



EUD-2006065-00

SmartScan AEI Systems Reference Guide

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STC's web site is www.southern-tech.com
their email address is email@southern-tech.com
their fax number is 423-499-0045
their phone number is 423-892-3029

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Chapter 1

Introduction

This chapter summarizes the purpose of this guide, introduces RFID/AEI technology as it applies to the rail industry, and overviews the workings of SmartScan AEI systems. It tells how to comment on this guide and how to order more copies of this guide. It also covers the cautions and disclaimers of which the customer should be aware.

1.1 Purpose of This Guide

The technical staff at Southern Technologies Corporation (STC) created the SmartScan product line. This line consists of readers, processors, modems, and other components.

In this guide, you'll find detailed information about SmartScan mainline and yard AEI systems. Here you'll learn how to install and setup your system. Here too, you'll learn how to produce various reports and how to isolate and eliminate the causes of problems in an up-and-running system.

This guide is for those who buy, install, maintain, manage, or use the products that make up a SmartScan AEI system. Other guides cover SmartScanIS and SmartScanNG.

1.2 Key Points

Automatic Equipment Identification (AEI), automated vehicle identification (AVI), and Radio Frequency Identification (RFID) are synonymous when referring to tag-reading equipment manufactured by Amtech Systems.

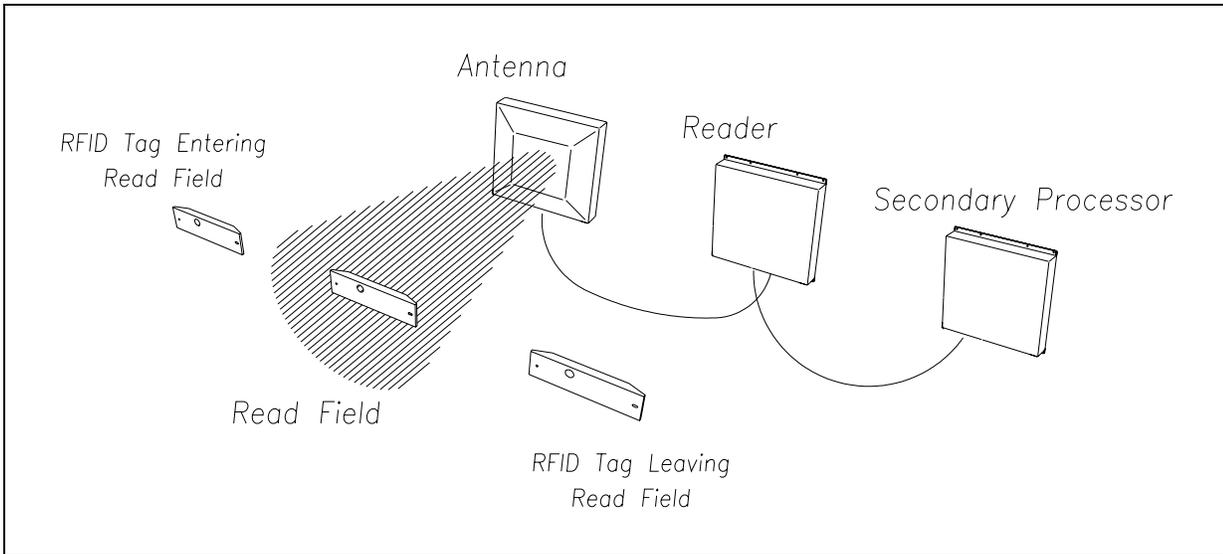
A basic RFID/AEI system consists of:

- An antenna
- A reader (transceiver with decoder)
- A radio frequency (RF) tag (transponder)

Vehicles and equipment are tagged with a wireless transponder. A reader reads these electronic tags as they pass a stationary antenna. When so equipped, the reader transfers the data read from the tags to a secondary processor or computer, where the data can be stored for later processing.

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

The figure below shows a tag as it is being read.



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 the carrier wave in accordance with the program in the tag and reflects that modulated signal back to the reader. The reader receives the returned signal and processes the radio signal into usable characters.

Three key points of general operation are:

- Only one tag can be in the read field at one time. The reader gets confused if more than one tag is reporting at a time.
- The reader only reports a tag to the secondary 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, such that the horizontal plane of the antenna must match the horizontal position of the tag.

1.3 Railroad Tags

All properly tagged railcars have two mounted RFID/AEI tags, one on each side of the car. Tags serve only as coded reflectors for the radio frequency signal emitted through the antenna. They aren't radio transmitters. They don't radiate signals by themselves.

RFID/AEI tags are categorized as either active or passive. Active tags are powered by an internal battery. Passive tags operate without a separate external power source. They obtain operating power from the RF signal generated by the reader. Passive tags are usually lighter than active tags, less expensive, and have a longer operational lifetime.

For most rail applications, two models of Amtech RFID/AEI tags are used. The tags are the AT5118 and the AT5125. The tag specified by the American Association of Railroads (AAR) for use in North America on most railcars and locomotives is the AT5118 read-only tag, which replaces the AT5110. The AT5125 high-temperature case tag is used on railcars that are exposed to thaw sheds. The AT5118 and AT5125 are referred to as beam-powered tags because they use part of the radio frequency field to power the internal circuitry. With this type of operation, the tags don't require batteries.

The AT5707 dynamic tag reports locomotive statistics such as fuel level. The dynamic tag has an external power source and a serial connection to an onboard computer, which updates the information in the tag as changes occur.

The tags can be programmed with up to 20 ASCII characters. These characters are read by the wayside readers. Before installation, the AT5110 and AT5125 tags are programmed offline through a programming port in the back of the tag. Before installation, the AT5118 tags are programmed offline by RF through the back of the tag. An Amtech Tag Programmer (TP) is needed to program tags. The TP connects to a computer via a serial interface.

The TP interfaces the tag's programming port to a computer. A DOS-based tag-programming software package is supplied with the TP. This software allows you to program tags, by filling in required information on templates that are specific to the different format in which the tags can be programmed.

The information format for programming railcar tags is specified by the AAR. To get more data into the tag than 20 characters would allow, the AAR specifies data encryption and compression techniques. This means that the 20 characters that are read directly from the tag have to be decoded into readable form. In a wayside reader system, a secondary processor usually does the decoding.

1.4 SmartScan

The SmartScan mainline and yard AEI systems integrate several subsystems to provide you with a complete consist listing of a train. A consist list is composed of date, time, direction of train, number of cars, and an individual list of the railcars. If the RFID/AEI tags are readable, the consist list provides railcar identification. If not, it provides an entry indicating an unidentified car with the number of axles for that car.

At the center of operations is the SmartScan 2200-100 Processor. This processor produces the consist list based on information received from the integrated subsystems.

Other subsystems used in a SmartScan AEI system are:

- Two AEI antennas.
- Two SmartScan 2200-504 Readers.
- Transducers to detect and count axles.
- Presence-detection equipment to sense train presence.
- SmartScan 2200-300 Interface board.
- Power supply and battery charger.
- Equipment enclosures.
- Either a landline modem or a cellular modem.

This guide provides detailed information about each of the subsystems mentioned above.

Here's an outline of how the SmartScan system operates.

- 1 The 2200-500 Presence Detector (or Reno A&E C-1300 2-Channel Loop Detector) starts the process by signaling the 2200-100 Processor when a train is approaching the site.
- 2 The 2200-100 Processor activates the two 2200-504 Readers and initiates the train scanning process.
- 3 As the train moves over the transducers, signals are sent to the 2200-100 Processor that represent wheel transitions (that is, wheels crossing the transducer pairs).
- 4 As the 2200-100 Processor collects wheel-transition records, they are placed into groups representing the rail vehicles that generated them. These groups of wheel-transition records form the car records.
- 5 As an individual RFID/AEI tag passes the antenna, the 2200-504 Reader reads the tag, appends a timestamp, and passes the data to the 2200-100 Processor. Tag-information records are associated with car records based on the tag-record timestamp.
- 6 The presence detector signals the 2200-100 Processor when the train is no longer in range.
- 7 The 2200-100 Processor turns off the 2200-504 Readers and organizes the train consist based on the wheel-transition data and tag-record data.
- 8 The data collected is stored in the system DRAM for later recall.
- 9 If desired, some of the stored data can be forwarded to a host computer through a modem.

1.5 Cautions

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

Do not install solar panels where flammable gases or vapors are present. Do not touch any unshielded wire coming from them. Do not let two unshielded wires touch. Work only under dry conditions. In sum, avoid all electrical hazards when installing, wiring, operating, and maintaining solar panels and other electrical parts of any solar-powered SmartScan system. Avoid all electrical hazards on all SmartScan systems. Failure to follow these instructions could result in injury or death.

1.6 Disclaimers

The correct use of this guide, the environmental conditions at the time of installation, and the method of installation itself 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 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.

1.7 How to Comment on This Guide

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Chapter 2 Enclosures

Most SmartScan mainline AEI systems use four Honeywell zero-speed transducers and one 2200-500 Presence Detector, which requires a track circuit. Most SmartScan yard AEI systems use three Reno A&E C-1300 2-Channel Loop Detectors, which require a track-presence loop and SAI rail-loop transducers. Track circuits, track-presence loops, and transducers are described in **Chapter 4 - Track Components**.

The controlling components of a SmartScan AEI system can be delivered in either:

- A tower enclosure, which is a 62 x 25 x 9.5-inch (157.5 x 63.5 x 24-centimeter) NEMA 4X-rated custom enclosure, designed for mounting out-of-doors on a tower or mast.
- An inside enclosure, which is a 53.4 x 14 x 10.5-inch (135.6 x 35.6 x 26.7-centimeter) hinged enclosure, designed for wall mounting inside a bungalow. (In this guide, the structure along side the track is called the "bungalow." This building goes by many other names, such as location case, apparatus housing, equipment enclosure, and railside building.)

There are two configurations of the tower enclosure. The 2200-900**AC** is powered by 110 VAC. The 2200-900**DC** is powered by a bank of batteries (in the 2200-340 Solar Battery Box) charged by a solar array. There is only one configuration of the inside enclosure. The 2200-950 is powered by 110 VAC. The 2200-950 can be shipped in a crate (prewired and ready for installation) or in a bungalow (already installed). Even though a solar-powered bungalow can be special ordered, it isn't covered in this guide.

This chapter examines each of these configurations in more detail. Installation of these enclosures, both trackside and remotely, is covered in **Chapter 5 - Installing the System**.

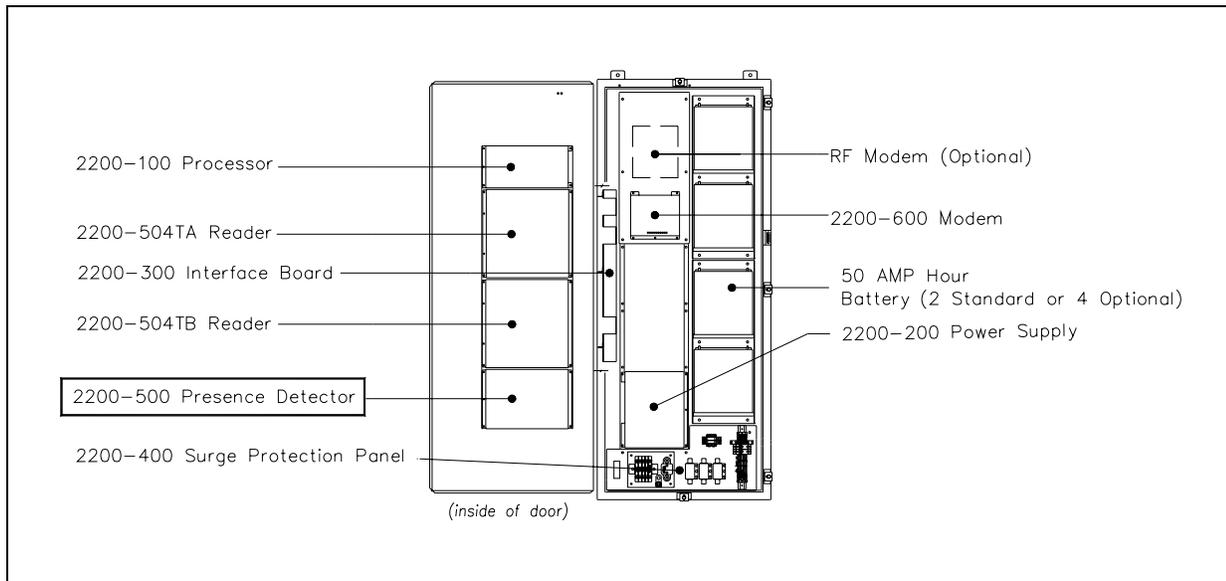
2.1 2200-900AC Tower Enclosure

The SmartScan 2200-900**AC** Tower Enclosure is an NEMA 4X-rated outdoor enclosure that provides mounting points and interconnections for the various modules that comprise a typical AEI system. The enclosure is coated with a white polyester powder coat to provide a long-lasting finish.

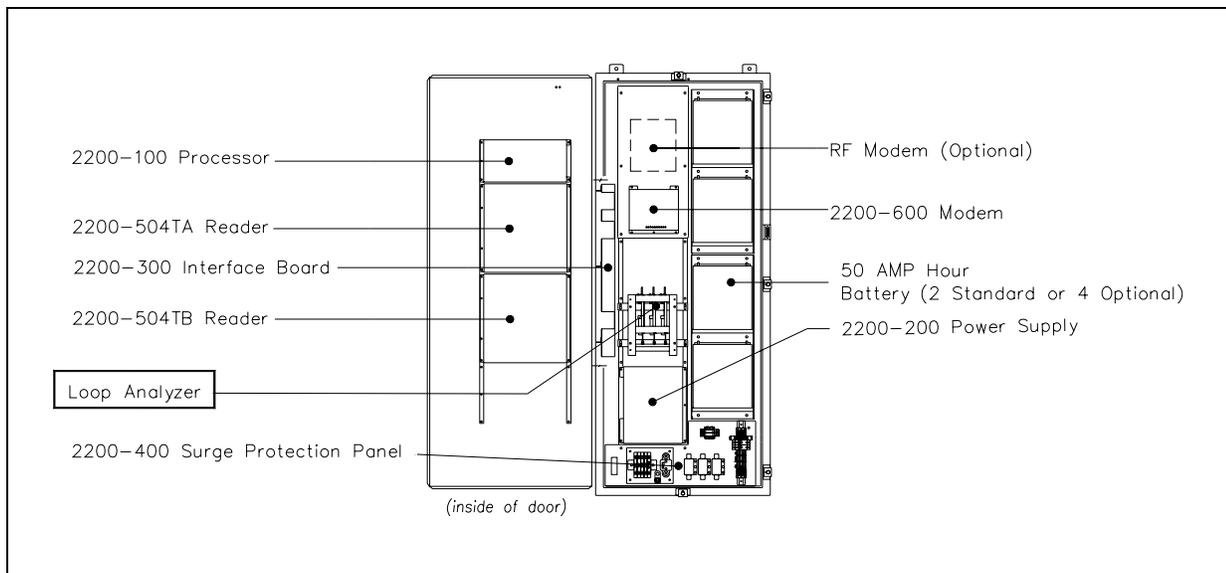
The system consists of a single-piece welded metal box with a full dimension door attached by a continuous hinge. This configuration allows mounting of system modules inside the door and in the main box section. The system has a small footprint, making it ideal for yard installations and locations that don't allow full-size bungalows, but do have easy access to 110 VAC.

The 2200-900 Tower Enclosure is designed to be mounted to a Rohn 25G tower section measuring 10 feet (3 meters) in length. The tower section is a welded triangular assembly, secured to a precast concrete foundation with a steel transition plate. The enclosure is mounted across two of the tower legs with specially fabricated channels. The third leg of the tower is used to support the antenna for the rail closest to the enclosure.

The figure below shows the inside of a 2200-900**AC** Tower Enclosure that is configured for use with Honeywell zero-speed transducers. Notice that, in this example, a SmartScan 2200-500 Presence Detector is used.



The figure below shows the inside of a 2200-900**AC** Tower Enclosure that is configured for use with SAI rail-loop transducers. Notice that, in this example, Reno A&E C-1300 2-Channel Loop Detectors are used.



Mounted in the left side of the enclosure base is the 2200-300 Interface board. This board acts as the distribution and connection point for the different system modules. Secondary lightning protection, in the form of gas arresters, is provided for each external connection to the system.

On the inside of the door, mounting points are provided for most of the system modules. Beginning at the top of the panel, the modules are:

- 2200-100 Processor
- 2200-504TA Reader, which is used with antenna1
- 2200-504TB Reader, which is used with antenna2
- 2200-500 Presence Detector, when track circuits are used

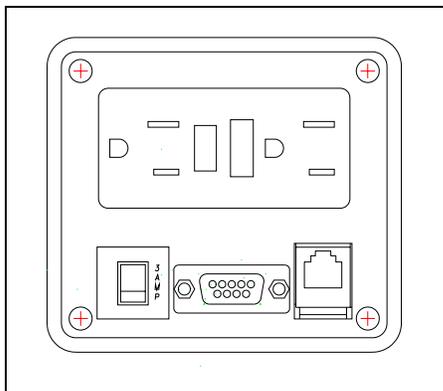
Each module is secured to the door with four 8-32 x 3/8 Phillips head screws. Ribbon cables provide interconnections to the 2200-300 Interface board. The remaining connections are provided through a wire harness with appropriate connectors at the attachment points to the modules. When the system arrives, the modules are already installed.

In the lower left corner of the enclosure base, mounting points are provided for the 2200-200 Power Supply. Above it, mounting points are provided for the loop-analyzer rack (when track-presence loops are used).

Mounting points are provided in the enclosure base for four battery-support brackets. These brackets can hold a maximum of four 12-volt 50-AH batteries wired in a series parallel arrangement to provide 24 volts at 100-AH capacity for backup power. The standard configuration includes two batteries with an option for two more.

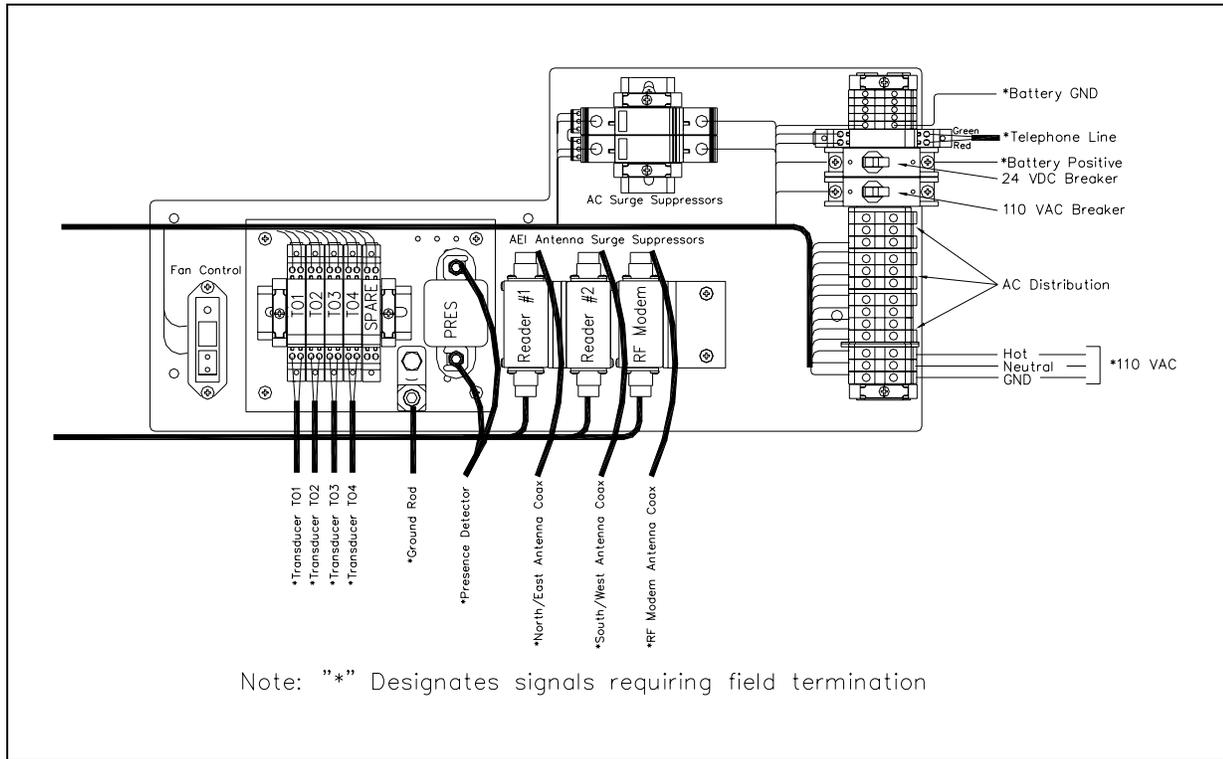
The enclosure is equipped with a thermostatically controlled blower-filter combination to provide temperature stability in the enclosure. Air is drawn in through the filter on the lower left side. It is expelled through two water-resistant vents on each side near the top of the enclosure.

On the lower right side of the enclosure is a small weatherproof box, which is known as a panel interface connector (PIC). This box contains a local RS232 connection to the 2200-100 Processor, a telephone plug, and a three-wire 120-volt outlet. The RS232 connector is known as a data tap.



The enclosure has a removable bottom plate that allows for field drilling of all conduit entrance holes. All underground conduits can be terminated to this plate before installation of the cabinet. The bottom plate has a predrilled flange that serves as the mounting point for the base of the enclosure.

Mounted in the bottom of the enclosure base is the 2200-400 Surge Protection Panel, which is shown below.

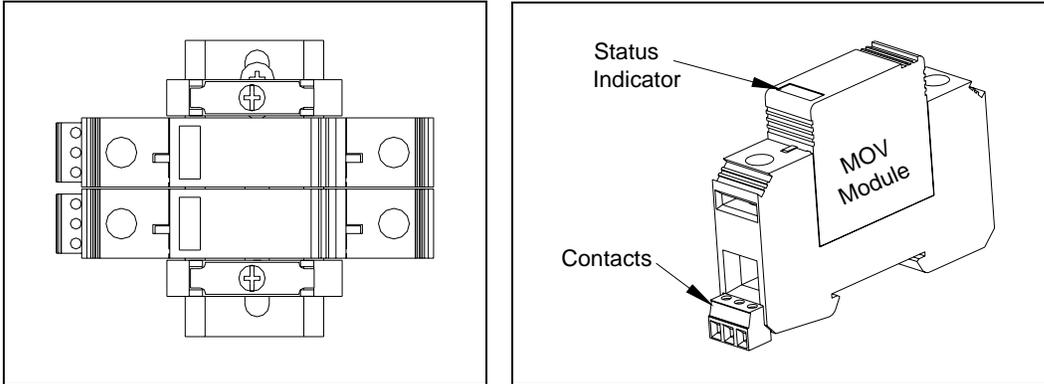


On the left side of the 2200-400 Surge Protection Panel are five DIN mounted Universal Transient Barriers (UTBs) to provide primary lightning protection for the track-mounted system components. The first four UTBs (leftmost UTBs) offer protection for the zero-speed transducers. The fifth UTB is a spare in most systems.

To the right of the UTBs is a three-terminal arrester (TTA) that provides surge protection for the track-mounted presence signal.

To the right of the TTA are three Joslyn coaxial lightning arresters. These arresters are prewired with coaxial cables and run to the mounting points for the two 2200-504 Readers and an optional cellular modem.

Above the Joslyn coaxial arresters are two DEHNguard P150 arresters. These provide the primary lightning protection for the AC line voltage.



The P150 consists of a DIN mount base and a replaceable MOV module with a thermal disconnect. Under normal operating conditions, the status indicator is green. When an overvoltage surge has tripped the thermal disconnect, the status indicator becomes red and the normally closed contacts open. Arrester integrity is monitored by the SmartScan 2200-100 Processor.

To the right of the Joslyn coaxial arresters are DIN mounted interconnected blocks. Incoming AC service is terminated here. AC is distributed to other parts of the system from here.

Two circuit breakers, also on the DIN rail, control the external AC and DC connections to the system. Above the breakers, is the surge protection for the telephone line.

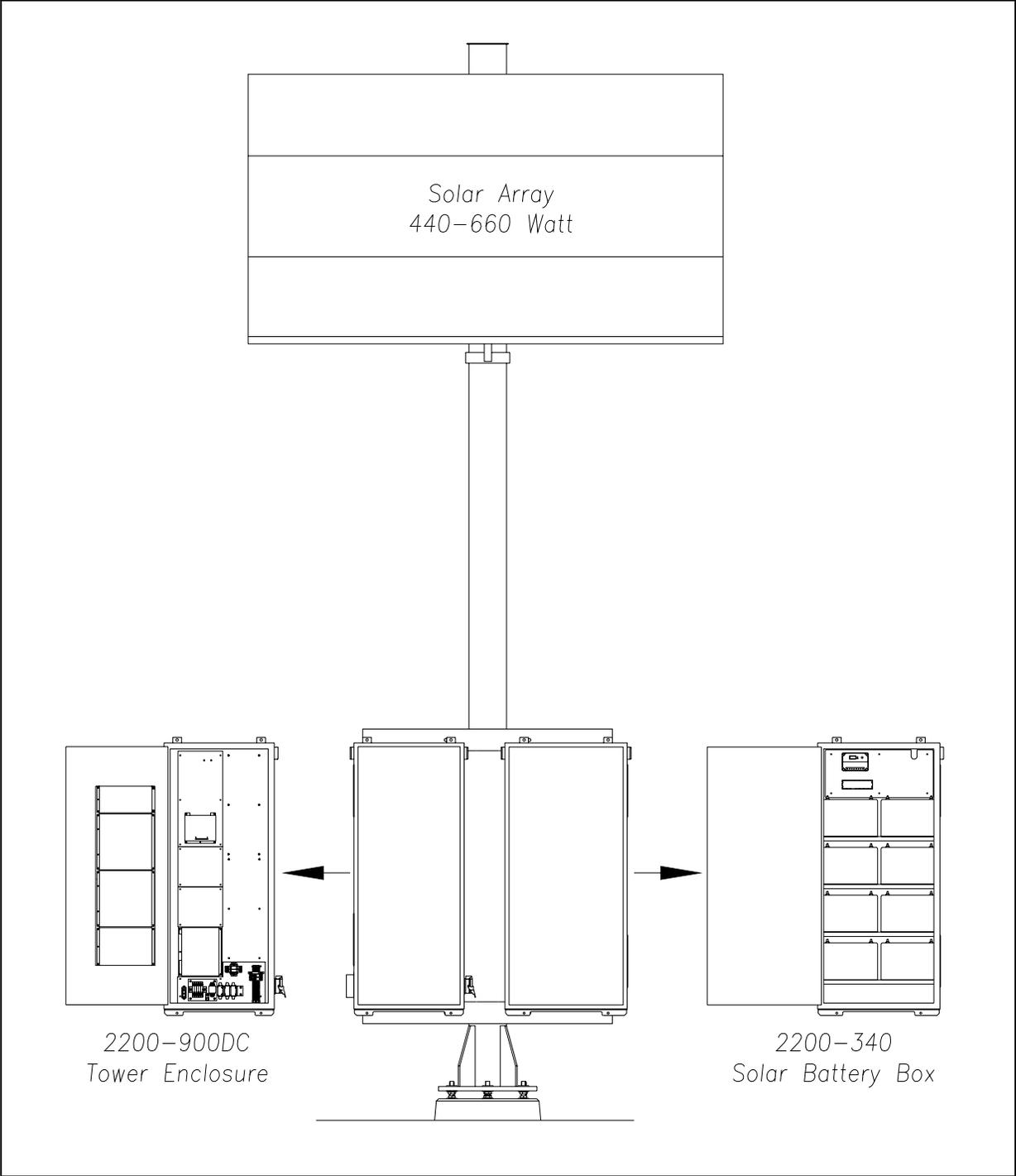
All system surge components are grounded to the copper ground plate. The prime ground for the system is brought to this point.

2.2 2200-900DC Tower Enclosure

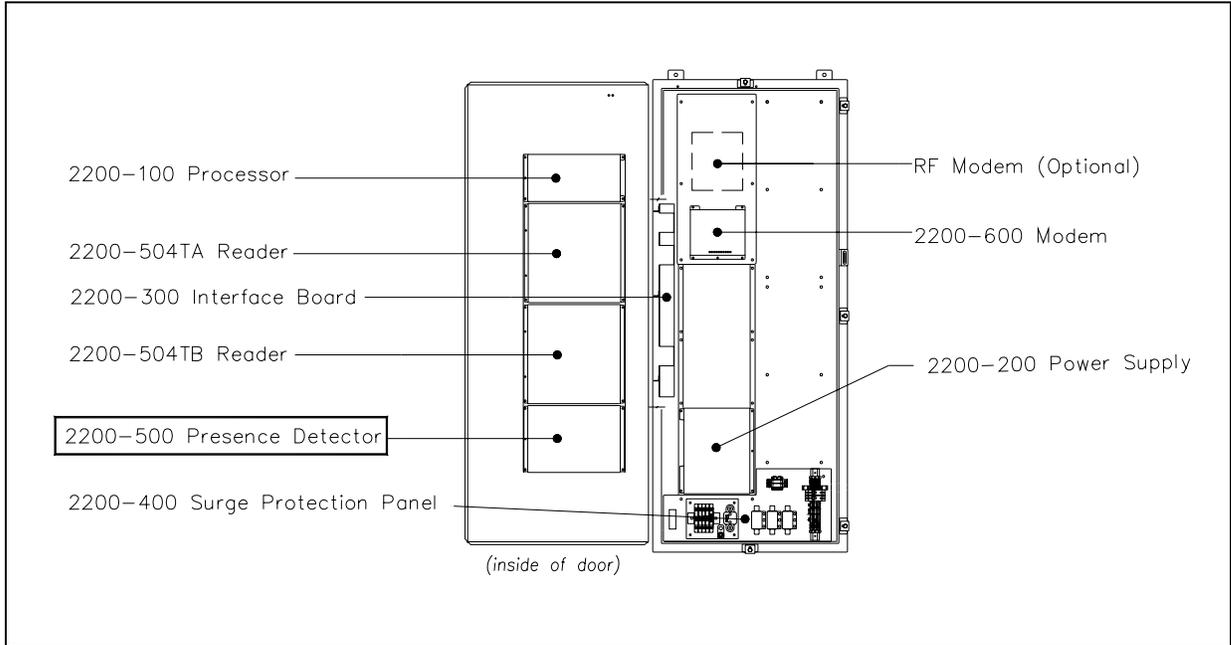
The SmartScan 2200-900DC Tower Enclosure is an NEMA 4X-rated outdoor enclosure that provides mounting points and interconnections for the various modules that comprise a typical yard AEI system. The enclosure is coated with a white polyester powder coat to provide a long-lasting finish.

The system consists of a single-piece welded metal box with a full dimension door attached by a continuous hinge. This configuration allows mounting of system modules inside the door and in the main box section. The system has a small footprint, making it ideal for yard installations and locations that don't allow full-size bungalows and that don't have easy access to 110 VAC.

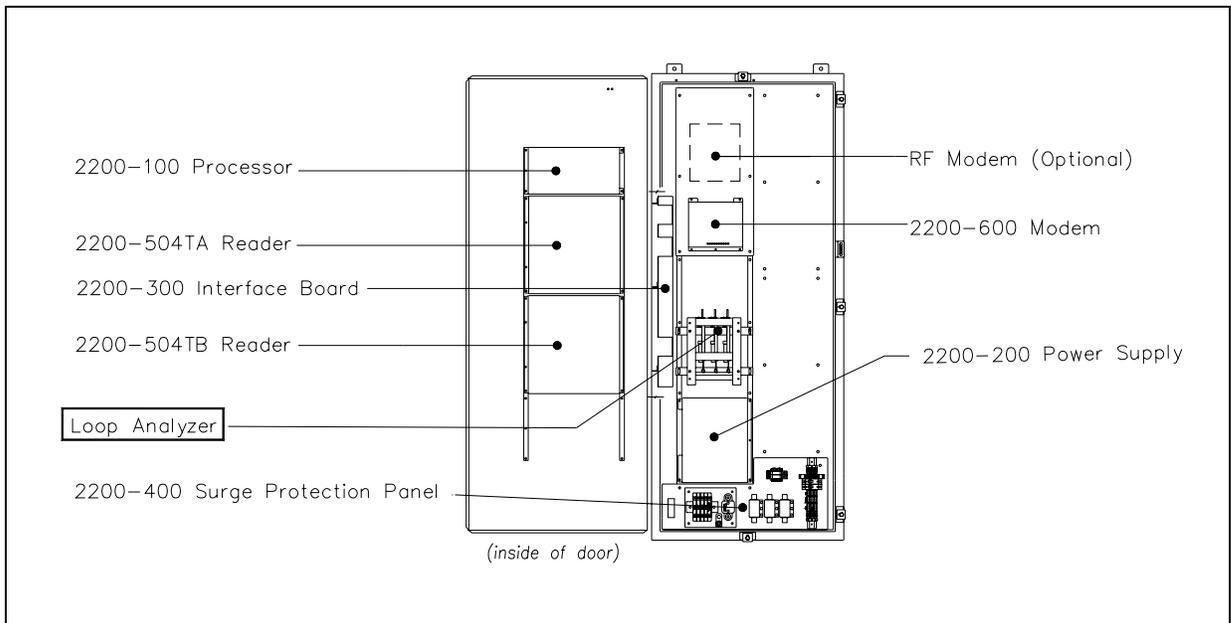
The 2200-900DC Tower Enclosure is mounted next to a 2200-340 Solar Battery Box on a 20-foot pole topped with solar panels, as shown below.



The figure below shows the inside of a 2200-900DC Tower Enclosure that is configured for use with Honeywell zero-speed transducers. Notice that, in this example, a SmartScan 2200-500 Presence Detector is used.



The figure below shows the inside of a 2200-900DC Tower Enclosure that is configured for use with SAI rail-loop transducers. Notice that, in this example, Reno A&E C-1300 2-Channel Loop Detectors are used.



Mounted in the left side of the enclosure base is the 2200-300 Interface board. This board acts as the distribution and interconnection point for the different system modules. Secondary lightning protection, in the form of gas arresters, is provided for each external connection to the system.

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- 2200-504TA Reader, which is used with antenna1
- 2200-504TB Reader, which is used with antenna2
- 2200-500 Presence Detector, when track circuits are used

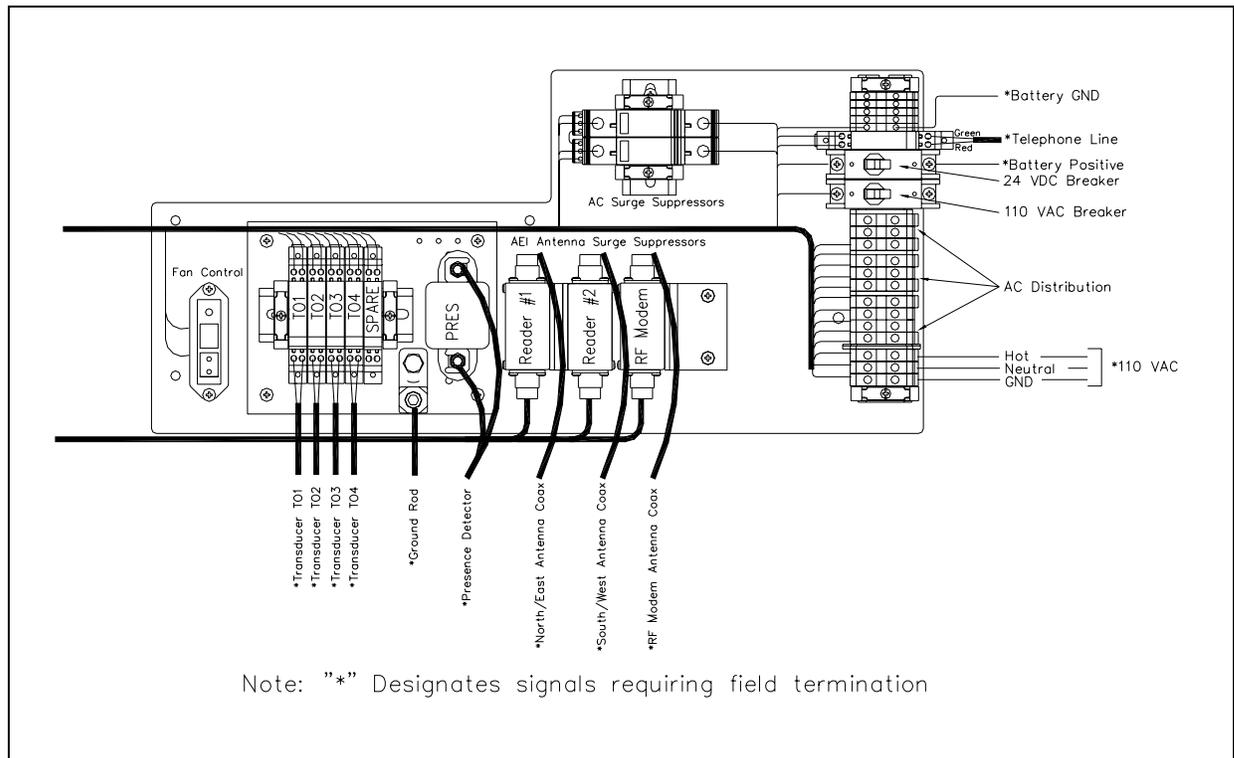
Each module is secured to the door with four 8-32 x 3/8 Phillips head screws. Ribbon cables provide interconnections to the 2200-300 Interface board. The remaining connections are provided through a wire harness with appropriate connectors at the attachment points to the modules. When the system arrives, the modules are already installed.

In the lower left corner of the enclosure base, mounting points are provided for the 2200-200 Power Supply. Above it, mounting points are provided for the loop-analyzer rack (when track-presence loops are used).

On the lower right side of the enclosure, a small weatherproof box contains a local RS232 connection (data tap) to the 2200-100 Processor and a telephone plug.

The enclosure has a removable bottom plate that allows for field drilling of all conduit entrance holes. All underground conduits can be terminated to this plate before installation of the cabinet. The bottom plate has a predrilled flange that serves as the mounting point for the base of the enclosure.

Mounted in the bottom of the enclosure base is the 2200-400 Surge Protection Panel, which is shown below.



On the left side of the 2200-400 Surge Protection Panel are five DIN mounted UTBs to provide primary lightning protection for the track-mounted system components. The first four UTBs (leftmost UTBs) offer protection for the zero-speed transducers. The fifth UTB is a spare in most systems.

To the right of the UTBs is a TTA that provides surge protection for the track-mounted presence signal.

To the right of the TTA are three Joslyn coaxial lightning arresters. These arresters are prewired with coaxial cables and run to the mounting points for the two 2200-504 Readers and an optional cellular modem.

Above the Joslyn coaxial arresters are two DEHNgard P150 arresters. These provide the primary lightning protection for the AC line voltage. These devices aren't used in a solar-powered system.

To the right of the Joslyn coaxial arresters are DIN mounted interconnected blocks. These blocks aren't used in a solar-powered system. On the DIN are two circuit breakers. One controls the external DC connection to the system. The other isn't used. Also on the DIN rail, above the breakers, is the surge protection for the telephone line.

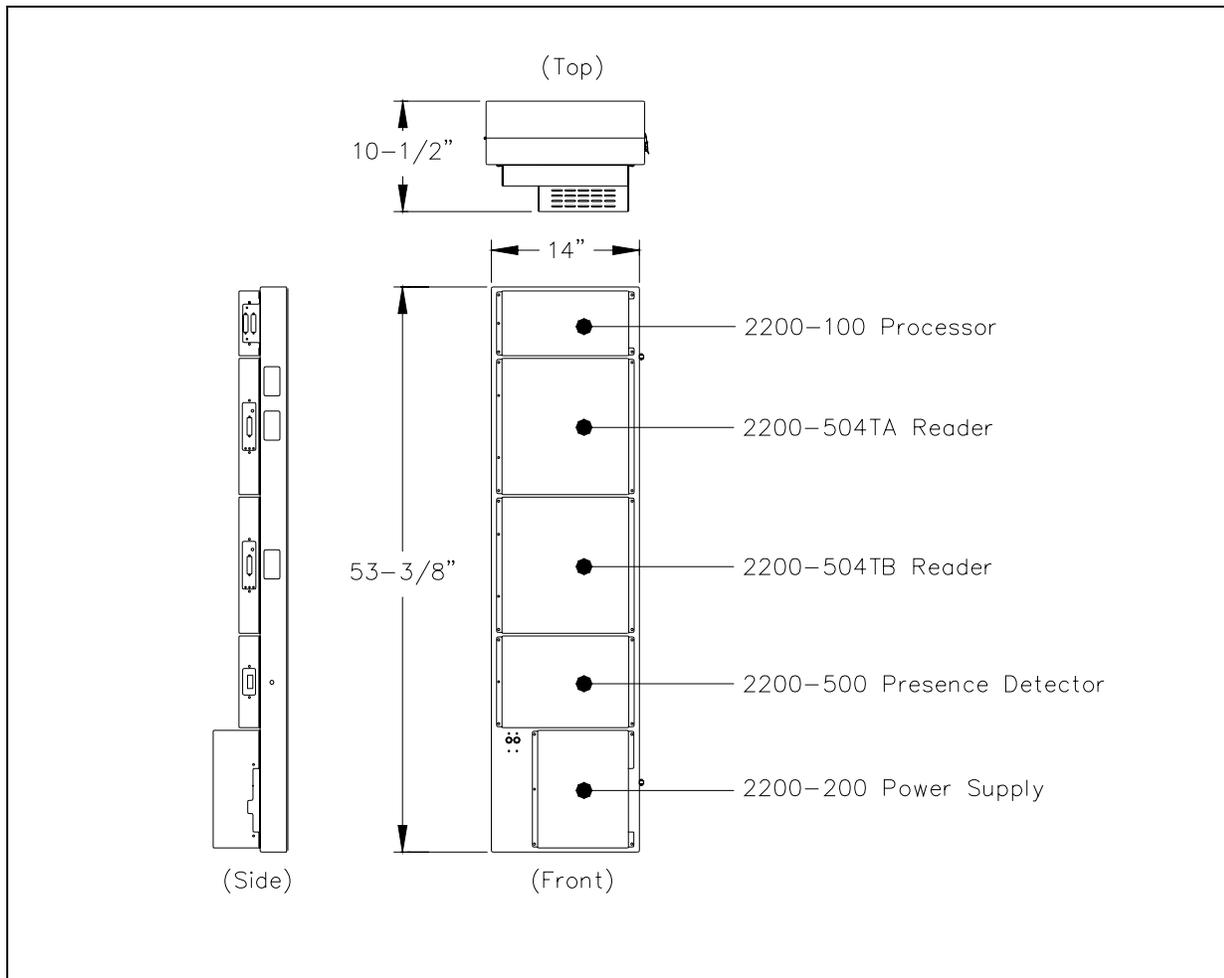
All system surge components are grounded to the copper ground plate. The prime ground for the system is brought to this point.

2.3 2200-950 Inside Enclosure

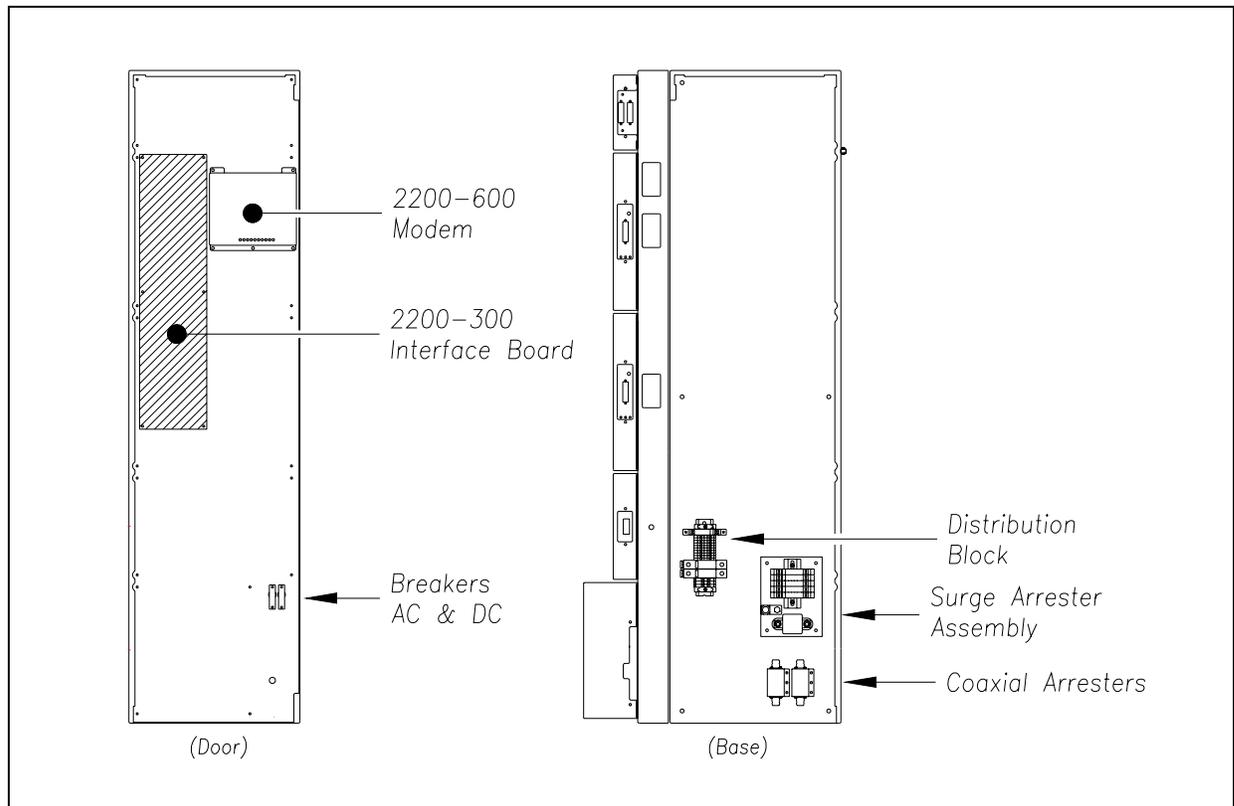
The 2200-950 Inside Enclosure is a wall-mounted system that provides mounting points and interconnections for the various modules that comprise a typical mainline AEI system. The enclosure is designed for applications where trackside space isn't limited, and the user would prefer the SmartScan AEI system located in a bungalow.

The same type of control equipment is used in the 2200-950 Inside Enclosure, as in the 2200-900 Tower Enclosure. The difference being in the type mounting and enclosure design. The 2200-950 Inside Enclosure is designed for easy installation inside the controlled environment of a bungalow. The system provides a compact hinged assembly that bolts easily to a wall or other secure structure. The enclosure requires wall space measuring 25 inches (63.5 centimeters) wide by 53.4 inches (135.6 centimeters) high by 18 inches (45.7 centimeters) deep. These dimensions are larger than the enclosure itself, because of the need to open the enclosure's front door.

The figure below shows the outside of the 2200-950 Inside Enclosure.



The figure below shows the inside of the 2200-950 Inside Enclosure.



The enclosure consists of two formed sheet-metal box panels that are joined by a continuous hinge and coated with a white polyester powder coat to provide a long-lasting finish. An enclosure can easily fit in a 4-foot x 4-foot signal bungalow. It is secured to a plywood backboard with six 1/4 x 1-inch lag screws. System modules are mounted inside and outside of the enclosure to minimize the size of the complete system.

Mounted inside the front panel is the 2200-300 Interface board. This board acts as the distribution and interconnection point for the different system modules. Secondary lightning protection in the form of gas arresters is provided for each external connection to the system. The 2200-300 Interface board is mounted to six threaded inserts pressed into the cover panel. All system component grounds are provided through similar attachment points to the panels.

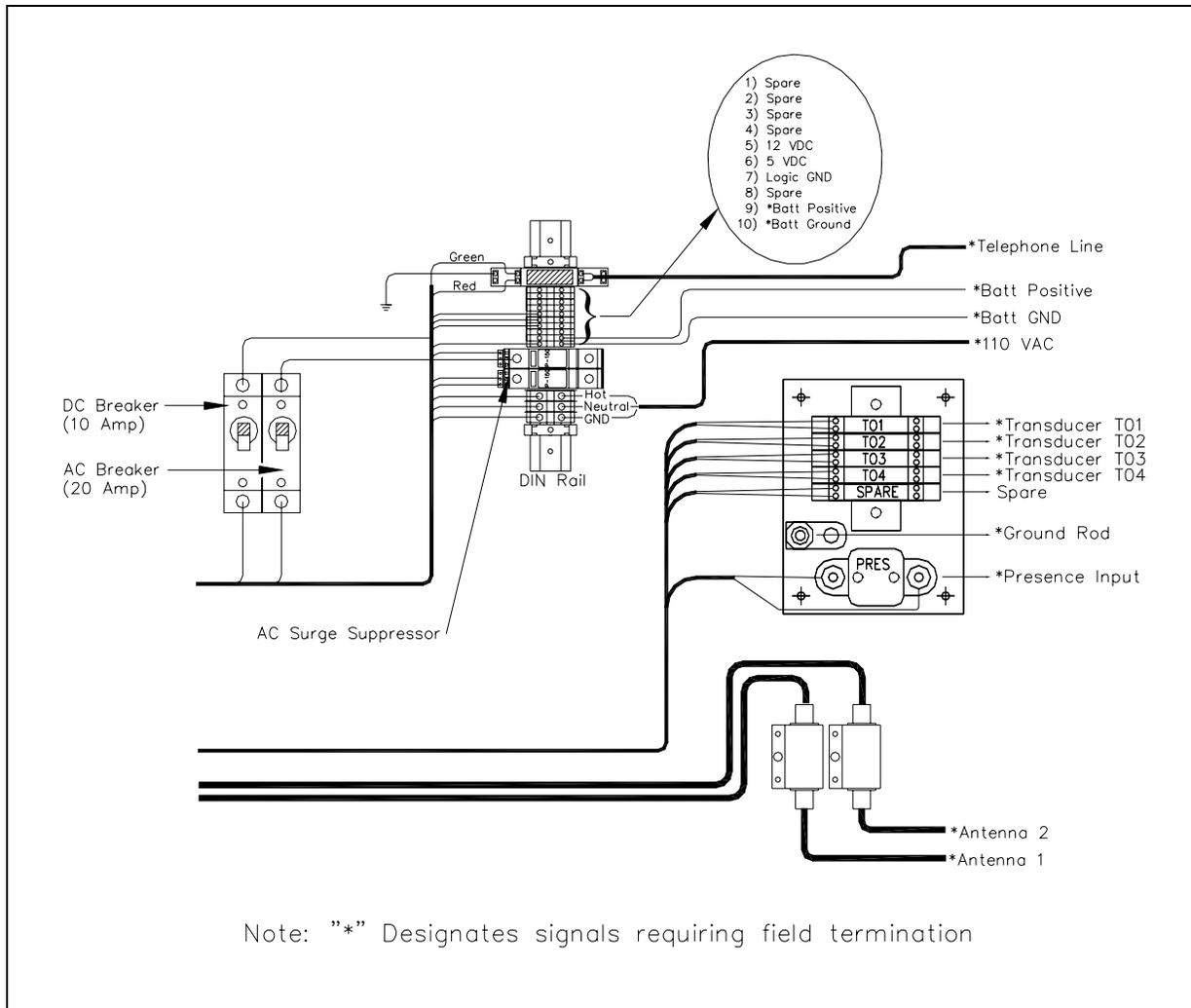
On the front panel, mounting points are provided for most of the system modules. Beginning at the top of the panel, the modules are:

- 2200-100 Processor
- 2200-504TA Reader, which is used with antenna1
- 2200-504TB Reader, which is used with antenna2
- 2200-500 Presence Detector
- 2200-200 Power Supply

Each module is secured to the panel with four Keps-nuts. Ribbon cables provide interconnections to the 2200-300 Interface board. The remaining connections are provided through a wire harness with appropriate connectors at the attachment points to the modules.

Two circuit breakers are provided to control the external AC and DC connections to the system. These breakers are located adjacent to the 2200-200 Power Supply on the front panel of the enclosure.

Most of the components that provide surge protection for the system are mounted inside the bottom of the enclosure, as shown below.



On the right side are five DIN mounted UTBs to provide primary lightning protection for the track-mounted system components. The first four UTBs (topmost UTBs) offer protection for the zero-speed transducers. The fifth UTB is a spare in most systems. Below the UTBs is a TTA that provides surge protection for the track-mounted presence signal. The UTBs and TTA are mounted to a copper plate. All system surge components are grounded to this plate. The prime ground for the system is brought to the ground lug on this plate.

Below the copper plate are two Joslyn coaxial lightning arresters. These arresters are prewired with coaxial cables and run to the mounting points for the two 2200-504 Readers.

To the left of the Joslyn coaxial arresters is a DIN rail that is provided for other system interconnections. This is where the surge protection for the telephone line resides. This is also where two DEHNguard P150 arresters reside. These provide the primary lightning protection for the AC line voltage.

Two circuit breakers are provided to control the external AC and DC connections to the system. These breakers are located adjacent to the 2200-200 Power Supply on the front panel of the 2200-950 Inside Enclosure.

Chapter 3

System Modules

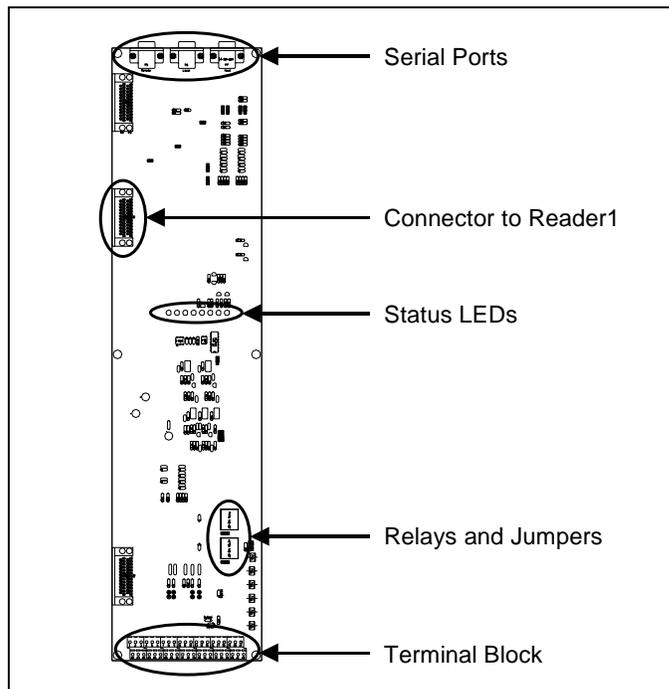
This chapter covers the major system modules that are used in most systems. Not all systems use all of the described modules.

3.1 2200-300 Interface Board

The SmartScan 2200-300 Interface board provides:

- All interconnections between the power supply, the processor, readers, and the presence detector.
- Surge protection and interface circuitry for all external inputs to and outputs from the SmartScan system.
- Filtering to suppress high frequency noise that may be induced on the transducer signals.
- A way to select one of four low-battery thresholds.
- LEDs for TO1, TO2, TO3, TO4, presence, sync, and the general-purpose output lines from the SmartScan system.

The figure below shows a 2200-300 Interface board.

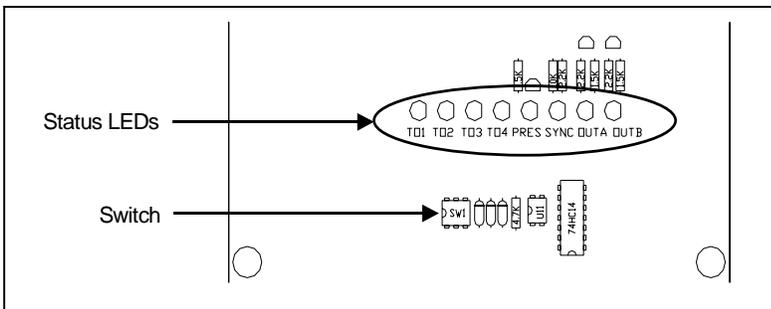


When mounted in a 2200-950 Inside Enclosure, the Interface board is installed inside the front panel. The board is secured to the panel by six 4-40 x 3/8 Phillips pan-head fasteners. When mounted in this position, ports are provided in the front panel for entrance of the interconnection cables to the system modules.

When mounted in a 2200-900 Tower Enclosure, the Interface board is attached to threaded inserts on the left side. In this configuration, a cover protects the board components from damage. The cover has ports to allow entrance of the interconnection cables to the system modules.

3.1.1 Status LEDs

On the 2200-300 Interface board, LEDs alert you to what is currently happening in the system. You can view the status LEDs on the main board through a hole in the cover protecting the Interface board.



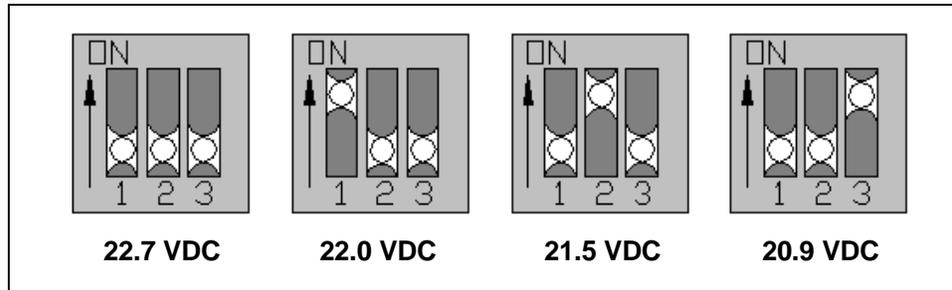
The table below describes what each lit LED on the main board means.

LED Name	LED Color	Meaning When Lit
TO1	Yellow	Wheel presence at transducer TO1.
TO2	Yellow	Wheel presence at transducer TO2.
TO3	Yellow	Wheel presence at transducer TO3.
TO4	Yellow	Wheel presence at transducer TO4.
Pres	Yellow	Detection equipment (track circuit or track-presence loop) indicates train presence.
Sync	Red	Loss of synchronization between two SmartScan systems. Not currently supported.
OutA	Green	Auxiliary output A active.
OutB	Green	Auxiliary output B active.

3.1.2 Switch (SW1)

On the Interface board, a three-position dual-inline-package (DIP) switch allows you to select from one of four preset levels for low-battery threshold. The Interface board monitors battery voltage and, when it reaches this threshold, alerts the 2200-100 Processor of the low-battery condition.

The four threshold values are:



3.1.3 Serial Ports (P5-P7)

The 2200-300 Interface board has three communication ports located across its top. From left to right, they are the labeled Remote, Local, and Host. These ports have DB-9 connectors for RS232 communications and are configured as Data Terminal Equipment (DTE).

The Host port (P7) connects to the host computer through either a landline modem or a cellular modem. Associated with this port is the ability to monitor the Clear To Send (CTS) control signal from an attached modem. The CTS control line is used to signal the SmartScan system when there is space in the modem's character buffer to insert more characters.

The Local port (P6) can be used for monitoring the system locally with a computer running a terminal emulation program, such as ProComm or HyperTerminal. The Remote port (P5) can also be used for local access.

Off-site communication with the SmartScan system is through the Host port. For a 2200-950 Inside Enclosure, **on-site** communication with the SmartScan system is through the Remote port or the Local port. For a 2200-900 Tower Enclosure, **on-site** communication with the SmartScan system is through the Local port (on the Interface board) or through the data tap (on the outside of the enclosure).

3.1.4 Module Connectors (P1-P4)

Connection to the 2200-100 Processor is made via two DB-25 connectors at the upper left side of the 2200-300 Interface board. These connectors are labeled P3 and P4 and are located directly across from the 2200-100 Processor. All signals to and from the processor are TTL level (0 VDC or 5 VDC) except the RS232 ports, which are +12 VDC and -12 VDC.

Connection to the 2200-504 Readers is made via two DB-25 connectors. Reader1 (2200-504TA) connects to the middle connector (P1) on the left side of the 2200-300 Interface board. Reader2 (2200-504TB) connects to the bottom connector (P2) on the left side of the 2200-300 Interface board.

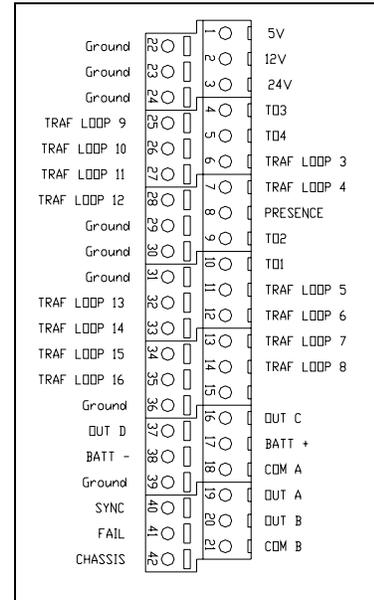
The 2200-500 Presence Detector is connected to terminal block TB1 at the bottom of the 2200-300 Interface board. So too is the 2200-200 Power Supply.

3.1.5 Terminal Block (TB1)

Terminal block TB1 provides all of the external connections to the SmartScan system.

The connections include:

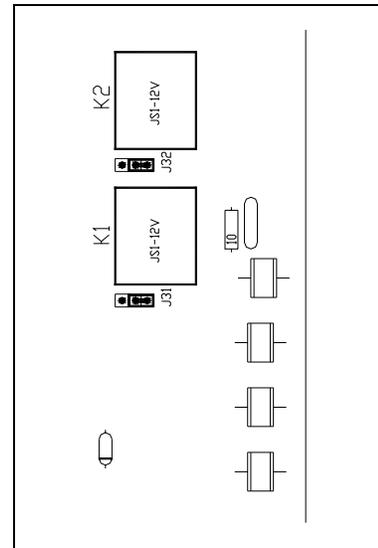
- 4 Transducers inputs (terminals 4, 5, 9, 10)
- Presence Detector input (terminal 8)
- 14 Traffic Loop inputs
- Battery Sense inputs (terminals 17, 38)
- 2 Auxiliary outputs (terminals 16, 37)
- 2 Relay outputs (terminals 19, 20)
- System Earth Ground (terminal 42)
- Power Supply DC outputs (terminals 1-3)
- Power Supply AC Fail input (terminal 41)



3.1.6 Relays (K1-K2) and Jumpers (J31-J32)

Interface board outputs OutA and OutB are driven through two 12V 10A relays. Controlled by firmware in the 2200-100 Processor, relay K2 provides a switched DC output to power the modem. This arrangement gives the Processor the ability to cycle power to "reset" the modem should conditions warrant. Though currently not supported in firmware, relay K1 is available to power a second peripheral device.

Normally open (NO) or normally closed (NC) contacts are user selectable via onboard jumpers J31 and J32. The figure to the right shows the default factory configuration of normally closed.



3.2 2200-100 Processor

The SmartScan 2200-100 Processor provides the signal and data processing capability for the SmartScan mainline and yard AEI systems. Its packaging is like the other modules of the SmartScan product line.

The 2200-100 Processor connects to the other system modules through the 2200-300 Interface board. All external connections to the 2200-100 Processor are also routed to the 2200-300 Interface board.

On the inside of the door of a 2200-900 Tower Enclosure, mounting points are provided for the 2200-100 Processor. Beginning at the top of the door, the processor is secured to the door with four 8-32 x 3/8 Phillips head screws. Two ribbon cables provide interconnections to the 2200-300 Interface board. When the system arrives, the processor is already installed.

On the outside of the door of a 2200-950 Inside Enclosure, mounting studs are provided for the 2200-100 Processor. Beginning at the top of the door, the processor is secured to the panel with four Keps-nuts. Two ribbon cables provide interconnections to the 2200-300 Interface board. If your 2200-950 Inside Enclosure was shipped in a bungalow, you'll need to install the processor. If it was shipped in a crate instead, the processor was already installed.

Communication with the 2200-100 Processor is conducted through a series of menus. By selecting menu options, the processor will display system parameters and generate reports. The system parameters also have options that allow you to change or modify those options.

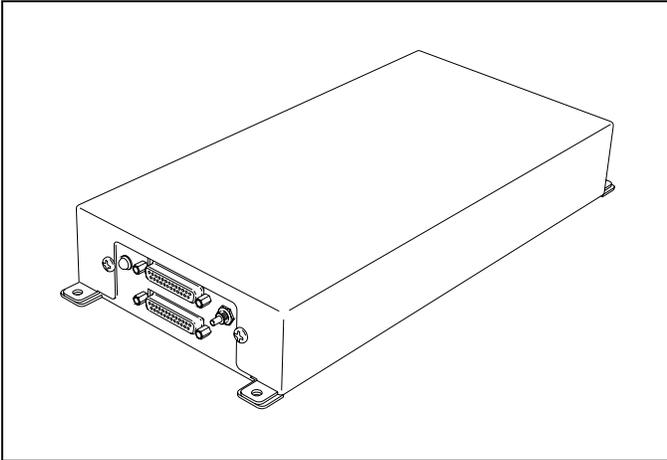
Direct communication is established through the Remote port or the Local port on the 2200-300 Interface board. The Host port allows access through a landline or cellular telephone connection. A computer running a terminal emulation program is needed to communicate with the SmartScan system.

Terminal emulation programs (such as ProComm and Hyper-Terminal) should be setup for 9600 baud, no parity, 8 data bits, and 1 stop bit. Since the Remote and Local ports are configured as DTE, a null modem adapter or cable is needed to interface correctly with the computer (which is also DTE).

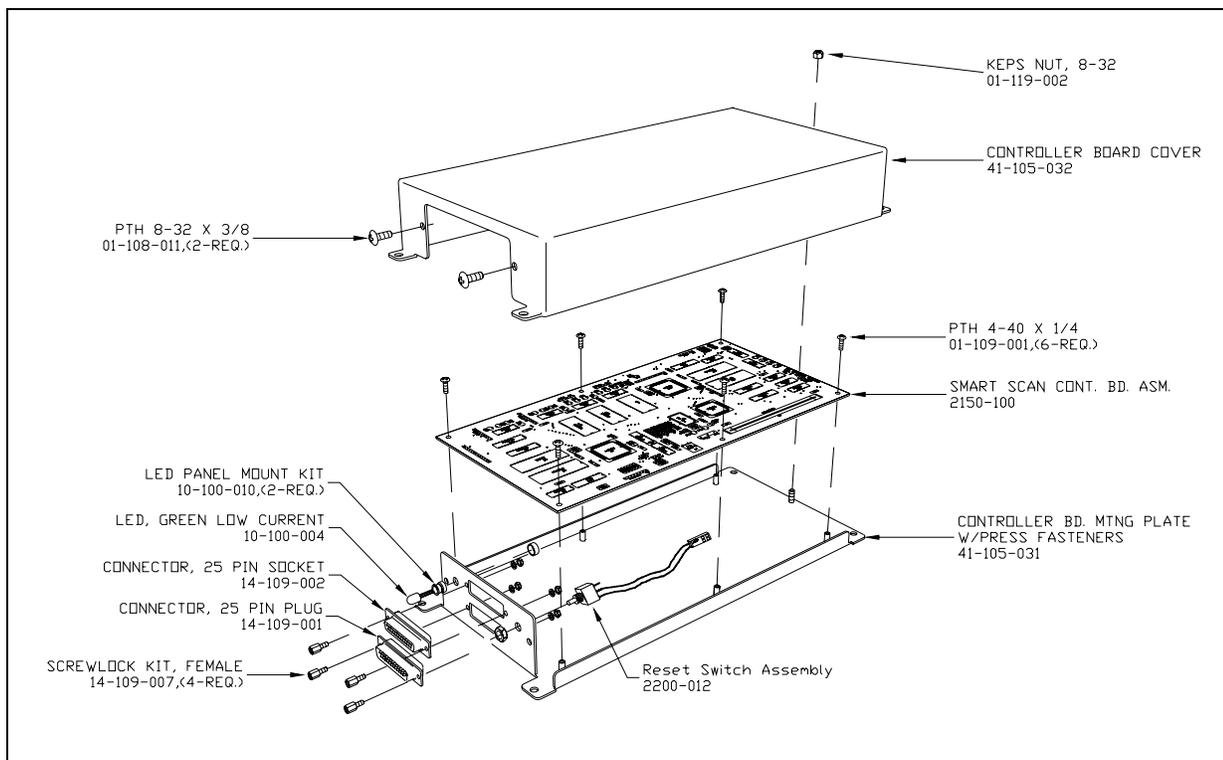
After establishing a connection with the SmartScan 2200-100 Processor, press **[Esc]** to gain access to the SmartScan menu set. The SmartScan system monitors these communications lines and will timeout the communication session when no activity has taken place for a while. If timed out, you need only press **[Esc]** to regain access.

3.2.1 Module Views

The figure below shows an assembled 2200-100 Processor.

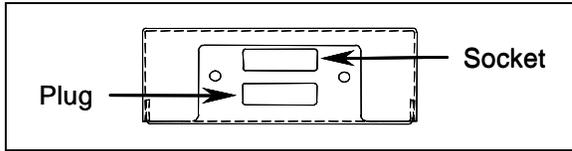


The figure below shows the parts of a 2200-100 Processor.



3.2.2 Front Panel

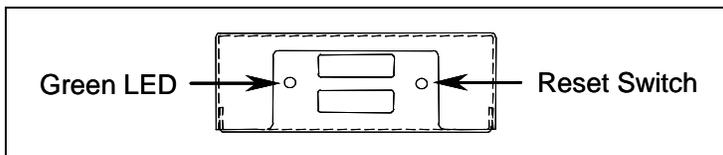
The next figure shows the front panel of a 2200-100 Processor. As shown below, the processor uses two connectors.



All connections to the 2200-100 Processor are made through these two DB-25 connectors. These connectors provide:

- Power (5 VDC)
- RS232 communications to a remote port
- RS232 communications to a local port, which allows **on-site** communication with the SmartScan system via a computer
- RS232 communications to a host port, which allows **off-site** communication with the SmartScan system via a modem and computer
- RS232 communications with each 2200-504 Reader
- Valid tag input signals from each 2200-504 Reader
- Train presence signal from the 2200-500 Presence Detector or Reno A&E C-1300 2-Channel Loop Detector
- Wheel presence signals from four transducers (TO1 through TO4)
- Twenty definable digital I/O lines (16 inputs and 4 outputs)
- AC power fail input from the 2200-200 Power Supply

As shown below, the processor has two LEDs.



The green LED stays lit as long as the processor is powered up. When lit, it shows that proper voltage is present.

The pushbutton reset switch is used to perform a soft reset of the system.

