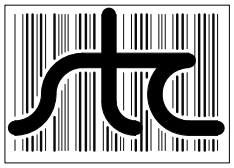

EUD-2014287-00

SmartScan
Model 2600 Series
AEI Reader Reference Guide

14 Oct 2014

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

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CAUTION

Contact with electrically active parts could result in sparks, burns, and electric shock. Because of this, you should avoid all electrical hazards when installing, wiring, operating, and maintaining the SmartScan system. Failure to do so could result in damage to the equipment or serious injury to you.

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Contents

Chapter 1 — Introduction

This chapter summarizes the purpose of this guide and outlines the features of the SmartScan Model 2600 Series AEI Reader. It also tells how to comment on this guide and how to order more copies of this guide, and covers Southern Technologies Corporation's standard warranty.

1.1 Purpose of This Guide

The technical staff at Southern Technologies Corporation (STC) created the SmartScan Model 2600 Series Next Generation Controller. This guide describes that system, and was written for those who purchase, install, maintain, troubleshoot, manage, or use the system.

1.2 Key Points and Considerations

Automatic Equipment Identification, Automatic Vehicle Identification, and Radio Frequency Identification are synonymous when referring to tag-reading equipment. In general use, vehicles and equipment are tagged with a wireless transponder. A reader reads these electronic tags as they pass a stationary antenna. The reader then transfers the data read from the tags to a host computer, where it is stored for later processing.

A basic RFID/AEI system consists of the following:

- an antenna;
- a reader (transceiver with decoder);
- a radio-frequency (RF) tag (transponder).

RFID/AEI systems use noncontact, not-line-of-sight technology. Tags can be read through poor atmospheric conditions, such as fog, rain, and snow. Tags can also be read through other poor visual conditions, such as grime, paint, and encrusted mud.

AEI tags serve only as coded reflectors for the radio frequency signal emitted through the antenna; they are not radio transmitters and therefore do not radiate signals by themselves.

RFID/AEI tags are categorized as either active or passive. An internal battery powers active tags. Passive tags operate without a separate external power source and obtain operating power from the RF signal generated by the reader.

In operation, the readers create a radio frequency field that provides a constant carrier wave to activate a tag that is present in the field. When activated, the tag modulates that carrier wave in accordance with the preprogrammed data in the tag, and reflects the modulated signal back to the reader. The reader receives the returned signal, processes the radio signal into usable characters, and sends them to a host computer.

The SmartScan multiplexer and readers are customizable, and provide versatility in reading and reporting RFID tags. These products can operate as a standalone AEI system, or they can be integrated with other equipment, such as dedicated processors, vehicle scales, vehicle-loading equipment, terminal management, asset management, and defect-management systems. As such, it should be noted that not all systems use all of the modules described within this document.

1.3 Disclaimers

The content published in this document is believed to be accurate. STC does not, however, provide any representation or warranty regarding the accuracy or completeness of its content.
The correct use of this guide, the environmental conditions at the time of installation, the method of installation itself, and the installation of customer-supplied components are beyond the control of STC. So, too, are the correct use and maintenance of all or part of the SmartScan system. Therefore, the installer, user, and maintainer must assume the risk of any injury that might occur during installation, use, and maintenance of all or part of the SmartScan system. STC assumes no risk, liability, or responsibility for errors and omissions on the part of the installer, user, or maintainer.

1.4 How to Comment on This Guide

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1.6 Standard Warranty

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

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

Purchaser is responsible for shipment of the defective product to STC. STC will pay the return shipping charges. Products purchased from others, but included in STC systems, carry the original manufacturer's warranty, which is typically 12 months. Warranty claims for these products must be made directly to the original equipment manufacturer.

Chapter 2 — System Overview

The Model 2600 Series Next Generation AEI Controller is the core processor/center of operations for both mainline and yard AEI systems. STC offers various configuration packages ranging from legacy upgrades (for existing sites) to complete turnkey site installation kits.

For a legacy upgrade, it is assumed that peripheral equipment, such as batteries, chargers, presence detectors, and antennas are already in place.

The SmartScan 2600 Series AEI Controller provides connectivity to TransCore Reader subsystems and several other ancillary devices commonly used in AEI systems. The main terminal block's connector pinout is compatible with that of SAIC's APU 102.

The Controller and its integrated subsystems gather data from each passing train in order to provide a complete consist listing which is formatted in the AAR standard. These consist reports are transmitted to a host computer via modem.

The Model 2600 Controller was designed to connect directly to a 24-volt battery supply that is maintained by a float-charge system. In the event of AC power failure, the system continues normal operation until the battery supply is depleted.

Associated subsystems used in a 2600 Series SmartScan system are:

- two AEI antennas;
- SmartScan 2600-750 Reader(s) or legacy RF units;
- Tiefenbach wheel detectors (to detect and count axles);
- presence-detection equipment (to sense train presence), including Safetran SOTC; PSO-4000; Zukinut ZEPIC III; radar-based field detectors or GE-Epic presence detectors;
- 2600-600 Surge Panel (to protect electronic components from high-voltage transients);
- power supply and battery charger;
- equipment enclosures;
- either a landline modem or a cellular modem.

A brief outline of how the SmartScan system operates is below:

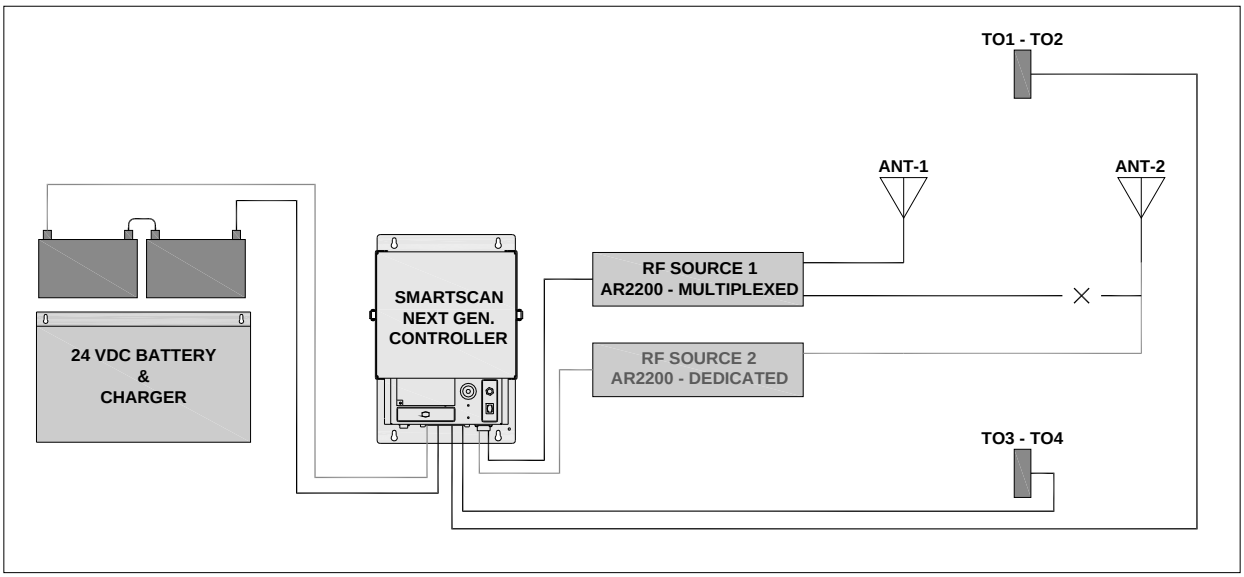
1. The presence detector signals the controller when a train is approaching the site.
2. The controller activates the 2600-750 Reader and initiates the train-scanning process.
3. As the train moves over the site, signals generated by the wheel detectors are sent to the Front-End Processor (FEP).
4. As the FEP collects wheel-transition records, they are placed into groups that loosely represent the rail vehicles that generated them. These groups of wheel-transition records form the initial basis for establishing records.
5. As an individual RFID/AEI tag passes the antenna, the 2600-750 Reader scans the tag, appends a timestamp, and passes the data to the FEP. Tag-information records are associated with car records based upon the tag-record timestamp.
6. The presence detector signals the controller when the train has cleared the site.
7. The controller turns off the RF transceiver and organizes the train consist based on the wheel-transition data and tag-record data.

8. The data collected is analyzed to establish the final consist/car breakout and, where appropriate, to filter out cross-track reads of RFID/AEI tags (e.g., at multi-track sites). The data is then stored in the system IPC for later recall.
9. If enabled, S918-specified, T94-formatted reports will be transmitted to a host computer via the system modem or network connection.

2.1 Technical Specifications

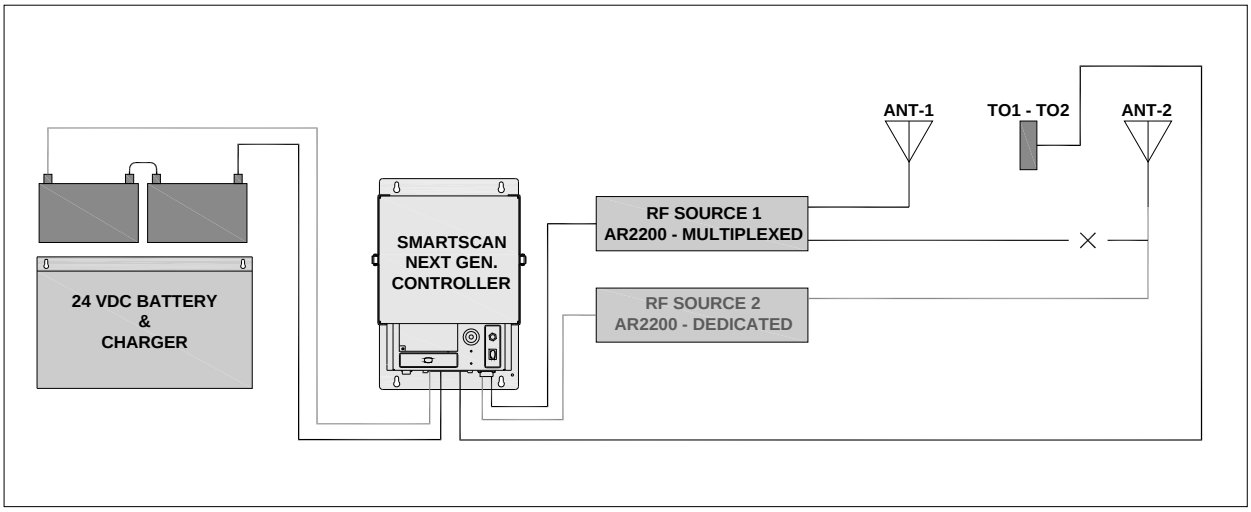
Below are the technical specifications for the Model 2600 Series AEI Reader.

General Specifications	
Operating Input Voltage	20 – 30 VDC @ 5 amps
Input Voltage Protection	Circuit breaker + self-restoring fuses on each processer and reader power supply. Reverse polarity and surge-protected.
Communications	External RS 232-ports – 2 Internal RS 232 ports – 3 RJ45- Ethernet port – 1 RJ11- Modem port - 1
Temperature Specification- Industrial	-40 + 70C fan-less operation.
Size	11.3” x 17.1” x 7”
Weight	21 lbs.
Finish	White-powder coat over stainless steel
Front-End Processor/Interface	
Manufacturer	Southern Technologies Corporation
Processor	Motorola 68 HC11
Program Storage	512K Bytes- Flash
Data Storage	512K Bytes- Non-volatile
Inputs	8- Analog- Battery voltage, internal temp., outside temp., 3v, 5v, 8v, 12v power supply monitor 6- Digital- Opto isolated switch point position 1 and 2, power fail, presence, test, spare 4- Zero speed wheel detector- RF filtration and surge suppression
Outputs	2- Digital- 24V relay drivers
Operating Temperature Range	-40 to +70C
Industrial PC	
Manufacturer	VersaLogic
Architecture	Single board- PC104-Plus Expansion
Processor	AMD LX 800
Operating System	Linux
Program Storage/Data Storage	Non-volatile Compact Flash- 2GB
Communications	Serial- Ethernet- TCP/IP
Operating Temperature Range	-40 to +70C



Typical Configuration – Mainline and Yard Management

Two Tiefenbach dual-head zero-speed wheel detectors spaced 9’ 6” apart are necessary to accurately break-out stop-and-reverse movements for car recognition and tag placement.



Typical Configuration – Sites with Straight Pull-Through Traffic

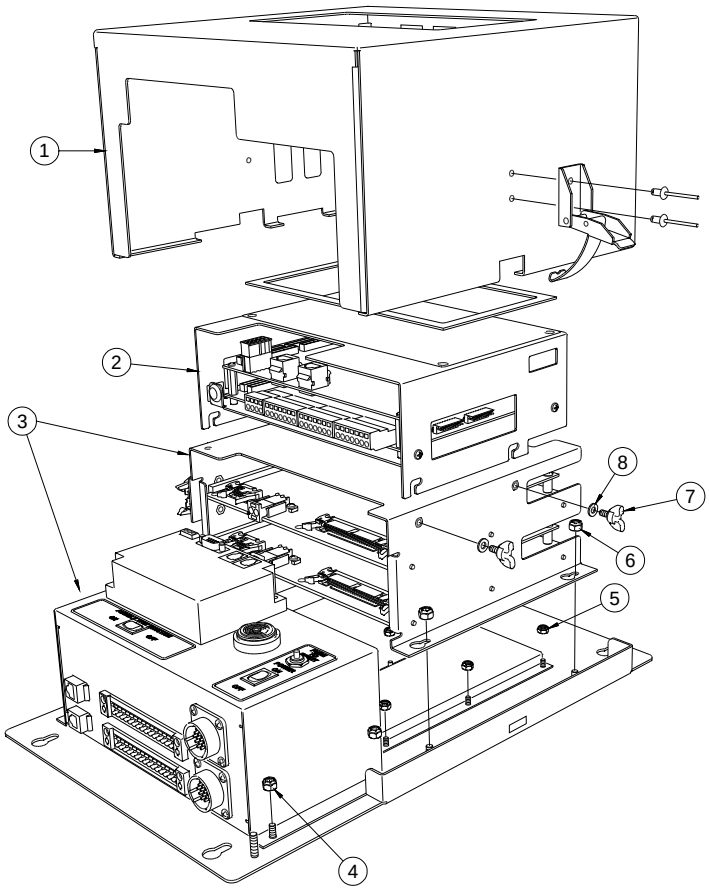
A single Tiefenbach dual-head zero-speed wheel detector can be used on those sites with straight pull-through traffic only.

2.2 SmartScan Model 2600-00x AEI Controller

The controller, which is modular, can be broken down into two basic subassemblies: the 2600-700 Processor module and the 2600-500 Chassis assembly. The 2600 Controller can be ordered in various configurations. The standard configuration features a multiplexed reader. The controller can be ordered with either a standard landline modem or cellular modem.

A dedicated reader for each antenna is an available alternative to the multiplexed reader. The controller can be ordered with or without the TransCore AI1200 Logic Board, which allows the customer to recycle components from a legacy system.

2600-00x AEI CONTROLLER PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	41-110-005	Controller Cover
2	1	2600-700	Processor Module
3	1	2600-500	Chassis Assembly
4	4	01-118-003	8-32 ESNA Nut
5	6	01-118-002	6-32 ESNA Nut
6	4	01-118-005	10-32 ESNA Nut
7	4	01-133-001	8-32 Wing Screw
8	4	01-121-003	#8 Flat Washer



2600-00x AEI Controller-Exploded View (refer to enlarged image in Appendix)

2.2.1 2600-700 Processor Module

The 2600-700 Processor is the “brains” of the system.

 This module can be easily removed from the chassis for service by simply loosening four wing nuts and disconnecting the wire harness.

The 2600-700 contains two processor cards, each with specific software and functionality: the Front End Processor (**FEP**) and the companion Industrial PC (**IPC**).

Did you know…?

The **FEP**, which is a proprietary micro-controller board developed by STC specifically for AEI integration, is a unit which provides the real-time control and data acquisition for all trackside devices; it is a combination processor/system interface board with signal conditioning, communications, filtering and surge suppression components as required. The FEP software develops data records that include presence, speed, direction, axle count, and timing and tag information in near real-time.

The **IPC** receives those records generated by the FEP for consist development, storage, and transmission to remote back-office applications. The IPC software provides advanced algorithms that convert the FEP records to clean-standing order consists grouped by railcar footprint. Once the cars and locomotives are defined in proper standing order, tags are assigned.

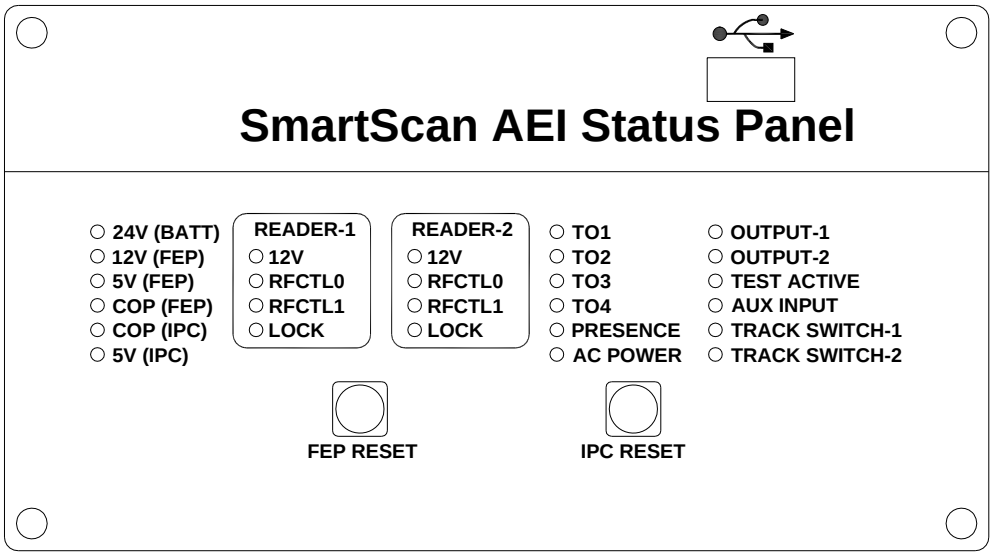
The IPC features:

- S918-compliant consist development and transmission/maintenance reporting;
- remote and local system setup and diagnostics;
- double-track logic;
- menu-driven user interface;
- non-volatile file management system for long-term storage of up to 300 consists;
- support for up to five defined consist reporting sessions and two maintenance reporting sessions;
- interfaces for multiple modem types (landline, cellular, and IP);
- remote and local software updates for IPC and FEP by file transfer (includes error checking);
- Linux Operating System;
- Ethernet connectivity.

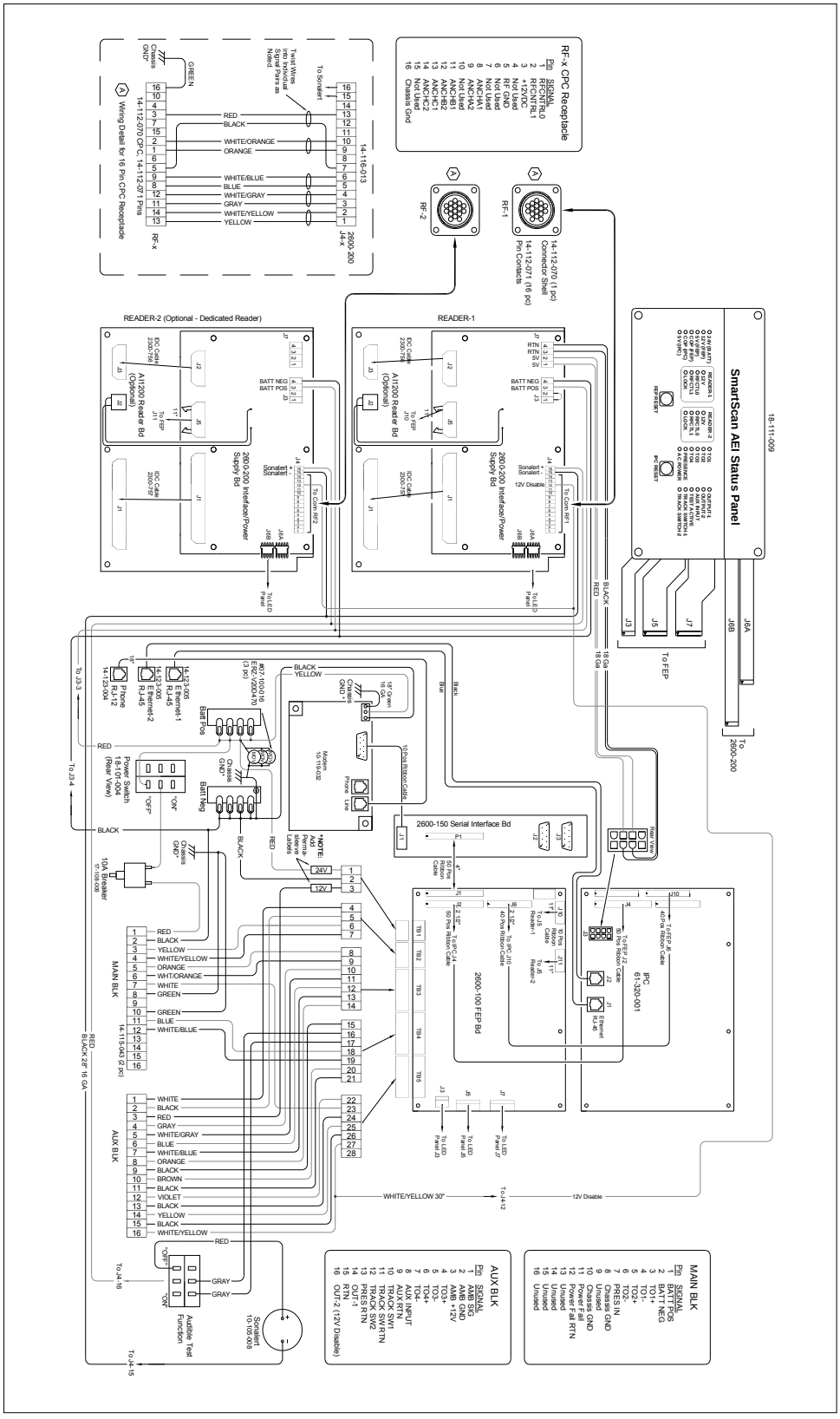
The 2600-700 module’s front panel is designed to assist maintenance personnel with system function diagnostics. The front panel contains 26 high-visibility LEDs, grouped by function, to provide a quick determination of the system's overall status. Additionally, the front panel is equipped with reset switches for the FEP and IPC.

USB Drive

The processor module includes a micro-USB drive installed through the SmartScan AEI Status Panel into the IPC board. Its purpose is to provide a mechanism for capturing the configuration information of a given site, and will be used to transfer the configuration information from one reader system to another. This might be done, for instance, when a hardware failure has been detected in a processor module and a replacement module is being installed.



2600-700 Processor Module Front Panel



2600-00x AEI Controller-Internal Wiring Schematic (refer to enlarged image in Appendix)

2.2.2 2600-500 Chassis

The 2600-500 Chassis provides a mounting base for various system components. Its integral wiring harness furnishes all necessary power and signal interconnections. The connector panel allows for the attachment of external peripheral devices. The chassis includes docking bays for the TransCore AI1200 Reader Logic Boards. Dedicated power supplies are provided for each reader/logic/RF package. The chassis houses a Sonalert buzzer, which is used in conjunction with the audible test function to assist with tag-read validation. The assembly also provides mounting for various system modems.

Modems currently supported include:

- Sixnet Industrial - Landline
- AirLink Raven XT - Cellular
- AirLink Raven X – IP

The side of the chassis includes two RS-232 communication ports.

Com-2 is used for local access with a laptop computer.
Com-3 is used for serial pass-through to other equipment.

2.3 Reader Subsystem

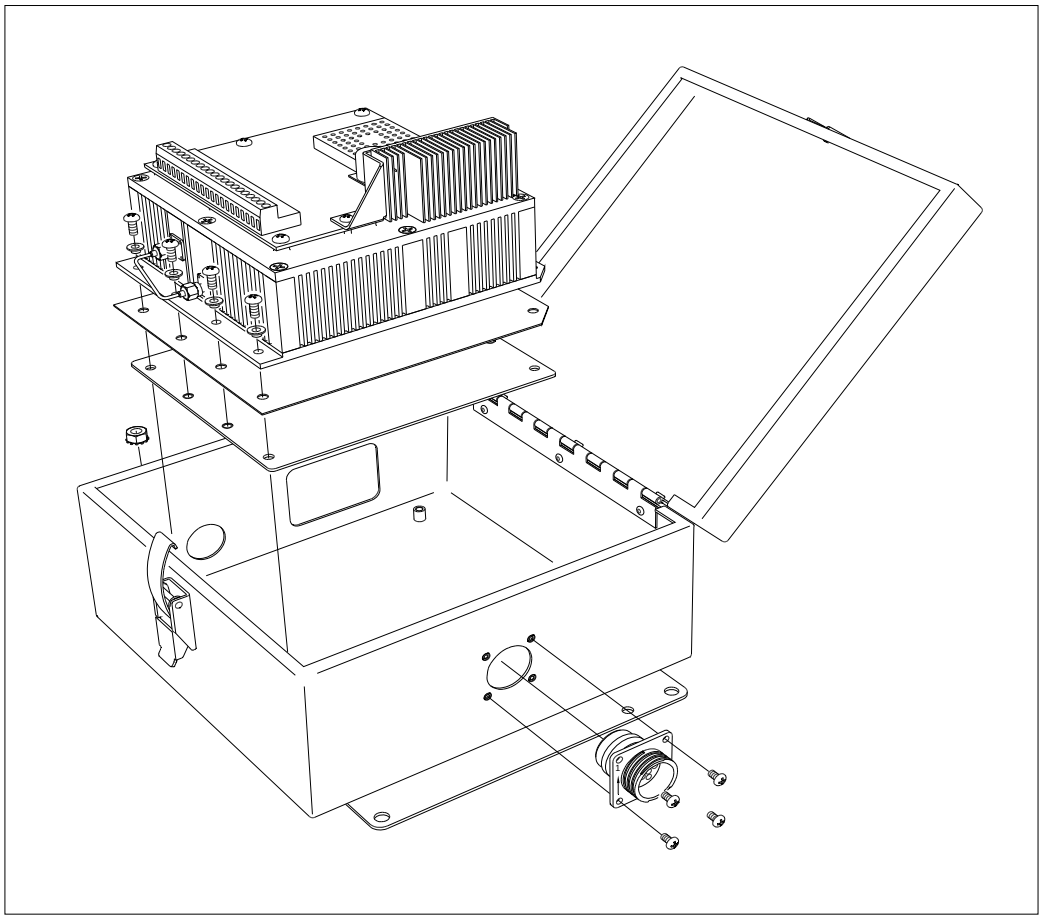
The 2600 Series Reader Subsystem is comprised of Amtech's AR2200 RF Module, an AI1200 Reader Logic Board, and a dedicated 2600-200 Power Supply. These components read and report Radio Frequency Identification (RFID) tags in the original programmed format. They also decode the owner's initials, equipment number, and side indicator of tags that are in the Association of American Railroads (AAR), International Standardization Organization (ISO), or American Trucking Association (ATA) data format.

Commands are used to control the operation of the reader subsystem. Setup commands are issued from the processor module upon startup to configure the operating parameters of the reader. The processor also sends the "RF ON" command whenever train presence is sensed. As RFID tags are scanned, the reader transmits data strings, with appended timestamps, to the processor. This tag data will be later be associated with its accompanying vehicle within the consist listing report.

The AI1200 Logic Board and 2600-200 Power Supply Board are paired and mounted as a board-stack. They are housed in the 2600-500 Chassis' docking bay. The AR2200 RF Module is mounted in a separate enclosure: the 2600-750 AEI RF Module.

The standard 2600 Series AEI Controller utilizes one reader subsystem with its RF unit setup in multiplex mode (i.e., a single RF output multiplexed between two antennas).

The controller can be ordered in a "dedicated reader" configuration. In this case, the chassis' docking bay is wired to accept an additional AI1200 board-stack and connect to a second external RF Unit.



2600-750 RF Module – Exploded View

Operation

Vehicles and equipment are tagged with a wireless transponder. The 2600 Reader subsystem reads these electronic tags as they pass a stationary antenna. The reader then transfers the data read from the tags to the 2600, where the data is processed and stored. As previously stated, RFID/AEI systems use non-contact, not-line-of-sight technology. Tags can be read despite inclement weather and otherwise poor visual conditions.

Three key points of general operation are:

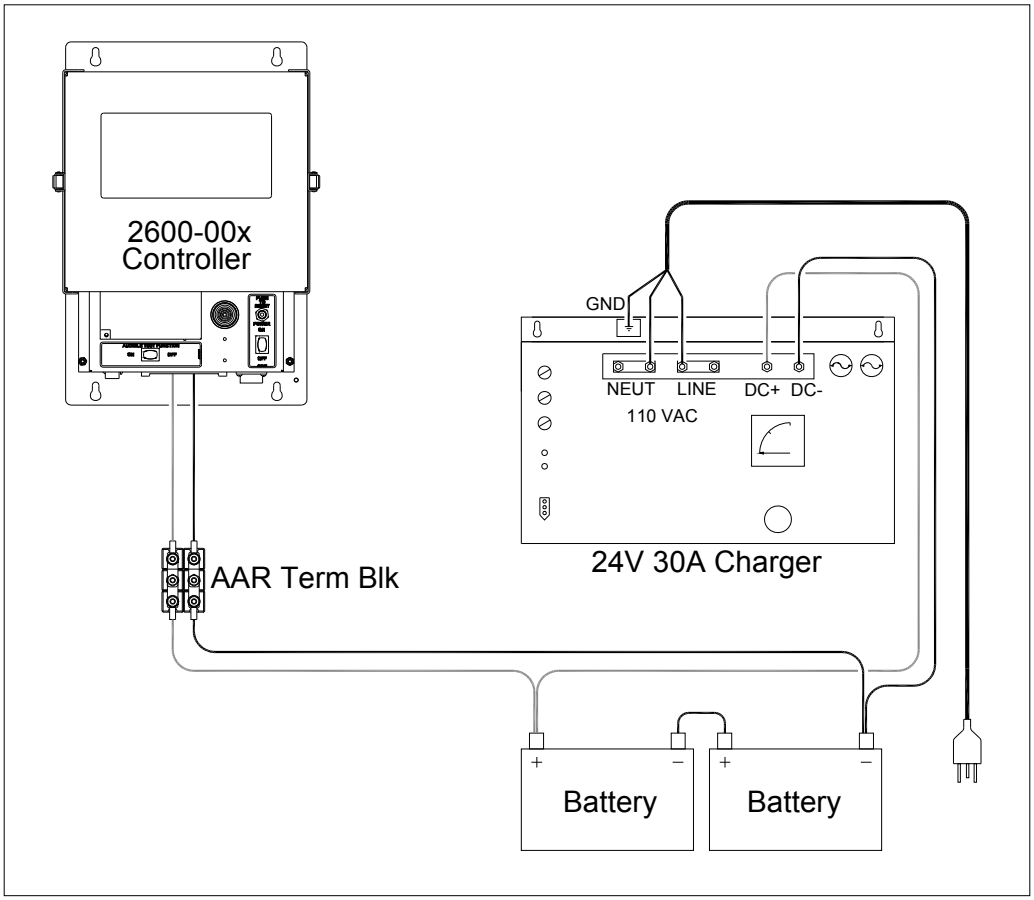
- Only one tag can be in the read field at any one time.
- The reader only reports a tag to the processor *one time*. If the tag must be read again, the reader must be reset by command instruction or by reading a different tag.
- The radio signal is horizontally polarized. The horizontal plane of the antenna must match the horizontal position of the tag.

2.4 Power Subsystem

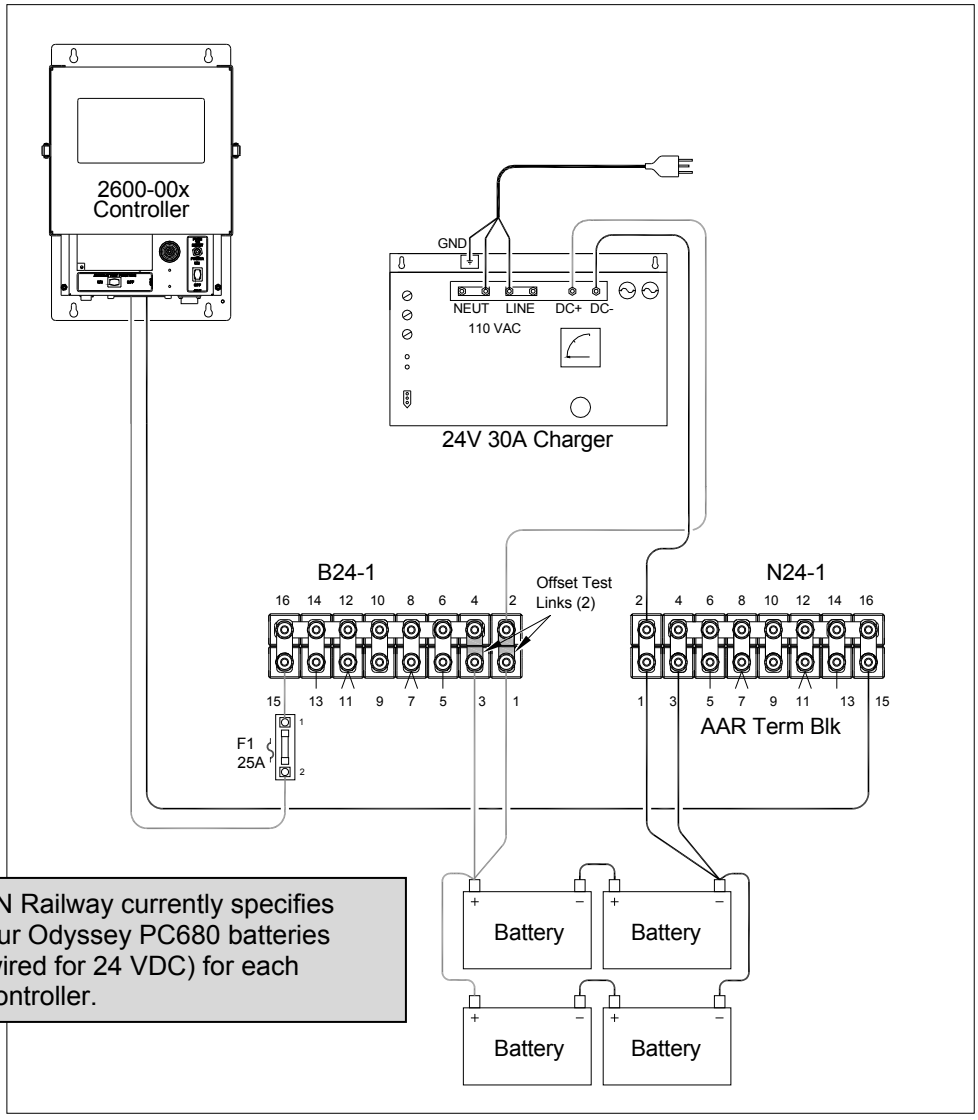
The SmartScan 2600 AEI requires a 24 VDC power supply for system operation. Its power subsystem is comprised of a 30A charger, a bank of batteries, and an AAR terminal block that can be used to break power to equipment.

> 12-volt, 115-ampere-hour batteries are recommended. The use of smaller-capacity batteries reduces the amount of time that the system can continue to operate after an AC power failure.

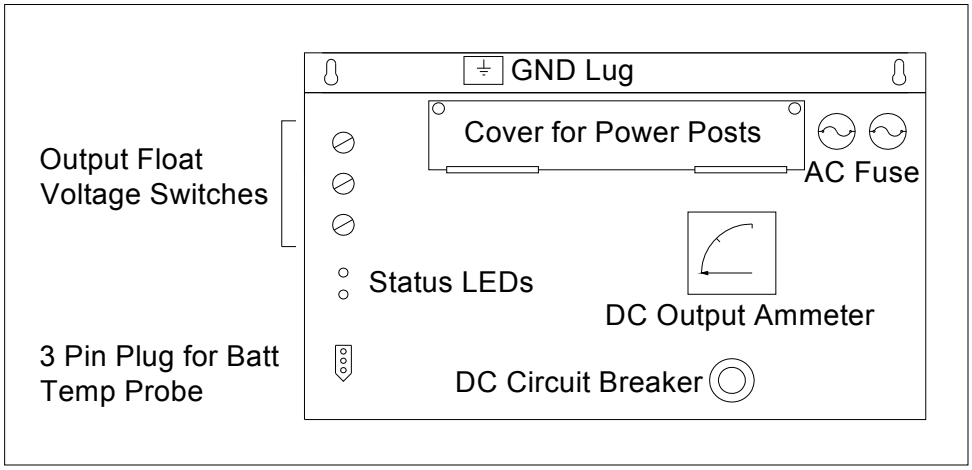
At multi-track sites, each controller requires its own dedicated batteries (a minimum of two, wired for 24 VDC). However, a single NRS 24/30 charger can efficiently charge all the batteries needed for a single-, double-, or triple- track application.



Battery Subsystem

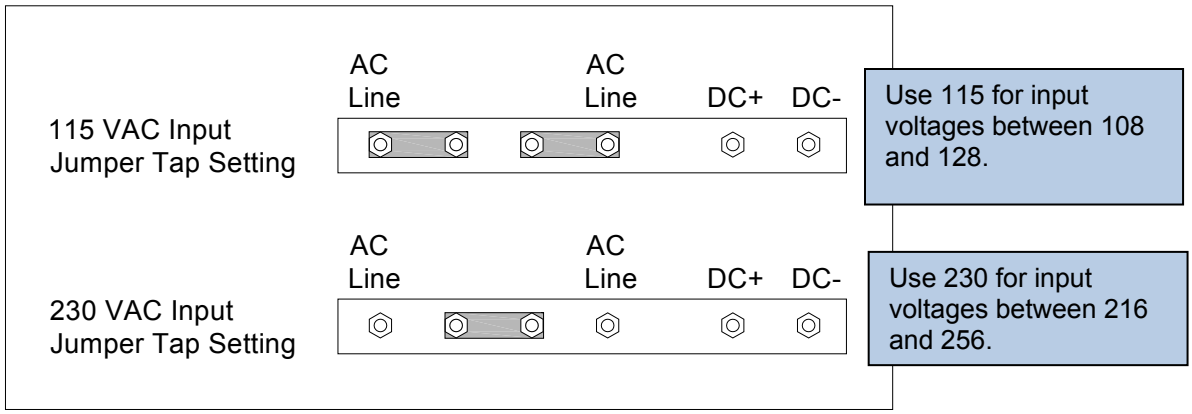


Battery Subsystem for CN Railway (refer to enlarged image in Appendix)



NRS Model 24/30 Battery Charger (Front)

An input voltage of either 115 VAC or 230 VAC can be selected by configuring the jumper tap settings.



The Model 24/30 is a convection-cooled, solid-state, SCR-regulated charger that provides either a constant current or constant voltage output.

Using the three rotary switches on the front of the charger, the output can be set to charge batteries within a voltage range of 20.0 to 39.9 volts for gel-cell, liquid lead-acid, nickel cadmium, nickel iron, and starved electrolytic batteries.

The factory default setting is 28.00 VDC.

To reset the switches to the proper charging voltage, use a small slotted screwdriver to turn each switch to the desired number. If the desired battery voltage is 26.8 volts, set the top switch to 2, the middle switch to 6, and the bottom switch to 8 (*refer to drawing on previous page*).

Ensure each switch is set **ON** and number and not **BETWEEN** numbers.

- If a switch is set between numbers, the output current will go to zero and the yellow "battery-charging" LED will flash.

Note: If the battery temperature probe is defective or not installed, the red "defective" LED is lit.

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

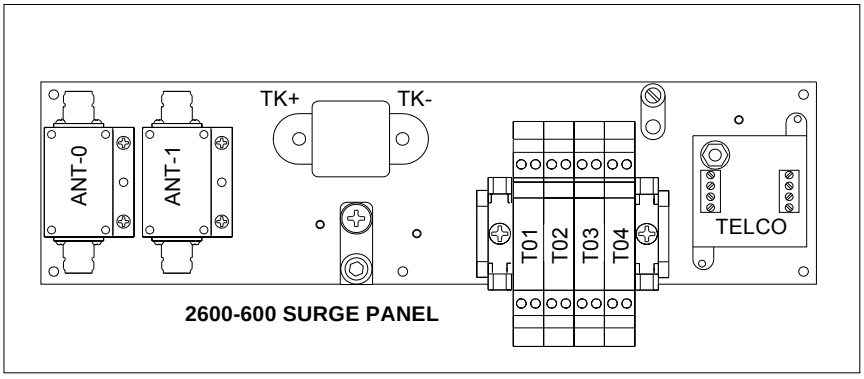
To the right of the AAR terminal posts are two 12-amp, 250-volt, fast-acting fuses. They protect the battery charger from excessive AC. Below the DC ammeter is a circuit breaker, which protects the battery charger from excessive DC current.

2.5 Presence Subsystem

Various types of presence-detection equipment, including audio overlay track circuits, loop detectors, and radar-based field detectors, can be utilized to activate the 2600 Controller and initiate train scanning. They need only provide a set of normally closed contacts to interface to the Controller's presence input. *Most systems use the ZEPIC III Audio Overlay.*

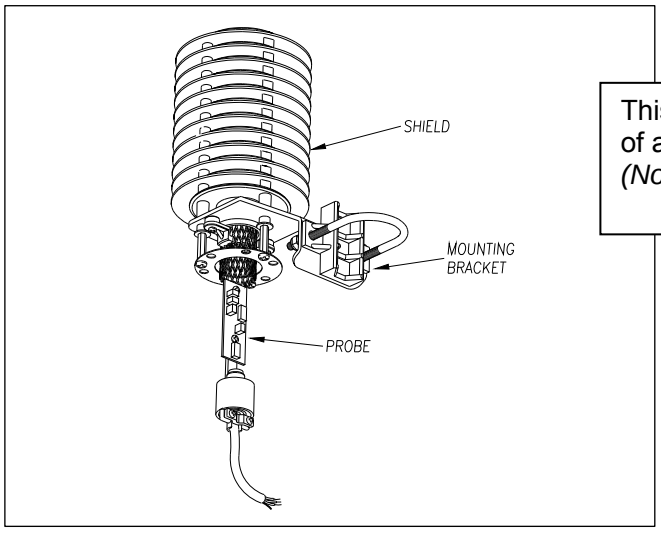
2.6 Surge Panel

The 2600-600 Surge Panel assembly consists of four UTBs (Universal Transient Barriers), a TTA (Three-Terminal Arrester), two coaxial arresters, and a phone line surge protector, all mounted to a copper ground plate. Its purpose is to provide transient protection for incoming wheel detector signals, track circuit, antennas, and phone lines.



2.7 Shielded Temperature Probe

The shielded temperature probe (one probe per system), which mounts to the outside wall of the wayside enclosure, provides accurate temperature indications over a range of -49°F to +149°F (-45°C to +65°C). Site-ambient temperature (at the time the train passed the site) is included with most system reports.



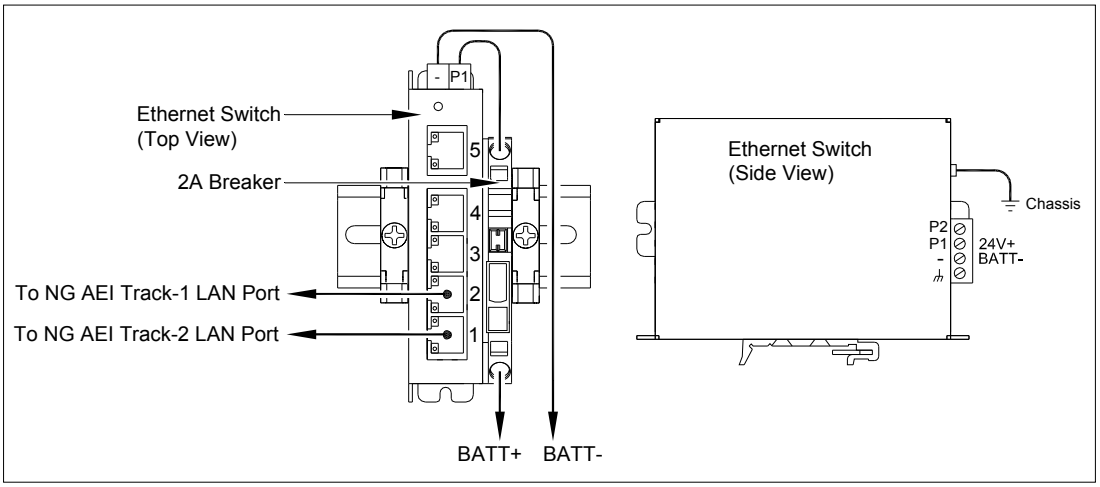
This figure shows the primary parts of a shielded temperature probe. *(Note: This is a future option.)*

The 2600-00x Controller supplies 12 volts to the shielded temperature probe. The probe returns zero to five volts. Zero volts indicate a -49°F (-45°C) reading. Five volts indicate a +149°F (+65°C) reading. *During normal operation, neither reading should occur*. If you get a -49°F (-45°C) reading, the probe could be malfunctioning or the cable from the probe to the controller could be cut. Similarly, if you get a +149°F (+65°C) reading, the probe could be malfunctioning or the ground wire from the probe to the controller could be cut.

2.8 Ethernet Switch

For multi-track installations, an Ethernet switch is included to provide for communications between the local reader systems. The primary purpose of the switch-enabled communications is to enable the reader systems to share consist information for the purpose of filtering out cross-track tag reads.

Only the LAN ports of the reader systems co-located at a multi-track site should be connected to the Ethernet switch.



Chapter 3 — Track Components

This section covers the installation and operation of the major track components that are used by SmartScan AEI systems:

- wheel detectors;
- three types of AEI antennas;
- presence detectors.

Note: As previously stated, no one system uses all of the described components.

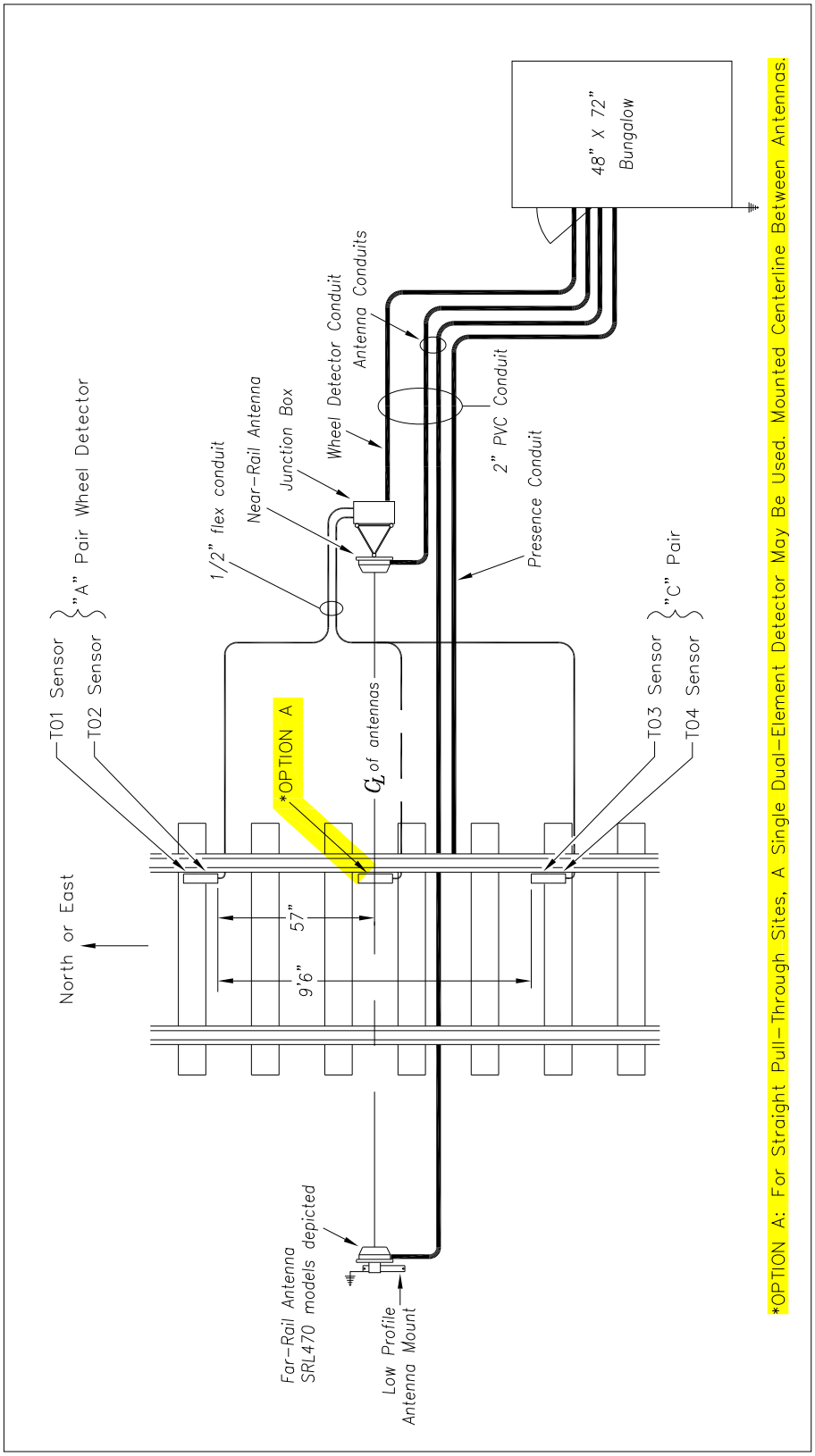
Where the Model 2600 AEI System is installed as a replacement for an existing legacy system, the installation process will typically consist of the following:

- installation of a second Tiefenbach double-wheel detector*;
- relocation of the existing AEI antennas and/or an existing Tiefenbach double-wheel detector;
- interfacing the existing presence-detection equipment to the Model 2600 Controller.

