



SMARTSCAN | NG²

Wayside Enclosure Components

"Wayside Enclosure Components" refer to those SmartScanNG² detector subsystems that are typically contained within the equipment bungalow. These components include:

- SmartScanNG² 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.

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

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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 SmartScanNG² system. Failure to do so could result in damage to the equipment or serious injury to you.

NOTICE:

If equipped with an AEI subsystem, the user is required to obtain a Part 90 site license from the FCC to operate in the United States. See product label for FCC ID number. Access the FCC Web site at www.fcc.gov/Forms/Form601/601.html for additional information concerning licensing requirements.

Users in all countries should check with the appropriate local authorities for licensing requirements.



6145 Preservation Drive, Chattanooga, TN 37416

web: www.southern-tech.com

email: stcemail@southern-tech.com

fax number: 423-499-0045

telephone number: 423-892-3029

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1.0 Introduction

This section summarizes the purpose of this guide, describes the SmartScanNG² system, tells how to comment on this guide, tells how to order more copies of this guide, and covers STC's standard warranty. It also covers the cautions and disclaimers of which the customer should be aware of.

1.1 Purpose of This Guide

The technical staff at Southern Technologies Corporation (STC) created the SmartScanNG² defect detection system. It is designed to monitor moving trains and report certain conditions detected on these trains. The SmartScanNG² 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 SmartScanNG² system differ from railroad to railroad.

This guide covers the portion of the SmartScanNG² system that is housed within the wayside enclosure. It describes the functionality, installation, and operation of these components.

1.2 SmartScanNG² - Wayside Enclosure Components

In this guide, the structure that houses the SmartScanNG² 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 SmartScanNG² detector per track
- One power subsystem per SmartScanNG² detector

Attached to the outside of most wayside enclosures is:

- One antenna per radio
- One shielded temperature probe per SmartScanNG² detector

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 SmartScanNG² 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 a battery explosion with a dispersion of casing fragments and corrosive liquid electrolyte. So, carefully follow the manufacturer's instructions. Keep all sources of gas ignition away from the batteries, and do not allow metallic articles to contact the negative and positive terminals of a battery at the same time.

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

1.4 Disclaimers

The correct use of this guide, the environmental conditions at the time of installation, the method of installation itself, and the installation of customer-supplied components are beyond the control of STC. So too are the correct use and maintenance of all or part of the SmartScan system. Therefore, the installer, user, and maintainer must assume the risk of any injury that might occur during the 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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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 an 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 the date of shipment. Warranty is limited to repair or replacement at the sole discretion of STC, of any goods found to be defective in either materials or workmanship during the 14-month period following shipment. Warranty does not apply to a product with signs of obvious abuse or a 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.

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

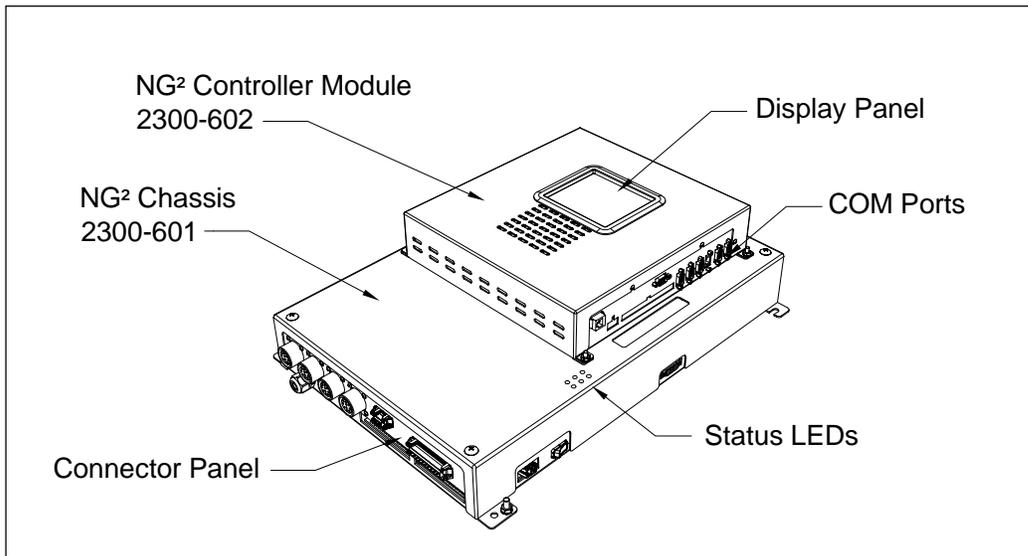
Products purchased from other vendors but included in STC systems carry the original manufacturer's warranty, typically 12 months. Warranty claims for these products must be made directly to the original equipment manufacturer.

2.0 SmartScanNG² Detector

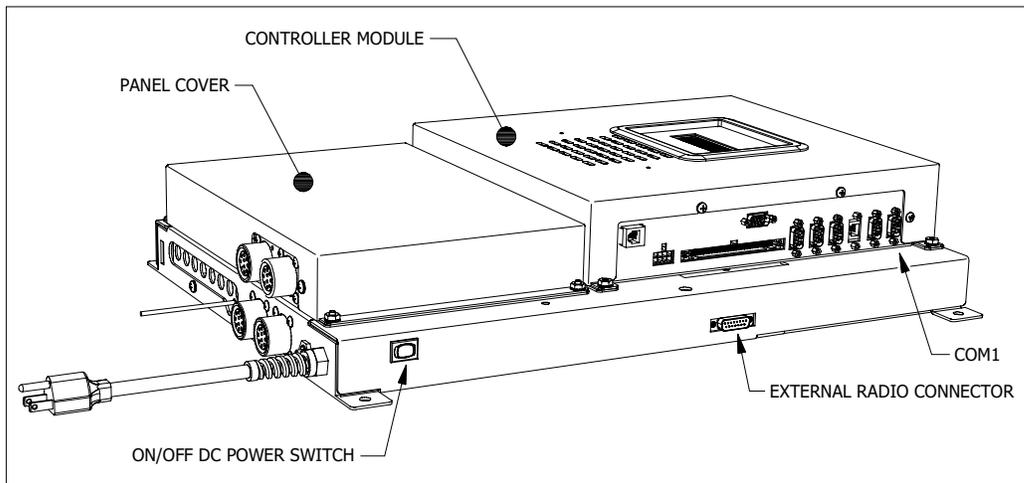
SmartScanNG² Detector

There is one SmartScanNG² Detector per track. At double-track sites, the one on the left supports Track-1, and the one on the right supports Track-2.

The two major components of the SmartScanNG² Detector are the Controller Module and the Chassis Assembly.



This figure depicts an NG² Controller Module mounted to a 2300-601 NG² Chassis.



This figure depicts an NG² Controller Module mounted to an older generation 2300-501NG Chassis.

The power cord at the bottom of the Chassis Assembly powers the heaters in the 2500-512AC scanner. This cord should be plugged into a grounded three-wire 120-volt outlet. The minimum operating voltage is 110 volts. **Plugging the cord into an outlet of more than 128-volts will severely damage your system.**

If 2500-512DC 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 Controller Module (2300-602)

The Controller module is the brains of the SmartScanNG² system. It contains the Interface board, the display panel, and the optional Velocity IP Device Manager. For ease of maintenance, the module detaches from the SmartScanNG² detector as a separate unit. It is easily removed by first unplugging the Molex and ribbon cable connectors and then by removing the fasteners.

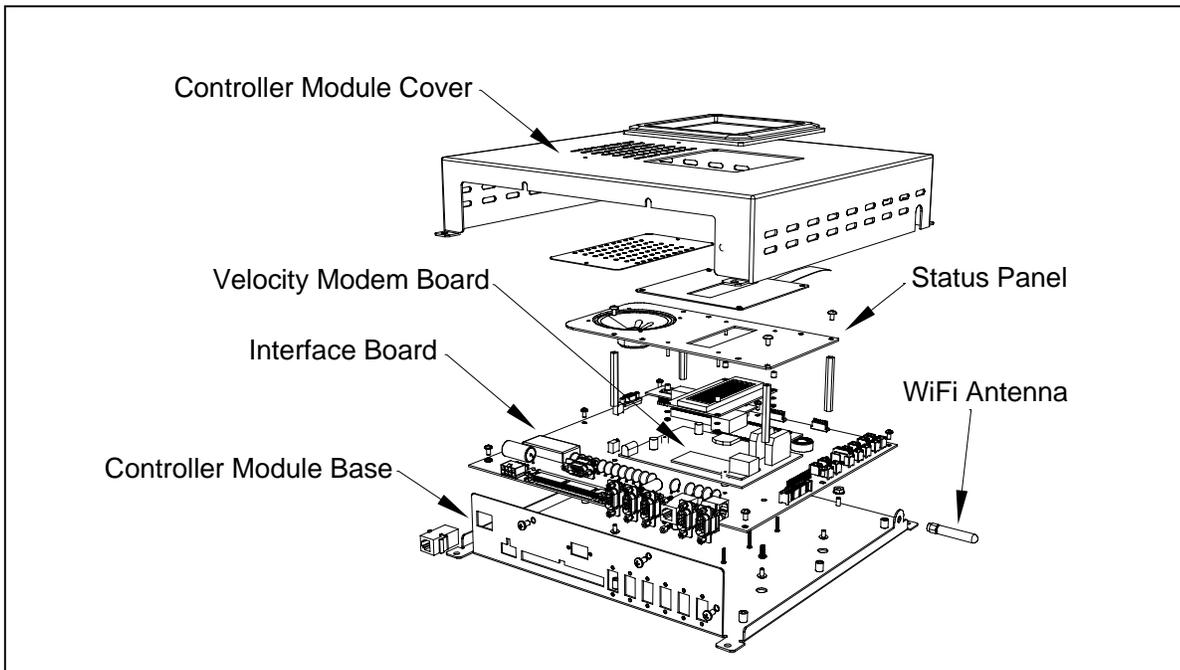
Communications with the controller module can be established locally via:

- Serial Interface through the local comm port
- WiFi Interface (wireless connection)
- Display panel/keypad on the front of the controller module

Communications with the controller module can be established remotely via:

- Web Interface with an internet connection
- Serial Interface through a Telnet connection
- Serial Interface through a hardline or cellular modem

The figure below shows the major parts of the Controller module (2300-602).



2.1.1 Display Panel

Located on the front of the SmartScanNG² Controller Module is the Display Panel. Its status indicators and display module provide a snapshot of the overall system health. As a convenience, the Display Panel also provides a user interface to execute some frequently used system functions (i.e., Auto Cal, Radio Test, etc.).

The display panel consists of 6 LEDs, a keypad, and an LED display, as shown below.



LED	Meaning when Lit
TO1	Indicates wheel sensor TO1 is active.
TO2	Indicates wheel sensor TO2 is active.
COP-A	Indicates the status of Processor-A. If the CPU is running its program correctly, the LED blinks on and off. If the program isn't operating as expected, the LED is lit solid or isn't lit at all.
COP-B	Indicates the status of Processor-B. If the CPU is running its program correctly, the LED blinks on and off. If the program isn't operating as expected, the LED is lit solid or isn't lit at all.
PTT	Indicates the radio PTT is active.
SYS WARN	Indicates a system warning has been detected.

Keypad Switch	Function
FUNC	The function key toggles from home screen to the Main Menu. It also serves as "Back" key in the system submenus to return to the previous menu level.
▼ (Arrow Down)	Scroll down the menu options.
▲ (Arrow Up)	Scroll up menu options.
SELECT	Selects the highlighted menu option.
RESET	Initiates system reset.

LED Display:

The display assembly includes a 4-line, 20-character OLED display and a five-key membrane switch panel. If unused for five minutes, the display will time out to conserve power. Press any key to turn the display back on.

The home screen displays the milepost, time, and temperature.

```
MP 1234.5  02:05:39
              Temp: 72
```

Menu Navigation:

- Press the **FUNC** key to toggle from the home screen to the Main Menu or to back out of the various submenus.
- Use the **▲UP** and **▼DOWN** keys to move the **▶** pointer next to the desired menu option.
- Press the **SELECT** key to choose the menu option. The "↓" symbol on the display screen indicates that there are more options available if you scroll down. Likewise, the "↑" symbol indicates more options are available if you scroll up.

```
Main Menu
  Sys. Health Menu
  ▶Reset Sys. Health
  ↓ Radio Test
```

System Functions

Various system functions can be performed from the display panel, such as:

- Radio Test
- Auto Cal
- Network Menu
- Radio Menu
- Volume Menu

Some functions are customer-specific. Refer to your Operator's Guide for detailed information about those functions available through the system's Display Panel.

2.1.2 Processor Modules

Running programs written by STC, the processor modules control the entire SmartScanNG² system. There are two independently operating processor modules: the Analyzer Processor and the Communications Processor. The Analyzer Processor (Processor-A) is responsible for data retrieval from external sources, such as the shielded temperature probe, scanners, transducers, and auxiliary devices. The Communications Processor (Processor-B) is used to process and store the retrieved data. It then presents information to the user in the form of reports.

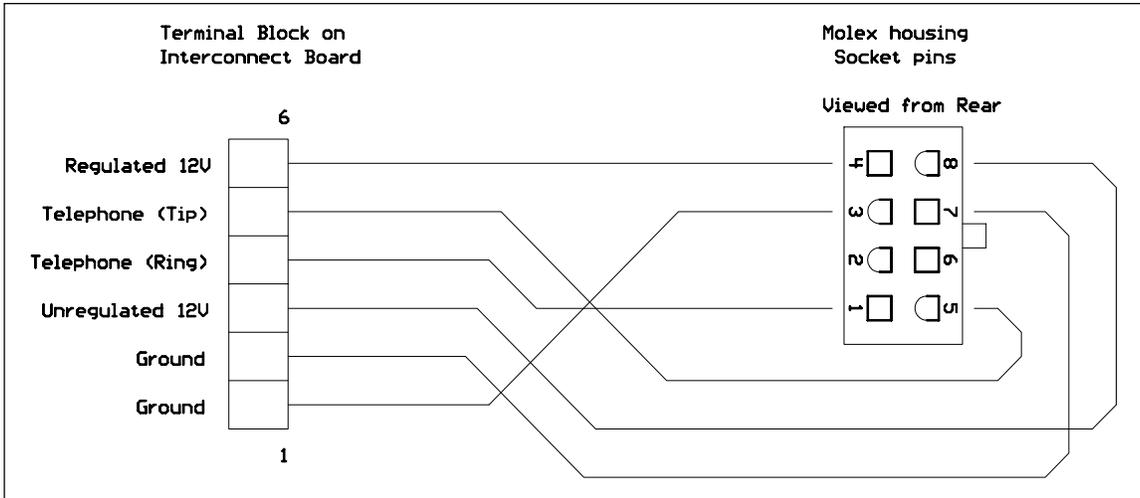
Processor-A initially stores train data in static random-access memory (SRAM) on the processor module. After train passage, Processor-B moves this data to a nonvolatile Flash memory for long-term storage. This memory contains:

- 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.

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.

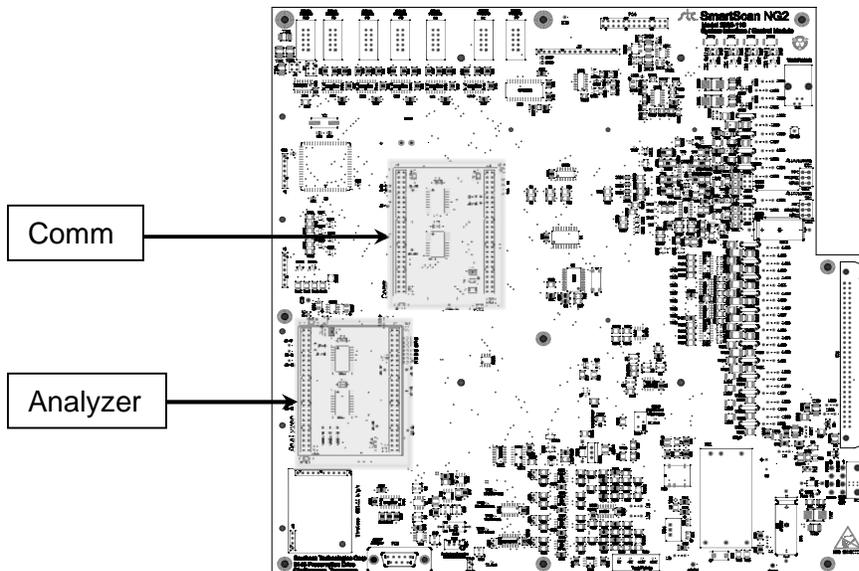
2.1.3 System Interface Board (2300-110)

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 operates from an unregulated battery voltage of 9VDC to 30VDC. The power input circuitry includes radio-frequency interference suppression, voltage surge protection, an open fuse LED indicator, a self-restoring fuse, and reverse polarity protection. The board produces regulated 3.3VDC, -5 VDC, regulated +5 VDC, regulated +12 VDC, and regulated +15 VDC to power the on-board circuitry, Velocity Board, and external scanner circuitry.

The figure below shows the System Interface board (2300-110). The board is shown as one would see it in service, which is the normal orientation for the board on a properly installed system.



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 (2300-110) has a red LED labeled **LED6**. This LED lights when the self-restoring fuse F1 opens due to an overcurrent condition on the +12-VDC supply voltage input.

LED 7

The Interface board (2300-110) has a red LED labeled **Valid DTMF** (also labeled **LED7**). If R19 is adjusted properly, this LED lights as valid touchtones are received from the radio.

LED 8

The Interface board (2300-110) has a red LED labeled **LED8**. This LED lights when the dragger (aka dragging-equipment detector) input activates.

LED 9

The Interface board (2300-110) has a red LED labeled **LED9**. This LED lights when the high-load input activates.

LED 10

The Interface board (2300-110) has a red LED labeled **LED10**. This LED lights when the wide-load-1 input activates.

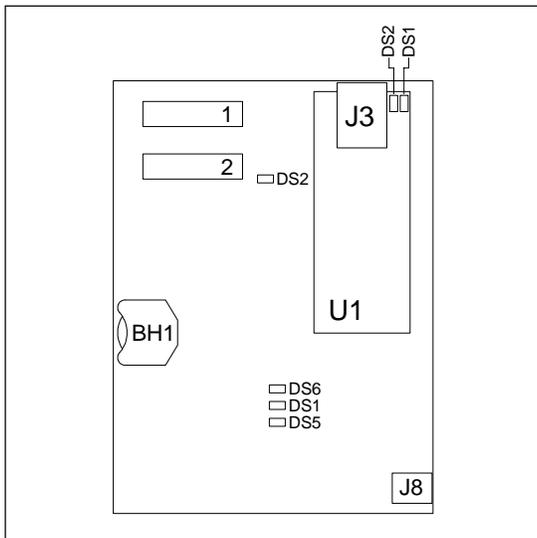
LED 11

The Interface board (2300-110) has a red LED labeled **LED11**. This LED lights when the wide-load-2 input activates.

2.1.4 Velocity IP Device Manager

The Velocity IP Device Manager lets the system (at the site) communicate with a computer (away from the site).

The figure below shows a Velocity IP Device Manager.



Power Jack (J8)

The power jack is used to supply 9 VDC to the Velocity. A power cord connects the power jack to **P13** on the Interface board.

Port 1 Connector

The **Port 1** connector connects the Velocity IP Device Manager to the rest of the system. A standard 10-position ribbon cable connects **Port 1** of the Velocity to **P7** on the Interface board.

Port 2 Connector

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

Battery (BH1)

During a power interruption to the Velocity IP Device Manager, 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 are lost. However, no train data is lost.

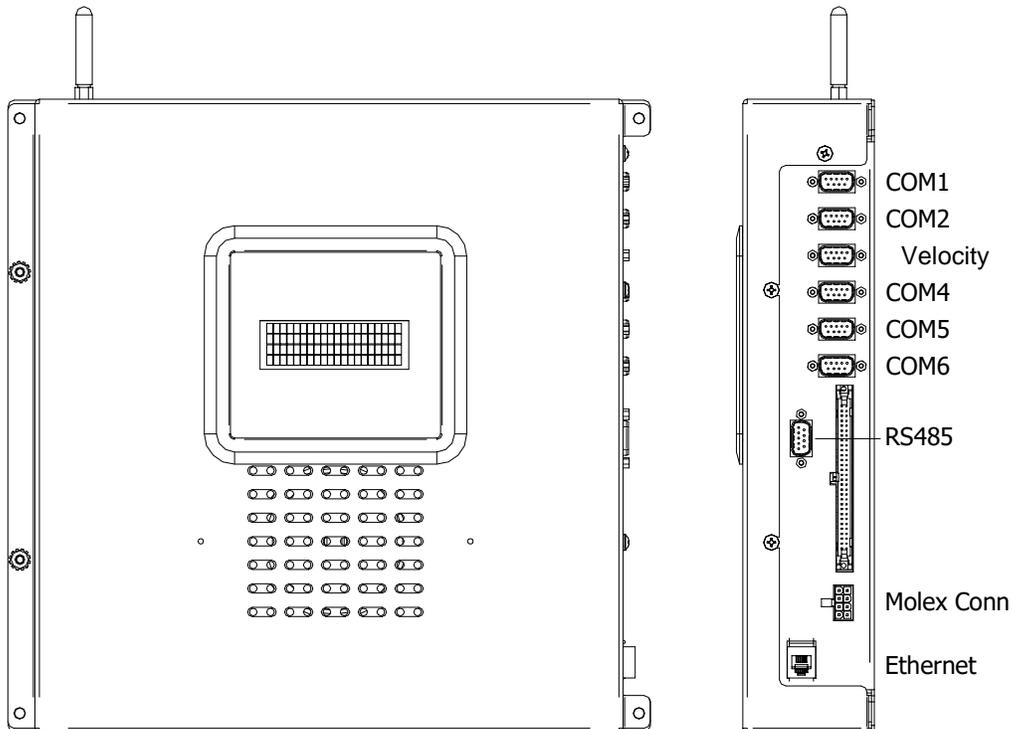
Status LEDs

On the Velocity IP Device Manager are six status LEDs. The table below describes what each lit LED means.

LED	Meaning When Lit
12V	Lights when the Velocity IP Device Manager is getting adequate DC power from the SmartScanNG ² 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 IP Device Manager is running properly.
LNK	Lights when an Ethernet connection is made.

2.1.5 Controller Module Connector Panel

On the right side of a mounted Controller module (2300-602) is a group of connectors, as shown below.



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.

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 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 <u>without</u> an installed modem). COM1 is connected to P6 on the Interface board.
COM2	Currently unused.
COM4	Currently unused.
COM5	Used to connect the AEI reader (2300-750 or MPRX) to the SmartScanNG ² system. COM5 is connected to P8 on the Interface board.
COM6	Currently unused.

Ethernet Connection (RJ45 Jack)

There are two Ethernet connectors on the right side of a mounted Controller module (2300-602). The Velocity (located between COM2 and COM4) and the Ethernet (located at the right-side bottom).

The **Velocity** connector is connected internally to the Velocity IP Device Manager (if so equipped). The Velocity is a data harvesting tool that reports to central office systems.

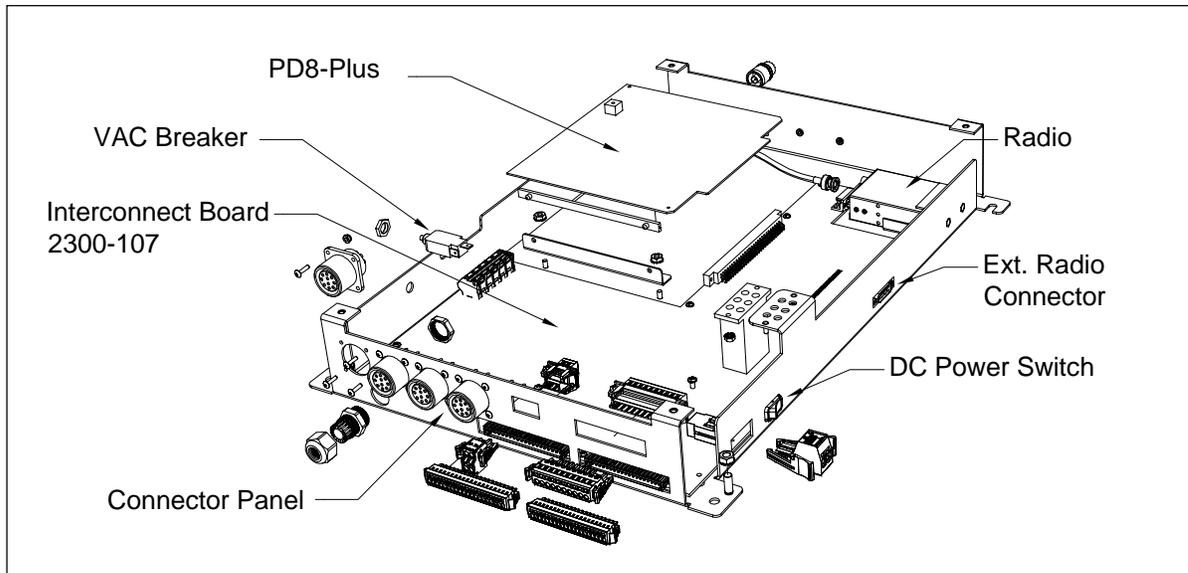
The **Ethernet** connector provides IP connectivity and allows for remote access via Telnet or Web User Interface.

2.2 2300-601 NG² Chassis Assembly

If your system is configured with the 2300-501 NG Chassis (previous generation), skip ahead to **Section 2.3**.

The Chassis Assembly provides all the necessary connectivity between peripheral equipment and the NG² Controller. Optional internal features include an internal radio and an SOTC presence detector.

The figure below shows the major components of the Chassis Assembly.



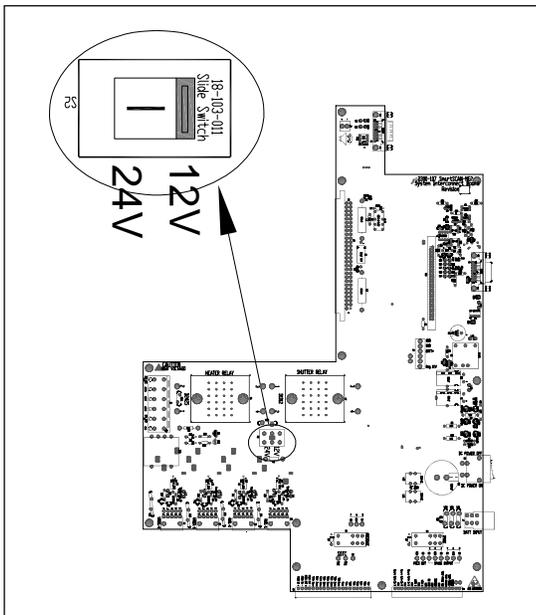
2.2.1 System-Interconnect Board (2300-107)

The System-Interconnect board provides connection points for incoming and outgoing wiring, including transducers, auxiliary-alarm detectors, shielded temperature probe, and DC power. Other wiring to this board is from the panel-mounted connectors located on the NG² Chassis, such as the external speaker, I/O, the external radio, bearing and wheel scanners, and the radio antenna.

The System-Interconnect board has only a few electronic components. 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, thus preventing a single device malfunction 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 ten 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 (or 24 VDC for 24V scanners), 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. It is protected by a circuit breaker on the side of the SmartScanNG² detector 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, protected by one circuit breaker, and indicated with a signal activation LED.

The SmartScanNG² is designed to operate from an input of 10-30 VDC, but the voltage of the battery subsystem must be selected on the Interconnect Board to provide proper voltage to the scanner modules. For a 12-VDC battery subsystem, slide the selector switch to the right. For a 24-VDC battery subsystem, slide the selector switch to the left (see figure below).



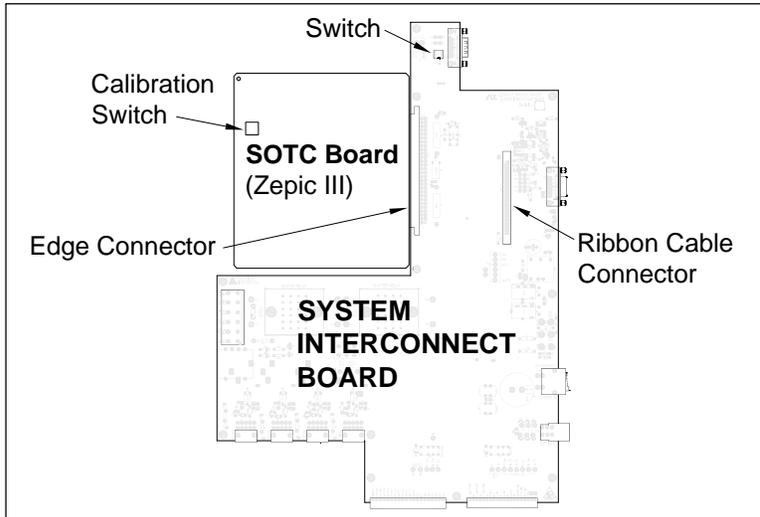
2300-107 Interconnect Board

NOTE: Make certain the operating voltage of all the bearing and wheel scanners used on your system to match your battery subsystem.

2.2.2 SOTC Board (Zepic III or Zepic PD8-Plus)

If your system uses advance transducers for presence detection, skip ahead to the 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. A green calibration switch is also brought out externally on the NG² chassis. See Section 10.7 Calibrating the Zepic III Presence Detector.