3.2.3 Pinout

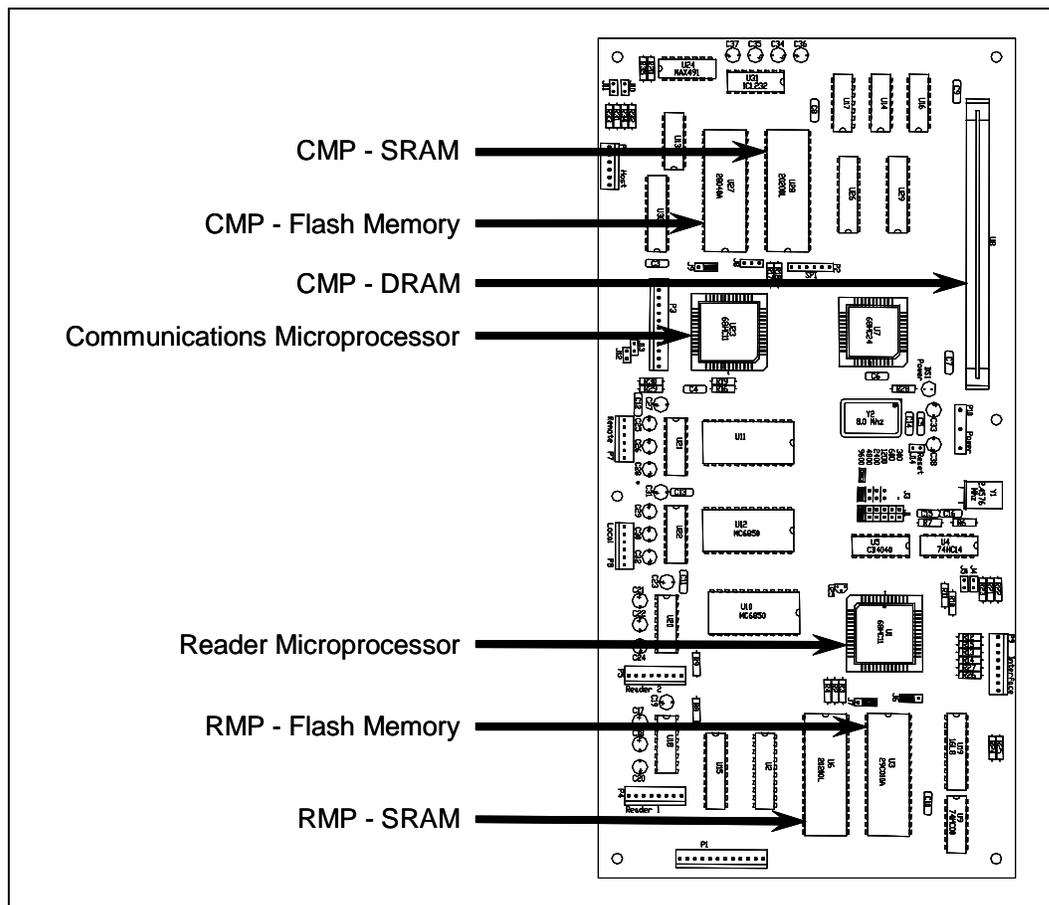
The next chart shows the pinout of the DB-25 socket and the DB-25 plug.

Pin #	Signal Name on Socket	Signal Name on Plug
1	+5 VDC	RTS (Local port)
2	Txd (Reader1)	Rxd (Local port)
3	Rxd (Reader1)	CTS (Remote port)
4	Out1 (Valid Tag Reader1)	RTS (Remote port)
5	RTS (Reader1)	Bit0(A) <i>unused output</i>
6	CTS (Reader1) / Traffic Loop 4	Rx2 / Txd (Host port)
7	Txd (Reader2)	Rx1 / Rxd (Host port)
8	Rxd (Reader2)	Presence input / Traffic Loop 7
9	Out2 (Valid Tag Reader2)	TO1 input
10	RTS (Reader2)	TO2 input
11	CTS (Reader2)	Bit1(A) <i>unused output</i>
12	Bit3(A) <i>unused output</i>	Traffic Loop 10
13	Ground	Traffic Loop 9
14	+5 VDC	Txd (Local port)
15	TO3 input	CTS (Local port)
16	TO4 input	Txd (Remote port)
17	Traffic Loop 3	Rxd (Remote port)
18	Traffic Loop 5	Tx2 / CTS (Host port)
19	Traffic Loop 6	Tx1 / RTS (Host port)
20	Traffic Loop 13	Synchronization In / Traffic Loop 8
21	Traffic Loop 13	Synchronization Out
22	Traffic Loop 14	PA0(B) <i>unused input</i>
23	Traffic Loop 15	PA1(B) <i>unused input</i>
24	Bit2(A) <i>unused output</i>	Traffic Loop 11
25	Ground	Traffic Loop 12

3.2.4 2150-100 Controller Board

The 2150-100 Controller board resides within the 2200-100 Processor. This circuit board contains two microprocessors. One is the reader microprocessor and the other is the communications microprocessor. The operating firmware for each internal microprocessor is stored in flash memory. This feature allows new firmware to be uploaded remotely or locally.

The figure below shows the layout of the 2150-100 Controller board. On the figure, CMP means communications microprocessor and RMP means reader microprocessor.



The **reader microprocessor** monitors the signals from the presence detector, the signals from the transducers, and the messages received from both readers. The car breakout and tag matching algorithms for the reader microprocessor use the timing of the transducer signals to calculate (or breakout) individual cars. Based on the timing of the RFID/AEI tag read, the identification from the 2200-504 Readers is assigned to individual cars. (In other words, the reader microprocessor matches tags to vehicles.) This information is temporarily stored in the reader microprocessor's static random-access memory (SRAM) and then sent to the communications microprocessor, where it is stored in the communications microprocessor's dynamic random-access memory (DRAM) for later transmission to a host computer.

The **communications microprocessor** is responsible for long-term data storage and communications with external devices. Three RS232 ports are provided. They are labeled Host, Local, and Remote. The communications microprocessor also handles all system setup and inquiry communications from the local and remote ports. Additionally, it handles dial-in calls through either a landline modem or a cellular modem.

The communications microprocessor manages consist information received from the reader microprocessor. Bidirectional communication between these internal microprocessors is provided through the SPI port of the 68HC11 microprocessors. Tag data can be stored in nonvolatile SRAM for some applications. For applications requiring more storage capability, a megabyte of DRAM (a standard one-megabyte SIMM module) is provided.

The unused I/O lines from each internal microprocessor are brought out to the external connector. These lines provide up to 16 digital inputs, which can be used for traffic loops, and 4 digital outputs for general-purpose use.

3.2.5 Jumpers

There are 14 jumpers on the 2150-100 Controller board. They are all set at the factory. You shouldn't change these settings. Doing so may cause your system not to work properly.

Of note is jumper 14 (J14). Shorting this jumper will reset the Model 2200-100 Processor. However, you shouldn't reset the Model 2200-100 Processor using this jumper. Doing so may cause your system not to work properly.

3.3 2200-504 Reader

The 2200-504 Reader reads and reports RFID tags in the original programmed format. It can also decode owner's initials, equipment number, and side indicator of tags that are in the AAR, ISO, or ATA data format.

The 2200-504 Reader is available with high or low RF power, in a factory set, narrow-band frequency between 902 and 928 megahertz. The low-power version is about 300 milliwatts. The high-power version is about 1.5 watts. In the standard configuration, the SmartScan system uses a 2200-504TA (911.5-megahertz high power) for reader1 and a 2200-504TB (918.5-megahertz high power) for reader2. Different frequencies prevent interference between readers. Always install the 2200-504TA Reader as reader1 (with input coming from antenna1) and the 2200-504TB Reader as reader2 (with input coming from antenna2).

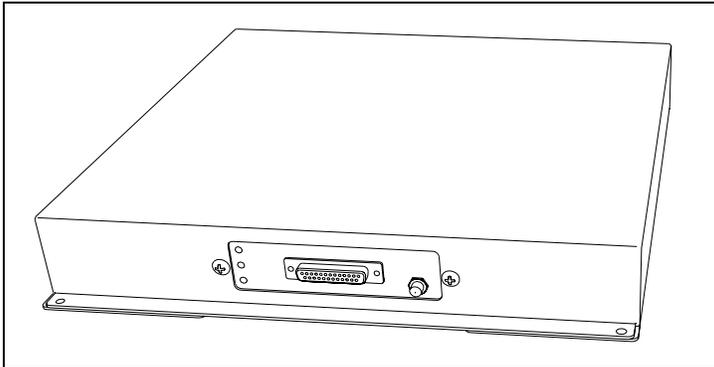
Data communication with the 2200-100 Processor is in RS232 format.

On the inside of the door of a 2200-900 Tower Enclosure, mounting points are provided for the 2200-504 Readers. Directly below the 2200-100 Processor, the 2200-504TA Reader is secured to the door with four 8-32 x 3/8 Phillips head screws. A ribbon cable connects the reader to the 2200-300 Interface board. A coaxial cable connects the reader to a lighting arrester that connects to an AEI antenna. The 2200-504TB Reader is installed directly under the 2200-504TA Reader. When the system arrives, the readers are already installed.

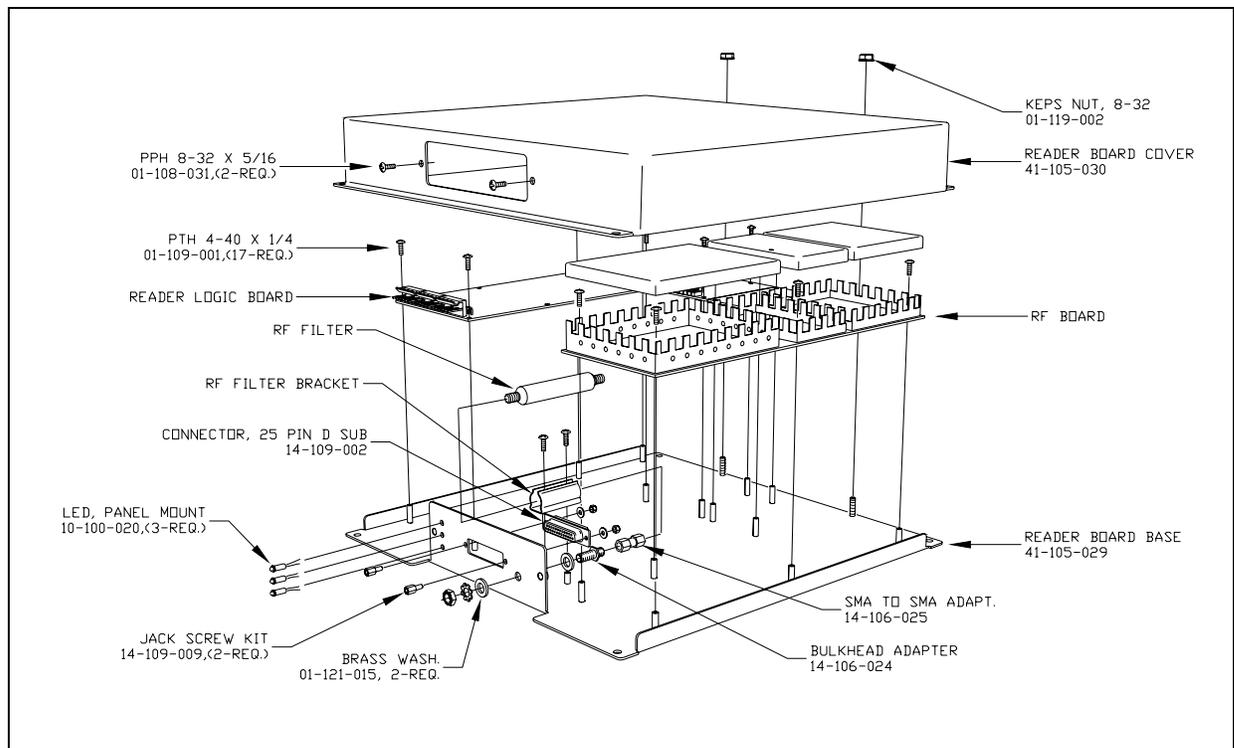
On the outside of the door of a 2200-950 Inside Enclosure, mounting studs are provided for the 2200-504 Readers. Directly below the 2200-100 Processor, the 2200-504TA Reader is secured to the panel with four Keps-nuts. A ribbon cable connects the reader to the 2200-300 Interface board. A coaxial cable connects the reader to a lightning arrester that connects to an AEI antenna. The 2200-504TB Reader is installed directly under the 2200-504TA Reader. If your 2200-950 Inside Enclosure was shipped in a bungalow, you'll need to install the readers. If it was shipped in a crate instead, the readers were already installed.

3.3.1 Module Views

The figure below shows an assembled 2200-504 Reader.

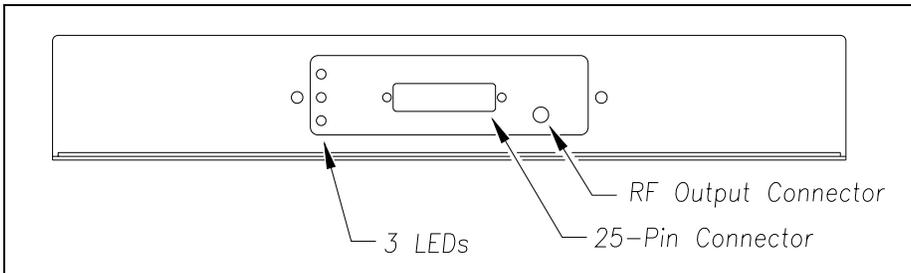


The figure below shows the parts of a 2200-504 Reader.



3.3.2 Front Panel

The next figure shows the front panel of a 2200-504 Reader. As shown below, the reader uses two connectors.



As shown above, the 2200-504 has three LEDs. The table below describes what each lit green LED means.

LED Name	LED Location	Meaning When Lit
Power	Top	Proper voltage is present. Stays lit as long as the reader is powered up.
Lock	Middle	A valid tag is in the read field. Stays lit as long as the reader senses a tag.
RF On	Bottom	RF power is on. Stays lit as long as RF power is on.

3.3.3 Pinout

The next chart shows the pinout of the DB-25 socket.

Pin #	Signal Name	Pin #	Signal Name
1	Ground (Power)	14	Ground (Power)
2	Rxd	15	Unused
3	Txd	16	Input0 (TTL)
4	CTS	17	Input1 (TTL)
5	RTS	18	Lock Signal (TTL)
6	Ground (Check Tag)	19	Unused
7	Signal Ground	20	Unused
8	Check Tag	21	Unused
9	+5 VDC	22	Unused
10	Unused	23	Unused
11	Output0 (TTL)	24	Unused
12	Output1 (TTL)	25	+12 VDC
13	+12 VDC		

3.3.4 Operation

Commands are used to control the operation of the readers. Setup commands are sent from the 2200-100 Processor at power startup to configure the readers. Direct communications with the reader can be established through the 2200-100 Processor. The ability to communicate directly with the reader may be used as a diagnostic aid or as a means to customize operating parameters further. Reader parameters were set at the factory. It is rarely necessary to alter these settings.

In data mode, the reader reads RFID tags and transmits data messages, such as tag IDs and reports, to the 2200-100 Processor. Reports provide information on input status changes (input0 and input1), a presence without tag report, and buffer overflow information. In data mode, the 2200-100 Processor will only send Command 01, which changes the reader from data mode to command mode.

In command mode, the 2200-100 Processor sends commands to the reader. These commands control the operation and configuration of the reader. After the reader receives a command, it sends an acknowledgment message. Typically, the acknowledgment message contains the word Error, the word Done, or data relating specifically to the command request. These messages may be of variable length since some commands require information as part of the message.

3.4 2200-500 Presence Detector

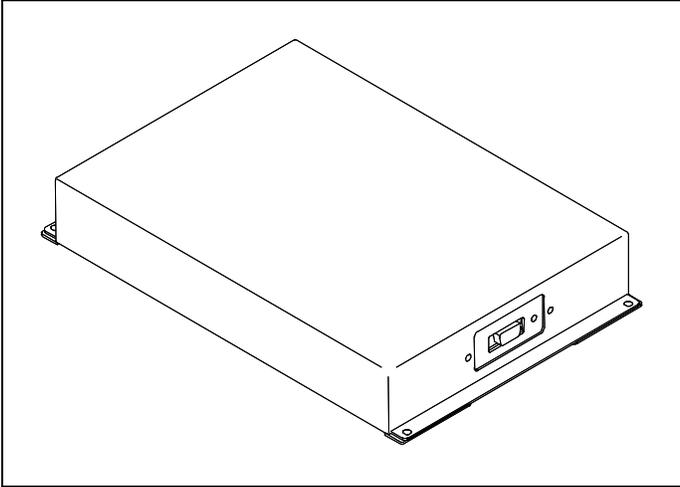
The 2200-500 Presence Detector tells the SmartScan system when a train is passing the site. Not all sites use it. Most SmartScan mainline AEI systems do. Most SmartScan yard AEI systems don't.

On the inside of the door of a 2200-900 Tower Enclosure, mounting points are provided for the 2200-500 Presence Detector. Directly below the 2200-504TB Reader, the 2200-500 Presence Detector is secured to the door with four 8-32 x 3/8 Phillips head screws. A ribbon cable connects the presence detector to terminal block TB1 at the bottom of the 2200-300 Interface board. When the system arrives, the presence detector is already installed.

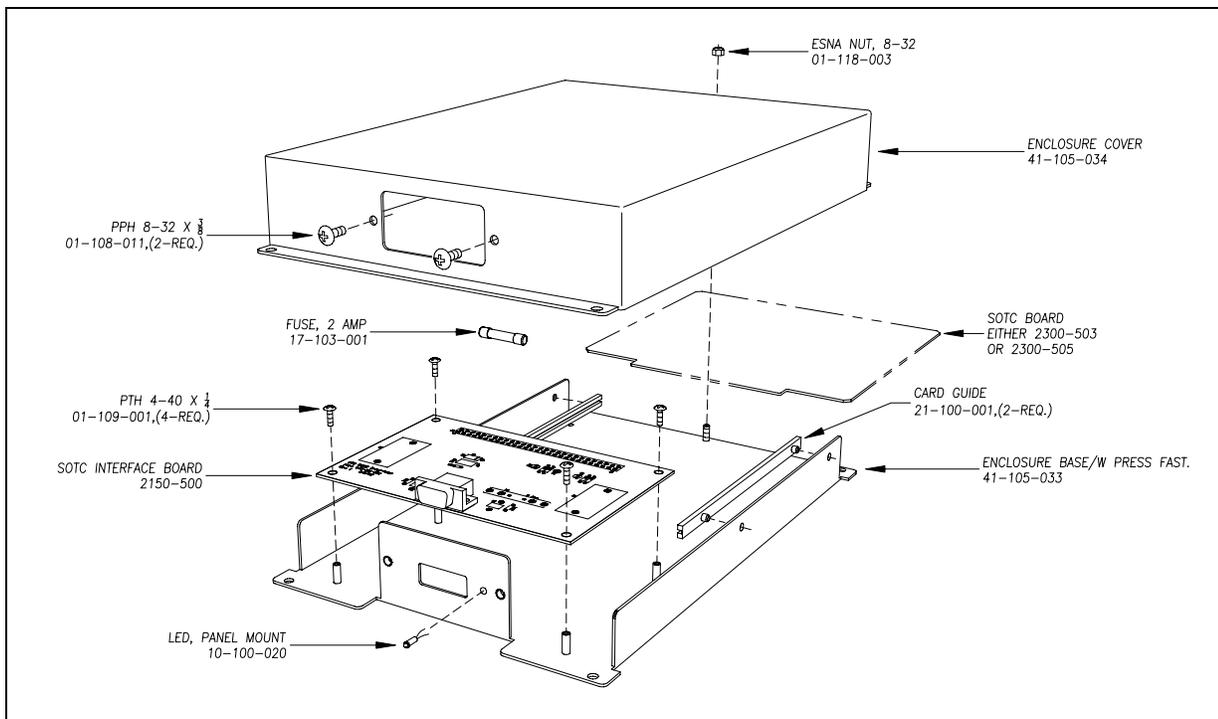
On the outside of the door of a 2200-950 Inside Enclosure, mounting studs are provided for the 2200-500 Presence Detector. Directly below the 2200-504TB Reader, the 2200-500 Presence Detector is secured to the panel with four Keps-nuts. A ribbon cable connects the presence detector to terminal block TB1 at the bottom of the 2200-300 Interface board. If your 2200-950 Inside Enclosure was shipped in a bungalow, you'll need to install the presence detector. If it was shipped in a crate instead, the presence detector was already installed.

3.4.1 Module Views

The figure below shows an assembled 2200-500 Presence Detector.

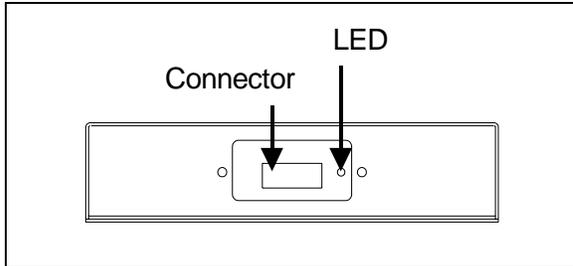


The figure below shows the parts of a 2200-500 Presence Detector.



3.4.2 Front Panel

The next figure shows the front panel of a 2200-500 Presence Detector. As shown below, the presence detector uses one connector. This 9-pin connector connects the presence detector to the rest of the SmartScan system and to the track.



As shown above, the 2200-500 has one LED. When lit, this LED indicates a received signal from the track circuit. If everything is functioning properly, a lit LED indicates that a train is present. When unlit, the LED indicates no signal from the track circuit. If everything is functioning properly, an unlit LED indicates that no train is present.

3.4.3 Pinout

The next chart shows the pinout of the DB-9 socket.

Pin #	Function
1 and 6	+12 VDC to SOTC
2	Output from SOTC (0 volts = no presence, 5 volts = presence)
3 and 7	Connection to one rail
4 and 8	Connection to other rail
5 and 9	Ground to SOTC

3.4.4 2300-503/505 SOTC Board

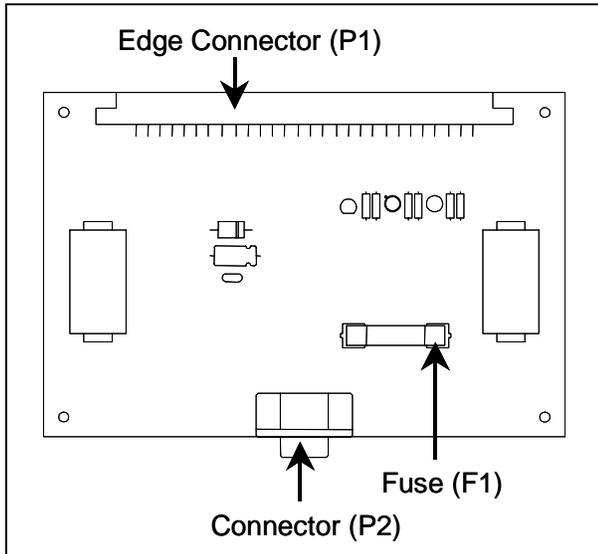
The 2200-500 Presence Detector uses either the 2300-503 (10.0 kHz) SOTC board or the 2300-505 (5.9 kHz) SOTC board to alert the system when a train is present at the site. The choice of operating frequencies offers flexibility in applications in which the site is located within close proximity of crossings or other equipment using a track circuit. On the board is potentiometer **R24**, which is used to adjust the gain control of the track circuit.

3.4.5 2150-500 SOTC Interface Board

Among other things, the 2150-500 SOTC Interface board provides:

- Connection points to the SOTC board and the rest of the system.
- Fusing for itself and the SOTC board.

The figure below shows a 2150-500 SOTC Interface board.



3.4.5.1 Fuse (F1)

Fuse F1 is a 2-amp 250-volt fast-acting fuse in the 12-volt supply to the SOTC. It protects both the 2300-503/505 SOTC board and the 2150-500 SOTC Interface board. If this fuse is blown, the 2200-500 Presence Detector won't operate.

3.4.5.2 Edge Connector (P1)

The 28-pin edge connector connects the 2150-500 SOTC Interface board to the 2300-503/505 SOTC board.

3.4.5.3 Connector (P2)

The 9-pin connector P2 connects the 2200-500 Presence Detector to the rest of the SmartScan system and to the track. This is the DB-9 socket on the front panel of a 2200-500 Presence Detector.

3.5 2200-200 Power Supply

The 2200-200 Power Supply is a combination power supply and battery charger for the SmartScan system. Three DC outputs are provided.

- A 24-volt output capable of charging batteries.
- A 12-volt (adjustable) output capable of 4-amps maximum current.
- A 5-volt (adjustable) output capable of 5-amps maximum current.

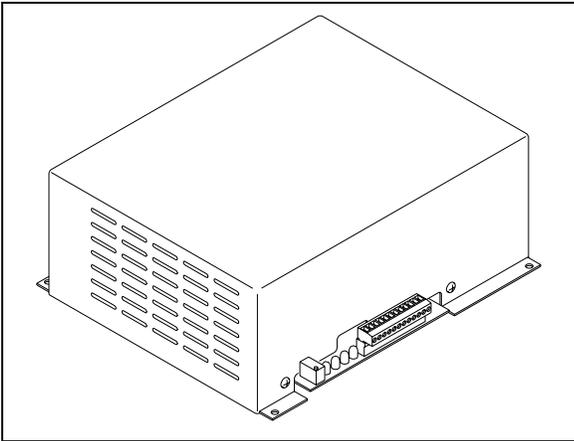
The 2200-900**DC** is powered by a bank of batteries charged by a solar array. At these sites, the batteries provide 24 VDC. This 24 VDC is routed to the 2200-200's DC-DC converter. This converter provides 12 VDC and 5 VDC to the rest of the SmartScan system. LED indicators are provided for the three DC outputs (24 VDC, 12 VDC, and 5 VDC).

The 2200-900**AC** and 2200-950 are powered by AC, with battery backup. Input power is 104-127 VAC. The 2200-200 Power Supply converts the externally supplied AC to regulated DC power. When AC power fails, the 12 VDC and 5 VDC outputs are supplied from the batteries through the 2200-200's DC-DC converter. LED indicators are provided for the three DC outputs, the AC input, and an AC power fail condition. A relay contact closure is also provided for the AC power fail condition. All connections to the 2200-200 Power Supply are made through a pluggable terminal block (TB1).

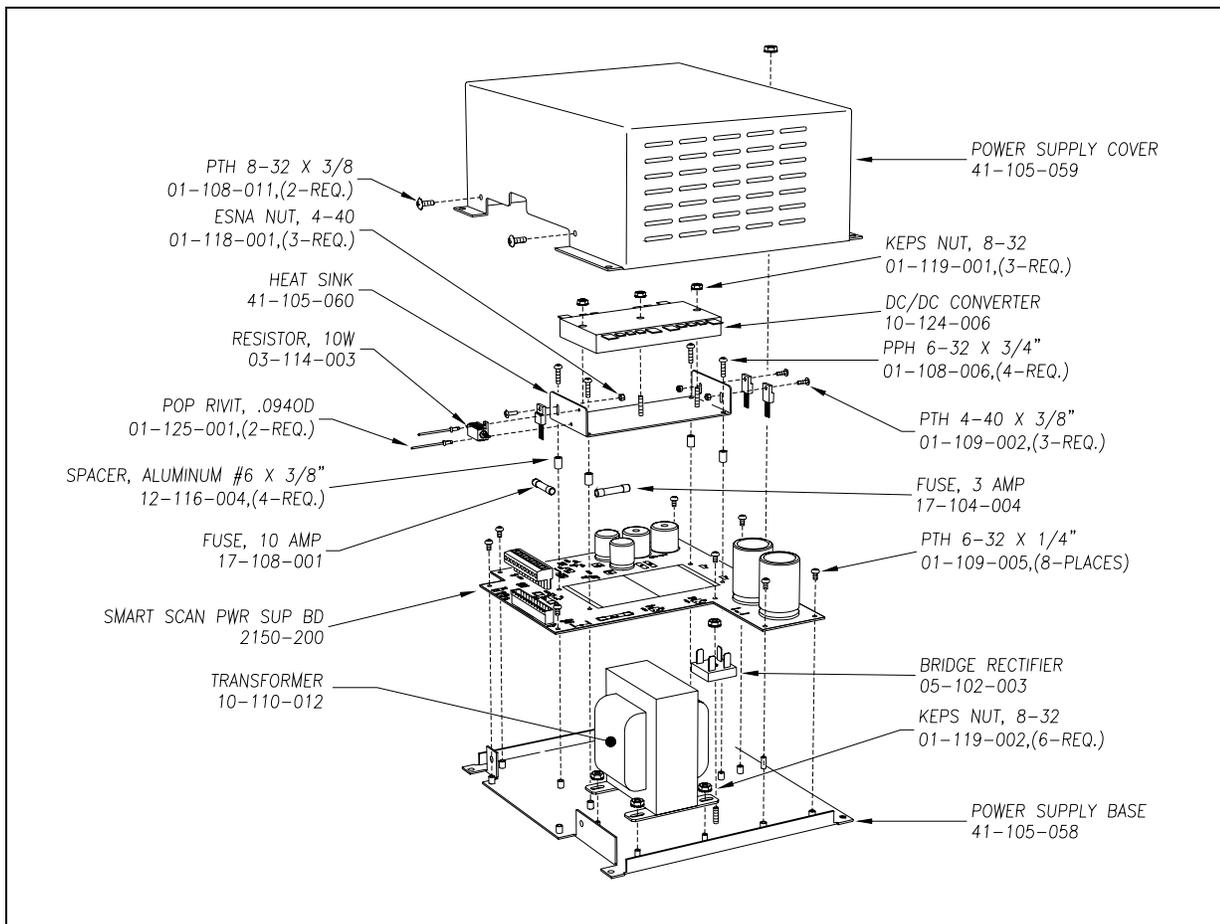
The 2200-200 Power Supply contains:

- Module cover
- Fuses
- Potentiometers
- Status LEDs
- Power converter and battery charger
- Power Supply board
- Module base

The figure below shows an assembled 2200-200 Power Supply.



The figure below shows the parts of a 2200-200 Power Supply.



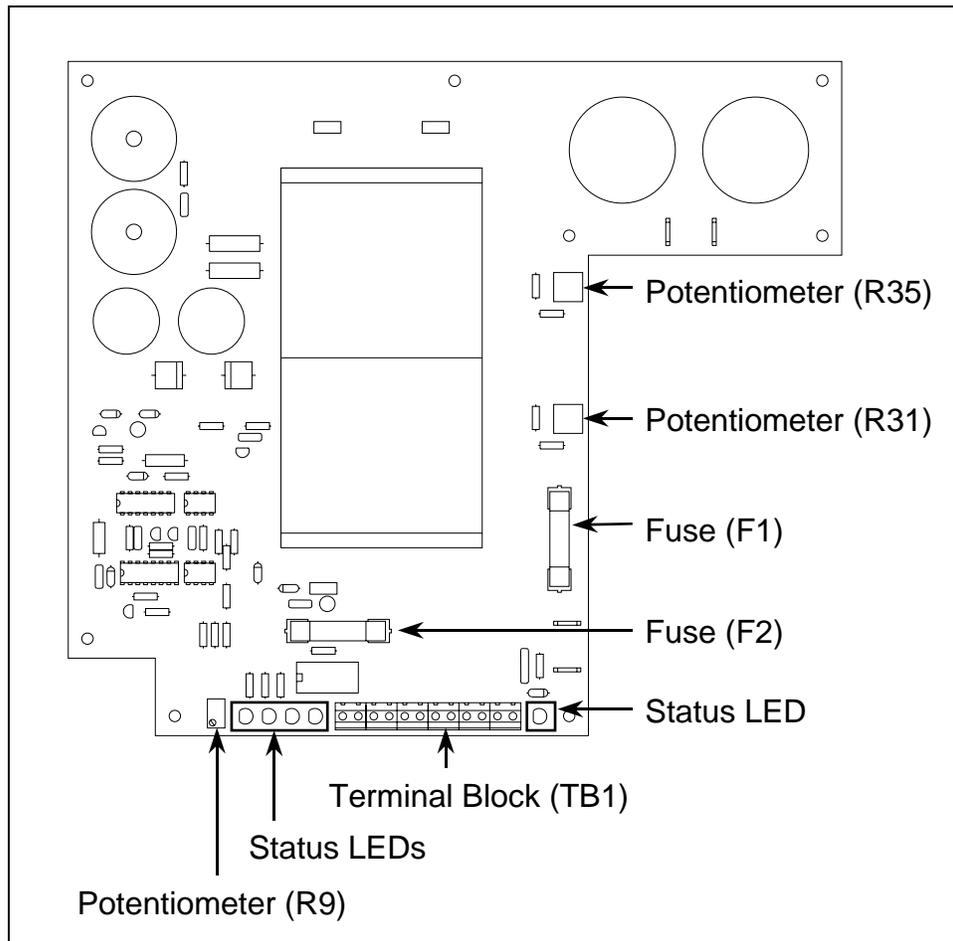
DANGER

When AC is present, there is a risk of shock inside and outside of the 2200-200 Power Supply. Some possible high-voltage danger areas are the transformer, bridge rectifier, AC fuse holder, and terminal block. Other dangerous areas also exist. So, when power is on, touching these areas could electrocute you.

3.5.1 Power Supply Board

The Power Supply board provides filtering and regulation of the DC voltages used by the SmartScan system. It also provides LED indicators for the input and output voltages and a terminal block for connections to the barrier strip and the Fuse panel. Fuses are provided on the board for the AC input and the DC output.

The figure below shows a Power Supply board.



3.5.1.1 Potentiometer (R9)

Potentiometer **R9** is used to adjust the battery float voltage. It was factory adjusted to 28 VDC. At the site, when the voltage is not between 27.8 and 28.2, adjust **R9** until a multimeter shows 28 VDC. You can do this by turning **R9** clockwise to increase the voltage or counterclockwise to decrease the voltage. The batteries must be disconnected while setting the float voltage. On a solar-powered systems, potentiometer **R9** isn't functional.

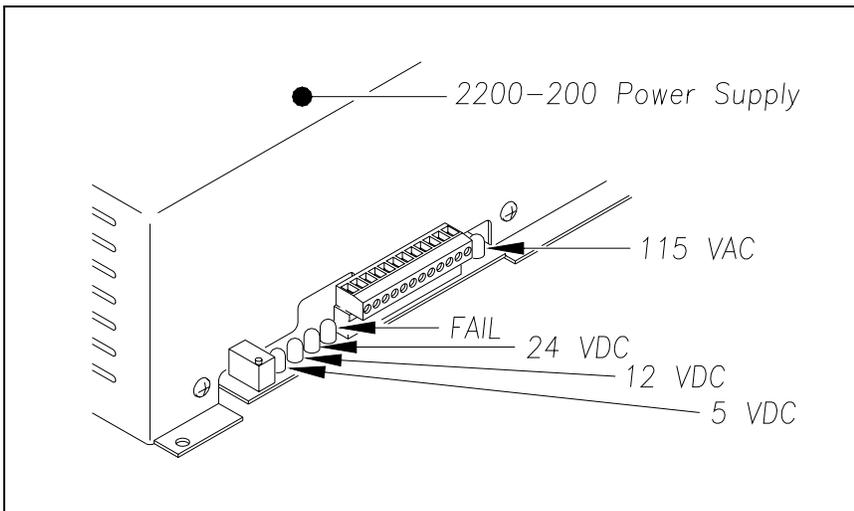
3.5.1.2 Potentiometers (R31, R35)

Potentiometer **R31** is used to adjust the DC voltage that is present at terminal 8 on TB1. At the factory, it is adjusted for a value of 12.5 VDC. Potentiometer **R35** is used to adjust the DC voltage that is present at terminal 6 on TB1. At the factory, it is adjusted for a value of 5.1 VDC. Turn either potentiometer clockwise to increase the voltage. Turn either counterclockwise to decrease the voltage.

3.5.1.3 Status LEDs

On the edge of the Power Supply board are five status LEDs.

The figure below shows the location of the LEDs.

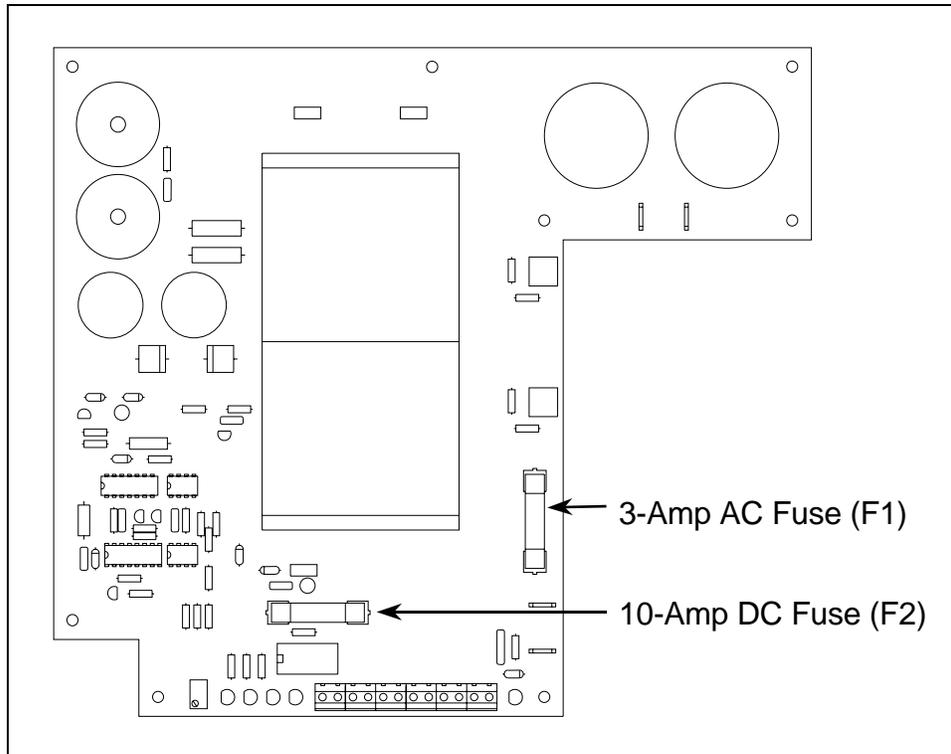


The table below describes what each lit LED means.

LED Name	LED Color	Meaning When Lit
5 VDC	Green	DC voltage is present on 5-volt output (terminal 6 on TB1). Stays lit as long as the system is powered up and DC is present.
12 VDC	Green	DC voltage is present on 12-volt output (terminal 8 on TB1). Stays lit as long as the system is powered up and DC is present.
24 VDC	Green	DC voltage is present on 24-volt output (terminal 4 on TB1). Stays lit as long as the system is powered up and DC is present.
FAIL	Red	Proper AC voltage isn't present at terminal 10 on TB1. Stays lit as long as the system is powered up, AC isn't present, and the system is running on battery backup. For the 2200-900DC, stays lit as long as 24 VDC is present.
115 VAC	Green	Proper AC voltage is present at terminal 10 on TB1. Stays lit as long as the system is powered up and AC is present. For the 2200-900DC, never lights. On a solar-powered system, the 115 VAC LED isn't lit.

3.5.1.4 Fuses (F1, F2)

There are two fuses on the Power Supply board. Both are 3AG glass-body fast-acting fuses. The 3-amp fuse (F1) protects the 2200-200 Power Supply from excessive AC. The 10-amp fuse (F2) protects the rest of the SmartScan system from excessive DC.



3.5.1.5 Terminal Block (TB1)

The 12-position terminal block connects the Power Supply board to the barrier strip and the Fuse panel.

DANGER

Do not touch the terminal block (TB1) without the power shut off. If the power is on, the high voltage present on part of this block could electrocute you.

The figure below shows what is wired to each terminal.

1	<input type="checkbox"/>	Power Fail
2	<input type="checkbox"/>	Power Fail
3	<input type="checkbox"/>	Battery -
4	<input type="checkbox"/>	Battery +
5	<input type="checkbox"/>	Ground
6	<input type="checkbox"/>	5VDC
7	<input type="checkbox"/>	Ground
8	<input type="checkbox"/>	12VDC
9	<input type="checkbox"/>	
10	<input type="checkbox"/>	AC Hot
11	<input type="checkbox"/>	AC Neutral
12	<input type="checkbox"/>	AC Ground

3.5.2 Power Converter and Battery Charger

Inside the module is the power converter and battery charger, consisting of these major parts.

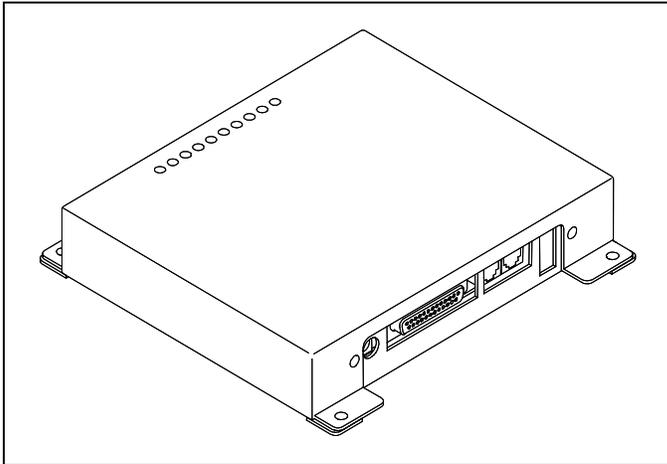
- Transformer
- Bridge rectifier
- Filter capacitors
- Regulators
- DC-DC converter

For the needs of the AC powered system, the 2200-200 Power Supply converts the externally supplied 120 VAC to a regulated 12 VDC and 24 VDC. The regulated 24 VDC is also used to float charge the standby battery system. This allows continued system operation for about 100 hours when there is an interruption in the externally supplied 120 VAC.

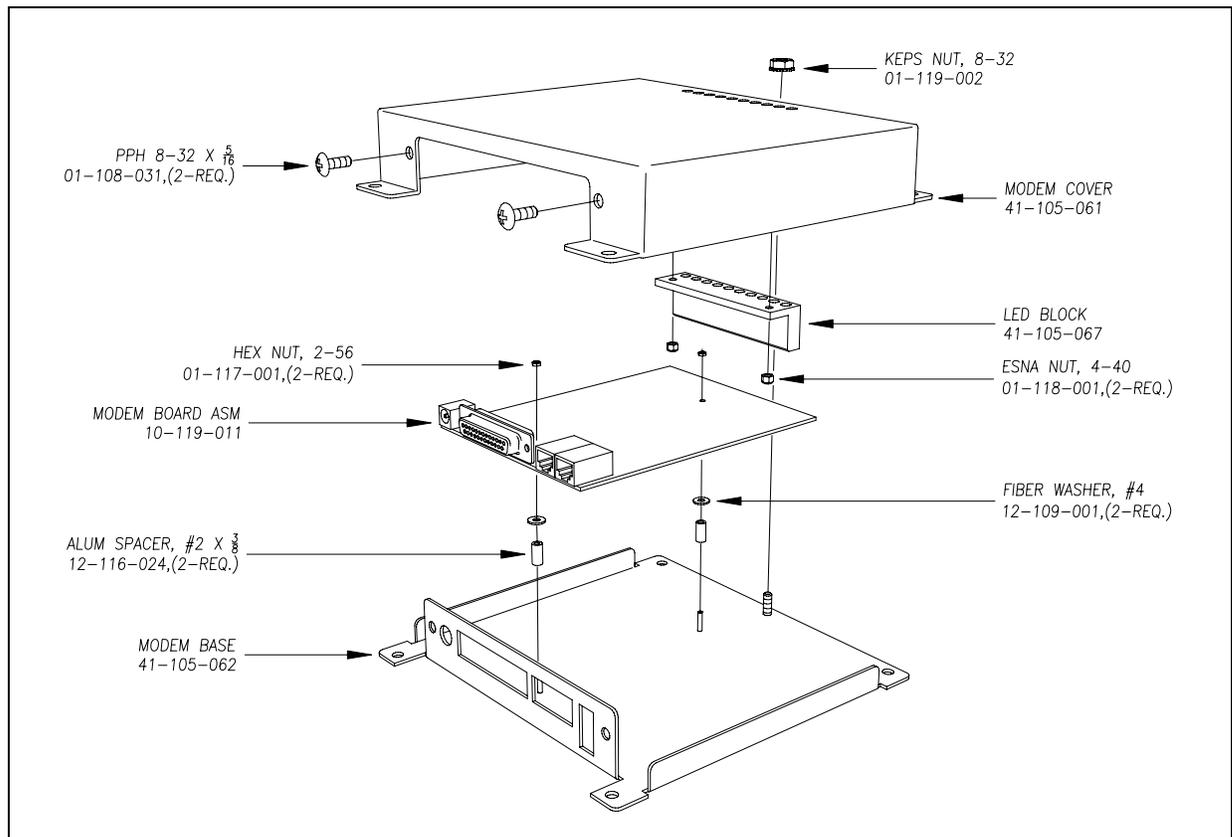
3.6 2200-600 Modem

The 2200-600 Modem is a device that lets the system (at the site) communicate with a computer (away from the site) over the landline telephone system. Inside the 2200-600 Modem is a MultiTech Systems modem, either model MT1932ZDX or MT2834ZDXb.

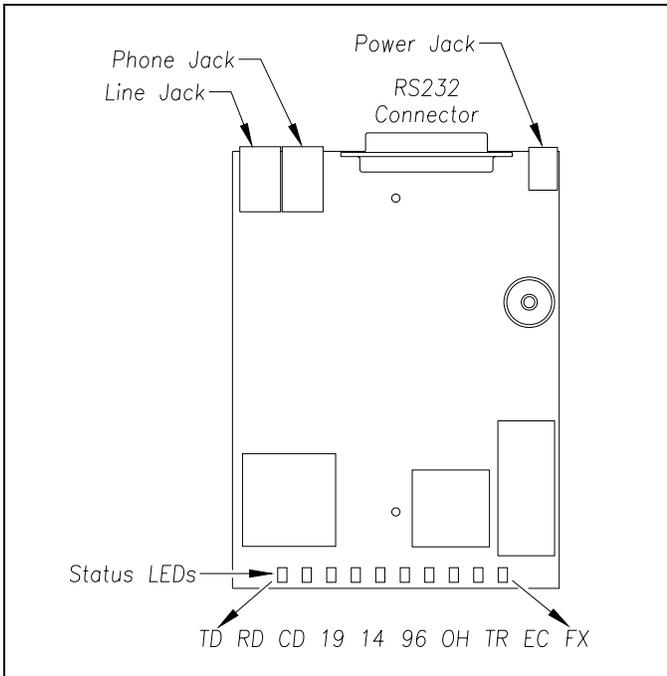
The figure below shows an assembled 2200-600 Modem.



The figure below shows the parts of a 2200-600 Modem.

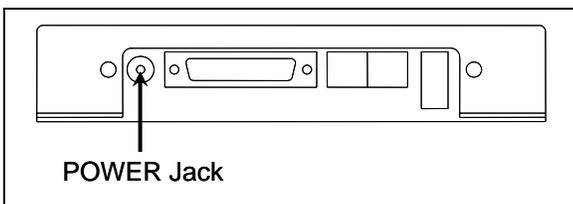


The figure below shows a Modem board.



3.6.1 Power Connection (POWER Jack)

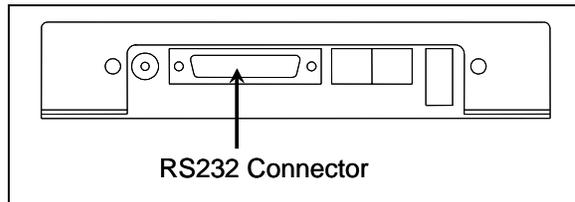
The POWER jack is used to supply low-voltage DC power to the modem.



At the factory, one end of a power cord was plugged into the POWER jack. The other end of the power cord was wired to terminals 20 (12 VDC) and 36 (Ground) on the 2200-300 Interface board.

3.6.2 System Connection (RS232 Connector)

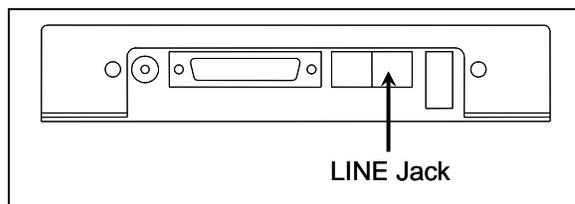
The RS232 connector is used to connect the modem to the rest of the system.



At the factory, the 25-pin end of a standard modem cable was plugged into the RS232 connector (on the 2200-600 Modem). The other end (that is, the 9-pin end) of the cable was plugged into the Host port on the top of the 2200-300 Interface board.

3.6.3 Line Cable Connection (LINE Jack)

The LINE jack is used to connect the modem to the telephone system.



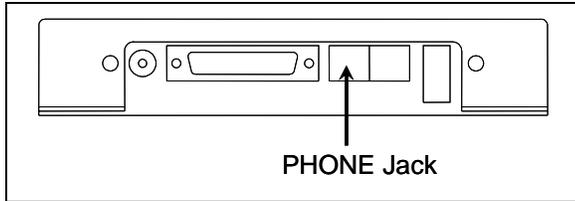
At the factory, one end of a telephone cord was plugged into the LINE jack (on the 2200-600 Modem). The other end was wired to a UTB (on the barrier strip). At the site, the customer finishes this wiring by supplying the site with normal telephone service, bringing the telephone line to a four-wire modular plug (type RJ11/14) in the bungalow, and wiring from the UTB (on the barrier strip) to this modular plug.

CAUTION

The LINE jack and the PHONE jack aren't interchangeable. Therefore, don't plug the line cable into the PHONE jack. Doing so will cause your modem not to work properly.

3.6.4 Telephone Connection (PHONE Jack)

The PHONE jack is used to plug a telephone into the modem for voice communications. When you do so, the telephone shares the same telephone line as the modem. This jack is provided as a convenience. It is rarely used.



3.6.5 Status LEDs

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

LED	Meaning When Lit
14	By itself, lights when the modem is operating at 14,400 bps. When lit with LED 33, the modem is operating at 16,800 bps. When lit with LED 96, the modem is operating at 12,000 bps.
33	By itself, lights when the modem is operating at 33,600 bps. When lit with LED 14, the modem is operating at 16,800 bps.
96	By itself, lights when the modem is operating at 9600 bps. When lit with LED 14, the modem is operating at 12,000 bps. When no speed LED is lit, the modem is operating at less than 9600 bps.
CD	Lights when valid carrier signal from another modem is detected.
EC	Lights when the modem is in error-correction mode. Blinks when compression is activated.
FX	Lights when the modem is in fax mode.
OH	Lights when the phone line is off-hook, which occurs when the modem is dialing, online, or answering a call. Flashes when the modem is pulse dialing.
RD	Blinks when data is being received.
TD	Blinks when data is being transmitted.
TR	STC's firmware configures the modem to ignore this light. So, it is never lit.

Chapter 4

Track Components

This chapter covers the major track components that are used by SmartScan AEI systems. Described are two types of transducers, two types of presence sensors, and three types of AEI antennas. No one system uses all the described components.

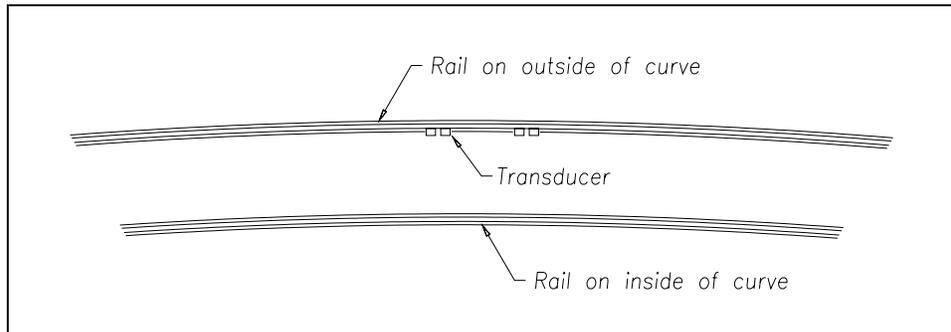
4.1 Transducers and Clamps

Each SmartScan mainline and yard AEI system requires four transducers, designated TO1 through TO4. The transducers provide inputs to the system that determine train speed, direction, and car recognition.

SmartScan supports two types of zero-speed transducers.

- Honeywell Zero-Speed Transducers
- SAI Rail-Loop Transducers

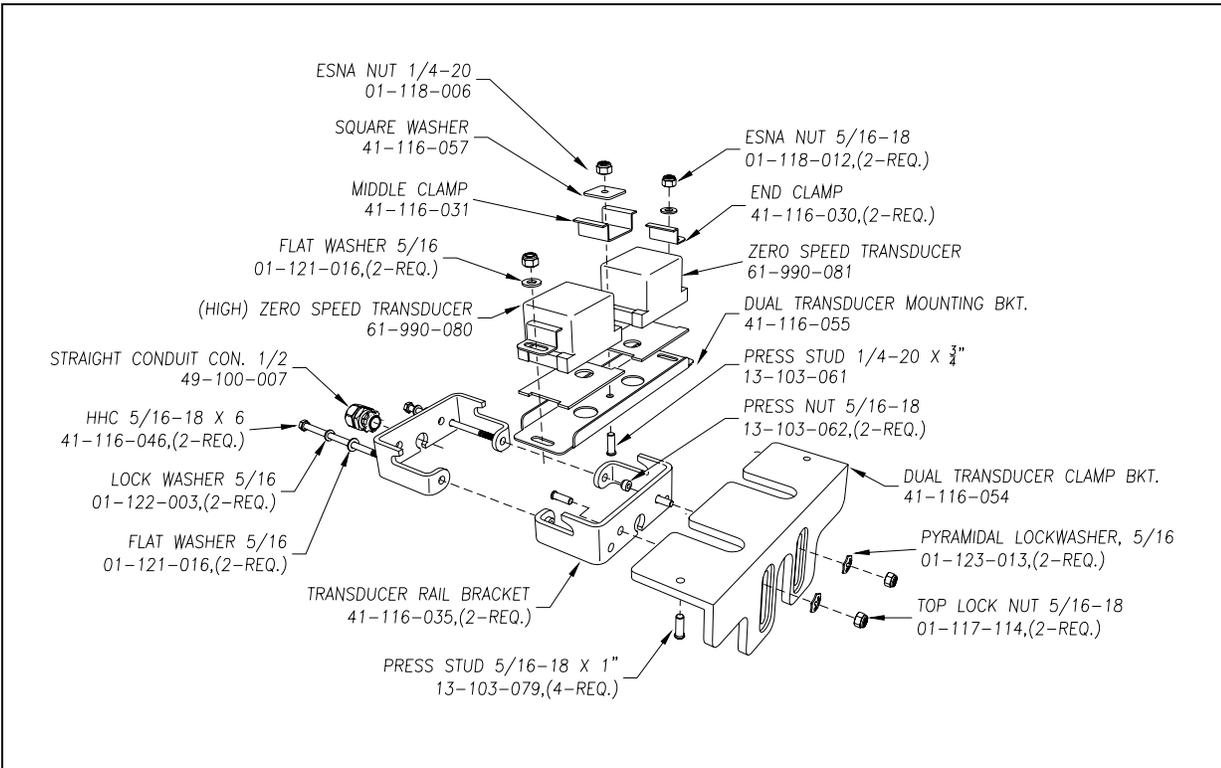
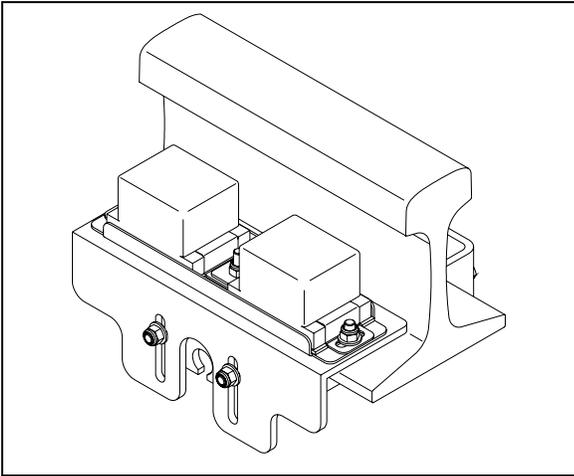
Proper transducer installation and alignment are critical to the operation of the SmartScan system. Missing wheel counts will severely limit the effectiveness of the vehicle identification algorithms in the SmartScan firmware. Always try to install the transducers on a track that is on gauge. Where possible, avoid placing the transducers in curves. If you must mount them in a curve, use the outside rail.



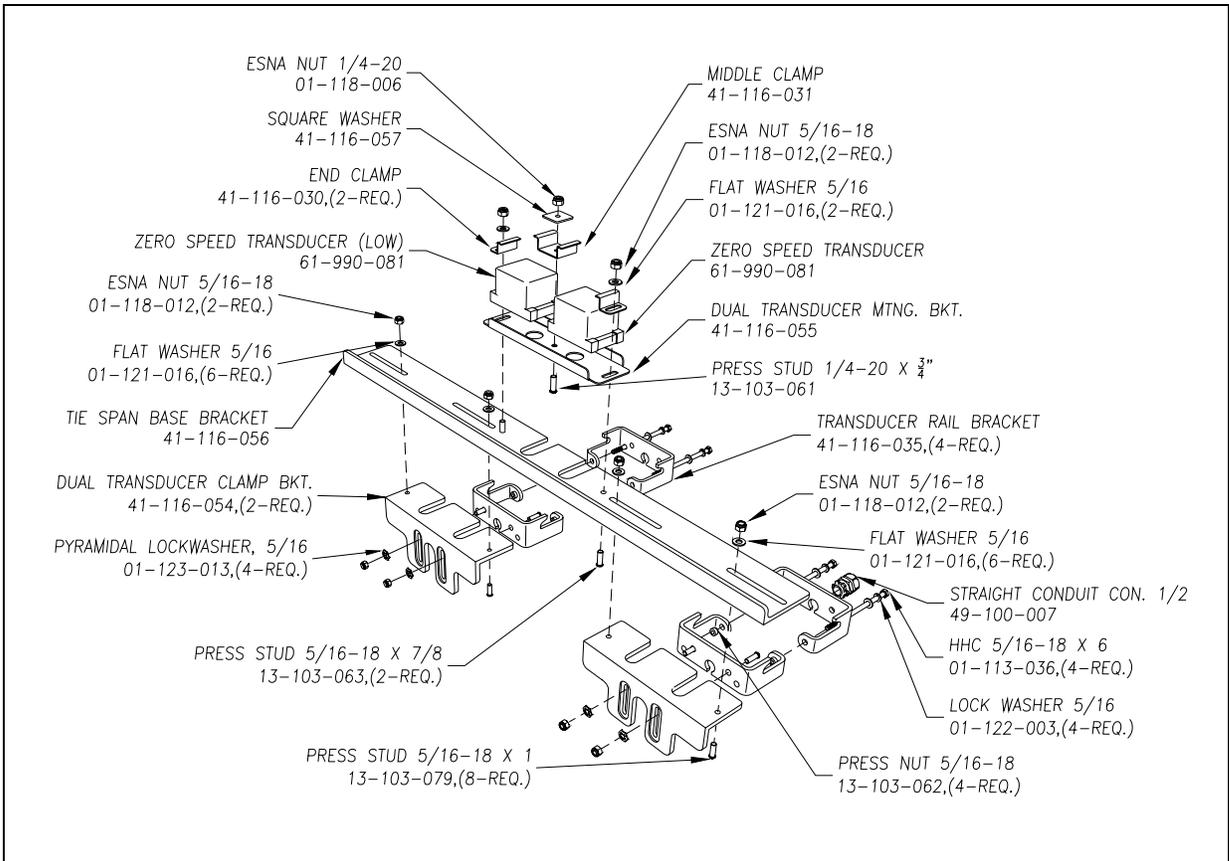
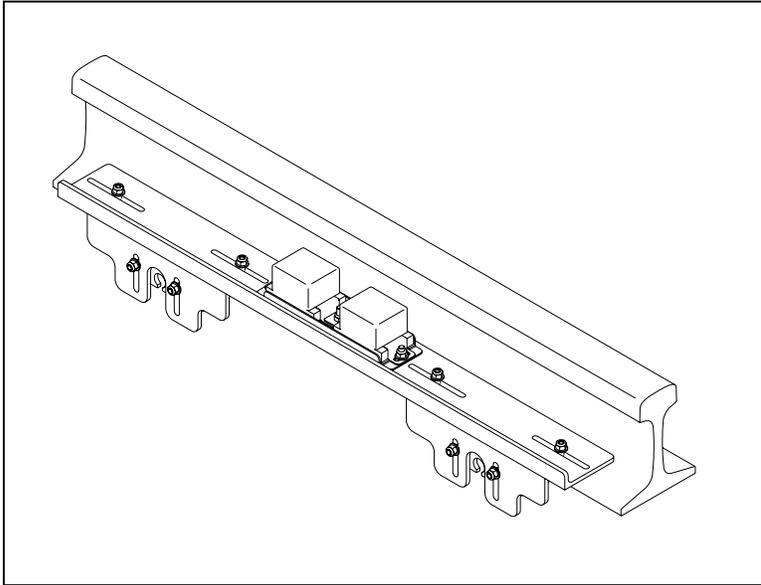
4.1.1 Honeywell Zero-Speed Transducers

The Honeywell zero-speed transducer is a two-wire DC inductive railwheel sensor. It is clamped to the rail, with no need for drilling or machining. The transducer can sense the wheel flange of railed vehicles that are stopped on top of it. It can also detect standard railwheels up to speeds of 281 mph.

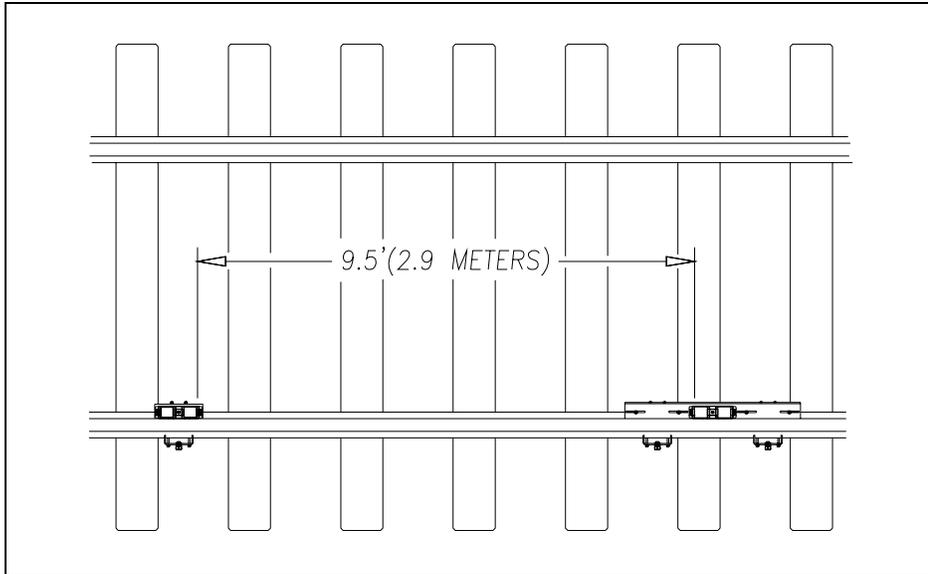
The SmartScan AEI system consists of two transducers on a short mount and a second pair on either another short mount or a tie-span bracket. The figures below show two zero-speed transducers on the 2100-580 short mount.



The figures below show two zero-speed transducers on a 2100-581 tie-span bracket.

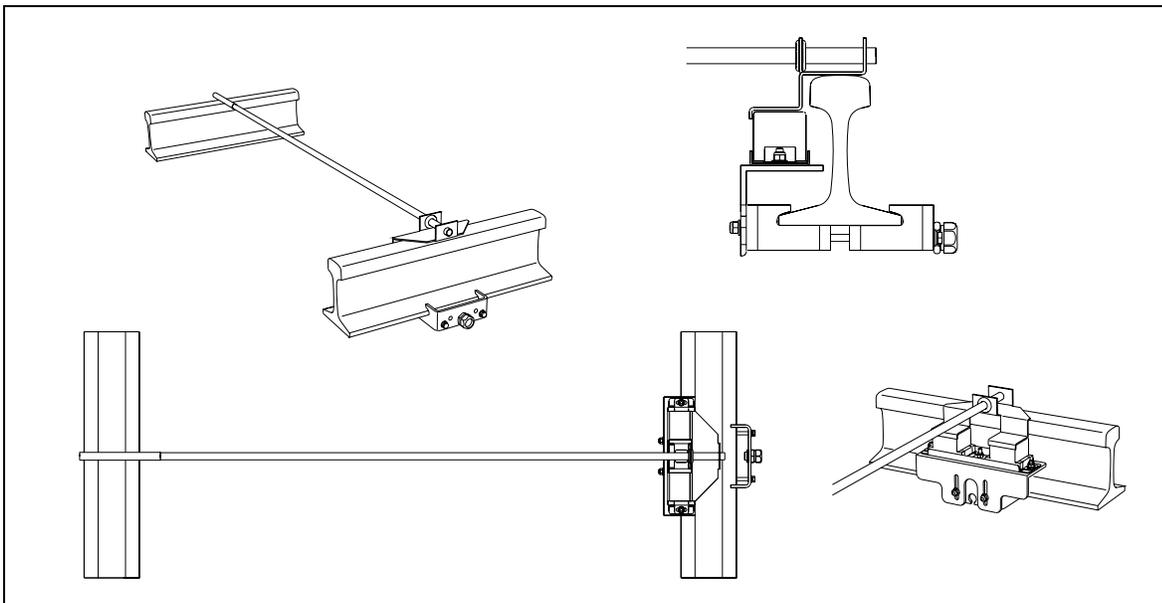


The first pair of zero-speed transducers should be mounted between two ties using the supplied single clamp bracket. When measured inside to inside (not center to center), the second pair of transducers should be mounted 9.5 feet (2.9 meters) away from the first pair. If the tie configuration permits, the second pair can be mounted between ties. If not, each system includes a tie-span bracket that allows the second pair to be mounted over the tie.



The 2100-584 Transducer Placement Gauge is used to align pairs of Honeywell zero-speed transducers. This gauge aligns both transducer height (in relationship to the top of the rail) and transducer distance from the rail.

The 2100-584 Transducer Placement Gauge consists of a rail-mountable aluminum fixture and an attached alignment pole. Use it as shown below.



It is important that the transducers be terminated in a consistent pattern. Use the following rule to determine transducer designation.

- On a north-south track, the northmost transducer pair is designated TO1 and TO2. The northmost transducer being TO1. The southmost transducer pair is designated TO3 and TO4. The southmost transducer being TO4.
- On an east-west track, the eastmost transducer pair is designated TO1 and TO2. The eastmost transducer being TO1. The westmost transducer pair is designated TO3 and TO4. The westmost transducer being TO4.

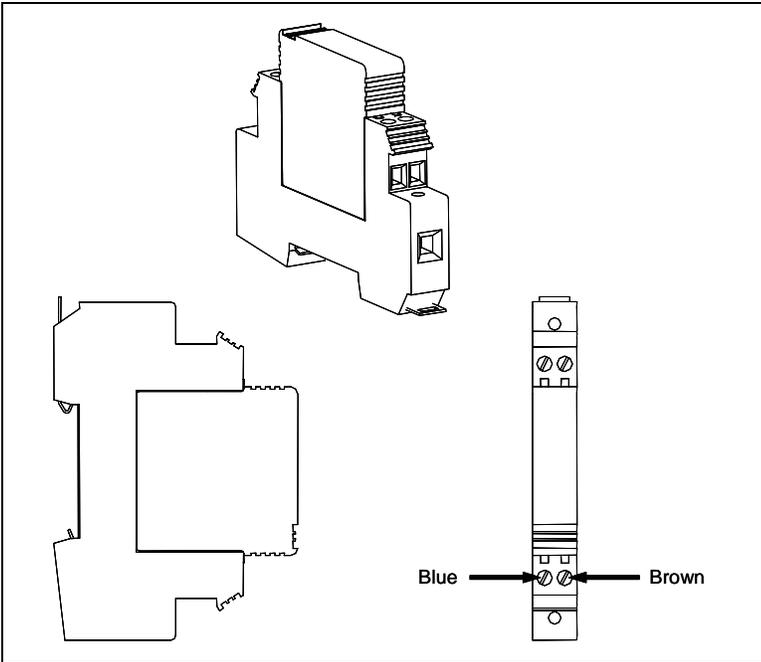
Terminations for the zero-speed transducers are provided on the surge panel located in the base of the SmartScan enclosure. One UTB is provided for each transducer.

In 2200-900 Tower Enclosures, a 2200-400 Surge Protection Panel is mounted to the bottom of the enclosure base. On the left side of this panel are five DIN mounted UTBs to provide primary lightning protection for the track-mounted system components. The first four UTBs (leftmost UTBs) protect the zero-speed transducers.

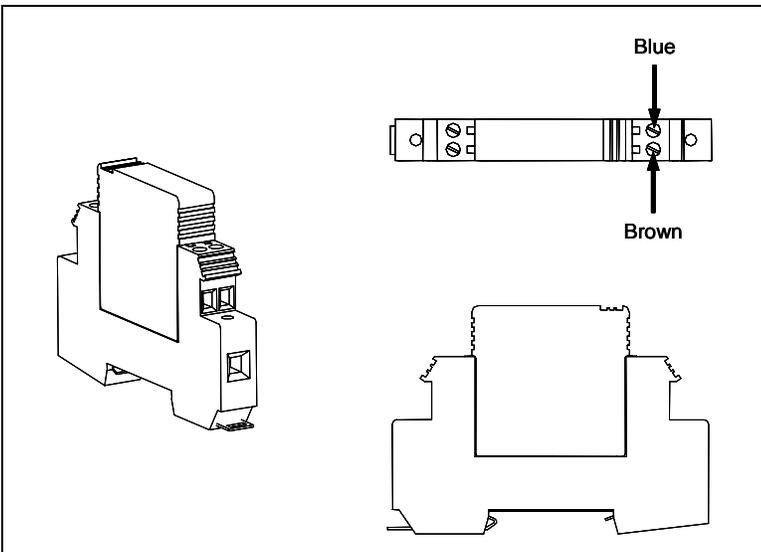
In 2200-950 Inside Enclosures, most of the components that provide surge protection for the system are mounted inside the bottom of the enclosure. On the right side are five DIN mounted UTBs to provide primary lightning protection for the track-mounted system components. The first four UTBs (topmost UTBs) protection the zero-speed transducers. The UTBs are mounted to a copper plate. The prime ground for the system is brought to the ground lug on this plate.

The zero-speed transducers have a two-wire cable attached to each of them. The wires are colored blue for signal and brown for signal ground.

In 2200-900 Tower Enclosures, attach the blue wire of transducer TO1 to the bottom left of the first (leftmost) DIN mounted UTB. Attach the brown wire of transducer TO1 to the bottom right of the first UTB. Attach the blue wire of transducer TO2 to the bottom left of the second DIN mounted UTB. Attach the brown wire of transducer TO2 to the bottom right of the second UTB. Attach the wires of transducers TO3 and TO4 in a like manner.



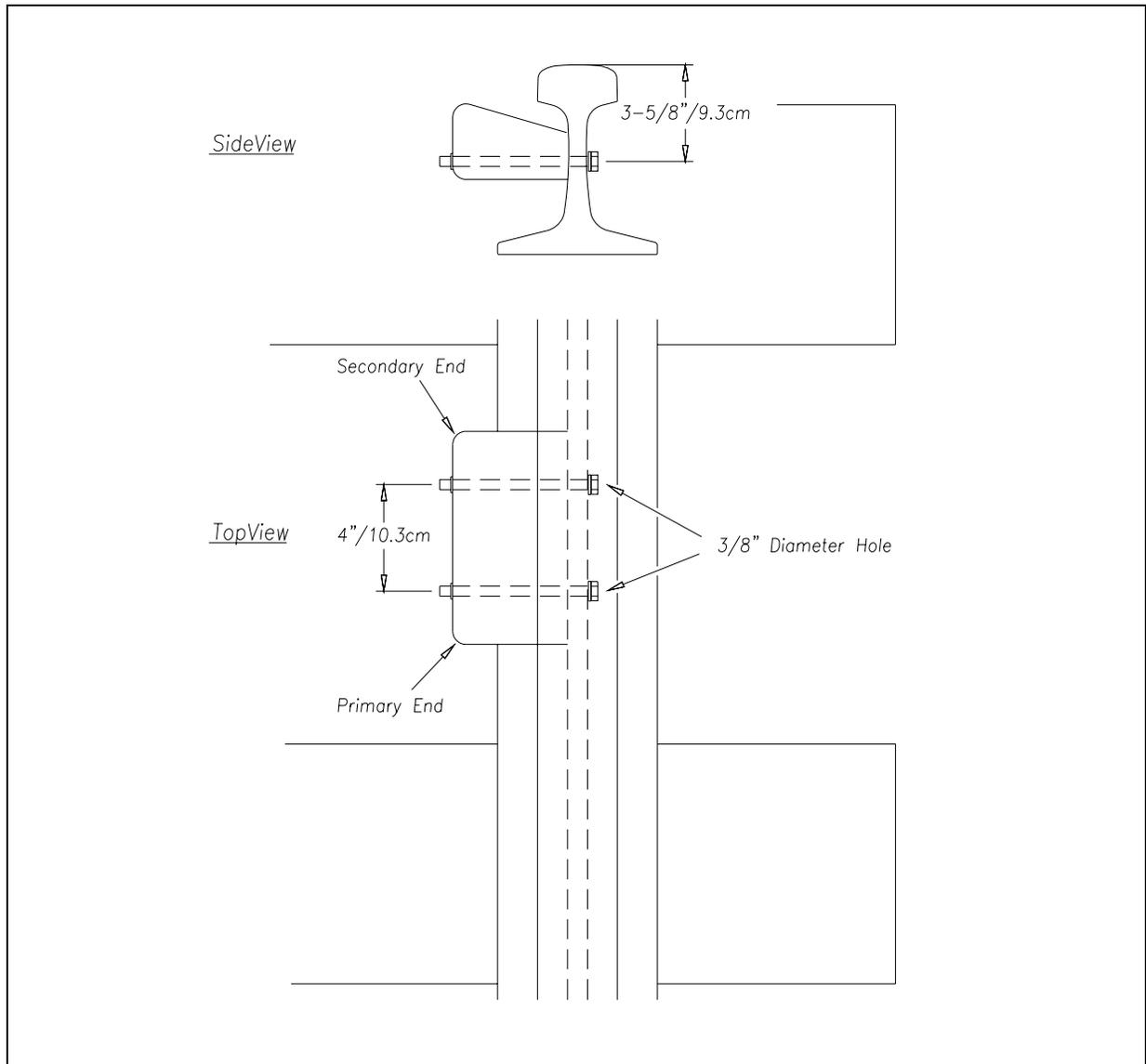
In 2200-950 Inside Enclosures, attach the blue wire of transducer TO1 to the top right of the first (highest) DIN mounted UTB. Attach the brown wire of transducer TO1 to the bottom right of the first UTB. Attach the blue wire of transducer TO2 to the top right of the second DIN mounted UTB. Attach the brown wire of transducer TO2 to the bottom right of the second UTB. Attach the wires of transducers TO3 and TO4 in a like manner.



