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# SmartScanNG

## Generic Operator's Guide for Domestic Systems

10 February 2020

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Printed in the USA.

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

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

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### **NOTICE**

This is a generic guide. And, as such, contains information of a general nature. No one user has all the hardware components described in this guide. Nor does any one user have the exact same firmware that is described herein.

In this guide, the instructions for installing the track hardware work only in the northern hemisphere (that is, in countries north of the equator). Also, parts of the systems described in this guide are powered by VAC. Systems powered solely by VDC (like those powered by a bank of batteries charged by a solar array) aren't covered.

### **CAUTION**

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

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# 1.0 Introduction

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This section summarizes the purpose of this guide, describes the SmartScanNG system, tells how to comment on this guide, and tells 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 SmartScanNG system. This guide describes that system.

The SmartScanNG system monitors moving trains and reports certain conditions detected on these trains. Parts of the system, like the bearing scanners, are installed on the tracks. Other parts of the system, like the controller module, are installed near the tracks.

The SmartScanNG system is modular and firmware driven. Hardware and firmware can be changed to meet the unique needs of a given railroad. Thus, some of the components that make up a SmartScanNG system differ from railroad to railroad.

**This is a generic guide. And, as such, contains information of a general nature. No one user has all the hardware components described in this guide. Nor does any one user have the exact same firmware that is described herein.**

There are three SmartScanNG generic guides. This guide is for those who purchase, install, maintain, troubleshoot, manage, or use domestic systems installed in the USA. Another guide is for export systems installed in the southern hemisphere. The last guide is for export (non-USA) systems installed in the northern hemisphere.

Your menus and submenus may not match those shown in this guide. Some of the options shown may not appear on your menus and submenus. For example, Event Log doesn't appear on everybody's Main menu. Also, some options that appear on your menus and submenus may not apply to your system. For example, if you don't have an AEI subsystem attached to your SmartScanNG, the AEI option on the Equipment submenu would not be applicable.

Because the shown menus and submenus may be different from what appears on your system, the letter that is associated with an option may be different from what appears on your system. So, where there is a difference, type the letter of the desired option as it appears on your menus and submenus.

## 1.2 SmartScanNG

The SmartScanNG system is a full-featured detection and reporting system. It monitors moving trains, providing real-time detection of:

- Overheated bearings
- Overheated wheels, when wheel scanners are installed and enabled
- Dragging equipment, when dragging-equipment detectors are installed and enabled
- Shifted loads, when wide-load detectors are installed and enabled
- Oversized loads, when high-load detectors are installed and enabled
- Automatic Equipment Identification (AEI) tags, when AEI hardware and firmware are installed and enabled
- Direction of the train
- Exit speed of the train

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

The SmartScanNG system monitors trains traveling from 7 to 90 mph (11.3 to 145 kph). It monitors trains heading in either direction on the track.

When the SmartScanNG system detects a defect, it informs the crew of the affected train. This is done by a voice transmission over an assigned radio channel. The voice is computer generated from previously digitized human speech. It tells the crew the milepost of the reporting SmartScanNG system, a warning that a defect has been detected, and other defect-related information. When no defect is detected, the voice tells the crew that the train was scanned and found free of defects.

There are three types of messages. Real-time messages are announced as the train is passing over the site. Post-train messages are announced after the train has left the site and all the recorded train data has been processed by the SmartScanNG system. Arrival messages are announced as the train enters the site. However, this type of message isn't available on all systems. On those systems it is available on, it's optional. The content and use of these three message types are railroad specific.

The results of train scans are also stored for later use. With this stored data, the system can create formatted reports. To get them at the site, you need a computer. With a modem and a computer, you can retrieve them remotely.



## 1.3 Cautions

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

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

## 1.4 Disclaimers

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

## 1.5 How to Comment on This Guide

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

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

## 1.6 How to Order More Copies of This Guide

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

## 1.7 Standard Warranty

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

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

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

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

## 2.0 Defect Detection

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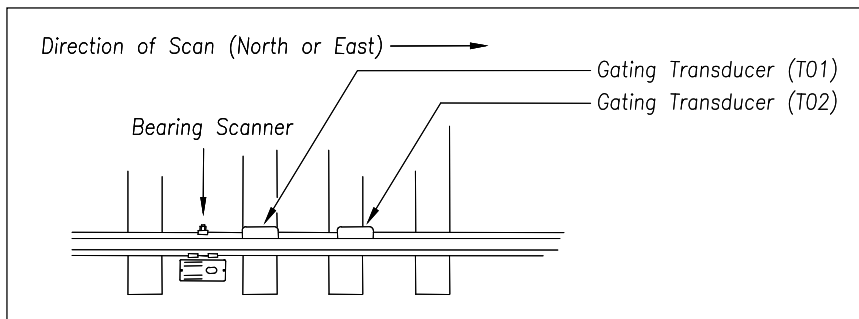
This section describes the Exception Alarms (aka defect alarms aka train alarms) and how they are detected. Also covered are miscellaneous train scanning features.

### 2.1 System Activation

System activation is the process used to detect train presence and to prepare for train scanning. It is during the scanning process that the system checks for defects.

The SmartScanNG system is equipped with one of two primary means of train arrival detection, which are the track circuit or advance transducers. In case of a failure in the primary detection method, the gating transducers act as a backup to detect train arrival. Once the system senses a train's presence, it enters scanning mode. In other words, the system has activated. It then opens the scanner's shutters and disables their heaters. It then waits for further evidence of a train at the site in the form of gating transducer activity.

Once the system is active, it reads pulses from the two rail-mounted gating transducers, which are designated TO1 and TO2. On the rail nearest the wayside enclosure, these transducers are mounted near and to the north or east of the bearing scanner. **TO1** is the gating transducer closest to the bearing scanner. **TO2** is the one farthest from the bearing scanner.



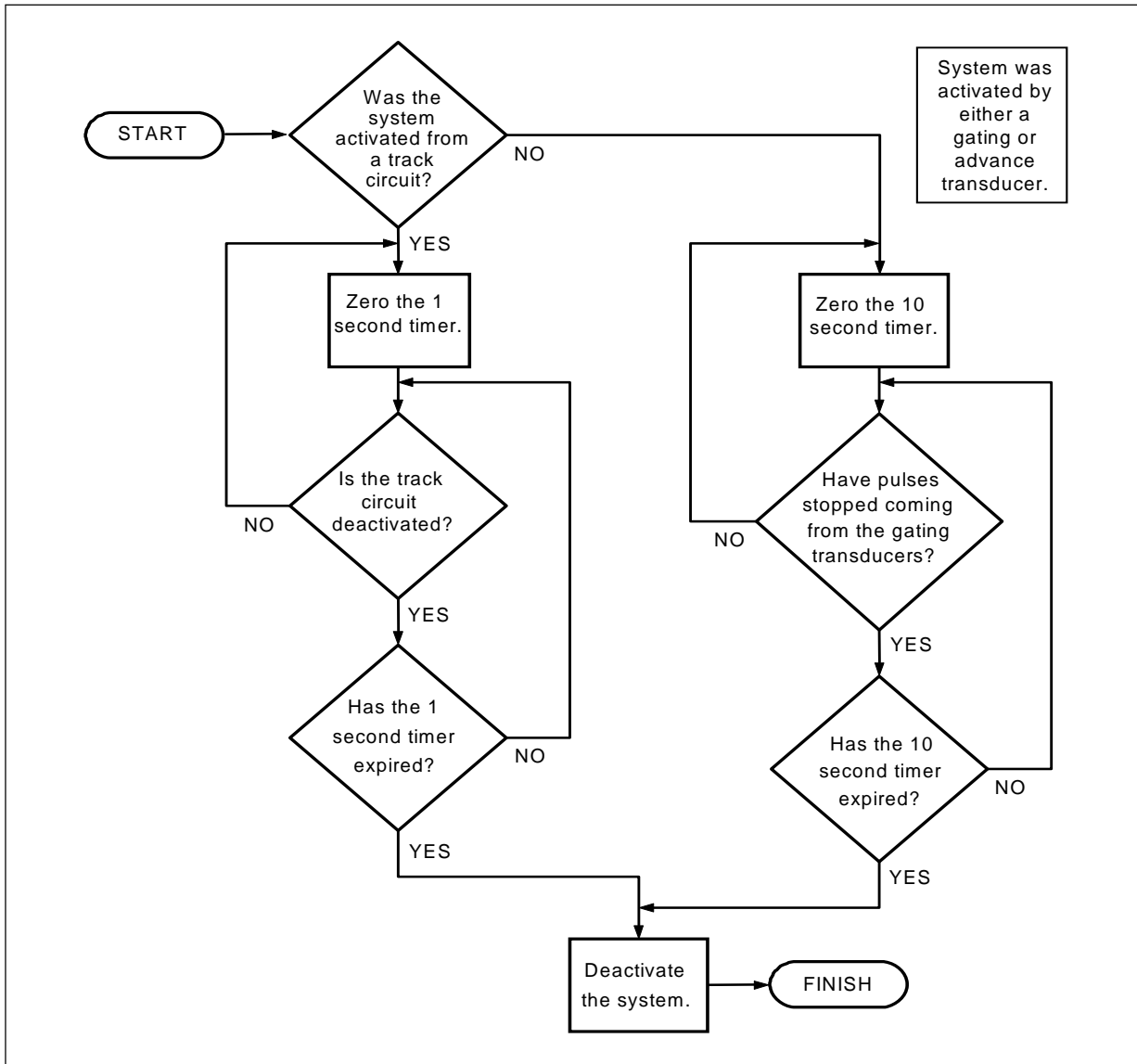
The signals from these gating transducers indicate to the system that passing wheels are in view of the scanners. Furthermore, the speed of the train is determined by using the known distance between TO1 and TO2 versus the time required for a given wheel to pass over them.

Four axles must pass over the gating transducers for the system to consider the event a valid train. This prevents maintenance equipment from generating alarms and causing unwanted voice messages on the road channel.

## 2.2 System Deactivation

System deactivation is the process used to detect the moment that the train exits the site. This happens in one of two ways, which is dependent upon whether the track circuit or one of the transducers has activated the system.

If the track circuit activated the system, it waits for the track-circuit signal to be absent for one second before deactivating. Likewise, if a transducer activated the system, it waits for ten seconds of inactivity from the gating transducers before deactivating. The flowchart below shows this process.



## 2.3 Speed Calculation

A train's exit speed is the speed shown on the reports. The system calculates this speed by using timing from the last eight axles as provided by the gating transducers. The system calculates the speed by knowing the distance between the two transducers versus the time that it takes a given wheel to pass over them. Calculated speeds over 99 mph (159 kph) are reported as 99 mph. If a train has fewer than eight axles, its speed is reported as 0 mph.

Trains traveling at less than 7 mph (11.3 kph) are considered "very slow." If a passing train drops below this speed threshold, the detection of Differential alarms, Pyrometer Saturation alarms, and Carside Slope alarms isn't performed. After the passage of these trains, the phrase "train too slow" is appended to the post-train message (when the Announce Slow Trains option is enabled) and a diagnostic message is noted on the Train Detail and Exception Detail reports. Also, after the passage of these trains, axle count, exit speed, length of train, and total number of cars isn't announced. This is true even when the Announce Axles option, Announce Speed option, Announce Train Length option, and Announce Number of Cars option are enabled.

The report fragment below, from the header section of a Train Detail report, shows the location of this message.

Southern Technologies Corporation  
Next Generation Detector System  
**TRAIN DETAIL**

=====

System Alarms

-----

VERY Slow Train

•

•

•

•

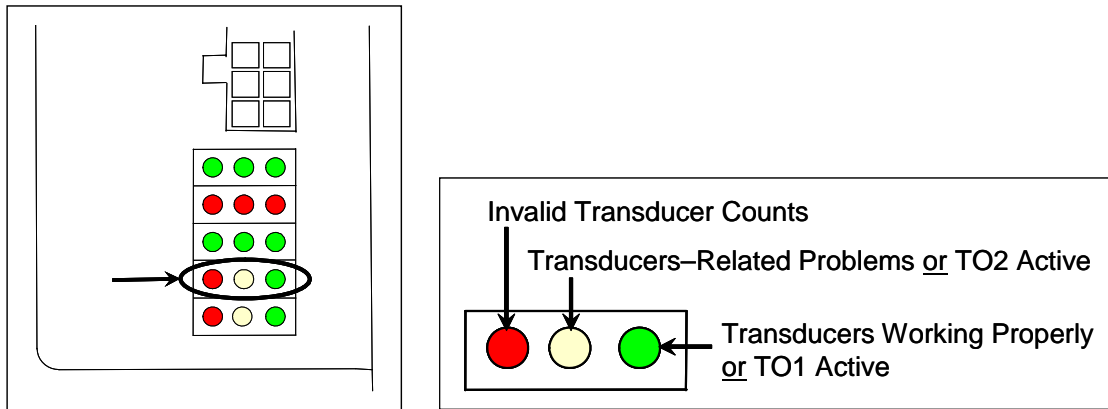
## 2.4 Train Direction

Train direction is based on whether TO1 or TO2 generated the first gating transducer pulse.

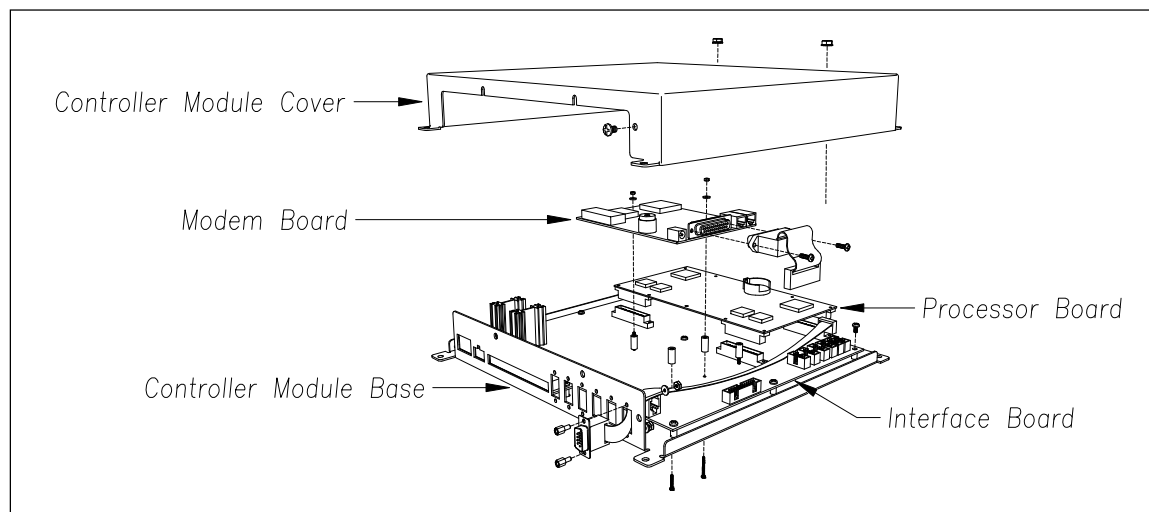
## 2.5 Transducer Pulse Processing

As a wheel enters the sensing range of a transducer, the transducer should respond with a positive going pulse. The polarization of the two wires from the transducer determines if this pulse is positive or negative.

Here is a simple test that you can use to verify the correct polarization of the gating transducers. While watching the TO1 and TO2 LEDs in row four on the status panel, have someone lay a metal wrench on one of the gating transducers. The corresponding LED should briefly light as the wrench touches the transducer. Then lift the wrench up. The LED shouldn't light as the wrench is lifted away. Repeat the test for the other transducer.



On the Interface board (in the Controller module), the transducer signals undergo RF filtering and amplification with a gain of 30. For validation, the amplified signals are fed into comparators, which create 5-VDC pulses lasting the period of time that the amplified signals remain above 620 millivolts. Processor-A (on the Processor board) receives these 5-VDC pulses through ports PA0 (TO1) and PA1 (TO2).



A firmware-controlled feature of the comparator circuit allows adjustment of the threshold voltage based on the speed of the train. Trains traveling less than 32 kph (20 mph) use the 620-millivolt threshold setting for maximum sensitivity. However, faster trains cause the transducers to generate a higher signal voltage, which allows the system to increase the threshold voltage. This improves the signal-to-noise ratio resulting in better signal validation.

Processor-A (on the Processor board) internally generates interrupts on the positive going and negative going edges of each transducer pulse coming from the comparator. The positive edge of each comparator pulse starts a timer. The timer stops with the detection of a negative going edge. The width of each pulse is a determining factor of signal validity. Three milliseconds or greater is considered to be a valid signal. The firmware rejects any pulse width shorter than 3-milliseconds. Rejected pulses don't increment the transducer counters.

In normal operation, the gating transducers fire in sequence, first one then the other. With 24-inch (61-centimeter) gating-transducer spacing, a wheel passes over both gating transducers before the next wheel passes over a gating transducer. Therefore, two consecutive pulses on the same gating transducer aren't physically possible. However, in the unlikely event that a gating transducer is ever caused to fire by another source, such as electrical interference from a locomotive's traction motor, a spike-counter for the gating transducer that misfired will be incremented by one. To increment the axle counter, one pulse from each gating transducer must occur in sequence.

## **2.6 Axle Scanning**

The SmartScanNG system begins reading the scanners for a heat signal when the wheel is at the center of the first gating transducer and will continue reading until the wheel is at the center of the second gating transducer. This is the period that the axle is in view of the scanner. A negative going edge of a transducer signal is an indication that the wheel is in the center of that transducer. The firmware uses Dynamic Scan Rate sampling, which means that heat readings taken every 1/2 inch (1.27 centimeters) of wheel movement are used to detect alarms, regardless of the speed of the train. As a result, the system takes 48, evenly spaced samples as the wheel rolls through the 24-inch (61-centimeter) detection zone that is established by the distance between the gating transducers.

## 2.7 Hot Bearing Alarms

The SmartScanNG system checks for hot bearings during the scanning process. It detects and records every Hotbox alarm that occurs. However, it only announces a maximum of four per train. For example, if a train contains seven Hotbox alarms, the Train Detail report will show all seven, but only the first four will be announced.

There are four types of Hotbox alarms.

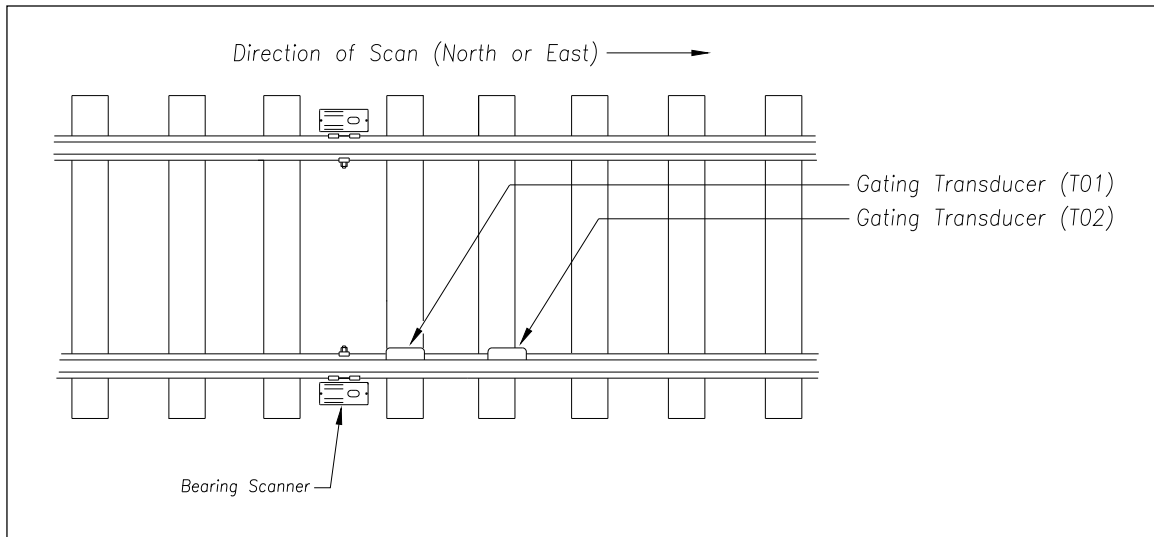
- **Absolute.** To trigger an Absolute alarm, a bearing temperature must exceed the limit that was established using the Absolute option. This alarm limit is an offset, in degrees Fahrenheit, above the ambient temperature.
- **Differential.** To trigger a Differential alarm, a bearing temperature must exceed the opposite side bearing temperature of the same axle by a differential amount established using the Differential option.
- **Pyrometer Saturation.** To trigger a Pyrometer Saturation alarm, an interaxle bearing temperature must exceed the limit that was established using the Absolute option. If an Absolute alarm or a Differential alarm has already been triggered for the axle, a Pyrometer Saturation alarm isn't generated.
- **Carside Slope.** To trigger a Carside Slope alarm, a bearing temperature must meet or exceed a calculated alarm level and a minimum heat value. The bearing temperature must also be at least twice the opposite bearing's temperature. If an Absolute alarm or a Differential alarm has already been triggered for the axle, a Carside Slope alarm isn't generated. The minimum heat value is established using the Carside Minimum option.

The system always checks for Absolute alarms. The system also checks for Differential alarms and Pyrometer Saturation alarms. However, their detection stops when the speed of the train drops below 7 mph (11.3 kph). In order for Carside Slope alarms to be processed, they must be enabled using the Carside Slope option on the Equipment submenu. The detection of Carside Slope alarms also stops when the speed of the train drops below 7 mph (11.3 kph).

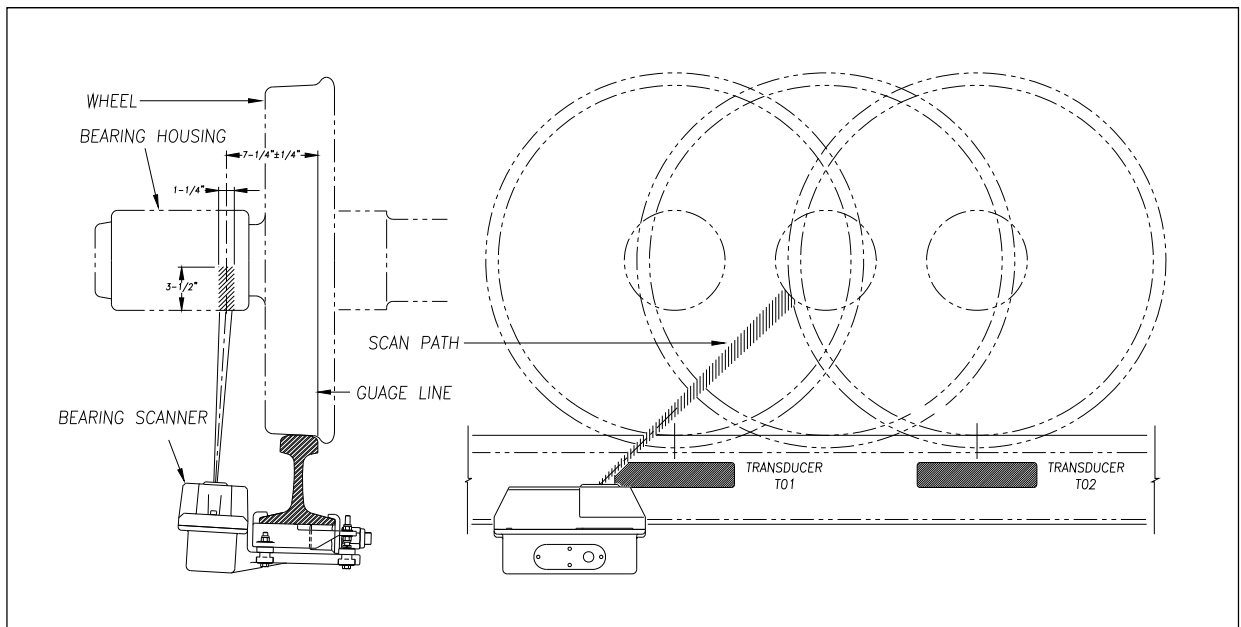


## 2.7.1 Bearing Scan Process

Bearing scanners are mounted in the center of the crib of two ties spaced at least 14 inches (35.6 centimeters) apart. Both bearing scanners are mounted in the crib immediately ahead of the gating transducers (that is, in the crib immediately to the south or west of the gating transducers). They are mounted directly opposite each other, one on each rail of the track. The hole on the top of the scanner covers faces north or east.



The bearing scanners are aligned to scan the bottom 3.5 inches (8.9 centimeters) of the bearing housing, about 7.25 inches (18.4 centimeters) from the gauge line. Bearing temperatures are sampled while the gate is open.



## 2.7.2 Referencing System

Pyrometers measure rapid changes in infrared energy emitted from objects passing through their field of view. The rail-mounted scanners are aligned to take advantage of this characteristic.

When no axle is present between the gating transducers, the scanner typically sees only the undersides of the cars passing over the site. The undersides of the cars are at or near ambient temperature, thus establishing the reference from which the elevated temperatures of bearings are measured. The pyrometers normalize during this time, producing a zero level signal.

Occasionally, the scanners are exposed to infrared emissions that are colder than the underside of the cars. Typically, this occurs in the gaps between cars when the scanners may reference on clear sky. This could present an erroneous reference if a bearing was scanned immediately following a sky shot, resulting in an abnormally high reading for the bearing. The pyrometers have internal circuitry to prevent the reference from shifting below the established zero reference.