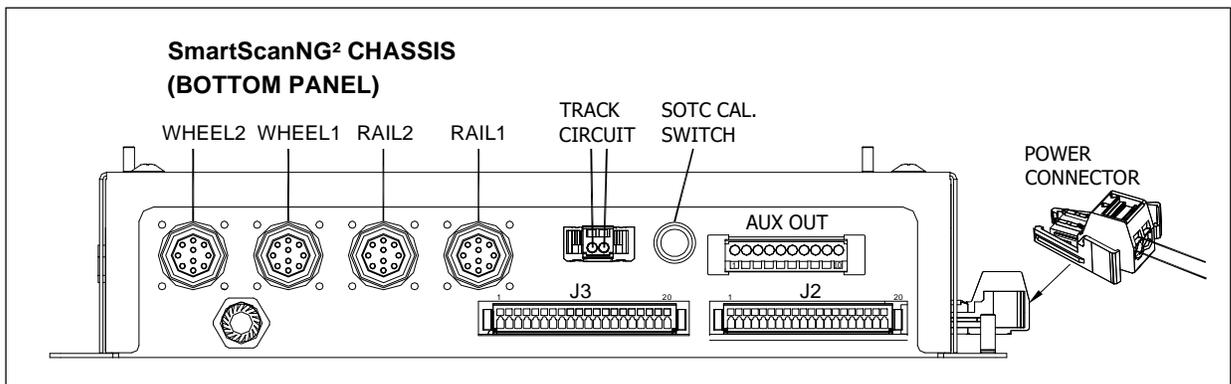


NOTE: If using an external presence detector, connect the dry, normally-open relay contacts to J3 pins 1 & 2 (PRES IN) of the chassis connector panel depicted below.

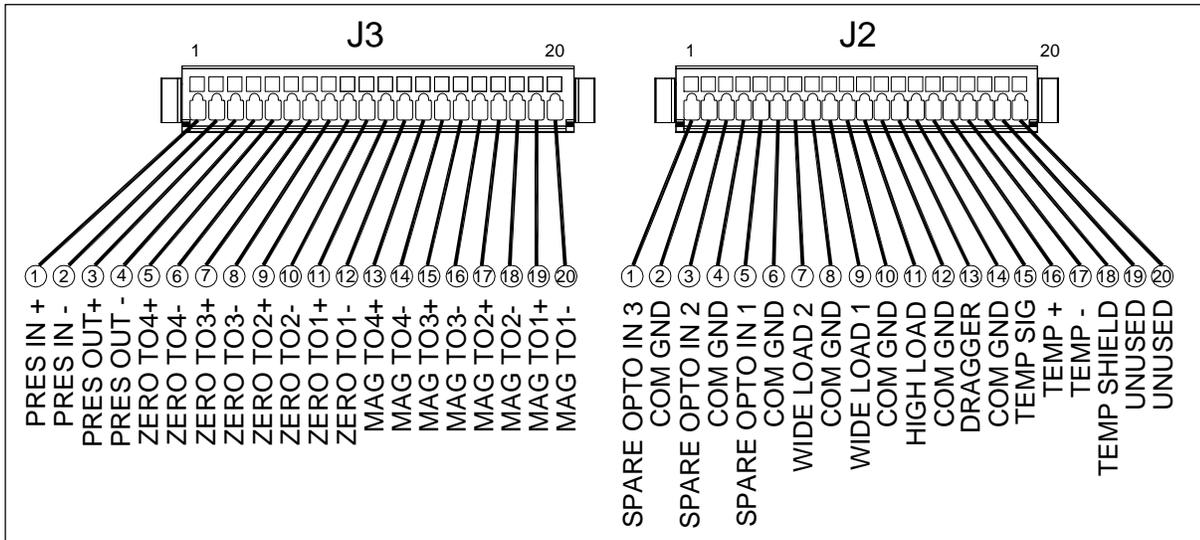
The SmartScanNG² chassis only has a SOTC board if the site is using a track circuit. If the site is using two advance transducers, there is no SOTC board.

2.2.3 Connector Panel

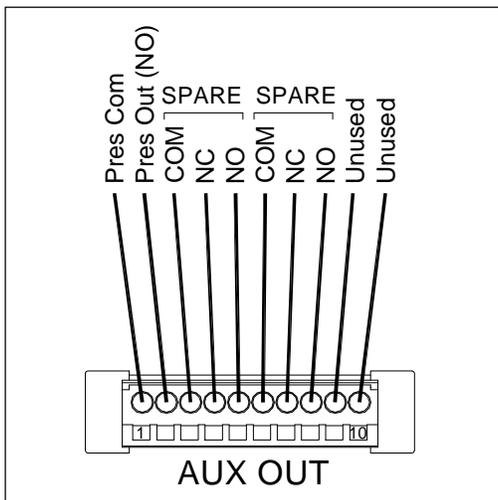
The system I/O and track circuit wiring is routed from the external surge protection panel to pluggable Wago connectors in the bottom of the SmartScanNG² chassis. Bearing and wheel scanner cables terminate to the connectors provided on the left side of the panel. Track circuit wires connect to a plug next to scanner cables. Power from the battery subsystem is brought in through a plug on the right side of the chassis.



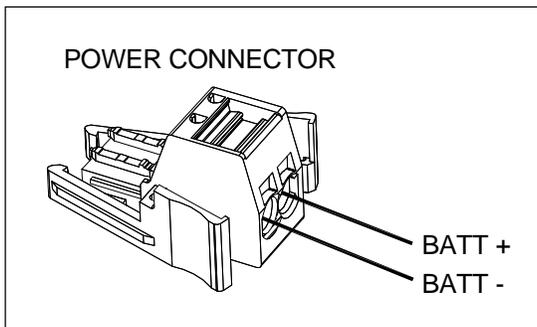
Shown below are the pinout assignments for connector plugs J3 and J2.



The AUX OUT connector includes Presence Out and two spare relay outputs (currently unassigned) that can be used to control auxiliary equipment.



The power plug connects to the battery subsystem.



2.2.4 Solid-State Relays

The SmartScanNG² system uses optically isolated solid-state relays (SSRs) to eliminate electromagnetic radiation, which would otherwise be generated by the arcing of mechanical relay contacts. There are two SSRs mounted on the Interconnect board inside the SmartScanNG² chassis. One SSR operates the scanner shutters, and the other energizes the scanner heaters. The signals to activate the SSRs originate at the Processor board.

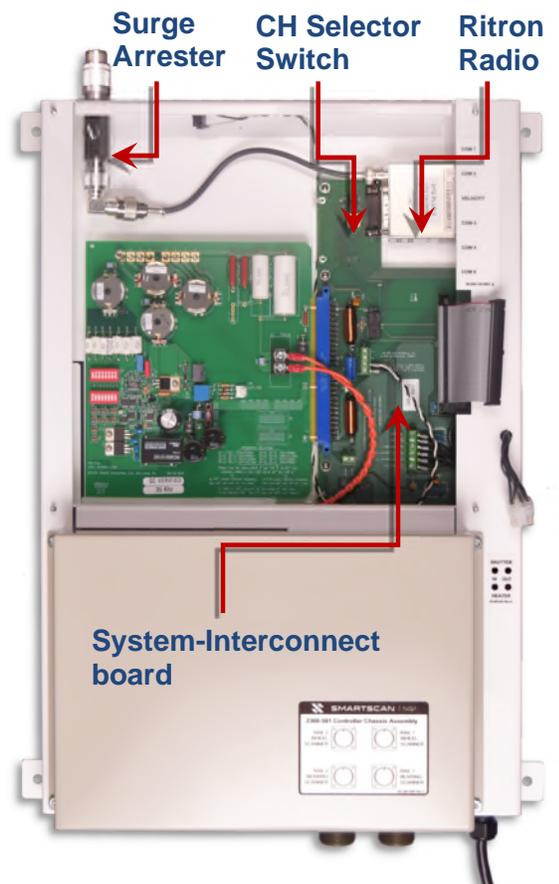
The power rating for each SSR is intentionally overrated to ensure long-lasting reliability. For example, the SSR associated with the scanner **shutters** is rated for 100 VDC at 12 amps, even though the shutters operate on 12 volts and require less than 2 amps each. Likewise, the SSR associated with the **heaters** in the 2500-512DC scanners is rated for 100 VDC at 12 amps, even though the heaters operate on 12 volts and require less than 1 amp each. The SSR associated with the **heaters** in the 2500-512AC scanners is rated for 240 VAC at 25 amps of current, even though the heaters require only 120 VAC at 1.6 amps each.

2.2.5 Radio

The "standard" chassis configuration - for both the 2300-501 NG Chassis and the 2300-601 NG² Chassis - includes a Ritron synthesized VHF transceiver. This radio mounts internally in the upper-right corner of the chassis. To access this radio, remove the controller module (see image below). For the 2300-601, the chassis cover must be removed.

The SmartScanNG² system provides the following connections to the radio.

- Regulated 11.5-VDC power supply, internally fused with a self-restoring fuse at 2.5 amps.
- PTT signal to the radio, which allows the SmartScanNG² 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
- CSN to the radio, which allows firmware control channel selection of two channels
- Eight-channel selector switch located on the System-Interconnect board (for manual selection)
- A coaxial surge arrester for the antenna connection, located inside the SmartScanNG² chassis

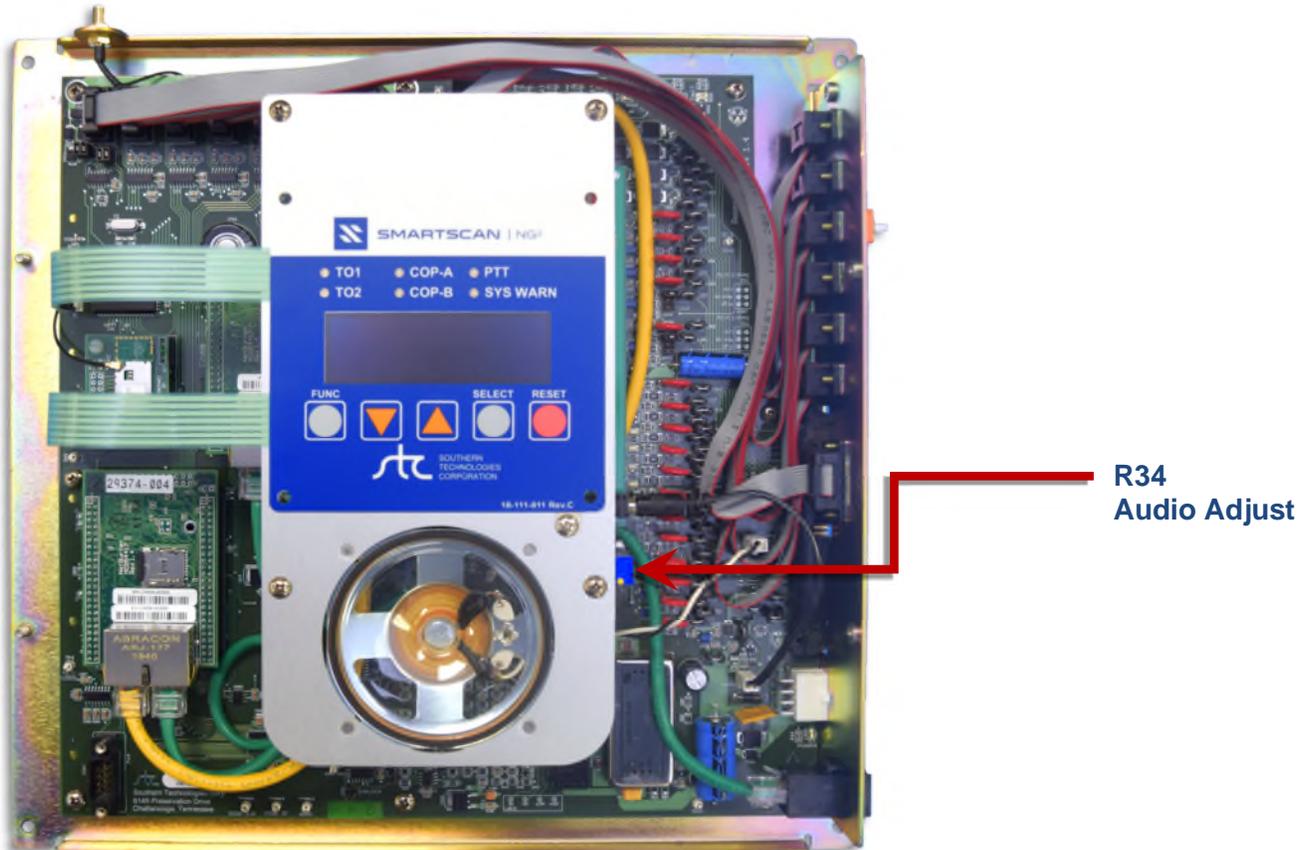


INTERNAL RADIO CONNECTOR (System Interconnect board)

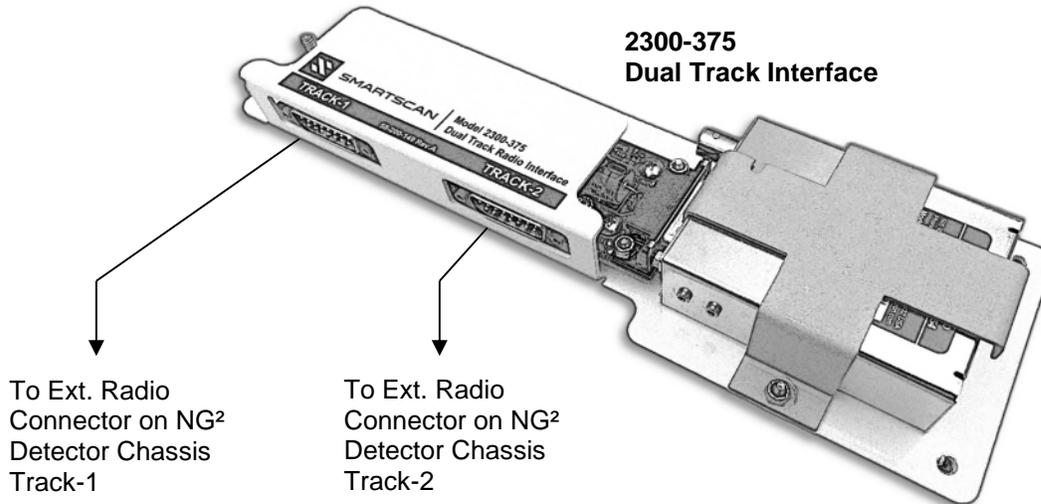
<u>PIN #</u>	<u>Name</u>	<u>Description</u>
1	CS0	Channel Select low-bit
2	CS1	Channel Select mid-bit
3	CS2	Channel Select high-bit
4	unused	
5	CSN	Channel 1 / 2
6	12V Out	11.5V @ 2.5A
7	AUD OUT	Audio Output
8	unused	
9	PGN IN/OUT	Programming I/O
10	unused	
11	unused	
12	AUDIO IN	Audio Input
13	DCD	Carrier Detect
14	PTT	Push-to-Talk
15	GND	Ground

Audio Level Adjustment:

Adjust R34 of the 2300-110 SICM board as necessary to set the audio signal level to the transmitter. Turn the pot clockwise to increase the audio level.



At double-track sites, there is usually one radio per track, which is the case when using internal radios. A second option is the 2300-375 Dual Track Interface Kit, which allows two NG² detectors to share a single radio. For this option, remove the internal radios (if present) and install one of them in the 2300-375 kit. The DB15 serial cables (supplied) connect the external radio connectors of each NG² chassis to the 2300-375.



2300-375 Installation:

1. Power down the SmartScanNG² detector system for each track. Locate and remove the Ritron radio from each chassis.
2. Install one of the *Ritron radios on the 2300-375 mounting bracket (as shown in the figure above). The remaining radio may be reallocated or kept as a spare.
3. Mount the completed 2300-375 assembly in a suitable location near both detectors.
4. With the DB15 serial cables provided, connect the Track-1 connector (of the 2300-375) to the External Radio Connector of the right-side panel of the Track-1 detector. Likewise, connect the Track-2 connector to the External Radio Connector of the Track-2 detector.
5. Connect the antenna output to an externally mounted antenna.
6. Reapply power to both detectors.
7. Frequency selection for the 2300-375's radio is controlled by the Track-1 detector **ONLY**. Select the active radio channel via the CH Select Switch on the Track-1 System-Interconnect board.
8. Adjust the audio level as necessary per R34 of the Track-1 SICM board.

**Ritron radio frequencies must be pre-programmed before installation. Radios connected to a Dual Track Interface board cannot be programmed via the NG² Radio Programming Menu.*

2.2.6 Other Components

On the outside of the SmartScanNG² chassis are connectors, LEDs, and other components.

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

- Antenna connector, when applicable
- Speaker with volume control (optional)
- Speaker jack

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

- Four scanner connectors
- AC power cord for powering the scanner heaters, when applicable
- AUX OUT connector
- I/O Connectors P3 & P4

On the **left-side edge** of the chassis are:

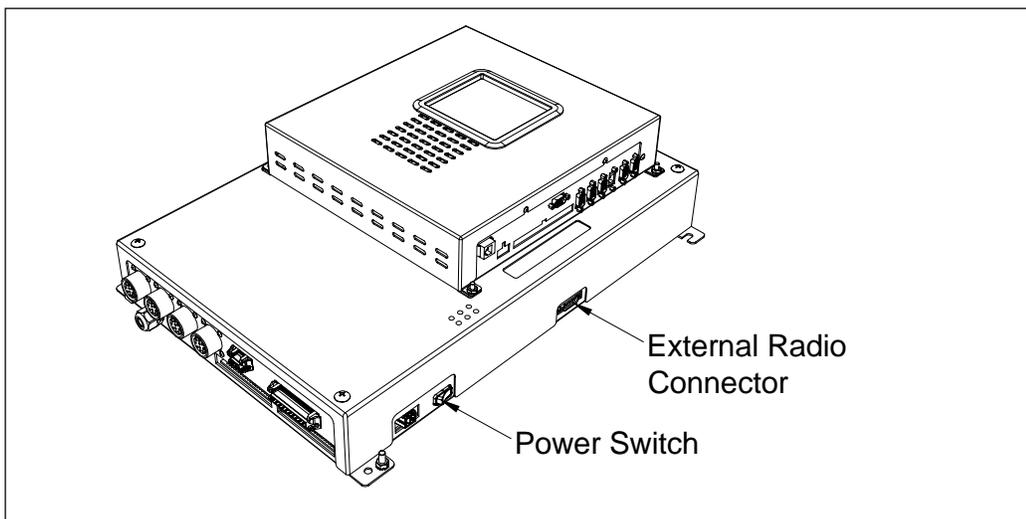
- Circuit breaker for scanner heaters

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

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

2.2.7 DC Power Switch

The SmartScanNG² detector 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 chassis. Toggle this switch off to disconnect all DC power to the SmartScanNG² detector.



2.2.8 External Radio Connector

The external radio connector is a DB15 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-5 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, which 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 SmartScanNG² system to an external radio. The audio level is adjustable using potentiometer R34 of the SICM board.

Pin-8 provides a ground return for 12V OUT.

Pin-12 provides audio input to the SmartScanNG² system (from the external radio) when the rebroadcast function is used.

Pin-13 is the carrier-detect input to the SmartScanNG² system. This signal is internally pulled high. A low level prevents the SmartScanNG² system from initiating a voice transmission.

Pin-14 is the PTT output from the SmartScanNG² system. It is an open-collector, active low signal, which is grounded while the SmartScanNG² system is transmitting.

Pin-15 should connect to the audio ground and radio ground of the external radio.

Pin-4, Pin-9, Pin-10, and Pin-11 aren't used.

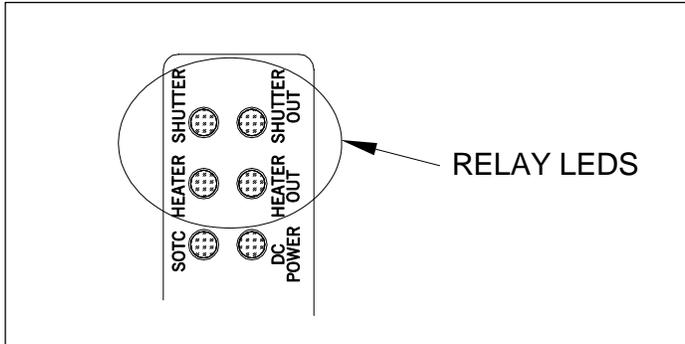
EXTERNAL RADIO CONNECTOR - NG²

<u>PIN #</u>	<u>Name</u>	<u>Description</u>
1	CS0	Channel Select low-bit
2	CS1	Channel Select mid-bit
3	CS2	Channel Select high-bit
4	unused	---
5	CSN	Channel 1 / 2
6	12V OUT	11.5V @ 2.5A
7	AUD OUT	Audio Output
8	BATT GND	GND RTN for 12V OUT
9	PGN IN/OUT	Programming I/O
10	unused	---
11	unused	---
12	AUDIO IN	Audio Input
13	DCD	Carrier Detect
14	PTT	Push-to-Talk
15	AUD GND	GND RTN for AUD, PTT, & DCD



2.2.9 Chassis Mounted LEDs

There is a group of six status LEDs on the lower right side of the chassis. The bottom-left LED (SOTC) indicates train presence (when lit). The bottom-right LED indicates that power is "ON." The middle and upper LEDs show the operation of the solid-state relays used to control the scanner shutters and heaters.



The four relay LEDs can 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 relay LEDs can be lit at the same time. Anytime the shutters are open; the heaters should be off. Under normal conditions, the upper two LEDs (shutters) should only be lit when the heaters are off. Conversely, under normal conditions, the middle two LEDs (heaters) should only be lit when the shutters are closed. In other words, when the system is working, only the upper two LEDs are lit when a train is rolling through the site. When no train is present, only the middle two relay 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.

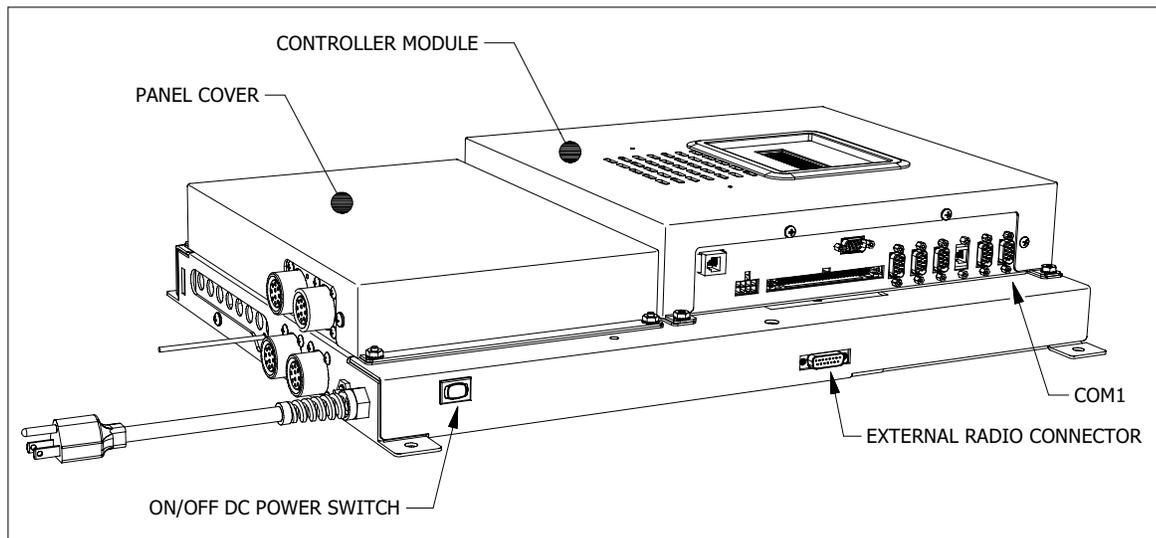
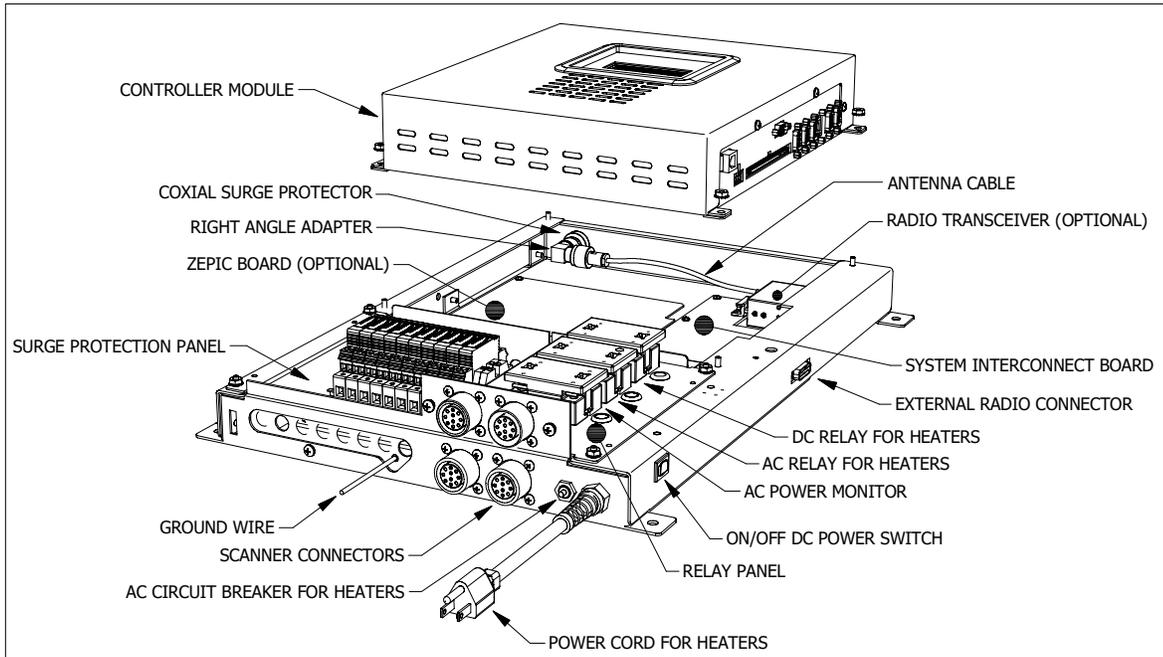
Shutter Control LED	Shutter Output LED	Heater Control LED	Heater Output LED	Explanation
On	Off	Off	Off	Invalid. The shutters are being commanded to open, but the relay isn't responding with shutter voltage.
On	On	Off	Off	Normal if a train is present. Invalid if a train isn't present.
Off	On	Off	Off	Invalid. No shutter signal, but the 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 the 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.

2.3 2300-501 NG Chassis Assembly

If your system is configured with the 2300-601 NG² Chassis, skip ahead to **Section 3.0**.

The Chassis Assembly provides all the necessary connectivity between peripheral equipment and the NG² Controller. Optional internal features include an internal radio and an SOTC presence detector.

The figure below shows the major components of the Chassis Assembly.



The power cord at the bottom of the SmartScanNG chassis is used to power the heaters in the 2500-512AC 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.**

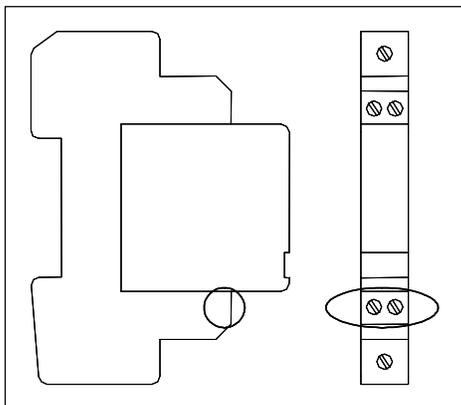
If 2500-512DC scanners are used, there usually isn't a power cord at the bottom of the chassis. If one is present, don't plug it into an outlet because the heaters in these scanners use 12 VDC.

2.3.1 Surge-Protection Panel

Along with the surge suppressors found on the Interface board, the SmartScanNG² system employs a primary layer of surge suppression, which is located on the surge-suppression panel. This section of the SmartScanNG chassis 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 SmartScanNG² detector.

- 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



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

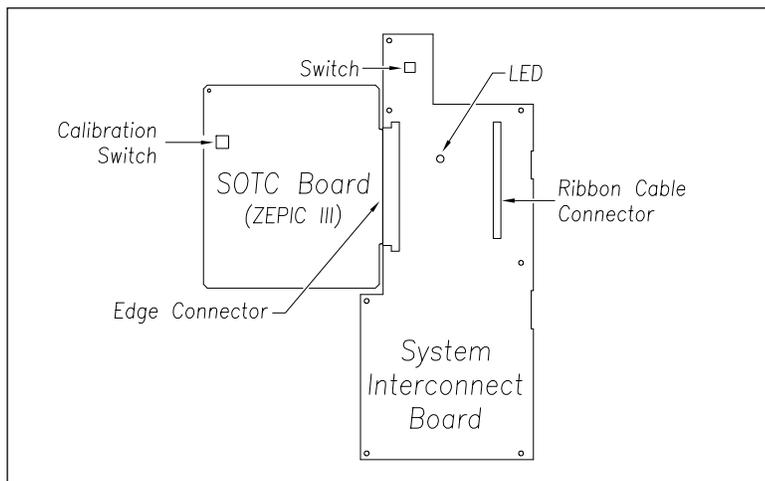
As you can see, there is one row of connectors on each side of the UTB.