4.1.2 SAI Rail-Loop Transducers

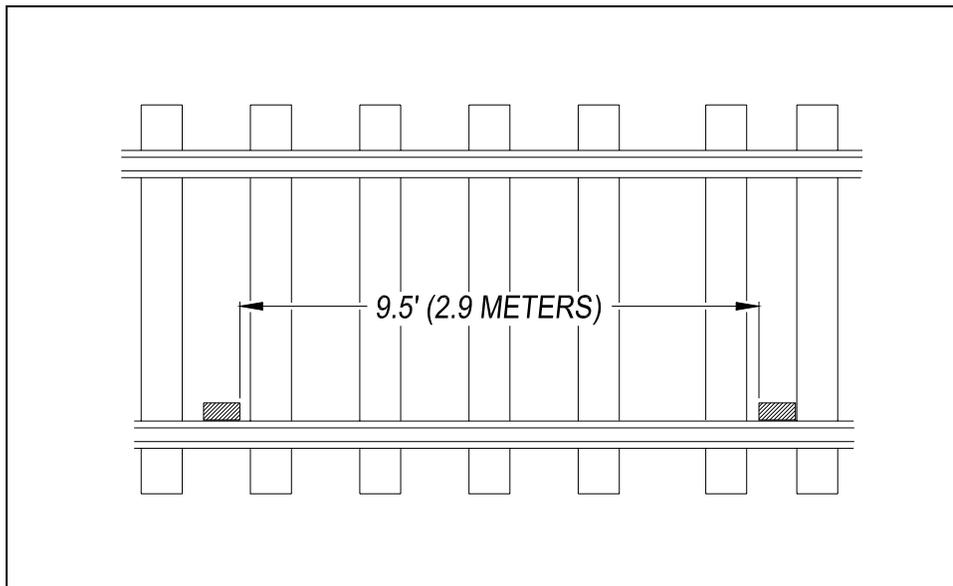
Each SAI rail-loop transducer is bolted to the inside of a rail, typically on the rail closest to the SmartScan enclosure. Each transducer contains a pair of railwheel sensors.

The figure below shows an installed rail-loop transducer.



Looking at an installed rail-loop transducer, the right side of the transducer contains the primary sensor and the left side contains the secondary sensor.

The rail-loop transducers can be mounted between two ties or over them. The inside edge of the second transducer should be mounted 9.5 feet (2.9 meters) away from the inside edge of the first one.



Rail-loop transducers are terminated (on the surge panel) in the same way and in the same order as for other zero-speed transducers. On systems using rail-loop transducers, before electrical pulses are sent to the 2200-300 Interface board, they go to a Reno A&E C-1300 2-Channel Loop Detector. This programmable analyzer uses a microcontroller to monitor and process signals from the transducers.

It is important that the transducers be terminated in a consistent pattern. Use the following rule to determine transducer designation.

- On a north-south track, the northmost transducer is designated TO1 and TO2. The transducer's northmost railwheel sensor being TO1. The southmost transducer is designated TO3 and TO4. The transducer's southmost sensor being TO4.
- On an east-west track, the eastmost transducer is designated TO1 and TO2. The transducer's eastmost railwheel sensor being TO4. The westmost transducer is designated TO3 and TO4. The transducer's westmost sensor being TO4.

Terminations for the rail-loop transducers are provided on the surge panel located in the base of the SmartScan enclosure. One UTB is provided for each transducer.

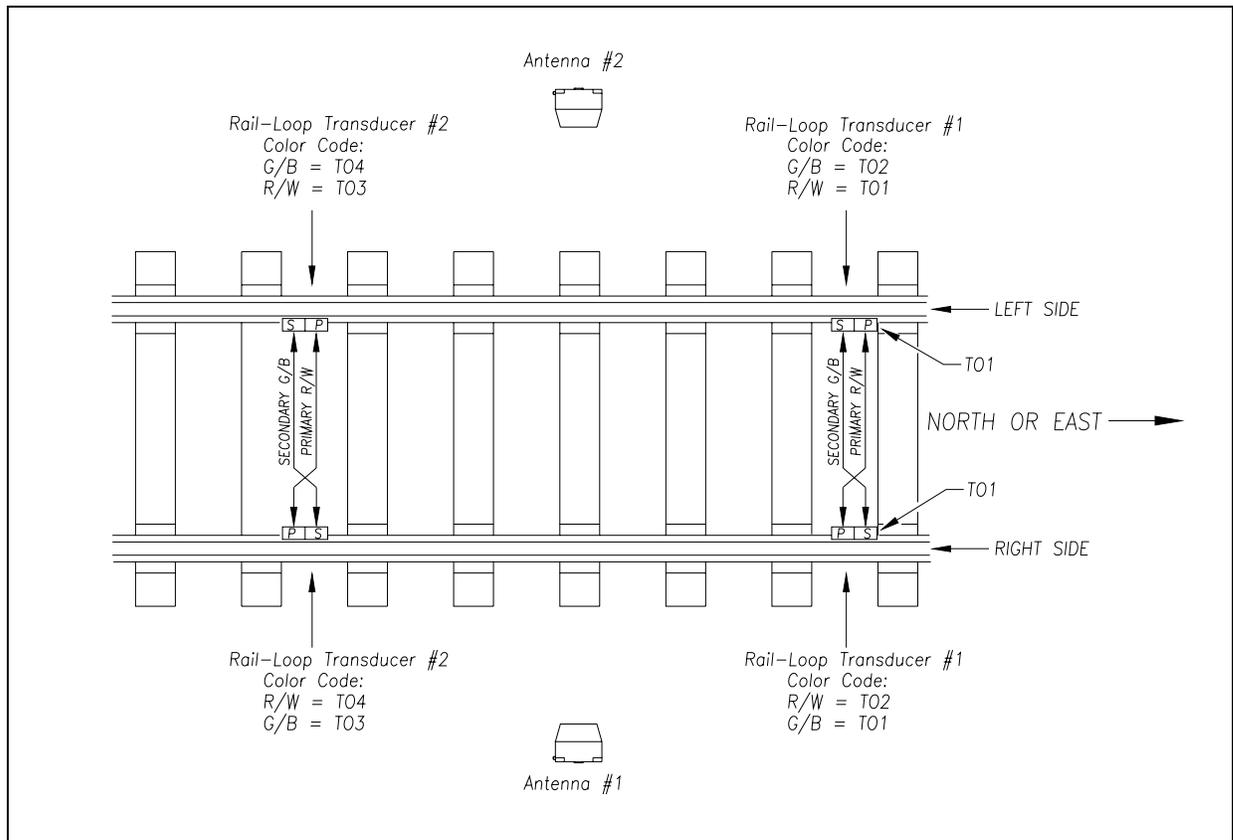
In 2200-900 Tower Enclosures, a 2200-400 Surge Protection Panel is mounted to the bottom of the enclosure base. On the left side of this panel are five DIN mounted UTBs to provide primary lightning protection for the track-mounted system components. The first four UTBs (leftmost UTBs) protect the rail-loop transducers.

In 2200-950 Inside Enclosures, most of the components that provide surge protection for the system are mounted inside the bottom of the enclosure. On the right side are five DIN mounted UTBs to provide primary lightning protection for the track-mounted system components. The first four UTBs (topmost UTBs) protect the rail-loop transducers.

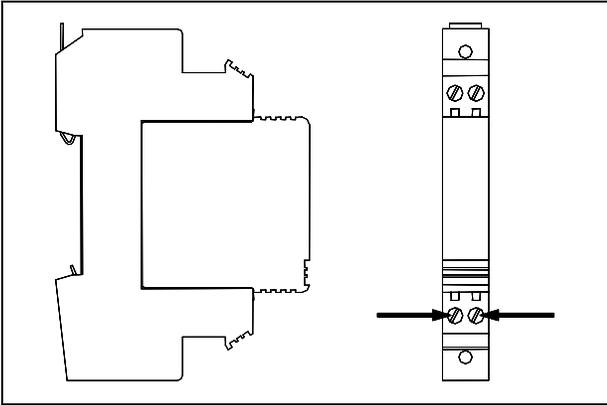
Each rail-loop transducer has a four-wire cable attached to it. The wires are colored:

- Red and white for the primary sensor.
- Green and black for the secondary sensor.

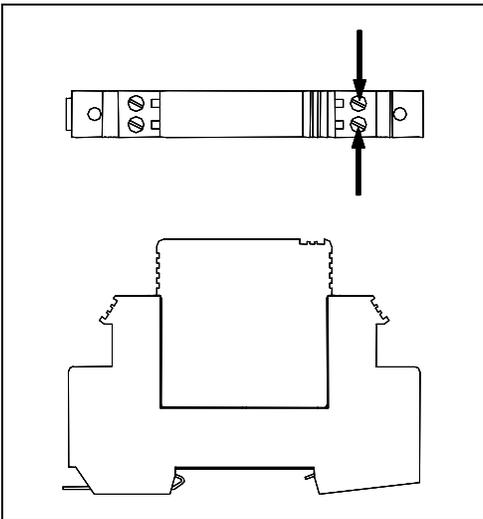
The figure below shows which sensor and which wires are TO1, TO2, TO3, and TO4. Use this figure when attaching the rail-loop transducers to the surge panel.



In 2200-900 Tower Enclosures, attach one of the wires from sensor TO1 to the bottom left of the first (leftmost) DIN mounted UTB. (Facing north or east, if on left rail, use either red or white wire. If on right rail, use either green or black wire.) Attach the other wire from sensor TO1 to the bottom right of the first UTB. Attach one of the wires from sensor TO2 to the bottom left of the second DIN mounted UTB. Attach the other wire from sensor TO2 to the bottom right of the second UTB. Following the information on the site-layout figure above, attach the wires from sensors TO3 and TO4 in a like manner.



In 2200-950 Inside Enclosures, attach one of the wires from sensor TO1 to the top right of the first (highest) DIN mounted UTB. (Facing north or east, if on left rail, use either red or white wire. If on right rail, use either green or black wire.) Attach the other wire from sensor TO1 to the bottom right of the first UTB. Attach one of the wires from sensor TO2 to the top right of the second DIN mounted UTB. Attach the other wire from sensor TO2 to the bottom right of the second UTB. Following the information on the site-layout figure above, attach the wires from sensors TO3 and TO4 in a like manner.



4.2 Presence Sensors

Most SmartScan **mainline AEI systems** use one 2200-500 Presence Detector, which requires one wire from each rail of a track circuit.

Most SmartScan **yard AEI systems** use three Reno A&E C-1300 2-Channel Loop Detectors. One of which requires one wire from each end of a track-presence loop. The other two detectors are for two SAI rail-loop transducers. (Each rail-loop transducer contains a pair of railwheel sensors.)

4.2.1 Track Circuit

At trackside, the track circuit is nothing more than two wires attached to the rails. One wire is attached to each rail. They are attached directly opposite each other, centered between the transducers. 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. Recommended practice is to weld a short length of bond strand to the web of each rail. Cadweld can provide these items as prepackaged kits, which include the bond strand (a 3/16-inch diameter strand is recommended), and the one-shot welding system. A reusable mold of the correct size is required.
- **Drilling** – The alternative to Cad-welding is to drill a 3/8-inch hole in the web of each rail at the neutral axis, and apply a bonding kit. The kit includes ready-made lengths of bond strand with "chicken heads" attached. The "chicken heads" are tapered solid metal inserts that can be driven into the 3/8-inch 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 in the base of the 2200-900 Tower Enclosure or 2200-950 Inside Enclosure. You do this by splicing a length of wire to each bond strand. Okonite Cable makes a twisted-pair cable (Okonite 113-12-3933) that is suitable for direct burial. The cable has two 6 AWG solid conductors and a very rugged insulation jacket. The cable should be attached to the bond strand using compression sleeves.

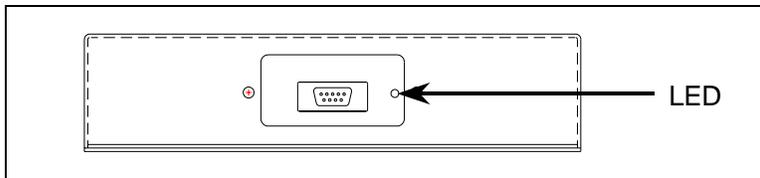
The track circuit is used in conjunction with the 2200-500 Presence Detector, which is described in the prior chapter. This module continuously sends a signal down one of the wires of the track circuit. When the wheels-axle of a train (or any metal object) shunts the track, this completes the circuit, causing the signal to return to the 2200-500 Presence Detector via the other wire. At a certain distance from the track circuit, the amplitude of the signal is strong enough to trigger an active high, which indicates to the SmartScan system that a train is present. This shunting zone is adjustable up to 150 feet (45.7 meters) on each side of the attached track-circuit wires.

To install the track circuit:

- 1 Following the directions that came with your track circuit, mount both track-wire connectors.
Mount one connector on each rail, directly opposite each other. Mount them centered, between the two pairs of transducers.
- 2 Attach wires to the track-wire connectors.
Wires should be as short as practical. They should be 9 AWG (or larger) insulated copper wire. Total wire resistance shouldn't exceed 0.2 ohm.
The wires coming from the track are terminated on the three-terminal arrester. Polarity isn't important for this connection.
- 3 Cut the track-circuit cable to the proper length.
- 4 Using a wire stripper, remove 1/4 inches (6.4 millimeters) of insulation from the ends of both wires coming from the track circuit.
- 5 Using ring terminals, crimp one terminal to the end of each of these wires.
- 6 Fasten one ring terminal to one side of the three-terminal arrester.
- 7 Fasten the other ring terminal to the other side of the three-terminal arrester.

To check and adjust the 2200-500 Presence Detector:

- 1 From the center of one of the transducer pairs, measure the shortest distance you want the track circuit to pick up the presence of a train.
The distance must be at least 15 feet (4.6 meters) and no more than 150 feet (45.7 meters).
- 2 At the point just measured, place a hardwire shunt across both rails.
When lit, the LED (on the front of the 2200-500 Presence Detector) indicates a received pulse from the track circuit.

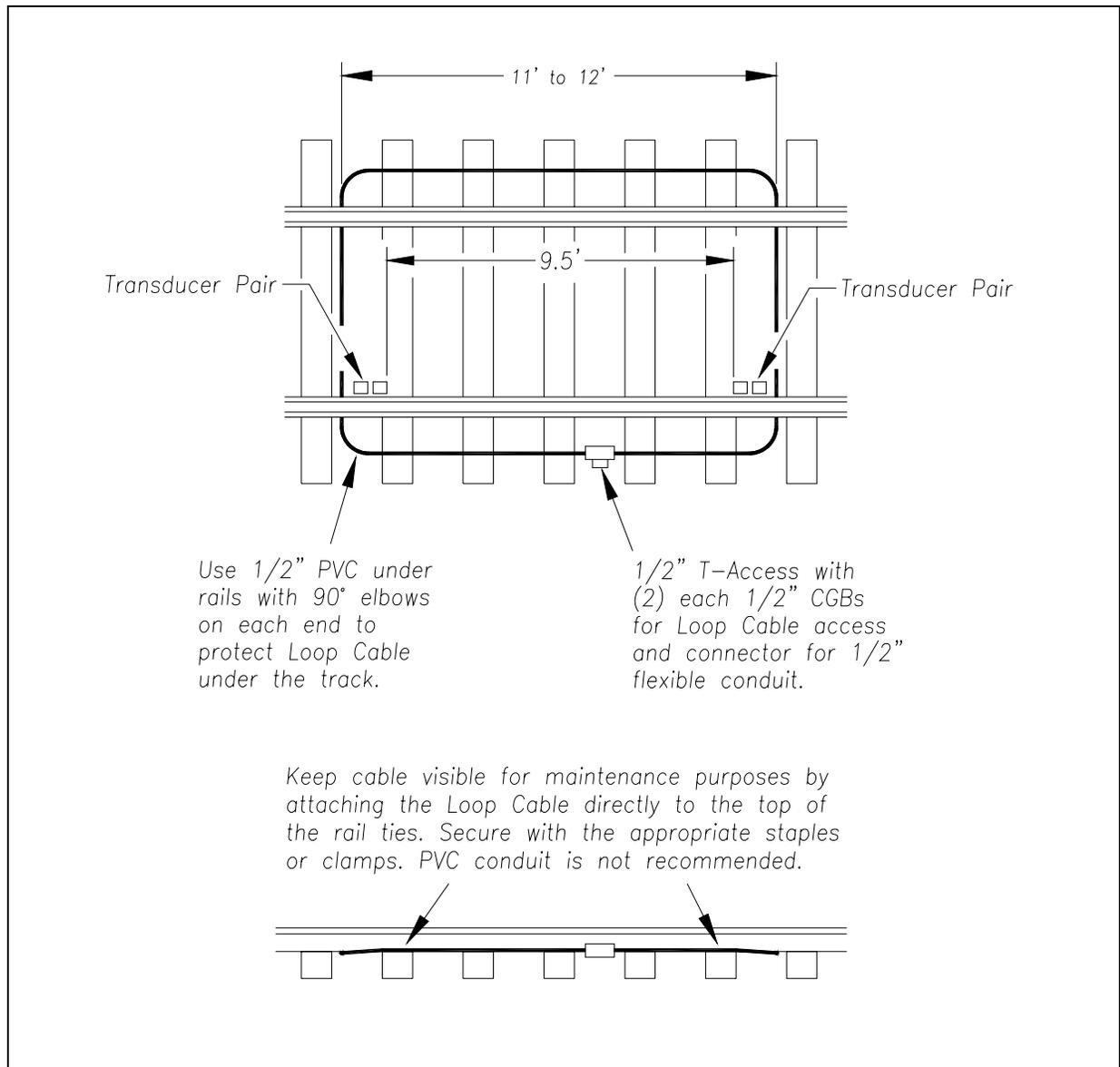


- 3 Using a small slotted screwdriver, turn potentiometer **R24** (on back of the Presence Detector) until the LED (on front of the 2200-500 Presence Detector) goes out.
- 4 Using a small slotted screwdriver, turn potentiometer **R24** until the SOTC relay just picks up the pulse from the track circuit.
The relay just picks up the pulse when the LED (on the front of the Presence Detector) first lights.

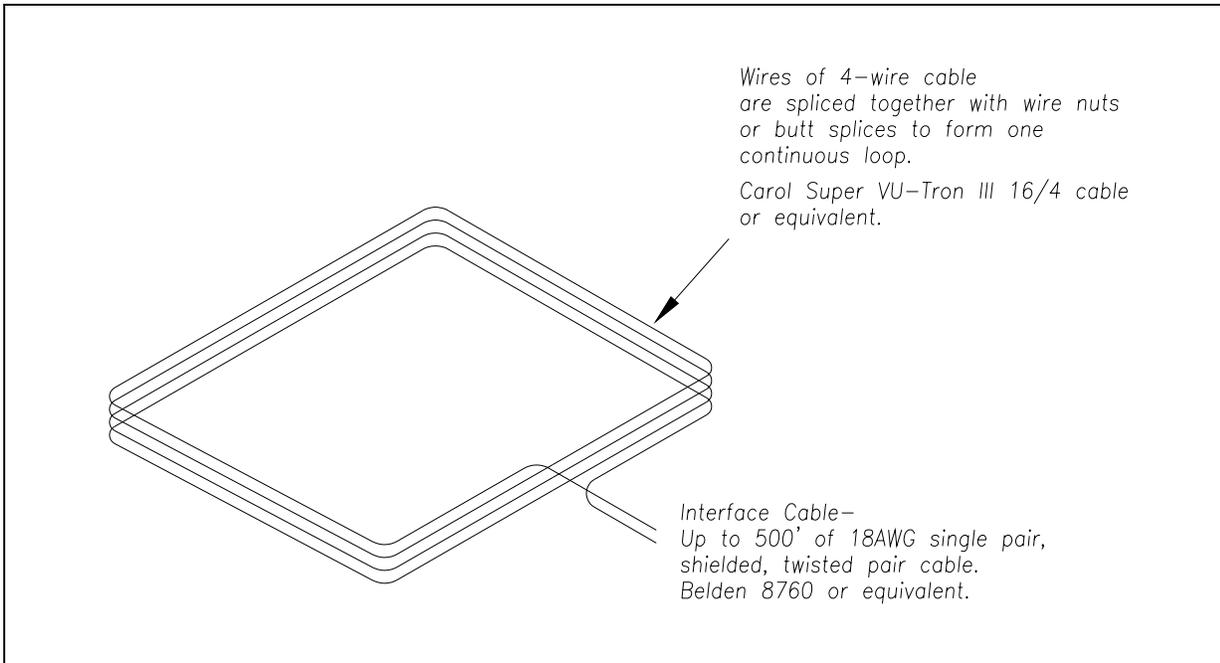
- 5 Place a hardwire shunt across both rails at the point two feet beyond the measured point (that is, two feet farther from the transducers).
- 6 If the LED (on the front of the Presence Detector module) is still lit, return to step 1.
- 7 Remove the hardwire shunt.

4.2.2 Track-Presence Loop

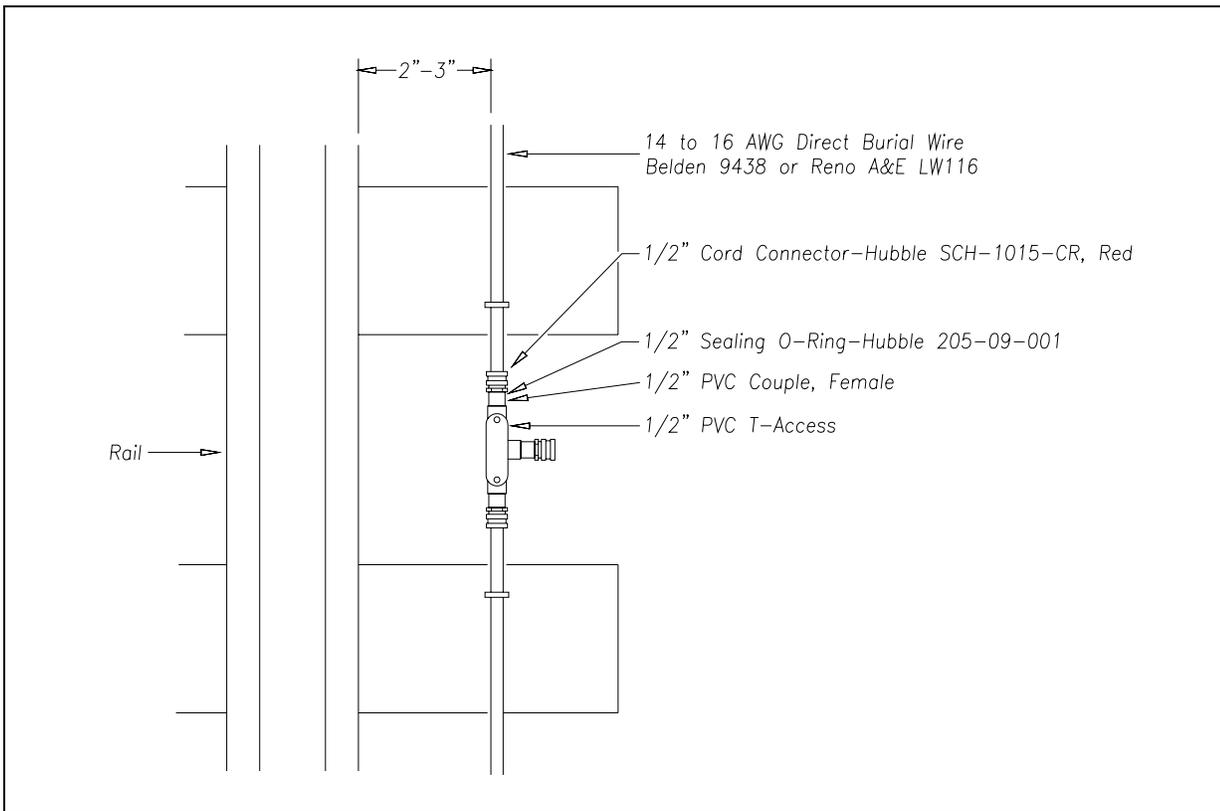
The figure below shows the track plan for the track-presence loop.



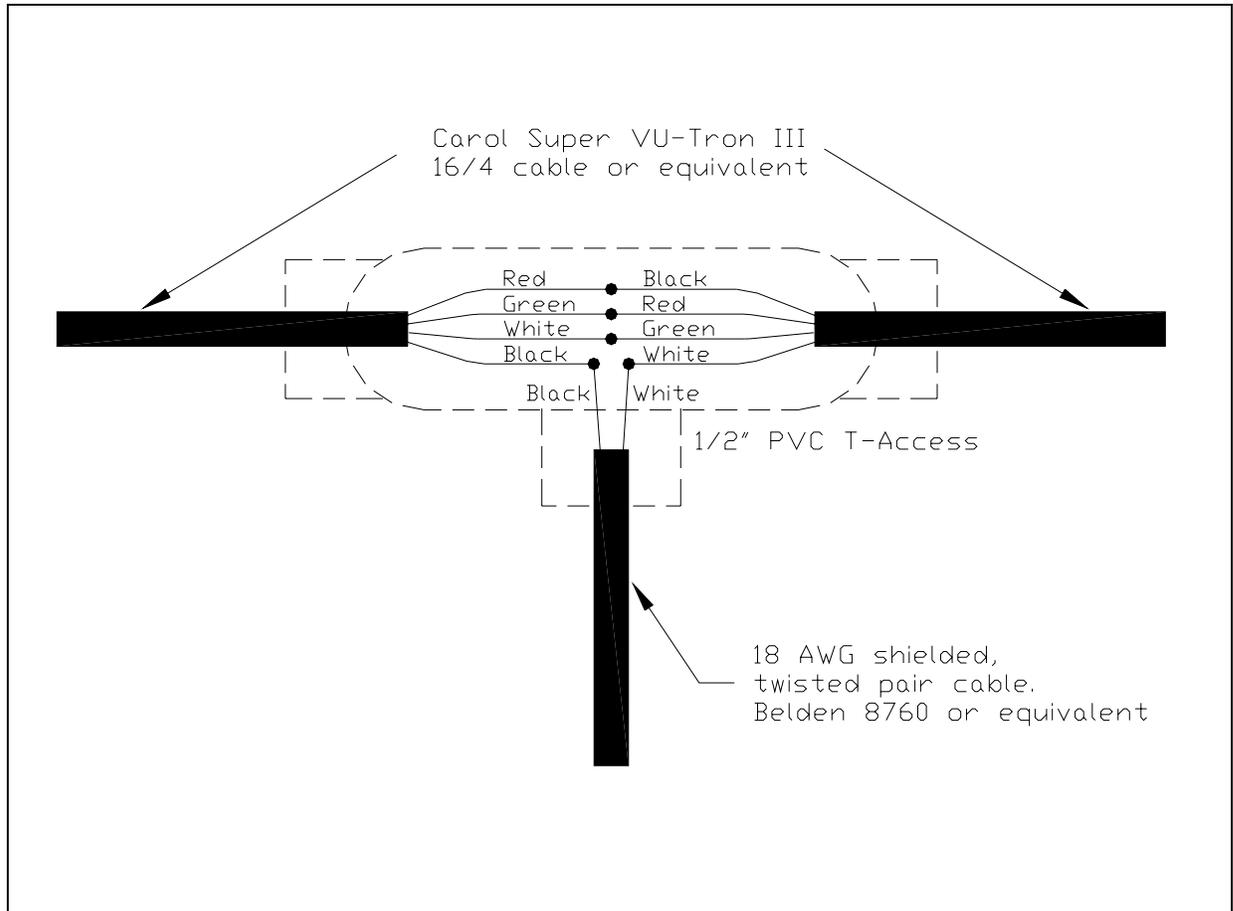
The figure below shows the loop wiring detail for the track-presence loop.



The figure below shows the conduit T-access detail for the track-presence loop.



The figure below shows the splicing detail for the track-presence loop.



Carol Super VU-Tron III 16/4 cable (or equivalent) is used to form the track-presence loop. To form one continuous loop, wires of the 4-wire cable are spliced together with wire nuts or butt connectors. The loop is then spliced to an 18 AWG shielded twisted-pair cable (up to 500 feet in length) to provide connection from the track-presence loop to its respective input at the equipment enclosure. All spliced connections are terminated within the 1/2-inch PVC T-Access.

4.3 AEI Antennas

Each SmartScan mainline and yard AEI system requires two antennas, designated antenna1 and antenna2. The antennas are used in conjunction with the 2200-504 Readers, which were described in the prior chapter.

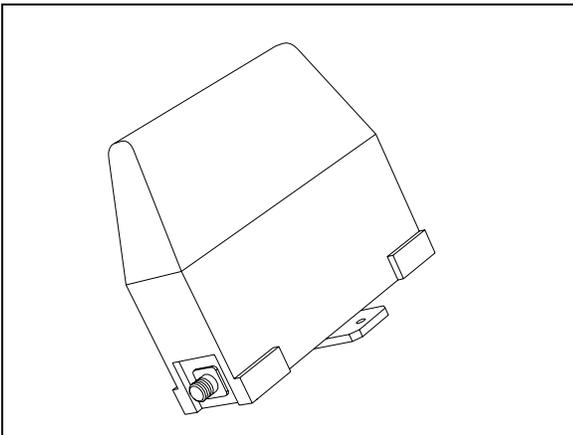
SmartScan supports three types of antennas.

- 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**.

These antennas are described below.

4.3.1 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. It is suitable for either pipe, tower, or wall mounting.



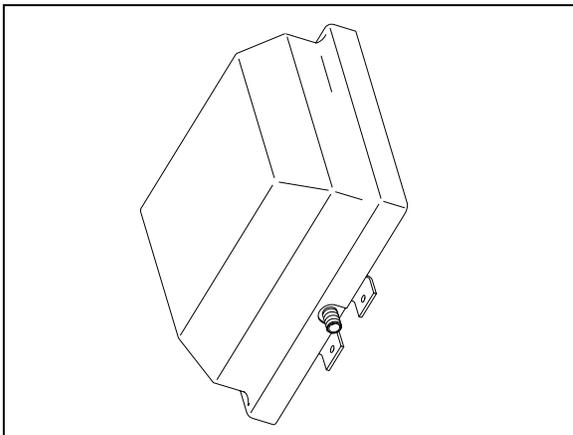
In reference to the track, antenna1 is the northmost or eastmost antenna. Antenna2 is the southmost or westmost antenna.

Each SRL440 antenna is installed:

- With its face parallel to the rails
- Horizontally with its N-type socket on the side, not pointing up or down
- 10 feet (3 meters) from the center of the track
- 3.5 feet (1.1 meters) above the top of the rails
- Centered between the transducers
- Opposite each other

4.3.2 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 either pipe, tower, or wall mounting.



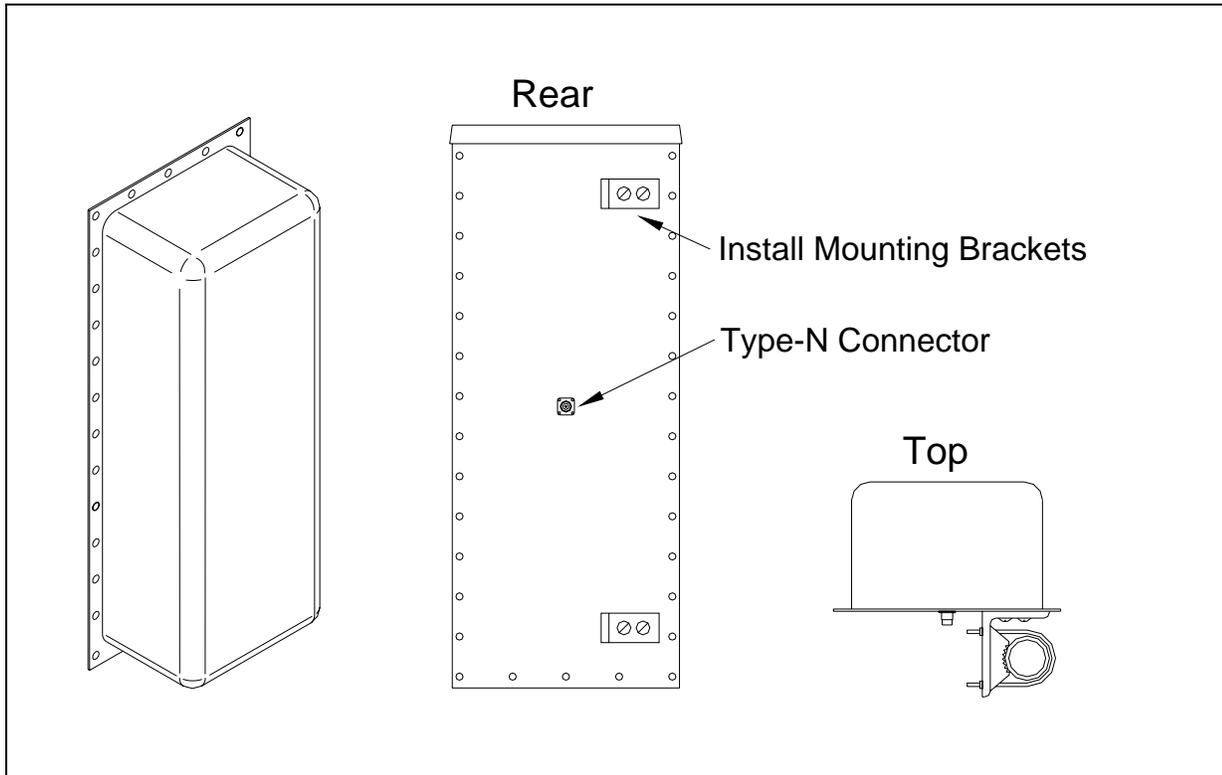
In reference to the track, antenna1 is the northmost or eastmost antenna. Antenna2 is the southmost or westmost antenna.

Each SRL470 antenna is installed:

- With its face parallel to the rails
- With its N-type socket pointing down
- 10 feet (3 meters) from the center of the track
- 3.5 feet (1.1 meters) above the top of the rails
- Centered between the transducers
- Opposite each other

4.3.3 Scala HP9-915 Antennas

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



In reference to the track, antenna1 is the northmost or eastmost antenna. Antenna2 is the southmost or westmost antenna.

Each HP9-915 antenna is installed:

- Vertically with its face parallel to the rails
- 10 feet (3 meters) from the center of the track
- 3.5 feet (1.1 meters) above the top of the rails
- Centered between the transducers
- Opposite each other

Chapter 5

Installing the System

This chapter shows how to install various types of SmartScan AEI systems. Both trackside and remote installations are covered.

Do not try to install any part of any SmartScan system until you have read and understood the information in this guide and in all other applicable guides.

5.1 2200-900AC Tower Enclosure

This section describes how to install a SmartScan AEI system controlled by the components of a 2200-900AC Tower Enclosure.

5.1.1 Installation Overview

Here is a typical installation task list for a SmartScan AEI system controlled by the components of a 2200-900AC Tower Enclosure.

- 1 Do site survey to determine optimum location.
- 2 Locate all underground utilities, signal cables, and communications cables.
- 3 Order power and communication services.
- 4 Complete necessary trenching.
This may include boring under the track for installation of far-rail antenna conduit. Each railroad has individual requirements for trenching and boring.
- 5 Install antenna-and-enclosure tower foundations.
- 6 Install conduit.
- 7 Erect antenna-and-enclosure towers.
- 8 Install enclosure bottom plate on enclosure tower.
- 9 Terminate conduit to bottom plate.

- 10** At trackside, install the transducers.
Zero-speed and rail-loop transducers are supported. Installation of these transducers is covered in **Chapter 4 - Track Components**.
- 11** At trackside, install the presence sensor.
Track circuits and track-presence loops are supported. Installation of these sensors is covered in **Chapter 4 - Track Components**.
- 12** Pull wiring into conduit.
- 13** Mount the 2200-900AC Tower Enclosure on tower.
- 14** Ground the 2200-900AC Tower Enclosure.
Grounding the enclosure is covered in **5.1.3 Grounding the Enclosure**.
- 15** Install backup batteries.
Installing the batteries is covered in **5.1.8 Installing the Batteries**.
- 16** If your SmartScan AEI system is using a cellular modem, mount its antenna to the tower to which the 2200-900AC Tower Enclosure is attached.
Installing the modem antenna is covered in **5.1.9 Installing the Cellular Modem's Antenna**.
- 17** At trackside, install the AEI antennas.
In reference to the track, antenna1 is the northmost or eastmost antenna. Antenna2 is the southmost or westmost antenna. Install the AEI antennas with the face of the antenna parallel to the rails, 3.5 feet (1.1 meters) above the top of the rails, centered between the two pairs of transducers, and opposite each other. Mount the SRL440 antenna horizontally with its N-type socket on the side, not pointing up or down. Mount the SRL470 antenna with its N-type socket pointing down. Mount the HP9-915 antenna vertically.
- 18** Terminate the SmartScan wiring in the 2200-900AC Tower Enclosure.
- 19** Terminate power and communication wiring.
- 20** Setup and test the SmartScan system.

5.1.2 Installing the Enclosure

The 2200-900AC Tower Enclosure is designed to be mounted to a Rohn 25G tower section measuring 10 feet (3 meters) in length. The tower section is a welded triangular assembly, secured to a precast concrete foundation with a steel transition plate. The enclosure is mounted across two of the tower legs with specially fabricated channels. For trackside installations, the third leg of the tower is used to support the antenna for the rail closest to the enclosure.

Ideally, the enclosure should be mounted to position the bottom about 24 inches (61 centimeters) above the ground. Doing so will position the modules at a convenient height for installation and servicing. A removable base plate is supplied with the enclosure. This feature allows the plate to be field drilled to accommodate all underground entrance conduits.

Underground services required are:

- For trackside installation, near-rail antenna conduit – 1-inch flexible conduit
- For remote installation, near-rail antenna conduit – 1-1/2-inch PVC conduit
- Far-rail antenna conduit – 1-1/2-inch PVC conduit
- Transducer and presence detector entrance – 1-1/2-inch PVC conduit
- 120 VAC 20 amp service entrance – 1-inch conduit
- Telephone entrance – 1-inch conduit
- Earth ground entrance – 1/2-inch

5.1.3 Grounding the Enclosure

The 2200-900AC Tower Enclosure system is equipped with industry standard components for surge and lightning protection of the equipment attached to it. However, if the attachment to the earth ground system isn't made correctly, the surge protection equipment may not work as designed, resulting in damaged or destroyed system components.

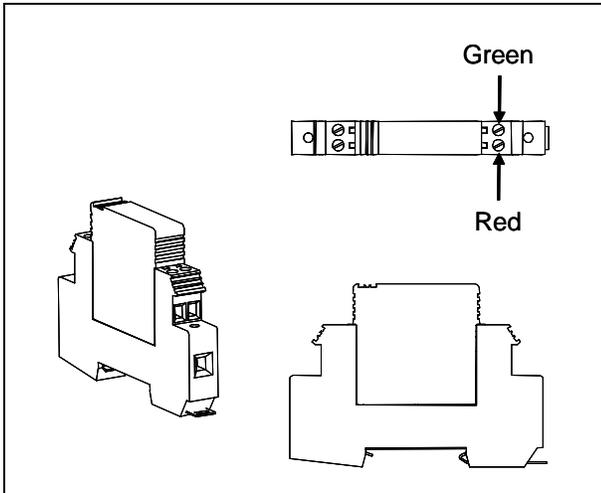
A least one driven ground should be installed at the tower base. A second driven ground should be installed at the power pole to which the AC power connection is made. A third driven ground should be placed beside the antenna mount on the far rail. All ground rods and the first horizontal leg of each tower should be interconnected and exothermically bonded with a 2 AWG bare stranded copper conductor. An exothermically bonded pigtail should be run through the base plate of the enclosure and terminated at the ground lug mounted to the 2200-400 Surge Protection Panel.

5.1.4 Connecting the Telephone

Telephone service is needed only on SmartScan systems equipped with a 2200-600 Modem. If your system is equipped with a cellular modem instead, skip this section and go to **5.1.5 Connecting the AEI Antennas.**

The telephone service provider should terminate their drop on a lightning arrester terminal on the service pole. From the lightning arrester block, run a four-wire service cord to the 2200-900 Tower Enclosure and route it to the DIN rail assembly.

At the top of the DIN rail assembly is the surge protector for the telephone line. This surge protector has two tiers (one above another) of connections on each side. Looking down on the surge protector, the green wire of the incoming telephone line is terminated at the top-tier top-right terminal on this surge protector. The red wire is terminated at the top-tier bottom-right terminal. The other two phone wires (yellow and black) aren't required for SmartScan applications.



5.1.5 Connecting the AEI Antennas

For both trackside and remote installations, the far-rail antenna connection should be made with a low-loss coaxial cable such as Andrews FSJ4. Each end of the cable requires a straight type-N plug such as Andrews F4NMV2. A 24-inch (61-centimeter) RG 8U transition cable with a right-angle connector should be used at the antenna due to the stiffness of the FSJ4.

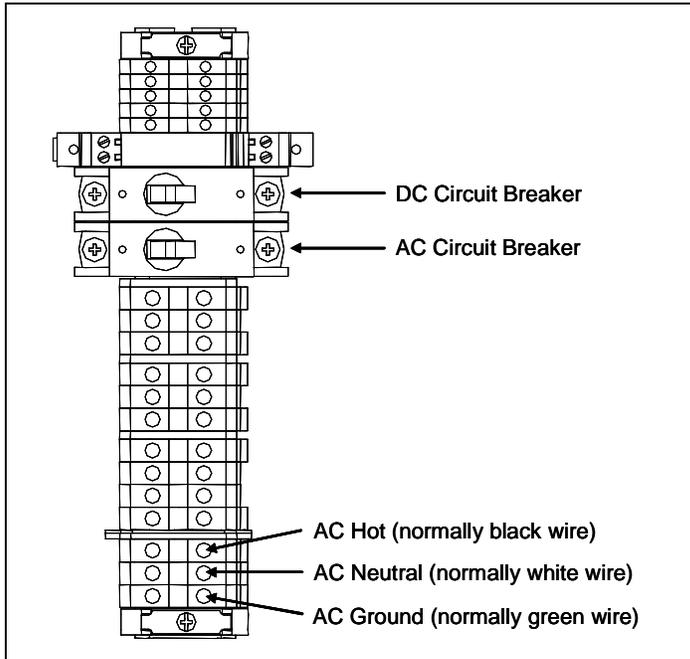
For trackside installations, the near-rail antenna is mounted to the same structure as the 2200-900AC Tower Enclosure. This connection can be made with RG8 coaxial cable with type-N connectors on both ends. It is desirable to use a right-angle connector at the antenna connection to maintain a low profile. For remote installations, the near-rail antenna connection is the same as for far-rail antenna connections.

Be sure the antenna connections are taped to prevent entrance of moisture.

In reference to the track, antenna1 is the northmost or eastmost antenna. Antenna2 is the southmost or westmost antenna.

5.1.6 Connecting to External AC

The power requirements of the SmartScan equipment mounted in the 2200-900AC Tower Enclosure are relatively modest. Typically, a three-wire 120-volt 20-ampere service is more than adequate. Because space is limited in the enclosure, the power should be routed from an external disconnect switch, through conduit to the enclosure. DIN rail terminals are provided for termination of the incoming AC. The enclosure is prewired from the DIN rail.



Before connecting the external AC to the SmartScan system, be sure that the incoming AC wiring is not live and that the AC and DC circuit breakers on the DIN rail are in the OFF position.

To connect the external AC to the SmartScan system:

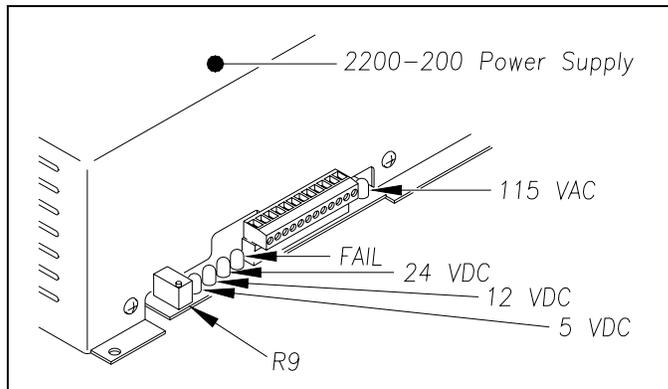
- 1 Shut off all incoming AC power.
- 2 Using an AC voltmeter, verify that the incoming AC power is dead.
Your AC cable should have three wires protruding from it.
- 3 Attach the AC ground wire (normally the green wire) to the bottom-most, right terminal.
- 4 Attach the AC neutral wire (normally the white wire) to the terminal just above where you terminated AC ground.
- 5 Attach the AC hot wire (normally the black wire) to the terminal just above where you terminated AC neutral.
- 6 Turn on the incoming AC power.
- 7 Toggle the AC circuit breaker on.

5.1.7 Verifying DC Voltage

Before verifying DC voltage, be sure that the AC circuit breaker on the DIN rail is in the ON position and that the DC circuit breaker on the DIN rail is in the OFF position.

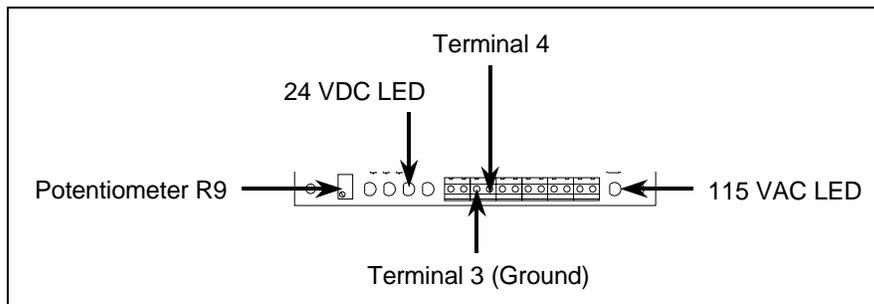
To verify the float voltage:

- 1 If the **115 VAC** and **24 VDC** LEDs on the edge of the 2200-200 Power Supply aren't lit, fix this problem before continuing.



Chapter 9 - Troubleshooting tells how to fix problems with the power input and with the 2200-200 Power Supply.

- 2 If the DC circuit breaker is on, toggle it off.
- 3 Using a DC voltmeter, touch the black lead to terminal 3 on terminal block TB1 (on the outside of the 2200-200 Power Supply).



- 4 Touch the red lead to terminal 4 on terminal block TB1 (on the outside of the 2200-200 Power Supply).
- 5 If the voltage isn't between 26.8 and 27.2 VDC, adjust potentiometer **R9** (on the outside of the 2200-200 Power Supply) until the voltmeter shows 27 VDC.

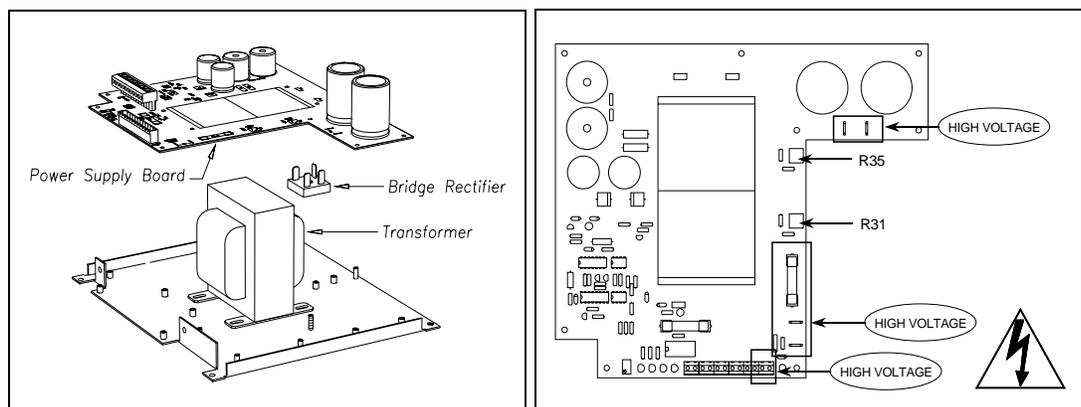
Turn **R9** clockwise to increase voltage. Turn it counterclockwise to decrease voltage.

To verify the other DC voltages:

- 1 If the **115 VAC**, **12 VDC**, and **5 VDC** LEDs on the edge of the 2200-200 Power Supply aren't lit, fix this problem before continuing.
- 2 If the DC circuit breaker is on, toggle it off.
- 3 Using a DC voltmeter, touch the black lead to terminal 3 on terminal block TB1 (on the outside of the 2200-200 Power Supply).
- 4 Touch the red lead to terminal 6 on terminal block TB1 (on the outside of the 2200-200 Power Supply).
- 5 If the voltage isn't between 5.0 and 5.2 VDC:
 - a Toggle the AC circuit breaker off.
 - b On the part of the Power Supply board that is protruding from the 2200-200 Power Supply, separate the plug of the terminal block from its header.
 - c Remove the four screws securing the 2200-200 Power Supply to the enclosure.
 - d Separate the 2200-200 Power Supply from the enclosure.
 - e Remove the three fasteners securing the 2200-200 Power Supply cover to its base.
 - f Separate the cover of the 2200-200 Power Supply from its base.

The Power Supply board is now exposed with its components in view.
 - g Without its cover, reattach the base of the 2200-200 Power Supply to the enclosure.
 - h Reconnect the plug of the terminal block to its header.

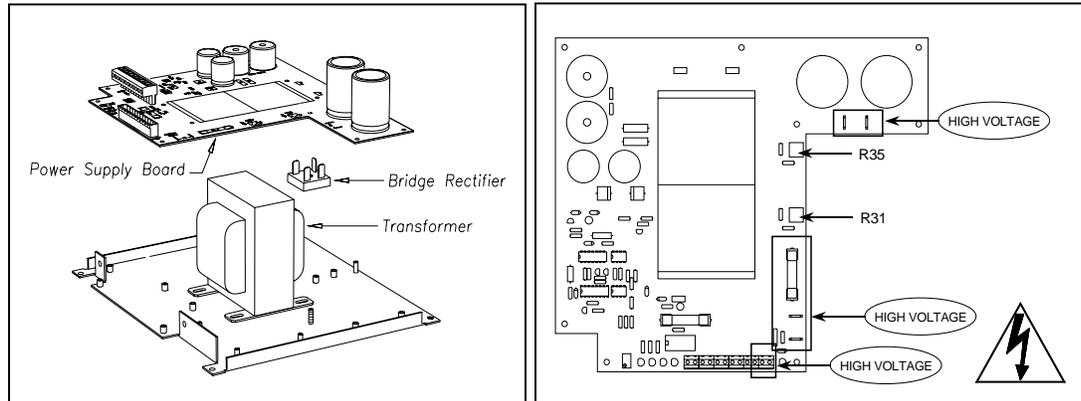
When AC is present, there is a risk of shock inside and outside of the 2200-200 Power Supply. Some possible high-voltage danger areas are the transformer, bridge rectifier, AC fuse holder, and terminal block. Other dangerous areas also exist. So, touch nothing. Let your insulated screwdriver touch only potentiometer R35.



- i Toggle the AC circuit breaker on.
 - j Using a small insulated screwdriver, adjust potentiometer **R35** until the voltmeter shows 5.1 VDC.
Turn **R35** clockwise to increase the voltage. Turn it counterclockwise to decrease the voltage.
 - k Toggle the AC circuit breaker off.
 - l Separate the plug of the terminal block from its header.
 - m Remove the four screws securing the base of the 2200-200 Power Supply to the enclosure.
 - n Separate the base of the 2200-200 Power Supply from the enclosure.
 - o Reattach the cover of the 2200-200 Power Supply to its base.
 - p Reattach the 2200-200 Power Supply to the enclosure.
 - q Reconnect the plug of the terminal block to its header.
 - r Toggle the AC circuit breaker on.
- 6** Using a DC voltmeter, touch the black lead to terminal 3 on terminal block TB1 (on the outside of the 2200-200 Power Supply).
- 7** Touch the red lead to terminal 8 on terminal block TB1 (on the outside of the 2200-200 Power Supply).
- 8** If the voltage isn't between 12.4 and 12.6 VDC:
- a Toggle the AC circuit breaker off.
 - b On the part of the Power Supply board that is protruding from the 2200-200 Power Supply, separate the plug of the terminal block from its header.
 - c Remove the four screws securing the 2200-200 Power Supply to the enclosure.
 - d Separate the 2200-200 Power Supply from the enclosure.
 - e Remove the three fasteners securing the 2200-200 Power Supply cover to its base.
 - f Separate the cover of the 2200-200 Power Supply from its base.
The Power Supply board is now exposed with its components in view.
 - g Without its cover, reattach the base of the 2200-200 Power Supply to the enclosure.

- h Reconnect the plug of the terminal block to its header.

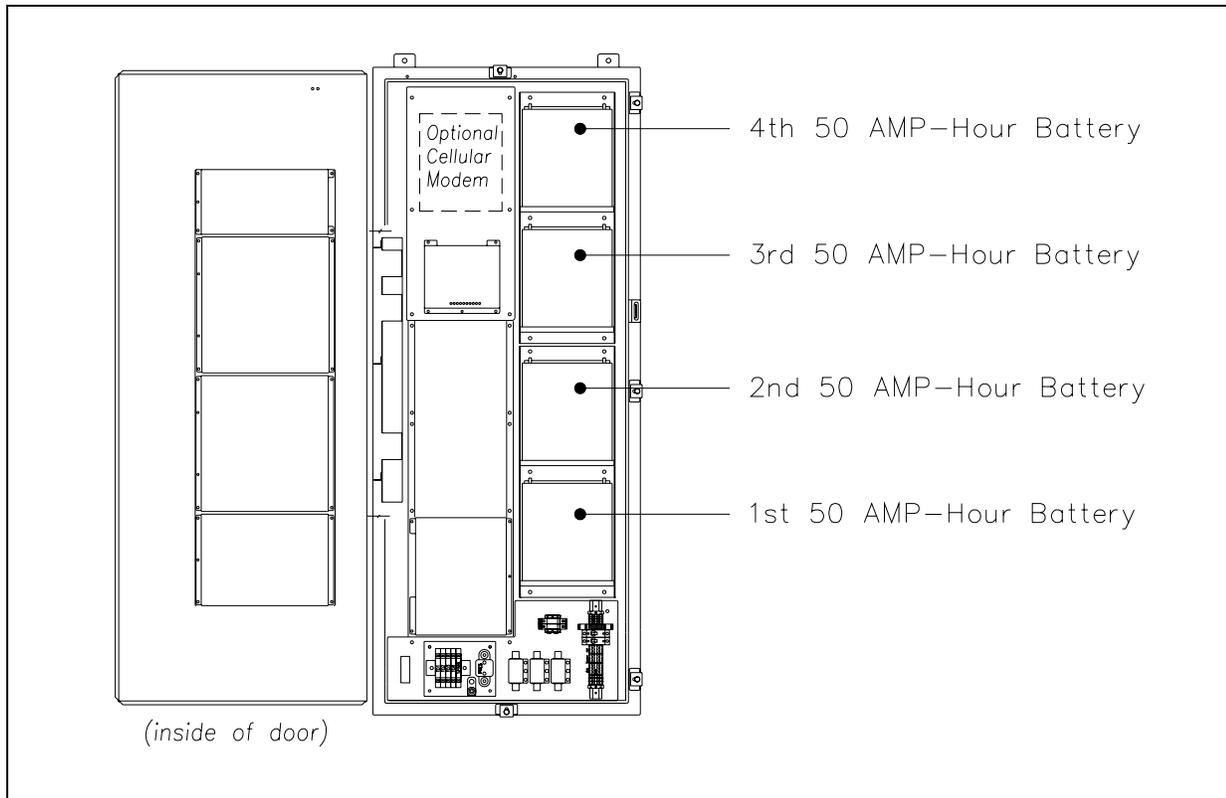
When AC is present, there is a risk of shock inside and outside of the 2200-200 Power Supply. Some possible high-voltage danger areas are the transformer, bridge rectifier, AC fuse holder, and terminal block. Other dangerous areas also exist. So, touch nothing. Let your insulated screwdriver touch only potentiometer R31.



- i Toggle the AC circuit breaker on.
- j Using a small insulated screwdriver, adjust potentiometer **R31** until the voltmeter shows 12.5 VDC.
- Turn **R31** clockwise to increase the voltage. Turn it counterclockwise to decrease the voltage.
- k Toggle the AC circuit breaker off.
- l Separate the plug of the terminal block from its header.
- m Remove the four screws securing the base of the 2200-200 Power Supply to the enclosure.
- n Separate the base of the 2200-200 Power Supply from the enclosure.
- o Reattach the cover of the 2200-200 Power Supply to its base.
- p Reattach the 2200-200 Power Supply to the enclosure.
- q Reconnect the plug of the terminal block to its header.
- r Toggle the AC circuit breaker on.
- 9 Toggle the DC circuit breaker on.

5.1.8 Installing the Batteries

Mounting points are provided in the 2200-900AC Tower Enclosure for four battery-support brackets. These brackets can hold a maximum of four 12-volt 50-AH batteries wired in a series parallel arrangement to provide 24 volts at 100-AH capacity for backup power. The standard configuration includes two batteries with an option for two more.



Before installing the batteries, be sure that the AC and DC circuit breakers on the DIN rail are in the OFF position.

WARNING

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

If your system uses two batteries:

- 1 Place the batteries into the bottom-two battery-support brackets.
- 2 Attach the end of the red wire (in the bottom-most bracket) to the plus terminal of the bottom-most battery.
- 3 Attach the end of the red wire (in the second-from-bottom bracket) to the plus terminal of the second-from-bottom battery.
- 4 Attach the end of the black wire (in the bottom-most bracket) to the negative terminal of the bottom-most battery.
- 5 Attach the end of the black wire (in the second-from-bottom bracket) to the negative terminal of the second-from-bottom battery.

If your system uses four batteries:

- 1 Place the batteries into the battery-support brackets.
- 2 Starting with the bottom-most bracket and moving up, attach the end of the red wire in each bracket to the plus terminal of the battery in the same bracket.
- 3 Starting with the bottom-most bracket and moving up, attach the end of the black wire in each bracket to the negative terminal of the battery in the same bracket.

WARNING

In operation, batteries generate and release flammable hydrogen gas, which, if ignited by a burning cigarette, naked flame, or spark, may cause battery explosion with dispersion of casing fragments and corrosive liquid electrolyte. So, carefully follow manufacturer's instructions for installation and service. Keep all sources of gas ignition away from the batteries and do not allow metallic articles to contact the negative and positive terminals of a battery at the same time.

WARNING

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

5.1.9 Installing the Cellular Modem's Antenna

Not all SmartScan AEI systems use a cellular modem. If yours doesn't, skip this section.

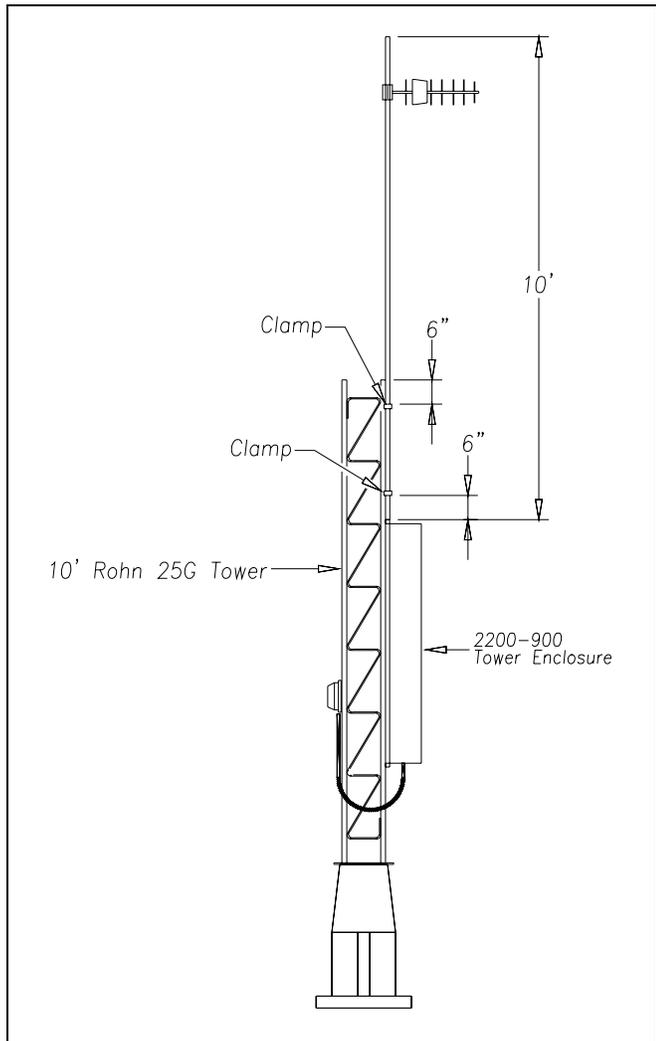
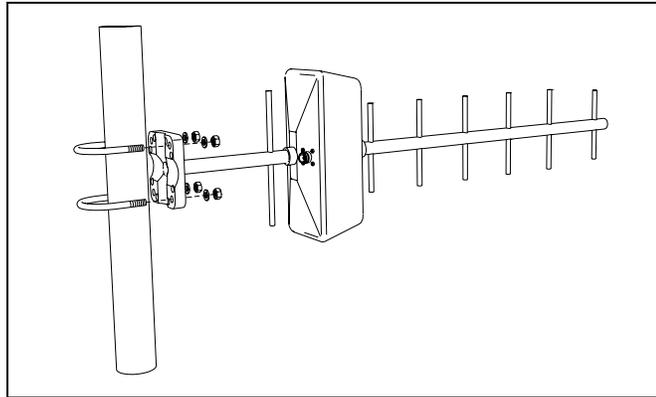
If a cellular modem is used, install its antenna to the tower to which the 2200-900AC Tower Enclosure is attached.

To install the antenna:

- 1 Mount the antenna to the 10-foot antenna pole, as shown top right.
- 2 Mount the antenna pole to the tower, as shown bottom right.

The figure shows an aboveground tower height of 10 feet (3 meters). Your aboveground tower height might be higher.

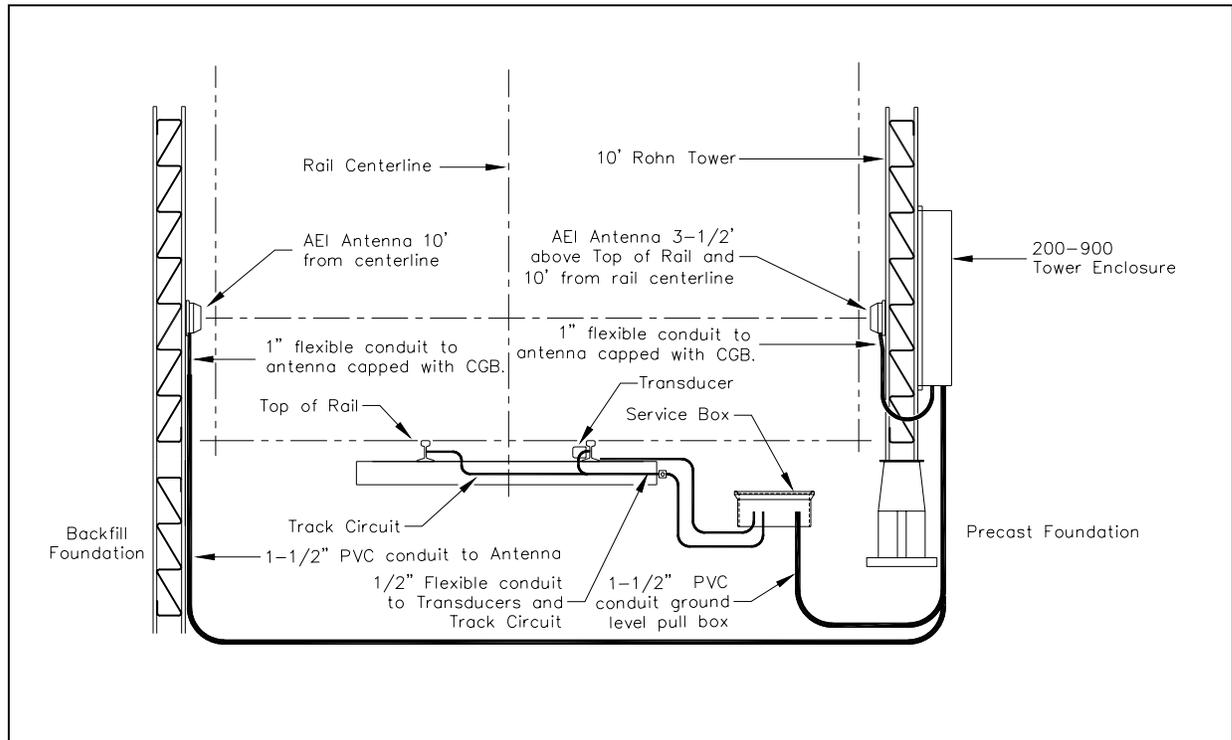
- 3 Be sure the drain hole in the antenna is facing down.
- 4 Connect the N-type connector on one end of a coaxial cable to the antenna.
- 5 Route the coaxial cable from the antenna to the Joslyn coaxial lightning arrester inside the enclosure.
- 6 Install an N-type connector on the other end of the coaxial cable.
- 7 Connect the N-type connector to the end of the arrester opposite the transceiver's connection.



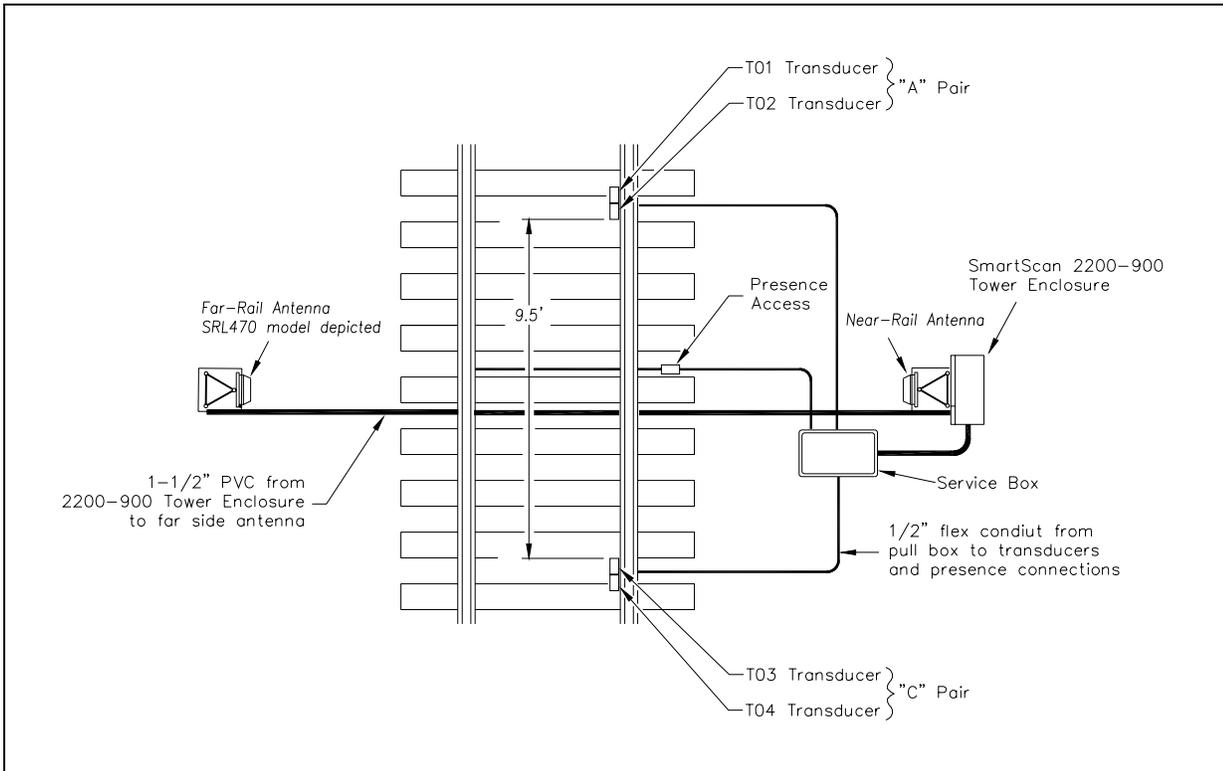
5.1.10 Trackside Installation Drawings

This section provides the SmartScan user with typical trackside installation guidelines that can be adapted to their specific application. Typical remote installation references and guidelines are covered in the next section, **5.1.11 Remote Installation Drawings**.

The figure below shows the trackside part of a trackside installation of a SmartScan AEI system controlled by a trackside 2200-900AC Tower Enclosure.

