



SMARTSCAN | NG²

Track Hardware

“Track Hardware” refers to those rail-mounted or rail-side components associated with a typical SmartScanNG² detector system. These components include:

- Bearing Scanners
- Wheel Scanners
- Transducers (Wheel Sensors)
- Deflectors
- Track Circuit
- Antennas

This manual provides an overview of these external subsystems as well as detailed procedures for their installation, alignment, and calibration.

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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.



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1.0 Introduction

1.1 Purpose of This Guide

The technical staff at Southern Technologies Corporation (STC) created the SmartScanNG² system. It is designed to monitor moving trains and report certain conditions detected on these trains. SmartScanNG² 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 is for those who purchase, install, maintain, troubleshoot, manage, or use the SmartScanNG² system.

This guide covers the track hardware portion of the SmartScanNG² system. It describes the functionality, installation, and operation of these components.

1.2 SmartScanNG² Track Hardware

The SmartScanNG² is a full-featured detection and reporting system that runs well in the harsh environments found along right-of-ways. It runs under the most adverse weather conditions, functioning over a temperature range of -40°C to +71°C (-40°F to +160°F). It runs in high-vibration situations. It runs unattended, carrying out all tasks without human intervention.

SmartScanNG² track hardware consists of those components located outside the wayside enclosure and mounted either on or near the rail. Some of these components are customer and/or application-specific and may not be used in every system.

Track hardware components include:

- Bearing Scanners
- Wheel Scanners
- Deflectors
- Gating Transducers
- Advance Transducers
- Auxiliary Alarm Detectors
- AEI Antennas
- Track Circuits

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

2.0 Scanners

2.1 Scanners

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

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

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

The SmartScanNG² system uses two kinds of scanners. One kind scans the temperature of axle bearings. The other kind scans the temperature of wheels. Except for different aluminum filter frames within the scanner module, the bearing scanner and wheel scanner covers and modules are identical and interchangeable.

There have been three generations of STC scanners. This guide covers the latest two generations (that is, the Type II and Type III scanners).

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

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

The scanner mounts can be installed on either rail, eliminating the need to maintain left-rail and right-rail models. However, bearing scanner mounts and wheel scanner mounts are different in design and are not interchangeable. Nevertheless, they contain many common parts, which means that fewer spare parts are needed.

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

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

The heat signal travels from the scanner through the cable to the SmartScanNG² enclosure. It then passes through the System-Interconnect board to the Interface board. Here, the amplitude of the heat signal is scaled to represent an accurate representation of the temperature. Next, the heat signal passes to the Processor board, where it is digitized for use by STC's Dynamic Scan Rate (DSR) algorithms.

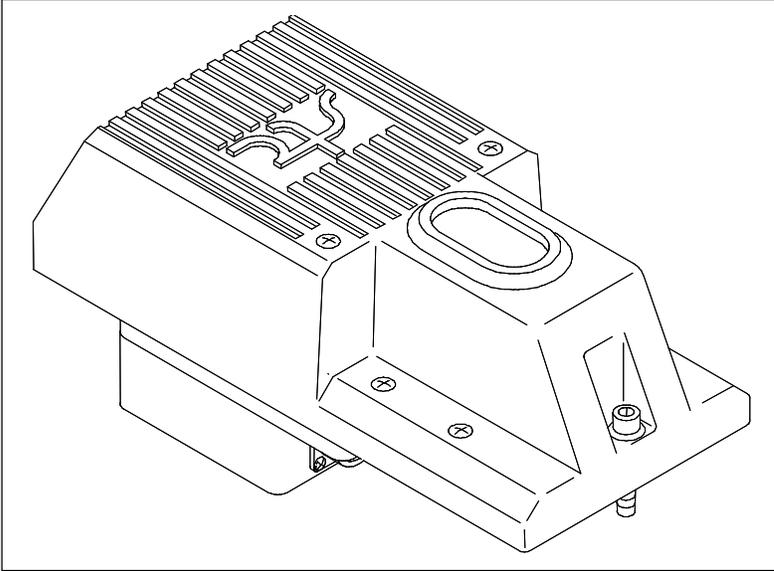
The Dynamic Scan Rate algorithms assure collection of samples every 1/2 inch (1.27 centimeters) of axle travel regardless of train speed. The heat signal waveform is always sampled 48 times between the gating transducers. It makes no difference what speed the train is going, as long as it is traveling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

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

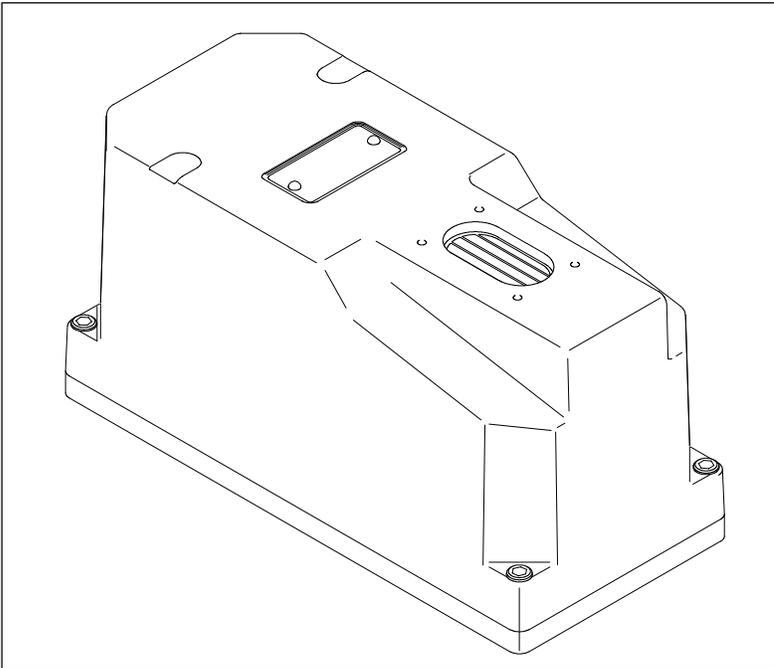
Scanner heaters remove moisture from the pyrometer lenses and reduce errant readings. The heaters are made active, for varying periods, when the ambient temperature is 26.7°C (80°F) or less.

2.2 Bearing Scanners

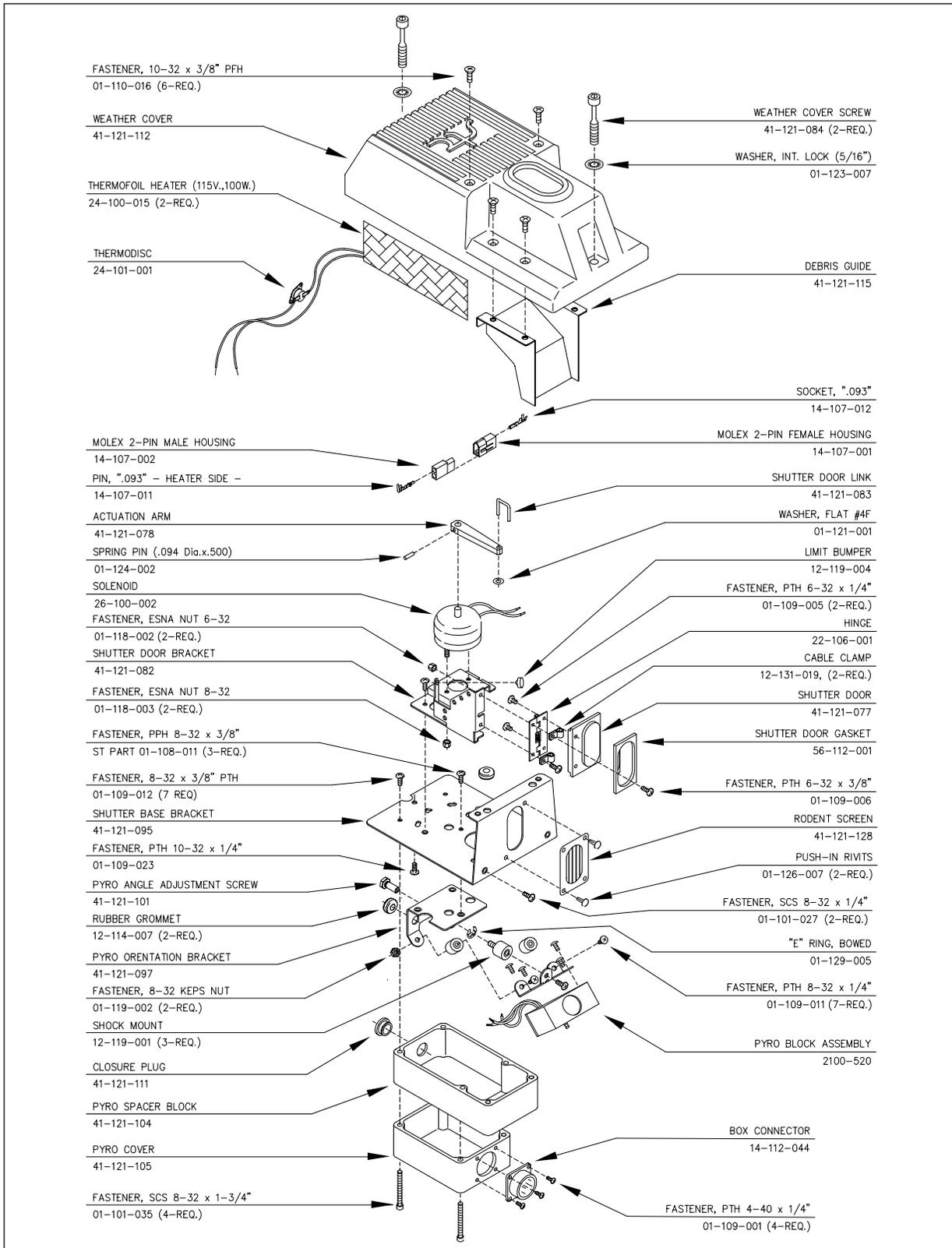
The figure below shows an assembled **Type II** bearing scanner cover and module.



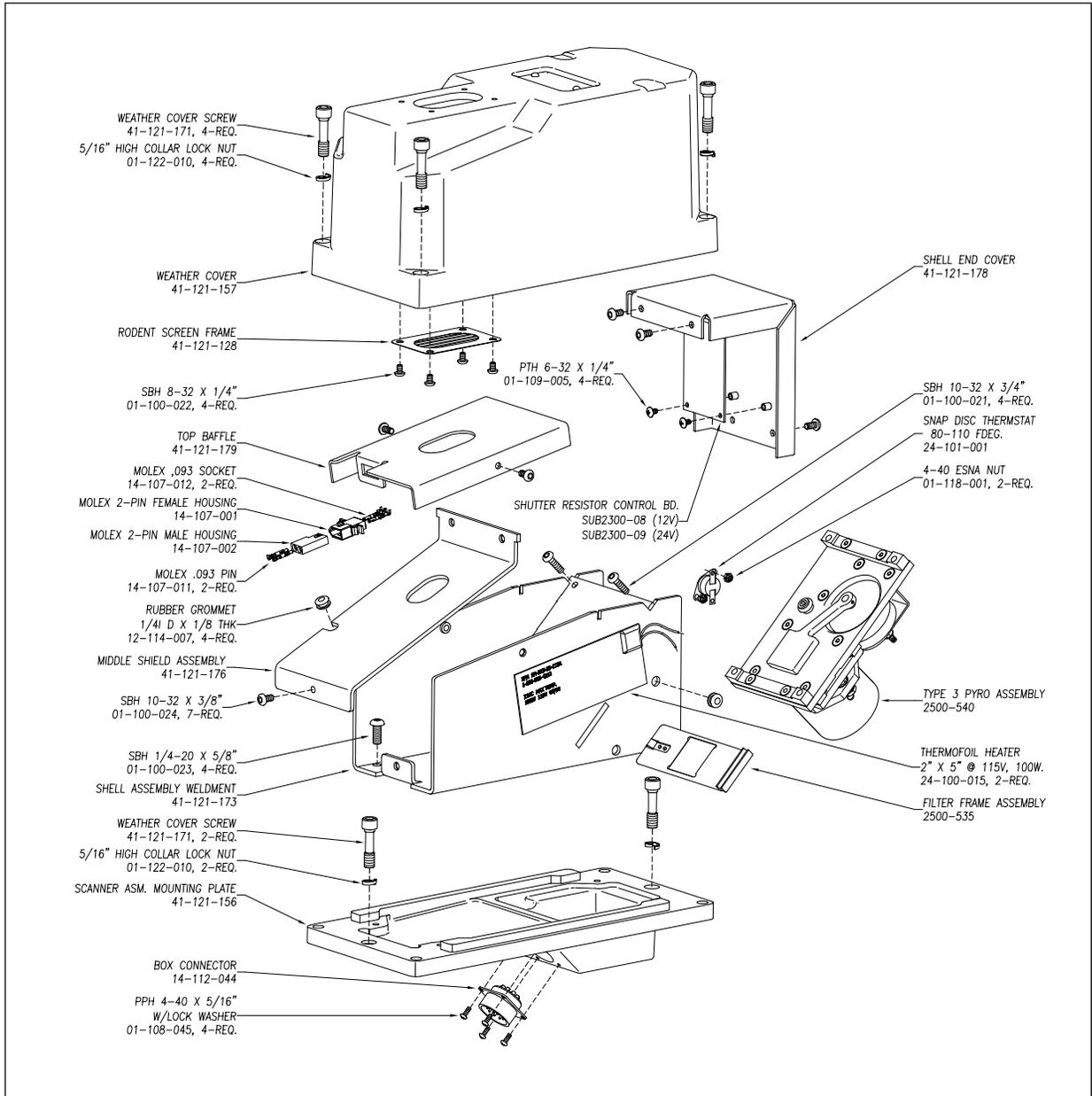
The figure below shows an assembled **Type III** bearing scanner cover and module.



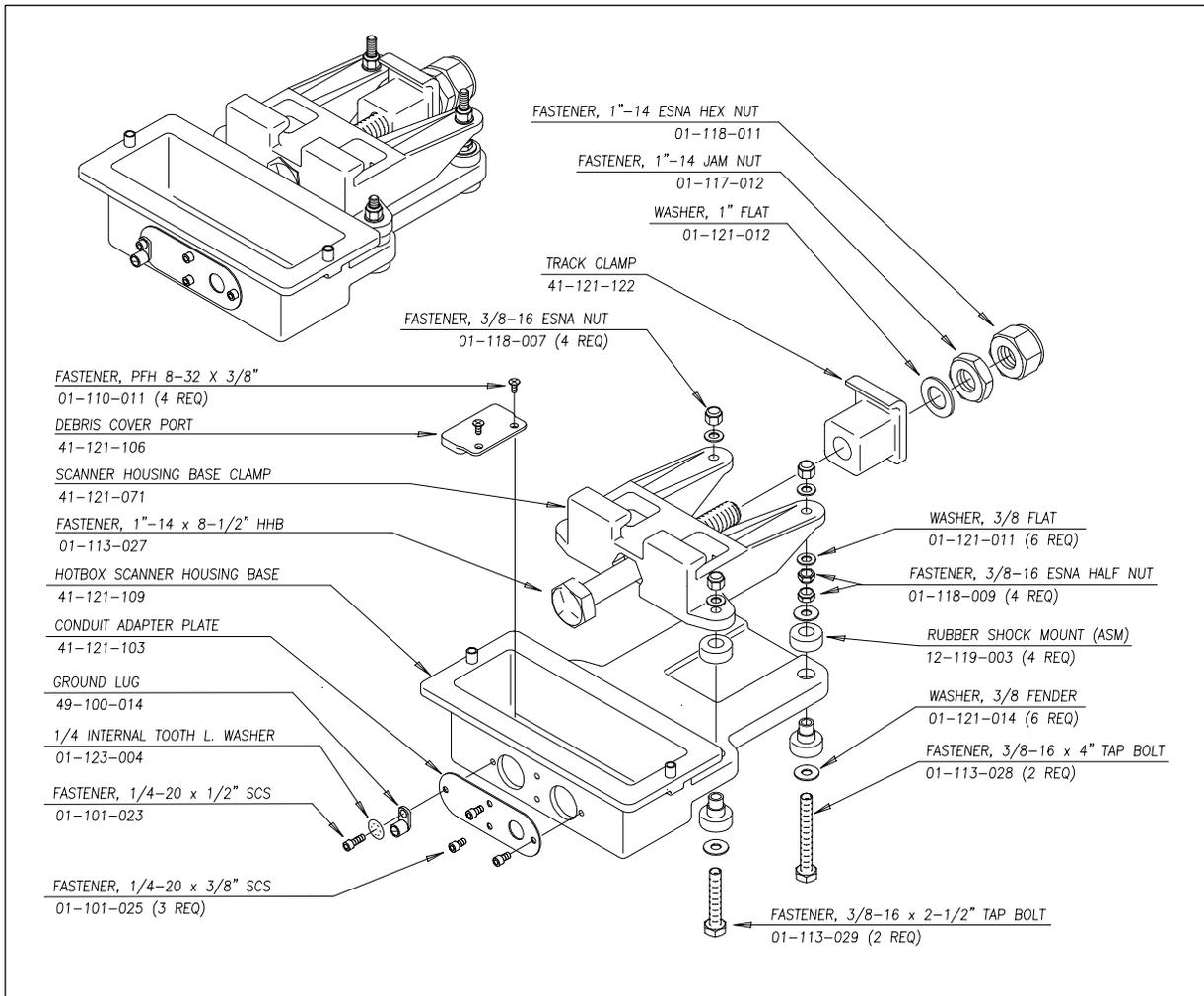
The figure below shows the parts of a **Type II** bearing scanner cover-and-module assembly (2100-512AC).



The figure below shows the parts of a bearing scanner cover-and-module assembly (2500-512AC). The bearing scanner uses a **black filter frame**. Bearing scanners are shipped from the factory with black filter frames installed.



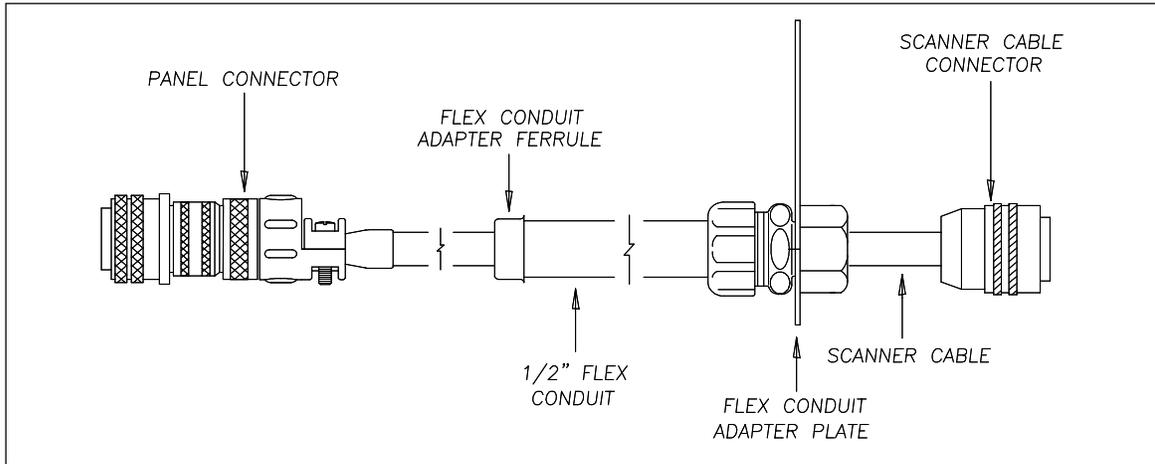
The figures below show a **Type II/Type III** bearing scanner mount (2100-501).



The bearing scanner cables are PVC jacketed with six individually shielded pairs of 20-gauge wire. The cable insulation is rated for 300-volt service. The bearing scanner cable has a potted connector for mating to the scanner and a circular connector at the SmartScanNG² enclosure.

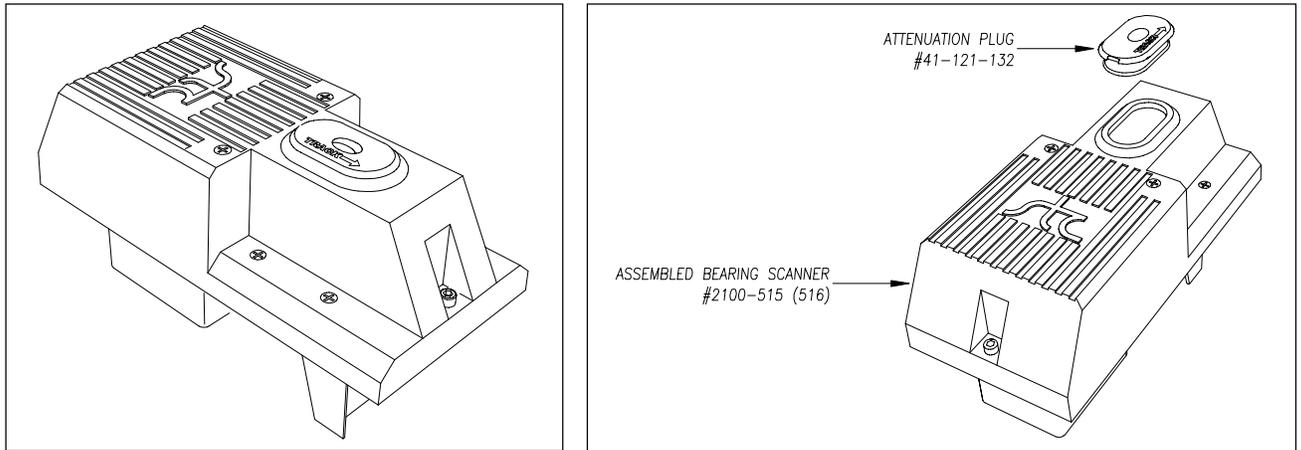
Single-track sites use two 65-foot (19.8-meter) bearing scanner cables. **Double-track sites** use two 65-foot bearing scanner cables for the track closest to the wayside enclosure (aka bungalow) and two 100-foot (30.5-meter) bearing scanner cables for the track farthest from the wayside enclosure. **Triple-track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

The figure below shows a bearing scanner cable. The part number for the 65-foot (19.8-meter) bearing scanner cable is 2058-260PM. For the 100-foot (30.5-meter) cable, it's 2058-265PM. For the 130-foot (39.6-meter) cable, it's 2058-267PM.

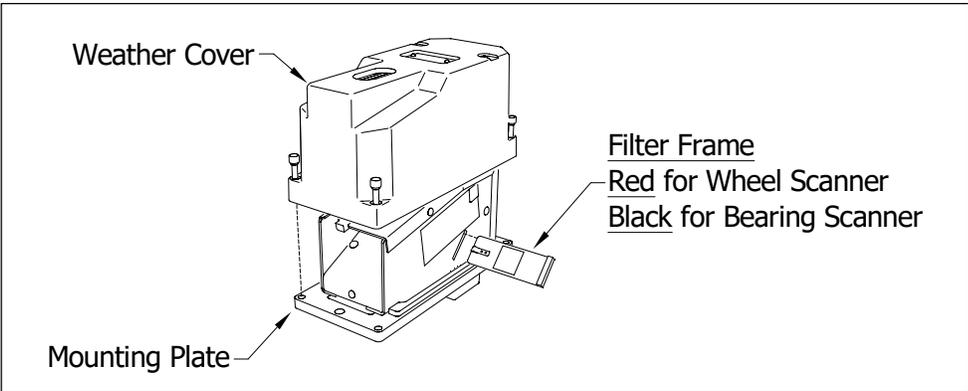
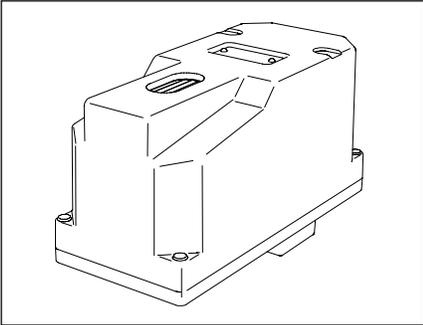


2.3 Wheel Scanners

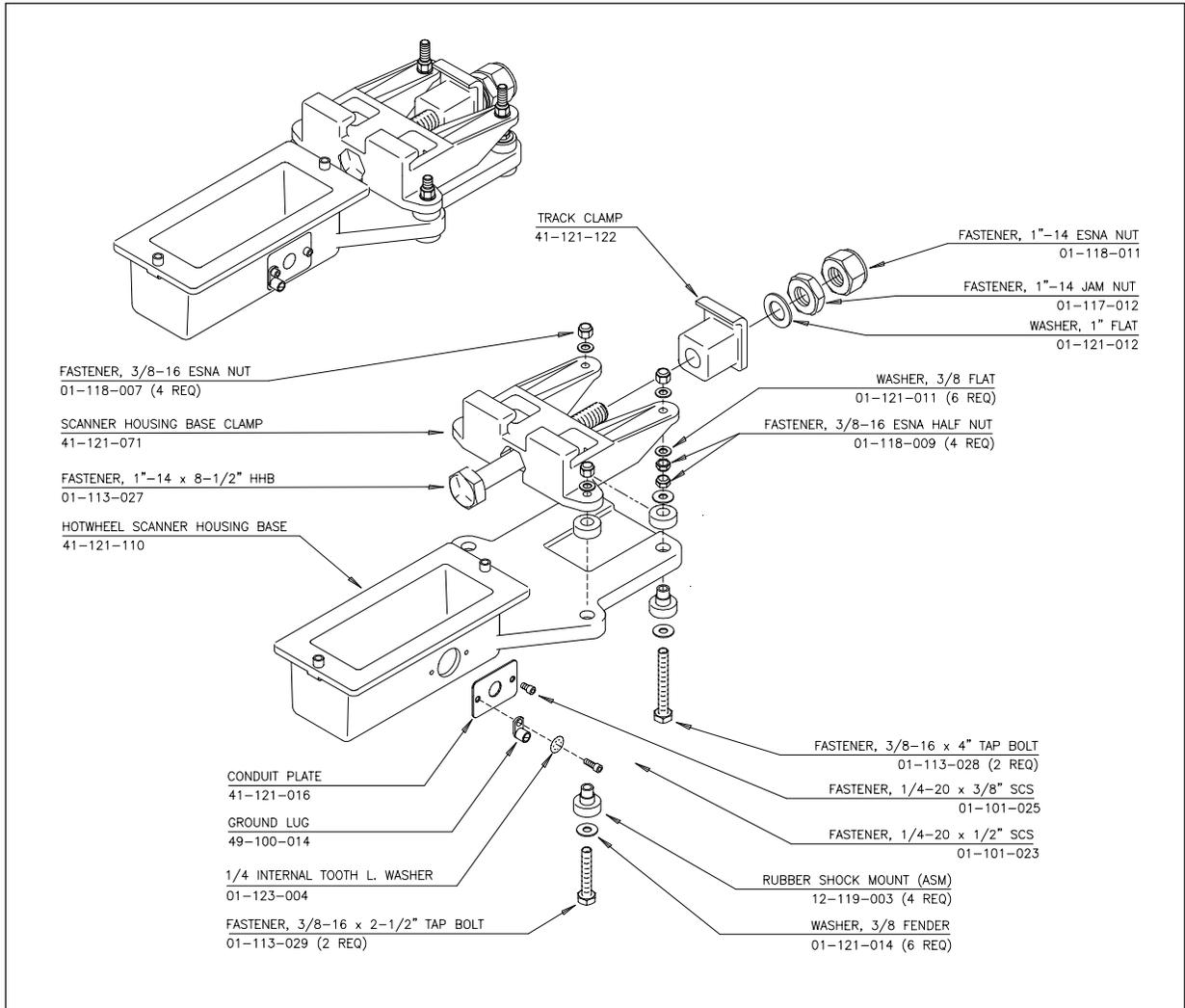
The figure below shows a **Type II** wheel scanner cover-and-module assembly. The only difference between the **Type II** wheel scanner cover-and-module assembly and the one for the **Type II** bearing scanner is the addition of the plastic attenuation plug.



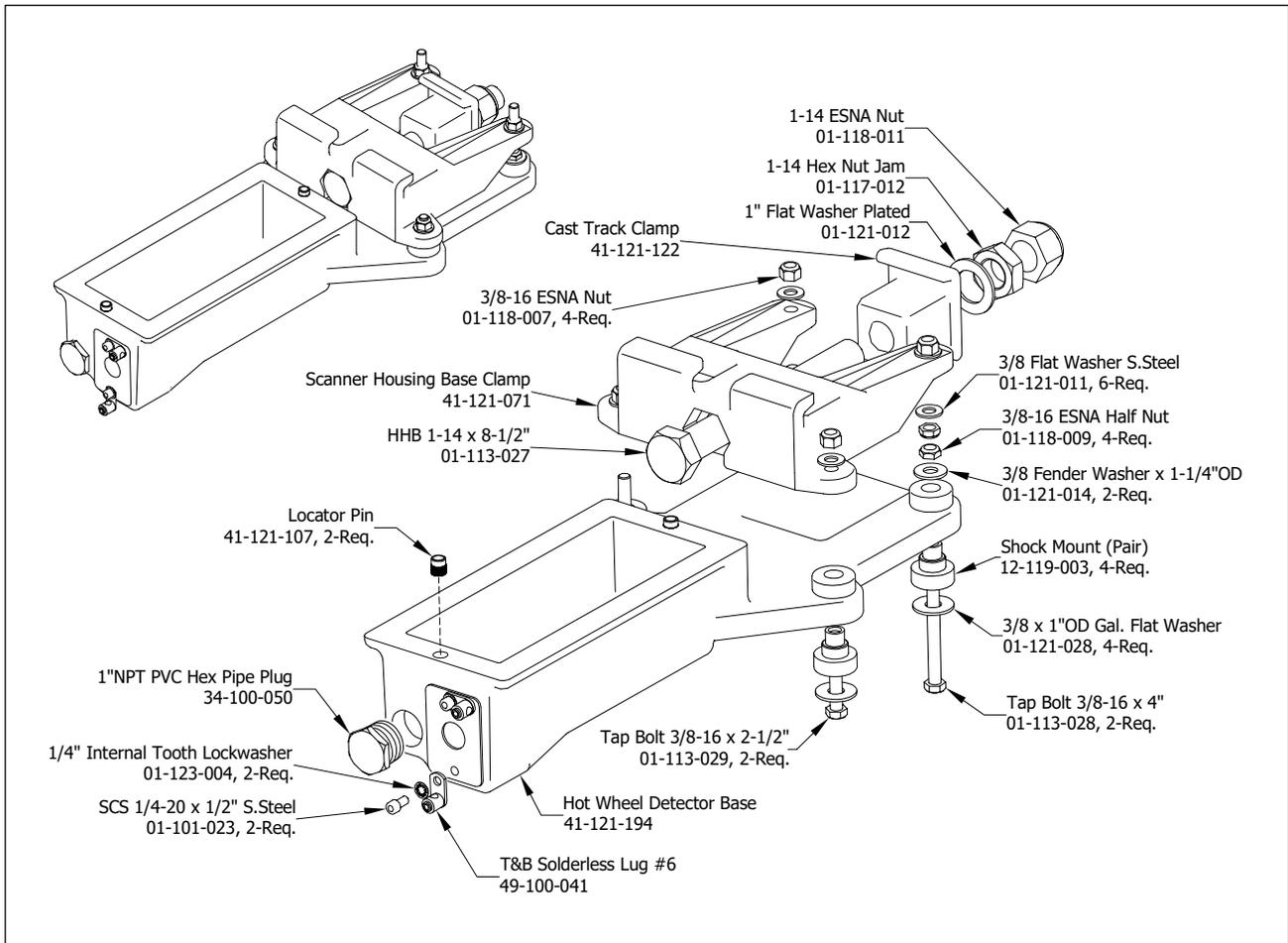
The figure below shows a **Type III** wheel scanner cover-and-module assembly. The only difference between the wheel scanner cover-and-module assembly and the one for the bearing scanner is a change of filter frames. The wheel scanner uses a **red filter frame**. However, wheel scanners ship from the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



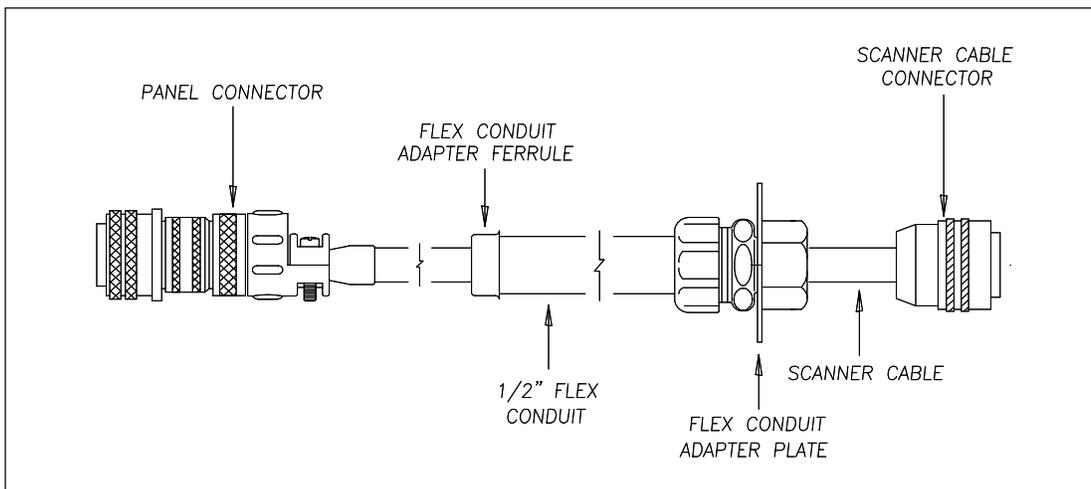
The figure below shows a **Type II** wheel scanner mount (2100-701). Though not recommended, this mount can also be used for **Type III** wheel scanners. However, this guide does not cover the use of this mount for **Type III** wheel scanners.



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



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

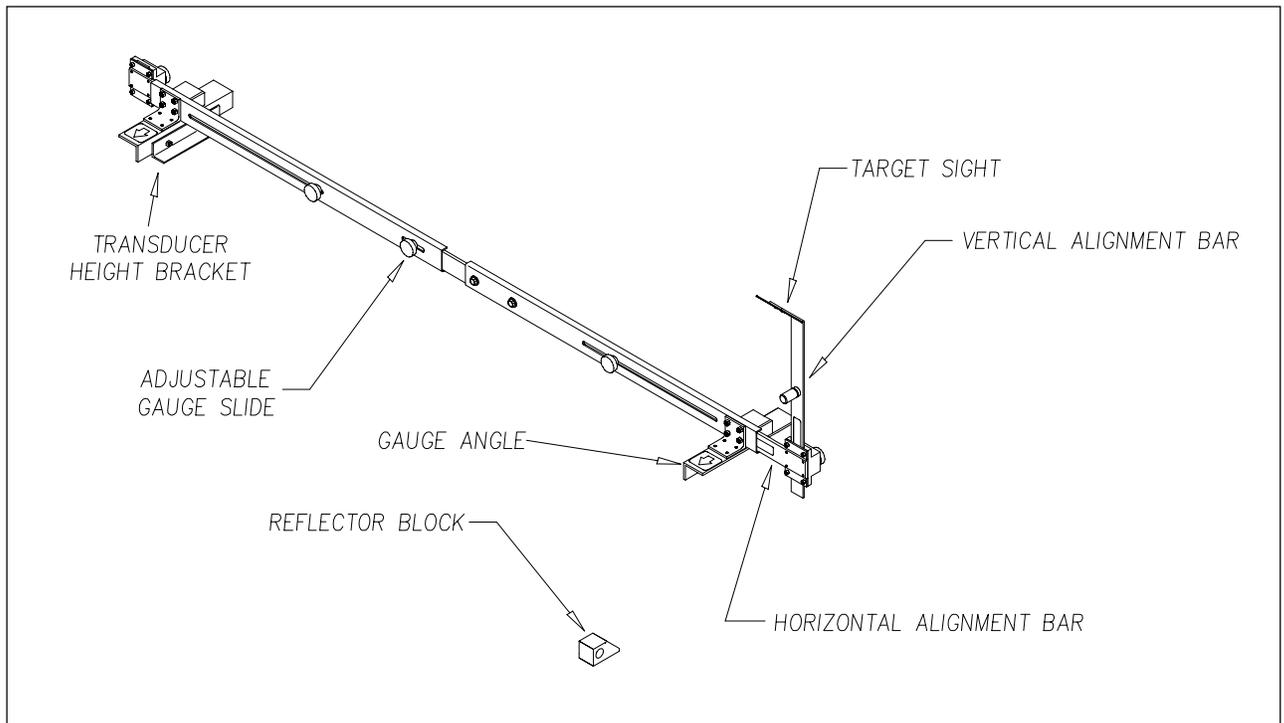


2.4 Scanner Alignment/Calibration Tools

This section describes the components used during the adjustment process. Covered are the alignment fixture and the calibrated heat source. STC supplies one of each for each SmartScanNG² site. **Section 10.0 - Aligning Scanners** and **Section 12.0 – Calibrating Scanner** tell how to use these components to establish proper scanner alignment and to set and verify the heat values seen by the scanners.

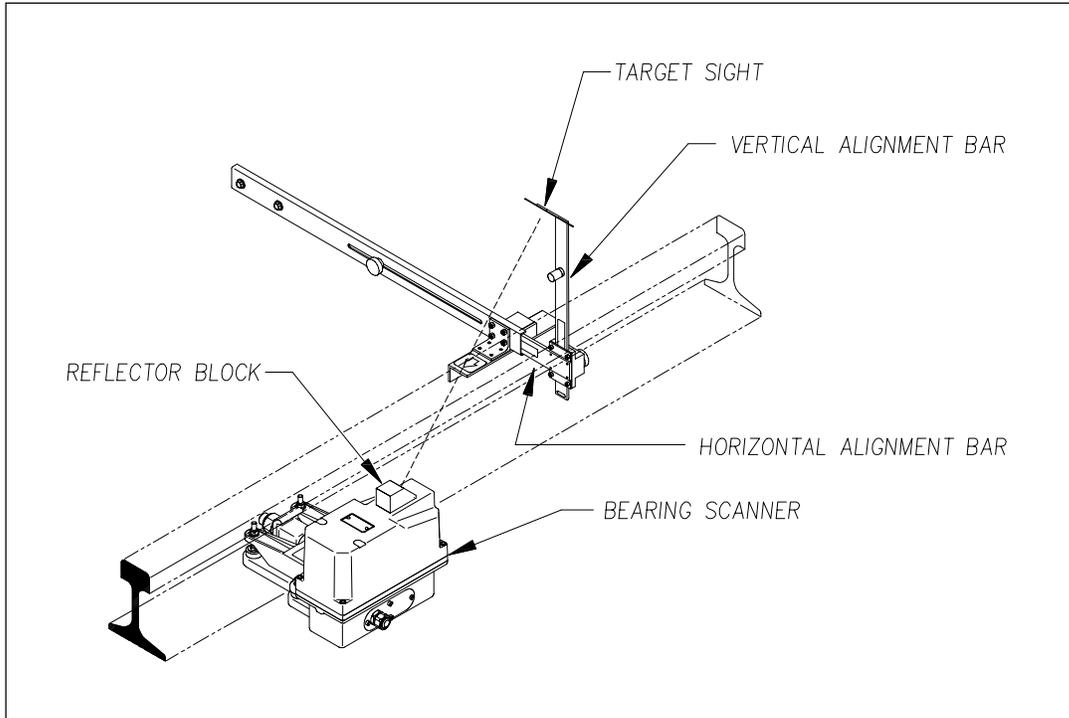
2.4.1 Alignment Fixture (2066-000)

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

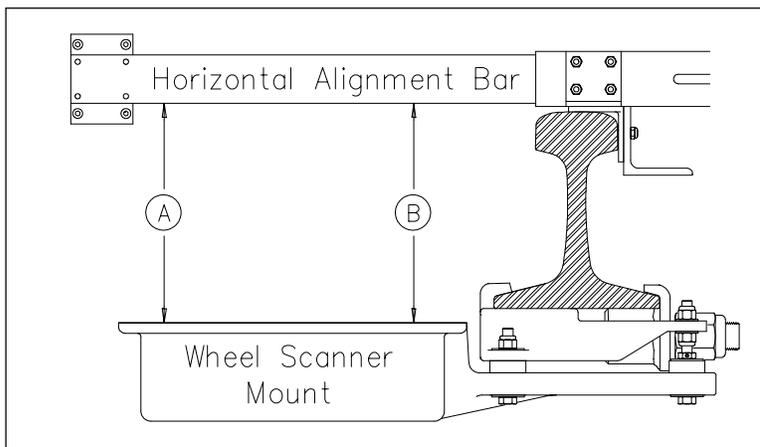


The fixture is used differently for bearing scanners and for wheel scanners. To align bearing scanners, you use the optical system of the fixture. The key parts of this optical system are the target sight and the reflector block.

Shown below is the alignment of a bearing scanner.

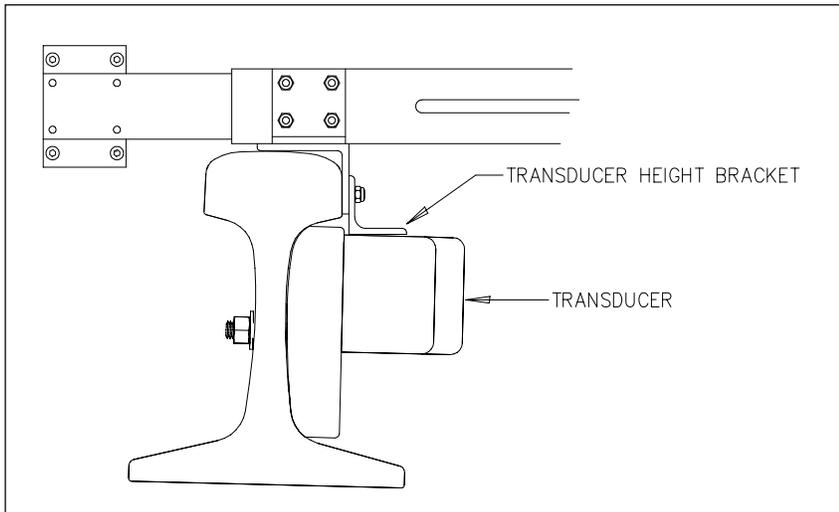


To align wheel scanners, you use the horizontal alignment bar of the fixture. Measure from the bottom of the extended bar to the top of both ends of the scanner mount. When both measurements are the same, alignment is correct. That is, as shown below, when distance **A** is equal to distance **B**, alignment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



Alignment must be performed during scanner installation. After that, unless the scanner is damaged, it is unlikely that alignment will change.

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



2.4.2 Calibrated Heat Source (2100-810NG)

Scanners are calibrated during installation. After that, calibration is usually done as needed or during scheduled maintenance.

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

For a site that doesn't have a 120-volt 60-Hz power source, power the heat source 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. Ground the inverter according to the manufacturer's recommendations.

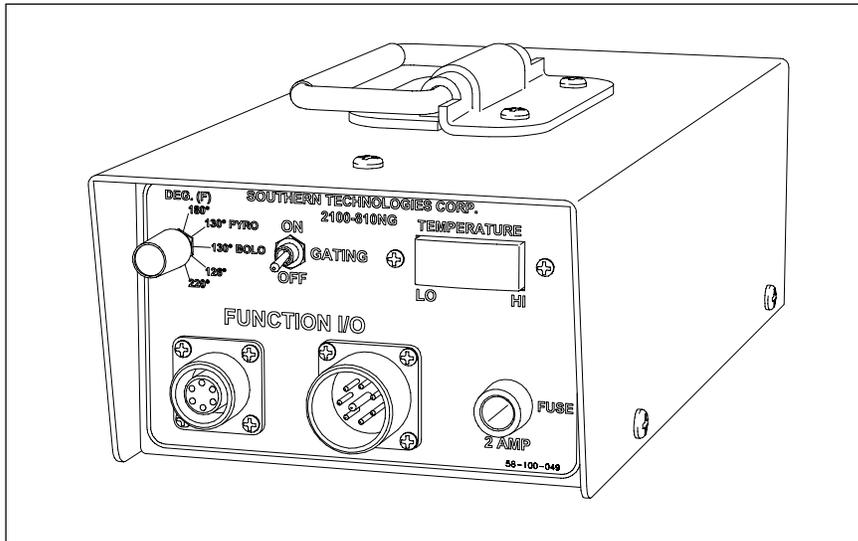
On the front of the calibrated heat source is a knob that lets you select one of five delta temperatures, ranging from 126°F to 220°F. The heat source contains a heat block that can reach a combined temperature of your delta temperature plus the ambient temperature. It can maintain this temperature for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

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

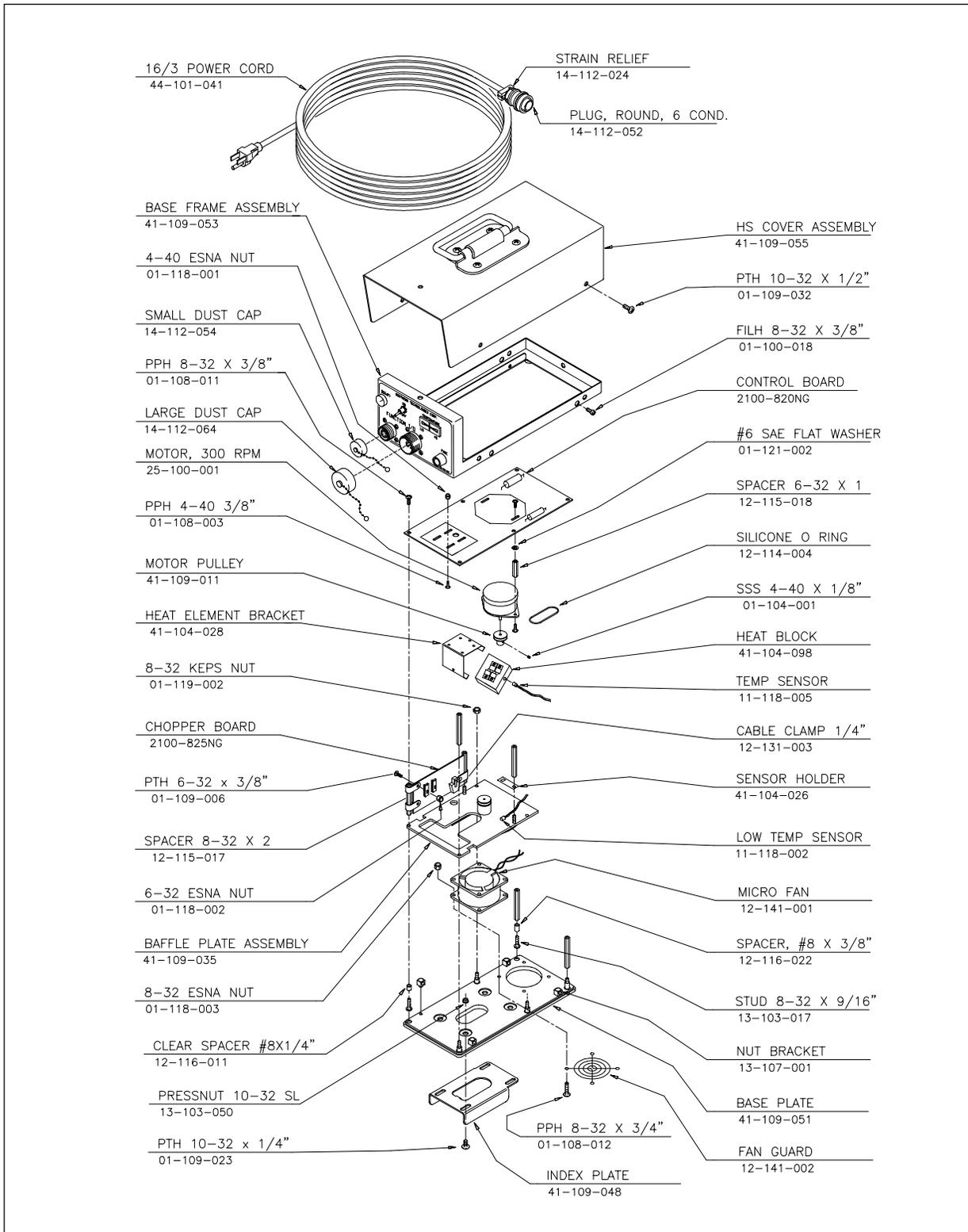
The calibrated heat source is placed over the opening of the scanner cover. With the heat source in place, it is then possible to calibrate the system at a precise value above ambient temperature.

STC recommends that you use the calibrated heat source (2100-810NG) only when the outside (ambient) temperature is above -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 set point, the heat source isn't operating properly.

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

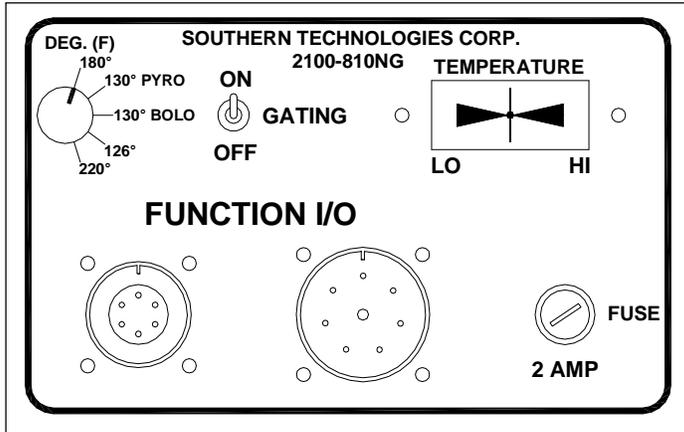


The figure below shows the parts of a calibrated heat source (2100-810NG).