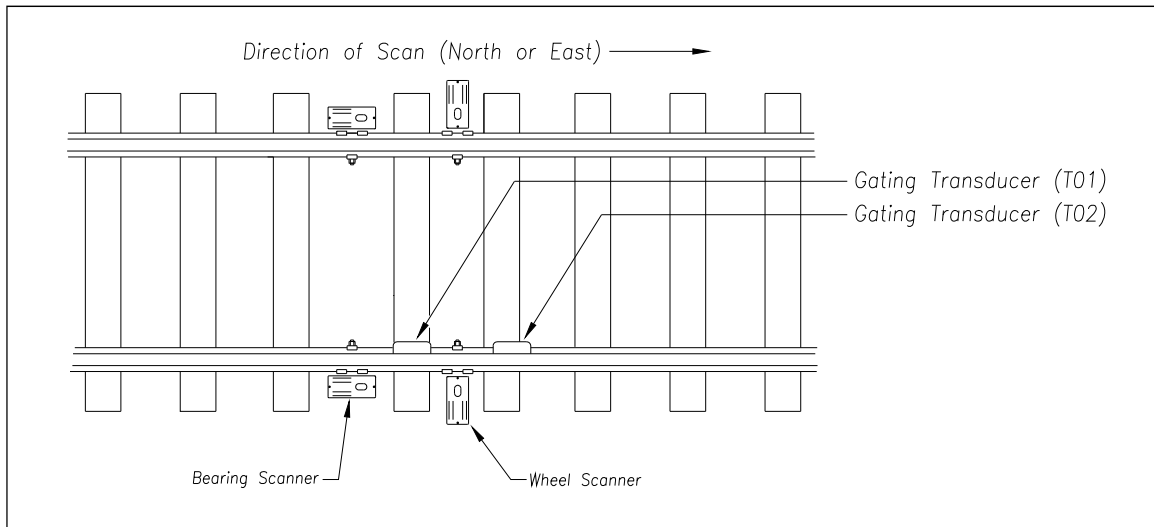
When a bearing passes through the field of view of the scanner, a rapid change in temperature is presented to the internal lithium tantalite crystal. This causes the signal level from the pyrometer to increase proportionally to the amount of exposed infrared energy. When an axle is between the gating transducers, the pyrometer signal is sampled at every 1/2 inch (1.27 centimeters) of wheel movement for a total of 48 samples and the maximum signal level is stored. This signal level measured in volts is converted to a digital value and expressed in degrees Fahrenheit above ambient temperature. This value is the basis for the alarm analysis done by the system.

## 2.7.3 Pyrometer Linearity

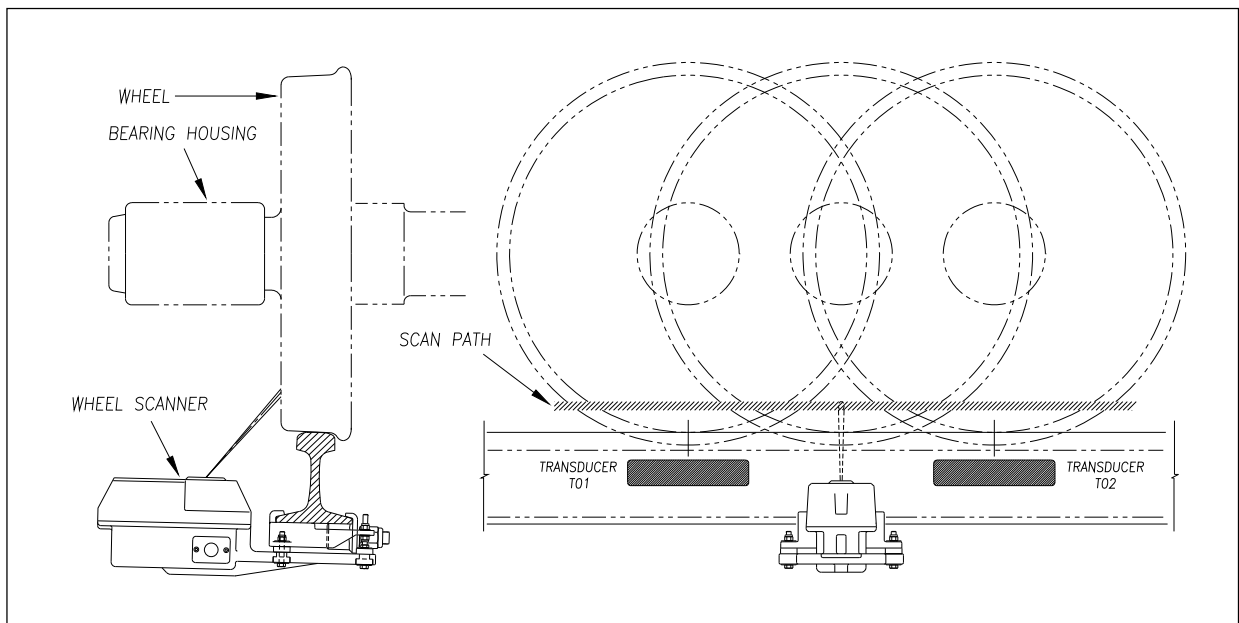
The output of the pyrometers is linear across most of the operating speed range of the system. However, the output of the pyrometers is nonlinear at either end of the operating speed range. To compensate for this nonlinear output, the firmware applies a correction factor to the sampled heat value. The correction factor applied to each bearing sample is based on the speed of the bearing (axle's ON time) as it passed through the gate and on the actual value read by the pyrometer. The correction factor is derived from a table that is keyed by the axle's ON time and heat value. Due to the fast nature of this lookup table, linearity compensation is done real-time so that detected alarms reflect the heat value after the linearity step has been done.

## 2.8 Hotwheel Alarms

When used, wheel scanners are mounted in the center of the crib of two ties spaced at least 14 inches (35.6 centimeters) apart. Both wheel scanners are mounted in the crib between the two gating transducers. They are mounted directly opposite each other, one on each rail of the track. The hole on the top of the scanner covers faces the center of the track.



The wheel scanners are aligned to scan about 4 inches (10 centimeters) above the rail.



The SmartScanNG system checks for hotwheels during the scanning process. Scan timing is controlled the same as for the bearing scanners.

Wheel scanning alarms are limited to absolute only. To trigger a Hotwheel alarm, wheel scanners must be properly installed, hotwheel detection must be enabled, and a wheel temperature must exceed the limit that was established using the Hotwheel option on the Alarm Limits submenu (aka Alarm Settings submenu). This alarm limit is an offset, in degrees Fahrenheit, above the ambient temperature. Hotwheel detection is enabled using the Hotwheel option on the Equipment submenu. When enabled, the SmartScanNG system detects and records every Hotwheel alarm that occurs. However, it only announces a maximum of four per train. For example, if a train contains nine Hotwheel alarms, the Train Detail report will show all nine, but only the first four will be announced.

## 2.9 Auxiliary Alarms

The SmartScanNG system can support input from as many as four external alarm devices. Any device that provides an open relay contact upon alarm detection can be supported by the system. Auxiliary alarms supported by the SmartScanNG system are:

- **Dragging Equipment.** To trigger a Dragging-Equipment alarm, a dragging-equipment detector must be properly installed, dragging-equipment detection must be enabled, and the SmartScanNG system must sense an open relay contact from the dragging-equipment detector. Dragging-equipment detection is enabled using the Dragger option on the Equipment submenu. When enabled, the SmartScanNG system detects and records every Dragging-Equipment alarm that occurs on a given train. However, it only announces the first two.
- **High Load (oversized loads).** To trigger a High-Load alarm, a high-load detector must be properly installed, high-load detection must be enabled, and the SmartScanNG system must sense an open relay contact from the high-load detector. High-load detection is enabled using the High-Load option on the Equipment submenu.

When a high-load detector is configured for trip-wire operation, the SmartScanNG system only records one High-Load alarm, regardless of the high-load signal status. This is because you can only break a wire once.

When a high-load detector is configured for light-beam operation, the SmartScanNG system records every High-Load alarm that occurs. This involves a caveat that the system won't flag High-Load alarms on consecutive axles. At least one unalarmed axle must separate the alarmed axles. Regardless of the number of detected High-Load alarms, it only announces a maximum of two.

The mode of operation (light beam or trip wire) isn't relevant when the SmartScanNG system finds a Stuck High-Load Detector Pretrain alarm. When this occurs, the system flags the pretrain condition as an integrity failure, disables high-load scanning for the remainder of the train, and doesn't assign a high-load condition to any of the axles.

- Wide Load (shifted loads). To trigger a Wide-Load alarm, two wide-load detectors (one on each side of the track) must be properly installed, wide-load detection must be enabled, and the SmartScanNG system must sense an open relay contact from either of the wide-load detectors. Wide-load detection is enabled using the Wide-Load option on the Equipment submenu.

When a wide-load detector is configured for trip-wire operation, the SmartScanNG system only records one Wide-Load alarm, regardless of the wide-load signal status. This is because you can only break a wire once.

When a wide-load detector is configured for light-beam operation, the SmartScanNG system records every Wide-Load alarm that occurs. This involves a caveat that the system won't flag Wide-Load alarms on consecutive axles. At least one unalarmed axle must separate the alarmed axles. Regardless of the number of detected Wide-Load alarms, it only announces a maximum of two.

The mode of operation (light beam or trip wire) isn't relevant when the SmartScanNG system finds a Stuck Wide-Load Detector Pretrain alarm. When this occurs, the system flags the pretrain condition as an integrity failure, disables wide-load scanning for the remainder of the train, and doesn't assign a wide-load condition to any of the axles.

Both high-load detectors and wide-load detectors must be either trip-wire detectors or light-beam detectors. The selection of trip wire or light beam is done using the Clearance Type option on the Equipment submenu.



## 3.0 Serial Interface

---

The serial interface allows **on-site** and **off-site** communication with the system. This interface is the only way to view reports and to modify system parameters. If your site doesn't have either telephone or Ethernet service, you cannot communicate with the system remotely (that is, **off-site**).

To use the interface locally, you need:

- A computer
- Communications software, which is installed on the computer
- A null modem cable from the computer to a communications port on the Controller module

For remote access via phone line:

- A computer with communications software
- A modem, which is connected to the computer
- A nonswitched analog telephone line, which is connected to the computer's modem
- Another modem, which is connected to COM3 on the Interface board (internally) or COM3 on the Controller module (externally)
- Another nonswitched analog telephone line, which is connected to the SmartScanNG's modem

For remote access via network:

- A computer with communications software and internet connectivity
- An Ethernet connection at the SmartScanNG<sup>2</sup> controller (with internal Velocity board)

This section describes the serial interface for the SmartScanNG system. It covers how to enter or change the system parameters. The next section tells how to use the serial interface to produce reports.

It is necessary to go through a complete setup the first time a SmartScanNG system is installed at a new site. (If this is a multitrack site, you need to do this for each SmartScanNG system.) After that, the Processor board (in the Controller module) retains the setup information. During a power outage, no setup information is lost if the battery on the Processor board is operative. If this battery isn't operative during the power outage, the only setup information that is lost is the date and time.

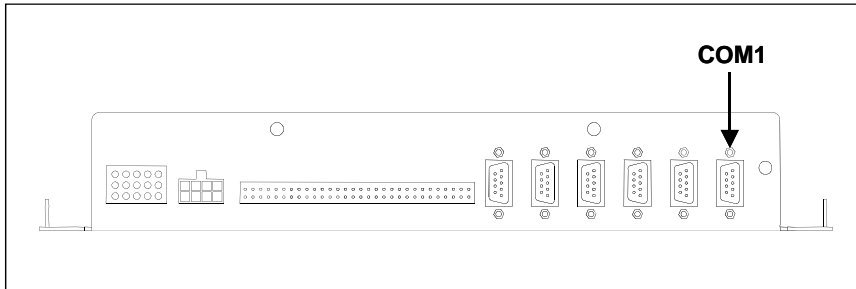
**Your menus and submenus may not match those shown in this guide. Some of the options shown may not appear on your menus and submenus. For example, No Defects doesn't appear on everybody's Messages submenu. Also, some options that appear on your menus and submenus may not apply to your system. For example, if you don't have an AEI subsystem attached to your SmartScanNG, the AEI option on the Equipment submenu would not be applicable.**

Because the shown menus and submenus may be different from what appears on your system, the letter that is associated with an option may be different from what appears on your system. So, where there is a difference, type the letter of the desired option as it appears on your menus and submenus.

### 3.1 Main Menu

To display the Main menu:

- 1 If **on-site**, plug your computer into COM1.



- 2 From your computer, connect to the site to which you want to communicate via Ethernet or phone line.
- 3 Be sure that your computer has installed communications software, that it is set to use full duplex, and that the baud rate is set to 19,200.

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

- 4 On your computer, open a LOG file.
- 5 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.



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

The Main menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Main Menu
-----
```

```
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
F) Last Train
G) Last Test Train
H) AEI Diagnostic Detail
I) Replay EOT Announcement
J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
```

?

From the Main Menu, you can:

- Produce one of the listed reports. This is explained in **Section 4.0 Producing Reports**.
- Replay an EOT announcement. This is explained below.
- Access the Setup menu. This is explained below. It is from the Setup menu that you can set system parameters.
- Enter pass-through mode. This is explained below. Pass-through mode allows you to access two SmartScanNG systems with one modem.
- Access the System Functions menu. This is explained below.

- 7 When done, close the LOG file.

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

When a session ends, if a modem was used, the system sends various commands to the modem to prepare it for future use. If at any time during the disconnect procedure, lines such as "+++ATH0" appear on your screen, these are merely commands preparing the modem for further use. They shouldn't be construed as anything that is meant for the user.

## 3.2 Setup Menu

To display the Setup menu:

- 1 Be sure that the Main menu is displayed.

The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Main Menu
-----
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
F) Last Train
G) Last Test Train
H) AEI Diagnostic Detail
I) Replay EOT Announcement
J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
?
```

- 2 Select Setup menu.

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

```
Enter Password:
```

You are given three chances to enter the correct password. When you have an **off-site** connection and you don't enter the correct password in three tries, the system hangs up your modem. When you have an **on-site** connection and you don't enter the correct password in three tries, the system returns to the Main menu.

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

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

If the Setup menu is not password protected, a menu and prompt like this appears. Also, after you type the password correctly for a password protected Setup menu, a menu and prompt like this appears.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Setup Menu
-----
A) Date and Time
B) MP/KP
C) Track Number
D) Alarm Limits
E) Equipment
F) Messages
G) AEI Reader Parameters
H) Load Default Setup Parameters
I) Serial Password
J) COM1 Tx 19200 / Rx 19200 N-8-1
K) COM2 Tx 19200 / Rx 19200 N-8-1
L) COM3 Tx 19200 / Rx 19200 N-8-1
M) COM4 Tx 19200 / Rx 19200 N-8-1
X) Exit
?
```

To access any of the Setup menu options, type the letter that corresponds to the desired menu option.

At any prompt, a timeout mechanism is in place to prevent the system from remaining in that state indefinitely. When a timeout occurs, the serial interface regresses to the previous menu. For example, if a timeout occurs in the Equipment submenu, the system reverts to the Setup menu. If this menu times out, the system reverts to the Main menu. If this menu times out, the system disconnects the modem connection and resumes normal operation. At the Main menu, the timeout is set for five minutes. For all other prompts, the system uses several different timeout values.

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

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

### 3.2.1 Date and Time

To set or change the date, the time, or both:

- 1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Setup Menu
-----
A) Date and Time
B) MP/KP
C) Track Number
D) Alarm Limits
      .
      .
      .
```

- 2 Select the Date and Time option.

A prompt like this appears.

```
Current date is: 09/30/2019
Enter new date:
```

Dates are in **mm/dd/yyyy** format, where **mm** is month, **dd** is day, and **yyyy** is year. You only type the last two digits of the year. The system automatically inserts the slashes and the first two digits of the year. For days, for months, or for the last two digits of years from 1 through 9, type leading zeros. Thus, for 8 April 2019, type **040819**.

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

- 3 Type a new date or press **[Enter]**.

A prompt like this appears.

```
Current time is: 21:57:34
Enter new time:
```

Time is in 24-hour **hh/mm/ss** 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., type **154217**. The system automatically inserts the colons. For hours, minutes, and seconds from 0 through 9, type leading zeros.

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

- 4 Type a new time or press **[Enter]**.

The Setup menu reappears.

### 3.2.2 Milepost/Kilometer Post (MP/KP)

To set or change the milepost/kilometer post (MP/KP) setting:

- 1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Setup Menu
-----
A) Date and Time
B) MP/KP
C) Track Number
D) Alarm Limits
E) Equipment
      .
      .
      .
```

- 2 Select the MP/KP submenu (aka Milepost submenu).

A prompt like this appears.

```
MP/KP: 1794.5
New MP/KP:
```

MP/KP is in **nnnn.n** format. If the desired MP/KP has less than five digits, type leading zeros. If the desired MP/KP is an integer, type a trailing zero. Thus, for MP/KP 30, type **00300**. The system automatically inserts the decimal point.

- 3 To keep the displayed MP/KP:

- a Press **[Enter]**.

The Setup menu reappears.

- b Skip the remaining steps.

- 4 To change the displayed MP/KP, type the new five-digit MP/KP.

This prompt appears.

```
Is this correct ?
```

At this point, you can type either **Y** (yes) or **N** (no).

- 5 If the MP/KP is incorrect:

- a Type **N**

- b Return to step 4.

- 6 If the MP/KP is correct, type **Y**

The Setup menu reappears.

### 3.2.3 Track Number

To set or change the track number:

- 1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Setup Menu
-----
A) Date and Time
B) MP/KP
C) Track Number
D) Alarm Limits
E) Equipment
      .
      .
      .
```

- 2 Select the Track Number option.

A prompt like this appears.

```
Track Direction is North/South, is this OK (Y/N)?
```

At this point, you can type either **Y** (yes) or **N** (no). If North/South is displayed (as it is above), typing **N** changes it to East/West. Typing **Y** keeps it North/South. If East/West is displayed, typing **N** changes it to North/South. Typing **Y** keeps it East/West.

- 3 To keep the displayed track direction:

- a Type **Y**

A prompt like this appears.

```
Is this a multi-track site (Y/N)?
```

At this point, you can type either **Y** (yes) or **N** (no).

- b Go to step 5.

**4** To change the displayed track direction:

**a** Type **N**

The track direction toggles between east/west and north/south.

**b** If the track direction is incorrect, go to step **a**.

**c** If the track direction is correct, type **Y**

A prompt like this appears.

```
Is this a multi-track site (Y/N)?
```

At this point, you can type either **Y** (yes) or **N** (no).

**5** At this site, if you have only one track:

**a** Type **N**

The Setup menu reappears.

**b** Skip the remaining steps.

**6** At this site, if you have two or more tracks, type **Y**

A prompt like this appears.

```
1 = NORTH
2 = SOUTH
3 = EAST
4 = WEST
5 = MIDDLE
6 = MAIN1
7 = MAIN2
8 = MAIN3
Enter number:
```

**7** Type the digit that corresponds to the track designator you want.

If you typed a correct digit (that is, one from 1 through 8), the Setup menu reappears.

If you typed an incorrect character, the message below appears followed by the above prompt. If this happens, retype the digit that corresponds to the track designator you want.

```
That was not one of the valid choices.
```

### 3.2.4 Alarm Limits

To set or change one or more of the alarm limits:

- 1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Setup Menu
-----
A) Date and Time
B) MP/KP
C) Track Number
D) Alarm Limits
E) Equipment
      .
      .
      .
```

- 2 Select the Alarm Limits submenu (aka Alarm Settings submenu).

A menu and prompt like this appears.

```
Alarm Settings, MP/KP-1794.5, Track-Single
-----
A Absolute..... 180
B Differential..... 100
C Hot Wheel..... 600
D Carside Slope..... 1.31
E Carside Minimum... 47
F Cold Rails..... 5
G Cold Rail Temp.... 20

Alarm to change or Esc to quit?
```

This menu option allows you to change the various alarm limits that affect system operations. The current setting for each limit is displayed. To change one of the alarm limit settings, start by typing the letter corresponding to the desired option.

- 3 To leave the Alarm Limits submenu (aka Alarm Settings submenu) and return to the Setup menu:

- a Press **[Esc]**.

The Setup menu reappears.

- b Skip the remaining steps.



**4** To change the displayed **absolute-alarm limit** :

The number after the word Absolute on the Alarm Limits submenu (aka Alarm Settings submenu) is an offset in degrees Fahrenheit above ambient temperature. When a bearing temperature exceeds this value, the system generates an Absolute alarm.

Alarm Settings, MP/KP-1794.5, Track-Single		
-----		
A	Absolute.....	180
B	Differential.....	100
C	Hot Wheel.....	600
D	Carside Slope.....	1.31
E	Carside Minimum...	47
F	Cold Rails.....	5
G	Cold Rail Temp....	20
Alarm to change or Esc to quit?		

- a** From the Alarm Settings submenu, select Absolute.

This prompt appears.

New Value ?
-------------

If the new limit has less than three digits, type leading zeros.

- b** Enter the three-digit limit.

A prompt like this appears.

New Value ? 200 Is this correct ?
--------------------------------------

At this point, you can type either **Y** (yes) or **N** (no).

- c** If the new limit is incorrect, type **N** and return to step **b**.

- d** If the new limit is correct, type **Y**

If you enter zero or a value greater than 300, an error message and a prompt like this appears.

Minimum valid value is 1, Maximum valid value is 300 New Value ?
---

If you enter an acceptable value, the Alarm Limits submenu (aka Alarm Settings submenu) reappears.

- e** If you get an error message, return to step **b**.  
**f** If you don't get an error message, return to step **3**.

**5** To change the displayed **differential-alarm limit** :

The number after the word Differential on the Alarm Limits submenu (aka Alarm Settings submenu) is an offset in degrees Fahrenheit between rail1 and rail2. A bearing temperature is compared to the bearing temperature on the opposite end of the same axle. When the difference in temperatures exceeds the value on the screen, the system generates a Differential alarm.

```
Alarm Settings, MP/KP-1794.5, Track-Single
-----
A Absolute..... 180
B Differential..... 100
C Hot Wheel..... 600
D Carside Slope..... 1.31
E Carside Minimum... 47
F Cold Rails..... 5
G Cold Rail Temp.... 20

Alarm to change or Esc to quit?
```

- a** From the Alarm Settings submenu, select Differential.

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, type leading zeros.

- b** Enter the three-digit limit.

A prompt like this appears.

```
New Value ? 110
Is this correct ?
```

At this point, you can type either **Y** (yes) or **N** (no).

- c** If the new limit is incorrect, type **N** and return to step **b**.  
**d** If the new limit is correct, type **Y**

If you enter zero or a value greater than 300, an error message and a prompt like this appears.

```
Minimum valid value is 1, Maximum valid value is 300
New Value ?
```

If you enter an acceptable value, the Alarm Limits submenu (aka Alarm Settings submenu) reappears.

- e** If you get an error message, return to step **b**.  
**f** If you don't get an error message, return to step **3**.

**6** To change the displayed **hotwheel-alarm limit**:

The number after the words Hot Wheel on the Alarm Limits submenu (aka Alarm Settings submenu) is an offset in degrees Fahrenheit above ambient temperature. When a wheel temperature exceeds this value, the system generates a Hotwheel alarm. However, when the Hotwheel option on the Equipment submenu is disabled, Hotwheel alarms aren't generated.

```
Alarm Settings, MP/KP-1794.5, Track-Single
```

```
-----  
A Absolute..... 180  
B Differential..... 100  
C Hot Wheel..... 600  
D Carside Slope..... 1.31  
E Carside Minimum... 47  
F Cold Rails..... 5  
G Cold Rail Temp.... 20
```

```
Alarm to change or Esc to quit?
```

**a** From the Alarm Settings submenu, select Hot Wheel.

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, type leading zeros.

**b** Enter the three-digit limit.

A prompt like this appears.

```
New Value ? 650  
Is this correct ?
```

At this point, you can type either **Y** (yes) or **N** (no).

**c** If the new limit is incorrect, type **N** and return to step **b**.

**d** If the new limit is correct, type **Y**

If you enter zero or a value greater than 900, an error message and a prompt like this appears.

```
Minimum valid value is 1, Maximum valid value is 900  
New Value ?
```

If you enter an acceptable value, the Alarm Limits submenu (aka Alarm Settings submenu) reappears.

**e** If you get an error message, return to step **b**.

**f** If you don't get an error message, return to step **3**.

**7** To change the displayed **carside slope value**:

The number after the words Carside Slope on the Alarm Limits submenu (aka Alarm Settings submenu) is the slope value used when doing carside slope analysis.

**Section 2.0 - Defect Detection** describes the Carside Slope alarm process. In order for Carside Slope alarms to be processed, they must be enabled using the Carside Slope option on the Equipment submenu. The detection of Carside Slope alarms stops if the speed of the train drops below 7 mph (11.3 kph).

```
Alarm Settings, MP/KP-1794.5, Track-Single
```

```
-----  
A Absolute..... 180  
B Differential..... 100  
C Hot Wheel..... 600  
D Carside Slope..... 1.31  
E Carside Minimum... 47  
F Cold Rails..... 5  
G Cold Rail Temp.... 20
```

```
Alarm to change or Esc to quit?
```

**a** From the Alarm Settings submenu, select Carside Slope.

This prompt appears.

```
New Value ?
```

Slope value is in **n.nn** format. If the new value has less than three digits, type leading zeros, trailing zeros, or both. Thus, for .98, type **098**. For 1.2, type **120**. The system automatically inserts a decimal point between the first and second digits.

**b** Enter the three-digit value.

A prompt like this appears.

```
New Value ? 1.40  
Is this correct ?
```

At this point, you can type either **Y** (yes) or **N** (no).

**c** If the new limit is incorrect, type **N** and return to step **b**.

**d** If the new value is correct, type **Y**

If you enter zero or a value greater than 2.55, an error message and a prompt like this appears.

```
Minimum valid value is 0.01, Maximum valid value is 2.55  
New Value ?
```

If you enter an acceptable value, the Alarm Limits submenu (aka Alarm Settings submenu) reappears.

- e If you get an error message, return to step **b**.
- f If you don't get an error message, return to step **3**.

**8** To change the displayed **carside minimum heat value**:

The number after the words Carside Minimum on the Alarm Limits submenu (aka Alarm Settings submenu) is a minimum offset (in degrees Fahrenheit) used when doing carside slope analysis. **Section 2.0 - Defect Detection** describes the Carside Slope alarm process.