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

2.3.2 SOTC Board (Zepic PD8-Plus)

If your system uses advance transducers for presence detection, skip ahead to the 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. See Section 10.7 Calibrating the Zepic III Presence Detector.



The SmartScanNG² chassis 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.

2.3.3 Relay Panel

The SmartScanNG² system uses optically isolated solid-state relays (SSRs) to eliminate electromagnetic radiation, which would otherwise be generated by the arcing of mechanical relay contacts. There are three SSRs mounted to the relay panel. One SSR operates the scanner shutters, and another energizes the scanner heaters. The signals to activate the SSRs originate at the Processor board.

A third SSR is used to monitor and flag AC power failures. If AC power is disrupted, a message will be posted to the Event Log, and "AC Power Off" will appear just before the menu header in the Serial Interface. If the AC power is off when a System Status report is requested, the message "AC Power Off" will be printed in the System Status report. If the AC power is off when a train passes the site, the message "AC Power Off" will appear in the System Alarms section of the Train Detail report.

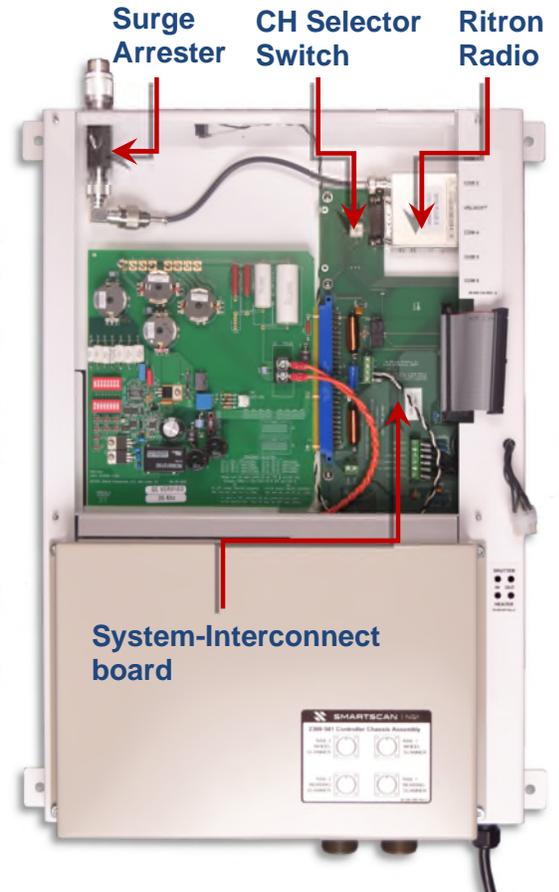
The power rating for each SSR is intentionally overrated to ensure long-lasting reliability. For example, the SSR associated with the scanner **shutters** is rated for 100 VDC at 12 amps, even though the shutters operate on 12 volts and require less than 2 amps each. Likewise, the SSR associated with the **heaters** in the 2500-512DC scanners is rated for 100 VDC at 12 amps, even though the heaters operate on 12 volts and require less than 1 amp each. The SSR associated with the **heaters** in the 2500-512AC scanners is rated for 240 VAC at 25 amps of current, even though the heaters require only 120 VAC at 1.6 amps each.

2.3.4 Radio

The "standard" chassis configuration - for both the 2300-501 NG Chassis and the 2300-601 NG² Chassis - includes a Ritron synthesized VHF transceiver. This radio mounts internally in the upper-right corner of the chassis. To access this radio, remove the controller module (see image below). For the 2300-601, the chassis cover must be removed.

The SmartScanNG² system provides the following connections to the radio.

- Regulated 11.5-VDC power supply, internally fused with a self-restoring fuse at 2.5 amps
- PTT signal to the radio, which allows the SmartScanNG² 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
- CSN to the radio, which allows firmware control channel selection of two channels
- Eight-channel selector switch located on the System-Interconnect board (for manual selection)
- A coaxial surge arrester for the antenna connection, located inside the SmartScanNG² chassis



INTERNAL RADIO CONNECTOR (System Interconnect board)

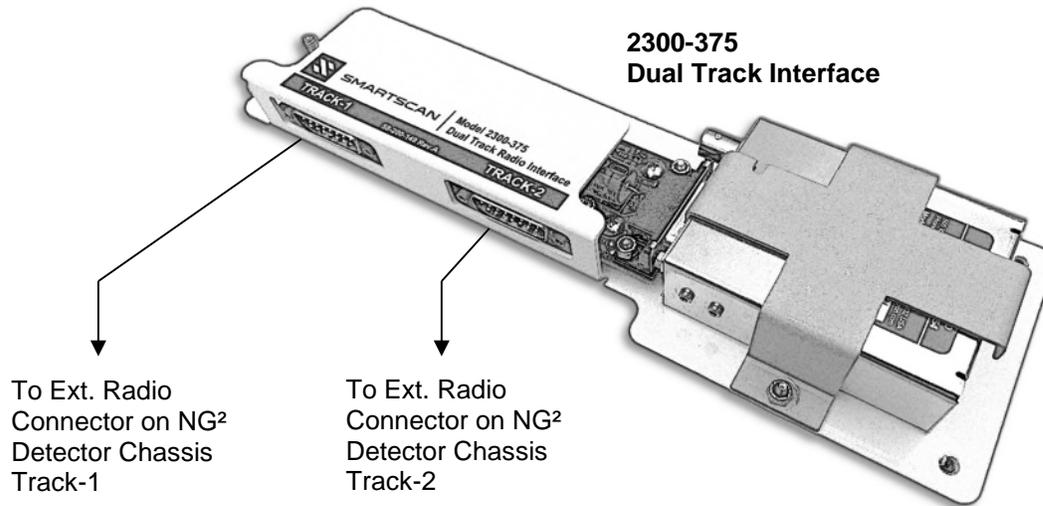
<u>PIN #</u>	<u>Name</u>	<u>Description</u>
1	CS0	Channel Select low-bit
2	CS1	Channel Select mid-bit
3	CS2	Channel Select high-bit
4	unused	
5	CSN	Channel 1 / 2
6	12V Out	11.5V @ 2.5A
7	AUD OUT	Audio Output
8	unused	
9	PGN IN/OUT	Programming I/O
10	unused	
11	unused	
12	AUDIO IN	Audio Input
13	DCD	Carrier Detect
14	PTT	Push-to-Talk
15	GND	Ground

Audio Level Adjustment:

Adjust R34 of the 2300-110 SICM board as necessary to set the audio signal level to the transmitter. Turn the pot clockwise to increase the audio level.



At double-track sites, there is usually one radio per track, which is the case when internal radios are used. A second option is the 2300-375 Dual Track Interface Kit, which allows two NG² detectors to share a single radio. For this option, the internal radios (if present) are removed, and one of them is installed in the 2300-375 kit. The DB15 serial cables (supplied) connect the external radio connectors of each NG chassis to the 2300-375.



2.3.5 Other Components

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

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

- Antenna connector, when applicable
- Speaker with volume control (optional)
- Speaker jack

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

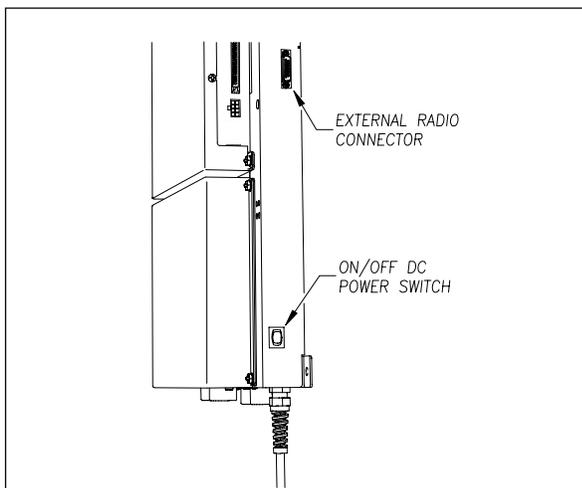
- Four scanner connectors
- AC power cord for powering the scanner heaters, when applicable
- Circuit breaker for scanner heaters

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

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

2.3.6 DC Power Switch

The SmartScanNG² detector 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 chassis. Toggle this switch off to disconnect all DC power to the SmartScanNG² detector.



2.3.7 External Radio Connector

The external radio connector is a DB15 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-5 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, which 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 SmartScanNG² system to an external radio. The audio level is adjustable using potentiometer R34 of the SICM board.

Pin-8 provides a ground return for 12V OUT.

Pin-12 provides audio input to the SmartScanNG² system (from the external radio) when the rebroadcast function is used.

Pin-13 is the carrier-detect input to the SmartScanNG² system. This signal is internally pulled high. A low level prevents the SmartScanNG² system from initiating a voice transmission.

Pin-14 is the PTT output from the SmartScanNG² system. This is an open-collector, active low signal, which is grounded while the SmartScanNG² system is transmitting.

Pin-15 should connect to the audio ground and radio ground of the external radio.

Pin-4, Pin-9, Pin-10, and Pin-11 aren't used.

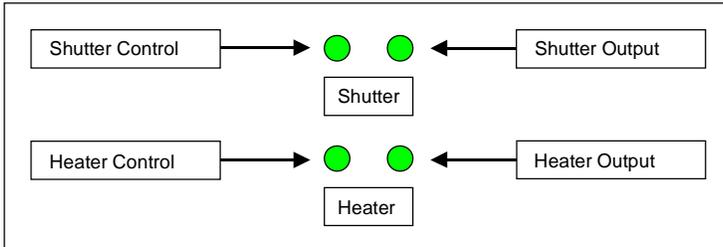
EXTERNAL RADIO CONNECTOR - NG²

<u>PIN #</u>	<u>Name</u>	<u>Description</u>
1	CS0	Channel Select low bit
2	CS1	Channel Select mid bit
3	CS2	Channel Select high bit
4	unused	---
5	CSN	Channel 1 / 2
6	12V OUT	11.5V @ 2.5A
7	AUD OUT	Audio Output
8	BATT GND	GND RTN for 12V OUT
9	PGN IN/OUT	Programming I/O
10	unused	---
11	unused	---
12	AUDIO IN	Audio Input
13	DCD	Carrier Detect
14	PTT	Push-to-Talk
15	AUD GND	GND RTN for AUD, PTT, & DCD



2.3.8 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 relay's 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.

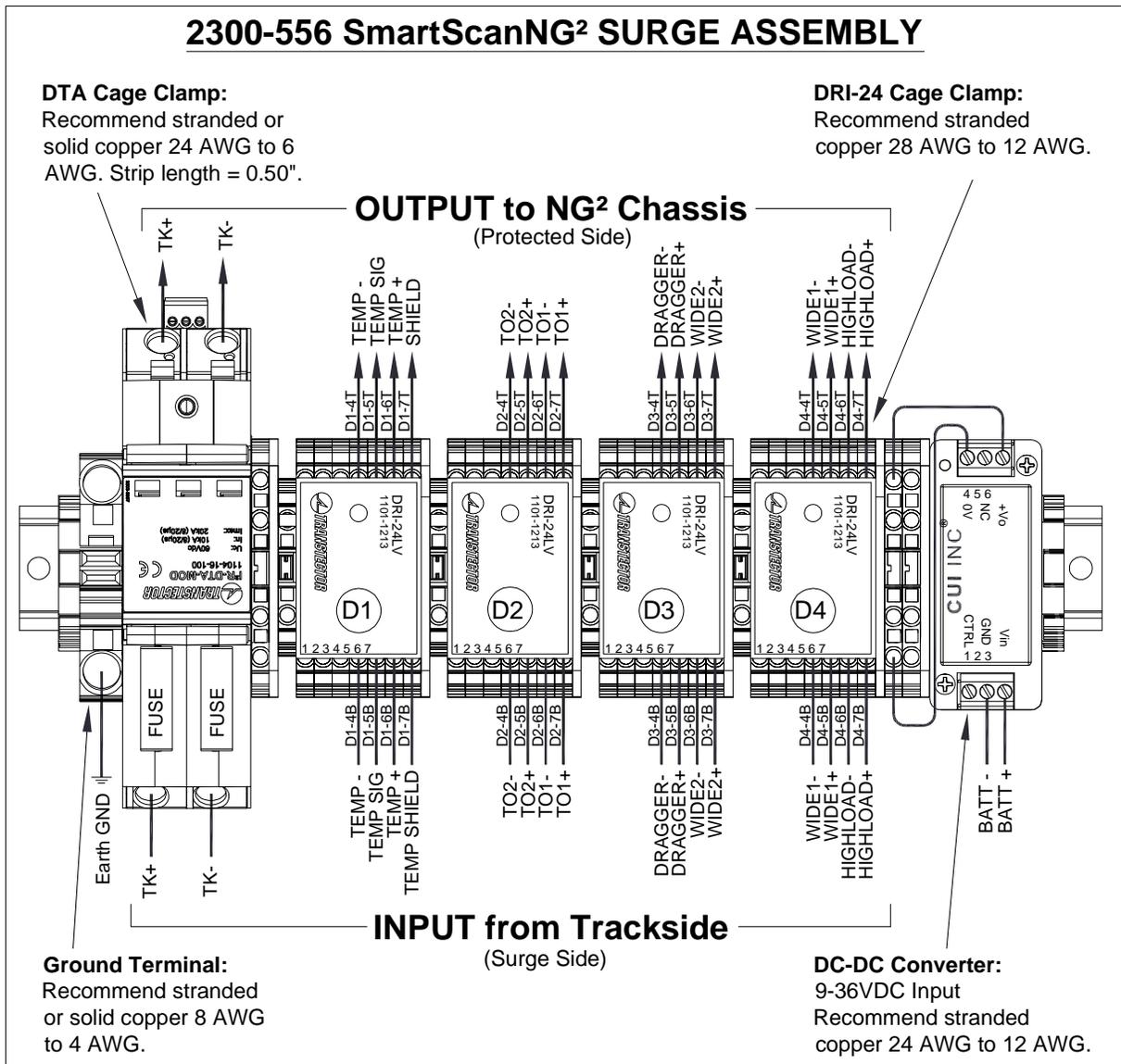
Shutter Control LED	Shutter Output LED	Heater Control LED	Heater Output LED	Explanation
On	Off	Off	Off	Invalid. The shutters are being commanded to open, but the relay isn't responding with shutter voltage.
On	On	Off	Off	Normal if a train is present. Invalid if a train isn't present.
Off	On	Off	Off	Invalid. No shutter signal, but the 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 the 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 Surge Panel

The 2300-601 NG² Chassis uses an external Surge Panel similar to the figure below. If your system has a 2300-501 NG Chassis, skip ahead to **Section 4**.

3.1 Surge Panel Assembly

The standard Surge Panel configuration has four DRI-24LV Transtector modules, an IR-DTA-MOD Transtector module, and a DC-DC converter. These components protect the track circuit, wheel sensors, temperature probe, dragger, and HiWide alarms. The ground terminal of this assembly must be connected to earth ground for the surge arrestors to function properly.



4.0 Power Subsystem

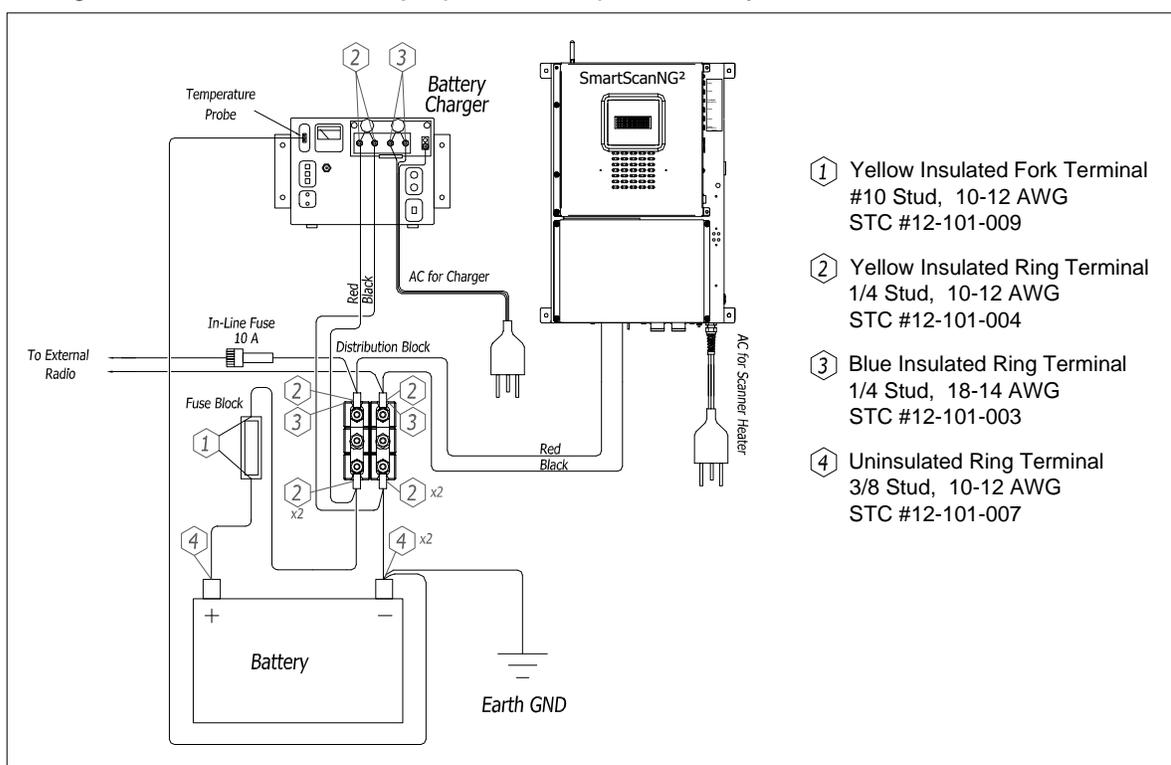
The SmartScanNG² can operate from 10 to 30 VDC. The maximum system current load (for two bearing scanners, two wheel scanners, train presence, and radio) is approximately 11.7 amps. The system idle current is approximately 900mA.

NOTE: Voltage Selector Switch on 2300-107 Interconnect Board **MUST** be set to 12V (for a 12-VDC Power Subsystem) or 24V (for a 24-VDC Power Subsystem). [The Voltage Selector Switch is **NOT** available on older the model SmartScanNG chassis]. See **Section 2.2.1** for details.

4.1 12 VDC Power Subsystem

If your system uses a 24 VDC power subsystem, skip ahead to Section 4.2.

The figures below show the major parts of the power subsystem.

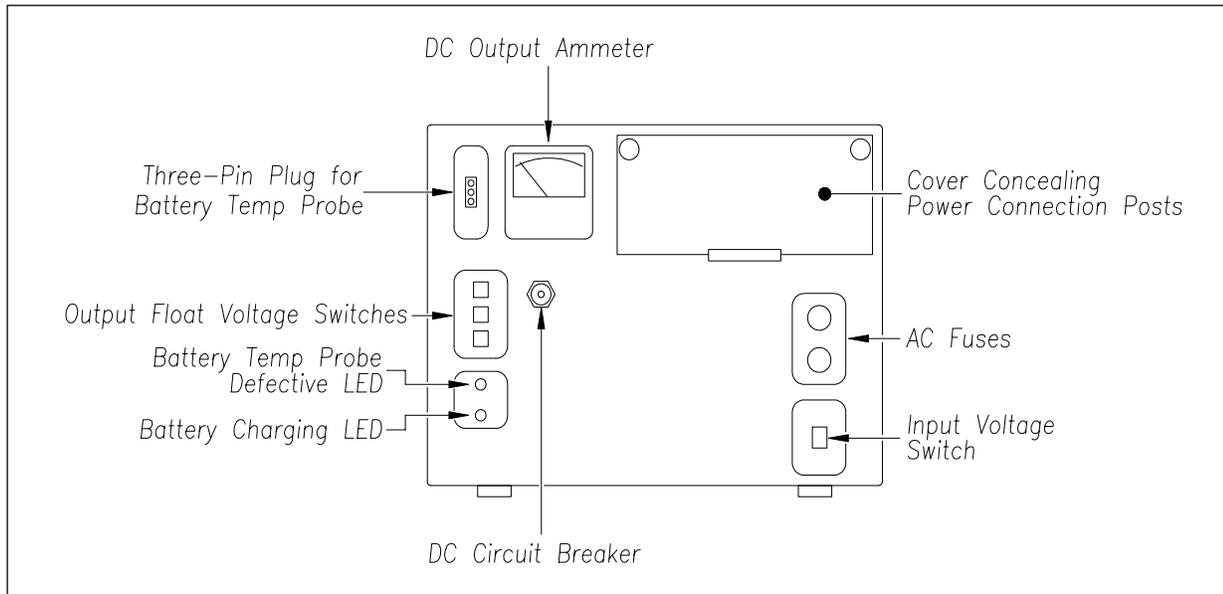


4.1.1 Battery

Each SmartScanNG² uses one 12-volt 115-ampere-hour battery for a 12-volt system. The use of a smaller battery reduces the amount of time that the SmartScanNG² system can continue to operate after AC power is removed.

4.1.2 Battery Charger

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



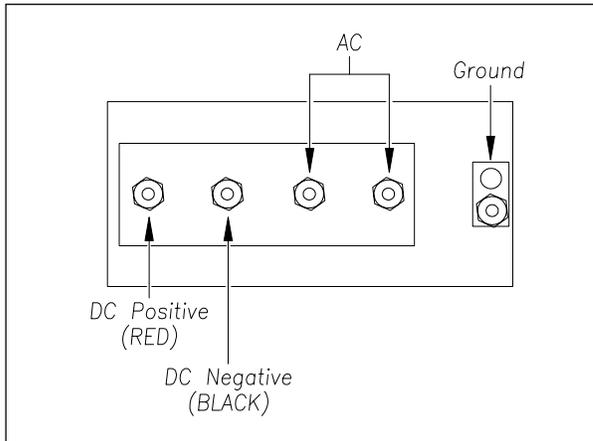
The input voltage switch can be set to 115 VAC or 230 VAC. Use 115 for input voltages between 108 and 128. Use 230 for input voltages between 216 and 256.

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

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

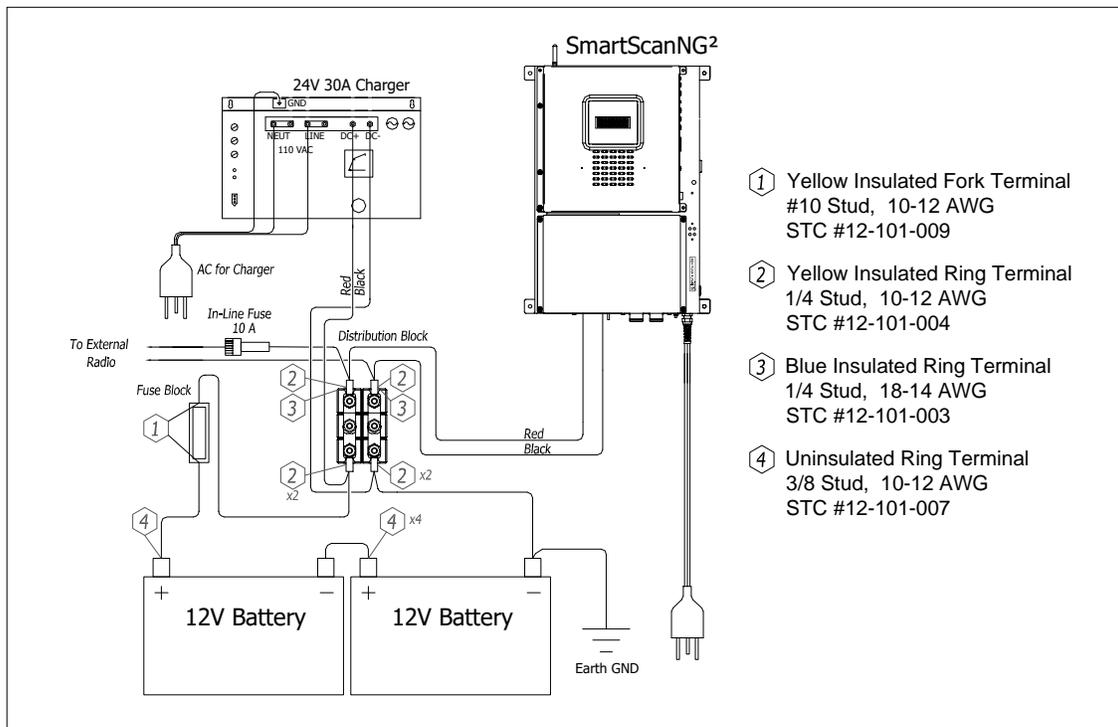
Above the input voltage switch are two 4-amp 250-volt fast-acting fuses. They protect the battery charger from excessive AC. To the right of the output float voltage switches is a circuit breaker. It protects the battery charger from excessive DC.

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



4.2 24 VDC Power Subsystem

The figures below show the major parts of the power subsystem.

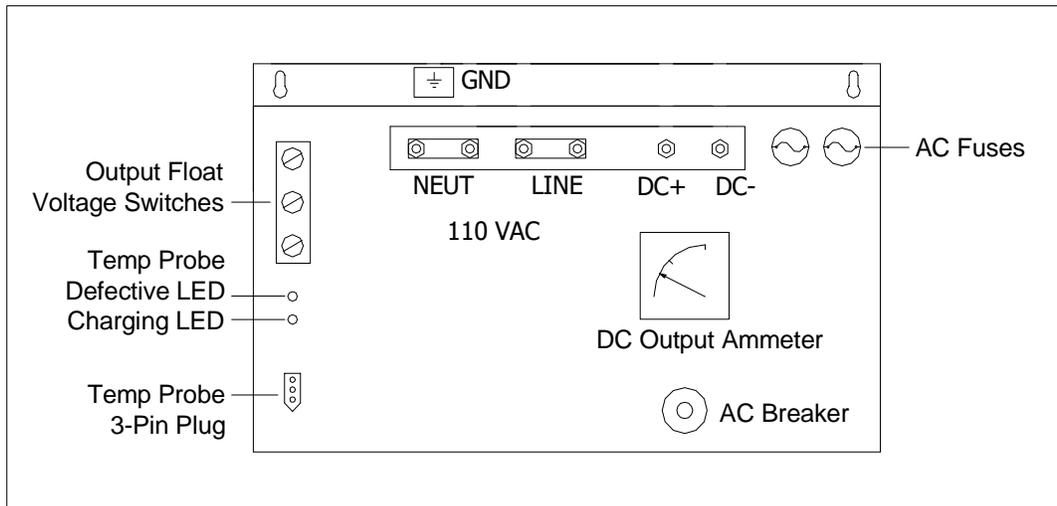


4.2.1 Battery

Each SmartScanNG² uses two 12-volt 115-ampere-hour batteries for a 24-volt system. The use of smaller batteries reduces the amount of time that the SmartScanNG² system can continue to operate after AC power is removed.

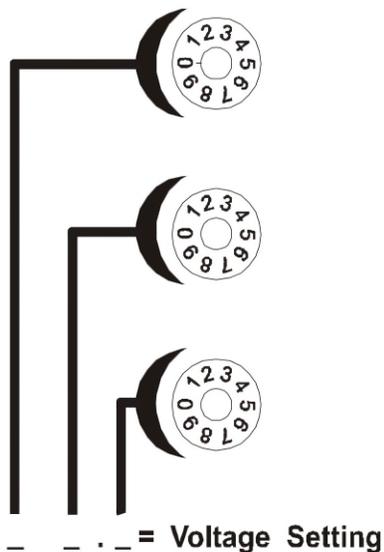
4.2.2 Battery Charger

The figure below shows the front of an NRS 24/30 battery charger.



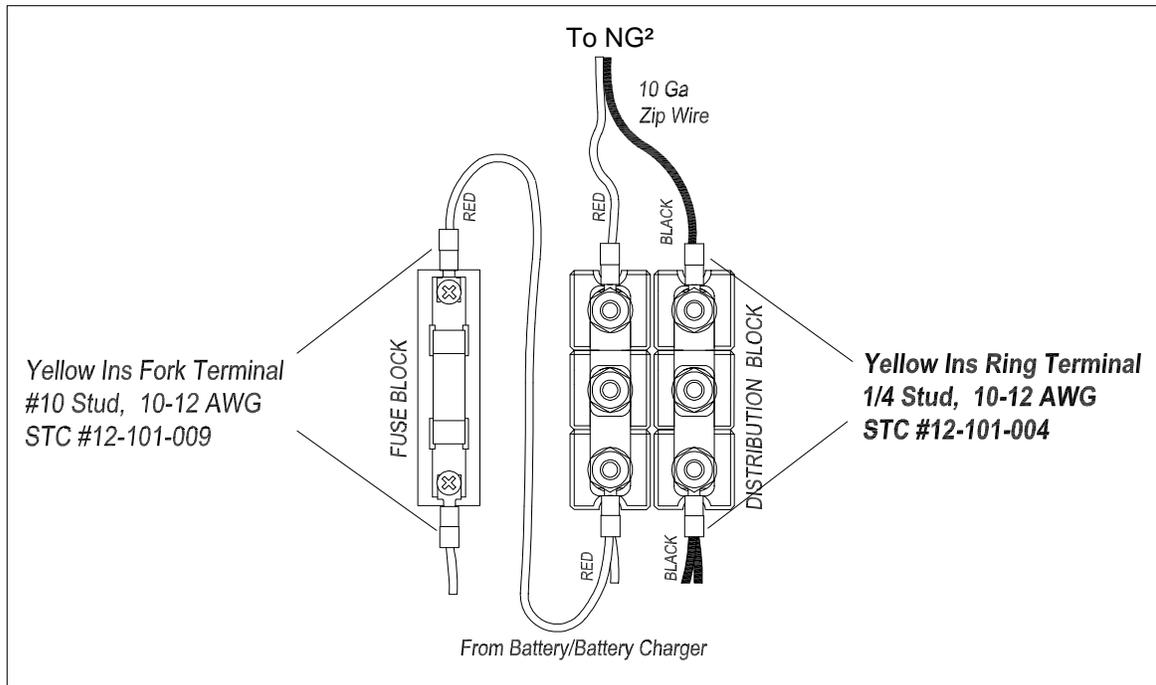
The input voltage switch can be set to 115 VAC or 230 VAC. Use 115 for input voltages between 108 and 128. Use 230 for input voltages between 216 and 256.