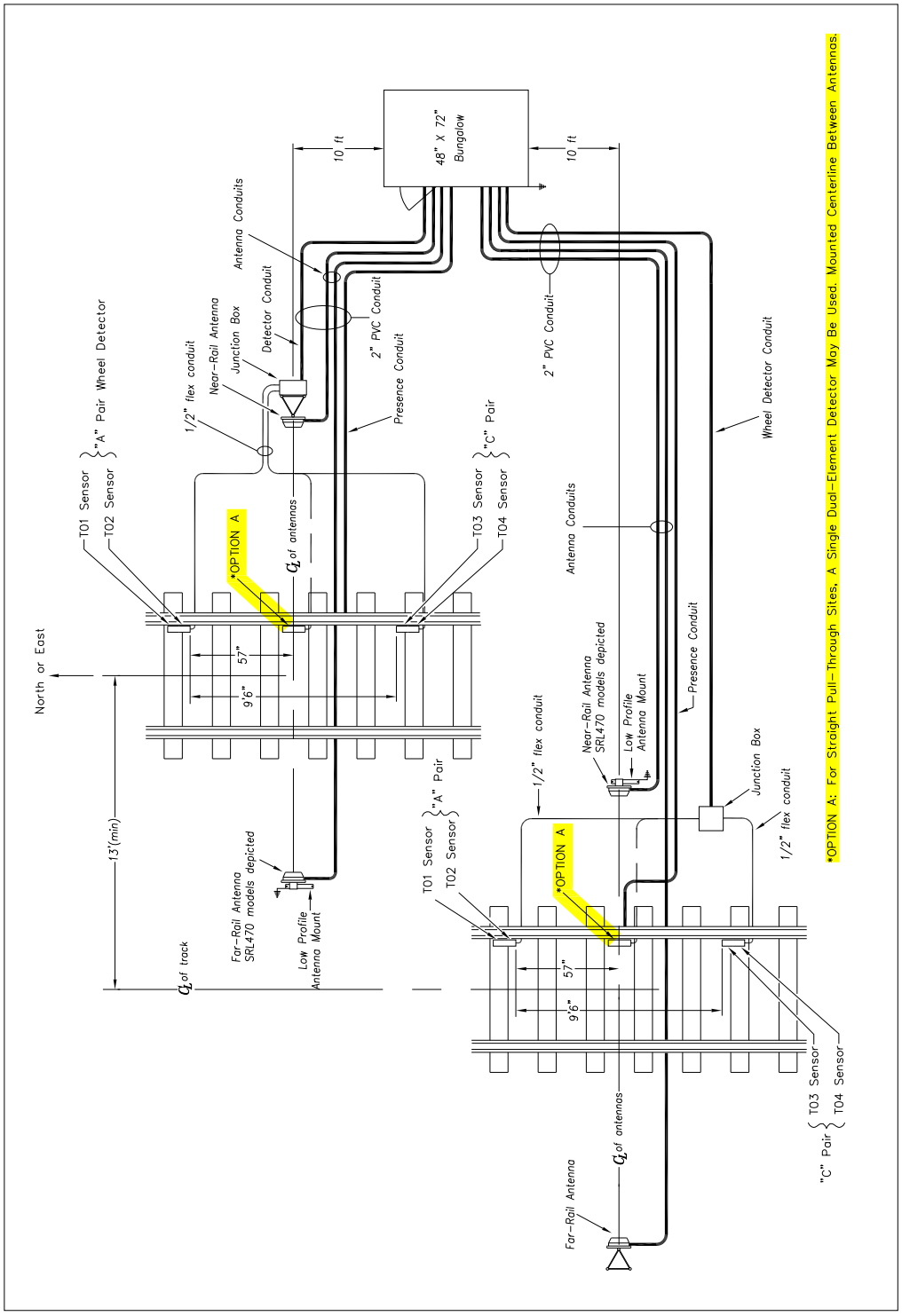
For new sites, the installation process will consist of the following:

- installation of Tiefenbach double-wheel detectors;
- installation of towers and AEI antennas;
- installation of presence-detection equipment.

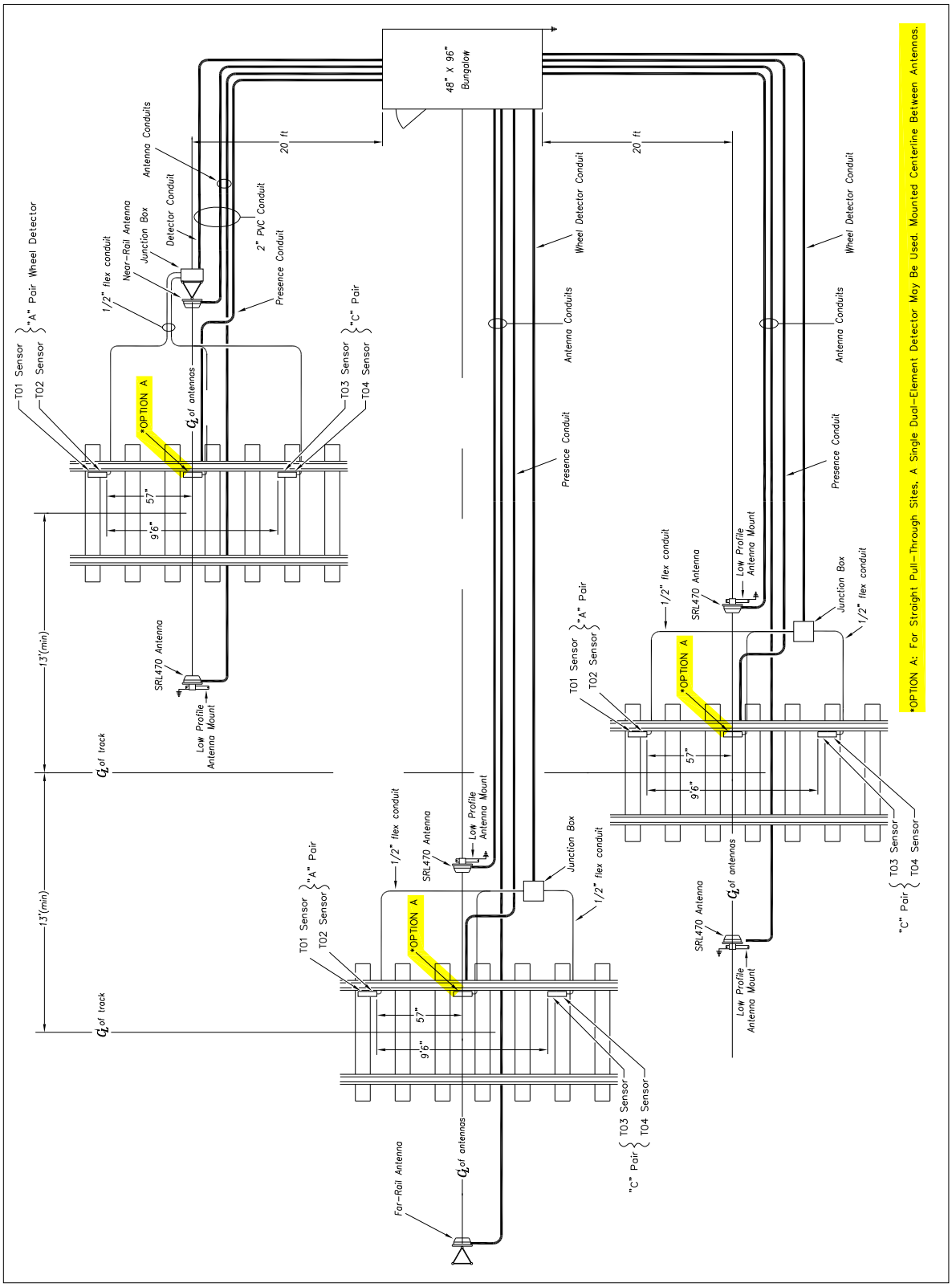
*A single Tiefenbach double-wheel detector application is only an option for those sites with straight pull-through traffic.



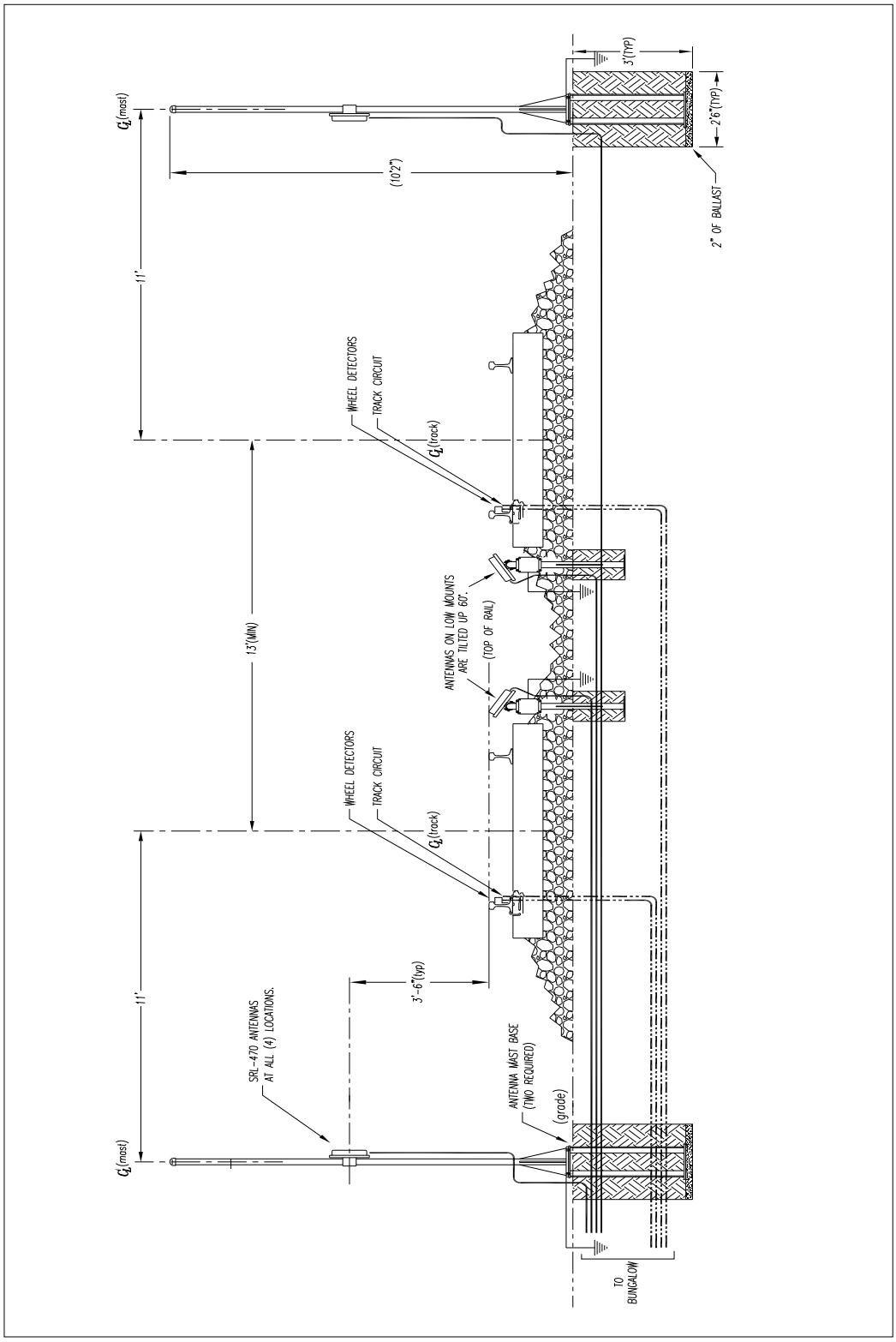
Typical Single-Track Equipment Layout (refer to enlarged image in Appendix)



Typical Double-Track Equipment Layout (refer to enlarged image in Appendix)



Typical Triple-Track Equipment Layout (refer to enlarged image in Appendix)



Double-Track Elevation Drawing (refer to enlarged image in Appendix)

3.1 Wheel Detectors

The Model 2600 Next Generation AEI Controller requires two Tiefenbach double-wheel detectors to accurately record axle patterns and, from those, establish a car breakout during stop- and reverse-type movements.

Each detector has a pair of independent sensing elements. The northernmost or easternmost detector is designated as the “A-Pair.” Its pair of sensing elements is designated TO1 and TO2, with TO1 being the northernmost or easternmost sensor. The second Tiefenbach is designated as the “C-Pair,” and its pair of sensing elements is designated TO3 and TO4, with TO4 being the southernmost or westernmost sensor.

Signals received from detectors TO1 through TO4 are processed by the controller to determine train speed, direction, and car recognition.

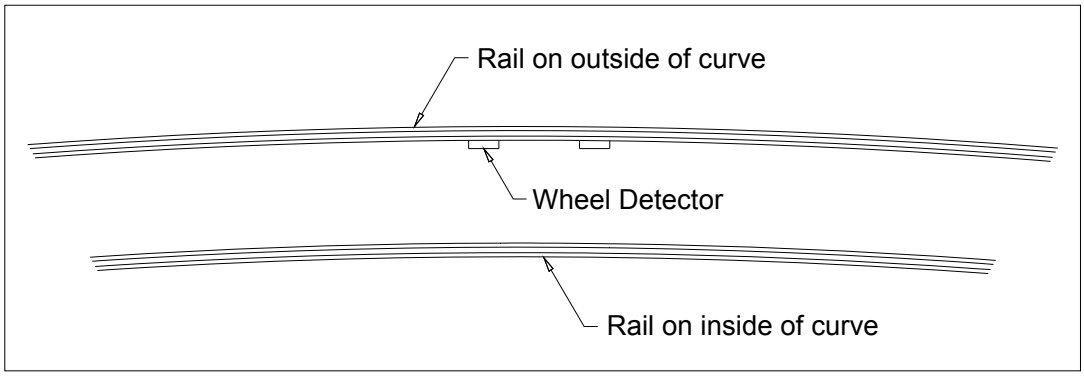
For those mainline AEI sites with straight pull-through traffic only, a single Tiefenbach double-wheel detector will provide adequate wheel data for vehicle breakout algorithms. For these applications, the detector will be mounted centerline of antennas.

3.1.1 Tiefenbach Detector Mounting Considerations

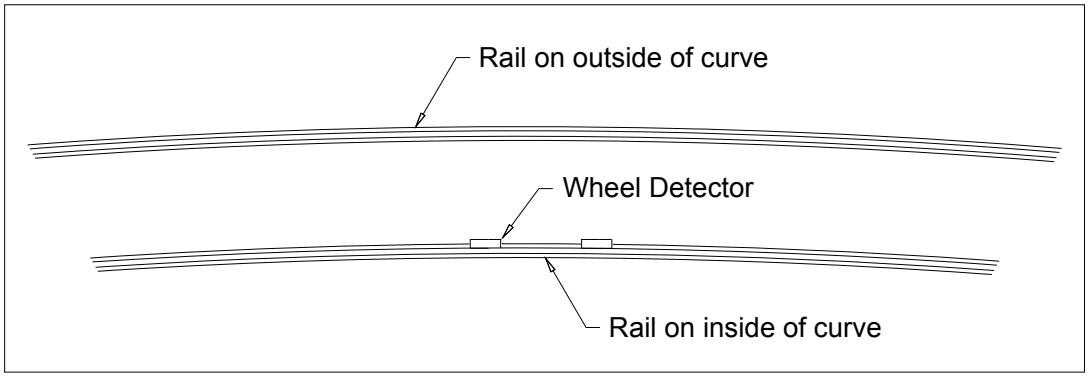
The following considerations (detailed below) should be regarded prior to mounting Tiefenbach double-wheel detectors to the rail.

Consideration 1:
If your site has a Tiefenbach double-wheel detector already installed, it can be recycled and used along with a second Tiefenbach (supplied). Relocation of the existing wheel detector will likely be necessary to comply with the standard track layout requirements.

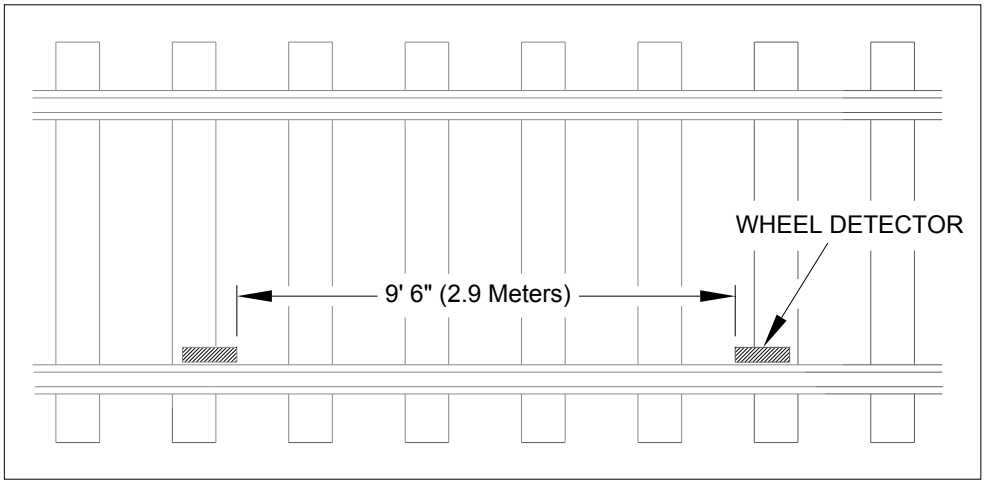
Consideration 2:
If mounting the detectors in a curved section of track, the standard practice is to mount them to the rail on the outside of the curve.



Exception: CN Railway specifies that wheel detectors be mounted to the *inside* of the curve.



Consideration 3:
For those sites with stop- and reverse-type movements, the quad-detector configuration (two Tiefenbach double-wheel detectors) is essential. Spacing between the mounted detector modules must be 9’- 6” when measuring the gap between the modules (inside-to-inside measurement). This measurement is critical for achieving accurate speed and car length calculations.

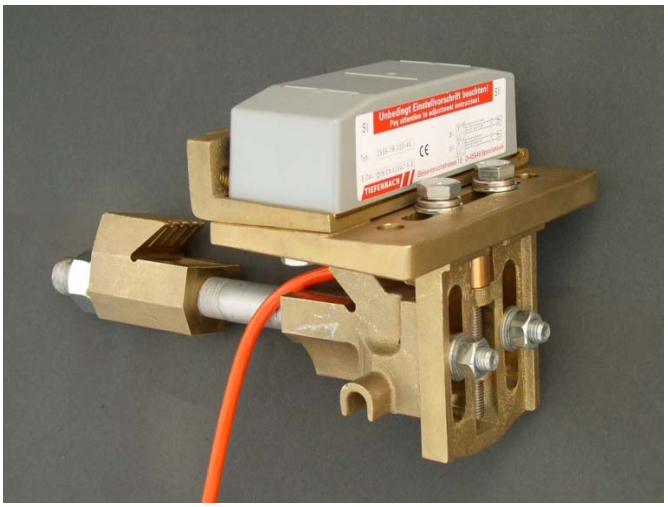


Consideration 4:
The detectors should be mounted such that the AEI reader antennas are as near the center of the 9’-6” gap as possible.

Consideration 5:
For those straight pull-through-type sites, a single Tiefenbach double-wheel detector should be mounted on centerline with antennas.

3.1.2 Tiefenbach Detector Installation

The Tiefenbach wheel detector is a reliable, proven device for use in AEI systems for the rail environment. However, due to many variables, such as railhead wear, wheel tread wear, and wheel flange thickness, the performance of the wheel detector can be severely compromised if improperly installed or incorrectly adjusted.



A properly installed wheel detector will be mounted on the gauge side of the rail and parallel with the top of the rail at a distance of 1 3/4” below the rail crown.

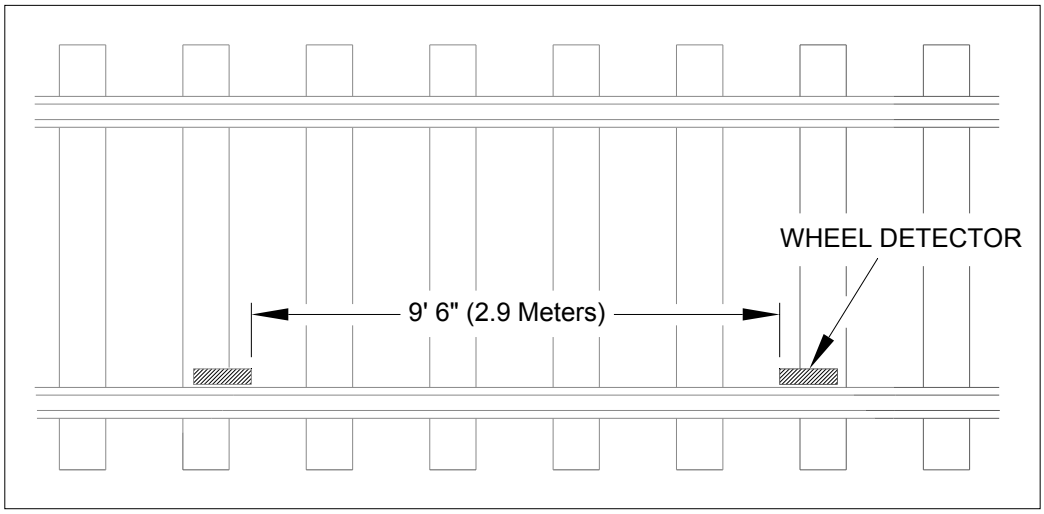
The wheel detector should never be under the rail crown when viewed from the top.

RAIL TYPE	ASSEMBLY PLATE (color)
115 RE	None
119 RE	thin red
132 RE	green
133RE	green
136 RE	1 thick red / 1 grey
140 RE	1 thick red / 1 thin red
141 RE	white

Mount the wheel detector modules to the rail using the approved Tiefenbach clamp system or by drilling the rail and mounting directly to the web. The alignment of the Tiefenbach detectors in relation to the head of the rail is critical to achieve optimal performance. Color-coded plates are included with each wheel detector to provide proper horizontal spacing for the various rail profiles.

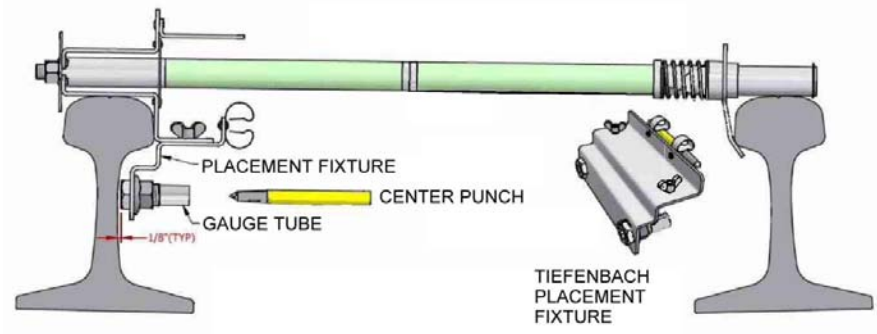
Drill-Mounted Detectors

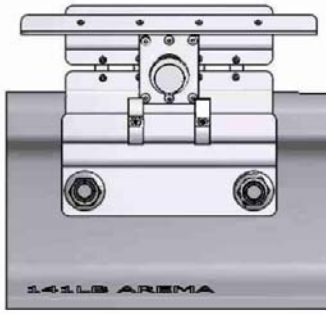
For quad- wheel detector installations (two Tiefenbach double-wheel detectors), each detector body is positioned approximately 57” either side of the antenna centerline to establish the proper wheel detector spacing of 9.6” (inside-to-inside measurement). If the site uses one double-wheel detector, install on the antenna centerline. The 2600-800 Placement Gauge can be used to mark holes for drilling.



1. Install the Tiefenbach Placement Fixture on the 2600-800 Wheel Detector Gauge, as shown. The fixture (web) depth is adjustable for different-sized rails.

2. Remove the center punch from the holder and place it in the Gauge Tube to mark the rail for drilling.





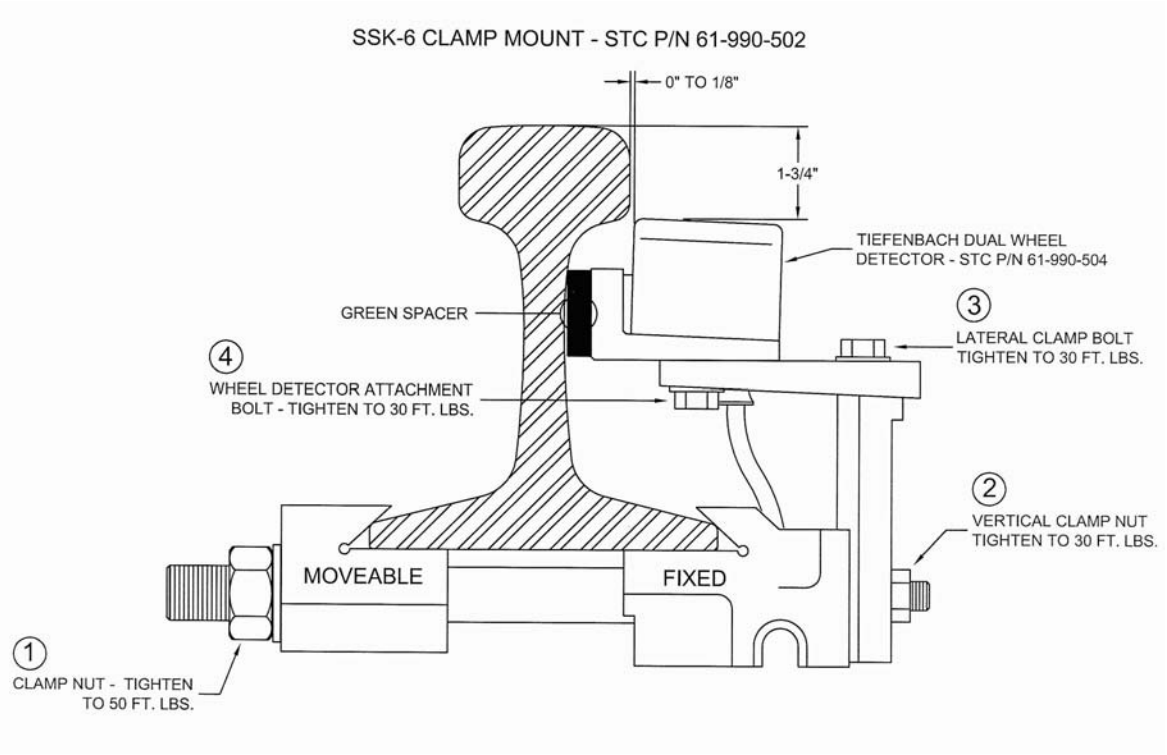
3. Mounting holes are to be drilled parallel to the foot of the rail (drill diameter = 13mm). Hole center to hole center = 145mm.

4. Place the proper-colored spacer combination (per rail size) on the side of the detector in order to obtain the required distance away from the rail web.

5. Mount the detector with the spacer to the web of rail, and then tighten to a torque of 50-60 Nm.

Clamp-Mounted Detectors

STC highly recommends use of the Tiefenbach SSK-6 bracket for permanent placement of the Tiefenbach wheel detector. The bracket provides a simple means for attaching the wheel detector to the rail, as well as a means for adjusting the wheel detector to its optimal location, both vertically and laterally. The clamp provides the additional advantage of eliminating the need for drilling the rail.



Step 1: Installing the clamp base

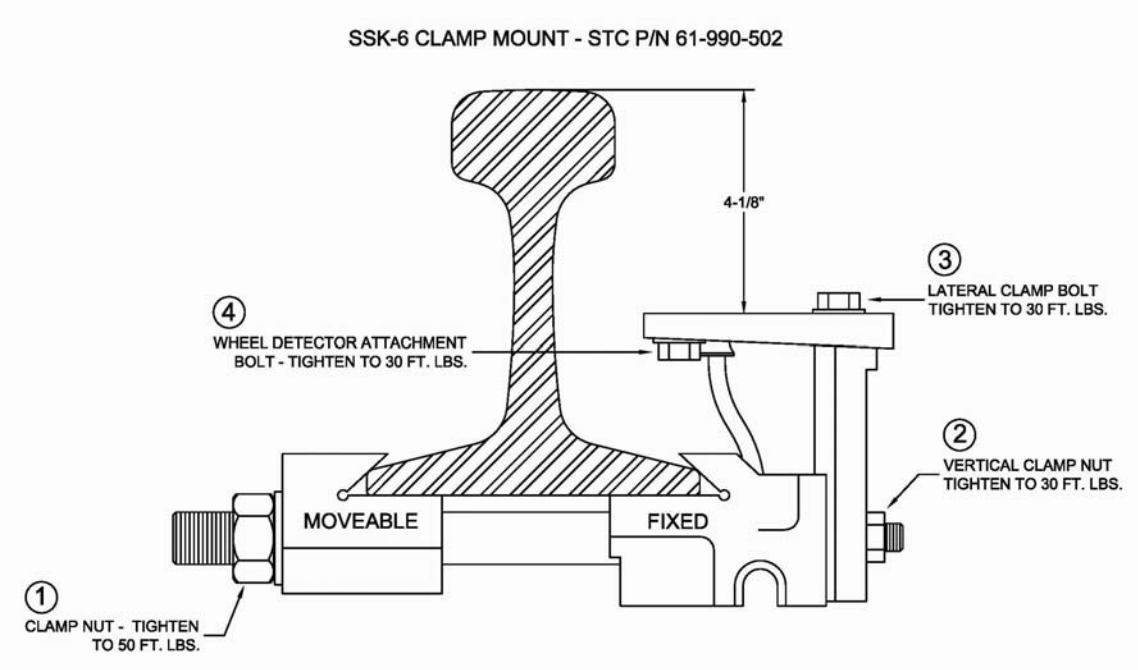
1. Select the tie crib where the wheel detector is to be installed and remove approximately 6” of ballast from beneath the rail.

Note: For quad- wheel detector installations (two Tiefenbach double-wheel detectors), each detector body is positioned approximately 57” either side of the antenna centerline. If the site uses one double-wheel detector, install the clamp on the antenna centerline.

2. Slide the mounting bolt and moveable clamp under the rail while engaging the fixed clamp on the rail base on the gauge side of the rail.

3. Loosen the clamp nut enough to allow the moveable clamp to engage the rail base.

4. Square the clamp with the rail base, and then tighten the clamp nut to a final torque of 50 ft. lbs.



Step 2: Setting height

Note: It is preferable to set the clamp height before attaching the wheel detector to the clamp assembly.

1. Place a straightedge across the top of both rails.

2. Loosen the vertical clamp nuts.

3. Using a 3/16” hex wrench, turn the vertical jack screw until the wheel detector mounting surface is 4-1/8” below the straightedge when measured to the machined surfaces of the mounting plate.

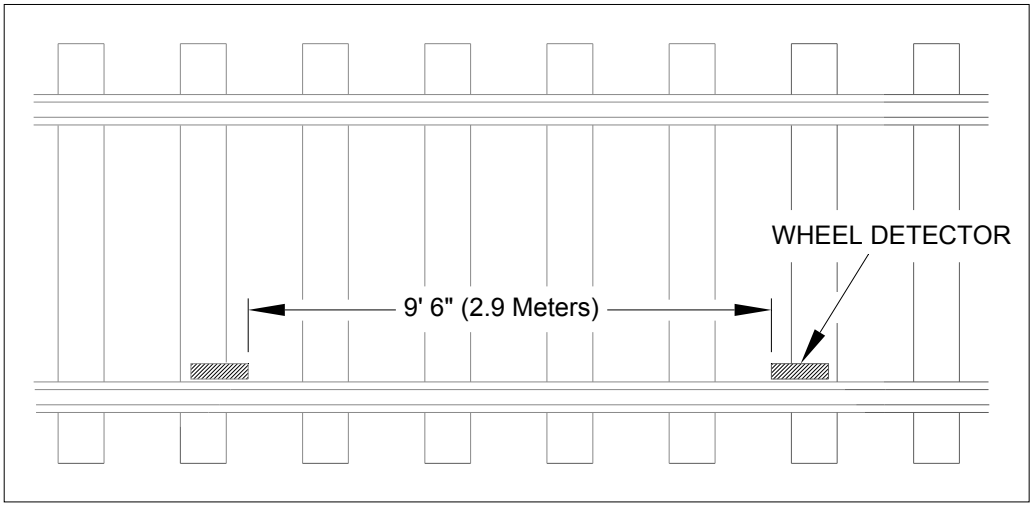
4. Check the 4-1/8” dimension at both ends of the mounting plate to be sure they are parallel with the top of the rail.

5. Tighten the vertical clamp nuts to a torque of 30 ft. lbs.

6. Place the Tiefenbach wheel detector on the mounting plate with the appropriate-colored shims installed.

7. Install the wheel detector attachment bolts and push the wheel detector toward the rail as far as it will go. If any portion of the wheel detector is under the rail head, install a thicker shim and repeat the process. Tighten the bolts to a torque of 30 ft. lbs.

8. Check the wheel detector spacing from inside to inside of wheel detectors (see below). This distance should be 9’-6”. If necessary, loosen the lateral clamp bolts and move the wheel detectors to achieve the proper spacing. Tighten the clamp bolts to a torque of 30 ft. lbs.



Step 3: Verifying alignment

1. Place a straightedge across both rails and measure from the bottom of the straightedge to the top of the wheel detector. The measurement should be 1-3/4" +/- 1/16" when taken at the gauge line.

2. Visually check the relationship of the wheel detector to the gauge surface of the rail to ensure the wheel detector is parallel from end to end and that it is ***not*** under the railhead.

This completes the installation and alignment functions for the wheel detectors.

Step 4: Connecting the wheel detectors to the 2600 Controller

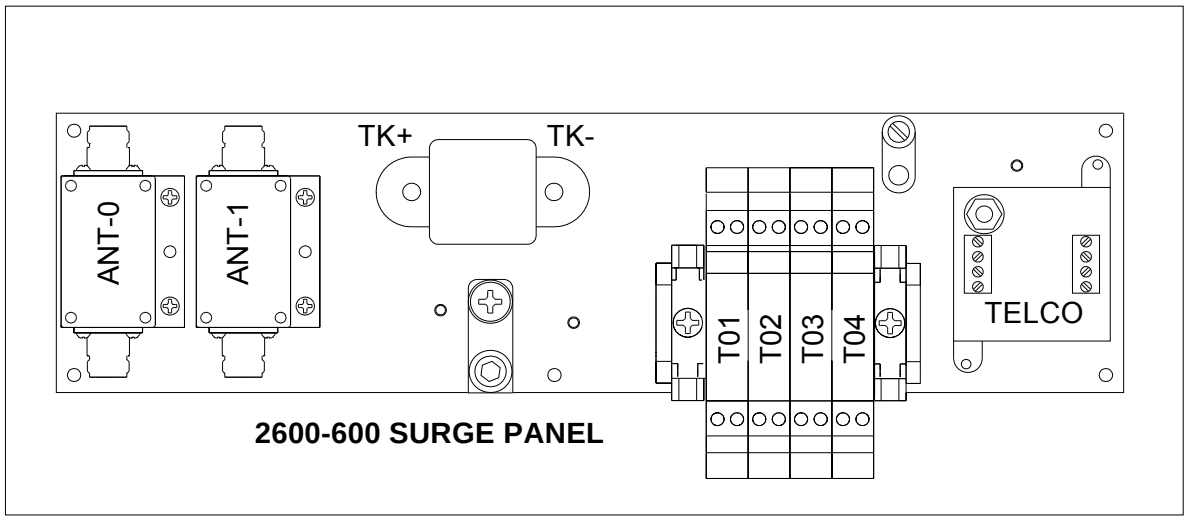
Wheel detector Designation

After mounting both wheel detector modules, use the following criteria to determine which will be the "A-Pair" and which will be the "C-Pair."

- On a north-south track, the A-Pair will be the first wheel detector a southbound train crosses. Within the A-Pair, sensing element TO1 will be the first element crossed, and TO2 will be the second.
- The second wheel detector crossed by a southbound train will be the C-Pair. The first sensing element of the C-Pair becomes TO3 and the second element becomes TO4.
- On an east-west track, the A-Pair will be the first wheel detector a westbound train crosses. Within the A-Pair, sensing element TO1 will be the first element crossed and TO2 will be the second.
- The second wheel detector crossed by a westbound train will be the C-Pair. The first sensing element of the C-Pair becomes TO3 and the second element becomes TO4.
- For those sites that use a single Tiefenbach double-wheel detector, it will be designated the A-Pair, with TO1 the northernmost or easternmost detector, and TO2 the southernmost or westernmost detector.

Routing and Connecting Wheel Detector Cables

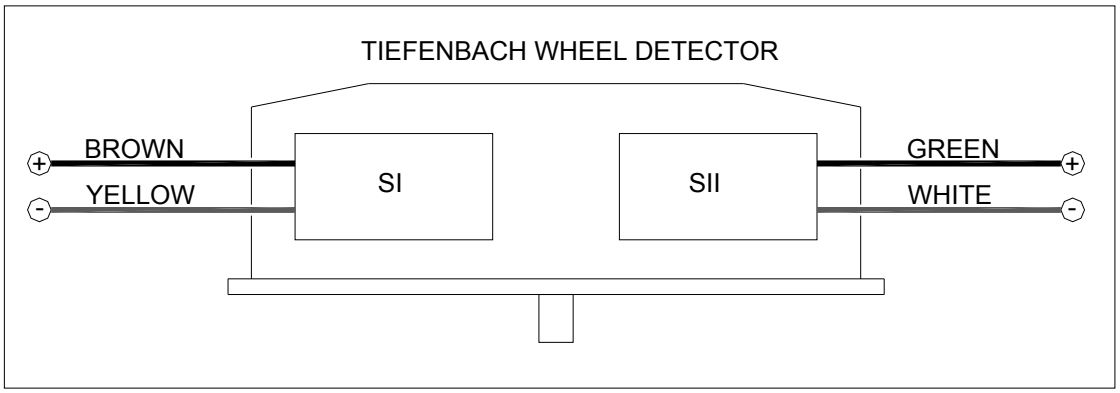
Each wheel detector pair has a four-conductor cable attached. You should label the individual cables as the A-Pair or the C-Pair before pulling them through any conduit. Route and terminate the cables to the 2600-600 Surge Suppressor Assembly located inside the bungalow. There are four UTB surge arresters (labeled TO1 – TO4).



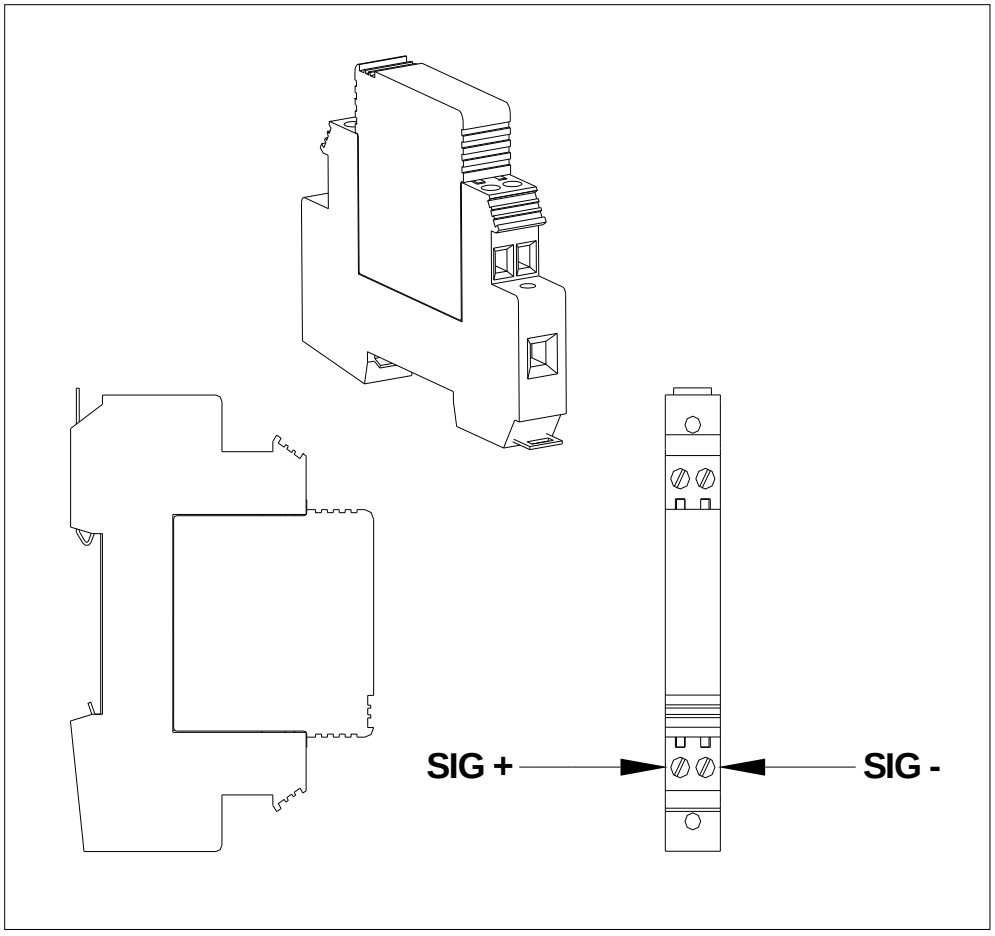
Terminations for the zero-speed wheel detectors are provided on the 2600-600 Surge Panel. One UTB is provided for each wheel detector. Examine the labels on the side of the Tiefenbach double-wheel detector to determine which sensing element within the wheel detector will be designated as TO1. The order of the elements may be reversed, depending upon which rail the wheel detector is mounted to.

Sensing Element SI and SII	Connections
If sensing element **SI** is to become **TO1**	Connect the Brown/Yellow pair to the designated UTB. Brown connects to the **+** terminal, and Yellow connects to the **–** terminal.
If sensing element **SII** is to become **TO1**	Connect the Green/White pair to the designated UTB. Green connects to the **+** terminal, and White connects to the **–** terminal.
If sensing element **SI** is to become **TO2**	Connect the Brown/Yellow pair to the designated UTB. Brown connects to the **+** terminal, and Yellow connects to the **–** terminal.
If sensing element **SII** is to become **TO2**	Connect the Green/White pair to the designated UTB. Green connects to the **+** terminal, and White connects to the **–** terminal.

Follow the same logic to determine the connections for the C-Pair and TO3 – TO4.

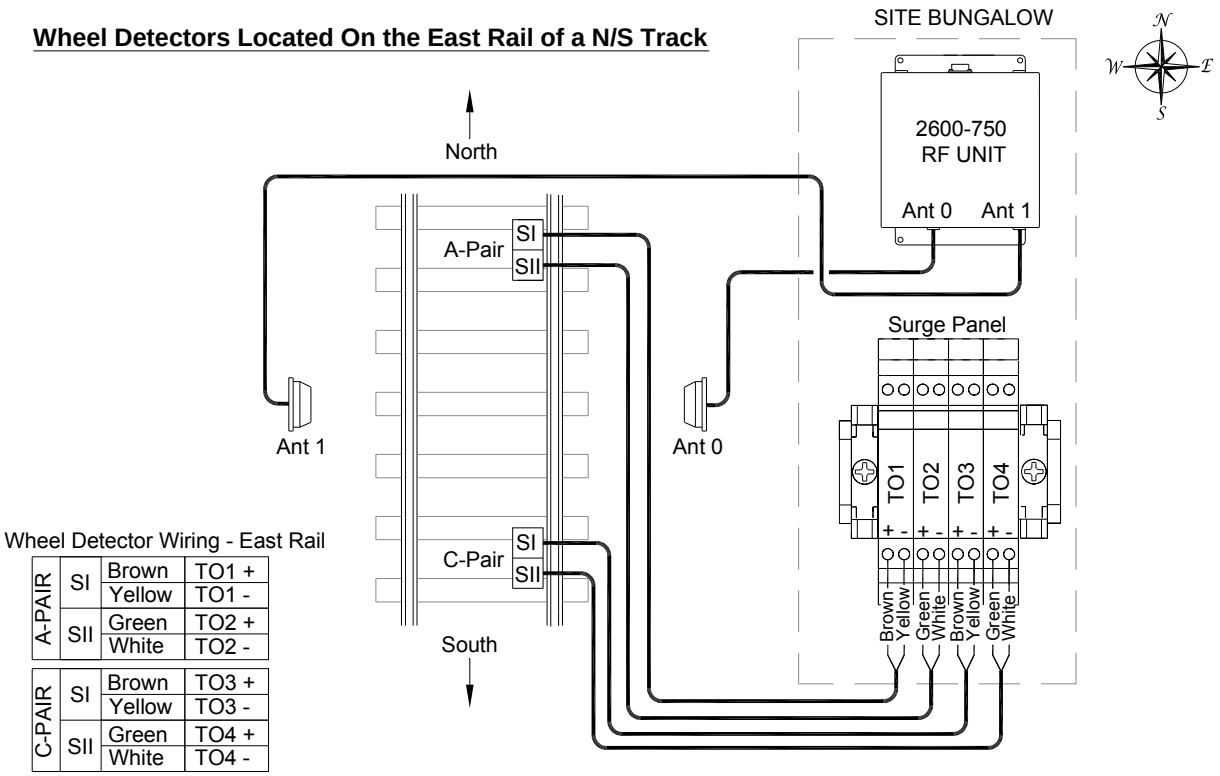


- Attach the SIG+ (signal positive) wire of wheel detector TO1 to the bottom left of the first (leftmost) DIN-mounted UTB. Attach the SIG- (signal negative) wire of wheel detector TO1 to the bottom right of the first UTB.
- Attach the SIG+ wire of wheel detector TO2 to the bottom left of the second DIN-mounted UTB. Attach the SIG- wire of wheel detector TO2 to the bottom right of the second UTB.
- Attach the wires of wheel detectors TO3 and TO4 in a like manner.



