EUD-2016027-00

SmartScanNG Wayside Enclosure Components

"Wayside Enclosure Components" refer to those SmartScanNG detector subsystems that are typically contained within the equipment bungalow. These components include:

- SmartScanNG Controller
- Power Subsystem
- AEI Subsystem
- Temperature Probe

This manual provides an overview of these subsystems as well as detailed procedures for site preparation, installation, and placing a system into service.

27 January 2016

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

STC assumes no responsibility for errors or omissions in this document. Nor does STC make any commitment to update the information contained herein.

WARNING!

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.

Southern Technologies Corporation
6145 Preservation Drive
Chattanooga, TN 37416
www.southern-tech.com

email: stcemail@southern-tech.com

fax number: 423-499-0045
telephone number: 423-892-3029

Contents

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

1.0 Introduction

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

1.1 Purpose of This Guide

The technical staff at Southern Technologies Corporation (STC) created the SmartScanNG defect detection system. It is designed to monitor moving trains and report certain conditions detected on these trains. 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 guide covers the portion of the SmartScanNG system that is housed within the wayside enclosure. It describes the functionality, installation, and operation of these components.

1.2 SmartScanNG - Wayside Enclosure Components

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

Attached to the inside of most wayside enclosures is:

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

Attached to the outside of most wayside enclosures is:

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

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.

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

1.4 Disclaimers

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

1.5 How to Comment on This Guide

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

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

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

1.6 How to Order More Copies of This Guide

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

1.7 Standard Warranty

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

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

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

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

2.0 SmartScanNG Enclosure

2.1 SmartScanNG Enclosure

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

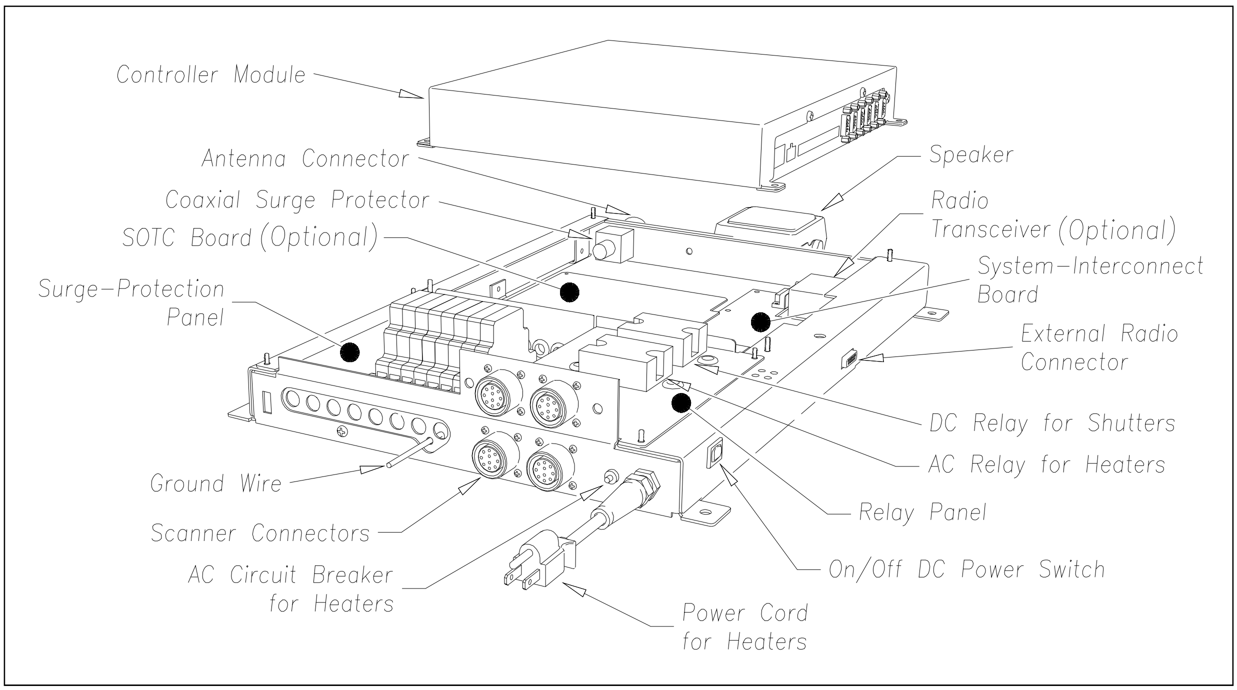
As a minimum, most SmartScanNG enclosures contain:

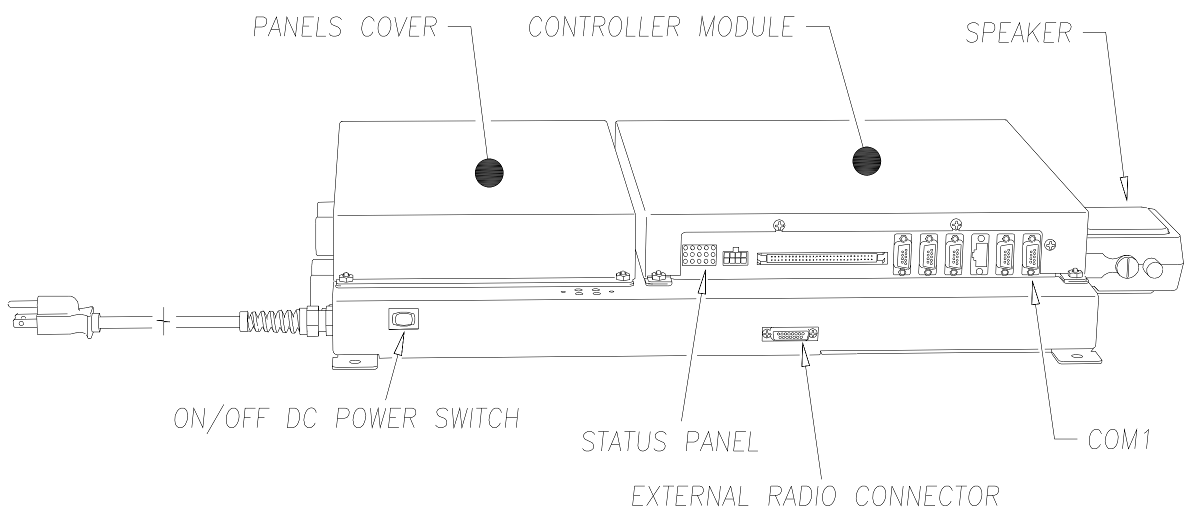
- System-Interconnect board
- Controller module, containing Processor, Interface, and Modem boards
- Surge-protection panel
- Relay panel

Additionally, most SmartScanNG enclosures usually contain:

- 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 2500-512**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 2500-512**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.

2.1.1 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.

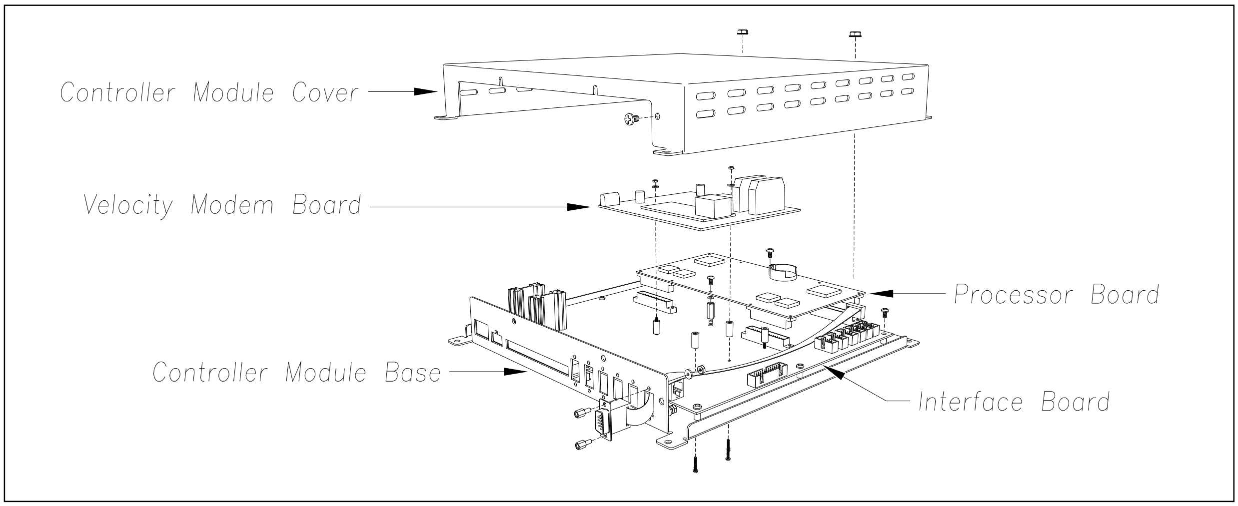
Only a few electronic components are located on the System-Interconnect board. Most of them are associated with power distribution. DC power from the System-Interconnect board is routed to the Interface board, shielded temperature probe, internal radio, bearing scanners, and wheel scanners. Much of the DC power originates from a common source before branching out to various destinations. 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 2500-512**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 2500-512**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.

2.1.2 Controller Module (2300-502)

The Controller module contains the Interface board, the Processor board, and the Velocity 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.

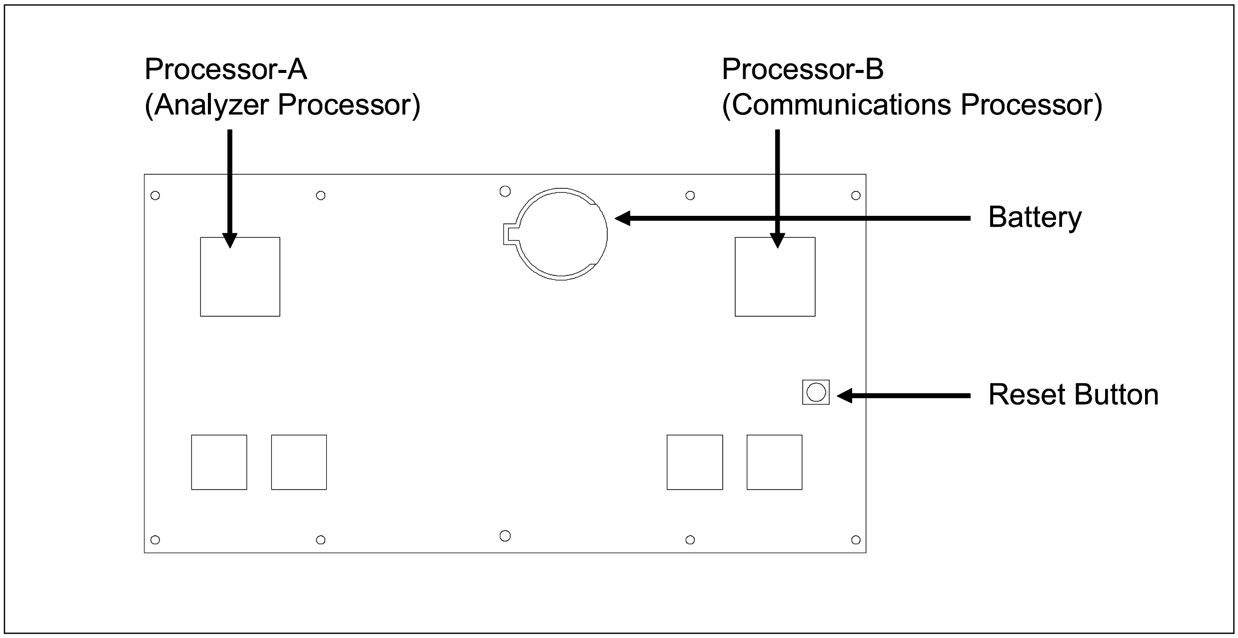
The figure below shows the major parts of the Controller module (2300-502).



2.1.2.1 Processor Board (2300-100)

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

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



The Processor board uses two, independently operating, central processing units (CPUs). The CPU on the left (aka processor-A aka Analyzer Processor) is responsible for data retrieval from external sources, such as the shielded temperature probe, scanners, transducers, and auxiliary devices. The CPU on the right (aka processor-B aka Communications Processor) is used to process and store the data retrieved by the other CPU. It then presents information to the user in the form of reports.

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

- The Trains directory, which contains data on each new train that passes the site. The Train Summary report and Train Detail report get their data from this directory.
- The Exceptions directory, which contains data on each train that has one or more Exception Alarms or System Alarms. The Exception Summary report and Exception Detail report get their data from this directory.
- The Test Train (aka Ramp Train) directory, which contains data on the last test train. The Last Test Train report gets its data from this directory.

Each directory is organized as a circular buffer. In this scheme, data is added to the directory until the directory is full. Once full, the oldest data in the directory is overwritten as new data is recorded. The buffer for the Trains directory holds data on about 140,000 axles, but no more than 100 trains. The buffer for the Exceptions directory holds data on about 4,500 axles, but no more than 50 trains.

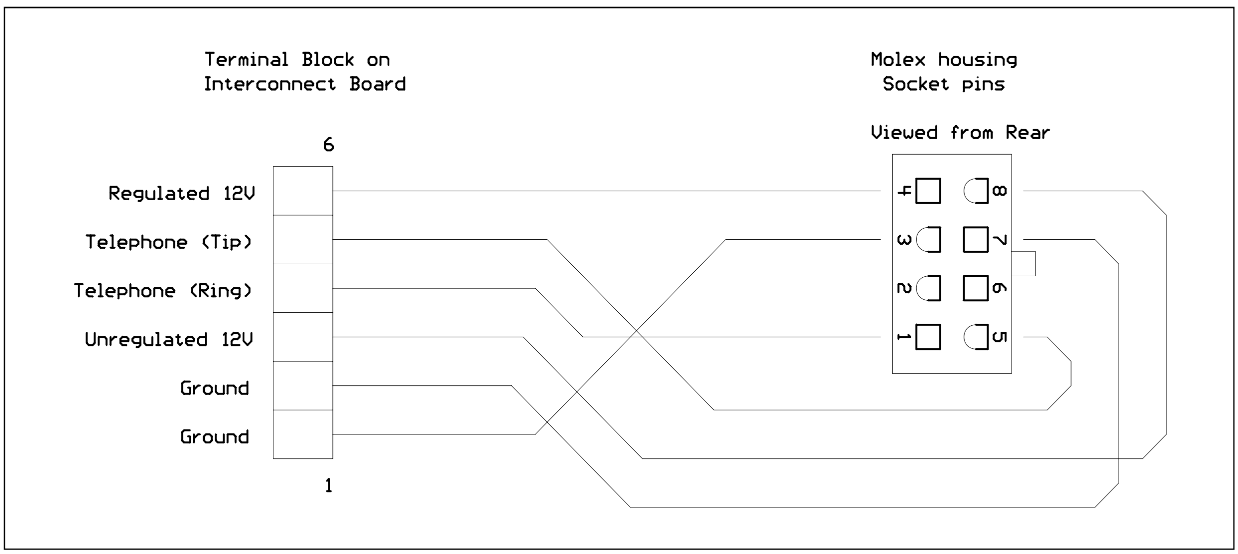
Under the CPU on the right is a white reset button. Pressing it causes a "hard reset" of the Processor board. (You can get the same results by toggling the on-off switch on the side of the SmartScanNG enclosure off, waiting 10 seconds, and toggling it back on.) As long as no train is present at the site,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

2.1.2.2 Interface Board (2300-105)

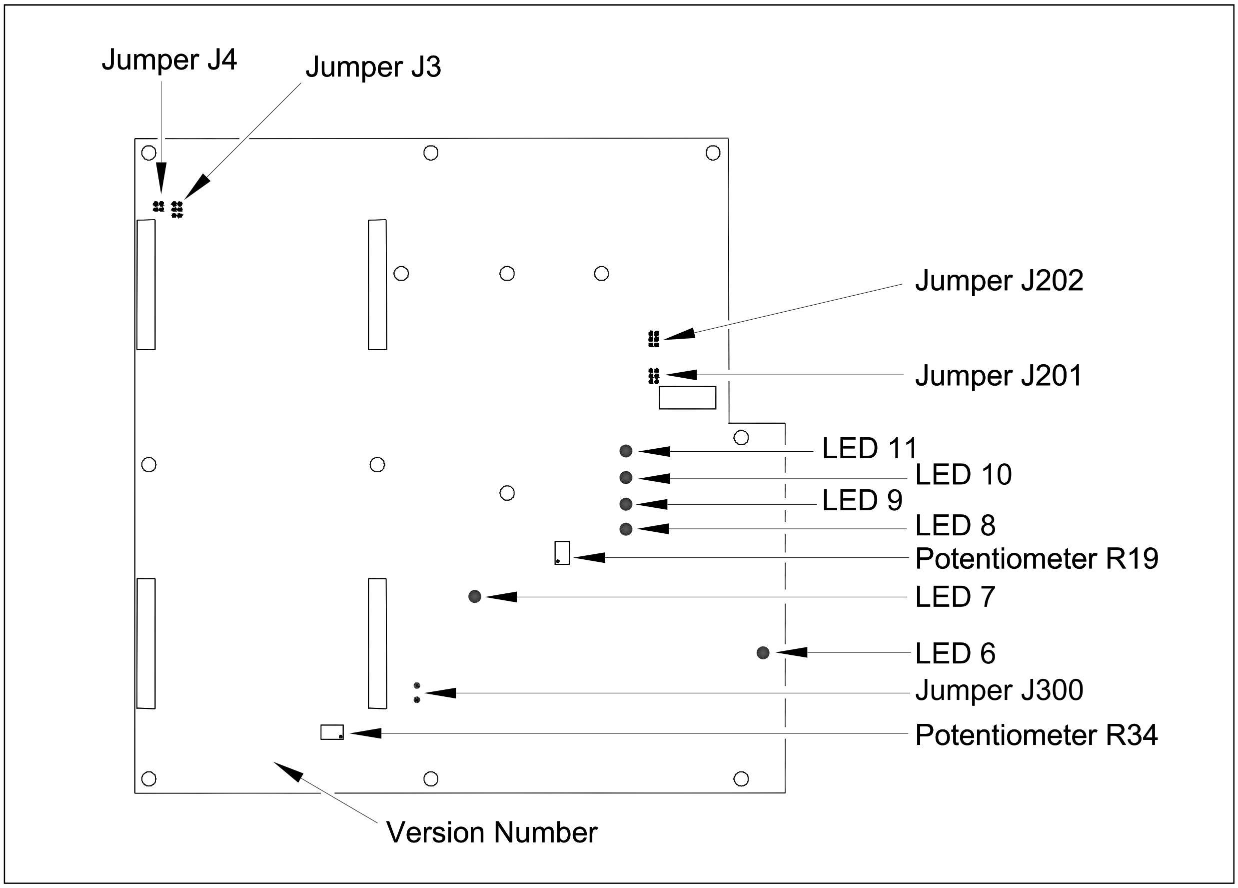
As its name implies, all of the interface and signal conditioning circuitry is located on the Interface board. This board connects to the System-Interconnect board with a 60-position ribbon connector and an 8-position Molex connector, which is shown below.



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

This guide only covers Interface board versions 1.21, 1.22, 1.30, and 1.40. Earlier versions of the board 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.

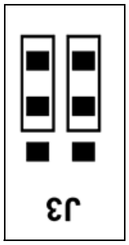


Jumper J3

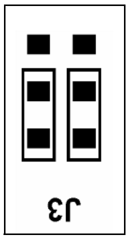
Jumper J3 lets you select RS422 mode or RS485 mode.

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



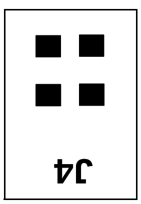
This is the jumper configuration for four-wire RS422 mode.



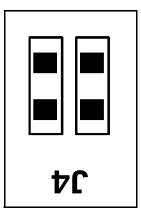
This is the jumper configuration for two-wire RS485 mode.

Jumper J4

Jumper J4 (in conjunction with jumper 3) lets you switch the output from the designated connector (on the edge of the Controller module) between RS422 and RS485 mode.



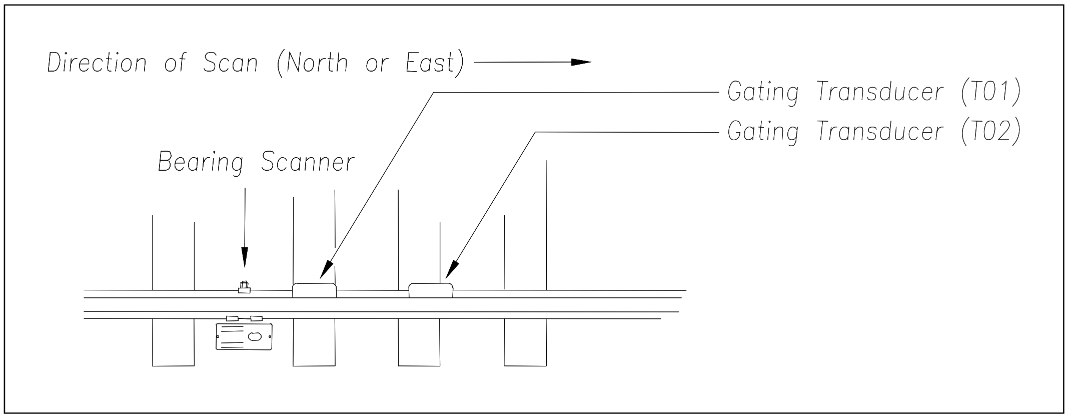
This is the jumper configuration for four-wire RS422 mode. Both transmit and receive are on continuously.



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

Jumper J201

Jumper J201 is used to select the sensitivity value for gating transducer TO1. TO1 is the first gating transducer going north or east from the bearing scanner. It is the gating transducer closest to the bearing scanner.