The output float voltage switches can be set so that a battery is charged within the range 20.0 VDC and 39.9 VDC. The **factory default is 28.00 VDC**. This setting should be adjusted per the battery manufacturer's specifications. 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 top switch controls the ten's digit. The middle switch controls the one's digit. The bottom switch controls the tenth's digit. Thus, to select 28.0 VDC, turn the top switch to 2, the middle switch to 8, and the bottom switch to 0.



4.3 DC Power Distribution

DC power distribution consists of a distribution block and a fuse block, which is shown below. There is one of each of these components per SmartScanNG² detector.



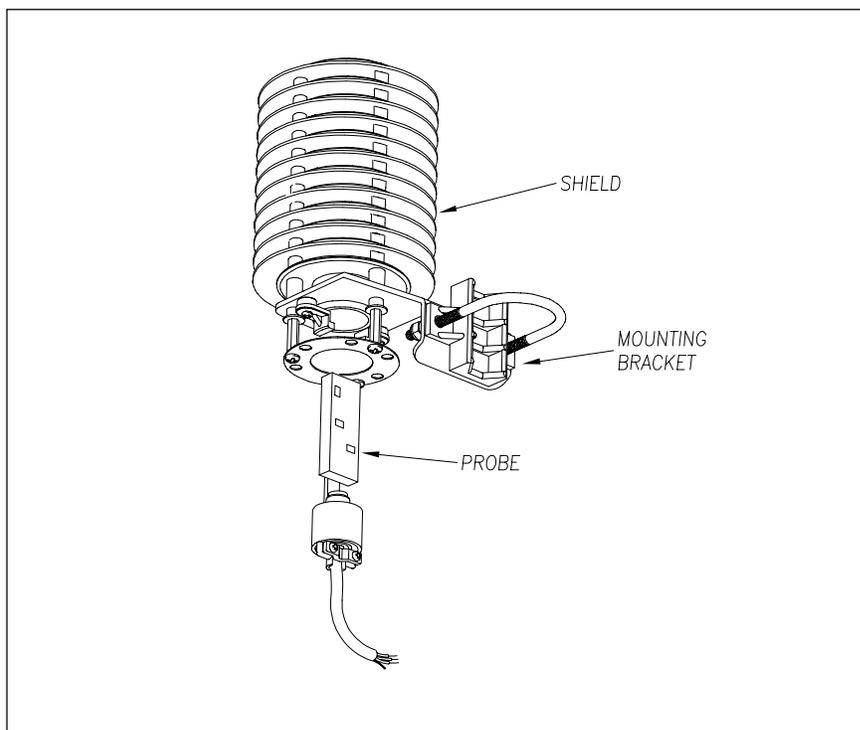
The **distribution block** contains six terminals. Loosening the middle gold nuts disconnects the DC power to the SmartScanNG² system.

The **fuse block** contains a standard 13/32 x 1-1/2-inch, 25-amp, fast blow fuse. The fuse protects battery cables in the event of a short circuit.

5.0 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 $+65^{\circ}\text{C}$ (-49°F to $+149^{\circ}\text{F}$). 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 SmartScanNG² system supplies 12 volts to the shielded temperature probe. The probe returns 0 to 5 volts. Zero volts indicate a -reading of 45°C (-49°F). Five volts indicates a $+65^{\circ}\text{C}$ ($+149^{\circ}\text{F}$) 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 SmartScanNG² detector could be cut, or the wiring to the System-Interconnect board could be disconnected. If you get a $+65^{\circ}\text{C}$ ($+149^{\circ}\text{F}$) reading, the probe could be malfunctioning, or the ground wire from the probe to the SmartScanNG² detector could be cut.

The system comes with a partially installed shielded temperature probe. **Section 9.8.5 - *Shielded Temperature Probe*** tells how to finish installing it.

6.0 AEI Subsystem

Not all SmartScanNG² detectors incorporate an AEI subsystem. If your SmartScanNG² system does not, skip ahead to section 7.0. The AEI subsystem consists of two AEI antennas and an AEI reader module. Described below is the 2300-752 AEI reader.

NOTICE:

If equipped with an AEI subsystem, the user is required to obtain a Part 90 site license from the FCC to operate in the United States. See product label for FCC ID number. Access the FCC Web site at <https://www.fcc.gov/licensing-databases/forms> for additional information concerning licensing requirements.

Users in all countries should check with the appropriate local authorities for licensing requirements.

6.1 2300-752 MPR(x) Panel

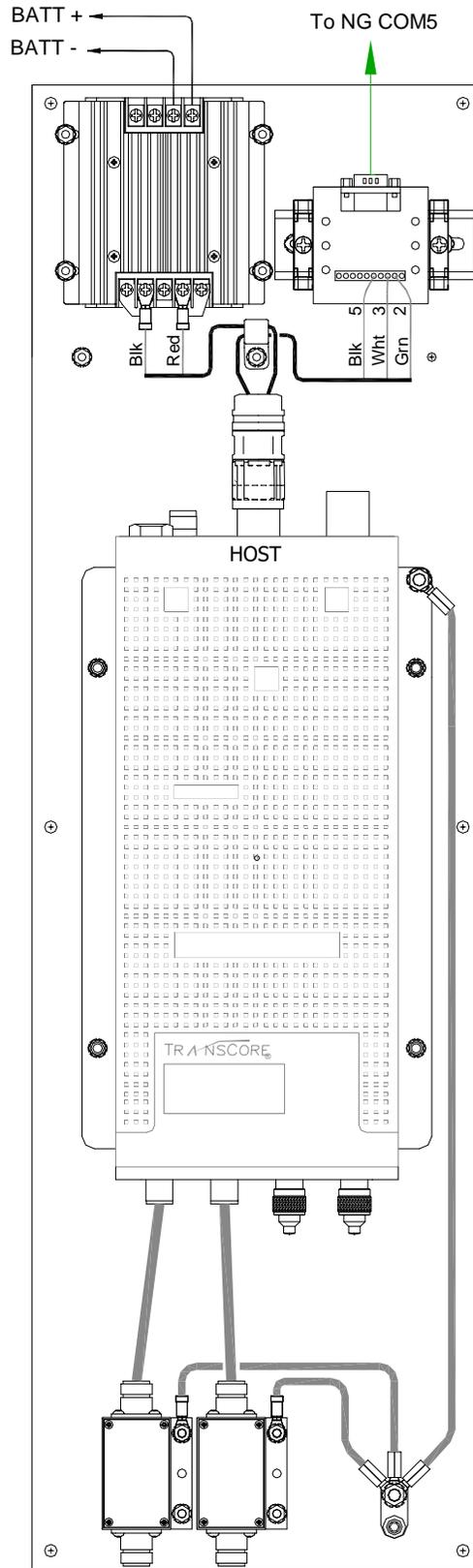
The 2300-752 MPR(x) Panel is a prewired, wall-mountable panel assembly consisting of an MPRR or MPRX, a boost converter, coaxial surge arresters, and a DB9 breakout board.

The MPR(x) reads and reports Radio Frequency Identification (RFID) tags in the original programmed format. It can also decode the 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 MPR(x). 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 MPR(x) "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 MPR(x) 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.

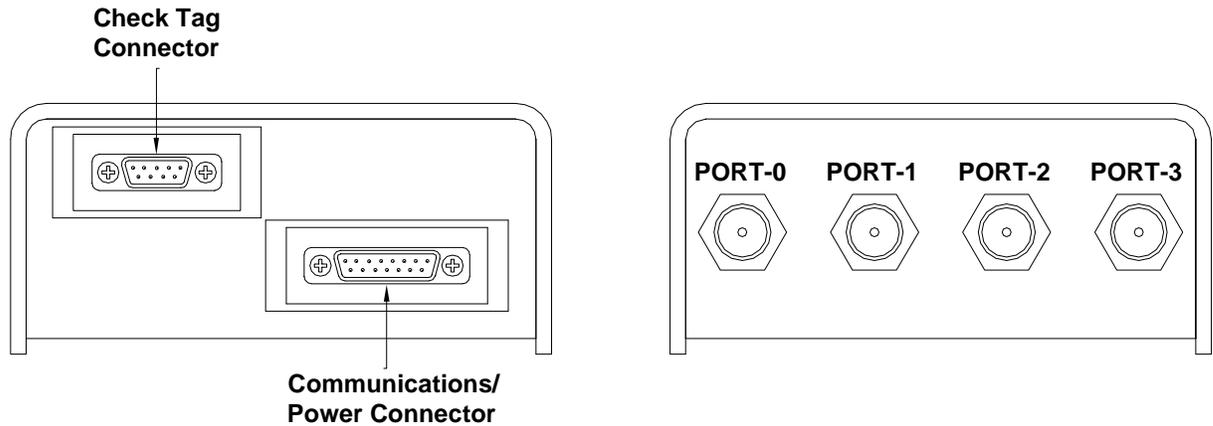
The Train Detail report displays the AEI information of each vehicle in the train's consist from which a tag was read. The Train Summary report displays a total tag count for each train.

2300-752 MPR(x) Panel

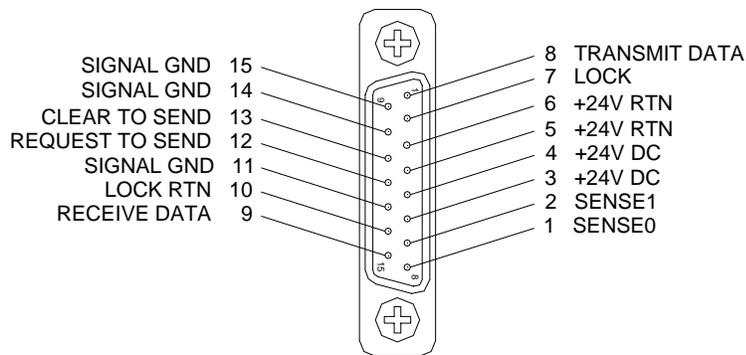


6.1.1 MPRR

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 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.



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

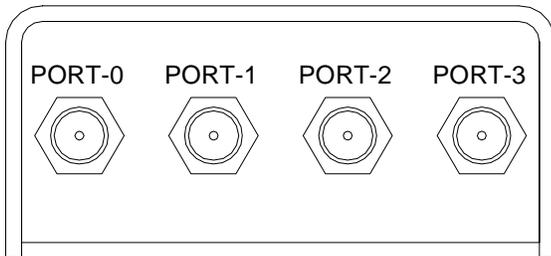
Power Supply Current Requirements:

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

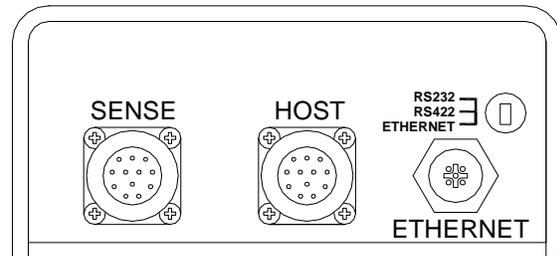
6.1.2 MPRX

The Multiprotocol Reader Extreme (MPRX) is TransCore's latest offering in RFID technology. It is slated to replace the MPRR by the end of 2018. The MPRX 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.

ANTENNA PORTS (4)



COMM PORTS



Pin Number	Operation
1	RS232_TX
2	RS232_RX
3	LOCK
4	LOCK_RTN
5	RS422_TX+
6	RS422_TX-
7	RS422_RX+
8	RS422_RX-
9	COM_GND (RS232 GND)
10	COM_GND (RS422 GND)
11	+V In
12	+V Return

Host Connector Pinout

Pin Number	Operation
1	+12VDC OUT
2	OUT1
3	I/O GROUND
4	I/O GROUND
5	PULSE OUT
6	OUT0
7	CTAG 0
8	CTAG 1
9	I/O GROUND
10	I/O GROUND
11	SENSE 1
12	SENSE 0

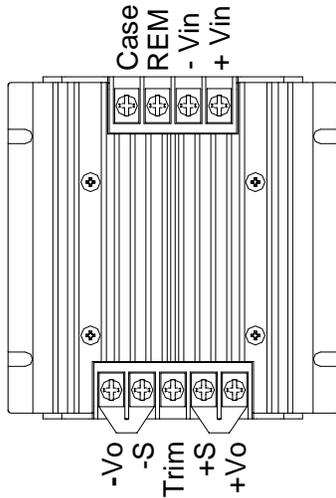
Sense Connector Pinout

Power Supply Current Requirements:

Supply	(RF On) Worst Case Maximum Current at 68°F	(RF Off) Standby Operating Current at 68°F
24 to 110VDC (Wide-Input Voltage Option)	1.7 A at 24V AC	1 A at 24V AC

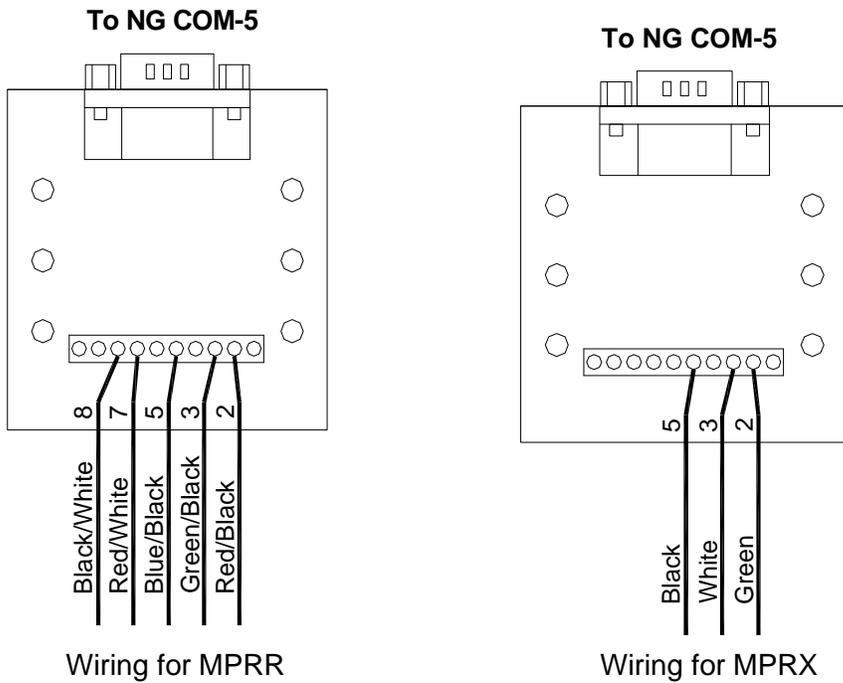
6.1.3 DC-DC Converter

The 28V 3.57A boost converter provides power to the MPR(x). It operates from an input voltage of 9 ~ 36 VDC.



6.1.4 DB9 Breakout Board

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



7.0 Wind Monitor

Not all SmartScanNG² detectors incorporate a wind monitor subsystem. If your SmartScanNG² system does not, skip ahead to section 8.0. The wind monitor subsystem consists of an RM Young Wind Monitor and a 2300-220 Wind Monitor Interface module.

7.1 RM Young Wind Monitor

The wind monitor features an optically encoded direction transducer and serial data output capability. The wind speed sensor is a four-blade helicoid propeller that turns a multipole magnet. Propeller rotation induces a variable frequency signal in a stationary coil. The wind direction sensor is a durable molded vane. An optical encoder measures the vane angle. The encoder is an absolute type, so direction output remains accurate even if power is interrupted. Raw transducer signals are processed by onboard electronics. A variety of serial protocols or a conventional calibrated voltage output may be selected with simple internal jumpers. The instrument mounts on a standard 1-inch pipe.

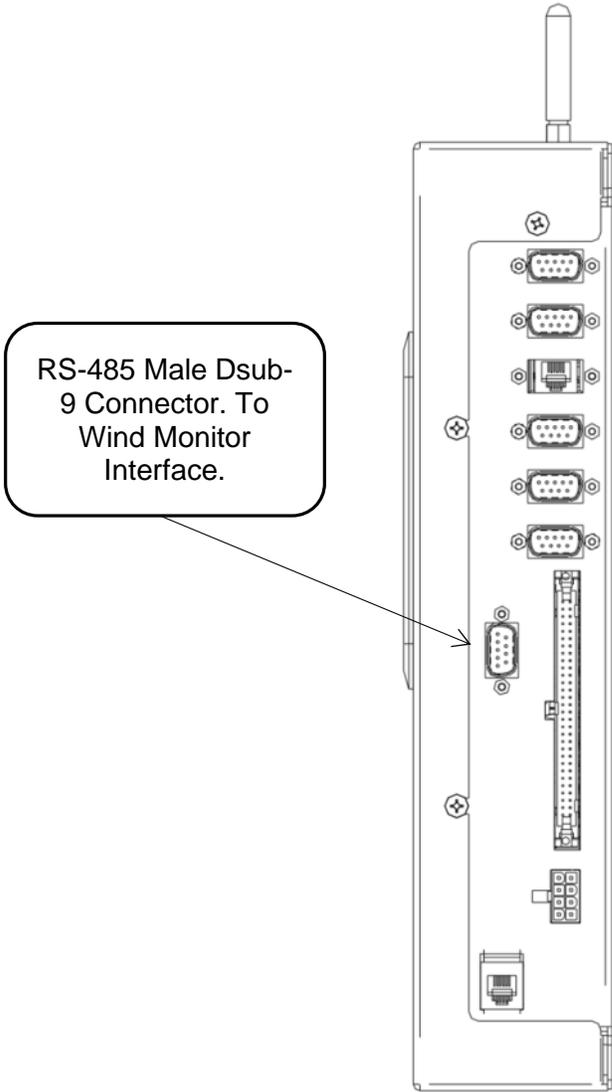
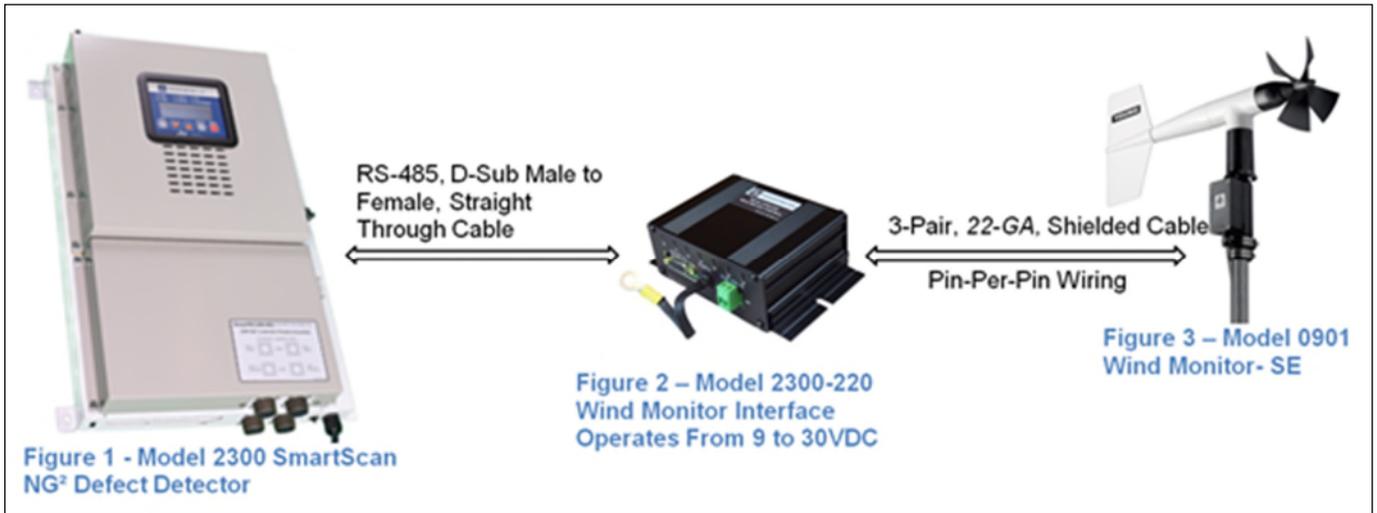


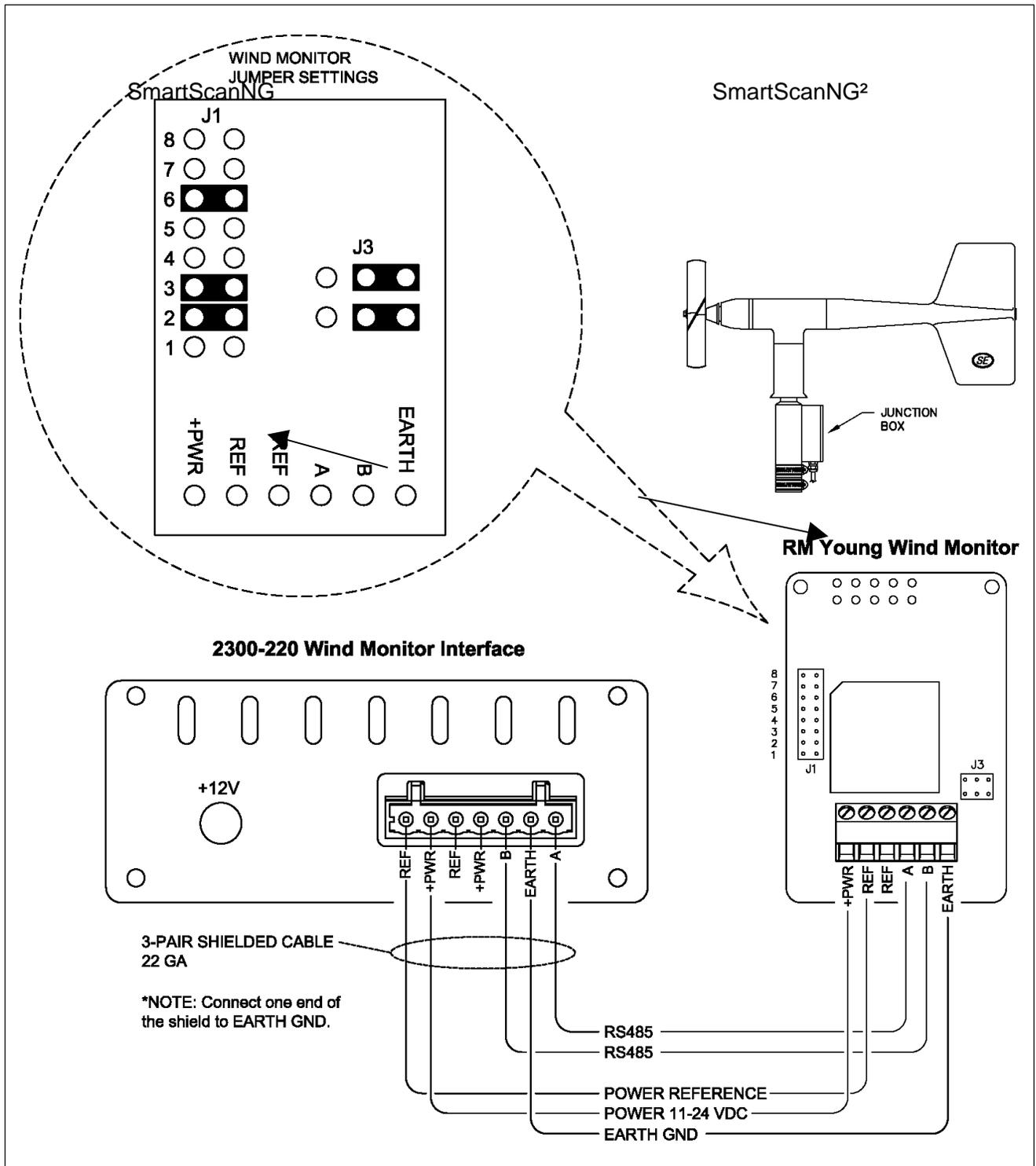
7.2 2300-220 Wind Monitor Interface

The Wind Monitor Interface offers a convenient means to connect the RM Young Wind Monitor to the SmartScanNG or NG² Defect Detector System. The unit provides the following.

- Multi-stage surge protection for power supply and RS-485 with 3KV power supply isolation.
- 9VDC to 30VDC input voltage expands the operating range of the Wind Monitor.
- Additional 12-Volt power terminals can supply applications such as a High/Wide detector.
- Rugged, compact design for easy installation and maintenance.
- A Dsub-9 female connector that connects with a straight-through cable to the defect detector's RS-485 port and the wiring terminals are labeled to match the terminals of the RM Young Wind Monitor for ease of installation.
- A grounding strap provides a path to ground for surge currents and to bleed off static electricity from the wind monitor.
- A green status LED indicates the +12V power supply output is present.

7.3 2300-220 Wind Monitor Wiring





WIRING NOTES:

- Use a twisted pair of wires for +PWR and REF.
- Use a twisted pair of wires for A and B signals.
- Connect one end of the shield of the cable to the EARTH terminal on the 2300-220 Wind Monitor Interface. Do not connect the shield to the Wind Monitor.

7.4 NG² J3 Jumper Settings for RS485 Communications

- Power down the detector and take ESD precautions by attaching a ground strap to your wrist.
- Remove the Controller Module cover.
- Locate the pair of jumpers labeled J3 in the upper-left corner of the Controller Module board, just under the bottom-right corner of the serial cable socket labeled "RS485 PROC-B." A red arrow points to these jumpers in the picture to the right.
- If necessary, move the J3 headers to match the picture at the right. The left-hand header should cover the middle and bottom pins. The right-hand header should cover the top and middle pins.
- Replace the Controller Module cover.
- Power up the system again.



7.5 Wind Monitor Setup

The screenshot below depicts a typical setup configuration for a wind monitor. These settings can be edited via the Setup Menu of the serial interface. Refer to the SmartScanNG² Operator's Manual for detailed setup instructions.

```
Wind Settings
-----
[A] - Wind Monitor ..... Installed
[B] - High Wind Alarm Limit ..... 50 mph
[C] - Display Wind Diagnostics ..... No
[D] - Wind Poll Interval ..... 15 sec
[E] - Slow Wind Speed Limit ..... 2 mph
[F] - Lower Interval Identical Limit ..... 360 min
[G] - Upper Interval Identical Limit ..... 30 min
[H] - Wind Gust Interval ..... 5 min
[I] - Suspicious Temp. Interval ..... 720 min
[J] - Re-enable Wind Updates ..... 10 min
[K] - Wind Alarm Reporting Interval ..... 5 min
[X] - Exit
```

8.0 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 SmartScanNG² system.

This section covers what needs to be done before the 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.

8.1 Selecting a Site

Locate the site:

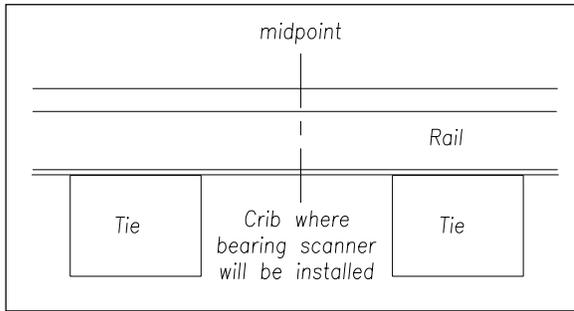
- On level, well-drained ground (avoid low areas where flooding may occur)
- In an area that doesn't normally require heavy braking by passing trains
- At least 300 feet (91.4 meters) from the nearest road crossing
- Away from a track joint, a track switch, and a sidetrack
- By a track that is on gauge (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)

8.2 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.

