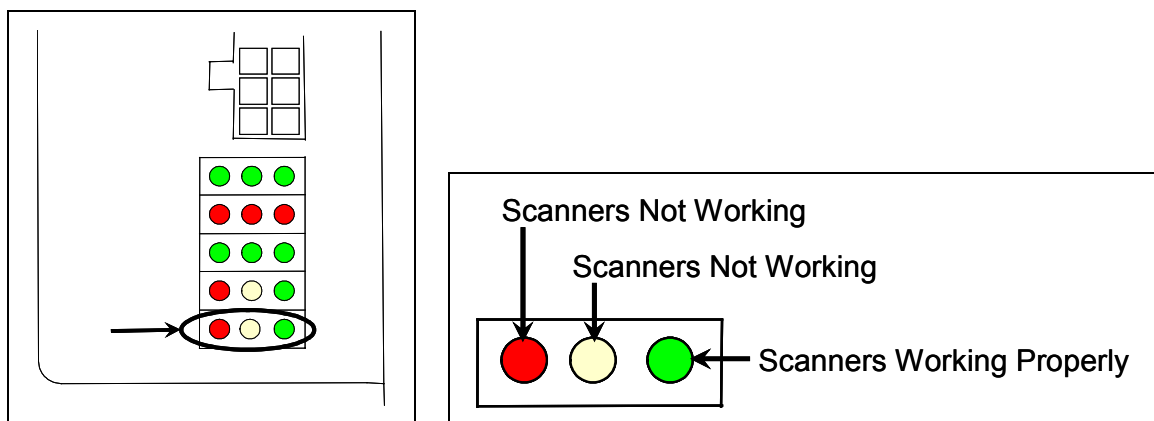
The status panel consists of 15 LEDs in 5 rows of LEDs, as shown below. The LEDs are shown as one would see them in service, which is their normal orientation on a properly installed system.



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 bottom 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 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.

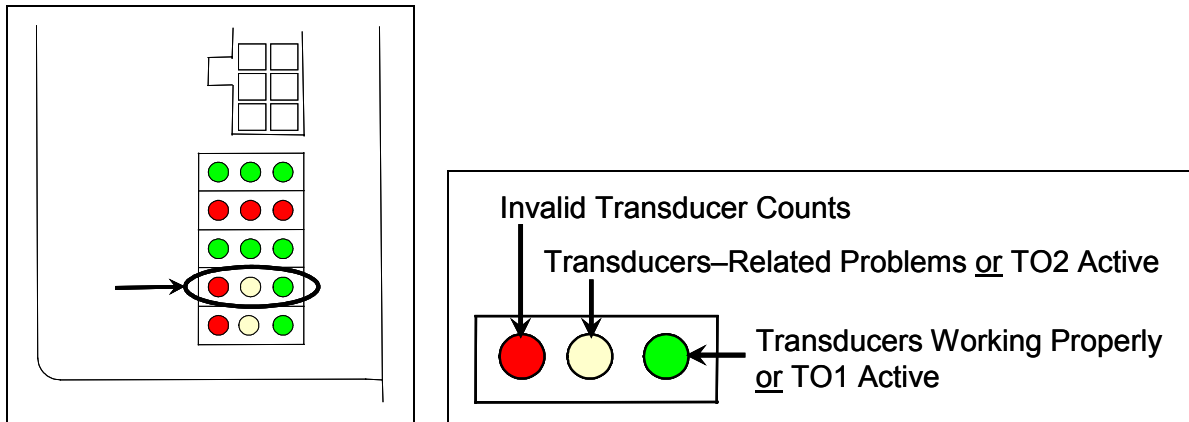
The middle yellow LED flashes when the difference between the average temperatures (recorded by the two bearing scanners or recorded by the two wheel scanners) isn't within acceptable balance limits for 20 consecutive trains. These limits are different for bearing and wheel scanners. For the bearing 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.

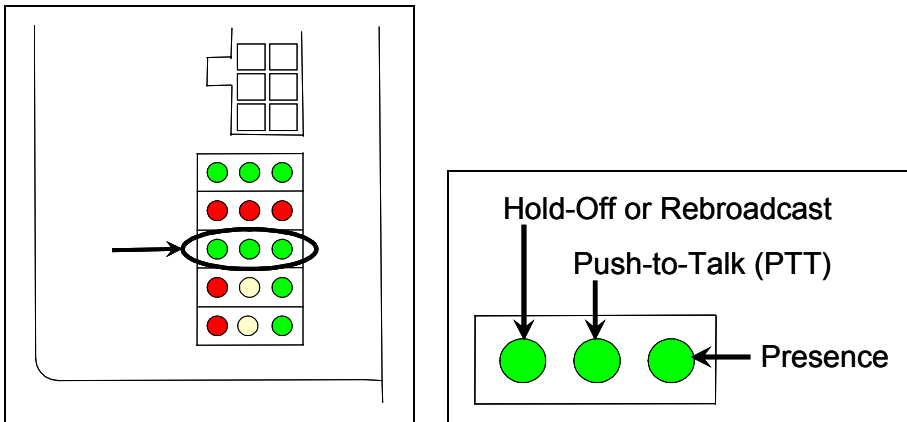
When a train isn't present at the site, the middle yellow LED is lit when:

- 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).

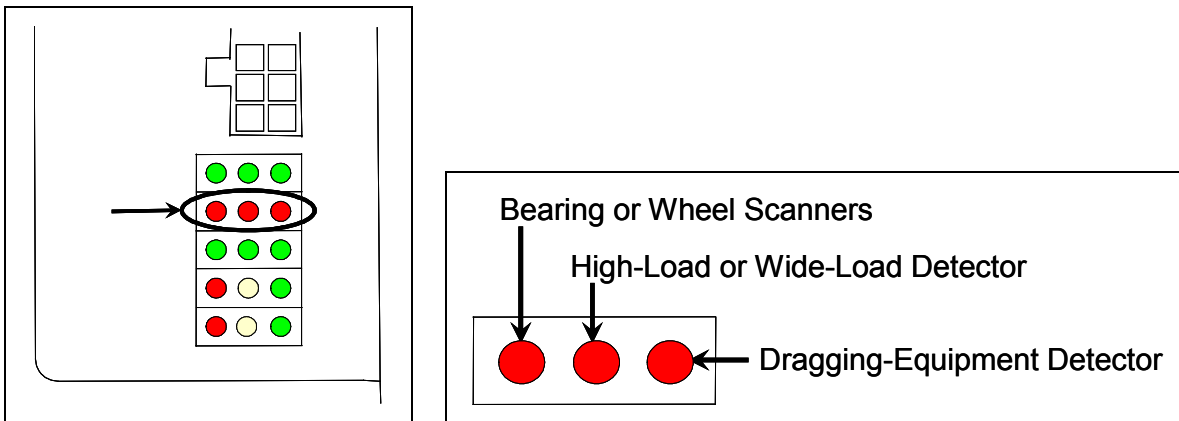
Function Activity

On a mounted Controller module, the middle row of green LEDs indicates system activities, 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.



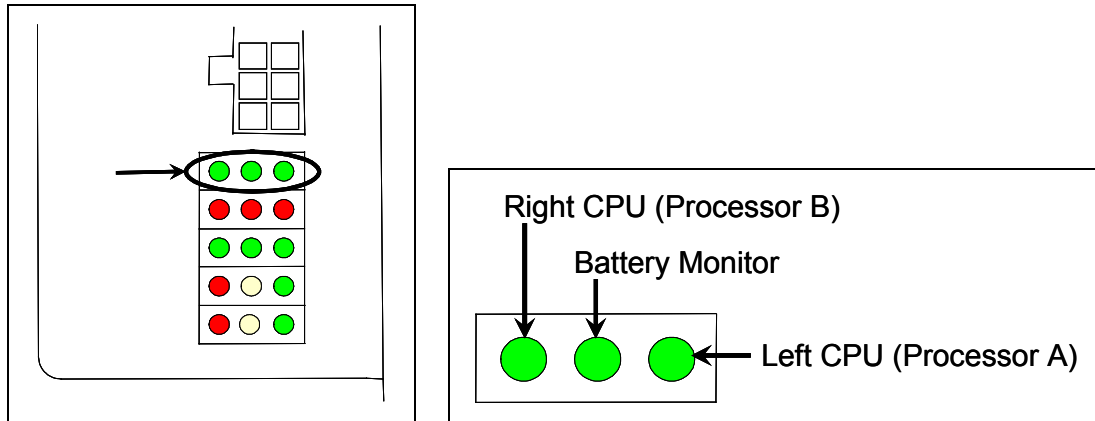
Defect Alarms

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 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.**

4.1.3 SOTC Board

The SOTC board tells the system when a train is present at the site. On the board is potentiometer R24, which adjusts the gain control of the track circuit.

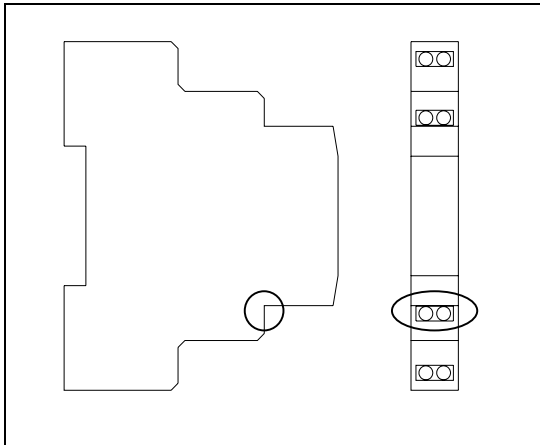
The SmartScanNG enclosure only has a SOTC board if the site is using a track circuit. If the site is using two advance transducers, there is no SOTC board.

4.1.4 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
- Spare auxiliary inputs, if needed
- Shielded temperature probe, 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 and the wiring from the track circuit is protected by a three-terminal arrester. Therefore, neither needs UTB protection.

4.1.5 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 is used to operate the scanner shutters. The other energizes the scanner heaters. The signals to activate the SSRs originate at the Processor board.

The power rating for each SSR is intentionally overrated to ensure long-lasting reliability. For example, the SSR associated with the scanner **shutters** is rated for 100 VDC at 12 amps, even though the shutters operate on 12 volts and require less than 2 amps each. Likewise, the SSR associated with the **heaters** in the 2100-512**DC** scanners is rated for 100 VDC at 12 amps, even though the heaters operate on 12 volts and require less than 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.

4.1.6 Radio

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

At multitrack 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 and track3 don't have to have their own radio. Instead, they can use the radio that supports track1. (Using only one radio at a multitrack 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

4.1.7 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:

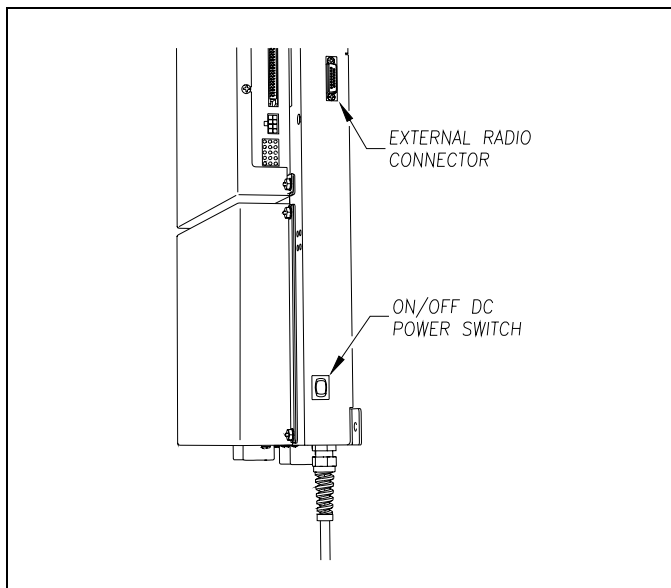
- Four scanner connectors
- AC power cord for powering the scanner heaters, when applicable
- AC circuit breaker for scanner heaters

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

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

4.1.7.1 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.



4.1.7.2 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.

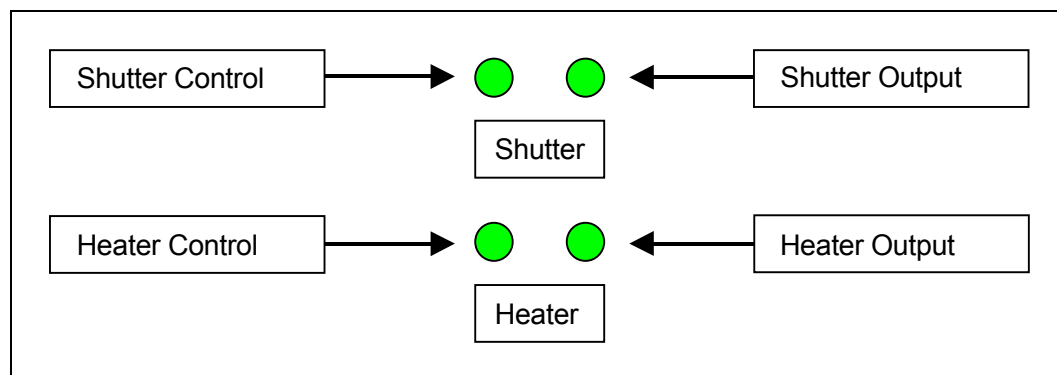
Pin-13 is the carrier-detect input to the SmartScanNG system. This signal is internally pulled high. A low level prevents the SmartScanNG system from initiating a voice transmission.

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.

4.1.7.3 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 will be 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.

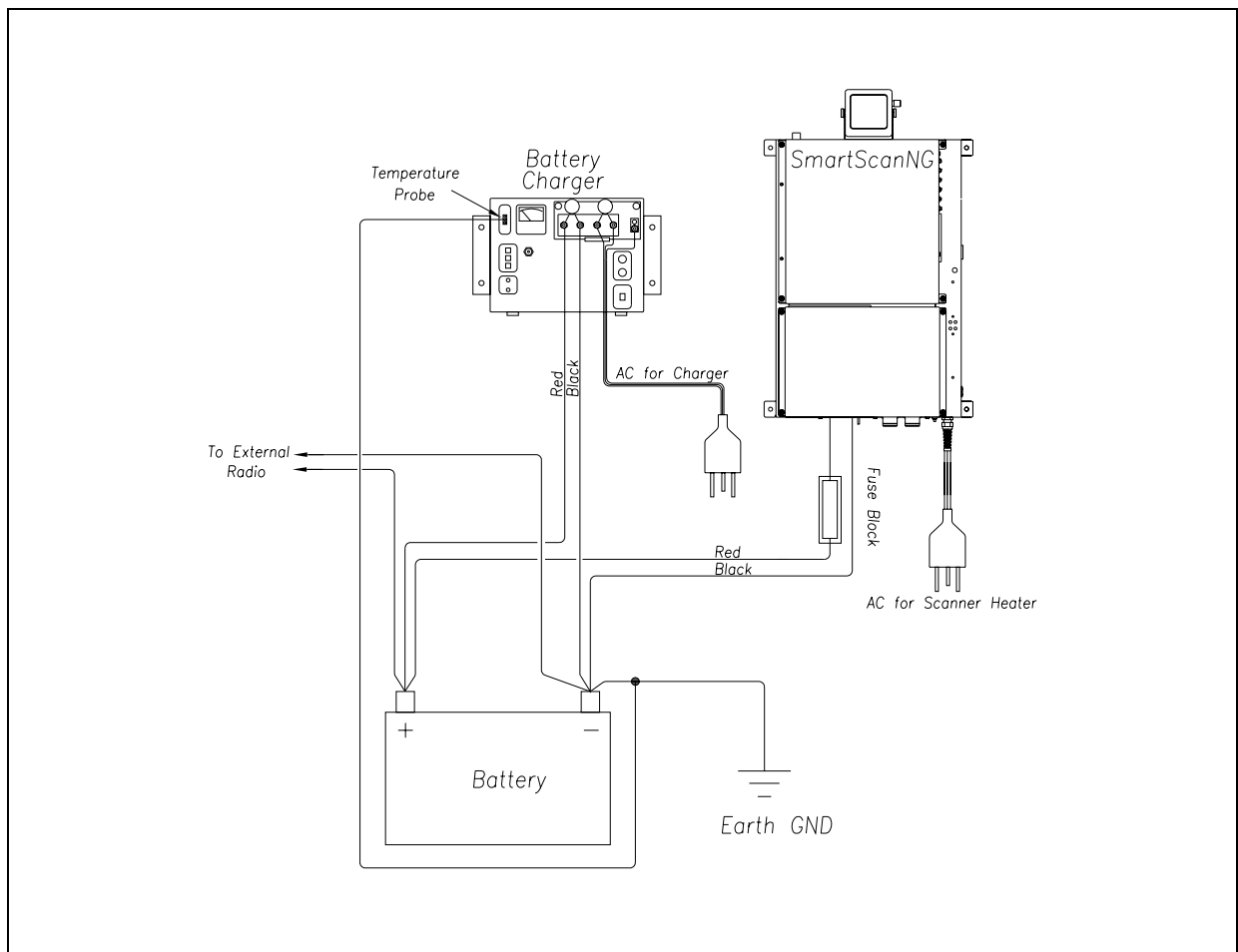
Shutter Control LED (Top Right)	Shutter Output LED (Top Left)	Heater Control LED (Bottom Right)	Heater Output LED (Bottom Left)	Explanation
On	Off	Off	Off	Invalid. The shutters are being commanded to open, but the relay isn't responding with shutter voltage.
On	On	Off	Off	Normal if a train is present. 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

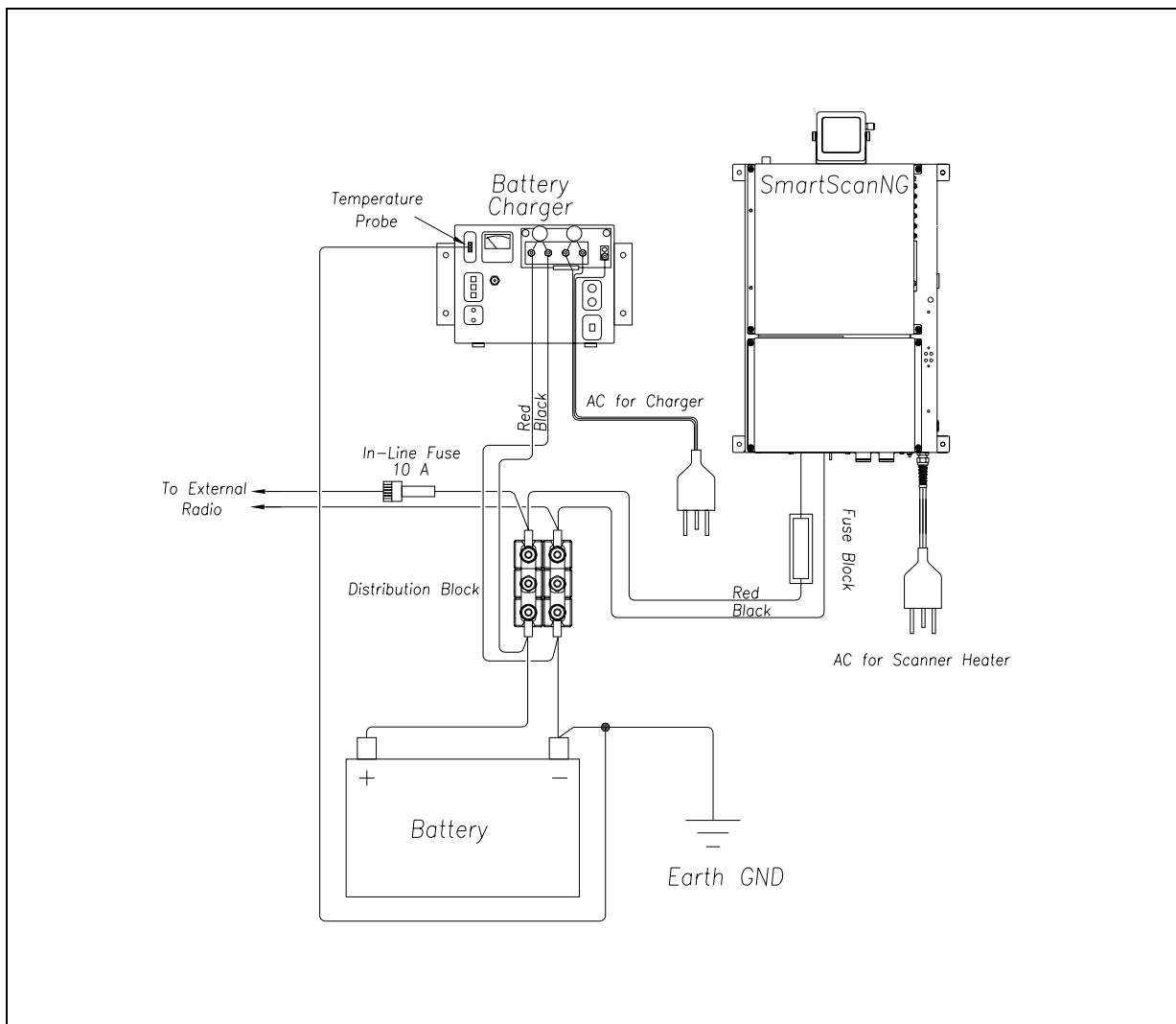
There is one SmartScanNG enclosure per track. At a **single-track site**, there is one power subsystem for the SmartScanNG enclosure, one battery, and one battery charger. At a **double-track site**, there are one or two power subsystems for the two SmartScanNG enclosures, two batteries, and one or two battery chargers. At a **triple-track site**, there are one or two power subsystems for the first two SmartScanNG enclosures and one power subsystem for the third SmartScanNG enclosure.

Not all generic systems use a distribution block. Usually, only some prewired systems that leave STC in a wayside enclosure do. All generic systems use the fuse block.

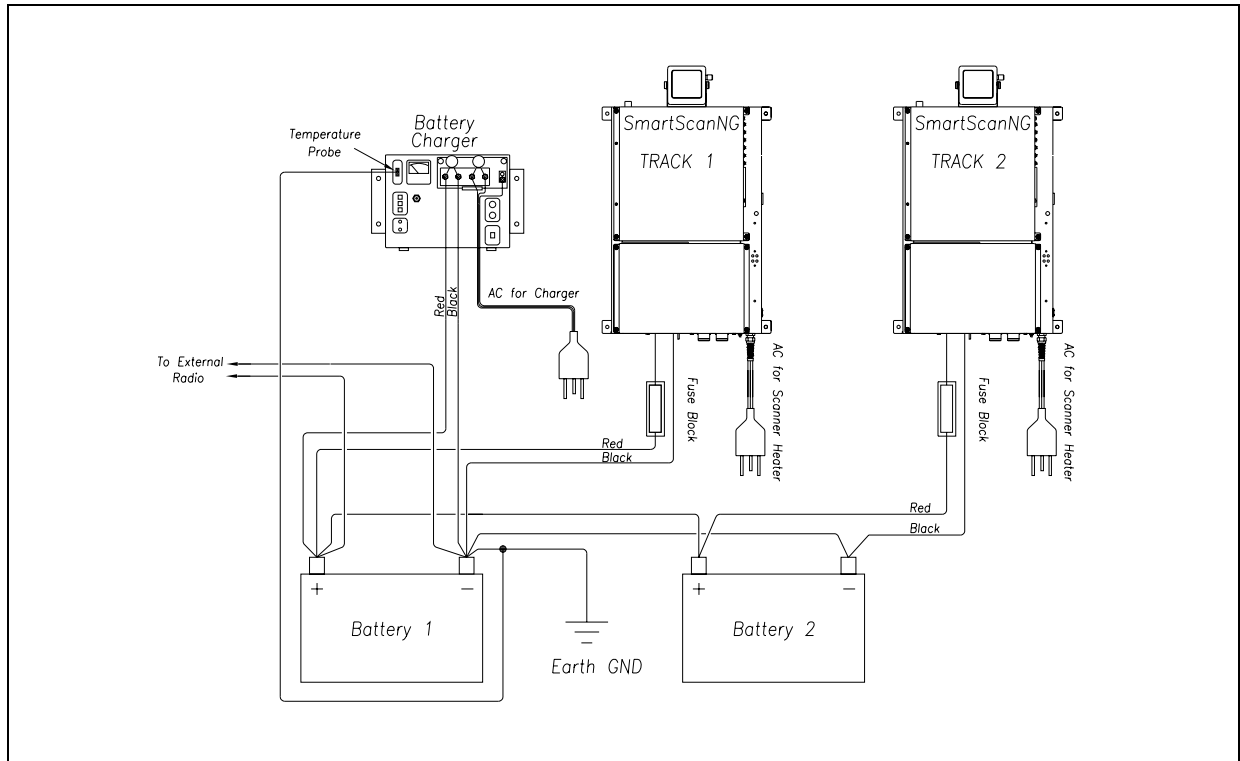
The figure below shows the major parts of one type of power subsystem at a **single-track site**. This one is powered from an AC power source and does not use a distribution block.



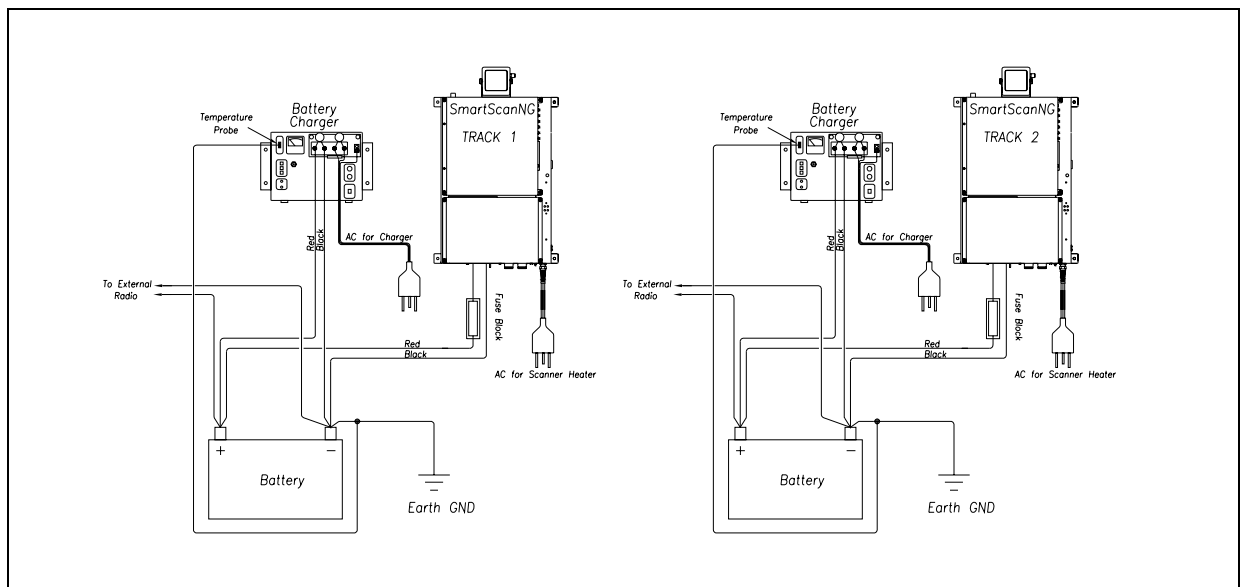
The figure below shows the major parts of one type of power subsystem at a **single-track site**. This one is powered from an AC power source and does use a distribution block.



The figure below shows the major parts of one type of power subsystem at a **double-track site**. This one is powered from an AC power source, does not use a distribution block, and uses one battery charger.



The figure below shows the major parts of one type of power subsystem at a **double-track site**. This one is powered from an AC power source, does not use a distribution block, and uses two battery chargers.



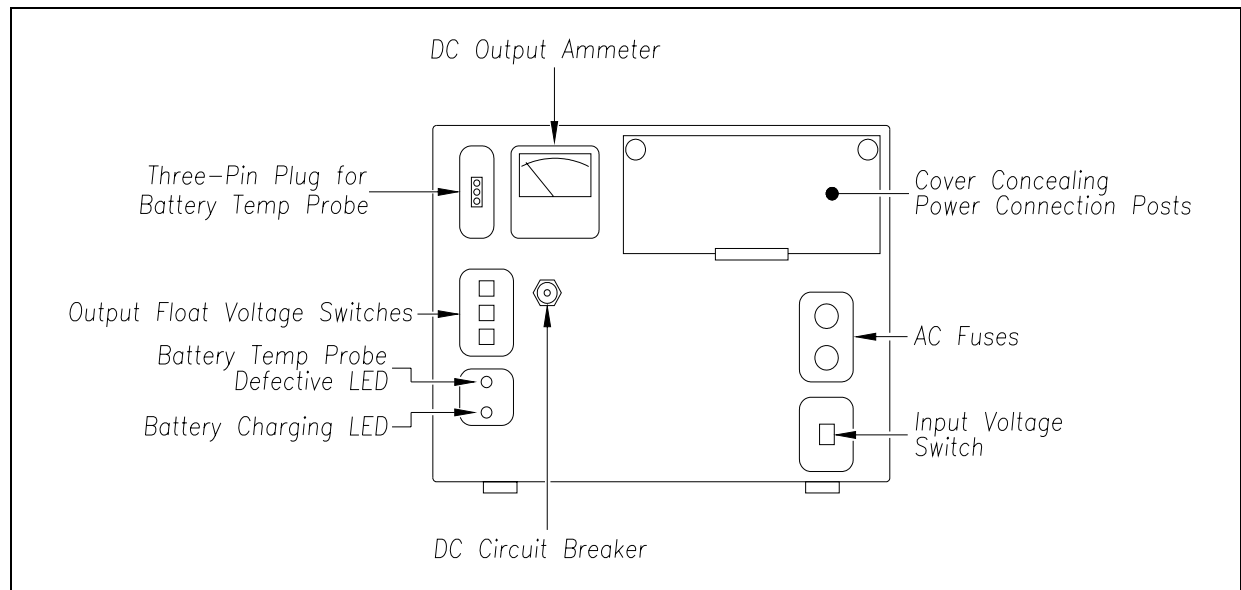
The diagram illustrates the electrical setup for the SmartScanNG system. Two batteries, Battery 1 and Battery 2, are connected to a common ground labeled 'Earth GND'. A 'Distribution Block' is connected to the positive terminals of both batteries. An 'In-Line Fuse 10 A' is placed on the line leading from the Distribution Block to the 'Battery Charger'. The Battery Charger is connected to 'AC for Charger' and has a 'Temperature Probe' attached. Two 'SmartScanNG' units, TRACK 1 and TRACK 2, are shown. Each track has a 'Fuse Block' connected to the Distribution Block and an 'AC for Scanner Heater' connection. The tracks are also connected to the common ground.

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.



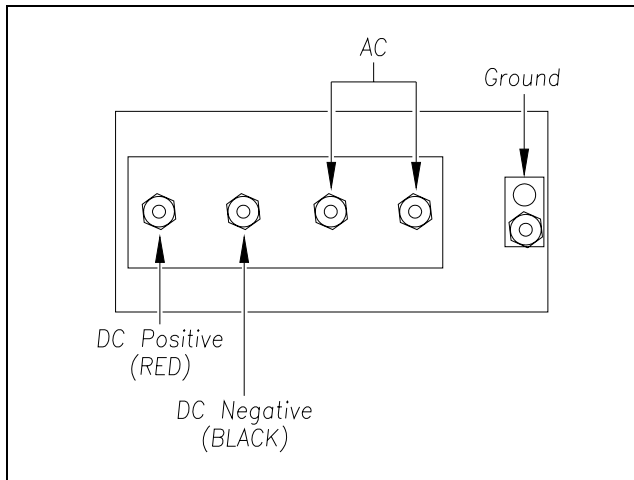
The input voltage switch can be set to 115 VAC or 230 VAC. Use 115 for input voltages between 108 and 128. Use 230 for input voltages between 216 and 256.

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.

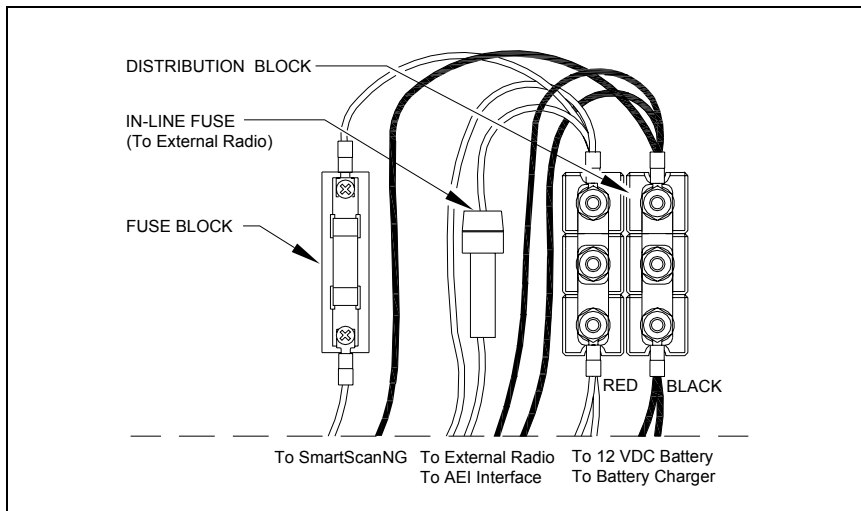
You can open the small door on the front of the charger by pulling out the push tabs. Doing so reveals the power connection posts, as shown below.



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.

Not all generic systems use a distribution block. Usually, only some prewired systems that leave STC in a wayside enclosure do. All generic systems use the fuse block.



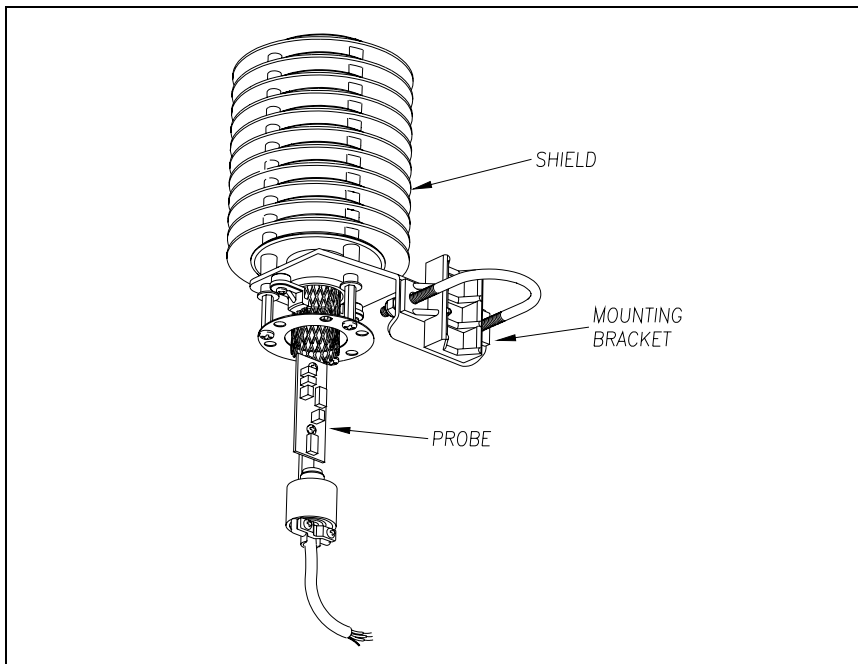
The **distribution block** contains six terminals. Loosening the middle gold nuts will disconnect DC power to the rest of the system. Wires from the bottom of the distribution block go to the 12V battery and to the battery charger. Wires from its top go to the fuse block, to the AEI Interface, and to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

The **fuse block** contains one fuse. This fuse is a standard 13/32x1-1/2-inch, 25-amp, fast blow fuse. It provides overload protection for the SmartScanNG enclosure. A wire from the equipment side of the fuse block goes to the surge-suppression panel inside the SmartScanNG enclosure. If a distribution block isn't present, a wire from the battery side of the fuse block goes directly to the battery. If a distribution block is present, it goes to the battery via the distribution block.

4.3 Shielded Temperature Probe (2090-100)

The shielded temperature probe, which mounts to the outside wall of the wayside enclosure, 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.



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.

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

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.

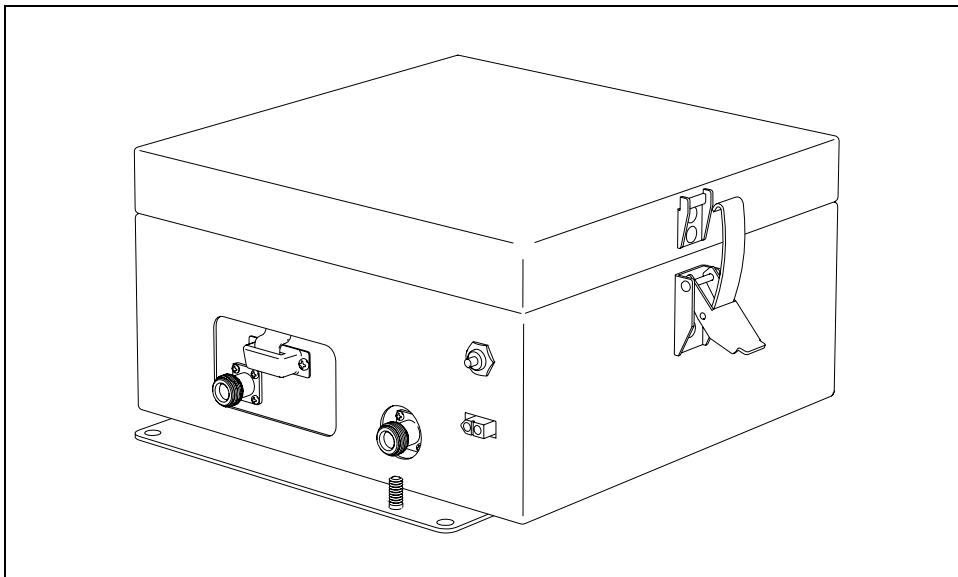
The AEI Interface module contains an Amtech AR2200 RF unit and an Amtech AI1200 Reader Logic board. The AR2200 has a single RF output that is multiplexed between two antenna connections (ant0 and ant1).

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 American Association of Railroads (AAR), International Standardization Organization (ISO), or American Trucking Association (ATA) data format.

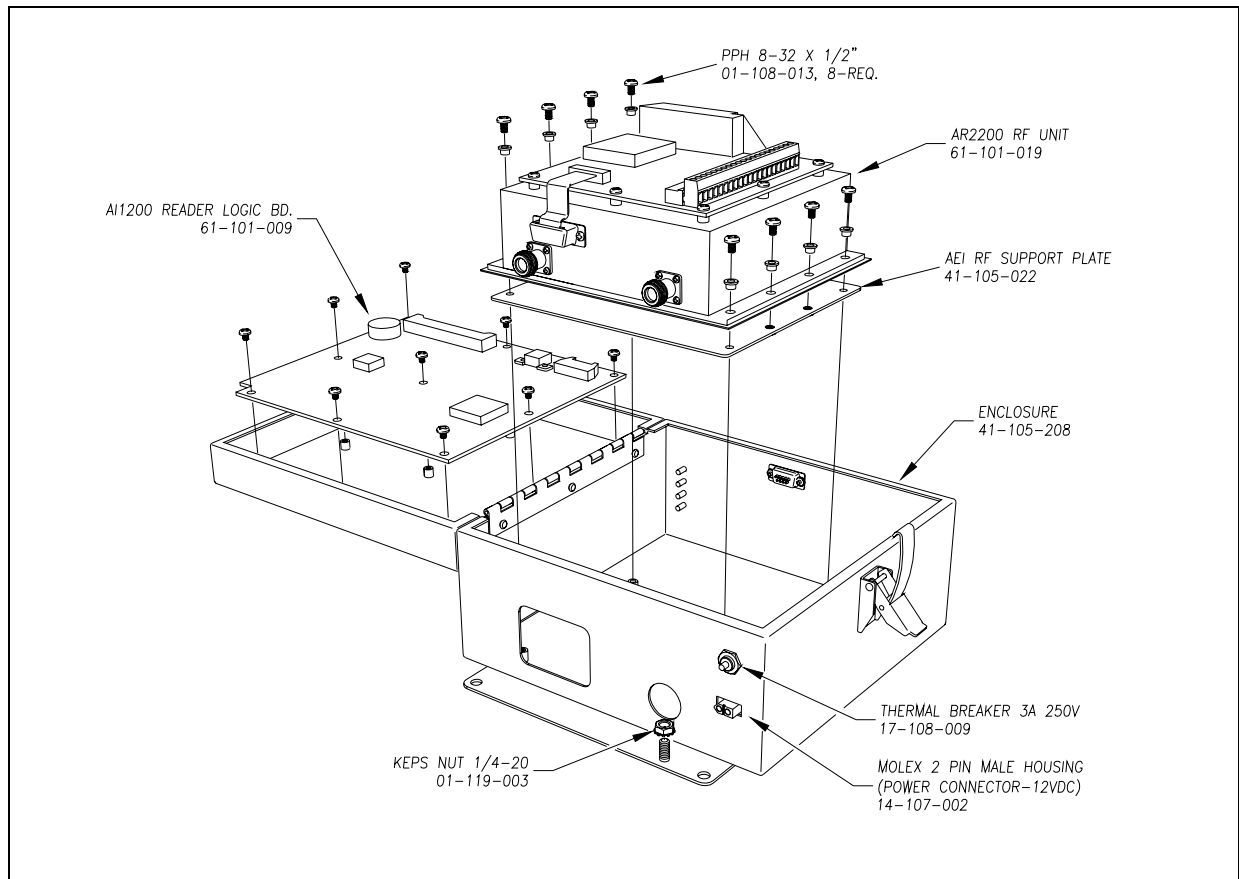
Commands are used to control the operation of the AEI Interface module. Setup commands are sent from the Processor board (2300-100) at power startup to configure the operating parameters of the AEI Interface module. When a train arrives at the site, the AEI Interface module "wakes up." It then starts 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 consist.

The Train Detail report displays the AEI information of each vehicle in the 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).



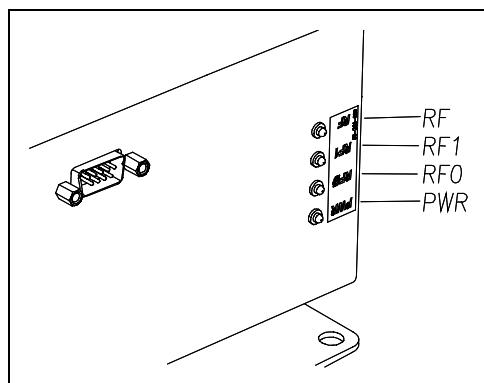
The figure below shows the major parts of an AEI Interface module (2300-750).



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.

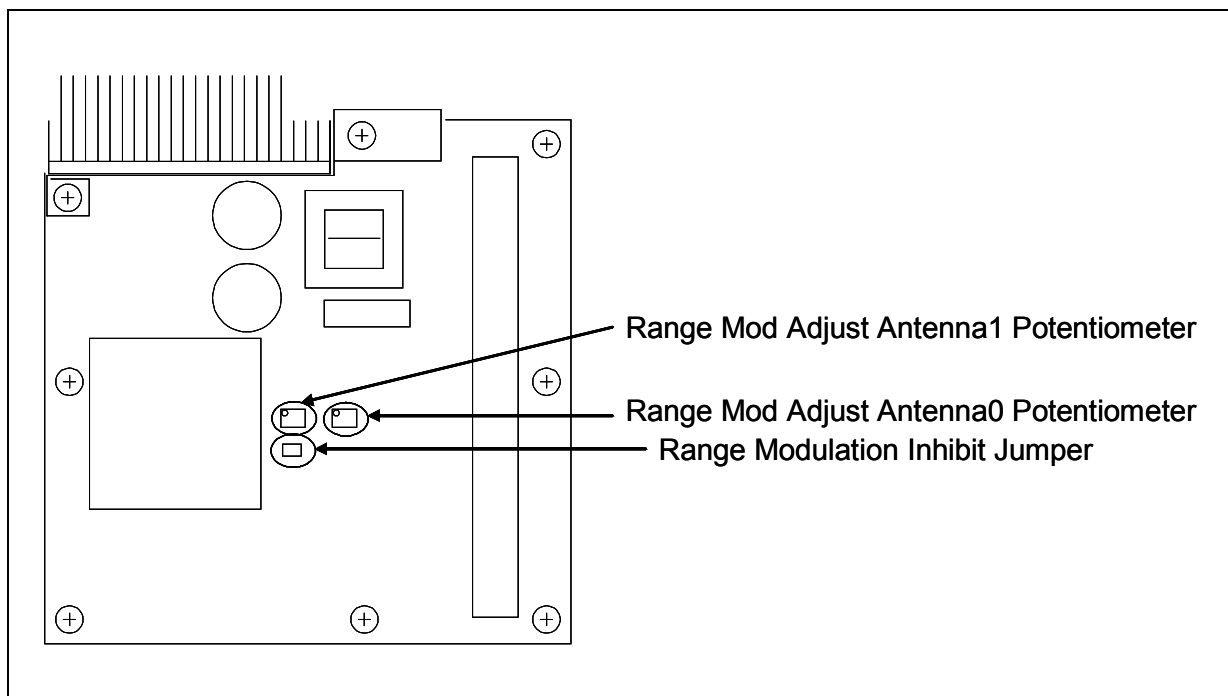
LED Name	LED Color	Meaning When Lit
PWR	Green	Proper voltage is present. Stays lit as long as the AEI Interface module is powered up.
RF	Green	RF power is "ON."
RF0	Green	RF power to antenna0 is "ON."
RF1	Green	RF power to antenna1 is "ON."

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.

5.1 Selecting a Site

Locate the site:

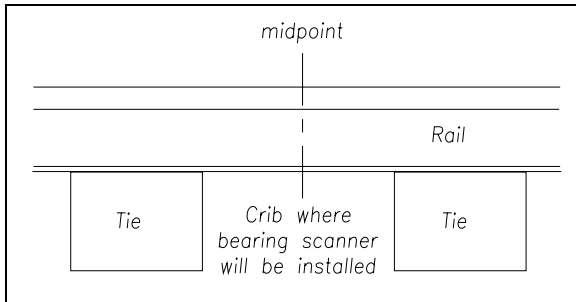
- On level, well-drained ground (avoid low areas where flooding may occur)
- In an area that doesn't normally require heavy braking by passing trains
- At least 300 feet (91.4 meters) from the nearest road crossing
- Away from a track joint, a track switch, and a side track
- By a track that is on gauge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

5.2 Preparing the Scanner Location

To ready the scanner location:

- 1 Select a location to install the bearing scanners.
- 2 Inspect the ties (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 centered in the crib of two ties spaced at least 14 inches (35.6 centimeters) apart.
- 6 If the ties aren't spaced at least 14 inches (35.6 centimeters) apart, fix this problem before proceeding.

7 Mark the rail at the midpoint between the ties.



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

8 If your installation has wheel scanners:

- a** Select a location to install them.

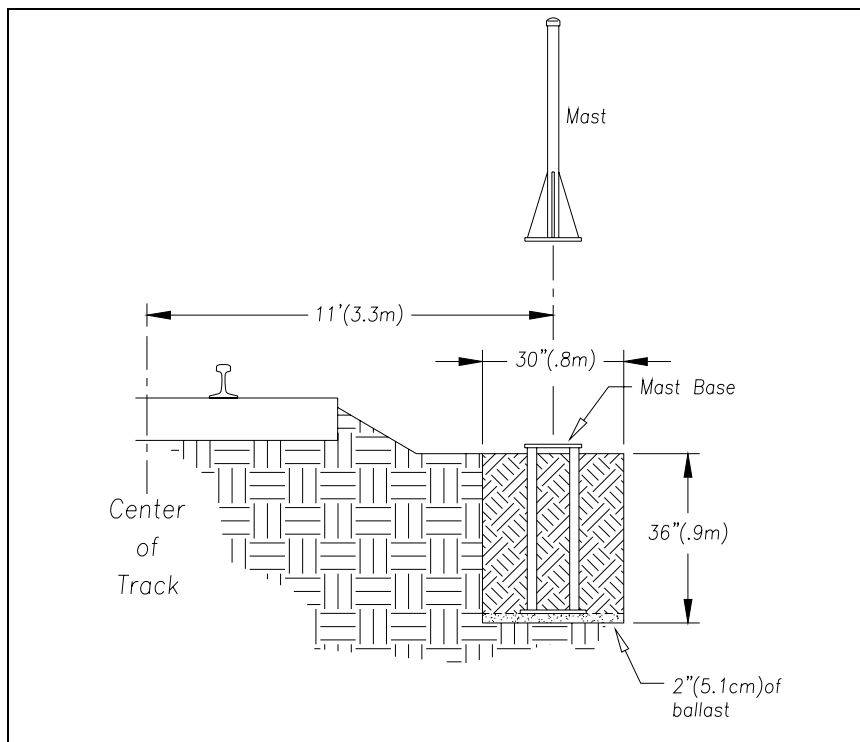
The wheel scanners should be centered in the crib of the two ties immediately ahead (and to the north or east) of the bearing scanners.

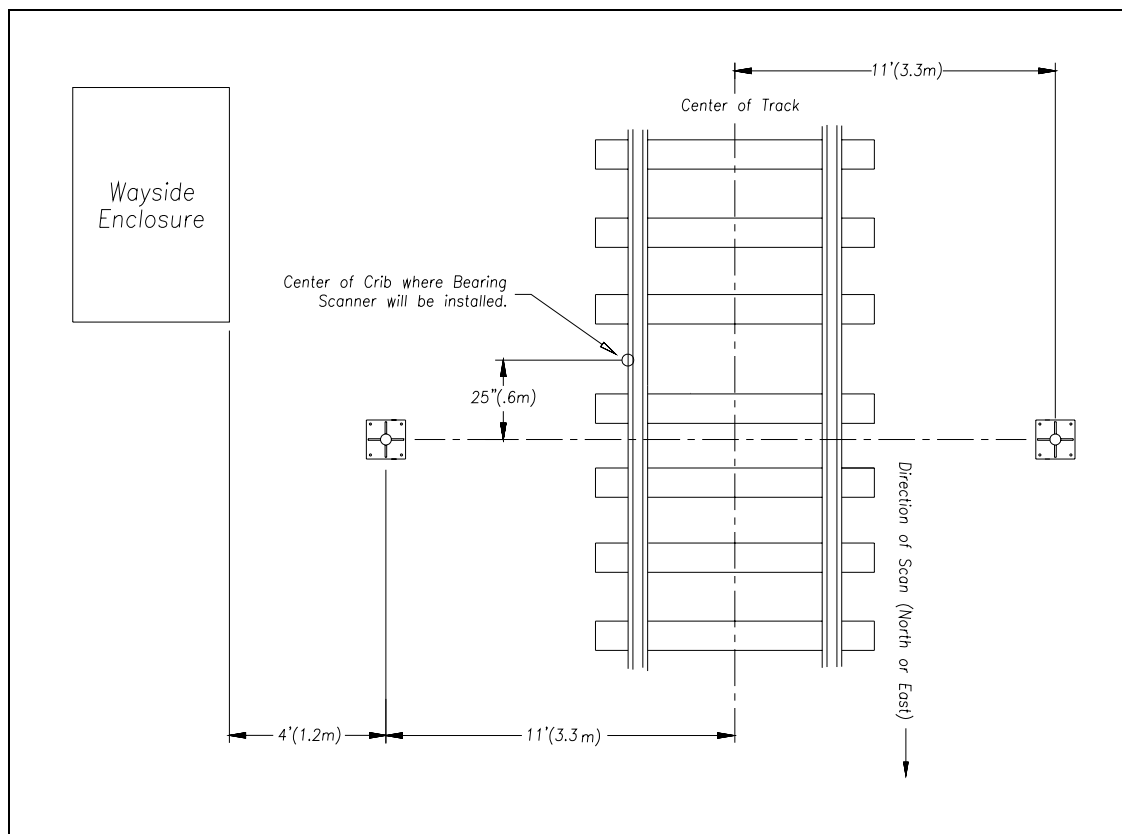
- b** Repeat steps 2 through 6.

5.3 Preparing the AEI Antenna Masts

If your SmartScanNG system uses AEI equipment, to ready the two antenna masts:

- 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 11 feet (3.3 meters) from the center of the track and 25 inches (0.6 meters) from the center of the crib in which the bearing scanner will be installed. Both bases will be north or east of the crib.

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

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

5.4 Preparing the 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 On the side of the wayside enclosure, drive at least one 8-foot (2.4-meter) or longer ground rod into the ground.
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 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 will 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 them 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. 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 (if not available, a 10-millimeter bit might work)
- 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
- Medium size adjustable box wrench (aka crescent wrench)
- Carpenters level
- 1/2-inch nutdriver (if not available, a 13-millimeter nutdriver might work)
- 11/32-inch nutdriver (if not available, a 9-millimeter nutdriver might work)
- #2 Phillips head screwdriver
- Small slotted screwdriver (aka flathead screwdriver)
- 3/8-inch transfer punch or center punch
- 50-foot (15-meter) or longer tape measure
- Multimeter, reading at least 110-120 VAC, 0-50 VDC, and 0-1 megohm

In the box containing the bearing scanners are these tools.

- Short-handle 1-1/2-inch open-end wrench, which is used to install the scanner mounts
- T-handle 3/16-inch hex-wrench, which is used to install the flex-conduit-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, track circuits, auxiliary-alarm detectors, and AEI antennas. This chapter tells how to install scanners, transducers, track circuits, and AEI antennas. The installation of dragging-equipment detectors and other auxiliary-alarm detectors isn't covered in this guide.

All 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.

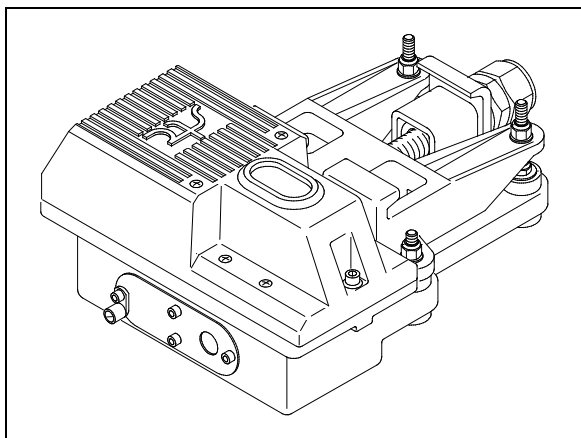
Track components are installed in this order.

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

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

6.1 Bearing Scanners

An assembled bearing scanner looks like:



To install the bearing scanners:

- 1 Be sure that you have on hand two bearing scanner covers, modules, and mounts.
- 2 Be sure that you have on hand a short-handle 1-1/2-inch open-end wrench, a T-handle 3/16-inch hex-wrench, a T-handle 1/4-inch hex-wrench, a #2 phillips head screwdriver, and a 50-foot (15-meter) or longer tape measure.

- 3 Select a location to install the bearing scanners.

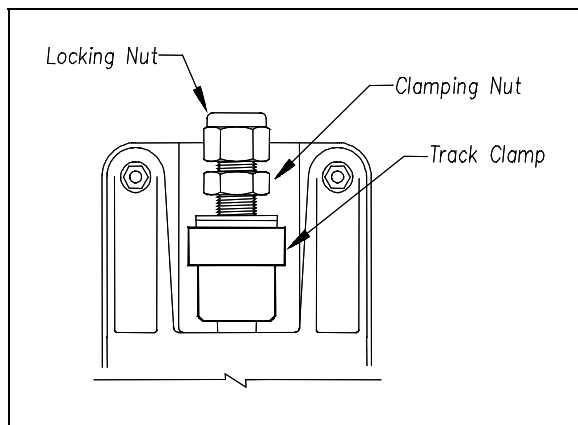
The bearing scanners should be centered in the crib of two ties spaced at least 14 inches (35.6 centimeters) apart.

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

You'll next install the first bearing scanner.

- 5 Using a T-handle 1/4-inch hex-wrench, loosen the two socket-head-cap screws on the cover of a not-yet-installed bearing scanner.
- 6 Separate the scanner cover, which contains an attached scanner module, from its mount.
- 7 Store the cover-and-module combination 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.