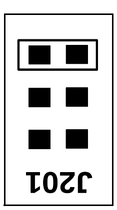


The table below lists the highest, middle, and lowest sensitivity for transducer loading for current board versions. Highest is the most sensitive. Lowest is the least sensitive. Middle is somewhat between these sensitivities.

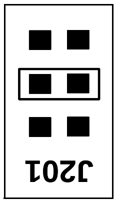
J201 Jumper Position	Version 1.21 and 1.22 and 1.30 and 1.40 Board
Top	Lowest Sensitivity
Center	Middle Sensitivity
Bottom	Highest Sensitivity

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

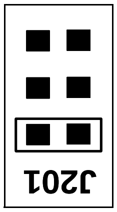
At the factory, J201 was set for optimal transducer loading. If you're having transducer miscounts, you can change this setting. However, this setting rarely needs changing. And, if changed, rarely needs to be changed again. Changes to the jumpers should be made only after all external conditions that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



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



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



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

Jumper J202

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

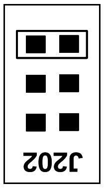
The table below lists the highest, middle, and lowest sensitivity for transducer loading for current board versions. Highest is the most sensitive. Lowest is the least sensitive. Middle is somewhat between these sensitivities.

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

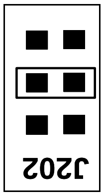
This table above only covers board versions 1.21, 1.22, 1.30, and 1.40. Earlier versions of the board have different jumper positions for each sensitivity level. That is, the available loading sensitivities vary depending on which version of Interface board you have, whether the board was modified, and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

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

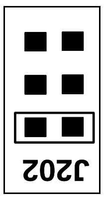
The top position selects the lowest sensitivity for transducer loading. The figure below shows the **top position** of J202 being selected. The top position is the jumper position closest to the speaker.



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



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



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

Jumper J300

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

Potentiometer R19

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

Potentiometer R34

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

LED 6

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

LED 7

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

LED 8

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

LED 9

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

LED 10

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

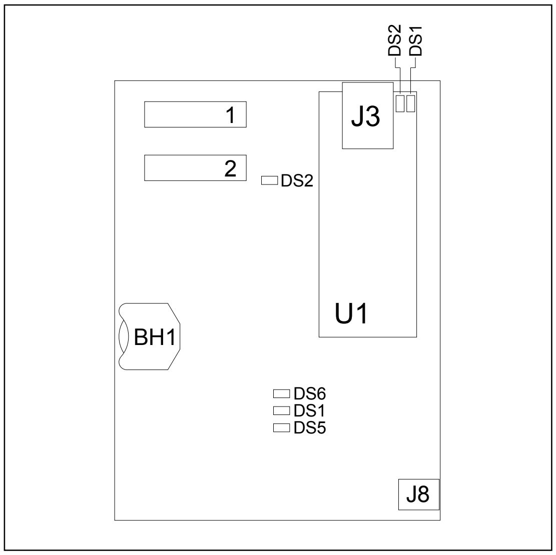
LED 11

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

2.1.2.3 Velocity Modem Board

The Velocity Modem board lets the system (at the site) communicate with a computer (away from the site).

The figure below shows a Velocity Modem board.



Power Jack (J8)

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.

Port 1 Connector

The **Port 1** connector connects the Velocity Modem board to the rest of the system. At the factory, one end of a standard 10-position ribbon cable was plugged into **Port 1** on the Velocity Modem board. The other end of the ribbon cable was plugged into **P7** on the Interface board.

Port 2 Connector

The **Port 2** connector connects the Velocity Modem board to outside world. **Port 2** on the Velocity Modem board is connected to **COM6** on the right edge of the Controller module. (You would normally plug your computer into **COM6** to access the modem's instruction set and database.)

Battery (BH1)

During a power interruption to the Velocity Modem board, the on-board coin cell battery keeps the internal real-time clock running. During a power interruption, if this battery is low, dead, or missing, the stored time and date will be lost. However, no train data will be lost.

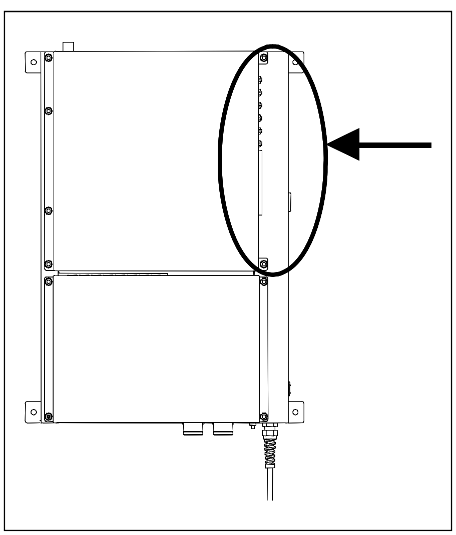
Status LEDs

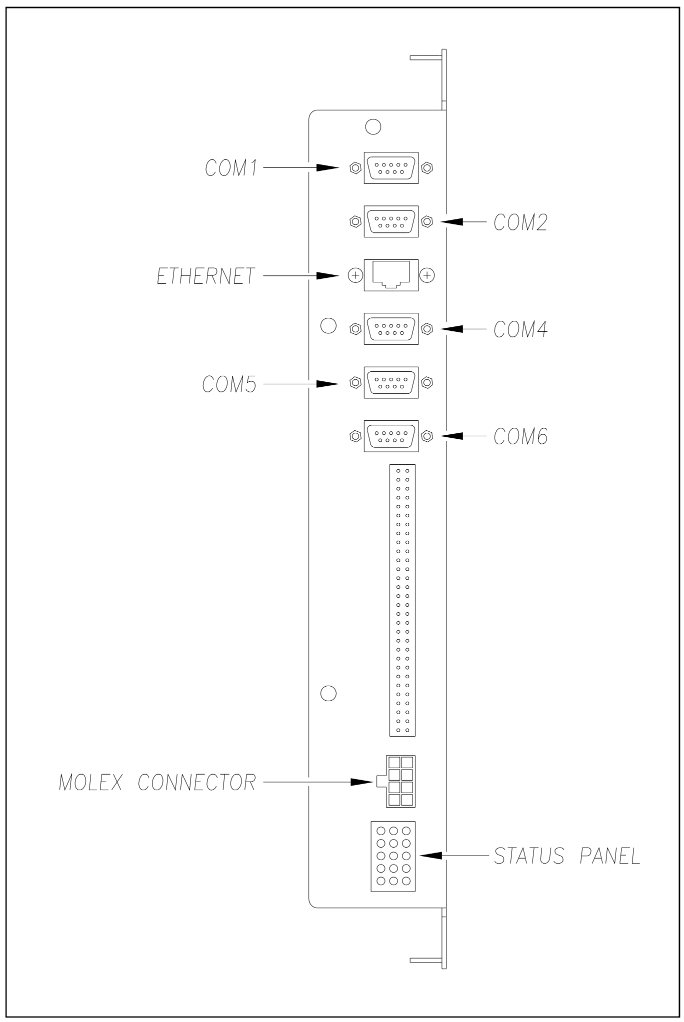
On the Velocity Modem board are 6 status LEDs. The table below describes what each lit LED means.

LED	Meaning When Lit
12V	Lights when the Velocity Modem board is getting adequate DC power from the SmartScanNG system.
3.3V	Lights when the onboard 3.3-VDC regulator is working.
5V	Lights when the onboard 5-VDC regulator is working.
ACT	Flashes when there is activity on the Ethernet connection. That is, it flashes when sending or receiving data.
HB	Flashes once a second when the Velocity Modem board is running properly.
LNK	Lights when an Ethernet connection is made.

2.1.3 Side of Controller Module

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





2.1.3.1 Serial Ports

On the right side of a mounted Controller module are five serial ports. They are labeled COM1, COM2, COM4, COM5, and COM6.

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

Port	Use
COM1	Used to communicate with a customer-provided external device. At single-track sites, a computer is normally connected here. At double-track sites, a crossover (null-modem) cable is attached from **COM4 of system1** (that is, the system with an installed modem) to **COM1 of system2** (that is, the system without an installed modem). COM1 is connected to **P6** on the Interface board.
COM2	Used to communicate with a customer-provided external device. COM2 is connected to **P9** on the Interface board.
COM4	At double-track sites, a crossover (null-modem) cable is attached from **COM4 of system1** (that is, the system with an installed modem) to **COM1 of system2** (that is, the system without an installed modem). COM4 is connected to **P5** on the Interface board.
COM5	Used to connect AEI Interface module (2300-750) to the SmartScanNG system. COM5 is connected to **P8** on the Interface board.
COM6	Used to communicate with the Velocity Modem board's instruction set and database. COM6 is connected to **Port 2** on the Velocity Modem board.

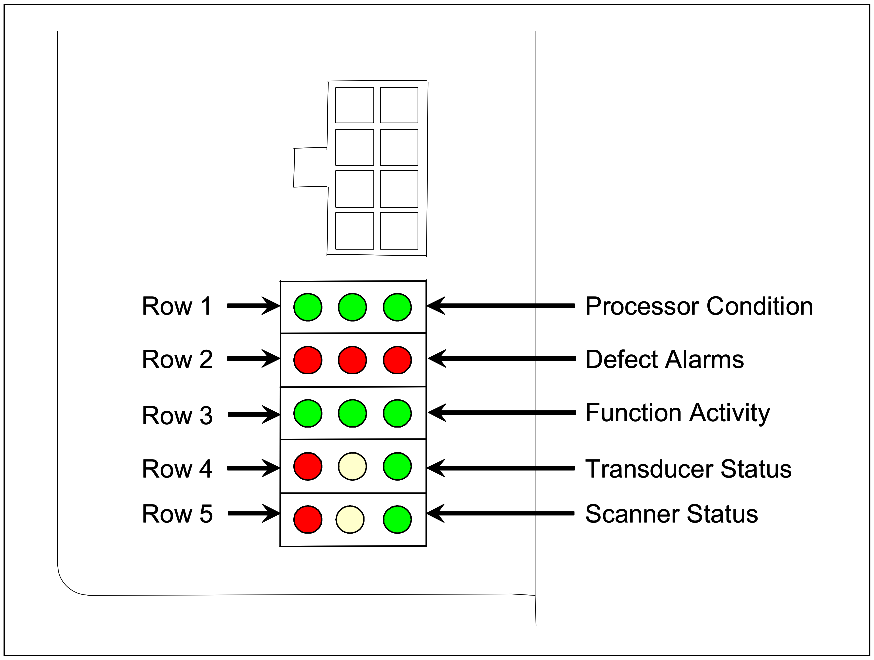
2.1.3.2 Ethernet Connection (RJ45 Jack)

On the right side of a mounted Controller module (2300-502), between COM2 and COM4, is a RJ45 jack. It is labeled ETHERNET.

To establish an Ethernet connection, you need a network interface card (NIC) in your computer and a Category 5 (CAT5) 8-wire network cable for basic 10/100 functionality. On each end of the cable should be a RJ45 plug. This plug is an 8-position modular connector that looks like a large phone plug.

2.1.3.3 Status Panel

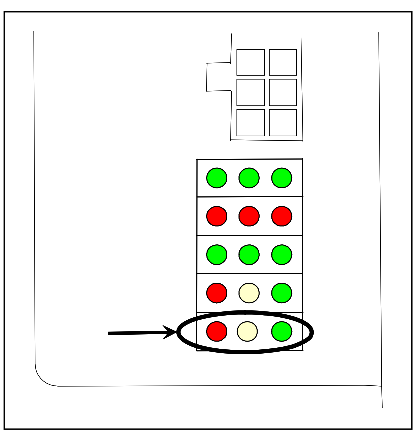
The status panel consists of 15 LEDs in 5 rows of LEDs, as shown below. The LEDs are shown as one would see them in service, which is their normal orientation on a properly installed system.

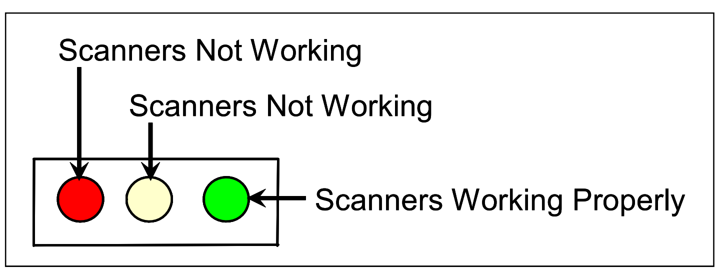


The information that is used to control rows 4 and 5 is contained in a log of the last 20 trains to pass the site. A separate log of the last 40 trains controls the LEDs in row 2. Both of these logs clear at power-up or reset.

Scanner Status

On a mounted Controller module, the 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 2.8°C (5°F) for an entire train or if either wheel scanner records less than 8.3°C (15°F) 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 11.1°C (20°F) or the difference between the average recorded temperatures for both wheel scanners was more than a delta temperature of 66.7°C (120°F).

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.

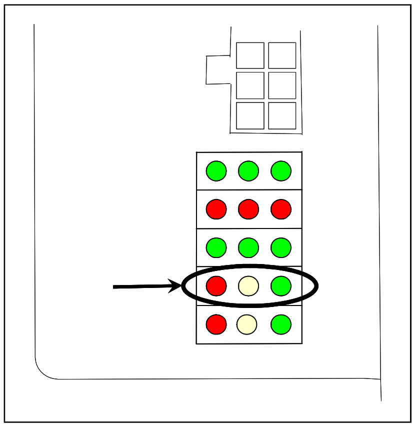
The middle yellow LED flashes when the difference between the average temperatures (recorded by the two bearing scanners or recorded by the two wheel scanners) isn't within acceptable balance limits for 20 consecutive trains. These limits are different for bearing and wheel scanners. For the bearing scanners this limit is 2.8°C (5°F) and for wheel scanners is 8.3°C (15°F). 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.

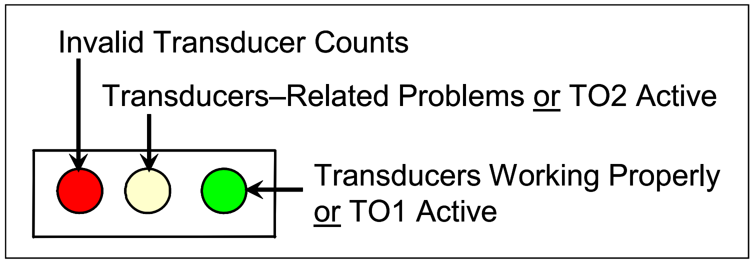
Within the scanner pairs, the scanner with the lower temperatures is considered the problem scanner. Its identity is revealed by the rate and pattern of flashing of the LED. For a scanner on the north or east rail, the repeated pattern is on for a half second, off for a full second. For a scanner on 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.

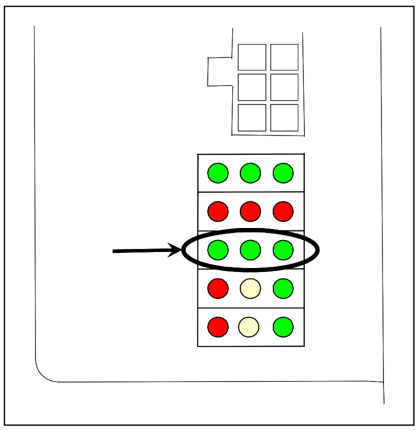
When a train isn't present at the site, the middle yellow LED is lit when:

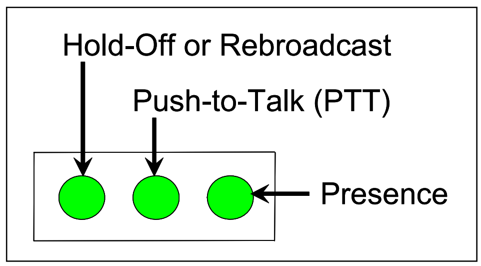
- A gating transducer experiences more than 20 filtered pulses on a train. In other words, a gating transducer experiences more than 20 pulses on a train that the SmartScanNG system considers noise.
- The gating transducers are activating the system.

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

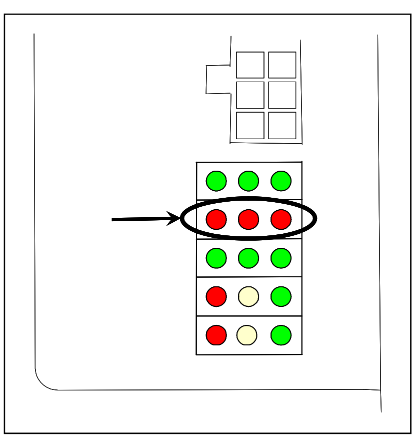
On a mounted Controller module, the middle row of green LEDs indicates system activities, including train presence, push-to-talk (PTT), and hold-off or rebroadcast. Each LED lights while its function is active. The hold-off LED lights during the reception of radio traffic. It will blink when there is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

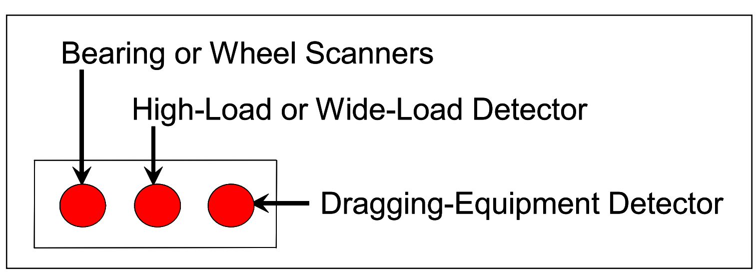




Defect Alarms

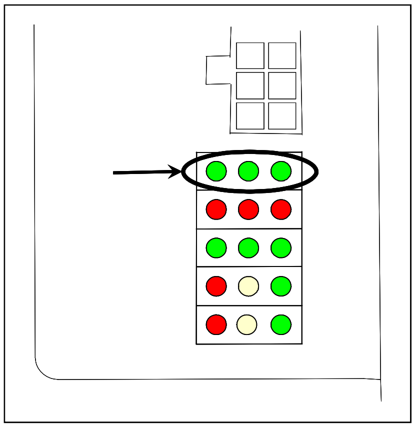
On a mounted Controller module, the second row of red LEDs indicates stored defect alarms, including those for bearing scanners, wheel scanners, dragging-equipment detectors, high-load detectors, and wide-load detectors. These LEDs are lit when a defect alarm (associated with one of those pieces of equipment) 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.

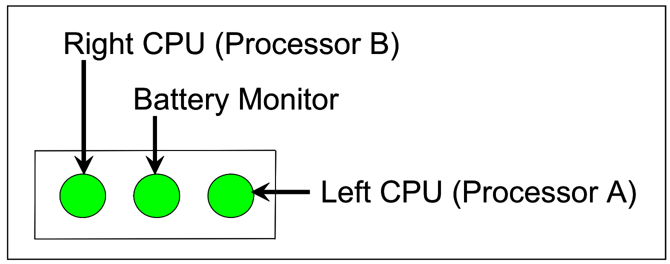




Processor Condition

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.



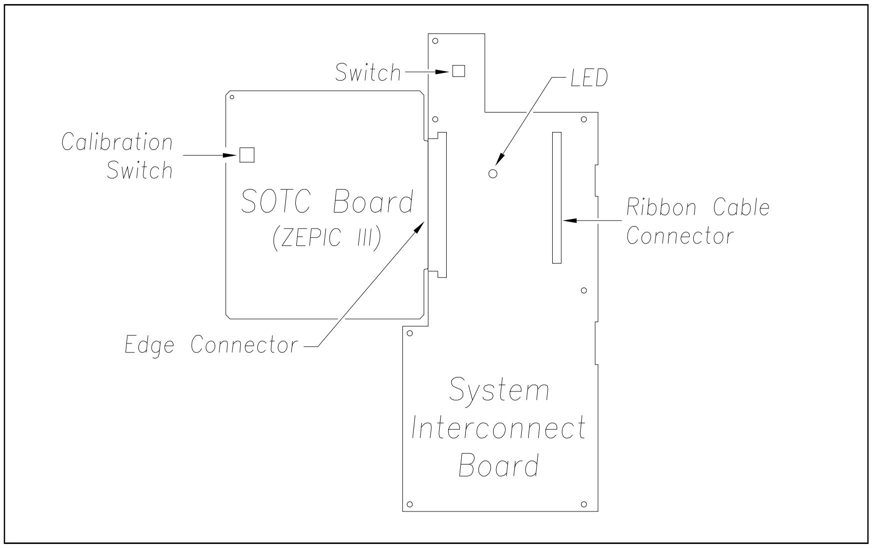


If the on-board coin cell battery is low or dead, the **middle LED** is lit. Otherwise, it isn't lit. During a power interruption to the Processor board, this battery keeps the stored train data from being lost and the time/date accurate. If the battery is low, there is no danger of losing train data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

2.1.4 SOTC Board

If your system uses advance transducers for presence detection, skip ahead to next section.

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



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

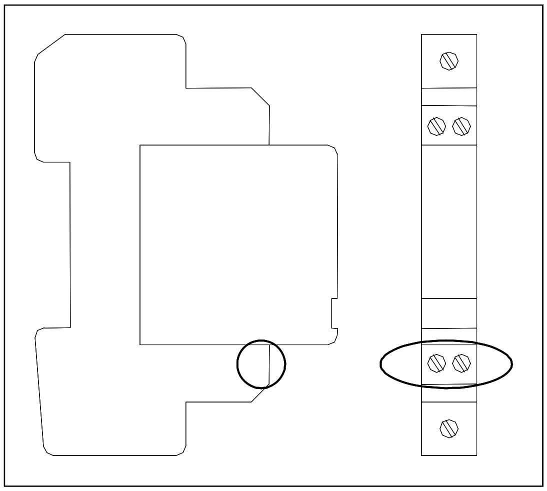
2.1.5 Surge-Protection Panel

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

Located inside are industrial grade surge suppressors (aka universal transient barriers or UTBs). They are capable of suppressing damaging electrical transients and surges, which can be induced onto signal lines by lightning. Here is a list of signals that pass through the UTBs on the surge-suppressor panel before entering the rest of the SmartScanNG enclosure.