2.4.2.1 Heat Source Front Panel

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



Temperature Knob

The temperature knob allows you to select one of five delta temperatures. The temperature label on each knob setting represents degrees Fahrenheit above ambient. Select the 180° setting for use with all STC scanners.

Gating Switch

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

Leave the Gating switch in the off position. The SmartScanNG² system does not use these signals during calibration.

Temperature Meter

The temperature meter shows when the heat block has reached the selected temperature setting and has stabilized within ± 2 degrees of the set point. From a cold start, this could take 5 to 8 minutes. A centered meter movement indicates heat block stabilization.

Function Connectors

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

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

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

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

Scanner calibration does not require the eight-contact circular connector (on the right side).
For safety's sake, always cover this connector with the supplied dust cap.

Fuse

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

2.4.2.2 Heat Source: Power Cable Warning

Warning - Caution

PLEASE – ONLY USE THE POWER CORD THAT WAS SHIPPED WITH THIS HEAT SOURCE.

USE OF THE OLD CORD WITH PINS IN THE CONNECTOR WILL DAMAGE THIS HEAT SOURCE

A few years ago, the power cord connector was found to be a shock hazard because the circular connector had pins that were not finger-safe. So the connectors on both the power cord and the heat source were changed. Because of that change, a new power cord was and is shipped with each new heat source.



Old style plug with pins



New heat source with pins

As you can see, even though the connectors will fit together, they won't work together. When the connectors are screwed together, the two sets of pins touch and cause a reverse polarity situation which damages the heat source.

3.0 Transducers

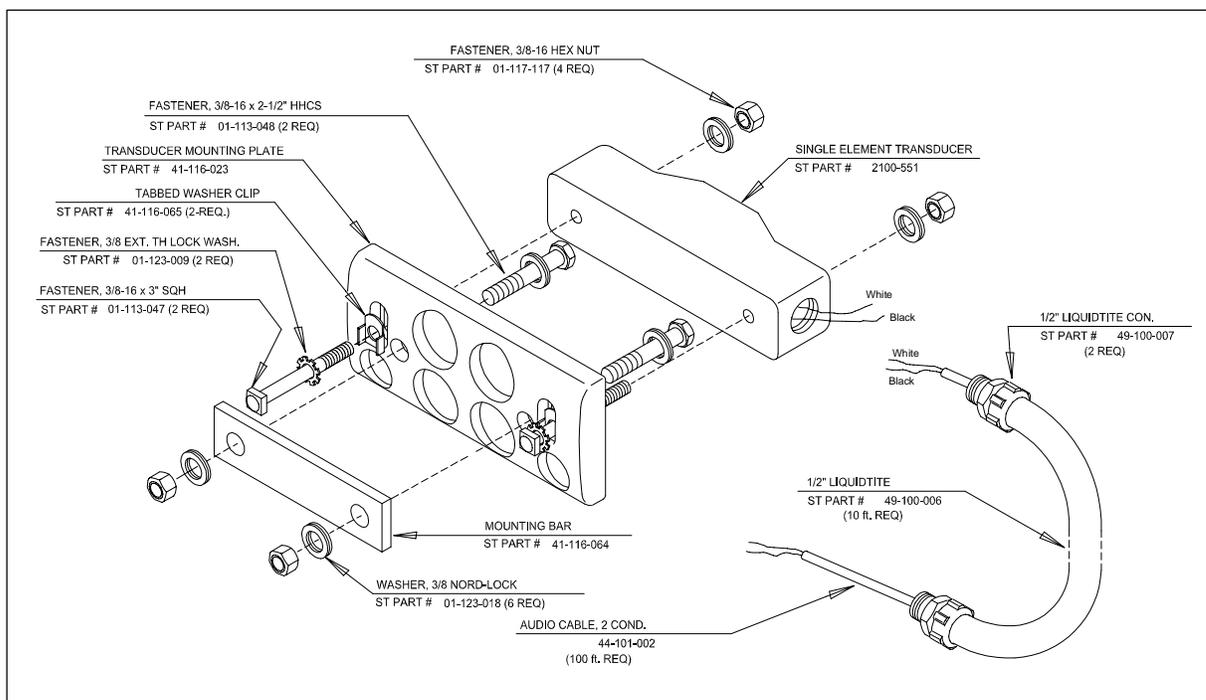
3.1 Transducers

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

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

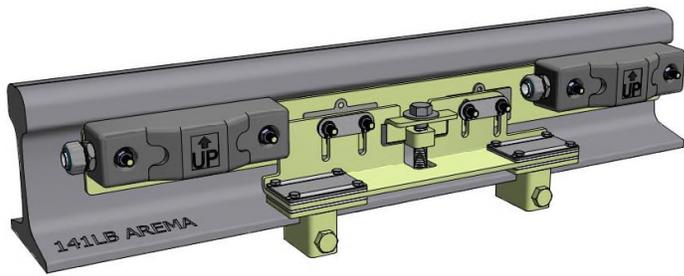
The SmartScanNG² can be configured to operate with either the STC Magnetic Transducer or the Frauscher Wheel Sensor.

The figure below shows the parts of an STC Magnetic Transducer.

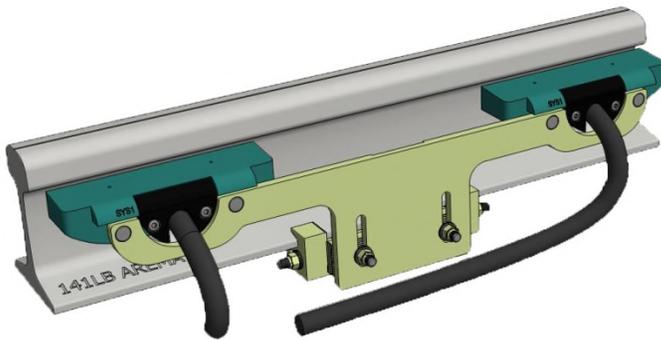


STC transducers consist of a horseshoe magnet with a tightly wound coil encapsulated in a rigid epoxy potting compound. Each transducer mounts 1-9/16 inches (3.97 centimeters) below the top of the rail. As the wheels of a railcar pass over the transducer, the wheel flange disturbs the flux field of the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

The figure below shows the 2100-596 Double Gating Transducer assembly.



The figure below shows the 2100-696 Frauscher Zero-Speed Double Gating Transducer assembly.



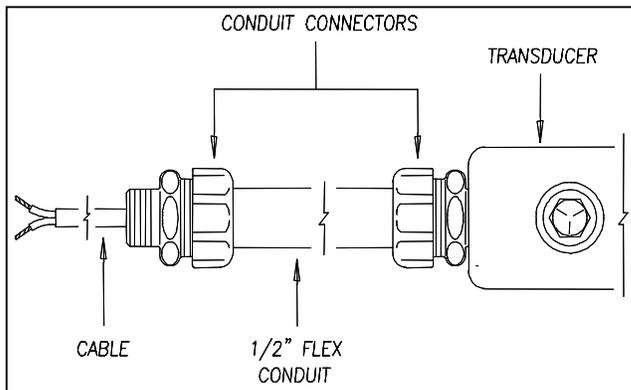
Both the 2100-596 & the 2100-696 mechanically clamp two gating transducers to the rail, thus eliminating the need to drill mounting holes. Each bracket is fully adjustable to fit a wide range of rail sizes.

The wheel transducer can be utilized in two different functions on a SmartScanNG² system - as a gating transducer or an advance transducer.

All tracks use two rail-mounted gating transducers. On the rail nearest the wayside enclosure, these transducers (labeled **TO1** and **TO2**) are mounted near and to the north or east of the bearing scanner. They control scan timing and car recognition.

Some but not all tracks use rail-mounted advance transducers (labeled **ADV1** and **ADV2**). On the rail nearest the wayside enclosure, the two advance transducers are usually mounted 32 feet (9.75 meters) on either side of the gating transducers. If so desired, they can also be mounted 40 feet (12.19 meters) on either side of the gating transducers. The first advance transducer encountered provides a signal that changes the state of an inactive system from idle to scan mode. Instead of two advance transducers, train presence can be ascertained by using a track circuit and an SOTC board.

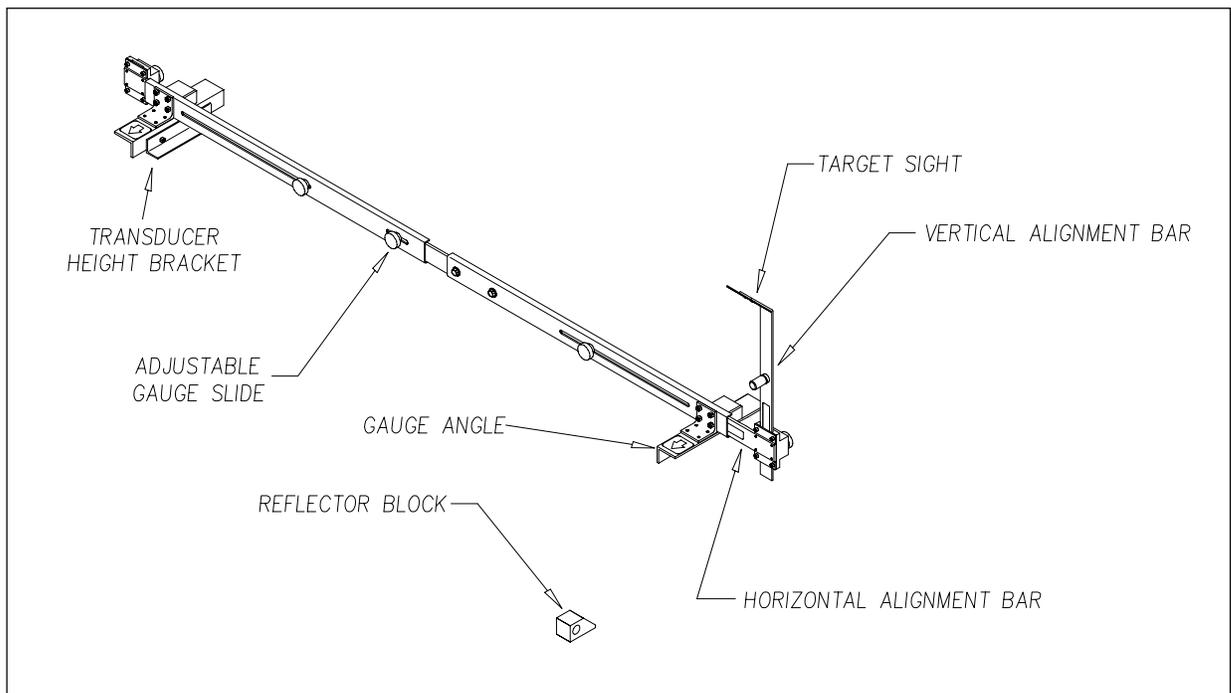
The figure below shows a cable for an STC Magnetic Transducer.



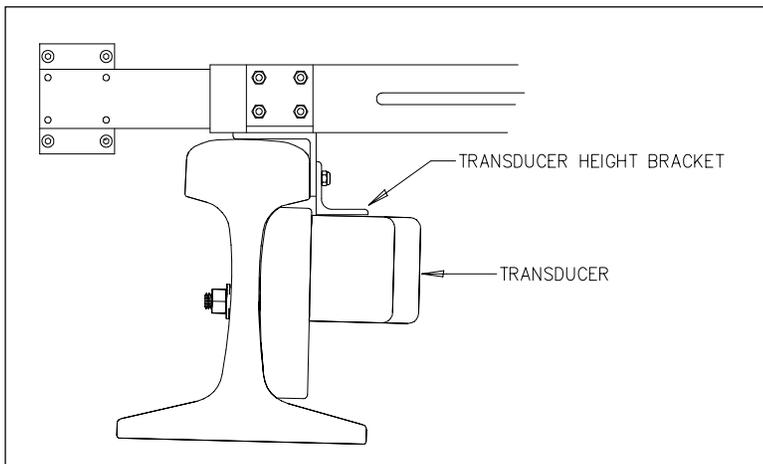
One end of the transducer cable comes attached to the transducer. The other end has two wires protruding from the conduit. These wires are black and white. They attach to a surge protector located on the surge-protection panel. There is one surge protector assigned to transducer TO1 and another to transducer TO2. These surge protectors protect the SmartScanNG² system from transients and surges, which can be induced onto external wiring by lightning.

3.2 Transducer Alignment Tools

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



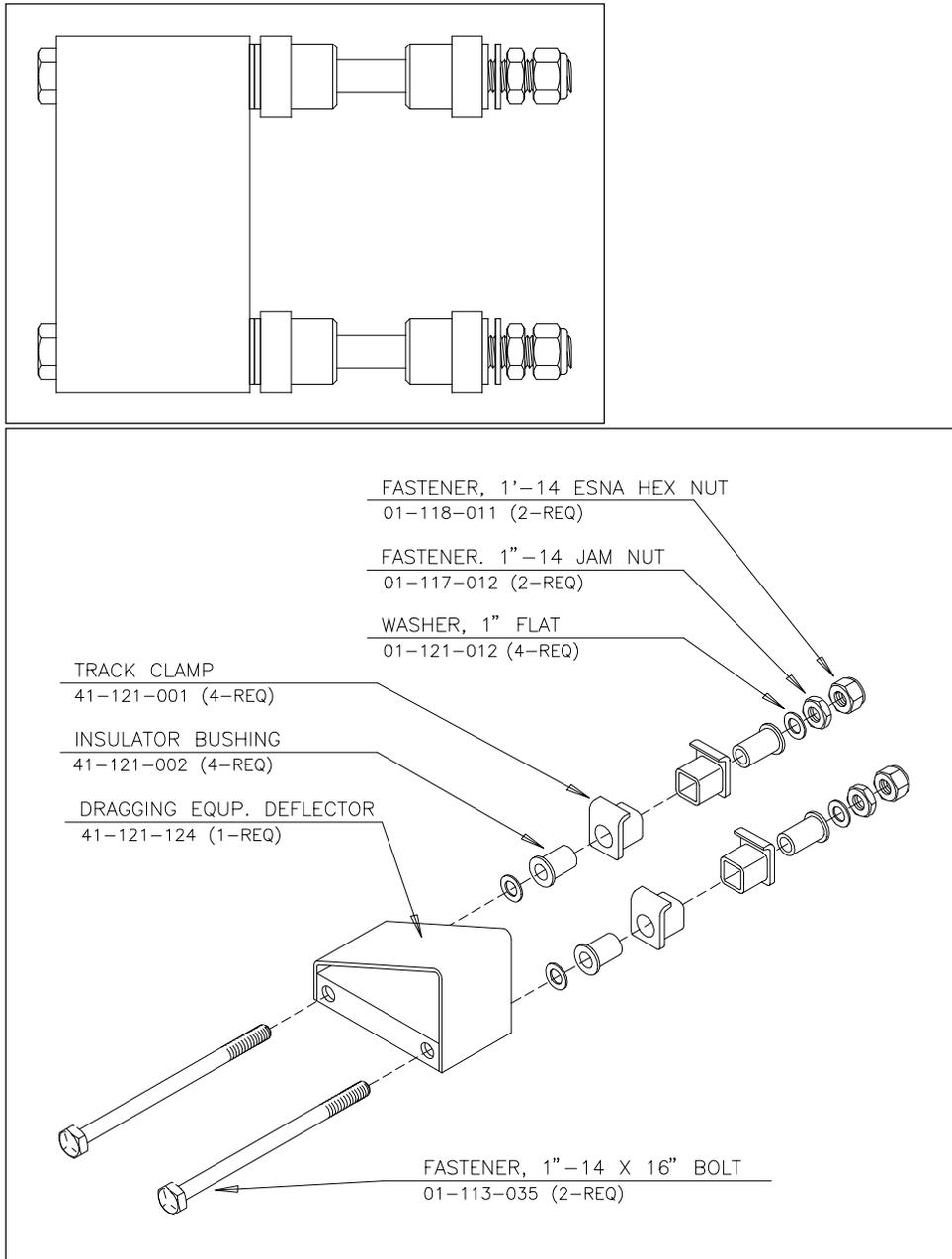
The transducer height bracket on the bottom of the alignment fixture can be used to ensure proper installation of the transducers. When the transducer body touches the bracket, the transducer body is 1-9/16 inches (3.97 centimeters) below the top of the rail and parallel to it.



4.0 Deflectors

4.1 Deflector Function

Deflectors are shields which are rail-mounted adjacent to scanners. They provide limited protection by deflecting dragging equipment up and over scanner during train passage. The figures below show a deflector.



5.0 Track Circuit

5.1 Track Circuit

Some SmartScanNG² sites use a track circuit to detect train presence. Other sites use advance transducers for this purpose.

The track circuit, combined with the SOTC board, makes up the presence subsystem. The track circuit is nothing more than two wires attached to the rails. One wire is attached to each rail. When the SOTC board senses a track shunt, it signals the SmartScanNG² system that a train is present. The shunting zone is adjustable up to 150 feet (45.7 meters) on each side of the attached track-circuit wires.

The track circuit wires are attached to each rail directly opposite from the other, centered between the gating transducers. Connection to the rail can be made in one of two ways.

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

Once the rail attachment is made, extend the connection to the three-terminal arrester mounted below the SmartScanNG² enclosure. You do this by splicing a length of wire to each bond strand. Okonite Cable makes a twisted-pair cable (Okonite 113-12-3933) that is suitable for direct burial. The cable has two 6-AWG solid conductors and a very rugged insulation jacket. The cable should be attached to the bond strand using compression sleeves.

6.0 Auxiliary-Alarm Detectors

6.1 Auxiliary-Alarm Detectors

The standard SmartScanNG² system can support input from as many as four external alarm devices. Any device that provides an open set of relay contacts upon alarm detection can be supported by the system. Electrical contacts on auxiliary-alarm equipment should have a minimum current rating of less than 17 mA. The system responds to an open contact by announcing the defect and the axle number nearest the defect. Alarm detection and announcement are in real-time. The SmartScanNG² system supports dragging-equipment alarms, high-load alarms, and wide-load alarms. Other alarm devices require custom speech programming.

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

7.0 Antennas

7.1 AEI Antennas

Not all SmartScanNG² systems use the AEI (Automatic Equipment Identification) subsystem. If your SmartScanNG² system does, the AEI subsystem consists of the AEI antennas (described below) and an AEI Reader module.

The SmartScanNG² system supports two types of antennas.

- Sinclair SRL470 antennas
- KPPA-900-120-11.5 Parapanel antennas

7.1.1 Sinclair SRL470 Antennas

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

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



Each SRL470 antenna is installed:

- with its face parallel to the rails;
- with its N-type socket pointing down;
- 11' to 14' from the center of the track;
- center of antenna 4.0' above the top of the rails;
- centered between the wheel detectors;
- opposite each other.

7.1.2 KPPA-900-120-11.5 Antennas

On mainline systems, two 50-watt KPPA-900-120-11.5 Parapanel antennas (or two Sinclair SRL470 antennas) are installed per track. The KPPA-900-120-11.5 is a directionally pointed, horizontally polarized, panel antenna. It has a gain of 11.5 dBi. It is housed in a compact white enclosure that is made from materials that do not interfere with the transmission and reception of radio waves. It is suitable for pipe or tower mounting.

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

Each KPPA-900-120-11.5 antenna is installed:

- vertically, with its face parallel to the rails;
- 11' to 14' from the center of the track;
- center of antenna 4.0' above the top of the rails;
- centered between the wheel detectors;
- opposite each other.



8.0 Site 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.

8.1 Selecting a Site

Locate the site:

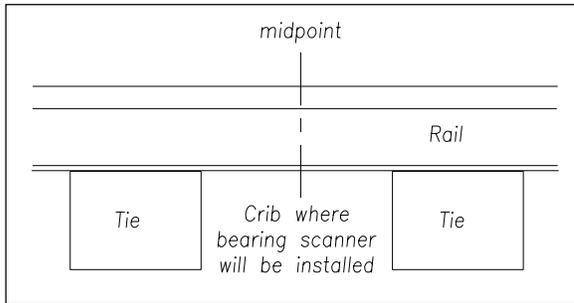
- On level, well-drained ground (avoid low areas where flooding may occur)
- In an area that doesn't normally require heavy braking by passing trains
- At least 300 feet (91.4 meters) from the nearest road crossing
- Away from a track joint, a track switch, and a side track
- By a track that is on gauge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

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.

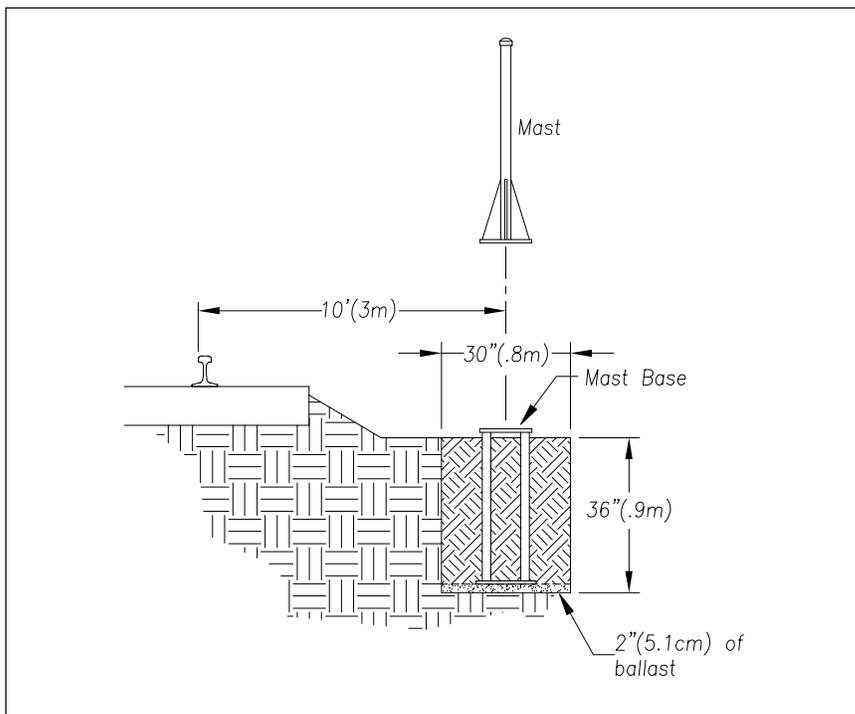
The wheel scanners should be centered in the crib of the two ties immediately ahead (and to the north or east) of the bearing scanners.

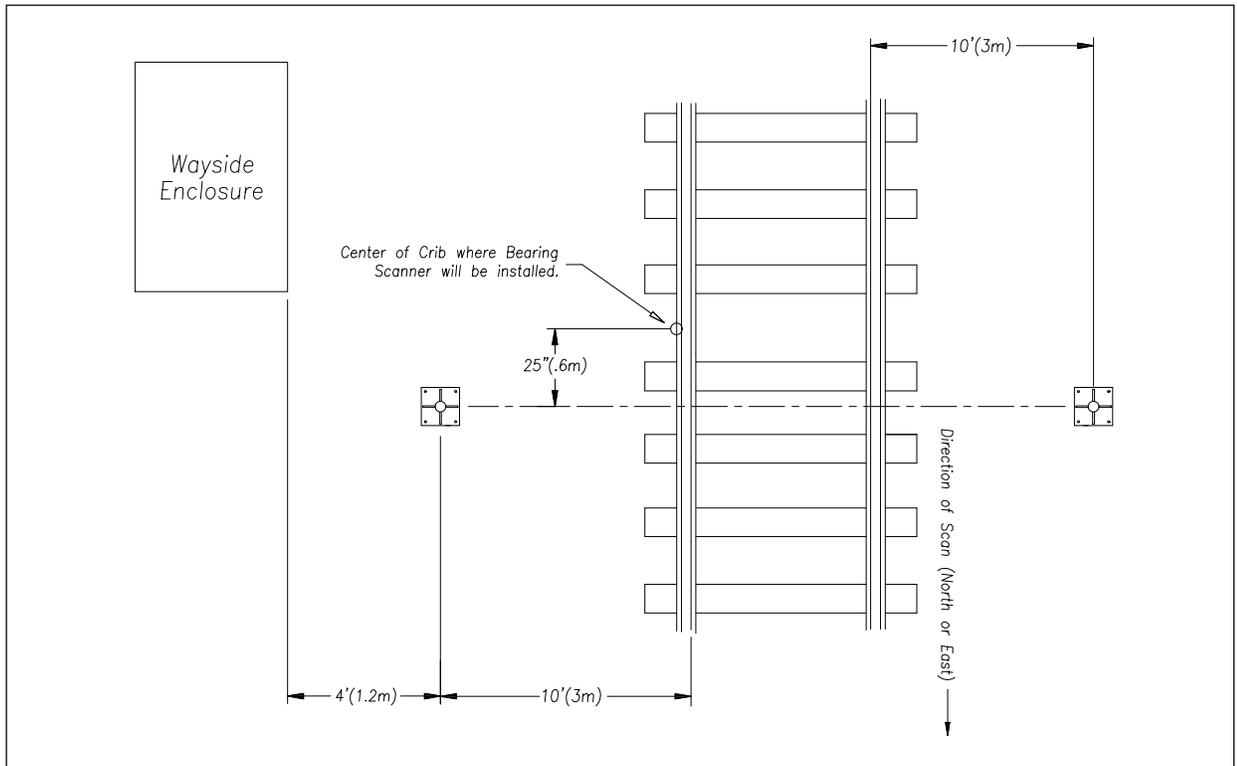
- b** Repeat steps 2 through 6.

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 center is 10 feet (3 meters) from the gauge side of the closest rail and 25 inches (0.6 meters) from the center of the crib in which the bearing scanner will be installed. Both bases will be north or east of the crib.

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

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

8.4 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.

8.5 Returning Damaged or Defective Hardware

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

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

With the returned hardware, include:

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

8.6 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.

8.7 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 Track Components

This section provides instruction for the installation of scanners, transducers, deflectors, track circuits, and AEI antennas. The installation of dragging-equipment detectors and other auxiliary-alarm detectors isn't covered in this guide.

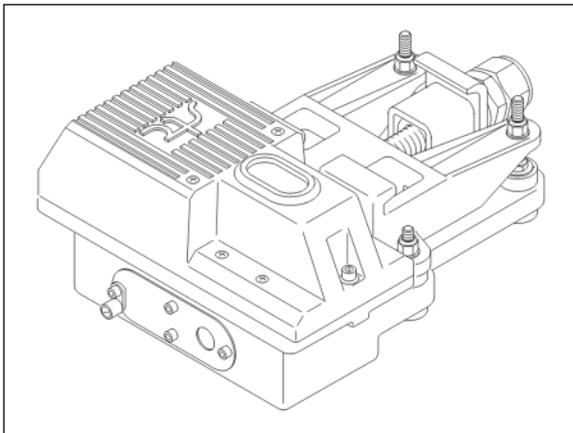
All SmartScanNG² sites have two bearing scanners per track. Some tracks also have two wheel scanners. All tracks have two gating transducers. They are used to control scan timing and car recognition. All tracks have either two advance transducers or a track circuit used to indicate train presence.

Track components are installed in this order:

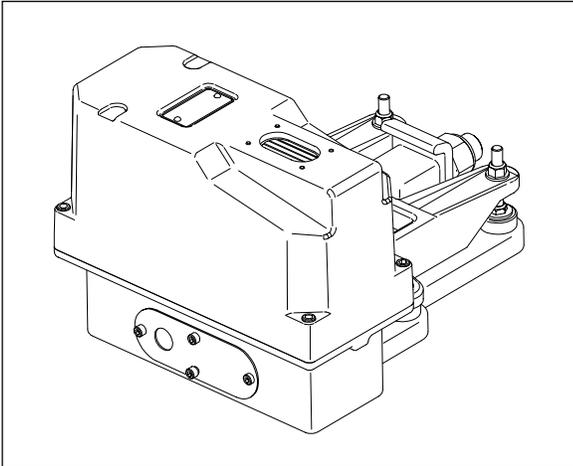
- Bearing scanners and their cables
- Gating transducers and their cables
- Advance transducers or Track Circuit
- When used, wheel scanners and their cables
- When used, deflectors
- When used, AEI antennas and their cables
- When used, auxiliary-alarm detectors and their cables

9.1 Bearing Scanners

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



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



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

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

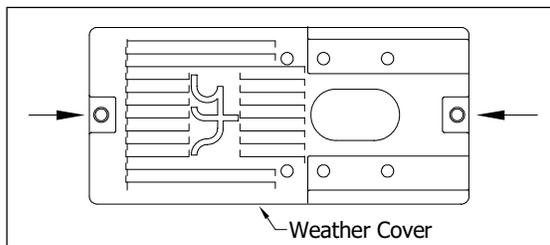
The bearing scanners should be centered in the crib of two ties spaced at least 14 inches (35.6 centimeters) apart.

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

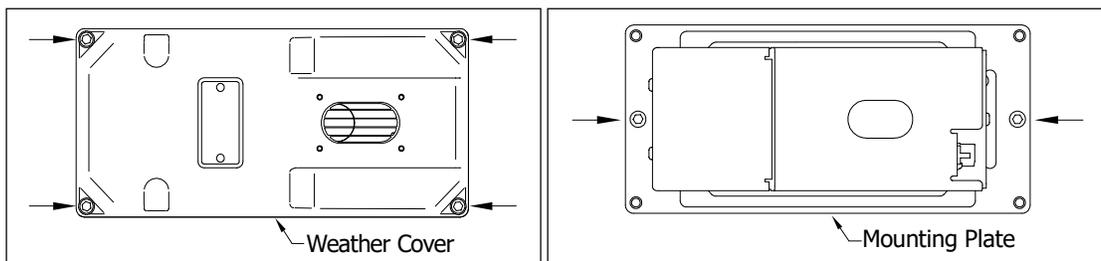
You'll next install the first bearing scanner.

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

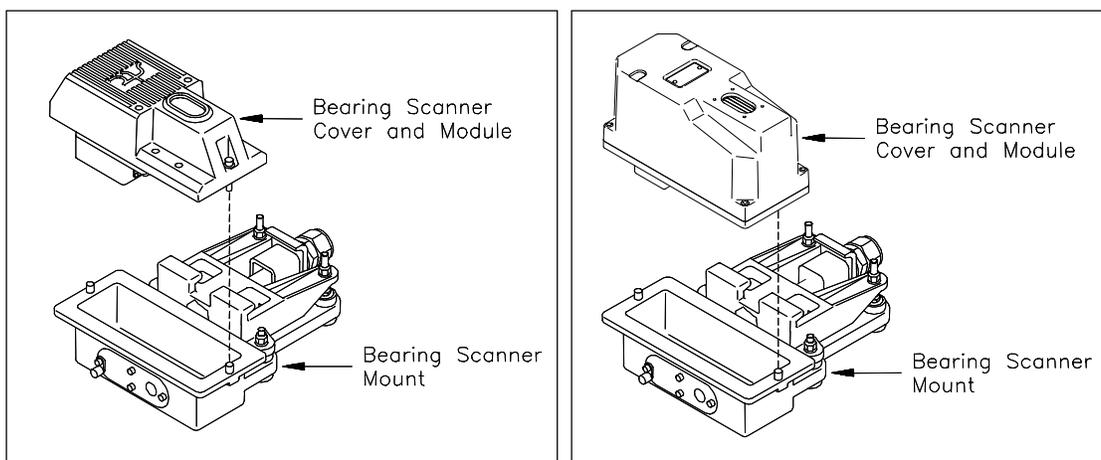
The **Type II** bearing scanner has two socket-head-cap screws that attach the weather cover to the mount.



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



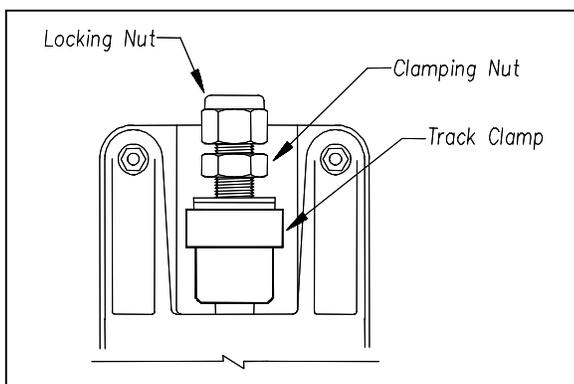
- 6** Separate the bearing scanner cover-and-module assembly from its mount.



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

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

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



- 9** Centered between the ties and on the rail closest to the wayside enclosure, place the mount so that the moveable track clamp extends under the rail and toward the center of the track.

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

This should hold the mount in place.

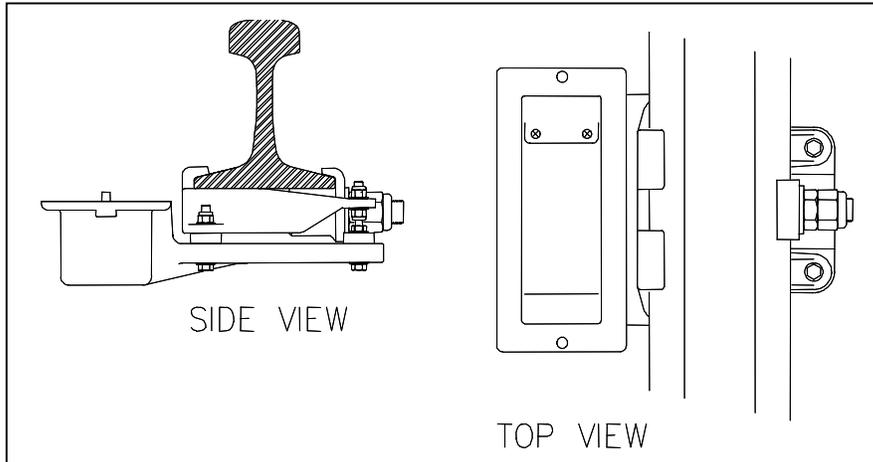
- 11 Using a short-handle 1-1/2-inch wrench, tighten the clamping nut to a **torque of 48 to 50 foot-pounds (65.1 to 67.8 newton-meters)**.

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

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

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

At this point, your work should look like this.



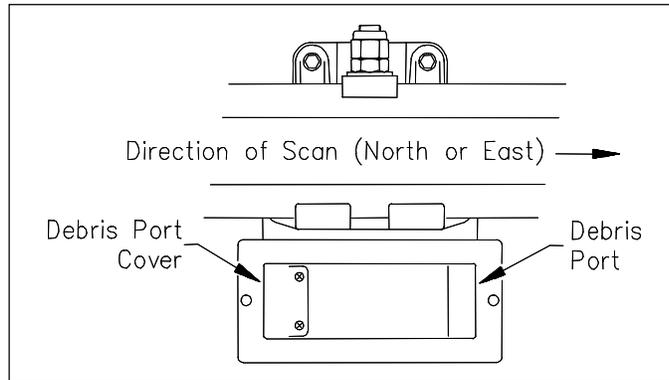
- 13 Determine the direction of scan.

NOTE:

On an N/S track, it is critical that bearing scanners be oriented to scan in a northerly direction to reduce the possibility of scanners looking directly into the sun during scanning operations. For E/W tracks, an easterly direction of scan is considered the "standard" and is strongly recommended by STC.

- If the track runs north and south, both the oval hole in the top of the scanner and the rectangular hole in the bottom of the mount should be pointed north.
- If the track runs east and west, both holes should be pointed east.

14 Examine the top of the mount.



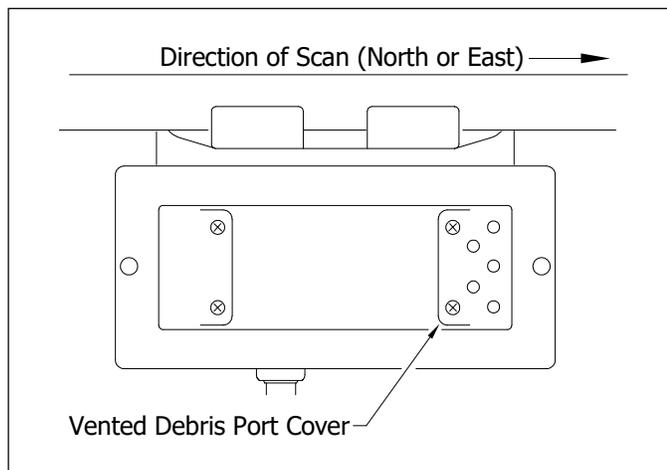
In the bottom of the mount are two rectangular holes called debris ports. One port is covered. One isn't. **Do the next step only if the uncovered debris port is at the southmost or westmost end of the mount.**

15 If the debris port cover isn't as shown above, follow these steps.

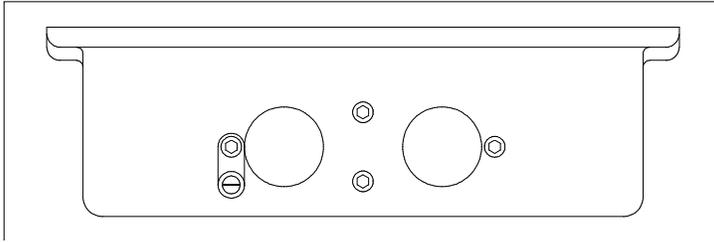
- a Using a #2 Phillips head screwdriver, remove the two screws holding the debris port cover.
- b With gentle pushing from underneath, remove the debris port cover.
- c Place the debris port cover over the debris port on the other end of the mount.
- d Using a #2 Phillips head screwdriver, replace the two screws through the debris port cover.

16 If you are installing a **Type III** bearing scanner, follow these steps.

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



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

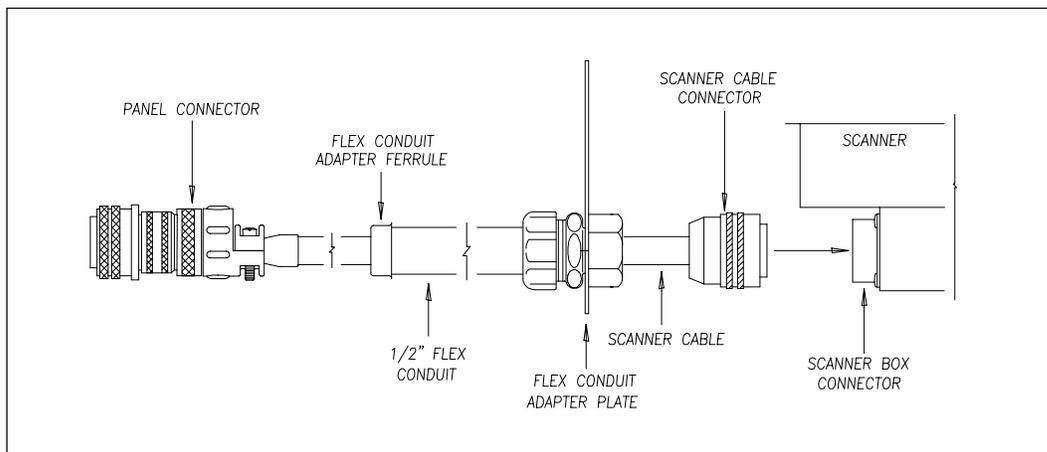


On the side of the mount are two large holes and four socket-head-cap screws. The longest screw is holding a ground lug and an internal-tooth washer.

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

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

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

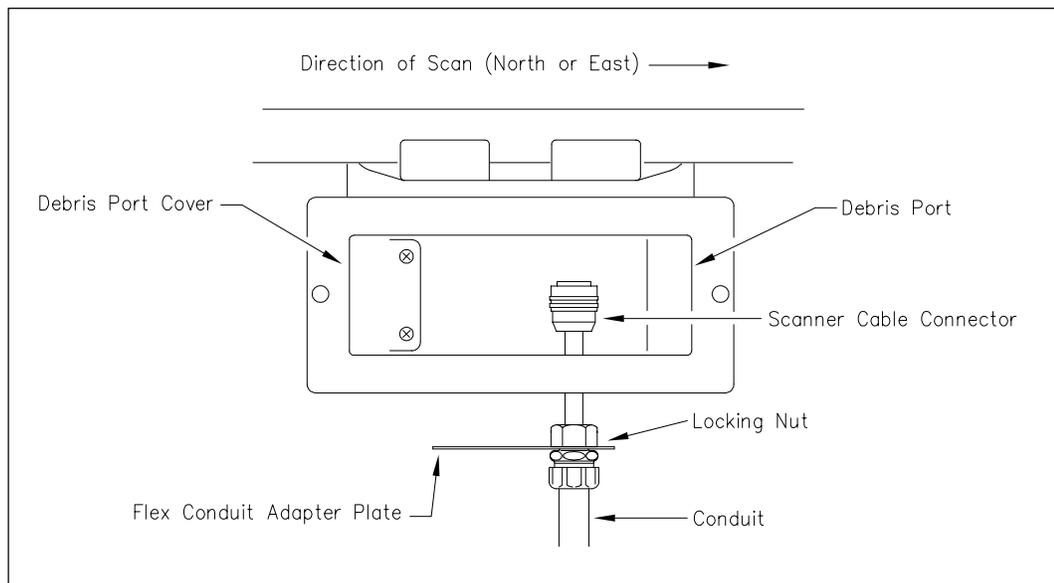


Single-track sites have two 65-foot (19.8-meter) bearing scanner cables.

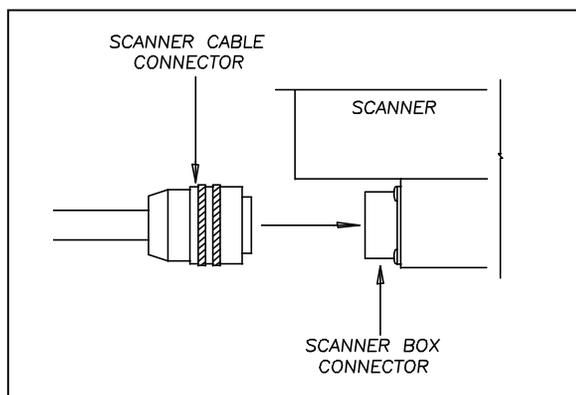
Double-track sites have two 65-foot bearing scanner cables for the track closest to the wayside enclosure and two 100-foot (30.5-meter) bearing scanner cables for the track farthest from the wayside enclosure. **Triple-track sites** have two 65-foot cables, two 100-foot cables, and two 130-foot (39.6-meter)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

20 If this is a multitrack site, select the correct length of cable.

- 21** Tighten the locking nut (on the conduit connector) until it is tight against the flex-conduit-adapter plate

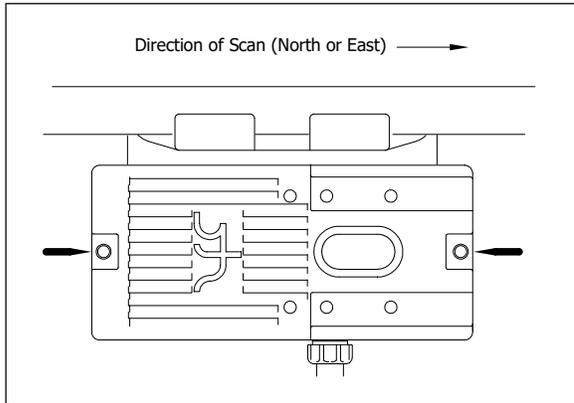


- 22** Put the scanner cable connector through the northmost or eastmost round hole in the side of the mount.
- 23** Align the screw holes in the flex-conduit-adapter plate with the screw holes in the mount.
Replace the two center screws and tighten them by hand to hold the flex-conduit adapter plate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



30 If this is a **Type II** bearing scanner:

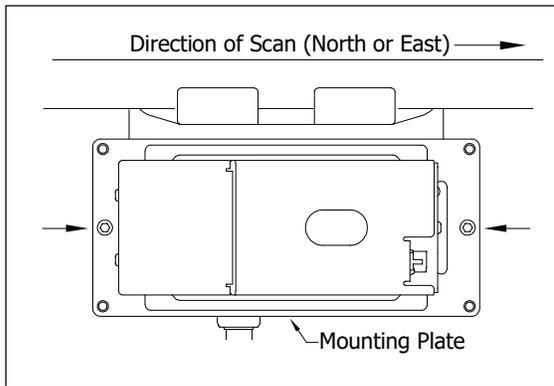
- a** With the hole on top of the bearing scanner cover facing north or east, set the cover-and-module assembly onto its mount.



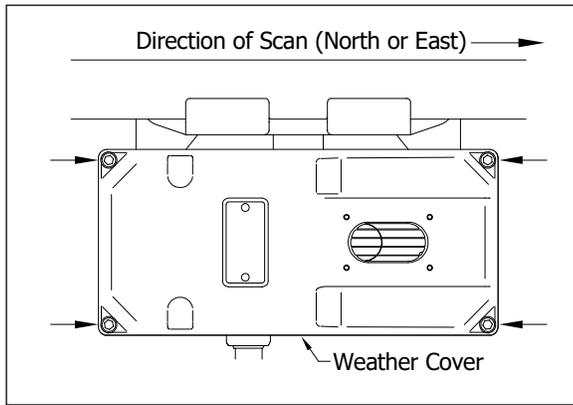
- b** Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.

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

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



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



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

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

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

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

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

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

Attach one end of an 8-AWG stranded copper wire to the ground lug on the flex-conduit-adapter plate and the other end to the ground connector on the ground rod. The ground rod was driven into the ground beside the wayside enclosure.

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

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

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

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

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

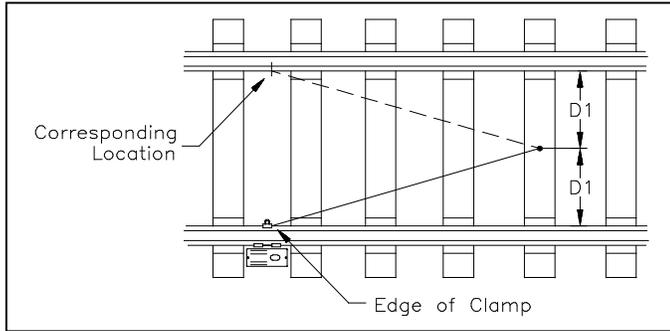
39 Store the cover-and-module assembly in a safe place until you replace it.

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

40 To locate the second mount on the opposite rail:

a Mark the center of the fourth tie ahead of the just-installed mount.

- b** From this mark, measure to the edge of the track clamp on the just installed mount.
- c** From the mark, measure the same distance on the opposite rail.



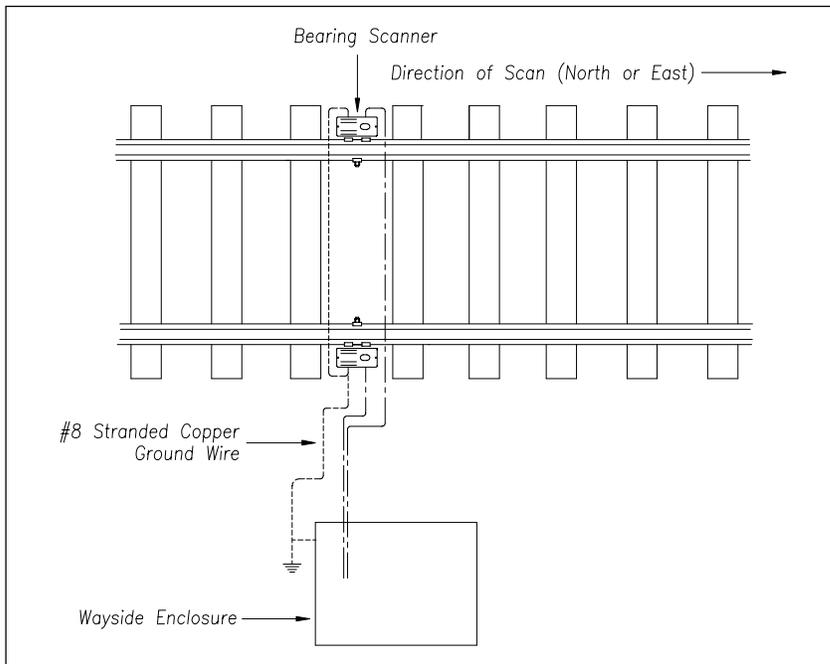
- d** Mark this location.

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

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

- 41** With the mark as a guide, place the second mount so that the moveable track clamp extends under the rail and toward the center of the track.
- 42** Repeat steps **10** through **36**.
- 43** Attach one end of an 8-AWG stranded copper wire to the ground lug on the flex-conduit-adapter plate and the other end to the ground lug on the other scanner mount.

From above, your site would look something like this.



- 44** If this is a multitrack site, repeat steps **1** through **45** on each track.

9.2 Transducers

The wheel transducer can be utilized in two different functions on a SmartScanNG² system - as a gating transducer or an advance transducer. All tracks use two rail-mounted gating transducers. On the rail nearest the wayside enclosure, these transducers (labeled **TO1** and **TO2**) are mounted near and to the north or east of the bearing scanner. They control scan timing and car recognition. Some but not all tracks use rail-mounted advance transducers (labeled **ADV1** and **ADV2**). The advance transducer provides a signal that activates the system.