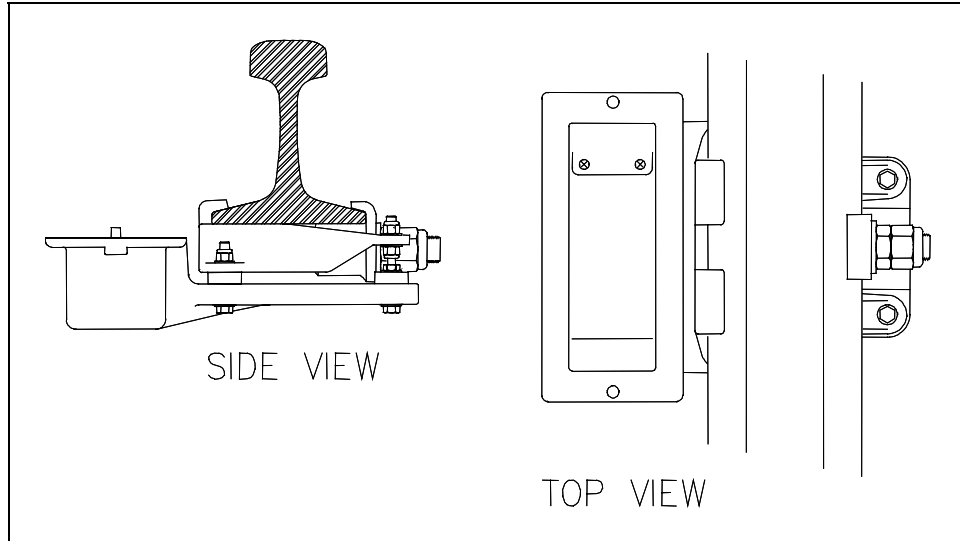
- 8 Centered between the ties and on the rail closest to the wayside enclosure, place the mount so that the moveable track clamp extends under the rail and toward the center of the track.
- 9 Tighten the inner nut (that is, the clamping nut) by hand.
This should hold the mount in place.
- 10 Using a 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.

- 11 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.

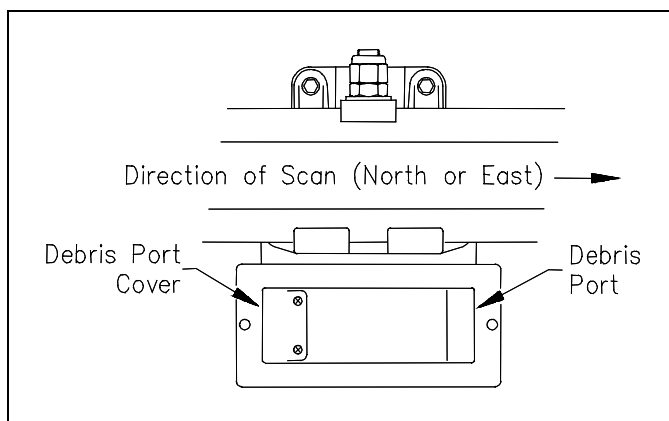


The next step is necessary to finish installing the bearing scanner mounts, to install the bearing scanners themselves, and to install the transducers.

- 12 Determine the direction of scan.

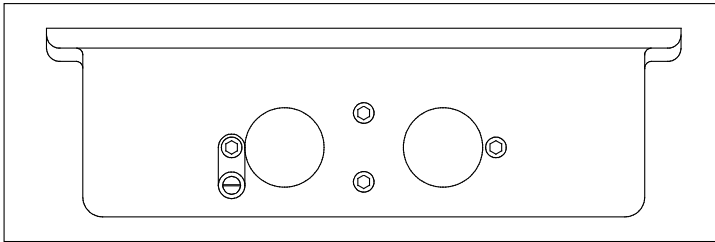
If the track runs north and south, both the oval hole in the top of the scanner and the rectangular hole in the bottom of the mount should be pointed north. If the track runs east and west, both holes should be pointed east. The goal of proper scanner orientation is to reduce the possibility of the scanners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

- 13 Examine the top of the mount.



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

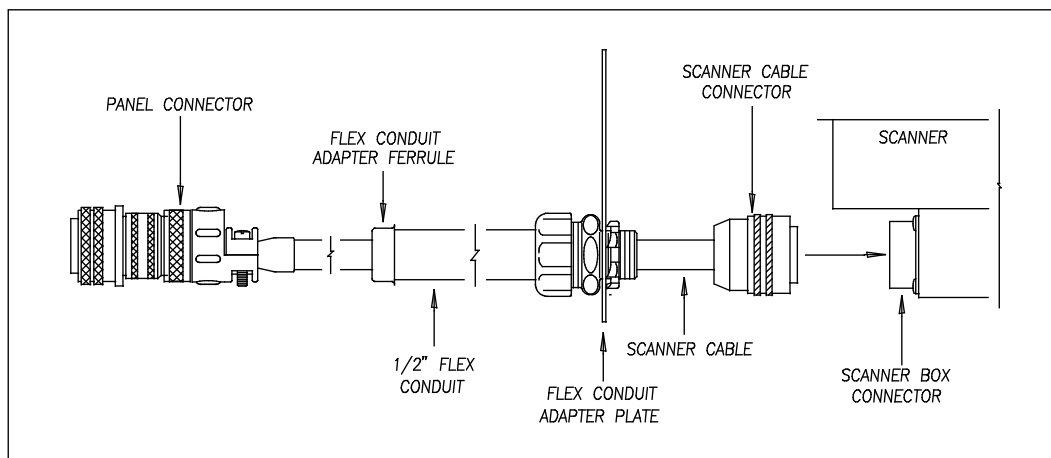
- 14 If the debris port cover isn't as shown above, follow these steps.
- Using a #2 phillips head screwdriver, remove the two screws holding the debris port cover.
 - Store the screws in a safe place until you replace them.
 - With gentle pushing from underneath, remove the debris port cover.
 - Place the debris port cover over the debris port on the other end of the mount.
 - Using a #2 phillips head screwdriver, replace the two screws through the debris port cover.
- 15 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.

- 16 Using a T-handle 3/16-inch hex-wrench, remove the four screws.
- 17 Store the screws, washer, and lug in a safe place until you replace them.

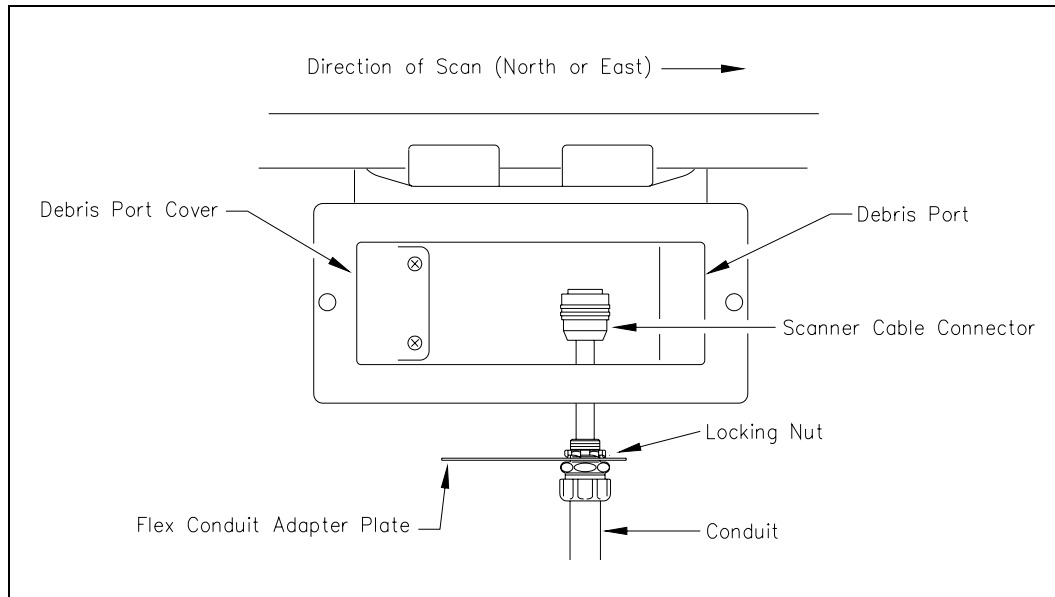
In the steps that follow, the terms scanner cable connector, panel connector, and flex-conduit-adapter plate are used. Notice where they are on a bearing scanner cable.



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

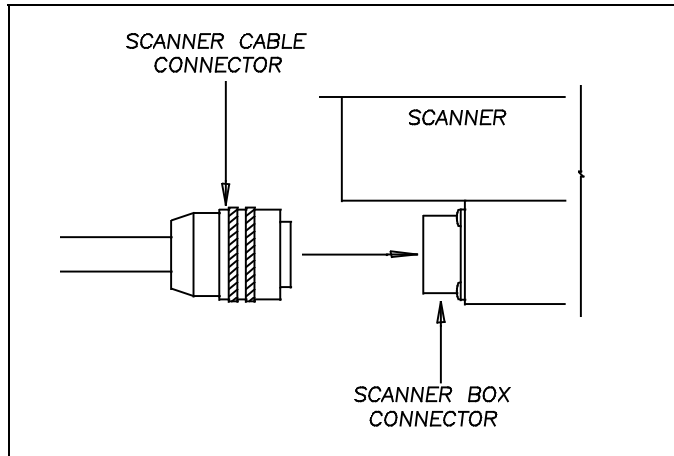
Double-track sites have two 65-foot bearing scanner cables for the track closest to the wayside enclosure and two 100-foot (30.5-meter) bearing scanner cables for the track farthest from the wayside enclosure. **Triple-track sites** have two 65-foot cables, two 100-foot cables, and two 130-foot (39.6-meter) cables.

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

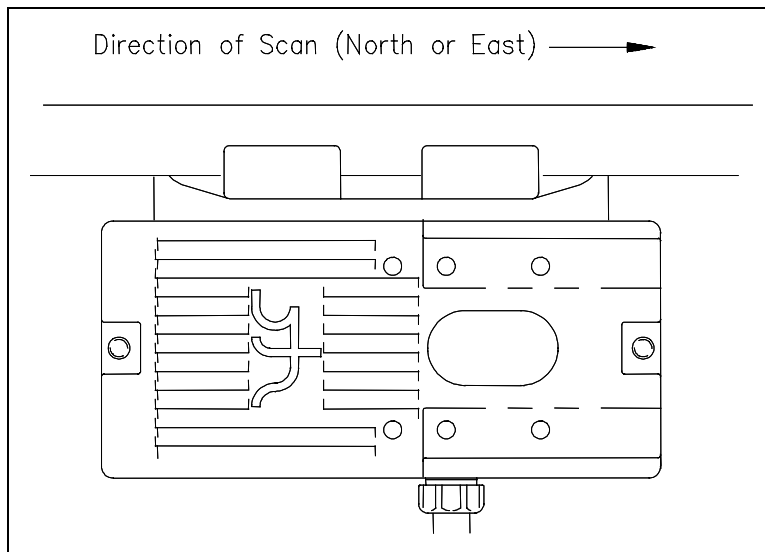


- 20** Put the scanner cable connector through the northmost or eastmost round hole in the side of the mount.
- 21** Align the screw holes in the flex-conduit-adapter plate with the screw holes in the mount.
- 22** Replace the two center screws and tighten by hand.
This should hold the flex-conduit-adapter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

- 28 Attach the scanner cable connector to the scanner box connector.



- 29 With the hole (on top of the scanner cover) facing north or east, replace the cover-and-module combination.



- 30 Using a T-handle 1/4-inch hex-wrench, tighten the two screws (on the scanner cover) until they are completely tight.
- 31 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.
- 32 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.

- 33** If this is a triple-track site, label the end of the cable that isn't attached to the bearing scanner **RAIL1-TRACK1**, **RAIL2-TRACK1**, **RAIL1-TRACK2**, **RAIL2-TRACK2**, **RAIL1-TRACK3**, or **RAIL2-TRACK3**, whichever is appropriate.

- 34** Extend the cable into the wayside enclosure and leave it coiled on the floor.

- 35** Attach one end of an 8 AWG stranded copper wire to the ground lug on the flex-conduit-adaptor plate and the other end to the ground connector on the ground rod.

The ground rod was driven into the ground beside the wayside enclosure.

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

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

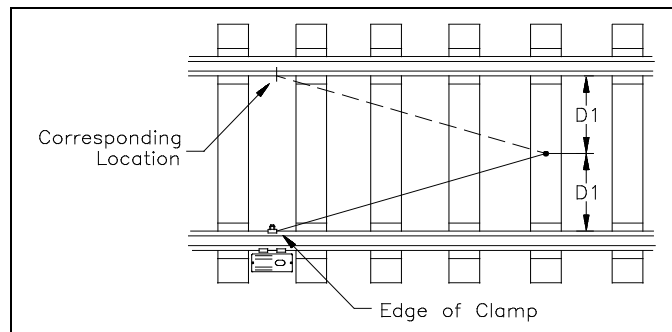
- 37** Separate the scanner cover, which contains an attached scanner module, from its mount.

- 38** Store the cover-and-module combination 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.

- 39** 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.

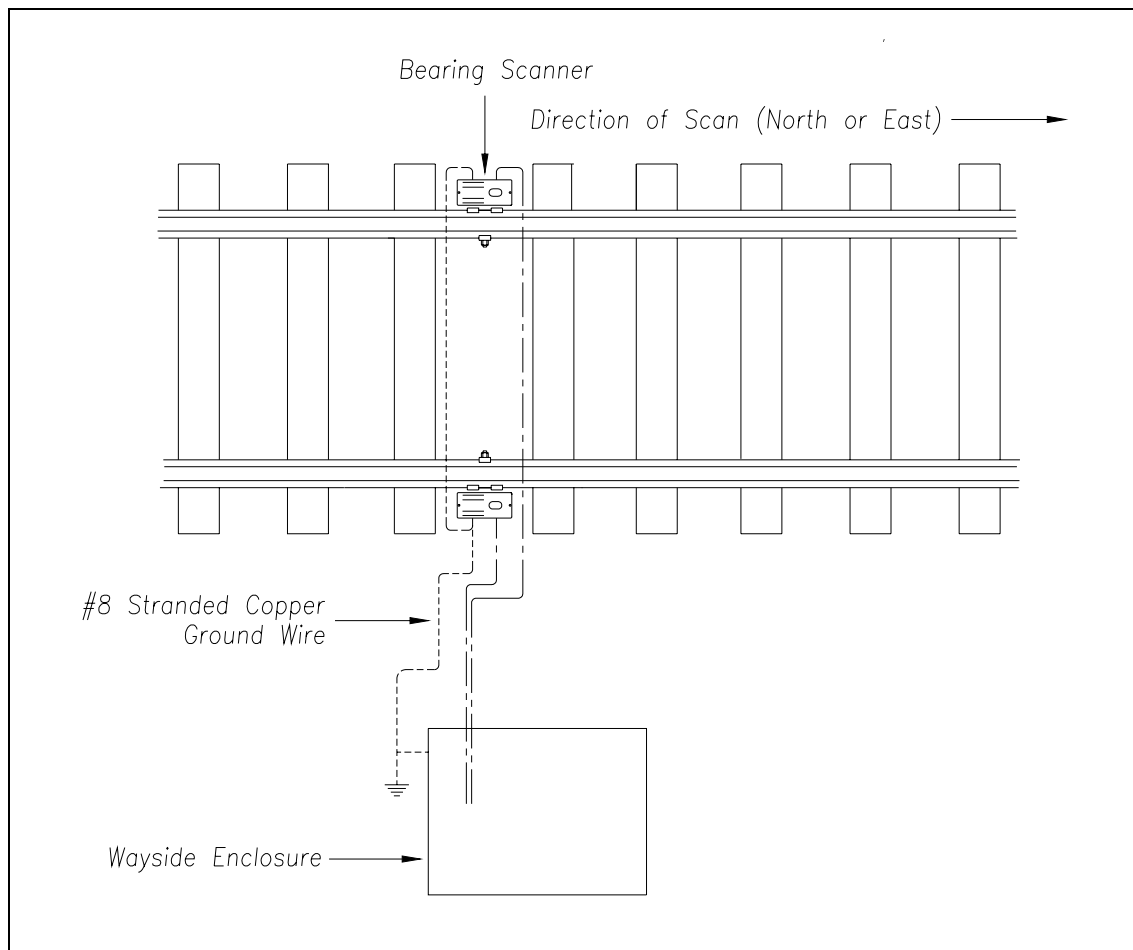
Use a permanent marker, magic marker, lumber crayon, or paint pen to mark the rail. Don't use a file or punch to mark the rail.

- 40** 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.

- 41** Repeat steps **9** through **34**.

- 42** 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.

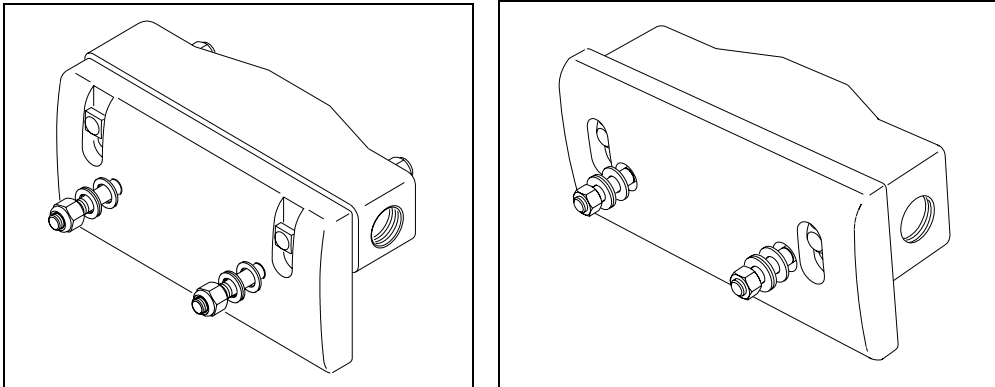
Seen from above, your site would look something like this.



- 43** If this is a single-track site, go to **6.2 Transducers**.
- 44** If this is a double-track site:
- a** Repeat steps **1** through **42** on the second track.
 - b** Go to **6.2 Transducers**.
- 45** If this is a triple-track site:
- a** Repeat steps **1** through **42** on the second track.
 - b** Repeat steps **1** through **42** on the third track.
 - c** Go to **6.2 Transducers**.

6.2 Transducers

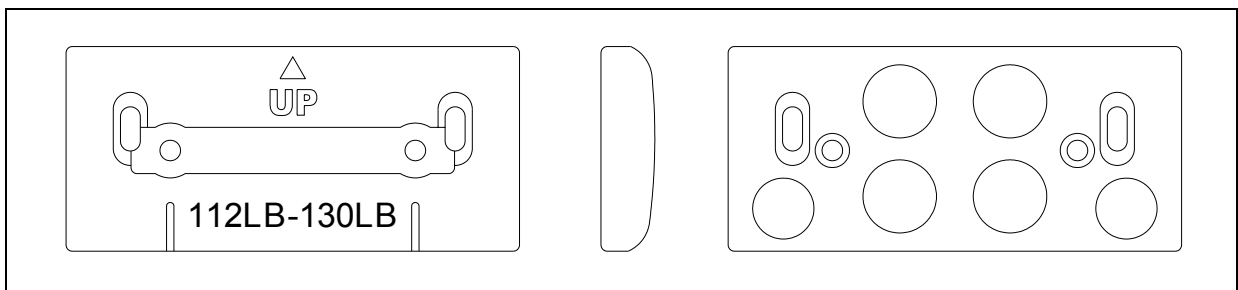
An assembled STC magnetic transducer looks like one of these.



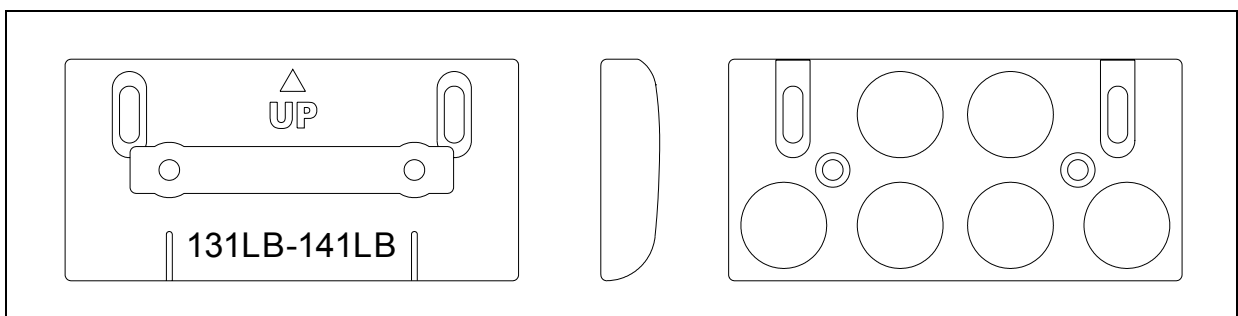
If your site uses transducers that don't look like either of the above, skip the instructions below and call STC for help. If your rail size isn't 115, 122, 127, 132, 136, or 141 pounds per yard (57.05, 60.52, 63.00, 65.48, 67.46, or 69.94 kilograms per meter), skip the instructions below and call STC 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 mounting plate 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 mounting plate 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 center punch, a track drill, a 3/8-inch bit, a 9/16-inch wrench, a 50-foot (15-meter) or longer tape measure, and a STC alignment fixture.
- 3 Determine the size of the rail at your site.

Supported sizes are 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).

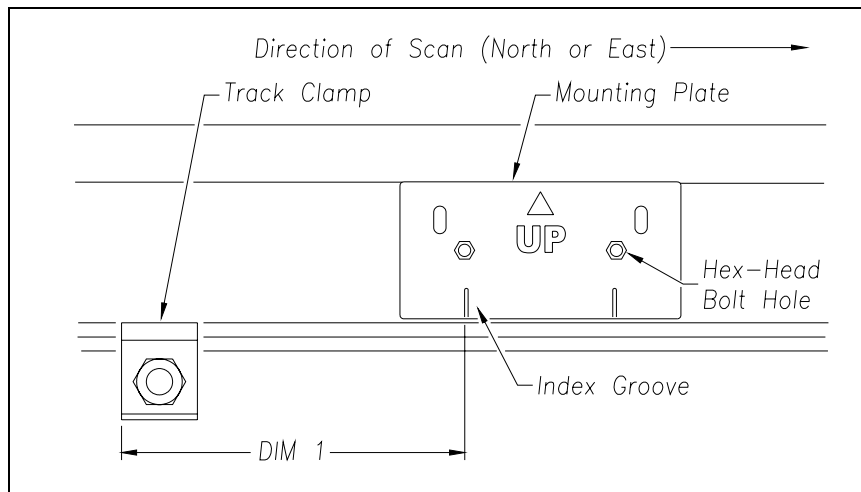
On the rail nearest to the wayside enclosure, you'll next install the gating transducer nearest to the bearing scanner. This transducer is **TO1**.

- 4 Using the table below, note the distance for your rail size.

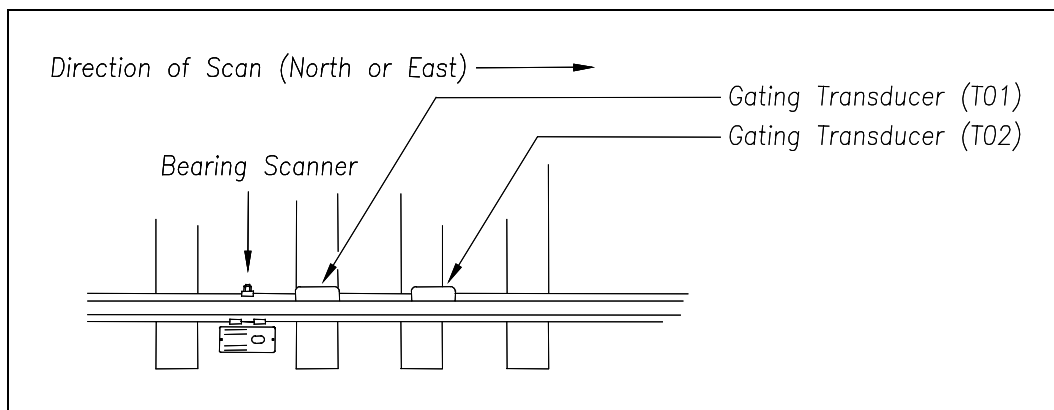
Rail Size pounds/yard	Rail Size kilograms/meter	Distance (DIM1)
115	57.05	10-13/16 inches (27.46 centimeters)
122	60.52	10-31/32 inches (27.86 centimeters)
127	63.00	11-3/16 inches (28.42 centimeters)
132	65.48	11-5/16 inches (28.73 centimeters)
136	67.46	11-3/8 inches (28.89 centimeters)
141	69.94	11-5/8 inches (29.53 centimeters)

For example, if your rail size is 132 pounds per yard (65.48 kilograms per meter), the distance is 11-5/16 inches (28.73 centimeters). This distance is **DIM1**.

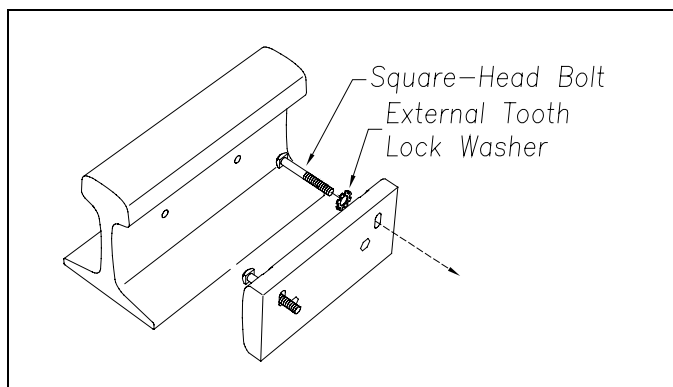
- 5 Separate the fiberglass-epoxy transducer body from the aluminum mounting plate.
- 6 With the arrow on the plate pointing up, place the mounting plate against the inside web of the rail (that is, against the gauge side of the rail).
- 7 Going north or east from the far edge of the track clamp on the 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."

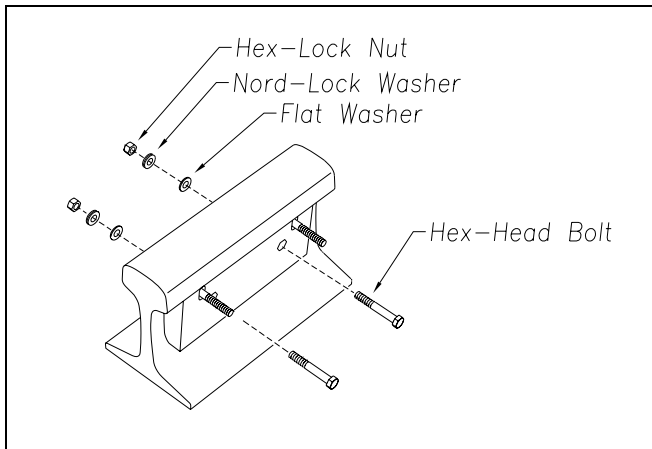


- 8** Hold the mounting plate against the rail and as high against the crown as possible.
- 9** Using the hex-head bolt holes as your guide, mark the two places on the rail where you'll later drill holes.
- 10** Remove the mounting plate.
- 11** Using a 3/8-inch bit, drill the two holes.
- 12** Place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

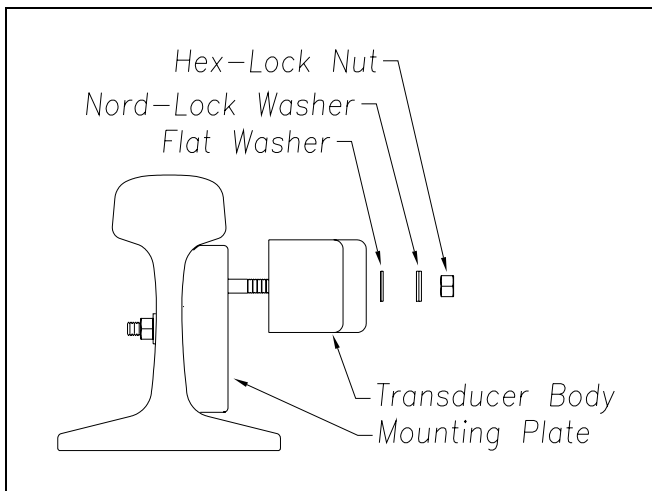
- 16** Loosely place the flat washers, Nord-Lock washers, and hex-lock nuts onto the hex-head bolts.



- 17** Tighten each hex-lock nut with a 9/16-inch torque wrench to a **torque of 10 to 12 foot-pounds (13.6 to 16.3 newton-meters)**.

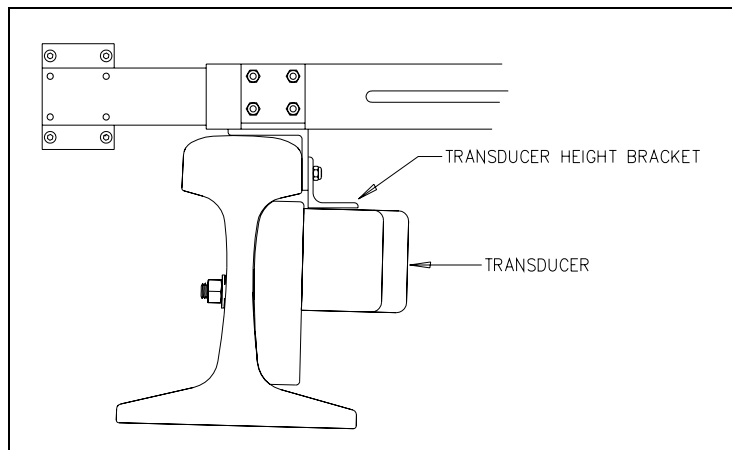
Don't exceed a torque of 12 foot-pounds (16.3 newton-meters). Doing so can weaken or break a bolt, requiring the bolt to be replaced.

- 18** 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.
- 19** Loosely place the flat washers, 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.

- 20** Place the alignment fixture across both rails, centered over the transducer.
- The fixture should be snug against the top and gauge of both rails.
- 21** Move the transducer body to where it just touches the height bracket.



- 22** Tighten each hex nut with a 9/16-inch wrench to a **torque of 8 to 10 foot-pounds (10.8 to 13.6 newton-meters)**.

Don't exceed a torque of 10 foot-pounds (13.6 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.

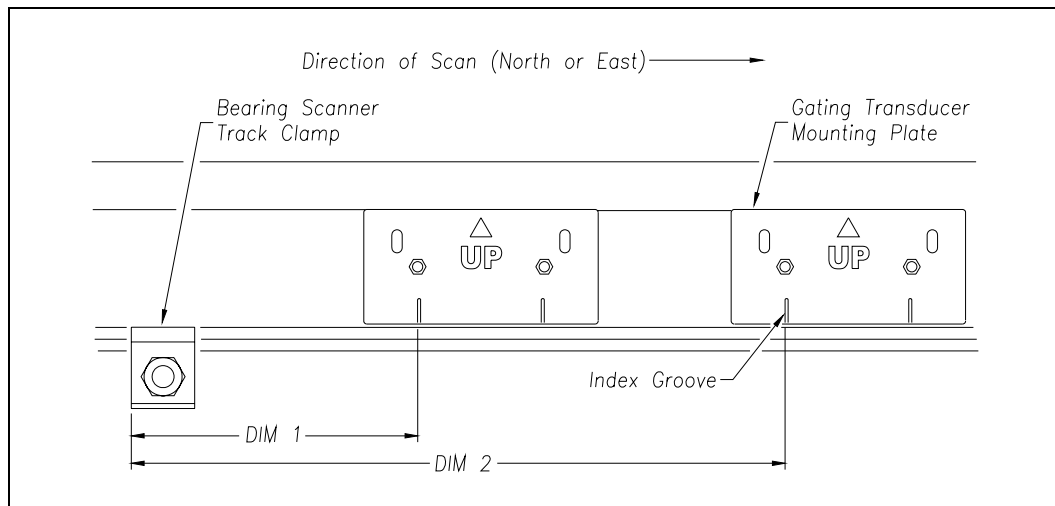
- 23** If this is a single-track site, label the two-wire end of the cable **TO1**.
- 24** If this is a double-track site, label the two-wire end of the cable **TO1-TRACK1** or **TO1-TRACK2**, whichever is appropriate.
- 25** If this is a triple-track site, label the two-wire end of the cable **TO1-TRACK1**, **TO1-TRACK2**, or **TO1-TRACK3**, 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 the table below, note the distance for your rail size.

Rail Size pounds/yard	Rail Size kilograms/meter	Distance (DIM2)
115	57.05	34-13/16 inches (88.42 centimeters)
122	60.52	34-31/32 inches (88.80 centimeters)
127	63.00	35-3/16 inches (89.38 centimeters)
132	65.48	35-5/16 inches (89.69 centimeters)
136	67.46	35-3/8 inches (89.85 centimeters)
141	69.94	35-5/8 inches (90.49 centimeters)

For example, if your rail size is 132 pounds per yard (65.48 kilograms per meter), the distance is 35-5/16 inches (89.69 centimeters). This distance is **DIM2**.

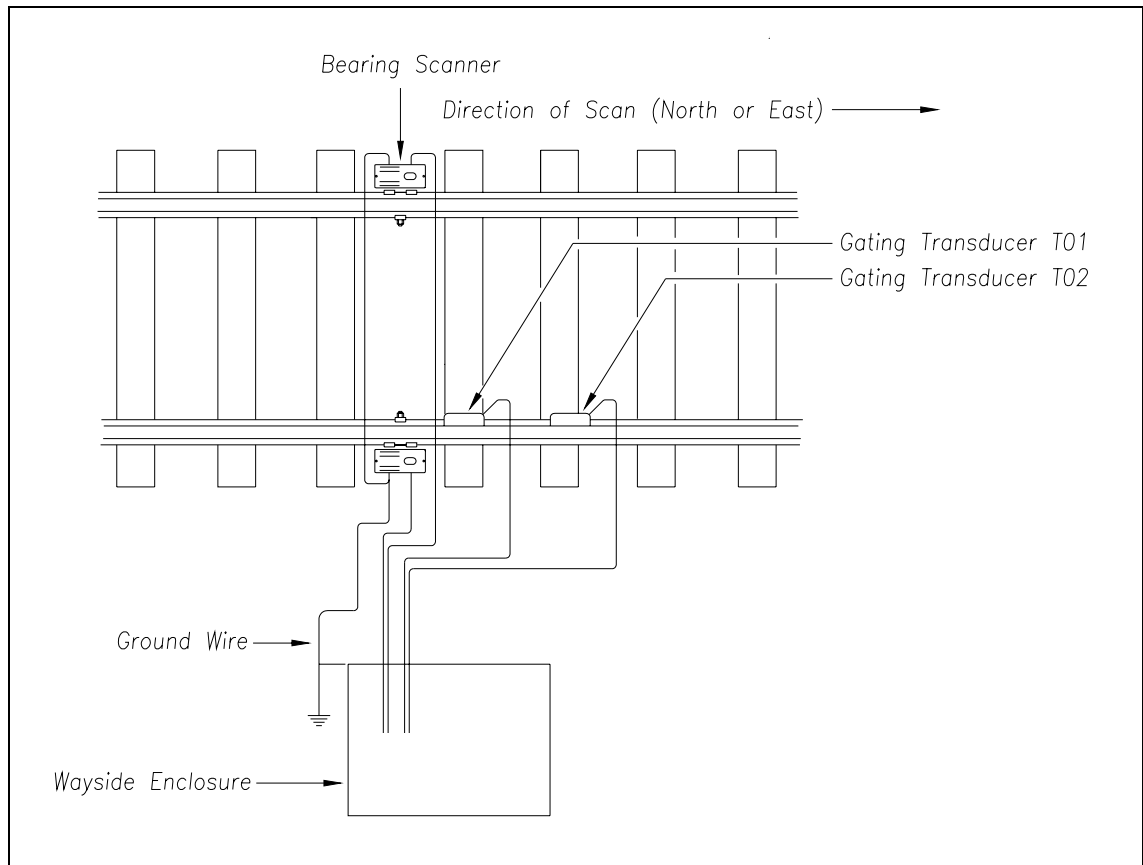
- 29 With the arrow on the plate pointing up, place the mounting plate against the inside web of the rail (that is, against the gauge side of the rail).
- 30 Going north or east from the far edge of the track clamp on the bearing scanner to the closest index groove on the mounting plate, measure the distance obtained in step 28.



- 31 Repeat steps 8 through 22.
- 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 If this is a triple-track site, label the two-wire end of the cable **TO2-TRACK1**, **TO2-TRACK2**, or **TO2-TRACK3**, whichever is appropriate.

35 Extend the cable into the wayside enclosure and leave it coiled on the floor.

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



36 If this is a single-track site, go to step **39**.

37 If this is a double-track site:

- a** Repeat steps **1** through **35** on the second track.
- b** Go to step **39**.

38 If this is a triple-track site:

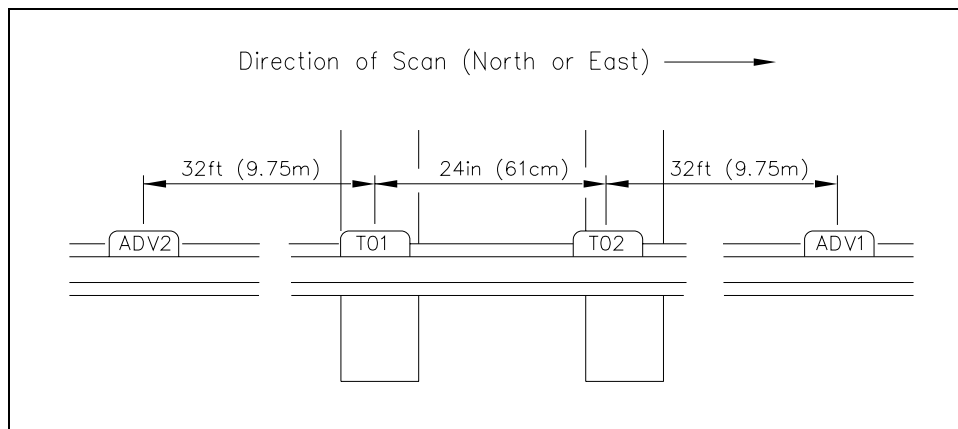
- a** Repeat steps **1** through **35** on the second track.
- b** Repeat steps **1** through **35** on the third track.

39 If you are going to install a track circuit instead of advance transducers:

a If your site has wheel scanners, go to **6.3 Wheel Scanners**.

b Go to **6.4 Track Circuit**.

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



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

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

42 Going right from the rightmost index groove of gating transducer **TO2**, measure 32 feet (9.75 meters) to the rightmost index groove on the new mounting plate.

43 Repeat steps **8** through **22**.

44 If this is a single-track site, label the two-wire end of the cable **ADV1**.

45 If this is a double-track site, label the two-wire end of the cable either **ADV1-TRACK1** or **ADV1-TRACK2**, whichever is appropriate.

46 If this is a triple-track site, label the two-wire end of the cable **ADV1-TRACK1**, **ADV1-TRACK2**, or **ADV1-TRACK3**, whichever is appropriate.

47 Extend the transducer cable into the wayside enclosure and leave it coiled on the floor.

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

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

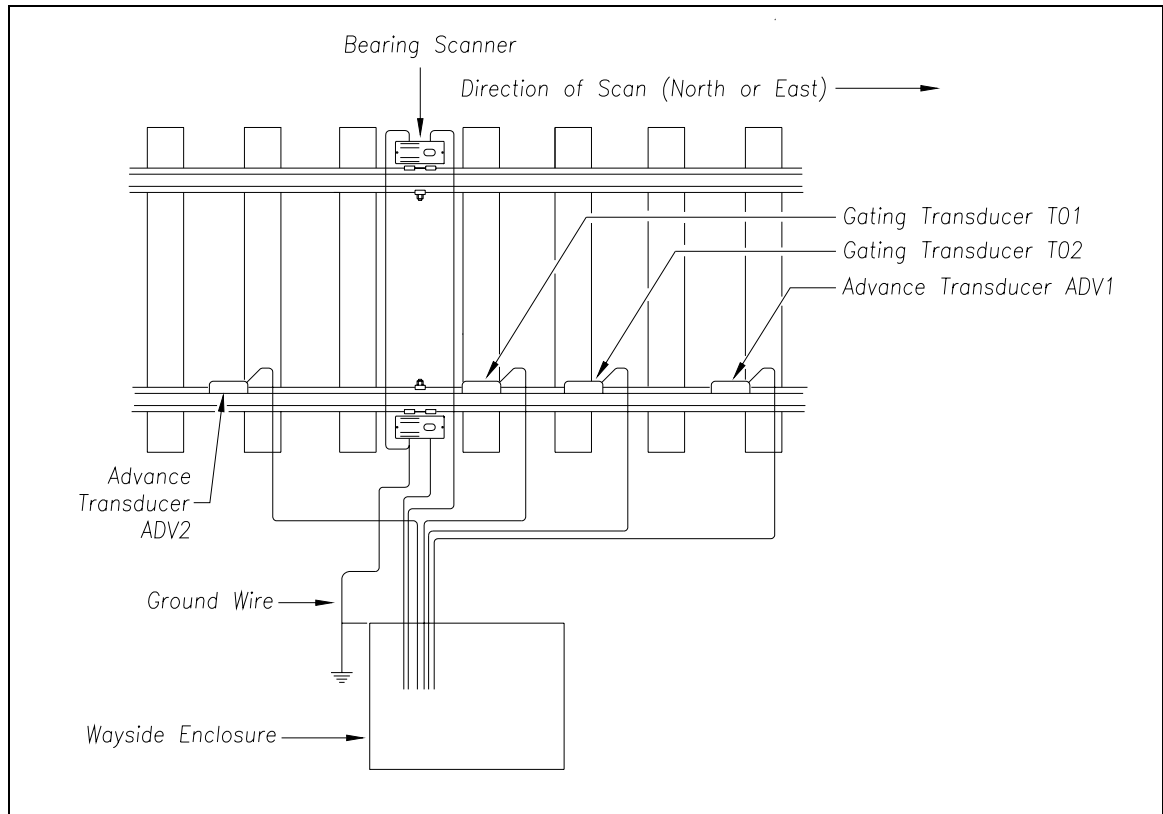
49 With the arrow on the plate pointing up, place the mounting plate against the gauge side of the rail.

50 Going left from the leftmost index groove of gating transducer **TO1**, measure 32 feet (9.75 meters) to the leftmost index groove on the new mounting plate.

51 Repeat steps **8** through **22**.

52 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.



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

54 If this is a triple-track site, label the two-wire end of the cable **ADV2-TRACK1**, **ADV2-TRACK2**, or **ADV2-TRACK3**, whichever is appropriate.

55 If this is a single-track site, go to **6.3 Wheel Scanners**.

56 If this is a double-track site:

a Repeat steps **1** through **53** on the second track.

b Go to **6.3 Wheel Scanners**.

57 If this is a triple-track site:

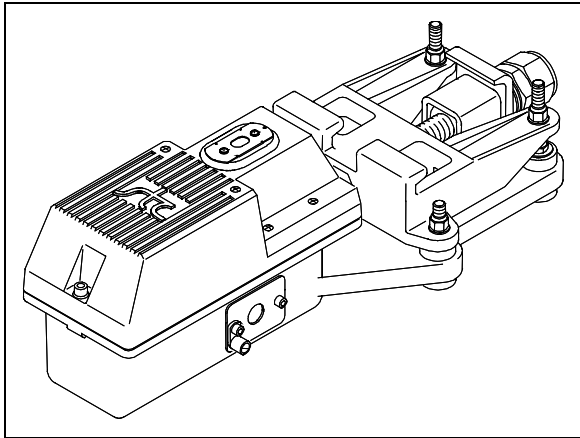
a Repeat steps **1** through **53** on the second track.

b Repeat steps **1** through **54** on the third track.

c Go to **6.3 Wheel Scanners**.

6.3 Wheel Scanners

An assembled wheel scanner looks like this.

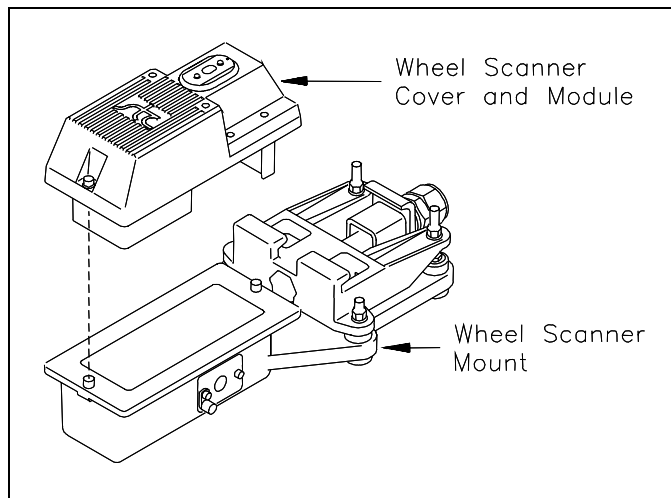


Not all sites use wheel scanners. If your site doesn't use them, skip the instructions below and go to **6.4 Track Circuit**.

To install the wheel scanners:

- 1 Be sure that you have on hand two assembled wheel scanners.
- 2 Be sure that you have on hand a short-handle 1-1/2-inch open-end wrench, a T-handle 3/16-inch hex-wrench, a T-handle 1/4-inch hex-wrench, and a 50-foot (15-meter) or longer tape measure.
- 3 If not done already, select a location to install the wheel scanners.
The wheel scanners should be centered in the crib of two ties spaced at least 14 inches (35.6 centimeters) apart. The crib of the two ties is the one immediately ahead (and to the north or east) of the bearing scanners. This places one wheel scanner between the two gating transducers. The other one is directly opposite, on the other rail of the track.
- 4 If not done already, remove ballast from under both rails between the ties.
You'll next install the first wheel scanner.
- 5 Using a T-handle 1/4-inch hex-wrench, loosen the two socket-head-cap screws on the cover of a not-yet-installed wheel scanner.

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



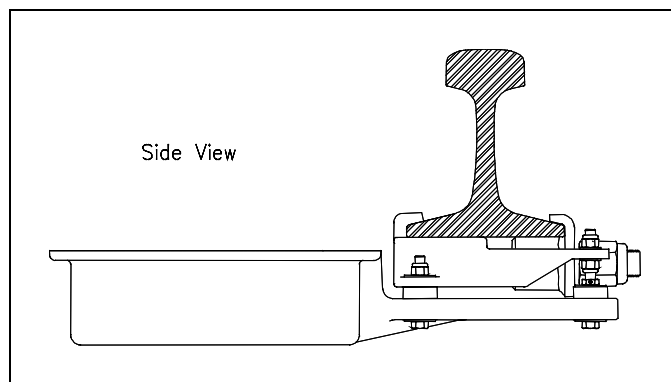
- 7 Store the cover-and-module combination in a safe place until you replace it.
- 8 Centered between the ties and on the rail closest the enclosure, place the mount so that the moveable track clamp extends under the rail and toward the center of the track.
- 9 Tighten the inner nut (that is, the clamping nut) by hand.
This should hold the mount in place.
- 10 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.

- 11 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.

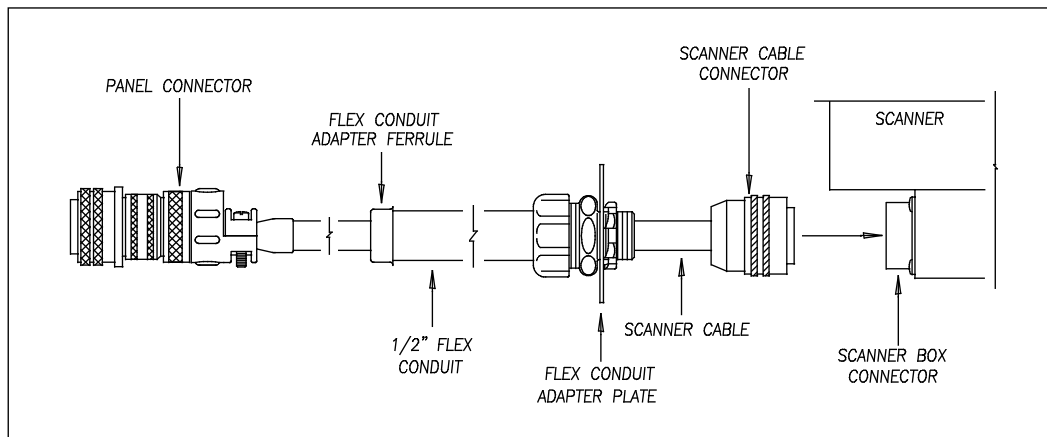
At this point, your work should look like this.



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.

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

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



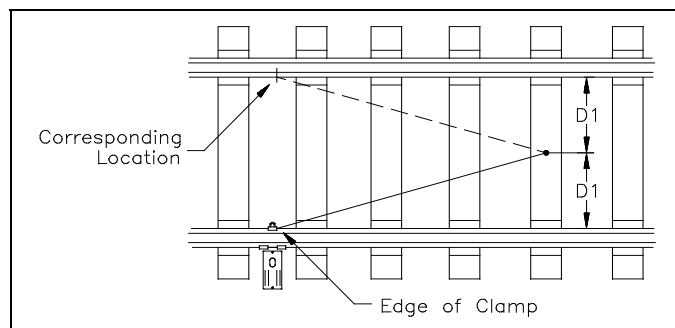
Single-track sites have two 65-foot (19.8-meter) wheel scanner cables. **Double-track sites** have two 65-foot wheel scanner cables for the track closest to the enclosure and two 100-foot (30.5-meter) wheel scanner cables for the track farthest from the enclosure. **Triple-track sites** have two 65-foot cables, two 100-foot cables, and two 130-foot (39.6-meter) cables.

- 14 If this is a multitrack site, select the correct length of cable.
- 15 Put the scanner cable connector through the round hole in the side of the mount.
- 16 Align the screw holes in the flex-conduit-adapter plate with the screw holes in the mount.
- 17 In the screw hole closest to the rail, replace the screw and tighten by hand.
- 18 In the screw hole farthest from the rail, replace the ground lug, internal-tooth washer, and screw.
- 19 Tighten by hand.

This should hold the flex-conduit-adapter plate in place.

- 20 Using a T-handle 3/16-inch hex-wrench, tighten the two socket head cap screws until they are completely tight.
- 21 Leave 6 inches (15.2 centimeters) of the scanner cable in the mount.
- 22 Attach the scanner cable connector to the scanner box connector.
- 23 With the hole on top of the scanner cover facing the center of the track, replace the scanner cover-and-module assembly onto its mount.
- 24 Using a T-handle 1/4-inch hex-wrench, tighten the two screws (on the scanner cover) until they are completely tight.

- 25** If this is a single-track site, label the end of the cable that isn't attached to the 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.
- 26** If this is a double-track site, label the end of the cable that isn't attached to the scanner **W-RAIL1-TRACK1**, **W-RAIL2-TRACK1**, **W-RAIL1-TRACK2**, or **W-RAIL2-TRACK2**, whichever is appropriate.
- 27** If this is a triple-track site, label the end of the cable that isn't attached to the scanner **W-RAIL1-TRACK1**, **W-RAIL2-TRACK1**, **W-RAIL1-TRACK2**, **W-RAIL2-TRACK2**, **W-RAIL1-TRACK3**, or **W-RAIL2-TRACK3**, whichever is appropriate.
- 28** Extend the cable into the wayside enclosure and leave it coiled on the floor.
- 29** Attach one end of an 8 AWG stranded copper wire to the ground lug on the flex-conduit-adaptor plate and the other end to the ground connector on the ground rod.
- You'll next install the second wheel scanner on the opposite rail.
- 30** Using a T-handle 1/4-inch hex-wrench, loosen the two socket-head-cap screws on the cover of the remaining not-yet-installed wheel scanner.
- 31** Separate the scanner cover, which contains an attached scanner module, from its mount.
- 32** Store the cover-and-module combination 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.
- 33** To locate the second mount on the opposite rail:
- Mark the center of the fourth tie ahead of the just installed mount.
 - From this mark, measure to the edge of the track clamp on the just installed mount.
 - From the mark, measure the same distance on the opposite rail.



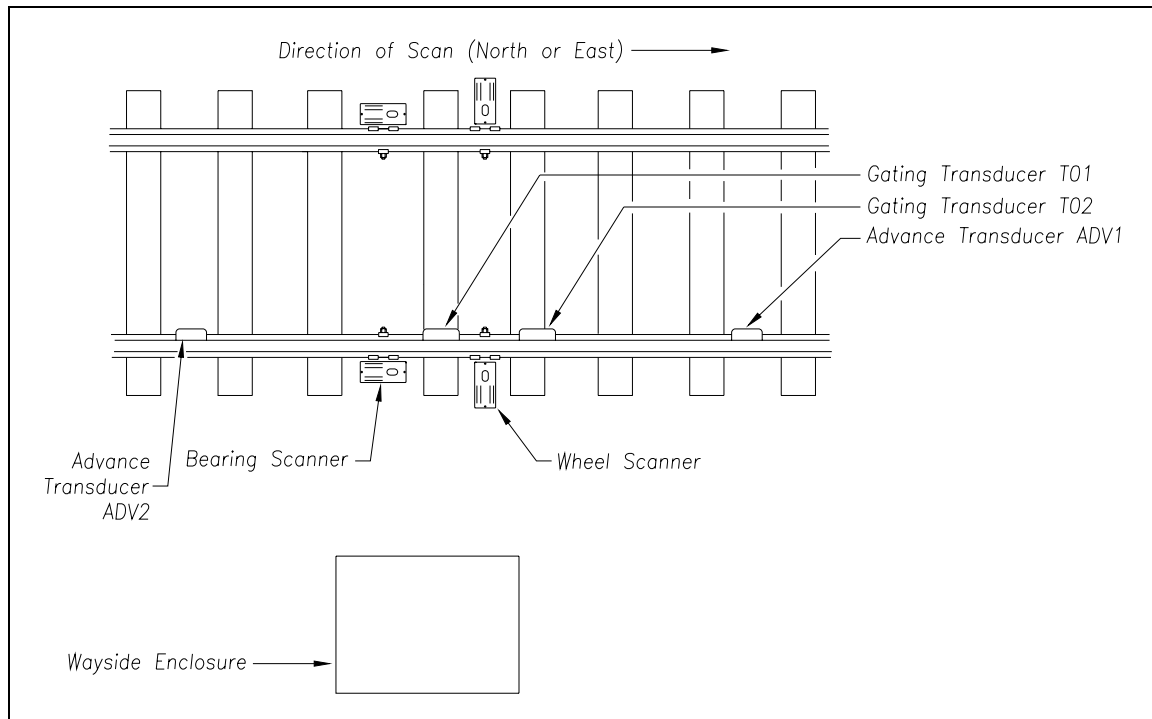
- Mark this location.

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.

- 34 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.
- 35 Repeat steps 9 through 27.
- 36 Attach one end of an 8 AWG stranded copper wire to the ground lug on the flex-conduit-adaptor plate and the other end to the ground lug on the other scanner mount.

Seen from above, your site would look something like this. At your site, you might not have installed the advance transducers that are shown below.



- 37 If this is a single-track site, go to **6.4 Track Circuit**.
- 38 If this is a double-track site:
 - a Repeat steps 1 through 36 on the second track.
 - b Go to **6.4 Track Circuit**.
- 39 If this is a triple-track site:
 - a Repeat steps 1 through 36 on the second track.
 - b Repeat steps 1 through 36 on the third track.
 - c Go to **6.4 Track Circuit**.

6.4 Track Circuit

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

Following the directions that came with your track circuit:

- 1 Mount both track-wire connectors.
Mount one connector on each rail, directly opposite each other. Mount them within 5 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 If this is a triple-track site, label the end of the wires that aren't attached to the track-wire connectors **TC-TRACK1**, **TC-TRACK2**, or **TC-TRACK3**, whichever is appropriate.
- 6 Extend the wires into the wayside enclosure and leave them coiled on the floor.
- 7 If this is a single-track site, go to **6.5 AEI Antennas**.
- 8 If this is a double-track site:
 - a Repeat steps 1 through 6 on the second track.
 - b Go to **6.5 AEI Antennas**.
- 9 If this is a triple-track site:
 - a Repeat steps 1 through 6 on the second track.
 - b Repeat steps 1 through 6 on the third track.
 - c Go to **6.5 AEI Antennas**.

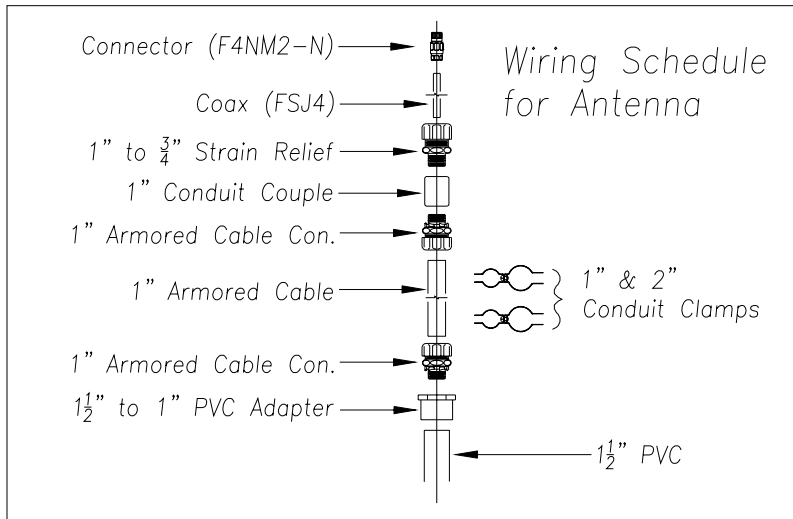
6.5 AEI Antennas

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

At each SmartScanNG site that uses AEI, two 100-watt Sinclair SRL470 antennas or two 100-watt Scala HP9-915 Parapanel antennas are installed per track. In reference to the track, **antenna0** is the northmost or eastmost antenna. **Antenna1** is the southmost or westmost antenna. (As a means of reference, transducer TO1 is the northmost or eastmost transducer.)