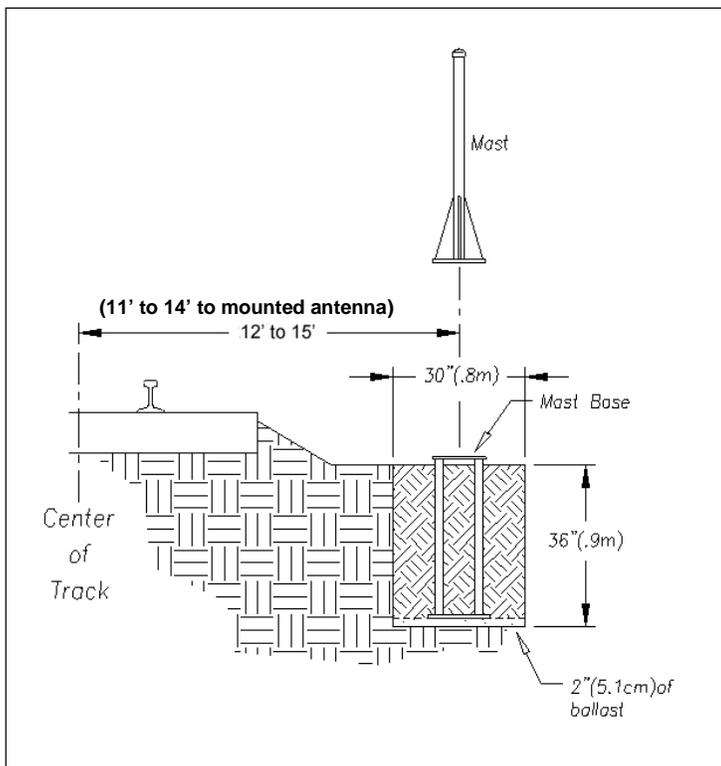
The wheel scanners should be centered in the crib of the two ties immediately ahead (and to the north or east) of the bearing scanners.

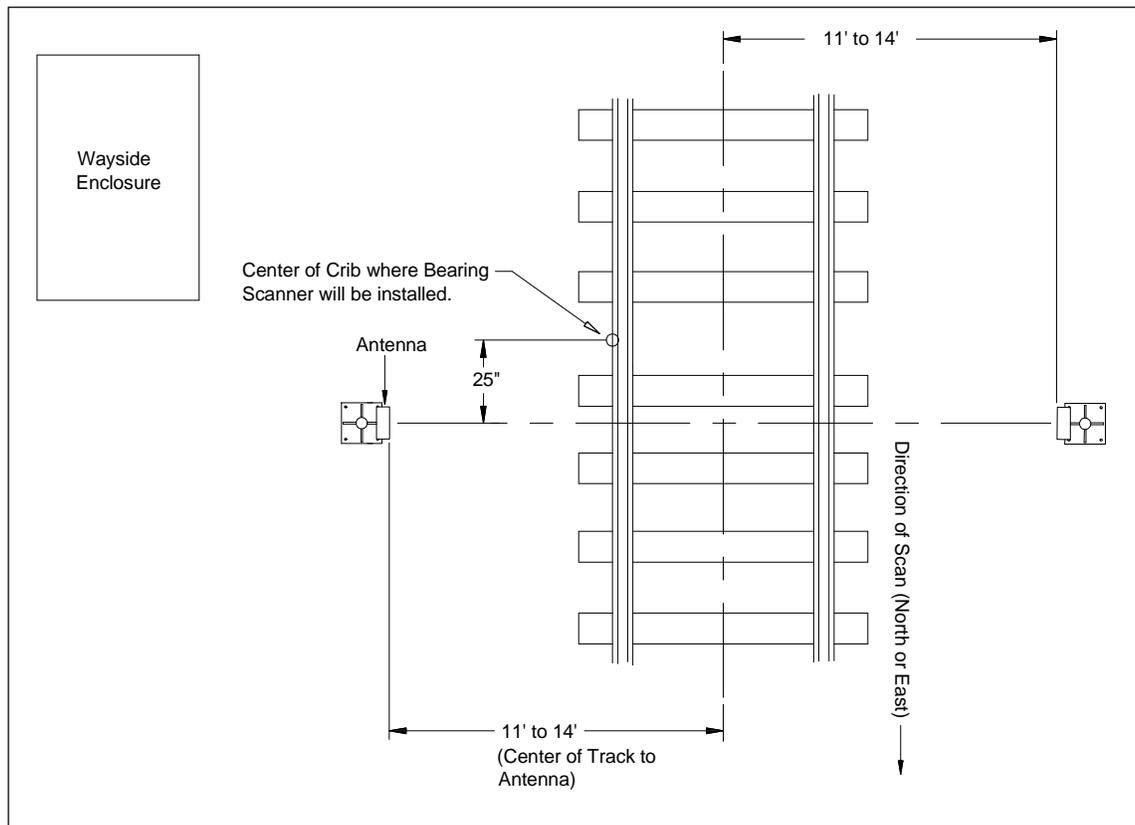
- b** Repeat steps 2 through 6.

8.3 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 mounted antenna will be 11-14 ft from the center of the track and 25 inches (0.6 meters) from the center of the crib in which the bearing scanner will be installed. Both bases will be north or east of the crib.

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

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

8.4 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.

NOTE:

Some railroads specify the use of four 5/8-inch diameter copper-clad rods, one on each corner of the wayside enclosure.

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 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.

- 6 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.

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

- 8 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.

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

In a later section, the SmartScanNG² detector and the battery charger will be plugged into this outlet. Don't plug it in now.

8.5 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 SmartScanNG² 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.

8.6 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:

- a return address
- the name and telephone number of the person who should be contacted to answer questions about the hardware
- a written explanation of the hardware damage or defect

8.7 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 a machine. These calls are returned promptly the next business day.

When calling, state that you are calling about a SmartScanNG² system. Your call will then be directed to the appropriate person.

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

8.8 Identifying the Installation Tools

Besides the tools needed to install signal cases, underground cables, and power services, you need these to install your SmartScanNG² 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-adaptor plates on the scanner mounts
- T-handle 1/4-inch hex-wrench, which is used to install the scanners on the scanner mounts
- Two combination 9/16-inch open-end box wrenches, which are used to install the transducers and align the scanners

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

9.0 Installing Wayside Enclosure Components

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

9.1 Grounding System

The SmartScanNG² system is equipped with components for surge and lightning protection of the equipment attached to it. However, if the attachment to the earth grounding system isn't made correctly, the surge protection equipment may not work as designed, resulting in damaged or destroyed system components.

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

As a minimum, **two driven ground rods** should be installed at opposite corners of the wayside enclosure (aka bungalow) in which the SmartScanNG² detector 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.

NOTE:

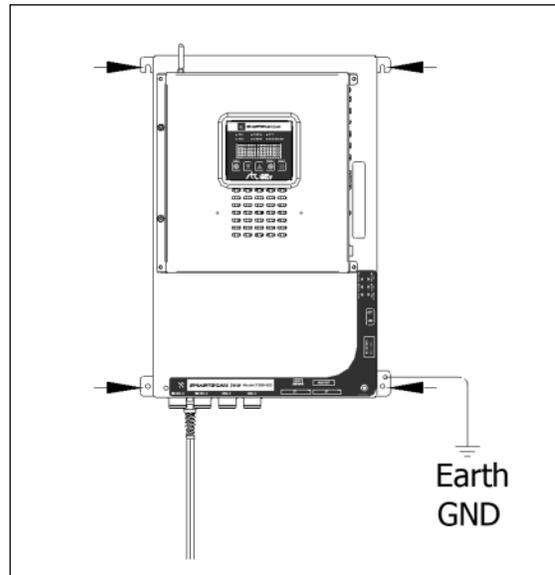
Some railroads specify the use of four 5/8-inch diameter copper-clad rods, one on each corner of the wayside enclosure.

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.

9.2 SmartScanNG² Detector

There is one SmartScanNG² detector per track. At double-track sites, the leftmost SmartScanNG² detector supports Track-1, and the rightmost one supports Track-2.

The SmartScanNG² detector 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 SmartScanNG² detector about 4 feet (1.2 meters) above the floor. Doing so positions it at a convenient height for installation and servicing.

Mount the SmartScanNG² within 4 feet (1.2 meters) of a grounded three-wire 110 to 120-VAC outlet. The detector chassis is provided with a 5-foot (1.5-meter) power cord. Be sure that the detector is level with the scanner connectors on the bottom.

To ground the SmartScanNG² chassis, attach one end of a 6-AWG stranded copper wire to the **ground bus** and the other end to the **ground stud** on the bottom right mounting tab.

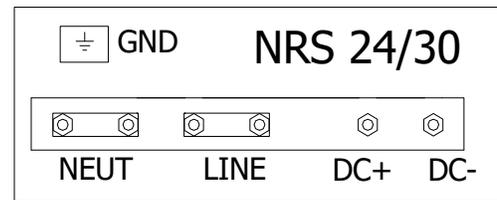
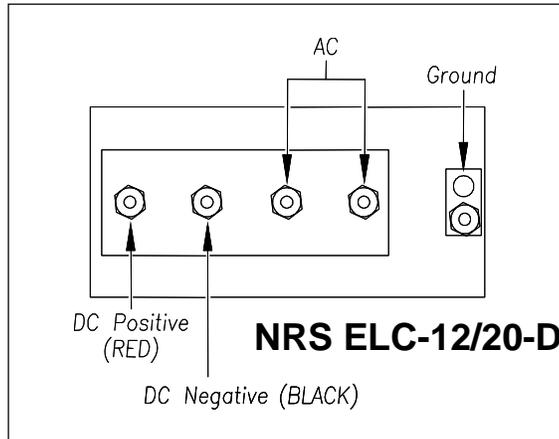
9.3 Battery Charger

Most SmartScanNG² units use the battery charger for 12 VDC systems or the NRS 24/30 for 24 VDC systems. The charger can be mounted to any suitable surface. 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 SmartScanNG² detector. 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 SmartScanNG² detector.

Be sure that the charger is level.

To ground the battery charger:

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



- 4 Attach one end of a 6-AWG-stranded copper wire to the **ground bus** and the other end to the copper **ground lug** on the right of the power connection posts.

To attach the power cord to the battery charger:

- 1 Be sure that you have on hand a wire stripper, a pliers-type crimping tool, a 1/2-inch nutdriver, and a midsize slotted screwdriver.
- 2 Remove all power to the system.
Be sure that the power cord isn't plugged into an outlet or in any other way attached to a power source.
- 3 Using a wire stripper, remove 1/4 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 not plug the just-wired power cord into an outlet or other power source.

9.4 Fuse Block

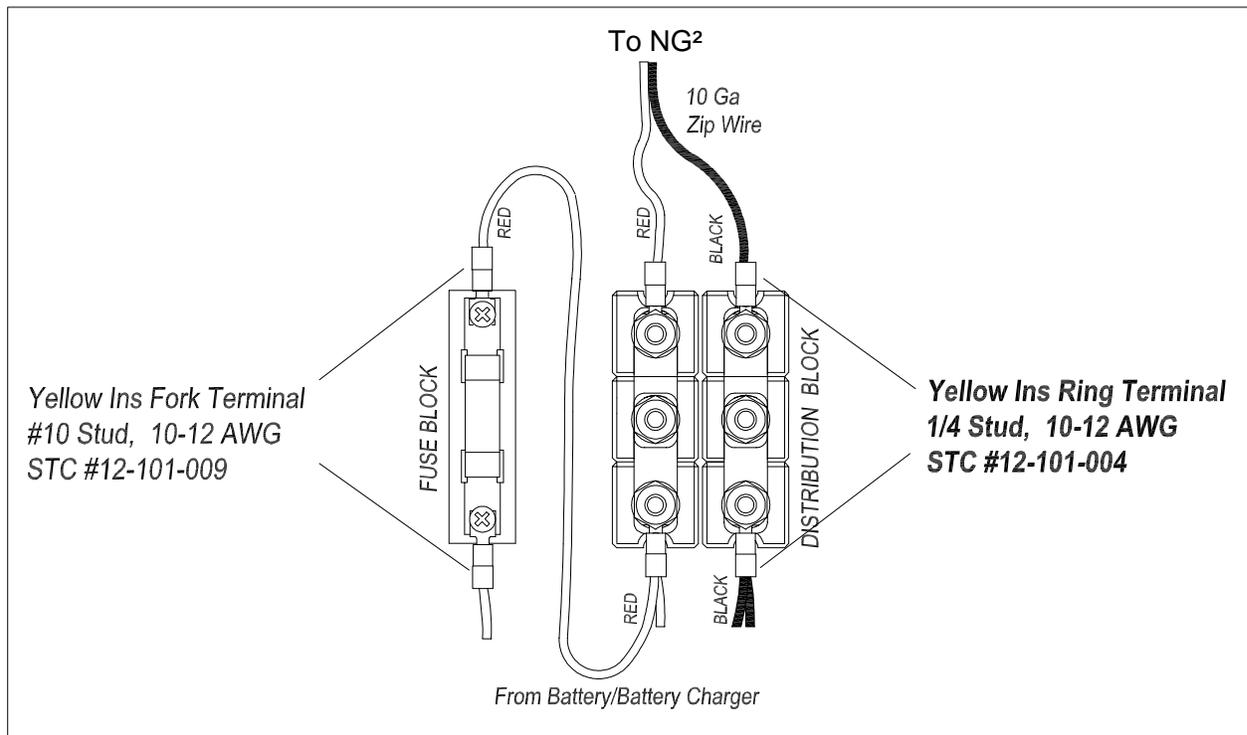
There is one fuse block per SmartScanNG² detector. To mount the fuse block and wire it to the SmartScanNG² detector:

- 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 SmartScanNG² detector. 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 AAR distribution block near the SmartScanNG² detector. 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.

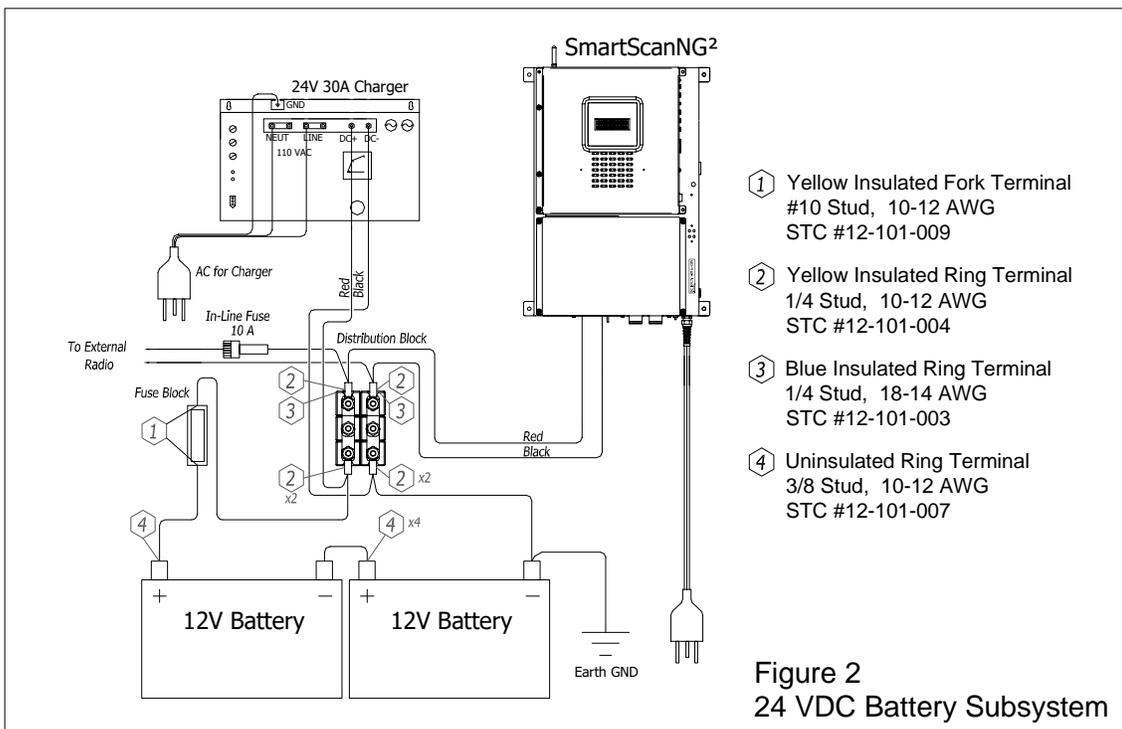
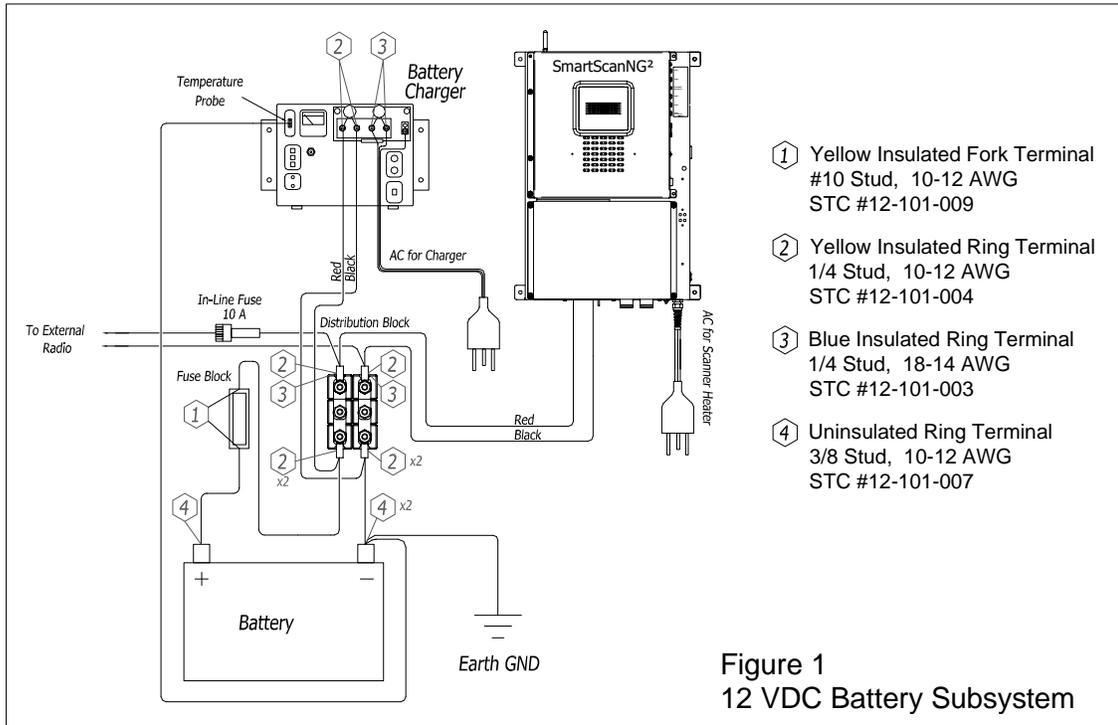
- 3 Wire the fuse block per the figure below. Connect the upper terminals of the AAR block to the power connector of the SmartScanNG² detector chassis.



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

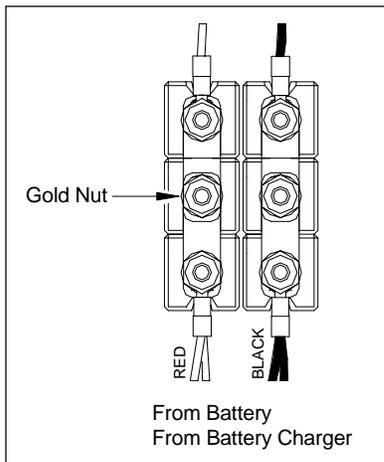
9.5 Power Subsystem

The figures below show the major parts of the power subsystem powered by 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 SmartScanNG² detector 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 the figure above.
- 4 The fuse block is wired in series between the positive battery terminal and 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 length and connect per figures 1 & 2 above.
- 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 wires to the distribution block as depicted in Figures 1 or 2.

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.

- 16 If this is a single-track site, go to the next section.
If this is a double-track site, repeat steps 1 through 16 on the second track.

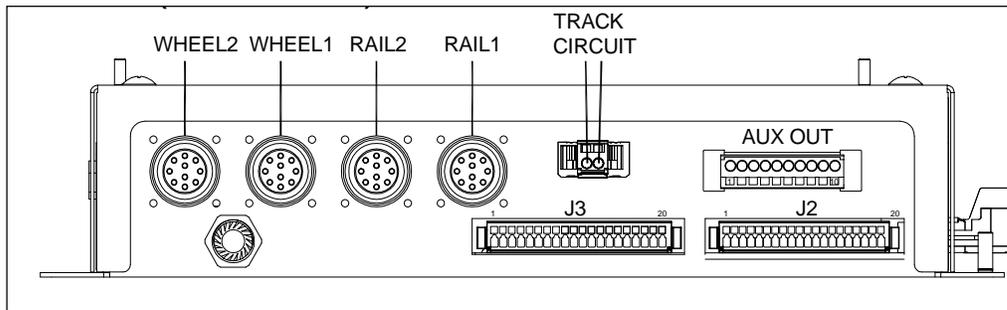
9.6 Bearing Scanners

There are two bearing scanners per track. At double-track sites, the cables from the bearing scanners on Track-1 connect to the bottom of the leftmost SmartScanNG² detector. The cables from Track-2 connect to the bottom of the rightmost SmartScanNG² detector.

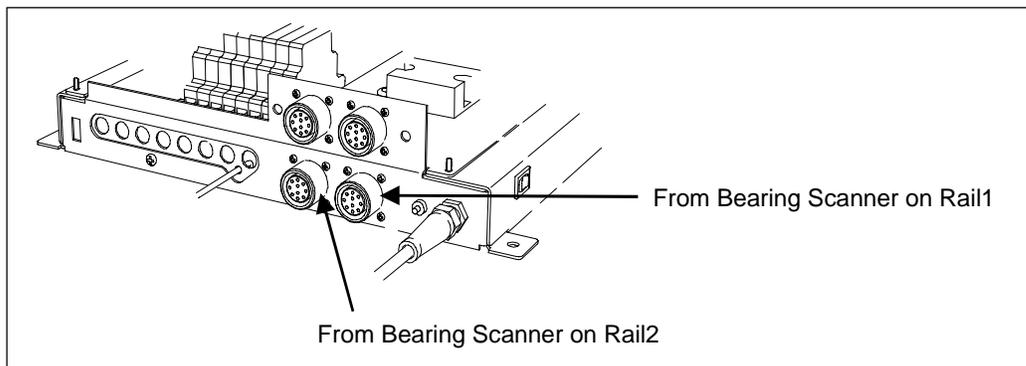
To connect the bearing scanners to the SmartScanNG² detector:

- 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-TRACK-1**, **RAIL2-TRACK-1**, **RAIL1-TRACK-2**, or **RAIL2-TRACK-2**, whichever is appropriate.

- 2 Plug the cable from the bearing scanner on rail1 (that is, from the north or east rail) into the box connector labeled Rail1.



2300-601 NG² Chassis



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- 3 Plug the cable from the bearing scanner on rail2 (that is, from the south or west rail) into the box connector labeled Rail2.
- 4 If this is a double-track site, repeat steps 1 through 3 on the second track.

9.7 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 Track-1 connect to the bottom of the leftmost SmartScanNG² chassis. The cables from the Track-2 connect to the bottom of the rightmost SmartScanNG² chassis.

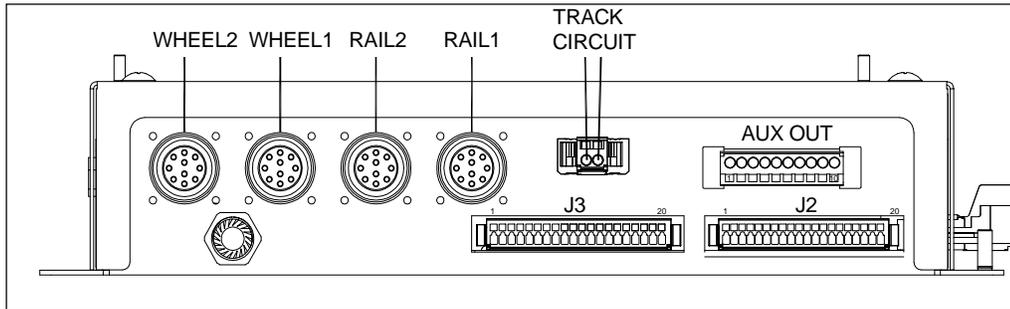
To connect the wheel scanners to the SmartScanNG² detector:

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

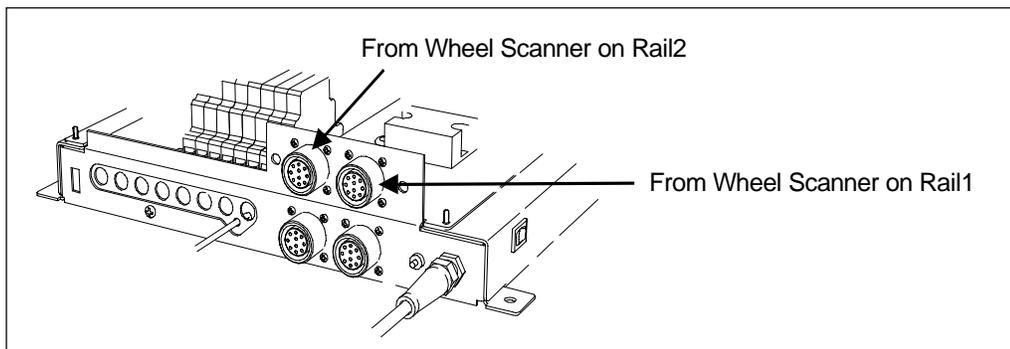
At a single-track site, the cable from the wheel scanner on rail1 should be labeled **W-RAIL1**. The cable from the wheel scanner on rail2 should be labeled **W-RAIL2**. If the track runs north and south, RAIL1 is the east rail, and RAIL2 is the west rail. If the track runs east and west, RAIL1 is the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

At a double-track site, they're labeled **W-RAIL1-TRACK-1**, **W-RAIL2-TRACK-1**, **W-RAIL1-TRACK-2**, or **W-RAIL2-TRACK-2**, whichever is appropriate.

- 2 Plug the cable from the wheel scanner on rail1 (that is, from the north or east rail) into the box connector labeled Wheel1.



2300-601 NG² Chassis



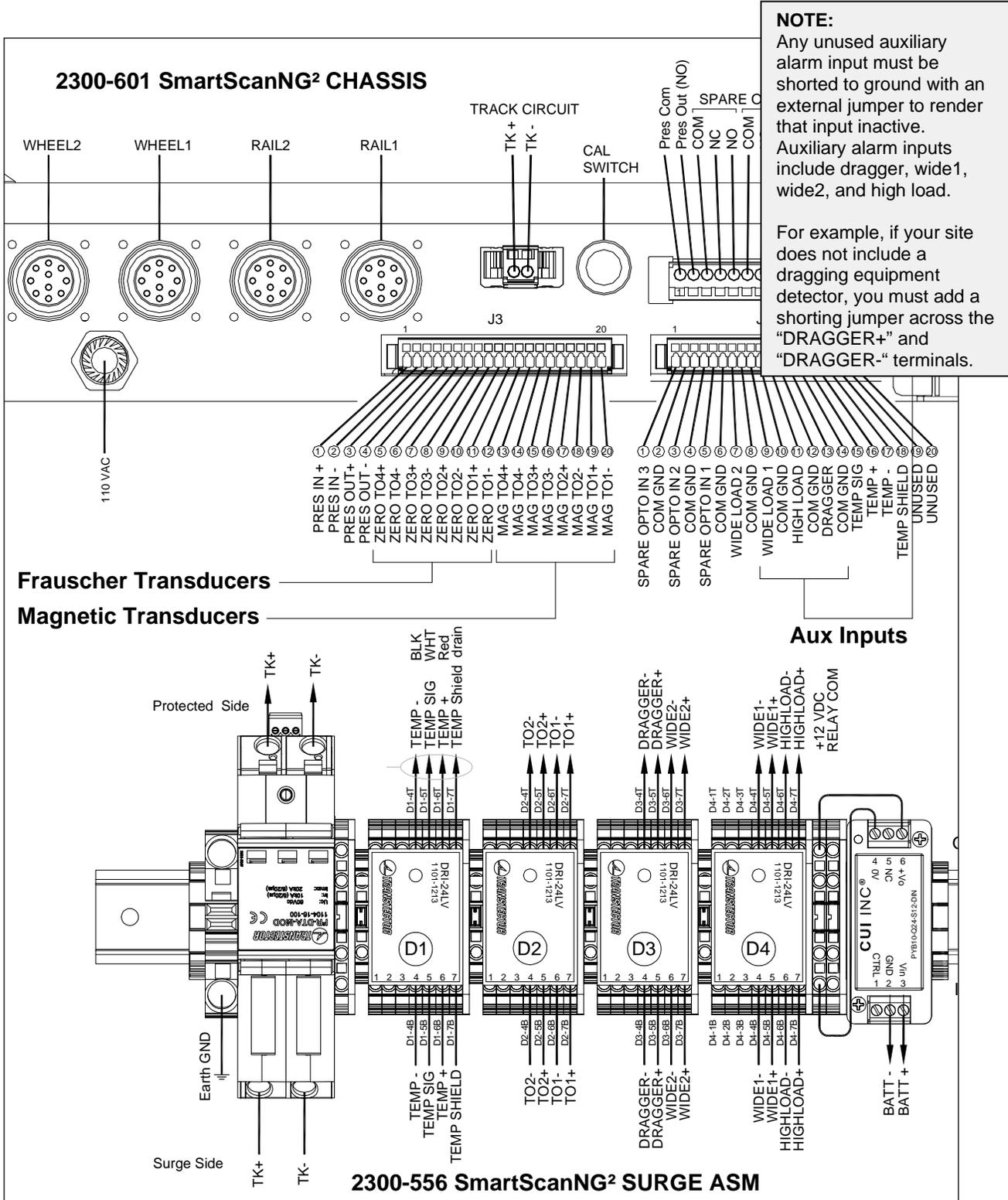
2300-501 NG Chassis

- 3 Plug the connector from the wheel scanner on rail2 (that is, from the south or west rail) into the box connector labeled Wheel2.
- 4 If this is a double-track site, Repeat steps 1 through 3 on the second track. The cables from Track-2 connect to the rightmost SmartScanNG² chassis.