UTB Views

Wheel Detectors Located On the East Rail of a N/S Track

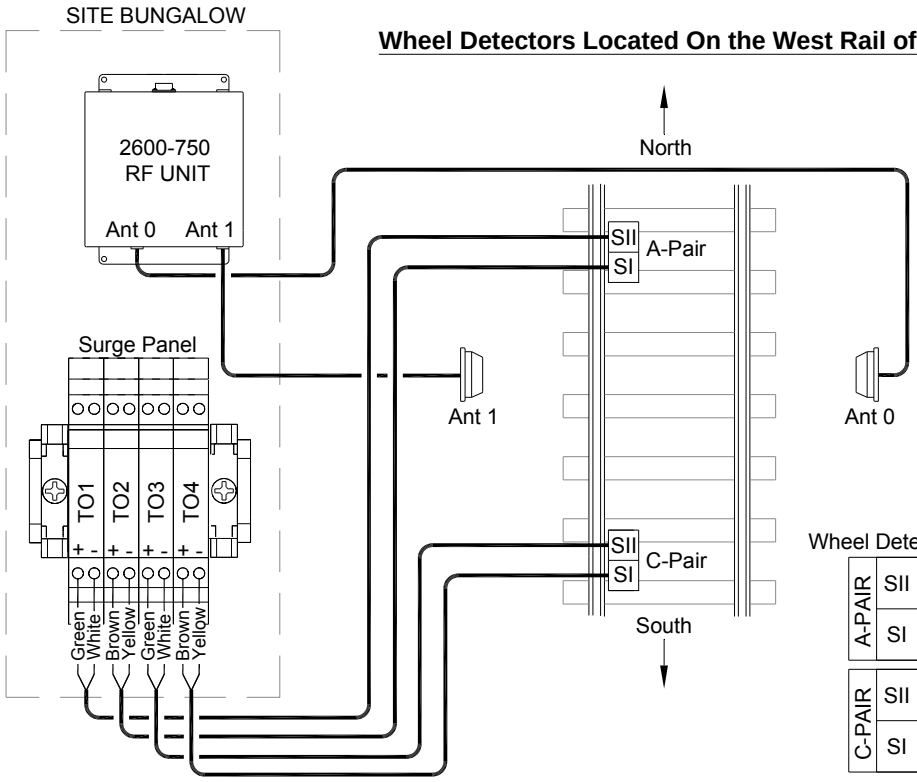


Wheel Detector Wiring - East Rail

A-PAIR	SI	Brown	TO1 +
		Yellow	TO1 -
	SII	Green	TO2 +
		White	TO2 -

C-PAIR	SI	Brown	TO3 +
		Yellow	TO3 -
	SII	Green	TO4 +
		White	TO4 -

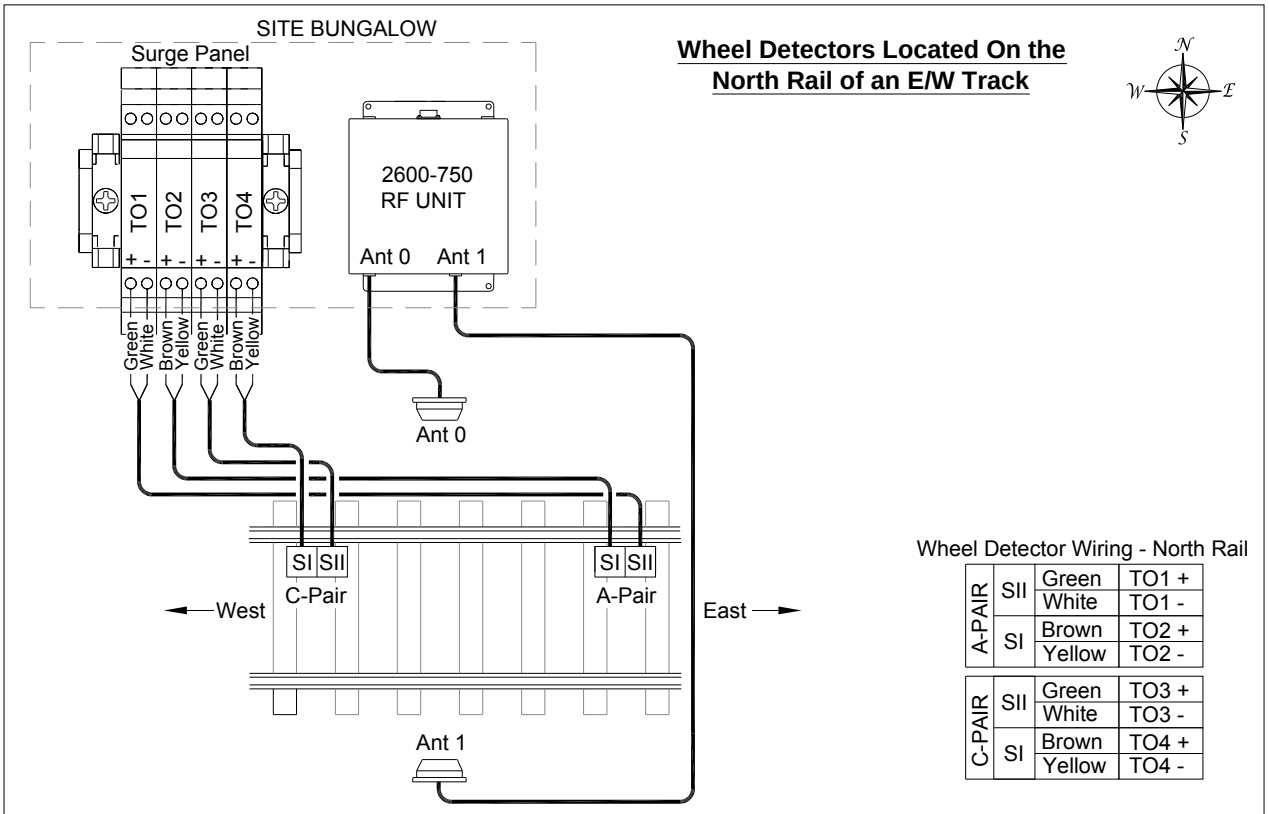
Wheel Detectors Located On the West Rail of a N/S Track



Wheel Detector Wiring - West Rail

A-PAIR	SII	Green	TO1 +
		White	TO1 -
	SI	Brown	TO2 +
		Yellow	TO2 -

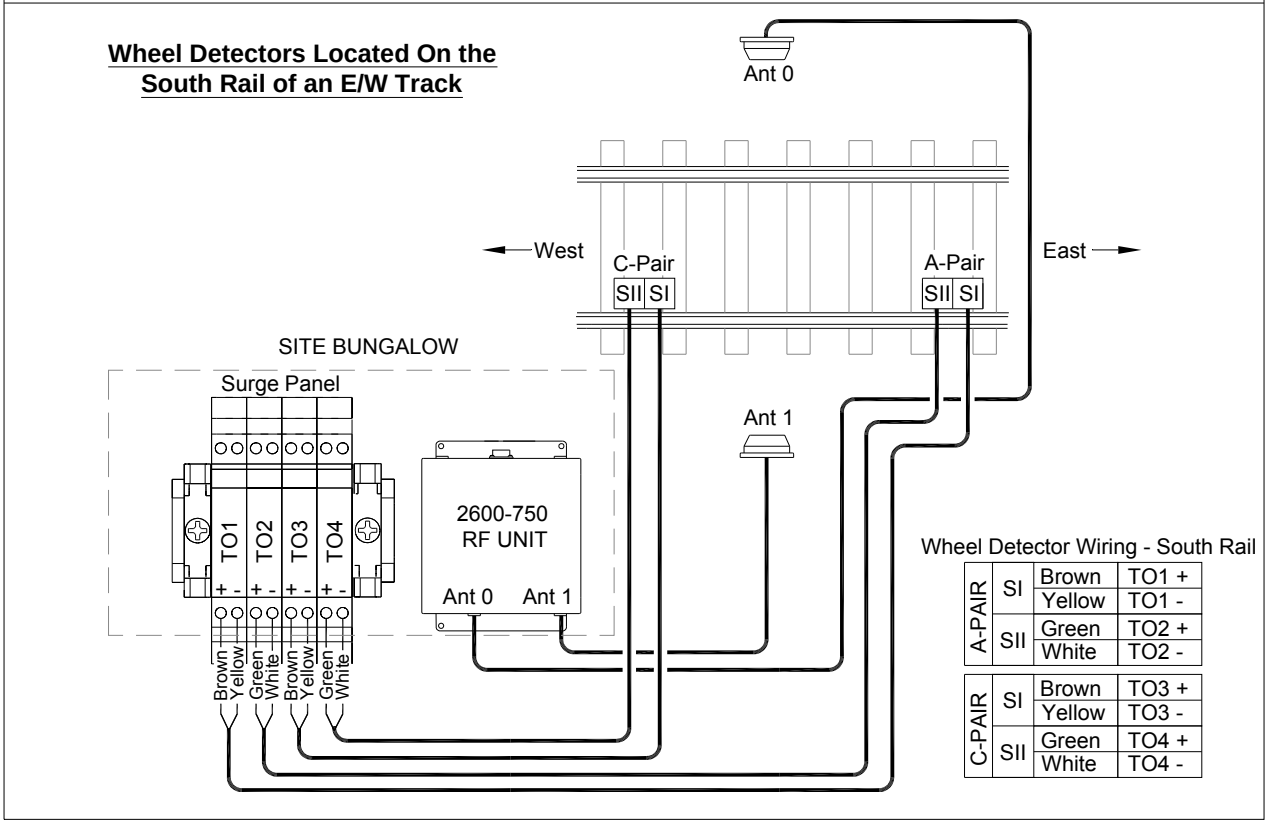
C-PAIR	SII	Green	TO3 +
		White	TO3 -
	SI	Brown	TO4 +
		Yellow	TO4 -



Wheel Detectors Located On the North Rail of an E/W Track

Wheel Detector Wiring - North Rail

A-PAIR	SII	Green	TO1 +
		White	TO1 -
	SI	Brown	TO2 +
		Yellow	TO2 -
C-PAIR	SII	Green	TO3 +
		White	TO3 -
	SI	Brown	TO4 +
		Yellow	TO4 -



Wheel Detectors Located On the South Rail of an E/W Track

Wheel Detector Wiring - South Rail

A-PAIR	SI	Brown	TO1 +
		Yellow	TO1 -
	SII	Green	TO2 +
		White	TO2 -
C-PAIR	SI	Brown	TO3 +
		Yellow	TO3 -
	SII	Green	TO4 +
		White	TO4 -

Step 5: Calibrating Sensitivity of the Wheel Detector

Each Tiefenbach double-wheel detector consists of two sensing elements. These elements have adjustments that allow them to be balanced with each other for proper sensitivity after installation, and are used to compensate for any abnormalities caused by the installation process and compensate for minor electrical differences within the wheel detector.


Proper sensitivity calibration is critical to the operation of the wheel detector and the Model 2600 AEI Controller. Incorrect sensitivity adjustment can manifest itself as system faults in several ways:

Missed wheels: If the sensitivity is set too coarsely, a new wheel with a shallow flange can pass undetected. The Model 2600 Controller has advanced algorithms that can compensate for a missed input from one element of the wheel detector when a straight-through move is in process.

Loss of consist definition: If the sensitivity is set too finely, it is possible for both elements of the wheel detector to activate simultaneously. If this happens, the Model 2600 Controller will lose some of its ability to recognize that a wheel has transitioned through the wheel detector. If this condition exists when consists are in the process of stopping and reversing, the consist definition will be lost.

Sensitivity Adjustment Feature of the Tiefenbach Double-Wheel Detector


To enable the calibration of sensitivity in the wheel detector:

1. Unscrew the two knurled nuts on the bottom side of the wheel detector to expose the sensitivity adjustment screws.
2. Retrieve the brass adjustment tool that came packaged with your wheel detector.
3. Screw the adjustment tool onto one of the adjustment screws, and lightly tighten.
4. Push the adjustment tool upward to unlock the protection mechanism.
5. Turn the setting tool to calibrate sensitivity.
6. Remove the adjustment tool and replace the knurled nuts when complete.

These steps are applicable to all tools and fixtures designed for Tiefenbach double-wheel detector adjustment. Depending on the tools available, calibration can be accomplished as a simple gross calibration (to get you in the ballpark) or the settings can be finely balanced (for long-term service).

Step 6: Fine-Tuned Wheel Detector Calibration

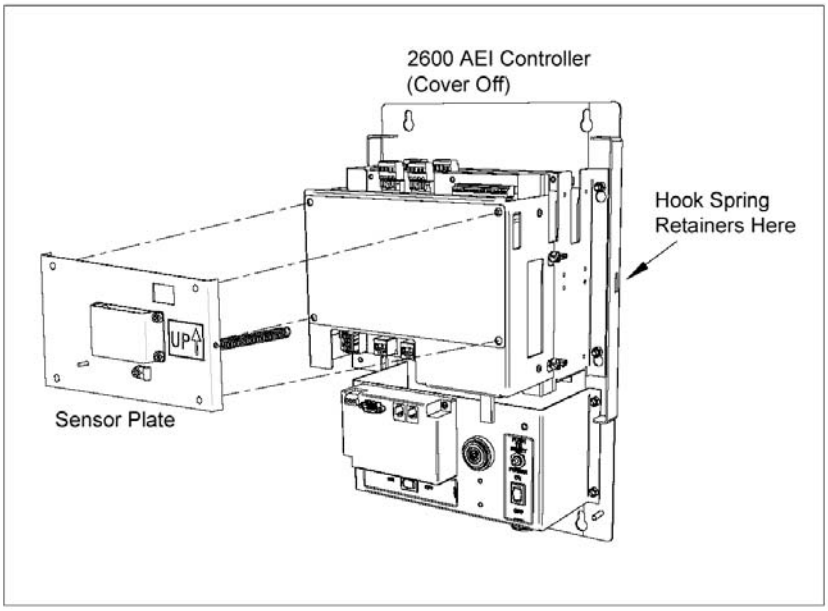
This procedure requires that you have on hand a 2600-800 Wheel Detector Gauge and a 2600-810 Alignment Status Panel. If these tools are not available at your site, proceed to Step 7 and perform simple gross calibration.

The 2600-800 provides a fixed, stable target over the wheel detector sensor body that is perfectly parallel to the railhead. The 2600-810 provides a high-visibility status display that is viewable from the rail. Used together, they make wheel detector calibration a simple, one-man operation.

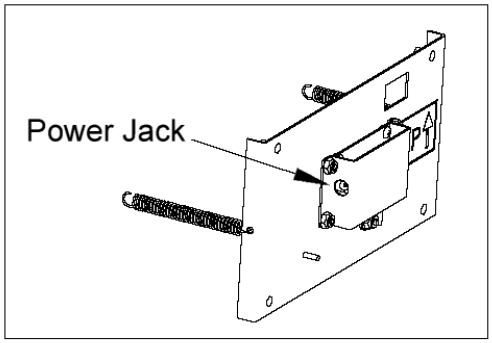
2600-810 Alignment Status Panel

1. With the Model 2600 AEI Controller powered up but inactive, verify that the front panel LEDs for TO1 –TO4 are not illuminated.

2. If the 2600-810 Alignment Status Panel is to be used, follow these steps:
    a. Remove the sheet metal cover from the 2600 Controller by releasing the draw latches on either side.
    b. Gently place the 2600-810 sensor plate over the face of the 2600 Controller and slide the bushings into the holes in the front LED panel as depicted on the following page.

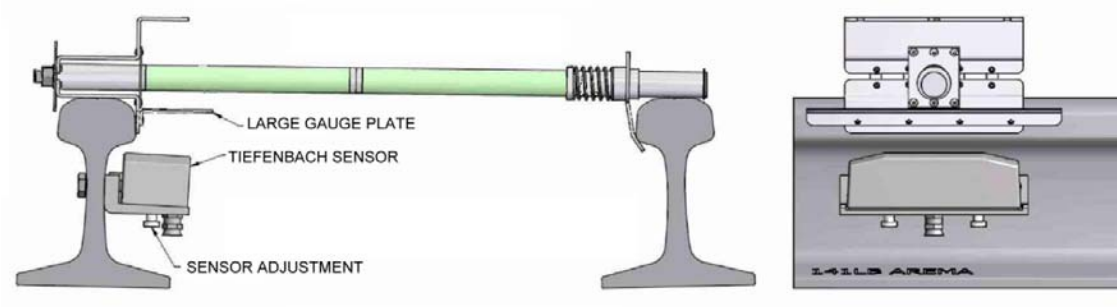


c. Secure the sensor plate by hooking the springs in the slots in the Controller base plate.
d. Plug the AC adapter into a wall outlet, and then connect the power plug to the jack on the front of the sensor plate.



e. Position the 2600-810 carrying case on the floor of the bungalow such that the LED display can be viewed from the track.

3. Locate and place the 2600-800 Wheel Detector Gauge across rails such that the large-gauge plate is positioned directly over the “A-Pair” Tiefenbach wheel detector. Make sure the gauge is properly seated on the railhead (see illustration on the following page).



4. At the bottom of the wheel detector, unscrew the knurled protective plastic nuts off of the adjustment screws. Locate the brass adjustment tool that came packaged with your Tiefenbach wheel detector. Screw on the adjustment tool and tighten without pushing the adjustment screw out of its adjustment protector. **Force should not be used to turn the adjustment screw; otherwise, the adjustment protection may be damaged**. Push the adjustment tool upwards to unlock the protection mechanism.

5. Calibration should begin with detectors in the inactive state (LED indicators located on the 2200-810 Status Panel should be off). If necessary, deactivate the detector by reducing sensitivity (turn the adjustment screw to left). Each element of the dual detector should be set to the "activation threshold" with the target (large-gauge plate) in place. Begin with TO1, which is the northernmost or easternmost detector. Slowly turn the adjustment screw to the right until the detector just activates (the corresponding LED indicator on 2600-810 will light). Next, set the TO2 detector to "activation threshold" in a like manner.

   Detectors are now calibrated.

   Remove the adjustment tool, replace the knurled nut, and lightly tighten. For the second dual wheel detector ("C-Pair"), relocate the 2600-800 Wheel Detector Gauge and repeat the calibration process on the TO3 and TO4 detectors. TO4 is the southernmost or westernmost detector.

6. Remove the sensor plate from the Model 2600 Controller and replace the cover.

7. Carefully store the sensor plate and AC adapter in the 2600-810 carrying case.

Calibration is now complete. Proceed to Section 3.2: AEI Antennas.

Step 7: Simple Gross Calibration

Gross calibration should be performed *only* if a 2600-800 wheel detector Gauge is not available at your site. This process can be accomplished with minimal tools.

NOTE: This is a rough calibration and may require further "tweaking." The accuracy of this procedure relies on the detector body being perfectly parallel with the railhead.

1. Each element of the double-wheel detector should be calibrated to the "activation threshold" with an appropriate target in place. During simple gross calibration, a dime will serve as a target.

It is important that the dime be placed directly over each sensing element, centered between the parallel lines molded into the wheel detector shell, and centered between the longitudinal edges of the wheel detector (as shown in the illustration below).

2. Position a dime over TO1 (northernmost or easternmost element of the “A-Pair").

3. Unscrew the knurled nut on the bottom side of the wheel detector to expose the sensitivity adjustment screw. Locate the brass adjustment tool that was packaged with your wheel detector. Screw the adjustment tool onto the adjustment screws and lightly tighten. Push the adjustment tool upward to unlock the protection mechanism.

4. Calibration should begin with the detector in an inactive state (LED indicator located on 2600 Controller Status Panel should be off). If necessary, deactivate the detector by reducing its sensitivity (turn the adjustment screw to the left). Slowly turn the adjustment screw to the right until the detector just activates (corresponding LED indicator on Status Panel will light). For this type of adjustment, it is beneficial to have a helper who can observe the LED activity in the bungalow.

5. Remove the adjustment tool, screw on the knurled nut, and lightly tighten.

6. Next, move the dime over the TO2 detector and set to “activation threshold” in like manner.

   Detectors are now calibrated.

7. For the second dual wheel detector (“C-Pair”), relocate the dime and repeat the calibration process on the TO3 and TO4 detectors. TO4 is the southernmost or westernmost detector.

   Gross calibration is complete.

Simple Gross Calibration should provide a ballpark setting for detector sensitivity**. It is important that both elements in a double-wheel detector be balanced in order for vehicle breakout algorithms to operate properly**. If consist corruption occurs after train passage, a train detail report can be used to determine which detector is in need of adjustment.

3.2 AEI Antennas

Each SmartScan mainline and yard AEI system requires two antennas, designated **antenna-0** and **antenna-1**. The antennas are used in conjunction with the reader subsystem.

SmartScan supports three types of antennas:

- Sinclair SRL440 antennas, which are normally used on **yard systems**;
- Sinclair SRL470 antennas, which are sometimes used on **mainline systems**;
- Scala HP9-915 Parapanel antennas, which are normally used on **mainline systems**.

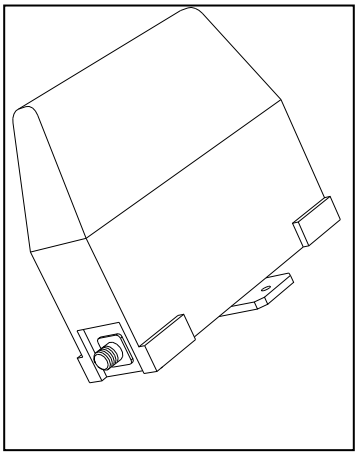
3.2.1 Sinclair SRL440 Antennas

On **yard systems**, two 25-watt Sinclair SRL440 antennas are installed per track. The SRL440 is a directionally pointed, vertically polarized, panel antenna. 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, and is suitable for pipe, tower, or wall mounting.

In reference to the track, antenna-0 is the northernmost or easternmost antenna. Antenna-1 is the southernmost or westernmost antenna.

Each SRL440 antenna is installed

- with its face parallel to the rails;
- horizontally, with its N-type socket on the side, neither pointing up nor down;
- 10’ (3 m) from the center of the track;
- 3.5’ (1.1 m) above the top of the rails;
- centered between the wheel detectors;
- opposite each other.



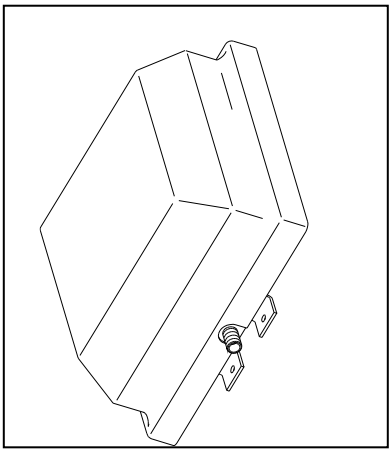
3.2.2 Sinclair SRL470 Antennas

On **mainline systems**, two 100-watt Sinclair SRL470 antennas (*or* two Scala HP9-915 Parapanel antennas) are installed per track. The SRL470 is a directionally pointed, horizontally polarized, panel antenna. It is housed in a compact white enclosure that is made from materials that do not interfere with the transmission and reception of radio waves. It is suitable for pipe, tower, or wall mounting.

In reference to the track, antenna-0 is the northernmost or easternmost antenna. Antenna-1 is the southernmost or westernmost antenna.

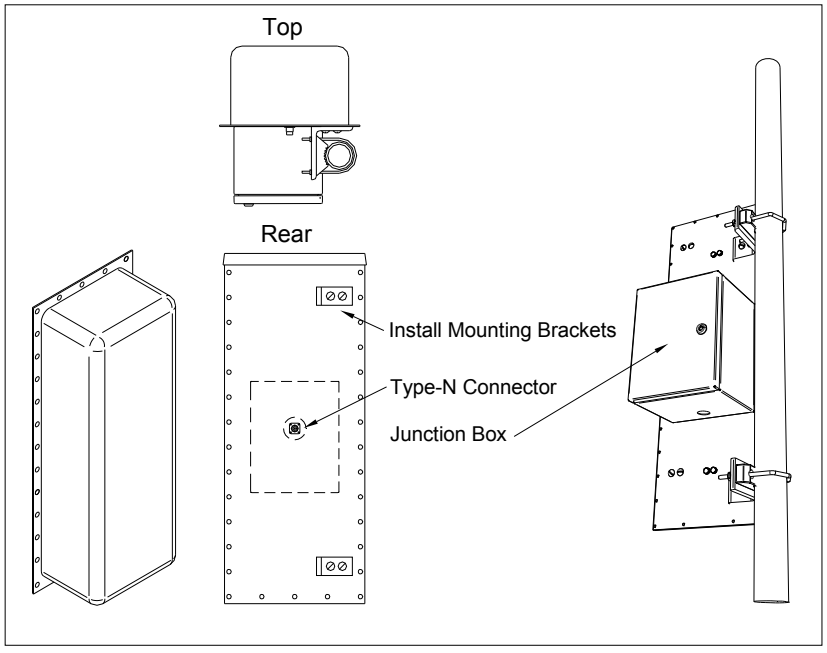
Each SRL470 antenna is installed:

- with its face parallel to the rails;
- with its N-type socket pointing down;
- 10’ (3 m) from the center of the track;
- 3.5’ (1.1 m) above the top of the rails;
- centered between the wheel detectors;
- opposite each other.



3.2.3 Scala HP9-915 Antennas

On **mainline systems**, two 100-watt Scala HP9-915 Parapanel antennas (*or* two Sinclair SRL470 antennas) are installed per track. The HP9-915 is a directionally pointed, horizontally polarized, panel antenna. It has a gain of 9.5 dBd. It is housed in a compact white enclosure that is made from materials that do not interfere with the transmission and reception of radio waves. It is suitable for pipe or tower mounting.



In reference to the track, antenna-0 is the northernmost or easternmost antenna and antenna-1 is the southernmost or westernmost antenna.

Each HP9-915 antenna is installed

- vertically, with its face parallel to the rails;
- 10’ (3 m) from the center of the track;
- 3.5’ (1.1 m) above the top of the rails;
- centered between the wheel detectors;
- opposite each other.

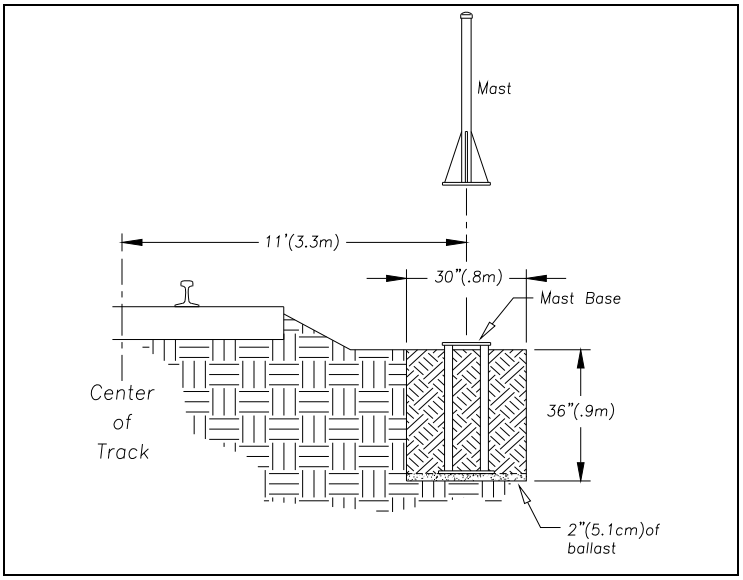
3.2.4 Locating AEI Antenna Masts

The antennas that read the rail vehicle AEI tags must be located as near as possible to the centerline between the two Tiefenbach wheel detectors. Where an existing site is being replaced with the Model 2600 Reader, this can be accomplished by either relocating the existing wheel detector or by relocating the antennas.

To ready the two antenna masts:

1. Using the dimensions provided 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 is plumb and so that its center is 11’ (3.3 m) from the center of the track and centered between the wheel sensors.
3. With the supplied hardware, attach one mast to each base.
4. Plumb each mast.
5. Ground each mast.

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



3.3 Presence Detectors

3.3.1 Zukinut ZEPIC III

Most SmartScan mainline AEI systems use the Zukinut ZEPIC III Presence Detector. At trackside, the track circuit is simply two wires attached to the rails, with one wire being attached to each rail. The wires are attached directly opposite each other, centered between the wheel detectors. For single Tiefenbach wheel detector sites, attach track circuit wires immediately adjacent to the wheel detector.

Connection to the rail can be made in one of two ways:

- **Bonding** – Cadweld manufactures a complete line of bond welding systems that are commonly used in the rail industry. The recommended practice is to weld a short length of bond strand to the web of each rail. Cadweld can provide these items as pre-packaged kits, which include the bond strand (*a 3/16"- diameter strand is recommended*), and the one-shot welding system. *Note: A reusable mold of the correct size, to be acquired by the distributor of your choice, is required.*

- **Drilling** – The alternative to "Cadwelding" is to drill a 3/8" 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" holes to establish a permanent connection to the rail.

Once the rail attachment is made, extend the connection to the three-terminal arrester (TTA) located on the 2600-600 Surge Panel inside the bungalow*. Polarity is **not** important for this particular connection*. This is done by splicing a length of wire (9-AWG or larger) to each bond strand. The Okonite Company manufactures 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. Total wire resistance should not exceed 0.2 Ω.

Calibration of the ZEPIC III Presence Detector

1. From the center of one of the double-wheel detectors (wheel detector pairs), measure the shortest distance you want the track circuit to pick up the presence of a train.

2. The distance must be at least 50' (15.2 m) and no more than 150' (45.7 m).

3.  At the point just measured, place a 0.06Ω shunt across both rails. *The track must be shunted before calibration button is pressed.*

4. Press and HOLD the blue RCVR CAL button until the relay drive LED starts blinking. Release the RCVR CAL button and the LED will stop blinking. The ZEPIC III will automatically begin the calibration process. *NOTE: The track shunt MUST remain in place during the calibration process.*

After the track has been shunted, press and hold this blue calibration button until the relay drive LED begins to blink.

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

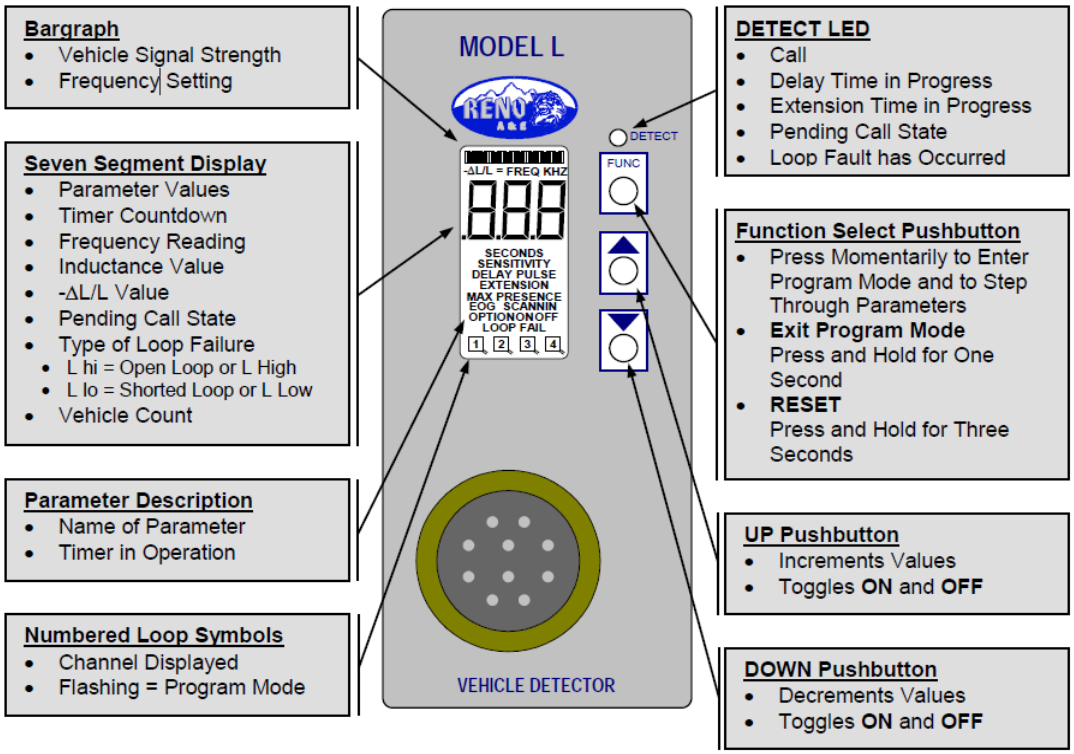
Verification

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

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

3.3.2 RENO L-1300-R Inductive Loop Vehicle Detector

Some railroads use a traffic loop such as the Reno A & E Model L-1300-R-24D inductive loop vehicle detector as their presence subsystem. Operation of the loop detector is detailed in this section. If your system does not use a presence loop, proceed to *Section 4.0*.



L-1300-R Front Panel

General Description

The Model L-1300-R is a single-channel, shelf-mount-type, inductive loop vehicle detector. It incorporates a microcontroller that monitors and processes signals from the loop/lead-in circuit. When presence is detected, the processor actuates a normally open relay output.

A LCD, a LED, and three front-panel pushbuttons are used to display and program all detector functions. The illustration on the previous page provides detailed descriptions of front-panel components.

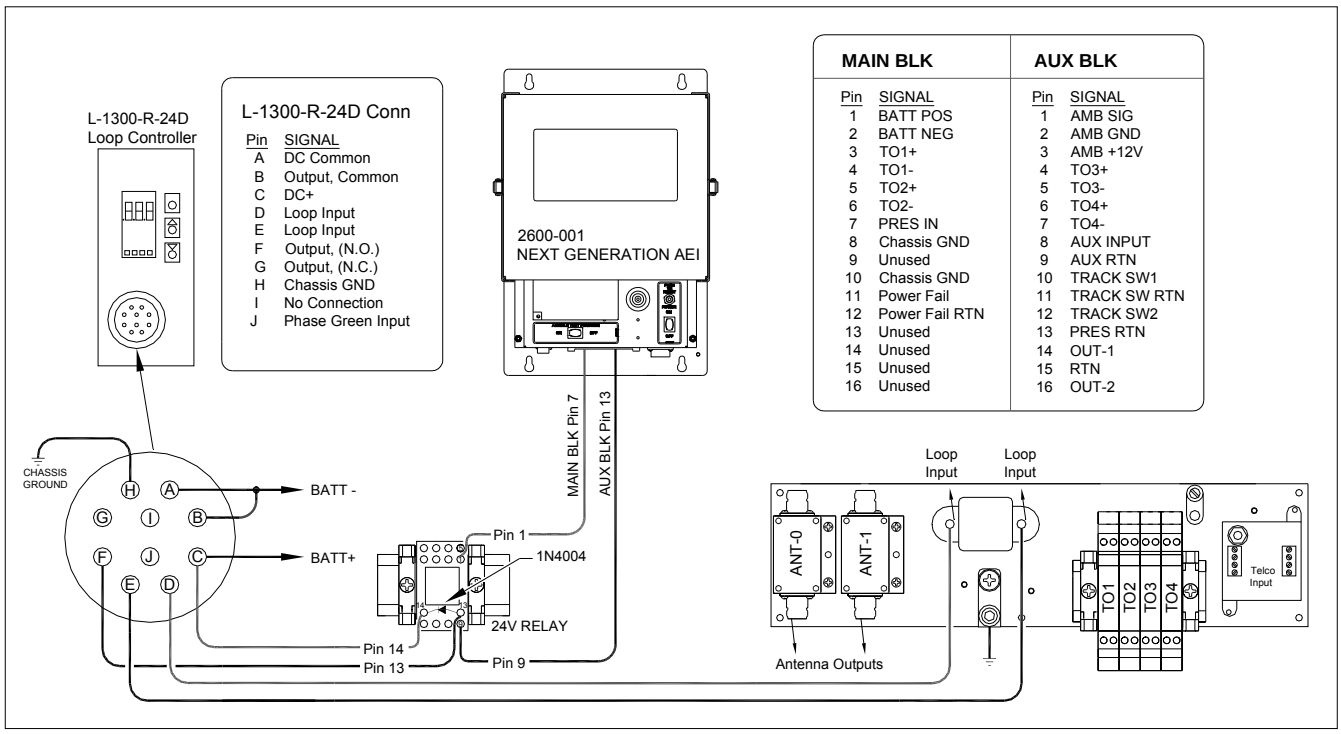
Several diagnostic modes are available to aid technicians and service personnel in troubleshooting detection problems. All programmed settings are stored in non-volatile memory and can only be changed by programming new settings. Loss of power or a detector reset will *not* change any of the programmed settings.

L-1300-R Detector Installation

If your AEI system was purchased as a bungalow package:
You should find the L-1300-R already mounted and pre-wired. Proceed to *Inductive Loop Installation*.

If you are providing your own L-1300-R or upgrading an existing system:

Mount the L-1300-R detector on a wall or shelf in a suitable location near the 2600-600 Surge Panel. The 10-pin circular connector on the front panel provides all the necessary power and I/O connections. This connector will need to be hard-wired and terminated to appropriate points in the AEI system as detailed below.



L-1300-R Wiring Schematic

Inductive Loop Installation

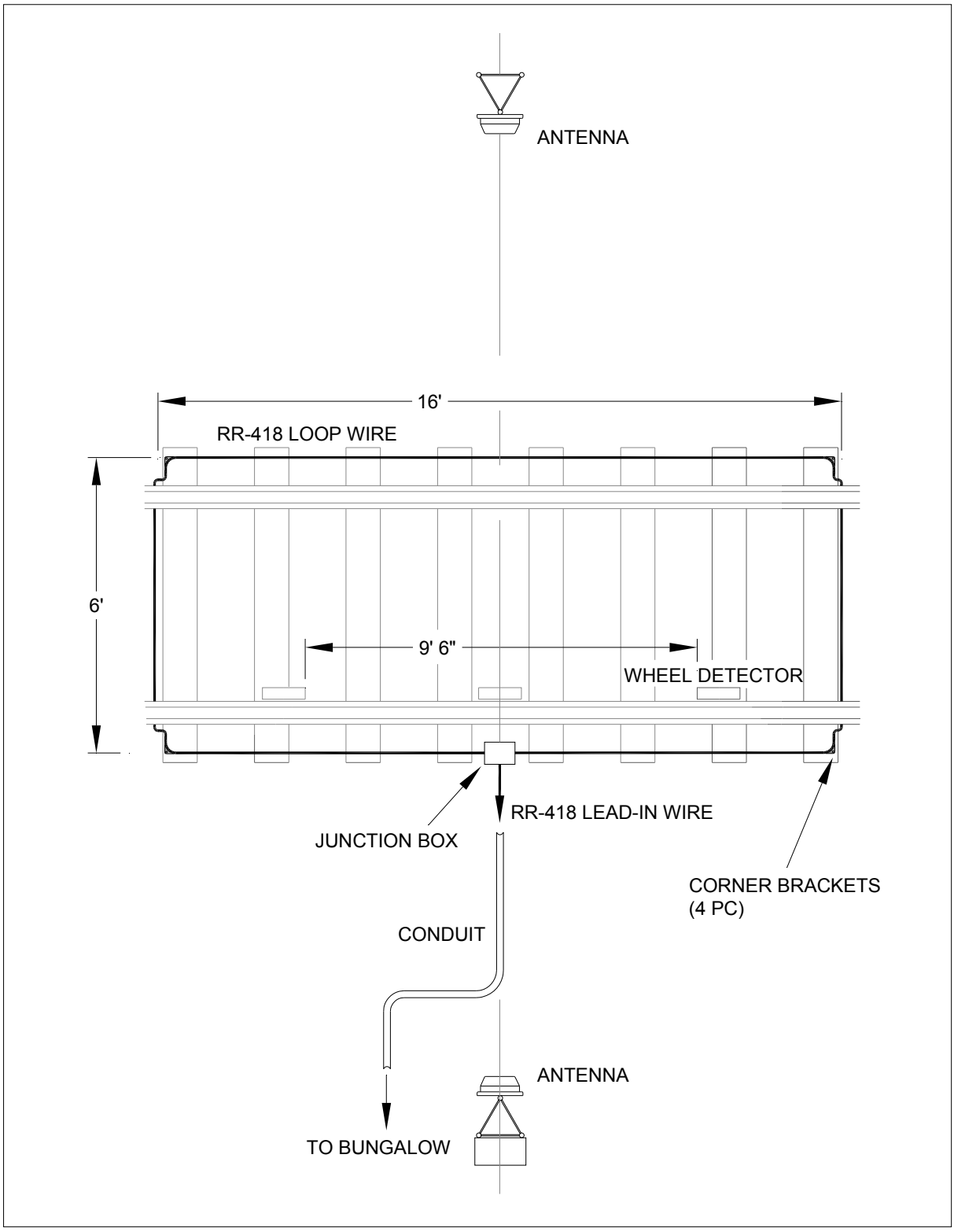
This section describes the installation of the loop/lead-in circuit used with the L-1300-R Inductive Loop Vehicle Detector.

Loop Installation Procedure

Step 1
Locate the Loop Installation Kit consisting of:

- RR-418 cable (18-AWG 4 Conductor)
- Corner Brackets (4 per track)
- PC-1 Circuit Board
- Loop Junction Housing and Backed Mastic Sheet
- Galvanized Strap – 2-Hole (20 per track)
- 8 Penny Galvanized Nails (50 per track)

Refer to *Typical Loop Installation Track View* drawing on the next page for the remaining steps.



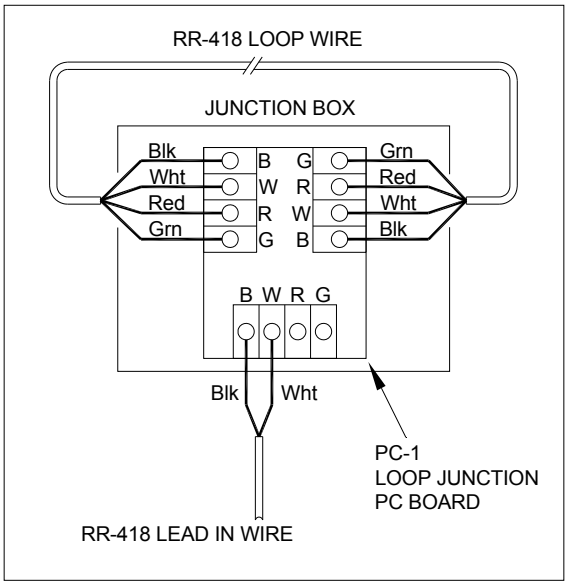
Typical Loop Installation – Track View

Step 2
Lay the RR-418 cable out onto the track to form a 16' x 6' (approx.) rectangular loop. Cut to length. Route the cable underneath the rail. The loop should be centered in relation to the AEI antennas. The cable ends should be butted together and oriented near center of loop on the nearside of the track.

Step 3
Secure the loop cable to rail ties using the corner brackets and galvanized straps provided.

Step 4
Pull a separate run of RR-418 cable through a protective conduit and into the bungalow. Coil the excess cable on the floor. This cable will form the lead-in circuit. Leave enough slack at trackside to reach the loop junction.

Step 5
Splice the loop wires and lead-in wires to PC-1 as depicted below. The Loop Junction PC-1 is a small PC board used to simplify the terminations of an inductive loop and the corresponding "home run" cable. The board terminals are labeled B (black), W (white), R (red) and G (green), and the terminals are color-coded.



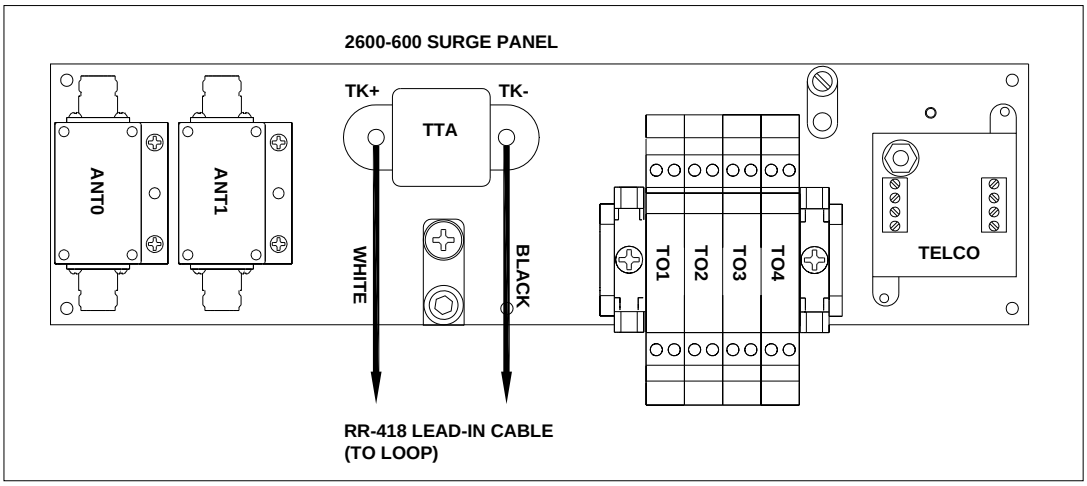
With the loop and home-run cables installed into the appropriate loop junction housing, strip each wire's insulation back approximately 3/8".

Insert each stripped wire end into the appropriate Wago cage-clamp terminal, as follows:

i. Insert a Wago screwdriver (or equivalent) into the desired terminal's actuator slot just above the wire entry slot to lift open the terminal contacts.
ii. Insert wire fully into terminal's wire slot and remove the screwdriver to close the clamp.
iii. Ensure the terminal contacts have engaged the wire conductor, *not* the insulation.

Step 6
Seal the board with the backed mastic sheet. Press the mastic sheet securely to seal each wire and the board. Place the sealed Loop Junction PC-1 into the loop junction housing, and then seal the housing securely.

Step7
Inside the system bungalow, locate the RR-418 lead-in cable and route it to the 2600-600 Surge Panel. Cut to length. Terminate the black and white conductors to the Three-Terminal-Arrester as depicted below. *The red and green conductors are not used.*



L-1300-R Setup/Programming

All operating parameters can be adjusted from the front panel via three normally open pushbutton switches. The detector continues to operate normally while it is in the Program mode. Pressing the FUNC button enters the Program mode. The FUNC button has an auto- repeat function, which allows quick navigation to the desired parameter. The FUNC button only moves forward through all of the parameters; there is no way to move backwards through the parameters. Pressing and holding either the ▲ (UP) or ▼ (DOWN) button will cause the value of the displayed parameter to change rapidly until the button is released. Pressing and holding the FUNC button for one second will exit the Program mode and return to the Normal mode.

There are eight (8) selectable loop frequency settings (normally in the range of 20 to 100 kHz). To eliminate cross-talk, be certain the loop frequency is set to a different channel from other loops in the vicinity. ***The default setting is Channel 2.***

There are nine (9) selectable sensitivity levels, plus Continuous-Call and Channel-Off. The sensitivity levels are designed so that a one-level increase actually doubles the sensitivity and a one-level decrease halves the sensitivity. A unique bar graph displayed on the LCD makes it easy to quickly set sensitivity at the ideal level for any loop/lead-in network configuration. ***STC recommends an initial sensitivity setting of Level-2***.

True Presence mode can be set from by pressing the ▲ (UP) or ▼(DOWN) pushbutton. When Option 13 is OFF (13.0), the detector operates in the normal Presence mode. When this option is set to 13.1, True Presence is ON. When Option 13 is ON, True Presence will hold the call for as long as the vehicle is present and power is not removed or the detector reset. ***Option 13.1 is the recommended setting.***

Factory Reset

If the detector is not new from the factory, it may be advantageous to reset the detector back to the factory defaults prior to programming. First, press and hold all three pushbutton switches simultaneously for five seconds. When all three buttons are depressed, the display will start counting down, from five (5). When the countdown reaches zero (0), releasing the pushbuttons will reload the factory defaults and reset the detector.

In most applications, the only parameters that need to be modified are **Sensitivity** and **True Presence Mode**. All other parameters should be set to factory default settings. The table below lists all programmable parameters and their recommended settings.

Recommended Settings

Function	Setting
Frequency	2
Sensitivity	2
Presence / Pulse Mode	Presence
Call Delay Time	0
Call Extension Time	0
Max Presence Time	OFF
End-of-Green (EOG)	OFF
Option 1 - Loop Inductance (L) Display	OFF
Option 2 - Loop Inductance Change (-ΔL/L) Display	OFF
Option 3 - Call Extension Control	OFF
Option 4 - Noise Filter Disable	OFF
Option 5 - Phase Green Loop Compensation	OFF
Option 11 - Audible Detect Signal	OFF
Option 12 - Detector Disconnect	OFF
Option 13 - True Presence Mode	13.1
Option 14 - Sensitivity Boost	OFF

The table below lists the pinout of the 10-pin circular connector on the L-1300-R-24D Front Panel.

Connector Pinout

Pin	Function
A	DC Common
B	Output, Common
C	DC +
D	Loop Input
E	Loop Input
F	Output, Relay Normally Open (N.O.)
G	Output (N.C.)
H	Chassis Ground
I	No Connection
J	Phase Green Input (Delay Override)

NOTE: Relay contact states are shown with power applied, loop(s) connected, and no vehicle(s) present.