9.2.1 Gating Transducers

If your system uses the 2100-596 transducer clamp mount assembly, skip ahead to the next section.

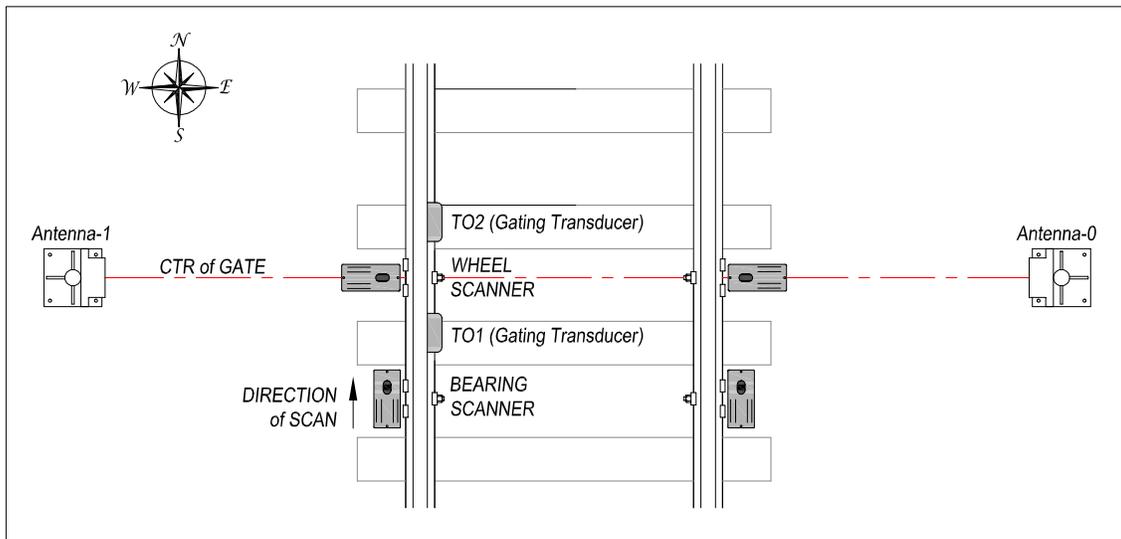
To install the **gating transducers**:

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

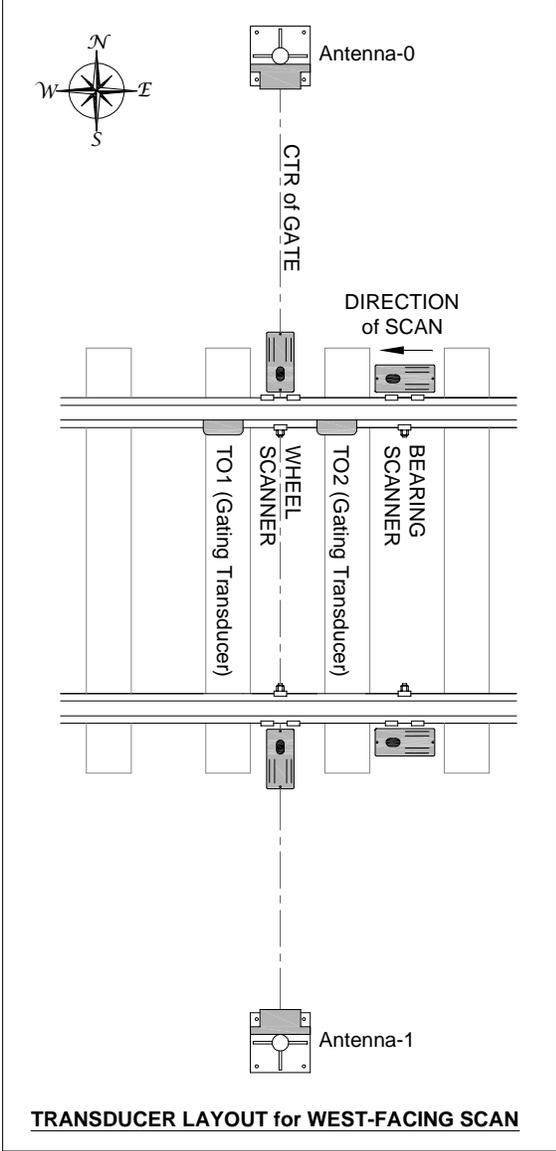
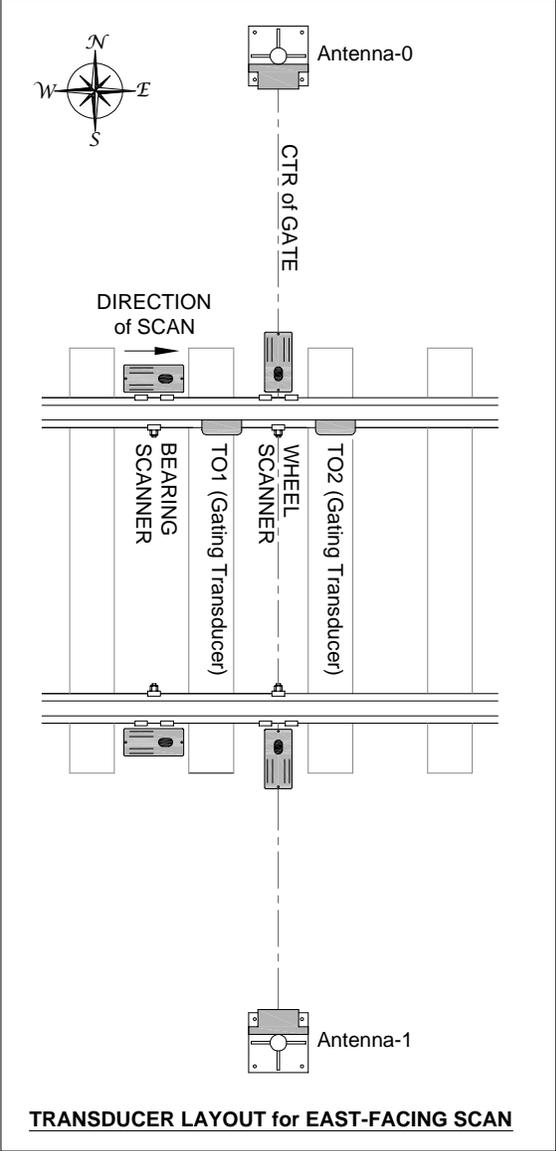
If your rail size isn't 115, 122, 127, 132, 136, or 141-pounds per yard (57.05, 60.52, 63.00, 65.48, 67.46, or 69.94-kilograms per meter), call STC for help.

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

The graphic below depicts component placement for a "standard" north/south track configuration. A north-facing scanner is highly recommended to reduce the possibility of looking directly into the sun during scanning operations. The east rail is Rail1, and the west rail is Rail2. The northmost transducer is always designated TO2, regardless of which rail it is mounted. The eastmost antenna is always designated Antenna-0.



The graphic (below left) depicts component placement for the typical east/west track configuration. An east-facing scanner is considered “standard” and is recommended by STC. An alternative configuration (west-facing scanner) is depicted in the lower-right graphic. The north rail is Rail1 and the south rail is Rail2. In either configuration, the eastmost transducer is always designated TO2 regardless of which rail it is mounted. The northmost antenna is always designated Antenna-0.



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

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

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

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

When using **Type II** bearing scanners:

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

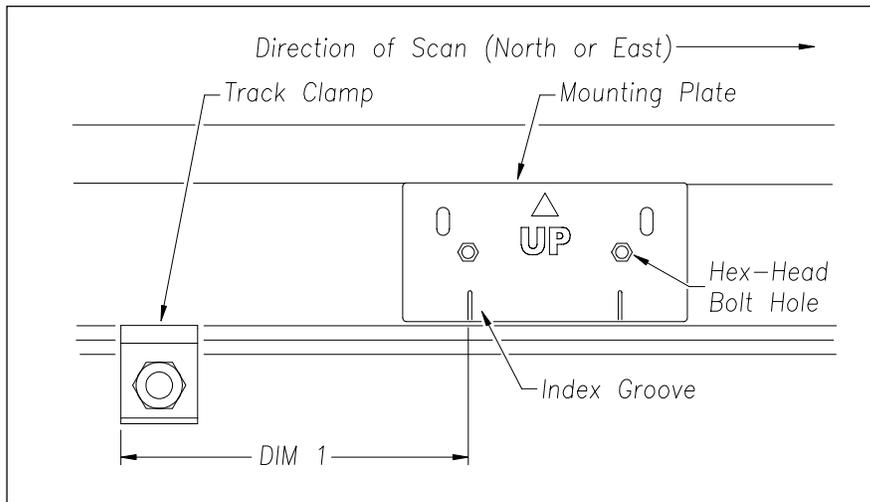
- 4 Separate the fiberglass-reinforced polyester transducer body from the aluminum mounting plate.

NOTE:

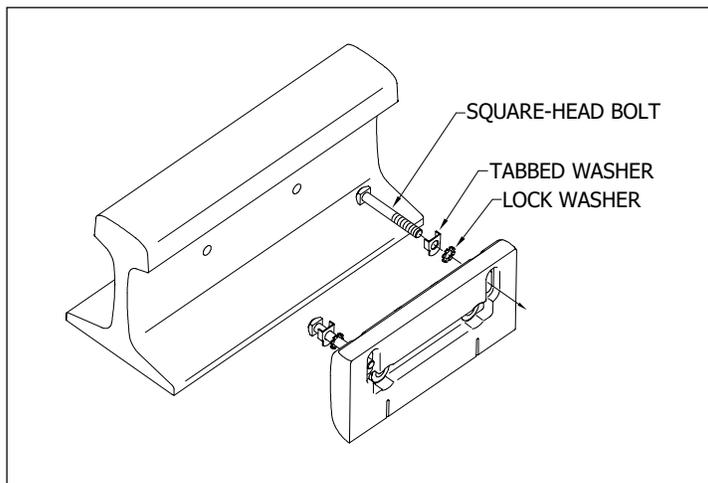
The hole on top of the bearing scanner cover faces the direction of scan (normally north or east). Note further that the gating transducers are mounted on the same side as where the bearing scanner is "looking."

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

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

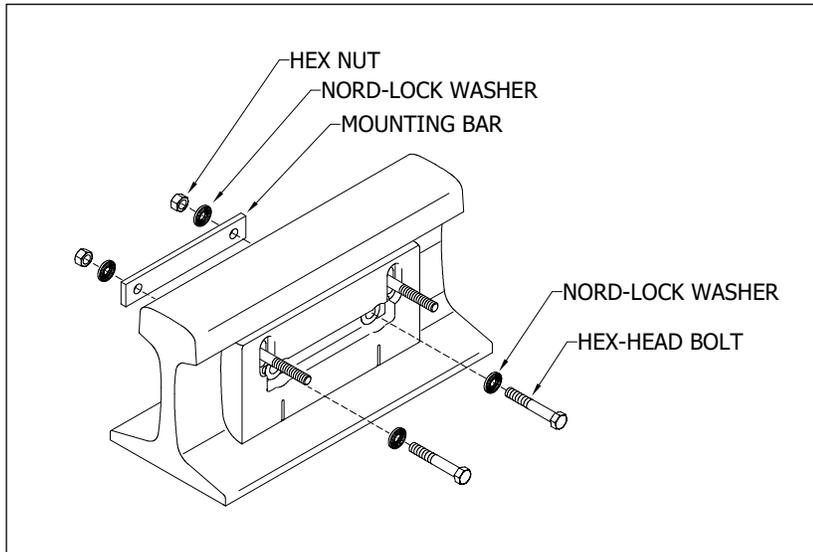


- 7 Hold the mounting plate against the rail and as high against the crown as possible.
- 8 Using the hex-head bolt holes as your guide, mark the two places on the rail where you'll later drill holes.
- 9 Remove the mounting plate.
- 10 Using a 3/8-inch bit, drill the two holes.
- 11 Place one tabbed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



- 13 With the arrow on the plate pointing up and the heads of the bolts against the gauge side of the rail, align the hex-head bolt holes in the plate with the drilled holes in the rail.
- 14 Place one Nord-Lock washer on each hex-head bolt.
- 15 Insert the two hex-head bolts with Nord-Lock washers through the aligned holes.

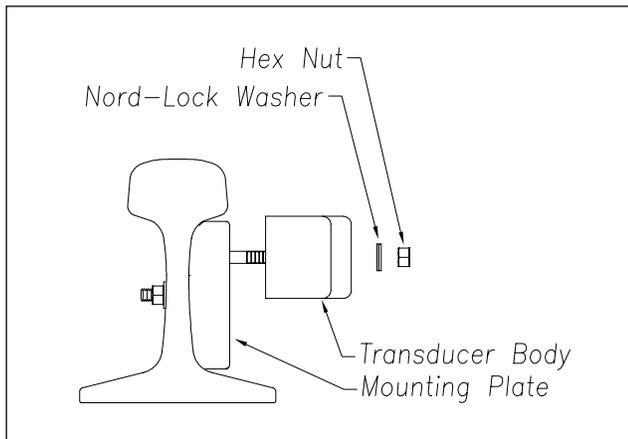
- 16** Loosely place the mounting bar, Nord-Lock washers, and hex-lock nuts onto the hex-head bolts.



- 17** Tighten each hex-lock nut with a 9/16-inch torque wrench to a **torque of 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.

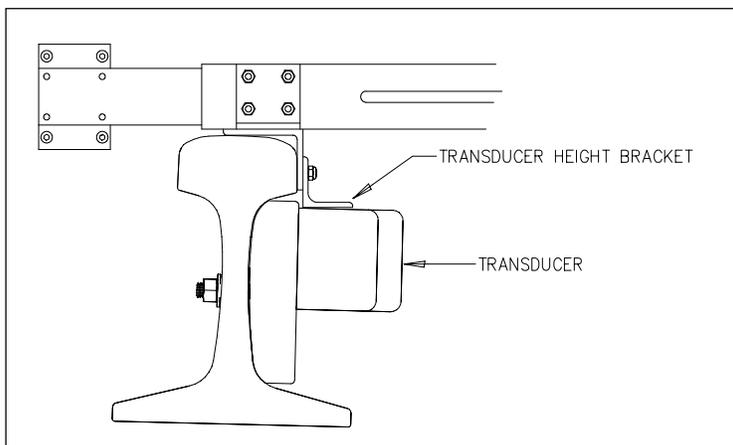
- 18** With the transducer body's magnetic side up (that is, with the arrow on the transducer body pointing up), slide it onto the square-head bolts.
- 19** Loosely place the Nord-Lock washers and hex-lock nuts onto the square-head bolts.



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

- 20** Place the alignment fixture across both rails, centered over the transducer. The fixture should be snug against the top and gauge of both rails.

21 Move the transducer body to where it just touches the height bracket.



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

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

The transducer body is now attached to the mounting plate.

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

When using **Type III** bearing scanners:

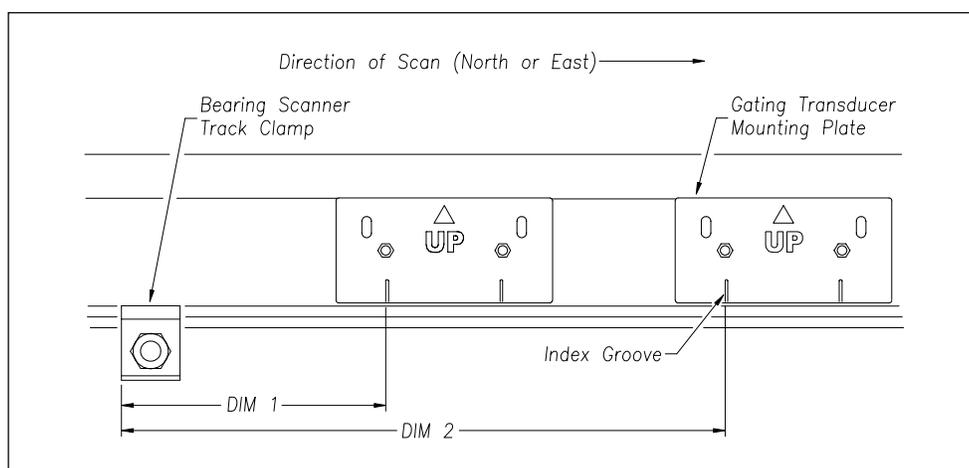
Rail Size pounds/yard	Rail Size kilograms/meter	Distance (DIM2), When Using With Type III Bearing Scanners
115	57.05	32-1/4 inches (81.92 centimeters)
122	60.52	32-7/16 inches (82.39 centimeters)
127	63.00	32-5/8 inches (82.87 centimeters)
132	65.48	32-3/4 inches (83.19 centimeters)
136	67.46	32-13/16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

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

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

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

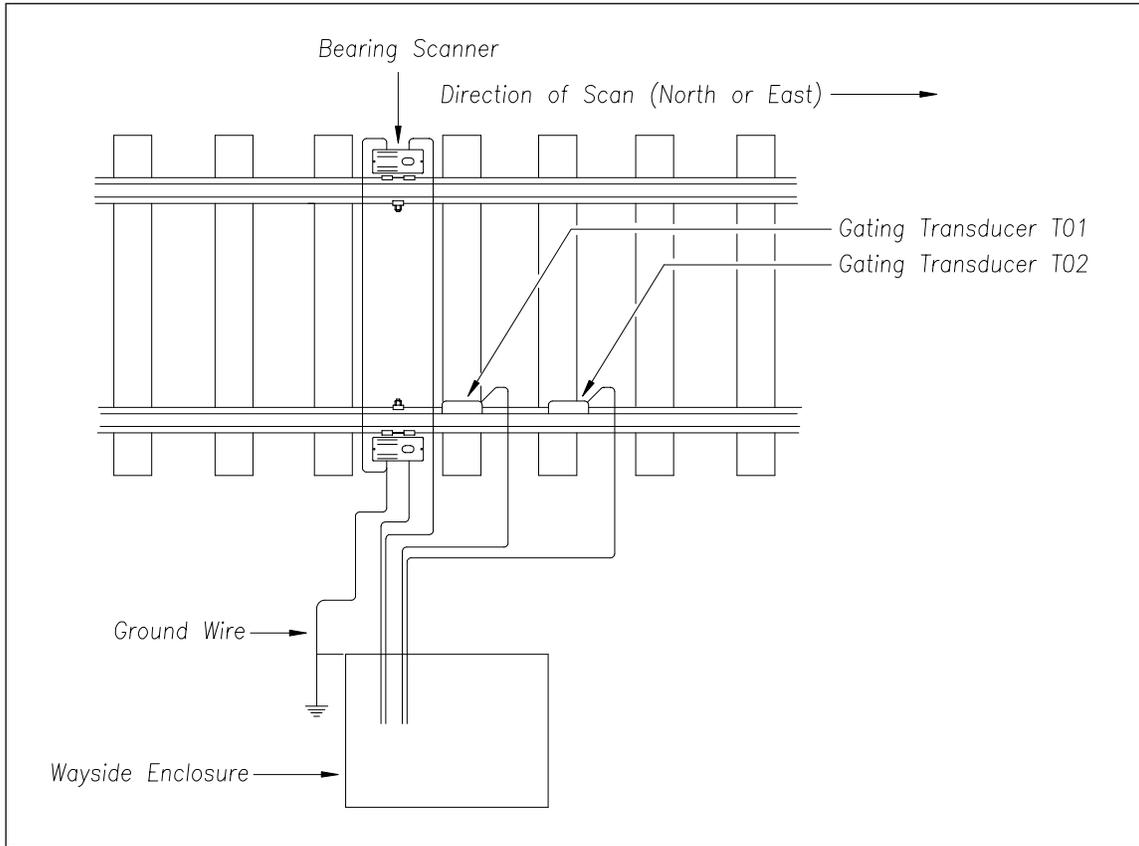
- 28** With the arrow on the plate pointing up, place the mounting plate against the gauge side of the rail.
- 29** Going north or east from the far edge of the track clamp on the bearing scanner to the closest index groove on the mounting plate, measure the distance obtained in step **28**.



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

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

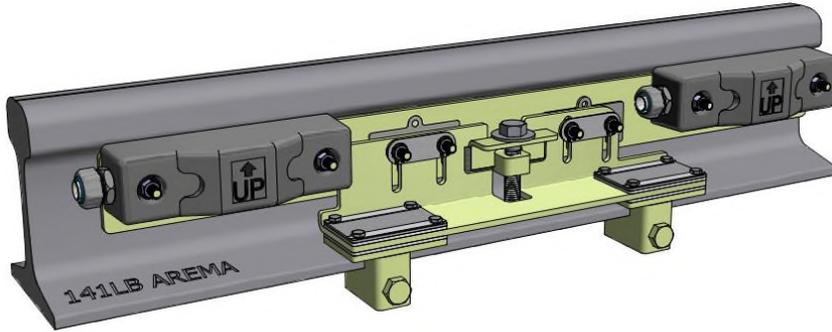
If this is a single-track site, you are done installing both gating transducers. From above, your site would look something like this.



34 If this is a double-track site, repeat steps **1** through **34** on the second track.

9.2.2 Installing the 2100-596 Double Gating Transducer Assembly

If your system does not use the clamp method of mounting wheel transducers, skip ahead to the next section.



To install the **2100-596**:

- 1 Be sure that you have all the required tools on hand – (see figure 3).
- 2 Determine the size of the rail at your site.

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

- 3 The 2100-596 is to be installed on the rail nearest to the wayside enclosure.

The graphic below depicts component placement for a “standard” north/south track configuration. A north-facing scanner is highly recommended to reduce the possibility of looking directly into the sun during scanning operations. The east rail is Rail1, and the west rail is Rail2. The northmost transducer is always designated TO2, regardless of which rail it is mounted. The eastmost antenna is always designated Antenna-0.

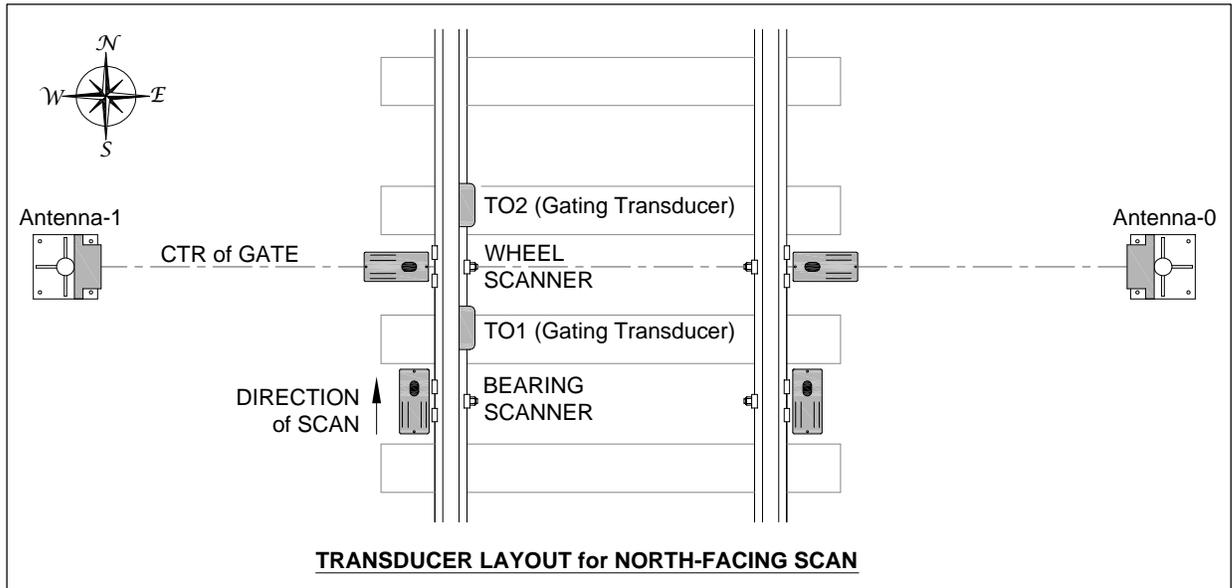


Figure 1

The graphic (below left) depicts component placement for the typical east/west track configuration. An east-facing scanner is considered “standard” and is recommended by STC. An alternative configuration (west-facing scanner) is depicted in the lower-right graphic. The north rail is Rail1, and the south rail is Rail2. In either configuration, the eastmost transducer is always designated TO2 regardless of which rail it is mounted. The northmost antenna is always designated Antenna-0.

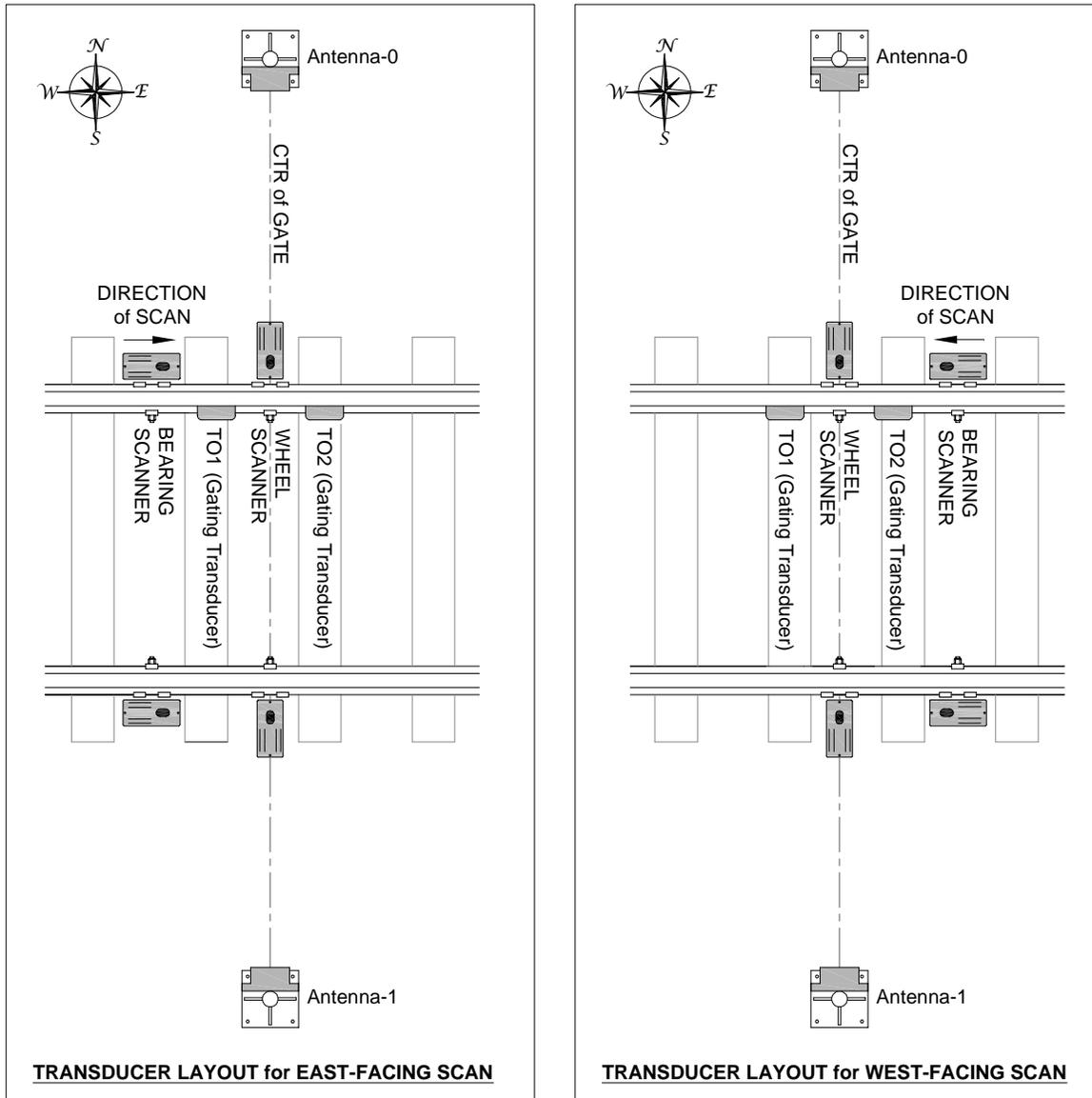
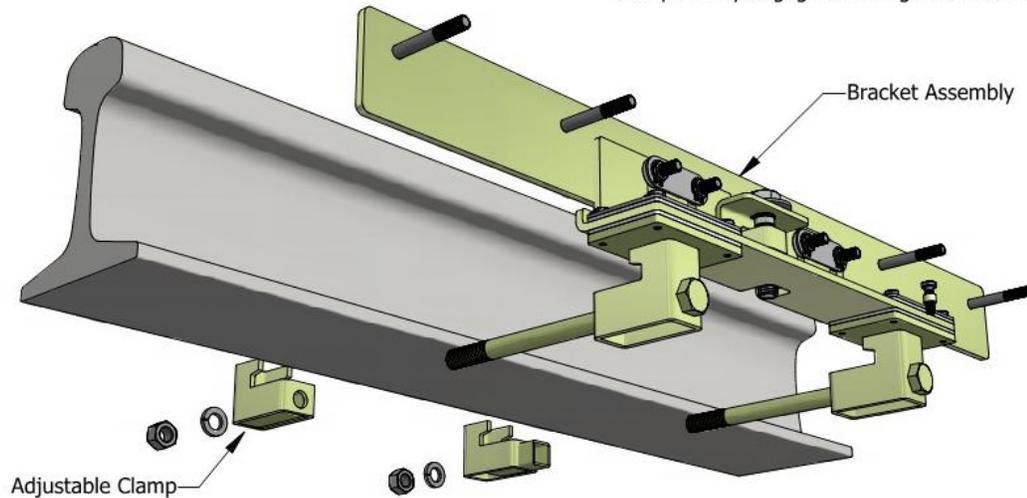


Figure 2

TOOLS REQUIRED

1. 9/16" Socket
2. 11/16" Socket
3. 1-1/16" Socket
4. 3/8" or 1/2" Socket Drive Wrench
5. 3/8" or 1/2" Socket Drive Torque Wrench
6. 3/8" or 1/2" Socket Drive Adapters and Extensions as required

Remove the adjustable track clamps nuts and washers from the bracket assembly. Mount the bracket assembly on the rail so that the slots in the clamps firmly engage the flanges on the rail foot.



Slide the adjustable clamps on to the clamp bolts and on to the rail foot flange. Secure the clamps with the lock washers and nuts. **Tighten the nuts to 35 ft lbs.**

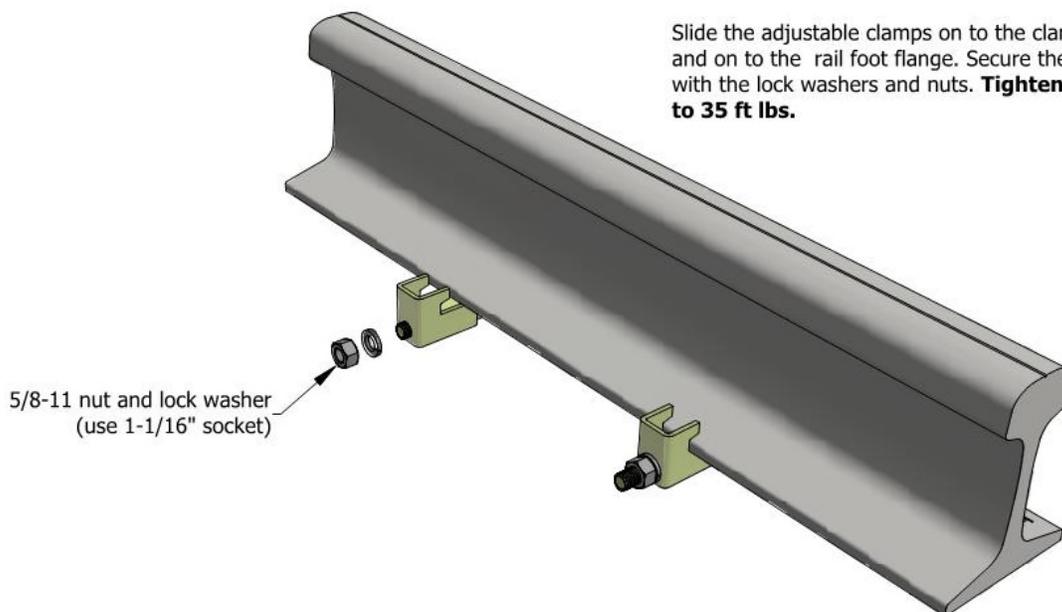
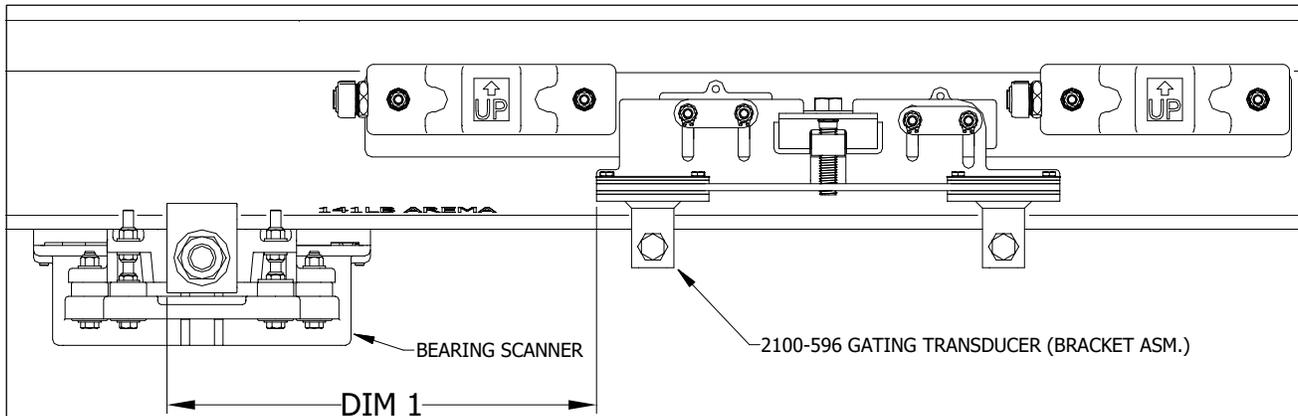


Figure 3

NOTE:

The hole on top of the bearing scanner cover faces the direction of scan (normally north or east). The gating transducers mount to the same side as the bearing scanner is "looking."

- 4 Per figure 3, loosely mount the clamp bracket against the gauge side of the rail.
- 5 Slide the bracket horizontally as necessary so that DIM1 is the correct distance for your rail size. DIM1 (shown below) is the distance from the far edge of the track clamp on the bearing scanner to the near edge of the bracket assembly. Tighten the nuts to 35 ft-lbs.



Using the tables below, note the distance for your rail size.

When using **Type III** bearing scanners:

Rail Size pounds/yard	Rail Size kilograms/meter	Distance (DIM1)
115	57.05	14-1/2 inches (36.83 centimeters)
122	60.52	14-11/16 inches (37.31 centimeters)
127	63.00	14-7/8 inches (37.78 centimeters)
132	65.48	15 inches (38.10 centimeters)
136	67.46	15-3/16 inches (38.58 centimeters)
141	69.94	15-5/16 inches (40.48 centimeters)

For example, if your rail size is 132 pounds per yard (65.48 kilograms per meter), the distance is 15 inches (38.10 centimeters). This distance is **DIM1**.

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

Rail Size pounds/yard	Rail Size kilograms/meter	Distance (DIM1)
115	57.05	16-5/8 inches (42.23 centimeters)
122	60.52	16-13/16 inches (42.70 centimeters)
127	63.00	17 inches (43.18 centimeters)
132	65.48	17-1/8 inches (43.50 centimeters)
136	67.46	17-5/16 inches (43.97 centimeters)
141	69.94	17-7/16 inches (44.29 centimeters)

For example, if your rail size is 132 pounds per yard (65.48 kilograms per meter), the distance is 17-1/8 inches (43.50 centimeters). This distance is **DIM1**.

Figure 4

- 6 To complete the installation, follow the assembly instructions as detailed in figures 5 through 9.

If the transducers are not installed, mount both (STC) transducers. **Torque the transducer nuts to 15 ft. lbs.** Make sure the flexible conduit, connected to the transducers, is *loosely* routed to allow minimum drag on the adjustment system of the bracket assembly.

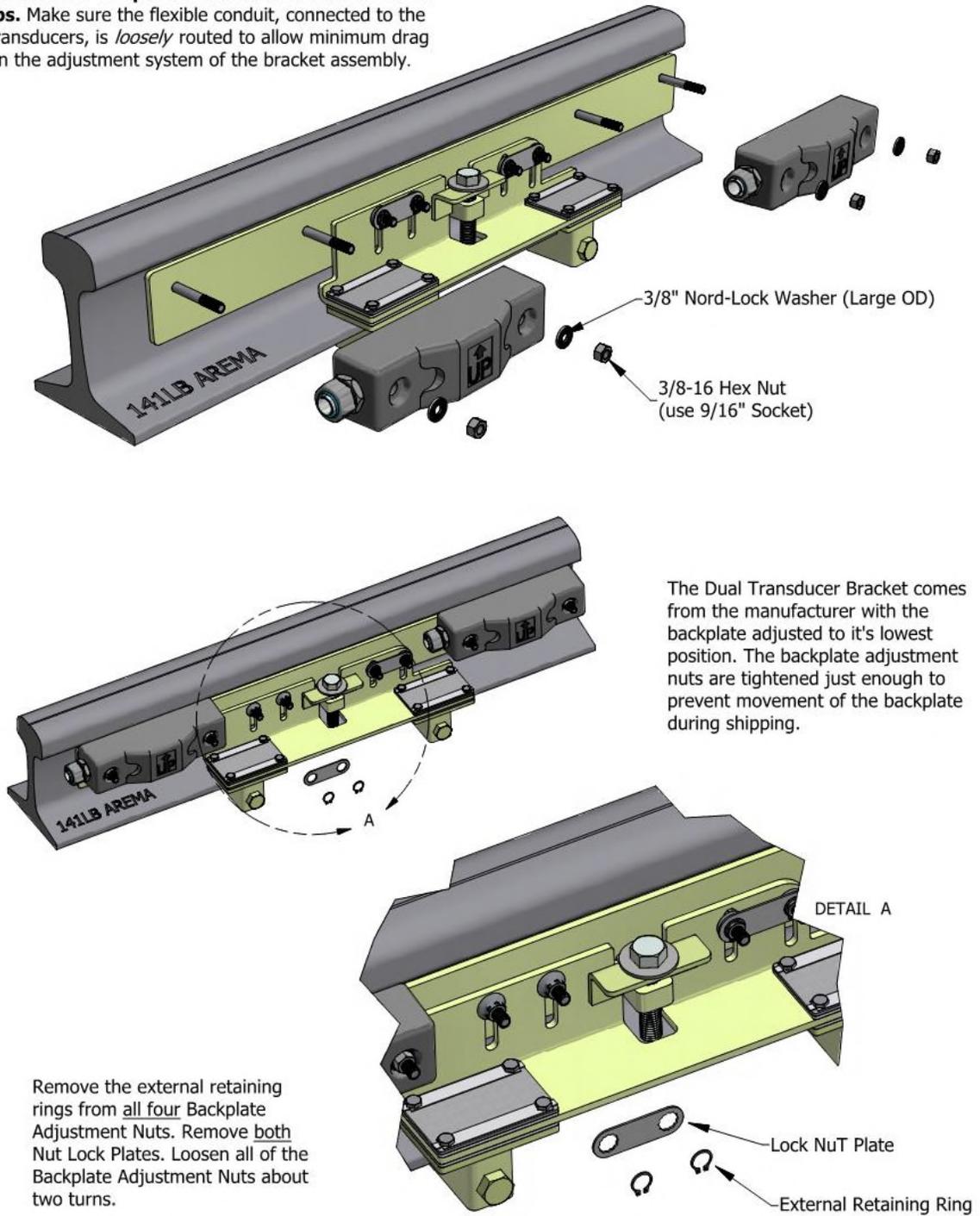
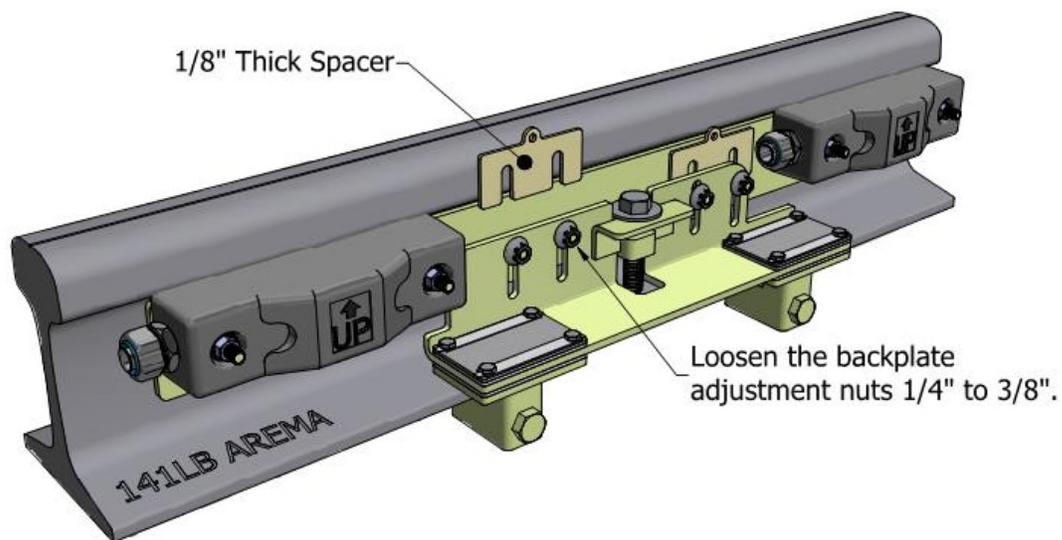
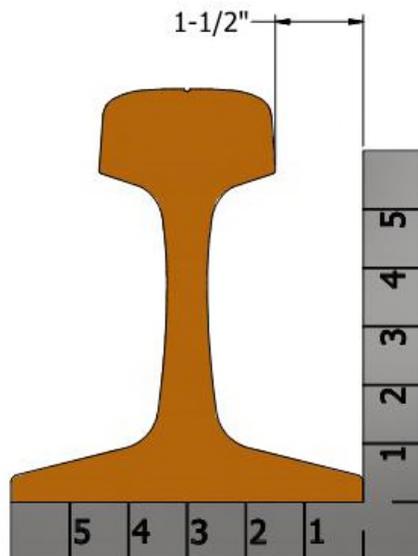


Figure 5

HORIZONTAL TRANSDUCER ADJUSTMENT (IF REQUIRED)



Insert one (or more) spacers between the Back Plate and the Back Plate Mounting Bracket and over the left and right pair of nut studs. (*note: There should be the same number of spacers installed on each pair of studs not to exceed 3 spacer each.*)



1. If the measured distance is less than 1-1/2", spacers should not be required.

2. If the measured distance is 1-1/2" or more, a spacer per every 1/8" over 1-1/2" should be required. (*not to exceed 3 spacers per side*)