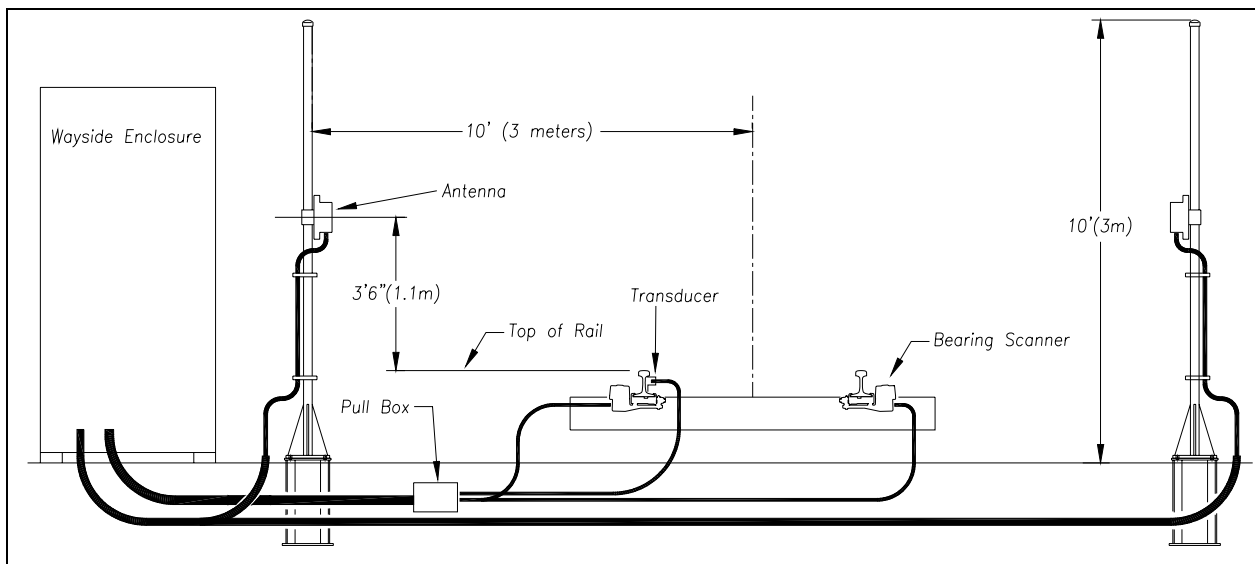
The instructions below assume that the masts that the antennas will be attached to have already been installed. Only the installation of the SRL470 is covered below. The installation of the HP9-915 isn't covered in this guide.

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.



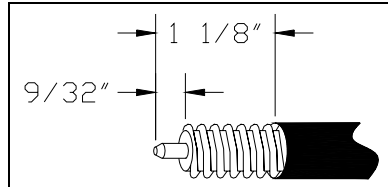
Each antenna is installed:

- 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

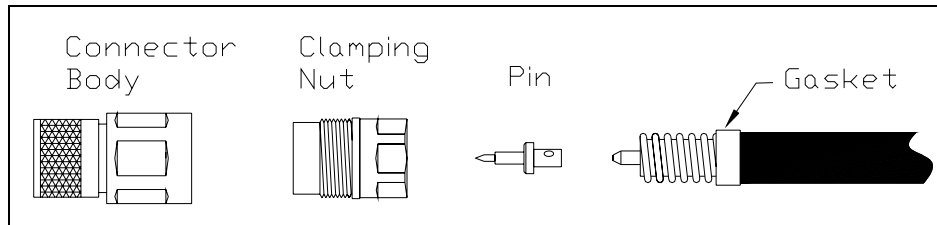


To install the antenna cables:

- 1 Run FSJ4 coaxial cable from each AEI antenna to the bottom of the AEI Interface module (2300-750).
- 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 will 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).

Chapter 7

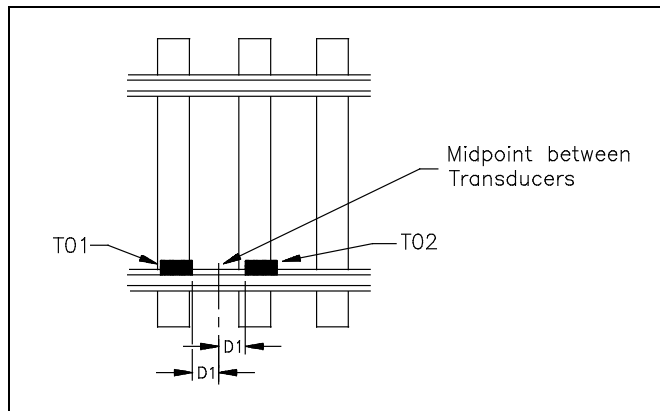
Aligning Scanners

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

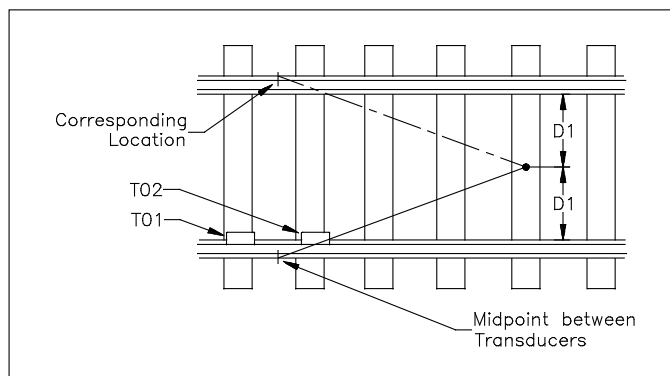
7.1 Bearing Scanners

To align the 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 SmartScanNG enclosure.
- 3 On the outside of the rail, mark the midpoint between TO1 and TO2.



- 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.

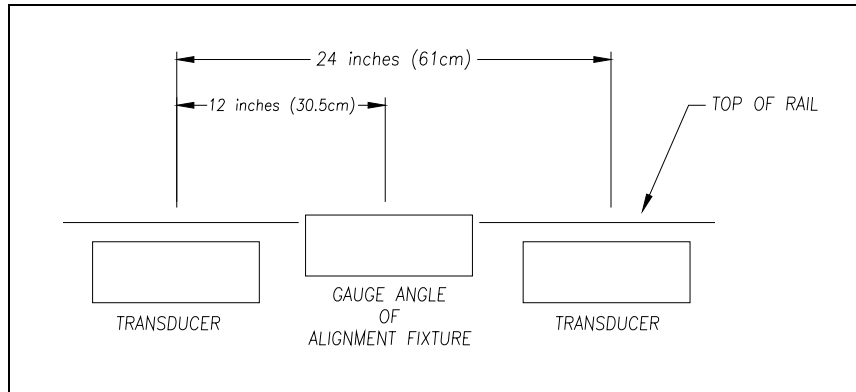


- 7** On the outside of the rail, mark this location.

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

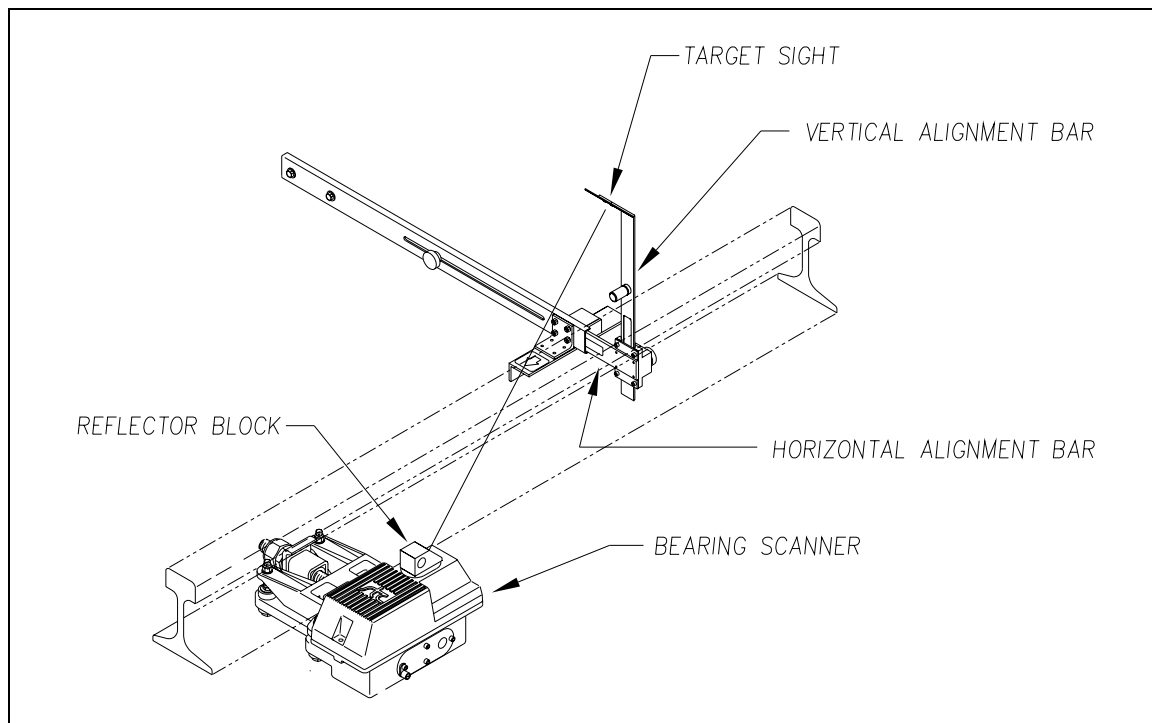
Use a permanent marker, magic marker, lumber crayon, or paint pen to mark the rail.
Don't use a file or punch to mark the rail.

- 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.

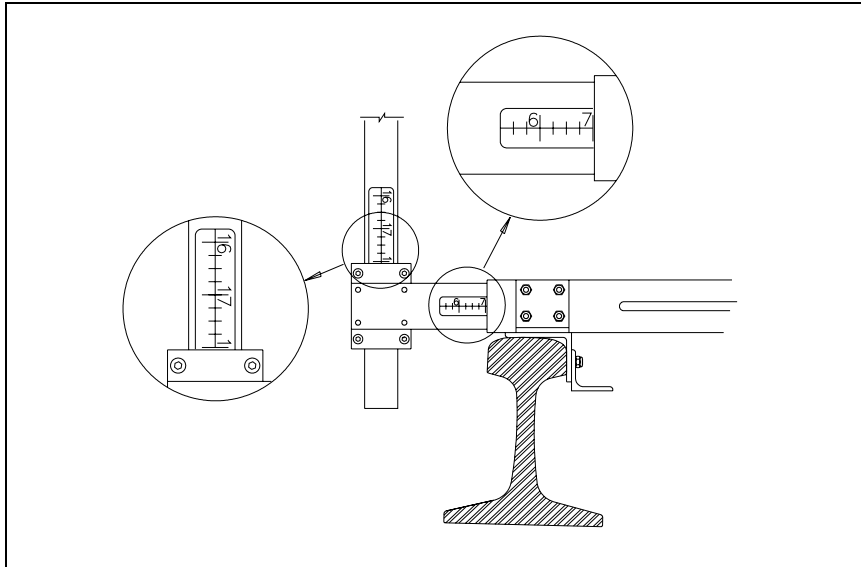


The fixture should be snug against the top and gauge of both rails.

- 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.



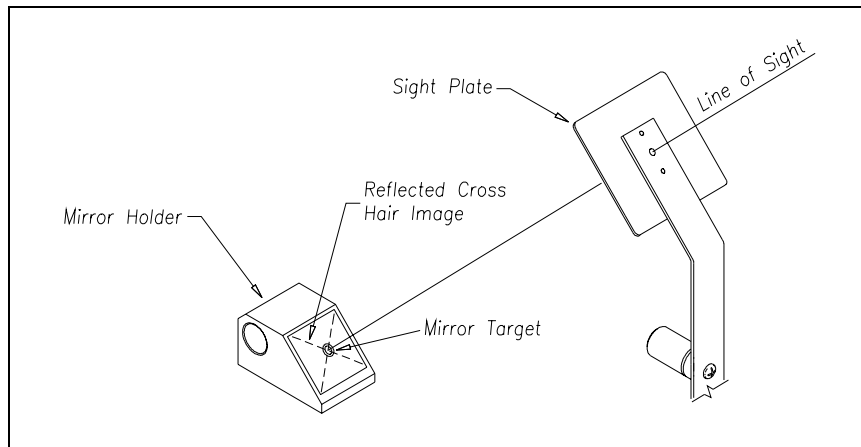
- 12** Extend the horizontal alignment bar to 7-1/4 inches \pm 1/4 inch on the scale.



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

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

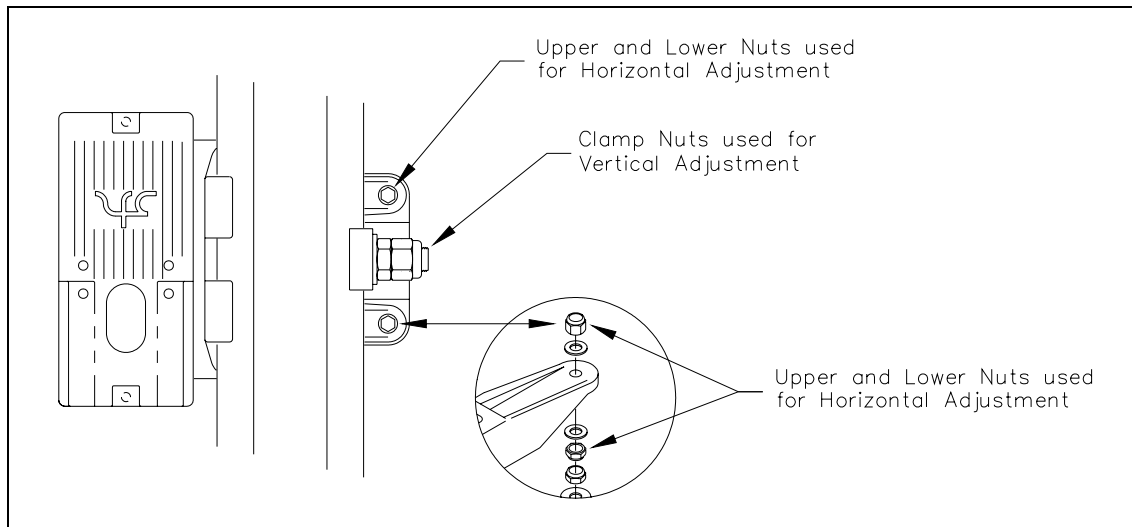
When the cross hairs are centered on the circle, alignment is correct.



- 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** Store the alignment fixture in the wayside enclosure.
 - b** If your site has wheel scanners, go to **7.2 Wheel Scanners**.
 - c** If your site doesn't have wheel scanners, go to the next chapter.
- 23** If this is a double-track site:
- a** Repeat steps **1** through **21** for the second track.
 - b** Store the alignment fixture in the wayside enclosure.
 - c** If your site has wheel scanners, go to **7.2 Wheel Scanners**.
 - d** If your site doesn't have wheel scanners, go to the next chapter.
- 24** If this is a triple-track site:
- a** Repeat steps **1** through **21** for the second track.
 - b** Repeat steps **1** through **21** for the third track.
 - c** Store the alignment fixture in the wayside enclosure.
 - d** If your site has wheel scanners, go to **7.2 Wheel Scanners**.
 - e** If your site doesn't have wheel scanners, go to the next chapter.

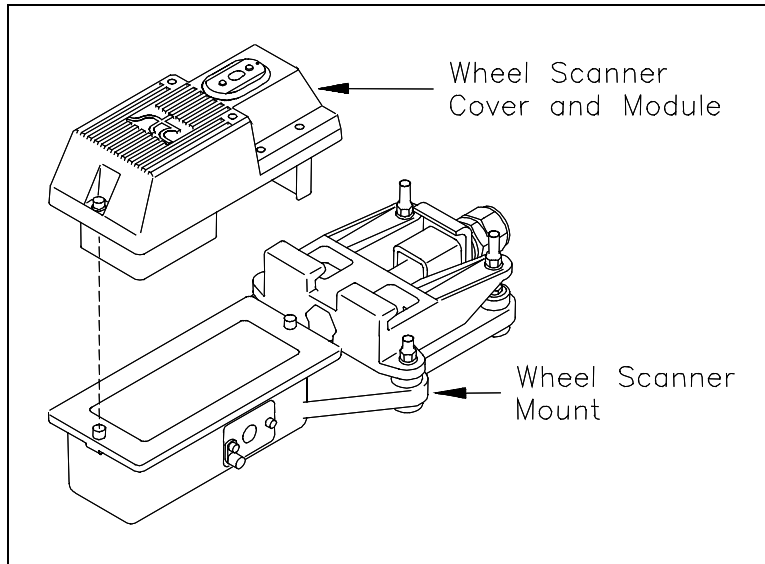
7.2 Wheel Scanners

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

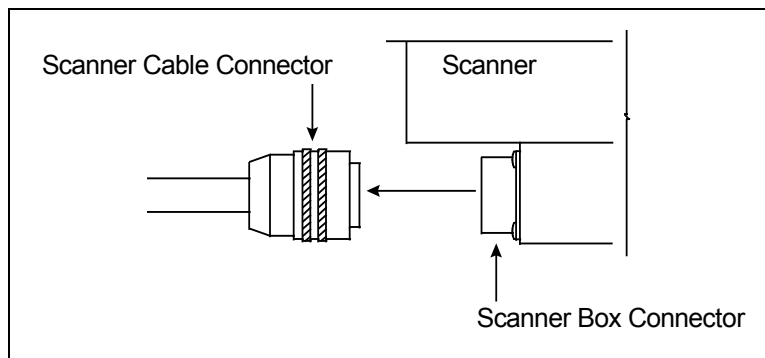
To align the wheel scanners:

- 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 SmartScanNG enclosure.
- 3** Using a T-handle 1/4-inch hex-wrench, loosen both scanner-cover screws on a wheel scanner.

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



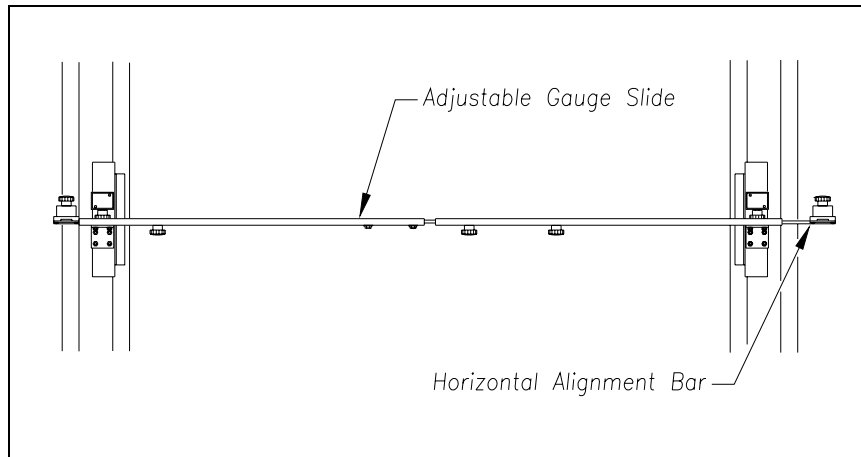
- 5 Disconnect the scanner cable connector from the scanner box connector.



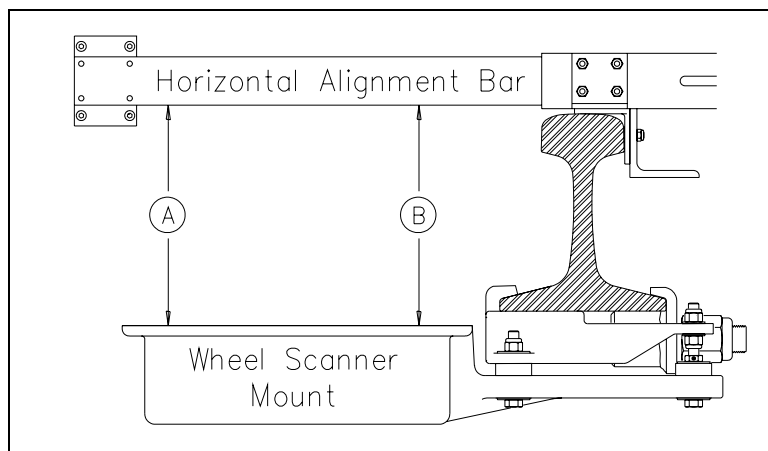
- 6 Store the cover-and-module combination in a safe place until you replace it.

- 7** 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.



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

- 11** 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.

- 12** Until both measurements are the same, repeat steps **10** and **11**.

- 13** Retract the horizontal alignment bar as far as it will go.
- 14** Attach the scanner cable connector to the scanner box connector (on the scanner cover-and-module assembly).
- 15** With the hole (on top of the scanner cover) facing north or east, replace the scanner cover-and-module assembly onto its mount.
- 16** Using a T-handle 1/4-inch hex-wrench, tighten the two screws (on the scanner cover) until they are completely tight.
- 17** Repeat steps **3** through **16** for the wheel scanner on the opposite rail.
- 18** Remove the alignment fixture from the track.
- 19** If this is a single-track site:
 - a** Store the alignment fixture in the wayside enclosure.
 - b** Go to the next chapter.
- 20** If this is a double-track site:
 - a** Repeat steps **1** through **18** for the second track.
 - b** Store the alignment fixture in the wayside enclosure.
 - c** Go to the next chapter.
- 21** If this is a triple-track site:
 - a** Repeat steps **1** through **18** for the second track.
 - b** Repeat steps **1** through **18** for the third track.
 - c** Store the alignment fixture in the wayside enclosure.
 - d** 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

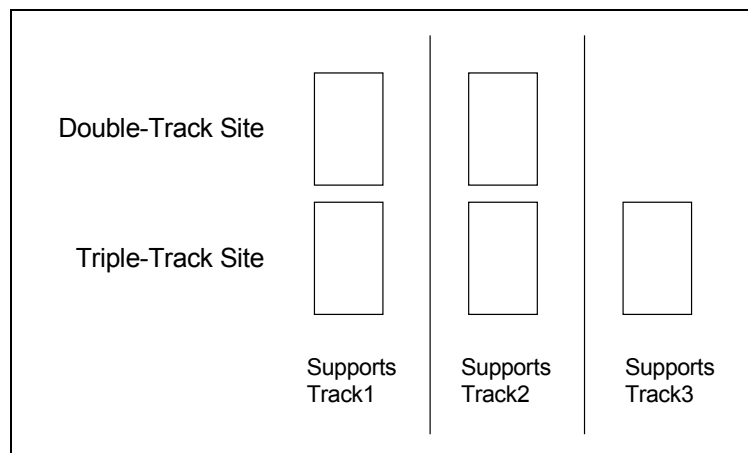
The SmartScanNG system is equipped with components for surge and lightning protection of the equipment attached to it. However, if the attachment to the earth grounding system isn't made correctly, the surge protection equipment may not work as designed, resulting in damaged or destroyed system components.

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

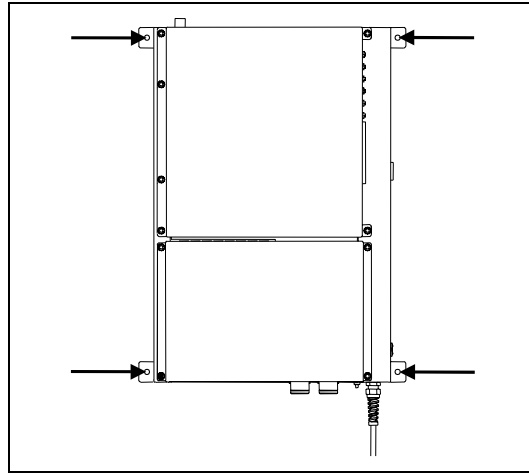
An exothermically bonded pigtail should be run through the floor of the wayside enclosure and terminated at a properly installed **ground bus** inside the wayside enclosure. There should be one ground bus per wayside enclosure.

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. At **triple-track sites**, the leftmost SmartScanNG enclosure supports track1, the middle one supports track2, and the rightmost one supports track3.



The SmartScanNG enclosure has four symmetrically placed 5/16-inch holes on the outside of the enclosure. Using these holes and four 1/4 by 1-inch lag screws and four 1/4-inch flat washers, the enclosure can be mounted to any flat wooden surface. Three-quarter-inch (1.9 centimeters) or thicker plywood works well. Many other flat wooden surfaces may work just as well.

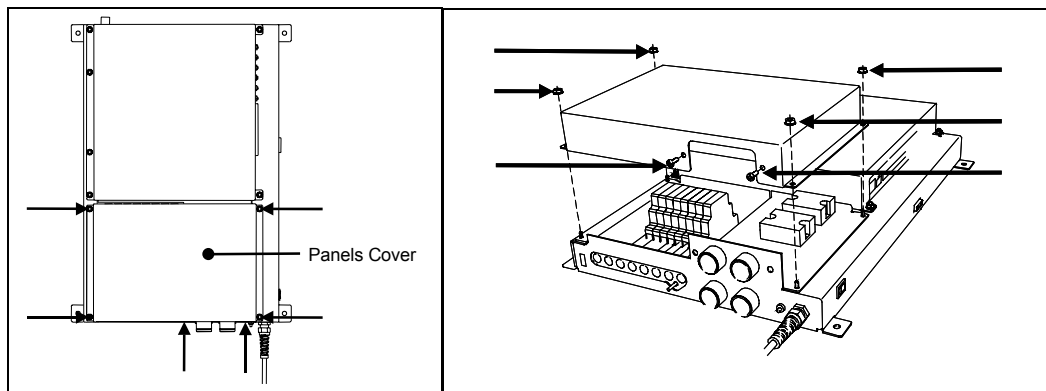


Mount the SmartScanNG enclosure about 4 feet (122 centimeters) above the floor. Doing so positions the enclosure at a convenient height for installation and servicing. Mounting it at this height also allows you to install the power subsystem below it.

Mount the SmartScanNG enclosure within 4 feet (122 centimeters) 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.



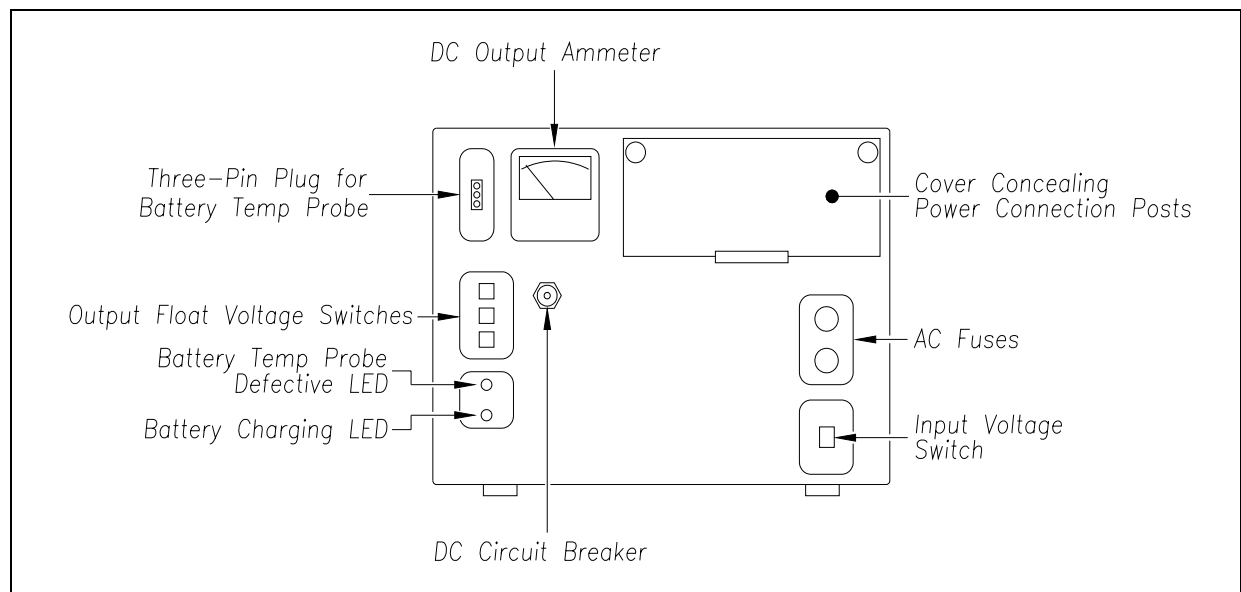
- 4 Separate the panels cover from the SmartScanNG enclosure.
- 5 Store the cover, screws, and nuts in a safe place until you replace them.
- 6 Attach one end of a 6 AWG stranded copper wire to the **ground bus** and the other end to the copper **ground lug** on the bottom right of the surge-suppression panel (in the SmartScanNG enclosure).

8.3 Battery Charger

The battery charger has four symmetrically placed 5/16-inch holes on the outside of the enclosure. Using these holes and four 1/4 by 1-inch lag screws and four 1/4-inch flat washers, the enclosure can be mounted to any flat wooden surface. Three-quarter-inch (1.9 centimeters) or thicker plywood works well. Many other flat wooden surfaces may work just as well.

Mount the battery charger about 1 foot (30 centimeters) above the floor and within 2 feet (61 centimeters) of the bottom of the SmartScanNG enclosure. Be sure that the charger is level.

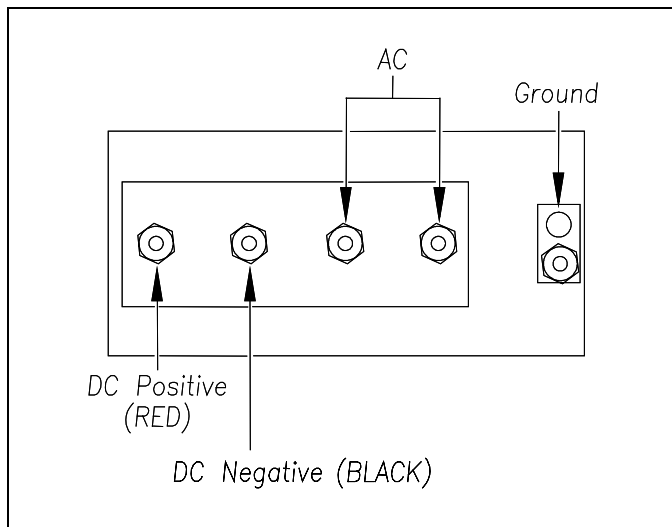
The figure below shows the front of a NRS ELC-12/20-D battery charger. (Solar-powered systems don't use this charger.)



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 will share the ground lug with the wire from the ground bus.

- 5 Using the supplied ring terminals, crimp a terminal to the end of the white wire and another 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 fuse from the fuse block.
- 4 Store the fuse in a safe place until you replace them in the next chapter.
- 5 Using the supplied screws, mount the fuse block below 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 three or five correctly sized lengths, which is dependent upon the location of various components in the wayside enclosure.

If a distribution block is used, these cut lengths of **red** wire are used between:

- The SmartScanNG enclosure and the fuse block
- The fuse block and the distribution block
- The distribution block and the positive terminal of the battery

If a distribution block is used, this cut length of **black** wire is used between:

- The SmartScanNG enclosure and the distribution block
- The distribution block and the negative terminal of the battery

If a distribution block is not used, these cut lengths of **red** wire are used between:

- The SmartScanNG enclosure and the fuse block
- The fuse block and the positive terminal of the battery

If a distribution block is not used, this cut length of **black** wire is used between:

- The SmartScanNG enclosure and the negative terminal of the battery

It may not be necessary to use all 15 feet (4.6 meters) of this zip wire. You should cut its red wire and its black wire 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 wires to the correct lengths.
- 7 Using a wire stripper, remove 1/4 inches (6.4 millimeters) of insulation from both ends of all cut wires.
- 8 Using a pliers-type crimping tool, crimp a spade terminal to the end of the red wires that will attach to the fuse block.

- 9 Using a pliers-type crimping tool, crimp a ring terminal to the end of the all wires that will attach to the battery and to the distribution block, if present.

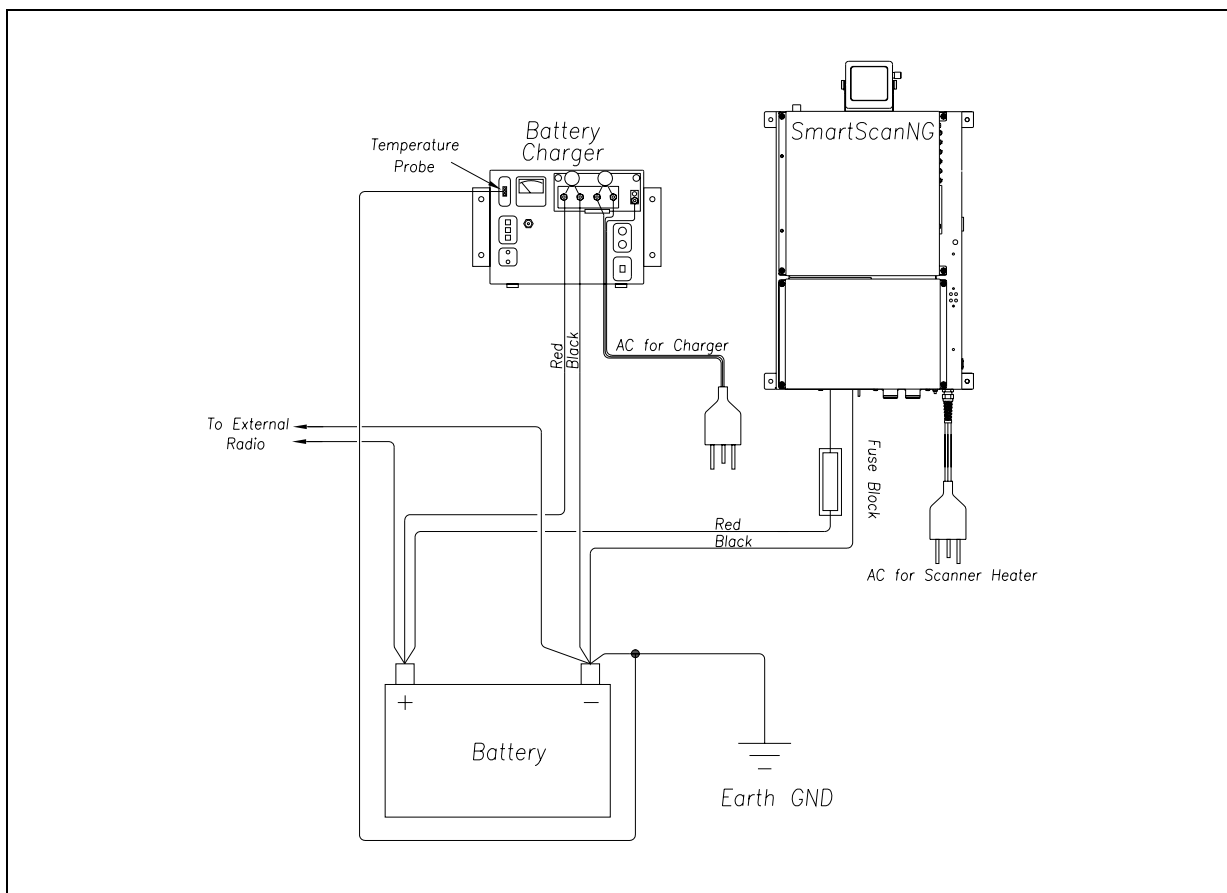
The ends that attaches to the terminal blocks in the SmartScanNG enclosure don't have terminals attached.

8.5 Rest of Power Subsystem

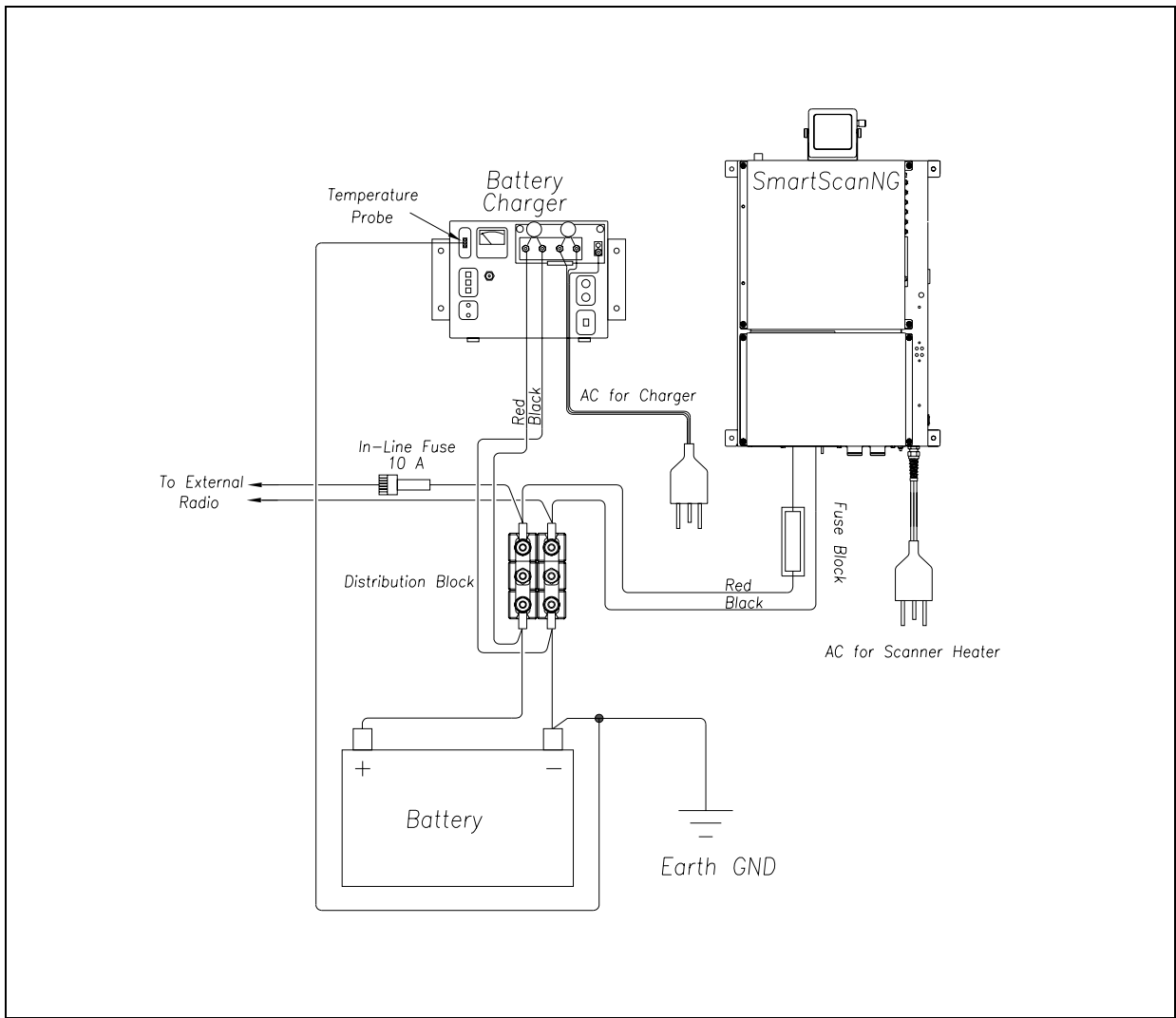
At a **single-track site**, there is one power subsystem for the SmartScanNG enclosure, one battery, and one battery charger. At a **double-track site**, there are one or two power subsystems for the two SmartScanNG enclosures, two batteries, and one or two battery chargers. At a **triple-track site**, there are one or two power subsystems for the first two SmartScanNG enclosures and one power subsystem for the third SmartScanNG enclosure.

Not all generic systems use a distribution block. Usually, only some prewired systems that leave STC in a wayside enclosure do. All generic systems use the fuse block.

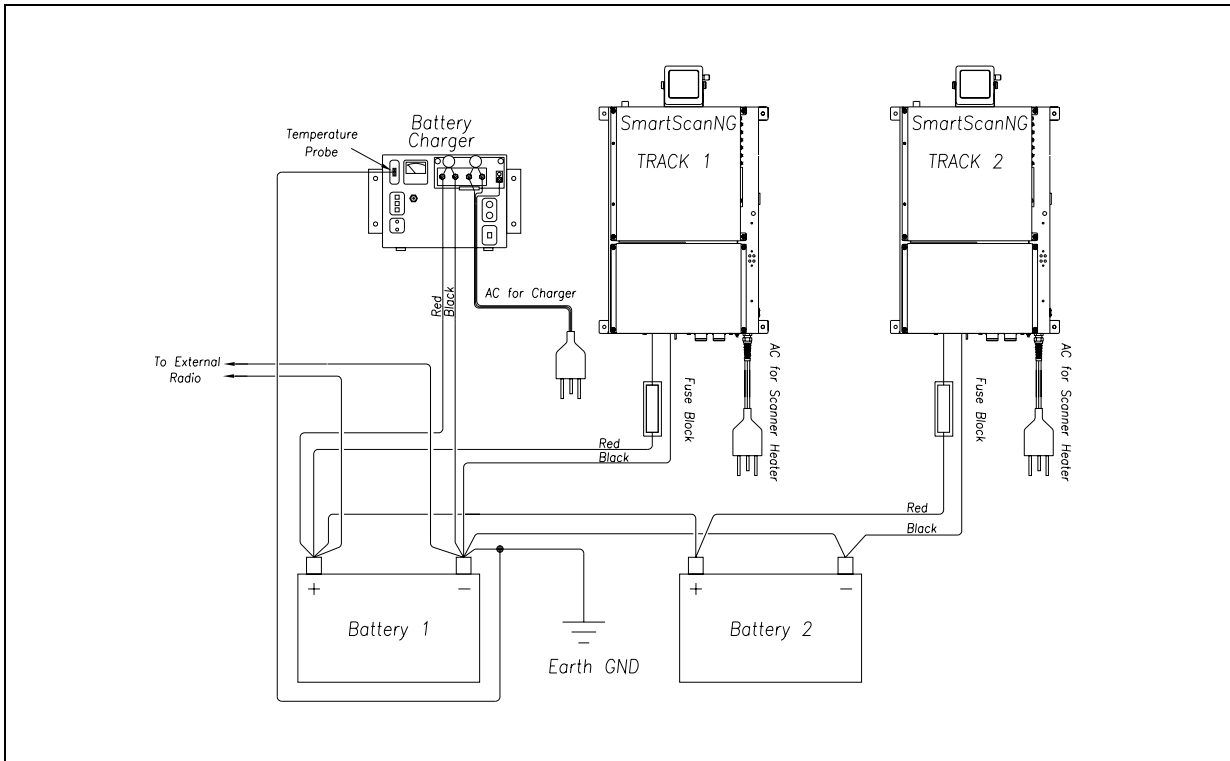
The figure below shows the major parts of one type of power subsystem at a **single-track site**. This one is powered from an AC power source and does not use a distribution block.



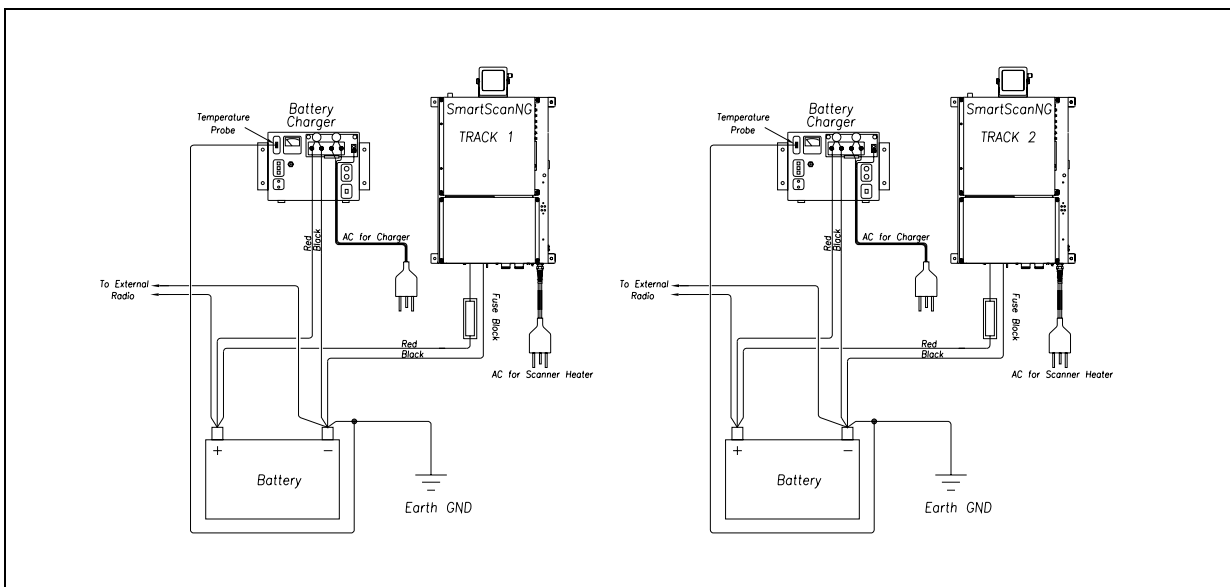
The figure below shows the major parts of one type of power subsystem at a **single-track site**. This one is powered from an AC power source and does use a distribution block.



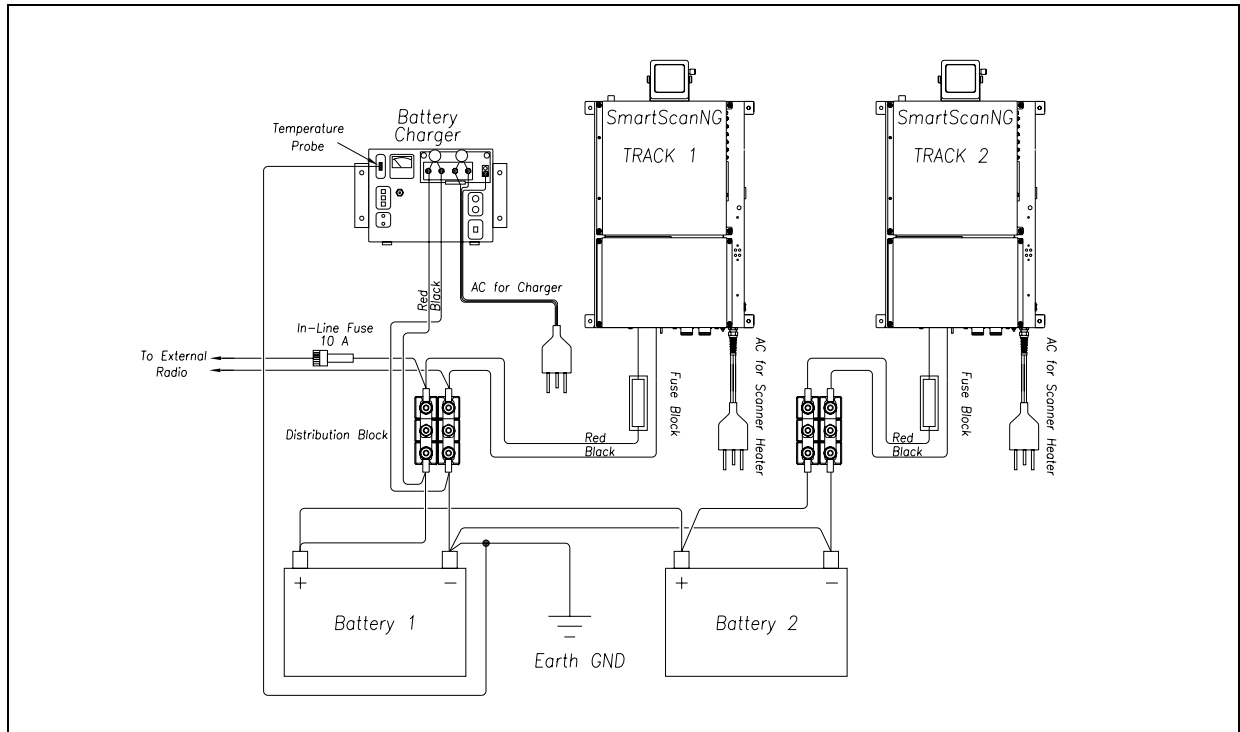
The figure below shows the major parts of one type of power subsystem at a **double-track site**. This one is powered from an AC power source, does not use a distribution block, and uses one battery charger.



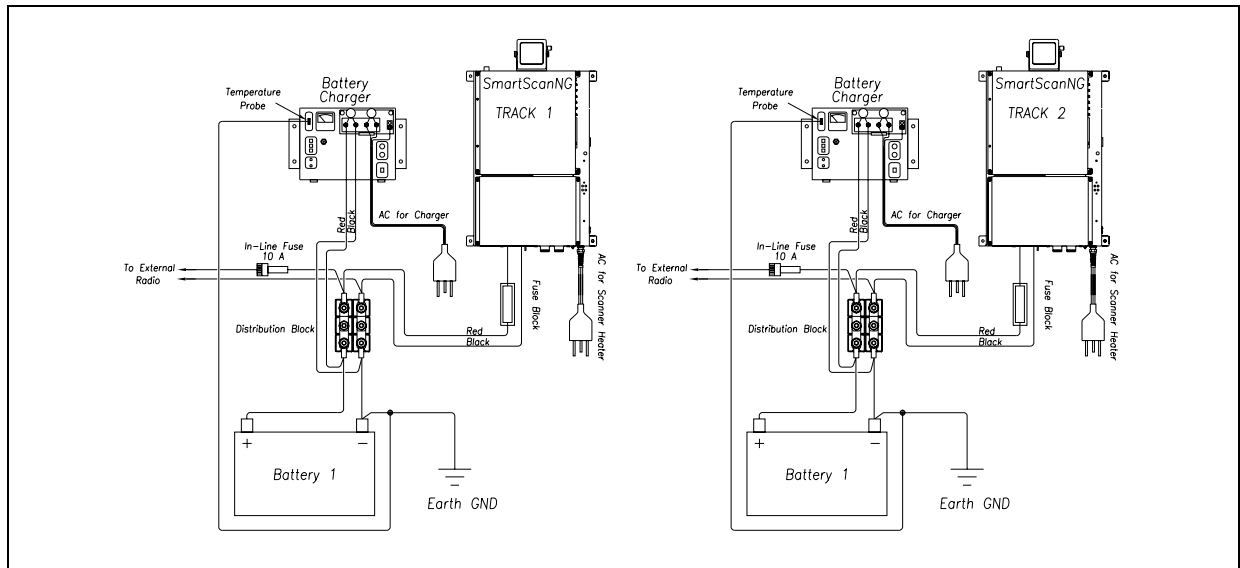
The figure below shows the major parts of one type of power subsystem at a **double-track site**. This one is powered from an AC power source, does not use a distribution block, and uses two battery chargers.



The figure below shows the major parts of one type of power subsystem at a **double-track site**. This one is powered from an AC power source, does use a distribution block, and uses one battery charger.



The figure below shows the major parts of one type of power subsystem at a **double-track site**. This one is powered from an AC power source, does use a distribution block, and uses two battery chargers.



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 **Be sure to follow the wiring diagrams on the prior four pages.**
- 3 Remove all power to the system.
- 4 Using a midsize slotted screwdriver, connect the appropriate spade terminal ends to the fuse block.
- 5 If a distribution block is not used, go to step 20.
- 6 If tight, loosen the middle gold nuts on the distribution block.
- 7 Using a 1/2-inch nutdriver, connect the appropriate ring terminal ends to the distribution block.
- 8 Cut the red-black 10 AWG 2-conductor zip wire to fit **between the battery charger and the bottom edge of the distribution block**.
- 9 Using a wire stripper, remove 1/4 inches (6.4 millimeters) of insulation from both ends of both conductors.
- 10 Using a pliers-type crimping tool, crimp one ring terminal to the end of each of these four conductors.
- 11 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.
- 12 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.
- 13 Cut the red-black 10 AWG 2-conductor zip wire to fit **between the battery and the bottom edge of the distribution block**.
- 14 Using a wire stripper, remove 1/4 inches (6.4 millimeters) of insulation from both ends of both conductors.
- 15 Using a pliers-type crimping tool, crimp one ring terminal to the end of each of these four conductors.

WARNING

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

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

- 17 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.
- 18 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.

- 19 Go to **8.6 Bearing Scanners**.
- 20 Cut the red-black 10 AWG 2-conductor zip wire to fit **between the battery charger and the battery**.
- 21 Using a wire stripper, remove 1/4 inches (6.4 millimeters) of insulation from both ends of both conductors.
- 22 Using a pliers-type crimping tool, crimp one ring terminal to the end of each of these four conductors.
- 23 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.
- 24 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.

WARNING

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

- 25 Using a 1/2-inch nutdriver, connect the battery temperature probe (from the battery charger) to the negative battery post.
- 26 Plug the other end of the battery temperature probe into the receptacle labeled **Temp Probe** on the front of the charger.
- 27 Using a 1/2-inch nutdriver, connect the red wires from the battery charger and from fuse block to the positive battery post.

- 28 Using a 1/2-inch nutdriver, connect the black wires from the battery charger and from the SmartScanNG enclosure to the negative battery post.

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.

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.

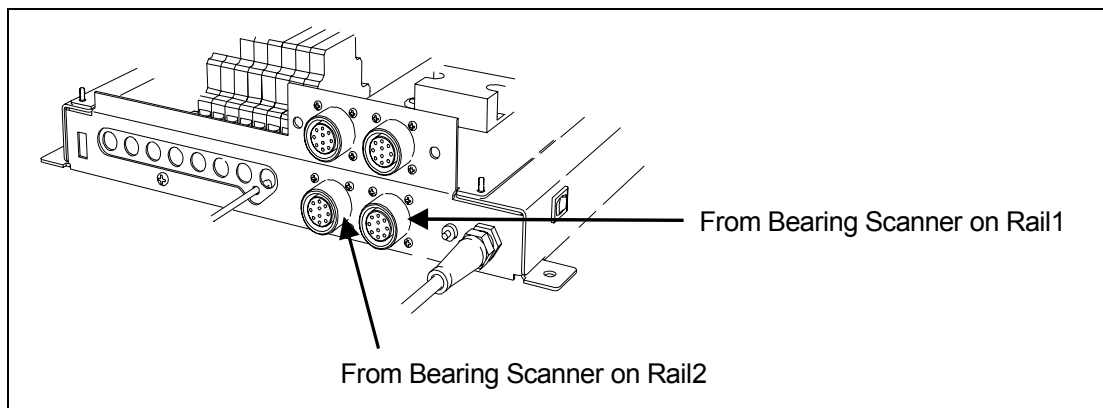
To connect the bearing scanners to the SmartScanNG enclosure:

- 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. If the track runs east and west, rail1 is the north 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.
 - b If your site has wheel scanners, go to **8.7 Wheel Scanners**.
 - c Go to **8.8 Gating Transducers**.
- 6 If this is a triple-track site:
 - a Repeat steps **1** through **3** on the second track.
The cables from track2 are connected to the middle SmartScanNG enclosure.
 - b Repeat steps **1** through **3** on the third track.
The cables from track3 are connected to the rightmost SmartScanNG enclosure.
 - c If your site has wheel scanners, go to **8.7 Wheel Scanners**.
 - d 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.

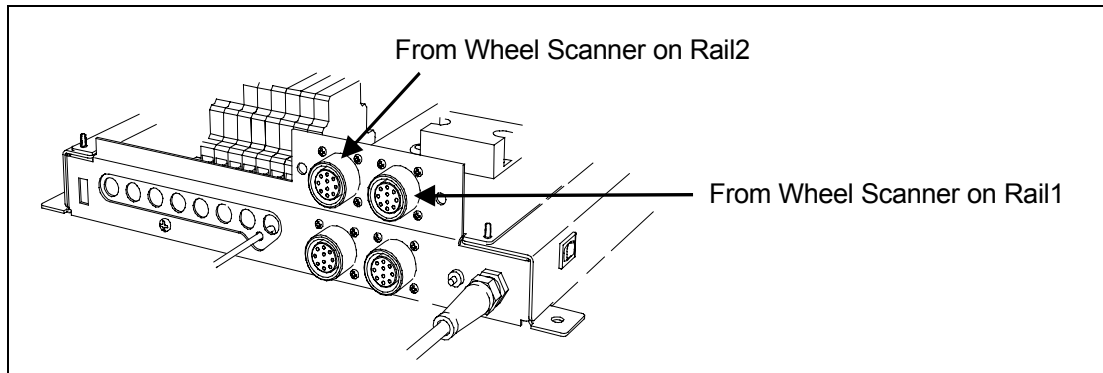
To connect the wheel scanners to the SmartScanNG enclosure:

- 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. If the track runs east and west, rail1 is the north 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.
 - b Go to **8.8 Gating Transducers**.
- 6 If this is a triple-track site:
 - a Repeat steps 1 through 3 on the second track.