Setting Sensitivity Using the Bar Graph

The bar graph is a graphical representation of the relative change of inductance as seen by the detector. It automatically takes into account the detector's sensitivity setting, loop geometry, configuration, lead-in length, etc. The first bar segment represents the minimum inductance change (set by the sensitivity level) necessary for the detector to output a call. Each additional segment to the right represents the inductance change in excess of the next sensitivity threshold. Usually, the larger the vehicle, the greater the -ΔL/L (loop inductance change); thus, more and more segments are displayed. The bar graph can be used as a precise indicator to select the proper sensitivity level. If the bar graph displays five or six segments for a vehicle in the loop, the sensitivity has been set to the proper range.

Troubleshooting Loop Failures

If the total inductance of the loop input network goes out of the range specified for the detector, or rapidly changes by more than ±25%, the detector will enter the Fail-Safe mode and LOOP FAIL will display on the LCD. The type of loop failure will also be displayed as L lo (for -25% change or shorted loop conditions) or L hi (for +25% change or open loop conditions). This will continue as long as the loop fault exists. Fail-Safe mode generates a continuous call in True Presence mode and in Pulse mode. At the time of a loop failure, the detect LED will begin to flash at a rate of three flashes per second. The LED will continue this display pattern until the detector is manually reset or power is removed.

If the loop self-heals, the LOOP FAIL message on the LCD will extinguish and the detector will resume operation in a normal manner; however, the LED will continue the three-flashes-per - second display pattern, thus providing an alert that a prior Loop Fail condition has occurred. Each loop failure is counted and accumulated into the Loop Fail Memory. The total number of loop failures for the detector is written into the Loop Fail Memory (since the last power interruption or manual reset) and can be seen by stepping through the functions in Program mode to the LOOP FAIL display.

This is a useful tool to identify intermittent loop problems. If the count is extremely high for the period of time observed, the problem is very likely a loose connection (check for loose connections at the terminal strip and bad splices in the field). The Loop Fail Count is reset when power is removed from the detector. This prevents the Loop Failure Count from moving to another loop, if the detector is moved to a new location.

To view the Loop Fail Count, repeatedly press the FUNC button until the LOOP FAIL display is shown. The Loop Fail Count display is after the OPTION displays. Pressing the ▲ (UP) or ▼ (DOWN) button while the Loop Fail Count is displayed will reset the count to zero.

NOTE: *The Loop Fail Count is not reset when the detector's sensitivity or frequency is changed. The prior Loop Fail indication will continue until the Loop Fail Count is reset to zero.*

Chapter 4 — Installation of the 2600 AEI Controller in an Existing Bungalow

4.1 Installation of the 2600 AEI Controller in an Existing Bungalow

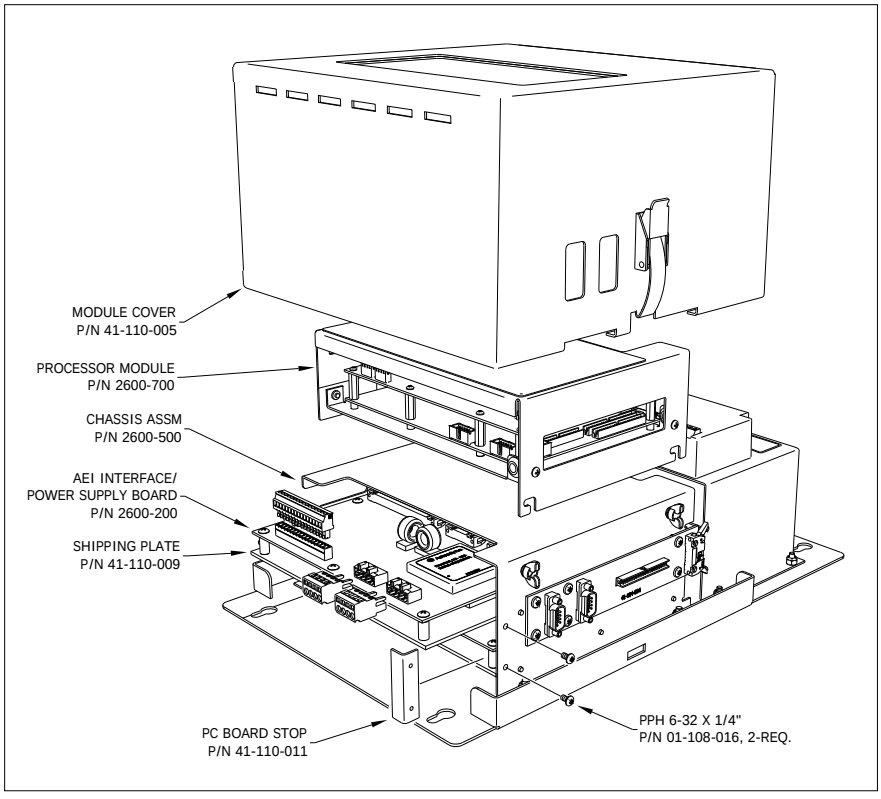
If your equipment was received pre-mounted in a bungalow package, go to Section 5.0.
If your 2600 Next Generation AEI Controller came pre-equipped with an AI1200 Reader, proceed to Section 4.2.

4.2 Recover and Install AI1200 Board from Legacy AEI Reader System

1. If applicable, remove all power and unplug all associated cabling supplies from the legacy AEI system. Remove legacy AEI electronics package from its mounted position on the panel board.

2. Locate and retrieve the AI1200 Reader board(s) from the existing legacy system (two AI1200s if system is to be configured with dedicated readers).

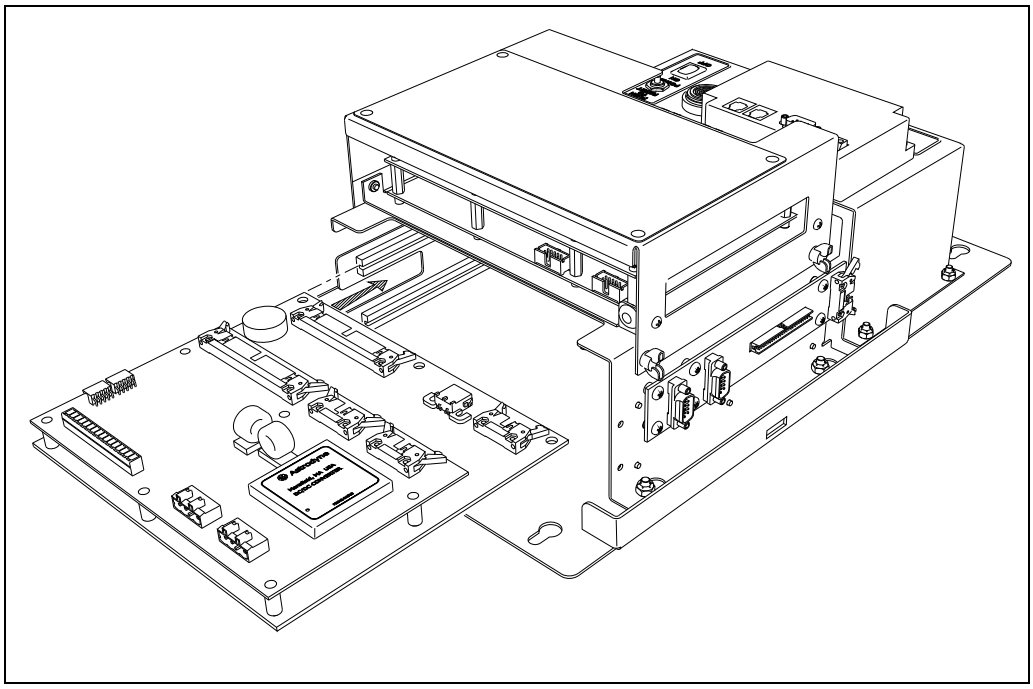
3. Remove Module Cover from 2600-001 by unhooking the two draw latches.



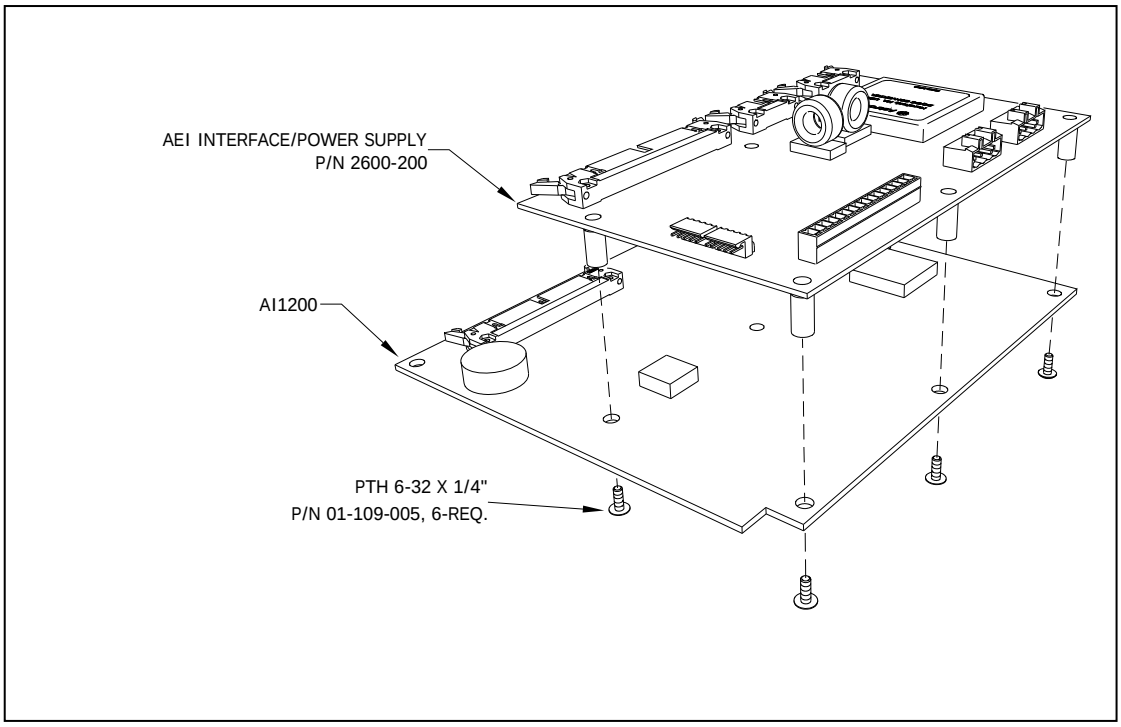
Model 2600 Reader; AI1200/Power Supply Board Access

4. Locate the 2600-200 Interface/power supply board inside the chassis assembly docking bay. Looking in from the top of the unit, you will find it has been temporarily mounted to an aluminum plate (for shipping purposes). Disconnect the wire harness from terminal blocks J3, J4, and J7 (top of board). Also disconnect the flat cable connected to J6 (right-hand side of board). Remove the PC board stop (41-110-011). Carefully slide the 2600-200 up and out of the card guides.

5. Transfer the 2600-200 from the shipping plate to the AI1200 Reader board. Using the same six 6-32 x ¼" PTH fasteners, mount as depicted below. Visually inspect the space between boards to ensure a minimum 1/8" air gap exists from all AI1200 components to the bottom of the 2600-200 board.

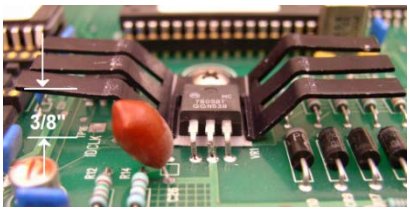


Removal/Installation of A11200/Power Supply Board



Mounting Power Supply Board to AI1200 Board

NOTE:
Clearance issues may be encountered when reusing certain "older revision" AI1200 boards during a legacy upgrade application, specifically on those boards that have a thermal heat sink (TO-220 package) on voltage regulator VR1. When assembled in the board-stack arrangement, the heat sink can come in contact with the underside of the 2600-200 power supply and can possibly cause electrical shorts between pins.

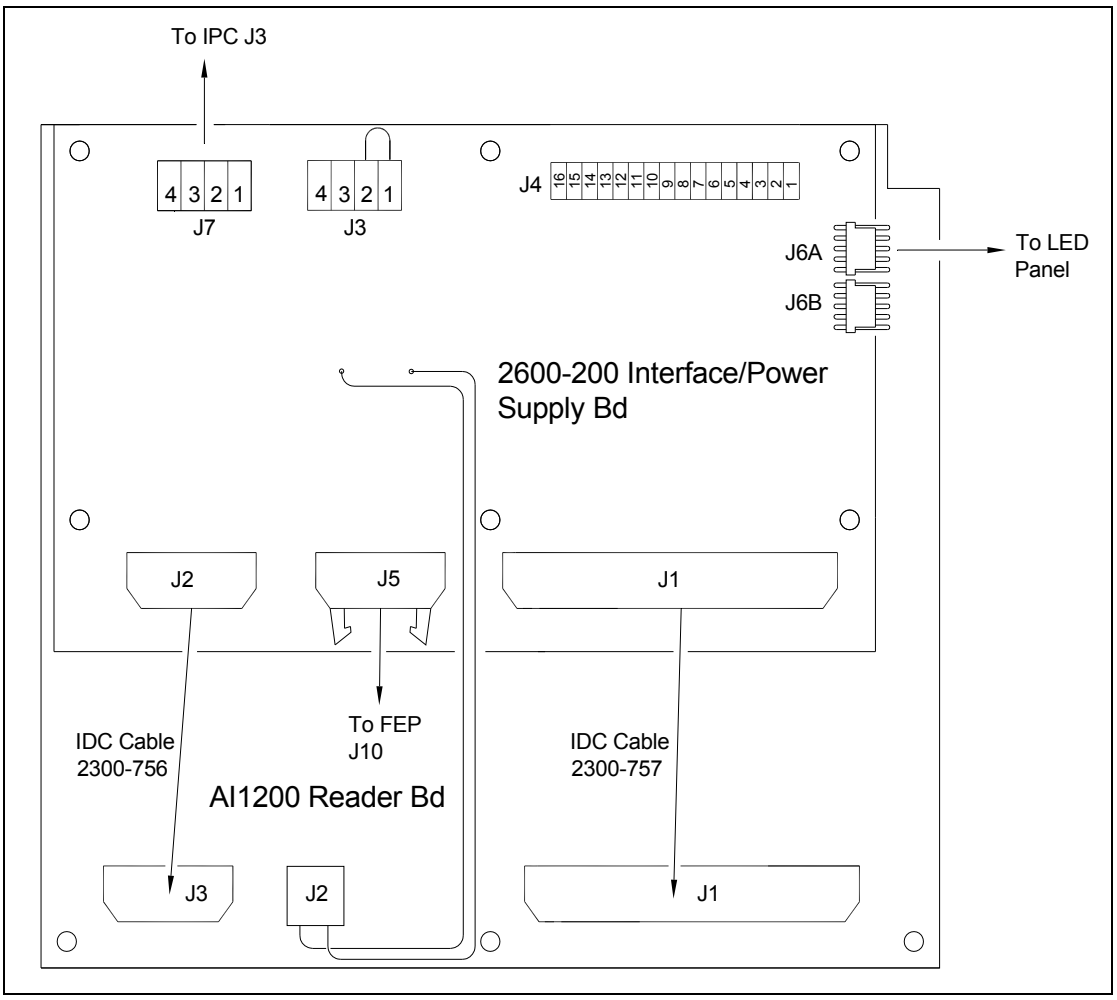


Using a pair of needle-nose pliers, gently bend and reform the fins of the heat sink so that the overall height is reduced to 3/8" or less.

Be careful not to allow the heat sink to come in contact with adjacent components on board.

1. Make all necessary board to board connections (as detailed in following figure):
   - 2600-200 J1 to AI1200 J1
   - 2600-200 J2 to AI1200 J3
   - 2600-200 J5 to FEP J10
   - 2600-200 J6A or J6B to LED Panel
   - 2600-200 J7 to IPC J3 **(NOTE: This connection is made for Reader1 only – the topmost board set)**
   - 2600-200 12V Power Cable to AI1200 J2

2. Slide assembled board-stack back into the card guides of the PCB Mounting Bracket. Reconnect wire harness to terminal blocks J7, J3, J4, and J6A(B). Replace PC board stop (41-110-011).

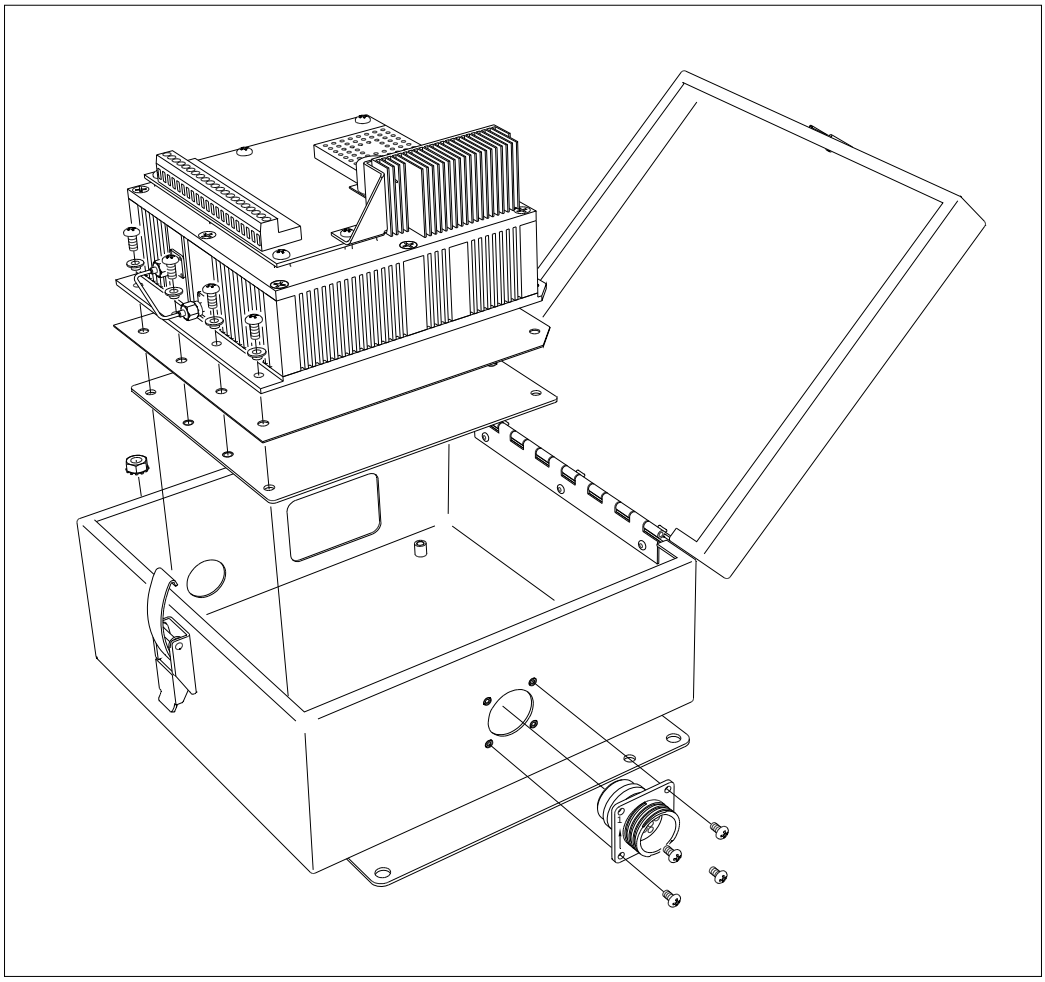


Cable Connections, AI1200/Power Supply Board

3. Replace and latch the Module Cover onto the 2600-001.

4.3 Reader Module

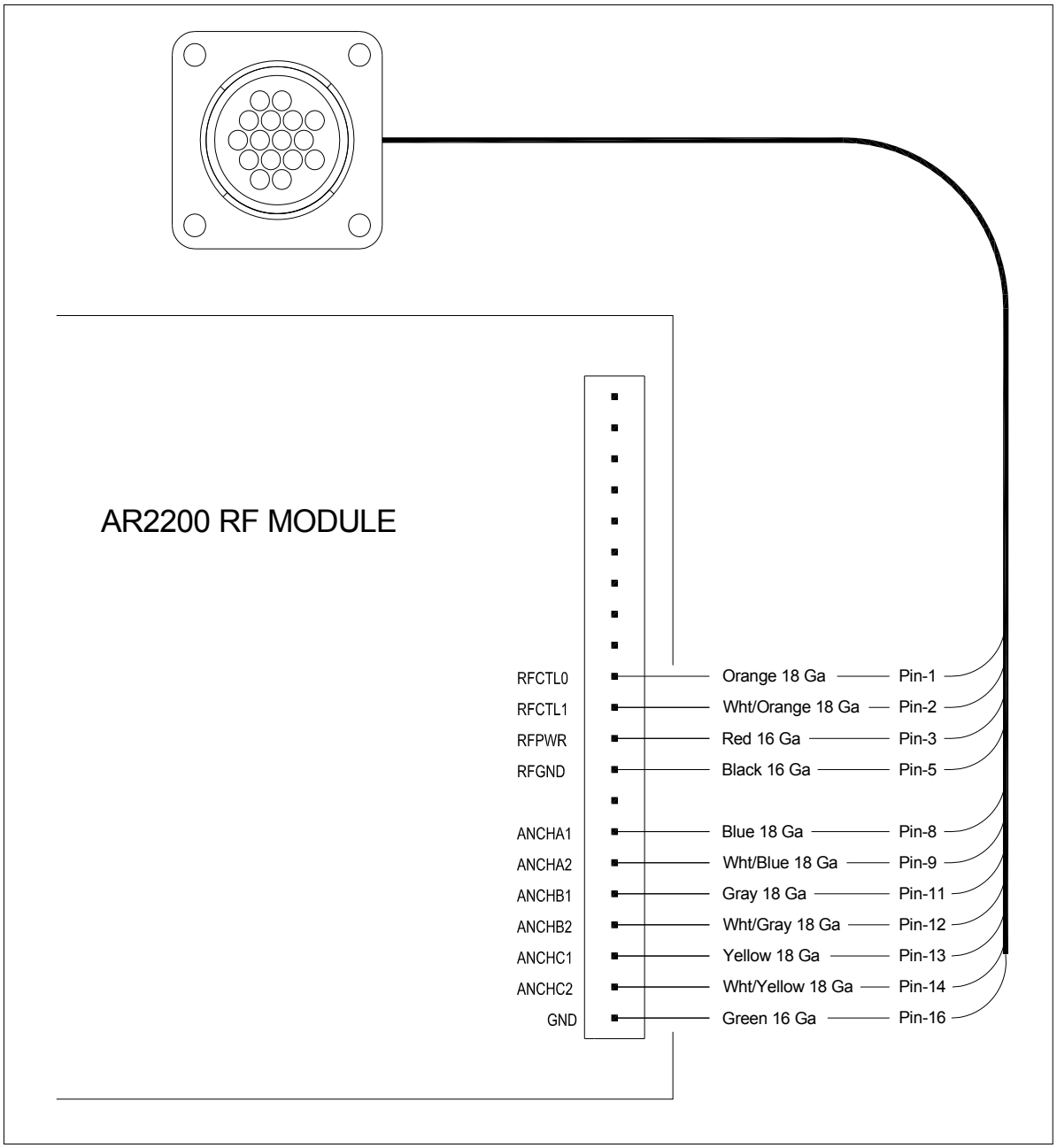
If your system came with a 2600-755 Reader Module (No RF unit), then you will need to recover a TransCore AR2200 RF Module from your legacy AEI system and install it in the 2600-755. Mount the RF Module with existing fasteners as depicted on the following page.



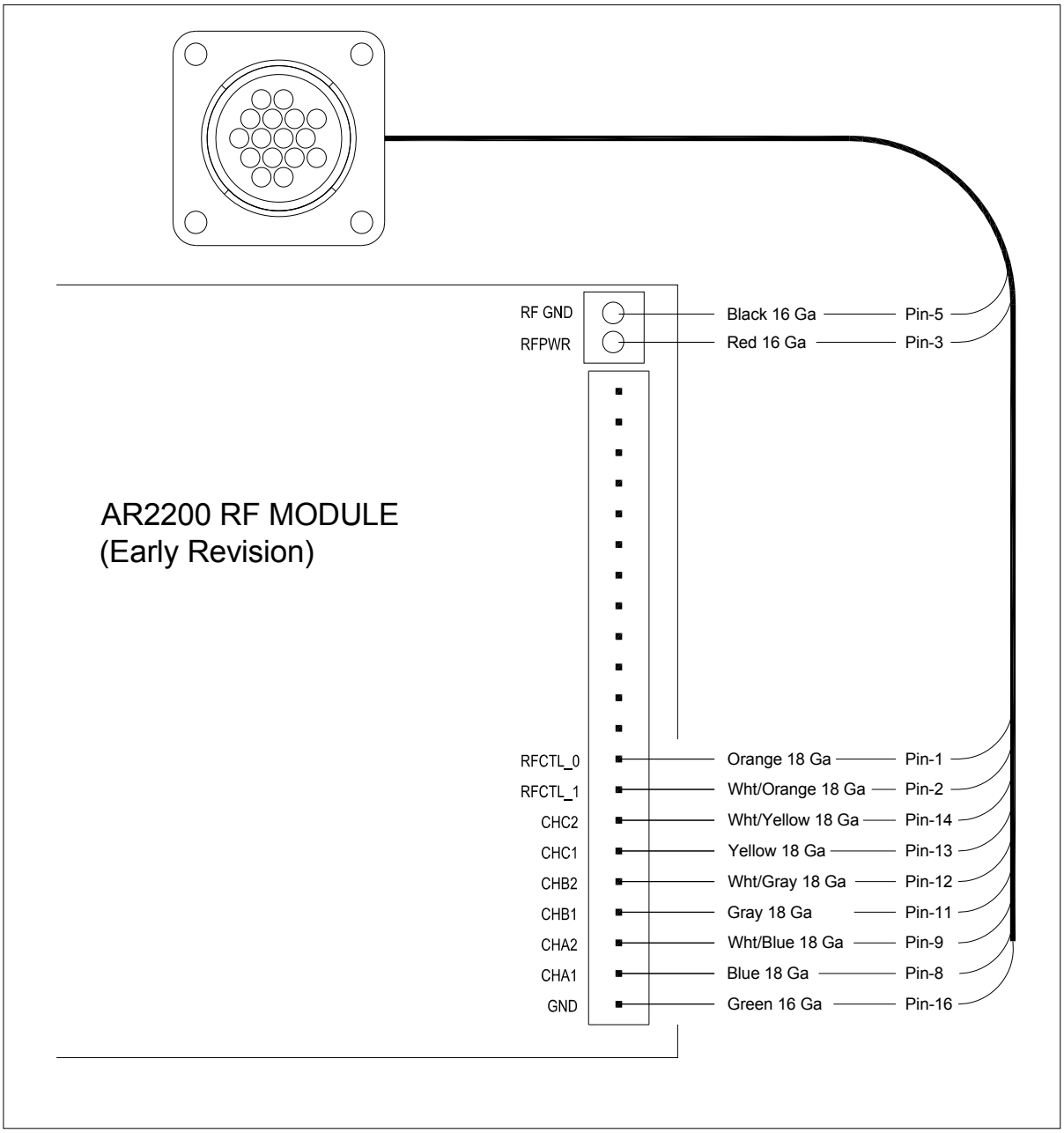
2600-755 Reader Module—Exploded View

The 2600-755 enclosure comes pre-wired, making the upgrade fast and simple. Simply plug the wire harness into the header on the newly installed AR2200.

NOTE: Some early revisions of the AR2200 have a non-pluggable header and are not compatible with the 2600-755 harness connector. In such cases, the harness will have to be rewired straight to the header. *See wiring detail drawings on the next two pages for pinout/wire assignments.* In addition, these early revisions may have clearance issues in the area of the antenna outputs. This issue can be resolved by mounting the AR2200 onto the included adapter plate (STC # 41-105-319).



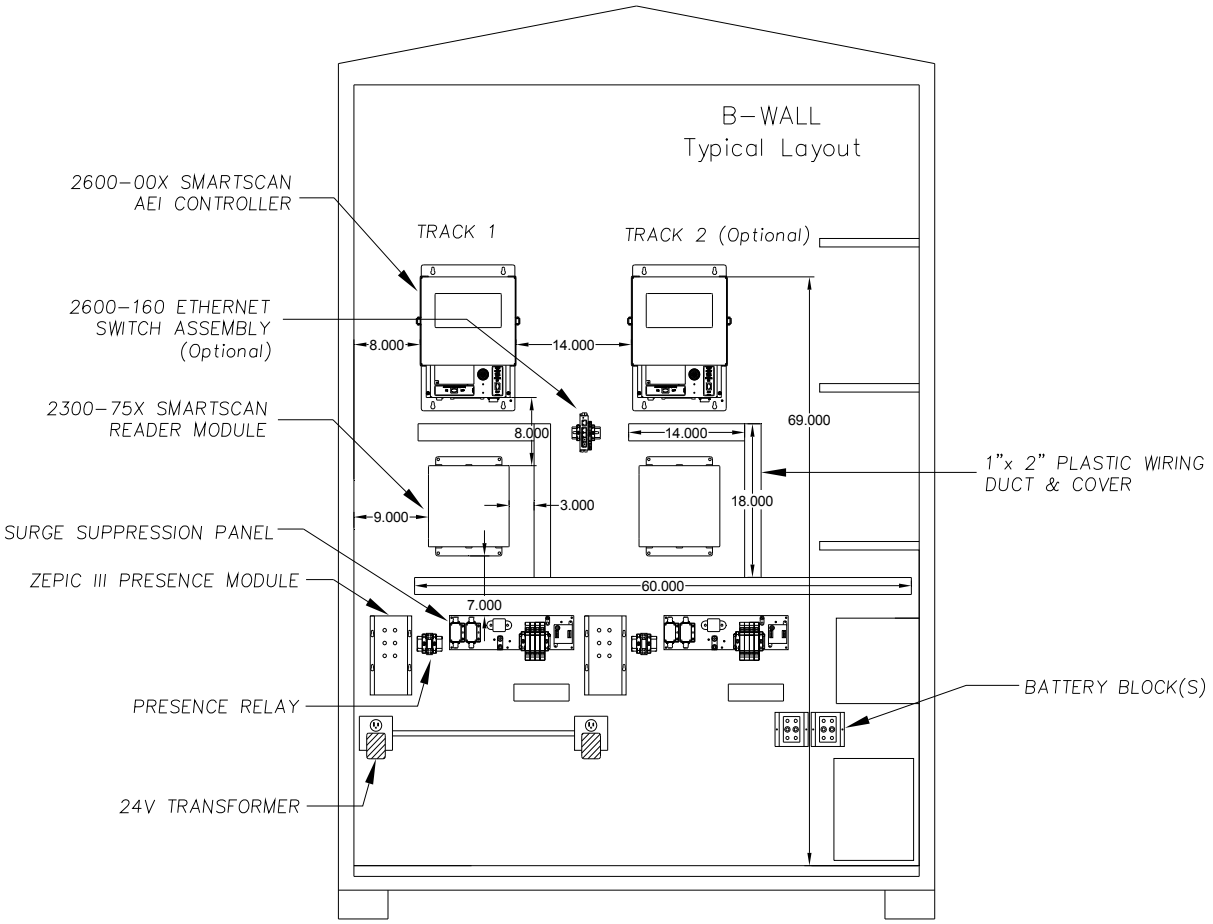
2600-755 Wiring Detail—Standard



2600-755 Wiring Detail – For Early Revisions of AR2200 RF Unit

4.4 Mount System Components in Bungalow

The figure below depicts a “typical” layout for a 2600 AEI system. Your system components should be securely mounted to the bungalow wall using appropriate mounting hardware.



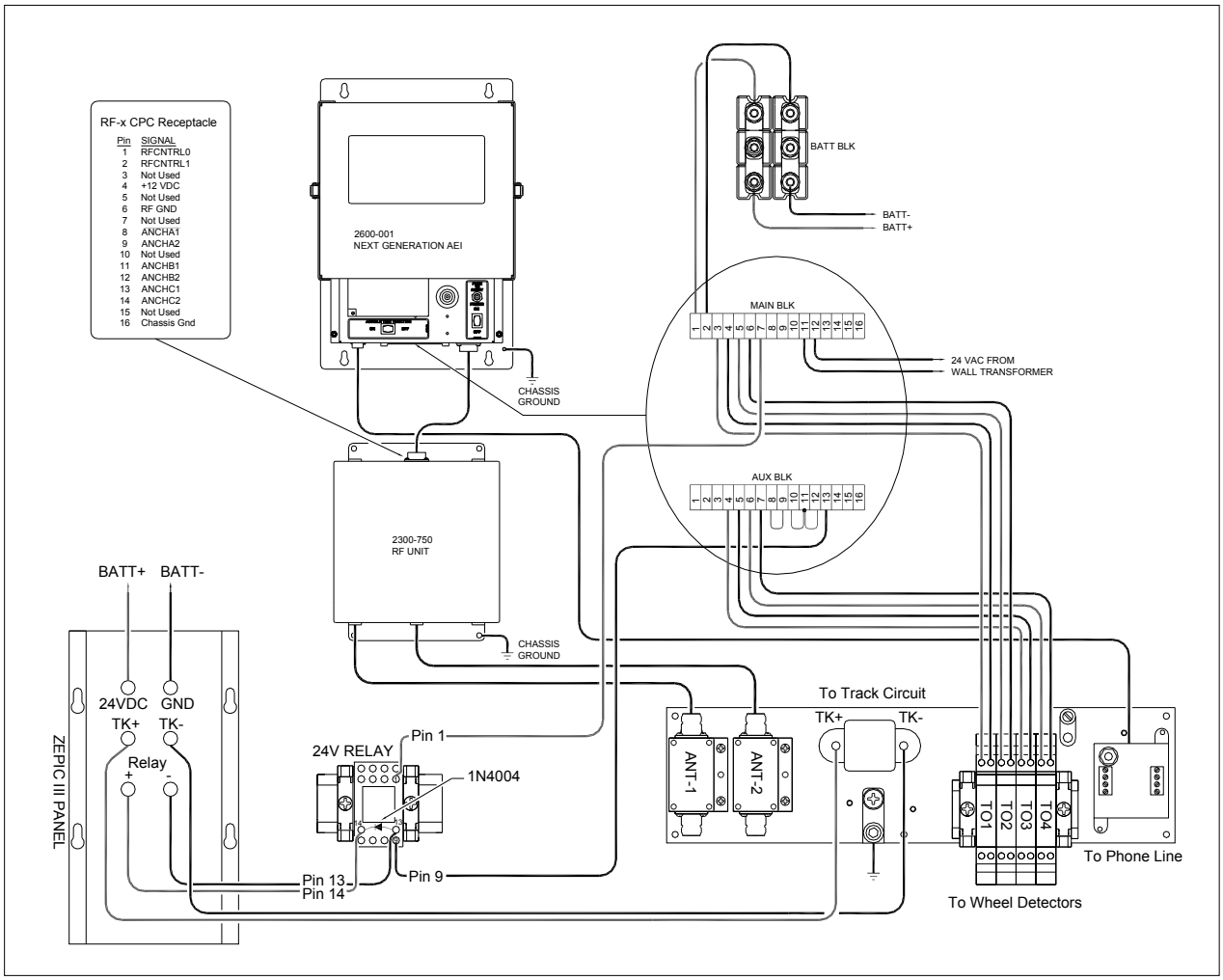
Typical 4’ x 6’ Bungalow

1. For ease of maintenance, the 2600-00x Controller should be mounted so that its Status Panel is approximately eye-level with the maintainer. The 2600-75x should be mounted directly below the Controller.

2. Locate and mount the 2600-600 wheel detector Surge Suppressor Assembly that was supplied with your system. By design, most surge arresters cannot provide effective protection unless they are properly grounded. Using the provided ground lug, tie the copper plate to a driven earth ground.

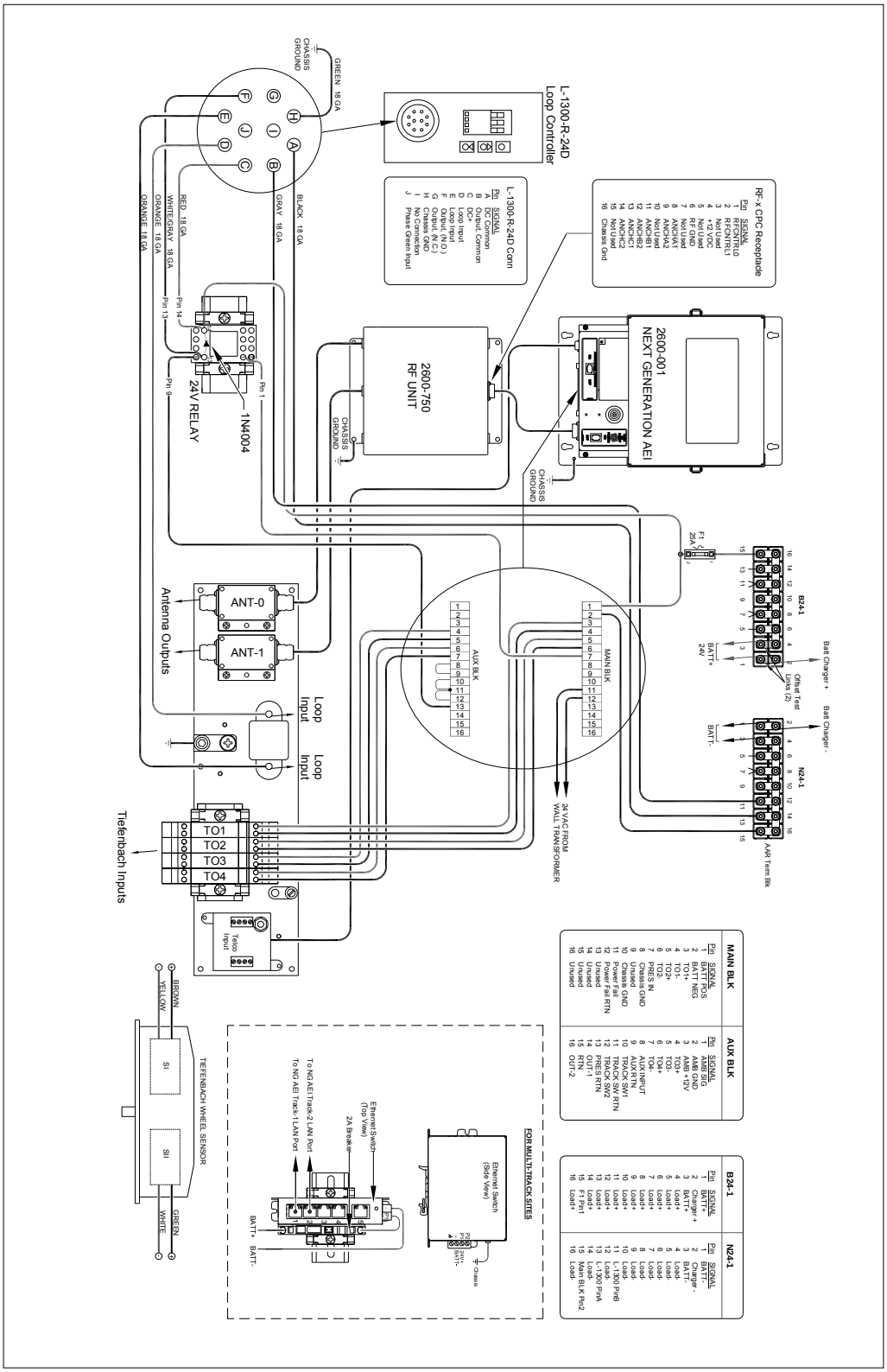
3. Install and route system wiring as indicated (*see figure next page*). Be certain to maintain proper polarity as indicated.

4. Tie the chassis of the Controller and the Reader module to earth ground. There is a threaded stud located on the bottom right side of the base plate that can be used for this purpose.



2600 AEI System Wiring Schematic (refer to enlarged image in Appendix)

NOTE: The Tiefenbach signal amplifier modules used on some legacy AEI systems are not required for the 2600 Controller and should not be used.



2600 AEI System Wiring Schematic for CN Railway (refer to enlarged image in Appendix)

NOTE: The Tiefenbach signal amplifier modules used on some legacy AEI systems are not required for the 2600 Controller and should not be used.

Connector Pinout for Main Block

PIN	SIGNAL
1	BATT POS
2	BATT NEG
3	TO1+
4	TO1-
5	TO2+
6	TO2-
7	PRES IN
8	Chassis GND
9	Unused
10	Chassis GND
11	Power Fail
12	Power Fail RTN
13	Unused
14	Unused
15	Unused
16	Unused

Connector Pinout for Aux Block

PIN	SIGNAL
1	AMB SIG
2	AMB GND
3	AMB +12V
4	TO3+
5	TO3-
6	TO4+
7	TO4-
8	AUX INPUT
9	AUX RTN
10	TRACK SW1
11	TRACK SW RTN
12	TRACK SW2
13	PRES RTN
14	OUT-1
15	RTN
16	OUT-2

NOTE: Aux Input and Track Switch 1 and 2 are designed to be connected to the "normally closed" contacts of the external device. The input is considered active when an "open circuit" is sensed. Hard-wire jumpers should be placed across all unused inputs. (For example, if Aux Input is unused, short Pins 8 and 9 of Aux Block together.)

Chapter 5 — Installing a System Bungalow

5.1 Selecting a Site

When selecting a site, consider the following criteria. The site should be:

- on level, well-drained ground (avoid low areas where flooding may occur);
- at least 300’ (91.4 m) from the nearest road crossing;
- by a track that is on-gauge (avoid placing track hardware in curves);
- by a roadbed that is tamped, stable, and well maintained.

5.2 Preparing the Wayside Enclosure

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

2. Level the wayside enclosure.

3. On the side of the wayside enclosure, drive at least one 8’ (2.4-m) or longer ground rod into the ground.
   Ground connectors, with attached copper wire, are welded to the underside of most wayside enclosures.

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

5. If your system has a cellular modem, go to step **8**.

6. Supply the site with normal telephone service.

7. Complying with all applicable codes and inspections, bring the telephone line into the wayside enclosure.
   In a later section, this telephone line will be wired to a surge protector in the SmartScan enclosure.

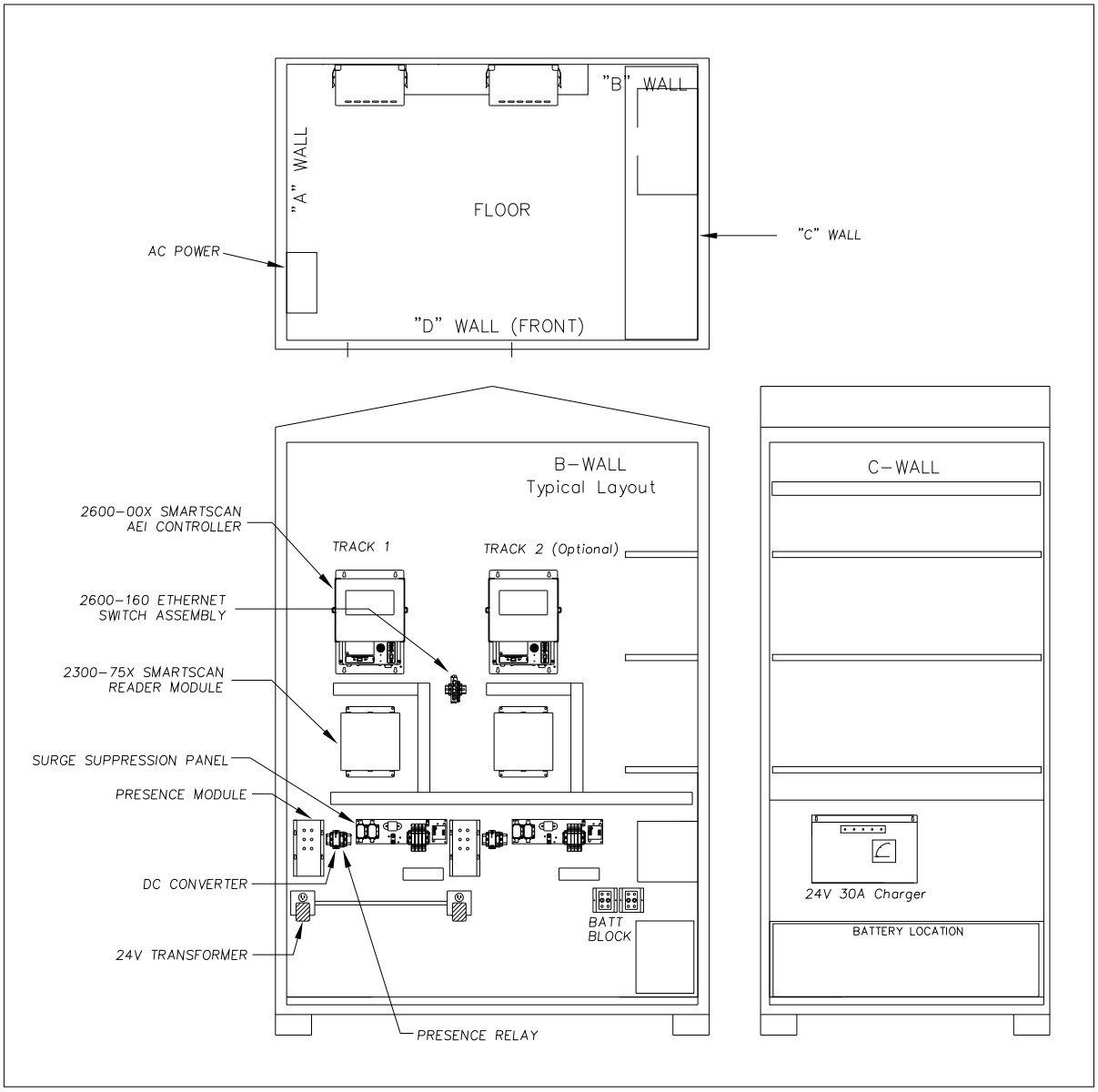
8. Supply the site with a stable AC power source of at least 110 volts at 20 amperes.

9. Complying with all applicable codes and inspections, bring the outside power line to the circuit-breaker box inside the wayside enclosure.
   The next step will remove power from the circuit-breaker box to the rest of the wayside enclosure.

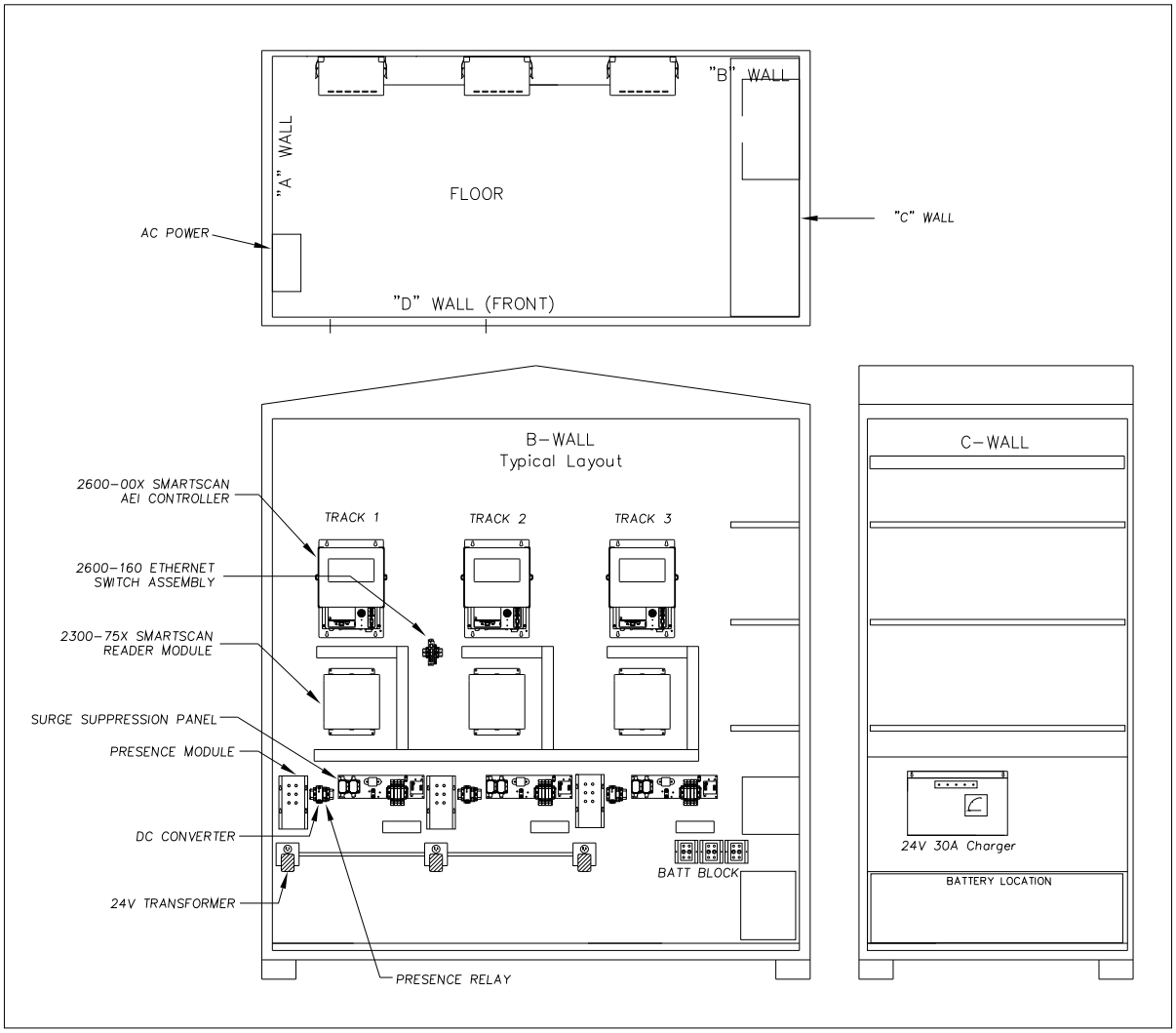
10. Toggle off all breakers in the circuit-breaker box.