Figure 6

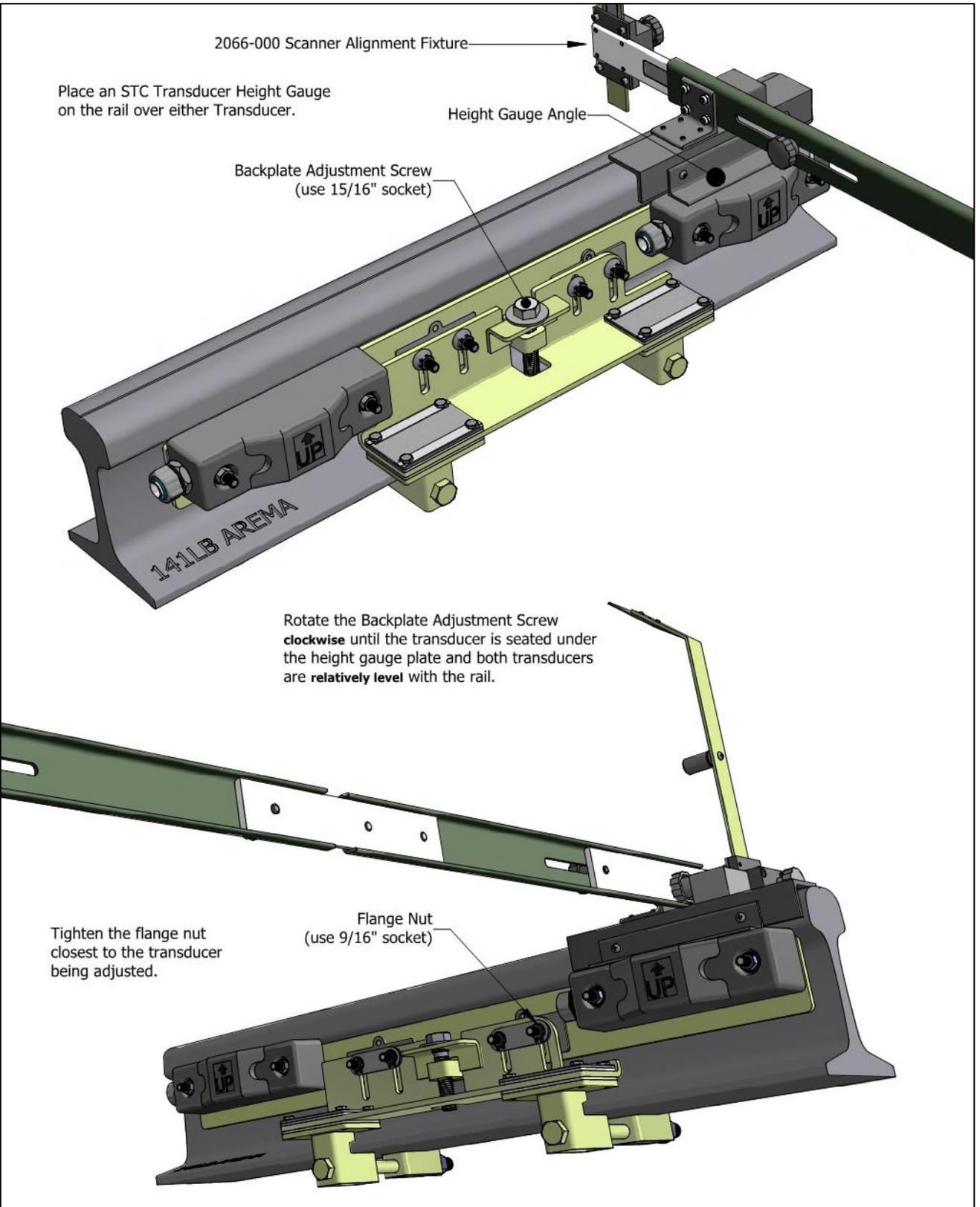


Figure 7

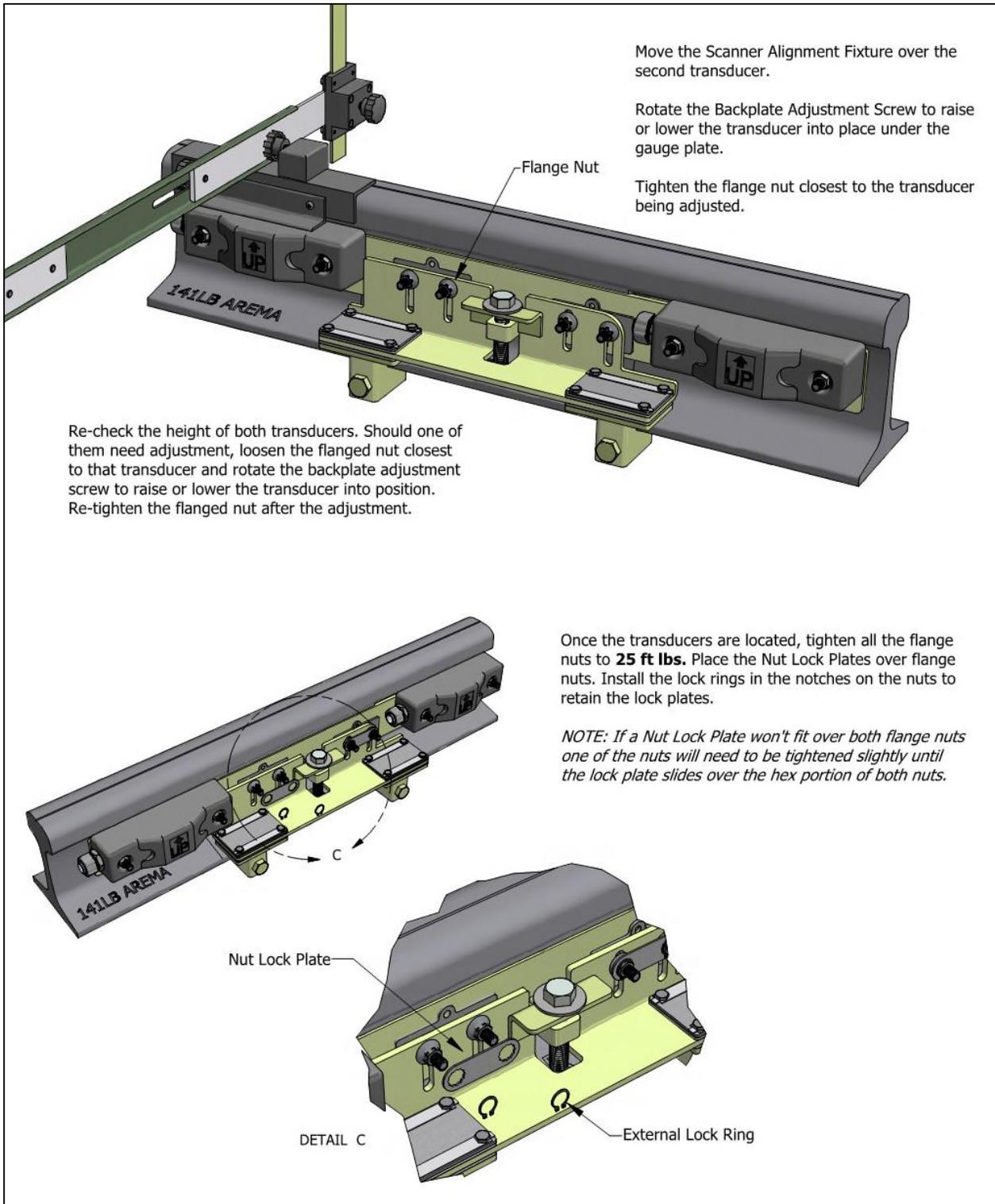


Figure 8

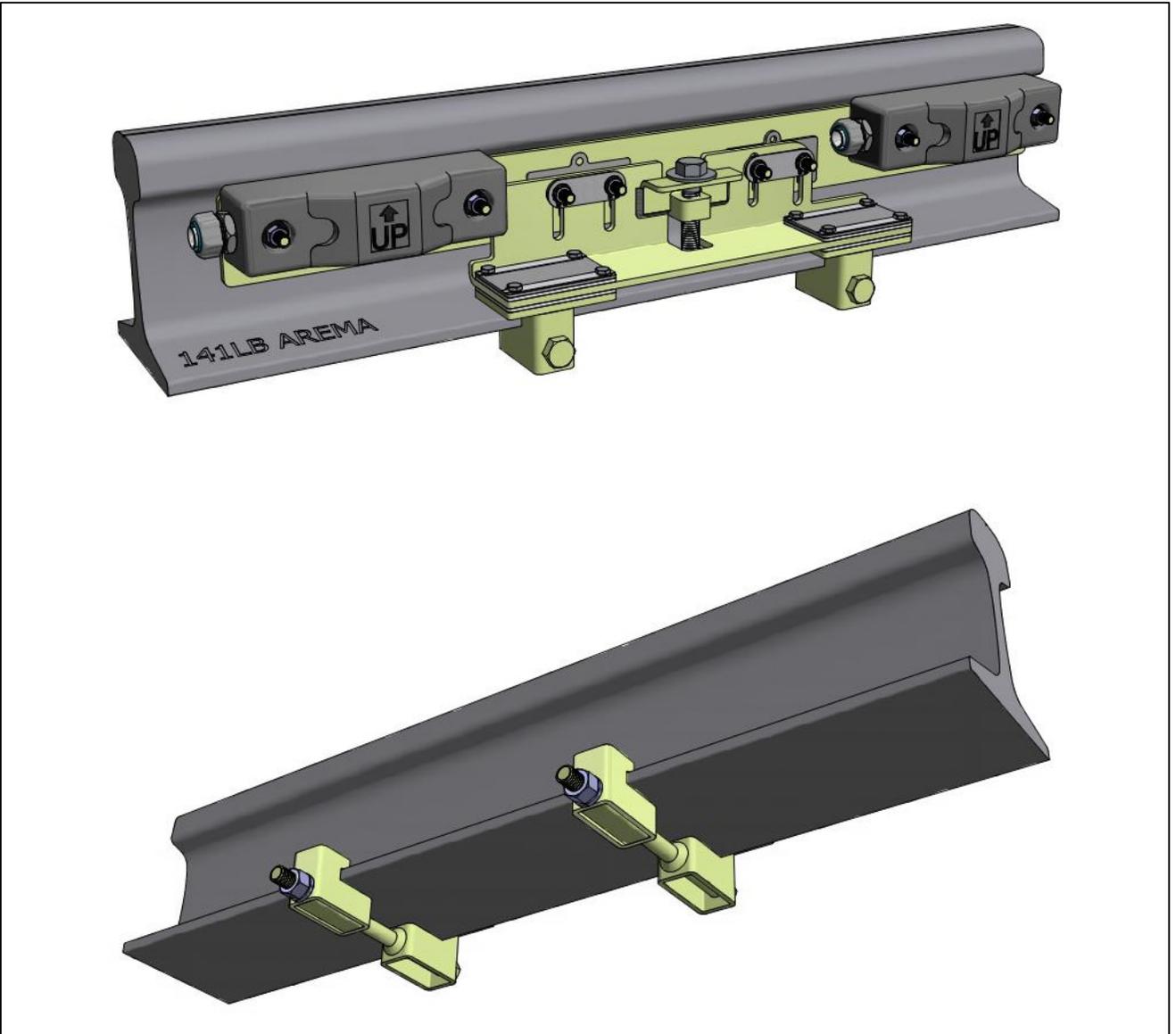
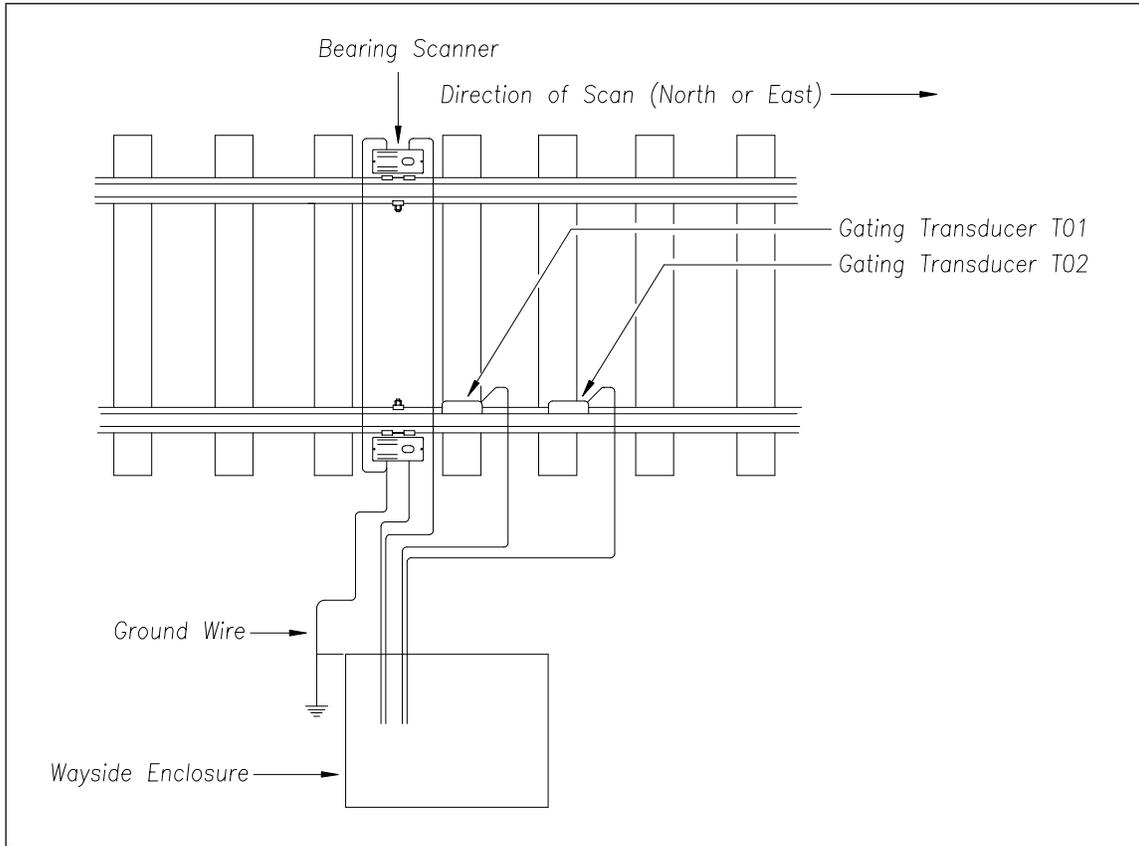


Figure 9

- 7** If this is a single-track site, label the southmost or westmost transducer cable **TO1**. Label the northmost or eastmost transducer cable **TO2**.
- 8** If this is a double-track site, include the track designation on the label (example: **TO1-TRACK1** or **TO1-TRACK2**).

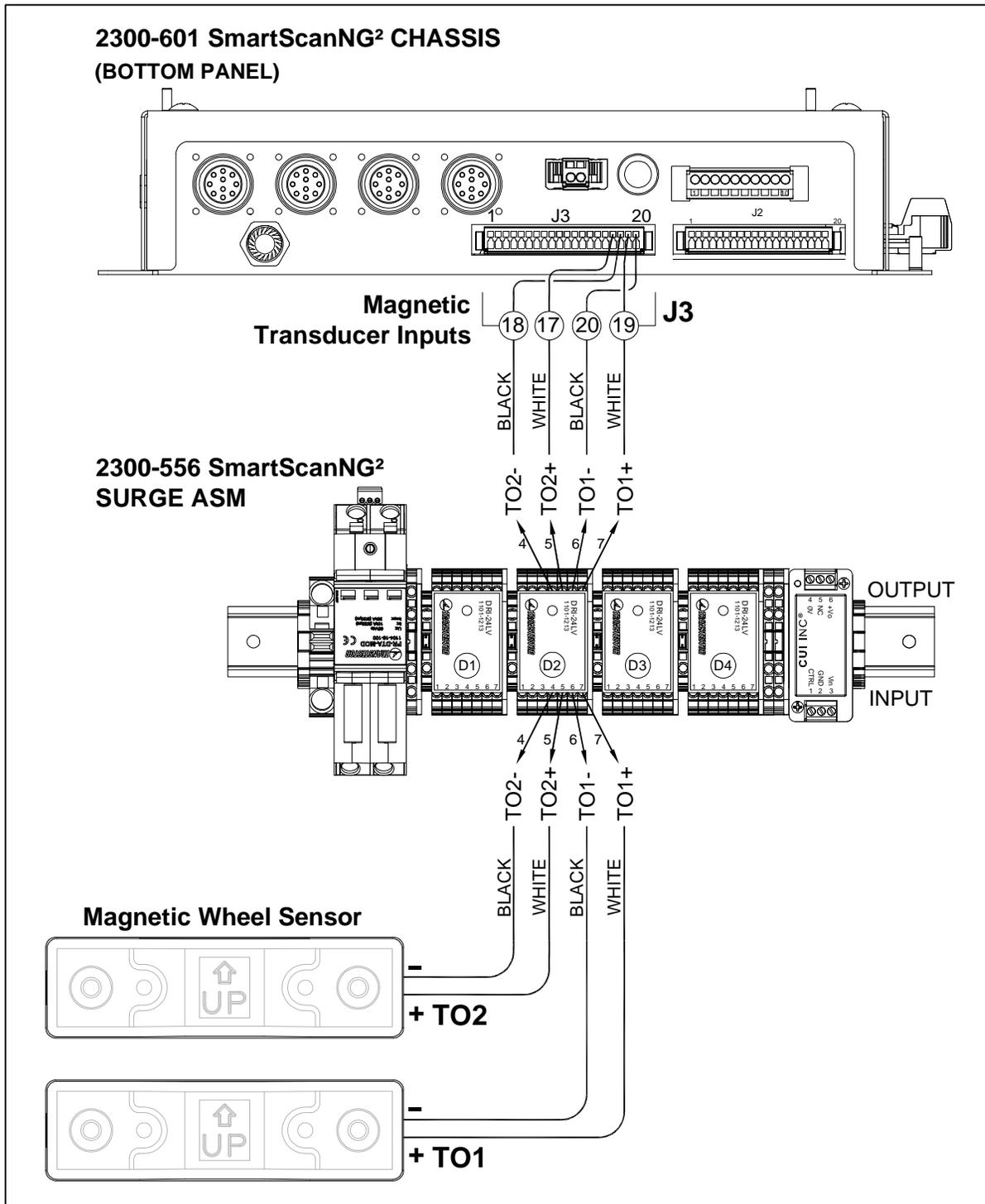
9 Extend the cable into the wayside enclosure and leave it coiled on the floor.

If this is a single-track site, you are done installing both gating transducers. From above, your site would look something like this.

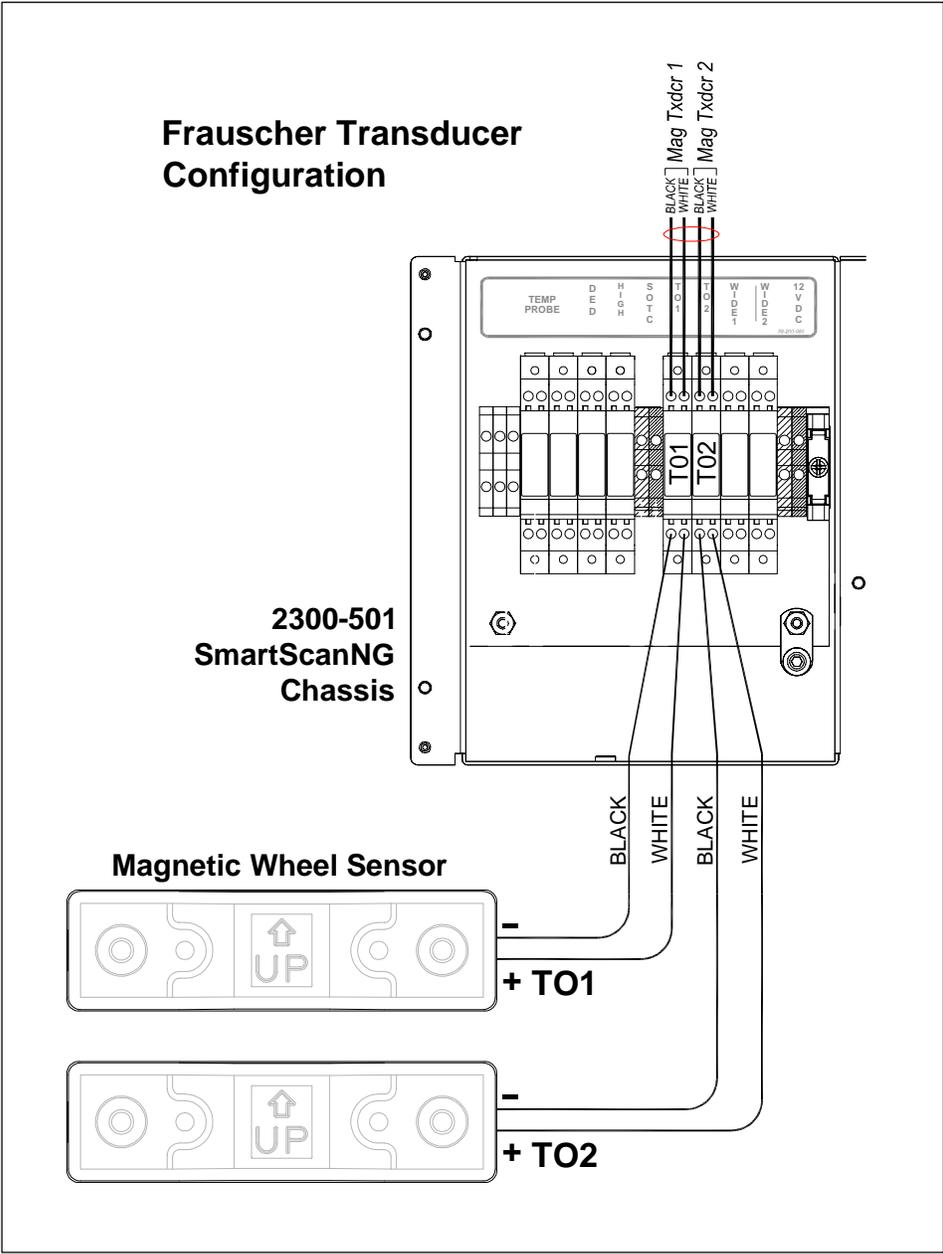


10 If this is a double-track site, repeat steps **1** through **9** on the second track.

11 If your system is equipped with a 2300-601 SmartScanNG² Chassis, see wiring details below.



12 If your system is equipped with a 2300-501 SmartScanNG² Chassis, see wiring details below.



9.2.3 Installing the 2100-696 Frauscher Dual Gating Transducer Assembly

If your system does not use the 2100-696, skip ahead to the next section. To determine if your system is compatible with Frauscher sensors, see Appendix C.



To install the **2100-696**:

1 Be sure that you have all the required tools on hand:

- 11/16" Socket
- 7/8" Socket
- 1-1/2" Socket
- Torque Wrench (foot-pound)
- External Retaining Ring Pliers
- 6mm Hex Key Wrench
- Straight Slot Screwdriver approximately 1/8" wide.
- Wire cutters
- Wire Strippers

2 Determine the size of the rail at your site.

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

3 The 2100-696 is to be installed on the rail nearest to the wayside enclosure.

The graphic below depicts the recommended component placement for a “standard” north/south track configuration. If this layout is not physically possible at your site, each scanner can be relocated up to 100 inches in either direction from the center of the gating transducers.

For the rail with 2100-696 Transducer Assembly:

The bearing scanner is typically mounted in the crib adjacent to the gating transducers. The wheel scanner is typically mounted in the crib on the other side of the gating transducers. The scanners should be centered in the crib to avoid contact with the cross-ties.

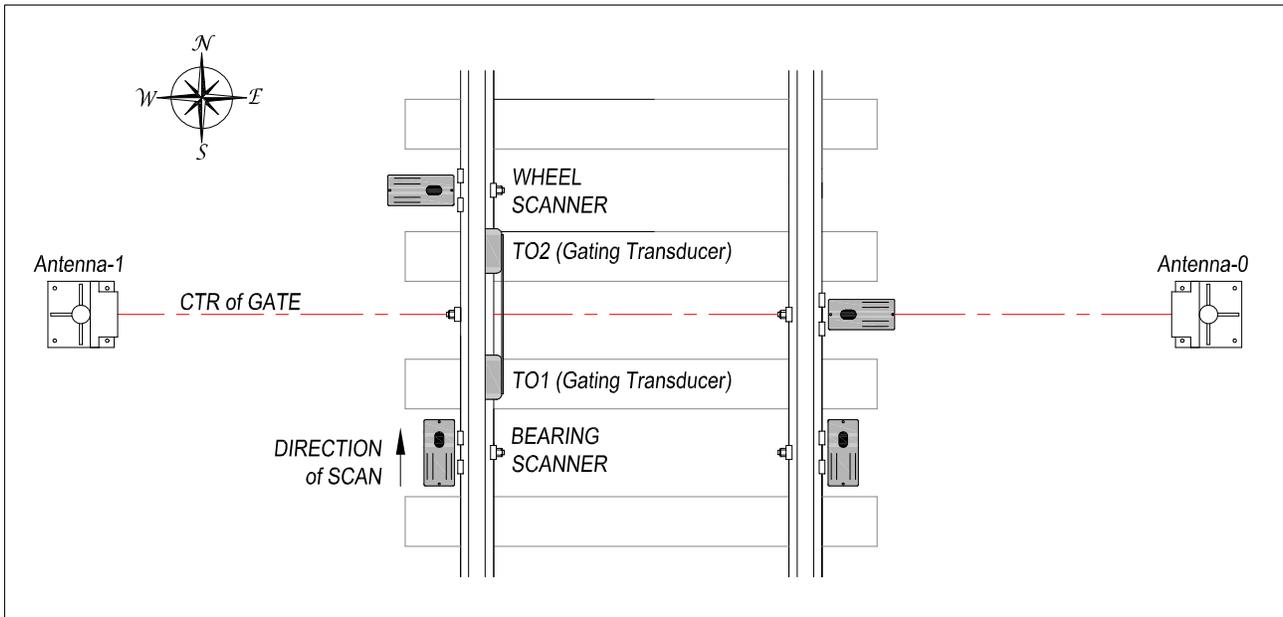
For the opposite rail:

The bearing scanner is typically aligned with the other bearing scanner. The wheel scanner is typically aligned with the center of the gating transducers. The scanners should be centered in the crib to avoid contact with the cross-ties.

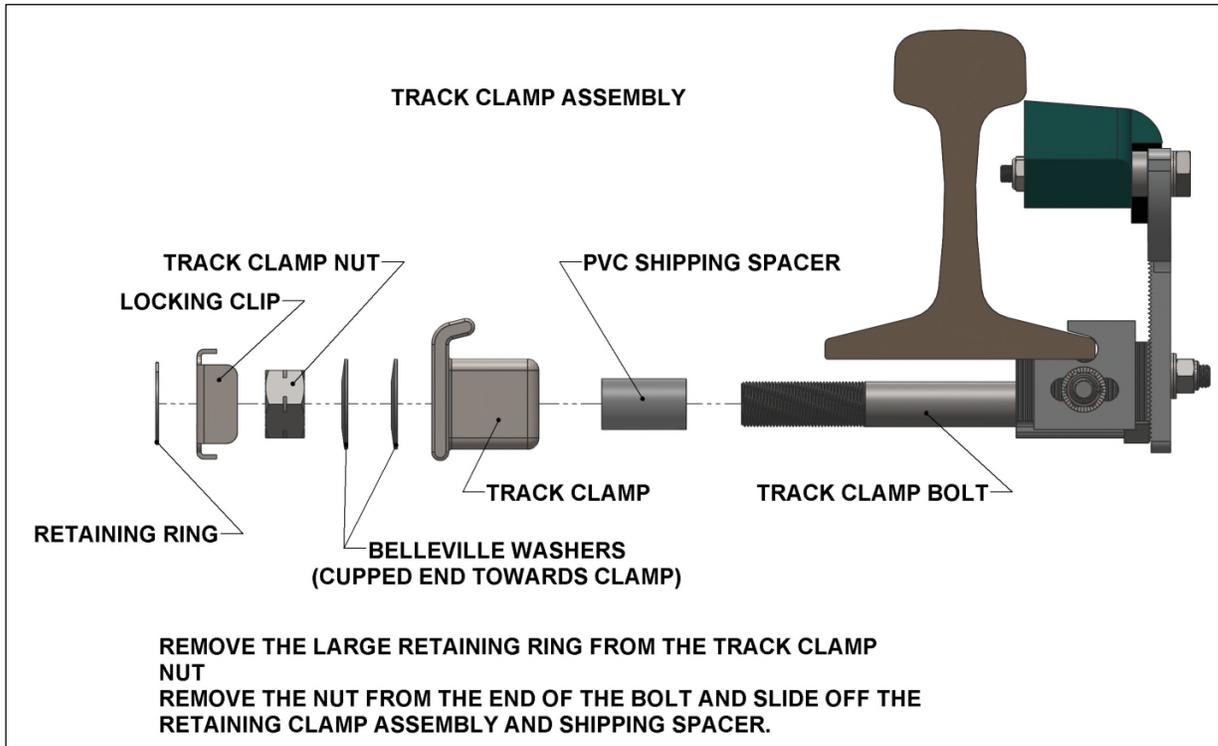
A north-facing scanner is highly recommended to reduce the possibility of looking directly into the sun during scanning operations. The east rail is Rail1, and the west rail is Rail2. The northmost transducer is always designated TO2, regardless of which rail it is mounted. The eastmost antenna is always designated Antenna-0.

NOTE:

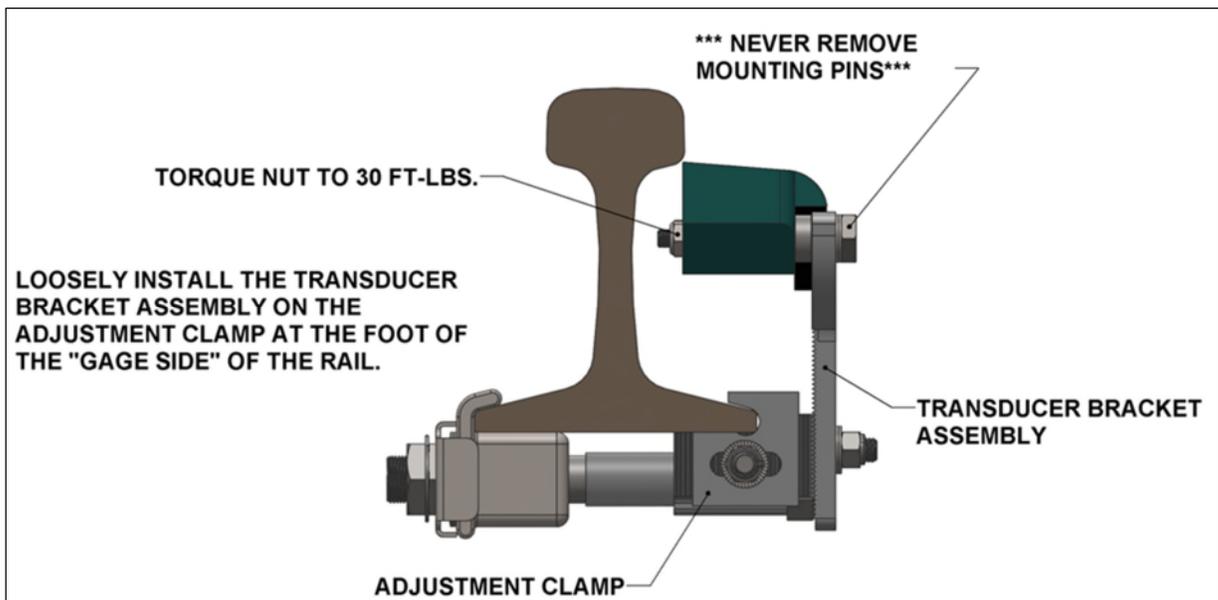
The SmartScanNG² controller automatically calculates the virtual gate for each scanner based on transducer type, rail size, orientation relative to the transducers, and the offset from the center of the gate.



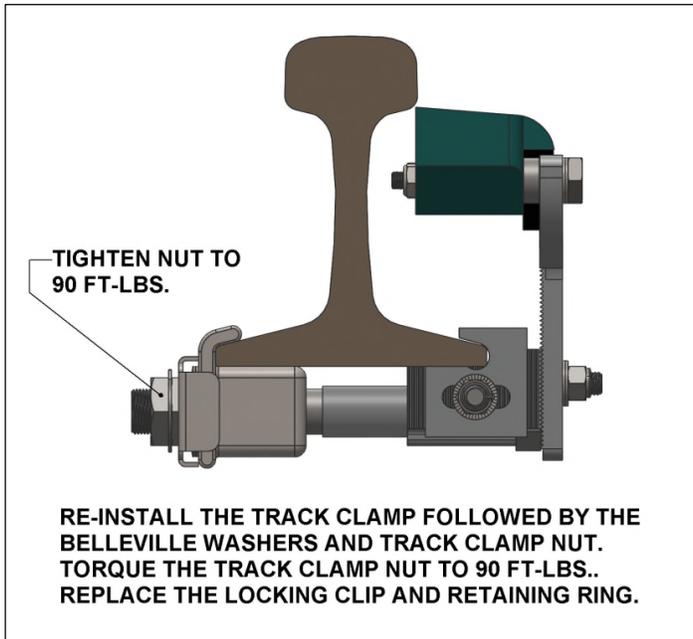
Removal of Mounting Hardware



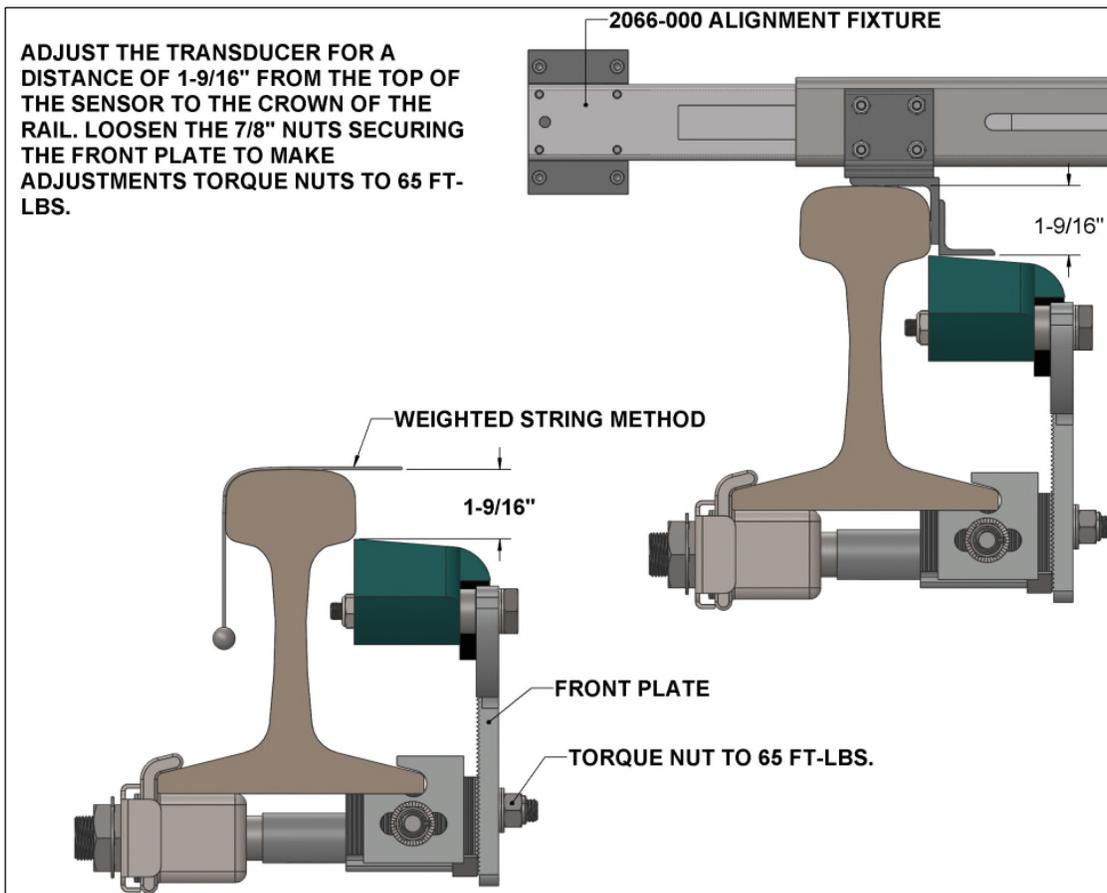
Locate Bracket on Foot of Rail



Installation of Transducer Assembly



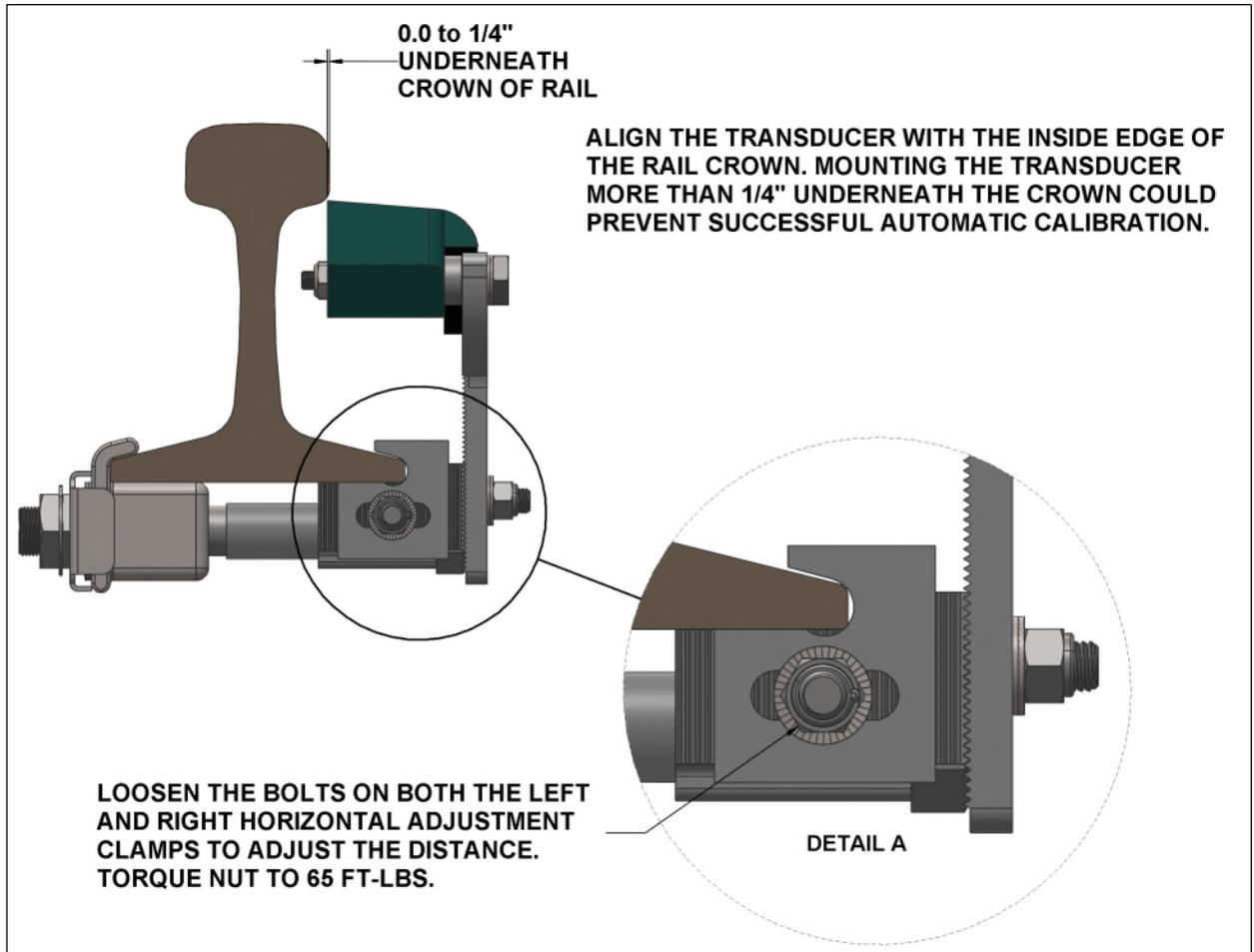
Vertical Adjustment



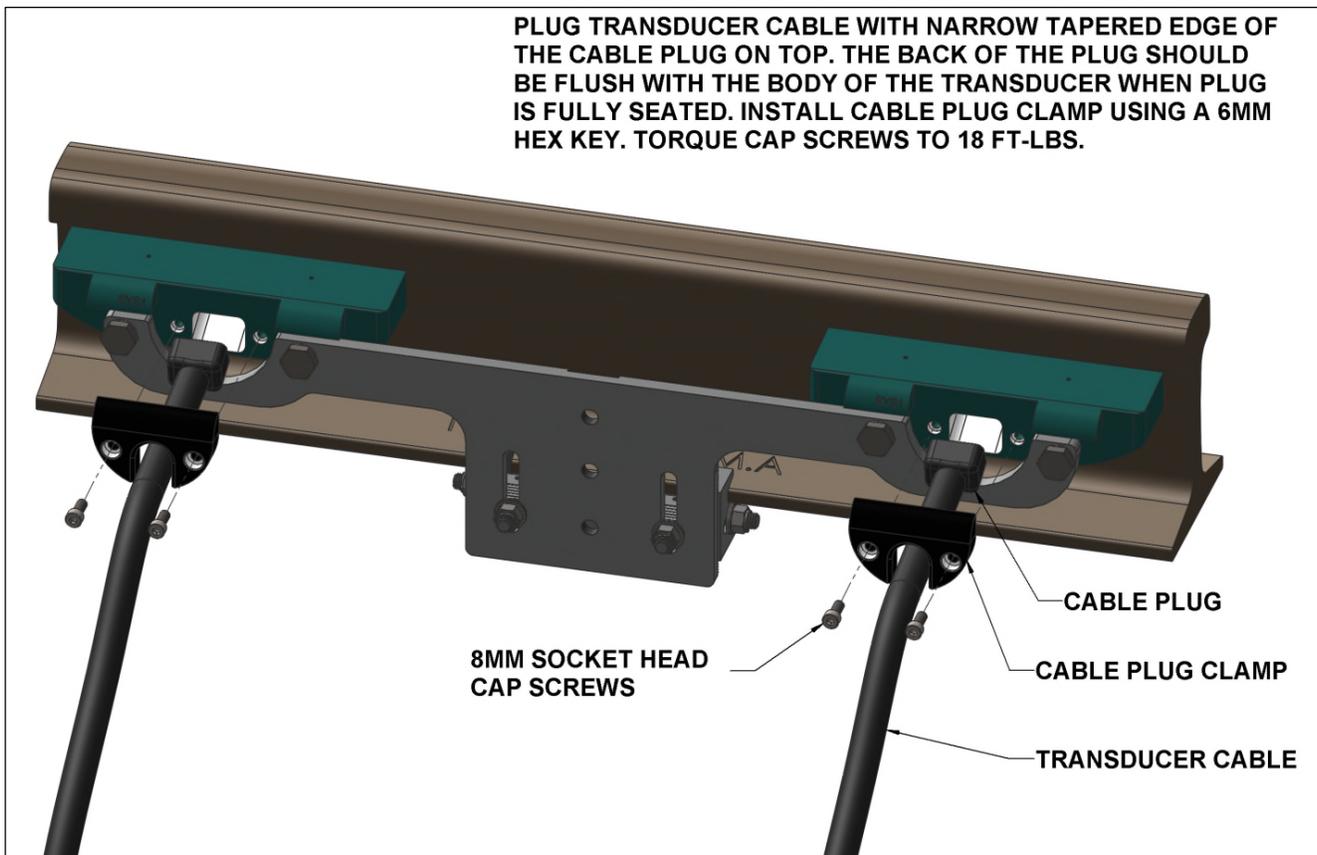
Loosen the two 7/8" nuts securing the Adjustable Mounting Plate and move the transducers into adjustment, referring to the dimensions in the previous figure.

Note: The transducer can be lowered one or two additional adjustment detents below the Alignment Fixture, and still be within specification, which in rare occasions may be necessary for successful Automatic Adjustment. Each adjustment detent represents 0.100 inch.

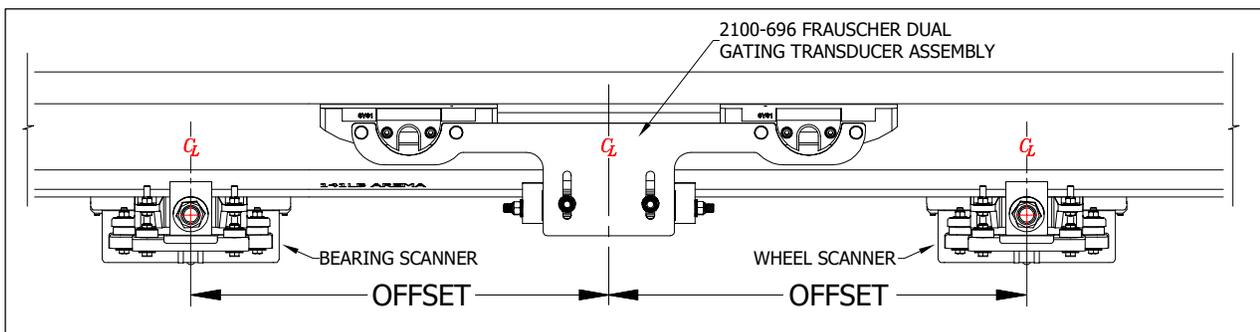
Horizontal Adjustment



Connection of Transducer Cables



Measuring the Location of the Scanners

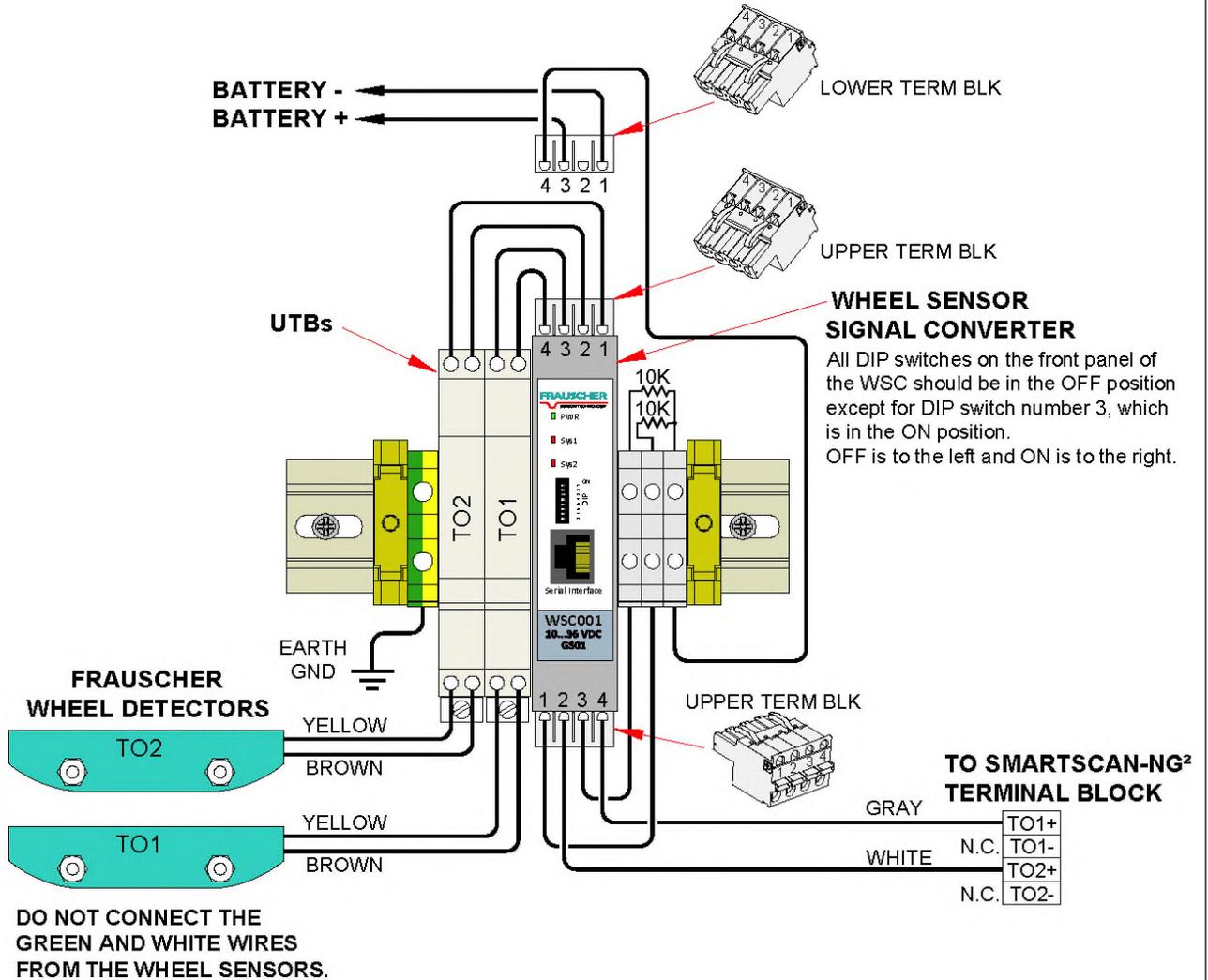


- 4 Measure and record the OFFSET dimensions as illustrated above for each bearing and wheel scanner. These values will be needed later when entering up the SmartScanNG² setup parameters via the serial interface.

NOTE: The offset dimension cannot exceed 100 inches in either direction.

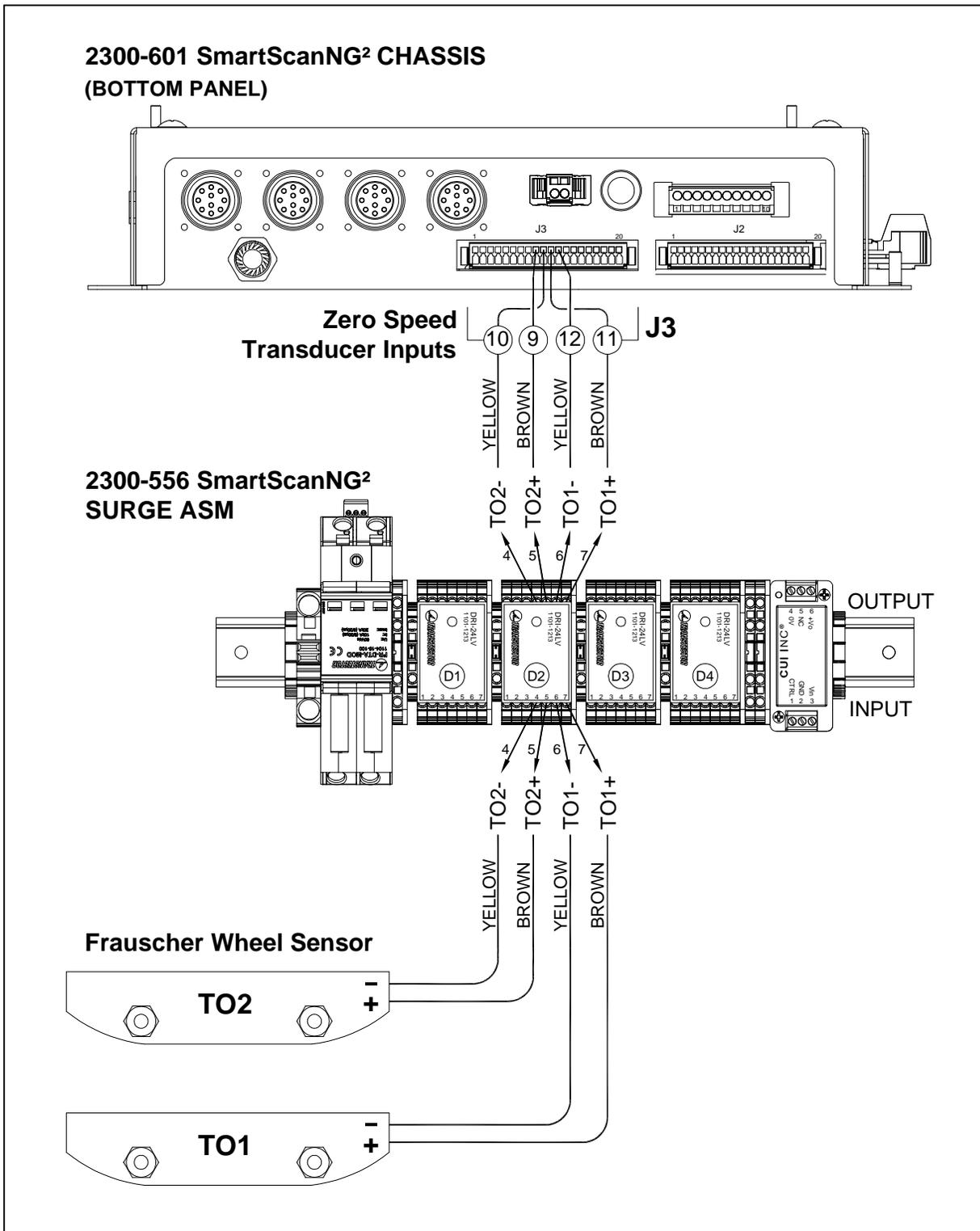
- 5 Run the provided cable from the transducers into the bungalow. The Frauscher RSR110-002_GS01 is a single element sensor. Terminate the brown (+) & yellow (-) wires from each sensor to proper transducer input on the NG² surge panel.
- 6 If you are adding Frauscher sensors to an older NG² system, a signal converter kit may be required - see wiring details below. For a detailed explanation of Frauscher compatibility, see Appendix C.

WIRING FOR 2300-547 FRAUSCHER SIGNAL CONVERTER KIT



NOTE: This supplemental kit is applicable ONLY for those SmartScanNG² systems equipped with SICM Board Version 1.2 or older. Newer designs have the Frauscher interface circuitry built-in and are easily identified by a **Compatible with Frauscher Wheel Sensors** label on the cover.

- 7 For CSX bungalow, see the wiring in Appendix D.
- 8 If your system is equipped with a 2300-601 SmartScanNG² Chassis, see wiring details below.