The cables from track2 are connected to the middle SmartScanNG enclosure.
 - b Repeat steps 1 through 3 on the third track.

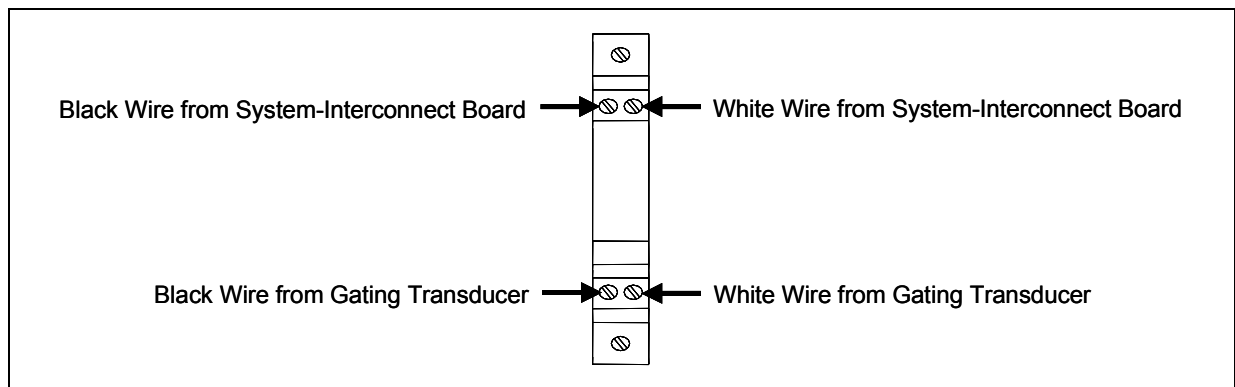
The cables from track3 are connected to the rightmost SmartScanNG enclosure.
 - c Go to **8.8 Gating Transducers**.

8.8 Gating Transducers

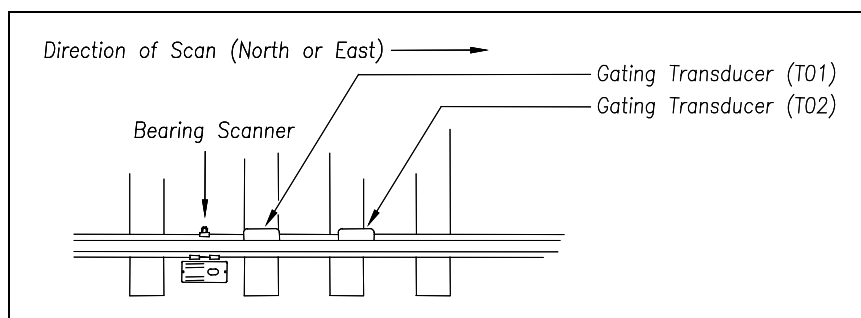
There are two gating transducers per track, each having two wires. One black wire and one white wire. At a single-track site, the wires from gating transducer **TO1** should be labeled **TO1**. The wires from gating transducer **TO2** should be labeled **TO2**.

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 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.



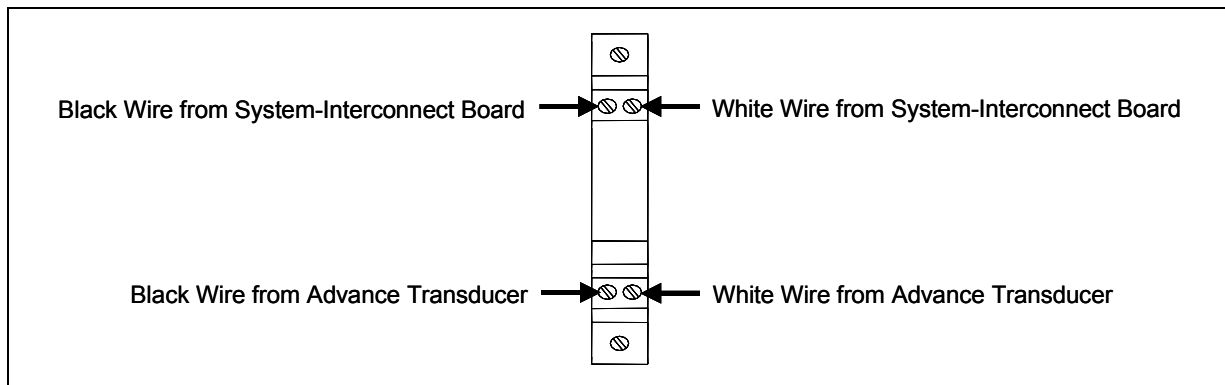
8.9 Advance Transducers

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**.

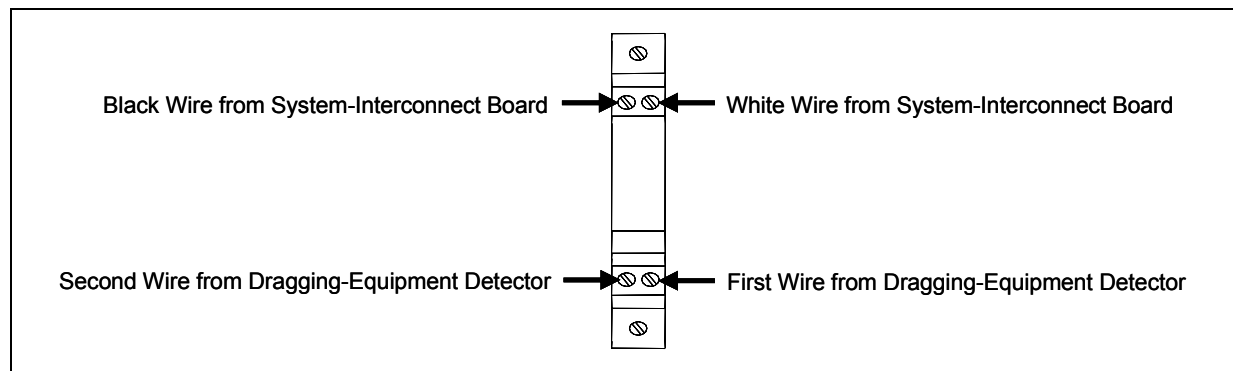
8.10 Dragging-Equipment Detector

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. 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

Most, but not all, systems use one track circuit per track. If your site doesn't, 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.

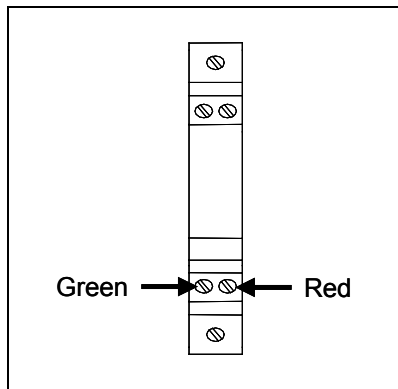
- 10 Wire from the three-terminal arrester to the appropriate terminal blocks on the DIN rail.
- 11 If this is a single-track site, go to **8.12 Telephone**.
- 12 If this is a double-track site:
 - a Repeat steps 1 through 10 on the second track.
The wires from track2 are connected to the rightmost SmartScanNG enclosure.
 - b Go to **8.12 Telephone**.
- 13 If this is a triple-track site:
 - a Repeat steps 1 through 9 on the second track.
The cable from track2 is connected to the middle SmartScanNG enclosure.
 - b Repeat steps 1 through 9 on the third track.
The cable from track3 is connected to the rightmost SmartScanNG enclosure.
 - c 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 the 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 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.

8.13 Shielded Temperature Probe

The shielded temperature probe, which mounts to the outside wall of the wayside enclosure, provides accurate temperature indications over a range of -45°C to +65°C (-49°F to +149°F). 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:

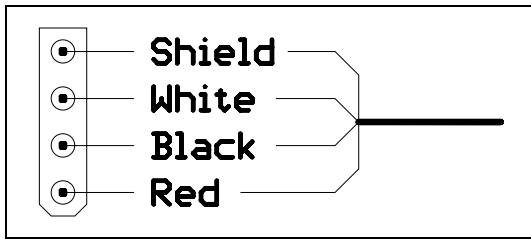
- 1 Be sure that you have on hand the customer-supplied fasteners needed to attach the shielded temperature probe to the outside of the wayside enclosure; a wire stripper; and the fasteners needed to attach the RF-filter assembly to the inside of the wayside enclosure.
- 2 If you haven't done so already,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

- 4 Route the cable from the probe to the bottom of the SmartScanNG enclosure that it is associated with.

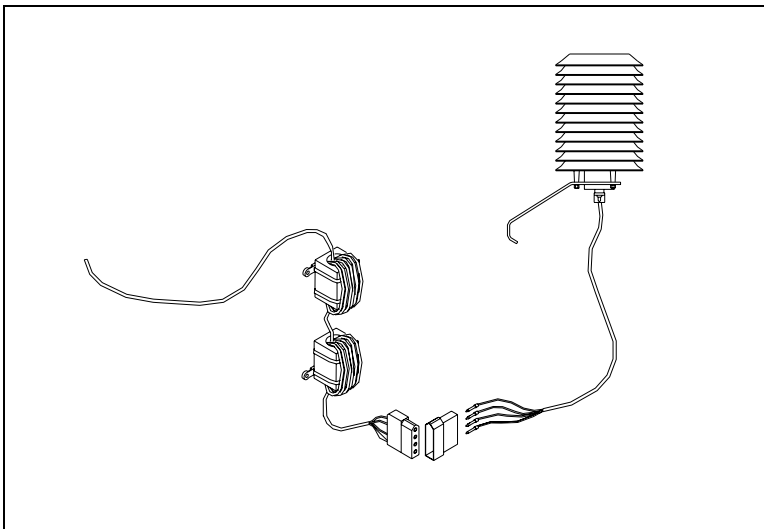
In sheet metal, use a rubber grommet in every hole through which you route the cable.

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



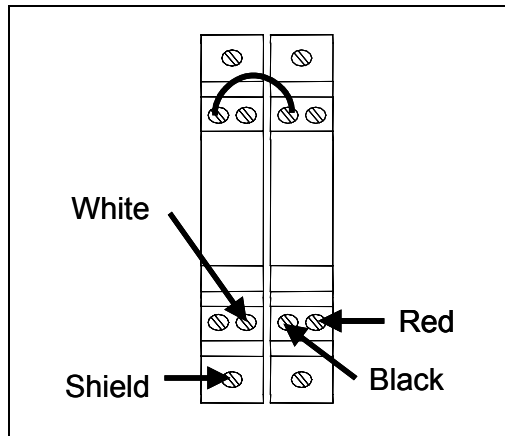
The red wire supplies 12 VDC to the shielded temperature probe.

- 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.

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-Wide Detector**.

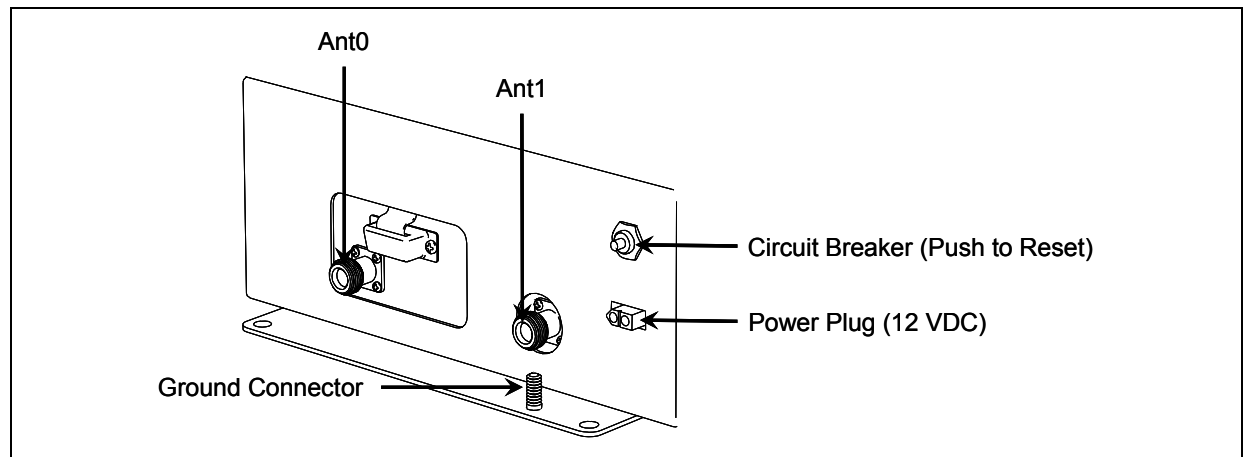
Mount the AEI Interface module (2300-750) next to the SmartScanNG enclosure. Under the AEI Interface module, mount two Joslyn surge protectors (aka Joslyn coaxial lightning arresters).

If a distribution block is used, attach the power cable from AEI Interface module to the top edge of the distribution block. If a distribution block is not used, attach the power cable from AEI Interface module directly to the battery.

Attach the serial communications cable (Dsub9F to Dsb9F 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 surge protectors to the AEI Interface module (2300-750).

Connect a ground wire to the ground connector provided on the enclosure's mounting tab.



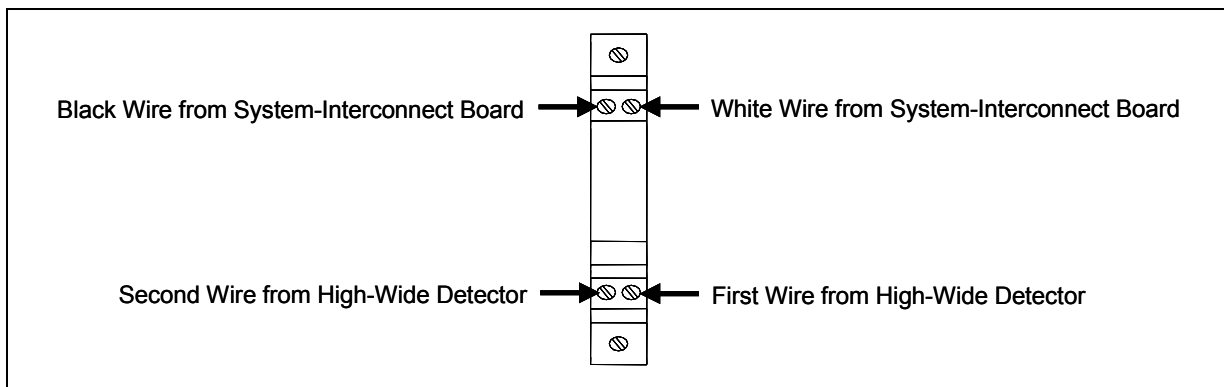
8.16 High-Wide Detector

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

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

At double-track sites, the wires from the 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 **HIWIDE** is for the high-wide 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-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-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.

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 Initial Activities

To do the initial activities:

- 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, and track circuit. 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.

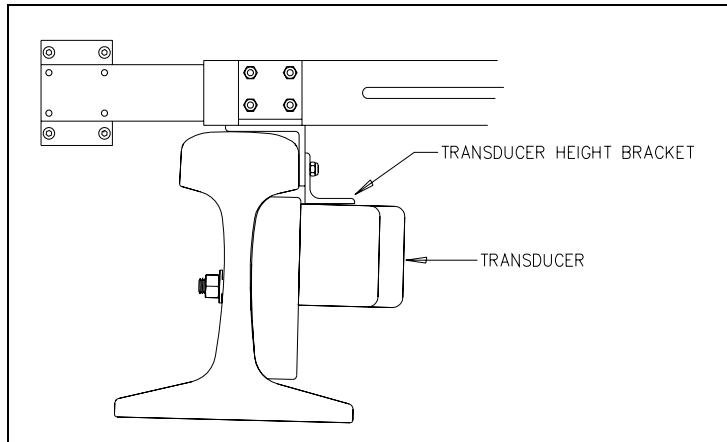
Four bolts are needed to hold the transducer in place. Two square-head bolts go through the mounting plate and transducer body. Two hex-head bolts go through the mounting plate and rail. If any of these bolts are sheared or missing, they must be replaced with the correct replacement bolt. Also, if any 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. Checking for these characteristics should be done with 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 wrench to a **torque of 8 to 10 foot-pounds (10.8 to 13.6 newton-meters)**.

Don't exceed a torque of 10 foot-pounds (13.6 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.
- 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.
- 15 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.

- 16 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.

- 17 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.
- 18 Check that all wayside enclosure components have been installed properly.

- 19** 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.

- 20** Inside the wayside enclosure, check that there are no loose wires or cables.

- 21** If there are any loose wires or cables, fix this problem before proceeding.

- 22** If this is an **AC-powered system**, go to step **35**.

Do steps **23** through **34** only if this is a **solar-powered system**.

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

- 24** 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.

- 25** Check all batteries.

- 26** 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 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.

- 27** Switch the multimeter to the DC volts scale.

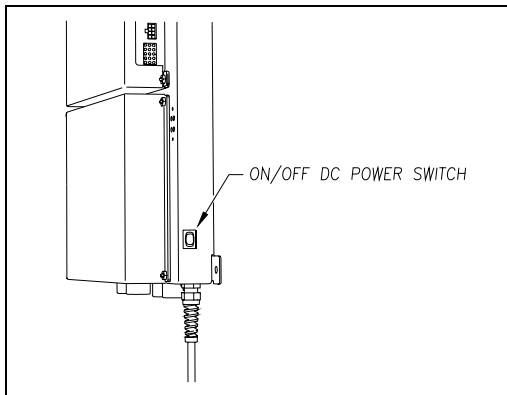
- 28** Touch the leads from the multimeter to the terminals on the top of the fuse block.

- 29** If voltage on the top of the fuse block is 11.5 through 15 VDC, go to step **55**.
- 30** If voltage on the top of the fuse block is greater than 0 VDC and less than 11.5 VDC:
- a** Fix this problem before proceeding.
 - b** Go to step **55**.
- 31** If voltage on the top of the fuse block is 0 VDC, touch the leads to the terminals on the bottom of the fuse block.
- 32** 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 **28**.
- 33** 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 **28**.
- 34** Go to step **55**.
- 35** If plugged in, unplug the SmartScanNG enclosure and the battery charger.

The 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.

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



- 37** Toggle on the AC circuit breaker in the circuit-breaker box.

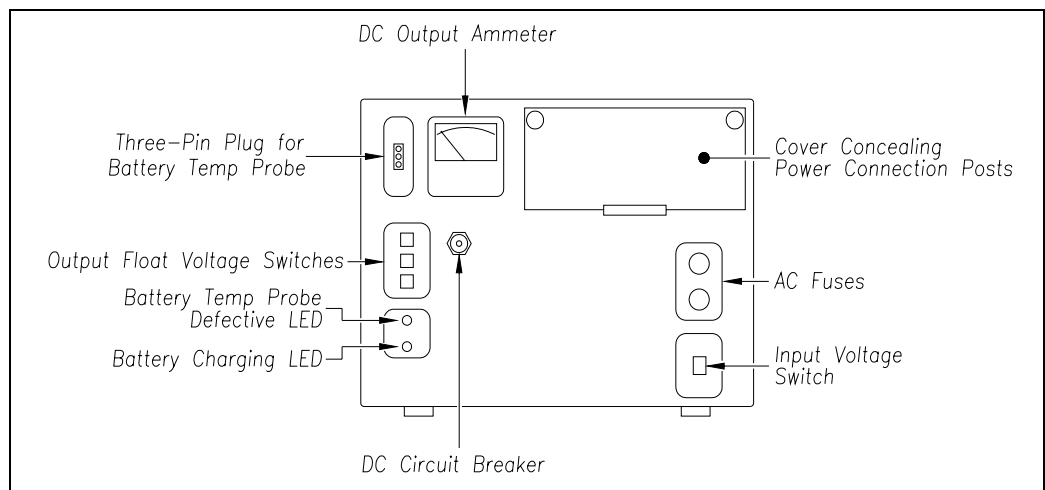
The next two steps assume your site uses 110-120 VAC. If your site uses 220-250 VAC, skip the next two steps. If your site uses any other AC voltage, skip all the steps below and call STC for help.

- 38 At all outlets, check if the AC power is stable and at least 110 volts at 20 amperes.
- 39 If the AC power isn't stable or if it isn't at least 110 volts at 20 amperes, fix this problem before proceeding.
- 40 If the battery charger hasn't been properly grounded to the ground bus, fix this problem before proceeding.
- 41 If the SmartScanNG enclosure hasn't been properly grounded to the ground bus, fix this problem before proceeding.
- 42 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.

- 43 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 12.30 through 14.00 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.
- 44** If loose, tighten the middle gold nuts on the distribution block, if present.
- 45** 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

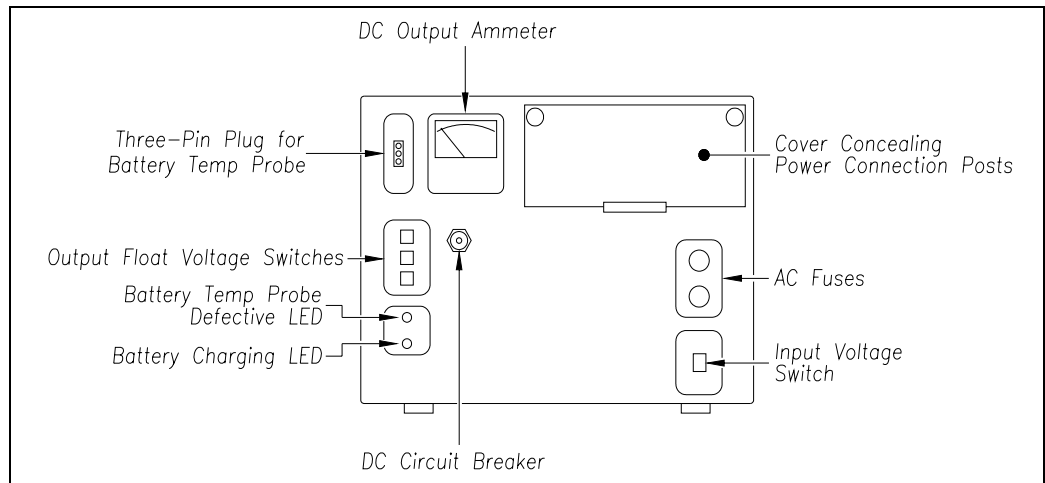
In operation, batteries generate and release flammable hydrogen gas, which, if ignited by a burning cigarette, naked flame, or spark, may cause battery explosion with dispersion of casing fragments and corrosive liquid electrolyte. So, carefully follow manufacturer's instructions for installation and 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 not 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.

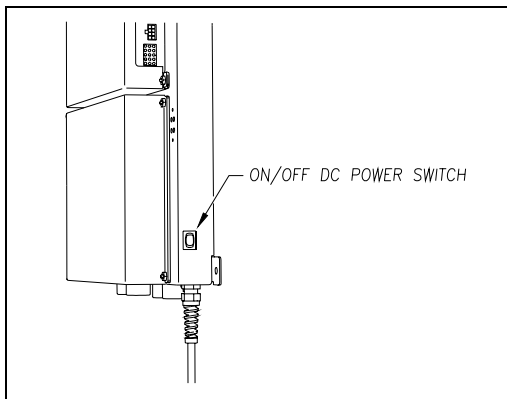
- 46** On the front of the battery charger, if the red defective-temperature-probe LED is lit, fix the underlying problem before proceeding.
- 47** Switch the multimeter to the DC volts scale.
- The **equipment side** of the fuse block is directly wired to the SmartScanNG enclosure. The **battery side** of the fuse block is wired to the battery via the distribution block.
- 48** Touch the leads from the multimeter to the terminal on the equipment side of the fuse block.
- 49** If voltage (on the equipment side of the fuse block) is 12.3 through 14 VDC, go to step **53**.
- 50** 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 the fuse in the fuse block with a BAF-25 (25-amp 250-volt) fast-acting fuse and return to step **48**.
 - 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 **48**.
- 51** If voltage is less than 12.3 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.

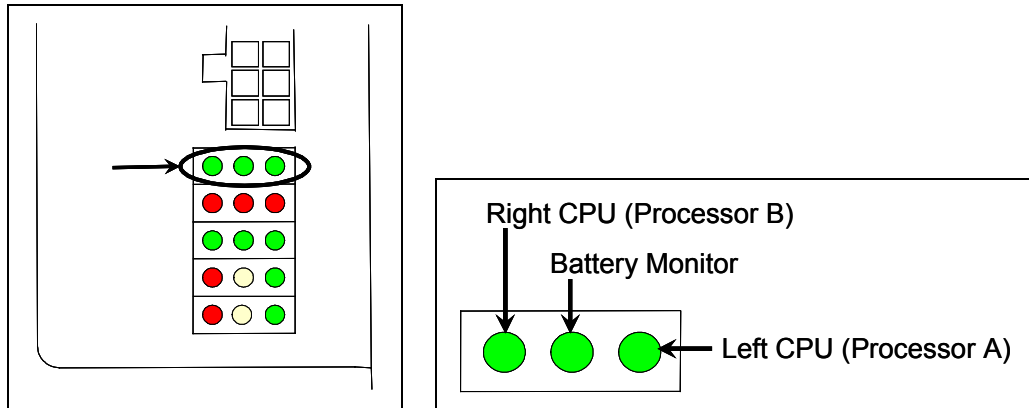
52 If voltage is greater than 14 VDC, cut all power to the SmartScanNG system and call STC for help in fixing this problem.

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



54 Wait 30 seconds.

- 55** On the status panel, look at the top row (aka first row) of LEDs.



The 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.**

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

Most SmartScanNG sites use a track circuit to detect train presence. Some 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.

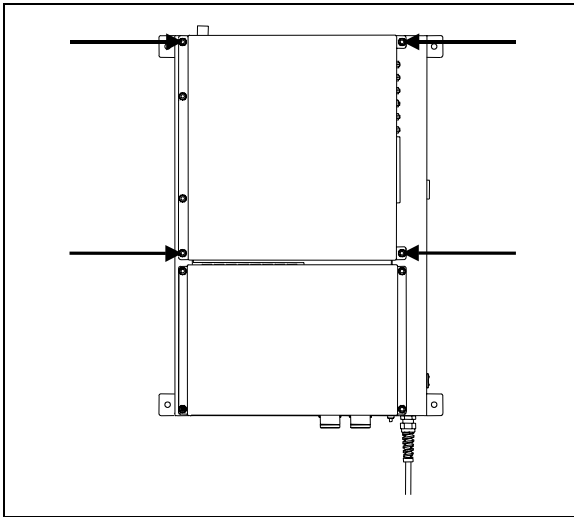
- 57** If your site uses advance transducers, go to step **59**.

Do the next step only if your site uses a track circuit

- 58** To check the operation of the SOTC and adjust it:

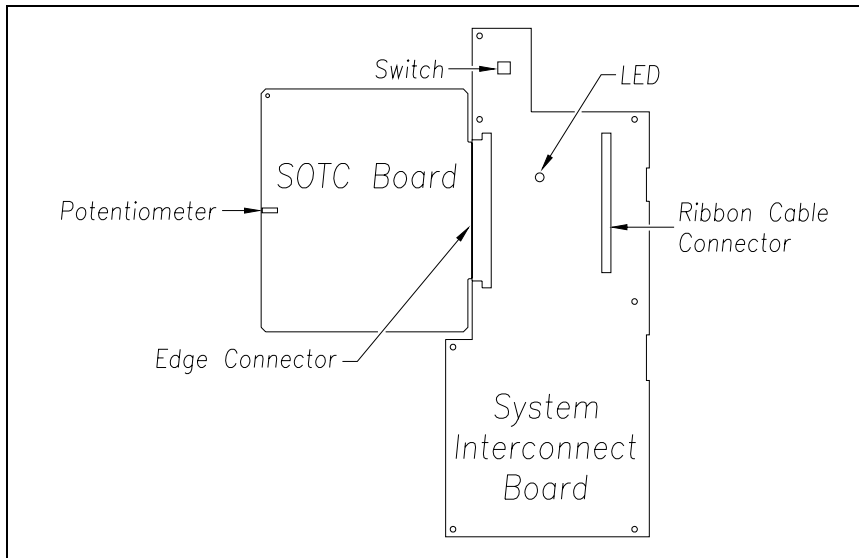
- a** Toggle off the DC power switch on the right edge of the SmartScanNG enclosure.
- b** Unplug the Molex and ribbon cables from the Controller module.

- 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.

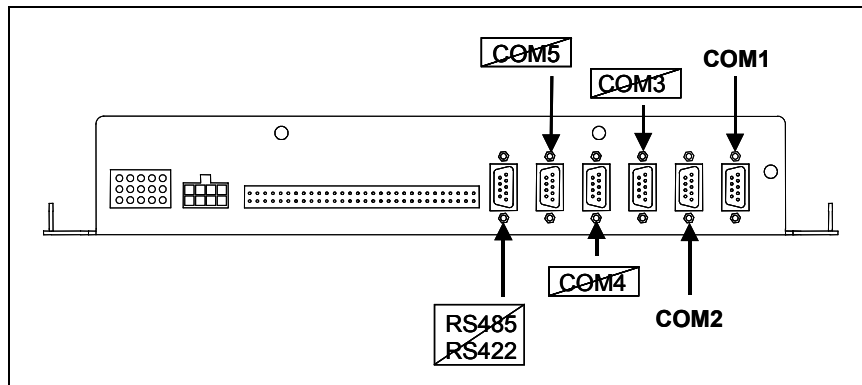


- e Store the removed Controller module and nuts in a safe place until you replace them.
- f Toggle on the DC power switch on the right edge of the SmartScanNG enclosure.
- g From the center of the gating transducer farthest from the track circuit, measure the furthest distance you want the track circuit 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).

- h** At the point just measured, place a hardwire shunt across both rails.
When lit, the LED on the System-Interconnect board indicates a received signal from the track circuit.
- i** Using a small slotted screwdriver, turn the potentiometer on the SOTC board until the LED on the System-Interconnect board goes out.
The potentiometer can be reached through a hole in the side of the SmartScanNG enclosure.
- j** Using a small slotted screwdriver, turn the potentiometer on the SOTC board until the SOTC relay just picks up the signal from the track circuit.
The relay just picks up the signal when the LED on the System-Interconnect board first lights.
- k** Remove the hardwire shunt.
- l** Place the hardwire shunt across both rails at the point 5 feet (1.5 meters) beyond the measured point (that is, five feet farther from the gating transducer).
- m** If the LED on the System-Interconnect board is still lit, return to step **g**.
- n** Remove the hardwire 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.

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

- a** Plug your computer into COM1 or COM2.



- 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.
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]**.

The Main menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 21:57
Main Menu
-----
      .
      .
      .

J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
?
```

- f** To go to the System Functions menu, type **L**

The System Functions menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 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
?
```

- g** To open the shutters by starting autocalibration, type **G**

The protective shutters in all scanners should open and stay open for three minutes. This might not be enough time to check and clean the shutters and optics. If it isn't enough time, type **G** again.

- 60 In each scanner, check if its shutter opened.
- 61 If any shutter didn't open, fix this problem before proceeding.
- 62 In each scanner, check for dirty optics.
- 63 If dirty, clean the scanner optics with the supplied lens cleaning kit.

Do not use solvents, ammonia-based cleaning solutions, or isopropyl alcohol on the optics. Use clean water or a mild solution of dishwashing liquid. After the liquid on the optics dries, lightly wipe the optics with a clean dry chamois patch.

- 64 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.

- 65 To return to the Main menu, type **X**
- 66 To exit the serial interface and return the system to normal operation, type **X**
- 67 If this is a double-track site **with solar-powered systems**, repeat steps 27 through 66 for the other SmartScanNG system.
- 68 If this is a double-track site **with AC-powered systems**, repeat steps 40 through 66 for the other SmartScanNG system.

9.2 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 and wheel scanners.

9.2.1 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 the 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 (15.2-meter) power cord into the **six**-contact circular connector on the front of the calibrated heat source.

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.

- 4 Plug the other end of the power cord into a grounded three-wire 120-volt USA socket.

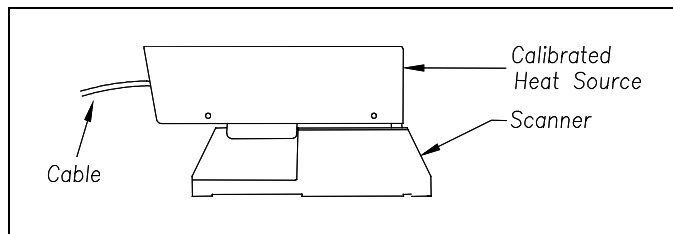
The function connector that is not being used has live AC present.

- 5 Cover the function connector that isn't being used with the supplied dust cover.
- 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.
- 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 cable to the front of the scanner, place the calibrated heat source on the scanner.



- 11 Be sure that a computer is plugged into COM1 (on the side of the Controller module), that it is turned on, that it has appropriate communications software installed, that the communications software is set to use full duplex, that the baud rate is set to 19,200, and that a LOG file is opened.

- 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
09/30/2008 21:57
Main Menu
-----
      .
      .
      .
J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
?
```

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

The System Functions menu appears.

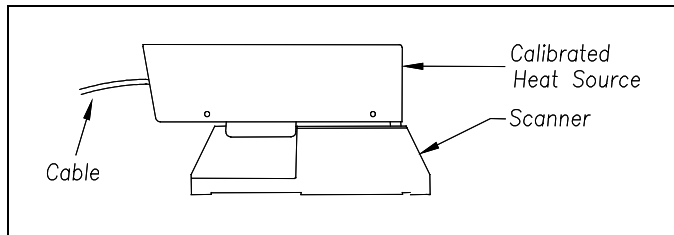
```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 21:57
System Functions Menu
-----
A) Radio Test
B) Vocabulary Test
C) Ramp Function
D) Radio Inhibit
E) Manual Test Mode
F) 1KHz Test Tone
G) Auto-Calibration
H) Reset the COP Counters
I) Remote System RESET
J) Delete All Stored Train Data
K) Clear Event Log
X) Exit
?
```

- 14** To start autocalibration, type **G**

The SmartScanNG system will now calibrate itself. Follow along on your interface 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).

- 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 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 **9.2.2 Wheel Scanners**.
 - b Store the calibrated heat source and its cable in the wayside enclosure.
 - c Go to **9.3 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 **9.2.2 Wheel Scanners**.
 - c Store the calibrated heat source and its cable in the wayside enclosure.
 - d Go to **9.3 Checking the Broadcast**.
- 23 If this is a triple-track site:
- a Repeat steps 1 through 20 for the second track.
 - b Repeat steps 1 through 20 for the third track.
 - c If your site has wheel scanners, go to **9.2.2 Wheel Scanners**.
 - d Store the calibrated heat source and its cable in the wayside enclosure.
 - e Go to **9.3 Checking the Broadcast**.

9.2.2 Wheel Scanners

Not all sites use wheel scanners. If your site doesn't use them, skip the instructions below and go to **9.3 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 wheel 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 (15.2-meter) power cord into the **six**-contact circular connector on the front of the calibrated heat source.

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.

- 4 Plug the other end of the power cord into a grounded three-wire 120-volt USA socket.

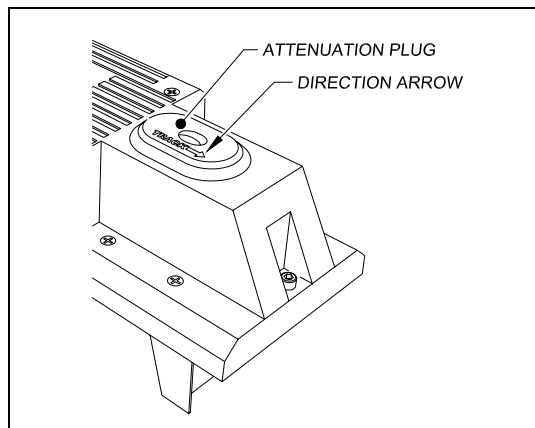
The function connector that is not being used has live AC present.

- 5 Cover the function connector that isn't being used with the supplied dust cover.
- 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.
- 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.

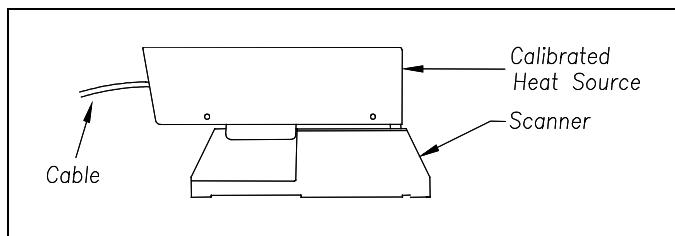
Once the temperature stabilizes, calibration may begin. Once stabilized, the temperature will change less than plus-or-minus one degree Fahrenheit.

- 9 To remove the attenuation plugs from both wheel scanners:
 - a From one of the wheel scanners, remove the plug.



- b Store the plug in a safe place until you're ready to replace it.
 - c For the other wheel scanner, repeat steps **a** and **b**.

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



- 12 Be sure that a computer is plugged into COM1 (on the side of the Controller module), that it is turned on, that it has appropriate communications software installed, that the communications software is set to use full duplex, that the baud rate is set to 19,200, and that a LOG file is opened.
- 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
09/30/2008 21:57
Main Menu
-----
      .
      .
      .

J) Setup
K) Enter Pass-Thru Mode
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-1794.5, Track-Single  
09/30/2008 21:57  
System Functions Menu  
-----
```

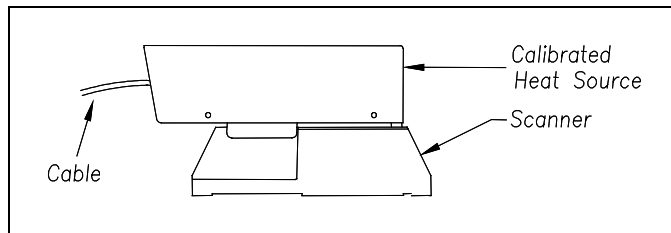
- A) Radio Test
- B) Vocabulary Test
- C) Ramp Function
- D) Radio Inhibit
- E) Manual Test Mode
- F) 1KHz Test Tone
- G) Auto-Calibration
- H) Reset the COP Counters
- I) Remote System RESET
- J) Delete All Stored Train Data
- K) Clear Event Log
- X) Exit

?

- 15** To start autocalibration, type **G**

The SmartScanNG system will now calibrate itself. Follow along on your interface 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).

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



- 19** Repeat steps **15** and **16**.
- 20** To return to the Main menu, type **X**
- 21** To exit the serial interface and return the system to normal operation, type **X**
- 22** Replace both attenuation plugs.

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

- 23** If this is a single-track site:
- a** Store the calibrated heat source and its cable in the wayside enclosure.
 - b** Go to **9.3 Checking the Broadcast**.
- 24** If this is a double-track site:
- a** Repeat steps **1** through **22** for the second track.
 - b** Store the calibrated heat source and its cable in the wayside enclosure.
 - c** Go to **9.3 Checking the Broadcast**.
- 25** If this is a triple-track site:
- a** Repeat steps **1** through **22** for the second track.
 - b** Repeat steps **1** through **22** for the third track.
 - c** Store the calibrated heat source and its cable in the wayside enclosure.
 - d** Go to **9.3 Checking the Broadcast**.

9.3 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 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
09/30/2008 21:57
Main Menu
-----
      .
      .
      .

J) Setup
K) Enter Pass-Thru Mode
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
09/30/2008 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.

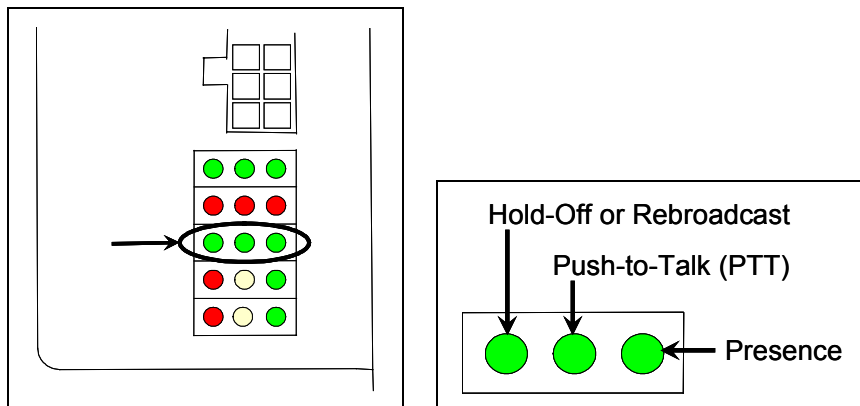
```
Starting 1kHz Test Tone
```

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 redisplay 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 track (that is, for the other SmartScanNG system).

9.4 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. The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 21:57
Main Menu
-----
      .
      .
      .
J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
?
```

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

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 21:57
System Functions Menu
-----
A) Radio Test
B) Vocabulary Test
C) Ramp Function
D) Radio Inhibit
      .
      .
      .
```

- 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 the speech 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 track (that is, for the other SmartScanNG system).

9.5 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. The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 21:57
Main Menu
-----
      .
      .
      .

J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
?
```

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

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 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, two Carside Slope alarms, and two Hotwheel alarms. It simulates the Carside Slope alarms and the Hotwheel alarms even if detection for those alarms is disabled in the Equipment submenu. However, disabled alarms don't appear on the Last Test Train report.

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

This message appears.

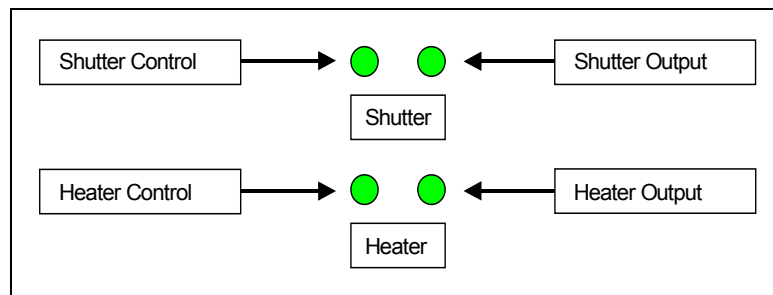
```
Running Ramp Function...
```

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.** When finished, this message appears followed by the System Functions menu.

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

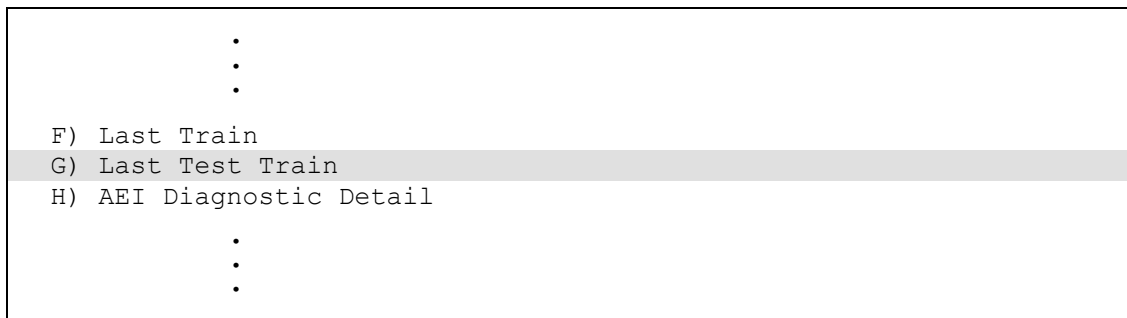
5 Wait until the two LEDs labeled **Shutter** go out.

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**.



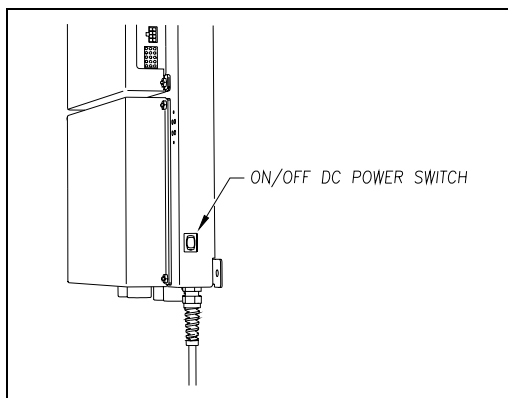
- 6 Produce a Last Test Train report.

Chapter 12 - Producing Reports tells how to produce this report. From the Main menu, you would type **G**.



The Last Test Train report is identical to the Train Detail report. The only difference is the way you specify which train you want reported. In this version of the report, you don't have to 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 track (that is, 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, you would type **F**.

The Last Train report is identical to the Train Detail report. The only difference is the way you specify the train for which you want a report. For this report, you don't have to specify a train. A report on the most current train is produced.

- 4 On the report, check that the number of axles agrees with the number of times that you stroked the gating transducers.
- 5 On the report, if the number of axles doesn't agree with the number of times that you stroked the gating transducers, call STC for help in fixing this problem.
- 6 If this is a double-track site, repeat steps 1 through 5 for the other track (that is, for the other SmartScanNG system).

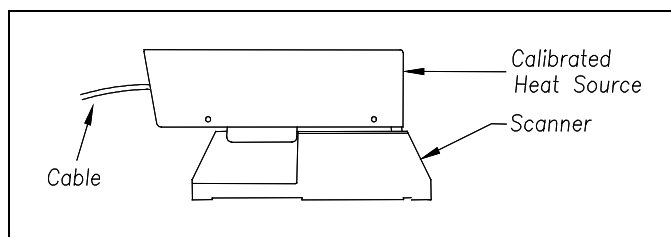
To generate a test train to check hot bearings:

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.

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, only the first four Hotbox alarms are ever announced.
- 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 track (that is, for the other SmartScanNG system).
- 12 Store the calibrated heat source and its cable in the wayside enclosure.

9.6 Setting Transducer Gain

The Equipment submenu 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  
      :  
      :  
      :
```

- 2 To go to the Setup menu, type J

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

```
Enter Password:
```

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

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."