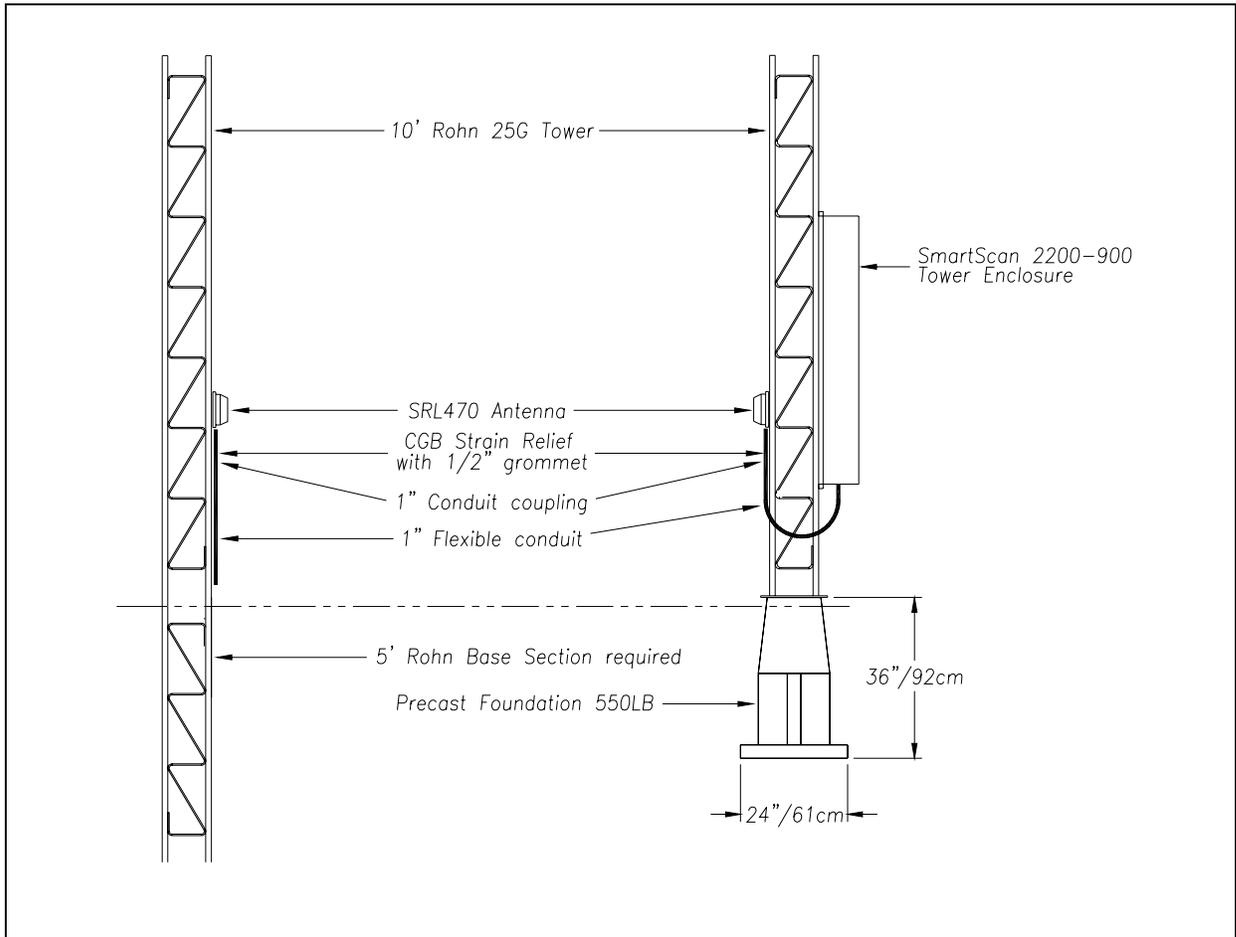


The figure below shows the trackside plan for a trackside installation of a SmartScan AEI system controlled by a trackside 2200-900AC Tower Enclosure.



In reference to the track, antenna1 is the northmost or eastmost antenna. Antenna2 is the southmost or westmost antenna. Also, transducer TO1 is the northmost or eastmost transducer.

The figure below shows the tower detail for an installation of a SmartScan AEI system controlled by a trackside 2200-900AC Tower Enclosure. What is shown is an aboveground tower height of 10 feet (3 meters). Your aboveground tower height might be higher.



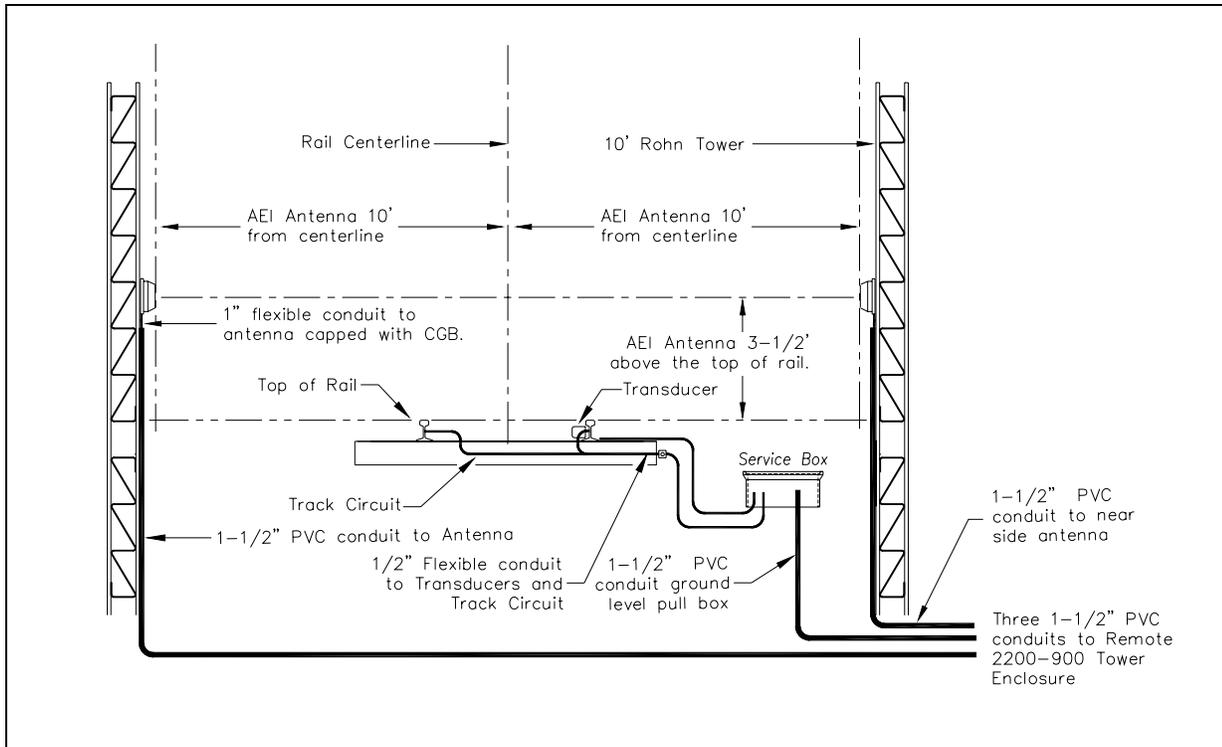
Shown in the figure above are two SRL470 antennas. These AEI antennas (or two Scala HP9-915 Parapanel antennas) are normally used on mainline systems. SRL440 antennas are normally used on yard systems.

Install the AEI antennas with the face of the antenna parallel to the rails, 3.5 feet (1.1 meters) above the top of the rails, centered between the two pairs of transducers, and opposite each other. Mount the SRL440 antenna horizontally with its N-type socket on the side, not pointing up or down. Mount the SRL470 antenna with its N-type socket pointing down. Mount the HP9-915 antenna vertically.

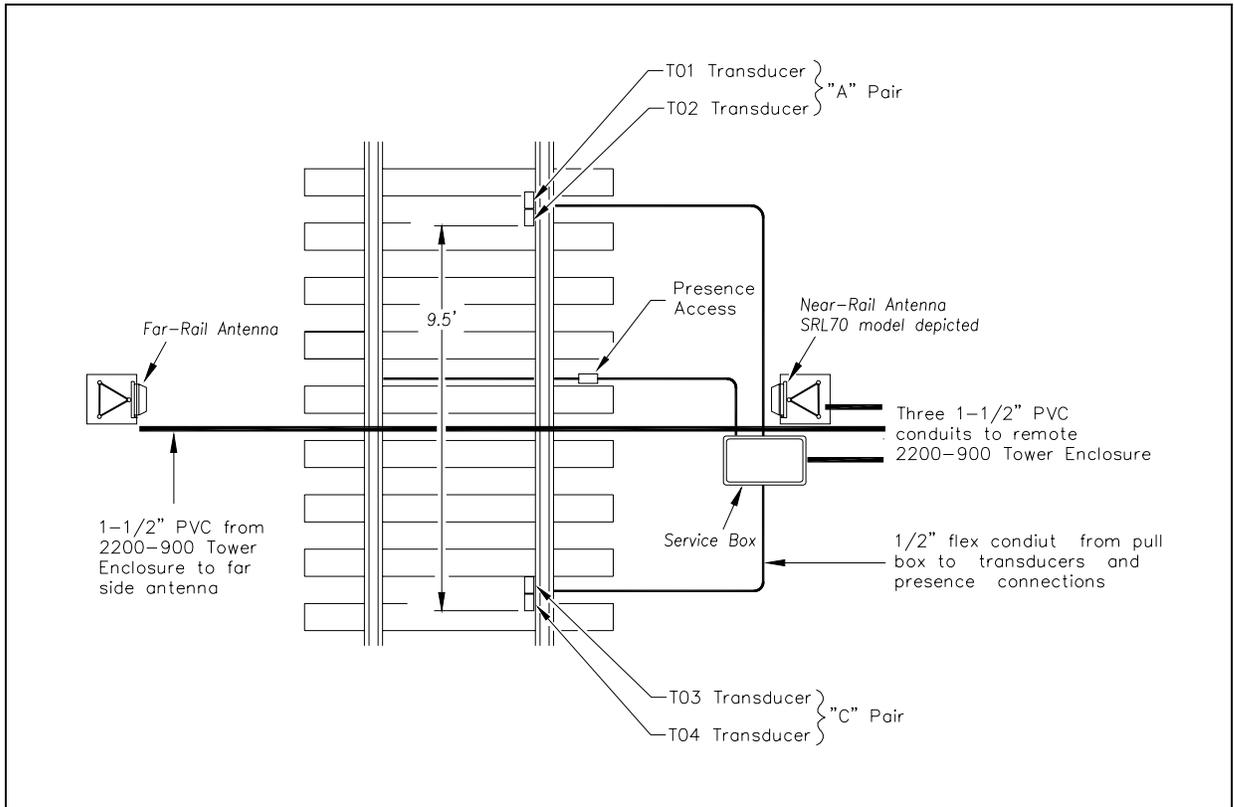
5.1.11 Remote Installation Drawings

This section provides the SmartScan user with typical remote installation guidelines that can be adapted to their specific application. Typical trackside installation references and guidelines are covered in the prior section, **5.1.10 Trackside Installation Drawings**.

The figure below shows the trackside part of a remote installation of a SmartScan AEI system controlled by a remote 2200-2200-900AC Tower Enclosure. What is shown is an aboveground tower height of 10 feet (3 meters). Your aboveground tower height might be higher.

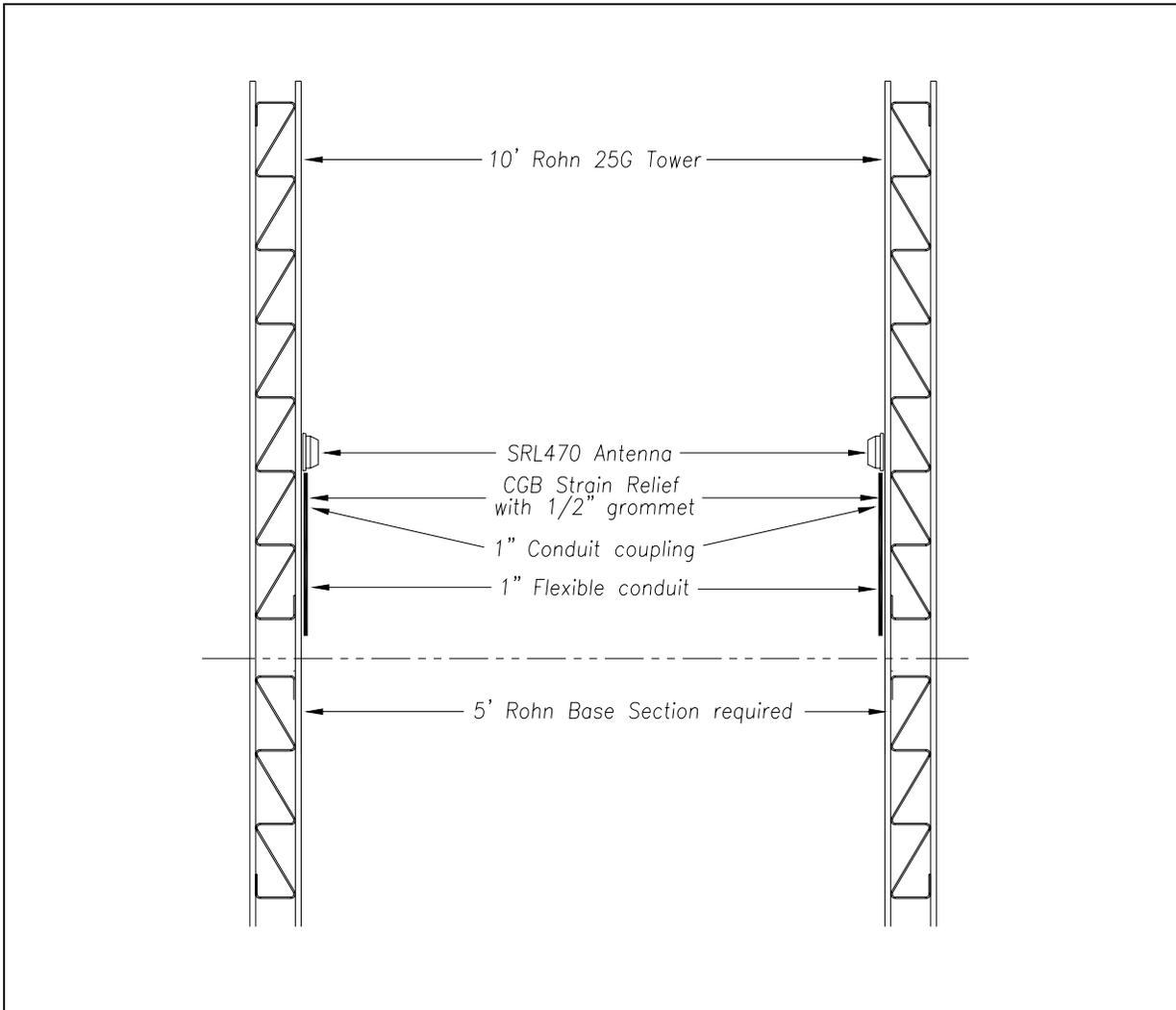


The figure below shows the trackside plan for a remote installation of a SmartScan AEI system controlled by a remote 2200-900AC Tower Enclosure.



In reference to the track, antenna1 is the northmost or eastmost antenna. Antenna2 is the southmost or westmost antenna. Also, transducer T01 is the northmost or eastmost transducer.

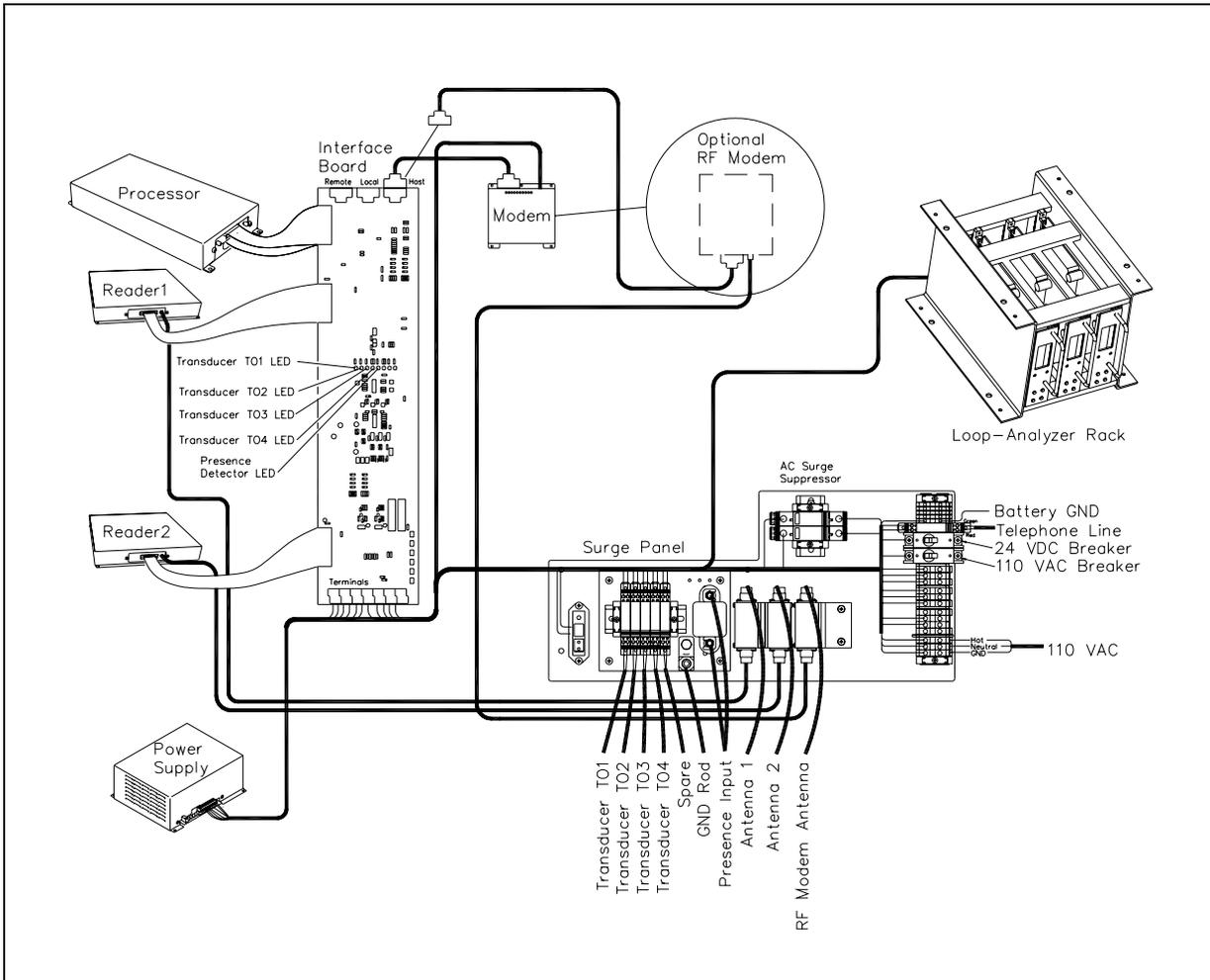
The figure below shows the tower detail for an installation of a SmartScan AEI system controlled by a remote 2200-900AC Tower Enclosure. What is shown is an aboveground tower height of 10 feet (3 meters). Your aboveground tower height might be higher.



Shown in the figure above are two SRL470 antennas. These AEI antennas (or two Scala HP9-915 Parapanel antennas) are normally used on mainline systems. SRL440 antennas are normally used on yard systems.

Install the AEI antennas with the face of the antenna parallel to the rails, 3.5 feet (1.1 meters) above the top of the rails, centered between the two pairs of transducers, and opposite each other. Mount the SRL440 antenna horizontally with its N-type socket on the side, not pointing up or down. Mount the SRL470 antenna with its N-type socket pointing down. Mount the HP9-915 antenna vertically.

The figure below shows the relationship of the components in a 2200-900AC Tower Enclosure that is attached to a track-presence loop and SAI rail-loop transducers. Most AC-powered SmartScan yard AEI systems use this configuration.



5.2 2200-900DC Tower Enclosure

This section describes how to install a solar-powered SmartScan AEI system controlled by the components of a 2200-900DC Tower Enclosure.

5.2.1 Installation Overview

Here is a typical installation task list for a solar-powered SmartScan AEI system controlled by the components of a 2200-900DC Tower Enclosure.

- 1 Do site survey to determine optimum location.
- 2 Locate all underground utilities, signal cables, and communications cables.
- 3 Order communication services.
- 4 Complete necessary trenching.

This may include boring under the track for installation of far-rail antenna conduit. Each railroad has individual requirements for trenching and boring.
- 5 Install the AEI antenna tower (or towers) and the solar-panels mounting pole foundations.

Trackside installations require foundations for one tower and one mounting pole. Remote installations require foundations for two towers and one mounting pole.
- 6 Install conduit.
- 7 Erect the AEI antenna tower (or towers) and the solar-panels mounting pole.
- 8 Install the mounting frame to the solar-panels mounting pole.
- 9 Install the enclosure bottom plate on the 2200-900DC Tower Enclosure.
- 10 Terminate conduit to bottom plate.
- 11 At trackside, install the transducers.

Zero-speed and rail-loop transducers are supported. Installation of these transducers is covered in **Chapter 4 - Track Components**.
- 12 At trackside, install the presence sensor.

Track circuits and track-presence loops are supported. Installation of these sensors is covered in **Chapter 4 - Track Components**.

- 13 Pull wiring into conduit.
- 14 Mount the 2200-900DC Tower Enclosure and then the 2200-340 Solar Battery Box.
- 15 Ground the SmartScan system.

Grounding the enclosure is covered in **5.2.3 Grounding the Enclosure**.

- 16 Install the batteries into the 2200-340 Solar Battery Box.

Installing the batteries is covered in **5.2.6 Installing the Batteries**.

- 17 If your SmartScan AEI system is using a cellular modem, mount its antenna to the solar-panel mounting pole.

Installing the modem antenna is covered in **5.2.9 Installing the Cellular Modem's Antenna**.

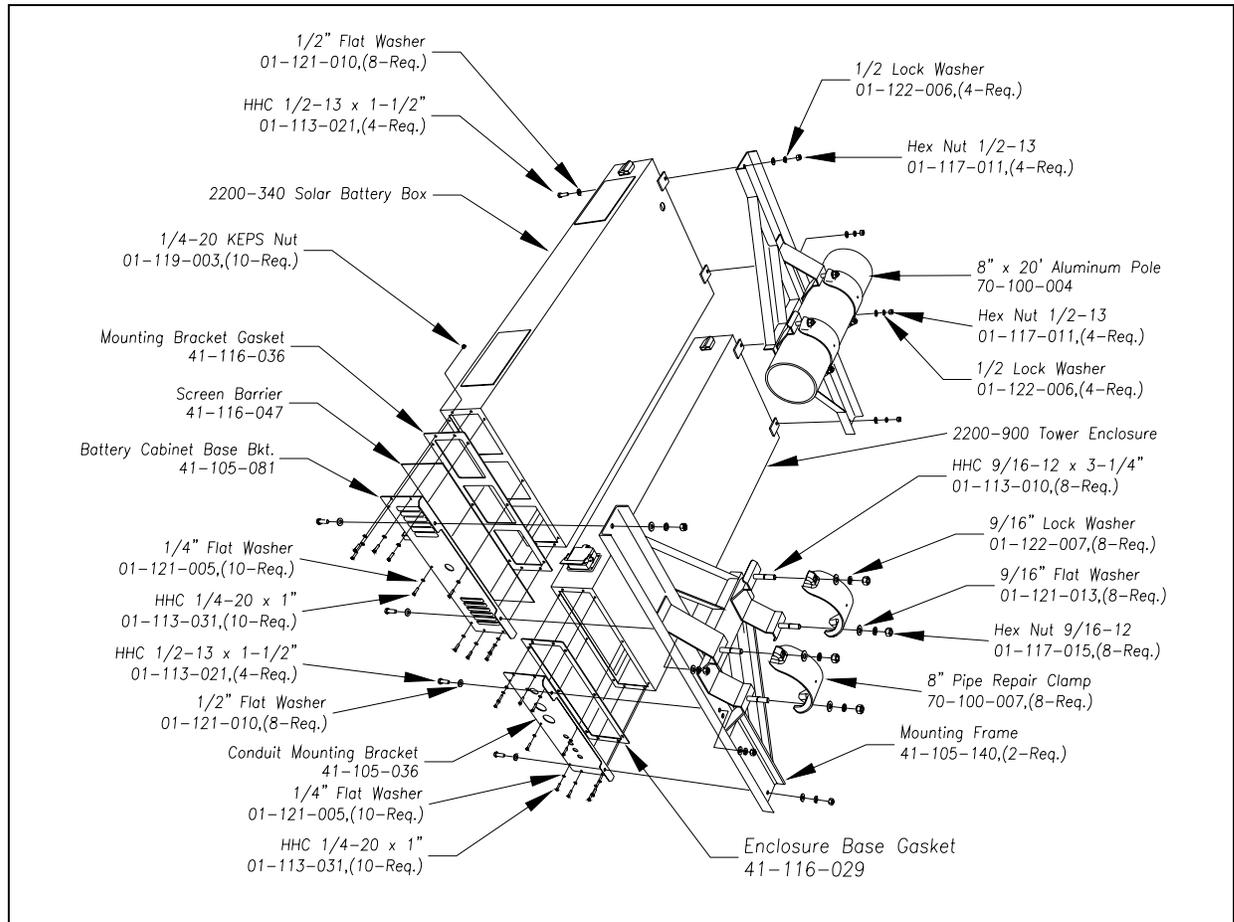
- 18 At trackside, install the AEI antennas.

In reference to the track, antenna1 is the northmost or eastmost antenna. Antenna2 is the southmost or westmost antenna. Install the AEI antennas with the face of the antenna parallel to the rails, 3.5 feet (1.1 meters) above the top of the rails, centered between the two pairs of transducers, and opposite each other. Mount the SRL440 antenna horizontally with its N-type socket on the side, not pointing up or down. Mount the SRL470 antenna with its N-type socket pointing down. Mount the HP9-915 antenna vertically.

- 19 Terminate the SmartScan wiring in the 2200-900DC Tower Enclosure.
- 20 Terminate communication wiring.
- 21 Setup and test the SmartScan system.

5.2.2 Installing the Tower Enclosure and the Battery Box

Using the manual that came with the mounting-pole assembly and the figure below, install the 2200-900DC Tower Enclosure and then the 2200-340 Solar Battery Box onto the pole.



5.2.3 Grounding the Enclosure

The 2200-900DC Tower Enclosure system is equipped with industry standard components for surge and lightning protection of the equipment attached to it. However, if the attachment to the earth ground system isn't made correctly, the surge protection equipment may not work as designed, resulting in damaged or destroyed system components.

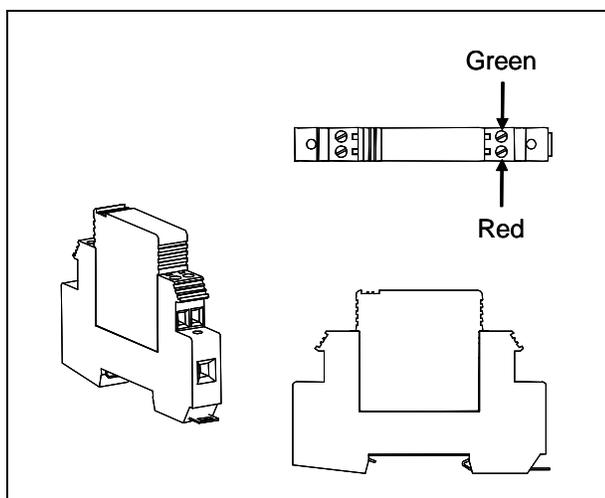
One or more ground rods should be driven at the base of the mounting pole. A second ground rod should be driven beside the tower on the far rail. If this is a remote installation, a third ground rod should be driven beside the tower on the near rail. All ground rods, the first horizontal leg of each tower, and the solar-panels mounting pole should be interconnected and exothermically bonded with a 2 AWG bare stranded copper conductor. An exothermically bonded pigtail should be run through the base plate of the enclosure and terminated at the ground lug mounted to the 2200-400 Surge Protection Panel.

5.2.4 Connecting the Telephone

Telephone service is needed only on SmartScan systems equipped with a 2200-600 Modem. If your system is equipped with a cellular modem instead, skip this section and go to **5.2.5 Connecting the AEI Antennas**.

The telephone service provider should terminate their drop on a lightning arrester terminal on the service pole. From the lightning arrester block, run a four-wire service cord to the 2200-900 Tower Enclosure and route it to the DIN rail assembly.

At the top of the DIN rail assembly is the surge protector for the telephone line. This surge protector has two tiers (one above another) of connections on each side. Looking down on the surge protector, the green wire of the incoming telephone line is terminated at the top-tier top-right terminal on this surge protector. The red wire is terminated at the top-tier bottom-right terminal. The other two phone wires (yellow and black) aren't required for SmartScan applications.



5.2.5 Connecting the AEI Antennas

For both trackside and remote installations, the far-rail antenna connection should be made with a low-loss coaxial cable such as Andrews FSJ4. Each end of the cable requires a straight type-N plug such as Andrews F4NMV2. A 24-inch (61-centimeter) RG 8U transition cable with a right-angle connector should be used at the antenna due to the stiffness of the FSJ4.

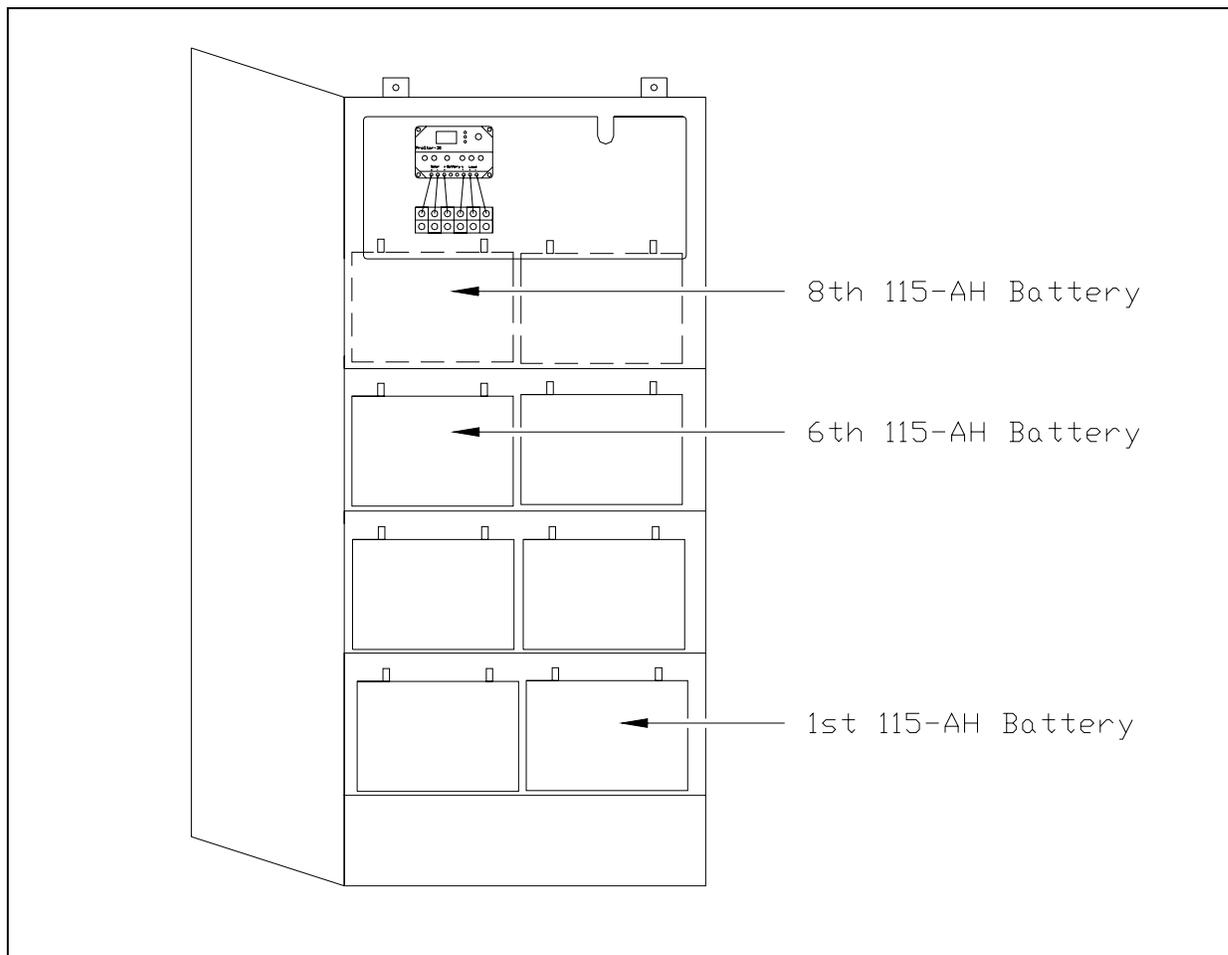
For trackside installations, the near-rail antenna is mounted to the same structure as the 2200-900DC Tower Enclosure. This connection can be made with RG8 coaxial cable with type-N connectors on both ends. It is desirable to use a right-angle connector at the antenna connection to maintain a low profile. For remote installations, the near-rail antenna connection is the same as for far-rail antenna connections.

Be sure the antenna connections are taped to prevent entrance of moisture.

In reference to the track, antenna1 is the northmost or eastmost antenna. Antenna2 is the southmost or westmost antenna.

5.2.6 Installing the Batteries

On a solar-powered SmartScan system, no batteries are stored in the 2200-900DC Tower Enclosure. All batteries are stored in the 2200-340 Solar Battery Box, which is to the right of the enclosure on a 20-foot pole topped with solar panels. Mounting points are provided in the box for four battery-support brackets. These brackets can hold a maximum of eight 12-volt 115-AH batteries wired in a series parallel arrangement to provide 24 volts to the system. The standard configuration includes six batteries with an option for two more.



Though not used in a solar-powered SmartScan system, there is still an AC circuit breaker on the DIN rail. Be sure this breaker is always kept in the OFF position.

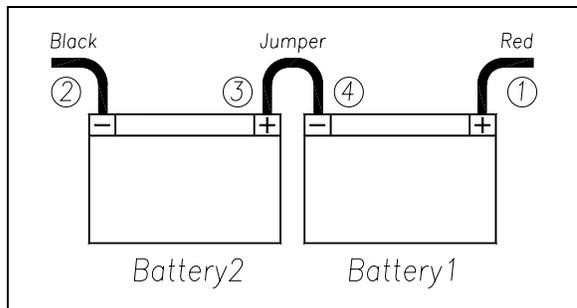
Before installing the batteries, be sure that the AC and DC circuit breakers on the DIN rail are in the OFF position.

WARNING

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

If your system uses six batteries:

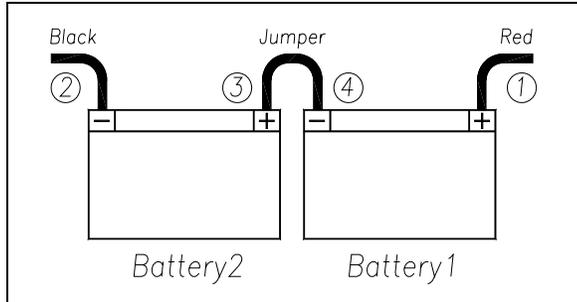
- 1 Place the batteries into the bottom-three battery-support brackets.
In each bracket, the rightmost battery is battery1. The leftmost battery is battery2.
- 2 Starting with the bottom-most bracket and moving up, attach the end of the red wire in each bracket to the plus terminal of battery1 in the same bracket.



- 3 Starting with the bottom-most bracket and moving up, attach the end of the black wire in each bracket to the negative terminal of battery2 in the same bracket.
- 4 Starting with the bottom-most bracket and moving up, attach one end of the supplied jumper to the plus terminal of battery2.
- 5 Starting with the bottom-most bracket and moving up, attach the other end of the supplied jumper to the negative terminal of battery1.

If your system uses eight batteries:

- 1 Place the batteries into the bottom-four battery-support brackets.
In each bracket, the rightmost battery is battery1. The leftmost battery is battery2.
- 2 Starting with the bottom-most bracket and moving up, attach the end of the red wire in each bracket to the plus terminal of battery1 in the same bracket.



- 3 Starting with the bottom-most bracket and moving up, attach the end of the black wire in each bracket to the negative terminal of battery2 in the same bracket.
- 4 Starting with the bottom-most bracket and moving up, attach one end of the supplied jumper to the plus terminal of battery2.
- 5 Starting with the bottom-most bracket and moving up, attach the other end of the supplied jumper to the negative terminal of battery1.

WARNING

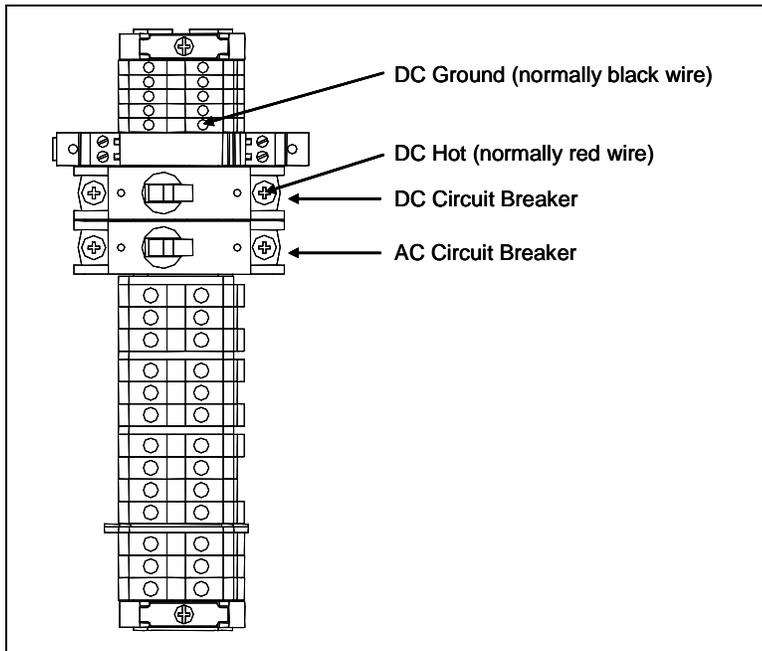
In operation, batteries generate and release flammable hydrogen gas, which, if ignited by a burning cigarette, naked flame, or spark, may cause battery explosion with dispersion of casing fragments and corrosive liquid electrolyte. So, carefully follow manufacturer's instructions for installation and service. Keep all sources of gas ignition away from the batteries and do not allow metallic articles to contact the negative and positive terminals of a battery at the same time.

WARNING

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

5.2.7 Connecting to External DC

The power requirements of the SmartScan equipment mounted in the 2200-900DC Tower Enclosure are relatively modest. Typically, a 10-ampere continuous 24 VDC power source is more than adequate. The power is routed from the 2200-340 Solar Battery Box to the enclosure. DIN rail terminals are provided for termination of the incoming DC. The 2200-900DC Tower Enclosure is prewired from the DIN rail.



Before connecting the external DC to the SmartScan system, be sure that the incoming DC wiring is not live and that the AC and DC circuit breakers on the DIN rail are in the OFF position.

To connect the external DC to the SmartScan system:

- 1 Turn off all incoming DC power before continuing.
You can turn off all incoming DC power by pressing the manual disconnect button on the Solar Charge Controller mounted to the inside top left of the 2200-340 Solar Battery Box.
- 2 Using a DC voltmeter, verify that the incoming DC power is dead.
Your DC cable should have two wires protruding from it.
- 3 Attach the DC ground wire (the black wire) to the right terminal just above the telephone surge protector.
- 4 Attach the DC hot wire (the red wire) to the right side of the DC circuit breaker.
- 5 Turn on incoming DC power.
- 6 Toggle the DC circuit breaker on.

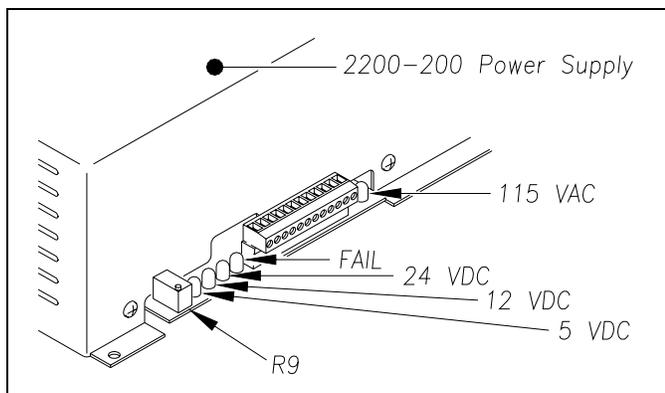
5.2.8 Verifying DC Voltage

Before verifying DC voltage, be sure that the DC circuit breaker on the DIN rail is in the **ON** position and that the AC circuit breaker on the DIN rail is in the **OFF** position.

To verify the three DC voltages:

The next steps should be done when sun-energy is reaching the solar panels.

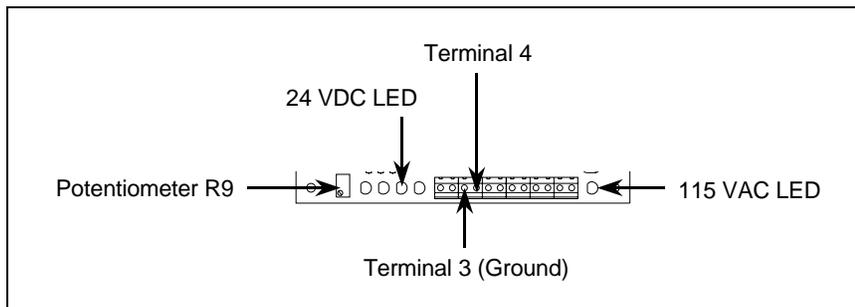
- 1 If the DC circuit breaker is off, toggle it on.
- 2 If sunlight isn't reaching the solar panels, wait until it is.
- 3 If the **24 VDC**, **12 VDC**, **5 VDC**, and **Fail** LEDs on the edge of the 2200-200 Power Supply aren't lit, fix this problem before continuing.



On a solar-powered system, the **115 VAC** LED isn't lit and potentiometer **R9** isn't functional.

Chapter 9 - Troubleshooting tells how to fix problems with the power input and with the 2200-200 Power Supply.

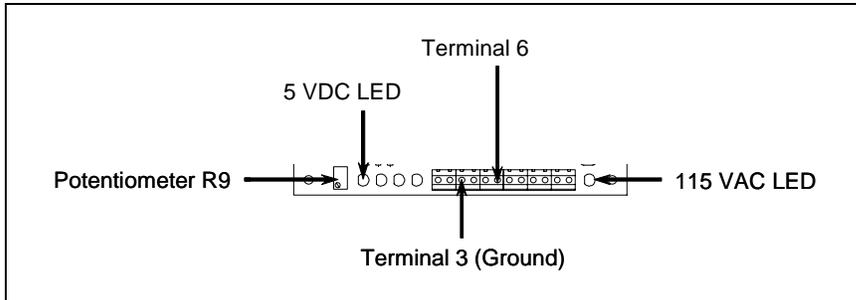
- 4 Using a DC voltmeter, touch the black lead to terminal 3 on terminal block TB1 (on the outside of the 2200-200 Power Supply).



- 5 Touch the red lead to terminal 4 on terminal block TB1 (on the outside of the 2200-200 Power Supply).

If sun-energy is reaching the solar panels, voltage should measure between 24 and 28 VDC. Also, if the battery bank is adequately charged, voltage should measure between 24 and 28 VDC.

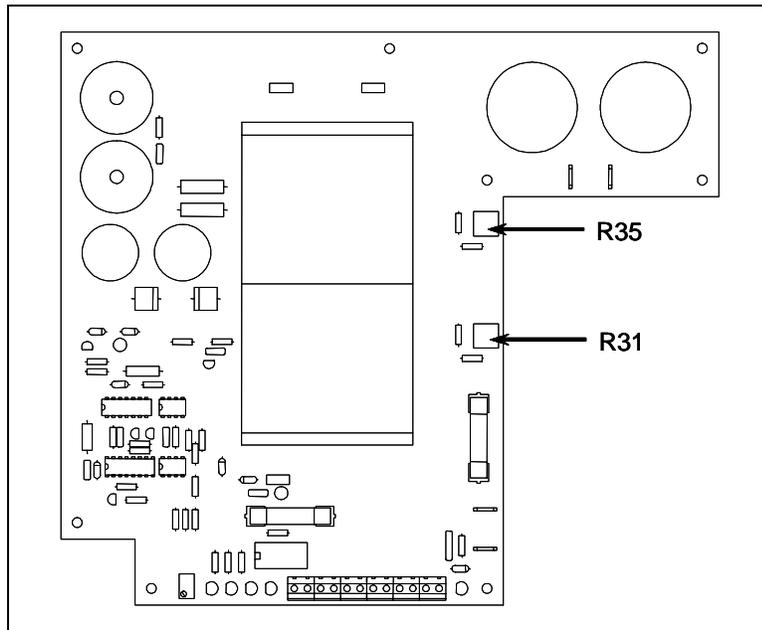
- 6 If the measured voltage isn't between 24 and 28 VDC, fix this problem before continuing.
- 7 Using a DC voltmeter, touch the black lead to terminal 3 on terminal block TB1 (on the outside of the 2200-200 Power Supply).



- 8 Touch the red lead to terminal 6 on terminal block TB1 (on the outside of the 2200-200 Power Supply).
- 9 If the voltage isn't between 5.0 and 5.2 VDC:
 - a Toggle the DC circuit breaker off.
 - b On the part of the Power Supply board that is protruding from the 2200-200 Power Supply, separate the plug of the terminal block from its header.
 - c Remove the four screws securing the 2200-200 Power Supply to the enclosure.
 - d Separate the 2200-200 Power Supply from the enclosure.
 - e Remove the three fasteners securing the 2200-200 Power Supply cover to its base.
 - f Separate the cover of the 2200-200 Power Supply from its base.

The Power Supply board is now exposed with its components in view.
 - g Without its cover, reattach the base of the 2200-200 Power Supply to the enclosure.
 - h Reconnect the plug of the terminal block to its header.
 - i Toggle the DC circuit breaker on.

- j** Using a small insulated screwdriver, adjust potentiometer **R35** until the voltmeter shows 5.1 VDC.



Turn **R35** clockwise to increase the voltage. Turn it counterclockwise to decrease the voltage.

- k** If a properly functioning and properly used voltmeter cannot be made to show 5.1 VDC, replace the 2200-200 Power Supply and retest.
- l** If you replaced the 2200-200 Power Supply and the voltmeter still cannot be made to show 5.1 VDC, call STC for help in isolating the problem.
- m** Toggle the DC circuit breaker off.
- n** Separate the plug of the terminal block from its header.
- o** Remove the four screws securing the base of the 2200-200 Power Supply to the enclosure.
- p** Separate the base of the 2200-200 Power Supply from the enclosure.
- q** Reattach the cover of the 2200-200 Power Supply to its base.
- r** Reattach the 2200-200 Power Supply to the enclosure.
- s** Reconnect the plug of the terminal block to its header.
- t** Toggle the DC circuit breaker on.
- 10** Using a DC voltmeter, touch the black lead to terminal 3 on terminal block TB1 (on the outside of the 2200-200 Power Supply).
- 11** Touch the red lead to terminal 8 on terminal block TB1 (on the outside of the 2200-200 Power Supply).

12 If the voltage isn't between 12.4 and 12.6 VDC:

- a** Toggle the DC circuit breaker off.
- b** On the part of the Power Supply board that is protruding from the 2200-200 Power Supply, separate the plug of the terminal block from its header.
- c** Remove the four screws securing the 2200-200 Power Supply to the enclosure.
- d** Separate the 2200-200 Power Supply from the enclosure.
- e** Remove the three fasteners securing the 2200-200 Power Supply cover to its base.
- f** Separate the cover of the 2200-200 Power Supply from its base.
The Power Supply board is now exposed with its components in view.
- g** Without its cover, reattach the base of the 2200-200 Power Supply to the enclosure.
- h** Reconnect the plug of the terminal block to its header.
- i** Toggle the DC circuit breaker on.
- j** Using a small insulated screwdriver, adjust potentiometer **R31** until the voltmeter shows 12.5 VDC.
Turn **R31** clockwise to increase the voltage. Turn it counterclockwise to decrease the voltage.
- k** If a properly functioning and properly used voltmeter cannot be made to show 12.5 VDC, replace the 2200-200 Power Supply and retest.
- l** If you replaced the 2200-200 Power Supply and the voltmeter still cannot be made to show 12.5 VDC, call STC for help in isolating the problem.
- m** Toggle the DC circuit breaker off.
- n** Separate the plug of the terminal block from its header.
- o** Remove the four screws securing the base of the 2200-200 Power Supply to the enclosure.
- p** Separate the base of the 2200-200 Power Supply from the enclosure.
- q** Reattach the cover of the 2200-200 Power Supply to its base.
- r** Reattach the 2200-200 Power Supply to the enclosure.
- s** Reconnect the plug of the terminal block to its header.
- t** Toggle the DC circuit breaker on.

13 Toggle the DC circuit breaker on.

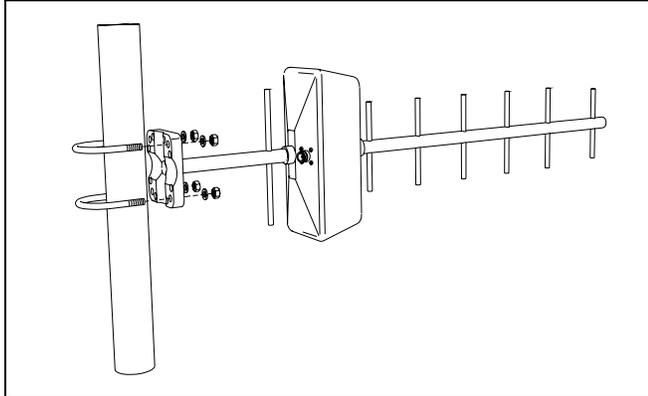
5.2.9 Installing the Cellular Modem's Antenna

Not all SmartScan AEI systems use a cellular modem. If yours doesn't, skip this section.

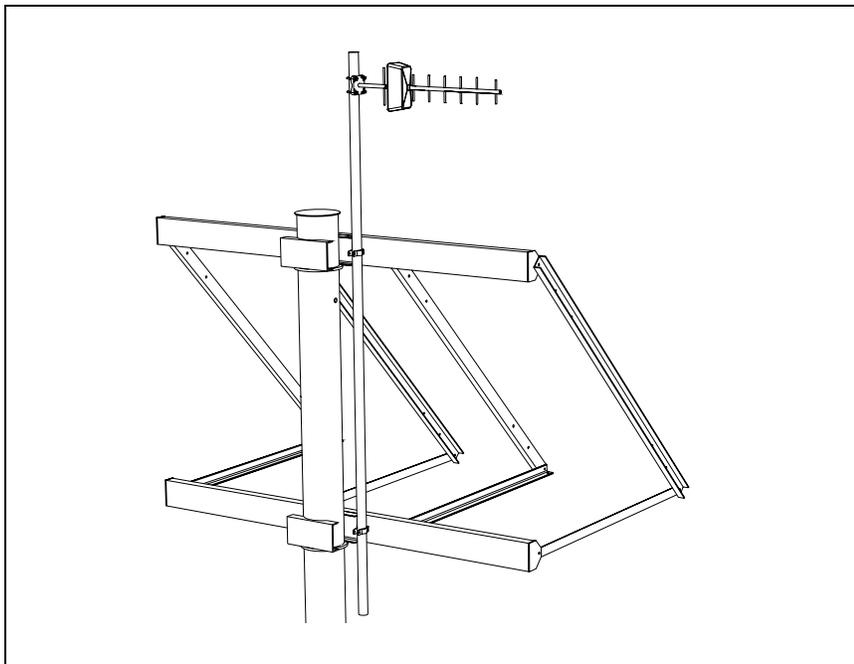
If a cellular modem is used, install its antenna above the solar panels.

To install the antenna:

- 1 Mount the antenna to the 10-foot antenna pole, as shown below.



- 2 Mount the antenna pole to the solar-panel mounting frame, as shown below.



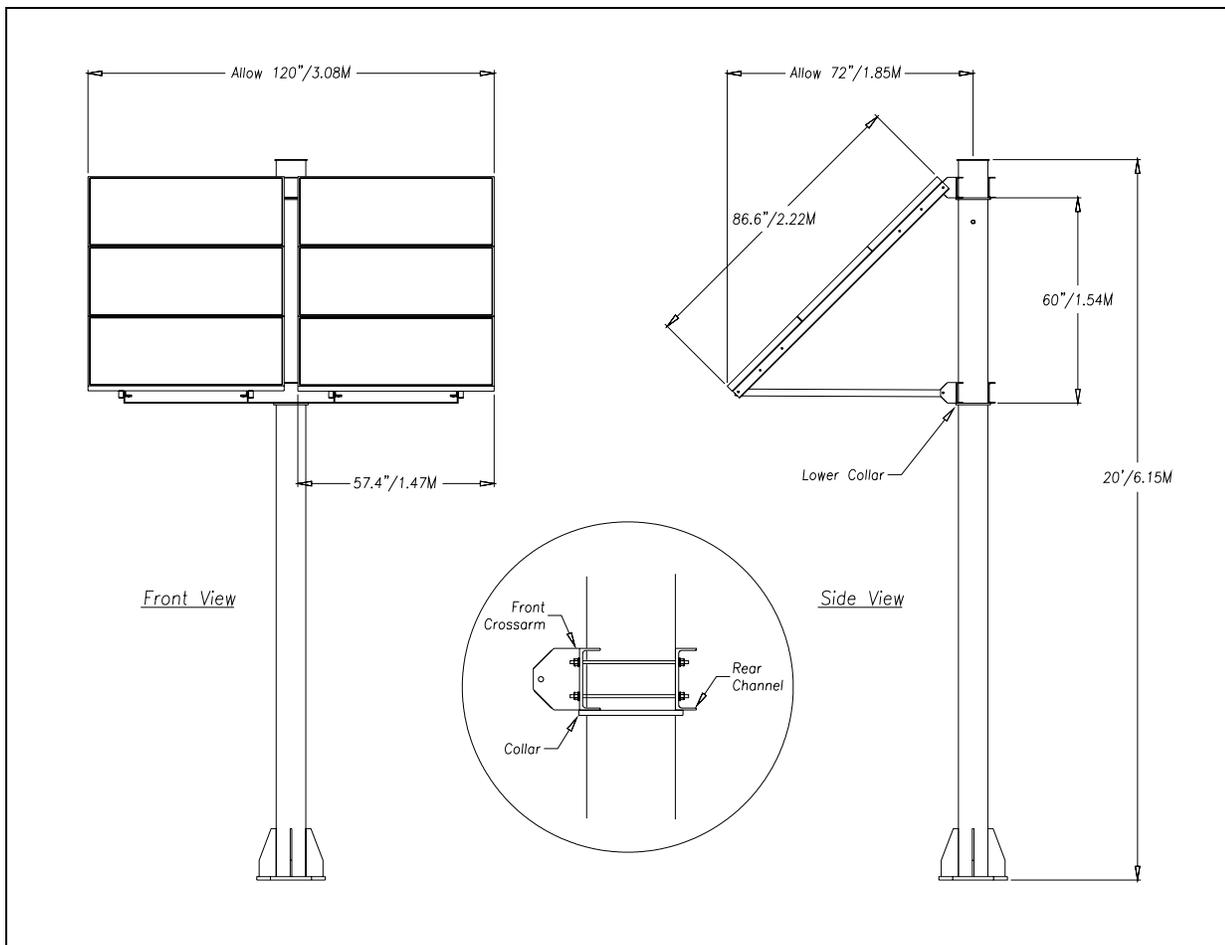
- 3 Be sure the drain hole in the antenna is facing down.
- 4 Connect the N-type connector on one end of a coaxial cable to the antenna.

- 5 Route the coaxial cable from the antenna to the Joslyn coaxial lightning arrester inside the enclosure.
- 6 Install an N-type connector on the other end of the coaxial cable.
- 7 Connect the N-type connector to the end of the arrester opposite the transceiver's connection.

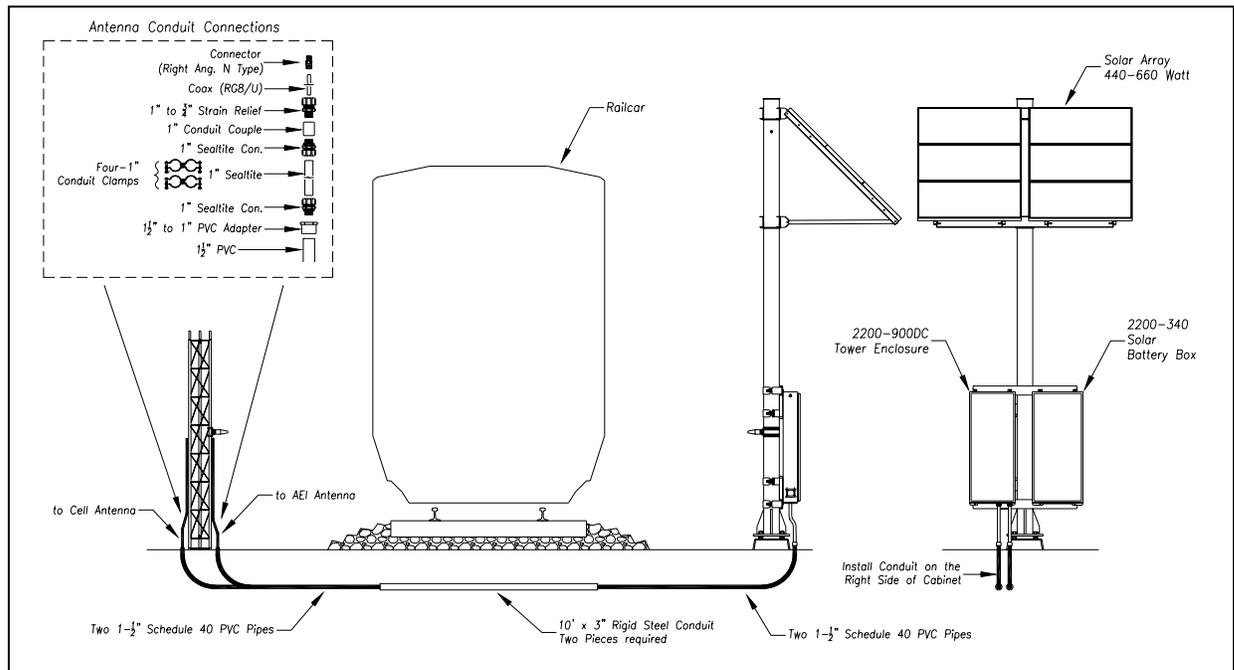
5.2.10 Trackside Installation Drawings

This section provides the SmartScan user with typical trackside installation guidelines that can be adapted to their specific application. Typical remote installation references and guidelines are covered in the next section, **5.2.11 Remote Installation Drawings**.

The figure below shows the dimensions of the solar-array panel and mounting pole.



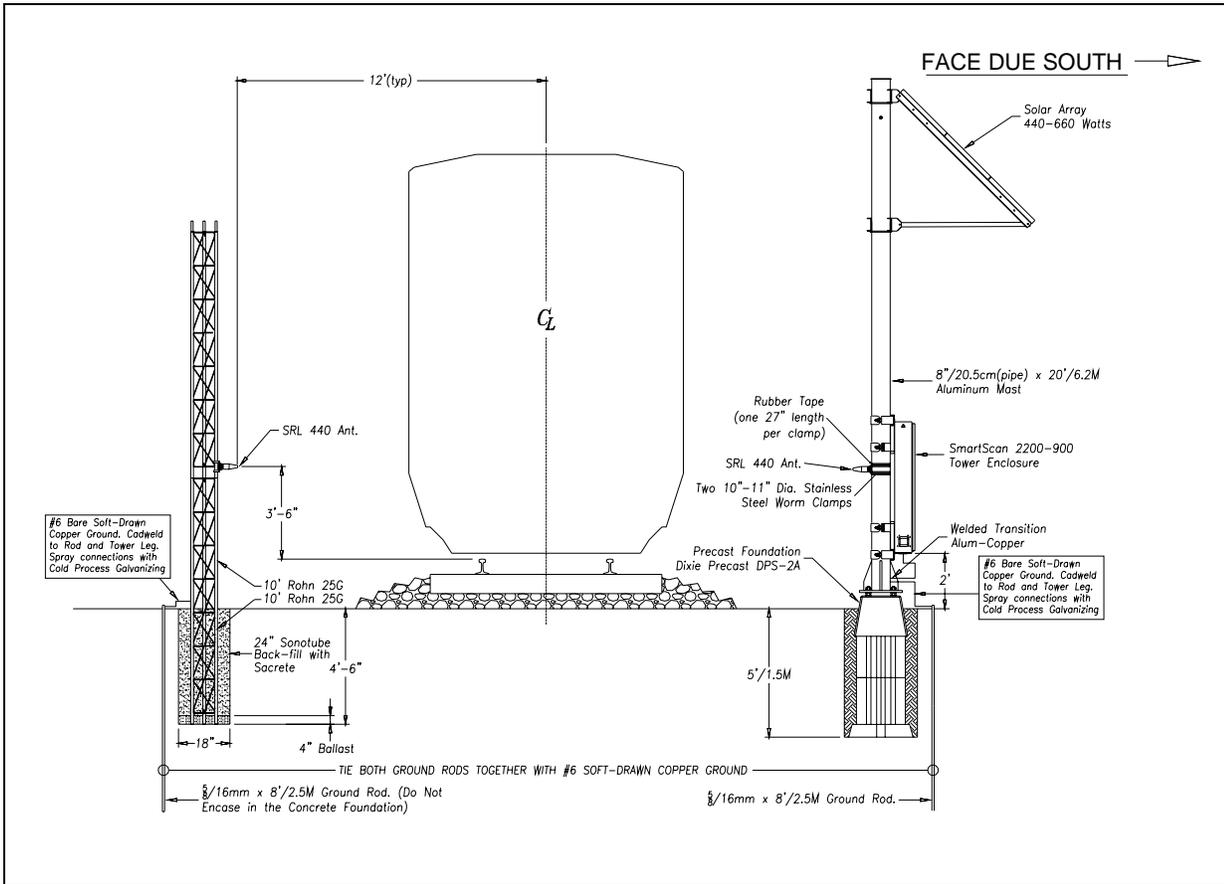
The next three figures show the trackside part of an installation of a SmartScan AEI system controlled by a trackside 2200-900DC Tower Enclosure.

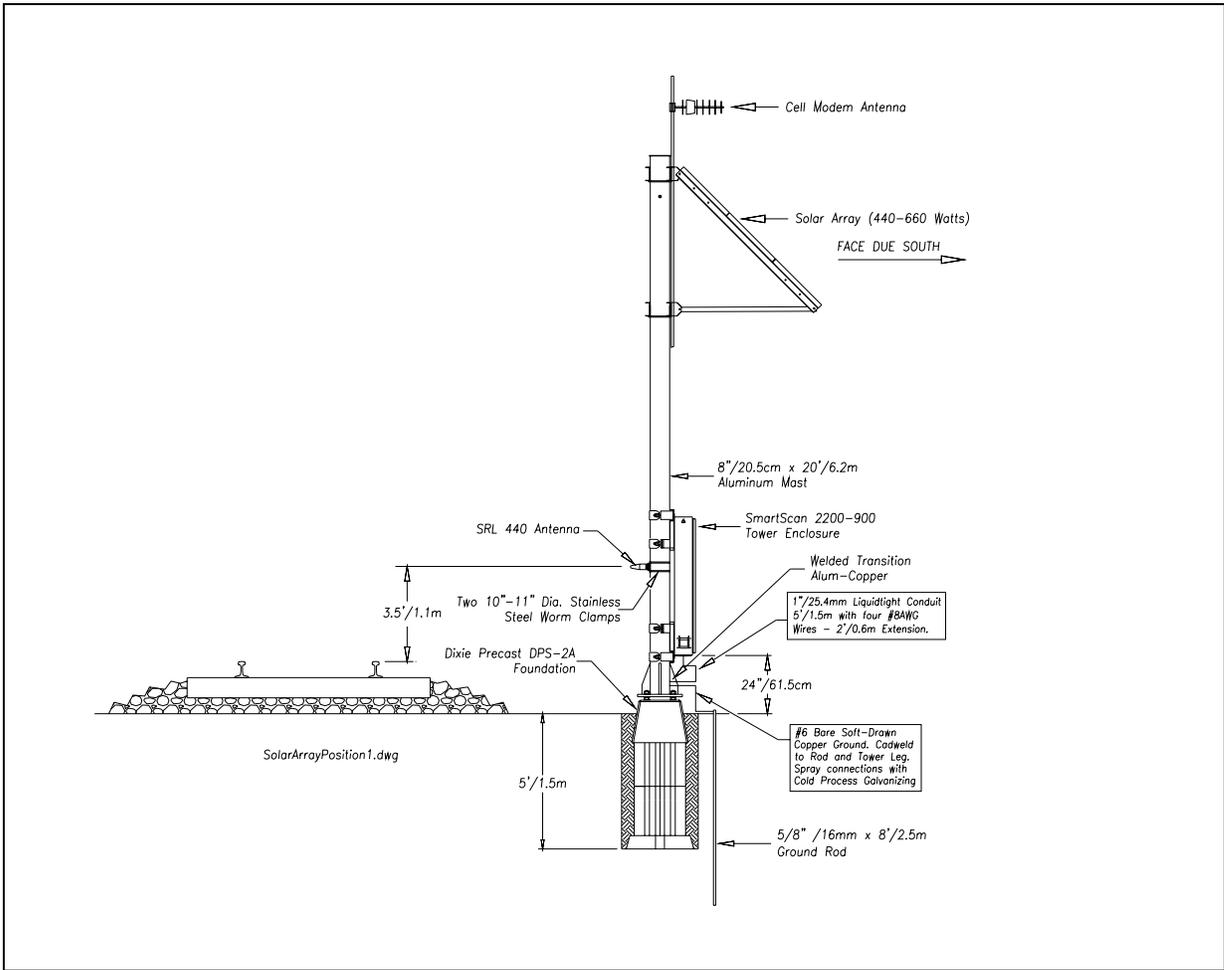


In reference to the track, antenna1 is the northmost or eastmost antenna. Antenna2 is the southmost or westmost antenna. Also, transducer TO1 is the northmost or eastmost transducer.

Shown in the figure above are two SRL440 antennas. These AEI antennas are normally used on yard systems. SRL470 antennas (or HP9-915 antennas) are normally used on mainline systems.

Install the AEI antennas with the face of the antenna parallel to the rails, 3.5 feet (1.1 meters) above the top of the rails, centered between the two pairs of transducers, and opposite each other. Mount the SRL440 antenna horizontally with its N-type socket on the side, not pointing up or down. Mount the SRL470 antenna with its N-type socket pointing down. Mount the HP9-915 antenna vertically.



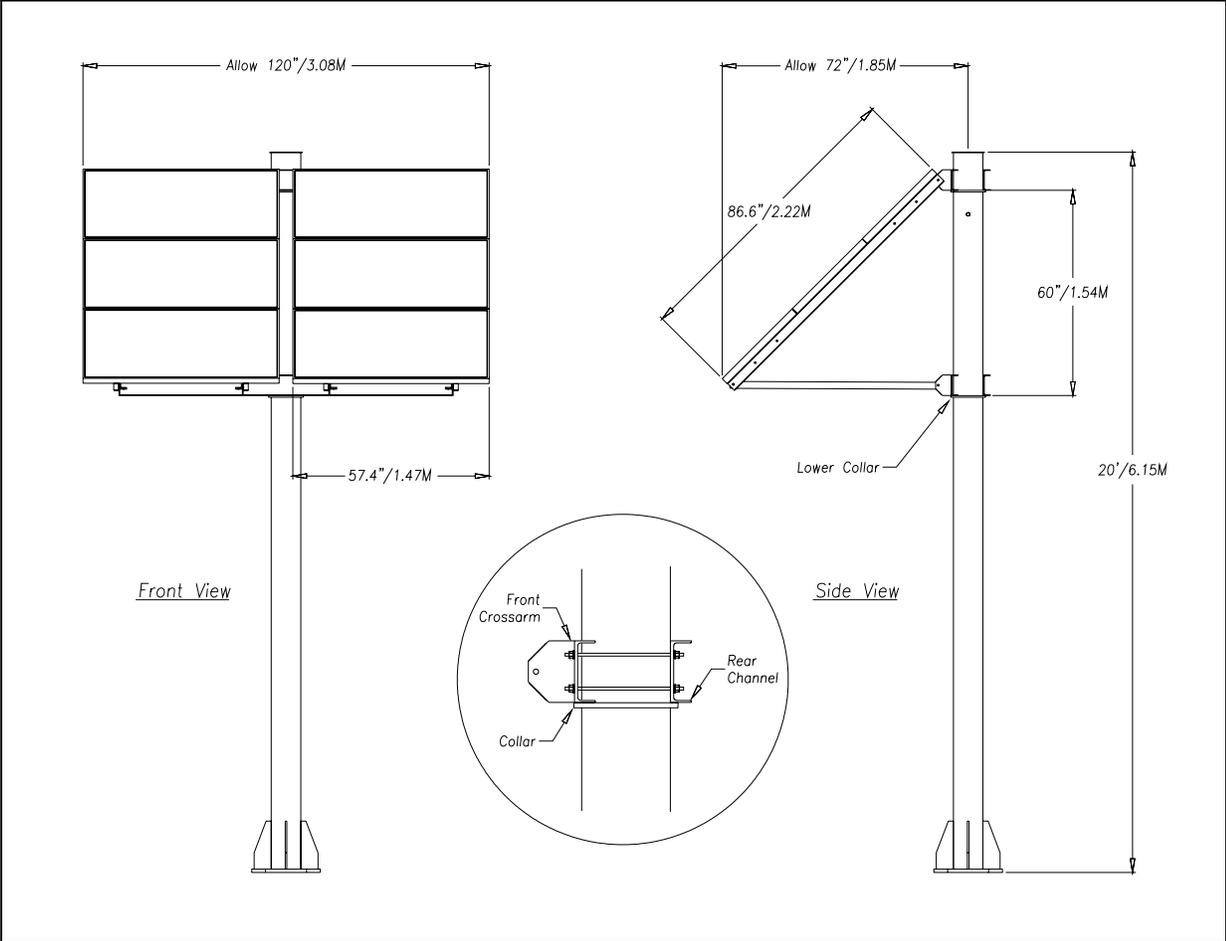


In the figure above, the cellular modem's antenna is pointing in the same direction as the solar panel. This alignment might not be best for you. The solar panels should always point due south. The cellular modem's antenna should always point in the direction of the highest receivable signal strength.

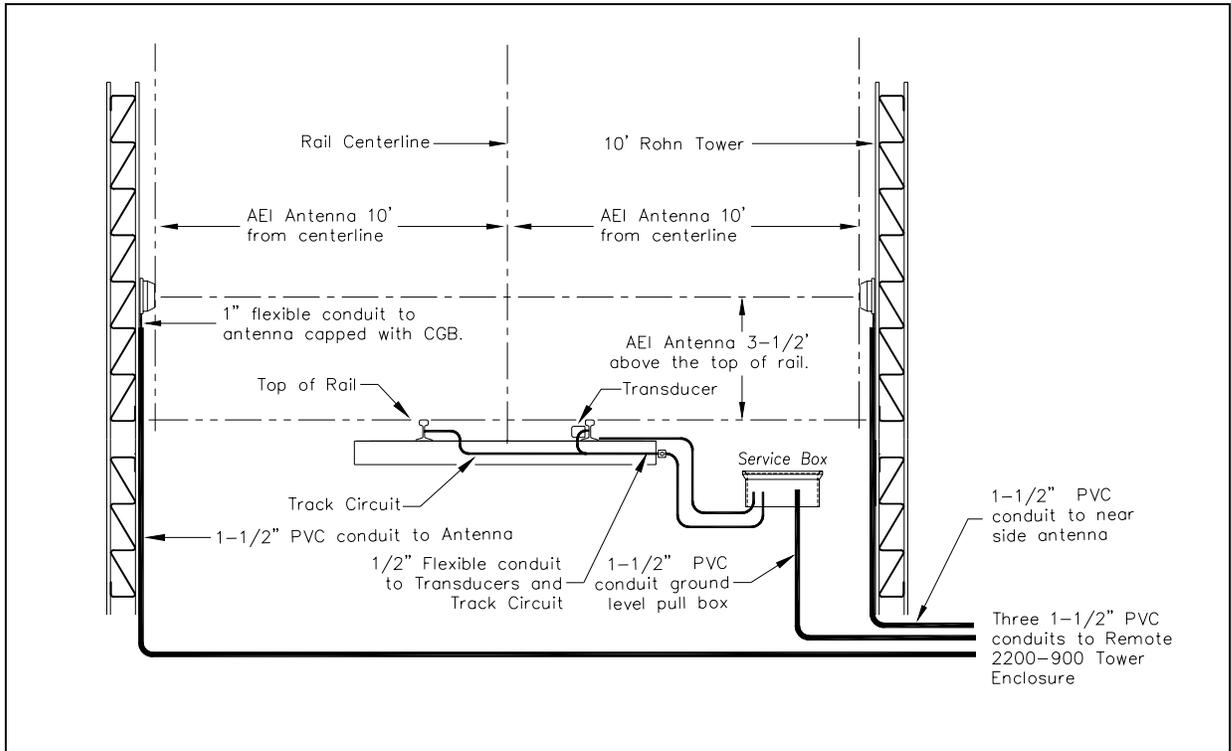
5.2.11 Remote Installation Drawings

This section provides the SmartScan user with typical remote installation guidelines that can be adapted to their specific application. Typical trackside installation references and guidelines are covered in the prior section, **5.2.10 Trackside Installation Drawings**.