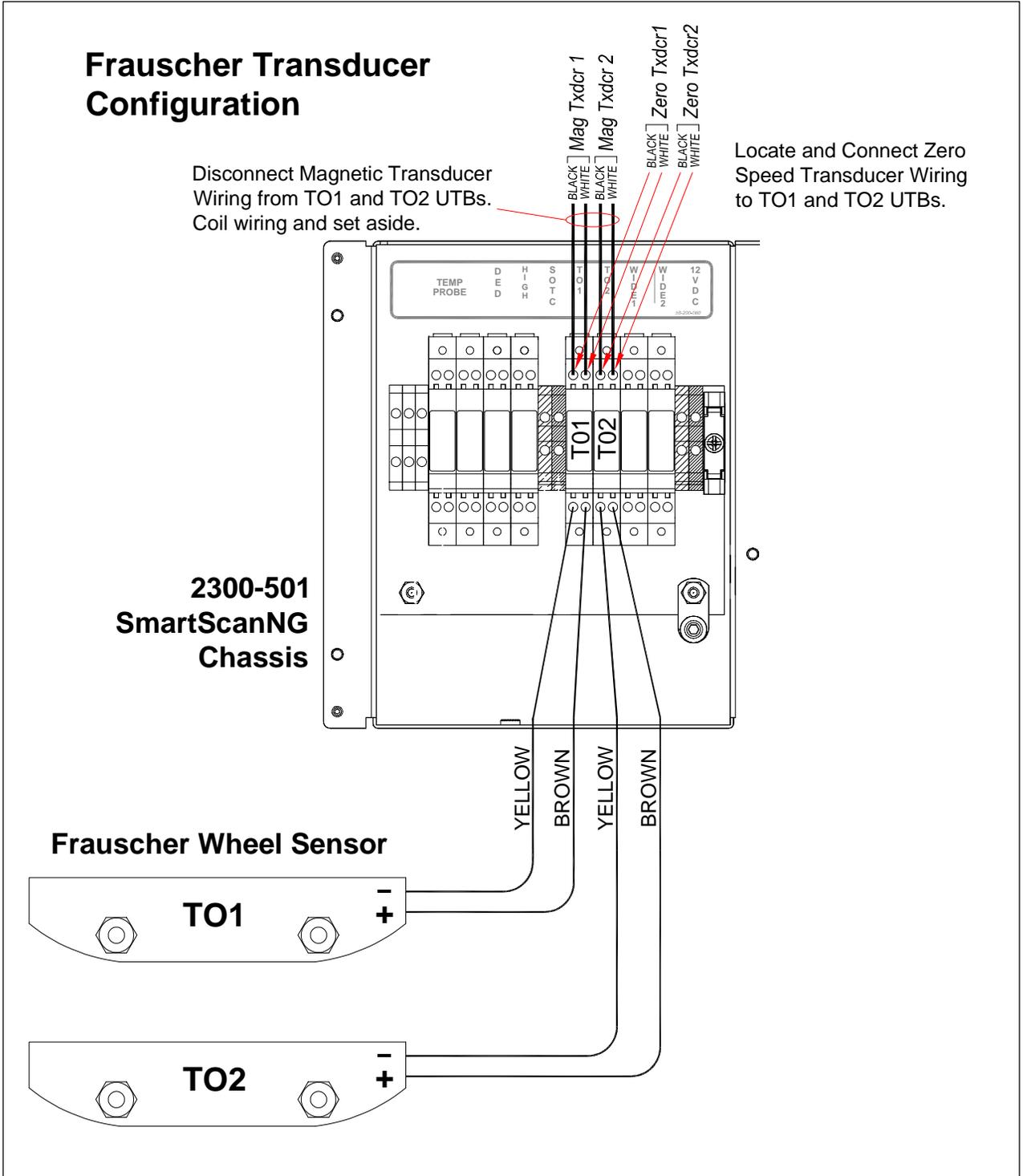


- If your system is equipped with a 2300-501 SmartScanNG² Chassis, see wiring details below. Verify that wires marked “Zero Txdcr 1” and “Zero Txdcr 2” are connected to the top of the wheel sensor UTBs.

Frauscher Transducer Configuration

Disconnect Magnetic Transducer Wiring from TO1 and TO2 UTBs. Coil wiring and set aside.

Locate and Connect Zero Speed Transducer Wiring to TO1 and TO2 UTBs.



Automated Calibration

- 10 The Automated Adjustment function nulls out any influence of the rail and mounting hardware located in the area of the sensor. Run the Automated Calibration process after installation and after making physical changes to transducer alignment. Tie plates, track spikes, rail anchors, rail clips – and similar hardware – used in the area under the transducer do not interfere with the operation. Run the Auto Calibration function after removing or adding metal hardware in the vicinity of the transducers.

Calibration Using the WSC

Initiate calibration via the NG² Serial Interface (see your operator's guide for login instructions). From the Main Menu, select System Function Menu.

```
SmartSCAN NG2, MP/KP:1234.5, Track:North
03/07/2019 08:33:57, 14.8V, 34°F
Main Menu - Comm
-----
[A] - Train Summary
      .
      .
      .
[K] - System Functions Menu
[L] - Replay train
[M] - Security Menu
[X] - Exit
```

Select Calibrate Frauscher Transducers.

```
SmartSCAN NG2, MP/KP:1234.5, Track:North
03/07/2019 08:34:11, 14.8V, 34°F
System Functions Menu
-----
[A] - Radio Test
      .
      .
      .
[Q] - Calibrate Frauscher Transducers
[R] - Virtual gate test
[X] - Exit
```

The following prompt appears.

```
Calibration started, please wait up to 60 seconds...
Calibration complete
Transducer 1: Success
Transducer 2: Success
```

If both wheel transducers indicate Success, calibration is complete.

Calibration is successful when the voltage on the yellow transducer wire, measured to battery ground, is approximately 1.65 VDC (+/- 2%) without a metal object near the SYS1 area on the transducer.

Automated Calibration Using the WSC (Optional Method)

Follow these steps to run the Auto Calibration feature.

- i. Connect transducers to the WSC by following the wiring diagram on the previous page.
- ii. Apply power to the system.
- iii. Confirm that the wheel sensors are mounted correctly and ready for use.
- iv. Locate the DIP switches on the WSC and move DIP switch number 8 to the ON position for between two and six seconds.
- v. Return DIP switch number 8 to the OFF position. As a result, the Sys1 and Sys2 LEDs should light up, indicating that the Automated Adjustment function has started.
 - The WSC adjusts both wheel sensors simultaneously, requiring up to forty seconds.
 - The Sys1 and Sys2 LEDs turn off when the session finishes, indicating successful calibration.
 - A blinking Sys LED after the calibration process means that the associated sensor(s) did not successfully adjust.



Wheel Signal Converter (WSC)

Troubleshooting After Automated Calibration

If one or both sensors fail to adjust correctly, check the following items.

- Wheel sensor alignment
- Wiring
- Possible faulty wheel sensor
- Possible calibration error — run the calibration function again.

Occupancy Detection

After successful automated calibration of both transducers, use the PB200 Test Wheel Sensor Target (pictured right) to test for occupancy detection as follows.

1. Place the Sensor Target on the Sys1 sensor of transducer TO1. Align the notch on the bottom of the Sensor Target with the hash mark on the top of the SYS1 transducer. The Sys1 LED located on the WSC and the TO1 LED on the SmartScan NG² should light up.
2. Repeat the procedure with transducer TO2. The Sys2 LED on the WSC and the TO2 LED on the SmartScan NG² should light up.



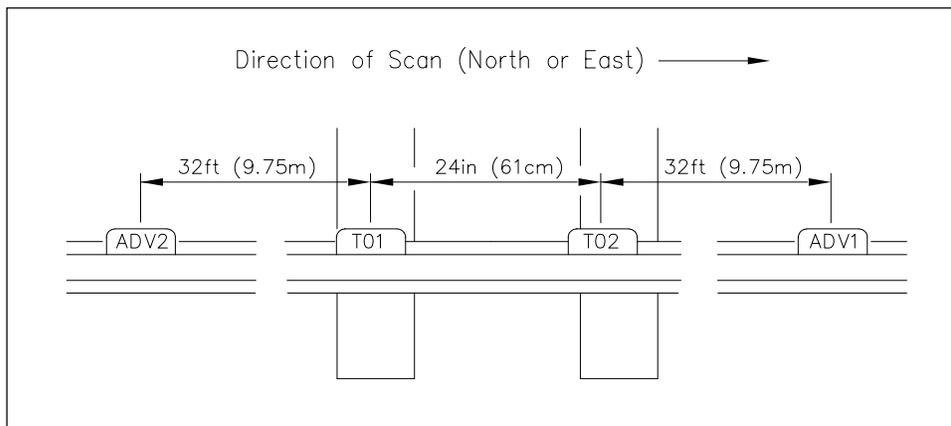
9.2.4 Advance Transducers

Not all sites use advance transducers. If your site uses a track circuit, skip ahead to the next section.

To install the **advance transducers** with their correct mounting plates:

- 1 Be sure that you have on hand all the parts for two advance transducers.
- 2 Be sure that you have on hand a track drill, a 3/8-inch bit, a 9/16-inch torque wrench, a 50-foot (15-meter) or longer tape measure, and the alignment fixture.

On the rail nearest the wayside enclosure, the two advance transducers are usually mounted 32 feet (9.75 meters) on either side of the gating transducers. If so desired, you can also mount them 40 feet (12.19 meters) on either side of the gating transducers.

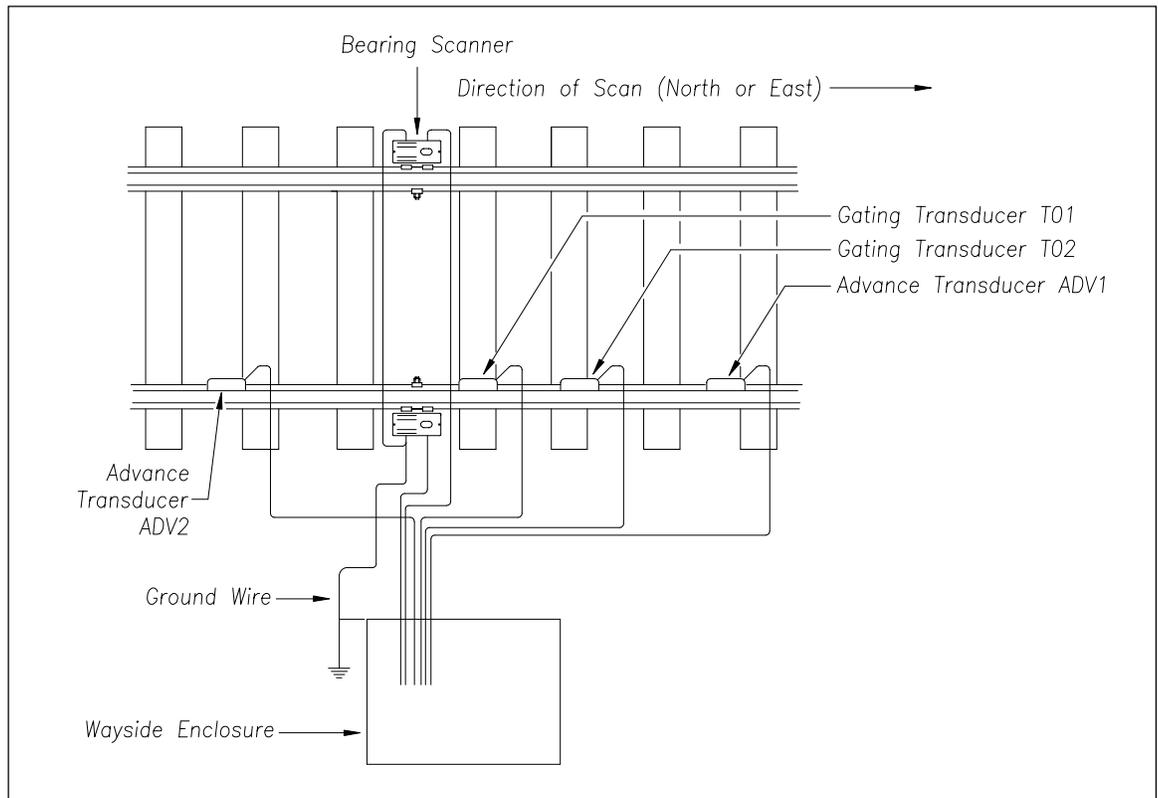


You'll next install advance transducer **ADV1** to the right of gating transducer **TO2**.

- 3 Separate the fiberglass-reinforced polyester transducer body from the aluminum mounting plate.
- 4 With the arrow on the plate pointing up, place the mounting plate against the gauge side of the rail.
- 5 Going right from the rightmost index groove of gating transducer **TO2**, measure 32 feet (9.75 meters) to the rightmost index groove on the new mounting plate.
- 6 Hold the mounting plate against the rail and as high against the crown as possible.
- 7 Using the hex-head bolt holes as your guide, mark the two places on the rail where you'll later drill holes.
- 8 Remove the mounting plate.
- 9 Using a 3/8-inch bit, drill the two holes.
- 10 Mount transducer to rail (see steps 12 through 22 of Section 9.2.1 for detailed mounting instructions).
- 11 If this is a single-track site, label the two-wire end of the cable **ADV1**.
- 12 If this is a double-track site, label the two-wire end of the cable either **ADV1-TRACK1** or **ADV1-TRACK2**, whichever is appropriate.

- 13 Extend the transducer cable into the wayside enclosure and leave it coiled on the floor.
You'll next install advance transducer **ADV2** to the left of gating transducer **TO1**.
- 14 Using another transducer, separate the body from the mounting plate.
- 15 With the arrow on the plate pointing up, place the mounting plate against the gauge side of the rail.
- 16 Going left from the leftmost index groove of gating transducer **TO1**, measure 32 feet (9.75 meters) to the leftmost index groove on the new mounting plate.
- 17 Mount transducer to the rail (see steps 11 through 22 of Section 9.2.1 for detailed mounting instructions).
- 18 If this is a single-track site, label the two-wire end of the cable **ADV2**.
- 19 If this is a double-track site, label the two-wire end of the cable either **ADV2-TRACK1** or **ADV2-TRACK2**, whichever is appropriate.
- 20 Extend the cable into the wayside enclosure and leave it coiled on the floor.

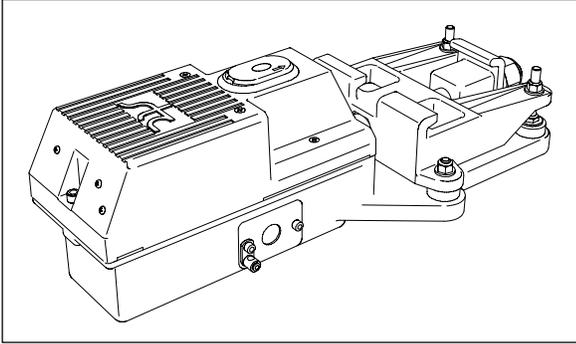
If this is a single-track site, you are done installing all the transducers. From above, your site would look something like this.



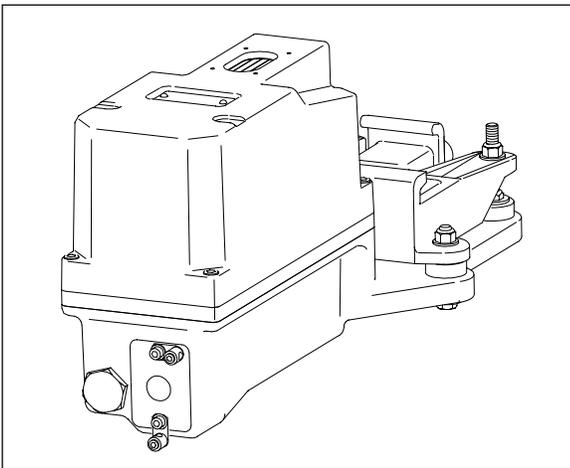
- 21 If this is a double-track site, repeat steps 1 through 20 on the second track.

9.3 Wheel Scanners

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



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



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

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

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

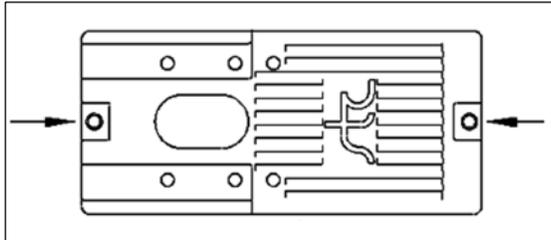
The wheel scanners should be centered in the crib of two ties spaced at least 14 inches (35.6 centimeters) apart. The crib is the one immediately ahead (and to the north or east) of the bearing scanners. This location places one wheel scanner between the two gating transducers. The other scanner is directly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

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

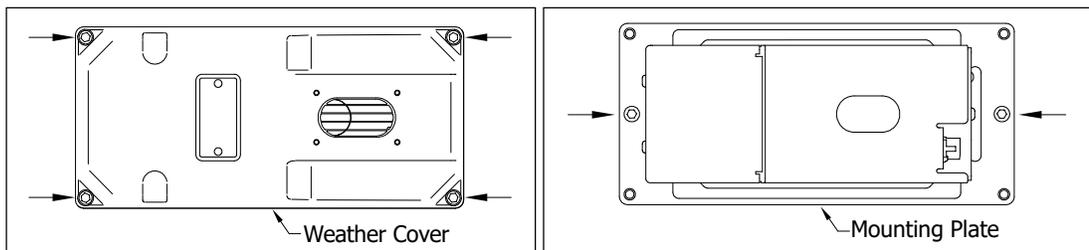
You'll next install the first wheel scanner.

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

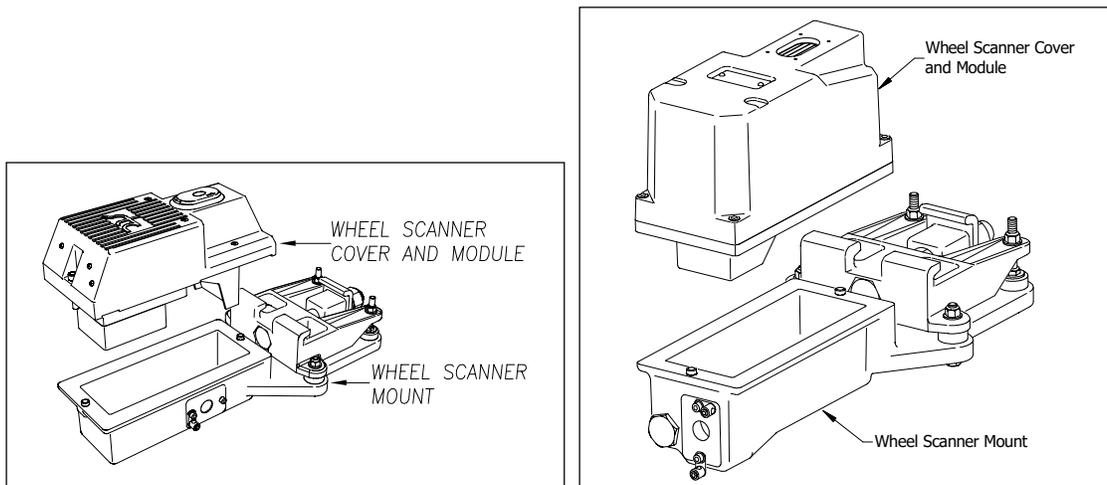
The **Type II** wheel scanner has two socket-head-cap screws that attach the weather cover to the mount.



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



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



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

Tighten the inner nut (that is, the clamping nut) by hand to hold the mount in place.

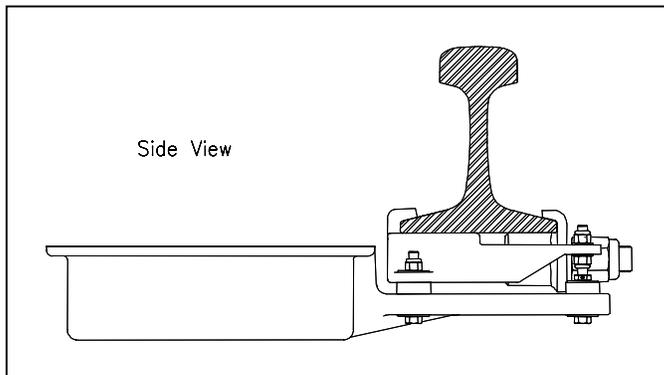
- 10 Using a short-handle 1-1/2-inch wrench, tighten the clamping nut to a **torque of 48 to 50 foot-pounds (65.1 to 67.8 newton-meters)**.

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

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

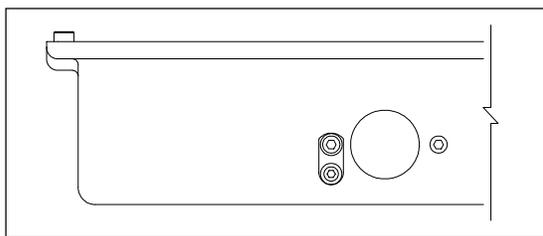
Don't exceed a torque of 50 foot-pounds (67.8 newton-meters). Doing so can cause failure of the mount.

At this point, your work should look like this.

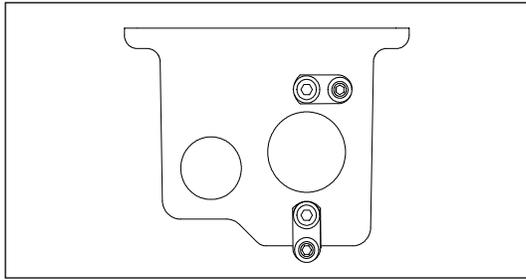


On the side of the mount are a large hole and two socket-head-cap screws. The longest screw is holding a ground lug and an internal-tooth washer.

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

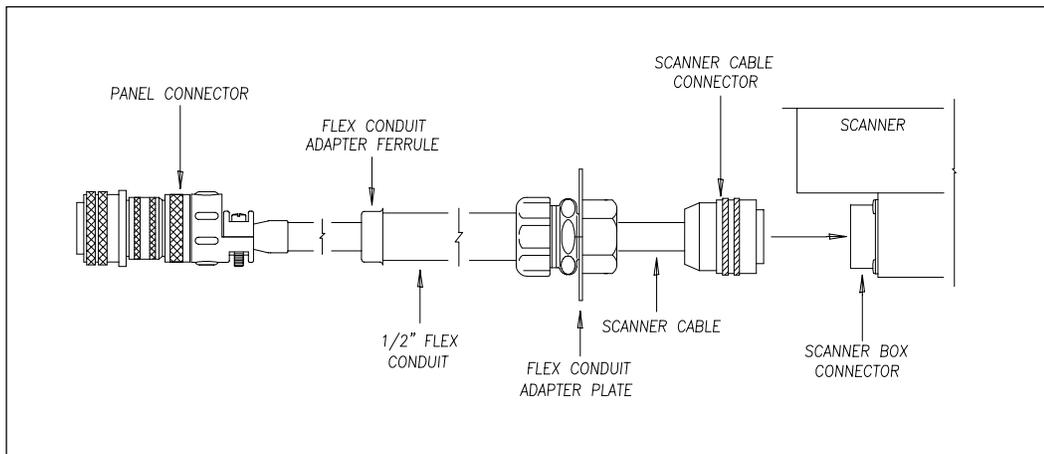


For the **Type III** wheel scanner, the large hole is on the side of the mount (2500-401) farthest from the track. Some of these scanners have two ground lugs, as shown below.



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

The following steps use the terms scanner cable connector, panel connector, and flex-conduit-adapter plate. Notice where they are on a wheel scanner cable.



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

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

18 If you are installing a **Type II** wheel scanner:

- a** In the screw hole closest to the rail, replace the screw.
- b** In the screw hole farthest from the rail, replace the ground lug, internal-tooth washer, and screw.

19 If you are installing a **Type III** wheel scanner:

- a** If your wheel scanner uses only one ground lug, replace the screw into the top screw hole.
- b** If your wheel scanner uses two ground lugs, replace the ground lug, internal-tooth washer, and screw into the top screw hole.
- c** In the bottom screw hole, replace the ground lug, internal-tooth washer, and screw. Tighten the screws by hand to hold the flex-conduit adapter plate in place.

20 Using a T-handle 3/16-inch hex-wrench, tighten the two socket-head-cap screws until they are completely tight.

21 Leave 6 inches (15.2 centimeters) of the scanner cable in the mount.

22 Attach the scanner cable connector to the scanner box connector.

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

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

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

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

25 If this is a single-track site, label the end of the cable that isn't attached to the wheel scanner **W-RAIL1** or **W-RAIL2**, whichever is appropriate.

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

26 If this is a multitrack site, label the end of the cable that isn't attached to the wheel scanner **W-RAIL1-TRACK1**, **W-RAIL2-TRACK1**, **W-RAIL1-TRACK2**, **W-RAIL2-TRACK2**, **W-RAIL1-TRACK3**, or **W-RAIL2-TRACK3**, whichever is appropriate.

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

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

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

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

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

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

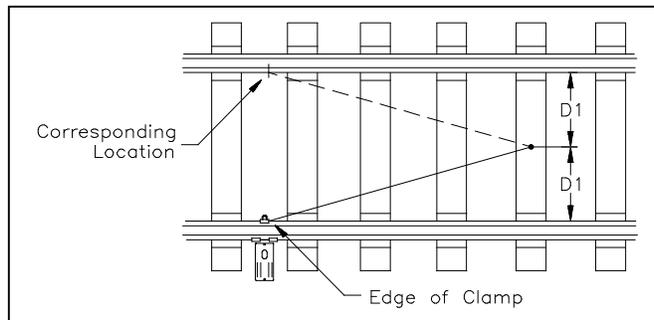
31 If this is a **Type III** wheel scanner, disconnect the heater wiring plug.

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

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

33 To locate the second mount on the opposite rail:

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



d Mark this location.

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

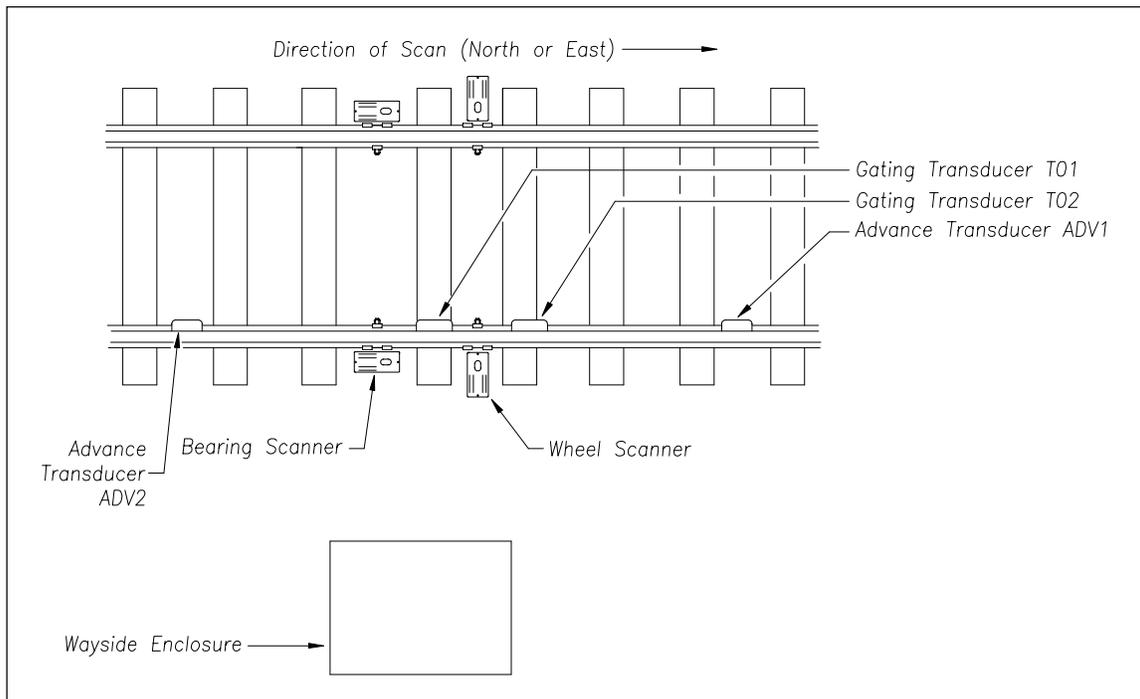
Use a permanent marker, magic marker, lumber crayon, or paint pen to mark the rail. Don't use a file or punch to mark the rail.

34 With the mark as a guide, place the second mount so that the moveable track clamp extends under the rail and toward the center of the track.

35 Repeat steps **9** through **30**.

36 Attach one end of an 8-AWG stranded copper wire to the ground lug on the flex-conduit-adaptor plate and the other end to the ground lug on the other scanner mount.

From above, your site would look something like this.



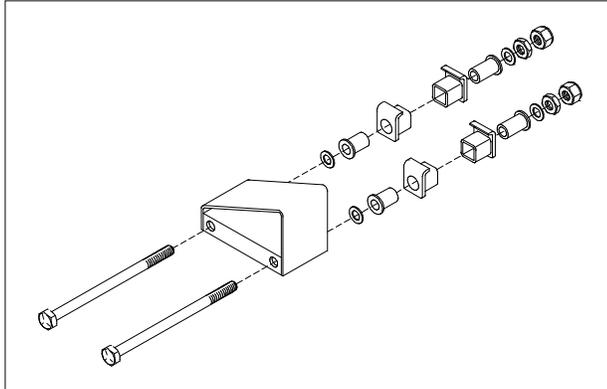
37 If this is a multitrack site, repeat steps **1** through **36** on each track.

9.4 Deflectors

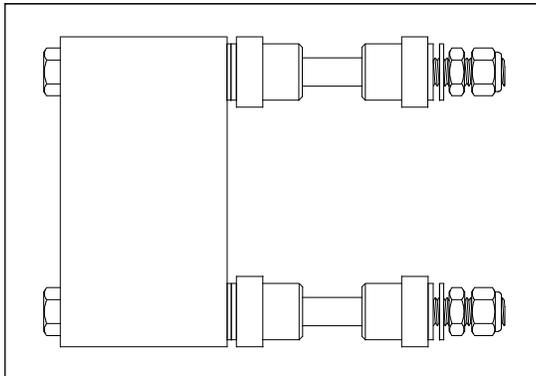
Not all sites use deflectors. If your site doesn't use them, skip ahead to the next section.

To assemble the deflectors:

- 1 Be sure that you have on hand all the parts for four deflectors.
You'll next put together two **left-hand deflectors**.
- 2 On a clean, flat surface, place a deflector ramp with its peak side toward you.
- 3 As shown below, place two bolts to the left and the rest of the needed parts to the right.



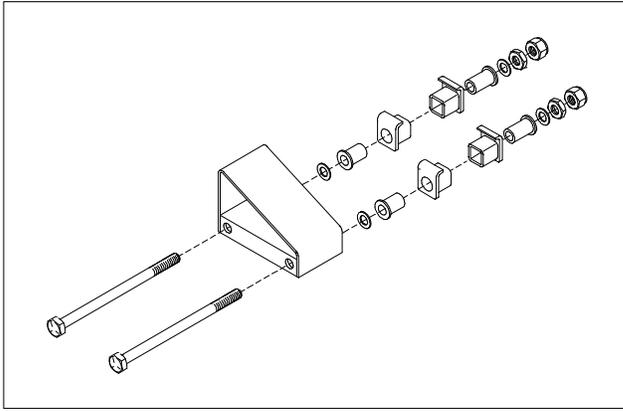
- 4 Assemble the parts, loosely putting on the final two nuts.
Your assembled deflector should look like this.



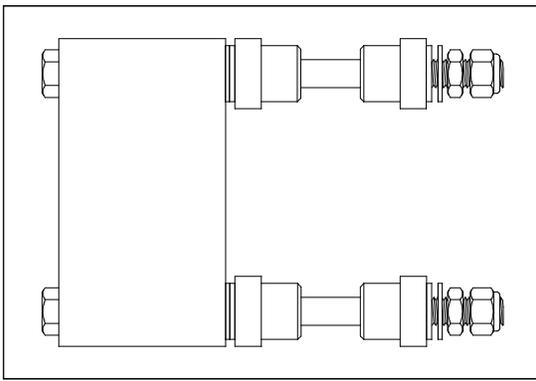
- 5 Put the deflector aside.
- 6 If you have only assembled one left-hand deflector, repeat steps 2 through 5.
You now have two assembled left-hand deflectors. One will be installed to the left of the leftmost scanner on one rail. The other will be installed to the left of the leftmost scanner on the opposite rail. The peak side of the deflector ramps will always be the ones closest to the scanner.

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

- 7 On a clean, flat surface, place a deflector ramp with its peak side away from you.
- 8 As shown below, place two bolts to the left and the rest of the needed parts to the right.



- 9** Assemble the parts, loosely putting on the final two nuts.
Your assembled deflector should look like this.

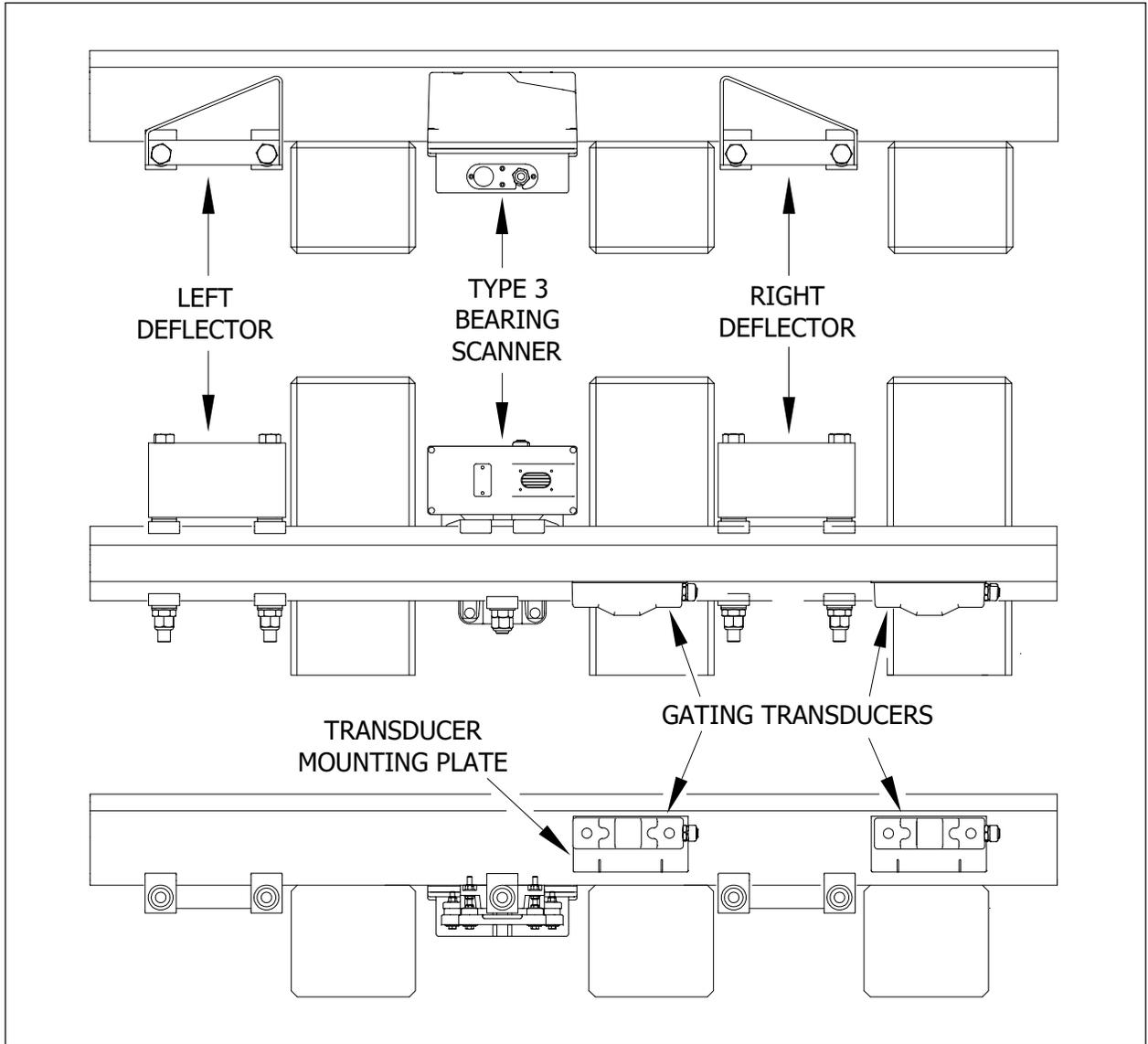


- 10** Put the deflector aside.
- 11** If you have only assembled one right-hand deflector, repeat steps **7** through **10**.
You now have two more assembled right-hand deflectors. One will be installed to the right of the rightmost scanner on one rail. The other will be installed to the right of the rightmost scanner on the opposite rail. The peak side of the deflector ramps will always be the ones closest to the scanner.
- You're now ready to install the deflectors.

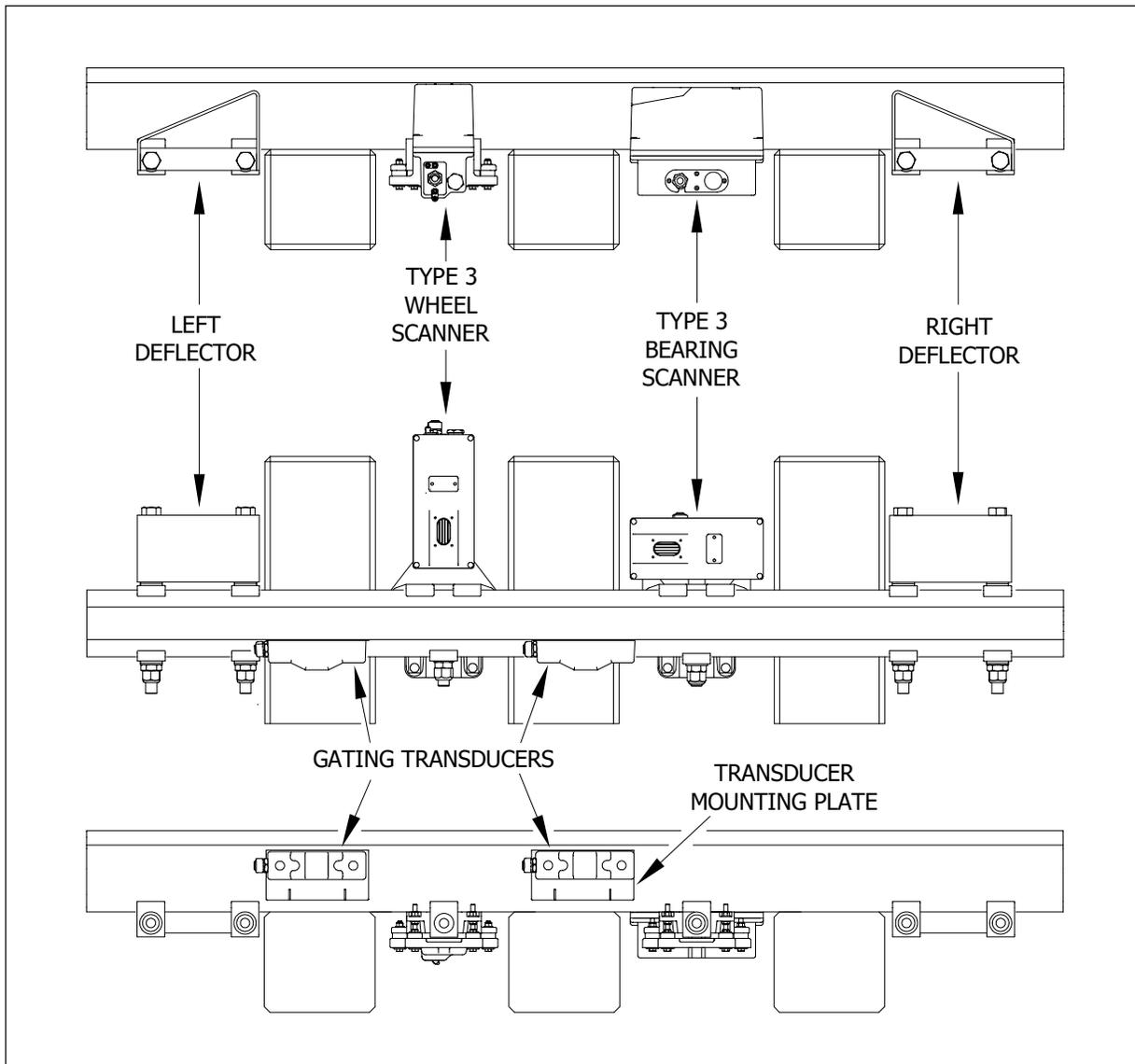
To install the deflectors:

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

- 3 As shown below, note where the deflectors are placed.
If your site has just bearing scanners, one installation will look like this.



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



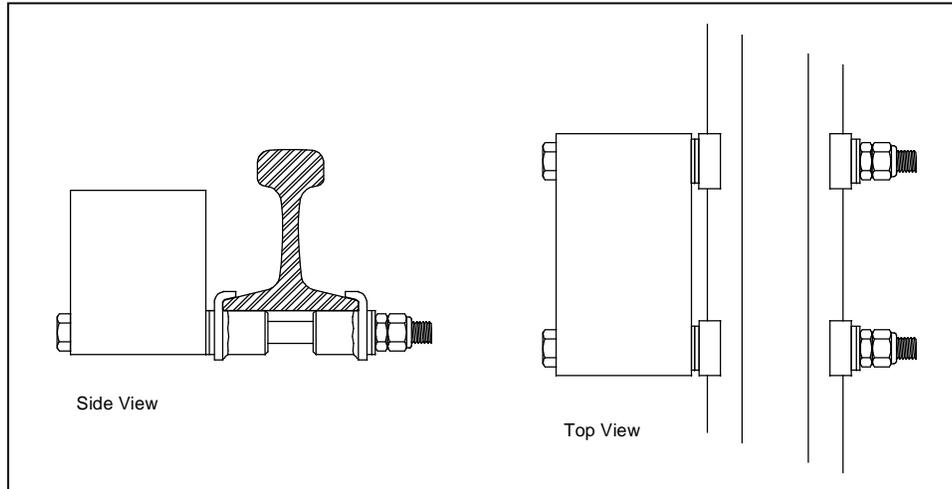
- 4 Under both rails between both ties, remove the ballast to a depth of 4 inches (10 centimeters).
- 5 To the right of the rightmost scanner and flush against the tie closest to it, place a right-hand deflector on the rail so that the bolts with the moveable clamps extend under the rail and toward the center of the track.
Tighten each inner nut (that is, each clamping nut) by hand to hold the deflector in place.
- 6 Using a short-handle 1-1/2-inch wrench, tighten the clamping nut to a **torque of 48 to 50 foot-pounds (65.1 to 67.8 newton-meters)**.

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

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

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

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



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

- To the left of the leftmost scanner and flush against the tie closest to it, place a left-hand deflector on the rail so that the bolts with the moveable clamps extend under the rail and toward the center of the track.
Tighten each clamping nut by hand to hold the deflector in place.
- Using a short-handle 1-1/2-inch wrench, tighten the clamping nut to a **torque of 48 to 50 foot-pounds (65.1 to 67.8 newton-meters)**.

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

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

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

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

- To install the other two deflectors on the opposite rail, repeat steps 5 through 12.
- If this is a double-track site, repeat steps 1 through 13 on the second track.

9.5 Track Circuit

Not all sites use a track circuit. If your site doesn't use one, skip ahead to the next section.

Following the directions that came with your track circuit:

- 1 Mount both track-wire connectors.

Install a track-wire connector on each rail. The connectors should be mounted directly opposite each other and within 5 feet (1.5 meters) of the scanners.

- 2 Attach wires to the track-wire connectors.

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

- 3 If this is a single-track site, label the end of the wires that aren't attached to the track-wire connectors **TC**.
- 4 Extend the wires into the wayside enclosure and leave them coiled on the floor.
- 5 If this is a multitrack site, repeat steps 1 through 4 on each track. Label the end of the wires that aren't attached to the track-wire connectors **TC-TRACK1**, **TC-TRACK2**, or **TC-TRACK3**, whichever is appropriate.

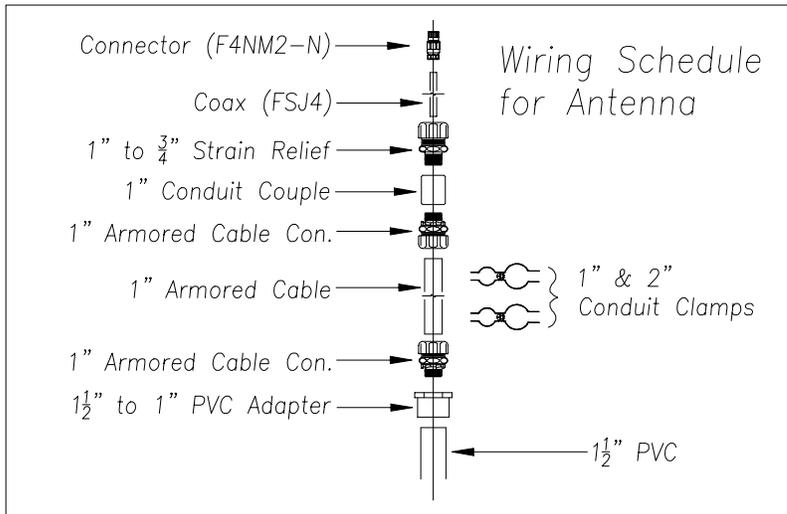
9.6 AEI Antennas

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

At each SmartScanNG² site that uses AEI, two Sinclair SRL470 antennas or two KPPA-900-120-11.5 Parapanel antennas are installed per track. In reference to the track, Antenna0 is the northmost or eastmost antenna. Antenna1 is the southmost or westmost antenna. (As a means of reference, transducer TO1 is the first gating transducer going north or east from the bearing scanner. It is the gating transducer closest to the bearing scanner.)

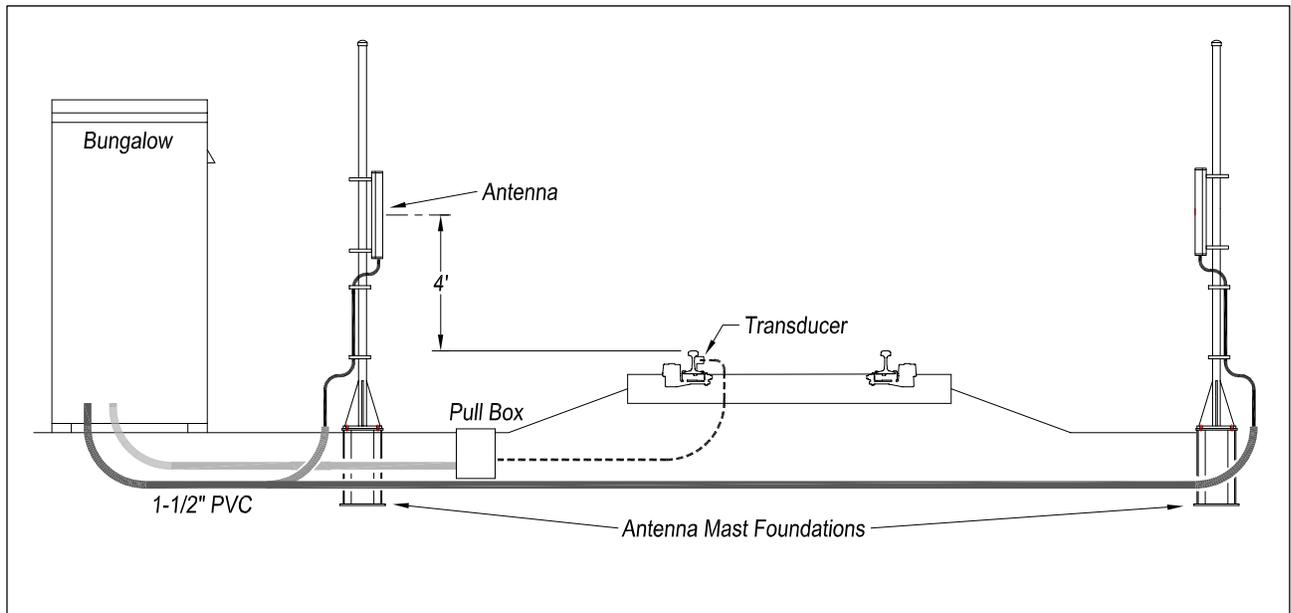
The instructions below assume that the antenna masts have already been installed. Their installation was described in **Section 8.3**.

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



Each KPPA-900-120-11.5 antenna is installed:

- With its face parallel to the rails
- With its N-type connector pointing down
- 10 feet (3 meters) from the gauge side of the closest rail
- Center of antenna 4.0 feet (1.2 meters) above the top of the rails
- Centered between the gating transducers
- Opposite each other

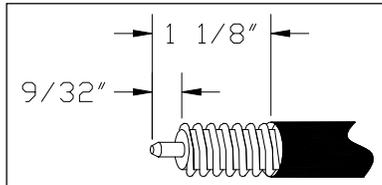


To install the antenna cables:

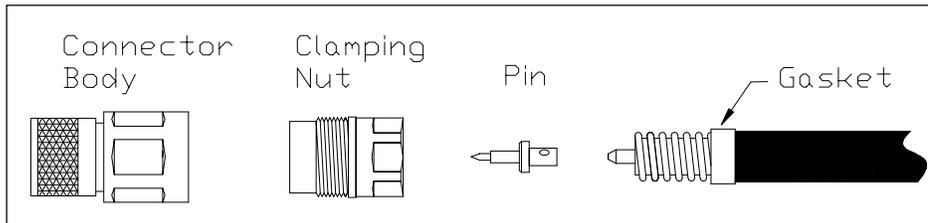
- 1 Run FSJ4 coaxial cable from each AEI antenna to the bottom of the SmartScanNG² enclosure.
- 2 Cut each cable to the correct length.

- 3 In the wayside enclosure, label the cable from the northmost or eastmost antenna Antenna0.
- 4 In the wayside enclosure, label the other cable Antenna1.
- 5 Install an N-type connector on each end of each cable as follows:

- a Trim the cable jacket on the FSJ4 back 1-1/8 inches (28.6 millimeters).