```
Alarm Settings, MP/KP-1794.5, Track-Single
-----
A Absolute..... 180
B Differential..... 100
C Hot Wheel..... 600
D Carside Slope..... 1.31
E Carside Minimum... 47
F Cold Rails..... 5
G Cold Rail Temp.... 20

Alarm to change or Esc to quit?
```

- a** From the Alarm Settings submenu, select Carside Minimum.

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, type leading zeros.

- b** Enter the three-digit value.

A prompt like this appears.

```
New Value ? 255
Is this correct ?
```

At this point, you can type either **Y** (yes) or **N** (no).

- c** If the new limit is incorrect, type **N** and return to step **b**.
- d** If the new limit is correct, type **Y**

If you enter zero or a value greater than 300, an error message and a prompt like this appears.

```
Minimum valid value is 1, Maximum valid value is 300
New Value ?
```

If you enter an acceptable value, the Alarm Limits submenu (aka Alarm Settings submenu) reappears.

- e If you get an error message, return to step **b**.
- f If you don't get an error message, return to step **3**.

**9 To change the displayed number of **consecutive cold rails**:**

The number after the words Cold Rails on the Alarm Limits submenu (aka Alarm Settings submenu) is the maximum number (per rai-side) of consecutive trains having:

- Cold Rail alarms needed to generate a Successive Cold Rails Exceeded alarm.
- Cold Resistor alarms needed to generate a Successive Cold Resistors Exceeded alarm.
- Cold Wheel Scanner alarms needed to generate a Successive Cold Wheels Exceeded alarm.
- Cold Wheel Scanner Resistor alarms needed to generate a Successive Cold Wheel Resistors Exceeded alarm.

```
Alarm Settings, MP/KP-1794.5, Track-Single
```

```
-----  
A Absolute..... 180  
B Differential..... 100  
C Hot Wheel..... 600  
D Carside Slope..... 1.31  
E Carside Minimum... 47  
F Cold Rails..... 5  
G Cold Rail Temp.... 20
```

```
Alarm to change or Esc to quit?
```

**a From the Alarm Settings submenu, select Cold Rails.**

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, type leading zeros.

**b Enter the three-digit number.**

A prompt like this appears.

```
New Value ? 006  
Is this correct ?
```

At this point, you can type either **Y** (yes) or **N** (no).

**c If the new limit is incorrect, type **N** and return to step **b**.**

**d If the new number is correct, type **Y****

If you enter zero or a value greater than 9, an error message and a prompt like this appears.

```
Minimum valid value is 1, Maximum valid value is 9  
New Value ?
```

If you enter an acceptable value, the Alarm Limits submenu (aka Alarm Settings submenu) reappears.

- e If you get an error message, return to step **b**.
- f If you don't get an error message, return to step **3**.

**10** To change the displayed **cold rail temperature**:

The number after the words Cold Rail Temp is an offset, in degrees Fahrenheit, above the ambient temperature. When no bearing on a given rail generates a delta temperature reading greater than or equal to this value, the system generates a Cold Rail alarm for the given rail. There is a different Cold Rail alarm for each rail. That is, there is a Cold North Rail alarm and a Cold South Rail alarm (or, depending on track direction, a Cold East Rail alarm and a Cold West Rail alarm).

```
Alarm Settings, MP/KP-1794.5, Track-Single
```

```
-----
A Absolute..... 180
B Differential..... 100
C Hot Wheel..... 600
D Carside Slope..... 1.31
E Carside Minimum... 47
F Cold Rails..... 5
G Cold Rail Temp.... 20
```

```
Alarm to change or Esc to quit?
```

- a** From the Alarm Settings submenu, select Cold Rail Temp.

This prompt appears.

```
New Value ?
```

If the new limit has less than three digits, type leading zeros.

- b** Enter the three-digit number.

A prompt like this appears.

```
New Value ? 015
Is this correct ?
```

At this point, you can type either **Y** (yes) or **N** (no).

- c** If the new limit is incorrect, type **N** and return to step **b**.

- d** If the new number is correct, type **Y**

If you enter a number less than 10 or greater than 30, an error message and a prompt like this appears.

```
Minimum valid value is 10, Maximum valid value is 30
New Value ?
```

If you enter an acceptable number, the Alarm Limits submenu (aka Alarm Settings submenu) reappears.

- e If you get an error message, return to step **b**.
- f If you don't get an error message, return to step **3**.

## 3.2.5 Equipment

To set or change one or more of the equipment parameters:

- 1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Setup Menu
-----
A) Date and Time
B) MP/KP
C) Track Number
D) Alarm Limits
E) Equipment
F) Messages
G) AEI Reader Parameters
      .
      .
      .
```

- 2 Select the Equipment submenu.

A menu and prompt like this appears.

```
Equipment, MP/KP-1794.5, Track-Single
-----
A  Dragger..... YES
B  High Load..... NO
C  Wide Load..... NO
D  Carside Slope..... YES
E  Hot Wheel..... NO
F  Clearance Type..... Trip Wire
G  Clearance Mode..... Multiplexed
H  Winter Cycle..... YES
I  Transducer Gain..... Normal
J  AEI..... NO
K  Resistor Test..... Enabled
L  Short Train Warning..... YES
M  Gate Distance..... 24.0 inches
N  Selected Modem..... Default
   Modem Setup Line 1 = +++
   Modem Setup Line 2 = AT&F
   Modem Setup Line 3 = AT &D0 &E1 &E15 S0=1 V0
   Modem Setup Line 4 = AT E0 X0 $SB19200
   Modem Setup Line 5 = AT &W0

Equipment to change or Esc to quit ?
```



The current setting for each menu option is displayed. For example, the screen above shows that Wide-Load alarm detection is inactive (NO). To change one of the settings, press the letter corresponding to the desired option. Except for the Gate Distance option, which requires a value entry, all the options toggle between two or three settings. If you choose Alternate for the Selected Modem type, you can change any of the five available lines of modem setup commands.

- 3 To leave the Equipment submenu and return to the Setup menu:

- a Press **[Esc]**.

The Setup menu reappears.

- b Skip the remaining steps.

- 4 To change the current **dragger** (aka dragging-equipment) setting:

The Equipment submenu shows whether Dragging-Equipment alarm detection is enabled (YES) or disabled (NO). When disabled, Dragging-Equipment alarms won't be announced nor stored. Since they aren't stored, they can't be printed. When enabled, Dragging-Equipment alarms will be announced and stored. Since they are stored, they can be printed. In the presence of a continuous Dragger signal, the system alarms consecutive axles. When the system reaches the fifth consecutive Dragger alarmed axle, it flags the Stuck Dragger condition.

Equipment, MP/KP-1794.5, Track-Single		
-----		
A	Dragger.....	YES
B	High Load.....	NO
	.	
	.	
	.	

- a From the Equipment submenu, select Dragger.

The dragging-equipment setting toggles between active (YES) and inactive (NO). The Dragger option on the Equipment submenu changes. The Equipment submenu reappears.

If you want Dragging-Equipment alarm detection to occur, YES must appear after the word Dragger on the Equipment submenu.

- b Return to step 3.

**5** To change the current **high-load** setting:

The Equipment submenu shows whether High-Load alarm detection is active (YES) or inactive (NO). To announce High-Load alarms, YES must appear after the words High Load on the Equipment submenu and Separate must appear after the words Clearance Mode on the Equipment submenu. To announce High-Wide alarms, YES must appear after the words High Load on the Equipment submenu and Multiplexed must appear after the words Clearance Mode on the Equipment submenu.

Equipment, MP/KP-1794.5, Track-Single		
-----		
A	Dragger.....	YES
B	High Load.....	NO
C	Wide Load.....	NO
	.	
	:	
	.	

**a** From the Equipment submenu, select High Load.

The high-load setting toggles between active (YES) and inactive (NO). The High-Load option on the Equipment submenu changes.

The Equipment submenu reappears.

**b** Return to step **3**.

**6** To change the current **wide-load** setting:

The Equipment submenu shows whether Wide-Load alarm detection is active (YES) or inactive (NO).

Equipment, MP/KP-1794.5, Track-Single		
-----		
A	Dragger.....	YES
B	High Load.....	NO
C	Wide Load.....	NO
D	Carside Slope.....	YES
	.	
	:	
	.	

**a** From the Equipment submenu, select Wide Load.

The wide-load setting toggles between active (YES) and inactive (NO). The Wide-Load option on the Equipment submenu changes.

The Equipment submenu reappears.

**b** Return to step **3**.

**7** To change the current **carside-slope** setting:

The Equipment submenu shows whether Carside Slope alarm detection is active (YES) or inactive (NO).

Equipment, MP/KP-1794.5, Track-Single		
-----		
A	Dragger.....	YES
B	High Load.....	NO
C	Wide Load.....	NO
D	Carside Slope.....	YES
E	Hot Wheel.....	NO
:		
:		
:		

- a** From the Equipment submenu, select Carside Slope.

The carside-slope setting toggles between active (YES) and inactive (NO). The Carside Slope option on the Equipment submenu changes.

The Equipment submenu reappears.

- b** Return to step **3**.

**8** To change the current **hotwheel** setting:

The Equipment submenu shows whether Hotwheel alarm detection is enabled (YES) or disabled (NO). When disabled, Hotwheel alarms won't be announced nor stored. Since they aren't stored, they can't be printed. When enabled, Hotwheel alarms will be announced and stored. Since they are stored, they can be printed.

Equipment, MP/KP -1794.5, Track-Single		
-----		
A	Dragger.....	YES
B	High Load.....	NO
C	Wide Load.....	NO
D	Carside Slope.....	YES
E	Hot Wheel.....	NO
F	Clearance Type.....	Trip Wire
:		
:		
:		

- a** From the Equipment submenu, select Hot Wheel.

The hotwheel setting toggles between active (YES) and inactive (NO). The Hotwheel option on the Equipment submenu changes.

The Equipment submenu reappears.

- b** Return to step **3**.

**9** To change the current **clearance-type** setting:

The Equipment submenu shows whether clearance type is trip wire or light beam. This option is only used for high-load detectors and wide-load detectors. Both high-load detectors and wide-load detectors must be either trip-wire detectors or light-beam detectors.

```
Equipment, MP/KP-1794.5, Track-Single
-----
A  Dragger..... YES
B  High Load..... NO
C  Wide Load..... NO
D  Carside Slope..... YES
E  Hot Wheel..... NO
F  Clearance Type..... Trip Wire
G  Clearance Mode..... Multiplexed
      .
      .
      .
```

**a** From the Equipment submenu, select Clearance Type.

The clearance-type setting toggles between trip wire and light beam. The Clearance Type option on the Equipment submenu changes.

The Equipment submenu reappears.

**b** Return to step 3.

**10** To change the current **clearance-mode** setting:

The Equipment submenu shows whether clearance mode is separate or multiplexed. This option is only used for high-load detectors and wide-load detectors. When set to separate, the alarms coming from the high-load detectors are announced as High-Load alarms and the alarms coming from the wide-load detectors are announced as Wide-Load alarms. When set to multiplexed, the alarms coming from the high-load detectors and wide-load detectors are announced as High-Wide alarms.

```
Equipment, MP/KP-1794.5, Track-Single
-----
A  Dragger..... YES
B  High Load..... NO
C  Wide Load..... NO
D  Carside Slope..... YES
E  Hot Wheel..... NO
F  Clearance Type..... Trip Wire
G  Clearance Mode..... Multiplexed
H  Winter Cycle..... YES
      .
      .
      .
```

- a** From the Equipment submenu, select Clearance Mode.

The clearance-mode setting toggles between separate and multiplexed. The Clearance Mode option on the Equipment submenu changes.

The Equipment submenu reappears.

- b** Return to step 3.

**11** To change the current **winter-cycle** setting:

The Equipment submenu shows whether the winter-cycle feature is enabled (YES) or disabled (NO). To avoid errant heat readings caused by moisture on the pyrometer lenses, the scanners have heaters built into them. The heaters are made active, for varying periods of time, depending on an ambient temperature of 80°F (26.7°C) or less.

The normal heater activation times aren't suitable for extremely cold climates, so the winter-cycle feature compensates for this. When this feature is disabled, the heater controls function normally. When enabled, the system increases the normal running time for the scanner heaters by four minutes every 10 minutes. The winter-cycle feature doesn't affect all the temperature ranges that the scanner heaters will activate on. It affects just the ones that are considered extremely cold.

	.
	.
	.
G	Clearance Mode..... Multiplexed
H	Winter Cycle..... YES
I	Transducer Gain..... Normal
	.
	.
	.

- a** From the Equipment submenu, select Winter Cycle.

The winter-cycle setting toggles between enabled (YES) and disabled (NO). The Winter Cycle option on the Equipment submenu changes.

The Equipment submenu reappears.

- b** Return to step 3.

**12** To change the current **transducer-gain** setting:

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

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

	.
	:
	.
H	Winter Cycle..... YES
I	Transducer Gain..... Normal
J	AEI..... NO
	.
	:
	.

- a** From the Equipment submenu, select Transducer Gain.

The transducer-gain setting toggles between normal and high. The Transducer Gain option on the Equipment submenu changes. The Equipment submenu reappears.

- b** Return to step 3.

**13** To change the current **AEI** setting:

The Equipment submenu indicates whether the AEI subsystem is enabled (YES) or disabled (NO). When tag readers and attendant antennas and cabling are present, this parameter should be set to YES, so that the system knows to configure the readers and to use the AEI data transmitted from them. When there is no installed AEI subsystem attached to the SmartScanNG system, this parameter should be set to NO.

	.
	:
	.
I	Transducer Gain..... Normal
J	AEI..... NO
K	Resistor Test..... Enabled
	.
	:
	.

- a** From the Equipment submenu, select AEI.

The AEI setting toggles between enabled (YES) and disabled (NO). The AEI option on the Equipment submenu changes.

The Equipment submenu reappears.

- b** Return to step 3.

**14 To change the current **resistor-test** setting:**

The Equipment submenu shows whether the resistor-test setting is enabled, reduced, or enabled.

After a train clears a site, the system does an integrity test to verify that the scanners are operational and that the system can read alarm level heat. This test consists of reading the temperature of power resistors, mounted to the back of the scanner shutters, after the shutters close. The recorded temperature of the shutter resistors is compared against expected values, which are calculated using a combination of the amount of time the shutters were open and the system battery voltage.

A site can be setup to perform the resistor integrity test in one of three modes. When the resistor integrity test is in enabled mode, the existing algorithm is used to determine the minimum acceptable resistor temperature values for a given train. When in reduced mode, the existing acceptable resistor values are reduced by 15% before the comparison is made to the temperature values read from the resistors. The third mode, disabled, prevents the resistor integrity test from being performed at all.

		.
		:
		:
J	AEI.....	NO
K	Resistor Test.....	Enabled
L	Short Train Warning ....	YES
		.
		:
		:

- a** From the Equipment submenu, select Resistor Test.

The resistor-test setting toggles from enabled to reduced, from reduced to disabled, or from disabled to enabled. The Resistor Test Mode option on the Equipment submenu changes. The Equipment submenu reappears.

- b** If the resistor-test mode isn't correct, return to step **a**.

- c** If the resistor-test mode is correct, return to step **3**.

**15 To change the current **short-train** setting:**

The Equipment submenu shows whether Short Train alarm detection is active (YES) or inactive (NO). The Short Train alarm indicates that a train had fewer than 50 axles.

		.
		:
		:
K	Resistor Test.....	Enabled
L	Short Train Warning ....	YES
M	Gate Distance.....	24.0 inches
		.
		:
		:

- a** From the Equipment submenu, select Short Train Warning.

The short-train setting toggles between active (YES) and inactive (NO). The Short Train option on the Equipment submenu changes.

The Equipment submenu reappears.

- b** Return to step 3.

**16** To change the current value for **gate distance** (aka gate width):

The Equipment submenu shows the number of inches between the centers of the gating transducers.

```
      .
      .
      .
L  Short Train Warning .... YES
M  Gate Distance..... 24.0 inches
N  Selected Modem..... Default
   Modem Setup Line 1 = +++
   Modem Setup Line 2 = AT&F
   Modem Setup Line 3 = AT &D0 &E1 &E15 S0=1 V0
   Modem Setup Line 4 = AT E0 X0 $SB19200
   Modem Setup Line 5 = AT &W0

Equipment to change or Esc to quit ?
```

- a** From the Equipment submenu, select Gate Distance.

This prompt appears.

```
Gate Distance:
```

The format for gate width (aka gate distance) is **nn.n**. If the new value has less than three digits, type leading zeros, trailing zeros, or both. Thus, for 2, type **020**. The system inserts the decimal point for you. The gate width (it is usually 24.0) can be recorded in 1/10-inch increments to reflect the actual transducer spacing. Accurate gating-transducer spacing results in accurate speed calculations.

- b** Enter the three-digit number.

The Gate Distance option on the Equipment submenu changes. The Equipment submenu reappears.

- c** Return to step 3.



**17 To change the **modem-configuration** data:**

The Equipment submenu shows the current modem configuration. Support exists in the firmware for two modem types. The "default" modem type provides a preset series of modem configuration commands. These commands cannot be altered. The "alternate" modem type provides the ability to edit and customize the modem setup commands. This submenu also provides a method for forcing the initialization of the modem.

```
      .
      .
      .

M  Gate Distance..... 24.0 inches
N  Selected Modem..... Default
   Modem Setup Line 1 = +++
   Modem Setup Line 2 = AT&F
   Modem Setup Line 3 = AT &D0 &E1 &E15 S0=1 V0
   Modem Setup Line 4 = AT E0 X0 $SB19200
   Modem Setup Line 5 = AT &W0

Equipment to change or Esc to quit ?
```

- a** From the Equipment submenu, choose the Selected Modem option.

A prompt like this

```
The Default modem is selected, is this OK (Y/N)?
```

or like this appears.

```
The Alternate modem is selected, is this OK (Y/N)?
```

- b** If the selected modem type is incorrect, type **N**  
The modem-selection setting toggles between default and alternate.
- c** If the selected modem type is correct, type **Y**  
If you select Default, the system reverts to the default modem configuration.

- d If the selected modem type is Default, go to step h.
- e If the selected modem type is Alternate, this prompt appears.

```
Are the setup commands OK (Y/N)?
```

- f If you need to modify one or more of the five displayed lines of modem setup commands, type **N**

This prompt appears.

```
Enter line number to change (1-5):
```

There are five available lines for setup command data, each line having a maximum of 25 characters of data. The entry of a line number is followed by a prompt for entry of the new modem setup data for the selected line number. Type in the desired modem commands, pressing **[Enter]** when done. If an entered command consumes the entire 25 characters of a line, the newly entered data is automatically saved upon entry of the 25th character. The contents of a line can be removed entirely by immediately pressing **[Enter]** when prompted for the new setup data. On the Equipment submenu and on the System Status report, lines that have been cleared of data this way will be left blank.

This screen fragment shows an example of changing the default baud rates, in the third line of setup data, from 9600 to 1200, and then erasing the fifth line of setup data. Pressing **[Enter]** to clear the fifth line is shown by **[Enter]** in the example.

```
Enter line number to change (1-5):3
Enter new setup commands (25 characters max):AT E0 X0 $SB1200 $MB1200
Are the setup commands OK (Y/N)?n

Enter line number to change (1-5):5
Enter new setup commands (25 characters max):[Enter]
Are the setup commands OK (Y/N)?
```

- g If you don't need to correct any of the five displayed lines of modem setup commands, type **Y**

If you plugged your computer into a serial port other than COM3 (the modem port), this prompt appears.

```
Do you want to initialize the modem now (Y/N)?
```

If you plugged into COM3 or have an **off-site** connection, this message appears.

```
The modem will initialize upon exiting the Main Menu.
```

- h** If you plugged into COM3 or have an **off-site** connection, return to step **3**.
- i** If you want to initialize the modem now, type **Y**  
The modem initialization routine uses the current modem setup data. A one-second pause is placed between each line of setup commands as they are outputted to the modem. Empty setup command lines aren't outputted to the modem. After the modem is initialized, the Equipment submenu reappears.
- j** If you don't want to initialize the modem now, type **N**  
The Equipment submenu reappears.
- k** Return to step **3**.

### 3.2.6 Messages

To set or change any of the messages parameters:

- 1** Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Setup Menu
-----
A) Date and Time
B) MP/KP
C) Track Number
D) Alarm Limits
E) Equipment
F) Messages
G) AEI Reader Parameters
      .
      .
      .
```

## 2 Select the Messages submenu.

A menu and prompt like this appears.

Messages, MP/KP-1794.5, Track-Single		
-----		
A	Axles.....	NO
B	Speed.....	NO
C	Temperature.....	NO
D	Length.....	NO
E	Slow.....	NO
F	Power Off.....	NO
G	Repeat No Defects....	YES
H	Cars Count .....	NO
I	Customer Name.....	YES
J	Arrival Message.....	NO
K	Lft/Rt Alarm Ref.....	NO
L	Car ID With Alarm....	NO
M	Request EOT Timer....	5
N	Rebroad DTMF Code....	001
O	Announce Cold Rail...	YES
P	Integrity Failure....	NO
Q	No Defects.....	NO
Message to change or Esc to quit ?		

Enabling one or more of these options generates the ancillary messages: A (axle count), B (train speed), C (site ambient temperature), D (train length), E (slow train), F (power off), and H (number of cars). The other options of the Messages submenu aren't used to generate ancillary messages.

## 3 To leave the Messages submenu and return to the Setup menu:

### a Press **[Esc]**.

The Setup menu reappears.

### b Skip the remaining steps.

**4** To change the **announce-axles** setting:

The Messages submenu shows whether the total axle count is to be announced (YES) or not announced (NO). When the Highrange Transducer Miscounts alarm or the Very Slow Train alarm occurs, the system won't announce axle count, even when this option is enabled. Typing **A** toggles between what is shown and its opposite.

Messages, MP/KP-1794.5, Track-Single		
-----		
A	Axles.....	YES
B	Speed.....	NO
C	Temperature.....	NO
	.	
	:	
	.	

**a** From the Messages submenu, select Axles.

The announce-axles setting toggles between announce (YES) or not announce (NO). The Announce Axles option on the Messages submenu changes. The Messages submenu reappears.

**b** Return to step 3.

**5** To change the **announce-speed** setting:

The Messages submenu shows whether the exit speed of the train is to be announced (YES) or not announced (NO). Typing **B** toggles between what is shown and its opposite.

Messages, MP/KP-1794.5, Track-Single		
-----		
A	Axles.....	YES
B	Speed.....	NO
C	Temperature.....	NO
	.	
	:	
	.	

**a** From the Messages submenu, select Speed.

The announce-speed setting toggles between announce (YES) or not announce (NO). The Announce Speed option on the Messages submenu changes. The Messages submenu reappears.

**b** Return to step 3.

**6** To change the **announce-temperature** setting:

The Messages submenu shows whether the ambient temperature (taken at the site by the shielded temperature probe as the train leaves the site) is to be announced (YES) or not announced (NO). Typing **C** toggles between what is shown and its opposite.

Messages, MP/KP-1794.5, Track-Single		
-----		
A	Axles.....	NO
B	Speed.....	NO
C	Temperature.....	NO
D	Length.....	NO
	.	
	:	
	.	

**a** From the Messages submenu, select Temperature.

The announce-temperature setting toggles between announce (YES) or not announce (NO). The Announce Temperature option on the Messages submenu changes. The Messages submenu reappears.

**b** Return to step 3.

**7** To change the **announce-train-length** setting:

The Messages submenu shows whether the train length is to be announced (YES) or not announced (NO). When the Highrange Transducer Miscounts alarm or the Very Slow Train alarm occurs, the system won't announce length of train, even when this option is enabled. Typing **D** toggles between what is shown and its opposite.

Messages, MP/KP-1794.5, Track-Single		
-----		
A	Axles.....	NO
B	Speed.....	NO
C	Temperature.....	NO
D	Length.....	NO
E	Slow.....	NO
	.	
	:	
	.	

**a** From the Messages submenu, select Length.

The announce-train-length setting toggles between announce (YES) or not announce (NO). The Announce Train Length option on the Messages submenu changes. The Messages submenu reappears.

**b** Return to step 3.

**8** To change the **announce-slow-trains** setting:

The Messages submenu shows whether a message indicating a very slow train (one going 7 mph or slower) is to be announced (YES) or not announced (NO). Typing **E** toggles between what is shown and its opposite.

Messages, MP/KP-1794.5, Track-Single		
-----		
A	Axles.....	NO
B	Speed.....	NO
C	Temperature.....	NO
D	Length.....	NO
E	Slow.....	NO
F	Power Off.....	NO
:		
:		
:		

**a** From the Messages submenu, select Slow.

The announce-slow-trains setting toggles between announce (YES) or not announce (NO). The Announce Slow Trains option on the Messages submenu changes. The Messages submenu reappears.

**b** Return to step 3.

**9** To change the **announce-power-off** setting:

The Messages submenu shows whether the power-off message is to be announced (YES) or not announced (NO). The generation of this message depends on battery voltage, not AC power. It is generated whenever the voltage coming from the battery is less than 12.6 VDC. AC power need never have been off to cause this to happen. However, most times it does indicate that AC power has been off, causing the battery to be drained. Typing **F** toggles between what is shown and its opposite.

Messages, MP/KP-1794.5, Track-Single		
-----		
A	Axles.....	NO
B	Speed.....	NO
C	Temperature.....	NO
D	Length.....	NO
E	Slow.....	NO
F	Power Off.....	NO
G	Repeat No Defects....	YES
:		
:		
:		

**a** From the Messages submenu, select Power Off.

The announce-power-off setting toggles between enabled (YES) and disabled (NO). The Announce Power Off option on the Messages submenu changes. The Messages submenu reappears.

**b** Return to step 3.

**10 To change the **repeat-no-defects-message** setting:**

The Messages submenu shows whether the no-defects message is to be repeated (YES) or not repeated (NO). Typing **G** toggles between what is shown and its opposite.

		:
		:
		:
F	Power Off.....	NO
G	Repeat No Defects....	YES
H	Cars Count .....	NO
		:
		:
		:

- a** From the Messages submenu select Repeat No Defects.

The repeat-no-defect-message setting toggles between enabled (YES) and disabled (NO). The Repeat No Defects option on the Messages submenu changes. The Messages submenu reappears.

- b** Return to step 3.

**11 To change the **announce-number-of-cars** setting:**

The Messages submenu shows whether the number of cars is to be announced (Y) or not announced (N). Typing **H** toggles between what is shown and its opposite.

		:
		:
		:
G	Repeat No Defects....	YES
H	Cars Count .....	NO
I	Customer Name.....	YES
		:
		:
		:

- a** From the Messages submenu, select Cars Count.

The announce-number-of-cars setting toggles between enabled (YES) and disabled (NO). The Announce Number of Cars option on the Messages submenu changes. The Messages submenu reappears.

- b** Return to step 3.



**12** To change the **announce-customer-name** setting:

The Messages submenu shows whether the customer's railroad name is to be announced (YES) or not announced (NO). Typing **I** toggles between what is shown and its opposite.

		.
		:
		.
H	Cars Count .....	NO
I	Customer Name.....	YES
J	Arrival Message.....	NO
		.
		:
		.

- a** From the Messages submenu, select Customer Name.

The announce-customer-name setting toggles between enabled (YES) and disabled (NO). The Announce Customer Name option on the Messages submenu changes. The Messages submenu reappears.

- b** Return to step **3**.

**13** To change the **announce-arrival-message** setting:

The Messages submenu shows whether the train-arrival message is to be announced (YES) or not announced (NO). Typing **J** toggles between what is shown and its opposite.

		.
		:
		.
I	Customer Name.....	YES
J	Arrival Message.....	NO
K	Lft/Rt Alarm Ref.....	NO
		.
		:
		.

- a** From the Messages submenu, select Arrival Message.

The announce-arrival-message setting toggles between announce (YES) or not announce (NO). The Announce Train Arrival option on the Messages submenu changes. The Messages submenu reappears.

- b** Return to step **3**.

**14** To change the **left-right-alarm-reference** setting:

The Messages submenu shows whether the alarm reference is announced as left or right (YES) or north, south, east, or west (NO).

		.
		:
		.
J	Arrival Message.....	NO
K	Lft/Rt Alarm Ref.....	NO
L	Car ID With Alarm....	NO
		.
		:
		.

- a** From the Messages submenu, select Lft/Rt Alarm Ref.

The left-right-alarm-reference setting toggles between YES and NO. The Announce Left-Right Alarm Reference option on the Messages submenu changes. The Messages submenu reappears.

- b** Return to step **3**.

**15** To change the **announce-car-identification** setting:

The Messages submenu shows whether the car-identification message is to be announced (YES) or not announced (NO). When this option is set to YES and an alarm is found on a car, the AEI car identification will be included in the post-train announcement of that alarm. Typing **L** toggles between what is shown and its opposite.

		.
		:
		.
K	Lft/Rt Alarm Ref.....	NO
L	Car ID With Alarm....	NO
M	Request EOT Timer....	5
		.
		:
		.

- a** From the Messages submenu, select Car ID With Alarm.

The announce-car-identification setting toggles between enabled (YES) and disabled (NO). The Announce Car Identification option of the Messages submenu changes. The Messages submenu reappears.

- b** Return to step **3**.

**16** To change the **repeat-EOT-message-timeout-period** setting:

The Messages submenu shows a value for the repeat-timeout-period setting. If a nonzero value is shown, the value is the number of minutes that you have to request a repeat of the last end-of-train (EOT) message. If zero is shown, the last EOT message is always available for rebroadcast. The train crew makes the actual request for rebroadcast. The repeated message has the word "rebroadcast" at the beginning and end of the message.

		.
		.
		.
L	Car ID With Alarm....	NO
M	Request EOT Timer....	5
N	Rebroad DTMF Code....	001
		.
		.
		.

- a** From the Messages submenu, select Request EOT Timer.

This prompt appears.

Request EOT Timer:
--------------------

If the new limit has less than three digits, type leading zeros.

- b** Enter the three-digit value.

If you enter 000, the last EOT message is always available for rebroadcast. If you enter 240, the train crew has four hours (that is, 240 minutes) to request a repeat of the last EOT message.

If you enter a value greater than 240, an error message and a prompt like this appears.

Value must be less than 241 minutes. Request EOT Timer:
--

If you enter an acceptable value, the Repeat Timeout Period option on the Messages submenu changes and the Messages submenu reappears.

- c** If you get an error message, return to step **b**.  
**d** If you don't get an error message, return to step **3**.

**17** To change the **rebroadcast-DTMF-code** setting:

The Messages submenu shows the rebroadcast-DTMF-code setting. The stored DTMF code is the touchtone digits that trigger a rebroadcast. Up to three digits may be entered into this setup parameter. The SmartScanNG system monitors radio traffic. When it receives the proper DTMF code, it will rebroadcast the last end-of-train message, provided the request EOT timer hasn't expired.

	:	
	:	
	:	
M	Request EOT Timer....	5
N	Rebroad DTMF Code....	001
O	Announce Cold Rail...	YES
	:	
	:	
	:	

- a** From the Messages submenu, select Rebroad DTMF Code.

This prompt appears.

Rebroadcast DTMF Code: 456
----------------------------

- b** Type the new DTMF code or press **[Esc]**.

- c** If you typed one or two digits, press **[ENTER]**.

The Messages submenu reappears. If you typed only nondigits and then pressed **[ENTER]**, the rebroadcast function would be turned off.

- d** Return to step **3**.

**18** To change the **announce-cold-rail** setting:

The Messages submenu shows whether an Integrity Failure message is to be announced when the cold-rail criteria was met (YES) or not announced (NO). Typing **O** toggles between what is shown and its opposite.

	:	
	:	
	:	
N	Rebroad DTMF Code....	001
O	Announce Cold Rail...	YES
P	Integrity Failure.....	NO
	:	
	:	
	:	

- a** From the Messages submenu, select Announce Cold Rail.

The announce-cold-rail setting toggles between announce (YES) or not announce (NO). The Announce Cold Rail option on the Messages submenu changes. The Messages submenu reappears.

- b** Return to step **3**.

**19** To change the **integrity-failure** setting:

The Messages submenu shows whether "Integrity Failure" is to be announced (YES) or not announced (NO).

If the Announce Integrity Failure option is disabled when no Exception Alarms are detected but an Integrity Failure is detected, nothing is announced. If enabled when no Exception Alarms are detected but an Integrity Failure is detected, Integrity Failure is announced.

If the Announce Integrity Failure option is disabled when one or more alarm conditions and an Integrity Failure are detected, only the alarm conditions are announced. If enabled when one or more alarm conditions and an Integrity Failure are detected, both are announced.

Select this setting to toggle between what is shown and its opposite.

		.
		:
		.
N	Rebroadcast DTMF Code....	001
O	Announce Cold Rail...	YES
P	Integrity Failure.....	NO
Q	No Defects.....	NO
		.
		:
		.

- a** From the Messages submenu, select Integrity Failure.

The announce-integrity-failure setting toggles between announce (YES) or not announce (NO). The Announce Integrity Failure option on the Messages submenu changes. The Messages submenu reappears.

- b** To leave the Messages submenu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

**20** To change the **no-defect-message** setting:

The Messages submenu shows whether "No Defects" is to be announced (YES) or not announced (NO).

When neither an Exception Alarm nor a System Alarm is detected and the Announce No Defects option is enabled, the no-defect message is announced. The no-defect message is the wording "no defects."

Select this setting to toggle between what is shown and its opposite.

	:
	:
	:
O	Announce Cold Rail... YES
P	Integrity Failure.... NO
Q	No Defects..... NO
Message to change or Esc to quit ?	

**a** From the Messages submenu, select No Defects.

The announce-no-defect-message setting toggles between announce (YES) or not announce (NO). The Announce No Defects option on the Messages submenu changes. The Messages submenu reappears.

The Setup menu reappears.

**b** To leave the Messages submenu and return to the Setup menu, press **[Esc]**.

The Setup menu reappears.

### 3.2.7 AEI Reader Parameters

The AEI reader parameters directly affect how the AEI readers operate to acquire tags while a train is passing the site.

To set or change any of the reader parameters:

- 1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
      .
      .
      .
F) Messages
G) AEI Reader Parameters
H) Load Default Setup Parameters
I) Serial Password
J) COM1 Tx 19200 / Rx 19200 N-8-1
K) COM2 Tx 19200 / Rx 19200 N-8-1
L) COM3 Tx 19200 / Rx 19200 N-8-1
M) COM4 Tx 19200 / Rx 19200 N-8-1
X) Exit
?
```

- 2 Select the AEI Reader Parameters menu.

A prompt like this appears.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 22:47
AEI Reader Parameters Menu
-----
A) ID Separation..... 2 IDs
B) Consecutive Reads..... 2 Reads
C) Decode As ASCII Tags.... Enabled
D) AEI Reader Interface.....
X) Exit
?
```

Shown above are the parameters currently defined in the system.

**ID Separation** specifies the number of intervening tags that must be read and reported before a given tag is reported again. Valid values are 1, 2, 3, and 4. The default is 2.

**Consecutive Reads** specifies the number of times that a tag must be read before it is considered a valid (reportable) tag. Valid values are 1, 2, 3, and 4. The default is 2.

**Decode as ASCII Tags** specifies whether the tag data is to be interpreted as ASCII characters or in the AAR encoded format.

- 3 Select the **ID-separation** option to change the setting,.

A prompt like this appears.

```
Current ID Separation: 2
Modify ? (Y/N):
```

- a Type **Y** until the value you want is shown.

Typing the letter **Y** toggles from 1 to 2, from 2 to 3, from 3 to 4, or from 4 to 1.

- b Type **N**

- 4 Select the **consecutive-reads** option to change the setting.

A prompt like this appears.

```
Current Consecutive Reads: 2
Modify ? (Y/N):
```

- a Type **Y** until the value you want is shown.

Typing the letter **Y** toggles from 1 to 2, from 2 to 3, from 3 to 4, or from 4 to 1.

- b Type **N**

- 5 Select the **decode-as-ASCII-tags** to change the setting.

The decode-as-ASCII-tags setting toggles between enabled (YES) and disabled (NO).  
The AEI Reader Parameters menu reappears.

- 6 Select the **AEI reader interface** to communicate directly with the reader unit.

This message appears.

```
Entering AEI Reader Interface
<Type EXIT to quit>
```

- 7 To leave the AEI reader interface:

- a Type **EXIT**

- b Press **[Enter]**.

- 8 To leave the AEI Reader Parameters menu and return to the Setup menu, type **X**

This prompt appears.

```
Initialize Reader now (Y/N)
```

- 9 To initialize the reader, type **Y**

The Setup menu reappears.

- 10 To not initialize the reader, type **N**

The Setup menu reappears.



### 3.2.8 Load Default Setup Parameters

The Load Default Setup Parameters option on the Setup menu is included to assist installers in setting up a new system. When this menu item is selected, the parameters listed below are assigned to the values listed below. A "yes" after a parameter means that it is "enabled." A "no" means that it is "disabled." The blanks after "Rebroad DTMF Code" mean that it is disabled.

<u>Alarms:</u>		<u>Equipment:</u>		<u>Messages:</u>	
Absolute	180	AEI	No	Arrival Message	No
Carside Minimum	155	Carside Slope	No	Axles	Yes
Carside Slope	1.60	Clearance Mode	Multiplexed	Car ID With Alarm	No
Cold Rail Temp	10	Clearance Type	Trip Wire	Cars Count	No
Cold Rails	1	Dragger	Yes	Cold Rail	Yes
Differential	130	Gate Distance	24.0	Customer Name	Yes
Hotwheel	650	High Load	No	Integrity Failure	Yes
		Hotwheel	No	Length	No
		Resistor Test	Enabled	Lft/Rt Alarm Ref	No
		Selected Modem	Default	No Defects	Yes
		Short Train Warning	No	Power Off	Yes
		Transducer Gain	Normal	Rebroad DTMF Code	
		Wide Load	No	Repeat No Defects	Yes
		Winter Cycle	No	Request EOT Timer	10
				Slow Train	Yes
				Speed	No
				Temperature	Yes

To load the default setup parameters:

- 1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

.
.
.
G) AEI Reader Parameters
H) Load Default Setup Parameters
I) Serial Password
J) COM1 Tx 19200 / Rx 19200 N-8-1
K) COM2 Tx 19200 / Rx 19200 N-8-1
L) COM3 Tx 19200 / Rx 19200 N-8-1
M) COM4 Tx 19200 / Rx 19200 N-8-1
X) Exit
?

- 2 Select the Load Default Setup Parameters option.

This prompt appears.

Load Default Setup Parameters?
--------------------------------

### 3.2.9 Setup Password

To set or change the password needed to enter the Setup menu:

- 1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

	.
	:
	.
H) Load Default Setup Parameters	
I) Serial Password	
J) COM1	Tx 19200 / Rx 19200 N-8-1
K) COM2	Tx 19200 / Rx 19200 N-8-1
L) COM3	Tx 19200 / Rx 19200 N-8-1
M) COM4	Tx 19200 / Rx 19200 N-8-1
X) Exit	
?	

- 2 Select the Change Passwords submenu.

A prompt like this appears.

Enter System Password:
------------------------

This prompt allows you to enter a password into the system. A password can consist of from 1 to 11 characters. If it is less than 11 characters long, press **[Enter]** after typing the last character. If it is the full 11 characters long, pressing **[Enter]** isn't necessary. If you type no characters and just press **[ENTER]**, the password function would be turned off. There would be no password required to access the Setup menu.

The entry of the password is case sensitive. For example, abc#123 isn't the same as ABC#123.

- 3 Type the password.
- 4 If the password is less than 11 characters, press **[Enter]**.

The Setup menu reappears.

3 To not load default setup parameters:

a Type **N**

This message appears followed by the Setup menu.

```
Default Setup Parameters Not Loaded...
```

b Return to step 1.

4 To load default setup parameters:

a Type **Y**

This message appears followed by the Setup menu.

```
Loading Default Setup Parameters...
```

Loading takes about two seconds. When finished, the Setup menu reappears.

b Return to step 1.

### 3.2.10 COM1

To change the parameters for serial port COM1:

1 Be sure that the Setup menu is displayed.

The Setup menu looks like this.

```
      .
      .
      .

F) Messages
G) AEI Reader Parameters
H) Load Default Setup Parameters
I) Serial Password
J) COM1 Tx 19200 / Rx 19200 N-8-1
K) COM2 Tx 19200 / Rx 19200 N-8-1
L) COM3 Tx 19200 / Rx 19200 N-8-1
M) COM4 Tx 19200 / Rx 19200 N-8-1
X) Exit
?
```

**2** Select the COM1 submenu.

The COM1 submenu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
COM1 Tx-19200/Rx-19200 N-8-1
```

```
-----
A) Increase Tx Baud
B) Decrease Tx Baud
C) Increase Rx Baud
D) Decrease Rx Baud
E) N-8-1
F) E-7-1
X) Exit
?
```

Type either **A** to increase or **B** to decrease the outgoing (aka transmit) baud rate for COM1. Type either **C** to increase or **D** to decrease the incoming (aka receive) baud rate for COM1. Depending on which letter you type and what baud rate was displayed when you typed it, the baud rate changes to either the next or the prior value from these values: 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200. Select **N-8-1** for no parity bit, 8 data bits, and 1 stop bit. Select **E-7-1** for even parity bit, 7 data bits, and 1 stop bit.

**3** Type the letter of what you want to change.

The COM1 submenu reappears.

**4** If you aren't done changing the parameters for COM1, return to step **3**.

**5** If you are done changing the parameters for COM1, type **X**

The Setup menu reappears.

### 3.2.11 COM2

To change the parameters for serial port COM2:

- 1 Be sure that the Setup menu is displayed.
- 2 Select the COM2 submenu.  
Type either **A** to increase or **B** to decrease the outgoing (aka transmit) baud rate for COM2. Type either **C** to increase or **D** to decrease the incoming (aka receive) baud rate for COM2. Depending on which letter you type and what baud rate was displayed when you typed it, the baud rate changes to either the next or the prior value from these values: 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200. Type **E** for no parity bit, 8 data bits, and 1 stop bit. Type **F** for even parity bit, 7 data bits, and 1 stop bit.
- 3 Type the letter of what you want to change.  
The COM2 submenu reappears.
- 4 If you aren't done changing the parameters for COM2, return to step 3.
- 5 If you are done changing the parameters for COM2, type **X**  
The Setup menu reappears.

### 3.2.12 COM3

To change the parameters for serial port COM3:

- 1 Be sure that the Setup menu is displayed.
- 2 Select the COM3 submenu.  
Type either **A** to increase or **B** to decrease the outgoing (aka transmit) baud rate for COM3. Type either **C** to increase or **D** to decrease the incoming (aka receive) baud rate for COM3. Depending on which letter you type and what baud rate was displayed when you typed it, the baud rate changes to either the next or the prior value from these values: 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200. Type **E** for no parity bit, 8 data bits, and 1 stop bit. Type **F** for even parity bit, 7 data bits, and 1 stop bit.
- 3 Type the letter of what you want to change.  
The COM3 submenu reappears.
- 4 If you aren't done changing the parameters for COM3, return to step 3.
- 5 If you are done changing the parameters for COM3, type **X**  
The Setup menu reappears.

### 3.2.13 COM4

To change the parameters for serial port COM4:

- 1 Be sure that the Setup menu is displayed.
- 2 Select the COM4 submenu.

Type either **A** to increase or **B** to decrease the outgoing (aka transmit) baud rate for COM4. Type either **C** to increase or **D** to decrease the incoming (aka receive) baud rate for COM4. Depending on which letter you type and what baud rate was displayed when you typed it, the baud rate changes to either the next or the prior value from these values: 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200. Type **E** for no parity bit, 8 data bits, and 1 stop bit. Type **F** for even parity bit, 7 data bits, and 1 stop bit.

- 3 Type the letter of what you want to change.  
The COM4 submenu reappears.
- 4 If you aren't done changing the parameters for COM4, return to step 3.
- 5 If you are done changing the parameters for COM4, type **X**  
The Setup menu reappears.

### 3.3 System Functions Menu

To execute one or more system functions:

- 1 Be sure that the Main menu is displayed.

The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Main Menu
-----
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
F) Last Train
G) Last Test Train
H) AEI Diagnostic Detail
I) Replay EOT Announcement
J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
?
```

- 2 Select the System Functions menu.

A menu and prompt like this appears. To access any of the System Functions menu options, type the letter that corresponds to the desired menu option.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
System Functions Menu
-----
A) Radio Test
B) Vocabulary Test
C) Ramp Function
D) Radio Inhibit
E) Manual Test Mode
F) 1KHz Test Tone
G) Auto-Calibration
H) Reset the COP Counters
I) Remote System RESET
J) Delete All Stored Train Data
K) Clear Event Log
X) Exit
?
```

**3** To leave the System Functions menu and return to the Main menu:

**a** Type **X**

The Main menu reappears.

**b** Skip the remaining steps.

**4** To execute the radio test:

The Radio Test option is used to broadcast a short message through the speaker (on top of the SmartScanNG enclosure) and through the radio.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
04/16/2019 21:57
System Functions Menu
-----
```

```
A) Radio Test
B) Vocabulary Test
C) Ramp Function
D) Radio Inhibit
E) Manual Test Mode
```

```
•
•
•
```

**a** Be sure that the speaker (on top of the SmartScanNG enclosure) is plugged in and its volume knob is turned to the middle position.

**b** From the System Functions menu, select Radio Test.

This message appears.

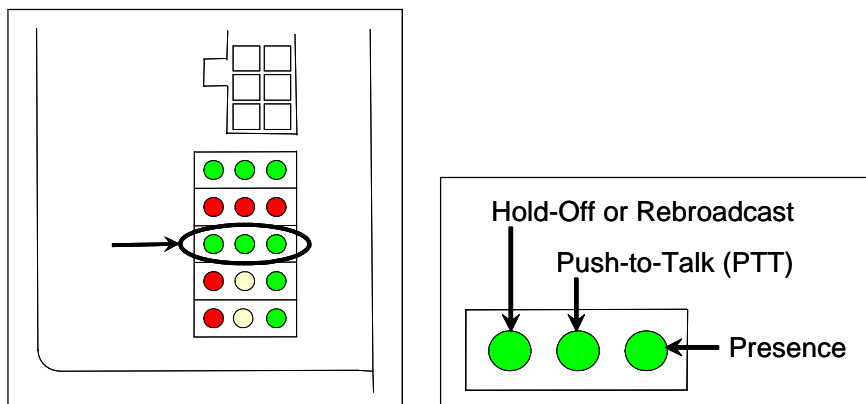
```
Starting Radio Test.
```

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

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



- c** While listening to the message, look at the third row of LEDs on the status panel. The middle green LED should be lit.



If this LED isn't lit, the system's ability to send a message to the radio might be inhibited by the Radio Inhibit submenu of the System Functions menu. If the radio is inhibited, the results of this check are invalid.

- d** Return to step 3.

**5** To execute the vocabulary test:

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

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
04/16/2019 21:57
System Functions Menu
-----
A) Radio Test
B) Vocabulary Test
C) Ramp Function
D) Radio Inhibit
E) Manual Test Mode
.
.
.
```

- a** Be sure that the speaker (on top of the SmartScanNG enclosure) is plugged in and its volume knob is turned to the middle position.

- b** From the System Functions menu, select Vocabulary Test.

This message appears.

```
Starting Vocabulary Test.
```

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

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

- c** Return to step 3.

- 6** To execute the ramp function:

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

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
04/16/2019 21:57
System Functions Menu
-----
A) Radio Test
B) Vocabulary Test
C) Ramp Function
D) Radio Inhibit
E) Manual Test Mode
      .
      .
      .
```

- a** From the System Functions menu, select Ramp Function.

This prompt appears.

```
Start Ramp Function?
```

- b** To not start the ramp function:

- Type **N**

The System Functions menu reappears.

- Return to step 3.

- c To start the ramp function, type **Y**

This message appears.

```
Running Ramp Function...
```

The advance input is made active, gating transducer signals are simulated, and heat values are ramped up (increased) and ramped down (decreased) in a predictable sequence to simulate eight Exception Alarms. **This may take a few minutes.** When finished, this message appears followed by the System Functions menu.

```
Running Ramp Function...Ramp Function Complete
```

- d Return to step 3.

7 To execute the radio inhibit:

The Radio Inhibit option is used to prevent radio activation for three minutes. During this time, any announcements generated by the system are broadcast through the speaker (on top of the SmartScanNG enclosure), but not through the radio. This feature may be overridden by recalling this submenu and then typing **N**.

- a From the System Functions menu, select the Radio Inhibit option.

This prompt appears.

```
Inhibit Radio?
```

If you want to inhibit the radio (that is, you want to disable road channel broadcasts), type **Y**. If you don't want to inhibit the radio (that is, you want to enable road channel broadcasts), type **N**.

- b To disable road channel broadcasts:

- Type **Y**

The System Functions menu reappears.

- Return to step 3.

- c To enable road channel broadcasts, type **N**

The System Functions menu reappears.

- d Return to step 3.

**8** To initiate the manual test mode:

The Manual Test Mode option is used to have the system open all the shutters and simulate transducer pulses for about two minutes. During this time, a person can check various aspects of the installed components. In this mode, the system runs the ramp function without generating heats. The train is marked as a test train. There won't be any voltage applied to the scanner inputs.

The test continues until 486 axles are simulated. You cannot stop this test by pressing **[Esc]**.

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

**a** From the System Functions menu, select Manual Test Mode.

This prompt appears.

```
Start Manual Test Mode?
```

If you want to start manual test mode, type **Y**. If you don't want to start manual test mode, type **N**.

**b** To not start manual test mode:

- Type **N**

The System Functions menu reappears.

- Return to step **3**.

**c** To start manual test mode, type **Y**

This message appears.

```
Entering Manual Test Mode  
You have about two minutes
```

After two minutes, this message appears followed by the System Functions menu.