9.8 Track Wiring for the 2300-601 NG² Chassis

Wiring from track hardware is typically routed through an external Surge Panel and then to the NG² Chassis Connector Panel. Refer to the connector pinouts depicted in the following figure.

If you have a 2300-501 NG Chassis, skip ahead to Section 9.9.

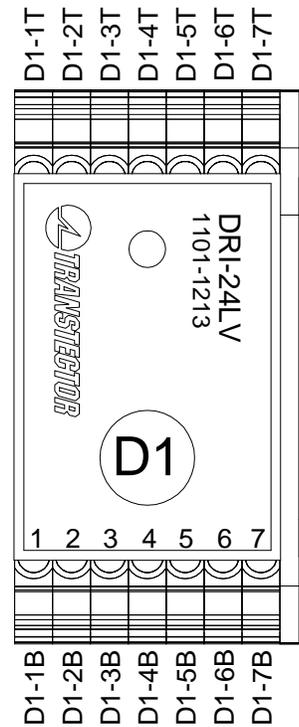


NOTE:
Any unused auxiliary alarm input must be shorted to ground with an external jumper to render that input inactive. Auxiliary alarm inputs include dragger, wide1, wide2, and high load. For example, if your site does not include a dragging equipment detector, you must add a shorting jumper across the "DRAGGER+" and "DRAGGER-" terminals.

Track Wiring to a 2300-601 NG² Chassis

DRI WIRING CHART		
SURGE PIN#	SIGNAL	NG ² PIN#
D1-4T	TEMP -	J2-17
D1-5T	TEMP SIG	J2-16
D1-6T	TEMP +	J2-15
D1-7T	TEMP SHIELD	J2-18
D2-4T	TO2-	J3-18 MAG or J3-10 ZERO
D2-5T	TO2+	J3-17 MAG or J3-9 ZERO
D2-6T	TO1-	J3-20 MAG or J3-12 ZERO
D2-7T	TO1+	J3-19 MAG or J3-11 ZERO
D3-4T	DRAGGER-	J2-14
D3-5T	DRAGGER+	J2-13
D3-6T	WIDE2-	J2-8
D3-7T	WIDE2+	J2-7
D4-4T	WIDE1-	J2-10
D4-5T	WIDE1+	J2-9
D4-6T	HIGHLOAD-	J2-12
D4-7T	HIGHLOAD+	J2-11
Dx-4T	ADV2-	J3-14 MAG or J3-6 ZERO
Dx-5T	ADV2+	J3-17 MAG or J3-5 ZERO
Dx-6T	ADV1-	J3-16 MAG or J3-8 ZERO
Dx-7T	ADV1+	J3-15 MAG or J3-7 ZERO

Example:

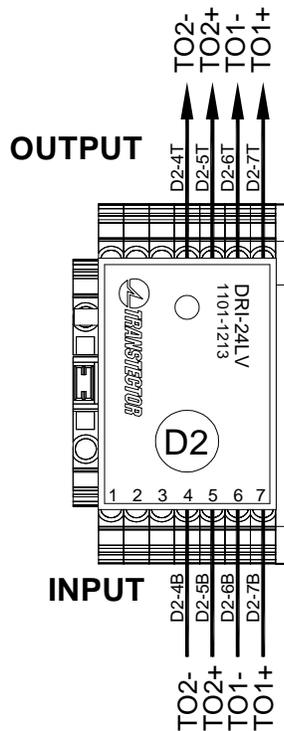


9.8.1 Gating Transducers

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

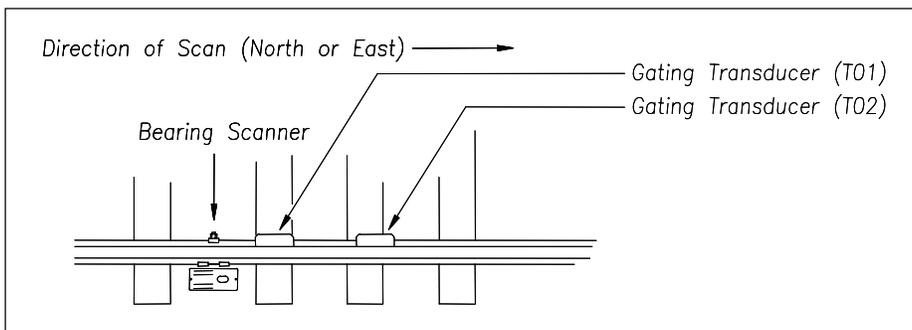
At a double-track site, they should be labeled **TO1-TRACK-1**, **TO2-TRACK-1**, **TO1-TRACK-2**, or **TO2-TRACK-2**, whichever is appropriate. At double-track sites, the wires from the gating transducers on Track-1 are routed through the surge panel of the leftmost SmartScanNG² detector. The wires from Track-2 are routed through the surge panel of the rightmost SmartScanNG² detector.

On each surge-suppression panel, there is one DRI-24 suppressor assigned to transducer **TO1** and transducer **TO2**. These suppressors protect the SmartScanNG² system from transients and surges, which can be induced onto external wiring by lightning.



NOTE: Magnetic transducers should be terminated to the corresponding MAG (magnetic) input terminal of the NG² chassis. Likewise, Frauscher transducer should be terminated to the corresponding ZERO (zero speed) input terminal of the NG² chassis

NOTE: Observe correct polarity when you connect the wires from the transducers. The polarity is correct when the transducer's white wire is connected to signal+ and the black wire is connected to signal-.



9.8.2 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-TRACK-1**, **ADV2-TRACK-1**, **ADV1-TRACK-2**, or **ADV2-TRACK-2**, whichever is appropriate. At double-track sites, the wires from the advance transducers on Track-1 connect to the leftmost SmartScanNG² detector. The wires from Track-2 connect to the rightmost SmartScanNG² detector.

9.8.3 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 Track-1 connect to the leftmost SmartScanNG² detector. The wires from Track-2 connect to the rightmost SmartScanNG² detector.

Refer to the wiring chart in **Section 9.8**.

9.8.4 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 Track-1 connect inside the leftmost SmartScanNG² detector. The wires from Track-2 connect inside the rightmost SmartScanNG² detector.

Refer to the wiring chart in **Section 9.8**.

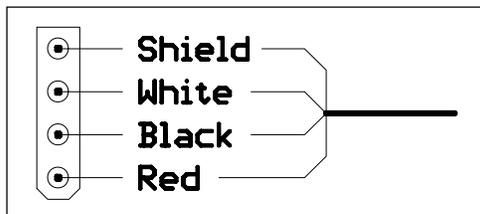
To designate High-Load alarms, YES must appear after the words High Load on the Equipment menu, and Separate must appear after the words Clearance Mode on the Equipment menu. **To designate High-Wide alarms**, YES must appear after the words High Load on the Equipment menu, and Multiplexed must appear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

9.8.5 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). Most system reports include ambient temperature (when the train passed the site).

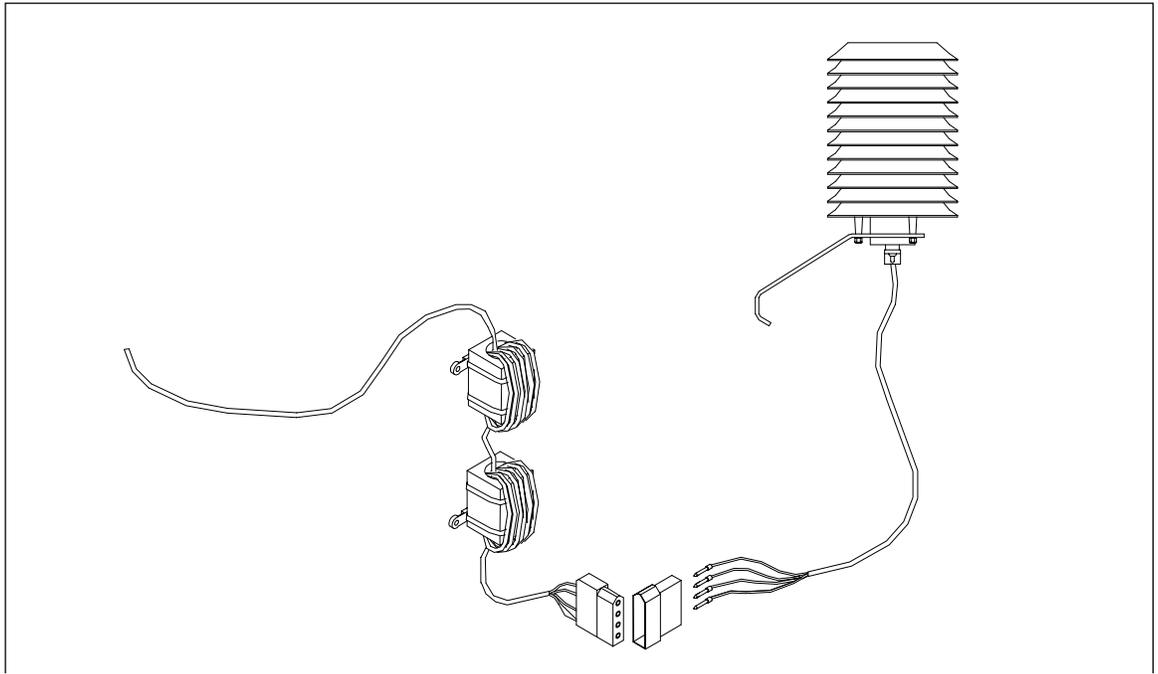
There is one shielded temperature probe per system. To install this probe:

- 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 on the side furthest from the track. This should be the side of the enclosure where the SmartScanNG² detector 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 its respective SmartScanNG² detector. 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.



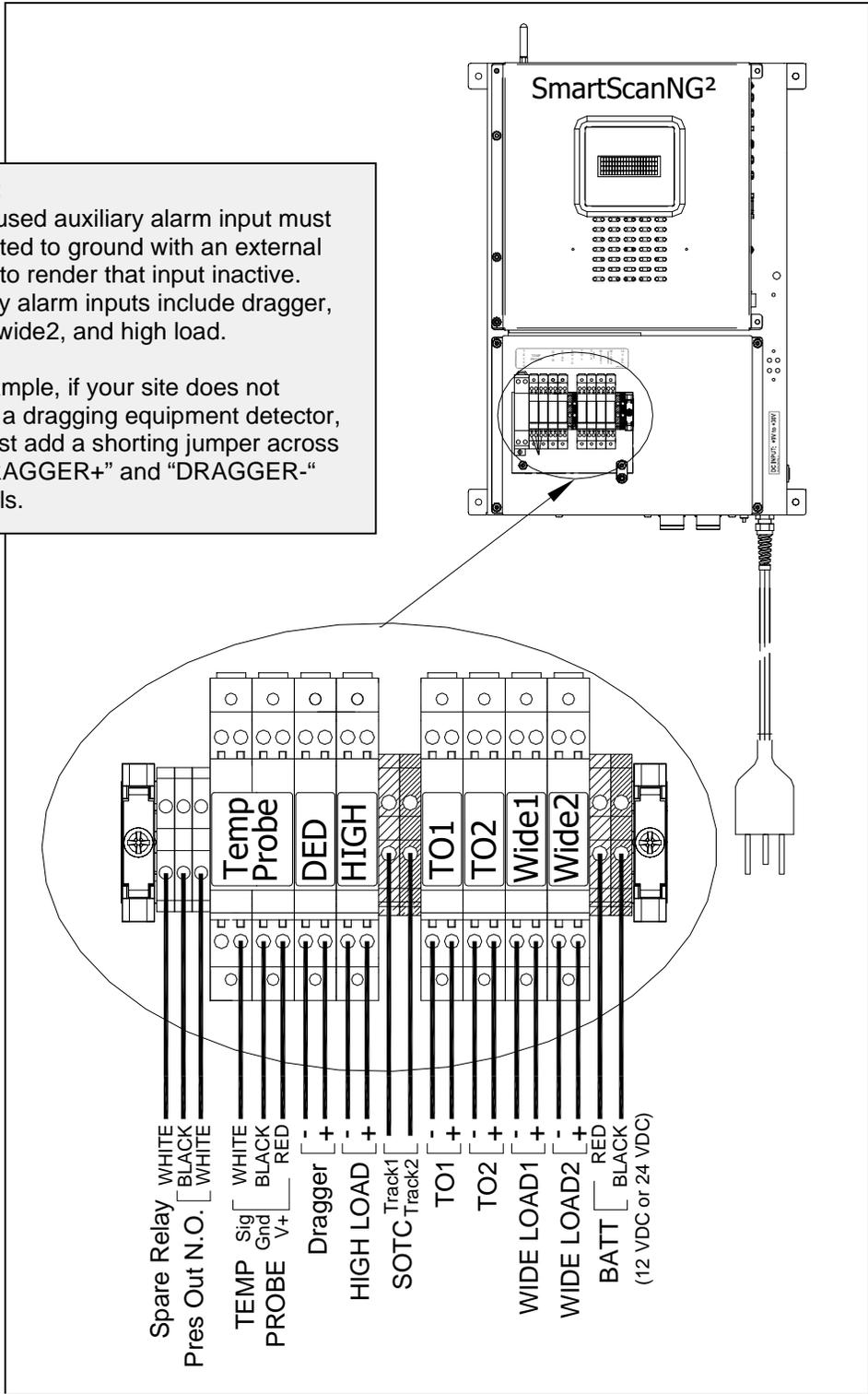
- 7** Using a wire stripper, remove 1/4 inches (6.4 millimeters) of insulation from the ends of the four wires coming from the other end of the RF-filter assembly.
- 8** Connect per the wiring chart in **Section 9.8**.
- 9** As shown above, terminate the wires from the end of the RF-filter assembly.
- 10** Mount the two filters of the RF-filter assembly to the inside wall of the wayside enclosure.

9.9 Track Wiring for the NG Chassis

Wiring from track hardware is routed through the internal Surge Panel and then to the NG Interconnect Board. Refer to the connector pinouts depicted in the following figure.

NOTE:
 Any unused auxiliary alarm input must be shorted to ground with an external jumper to render that input inactive. Auxiliary alarm inputs include dragger, wide1, wide2, and high load.

For example, if your site does not include a dragging equipment detector, you must add a shorting jumper across the "DRAGGER+" and "DRAGGER-" terminals.



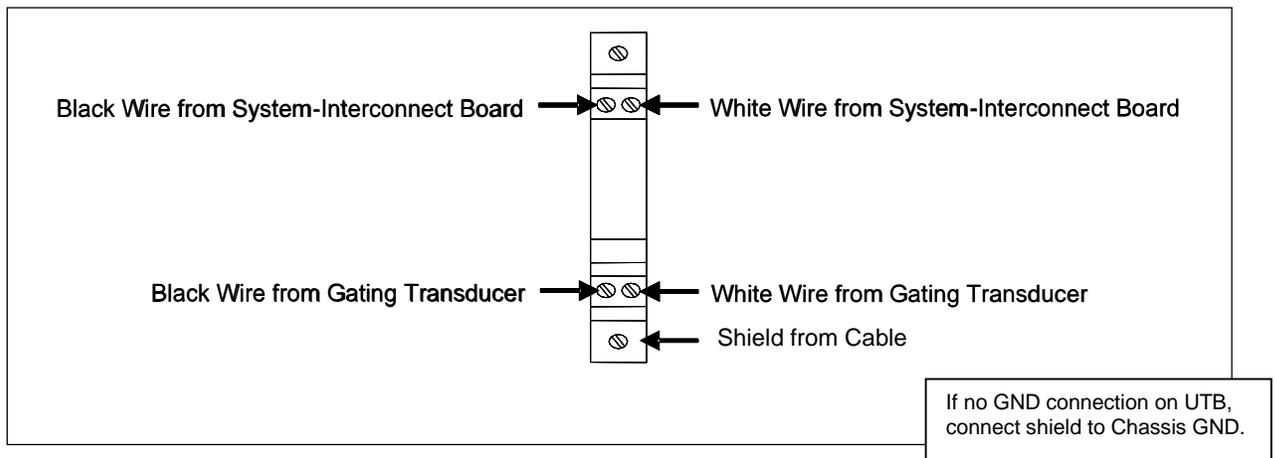
Track Wiring to a 2300-501 NG Chassis

9.9.1 Gating Transducers

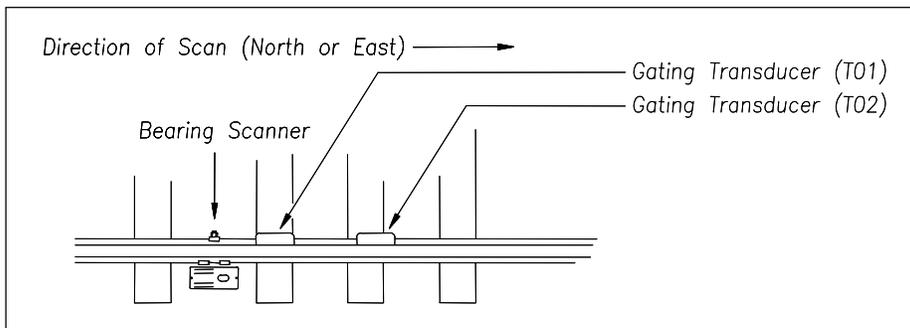
There are two gating transducers per track, each having two wires. At a single-track site, the wires from gating transducer TO1 should be labeled **TO1**. The wires from gating transducer TO2 should be labeled **TO2**.

At a double-track site, they should be labeled **TO1-TRACK-1**, **TO2-TRACK-1**, **TO1-TRACK-2**, or **TO2-TRACK-2**, whichever is appropriate. At double-track sites, the wires from the gating transducers on Track-1 connect inside the leftmost SmartScanNG² enclosure. The wires from Track-2 connect inside the rightmost SmartScanNG² 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 SmartScanNG² system from transients and surges, which can be induced onto external wiring by lightning. Each UTB has two rows of connectors. The wires from each gating transducer terminate to the bottom row of its respective UTB. The top row of connectors is prewired at the factory to TS3 on the System-Interconnect board.



Observe the 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 the top of the UTB, and the transducer's black wire is connected directly under the existing black wire at the top of the UTB. Connect **TO1** first and **TO2** second. **TO2** is the northmost or eastmost gating transducer.

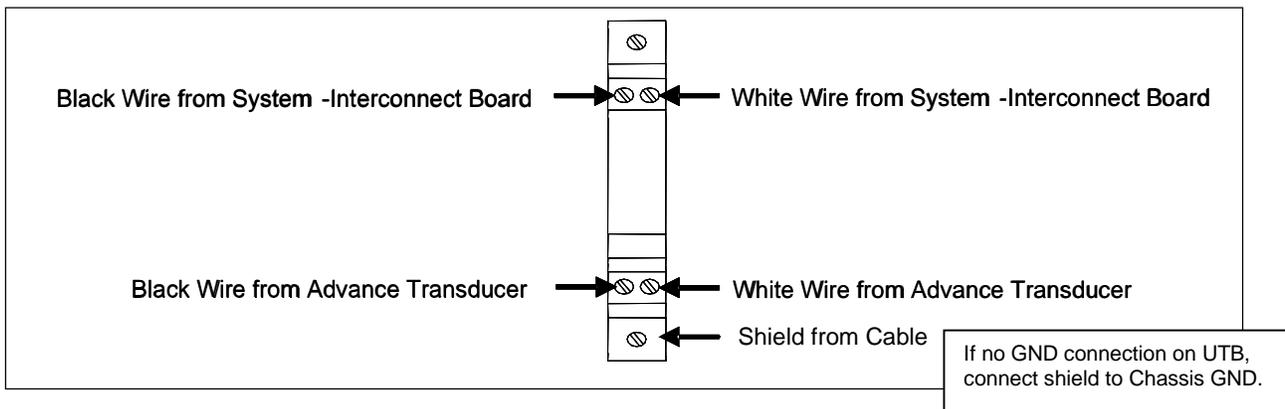


9.9.2 Advance Transducers

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-TRACK-1**, **ADV2-TRACK-1**, **ADV1-TRACK-2**, or **ADV2-TRACK-2**, whichever is appropriate. At double-track sites, the wires from the advance transducers on Track-1 connect inside the leftmost SmartScanNG² enclosure. The wires from Track-2 connect inside the rightmost SmartScanNG² enclosure.

On each surge-suppression panel, there is one UTB assigned to transducer **ADV1** and another to transducer **ADV2**. These UTBs protect the SmartScanNG² system from transients and surges, which can be induced onto external wiring by lightning. Each UTB has two rows of connectors. The wires from one advance transducer terminate to the bottom row of connectors. The top row of connectors is prewired 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 the top of the UTB, and the transducer's black wire is connected directly below the existing black wire at the top of the UTB. Connect **ADV1** first and **ADV2** second. **ADV1** is the advance transducer to the right of the gating transducer **TO2**. **ADV2** is the one to the left of gating transducer **TO1**.

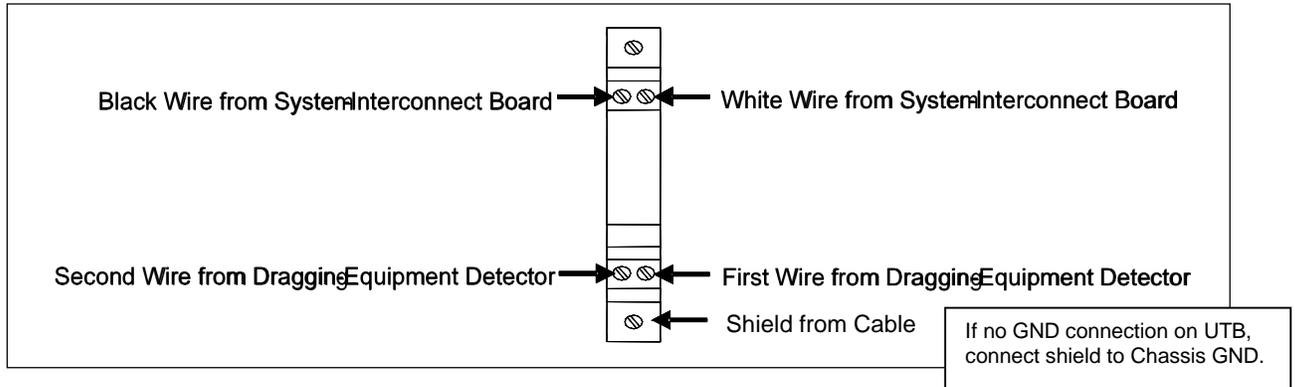
9.9.3 Dragging-Equipment Detector

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 Track-1 connect inside the leftmost SmartScanNG² enclosure. The wires from Track-2 connect inside the rightmost SmartScanNG² enclosure.

On the DIN rail assembly, the UTB labeled **DED** is for the dragging-equipment detector. This UTB protects the SmartScanNG² system from transients and surges, which can be induced onto external wiring by lightning. The UTB has two rows of connectors. The wires from the dragging-equipment detector terminate to the bottom row of connectors. The top row of connectors is prewired 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 the top of the UTB, and the other wire should be connected directly below the existing black wire at the top of the UTB.

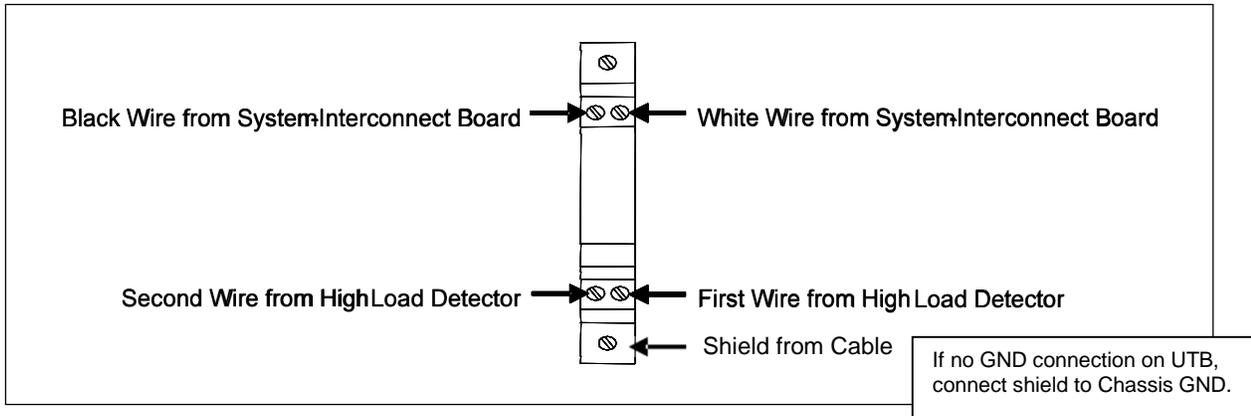
9.9.4 High-Load/High-Wide Detector

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 Track-1 connect inside the leftmost SmartScanNG² enclosure. The wires from Track-2 connect inside the rightmost SmartScanNG² 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 SmartScanNG² system from transients and surges, which can be induced onto external wiring by lightning. The UTB has two rows of connectors. The wires from the high-load/high-wide detector terminate to the bottom row of connectors. The top row is prewired 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 Equipment menu.

9.9.5 Shielded Temperature Probe

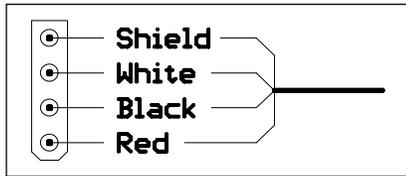
The temperature probe is encased in a radiation shield that shields it from direct sunlight and allows ambient air to flow through and around it. The probe mounts to the outside wall of the wayside enclosure and provides accurate temperature indications over a range of -45°C to +65°C (-49°F to +149°F).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

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 on the side furthest from the track. This should be the side of the enclosure where the SmartScanNG² 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 its respective SmartScanNG² enclosure.

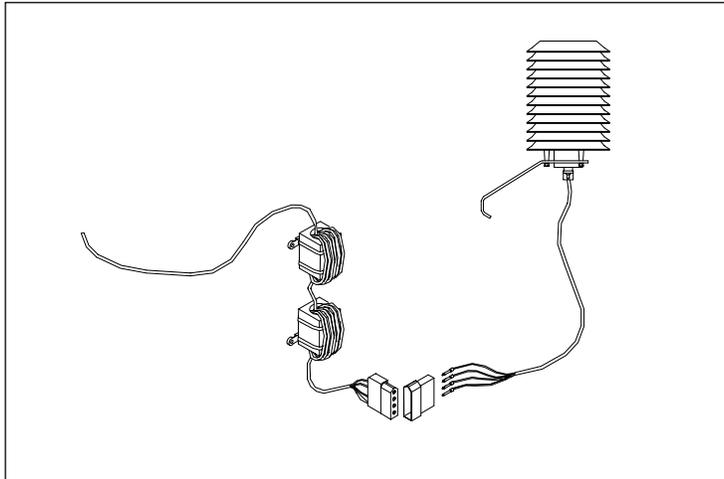
In sheet metal, use a rubber grommet in every hole through which you route the cable.

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



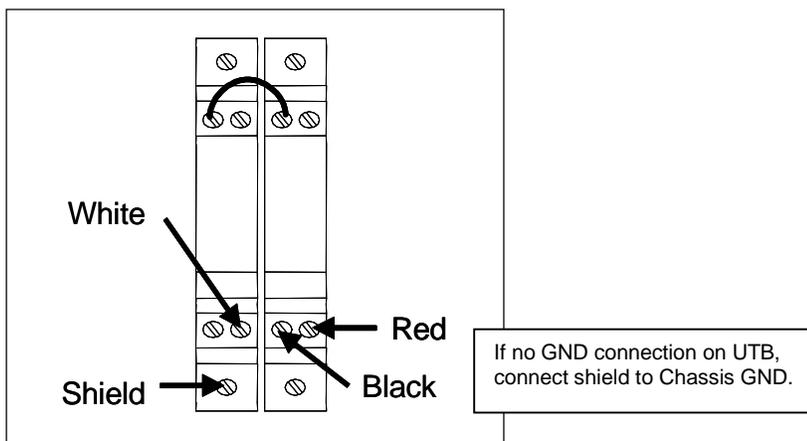
The red wire supplies 12 VDC to the shielded temperature probe.

- 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.



- 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.