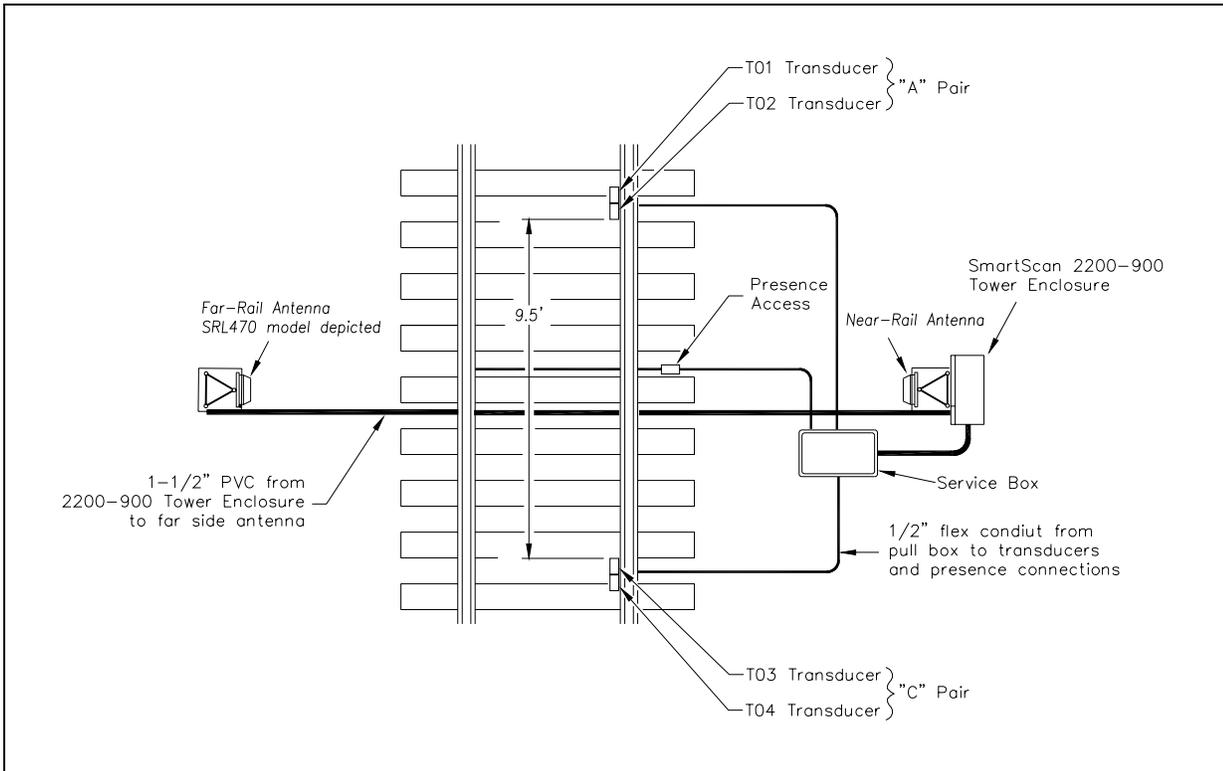
The figure below shows the dimensions of the solar-array panel and mounting pole.



The figure below shows the trackside part of an installation of a SmartScan AEI system controlled by a remote 2200-2200-900DC Tower Enclosure. What is shown is an aboveground tower height of 10 feet (3 meters). Your aboveground tower height might be higher.

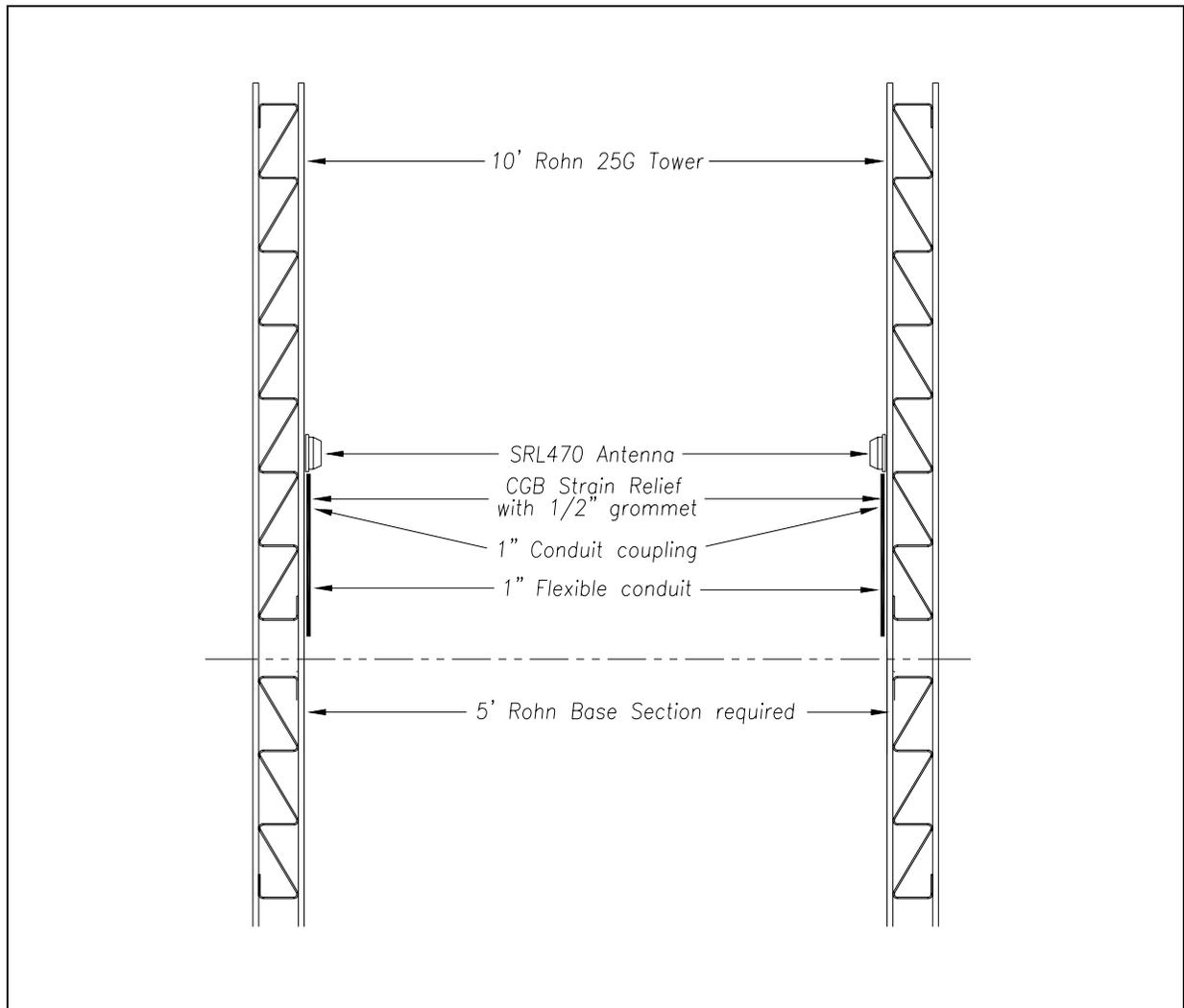


The figure below shows the trackside plan for an installation of a SmartScan AEI system controlled by a remote 2200-900DC Tower Enclosure.



In reference to the track, antenna1 is the northmost or eastmost antenna. Antenna2 is the southmost or westmost antenna. Also, transducer TO1 is the northmost or eastmost transducer.

The figure below shows the tower detail for an installation of a SmartScan AEI system controlled by a remote 2200-900DC Tower Enclosure. What is shown is an aboveground tower height of 10 feet (3 meters). Your aboveground tower height might be higher.

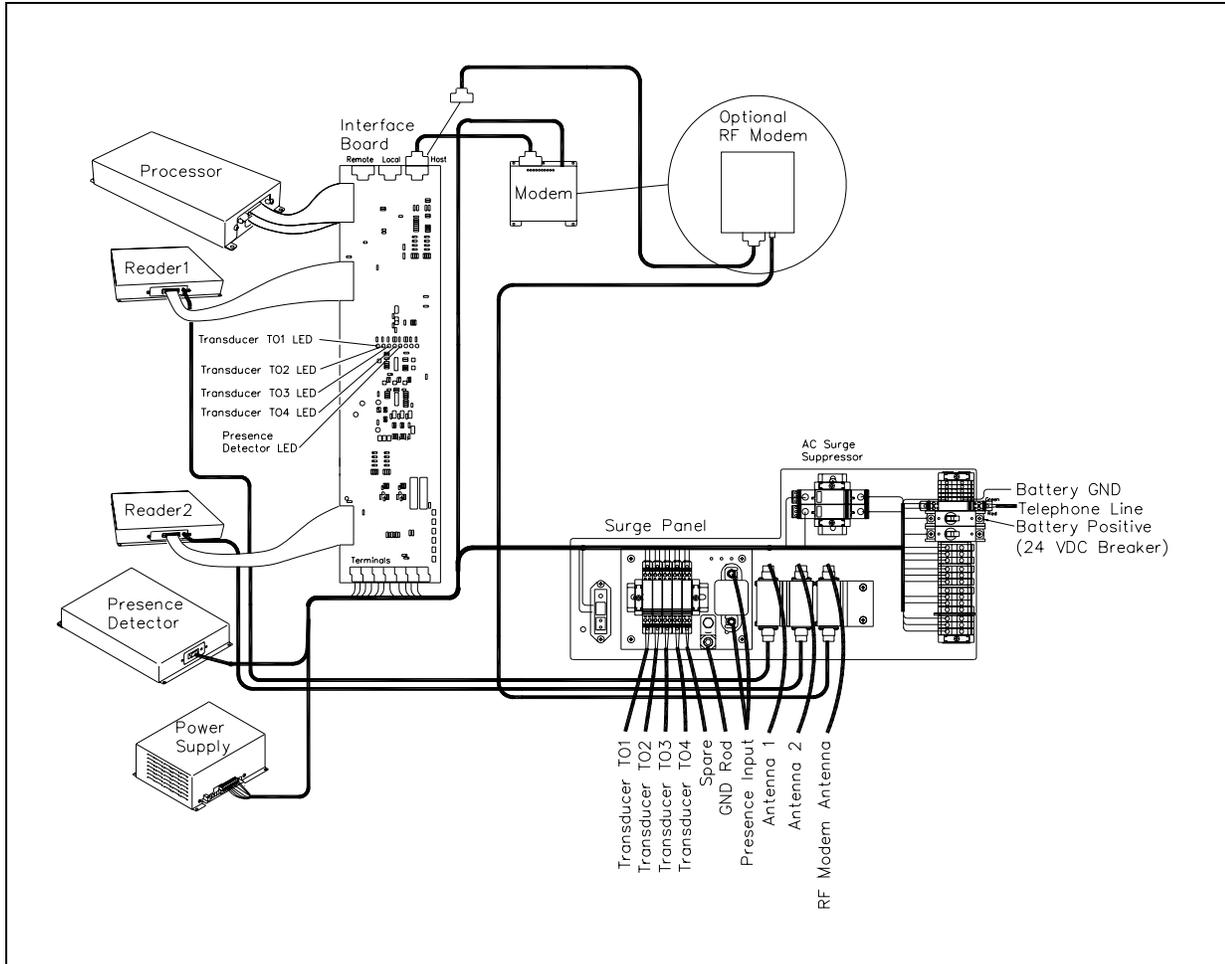


Shown in the figure above are two SRL470 antennas. These AEI antennas (or two Scala HP9-915 Parapanel antennas) are normally used on mainline systems. SRL440 antennas are normally used on yard systems.

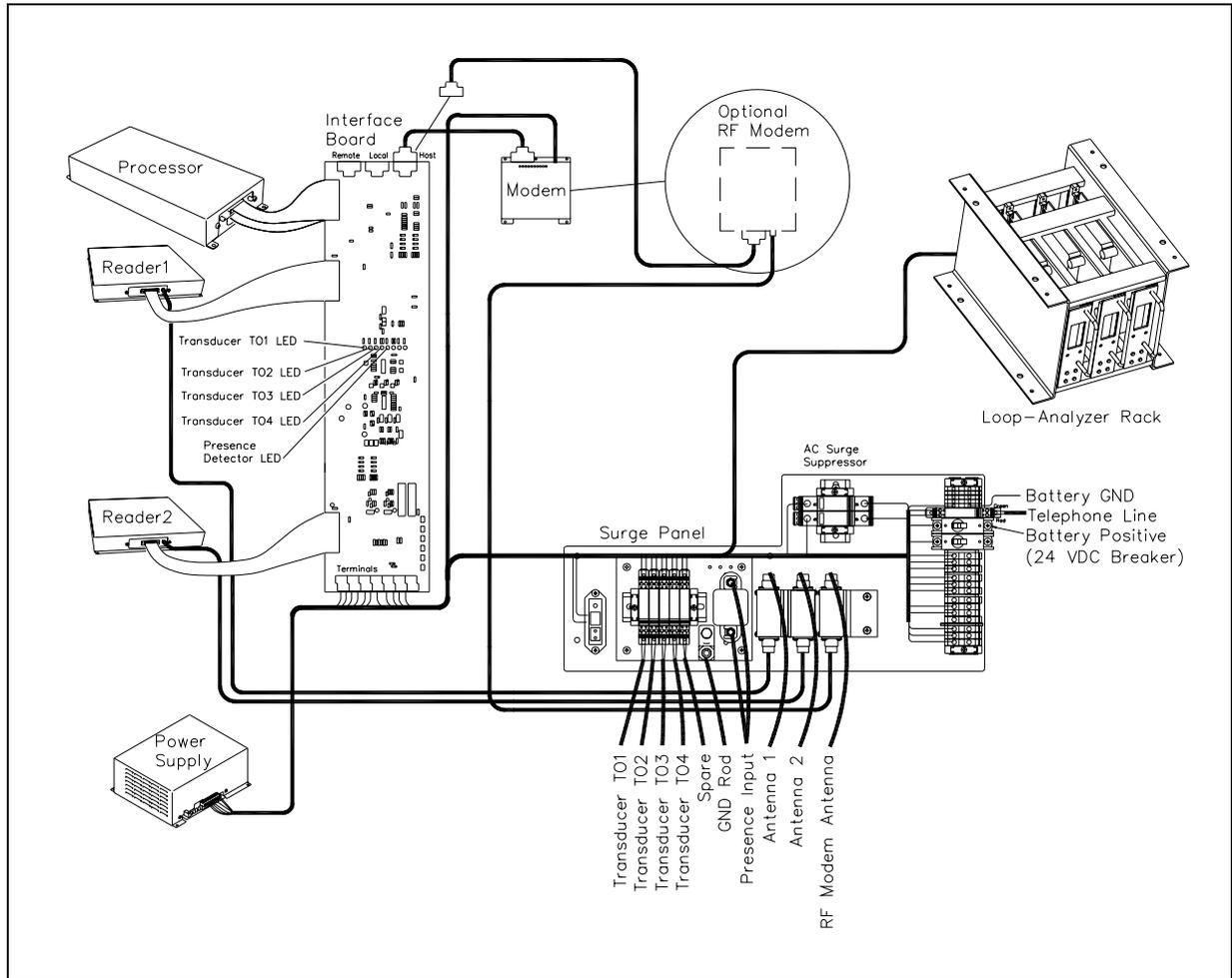
Install the AEI antennas with the face of the antenna parallel to the rails, 3.5 feet (1.1 meters) above the top of the rails, centered between the two pairs of transducers, and opposite each other. Mount the SRL440 antenna horizontally with its N-type socket on the side, not pointing up or down. Mount the SRL470 antenna with its N-type socket pointing down. Mount the HP9-915 antenna vertically.

5.2.12 Component-Relationship Diagrams

The figure below shows the relationship of the components in a 2200-900DC Tower Enclosure that is attached to a track circuit and Honeywell zero-speed transducers. Most solar-powered SmartScan mainline AEI systems use this configuration.



The figure below shows the relationship of the components in a 2200-900DC Tower Enclosure that is attached to a track-presence loop and SAI rail-loop transducers. Most solar-powered SmartScan yard AEI systems use this configuration.



5.3 2200-950 Inside Enclosure

This section describes how to install a SmartScan AEI system controlled by the components of a 2200-950 Inside Enclosure.

5.3.1 Installation Overview

Here is a typical installation task list for a SmartScan AEI system controlled by the components of a 2200-950 Inside Enclosure.

- 1 Do site survey to determine optimum location.
- 2 Locate all underground utilities, signal cables, and communications cables.

- 3 Order power and communication services.
- 4 Complete necessary trenching.

This may include boring under the track for installation of far-rail antenna conduit. Each railroad has individual requirements for trenching and boring.
- 5 Install the antenna tower foundations.
- 6 Install or prepare the bungalow.
- 7 At trackside, install a service box.
- 8 Install conduit.
- 9 At trackside, erect the antenna towers.
- 10 At trackside, install the zero-speed transducers.

Installing transducers is covered in **Chapter 4 - Track Components**.
- 11 At trackside, install the track circuit.

Installing track circuits is covered in **Chapter 4 - Track Components**.
- 12 Pull wiring into conduit.
- 13 If your 2200-950 Inside Enclosure was shipped in a crate, mount it in the bungalow.

Installing the enclosure is covered in **5.3.2 Installing the Enclosure**.
- 14 Ground the 2200-950 Inside Enclosure.

Grounding the enclosure is covered in **5.3.3 Grounding the Enclosure**.
- 15 If your 2200-950 Inside Enclosure was shipped in a bungalow, install the modules.

Installing the modules is covered in **5.3.4 Installing the Modules**.
- 16 If your SmartScan AEI system is using a cellular modem, mount it in the bungalow.

Installing the cellular modem is covered in **5.3.10 Installing the Cellular Modem and Its Antenna**.
- 17 If your SmartScan AEI system is using a cellular modem, mount its antenna to the outside of the building.
- 18 Install the backup batteries.

Installing the batteries is covered in **5.3.9 Connecting the Batteries**.
- 19 At trackside, install the AEI antennas.

In reference to the track, antenna1 is the northmost or eastmost antenna. Antenna2 is the southmost or westmost antenna. Install the AEI antennas with the face of the antenna parallel to the rails, 3.5 feet (1.1 meters) above the top of the rails, centered between the two pairs of transducers, and opposite each other. Mount the SRL440 antenna horizontally with its N-type socket on the side, not pointing up or down. Mount the SRL470 antenna with its N-type socket pointing down. Mount the HP9-915 antenna vertically.

- 20 Terminate the SmartScan wiring in the 2200-950 Inside Enclosure.
- 21 Terminate power and communication wiring.
- 22 Setup and test the SmartScan AEI system.

5.3.2 Installing the Enclosure

If your 2200-950 Inside Enclosure was shipped in a crate, you'll need to install it. If it was shipped in a bungalow instead, skip this section and go to **5.3.3 Grounding the Enclosure**.

The enclosure has six, symmetrically placed 5/16-inch holes in the base panel. Using these holes and 1/4 x 1-inch lag screws, the enclosure can be mounted to any flat surface.

Mount the enclosure about 24 inches (61 centimeters) above the floor. Doing so positions the modules at a convenient height for installation and servicing. The enclosure should be mounted within 12 inches (30.5 centimeters) of a 120-volt AC source, equipped with a twist-lock outlet. The enclosure is provided with a 24-inch (61-centimeter) power cord, equipped with a twist-lock plug.

5.3.3 Grounding the Enclosure

The 2200-950 Inside Enclosure system is equipped with industry standard components for surge and lightning protection of the equipment attached to it. However, if the attachment to the earth ground system isn't made correctly, the surge protection equipment may not work as designed, resulting in damaged or destroyed system components.

A minimum of two driven grounds should be installed at opposite corners of the bungalow in which the 2200-950 Inside Enclosure is installed. A third driven ground should be installed at the power pole to which the AC power connection is made. All three ground rods should be interconnected and exothermically bonded with a 2 AWG bare stranded copper conductor. A minimum of two #2 copper transitions welded to the skin of the bungalow should be exothermically bonded to the driven grounds at the corners of the bungalow. An exothermically bonded pigtail should be run through the floor of the bungalow and terminated at the ground lug mounted on the copper plate inside the bottom of the enclosure.

5.3.4 Installing the Modules

If your 2200-950 Inside Enclosure was shipped in a bungalow, you'll need to install the system modules. If it was shipped in a crate instead, skip this section and go to **5.3.5 Connecting the Telephone**.

When the system arrives, the modules won't be installed. They are packed separately to prevent damage during shipment. Remove the modules from their packaging material and check for damage. (A bag of Keps-nuts is taped to the front of the enclosure.)

Most of the system modules are mounted on the front panel of the enclosure. Mounting studs are provided for each module. Slight differences in size dictate where the modules are installed and connected to the 2200-300 Interface board. Beginning at the top, install the modules in the following order.

- 2200-100 Processor
- 2200-504TA Reader, which is used with antenna1
- 2200-504TB Reader, which is used with antenna2
- 2200-500 Presence Detector
- 2200-200 Power Supply

Each module is secured to the panel with four Keps-nuts. Ribbon cables provide connections to the 2200-300 Interface board. The remaining connections are provided through a wire harness with appropriate connectors at the attachment points to the modules.

Starting at the top, slide the 2200-100 Processor onto the four mounting studs and secure it with four Keps-nuts. The connectors should be facing the right side of the panel. Using a nut driver, tighten the nuts until they are snug. The Keps-nuts must be tight, but not overtight. The serrated washer on the Keps-nut provides a ground connection between the attached module and the 2200-950 Inside Enclosure. They must be tight enough to bite through the paint on the cover of each module.

Four ribbon cables are rolled up and placed in pockets on the side of the enclosure's front panel. Each cable is attached to the 2200-300 Interface board mounted inside the front panel. Unroll the top two ribbon cables and extend them to the 2200-100 Processor. Plug each into the mating connector on the processor and secure it with the captive screws in the connector.

Next, install the 2200-504TA Reader under the 2200-100 Processor and the 2200-504TB Reader under it. The only difference between the 2200-504TA and 2200-504TB Readers is their operating frequency. The 2200-504TA Reader operates at 911.5 megahertz. The 2200-504TB Reader operates at 918.5 megahertz. Different frequencies prevent interference between readers. Always install the 2200-504TA Reader as reader1 (with input coming from antenna1) and the 2200-504TB Reader as reader2 (with input coming from antenna2).

The control cables for the readers are attached in the same manner as the processor cable. Each reader cable also has a coaxial cable with it. Attach the coaxial cable to the SMA connector on each reader. Be sure these connections are tight.

Next, install the 2200-500 Presence Detector under the 2200-504TB Reader. Connect the adjacent cable to the DB-9 connector on the detector's front. Secure it with the captive fasteners.

Next, install the 2200-200 Power Supply under the 2200-500 Presence Detector. Connect the 12-position shrouded header from the wire harness to the respective terminal block on the 2200-200 Power Supply. Be sure this connector is fully mated before applying power to the system.

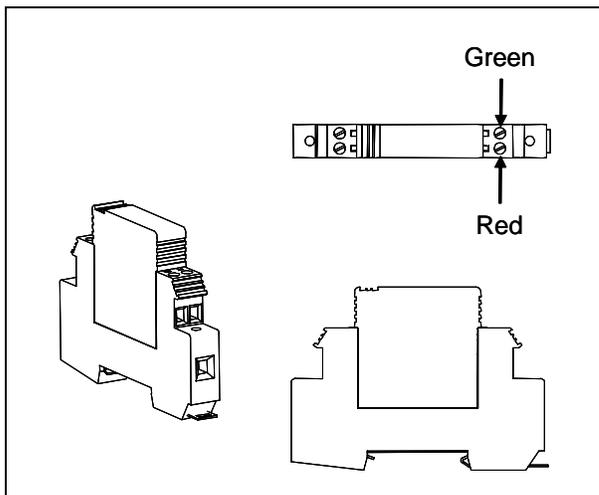
If the system is equipped with a 2200-600 Modem, it is mounted inside the front panel, adjacent to the 2200-300 Interface board. Attach the modem to the four threaded studs provided. Connect the data, phone, and power cables to the back of the modem. Each of these cables is present in the wire harness if the system was ordered with the modem. There are two RJ connectors on the 2200-600 Modem. Connect the phone line to the outermost connector.

5.3.5 Connecting the Telephone

Telephone service is needed only on SmartScan systems equipped with a 2200-600 Modem. If your system is equipped with a cellular modem instead, skip this section and go to **5.3.6 Connecting the AEI Antennas**.

The telephone service provider should terminate their drop on a lightning arrester terminal outside the bungalow and bring a four-wire connection inside for termination on a standard service block. From the service block, run a four-wire service cord to the 2200-950 Inside Enclosure and route it to the DIN rail assembly.

At the top of the DIN rail assembly is the surge protector for the telephone line. This surge protector has two tiers (one above another) of connections on each side. Looking down on the surge protector, the green wire of the incoming telephone line is terminated at the top-tier top-right terminal on this surge protector. The red wire is terminated at the top-tier bottom-right terminal. The other two phone wires (yellow and black) aren't required for SmartScan applications.



5.3.6 Connecting the AEI Antennas

Each antenna connection should be made with a low-loss coaxial cable such as Andrews FSJ4. Each end of the cable requires a straight type-N plug such as Andrews F4NMV2. A 24-inch (61-centimeter) RG 8U transition cable with a right-angle connector should be used at the antenna due to the stiffness of the FSJ4.

Be sure the antenna connections are taped to prevent entrance of moisture.

Beneath the copper plate inside the bottom of the enclosure are two Joslyn coaxial lightning arresters. The tops of these arresters are prewired with coaxial cables and run to the mounting points for the system's two readers. The left arrester is wired to the 2200-504TA Reader (reader1). The right one is wired to the 2200-504TB Reader (reader2). The bottoms of these arresters are connected to the antennas. The left arrester is connected to antenna1, the antenna on the north side or east side of the track. The right one is connected to antenna2, the antenna on the south side or west side of the track.

In reference to the track, antenna1 is the northmost or eastmost antenna. Antenna2 is the southmost or westmost antenna.

5.3.7 Connecting to External AC

The power requirements of the SmartScan equipment mounted in the 2200-950 Inside Enclosure are relatively modest. Typically, a three-wire 120-volt 20-ampere service is more than adequate.

Before connecting the external AC to the SmartScan system, be sure that the AC and DC circuit breakers on the enclosure are in the OFF position.

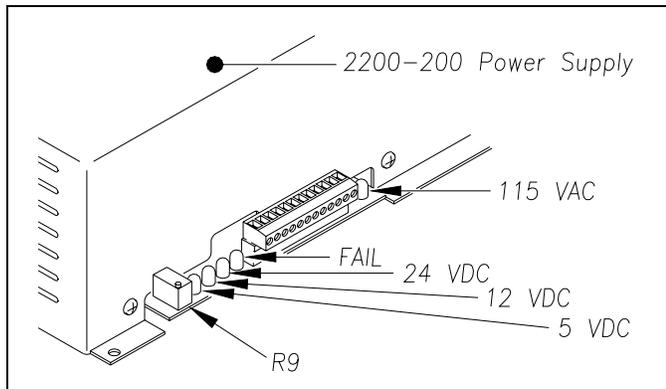
The 2200-950 Inside Enclosure is provided with a 24-inch (61-centimeter) power cord, ending in a twist-lock plug. To connect the external AC to the SmartScan system, plug this power cord into the twist-lock outlet in the bungalow.

5.3.8 Verifying DC Voltage

Before verifying DC voltage, be sure that the AC circuit breaker on the enclosure is in the ON position and that the DC circuit breaker is in the OFF position.

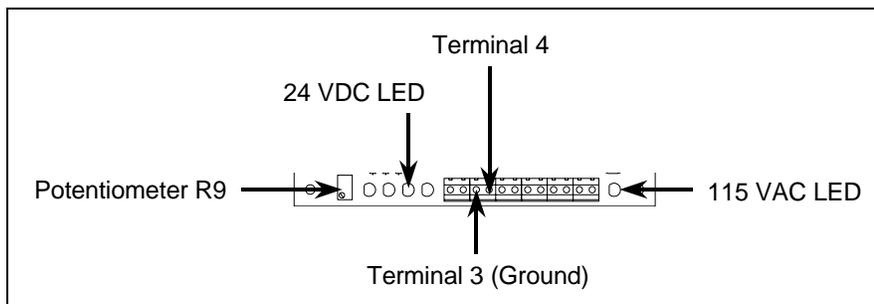
To verify the float voltage:

- 1 If the **115 VAC** and **24 VDC** LEDs on the edge of the 2200-200 Power Supply aren't lit, fix this problem before continuing.



Chapter 9 - Troubleshooting tells how to fix problems with the power input and with the 2200-200 Power Supply.

- 2 If the DC circuit breaker is on, toggle it off.
- 3 Using a DC voltmeter, touch the black lead to terminal 3 on terminal block TB1 (on the outside of the 2200-200 Power Supply).



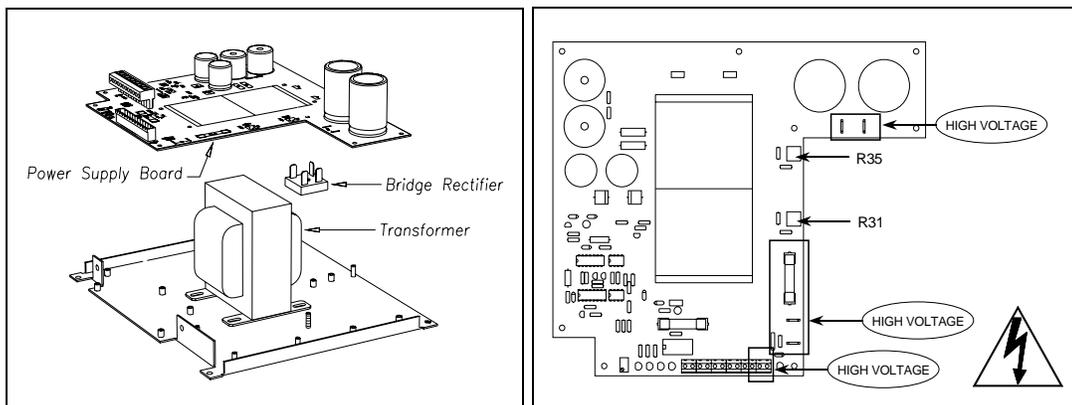
- 4 Touch the red lead to terminal 4 on terminal block TB1 (on the outside of the 2200-200 Power Supply).
- 5 If the voltage isn't between 26.8 and 27.2 VDC, adjust potentiometer **R9** (on the outside of the 2200-200 Power Supply) until the voltmeter shows 27 VDC.

Turn **R9** clockwise to increase voltage. Turn it counterclockwise to decrease voltage.

To verify the other DC voltages:

- 1 If the **115 VAC**, **12 VDC**, and **5 VDC** LEDs on the edge of the 2200-200 Power Supply aren't lit, fix this problem before continuing.
- 2 If the DC circuit breaker is on, toggle it off.
- 3 Using a DC voltmeter, touch the black lead to terminal 3 on terminal block TB1 (on the outside of the 2200-200 Power Supply).
- 4 Touch the red lead to terminal 6 on terminal block TB1 (on the outside of the 2200-200 Power Supply).
- 5 If the voltage isn't between 5.0 and 5.2 VDC:
 - a Toggle the AC circuit breaker off.
 - b On the part of the Power Supply board that is protruding from the 2200-200 Power Supply, separate the plug of the terminal block from its header.
 - c Remove the four screws securing the 2200-200 Power Supply to the enclosure.
 - d Separate the 2200-200 Power Supply from the enclosure.
 - e Remove the three fasteners securing the 2200-200 Power Supply cover to its base.
 - f Separate the cover of the 2200-200 Power Supply from its base.
The Power Supply board is now exposed with its components in view.
 - g Without its cover, reattach the base of the 2200-200 Power Supply to the enclosure.
 - h Reconnect the plug of the terminal block to its header.

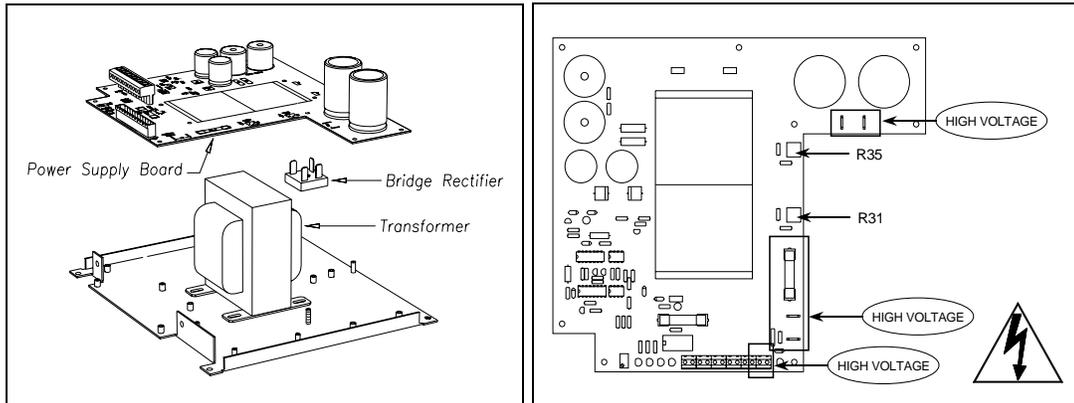
When AC is present, there is a risk of shock inside and outside of the 2200-200 Power Supply. Some possible high-voltage danger areas are the transformer, bridge rectifier, AC fuse holder, and terminal block. Other dangerous areas also exist. So, touch nothing. Let your insulated screwdriver touch only potentiometer R35.



- i Toggle the AC circuit breaker on.
 - j Using a small insulated screwdriver, adjust potentiometer **R35** until the voltmeter shows 5.1 VDC.
Turn **R35** clockwise to increase the voltage. Turn it counterclockwise to decrease the voltage.
 - k Toggle the AC circuit breaker off.
 - l Separate the plug of the terminal block from its header.
 - m Remove the four screws securing the base of the 2200-200 Power Supply to the enclosure.
 - n Separate the base of the 2200-200 Power Supply from the enclosure.
 - o Reattach the cover of the 2200-200 Power Supply to its base.
 - p Reattach the 2200-200 Power Supply to the enclosure.
 - q Reconnect the plug of the terminal block to its header.
 - r Toggle the AC circuit breaker on.
- 6** Using a DC voltmeter, touch the black lead to terminal 3 on terminal block TB1 (on the outside of the 2200-200 Power Supply).
- 7** Touch the red lead to terminal 8 on terminal block TB1 (on the outside of the 2200-200 Power Supply).
- 8** If the voltage isn't between 12.4 and 12.6 VDC:
- a Toggle the AC circuit breaker off.
 - b On the part of the Power Supply board that is protruding from the 2200-200 Power Supply, separate the plug of the terminal block from its header.
 - c Remove the four screws securing the 2200-200 Power Supply to the enclosure.
 - d Separate the 2200-200 Power Supply from the enclosure.
 - e Remove the three fasteners securing the 2200-200 Power Supply cover to its base.
 - f Separate the cover of the 2200-200 Power Supply from its base.
The Power Supply board is now exposed with its components in view.
 - g Without its cover, reattach the base of the 2200-200 Power Supply to the enclosure.

- h Reconnect the plug of the terminal block to its header.

When AC is present, there is a risk of shock inside and outside of the 2200-200 Power Supply. Some possible high-voltage danger areas are the transformer, bridge rectifier, AC fuse holder, and terminal block. Other dangerous areas also exist. So, touch nothing. Let your insulated screwdriver touch only potentiometer R31.



- i Toggle the AC circuit breaker on.
- j Using a small insulated screwdriver, adjust potentiometer **R31** until the voltmeter shows 12.5 VDC.
- Turn **R31** clockwise to increase the voltage. Turn it counterclockwise to decrease the voltage.
- k Toggle the AC circuit breaker off.
- l Separate the plug of the terminal block from its header.
- m Remove the four screws securing the base of the 2200-200 Power Supply to the enclosure.
- n Separate the base of the 2200-200 Power Supply from the enclosure.
- o Reattach the cover of the 2200-200 Power Supply to its base.
- p Reattach the 2200-200 Power Supply to the enclosure.
- q Reconnect the plug of the terminal block to its header.
- r Toggle the AC circuit breaker on.
- 9 Toggle the DC circuit breaker on.

5.3.9 Connecting the Batteries

Normally, the system battery connection requires wire of a gauge that is heavier than the terminal blocks in the enclosure can accommodate. Because of this requirement, it is desirable to place an AAR terminal next to the enclosure to serve as a transition point. Ideally, the AAR terminal should be configured with test clips that allow the battery to be easily disconnected from the system. This feature greatly simplifies the process of adjusting the charging voltage of the 2200-200 Power Supply.

The connection from the battery to the AAR terminal should be 10 AWG (or larger) stranded copper. The connection from the equipment to the battery terminal should be 14 AWG stranded copper. Use red for the positive connection and black for the negative.

Before installing the batteries, be sure that the AC and DC circuit breakers on the DIN rail are in the OFF position.

WARNING

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

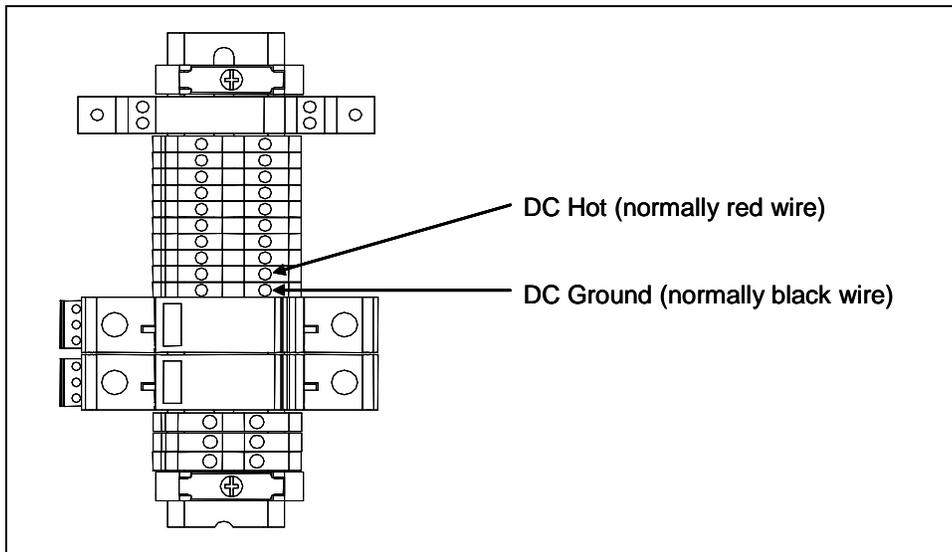
WARNING

In operation, batteries generate and release flammable hydrogen gas, which, if ignited by a burning cigarette, naked flame, or spark, may cause battery explosion with dispersion of casing fragments and corrosive liquid electrolyte. So, carefully follow manufacturer's instructions for installation and service. Keep all sources of gas ignition away from the batteries and do not allow metallic articles to contact the negative and positive terminals of a battery at the same time.

WARNING

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

Connections to the 2200-950 Inside Enclosure are made at the DIN rail located in the base panel. Terminate the black conductor to terminal 10 of the DIN rail. Terminal 10 is the terminal just above the two AC surge suppressers. Terminate the red conductor to terminal 9 of the DIN rail.



5.3.10 Installing the Cellular Modem and Its Antenna

Not all SmartScan AEI systems use a cellular modem. If yours doesn't, skip this section.

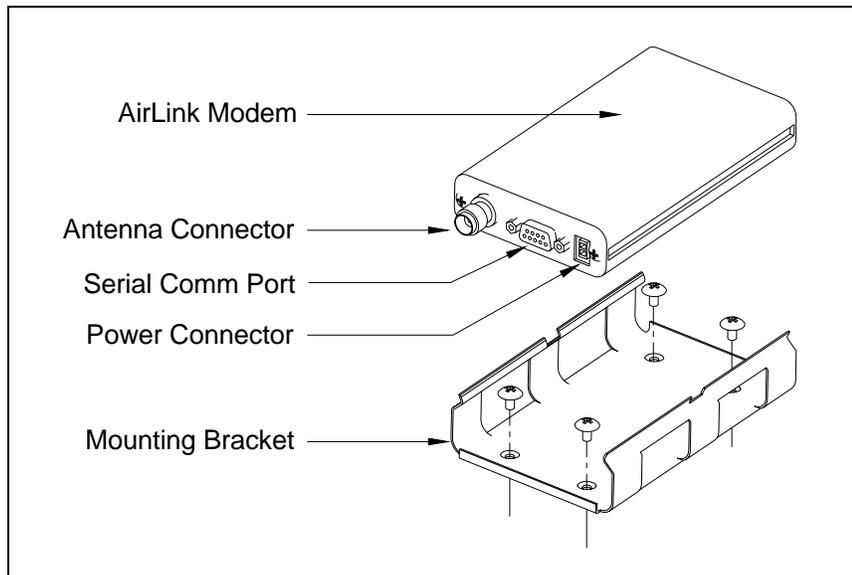
To install the cellular modem and the surge arrester:

- 1 With the transceiver in place under its mounting bracket, mount the AirLink cellular modem to an appropriate mounting surface.
Place the modem so that no cable, which is attached to it, exceeds 50 feet (15 meters). Be sure there is sufficient space around the transceiver to allow for airflow.
- 2 Mount the Joslyn coaxial lightning arrester.
Place the arrester less than 10 feet (3 meters) from the modem. The arrester's ground plate should be secured directly to an earth-grounded bus or mounting surface.

- 3 Connect the coaxial cable from the cellular modem to one end of the arrester.
The arrester is symmetrical and bidirectional. Therefore, either end may be used for the input or for the output.

Before making any connections to the 2200-300 Interface board, verify that the AC and DC circuit breakers on the front of the 2200-950 Inside Enclosure are in the DOWN or OFF position.

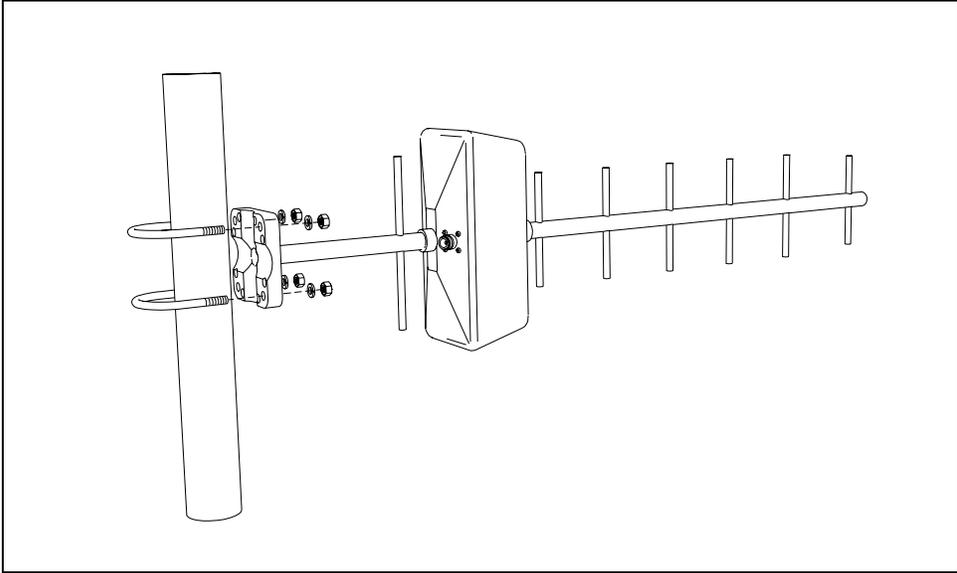
- 4 Connect an EIA-232 serial data DB-9 cable from the DB-9 connector (that is, the serial communication port) on the transceiver to the Host port on the 2200-300 Interface board.



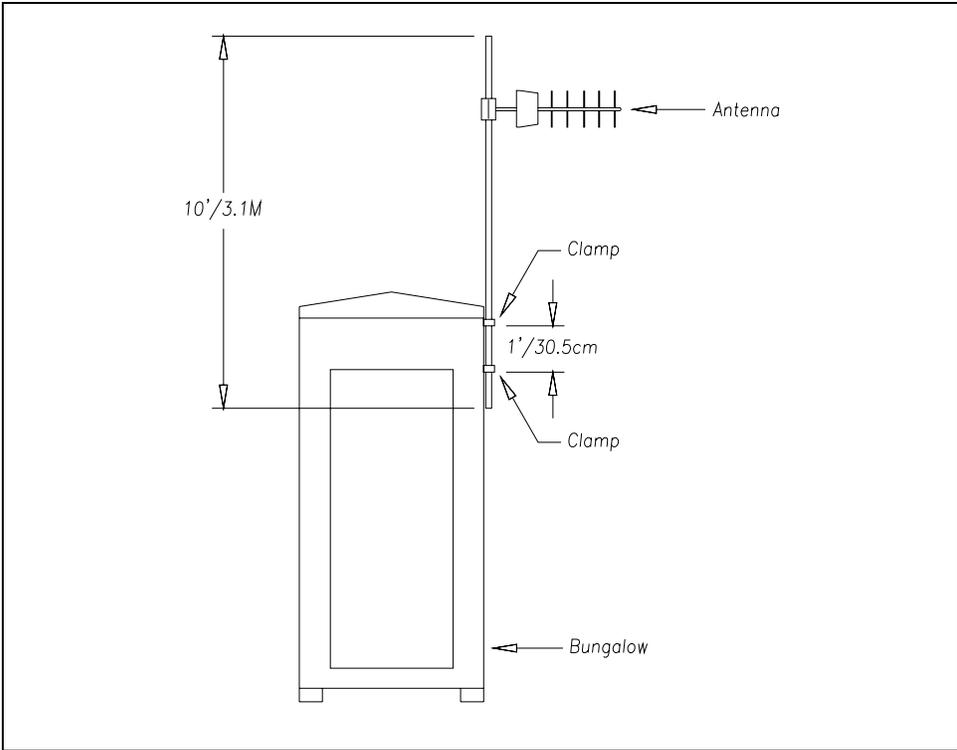
- 5 If not done already, connect the power cable to the power connector on the transceiver.
- 6 Connect the red wire from the power cable to terminal 21 on the 2200-300 Interface board.
- 7 Connect the black wire from the power cable to terminal 22 on the 2200-300 Interface board.

To install the antenna:

- 1 Mount the antenna to the 10-foot antenna pole, as shown below.



- 2 Mount the antenna pole to the outside of the enclosure, as shown below.



- 3 Be sure the drain hole in the antenna is facing down.
- 4 Connect the N-type connector on one end of a coaxial cable to the antenna.
- 5 Route the coaxial cable from the antenna to the Joslyn coaxial lightning arrester inside the bungalow.

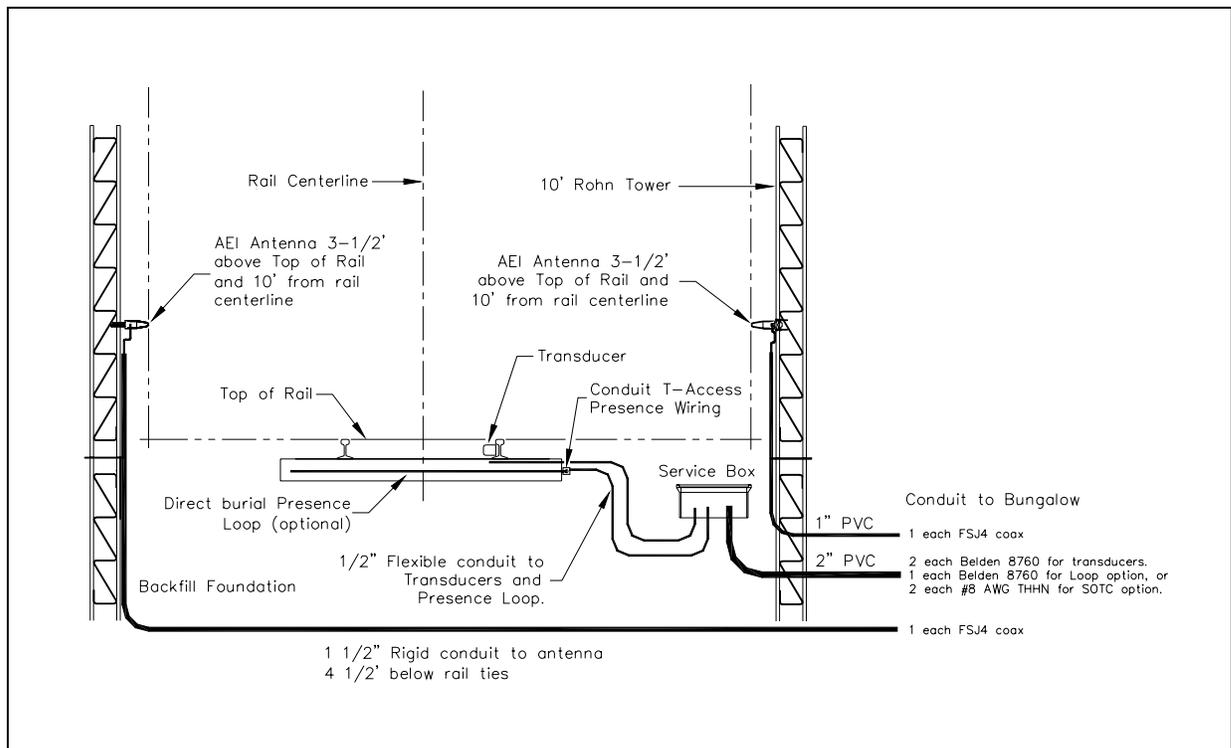
In sheet metal, use a rubber grommet in every hole through which you route the cable.

- 6 Install an N-type connector on the other end of the coaxial cable.
- 7 Connect the N-type connector to the end of the arrester opposite the transceiver's antenna connection.

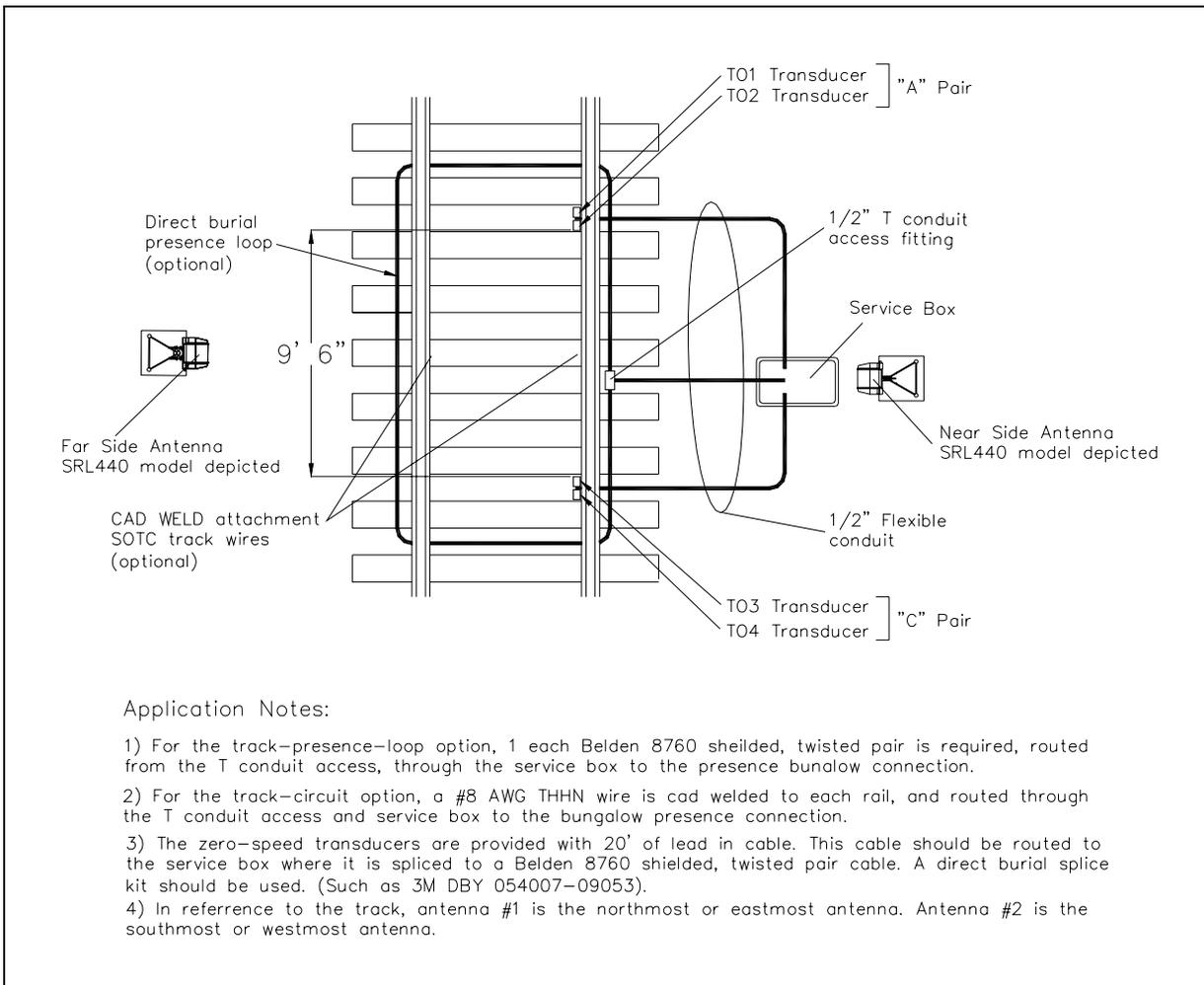
5.3.11 Installation Drawings

This section provides the SmartScan user with typical installation references and guidelines that can be adapted to their specific application.

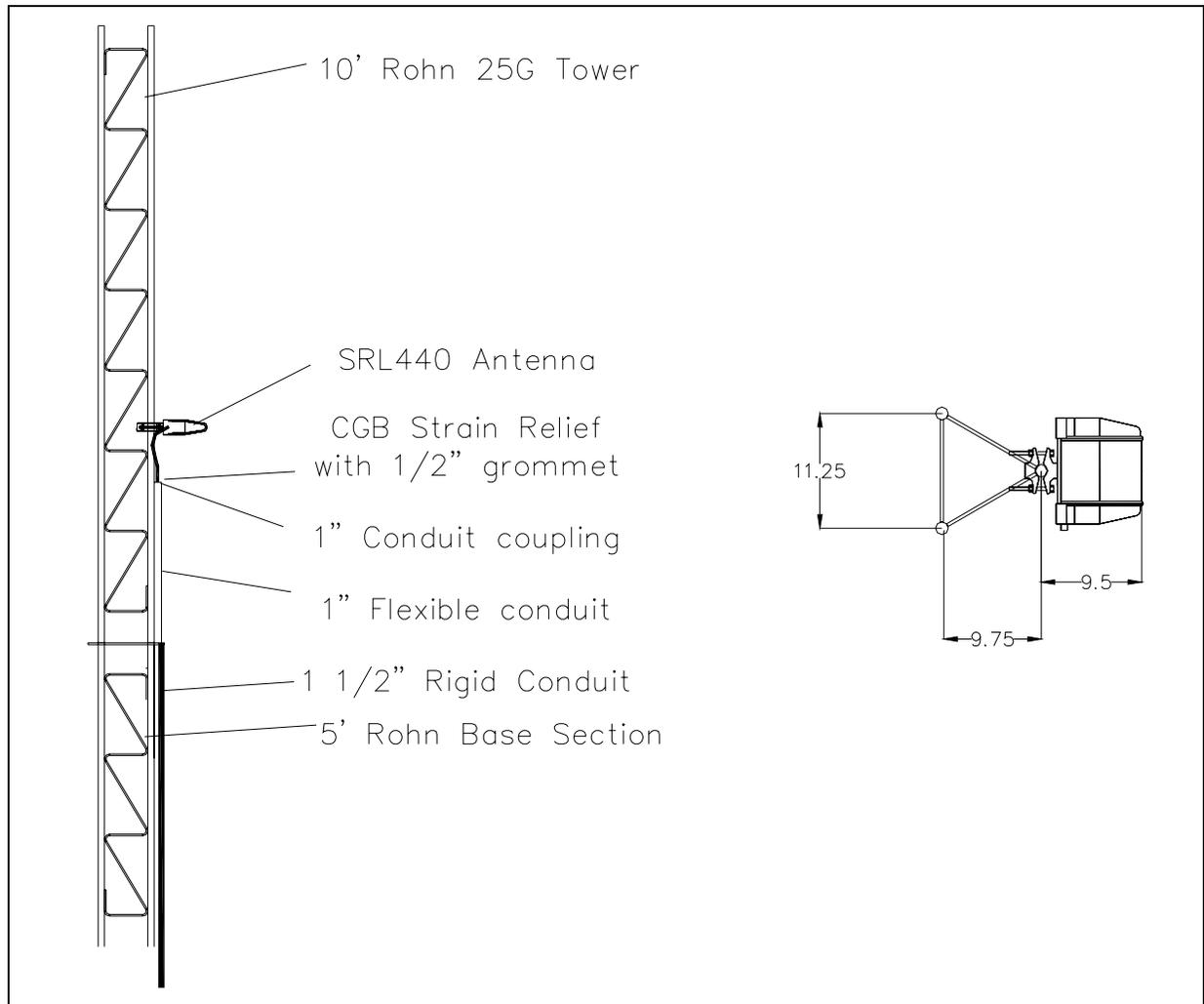
The figure below shows the trackside part of an installation of a SmartScan AEI system controlled by the components of a 2200-950 Inside Enclosure. What is shown is an aboveground tower height of 10 feet (3 meters). Your aboveground tower height might be higher.



The figure below shows the trackside plan for an installation of a SmartScan AEI system controlled by the components of a 2200-950 Inside Enclosure.



The figure below shows the tower detail for an installation of a SmartScan AEI system controlled by the components of a 2200-950 Inside Enclosure. What is shown is an aboveground tower height of 10 feet (3 meters). Your aboveground tower height might be higher.

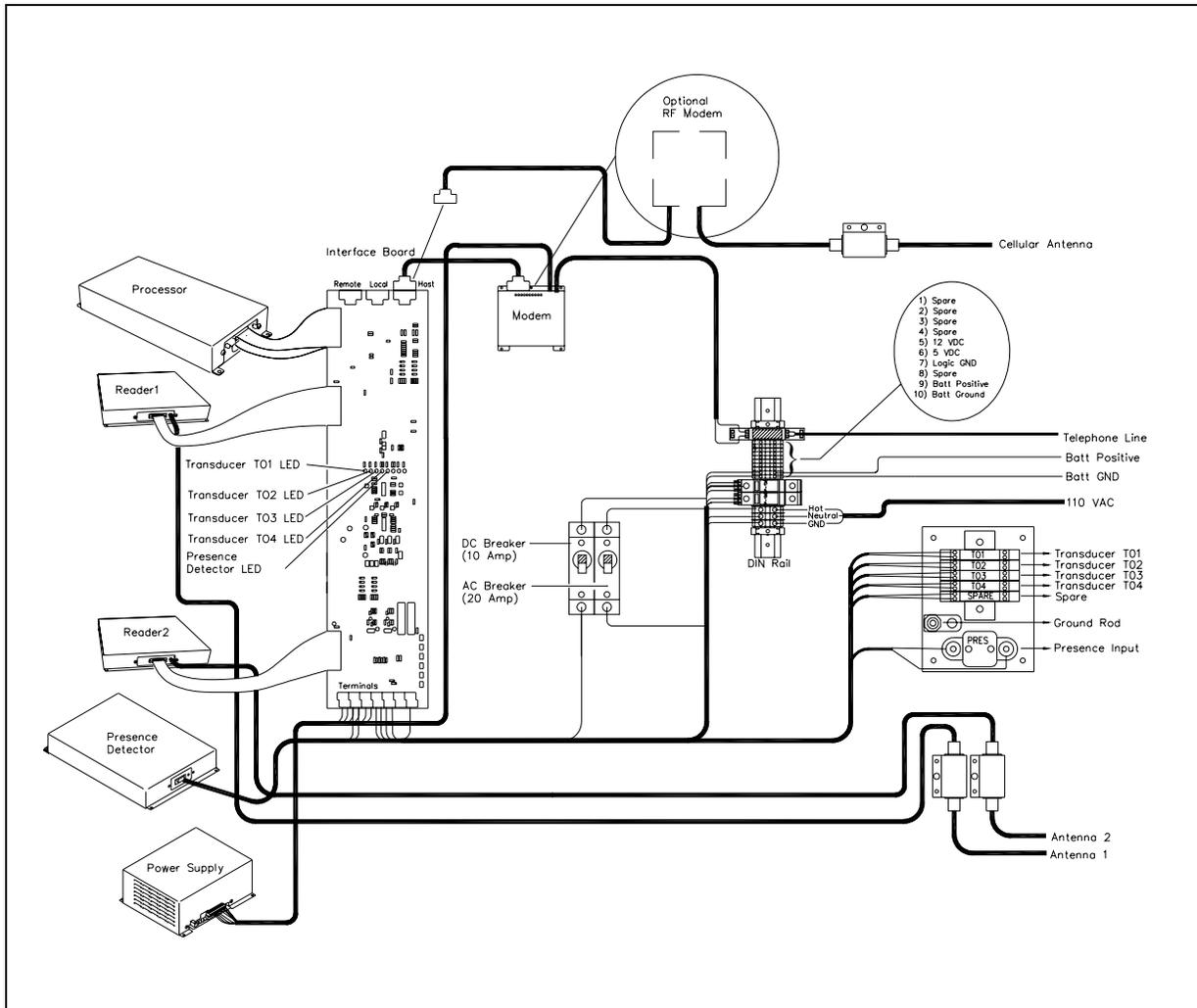


Shown in the figure above are two SRL440 antennas. These AEI antennas are normally used on yard systems. SRL470 antennas (or HP9-915 antennas) are normally used on mainline systems.

Install the AEI antennas with the face of the antenna parallel to the rails, 3.5 feet (1.1 meters) above the top of the rails, centered between the two pairs of transducers, and opposite each other. Mount the SRL440 antenna horizontally with its N-type socket on the side, not pointing up or down. Mount the SRL470 antenna with its N-type socket pointing down. Mount the HP9-915 antenna vertically.

5.3.12 Component-Relationship Diagram

The figure below shows the relationship of the components in a 2200-950 Inside Enclosure and their relationship to the optional bungalow-mounted cellular modem.

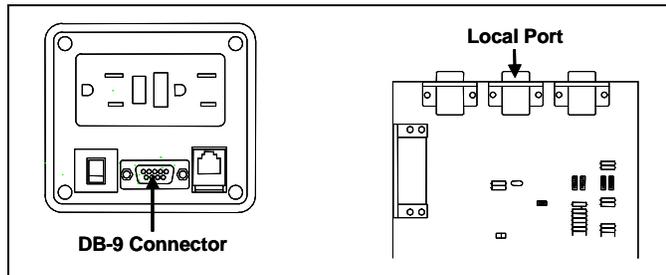


Chapter 6 System Setup

The SmartScan AEI system is configured for operation through menu selections. The following example shows a typical system setup for rail applications. You may choose to setup your system in a different order. If you do, be sure to setup everything that needs to be setup. Even though you can setup your system remotely (**off-site**), STC recommends that you do your first setup locally (**on-site**).

You can make menu selections by using the:

- Keyboard on a computer with installed communications software that is plugged into the DB-9 connector in the small weatherproof box on the lower right side of a 2200-900 Tower Enclosure or the Local port at the top of the 2200-300 Interface board in a 2200-950 Inside Enclosure. With this method, the selection is made at the site.



- Keyboard on a computer with installed communications software and modem. Your modem must be able to communicate with the installed 2200-600 Modem or cellular modem. With this method, the selection is made away from the site.

You access the system configuration and setup options via the System menu. To get to the System menu:

- 1 If **on-site**, plug your computer into the SmartScan system.

On a SmartScan system installed with a 2200-900 Tower Enclosure, use the DB-9 connector in the small weatherproof box on the lower right side of the enclosure. On a system installed with a 2200-950 Inside Enclosure, use the Local port at the top of the 2200-300 Interface board in the enclosure.

- 2 If **off-site**, plug your computer into a modem that is plugged into a nonswitched analog telephone line.
- 3 Turn on your computer.

- 4 Be sure that your computer has installed communications software, that it is set to use full duplex, and that the baud rate is set correctly.

If **on-site**, the baud rate of your computer must match the baud rate of the selected serial port because they are in direct, one-to-one, communication with one another. For example, the baud rate for the Local port was set to 9600 at the factory. If this baud rate was changed by the customer, your computer must be set to the changed value.

For **off-site** connections, the baud rate of your computer doesn't have to match the baud rate of the selected serial port because the telephone network between the two modems breaks this direct physical connection. In an off-site setup, your computer and its modem have a direct connection, the two modems have a direct connection, and the SmartScan system and its modem have a direct connection. Each of these individual direct connections must have matching baud rates. However, the different connection "types" (user computer to modem, modem to modem, SmartScan system to modem) don't have to share a common baud rate (although it's simpler if they do).

Opening a LOG file captures the whole session to the file. Then, when your session is done, you can view what you have done with an editor, print it with a printer, or store it for later retrieval.

- 5 On your computer, open a LOG file.

- 6 If **off-site**:

- a From your computer, dial and connect to the modem at the site to which you want to communicate.

- b Wait for the "connect" message from your modem.

- 7 To get the serial interface to come up, press **[Esc]**.

If you have established a clean connection, the Main menu might appear.

```
STC SmartScan System
Site ID:
Main Menu
-----
1) System Menu
2) Report Menu
3) Route Comm Through Local Port
4) Reserved
X) Exit Menu
?
```

Or, if you have established a clean connection, the prompt below might appear.

```
Enter Password:
```

The above prompt appears on systems that have a Main menu that is password protected. On such systems, after you type the correct password, the Main menu appears. The system gives you three tries to type the password correctly. After three incorrect tries, you'll need to press **[Esc]** again.

8 From the Main menu, type **1**

9 Press **[Enter]**.

The System menu appears. If your System menu is password protected, you'll need to type in the correct password before this menu appears.

```
STC SmartScan System
Site ID:
System Menu
-----
 1) AEI Processor/Reader Configuration Menu
 2) Set System Date and Time
 3) Check AEI Processor
 4) Modem Setup
 5) T94 Session Configuration
 6) Site ID
 7) Host Port CTS Status
 8) Suspend Train Scanning
 9) Statistics Session Configuration Menu
10) Set/Change Menu Passwords
11) Daylight Savings Clock Adjustment
12) Clear All Stored Data
13) Multi-Track Site
14) AC/Battery Monitor
 X) Exit Menu
?
```

6.1 Date and Time (Options 2 and 11)

To set or change the date and time:

1 Be sure the System menu is displayed.

```
STC SmartScan System
Site ID:
System Menu
-----
 1) AEI Processor/Reader Configuration Menu
 2) Set System Date and Time
 3) Check AEI Processor
 4) Modem Setup
 5) T94 Session Configuration
 6) Site ID
 7) Host Port CTS Status
 8) Suspend Train Scanning
 9) Statistics Session Configuration Menu
10) Set/Change Menu Passwords
11) Daylight Savings Clock Adjustment
12) Clear All Stored Data
13) Multi-Track Site
14) AC/Battery Monitor
 X) Exit Menu
?
```

2 From the System menu, type **11**

3 Press **[Enter]**.

A prompt like this appears, stating whether the daylight-saving-time adjustment is currently disabled or enabled.

```
Current Daylight Savings Time: Disabled
Modify ? (Y/N)
```

If disabled, all times throughout the year are in standard time. If enabled, all times between the first Sunday in April and the last Sunday in October are in daylight-saving time. All other times are in standard time. Any change takes effect immediately. Later, if enabled, at 2:00 a.m. on the first Sunday in April the system will adjust the system's clock forward an hour to 3:00 a.m. and at 2:00 a.m. on the last Sunday in October the system will adjust the system's clock backward to 1:00 a.m.

4 If you want to modify the adjustment:

a Type **y**

A message like this appears, stating whether the daylight-saving-time adjustment is now disabled or enabled.

```
Daylight Savings Time: Enabled
```

b Go to step **6**.

5 If you don't want to modify the adjustment, type **n**

A message like this appears, stating whether the daylight-saving-time adjustment is now disabled or enabled.

```
Daylight Savings Time: Disabled
```

6 From the System menu, type **2**

7 Press **[Enter]**.

A prompt like this appears.

```
Current Date: 04/28/2006
Enter New Date:
```

Dates are in **mm/dd/yyyy** format, where **mm** is the month, **dd** is the day, and **yyyy** is the year. The system automatically inserts the slashes. For days and months from 1 through 9, enter leading zeros. Thus, for 4 July 2008, enter **07042008**.

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

8 Enter a new date or press **[Enter]**.

A prompt like this appears.

```
Current Time: 08:27:34
Enter New Time:
```

Time is in 24-hour format, where 8 a.m. is 08:00:00, noon is 12:00:00, 8 p.m. is 20:00:00, and midnight is 00:00:00. Thus, for 17 seconds past 3:42 p.m., enter **154217**. The system automatically inserts the colons. For hours, minutes, and seconds from 0 through 9, enter leading zeros.

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

9 Enter a new time or press **[Enter]**.

A prompt like this appears.

```
Current Time Zone: 7
Enter New Time Zone (hrs from GMT)
(5=Eastern, 6=Central, 7=Mountain, 8=Pacific):
```

If you want to keep the displayed offset, press **[Esc]**. If you don't, type any number between 0 and 23. If you type a single-digit number, either add a leading zero or press **[Enter]** after typing the digit. If you press **[Enter]** and type no digits, the offset is set to zero.

10 Enter a new offset or press **[Esc]** or press **[Enter]**.

A message like this appears. Then the System menu reappears.

```
Time is: 04/28/2006 06:13:42 Standard Time
Time Zone: 07
```

6.2 Site Identifier (Option 6)

To set or change the site identifier:

1 Be sure the System menu is displayed.

```
STC SmartScan System
Site ID:
System Menu
-----
1) AEI Processor/Reader Configuration Menu
2) Set System Date and Time
3) Check AEI Processor
4) Modem Setup
5) T94 Session Configuration
6) Site ID
7) Host Port CTS Status
.
.
.
```

- 2 From the System menu, type **6**
- 3 Press **[Enter]**.

A prompt like this appears.

```
Current Site ID: MacCook
Enter New Site ID:
```

If you want to keep the displayed site identifier, press **[Esc]**. If you don't, type up to seven characters. If you type less than seven characters, press **[Enter]** after typing the last character. If you type seven characters, pressing **[Enter]** isn't necessary. If you press **[Enter]** without typing any characters first, the system will delete the contents of the site-identifier field.

- 4 Enter a new identifier or press **[Esc]** or press **[Enter]**.

The System menu reappears.

6.3 Password Protection (Option 10)

To set or change the password protection for the Main menu, System menu, or both menus:

- 1 Be sure the System menu is displayed.

```
      .
      .
      .
8) Suspend Train Scanning
9) Statistics Session Configuration Menu
10) Set/Change Menu Passwords
11) Daylight Savings Clock Adjustment
12) Clear All Stored Data
13) Multi-Track Site
14) AC/Battery Monitor
X) Exit Menu
?
```

- 2 From the System menu, type **10**

- 3 Press **[Enter]**.