11. Complying with all applicable codes and inspections, wire the power line to the circuit-breaker box. *You can also wire the power line to a surge protector and then to the circuit-breaker box.*

12. If not done already, wire from the circuit-breaker box to a grounded outlet.
    Most times, equipment is removed from walls during shipping. Mount all system components at this time with supplied hardware in the pre-drilled mounting holes.



Typical 4' x 6' Bungalow Layout (refer to enlarged image in Appendix)



Typical Triple Track 4' x 8' Bungalow Layout (refer to enlarged image in Appendix)

Chapter 6 — Placing the Model 2600 Next Generation AEI Controller into Service

6.1 Placing the Model 2600 AEI Controller into Service

Before applying power to the system for the first time, verify the following:

- ✔ The Tiefenbach double-wheel detectors are mounted, aligned, spaced 9'-6" apart, and wired to the wheel detector Surge Suppressor Assembly. If application calls for a single Tiefenbach double-wheel detector, make sure it is mounted, aligned, and on centerline with system antennas.
- ✔ The reader antennas are mounted directly opposite each other and are centered between the wheel detectors. The northernmost or easternmost antenna is connected to the Antenna-0 output of the AR200 RF unit, and the southernmost or westernmost antenna is connected to the Antenna-1 output.
- ✔ The 2600 AEI Controller is securely mounted in wayside enclosure and is properly grounded.
- ✔ The presence subsystem is properly installed and its output is connected to the controller.
- ✔ The float-controlled 24VDC battery subsystem is in place, has the proper voltage, and is connected to the appropriate terminals of the controller.
- ✔ All system wiring has been completed and verified; the Main and Aux terminal blocks are connected and firmly seated; the AR2200 RF unit is connected; the phone line and/or Ethernet cables are connected (if applicable).

Apply power to the 2600 Controller with power switch on the Connector Panel.

- ✔ Verify that the various system voltages are indicated on the LED Status Panel (see Section 7.1).
- ✔ Connect a laptop running a terminal emulation program (i.e., HyperTerminal, ProComm, etc.) to serial port COM-2. Establish communications with Controller via the UI. Comm settings (19200, N, 8, 1.)
- ✔ Set up time, date, and site parameters.
- ✔ Simulate a train. Activate Presence, and hand stroke several axles on the wheel detectors with a wrench. Pass a test AEI tag(s) in front of each antenna. Verify that the indicators on the LED Status Panel illuminate when their respective input becomes active.
- ✔ Set the "Audible Test Tone" switch to the ON position and pass a test AEI tag in front of each of antenna. The system will issue a loud "beep" each time an AEI tag is read.
- ✔ Review the Train Detail Report for a manually generated "test train" to verify system operation (see Section 7.5.2).
- ✔ Set up and enable T-94 Session(s).

Calibrate/Align Tiefenbach Wheel Detectors

Tiefenbach calibration/alignment is critical for generating the accurate axle data needed for vehicle breakout algorithms. Calibration is easily achieved using the 2600-810 Tiefenbach Precision Alignment System. The 2600-810 is a portable device that is used in conjunction with the 2600-800 Wheel Detector Gauge. The 2600-810 consists of a sensor plate and a display board housed in a weatherproof case. The sensor plate attaches to the front of the AEI Status Panel and monitors the state of each wheel detector input during calibration. The display board provides high-intensity LED indicators that can easily be seen from the rail, thus making the Tiefenbach alignment procedure a one-man operation.

NOTE: If a 2600-800 Wheel Detector Gauge and 2600-810 Tiefenbach Precision Alignment System are not available at your site, a simple gross calibration can be performed (see Section 3.12, Step 7).

Instructions for 2600-810

1. Unlatch and remove the cover from the 2600 AEI Controller during the calibration procedure.

2. Open the 2600-810 case and locate the sensor plate and 24-VDC power supply (wall transformer). Gently place the sensor plate over the AEI Status Panel (see Figure-1). The press nuts in the sensor plate will slide into the four existing holes in panel to achieve proper alignment. Ensure the plate is flush against the panel. Temporarily secure by hooking retainer springs into the slotted holes on the AEI base. Plug in the wall transformer to the 110-VAC outlet and connect to the power jack (*see Figure 2)* on the sensor plate.

3. Position the 2600-810 case so that the display board inside its lid can be viewed from the rail.

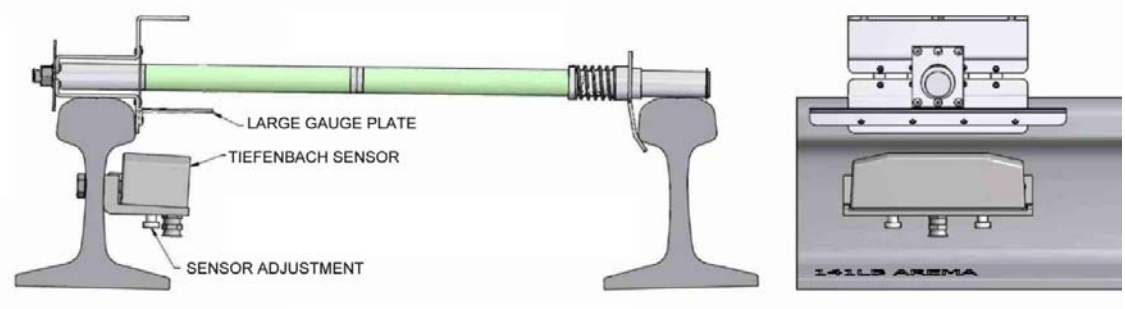
4. Locate and place the 2600-800 Wheel Detector Gauge across rails so the large-gauge plate is positioned directly over the “A-Pair” Tiefenbach wheel detector. Make sure the gauge is properly seated on the railhead (*refer to illustration, next page*).

5. At the bottom of the wheel detector, unscrew the knurled protective plastic nuts off of the adjustment screws. Locate the brass adjustment tool that came packaged with your Tiefenbach wheel detector. Screw on the tool and tighten without pushing the adjustment screw out of its adjustment protector. Force should not be used to turn the adjusting screw; otherwise, the adjustment protection may be damaged. Push the adjustment tool upwards to unlock the protection mechanism. *Note: A 3mm hex bit (included) can be used in lieu of a brass adjustment tool.*

6. **Calibration**
   Calibration should begin with detectors in the inactive state (LED indicators off). If necessary, deactivate the detector by reducing the sensitivity (turn adjustment screw to left). Each element of the dual detector should be set to the “activation threshold” with the target (large-gauge plate) in place. Begin with TO1, which is the northernmost or easternmost detector. Slowly turn the adjustment screw to the right until detector just activates (the corresponding LED indicator on 2600-810 will illuminate). Next, set the TO2 detector to the “activation threshold” in a like manner. *Detectors are now calibrated.*

(Calibration cont.)
Remove the adjustment tool. Screw on the knurled nut again and lightly tighten. If a second dual wheel detector ("C-Pair") is used in your system, relocate the 2600-800 Wheel Detector Gauge and repeat the calibration process on the TO3 and TO4 detectors. TO4 is the southernmost or westernmost detector.

7. Remove the sensor plate from the AEI Controller and store it in its 2600-810 case, and then replace the cover on the 2600 AEI Controller.



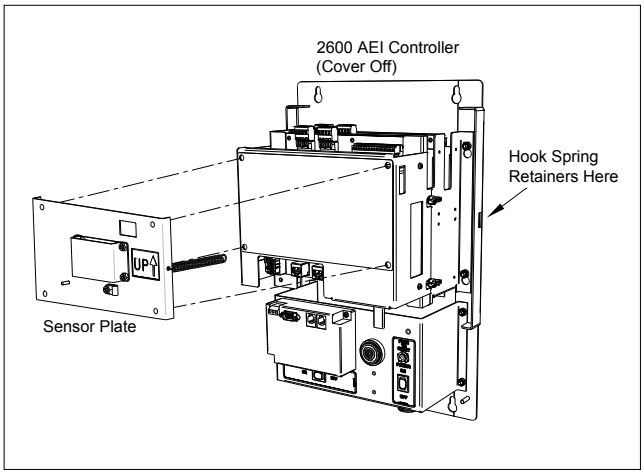


Figure 1: Mounting of the Calibration System Sensor Plate onto the 2600 Reader Status Panel

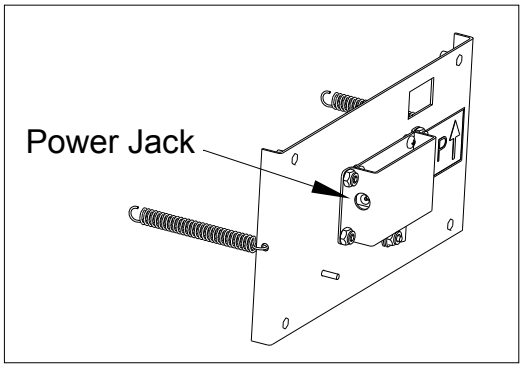


Figure 2: 2600-810 Sensor Plate

Chapter 7 — User Interface

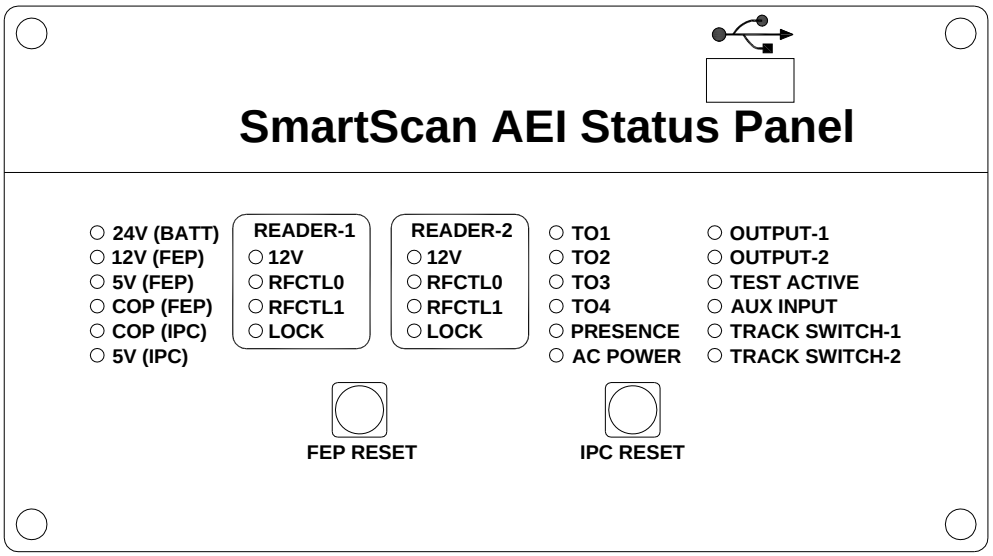
The user interface for the Model 2600 AEI Reader System consists of

- The LED Status Panel
  Provides a snapshot of the system status
- The User Interface Menus
  Provide access to system status, reports, and the system setup options. Menus are available via a system serial port and/or network interface (Telnet, SSH)

7.1 LED Status Panel

The LED Status Panel provides for a quick determination of the system's overall status. It contains:

- indicators for the various system power supplies;
- indicators as to the current status of the reader module(s), wheel detectors, and presence subsystem;
- indicators as to the current status of auxiliary I/O
- reset switches for each of the system processor boards.



The LEDs on the LED Status Panel are effectively divided into four distinct groups. Working from left to right, the columns on the panel could be referred to in this way:

- system power supply and processor status;
- reader module(s) status;
- track equipment status and AC power status;
- auxiliary I/O status.

Using the above “classifications,” the table below provides explanations for the status LEDs.

Power Supply and Processor Status	
24V (BATT)	Indicates whether the 24V supply from the system batteries is present
12V (FEP)	Indicates whether the 12V supply, generated on the FEP board, is present
5V (FEP)	Indicates whether the 5V supply, generated on the FEP board, is present
COP (FEP)	Indicates status of FEP board • normal operations, idle = “heartbeat”; slow phase-in, phase-out • normal operations, train present = blinks pattern: short, long, short, long, short • boot-up/CRC check = quickly flashing • stuck in boot mode = ½ second on, ½ second off, ½ second on, ½ second off ...
COP (IPC)	Indicates status of the IPC board • normal operation = blinks, 1 second on, 1 second off, 1second on, ... • takes approximately 60 seconds after power-on to start blinking
5V (IPC)	Indicates whether the 5V supply for the IPC board is present
Reader Module Status	
12V	Indicates whether the 12V supply for the reader module is present
RFCTL 0	Indicates whether the RF output is activated on antenna #0
RFCTL 1	Indicates whether the RF output is activated on antenna #1
Lock	Indicates when an AEI tag has been “acquired” by the reader
Track Equipment and AC Status	
T01 – T04	Indicates when the referenced wheel detector element is active. These LEDs will be lit when a wheel (or other object, such as a wrench or steel-toe boot, etc.) is positioned over the wheel detector, or there is a break in the wiring between the wheel detector and the Model 2600 Processor module
Presence	Indicates when the presence input to the Model 2600 Processor module is active
AC	Indicates when the system’s AC sense circuit confirms presence of AC service
Auxiliary I/O Status	
Output-1	Indicates when the system's configurable output is active
Output-2	Indicates when the system’s configurable output is active.
Test Active	Indicates that the Audible Test Function is enabled.
Aux. Input	Indicates when the system's auxiliary input is active. *This feature has not yet been implemented in the Model 2600.*
Track Switch-1	Indicates when the track switch being monitored by the system has been thrown one way or the other. *This feature has not yet been implemented in the Model 2600.*
Track Switch-2	Indicates when the track switch being monitored by the system has been thrown one way or the other. *This feature has not yet been implemented in the Model 2600.*

7.2 Tiered Access to System Resources

The Model 2600 AEI Reader's User Interface menus regulate access to the system resources by providing three different login identifiers. The resources available to each of these identities are outlined below.

Accessible Resources			
Login ID	Reports and Logs	System Operations Parameters	System Administration Functions
guest	X		
tech	X	X	
system	X	X	X

7.3 Accessing the User Interface Menus

The primary means of connecting to the Model 2600 are:

- via dial-up modem;
- via a direct RS232 connection to one of the Model 2600's serial ports;
- via network interface, e.g., Telnet, SSH.

When connecting directly to the Model 2600 Reader, the connecting computer's serial port should be configured as follows (19200, N81):

- Baud rate = 19200
- Parity = None
- Data Bits = 8
- Stop Bits = 1

A null-modem cable is required to connect a computer directly to one of the system serial ports.

Login Prompt
Upon successful connection to the Model 2600, the login prompt shown below will be presented:

```
Southern Technologies Corp.
SmartSCAN 2600 AEI Reader

Enter "guest" or "tech" To Proceed
debian login:
```

Login Prompt

Guest Login and Password
When logged into the system as “guest,” all reports and system logs are available for printing/review.
For operating firmware released prior to September 2014:

- The default password for the guest identifier is **guest**

For operating firmware released after September 2014:

- The default password for the guest identifier is **guest@2600**

Tech Login and Password
When logged into the system as “tech,” system reports and logs are available for printing/review. In addition, the parameters that govern system operations are available for modification. Such parameters include site configuration and reporting session configuration.
For operating firmware released prior to September 2014:

- The default password for the tech identifier is **tech**

For operating firmware released after September 2014:

- The default password for the tech identifier is **tech@2600**

System Login and Password
When logged into the system with the “system” ID, to those functions available to the “tech” login are added system administration operations such as the ability to set the passwords for each of the three login identifiers and the ability to execute system software updates.

For operating firmware released prior to September 2014:

- The default password for the system identifier is **system**

For operating firmware released after September 2014:

- The default password for the system identifier is **system@2600**

Note: If, upon initial connection to the Model 2600, the login prompt is not presented automatically, press the [Enter] key. This should cause the login prompt to be presented.

7.4 Menus Overview

The following discussion presents an overview of the Model 2600's UI menus. In practice, only when logged in as “system” would all of the menus and functionality actually be available. When logged in as “guest,” only the **Report Menu** (and its submenus) will be presented to the user. When logged in as “tech,” some of the options shown on the **System Functions Menu** are not presented (as noted).

7.4.1 Main Menu

The system's **Main Menu** is presented once the system login process has been completed.

```
STC Model 2600 AEI Reader, Site ID: Cromwell
Tue May 17 11:28:10 EDT 2011
Main Menu
-------------------------------------
  A) Report Menu
  B) Setup Menu
  C) Session Configuration Menu
  D) System Functions Menu
  X) Exit Menu
? _
```

As shown here, the **Main Menu** provides access to the Report Menu, the Setup Menu, the Session Configuration Menu and the System Functions Menu.

Main Menu

7.4.2 Report Menu

The **Report Menu** provides access to the data stored on the Model 2600 as well as information regarding the system's current status and recent operations. When a user is logged in as “guest,” only the **Report Menu** and its submenus are presented.

```
STC Model 2600 AEI Reader, Site ID:
Cromwell
Tue Oct 14 11:30:44 EDT 2014
Report Menu
---------------------------------------
  A) Train Summary
  B) Train Detail
  C) Train Detail (Last Train)
  D) Train Detail (Range Of Trains)
  E) T94
  F) T94 (Last Train)
  G) T94 (Range Of Trains)
  H) System Status
  I) Event Log
  J) Maintenance Log
  K) Diagnostic Report Menu
  X) Exit Menu
? _
```

From the **Report Menu**, data can be viewed in the following formats:

- Summary data that provides an overview of the data currently stored. Summary information for each consist is presented, one line per consist.
- Consist detail data that presents the standing order of a specified train with AEI ID information, as well as vehicle-related data such as axle count
- T94-formatted reports.

- Diagnostic reports (at both summary and detail levels) geared primarily for isolating the causes of operational problems.

The **System Status Report** provides a listing of the current value of all of the system's settable parameters. This includes parameters pertinent to the system's track-side equipment, AEI reader module(s), and the dial-out reporting sessions' status.

The **Event Log Menu** provides methods for examining the contents of a system log used to track the software operations of the Model 2600 Reader. This log would primarily be used to trace the series of events that led to problems detected in the system's operations.

The **Maintenance Log Menu** provides access to entries posted to the maintenance message log. The contents of this log form the basis of the Model 2600's maintenance-reporting function.

The **Diagnostic Report Menu** provides access to reports that are intended for use in diagnosing problems detected in the operations of the system:

1. The Diagnostic Summary Report is effectively an extension of the Train Summary Report, in that it provides more information regarding wheel detector activity and AEI tag reads/reader activity.

2. The Diagnostic Detail Report contains extensive data pertaining to each train, regarding the timing of wheel-detector activity, the timing of AEI tag reads and flags, etc. that indicate how the consist axle records were broken down into vehicle records, etc.

7.4.3 Setup Menu

The **Setup Menu**, below, provides access, for review and modification, to the system' settable parameters related to the train scanning process.

```
STC Model 2600 AEI Reader, Site Name:  Cromwell
Tue Oct 14 11:30:44 EDT 2014
Setup Menu
-------------------------------------------------------
  A) Set Date and Time
  B) Set Time Zone
  C) Site Name                          : Cromwell
  D) Train Scanning                     : Enabled
  E) Multi-Track Site                   : No
  F) Antenna Between Tracks             : N/A
  G) Track Orientation                  : North/South
  H) Wheel Detector Configuration       : Single
  I) Ant. Offset From Wheel Detector    : Ant0: 240"[S]  Ant1: 123"[N]
  J) Maximum Number Of Stored Trains    : 100
  K) Maximum Train Number               : 100
  L) Load Default Settings
  M) Track Hardware Setup Menu
  N) Load or Dump Reader Setup Parameters
  X) Exit Menu
?
```

The **Setup Menu** itself provides access to some general system level parameters, as shown here.

Setup Menu

The **Track Hardware Configuration Menu**, shown below, provides access to the setup parameters that affect the operations of the wheel detectors, the presence subsystem, and the AEI reader module(s). The **Track Hardware Configuration Menu** is shown below.

```
STC Model 2600 AEI Reader, Site Name: Cromwell
Tue Oct 14 11:30:44 EDT 2014
Track Hardware Configuration Menu
-------------------------------------------------------
  A) Presence Timeout Period (mm:ss)          : 00:10
  B) Presence Input Debounce Filter (mS)      : 3
  C) Wheel Detector Pulse Width Filter (mS)   : 3
  D) Wheel Detector Pair Spacing (inches)     : 114
  E) Tag ID Separation (# ID's)               : 2
  F) Tag Uniqueness Timeout (seconds)         : 30
  G) Tag Consecutive Reads                    : 2
  H) Load Default Settings
  X) Exit Menu
?
```

Track Hardware Configuration Menu

7.4.4 Session Configuration Menu

The **Session Configuration Menu** provides access to the parameters that control the automated reporting functions of the system. Reporting “sessions” are used to manage the process of transferring data from the Model 2600 Reader to remote computers. Five sessions are available for managing consist data reporting. Two sessions are available for managing the reporting of system maintenance-related information. The parameters that can be configured for each session include (among others) phone number, site ID, and the protocol to be used to communicate with the remote computer/server.

```
STC Model 2600 AEI Reader, Site ID: Cromwell
Tue Oct 14 11:30:44 EDT 2014
Session Configuration Menu
-------------------------------------------------------
  A) Consist Sessions Menu
  B) Maintenance Sessions Menu
  X) Exit Menu
? _
```

Session Configuration Menu

```
STC Model 2600 AEI Reader, Site Name: Cromwell
Tue Oct 14 11:30:44 EDT 2014
Session 1 Configuration Menu
-----------------------------------------------------------
A) Auto Reporting               : Enabled
B) Site ID                      : TEST5
C) AAR Billing Code             : 00502
D) Time Zone                    : 5
E) Units Of Measure             : English
F) Report Field Delimiter       : (space)
G) Phone Number                 : 1-888-555-1212
H) Baud Rate                    : 9600
I) Report Reverse-out Trains    : Disabled
J) Reporting Protocol           : ns
K) Max Retry Attempts           : 6
L) Retry Delay Time             : 3
M) Minimum Axle Count           : 4
N) Report Raw Tag Records       : Disabled
O) Synch. Clock With Host       : Enabled
P) Header                       : SIH 0000000000 SINGLE      NS
Q) Login ID                     : None
R) Password                     : None
S) Destination Directory        : None
T) Host Name|IP                 : none
X) Exit Menu
?
```

The details of the **Session Configuration Menus** are discussed in section 7.6 of this document.

Session Configuration Menu

7.4.5 System Functions Menu

The **System Function Menu** presents system level configuration and housekeeping options. *Options H, I, and J shown on this menu will be present only when a user is logged in with the "system" ID.*

```
STC Model 2600 AEI Reader, Site ID: Cromwell
Tue Oct 14 09:05:07 EST 2014
System Functions Menu
-----------------------------------------------------------
  A) Configure Network Interfaces Menu
  B) Configure time synch with NTP Server
  C) Delete All Train Data
  D) System Reset Menu
  E) Telnet Pass-Thru
  F) Serial Pass-Thru
  G) Reader Module Direct Comm. Link (Manual RF Functions)
  H) Passwords Menu
  I) Software Update
  J) Override FEP CRC Check
  T) Track Hardware Signal Status
  X) Exit Menu
  ? _
```

The details of the **System Function Menus** are discussed in section 7.7 of this document.

System Functions Menu

7.5 Setup Menu Details

The configuring of parameters that primarily affect the acquisition of consist data is accomplished via the **Setup Menu**, which is one of the four options available on the system's **Main Menu**. A few general, site-related parameters can be accessed directly from the **Setup Menu.** These include time and date, time zone, site name, the enabling/disabling of train scanning, etc. The **Track Hardware Menu** provides access to parameters directly related to the operations of the wheel detectors, antennas and reader module(s) and the presence subsystem.

7.5.1 Setup Menu

Depicted below is the **Setup Menu** from the Model 2600 AEI system. Below that, the entries in the menu are discussed.

```
     STC Model 2600 AEI Reader, Site ID: Cromwell
     Tue Oct 14 11:36:56 EDT 2014
     Setup Menu
     ------------------------------------------------------
     A) Set Date and Time
     B) Set Time Zone
     C) Site Name                          : Cromwell
     D) Train Scanning                     : Enabled
     E) Multi-Track Site                   : No
     F) Antenna Between Tracks             : N/A
     G) Track Orientation                  : North/South
     H) Wheel Detector Configuration       : Dual
     I) Ant. Offset From Wheel Detector    : (applies only to single W/D config.)
     J) Maximum Number Of Stored Trains    : 100
     K) Maximum Train Number               : 100
     L) Load Default Settings
     M) Track Hardware Setup Menu
     N) Load or Dump Reader Setup Parameters
     X) Exit Menu
   ?
```

Setup Menu

Setup Menu Options	
A – Set Date and Time	This option provides a dialog for setting the system date and time.
B – Set Time Zone	This option provides a series of menus that guide the user through identifying the time zone in which the system is located.
C – Site Name	This option is used to specify an identifier for the site/system. This identifier is used in the header of various train data reports, etc. It is not used when generating T94 reports in the dial-out reporting process; session-specific identifiers are specified via the Session Setup Menus.
D – Train Scanning	This option is used to enable/disable the system's train scanning function. When this option is set to “Enabled,” the system will record consist data. When this option is set to “Disabled,” trains that cross the reader site will be ignored. The “Disabled” state can be used in diagnostic procedures.
E – Multi-Track Site	This option is used to specify whether the Model 2600 Reader is installed at a multi-track site. When this option is set to “Yes,” the data gathered for a consist is submitted to a secondary evaluation in an effort to filter out any errant AEI tags read from a train on an adjacent track.

(Setup Menu Options, cont.)

<table>
<tr><td>F – Antenna Between Tracks</td><td>This option is used to specify which antenna is located between the tracks at a multi-track site. This information is used in the filtering of cross-track reads that might occur in a multi-track installation.</td></tr>
<tr><td>G – Track Orientation</td><td>This option is used to specify whether the Model 2600 Reader is installed on a track that is oriented in either the north-south or east-west direction.</td></tr>
<tr><td>H – Wheel Detector Configuration</td><td>The Model 2600 Reader can operate using either a single (dual element) Tiefenbach wheel detector or two (dual element) Tiefenbach wheel detectors. This option on the setup menu is used to specify the wheel detector configuration of a given site – either Single or Dual. Note: The Dual wheel detector configuration is recommended where switching activity or stop-and-go traffic is anticipated.</td></tr>
<tr><td>I – Ant. Offset From Wheel Detectors</td><td>This option is applicable only where a system is configured with a single wheel detector. (This option provides a means for specifying the distance a site's antennas are from being centered on the system's wheel detector.)</td></tr>
<tr><td>J – Maximum Number Of Stored Trains</td><td>This option is used to specify the number of train data files that should be maintained at a given time. The maximum allowed value for this field is 300.</td></tr>
<tr><td>K – Maximum Train Number</td><td>This option is used to specify the maximum number that will be assigned to a train as it is processed by the Model 2600 Reader. Trains are numbered consecutively from 1 to the maximum specified, chronologically. When the specified Maximum Train Number is reached, the next train read will be assigned the number 1. This value must be less than 10,000 and must be greater than or equal to the Maximum Number Of Stored Trains option.</td></tr>
<tr><td>L – Load Default Settings</td><td>This option will set the following setup parameters to the values shown below:

<table>
<tr><th>Parameter</th><th>Default Value</th></tr>
<tr><td>Train Scanning</td><td>Enabled</td></tr>
<tr><td>Multi-Track Site</td><td>No</td></tr>
<tr><td>Antenna Between Tracks</td><td>N/A</td></tr>
<tr><td>Track Orientation</td><td>North/South</td></tr>
<tr><td>Wheel Detector Configuration</td><td>Dual</td></tr>
<tr><td>Ant. Offset from Wheel Detector</td><td>(applies only to single W/D config.)</td></tr>
<tr><td>Maximum Trains Stored</td><td>100</td></tr>
<tr><td>Maximum Train Number</td><td>100</td></tr>
</table>
</td></tr>
<tr><td>M –Track Hardware Configuration Menu</td><td>This option causes the Track Hardware Configuration Menu to display. The Track Hardware Configuration Menu provides for the configuration of parameters that affect the wheel detector, Presence, and AEI Reader module subsystems of the Model 2600 Reader.</td></tr>
</table>

N - Load or Dump Reader Setup Parameters	The **Dump** command option generates a report of all Reader Setup parameters as they are currently configured. This report includes site configurations, track hardware config, network interfaces config, name resolution config, T-94 sessions setup, and maintenance sessions setup. The report can be captured as a text file and stored to a host computer as a record of site specific settings.
	
	The **Load** command option allows the user to upload those site specific Reader setup parameters that were previously captured and stored in a text file.
	
	From the Setup Menu, select **Load or Dump Reader Setup Parameters**:
	
	`STC Model 2600 AEI Reader, Site Name: AEI Site 123`
	`Fri Oct 10 10:58:06 EDT 2014`
	`Load/Dump Reader Setup Parameters Menu`
	`----------`
	`D) Dump Reader Setup Parameters`
	`L) Load Reader Setup Parameters File`
	`X) Exit Menu`
	`?`
	
	Type "**D**" to Dump Reader Setup Parameters. The following prompt will appear:
	`Dump (print) Reader Setup Parameters now (Y/N)?:` **Y**
	`Prepare to capture/log data.`
	`Press <ENTER> to start download...`
	
	Type "**L**" to load a previously captured setup file. The following prompt will appear:
	`Load Reader Setup Parameters now (Y/N)?:` **Y**
	`Waiting for Reader Setup Parameters upload ...`
	
	From your terminal emulation program, locate and send the selected setup file. The following prompt will appear:
	`Receiving data ...`
	`Finished reading data. Total lines read = 224`
	`Preparing to write uploaded param to Reader config files ...`
	`Successfully loaded Reader configuration parameters`
	
	NOTE: "Load" function will time out in 30 seconds if setup file is not sent.

Example report below was generated by **Dump Reader Setup Parameter Command**:

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++ STC Model 2600 AEI Reader Configuration Summary
++ Generated: 10-13-2014 11:07:36
++ Config. Summary App. Version [1.09, 06/07/2013]
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

FILE:<Reader Setup>
SECTION:<Site Configuration> ----------------------------------------------
MultiTrackSite                = No
MaxTrainsStored               = 100
MaxTrainNumber                = 100
    •
    •
    •
<EOS>
SECTION:<Track Hardware Configuration> -----------------------------------
PresenceTimeoutPeriod         = 00:10
PresenceInputDebounceFilter   = 3
XdcrPulseWidthFilter          = 3
    •
    •
    •
FILE:<Network Config.>
SECTION:<Network Interfaces Config> --------------------------------------
LAN mode                      = manual
LAN address                   = 10.14.22.31
WAN netmask                   = 255.255.255.0
    •
    •
    •
SECTION:<Name Resolution Config> -----------------------------------------
Resolve search                = ST.local
Resolve nameserver_1          = 10.14.22.15
Resolve nameserver_2          = 66.18.32.2
    •
    •
    •
FILE:<Sessions Setup>
SECTION:<SessionNum_1> ---------------------------------------------------
Auto Reporting                = Disabled
Site ID                       = AEI1111
AAR Billing Code              = 00000
    •
    •
    •
SECTION:<MaintSessNum_1> -------------------------------------------------
Auto Reporting                = Disabled
Site ID                       = AEI1234
AAR Billing Code              = 00000
    •
    •
    •
     -- Report Complete --
```

7.5.2 Track Hardware Configuration Menu Details

The **Track Hardware Configuration Menu** provides for the configuration of parameters that affect the wheel detectors, the presence subsystem, and the AEI reader module of the Model 2600 Reader. This menu is accessed from the **Setup Menu,** which itself is available from the **Main Menu**.

The **Track Hardware Configuration Menu** is shown below, and the options on this menu are discussed below that.

```
STC Model 2600 AEI Reader, Site Name: Cromwell
Tue Oct 14 11:42:56 EDT 2014
Track Hardware Configuration Menu
-------------------------------------------------------
  A) Presence Timeout Period (mm:ss)          : 00:10
  B) Presence Input Debounce Filter (mS)      : 3
  C) Wheel Detector Pulse Width Filter (mS)   : 3
  D) Wheel Detector Pair Spacing (inches)     : 114
  E) Tag ID Separation (# ID's)               : 2
  F) Tag Uniqueness Timeout (seconds)         : 30
  G) Tag Consecutive Reads                    : 2
  H) Load Default Settings
  X) Exit Menu
?
```

Track Hardware Configuration Menu

Track Hardware Setup Menu Options	
A – Presence Timeout Period	This option is used to specify the amount of time, in seconds, that the Model 2600 Reader should wait before closing out the processing of a train. The Presence Timeout parameter determines how many seconds of inactivity (e.g., where presence has cleared and no signals are received from the wheel detectors) should pass before the reader considers a given train to have cleared the site. **This parameter is typically set to 10 seconds.**
B – Presence Input Debounce Filter	This option is used to specify, in milliseconds, the amount of time to wait before considering an active presence signal as valid. Its purpose is to filter noise/signals detected by the presence subsystem that aren't generated by an approaching train. **This parameter is typically set from three to five milliseconds.**

<table>
<tr><td>C – Wheel Detector Pulse Width Filter</td><td>This parameter is used to specify a value, in milliseconds, to be used to filter errant noise detected on the wheel detector inputs. The Model 2600 Reader will filter (ignore) signals detected at the wheel detector inputs that have a narrower pulse width than the value of the Transducer Pulse Width parameter. This parameter is typically set to five milliseconds.</td></tr>
<tr><td>D – Wheel Detector Pair Spacing</td><td>This option applies only where a site is configured with dual Tiefenbach wheel detectors. This option is used to enter the actual distance (in inches) measured between the two wheel detector modules. This measurement is made from the inside edge of one detector module to the inside edge of the other. This value is normally 114” (9.5’). Note: The value should be no less than 9’ and no more than 10.5’.
The Wheel Detector Pair Spacing parameter is used internally by the Model 2600 Reader to calculate speed and length of the rail vehicles that cross the site.</td></tr>
<tr><td>E – Tag ID Separation</td><td>This parameter is used by the system to filter multiple reads of a given AEI tag. It specifies the number of other tags that must be read before a subsequent read of a given tag is again considered a valid read. This parameter should be set to 2.</td></tr>
<tr><td>F – Tag Uniqueness Timeout</td><td>This parameter is used by the system to filter multiple reads of a given AEI tag. It specifies the amount of time that must elapse before a subsequent read of a given tag is again considered a valid read. This parameter should be set to 30 seconds.</td></tr>
<tr><td>G – Tag Consecutive Reads</td><td>This parameter is used by the system to ensure that a read of a given AEI tag is valid. It specifies the number of times a given tag must be “sensed” by the reader module before it can be considered a valid read. This parameter should be set to 2.</td></tr>
<tr><td>H– Load Default Settings</td><td>This option will set the following setup parameters to the values shown below:

<table>
<tr><th>Parameter</th><th>Default Value</th></tr>
<tr><td>Presence Timeout Period</td><td>10 seconds</td></tr>
<tr><td>Presence Input Debounce Filter</td><td>3 milliseconds</td></tr>
<tr><td>Wheel Detector Pulse Width Filter</td><td>3 milliseconds</td></tr>
<tr><td>Wheel Detector Pulse Latch Percentage</td><td>50 percent</td></tr>
<tr><td>Wheel Detector Spacing to 114</td><td>114 inches</td></tr>
<tr><td>ID Separation</td><td>2 (tag ID's)</td></tr>
<tr><td>Uniqueness Timeout</td><td>30 seconds</td></tr>
<tr><td>Consecutive Reads</td><td>2 (reads)</td></tr>
</table>
</td></tr>
</table>

7.6 Session Configuration Menu Details

Reporting “sessions” are used to manage the process of transferring data from the Model 2600 Reader to remote computers. This menu is available from the system's **Main Menu**.
The consist reporting sessions manage the process of formatting the consist’s AEI-related data (as specified by the AAR's standard, S-918) and transmitting this data to a remote host computer. The maintenance reporting sessions manage the process of formatting system maintenance-related information (as specified by the AAR's standard, S-918) and transmitting this data to a remote host. Any combination of the five available consist sessions and the two maintenance sessions can be enabled for reporting.

```
STC Model 2600 AEI Reader, Site ID: Cromwell
 Tue Oct 14 13:31:29 EDT 2014
 Session Configuration Menu
  ------------------------------------------------------
   A) Consist Sessions Menu
   B) Maintenance Sessions Menu
   X) Exit Menu
 ? _
```

Session Configuration Menu

7.6.1 Consist Session Setup Menu

The **Consist Session Setup Menu** presents a reference to each of the five available dial-out reporting sessions.

Each of the “Session x” entries in the menu indicate:

- whether that session is enabled (configured to transmit T94 reports);
- the reporting protocol has been selected for that session.

```
STC Model 2600 AEI Reader, Site ID: Cromwell
Tue Oct 14 13:44:35 EDT 2014
Session Setup Menu
-----------------------------------------
A) Session 1  (Enabled,ns)
B) Session 2  (Disabled,bnsf)
C) Session 3  (Disabled,cp)
D) Session 4  (Disabled,ftp)
E) Session 5  (Disabled,ptra)
F) Retransmit T94 Reports
G) Transmit Test Train
X) Exit Menu
? _
```

Session Setup Menu Example

By selecting one of the **Session x Menu** options (**A**, **B**, **C**, **D** or **E**), the configuration of each session can be viewed and/or modified. An example of a **Session x Configuration Menu** is depicted on the following page.

The **Retransmit T94 Reports** option (option **F**, as shown), provides a means for selecting one or more trains currently stored in the Model 2600 Reader to be transmitted via a specified session.

The **Transmit Test Train** option (option **G**, as shown), provides a means for causing the Model 2600 Reader to transmit a pre-formatted S-918 (T94) consist data report via a specified session.

7.6.2 Session x Configuration Menu

The **Session x Configuration Menu** provides access parameters that affect how a consist report gets reported and, to a limited extent, how the consist report is formatted.

```
STC Model 2600 AEI Reader, Site ID: Cromwell
Tue Oct 14 13:44:35 EDT 2014
Session 1 Configuration Menu
-----------------------------------------------------------
A) Auto Reporting                : Enabled
B) Site ID                       : TEST5
C) AAR Billing Code              : 00502
D) Time Zone                     : 5
E) Units Of Measure              : English
F) Report Delimiter              : (space)
G) Phone Number                  : 1-888-672-2032
H) Baud Rate                     : 9600
I) Report Reverse-out Trains     : Disabled
J) Reporting Protocol            : ns
K) Max Retry Attempts            : 6
L) Retry Delay Time              : 3
M) Minimum Axle Count            : 4
N) Report Raw Tag Records        : Disabled
O) Synch. Clock With Host        : Enabled
P) Header                        : SIH 0000000000 SINGLE      NS
Q) Login ID                      : None
R) Password                      : None
S) Destination Directory         : None
T) Host Name|IP                  : none
X) Exit Menu
? x
```

Session x Configuration Menu Example – Session 1

Session X Configuration Menu	
A - Auto Reporting	This parameter is used to activate and deactivate the reporting session. When set to "Enabled," the 2600 Reader will attempt to transmit a T94 report for each train that passes the site.
B - Site ID	This parameter specifies the "official" identifier for the AEI reader site as far as the reporting session is concerned. This identifier is used to populate a field in the header (AEM record) of the T94 reports generated for this session.

C - AAR Billing Code	This parameter corresponds to another field in the header (AEM record) of the T94 reports that are generated for this reporting session. The AAR Billing Code loosely identifies the railroad that the reporting session is configured to report to or for.
D - Time Zone	This parameter is used to specify the time zone in which the 2600 Reader is located. When this option is selected from the menu, the following prompt is presented: **Enter New Time Zone (Eastern=5 Central=6 Mountain=7 Pacific=8)**
E - Units of Measure	This parameter is used to specify the units used in some T94 report fields such as speed and length. When this option is selected from the menu, the user is presented with a choice between English and metric units.
F - Report Delimiter	This parameter is used to specify what character (if any) is to be used to delimit the fields in the T94 reports. When this option is selected from the menu, the following prompt is presented: Current Report Delimiter: (space) Enter New Report Delimiter: When this prompt is presented, any printable character can be specified by pressing that key on the keyboard. Pressing the spacebar will cause a space to be used. Pressing <Enter> will cause the system to not insert a delimiter between report fields. When the use of no delimiter is selected in this way, "(null)" appears as the setting for the Report Delimiter option.
G - Phone Number	This option is used to specify the phone number that the site is to use when attempting to deliver T94 reports for this reporting session. This parameter applies only when a dial-out (either landline or cellular) modem is installed in the system.
H - Baud Rate	This option is used to specify the baud rate the system modem is to use when initiating a dial-out connection with a remote modem. The specified baud rate will be the maximum baud at which a connection will be made.
I - Report Reverse-out Trains	This option is used to specify whether the reporting session is to report those trains/movements wherein the train pulls onto the site and then reverses back off of the site.
J - Reporting Protocol	This parameter is used to specify which predefined protocol is to be used when communicating with the remote server/computer that the reporting session directs T94 reports to. When this option is selected, a menu similar to the following is presented: STC Model 2600 AEI Reader, Site Name: Cromwell Mon Feb 6 15:48:46 EST 2014 Current Reporting Protocol (ns) Menu ---------- A) bnsf B) cn-ftp C) cn D) cp E) csx F) dial-and-dump G) ftp H) ns-http I) ns J) ptra K) up L) xmodem X) Exit ? _

K - Max Retry Attempts	This parameter is used to specify the number of times the 2600 Reader is to attempt to deliver a T94 report for this reporting session before pausing. What this means is that, where phone line issues preclude delivery of a report (e.g., the modem reports NO CARRIER or BUSY) or where a communications timeout with the remote server/computer occurs, after attempting the amount of time specified by this parameter, the site will pause in its attempt to deliver a report until the next train crosses the site.
L - Retry Delay Time	This parameter is used to specify the amount of time, in minutes, that the 2600 Reader is to wait between attempts to deliver a given T94 report to the server/computer referenced by this session.
M - Minimum Axle Count	This parameter is used to specify the minimum train/consist size that the 2600 Reader is to report to the server/computer referenced by this session. In this way, the 2600 Reader can be prevented from delivering T94 reports for high-rail vehicles, for instance.
N - Report Raw Tag Records	This parameter is used to specify whether the 2600 Reader is to include in the T94 reports generated for this session the 20-character raw ("six-bit") form of the AEI tags read by the reader for each consist.
O - Synch. Clock With Host	This parameter is used to specify whether the 2600 Reader is to synchronize its clock with that of the remote server using a timestamp supplied by the server. The referenced timestamp must be one that is supplied via the predefined reporting protocol selected for this reporting session.
P - Header	This parameter is used to specify a line of text that is to precede any T94 report delivered in accordance with the reporting session. Some of the available predefined reporting protocols require a header in a specified format. For those reporting protocols that do not require it, this parameter will be ignored.
Q - Login ID	This parameter is used to specify a login ID that is expected by the server/computer to which this session directs T94 reports, in accordance with the selected reporting protocol. For those reporting protocols that do not require it, this parameter will be ignored.
R - Password	This parameter is used to specify a password that is expected by the server/computer to which this session directs T94 reports, in accordance with the selected reporting protocol. For those reporting protocols that do not require it, this parameter will be ignored.
S - Destination Directory	This parameter is used to specify a directory on the remote server/computer to which this session directs T94 reports, which reports are to be routed to, in accordance with the selected reporting protocol (e.g., where the FTP protocol has been specified). For those reporting protocols that don't require it, this parameter will be ignored.
T - Host Name | IP	This parameter is used to specify the name or IP address of the remote server/computer to which this session directs T94 reports. This parameter applies only to those reporting protocols that employ an Ethernet connection and/or IP protocol to deliver T94 reports. For those reporting protocols that do not require it, this parameter will be ignored.

7.6.3 Maintenance Session x Configuration Menu

The **Maintenance Session x Configuration Menu** provides access to parameters that affect how a maintenance report gets reported and, to a limited extent, to how the consist report is formatted.