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

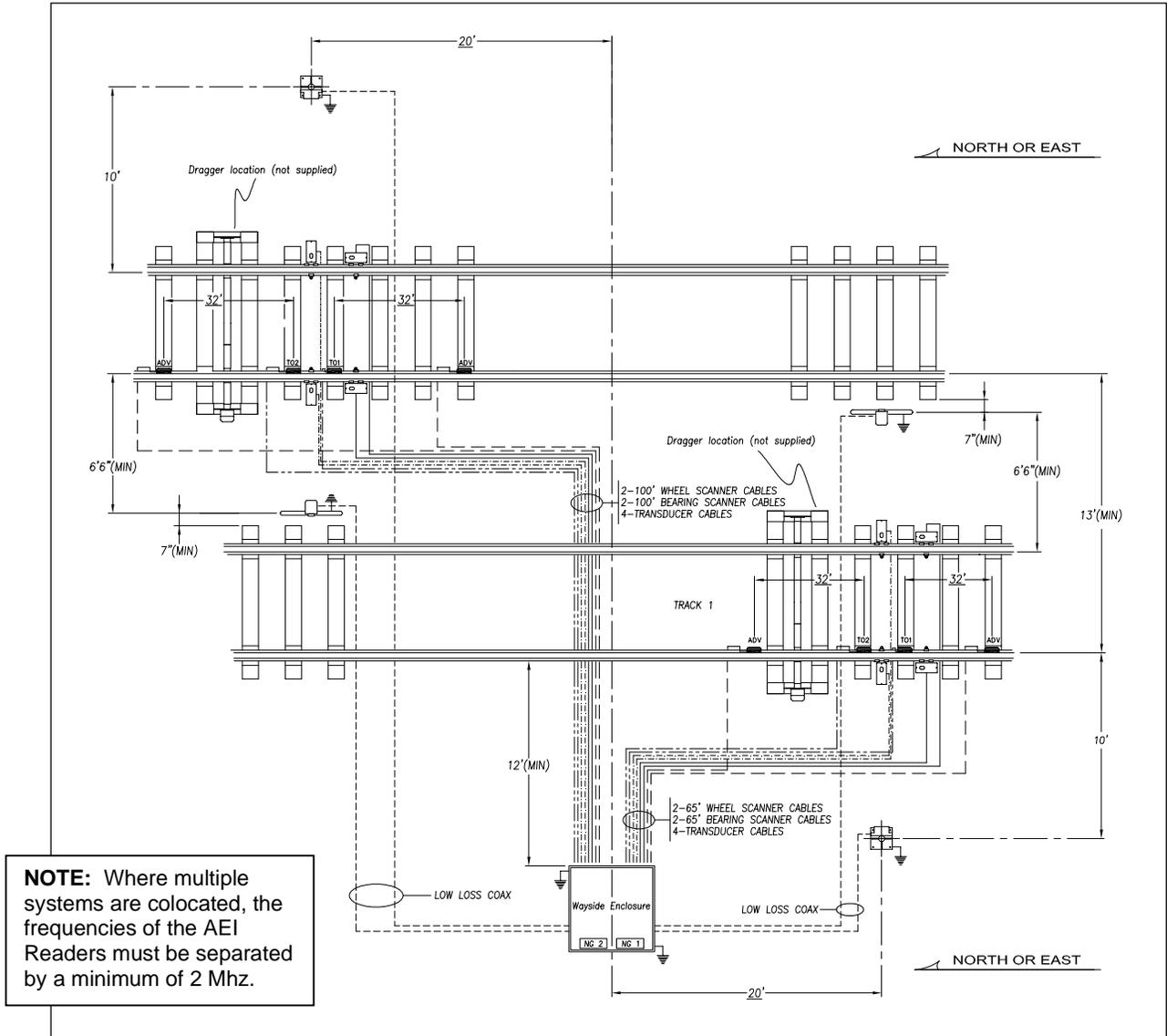


- f Place the supplied heat shield over the inner conductor, slide the pin on, and solder.
 - g Remove the heat shield and trim any excess solder from the pin.
 - h Add grease to the gasket and the rubber O-ring (on the clamping nut).
 - i Thread the clamping nut onto cable until it stops.
 - j Attach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

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

9.7 Installation Diagrams

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

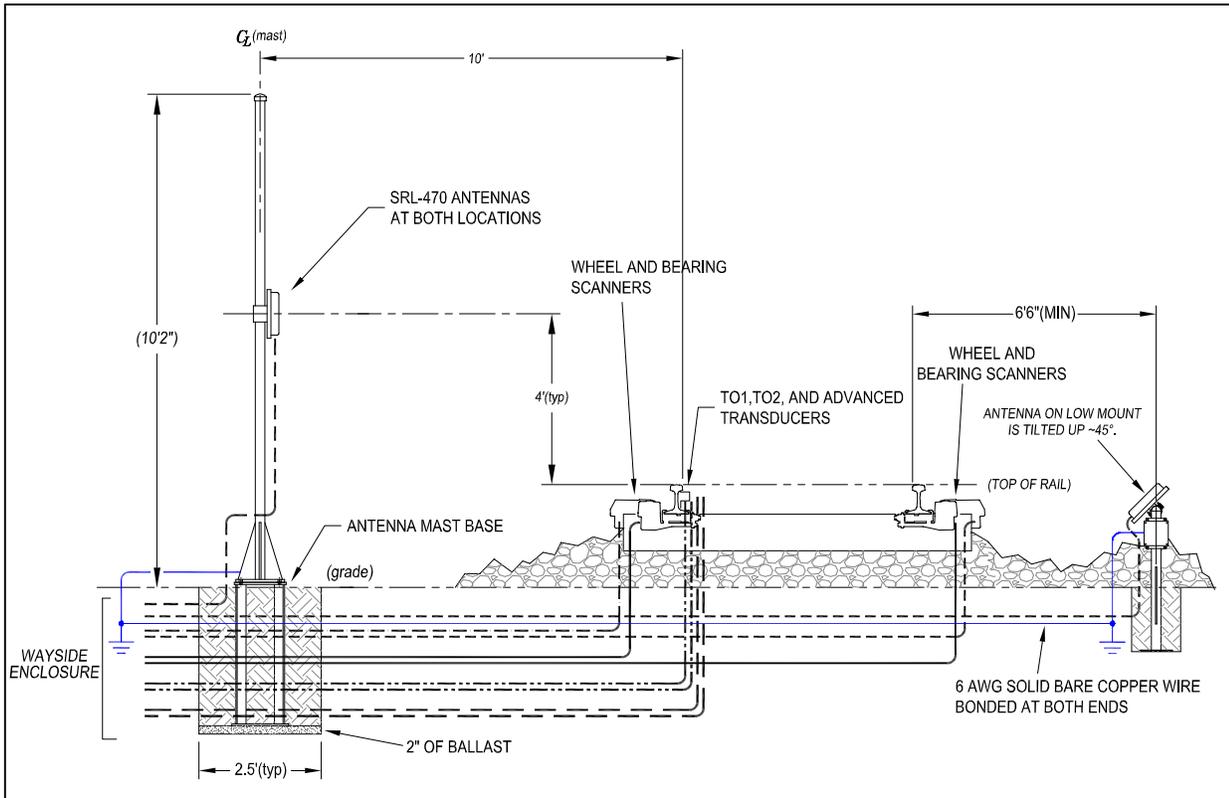


The minimum distance between the gauge of the closest rail and the center of the low antenna mount should be 6.5 feet (2 meters). The low antenna should be positioned at the end of the ties and centered between the two gating transducers.

Be sure to provide one continuous ground between the antennas, scanners, and the wayside enclosure.

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

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



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

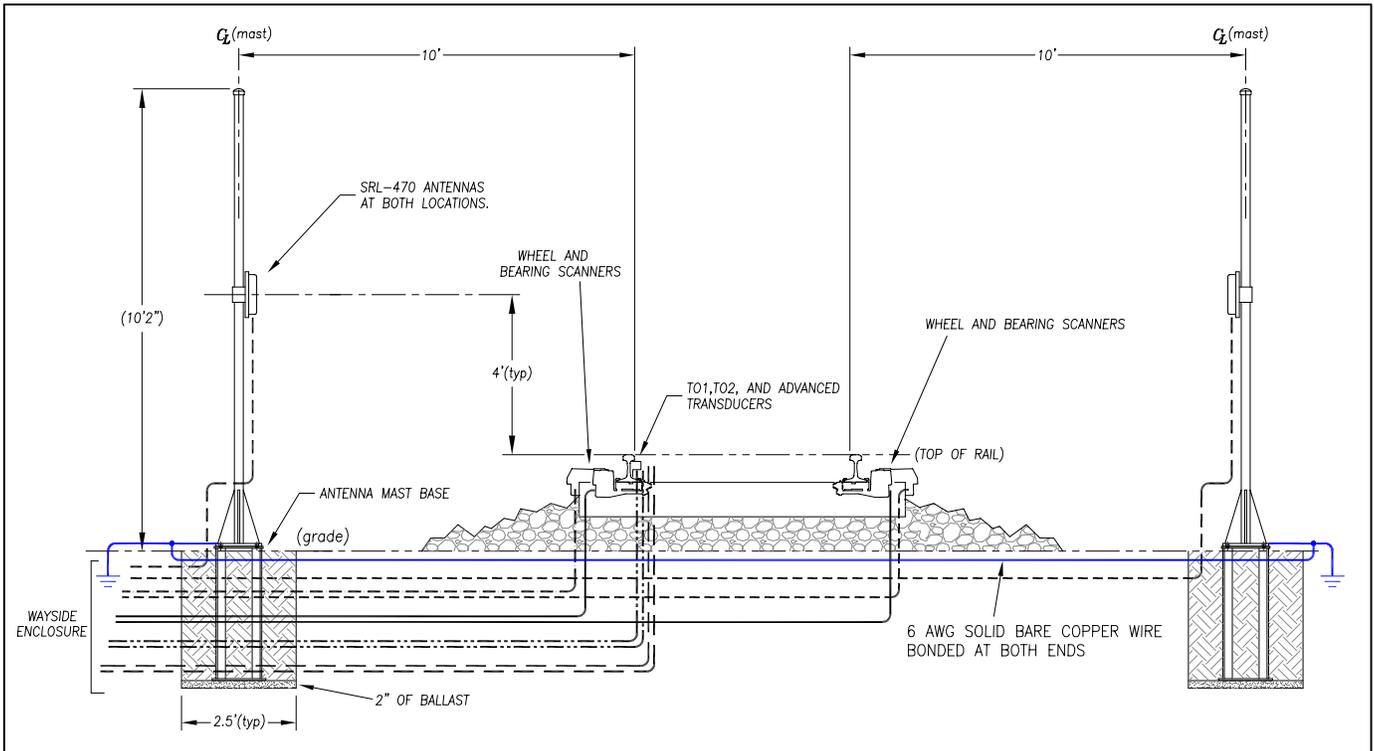
Install the AEI antennas centered between the two pairs of gating transducers and directly opposite each other. Mount them with their N-type connector pointing down.

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

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

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

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



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

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

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

See **Section 8.3** for more information on installing the pole and its base.

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

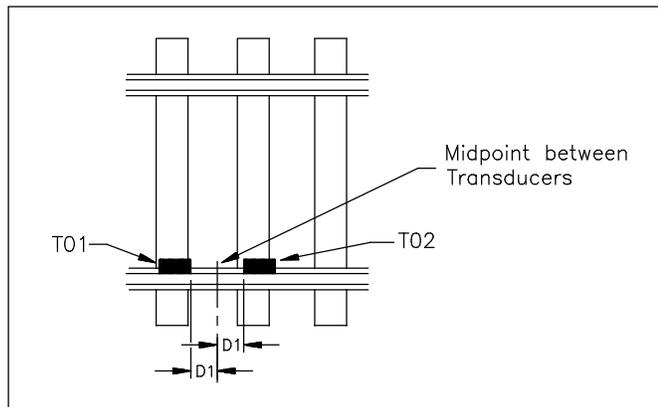
10.0 Aligning Scanners

This section tells how to align the scanners so that the SmartScanNG² system can use them.

10.1 Bearing Scanners

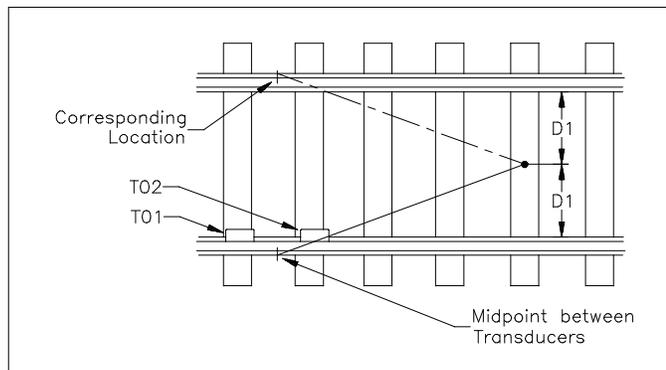
To align the bearing scanners:

- 1 Be sure that you have on hand a short-handle 1-1/2-inch open-end wrench, a combination 9/16-inch open-end box wrench, and an STC alignment fixture.
- 2 Turn off all power to the SmartScanNG².
- 3 On the outside of the rail, mark the midpoint between TO1 and TO2.



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

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

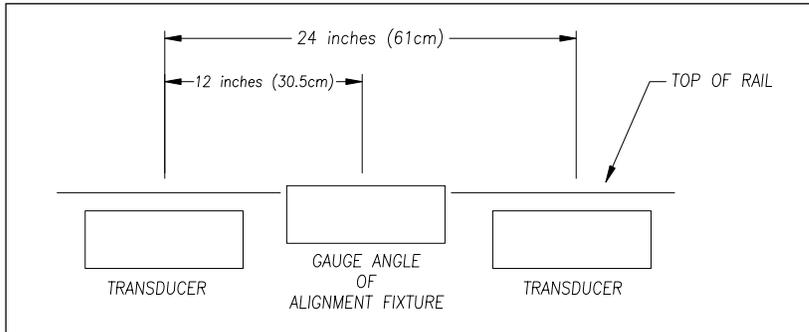


- 7 On the outside of the rail, mark this location.

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

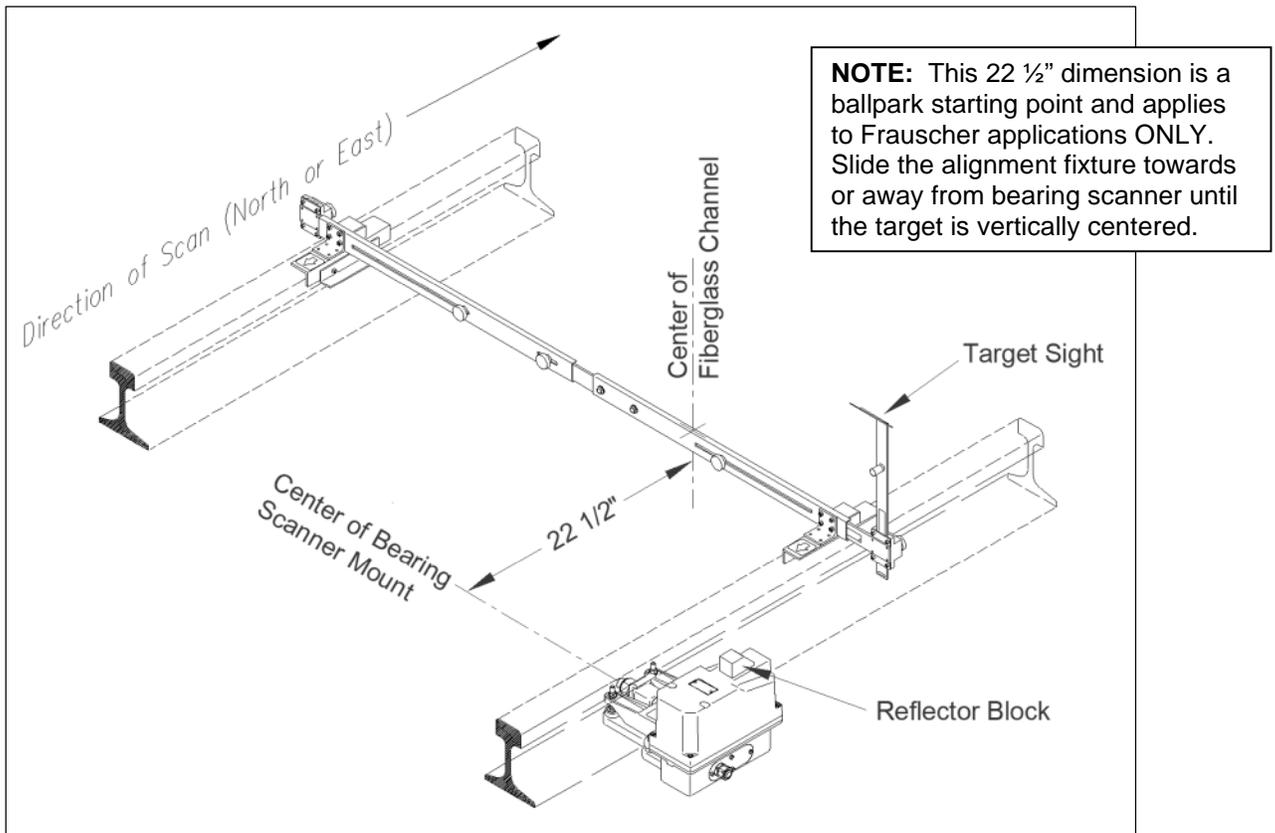
Use a permanent marker, magic marker, lumber crayon, or paint pen to mark the rail.
Don't use a file or punch to mark the rail.

- 8 For “standard” configurations (bearing scanners are located in the crib adjacent to the transducers), place the alignment fixture across both rails and adjust it so that the north or east side of the adjustable gauge slide is even with the two rail marks.



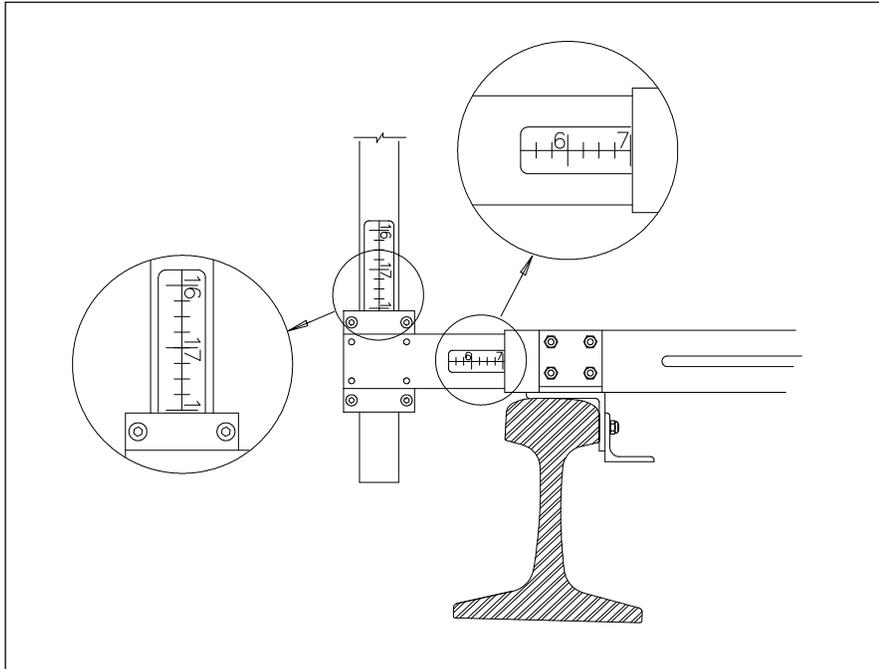
The fixture should be snug against the top and gauge of both rails.

If the scanner is mounted in a non-standard crib location (i.e., not adjacent to the Frauscher transducers), place the alignment fixture across both rails approximately 22 1/2" from the center of the scanner mount.



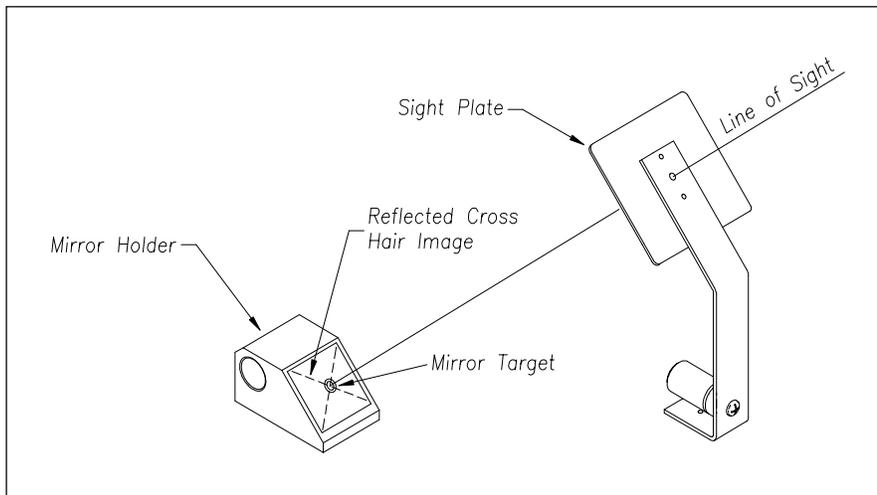
- 9 Remove the reflector block from the vertical alignment bar.

- 10** Install the vertical alignment bar with the target sight tilted toward the bearing scanner.
- 11** Install the reflector block in the top of the scanner cover with the sloping surface facing the target.
- 12** Extend the horizontal alignment bar to 7-1/4 inches \pm 1/4 inch on the scale.



- 13** Extend the vertical alignment bar to 18 inches \pm 1 inch on the scale. If this alignment tolerance cannot be achieved, it will be necessary to relocate a crossstie.
- 14** Look through the hole in the center of the target and note the relationship of the target crosshairs to the circle in the center of the reflector block.

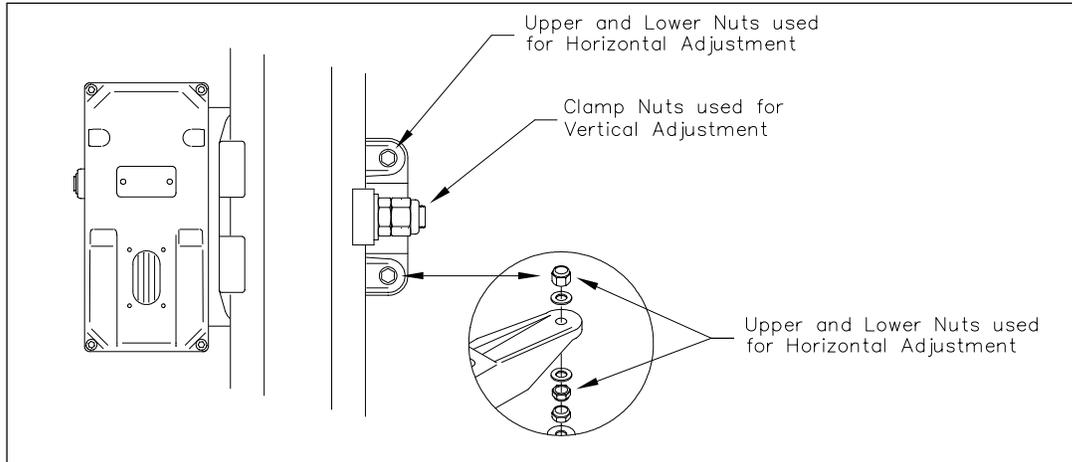
When the crosshairs are centered on the circle, alignment is correct.



- 15** If the crosshairs are centered on the circle, go to step **19**.

- 16** If horizontal adjustment is necessary, adjust the upper and lower nuts on the edge of the arm of the bearing scanner mount.

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



- 17** If vertical adjustment is necessary

Skip this step if using Frauscher Wheel Transducers!

- a** Using a short-handle 1-1/2-inch wrench, loosen both nuts on the side of the mount. The inner nut is the clamping nut. The outer nut is the locking nut.
- b** Slide the entire mount toward or away from the alignment fixture.
Sliding toward the fixture raises the crosshairs on the circle. Sliding away from the fixture lowers the crosshairs on the circle.
- c** Using a short-handle 1-1/2-inch wrench, tighten the clamping nut to a **torque of 48 to 50 foot-pounds (65.1 to 67.8 newton-meters)**.

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

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

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

- 18** Until the crosshairs are centered on the circle, repeat steps **16** and **17**.
- 19** Remove the vertical alignment bar, target sight, and reflector block.
- 20** Repeat steps **10** through **18** for the bearing scanner on the opposite rail.
- 21** Remove the alignment fixture from the track.
- 22** If this is a multitrack site, repeat steps **1** through **21** for each track.

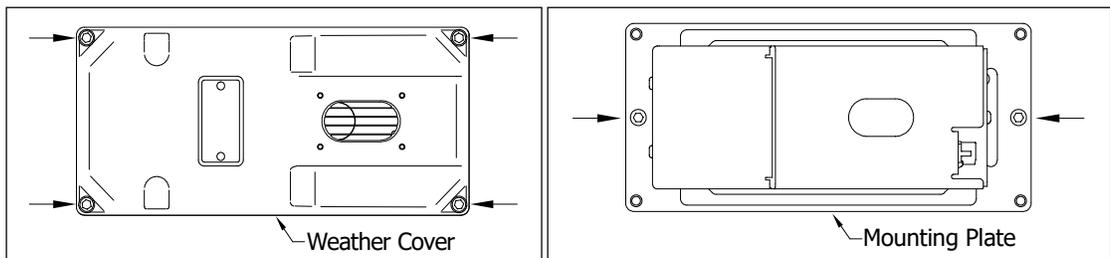
10.2 Wheel Scanners

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

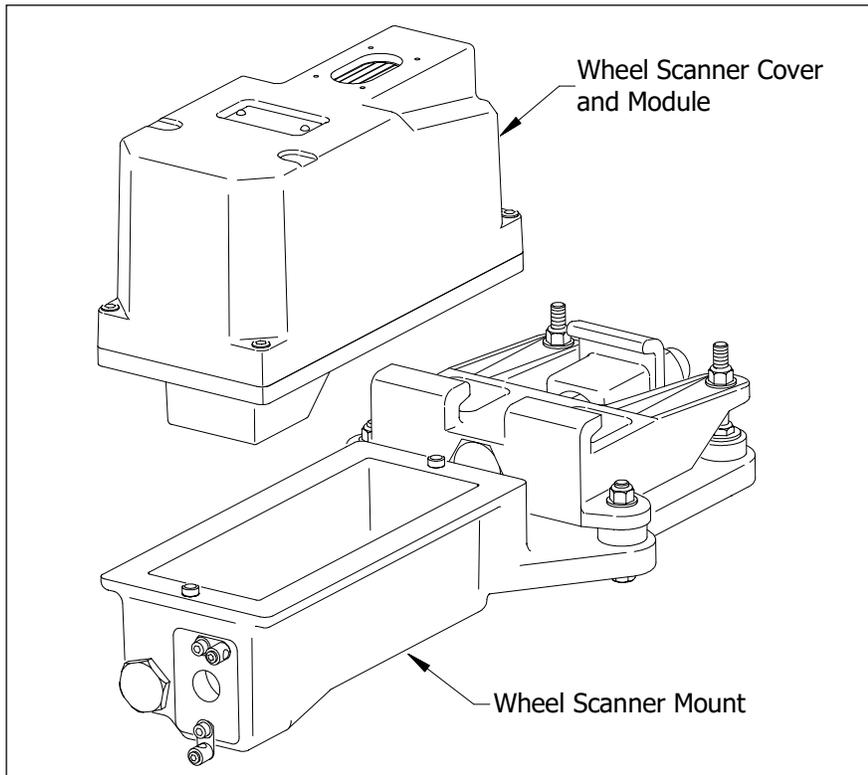
To align the wheel scanners:

- 1 Be sure that you have on hand a T-handle 1/4-inch hex-wrench, a combination 9/16-inch open-end box wrench, and an STC alignment fixture.
- 2 Turn off all power to the SmartScanNG².
- 3 Using a T-handle 1/4-inch hex-wrench, loosen the six socket-head-cap screws on the cover of a wheel scanner.

Four screws attach the weather cover to the mounting plate, and two screws attach the mounting plate to the mount.

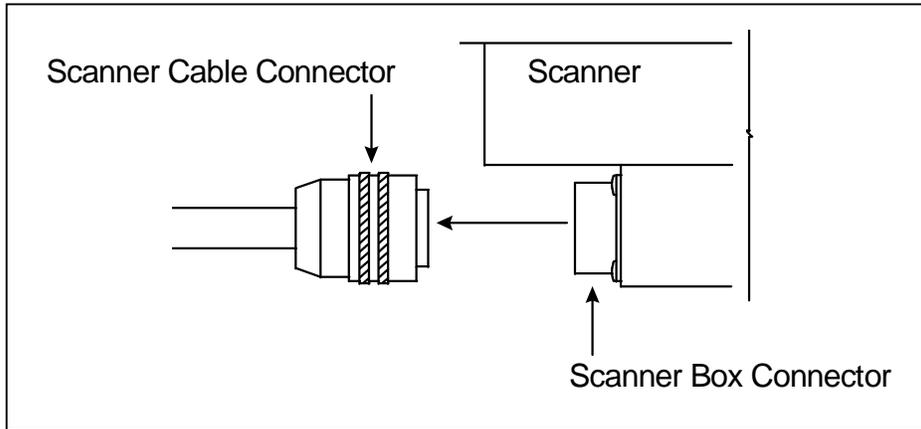


- 4 Separate the wheel scanner cover-and-module assembly from its mount.



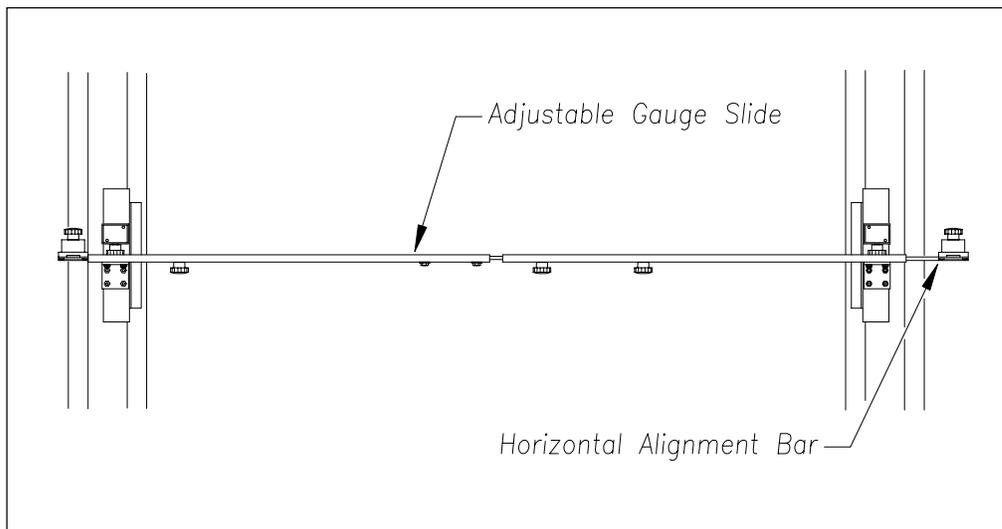
- 5 Disconnect the heater wiring plug.

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

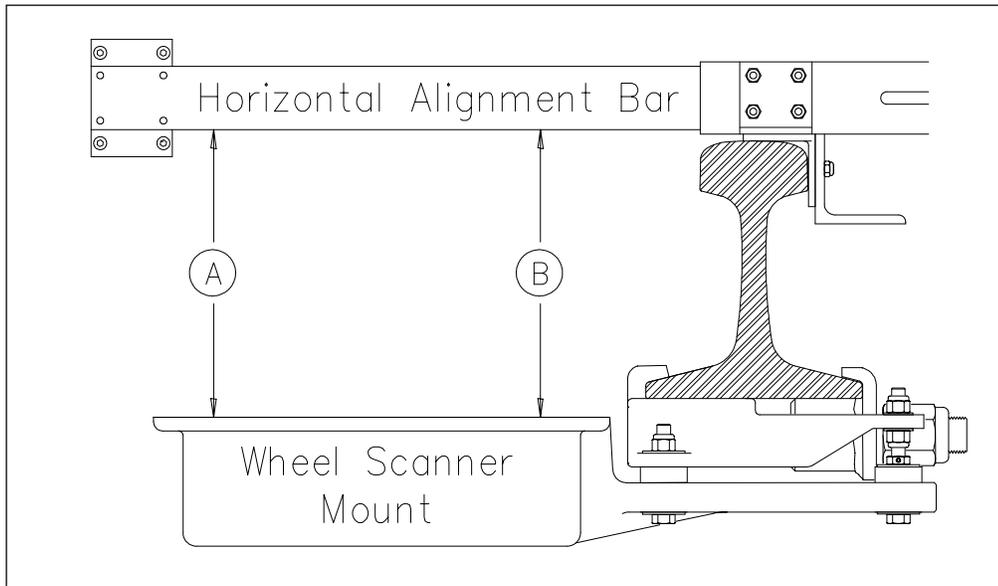


- 7 Store the cover-and-module assembly in a safe place until you replace it.
- 8 If not done already, place the alignment fixture on the rails so that the adjustable gauge slide is over both wheel scanners.

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



- 9 Over the scanner mount, extend the horizontal alignment bar of the fixture as far as it will go.
- 10 Tighten the extended bar.
- 11 At both ends of the scanner mount, measure from the bottom of the extended bar to the top surface of the mount.



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

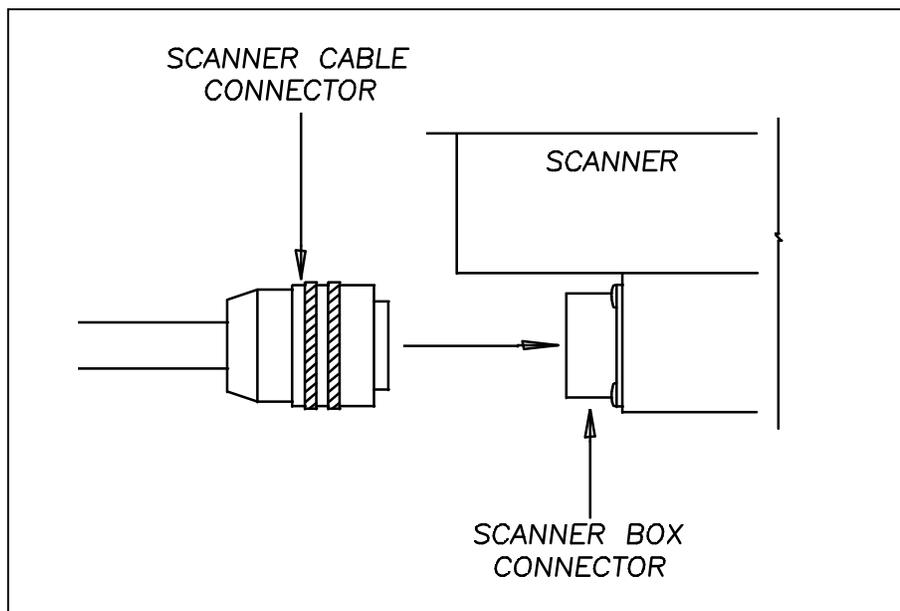
- 12** If adjustment is necessary, adjust the upper and lower nuts on the edge of the wheel scanner mount's arm.

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

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

- 14** Fully Retract the horizontal alignment bar.

- 15** Attach the scanner cable connector to the scanner box connector.



- 16** With the hole on top of the wheel scanner cover facing the center of the track, set the mounting plate back onto its scanner mount.
- 17** Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.
- 18** Reconnect the heater wiring plug.
- 19** With the hole on top of the wheel scanner cover facing the center of the track, set the weather cover back onto its mounting plate.
- 20** Using the T-handle 1/4-inch hex-wrench, uniformly tighten the four socket-head-cap screws.
- 21** Repeat steps **3** through **20** for the wheel scanner on the opposite rail.
- 22** Remove the alignment fixture from the track.
- 23** If this is a multitrack site, repeat steps **1** through **22** for each track.

11.0 Connecting Track Hardware to SmartScanNG²

This section tells how to connect track hardware wiring to the proper termination points within the SmartScanNG² wayside enclosure.

11.1 Bearing Scanners

There are two bearing scanners per track. At double-track sites, the cables from the bearing scanners on track1 connect to the bottom of the leftmost SmartScanNG² enclosure. The cables from track2 connect to the bottom of the rightmost SmartScanNG² enclosure.

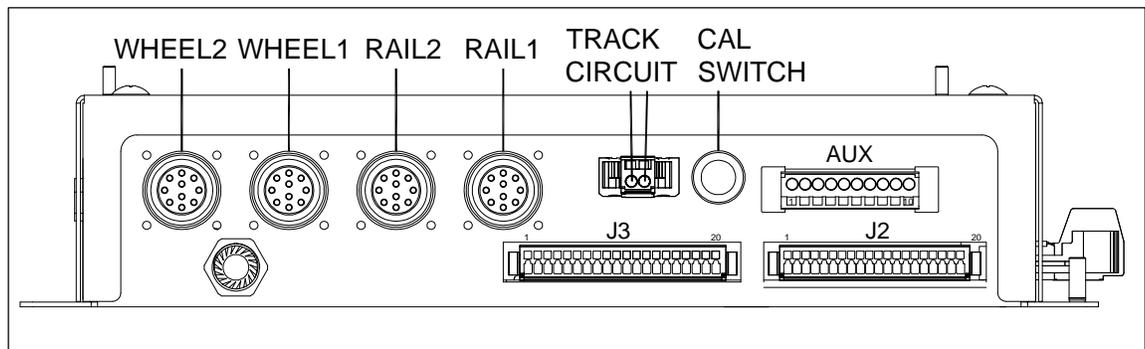
To connect the bearing scanners to the SmartScanNG² enclosure:

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

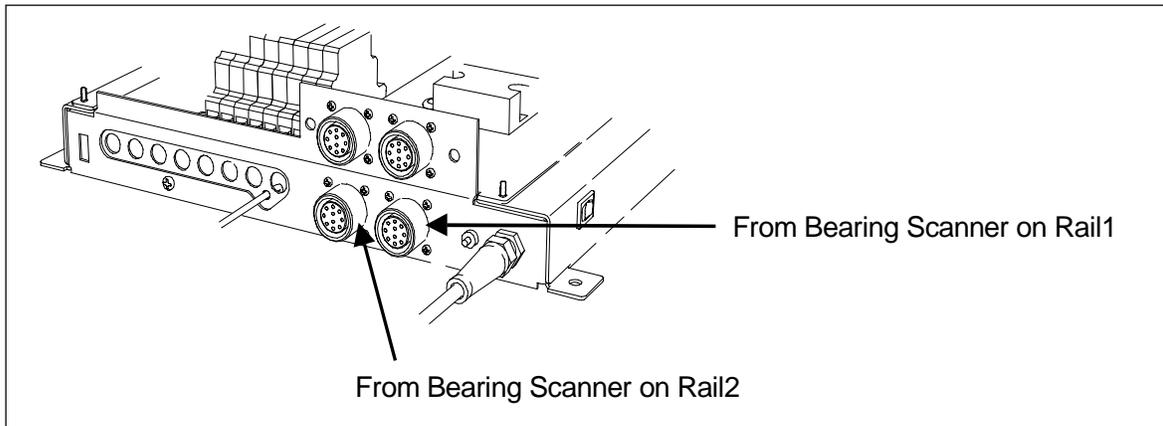
At a single-track site, the cable from the bearing scanner on rail1 should be labeled **RAIL1**. The cable from the bearing scanner on rail2 should be labeled **RAIL2**. If the track runs north and south, RAIL1 is the east rail and RAIL2 is the west rail. If the track runs east and west, RAIL1 is the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

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

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



2300-601 NG² Chassis



2300-501 NG Chassis

- 3 Plug the connector from the bearing scanner on rail2 (that is, from the south or west rail) into the box connector labeled Rail2.

If this is a double-track site, repeat steps 1 through 3 on the second track. Connect the cables from track2 to the rightmost SmartScanNG² enclosure.

11.2 Wheel Scanners

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

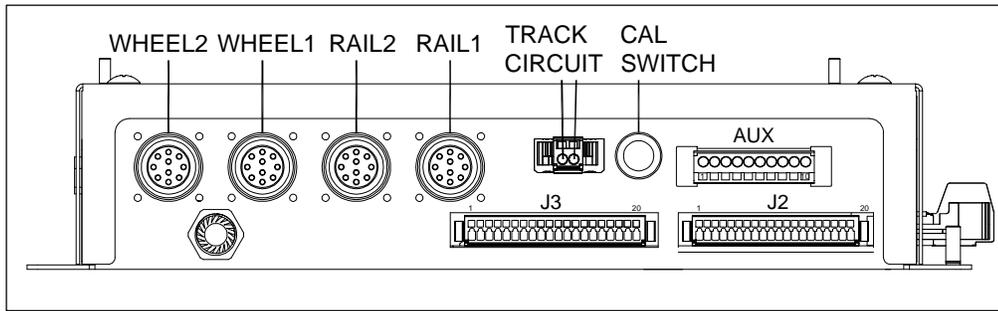
If your site uses them, there are two wheel scanners per track. At double-track sites, the cables from the wheel scanners on track1 connect to the bottom of the leftmost SmartScanNG² enclosure. The cables from track2 connect to the bottom of the rightmost SmartScanNG² enclosure.

To connect the wheel scanners to the SmartScanNG² enclosure:

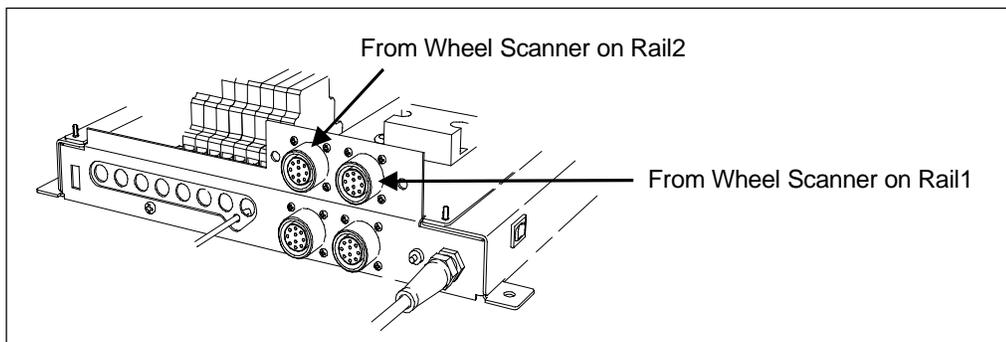
- 1 Be sure that both wheel scanners are installed on the track.

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

At a double-track site, they're labeled **W-RAIL1-TRACK1**, **W-RAIL2-TRACK1**, **W-RAIL1-TRACK2**, or **W-RAIL2-TRACK2**, whichever is appropriate.
- 2 Plug the connector from the wheel scanner on rail1 (that is, from the north or east rail) into the box connector labeled Wheel1.



2300-601 NG² Chassis



2300-501 NG Chassis

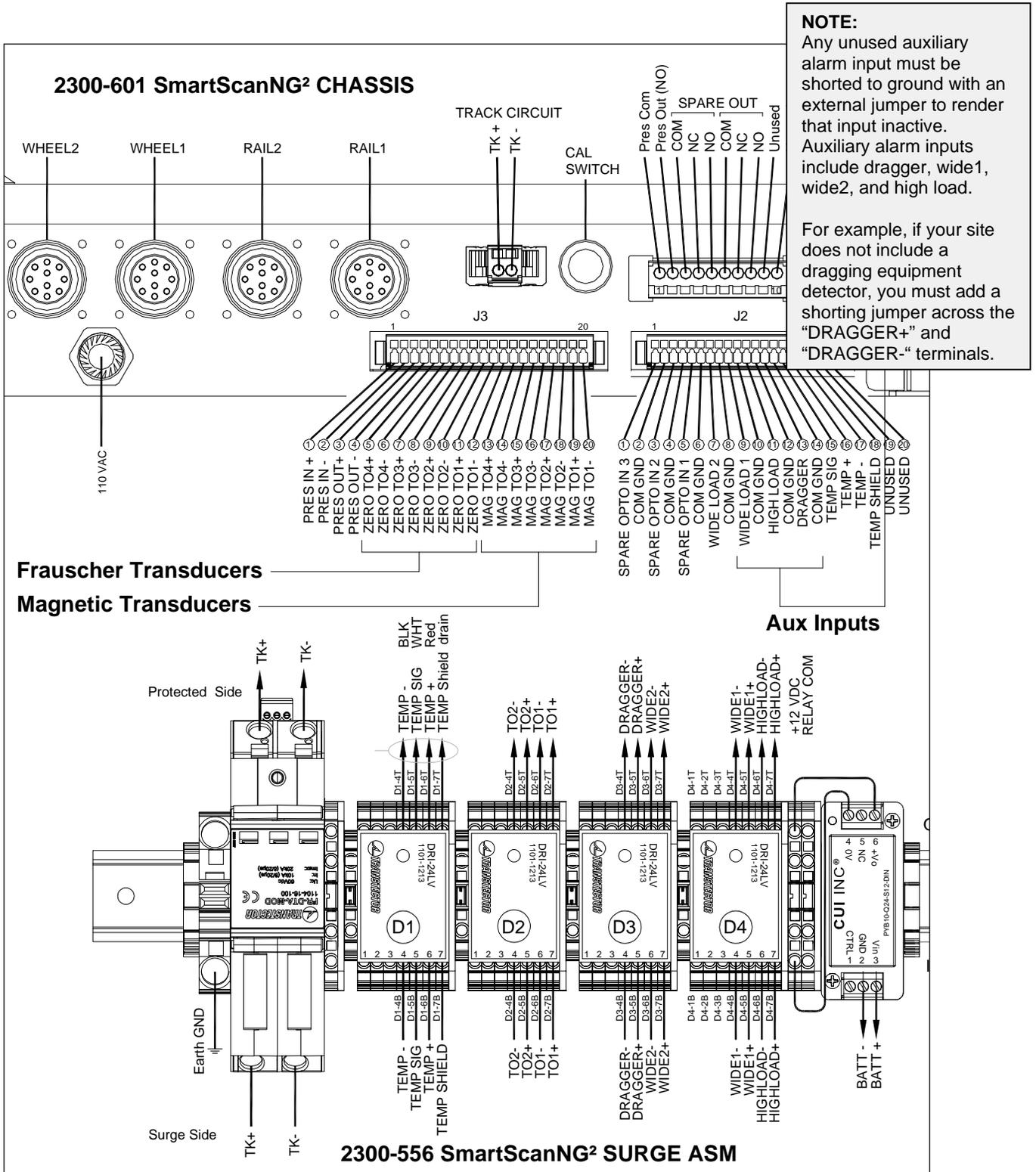
- 3 Plug the connector from the wheel scanner on rail2 (that is, from the south or west rail) into the box connector labeled Wheel2.
- 4 If this is a double-track site, repeat steps 1 through 3 on the second track. Connect the cables from track2 to the rightmost SmartScanNG² enclosure.