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  
09/30/2008 21:57  
Setup Menu  
-----  
A) Date and Time  
B) MP/KP  
C) Track Number  
D) Alarm Limits  
E) Equipment  
F) Messages  
      :  
      :  
      :
```

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

	.	
	:	
	.	
G	Clearance Mode.....	Multiplexed
H	Winter Cycle.....	YES
I	Transducer Gain.....	Normal
J	AEI.....	YES
K	Resistor Test.....	Enabled
	.	
	:	
	.	

The Equipment submenu 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 submenu is set to Normal, go to step 6.
- 5 If the Transducer Gain option of the Equipment submenu is set to High, type **I**
The transducer-gain setting toggles from high to normal. The Transducer Gain option on the Equipment submenu changes. The Equipment submenu reappears.
- 6 To leave the Equipment submenu 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 plugged in, powered, and turned on.
- 10 If this is a double-track site, repeat steps 1 through 9 for the other track (that is, 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.

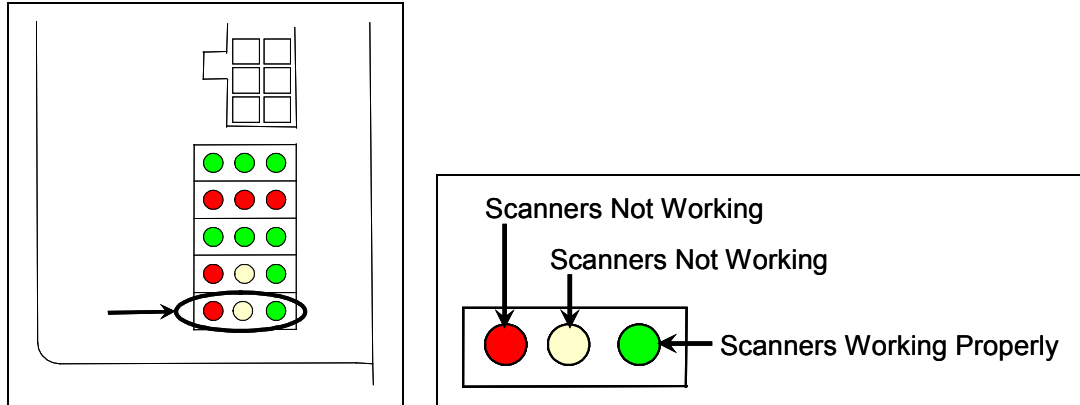
9.7 Final Activities

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 (aka fifth row) of LEDs.



The fifth 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 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.

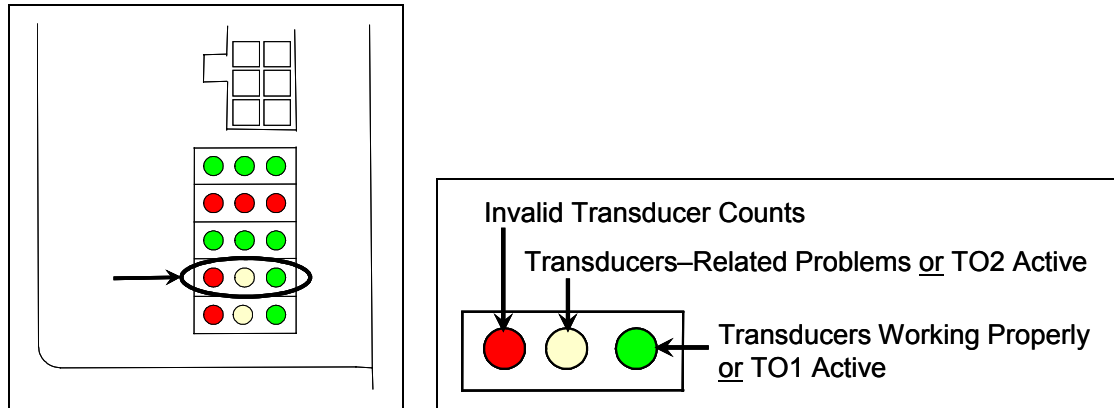
The **middle yellow LED** flashes when the difference between the average temperatures (recorded by the two bearing scanners or recorded by the two wheel scanners) isn't within acceptable balance limits for 20 consecutive trains. These limits are different for bearing and wheel scanners. For the bearing 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.

- 3 If the **rightmost green LED** (on the fifth 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 16 kph (10 mph).
- 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 **10**.
- 6 To see if the system is being activated by the gating transducers:
 - a Produce a Last Train report.

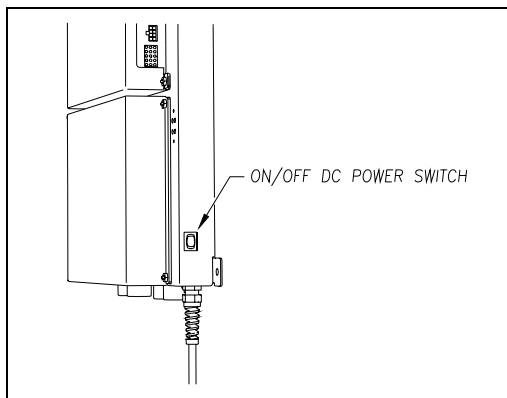
Chapter 12 - Producing Reports tells how to produce this report. From the Main menu, type **F**.

The Last Train report is identical to the Train Detail report. The only difference is the way you specify the train on which you want a report. For this report, you don't have to 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 "Advance System Failure" or "No Approach Track."

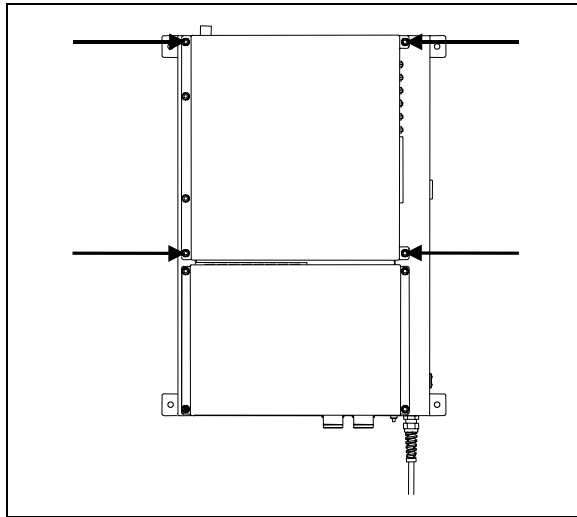
The Advance System Failure alarm (on some systems, called the No Approach Track alarm) indicates that the track circuit (or the advance transducers) failed to signal the presence of a train and that the SmartScanNG system started from the train passing over the gating transducers.

- c If the words "Advance System Failure" or "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.



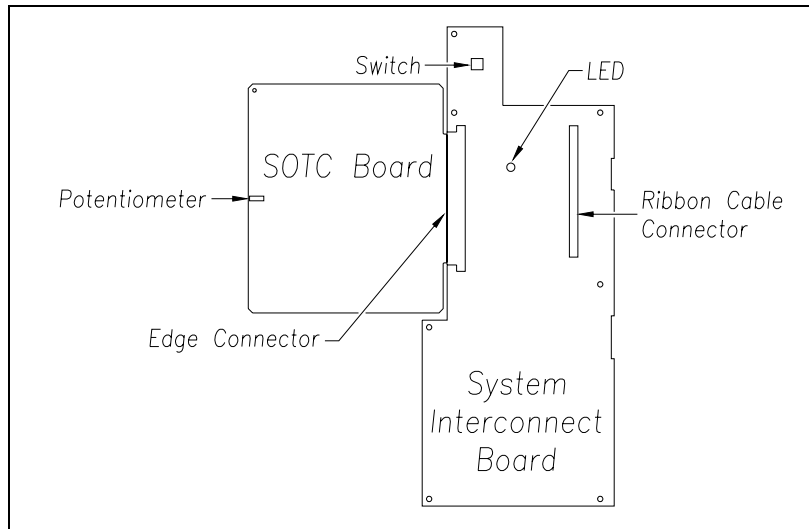
- b Unplug the Molex and ribbon cables from the Controller module.

- 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 on 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 furthest 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).

- h** At the point just measured, place a hardwire shunt across both rails.
When lit, the LED on the System-Interconnect board indicates a received signal from the track circuit.
 - i** Using a small slotted screwdriver, turn the potentiometer on the SOTC board until the LED on the System-Interconnect board goes out.
The potentiometer can be reached through a hole in the side of the SmartScanNG enclosure.
 - j** Using a small slotted screwdriver, turn the potentiometer on the SOTC board until the SOTC relay just picks up the signal from the track circuit.
The relay just picks up the signal when the LED on the System-Interconnect board first lights.
 - k** Remove the hardwire shunt.
 - l** Place the hardwire shunt across both rails at the point 1.5 meters (5 feet) beyond the measured point (that is, 1.5 meters (5 feet) farther from the gating transducer).
 - m** If the LED on the System-Interconnect board is still lit, return to step **j**.
 - n** Remove the hardwire 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 **10**.
- 9** If your system uses advance transducers:
- You will 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
09/30/2008 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.

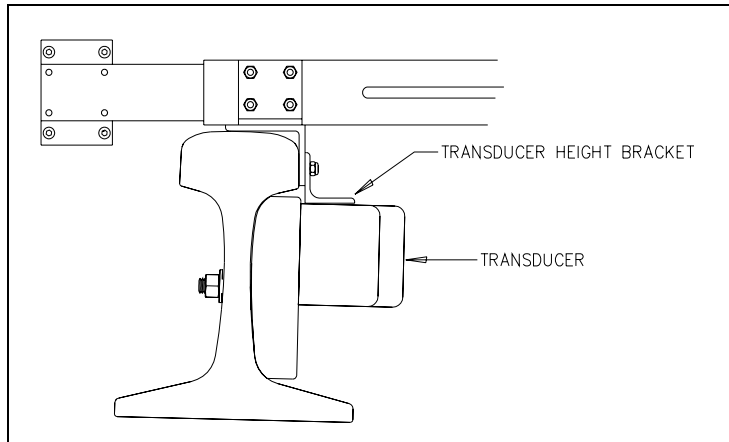
Four bolts are needed to hold the transducer in place. Two square-head bolts go through the mounting plate and transducer body. Two hex-head bolts go through the mounting plate and rail. If any of these bolts are sheared or missing, they must be replaced with the correct replacement bolt. Also, if any 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. Checking for these characteristics should be done with 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 wrench to a **torque of 8 to 10 foot-pounds (10.8 to 13.6 newton-meters)**.

Don't exceed a torque of 10 foot-pounds (13.6 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.

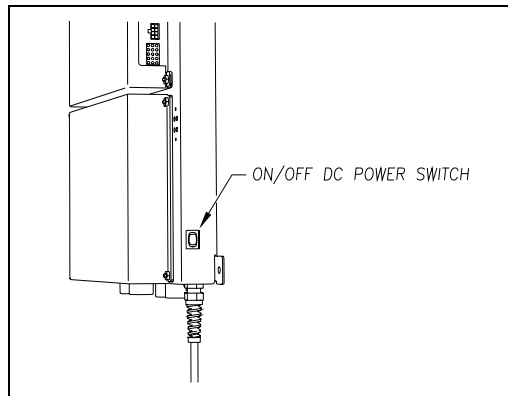
Determine which gating transducer is recording incorrect axle counts and whether it isn't counting all axles or counting extra ones. You may not be able to do this by just looking at the values under the Axles, TO1, and TO2 columns of the Train Summary report. Sometimes, a transducer problem causes the 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 that encounters the train with the transducer-count imbalance encountered.

After you determine which gating transducer is miscounting, you will need to change a jumper setting on the Interface board. If TO1 is the problem, you will change the setting for J201. If TO2 is the problem, you will 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.

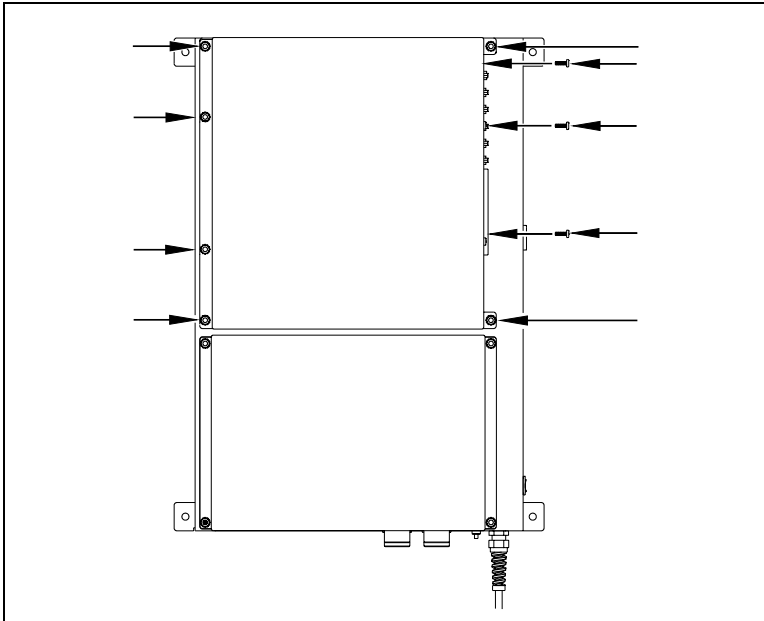
The process of adjusting the transducer loading is trial and error. Generally, if you are having too many transducer counts, lower the loading resistance to make the transducer less sensitive. Likewise, too few counts suggest that the transducer is not sensitive enough, so select a loading value with 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):

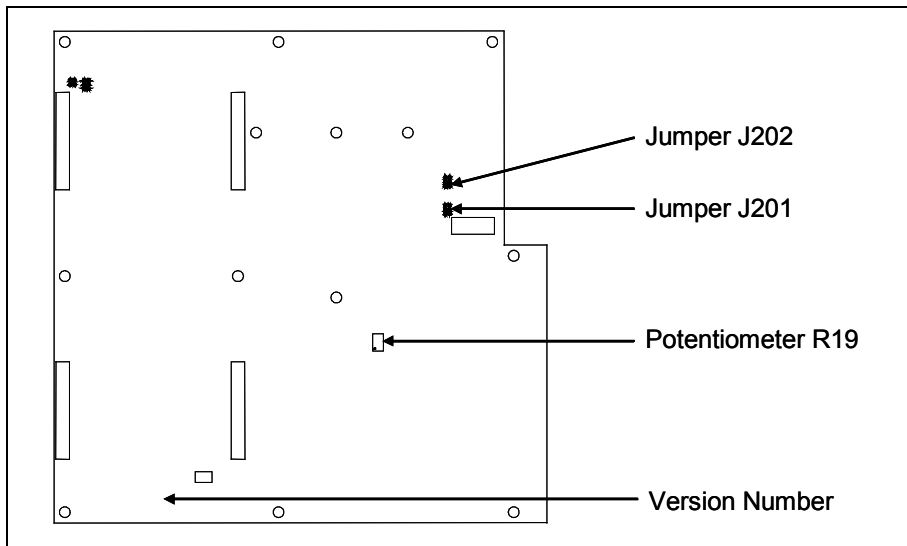
- a** Toggle off the DC power switch on the right edge of the SmartScanNG enclosure.



- 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.

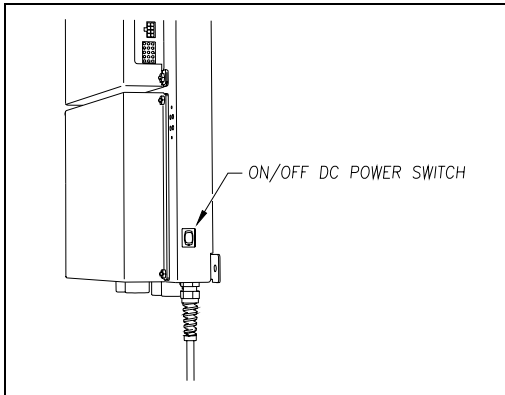
J201 or J202 Jumper Position	Version 1.21 and 1.22 and 1.30 and 1.40 Board
Top	Lowest Sensitivity
Center	Middle Sensitivity
Bottom	Highest Sensitivity

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.

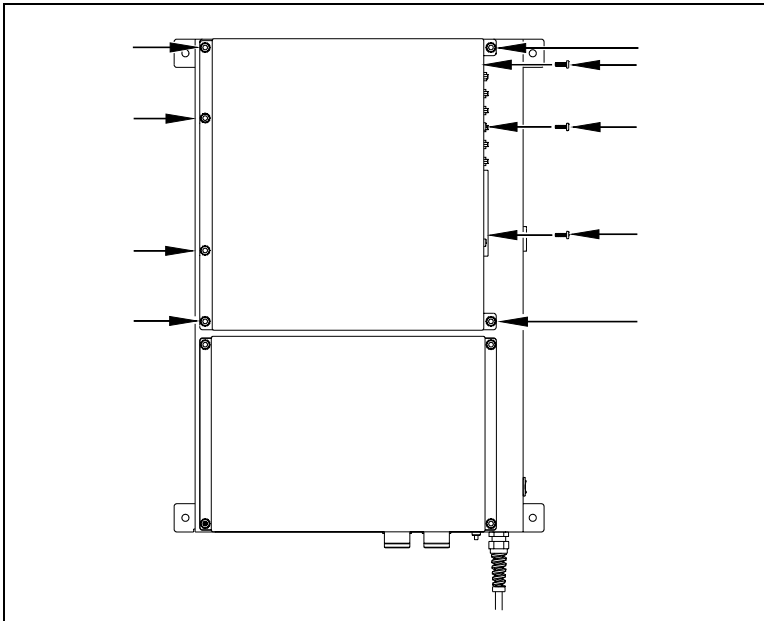
- f If TO1 is the selected gating transducer and the J201 jumper is currently on the lowest sensitivity position, move it to the middle sensitivity position.
- g If TO1 is the selected gating transducer and the J201 jumper is currently on the middle sensitivity position, move it to the highest sensitivity 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):

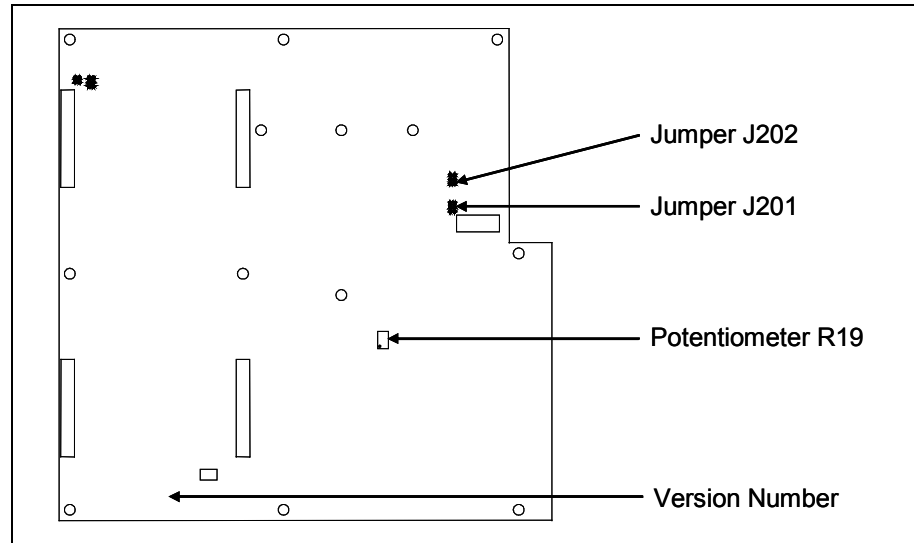
- a** Toggle off the DC power switch on the right edge of the SmartScanNG enclosure.



- 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 <u>or</u> 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 13.0 and 14.5 volts.

If this is an **AC-powered system**, values outside this range may be caused by:

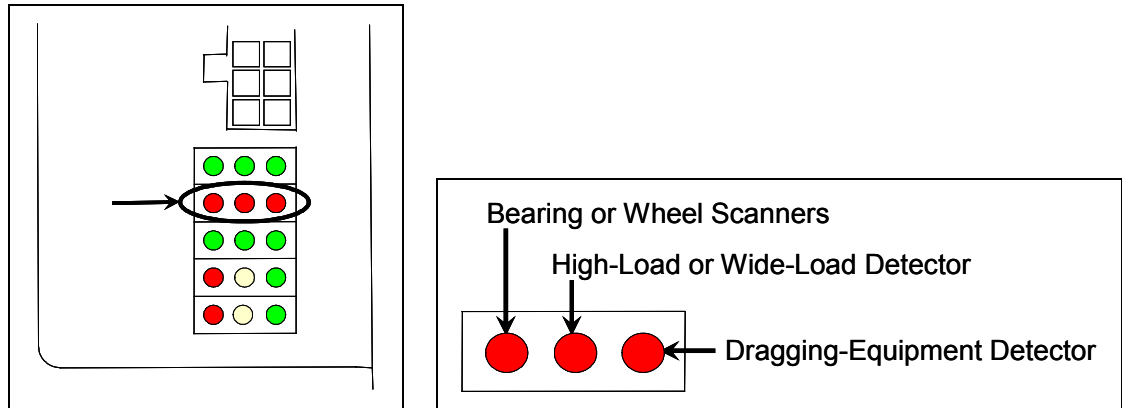
- No AC power for an extended period
- Improperly adjusted float voltage
- Defective battery
- Blown fuses
- Defective battery charger

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 13.0 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
09/30/2008 21:57
Main Menu
```

```
-----
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
```

```

:
:
:
```

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 **28**.
 - 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 **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 and the battery charger plugged in, powered, and turned on.
- 29** If this is a **solar-powered system**, leave the SmartScanNG enclosure plugged in, powered, and 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

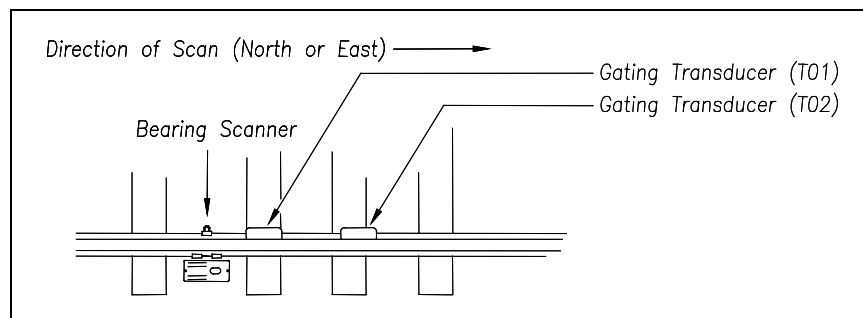
This chapter describes the Exception Alarms (aka defect alarms aka train alarms) and how they are detected. Also covered are miscellaneous train scanning features.

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



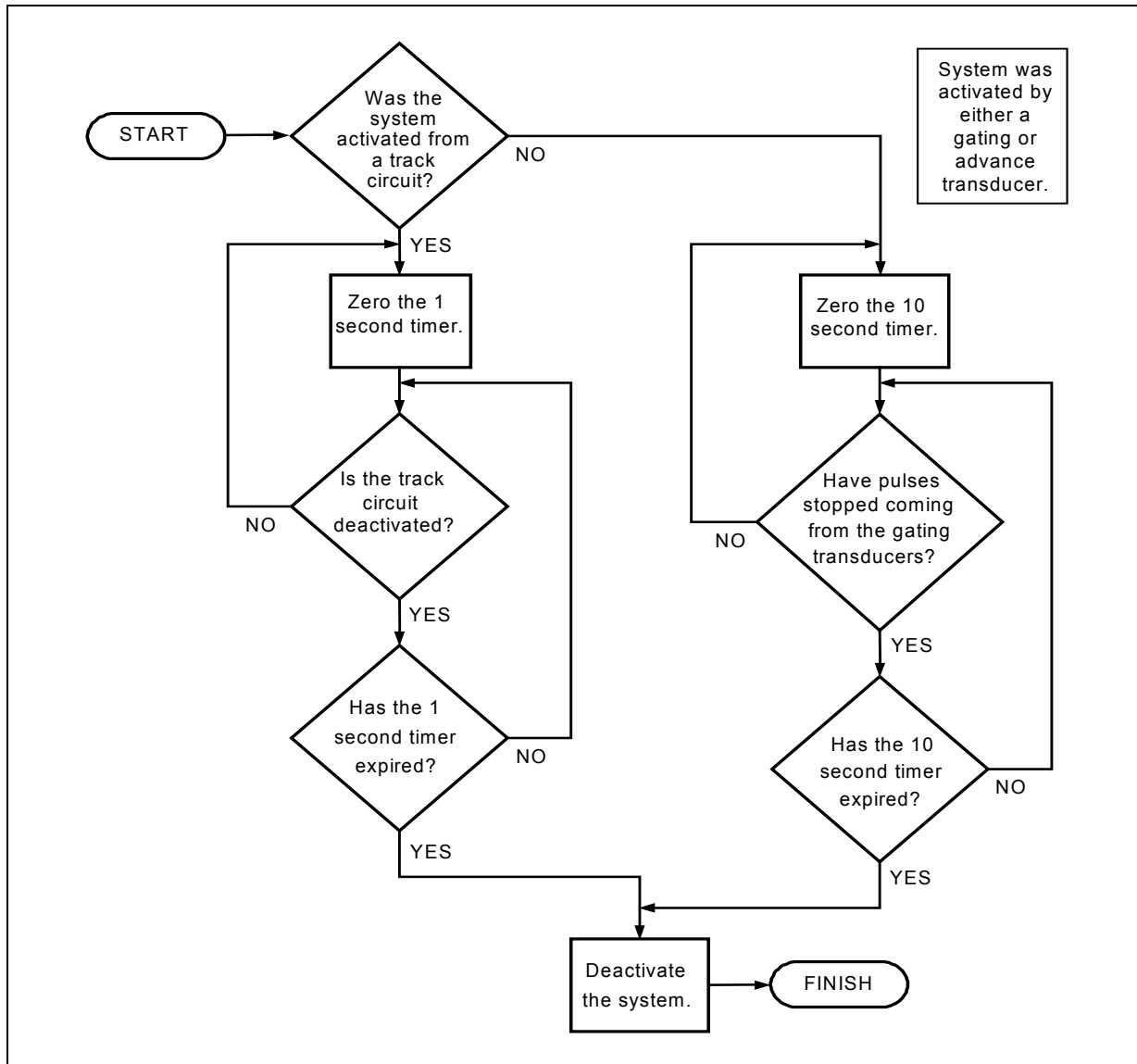
The signals from these gating transducers indicate to the system that passing wheels are in view of the scanners. Furthermore, the speed of the train is determined by using the known distance between TO1 and TO2 versus the time required for a given wheel to pass over them.

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, it waits for the track-circuit signal to be absent for one second before deactivating. Likewise, if a transducer activated the system, it waits for ten seconds of inactivity from the gating transducers before deactivating. The flowchart below shows this process.



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. If a train has fewer than eight axles, its speed is reported as 0 mph.

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 Trains 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	
	.
	.

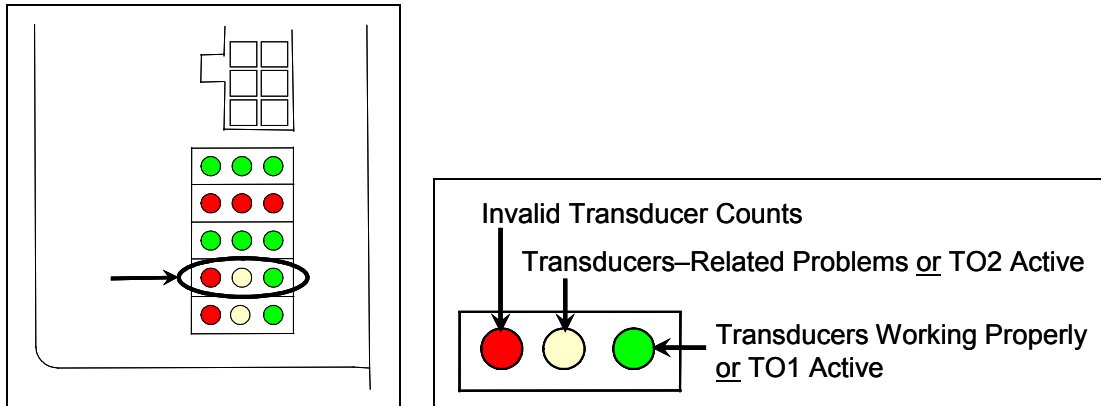
10.4 Train Direction

Train direction is based on whether TO1 or TO2 generated the first gating transducer pulse.

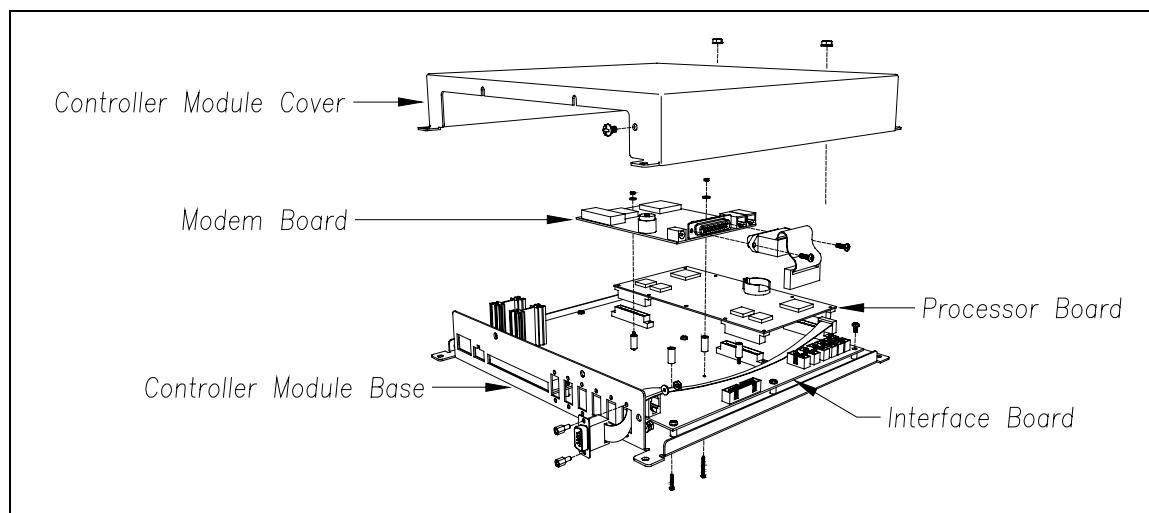
10.5 Transducer Pulse Processing

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 32 kph (20 mph) 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

The SmartScanNG system begins reading the scanners for a heat signal when the wheel is at the center of the first gating transducer and will continue reading until the wheel is at the center of the second gating transducer. This is the period that the axle is in view of the scanner. A negative going edge of a transducer signal is an indication that the wheel is in the center of that transducer. The firmware uses Dynamic Scan Rate sampling, 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 will be announced.

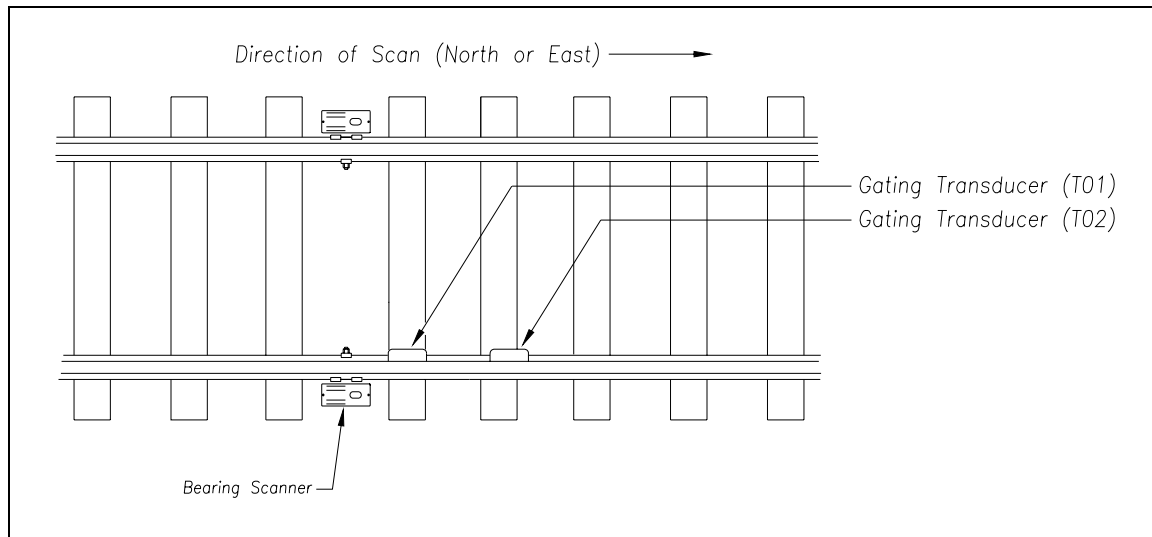
There are four types of Hotbox alarms.

- **Absolute.** To trigger an Absolute alarm, a bearing temperature must exceed the limit that was established using the Absolute option. 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.
- **Pyrometer Saturation.** To trigger a Pyrometer Saturation alarm, an interaxle bearing temperature must exceed the limit that was established using the Absolute option. 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.

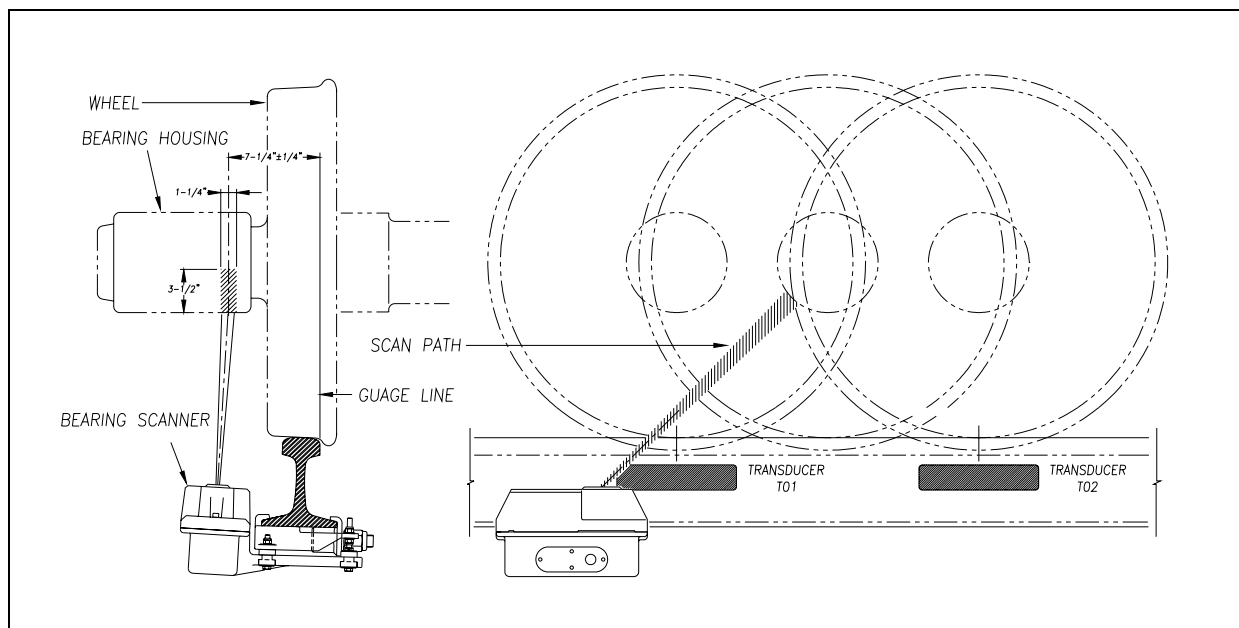
The system always checks for Absolute alarms. The system also checks for Differential alarms and Pyrometer Saturation alarms. However, their detection stops when the speed of the train drops below 7 mph (11.3 kph). In order for Carside Slope alarms to be processed, they must be enabled using the Carside Slope option on the Equipment submenu. 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 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 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.

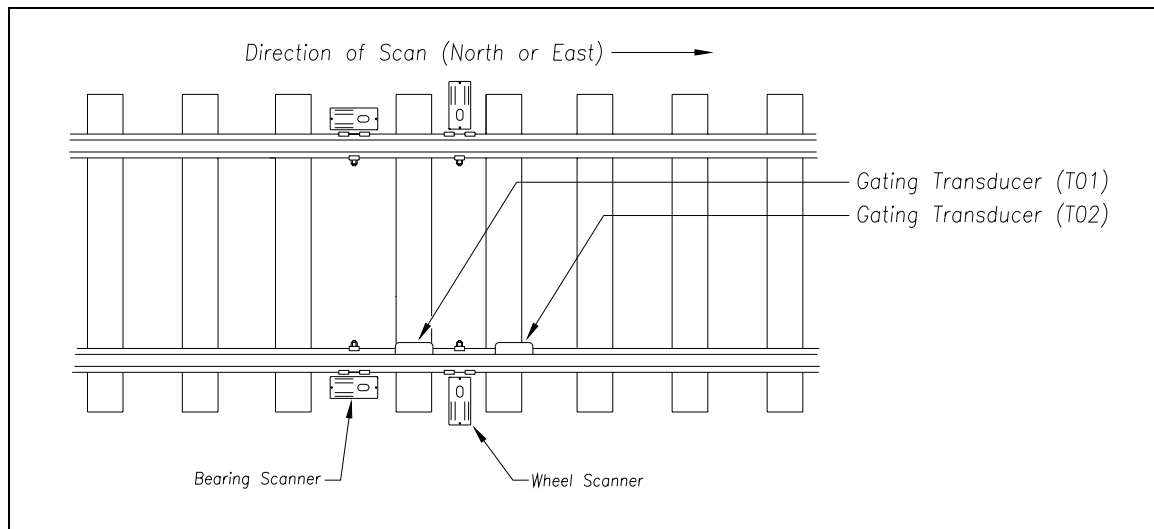
When a bearing passes through the field of view of the scanner, a rapid change in temperature is presented to the internal lithium tantalite crystal. This causes the signal level from the pyrometer to increase proportionally to the amount of exposed infrared energy. When an axle is between the gating 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

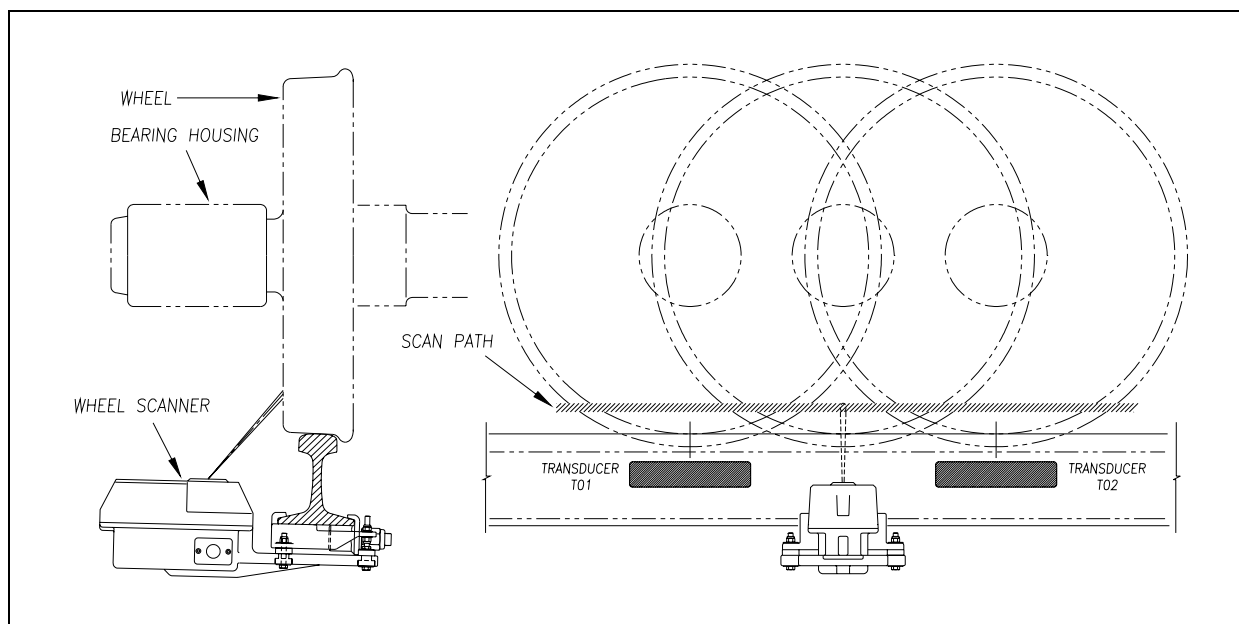
The output of the pyrometers is linear across most of the operating speed range of the system. However, the output of the pyrometers is nonlinear at either end of the operating speed range. To compensate for this nonlinear output, the firmware applies a correction factor to the sampled heat value. The 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 wheel scanners are aligned to scan about 4 inches (10 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 Limits submenu (aka Alarm Settings submenu). This alarm limit is an offset, in degrees Fahrenheit, above the ambient temperature. Hotwheel detection is enabled using the Hotwheel option on the Equipment submenu. 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 will be 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 submenu. When enabled, the SmartScanNG system detects and records every Dragging-Equipment alarm that occurs on a given train. However, it 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 submenu.

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. This involves a caveat that 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 submenu.

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. This involves a caveat that 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.

Both high-load detectors and wide-load detectors must be either 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 submenu.

Chapter 11

Serial Interface

The serial interface allows **on-site** and **off-site** communication with the system. This interface is the only way to view reports and to modify 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.

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 multitrack 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.

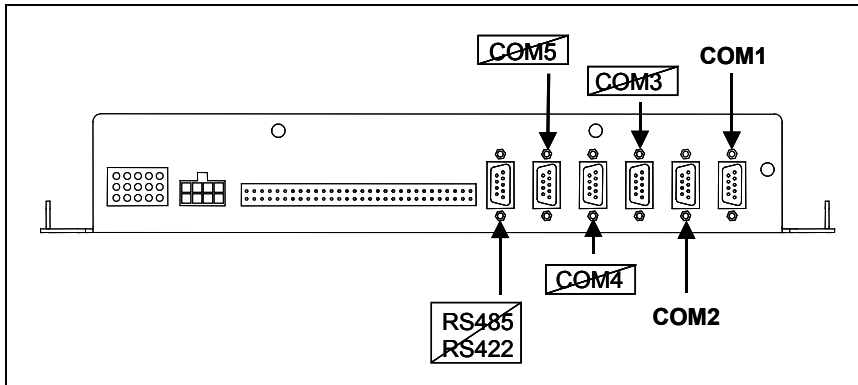
Your menus and submenus may not match those shown in this guide. Some of the options shown may not appear on your menus and submenus. For example, No Defects doesn't appear on everybody's Messages submenu. Also, some options that appear on your menus and submenus may not apply to your system. For example, if you don't have an AEI subsystem attached to your SmartScanNG, the AEI option on the Equipment submenu 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.

11.1 Main Menu

To display the Main menu:

- 1 If **on-site**, plug your computer into COM1 or COM2.



- 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]**.

The Main menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 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
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.
- 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.

- 8 When done, close the LOG file.

- 9 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.

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
09/30/2008 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
L) System Functions
M) Event Log
X) Exit
?
```

- 2 To go to the Setup menu, type J

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

```
Enter Password:
```

You are given three chances to enter the correct password. When you have an **off-site** connection and you don't enter the correct password in three tries, the system hangs up your modem. When you have an **on-site** connection and you don't enter the correct password in three tries, the system returns to the Main menu.

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."

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

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 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) Serial Password
J) COM1 Tx 19200 / Rx 19200 N-8-1
K) COM2 Tx 19200 / Rx 19200 N-8-1
L) COM3 Tx 19200 / Rx 19200 N-8-1
M) COM4 Tx 19200 / Rx 19200 N-8-1
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 submenu, the system reverts to the Setup menu. If this menu times out, the system reverts to the Main menu. If this menu times out, the system disconnects the modem connection and resumes normal operation. At the Main menu, the timeout is set for five minutes. For all other prompts, the system uses several different timeout values.

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
09/30/2008 21:57
Setup Menu
-----
A) Date and Time
B) MP/KP
C) Track Number
D) Alarm Limits
      .
      .
      .
```

- 2 To go to the Date and Time submenu, type **A**

A prompt like this appears.

```
Current date is: 09/30/2008
Enter new date:
```

Dates are in **mm/dd/yyyy** format, where **mm** is month, **dd** is day, and **yyyy** is year. You only type the last two digits of the year. The system automatically inserts the slashes and the first two digits of the year. For days, for months, or for the last two digits of years from 1 through 9, type leading zeros. Thus, for 8 April 2009, type **040809**.

If you want to keep the displayed date, press **[Enter]**. If you don't, type a new date.

- 3 Type a new date or 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]**.

The Setup menu reappears.

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
09/30/2008 21:57
Setup Menu
-----
A) Date and Time
B) MP/KP
C) Track Number
D) Alarm Limits
E) Equipment
      .
      .
      .
```

- 2 To go to the MP/KP submenu (aka Milepost 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, you can type either **Y** (yes) or **N** (no).

- 5 If the MP/KP is incorrect:

- a Type **N**

- 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
09/30/2008 21:57
Setup Menu
-----
A) Date and Time
B) MP/KP
C) Track Number
D) Alarm Limits
E) Equipment
      .
      .
      .
```

- 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, you can 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**

A prompt like this appears.

```
Is this a multi-track site (Y/N)?
```

At this point, you can 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**

A prompt like this appears.

```
Is this a multi-track site (Y/N)?
```

At this point, you can type either **Y** (yes) or **N** (no).

5 At this site, if you have only one track:

a Type **N**

The Setup menu reappears.

b Skip the remaining steps.

6 At this site, if you have two or more tracks, type **Y**

A prompt like this appears.

```
1 = NORTH
2 = SOUTH
3 = EAST
4 = WEST
5 = MIDDLE
6 = MAIN1
7 = MAIN2
8 = MAIN3
Enter number:
```

7 Type the digit that corresponds to the track designator you want.

If you typed a correct digit (that is, one from 1 through 8), the Setup menu reappears.

If you typed an incorrect character, 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.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 21:57
Setup Menu
-----
A) Date and Time
B) MP/KP
C) Track Number
D) Alarm Limits
E) Equipment
      .
      .
      .
```

- 2 To go to the Alarm Limits submenu (aka Alarm Settings submenu), type **D**

A menu and prompt like this appears.

```
Alarm Settings, MP/KP-1794.5, Track-Single
-----
A Absolute..... 180
B Differential..... 100
C Hot Wheel..... 600
D Carside Slope..... 1.31
E Carside Minimum... 47
F Cold Rails..... 5
G Cold Rail Temp.... 20

Alarm to change or Esc to quit?
```

This menu option allows you to change the various alarm limits that affect system operations. The current setting for each limit is displayed. To change one of the alarm limit settings, start by typing the letter corresponding to the desired option.

- 3 To leave the Alarm Limits submenu (aka Alarm Settings submenu) 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 Limits submenu (aka Alarm Settings submenu) is an offset in degrees Fahrenheit above 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..... 100
C Hot Wheel..... 600
D Carside Slope..... 1.31
E Carside Minimum... 47
F Cold Rails..... 5
G Cold Rail Temp.... 20

Alarm to change or Esc to quit?
```

- a** From the Alarm Limits submenu (aka Alarm Settings submenu), type **A**

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, type leading zeros.

- b** Enter the three-digit limit.

A prompt like this appears.

```
New Value ? 200
Is this correct ?
```

At this point, you can type either **Y** (yes) or **N** (no).

- c** If the new limit is incorrect, type **N** and return to step **b**.

- d** If the new limit is correct, type **Y**

If you enter zero or a value greater than 300, an error message and a prompt like this appears.

```
Minimum valid value is 1, Maximum valid value is 300
New Value ?
```

If you enter an acceptable value, the Alarm Limits submenu (aka Alarm Settings submenu) reappears.

- e** If you get an error message, return to step **b**.
f If you don't get an error message, return to step **3**.

5 To change the displayed **differential-alarm limit :**

The number after the word Differential on the Alarm Limits submenu (aka Alarm Settings submenu) is an offset in degrees Fahrenheit between rail1 and rail2. A bearing temperature is compared to the bearing temperature on the opposite end of the same axle. When the difference in temperatures exceeds the value on the screen, the system generates a Differential alarm.

```
Alarm Settings, MP/KP-1794.5, Track-Single
-----
A Absolute..... 180
B Differential..... 100
C Hot Wheel..... 600
D Carside Slope..... 1.31
E Carside Minimum... 47
F Cold Rails..... 5
G Cold Rail Temp.... 20

Alarm to change or Esc to quit?
```

a From the Alarm Limits submenu (aka Alarm Settings submenu), type **B**

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, type leading zeros.

b Enter the three-digit limit.

A prompt like this appears.

```
New Value ? 110
Is this correct ?
```

At this point, you can type either **Y** (yes) or **N** (no).

c If the new limit is incorrect, type **N and return to step **b**.**

d If the new limit is correct, type **Y**

If you enter zero or a value greater than 300, an error message and a prompt like this appears.

```
Minimum valid value is 1, Maximum valid value is 300
New Value ?
```

If you enter an acceptable value, the Alarm Limits submenu (aka Alarm Settings submenu) reappears.

e If you get an error message, return to step **b.**

f If you don't get an error message, return to step **3.**

6 To change the displayed **hotwheel-alarm limit:**

The number after the words Hot Wheel on the Alarm Limits submenu (aka Alarm Settings submenu) is an offset in degrees Fahrenheit above ambient temperature. When a wheel temperature exceeds this value, the system generates a Hotwheel alarm. However, when the Hotwheel option on the Equipment submenu is disabled, Hotwheel alarms aren't generated.

```
Alarm Settings, MP/KP-1794.5, Track-Single
```

```
-----  
A Absolute..... 180  
B Differential..... 100  
C Hot Wheel..... 600  
D Carside Slope..... 1.31  
E Carside Minimum... 47  
F Cold Rails..... 5  
G Cold Rail Temp.... 20
```

```
Alarm to change or Esc to quit?
```

a From the Alarm Limits submenu (aka Alarm Settings submenu), type **C**

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, type leading zeros.

b Enter the three-digit limit.

A prompt like this appears.

```
New Value ? 650  
Is this correct ?
```

At this point, you can type either **Y** (yes) or **N** (no).

c If the new limit is incorrect, type **N and return to step **b**.**

d If the new limit is correct, type **Y**

If you enter zero or a value greater than 900, an error message and a prompt like this appears.

```
Minimum valid value is 1, Maximum valid value is 900  
New Value ?
```

If you enter an acceptable value, the Alarm Limits submenu (aka Alarm Settings submenu) reappears.

e If you get an error message, return to step **b.**

f If you don't get an error message, return to step **3.**

7 To change the displayed **carside slope value:**

The number after the words Carside Slope on the Alarm Limits submenu (aka Alarm Settings submenu) is the slope value used when doing carside slope analysis.

Chapter 10 - Defect Detection describes the Carside Slope alarm process. In order for Carside Slope alarms to be processed, they must be enabled using the Carside Slope option on the Equipment submenu. The detection of Carside Slope alarms stops if 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..... 100  
C Hot Wheel..... 600  
D Carside Slope..... 1.31  
E Carside Minimum... 47  
F Cold Rails..... 5  
G Cold Rail Temp.... 20
```

```
Alarm to change or Esc to quit?
```

a From the Alarm Limits submenu (aka Alarm Settings submenu), type **D**

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 Enter the three-digit value.

A prompt like this appears.

```
New Value ? 1.40  
Is this correct ?
```

At this point, you can type either **Y** (yes) or **N** (no).

c If the new limit is incorrect, type **N and return to step **b**.**

d If the new value is correct, type **Y**

If you enter zero or a value greater than 2.55, an error message and a prompt like this appears.

```
Minimum valid value is 0.01, Maximum valid value is 2.55  
New Value ?
```

If you enter an acceptable value, the Alarm Limits submenu (aka Alarm Settings submenu) reappears.

- e If you get an error message, return to step b.
- f If you don't get an error message, return to step 3.

8 To change the displayed **carside minimum heat value:**

The number after the words Carside Minimum on the Alarm Limits submenu (aka Alarm Settings submenu) is a minimum offset (in degrees Fahrenheit) used when doing carside slope analysis. **Chapter 10 - Defect Detection** describes the Carside Slope alarm process.

```
Alarm Settings, MP/KP-1794.5, Track-Single
-----
A Absolute..... 180
B Differential..... 100
C Hot Wheel..... 600
D Carside Slope..... 1.31
E Carside Minimum... 47
F Cold Rails..... 5
G Cold Rail Temp.... 20

Alarm to change or Esc to quit?
```

- a** From the Alarm Limits submenu (aka Alarm Settings submenu), type **E**

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, type leading zeros.

- b** Enter the three-digit value.

A prompt like this appears.

```
New Value ? 255
Is this correct ?
```

At this point, you can type either **Y** (yes) or **N** (no).

- c** If the new limit is incorrect, type **N** and return to step b.
- d** If the new limit is correct, type **Y**

If you enter zero or a value greater than 300, an error message and a prompt like this appears.

```
Minimum valid value is 1, Maximum valid value is 300
New Value ?
```

If you enter an acceptable value, the Alarm Limits submenu (aka Alarm Settings submenu) reappears.

- e If you get an error message, return to step b.
- f If you don't get an error message, return to step 3.

9 To change the displayed number of **consecutive cold rails:**

The number after the words Cold Rails on the Alarm Limits submenu (aka Alarm Settings submenu) is the maximum number (per rai-side) of consecutive trains having:

- Cold Rail alarms needed to generate a Successive Cold Rails Exceeded alarm.
- 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.

```
Alarm Settings, MP/KP-1794.5, Track-Single
```

```
-----  
A Absolute..... 180  
B Differential..... 100  
C Hot Wheel..... 600  
D Carside Slope..... 1.31  
E Carside Minimum... 47  
F Cold Rails..... 5  
G Cold Rail Temp.... 20
```

```
Alarm to change or Esc to quit?
```

a From the Alarm Limits submenu (aka Alarm Settings submenu), type **F**

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, type leading zeros.

b Enter the three-digit number.

A prompt like this appears.

```
New Value ? 006  
Is this correct ?
```

At this point, you can type either **Y** (yes) or **N** (no).

c If the new limit is incorrect, type **N and return to step **b**.**

d If the new number is correct, type **Y**

If you enter zero or a value greater than 9, an error message and a prompt like this appears.

```
Minimum valid value is 1, Maximum valid value is 9  
New Value ?
```

If you enter an acceptable value, the Alarm Limits submenu (aka Alarm Settings submenu) reappears.

- e If you get an error message, return to step **b**.
- f If you don't get an error message, return to step **3**.

10 To change the displayed **cold rail temperature**:

The number after the words Cold Rail Temp 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 Rail alarm for the given rail. There is a different Cold Rail alarm for each rail. That is, there is a Cold North Rail alarm and a Cold South Rail alarm (or, depending on track direction, a Cold East Rail alarm and a Cold West Rail alarm).

```
Alarm Settings, MP/KP-1794.5, Track-Single
```

```
-----
A Absolute..... 180
B Differential..... 100
C Hot Wheel..... 600
D Carside Slope..... 1.31
E Carside Minimum... 47
F Cold Rails..... 5
G Cold Rail Temp.... 20
```

```
Alarm to change or Esc to quit?
```

- a From the Alarm Limits submenu (aka Alarm Settings submenu), type **G**
This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, type leading zeros.

- b Enter the three-digit number.
A prompt like this appears.

```
New Value ? 015
Is this correct ?
```

At this point, you can type either **Y** (yes) or **N** (no).

- c If the new limit is incorrect, type **N** and return to step **b**.
- d If the new number is correct, type **Y**

If you enter a number less than 10 or greater than 30, an error message and a prompt like this appears.

```
Minimum valid value is 10, Maximum valid value is 30
New Value ?
```

If you enter an acceptable number, the Alarm Limits submenu (aka Alarm Settings submenu) reappears.

- e If you get an error message, return to step **b**.
- f If you don't get an error message, return to step **3**.

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.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 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
      .
      .
      .
```

- 2 To go to the Equipment submenu, 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  Resistor Test..... Enabled
L  Short Train Warning..... YES
M  Gate Distance..... 24.0 inches
N  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 X0 $SB19200
  Modem Setup Line 5 = AT &W0

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 leave the Equipment submenu and return to the Setup menu:

- a Press **[Esc]**.

The Setup menu reappears.

- b Skip the remaining steps.

- 4 To change the current **dragger** (aka dragging-equipment) setting:

The Equipment submenu 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 will be 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
	.	
	:	
	.	

- a From the Equipment submenu, type **A**

The dragging-equipment setting toggles between active (YES) and inactive (NO). The Dragger option on the Equipment submenu changes. The Equipment submenu reappears.

If you want Dragging-Equipment alarm detection to occur, YES must appear after the word Dragger on the Equipment submenu.

- b Return to step 3.

5 To change the current **high-load** setting:

The Equipment submenu shows whether High-Load alarm detection is active (YES) or inactive (NO). To announce High-Load alarms, YES must appear after the words High Load on the Equipment submenu and Separate must appear after the words Clearance Mode on the Equipment submenu. To announce High-Wide alarms, YES must appear after the words High Load on the Equipment submenu and Multiplexed must appear after the words Clearance Mode on the Equipment submenu.

Equipment, MP/KP-1794.5, Track-Single	

A	Dragger..... YES
B	High Load..... NO
C	Wide Load..... NO
	·
	·
	·

a From the Equipment submenu, type **B**

The high-load setting toggles between active (YES) and inactive (NO). The High-Load option on the Equipment submenu changes.

The Equipment submenu reappears.

b Return to step **3**.

6 To change the current **wide-load** setting:

The Equipment submenu 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 submenu, type **C**

The wide-load setting toggles between active (YES) and inactive (NO). The Wide-Load option on the Equipment submenu changes.

The Equipment submenu reappears.

b Return to step **3**.

7 To change the current **carside-slope setting:**

The Equipment submenu shows whether Carside Slope 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
E	Hot Wheel.....	NO
	.	
	:	
	.	

a From the Equipment submenu, type **D**

The carside-slope setting toggles between active (YES) and inactive (NO). The Carside Slope option on the Equipment submenu changes.

The Equipment submenu reappears.

b Return to step 3.

8 To change the current **hotwheel setting:**

The Equipment submenu 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 will be announced and stored. Since they are stored, they can be printed.

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
	.	
	:	
	.	

a From the Equipment submenu, type **E**

The hotwheel setting toggles between active (YES) and inactive (NO). The Hotwheel option on the Equipment submenu changes.

The Equipment submenu reappears.

b Return to step 3.

9 To change the current **clearance-type** setting:

The Equipment submenu shows whether clearance type is 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.

```
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
      .
      .
      .
```

a From the Equipment submenu, type **F**

The clearance-type setting toggles between trip wire and light beam. The Clearance Type option on the Equipment submenu changes.

The Equipment submenu reappears.

b Return to step **3**.

10 To change the current **clearance-mode** setting:

The Equipment submenu shows whether clearance mode is separate or multiplexed. This option is only used for high-load detectors and wide-load detectors. When 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 set to multiplexed, the alarms coming from the high-load detectors and wide-load detectors are announced as High-Wide alarms.

```
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
      .
      .
      .
```

- a** From the Equipment submenu, type **G**

The clearance-mode setting toggles between separate and multiplexed. The Clearance Mode option on the Equipment submenu changes.

The Equipment submenu reappears.

- b** Return to step 3.

11 To change the current **winter-cycle** setting:

The Equipment submenu 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 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 by four minutes every 10 minutes. 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 submenu, type **H**

The winter-cycle setting toggles between enabled (YES) and disabled (NO). The Winter Cycle option on the Equipment submenu changes.

The Equipment submenu reappears.

- b** Return to step 3.

12 To change the current **transducer-gain** setting:

The Equipment submenu 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.....	NO
	:	
	:	
	:	

- a** From the Equipment submenu, type **I**

The transducer-gain setting toggles between normal and high. The Transducer Gain option on the Equipment submenu changes. The Equipment submenu reappears.

- b** Return to step **3**.

13 To change the current **AEI** setting:

The Equipment submenu indicates 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.....	NO
K	Resistor Test.....	Enabled
	:	
	:	
	:	

- a** From the Equipment submenu, type **J**

The AEI setting toggles between enabled (YES) and disabled (NO). The AEI option on the Equipment submenu changes.

The Equipment submenu reappears.

- b** Return to step **3**.

14 To change the current **resistor-test** setting:

The Equipment submenu 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.

	.
	.
	.
J	AEI..... NO
K	Resistor Test..... Enabled
L	Short Train Warning YES
	.
	.
	.

a From the Equipment submenu, type **K**

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 submenu changes. The Equipment submenu reappears.

b If the resistor-test mode isn't correct, return to step **a**.

c If the resistor-test mode is correct, return to step **3**.

15 To change the current **short-train** setting:

The Equipment submenu shows whether Short Train alarm detection is active (YES) or inactive (NO). The Short Train alarm indicates that a train had fewer than 50 axles.

	.
	.
	.
K	Resistor Test..... Enabled
L	Short Train Warning YES
M	Gate Distance..... 24.0 inches
	.
	.
	.

- a** From the Equipment submenu, type **L**

The short-train setting toggles between active (YES) and inactive (NO). The Short Train option on the Equipment submenu changes.

The Equipment submenu reappears.

- b** Return to step **3**.

16 To change the current value for **gate distance** (aka gate width):

The Equipment submenu shows the number of inches between the centers of the gating transducers.

```
      .
      .
      .

L  Short Train Warning .... YES
M  Gate Distance..... 24.0 inches
N  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 X0 $SB19200
   Modem Setup Line 5 = AT &W0

Equipment to change or Esc to quit ?
```

- a** From the Equipment submenu, type **M**

This prompt appears.

```
Gate Distance:
```

The format for gate width (aka gate distance) is **nn.n**. If the new value has less than three digits, type leading zeros, trailing zeros, or both. Thus, for 2, type **020**. The system inserts the decimal point for you. The gate width (it is usually 24.0) can be recorded in 1/10-inch increments to reflect the actual transducer spacing. Accurate gating-transducer spacing results in accurate speed calculations.

- b** Enter the three-digit number.

The Gate Distance option on the Equipment submenu changes. The Equipment submenu reappears.

- c** Return to step **3**.

17 To change the **modem-configuration data:**

The Equipment submenu shows the current modem configuration. Support exists in the firmware for two modem types. The "default" modem type provides a preset series of modem configuration commands. These commands cannot be altered. The "alternate" modem type provides the ability to edit and customize the modem setup commands. This submenu also provides a method for forcing the initialization of the modem.

```
      .
      .
      .

M  Gate Distance..... 24.0 inches
N  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 X0 $SB19200
Modem Setup Line 5 = AT &W0

Equipment to change or Esc to quit ?
```

a From the Equipment submenu, type **N**

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-selection setting toggles between default and alternate.

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 submenu and on the System Status report, lines that have been cleared of data this way will be 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 submenu reappears.
- j** If you don't want to initialize the modem now, type **N**
The Equipment submenu reappears.
- k** Return to step **3**.

11.2.6 Messages

To set or change any of the messages parameters:

- 1** Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 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
      .
      .
      .
```

2 To go to the Messages submenu, type **F**

A menu and prompt like this appears.

Messages, MP/KP-1794.5, Track-Single		

A	Axles.....	NO
B	Speed.....	NO
C	Temperature.....	NO
D	Length.....	NO
E	Slow.....	NO
F	Power Off.....	NO
G	Repeat No Defects....	YES
H	Cars Count	NO
I	Customer Name.....	YES
J	Arrival Message.....	NO
K	Lft/Rt Alarm Ref.....	NO
L	Car ID With Alarm....	NO
M	Request EOT Timer....	5
N	Rebroad DTMF Code....	001
O	Announce Cold Rail...	YES
P	Integrity Failure.....	NO
Q	No Defects.....	NO
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 submenu aren't used to generate ancillary messages.

3 To leave the Messages submenu and return to the Setup menu:

a Press **[Esc]**.

The Setup menu reappears.

b Skip the remaining steps.

4 To change the **announce-axles setting:**

The Messages submenu shows whether the total axle count is to be announced (YES) or not announced (NO). When the Highrange Transducer Miscounts alarm or the Very Slow Train alarm occurs, the system won't announce axle count, even when this option is enabled. Typing **A** toggles between what is shown and its opposite.

Messages, MP/KP-1794.5, Track-Single		

A	Axles.....	YES
B	Speed.....	NO
C	Temperature.....	NO
	.	
	:	
	.	

a From the Messages submenu, type **A**

The announce-axles setting toggles between announce (YES) or not announce (NO). The Announce Axles option on the Messages submenu changes. The Messages submenu reappears.

b Return to step 3.

5 To change the **announce-speed setting:**

The Messages submenu shows whether the exit speed of the train is to be announced (YES) or not announced (NO). Typing **B** toggles between what is shown and its opposite.

Messages, MP/KP-1794.5, Track-Single		

A	Axles.....	YES
B	Speed.....	NO
C	Temperature.....	NO
	.	
	:	
	.	

a From the Messages submenu, type **B**

The announce-speed setting toggles between announce (YES) or not announce (NO). The Announce Speed option on the Messages submenu changes. The Messages submenu reappears.

b Return to step 3.

6 To change the **announce-temperature setting:**

The Messages submenu shows whether the ambient temperature (taken at the site by the shielded temperature probe as the train leaves the site) is to be announced (YES) or not announced (NO). Typing **C** toggles between what is shown and its opposite.

Messages, MP/KP-1794.5, Track-Single		

A	Axles.....	NO
B	Speed.....	NO
C	Temperature.....	NO
D	Length.....	NO
	.	
	:	
	.	

a From the Messages submenu, type **C**

The announce-temperature setting toggles between announce (YES) or not announce (NO). The Announce Temperature option on the Messages submenu changes. The Messages submenu reappears.

b Return to step 3.

7 To change the **announce-train-length setting:**

The Messages submenu shows whether the train length is to be announced (YES) or not announced (NO). 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.

Messages, MP/KP-1794.5, Track-Single		

A	Axles.....	NO
B	Speed.....	NO
C	Temperature.....	NO
D	Length.....	NO
E	Slow.....	NO
	.	
	:	
	.	

a From the Messages submenu, type **D**

The announce-train-length setting toggles between announce (YES) or not announce (NO). The Announce Train Length option on the Messages submenu changes. The Messages submenu reappears.

b Return to step 3.

8 To change the **announce-slow-trains setting:**

The Messages submenu shows whether a message indicating a very slow train (one going 7 mph or slower) is to be announced (YES) or not announced (NO). Typing **E** toggles between what is shown and its opposite.

Messages, MP/KP-1794.5, Track-Single		

A	Axles.....	NO
B	Speed.....	NO
C	Temperature.....	NO
D	Length.....	NO
E	Slow.....	NO
F	Power Off.....	NO
:		
:		
:		

a From the Messages submenu, type **E**

The announce-slow-trains setting toggles between announce (YES) or not announce (NO). The Announce Slow Trains option on the Messages submenu changes. The Messages submenu reappears.

b Return to step 3.

9 To change the **announce-power-off setting:**

The Messages submenu shows whether the power-off message is to be announced (YES) or not announced (NO). 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. 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.

Messages, MP/KP-1794.5, Track-Single		

A	Axles.....	NO
B	Speed.....	NO
C	Temperature.....	NO
D	Length.....	NO
E	Slow.....	NO
F	Power Off.....	NO
G	Repeat No Defects....	YES
:		
:		
:		

a From the Messages submenu, type **F**

The announce-power-off setting toggles between enabled (YES) and disabled (NO). The Announce Power Off option on the Messages submenu changes. The Messages submenu reappears.

b Return to step 3.

10 To change the **repeat-no-defects-message setting:**

The Messages submenu shows whether the no-defects message is to be repeated (YES) or not repeated (NO). Typing **G** toggles between what is shown and its opposite.

		.
		:
		.
F	Power Off.....	NO
G	Repeat No Defects....	YES
H	Cars Count	NO
		.
		:
		.

- a** From the Messages submenu, type **G**

The repeat-no-defect-message setting toggles between enabled (YES) and disabled (NO). The Repeat No Defects option on the Messages submenu changes. The Messages submenu reappears.

- b** Return to step **3**.

11 To change the **announce-number-of-cars setting:**

The Messages submenu shows whether the number of cars is to be announced (Y) or not announced (N). Typing **H** toggles between what is shown and its opposite.

		.
		:
		.
G	Repeat No Defects....	YES
H	Cars Count	NO
I	Customer Name.....	YES
		.
		:
		.

- a** From the Messages submenu, type **H**

The announce-number-of-cars setting toggles between enabled (YES) and disabled (NO). The Announce Number of Cars option on the Messages submenu changes. The Messages submenu reappears.

- b** Return to step **3**.

12 To change the **announce-customer-name** setting:

The Messages submenu shows whether the customer's railroad name is to be announced (YES) or not announced (NO). Typing **I** toggles between what is shown and its opposite.

		:
		:
		:
H	Cars Count	NO
I	Customer Name.....	YES
J	Arrival Message.....	NO
		:
		:
		:

a From the Messages submenu, type **I**

The announce-customer-name setting toggles between enabled (YES) and disabled (NO). The Announce Customer Name option on the Messages submenu changes. The Messages submenu reappears.

b Return to step **3**.

13 To change the **announce-arrival-message** setting:

The Messages submenu shows whether the train-arrival message is to be announced (YES) or not announced (NO). Typing **J** toggles between what is shown and its opposite.

		:
		:
		:
I	Customer Name.....	YES
J	Arrival Message.....	NO
K	Lft/Rt Alarm Ref.....	NO
		:
		:
		:

a From the Messages submenu, type **J**

The announce-arrival-message setting toggles between announce (YES) or not announce (NO). The Announce Train Arrival option on the Messages submenu changes. The Messages submenu reappears.

b Return to step **3**.

14 To change the **left-right-alarm-reference** setting:

The Messages submenu shows whether the alarm reference is announced as left or right (YES) or north, south, east, or west (NO).

		.
		:
		.
J	Arrival Message.....	NO
K	Lft/Rt Alarm Ref.....	NO
L	Car ID With Alarm....	NO
		.
		:
		.

- a** From the Messages submenu, type **K**

The left-right-alarm-reference setting toggles between YES and NO. The Announce Left-Right Alarm Reference option on the Messages submenu changes. The Messages submenu reappears.

- b** Return to step **3**.

15 To change the **announce-car-identification** setting:

The Messages submenu shows whether the car-identification message is to be announced (YES) or not announced (NO). When this option is set to YES and an alarm is found on a car, the AEI car identification will be included in the post-train announcement of that alarm. Typing **L** toggles between what is shown and its opposite.

		.
		:
		.
K	Lft/Rt Alarm Ref.....	NO
L	Car ID With Alarm....	NO
M	Request EOT Timer....	5
		.
		:
		.

- a** From the Messages submenu, type **L**

The announce-car-identification setting toggles between enabled (YES) and disabled (NO). The Announce Car Identification option of the Messages submenu changes. The Messages submenu reappears.

- b** Return to step **3**.

16 To change the **repeat-EOT-message-timeout-period** setting:

The Messages submenu 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.

	:	
	:	
	:	
L	Car ID With Alarm....	NO
M	Request EOT Timer....	5
N	Rebroad DTMF Code....	001
	:	
	:	
	:	

a From the Messages submenu, type **M**

This prompt appears.