A prompt like this appears.

```
Enter Main Menu Password:
```

If you don't want the Main menu protected by a password, press **[Enter]**. If you want it protected by a password, type up to eight characters. The password isn't case sensitive. As viewed by the system, the character strings "word3%" and "WoRd3%" are equivalent. If the password is less than eight characters, press **[Enter]** after typing the last character. If it is eight characters, pressing **[Enter]** isn't necessary.

- 4 Enter a new password or press **[Enter]**.

A prompt like this appears.

Enter System Menu Password:

If you don't want the System menu protected by a password, press **[Enter]**. If you want it protected by a password, type up to eight characters. The password isn't case sensitive. As viewed by the system, the character strings "a\$\$ume" and "A\$\$UME" are equivalent. If the password is less than eight characters, press **[Enter]** after typing the last character. If it is eight characters, pressing **[Enter]** isn't necessary.

- 5 Enter a new password or press **[Enter]**.

The System menu reappears.

6.4 Host Port CTS Status (Option 7)

The SmartScan 2200-300 Interface board has three communication ports located across its top. These ports have DB-9 connectors for RS232 communications, and they are configured as DTE. One of the three ports, the Host port, connects with the host computer through either a landline modem or a cellular modem.

Associated with the Host port is the ability to monitor the Clear To Send (CTS) control signal from an attached modem. The CTS control line is used to signal the SmartScan system when there is space in the modem's character buffer to insert more characters (to be sent across the telephone line). When the modem's character buffer fills up, the modem "deactivates" the CTS line to signal the SmartScan system to discontinue sending characters. Later, when space opens up in the modem's character buffer, the modem activates its CTS control line, signaling the SmartScan system to continue sending characters.

If the Host port CTS isn't enabled, data could be lost when transferred via the system modem. However, if a modem isn't connected to the system when the CTS is enabled, system operation can be slowed down drastically.

To view, set, or change the host port CTS status:

- 1 Be sure the System menu is displayed.

```
STC SmartScan System
Site ID:
System Menu
-----
 1) AEI Processor/Reader Configuration Menu
 2) Set System Date and Time
 3) Check AEI Processor
 4) Modem Setup
 5) T94 Session Configuration
 6) Site ID
 7) Host Port CTS Status
 8) Suspend Train Scanning
 9) Statistics Session Configuration Menu
10) Set/Change Menu Passwords
11) Daylight Savings Clock Adjustment
12) Clear All Stored Data
13) Multi-Track Site
14) AC/Battery Monitor
X) Exit Menu
?
```

- 2 From the System menu, type 7

- 3 Press **[Enter]**.

A prompt like this appears, stating whether the status is currently enabled or disabled.

```
Current Host Port CTS Status: Disabled
Modify ? (Y/N):
```

- 4 If you want to change the status, type **y**

A message like this appears, stating whether the status is now enabled or disabled. Then the System menu reappears.

```
Host Port CTS Status: Enabled
```

- 5 If you want to keep the status, type **n**

A message like this appears, stating whether the status is now enabled or disabled. Then the System menu reappears.

```
Host Port CTS Status: Disabled
```

6.5 Processor and Readers (Option 1)

The SmartScan 2200-100 Processor monitors all the signals produced by the system transducers, train presence monitor, and readers. Several parameters are used to modify the response of the processor to these signals. These parameters are accessed via the AEI Processor/Reader Configuration menu.

In addition, the 2200-504 Readers have their own subset of setup parameters that affect the way they process the AEI tag data received from the AEI antennas. These parameters are also accessed via the AEI Processor/Reader Configuration menu.

To view, set, or change the processor and readers configuration information:

- 1 Be sure the System menu is displayed.

```
STC SmartScan System
Site ID:
System Menu
-----
1) AEI Processor/Reader Configuration Menu
2) Set System Date and Time
3) Check AEI Processor
4) Modem Setup
5) T94 Session Configuration
   .
   .
   .
```

- 2 From the System menu, type 1

- 3 Press **[Enter]**.

The message below appears.

```
Retrieving Reader Setup!
```

Then the AEI Processor/Reader Configuration menu appears.

```
STC SmartScan System
Site ID:
AEI Processor/Reader Configuration Menu
-----
1) Display Configuration
2) AEI Processor Setup Menu
3) Amtech Reader Setup Menu
4) Amtech Reader Interface
X) Exit Menu
?
```

- 4 To view the configuration information for the processor and readers, type 1

5 Press [Enter].

The configuration information appears. Your information will be different. The version information in the sample below is for illustrative purposes only. It doesn't represent any real release of the firmware.

```
SmartScan Reader Processor Configuration Info

Firmware Version - Comm: ML2.1t 12/23/05 Reader: ML2.1t 01/27/05

Transducer Pulse Width Filter (mS): 6
Gate Inactivity Timeout (mmm): 0
Presence Timeout Period (mm:ss): 00:10
Presence Input Debounce Filter (mS): 5
Txd. Pulse Latch Percentage: 50
Track Orientation: North/South

Train Scanning Suspension: Disabled
-----
Amtech Reader Configuration Info.

ID for Reader 1: 1
ID for Reader 2: 2

Tag ID Uniqueness Criteria
-----
ID Separation Criteria = 2 ID's
Uniqueness Timeout Period = 2 Minutes
Consecutive Reads Requirement: 2 reads = valid ID

Reader Type
-----
R1 - Smartpass
R2 - Smartpass
```

Then the AEI Processor/Reader Configuration menu reappears.

```
STC SmartScan System
Site ID:
AEI Processor/Reader Configuration Menu
-----
1) Display Configuration
2) AEI Processor Setup Menu
3) Amtech Reader Setup Menu
4) Amtech Reader Interface
X) Exit Menu
?
```

6 To edit the configuration information for the processor, type 2

7 Press **[Enter]**.

The AEI Processor Setup menu appears.

```
STC SmartScan System
Site ID:
AEI Processor Setup Menu
-----
 1) Txd. Pulse Latch Percentage
 2) Transducer Pulse Width Filter
 3) Gate Inactivity Timeout
 4) Presence Timeout Period
 5) Presence Input Debounce Filter
 6) Track Orientation Menu
 7) Train Scanning Suspension
 8) Reset Presence Subsystem
 9) Txd. Pair Spacing
 X) Exit Menu
?
```

At this time, you can initialize the setup parameters for the processor. Ten options are provided. Below is what would appear if you select a given option.

If you type **1** and press **[Enter]**, a prompt like this appears.

```
Current Txd. Pulse Latch Percentage: 50
Enter New Txd. Pulse Latch Percentage (0-500):
```

If you type **2** and press **[Enter]**, a prompt like this appears.

```
Current Transducer Pulse Width Filter (mS): 06
Enter New Transducer Pulse Width Filter (mS):
```

If you type **3** and press **[Enter]**, a prompt like this appears. If you type a value greater than 120, the system ignores it.

```
Current Gate Inactivity Timeout (mmm): 000
Enter New Gate Inactivity Timeout (mmm):
```

If you type **4** and press **[Enter]**, a prompt like this appears. If you type a value greater than 9900, the system ignores it.

```
Current Presence Timeout Period (mm:ss): 00:10
Enter New Presence Timeout Period (mm:ss):
```

If you type **5** and press **[Enter]**, a prompt like this appears.

```
Current Presence Input Debounce Filter (mS): 05
Enter New Presence Input Debounce Filter (0-50mS):
```

If you type **6** and press **[Enter]**, a prompt like this appears.

```
STC SmartScan System
Site ID:
Track Orientation Menu
-----
 1) North/South
 2) East/West
 X) Exit Menu
?
```

If you type **7** and press **[Enter]**, a prompt like this appears.

```
Current Train Scanning Suspension: Enabled
Modify ? (Y/N):
```

If you type **8** and press **[Enter]**, a prompt like this appears.

```
Are you sure?
```

If you type **9** and press **[Enter]**, a prompt like this appears.

```
Current Txd. Pair Spacing (inches): 114
Enter New Txd. Pair Spacing (inches):
```

8 When you are done initializing the parameters, type **x**

The AEI Processor/Reader Configuration menu reappears.

```
STC SmartScan System
Site ID:
AEI Processor/Reader Configuration Menu
-----
 1) Display Configuration
 2) AEI Processor Setup Menu
 3) Amtech Reader Setup Menu
 4) Amtech Reader Interface
 X) Exit Menu
?
```

9 To edit the configuration information for the readers, type **3**

10 Press [Enter].

The Amtech Reader Setup menu appears.

```
STC SmartScan System
Site ID:
Amtech Reader Setup Menu
-----
1) ID for Reader 1
2) ID for Reader 2
3) Tag ID Uniqueness Criteria
X) Exit Menu
?
```

At this time, you can initialize the setup parameters for the readers. Four options are provided. Below is what would appear if you select a given option.

If you type **1** and press **[Enter]**, a prompt like this appears.

```
Current ID for Reader 1: 1
Enter New ID for Reader 1:
```

If you type **2** and press **[Enter]**, a prompt like this appears.

```
Current ID for Reader 2: 2
Enter New ID for Reader 2:
```

If you type **3** and press **[Enter]**, the Tag ID Uniqueness Criteria menu appears.

```
STC SmartScan System
Site ID:
Tag ID Uniqueness Criteria Menu
-----
1) ID Separation Criteria
2) Consecutive Reads Requirement
3) Uniqueness Timeout Period
X) Exit Menu
?
```

11 When you are done initializing the parameters, type x

The AEI Processor/Reader Configuration menu reappears.

```
STC SmartScan System
Site ID:
AEI Processor/Reader Configuration Menu
-----
1) Display Configuration
2) AEI Processor Setup Menu
3) Amtech Reader Setup Menu
4) Amtech Reader Interface
X) Exit Menu
?
```

12 To verify that the reader interface works, type 4

13 Press [Enter].

A prompt like this appears.

```
Reader 1 or Reader 2:
```

14 Type either 1 or 2

15 When you are done verifying that the selected reader interface works, type **exit**

The AEI Processor/Reader Configuration menu reappears.

```
STC SmartScan System
Site ID:
AEI Processor/Reader Configuration Menu
-----
 1) Display Configuration
 2) AEI Processor Setup Menu
 3) Amtech Reader Setup Menu
 4) Amtech Reader Interface
 X) Exit Menu
?
```

16 To return to the System menu, type **x**

6.6 T94 Dial-Out Sessions (Option 5)

The SmartScan system can be configured to report AEI data to computers that are setup to receive T94 reports via a modem connection. The SmartScan is configured to do this dial-out reporting through what are called T94 sessions. The T94 sessions are used to specify where and how the T94 consist reports are to be sent to customers. There are six different dial-out sessions available for use in specifying T94 reporting. In most cases, only one or two of these sessions will be enabled.

To view, set, or change the T94 reporting session parameters:

1 Be sure the System menu is displayed.

```
STC SmartScan System
Site ID:
System Menu
-----
 1) AEI Processor/Reader Configuration Menu
 2) Set System Date and Time
 3) Check AEI Processor
 4) Modem Setup
 5) T94 Session Configuration
 6) Site ID
    .
    .
    .
```

2 From the System menu, type **5**

3 Press [Enter].

The T94 Sessions Configuration menu appears.

```
STC SmartScan System
Site ID:
T94 Sessions Configuration Menu
-----
  1) Consist Sessions
  2) Maintenance Session
  X) Exit Menu
?
```

There can be up to five consist sessions. There can be only one maintenance session.

4 If you do not want to view the Consist Sessions menu, go to step 45.

5 To view the Consist Sessions menu, type 1

6 Press [Enter].

The Consist Sessions menu appears.

```
STC SmartScan System
Site ID:
Session Configuration
-----
  1) Display Config.
  2) Edit Config.
  3) Reset Session
  X) Exit Menu
?
```

7 To view the configuration information for one or all consist sessions, type 1

8 Press [Enter].

A prompt like this appears.

```
Which Session To Display? (1 - 5 or (A)ll):
```

The above prompt asks you to pick the consist session whose configuration information you want to display. You can also display all five sessions, one at a time, by typing the letter **a** and then pressing **[Enter]**. For example purposes, we'll next pick session1's configuration information to view.

9 To view session1's configuration information, type 1

10 Press [Enter].

The configuration information appears. Your information will be different.

```
T94 Session Configuration - Session #1

Auto Reporting           : Disabled
Site ID                  : AEISite
AAR Billing Code         : 99999
Time Zone (hrs from GMT) : 06
Units of Measure        : English
Report Delimiter        : null
Phone Number            : 12223337395
Baud Rate                : 2400
Report Reverse-out Trains : Disabled
Reporting Protocol      : Generic
```

Then the Consist Sessions menu reappears.

```
STC SmartScan System
Site ID:
Session Configuration
-----
1) Display Config.
2) Edit Config.
3) Reset Session
X) Exit Menu
?
```

11 To edit some or all the configuration information for one consist session, type 2

12 Press [Enter].

A prompt like this appears.

```
Enter Session To Edit? (1 - 5):
```

The above prompt asks you to pick the session whose configuration information you want to edit. For example purposes, we'll next pick session1's configuration information to edit.

13 To edit session1's configuration information, type 1

14 Press [Enter].

The configuration information appears.

```
T94 Session Configuration - Session #1

Auto Reporting           : Disabled
Site ID                  : AEISite
AAR Billing Code         : 99999
Time Zone (hrs from GMT) : 06
Units of Measure        : English
Report Delimiter        : null
Phone Number            : 12223337395
Baud Rate                : 2400
Report Reverse-out Trains : Disabled
Reporting Protocol      : Generic
```

Then the T94 Session Edit menu appears.

```
STC SmartScan System
Site ID:
T94 Session Edit Menu
-----
1) Auto Reporting
2) Site ID
3) AAR Billing Code
4) Time Zone
5) Units of Measure
6) Report Delimiter
7) Phone Number
8) Baud Rate
9) Report Reverse-out Trains
10) Reporting Protocol
11) Resend Trains
X) Exit Menu
?
```

15 To change the auto reporting status, type 1

16 Press [Enter].

A prompt like this appears. Your prompt states whether automatic reporting is currently disabled or enabled.

```
Auto Reporting - Disabled  Modify ? (Y/N) :
```

If enabled, the SmartScan system tries to send T94 reports to a customer's computer that can be accessed via the telephone number entered for the session. If disabled, the session will be ignored when it comes time to report the T94 data for each train that passes the site.

17 If you want to modify the auto reporting status:

a Type **y**

A message like this appears. The message indicates to what state you changed the session status. Then the T94 Session Edit menu reappears.

```
New Auto Reporting: Enabled
```

b Go to step 16.

18 If you don't want to modify the auto reporting status, type **n**

The T94 Session Edit menu reappears.

```
STC SmartScan System
Site ID:
T94 Session Edit Menu
-----
 1) Auto Reporting
 2) Site ID
 3) AAR Billing Code
 4) Time Zone
 5) Units of Measure
    ●
    ●
    ●
?
```

19 To change the site identifier, type **2**

20 Press **[Enter]**.

A prompt like this appears.

```
Current Site ID: AEISite
Enter New Site ID:
```

If you want to keep the displayed site identifier, press **[Esc]**. If you don't, type up to seven characters. If you type less than seven characters, press **[Enter]** after typing the last character. If it is seven characters, pressing **[Enter]** isn't necessary. If you press **[Enter]** without typing any characters first, the system will delete the contents of the site-identifier field. This site identifier will be inserted into the header record (AEM) of T94 Reports generated for this session.

21 Enter a new identifier or press **[Esc]** or press **[Enter]**.

The T94 Session Edit menu reappears.

```
STC SmartScan System
Site ID:
T94 Session Edit Menu
-----
 1) Auto Reporting
 2) Site ID
 3) AAR Billing Code
 4) Time Zone
 5) Units of Measure
    •
    •
    •
?
```

22 To change the billing code, type **3**

23 Press **[Enter]**.

A prompt like this appears.

```
Current AAR Billing Code: 99999
Enter New AAR Billing Code:
```

If you want to keep the displayed billing code, which is enclosed in parentheses, press **[Esc]**. If you don't, type up to five characters. If you type less than five characters, press **[Enter]** after typing the last character. If you type five characters, pressing **[Enter]** isn't necessary. If you press **[Enter]** without typing any characters first, the system will delete the contents of the billing-code field.

24 Enter a new code or press **[Esc]** or press **[Enter]**.

The T94 Session Edit menu reappears.

```
STC SmartScan System
Site ID:
T94 Session Edit Menu
-----
 1) Auto Reporting
 2) Site ID
 3) AAR Billing Code
 4) Time Zone
 5) Units of Measure
    •
    •
    •
```

25 To change the time zone, type **4**

26 Press **[Enter]**.

A prompt like this appears.

```
Current Time Zone: 6
Enter New Time Zone (hrs from GMT)
(5=Eastern, 6=Central, 7=Mountain, 8=Pacific):
```

If you want to keep the displayed offset, press **[Esc]**. If you don't, type any number between 0 and 23. If you type a single-digit number, either add a leading zero or press **[Enter]** after typing the digit. If you press **[Enter]** without typing any digits, the offset is set to zero.

27 Enter a new offset or press **[Esc]** or press **[Enter]**.

The T94 Session Edit menu reappears.

```
STC SmartScan System
Site ID:
T94 Session Edit Menu
-----
1) Auto Reporting
2) Site ID
3) AAR Billing Code
4) Time Zone
5) Units of Measure
6) Report Delimiter
7) Phone Number
8) Baud Rate
9) Report Reverse-out Trains
10) Reporting Protocol
11) Resend Trains
X) Exit Menu
?
```

28 To change the unit of measure, type **5**

29 Press **[Enter]**.

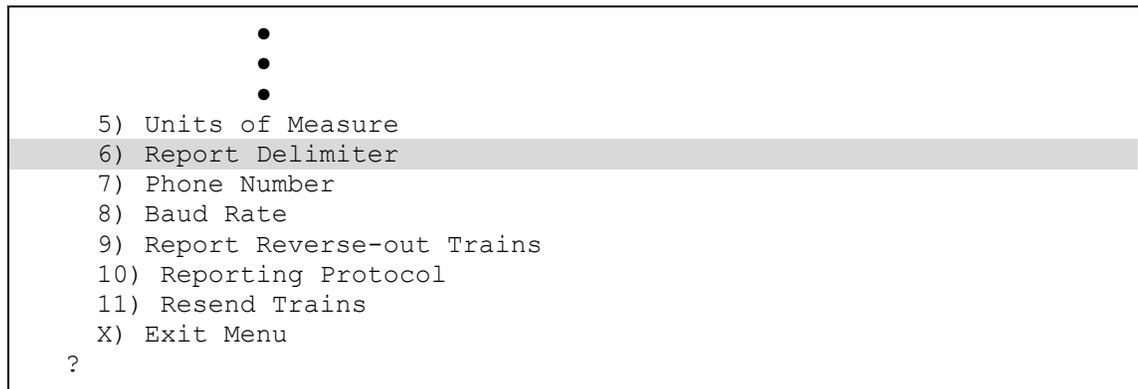
A prompt like this appears.

```
Current Units of Measure: English
Enter New Units of Measure (E=English, M=Metric):
```

If you want to keep the displayed unit of measure, which is enclosed in parentheses, press **[Esc]**. If you don't, type either **e** or **m**.

30 Press **[Esc]** or type either **e** or **m**

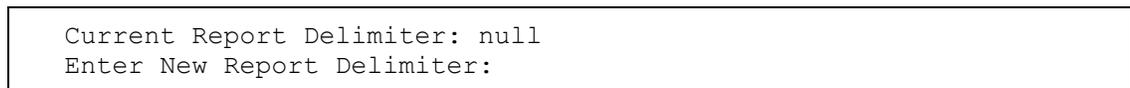
The T94 Session Edit menu reappears.



31 To change the report delimiter, type **6**

32 Press **[Enter]**.

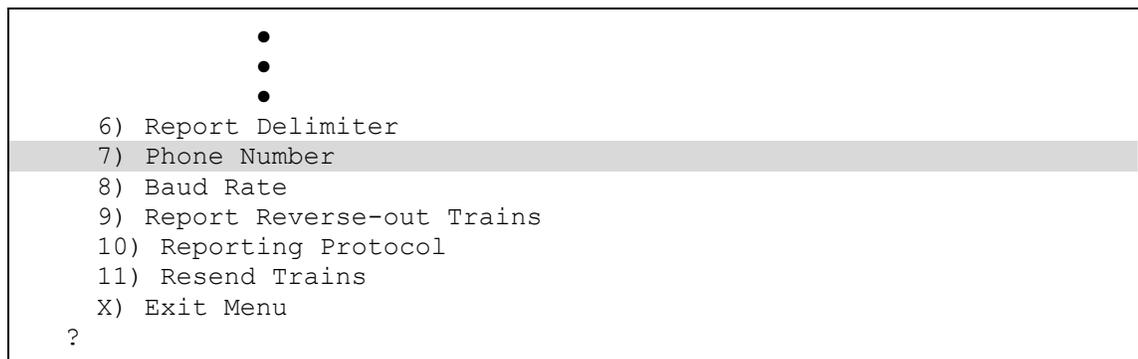
A prompt like this appears.



If you want to keep the displayed report delimiter, press **[Esc]**. If you don't, type a character. If you press **[Enter]** without typing a character, the delimiter is null. In other words, there is no delimiter.

33 Enter a new delimiter or press **[Esc]** or press **[Enter]**.

The T94 Session Edit menu reappears.



34 To change the phone number of where the T94 report will be sent, type **7**

35 Press [Enter].

A prompt like this appears.

```
Current Phone Number: none
Enter New Phone Number:
```

If you want to keep the displayed phone number, press **[Esc]**. If you don't, type up to 25 digits. If you type less than 25 digits, press **[Enter]** after typing the last digit. If you type 25 digits, pressing **[Enter]** isn't necessary. If you press **[Enter]** without typing any digits, the phone number is set to none. In other words, there is no phone number.

36 Enter a new phone number or press [Esc] or press [Enter].

A message appears. It consists of the word "entered" followed by the phone number or the word "none." After this message, the T94 Session Edit menu reappears.

```
      •
      •
      •
7) Phone Number
8) Baud Rate
9) Report Reverse-out Trains
10) Reporting Protocol
11) Resend Trains
X) Exit Menu
?
```

37 To change the baud rate, type 8

38 Press [Enter].

A prompt like this appears.

```
Current Baud Rate: 2400
Modify ? (Y/N):
```

If 1200 appears, typing **y** changes it to 2400. If 2400 appears, typing **y** changes it to 9600. If 9600 appears, typing **y** changes it to 1200.

If you want to keep the displayed baud rate, type **n**. If you don't want to keep it, keep typing **y** until the desired baud rate appears.

39 Keep typing y until the desired baud rate appears.

40 Type n

The T94 Session Edit menu reappears.

```
      •
      •
      •
7) Phone Number
8) Baud Rate
9) Report Reverse-out Trains
10) Reporting Protocol
11) Resend Trains
X) Exit Menu
?
```

41 To change the reporting protocol, type 10

42 Press [Enter].

A prompt like this appears.

```
Current Reporting Protocol: Generic Reporting Protocol
Enter New Reporting Protocol (1=Generic, 2=NS, 3=UP, 4=BNSF, 5=CP, 6=CSX):
```

If you want to keep the displayed protocol, press [Esc]. If you don't, type either 1 or 2 or 3 or 4 or 5 or 6.

43 Press [Esc] or type either 1 or 2 or 3 or 4 or 5 or 6

If you pressed [Esc] or typed 1, the T94 Session Edit menu reappears. If you typed 2 or 3 or 4 or 5 or 6, you need to answer a series of prompts before the T94 Session Edit menu reappears.

```
      •
      •
      •
7) Phone Number
8) Baud Rate
9) Report Reverse-out Trains
10) Reporting Protocol
11) Resend Trains
X) Exit Menu
?
```

44 When you are done editing a consist session's configuration information, type xx

The T94 Sessions Configuration menu reappears.

```
STC SmartScan System
Site ID:
T94 Sessions Configuration Menu
-----
1) Consist Sessions
2) Maintenance Session
X) Exit Menu
?
```

45 If you do not want to view the Maintenance Session menu, go to step **57**.

46 To view the Maintenance Session menu, type **1**

47 Press **[Enter]**.

The Maintenance Session menu appears.

```
STC SmartScan System
Site ID:
Maintenance Session Configuration
-----
1) Display Config.
2) Edit Session Config.
3) Edit Maintenance Reporting Config.
4) Reset Session
X) Exit Menu
?
```

48 To view the configuration information for maintenance session, type **1**

49 Press **[Enter]**.

The configuration information appears. Your information will be different.

```
Maintenance Session Configuration

Auto Reporting           : Disabled
Site ID                  : AEISite
AAR Billing Code          : 99999
Time Zone (hrs from GMT) : 06
Units of Measure         : N/A
Report Delimiter         : null
Phone Number             : none
Baud Rate                : 2400
Report Reverse-out Trains : N/A
Reporting Protocol       : Generic
.....
Maintenance Reporting Config.

Reporting Interval       : 01:00 (hh:mm)
Extended Delay           : 10 (mm)
Record Format             : Include Century Field
```

Then the Maintenance Session menu reappears.

```
STC SmartScan System
Site ID:
Maintenance Session Configuration
-----
1) Display Config.
2) Edit Session Config.
3) Edit Maintenance Reporting Config.
4) Reset Session
X) Exit Menu
?
```

50 To edit some or all the configuration information for the maintenance session, type **2**

51 Press **[Enter]**.

The configuration information appears.

```
Maintenance Session Configuration

Auto Reporting           : Disabled
Site ID                  : AEISite
AAR Billing Code         : 99999
Time Zone (hrs from GMT) : 06
Units of Measure        : N/A
Report Delimiter        : null
Phone Number            : none
Baud Rate               : 2400
Report Reverse-out Trains : N/A
Reporting Protocol      : Generic
.....
Maintenance Reporting Config.

Reporting Interval      : 01:00 (hh:mm)
Extended Delay         : 10 (mm)
Record Format           : Include Century Field
```

Then the T94 Session Edit menu appears.

```
STC SmartScan System
Site ID:
T94 Session Edit Menu
-----
 1) Auto Reporting
 2) Site ID
 3) AAR Billing Code
 4) Time Zone
 5) Units of Measure
 6) Report Delimiter
 7) Phone Number
 8) Baud Rate
 9) Report Reverse-out Trains
10) Reporting Protocol
11) Resend Trains
 X) Exit Menu
?
```

Refer to steps **14** through **44** for information regarding setting up a dial-out session.

52 When you are done editing the maintenance session's configuration information, type **x**
The Maintenance Session menu reappears.

```
STC SmartScan System
Site ID:
Maintenance Session Configuration
-----
 1) Display Config.
 2) Edit Session Config.
 3) Edit Maintenance Reporting Config.
 4) Reset Session
 X) Exit Menu
?
```

53 To edit some or all the maintenance reporting configuration, type **3**

54 Press **[Enter]**.

The configuration information appears.

```
Maintenance Reporting Config.

Reporting Interval      : 01:00 (hh:mm)
Extended Delay         : 10 (mm)
Record Format           : Include Century Field
```

Then the Maintenance Reporting Configuration menu appears.

```
STC SmartScan System
Site ID:
Maintenance Reporting Config. Menu
-----
 1) Reporting Interval
 2) Extended Delay
 3) Record Format
 4) Maint. Code Severity Levels
 X) Exit Menu
```

At this time, you can initialize the maintenance-reporting configuration. Five options are provided. Below is what would appear if you select a given option.

If you type **1** and press **[Enter]**, a prompt like this appears. Valid values are 0000 through 2500. If you type a value greater than 2500, the system changes it to 2500.

```
Current Reporting Interval (hh:mm): 01:00
Enter New Reporting Interval (hh:mm):
```

If you type **2** and press **[Enter]**, a prompt like this appears. Valid values are 00 through 60. If you type a value greater than 60, the system changes it to 60.

```
Current Extended Delay (mm): 10
Enter New Extended Delay (mm):
```

If you type **3** and press **[Enter]**, a prompt like this appears. If you type **y**, the value toggles between include century field and exclude century field.

```
Current Record Format: Include Century Field
Modify ? (Y/N):
```

If you type **4** and press **[Enter]**, a prompt like this appears.

```
Maint. Code Severity Levels

|Code Lvl|Code Lvl|Code Lvl|Code Lvl|Code Lvl|Code Lvl|
|----  ---|----  ---|----  ---|----  ---|----  ---|----  ---|
|  0  N |  3  N |  4  N |  5  N | 15  N | 21  N |
| 29  N | 30  N | 42  N | 44  N | 46  N | 53  W |
| 54  W | 80  N | 82  N | 84  N | 94  W | 95  W |
| 96  W | 97  W |100  F |101  F |102  F |103  F |
|105  F |109  F |110  F |113  W |118  F |120  F |
|121  F |125  W |126  W |127  W |141  F |142  F |
|143  F |

=====

STC SmartScan System
Site ID:
Severity Levels
-----
  1) Edit
  2) Load Defaults
  X) Exit Menu
  ?
```

55 When you are done editing the maintenance session's configuration information, type **x**
The Maintenance Session menu reappears.

```
STC SmartScan System
Site ID:
Maintenance Session Configuration
-----
  1) Display Config.
  2) Edit Session Config.
  3) Edit Maintenance Reporting Config.
  4) Reset Session
  X) Exit Menu
  ?
```

56 Type **x**
The T94 Sessions Configuration menu reappears.

57 Type **x**
The System menu reappears.

6.7 System Statistics Reporting Parameters (Option 9)

The SmartScan's System Statistics log is used to collect certain statistics as each train passes a site. The data collected on each train is stored in a record in the System Statistics log. These records can also be sent via modem to a customer's computer that is setup to receive such data via a modem connection. The Statistics Session Configuration menu is used to specify where the System Statistics records are to be sent, when enabled.

To set or change the Statistics Session configuration values:

- 1 Be sure the System menu is displayed.

```
STC SmartScan System
Site ID:
System Menu
-----
 1) AEI Processor/Reader Configuration Menu
 2) Set System Date and Time
 3) Check AEI Processor
 4) Modem Setup
 5) T94 Session Configuration
 6) Site ID
 7) Host Port CTS Status
 8) Suspend Train Scanning
 9) Statistics Session Configuration Menu
10) Set/Change Menu Passwords
11) Daylight Savings Clock Adjustment
12) Clear All Stored Data
13) Multi-Track Site
14) AC/Battery Monitor
X) Exit Menu
?
```

- 2 From the System menu, type **9**

- 3 Press **[Enter]**.

The Statistics Session Configuration menu appears.

```
STC SmartScan System
Site ID:
Statistics Session Configuration Menu
-----
 1) Display Configuration
 2) Auto Reporting
 3) Site ID
 4) Time Zone
 5) Phone Number
X) Exit Menu
?
```

- 4 To display the statistic session's configuration information, type **1**

5 Press [Enter].

The configuration information appears. Your information will be different.

```
Statistics Session Configuration      Last Stat Rec Sent: 0

Auto Reporting                       : Disabled
Site ID                              : NeelGap
Time Zone (hrs from GMT)             : 05
Phone #                              : 12223334455
```

Then the Statistics Session Configuration menu reappears.

```
STC SmartScan System
Site ID:
Statistics Session Configuration Menu
-----
 1) Display Configuration
 2) Auto Reporting
 3) Site ID
 4) Time Zone
 5) Phone Number
 X) Exit Menu
?
```

6 To change the status of automatic reporting, type 2

7 Press [Enter].

A prompt like this appears. Your prompt states whether automatic reporting is currently disabled or enabled.

```
Current Auto Reporting: Disabled
Modify ? (Y/N):
```

If enabled, the SmartScan system tries to send System Statistics records to a computer that can be accessed via the telephone number entered for the session. If disabled, the System Statistics records won't be sent.

8 If you want to modify the auto reporting status:

a Type y

A message like this appears. The message states to what you changed the automatic reporting. Then the Statistics Session Configuration menu reappears.

```
Current Auto Reporting: Enabled
Modify ? (Y/N):
```

b Go to step 10.

9 If you don't want to modify the auto reporting status, type **n**

The Statistics Session Configuration menu reappears.

```
STC SmartScan System
Site ID:
Statistics Session Configuration Menu
-----
 1) Display Configuration
 2) Auto Reporting
 3) Site ID
 4) Time Zone
 5) Phone Number
 X) Exit Menu
?
```

10 To change the site identifier, type **3**

11 Press **[Enter]**.

A prompt like this appears.

```
Current Site ID: NeelGap
Enter New Site ID:
```

If you want to keep the displayed site identifier, press **[Esc]**. If you don't, type up to seven characters. If you type less than seven characters, press **[Enter]** after typing the last character. If it is seven characters, pressing **[Enter]** isn't necessary. If you press **[Enter]** without typing any characters first, the system will delete the contents of the site-identifier field.

12 Enter a new identifier or press **[Esc]** or press **[Enter]**.

The Statistics Session Configuration menu reappears.

```
STC SmartScan System
Site ID:
Statistics Session Configuration Menu
-----
 1) Display Configuration
 2) Auto Reporting
 3) Site ID
 4) Time Zone
 5) Phone Number
 X) Exit Menu
?
```

13 To change the time zone, type **4**

14 Press [Enter].

A prompt like this appears.

```
Current Time Zone: 5
Enter New Time Zone (hrs from GMT)
(5=Eastern, 6=Central, 7=Mountain, 8=Pacific):
```

If you want to keep the displayed offset, press **[Esc]**. If you don't, type any number between 0 and 23. If you type a single-digit number, either add a leading zero or press **[Enter]** after typing the digit. If you press **[Enter]** without typing any digits, the offset is set to zero.

15 Enter a new offset or press [Esc] or press [Enter].

The Statistics Session Configuration menu reappears.

```
STC SmartScan System
Site ID:
Statistics Session Configuration Menu
-----
1) Display Configuration
2) Auto Reporting
3) Site ID
4) Time Zone
5) Phone Number
X) Exit Menu
?
```

16 To change the phone number of where the System Statistics records will be sent, type 5

17 Press [Enter].

A prompt like this appears.

```
Current Phone Number: 12223334455
Enter New Phone Number:
```

If you want to keep the displayed phone number, press **[Esc]**. If you don't, type up to 25 digits. If you type less than 25 digits, press **[Enter]** after typing the last digit. If you type 25 digits, pressing **[Enter]** isn't necessary. If you press **[Enter]** without typing any digits, the phone number is set to none. In other words, there is no phone number.

18 Enter a new phone number or press **[Esc]** or press **[Enter]**.

A message appears. It consists of the word "entered" followed by the phone number or the word "none." After this message, the Statistics Session Configuration menu reappears.

```
STC SmartScan System
Site ID:
Statistics Session Configuration Menu
-----
 1) Display Configuration
 2) Auto Reporting
 3) Site ID
 4) Time Zone
 5) Phone Number
 X) Exit Menu
?
```

19 Type **x**

The System menu reappears.

6.8 Modem (Option 4)

The SmartScan system monitors the amount of time that has passed since the last time a connection was made with a host computer via the system modem. If the time since the last connection was made exceeds the value entered for the Modem No-Connect Reset Timeout, the system causes a hard reset of the modem by toggling the modem power off and then on again. The Modem Setup menu lets you set or change the time since the last connection. It also lets you set or change the current modem type and initialize the modem.

To set or change the modem setup values:

1 Be sure the System menu is displayed.

```
STC SmartScan System
Site ID:
System Menu
-----
 1) AEI Processor/Reader Configuration Menu
 2) Set System Date and Time
 3) Check AEI Processor
 4) Modem Setup
 5) T94 Session Configuration
 6) Site ID
    .
    .
    .
```

2 From the System menu, type **4**

The Modem Setup menu appears.

```
STC SmartScan System
Site ID:
Modem Setup
-----
 1) Modem Type
 2) No-Connect Reset Timeout
 3) Initialize Modem
 X) Exit Menu
?
```

At this time, you can initialize the setup parameters for the modem. Four options are provided. Below is what would appear if you select a given option.

If you type **1** and press **[Enter]**, a prompt like this appears. If MultiTech ZDX appears, typing **y** changes it to Motorola Cell. If Motorola Cell appears, typing **y** changes it to AirLink Redwing. If AirLink Redwing appears, typing **y** changes it to MultiTech ZDX.

```
Current Modem Type: MultiTech ZDX
Modify ? (Y/N):
```

If you type **2** and press **[Enter]**, a prompt like this appears. Time is in **hhmm** format, where **hh** is the hours and **mm** is the minutes. The system automatically inserts the colon. For hours and minutes from 1 through 9, enter leading zeros. Thus, for 1 hour and 6 minutes, enter **0106**. If a zero is entered for this parameter, the time since the last connection with a host computer is not monitored. Valid values are 0000 through 2500. If you type a value greater than 2500, the system changes it to 2500.

```
Current No-Connect Reset Timeout (hh:mm): 00:00
Enter New No-Connect Reset Timeout (hh:mm):
```

If you type **3** and press **[Enter]**, a prompt like this appears.

```
Initialize Modem? (Y/N):
```

3 To return to the System menu, type **x**

The System menu reappears.

6.9 Clear All Stored Data (Option 12)

This option allows you to erase all of the train data that is data stored on the system. After deleting this data, there isn't any way of regenerating it. The data is gone forever.

To erase all train data:

- 1 Be sure the System menu is displayed.

```
      •
      •
      •
      8) Suspend Train Scanning
      9) Statistics Session Configuration Menu
      10) Set/Change Menu Passwords
      11) Daylight Savings Clock Adjustment
      12) Clear All Stored Data
      13) Multi-Track Site
      14) AC/Battery Monitor
      X) Exit Menu
      ?
```

- 2 From the System menu, type **12**

This prompt appears.

```
Clear All Stored Data ? (Y/N):
```

- 3 If you want to erase all train data, type **y**

This message appears.

```
Clearing Stored Train Data...
```

Clearing the train data takes about two seconds. When finished, this message appears followed by the System menu.

```
Clearing Stored Train Data...Done
```

- 4 If you don't want to erase all train data, type **n**

The System menu reappears.

6.10 Multi-Track Site (Option 13)

Sites can either be single track or multitrack. It is important for the proper functioning of the software for it to know which.

To tell the software if this is a multitrack site or not:

- 1 Be sure the System menu is displayed.

```
      .
      .
      .
      8) Suspend Train Scanning
      9) Statistics Session Configuration Menu
      10) Set/Change Menu Passwords
      11) Daylight Savings Clock Adjustment
      12) Clear All Stored Data
      13) Multi-Track Site
      14) AC/Battery Monitor
      X) Exit Menu
      ?
```

- 2 From the System menu, type **13**

- 3 Press **[Enter]**.

A prompt like this appears, stating whether the software considers this a multitrack site or not. At this site, if you have only one track, the last word in the first line below should be no. At this site, if the site is installed on a track that is adjacent to one or more tracks, the last word in the first line below should be yes.

```
Multi-Track Site: No
Modify ? (Y/N):
```

- 4 If you want to change the stated multitrack indicator, type **y**

A message like this appears, stating whether the software considers this a multitrack site or not. Then the System menu reappears.

```
Multi-Track Site: Yes
```

- 5 If you want to keep the stated multitrack indicator, type **n**

A message like this appears, stating whether the software considers this a multitrack site or not. Then the System menu reappears.

```
Multi-Track Site: No
```

6.11 AC/Battery Monitor (Option 14)

The SmartScan system is capable of monitoring for loss of incoming line power (120 VAC) and low-voltage output from the system backup batteries (24 VDC). These monitoring functions are enabled and disabled using option 14. When this option is enabled and no AC power is detected, a message is posted to the system log.

When this option is enabled and the DC power drops below a predetermined value, a message is posted to the system log. On the Interface board is a switch that allows you to select from one of four preset levels for low-battery threshold. The selectable values are 20.9 VDC, 21.5 VDC, 22.0 VDC, and 22.7 VDC.

To tell the software if it should monitor the incoming AC and the outgoing DC:

- 1 Be sure the System menu is displayed.

```
      •
      •
      •
8) Suspend Train Scanning
9) Statistics Session Configuration Menu
10) Set/Change Menu Passwords
11) Daylight Savings Clock Adjustment
12) Clear All Stored Data
13) Multi-Track Site
14) AC/Battery Monitor
X) Exit Menu
?
```

- 2 From the System menu, type **14**

- 3 Press **[Enter]**.

A prompt like this appears, stating whether the AC/Battery Monitor is currently enabled or disabled.

```
AC/Battery Monitor: Disabled
Modify ? (Y/N):
```

- 4 If you want to change the status of the monitor, type **y**

A message like this appears, stating whether the AC/Battery Monitor is now enabled or disabled. Then the System menu reappears.

```
AC/Battery Monitor: Enabled
```

- 5 If you want to keep the status of the monitor, type **n**

A message like this appears, stating whether the AC/Battery Monitor is now enabled or disabled. Then the System menu reappears.

```
AC/Battery Monitor: Disabled
```

6.12 Suspend Train Scanning (Option 8)

Under normal conditions, when the transducer or presence inputs are activated, communication with the AEI processor is prohibited, including those times when an error condition causes one of these inputs to activate when a train is not present.

This option allows you to put the system in a mode whereby the transducer and presence inputs can be monitored without activating the train scanning processes. Once train scanning has been suspended, the Check AEI Processor option can be used to monitor the states of the transducer and presence inputs. Any inputs that are enabled when the AEI processor is queried will be flagged as being "active."

Once the Suspend Train Scanning option is selected, no trains will be recorded by the system until train scanning is enabled via the AEI Processor Setup menu.

To suspend train scanning:

- 1 Be sure the System menu is displayed.

```
STC SmartScan System
Site ID:
System Menu
-----
 1) AEI Processor/Reader Configuration Menu
 2) Set System Date and Time
 3) Check AEI Processor
 4) Modem Setup
 5) T94 Session Configuration
 6) Site ID
 7) Host Port CTS Status
 8) Suspend Train Scanning
 9) Statistics Session Configuration Menu
10) Set/Change Menu Passwords
11) Daylight Savings Clock Adjustment
12) Clear All Stored Data
13) Multi-Track Site
14) AC/Battery Monitor
X) Exit Menu
?
```

- 2 From the System menu, type 8

This message appears followed by the System menu.

```
Polling Reader, One Moment Please
Suspend Train Scanning: Enabled
```

6.13 Reader Microprocessor (Option 3)

To check the health of the reader microprocessor in the 2200-100 Processor:

- 1 Be sure the System menu is displayed.

```
STC SmartScan System
Site ID:
System Menu
-----
1) AEI Processor/Reader Configuration Menu
2) Set System Date and Time
3) Check AEI Processor
4) Modem Setup
5) T94 Session Configuration
   .
   .
   .
```

- 2 From the System menu, type **3**

- 3 Press **[Enter]**.

A message like this appears. Then the System menu reappears.

```
Polling Reader, One Moment Please.
*** Reader is OK!
```

Chapter 7

System Operation

Most of the time, the SmartScan system is waiting for a train to arrive. When a train activates the presence detector, the system starts the train recording process. This process records all events such as train presence, train direction, axle counts, and RFID/AEI tag reads. As the data is received, the 2200-100 Processor correlates the information into one train-header record and many individual car records. When the train has passed, the SmartScan system stores these records and transmits them to the host computer, if so configured.

This chapter describes the flow of signals and data within the SmartScan system during and after train passage. It also describes the T94 and Train Detail reports.

7.1 Train Algorithm Activation

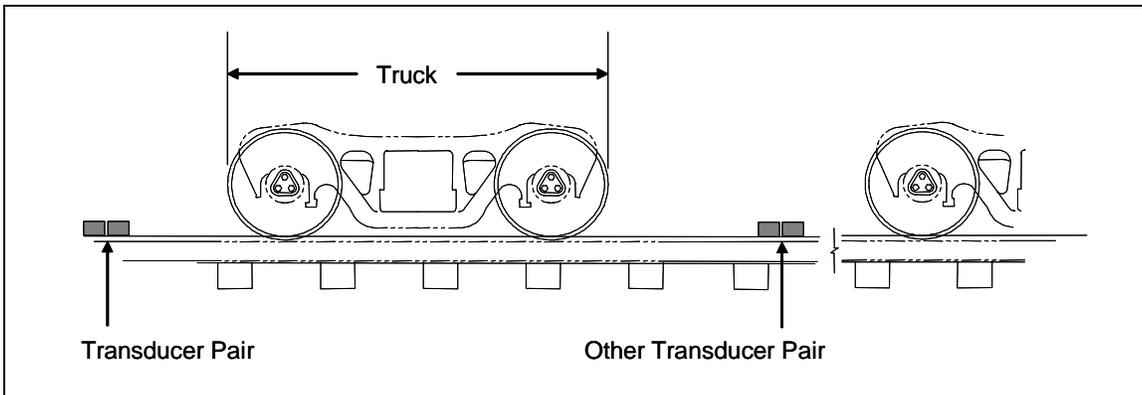
When the presence detector signal goes active, the reader microprocessor (in the 2200-100 Processor) starts the train algorithm. As a backup to this process, the train algorithm may also be started when the leading edge of a transducer signal is received, provided the presence detector hasn't already activated the process.

All events are recorded. They are referenced in milliseconds of elapsed time from the start of the algorithm. Other events referenced from the start of the algorithm are:

- The beginning and end times of transducer pulses.
- The timestamps assigned to tags as they are read by the AEI readers.
- The time the presence detector signal deactivates.

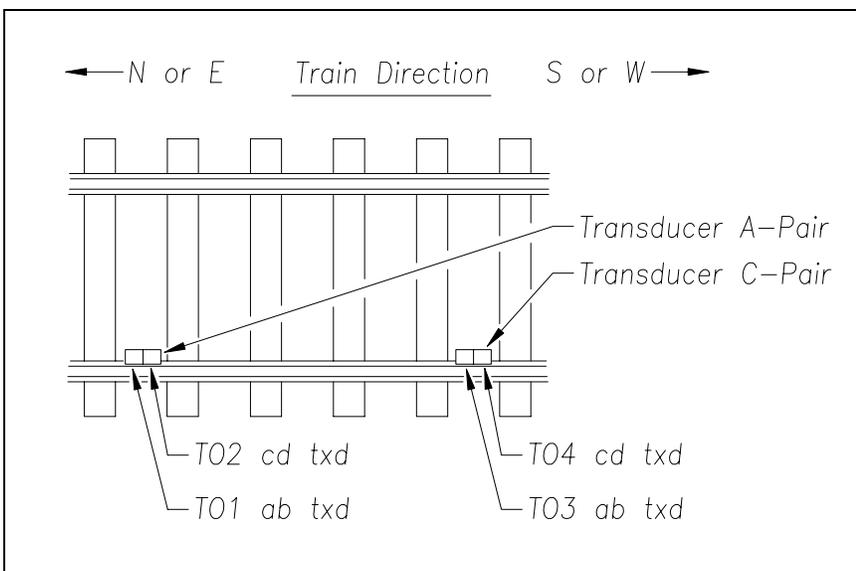
7.2 Car Breakout and Wheel Transducers

The SmartScan AEI system uses four transducers that are configured in two transducer pairs. When measured inside to inside, the second pair of transducers should be 9.5 feet (2.9 meters) away from the first pair. This distance enables the system to isolate the trucks of most railroad vehicles between the two transducer pairs.



By isolating the trucks on the vehicles as they pass over the transducers, the individual vehicles of a consist can be identified and the vehicle breakout for the consist can be developed. The use of pairs of transducers enables the system to determine which direction each wheel is traveling as it passes over a transducer pair. This is especially important when developing the consist vehicle breakout for stop-and-reverse traffic.

In the SmartScan AEI system, the transducer pairs are labeled A-pair and C-pair. The figure below shows the orientation of these pairs when installed. The transducers in a given pair are located so that, as a wheel passes over the pair, first one transducer turns on and then the other turns on. Both transducers are on for a period of time and then the first to turn on, turns off, and then the second to turn on, turns off.



As a train passes over the site, an elapsed time counter assigns timestamps to events such as when a RFID/AEI tag is read or when a wheel crosses a transducer. This counter is zeroed and started when a train enters a site. The counter increments once every millisecond so the timestamps assigned are recorded in milliseconds. The counter runs until the train exits the site. The content of the counter is then used to record the amount of time that a train was present at the site.

As a wheel passes over a transducer, the 2200-100 Processor senses when the transducer turns on. It also senses when the wheel completely passes over, and the transducer turns off. For every wheel that passes over a transducer, two timestamps are recorded – one for the turn-on time and one for the turn-off time. As a wheel passes over each transducer pair, four timestamps are recorded – one for each of the turn-on times of each transducer and one for each of the turn-off times of each transducer.

The transducers in a transducer pair are identified in two different ways depending on the context. Transducers TO1 and TO2 make up the A-pair. Transducers TO3 and TO4 make up the C-pair. These labels are referenced during installation. When interpreting a Train Detail report produced by the SmartScan system, the transducers are referenced by their **ab** and **cd** designations. This is necessary because a transducer record in the Train Detail report contains the turn-on and turn-off timestamp for both transducers of a given pair.

The **ab** and **cd** designators are used to indicate the order in which the transducers in a pair were activated. Both of the transducer pairs contain an **ab** transducer and a **cd** transducer.

The **ab** and **cd** designators serve a dual purpose in that they are also used to indicate whether a timestamp in a transducer record corresponds to a transducer turn-on event or a transducer turn-off event. In the Train Detail report, the letter **a** indicates the timestamp that corresponds to the turn-on time of a specific transducer and the letter **b** indicates the timestamp that corresponds to the turn-off time of that transducer. Likewise, the letter **c** indicates the timestamp that corresponds to a turn-on event and the letter **d** indicates the timestamp that corresponds to the turn-off event for a given transducer.

The figure below shows part of a Train Detail report from a SmartScan AEI system. The locomotive represented in this report pulled straight through the site. That is, it didn't stop or reverse direction while over the site.

Car Number	Truck Number	Txd Pair ID	Timestamps Recorded	Txd Pair Off-Time	Txd On-Off Order	Txd On-Off Timestamps			
1	0	A	4	3923	abcd	3923	3959	3942	3981
1	0	A	4	259	abcd	4240	4276	4259	4298
1	0	C	4	4400	abcd	4400	4427	4421	4447
1	0	A	4	276	abcd	4574	4609	4592	4631
1	0	C	4	271	abcd	4718	4744	4738	4763
1	0	C	4	288	abcd	5051	5077	5071	5097
1	1	A	4	1343	abcd	5974	6009	5992	6031
1	1	A	4	278	abcd	6309	6344	6328	6366
1	1	C	4	1356	abcd	6453	6479	6474	6498
1	1	A	4	261	abcd	6627	6662	6646	6684
1	1	C	4	291	abcd	6789	6813	6810	6833
1	1	C	4	273	abcd	7106	7132	7127	7151

This excerpt shows the transducer records generated for a six-axle locomotive as it crossed a site. There are 12 records. Each transducer pair produced one record for each axle.

The **Car Number** field identifies the number assigned to consecutive vehicles in a consist. This field indicates which car a given transducer record was assigned to.

The **Truck Number** field identifies the number assigned to the trucks in a consist. This field reflects the truck that a given transducer record was assigned to.

The **Txd Pair ID** field identifies which transducer pair produced the data for a given line in the report. In this example, the A-pair produced the data for the first two records (lines), the C-pair produced the data for the third record, and so on.

The **Timestamps Recorded** field indicates the number of turn-on and turn-off timestamps that were recorded for a given transducer record. This value can vary from two to five. In this example, all of the records contain four timestamps.

The **Txd Pair Off-Time** field indicates the amount of time that elapsed between consecutive "hits" on a transducer pair. For example, in this example, the second record indicates that 259 milliseconds elapsed between the first and second wheels of this locomotive as they crossed the transducer A-pair.

The **Txd On-Off Order** field serves two purposes. First, it identifies the order in which the transducers of the pair "fired." Second, it specifies how the timestamps in the **Txd On-Off Timestamps** field should be interpreted – each letter in this field corresponds to a column in the **Txd On-Off Timestamps** field. The **Txd On-Off Order** field indicates that, for every record, the first column corresponds to the turn-on event for the **ab** transducer of each pair. It also indicates that the second column corresponds to the turn-off event for that same transducer. The **cd** transducer of each pair generated the third and fourth columns. The third column is the turn-on event and the fourth column is the turn-off event. Note that for a train traveling in the opposite direction of the one represented by the example above, the **Txd On-Off Order** field would read **cdab**.

The **Txd On-Off Timestamps** field contains the timestamps that correspond to the turn-on and turn-off events for each of the transducers in a pair.

The figure below shows part of another Train Detail report from a SmartScan AEI system. In this report, a four-axle car stopped on the site and then reversed direction and exited the site.

Txd Pair ID		Txd On-Off Order		Txd On-Off Timestamps					
5	8 C 4	3474	cadb	102636	102846	103381	103563		
5	8 C 4	2238	cadb	105801	106011	106564	106735		
5	8 A 4	3502	cadb	108394	108576	109248	109418		
5	8 A 4	2116	cadb	111534	111737	112377	112544		
5	9 C 4	18601	cadb	125336	125576	126190	126393		
5	9 C 4	3167	cadb	129560	129962	131040	131380		
5	9 A 4	23091	cabd	135635	136718	143336	144253		
5	9 C 4	18189	acbd	149569	150017	151344	151811		
5	9 C 4	4412	acbd	156223	156550	157534	157882		
5	9 A 4	27874	acbd	172127	172282	172923	173053		
5	9 A 4	1465	acbd	174518	174648	175123	175289		
5	9 C 4	18467	acbd	176349	176470	176882	177010		
5	9 A 4	2258	acbd	177547	177669	178098	178235		
5	9 C 4	1460	acbd	178470	178584	178970	179095		

As in the previous example, the letters in the **Txd On-Off Order** field indicate to which event each column in the **Txd On-Off Timestamps** field corresponds. In this example, for the first seven records, the **cd** transducer turned on first, the **ab** transducer turned on second, the **cd** transducer turned off third, and the **ab** transducer turned off last. Thus, for the first seven records, the first column in the **Txd On-Off Timestamps** field indicates when the **cd** transducer of each pair turned on. The second column indicates when the **ab** transducer of each pair turned on.

The eighth record in this example shows where the vehicle reversed direction. This is indicated by the change in the order of transducer events, as shown by the **Txd On-Off Order** field. The **Txd On-Off Order** field in the last seven records indicates, that the **ab** transducer of each pair is the first to be "hit" by each wheel (the **cd** transducer was the first "hit" for the first seven records).

In this example, all four of the axles of this vehicle crossed over the transducer C-pair before the car reversed direction. Three of the axles of the vehicle had crossed over the transducer A-pair before reversing. This is indicated by the entries in the **Txd Pair ID** field in each of the records.

The ability to keep track of axle count and direction allows the 2200-100 Processor to maintain accurate vehicle identification in the stop-and-reverse movement environment of a switchyard.

7.3 RFID/AEI Tag Read Association

Each railcar in North American Interchange service must have two RFID/AEI tags. With the exception of the side indicator, the information in the pair of tags is identical. The SmartScan systems monitor, record, and assign all tags in reference to the time they were read, and if they have a mate or matching tag. Following is the sequence of reading and association of tags to individual railcars.

- When the presence detector is activated, the 2200-100 Processor starts the car breakout algorithm, commands both AEI readers to activate RF power, and retrieves the current value of the onboard clock from each reader.
- As the train passes the AEI antenna and a tag comes into the antenna field, the reader that decodes that tag's information appends a timestamp to the tag record and sends the record to the 2200-100 Processor.
- The 2200-100 Processor records which antenna read the tag and which tag was read (left or right). Based on timestamps, the tag is assigned to a car record.
- When the next tag is received and decoded, it is compared to previously recorded tags to determine if it is a matching tag or a newly identified tag. If a match is found, the tag is assigned to the car record of the matching tag. If no match is found, it is assigned to a car based on the elapsed time record.

7.4 Train Algorithm Completion

When the presence detector is deactivated, the algorithm defines the end of train as the last transducer transition and completes the train record. Some post-processing routines may be activated at this time to verify data integrity.

7.5 Data Transfer

Within the 2200-100 Processor, the reader microprocessor transfers the data to the communications microprocessor. The communications microprocessor stores the data in DRAM. After a train has been stored, the following operations take place.

- The communications microprocessor organizes the data into T94 format.
- The landline modem or cellular modem is activated to call the host computer.
- When a connection is established, the train record is transferred to the host computer.

T94 is a data format standard developed and used by many railroads in North America. The express purpose of T94 format is to provide a standardized method for the exchange of data between an AEI reader and a railroad's host computer or server. The SmartScan system reports train data using the T94 specified format.

7.6 T94 Report

Below is a sample of a T94 report of a 16-vehicle train consisting of 3 locomotives, 13 railcars, and 1 end-of-train (EOT) device. The end-of-consist (EOC) segment serves as a simple data validation for ensuring successful receipt of a T94 report by a host computer. **Chapter 8 – Producing Reports** tells how to produce this and other reports.

```
AEM00802001320405112210251027050Y4116080GDE0E074065067ANFN01145G0303013120162
RRE001DUP 0000006288A GGK03030680601
RRE002DUP 0000006026B GGK03030680601
RRE003DUP 0000006130A GGK04030670601
RRE004RDTTX0000720503A GGP03030671205
RRE005RBN 0000064191B GGK03040691205
RRE006RDTTX0000072866A GGK03030661205
RRE007RDTTX0000072706B GGP03030651205
RRE008RDTTX0000073340A GGK04040661205
RRE009RDTTX0000075153A GLP00030651205
RRE010RDTTX0000073895A GGM03040700803
RRE011R 0000000000A GNK00000740401
RRE012RDTTX0000062110A GGM03040721205
RRE013RDTTX0000073312B GGK02030651205
RRE014RDTTX0000072508B GGP04030661205
RRE015RDTTX0000072593A GGP02020671205
RRE016RAPLX0000004511B GGP03000671205
EOT016ESFQ 00000024230000K
EOC0000000732
```

The first line of the above report is the header segment, the individual lines in the middle are the rail-equipment segments, and the last line is the end-of-consist segment.

7.6.1 T94 Header Segment

The data in the header segment is described below. This segment contains information that applies to the whole train. One header segment is always sent with each consist reported. It is always the first segment.

AEM00802001320405112210251027050Y4116080GDE0E074065067ANFN01145G03030130120162

Value	Meaning
AEM	Segment ID "Automatic Equipment Message"
00802	AAR Billing Code
0013204	Site ID
051122	Event Start Date (in yymmdd format)
1025	Event Start Time (in hhmm format)
1027	Event Stop Time (in hhmm format)
050	Time Zone (hours offset from GMT; xx.x decimal point assumed)
Y	Daylight-Savings Time Indicator (Y=Yes; N=No)
411	Data Format Version Number (x.xx decimal point assumed)
6080	Train Sequence Number (site relative; range=0001-9999; 0000 is invalid)
G	Locomotive Conversion Status
D	Railcar Conversion Status
E	Direction of Travel
0	Switch/Direction Indicator
E	Units of Measure (E=English; M=Metric)
074	Maximum Speed (fastest vehicle; in miles per hour or kilometer per hour)
065	Minimum Speed (slowest vehicle; in miles per hour or kilometer per hour)
067	Average Speed (average vehicle; in miles per hour or kilometer per hour)
A	Movement Status, where A=through movement over 5 mph
N	Termination Status, where N=Normal
F	Transmission Type, where F=first transmission
N	Adjacent Track Occupied (Y=Yes; N=No)
01145	Train Length (in feet or decimeters)
G	Equipment Status Code, where G=Good (no problems detected)
03	Locomotive Count
03	Locomotives Tagged
013	Railcar Count
012	Railcars Tagged
0162	Total Axle Count

7.6.2 First Locomotive Segment

The data in the first locomotive segment is described below. At least one rail-equipment segment is sent for each locomotive on the train.

RRE001DUP 0000006288A G GK03030680601

Value	Meaning
RRE	Segment ID "Railroad Equipment"
001	Sequence Number (standing order of vehicle in consist)
D	Equipment Group Code (D=Locomotive; R=Railcar; ?=unknown)
UP	Owners Code
0000006288	Owner Equipment Number
A	Orientation (A=A-end of vehicle; B=B-end (brake-end) of vehicle)
	<i>Reserved for future use</i>
G	Axle Conversion Code, where G=Good
G	Tag Status, where G=Good (both tags were read)
K	Tag Detail Status, where K=OK
03	Handshakes from Antenna1
03	Handshakes from Antenna2
068	Speed of Vehicle (in miles per hour or kilometer per hour)
06	Number of Axles
01	Number of Platforms

7.6.3 First Railcar Segment

The data in the first railcar segment is described below. At least one rail-equipment segment is sent for each railcar on the train.

RRE004RDTTX0000720503A GGP03030671205

Value	Meaning
RRE	Segment ID "Railroad Equipment"
004	Sequence Number (standing order of vehicle in consist)
R	Equipment Group Code (D=Locomotive; R=Railcar; ?=unknown)
DTTX	Owners Code
0000720503	Owner Equipment Number
A	Orientation (A=A-end of vehicle; B=B-end (brake-end) of vehicle)
	<i>Reserved for future use</i>
G	Axle Conversion Code, where G=Good
G	Tag Status, where G=Good (both tags were read)
P	Tag Detail Status, where P=Platform code error
03	Handshakes from Antenna1
03	Handshakes from Antenna2
067	Speed of Vehicle (in miles per hour or kilometer per hour)
12	Number of Axles
05	Number of Platforms

7.6.4 End-of-Train Device Segment

The data in the end-of-train device segment is described below. Since not all trains have a tag that generates this segment, this segment doesn't exist on all T94 reports.

EOT016ESFQ 00000024230000K

Value	Meaning
EOT	Segment ID "End-of-Train" device
016	Sequence Number (standing order of vehicle in consist)
E	Equipment Group Code, where E=End-of-Train device
SFQ	Owners Code
0000002423	Owner Equipment Number
00	Number of Handshakes from Antenna1
00	Number of Handshakes from Antenna2
K	Tag Detail Status, where K=OK

7.6.5 End-of-Consist Segment

The data in the end-of-consist segment is described below. This segment isn't data from a tag, but, rather, a calculation that is made after no more tags are read. One end-of-consist segment is always sent with each consist reported. It is always the last segment.

EOC0000000732

Value	Meaning
EOC	Segment ID "End of Consist"
0000000732	Total byte count

7.7 Train Detail Report

Of the nine types of reports the SmartScan system can produce, five are a type of the Train Detail report. Even though one of these reports only provides data on the last train and another on a range of trains, they still look much the same. **Chapter 8 – Producing Reports** tells how to produce these and other reports.

The following Train Detail report is an example of the information available for recording or troubleshooting. It can be accessed through the Report menu. Following this example is an explanation of the individual car records. The version information in the sample below is for illustrative purposes only. It doesn't represent any real release of the firmware.

```

Run Date: 02/19/2005 06:21:38 Winemuc
=====
Firmware Version - Comm: ML2.1s 03/23/05 Reader: ML2.1s 04/24/05
=====
Train Information Summary | Tag Information Summary
-----|-----
Train: 97 | Direction: S | Total Tags Sensed: 179
Date: 02/19/2006 | Axles: 356 | Tags Read: 350
Time: 05:09:54 | Cars: 88 | Tag Read Errors: 0
Post Proc Cnt: 1 | Max Speed: 47 | Unique Tag ID's Stored: 89
File Size: | Min Speed: 45 |
33752 | Avg Speed: 45 | Post Train Error Tags: 0
33609 | Length: 5522 ft|
Txd. Filters: AB = 0 CD = 0 [T94: Axles 356 Cars 87]
=====
.
.
.
=====
Total N/E S/W
Vehicle Count: 87 0 87
Locomotives Tagged: 2 0 2
Untagged: 0 0 0
Rail Cars Tagged : 85 0 85
Untagged: 0 0 0
=====
T P E M
r l x v
A T u a t s
x a T94 c t D t
l g O ----- k f i a Car
Car s s r Car Ax Tg Spd s s r t Flags Lock Times Hand Tag Tag
Shakes Trk Len Flags
-----
1 6 1 B 1 6 1 20 2 1 S A 1030 ST 1997 ET 4195 G 68
6 GK 5 UP 4683 P 0 3517 2357 30| 28 3|1 72 0
1 0 A 4 1997 acbd 1997 2011 2020 2037
1 0 A 4 167 acbd 2204 2218 2225 2242
1 0 C 4 2327 acbd 2327 2341 2347 2363
1 0 A 4 178 abcd 2420 2442 2434 2459
1 0 C 4 170 abcd 2533 2553 2548 2569
1 0 C 4 181 abcd 2750 2769 2764 2786
1 1 A 4 950 abcd 3409 3427 3423 3444
1 1 A 4 180 abcd 3624 3645 3638 3662
1 1 C 4 955 abcd 3741 3753 3755 3771
1 1 A 4 169 abcd 3831 3850 3845 3867
1 1 C 4 184 abcd 3955 3972 3969 3989
1 1 C 4 172 abcd 4161 4178 4176 4195

2 12 1 B 3 12 1 20 6 5 S A 1029 ST 7062 ET 15381 G 251
12 GM 19 TTAX 78777 P 0 14817 7257 29| 27 10|1 49 0
2 4 A 4 427 abcd 7062 7087 7077 7103
2 4 A 4 136 abcd 7239 7261 7254 7278
2 4 C 4 429 abcd 7392 7416 7407 7432

```


Trucks	2	The number of trucks detected on the vehicle.
Platfs	1	The number of platforms associated with the vehicle.
ExtDir	S	The direction the car was traveling as it left the site.
Movement Status	A	A = Pull through B = Pull through with a multiple direction changes C = Reversed to exit site D = Reversed to exit with multiple direction changes.
Car Flags	1030	Diagnostic code used by STC.
Start Time	1997	Elapsed time (in milliseconds) at which the car's lead axle crossed the first transducer.
End Time	4195	Elapsed time (in milliseconds) at which the car's trailing axle crossed the last transducer.
Axle Conversion Code	G	T94 record (RRE) field indicating the "goodness" of the axle pattern seen for this car, where: B = Bad G = Good S = Inconclusive
Length	68	Vehicle length (in feet) as calculated by the SmartScan system.

The second line contains data that pertains to the RFID/AEI tag that was associated with this car.

6	GK	5	UP	4683	P	0	3517	2357	30		28	3		72	0
---	----	---	----	------	---	---	------	------	----	--	----	---	--	----	---

In this tag record, the fields from left to right indicate the following:

Field	Value	Meaning
Tag Axle Count	6	Axle count field in tag.
Tag Status	G	Indicates worthiness of tag pair read, where: G = Good read of tag pair L = Left tag missing M = Mismatched tags N = No tag read R = Right tag missing ? = Other.
Tag Detail Status	K	Indicates worthiness of tag data versus axle pattern, where: A = Axle error L = Length error K = OK M = Multiple errors P = Platform code error
Equipment Group Code	5	The Equipment Group Code field in the tag.
Owner ID	UP	The Owner ID field in the tag.
Equipment Number	4683	The Equipment Number field in the tag.
Platform Code	0	The Platform Code field in the tag.
Lock Time Reader1	3517	The elapsed time (in milliseconds) at which reader1 read a tag.
Lock Time Reader2	2357	The elapsed time (in milliseconds) at which reader2 read a tag.

Handshakes Reader1	30	The number of times reader1 read the tag as it passed.
Handshakes Reader2	28	The number of times reader2 read the tag as it passed.
Tag Location Reader1	3	Relative location on the car at which reader1 read a tag. 0 = Before lead axle hit first transducer. Vehicle truck count + 1 = After last axle crossed last transducer.
Tag Location Reader2	1	Relative location on the car at which reader1 read a tag.
Tag Length Field	72	Vehicle length (in feet) from the tag.
Diagnostic Code	0	Diagnostic code used by STC.

7.8 Abbreviated Train Detail Report

An alternative form of the Train Detail report is the abbreviated form. In this form, the axle timing records are not shown. The report header is shown and then all of the car records and tag records for the specified train are shown. The following is an example of the records produced in an abbreviated Train Detail report. The definitions of the fields in these records are the same as above.

```

=====
                T P E M
                r l x v
                u a t s
                c t D t
                k f i a Car
Car  s  s r Car Ax Tg Spd  s  s r t Flags  Lock Times  Hand  Tag  Tag
-----
1  4  1 B  1  4  1  12  2  1 S A  1030 ST  4020 ET  6440 G      41
4  GK  5  UPY      1298 P 0      4626  5326  41| 36  1|2  48  0

2  4  1 A  2  4  1  12  2  1 S A  1029 ST  6403 ET  9768 G      66
4  GK 19  FURX    850404 P 0      6866  8746  44| 38  1|2  58  0

3  4  1 B  3  4  1  12  2  1 S A  1029 ST  9866 ET 13340 G      66
4  GL 19  FPAX    200804 P 0      9956 12416  40| 34  1|2  20  0

4  4  1 B  4  4  1  12  2  1 S A  1029 ST 13459 ET 16779 G      63
4  GK 19  ECUX    845012 P 0      13366 16096  42| 24  0|3  64  0

5  4  2 B  5  4  2  12  2  1 S A  1037 ST 16882 ET 19853 G      57
4  GK 19  USLX    20166 P 0      16856 19106  44| 24  0|3  58  0
1  R?  6  UPRQ    29502 P 0      19686      0  44|  0  3|-  41  0

```

Chapter 8

Producing Reports

The SmartScan system provides:

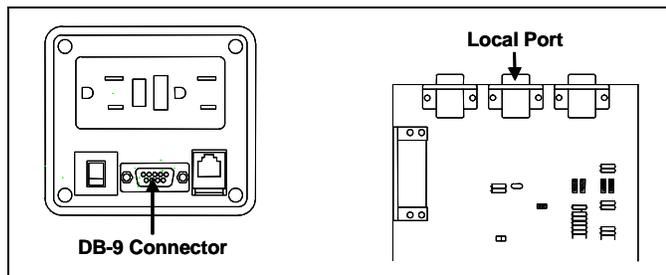
- Train Summary report
- Specified Train report (a type of Train Detail report)
- Last Train report (a type of Train Detail report)
- All Trains Forward report (a type of Train Detail report)
- All Trains Backward report (a type of Train Detail report)
- Range of Trains report (a type of Train Detail report)
- System Statistics report
- T94 report
- System Log report

As you can see, there are nine reports the SmartScan system can produce. None of these reports is specially called the Train Detail report. However, five of the nine reports are of a type that is generally known as a Train Detail report. Even though these five reports are different, they still look much the same.

Since the generic Train Detail report is described in the prior chapter, this chapter only shows a sample of the four reports that don't look like a Train Detail report. The contents of the fields on these shown reports are also covered. For these four reports and the five others, instructions on how to produce each of them, both **on-site** and **off-site**, are given.

You can produce any of these nine reports by using the:

- Keyboard on a computer with installed communications software that is plugged into the DB-9 connector in the small weatherproof box on the lower right side of a 2200-900 Tower Enclosure or the Local port at the top of the 2200-300 Interface board in a 2200-950 Inside Enclosure. With this method, the report is produced at the site.



- Keyboard on a computer with installed communications software and modem. Your modem must be able to communicate with the installed 2200-600 Modem or cellular modem. With this method, the report is produced away from the site.

8.1 Train Summary Report (Option 1)

The Train Summary report provides a listing of all of the trains currently stored in memory. Each line in the report provides summary information for a specific train.

8.1.1 Sample Report with Explanation of Fields

Below is a sample of part of a Train Summary report. The contents of your report will be different. The version information in the sample below is for illustrative purposes only. It doesn't represent any real release of the firmware.

```

=====
                Southern Technologies Corporation
                  SmartScan System
                Train Summary Report
          Run Date: 02/19/2006   06:23:45                Milpita
=====
Firmware Version - Comm: ML4.1k 02/03/05 Reader: ML4.1d 11/27/05
=====

```

Trn Num	Date	Time	Lead Veh	ID	Num Cars	Num Axle	Speed Max	Speed Min	Dir	Tags Rdr1	Read Rdr2	Event Duration
* 5	02/19/06	05:09	BNSF	2283	87	356	47	45	S	87	88	87094 A
4	02/19/06	03:38	UP	4922	50	236	47	45	S	51	50	85361 A
3	02/19/06	02:50	UP	7186	103	418	46	44	S	101	101	99743 A
* 2	02/19/06	02:20	UP	7205	63	256	47	45	S	64	64	93242 A
1	02/19/06	01:35	BNSF	4966	14	126	46	43	S	14	14	50980 A
100	02/18/06	23:47	AMTK	6871	76	310	46	43	S	85	76	77695 A
99	02/18/06	19:09	UP	5782	50	204	45	44	S	51	49	56556 A

Looking at this excerpt from the report above, an explanation of the report fields follows.