11.3 Chassis Wiring Connections

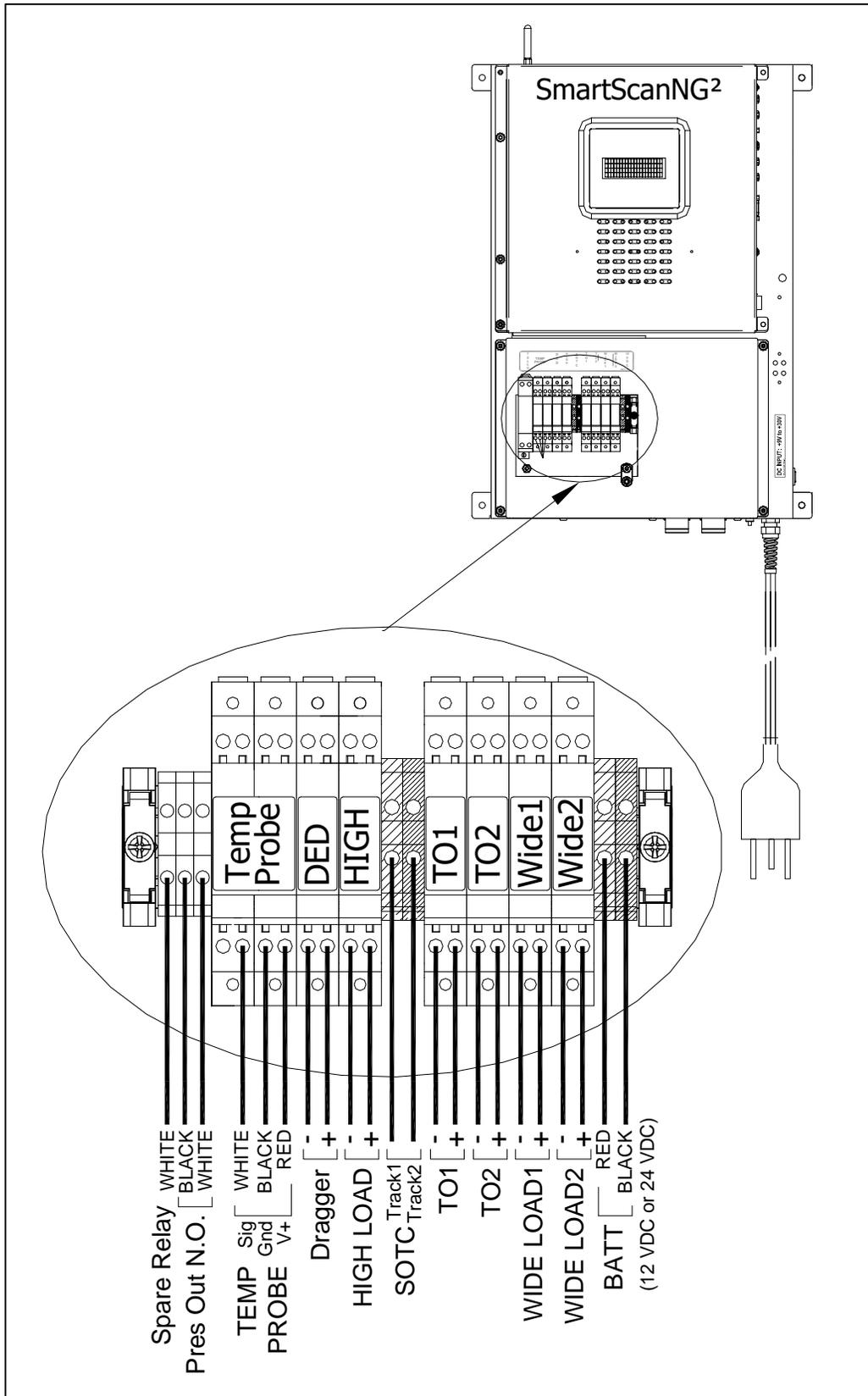
The wiring diagrams on the next three pages represent the following configurations:

- SmartScanNG² with a 2300-601 NG² Chassis
- SmartScanNG² with a 2300-501 NG Chassis
- SmartScanNG² with a 2300-501 NG Chassis with Quick Disconnect Panel (NS Rwy)

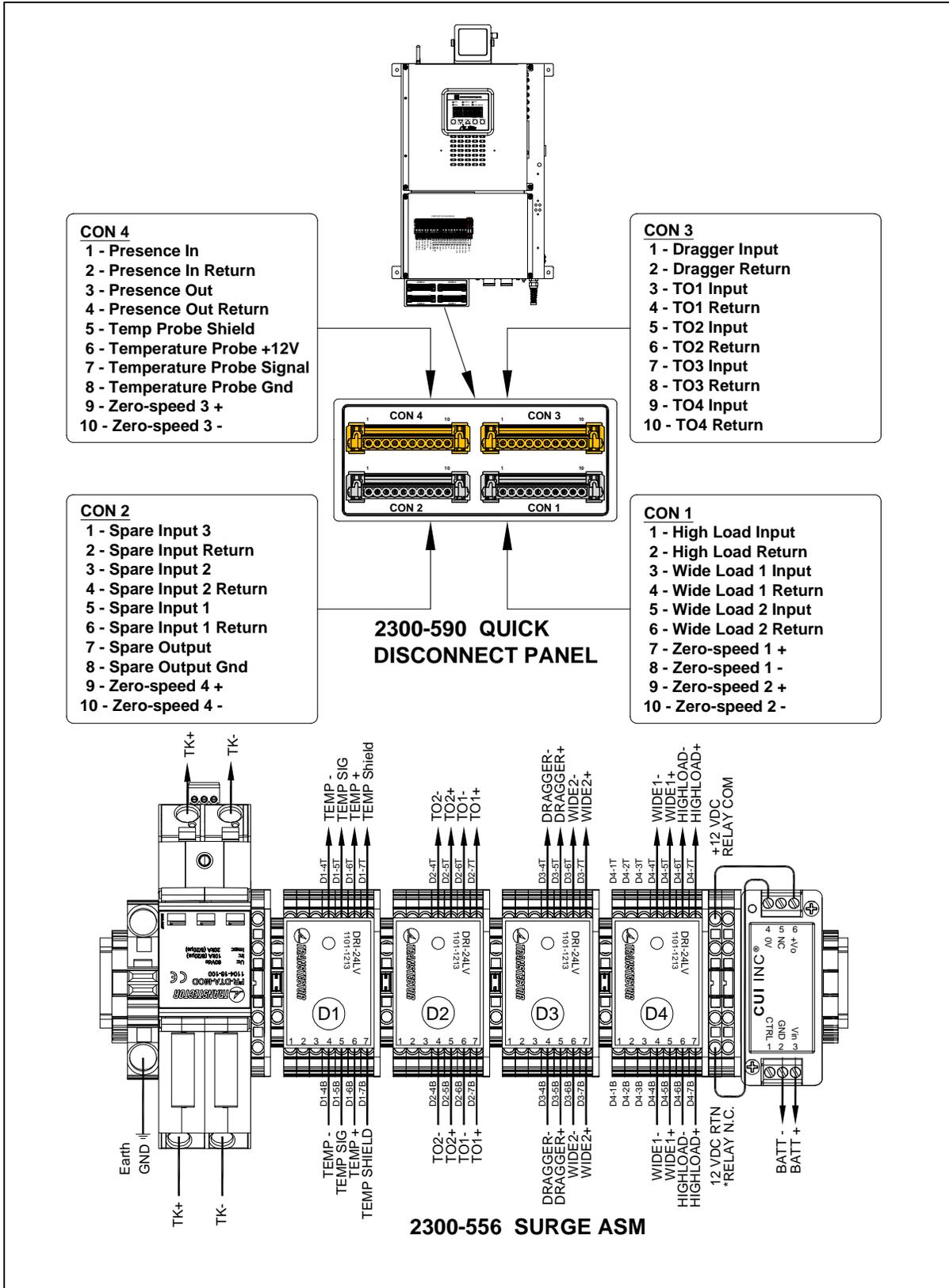
Wiring for the CSX Bungalow with Faraday cage is detailed in Appendix C.



Track Wiring to a 2300-601 NG² Chassis



Track Wiring to SmartScanNG Chassis



Track Wiring for Quick Disconnect Panel (NS Rwy)

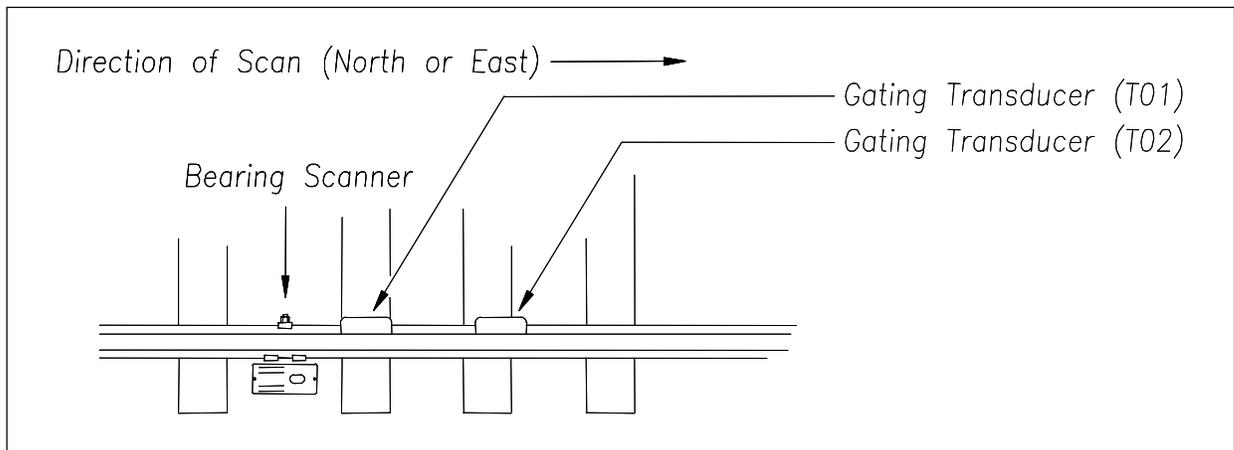
11.4 Gating Transducers

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-TRACK1**, **TO2-TRACK1**, **TO1-TRACK2**, or **TO2-TRACK2**, whichever is appropriate. At double-track sites, the wires from the gating transducers on track1 are routed through the surge panel of the leftmost SmartScanNG² detector. The wires from track2 are routed through the surge panel of the rightmost SmartScanNG² detector.

Refer to **Section 9.2** for detailed wiring schematics.

NOTE: Observe correct polarity when you connect the wires from the transducers. For Frauscher transducers, the polarity is correct when the brown wire is connected to signal+ and the yellow wire is connected to signal-. For magnetic transducers, the polarity is correct when the transducer's white wire is connected to signal+ and the black wire is connected to signal-.

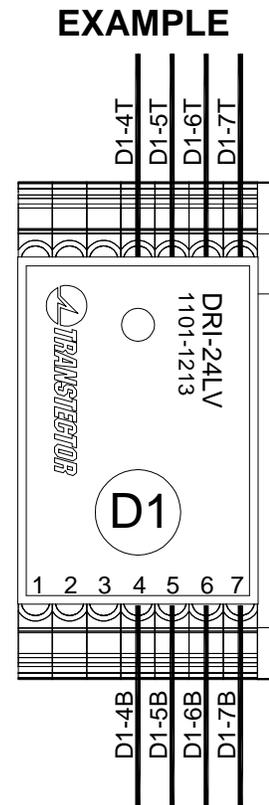


11.5 Advance Transducers

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

There are two advance transducers per track, each having two wires: one black wire and one white wire. At a single-track site, the wires should be labeled **ADV1** and **ADV2**. At a double-track site, they should be labeled **ADV1-TRACK1**, **ADV2-TRACK1**, **ADV1-TRACK2**, or **ADV2-TRACK2**, whichever is appropriate. At double-track sites, the wires from the advance transducers on track1 connect to the leftmost SmartScanNG² detector. The wires from track2 connect to the rightmost SmartScanNG² detector.

DRI WIRING CHART		
SURGE PIN#	SIGNAL	NG ² PIN#
D1-4T	TEMP -	J2-17
D1-5T	TEMP SIG	J2-15
D1-6T	TEMP +	J2-16
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



11.6 Dragging-Equipment Detector

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

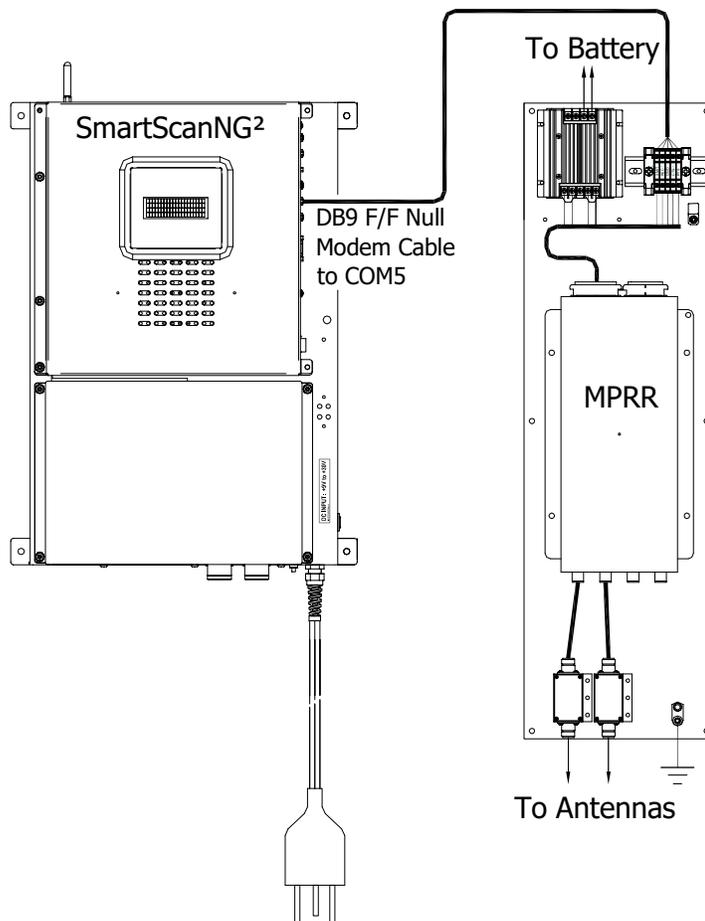
When used, there is one dragging-equipment detector per track, each having two wires — usually, one black wire and one white wire. The color of your wires may be different.

At double-track sites, the wires from the dragging-equipment detector on track1 connect to the leftmost SmartScanNG² detector. The wires from track2 connect to the rightmost SmartScanNG² detector.

Refer to the wiring chart in **Section 11.4**.

11.7 AEI Antenna

Most, but not all systems are equipped with AEI. If yours is not, skip ahead to the next section. Attach the coaxial cables coming from the AEI antennas to their respective Joslyn surge protectors (aka Joslyn coaxial lightning arresters). In reference to the track, Antenna0 is the northmost or eastmost antenna. Antenna1 is the southmost or westmost antenna.



11.8 High-Load/High-Wide Detector

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

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

At double-track sites, the wires from the high-load/high-wide detector on track1 connect inside the leftmost SmartScanNG² detector. The wires from track2 connect inside the rightmost SmartScanNG² detector.

Refer to the wiring chart in **Section 11.4**.

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.

12.0 Calibrating Scanners

12.1 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 progress by analyzing changes in the heat signals. Once the procedure has been completed, the 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.

12.2 Bearing Scanner Calibration

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 set point, 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, power the heat source 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. Connect the inverter to earth ground according to the manufacturer's recommendations.

WARNING

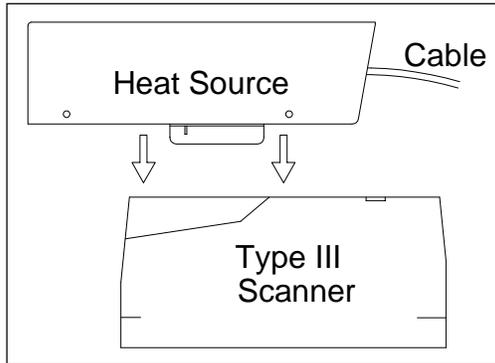
Once plugged in, live AC is present on both function connectors.

- 4 Using the supplied dust cap, cover the used function connector.
- 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.

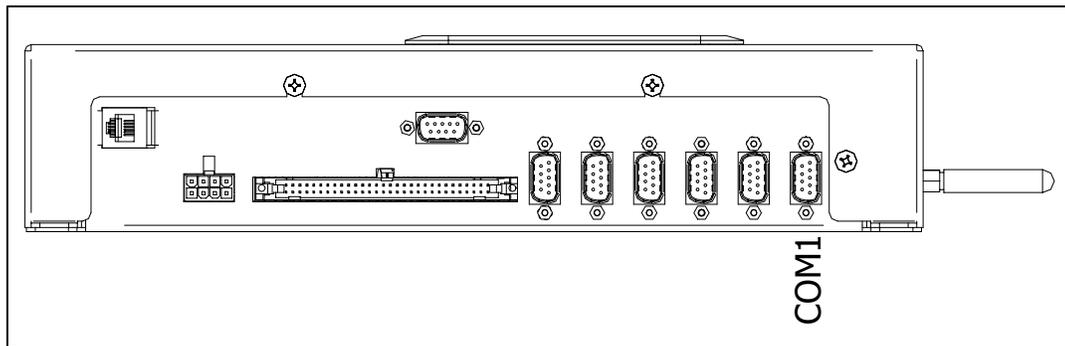
Once the temperature stabilizes, calibration may begin. Once stabilized, the temperature changes less than plus-or-minus one degree Fahrenheit.

- 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 or COM2 (whichever is available) 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 baud rate is set to the appropriate setting (typically 19,200).

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

- d On your computer, open a LOG file.

12 Using the serial interface, display the Main menu.

The Main menu looks similar to this.

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

13 Select **System Functions** menu.

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] - Reboot System
[H] - Delete All Stored Train Data
[I] - Clear Event Log
[J] - Update Menu
[K] - Maintenance Menu
[L] - Volume up (4)
[M] - Volume down (4)
[N] - Resistor Data
[O] - Radio Programming Menu
[P] - Scanner test
[Q] - Virtual gate test
[X] - Exit
```

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

14 Select Auto-Calibration to begin scanner calibration process.

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 has completed the calibration procedure. To abort the process, press **[Esc]** on your computer or remove the heat source from the bearing scanner.

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

```
Auto Calibration Selected

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

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

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

Testing Digital-Pot U-306. Stand by.
Digital-pot checks OK.
Previous calibrated digital-pot. setting was 38.
Adjusting digital-pot.
Temp = 225F Pot = 59 Sec = 1 Pot. decremented by 1 step.
Temp = 224F Pot = 58 Sec = 1 Pot. decremented by 1 step.
Temp = 221F Pot = 57 Sec = 2 Pot. decremented by 1 step.
Temp = 219F Pot = 56 Sec = 3 Pot. decremented by 1 step.

      .
      .
      .

Temp = 183F Pot = 35 Sec = 15 Pot. decremented by 1 step.
Temp = 182F Pot = 34 Sec = 18 Pot. decremented by 1 step.
Temp = 181F Pot = 33 Sec = 29 Pot. decremented by 1 step.
Temp = 179F Pot = 33 Sec = 93 Monitoring heat source temperature.
Rail1 digital-pot setting of 33 was stored in EEPROM.
East Rail Scanner Calibration complete.
The setpoint is 180F. The calibrated temp. is 179F.
Closing the shutters.
Resistor test pending.

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

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

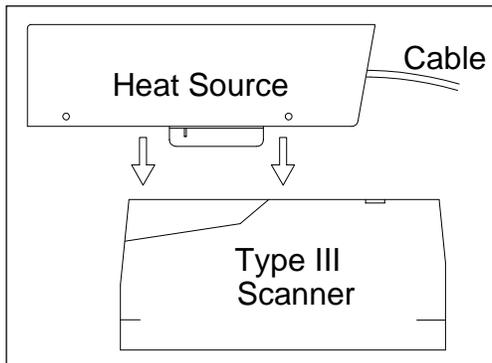
```

Auto Calibration Selected

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

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

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



- 18 Repeat the calibration procedure. Select **Auto-Calibration** from System Function Menu to initiate.
- 19 To return to the Main menu, select **Exit**.
- 20 To exit the serial interface and return the system to normal operation, select **Exit**.
- 21 If this is a multitrack site, repeat steps 1 through 20 for the second track.

NOTE:

Upon completion of autocalibration, the system acquires the scanner resistor temperature baseline values. The process begins with a 20-minute wait period in which the resistors are allowed to cool down. The system counts down during this period, sounding a tone each minute. After the 20-minute cooldown period, the system opens and closes the shutters for a period of 8 minutes.

12.3 Wheel Scanner Calibration

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

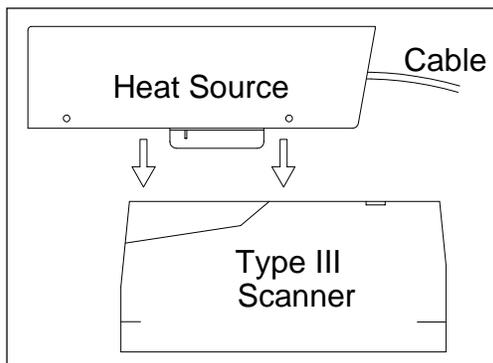
To calibrate the wheel scanners:

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

NOTE:

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

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



If you experience a clearance issue between the heat source power connector and the crown of the rail, the heat source will require modifications. See Section 2.4.2.2 for details. These issues typically occur only with 115-LB rail.

3 Begin autocalibration. Refer to 12.2 Bearing Scanner Calibration for setup details.

4 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 has completed the calibration procedure. To abort the process, press **[Esc]** on your computer or remove the heat source from the wheel scanner.

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

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

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

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

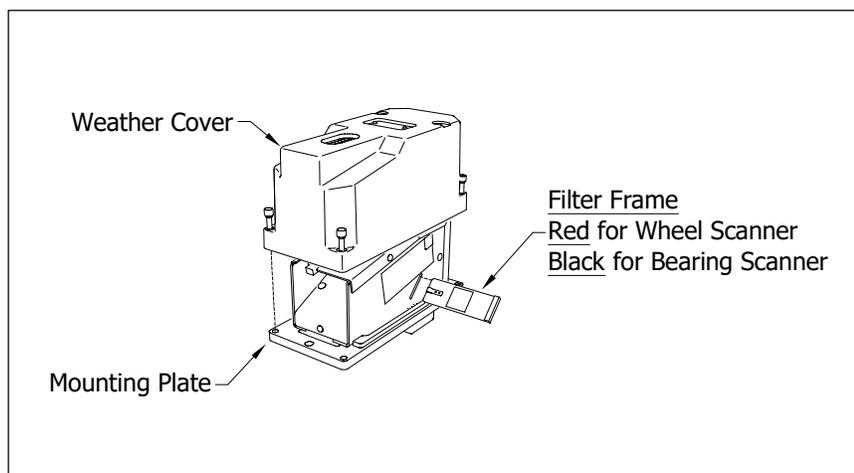
7 With the power cord to the front of the scanner, place the calibrated heat source on the wheel scanner.

8 Repeat steps 3 through 5.

9 To return to the Main menu, select **Exit**.

10 To exit the serial interface and return the system to normal operation, select **Exit**.

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



Before continuing, be sure that the red filter frame is securely in place and that the four socket-head-cap screws on the weather cover are completely tight.

Upon completion of autocalibration, the system acquires the scanner resistor temperature baseline values. The process begins with a 20 minute wait period in which the resistors are allowed to cool down. The system counts down during this period, sounding a tone each minute. After the 20-minute cooldown period, the system opens and closes the shutters for a period of 8 minutes.

NOTE: The red filter frame MUST be in place during the resistor temperature baseline acquisition process.

12 If this is a multitrack site, repeat steps **1** through **11** for each track.

NOTE:

Upon completion of autocalibration, the system acquires the scanner resistor temperature baseline values. The process begins with a 20 minute wait period in which the resistors are allowed to cool down. The system counts down during this period, sounding a tone each minute. After the 20-minute cooldown period, the system opens and closes the shutters for a period of 8 minutes.

12.4 Scanner Resistor Baseline Acquisition

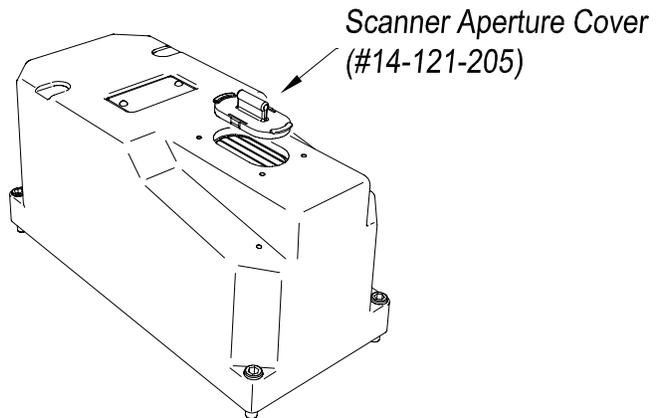
Upon completion of autocalibration, the system acquires the scanner resistor temperature baseline values. The process begins with a 20-minute wait period in which the resistors are allowed to cool down. The system counts down during this period, sounding a tone each minute. After the 20-minute cooldown period, the system opens and closes the shutters for a period of 8 minutes.

NOTE: For wheel scanners, it is imperative that the red filter frame is immediately replaced after autocalibration has disengaged and before resistor baseline acquisition begins.

The reason for establishing the baseline tables at the end of the Auto-Cal cycle is the assumption that the system is then at its peak operating efficiency. The system is freshly calibrated, and the lenses are clean. With the baselines established, the system can then recognize and compensate for slight degradations of the lens caused by moisture or dirt accumulation on the lens surface.

12.4.1 Scanner Aperture Covers (No Longer Needed for NG²)

The post-calibration scanner plugs that were previously used during the resistor baseline to account for variances in the sky/weather are no longer necessary on the SmartScanNG². They have been replaced with software that factors in the temperature of the sky as a reference point for the resistor baseline data.



12.4.2 Bungalow Speaker Announcements

During the resistor-cooling period, the system announces through the speaker the following. These announcements aren't broadcast over the radio.

- A beep sounds once per minute until two minutes before the resistor test.
- At two minutes until the test, "Scanner resistor test beginning in 2 minutes" is voiced.
- At one minute until the test, "Scanner resistor test beginning in 1 minute" is voiced.

After the resistor cooling period:

- As the test begins, "Testing" is voiced. During this time, the word PENDING appears in the status column of the Resistor Data section.
- If the test was successful, "System working" is voiced. The word VALID appears in the status column of the Resistor Data section, signifying that the baseline test applies to each passing train.
- If the test wasn't successful, "Scanner resistor test beginning in two-zero minutes" is voiced, meaning that the system will try once more after 20 minutes to acquire an accurate resistor heat profile. During this time, the word PENDING appears in the status column of the Resistor Data section of the System Status Report. If the test fails a second time, the word INVALID appears in the same column. The system applies the interim integrity test to each passing train while either PENDING or INVALID appears.

12.4.3 Processing Resistor Baseline Results

Here are two rules the system uses:

- If any of the temperatures in the baseline table are less than or equal to 40°F, we consider the baseline to be invalid.
- The next sequential temperature has to increase or be no less than 6°F cooler than the last temperature. That is, if a temperature is 100°F, for example, the next temperature has to be greater than 100, equal to 100, but not less than 94.

If the system gets an invalid baseline, it automatically tries a second time. If it gets interrupted, it also tries a second time. The 300°F temperatures that occasionally show up in the baselines are more a reflection of the duty cycle controller for the shutter resistor. Some controllers cause the shutter resistors to heat up more quickly and sometimes overshoot the desired set point, whereas a controller that is operating at its optimum efficiency ramps up to a value slightly below 300°F. Temperatures above 300°F do not result in an invalid baseline.

Look at the Resistor Data section of the System Status Report. INVALID indicates that the system has tried twice and could not acquire valid resistor data. If any of the baseline results for a scanner show INVALID, the only way to capture a new baseline is to run the Auto Cal process again. If the word PENDING appears in the status column, the system is waiting for the resistors to cool before acquiring resistor data or for the battery to charge to 13 volts. INVALID indicates that the system has tried twice and could not acquire valid resistor data. In either case, the system applies the interim integrity test to passing trains, which doesn't require resistor baseline data.

13.0 Setting Transducer Gain

13.1 Procedure for 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. With this feature, 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, thus causing the system to be more sensitive to transducer output. When the comparator is in normal mode, the comparator has a better chance of filtering transducer pulses not caused by a wheel.

To set the transducer-gain setting to normal:

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

The Main menu looks like this.

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

- 2 Select the **Setup** menu.

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

```
Enter Setup Password:
```

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

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

```
Password Incorrect
```

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

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

Passwords can be created or changed using the Setup Password submenu on the Setup menu.

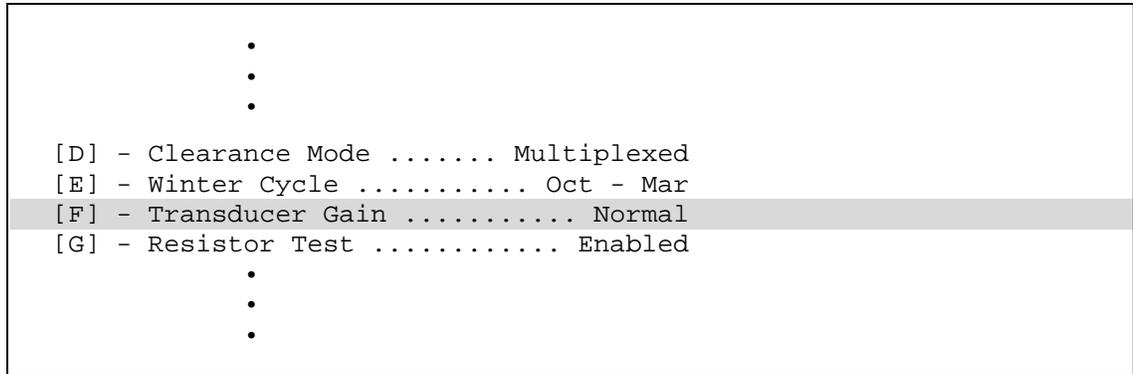
If the Setup menu is not password protected, the Setup menu appears. Also, after you type the password correctly for a password-protected Setup menu, the Setup menu appears.

```
SmartSCAN NG2, MP/KP:0159.0, Track:Single
05/28/2019 15:32:36, 28.3V, 75°F
Setup Menu
-----
[A] - Date and Time
[B] - Site ID ..... NONAME
[C] - MP/KP
[D] - Track Designation ..... Single
[E] - Track Direction ..... N/S
[F] - Alarm Settings
[G] - Equipment Settings
[H] - Messages Settings
      .
      .
      .
```

3 Select Equipment Settings.