- Gating transducer **TO1**
- Gating transducer **TO2**
- Advance transducer **ADV1**, if used
- Advance transducer **ADV2**, if used
- Dragging-equipment detector **DED**
- High-load detector **HIGH**, if used

- Wide-load detector **WIDE1**, if used
- Wide-load detector **WIDE2**, if used
- Shielded temperature probe **TempProbe**, which uses two UTBs
- Telephone line **TelCo**, if used



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.

2.1.6 Relay Panel

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

The power rating for each SSR is intentionally overrated to ensure long-lasting reliability. For example, the SSR associated with the scanner **shutters** is rated for 100 VDC at 12 amps, even though the shutters operate on 12 volts and require <u>less than</u> 2 amps each. Likewise, the SSR associated with the **heaters** in the 2500-512**DC** scanners is rated for 100 VDC at 12 amps, even though the heaters operate on 12 volts and require <u>less than</u> 1 amp each. The SSR associated with the **heaters** in the 2500-512**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.

2.1.7 Radio

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

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

The SmartScanNG system provides the following connections to the radio.

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

2.1.8 Other Components

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

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

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

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

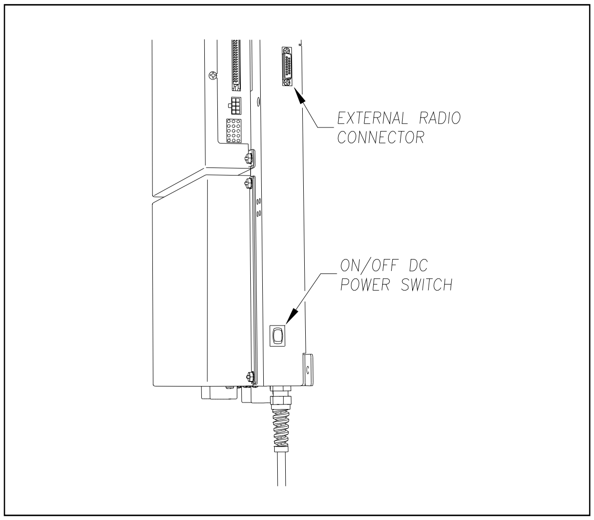
- Four scanner connectors
- AC power cord for powering the scanner heaters, when applicable
- Circuit breaker for scanner heaters

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

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

2.1.8.1 DC Power Switch

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



2.1.8.2 External Radio Connector

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

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

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

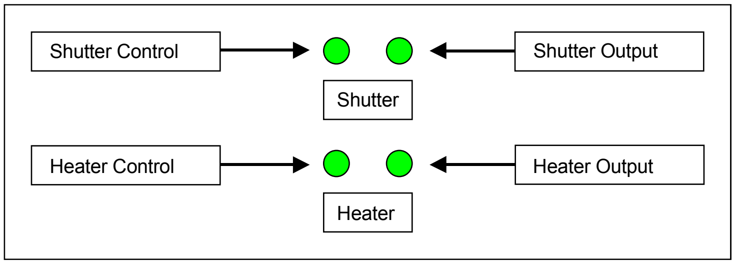
Pin-13 is the carrier-detect input to the SmartScanNG system. This signal is internally pulled high. A low level prevents the SmartScanNG system from initiating a voice transmission.

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

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

2.1.8.3 Chassis Mounted LEDs

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



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

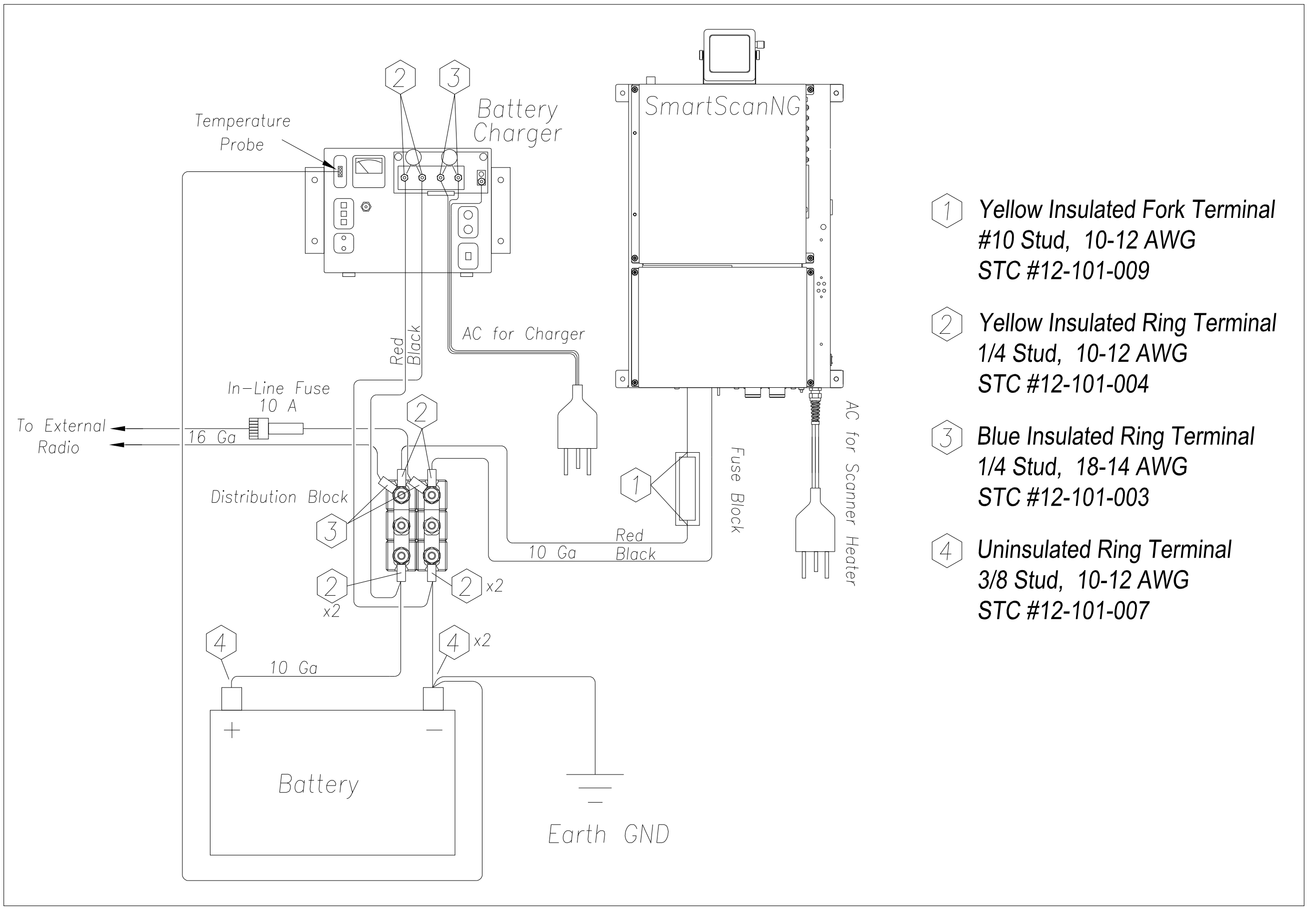
The LEDs can indicate that the relay has failed to activate when a control signal is applied, as shown in the table below. In the table, a shaded area means that an LED is lit. An unshaded area means that an LED isn't lit. Only seven of the possible combinations of lit LEDs are listed below. All other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

Shutter Control LED	Shutter Output LED	Heater Control LED	Heater Output LED	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.

3.0 Power Subsystem

3.1 Power Subsystem

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



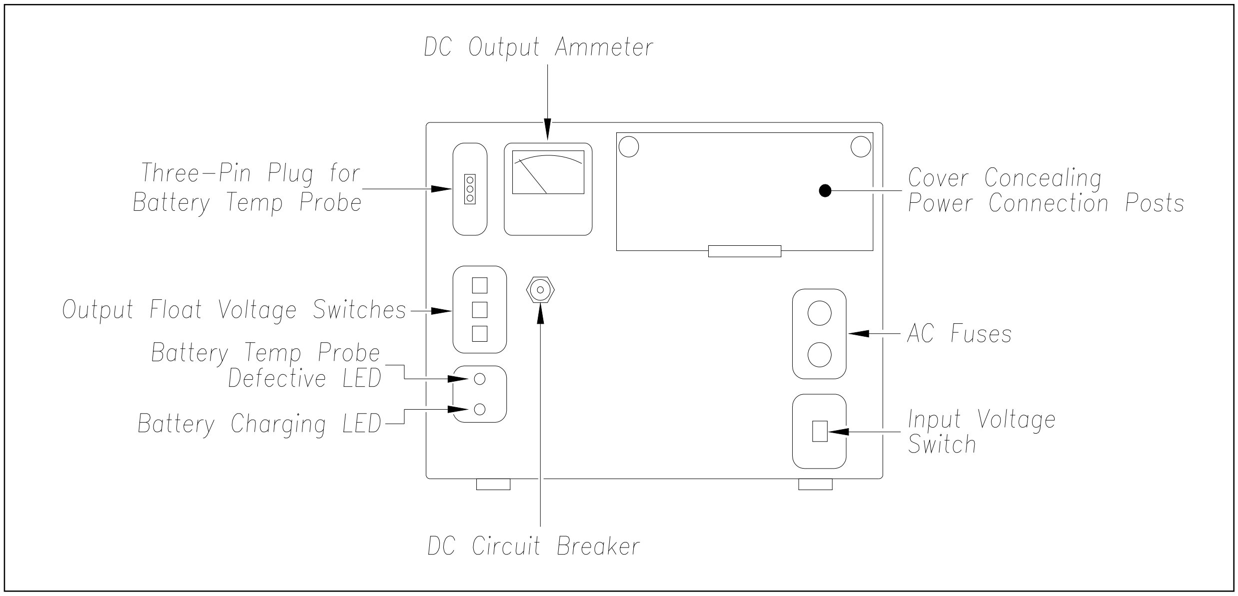
There is one SmartScanNG enclosure per track. One power subsystem per SmartScanNG enclosure. One battery per power subsystem. One battery charger per battery.

3.2 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.

3.3 Battery Charger

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



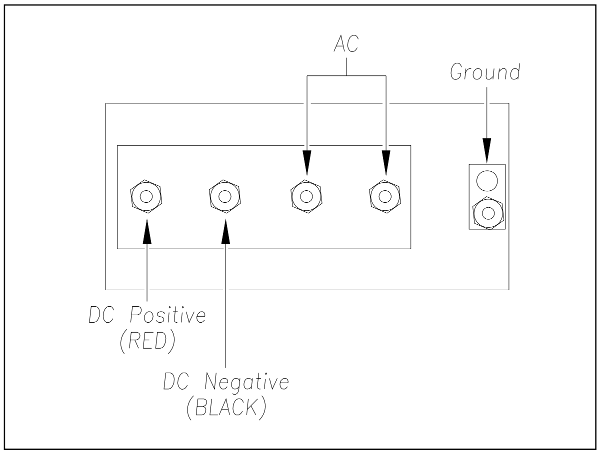
The input voltage switch can be set to 115 VAC or 230 VAC. Use 115 for input voltages between 108 and 128. Use 230 for input voltages between 216 and 256.

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.

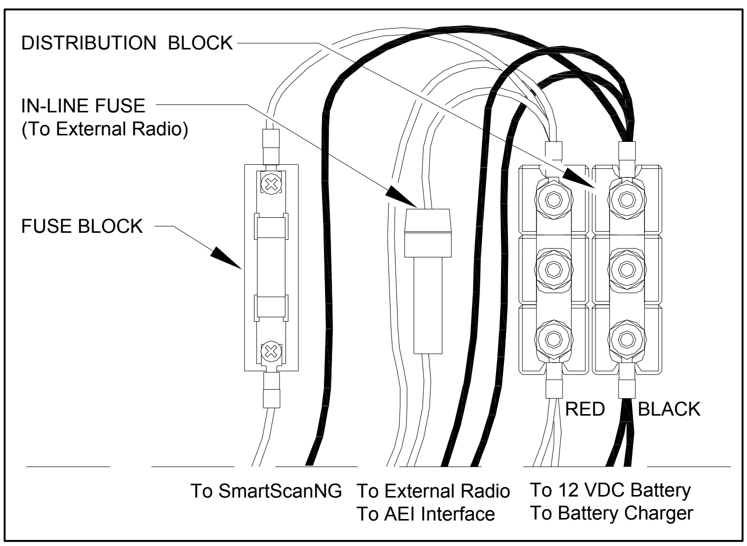
Above the input voltage switch are two 4-amp 250-volt fast-acting fuses. They protect the battery charger from excessive AC. To the right of the output float voltage switches is a circuit breaker. It protects the battery charger from excessive DC.

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.



3.4 DC Power Distribution

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



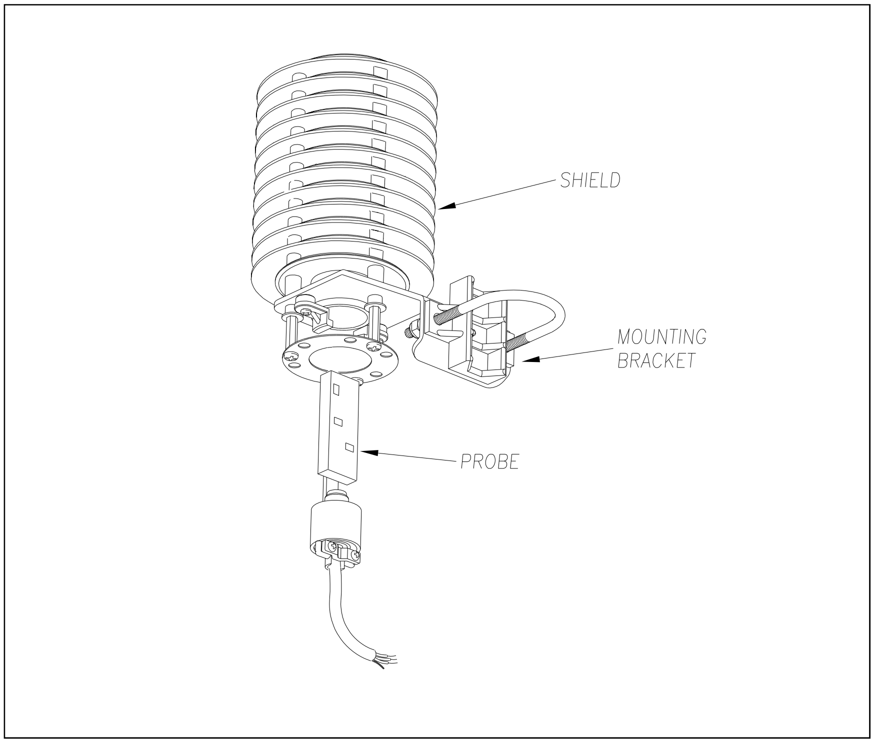
The **distribution block** contains six terminals. Loosening the middle gold nuts will disconnect DC power to the rest of the system. Wires from the bottom of the distribution block go to the 12V battery and to the battery charger. Wires from its top go to the fuse block, to the AEI Interface, and to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

The **fuse block** contains a standard 13/32 x 1-1/2-inch, 25-amp, fast blow fuse. The fuse provides overload protection for the SmartScanNG enclosure. The equipment side of the fuse block is connected to the surge-suppression panel inside the SmartScanNG enclosure. The battery side of the fuse block is connected to the battery via the distribution block.

4.0 Shielded Temperature Probe

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

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



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

The system comes with a partially installed shielded temperature probe. **Section 7.12 - *Shielded Temperature Probe*** tells how to finish installing it.

5.0 AEI Subsystem

Not all SmartScanNG detectors incorporate an AEI subsystem. If your SmartScanNG system does not, skip ahead to section 6.0. The AEI subsystem consists of two AEI antennas and a reader module. Described below are the optional AEI readers - the 2300-750 and the 2300-752.

5.1 2300-750 AEI Interface Module

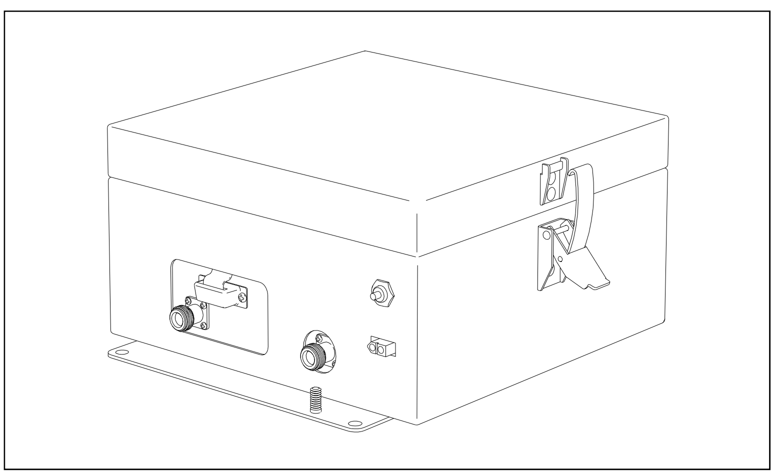
The AEI Interface module contains a Transcore AR2200 RF unit and a Transcore AI1200 Reader Logic board. The AR2200 has a single RF output that is multiplexed between two antenna connections (ant0 and ant1). One or both antennas can be enabled via setup commands.

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

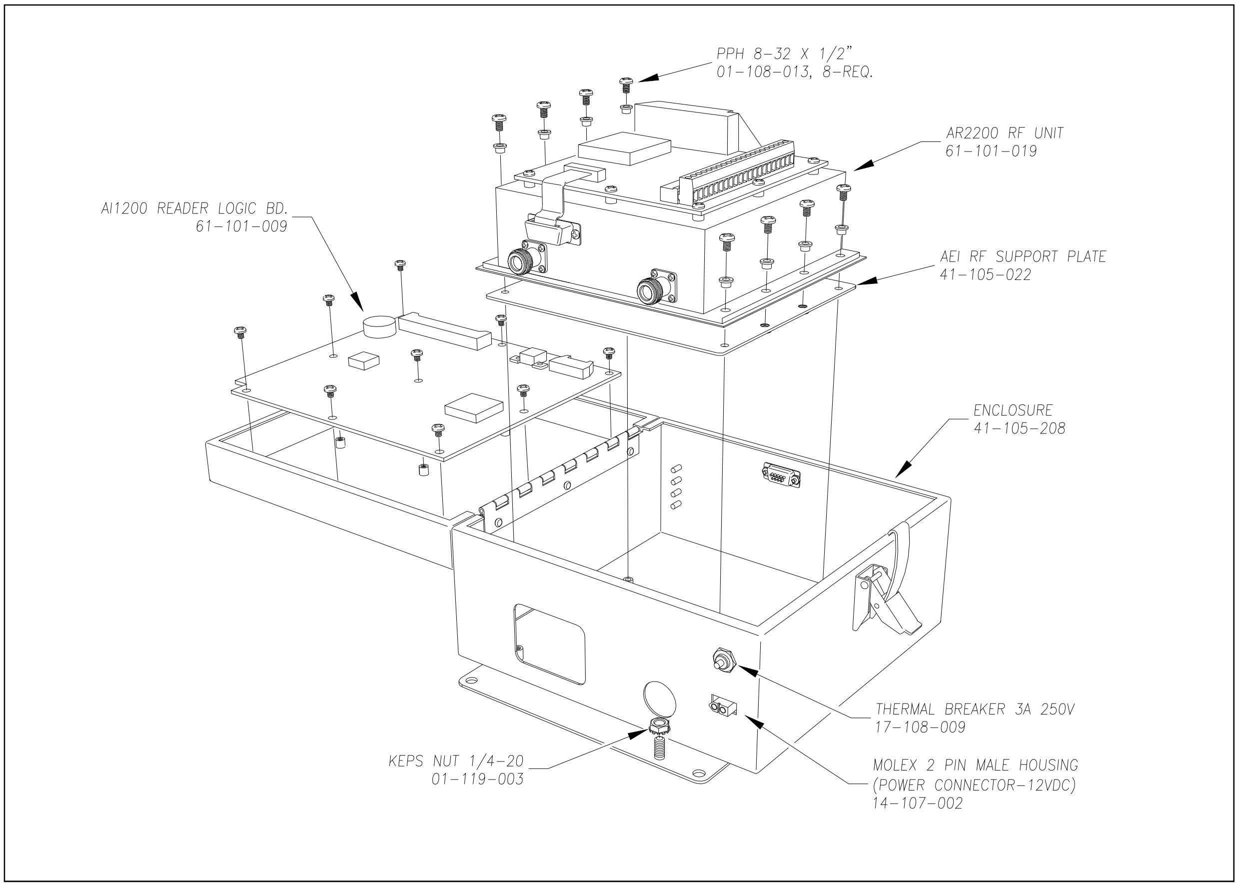
Commands are used to control the operation of the AEI Interface module. Setup commands are sent from the Processor board (2300-100) at power startup to configure the operating parameters of the AEI Interface module. When a train arrives at the site, the AEI Interface module "wakes up." It then starts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

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

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



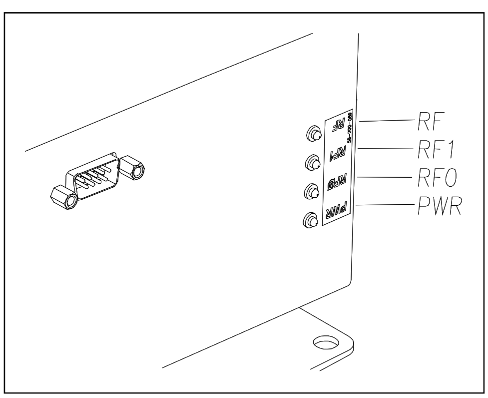
The figure below shows the major parts of an AEI Interface module (2300-750).