Trn Num	Date	Time	Lead Veh	ID	Num Cars	Num Axle	Speed Max	Speed Min	Dir	Tags Rdr1	Tags Rdr2	Event Duration
* 5	02/19/06	05:09	BNSF	2283	87	356	47	45	S	87	88	87094 A

Field	Value	Meaning
(System Startup Flag)	*	An asterisk means that the presence detector didn't worked properly. That is, train scanning started when the leading edge of a transducer signal was received. The absence of an asterisk means that the presence detector worked properly. That is, train scanning started when the presence detector signal went active.
Trn Num	5	The number that identifies the train in the Trains directory. Trains are numbered sequentially from 1 to 100. Even though more than 100 trains have passed the site, less than 100 trains might be stored in the Trains directory. This is because only data for about 2000 vehicles can be stored.
Date	02/19/06	The date on which a train was first detected by a system. Date is in day/month/year format.
Time	05:09	The time at which a train was first detected by a system. Time is in 24-hour format, where 8 a.m. is 08:00, noon is 12:00, 8 p.m. is 20:00, and midnight is 00:00.
Lead Veh ID	BNSF 2283	The owner ID and number from the AEI tag read on the lead vehicle of the train.
Num Cars	87	The total number of vehicles detected on a train.
Num Axle	356	The total number of axles detected on a train.
Speed – Max	47	The maximum speed (in mph) recorded as a train passed the site.
Speed – Min	45	The minimum speed (in mph) recorded as a train passed the site. If the train stopped at a site, this value is 0.
Dir	S	The direction the train was traveling on entering the site.
Tags Read - Rdr1	87	The total number of tags read by reader1 as a train passed.
Tags Read - Rdr2	88	The total number of tags read by reader2 as a train passed.
Event Duration	87094	The number of milliseconds that elapsed as a train passed.
(Movement Status Flag)	A	T94 specified movement type indicator, where: A = Through movement over 5 mph B = Through movement under 5 mph C = Through movement, stop and go D = Through movement, switching E = Simulation F = Reverse exit ? = Other

8.1.2 Producing the Report

To produce a Train Summary report:

- 8 If **on-site**, plug your computer into the SmartScan system.
On a SmartScan system installed with a 2200-900 Tower Enclosure, use the DB-9 connector in the small weatherproof box on the lower right side of the enclosure. On a system installed with a 2200-950 Inside Enclosure, use the Local port at the top of the 2200-300 Interface board in the enclosure.
- 9 If **off-site**, plug your computer into a modem that is plugged into a nonswitched analog telephone line.
- 10 Turn on your computer.
- 11 Be sure that your computer has installed communications software, that it is set to use full duplex, and that the baud rate is set correctly.

If **on-site**, the baud rate of your computer must match the baud rate of the selected serial port because they are in direct, one-to-one, communication with one another. For example, the baud rate for the Local port was set to 9600 at the factory. If this baud rate was changed by the customer, your computer must be set to the changed value.

For **off-site** connections, the baud rate of your computer doesn't have to match the baud rate of the selected serial port because the telephone network between the two modems breaks this direct physical connection. In an off-site setup, your computer and its modem have a direct connection, the two modems have a direct connection, and the SmartScan system and its modem have a direct connection. Each of these individual direct connections must have matching baud rates. However, the different connection "types" (user computer to modem, modem to modem, SmartScan system to modem) don't have to share a common baud rate (although it's simpler if they do).

Opening a LOG file captures the whole session to the file. Then, when your session is done, you can view what you have done with an editor, print it with a printer, or store it for later retrieval.

- 12 On your computer, open a LOG file.
- 13 If **off-site**:
 - a From your computer, dial and connect to the modem at the site to which you want to communicate.
 - b Wait for the "connect" message from your modem.

14 To get the serial interface to come up, press **[Esc]**.

If you have established a clean connection, the Main menu appears. If your Main menu is password protected, you'll need to type in the correct password before this menu appears.

```
STC SmartScan System
Site ID:
Main Menu
-----
 1) System Menu
 2) Report Menu
 3) Route Comm Through Local Port
 4) Reserved
 X) Exit Menu
?
```

15 From the Main menu, type **2**

The Report menu appears.

```
STC SmartScan System
Site ID:
Report Menu
-----
 1) Train Summary
 2) Specified Train
 3) Last Train
 4) All Trains Forward
 5) All Trains Backward
 6) Range of Trains
 7) System Statistics
 8) T94 Report Menu
 9) System Log
 X) Exit Menu
?
```

16 To produce a Train Summary report, type **1**

At this time, you can produce another report by typing one of the digits **1** through **9**.

17 When done, close the LOG file.

18 To return to the Main menu, type **x**

19 To exit the serial interface and return the SmartScan system to normal operation, type **x**

20 If **on-site**, unplug your computer from the SmartScan system.

8.2 Specified Train Report (Option 2)

The Specified Train report provides detailed information on a single train that is currently stored in the system memory. When choosing this report, you'll be prompted for a train number. When prompted, enter a train number from the Train Summary report.

The Specified Train report is identical to the generic Train Detail report, which was described in the prior chapter.

To produce the Specified Train report:

- 1 If **on-site**, plug your computer into the SmartScan system.

On a SmartScan system installed with a 2200-900 Tower Enclosure, use the DB-9 connector in the small weatherproof box on the lower right side of the enclosure. On a system installed with a 2200-950 Inside Enclosure, use the Local port at the top of the 2200-300 Interface board in the enclosure.

- 2 If **off-site**, plug your computer into a modem that is plugged into a nonswitched analog telephone line.
- 3 Turn on your computer.
- 4 Be sure that your computer has installed communications software, that it is set to use full duplex, and that the baud rate is set correctly.

If **on-site**, the baud rate of your computer must match the baud rate of the selected serial port because they are in direct, one-to-one, communication with one another. For example, the baud rate for the Local port was set to 9600 at the factory. If this baud rate was changed by the customer, your computer must be set to the changed value.

For **off-site** connections, the baud rate of your computer doesn't have to match the baud rate of the selected serial port because the telephone network between the two modems breaks this direct physical connection. In an off-site setup, your computer and its modem have a direct connection, the two modems have a direct connection, and the SmartScan system and its modem have a direct connection. Each of these individual direct connections must have matching baud rates. However, the different connection "types" (user computer to modem, modem to modem, SmartScan system to modem) don't have to share a common baud rate (although it's simpler if they do).

Opening a LOG file captures the whole session to the file. Then, when your session is done, you can view what you have done with an editor, print it with a printer, or store it for later retrieval.

- 5 On your computer, open a LOG file.
- 6 If **off-site**:
 - a From your computer, dial and connect to the modem at the site to which you want to communicate.
 - b Wait for the "connect" message from your modem.

- 7 To get the serial interface to come up, press **[Esc]**.

If you have established a clean connection, the Main menu appears. If your Main menu is password protected, you'll need to type in the correct password before this menu appears.

```
STC SmartScan System
Site ID:
Main Menu
-----
 1) System Menu
 2) Report Menu
 3) Route Comm Through Local Port
 4) Reserved
 X) Exit Menu
?
```

- 8 From the Main menu, type **2**

The Report menu appears.

```
STC SmartScan System
Site ID:
Report Menu
-----
 1) Train Summary
 2) Specified Train
 3) Last Train
 4) All Trains Forward
 5) All Trains Backward
 6) Range of Trains
 7) System Statistics
 8) T94 Report Menu
 9) System Log
 X) Exit Menu
?
```

- 9 To produce a Specified Train report, type **2**

This prompt appears.

```
Enter Train Number ?
```

If the train number is less than three digits, press **[Enter]** after typing the last digit. If it is three digits, pressing **[Enter]** isn't necessary.

- 10 Type a valid three-digit train number.

This prompt appears.

```
Abbreviated (Y or N) ?
```

If you want an abbreviated report, type **y**. If you want a full report, type **n**. If you don't respond to this prompt within 30 seconds, the system produces a full report.

- 11 To indicate your preference, type either **n** or **y**

If you typed a valid three-digit train number, a report for the train is now produced. If you typed an invalid number, the message "invalid train specified" appears.

At this time, you can produce another report by typing one of the digits **1** through **9**.

- 12 When done, close the LOG file.

- 13 To return to the Main menu, type **x**

- 14 To exit the serial interface and return the SmartScan system to normal operation, type **x**

- 15 If **on-site**, unplug your computer from the SmartScan system.

8.3 Last Train Report (Option 3)

The Last Train report provides detailed information on the most recent train that is currently stored in the system memory. The Last Train report is identical to the generic Train Detail report, which was described in the prior chapter.

To produce the Last Train report:

- 1 If **on-site**, plug your computer into the SmartScan system.

On a SmartScan system installed with a 2200-900 Tower Enclosure, use the DB-9 connector in the small weatherproof box on the lower right side of the enclosure. On a system installed with a 2200-950 Inside Enclosure, use the Local port at the top of the 2200-300 Interface board in the enclosure.

- 2 If **off-site**, plug your computer into a modem that is plugged into a nonswitched analog telephone line.
- 3 Turn on your computer.

- 4 Be sure that your computer has installed communications software, that it is set to use full duplex, and that the baud rate is set correctly.

If **on-site**, the baud rate of your computer must match the baud rate of the selected serial port because they are in direct, one-to-one, communication with one another. For example, the baud rate for the Local port was set to 9600 at the factory. If this baud rate was changed by the customer, your computer must be set to the changed value.

For **off-site** connections, the baud rate of your computer doesn't have to match the baud rate of the selected serial port because the telephone network between the two modems breaks this direct physical connection. In an off-site setup, your computer and its modem have a direct connection, the two modems have a direct connection, and the SmartScan system and its modem have a direct connection. Each of these individual direct connections must have matching baud rates. However, the different connection "types" (user computer to modem, modem to modem, SmartScan system to modem) don't have to share a common baud rate (although it's simpler if they do).

Opening a LOG file captures the whole session to the file. Then, when your session is done, you can view what you have done with an editor, print it with a printer, or store it for later retrieval.

- 5 On your computer, open a LOG file.

- 6 If **off-site**:

- a From your computer, dial and connect to the modem at the site to which you want to communicate.
- b Wait for the "connect" message from your modem.

- 7 To get the serial interface to come up, press **[Esc]**.

If you have established a clean connection, the Main menu appears. If your Main menu is password protected, you'll need to type in the correct password before this menu appears.

```
STC SmartScan System
Site ID:
Main Menu
-----
 1) System Menu
 2) Report Menu
 3) Route Comm Through Local Port
 4) Reserved
 X) Exit Menu
?
```

8 From the Main menu, type **2**

The Report menu appears.

```
STC SmartScan System
Site ID:
Report Menu
-----
 1) Train Summary
 2) Specified Train
 3) Last Train
 4) All Trains Forward
 5) All Trains Backward
 6) Range of Trains
 7) System Statistics
 8) T94 Report Menu
 9) System Log
 X) Exit Menu
?
```

9 To produce a Last Train report, type **3**

This prompt appears.

```
Abbreviated (Y or N) ?
```

If you want an abbreviated report, type **y**. If you want a full report, type **n**. If you don't respond to this prompt within 30 seconds, the system produces a full report.

10 To indicate your preference, type either **n** or **y**

At this time, you can produce another report by typing one of the digits **1** through **9**.

11 When done, close the LOG file.

12 To return to the Main menu, type **x**

13 To exit the serial interface and return the SmartScan system to normal operation, type **x**

14 If **on-site**, unplug your computer from the SmartScan system.

8.4 All Trains Forward Report (Option 4)

The All Trains Forward report provides detailed information for all the trains currently stored in memory. There is one report for each train. Each report is identical to a generic Train Detail report, which was described in the prior chapter. The Train Detail report for the oldest train in memory is produced first and the report for the most recent train (the last train that was stored in memory) is produced last.

To produce the All Trains Forward report:

- 1 If **on-site**, plug your computer into the SmartScan system.

On a SmartScan system installed with a 2200-900 Tower Enclosure, use the DB-9 connector in the small weatherproof box on the lower right side of the enclosure. On a system installed with a 2200-950 Inside Enclosure, use the Local port at the top of the 2200-300 Interface board in the enclosure.

- 2 If **off-site**, plug your computer into a modem that is plugged into a nonswitched analog telephone line.
- 3 Turn on your computer.
- 4 Be sure that your computer has installed communications software, that it is set to use full duplex, and that the baud rate is set correctly.

If **on-site**, the baud rate of your computer must match the baud rate of the selected serial port because they are in direct, one-to-one, communication with one another. For example, the baud rate for the Local port was set to 9600 at the factory. If this baud rate was changed by the customer, your computer must be set to the changed value.

For **off-site** connections, the baud rate of your computer doesn't have to match the baud rate of the selected serial port because the telephone network between the two modems breaks this direct physical connection. In an off-site setup, your computer and its modem have a direct connection, the two modems have a direct connection, and the SmartScan system and its modem have a direct connection. Each of these individual direct connections must have matching baud rates. However, the different connection "types" (user computer to modem, modem to modem, SmartScan system to modem) don't have to share a common baud rate (although it's simpler if they do).

Opening a LOG file captures the whole session to the file. Then, when your session is done, you can view what you have done with an editor, print it with a printer, or store it for later retrieval.

- 5 On your computer, open a LOG file.
- 6 If **off-site**:
 - a From your computer, dial and connect to the modem at the site to which you want to communicate.
 - b Wait for the "connect" message from your modem.

- 7 To get the serial interface to come up, press **[Esc]**.

If you have established a clean connection, the Main menu appears. If your Main menu is password protected, you'll need to type in the correct password before this menu appears.

```
STC SmartScan System
Site ID:
Main Menu
-----
 1) System Menu
 2) Report Menu
 3) Route Comm Through Local Port
 4) Reserved
 X) Exit Menu
?
```

- 8 From the Main menu, type **2**

The Report menu appears.

```
STC SmartScan System
Site ID:
Report Menu
-----
 1) Train Summary
 2) Specified Train
 3) Last Train
 4) All Trains Forward
 5) All Trains Backward
 6) Range of Trains
 7) System Statistics
 8) T94 Report Menu
 9) System Log
 X) Exit Menu
?
```

- 9 To produce an All Trains Forward report, type **4**

This prompt appears.

```
Abbreviated (Y or N) ?
```

You'll get this prompt before each train's report is produced. If you want an abbreviated report for that train, type **y**. If you want a full report for the train, type **n**. If you don't respond to this prompt within 30 seconds, the system produces a full report.

- 10 Before each train's report is produced, specify your preference by typing either **n** or **y**.

After all reports have been produced and the Report menu reappears, you can produce another report by typing one of the digits **1** through **9**.

- 11 When done, close the LOG file.
- 12 To return to the Main menu, type **x**
- 13 To exit the serial interface and return the SmartScan system to normal operation, type **x**
- 14 If **on-site**, unplug your computer from the SmartScan system.

8.5 All Trains Backward Report (Option 5)

The All Trains Backward report provides detailed information for all the trains currently stored in memory. There is one report for each train. Each report is identical to a generic Train Detail report, which was described in the prior chapter. The Train Detail report for the most recent train (the last train that was stored in memory) is produced first and the report for the oldest train in memory is produced last.

To produce the All Trains Backward report:

- 1 If **on-site**, plug your computer into the SmartScan system.

On a SmartScan system installed with a 2200-900 Tower Enclosure, use the DB-9 connector in the small weatherproof box on the lower right side of the enclosure. On a system installed with a 2200-950 Inside Enclosure, use the Local port at the top of the 2200-300 Interface board in the enclosure.

- 2 If **off-site**, plug your computer into a modem that is plugged into a nonswitched analog telephone line.
- 3 Turn on your computer.
- 4 Be sure that your computer has installed communications software, that it is set to use full duplex, and that the baud rate is set correctly.

If **on-site**, the baud rate of your computer must match the baud rate of the selected serial port because they are in direct, one-to-one, communication with one another. For example, the baud rate for the Local port was set to 9600 at the factory. If this baud rate was changed by the customer, your computer must be set to the changed value.

For **off-site** connections, the baud rate of your computer doesn't have to match the baud rate of the selected serial port because the telephone network between the two modems breaks this direct physical connection. In an off-site setup, your computer and its modem have a direct connection, the two modems have a direct connection, and the SmartScan system and its modem have a direct connection. Each of these individual direct connections must have matching baud rates. However, the different connection "types" (user computer to modem, modem to modem, SmartScan system to modem) don't have to share a common baud rate (although it's simpler if they do).

Opening a LOG file captures the whole session to the file. Then, when your session is done, you can view what you have done with an editor, print it with a printer, or store it for later retrieval.

- 5 On your computer, open a LOG file.

6 If off-site:

- a** From your computer, dial and connect to the modem at the site to which you want to communicate.
- b** Wait for the "connect" message from your modem.

7 To get the serial interface to come up, press **[Esc]**.

If you have established a clean connection, the Main menu appears. If your Main menu is password protected, you'll need to type in the correct password before this menu appears.

```
STC SmartScan System
Site ID:
Main Menu
-----
 1) System Menu
 2) Report Menu
 3) Route Comm Through Local Port
 4) Reserved
 X) Exit Menu
?
```

8 From the Main menu, type **2**

The Report menu appears.

```
STC SmartScan System
Site ID:
Report Menu
-----
 1) Train Summary
 2) Specified Train
 3) Last Train
 4) All Trains Forward
 5) All Trains Backward
 6) Range of Trains
 7) System Statistics
 8) T94 Report Menu
 9) System Log
 X) Exit Menu
?
```

- 9 To produce an All Trains Backward report, type **5**

This prompt appears.

Abbreviated (Y or N) ?

You'll get this prompt before each train's report is produced. If you want an abbreviated report for that train, type **y**. If you want a full report for the train, type **n**. If you don't respond to this prompt within 30 seconds, the system produces a full report.

- 10 Before each train's report is produced, specify your preference by typing either **n** or **y**.
After all reports have been produced and the Report menu reappears, you can produce another report by typing one of the digits **1** through **9**.
- 11 When done, close the LOG file.
- 12 To return to the Main menu, type **x**
- 13 To exit the serial interface and return the SmartScan system to normal operation, type **x**
- 14 If **on-site**, unplug your computer from the SmartScan system.

8.6 Range Of Trains Report (Option 6)

The Range of Trains report is a set of Train Detail reports for a specific collection of trains. The Train Summary report can be used to obtain a list of train numbers for trains that are currently stored in the memory. You are prompted to enter a train number from which to begin producing reports and a train number at which to finish producing them. A report will be produced for all of the trains between the two numbers entered, inclusive.

To produce the Range Of Trains report:

- 1 If **on-site**, plug your computer into the SmartScan system.
On a SmartScan system installed with a 2200-900 Tower Enclosure, use the DB-9 connector in the small weatherproof box on the lower right side of the enclosure. On a system installed with a 2200-950 Inside Enclosure, use the Local port at the top of the 2200-300 Interface board in the enclosure.
- 2 If **off-site**, plug your computer into a modem that is plugged into a nonswitched analog telephone line.
- 3 Turn on your computer.

- 4 Be sure that your computer has installed communications software, that it is set to use full duplex, and that the baud rate is set correctly.

If **on-site**, the baud rate of your computer must match the baud rate of the selected serial port because they are in direct, one-to-one, communication with one another. For example, the baud rate for the Local port was set to 9600 at the factory. If this baud rate was changed by the customer, your computer must be set to the changed value.

For **off-site** connections, the baud rate of your computer doesn't have to match the baud rate of the selected serial port because the telephone network between the two modems breaks this direct physical connection. In an off-site setup, your computer and its modem have a direct connection, the two modems have a direct connection, and the SmartScan system and its modem have a direct connection. Each of these individual direct connections must have matching baud rates. However, the different connection "types" (user computer to modem, modem to modem, SmartScan system to modem) don't have to share a common baud rate (although it's simpler if they do).

Opening a LOG file captures the whole session to the file. Then, when your session is done, you can view what you have done with an editor, print it with a printer, or store it for later retrieval.

- 5 On your computer, open a LOG file.

- 6 If **off-site**:

- a From your computer, dial and connect to the modem at the site to which you want to communicate.
- b Wait for the "connect" message from your modem.

- 7 To get the serial interface to come up, press **[Esc]**.

If you have established a clean connection, the Main menu appears. If your Main menu is password protected, you'll need to type in the correct password before this menu appears.

```
STC SmartScan System
Site ID:
Main Menu
-----
 1) System Menu
 2) Report Menu
 3) Route Comm Through Local Port
 4) Reserved
 X) Exit Menu
?
```

8 From the Main menu, type **2**

The Report menu appears.

```
STC SmartScan System
Site ID:
Report Menu
-----
 1) Train Summary
 2) Specified Train
 3) Last Train
 4) All Trains Forward
 5) All Trains Backward
 6) Range of Trains
 7) System Statistics
 8) T94 Report Menu
 9) System Log
 X) Exit Menu
?
```

9 To produce a Range Of Trains report, type **6**

This prompt appears.

```
Print Range of Trains, Newest to Oldest.
Enter Start Train Number (most recent train):
```

If the train number is less than three digits, press **[Enter]** after typing the last digit. If it is three digits, pressing **[Enter]** isn't necessary.

10 Type a valid three-digit starting train number.

This prompt appears.

```
Enter End Train Number (oldest train):
```

If the train number is less than three digits, press **[Enter]** after typing the last digit. If it is three digits, pressing **[Enter]** isn't necessary.

11 Type a valid three-digit ending train number.

This prompt appears.

```
Abbreviated (Y or N) ?
```

You'll get this prompt before each train's report is produced. If you want an abbreviated report for that train, type **y**. If you want a full report for the train, type **n**. If you don't respond to this prompt within 30 seconds, the system produces a full report.

12 Before each train's report is produced, specify your preference by typing either **n** or **y**.

After all reports have been produced and the Report menu reappears, you can produce another report by typing one of the digits **1** through **9**.

- 13 When done, close the LOG file.
- 14 To return to the Main menu, type **x**
- 15 To exit the serial interface and return the SmartScan system to normal operation, type **x**
- 16 If **on-site**, unplug your computer from the SmartScan system.

8.7 System Statistics Report (Option 7)

After each train passes a site, a record is inserted into the System Statistics log. The contents of the System Statistics log are viewed via the System Statistics report. The records in this report contain statistics that represent the data collected for each train.

8.7.1 Sample Report with Explanation of Fields

Below is a sample of part of a System Statistics report. The contents of your report will be different. The version information in the sample below is for illustrative purposes only. It doesn't represent any real release of the firmware.

```

=====
                Southern Technologies Corporation
                  SmartScan System
            System Statistics Report
            Run Date: 02/19/2006   06:19:31                Winemuc
=====
Firmware Version - Comm: ML2.1n 02/03/05 Reader: ML2.1n 10/22/05
=====

```

Sta	Trn	Num	i	Speed	Num Axles	Fltrd	Pls	Tag	Cnt	Avg Hsk	M	S	Sessions	Xfr	Flags					
Num	Num	Crs	r	Max	Min	Trn	PrA	PrC	Pair	Pair	1	2	1	2	e	r	#	Att	NE	SW
105	5	87	S	47	45	356	356	356	0	0	87	88	15	12	A	N	2	2	N	S
104	4	50	S	47	45	236	236	236	0	0	51	50	15	12	A	N	2	1	N	S
103	3	103	S	46	44	418	418	418	44	37	101	101	14	12	A	N	2	1	N	S
102	2	63	S	47	45	256	256	256	32	32	64	64	15	13	A	N	2	1	N	S
101	1	14	S	46	43	126	126	126	0	0	14	14	14	12	A	N	2	1	N	S
100	100	76	S	46	43	310	310	310	0	0	85	76	13	11	A	N	2	1	N	S
99	99	50	S	45	44	204	204	204	50	22	51	49	15	12	A	N	2	1	N	S
98	98	33	S	42	40	288	288	288	1	1	33	32	17	14	A	N	2	1	N	S

Looking at this excerpt from the sample above, an explanation of the report fields follows.

```

-----
      | | Speed |   Num Axles   | Fltrd Pls | Tag Cnt | Avg Hsk | M | S | Sessions |
      |D|-----|-----|-----|-----|-----|o|o|-----|
Sta|Trn|Num|i|           | Xdcr Xdcr | A   C   | Rdr Rdr | Rdr Rdr | v | l | Xfr Flags |
Num|Num|Crs|r|Max Min| Trn  PrA PrC | Pair Pair | 1   2   | 1   2   | e|r|# Att NE SW |
---|---|---|---|---  ---|-----  ---|-----  ---|-----  ---|---  ---|---  ---|
105| 5 | 87 S | 47 45 | 356 356 356 | 0   0   | 87 88 | 15 12 | A N 2 | 2   2   | N   S
-----

```

Field	Value	Meaning
Sta Num	105	Sequential value assigned records as they inserted in the System Statistics log – from 1 to 400.
Trn Num	5	The train number of the train that produced the Statistics record.
Num Crs	87	The number of vehicles on the train.
Dir	S	The direction the train was traveling on entering the site.
Speed – Max	47	The maximum speed (in mph) recorded as a train passed the site.
Speed – Min	45	The minimum speed (in mph) recorded as a train passed the site. If the train stopped at a site, this value is 0.
Num Axles – Trn	356	For sites where traffic is predominantly pull-through, this field and the next two fields will have the same values if the transducers are operating properly. For sites where switching movements are common, this field and the next two fields will often have differing values. For such a site, Train Detail reports should be examined where transducer problems are suspected.
Num Axles – Xdcr PrA	356	The total number of axles recorded by the transducer A-pair.
Num Axles – Xdcr PrC	356	The total number of axles recorded by the transducer C-pair.
Fltrd Pls – A Pair	0	The number of pulses filtered by transducer pulse-width filter on the transducer A-pair.
Fltrd Pls – C Pair	0	The number of pulses filtered by transducer pulse-width filter on the transducer C-pair.
Tag Cnt – Rdr 1	87	The total number of tags read by reader1.
Tag Cnt – Rdr 2	88	The total number of tags read by reader2.
Avg Hsk – Rdr 1	15	The average number of times that each tag on a train was read by reader1.
Avg Hsk – Rdr 2	12	The average number of times that each tag on a train was read by reader2.
Move	A	T94 specified movement type indicator, where: A = Through movement over 5 mph B = Through movement under 5 mph C = Through movement, stop and go D = Through movement, switching E = Simulation F = Reverse exit ? = Other

Field	Value	Meaning
Solr	N	Indicates status of solar-power subsystem – not implemented at this time.
Sessions – #	2	The number of the session to which the subsequent fields apply.
Sessions – Xfr Att	2	The number of attempts it took to transfer the T94 report for this train, for this session.
Sessions – Flags NE	N	Indicates status of transfer attempts for those vehicles recorded traveling in either the north or east direction, where: S = Success N = No vehicles traveled in this direction on this consist F = Failure to transfer to session host ? = Transfer process not yet complete
Sessions – Flags SW	S	Indicates status of transfer attempts for those vehicles recorded traveling in either the south or west direction, where: S = Success N = No vehicles traveled in this direction on this consist F = Failure to transfer to session host ? = Transfer process not yet complete

8.7.2 Producing the Report

To produce the System Statistics report:

- 1 If **on-site**, plug your computer into the SmartScan system.
On a SmartScan system installed with a 2200-900 Tower Enclosure, use the DB-9 connector in the small weatherproof box on the lower right side of the enclosure. On a system installed with a 2200-950 Inside Enclosure, use the Local port at the top of the 2200-300 Interface board in the enclosure.
- 2 If **off-site**, plug your computer into a modem that is plugged into a nonswitched analog telephone line.
- 3 Turn on your computer.
- 4 Be sure that your computer has installed communications software, that it is set to use full duplex, and that the baud rate is set correctly.

If **on-site**, the baud rate of your computer must match the baud rate of the selected serial port because they are in direct, one-to-one, communication with one another. For example, the baud rate for the Local port was set to 9600 at the factory. If this baud rate was changed by the customer, your computer must be set to the changed value.

For **off-site** connections, the baud rate of your computer doesn't have to match the baud rate of the selected serial port because the telephone network between the two modems breaks this direct physical connection. In an off-site setup, your computer and its modem have a direct connection, the two modems have a direct connection, and the SmartScan system and its modem have a direct connection. Each of these individual direct connections must have matching baud rates. However, the different connection "types" (user computer to modem, modem to modem, SmartScan system to modem) don't have to share a common baud rate (although it's simpler if they do).

Opening a LOG file captures the whole session to the file. Then, when your session is done, you can view what you have done with an editor, print it with a printer, or store it for later retrieval.

- 5 On your computer, open a LOG file.
- 6 If **off-site**:
 - a From your computer, dial and connect to the modem at the site to which you want to communicate.
 - b Wait for the "connect" message from your modem.
- 7 To get the serial interface to come up, press **[Esc]**.

If you have established a clean connection, the Main menu appears. If your Main menu is password protected, you'll need to type in the correct password before this menu appears.

```
STC SmartScan System
Site ID:
Main Menu
-----
 1) System Menu
 2) Report Menu
 3) Route Comm Through Local Port
 4) Reserved
 X) Exit Menu
?
```

8 From the Main menu, type **2**

The Report menu appears.

```
STC SmartScan System
Site ID:
Report Menu
-----
 1) Train Summary
 2) Specified Train
 3) Last Train
 4) All Trains Forward
 5) All Trains Backward
 6) Range of Trains
 7) System Statistics
 8) T94 Report Menu
 9) System Log
 X) Exit Menu
?
```

9 To produce a System Statistics report, type **7**

At this time, you can produce another report by typing one of the digits **1** through **9**.

10 When done, close the LOG file.

11 To return to the Main menu, type **x**

12 To exit the serial interface and return the SmartScan system to normal operation, type **x**

13 If **on-site**, unplug your computer from the SmartScan system.

8.8 T94 Report (Option 8)

T94 is a data format standard developed and used by many railroads in North America. The express purpose of T94 format is to provide a standardized method for the exchange of data between an AEI reader and a railroad's host computer or server.

After a train passes a site, the SmartScan system uses its modem to dial out to the host computers and transfer a T94 report to them. The currently active sessions tell to whom to send the report. You can locally produce a copy of this report.

8.8.1 Sample Report

Below is a sample of part of a T94 report. The contents of your report will be different.

```
AEM99999Milpita02040102230224080N4110043GGS0E012012012ANFN00295G01010040040020
RRE001DUPY 0000001298B GGK41360120401
RRE002RFURX0000850404A GGK44380120401
RRE003RFPAX0000200804B GGL40340120401
RRE004RECUX0000845012B GGK42240120401
RRE005RUSLX0000020166B GGK44240120401
EOT005EUPRQ00000295024400K
EOC0000000303
```

For definitions of the fields in this report, see *Chapter 7 - System Operation*.

8.8.2 Producing the Report

To produce the T94 report:

- 1 If **on-site**, plug your computer into the SmartScan system.

On a SmartScan system installed with a 2200-900 Tower Enclosure, use the DB-9 connector in the small weatherproof box on the lower right side of the enclosure. On a system installed with a 2200-950 Inside Enclosure, use the Local port at the top of the 2200-300 Interface board in the enclosure.

- 2 If **off-site**, plug your computer into a modem that is plugged into a nonswitched analog telephone line.
- 3 Turn on your computer.
- 4 Be sure that your computer has installed communications software, that it is set to use full duplex, and that the baud rate is set correctly.

If **on-site**, the baud rate of your computer must match the baud rate of the selected serial port because they are in direct, one-to-one, communication with one another. For example, the baud rate for the Local port was set to 9600 at the factory. If this baud rate was changed by the customer, your computer must be set to the changed value.

For **off-site** connections, the baud rate of your computer doesn't have to match the baud rate of the selected serial port because the telephone network between the two modems breaks this direct physical connection. In an off-site setup, your computer and its modem have a direct connection, the two modems have a direct connection, and the SmartScan system and its modem have a direct connection. Each of these individual direct connections must have matching baud rates. However, the different connection "types" (user computer to modem, modem to modem, SmartScan system to modem) don't have to share a common baud rate (although it's simpler if they do).

Opening a LOG file captures the whole session to the file. Then, when your session is done, you can view what you have done with an editor, print it with a printer, or store it for later retrieval.

- 5 On your computer, open a LOG file.
- 6 If **off-site**:
 - a From your computer, dial and connect to the modem at the site to which you want to communicate.
 - b Wait for the "connect" message from your modem.
- 7 To get the serial interface to come up, press **[Esc]**.

If you have established a clean connection, the Main menu appears. If your Main menu is password protected, you'll need to type in the correct password before this menu appears.

```
STC SmartScan System
Site ID:
Main Menu
-----
 1) System Menu
 2) Report Menu
 3) Route Comm Through Local Port
 4) Reserved
 X) Exit Menu
?
```

- 8 From the Main menu, type **2**

The Report menu appears.

```
STC SmartScan System
Site ID:
Report Menu
-----
 1) Train Summary
 2) Specified Train
 3) Last Train
 4) All Trains Forward
 5) All Trains Backward
 6) Range of Trains
 7) System Statistics
 8) T94 Report Menu
 9) System Log
 X) Exit Menu
?
```

9 From the Report menu, type **8**

The T94 Report menu appears.

```
STC SmartScan System
Site ID:
T94 Report Menu
-----
 1) Specified Train
 2) Last Train
 3) Range Of Trains
 X) Exit Menu
?
```

At this point, you can produce a T94 for a specific train, the last train, or a range of trains.

10 To produce a T94 report for a specific train:

a Type **1**

This prompt appears.

```
Enter Train Number ?
```

If the train number is less than three digits, press **[Enter]** after typing the last digit. If it is three digits, pressing **[Enter]** isn't necessary.

b Type a valid three-digit train number.

At this time, you can produce another T94 report by typing one of the digits **1** through **3**.

c Go to step **8**.

11 To produce a T94 report for the last train:

a Type **2**

At this time, you can produce another T94 report by typing one of the digits **1** through **3**.

b Go to step **8**.

12 To produce the T94 reports for a range of trains:

a Type **3**

This prompt appears.

```
Print Range of Trains, Newest to Oldest.  
Enter Start Train Number (most recent train):
```

If the train number is less than three digits, press **[Enter]** after typing the last digit. If it is three digits, pressing **[Enter]** isn't necessary.

b Type a valid three-digit starting train number.

This prompt appears.

```
Enter End Train Number (oldest train):
```

If the train number is less than three digits, press **[Enter]** after typing the last digit. If it is three digits, pressing **[Enter]** isn't necessary.

c Type a valid three-digit ending train number.

At this time, you can produce another T94 report by typing one of the digits **1** through **3**.

d Go to step **8**.

13 To return to the Report menu, type **x**

At this time, you can produce another report by typing one of the digits **1** through **9**.

14 When done, close the LOG file.

15 To return to the Main menu, type **x**

16 To exit the serial interface and return the SmartScan system to normal operation, type **x**

17 If **on-site**, unplug your computer from the SmartScan system.

8.9 System Log Report (Option 9)

The System Log is used to record the occurrence of certain events as the SmartScan records and reports train data. The bulk of the events recorded are involved in the process of reporting T94 data as specified by the enabled sessions. The types of entries in the System Log include train arrival, dial-out attempts of enabled sessions, the protocol specified for use by enabled sessions, the phone number specified for use by an enabled session and an indication of success or failure of an attempt to transmit a T94 report. The purpose of recording these events is to assist in resolving communications issues that can arise at remote sites. Another type of System Log record records a user's request to retransmit one or more trains.

8.9.1 Sample Report

Below is a sample of part of a System Log report. The contents of your report will be different. The version information in the sample below is for illustrative purposes only. It doesn't represent any real release of the firmware.

```
=====
                        Southern Technologies Corporation
                          SmartScan System
                          System Log Report
                        Run Date: 02/19/2006   06:19:56                               Winemuc
=====
Firmware Version - Comm: ML5.1n 12/03/05 Reader: ML5.1n 11/27/05
-----
126 02/19/03 06:17 <Resend: #3 Start71 End68: Enabled>
125 02/19/03 05:20 <Connection Made.: 12>
124 02/19/03 05:20 <Dialing Now: 12223334455 - >
123 02/19/03 05:18 <T94 Report Sent - Trn #97>
122 02/19/03 05:17 <Connection Made.: 10>
121 02/19/03 05:16 <Dialing Now: 18009921139 - >
120 02/19/03 05:16 <Cars:N/E=0 S/W=87 Sent:N/E=T S/W=F 2>
119 02/19/03 05:16 <UP Reporting Protocol>
```

Some of the lines on this report are for STC diagnostic purposes only. If they or any other lines need customer translation, call STC for help.

8.9.2 Producing the Report

To produce the System Log report:

- 1 If **on-site**, plug your computer into the SmartScan system.

On a SmartScan system installed with a 2200-900 Tower Enclosure, use the DB-9 connector in the small weatherproof box on the lower right side of the enclosure. On a system installed with a 2200-950 Inside Enclosure, use the Local port at the top of the 2200-300 Interface board in the enclosure.

- 2 If **off-site**, plug your computer into a modem that is plugged into a nonswitched analog telephone line.
- 3 Turn on your computer.
- 4 Be sure that your computer has installed communications software, that it is set to use full duplex, and that the baud rate is set correctly.

If **on-site**, the baud rate of your computer must match the baud rate of the selected serial port because they are in direct, one-to-one, communication with one another. For example, the baud rate for the Local port was set to 9600 at the factory. If this baud rate was changed by the customer, your computer must be set to the changed value.

For **off-site** connections, the baud rate of your computer doesn't have to match the baud rate of the selected serial port because the telephone network between the two modems breaks this direct physical connection. In an off-site setup, your computer and its modem have a direct connection, the two modems have a direct connection, and the SmartScan system and its modem have a direct connection. Each of these individual direct connections must have matching baud rates. However, the different connection "types" (user computer to modem, modem to modem, SmartScan system to modem) don't have to share a common baud rate (although it's simpler if they do).

Opening a LOG file captures the whole session to the file. Then, when your session is done, you can view what you have done with an editor, print it with a printer, or store it for later retrieval.

- 5 On your computer, open a LOG file.
- 6 If **off-site**:
 - a From your computer, dial and connect to the modem at the site to which you want to communicate.
 - b Wait for the "connect" message from your modem.
- 7 To get the serial interface to come up, press **[Esc]**.

If you have established a clean connection, the Main menu appears. If your Main menu is password protected, you'll need to type in the correct password before this menu appears.

```
STC SmartScan System
Site ID:
Main Menu
-----
 1) System Menu
 2) Report Menu
 3) Route Comm Through Local Port
 4) Reserved
 X) Exit Menu
?
```

- 8** From the Main menu, type **2**

The Report menu appears.

```
STC SmartScan System
Site ID:
Report Menu
-----
 1) Train Summary
 2) Specified Train
 3) Last Train
 4) All Trains Forward
 5) All Trains Backward
 6) Range of Trains
 7) System Statistics
 8) T94 Report Menu
 9) System Log
 X) Exit Menu
?
```

- 9** To produce a System Log report, type **9**

At this time, you can produce another report by typing one of the digits **1** through **9**.

- 10** When done, close the LOG file.

- 11** To return to the Main menu, type **x**

- 12** To exit the serial interface and return the SmartScan system to normal operation, type **x**

- 13** If **on-site**, unplug your computer from the SmartScan system.

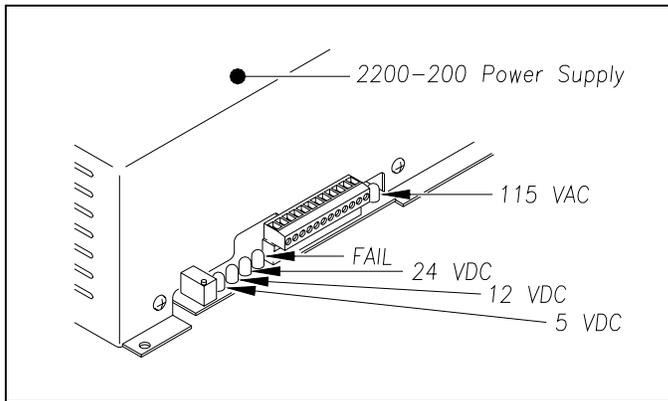
Chapter 9

Troubleshooting

This chapter describes how to isolate and eliminate the causes of problems in an up-and-running SmartScan AEI system. All actions described herein are done at the site.

9.1 115 VAC LED Not Lit on 2200-200 Power Supply

The green **115 VAC** LED (on the 2200-200 Power Supply) stays lit as long as an AC-powered SmartScan system is powered up and AC is present. It indicates that proper AC voltage is present for the 2200-200 Power Supply. This LED won't light on a solar-powered system.

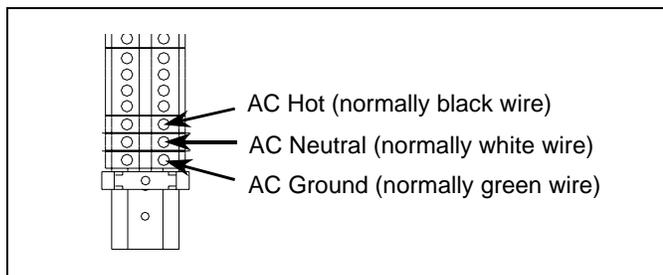


An unlit **115 VAC** LED on an AC-powered system may be due to:

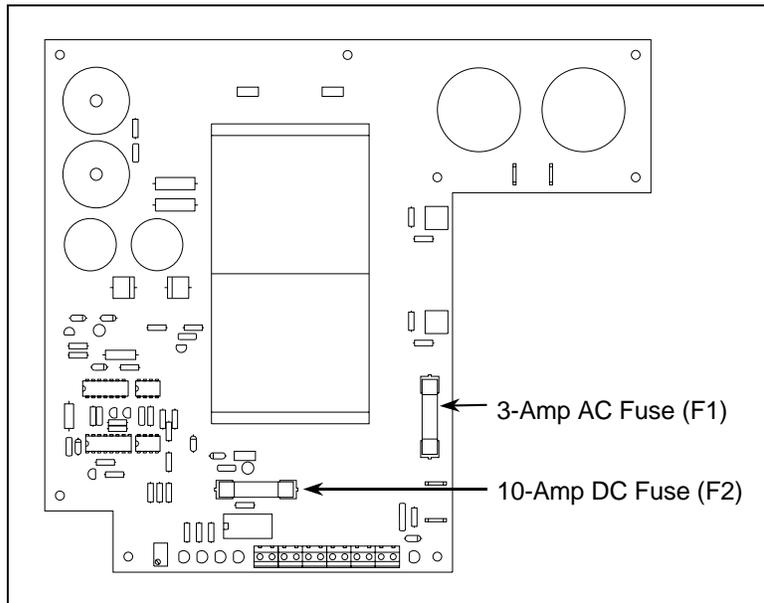
- No incoming AC power
- Blown or missing AC fuse on the Power Supply board
- Defective 2200-200 Power Supply

On AC-powered systems, if the **115 VAC** LED isn't lit:

- 1 If the incoming AC power isn't connected to the DIN rail properly, fix this problem before continuing.



- 2 If the AC power isn't stable or if it isn't at least 110 volts at 20 amperes, fix this problem before proceeding.
- 3 If the AC circuit breaker is toggled off, toggle it on.
On 2200-900**AC** Tower Enclosures, the AC circuit breaker is on the DIN rail inside the enclosure. On 2200-950 Inside Enclosures, it's on the outside of the enclosure.
- 4 If the **115 VAC** LED is now lit, skip the steps below.
- 5 Toggle off the AC circuit breaker.
- 6 On the part of the Power Supply board that is protruding from the 2200-200 Power Supply, separate the plug of the terminal block from its header.
- 7 Remove the four fasteners securing the 2200-200 Power Supply to the enclosure.
On 2200-900**AC** Tower Enclosures, four screws secure the 2200-200 Power Supply to the inside of the enclosure. On 2200-950 Inside Enclosures, four nuts secure it to the outside of the enclosure.
- 8 Separate the 2200-200 Power Supply from the enclosure.
- 9 Remove the three fasteners securing the 2200-200 Power Supply cover to its base.
- 10 Separate the cover of the 2200-200 Power Supply from its base.
The Power Supply board is now exposed with its components in view.
- 11 Replace the 3-ampere AC power fuse at F1.



- 12 Attach the cover of the 2200-200 Power Supply to its base.
- 13 Attach the 2200-200 Power Supply to the enclosure.
- 14 On the part of the Power Supply board that is protruding from the 2200-200 Power Supply, connect the plug of the terminal block to its header.

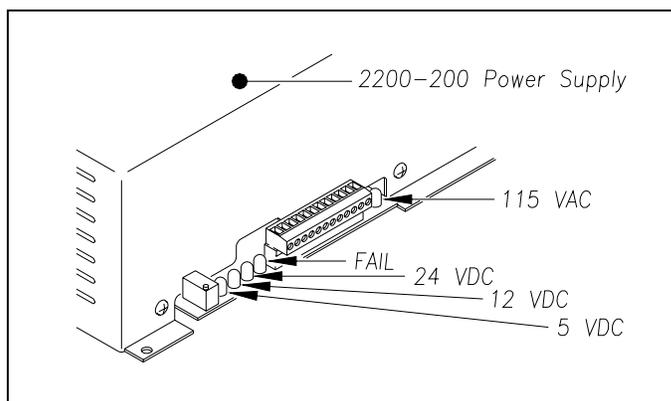
15 Toggle on the AC circuit breaker.

16 If the **115 VAC** LED is still not lit, replace the 2200-200 Power Supply and retest.

17 After the 2200-200 Power Supply is replaced and retested, if the **115 VAC** LED is still not lit, call STC for help in isolating the problem.

9.2 24 VDC LED Not Lit on 2200-200 Power Supply

The green **24 VDC** LED (on the 2200-200 Power Supply) stays lit as long as the SmartScan system is powered up and DC is present. It indicates that proper DC voltage is present for the 2200-200 Power Supply.



An unlit **24 VDC** LED may be due to:

- On AC-powered systems, no incoming AC power for an extended period, causing the batteries not to be charged adequately
- On solar-powered systems, no incoming DC power for an extended period, causing the batteries not to be charged adequately
- On AC-powered systems, improperly adjusted float voltage
- One or more defective batteries
- Faulty wiring from the power source to the 2200-200 Power Supply
- Blown or missing DC fuse on the Power Supply board
- Defective 2200-200 Power Supply

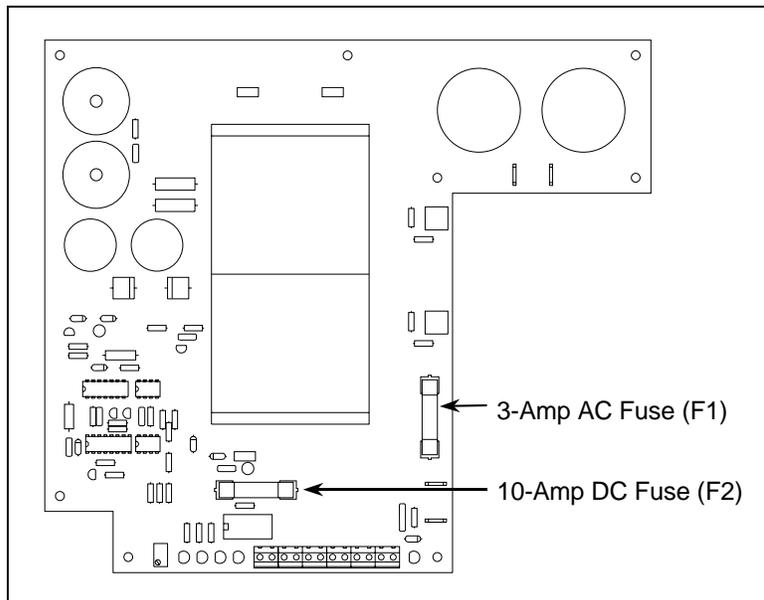
On AC-powered systems, if the **24 VDC** LED isn't lit:

- 1 If the DC circuit breaker is toggled on, toggle it off.

On 2200-900AC Tower Enclosures, the DC circuit breaker is on the DIN rail inside the enclosure. On 2200-950 Inside Enclosures, it's on the outside of the enclosure.

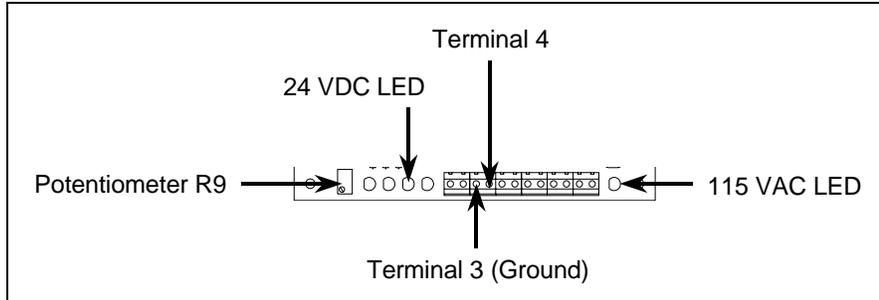
- 2 If the green **115 VAC** LED (on the 2200-200 Power Supply) isn't lit, fix this problem before proceeding.

- 3 If both the **24 VDC** and **115 VAC** LEDs are now lit, go to step 17.
- 4 Toggle off the AC circuit breaker.
- 5 On the part of the Power Supply board that is protruding from the 2200-200 Power Supply, separate the plug of the terminal block from its header.
- 6 Remove the four fasteners securing the 2200-200 Power Supply to the enclosure.
On 2200-900**AC** Tower Enclosures, four screws secure the 2200-200 Power Supply to the inside of the enclosure. On 2200-950 Inside Enclosures, four nuts secure it to the outside of the enclosure.
- 7 Separate the 2200-200 Power Supply from the enclosure.
- 8 Remove the three fasteners securing the 2200-200 Power Supply cover to its base.
- 9 Separate the cover of the 2200-200 Power Supply from its base.
The Power Supply board is now exposed with its components in view.
- 10 Replace the 10-ampere DC power fuse at F2.



- 11 Attach the cover of the 2200-200 Power Supply to its base.
- 12 Attach the 2200-200 Power Supply to the enclosure.
- 13 On the part of the Power Supply board that is protruding from the 2200-200 Power Supply, connect the plug of the terminal block to its header.
- 14 Toggle on the AC circuit breaker.
- 15 If the **24 VDC** LED is still not lit and the **115 VAC** LED is still lit, replace the 2200-200 Power Supply and retest.

- 16 After the 2200-200 Power Supply is replaced and retested, if the **24 VDC** LED is still not lit and the **115 VAC** LED is still lit, call STC for help in isolating the problem.
- 17 If the DC circuit breaker is on, toggle it off.
- 18 Using a DC voltmeter, touch the black lead to terminal 3 on terminal block TB1 (on the outside of the 2200-200 Power Supply).

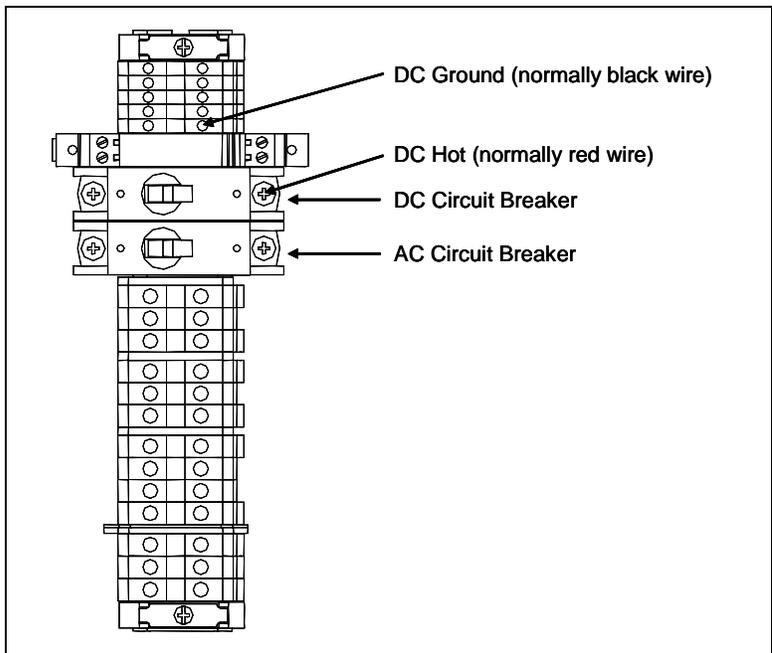


- 19 Touch the red lead to terminal 4 on terminal block TB1 (on the outside of the 2200-200 Power Supply).
- 20 If the voltage isn't between 26.8 and 27.2 VDC, adjust potentiometer **R9** (on the outside of the 2200-200 Power Supply) until the voltmeter shows 27 VDC.
Turn **R9** clockwise to increase voltage. Turn it counterclockwise to decrease voltage.
- 21 Toggle on the DC circuit breaker.
Note that the float voltage drops when the batteries are brought back online.
- 22 If the float voltage drops below 22 volts, monitor the voltage for five minutes:
If the voltage is gradually increasing, the batteries are probably charging. After the batteries have charged for five or more hours, the battery voltage should return to its normal range of 24 to 27.2 volts. If the voltage isn't gradually increasing, the batteries are probably not charging. This may indicate that one or more of the batteries are defective and should be replaced.

On solar-powered systems, if the **24 VDC** LED isn't lit:

- 1 If this is an AC-powered system, skip the steps below.
On a solar-powered system, the **115 VAC** LED (on the 2200-200 Power Supply) isn't lit and potentiometer **R9** isn't functional.

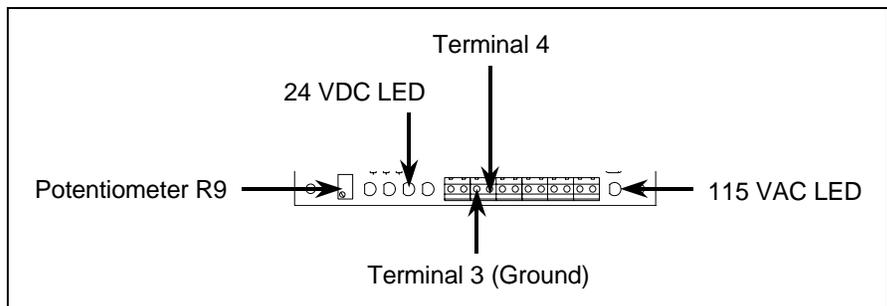
- If the DC circuit breaker is toggled off, toggle it on.



- If the **24 VDC** LED is now lit, skip the steps below.
- Using a DC voltmeter, touch the black lead to the DC ground wire (the right terminal just above the telephone surge protector).
- Touch the red lead to the DC hot wire (the terminal just above where you terminated DC ground).

If the battery bank is adequately charged, voltage should measure between 24 and 28 VDC.

- If voltage is zero, fix this problem before continuing.
Zero voltage is usually caused by faulty wiring between the Din rail and the 2200-340 Solar Battery Box or by the manual disconnect button on the Solar Charge Controller (mounted to the inside top left of the 2200-340 Solar Battery Box) being pressed.
- If voltage isn't between 24 and 28 VDC, wait until the battery bank is adequately charged.
- If the **24 VDC** LED is now lit, skip the steps below.
- Using a DC voltmeter, touch the black lead to terminal 3 on terminal block TB1 (on the outside of the 2200-200 Power Supply).



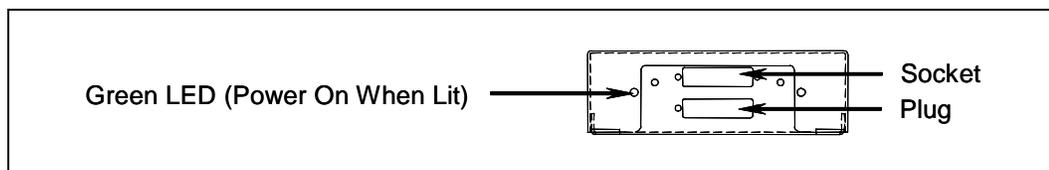
- 10 Touch the red lead to terminal 4 on terminal block TB1 (on the outside of the 2200-200 Power Supply).
- 11 If voltage is zero, fix this problem before continuing.
Zero voltage is usually caused by faulty wiring between the Din rail and the 2200-200 Power Supply.
- 12 If the **24 VDC** LED is now lit, skip the steps below.
- 13 Replace the 2200-200 Power Supply and retest.
- 14 After the 2200-200 Power Supply is replaced and retested, if the **24 VDC** LED is still not lit, call STC for help in isolating the problem.

9.3 No Communications After Pressing [Esc]

If someone is communicating with the SmartScan system through a modem, you won't be able to logon locally. When this is the case, the 2200-100 Processor won't respond with a Main menu after you press **[Esc]**. At all other times, it should.

If the 2200-100 Processor doesn't respond with a Main menu after you press **[Esc]**:

- 1 If the green LED on the 2200-100 Processor isn't lit, fix this problem before continuing.



- 2 If the setting on your computer's terminal-emulation software isn't 9600 baud, no parity, 8 data bits, 1 stop bit, and no flow control, make it so.
- 3 If a standard 9-pin-to-9-pin null-modem serial cable isn't being used between your computer and the SmartScan system, use one.
- 4 If your computer isn't plugged into the correct DB-9 connector on the SmartScan system, do so.
On a system installed with a 2200-900 Tower Enclosure, use the DB-9 connector in the small weatherproof box on the lower right side of the enclosure. On a system installed with a 2200-950 Inside Enclosure, use the Local port at the top of the 2200-300 Interface board in the enclosure.
- 5 Reset the 2200-100 Processor by toggling off both the AC and DC circuit breakers, waiting five seconds, and toggling them back on.
- 6 If this doesn't solve the problem, replace the 2200-100 Processor.
- 7 If replacing the processor doesn't solve the problem, call STC for help in isolating the problem.

When communication is established, an error message could appear stating that the communications microprocessor (in the 2200-100 Processor) is in BANK0. If this happens, the communications microprocessor program memory will have to be re-flashed by STC. Normally, this can be done via a telephone-and-modem connection. If this isn't possible, the 2200-100 Processor must be returned to STC for reprogramming.

9.4 No Communications When Trains Are Absent

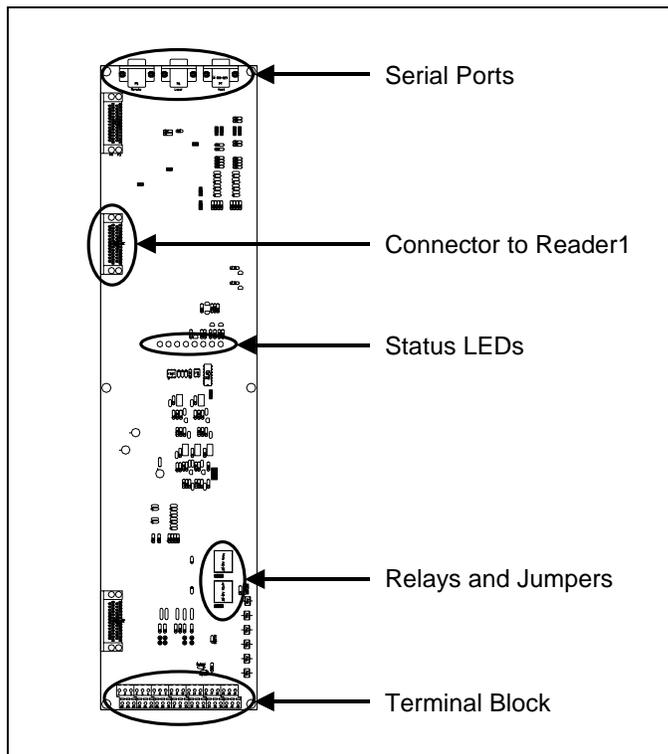
While a train is present at a site, the system won't allow communications between the reader microprocessor (in the 2200-100 Processor) and communications microprocessor (also in the 2200-100 Processor). This is manifested by the message "reader processor not responding" and by the inability to obtain the setup information from the reader microprocessor. But, when a train isn't present, communication between the two processors should be uninhibited. If it isn't, it is most commonly caused by:

- Faulty installation or operation of one or more transducers.
- Faulty installation or operation of some piece of presence-detection hardware.

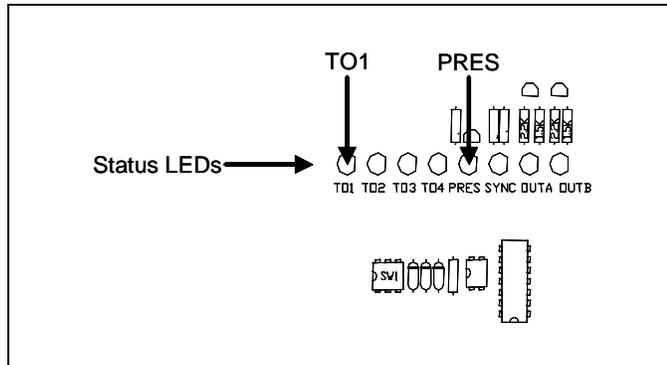
When a train isn't present and you can't get setup information:

- 1 Remove the cover protecting the 2200-300 Interface board.

The interface board is now exposed with its components in view.



- 2 On the 2200-300 Interface board, if the yellow **Pres** LED is lit:



- a Fix any installation problem with the presence-detection hardware.
Installing track circuits is covered in **Chapter 4 - Track Components**.
 - b Replace any presence-detection hardware that isn't working properly.
- 3 On the 2200-300 Interface board, if the yellow **TO1**, **TO2**, **TO3**, or **TO4** LED is lit:
 - a Fix any installation problem with the transducers.
Installing transducers is covered in **Chapter 4 - Track Components**.
 - b Replace any transducer or related component that isn't working properly.
- 4 Reset the 2200-100 Processor by toggling off both the AC and DC circuit breakers, waiting five seconds, and toggling them back on.
- 5 If this doesn't solve the problem, replace the 2200-100 Processor.
- 6 If replacing the processor doesn't solve the problem, call STC for help in isolating the problem.

When communications is established, an error message could appear stating that the reader microprocessor (in the 2200-100 Processor) is in BANK0. If this happens, the reader microprocessor program memory will have to be re-flashed by STC. Normally, this can be done via a telephone-and-modem connection. If this isn't possible, the 2200-100 Processor must be returned to STC for reprogramming.

9.5 Missing RFID/AEI tags

If recorded trains are missing RFID/AEI tag identification, you'll need to:

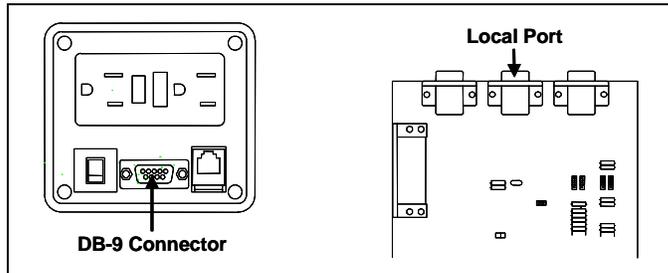
- Generate and examine a current System Statistics report.
- Check the system power supply for proper voltage levels.
- Verify that the **Power** LED lights on each of the readers.
- Verify that the **RF On** LED lights on each of the readers.
- Verify that the **Lock** LED lights on each of the readers.

9.5.1 Generate System Statistics Report

To generate and examine a current System Statistics report:

- 1 Plug your computer into the SmartScan system.

On a SmartScan system installed with a 2200-900 Tower Enclosure, use the DB-9 connector in the small weatherproof box on the lower right side of the enclosure. On a system installed with a 2200-950 Inside Enclosure, use the Local port at the top of the 2200-300 Interface board in the enclosure.



- 2 Be sure your computer has appropriate communications software installed.
- 3 Be sure your communications software is set to use full duplex.

The SmartScan system doesn't contain logic to pause when the screen is filled. Because of this, you need to use your communications software to open a LOG file and capture the reports to the file. When your session is complete, you may then view the recorded reports with an editor or print them with a printer.

- 4 On your computer, open a LOG file.
- 5 Generate a System Statistics report.
 - a To get the serial interface to come up, press **[Esc]**.

If you have established a clean connection, the Main menu appears. If your Main menu is password protected, you'll need to type in the correct password before this menu appears.

- b To select the Report menu, type **2**

```
STC SmartScan System
Site ID:
Main Menu
-----
1) System Menu
2) Report Menu
3) Route Comm Through Local Port
4) Reserved
X) Exit Menu
?
```

c To generate a System Statistics report, type 7

```

STC SmartScan System
Site ID:
Report Menu
-----
1) Train Summary
2) Specified Train
3) Last Train
4) All Trains Forward
5) All Trains Backward
6) Range of Trains
7) System Statistics
8) T94 Report Menu
9) System Log
X) Exit Menu
?
  
```

d To return to the Main menu, type xx

6 Close the LOG file.

7 On the System Statistics report, locate the Tag Cnt and Avg Hsk fields.

The Tag Cnt field indicates the number of tags read by each of the readers as a train crossed the site. The Avg Hsk (average handshakes) field reflects the average number of times each of the tags was read by the specified reader as a train crossed the site.

```

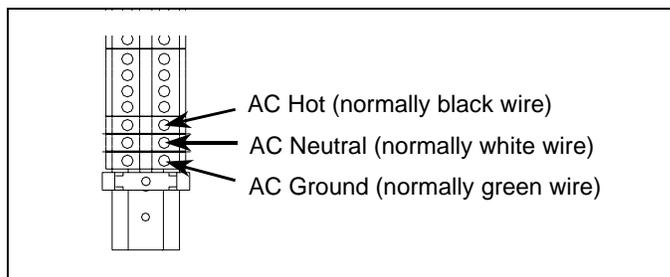
=====
                Southern Technologies Corporation
                  SmartScan System
                System Statistics Report
          Run Date: 09/30/2006 15:35:27                AEI#475
=====
Firmware Version - Comm: ML4.4k 02/23/06 Reader: ML4.4d 01/27/06
=====
| | Speed | Num Axles | Fltrd Pls | Tag Cnt | Avg Hsk | M | S | Sessions |
|D|-----|-----|-----|-----|-----|o|o|-----|
Sta|Trn|Num|i| Xdcr Xdcr | A C | Rdr Rdr | Rdr Rdr | v | l | Xfr Flags |
Num|Num|Crs|r|Max Min| Trn PrA PrC|Pair Pair| 1 2 | 1 2 | e|r|# Att NE SW|
-----|-----|-----|-----|-----|-----|-----|-----|-----|
.
.
.
  
```

- 8 Look for consistently lower values in either the Tag Cnt or Avg Hsk fields.
 On a "healthy" system, the Rdr 1 and Rdr 2 columns of the Tag Cnt fields in each record (on the System Statistics report) are nearly equal. A difference of plus or minus five, on a consist of 100 or more cars, is normal. Where a reader is missing tags, the Tag Cnt field for that reader is consistently lower than that of the other reader.
 Likewise, the Rdr 1 and Rdr 2 columns of the Avg Hsk fields in each record should be nearly equal. Where one column is consistently lower or shows a steady decrease over time, it indicates a problematic reader, antenna, or other component.
- 9 If the Tag Cnt Rdr 1 and Tag Cnt Rdr 2 columns in every record aren't nearly equal, investigate and fix any problems before proceeding.
- 10 If the Avg Hsk Rdr 1 and Avg Hsk Rdr 2 columns in every record aren't nearly equal, investigate and fix any problems before proceeding.
- 11 To exit the serial interface and return to normal operation, type **x**
- 12 Unplug your computer from the SmartScan system.

9.5.2 Check For Proper Voltage Levels

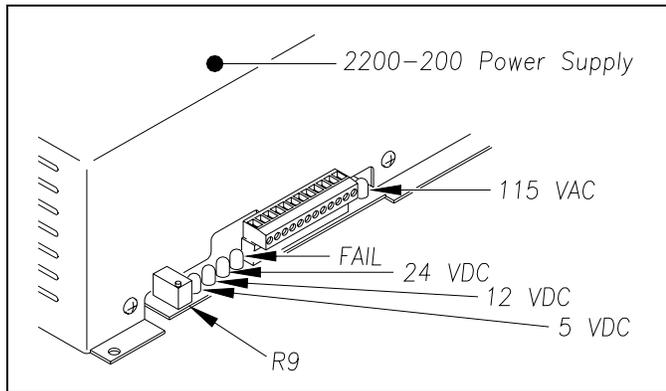
To check for proper voltage levels on AC-powered systems:

- 1 If your system is solar powered, skip the steps below.
- 2 If the incoming AC power isn't connected to the DIN rail properly, fix this problem before continuing.



- 3 If the AC power isn't stable or if it isn't at least 110 volts at 20 amperes, fix this problem before proceeding.
- 4 If the AC circuit breaker is off, toggle it on.
 On 2200-900AC Tower Enclosures, the AC circuit breaker is on the DIN rail inside the enclosure. On 2200-950 Inside Enclosures, it's on the outside of the enclosure.
- 5 If the DC circuit breaker is on, toggle it off.
 The DC circuit breaker is toggled off, so no DC power comes from the batteries.

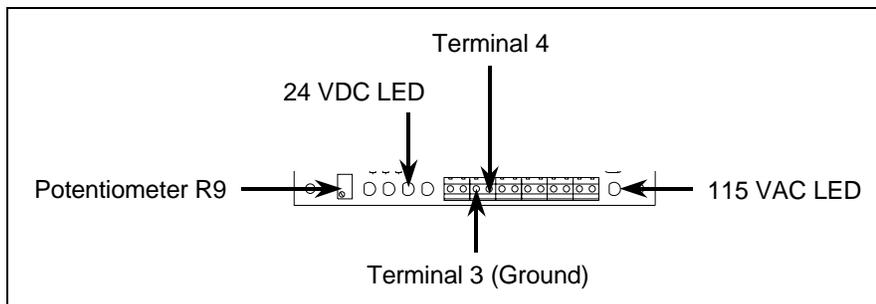
- 6 If the **115 VAC** and **24 VDC** LEDs on the edge of the 2200-200 Power Supply aren't lit, fix this problem before continuing.



9.1 115 VAC LED Not Lit on 2200-200 Power Supply and **9.2 24 VDC LED Not Lit on 2200-200 Power Supply** tell how to fix this problem.

You'll next verify the float voltage.

- 7 Using a DC voltmeter, touch the black lead to terminal 3 on terminal block TB1 (on the edge of the 2200-200 Power Supply).



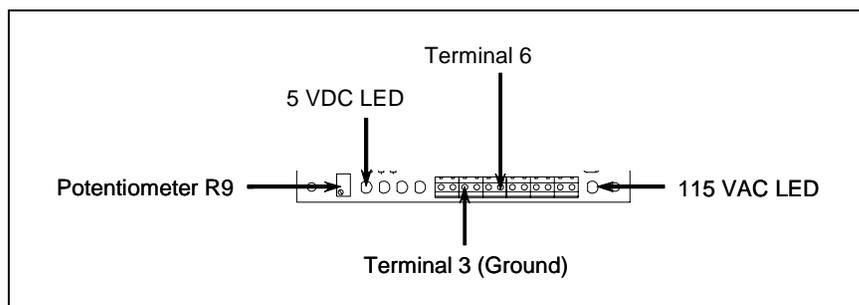
- 8 Touch the red lead to terminal 4 on terminal block TB1 (on the edge of the 2200-200 Power Supply).
- 9 If the voltage isn't between 26.8 and 27.2 VDC, adjust potentiometer **R9** (on the edge of the 2200-200 Power Supply) until the voltmeter shows 27 VDC.
Turn **R9** clockwise to increase voltage. Turn it counterclockwise to decrease voltage.
- 10 If a properly functioning and properly used voltmeter cannot be made to show 27 VDC, replace the 2200-200 Power Supply and retest.
- 11 If you replaced the 2200-200 Power Supply and the voltmeter still cannot be made to show 27 VDC, call STC for help in isolating the problem.