```
STC Model 2600 AEI Reader, Site ID: Cromwell
Tue Oct 14 13:44:35 EDT 2014
Maintenance Session 1 Configuration Menu
-------------------------------------------------------
A) Auto Reporting                : Enabled
B) Site ID                       : TEST5
C) AAR Billing Code              : 00502
D) Time Zone                     : 5
E) Units Of Measure              : English
F) Report Delimiter              : (space)
G) Phone Number                  : 1-888-672-2032
H) Baud Rate                     : 9600
I) Report Reverse-out Trains     : Disabled
J) Reporting Protocol            : ns
K) Max Retry Attempts            : 6
L) Retry Delay Time              : 3
M) Minimum Axle Count            : 4
N) Report Raw Tag Records        : Disabled
O) Synch. Clock With Host        : Enabled
P) Header                        : SIH 0000000000 SINGLE      NS
Q) Login ID                      : None
R) Password                      : None
S) Destination Directory         : None
T) Host Name|IP                  : none
X) Exit Menu
? x
```

Maintenance Session X Configuration Menu Example- Session 1

Maintenance Session x Configuration Menu	
A - Auto Reporting	This parameter is used to activate and deactivate the reporting session. When set to "Enabled," the 2600 Reader will attempt to transmit maintenance reports as scheduled by this session.
B - Site ID	This parameter specifies the "official" identifier for the AEI reader site as far as the reporting session is concerned. This specified identifier is used to populate a field in the header (AMH record) of the maintenance reports generated for this session.
C - AAR Billing Code	This parameter corresponds to another field in the header (AMH record) of the maintenance reports that are generated for this reporting session. The AAR Billing Code loosely identifies the railroad that the reporting session is configured to report to or for.
D - Time Zone	This parameter is used to specify the time zone in which the 2600 Reader is located. When this option is selected from the menu, the following prompt is presented; **Enter New Time Zone (Eastern=5 Central=6 Mountain=7 Pacific=8)**

E - Report Delimiter	This parameter is used to specify what character (if any) is to be used to delimit the fields in the maintenance reports generated in association with the reporting session. When this option is selected from the menu, the following prompt is presented: Current Report Delimiter: (space) Enter New Report Delimiter: When this prompt is presented, any printable character can be specified by pressing that key on the keyboard. Pressing the spacebar will cause a space to be used. Pressing <Enter> will cause the system to not insert a delimiter between report fields. When the use of no delimiter is selected in this way "(null)" appears as the setting for the Report Delimiter option.
F - Phone Number	This option is used to specify the phone number that the site is to use when attempting to deliver maintenance reports for this reporting session. This parameter applies only when a dial-out (either landline or cellular) modem is installed in the system.
G - Baud Rate	This option is used to specify the baud rate the system modem is to use when initiating a dial-out connection with a remote modem. The specified baud rate will be the maximum baud at which a connection will be made.
H - Reporting Protocol	This parameter is used to specify which predefined protocol is to be used when communicating with the remote server/computer that this reporting session directs maintenance reports to. When this option is selected, a menu similar to the following is presented: STC Model 2600 AEI Reader, Site Name: Cromwell Mon Feb 6 15:48:46 EST 2014 Current Reporting Protocol (ns) Menu ---------- A) bnsf B) cn-ftp C) cn D) cp E) csx F) dial-and-dump G) ftp H) ns-http I) ns J) ptra K) up L) xmodem X) Exit ? _
I - Reporting Interval	This parameter is used to specify the amount of time that should elapse between the 2600 Reader's attempts to transmit a maintenance report. For instance, if the Reporting Interval was set to 02:00 (2 hours) the 2600 Reader would attempt to transmit a maintenance report every two hours.
J - Retry Delay Time	This parameter is used to specify the amount of time, in minutes, that the 2600 Reader is to wait between failed attempts to transmit a maintenance report to the server/computer referenced by this session. The Retry Delay Time comes into play only when the 2600 Reader makes an attempt to transmit a maintenance report as scheduled by the Reporting Interval parameter and the attempt fails (for instance, if the dialed phone number is busy).

K - Extended Delay	This parameter is used to specify a wait period for the 2600 Reader in the case where it is having difficulty establishing a connection with a remote server/computer. If, after five attempts, the 2600 Reader fails to successfully transmit a maintenance report, it will then wait the specified Extended Delay time before making the next attempt.
L - Include Century Field	Some versions of the S-918 specification included a requirement for a two-digit field that specifies the year/century of the date that a maintenance report is generated. This parameter provides the option of either including this field or omitting it.
M - Use Extended (STC) Code List	The AEI Users Group (membership is primarily Class I Railroad representatives) has published an informal list of possible alternative, vendor-specific "maintenance issue" codes that can be used in the generation of maintenance reports. This parameter provides the option to use the historic/standard code list or to use the AEI User Group's alternative, vendor-specific code list.
N- Synch. Clock with Host	This parameter is used to specify whether the 2600 Reader is to synchronize its clock with that of the remote server using a timestamp supplied by the server. The referenced timestamp must be one that is supplied via the predefined reporting protocol selected for this reporting session.
O - Header	This parameter is used to specify a line of text that is to precede any maintenance report delivered in accordance with this reporting session. Some of the available, predefined reporting protocols require a header in a specified format. For those reporting protocols that do not require it, this parameter will be ignored.
P - Login ID	This parameter is used to specify a login id that is expected by the server/computer to which this session directs maintenance reports, in accordance with the selected reporting protocol. For those reporting protocols that do not require it, this parameter will be ignored.
Q - Password	This parameter is used to specify a password that is expected by the server/computer to which this session directs maintenance reports, in accordance with the selected reporting protocol. For those reporting protocols that do not require it, this parameter will be ignored.
R - Destination Directory	This parameter is used to specify a directory on the remote server/computer to which this session directs maintenance reports (in which reports are to be routed to in accordance with the selected reporting protocol, e.g., where the FTP protocol has been specified). For those reporting protocols that do not require it, this parameter will be ignored.
S - Host Name | IP	This parameter is used to specify the name or IP address of the remote server/computer to which this session directs maintenance reports. This parameter applies only to those reporting protocols that employ an Ethernet connection and/or IP protocol to deliver T94 reports. For those reporting protocols that do not require it, this parameter will be ignored.

7.7 System Functions Menu Details

The **System Functions Menu,** below, presents system level configuration and housecleaning options. This menu is available from the **Main Menu**. *Options H, I, and J shown on this menu will be present only when a user is logged in with the "system" ID.*

```
STC Model 2600 AEI Reader, Site ID: Cromwell
Tue Oct 14 09:05:07 EST 2014
System Functions Menu
------------------------------------------------------------
  A) Configure Network Interfaces Menu
  B) Configure time synch with NTP Server
  C) Delete All Train Data
  D) System Reset Menu
  E) Telnet Pass-Thru
  F) Serial Pass-Thru
  G) Reader Module Direct Comm. Link (Manual RF Functions)
  H) Passwords Menu
  I) Software Update
  J) Override FEP CRC Check
  T) Track Hardware Signal Status
  X) Exit Menu
  ? _
```

System Functions Menu

System Functions Menu Details	
Configure Network Interfaces	Presents the parameters required to communicate via an Ethernet (TCP/IP) network. This would apply (for example) to those cases where consist or maintenance reports are transmitted via the FTP protocol.
Configure time synch with NTP Server	The Network Time Protocol (NTP) provides a means for synchronizing a computer's clock with a known good source that is accessible via a network connection. Through this option an NTP server can be used to ensure the accuracy of the 2600 Reader's clock.
Delete All Train Data	Provides a means for clearing out the Model 2600 Reader's train data directory.
System Reset Menu	Provides options for resetting/rebooting various system components – the Front End Processor (FEP), the IPC, and the AI1200 Reader board.
Telnet Pass-Thru	Provides a means for communicating via Telnet with other Model 2600 Readers (or other devices) that are connected via an Ethernet network. (e.g., at a double-track location)
Serial Pass-Thru	Provides a means for communicating with a device that's connected to the Model 2600 Reader's COM2 serial port.
Reader Module Direct Comm. Link	Provides a means for communicating directly with the system's AI1200 board(s). These options are provided for troubleshooting purposes.
Passwords	Provides the means for changing the passwords for each of the different system login identifiers – guest, tech, and system.
Software Update	Provides a means for updating the Model 2600 Reader's system software.
Override FEP CRC Check	This option is normally required only during the manufacturing process the first time a system is powered up.
Track Hardware Signal Status	Provides a series of snapshots of the state of the wheel detector and presence inputs. The FEP board provides these snapshot samples periodically. The frequency and timeliness of these snapshots is dependent upon the current setting of the system setup parameter, "Train Scanning" and the version of the FEP's firmware.

7.7.1 Network Interfaces Configuration Menu

The Network Interfaces Configuration Menu provides access to the menus that enable to setup of the Model 2600 Reader's two Ethernet ports as well as the system's Domain Name Server(s) (DNS).

```
STC Model 2600 AEI Reader, Site ID: Cromwell
Tue Oct 14 14:55:12 EDT 2014
Network Interfaces Configuration Menu
-----------------------------------------------
 A) LAN Interface (Active, 100Mbps)
 B) WAN Interface (Active, 100Mbps)
 C) DNS Name Servers (Optional)
 D) Load Default Settings
 X) Exit Menu
 ? _
```

The **LAN** network interface is intended for interconnection between multiple Model 2600 Readers at a given site.

The **WAN** network interface is intended for connecting a Model 2600 Reader to a customer's network for data reporting purposes.

Network Interfaces Configuration Menu

Selecting either **A** or **B** from this menu will cause the **Configure xAN Menu** to be generated with the appropriate interface (LAN or WAN) parameters presented. The **Configure LAN/WAN Menu** is shown below.

Selecting **C** from this menu will cause the **Configure DNS Name Servers** menu to be presented. This menu is also shown below.

Configure LAN/WAN Interface Menu

The figure below depicts an example of the **Configure LAN Interface Menu**. It is used to specify the configuration of the LAN network interface. The **Configure WAN Interface Menu** is identical.

```
STC Model 2600 AEI Reader, Site ID: Cromwell
  Tue Oct 14 14:55:12 EDT 2014
 (Active, 100Mbps) Configure LAN Interface Menu
 -------------------------------------------------------
   A) IP Assignment             : Static
   B) IP Address               : 10.14.22.31
   C) Subnet Mask               : 255.255.255.0
   D) Default Gateway           : 10.14.22.1
   X) Exit Menu
 ? _
```

Configure LAN Interface Menu

The **IP Assignment Menu** item provides the means for specifying how an IP address is assigned to the interface (WAN or LAN) that is being configured. The options available for the IP Assignment item are:

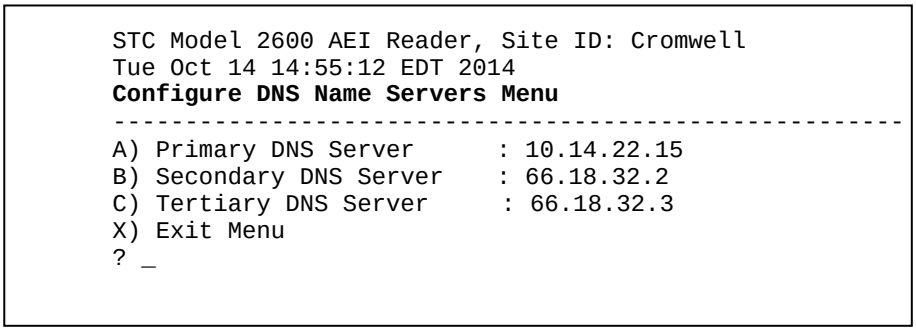
- Static
- Dynamic (DHCP)
- Disabled

To select one of these options, press 'A' on your keyboard to cause the system to cycle through them until the desired option is displayed. When you exit the **Configure LAN/WAN Interface Menu**, the option that is displayed will be implemented by the system. If a change has been made, the network interfaces will be stopped and restarted to implement the selected settings.

The **IP Address Menu** item presents a simple dialog for entering an IP address for the interface. However, if the **IP Assignment** option has been set to **Dynamic DHCP,** the system will not allow you to enter an address.

The **Subnet Mask** and **Default Gateway** menu items each present a simple dialog, allowing you to enter an IP address.

Configure DNS Name Servers Menu



Configure DNS Name Servers Menu

The **Primary DNS Server**, **Secondary DNS Server,** and **Tertiary DNS Server Menu** items each present a simple dialog which allows you to enter an IP address.

7.7.2 Track Hardware Signal Status

In normal operations, the “Train Scanning” option (see the **Setup Menu**) is set to Enabled. When in this mode, the 2600 Reader collects the data for trains that cross the AEI site. If this option is set to Disabled, then the 2600 Reader will essentially ignore any activation of the wheel detector and Presence inputs; thus no trains will be recorded when in this mode. This mode of operation provides for near real-time snapshots of the status of these system inputs. These snapshots are posted in ten-second intervals.

When the “Train Scanning” option is set to disabled and the Track Hardware Signal Status option is selected from the **System Function Menu,** then a display similar to the following will be presented.

If the FEP firmware version is equal to or older than **ML0.6b 01/10/12**, the FEP will provide snapshot samples to the IPC (to be presented here) every 60 seconds. Newer FEP firmware, such as the version below, will provide status updates every ten seconds.

```
FEP Firmware Version = ML0.6c 02/17/14
Train Scanning       = Disabled

Continue (Y/N)?: y

Press any key to halt the status updates. Will quit after 10 minutes.

Track Hardware Signal Status                              Timestamps
-------------------------------------------------------------------------
T01 T02 T03 T04  Pres            | Sample: Feb 20 08:56:35 2014
--- --- --- ---  ----            | Now: Feb 20 08:56:41 2014
Off Off Off Off   Off

T01 T02 T03 T04  Pres            | Sample: Feb 20 08:56:47 2014
--- --- --- ---  ----            | Now: Feb 20 08:56:52 2014
Off Off  On Off   Off            |

T01 T02 T03 T04  Pres            | Sample: Feb 20 08:56:59 2014
--- --- --- ---  ----            | Now: Feb 20 08:57:03 2014
Off Off Off  On    On            |

T01 T02 T03 T04  Pres            | Sample: Feb 20 08:57:11 2014
--- --- --- ---  ----            | Now: Feb 20 08:57:14 2014
On  On Off Off    On             |

T01 T02 T03 T04  Pres            | Sample: Feb 20 08:57:23 2014
--- --- --- ---  ----            | Now: Feb 20 08:57:25 2014
On Off Off Off   Off             |
```

Track Hardware Signal Status Snapshot Examples

In the figure above, the columns on the left display the status of the wheel detector and Presence system inputs. The right-hand column provides the timestamp for when the input sample was provided by the FEP and, for comparison, the time at which the sample update was “posted” to the screen. If, for instance, the sample timestamps were not continuously increasing, then either the “Train Scanning” option is not set to Disabled or communications between the FEP board and the IPC board have broken down.

7.8 Report Examples

The system reports can be printed by accessing the **Report Menu**, which is available from the **Main Menu.**

7.8.1 Train Summary Report

The Train Summary Report can be printed by selecting the Train Summary options located on the **Report Menu**.

```
================================================================================
                        Southern Technologies Corporation
                             Model 2600 AEI Reader
                              Train Summary Report

                          Run Date: 09/14/2014  08:11:54              Cromwell
================================================================================
 Trn                                 Num  Num   Speed      Tags Read       T94
 Num   Date   Time   Lead Veh ID Cars Axle Max Min Dir Ant1 Ant2 Durat Xmit
 --- -------- -----  ----------- ---- ---- --- --- --- ---- ---- ----- -----
  49 09/14/14 08:00  CSXT   5300   58  252  22  18  N    57   58   130 S----  A
 *48 09/14/14 07:15  CSXT   4804   66  270  31  18  S    67   66   138 S----  A
  47 09/14/14 06:24  ADMX  30187   46  234  12   2  S    53   54   284 S----  D
  46 09/14/14 06:18  CSXT   5300   53  232  10   4  N    52   54   268 S----  B
  45 09/14/14 05:40  CSXT     72  112  452  39  33  N   113  113   128 S----  A
 *44 09/14/14 01:16  CSXT   2336   36  144  29  27  S    37   35    68 S----  A
  43 09/13/14 23:51  CSXT   7664   48  340  43  38  S    49   47   140 S----  A
   .
   .
   .
```

Train Summary Report Example

Train Summary Report Field Descriptions	
Trn Num (Train Number)	This column contains the chronologically sequential number assigned to each train as they are processed by the 2600 Reader. The maximum value that this field can have is specified by the "Maximum Train Number" option of the Setup Menu. When the Train Number reaches the specified maximum value, the Train Number field wraps back to 1, whereupon data for older trains having the same train number is deleted.
Date/Time	These fields reflect the date and time at which a train arrived at the reader site.
Lead Veh ID (Lead Vehicle Identifier)	This field contains the Owner and Number fields decoded from the AEI tag that was read on the first vehicle of a train. If no tag was read on the first vehicle, this field will remain blank.
Num Cars (Number of Cars)	This field contains the count of the number of vehicles (locomotives and railcars) that were identified in a train.
Num Axles (Number of Axles)	This field contains the number of axles that were detected for a given train by the systems wheel detectors.
Speed Max, Min	These fields contain the maximum and minimum speeds that a train traveled as it crossed the reader site.

Dir (Direction)	This field indicates the direction that the train was traveling as it exited the reader site.
Tags Read, Ant0, Ant1 (Tags Read, Antenna 0, Antenna 1)	These two fields contain a count of the number of AEI tags that were read by each antenna as a train crossed the reader site.
Durat (Duration)	This field reflects the elapsed time, in seconds, it took for a train to completely cross a reader site.
T94 Xmit (T94 Transmit)	This field is used to indicate the status of the T94 consist reporting process as it affects each train. This field consists of five columns, each of which reflects the status of the five available consist sessions. In the above example, the system has (S)uccessfully reported, for session #1, all of the trains shown. The remaining four sessions are not currently enabled, as indicated by the '-' in the other four columns. The possible entries for the columns in this field are: **S - Success** The T94 report for the indicated train was successfully transferred as specified by the referenced reporting session. **R - Rejected** The T94 report for the indicated train was rejected by the receiving server/computer in at least five attempts to transmit it. **T - Trying** The 2600 Reader has made at least one attempt to transmit the T94 report for the indicated train, and further attempts will be made to do so. **H - On Hold** The 2600 Reader has failed in at least five attempts to transmit the T94 report for the indicated train. The 2600 Reader is waiting for the next train to cross the site before making further attempts. **K - Skipped** The 2600 Reader did not attempt to transmit the T94 report for the indicated train because it failed to meet some criteria established by the Reporting Session configuration. For instance, if the "Minimum Axle Count" field is set to 4 and only two axles are recorded for a movement, then the train will be skipped (for reporting purposes).
Unlabeled Last Column	The last column on the report indicates the type of movement that the recorded train represented. Possible values for this column are as follows: A = through movement, over 5 mph for the entire train; B = through movement, speed was under 5 mph for some part of the train; C = through movement, the train stopped at some point; D = through movement, switching move, some changes in direction were detected; E = simulated train; F = reverse exit.

7.8.2 Train Detail Report

The Train Detail Report can be printed by selecting one of the Train Detail options located on the **Report Menu.**

```
================================================================================
                Southern Technologies Corporation
                      Model 2600 AEI Reader
                       Train Detail Report

                  Run Date: 05/17/2014  15:14:04              Cromwell
================================================================================

File Name: 201104081333_0044.trn
================================================================================
Train : 44        | Axles    : 448  |                 Total  N/E  S/W
Date  : 04-08-14  | Cars     : 109  | Vehicle Count   :  109  109    0
Time  : 13:33     | Max Speed: 38   | Locos Tagged    :    2    2    0
Dir   : N         | Min Speed: 36   |        Untagged :    0    0    0
Length: 9721   ft | Avg Speed: 37   | Railcars Tagged :  106  106    0
                  |                 |        Untagged :    1    1    0
================================================================================
 Car                    Num  Num  Num  Tag      Lead             Handshakes
 Num   Vehicle ID  EGC Axls Trks Plat Axls Dir  End Speed Length Ant0 Ant1
---  ------------ --- ---- ---- ---- ---- --- ---- ----- ------ ---- ----
  1  UP   7914      5    6    2    1    6  N    A    38     68    4    5
  2  UP   7452      5    6    2    1    6  N    A    38     69    3    4
  3  TTGX 978457   19    4    2    1    4  N    A    38     81    5    7
  4  TTGX 851023   19    4    2    1    4  N    A    38     81    5    5
  5  TTUX 891057   19    4    2    1    4  N    B    38     81    4    5
  6  TTGX 942200   19    4    2    1    4  N    A    38     88    3    5
  7  TTGX 978038   19    4    2    1    4  N    A    38     88    4    6
  8  TTGX 153506   19    4    2    1    4  N    A    38     88    6    7
  9  TTGX 990796   19    4    2    1    4  N    B    38     88    2    3
 10  TTGX 993121   19    4    2    1    4  N    B    38     88    2    5
 11  TTUX 891029   19    4    2    1    4  N    B    38     80    4    6
 12  TTUX 891093   19    4    2    1    4  N    A    38     80    6    6
 13  TTGX 973877   19    4    2    1    4  N    A    38     88    5    7
 14  TTGX 978848   19    4    2    1    4  N    B    38     87    3    6

.
.
.

102  TTGX 913600   19    4    2    1    4  N    B    37     86    4    5
103  TTGX 991165   19    4    2    1    4  N    B    37     85    4    6
104  TTGX 978097   19    4    2    1    4  N    A    37     85    3    5
105  ETTX 801052   19    4    2    1    4  N    A    37     89    5    6
106  ETTX 850903   19    4    2    1    4  N    A    37     89    4    5
107  ETTX 702693   19    4    2    1    4  N    B    37     91    3    5
108  ETTX 901218   19    4    2    1    4  N    B    37     89    5    5
109  ETTX 902915   19    4    2    1    4  N    B    37     89    4    6
```

Train Detail Report Example

Train Detail Report Field Descriptions	
Car Num (Car Number)	This field contains the sequential number of each vehicle detected in the train consist.
Vehicle ID (Vehicle Identifier)	This field contains the owner code and car number fields decoded from the AEI tag associated with the first vehicle in the consist. If multiple AEI tags have been associated with the lead vehicle which cannot be resolved to one legitimate identifier, this field will be empty.
EGC (Equipment Group Code)	This field contains the "Equipment Group Code" field decoded from the vehicles identifying AEI tag.
Num Axls (Number of Axles)	This field contains the number of axles associated with each vehicle as determined by the 2600 Reader's consist breakout logic (based upon wheel detector signal timing).
Num Trks (Number of Trucks)	This field contains the number of trucks that the consist breakout logic has determined are associated with each vehicle.
Num Plat (Number of Platforms)	This field contains the number of platforms that the consist breakout logic has determined are associated with each vehicle.
Tag Axls (Tag Axles)	This field contains the axle-count field decoded from the vehicle's identifying AEI tag.
Dir (Direction)	This field indicates the direction each vehicle was traveling as it exited the reader site. This field becomes significant when reviewing reports for consists on which switching operations have occurred.
Speed	This field contains the speed recorded for each vehicle.
Length	This field contains the length calculated for each vehicle (based upon speed and wheel detector signal timing).
Handshakes Ant0, Ant1	These two columns reflect the "handshake" values recorded for the identifying tag of each vehicle. The term "handshakes" refers to the number of times a given tag was read as it passed through the RF signal produced by the trackside AEI antennas.

7.8.3 T94 Report

The format of the T94 report is specified by the document AAR Manual of Standards and Recommended Practices, S-918A, section K, AEI Site-To-Host Consist Report Format.

The T94 Report can be printed by selecting one of the T94 options located on the **Report Menu.**

```
AEM 00123 Cromwel 090914 0800 0803 050 Y 411 0049 G G N 0 E 022 018 019 A N F N 03339 G
RRE 001 D CSXT 0000005300 A   G G P 12 09 018 06 01
RRE 002 D CSXT 0000007570 A   G G P 10 06 018 06 01
RRE 003 D CSXT 0000005950 A   G G P 11 11 018 04 01
RRE 004 R NDYX 0000475493 A   G G K 09 09 018 04 01
RRE 005 R KRL  0000050805 B   G G K 10 11 018 08 01
RRE 006 R GACX 0000013661 A   G G K 10 09 018 04 01
RRE 007 R KRL  0000050807 B   G G K 13 11 022 08 01
RRE 008 R CEFX 0000011736 A   G G K 13 11 018 04 01
RRE 009 R QTTX 0000131365 A   G G K 13 13 018 08 01
RRE 010 R MWCX 0000461779 A   G G L 07 05 019 04 01
RRE 011 R QTTX 0000131427 A   G G K 12 12 019 08 01
RRE 012 R CSXT 0000224519 B   G G K 12 10 019 04 01
RRE 013 R CSXT 0000225127 A   G G K 09 08 019 04 01
RRE 014 R CSXT 0000225131 B   G G K 10 09 019 04 01
RRE 015 R SRLX 0000000508 A   G G K 13 12 019 04 01
RRE 016 R ANAX 0000003775 B   G G K 13 11 019 04 01
RRE 017 R CSXT 0000136791 B   G G K 12 11 019 04 01
RRE 018 R CSXT 0000223367 A   G G K 12 10 019 04 01
RRE 019 R FURX 0000815465 B   G G K 11 10 019 04 01
RRE 020 R CSXT 0000507263 B   G G K 12 10 019 04 01
RRE 021 R SRLX 0000000625 A   G G K 12 10 019 04 01
RRE 022 R CSXT 0000224227 B   G G K 11 12 019 04 01
RRE 023 R CSXT 0000225123 A   G G K 09 09 019 04 01
RRE 024 R USLX 0000001711 B   G G K 11 10 019 04 01
 .
 .
 .
RRE 049 R DUPX 0000039007 A   G G K 03 08 021 04 01
RRE 050 R BPRX 0000005370 A   G G K 09 09 021 04 01
RRE 051 R BPRX 0000206214 A   G G K 09 08 021 04 01
RRE 052 R NATX 0000301405 B   G G K 10 10 022 04 01
RRE 053 R ADMX 0000031304 B   G G K 09 09 022 04 01
RRE 054 R ADMX 0000030187 A   G G K 07 07 022 04 01
RRE 055 R ADMX 0000030425 A   G G K 11 10 022 04 01
RRE 056 R TILX 0000191029 A   G G K 11 08 022 04 01
RRE 057 R TILX 0000191057 B   G G K 10 10 022 04 01
RRE 058 R ADMX 0000030818 B   G G K 10 10 022 04 01
EOC 0000003182
```

T94 Report Example
(Note: AEM record has been truncated)

7.8.4 System Status Report

The System Status Report provides an overall snapshot of the current configuration of the Reader system.

```
================================================================================
                        Southern Technologies Corporation
                              Model 2600 AEI Reader
                              System Status Report

                         Run Date: 04/26/2014 11:44 EDT          {Cromwell}
================================================================================
System Supply Voltages (last updated: Thu Apr 26 11:44:17 2014)
--------------------------------------------------------------------------------
AC Power Status..... OK           FEP 5V Supply..... 5.0V
24V System Supply..... 24V        IPC 5V Supply..... 0.8V
12V Supply..... 11.9V             Internal Temp..... +86F


System Setup Parameters
--------------------------------------------------------------------------------
Site ID..... Cromwell      Train Scanning..... Enabled
Multi-Track Site..... No   Antenna Between Tracks... N/A
Track Orientation..... North/South   Whl Detector Config..... Dual
Max Num Of Stored Trains.... 100     Max Train Number..... 100

Reader 1 Type..... AI1200  Reader 2 Type..... None


Track Hardware Setup Parameters
--------------------------------------------------------------------------------
Whl Det Pulse Width Filter.. 3       Presence Timeout Period.. 00:10 mm:ss
Whl Det Pair Spacing..... 114        Presence Debounce Filter. 3
Tag ID Separation..... 2             Antenna Offsets..... N/A
Tag Consecutive Reads..... 2
Tag Uniqueness Timeout..... 30 sec


Session Status
--------------------------------------------------------------------------------
Session 1              (Enabled,ns)
Session 2              (Disabled,cn)
Session 3              (Disabled,none)
Session 4              (Disabled,none)
Session 5              (Disabled,None)
Maintenance Session 1  (Disabled,none)
Maintenance Session 2  (Disabled,None)

.
.
.

================================================================================
```

First section of the System Status Report
(continues on the following page)

(System Status Report, cont.)

```
Network Interfaces Setup Parameters
-------------------------------------------------------------------------------
LAN Interface (Inactive):                MAC Address (LAN)....00:04:BF:91:4F:5B
IP Assignment (LAN)...... Disabled       IP Address (LAN)......... 10.14.22.31
Subnet Mask (LAN)........ 255.255.255.0  Default Gateway (LAN)....

WAN Interface (Active, 100Mbps):         MAC Address (WAN)....00:04:BF:91:4F:5C
IP Assignment (WAN)...... Dynamic (DHCP) IP Address (WAN)......... 10.14.22.171
Subnet Mask (WAN)........ 255.255.255.0  Default Gateway (WAN).... 10.14.22.1

DNS Servers:
Primary DNS Server....... 10.14.22.15
Secondary DNS Server..... 66.18.32.2
Tertiary DNS Server...... 66.18.32.3



-------------------------------------------------------------------------------
FEP Firmware Version: ML0.6d 02/22/12

IPC Software Revision Status
-------------------------------------------------------------------------------
 IPC Build Image Timestamp: 2014-02-29_13:45   Build Label: Release_Feb_2014b



System Processes Versions
-------------------------------------------------------------------------------
  CommsMonitor............. 1.02f 02/23/14
  MaintAlarmTrnScanner..... 1.02 08/23/14
  MultiTrackCommsManager... 1.07  09/28/14
  SessionManager........... 1.06e 03/06/14
  TDProcess................ 1.06o 02/28/14
```

The System Status Report can be printed by selecting the System Status option located on the on the **Report Menu.**

7.8.5 Event Log Report

The purpose of the Event Log in the Model 2600 AEI Reader is to provide a means for tracking the operations that have been performed by the system and for logging specific error events encountered by the system. The Event Log is used to document the status and operations performed by the Model 2600 Reader. Messages are posted to the log chronologically as certain events are detected by the system, as the system executes certain functions, and when certain error conditions are encountered. The Event Log Report example provided on the following page was retrieved from an operational site and, as such, the records contained therein are specific to that site.

The Event Log Report can be printed by accessing the **Event Log Menu** option located on the **Report Menu.**

```
May 17 01:43:29 localhost SessMgr: _SUCCESS
May 17 01:43:29 localhost serial-port-open: exited normally.
May 17 01:43:21 localhost logger: ptra_protocol.sh finished normally.
May 17 01:43:20 localhost logger: ptra_protocol.sh: Timestamp extracted: 2011-05-17,02:44:2T
May 17 01:43:20 localhost logger: ptra_protocol.sh: Synch. clock with host timestamp disabld
May 17 01:43:19 localhost logger: ptra_protocol.sh: Zmodem transfer completed normally.
May 17 01:43:19 localhost logger: ptra_protocol.sh: Server response = ZCOMP 4DD227541.Xfr,1T
May 17 01:43:12 localhost logger: ptra_protocol.sh: Starting zmodem transfer, filename: 1107
May 17 01:43:09 localhost logger: ptra_protocol.sh: "Go" response received.
May 17 01:43:07 localhost logger: ptra_protocol.sh: ZMod prompt transmitted.
May 17 01:43:02 localhost logger: ptra_protocol.sh: modem_dialout (): Connected to 1-866-20.
May 17 01:42:38 localhost logger: ptra_protocol.sh: modem_dialout (): Dialing 1-866-201-060.
May 17 01:42:37 localhost logger: ptra_protocol.sh: get_modems_attention (): Found modem on.
May 17 01:42:34 localhost serial-port-open: started.
May 17 01:42:34 localhost serial-port-open: serialportwrapper: isSerialportAvailable()
May 17 01:42:34 localhost serial-port-open: serialportwrapper: checkForActiveLockFile(): Cr
May 17 01:42:34 localhost logger: ptra_protocol.sh: started.
May 17 01:42:33 localhost SessMgr: Trn#23 N/E cars=0 axles=0 sent=Y S/W cars=25 axles=100 s]
May 17 01:42:33 localhost SessMgr: Reporting Session: SessionNum_2
May 17 01:42:33 localhost SessMgr: ptra_protocol.sh "/var/local/ngaei_data/t94/2011051701401
May 17 01:42:33 localhost SessMgr: Print T94 Report - DONE.
May 17 01:42:33 localhost SessMgr: Building T94 Report: Train #23
May 17 01:42:26 localhost MaintAlarmTrnScanner: Scanning "/var/local/ngaei_data/20110517014"
May 17 01:42:23 localhost SessMgr: Train data directory change detected: Newest Train = #23
May 17 01:42:11 localhost TDProcess: Writing train data to file: /var/local/ngaei_data/2011n
May 17 01:42:11 localhost TDProcess: Writing diagnostic data to file: /var/local/ngaei_dataw
May 17 01:42:11 localhost TDProcess: Wheel detector config. = Single
May 17 01:42:11 localhost TDProcess: Total CBAs Rcvd: 100 Total Tags Rcvd: 49
May 17 01:42:11 localhost TDProcess: Presence Clear; Train Number 23
May 17 01:40:02 localhost TDProcess: (SWDO) Presence Startup; Train Number 23
```

Event Log Report Example

7.8.6 Maintenance Log Report

The Model 2600 AEI Reader maintains the Maintenance Log for the purpose of supporting the maintenance reporting requirements of the document “AAR Manual of Standards and Recommended Practices.” S-918A, section K, “AEI Site-To-Host Consist Report Format.”

The Maintenance Log Report can be printed by accessing the **Maintenance Log Menu** option located on the **Report Menu.**

```
                          Train Maint
   Date      Time   PID  Num   Code    Maint. Message         Add. Text
---------- -------- --- ----- ----- -------------------- ---------------------
02-14-2014 11:36:20 012  0000  0031 Front Door Start
02-14-2014 11:08:52 011  0012  0080 Host Time Sync       2014-02-14,11:09:15_EST
02-14-2014 11:08:52 011  0012  0044 Data Accepted
02-14-2014 11:08:40 011  0012  0021 Response Match       T94 SEND
02-14-2014 11:08:38 011  0012  0021 Response Match       READY
02-14-2014 11:08:38 011  0012  0015 Modem Connected      1-888-672-2032
02-14-2014 11:08:11 011  0012  0003 General Info         ns_protocol.sh
02-14-2014 11:07:57 002  0012  0084 Record Complete      CR:040 AX:0166 TG:038/041
02-14-2014 11:07:57 002  0012  0005 Presence Clear
02-14-2014 11:06:49 002  0012  0004 Presence Startup
02-14-2014 08:48:37 011  0011  0080 Host Time Sync       2014-02-14,08:49:00_EST
02-14-2014 08:48:37 011  0011  0044 Data Accepted
02-14-2014 08:48:22 011  0011  0021 Response Match       T94 SEND
02-14-2014 08:48:21 011  0011  0021 Response Match       READY
02-14-2014 08:48:21 011  0011  0015 Modem Connected      1-888-672-2032
02-14-2014 08:47:54 011  0011  0003 General Info         ns_protocol.sh
02-14-2014 08:44:33 011  0011  0016 Modem Connect Error  1-888-672-2032
02-14-2014 08:43:50 004  0011  0110 Antenna Failure      CR:127 AX:0514 TG:000/126
02-14-2014 08:43:32 011  0011  0003 General Info         ns_protocol.sh
02-14-2014 08:43:26 002  0011  0084 Record Complete      CR:127 AX:0514 TG:000/126
02-14-2014 08:43:26 002  0011  0005 Presence Clear
02-14-2014 08:41:22 002  0011  0004 Presence Startup
02-14-2014 08:28:42 011  0010  0080 Host Time Sync       2014-02-14,08:29:05_EST
02-14-2014 08:28:42 011  0010  0044 Data Accepted
02-14-2014 08:28:29 011  0010  0021 Response Match       T94 SEND
02-14-2014 08:28:28 011  0010  0021 Response Match       READY
02-14-2014 08:28:28 011  0010  0015 Modem Connected      1-888-672-2032
02-14-2014 08:27:59 011  0010  0003 General Info         ns_protocol.sh
02-14-2014 08:27:30 002  0010  0084 Record Complete      CR:074 AX:0300 TG:068/072
02-14-2014 08:27:30 002  0010  0005 Presence Clear
```

Maintenance Log Report Example

7.8.7 Diagnostic Train Summary Report

The Diagnostic Train Summary Report can be printed by accessing the **Diagnostic Report Menu** option located on the **Report Menu.**

```
================================================================================
                        Southern Technologies Corporation
                              Model 2600 AEI Reader
                         Diagnostic Train Summary Report

                         Run Date: 09/14/2014  08:13:33              Cromwell
================================================================================
        | | Speed |  Num Axles   |Fltrd Pls|Tag Cnt|Avg Hsk|M| Sessions  |
        |D|-------|--------------|---------|-------|-------|o|-----------|
Trn  |Num|i|       |     T01/ T03/|T01/ T03/|Ant Ant|Ant Ant|v|  Xfr Flags|
Num  |Crs|r|Max Min| Trn  T02  T04| T02  T04| 1   2 | 1   2 |e|# Att NE SW|
-----|---|-|--- ---|---- ---- ----|---- ----|--- ---|--- ---|-|- --- -- --|-----
  49   58 N  22  18  252  252  251    0    0  57  58  10   9 A 1   1  S  -
                      250  252    0    0
  48   66 S  31  18  270  270  270    0    0  67  66   9   8 A 1   1  -  S
                      270  270    0    0
  47   46 S  12   2  234  234  236    0    0  53  54  25  23 D 1   1  -  S
                      234  236    0    0
  46   53 N  10   4  232  234  234    0    0  52  54  23  20 B 1   1  S  -
                      234  234    0    0
  45  112 N  39  33  452  452  452    0    0 113 113   6   5 A 1   1  S  -
                      452  452    0    0
  44   36 S  29  27  144  144  144    0    0  37  35   7   6 A 1   1  -  S
                      144  144    0    0
  43   48 S  43  38  340  340  340    0    0  49  47   5   5 A 1   1  -  S
                      340  340    0    0
  42    8 N  42  42   32   32   32    0    0   8   9   4   3 A 1   1  S  -
                       32   32    0    0
  41   15 S  44  39   88   88   88    0    0  16  15   4   4 A 1   1  -  S
                       88   88    0    0
   .
   .
   .
```

Diagnostic Train Summary Report Example

```
=============================================================================
        | | Speed | Num Axles    |Fltrd Pls|Tag Cnt|Avg Hsk|M| Sessions  |
        |D|-------|--------------|---------|-------|-------|o|-----------|
Trn  |Num|i|       |    T01/ T03/ |T01/ T03/|Ant Ant|Ant Ant|v|  Xfr Flags|
Num  |Crs|r|Max Min| Trn T02  T04 | T02  T04| 1   2 | 1   2 |e|# Att NE SW|
-----|---|-|--- ---|---- ---- ----|---- ----|--- ---|--- ---|-|- --- -- --|-----
```

The following descriptions apply to the fields found in the Diagnostic Train Detail Report. The excerpt above is provided for reference.

Diagnostic Train Detail Report	
Trn Num (Train Number)	This column contains the chronologically sequential number assigned to each train as they are processed by the 2600 Reader.
Num Crs (Number of Cars)	This field indicates the number of vehicles (locomotives and railcars) that were identified in the consist.
Dir (Direction)	This field indicates the direction that the train was traveling as it exited the reader site.
Speed, Max, Min	These fields indicate the fastest and slowest speeds recorded for the train as it crossed the 2600 Reader site.
Num Axles, Trn (Number of Axles, Train)	This field reflects the number of axles that were detected by the 2600 Reader's wheel detectors.
Num Axles, T01/T02, T03/T04 (Number of Axles, T01/T02, T03/T04)	These four fields reflect the number of times that the individual wheel detector elements were activated as a train crossed a 2600 Reader site. In the above example, T01 was activated 252 times while T02 was activated 250 times. T03 was activated 251 times and T04 was activated 252 times. Differences between these four fields generally indicate a problem with a wheel detector. However, where switching moves or stop/roll-back activity is common, small differences would be expected.
Fltrd Pls, T01/T02, T03/T04 (Filtered Pulses, T01/T02, T03/T04)	These four fields reflect the numbers of noise "spikes" that were filtered from the wheel detector inputs. Where Tiefenbach wheel detectors are used, these fields should always have the value of zero.
Tag Cnt, Ant 1, Ant 2 (Tag Count, Antenna 1, Antenna 2)	These two fields reflect the number of AEI tags that were read as a train crossed the 2600 Reader site.
Avg Hsk, Ant 1, Ant 2 (Average Handshakes, Antenna 1, Antenna 2)	These fields reflect the average number of times that each tag (recorded for the consist) was read as it passed through the RF field produced by the antennas. In the above example, the 57 AEI tags read by Antenna 1 were each read an average of 10 times as they passed through the RF field produced by Antenna 1.
Move (Movement Type)	This field reflects the type of the movement recorded, as follows: A = through movement, over 5 mph for the entire train. B = through movement, speed was under 5 mph for some part of the train. C = through movement, the train stopped at some point. D = through movement, switching move, some changes in direction were detected. E = simulated train F = reverse exit

Session Fields

These fields reflect the progress made by the activated T94 Reporting Sessions in reporting the referenced trains. The excerpt shown below is provided for reference.

```
-------------------------------------------------------------------------------
        | | Speed |  Num Axles   |Fltrd Pls|Tag Cnt|Avg Hsk|M| Sessions  |
        |D|-------|--------------|---------|-------|-------|o|-----------|
Trn |Num|i|       |     T01/ T03/|T01/ T03/|Ant Ant|Ant Ant|v|  Xfr Flags|
Num |Crs|r|Max Min| Trn  T02  T04| T02  T04| 1   2 | 1   2 |e|# Att NE SW|
----|---|-|--- ---|---- ---- ----|---- ----|--- ---|--- ---|-|- --- -- --|-----
 711  54 S   9   0  218  220  220    0    0  56  53  39  39 C 1   1  -  S
                     220  220    0    0                     3   4  -  T
                                                           5   7  -  S
```

Session Fields Detail	
Session #	This field indicates for which Reporting Session status is being provided. Each active/enabled reporting session will be represented for each train. In the above example, Reporting Sessions #1, #3, and #5 are enabled and their status, regarding the reporting of the indicated train (#711), is indicated.
Xfr Att (Transfer Attempts)	This field indicates the number of attempts that have been made to transfer the T94 report for the indicated train, according to the specified reporting session number. In the above example, it took the 2600 Reader one attempt to successfully transmit the T94 report for Train #711, as indicated by reporting session #1. It took the reader seven attempts for session #5. For session #3, the reader is still trying (**T**) to transmit the report (after four attempts).
Flags, NE SW	The flags fields reflect the possibility that two different T94 reports could be generated for the same consist. This would occur where a switching move was recorded and net changes in the consist were detected in both directions. In the above example, the train recorded was a straight pull-through movement, going South, so only a "southbound" T94 report would have transmitted. The dashes (-) in the NE column indicate that there was no reportable movement recorded in the northbound direction.
Flags, NE SW, possible entries	**S-Success**: The T94 report for the indicated train was successfully transferred as specified by the referenced reporting session. **R-Rejected**: The T94 report for the indicated train was rejected by the receiving server/computer in at least five attempts to transmit it. **T-Trying:** The 2600 Reader has made at least one attempt to transmit the T94 report for the indicated train, and further attempts will be made to do so. **H-On Hold**: The 2600 Reader has attempted the number of times specified by the session's **Maximum Retry Attempts** parameter and has failed to transmit the T94 report for the indicated train. The 2600 Reader is waiting for the next train to cross the site before making further attempts. **K-Skipped:** The 2600 Reader did not attempt to transmit the T94 report for the indicated train because it failed to meet some criterion/criteria established by the Reporting Session configuration. For instance, if the "Minimum Axle Count" field is set to 4 and only two axles are recorded for a movement, then the train will be skipped (for reporting purposes).

7.8.8 Diagnostic Train Detail Report

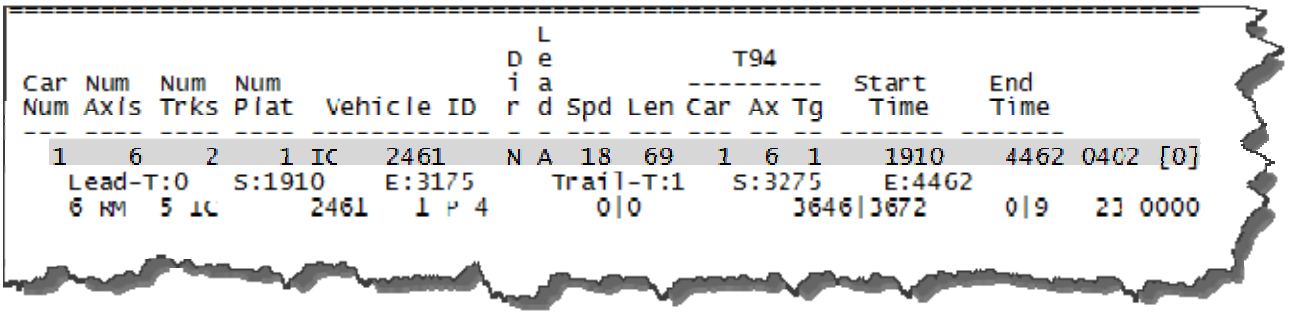
The Diagnostic Train Detail Report can be printed by accessing the **Diagnostic Report Menu** option located on the **Report Menu.**

```
================================================================================
                        Southern Technologies Corporation
                              Model 2600 AEI Reader
                         Diagnostic Train Detail Report


                         Run Date: 02/09/2014  15:55:04               Cromwell
================================================================================
File Name: 201402062342_0005.trn
================================================================================
Train : 5          | Axles    : 112  |                  Total  N/E  S/W
Date  : 02-06-14   | Cars     : 27   | Vehicle Count   :   27   27    0
Time  : 23:42      | Max Speed: 21   | Locos Tagged    :    2    2    0
Dir   : N          | Min Speed: 18   |        Untagged :    0    0    0
Length: 1698   ft  | Avg Speed: 19   | Railcars Tagged :   25   25    0
                   |                 |        Untagged :    0    0    0
================================================================================
Txdr. Count  Fltr |         Count    | Total Tags Read:   55
T01 :   112    0  |   PairA:  112    |
T02 :   112    0  |                  |              Ant1  Ant2
T03 :   112    0  |   PairC:  112    | Tag Count  :   27    28
T04 :   112    0  |                  | Avg Hndshks:    6    11
                   |                  | Timestamp  :    Y     N
================================================================================
                                    L
                                  D e            T94
 Car Num  Num  Num                i a         ---------  Start    End
 Num Axls Trks Plat  Vehicle ID   r d Spd Len Car Ax Tg   Time    Time
 --- ---- ---- ---- ------------ - - --- --- --- -- -- -------- -------
   1    6    2    1 IC   2461    N A  18  69   1  6  1    1910    4462 0402 [0]
    Lead-T:0   S:1910    E:3175     Trail-T:1   S:3275    E:4462
    6 RM  5 IC      2461   1 P 4       0|0          3646|3672     0|9   23 0000
   1     0 C  4   1910   cadb    1910    1924    1968    1978    58   54    68
   1     0 C  4    178   cadb    2156    2170    2215    2225    59   55    69
   1     0 A  4   2282   cadb    2282    2299    2349    2353    67   54    71
   1     0 C  4    191   cadb    2416    2429    2474    2484    58   55    68
   1     0 A  4    175   cdab    2528    2594    2545    2599    66   54    71
   1     0 A  4    188   cdab    2787    2851    2804    2857    64   53    70
   1     1 C  4   1036   cdab    3520    3578    3534    3588    58   54    68
   1     1 C  4    177   cdab    3765    3824    3779    3834    59   55    69
   1     1 A  4   1033   cdab    3890    3956    3907    3960    66   53    70
   1     1 C  4    187   cdab    4021    4082    4035    4092    61   57    71
   1     1 A  4    174   cdab    4134    4201    4151    4205    67   54    71
   1     1 A  4    186   cdab    4391    4457    4409    4462    66   53    71

   2    6    2    1 CN   5682    N B  18  71   2  6  1    4306    7139 0406 [1]
    Lead-T:2   S:4306    E:5778     Trail-T:3   S:5944    E:7139
    6 GK  5 CN      5682   2 P 0    5236|5249       6256|6295     7|10  72 2000
   2     2 C  4    428   cdab    4520    4579    4533    4589    59   56    69
   2     2 C  4    176   cdab    4765    4825    4779    4835    60   56    70
   2     2 A  4    425   cdab    4887    4957    4905    4960    70   55    73
   2     2 C  4    188   cdab    5023    5083    5036    5093    60   57    70
   2     2 A  4    173   cdab    5133    5201    5150    5205    68   55    72
   2     2 A  4    186   cdab    5391    5457    5407    5462    66   55    71
   2     3 C  4   1108   cdab    6201    6262    6215    6272    61   57    71
   2     3 C  4    186   cdab    6458    6518    6472    6527    60   55    69
   2     3 A  4   1105   cdab    6567    6635    6584    6639    68   55    72
   2     3 C  4    175   cdab    6702    6762    6716    6772    60   56    70
   2     3 A  4    185   cdab    6824    6891    6841    6895    67   54    71
   2     3 A  4    173   cdab    7068    7134    7084    7139    66   55    71
```

Diagnostic Train Detail Report

Vehicle Header Lines

The vehicle header lines of the Train Detail Report provide a compact summary of the wheel detector and AEI tag data that is accumulated for each vehicle and is used in establishing the consist breakout, etc. The figure below identifies the function of each of the lines in the vehicle header. *The data provided was taken from that of the first vehicle shown in the Diagnostic Train Detail Report above.*

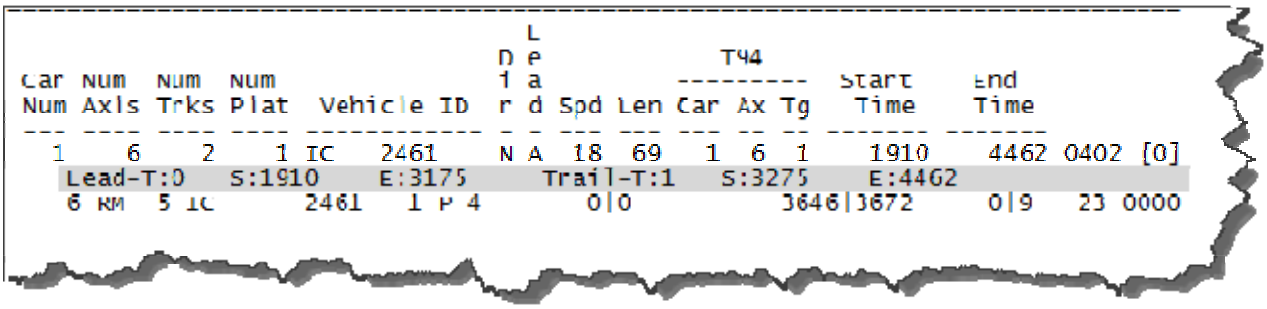


Vehicle Data Summary Line

This line provides summary level information for the vehicle represented including axle count, AEI tag count, direction of travel, vehicle orientation, speed, etc. Using data from the highlighted example above, the fields in this line are described below.

Car Num		1	The sequential number of the vehicle in the consist
Num Axls		6	The number of axles assigned to the vehicle – based upon wheel detector signal timings
Num Trks		2	The number of trucks detected on the vehicle
Num Plat		1	The number of platforms detected on the vehicle
Vehicle ID		IC 2461	The AEI tag determined to be the identifier for a vehicle
Dir		N	The vehicle's direction of travel.
Lead		A	Identifies the orientation of the car; B = brake end
Spd		18	The speed of the vehicle
Len		69	The calculated length of the vehicle
T94	Car	1	The corresponding sequence number in the consists T94 report
	Ax	6	The axle count shown in the corresponding T94 report record
	Tg	1	The tag count shown in the corresponding T94 report record
Start Time		1910	The elapsed time, in milliseconds, from the start of the consist, that a vehicle arrived on the site.
End Time		4462	The elapsed time, in milliseconds, from the start of the consist, that a vehicle exited the site.
diagnostic flags		0402	This field contains encoded information that STC uses to analyze consist breakout issues.
logical car num		[0]	The logical sequence number (position in the consist) of a car. This field becomes significant when analyzing consist switching movements.

Truck Timing Information Line



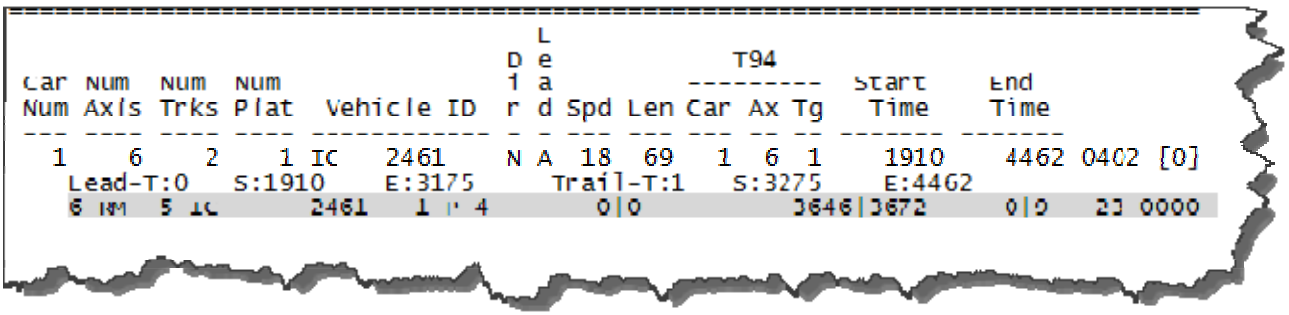
This line provides timing/positional information regarding the leading and trailing trucks of a vehicle. This information is used by STC when evaluating tag placement issues. The data is used in isolating the correct AEI tag to use in identifying a vehicle, where multiple tags have been associated with a vehicle (e.g., in double-track applications).

Refer to the highlighted data, above, for the following table.

Lead-T	0	The sequence number assigned to the lead truck of a vehicle; the truck sequence number starts at 0 and is incremented throughout the consist
S	1910	The elapsed time, in milliseconds, from presence detection, that the lead truck entered the site.
E	3175	The elapsed time, in milliseconds, from presence detection, that the lead truck exited the site.
Trail-T	1	The sequence number assigned to the last (trailing) truck of a vehicle.
S	3275	The elapsed time, in milliseconds, from presence detection, that the trailing truck entered the site.
E	4462	The elapsed time, in milliseconds, from presence detection, that the trailing truck entered the site.

AEI Tag Data Line

This line provides information specific to each of the AEI tags (tag pairs) that have been associated with a vehicle.