```
Manual Test Mode Complete
```

**d** Return to step **3**.

**9** To generate the 1KHz test tone:

The 1KHz Test Tone option is used to generate a continuous 1KHz tone for about 10 seconds. This test tone is to broadcast through the speaker (on top of the SmartScanNG enclosure) and through the radio.

**a** Be sure that the speaker (on top of the SmartScanNG enclosure) is plugged in and its volume knob is turned to the middle position.

- b** From the System Functions menu, select 1kHz Test Tone.

This message appears.

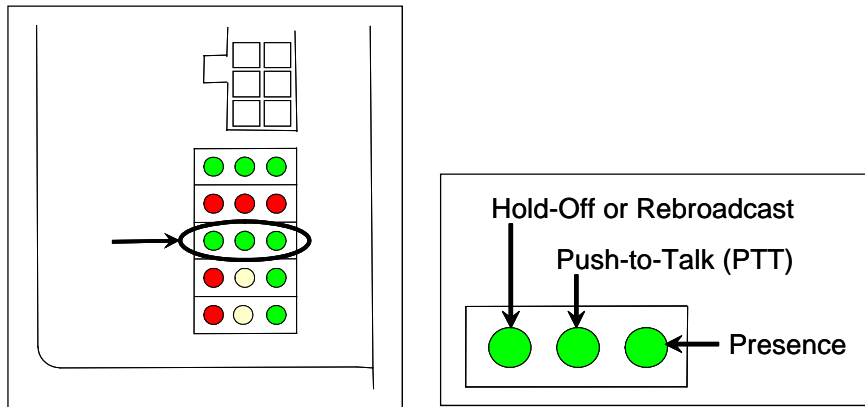
Starting 1kHz Test Tone

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

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

- c** While listening to the tone, look at the third row of LEDs on the status panel.

The middle green LED should be lit.



If this LED isn't lit, the system's ability to send a tone to the radio might be inhibited by the Radio Inhibit submenu of the System Functions menu. If the radio is inhibited, the results of this check are invalid.

- d** Return to step 3.

**10** To start autocalibration:

The SmartScanNG system self-calibrates its pyrometer interface circuitry. You need only put a preheated calibrated heat source on a scanner and place the system in autocalibration mode by using the Auto-Calibration option. The system then scans all pyrometer inputs until the signal from the calibrated heat source is located. The necessary adjustments to the related interface circuitry are automatically made while the system monitors its own progress by analyzing changes in the heat signals. Once the procedure has been completed, autocalibration mode is disengaged and the calibration results are displayed on your computer. For more details, see **Appendix E & Appendix F - Calibration of Scanners**.

- a** Place a preheated calibrated heat source on the scanner to be calibrated.

- b** From the System Functions menu, select Autocalibration.

The SmartScanNG system will now calibrate the channel associated with the scanner on which the heat source has been placed. Follow along on your interface screen until you see: "Auto-Calibration Disengaged." This message is an indication that the system is done with the calibration procedure. To abort the process, press **[Esc]** (on your computer) or remove the heat source (from the scanner).

- c** When "Auto-Calibration Disengaged" is displayed on your computer, remove the calibrated heat source.
- d** Return to step 3.

**11** To reset the COP counters:

Associated with each microprocessor on the Processor board is a Computer Operating Properly (COP) counter. The SmartScanNG system uses these counters to keep track of every time the system automatically resets itself or the customer manually resets it, via the Remote System Reset option on the System Functions menu. These counters are used for diagnostic purposes only. The current value of these counters appears on the System Status report. Typing **H** resets each COP counter to zero.

- a** From the System Functions menu, select Reset COP Counter.

The firmware clears the COP counter for both microprocessors.

The System Functions menu reappears.

- b** Return to step 3.

**12** To force a system reset:

The Remote System Reset feature allows you to force a system reset through a remote connection. It can also be used locally.

- a** From the System Functions menu, select System Reset.

This prompt appears.

Are You Sure?

- b** To not reset the system:

- Type **N**

The System Functions menu reappears.

- Return to step 3.

- c** To reset the system, type **Y**

This message appears.

System RESET will occur 5 seconds after exiting from  
the Serial Interface!

After three seconds, the System Functions menu reappears.

- d** Return to step 3.

**13** To delete all stored train data:

The Delete All Stored Train Data feature allows you to erase all of the stored train data. This encompasses all of the data on the trains in the Trains, Exceptions, and Test Train (aka Ramp Train) directories. After deleting all train data, there isn't any way of regenerating it. The data is gone forever.

- a** From the System Functions menu, select Delete Train Data.

This prompt appears.

Are You Sure?

- b** To not delete all stored train data:

- Type **N**

The System Functions menu reappears.

- Return to step **3**.

- c** To delete all stored 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 Functions menu.

Clearing Stored Train Data...Done

- d** Return to step **3**.

### 3.4 Replay EOT Announcement

The EOT message for every train that is stored in longterm memory can be replayed through the local speaker. The replaying of the EOT message doesn't activate the PTT so it isn't broadcast over the radio.

To replay the EOT announcement for a given train:

- 1 Be sure that the Main menu is displayed.

The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Main Menu
-----
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
F) Last Train
G) Last Test Train
H) AEI Diagnostic Detail
I) Replay EOT Announcement
J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
?
```

- 2 From the Main menu, select Replay EOT Announcement.

This prompt appears.

```
Train Number ?
```

- 3 Type the train number.

If you typed a three-digit valid train number, you'll hear the EOT announcement through the speaker.

- 4 If you typed one or two digits, press **[ENTER]**.

If the typed train number is valid, pressing **[ENTER]** produces the announcement.

## 3.5 Enter Pass-Through Mode

Pass-through mode allows you to access two or more SmartScanNG systems with one modem. To make this happen:

- At multitrack sites, attach a serial cable from COM5 of system1 to COM1 of system2, a serial cable from COM5 of system2 to COM1 of system3, and so on.  
System1 is the one with the telephone line attached and the modem installed.
- Dial into system1.
- Keep selecting pass-through mode from the Main menus, until the system you want to communicate with is reached.



To use pass-through mode at a double-track site:

- 1 Be sure that the Main menu for system1 is displayed.

The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Main Menu
-----
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
F) Last Train
G) Last Test Train
H) AEI Diagnostic Detail
I) Replay EOT Announcement
J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
?
```

- 2 Select Enter Pass-Thru Mode.

If there is a response from the SmartScanNG system on COM5 within five seconds, this message appears.

```
Entering Pass-Thru Mode.
```

If there isn't a response from the SmartScanNG system on COM5 within five seconds, this message appears followed by the reappearance of the Main menu.

```
COM5 does not have a detector attached serially!
```

- 3 After receiving the "entering pass-thru mode" message, to display the Main menu for system2, press **[Esc]**.

You can now communicate with system2.

- 4 To return to system1, from the Main menu, type **X**

Upon leaving system2, this message appears followed by the Main menu for system1.

```
Leaving Pass-Thru Mode.
```



## 4.0 Producing Reports

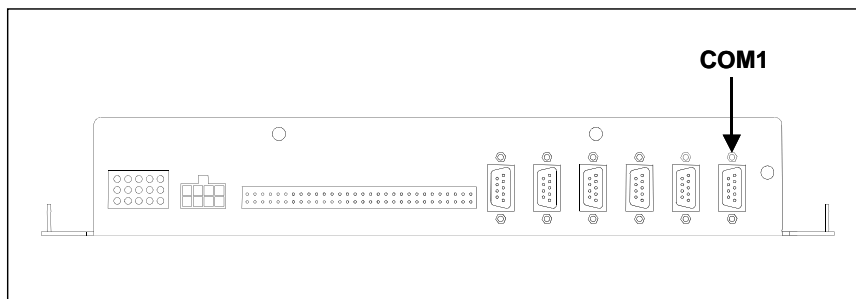
---

The SmartScanNG system provides:

- Train Summary report
- Train Detail report
- Exception Summary report
- extended Exception Detail report
- abbreviated Exception Detail report
- System Status report
- Last Train report
- Last Test Train report
- AEI Diagnostic Detail report
- Event Log report

This section shows a sample of each report with a description of each field. It also lists step-by-step instructions on producing each report both **on-site** and **off-site**. The instructions for each report start with you being at the Main menu, which is described below. If your site does not have telephone service, you cannot communicate with the system remotely (that is, **off-site**).

- 1 Plug your computer into COM1.



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

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

- 4 On your computer, open a LOG file.

- 5 If **off-site**:

From your computer, connect to the site to which you want to communicate via Ethernet or phone line.

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

The Main menu appears.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Main Menu
-----
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
F) Last Train
G) Last Test Train
H) AEI Diagnostic Detail
I) Replay EOT Announcement
J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
?
```

At the above prompt, you can produce one of the listed reports by typing one of the letters **A** through **H** or **M**.

**7** When done, close the LOG file.

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

When a session ends, if a modem was used, the system sends various commands to the modem to prepare it for future use. If at any time during the disconnect procedure, lines such as "+++ATH0" appear on your screen, these are merely commands preparing the modem for further use. They shouldn't be construed as anything that is meant for the user.

**Your menus and submenus may not match those shown in this guide. Some of the options shown may not appear on your menus and submenus. For example, Event Log doesn't appear on everybody's Main menu. Also, some options that appear on your menus and submenus may not apply to your system. For example, if you don't have an AEI subsystem attached to your SmartScanNG, the AEI option on the Equipment submenu would not be applicable.**

**Because the shown menus and submenus may be different from what appears on your system, the letter that is associated with an option may be different from what appears on your system. So, where there is a difference, type the letter of the desired option as it appears on your menus and submenus.**

**Also, the headings in your reports may not match those shown in this guide. The contents of your report will be different from what is shown. The version information that is shown doesn't represent any real release of the firmware.**

## **4.1 Train Summary Report**

The Train Summary report lists all trains currently stored in the Trains directory. A train number is shown for each train entry so that a Train Detail report may easily be produced for any train listed on the summary.

The report is divided into a header section and a detail section. The header section contains general information about the site. The detail section contains summary information on each train that passed the site.

Below is a sample of part of a Train Summary report when Hotwheel alarm detection was disabled during report processing and when the AEI subsystem was disabled during train passage. (When the report is run, if the Hotwheel option on the Equipment submenu is disabled, the hotwheel information is hidden. When the report is run, if the AEI option is disabled, the tag information isn't hidden.) 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
Next Generation Detector System
TRAIN SUMMARY
=====
Version Info.... Analyzer:  DM1.11-A  01/24/07          MP/KP: 1234.5
                  Communicator: DM2.22-A 01/24/07      Track: Single

Alarm Limits..      Absolute: 180          Carside Slope..... 1.31
                   Differential: 120        Minimum... 100
                                           Cool Wheel Temp... 20
-----
Train#  Date   Time  Cars Axles TO1 TO2 Tags (MPH) D Rail Average  Amb Bat
              D      r      North South Temp
178    09/22/19 15:47   18   78   78   78   0   53   W   56   21  +77F  14.0v
177 A  09/21/19 08:32   20   86   86   86   0   56   E   36   37  +68F  14.0v
176 I  09/21/19 07:40   10   46   46   46   0   57   E   43   7   +66F  14.0v
175 B  09/21/19 06:28   14   62   62   62   0   57   E   36   37  +60F  13.8v

174    09/20/19 11:33   18   78   78   78   0   53   W   55   55  +73F  14.0v
173    CHECKSUM ERROR: StartAddr 134879 EndAddr 134930
172    09/20/19 01:19   18   78   78   78   0   55   E   58   20  +59F  14.0v

171    09/19/19 11:24   53  218  218  218   0   49   E   54   18  +72F  14.0v
170 I  09/19/19 01:22    8   38   38   38   0   53   E   55   18  +60F  14.0v

      .
      .
      .

END OF REPORT - Press any key...

```

Below is a sample of part of a Train Summary report when the Hotwheel option on the Equipment submenu is enabled. The contents of your report will be different.

<div><div>•</div><div>•</div><div>•</div></div>															
Alarm Limits..		Absolute: 180					Carside Slope... 1.60								
		Differential: 130					Minimum... 300								
		Hot Wheel: 652					Cold Rail Temp... 10								
-----															
								D Rail		Wheel					
								AEI Speed i		Average		Average		Amb	
Train#	Date	Time	Cars	Axles	T01	T02	Tags	(MPH)	r	East	West	East	West	Temp	Bat
-----															
<div><div>•</div><div>•</div><div>•</div></div>															
END OF REPORT - Press any key...															

The table below lists the fields from the header section and the contents of each field.

Heading	Contents of Field
Version Info	The version numbers of the firmware and their release dates, which are in mm/dd/yy format. This firmware resides on the Processor board (2300-100).
MP/KP	The five-digit milepost/kilometer post of the site. <b>Section 3.0 - Serial Interface</b> tells how to change this value using the MP/KP submenu (aka Milepost submenu).
Track	The track designator of the site. For single-track sites, valid value is Single. For multitrack sites, valid values are North, South, East, West, Main 1, Main 2, Main 3, and Middle. <b>Section 3.0 - Serial Interface</b> tells how to set this value using the Track Number submenu.
Alarm Limits	<p>The alarm parameters currently defined in the system setup. These values were in place at the time this report was run.</p> <ul style="list-style-type: none"> <li>The value after Absolute is set by the Absolute option on the Alarm Limits submenu (aka Alarm Settings submenu).</li> <li>The value after Differential is set by the Differential option on the Alarm Limits submenu.</li> <li>The heading Hot Wheel only appears when the Hotwheel option on the Equipment submenu is <u>enabled</u>. The value after Hot Wheel is set by the Hotwheel option on the Alarm Limits submenu.</li> <li>The value after Carside Slope is set by the Carside Slope option on the Alarm Limits submenu.</li> <li>The value after Minimum is set by the Carside Minimum option on the Alarm Limits submenu.</li> <li>The value after Cool Wheel Temp is set by the Cold Rail Temperature option on the Alarm Limits submenu.</li> </ul> <p><b>Section 3.0 - Serial Interface</b> tells how to set these values.</p>

The table below lists the fields from the detail section and the contents of each field.

Heading	Contents of Field
Train#	The number that identifies the train in the Trains directory.
	There is one unlabeled column between those labeled "Train#" and "Date." This column can contain <b>A</b> , <b>B</b> , <b>I</b> , <b>S</b> , or nothing. If "A," an Exception Alarm was detected on the train. If "I," an Integrity Failure was detected. If "B," both an Exception Alarm and an Integrity Failure were detected. If "S," a System Alarm was detected, but Exception Alarms and Integrity Failures weren't. If blank, no Exception Alarm, Integrity Failure, or System Alarm was detected.
Date	The date the train arrived at the site. Date is in <b>mm/dd/yy</b> format, where <b>mm</b> is month, <b>dd</b> is day, and <b>yy</b> is year. <b>Section 3.0 - Serial Interface</b> tells how to change this value using the Date and Time submenu.
Time	The time the train arrived at the site. Time is in 24-hour <b>hh:mm</b> format, where 8 a.m. is 08:00, noon is 12:00, 8 p.m. is 20:00, and midnight is 00:00. <b>Section 3.0 - Serial Interface</b> tells how to change this value using the Date and Time submenu.
Cars	The total number of cars counted by the SmartScanNG system.
Axles	The total number of axles counted by the SmartScanNG system.
TO1	The total number of hits counted by gating transducer TO1. TO1 is the first gating transducer going north or east from the bearing scanner. It is the gating transducer <u>closest</u> to the bearing scanner.
TO2	The total number of hits counted by gating transducer TO2. TO2 is the second gating transducer going north or east from the bearing scanner. It is the gating transducer <u>farthest</u> from the bearing scanner.
AEI Tags	The total number of AEI tags stored. The number of tag pairs found plus those single tags that lack a match. This heading always appears, even if the AEI subsystem is disabled using the AEI option on the Equipment submenu.
Speed (mph)	The train's exit speed in miles per hour.
Dir	The direction the train was traveling. Valid values are N, S, E, and W.
Rail Average	Under this heading are two columns, one for each bearing scanner, containing the average temperature read by the bearing scanners. If the track orientation is east and west, the bearing scanners are labeled north and south. If the track orientation is north and south, they are labeled east and west.
Wheel Average	Under this heading are two columns, one for each wheel scanner, containing the average temperature read by the wheel scanners. If the track orientation is east and west, the wheel scanners are labeled north and south. If the track orientation is north and south, they are labeled east and west. This field appears only when the Hotwheel option on the Equipment submenu is enabled.
Amb Temp	The ambient temperature, in degrees Fahrenheit, at the time the train passed the site.
Bat	The system battery voltage at the time the train passed the site.



To produce a Train Summary report:

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

**Section 3.0 - Serial Interface** tells how to display the Main menu. The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Main Menu
-----
```

```
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
```

```
·
·
·
```

- 2 Select the Train Summary option.

The last line of the report reads: "END OF REPORT - Press any key..."

- 3 To return to the Main menu, press any key.

At this time, you can produce another report by typing one of the letters **A** through **H** or **M**.

- 4 When done, close the LOG file.

- 5 To exit the serial interface and return the SmartScanNG system to normal operation, type **X**

## 4.2 Train Detail Report

The Train Detail report provides detailed information on a single train. When choosing this report, you'll be prompted for a train number. When prompted, enter a train number from the Train Summary report. The train number appears under the column titled "Train#" in the detail section of the Train Summary report.

Carside Slope alarm detection is enabled/disabled using the Carside Slope option on the Equipment submenu. Hotwheel alarm reporting is enabled/disabled using the Hotwheel option on the Equipment submenu. The AEI subsystem is enabled/disabled using the AEI option on the Equipment submenu.

Where wheel scanners are properly installed, wheel temperatures are always recorded, even if the Hotwheel option is disabled. On the other hand, if the AEI option is disabled during train passage, no AEI information is recorded. If the Carside Slope option is disabled during train passage, no Carside Slope alarms are generated. But, if it is enabled at the time a report is requested, a carside-slope alarm-limit line is generated for each car of the train.

Below is a sample of part of a Train Detail report when both the AEI option and Hotwheel option were disabled at the time the report was requested. The Carside Slope option was enabled. 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
Next Generation Detector System
TRAIN DETAIL
=====
Train#: 321           Speed: 57MPH           MP/KP: 1111.1
Date: 09/16/19       Axles: 86           Track: Single
Time: 08:41          Direction: East       Temperature: + 71F
Length: 1776         Shutters Open: 32     Battery: 13.4v
=====
Resistor
Rail  Max  Avg  Read  Req  Txdr Counts  Alarm  Limit  Carside Parm
-----
North 289  24   300  81I  TO1 132  Absolute  180      Slope: 1.60
South  0    0   104  81I  TO2 132  Differential 130  Minimum: 75
Hot Wheel 652
Resistor Test Mode: Enabled      Cold Rail Temp 10
=====
Firmware Versions
=====
Analyzer: DM1.11-A 01/24/07  Comm: DM2.22-A 01/24/07
=====

System Alarms
-----
Cold North Resistor
Cold South Resistor

Axle Alarm Summary
-----
46 South Rail Absolute
77 South Rail Differential
143 North Rail Absolute
143 South Rail Absolute
144 North Rail Absolute

-----
Car  Axle  Trk  North  South  ON  OFF  PW1 PW2  Alarms
-----
1    1    0   56     21   25   0    6   6
    2    0   57     21   25   59    6   6
    3    0   56     21   25   59    8   8
    4    1   56     21   25   362   5   5
    5    1   56     21   25   59    6   6
    6    1   56     21   25   59    6   6
Carside Ave: North 56 South 21  Carside Alarms: North 184 South 204

2    7    2   56     20   25   162   6   6
    8    2   56     21   25   59    6   6
      .
      .
      .
143  66   186    181   25   59    6   6  North Rail Absolute
      South Rail Absolute
144  66   183    170   25  641    6   6  North Rail Absolute
=====
END OF REPORT - Press any key...

```

Below is a sample of part of a Train Detail report when both the AEI option and the Hotwheel option on the Equipment submenu were enabled at the time the report was requested. The Carside Slope option on the Equipment submenu was disabled. Also, both the AEI and Hotwheel options were enabled while the specified train was passing the site. 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

Next Generation Detector System

TRAIN DETAIL

=====

Train#: 321Speed: 57MPHMP/KP: 1111.1

Date: 09/16/19Axles: 86Track: Single

Time: 08:41Direction: NorthTemperature: + 71F

Length: 1776Shutters Open: 32Battery: 13.4v

=====

Resistor

RailMaxAvgReadReqTxdr CountsAlarmLimitCarside Parm

-----

East2892430081IT01 132Absolute180Slope: 1.60

West0010481IT02 132Differential130Minimum: 75

Hot Wheel652

Resistor Test Mode: EnabledCold Rail Temp10

Resistor

WheelMaxAvgReadReq

-----

East200196368I

West106268I

=====

AEI System Data

Tags ReadTags Stored: 30

-----

Antenna 0: 30

Antenna 1: 0

=====

Firmware Versions

-----

Analyzer: DM1.11-A01/24/07Comm: DM2.22-A01/24/07

-----

System Alarms

-----

Successive Cold Wheel Resistors Exceeded

Integrity Failure

Cold North Wheel Scanner Resistor

Axle Alarm Summary

-----

97North Hot Wheel

98South Hot Wheel

•

•

•

-----

RailWheel

Car Axle East West East WestONOFFPW1PW2Alarms

-----

•

•

•

The Train Detail report is divided into three sections. The header section contains general information about the site (like the MP/KP) and some detail information about the specific train (like the train's exit speed) that passed the site. The detail section contains more detailed information (like the car number) about the specific train. In between these two sections is the system-events section, which contains all System Alarms and Exception Alarms associated with the train.

The SmartScanNG system calculates a checksum for each train. This checksum is stored with the train data. Later, when the system retrieves this data, it recalculates the checksum. If the two checksums don't match, the Train Detail report so states (as shown below).

```
Southern Technologies Corporation
Next Generation Detector System
TRAIN DETAIL
=====
CHECKSUM ERROR: StartAddr 134879 EndAddr 134930
```

In addition, each axle has a checksum associated with it. If an axle is determined to have an invalid checksum, the Train Detail report so states in the associated axle's row (as shown below).

```
Southern Technologies Corporation
Next Generation Detector System
TRAIN DETAIL
=====
.
.
.
-----
Car  Axle  Trk  North  South  ON  OFF  PW1 PW2  Alarms
-----
1      1    0   56    21   25   0    6    6
      2    0   57    21   25   59    6    6
      3    0   56    21   25   59    8    8
      4      CHECKSUM ERROR: StartAddr 136416 EndAddr 136427
      5    1   56    21   25   59    6    6
      6    1   56    21   25   59    6    6

2      7    2   56    20   25  162    6    6
      8    2   56    21   25   59    6    6

.
.
.
END OF REPORT - Press any key...
```

The table below lists the fields from the header section and the contents of each field.

Heading	Contents of Field
Train#	The number that identifies the train in the Trains directory.
Date	The date the train arrived at the site. Date is in <b>mm/dd/yy</b> format, where <b>mm</b> is month, <b>dd</b> is day, and <b>yy</b> is year. <b>Section 3.0 - Serial Interface</b> tells how to change this value using the Date and Time submenu.
Time	The time the train arrived at the site. Time is in 24-hour <b>hh:mm</b> format, where 8 a.m. is 08:00, noon is 12:00, 8 p.m. is 20:00, and midnight is 00:00. <b>Section 3.0 - Serial Interface</b> tells how to change this value using the Date and Time submenu.
Length	The length of the train in feet.
Speed	The train's exit speed in miles per hour.
Axles	The total number of axles counted by the SmartScanNG system.
Direction	The direction the train was traveling. Valid values are North, South, East, and West.
Shutters Open	The number of seconds it took the train to pass over the site.
MP/KP	The five-digit milepost/kilometer post of the site. <b>Section 3.0 - Serial Interface</b> tells how to change this value using the MP/KP submenu.
Track	The track designator of the site. For single-track sites, the valid value is Single. For multitrack sites, valid values are North, South, East, West, Main 1, Main 2, Main 3, and Middle. <b>Section 3.0 - Serial Interface</b> tells how to set this value using the Track Number submenu.
Temperature	The ambient temperature at the time the train arrived at the site. Temperature is in degrees Fahrenheit.
Battery	The system battery voltage at the time the train passed the site.
Rail	Location of the bearing scanners. If the track orientation is east and west, the bearing scanners are labeled north and south. If the track orientation is north and south, they are labeled east and west.
Max	The maximum temperature, above the ambient temperature in degrees Fahrenheit, recorded by the bearing scanner on a given railside. For example, if the ambient temperature (at the time the train arrived at the site) is 77°F (25°C) and the value in this field is 112, the maximum temperature would be 189°F (87.2°C).
Avg	The average temperature, above the ambient temperature in degrees Fahrenheit, calculated from all recorded temperatures from the bearing scanner on a given railside. For example, if the ambient temperature (at the time the train arrived at the site) is 86°F (30°C) and the value in this field is 55, the average temperature would be 141°F (60.6°C).
Resistor Read	The scanner resistor temperature (read after train passage), in degrees Fahrenheit, recorded by the bearing scanner on a given railside.

Heading	Contents of Field
Resistor Req	The resistor temperature, in degrees Fahrenheit, required by the bearing scanner on a given raiiside to avoid a Cold Resistor alarm. This value was calculated using the amount of time the shutters were open and the Resistor Test Mode option in effect at the time the train exits the site. If the Resistor Test Mode option is <u>disabled</u> , a zero appears in this field.
	<p>One of five uppercase letters follows the Resistor Req temperature.</p> <ul style="list-style-type: none"> <li><b>B</b> The baseline resistor integrity test method was used for this train.</li> <li><b>D</b> The resistor integrity test (that is, the Resistor Test Mode option) was disabled by the user.</li> <li><b>I</b> The interim resistor integrity test method was used for this train.</li> <li><b>T</b> For this train, the shutters were open for less than 30 seconds.</li> <li><b>V</b> For this train, the battery voltage (measured with the shutters open) was less than 13 volts.</li> </ul> <p>For <b>D</b>, <b>T</b>, and <b>V</b>, the required resistor heat is set to zero (that is, a zero appears in the Resistor Read field). A <b>T</b> or <b>V</b> indicates that the integrity test was not performed due to low voltage or insufficient shutter open time, which could result in an invalid resistor integrity test if it was performed.</p>
Txdr Counts	The gating transducer designator (either TO1 or TO2) followed by the total number of hits on that transducer.
Alarm Limit	<p>The Hotwheel alarm level; the Hotbox alarm levels for Absolute and Differential; and the Cold Rail Temperature offset. These values were in place at the time the train arrived at the site.</p> <ul style="list-style-type: none"> <li>• The value after Absolute is set by the Absolute option on the Alarm Limits submenu (aka Alarm Settings submenu).</li> <li>• The value after Differential is set by the Differential option on the Alarm Limits submenu.</li> <li>• The value after Hot Wheel is set by the Hotwheel option on the Alarm Limits submenu.</li> <li>• The value after Cold Rail Temp is set by the Cold Rail Temperature option on the Alarm Limits submenu.</li> </ul> <p><b>Section 3.0 - Serial Interface</b> tells how to set these values.</p>
Carside Parm	<p>The Carside Slope alarm parameter values that were in place at the time the train arrived at the site.</p> <ul style="list-style-type: none"> <li>• The value after Carside Slope is set by the Carside Slope option on the Alarm Settings submenu.</li> <li>• The value after Minimum is set by the Carside Minimum option on the Alarm Settings submenu.</li> </ul> <p><b>Section 3.0 - Serial Interface</b> tells how to set these values.</p>
Resistor Test Mode	<p>Status of the post-train resistor integrity test at the time the train arrived at the site. Valid values (aka modes) are Enabled, Reduced, and Disabled.</p> <p><b>Section 3.0 - Serial Interface</b> tells how to set this value using the Resistor Test Mode option on the Equipment submenu.</p>

Heading	Contents of Field
Wheel	Location of the wheel scanners. If the track orientation is east and west, the wheel scanners are labeled north and south. If the track orientation is north and south, they are labeled east and west. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the Hotwheel option on the Equipment submenu.
Max	The maximum temperature, above the ambient temperature in degrees Fahrenheit, recorded by the wheel scanner on a given raiiside. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the Hotwheel option on the Equipment submenu.
Avg	The average temperature, above the ambient temperature in degrees Fahrenheit, calculated from all recorded temperatures from the wheel scanner on a given raiiside. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the Hotwheel option on the Equipment submenu.
Resistor Read	The scanner resistor temperature (read after train passage), in degrees Fahrenheit, recorded by the wheel scanner on a given raiiside. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the Hotwheel option on the Equipment submenu.
Resistor Req	The resistor temperature, in degrees Fahrenheit, required by the wheel scanner on a given raiiside to avoid a Cold Wheel Scanner Resistor alarm. This value was calculated using the amount of time the shutters were open and the Resistor Test Mode option in effect at the time the train exits the site. If the Resistor Test Mode option is <u>disabled</u> , a zero appears in this field. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the Hotwheel option on the Equipment submenu.
	<p>One of five uppercase letters follows the Resistor Req temperature.</p> <ul style="list-style-type: none"> <li><b>B</b> The baseline resistor integrity test method was used for this train.</li> <li><b>D</b> The resistor integrity test (that is, the Resistor Test Mode option) was disabled by the user.</li> <li><b>I</b> The interim resistor integrity test method was used for this train.</li> <li><b>T</b> For this train, the shutters were open for less than 30 seconds.</li> <li><b>V</b> For this train, the battery voltage (measured with the shutters open) was less than 13 volts.</li> </ul> <p>For <b>D</b>, <b>T</b>, and <b>V</b>, the required resistor heat is set to zero (that is, a zero appears in the Resistor Read field). A <b>T</b> or <b>V</b> indicates that the integrity test was not performed due to low voltage or insufficient shutter open time, which could result in an invalid resistor integrity test if it was performed.</p>
AEI System Data	The number of AEI tags read (by antenna0 and antenna1) and the total number of tags stored for the train. Where both tags of a tag pair are operational, each antenna will read one tag of the pair. The total number of tags stored represents the number of tag pairs found plus those single tags that lack a match. This heading and the columns under it appear only when the AEI subsystem is <u>enabled</u> using the AEI option on the Equipment submenu.
Firmware Versions	The version numbers of the firmware and their release dates, which are in mm/dd/yy format. This firmware resides on the Processor board (2300-100).

The table below lists the fields from the system-events section and the contents of each field.

Heading	Contents of Field
System Alarms	Lists any System Alarms and Integrity Failures detected at the time the train passed the site. If none were detected, this header is followed by the word "none." <b>Appendix A - System Alarms</b> describes the conditions and events that the system flags as System Alarms. <b>Appendix B - Integrity Failures</b> describes the conditions and events that the system flags as Integrity Failures.
Axle Alarm Summary	Lists each Exception Alarm found on the train and the axle on which it was found. If none were found, this header is followed by the word "none."

The table below lists the fields from the detail section and the contents of each field.

Heading	Contents of Field
Car	The car number as determined by the firmware.
Axle	The axle number.
Trk	The truck number. Each railroad vehicle has two or more trucks (that is, wheel assemblies). The trucks are numbered, starting with 0, and increasing from the beginning of the train to the end. Each axle record is associated with one of these trucks. The axles are assigned the number of the truck with which they've been associated. These assigned truck numbers appear in this field. If the Hotwheel option on the Equipment submenu is <u>enabled</u> , this field doesn't appear.
Rail	Under this heading are two columns, one for each bearing scanner, containing the temperature read by the bearing scanners. If the track orientation is east and west, rails are north and south. If the track orientation is north and south, rails are east and west. If the Hotwheel option on the Equipment submenu is <u>disabled</u> , the word "Rail" doesn't appear, but the two columns do.
Wheel	Under this heading are two columns, one for each wheel scanner, containing the temperature read by the wheel scanners. If the track orientation is east and west, rails are north and south. If the track orientation is north and south, rails are east and west. This heading and the two columns under it appear only when the Hotwheel option on the Equipment submenu is <u>enabled</u> .
ON	The number of milliseconds a bearing was scanned.
OFF	The number of milliseconds between axles (when no axle was between the gating transducers).
PW1	The recorded width of the pulse generated by gating transducer TO1. There is no fixed value for the pulse widths. Slower trains generate wider pulse widths (that is, they generate larger values) than faster moving trains.
PW2	The recorded width of the pulse generated by gating transducer TO2. There is no fixed value for the pulse widths. Slower trains generate wider pulse widths (that is, they generate larger values) than faster moving trains.
Alarms	Any Exception Alarm found on the given axle.



To produce a Train Detail report:

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

**Section 3.0 - Serial Interface** tells how to display the Main menu. The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Main Menu
-----
```

```
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
```

```
·
·
·
```