5.1.1 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 is used to connect 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."

5.1.2 Components on Transcore 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.

5.2 2300-752 MPRR Panel

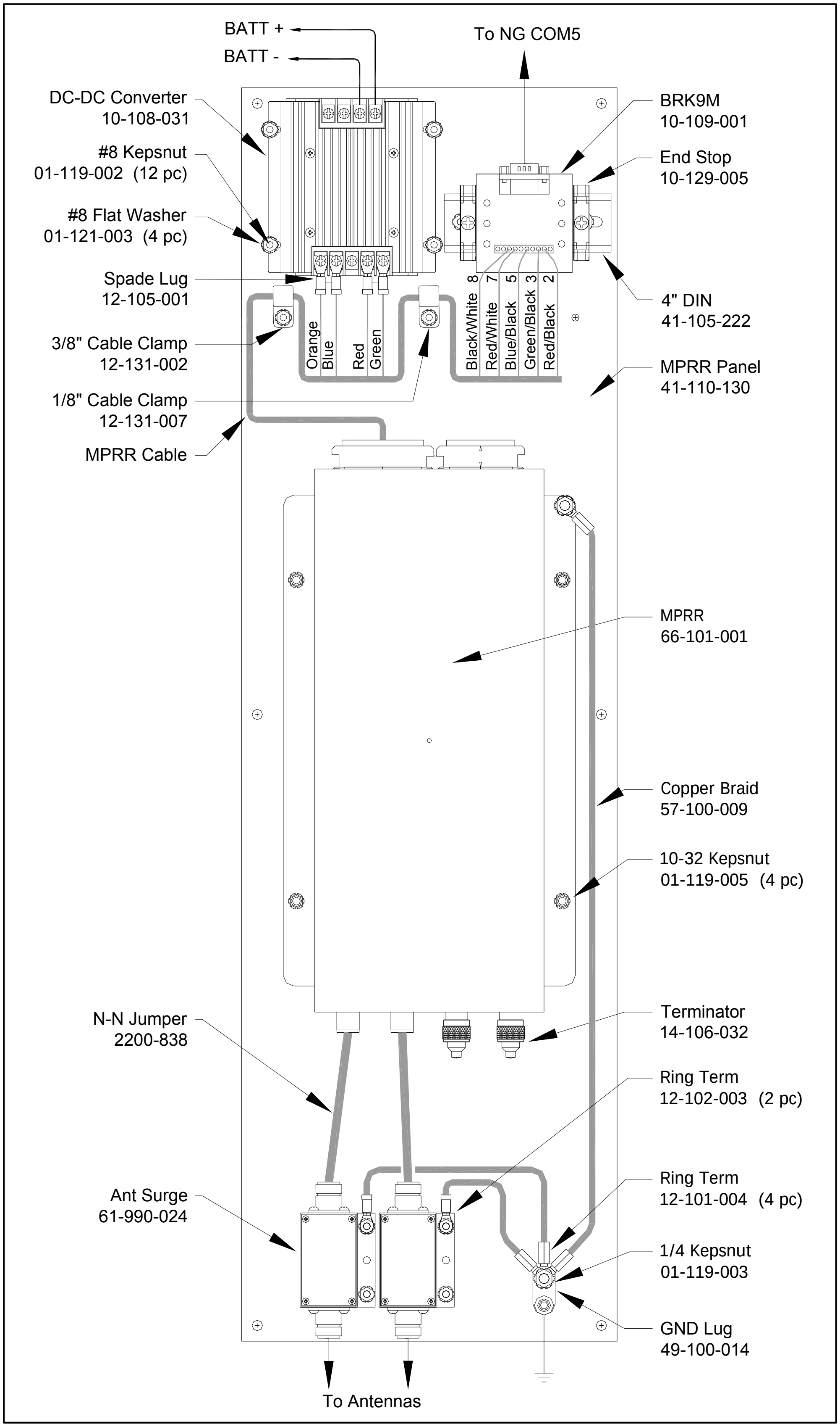
The 2300-752 MPRR Panel is a prewired, wall mountable panel assembly consisting of an MPRR, a boost converter, coaxial surge arresters, and a DB9 breakout board.

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

Commands are used to control the operation of the MPRR. Setup commands are sent from the Processor board (2300-100) at power startup to configure its operating parameters. When a train arrives at the site, the MPRR "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 MPRR appends a timestamp to each tag record that indicates when the tag was read. After a train has left the site, the timestamp is used to match each tag to a vehicle in the train's consist.

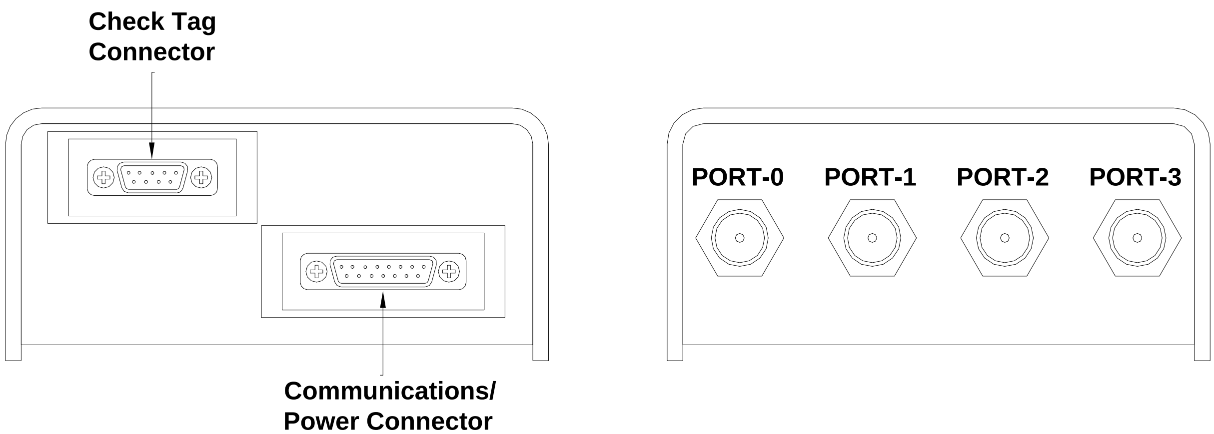
The Train Detail report displays the AEI information of each vehicle in the train's consist from which a tag was read. The Train Summary report displays a total tag count for each train.

2300-752 MPRR Panel

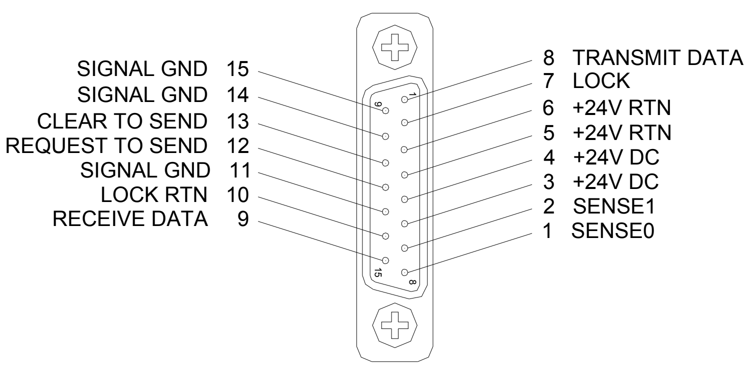


5.2.1 MPRR

TransCore's Multiprotocol Rail Reader (MPRR) is a fully integrated, self-contained 902- to 928-MHz wireless radio frequency identification (RFID) reader that is specifically designed for rail applications. The MPRR is the recommended replacement reader for TransCore's AI1200 Reader/AR2200 RF Module systems.



Power and serial communications are brought in through the DB15F connector.



MPRR Cable Assignments

Pin No.	Color	Signal
1	Black	Sense0
2	White	Sense1
3	Red	+24V DC
4	Green	+24V DC
5	Orange	+24V RTN
6	Blue	+24V RTN
7	White/Black	Lock
8	Red/Black	Xmit Data
9	Green/Black	Rec Data
10	Orange/Black	Lock RTN
11	Blue/Black	Signal GND
12	Black/White	RTS
13	Red/White	CTS
14	Green/White	Signal GND
15	Blue/White	Signal GND

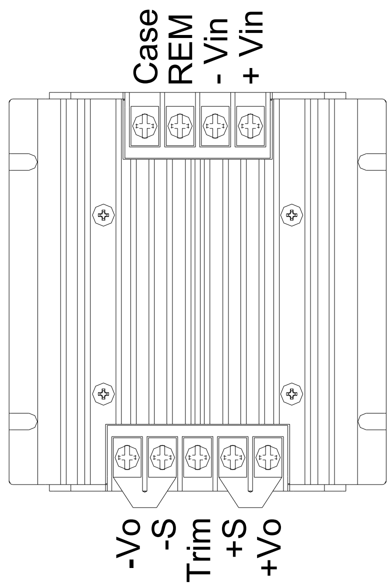
Power Supply Current Requirements:

Supply	(RF On) Worst Case Maximum Current at 68°F	(RF Off) Standby Operating Current at 68°F
16 to 20V AC	1.7 A at 18V AC	1 A at 18V AC
16 to 28V DC	1.7 A at 18V DC	1 A at 18V DC

The MPRR has a single RF output that can be multiplexed with up to four antennas. Unused antenna ports should be terminated into a 50 Ohm terminator.

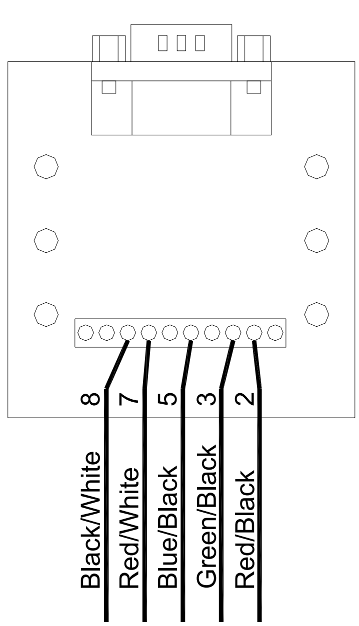
5.2.2 DC-DC Converter

The 24V 2.08A boost converter provides power to the MPRR. It operates from an input voltage of 9 ~ 36 VDC.



5.2.3 DB9 Breakout Board

RS232 serial communications to MPRR are provided through the DB9M connector. A standard DB9F to DB9F straight serial cable connects the MPRR panel to COM-5 of the SmartSCAN-NG.



6.0 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 section 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.

6.1 Selecting a Site

Locate the site:

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

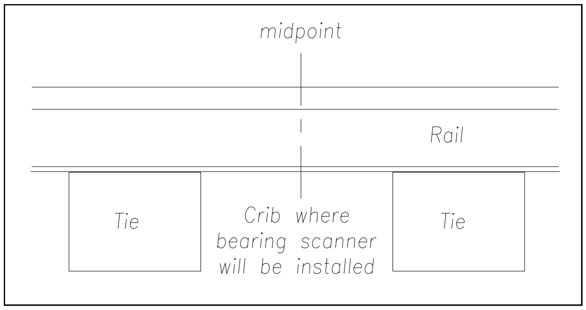
6.2 Preparing the Scanner Location

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.

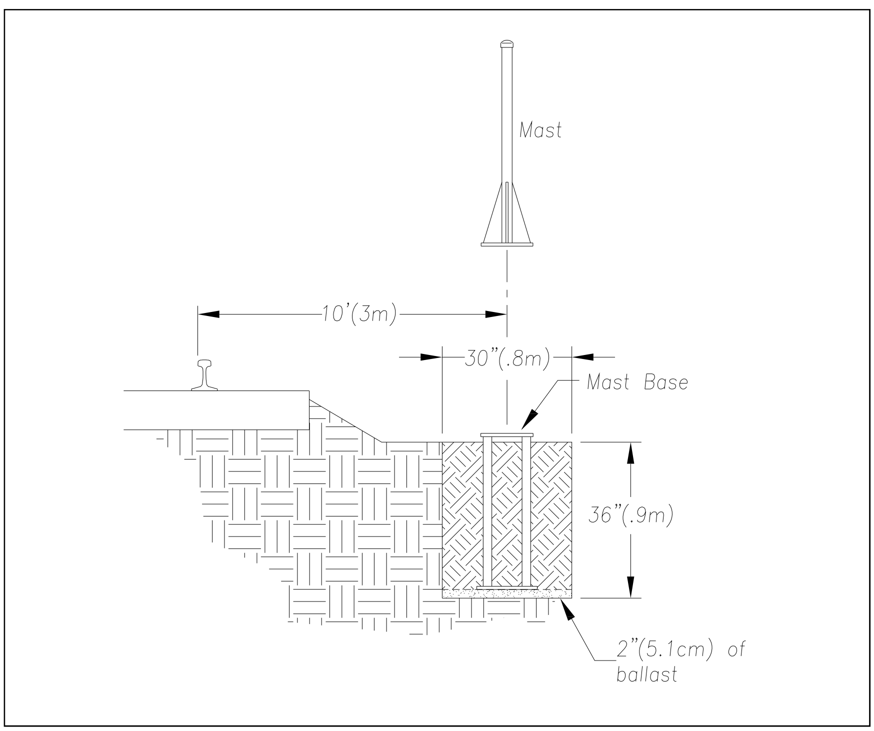
The wheel scanners should be centered in the crib of the two ties immediately ahead (and to the north or east) of the bearing scanners.

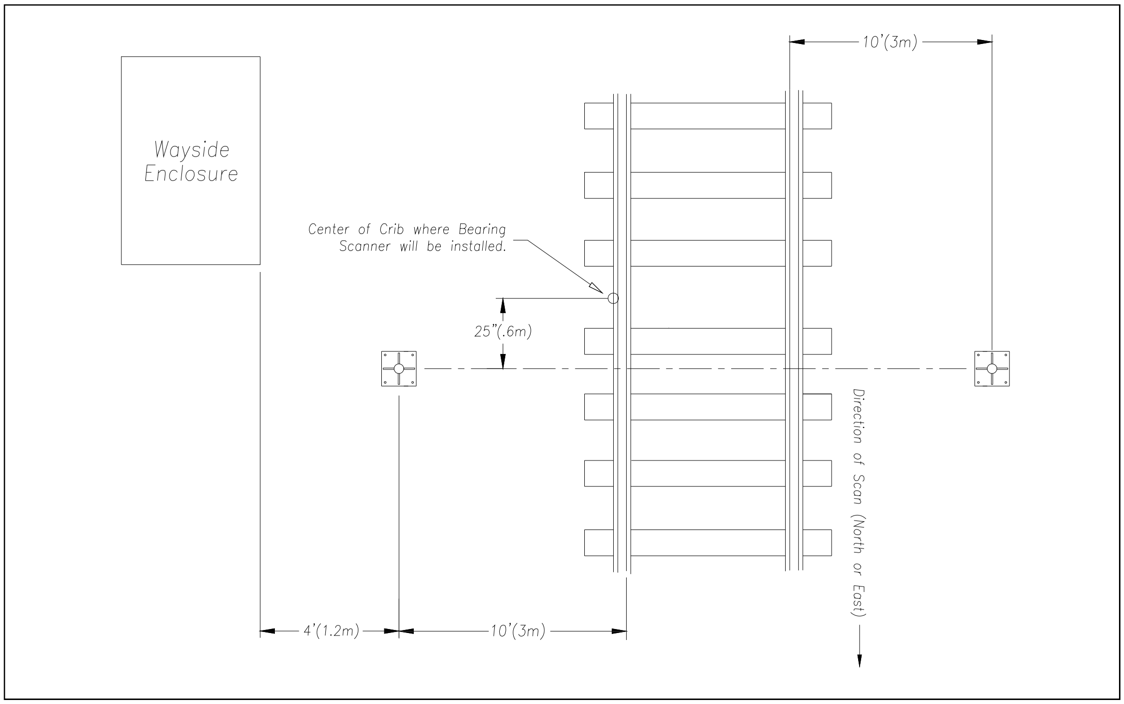
b Repeat steps **2** through **6**.

6.3 Preparing the AEI Antenna Masts

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

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





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

Install each base so that it's plumb and so that its center is 10 feet (3 meters) from the gauge side of the closest rail and 25 inches (0.6 meters) from the center of the crib in which the bearing scanner will be installed. Both bases will be north or east of the crib.

3 With the supplied hardware, attach one mast to each base.

4 Plumb each mast.

5 Ground each mast.

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

6.4 Preparing the Wayside Enclosure

To ready the wayside enclosure:

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

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

2 Level the wayside enclosure.

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

Ground rods should be at least 5/8-inch (1.59-centimeter) diameter copper-clad steel rods or 1-inch (2.5-centimeter) diameter zinc-coated steel rods. The minimum length of a ground rod is 8 feet (2.4 meters). Ground rods should be driven vertically for their full length, and the top of the ground rod should be located a minimum of 12 inches (30.5 centimeters) below the top of the subgrade at the toe of the ballast slope. The maximum allowable resistance of grounded rail or structures is 25 ohms.

Canadian Pacific typically uses 5/8-inch diameter copper-clad rods, one on each corner of the wayside enclosure for a total of four.

Ground connectors, with attached copper wire, are welded to the underside of most wayside enclosures.

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

Telephone or Ethernet 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 section, 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 15-amperes.

This manual only covers AC powered systems. If your site is going to use a DC power source, contact STC for help in doing so.

9 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.

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

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

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

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

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

6.5 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.

6.6 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.

6.7 Getting Help with the Installation

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

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

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

6.8 Identifying the Installation Tools

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

- Laptop computer
- Track drill with 3/8-inch bit
- 1/2-inch drive socket with 9/16-inch deep well socket
- 3/4-inch drive socket with 1-7/16-inch socket
- 9/16-inch torque wrench
- Medium size adjustable box wrench
- Carpenters level
- 1/2-inch nutdriver
- 11/32-inch nutdriver
- #2 Phillips head screwdriver
- Small slotted screwdriver (aka flathead screwdriver)
- 50-foot (15-meter) or longer tape measure
- Multimeter, reading at least 110 to 120 VAC, 0 to 50 VDC, and 0 to 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 and the deflectors
- 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.

7.0 Installing Wayside Enclosure Components

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

7.1 Grounding System

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

Ground rods should be <u>at</u> <u>least</u> 5/8-inch (1.59-centimeter) diameter copper-clad steel rods or 1-inch (2.5-centimeter) diameter zinc-coated steel rods. The <u>minimum</u> length of a ground rod is 8 feet (2.4 meters). Ground rods should be driven <u>vertically</u> for their full length, and the top of the ground rod should be located a minimum of 12 inches (30.5 centimeters) below the top of the subgrade at the toe of the ballast slope. The maximum allowable resistance of grounded rail or structures is 25 ohms.

As a <u>minimum</u>, **two driven ground rods** should be installed at opposite corners of the wayside enclosure (aka bungalow) in which the SmartScanNG enclosure is installed. **A third driven ground rod** should be installed at the power pole to which the AC power connection is made. All three ground rods should be interconnected and exothermically bonded with a 6-AWG bare stranded copper wire. Two 6-AWG copper transitions welded to the skin of the wayside enclosure should be exothermically bonded to the driven grounds at its corners.

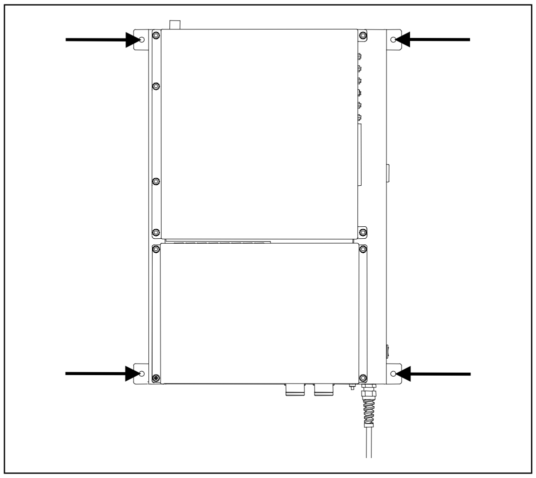
Canadian Pacific typically uses 5/8-inch diameter copper-clad rods, one on each corner of the wayside enclosure for a total of four.

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.

7.2 SmartScanNG Enclosure

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

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



Mount the SmartScanNG enclosure about 4 feet (1.2 meters) above the floor. Doing so positions the enclosure at a convenient height for installation and servicing. Mounting it at this height also allows you to install the power subsystem below it.

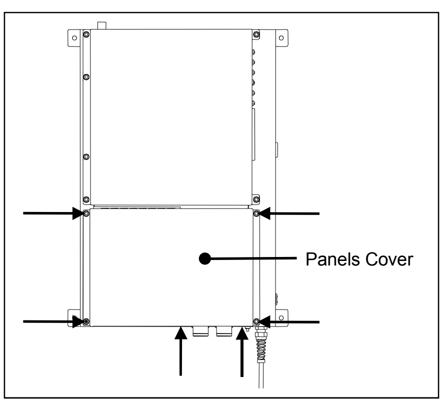
Mount the SmartScanNG enclosure within 4 feet (1.2 meters) of a grounded three-wire 110 to 120-VAC outlet. The enclosure is provided with a 5-foot (1.5-meter) power cord. Be sure that the enclosure is level with the speaker on the top and the scanner connectors on the bottom.