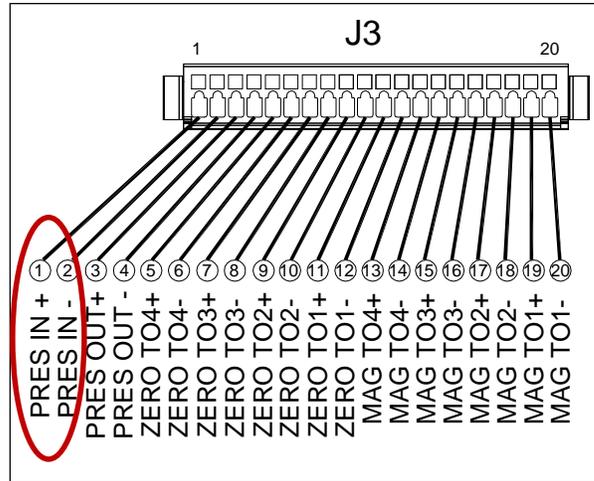
On the DIN rail assembly, the two UTBs labeled **TempProbe** are for the shielded temperature probe. Each UTB has four rows of connectors. As shown below, the wires from the shielded temperature probe terminate at the bottom row of connectors. The top connectors on these UTBs are prewired at the factory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



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

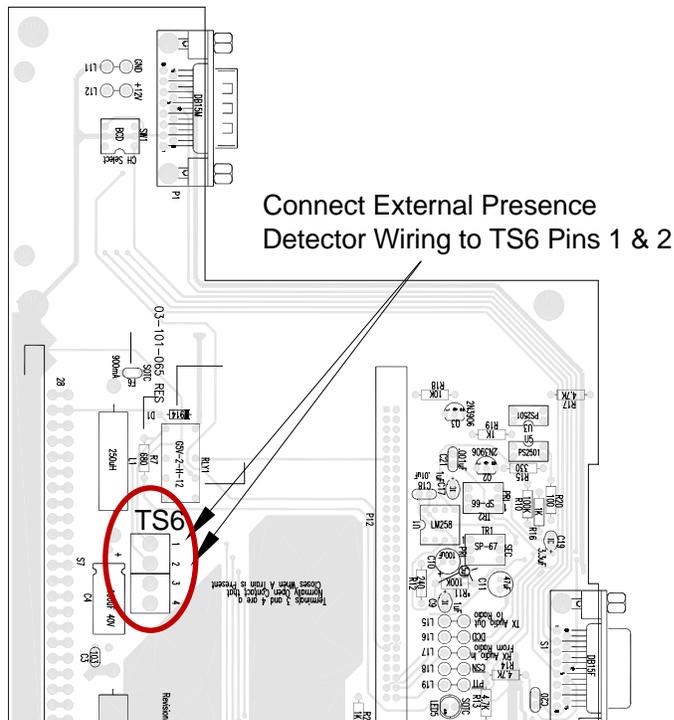
9.10 External Presence Detector (optional)

The 2300-601 NG² Chassis provides inputs for an external presence signal. “Presence In” wiring connects to J3-1 and J3-2 on the connector panel. A dry contact closure input is needed to indicate train presence and activate the detector system.



2300-601 NG² Chassis – Bottom Panel

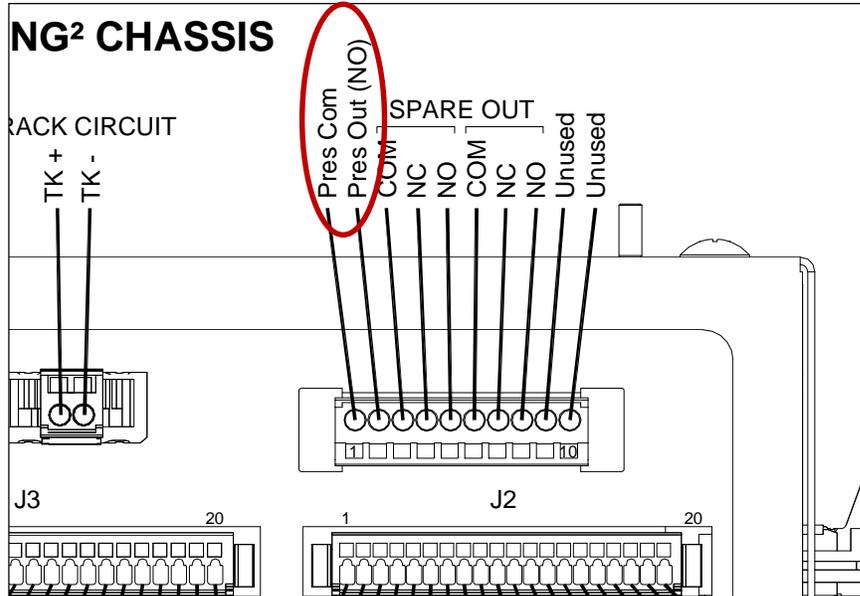
The 2300-501 NG Chassis also provides inputs for an external presence subsystem. Terminals 1 and 2 of TS6 can connect to an external train sensing device if the NG chassis does not have an internal Audio Overlay Track Circuit. A dry contact closure is needed to activate the detector system.



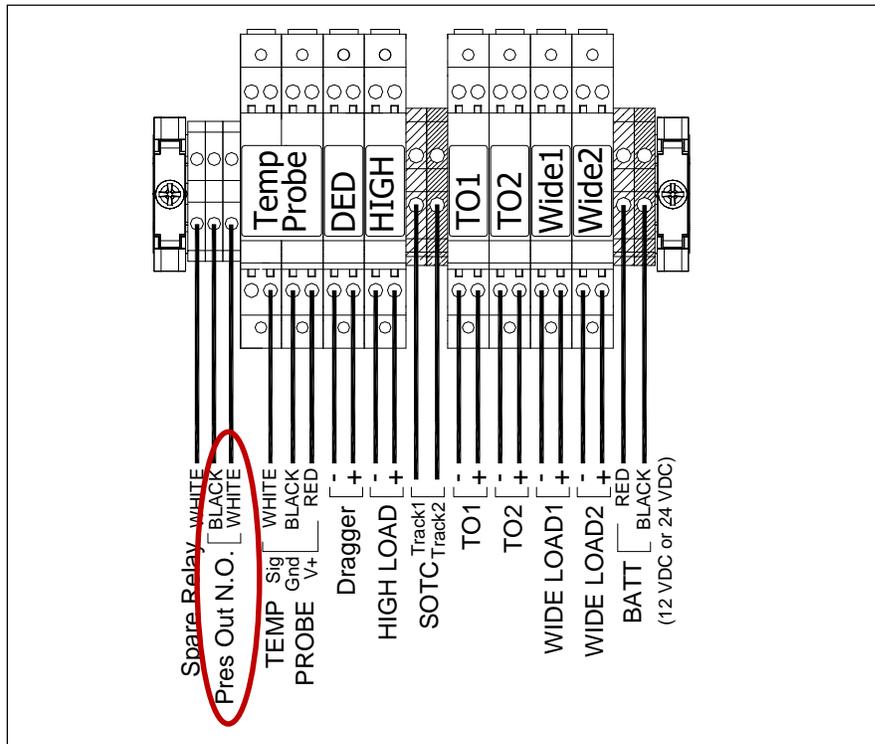
2300-501 NG Chassis – Interconnect Board

9.11 Presence Out

The Presence Out signal can be used to drive an external relay that activates additional equipment upon train arrival. "PRES OUT" contacts (normally open) are provided in the AUX Connector on the 2300-601 NG² Chassis and on the Surge Panel of the 2300-501 NG Chassis.



2300-601 NG² Chassis – Bottom Panel



2300-501 NG Chassis – Surge Panel

9.12 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 Track-2 don't need to have their own radio. Instead, they can use the radio that supports Track-1 (see Section 2.3.4)

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 the roofline.

- 2** Route the coaxial cable from the antenna mounting base to the SmartScanNG² detector.

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

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

- 4** Connect this plug to the type-N jack on the top of the SmartScanNG² detector.

The detector chassis is equipped with a type-N jack. For those using a PL-259 UHF plug, a UHF-to-type-N adapter is included with the shipment.

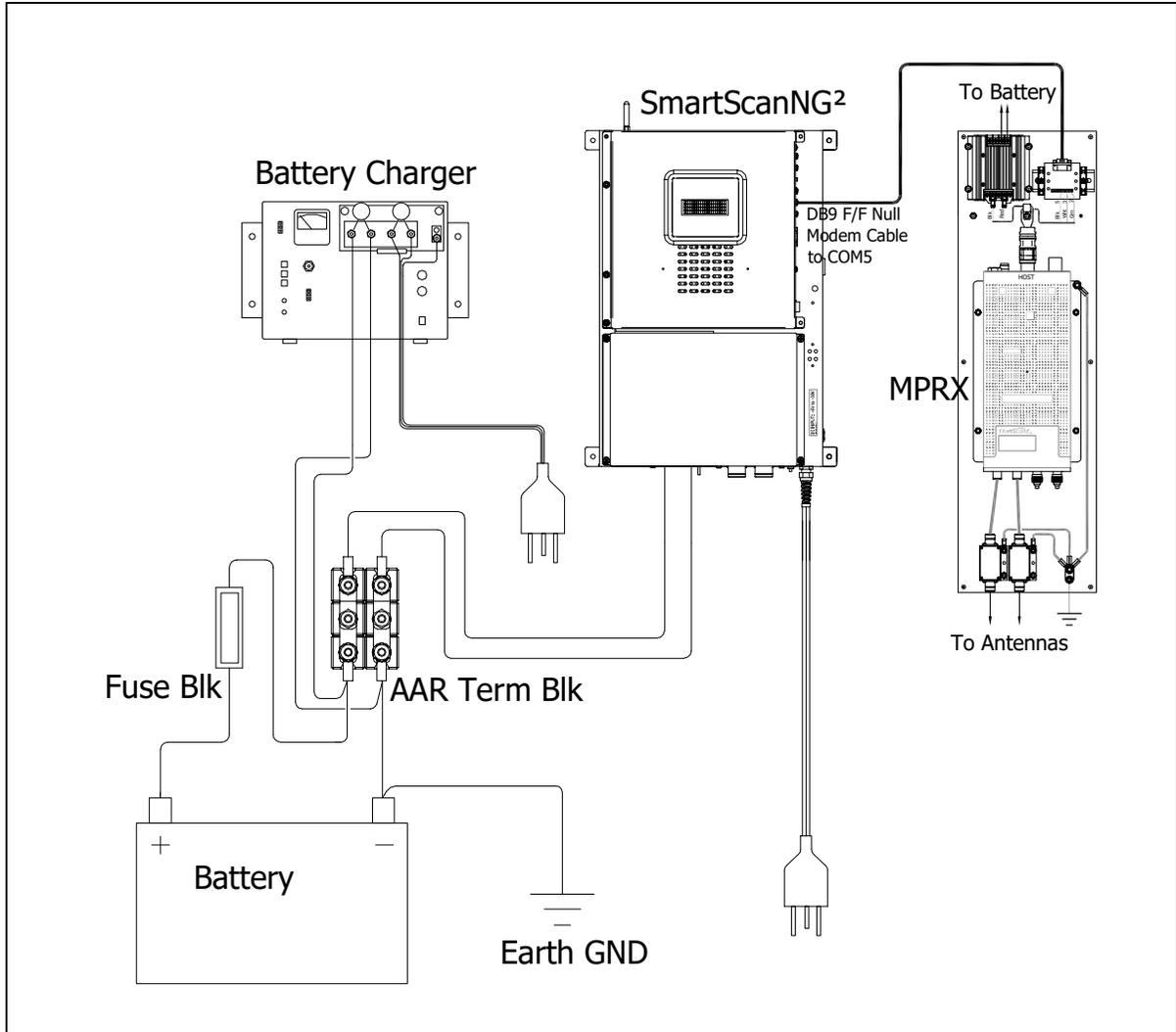
- 5** If this is a double-track site, repeat steps **1** through **4** for the radio in the other SmartScanNG² detector.

9.13 MPRR/MPRX Panel

Not all sites use an MPR(x) Panel. If your site doesn't use one, skip ahead to the next section.

Mount the panel next to the SmartScanNG² detector.

Refer to drawings below - attach power wires from the battery to the DC-DC converter of the panel. Attach the serial communications cable (Dsub9F to Dsub9F null) to **COM5** of the Controller module (2300-602). Attach the coaxial cables coming from the AEI antennas to their respective Joslyn surge protectors (aka Joslyn coaxial lightning arresters).



NOTE: The MPR(x) Panel should be tied to earth ground. To do this, connect an appropriately sized ground wire to the ground connector on the panel.

10.0 Placing a System into Service

This section describes all the tasks that need to be completed before placing a SmartScanNG² system into service.

10.1 Checking the Trackside Components

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

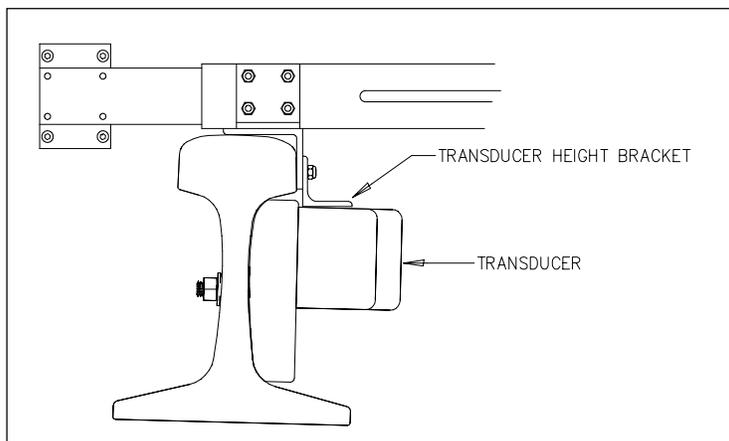
- 1 Be sure that you have on hand a tape measure, a #2 Phillips head screwdriver, a small slotted screwdriver, a 9/16-inch deep-well socket, a torque wrench, a laptop computer, a multimeter, and the alignment fixture.
- 2 At trackside, check track conditions on all tracks. If any track is pumping (vertical 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 is 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, replaced them 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 and 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.

10.2 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 9.0 - 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 9.1- Grounding System tells how to ground the SmartScanNG² system properly.

- 3 Check that all wayside enclosure components are installed properly.
- 4 Inside the wayside enclosure, check that there are no loose wires or cables.

10.3 Powering-up the SmartScanNG² System

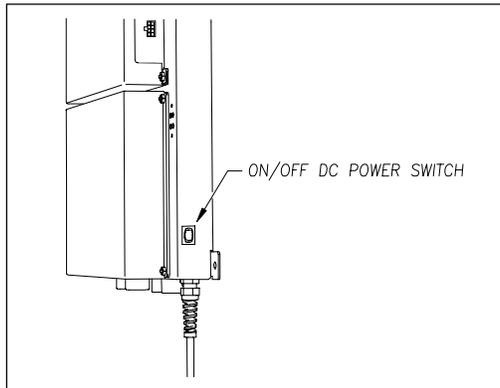
To power up the SmartScanNG² system:

- 1 If plugged in, unplug the SmartScanNG² detector 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 SmartScanNG² detector doesn't have an AC power switch and needs to be disconnected from its AC power source to stop AC from entering the detector. However, it does have a DC power switch.

- 2 If toggled on, toggle off the DC power switch on the right edge of the SmartScanNG² chassis.



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

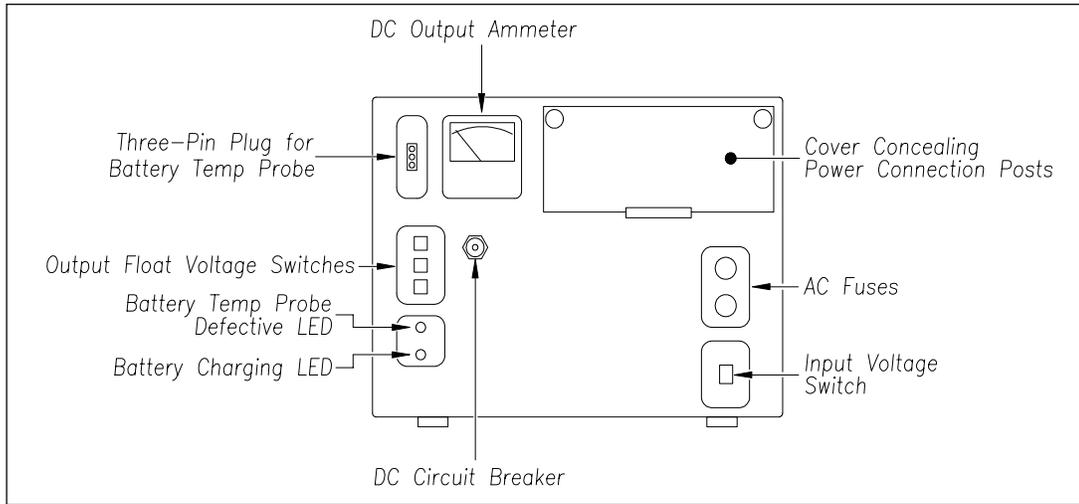
The next two steps assume your site uses 110-120 VAC. If your site uses 220-250 VAC, skip the next two steps. If your site uses any other AC voltage, skip all the steps below and call STC for help.

- 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.

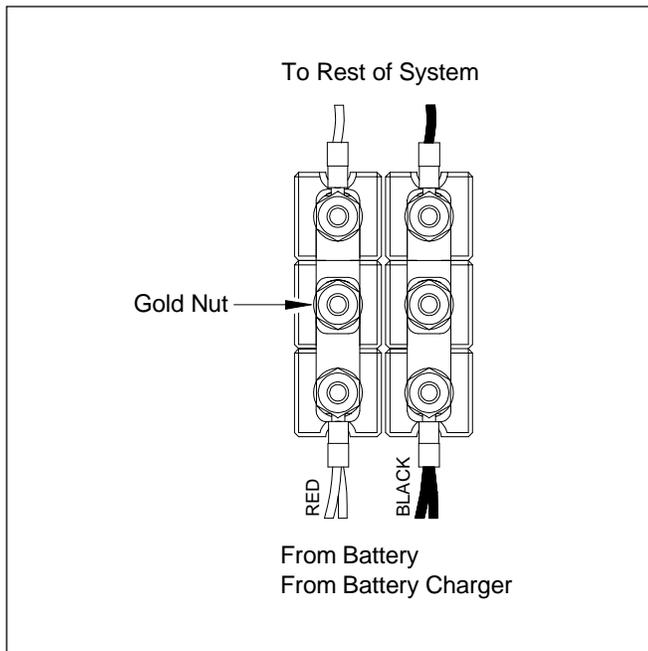
There are vents on the top, bottom, and sides of the charger. Blocking any of these vents could result in damage to the charger or battery.

- 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** Set float voltage to the desired setting. Factory default settings are 14.00 VDC for a 12V system and 28.0 VDC for a 24V system. [If using GNB batteries, set the charger based on the number of cells times the cell voltage listed on the GNB battery.]
- d** Open the small door cover on the top-right corner. Check that all binding-post nuts are tight and that all wiring is correct.
- e** If loose, tighten the middle gold nuts on the distribution block.



- 6 Plug in the SmartScanNG² detector and the battery charger.

WARNING

Plugging the power cord at the bottom of the SmartScanNG² detector 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 a battery explosion with a dispersion of casing fragments and corrosive liquid electrolyte. So, carefully follow the manufacturer's instructions for installation and service. Keep all sources of gas ignition away from the batteries and do not allow metallic articles to contact the negative and positive terminals of a battery at the same time.

WARNING

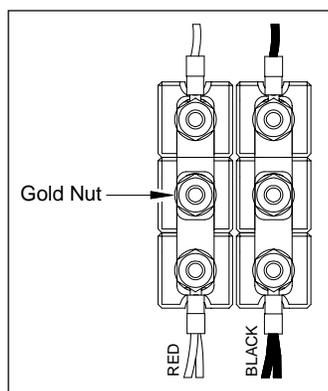
A damaged or aged battery, in combination with the connected battery charger, can pose a serious health threat. The battery can produce hydrogen sulfide gas, which is characterized by its unique "rotten egg" smell. So, when a strong sulfurous odor is detected, remove power to the battery charger and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

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

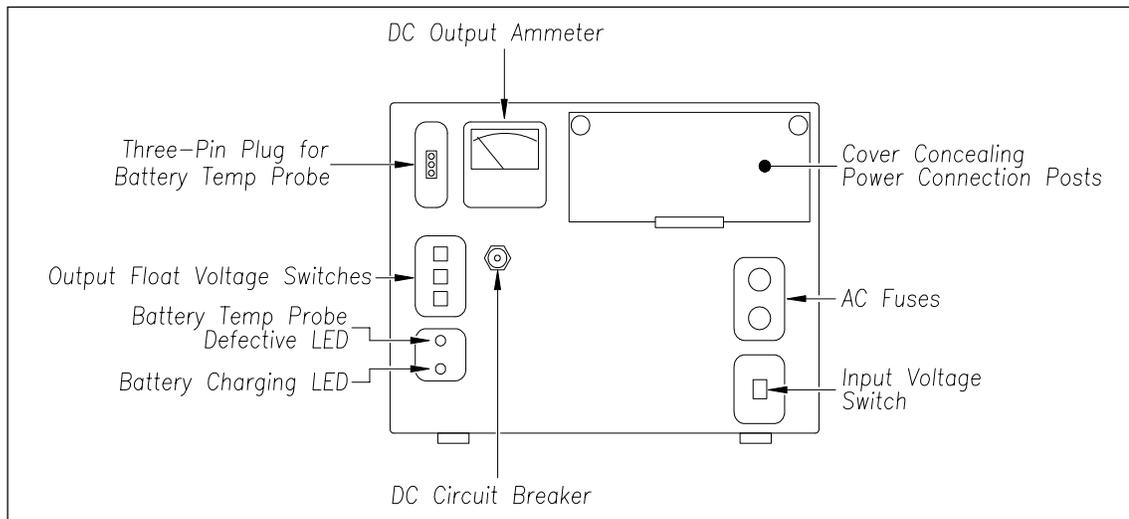
- 7 On the front of the battery charger, if the red defective-temperature-probe LED is lit, fix the underlying problem before proceeding.
- 8 Switch the multimeter to the DC volts scale.

The SmartScanNG² detector is directly wired to the **equipment side** of the distribution block. The **battery side** of the distribution block is wired to the battery.

- 9 Touch the leads from the multimeter across the terminals on the equipment side of the distribution block.



- 10** If the voltage on the equipment side of the distribution block is 12.7 through 14.5 VDC (25.4 through 29.0 VDC for a 24V system), go to step **14**.
- 11** If the voltage (on the equipment side of the distribution block) is 0 VDC:
- a** Touch the positive lead to the battery side of the fuse block.
 - b** If the 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 the 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 the voltage is less than 12.7 VDC (25.4V for a 24-volt system):
- a** On the battery charger, check the AC fuses to see if either is blown.

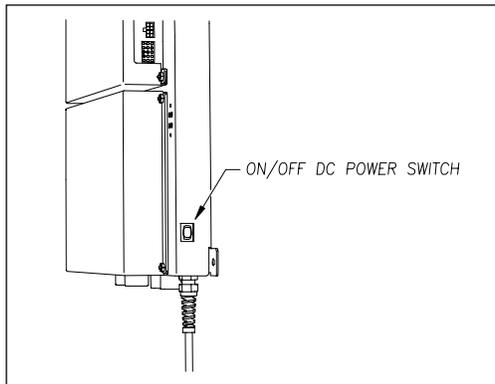


- b** If need be, replace with 4-amp 250-volt fast-acting fuses.
- c** On the battery charger, check the DC circuit breaker to see if it is open (tripped).
When closed, about 0.09 inch (0.23 centimeters) of the breaker's button is seen.
When open, the button is popped out, showing about 0.25 inch (0.64 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, which may indicate that the battery is defective and should be replaced.

13 If the voltage is greater than 14.5 VDC (on a 12V system), cut all power to the SmartScanNG² system and call STC for help in fixing this problem.

14 Toggle on the DC power switch on the right edge of the SmartScanNG² detector.



15 Wait 30 seconds.

16 On the display panel, look at the COP LEDs.



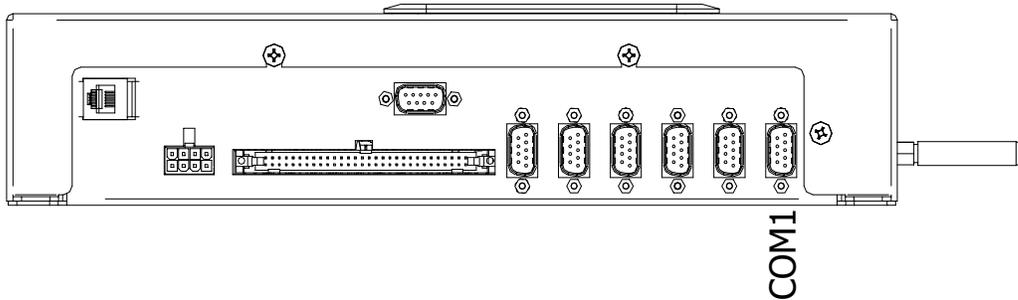
The COP-A and COP-B LEDs indicate the general health of each processor. If both the analyzer processor and the communications processor are running their programs correctly, their LEDs blink on and off. If a program isn't operating as expected, the LED for the affected processor is lit solid or isn't lit at all.

17 If either or both of the COP LEDs are lit solid or aren't lit at all, call STC for help in fixing this problem.

10.4 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 using a 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 communication settings are 19200 N-8-1.

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.

```
Main Menu - Comm
-----
      .
      .
      .
[J] - Event log
[K] - System Functions Menu
[L] - Replay train
[M] - Security Menu
[X] - Exit
```

- f Select Auto-Calibration to open the shutters.

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

```
System Functions Menu
-----
[A] - Radio Test
[B] - Vocabulary Test
[C] - Radio Inhibit
[D] - Start Manual Train
[E] - 1KHz Test Tone
[F] - Auto-Calibration
[G] - Remote System RESET
[H] - Delete All Stored Train Data
[I] - Clear Event Log
[J] - Get DHCP address
[K] - Update Menu
[M] - View maintenance statistics
[N] - Reset System Health
[O] - Maintenance email list
[R] - Volume up (3)
[S] - Volume down (3)
[T] - Web security settings
[X] - Exit
```

- g In each scanner, check if its shutter opened.
- 2 If any shutter didn't open, fix this problem before proceeding.
 - 3 In each scanner, inspect optics and clean if necessary.
 - 4 If the date and time displayed on the top of the System Functions menu are incorrect, fix them before proceeding.
 - 5 To return to the Main menu, type **X**.
 - 6 To exit the serial interface and return the system to normal operation, type **X**.
 - 7 If this is a double-track site, repeat steps 1 through 7 for the other SmartScanNG² system.

10.5 Calibrating Scanners

The SmartScanNG² 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.

10.5.1 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 the setpoint, the heat source isn't operating properly.

To calibrate the bearing scanners:

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

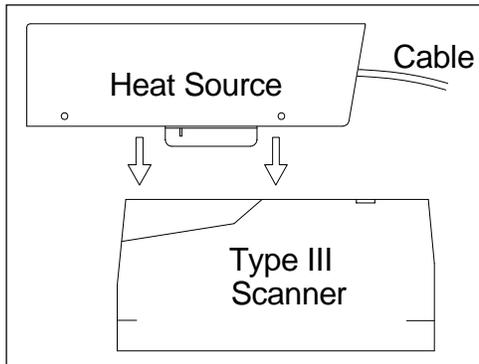
Sixty Hz is critical for proper operation. For a site that doesn't have a 120-volt 60-Hz power source, the heat source should be powered from a true sine wave inverter capable of 250 watts with an output of at least 110 volts at 60 Hz. The inverter should operate from an input voltage of 10.5 VDC to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

WARNING

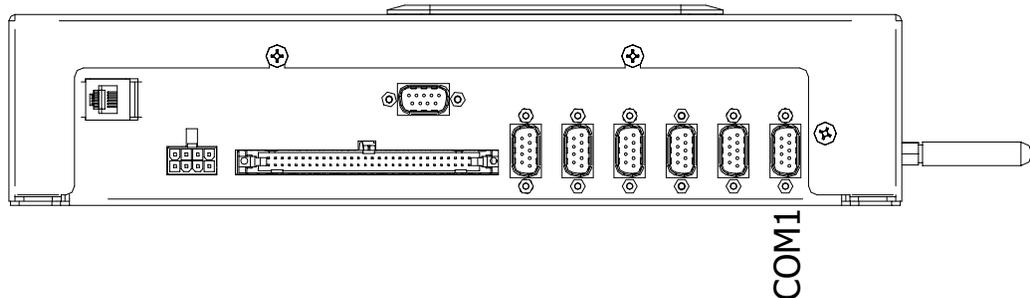
Once plugged in, both function connectors will have live AC present.

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

- 8 Wait about 8 minutes for the heat source to reach operating temperature and stabilize.
The heat source has reached operating temperature and stabilized when the temperature meter needle remains centered.
Once the temperature stabilizes, calibration may begin. Once stabilized, the temperature will change less than plus-or-minus one degree Fahrenheit.
- 9 Take the calibrated heat source to the bearing scanner on the north or east rail.
- 10 With the power cord to the rear of the scanner, place the calibrated heat source on the bearing scanner.



- 11 To prepare your computer:
 - a Plug your computer into COM1 using a 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 communication settings are 19200 N-8-1.
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.

NOTE: The following menu screenshots depict a typical NG² system. They may not exactly match your system. Refer to your Operators Guide for a more accurate representation of your User Interface.

Using the serial interface, display the Main menu.

The Main menu looks like this.

```
Main Menu - Comm
-----
      .
      .
      .
[K] - System Functions Menu
[L] - Replay train
[M] - Security Menu
[X] - Exit
```

12 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.

```
System Functions Menu
-----
[A] - Radio Test
[B] - Vocabulary Test
[C] - Radio Inhibit
[D] - Start Manual Train
[E] - 1KHz Test Tone
[F] - Auto-Calibration
[G] - Remote System RESET
[H] - Delete All Stored Train Data
[I] - Clear Event Log
[J] - Get DHCP address
[K] - Update Menu
[M] - View maintenance statistics
[N] - Reset System Health
[O] - Maintenance email list
[R] - Volume up (3)
[S] - Volume down (3)
[T] - Web security settings
[X] - Exit
```

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

13 Select Auto-Calibration.

The SmartScanNG² 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 something 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.