- 2 Select the Train Detail option.

This prompt appears.

```
Train Number ?
```

- 3 Type the train number.

If you typed a three-digit invalid train number, the Main menu reappears. If you typed a three-digit valid train number, a report for that train is produced. The last line of the report reads: "END OF REPORT - Press any key..."

- 4 If you typed one or two digits, press **[ENTER]**.

If you typed an invalid train number, pressing **[ENTER]** causes the Main menu to reappear. If the typed train number is valid, pressing **[ENTER]** produces a report for it. The last line of the report reads: "END OF REPORT - Press any key..."

- 5 To return to the Main menu after a report is produced, press any key.

At this time, you can produce another report by typing one of the letters **A** through **H** or **M**.

- 6 When done, close the LOG file.

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

## 4.3 Exception Summary Report

The Exception Summary report lists all trains currently stored in the Exceptions directory. A train is stored in the Exceptions directory if either an Exception Alarm or an Integrity Failure was detected on it as it passed the site. A train number is shown for each train entry so that an Exception Detail report may easily be produced for any train listed on the summary.

The report is divided into a header section and a detail section. The header section contains general information about the site. The detail section contains summary information on each exception train (that is, on each train having an Exception Alarm, an Integrity Failure, or both) that passed the site.

The SmartScanNG system calculates a checksum for each train. This checksum is stored with the train data. Later, when the system retrieves this data, it recalculates the checksum. If the two checksums don't match, the Exception Summary report so states in the detail section. So, instead of getting a train record, you'll get a checksum-error line.

Below is a sample of part of an Exception Summary report when Hotwheel alarm detection was disabled during report processing and when the AEI subsystem was disabled during train passage. (When the report is run, if the Hotwheel option on the Equipment submenu is disabled, the hotwheel information is hidden. When the report is run, if the AEI option is disabled, the tag information isn't hidden.) 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
Next Generation Detector System
EXCEPTION SUMMARY
=====
Version Info.... Analyzer:  DM1.11-A  01/24/07      MP/KP: 1234.5
                  Communicator: DM2.22-A 01/24/07      Track: Single

Alarm Limits..      Absolute: 180          Carside Slope..... 1.31
                  Differential: 120          Minimum... 100
                  Cool Wheel Temp... 20
-----

Train#   Date   Time   Cars Axles T01 T02   AEI Speed i   D   Rail
          |     |     |     |     |     |     |     |     |   Average
          |     |     |     |     |     |     |     |     |   North South
          |     |     |     |     |     |     |     |     |   Temp    Bat
-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
177 A 09/21/19 08:32   20   86   86 86   0  56 E   36   37   +68F 14.0v
176 I 09/21/19 07:40   10   46   46 46   0  57 E   43    7   +66F 14.0v
175 B 09/21/19 06:28   14   62   62 62   0  57 E   36   37   +60F 13.8v

170 I 09/19/19 01:22    8   38   38 38   0  53 E   55   18   +60F 14.0v

.
.
.

END OF REPORT - Press any key...

```

Below is a sample of part of an Exception Summary report when Hotwheel option on the Equipment submenu is enabled. The contents of your report will be different.

<div><div>•</div><div>•</div><div>•</div></div>															
Alarm Limits..		Absolute: 180				Carside Slope... 1.60									
		Differential: 130				Minimum... 300									
		Hot Wheel: 652				Cold Rail Temp... 10									
-----															
						D Rail				Wheel					
						AEI Speed i Average				Average					
Train#		Date		Time Cars Axles T01		T02 Tags (MPH) r		East West		East West		Temp		Bat	
-----															
<div><div>•</div><div>•</div><div>•</div></div>															
END OF REPORT - Press any key...															

The table below lists the fields from the header section and the contents of each field.

Heading	Contents of Field
Version Info	The version numbers of the firmware and their release dates, which are in mm/dd/yy format. This firmware resides on the Processor board (2300-100).
MP/KP	The five-digit milepost/kilometer post of the site. <b>Section 3.0 - Serial Interface</b> tells how to change this value using the MP/KP submenu (aka Milepost submenu).
Track	The track designator of the site. For single-track sites, valid value is Single. For multitrack sites, valid values are North, South, East, West, Main 1, Main 2, Main 3, and Middle. <b>Section 3.0 - Serial Interface</b> tells how to set this value using the Track Number submenu.

Heading	Contents of Field
Alarm Limits	<p>These are the alarm parameters currently defined in the system setup. These values were in place at the time this report was run.</p> <ul style="list-style-type: none"> <li>• The value after Absolute is set by the Absolute option on the Alarm Limits submenu (aka Alarm Settings submenu).</li> <li>• The value after Differential is set by the Differential option on the Alarm Limits submenu.</li> <li>• The heading Hot Wheel only appears when the Hotwheel option on the Equipment submenu is <u>enabled</u>. The value after Hot Wheel is set by the Hotwheel option on the Alarm Limits submenu.</li> <li>• The value after Carside Slope is set by the Carside Slope option on the Alarm Limits submenu.</li> <li>• The value after Minimum is set by the Carside Minimum option on the Alarm Limits submenu.</li> <li>• The value after Cool Wheel Temp is set by the Cold Rail Temperature option on the Alarm Limits submenu.</li> </ul> <p><b>Section 3.0 - Serial Interface</b> tells how to set these values.</p>

The table below lists the fields from the detail section and the contents of each field.

Heading	Contents of Field
Train#	The number that identifies the train in the Exceptions directory.
	<p>There is one unlabeled column between those labeled "Train#" and "Date." This column can contain <b>A, B, I, S</b>, or nothing. If "A," an Exception Alarm was detected on the train. If "I," an Integrity Failure was detected. If "B," both an Exception Alarm and an Integrity Failure were detected. If "S," a System Alarm was detected, but Exception Alarms and Integrity Failures weren't. If blank, no Exception Alarm, Integrity Failure, or System Alarm was detected.</p>
Date	<p>The date the train arrived at the site. Date is in <b>mm/dd/yy</b> format, where <b>mm</b> is month, <b>dd</b> is day, and <b>yy</b> is year. <b>Section 3.0 - Serial Interface</b> tells how to change this value using the Date and Time submenu.</p>
Time	<p>The time the train arrived at the site. Time is in 24-hour hh:mm format, where 8 a.m. is 08:00, noon is 12:00, 8 p.m. is 20:00, and midnight is 00:00. <b>Section 3.0 - Serial Interface</b> tells how to change this value using the Date and Time submenu.</p>

Heading	Contents of Field
Cars	The total number of cars counted by the SmartScanNG system.
Axles	The total number of axles counted by the SmartScanNG system.
TO1	The total number of hits counted by gating transducer TO1. TO1 is the first gating transducer going north or east from the bearing scanner. It is the gating transducer <u>closest</u> to the bearing scanner.
TO2	The total number of hits counted by gating transducer TO2. TO2 is the second gating transducer going north or east from the bearing scanner. It is the gating transducer <u>farthest</u> from the bearing scanner.
AEI Tags	The total number of AEI tags stored. The number of tag pairs found plus those single tags that lack a match. This heading always appears, even if the AEI subsystem is disabled using the AEI option on the Equipment submenu.
Speed (mph)	The train's exit speed in miles per hour.
Dir	The direction the train was traveling. Valid values are N, S, E, and W.
Rail Average	Under this heading are two columns, one for each bearing scanner, containing the average temperature read by the bearing scanners. If the track orientation is east and west, the bearing scanners are labeled north and south. If the track orientation is north and south, they are labeled east and west.
Wheel Average	Under this heading are two columns, one for each wheel scanner, containing the average temperature read by the wheel scanners. If the track orientation is east and west, the wheel scanners are labeled north and south. If the track orientation is north and south, they are labeled east and west. This field appears only when the Hotwheel option on the Equipment submenu is enabled.
Amb Temp	The ambient temperature, in degrees Fahrenheit, at the time the train passed the site.
Bat	The system battery voltage at the time the train passed the site.

To produce an Exception Summary report:

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

**Section 3.0 - Serial Interface** tells how to display the Main menu. The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Main Menu
-----
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
      .
      .
      .
```

- 2 Select the Exception Summary report option.

The last line of the report reads: "END OF REPORT - Press any key..."

- 3 To return to the Main menu, press any key.

At this time, you can produce another report by typing one of the letters **A** through **H** or **M**.

- 4 When done, close the LOG file.
- 5 To exit the serial interface and return the SmartScanNG system to normal operation, type **X**

## 4.4 Extended Exception Detail Report

The extended Exception Detail report provides detailed information on a single train. When choosing this report, you'll be prompted for a train number. When prompted, enter a train number from the Exception Summary report. The train number appears under the column titled "Train#" in the detail section of the Exception Summary report.

Below is a sample of part of an extended Exception Detail report when both the AEI option and Hotwheel option were disabled at the time the report was requested. The Carside Slope option was enabled. 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  
Next Generation Detector System

**EXCEPTION DETAIL**

```
=====
Train#: 321                      Speed: 57MPH                      MP/KP: 1111.1
Date: 09/16/19                  Axles: 86                      Track: Single
Time: 08:41                     Direction: East                Temperature: + 71F
Length: 1776                    Shuttters Open: 32             Battery: 13.4v
=====
```

```
=====
Resistor
Rail Max Avg Read Req Txdr Counts Alarm Limit Carside Parm
-----
North 289 24 300 81I T01 132 Absolute 180 Slope: 1.60
South 0 0 104 81I T02 132 Differential 130 Minimum: 75
Hot Wheel 652
Resistor Test Mode: Enabled Cold Rail Temp 10
=====
```

Firmware Versions

```
-----
Analyzer: DM1.11-A 01/24/07 Comm: DM2.22-A 01/24/07
-----
```

System Alarms

```
-----
Cold North Resistor
Cold South Resistor
```

Axle Alarm Summary

```
-----
46 South Rail Absolute
77 South Rail Differential
143 North Rail Absolute
143 South Rail Absolute
144 North Rail Absolute
-----
```

```
-----
Car Axle Trk North South ON OFF PW1 PW2 Alarms
-----
1 1 0 56 21 25 0 6 6
  2 0 57 21 25 59 6 6
  3 0 56 21 25 59 8 8
  4 1 56 21 25 362 5 5
  5 1 56 21 25 59 6 6
  6 1 56 21 25 59 6 6
Carside Ave: North 56 South 21 Carside Alarms: North 184 South 204

2 7 2 56 20 25 162 6 6
  8 2 56 21 25 59 6 6

.
.
.

143 66 186 181 25 59 6 6 North Rail Absolute
South Rail Absolute
144 66 183 170 25 641 6 6 North Rail Absolute
-----
```

END OF REPORT - Press any key...

Below is a sample of part of an extended Exception Detail report when both the AEI option and the Hotwheel option on the Equipment submenu were enabled at the time the report was requested. The Carside Slope option on the Equipment submenu was disabled. Also, both the AEI and Hotwheel options were enabled while the specified train was passing the site. 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

Next Generation Detector System

EXCEPTION DETAIL

=====

Train#: 321Speed: 57MPHMP/KP: 1111.1

Date: 09/16/19Axles: 86Track: Single

Time: 08:41Direction: NorthTemperature: + 71F

Length: 1776Shutters Open: 32Battery: 13.4v

=====

Resistor

RailMaxAvgReadReqTxdr CountsAlarmLimitCarside Params

-----

East2892430081ITO1 132Absolute180Slope: 1.60

West0010481ITO2 132Differential130Minimum: 75

Hot Wheel652

Resistor Test Mode: EnabledCold Rail Temp10

Resistor

WheelMaxAvgReadReq

-----

East200196368I

West106268I

=====

AEI System Data

Tags ReadTags Stored: 30

-----

Antenna 0: 30

Antenna 1: 0

=====

Firmware Versions

-----

Analyzer: DM1.11-A 01/24/07Comm: DM2.22-A 01/24/07

-----

System Alarms

-----

Successive Cold Wheel Resistors Exceeded

Integrity Failure

Cold North Wheel Scanner Resistor

Axle Alarm Summary

-----

97 North Hot Wheel

98 South Hot Wheel

•

•

•

-----

RailWheel

Car Axle East West East WestONOFF PW1 PW2 Alarms

-----

•

•

•



The extended Exception Detail report is divided into three sections. The header section contains general information about the site (like the MP/KP) and some detail information about the specific train (like the train's exit speed) that passed the site. The detail section contains more detailed information (like the car number) about the specific train. In between these two sections is the system-events section, which contains all System Alarms and Exception Alarms associated with the train.

The SmartScanNG system calculates a checksum for each train. This checksum is stored with the train data. Later, when the system retrieves this data, it recalculates the checksum. If the two checksums don't match, the extended Exception Detail report so states (as shown below).

```

Southern Technologies Corporation
Next Generation Detector System
EXCEPTION DETAIL
=====
CHECKSUM ERROR: StartAddr 134879 EndAddr 134930

```

In addition, each axle has a checksum associated with it. If an axle is determined to have an invalid checksum, the extended Exception Detail report so states in the associated axle's row (as shown below).

```

Southern Technologies Corporation
Next Generation Detector System
EXCEPTION DETAIL
=====
.
.
.
-----
Car  Axle  Trk  North  South  ON  OFF  PW1  PW2  Alarms
-----
1      1    0   56    21   25   0    6    6
      2    0   57    21   25   59    6    6
      3    0   56    21   25   59    8    8
      4      CHECKSUM ERROR: StartAddr 136416 EndAddr 136427
      5    1   56    21   25   59    6    6
      6    1   56    21   25   59    6    6

2      7    2   56    20   25  162    6    6
      8    2   56    21   25   59    6    6

.
.
.
END OF REPORT - Press any key...

```

The table below lists the fields from the header section and the contents of each field.

Heading	Contents of Field
Train#	The number that identifies the train in the Exceptions directory.
Date	The date the train arrived at the site. Date is in <b>mm/dd/yy</b> format, where <b>mm</b> is month, <b>dd</b> is day, and <b>yy</b> is year. <b>Section 3.0 - Serial Interface</b> tells how to change this value using the Date and Time submenu.
Time	The time the train arrived at the site. Time is in 24-hour <b>hh:mm</b> format, where 8 a.m. is 08:00, noon is 12:00, 8 p.m. is 20:00, and midnight is 00:00. <b>Section 3.0 - Serial Interface</b> tells how to change this value using the Date and Time submenu.
Length	The length of train in feet.
Speed	The train's exit speed in miles per hour.
Axles	The total number of axles counted by the SmartScanNG system.
Direction	The direction the train was traveling. Valid values are North, South, East, and West.
Shutters Open	The number of seconds it took the train to pass over the site.
MP/KP	The five-digit milepost/kilometer post of the site. <b>Section 3.0 - Serial Interface</b> tells how to change this value using the MP/KP submenu (aka Milepost submenu).
Track	The track designator of the site. For single-track sites, valid value is Single. For multitrack sites, valid values are North, South, East, West, Main 1, Main 2, Main 3, and Middle. <b>Section 3.0 - Serial Interface</b> tells how to set this value using the Track Number submenu.
Temperature	The ambient temperature at the time the train arrived at the site. Temperature is in degrees Fahrenheit.
Battery	The system battery voltage at the time the train passed the site.
Rail	Location of the bearing scanners. If the track orientation is east and west, the bearing scanners are labeled north and south. If the track orientation is north and south, they are labeled east and west
Max	The maximum temperature, above the ambient temperature in degrees Fahrenheit, recorded by the bearing scanner on a given railside. For example, if the ambient temperature (at the time the train arrived at the site) is 77°F (25°C) and the value in this field is 112, the maximum temperature would be 189°F (87.2°C).
Avg	The average temperature, above the ambient temperature in degrees Fahrenheit, calculated from all recorded temperatures from the bearing scanner on a given railside. For example, if the ambient temperature (at the time the train arrived at the site) is 86°F (30°C) and the value in this field is 55, the average temperature would be 141°F (60.6°C).
Resistor Read	The scanner resistor temperature (read after train passage), in degrees Fahrenheit, recorded by the bearing scanner on a given railside.

Heading	Contents of Field
Resistor Req	The resistor temperature, in degrees Fahrenheit, required by the bearing scanner on a given raiiside to avoid a Cold Resistor alarm. This value was calculated using the amount of time the shutters were open and the Resistor Test Mode option in effect at the time the train exits the site. If the Resistor Test Mode option is <u>disabled</u> , a zero appears in this field.
	<p>One of five uppercase letters follows the Resistor Req temperature.</p> <p><b>B</b> The baseline resistor integrity test method was used for this train.</p> <p><b>D</b> The resistor integrity test (that is, the Resistor Test Mode option) was disabled by the user.</p> <p><b>I</b> The interim resistor integrity test method was used for this train.</p> <p><b>T</b> For this train, the shutters were open for less than 30 seconds.</p> <p><b>V</b> For this train, the battery voltage (measured with the shutters open) was less than 13 volts.</p> <p>For <b>D</b>, <b>T</b>, and <b>V</b>, the required resistor heat is set to zero (that is, a zero appears in the Resistor Read field). A <b>T</b> or <b>V</b> indicates that the integrity test was not performed due to low voltage or insufficient shutter open time, which could result in an invalid resistor integrity test if it was performed.</p>
Txdr Counts	The gating-transducer designator (either TO1 or TO2) followed by the total number of hits on that transducer.
Alarm Limit	<p>The Hotwheel alarm level; the Hotbox alarm levels for Absolute and Differential; and the Cold Rail Temperature offset. These values were in place at the time the train arrived at the site.</p> <ul style="list-style-type: none"> <li>• The value after Absolute is set by the Absolute option on the Alarm Limits submenu (aka Alarm Settings submenu).</li> <li>• The value after Differential is set by the Differential option on the Alarm Limits submenu.</li> <li>• The value after Hot Wheel is set by the Hotwheel option on the Alarm Limits submenu.</li> <li>• The value after Cold Rail Temp is set by the Cold Rail Temperature option on the Alarm Limits submenu.</li> </ul> <p><b>Section 3.0 - Serial Interface</b> tells how to set these values.</p>
Carside Parm	<p>The Carside Slope alarm parameter values that were in place at the time the train arrived at the site.</p> <ul style="list-style-type: none"> <li>• The value after Carside Slope is set by the Carside Slope option on the Alarm Settings submenu.</li> <li>• The value after Minimum is set by the Carside Minimum option on the Alarm Settings submenu.</li> </ul> <p><b>Section 3.0 - Serial Interface</b> tells how to set these values.</p>
Resistor Test Mode	<p>Status of the post-train resistor integrity test at the time the train arrived at the site. Valid values (aka modes) are Enabled, Reduced, and Disabled.</p> <p><b>Section 3.0 - Serial Interface</b> tells how to set this value using the Resistor Test Mode option on the Equipment submenu.</p>

Heading	Contents of Field
Wheel	Location of the wheel scanners. If the track orientation is east and west, the wheel scanners are labeled north and south. If the track orientation is north and south, they are labeled east and west. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the Hotwheel option on the Equipment submenu.
Max	The maximum temperature, above the ambient temperature in degrees Fahrenheit, recorded by the wheel scanner on a given raiiside. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the Hotwheel option on the Equipment submenu.
Avg	The average temperature, above the ambient temperature in degrees Fahrenheit, calculated from all recorded temperatures from the wheel scanner on a given raiiside. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the Hotwheel option on the Equipment submenu.
Resistor Read	The scanner resistor temperature (read after train passage), in degrees Fahrenheit, recorded by the wheel scanner on a given raiiside. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the Hotwheel option on the Equipment submenu.
Resistor Req	The resistor temperature, in degrees Fahrenheit, required by the wheel scanner on a given raiiside to avoid a Cold Wheel Scanner Resistor alarm. This value was calculated using the amount of time the shutters were open and the Resistor Test Mode option in effect at the time the train exits the site. If the Resistor Test Mode option is <u>disabled</u> , a zero appears in this field. This field only appears when Hotwheel alarm reporting is <u>enabled</u> using the Hotwheel option on the Equipment submenu.
	<p>One of five uppercase letters follows the Resistor Req temperature.</p> <ul style="list-style-type: none"> <li><b>B</b> The baseline resistor integrity test method was used for this train.</li> <li><b>D</b> The resistor integrity test (that is, the Resistor Test Mode option) was disabled by the user.</li> <li><b>I</b> The interim resistor integrity test method was used for this train.</li> <li><b>T</b> For this train, the shutters were open for less than 30 seconds.</li> <li><b>V</b> For this train, the battery voltage (measured with the shutters open) was less than 13 volts.</li> </ul> <p>For <b>D</b>, <b>T</b>, and <b>V</b>, the required resistor heat is set to zero (that is, a zero appears in the Resistor Read field). A <b>T</b> or <b>V</b> indicates that the integrity test was not performed due to low voltage or insufficient shutter open time, which could result in an invalid resistor integrity test if it was performed.</p>
AEI System Data	The number of AEI tags read (by antenna0 and antenna1) and the total number of tags stored for the train. Where both tags of a tag pair are operational, each antenna will read one tag of the pair. The total number of tags stored represents the number of tag pairs found plus those single tags that lack a match. This heading and the columns under it appear only when the AEI subsystem is <u>enabled</u> using the AEI option on the Equipment submenu.
Firmware Versions	The version numbers of the firmware and their release dates, which are in mm/dd/yy format. This firmware resides on the Processor board (2300-100).

The table below lists the fields from the system-events section and the contents of each field.