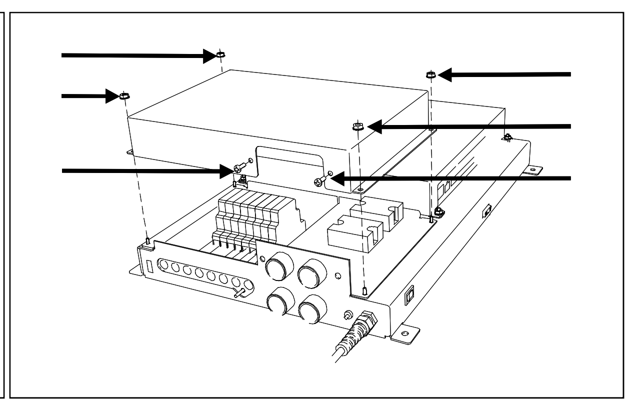
To ground the SmartScanNG enclosure:

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).

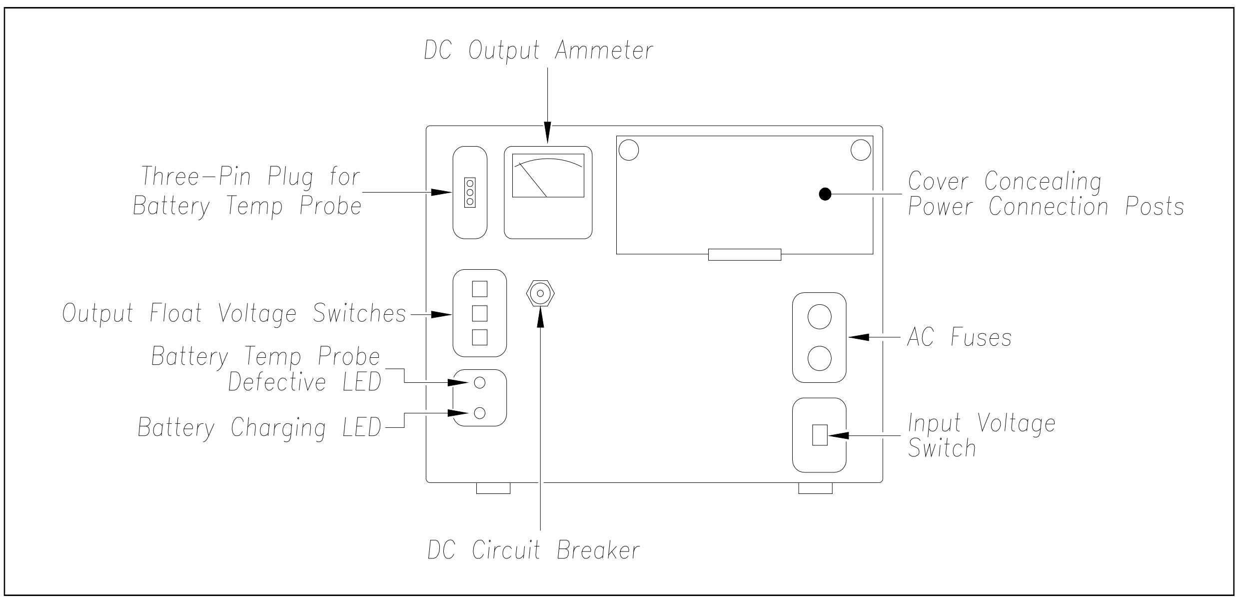
7.3 Battery Charger

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

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

Be sure that the charger is level.

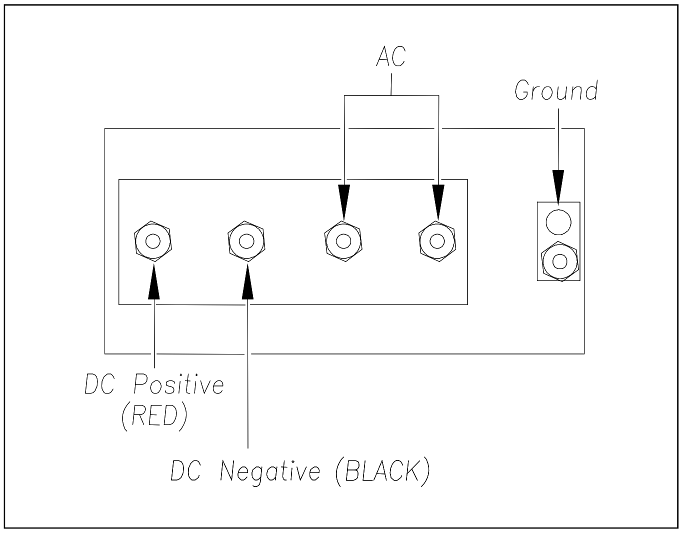
The figure below shows the front of a NRS ELC-12/20-D battery charger.



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 <u>ground</u> 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 <u>attach</u> 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 inch (6.4 millimeters) of insulation from the ends of the three wires coming from the supplied power cord.
4. Connect the green wire to the copper ground lug to the right of the power connection posts.

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

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

7.4 Fuse Block

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

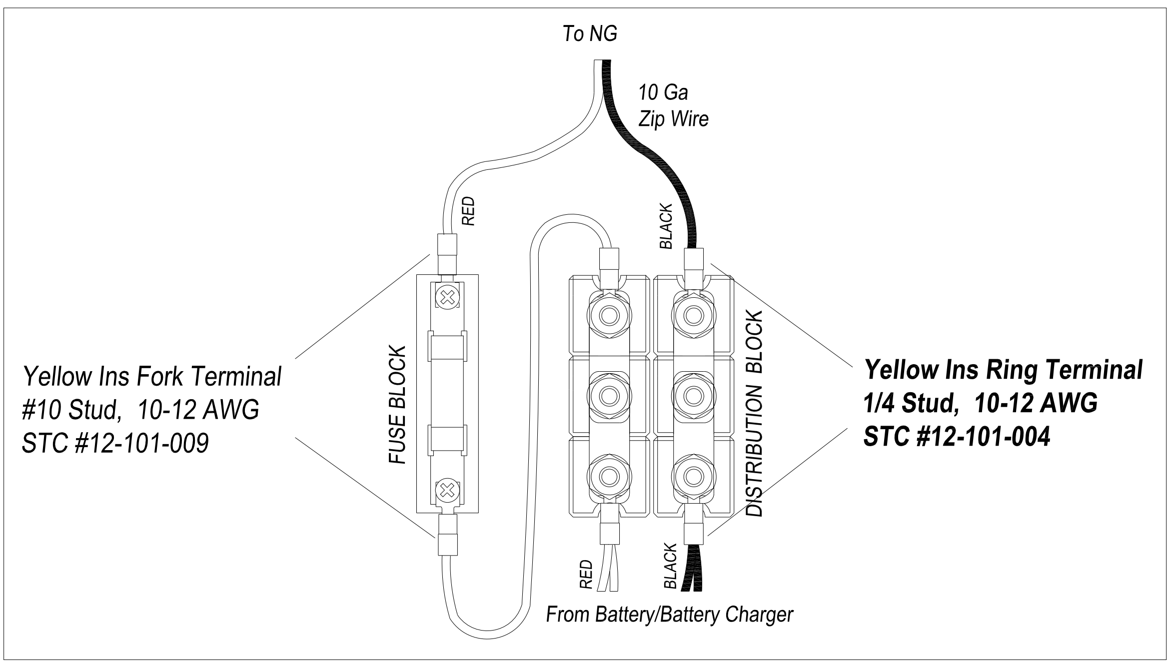
1 Be sure that you have on hand a wire cutter, a wire stripper, a pliers-type crimping tool, and a midsize slotted screwdriver.

2 Remove all power to the SmartScanNG enclosure. Remove the fuse from the fuse block and store it in a safe place until you replace it (next section).

Using the supplied screws, mount the fuse block and the distribution block near 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. It may not be necessary to use all 15 feet (4.6 meters) of this zip wire. You should cut it to the appropriate length for your configuration.

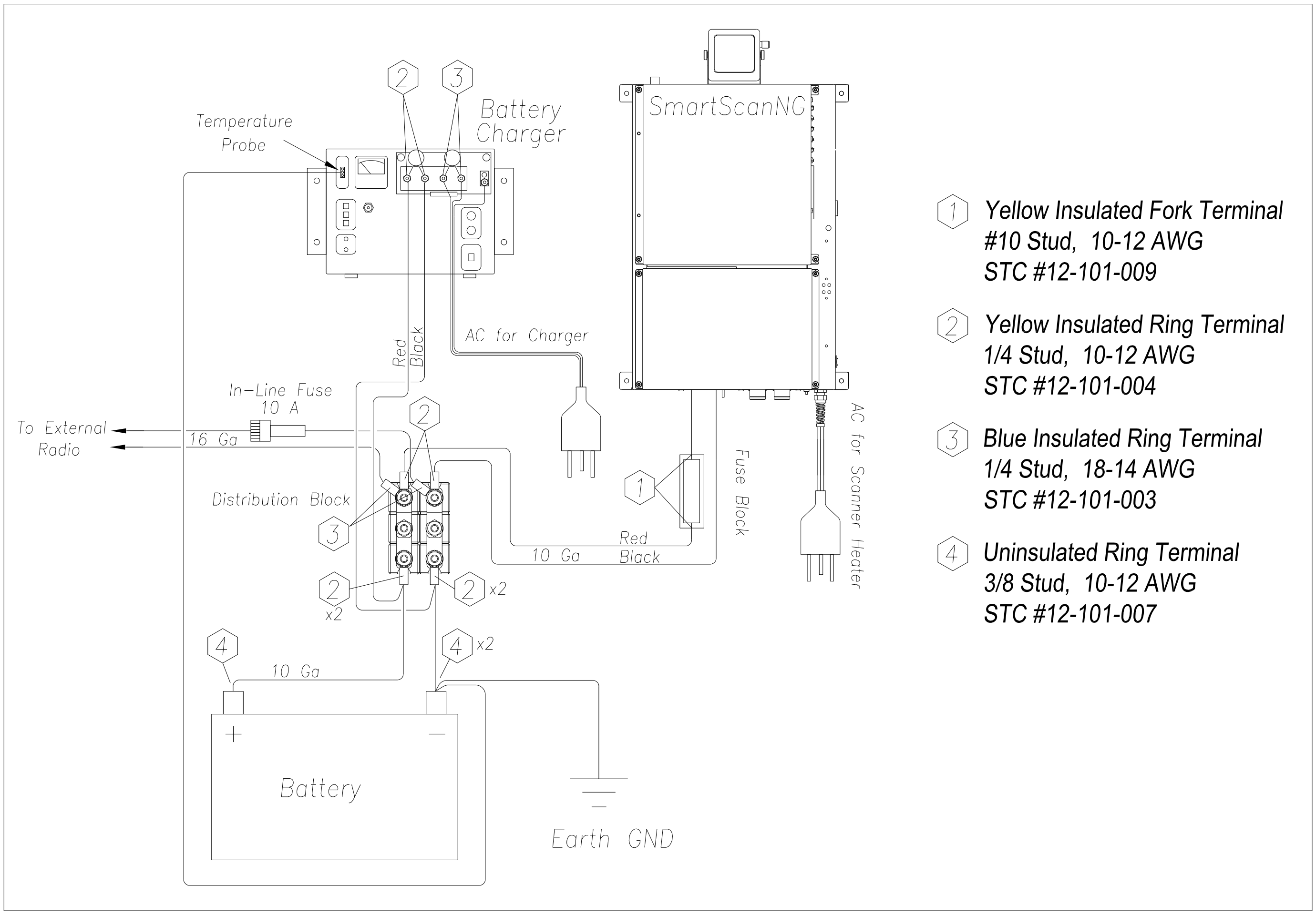
3 Wire fuse block per figure below. Connect to surge suppression panel of the SmartScanNG enclosure (red & black terminal blocks on the right side of DIN rail).



4 If this is a multi-track site, repeat steps **2** through **3** on the other systems.

7.5 Power Subsystem

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



To finish installing the power subsystem:

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

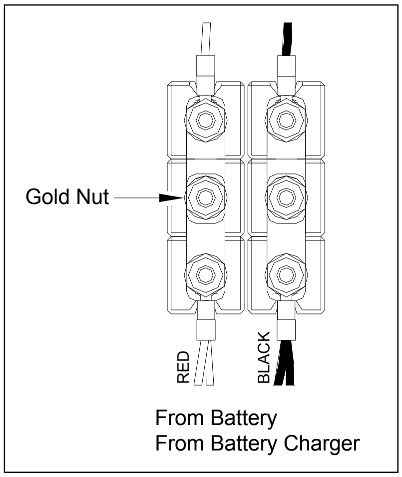
2 Remove all power to the system.

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

3 Complete all system wiring per figure above.

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

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



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

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

8 Strip 1/4 inches (6.4 millimeters) of insulation from both ends of both conductors. Crimp one ring terminal to the end of each of these four conductors.

9 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.

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

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

12 Strip 1/4 inches (6.4 millimeters) of insulation from both ends of both conductors. Crimp one ring terminal to the end of each of these four conductors.

WARNING

Wear appropriate eye and skin protection when servicing batteries.

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

14 Plug the other end of the battery temperature probe into the receptacle labeled **Temp Probe** on the front of the charger.

15 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.

16 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.

17 If this is a single-track site, go to next section..

If this is a double-track site, repeat steps **1** through **16** on the second track.

7.6 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.

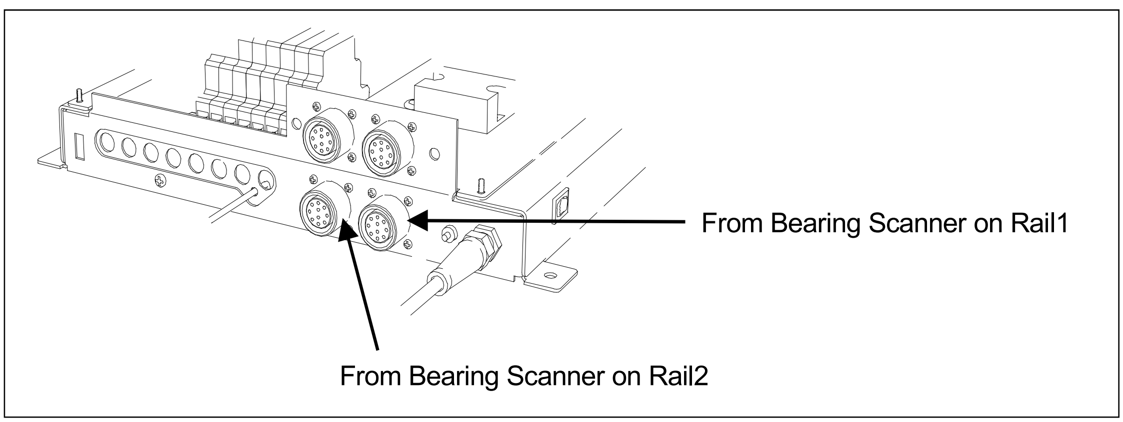
To connect the bearing scanners to the SmartScanNG enclosure:

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 and RAIL2 is the west rail. If the track runs east and west, RAIL1 is the north rail and RAIL2 is the south rail.

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

2 Plug the connector from the bearing scanner on rail1 (that is, from the north or east rail) into the rightmost box connector on the backmost part of the bottom of the SmartScanNG enclosure.



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

4 If this is a double-track site, repeat steps **1** through **3** on the second track.

7.7 Wheel Scanners

Not all sites use wheel scanners. If your site doesn't use them, skip to the next section.

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.

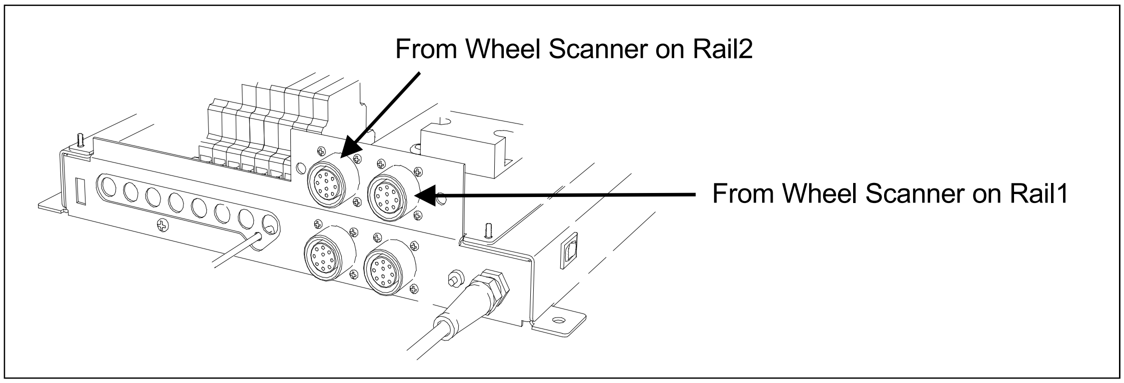
To connect the wheel scanners to the SmartScanNG enclosure:

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 and RAIL2 is the west rail. If the track runs east and west, RAIL1 is the north rail and RAIL2 is the south rail.

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

2 Plug the connector from the wheel scanner on rail1 (that is, from the north or east rail) into the rightmost box connector on the frontmost part of the bottom of the SmartScanNG enclosure.



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

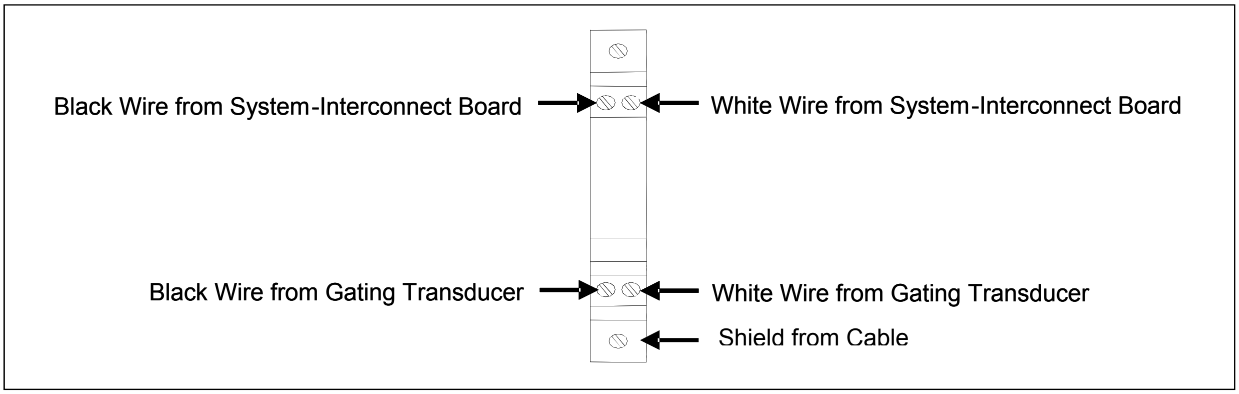
4 If this is a double-track site, Repeat steps **1** through **3** on the second track. The cables from track2 are connected to the rightmost SmartScanNG enclosure.

7.8 Gating Transducers

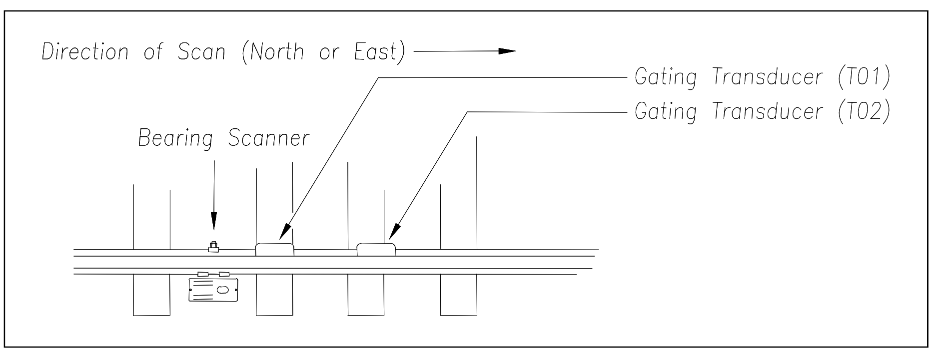
There are two gating transducers per track, each having two wires. One black wire and one white wire. At a single-track site, the wires from gating transducer TO1 should be labeled **TO1**. The wires from gating transducer TO2 should be labeled **TO2**.

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

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



Observe correct polarity when you connect the wires from the transducers. The polarity is correct when the transducer's white wire is connected directly under the existing white wire at row two of the UTB, and the transducer's black wire is connected directly under the existing black wire at row two of the UTB. Connect **TO1** first and **TO2** second. **TO2** is the northmost or eastmost gating transducer.