```
                                        L
                                   D    e                  T94
Car Num  Num  Num                  i    a          ---------  Start     End
Num Axis Trks Plat  Vehicle ID     r    d Spd Len  Car Ax Tg   Time     Time
--- ---- ---- ---- ------------ -  -  --- --- --- -- -- -------- --------
  1    6    2    1 IC   2461    N  A  18  69   1  6  1    1910     4462 0402 [0]
   Lead-T:0   S:1910    E:3175      Trail-T:1   S:3275    E:4462
   6 R  5 IC       2461   1 P 4        0|0           3646|3672     0|9   23 0000
```

Refer to the highlighted data, above, for the following table.

	6	Axle count field decoded from tag record
	R	Tags, of a pair, read: R = Right only, L= Left only, G = “Good” - both tags of a pair read.
	L	The “Tag Detail Status” field that would appear in a T94 RRE record with this tag. K = OK, A = Axles error, L= Length error, P = Platform Code error, W = Window violation, M = Multiple
	5	The Equipment Group Code (EGC) field decoded from the tag record
	IC 2461	The Owner Code and Equipment Number fields decoded from the tag record
P	0	The Platform Code decoded from the tag record
	0 | 0	The timestamp and adjusted timestamp that reflect when the tag was read by Antenna 0 (elapsed time, in milliseconds, from presence detection). 0 indicates tag was not read by Antenna 0. The adjusted timestamp reflects an offset added that the handshakes field is used to calculate
	3646 | 3672	The timestamp and adjusted timestamp that reflect when the tag was read by Antenna 1 (elapsed time, in milliseconds, from presence detection). The adjusted timestamp reflects the addition of an offset that is calculated using the Handshakes field
	0 | 9	Handshakes for tag read by Ant0 | Ant1; 0 indicates tag was not read by the respective antenna
	23	The length field decoded from the tag record
	0000	Diagnostic flags field; used by STC in isolating tag association/reporting issues.

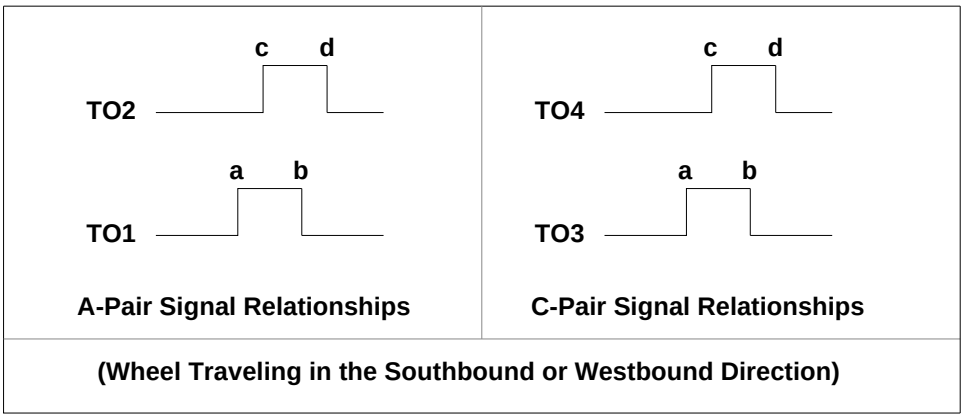
Wheel Detector Detail Data Lines

Notes regarding the data used in the following example:

- The wheel detectors each contain two sense elements –a pair of sense elements. Where the dual wheel detector configuration is used, the wheel detectors are labeled the A-Pair and the C-Pair. So, in the Wheel Detector Data Detail figure in the **W/D Pair Identifier** column, the 'A's and 'C's refer to data/records produced by the A-Pair and C-Pair wheel detectors, respectively.

- The sense elements within the A-Pair wheel detector are referred to as T01 and T02.
- The sense elements within the C-Pair wheel detector are referred to as T03 and T04.
- The signals generated by the T01 and T03 wheel detector elements are labeled: ab.
- The signals generated by the T02 and T04 wheel detector elements are labeled: cd.

The relationships between the signals produced by the elements of each of the wheel detector pairs are shown in the Wheel Detector Signal Relationships diagram below.



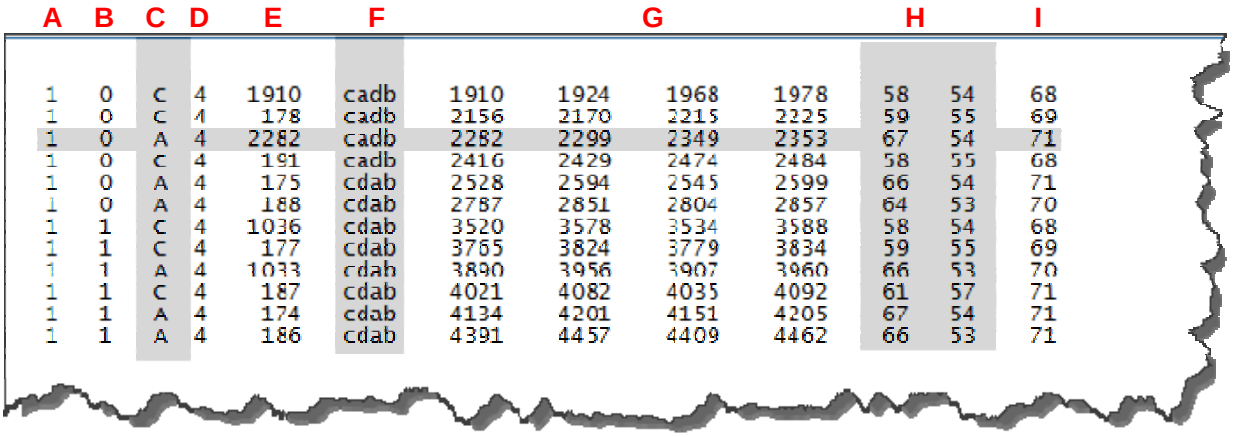
Wheel Detector Signal Relationships

Note that, as depicted in the diagram above, where ab and cd are used in conjunction with the wheel detector element signals;

- a –refers to a signal rising edge
- b –refers to a signal falling edge
- c –refers to a signal rising edge
- d –refers to a signal falling edge

The A-Pair wheel detector is installed as the **northernmost** wheel detector on a **north-south** track. The A-Pair wheel detector is installed as the **easternmost** wheel detector on an **east-west** track.

In summary, in respect to the wheel detector data records (as depicted in the figure below), where the A-Pair wheel detector is referenced, ab refers to the rising and falling edges, respectively, of a signal produced by T01, and cd refers to the rising and falling edges, respectively, of a T02 produced signal.



Refer to the corresponding columns in the table below for descriptions of the fields in the image above. *Note: the data shown above was generated at a 2600 Reader site where the dual wheel detector configuration was used.*

Wheel Detector Detail Data Lines	
A--Prelim. Car Number	This number gets assigned to the wheel detector records when they are first generated. This number represents a first, rough-cut at the consist breakout, and is useful to STC for diagnostic purposes.
B--TruckNumber	This number is assigned to the wheel detector records as they are evaluated by the system consist/vehicle breakout logic as the individual trucks of a consist are identified.
C--W/D Pair Identifier	This field identifies which wheel detector generated the data for the record. In the above example, the highlighted horizontal line contains an **A** for this field. This means that the data in the record was generated by the **A-Pair** wheel detector. Further, this means that the **ab** and **cd** references in the "Pulse Edge Labels" column of the record refer to T01 and T02, respectively. The W/D Pair Identifier fields in consecutive records form a predictable pattern. In the example shown, the **CCACAA** pattern of the first six records is the pattern generated by the first truck of **a six-axle locomotive**. A locomotive traveling in the opposite direction would produce the pattern **AACACC**. Where the wheel detectors are operating properly, the trucks of **four axle vehicles** will typically produce the following pattern **CCAA** or **AACC**, depending upon direction of travel.
D--Pulse Edge Count	This field indicates the number of pulse edges that were recorded for the record. Where the wheel detectors are operating properly, this field will contain the value 4. Where a wheel detector is misaligned, this field could contain the value 2 (where one of the wheel detector elements did not fire) or it could contain the value 5 (where multiple hits were generated by one or more of the wheel detector elements).

E--Offtime	This field contains the amount of time, in milliseconds, that elapsed between the previous hit (wheel crossing) of the indicated wheel detector pair and the hit represented by a given detail data record. In the example above, the designated horizontal line contains the value 2282. This indicates that 2282 milliseconds (2 seconds, 282 milliseconds) separated the wheel/axle represented by the record and the wheel/axle represented by the previous A-Pair record (2282 milliseconds separated consecutive "hits" on the A-Pair wheel detector). In this case, the 2282 milliseconds elapsed between initial detection of train presence and when the first wheel crossed the A-Pair wheel detector
F--Pulse Edge Labels	This field indicates which element(s) of a wheel detector fired to produce the record and in which order. The order of the letters/labels in this field indicates how the values in the subsequent "Rising/Falling Edge Timestamps" field are ordered. In the example above, the designated horizontal line contains **cadb** in this field. Because the "W/D Pair Identifier" field for this record indicates the **A-Pair** wheel detector produced this record, the **cd** in this field refers to the rising and falling edges produced by **T02** and **ab** refers to the rising and falling edges produced by **T01**. Referring to the "Rising/Falling Edge Timestamps" field, wheel detector element T02 was energized at 2282 milliseconds and was de-energized at 2349 milliseconds elapsed time since presence detection. Note that this corresponds to the value 67 (milliseconds) in the "Lead W/D Pair Pulse Within" column of this record. Where only a **cd** or only an **ab** appear in this field, this indicates that one of the elements with a wheel detector did not activate for the wheel represented.
G--Rising/Falling Edge Timestamps	The values in these fields represent the elapsed time, in milliseconds, since train presence was detected, that a change in signal state was detected at a wheel detector input. The contents of the "Pulse Edge Labels" field, in conjunction with that of the "W/D Pair Identifier" field are used to interpret the values shown for a given record. In the example above, the highlighted horizontal record indicates that a wheel first activated wheel detector element T02 at 2282mS then activated T01 at 2299mS. Subsequently, T02 deactivated at 2349mS and T01 deactivated at 2353mS.
H--Pulse Widths	This field indicates the amount of time that each element within a wheel detector was energized as a wheel crossed over it. In the highlighted line in the example above, because the record was produced by the A-Pair wheel detector and the T02 element was the first element activated, the Pulse Widths fields indicate that T02 wheel detector element was active for 67 mS and the T01 element was active for 54 mS. Ideally, the values in these fields should be within five milliseconds of each other. Unbalanced values in these fields indicate that one element within a wheel detector is more sensitive than the other. This might indicate a physically misaligned wheel detector, or it could just mean that the wheel detector elements are in need of being aligned or adjusted.
I--Wheel Dwell Time	This field indicates the amount of time, in milliseconds that a given wheel took to cross completely over a wheel detector. In the example above, the designated record indicates that the represented wheel took 71 milliseconds to cross completely over the wheel detector.

Below is an example of a Diagnostic Train Detail Report where a single Tiefenbach wheel detector was used.

```
================================================================================
                Southern Technologies Corporation
                     Model 2600 AEI Reader
                **Diagnostic Train Detail Report**

                 Run Date: 05/17/2014  15:08:07            {MAPLESVILLE}
================================================================================

File Name: 201105170140_0023.trn
================================================================================
Train : 23        | Axles    : 100  |                 Total  N/E  S/W
Date  : 05-17-14  | Cars     : 25   | Vehicle Count   :   25    0   25
Time  : 01:40     | Max Speed: 10   | Locos Tagged    :    2    0    2
Dir   : S         | Min Speed: 6    |        Untagged :    0    0    0
Length: 1563   ft | Avg Speed: 9    | Railcars Tagged :   23    0   23
                  |                 |        Untagged :    0    0    0
================================================================================
Txdr. Count  Fltr |         Count   | Total Tags Read:   49
T01 :   100    0  |   PairA:  100   |
T02 :   100    0  |                 |             Rdr1  Rdr2
T03 :     0    0  |   PairC:    0   | Tag Count  :   25    24
T04 :     0    0  |                 | Avg Hndshks:   22    31
                  |                 | Timestamp  :    Y     N
================================================================================
                             L
                          D e            T94
Car Num  Num  Num              i a         ---------  Start    End
Num Axls Trks Plat  Vehicle ID  r d Spd Len Car Ax Tg   Time    Time
--- ---- ---- ---- ------------ - - --- --- --- -- -- ------- -------
1    4    1    0 WAMX 3908    S B   6  30   1  4  1       1    3349 0406
 Lead-T:0   S:1       E:3349     Trail-T:0   S:-629    E:3349
4 GL  5 WAMX    3908   2 P 4    1777|1920        377|494     26|23  59 2000
 1     0 A  4      0   acbd       0      23      82     106    82   83   106
 1     0 A  4    629   acbd     629     652     711     735    82   83   106
 1     0 A  4   1604   acbd    2233    2255    2317    2341    84   86   108
 1     0 A  4    626   acbd    2859    2882    2944    2968    85   86   109

2    4    1    0 WAMX 3909    S A   6  34   2  4  1    3351    7121 0406
 Lead-T:1   S:3351    E:7121     Trail-T:1   S:3218    E:7121
4 GL  5 WAMX    3909   2 P 4    5737|5880       4047|4229    26|33  59 2000
 1     1 A  4    983   abcd    3842    3921    3865    3945    79   80   103
 1     1 A  4    624   abcd    4466    4550    4488    4574    84   86   108
 1     1 A  4   1592   abcd    6058    6142    6081    6165    84   84   107
 1     1 A  4    626   abcd    6684    6761    6707    6785    77   78   101