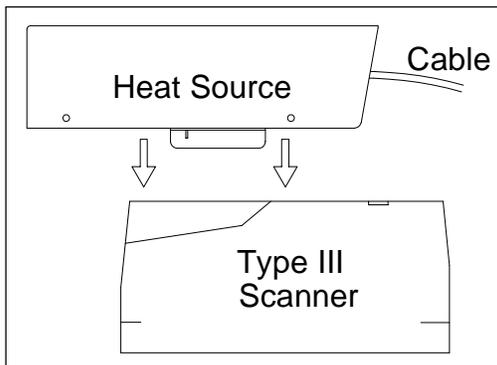
```

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 of 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.

- 14 When "Auto-Calibration Disengaged" is displayed on your computer, remove the calibrated heat source.
- 15 Take the calibrated heat source to the bearing scanner on the south or west rail.
- 16 With the power cord to the rear of the scanner, place the calibrated heat source on the bearing scanner.



- 17 Repeat steps 14 through 15.
- 18 To return to the Main menu, type **X**.
- 19 To exit the serial interface and return the system to normal operation, type **X**.
- 20 If this is a double-track site, repeat steps 1 through 20 for the second track.

10.5.2 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 the setpoint, the heat source isn't operating properly.

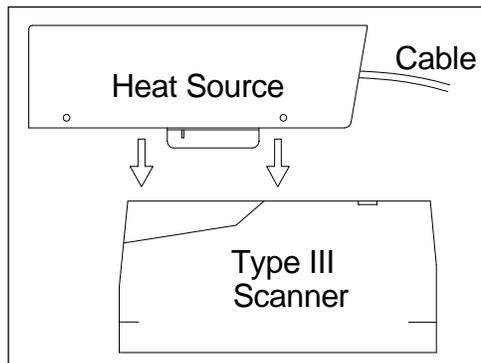
To calibrate the wheel scanners:

- 1 Be sure that you have an STC calibrated heat source (2100-810NG) and a laptop computer on hand. The wheel scanner calibration procedure is the same as that for a bearing scanner.

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 rear of the scanner, place the calibrated heat source on the north or east wheel scanner.



- 3 Begin autocalibration. Refer to 10.5.1 Bearing Scanners for details.
- 4 Select Auto-Calibration from the **System Functions** menu.

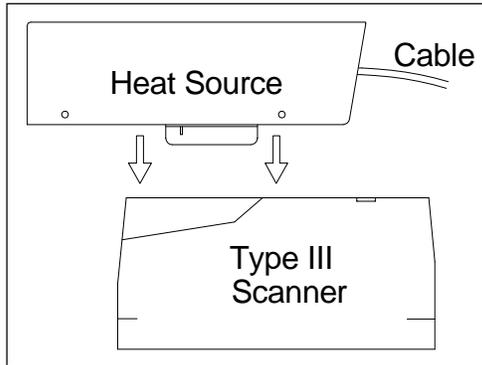
The SmartScanNG² system will now calibrate itself. **Follow along on your computer screen until you see "Auto-Calibration Disengaged."** This message is an indication that the system is done with the calibration procedure. To abort the process, press **[Esc]** on your computer or remove the heat source 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 \pm 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.

- 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 rear 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.

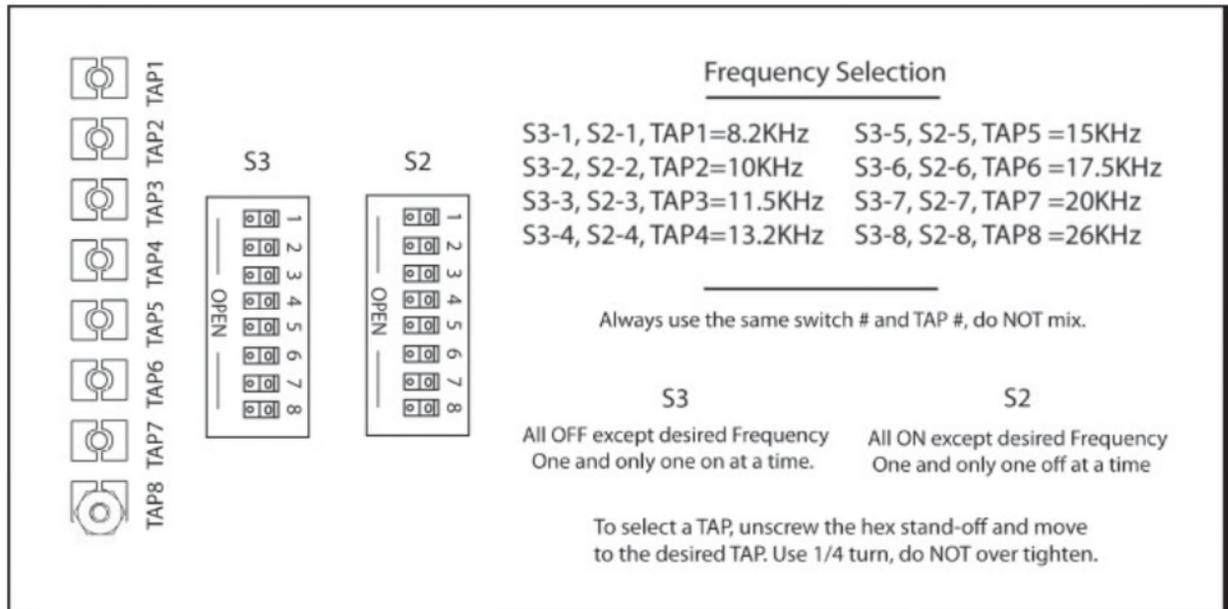
Before continuing, be sure that for each wheel scanner that the red filter frame is securely in place, that the hole on top of the wheel scanner cover is facing the center of the track, and that the four socket-head-cap screws on the weather cover are completely tight.

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

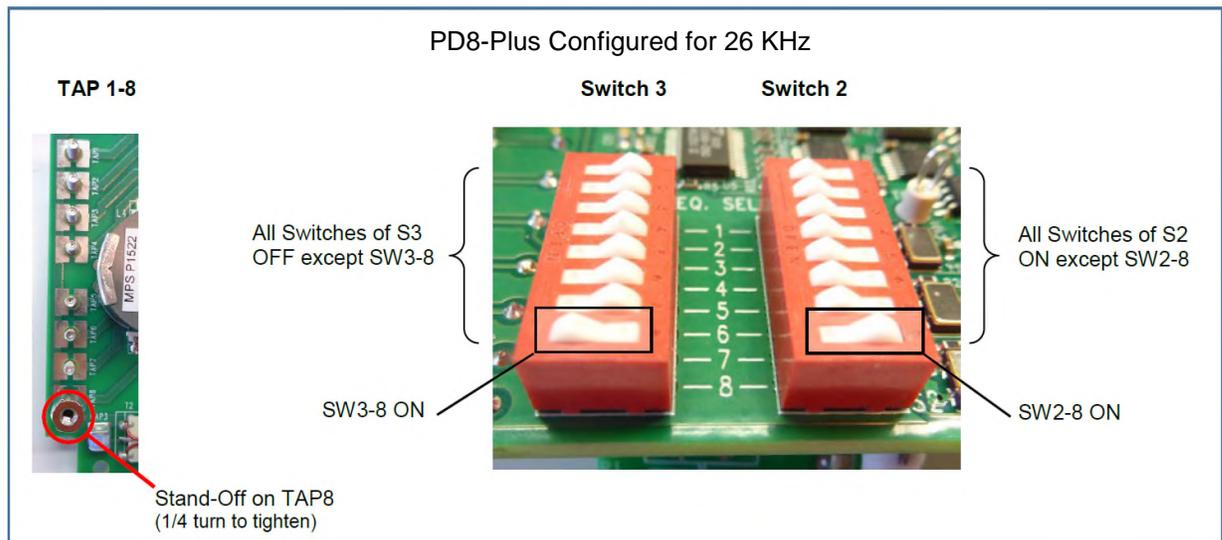
10.6 Configure the Drive Frequency of a PD8-Plus

The Zepic PD8-Plus module is capable of outputting the following track drive frequencies: 8.2K, 10K, 11.5K, 13.2K, 15K, 17.5K, 20K, 26KHz. These track frequencies can be configured in the field without the need of specialized tools. The figure below details the switch and TAP setting required to configure the unit for each frequency.

Note: Perform the calibration procedure after changing the track frequency.



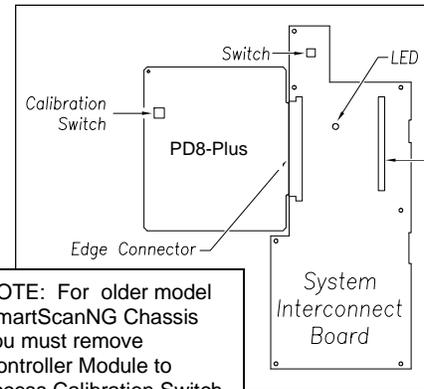
Example:



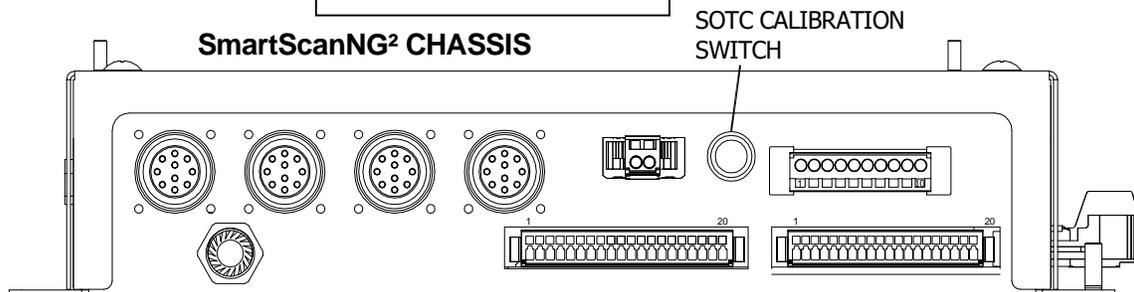
***NOTE:** Older model track circuit boards have a fixed drive frequency and are not configurable.

10.7 Calibrating the PD8-Plus Presence Detector

1. Obtain track & time authority.
2. From the center of the gating transducers, measure the distance you want the track circuit to pick up the presence of a train.
3. The recommended distance is at least 50' (15.24 m) and no more than 150' (45.7 m).
4. At the point just measured, place a 0.06Ω shunt across both rails. The track must be shunted before the calibration switch is pressed.
5. Press and HOLD the Calibration Switch until the relay drive LED starts blinking. Release the switch, 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.



NOTE: the relay drive LED is the same as the SOTC LED visible on the lower right side of the NG² Chassis cover.



6. 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. After calibration, lift the shunt, and the relay drive should drop (LED off). Replace the shunt, and the relay drive will pick up (LED on).
2. Move the shunt approximately 10' farther out from the calibration point. The relay drive should not pick up (LED stays off). If this test fails, perform Short Track Calibration (detailed below).
3. The PD8-Plus is now operating properly and will activate at an equal distance on either side of the track feed point.
4. After trackside calibration procedures have been successfully completed, place a temporary shunt across the track wires inside the bungalow and verify that the signal system goes to stop. Once verified, remove the temporary shunt.

IMPORTANT: To ensure an accurate activation point, always place the shunt BEFORE pressing the Calibration Switch.

If the PD8-Plus 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 Calibration Switch), allowing you to troubleshoot the track circuit, wiring, and battery. Once the issue has been corrected, repeat the calibration procedure.

Both the ZEPIC III and Zepic PD8-Plus have a two-wire track circuit and will activate an equal distance on both sides of the track feed point.

PD8-Plus Short-Track Circuit Calibration

1. The system may fail the 10 ft calibration verification step noted above if the installation is using 26KHz and the desired CAL point is ~30ft from the feed points (Short track circuit), and the bungalow is near the track (short track wires).
2. If this is the case, reconfigure the PD8-Plus to a lower frequency that is compatible with other equipment that may be on the track. In general, changing from 26KHz to 20KHz or 17.5KHz should solve the short-track circuit calibration issue.
3. Once the module has been reconfigured for the new operating frequency, repeat the normal calibration procedure detailed above.

PD8-Plus Troubleshooting and Application Notes

1. If the unit will not calibrate, watch the relay drive LED for approx 45 seconds. If it blinks, this means the PD8-Plus has turned its receiver gain to the maximum setting and cannot see the track shunt. Look for open circuits between the PD8-Plus and the shunt on the track. I.e., track wires, bond wires, etc.
2. The PD8-Plus will look equally in both directions. If one side of the circuit has insulated joints, the PD8-Plus will operate. However, the activation distance will not be the same. In general, track circuit equipment cannot see past insulated joints.
3. Audio overlay systems like the PD8-Plus will not work with wideband shunts in their track circuit range.
4. If the relay drive is stuck ON, look for short circuits between the PD8-Plus and the desired pick point.
5. The greater the distance between the PD8-Plus and track connections, the greater the effects ballast will have on the PD8-Plus performance.
6. Presence output is a dry contact configuration Form –C dry contact, 225mA max current. (N.O. contact with no train presence)
7. In good track ballast conditions, a PD8-Plus circuit can travel up to 500 ft in each direction. Rotating operating frequencies to avoid interference with other equipment is recommended.
8. The higher the operating frequency, the shorter the track circuit.

10.8 Checking the Broadcast

The **Radio Test option** on the System Functions menu is used to broadcast a short message through the speaker and over 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 over the radio. Using either of these options allows you to verify that the speaker and radio are working properly.

To check the operation of the speaker and the radio:

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

The Main menu looks like this.

```
      .
      .
      .
[I] - Setup
[J] - Event log
[K] - System Functions Menu
[L] - Replay train
[M] - Security Menu
[X] - Exit
```

- 2 Select the **System Functions** menu.

This prompt appears.

```
System Functions Menu
-----
[A] - Radio Test
[B] - Vocabulary Test
[C] - Radio Inhibit
[D] - Start Manual Train
[E] - 1KHz Test Tone
[F] - Auto-Calibration
[G] - Remote System RESET
[H] - Delete All Stored Train Data
[I] - Clear Event Log
[J] - Get DHCP address
[K] - Update Menu
[M] - View maintenance statistics
[N] - Reset System Health
[O] - Maintenance email list
[R] - Volume up (3)
[S] - Volume down (3)
[T] - Web security settings
[X] - Exit
```

- 3 Select the **Volume up** or **Volume down** options of the System Functions menu to adjust the speaker volume.
- 4 To start outputting either the phrases or the tones, select **Radio Test** or **1KHz Test Tone**.

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

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

- 5 While listening to the message or tone, look at the display panel.

The **PTT 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 **PTT LED** isn't lit and the radio is inhibited, wait three minutes and return to step 4.
- 7 If the **PTT LED** 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 SmartScanNG² system.

10.9 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 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 Using the serial interface, display the Main menu.

The Main menu looks similar to this.

```
      .
      .
[J] - Event log
[K] - System Functions Menu
[L] - Replay train
[M] - Security Menu
[X] - Exit
```

- 2 Select the **System Functions** menu.

```
System Functions Menu
-----
[A] - Radio Test
[B] - Vocabulary Test
[C] - Radio Inhibit
[D] - Start Manual Train
      .
      .
```

- 3 Select the **Volume up** or **Volume down** options of the System Functions menu to adjust the speaker volume.
- 4 From the System Functions menu, select **Vocabulary Test**.

This message appears.

```
Vocabulary test started
```

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 SmartScanNG² system.

10.10 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 similar to this.

```

      .
      .
      .
[J] - Event log
[K] - System Functions Menu
[L] - Replay train
[M] - Security Menu
[X] - Exit

```

2. Select the **System Functions** menu.

```

System Functions Menu
-----
[A] - Radio Test
[B] - Vocabulary Test
[C] - Radio Inhibit
[D] - Start Manual Train
[E] - 1KHz Test Tone
      .
      .
      .

```

3. From the System Functions menu, select **Start Manual Train**.

A prompt like this appears.

```

Manual train started.

Train Arrival

Train Departure

```

In Manual Train Mode, the system opens all the shutters and simulates transducer pulses for about one minute. During this time, a person can check various aspects of the installed components. In this mode, the system runs the ramp function without generating heats. The train is marked as a test train. There won't be any voltage applied to the scanner inputs.

Manual Train Mode is a timed test that should gate approximately 164 simulated axles. You can stop this test by selecting the Stop Manual Train option.

The data generated for this test train is stored in the Test Train directory, which contains data on the last test train only. The Last Test Train report gets its data from this directory.

There will be an arrival message broadcast through the speaker only. During the test train, the TO1 & TO2 LEDs on the Display Panel will flash with each simulated axle.

After about a minute, the post-train announcements will be broadcast over the speaker.

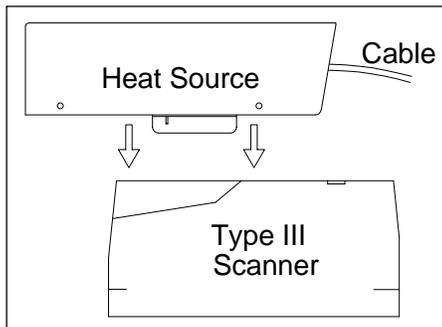
4. To generate a test train to check hot bearings:

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 the setpoint, the heat source isn't operating properly.

a. Ready the calibrated heat source.

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

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



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

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

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

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

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

If you do not hear anything, no alarm-level heat was recorded. No measurable heat from a bearing scanner may be due to loose connections, a scanner not being connected to the bottom of the SmartScanNG² detector, a defective shutter motor in the scanner, or a damaged scanner.

- f. If you do not hear any Hotbox alarms being announced, fix this problem before proceeding.
- g. If the Hotbox alarms are announced for the wrong side, switch the bearing scanner connections on the bottom of the SmartScanNG² detector.
- h. Repeat the test, this time placing the calibrated heat source on the bearing scanner on the opposite rail.
- i. Verify the results as before.
If the results are correct, your system should function properly when scanning the bearings of real trains.
- j. Remove the calibrated heat source.
- k. If this is a double-track site, repeat steps **1** through **10** for the other SmartScanNG² system.
- l. Store the calibrated heat source and its power cord in the wayside detector.

10.11 Setting Transducer Gain

The Equipment menu shows whether the transducer-gain setting is normal or high. Regardless of the setting, the SmartScanNG² 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, which 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 similar to this.

```

      •
      •
      •
[H] - Test Menu
[I] - Setup
[J] - Event log
[K] - System Functions Menu
[L] - Replay train
[M] - Security Menu
[X] - Exit

```

2 Select the **Setup** menu.

If the Setup menu is password-protected, a prompt similar to this appears.

```
You are not logged in with admin privileges
Enter 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 not password protected, the Setup menu appears. Also, after you type the password correctly for a password-protected Setup menu, the Setup menu appears.

```
Setup Menu
-----
[A] - Date and Time
[B] - MP/KP
[C] - Alarm Settings
[D] - Equipment Settings
[E] - Messages Settings
      .
      .
      .
```

3 Select **Equipment** menu.

```
      .
      .
[J] - Winter Cycle ..... NO
[K] - Transducer Gain ..... Normal
[L] - AEI ..... NO
      .
      .
      .
```

The Equipment menu shows whether the transducer-gain setting is normal or high.

- 4 If the **Transducer Gain option** on the Equipment menu is set to Normal, go to step 6.
If the **Transducer Gain option** on the Equipment menu is set to High, select the option to toggle the setting from High to Normal. The **Transducer Gain option** on the Equipment menu changes, and the Equipment menu reappears.
- 5 To leave the Equipment menu and return to the Setup menu, type **X**.
- 6 To leave the Setup menu and return to the Main menu, type **X**.
Changes to the system parameters aren't reflected until after you have exited the Setup menu.
- 7 To exit the serial interface and return the system to normal operation, type **X**.
- 8 Leave the SmartScanNG² detector 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 SmartScanNG² 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.

10.12 Doing the Final Activities

To do the final activities:

When possible, STC recommends that at least 20 trains have passed over the site before placing the system into service. You are not done until all the steps below are done.

- 1 To see if the system is being activated by the gating transducers:
 - a Produce a Train Detail report for the last recorded train.

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

```

Main Menu - Comm
-----
[A] - Train Summary
[B] - Train Detail
[C] - Exception Summary
[D] - Exception Detail
      .
      .
      .
```

- b** On the Train Detail 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 **12**.

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

- 2** Using a metal wrench, stroke the top of one of the advance transducers.
The scanner shutters should open completely for 10 seconds.
- 3** On one of the bearing scanners, check to see if the shutter opens.
- 4** If the shutter didn't open, fix this problem before proceeding.
- 5** Using a metal wrench, stroke the top of the other advance transducer.
The scanner shutters should open completely for 10 seconds.
- 6** On one of the bearing scanners, check to see if the shutter opens.
- 7** If the shutter didn't open, fix this problem before proceeding.
- 8** Produce a Train Summary report.

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

```
Main Menu - Comm
-----
[A] - Train Summary
[B] - Train Detail
[C] - Exception Summary
[D] - Exception Detail
      .
      .
      .
```

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.

- 9** On the Train Summary report, check the Axles column.

The axle count should be an even number. Odd-numbered axle counts are possible indications of gating transducer problems. If there is an odd axle count and if the train speed is always above 7 mph (11.3 kph), go to step **16**.

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.

- 10** If there is an even axle count and the values under "Axles," "TO1," and "TO2" are the same, go to step **24**.

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.

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

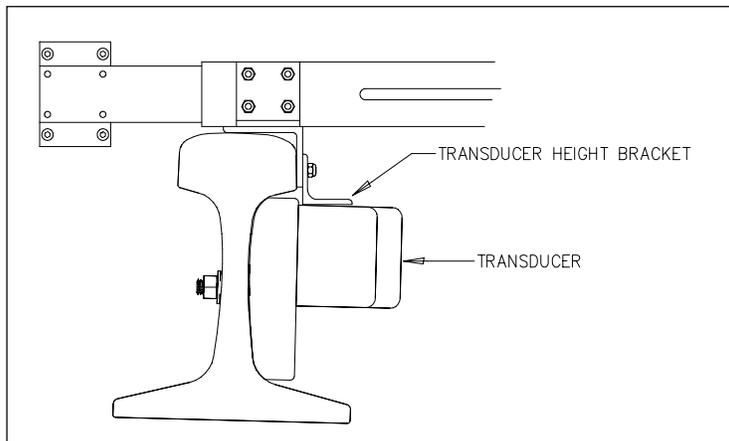
Four bolts are needed to hold the transducer in place. Two square-head bolts go through the mounting plate and transducer body. Two hex-head bolts go through the mounting plate and rail. If any of these bolts are sheared or missing, replace them. Also, if any washers or nuts are missing, they must be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

- 12** 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.

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

14 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.

15 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.

16 Determine which gating transducer is recording incorrect information.

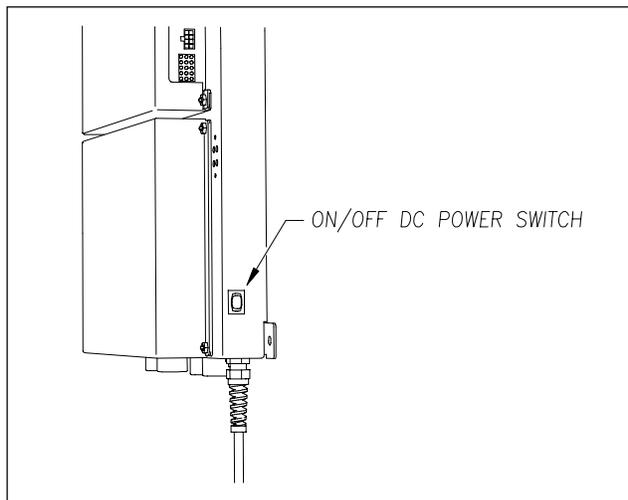
Determine which gating transducer is recording incorrect axle counts and whether it isn't counting all axles or counting extra ones. You may not be able to do this by just looking at the values under the Axles, TO1, and TO2 columns of the Train Summary report. Sometimes, a transducer problem causes the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

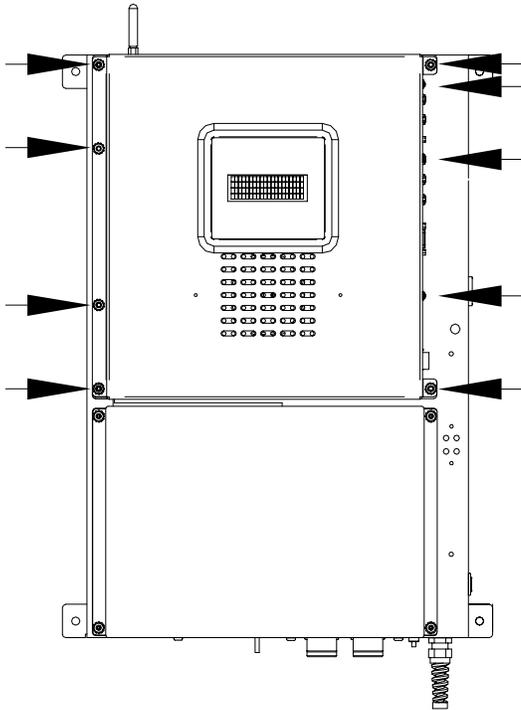
The process of adjusting the transducer loading is trial and error. Generally, if you have too many transducer counts, lower the loading resistance to make the transducer less sensitive. Likewise, too few counts suggest that the transducer isn't sensitive enough, so you would select a loading value with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

17 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):

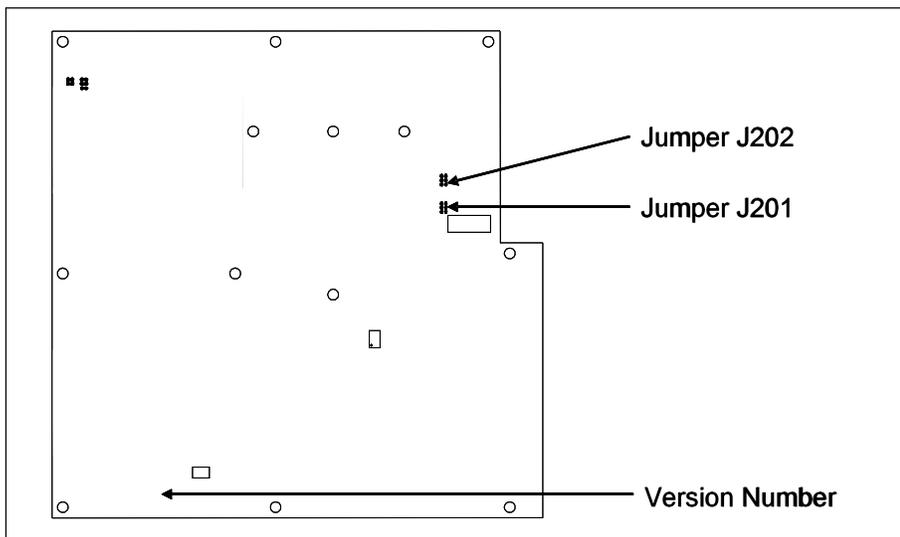
- a** Toggle off the DC power switch on the right edge of the SmartScanNG² detector.



- 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 SmartScanNG² detector.
- d** Store the removed cover, three screws, and the 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 The table below lists the highest, middle, and lowest sensitivity for transducer loading for current board versions. Highest is the most sensitive.

J201 or J202 Jumper Position	Sensitivity Level
Top	Lowest Sensitivity
Center	Middle Sensitivity
Bottom	Highest Sensitivity

- 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 SmartScanNG² detector.
 - 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 SmartScanNG² detector.
 - k Wait until 20 more trains have passed over the site and then return to step 1.
- 18 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 the 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 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	Sensitivity Level
Top	Lowest Sensitivity
Center	Middle Sensitivity
Bottom	Highest Sensitivity

- c If TO1 is recording extra axles, move the J201 jumper to the next lower sensitivity position. If it is currently on the lowest sensitivity position, call STC for help in fixing this problem.
- d If TO2 is recording extra axles, move the J202 jumper to the next lower sensitivity position. If it is currently on the lowest sensitivity position, call STC for help in fixing this problem.
- e Reattach the cover over the Interface board.

- f** Toggle on the DC power switch on the right edge of the SmartScanNG² detector.
- g** Wait until 20 more trains have passed over the site and then return to step **1**.
- 19** 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.
- 20** If the columns aren't within four degrees and if the scanner optics are clean, recalibrate and realign the scanner.
- 21** 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 (12V systems) and 25.4 and 29.0 volts (24V systems). 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
- 22** If the most recent value isn't within the valid voltage range, investigate and fix any problems before proceeding.
- 23** Leave the SmartScanNG² detector and the battery charger plugged in, powered, and turned on.
- 24** If this is a double-track site, repeat steps **1** through **28** for the other track (that is, for the other SmartScanNG² system).

11.0 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.

11.1 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.

11.2 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 the person who should be contacted to answer questions about the equipment
- A written explanation of the equipment defect or malfunction
- Any reports or other data that would help diagnose the problem
- If out of warranty, a Purchase Order Number for the order or credit card number (to be charged) with its expiration date

11.3 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.

11.4 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.

11.5 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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