```
Request EOT Timer:
```

If the new limit has less than three digits, type leading zeros.

b Enter the three-digit value.

If you enter 000, the last EOT message is always available for rebroadcast. If you enter 240, the train crew has four hours (that is, 240 minutes) to request a repeat of the last EOT message.

If you enter a value greater than 240, an error message and a prompt like this appears.

```
Value must be less than 241 minutes.  
Request EOT Timer:
```

If you enter an acceptable value, the Repeat Timeout Period option on the Messages submenu changes and the Messages submenu reappears.

- c** If you get an error message, return to step **b**.
- d** If you don't get an error message, return to step **3**.

17 To change the **rebroadcast-DTMF-code setting:**

The Messages submenu shows the rebroadcast-DTMF-code setting. The stored DTMF code is the touchtone digits that trigger a rebroadcast. Up to three digits may be entered into this setup parameter. The SmartScanNG system monitors radio traffic. When it receives the proper DTMF code, it will rebroadcast the last end-of-train message, provided the request EOT timer hasn't expired.

```
      :  
      :  
      :  
M Request EOT Timer.... 5  
N Rebroad DTMF Code.... 001  
O Announce Cold Rail... YES  
      :  
      :  
      :
```

- a** From the Messages submenu, type **N**

This prompt appears.

```
Rebroadcast DTMF Code: 456
```

- b** Type the new DTMF code or press **[Esc]**.

- c** If you typed one or two digits, press **[ENTER]**.

The Messages submenu reappears. If you typed only nondigits and then pressed **[ENTER]**, the rebroadcast function would be turned off.

- d** Return to step **3**.

18 To change the **announce-cold-rail setting:**

The Messages submenu shows whether an Integrity Failure message is to be announced when the cold-rail criteria was met (YES) or not announced (NO). Typing **O** toggles between what is shown and its opposite.

```
      :  
      :  
      :  
N Rebroad DTMF Code.... 001  
O Announce Cold Rail... YES  
P Integrity Failure..... NO  
      :  
      :  
      :
```

- a** From the Messages submenu, type **O**

The announce-cold-rail setting toggles between announce (YES) or not announce (NO). The Announce Cold Rail option on the Messages submenu changes. The Messages submenu reappears.

- b** Return to step **3**.

19 To change the **integrity-failure** setting:

The Messages submenu shows whether "Integrity Failure" is to be announced (YES) or not announced (NO).

If the Announce Integrity Failure option is disabled when no Exception Alarms are detected but an Integrity Failure is detected, nothing is announced. If enabled when no Exception Alarms are detected but an Integrity Failure is detected, Integrity Failure is announced.

If the Announce Integrity Failure option is disabled when one or more alarm conditions and an Integrity Failure are detected, only the alarm conditions are announced. If enabled when one or more alarm conditions and an Integrity Failure are detected, both are announced.

Typing **P** toggles between what is shown and its opposite.

		.
		:
		.
N	Rebroadcast DTMF Code....	001
O	Announce Cold Rail...	YES
P	Integrity Failure.....	NO
Q	No Defects.....	NO
		.
		:
		.

a From the Messages submenu, type **P**

The announce-integrity-failure setting toggles between announce (YES) or not announce (NO). The Announce Integrity Failure option on the Messages submenu changes. The Messages submenu reappears.

b To leave the Messages submenu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

20 To change the **no-defect-message** setting:

The Messages submenu shows whether "No Defects" is to be announced (YES) or not announced (NO).

When neither an Exception Alarm nor a System Alarm is detected and the Announce No Defects option is enabled, the no-defect message is announced. The no-defect message is the wording "no defects."

Typing **Q** toggles between what is shown and its opposite.

	:
	:
	:
O	Announce Cold Rail... YES
P	Integrity Failure.... NO
Q	No Defects..... NO
Message to change or Esc to quit ?	

a From the Messages submenu, type **Q**

The announce-no-defect-message setting toggles between announce (YES) or not announce (NO). The Announce No Defects option on the Messages submenu changes. The Messages submenu reappears.

The Setup menu reappears.

b To leave the Messages submenu and 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 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
I) Serial Password
J) COM1 Tx 19200 / Rx 19200 N-8-1
K) COM2 Tx 19200 / Rx 19200 N-8-1
L) COM3 Tx 19200 / Rx 19200 N-8-1
M) COM4 Tx 19200 / Rx 19200 N-8-1
X) Exit
?
```

- 2 To display the AEI Reader Parameters menu, type **G**

A prompt like this appears.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 22:47
AEI Reader Parameters Menu
-----
A) ID Separation..... 2 IDs
B) Consecutive Reads..... 2 Reads
C) Decode As ASCII Tags.... Enabled
D) AEI Reader Interface.....
X) Exit
?
```

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 AAR 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, type **X**

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

The Load Default Setup Parameters option on the Setup menu is included to assist installers in setting up a new system. When this menu item is selected, the parameters listed below are assigned to the values listed below. A "yes" after a parameter means that it is "enabled." A "no" means that it is "disabled." The blanks after "Rebroad DTMF Code" mean that it is disabled.

<u>Alarms:</u>		<u>Equipment:</u>		<u>Messages:</u>	
Absolute	180	AEI	No	Arrival Message	No
Carside Minimum	155	Carside Slope	No	Axles	Yes
Carside Slope	1.60	Clearance Mode	Multiplexed	Car ID With Alarm	No
Cold Rail Temp	10	Clearance Type	Trip Wire	Cars Count	No
Cold Rails	1	Dragger	Yes	Cold Rail	Yes
Differential	130	Gate Distance	24.0	Customer Name	Yes
Hotwheel	650	High Load	No	Integrity Failure	Yes
		Hotwheel	No	Length	No
		Resistor Test	Enabled	Lft/Rt Alarm Ref	No
		Selected Modem	Default	No Defects	Yes
		Short Train Warning	No	Power Off	Yes
		Transducer Gain	Normal	Rebroad DTMF Code	
		Wide Load	No	Repeat No Defects	Yes
		Winter Cycle	No	Request EOT Timer	10
				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) Serial Password
J) COM1 Tx 19200 / Rx 19200 N-8-1
K) COM2 Tx 19200 / Rx 19200 N-8-1
L) COM3 Tx 19200 / Rx 19200 N-8-1
M) COM4 Tx 19200 / Rx 19200 N-8-1
X) Exit
?

- 2 Type H

This prompt appears.

Load Default Setup Parameters?

11.2.9 Setup Password

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.

·
·
·
H) Load Default Setup Parameters
I) Serial Password
J) COM1 Tx 19200 / Rx 19200 N-8-1
K) COM2 Tx 19200 / Rx 19200 N-8-1
L) COM3 Tx 19200 / Rx 19200 N-8-1
M) COM4 Tx 19200 / Rx 19200 N-8-1
X) Exit
?

- 2 To go to the Change Passwords submenu, type **I**

A prompt like this appears.

Enter System 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, abc#123 isn't the same as ABC#123.

- 3 Type the password.
- 4 If the password is less than 11 characters, press **[Enter]**.

The Setup menu reappears.

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 about two seconds. When finished, the Setup menu reappears.

b Return to step 1.

11.2.10 COM1

To change the parameters for serial port COM1:

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
I) Serial Password
J) COM1 Tx 19200 / Rx 19200 N-8-1
K) COM2 Tx 19200 / Rx 19200 N-8-1
L) COM3 Tx 19200 / Rx 19200 N-8-1
M) COM4 Tx 19200 / Rx 19200 N-8-1
X) Exit
?
```

- 2 To go to the COM1 submenu, type **I**

The COM1 submenu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 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.

11.2.11 COM2

To change the parameters for serial port COM2:

- 1 Be sure that the Setup menu is displayed.
- 2 To go to the COM2 submenu, type **J**
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.

11.2.12 COM3

To change the parameters for serial port COM3:

- 1 Be sure that the Setup menu is displayed.
- 2 To go to the COM3 submenu, type **K**
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.

11.2.13 COM4

To change the parameters for serial port COM4:

1 Be sure that the Setup menu is displayed.

2 To go to the COM4 submenu, type **L**

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.

11.3 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
09/30/2008 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
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
09/30/2008 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
?
```

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 is used to broadcast a short message through the speaker (on top of the SmartScanNG enclosure) and through the radio.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
04/16/2008 21:57
System Functions Menu
-----
```

```
A) Radio Test
B) Vocabulary Test
C) Ramp Function
D) Radio Inhibit
E) Manual Test Mode
```

```
•
•
•
```

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**

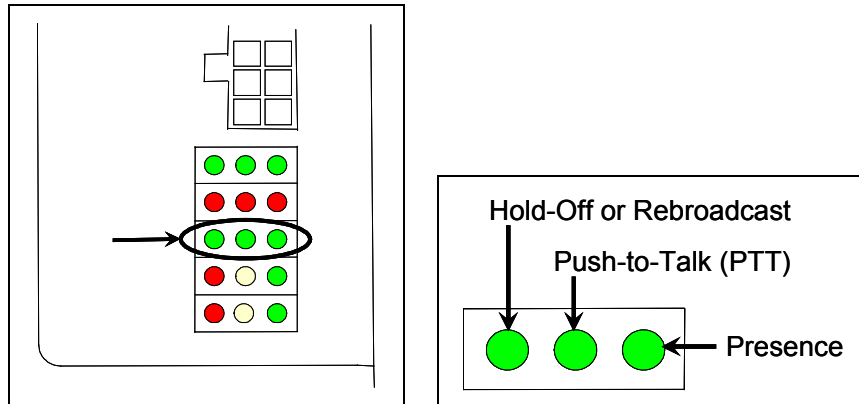
This message appears.

```
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 redisplay 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 submenu of 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 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.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
04/16/2008 21:57
System Functions Menu
-----
A) Radio Test
B) Vocabulary Test
C) Ramp Function
D) Radio Inhibit
E) Manual Test Mode
.
.
.
```

- 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 is used to generate a test train. It simulates two Absolute alarms, two Differential alarms, two Carside Slope alarms, and two Hotwheel alarms. It simulates the Carside and Hotwheel alarms even if detection for those alarms is disabled in the Equipment setup. However, disabled alarms don't appear on the Last Test Train report.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
04/16/2008 21:57
System Functions Menu
-----
A) Radio Test
B) Vocabulary Test
C) Ramp Function
D) Radio Inhibit
E) Manual Test Mode
      .
      .
      .
```

- 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.** 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 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**.

- 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 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.

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 not 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 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.

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.

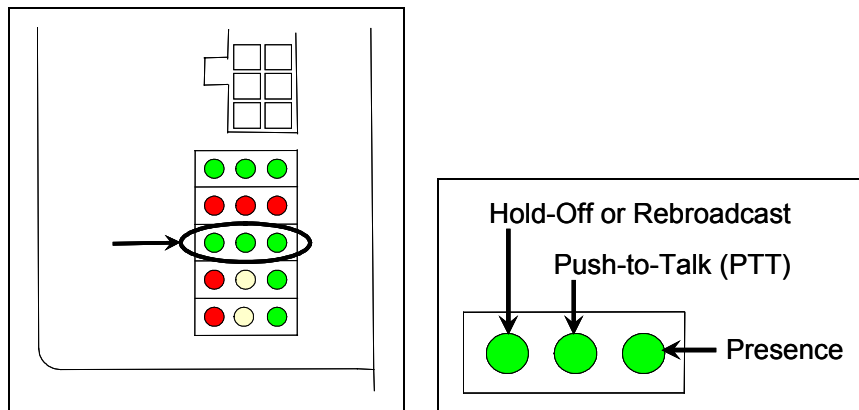
Starting 1kHz Test Tone

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 redisplay 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 submenu of 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. 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 interface 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.
- 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. Typing **H** 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 feature 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 feature allows you to erase all of the stored train data. This encompasses all of the data on the trains in the Trains, Exceptions, and Test Train (aka Ramp Train) directories. After deleting all train data, there isn't any way of regenerating it. The data is gone forever.

- 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**.

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.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 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
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 multitrack sites, attach a serial cable from COM5 of system1 to COM1 of system2, a serial cable from COM5 of system2 to COM1 of system3, and so on.
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.

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.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 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
L) System Functions
M) Event Log
X) Exit
?
```

- 2 To enter pass-through mode, type **K**

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, to display the Main menu for system2, press **[Esc]**.

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

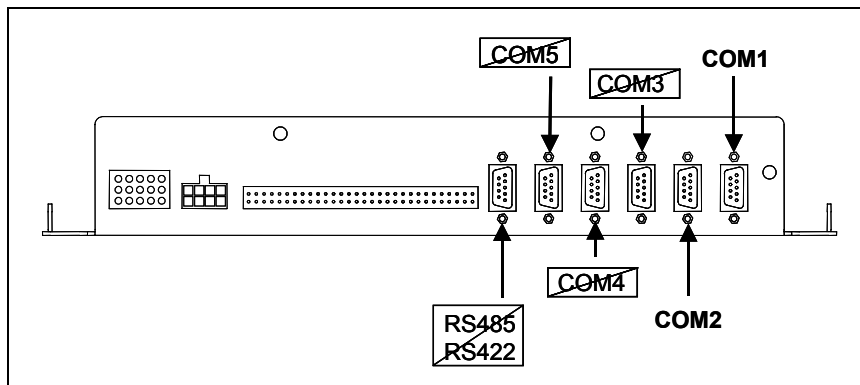
Producing Reports

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. If your site doesn't have telephone service, you cannot communicate with the system remotely (that is, **off-site**).

- 1 If **on-site**, plug your computer into COM1 or COM2.



- 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]**.

The Main menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 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
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**.

8 When done, close the LOG file.

9 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 submenu 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. 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 submenu is disabled, the hotwheel information is hid. When the report is run, if the AEI option is disabled, the tag information isn't hid.) 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 SUMMARY													
=====													
Version Info.... Analyzer: DM1.11-A 01/24/07 MP/KP: 1234.5													
Communicator: DM2.22-A 01/24/07 Track: Single													
Alarm Limits.. Absolute: 180 Carside Slope..... 1.31													
Differential: 120 Minimum... 100													
Cool Wheel Temp... 20													

Train# Date Time Cars Axles TO1 TO2 Tags AEI Speed i D Rail Average Amb Bat													

178	09/22/08	15:47	18	78	78	78	0	53	W	56	21	+77F	14.0v
177 A	09/21/08	08:32	20	86	86	86	0	56	E	36	37	+68F	14.0v
176 I	09/21/08	07:40	10	46	46	46	0	57	E	43	7	+66F	14.0v
175 B	09/21/08	06:28	14	62	62	62	0	57	E	36	37	+60F	13.8v
174	09/20/08	11:33	18	78	78	78	0	53	W	55	55	+73F	14.0v
173	CHECKSUM ERROR: StartAddr	134879	EndAddr	134930									
172	09/20/08	01:19	18	78	78	78	0	55	E	58	20	+59F	14.0v
171	09/19/08	11:24	53	218	218	218	0	49	E	54	18	+72F	14.0v
170 I	09/19/08	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 submenu is enabled. The contents of your report will be different.

<div><div>•</div><div>•</div><div>•</div></div>															
Alarm Limits..		Absolute: 180				Carside Slope... 1.60									
		Differential: 130				Minimum... 300									
		Hot Wheel: 652				Cold Rail Temp... 10									

								D Rail		Wheel					
								AEI Speed i Average		Average		Amb			
Train#	Date	Time	Cars	Axles	T01	T02	Tags	(MPH)	r	East	West	East	West	Temp	Bat

<div><div>•</div><div>•</div><div>•</div></div>															
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
Version Info	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).
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 (aka Milepost submenu).
Track	The track designator of the site. For single-track sites, valid value is Single. For multitrack 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.
Alarm Limits	<p>The alarm parameters currently defined in the system setup. These values were in place at the time this report was run.</p> <ul style="list-style-type: none"> The value after Absolute is set by the Absolute option on the Alarm Limits submenu (aka Alarm Settings submenu). The value after Differential is set by the Differential option on the Alarm Limits submenu. The heading Hot Wheel only appears when the Hotwheel option on the Equipment submenu is <u>enabled</u>. The value after Hot Wheel is set by the Hotwheel option on the Alarm Limits submenu. The value after Carside Slope is set by the Carside Slope option on the Alarm Limits submenu. The value after Minimum is set by the Carside Minimum option on the Alarm Limits submenu. The value after Cool Wheel Temp is set by the Cold Rail Temperature option on the Alarm Limits submenu. <p>Chapter 11 - Serial Interface tells how to set these values.</p>

The table below lists the fields from the detail section and the contents of each field.

Heading	Contents of Field
Train#	The number that identifies the train in the Trains directory.
	There is one unlabeled column between those labeled "Train#" and "Date." This column can contain A , B , I , S , or nothing. If "A," an Exception Alarm was detected on the train. If "I," an Integrity Failure was detected. If "B," both an Exception Alarm and an Integrity Failure were detected. If "S," a System Alarm was detected, but Exception Alarms and Integrity Failures weren't. If blank, no Exception Alarm, Integrity Failure, or System Alarm was detected.
Date	The date the train arrived at the site. Date is in mm/dd/yy format, where mm is month, dd is day, and yy is year. Chapter 11 - Serial Interface tells how to change this value using the Date and Time submenu.
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 this value using the Date and Time submenu.
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 <u>closest</u> 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 <u>farthest</u> 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 submenu.
Speed (mph)	The train's exit speed in miles per hour.
Dir	The direction the train was traveling. Valid values are N, S, E, and W.
Rail 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 submenu is enabled.
Amb Temp	The ambient temperature, in degrees Fahrenheit, at the time the train passed the site.
Bat	The system battery voltage at the time the train passed 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
09/30/2008 21:57
Main Menu
-----
```

```
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
```

```

.
.
.
```

- 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 submenu. Hotwheel alarm reporting is enabled/disabled using the Hotwheel option on the Equipment submenu. The AEI subsystem is enabled/disabled using the AEI option on the Equipment submenu.

Where wheel scanners are properly installed, wheel temperatures are always recorded, even if the Hotwheel option is disabled. On the other hand, if the AEI option is disabled 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 at the time 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 Hotwheel option were disabled at the time 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.

```

Southern Technologies Corporation
Next Generation Detector System
TRAIN DETAIL
=====
Train#: 321           Speed: 57MPH           MP/KP: 1111.1
Date: 09/16/08       Axles: 86           Track: Single
Time: 08:41          Direction: East      Temperature: + 71F
Length: 1776         Shutters Open: 32   Battery: 13.4v
=====
Resistor
Rail  Max  Avg  Read  Req  Txdr Counts  Alarm  Limit  Carside Parm
-----
North 289  24  300  81I  TO1 132  Absolute  180  Slope: 1.60
South 0    0   104  81I  TO2 132  Differential 130 Minimum: 75
Hot Wheel 652
Resistor Test Mode: Enabled Cold Rail Temp 10
=====
Firmware Versions
-----
Analyzer: DM1.11-A 01/24/07 Comm: DM2.22-A 01/24/07
-----
System Alarms
-----
Cold North Resistor
Cold South Resistor

Axle Alarm Summary
-----
46 South Rail Absolute
77 South Rail Differential
143 North Rail Absolute
143 South Rail Absolute
144 North Rail Absolute

-----
Car  Axle  Trk  North  South  ON  OFF  PW1 PW2  Alarms
-----
1    1    0    56    21    25  0    6    6
    2    0    57    21    25  59    6    6
    3    0    56    21    25  59    8    8
    4    1    56    21    25  362   5    5
    5    1    56    21    25  59    6    6
    6    1    56    21    25  59    6    6
Carside Ave: North 56 South 21 Carside Alarms: North 184 South 204

2    7    2    56    20    25  162   6    6
    8    2    56    21    25  59    6    6
    .
    .
    .

143  66   186   181   25   59    6    6 North Rail Absolute
    66   183   170   25  641    6    6 South Rail Absolute
144  66   183   170   25  641    6    6 North Rail Absolute
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 submenu were enabled at the time the report was requested. The Carside Slope option on the Equipment submenu was disabled. Also, both the AEI and Hotwheel options 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.

```

Southern Technologies Corporation
Next Generation Detector System
TRAIN DETAIL
=====
Train#: 321           Speed: 57MPH           MP/KP: 1111.1
Date: 09/16/08       Axles: 86           Track: Single
Time: 08:41          Direction: North       Temperature: + 71F
Length: 1776         Shuttters Open: 32       Battery: 13.4v
=====

Resistor
Rail  Max  Avg  Read  Req  Txdr Counts  Alarm  Limit  Carside Parm
-----
East  289  24   300   81I  TO1 132     Absolute  180     Slope: 1.60
West   0   0   104   81I  TO2 132     Differential 130   Minimum: 75
                                Hot Wheel  652
Resistor Test Mode: Enabled      Cold Rail Temp  10

Resistor
Wheel Max  Avg  Read  Req
-----
East  200  196   3   68I
West   10   6   2   68I
=====
AEI System Data

Tags Read          Tags Stored: 30
-----
Antenna 0: 30
Antenna 1: 0
=====
Firmware Versions
-----
Analyzer: DM1.11-A 01/24/07  Comm: DM2.22-A 01/24/07
-----

System Alarms
-----
Successive Cold Wheel Resistors Exceeded
Integrity Failure
Cold North Wheel Scanner Resistor

Axle Alarm Summary
-----
97 North Hot Wheel
98 South Hot Wheel

.
.
.

-----
Rail      Wheel
Car Axle East  West  East  West  ON  OFF PW1 PW2  Alarms
-----
.
.
.

```

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 doesn'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
=====
.
.
.
-----
Car  Axle  Trk  North  South  ON  OFF  PW1  PW2  Alarms
-----
1      1    0   56    21   25   0    6    6
      2    0   57    21   25   59    6    6
      3    0   56    21   25   59    8    8
      4      CHECKSUM ERROR: StartAddr 136416 EndAddr 136427
      5    1   56    21   25   59    6    6
      6    1   56    21   25   59    6    6

2      7    2   56    20   25  162    6    6
      8    2   56    21   25   59    6    6

.
.
.
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 mm/dd/yy format, where mm is month, dd is day, and yy is year. Chapter 11 - Serial Interface tells how to change this value using the Date and Time submenu.
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 this value using the Date and Time submenu.
Length	The length of train in feet.
Speed	The train's exit speed in miles per hour.
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.
Track	The track designator of the site. For single-track sites, valid value is Single. For multitrack 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.
Temperature	The ambient temperature at the time the train arrived at the site. Temperature is in degrees Fahrenheit.
Battery	The system battery voltage at the time the train passed the site.
Rail	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 (at the time 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).
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 (at the time 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.

Heading	Contents of Field
Resistor Req	The resistor temperature, in degrees Fahrenheit, required by the bearing scanner on a given raiiside to avoid a Cold Resistor alarm. This value was calculated using the amount of time the shutters were open and the Resistor Test Mode option in effect at the time the train exits the site. If the Resistor Test Mode option is <u>disabled</u> , a zero appears in this field.
	<p>One of five uppercase letters follows the Resistor Req temperature.</p> <p>B The baseline resistor integrity test method was used for this train.</p> <p>D The resistor integrity test (that is, the Resistor Test Mode option) was disabled by the user.</p> <p>I The interim resistor integrity test method was used for this train.</p> <p>T For this train, the shutters were open for less than 30 seconds.</p> <p>V For this train, the battery voltage (measured with the shutters open) was less than 13 volts.</p> <p>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.</p>
Txdr Counts	The gating transducer designator (either TO1 or TO2) followed by the total number of hits on that transducer.
Alarm Limit	<p>The Hotwheel alarm level; the Hotbox alarm levels for Absolute and Differential; and the Cold Rail Temperature offset. These values were in place at the time the train arrived at the site.</p> <ul style="list-style-type: none"> • The value after Absolute is set by the Absolute option on the Alarm Limits submenu (aka Alarm Settings submenu). • The value after Differential is set by the Differential option on the Alarm Limits submenu. • The value after Hot Wheel is set by the Hotwheel option on the Alarm Limits submenu. • The value after Cold Rail Temp is set by the Cold Rail Temperature option on the Alarm Limits submenu. <p>Chapter 11 - Serial Interface tells how to set these values.</p>
Carside Parm	<p>The Carside Slope alarm parameter values that were in place at the time the train arrived at the site.</p> <ul style="list-style-type: none"> • The value after Carside Slope is set by the Carside Slope option on the Alarm Settings submenu. • The value after Minimum is set by the Carside Minimum option on the Alarm Settings submenu. <p>Chapter 11 - Serial Interface tells how to set these values.</p>
Resistor Test Mode	<p>Status of the post-train resistor integrity test at the time the train arrived at the site. Valid values (aka modes) are Enabled, Reduced, and Disabled.</p> <p>Chapter 11 - Serial Interface tells how to set this value using the Resistor Test Mode option on the Equipment submenu.</p>

Heading	Contents of Field
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 submenu.
Max	The maximum temperature, above the ambient temperature in degrees Fahrenheit, recorded by the wheel scanner on a given raiiside. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the Hotwheel option on the Equipment submenu.
Avg	The average temperature, above the ambient temperature in degrees Fahrenheit, calculated from all recorded temperatures from the wheel scanner on a given raiiside. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the Hotwheel option on the Equipment submenu.
Resistor Read	The scanner resistor temperature (read after train passage), in degrees Fahrenheit, recorded by the wheel scanner on a given raiiside. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the Hotwheel option on the Equipment submenu.
Resistor Req	The resistor temperature, in degrees Fahrenheit, required by the wheel scanner on a given raiiside to avoid a Cold Wheel Scanner Resistor alarm. This value was calculated using the amount of time the shutters were open and the Resistor Test Mode option in effect at the time the train exits the site. If the Resistor Test Mode option is <u>disabled</u> , a zero appears in this field. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the Hotwheel option on the Equipment submenu.
	<p>One of five uppercase letters follows the Resistor Req temperature.</p> <ul style="list-style-type: none"> 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. <p>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.</p>
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 <u>enabled</u> using the AEI option on the Equipment submenu.
Firmware Versions	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).

The table below lists the fields from the system-events section and the contents of each field.

Heading	Contents of Field
System Alarms	Lists any System Alarms and Integrity Failures detected at the time the train passed the site. If none were detected, this header is followed by the word "none." Appendix A - System Alarms describes the conditions and events that the system flags as System Alarms. Appendix B - Integrity Failures describes the conditions and events that the system flags as Integrity Failures.
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 submenu is <u>enabled</u> , this field doesn't appear.
Rail	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, rails are north and south. If the track orientation is north and south, rails are east and west. If the Hotwheel option on the Equipment submenu is <u>disabled</u> , the word "Rail" 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, rails are north and south. If the track orientation is north and south, rails are east and west. This heading and the two columns under it appear only when the Hotwheel option on the Equipment submenu is <u>enabled</u> .
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
09/30/2008 21:57
Main Menu
-----
```

```
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
```

```
·
·
·
```

- 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**

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 train number is shown for each train entry so that an Exception Detail report may easily be produced for any train listed on the summary.

The 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.

```

Southern Technologies Corporation
Next Generation Detector System
EXCEPTION SUMMARY
=====
Version Info.... Analyzer:   DM1.11-A    01/24/07           MP/KP: 1234.5
                  Communicator: DM2.22-A  01/24/07           Track: Single

Alarm Limits..      Absolute: 180          Carside Slope..... 1.31
                   Differential: 120        Minimum... 100
                                           Cool Wheel Temp... 20
-----
Train#   Date     Time   Cars Axles TO1 TO2 AEI Speed i D Rail Average Amb Bat
              |       |       |   |   |   |   |   |   |   |   |   |
177 A 09/21/08 08:32   20   86   86 86   0   56 E   36   37 +68F 14.0v
176 I 09/21/08 07:40   10   46   46 46   0   57 E   43   7  +66F 14.0v
175 B 09/21/08 06:28   14   62   62 62   0   57 E   36   37 +60F 13.8v

170 I 09/19/08 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 Hotwheel option on the Equipment submenu is enabled. The contents of your report will be different.

.															
.															
.															
Alarm Limits..		Absolute: 180					Carside Slope... 1.60								
		Differential: 130					Minimum... 300								
		Hot Wheel: 652					Cold Rail Temp... 10								

								D Rail		Wheel					
								AEI Speed i		Average		Average		Amb	
Train#	Date	Time	Cars	Axles	T01	T02	Tags	(MPH)	r	East	West	East	West	Temp	Bat

.															
.															
.															
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
Version Info	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).
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 (aka Milepost submenu).
Track	The track designator of the site. For single-track sites, valid value is Single. For multitrack 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.

Heading	Contents of Field
Alarm Limits	<p>These are the alarm parameters currently defined in the system setup. These values were in place at the time this report was run.</p> <ul style="list-style-type: none"> • The value after Absolute is set by the Absolute option on the Alarm Limits submenu (aka Alarm Settings submenu). • The value after Differential is set by the Differential option on the Alarm Limits submenu. • The heading Hot Wheel only appears when the Hotwheel option on the Equipment submenu is <u>enabled</u>. The value after Hot Wheel is set by the Hotwheel option on the Alarm Limits submenu. • The value after Carside Slope is set by the Carside Slope option on the Alarm Limits submenu. • The value after Minimum is set by the Carside Minimum option on the Alarm Limits submenu. • The value after Cool Wheel Temp is set by the Cold Rail Temperature option on the Alarm Limits submenu. <p>Chapter 11 - Serial Interface tells how to set these values.</p>

The table below lists the fields from the detail section and the contents of each field.

Heading	Contents of Field
Train#	The number that identifies the train in the Exceptions directory.
	<p>There is one unlabeled column between those labeled "Train#" and "Date." This column can contain A, B, I, S, or nothing. If "A," an Exception Alarm was detected on the train. If "I," an Integrity Failure was detected. If "B," both an Exception Alarm and an Integrity Failure were detected. If "S," a System Alarm was detected, but Exception Alarms and Integrity Failures weren't. If blank, no Exception Alarm, Integrity Failure, or System Alarm was detected.</p>
Date	The date the train arrived at the site. Date is in mm/dd/yy format, where mm is month, dd is day, and yy is year. Chapter 11 - Serial Interface tells how to change this value using the Date and Time submenu.
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 this value using the Date and Time submenu.

Heading	Contents of Field
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 <u>closest</u> 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 <u>farthest</u> 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 submenu.
Speed (mph)	The train's exit speed in miles per hour.
Dir	The direction the train was traveling. Valid values are N, S, E, and W.
Rail 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 submenu is enabled.
Amb Temp	The ambient temperature, in degrees Fahrenheit, at the time the train passed the site.
Bat	The system battery voltage at the time the train passed 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
09/30/2008 21:57
Main Menu
-----
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
      .
      .
      .
```

- 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 both the AEI option and Hotwheel option were disabled at the time 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.

Southern Technologies Corporation
Next Generation Detector System

EXCEPTION DETAIL

```
=====
Train#: 321           Speed: 57MPH           MP/KP: 1111.1
Date: 09/16/08       Axles: 86             Track: Single
Time: 08:41          Direction: East       Temperature: + 71F
Length: 1776         Shutter Open: 32         Battery: 13.4v
=====
```

```
=====
Resistor
Rail Max Avg Read Req Txdr Counts Alarm Limit Carside Parm
-----
North 289 24 300 81I T01 132 Absolute 180 Slope: 1.60
South 0 0 104 81I T02 132 Differential 130 Minimum: 75
Hot Wheel 652
Resistor Test Mode: Enabled Cold Rail Temp 10
=====
```

Firmware Versions

```
-----
Analyzer: DM1.11-A 01/24/07 Comm: DM2.22-A 01/24/07
-----
```

System Alarms

```
-----
Cold North Resistor
Cold South Resistor
```

Axle Alarm Summary

```
-----
46 South Rail Absolute
77 South Rail Differential
143 North Rail Absolute
143 South Rail Absolute
144 North Rail Absolute
```

```
-----
Car Axle Trk North South ON OFF PW1 PW2 Alarms
-----
1 1 0 56 21 25 0 6 6
2 0 57 21 25 59 6 6
3 0 56 21 25 59 8 8
4 1 56 21 25 362 5 5
5 1 56 21 25 59 6 6
6 1 56 21 25 59 6 6
Carside Ave: North 56 South 21 Carside Alarms: North 184 South 204

2 7 2 56 20 25 162 6 6
8 2 56 21 25 59 6 6

.
.
.

143 66 186 181 25 59 6 6 North Rail Absolute
South Rail Absolute
144 66 183 170 25 641 6 6 North Rail Absolute
```

END OF REPORT - Press any key...

Below is a sample of part of an extended Exception Detail report when both the AEI option and the Hotwheel option on the Equipment submenu were enabled at the time the report was requested. The Carside Slope option on the Equipment submenu was disabled. Also, both the AEI and Hotwheel options 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.

Southern Technologies Corporation

Next Generation Detector System

EXCEPTION DETAIL

Train#: 321

Date: 09/16/08

Time: 08:41

Length: 1776

Speed: 57MPH

Axles: 86

Direction: North

Shutters Open: 32

MP/KP: 1111.1

Track: Single

Temperature: + 71F

Battery: 13.4v

Resistor

Rail Max Avg Read Req Txdr Counts Alarm Limit Carside Params

East 289 24 300 81I TO1 132 Absolute 180 Slope: 1.60

West 0 0 104 81I TO2 132 Differential 130 Minimum: 75

Hot Wheel 652

Resistor Test Mode: Enabled Cold Rail Temp 10

Resistor

Wheel Max Avg Read Req

East 200 196 3 68I

West 10 6 2 68I

AEI System Data

Tags Read

Antenna 0: 30

Antenna 1: 0

Tags Stored: 30

Firmware Versions

Analyzer: DM1.11-A 01/24/07 Comm: DM2.22-A 01/24/07

System Alarms

Successive Cold Wheel Resistors Exceeded

Integrity Failure

Cold North Wheel Scanner Resistor

Axle Alarm Summary

97 North Hot Wheel

98 South Hot Wheel

.

.

.

Rail Wheel

Car Axle East West East West ON OFF PW1 PW2 Alarms

.

.

.

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 doesn'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
=====
.
.
.
-----
Car  Axle  Trk  North  South  ON  OFF  PW1  PW2  Alarms
-----
1      1    0   56    21   25   0    6    6
      2    0   57    21   25   59    6    6
      3    0   56    21   25   59    8    8
      4      CHECKSUM ERROR: StartAddr 136416 EndAddr 136427
      5    1   56    21   25   59    6    6
      6    1   56    21   25   59    6    6

2      7    2   56    20   25  162    6    6
      8    2   56    21   25   59    6    6

.
.
.
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 Exceptions directory.
Date	The date the train arrived at the site. Date is in mm/dd/yy format, where mm is month, dd is day, and yy is year. Chapter 11 - Serial Interface tells how to change this value using the Date and Time submenu.
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 this value using the Date and Time submenu.
Length	The length of train in feet.
Speed	The train's exit speed in miles per hour.
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 (aka Milepost submenu).
Track	The track designator of the site. For single-track sites, valid value is Single. For multitrack 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.
Temperature	The ambient temperature at the time the train arrived at the site. Temperature is in degrees Fahrenheit.
Battery	The system battery voltage at the time the train passed the site.
Rail	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 (at the time 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).
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 (at the time 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.

Heading	Contents of Field
Resistor Req	The resistor temperature, in degrees Fahrenheit, required by the bearing scanner on a given raiiside to avoid a Cold Resistor alarm. This value was calculated using the amount of time the shutters were open and the Resistor Test Mode option in effect at the time the train exits the site. If the Resistor Test Mode option is <u>disabled</u> , a zero appears in this field.
	<p>One of five uppercase letters follows the Resistor Req temperature.</p> <p>B The baseline resistor integrity test method was used for this train.</p> <p>D The resistor integrity test (that is, the Resistor Test Mode option) was disabled by the user.</p> <p>I The interim resistor integrity test method was used for this train.</p> <p>T For this train, the shutters were open for less than 30 seconds.</p> <p>V For this train, the battery voltage (measured with the shutters open) was less than 13 volts.</p> <p>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.</p>
Txdr Counts	The gating-transducer designator (either TO1 or TO2) followed by the total number of hits on that transducer.
Alarm Limit	<p>The Hotwheel alarm level; the Hotbox alarm levels for Absolute and Differential; and the Cold Rail Temperature offset. These values were in place at the time the train arrived at the site.</p> <ul style="list-style-type: none"> • The value after Absolute is set by the Absolute option on the Alarm Limits submenu (aka Alarm Settings submenu). • The value after Differential is set by the Differential option on the Alarm Limits submenu. • The value after Hot Wheel is set by the Hotwheel option on the Alarm Limits submenu. • The value after Cold Rail Temp is set by the Cold Rail Temperature option on the Alarm Limits submenu. <p>Chapter 11 - Serial Interface tells how to set these values.</p>
Carside Parm	<p>The Carside Slope alarm parameter values that were in place at the time the train arrived at the site.</p> <ul style="list-style-type: none"> • The value after Carside Slope is set by the Carside Slope option on the Alarm Settings submenu. • The value after Minimum is set by the Carside Minimum option on the Alarm Settings submenu. <p>Chapter 11 - Serial Interface tells how to set these values.</p>
Resistor Test Mode	<p>Status of the post-train resistor integrity test at the time the train arrived at the site. Valid values (aka modes) are Enabled, Reduced, and Disabled.</p> <p>Chapter 11 - Serial Interface tells how to set this value using the Resistor Test Mode option on the Equipment submenu.</p>

Heading	Contents of Field
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 submenu.
Max	The maximum temperature, above the ambient temperature in degrees Fahrenheit, recorded by the wheel scanner on a given raiiside. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the Hotwheel option on the Equipment submenu.
Avg	The average temperature, above the ambient temperature in degrees Fahrenheit, calculated from all recorded temperatures from the wheel scanner on a given raiiside. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the Hotwheel option on the Equipment submenu.
Resistor Read	The scanner resistor temperature (read after train passage), in degrees Fahrenheit, recorded by the wheel scanner on a given raiiside. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the Hotwheel option on the Equipment submenu.
Resistor Req	The resistor temperature, in degrees Fahrenheit, required by the wheel scanner on a given raiiside to avoid a Cold Wheel Scanner Resistor alarm. This value was calculated using the amount of time the shutters were open and the Resistor Test Mode option in effect at the time the train exits the site. If the Resistor Test Mode option is <u>disabled</u> , a zero appears in this field. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the Hotwheel option on the Equipment submenu.
	<p>One of five uppercase letters follows the Resistor Req temperature.</p> <ul style="list-style-type: none"> 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. <p>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.</p>
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 <u>enabled</u> using the AEI option on the Equipment submenu.
Firmware Versions	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).

The table below lists the fields from the system-events section and the contents of each field.

Heading	Contents of Field
System Alarms	Lists any System Alarms and Integrity Failures detected at the time the train passed the site. If none were detected, this header is followed by the word "none." Appendix A - System Alarms describes the conditions and events that the system flags as System Alarms. Appendix B - Integrity Failures describes the conditions and events that the system flags as Integrity Failures.
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 submenu is <u>enabled</u> , this field doesn't appear.
Rail	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, rails are north and south. If the track orientation is north and south, rails are east and west. If the Hotwheel option on the Equipment submenu is <u>disabled</u> , the word "Rail" 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, rails are north and south. If the track orientation is north and south, rails are east and west. This heading and the two columns under it appear only when the Hotwheel option on the Equipment submenu is <u>enabled</u> .
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
09/30/2008 21:57
Main Menu
-----
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
F) Last Train
      :
      :
      :
```

- 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 a three-digit invalid train number, the Main menu reappears. If you typed a three-digit valid train number, this prompt appears.

```
Abbreviated Listing ?
```

- 5 To produce the extended Exception Detail report, type **N**

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 at the time the report was requested. The contents of your report will be different.

Southern Technologies Corporation
Next Generation Detector System
EXCEPTION DETAIL - ABBREVIATED

```
=====
Train#: 321           Speed: 57MPH           MP/KP: 1111.1
Date: 09/16/08       Axles: 86              Track: Single
Time: 08:41          Direction: East        Temperature: + 71F
Length: 1776         Shutter Open: 32        Battery: 13.4v
=====
```

•
•
•

System Alarms

Cold North 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	6	6	
	2	0	57	21	25	59	6	6	
	3	1	56	21	25	59	8	8	
	4	1	56	21	25	562	5	5	
2	5	3	56	22	25	162	6	6	
	6	3	189	110	25	641	6	6	North Rail Absolute
	7	4	57	22	25	59	6	6	
	8	4	57	22	25	562	6	6	
3	9	5	56	113	25	162	6	6	
	10	5	57	23	25	59	6	6	
	11	6	57	24	25	59	6	6	
	12	6	57	23	25	562	6	6	
6	21	11	56	23	25	162	6	6	
	22	11	57	23	26	58	6	6	
	23	12	57	23	26	561	6	6	
	24	12	57	22	26	58	6	6	
7	25	13	56	22	25	162	6	6	
	26	13	57	21	26	58	6	6	
	27	14	57	22	26	561	6	6	Dragging Equipment
	28	14	57	23	26	58	6	6	Dragging Equipment
8	29	15	56	22	25	162	6	6	
	30	15	57	22	26	58	6	6	

•
•
•

END OF REPORT - Press any key...

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
09/30/2008 21:57
Main Menu
-----
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
F) Last Train
      :
      :
      :
```

- 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 a three-digit invalid train number, the Main menu reappears. If you typed a three-digit valid train number, this prompt appears.

```
Abbreviated Listing ?
```

- 5 To produce the abbreviated Exception Detail report, type **Y**

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 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: 11/29/08	Time: 11:20	Battery: 14.0v	Ambient Temp.: +71F

MP/KP... 1234.5 Track Dir... N/S Track..... Single			
Alarm Settings			

Absolute.....	180	Carside Slope.....	1.31
Differential....	100	Minimum....	47
Hot Wheel.....	334	Cold Rails.....	5
		Cold Rail Temp....	20
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.....	YES	Resistor Test....	Enabled
Short Train Warning	NO		
Default Modem Selected			
Modem Setup Line 1 = +++AT&F			
Modem Setup Line 2 = AT &D0 &E0 &E14 S0=1 V0			
Modem Setup Line 3 = AT E0 X0 \$SB9600 \$MB9600			
Modem Setup Line 4 = AT &E3			
Modem Setup Line 5 = AT &W0			
Messages			

Axles.....	YES	Speed.....	NO
Temperature.....	YES	Length.....	NO
Slow.....	YES	Power Off.....	YES
Customer Name....	NO	Arrival Message...	NO
Repeat No Defects.	YES	Cars.....	NO
Car ID With Alarm.	NO	Lft/Rt Alrm Ref...	NO
Rebroadcast DTMF Code.		Request EOT Timer.	10
Announce Cold Rail	YES		
Scanner Calibration Date			

Rail1...06/04/2007	09:50	Rail2...06/04/2007	09:54
Wheel1..06/04/2007	09:57	Wheel2..06/04/2007	09:59
	.		
	.		
	.		

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.

```

      .
      .
      .

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

AEI Reader Parameter Menu
-----
ID Separation..... 2 ID's
Consecutive Reads... 2 Reads
Decode As ASCII Tags Disabled

Software Versions                                COP
                                                Resets
-----
Analyzer..... DM1.11-A 01/24/07      1
Comm..... DM2.22-A 01/24/07      1

Resistor Data
-----
VOLTS  DATE      TIME    30   40   50   60   70   80   90  100  110  120 STATUS
-----
RAIL 1
13.8  06/04/08  09:20   37,   9, 300, 297,   3, 180,   5, 300, 300, 300 VALID
RAIL 2
13.8  06/04/08  09:30  300, 300, 300, 300, 300, 300, 300, 300, 300, 300 VALID
WHEEL 1
13.8  06/04/08  09:40  300, 300, 300, 300, 300, 300, 300, 300, 300, 300 VALID
WHEEL 2
13.8  06/04/08  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 at the time this report was generated. Date is in mm/dd/yy format. Chapter 11 - Serial Interface tells how to change this value using the Date and Time submenu.
Time	The time at the time 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.
Battery	The system battery voltage at the time this report was generated.
Ambient Temp	The ambient temperature at the time this report was generated. Temperature is in degrees Fahrenheit.
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 (aka Milepost 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, valid value is Single. For multitrack 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 Limits submenu (aka Alarm Settings submenu).
Equipment	Equipment configuration as currently defined in system setup. Chapter 11 - Serial Interface tells how to change this configuration using the Equipment submenu.
Messages	Message configuration as currently defined in system setup. Chapter 11 - Serial Interface tells how to change this configuration using the Messages submenu.
Scanner Calibration Date	Date and time that each scanner was last calibrated. The autocalibration function maintains these fields.
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. Serial Interface tells how to change these parameter settings.

Heading	Contents of Field
AEI Reader Parameters	<p>This heading appears when the AEI subsystem is enabled using the AEI option on the Equipment submenu.</p> <p>Below are the AEI Reader Parameters currently defined in the system setup. These values were in place at the time this report was run.</p> <ul style="list-style-type: none"> • 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 AAR encoded format. <p>Chapter 11 - Serial Interface tells how to set these values using the AEI Reader Parameters menu.</p>
Software Versions	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).
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 bottom 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 of the Main menu.
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	03/08/08	13:39	103,	130,	152,	168,	183,	195,	204,	211,	217,	223	VALID
RAIL 2													
13.5	03/09/08	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 13.8 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.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 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
L) System Functions
M) Event Log
X) Exit
```

?

- 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. The only difference is the way you specify the train on which you want a report. For this report, you don't have to 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.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 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
L) System Functions
M) Event Log
X) Exit
?
```

- 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. The only difference is the way you specify which train you want reported. In this version of the report, you don't have to specify a train. The most current test train (aka ramp 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.

```
      .
      .
      .
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
L) System Functions
M) Event Log
X) Exit
?
```

- 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.

Carside Slope alarm detection is enabled or disabled using the Carside Slope option on the Equipment submenu. Hotwheel alarm reporting is enabled/disabled using the Hotwheel option on the Equipment submenu. The AEI subsystem is enabled or disabled using the AEI option on the Equipment submenu.

Where wheel scanners are properly installed, wheel temperatures are always recorded, even if the Hotwheel option is disabled. On the other hand, if the AEI option is disabled 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 at the time 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 an AEI Diagnostic Detail report when both the AEI option and the Hotwheel option on the Equipment submenu were enabled at the time the report was requested. The Carside Slope option on the Equipment submenu was disabled. Also, both the AEI and Hotwheel options 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.

Southern Technologies Corporation
Next Generation Detector System

TRAIN DETAIL

```
=====
Train#: 321                      Speed: 48 KPH                      MP/KP: 1234.5
Date: 08/04/08                  Axles: 52                      Track: Single
Time: 08:26                      Direction: South                Temperature: + 21C
Length: 1013 m                   Shuttters Open: 36 sec          Battery: 14.2v
=====
```

```
=====
Resistor
Rail  Max  Avg  Read  Req  Txdr Counts  Alarm  Limit  Carside Parms
-----
East 258  16   46  58I  TO1  52    Absolute 180    Slope: 1.60
West 252  18   46  58I  TO2  52    Differential 130  Minimum: 130
                        Hot Wheel  652
Resistor Test Mode: Reduced      Cold Rail Temp 10
=====
```

```
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: DM1.11-A 01/24/07 Comm: DM2.22-A 01/24/07

=====

System Alarms

Cold East Resistor
Cold West Resistor
Successive Cold Resistors Exceeded
Integrity Failure

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 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 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 consist – A -end or B -end forward.	Yes
0 0 0 0 0	<i>Reserved for future diagnostics development.</i>	-----
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
?	<i>Reserved for future diagnostics development.</i>	-----
5	Equipment Group Code from tag data.	Yes
XYZ 8440	AEI vehicle identification.	No
0	<i>Reserved for future diagnostics development.</i>	-----
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.

```
      :  
      :  
      :  
F) Last Train  
G) Last Test Train  
H) AEI Diagnostic Detail  
I) Replay EOT Announcement  
J) Setup  
K) Enter Pass-Thru Mode  
L) System Functions  
M) Event Log  
X) Exit  
?  
?
```

- 2 To produce the AEI Diagnostic Detail report, type **H**

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 **G** 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 at the time the report was generated. The contents of your report may be different.

```
Southern Technologies Corporation                               Event Log

                                06/07/2008
                                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 at the time the report was generated. Each line of text (that is, each event) contains these fields.

- The sequential number assigned to the event as it was generated
- The date at which the event was recorded (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

                                09/07/2008
                                10:08:02
=====
42 06/05/08 13:36:20 <Train Stored>
41 06/05/08 13:36:17 <Store Train #118>
40 05/30/08 19:18:47 <Excep. Train Stored>
49 05/30/08 19:18:43 <Store Excep. Train #105>

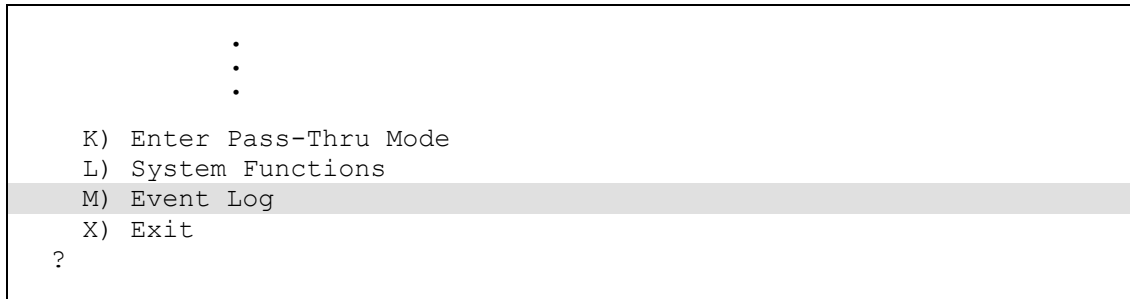
                                .
                                .
                                .

----- 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.



- 2 To produce the Event Log report, type **M**

At this time, you can produce another report by typing one of the letters **A** through **G** or **M**.

- 3 When done, close the LOG file.
- 4 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 describes 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.

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 submenu. 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. 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 is available on your system, enable or disable it using the **Announce Train Arrival option** on the Messages submenu. The format of this announcement is:

[customer name] Milepost (mile) [track indicator]

At a multitrack 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, the announcement is like this.

S-I-T-E Detector
Milepost 3-5-9 point 4

At a multitrack site, the announcement is like this.

S-I-T-E Detector
Milepost 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 format for this announcement and it is:

[customer name] Milepost (mile) [track indicator] You Have A Defect

For example, at a single-track site, 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 multitrack site, the announcement is like this. In this example, milepost 5472.9 was used.

S-I-T-E Detector
Milepost 5-4-7-2 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 submenu 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.

Below is the Messages submenu. The options on this submenu affect the phrases broadcast to a passing train or are used to modify the parameters associated with the rebroadcast function.

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 Count	NO
I	Customer Name.....	YES
J	Arrival Message.....	YES
K	Lft/Rt Alarm Ref.....	YES
L	Car ID With Alarm.....	NO
M	Request EOT Timer.....	10
N	Rebroad DTMF Code.....	999
O	Announce Cold Rail.....	NO
P	Integrity Failure.....	NO
Q	No Defects.....	NO
Message to change or Esc to quit ?		

The ancillary messages are generated by enabling one or more of these options: 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 submenu 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. 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 submenu.

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).

13.3.1 Nothing Detected

When neither an Exception Alarm nor an Integrity Failure is detected and the **Announce No Defects option** on the Messages submenu is enabled, the no-defect message is announced. If you disable this option, nothing is announced when nothing was detected. However, some systems don't have this option. In this case, when neither an Exception Alarm nor an Integrity Failure is detected, the no-defect message is always announced. If the **Repeat No Defects option** on the Messages submenu is disabled, the format of this announcement is:

[customer name] Milepost (mile) [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 (mile) [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 and the **Announce No Defects option** on the Messages submenu is enabled, 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 and the **Announce No Defects option** on the Messages submenu 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 multitrack site when the **Repeat No Defects option** is enabled and the **Announce No Defects option** on the Messages submenu 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.

If the **Announce Integrity Failure option** on the Messages submenu is disabled when no Exception Alarms are detected but an Integrity Failure is detected, nothing is announced. If the **Announce Integrity Failure option** is enabled when no Exception Alarms are detected but an Integrity Failure is detected, only Integrity Failure is announced. If your system doesn't have this option when only an Integrity Failure is detected, Integrity Failure is announced.

The format of this announcement is:

[customer name] Milepost (mile) [track indicator]
[ancillary messages] Integrity Failure
(a pause)
[customer name] Milepost (mile) [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 (mile) [track indicator] [speed indicator]
[alarm announcements] [other ancillary messages] [excessive-alarms indicator]
(a pause)
[customer name] Milepost (mile) [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 submenu 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 submenu 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 submenu 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 submenu is enabled (YES) and the AEI subsystem is functioning properly during train passage. In the examples that follow, the **Announce Car Identification option** was set to NO.