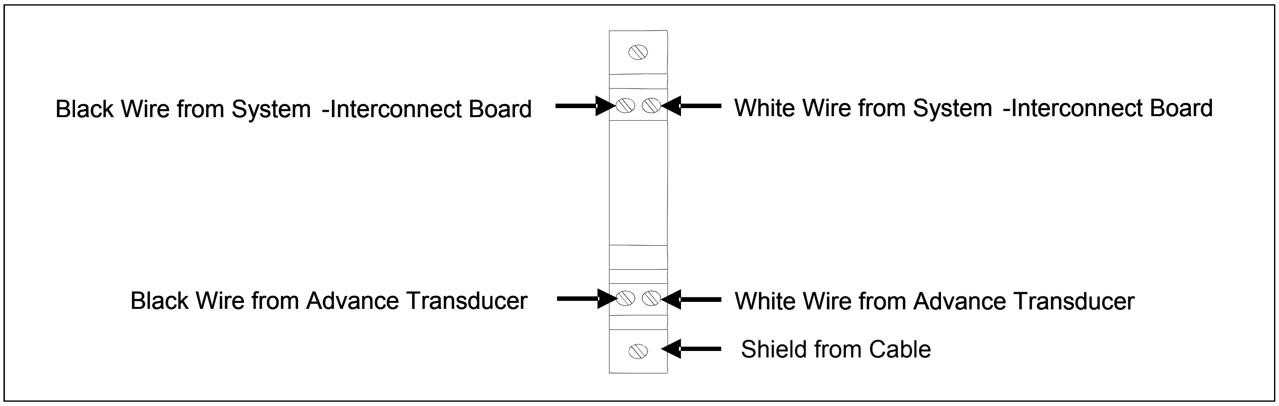


7.9 Advance Transducers

Not all systems use advance transducers. If yours doesn’t, skip ahead to the next section.

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 should be labeled **ADV1** and **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 <u>third</u> <u>row</u> of connectors <u>from</u> <u>the</u> <u>top</u>. 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 <u>right</u> of gating transducer **TO2**. **ADV2** is the one to the <u>left</u> of gating transducer **TO1**.

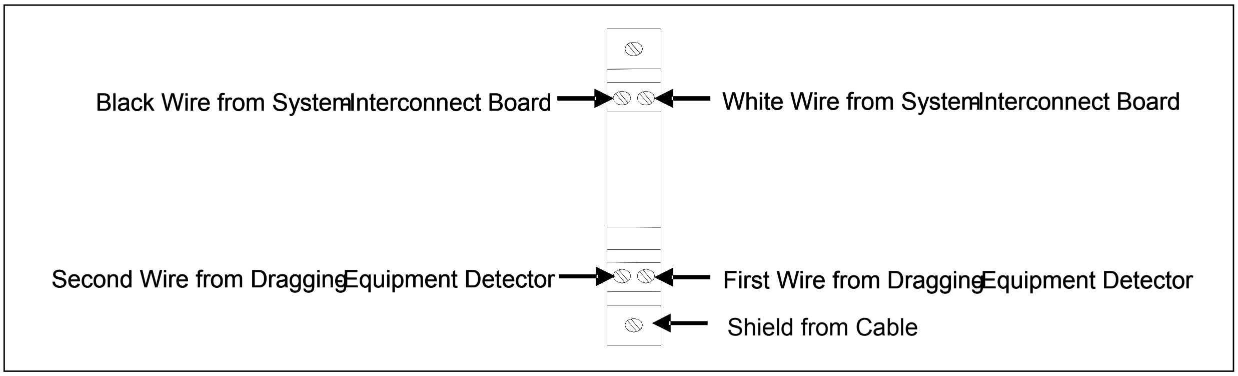
7.10 Dragging-Equipment Detector

Most, but not all, systems use dragging-equipment detectors. If your site doesn't use them, skip ahead to the next section.

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

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

On the DIN rail assembly, the UTB labeled **DED** is for the dragging-equipment detector. This UTB protects the SmartScanNG system from transients and surges, which can be induced onto external wiring by lightning. The UTB has four rows of connectors. The wires from the dragging-equipment detector are terminated at the third row of connectors from the top. The second row from the top is wired at the factory to TS4 on the System-Interconnect board.



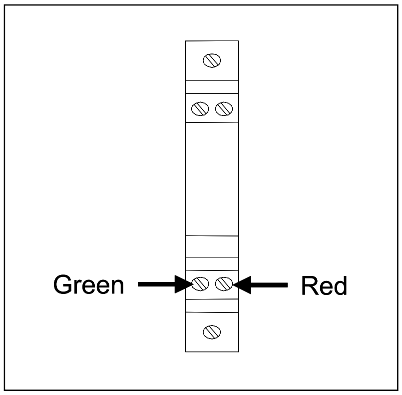
Correct polarity need not be observed when connecting the wires from the detector. One wire from the detector should be connected directly below the existing white wire at row two of the UTB, and the other wire should be connected directly below the existing black wire at row two of the UTB.

7.11 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 ahead to the next section.

The telephone service provider should terminate their drop on a lightning arrester terminal on the service pole. From the lightning arrester block, run a four-wire service cord to the wayside enclosure and route it to the DIN rail assembly on the surge-suppression panel (in the SmartScanNG enclosure). At double-track sites, the service cord is routed to the DIN rail assembly in the leftmost SmartScanNG enclosure.

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



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

7.12 Shielded Temperature Probe

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

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

1 Be sure that you have on hand the customer-supplied fasteners needed to attach the shielded temperature probe to the outside of the wayside enclosure; a wire stripper; and the fasteners needed to attach the RF-filter assembly to the inside of the wayside enclosure.

2 If you haven't done so already, remove the shielded temperature probe and the RF-filter assembly from its box.

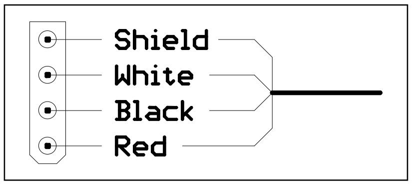
3 Mount the probe onto the outside of the wayside enclosure.

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

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

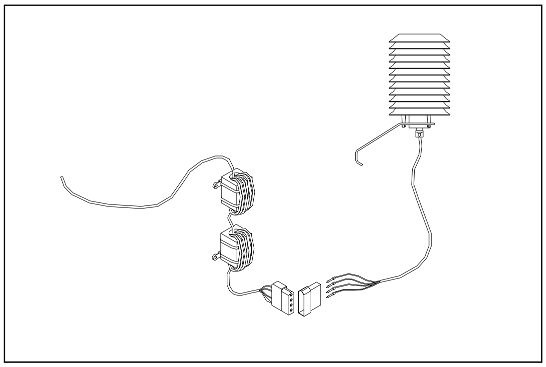
In sheet metal, use a rubber grommet in every hole through which you route the cable.

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



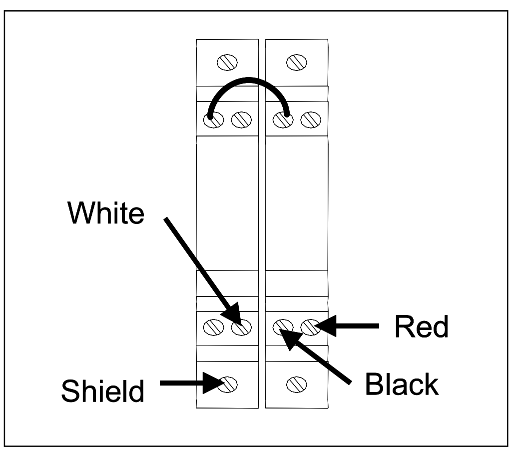
The red wire supplies 12 VDC to the shielded temperature probe.

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



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

On the DIN rail assembly, the two UTBs labeled **TempProbe** are for the shielded temperature probe. Each UTB has four rows of connectors. As shown below, the wires from the shielded temperature probe are terminated at the third row and fourth row of connectors from the top. The top connectors on these UTBs are prewired at the factory and need no further wiring.



8 As shown above, terminate the wires from the end of the RF-filter assembly.

9 Mount the two filters of the RF-filter assembly onto the inside of the wayside enclosure.

7.13 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 <u>or</u> 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 double-track site, repeat steps **1** through **4** for the radio in the other SmartScanNG enclosure.

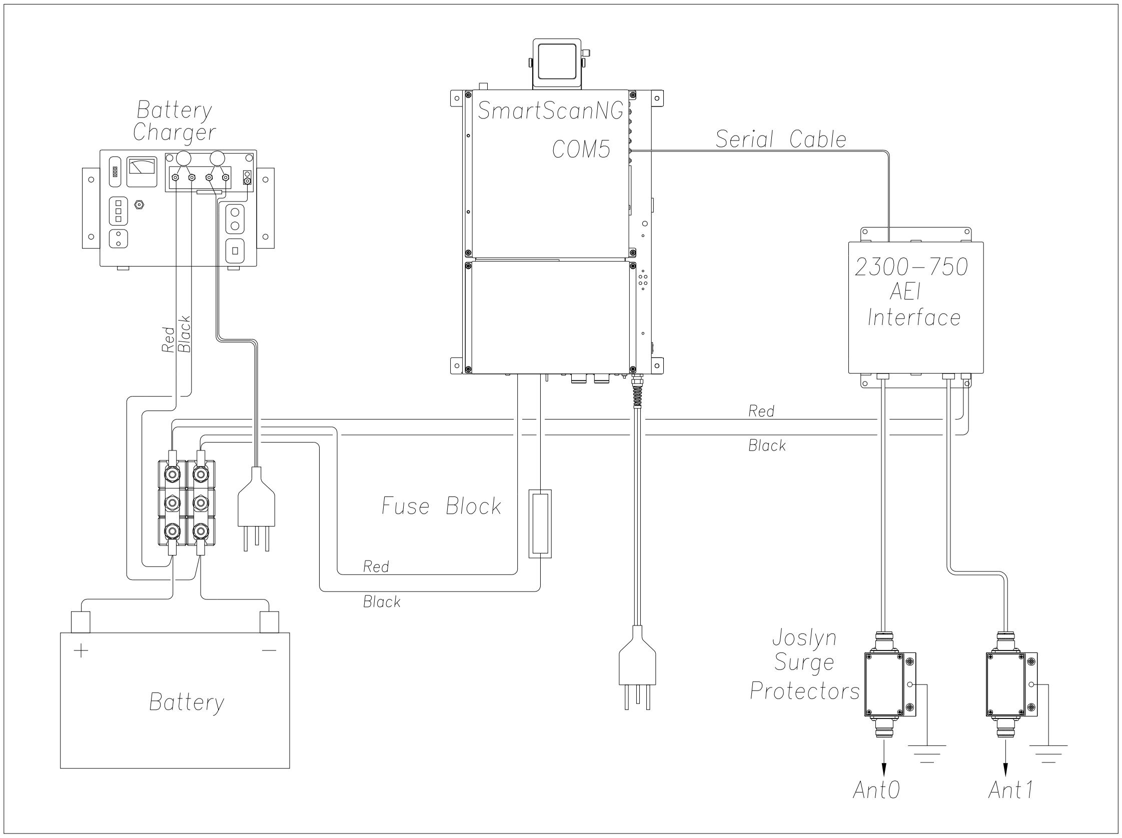
7.14 AEI Interface Module

Not all sites use an AEI Interface module. If your site doesn't use one, skip ahead to the next section.

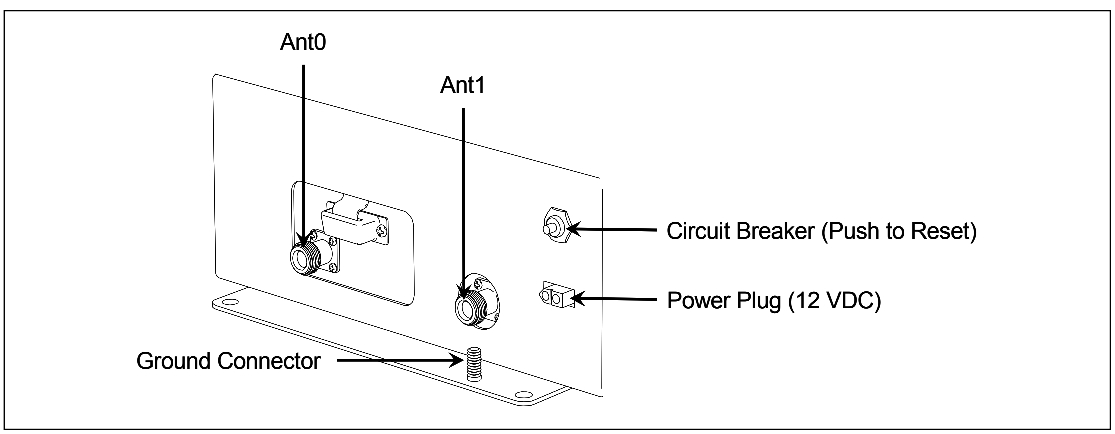
Mount the AEI Interface module (2300-750) next to the SmartScanNG enclosure. Under the AEI Interface module, mount two Joslyn surge protectors (aka Joslyn coaxial lightning arresters).

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

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



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



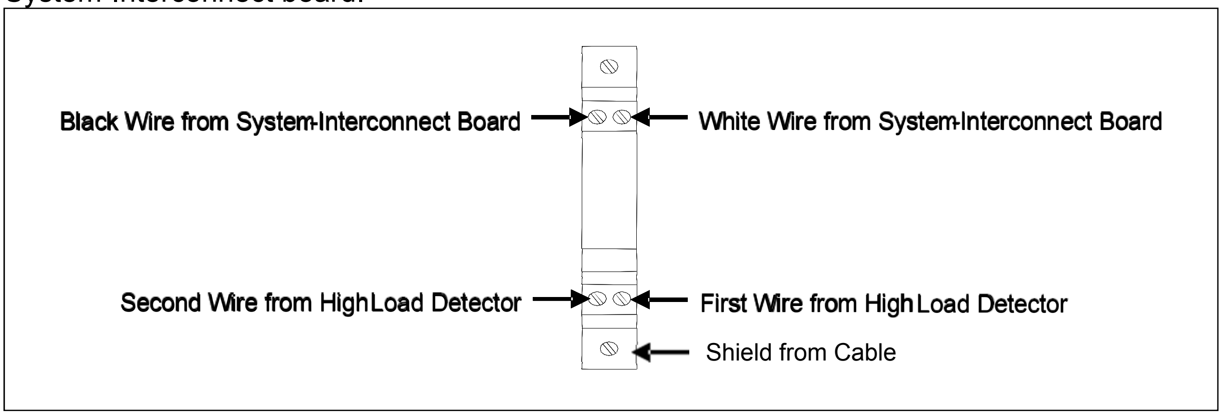
7.15 High-Load/High-Wide Detector

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

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

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

On the DIN rail assembly, the UTB labeled **HIGH** is either for the high-wide detector or the high-load detector. This UTB protects the SmartScanNG system from transients and surges, which can be induced onto external wiring by lightning. The UTB has four rows of connectors. The wires from the high-load/high-wide detector are terminated at the third row of connectors from the top. The second row from the top is wired at the factory to TS4 on the System-Interconnect board.



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

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

8.0 Placing a System into Service

This section describes all the things that need to be done before placing a SmartScanNG system into service.

8.1 Checking the Trackside Components

To <u>check</u> the correctness of the installation of the trackside components:

1 Be sure that you have on hand a tape measure, a #2 Phillips head screwdriver, a small slotted screwdriver, a 9/16-inch torque wrench, a laptop computer, a multimeter, and the alignment fixture.

2 At trackside, check track conditions on all tracks. 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.

3 Before proceeding, check that all the track-mounted hardware has been installed properly.

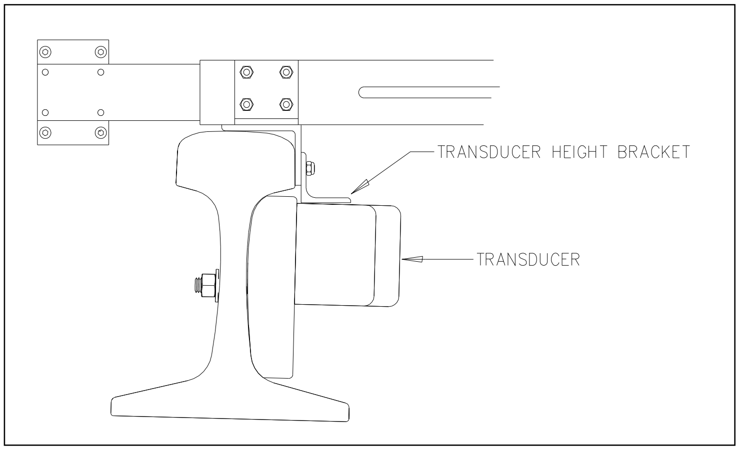
4 At trackside, check all transducer-mounting bolts on all tracks to make sure that all transducers are snug against the rail.

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.

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

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

6 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.

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

a Loosen the nuts holding the transducer body to its mounting plate.

b By sliding it up and down, adjust the transducer body to the proper height.

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

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

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

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

9 From under all scanners, remove ballast that could damage the scanners during train passage. Remove all obstructions to the scan path of each scanner.

8.2 Checking the Wayside Enclosure Components

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

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

Section 7.0 - Installing Wayside Enclosure Components tells how to install the radio antenna and the shielded temperature probe.

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

   Section 7.1- Grounding System tells how to properly ground the SmartScanNG system.

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

4 Inside the wayside enclosure, check that there are no loose wires or cables.

8.3 Powering-up the SmartScanNG System

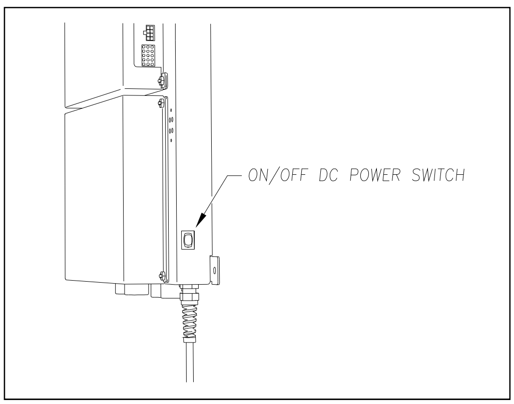
To power-up the SmartScanNG system:

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

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

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

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



3 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.

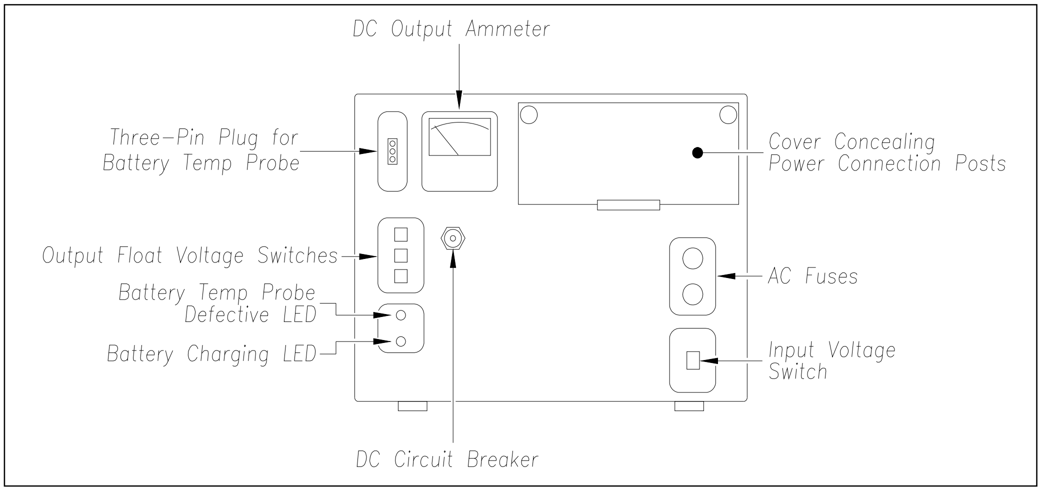
4 Before proceeding, ensure the AC power at all outlets is stable and at least 110 volts at 15 amperes. Confirm that the battery charger is properly grounded to the ground bus and its vents are not blocked.

   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.

5 On the front of the unplugged battery charger:

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

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.



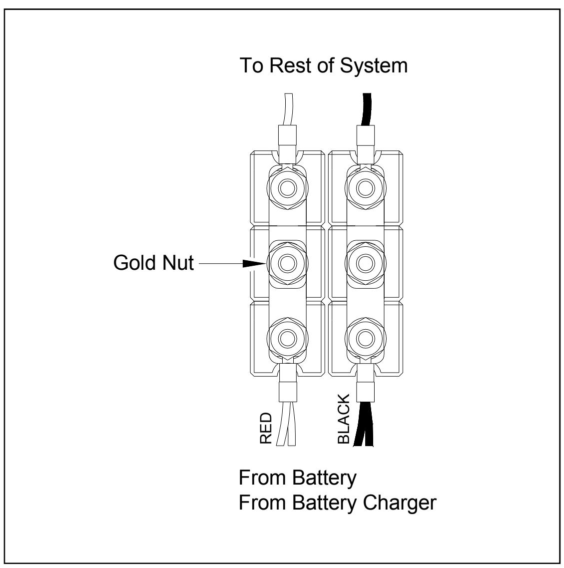
b Check the output float voltage switches on the center-left edge. Be sure each switch is set on a number and not between numbers.

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

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

d Open the small door cover on the top-right corner. Check that all binding posts nuts are tight <u>and</u> that all wiring is correct.

e If loose, <u>tighten</u> the middle gold nuts on the distribution block.



6 Plug in the SmartScanNG enclosure <u>and</u> 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 <u>not</u> allow metallic articles to contact the negative and positive terminals of a battery at the same time.

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

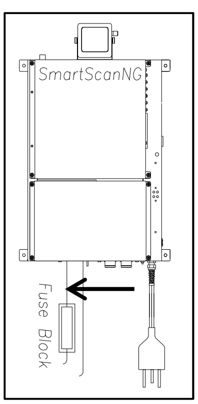
One end of the battery temperature probe cable has a three-pin plug, which plugs into a receptacle on the front of the battery charger. The other end, which has a temperature sensor sealed in it, should be attached to the <u>negative</u> <u>battery</u> <u>post</u>. If the battery temperature probe is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

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

8 Switch the multimeter to the <u>DC</u> <u>volts</u> 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.

9 Touch the leads from the multimeter to the terminal on the <u>equipment</u> <u>side</u> of the fuse block.



10 If voltage (on the equipment side of the fuse block) is 12.7 through 14.5 VDC, go to step **14**.

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

a Touch the leads to the terminals on the battery side of the fuse block.