Heading	Contents of Field
System Alarms	Lists any System Alarms and Integrity Failures detected at the time the train passed the site. If none were detected, this header is followed by the word "none." <b>Appendix A - System Alarms</b> describes the conditions and events that the system flags as System Alarms. <b>Appendix B - Integrity Failures</b> describes the conditions and events that the system flags as Integrity Failures.
Axle Alarm Summary	Lists each Exception Alarm found on the train and the axle on which it was found. If none were found, this header is followed by the word "none."

The table below lists the fields from the detail section and the contents of each field.

Heading	Contents of Field
Car	The car number as determined by the firmware.
Axle	The axle number.
Trk	The truck number. Each railroad vehicle has two or more trucks (that is, wheel assemblies). The trucks are numbered, starting with 0, and increasing from the beginning of the train to the end. Each axle record is associated with one of these trucks. The axles are assigned the number of the truck with which they've been associated. These assigned truck numbers appear in this field. If the Hotwheel option on the Equipment submenu is <u>enabled</u> , this field doesn't appear.
Rail	Under this heading are two columns, one for each bearing scanner, containing the temperature read by the bearing scanners. If the track orientation is east and west, rails are north and south. If the track orientation is north and south, rails are east and west. If the Hotwheel option on the Equipment submenu is <u>disabled</u> , the word "Rail" doesn't appear, but the two columns do.
Wheel	Under this heading are two columns, one for each wheel scanner, containing the temperature read by the wheel scanners. If the track orientation is east and west, rails are north and south. If the track orientation is north and south, rails are east and west. This heading and the two columns under it appear only when the Hotwheel option on the Equipment submenu is <u>enabled</u> .
ON	The number of milliseconds a bearing was scanned.
OFF	The number of milliseconds between axles (when no axle was between the gating transducers).
PW1	The recorded width of the pulse generated by gating transducer TO1. There is no fixed value for the pulse widths. Slower trains generate wider pulse widths (that is, they generate larger values) than faster moving trains.
PW2	The recorded width of the pulse generated by gating transducer TO2. There is no fixed value for the pulse widths. Slower trains generate wider pulse widths (that is, they generate larger values) than faster moving trains.
Alarms	Any Exception Alarm found on the given axle.

To produce the extended Exception Detail report:

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

**Section 3.0 - Serial Interface** tells how to display the Main menu. The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Main Menu
-----
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
F) Last Train
      .
      .
      .
```

- 2 Select the Exception Detail report option.

This prompt appears.

```
Train Number ?
```

- 3 Type the train number.

If you typed a three-digit invalid train number, the Main menu reappears. If you typed a three-digit valid train number, the prompt below appears.

- 4 If you typed one or two digits, press **[ENTER]**.

If you typed a three-digit invalid train number, the Main menu reappears. If you typed a three-digit valid train number, this prompt appears.

```
Abbreviated Listing ?
```

- 5 To produce the extended Exception Detail report, type **N**

The last line of the report reads: "END OF REPORT - Press any key..."

- 6 To return to the Main menu after a report is produced, press any key.

At this time, you can produce another report by typing one of the letters **A** through **H** or **M**.

- 7 When done, close the LOG file.

- 8 To exit the serial interface and return the SmartScanNG system to normal operation, type **X**

## 4.5 Abbreviated Exception Detail Report

The abbreviated Exception Detail report is like the extended Exception Detail report. However, the abbreviated report doesn't display all the recorded axle data. It only displays axle data for:

- The car immediately preceding a car with an alarmed axle.
- The car containing the alarmed axle.
- The car immediately following the car with the alarmed axle.

For example, assume that a train consisted of 3 locomotives and 20 cars, and Exception Alarms were found on cars 3, 10, 15, and 17. The Abbreviated Exception Detail report for this train would only list axle data for cars 2, 3, 4, 9, 10, 11, 14, 15, 16, 17, and 18. These car numbers comprise the alarmed cars themselves and all cars immediately before and immediately after them.

Like the extended Exception Detail report, the abbreviated Exception Detail report is divided into three sections. The header section contains general information about the site (like the MP/KP) and some detail information about the specific train (like the train's exit speed) that passed the site. The detail section contains more detailed information (like the car number) about the specific train. In between these two sections is the system-events section, which contains all System Alarms and Exception Alarms associated with the train.

Below is a sample of part of an abbreviated Exception Detail report when the AEI option, the Carside Slope option, and the Hotwheel option were all disabled at the time the report was requested. The contents of your report will be different.

Southern Technologies Corporation  
Next Generation Detector System  
**EXCEPTION DETAIL - ABBREVIATED**

```
=====
Train#: 321           Speed: 57MPH           MP/KP: 1111.1
Date: 09/16/19       Axles: 86             Track: Single
Time: 08:41          Direction: East         Temperature: + 71F
Length: 1776         Shutter Open: 32          Battery: 13.4v
=====
```

.

.

.

System Alarms

-----

Cold North Resistor

Axle Alarm Summary

-----

6 North Rail Absolute  
27 Dragging Equipment  
28 Dragging Equipment  
37 North Rail Absolute  
105 North Rail Differential

Car	Axle	Trk	North	South	ON	OFF	PW1	PW2	Alarms
-----									
1	1	0	56	21	25	0	6	6	
	2	0	57	21	25	59	6	6	
	3	1	56	21	25	59	8	8	
	4	1	56	21	25	562	5	5	
2	5	3	56	22	25	162	6	6	
	6	3	189	110	25	641	6	6	North Rail Absolute
	7	4	57	22	25	59	6	6	
	8	4	57	22	25	562	6	6	
3	9	5	56	113	25	162	6	6	
	10	5	57	23	25	59	6	6	
	11	6	57	24	25	59	6	6	
	12	6	57	23	25	562	6	6	
6	21	11	56	23	25	162	6	6	
	22	11	57	23	26	58	6	6	
	23	12	57	23	26	561	6	6	
	24	12	57	22	26	58	6	6	
7	25	13	56	22	25	162	6	6	
	26	13	57	21	26	58	6	6	
	27	14	57	22	26	561	6	6	Dragging Equipment
	28	14	57	23	26	58	6	6	Dragging Equipment
8	29	15	56	22	25	162	6	6	
	30	15	57	22	26	58	6	6	

.

.

.

END OF REPORT - Press any key...



To produce the abbreviated Exception Detail report:

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

**Section 3.0 - Serial Interface** tells how to display the Main menu. The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Main Menu
-----
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
F) Last Train
      .
      .
      .
```

- 2 Select the Exception Detail report option.

This prompt appears.

```
Train Number ?
```

- 3 Type the train number.

If you typed a three-digit invalid train number, the Main menu reappears. If you typed a three-digit valid train number, the prompt below appears.

- 4 If you typed one or two digits, press **[ENTER]**.

If you typed a three-digit invalid train number, the Main menu reappears. If you typed a three-digit valid train number, this prompt appears.

```
Abbreviated Listing ?
```

- 5 To produce the abbreviated Exception Detail report, type **Y**

The last line of the report reads: "END OF REPORT - Press any key..."

- 6 To return to the Main menu after a report is produced, press any key.

At this time, you can produce another report by typing one of the letters **A** through **H** or **M**.

- 7 When done, close the LOG file.

- 8 To exit the serial interface and return the SmartScanNG system to normal operation, type **X**

## 4.6 System Status Report

The System Status report contains the system's current setup configuration. Once a SmartScanNG system is set up properly, print this report and keep it in the wayside enclosure for future reference. Should you ever need to set up the system again, you'll have most of the information on this report.

Below is a sample of the top half of a System Status report. The contents of your report will be different.

Southern Technologies Corporation Next Generation Detector System <b>SYSTEM STATUS REPORT</b>			
=====			
Date: 11/29/19	Time: 11:20	Battery: 14.0v	Ambient Temp.: +71F
-----			
MP/KP... 1234.5    Track Dir... N/S    Track..... Single			
Alarm Settings			
-----			
Absolute.....	180	Carside Slope.....	1.31
Differential....	100	Minimum....	47
Hot Wheel.....	334	Cold Rails.....	5
		Cold Rail Temp....	20
Equipment			
-----			
Dragger.....	YES	Gate Distance....	24.0 inches
High Load.....	NO	Clearance Type...	Trip Wire
Wide Load.....	NO	Clearance Mode...	Multiplexed
Carside Slope....	NO	Winter Cycle.....	NO
Hot Wheel.....	NO	Transducer Gain..	Normal
AEI.....	YES	Resistor Test....	Enabled
Short Train Warning	NO		
Default Modem Selected			
Modem Setup Line 1 = +++AT&F			
Modem Setup Line 2 = AT &D0 &E0 &E14 S0=1 V0			
Modem Setup Line 3 = AT E0 X0 \$SB9600 \$MB9600			
Modem Setup Line 4 = AT &E3			
Modem Setup Line 5 = AT &W0			
Messages			
-----			
Axles.....	YES	Speed.....	NO
Temperature.....	YES	Length.....	NO
Slow.....	YES	Power Off.....	YES
Customer Name....	NO	Arrival Message...	NO
Repeat No Defects.	YES	Cars.....	NO
Car ID With Alarm.	NO	Lft/Rt Alrm Ref...	NO
Rebroad DTMF Code.		Request EOT Timer.	10
Announce Cold Rail	YES		
Scanner Calibration Date			
-----			
Rail1...06/04/2019	09:50	Rail2...06/04/2019	09:54
Wheel1...06/04/2019	09:57	Wheel2...06/04/2019	09:59

Below is a sample of the bottom half of a System Status 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.

```

      .
      .
      .

Port Settings
-----
COM1 Tx/Rx Baud 19200/19200 N-8-1
COM2 Tx/Rx Baud 19200/19200 N-8-1
COM3 Tx/Rx Baud 19200/19200 N-8-1
COM4 Tx/Rx Baud 19200/19200 N-8-1

AEI Reader Parameter Menu
-----
ID Separation..... 2 ID's
Consecutive Reads... 2 Reads
Decode As ASCII Tags Disabled

Software Versions                                COP
                                                Resets
-----
Analyzer..... DM1.11-A 01/24/07      1
Comm..... DM2.22-A 01/24/07      1

Resistor Data
-----
VOLTS  DATE      TIME    30    40    50    60    70    80    90   100   110   120 STATUS
-----
RAIL 1
13.8  06/04/19   09:20   37,    9, 300, 297,    3, 180,    5, 300, 300, 300 VALID
RAIL 2
13.8  06/04/19   09:30  300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300 VALID
WHEEL 1
13.8  06/04/19   09:40  300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300 VALID
WHEEL 2
13.8  06/04/19   09:50  300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300, 300 VALID
=====
END OF REPORT - Press any key...

```

The table below lists the fields on the System Status report and the contents of each field.

Heading	Contents of Field
Date	The date at the time this report was generated. Date is in mm/dd/yy format. <b>Section 3.0 - Serial Interface</b> tells how to change this value using the Date and Time submenu.
Time	The time at the time this report was generated. Time is in 24-hour hh:mm format, where 8 a.m. is 08:00, noon is 12:00, 8 p.m. is 20:00, and midnight is 00:00. <b>Section 3.0 - Serial Interface</b> tells how to change this value using the Date and Time submenu.
Battery	The system battery voltage at the time this report was generated.
Ambient Temp	The ambient temperature at the time this report was generated. Temperature is in degrees Fahrenheit.
MP/KP	The five-digit milepost/kilometer post of the site. <b>Section 3.0 - Serial Interface</b> tells how to change this value using the MP/KP submenu (aka Milepost submenu).
Track Dir	The track direction of the site. Valid values are N/S (for north/south) and E/W (for east/west). <b>Section 3.0 - Serial Interface</b> tells how to change this value using the Track Number submenu.
Track	The track designator of the site. For single-track sites, valid value is Single. For multitrack sites, valid values are North, South, East, West, Main 1, Main 2, Main 3, and Middle. <b>Section 3.0 - Serial Interface</b> tells how to change this value using the Track Number submenu.
Alarm Settings	The alarm parameters and limits as they are currently defined in the system setup. <b>Section 3.0 - Serial Interface</b> tells how to change these parameters and limits using the Alarm Limits submenu (aka Alarm Settings submenu).
Equipment	Equipment configuration as currently defined in system setup. <b>Section 3.0 - Serial Interface</b> tells how to change this configuration using the Equipment submenu.
Messages	Message configuration as currently defined in system setup. <b>Section 3.0 - Serial Interface</b> tells how to change this configuration using the Messages submenu.
Scanner Calibration Date	Date and time that each scanner was last calibrated. The autocalibration function maintains these fields.
Port Settings	Communications port parameter settings as currently defined in system setup. These parameters reflect the baud rate and parity settings for each communications port. <b>Serial Interface</b> tells how to change these parameter settings.

Heading	Contents of Field
AEI Reader Parameters	<p>This heading appears when the AEI subsystem is enabled using the AEI option on the Equipment submenu.</p> <p>Below are the AEI Reader Parameters currently defined in the system setup. These values were in place at the time this report was run.</p> <p><b>ID Separation</b> specifies the number of intervening tags that must be read and reported before a given tag is reported again. Valid values are 1, 2, 3, and 4. The default is 2.</p> <p><b>Consecutive Reads</b> specifies the number of times that a tag must be read before it is considered a valid (reportable) tag. Valid values are 1, 2, 3, and 4. The default is 2.</p> <p><b>Decode as ASCII Tags</b> specifies whether the tag data is to be interpreted as ASCII characters or in the AAR encoded format.</p> <p><b>Section 3.0 - Serial Interface</b> tells how to set these values using the AEI Reader Parameters menu.</p>
Software Versions	The version numbers of the firmware and their release dates, which are in mm/dd/yy format. This firmware resides on the Processor board (2300-100).
COP Resets	Number of COP resets occurring since the last time the counters were cleared. The top value is for processor-A (aka Analyzer Processor) on the Processor Board (2300-100). The bottom value is for processor-B (aka Communications Processor) on the same board. <b>Section 3.0 - Serial Interface</b> tells how to clear the counters using the System Functions menu of the Main menu.
Resistor Data	<b>See the explanation below.</b>

For the resistor integrity test that is performed after train passage, there are two methods used to calculate the expected resistor temperature. The baseline resistor integrity test method requires the prerequisite of valid resistor baseline data to be stored in nonvolatile memory. Until the system acquires this data, it applies the interim resistor integrity test method to each train. The resistor data used in the baseline resistor integrity test method appears at the bottom of the System Status report, as shown below.

Resistor Data													
VOLTS	DATE	TIME	30	40	50	60	70	80	90	100	110	120	STATUS
RAIL 1													
13.4	03/08/19	13:39	103,	130,	152,	168,	183,	195,	204,	211,	217,	223	VALID
RAIL 2													
13.5	03/09/19	08:50	76,	92,	104,	111,	118,	123,	127,	130,	132,	134	VALID

Included in the data above is a resistor heat profile of each scanner resistor, which covers a period of 30 to 120 seconds, in 10-second intervals. The differences in resistor heat between the two scanners are due to the cable lengths used in this example. A 65-foot (19.8-meter) cable for the RAIL-1 bearing scanner and a 100-foot (30.5-meter) cable for the RAIL-2 bearing scanner. Additional items in the data are the battery voltage measured with the shutters open, the date and time of the data acquisition, and the status of the heat profile data.

In this example, the status of both sets of resistor data is valid. Meaning they are being used in the baseline integrity test for each train. There are two other possibilities for status, pending and invalid. If the word PENDING appears in the status column, the system is waiting for the resistors to cool before acquiring resistor data or for the battery to charge to 13.8 volts. INVALID indicates that the system has tried twice and could not acquire valid resistor data. In either case, the system applies the interim integrity test to passing trains, which doesn't require resistor baseline data.

The system acquires the resistor data 20 minutes after the user calibrates the scanners with the autocalibration function. The resistor data acquisition runs unattended. Twenty minutes is the cooling period required to allow the resistors to return to ambient temperature after autocalibration. If a train should interrupt the cooling period, the resistor data acquisition runs 20 minutes after the shutters close following the passage of the train.

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

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

After the resistor cooling period:

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

To produce a System Status report:

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

**Section 3.0 - Serial Interface** tells how to display the Main menu. The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Main Menu
-----
```

```
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
F) Last Train
G) Last Test Train
H) AEI Diagnostic Detail
I) Replay EOT Announcement
J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
?
```

- 2 Select the System Status report option.

The last line of the report reads: "END OF REPORT - Press any key..."

- 3 To return to the Main menu, press any key.

At this time, you can produce another report by typing one of the letters **A** through **H** or **M**.

- 4 When done, close the LOG file.

- 5 To exit the serial interface and return the SmartScanNG system to normal operation, type **X**

## 4.7 Last Train Report

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

To produce a Last Train report:

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

**Section 3.0 - Serial Interface** tells how to display the Main menu. The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Main Menu
-----
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
F) Last Train
G) Last Test Train
H) AEI Diagnostic Detail
I) Replay EOT Announcement
J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
?
```

- 2 Select the Last Train report option.

The last line of the report reads: "END OF REPORT - Press any key..."

- 3 To return to the Main menu, press any key.

At this time, you can produce another report by typing one of the letters **A** through **H** or **M**.

- 4 When done, close the LOG file.
- 5 To exit the serial interface and return the SmartScanNG system to normal operation, type **X**.



## 4.8 Last Test Train Report

The Last Test Train report is identical to the Train Detail report. The only difference is the way you specify which train you want reported. In this version of the report, you don't have to specify a train. The most current test train (aka ramp train) is produced.

To produce a Last Test Train report:

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

**Section 3.0 - Serial Interface** tells how to display the Main menu. The Main menu looks like this.

```
      .
      .
      .
E) System Status
F) Last Train
G) Last Test Train
H) AEI Diagnostic Detail
I) Replay EOT Announcement
J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
?
```

- 2 Select the Last Test Train report option.

The last line of the report reads: "END OF REPORT - Press any key..."

- 3 To return to the Main menu, press any key.

At this time, you can produce another report by typing one of the letters **A** through **H** or **M**.

- 4 When done, close the LOG file.

- 5 To exit the serial interface and return the SmartScanNG system to normal operation, type **X**

## 4.9 AEI Diagnostic Detail Report

The AEI Diagnostic Detail report provides detailed information on a single train. It contains information that can be useful in troubleshooting AEI related problems. When choosing this report, you'll be prompted for a train number. When prompted, type a train number from the Train Summary report. The train number appears under the column titled "Train#" in the detail section of that report.

Carside Slope alarm detection is enabled or disabled using the Carside Slope option on the Equipment submenu. Hotwheel alarm reporting is enabled/disabled using the Hotwheel option on the Equipment submenu. The AEI subsystem is enabled or disabled using the AEI option on the Equipment submenu.

Where wheel scanners are properly installed, wheel temperatures are always recorded, even if the Hotwheel option is disabled. On the other hand, if the AEI option is disabled during train passage, no AEI information is recorded. If the Carside Slope option is disabled during train passage, no Carside Slope alarms are generated. But, if it is enabled at the time a report is requested, a carside-slope alarm-limit line is generated for each car of the train.

Below is a sample of part of an AEI Diagnostic Detail report when both the AEI option and the Hotwheel option on the Equipment submenu were enabled at the time the report was requested. The Carside Slope option on the Equipment submenu was disabled. Also, both the AEI and Hotwheel options were enabled while the specified train was passing the site. 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  
Next Generation Detector System

**TRAIN DETAIL**

```
=====
Train#: 321                      Speed: 48 KPH                      MP/KP: 1234.5
Date: 08/04/19                  Axles: 52                      Track: Single
Time: 08:26                     Direction: South                Temperature: + 21C
Length: 1013 m                  Shuttters Open: 36 sec          Battery: 14.2v
=====
```

```
=====
Resistor
Rail Max Avg Read Req Txdr Counts Alarm Limit Carside ParmS
-----
East 258 16 46 58I TO1 52 Absolute 180 Slope: 1.60
West 252 18 46 58I TO2 52 Differential 130 Minimum: 130
Hot Wheel 652
Resistor Test Mode: Reduced Cold Rail Temp 10
=====
```

```
=====
Resistor
Wheel Max Avg Read Req
-----
East 10 10 49 58I
West 14 14 48 58I
=====
```

=====

AEI System Data

Tags Read Tags Stored: 11

Antenna 0: 12

Antenna 1: 0

=====

Firmware Versions

Analyzer: DM1.11-A 01/24/07 Comm: DM2.22-A 01/24/07

-----

System Alarms

Cold East Resistor  
Cold West Resistor  
Successive Cold Resistors Exceeded  
Integrity Failure

Axle Alarm Summary

```
-----
14 East Rail Absolute TTEX 354063 R2, B End Leading
16 West Rail Absolute TTEX 354063 L4, B End Leading
-----
```

```
-----
Bearing Wheel
Car Axle East West East West ON OFF PW1 PW2 Alarms
-----
1 6 1 B 0 0 0 0 0 E ST:000985 ET:001713 0
6 L? 5 XYZ 8440 0 P0 001568|000000 001|000 70
-----
1 1 4 4 10 14 104 0 133 86 XYZ 8440 B End Leading
2 4 4 10 14 100 103 82 84
3 4 4 10 14 99 95 72 83
4 5 5 10 14 101 95 79 83
5 4 4 10 14 95 99 77 81
6 4 4 10 14 110 94 96 74
-----
2 6 1 B 0 0 0 0 0 S ST:002855 ET:005041 0
6 L? 5 XYZ 6064 0 P0 004652|000000 001|000 70
-----
2 7 4 4 10 14 101 108 84 88 XYZ 6064 A End Leading
8 4 4 10 14 100 102 83 85
-----
.
.
.
-----
```

Like the Train Detail report, the AEI Diagnostic Detail report is divided into three sections. The header section contains general information about the site (like the MP/KP) and some detail information about the specific train (like the train's exit speed) that passed the site. The detail section contains more detailed information (like the car number) about the specific train. In between these two sections is the system-events section, which contains all System Alarms and Exception Alarms associated with the train.

Unlike the Train Detail report, the AEI Diagnostic Detail report has an additional two lines per car. Below is part of the sample AEI Diagnostic Detail report that dealt specifically with AEI diagnostic data. These two lines are representative of similar lines added for each vehicle in the consist.

1	6	1	B	0	0	0	0	0	E	ST:000985	ET:001713	0	<- Vehicle related data
6	L?	5	XYZ	8440	0	P0	001568	000000	001 000	70	<- Tag related data		

The first line above contains data that is associated with the vehicle that consists of the axle records that follow. The second line shown contains data that is related to an AEI tag that has been associated with the vehicle.

The table below defines the relevant fields in line one (vehicle related data).

Field Value	Field Definition	AAR Format Only
1	Vehicle number – the standing order number of the associated vehicle in relation to the consist.	No
6	Axle count – the number of axles recorded for the vehicle.	No
1	Tag count – the number of AEI tag records associated with the vehicle.	No
B	The orientation of the vehicle in the consist – <b>A</b> -end or <b>B</b> -end forward.	Yes
0 0 0 0 0	<i>Reserved for future diagnostics development.</i>	-----
E	The direction the vehicle traveled.	No
ST:000985	Vehicle starting timestamp – the timer starts when train presence is detected.	No
ET:001713	Vehicle ending timestamp.	No

The table below defines the relevant fields in line two (tag related data). For those items that contain "Yes" in the last column, when ASCII format AEI tags are being used, these fields aren't available from the tags or cannot be determined due to unavailable tag data. In reference to the track, **antenna0** is the northmost or eastmost antenna. **Antenna1** is the southmost or westmost antenna.

Field Value	Field Definition	AAR Format Only
6	Axle count – from tag data.	Yes
L	Tag pair read indicator – <b>L</b> = left tag missing, <b>R</b> = right tag missing <b>G</b> = both tags present.	Yes
?	<i>Reserved for future diagnostics development.</i>	-----
5	Equipment Group Code from tag data.	Yes
XYZ 8440	AEI vehicle identification.	No
0	<i>Reserved for future diagnostics development.</i>	-----
P0	Platform code – from tag data.	Yes
001568	Antenna0 tag read timestamp – in milliseconds from start of train.	No
000000	Antenna1 tag read timestamp – in milliseconds from start of train.	No
001	Antenna0 tag read "handshakes" – the number of times a tag was read.	No
000	Antenna1 tag read "handshakes" – the number of times a tag was read.	No
70	Vehicle length – from tag data.	Yes

To produce an AEI Diagnostic Detail report:

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

**Section 3.0 - Serial Interface** tells how to display the Main menu. The Main menu looks like this.

```
      .
      .
      .
F) Last Train
G) Last Test Train
H) AEI Diagnostic Detail
I) Replay EOT Announcement
J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
?
```

- 2 Select the AEI Diagnostic Detail report option.

This prompt appears.

```
Train Number ?
```

- 3 Type the train number.

If you typed a three-digit invalid train number, the Main menu reappears. If you typed a three-digit valid train number, a report for that train is produced. The last line of the report reads: "END OF REPORT - Press any key..."

- 4 If you typed one or two digits, press **[Enter]**.

If you typed an invalid train number, pressing **[Enter]** causes the Main menu to reappear. If the typed train number is valid, pressing **[Enter]** produces a report for it. The last line of the report reads: "END OF REPORT - Press any key..."

- 5 To return to the Main menu after a report is produced, press any key.

At this time, you can produce another report by typing one of the letters **A** through **G** or **M**.

- 6 When done, close the LOG file.

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

## 4.10 Event Log Report

The Event Log report is used for diagnostics. As certain system events occur, entries are posted into the event log. Each time an entry is made into this log, it receives an event number, the date and time that the event was recorded, and an event description.

The entries are stored in a section of SRAM that can hold up to 300 separate entries. Each time an event is recorded which exceeds this maximum, the new one overwrites the oldest recorded event. The entries are saved during a power outage, but can be deleted with the Clear Event Log option on System Functions menu. Producing the report at this time produces a "No Events" message. If events have been recorded and not cleared, they're listed in chronological order, beginning with the most recently recorded event.