```
SmartSCAN NG2, MP/KP:0159.0, Track:Single
05/28/2019 15:24:33, 28.3V, 75°F
Equipment Settings
-----
[A] - Dragger ..... No
[B] - High Load ..... No
[C] - Wide Load ..... No
[D] - Hot Wheel ..... No
[E] - AEI ..... Yes
[F] - Hot Bearing ..... Yes
[G] - Presence Hardware ..... No
[H] - AC Power Off Monitor ..... Yes
[I] - Cold Rail Test ..... All trains
[J] - Select scanner types
[K] - Advanced
[X] - Exit
```

4 Select **Advanced**.



The Advanced 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. With this feature, 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, thus causing 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.

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

6 If the **Transducer Gain option** on the Equipment menu is set to High, select **Transducer Gain**.

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

7 To leave the Equipment menu and return to the Setup menu, select **Exit**.

8 To leave the Setup menu and return to the Main menu, select **Exit**.

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

9 To exit the serial interface and return the system to normal operation, select **Exit**.

10 If this is a multitrack site, repeat steps **1** through **8** for the other SmartScanNG² systems.

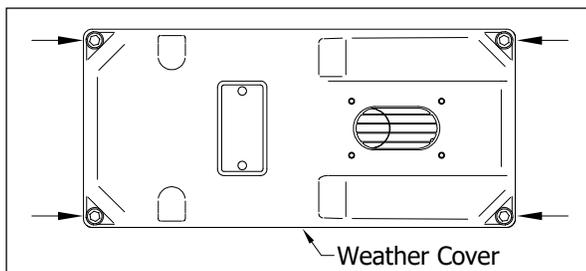
Appendix A

Lens Cleaning of Scanners

This appendix tells how to clean the optics in the scanners.

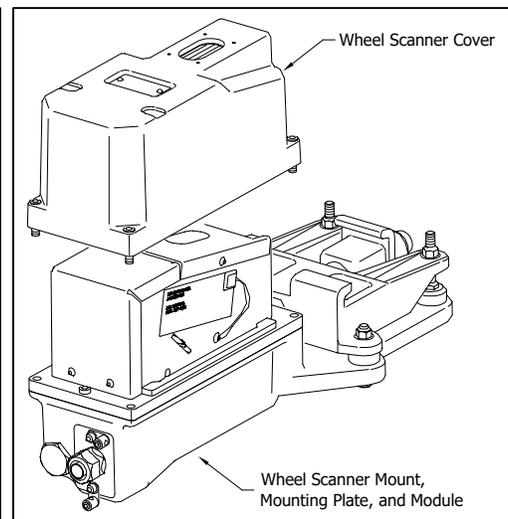
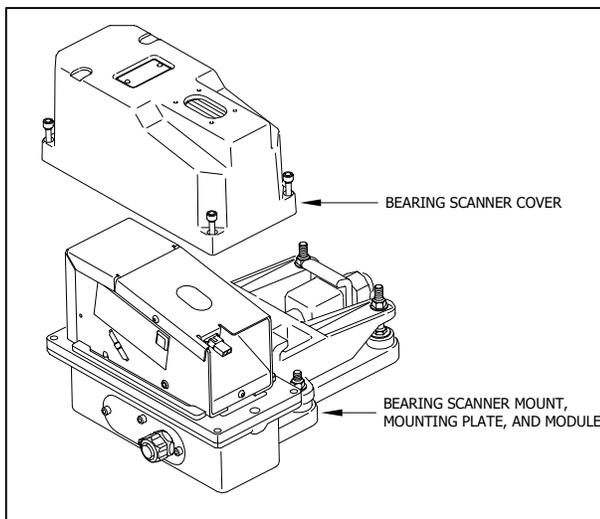
To clean the optics in the scanners:

- 1 Be sure that you have on hand a T-handle 1/4-inch hex-wrench.
- 2 Using the T-handle 1/4-inch hex-wrench, loosen the four socket-head-cap screws that attach the weather cover to the mounting plate.



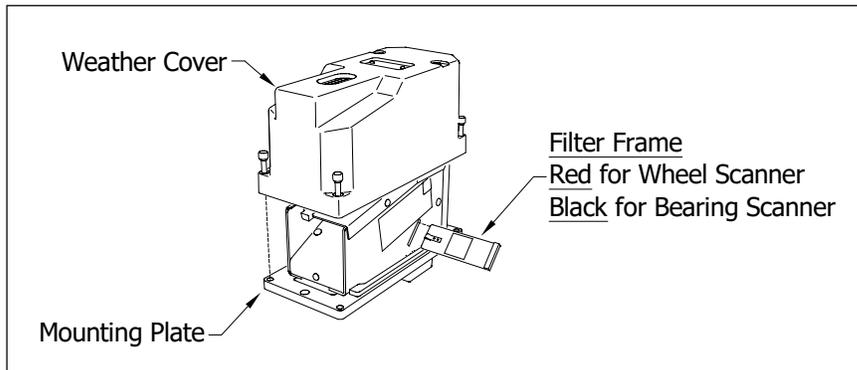
- 3 Remove the weather cover from its mounting plate.

Be careful not to damage the electrical connection for the cover heaters.



- 4 Disconnect the heater wiring plug.

On the side of the scanner module, you'll find a metal tab that protrudes about 1/4 inch outside the module.

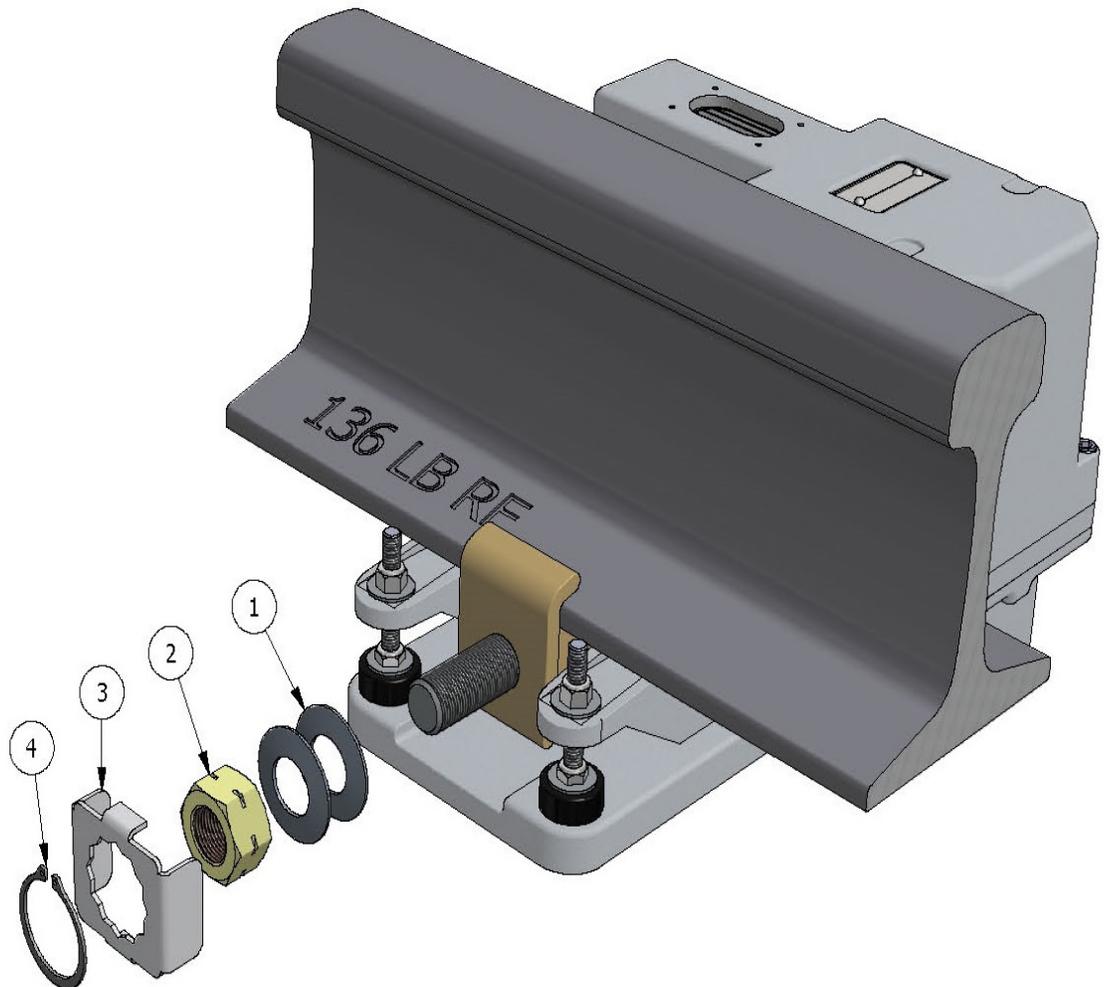


- 5 Grasp the tab and pull the filter frame out of the scanner module.
- 6 Using the brush supplied with the tool kit, lightly dust any excess material from the filter frame glass.
Be careful not to abrade or scratch the surface of the lens.
- 7 Apply a small amount of Vallen V8L cleaning solution (included in the tool kit) directly to the glass filter to loosen any remaining contamination.
- 8 Gently polish the reflective glass surface of the filter to remove any remaining contamination.
Pay close attention to the area around the perimeter of the lens. It is important that the entire surface of the lens is clean.
- 9 Open the shutter by stroking one of the gating transducers with a piece of ferrous metal.
- 10 If the lens surface appears to have any dust on it, insert the brush from the tool kit through the baffle plates until it contacts the lens surface. Apply a twisting motion to dislodge any accumulated dust.
- 11 Remove the brush and visually inspect the lens for cleanliness.
- 12 Reinstall the filter frame assembly properly - (The reflective surface faces the viewport opening of the scanner) Reconnect the heater wiring plug.
- 13 Re-connect the scanner cover heater.
- 14 If this is a **bearing scanner**:
With the hole on top of the bearing scanner cover facing north or east, set the weather cover back onto its mounting plate. Using the T-handle 1/4-inch hex-wrench, uniformly tighten the four socket-head-cap screws.
- 15 If this is a **wheel scanner**:
With the hole on top of the wheel scanner cover facing the center of the track, set the weather cover back onto its mounting plate. Using the T-handle 1/4-inch hex-wrench, uniformly tighten the four socket-head-cap screws.

Appendix B

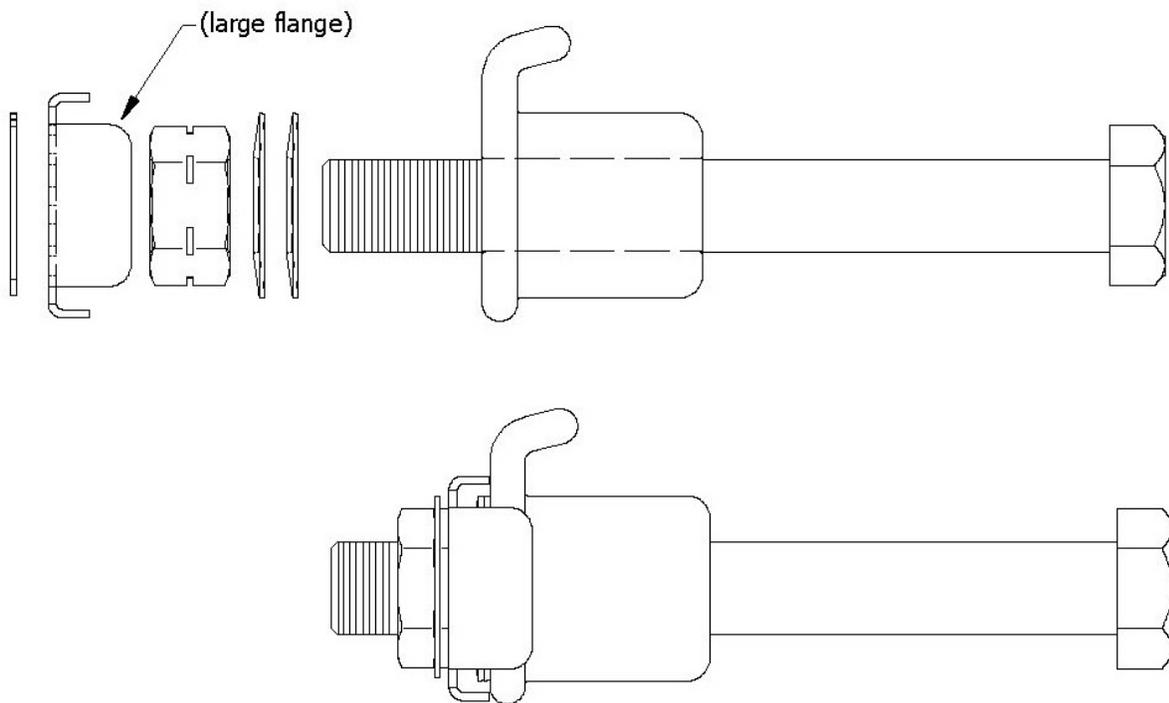
2100-610 Track Mount Nut Lock

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	12-126-007	2in x 1.016in x .065in Belleville washer
2	1	41-121-208	1-14 Hex Nut
3	1	41-121-197	Lock Clip
4	1	01-129-008	Industrial Ext. Retaining Rings, Series 3100



Installation Instructions

1. Remove both Hex Nuts and Washer from the Clamp Assembly.
2. Install the Spring Washers over the 1" bolt with the inside of the washers against the Rail Clamp.
3. Install the Hex Nut and torque to 30 ft/lbs.
4. Slide the Lock Clip over the Hex Nut and against the Rail Clamp. The two large flanges on the clip fit over the left and right sides of the rail clamp. (note: the Hex Nut may need to be torqued a little more to get the Lock Clip and Rail Clamp to align properly.)
5. Install the Retaining Ring in the groove in the Hex Nut.



Appendix C

Frauscher Transducer Troubleshooting

C.1 Frauscher Compatibility

This section provides information for determining if your SmartScanNG² requires the Frauscher Wheel Signal Converter (WSC) to interface with Frauscher Zero-Speed Transducers. All the NG² systems currently being shipped have built-in Frauscher interface circuitry permitting the transducer wires to be connected directly into the NG² chassis without the need of the WSC. The NG² system is Frauscher compatible beginning in February of 2017. However, our earlier systems did require the use of the WSC.

The first version of Controller Module that did not require WSC had SICM Board Rev 1.3 installed. Consult the System Status Report from the NG² for the SICM Board Revision. A Controller Module with SICM Board Rev 1.3 or higher has the Frauscher interface circuitry and does not require a WSC; that is, if you also have a late-model chassis.

The Interconnect Board resides in the chassis and routes external signals up to the Controller Module. We are currently shipping Interconnect Board revision 1.8 at the time of writing this document, which does not require the WSC. See Figure – 1 below for Interconnect Board access and identification. All Interconnect Board versions earlier than 1.8 need the WSC regardless of the Controller Module's SICM Board version.

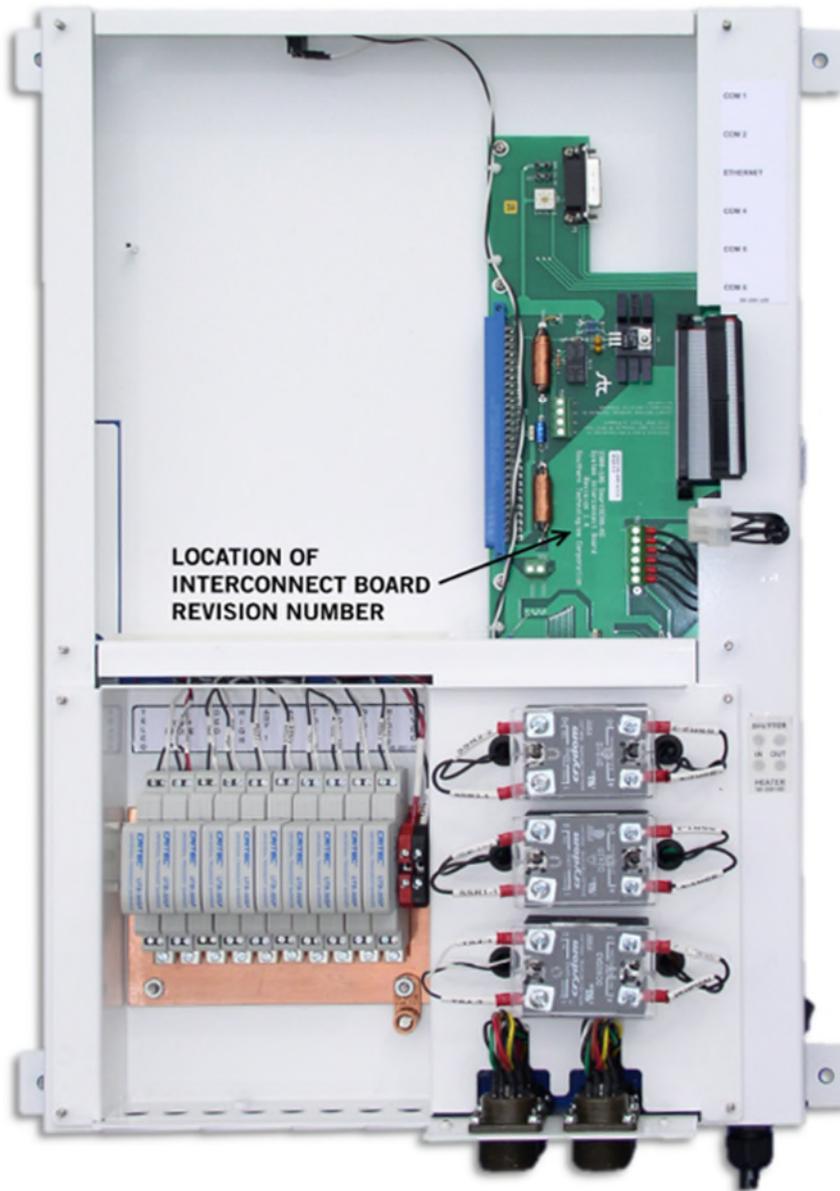


Figure 1 – Location of Interconnect Board and revision number inside the SmartScanNG chassis.

The chassis above is representative of the SmartScanNG (pre-NG²) chassis. This chassis is forward compatible with the SmartScanNG² Controller Module.



Figure 2 - SmartScanNG² Controller Module and SmartScanNG² Chassis.

The NG² chassis have dedicated Frauscher transducer wiring terminals, so it does not require a Wheel Signal Conditioner interface. The configuration in Figure 2 represents the most current hardware.

Summary:

- Revisions 1.3 and 1.4 of the Controller Module’s SICM Board do not need the Frauscher Wheel Signal Conditioner, and you must have an Interconnect Board in the chassis that is version 1.8 or newer or an NG² chassis represented in Figure 2.
- If you have an Interconnect Board that is older than revision 1.8, you need a WSC regardless of which Controller Module you have.
- If you purchased the system after January of 2017, do not install the WSC. The Frauscher connections are in the chassis, and the interface circuitry is in the Controller Module’s SICM Board.

SICM BOARD Revision	INTERCONNECT BOARD Revision	Wheel Signal Converter Needed
1.3 and up	1.8 and up	NO
1.2 and lower	ANY	YES
ANY	1.7 and lower	YES

C.2 Troubleshooting the Wheel Signal Converter (WSC)

The following troubleshooting charts provide methods for correcting issues with the WSC.

PWR LED Off

MEANING	POSSIBLE SOLUTIONS
No power supply	Apply power supply
Wrong polarity	Reverse polarity
Open fuse	Replace WSC

Sys1 / Sys2 LED Flashes Slowly

MEANING	POSSIBLE SOLUTIONS
WSC did not initiate Automated Adjustment correctly	Run Automated Adjustment Function
Wire break in the wheel sensor circuit	Check wiring for open circuit
Overcurrent in wheel sensor circuit	Check wiring for short circuit

C.3 Checking the Frauscher Sensor for Correct Current Flow

The following information outlines a procedure to measure and verify current flow through a Frauscher wheel transducer. By doing so, you may rule out a possible faulty wheel transducer while troubleshooting a system.

There are approximately five milliamps of current flow through the sensor when it is working correctly, and it is not sensing a target. During this procedure, disconnect the yellow sensor wire and connect a DC milliamp meter in series with the transducer wiring, thus providing a means to measure current flow through the transducer.

Tools Needed

- A digital Volt/Ohm meter (VOM) with a milliamps setting.
- Small bladed straight slot screwdriver approximately 1/8" wide.

Set the VOM to DC mA and connect in series with the yellow transducer wire. Perform the following steps:

1. Measure the voltage from the brown wire to the battery ground. A voltage reading of from 23 to 24 VDC indicates that the transducer is powered.
2. Set the VOM to measure DC milliamperes as follows. Unplug the red meter lead from the voltage jack on your VOM and plug it into the milliamps jack on the VOM.
3. Disconnect the yellow sensor wire from any connection between the transducer and the SmartScanNG² and connect the black VOM probe in its place under the terminal.
4. Touch the red meter probe to the loose yellow sensor wire that you removed from the terminal. You now have the VOM set for milliamps and connected in series with the yellow sensor wire.

5. The meter should measure 5 mA, within a tolerance of +/- 2%.
6. The current measurement should decrease from 5 mA (+/- 2%) as a metal object comes near the sensor. The SmartScanNG²'s TO-1 or TO-2 LED should indicate presence as the current measurement drops.

If the current flow is not correct, try the following:

- Run the Automated Adjustment function.
- Check for breaks in the sensor wiring.
- Rule out the possibility of a faulty surge suppressor.
- Replace sensor.

C.4 Failure to Calibrate

This section applies to SmartScanNG² systems that *do not* use the Frauscher Wheel Signal Converter (WSC). On systems not using the WSC, the brown and yellow transducer wires from the wheel transducers connect to surge protection devices, and then to terminals on the SmartScanNG² chassis.

Possible Causes of Unsuccessful Calibration

- The brown and yellow transducer wires from the wheel transducer(s) are connected in reverse polarity.
- Transducers are adjusted too close to the rail.

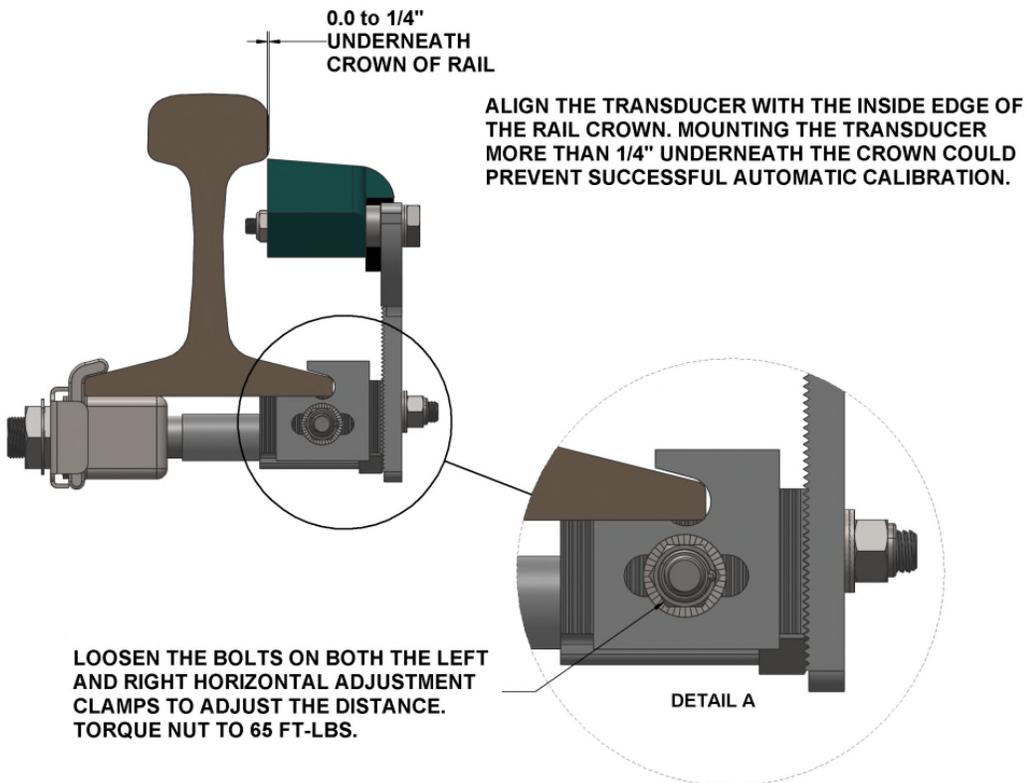
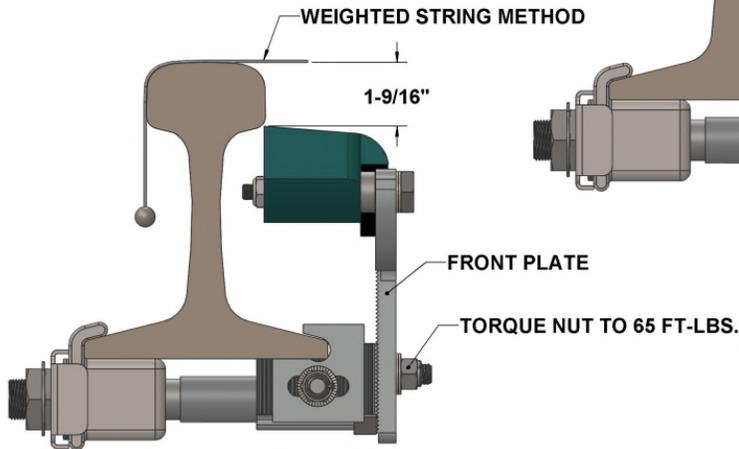
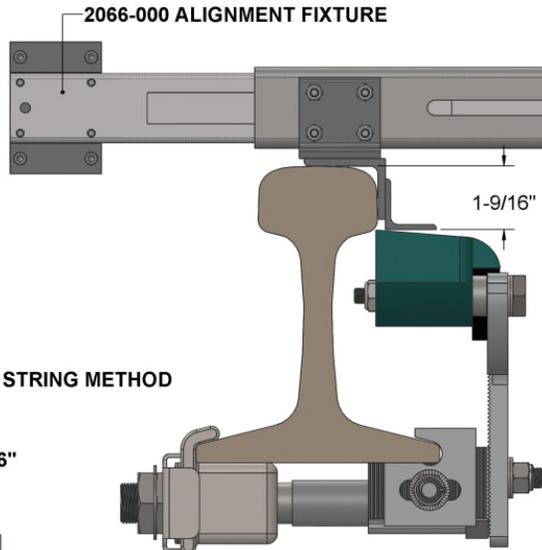
Before checking the wiring polarity, verify that both COP LEDs are blinking on the SmartScanNG² and that no metal object, except the rail, is near the SYS1 area of either wheel transducer. Use a DC voltmeter to measure from the system ground (same as battery ground) to the transducer's brown wire and also to the transducer's yellow wire from the system ground. Verify that the voltage measured on the yellow wire is less than the brown wire's voltage. If the brown wire's voltage is less than the yellow wire's voltage, then swap the two wires and recalibrate.

If calibration is not successful with correct wiring, the next step is to verify transducer alignment. A transducer adjusted too close to the rail can prevent successful calibration.

First, verify the accuracy of the Horizontal and Vertical Adjustments as per the drawing below. Then lower the transducer's Vertical Adjustment by one notch (0.100 inch) on the transducer bracket. Up to 0.200 inch of space between the alignment gauge and the top of the transducer is still within specification, but 0.300 inch of clearance is too low for reliable operation. Each adjustment detent in the transducer mounting bracket represents 0.100 inch. If the calibration is not successful after lowering by one notch, drop the transducers by a total of two detents (0.200 inch) below the alignment fixture and recalibrate. Be aware that the bracket may rise while tightening, so recheck your measurement before continuing.

If the transducer does not calibrate successfully after performing all the steps above, consult with Southern Technologies customer support (phone number 423-892-3029).

ADJUST THE TRANSDUCER FOR A DISTANCE OF 1-9/16" FROM THE TOP OF THE SENSOR TO THE CROWN OF THE RAIL. LOOSEN THE 7/8" NUTS SECURING THE FRONT PLATE TO MAKE ADJUSTMENTS TORQUE NUTS TO 65 FT-LBS.



Additional Information - A voltage measurement on the brown wire of approximately 23.5 to 24.8 volts is typical for a correctly wired transducer. The voltage on the yellow transducer wire represents the transducer signal and should be 1.65 VDC (+/- 2%) after successful calibration with no metal object near the transducer's sensing area. The voltage level on the yellow wire from an uncalibrated transducer is not predictable but is less than the voltage on the brown wire.

Wiring a Frauscher transducer in reverse polarity into a SmartScanNG² or a Frauscher WSC cannot cause damage to the transducer, NG², or the WSC. However, this is an alternate way to make the transducer run its automatic calibration function. Since it cannot detect wheels with the wires swapped, you must correct the wiring and check for proper voltage (1.65VDC +/- 2%) on the yellow wire to determine if the calibration was successful. The Frauscher automatic calibration function requires about 40 seconds to complete.

C.5 Troubleshooting Transducer Miscounts

This section provides troubleshooting guidance for a SmartScanNG² system experiencing transducer miscounts.

The system should perform as follows.

- The axle count reported for a given train by each transducer should be an even number and equal in value.
- Neither transducer should report an odd number of axles for any train.
- The number of axles for a given train should match the count from each transducer.

If the system is not carrying out all of the above functions, perform the following:

- 1 Run the transducer's Automatic Calibration function. If you are working with a SmartScanNG² that *does not* have the Frauscher Wheel Signal Conditioner (WSC), run the Automatic Calibration function using the menu system, either while on-site or from a remote location. If the system includes a WSC, refer to the Automated Adjustment section of this document.
- 2 Check the transducer mounting bracket and the transducers for a secure fit. If necessary, tighten the mounting hardware to the torque specifications provided in the "Installation of Transducer Assembly" section of this document. It is required to recalibrate after any movement of the transducers.
- 3 Verify secure wiring connections.
- 4 Temporarily bypass the surge arrestors in the transducer circuit. If the transducers perform correctly, replace the surge arrestors and monitor the system for accurate counts.

C.6 Preventive Maintenance

Periodically perform the following maintenance work with frequency adapted to the conditions of the track, but at least every two years.

- Visual and mechanical check.
- Check the wheel transducers for excessive dirt build-up. Clean as necessary.
- Check the wheel transducers for visual damage. The replacement of the transducer could be required.
- Check the mounting bracket for a secure fit on the rail. Torque the rail clamp nut to 90 ft/lbs.
- Check the transducer mounting plate for vertical and horizontal movement. Torque each adjustment nut to 65 ft/lbs.
- Check the transducers for a secure fit to the mounting bracket. Torque each to 30 ft/lbs.
- Check the rubber conduit tube for damage.
- Check cable connection terminals for a secure fit.

C.7 Rail Temperature Imbalance

A general health check of the system is to determine if the Bearing Scanners are reporting roughly the same temperature for both sides of each train. This appendix guides in making that determination and, if necessary, provides solutions for correcting the problem.

What to do if the difference in average rail temperatures is consistently more than 4° F

From the Main Menu, select the Train Summary Report. On the Train Summary Report, locate the “Avg Bearing” heading. Under this heading are two columns, one for each rail, representing the average temperature read by the bearing scanners on a train-by-train basis. With a properly functioning system, the two average temperatures reported for each train are within approximately four degrees of each other. If the difference in average temperatures per train is consistently higher than four degrees, do the following.

- Referring to the “[Offset Measurements](#)” section, confirm that the measurements entered into the system are correct. Re-measure and confirm all entries are accurate. Incorrect Offset Measurements result in the system looking at the wrong point in time for the bearings or wheels as a train moves through the site. Note that since you do not have to mount the scanners across from each other, as with traditional Hotbox Detectors, there are separate Offset Measurements associated with each rail as covered in the “[Offset Measurements](#)” section.
- Realign and recalibrate the scanners. See the instructions for scanner alignment and calibration in the SmartScanNG² Track Hardware Manual located at <https://www.southern-tech.com/our-services/resources>.

C.8 Acronyms

SICM: System Interface & Controller Module – Electronics package mounted on the chassis providing interface circuitry and several modes of communications to two onboard microprocessor modules running custom-engineered software.

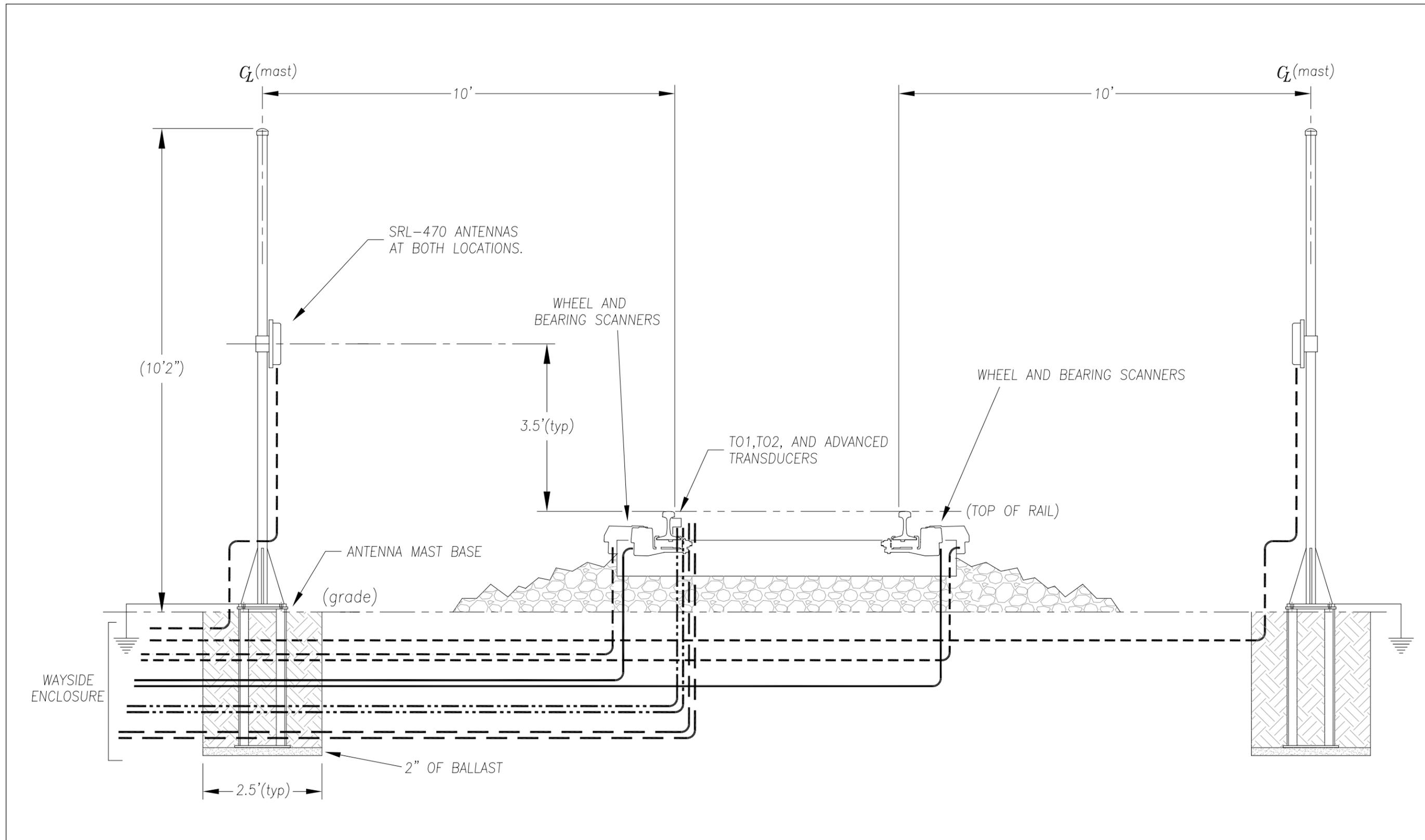
TO1, TO2: Wheel Transducer 1 and Wheel Transducer 2 – The wheel sensors provide signals for the SICM to calculate speed, direction, and a reference location for bearing and wheel temperature measurements.

UTB: Universal Transient Barrier – A brand name from ERICO for electrical surge protection devices.

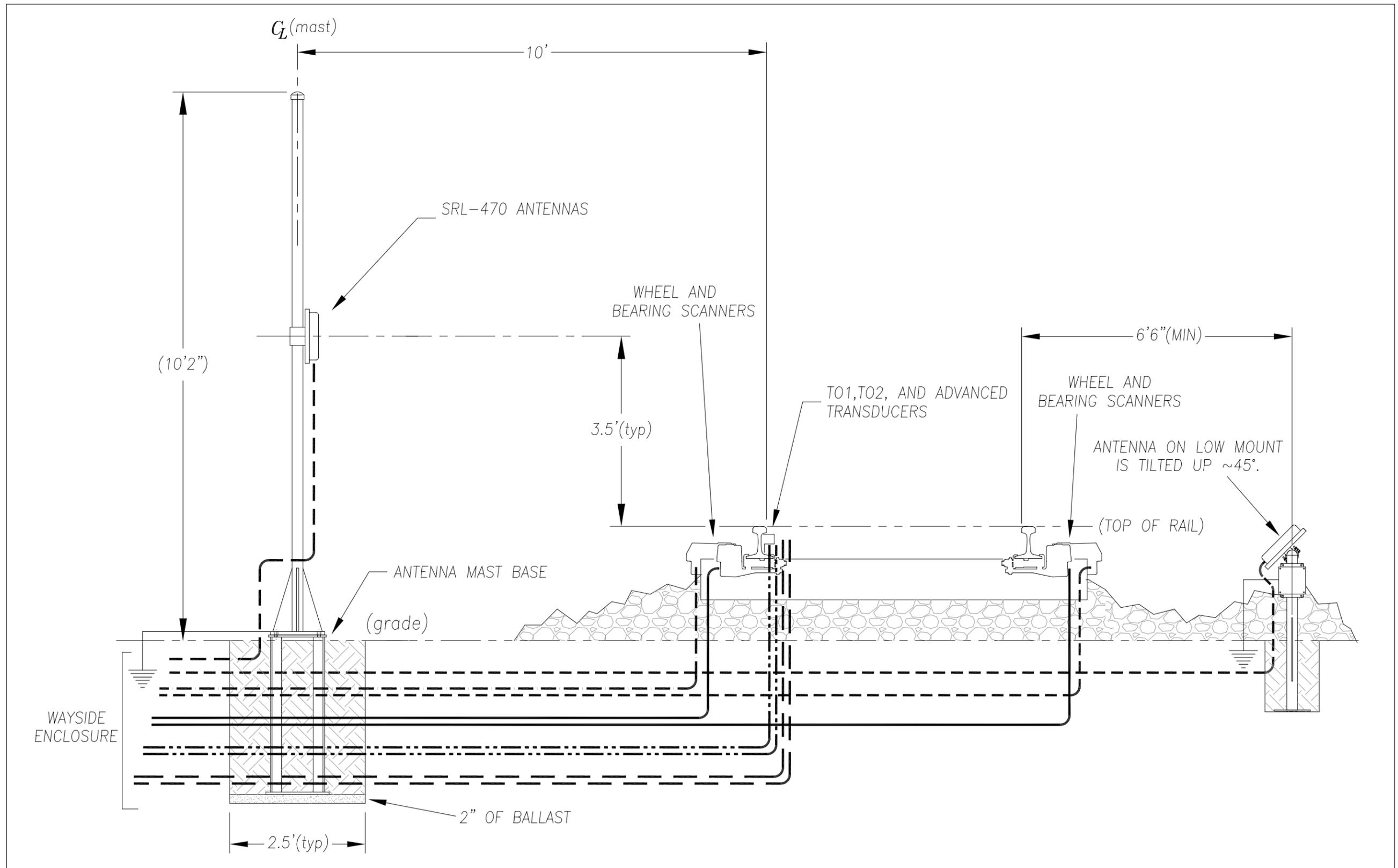
WSC: Frauscher Wheel Signal Converter – Interface device used with early versions of the SmartScanNG² before incorporating interface circuitry into the SICM.

Appendix D

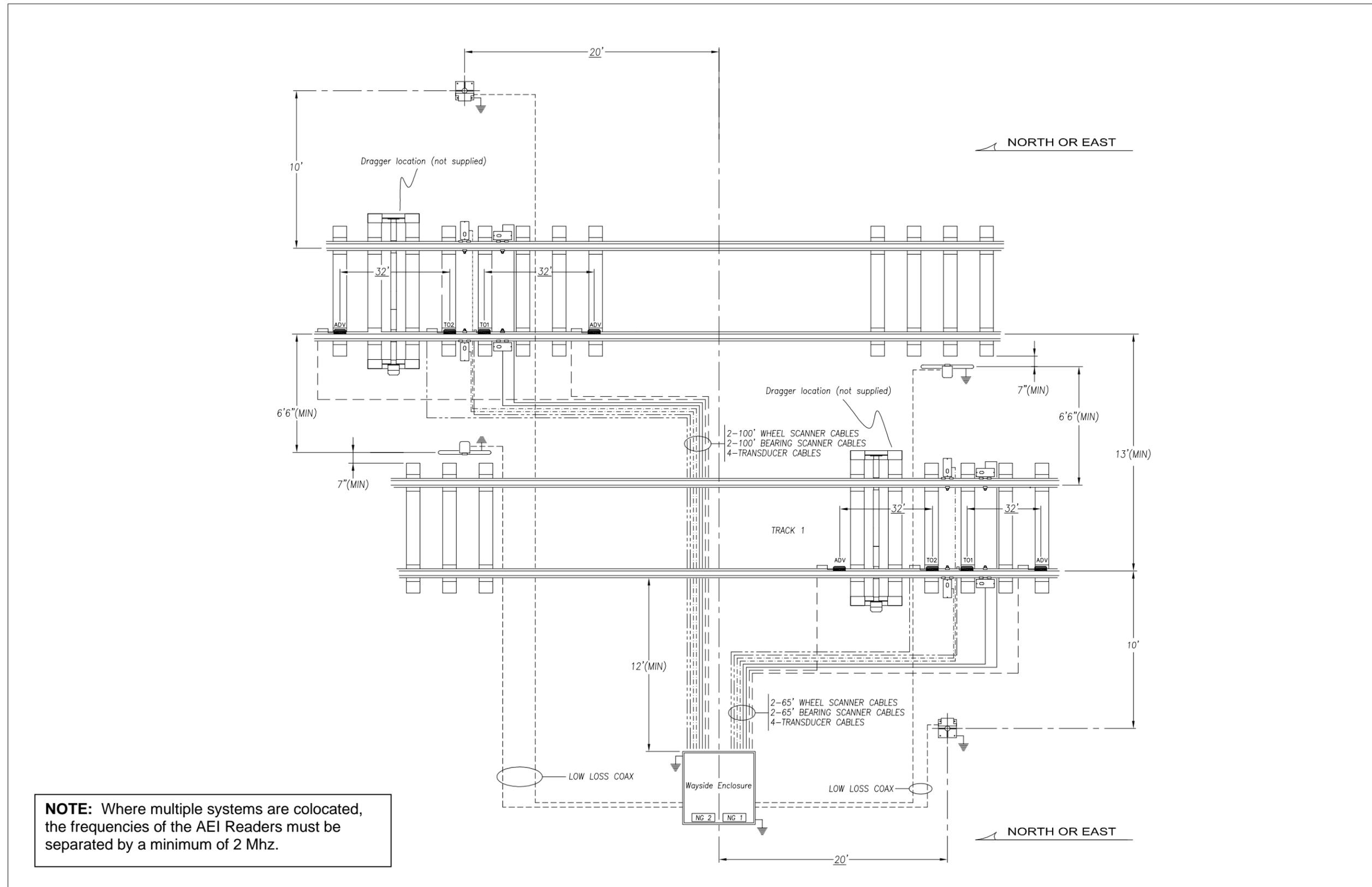
Installation Drawings



Single Track Elevation Drawing



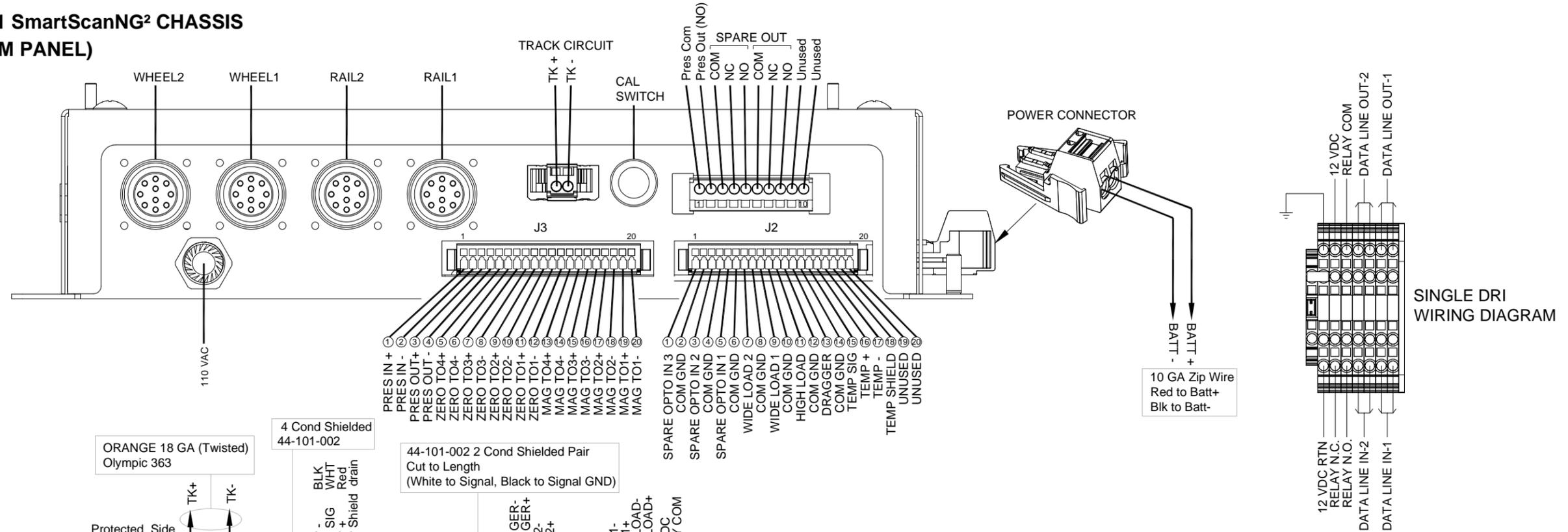
Multitrack Elevation Drawing (Track 1)



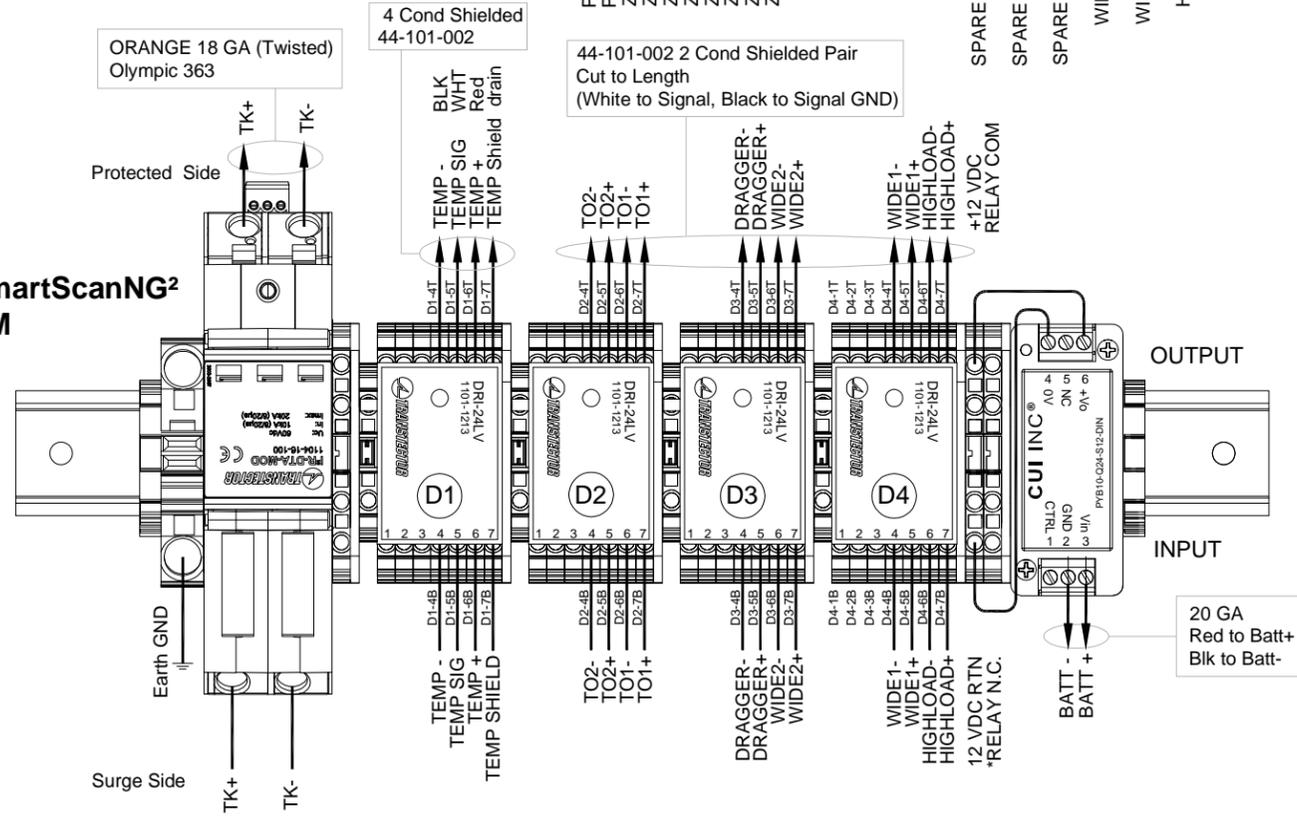
NOTE: Where multiple systems are colocated, the frequencies of the AEI Readers must be separated by a minimum of 2 Mhz.

Double Track Layout (Typical)

**2300-601 SmartScanNG² CHASSIS
(BOTTOM PANEL)**



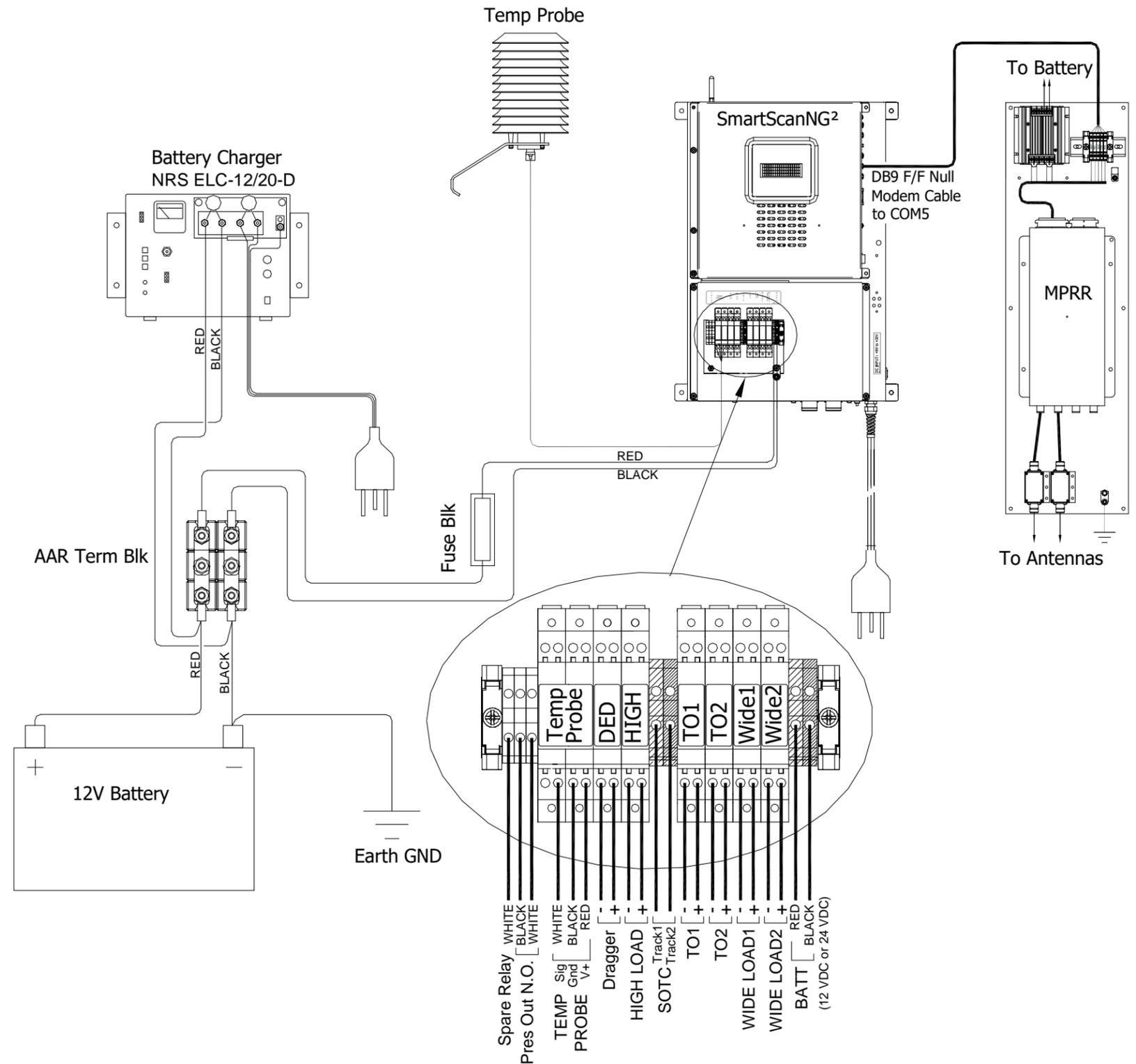
**2300-556 SmartScanNG²
SURGE ASM**



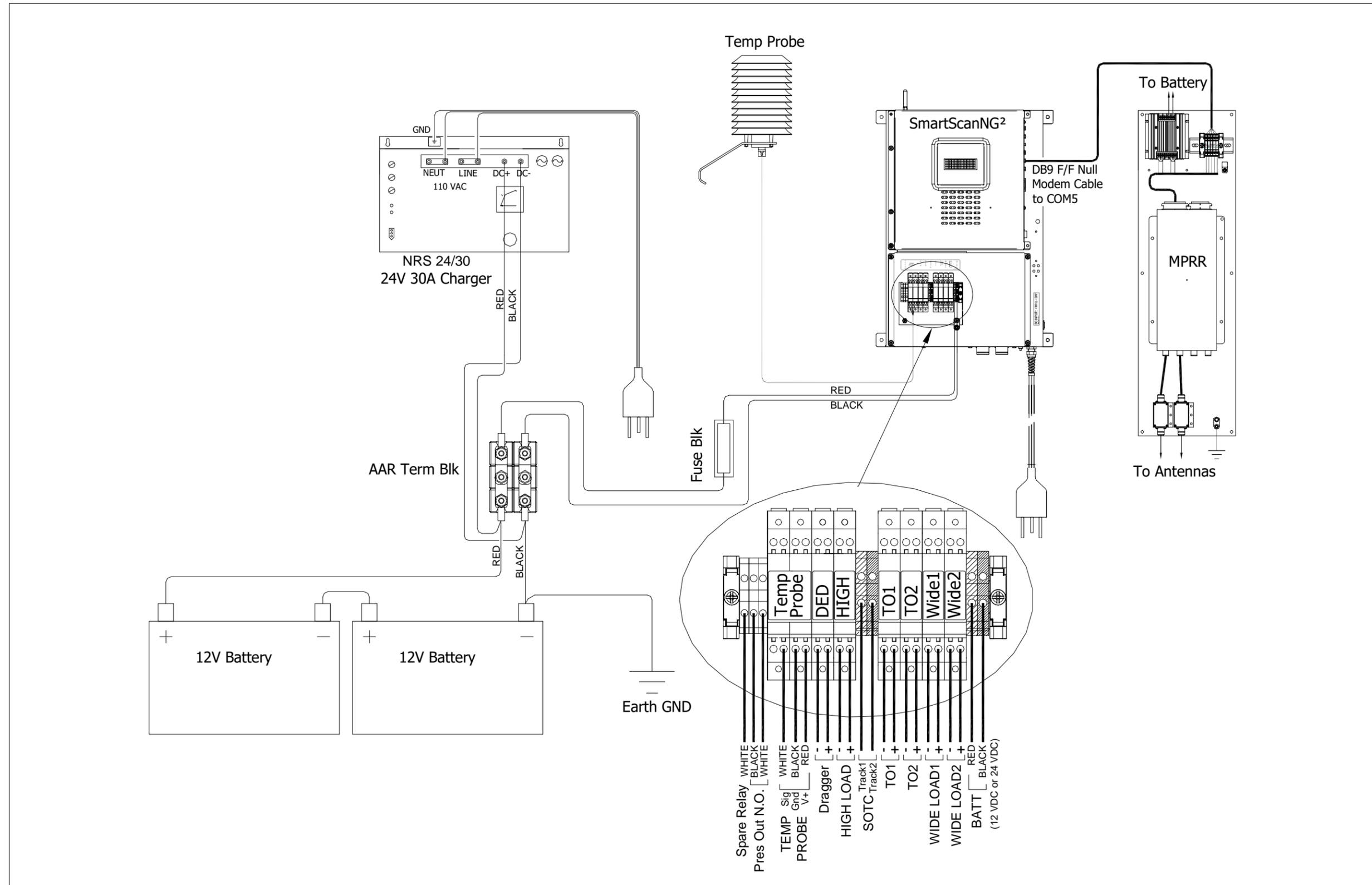
*RELAY N.C. CONTACTS FROM EACH DRI ARE DAISY-CHAINED TOGETHER.

DRI WIRING CHART		
SURGE PIN#	SIGNAL	NG ² PIN#
D1-4T	TEMP -	J2-17
D1-5T	TEMP SIG	J2-15
D1-6T	TEMP +	J2-16
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

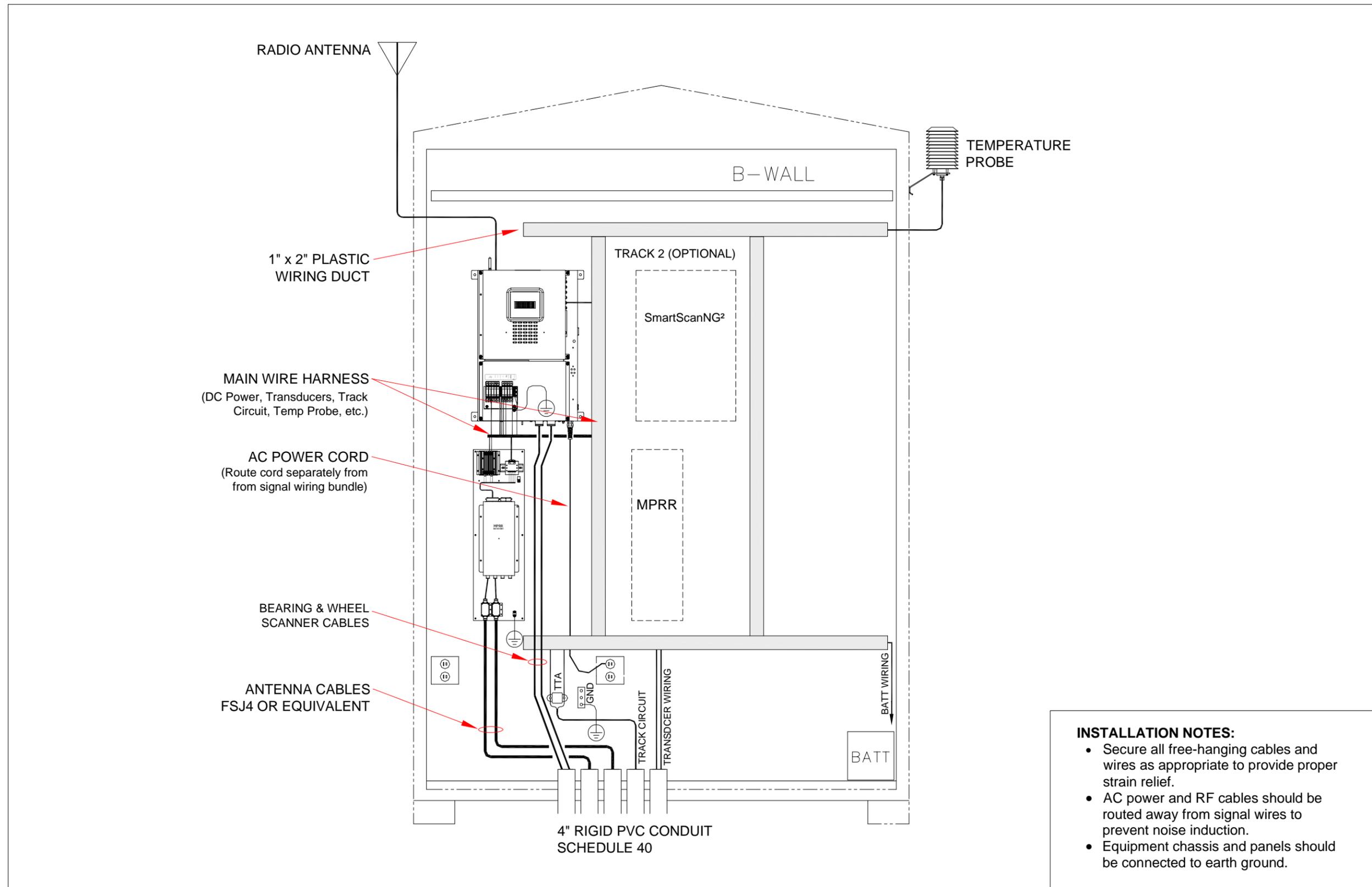
Track Wiring Diagram for SmartScanNG² Chassis



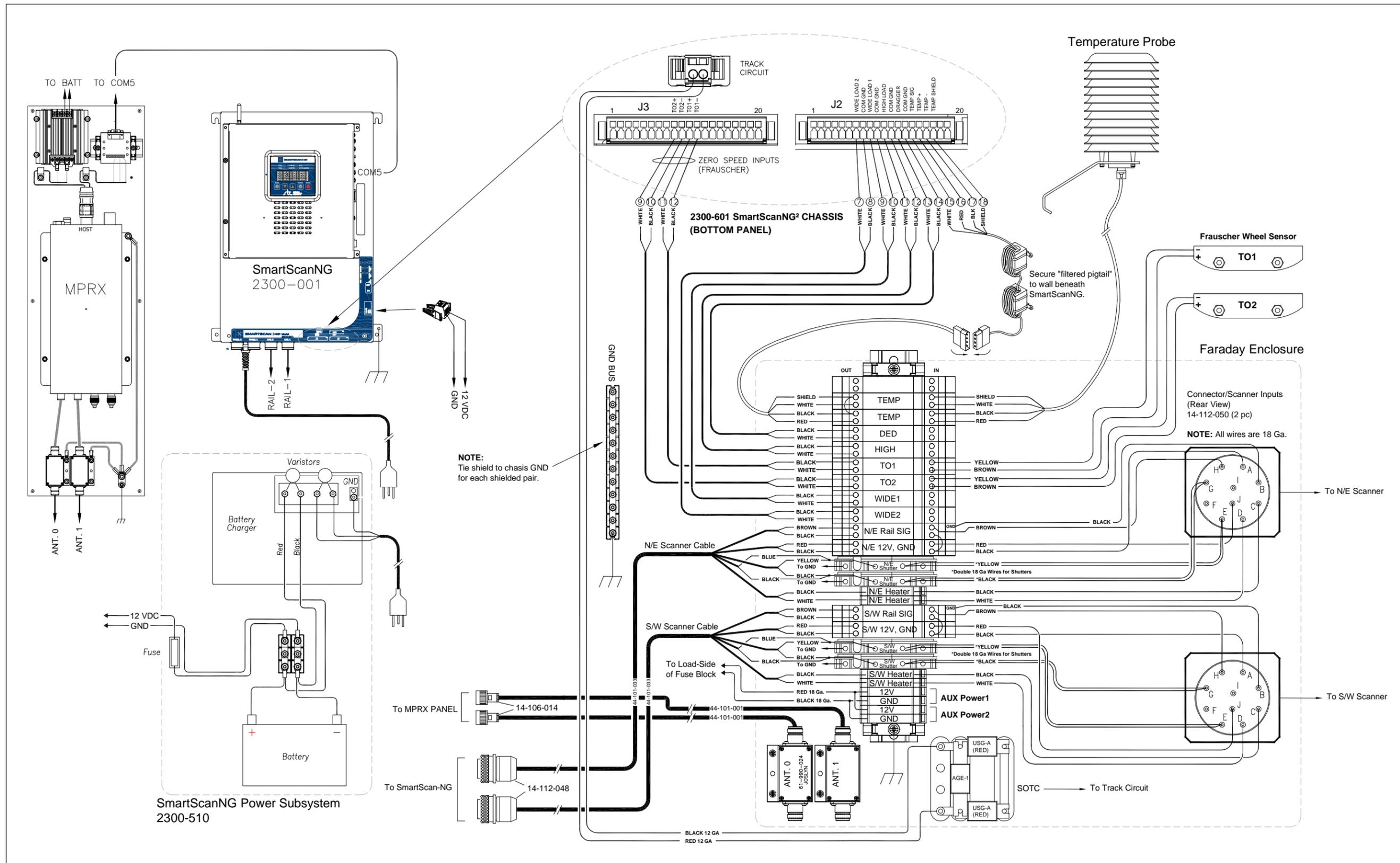
SmartScanNG² Wiring Diagram (NG Chassis) – 12 VDC System



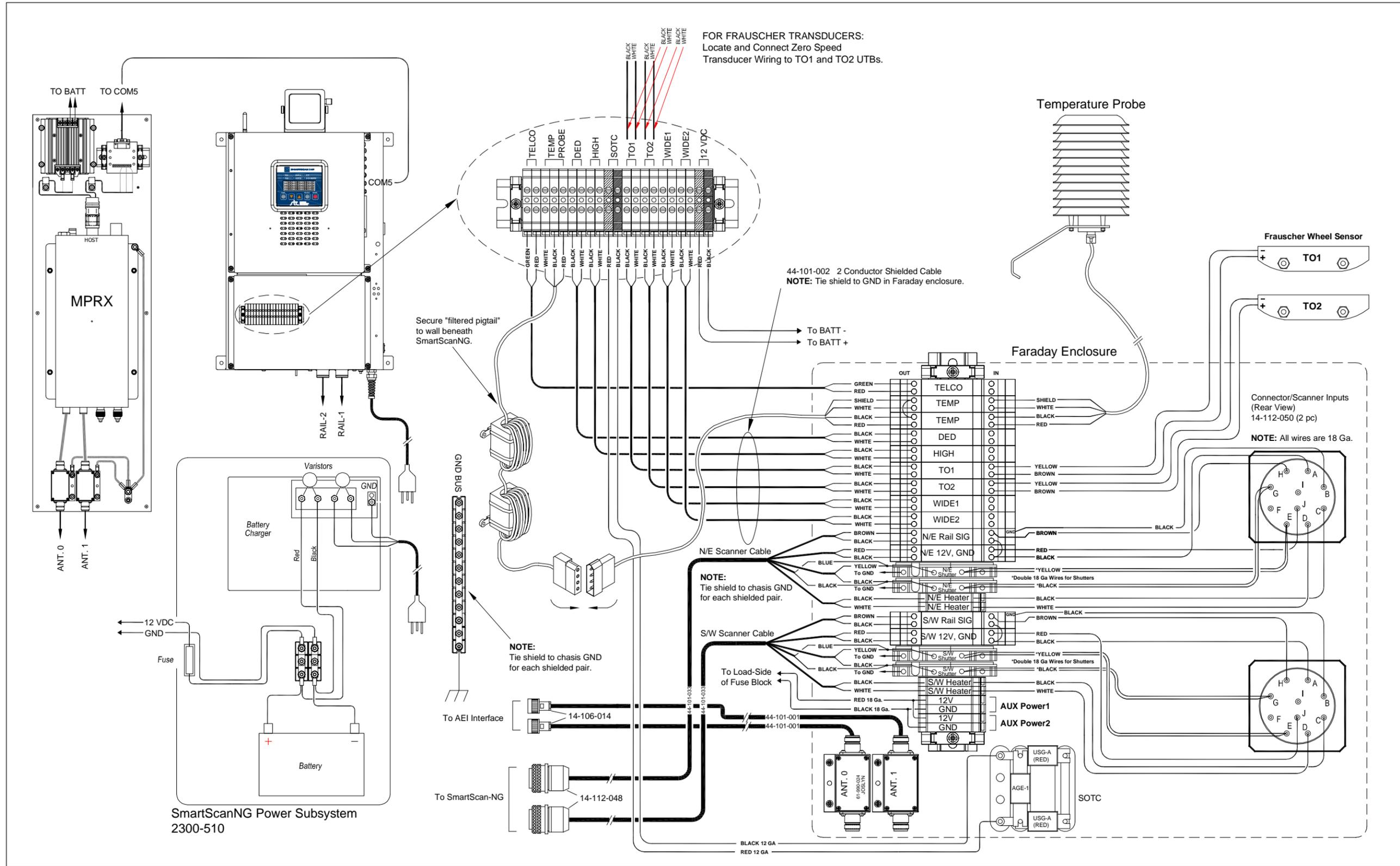
SmartScanNG² Wiring Diagram (NG Chassis) – 24 VDC System



Typical Routing of System Wiring



Typical Wiring of CSX Bungalow (with 2300-601 NG² Chassis)



Typical Wiring of CSX Bungalow (with 2300-511 NG Chassis)

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