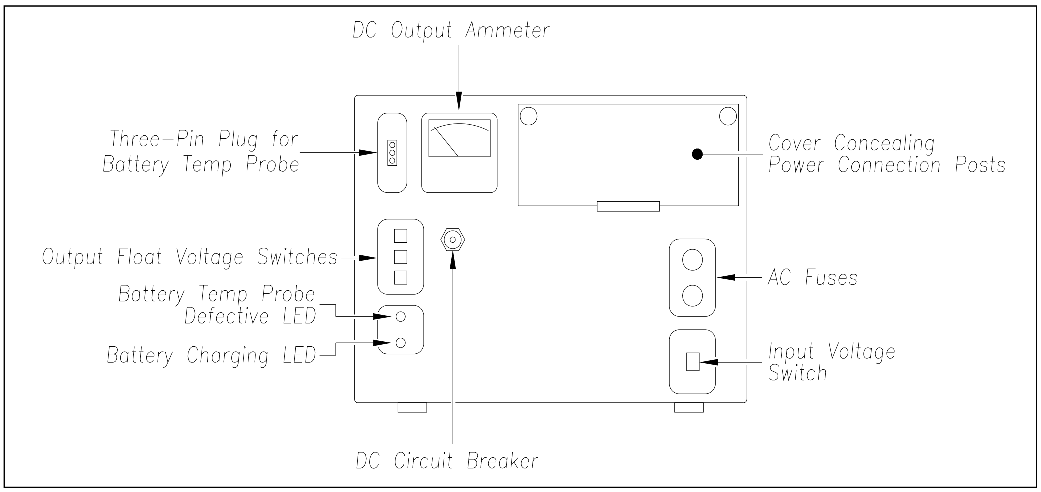
b If voltage (on the battery side of the fuse block) is greater than 0 VDC, replace each fuse in the fuse block with a BAF-25 (25-amp 250-volt) fast-acting fuse and return to step **10**.

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 **10**.

12 If voltage is less than 12.7 VDC:

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



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

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

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

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

e 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.

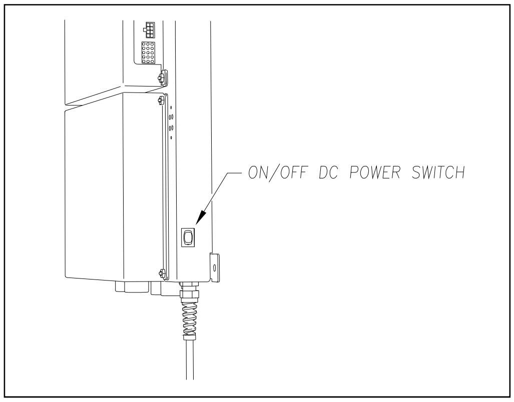
f If the yellow battery-charging LED isn't lit, call STC for help in fixing this problem.

g 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.

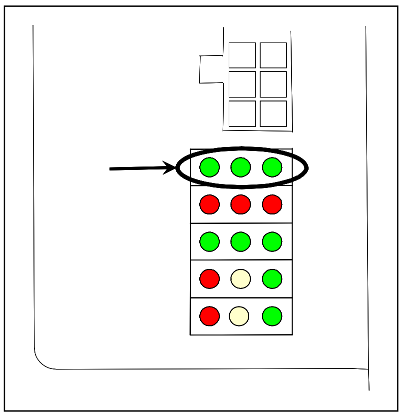
13 If voltage is greater than 14.5 VDC, cut all power to the SmartScanNG system and call STC for help in fixing this problem.

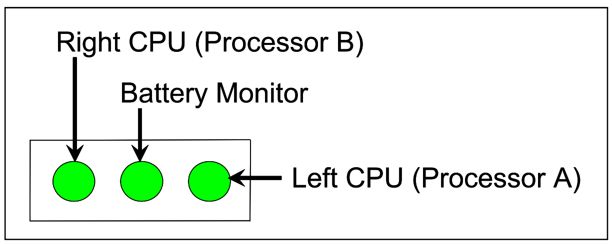
14 Toggle on the DC power switch on the right edge of the SmartScanNG enclosure.



15 Wait 30 seconds.

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





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

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

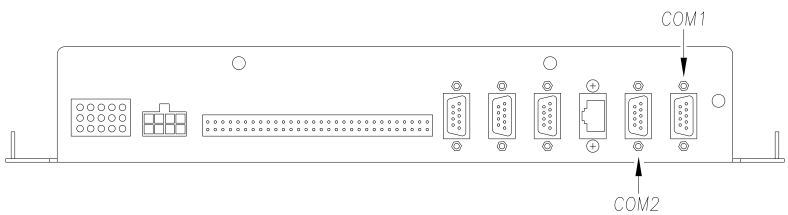
17 If either or both of the **rightmost** and **leftmost LEDs** (on the top row) blinks on and off, is lit solid, or isn't lit at all, call STC for help in fixing this problem.

8.4 Checking the Scanner Shutters

To check the operation of the scanner shutters:

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

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



b Turn on your computer.

c Be sure that your computer has installed communications software, that it is set to use full duplex, 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 Main menu, press **[Esc]**.

The Main menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
Subdivision: NONE
10/17/2012 21:57
Main Menu
-------------------------------------------------
            .
            .
            .

  M) Enter Pass-Thru Mode
  N) System Functions
  O) Dynamic Scan Records - Train Directory
  P) Dynamic Scan Records - Exception Directory
  Q) Straight-Thru Comms (COM2)
  R) Comma Separated Setup Parameters
  X) Exit
```

f Select **System Functions** menu.

This prompt appears.

```
Type "System":
```

You are given unlimited chances to type the word "system." The entry of this word is **not** case sensitive. After you type it, the System Functions menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
Subdivision: NONE
10/17/2012 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 Select Auto-Calibration to open the shutters.

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

2 In each scanner, check if its shutter opened.

3 If any shutter didn't open, fix this problem before proceeding.

4 In each scanner, inspect optics and clean if necessary.

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

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

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

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

8.5 Calibrating Scanners

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

8.5.1 Bearing Scanners

STC recommends that you use the calibrated heat source (2100-810NG) only when the outside (ambient) temperature is above -18°C (0°F) and below 32°C (90°F). 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-meter) power cord into the **six**-contact circular connector on the front of the calibrated heat source.

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

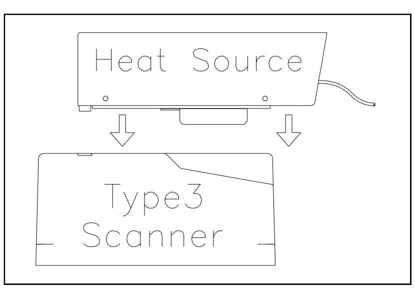
WARNING

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

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

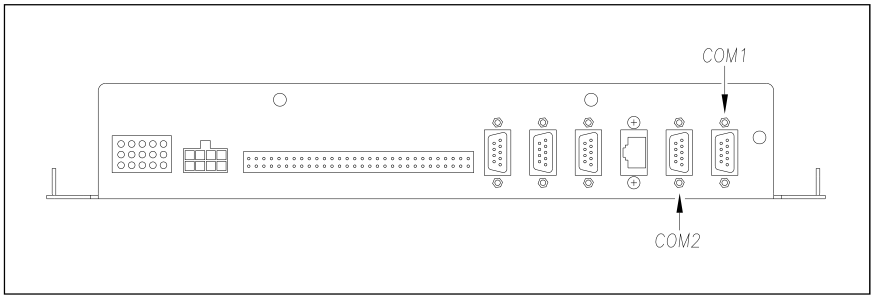
   The heat source has reached operating temperature and stabilized when the temperature meter needle remains centered.

   Once the temperature stabilizes, calibration may begin. Once stabilized, the temperature will change less than plus-or-minus one degree Fahrenheit.
9. Take the calibrated heat source to the bearing scanner on the north or east rail.
10. With the power cord to the front of the scanner, place the calibrated heat source on the bearing scanner.



11 To prepare your computer:

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



b Turn on your computer.

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

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.

12 Using the serial interface, display the Main menu.

The Main menu looks like this.

```
              .
              .
              .

   M) Enter Pass-Thru Mode
   N) System Functions
   O) Dynamic Scan Records - Train Directory
   P) Dynamic Scan Records - Exception Directory
   Q) Straight-Thru Comms (COM2)
   R) Comma Separated Setup Parameters
   X) Exit
```

13 Select **System Functions** menu.

This prompt appears.

```
Type "System":
```

You are given unlimited chances to type the word "system." The entry of this word is **not** case sensitive. After you type it, the System Functions menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
Subdivision: NONE
10/17/2012 21:57
System Functions Menu
-------------------------------------------------
  A) Radio Test
  B) Vocabulary Test
  C) Ramp Function
  D) Radio Inhibit
  E) Manual Test Mode
  F) 1KHz Test Tone
  G) Auto-Calibration
  H) Reset the COP Counters
  I) Remote System RESET
  J) Delete All Stored Train Data
  K) Clear Event Log
  X) Exit
```

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

14 Select Auto-Calibration.

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

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

```
Auto Calibration Selected

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

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

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

Testing Digital-Pot U-306. Stand by.
Digital-pot checks OK.
Previous calibrated digital-pot. setting was 38.
Adjusting digital-pot.
Temp = 225F  Pot = 59  Sec =   1   Pot. decremented by 1 step.
Temp = 224F  Pot = 58  Sec =   1   Pot. decremented by 1 step.
Temp = 221F  Pot = 57  Sec =   2   Pot. decremented by 1 step.
Temp = 219F  Pot = 56  Sec =   3   Pot. decremented by 1 step.
             •
             •
             •
Temp = 183F  Pot = 35  Sec =  15   Pot. decremented by 1 step.
Temp = 182F  Pot = 34  Sec =  18   Pot. decremented by 1 step.
Temp = 181F  Pot = 33  Sec =  29   Pot. decremented by 1 step.
Temp = 179F  Pot = 33  Sec =  93   Monitoring heat source temperature.
Rail1 digital-pot setting of 33 was stored in EEPROM.
East Rail Scanner Calibration complete.
The setpoint is 180F. The calibrated temp. is 179F.
Closing the shutters.
Resistor test pending.

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

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

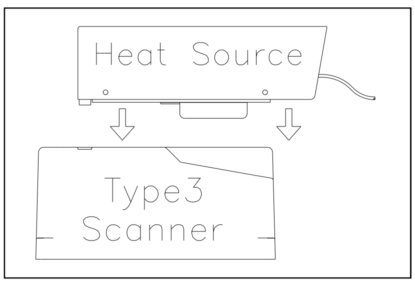
```
Auto Calibration Selected

Signal levels in millivolts with closed shutters
    Rail1             Rail2             Wheel1            Wheel2
Min/Max/Average  Min/Max/Average  Min/Max/Average  Min/Max/Average
210 250    210      0   60    20      0   60    20      20  80    40
                .
                .
                .
```

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

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

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

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



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

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

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

21 If this is a double-track site, repeat steps **1** through **20** for the second track.

8.5.2 Wheel Scanners

Not all sites use wheel scanners. If your site doesn't use them, skip ahead to the next section.

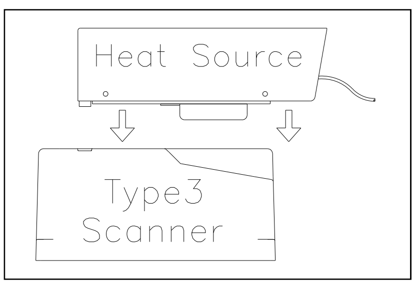
STC recommends that you use the calibrated heat source (2100-810NG) only when the outside (ambient) temperature is above -18°C (0°F) and below 32°C (90°F). If you must use it at other times, do so only when the needle is centered on the front of the temperature meter. If the needle isn't stabilized within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

NOTE:
The black filter frames **MUST** be installed during wheel scanner calibration! After calibration is complete, exchange the black filter frame with the red. The red filter frame should be installed for normal wheel scanning operation.

2 With the power cord to the front of the scanner, place the calibrated heat source on the north or east wheel scanner.



3 Begin autocalibration. Refer to 8.5.1 Bearing Scanners for details.

4 Select Auto-Calibration from **System Functions** menu.

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

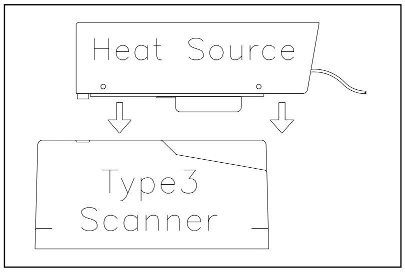
Before the shutters are opened, if you get a signal level greater than 200 millivolts, it usually means that there is noise on the scanner inputs, which most times is caused by an electrical problem with the scanner. If you cannot isolate and fix the cause of this problem, call STC for help.

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

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

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

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



8 Repeat steps **3** through **5**.

9 To return to the Main menu, type **X**.

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

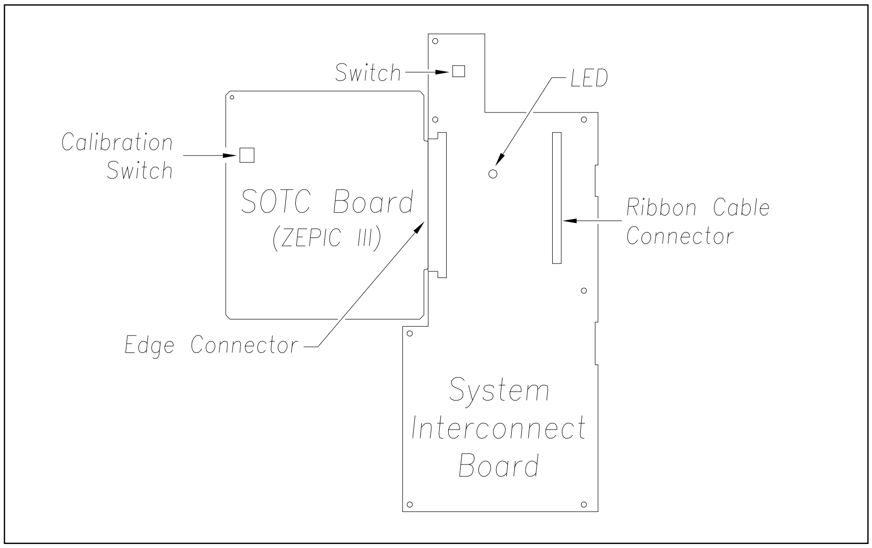
11 Replace the black filter frame with the red one in both wheel scanners.

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

12 If this is a double-track site, repeat steps **1** through **11** for the second track.

8.6 Calibrating the Zepic III Presence Detector

1. From the center of the gating transducers, measure the shortest distance you want the track circuit to pick up the presence of a train.
2. The distance must be at least 25’ (7.62 m) and no more than 150’ (45.7 m).
3. At the point just measured, place a 0.06Ω shunt across both rails. The track must be shunted before calibration button is pressed.
4. Remove cover of SmartSCAN-NG and locate the Zepic III Presence Detector board. Press and HOLD the blue RCVR CAL button until the relay drive LED starts blinking. Release the RCVR CAL button and the LED will stop blinking. The ZEPIC III will automatically begin the calibration process. NOTE: The track shunt MUST remain in place during the calibration process.



5. The relay drive will pick up (LED on) when the unit has successfully calibrated. This process can take up to 45 seconds to complete.

Verification

1. Lift the shunt, and the relay drive should drop.
2. Move the shunt 10’ farther out from the calibration point and verify the relay drive does not pick up.
3. IMPORTANT: To ensure accurate activation point, always place the shunt BEFORE pressing the RCVR CAL button.
   If the ZEPIC cannot achieve calibration, it will blink the relay drive LED three (3) times in rapid succession, indicating a calibration error. The unit will continuously repeat the calibration procedure (there is no need to press the blue RCVR CAL button), allowing you to troubleshoot the track circuit, wiring, and battery. Once the issue has been corrected, repeat the calibration procedure outlined in steps 2 - 4.

Because the ZEPIC III is a two-wire system, it will activate an equal distance on both sides of the track feed point.

8.7 Checking the Broadcast

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

The **Radio Test option** on the System Functions menu is used to broadcast a short message through the speaker (on top of the SmartScanNG enclosure) **and** through the radio. Similarly, the **1KHz Test Tone option** on the System Functions menu is used to generate a continuous tone for about 10 seconds through the speaker and through the radio. Using either of these options will let 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.

   The Main menu looks like this.

```
          .
          .
          .

M) Enter Pass-Thru Mode
N) System Functions
O) Dynamic Scan Records - Train Directory
P) Dynamic Scan Records - Exception Directory
Q) Straight-Thru Comms (COM2)
R) Comma Separated Setup Parameters
X) Exit
```

3. Select the **System Functions** menu.

   This prompt appears.

```
Type "System":
```

You are given unlimited chances to type the word "system." The entry of this word is **not** case sensitive. After you type it, the System Functions menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
Subdivision: NONE
10/17/2012 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, select **Radio Test** or **1KHz Test Tone**.

This message appears.

```
Starting Radio Test
```

Or this message appears.

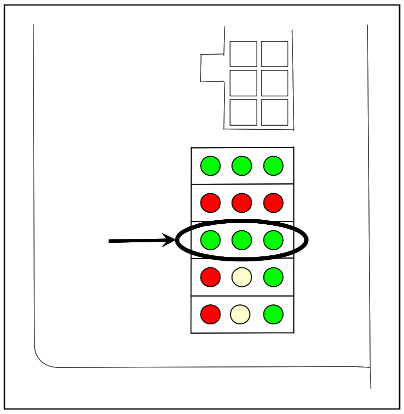
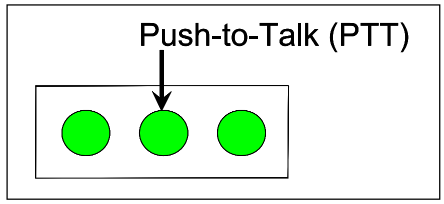
```
Starting 1kHz Test Tone
```

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

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

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

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

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

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

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

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

8 To return to the Main menu, type **X**.

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

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

8.8 Checking the Speech Data

The **Vocabulary Test option** on the System Functions menu is used to enunciate all of the stored speech phrases. This announcement is broadcast through the speaker (on top of the SmartScanNG enclosure), but not through the radio. Therefore, it isn't affected by the **Radio Inhibit option** on the System Functions menu being enabled. The text of the message is specific to each railroad.

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.

The Main menu looks like this.

```
              .
              .
              .

   M) Enter Pass-Thru Mode
   N) System Functions
   O) Dynamic Scan Records - Train Directory
   P) Dynamic Scan Records - Exception Directory
   Q) Straight-Thru Comms (COM2)
   R) Comma Separated Setup Parameters
   X) Exit
```

3 Select **System Functions** menu.

This prompt appears.

```
Type "System":
```

You are given unlimited chances to type the word "system." The entry of this word is **not** case sensitive. After you type it, the System Functions menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
Subdivision: NONE
10/17/2012 21:57
System Functions Menu
-------------------------------------------------
  A) Radio Test
  B) Vocabulary Test
  C) Ramp Function
             .
             .
             .
```

4 From the System Functions menu, select **Vocabulary Test**.

This message appears.

```
Starting Vocabulary Test
```

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

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

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

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

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

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

8.9 Generating Test Trains

To generate a test train to check simulated alarms:

1 Using the serial interface, display the Main menu.

The Main menu looks like this.

```
              .
              .
              .

    M) Enter Pass-Thru Mode
    N) System Functions
    O) Dynamic Scan Records - Train Directory
    P) Dynamic Scan Records - Exception Directory
    Q) Straight-Thru Comms (COM2)
    R) Comma Separated Setup Parameters
    X) Exit
```

2 Select the **System Functions** menu.

This prompt appears.

```
Type "System":
```

You are given unlimited chances to type the word "system." The entry of this word is **not** case sensitive. After you type it, the System Functions menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
Subdivision: NONE
10/17/2012 21:57
System Functions Menu
-------------------------------------------------
  A) Radio Test
  B) Vocabulary Test
  C) Ramp Function
  D) Radio Inhibit
           .
           .
           .
```

3 From the System Functions menu, select **Ramp Function**.

This prompt appears.