The **Announce Left-Right Alarm Reference option** on the Messages submenu shows whether the alarm reference is announced as left or right (YES) or north, south, east, or west (NO). In the examples that follow, this option was set to YES.

For example, at a single-track site having one Hotbox alarm and no Integrity Failure, the announcement is like this. This example assumes that the Announce Left-Right Alarm Reference option on the Messages submenu was enabled.

S-I-T-E Detector
Milepost 3-2-1 Point 4
Speed 4-5
Hotbox Left-Side Axle-7-5
Total Axles 9-8
(a pause)
S-I-T-E Detector
Milepost 3-2-1 Point 4
Speed 4-5
Hotbox Left-Side 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. This example makes no assumption as to whether the Announce Left-Right Alarm Reference option was disabled or enabled. Either will result in the following.

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. This example assumes that the Announce Left-Right Alarm Reference option was enabled.

S-I-T-E Detector
Milepost 3-2-1 Point 4
Speed 4-5
First-Hotbox Left-Side Axle-7-5
Second-Hotbox Left-Side 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 Left-Side Axle-7-5
Second-Hotbox Left-Side 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 Left-Side 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 single-track site having one Hotbox alarm, one Dragging-Equipment 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 Left-Side Axle-7-5
Dragging-Equipment Near-Axle-8-4
Total Axles 9-8
(a pause)
S-I-T-E Detector
Milepost 3-2-1 Point 4
Speed 4-5
Hotbox Left-Side Axle-7-5
Dragging-Equipment Near-Axle-8-4
Total Axles 9-8
Detector Out

At a single-track site having three or more Dragging-Equipment 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-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
Milepost 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

If the **Announce Integrity Failure option** on the Messages submenu is disabled when one or more alarm conditions and an Integrity Failure are detected, only the alarm conditions are announced. The format of this announcement is:

[customer name] Milepost (mile) [track indicator] [speed indicator]
[alarm announcements] [ancillary messages] [excessive-alarms indicator]
(a pause)
[customer name] Milepost (mile) [track indicator] [speed indicator]
[alarm announcements] [ancillary messages] [excessive-alarms indicator] Detector Out

If the **Announce Integrity Failure option** is enabled when one or more alarm conditions and an Integrity Failure are detected, both are announced. The format of this announcement is:

[customer name] Milepost (mile) [track indicator] [speed indicator]
[alarm announcements] [ancillary messages] Integrity Failure [excessive-alarms indicator]
(a pause)
[customer name] Milepost (mile) [track indicator] [speed indicator]
[alarm announcements] [ancillary messages] Integrity Failure [excessive-alarms indicator]
Detector Out

For the rest of the examples in this chapter, the **Announce Integrity Failure option** and the **Announce Left-Right Alarm Reference option** were set to YES. And, the **Announce Car Identification option** was set to NO. **Chapter 11 - Serial Interface** tells how to change these options.

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
Milepost 3-2-1 Point 4
Speed 6-0
Hotbox Right-Side Axle-7-5
Total Axles 9-8
Integrity Failure
(a pause)
S-I-T-E Detector
Milepost 3-2-1 Point 4
Speed 6-0
Hotbox Right-Side 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
Milepost 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
Milepost 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
Milepost 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
Milepost 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
Milepost 3-2-1 Point 4
Speed 5-4
First-Dragging-Equipment Near-Axle-2-1
Second-Dragging-Equipment Near-Axle-2-9
Hotbox Left-Side Axle-7-5
Total Axles 1-0-8
Integrity Failure
Excessive Alarms
(a pause)
S-I-T-E Detector
Milepost 3-2-1 Point 4
Speed 5-4
First-Dragging-Equipment Near-Axle-2-1
Second-Dragging-Equipment Near-Axle-2-9
Hotbox Left-Side 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 recommends. For normal scheduled maintenance, STC recommends these steps.

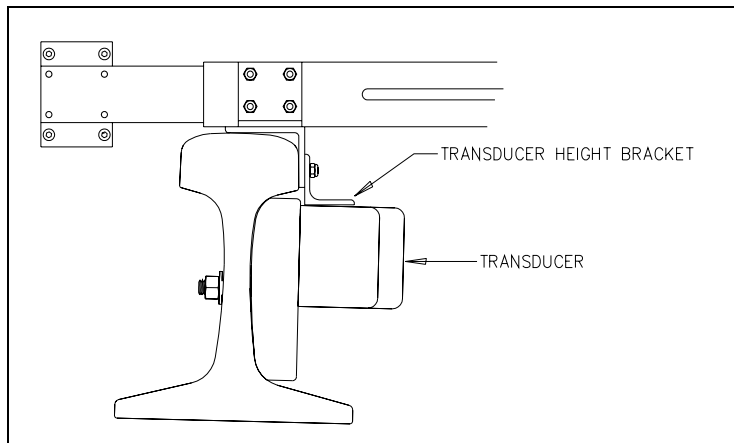
- 1 Be sure that you have on hand a tape measure, a #2 phillips head screwdriver, a small slotted screwdriver, a 9/16-inch torque wrench, a laptop computer, a multimeter, and the alignment fixture.
- 2 At trackside, check track conditions on all tracks.
- 3 If any track is pumping (vertical displacement 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. Checking for these characteristics can be done 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 (14.3-millimeter) torque wrench to a **torque of 8 to 10 foot-pounds (10.8 to 13.6 newton-meters)**.

Don't exceed a torque of 10 foot-pounds (13.6 newton-meters). Overtightening 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.
- 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 At all outlets, check if the AC power is stable and at least 110 volts at 20 amperes.
- 17 If the AC power isn't stable or if it isn't at least 110 volts at 20 amperes, fix this problem before proceeding.
- 18 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.

- 19** If the battery is dead, damaged, or emitting a strong sulfurous odor, replace it before proceeding.

WARNING

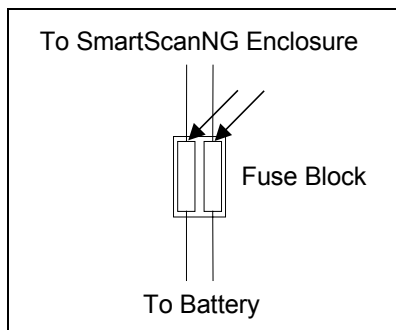
In operation, batteries generate and release flammable hydrogen gas, which, if ignited by a burning cigarette, naked flame, or spark, may cause battery explosion with dispersion of casing fragments and corrosive liquid electrolyte. So, carefully follow manufacturer's instructions for installation and 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.

- 20** If the battery charger hasn't been properly grounded to the ground bus, fix this problem before proceeding.
- 21** If the SmartScanNG enclosure hasn't been properly grounded to the ground bus, 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.

25 Touch the leads from the multimeter to the terminals on the top of the fuse block.



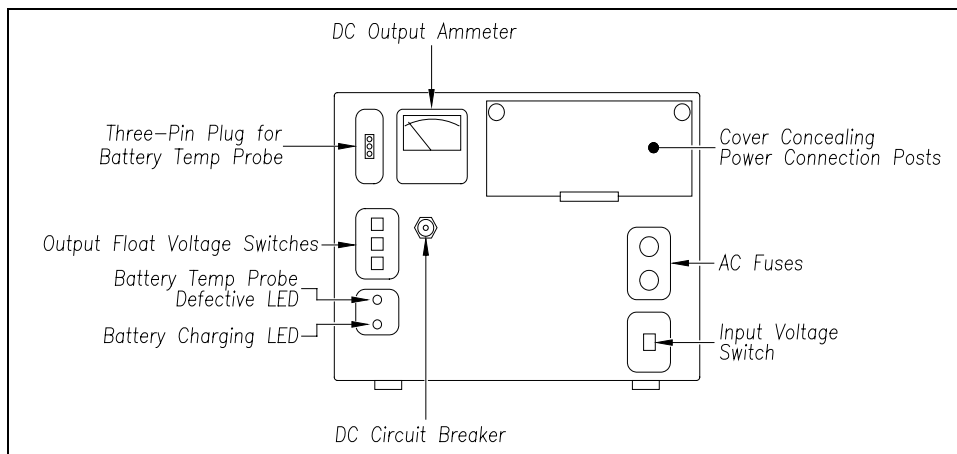
26 If voltage (on the top of the fuse block) is 12.3-14 VDC, go to step **30**.

27 If voltage (on the top of the fuse block) is 0 VDC:

- a** Touch the leads to the terminals on the bottom of the fuse block.
- b** If voltage (on the bottom 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 bottom of the fuse block) is 0 VDC, check the wiring between the fuse block and the battery and between the battery and the charger.

28 If voltage is less than 12.3 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 12.30 VDC, reset them to 12.30-14.00 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.

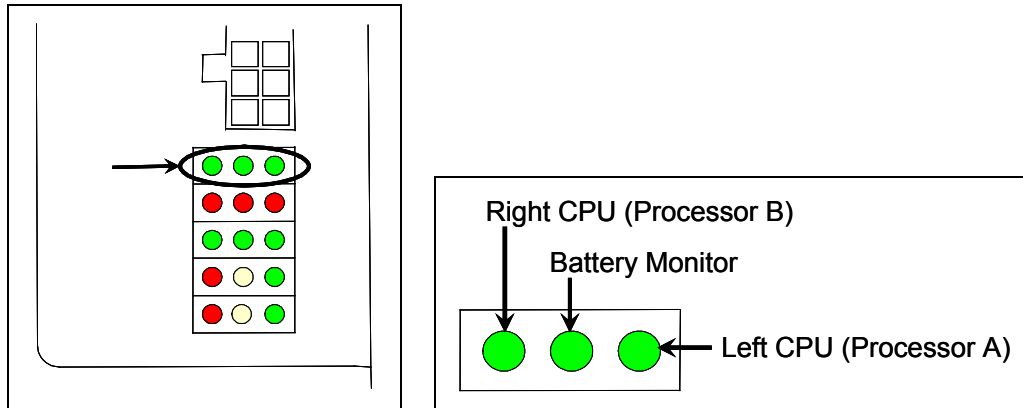
If the voltage is gradually increasing, the battery is probably charging. After the battery has charged for five hours, the battery voltage should be very near the float voltage setting. If the voltage isn't gradually increasing, the battery is probably not charging. This may indicate that the battery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

29 If voltage is greater than 14 VDC:

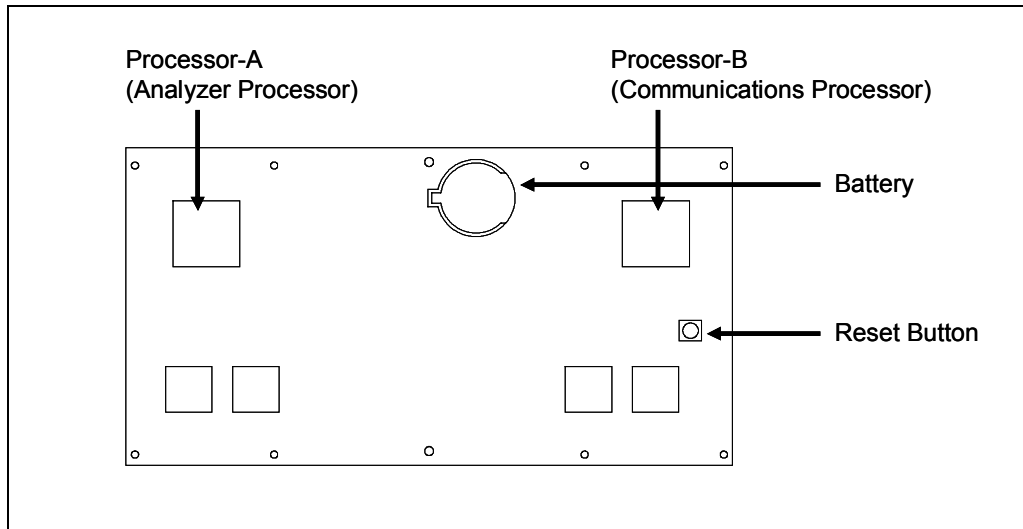
- a Check the output float voltage switches on the center-left edge of the battery charger.
- b Be sure each switch is set on a number and not between numbers.
- c If the switches are set to 14.00 VDC or less, cut all power to the SmartScanNG system and call STC for help in fixing this problem.
- d If the switches are set higher than 14.00 VDC, reset them to 12.30-14.00 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.



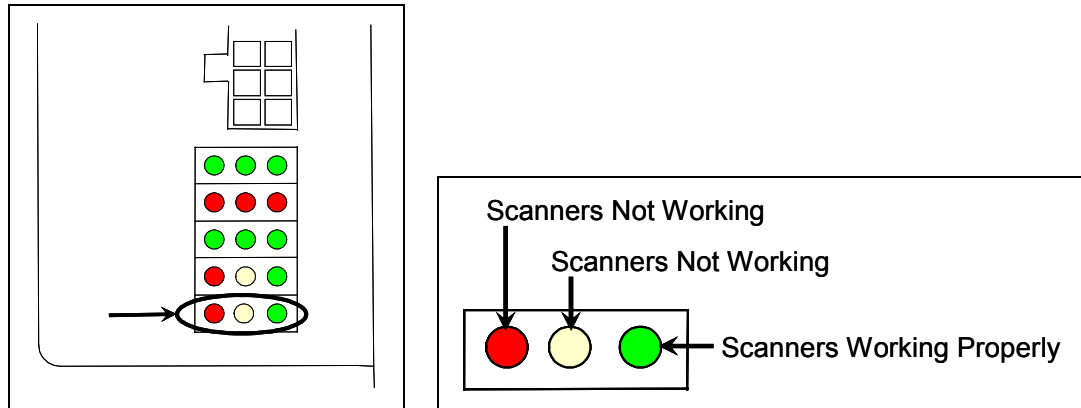
The first row of green LEDs indicates the condition of the CPUs and the battery on the Processor board. If both CPUs are running their programs correctly, their LEDs pulsate (that is, repeat the cycle off, dim, bright, dim). If a program isn't operating as expected, the LED for the affected CPU blinks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



If the on-board 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.**

- 31** If either or both of the **rightmost** and **leftmost LEDs** (on the first 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 first 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 fifth 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 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).

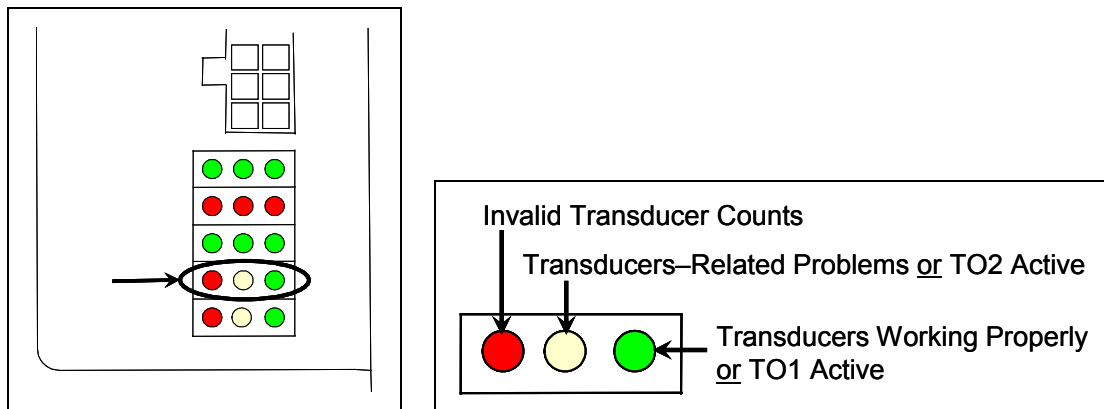
If all of the last 20 trains have passed integrity, the **leftmost red LED** isn't lit. In the last 20 trains, if both bearing scanners or both wheel scanners failed the integrity check, this LED is lit solid. In the last 20 trains, if just one bearing scanner or one wheel scanner failed the integrity 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 fifth 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 system has a track circuit or advance transducers, but is being activated by the gating transducers.

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.

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. The only difference is the way you specify the train on which you want a report. For this report, you don't have to 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."

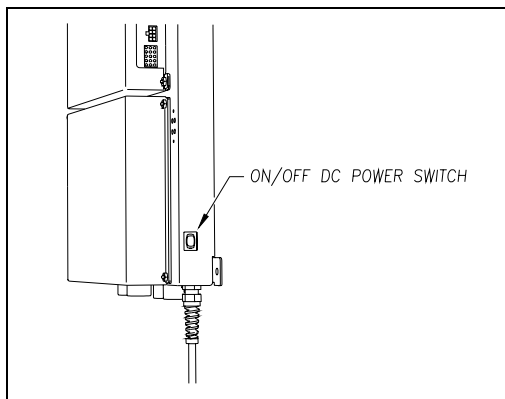
The No Approach Track alarm indicates that the track circuit (or the advance transducers) failed to signal the presence of a train and that the SmartScanNG system started from the train passing over the gating transducers.

- c** If the words "No Approach Track" don't appear, go to step **41**.

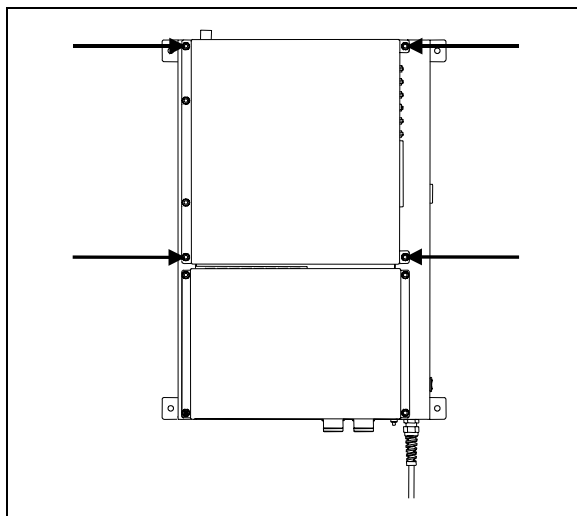
38 If your system uses advance transducers, go to step **40**.

39 If your system uses a track circuit:

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

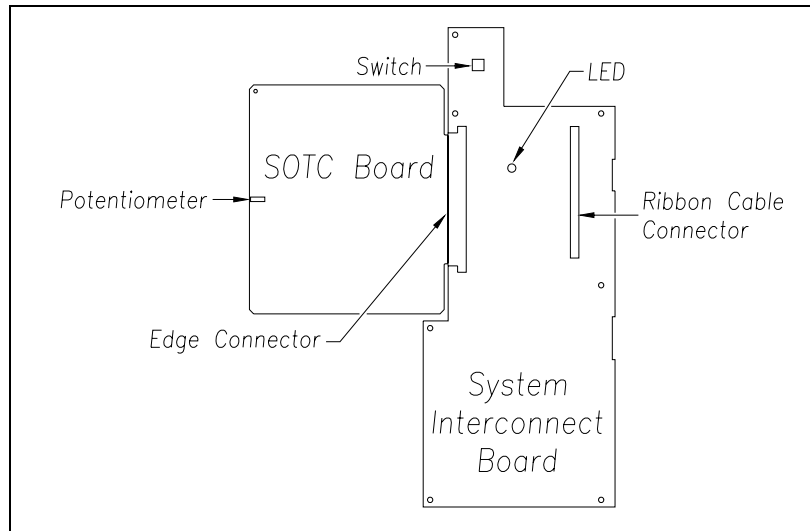


- b** Unplug the Molex and ribbon cables from the Controller module.
- c** Remove the four nuts that hold the Controller module to the rest of the SmartScanNG enclosure.



- 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 on 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 furthest 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).
- h** At the point just measured, place a hardwire shunt across both rails.
When lit, the LED on the System-Interconnect board indicates a received signal from the track circuit.
- i** Using a small slotted screwdriver, turn the potentiometer on the SOTC board until the LED on the System-Interconnect board goes out.
The potentiometer can be reached through a hole in the side of the SmartScanNG enclosure.
- j** Using a small slotted screwdriver, turn the potentiometer on the SOTC board until the SOTC relay just picks up the signal from the track circuit.
The relay just picks up the signal when the LED on the System-Interconnect board first lights.
- k** Remove the hardwire shunt.
- l** Place the hardwire shunt across both rails at the point 5 feet (1.5 meters) beyond the measured point (that is, five feet farther from the gating transducer).
- m** If the LED on the System-Interconnect board is still lit, return to step j.

- n Remove the hardwire 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 will 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**.

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, 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, 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 slow trains (that is, many trains traveling less than 7 mph) 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. You will do the next step only if things aren't working correctly.

- 45** Determine which gating transducer is recording incorrect information.

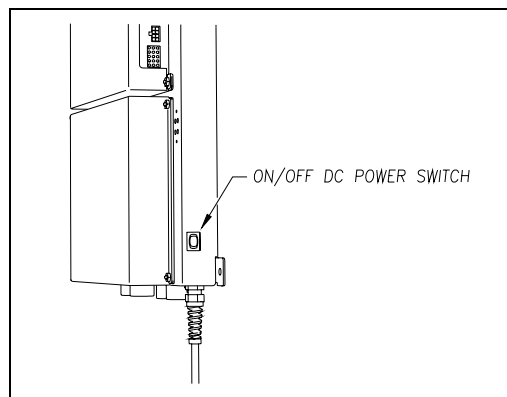
Determine which gating transducer is recording incorrect axle counts and whether it isn't counting all axles or counting extra ones. You may not be able to do this by just looking at the values under the Axles, TO1, and TO2 columns of the Train Summary report. Sometimes, a transducer problem causes the 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 will need to change a jumper setting on the Interface board. If TO1 is the problem, you will change the setting for J201. If TO2 is the problem, you will change the setting for J202. If both TO1 and TO2 have a problem, both jumpers will need to be changed.

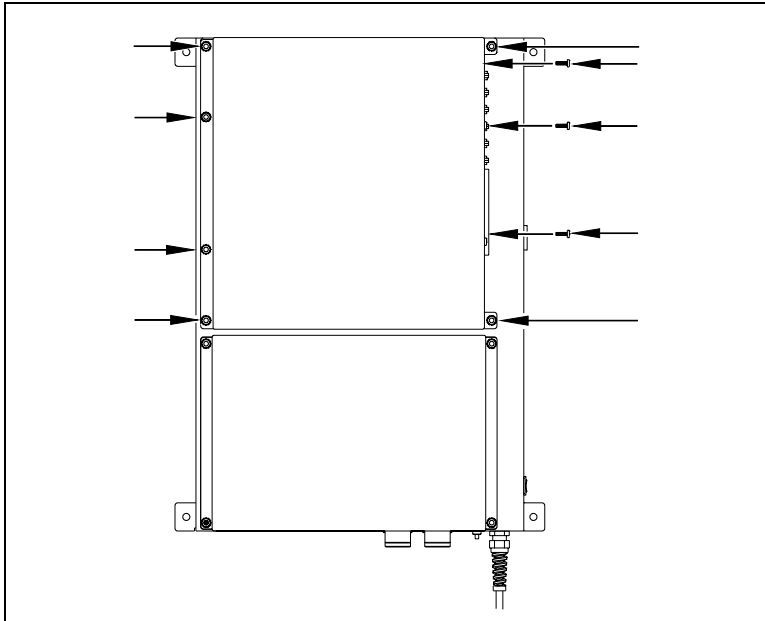
Changes to the jumpers should be made only after all external conditions that cause transducer miscounts have been corrected. Some of these external conditions are improperly installed transducers, loose transducer bolts, incorrect transducer heights, damaged transducers, damaged transducer cables, and 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 trial 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 select a loading value with more resistance.

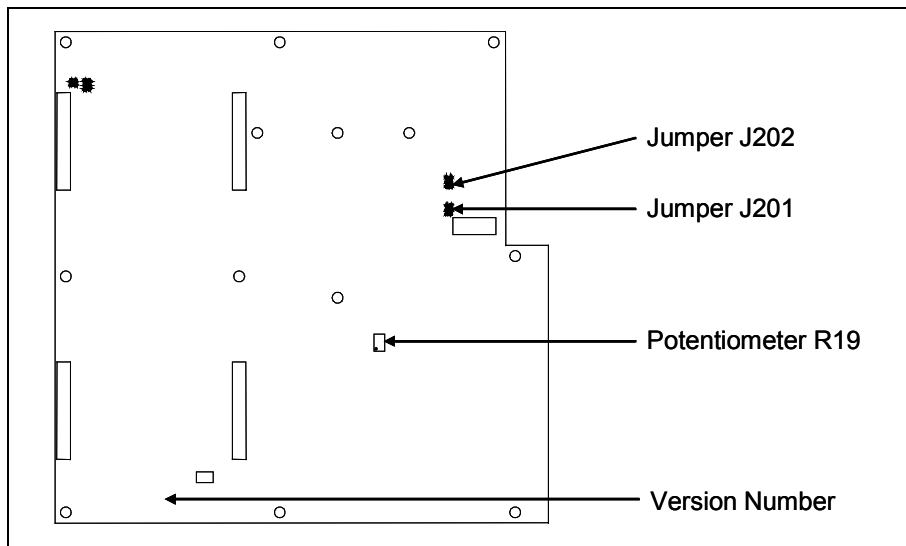
- 46** If you corrected all external conditions that negatively affect gating transducers and you think this fixes gating transducer miscounting, go to step **49**.
- 47** If the selected gating transducer appears to be missing axles (that is, the transducer that is showing a number of hits less than 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 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.

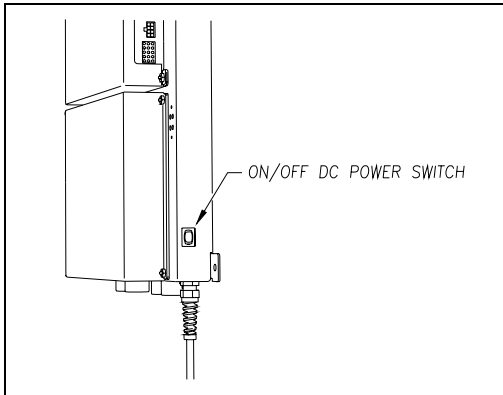
J201 or J202 Jumper Position	Version 1.21 and 1.22 and 1.30 and 1.40 Board
Top	Lowest Sensitivity
Center	Middle Sensitivity
Bottom	Highest Sensitivity

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.

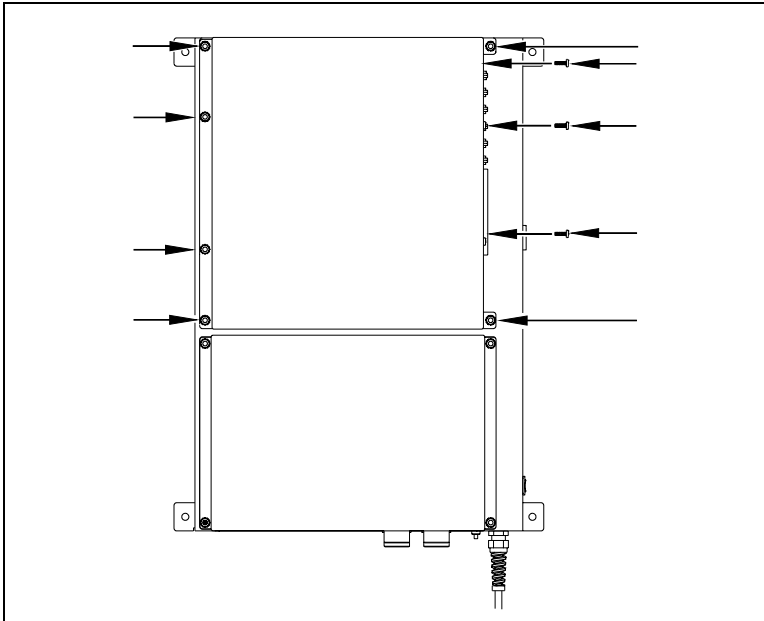
- f If TO1 is the selected gating transducer and the J201 jumper is currently on the lowest sensitivity position, move it to the middle sensitivity position.
- g If TO1 is the selected gating transducer and the J201 jumper is currently on the middle sensitivity position, move it to the highest sensitivity 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.

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):

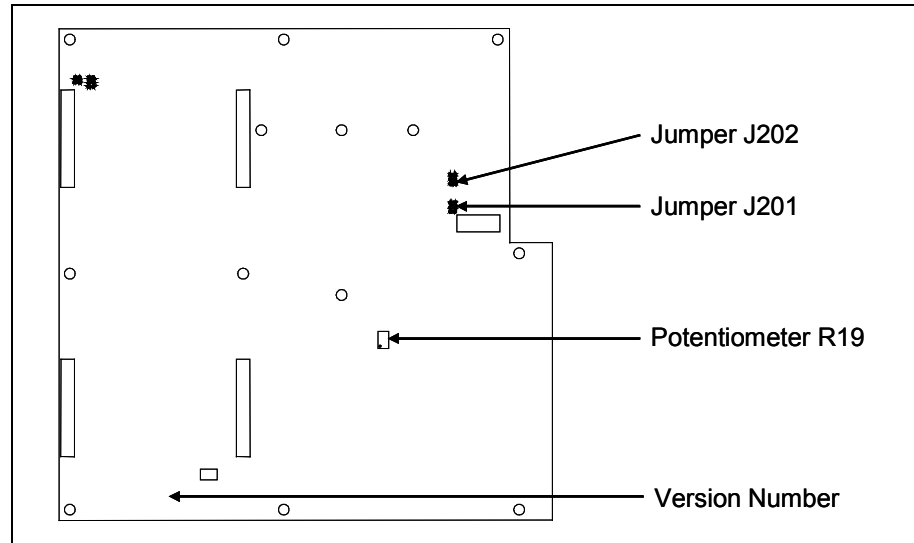
- a** Toggle off the DC power switch on the right edge of the SmartScanNG enclosure.



- 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 <u>or</u> 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

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 21:57
Main Menu
-----
          :
          :
          :
J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
?
```

- 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. This might not be enough time to check and clean the shutters and optics. If it isn't enough time, 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 with the supplied lens cleaning kit.

Do not use solvents, ammonia-based cleaning solutions, or isopropyl alcohol on the optics. Use clean water or a mild solution of dishwashing liquid. After the liquid on the optics dries, lightly wipe the optics with a clean dry chamois patch.

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.

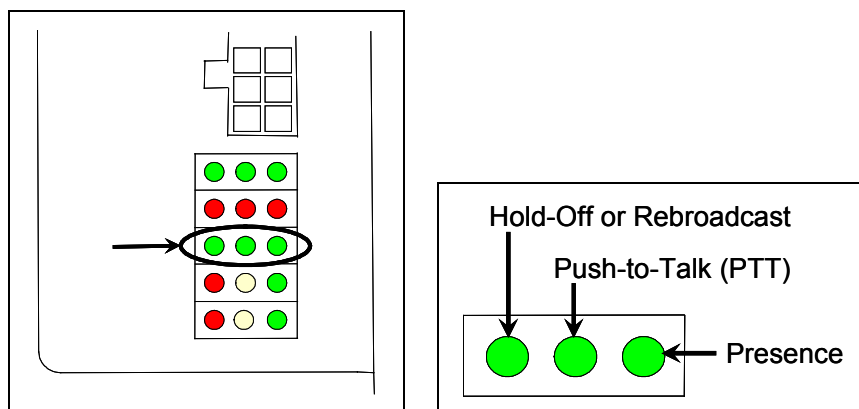
55 To check the operation of the radio:

a From the System Functions menu, type **A**

During a radio test, the SmartScanNG system outputs phrases through the speaker (on the top of the SmartScanNG enclosure) and through the radio. Alternatively, you can output a 1kHz test tone instead of phrases. To do this, type **F** instead of **A**. After typing **F**, the system prints a "Starting 1kHz Test Tone" message and then sounds the tone.

b 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 submenu of the System Functions menu. If the radio is inhibited, the results of this check are invalid.

c 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:

- 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
04/16/2008 21:57
System Functions Menu
-----
A) Radio Test
B) Vocabulary Test
C) Ramp Function
D) Radio Inhibit
E) Manual Test Mode
      .
      .
      .
```

- 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 simulated alarms:

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

This prompt appears.

```
Start Ramp Function?
```

b Type **Y**

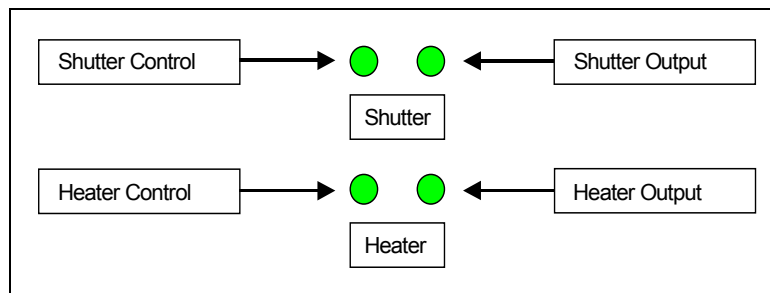
The advance input is made active, gating transducer signals are simulated, and heat values are ramped up (increased) and ramped down (decreased) in a predictable sequence to simulate eight Exception Alarms. **This may take a few minutes.** When finished, this message appears followed by the System Functions menu.

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

The Ramp Function simulates two Absolute alarms, two Differential alarms, two Carside Slope alarms, and two Hotwheel alarms. It simulates the Carside and Hotwheel alarms even if detection for those alarms is disabled in the Equipment setup. 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. The only difference is the way you specify which train you want reported. In this version of the report, you don't have to specify a train. The most current test train (aka 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. The only difference is the way you specify the train on which you want a report. For this report, you don't have to 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.

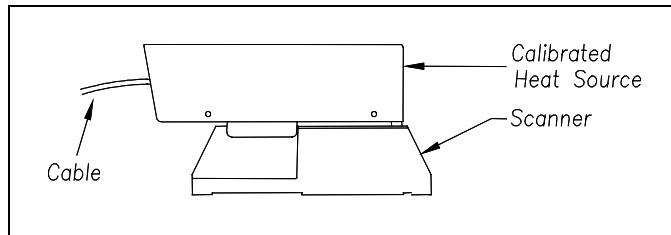
59 To generate a test train to check hot bearings:

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.

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 cable 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 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.

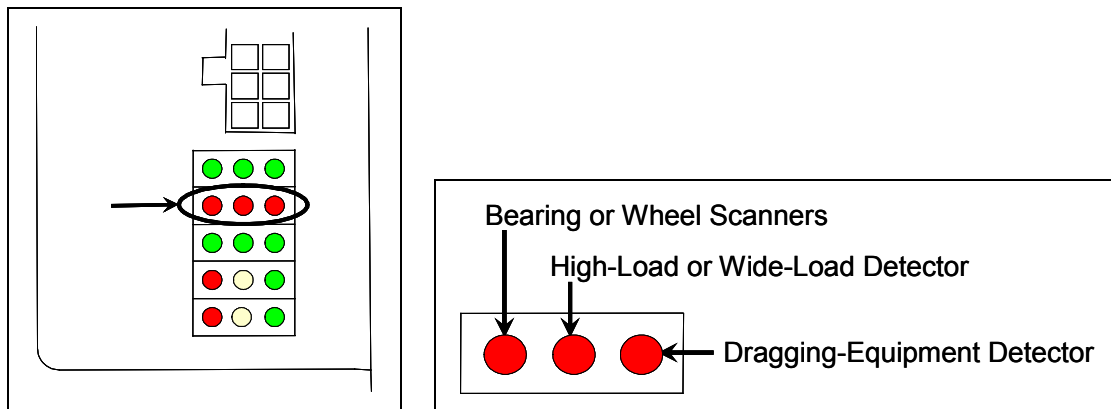
62 On the Train Summary report, check the last column of the report.

The last column shows the battery voltage at the time each train passed the site. It should show values between 13.0 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 13.0 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 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.

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 multitrack site, repeat steps **18** through **65** for each track (that is, for each SmartScanNG system).

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 may take longer.

By telephone, 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 email@southern-tech.com. Email is replied to as soon as possible, normally within one working day.

15.2 Returning Equipment for Repair

Return any 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, 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 Advance System Failure Alarm (No Approach Track Alarm)

The Advance System Failure alarm (on some systems, called the No Approach Track alarm) indicates that the track circuit (or the advance transducers) failed to signal the presence of a train and that the SmartScanNG system started from the train passing over the gating transducers.

A.2 Cold Rail Alarm (Cold Bearing Scanner Alarm)

The Cold Rail alarm (on some systems, called the Cold Bearing Scanner 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 Rail Temperature option on the Alarm Limits submenu (aka Alarm Settings submenu), the system generates a Cold Rail alarm.

Chapter 11 - Serial Interface tells how to view or change the Cold Rail Temperature option.

Alarm Settings, MP/KP-1794.5, Track-Single	

A	Absolute..... 180
B	Differential..... 130
C	Hot Wheel..... 650
D	Carside Slope..... 1.60
E	Carside Minimum... 300
F	Cold Rails..... 1
G	Cold Rail Temp.... 10
Alarm to change or Esc to quit?	

There is a different Cold Rail alarm for each rail. That is, there is a Cold North Rail alarm and a Cold South Rail alarm (or, depending on track direction, a Cold East Rail alarm and a Cold West Rail alarm).

The maximum number (per rai1side) of consecutive trains, having Cold Rail alarms, allowed before generating a Successive Cold Rails Exceeded alarm is set by the Cold Rails option on the Alarm Limits submenu (aka Alarm Settings submenu). If the number of consecutive trains bearing identical Cold Rail alarms equals or exceeds the cold-rail-alarm limit, the System Alarms section of the Train Detail and Exception Detail reports displays the message "Successive Cold Rails Exceeded." Successive Cold Rails Exceeded alarms are covered in the next appendix. **Chapter 11 - Serial Interface** tells how to change the Cold Rails option.

```
Alarm Settings, MP/KP-1794.5, Track-Single
```

```
-----  
A Absolute..... 180  
B Differential..... 130  
C Hot Wheel..... 650  
D Carside Slope..... 1.60  
E Carside Minimum... 300  
F Cold Rails..... 1  
G Cold Rail Temp.... 10
```

```
Alarm to change or Esc to quit?
```

A.3 Cold Resistor Alarm

A resistor is mounted to the inside of the bearing scanner's shutter. A voltage is applied to this resistor while the shutter is open, causing it to heat up. After a train has left 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 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 Limits submenu (aka Alarm Settings submenu). (This alarm limit is an offset, in degrees Fahrenheit, above the ambient temperature.) If the recorded resistor temperature meets or exceeds the absolute-alarm limit, the firmware cancels any previously flagged Cold Resistor alarms.

Chapter 11 - Serial Interface tells how to change the Absolute option.

```
Alarm Settings, MP/KP-1794.5, Track-Single
```

```
-----  
A Absolute..... 180  
B Differential..... 130  
C Hot Wheel..... 650  
D Carside Slope..... 1.60  
E Carside Minimum... 300  
F Cold Rails..... 1  
G Cold Rail Temp.... 10
```

```
Alarm to change or Esc to quit?
```

There is a different Cold Resistor alarm for each rail. That is, there is a Cold North Resistor alarm and a Cold South Resistor alarm (or, depending on track direction, a Cold East Resistor alarm and a Cold West Resistor alarm).

The maximum number (per rai1side) of consecutive trains, having Cold Resistor alarms, allowed before generating a Successive Cold Resistors Exceeded alarm is set by the Cold Rails option on the Alarm Limits submenu (aka Alarm Settings submenu). Successive Cold Resistors Exceeded alarms are covered in the next appendix. **Chapter 11 - Serial Interface** tells how to view or change the Cold Rails option.

```
Alarm Settings, MP/KP-1794.5, Track-Single
-----
A Absolute..... 180
B Differential..... 130
C Hot Wheel..... 650
D Carside Slope..... 1.60
E Carside Minimum... 300
F Cold Rails..... 1
G Cold Rail Temp.... 10

Alarm to change or Esc to quit?
```

A.4 Cold Wheel Scanner Alarm

The Cold Wheel Scanner alarm represents the wheel scanner's equivalent of the bearing scanner's Cold Rail alarm. When no wheel on a given rail generates a delta temperature reading greater than 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 9°F above ambient (5°C above ambient). The customer can't change this value. Just like Cold Rail alarms, separate Cold Wheel Scanner alarms exist for each rai1side.

The maximum number (per rai1side) of consecutive trains, having Cold Wheel Scanner alarms, allowed before generating a Successive Cold Wheels Exceeded alarm is set by the Cold Rails option on the Alarm Limits submenu (aka Alarm Settings submenu). Successive Cold Wheels Exceeded alarms are covered in the next appendix. **Chapter 11 - Serial Interface** tells how to view or change the Cold Rails option.

```
Alarm Settings, MP/KP-1794.5, Track-Single
-----
A Absolute..... 180
B Differential..... 130
C Hot Wheel..... 650
D Carside Slope..... 1.60
E Carside Minimum... 300
F Cold Rails..... 1
G Cold Rail Temp.... 10

Alarm to change or Esc to quit?
```

A.5 Cold Wheel Scanner Resistor Alarm

The Cold Wheel Scanner Resistor alarm represents the wheel scanner's equivalent of the bearing scanner's Cold Resistor alarm. Evaluation of Cold Wheel Scanner Resistor alarm occurs in two stages. The first stage mimics the same logic used in the evaluation of Cold Resistor alarms. After finishing this check, and possibly flagging a Cold Wheel Scanner Resistor alarm, the firmware compares the recorded resistor temperature against a value of one-third the hot wheel alarm limit. If the recorded resistor temperature meets or exceeds this value, the firmware cancels any previously flagged Cold Wheel Scanner Resistor alarm. In this way, the system confirms the scanner's ability to read alarm level heat. Just like Cold Resistor alarms, separate Cold Wheel Scanner Resistor alarms exist for each railside.

The maximum number (per railside) of consecutive trains, having Cold Wheel Scanner Resistor alarms, allowed before generating a Successive Cold Wheel Resistors Exceeded alarm is set by the Cold Rails option on the Alarm Limits submenu (aka Alarm Settings submenu). Successive Cold Wheel Resistors Exceeded alarms are covered in the next appendix. **Chapter 11 - Serial Interface** tells how to view or change the Cold Rails option.

```
Alarm Settings, MP/KP-1794.5, Track-Single
```

```
-----  
A Absolute..... 180  
B Differential..... 130  
C Hot Wheel..... 650  
D Carside Slope..... 1.60  
E Carside Minimum... 300  
F Cold Rails..... 1  
G Cold Rail Temp.... 10
```

```
Alarm to change or Esc to quit?
```

A.6 Highrange Transducer Miscounts Alarm

The Highrange Transducer Miscounts alarm indicates that the transducer counts for TO1 and TO2 are off 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.

A.7 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.8 Low Battery Alarm

The Low Battery alarm indicates a float voltage of at least 11.8 volts, but less than 12.6 volts, on the standby battery. On a solar-powered system, it indicates a regulated voltage of at least 11.8 volts, but less than 11.5 volts, from the solar subsystem.

A.9 Midrange Transducer Miscounts Alarm

The Midrange Transducer Miscounts alarm indicates that the transducer counts for TO1 and TO2 are off by five or six. This calculation is made after each axle crosses both gating transducers.

A.10 Reverse Direction Detected Alarm

Trains that are being scanned correctly will have axles whose on times are less than their off times. For each axle of a passing train (except for the first axle), the system checks for an on time that is greater than the off time. If the axle's on time is greater than its off time, the system reverses the 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 to be the transducer that is opening the gate.

A.11 Short Train Alarm

The Short Train alarm indicates that a train had fewer than 50 axles.

A.12 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.13 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.14 Unstable SOTC Alarm

The Unstable SOTC alarm indicates that that upon train arrival, the system was activated by a track circuit and at some point during train passage (and before the end of train is reached) the track circuit deactivated at least once. When this alarm occurs, the track circuit should be examined.

The SmartScanNG is capable of operating without a track circuit or advance transducer. However, when this happens, the heat readings for the first axle may be invalid.

A.15 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 11.8 volts on the standby battery. On a solar-powered system, it indicates a regulated voltage of less than 11.8 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 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 Rail Temperature option on the Alarm Limits submenu (aka Alarm Settings submenu). **Chapter 11 - Serial Interface** tells how to view or change the Cold Rail Temperature option.

Alarm Settings, MP/KP-1794.5, Track-Single	

A	Absolute..... 180
B	Differential..... 130
C	Hot Wheel..... 650
D	Carside Slope..... 1.60
E	Carside Minimum... 300
F	Cold Rails..... 1
G	Cold Rail 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 Rail Temperature option on the Alarm Limits submenu (aka Alarm Settings submenu). **Chapter 11 - Serial Interface** tells how to view or change the Cold Rail Temperature option.

```
Alarm Settings, MP/KP-1794.5, Track-Single
```

```
-----  
A Absolute..... 180  
B Differential..... 130  
C Hot Wheel..... 650  
D Carside Slope..... 1.60  
E Carside Minimum... 300  
F Cold Rails..... 1  
G Cold Rail 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 are off 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 11.3 kph (7 mph), 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 Rail alarms (on some systems, called Cold Bearing Scanner alarms) on the same railside, have passed a site. The maximum number (per railside) of consecutive trains having Cold Rail alarms allowed before generating an Integrity Failure alarm is set by the Cold Rails option on the Alarm Limits submenu (aka Alarm Settings submenu). **Chapter 11 - Serial Interface** tells how to view or change the Cold Rails option.

```
Alarm Settings, MP/KP-1794.5, Track-Single
```

```
-----  
A Absolute..... 180  
B Differential..... 130  
C Hot Wheel..... 650  
D Carside Slope..... 1.60  
E Carside Minimum... 300  
F Cold Rails..... 1  
G Cold Rail 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 the same Cold Rail alarm equals or exceeds the cold-rail-alarm limit, this condition becomes an Integrity Failure. If the number of consecutive trains bearing identical Cold Rail alarms equals or exceeds the cold-rail-alarm limit, 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 Resistor alarms on the same railside, have passed a site. The maximum number (per railside) of consecutive trains having Cold Resistor alarms allowed before generating an Integrity Failure alarm is set by the Cold Rails option on the Alarm Limits submenu (aka Alarm Settings submenu). **Chapter 11 - Serial Interface** tells how to view or change the Cold Rails option.

Alarm Settings, MP/KP-1794.5, Track-Single	

A	Absolute..... 180
B	Differential..... 130
C	Hot Wheel..... 650
D	Carside Slope..... 1.60
E	Carside Minimum... 300
F	Cold Rails..... 1
G	Cold Rail 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 Rail alarms equals or exceeds the Cold Rails option on the Alarm Settings submenu, this condition becomes an Integrity Failure. If the number of consecutive trains bearing identical Cold Resistor alarms equals or exceeds the cold-rail-alarm limit, 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 Rails option on the Alarm Limits submenu (aka Alarm Settings submenu). **Chapter 11 - Serial Interface** tells how to view or change the Cold Rails option.

```
Alarm Settings, MP/KP-1794.5, Track-Single
```

```
-----  
A Absolute..... 180  
B Differential..... 130  
C Hot Wheel..... 650  
D Carside Slope..... 1.60  
E Carside Minimum... 300  
F Cold Rails..... 1  
G Cold Rail 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 Rails option on the Alarm Limits submenu (aka Alarm Settings submenu), 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 Rails option on the Alarm Limits submenu (aka Alarm Settings submenu). **Chapter 11 - Serial Interface** tells how to view or change the Cold Rails option.

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 Rails option on the Alarm Limits submenu (aka Alarm Settings submenu), 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
09/30/2008 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
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  
09/30/2008 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

?

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, the text of the message is usually "Testing, detector at milepost (*milepost number*), testing, one, two, three, four, five, four, three, two, one, testing." At double-track sites, the text of the message is usually "Testing, detector at milepost (*milepost number*), track (*track designation*), testing, one, two, three, four, five, four, three, two, one, testing."

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 text of the message is usually "zero, one, two, three, four, five, six, seven, eight, nine, integrity-failure, *beep*, detector-at, milepost, 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, first, second, third, fourth, left, right, side, load, scanner resistor test, beginning in, minutes." Not all systems broadcast all the words/letters listed above.

C.3 Ramp Function

Selection of the Ramp Function option generates a test train. It simulates two Absolute alarms, two Differential alarms, two Carside Slope alarms, and two Hotwheel alarms. It simulates the Carside and Hotwheel alarms even if detection for those alarms is disabled in the Equipment submenu. 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 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.

C.6 1KHz Test Tone

Selection of the 1KHz Test Tone option generates a continuous tone for about 10 seconds through the speaker and the radio. 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.

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.

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.

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.

Appendix D

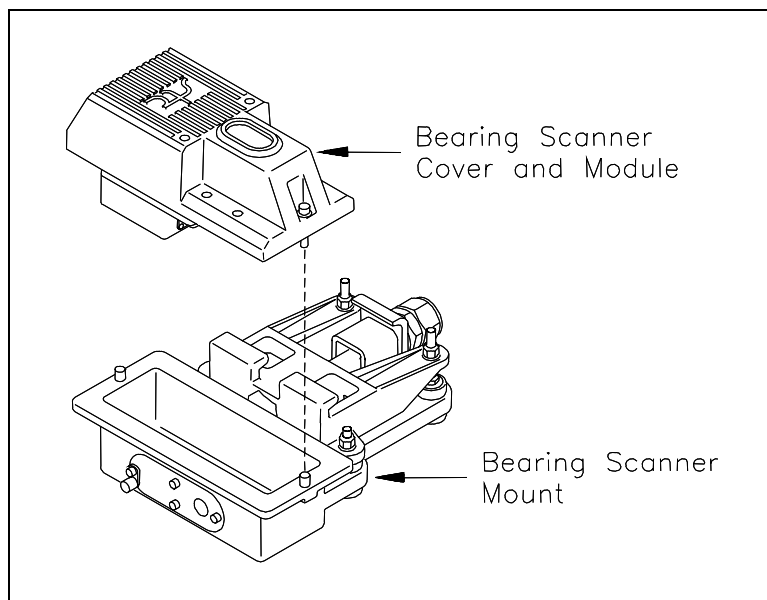
Replacement of Scanners

There are bearing scanners and 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.

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

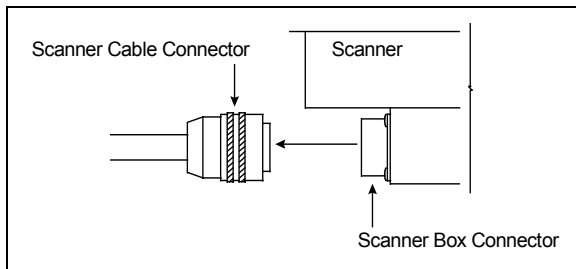
The figure below shows the major parts of a bearing scanner.



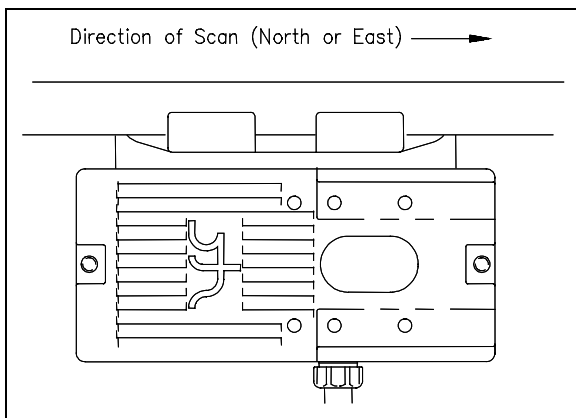
To replace a bearing scanner cover-and-module assembly:

- 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 SmartScanNG enclosure.
- 4 Using a T-handle 1/4-inch hex-wrench, loosen both socket-head-cap screws on the cover of the bearing scanner.
- 5 Separate the scanner cover-and-module assembly from its mount.
- 6 Disconnect the scanner cable connector from the scanner box connector.



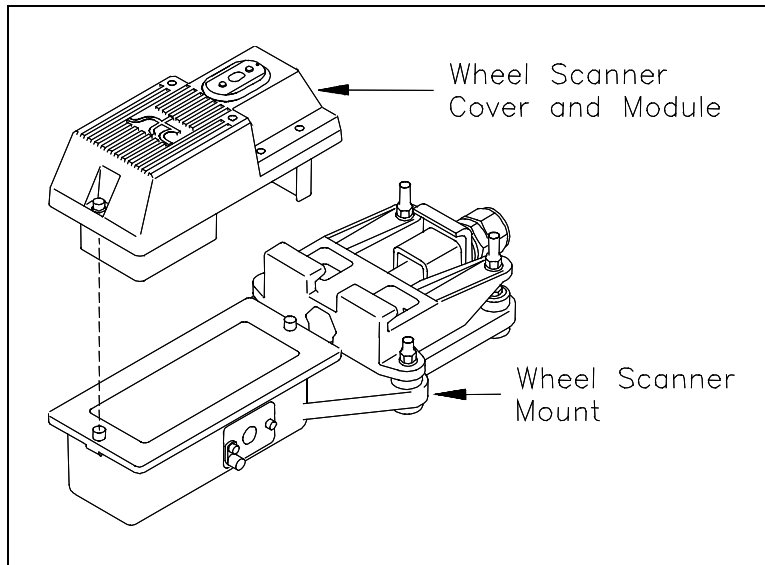
- 7 Store the removed scanner cover-and-module assembly in a safe place until you return it to STC for repair.
- 8 Attach the scanner cable connector to the scanner box connector (on the new scanner cover-and-module assembly).
- 9 With the hole (on top of the scanner cover) facing north or east, replace the scanner cover-and-module assembly onto its mount.



- 10 Using a T-handle 1/4-inch hex-wrench, tighten the two screws (on the scanner cover) until they are completely tight.
- 11 Turn on power to the SmartScanNG enclosure.

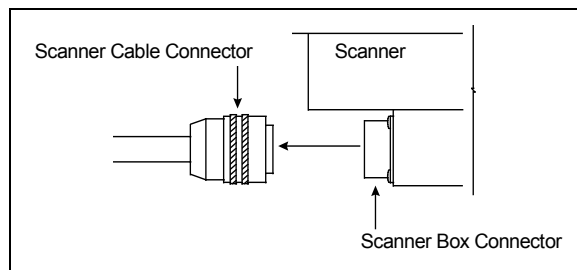
D.2 Wheel Scanners

The figure below shows the major parts of a wheel scanner.



To replace a 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 SmartScanNG enclosure.
- 4 Using a T-handle 1/4-inch hex-wrench, loosen the two socket-head-cap screws on the cover of the bearing scanner.
- 5 Separate the scanner cover-and-module assembly from its mount.
- 6 Disconnect the scanner cable connector from the scanner box connector.



- 7 Store the removed scanner cover-and-module assembly in a safe place until you return it to STC for repair.

- 8 Attach the scanner cable connector to the scanner box connector (on the new scanner cover-and-module assembly).
- 9 With the hole (on top of the scanner cover) facing the center of the track, replace the scanner cover-and-module assembly onto its mount.
- 10 Using a T-handle 1/4-inch hex-wrench, tighten the two screws (on the scanner cover) until they are completely tight.
- 11 Turn on power to the SmartScanNG enclosure.

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 bearing scanner:

- 1 Be sure that you have on hand a STC calibrated heat source 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 calibrated heat source cable into the **six**-contact circular connector on the front of the calibrated heat source.
- 4 Plug the other end of the calibrated heat source cable into a grounded three-wire 110-120 VAC outlet in the wayside enclosure.

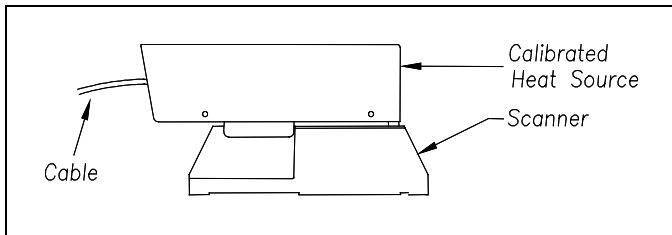
The function connector that is not being used has live AC present.

- 5 Cover the function connector that isn't being used with the supplied dust cover.
- 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.
- 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 Be sure that a computer is plugged into COM1 (on the side of the Controller module), that it is turned on, that it has appropriate communications software installed, that the communications software is set to use full duplex, that the baud rate is set to 19,200, and that a LOG file is opened.
- 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.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 21:57
Main Menu
-----
      .
      .
      .
J) Setup
K) Enter Pass-Thru Mode
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-1794.5, Track-Single
09/30/2008 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

?

13 To start autocalibration, type G

The SmartScanNG system will now calibrate itself. Follow along on your interface 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).

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

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 cable 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 wheel scanner:

- 1 Be sure that you have on hand a STC calibrated heat source 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 calibrated heat source cable into the **six**-contact circular connector on the front of the calibrated heat source.
- 4 Plug the other end of the calibrated heat source cable into a grounded three-wire 110-120 VAC outlet in the wayside enclosure.

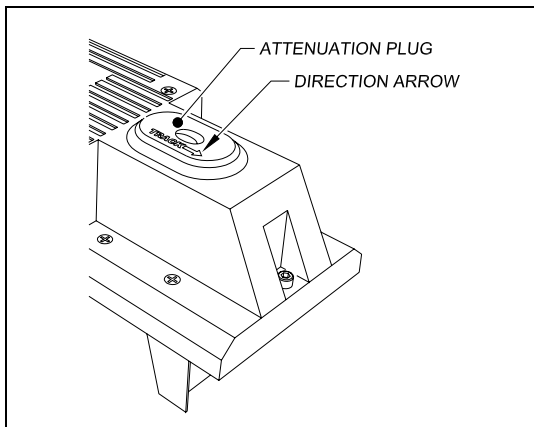
The function connector that is not being used has live AC present.

- 5 Cover the function connector that isn't being used with the supplied dust cover.
- 6 On the control panel, turn the temperature knob to **180**.
- 7 Put the heat source in a shady area, out of direct sunlight.
- 8 Wait about 8 minutes for the heat source to reach operating temperature and stabilize.

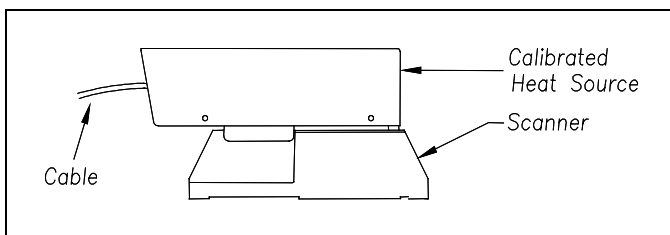
The heat source has reached operating temperature and stabilized when the temperature meter needle remains centered.

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

- 9 Remove the attenuation plug from the wheel scanner.



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



- 11 Be sure that a computer is plugged into COM1 (on the side of the Controller module), that it is turned on, that it has appropriate communications software installed, that the communications software is set to use full duplex, that the baud rate is set to 19,200, and that a LOG file is opened.

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
09/30/2008 21:57
Main Menu
-----
      .
      .
      .
J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
?
```