On terminal block TB1 on the edge of the 2200-200 Power Supply, voltage at terminal 6 should be between 5.0 and 5.2 VDC and at terminal 8 between 12.4 and 12.6 VDC. If it is, the 2200-200 Power Supply is working properly and no SmartScan component is loading it down.

- 12 If the voltage at terminal 6 is between 5.0 and 5.2 VDC and at terminal 8 between 12.4 and 12.6 VDC, skip the steps below.

You'll next verify the other DC voltages.

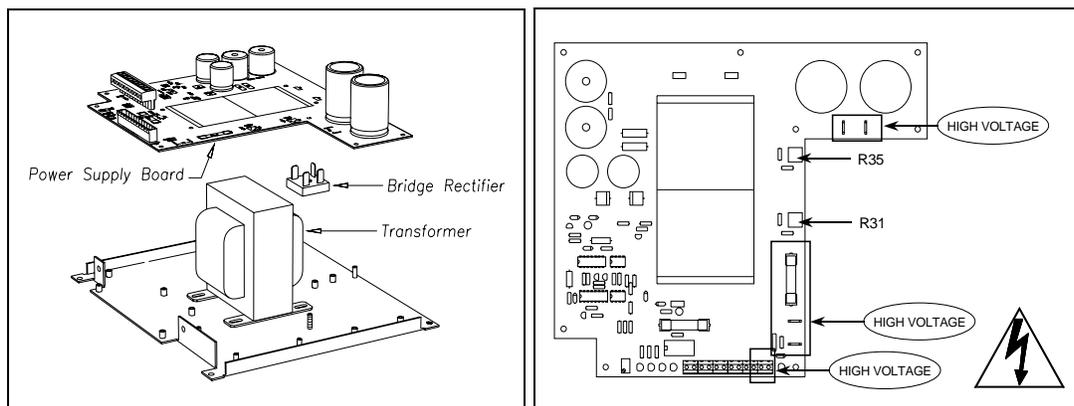
- 13 If the **115 VAC**, **12 VDC**, and **5 VDC** LEDs on the edge of the 2200-200 Power Supply aren't lit, fix this problem before continuing.
- 14 Toggle the AC circuit breaker off.
- 15 Remove the cover protecting the 2200-300 Interface board.
The interface board is now exposed with its components in view.
- 16 Disconnect the terminal-block plug from the terminal-block header on the 2200-300 Interface board.
- 17 Toggle the AC circuit breaker on.
- 18 If the DC circuit breaker is on, toggle it off.
- 19 Using a DC voltmeter, touch the black lead to terminal 3 on terminal block TB1 (on the outside of the 2200-200 Power Supply).



- 20 Touch the red lead to terminal 6 on terminal block TB1 (on the outside of the 2200-200 Power Supply).
- 21 If the voltage isn't between 5.0 and 5.2 VDC:
- Toggle the AC circuit breaker off.
 - On the part of the Power Supply board that is protruding from the 2200-200 Power Supply, separate the plug of the terminal block from its header.
 - Remove the four screws securing the 2200-200 Power Supply to the enclosure.
 - Separate the 2200-200 Power Supply from the enclosure.
 - Remove the three fasteners securing the 2200-200 Power Supply cover to its base.
 - Separate the cover of the 2200-200 Power Supply from its base.
The Power Supply board is now exposed with its components in view.
 - Without its cover, reattach the base of the 2200-200 Power Supply to the enclosure.

- h Reconnect the plug of the terminal block to its header.

When AC is present, there is a risk of shock inside and outside of the 2200-200 Power Supply. Some possible high-voltage danger areas are the transformer, bridge rectifier, AC fuse holder, and terminal block. Other dangerous areas also exist. So, touch nothing. Let your insulated screwdriver touch only potentiometer R35.

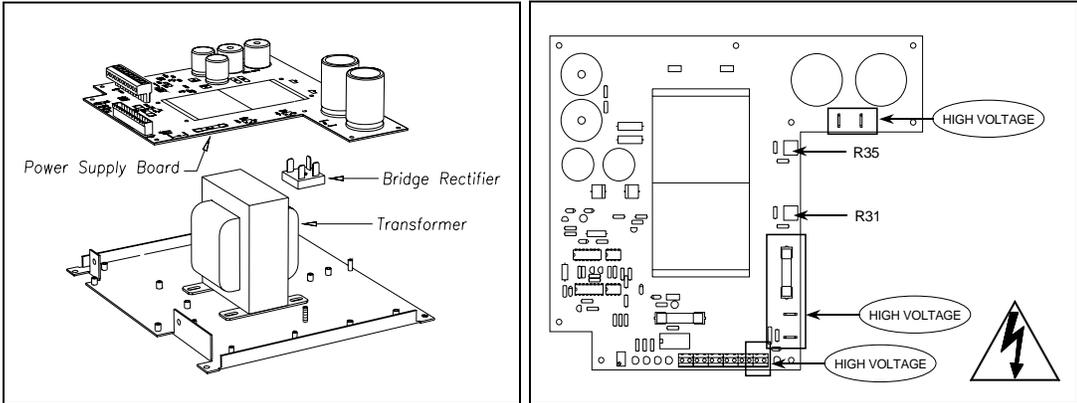


- i Toggle the AC circuit breaker on.
- j Using a small insulated screwdriver, adjust potentiometer **R35** until the voltmeter shows 5.1 VDC.
Turn **R35** clockwise to increase voltage. Turn it counterclockwise to decrease voltage.
- k If a properly functioning and properly used voltmeter cannot be made to show 5.1 VDC, replace the 2200-200 Power Supply and retest.
- l If you replaced the 2200-200 Power Supply and the voltmeter still cannot be made to show 5.1 VDC, call STC for help in isolating the problem.
- m Toggle the AC circuit breaker off.
- n Separate the plug of the terminal block from its header.
- o Remove the four screws securing the base of the 2200-200 Power Supply to the enclosure.
- p Separate the base of the 2200-200 Power Supply from the enclosure.
- q Reattach the cover of the 2200-200 Power Supply to its base.
- r Reattach the 2200-200 Power Supply to the enclosure.
- s Reconnect the plug of the terminal block to its header.
- t Toggle the AC circuit breaker on.
- 22** Using a DC voltmeter, touch the black lead to terminal 3 on terminal block TB1 (on the edge of the 2200-200 Power Supply).
- 23** Touch the red lead to terminal 8 on terminal block TB1 (on the edge of the 2200-200 Power Supply).

24 If the voltage isn't between 12.4 and 12.6 VDC:

- a Toggle the AC circuit breaker off.
- b On the part of the Power Supply board that is protruding from the 2200-200 Power Supply, separate the plug of the terminal block from its header.
- c Remove the four screws securing the 2200-200 Power Supply to the enclosure.
- d Separate the 2200-200 Power Supply from the enclosure.
- e Remove the three fasteners securing the 2200-200 Power Supply cover to its base.
- f Separate the cover of the 2200-200 Power Supply from its base.
The Power Supply board is now exposed with its components in view.
- g Without its cover, reattach the base of the 2200-200 Power Supply to the enclosure.
- h Reconnect the plug of the terminal block to its header.

When AC is present, there is a risk of shock inside and outside of the 2200-200 Power Supply. Some possible high-voltage danger areas are the transformer, bridge rectifier, AC fuse holder, and terminal block. Other dangerous areas also exist. So, touch nothing. Let your insulated screwdriver touch only potentiometer R31.



- i Toggle the AC circuit breaker on.
- j Using a small insulated screwdriver, adjust potentiometer **R31** until the voltmeter shows 12.5 VDC.
Turn **R31** clockwise to increase voltage. Turn it counterclockwise to decrease voltage.
- k If a properly functioning and properly used voltmeter cannot be made to show 12.5 VDC, replace the 2200-200 Power Supply and retest.
- l If you replaced the 2200-200 Power Supply and the voltmeter still cannot be made to show 12.5 VDC, call STC for help in isolating the problem.
- m Toggle the AC circuit breaker off.
- n Separate the plug of the terminal block from its header.

- o Remove the four screws securing the base of the 2200-200 Power Supply to the enclosure.
 - p Separate the base of the 2200-200 Power Supply from the enclosure.
 - q Reattach the cover of the 2200-200 Power Supply to its base.
 - r Reattach the 2200-200 Power Supply to the enclosure.
 - s Reconnect the plug of the terminal block to its header.
- 25 Toggle the AC circuit breaker off.
- 26 Reconnect the terminal-block plug to the terminal-block header on the 2200-300 Interface board.
- 27 Replace the cover that protects the 2200-300 Interface board.
- 28 Toggle the AC circuit breaker on.
- On terminal block TB1 on the edge of the 2200-200 Power Supply, voltage at terminal 6 should be between 5.0 and 5.2 VDC and at terminal 8 between 12.4 and 12.6 VDC. If it is, the 2200-200 Power Supply is working properly and no SmartScan component is loading it down.
- 29 If the voltage at terminal 6 is between 5.0 and 5.2 VDC and at terminal 8 between 12.4 and 12.6 VDC, skip the steps below.
- If the DC voltages aren't correct, one or more defective modules may be loading down the power supply. You'll next isolate and replace any faulty modules.

In the steps below, cut all power before you disconnect, reconnect, or remove any system module. Be sure to turn power back on before doing any test.

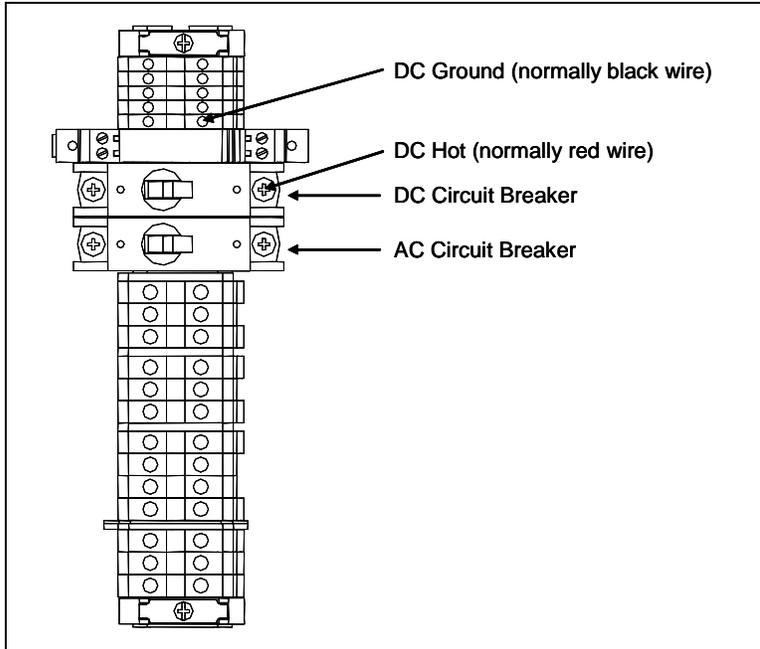
- 30 Disconnect the 2200-100 Processor from the 2200-300 Interface board.
- 31 On terminal block TB1 on the edge of the 2200-200 Power Supply, if the voltage at terminal 6 is between 5.0 and 5.2 VDC and at terminal 8 between 12.4 and 12.6 VDC, replace the 2200-100 Processor and retest.
- 32 Reconnect the 2200-100 Processor to the 2200-300 Interface board.
- 33 Disconnect the 2200-504TA Reader from the 2200-300 Interface board.
- 34 On terminal block TB1 on the edge of the 2200-200 Power Supply, if the voltage at terminal 6 is between 5.0 and 5.2 VDC and at terminal 8 between 12.4 and 12.6 VDC, replace the 2200-504TA Reader and retest.
- 35 Reconnect the 2200-504TA Reader to the 2200-300 Interface board.
- 36 Disconnect the 2200-504TB Reader from the 2200-300 Interface board.
- 37 On terminal block TB1 on the edge of the 2200-200 Power Supply, if the voltage at terminal 6 is between 5.0 and 5.2 VDC and at terminal 8 between 12.4 and 12.6 VDC, replace the 2200-504TB Reader and retest.
- 38 Reconnect the 2200-504TB Reader to the 2200-300 Interface board.
- 39 On terminal block TB1 on the edge of the 2200-200 Power Supply, if the voltage at terminal 6 isn't between 5.0 and 5.2 VDC or if the voltage at terminal 8 isn't between 12.4 and 12.6 VDC, call STC for help in isolating the problem.

To check for proper voltage levels on solar-powered systems:

- 1 If your system is AC powered, skip the steps below.

The next steps should be done when sun-energy is reaching the solar panels.

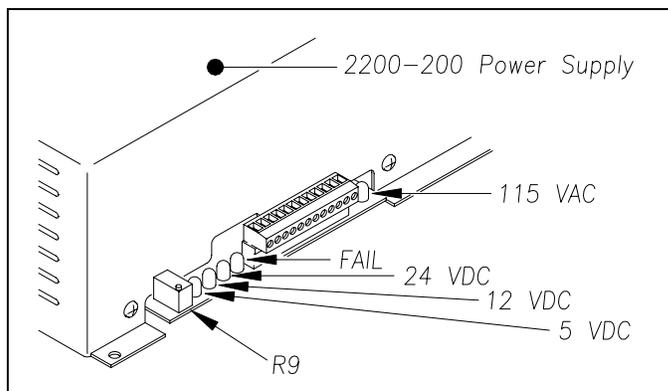
- 2 If the incoming DC power isn't connected to the DIN rail properly, fix this problem before continuing.



- 3 If the DC power isn't stable or if it isn't at least 24 volts, fix this problem before proceeding.

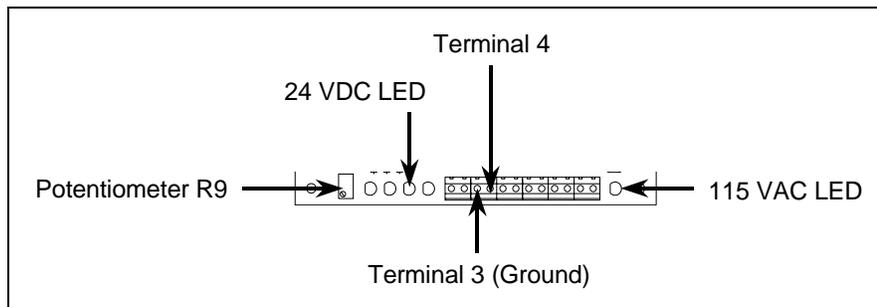
You can turn on incoming DC power by pressing the manual disconnect button on the Solar Charge Controller mounted to the inside top left of the 2200-340 Solar Battery Box. This button is lit when power is coming from the solar panels.

- 4 If the DC circuit breaker is off, toggle it on.
- 5 If the **24 VDC**, **12 VDC**, **5 VDC**, and **Fail** LEDs on the edge of the 2200-200 Power Supply aren't lit, fix this problem before continuing.



On a solar-powered system, the **115 VAC** LED isn't lit and potentiometer **R9** isn't functional. You'll next verify the DC voltages.

- Using a DC voltmeter, touch the black lead to terminal 3 on terminal block TB1 (on the outside of the 2200-200 Power Supply).



- Touch the red lead to terminal 4 on terminal block TB1 (on the outside of the 2200-200 Power Supply).

If sun-energy is reaching the solar panels, voltage should measure between 24 and 28 VDC. Also, if the battery bank is adequately charged, voltage should measure between 24 and 28 VDC.

- If a properly functioning and properly used voltmeter doesn't show between 24 and 28 VDC, replace the 2200-200 Power Supply and retest.
- If you replaced the 2200-200 Power Supply and the voltmeter still doesn't show between 24 and 28 VDC, call STC for help in isolating the problem.

On terminal block TB1 on the edge of the 2200-200 Power Supply, voltage at terminal 6 should be between 5.0 and 5.2 VDC and at terminal 8 between 12.4 and 12.6 VDC. If it is, the 2200-200 Power Supply is working properly and no SmartScan component is loading it down.

- If the voltage at terminal 6 is between 5.0 and 5.2 VDC and at terminal 8 between 12.4 and 12.6 VDC, skip the steps below.
- Toggle the DC circuit breaker off.
- Remove the cover protecting the 2200-300 Interface board.
The interface board is now exposed with its components in view.
- Disconnect the terminal-block plug from the terminal-block header on the 2200-300 Interface board.
- Toggle the DC circuit breaker on.
- Using a DC voltmeter, touch the black lead to terminal 3 on terminal block TB1 (on the outside of the 2200-200 Power Supply).
- Touch the red lead to terminal 6 on terminal block TB1 (on the outside of the 2200-200 Power Supply).

- 17** If the voltage isn't between 5.0 and 5.2 VDC:
- a** Toggle the DC circuit breaker off.
 - b** On the part of the Power Supply board that is protruding from the 2200-200 Power Supply, separate the plug of the terminal block from its header.
 - c** Remove the four screws securing the 2200-200 Power Supply to the enclosure.
 - d** Separate the 2200-200 Power Supply from the enclosure.
 - e** Remove the three fasteners securing the 2200-200 Power Supply cover to its base.
 - f** Separate the cover of the 2200-200 Power Supply from its base.
The Power Supply board is now exposed with its components in view.
 - g** Without its cover, reattach the base of the 2200-200 Power Supply to the enclosure.
 - h** Reconnect the plug of the terminal block to its header.
 - i** Toggle the DC circuit breaker on.
 - j** Using a small insulated screwdriver, adjust potentiometer **R35** until the voltmeter shows 5.1 VDC.
Turn **R35** clockwise to increase the voltage. Turn it counterclockwise to decrease the voltage.
 - k** If a properly functioning and properly used voltmeter cannot be made to show 5.1 VDC, replace the 2200-200 Power Supply and retest.
 - l** If you replaced the 2200-200 Power Supply and the voltmeter still cannot be made to show 5.1 VDC, call STC for help in isolating the problem.
 - m** Toggle the DC circuit breaker off.
 - n** Separate the plug of the terminal block from its header.
 - o** Remove the four screws securing the base of the 2200-200 Power Supply to the enclosure.
 - p** Separate the base of the 2200-200 Power Supply from the enclosure.
 - q** Reattach the cover of the 2200-200 Power Supply to its base.
 - r** Reattach the 2200-200 Power Supply to the enclosure.
 - s** Reconnect the plug of the terminal block to its header.
 - t** Toggle the DC circuit breaker on.
- 18** Using a DC voltmeter, touch the black lead to terminal 3 on terminal block TB1 (on the outside of the 2200-200 Power Supply).
- 19** Touch the red lead to terminal 8 on terminal block TB1 (on the outside of the 2200-200 Power Supply).

- 20** If the voltage isn't between 12.4 and 12.6 VDC:
- a** Toggle the DC circuit breaker off.
 - b** On the part of the Power Supply board that is protruding from the 2200-200 Power Supply, separate the plug of the terminal block from its header.
 - c** Remove the four screws securing the 2200-200 Power Supply to the enclosure.
 - d** Separate the 2200-200 Power Supply from the enclosure.
 - e** Remove the three fasteners securing the 2200-200 Power Supply cover to its base.
 - f** Separate the cover of the 2200-200 Power Supply from its base.
The Power Supply board is now exposed with its components in view.
 - g** Without its cover, reattach the base of the 2200-200 Power Supply to the enclosure.
 - h** Reconnect the plug of the terminal block to its header.
 - i** Toggle the DC circuit breaker on.
 - j** Using a small insulated screwdriver, adjust potentiometer **R31** until the voltmeter shows 12.5 VDC.
Turn **R31** clockwise to increase the voltage. Turn it counterclockwise to decrease the voltage.
 - k** If a properly functioning and properly used voltmeter cannot be made to show 12.5 VDC, replace the 2200-200 Power Supply and retest.
 - l** If you replaced the 2200-200 Power Supply and the voltmeter still cannot be made to show 12.5 VDC, call STC for help in isolating the problem.
 - m** Toggle the DC circuit breaker off.
 - n** Separate the plug of the terminal block from its header.
 - o** Remove the four screws securing the base of the 2200-200 Power Supply to the enclosure.
 - p** Separate the base of the 2200-200 Power Supply from the enclosure.
 - q** Reattach the cover of the 2200-200 Power Supply to its base.
 - r** Reattach the 2200-200 Power Supply to the enclosure.
 - s** Reconnect the plug of the terminal block to its header.
 - t** Toggle the DC circuit breaker on.
- 21** Toggle the DC circuit breaker off.
- 22** Reconnect the terminal-block plug to the terminal-block header on the 2200-300 Interface board.
- 23** Replace the cover that protects the 2200-300 Interface board.

- 24** Toggle the DC circuit breaker on.

On terminal block TB1 on the edge of the 2200-200 Power Supply, voltage at terminal 6 should be between 5.0 and 5.2 VDC and at terminal 8 between 12.4 and 12.6 VDC. If it is, the 2200-200 Power Supply is working properly and no SmartScan component is loading it down.

- 25** If the voltage at terminal 6 is between 5.0 and 5.2 VDC and at terminal 8 between 12.4 and 12.6 VDC, skip the steps below.

If the DC voltages aren't correct, one or more defective modules may be loading down the power supply. You'll next isolate any faulty modules.

In the steps below, cut all power before you disconnect, reconnect, or remove any system module. Be sure to turn power back on before doing any test.

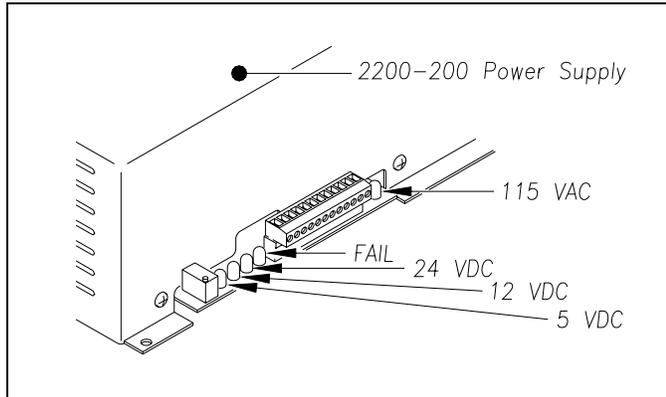
- 26** Disconnect the 2200-100 Processor from the 2200-300 Interface board.
- 27** On terminal block TB1 on the edge of the 2200-200 Power Supply, if the voltage at terminal 6 is between 5.0 and 5.2 VDC and at terminal 8 between 12.4 and 12.6 VDC, replace the 2200-100 Processor and retest.
- 28** Reconnect the 2200-100 Processor to the 2200-300 Interface board.
- 29** Disconnect the 2200-504TA Reader from the 2200-300 Interface board.
- 30** On terminal block TB1 on the edge of the 2200-200 Power Supply, if the voltage at terminal 6 is between 5.0 and 5.2 VDC and at terminal 8 between 12.4 and 12.6 VDC, replace the 2200-504TA Reader and retest.
- 31** Reconnect the 2200-504TA Reader to the 2200-300 Interface board.
- 32** Disconnect the 2200-504TB Reader from the 2200-300 Interface board.
- 33** On terminal block TB1 on the edge of the 2200-200 Power Supply, if the voltage at terminal 6 is between 5.0 and 5.2 VDC and at terminal 8 between 12.4 and 12.6 VDC, replace the 2200-504TB Reader and retest.
- 34** Reconnect the 2200-504TB Reader to the 2200-300 Interface board.
- 35** On terminal block TB1 on the edge of the 2200-200 Power Supply, if the voltage at terminal 6 isn't between 5.0 and 5.2 VDC or if the voltage at terminal 8 isn't between 12.4 and 12.6 VDC, call STC for help in isolating the problem.

9.5.3 Verify That Power LED Lights on Each Reader

The 2200-504 Readers connect to the 2200-300 Interface board through a single 25-pin flat ribbon cable. Both ends of this cable have DB-25 connectors attached to them. The 2200-200 Power Supply is attached to terminal block TB1 at the bottom of the 2200-300 Interface board.

To verify that the **Power** LED lights on each of the readers:

- 1 If the **12 VDC** and **5 VDC** LEDs on the edge of the 2200-200 Power Supply aren't lit, fix this problem before continuing.



- 2 If the 2200-200 Power Supply isn't supplying the correct voltages, fix this problem before continuing.

On the 2200-200 Power Supply, terminal 6 on terminal block TB1 should be supplying about 5 VDC and terminal 8 should be supplying about 12 VDC. Terminal 3 is ground.

- 3 Verify that the 2200-300 Interface board is receiving the correct voltages.

On the 2200-300 Interface board, terminal 1 on terminal block TB1 should be receiving about 5 VDC and terminal 2 should be receiving about 12 VDC. Terminal 22 is ground.

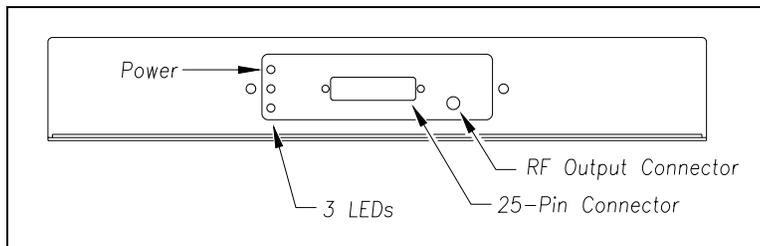
- 4 If correct voltages are measured at TB1, go to step 7.

- 5 If the correct voltages are not received, verify that the ends of the wire between terminal 6 and 1 and the ends of the wire between terminal 8 and 2 are seated properly in their respective terminal blocks.

Terminals 1 and 2 are on the 2200-300 Interface board. Terminals 6 and 8 are on the 2200-200 Power Supply.

- 6 If the ends of the wires are seated properly, replace the two wires.

- 7 With the system turned on, check the **Power** LED on 2200-504TA Reader (that's reader1).



- 8 If lit, go to step 16.

- 9 Remove the DB-25 connector from the 2200-504TA Reader.

- 10 Verify correct supply voltages in the plug at the end of the reader's cable.
Pin 1 is ground. Pin 9 should supply about 5 VDC. Pin 13 and pin 25 should each supply about 12 VDC.
- 11 If you encounter adequate supply voltage, replace the defective reader and retest.
- 12 If you encounter missing or inadequate supply voltage, remove the DB-25 connector at the other end of the reader's cable.
This DB-25 connector is attached to the 2200-300 Interface board.
- 13 Verify correct supply voltages in the socket on the 2200-300 Interface board, where you just removed the connector.
Socket 1 is ground. Socket 9 should supply about 5 VDC. Socket 13 and socket 25 should each supply about 12 VDC.
- 14 If you encounter correct supply voltage, replace the defective cable and retest.
- 15 If you encounter missing or inadequate supply voltage, replace the 2200-300 Interface board and retest.

STC can walk you through the removal of the defective 2200-300 Interface board and its replacement. Give them a call.

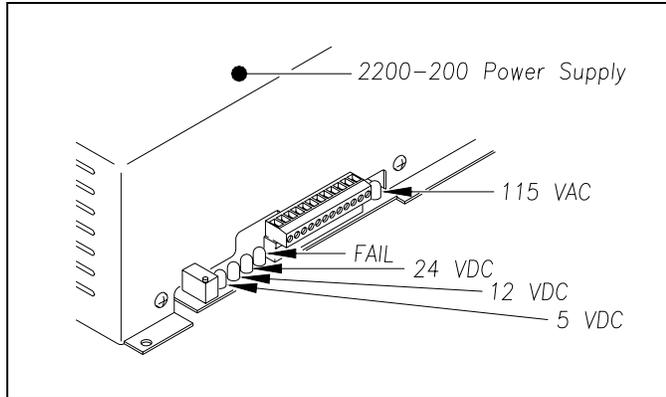
- 16 With the system turned on, check the **Power** LED on 2200-504TB Reader (that's reader2).
- 17 If lit, skip the steps below.
- 18 Remove the DB-25 connector from the 2200-504TB Reader.
- 19 Verify correct supply voltages in the plug at the end of the reader's cable.
Pin 1 is ground. Pin 9 should supply about 5 VDC. Pin 13 and pin 25 should each supply about 12 VDC.
- 20 If you encounter adequate supply voltage, replace the defective reader and retest.
- 21 If you encounter missing or inadequate supply voltage, remove the DB-25 connector at the other end of the reader's cable.
This DB-25 connector is attached to the 2200-300 Interface board.
- 22 Verify correct supply voltages in the socket on the 2200-300 Interface board, where you just removed the connector.
Socket 1 is ground. Socket 9 should supply about 5 VDC. Socket 13 and socket 25 should each supply about 12 VDC.
- 23 If you encounter correct supply voltage, replace the defective cable and retest.
- 24 If you encounter missing or inadequate supply voltage, replace the 2200-300 Interface board and retest.

STC can walk you through the removal of the defective 2200-300 Interface board and its replacement. Give them a call.

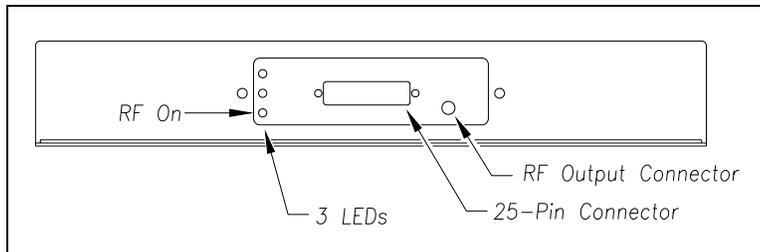
9.5.4 Verify That RF On LED Lights on Each Reader

To verify that the **RF On** LED lights on each of the readers:

- 1 If the **12 VDC** and **5 VDC** LEDs on the 2200-200 Power Supply aren't lit, fix this problem before continuing.



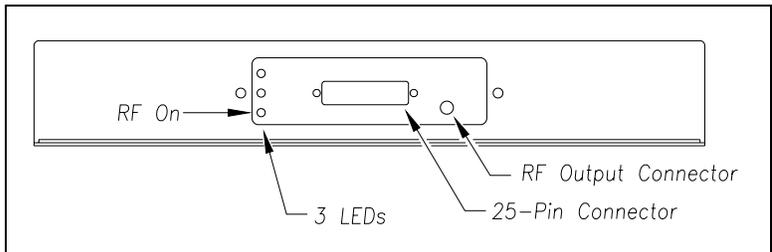
- 2 If the **Power** LED on both readers isn't lit, fix this problem before continuing.
- 3 Check the **RF On** LED on 2200-504TA Reader (that's reader1) when a train is present or by simulating presence or transducer operation.



- 4 If lit, go to step 10.
- 5 Verify proper communications with the 2200-504TA Reader using a computer and the SmartScan's system menu options.

You can verify proper communications by progressing through the menus as such: from the Main menu type 1 to go to the System menu, type 1 to go to the AEI Processor/Reader Configuration menu, type 4 to go to Amtech Reader Interface, and type 1, which is the number of the reader. When proper communications exists, the message "#Model SP-ACC Ver 2.00D" is displayed.
- 6 If no communications can be established, reset the 2200-100 Processor by toggling off both the AC and DC circuit breakers, waiting five seconds, and toggling them back on.
- 7 If the **RF On** LED on 2200-504TA Reader still isn't lit when train presence is simulated, replace the reader and retest.
- 8 After replacing and retesting the reader, if the **RF On** LED on 2200-504TA Reader still isn't lit when train presence is simulated, replace the 2200-100 Processor and retest.
- 9 After replacing and retesting the processor, if the **RF On** LED on 2200-504TA Reader still doesn't light, call STC for help in isolating the problem.

- 10** With the system turned on, check the **RF On** LED on 2200-504TB Reader (that's reader2) when a train is present or by simulating presence or transducer operation.

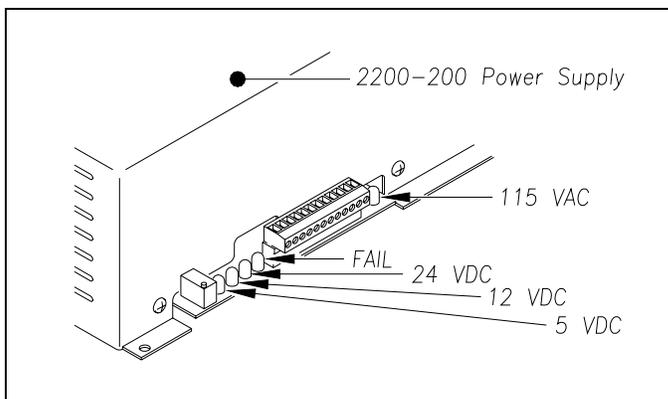


- 11** If lit, skip the steps below.
- 12** Verify proper communications with the 2200-504TB Reader using a computer and the SmartScan's system menu options
- You can verify proper communications by progressing through the menus as such: from the Main menu type 1 to go to the System menu, type 1 to go to the AEI Processor/Reader Configuration menu, type 4 to go to Amtech Reader Interface, and type 2, which is the number of the reader. When proper communications exists, the message "#Model SP-ACC Ver 2.00D" is displayed.
- 13** If no communications can be established, reset the 2200-100 Processor by toggling off both the AC and DC circuit breakers, waiting five seconds, and toggling them back on.
- 14** If the **RF On** LED on 2200-504TB Reader still isn't lit when train presence is simulated, replace the reader and retest.
- 15** After replacing and retesting the reader, if the **RF On** LED on 2200-504TB Reader still isn't lit when train presence is simulated, replace the 2200-100 Processor and retest.
- 16** After replacing and retesting the processor, if the **RF On** LED on 2200-504TB Reader still doesn't light, call STC for help in isolating the problem.

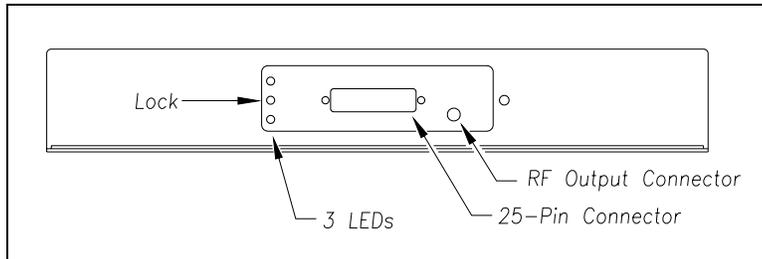
9.5.5 Verify That Lock LED Lights on Each Reader

To verify that the **Lock** LED lights on each of the readers:

- 1** If the **12 VDC** and **5 VDC** LEDs on the 2200-200 Power Supply aren't lit, fix this problem before continuing.



- 2 Simulate train presence or transducer operation.
- 3 If the **Power** and **RF On** LEDs on the reader doesn't light when train presence is simulated, fix this problem before continuing.
- 4 Place a test tag in front of the antenna.
- 5 Verify that the **Lock** LED comes on.



- 6 If the **Lock** LED comes on:
 - a Hold the test tag in front of the antenna from the middle of the track.
If you are using an AT5118 tag for testing, it must be mounted on a metal ground plate to be read at maximum range.
 - b Simulate train presence or transducer operation.
 - c Verify that the **Lock** LED comes on.
 - d If the **Lock** LED comes on, skip the steps below.

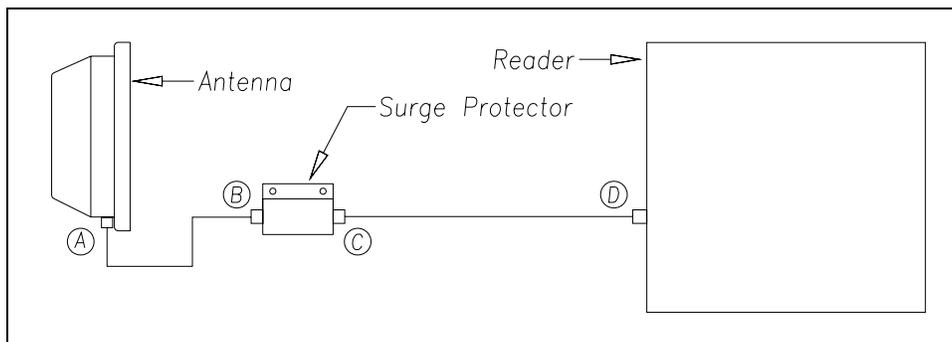
- 7 If the antennas aren't installed correctly, fix this problem before continuing.

The AEI antennas should be installed with the face of the antenna parallel to the rails, 3.5 feet (1.1 meters) above the top of the rails, centered between the two pairs of transducers, and opposite each other. The SRL440 antenna should be mounted horizontally with its N-type socket on the side, not pointing up or down. The N-type socket on a SRL470 antenna should be pointing down. The HP9-915 antenna should be mounted vertically with its N-type socket on the back.

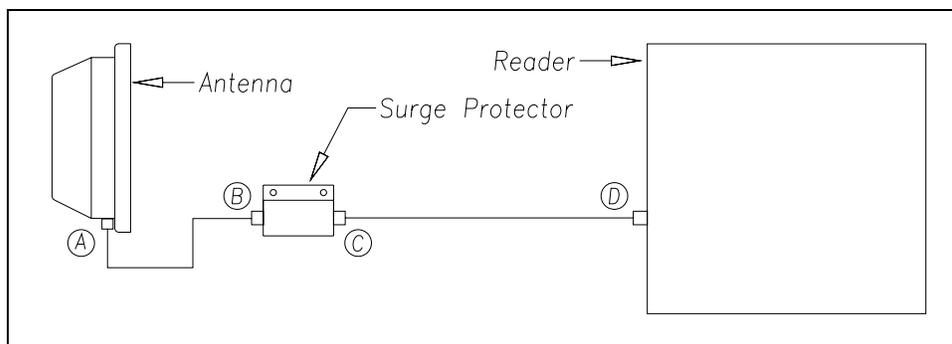
- 8 Be sure you have on hand a 900-megahertz-capable wattmeter, that it is turned on, and that it is working properly.

The wattmeter must have cables or adapters to connect to N-type plugs, N-type sockets, and SMA sockets.

- 9 Disconnect the N-type connector ("A" in figure below) from the antenna.



- 10** Attach the disconnected N-type plug to the wattmeter.
- 11** Simulate train presence or transducer operation.
- 12** If you don't get a reading:
 - a** Reconnect the N-type connector to the antenna.
 - b** From the antenna being tested, disconnect the N-type connector ("B" in figure above) at the surge protector.
 - c** Attach the wattmeter to the N-type socket on the surge protector.
 - d** Simulate train presence or transducer operation.
 - e** If you get any reading, replace the defective cable (between "A" and "B") and go back to step **2**.
 - f** If you still get no reading, reconnect the N-type plug to the surge protector and go to step **14**.
- 13** If you get a reading between 0.75 and 1.1 watts, replace the defective antenna and go back to step **2**.
 If you go to the next step, you got some reading, but it wasn't in the range of 0.75 and 1.1 watts. In this case, the antenna and the cable from it to the surge protector are probably working properly.
- 14** Reconnect the N-type plug to the antenna.
- 15** From the antenna being tested, disconnect the N-type connector ("C" in figure below) from the far end of the surge protector.

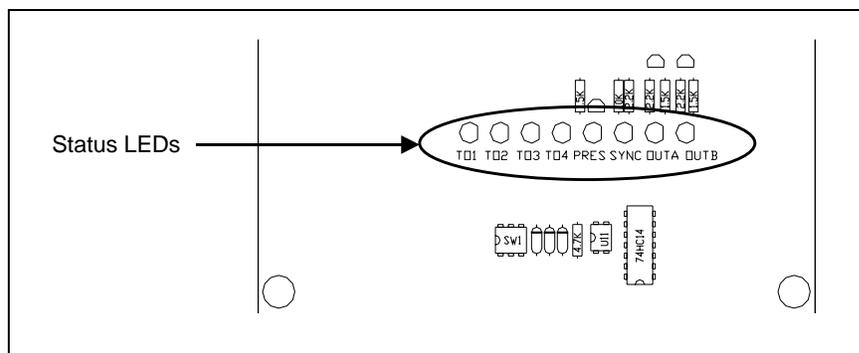


- 16** Attach the disconnected N-type plug from the cable to the wattmeter.
- 17** Simulate train presence or transducer operation.
- 18** If you get a reading between 0.75 and 1.1 watts, replace the defective surge protector and go back to step **2**.
- 19** From the antenna being tested, disconnect the SMA connector ("D" in figure above) from the reader.

- 20 Attach the wattmeter to the SMA socket on the reader.
- 21 Simulate train presence or transducer operation.
- 22 If you get any reading, replace the defective cable (between "C" and "D") and go back to step 2.
- 23 If you don't get a reading between 0.75 and 1.1 watts, replace the defective reader and go back to step 2.

9.6 On Interface Board, Transducer's LED Is Always On

Status indicators for transducer inputs are located on the 2200-300 Interface board. A transducer's LED should be lit only when a wheel rim is present within the target zone above the transducer. A problem exists if a transducer's LED stays lit when no train is present.



To test the transducers manually, verify that the associated LED on the 2200-300 Interface board toggles on and off when a piece of metal is passed over the transducer.

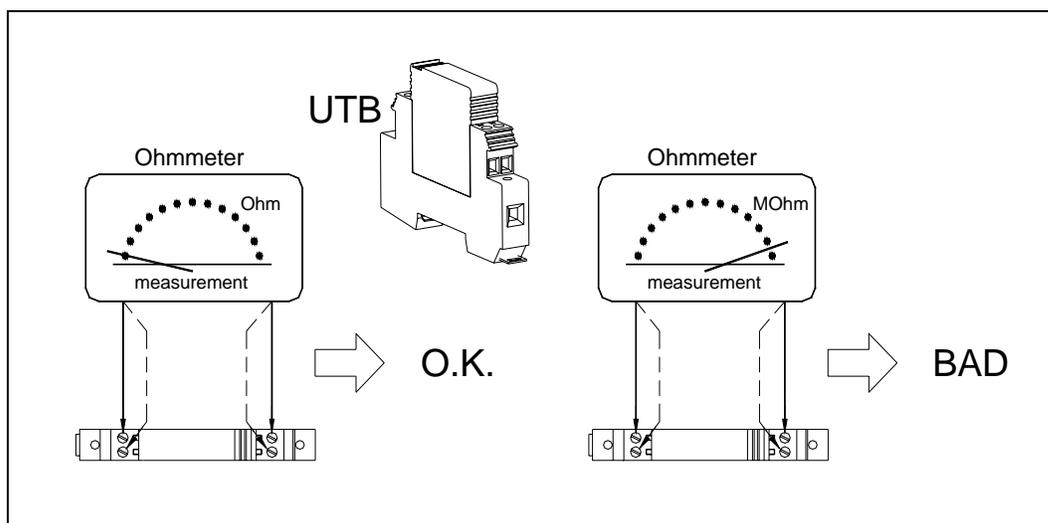
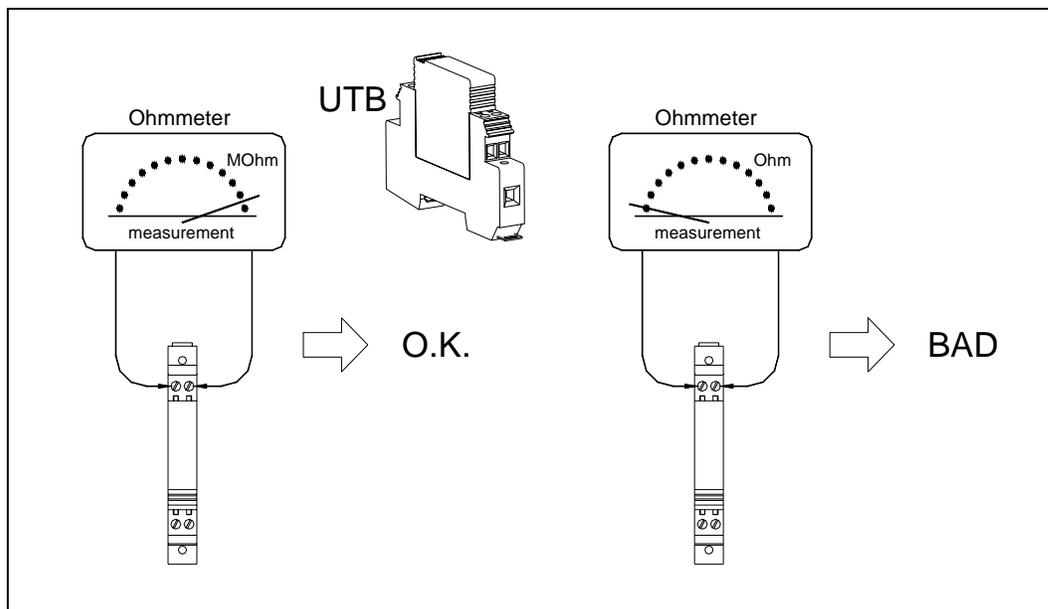
9.6.1 Honeywell Zero-Speed Transducer

Where Honeywell zero-speed transducers are installed, a transducer's LED stays lit if the circuit from the Interface board to the transducer is open. Other factors could also cause it to be lit when no train is present.

If a Honeywell zero-speed transducer's LED is lit when no train is present.

- 1 If your site has SAI rail-loop transducers installed, skip the steps below.
- 2 If the transducer, whose LED stays lit on the 2200-300 Interface board, has anything on top of it, remove it before continuing.
- 3 If the transducer, whose LED stays lit on the 2200-300 Interface board, is physically damaged, replace the damaged transducer before continuing.
- 4 If the transducer, whose LED stays lit on the 2200-300 Interface board, is misaligned, realign the misaligned transducer before continuing.

- 5 At the trackside service box, if transducer connections weren't done properly, correct before continuing.
- 6 If the transducer's LED is now off, skip the steps below.
- 7 If the transducer, whose LED stays lit on the 2200-300 Interface board, is faulty, replace the defective transducer.
- 8 If the wiring between the DIN mounted UTB and the transducer is faulty, repair or replace it.
- 9 If the transducer's LED is now off, skip the steps below.
- 10 Using an ohmmeter, test the DIN mounted UTB.



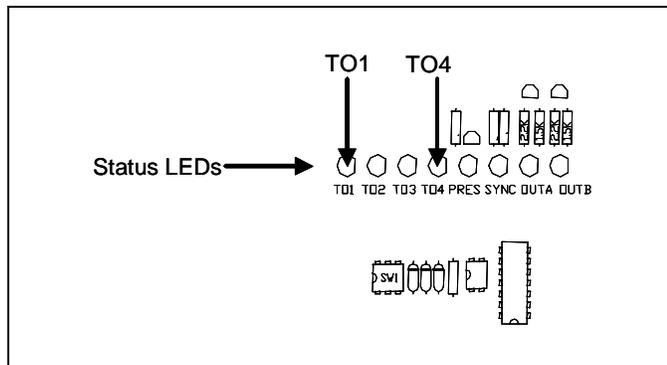
- 11 If the DIN mounted UTB is faulty, replace it and retest.

- 12 If the wiring between the DIN mounted UTB and the 2200-300 Interface board is faulty, replace it and retest.
- 13 If you didn't find a faulty arrester or faulty wiring, replace the 2200-300 Interface board and retest.
- 14 If replacing the 2200-300 Interface board doesn't fix the problem, call STC for help.
- 15 If you removed the cover protecting the 2200-300 Interface board, replace it.

9.6.2 SAI Rail-Loop Transducer

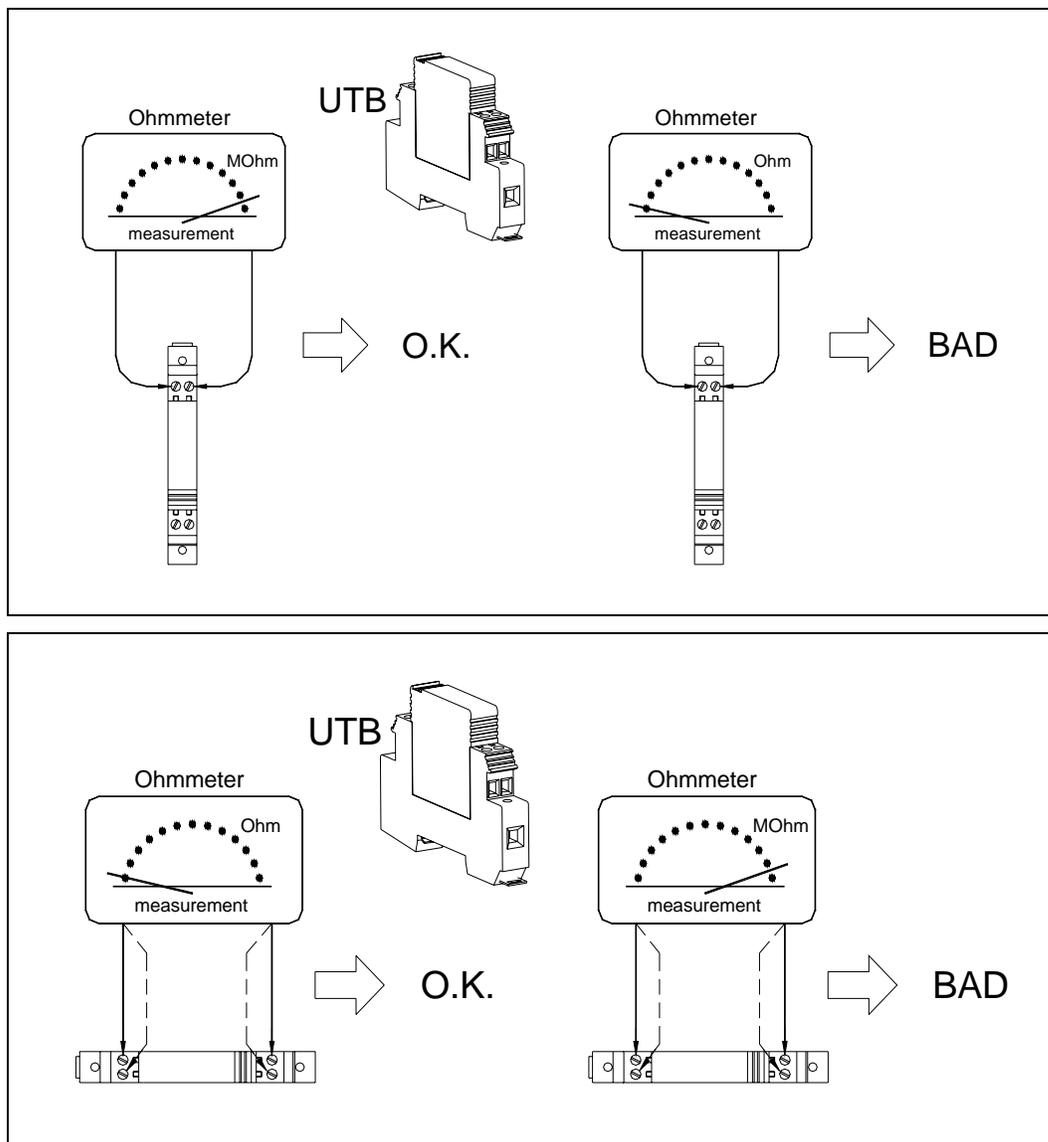
If a SAI rail-loop transducer's LED is lit when no train is present.

- 1 If your site has Honeywell zero-speed transducers installed, skip the steps below.
- 2 If the transducer, whose LED stays lit on the 2200-300 Interface board, has anything on top of it, remove it before continuing.



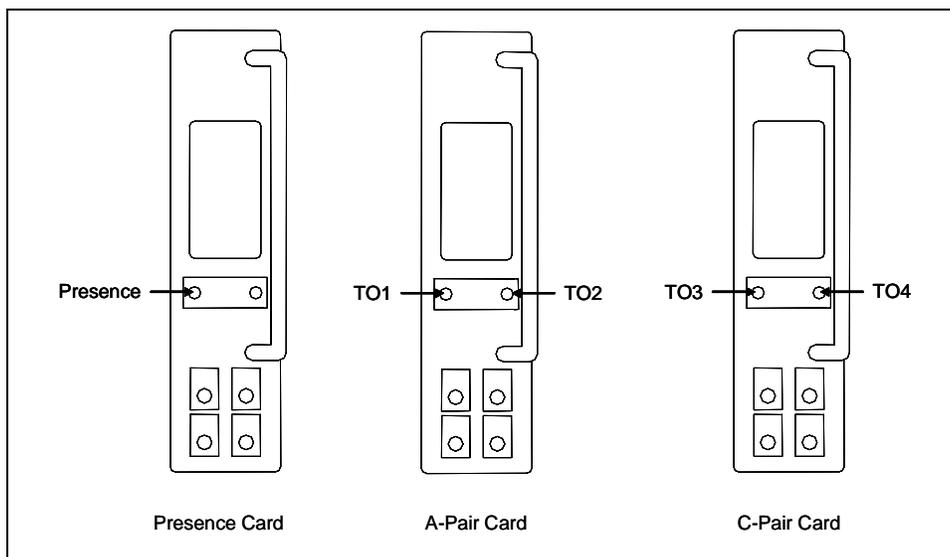
- 3 If the transducer, whose LED stays lit on the 2200-300 Interface board, is physically damaged, replace the damaged transducer before continuing.
- 4 If the transducer, whose LED stays lit on the 2200-300 Interface board, is misaligned, realign the misaligned transducer before continuing.
- 5 At the trackside service box, if transducer connections weren't done properly, correct before continuing.
- 6 If the transducer's LED is now off, skip the steps below.
- 7 If the transducer, whose LED stays lit on the 2200-300 Interface board, is faulty, replace the defective transducer.
- 8 If the wiring between the DIN mounted UTB the transducer is faulty, repair or replace it.
- 9 If the transducer's LED is now off, skip the steps below.

10 Using an ohmmeter, test the DIN mounted UTB.



- 11** If the DIN mounted UTB is faulty, replace it and retest.
- 12** If the wiring between the DIN mounted UTB and the Reno A&E C-1300 2-Channel Loop Detector is faulty, repair or replace it.
- 13** If the wiring between the Reno A&E C-1300 2-Channel Loop Detector and the 2200-300 Interface board is faulty, repair or replace it.

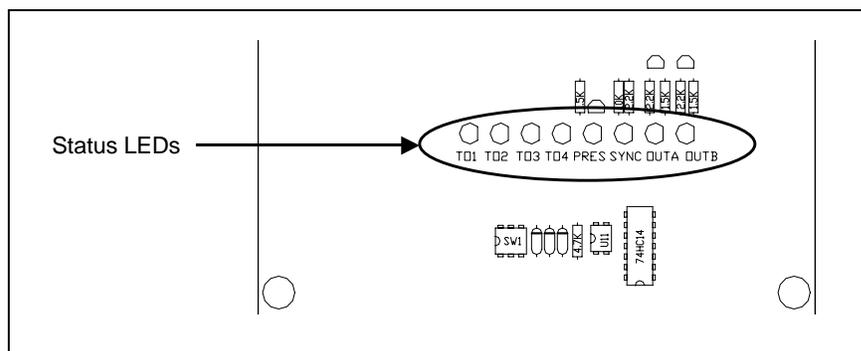
- 14** On the Reno A&E C-1300 2-Channel Loop Detector card, if the transducer's LED is lit, hold the card's CHAN button down for three seconds.



- 15** If the LED is still lit, replace the card.
- 16** On the 2200-300 Interface board, if the transducer's LED is now off, skip the steps below.
- 17** Replace the 2200-300 Interface board and retest.
- 18** If replacing the 2200-300 Interface board doesn't fix the problem, call STC for help.
- 19** If you removed the cover protecting the 2200-300 Interface board, replace it.

9.7 On Interface Board, Transducer's LED Is Never On

Status indicators for transducer inputs are located on the 2200-300 Interface board. A transducer's LED should be lit only when a wheel rim is present within the target zone above the transducer. A problem exists if a LED doesn't light as a train passes over its transducer.



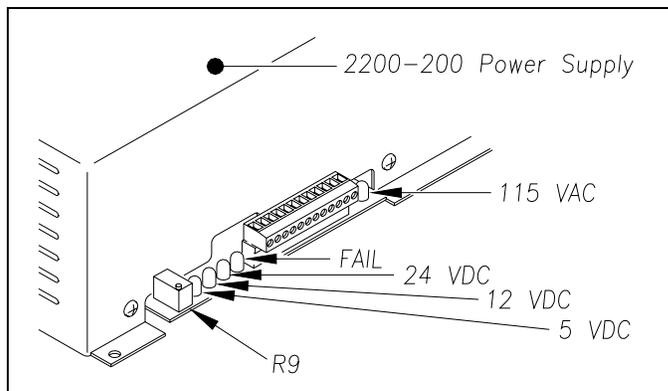
To test the transducers manually, verify that the associated LED on the 2200-300 Interface board toggles on and off when a piece of metal is passed over the transducer.

9.7.1 Honeywell Zero-Speed Transducer

Where Honeywell zero-speed transducers are installed, a transducer's LED won't light if the wiring from the transducer is shorted. Other factors could also cause it not to light.

If a Honeywell zero-speed transducer's LED doesn't light:

- 1 If your site has SAI rail-loop transducers installed, skip the steps below.
- 2 If the non-LED-lighting transducer is physically damaged, replace it before continuing.
- 3 If the non-LED-lighting transducer is misaligned, realign it before continuing.
- 4 At the trackside service box, if transducer connections weren't done properly, correct before continuing.
- 5 If the **115 VAC** and **24 VDC** LEDs on the edge of the 2200-200 Power Supply aren't lit, fix this problem before continuing.



9.1 115 VAC LED Not Lit on 2200-200 Power Supply and **9.2 24 VDC LED Not Lit on 2200-200 Power Supply** tell how to fix this problem.

- 6 On the surge panel, tighten any loose connection.
In 2200-900 Tower Enclosures, the LEDs for TO1 through TO4 can be viewed through a hole in the cover protecting the 2200-300 Interface board. In 2200-950 Inside Enclosures, the 2200-300 Interface board is coverless with all its components in view. In both cases, the LED for TO1 is the leftmost LED.
- 7 Place a piece of metal on top of the transducer whose LED never lights.
Terminations for the transducers are provided on the surge panel located in the base of the SmartScan enclosure. One UTB is provided for each transducer. In 2200-900 Tower Enclosures, TO1 is wired to the leftmost UTB. TO2 is wired to the next UTB to the right, and so on. In 2200-950 Inside Enclosures, TO1 is wired to the topmost UTB. TO2 is wired to the next UTB below it, and so on.
- 8 Measure the signal voltage across the transducer's UTB on the surge panel.
- 9 If the measured voltage isn't between 14 and 16 VDC, replace the transducer and retest.

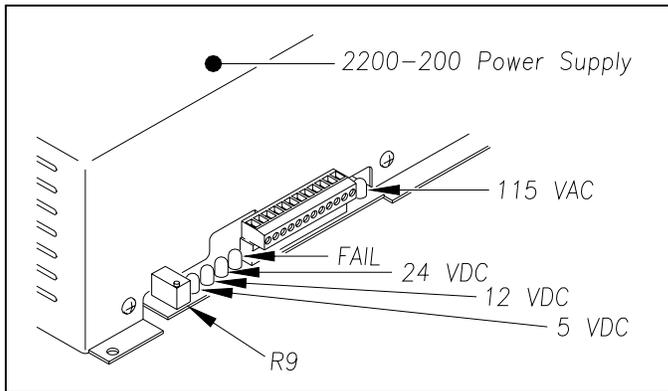
- 10** If the measured voltage is between 14 and 16 VDC and the transducer's LED (on the 2200-300 Interface board) is lit, remove the piece of metal from the top of the transducer and skip the steps below.
- 11** Remove the piece of metal from the top of the transducer.
An active transducer can be simulated by opening the transducer circuit.
- 12** For the transducer whose LED never lights, disconnect the transducer from the DIN mounted UTB.
If the transducer's LED is lit, the problem is with the transducer or the wiring between the DIN mounted UTB and the transducer. If the transducer's LED isn't lit, the problem is with its DIN mounted UTB, the 2200-300 Interface board, or the wiring between the DIN mounted UTB and the interface board.
- 13** If the transducer's LED isn't lit, go to step **17**.
- 14** If the transducer's LED is lit and the transducer is faulty, replace the transducer and retest.
- 15** If the transducer's LED is lit and the wiring between the DIN mounted UTB and the transducer is faulty, replace the wiring and retest the transducer.
- 16** If you didn't find a faulty transducer or faulty wiring, call STC for help in isolating the problem.
- 17** If the DIN mounted UTB is faulty, replace it and retest.
- 18** If the wiring between the DIN mounted UTB and the 2200-300 Interface board is faulty, replace it and retest.
- 19** If you didn't find a faulty the DIN mounted UTB or faulty wiring, replace the 2200-300 Interface board and retest.
- 20** If replacing the 2200-300 Interface board doesn't fix the problem, call STC for help.
- 21** If you removed the cover protecting the 2200-300 Interface board, replace it.

9.7.2 SAI Rail-Loop Transducer

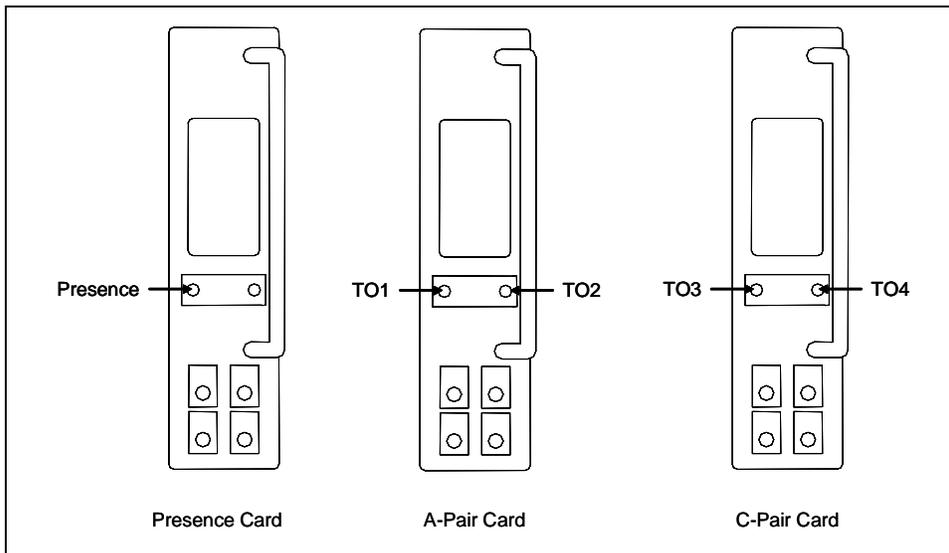
If a SAI rail-loop transducer's LED doesn't light:

- 1** If your site has Honeywell zero-speed transducers installed, skip the steps below.
- 2** If the non-LED-lighting transducer is physically damaged, replace it before continuing.
- 3** If the non-LED-lighting transducer is misaligned, realign it before continuing.
- 4** At the trackside service box, if transducer connections weren't done properly, correct before continuing.

- 5 If the **115 VAC** and **24 VDC** LEDs on the edge of the 2200-200 Power Supply aren't lit, fix this problem before continuing.



- 6 On the surge panel, tighten any loose connection.
In 2200-900 Tower Enclosures, the LEDs for TO1 through TO4 can be viewed through a hole in the cover protecting the 2200-300 Interface board. In 2200-950 Inside Enclosures, the 2200-300 Interface board is coverless with all its components in view. In both cases, the LED for TO1 is the leftmost LED.
- 7 Place a piece of metal on top of the transducer whose LED never lights.
- 8 On the 2200-300 Interface board, if the transducer's LED is lit:
 - a Remove the piece of metal from the top of the transducer.
 - b Skip the steps below.
- 9 On the Reno A&E C-1300 2-Channel Loop Detector card, check the non-LED-lighting transducer's LED.



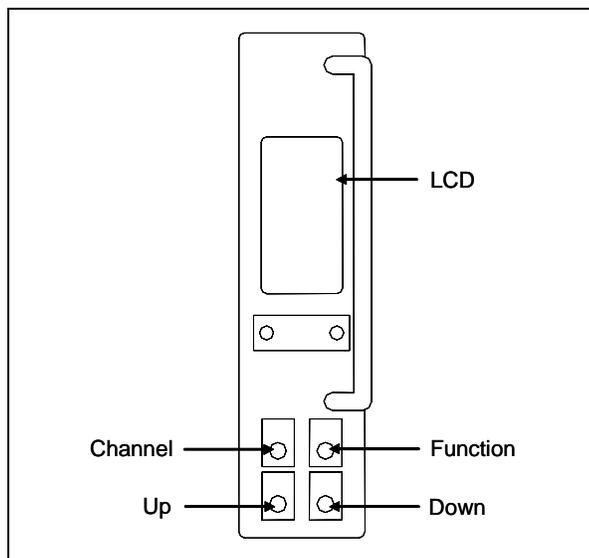
10 If LED is lit:

- a** If the wiring between the Reno A&E C-1300 2-Channel Loop Detector and the 2200-300 Interface board is faulty, repair or replace it.
- b** If the wiring between the Reno A&E C-1300 2-Channel Loop Detector and the 2200-300 Interface board isn't faulty, replace the 2200-300 Interface board and retest.
- c** If you didn't find a faulty 2200-300 Interface board or faulty wiring, call STC for help in isolating the problem.

11 If the Reno A&E C-1300 2-Channel Loop Detector card isn't adequately powered, fix this problem before continuing.

As mounted in the enclosure, pin A is the bottom-most pin on the card. Pin B is just above it. Pin A is ground. Pin B should be 24 VDC.

12 On the Reno A&E C-1300 2-Channel Loop Detector card, keep pressing the Channel button until the corresponding channel is displayed at the bottom of the LCD.



13 On the Reno A&E C-1300 2-Channel Loop Detector card, if the LCD displays the Off message:

- a** Press the Function button to enter Program mode.
The Function button only moves forward through the parameters.
- b** Keep pressing the Function button until the LCD displays the Sensitivity parameter.
- c** Press the Up button until a value of 2 is displayed.
Pressing and holding the Channel button for 2 seconds exits Program mode and returns to Normal mode.
- d** Press and hold the Channel button for 2 seconds.

If the LCD displays either the L-hi message or L-lo message, a loop failure has occurred. Also, on the Reno A&E C-1300 2-Channel Loop Detector card, the transducer's LED will be flashing when a loop failure has occurred.

- 14 If you have a loop failure:
 - a If the transducer is faulty, replace the transducer and retest.
 - b If the wiring between DIN mounted UTB and the transducer is faulty, replace the wiring and retest the transducer.
 - c If the DIN mounted UTB is faulty, replace it and retest.
- 15 If a SAI rail-loop transducer's LED still doesn't light, call STC for help.
- 16 Remove the piece of metal from the top of the transducer.
- 17 Replace the cover protecting the 2200-300 Interface board.

9.8 Incorrect Axle Counts

When looking at a System Statistics report, if the axle counts for the transducer A-pair don't match those for the transducer C-pair on the same train, you have a problem. This problem is usually caused by faulty transducer operation. One or more transducers might not be counting each axle. Other factors could also be at play.

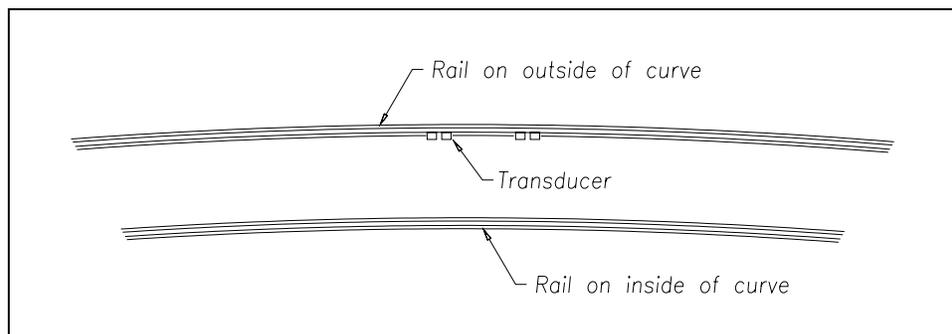
```

=====
                Southern Technologies Corporation
                  SmartScan System
                System Statistics Report
                Run Date: 02/19/2006  06:19:31
=====
Firmware Version - Comm: ML4.1n 02/03/06 Reader: ML4.1n 01/27/06
-----
| | Speed | Num Axles | Fltrd Pls| Tag Cnt| Avg Hsk| M|S| Sessions |
|D|-----|-----|-----|-----|-----|o|o|-----|
Sta|Trn|Num|i|      Xdcr Xdcr| A  C |Rdr Rdr|Rdr Rdr|v|l| Xfr Flags|
Num|Num|Crs|r|Max Min| Trn PrA PrC|Pair Pair| 1  2 | 1  2 |e|r|# Att NE SW|
-----|-----|-----|-----|-----|-----|-----|-----|-----|
          .
          .
          .
  
```

To correct the causes of miscounted axles:

- 1 Replace any physically damaged transducer.

If possible, transducers should be located in a section of track that's straight.
- 2 If the transducers are located on a curved section of track and they are mounted to the rail on the inside of the curve, move them to the rail on the outside of the curve.



- 3 Remove any debris that is on or near the transducers.
- 4 Realign any misaligned transducer.
- 5 Replace any faulty transducer.
- 6 If the above steps don't solve the problem, call STC for help.

9.9 Reports Skip Records

If the reports received are missing lines of data, verify that the CTS setup configuration is turned ON. To do this:

- 1 Plug your computer into the SmartScan system.

On a SmartScan system installed with a 2200-900 Tower Enclosure, use the DB-9 connector in the small weatherproof box on the lower right side of the enclosure. On a system installed with a 2200-950 Inside Enclosure, use the Local port (that's the middle RS232 connection) at the top of the 2200-300 Interface board in the enclosure.

- 2 Be sure your computer has appropriate communications software installed.
- 3 Be sure your communications software is set to use full duplex.

SmartScan doesn't contain logic to pause when the screen is filled. Because of this, you need to use your communications software to open a LOG file and capture the reports to the file. When your session is complete, you may then view the recorded reports with an editor or print them with a printer.

- 4 To start communications, press **[Esc]**.

If you have established a clean connection, the Main menu appears. If your Main menu is password protected, you'll need to type in the correct password before this menu appears.

```
STC SmartScan System
Site ID:
Main Menu
-----
1) System Menu
2) Report Menu
3) Route Comm Through Local Port
4) Reserved
X) Exit Menu
?
```

- 5 To progress to the System menu, type **1**

6 Press [Enter].

The System menu appears. If your System menu is password protected, you'll need to type in the correct password before this menu appears.

```
STC SmartScan System
Site ID:
System Menu
-----
1) AEI Processor/Reader Configuration Menu
2) Set System Date and Time
3) Check AEI Processor
4) T94 Sessions Configuration Menu
5) Site ID
6) Host Port CTS Status
7) Suspend Train Scanning
8) Statistics Session Configuration Menu
9) Set/Change Menu Passwords
10) Daylight Savings Clock Adjustment
11) Modem No-Connect Reset Timeout
12) Clear All Stored Data
X) Exit Menu
?
```

7 To check the CTS setup, type 6

8 Press [Enter].

A prompt like this appears.

```
Current Host Port CTS Status: Disabled
Modify ? (Y/N):
```

9 If you want to change the status, type y

10 If you want to keep the status, type n

11 To return to the Main menu, type x

12 To exit the serial interface and return to normal operation, type x

13 Unplug your computer from the SmartScan system.

Chapter 10

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.

10.1 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
USA

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

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

10.2 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 of 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, credit card number (to be charged) with its expiration date.

10.3 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're calling about. Your call will then be directed to the right person.

10.4 Ordering Spare Parts

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

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

When faxing, include:

- Purchase Order Number for the order or credit card number (to be charged) with its expiration date.
- Complete address where the parts are to be shipped.
- Complete address where the invoice is to be mailed.
- Name and 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.

10.5 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're checking the status of a shipment or order. Your call will then be directed to the right person. Have your Purchase Order Number ready when you call. However, if you don't have the order number, the sales staff can locate your order number and provide you with the status of the shipment or order.

When faxing, include:

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

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