```
Start Ramp Function?
```

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

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

A message like this appears.

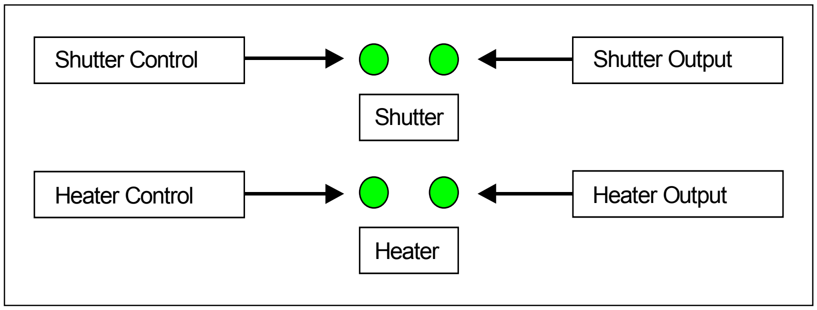
```
Running Ramp Function... 10/17/2012 08:48:24 Train Arrival
```

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

```
Ramp Function Complete
Store Ramp Train #1...Ramp Train Stored 10/17/2012 08:50:17
```

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.

From the Main menu, select **Last Train Report**.

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

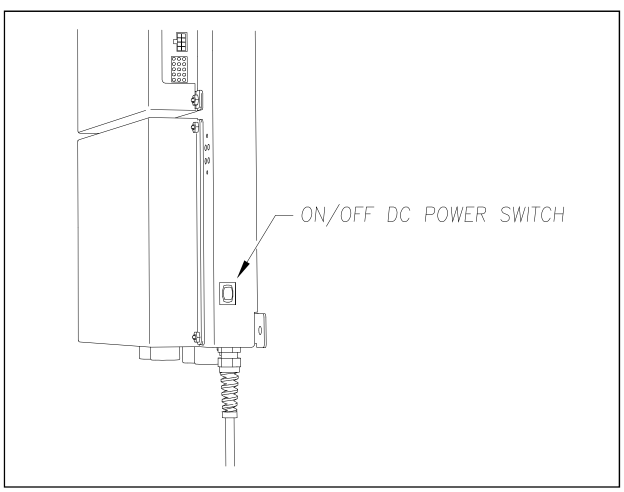
The Last Test Train report is identical to the Train Detail report. There is a difference in the way you specify the train on which you want a report. For this report, you don't specify a train. The most current test train (aka ramp train) is produced.

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

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

9 To purge the system of the test train data:

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



b Wait 10 seconds.

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

10 To return to the Main menu, type **X**.

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

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

To generate a test train to check number of axles:

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

2 Wait for the system to time out and the shutters to close.

3 Produce a Last Train report.

From the Main menu, select **Last Train**.

```
            •
            •

    E) System Status
    F) Last Train
    G) Last Test Train

            •
            •
            •
```

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

4 On the report, check that the number of axles agrees with the number of times that you stroked the gating transducers.

5 On the report, if the number of axles doesn't agree with the number of times that you stroked the gating transducers, call STC for help in fixing this problem.

6 If this is a double-track site, repeat steps **1** through **5** for the other SmartScanNG system.

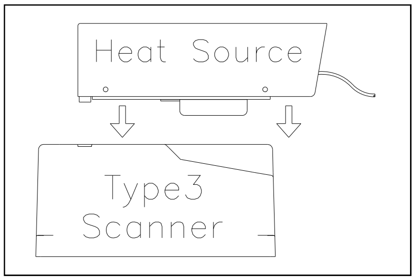
To generate a test train to check hot bearings:

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

1 Ready the calibrated heat source.

After powering it up, let the heat source sit in the shade and out of the wind for at least 8 minutes to stabilize. The heat source has reached operating temperature and stabilized when the temperature meter needle remains centered.

2 With the power cord to the front of the scanner, place the calibrated heat source on the bearing scanner that is on the rail with the gating transducers.



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

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

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

You should hear an end-of-train message with six Hotbox alarms. Per train, the system only announces a maximum of six total alarms.

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

If you do not hear anything, no alarm-level heat was recorded. No measurable heat from a bearing scanner may be due to loose connections, a scanner not being connected to the bottom of the SmartScanNG enclosure, a defective shutter motor in the scanner, or a damaged scanner.

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

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

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

9 Verify the results as before.

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

10 Remove the calibrated heat source.

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

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

8.10 Setting Transducer Gain

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

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

To set the transducer-gain setting to normal:

1 Using the serial interface, display the Main menu.

The Main menu looks like this.

```
              .
              .
              .

    K) Maintenance Report
    L) Setup
    M) Enter Pass-Thru Mode
    N) System Functions
    O) Dynamic Scan Records - Train Directory
    P) Dynamic Scan Records - Exception Directory
    Q) Straight-Thru Comms (COM2)
    R) Comma Separated Setup Parameters
    X) Exit
```

2 Select the **Setup** menu.

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

```
Enter Setup Password:
```

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

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

```
Password Incorrect
```

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

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

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

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
Subdivision: NONE
10/17/2012 21:57
Setup Menu
------------------------------------------------
  A) Date and Time
  B) MP/KP & Subdivision
  C) Track Number
  D) Alarm Limits
  E) Equipment
  F) Messages
            •
            •
```

3 Select **Equipment** menu.

```
            •
            •

  I) Winter Cycle.................. YES
  J) Transducer Gain............. Normal
  K) AEI........................... YES
            •
            •
            •
```

The Equipment menu shows whether the transducer-gain setting is normal or high. Regardless of the setting, the SmartScanNG system starts every train with the transducer input comparator set to high mode. Then, if the train is traveling 20 mph (32 kph) or more <u>and</u> 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. **<u>Normal</u> is the recommended starting position**.

When the comparator is in <u>high</u> 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 <u>normal</u> mode, the comparator has a better chance of filtering transducer pulses not caused by a wheel.

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

If the **Transducer Gain option** on the Equipment menu is set to <u>High</u>, select option to toggle setting from High to Normal. The **Transducer Gain option** on the Equipment menu changes <u>and</u> the Equipment menu reappears.

5 To <u>leave</u> the Equipment menu <u>and</u> return to the Setup menu, type **X**.

6 To <u>leave</u> the Setup menu <u>and</u> return to the Main menu, type **X**.

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

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

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

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

10 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.

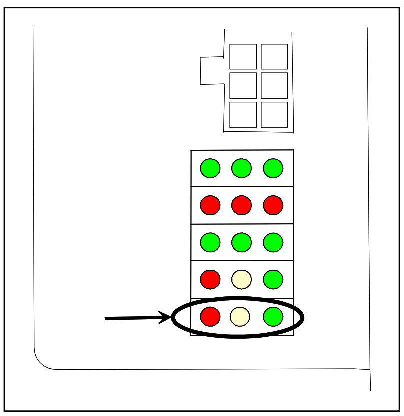
8.11 Doing the Final Activities

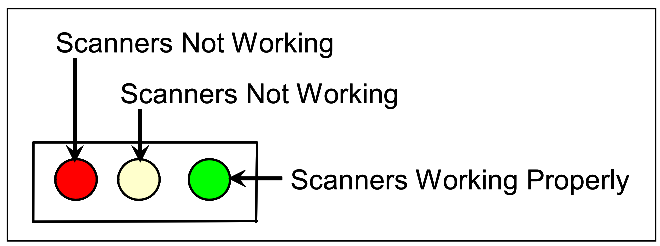
To do the final activities:

1 **Be sure that at least 20 trains have passed over the site.**

You are not done (that is, you have not placed the system in service) until all the steps below are done.

2 On the status panel, look at the bottom row of LEDs.





The bottom row of LEDs indicates the operational condition of the bearing and wheel scanners when the system is at rest (that is, when a train isn't present at the site). Several conditions are monitored and logged.

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

- Insufficient heat from one or both bearing scanners or from one or both wheel scanners was detected. If either bearing scanner records less than 2.8°C (5°F) for an entire train or if either wheel scanner records less than 8.3°C (15°F) 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 11.1°C (20°F) or the difference between the average recorded temperatures for both wheel scanners was more than a delta temperature of 66.7°C (120°F).

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.

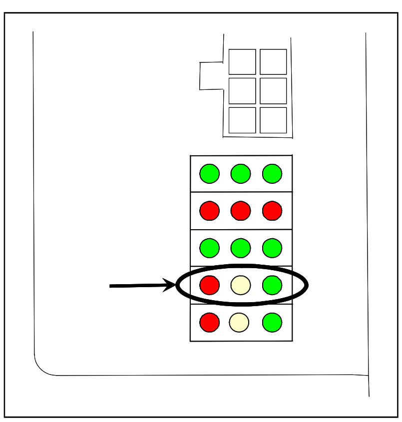
The **middle yellow LED** flashes when the difference between the average temperatures (recorded by the two bearing scanners or recorded by the two wheel scanners) isn't within acceptable balance limits for 20 consecutive trains. These limits are different for bearing and wheel scanners. For the bearing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

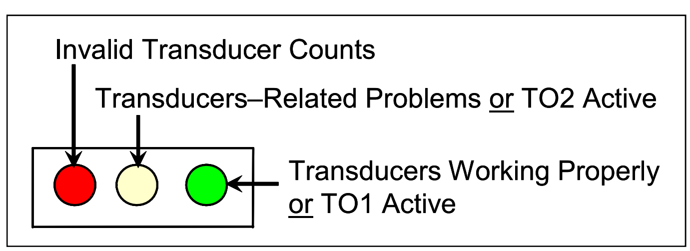
Within the scanner pairs, the scanner with the lower temperatures is considered the problem scanner. Its identity is revealed by the rate and pattern of flashing of the LED. For a scanner on the north or east rail, the repeated pattern is on for a half second, off for a full second. For a scanner on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

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

3 If the **rightmost green LED** (on the bottom row) isn't flashing, call STC for help in fixing this problem.

4 On the status panel, look at the fourth row of LEDs when no train is present.





The fourth row of LEDs operates differently when a train is at the site and when it isn't.

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

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

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

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

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

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

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

The gating transducers are probably functioning properly when the **rightmost green LED** flashes, the **leftmost red LED** isn't lit, and the **middle yellow LED** isn't lit. But, to be sure, you still need to examine a Train Summary report.

5 When a train isn't present at the site, if the **middle yellow LED** (on the fourth row) isn't lit, go to step **7**.

6 To see if the system is being activated by the gating transducers:

a Produce a Last Train report.

From the Main menu, select **Last Train**.

```
            •

    E) System Status
    F) Last Train
    G) Last Test Train

            •
```

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

b On the Last Train report, check under the System Alarms section of the report for the words "No Approach Track."

The No Approach Track alarm indicates that the system presence detection system (that is, the advance transducers) didn't detect the arrival of the train at the site. Instead, the system started the train scanning process when a gating transducer sensed the train.

c If the words "No Approach Track" don't appear, go to step **13**.

You'll next verify that that each advance transducer is functional.

7 Using a metal wrench, stroke the top of one of the advance transducers.

The scanner shutters should open completely for 10 seconds.

8 On one of the bearing scanners, check to see if the shutter opens.

9 If the shutter didn't open, fix this problem before proceeding.

10 Using a metal wrench, stroke the top of the other advance transducer.

The scanner shutters should open completely for 10 seconds.

11 On one of the bearing scanners, check to see if the shutter opens.

12 If the shutter didn't open, fix this problem before proceeding.

13 Produce a Train Summary report.

From the Main menu, select **Train Summary**.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
Subdivision: NONE
10/17/2012 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.

14 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.

15 If there is an odd axle count and if train speed was always above 7 mph (11.3 kph), go to step **17**.

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.

16 If there is an even axle count and the values under "Axles", "TO1," and "TO2" are the same, go to step **25**.

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.

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

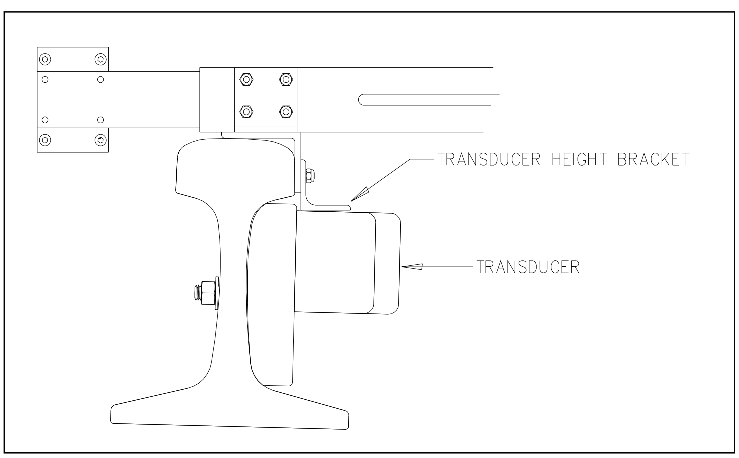
Four bolts are needed to hold the transducer in place. Two square-head bolts go through the mounting plate and transducer body. Two hex-head bolts go through the mounting plate and rail. If any of these bolts are sheared or missing, they must be replaced with the correct replacement bolt. Also, if any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

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

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

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

20 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.

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

a Loosen the nuts holding the transducer body to its mounting plate.

b By sliding it up and down, adjust the transducer body to the proper height.

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

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

d Wait until 20 more trains have passed over the site and then return to step **1**.

22 Determine which gating transducer is recording incorrect information.

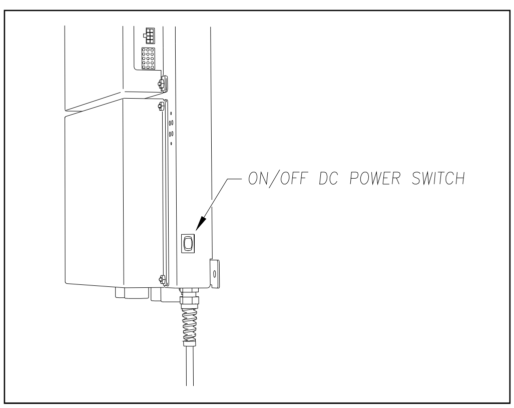
Determine which gating transducer is recording incorrect axle counts and whether it isn't counting all axles or counting extra ones. You may not be able to do this by just looking at the values under the Axles, TO1, and TO2 columns of the Train Summary report. Sometimes, a transducer problem causes the number in the Axles column to be incorrect. Therefore, the true axle count may have to be determined from an alternate source such as the next detector system that encounters the train with the transducer-count imbalance.

After you determine which gating transducer is miscounting, you'll need to change a jumper setting on the Interface board. If TO1 is the problem, you'll change the setting for J201. If TO2 is the problem, you'll change the setting for J202. If both TO1 and TO2 have a problem, both jumpers will need to be changed. Changes to the jumpers should be made only after all external conditions that cause transducer miscounts have been corrected. Some of these external conditions are improperly installed transducers, loose transducer bolts, incorrect transducer heights, damaged transducers, damaged transducer cables, and loose wiring connections.

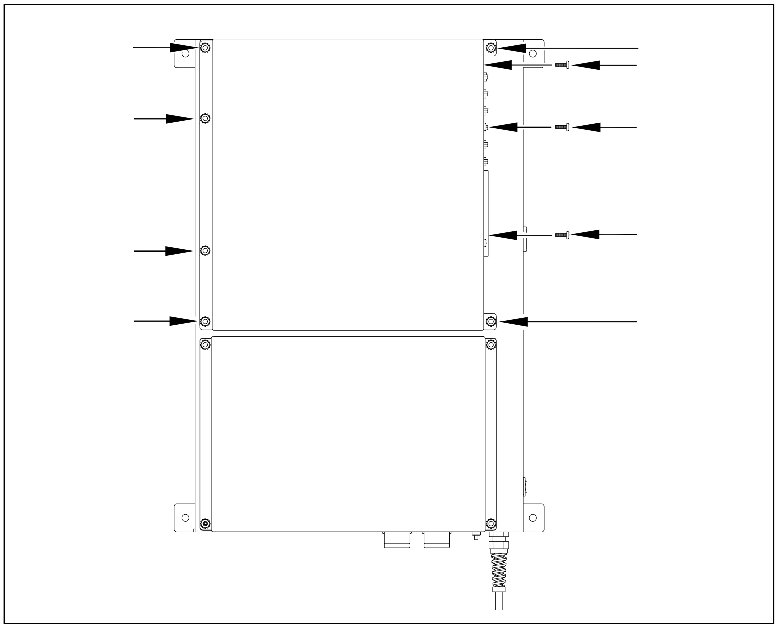
The process of adjusting the transducer loading is trial and error. Generally, if you are having too many transducer counts, lower the loading resistance to make the transducer less sensitive. Likewise, too few counts suggest that the transducer isn't sensitive enough, so you would select a loading value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

23 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):

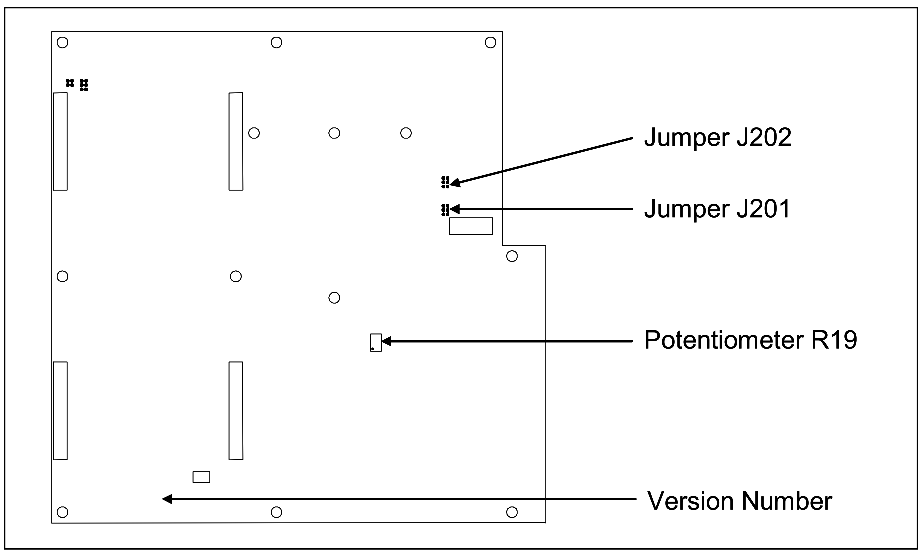
a Toggle off the DC power switch on the right edge of the SmartScanNG enclosure.



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 missing axles, move the J201 jumper to the next higher sensitivity position. If it is currently on the highest sensitivity position, call STC for help in fixing this problem.

g If TO2 is missing axles, move the J202 jumper to the next higher sensitivity position. If it is currently on the highest sensitivity position, call STC for help in fixing this problem.

h Remove the two nuts holding the base assembly to the SmartScanNG enclosure.

i Using the saved six nuts and three screws, reattach the cover over the Interface board.

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

k Wait until 20 more trains have passed over the site and then return to step **1**.

24 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 Access Interface Board as detailed in Step 23.

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.

b 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 recording extra axles, move the J201 jumper to the next lower sensitivity position. If is currently on the lowest sensitivity position, call STC for help in fixing this problem.

g If TO2 is recording extra axles, move the J202 jumper to the next lower sensitivity position. If is currently on the lowest sensitivity position, call STC for help in fixing this problem.

h Reattach the cover over the Interface board.

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

j Wait until 20 more trains have passed over the site and then return to step **1**.

25 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.

26 If the columns aren't within four degrees and if the scanner optics are clean, recalibrate and realign the scanner.

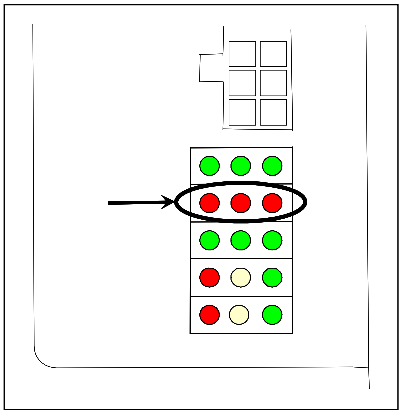
27 On the Train Summary report, check the last column of the report.

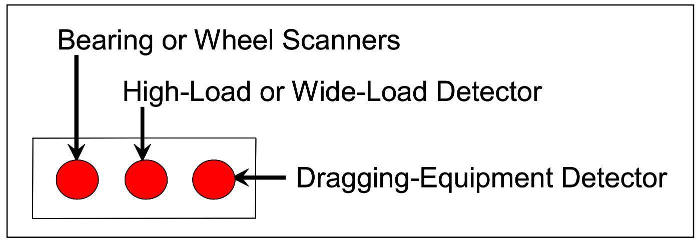
The last column shows the system battery voltage when each train passed the site. It should show values between 12.7 and 14.5 volts. Values outside this range may be caused by:

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

28 If the most recent value isn't between 12.7 and 14.5 volts, investigate and fix any problems before proceeding.

29 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.

30 If any LED (on the second row) is lit:

a Produce an Exception Summary report.

From the Main menu, type **C**.

```
STC SmartScanNG, MP/KP-1794.5, Track:Single
Subdivision: NONE
10/17/2012 21:57
Main Menu
-------------------------------------------------
  A) Train Summary
  B) Train Detail
  C) Exception Summary
              .
```

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 **31**.
- **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 **31**.
- **i** If no problems are found with the hardware and wiring, call STC for help in fixing this problem.

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

32 If this is a double-track site, repeat steps **1** through **31** for the other track (that is, for the other SmartScanNG system).

9.0 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 section tells how to get answers for questions, fixes for problems, and parts for spares.

9.1 Reaching STC

You can reach STC by mail, telephone, fax, and email. By mail, you can reach STC at:

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

Mail and shipments are replied to as soon as possible, normally within one working day. Equipment repair usually takes longer.

By telephone, except on major holidays, you can reach STC at 423-892-3029, Monday through Friday, from 8:00 a.m. until 5:00 p.m. Eastern time. After business hours, a machine answers the calls. These calls are returned promptly the next business day. By fax, you can reach STC at 423-499-0045. The fax machine can receive faxes at all times. Faxes are replied to as soon as possible, normally within one working day. By email, you can reach STC at stcemail@southern-tech.com. Email is replied to as soon as possible, normally within one working day.

9.2 Returning Equipment for Repair

Return any damaged, defective, or malfunctioning equipment to STC for repair or replacement. You don't need a return authorization number. You don't even need to make a telephone call first. Just ship it directly to the **Repair Department** at the address above.

With the returned equipment, include:

- Complete address of where the equipment is to be returned.
- Name and telephone number of person who should be contacted to answer questions about the equipment.
- Written explanation of the equipment defect or malfunction.
- Any reports or other data that would be helpful in diagnosing the problem.
- If out of warranty, If out of warranty, Purchase Order Number for the order or credit card number (to be charged) with its expiration date.

9.3 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.

9.4 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.

9.5 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.

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