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

The System Functions menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2008 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
?
```

14 To start autocalibration, type **G**

The SmartScanNG system will now calibrate itself. Follow along on your interface 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).

- 15** When "Auto-Calibration Disengaged" is displayed on your computer, remove the calibrated heat source.
- 16** To return to the Main menu, type **X**
- 17** To exit the serial interface and return the system to normal operation, type **X**
- 18** 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.
- 19** Store the calibrated heat source and its cable in the wayside enclosure.

Appendix F

Predictive Gate Scanning

This appendix describes predictive gate scanning of bearings.

F.1 Overview

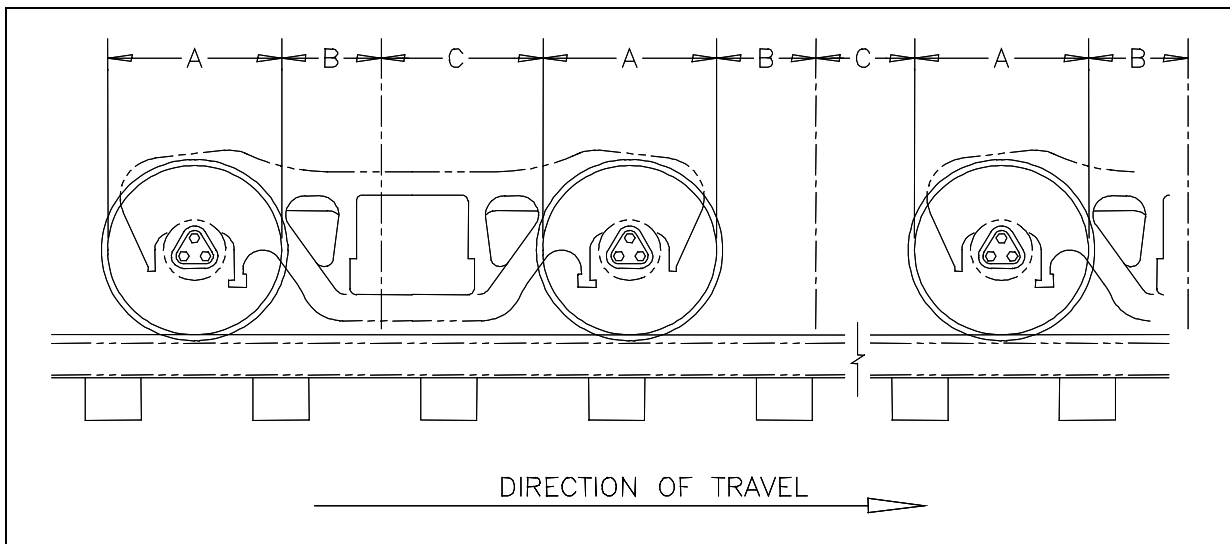
If a pyrometer is exposed to extreme infrared energy emission, the device itself can be driven into a saturated state. When this happens, it is blinded to subsequent changes in infrared energy emission. This blinded state can last up to 1-1/2 seconds.

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. 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.

F.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.

F.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 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	East Rail	West Rail	East Wheel	West Wheel	ON	OFF	PW1	PW2	Alarms

1	1	58°	22°	176°	154°	25	0	17	18	East Rail Pyro Saturation Alarm
	2	58°	22°	176°	186°	25	59	14	14	
	3	210°	22°	176°	186°	25	59	14	14	
	4	58°	22°	186°	176°	25	562	14	14	
	5	58°	22°	186°	172°	25	60	14	14	
	6	58°	22°	186°	176°	25	59	14	14	
2	7	60°	22°	172°	186°	25	162	14	14	
	8	58°	22°	176°	186°	25	59	14	14	
						.				
						.				
						.				

Index

This section lists the page numbers for keywords and phrases used in this guide.

0°F (-18°C), 31, 147, 150, 161, 334, 361, 363

10 foot-pounds (13.6 newton-meters), 89, 136, 172, 314

10 mph (16 kph), 53, 71, 167, 168, 321

100-foot (30.5-meter) scanner cable, 17, 18, 19, 80, 96, 288

110-120 VAC, 15, 16, 30, 36, 37, 57, 65, 74, 76, 112, 113, 138, 139, 148, 151, 314, 316, 361, 364

112LB-130LB (transducer mounting plate), 20, 85

12 foot-pounds (16.3 newton-meters), 88

12 VDC, 36, 37, 39, 40, 47, 56, 69, 130

130-foot (39.6 meter) scanner cable, 17, 18, 19, 80, 96

131LB-141LB (transducer mounting plate), 20, 85

14 VDC, 141, 142, 316, 317

15 feet (4.6 meters), 115, 144, 169, 323

19,200 baud rate, 145, 148, 152, 194, 254, 362, 364

1KHz test tone, 146, 149, 153, 154, 155, 241, 246, 354, 355, 363, 365

1KHz Test Tone option (on System Functions menu), 154, 246, 355

24-hour format, 258, 263, 270, 276, 286, 297

300 rpm, 31

32 feet (9.75 meters), 22, 92

5 VDC, 30, 39, 40, 57, 138, 148, 151

50 foot-pounds (67.8 newton-meters), 78, 79, 95, 106

65-foot (19.8-meter) scanner cable, 17, 18, 19, 80, 96, 288

7 mph (11.3 kph), 171, 183, 186, 206, 225, 324, 344, 346, 348, 369

9 VDC, 40, 48

90°F (32°C), 31, 147, 150, 161, 334, 361, 363

9600 baud rate, 220, 238, 239, 240

AAR (American Association of Railroads), 68, 233, 287, 294, 295

abbreviated Exception Detail report, 253, 281, 283

above 0°F (-18°C), 31, 147, 150, 161, 334, 361, 363

Absolute alarm, 159, 160, 186, 203, 244, 302, 333, 334, 355, 368

Absolute option (on Alarm Limits submenu), 186, 203, 257, 264, 270, 277, 342

adjustment components, 27

ADV1 (advance transducer), 56, 92, 126

ADV2 (advance transducer), 56, 92, 93, 126

advance transducers, 22, 23, 35, 55, 56, 77, 86, 92, 93, 98, 126, 143, 168, 170, 181, 321, 322, 324, 341, 346, 349

AEI (automatic equipment identification), 9, 10, 13, 24, 25, 66, 68, 69, 70, 71, 72, 77, 99, 101, 129, 132, 133, 160, 164, 193, 195, 196, 197, 210, 216, 217, 221, 228, 233, 234, 235, 237, 241, 250, 251, 253, 254-261, 265, 268, 269, 271, 272, 274, 278, 281, 284, 285, 287, 289-296, 306, 353

- AEI antenna, 13, 24, 68, 72, 77, 99, 101, 133
- AEI Diagnostic Detail report, 253, 292, 294, 296
- AEI Interface module (2300-750), 24, 68, 69, 70, 101, 132, 133
- AEI option (on Equipment submenu), 9, 193, 216, 255, 256, 258, 259, 260, 261, 265, 268, 271, 272, 274, 278, 281, 287, 292, 306
- AEI tags, 68, 258, 265, 271, 278, 294, 295
- AI1200 board, 68
- alarm
 - Absolute, 159, 160, 186, 203, 244, 302, 333, 334, 355, 368
 - Carside Slope, 159, 183, 186, 206, 207, 213, 244, 259, 264, 277, 292, 302, 333, 355
 - Cold Rail, 208, 209, 341, 342, 343, 347, 350, 351
 - Cold Resistor, 52, 165, 208, 264, 277, 319, 342, 343, 344, 351
 - Cold Wheel Scanner, 208, 343, 348, 352
 - Cold Wheel Scanner Resistor, 208, 265, 278, 344, 352
 - Dead Battery, 347
 - Dead Resistor, 347
 - Dead Wheel Scanner Resistor, 348
 - Differential, 159, 160, 183, 186, 204, 244, 302, 333, 334, 355
 - Dragging-Equipment, 190, 211, 306, 307, 308, 309, 311, 312, 349
 - Exception, 39, 159, 179, 181, 231, 232, 245, 258, 262, 266, 268, 270, 275, 279, 281, 294, 301, 303, 304, 305, 306, 310, 333, 337
 - High-Load, 190, 212, 214, 306
 - Highrange Transducer Miscounts, 223, 224, 302, 344, 348
 - High-Wide, 212, 214, 306
 - Hotbox, 162, 186, 264, 277, 302, 305, 306, 307, 308, 309, 310, 312, 335
 - Hotwheel, 159, 189, 190, 205, 213, 244, 256, 259, 264, 265, 268, 277, 278, 292, 305, 306, 308, 309, 333, 355
 - Integrity Failure, 345, 350, 351
 - Low Battery, 345
 - Midrange Transducer Miscounts, 345
 - No Approach Track, 168, 321, 341
 - Pyrometer Saturation, 183, 186, 301, 302, 368, 369
 - Reverse Direction Detected, 345
 - Short Train, 217, 345
 - Stuck Dragger During Train Passage, 302, 349
 - Stuck Dragger Pretrain, 302, 349
 - Stuck Dragger Recovered, 346
 - Stuck High-Load Detector Pretrain, 190, 302, 349
 - Stuck Wide-Load Detector Pretrain, 191, 302, 349
 - Successive Cold Rails Exceeded, 208, 302, 342, 350
 - Successive Cold Resistors Exceeded, 208, 293, 302, 343, 351
 - Successive Cold Wheel Resistors Exceeded, 208, 261, 274, 302, 344, 352
 - Successive Cold Wheels Exceeded, 208, 302, 343, 352
 - Test Train, 346
 - Unstable SOTC Alarm, 346
 - Very Slow Train, 171, 223, 224, 302, 324, 344, 346, 348, 369
 - Wide-Load, 191, 211, 212, 214, 301, 306
- Alarm Limits submenu (aka Alarm Settings submenu), 190, 202, 203, 204, 205, 206, 207, 208, 209, 257, 264, 270, 277, 286, 341, 342, 343, 344, 347, 348, 350, 351, 352
- Alarm Settings submenu (aka Alarm Limits submenu), 190, 202, 203, 204, 205, 206, 207, 208, 209, 257, 264, 270, 277, 286, 341, 342, 343, 344, 347, 348, 350, 351, 352
- alcohol, isopropyl, 147, 331
- aligning scanners, 27, 103, 178, 336
- alignment, 27, 28, 29, 30, 86, 88, 89, 103, 104, 105, 106, 107, 109, 110, 135, 172, 313, 314
- alignment fixture, 27, 28, 30, 86, 88, 89, 103, 104, 106, 107, 109, 110, 135, 172, 313, 314

- ambient temperature, 14, 30, 31, 67, 129, 186, 188, 190, 203, 205, 209, 215, 222, 224, 258, 263, 265, 271, 276, 278, 286, 288, 302, 342
- American Association of Railroads (AAR), 68, 233, 287, 294, 295
- American Wire Gauge (AWG), 23, 83, 84, 97, 98, 99, 111, 113, 114, 115, 120, 121
- ancillary messages, 222, 302, 303, 304, 305, 310
- Announce Axles option (on Messages submenu), 183, 223
- Announce Car Identification option (on Messages submenu), 228, 306, 310
- Announce Cold Rail option (on Messages submenu), 230
- Announce Customer Name option (on Messages submenu), 227, 299
- Announce Left-Right Alarm Reference option (on Messages submenu), 228, 306, 307, 308, 310
- Announce Number of Cars option (on Messages submenu), 183, 226
- Announce Power Off option (on Messages submenu), 225
- Announce Slow Trains option (on Messages submenu), 183, 225
- Announce Speed option (on Messages submenu), 183, 223
- Announce Temperature option (on Messages submenu), 224
- Announce Train Arrival option (on Messages submenu), 227, 300
- Announce Train Length option (on Messages submenu), 183, 224
- antenna, 24, 25, 35, 37, 57, 58, 68, 69, 71, 72, 99, 100, 101, 132, 136, 261, 265, 274, 278, 293, 295
- antenna masts, 72, 73
- antenna0, 24, 25, 68, 70, 99, 100, 265, 278, 295
- antenna1, 24, 25, 68, 70, 99, 100, 265, 278, 295
- antennas
 - AEI, 13, 24, 68, 72, 77, 99, 101, 133
 - HP9-915, 24, 25, 99
 - radio, 35, 37, 132, 136
 - SRL470, 24, 25, 99
- AR2200 board, 68, 70
- arresters, 23, 56, 57, 101, 128, 129, 133
- arrival message, 222, 227, 228, 235, 284, 300, 302
- attenuation plug (on wheel scanner), 13, 18, 151, 153, 357, 364, 366
- autocalibration, 46, 146, 147, 149, 153, 155, 241, 247, 248, 286, 288, 330, 354, 356, 361, 363, 365, 366
- autocalibration disengaged, 149, 153, 248, 363, 365, 366
- Auto-Calibration option (on System Functions menu), 247, 356
- automatic equipment identification (AEI), 9, 10, 13, 24, 25, 66, 68, 69, 70, 71, 72, 77, 99, 101, 129, 132, 133, 160, 164, 193, 195, 196, 197, 210, 216, 217, 221, 228, 233, 234, 235, 237, 241, 250, 251, 253, 254-261, 265, 268, 269, 271, 272, 274, 278, 281, 284, 285, 287, 289-296, 306, 353
- auxiliary alarms, 190
- auxiliary-alarm detectors, 13, 23, 37, 77, 135
- AWG (American Wire Gauge), 23, 83, 84, 97, 98, 99, 111, 113, 114, 115, 120, 121
- axle alarm summary, 260, 261, 266, 273, 274, 279, 282, 293
- axle count, 53, 167, 168, 171, 173, 176, 183, 185, 222, 223, 302, 321, 324, 325, 328, 344, 346, 348
- axle number, 23, 266, 279
- axle scanning, 185

- ballast, 72, 78, 94, 136, 314
- batteries, 2, 11, 39, 40, 55, 61, 63, 64, 65, 66, 67, 74, 113, 114, 115, 116, 118, 119, 120, 121, 122, 133, 137, 138, 139, 140, 141, 142, 143, 178, 180, 193, 217, 225, 258, 263, 264, 265, 271, 276, 277, 278, 286, 288, 315, 316, 317, 318, 336, 345, 347
- battery charger, 61, 63-66, 74, 113, 114, 116, 118-122, 137-142, 178, 180, 315, 316, 317, 336
- battery post, 120, 121, 122, 140, 315
- battery side of fuse block, 67, 141
- battery temperature probe, 65, 120, 121, 140, 315
- battery voltage, 40, 142, 178, 217, 225, 258, 263, 264, 265, 271, 276, 277, 278, 286, 288, 317, 336
- battery-charging LED (on charger), 65, 142, 317
- baud rate, 145, 148, 152, 194, 220, 238, 239, 240, 254, 286, 362, 364

- bearing scanner cable, 17, 18, 19, 80, 81
- bearing scanners, 9, 14-19, 22, 29, 43, 45, 52, 54, 71, 72, 73, 76-83, 86-90, 94, 103, 104, 106, 121, 122, 125, 147, 148, 149, 161, 162, 165, 166, 170, 181, 187, 190, 258, 263, 264, 266, 271, 276, 277, 279, 288, 319, 320, 324, 335, 342, 343, 344, 347, 357, 358, 359, 361, 362, 367
- below 90°F (32°C), 31, 147, 150, 161, 334, 361, 363
- board
 - AI1200, 68
 - AR2200, 68, 70
 - Interface, 14, 37-41, 43, 45-49, 56, 59, 173-178, 184, 193, 325, 326, 327, 328, 329, 330
 - Modem, 35, 37, 48, 49
 - Processor, 14, 37, 38, 39, 55, 57, 59, 68, 143, 184, 185, 193, 248, 257, 265, 269, 278, 287, 318, 356
 - SOTC, 23, 35, 37, 55, 143, 144, 145, 169, 170, 323
 - System-Interconnect, 14, 35, 37, 38, 40, 57, 59, 67, 125, 126, 127, 134, 144, 145, 169, 170, 323
- bottom row (fifth row) of LEDs on status panel, 165, 319
- cable
 - bearing scanner, 17, 18, 19, 80, 81
 - transducer, 22, 43, 45, 92, 173, 313, 325
 - wheel scanner, 19, 96
- calibrated heat source, 27, 30-33, 147-154, 161, 162, 247, 248, 334, 335, 356, 361, 362, 363, 364, 366
- calibration, 30, 33, 147, 148, 149, 151, 153, 247, 248, 356, 361, 363, 364, 365
- Carside Minimum option (on Alarm Limits submenu), 207, 257, 264, 270, 277
- Carside Slope alarm, 159, 183, 186, 206, 207, 213, 244, 259, 264, 277, 292, 302, 333, 355
- Carside Slope option (on Alarm Limits submenu), 206, 257, 264, 270, 277
- Carside Slope option (on Equipment submenu), 186, 206, 213, 259, 261, 274, 292
- carside-slope alarm-limit lines, 259, 292
- cautions, dangers, warnings, 2, 10, 39, 49, 55, 120, 121, 122, 137, 140, 143, 315, 318
- channel, 10, 57, 59, 181, 245, 248, 299, 300
- checking on shipments and orders, 340
- circuit breakers, 37, 58, 65, 138, 142, 317
- circuit-breaker box, 74, 138
- clamping nut, 78, 95, 101, 106
- Clear Event Log option (on System Functions menu), 297, 356
- Clearance Mode option (on Equipment submenu), 212, 215, 301, 306
- Clearance Type option (on Equipment submenu), 191, 214, 306
- coaxial cables, 101, 132, 133
- Cold Rail alarm, 208, 209, 341, 342, 343, 347, 350, 351
- Cold Rail Temperature option (on Alarm Limits submenu), 257, 264, 270, 277, 341, 347, 348
- Cold Rails option (on Alarm Limits submenu), 208, 342, 343, 344, 350, 351, 352
- Cold Resistor alarm, 52, 165, 208, 264, 277, 319, 342, 343, 344, 351
- Cold Wheel Scanner alarm, 208, 343, 348, 352
- Cold Wheel Scanner Resistor alarm, 208, 265, 278, 344, 352
- COM1, 129, 145, 148, 152, 194, 197, 233, 235, 236, 237, 238, 250, 253, 285, 362, 364
- COM2, 145, 194, 197, 233, 235, 236, 237, 239, 253, 285
- COM3, 193, 197, 220, 221, 233, 235, 236, 237, 239, 285
- COM4, 129, 197, 233, 235, 236, 237, 240, 285
- COM5, 69, 129, 133, 250, 251
- comment on this guide, 11
- computer, 10, 48, 76, 135, 145, 147, 148, 149, 151, 152, 153, 193, 194, 220, 247, 248, 253, 254, 313, 356, 361, 362, 363, 364, 365, 366
- conduit, 19, 22, 76, 80, 81, 83, 84, 96, 97, 98
- Controller module (2300-502), 9, 35, 37, 38, 42, 50, 51, 53, 54, 55, 69, 133, 143, 144, 145, 148, 152, 168, 169, 170, 184, 193, 322, 323, 324, 362, 364
- COP reset, 146, 149, 153, 155, 241, 287, 354, 356, 363, 365
- crate, 75
- customer service, 339

damaged or defective hardware, 75
 damp environment, 313
 dangers, warnings, cautions, 2, 10, 39, 49, 55, 120, 121, 122, 137, 140, 143, 315, 318
 date and time, 147, 163, 193, 197-200, 202, 210, 221, 258, 263, 270, 276, 286, 288, 297, 331
 Date and Time submenu, 198, 258, 263, 270, 276, 286
 DB15, 59
 DB9, 41
 DC circuit breaker (on charger), 142, 317
 DC power switch, 58, 138, 142-145, 160, 168-170, 173, 175, 176, 178, 322-325, 327, 328, 330
 dead battery, 302, 347
 Dead Battery alarm, 347
 Dead Resistor alarm, 347
 Dead Wheel Scanner Resistor alarm, 348
 debris port, 79, 80
 default setup parameters, 197, 233, 235, 236, 237
 defects, 10, 23, 54, 75, 120, 121, 161, 179, 180, 181, 226, 232, 299, 301, 303, 335, 336, 337, 339, 354
 Delete All Stored Train Data option (on System Functions menu), 356
 delete all train data, 146, 149, 153, 155, 241, 249, 354, 356, 363, 365
 Differential alarm, 159, 160, 183, 186, 204, 244, 302, 333, 334, 355
 Differential option (on Alarm Limits submenu), 186, 204, 257, 264, 270, 277
 digitized, 10, 14
 DIN rail, 56, 115, 127, 128, 129, 131, 134
 direction of scan, 79
 direction of track, 200, 201, 209, 286, 341, 343, 347, 348, 349
 directory, 39, 171, 179, 246, 249, 255, 258, 263, 268, 270, 276, 324, 337, 355, 356
 dirty optics, 147, 331
 distribution block, 61, 62, 63, 64, 66, 67, 115, 116, 117, 118, 119, 120, 121, 122, 133, 140, 141
 double-track site, 35, 61, 63, 64, 82, 84, 89-93, 97-99, 107, 110, 111, 116, 118, 119, 122-129, 132, 134, 147, 150, 154, 156, 158, 160, 161, 162, 164, 180, 251, 305, 307, 311, 354
 Dragger option (on Equipment submenu), 190, 211
 Dragging-Equipment alarm, 190, 211, 306, 307, 308, 309, 311, 312, 349
 dragging-equipment detectors, 10, 13, 23, 54, 56, 75, 77, 126, 127, 135, 190, 346, 349
 DTMF code, 222, 229, 230, 231, 235, 284, 302
 dusty environment, 313

 equipment side of fuse block, 67, 141
 Equipment submenu, 9, 159, 162, 164, 186, 190, 191, 193, 197, 205, 206, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 255, 256, 257, 258, 259, 261, 264, 265, 266, 268, 269, 270, 271, 274, 277, 278, 279, 286, 287, 292, 306, 355
 event log, 9, 146, 149, 152, 153, 154, 155, 157, 158, 195, 196, 241, 250, 251, 253, 254, 255, 289, 290, 291, 296, 297, 298, 330, 353, 354, 356, 362, 363, 365
 Event Log report, 253, 297, 298, 356
 Exception Alarms, 39, 159, 179, 181, 231, 232, 245, 258, 262, 266, 268, 270, 275, 279, 281, 294, 301, 303, 304, 305, 306, 310, 333, 337
 Exception Detail report, 39, 180, 183, 253, 268, 272, 274, 275, 280, 281, 283, 304, 337, 341, 342, 347, 350, 351, 352
 Exception Summary report, 39, 179, 180, 253, 268, 269, 272, 336, 337
 exception train, 268
 Exceptions directory, 39, 179, 268, 270, 276, 337, 356
 excessive AC, 65
 excessive DC, 65
 exit speed, 10, 20, 183, 223, 258, 262, 263, 271, 275, 276, 281, 294, 344, 346, 348
 extended Exception Detail report, 180, 253, 272, 274, 275, 280, 281, 337

fax number of STC (423-499-0045), 2, 11, 339
 fifth row (bottom row) of LEDs on status panel, 165, 319
 firmware, 2, 9, 10, 14, 46, 49, 57, 155, 157, 185, 188, 219, 242, 244, 247, 248, 255-257, 260, 261, 265, 266, 268, 269, 272-274, 278, 279, 285, 287, 292, 293, 332, 342, 343, 344, 346, 348, 349, 369
 first row (top row) of LEDs on status panel, 143, 318
 flammable hydrogen gas (from battery), 11, 137, 140, 315
 flex-conduit-adapter plate (on scanner), 19, 76, 80, 81, 83, 84, 96, 97, 98
 float voltage, 65, 139, 142, 178, 316, 317, 336, 345, 347
 float voltage switches, 65, 139, 142, 316, 317
 fuse block, 56, 61, 66, 67, 74, 115, 116, 120, 121, 137, 138, 141, 316
 fuses, 34, 37, 40, 47, 56, 57, 61, 66, 67, 74, 115, 116, 120, 121, 137, 138, 141, 316

 gate distance (aka gate width), 210, 211, 217, 218, 219, 235, 284
 Gate Distance option (on Equipment submenu), 211, 218
 gate width (aka gate distance), 210, 211, 217, 218, 219, 235, 284
 Gating switch (on calibrated heat source), 33, 148, 151, 361, 364
 gating transducer loading, 43, 44, 45, 46, 173, 175, 177, 325, 327, 329
 gating transducers, 14, 22, 23, 33, 34, 43, 45, 53, 56, 77, 86, 87, 89, 90, 92, 94, 99, 100, 103, 125, 126, 144, 145, 159, 161, 167, 168, 169, 170, 171, 173, 175, 176, 177, 178, 181, 182, 183, 184, 185, 187, 188, 189, 218, 245, 256, 257, 258, 260, 261, 264, 266, 268, 269, 271, 273, 274, 277, 279, 293, 320, 321, 323, 324, 325, 327, 328, 330, 333, 334, 335, 341, 344, 345, 346, 348, 349, 369
 generating test trains (when placing system into service), 158
 generic guide, 2, 9
 ground, 30, 56, 59, 67, 69, 71, 73, 74, 80, 81, 83, 84, 95, 96, 97, 98, 111, 112, 113, 114, 128, 133, 136, 139, 314, 315
 ground bus, 111, 113, 114, 136, 139, 314, 315
 ground lug, 80, 81, 83, 84, 95, 96, 97, 98, 113, 114
 ground rod, 74, 83, 97, 111

 hardwire shunt, 145, 170, 323, 324
 heat block, 30, 31, 34
 heaters, 13, 14, 36, 37, 57, 58, 59, 60, 159, 181, 215, 333
 height, 30, 88, 89, 112, 135, 136, 172, 313, 314
 height bracket (on alignment fixture), 30, 88, 135, 172, 313
 highest sensitivity (for transducer loading), 44, 46, 175, 177, 178, 327, 330
 High-Load alarm, 190, 212, 214, 306
 high-load detectors, 10, 54, 56, 190, 191, 214, 302, 306, 349
 High-Load option (on Equipment submenu), 190, 212
 Highrange Transducer Miscounts alarm, 223, 224, 302, 344, 348
 High-Wide alarm, 212, 214, 306
 Holdoff line, 300
 Holdoff timer, 300
 horizontal alignment bar (on alignment fixture), 29, 105, 109, 110
 Hotbox alarm, 162, 186, 264, 277, 302, 305, 306, 307, 308, 309, 310, 312, 335
 Hotwheel alarm, 159, 190, 205, 213, 244, 256, 259, 264, 265, 268, 277, 278, 292, 305, 306, 308, 309, 333, 355
 Hotwheel option (on Alarm Limits submenu), 190, 205, 257, 264, 270, 277
 how to comment on this guide, 11
 how to order more copies of this guide, 11
 HP9-915 antenna, 24, 25, 99
 hydrogen gas (from battery), 11, 137, 140, 315

installing track components, 13, 77, 135
 Integrity Failure alarm, 345, 350, 351
 Interface board, 14, 37, 38-41, 43, 45-49, 56, 59, 173-178, 184, 193, 325, 326, 327, 328, 329, 330
 isopropyl alcohol, 147, 331

 J201 (jumper on Interface board), 43, 44, 173, 175, 177, 178, 325, 327, 329, 330
 J202 (jumper on Interface board), 45, 46, 173, 175, 177, 178, 325, 327, 329, 330
 J300 (jumper on Interface board), 46
 jumpers, 41, 42, 43, 44, 45, 46, 70, 173, 174, 175, 177, 178, 325, 326, 327, 329, 330

 kilograms per meter (kg/m), 20, 85, 86, 90
 kilometer post, 199, 257, 263, 269, 276, 286

 laptop, 135, 148, 151, 313, 361, 364
 Last Test Train report, 39, 159, 160, 244, 246, 253, 291, 333, 334, 355
 Last Train report, 161, 168, 253, 290, 321, 334
 leading zeros, 198, 199, 203, 204, 205, 206, 207, 208, 209, 218, 229
 LED (light-emitting diode), 37, 47, 49, 50, 51, 52, 53, 54, 55, 58, 59, 60, 65, 69, 70, 140, 141, 142, 143, 144, 145, 156, 159, 165, 166, 167, 168, 169, 170, 179, 180, 184, 243, 247, 315, 317, 318, 319, 320, 321, 323, 331, 333, 336, 337
 light beam, 190, 191, 214, 306
 light-emitting diode (LED), 37, 47, 49, 50, 51, 52, 53, 54, 55, 58, 59, 60, 65, 69, 70, 140, 141, 142, 143, 144, 145, 156, 159, 165, 166, 167, 168, 169, 170, 179, 180, 184, 243, 247, 315, 317, 318, 319, 320, 321, 323, 331, 333, 336, 337
 line jack, 49
 linearity, 188
 load default setup parameters, 197, 233, 235, 236, 237
 loading of gating transducers, 43, 44, 45, 46, 173, 175, 177, 325, 327, 329
 locking nut, 78, 79, 81, 95, 106
 LOG file, 145, 148, 152, 194, 195, 254, 255, 259, 267, 272, 280, 283, 289, 290, 291, 296, 298, 362, 364
 low battery, 345
 Low Battery alarm, 345
 lowest sensitivity (for transducer loading), 43, 44, 45, 175, 177, 178, 327, 329, 330

 Main menu, 9, 129, 146, 147, 149, 150, 152, 153, 154, 156, 157, 158, 160, 161, 163, 164, 168, 171, 179, 194, 195, 196, 197, 220, 241, 242, 250, 251, 253, 254, 255, 259, 267, 272, 280, 283, 287, 289, 290, 291, 296, 298, 321, 324, 330, 332, 334, 337, 353, 362, 363, 365, 366
 Manual Test Mode option (on System Functions menu), 246, 355
 mast, 72, 73
 menu
 Main, 9, 129, 146, 147, 149, 150, 152-158, 160, 161, 163, 164, 168, 171, 179, 194-197, 220, 241, 242, 250, 251, 253-255, 259, 267, 272, 280, 283, 287, 289-291, 296, 298, 321, 324, 330, 332, 334, 337, 353, 362, 363, 365, 366
 Setup, 163, 164, 195-202, 210, 211, 221, 222, 231, 232-240
 System Functions, 146, 147, 149, 153, 155, 156, 157, 158, 159, 195, 241, 242, 243, 244, 245, 246, 247, 248, 249, 287, 297, 330, 331, 332, 333, 354, 356, 363, 365
 Messages submenu, 193, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 286, 299, 300, 301, 302, 303, 304, 306, 307, 310
 middle sensitivity (for transducer loading), 44, 46, 175, 177, 178, 327, 330
 Midrange Transducer Miscounts alarm, 345
 milepost, 10, 199, 257, 263, 269, 276, 286, 300, 301, 303, 304, 305, 307, 308, 309, 310, 311, 312, 354
 Milepost submenu (aka MP/KP submenu), 199, 257, 269, 276, 286
 miles per hour (mph), 10, 14, 53, 71, 162, 164, 167, 168, 171, 183, 185, 186, 206, 215, 225, 256, 257, 258, 268, 269, 271, 321, 324, 344, 346, 348, 369

modem, 10, 35, 37, 40, 48, 49, 129, 193, 194, 195, 196, 197, 210, 211, 218, 219, 220, 221, 235, 250, 253, 254, 255, 284
 Modem board, 35, 37, 48, 49
 mounting plate (on transducer), 20, 21, 85, 86, 87, 89, 90, 92, 135, 136, 171, 172, 313, 314
 MP/KP submenu (aka Milepost submenu), 199, 257, 263, 269, 276, 286
 mph (miles per hour), 10, 14, 53, 71, 162, 164, 167, 168, 171, 183, 185, 186, 206, 215, 225, 256, 257, 258, 268, 269, 271, 321, 324, 344, 346, 348, 369
 multimeter, 76, 135, 137, 141, 313, 315, 316
 multiplexed, 68, 214, 215, 301, 306
 multitrack site, 35, 57, 61, 63, 64, 81-84, 89-93, 96-99, 107, 110, 111, 116, 118, 119, 122-129, 132, 134, 147, 150, 154, 156, 158, 160-162, 164, 180, 193, 250, 251, 257, 263, 269, 276, 286, 300, 301, 304, 305, 307, 311, 337, 354

 No Approach Track alarm, 168, 321, 341
 no measurable heat from one scanner, 162, 335
 northern hemisphere, 2, 9, 77
 nothing detected, 303
 N-type, 24, 69, 100, 101

 optics, 13, 146, 147, 178, 313, 330, 331, 336
 option on Alarm Limits submenu
 Absolute, 186, 257, 264, 270, 277, 342
 Carside Minimum, 207, 257, 264, 270, 277
 Carside Slope, 206, 257, 264, 270, 277
 Cold Rail Temperature, 209, 257, 264, 270, 277, 341, 347, 348
 Cold Rails, 208, 342, 343, 344, 350, 351, 352
 Differential, 186, 204, 257, 264, 270, 277
 Hotwheel, 190, 205, 257, 264, 270, 277
 option on Equipment submenu
 AEI, 9, 193, 216, 255, 256, 258, 259, 260, 261, 265, 268, 271, 272, 274, 278, 281, 287, 292, 306
 Carside Slope, 186, 206, 213, 259, 261, 274, 292
 Clearance Mode, 212, 215, 301, 306
 Clearance Type, 191, 214, 306
 Dragger, 190, 211
 Gate Distance, 211, 218
 High-Load, 190, 212
 Hotwheel, 190, 205, 213, 256, 257, 258, 259, 261, 265, 266, 268, 269, 270, 271, 274, 278, 279, 292
 Resistor Test Mode, 217, 264, 265, 277, 278
 Transducer Gain, 164, 216
 Wide-Load, 191, 212
 Winter Cycle, 215
 option on Messages submenu
 Announce Axles, 183, 223
 Announce Car Identification, 228, 306, 310
 Announce Customer Name, 227, 299
 Announce Left-Right Alarm Reference, 228, 306, 307, 308, 310
 Announce Number of Cars, 183, 226
 Announce Power Off, 225
 Announce Slow Train, 183, 225
 Announce Speed, 183, 223
 Announce Temperature, 224
 Announce Train Arrival, 227, 300
 Announce Train Length, 183, 224
 Repeat No Defects, 226, 303, 304
 Repeat Timeout Period, 229

- option on System Functions menu
 - 1KHz Test Tone, 154, 246, 355
 - Auto-Calibration, 247, 356
 - Clear Event Log, 297, 356
 - Delete All Stored Train Data, 356
 - Manual Test Mode, 246, 355
 - Radio Inhibit, 156, 243, 245, 354, 355
 - Radio Test, 154, 242, 354
 - Ramp Function, 159, 355
 - Remote System Reset, 248, 356
 - Reset the COP Counters, 356
 - Vocabulary Test, 156, 243, 354
- order more copies of this guide, 11
- order status, 340
- ordering spare parts, 340
- orders, checking on, 340
- output float voltage switches, 65, 139, 142, 316, 317
- overtightening nuts, 314
- packing list, 75
- parameters, system, 164, 193, 195, 197
- parity, 238, 239, 240, 286
- pass-through mode, 195, 250, 251
- password, 163, 196, 197, 233, 235, 236, 237
- phone jack, 49
- phone number of STC (423-892-3029), 2, 11, 75, 339
- placing a system into service, 27, 135
- placing an order for more copies of this guide, 11
- post-train message, 162, 183, 229, 230, 249, 301, 306, 335
- potentiometer, 46, 55, 59, 70, 145, 170, 323
- pounds per yard (lb/yd), 20, 85, 86, 90
- power subsystem, 35, 61, 62, 63, 64, 112, 116, 117, 118, 119, 120
- predictive gate scanning (appendix F), 367
- pretrain alarms, 190, 191, 302, 349
- printer, 145, 194, 254
- Processor board, 14, 37-39, 55, 57, 59, 68, 143, 184, 185, 193, 248, 257, 265, 269, 278, 287, 318, 356
- processor-A, 39, 287
- processor-B, 39, 287
- PTT (push-to-talk), 54, 57, 59, 249
- pulse width, 185, 266, 279
- push-to-talk (PTT), 54, 57, 59, 249
- PW1 (pulse width generated by TO1), 260, 261, 262, 266, 273, 274, 275, 279, 282, 293, 369
- PW2 (pulse width generated by TO2), 260, 261, 262, 266, 273, 274, 275, 279, 282, 293, 369
- pyrometer, 14, 147, 183, 186, 188, 215, 247, 301, 302, 342, 356, 361, 367, 368, 369
- Pyrometer Saturation alarm, 183, 186, 301, 302, 368, 369
- questions about STC equipment, 340
- R19 (on Interface board), 46, 47
- R24 (on SOTC board), 55
- R34 (on Interface board), 46, 59
- radio, 10, 24, 25, 35, 37, 46, 47, 54, 57, 58, 59, 66, 68, 132, 136, 146, 149, 153, 154, 155, 156, 157, 158, 230, 241, 242, 243, 244, 245, 246, 247, 249, 288, 299, 331, 332, 354, 355, 363, 365
- radio antenna, 35, 37, 132, 136

- Radio Inhibit option (on System Functions menu), 156, 243, 245, 354, 355
- Radio Inhibit submenu, 243, 247, 331
- Radio Test option (on System Functions menu), 154, 242, 354
- rail size, 20, 85, 86, 90
- rail1, 82, 83, 97, 122, 124, 204, 284
- rail2, 82, 83, 97, 122, 124, 204, 284
- railcar, 22
- ramp, 39, 146, 149, 153, 155, 157-160, 241-246, 249, 291, 332, 333, 334, 354, 355, 363, 365
- Ramp Function option (on System Functions menu), 159, 355
- reaching STC, 339
- real-time detection, 10
- real-time message, 10, 301
- reflector block (on alignment fixture), 29, 104, 105, 106
- relay panel, 37, 57
- relays, 23, 37, 57, 59, 60, 145, 159, 170, 190, 191, 323, 333
- Remote System Reset option (on System Functions menu), 248, 356
- Repeat No Defects option (on Messages submenu), 226, 303, 304
- Repeat Timeout Period option (on Messages submenu), 229
- report
 - abbreviated Exception Detail, 253, 281, 283
 - AEI Diagnostic Detail, 253, 292, 294, 296
 - Event Log, 253, 297, 298, 356
 - Exception Detail, 39, 180, 183, 253, 268, 272, 274, 275, 280, 281, 283, 304, 337, 341, 342, 347, 350, 351, 352
 - Exception Summary, 39, 179, 180, 253, 268, 269, 272, 336, 337
 - extended Exception Detail, 180, 253, 272, 274, 275, 280, 281, 337
 - Last Test Train, 39, 159, 160, 244, 246, 253, 291, 333, 334, 355
 - Last Train, 161, 168, 253, 290, 321, 334
 - System Status, 220, 248, 253, 284, 285, 286, 287, 289, 356
 - Train Detail, 39, 68, 160, 161, 168, 171, 183, 186, 190, 253, 255, 259, 260, 261, 262, 267, 290, 291, 294, 304, 321, 324, 334, 369
 - Train Summary, 39, 68, 168, 171, 173, 178, 253, 255, 256, 257, 259, 292, 321, 324, 325, 336
- reporting problems or suggestions, 340
- Reset the COP Counters option (on System Functions menu), 356
- resistor, 52, 165, 217, 263, 264, 265, 276, 277, 278, 287, 288, 319, 342, 344, 347, 348, 352, 354
- Resistor Test Mode option (on Equipment submenu), 217, 264, 265, 277, 278
- Reverse Direction Detected alarm, 345
- risk, 11
- rotten egg smell (from battery), 137, 140, 315
- RS232, 48
- RS422, 41, 42
- RS485, 41, 42
- rubber grommets, 130, 132

- scanner box connector, 82, 96, 108, 110, 358, 359, 360
- scanner cable connector, 80, 81, 82, 96, 108, 110, 358, 359, 360
- scanner cover, 13, 14, 15, 16, 18, 31, 78, 82, 83, 87, 95, 96, 97, 104, 108, 110, 187, 189, 357, 358, 359, 360
- scanner location, 71
- scanners, 9, 10, 13-19, 22, 27-31, 33, 34, 36, 37, 39, 40, 43, 45, 51, 52, 54, 57, 58, 59, 71, 72, 73, 76, 77, 78, 79, 80, 81, 82, 83, 84, 86, 87, 89, 90, 92, 94, 95, 96, 97, 98, 99, 103, 104, 106, 107, 108, 109, 110, 112, 122, 123, 124, 125, 135, 136, 145-153, 159, 161, 162, 165, 166, 170, 171, 178, 179, 181, 185, 187, 188, 189, 190, 215, 217, 246, 247, 248, 258, 259, 263, 264, 265, 266, 271, 276-279, 286, 288, 292, 314, 319, 320, 324, 330, 331, 333, 335, 336, 342, 343, 344, 347, 348, 349, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 367

- selecting a site, 71
- sensitivity for transducer loading, 43, 44, 45, 46, 175, 177, 178, 327, 329, 330
- separate, 37, 51, 89, 92, 190, 191, 214, 215, 297, 301, 306, 343, 344, 347, 348
- serial interface, 145-150, 152, 153, 154, 156, 157, 158, 160, 163, 164, 193, 195, 197, 248, 254, 255, 257, 258, 259, 263, 264, 267, 269, 270, 272, 276, 277, 280, 283, 286, 287, 289, 290, 291, 296, 298, 302, 310, 330, 331, 332, 341, 342, 343, 344, 347, 348, 350, 351, 352, 353, 362, 363, 365, 366
- serial ports, 220, 237, 239, 240
- series overlay track circuit (SOTC), 23, 35, 37, 55, 56, 128, 143, 144, 145, 169, 170, 323, 346
- setting transducer gain (when placing system into service), 162
- Setup menu, 163, 164, 195, 196, 197, 198, 199, 200, 201, 202, 210, 211, 221, 222, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240
- shielded temperature probe, 35, 37, 39, 67, 129, 130, 131, 136, 224
- shipments, checking on, 340
- shock mounts (on scanners), 106, 109
- short train, 210, 217, 218, 235, 284, 345
- Short Train alarm, 217, 345
- shunt, 145, 170, 323, 324
- shunting zone, 23
- shutters, 13, 37, 57, 59, 60, 145, 146, 147, 159, 161, 162, 170, 181, 217, 246, 264, 265, 277, 278, 288, 324, 330, 333, 334, 335, 342, 355
- shutters open (field on reports), 260, 261, 263, 273, 274, 276, 282, 293
- single-track site, 61, 62, 82, 84, 89, 90, 91, 92, 93, 97, 98, 99, 107, 110, 116, 117, 122, 123, 124, 125, 126, 128, 132, 150, 154, 257, 263, 269, 276, 286, 300, 301, 303, 307, 308, 309, 310, 311, 312, 354
- site selection, 71
- sleeper plates (aka tie plates), 71
- sleepers (aka ties), 71, 72, 78, 94, 95, 187, 189
- slow train, 171, 183, 222, 223, 224, 225, 235, 302, 324, 344, 346, 348, 369
- SmartScanNG enclosure, 14, 17, 23, 35-37, 39, 49, 55-58, 61, 65, 66, 67, 74, 103, 107, 111, 112, 113, 115, 116, 122, 123, 124, 125, 126, 127, 128, 129, 130, 132, 133, 134, 137, 138, 139, 140, 141, 142, 143, 144, 145, 154, 156, 160, 162, 164, 168, 169, 170, 173, 174, 175, 176, 177, 178, 180, 242, 243, 245, 246, 315, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 335, 354, 355, 358, 359, 360
- SmartScanNG system, 2, 9, 10, 11, 13, 22-24, 33, 38, 53, 56, 57, 59, 65, 67, 68, 71, 72, 75, 76, 103, 111, 125-127, 129, 134, 135, 136, 142, 147, 149, 153, 156, 158, 160-162, 164, 167, 168, 180, 181, 185, 186, 190, 191, 193, 195, 215, 216, 230, 247, 248, 250, 251, 253, 256, 258, 259, 262, 263, 267, 268, 271, 272, 275, 276, 280, 283, 284, 289, 290, 291, 296, 298, 299, 301, 304, 313, 317, 321, 331, 332, 337, 341, 345, 346, 347, 349, 353, 356, 361, 363, 365, 367
- solar, 2, 30, 137, 138, 147, 178, 180, 345, 347
- solid-state relay (SSR), 37, 57, 59, 159, 333
- SOTC (series overlay track circuit), 23, 35, 37, 55, 56, 128, 143, 144, 145, 169, 170, 323, 346
- SOTC board, 23, 35, 37, 55, 143, 144, 145, 169, 170, 323
- spare parts, ordering, 340
- speaker, 37, 44, 45, 112, 154, 156, 175, 177, 242, 243, 245, 246, 249, 250, 288, 327, 329, 331, 332, 354, 355
- speed calculation, 183, 218
- speed of train, 10, 20, 183, 223, 258, 262, 263, 271, 275, 276, 281, 294, 344, 346, 348
- SRAM (static random-access memory), 39, 297
- SRL470 antenna, 24, 25, 99
- SSR (solid-state relay), 37, 57, 59, 159, 333
- standard warranty, 12
- static random-access memory (SRAM), 39, 297
- status LEDs, 49, 59, 159, 333
- status panel, 50, 51, 143, 156, 165, 167, 179, 184, 243, 247, 318, 319, 320, 331, 336
- STC's fax number (423-499-0045), 2, 11, 339
- STC's phone number (423-892-3029), 2, 11, 75, 339

Stuck Dragger During Train Passage alarm, 302, 349
 Stuck Dragger Pretrain alarm, 302, 349
 Stuck Dragger Recovered alarm, 346
 Stuck High-Load Detector Pretrain alarm, 190, 302, 349
 Stuck Wide-Load Detector Pretrain alarm, 191, 302, 349
 Successive Cold Rails Exceeded alarm, 208, 302, 342, 350
 Successive Cold Resistors Exceeded alarm, 208, 293, 302, 343, 351
 Successive Cold Wheel Resistors Exceeded alarm, 208, 261, 274, 302, 344, 352
 Successive Cold Wheels Exceeded alarm, 208, 302, 343, 352
 suggestions on STC equipment, 340
 sulfurous odor (from battery), 137, 140, 315
 surge protectors, 22, 74, 101, 133
 system activation, 181
 system alarms, 39, 168, 183, 211, 232, 258, 260, 261, 262, 266, 270, 273, 274, 275, 279, 281, 282, 293, 294, 321, 341, 342, 344, 347, 348, 350, 351, 352
 system deactivation, 182
 System Functions menu, 146, 147, 149, 153, 155-159, 195, 241, 242, 243, 244, 245, 246, 247, 248, 249, 287, 297, 330, 331, 332, 333, 354, 356, 363, 365
 system parameters, 164, 193, 195, 197
 System Status report, 220, 248, 253, 284, 285, 286, 287, 289, 356
 system1, 129, 250, 251
 system2, 129, 250, 251
 System-Interconnect board, 14, 35, 37, 38, 40, 57, 59, 67, 125, 126, 127, 134, 144, 145, 169, 170, 323

 tag data, 233, 287, 295
 target sight (on alignment fixture), 29, 104, 106
 telephone jack, 49
 telephone number of STC (423-892-3029), 2, 11, 75, 339
 telephone service, 48, 49, 74, 129, 193, 253
 temperature probe, 35, 37, 39, 56, 65, 67, 120, 121, 129, 130, 131, 136, 140, 224, 315
 terminal blocks, 115, 116, 128
 test mode, 146, 149, 153, 155, 217, 241, 242, 243, 244, 246, 260, 261, 264, 265, 273, 274, 277, 278, 293, 332, 354, 355, 363, 365
 Test Train (aka Ramp Train) directory, 39, 246, 355, 356
 Test Train alarm, 346
 third track, 84, 91, 93, 98, 99, 107, 110, 123, 124, 128, 150, 154
 three-terminal arrester (TTA), 23, 56, 128
 tie plates (aka sleeper plates), 71
 ties (aka sleepers), 71, 72, 78, 94, 95, 187, 189
 time and date, 147, 163, 193, 197-200, 202, 210, 221, 258, 263, 270, 276, 286, 288, 297, 331
 timeout, 197, 229, 299
 timestamp, 68, 294, 295
 TO1 (gating transducer), 22, 33, 34, 43, 53, 56, 86, 89, 92, 99, 103, 125, 126, 161, 167, 168, 171, 173, 175, 177, 178, 181, 183, 184, 256-258, 260, 261, 264, 266, 268, 269, 271, 273, 274, 277, 279, 293, 320, 321, 325, 327, 330, 334, 335, 344, 345, 348
 TO2 (gating transducer), 22, 33, 34, 45, 53, 56, 89, 90, 92, 103, 125, 126, 161, 167, 168, 171, 173, 175, 178, 181, 183, 184, 256-258, 260, 261, 264, 266, 268, 269, 271, 273, 274, 277, 279, 293, 320, 321, 325, 327, 330, 334, 335, 344, 345, 348
 tone, 154, 155, 156, 246, 247, 331, 355
 top of rail, 22, 24, 25, 28, 30, 88, 100, 135, 136, 172, 313, 314
 top row (first row) of LEDs on status panel, 143, 318
 torque, 76, 78, 79, 88, 89, 95, 101, 106, 135, 136, 172, 313, 314
 track circuit, 13, 22, 23, 55, 56, 77, 92, 99, 126, 128, 135, 143, 144, 145, 168, 169, 170, 181, 182, 321, 322, 323, 341, 346, 349
 track clamp, 78, 83, 86, 90, 95, 97, 98
 track components, 13, 77, 135

track direction, 200, 201, 209, 286, 341, 343, 347, 348, 349
 track number, 163, 197, 198, 199, 200, 202, 210, 221, 257, 263, 269, 276, 286, 299
 Track Number submenu, 200, 257, 263, 269, 276, 286, 299
 track1, 35, 57, 82, 83, 89, 90, 92, 93, 97, 99, 111, 122, 123, 124, 125, 126, 127, 128, 132, 134
 track2, 35, 57, 82, 83, 89, 90, 92, 93, 97, 99, 111, 122, 123, 124, 125, 126, 127, 128, 132, 134
 track3, 35, 57, 83, 89, 90, 92, 93, 97, 99, 111, 123, 124, 128
 trackside, 101, 135, 136, 171, 313, 314
 track-wire connectors (for track circuit), 99
 Train Alarms (aka Exception Alarms), 39, 159, 181, 231, 245, 258, 262, 270, 275, 281, 294, 301, 304, 305, 310, 333
 Train Detail report, 39, 68, 160, 161, 168, 171, 183, 186, 190, 253, 255, 259-262, 267, 290, 291, 294, 304, 321, 324, 334, 369
 train speed, 10, 14, 20, 53, 168, 171, 183, 222, 223, 258, 262, 263, 271, 275, 276, 281, 294, 302, 321, 324, 344, 346, 348
 Train Summary report, 39, 68, 168, 171, 173, 178, 253, 255, 256, 257, 259, 292, 321, 324, 325, 336
 Trains directory, 39, 171, 255, 258, 263, 324, 356
 transceiver, 10, 24, 25, 35, 37, 46, 47, 54, 57, 58, 59, 66, 132, 136, 154, 156, 230, 242, 243, 245, 246, 247, 249, 288, 299, 331, 332, 354, 355
 transducer cable, 22, 43, 45, 92, 173, 313, 325
 transducer gain, 162, 164, 210, 215, 216, 235, 284
 Transducer Gain option (on Equipment submenu), 164, 216
 transducer height bracket (on alignment fixture), 30, 88, 135, 172, 313
 transducer loading, 43, 44, 45, 46, 173, 175, 177, 325, 327, 329
 transducer pulse, 162, 164, 183, 184, 185, 216, 246, 345, 355
 transducer sensitivity, 43, 44, 45, 46, 175, 177, 178, 327, 329, 330
 transducers, 13, 14, 20-25, 30, 33, 35, 37, 39, 43, 44, 45, 46, 53, 55, 56, 76, 77, 79, 85-89, 92, 93, 94, 98, 99, 100, 103, 125, 126, 135, 136, 143, 144, 145, 159, 161, 162, 163, 164, 167, 168, 169, 170, 171, 172, 173, 175, 176, 177, 178, 181, 182, 183, 184, 185, 187, 188, 189, 210, 215, 216, 218, 223, 224, 235, 245, 246, 258, 264, 266, 271, 277, 279, 284, 302, 313, 314, 320, 321, 322, 323, 324, 325, 327, 328, 329, 330, 333, 334, 335, 341, 344, 345, 346, 348, 349, 355, 368, 369
 trip wire, 190, 191, 210, 213, 214, 235, 284, 306
 triple-track site, 35, 61, 83, 84, 89-93, 97, 98, 99, 107, 110, 111, 116, 123, 124, 128, 150, 154
 truck number, 266, 279
 TTA (three-terminal arrester), 23, 56, 128

 underside of car, 188
 Unstable SOTC alarm, 346
 UTBs, 56, 125, 126, 127, 129, 131, 134

 varistors, 114, 120, 121
 version number of firmware, 256, 257, 260, 261, 265, 268, 269, 272, 274, 278, 285, 287, 292
 version of Interface board, 43, 45, 174, 175, 177, 326, 327, 329
 vertical alignment bar (on alignment fixture), 104, 105, 106
 Very Slow Train alarm, 171, 223, 224, 302, 324, 344, 346, 348, 369
 vibration, 10, 13
 Vocabulary Test option (on System Functions menu), 156, 243, 354
 volume, 46, 58, 154, 156, 242, 243, 246, 332

 warnings, cautions, dangers, 2, 10, 39, 49, 55, 120, 121, 122, 137, 140, 143, 315, 318
 warranty, 12
 wayside enclosure, 17, 22, 35, 61, 66, 67, 71, 73-76, 78, 80, 83, 86, 89, 91, 92, 97, 99, 101, 107, 110, 111, 115, 116, 129-132, 136, 137, 150, 154, 162, 180, 181, 284, 314, 335, 337, 361, 363, 364, 366
 wayside enclosure defined, 35

wheel assemblies (trucks), 266, 279
wheel scanner cable, 19, 96
wheel scanners, 10, 13, 14, 18, 19, 29, 37, 52, 54, 72, 77, 92, 93, 94, 96, 97, 107, 109, 110, 123, 124, 147, 150, 151, 152, 153, 165, 166, 179, 189, 190, 258, 259, 265, 266, 271, 278, 279, 292, 319, 320, 336, 343, 344, 348, 357, 359, 363, 364
Wide-Load alarm, 191, 211, 212, 214, 301, 306
wide-load detector, 10, 54, 56, 191, 214, 302, 306, 349
Wide-Load option (on Equipment submenu), 191, 212
Winter Cycle option (on Equipment submenu), 215

year, 198, 257, 258, 263, 265, 269, 270, 276, 278, 286, 287, 297

zero level signal, 188
zero reference, 188