3    4    2    1 NS   198527  S A   9  75   3  4  1    7122   12394 0405
Lead-T:2   S:7122    E:8575     Trail-T:3   S:11261   E:12394
4 GK 19 NS    198527   2 P 0   11327|11457      7497|7666    24|31  75 2000
 1     2 A  4    876   abcd    7560    7644    7582    7667    84   85   107
 1     2 A  4    406   abcd    7966    8045    7989    8069    79   80   103
 1     3 A  4   3696   abcd   11662   11741   11684   11764    79   80   102
 1     3 A  4    401   abcd   12063   12144   12085   12167    81   82   104
```

Diagnostic Train Detail Report—Use of Single Tiefenbach Wheel Detector

Chapter 8 — Customer Service

At STC, the customer is number one. STC is committed to products that work and customers that are satisfied. Nothing less is acceptable. This chapter tells how to get answers for questions, fixes for problems, and parts for spares.

8.1 Reaching STC

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

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

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

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

8.2 Returning Equipment for Repair

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

With the returned equipment, include:

- complete address where the equipment is to be returned;
- name and phone number of the person who should be contacted to answer questions about the equipment;
- written explanation of the equipment defect or malfunction;
- any reports or other data that would be helpful in diagnosing the problem;
- if out of warranty, Purchase Order number for the order *or* credit card number (to be charged) with its expiration date.

8.3 Reporting Problems or Suggestions

If you have any problems, suggestions, or questions related to STC equipment, phone the **Engineering Department** at the phone number above. When calling, state the equipment you are calling about. Your call will then be directed to the right person.

8.4 Ordering Spare Parts

If you need any spare parts to support STC equipment, phone or fax the **Sales Department** at the phone numbers provided.

When calling, state that you are calling to order parts. Your call will then be directed to the right person. When placing the order, reference the STC part numbers listed in this guide. However, if you don't have the part numbers, the sales staff can obtain them for you and provide you with current pricing and availability.

When faxing, include:

- Purchase Order number for the order *or* credit card number (to be charged), with its expiration date;
- complete address where the parts are to be shipped;
- complete address where the invoice is to be mailed;
- name and phone number of the person who should be contacted to answer questions about the order;
- your fax number, if available;
- for each item ordered, part number, complete description, and quantity needed.

8.5 Checking on Shipments and Orders

If you need to check on the status of any shipment or order, phone or fax the **Sales Department** at the phone numbers above.

When calling, state that you are checking the status of a shipment or order. Your call will then be directed to the right person. Have your Purchase Order Number ready when you call. However, if you don't have the order number, the sales staff can obtain it for you and provide you with the status of the shipment or order.

When faxing, include:

- Purchase Order number for the shipment or order being checked;
- name and phone number of the person who should be contacted after the order status is checked;
- your fax number, if available.

8.6 Glossary of Terms

A

AAR Billing Code: *Pertains to Session Configuration Menu and Maintenance Session Configuration*
Loosely identifies the railroad the reporting session is configured to or for.

AC: *Pertains to AC Status*
Indicates when the system's AC sense circuit confirms presence of 110 VAC service.

Ammeter: An instrument for measuring the flow of electrical current in amperes.

Ampere: The fundamental unit of measure for electric current. One ampere is defined as the current that flows when a potential of one volt is impressed on a resistance of one Ohm (Ω).

Ant. Offset From Wheel Detectors: *Pertains to Setup Menu Options*
This option is applicable only where a system is configured with a single wheel detector, and provides a means for specifying the distance a site's antennas are from being centered on the system's wheel detector.

Antenna Between Tracks: *Pertains to Setup Menu Options*
This option is used to specify which antenna is located between the tracks at a multi-track site. This information is used in the filtering of cross-track reads that might occur in a multi-track installation.

Automatic Block Signal (ABS): A train control subsystem based on a series of consecutive blocks governed by block signals which are controlled by the movement of trains and certain other conditions (e.g., detection of level crossing closure) rather than by a signaller.

Automatic Equipment Identification (AEI): An electronic recognition system consisting of passive tags mounted on each side of rolling stock and active trackside readers.

Auto Reporting: *Pertains to Session Configuration Menu and Maintenance Session Configuration*
This parameter is used to activate and deactivate the reporting session.

Aux. Input: *Pertains to Auxiliary I/O Status*
Indicates when the system's auxiliary input is active.

B

Ballast: Selected material, such as crushed rock/broken stone, used for the foundation of a railway track.

Baud Rate: *Pertains to Session Configuration and Maintenance Session Configuration Menu*
This option is used to specify the baud rate the system modem is to use when initiating a dial-out connection with a remote modem.

Bonding: Cadweld manufactures a complete line of bond welding systems that are commonly used in the rail industry. The recommended practice is to weld a short length of bond strand to the web of each rail.

Bushing: A hollow insulator, allowing a conductor to pass along its center and connect at both ends to other equipment.

C

Calibration: The determination or rectification of the graduations used on a testing instrument.

Car Num (Car Number): *Pertains to Train Detail Report and Vehicle Data Line Summary*
This field contains the sequential number of each vehicle detected in the train consist.

Chicken head: Tapered solid metal inserts that can be driven into the 3/8” holes to establish a permanent connection to the rail.

Conduit: A pipe, tube, or tile for protecting electric wires or cables.

Configure time synch with NTP Server: *Pertains to System Functions Menu*
The Network Time Protocol (NTP) provides a means for synchronizing a computer's clock with a known good source that is accessible via a network connection. Through this option, an NTP server can be used to ensure the accuracy of the 2600 Reader's clock.

Consist: The standing order of vehicles in a train.

COP (FEP/IPC): *Pertains to LED Status Panel Feature*
Indicates the status of the FEP or IPC board, respectively.

Current: Movement of electricity along a conductor. Current is measured in **amperes**.

D

Date/Time: *Pertains to Train Summary Report*
These fields reflect the date and time at which a train arrived at the Reader site.

Delete All Train Data: *Pertains to Configure Network Interfaces Menu*
Provides a means for clearing out the Model 2600 Reader's train data directory.

Destination Directory: *Pertains to Session Configuration Menu and Maintenance Session Configuration Menu*
This parameter is used to specify a directory on the remote server/computer to which this session directs maintenance reports (in which reports are to be routed to in accordance with the selected reporting protocol (e.g., where the FTP has been specified).

Dir (Direction): *Pertains to Train Detail Report, Train Summary Report, Vehicle Data Line Summary, and Diagnostic Train Detail Report*
This field indicates the direction each vehicle was traveling as it exited the Reader site.

Durat (Duration): *Pertains to Train Summary Report*
This field reflects the elapsed time, in seconds, which it took for a train to completely cross a Reader site.

E

E: *Pertains to Truck Timing Information Line*
The elapsed time, in milliseconds, from presence detection, that the lead truck exited the site.

EGC (Equipment Group Code): *Pertains to Train Detail Report*
This field contains the "Equipment Group Code" field decoded from the vehicle’s identifying AEI tag.

Extended Delay: *Pertains to Maintenance Session Configuration Menu*
This parameter is used to specify a wait period for the 2600 Reader in the case where it is having difficulty establishing a connection with a remote server/computer.

F

Flags, NE SW: *Pertains to Diagnostic Train Detail Report*
This field reflects the possibility that two different T94 reports could be generated for the same consist.

Flange (of a wheel): The vertical projection along the inner rim of a wheel that serves, in conjunction with the flange of the mating wheel, to keep the wheel set on the track, and provides the lateral guidance system for the mounted pair.

Front-End Processor (FEP): A small computer that receives data from input devices and performs some initial processing tasks on it before passing it to a more powerful computer for final processing.

G

Ground: The reference point in an electrical circuit from which other voltage is measured, or is a common return path for electric current or a direct physical connection to the earth.

H

Handshake: The number of times a given tag was read as it passed through the RF signal produced by the trackside AEI antennas.

Header: *Pertains to Session Configuration Menus*
This parameter is used to specify a line of text that is to precede any maintenance report delivered in accordance with the reporting session. Some of the available, predefined reporting protocols require a header in a specified format. For those reporting protocols that do not require it, this parameter will be ignored.

Heat Sink: A passive component that cools a device by dissipating heat into the surrounding air.

Host Name/IP: *Pertains to Session Configuration Menu Details*
This parameter is used to specify the name or IP address of the remote server/computer to which the session directs T94 reports.

I

Include Century Field: *Pertains to Maintenance Session Configuration Menu*
Some versions of the S-918 specification included a requirement for a two-digit field that specifies the year/century of the date that a maintenance report is generated. This parameter provides the option of either including this field or omitting it.

IPC (Industrial PC): A PC-based computing platform for industrial applications. It is used primarily for process control and/or data acquisition. Software can be custom written for a particular application or an off-the-shelf package.

J

K

L

Lead: *Pertains to Vehicle Data Line Summary*
Identifies the orientation of the car.

Lead-T: *Pertains to Truck Timing Information Line*
The sequence number assigned to the lead truck of a vehicle.

Lead Veh ID (Lead Vehicle Identifier): *Pertains to Train Summary Report*
This field contains the Owner and Number fields decoded from the AEI tag that was read on the first vehicle of a train.

Legacy: Of or pertaining to old or outdated computer hardware, software, or data that, while still functional, does not work well with up-to-date systems.

Len/Length: *Pertains to Train Detail Report and Vehicle Data Line Summary*
This field contains the length calculated for each vehicle (based upon speed and wheel detector signal timing).

Light-Emitting Diode (LED): A semiconductor diode that emits light when conducting current, and is used in electronic equipment, especially for displaying readings on digital watches, calculators, etc.

Liquid Crystal Display (LCD): A display device utilizing a special crystal fluid to allow segmented displays.

Load Default Settings: *Pertains to Setup Menu Options and Track Hardware Setup Menu*
This option will set parameters to the default values.

Local Area Network (LAN): A network that links together computers and peripheral equipment within a limited area, such as a building or a group of buildings. The computers in an LAN have independent central processing units, but they are able to exchange data with each other and to share resources, e.g., printers.

Lock: *Pertains to Reader Module Status*
Indicates when an AEI tag has been "acquired" by the Reader.

Login ID: *Pertains to Session Configuration Menu Details*
This parameter is used to specify a login ID that is expected by the server/computer to which the session directs T94 reports or maintenance reports, in accordance with the selected reporting protocol.

M

Mast: As it relates to the Model 2600 Reader, mast pertains to the vertical pole on the AEI antenna.

Max Retry Attempts: *Pertains to Session Configuration Menu Details*
This parameter is used to specify the number of times the 2600 Reader is to attempt to deliver a T94 report for a reporting session before pausing, in the event that phone issues preclude delivery of a report.

Maximum Number Of Stored Trains: *Pertains to Setup Menu Options*
This option is used to specify the number of train data files that should be maintained at a given time.

Maximum Train Number: *Pertains to Setup Menu Options*
This option is used to specify the maximum number that will be assigned to a train as it is processed by the Model 2600 Reader. Trains are numbered consecutively from 1 to the maximum specified. When the specified Maximum Train Number is reached, the next train read will be assigned the number 1.

Minimum Axle Count: *Pertains to Session Configuration Menu Details*
This parameter is used to specify the minimum train/consist size that the 2600 Reader is to report to the server/computer referenced by the session.

Multi-Track Site: *Pertains to Setup Menu Options*
This option is used to specify whether the Model 2600 Reader is installed at a multi-track site

N

Num Axles (Number of Axles): *Pertains to Train Summary Report*
This field contains the number of axles that were detected for a given train by the system's wheel detectors.

Num Axls (Number of Axles): *Pertains to Train Detail Report*
This field contains the number of axles associated with each vehicle as determined by the 2600 Reader's consist breakout logic (based upon wheel detector signal timing).

Num Axles, Trn (Number of Axles, Train): *Pertains to Diagnostic Train Detail Report*
This field reflects the number of axles that were detected by the 2600 Reader's wheel detectors.

Num Cars (Number of Cars): *Pertains to Train Summary Report and Diagnostic Train Detail Report*
This field contains the count of the number of vehicles (locomotives and railcars) that were identified in a train.

Num Plat (Number of Platforms): *Pertains to Train Detail Report and Vehicle Data Line Summary*
This field contains the number of platforms that the consist breakout logic has determined are associated with each vehicle.

Num Trks (Number of Trucks): *Pertains to Train Detail Report and Vehicle Data Line Summary*
This field contains the number of trucks that the consist breakout logic has determined are associated with each vehicle.

O

Offtime: *Pertains to Wheel Detector Detail Data*
This field contains the amount of time, in milliseconds, that elapsed between the previous wheel crossing of the indicated wheel detector pair and the wheel crossing represented by a given detail data record.

Ohm: A unit of electric resistance. One ohm is equal to that resistance required to cause a one-volt drop in potential when the current is one amp.

On Hold: *Pertains to Train Summary Report and Diagnostic Train Detail Report*
The 2600 Reader has failed in at least five attempts to transmit the T94 Report for the indicated train, and is waiting for the next train to cross the site before making further attempts.

Operating System (OS): The collection of software that directs a computer's operations, controlling and scheduling the execution of other programs, and managing storage, input/output, and communication resources.

Output-1/Output-2: *Pertains to Auxiliary I/O Status*
Indicates when the system's configurable output is active.

Override FEP CRC Check: *Pertains to Configure Network Interfaces Menu*
This option is normally required only during the manufacturing process the first time a system is powered up.

P

Password-Session Config: *Pertains to Session Configuration Menu Details and Maintenance Session Configuration Menu*
This parameter is used to specify a password that is expected by the server/computer to which this session directs T94 and maintenance reports, in accordance with the selected reporting protocol.

Passwords-Menu Access: *Pertains to Configure Network Interfaces Menu*
Provides the means for changing the passwords for each of the different system login identifiers for guest, tech, and system.

Phone Number: *Pertains to Session Configuration Menu Details and Maintenance Session Configuration Menu*
This option is used to specify the phone number the site is to use when attempting to deliver T94 reports for a reporting session. Applies only when a dial-out modem is installed in the system.

Pinout: The allocation of logical functions or signals to the electrical connection points (pins) of an integrated circuit or other component or connector.

Plumb: To precisely place in a perpendicular or vertical direction.

Polarity: A collective term applied to the positive (+) and negative (-) ends of a magnet or electrical mechanism such as a coil or battery.

Prelim Car Number: *Pertains to Wheel Detector Detail Data*
The number that gets assigned to the wheel detector records when they are first generated.

Presence: *Pertains to Track Equipment*
Indicates when the presence input to the Model 2600 Processor module is active.

Presence Input Debounce Filter: *Pertains to Track Hardware Setup Menu Options*
This option is used to specify, in milliseconds, the amount of time to wait before considering an active presence signal as valid. Its purpose is to filter noise/signals detected by the presence subsystem that are not generated by an approaching train.

Presence Timeout Period: *Pertains to Track Hardware Setup Menu Options*
This option is used to specify the amount of time, in seconds, that the Model 2600 Reader should wait before closing out the processing of a train. The Presence Timeout parameter determines how many seconds of inactivity (e.g., where presence has cleared and no signals are received from the wheel detectors) should pass before the reader considers a given train to have cleared the site.

Pulse Edge Count: *Pertains to Wheel Detector Detail Data Lines*
This field indicates the number of pulse edges that were recorded for the record.

Pulse Edge Labels: *Pertains to Wheel Detector Detail Data Lines*
This field indicates which element or elements of a wheel detector fired to produce the record, and in which order.

Pulse Width: *Pertains to Wheel Detector Detail Data Lines*
This field indicates the amount of time that each element within a wheel detector was energized as a wheel crossed over it.

Q

R

Rail Crown: Refers to the highest vertical point of the rail head.

Rail Head: The farthest point to which the rails of a railroad have been laid. May also refer to the upper part of a rail, used for supporting and guiding the wheels of railroad cars.

Reader Module Direct Comm. **Link:** *Pertains to Configure Network Interfaces Menu*
Provides a means for communicating directly with the system's AI1200 board(s). These options are provided for troubleshooting purposes.

Rejected: *Pertains to Train Summary Report and Diagnostic Train Detail Report*
The T94 report for the indicated train was rejected by the receiving server/computer in at least five attempts to transmit it.

Report Delimiter: *Pertains to Session Configuration Menu Details and Maintenance Session Configuration Menu*
This parameter is used to specify what character, if any, is to be used to delimit the fields in the T94 reports generated in association with the reporting session**.**

Report Raw Tag Records: *Pertains to Session Configuration Menu Details*
This parameter is used to specify whether the 2600 Reader is to include in the T94 reports generated for this session the 20-character raw (six-bit) form of the AEI tags read by the Reader for each consist**.**

Report Reverse-out Trains: *Pertains to Session Configuration Menu Details*
This option is used to specify whether the reporting session is to report those trains/movements when the train pulls onto the site and the reverses back off of the site.

Reporting Interval: *Pertains to Maintenance Session Configuration Menu*
This parameter is used to specify the amount of time that should elapse between the 2600 Reader's attempts to transmit a maintenance report. For instance, if the Reporting Interval was set to 02:00 (2 hours) the 2600 Reader would attempt to transmit a maintenance report every two hours.

Reporting Protocol: *Pertains to Session Configuration Menu Details and Maintenance Session Configuration Menu*
This parameter is used to specify, to the 2600 Reader, which pre-defined protocol is to be used when communicating with the remote server/computer.

Retry Delay Time: *Pertains to Session Configuration Menu and Maintenance Session Configuration Menu*
This parameter is used to specify the amount of time, in minutes, that the 2600 Reader is to wait between failed attempts to transmit a maintenance report to the server/computer referenced by this session.

RFCTL 0: *Pertains to Reader Module Status*
Indicates whether the RF output is activated on antenna #0.

RFCTL 1: *Pertains to Reader Module Status*
Indicates whether the RF output is activated on antenna #1.

RFID (Radio-frequency Identification): An automatic identification method which relies on storing and remotely retrieving data using devices called RFID tags or transponders.

Rising/Falling Edge Timestamps: *Pertains to Wheel Detector Detail Data*
The values in these fields represent the elapsed time, in milliseconds, since train presence was detected, that a change in signal state was detected at a wheel detector input.

S

S: *Pertains to Truck Timing Information Line*
The elapsed time, in milliseconds, from presence detection, that the lead truck entered the site.

S-918 Compliant: Refers to the design, construction, operation, performance, and coding principles for the AEI system, which shall comply with the requirements of Association of American Railroads (AAR), Standard S-918, in Section K of the AAR Manual of Standards and Recommended Practices.

Serial Pass-Thru: *Pertains to Configure Network Interfaces Menu*
Provides a means for communicating with a device that is connected to the Model 2600 Reader's COM2 serial port.

Sessions: *Pertains to Diagnostic Train Detail Report*
These fields reflect the progress made by the activated T94 reporting sessions in reporting the referenced train.

Set Date and Time: *Pertains to Setup Menu Options*
This option provides a dialog for setting the system date and time

Set Time Zone: *Pertains to Setup Menu Options*
This option provides a series of menus that guide the user through identifying the time zone that the system is in.

Shunt: A conductor joining two points in a circuit so as to form a parallel circuit through which a portion of the current may pass.

Site ID: *Pertains to Session Configuration Menu and Maintenance Session Configuration*
This parameter specifies the "official" identifier for the AEI Reader site, for reporting purposes. It is used to populate a field in the header of the T94 reports generated for the session.

Site Name: *Pertains to Setup Menu Options*
This option is used to specify an identifier for the site/system. This identifier is used in the header of various train data reports, etc. This identifier is not used when generating T94 reports in the dial-out reporting process (session-specific identifiers are specified via the Session Setup menus).

Skipped: *Pertains to Train Summary Report and Diagnostic Train Detail Report*
The 2600 Reader did not attempt to transmit the T94 report for the indicated train because it failed to meet some criteria established by the reporting session configuration. For example, if the "minimum axle count" is set to 4 and only 2 axles are recorded for a movement, the train will be skipped (for reporting purposes).

Software Update: *Pertains to Configure Network Interfaces Menu*
Provides a means for updating the Model 2600 Reader's system software.

Spd/Speed: *Pertains to Train Detail Report and Vehicle Data Line Summary*
This field contains the speed recorded for each vehicle.

Speed Max, Min: *Pertains to Train Summary Report and Diagnostic Train Detail Report*
These fields contain the maximum and minimum speeds that a train traveled as it crossed the 2600 Reader site.

Success*: Pertains to Train Summary Report Diagnostic Train Detail Report*
The T94 report for the indicated train was successfully transferred as specified by the referenced reporting session.

Synch Clock with Host: *Pertains to Session Configuration Menu Details and Maintenance Session Configuration Menu*
This parameter is used to specify whether the 2600 Reader is to synchronize its clock with that of the remote server using a timestamp supplied by the server.

System Reset Menu: *Pertains to Configure Network Interfaces Menu*
Provides options for resetting/rebooting various system components – the FEP, the IPC, and the AI1200 Reader board.

T

T01 – T04: *Pertains to Track Equipment*
Indicates when the referenced wheel detector element is active. These LEDs will be lit when a wheel or other object is positioned over the wheel detector or if there is a break in the wiring between the wheel detector and the Model 2600 Processor module.

T94 Xmit (T94 Transmit): *Pertains to Train Summary Report*
This field is used to indicate the status of the T94 consist reporting process as it affects each train. This field consists of five columns, each of which reflects the status of the five available consist sessions: Success; Rejected; Trying; On Hold; Skipped.

Tag Axls (Tag Axles): *Pertains to Train Detail Report*
This field contains the axle-count field decoded from the vehicles identifying AEI tag.

Tag Consecutive Reads: *Pertains to Track Hardware Setup Menu Options*
This parameter is used by the system to ensure that a read of a given AEI tag is valid. It specifies the number of times a given tag must be "sensed" by the reader module before it can be considered a valid read.

Tag ID Separation: *Pertains to Track Hardware Setup Menu Options*
This parameter is used by the system to filter multiple reads of a given AEI tag. It specifies the number of other tags that must be read before a subsequent read of a given tag is again considered a valid read.

Tags Read, Ant0, Ant1 (Tags Read, Antenna 0, Antenna 1): *Pertains to Train Summary Report*
These two fields contain a count of the number of AEI tags that were read by each antenna as a train crossed the Reader site.

Tag Uniqueness Timeout: *Pertains to Track Hardware Setup Menu Options*
This parameter is used by the system to filter multiple reads of a given AEI tag. It specifies the amount of time that must elapse before a subsequent read of a given tag is again considered a valid read

Telnet Pass-Thru: *Pertains to Configure Network Interfaces Menu*
Provides a means for communicating via Telnet with other Model 2600 Readers (or other devices) that are connected via an Ethernet network.

Terminal Emulation: The ability to make one computer terminal, typically a PC, appear to look like another, usually older type of terminal so that a user can access programs originally written to communicate with the other terminal type. Terminal emulation is often used to give PC users the ability to log on and gain direct access to legacy programs in a mainframe OS.

Test Active: *Pertains to Auxiliary I/O Status*
Indicates that the Audible Test Function is enabled.

Three-Terminal Arrester (TTA): Generally refers to a protective device for limiting surge voltages by discharging or bypassing surge current, and it also prevents the flow of follow current while remaining capable of repeating these functions. A three-terminal voltage surge arrestor is an ionization chamber formed in an electrically conductive housing wherein a pair of opposed electrodes are inserted into the chamber with a gap defined between the opposing ends of the electrodes and another gap defined between the end of each electrode and the housing side wall. The two electrodes constitute the two active terminals of the surge arrestor which are connected across an electrical instrument to be protected, whereas the third terminal of the arrester is defined by the housing side wall which is grounded.

Tiefenbach Double-Wheel Detector: A no-contact, electronic sensor consisting of two individual systems that are constructed with special resonant circuits.

Time Zone: *Pertains to Session Configuration Menu and Maintenance Session Configuration*
This parameter is used to specify the time zone in which the 2600 Reader is located.

Torque: A term used to describe the twisting force required to turn a bolt or a rotating shaft. Torque is measured in units of foot pounds (ft. lbs.) or inch pounds (in. lbs.) and is calculated by multiplying the applied force (in pounds) by the distance to its point of application (in feet or inches).

Track Hardware Configuration Menu: *Pertains to Setup Menu Options*
Provides for the configuration of parameters that affect the wheel detector, presence, and AEI Reader module subsystems of the Model 2600 Reader.

Track Hardware Signal Status: *Pertains to Configure Network Interfaces Menu*
A series of periodic snapshots, provided by the FEP board, of the state of the wheel detector and presence inputs.

Track Orientation: *Pertains to Setup Menu Options*
This option is used to specify whether the Model 2600 Reader is installed on a track that is oriented in the north-south or east-west direction.

Track Switch-1/Track Switch 2: *Pertains to Auxiliary I/O Status*
Indicates when the track switch being monitored by the system has been thrown one way or the other.

Trail-T: *Pertains to Truck Timing Information Line*
The sequence number assigned to the last (trailing) truck of a vehicle.

Train Scanning: *Pertains to Setup Menu Options*
This option is used to enable/disable the system's train scanning function. When this option is set to "Enabled," the system will record consist data. When this option is set to "Disabled," trains that cross the reader site will be ignored.

Transceiver: A transmitter and receiver combined in one unit.

Transponder: A type of radio or radar transmitter-receiver that transmits signals automatically when it receives predetermined signals.

Trn Num (Train Number): *Pertains to Train Summary Report and Diagnostic Train Detail Report*
This column contains the chronologically sequential number assigned to each train as they are processed by the 2600 Reader.

Truck Number: *Pertains to Wheel Detector Detail Data*
The number that is assigned to the wheel detector records as they are evaluated by the system consist/vehicle breakout logic as the individual trucks of a consist are identified.

Trying: *Pertains to Train Summary Report and Diagnostic Train Detail Report*
The 2600 Reader has made at least one attempt to transmit the T94 report for the indicated train, and further attempts will be made to do so.

U

Units of Measure: *Pertains to Session Configuration Menu*
This parameter is used to specify the units of measure used in some T94 reports, such as speed and length.

Unlabeled First Column: *Pertains to Train Summary Report*
In the first column of the report's main body, an asterisk (*) character can appear. When an asterisk character appears in the leftmost column of the report, it indicates that train presence at the 2600 Reader site was first detected by the system's wheel detectors, not by the system's subsystem.

Unlabeled Last Column: *Pertains to Train Summary Report*
The last column on the report indicates the type of movement that the recorded train represented.

USB (Universal Serial Bus): A standard for connection sockets on computers and other electronic equipment.

Use Extended (STC) Code List: *Pertains to Maintenance Session Configuration Menu*
An informal list of possible alternative, vendor-specific "maintenance issue" codes that can be used in the generation of maintenance reports. This parameter provides the option to use the historic/standard code list or to use the AEI User Group's alternative, vendor-specific code list.

User Interface (UI): The aspects of a computer system or program which can be seen (or heard or otherwise perceived) by the end user, and the commands and mechanisms the user uses to control its operation and input data.

V

Vehicle ID (Vehicle Identifier) *Pertains to Train Detail Report*
This field contains the owner code and car number fields decoded from the AEI tag associated with the first vehicle in the consist.

Volt: A unit of electrical pressure (or electromotive force) which causes current to flow in a circuit. One volt is the amount of pressure required to cause one ampere of current to flow against one ohm of resistance.

W

Watt: A unit of measure for indicating the electrical power applied in a circuit. It is obtained by multiplying the current (in amperes) by the electrical pressure (in volts) which causes it to flow.

W/D Pair Identifier (Wheel Detector Identifier): *Pertains to Wheel Detector Detail Data Lines*
This field identifies which wheel detector generated the data for the record.

Wheel Detector: A rail-mounted transducer used to sense the wheels of passing railcars.

Wheel Detector Configuration: *Pertains to Setup Menu Options*
The Model 2600 Reader can operate using either a single (dual element) Tiefenbach wheel detector or two (dual element) Tiefenbach wheel detectors. This option on the setup menu is used to specify the wheel detector configuration of a given site – either Single or Dual.

Wheel Detector Pair Spacing: *Pertains to Track Hardware Setup Menu Options*
This option applies only where a site is configured with dual Tiefenbach wheel detectors. This option is used to enter the actual distance (in inches) measured between the two wheel detector modules

Wheel Detector Pulse Latch Percentage: *Pertains to Track Hardware Setup Menu Options*
This parameter is used to bolster potentially weak or narrow signals detected on the wheel detector inputs. The normal operation of the wheel detector modules dictates that the signals produced by each of the two enclosed detectors (two per module) overlap one another in time.

Wheel Detector Pulse Width Filter: *Pertains to Track Hardware Setup Menu Options*
This parameter is used to specify a value, in milliseconds, to be used to filter errant noise detected on the wheel detector inputs. The Model 2600 Reader will filter (ignore) signals detected at the wheel detector inputs that have a narrower pulse width than the value of the Wheel Detector Pulse Width parameter.

Wheel Dwell Time: *Pertains to Wheel Detector Detail Data*
This field indicates the amount of time, in milliseconds, that a given wheel took to cross completely over a wheel detector.

Wide Area Network (WAN): A computer network that spans a relatively large geographical area.

X

Xfr Att (Transfer Attempts:) *Pertains to Diagnostic Train Detail Report*
This field indicates the number of attempts that have been made to transfer the T94 report for the indicated train, according to the specified session number.

 # (Session Number): *Pertains to Diagnostic Train Detail Report*
This field indicates for which reporting session the status is being provided.

5V (FEP/IPC): *Pertains to LED Status Panel Features (power supply and processor status)*
Indicates whether the 5V supply, generated on the FEP board or IPC board, respectively, is present.

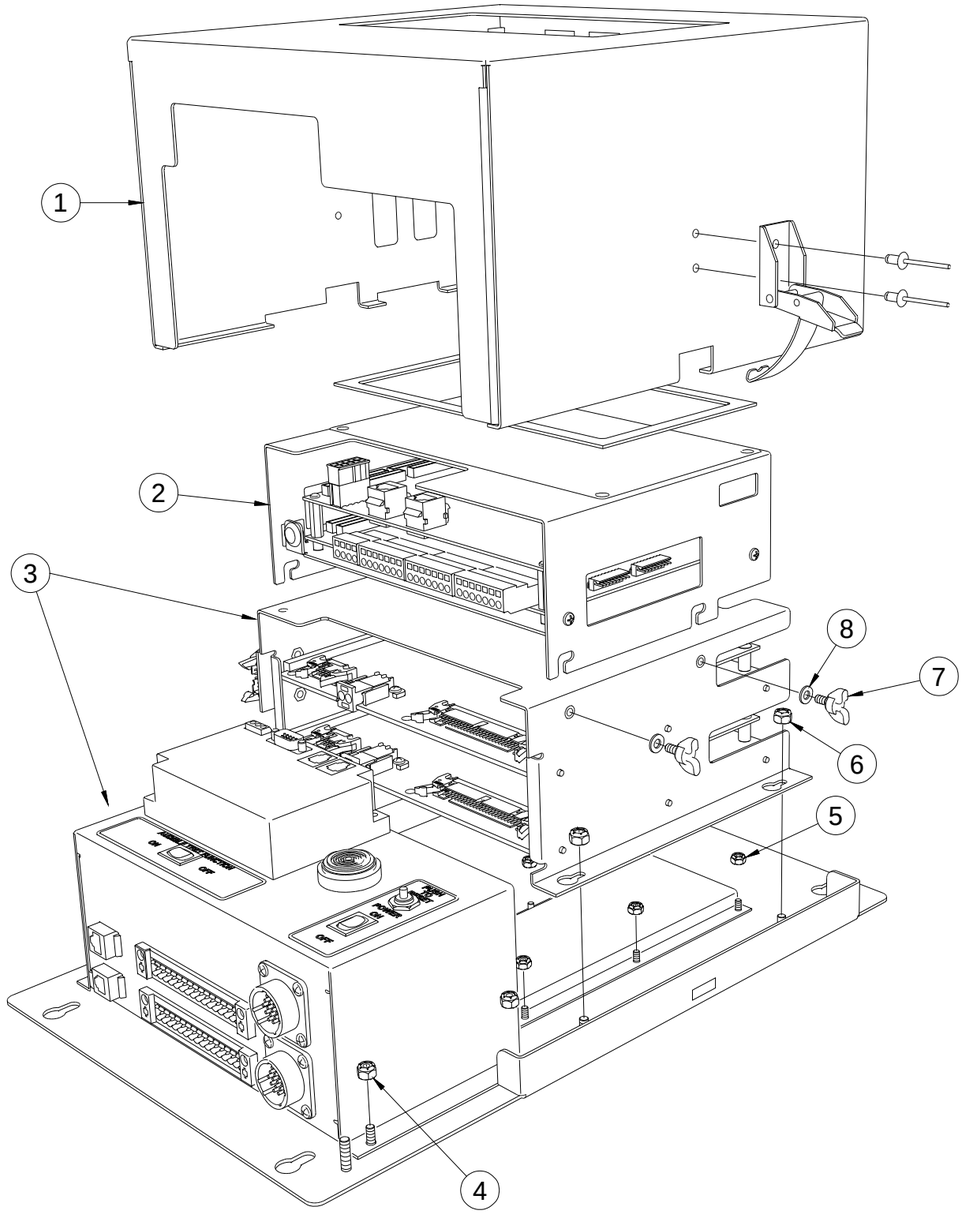
12V: *Pertains to Reader Module Status*
Indicates whether the 12V supply for the Reader module is present.

12V (FEP): *Pertains to LED Status Panel Features (power supply and processor status)*
Indicates whether the 12V supply, generated on the FEP board, is present.

24V (BATT): *Pertains to LED Status Panel Features (power supply and processor status)*
Indicates whether the 24V supply from the system batteries is present.

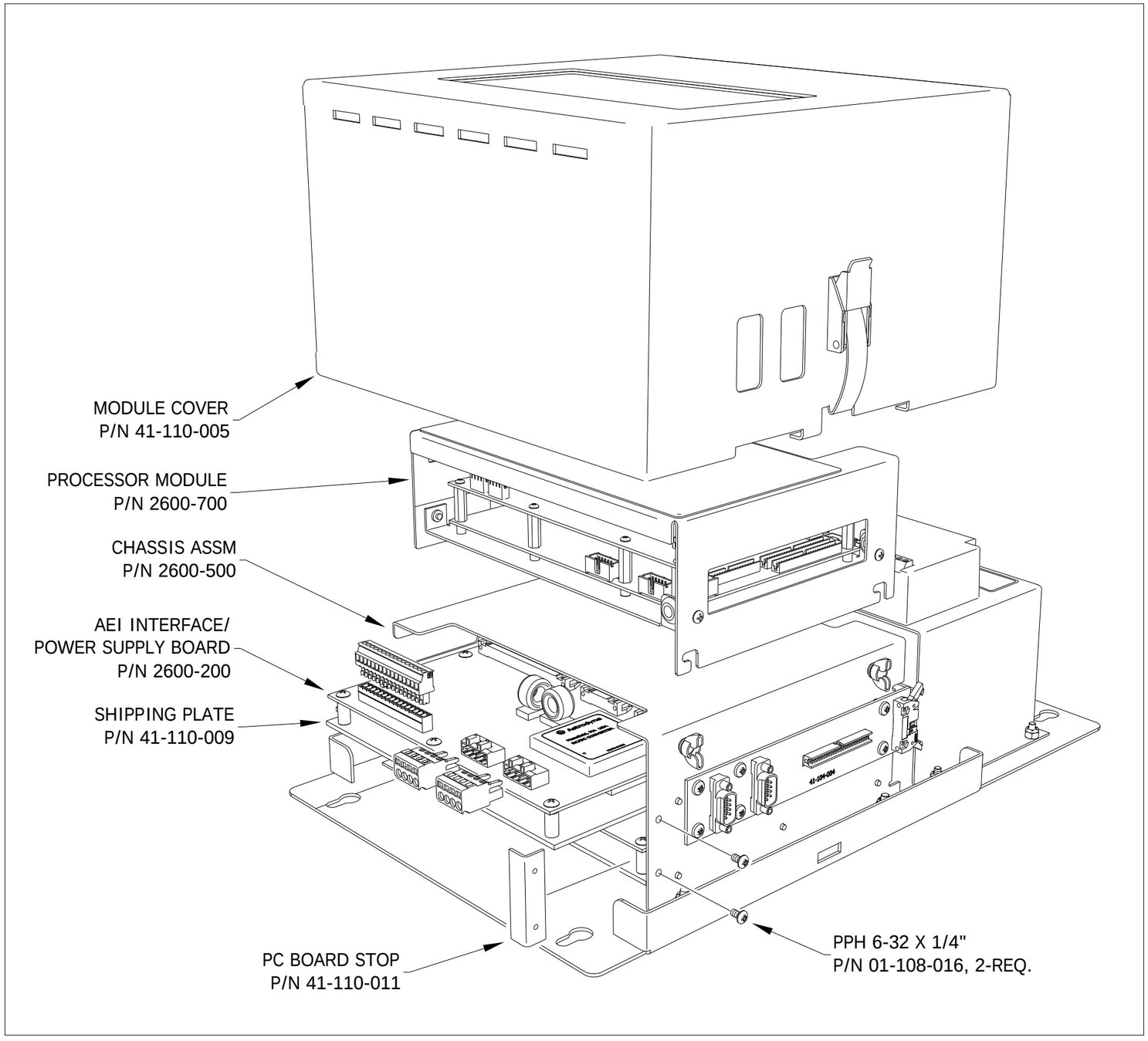
Appendix A: Drawings and Schematics

2600-AEI Controller- Exploded View

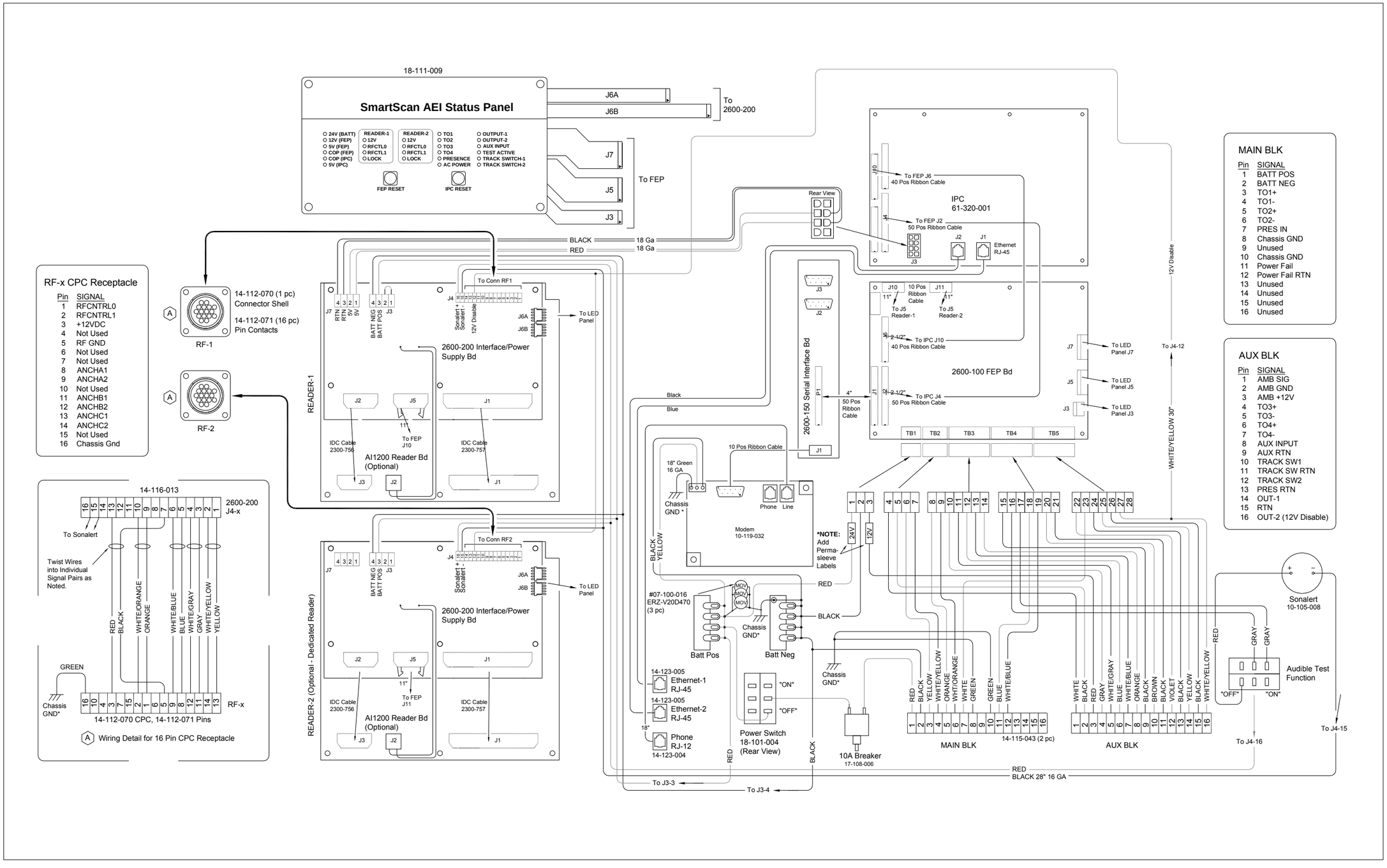


2600-00x AEI CONTROLLER PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	41-110-005	Controller Cover
2	1	2600-700	Processor Module
3	1	2600-500	Chassis Assembly
4	4	01-118-003	8-32 ESNA Nut
5	6	01-118-002	6-32 ESNA Nut
6	4	01-118-005	10-32 ESNA Nut
7	4	01-133-001	8-32 Wing Screw
8	4	01-121-003	#8 Flat Washer

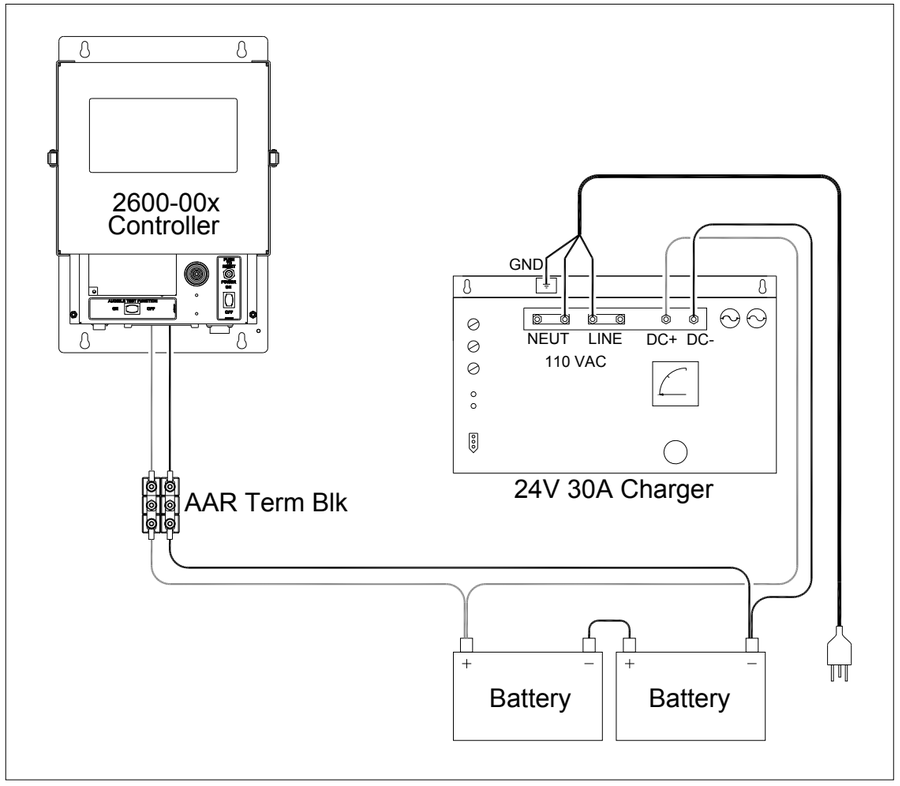
Model 2600 Reader; AI1200/Power Supply Board Access



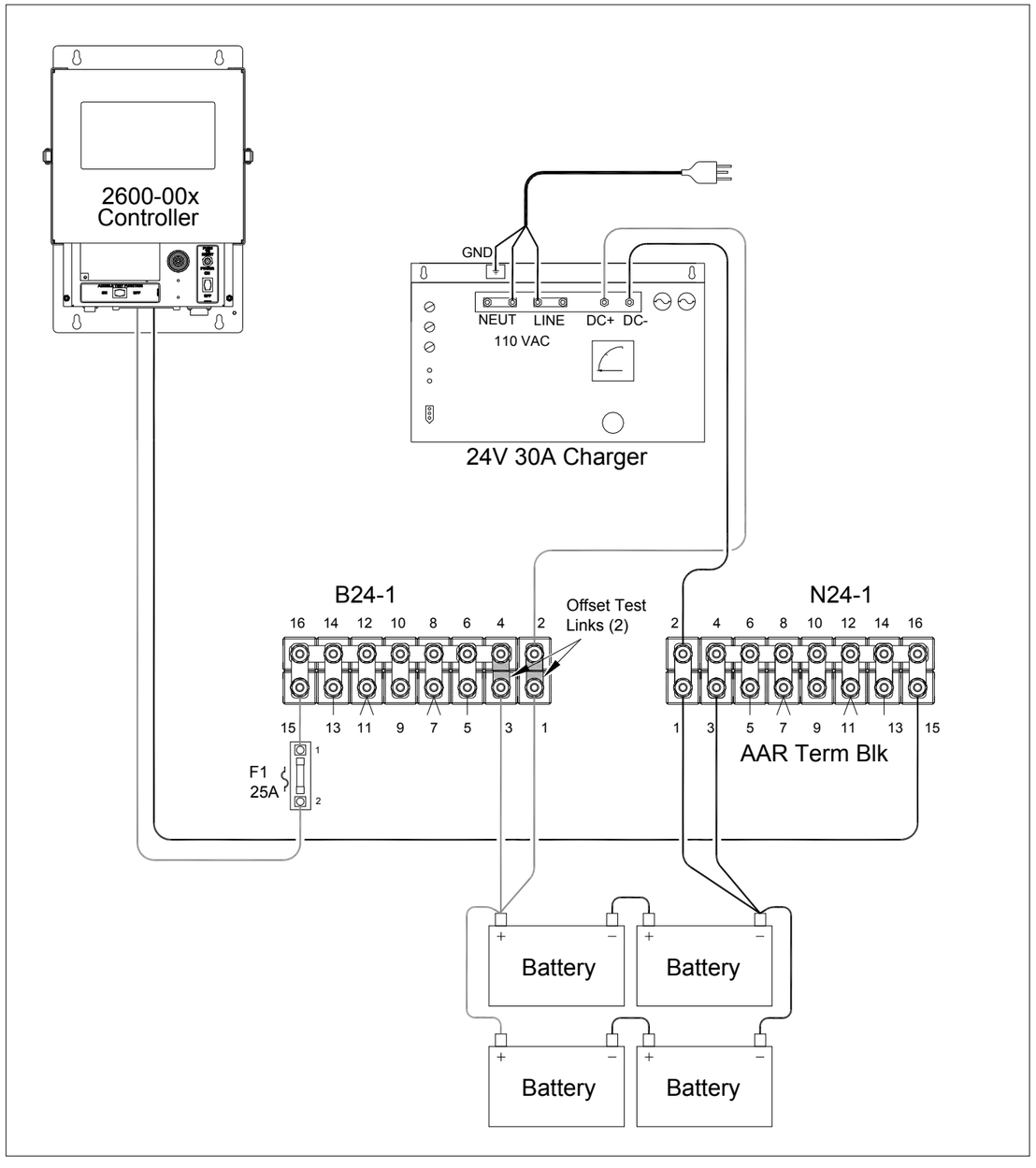
2600-00x AEI Controller- Internal Wiring Schematic



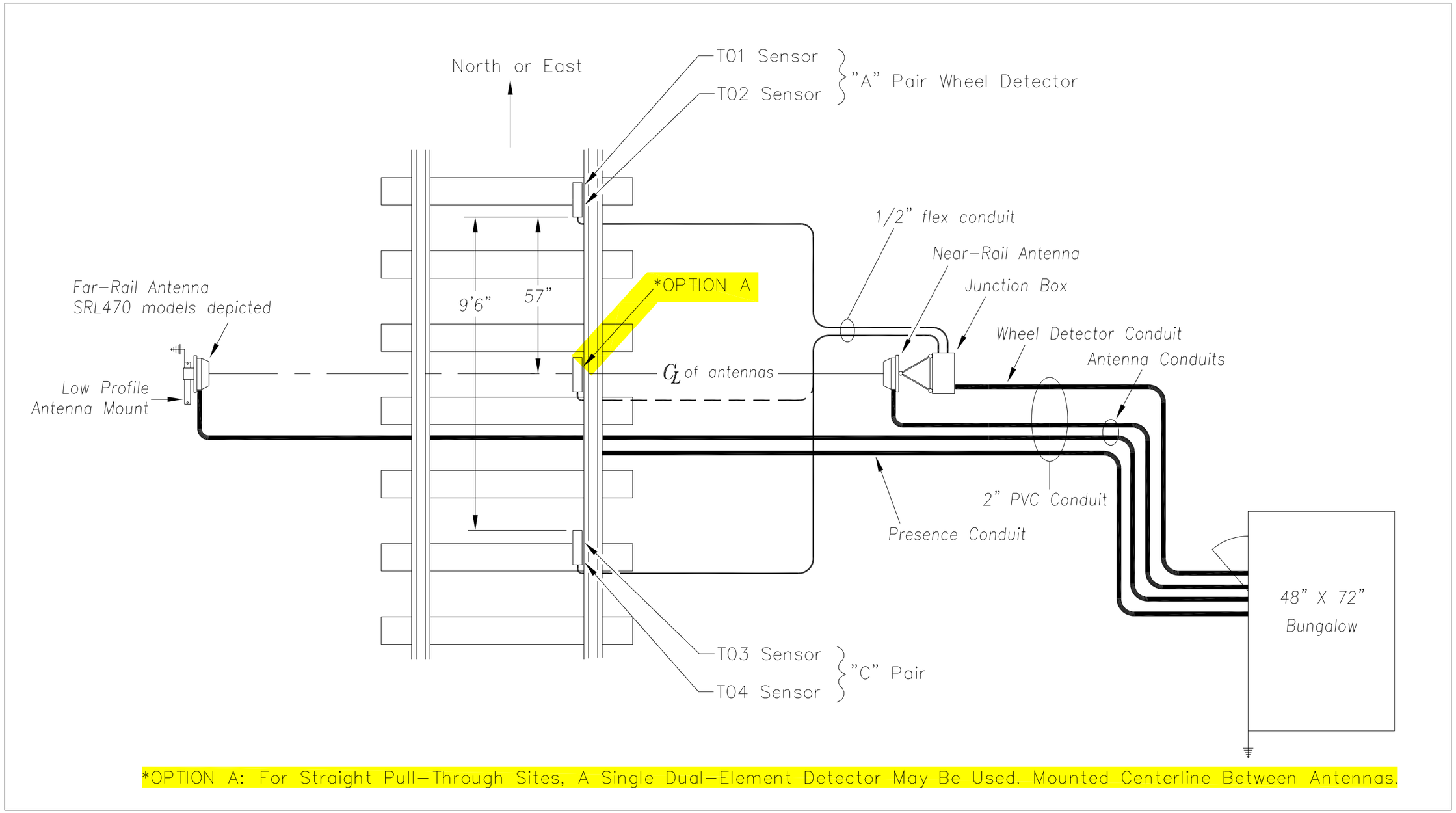
Battery Subsystem (Typical)



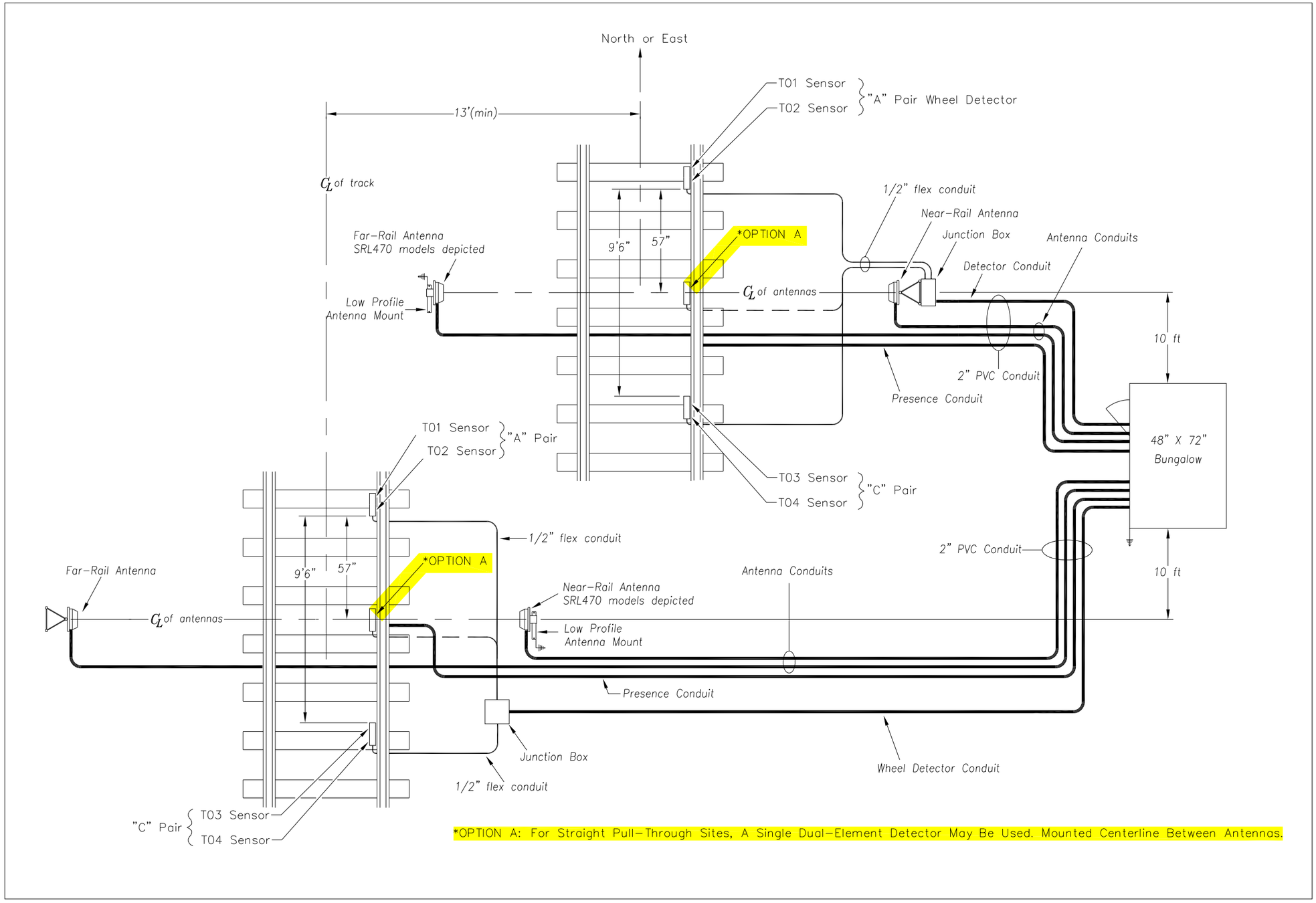
Battery Subsystem for CN Railway (Typical)



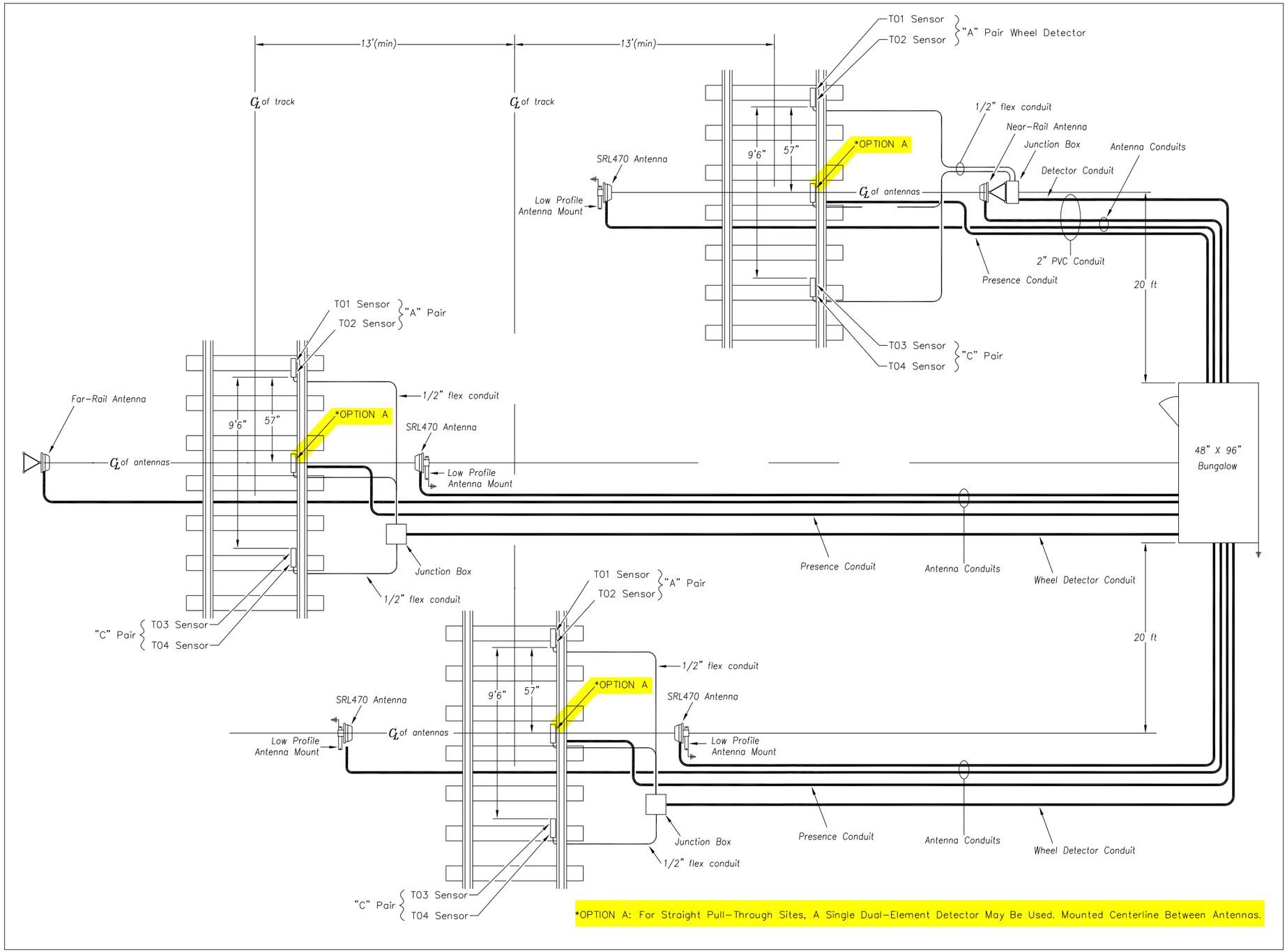
Typical Single-Track Equipment Layout



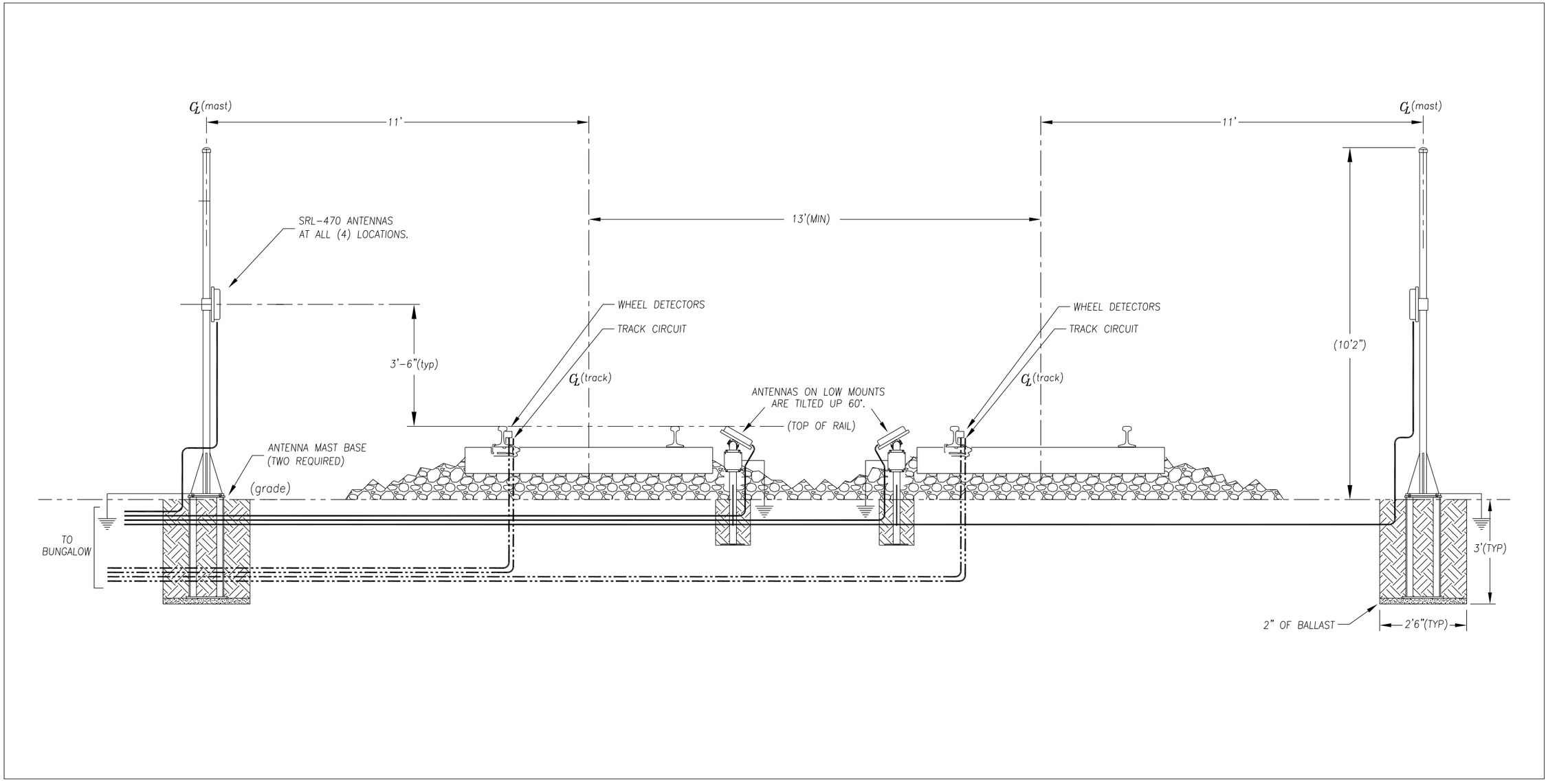
Typical Double-Track Equipment Layout



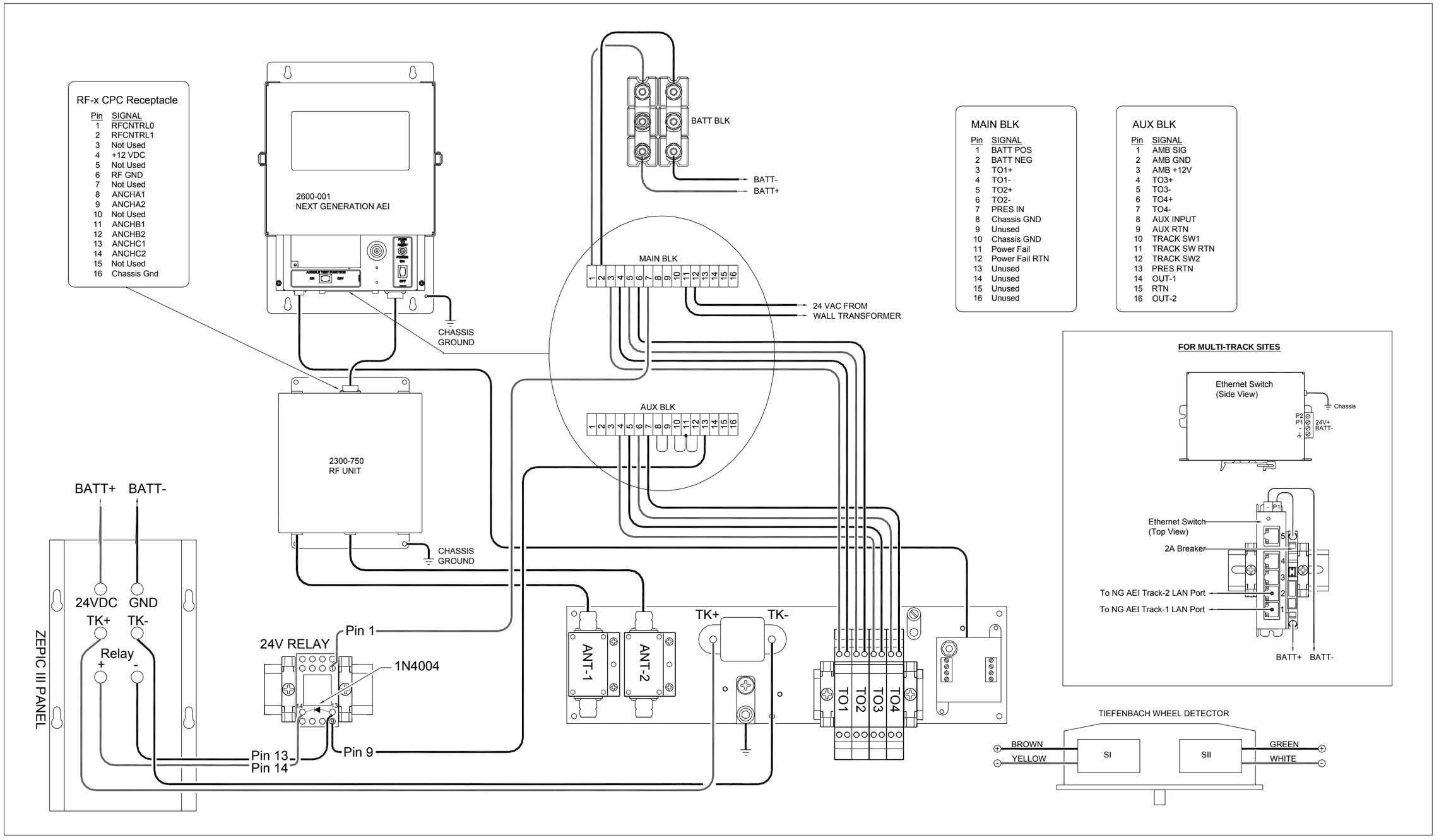
Typical Triple-Track Equipment Layout



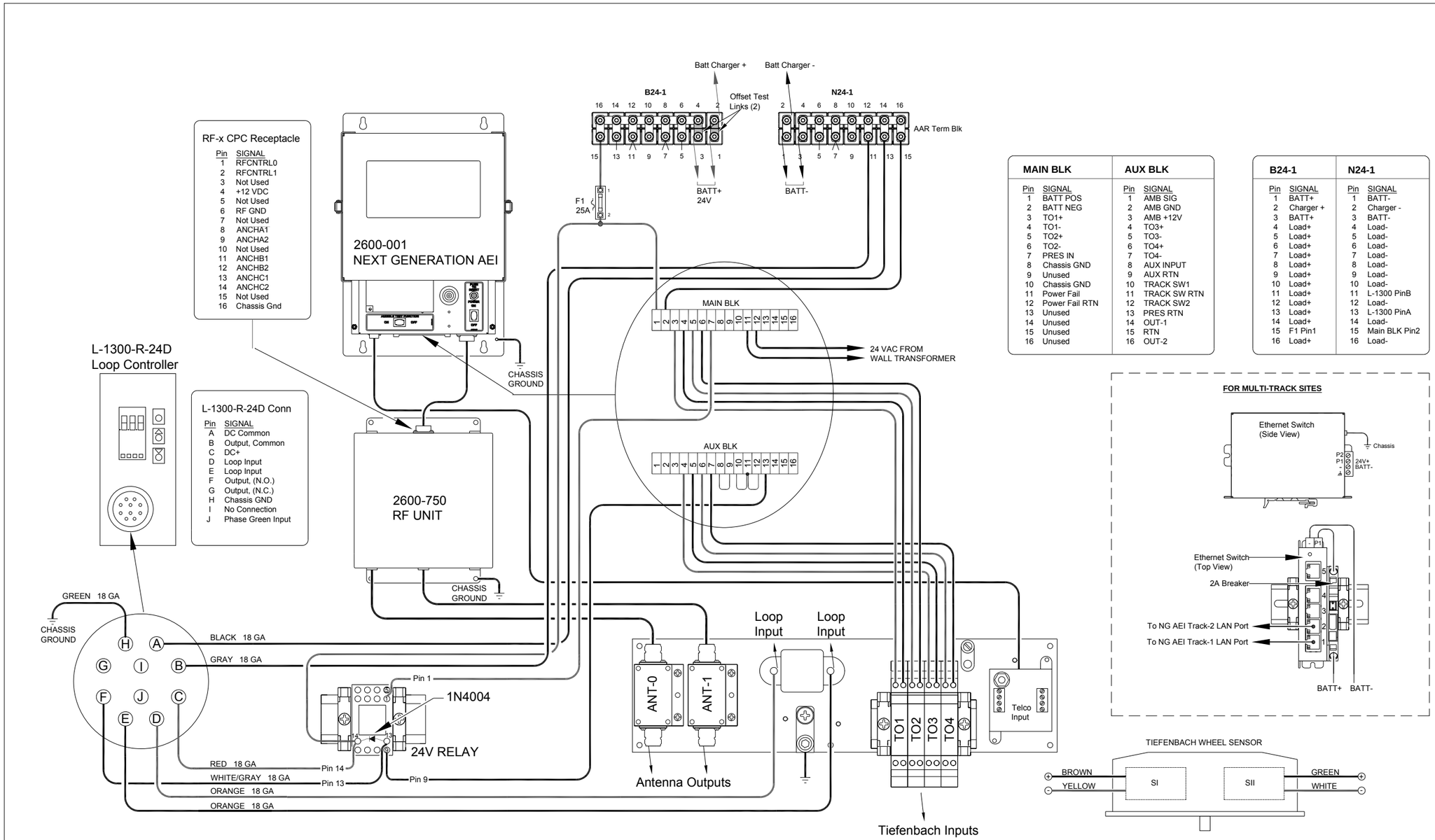
Double Track Elevation Drawing



2600 AEI System Wiring Schematic



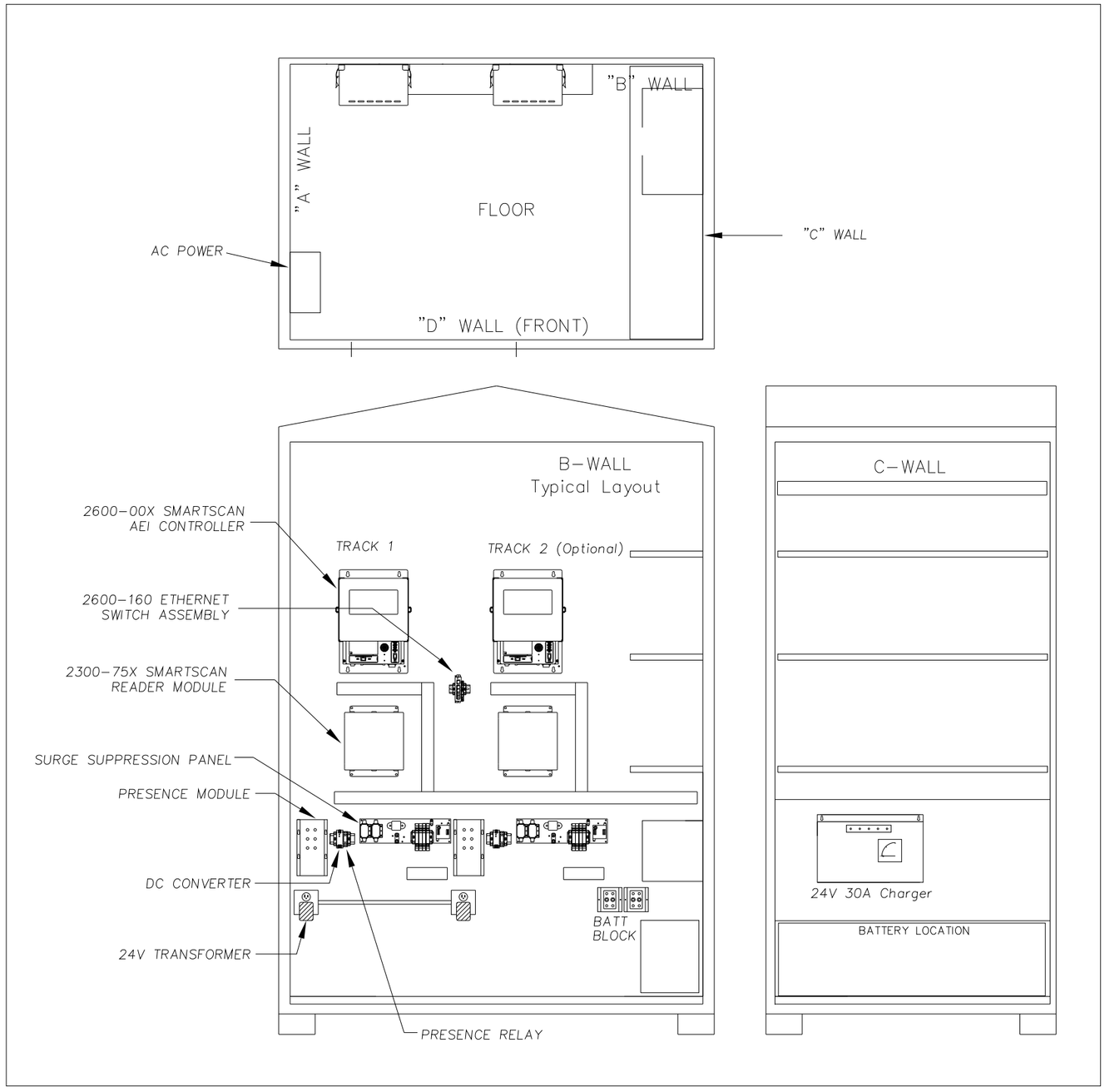
2600 AEI System Wiring Schematic for CN Railway



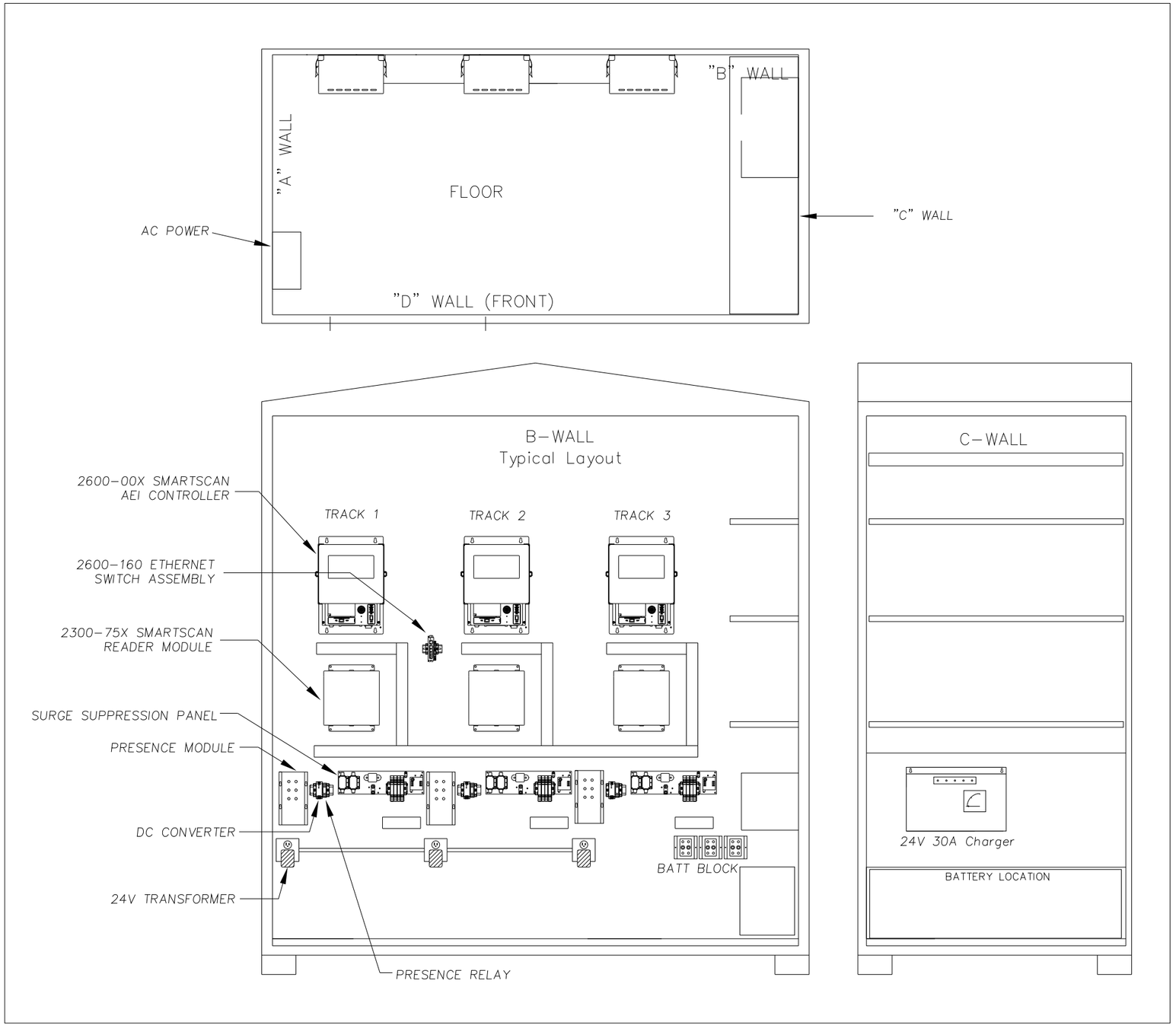
MAIN BLK		AUX BLK	
Pin	SIGNAL	Pin	SIGNAL
1	BATT POS	1	AMB SIG
2	BATT NEG	2	AMB GND
3	TO1+	3	AMB +12V
4	TO1-	4	TO3+
5	TO2+	5	TO3-
6	TO2-	6	TO4+
7	PRES IN	7	TO4-
8	Chassis GND	8	AUX INPUT
9	Unused	9	AUX RTN
10	Chassis GND	10	TRACK SW1
11	Power Fail	11	TRACK SW RTN
12	Power Fail RTN	12	TRACK SW2
13	Unused	13	PRES RTN
14	Unused	14	OUT-1
15	Unused	15	RTN
16	Unused	16	OUT-2

B24-1		N24-1	
Pin	SIGNAL	Pin	SIGNAL
1	BATT+	1	BATT-
2	Charger +	2	Charger -
3	BATT+	3	BATT-
4	Load+	4	Load-
5	Load+	5	Load-
6	Load+	6	Load-
7	Load+	7	Load-
8	Load+	8	Load-
9	Load+	9	Load-
10	Load+	10	Load-
11	Load+	11	L-1300 PinB
12	Load+	12	Load-
13	Load+	13	L-1300 PinA
14	Load+	14	Load-
15	F1 Pin1	15	Main BLK Pin2
16	Load+	16	Load-

Typical 4’ x 6’ Bungalow Layout



Typical Triple Track 4’ x 8’ Bungalow Layout



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