Below is a sample of an Event Log report containing no events. The date/time at the top of the report is the system date/time at the time the report was generated. The contents of your report may be different.

```
Southern Technologies Corporation                                Event Log

                                06/07/2019
                                13:39:02
=====
No Events!

----- End of Report -----
```

Below is a sample of part of an Event Log report containing some events. The contents of your report will be different. The date/time at the top of the report is the system date/time at the time the report was generated. Each line of text (that is, each event) contains these fields.

- The sequential number assigned to the event as it was generated
- The date at which the event was recorded (date is in mm/dd/yy format)
- The time at which the event was recorded (time is in 24-hour hh:mm:ss 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)
- The event description

```
Southern Technologies Corporation                                Event Log

                                09/07/2019
                                10:08:02
=====
42 06/05/19 13:36:20 <Train Stored>
41 06/05/19 13:36:17 <Store Train #118>
40 05/30/19 19:18:47 <Excep. Train Stored>
49 05/30/19 19:18:43 <Store Excep. Train #105>

                                .
                                .
                                .

----- End of Report -----
```

To produce an Event Log report:

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

**Section 3.0 - Serial Interface** tells how to display the Main menu. The Main menu looks like this.

```
      .  
      .  
      .  
K) Enter Pass-Thru Mode  
L) System Functions  
M) Event Log  
X) Exit  
?  

```

- 2 Select the Event Log report option.

At this time, you can produce another report by typing one of the letters **A** through **G** or **M**.

- 3 When done, close the LOG file.
- 4 To exit the serial interface and return the SmartScanNG system to normal operation, type **X**



## 5.0 Radio Announcements

---

Currently, the two ways of reporting defects are:

- Announcements made via the road channel
- Reports, which may be printed to provide detailed defect information

This section describes radio announcements. The prior section describes reports.

Radio announcements consist of a set of predefined spoken messages with each message triggered by a particular event or set of events. The message formats and announcement criteria are covered below.

In the examples that follow, the use of the abbreviation SITE is for example purposes only. There is no railroad named SITE. In the actual announcement, SITE will normally be replaced with the customer's railroad name. In the examples that follow, the message "S-I-T-E Detector" is announced because it was enabled using the **Announce Customer Name option** on the Messages submenu. Not all systems have this option. If your system doesn't have it, sometimes just the word "Detector" is announced instead of a customer's railroad name.

Each SmartScanNG system has a priority level assigned to it, based on the setting of the Track Number submenu. Associated with these priorities are two timers, as shown below.

Track Designator	Priority	Broadcast Delay	Maximum Holdoff
Single	1	3 sec	50 sec
Main 1	1	3 sec	50 sec
Main 2	2	5 sec	60 sec
Main 3	3	7 sec	70 sec
North	4	9 sec	80 sec
East	4	9 sec	80 sec
South	5	11 sec	90 sec
West	5	11 sec	90 sec
Middle	6	13 sec	100 sec

**Broadcast Delay** is the amount of time a given SmartScanNG system delays the broadcasting of a message, after it has detected an inactive Holdoff input. **Maximum Holdoff** is the maximum amount of time a given SmartScanNG system delays broadcasting a message while waiting for the holdoff input to clear. If this timeout period expires and the holdoff input remains active, the detector will broadcast its pending message anyway.

Anytime a message needs to be announced, the expanded holdoff logic kicks in, and the process is as follows:

- 1 Start the Broadcast Delay timer and wait until it expires.  
The Holdoff line is enabled when the road channel is busy.
- 2 Check the Holdoff line.
- 3 If the Holdoff line is free, announce your messages and skip the remaining steps.
- 4 If the Holdoff line is currently in use, start the Holdoff timer and begin monitoring the Holdoff line.
- 5 If the Holdoff line becomes free (that is, if the Holdoff line frees up before the Holdoff timer expires), return to step 1.
- 6 If the Holdoff timer expires (that is, if the Holdoff timer expires without the Holdoff line ever becoming free), announce your messages.

## 5.1 Arrival Messages

The arrival message is used to announce train arrival at the site. This message isn't available on all systems. On those systems on which it is available, it's optional. If it is available on your system, enable or disable it using the **Announce Train Arrival option** on the Messages submenu. The format of this announcement is:

[customer name] Milepost (mile) [track indicator]

At a multitrack site, "track indicator" represents the position in the message text that the track designator (such as "East Track") is inserted into the announcements. At a single-track site, no message text is inserted for track indicator.

For example, at a single-track site, the announcement is like this.

S-I-T-E Detector  
Milepost 3-5-9 point 4

At a multitrack site, the announcement is like this.

S-I-T-E Detector  
Milepost 2-9-7 Point 1  
South Track

The arrival message is only announced once per train.

## 5.2 Real-Time Messages

Real-time messages consist of announcements that occur as the train is passing over the site. No matter what kind of defect was detected, there is only one format for this announcement and it is:

[customer name] Milepost (mile) [track indicator] You Have A Defect

For example, at a single-track site, the announcement is like this. In this example, milepost 321.4 was used.

S-I-T-E Detector  
Milepost 3-2-1 Point 4  
You Have A Defect

At a multitrack site, the announcement is like this. In this example, milepost 5472.9 was used.

S-I-T-E Detector  
Milepost 5-4-7-2 Point 9  
South Track  
You Have A Defect

No matter how many defects are found, the real-time message is only announced once per train.

## 5.3 Post-Train Messages

Post-train (that is, end-of-train) announcements are given after the train has left the site and all the recorded train data has been processed by the SmartScanNG system.

These messages consist of four distinct scenarios, each with its own spoken message. The scenarios are:

- Exception Alarms not detected and Integrity Failures not detected
- Exception Alarms not detected and Integrity Failures detected
- Exception Alarms detected and Integrity Failures not detected
- Exception Alarms detected and Integrity Failures detected

**Exception Alarms** are associated with axles. When the **Clearance Mode option** on the Messages submenu is set to separate, there are eight Exception Alarms. They are the Absolute, Carside Slope, Differential, Dragging-Equipment, **High-Load**, Hotwheel, Pyrometer Saturation, and **Wide-Load** alarms. When the **Clearance Mode option** is set to multiplexed, there are seven Exception Alarms. They are the Absolute, Carside Slope, Differential, Dragging-Equipment, **High-Wide**, Hotwheel, and Pyrometer Saturation alarms.

The four types of Hotbox alarms are Absolute alarms, Differential alarms, Pyrometer Saturation alarms, and Carside Slope alarms. When one of these four alarms occurs, a Hotbox alarm is announced. The system only announces Dragging-Equipment, High-Load, High-Wide, Hotbox, Hotwheel, and Wide-Load.

**Integrity Failures** are the Dead Battery, Dead Resistor, Dead Wheel Scanner Resistor, Stuck Dragger During Train Passage, Stuck Dragger Pretrain, Stuck High-Load Detector Pretrain, Stuck Wide-Load Detector Pretrain, Successive Cold Rails Exceeded, Successive Cold Resistors Exceeded, Successive Cold Wheel Resistors Exceeded, Successive Cold Wheels Exceeded, and sometimes Highrange Transducer Miscounts alarms.

Below is the Messages submenu. The options on this submenu affect the phrases broadcast to a passing train or are used to modify the parameters associated with the rebroadcast function.

Messages, MP/KP-1234.5, Track-Single		
-----		
A	Axles.....	YES
B	Speed.....	NO
C	Temperature.....	YES
D	Length.....	NO
E	Slow.....	YES
F	Power Off.....	YES
G	Repeat No Defects.....	YES
H	Cars Count .....	NO
I	Customer Name.....	YES
J	Arrival Message.....	YES
K	Lft/Rt Alarm Ref.....	YES
L	Car ID With Alarm.....	NO
M	Request EOT Timer.....	10
N	Rebroad DTMF Code.....	999
O	Announce Cold Rail.....	NO
P	Integrity Failure.....	NO
Q	No Defects.....	NO
Message to change or Esc to quit ?		

The ancillary messages are generated by enabling one or more of these options: A (axle count), B (train speed), C (site ambient temperature), D (train length), E (slow train), F (power off), and H (number of cars). The other options of the Messages submenu aren't used to generate ancillary messages.

In the examples that follow, not all ancillary messages are shown. This is because only axle count and train speed were enabled. Site ambient temperature, train length, number of cars, power off, and slow train were disabled. **Section 3.0 - Serial Interface** tells how to enable and disable these messages using the Messages submenu.

When the Highrange Transducer Miscounts alarm or Very Slow Train alarm occurs, the system won't announce axle count, train speed, train length, or number of cars (even if these messages are enabled).

### 5.3.1 Nothing Detected

When neither an Exception Alarm nor an Integrity Failure is detected and the **Announce No Defects option** on the Messages submenu is enabled, the no-defect message is announced. If you disable this option, nothing is announced when nothing was detected. However, some systems don't have this option. In this case, when neither an Exception Alarm nor an Integrity Failure is detected, the no-defect message is always announced. If the **Repeat No Defects option** on the Messages submenu is disabled, the format of this announcement is:

[customer name] Milepost (mile) [track indicator] [speed indicator]  
No Defects  
[other ancillary messages] Detector Out

If the **Repeat No Defects option** is enabled, the format of this announcement is:

[customer name] Milepost (mile) [track indicator] [speed indicator]  
No Defects  
Repeat No Defects  
[other ancillary messages] Detector Out

For example, at a single-track site when the **Repeat No Defects option** is disabled and the **Announce No Defects option** on the Messages submenu is enabled, the announcement is like this.

S-I-T-E Detector  
Milepost 3-2-1 Point 4  
Speed 4-5  
No Defects  
Total Axles 9-8  
Detector Out

At a single-track site when the **Repeat No Defects option** is enabled and the **Announce No Defects option** on the Messages submenu is enabled, the announcement is like this.

S-I-T-E Detector  
Milepost 3-2-1 Point 4  
Speed 4-5  
No Defects  
Repeat No Defects  
Total Axles 9-8  
Detector Out

At a multitrack site when the **Repeat No Defects option** is enabled and the **Announce No Defects option** on the Messages submenu is enabled, the announcement is like this.

S-I-T-E Detector  
Milepost 3-9-9 Point 1  
South Track  
Speed 5-3  
No Defects  
Repeat No Defects  
Total Axles 1-6-2  
Detector Out

### 5.3.2 Only an Integrity Failure Detected

Integrity failures are caused when the system determines that a condition exists that could prevent proper scanning of a train. They indicate an unusual operating condition that may require train stoppage, later maintenance, or both. Integrity failures appear in the header of Train Detail reports and Exception Detail reports. **Section 4.0 - Producing Reports** tells how to produce these reports. **Appendix B - Integrity Failures** describes the conditions and events that the SmartScanNG system flags as Integrity Failures.

If the **Announce Integrity Failure option** on the Messages submenu is disabled when no Exception Alarms are detected but an Integrity Failure is detected, nothing is announced. If the **Announce Integrity Failure option** is enabled when no Exception Alarms are detected but an Integrity Failure is detected, only Integrity Failure is announced. If your system doesn't have this option when only an Integrity Failure is detected, Integrity Failure is announced.

The format of this announcement is:

[customer name] Milepost (mile) [track indicator]  
[ancillary messages] Integrity Failure  
(a pause)  
[customer name] Milepost (mile) [track indicator]  
[ancillary messages] Integrity Failure Detector Out

For example, at a double-track site, the announcement is like this.

S-I-T-E Detector  
Milepost 3-9-9 Point 1  
South Track  
Speed 5-3  
Total Axles 9-2  
Integrity Failure  
*(a pause)*  
S-I-T-E Detector  
Milepost 3-9-9 Point 1  
South Track  
Speed 5-3  
Total Axles 9-2  
Integrity Failure  
Detector Out

### 5.3.3 Only Exception Alarms Detected

When one or more Exception Alarms are detected and an Integrity Failure isn't detected, the alarms are announced. The format of this announcement is:

[customer name] Milepost (mile) [track indicator] [speed indicator]  
[alarm announcements] [other ancillary messages] [excessive-alarms indicator]  
*(a pause)*  
[customer name] Milepost (mile) [track indicator] [speed indicator]  
[alarm announcements] [other ancillary messages] [excessive-alarms indicator]  
Detector Out

Per train, only the first four Hotbox alarms and first four Hotwheel alarms are ever announced. Per train, only the first eight alarms are announced. When Excessive Alarms is announced, the train had more than four Hotbox alarms, more than four Hotwheel alarms, or more than eight Exception Alarms. When a system broadcasts the "Excessive Alarms" phrase for a train, the Excessive Alarms alarm will appear on a detail report for that train.

Hotwheel alarms use the same general format as Hotbox alarms. High-Load, High-Wide, and Wide-Load alarms use the same general format as Dragging-Equipment alarms.

The **Clearance Type option** on the Equipment submenu is either trip wire or light beam. This option is only used for high-load detectors and wide-load detectors. Both high-load detectors and wide-load detectors must be either trip-wire detectors or light-beam detectors.

When a wide-load detector is configured for trip-wire operation, the system only records one Wide-Load alarm, regardless of the wide-load signal status. This is because you can only break a wire once.

When it is configured for light-beam operation, the system records every Wide-Load alarm that occurs. However, the system won't flag Wide-Load alarms on consecutive axles. At least one unalarmed axle must separate the alarmed axles. Regardless of the number of detected Wide-Load alarms, the system only announces a maximum of two.

When a high-load detector is configured for trip-wire operation, the system only records one High-Load alarm, regardless of the high-load signal status. This is because you can only break a wire once.

When it is configured for light-beam operation, the system records every High-Load alarm that occurs. However, the system won't flag High-Load alarms on consecutive axles. At least one unalarmed axle must separate the alarmed axles. Regardless of the number of detected High-Load alarms, the system only announces a maximum of two.

The **Clearance Mode option** on the Equipment submenu is either separate or multiplexed. This option is only used for high-load detectors and wide-load detectors. When this option is set to separate, the alarms coming from the high-load detectors are announced as High-Load alarms and the alarms coming from the wide-load detectors are announced as Wide-Load alarms. When this option is set to multiplexed, the alarms coming from the high-load detectors and wide-load detectors are announced as High-Wide alarms.

The **Announce Car Identification option** on the Messages submenu shows whether car-identification information is to be announced (YES) or not announced (NO). When this option is set to YES and an Exception Alarm is found on a car, the car-identification information is announced right after the Exception Alarm is announced during the second pass through the end-of-train message. This, of course, will only happen if the **AEI option** on the Equipment submenu is enabled (YES) and the AEI subsystem is functioning properly during train passage. In the examples that follow, the **Announce Car Identification option** was set to NO.

The **Announce Left-Right Alarm Reference option** on the Messages submenu shows whether the alarm reference is announced as left or right (YES) or north, south, east, or west (NO). In the examples that follow, this option was set to YES.



For example, at a single-track site having one Hotbox alarm and no Integrity Failure, the announcement is like this. This example assumes that the Announce Left-Right Alarm Reference option on the Messages submenu was enabled.

S-I-T-E Detector  
Milepost 3-2-1 Point 4  
Speed 4-5  
Hotbox Left-Side Axle-7-5  
Total Axles 9-8  
*(a pause)*  
S-I-T-E Detector  
Milepost 3-2-1 Point 4  
Speed 4-5  
Hotbox Left-Side Axle-7-5  
Total Axles 9-8  
Detector Out

At a double-track site having one Dragging-Equipment alarm and no Integrity Failure, the announcement is like this. This example makes no assumption as to whether the Announce Left-Right Alarm Reference option was disabled or enabled. Either will result in the following.

S-I-T-E Detector  
Milepost 3-9-9 Point 1  
South Track  
Speed 4-5  
Dragging-Equipment Near-Axle-8-4  
Total Axles 8-8  
*(a pause)*  
S-I-T-E Detector  
Milepost 3-9-9 Point 1  
South Track  
Speed 4-5  
Dragging-Equipment Near-Axle-8-4  
Total Axles 8-8  
Detector Out

At a single-track site having two Hotbox alarms and no Integrity Failure, the announcement is like this. This example assumes that the Announce Left-Right Alarm Reference option was enabled.

S-I-T-E Detector  
Milepost 3-2-1 Point 4  
Speed 4-5  
First-Hotbox Left-Side Axle-7-5  
Second-Hotbox Left-Side Axle-8-0  
Total Axles 9-0  
(a pause)  
S-I-T-E Detector  
Milepost 3-2-1 Point 4  
Speed 4-5  
First-Hotbox Left-Side Axle-7-5  
Second-Hotbox Left-Side Axle-8-0  
Total Axles 9-0  
Detector Out

The post-train announcement for a detected Hotwheel alarm uses the same general format: "First-Hotwheel Left-Side Axle-7-5."

At a single-track site having two Dragging-Equipment alarms and no Integrity Failure, the announcement is like this.

S-I-T-E Detector  
Milepost 3-2-1 Point 4  
Speed 5-7  
First-Dragging-Equipment Near-Axle-8-4  
Second-Dragging-Equipment Near-Axle-8-8  
Total Axles 1-0-8  
(a pause)  
S-I-T-E Detector  
Milepost 3-2-1 Point 4  
Speed 5-7  
First-Dragging-Equipment Near-Axle-8-4  
Second-Dragging-Equipment Near-Axle-8-8  
Total Axles 1-0-8  
Detector Out

At a single-track site having one Hotbox alarm, one Dragging-Equipment alarm, and no Integrity Failure, the announcement is like this.

S-I-T-E Detector  
Milepost 3-2-1 Point 4  
Speed 4-5  
Hotbox Left-Side Axle-7-5  
Dragging-Equipment Near-Axle-8-4  
Total Axles 9-8  
(a pause)  
S-I-T-E Detector  
Milepost 3-2-1 Point 4  
Speed 4-5  
Hotbox Left-Side Axle-7-5  
Dragging-Equipment Near-Axle-8-4  
Total Axles 9-8  
Detector Out

At a single-track site having three or more Dragging-Equipment alarms and no Integrity Failure, the announcement is like this.

S-I-T-E Detector  
Milepost 3-2-1 Point 4  
Speed 4-5  
First-Dragging-Equipment Near-Axle-1-2  
Second-Dragging-Equipment Near-Axle-3-4  
Total Axles 9-8  
Excessive Alarms  
(a pause)  
S-I-T-E Detector  
Milepost 3-2-1 Point 4  
Speed 4-5  
First-Dragging-Equipment Near-Axle-1-2  
Second-Dragging-Equipment Near-Axle-3-4  
Total Axles 9-8  
Excessive Alarms  
Detector Out

Per train, only the first two Dragging-Equipment alarms are ever announced. Per train, only the first four Hotbox alarms or Hotwheel alarms are ever announced.

### 5.3.4 Both Exception Alarms and an Integrity Failure Detected

If the **Announce Integrity Failure option** on the Messages submenu is disabled when one or more alarm conditions and an Integrity Failure are detected, only the alarm conditions are announced. The format of this announcement is:

[customer name] Milepost (mile) [track indicator] [speed indicator]  
[alarm announcements] [ancillary messages] [excessive-alarms indicator]  
(a pause)  
[customer name] Milepost (mile) [track indicator] [speed indicator]  
[alarm announcements] [ancillary messages] [excessive-alarms indicator] Detector Out

If the **Announce Integrity Failure option** is enabled when one or more alarm conditions and an Integrity Failure are detected, both are announced. The format of this announcement is:

[customer name] Milepost (mile) [track indicator] [speed indicator]  
[alarm announcements] [ancillary messages] Integrity Failure [excessive-alarms indicator]  
(a pause)  
[customer name] Milepost (mile) [track indicator] [speed indicator]  
[alarm announcements] [ancillary messages] Integrity Failure [excessive-alarms indicator]  
Detector Out

For the rest of the examples in this section, the **Announce Integrity Failure option** and the **Announce Left-Right Alarm Reference option** were set to YES. And, the **Announce Car Identification option** was set to NO. **Section 3.0 - Serial Interface** tells how to change these options.

For example, at a single-track site having one Hotbox alarm and an Integrity Failure, the announcement is like this.

S-I-T-E Detector  
Milepost 3-2-1 Point 4  
Speed 6-0  
Hotbox Right-Side Axle-7-5  
Total Axles 9-8  
Integrity Failure  
(a pause)  
S-I-T-E Detector  
Milepost 3-2-1 Point 4  
Speed 6-0  
Hotbox Right-Side Axle-7-5  
Total Axles 9-8  
Integrity Failure  
Detector Out

At a double-track site having one Dragging-Equipment alarm and an Integrity Failure, the announcement is like this.

S-I-T-E Detector  
Milepost 3-9-9 Point 1  
North Track  
Speed 5-7  
Dragging-Equipment Near-Axle-2-4  
Total Axles 8-6  
Integrity Failure  
*(a pause)*  
S-I-T-E Detector  
Milepost 3-9-9 Point 1  
North Track  
Speed 5-7  
Dragging-Equipment Near-Axle-2-4  
Total Axles 8-6  
Integrity Failure  
Detector Out

At a single-track site having three or more Dragging-Equipment alarms and an Integrity Failure, the announcement is like this.

S-I-T-E Detector  
Milepost 3-2-1 Point 4  
Speed 4-5  
First-Dragging-Equipment Near-Axle-1-2  
Second-Dragging-Equipment Near-Axle-3-4  
Total Axles 9-8  
Integrity Failure  
Excessive Alarms  
*(a pause)*  
S-I-T-E Detector  
Milepost 3-2-1 Point 4  
Speed 4-5  
First-Dragging-Equipment Near-Axle-1-2  
Second-Dragging-Equipment Near-Axle-3-4  
Total Axles 9-8  
Integrity Failure  
Excessive Alarms  
Detector Out

At a single-track site having one Hotbox alarm, six Dragging-Equipment alarms, and an Integrity Failure, the announcement is like this.

S-I-T-E Detector  
Milepost 3-2-1 Point 4  
Speed 5-4  
First-Dragging-Equipment Near-Axle-2-1  
Second-Dragging-Equipment Near-Axle-2-9  
Hotbox Left-Side Axle-7-5  
Total Axles 1-0-8  
Integrity Failure  
Excessive Alarms  
*(a pause)*  
S-I-T-E Detector  
Milepost 3-2-1 Point 4  
Speed 5-4  
First-Dragging-Equipment Near-Axle-2-1  
Second-Dragging-Equipment Near-Axle-2-9  
Hotbox Left-Side Axle-7-5  
Total Axles 1-0-8  
Integrity Failure  
Excessive Alarms  
Detector Out

## 6.0 Scheduled Maintenance

---

This section lists the items that STC recommends be done during scheduled maintenance.

An up-and-running SmartScanNG system needs to be visited from time to time to do scheduled maintenance. The frequency of these visits is up to the customer. STC recommends visits every 30 to 90 days. Maintenance requirements change with environmental conditions. For example, if the system is installed in a damp or a dusty environment, it may be necessary to visit the location more frequently to clean the optics. The optical system is the item most likely to need periodic maintenance. If moisture or dust isn't a problem, you may not need to do scheduled maintenance more often than every 90 days.

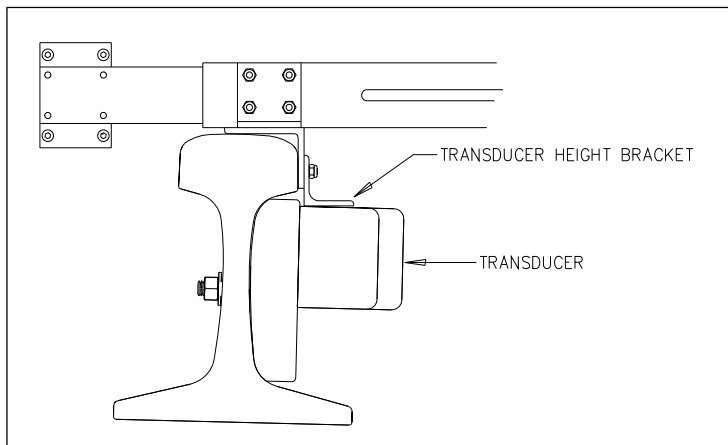
What is done during a maintenance visit is up to the customer. However, STC does have some recommends. For normal scheduled maintenance, STC recommends these steps.

- 1 Be sure that you have on hand a tape measure, a #2 phillips head screwdriver, a small slotted screwdriver, a 9/16-inch torque wrench, a laptop computer, a multimeter, and the alignment fixture.
- 2 At trackside, check track conditions on all tracks.
- 3 If any track is pumping (vertical displacement of the rails) or running (lateral displacement of the rails) more than 2 inches (5 centimeters), have it repaired before proceeding.
- 4 At trackside, check for damaged transducers, damaged transducer cables, and other damaged components.
- 5 If you find any damaged components, repair or replace them before proceeding.  
STC transducers don't require a lot of care and attention. Once installed correctly, you don't need to remove them from the rail for cleaning or readjustment.
- 6 At trackside, check all transducer-mounting bolts on all tracks to make sure that all transducers are snug against the rail.

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

- 7 If all transducers aren't snug against the rail, fix this problem before proceeding.  
Each installed transducer body should be 1-9/16 inches (3.97 centimeters) below the top of the rail and parallel to it. Checking for these characteristics can be done by using the transducer height bracket on the bottom of the alignment fixture.

- 8 Place the alignment fixture across both rails, centered over each transducer in turn.
- 9 Check if each transducer body just touches the bracket.



The fixture should be snug against the top and gauge of both rails. This may be impossible if the transducer body is less than 1-9/16 inches (3.97 centimeters) below the top of the rail or if the transducer body isn't parallel to the top of the rail.

- 10 If a transducer body doesn't just touch the bracket:
  - a Loosen the nuts holding the transducer body to its mounting plate.
  - b By sliding it up and down, adjust the transducer body to the proper height.
  - c Tighten each hex nut with a 9/16-inch (14.3-millimeter) torque wrench to a **torque of 8 to 10 foot-pounds (10.8 to 13.6 newton-meters)**.

**Don't exceed a torque of 10 foot-pounds (13.6 newton-meters). Overtightening can weaken or break a bolt, requiring the bolt to be replaced.**

- 11 At the trackside, check all scanner-mounting bolts on all tracks.
- 12 If all scanner mounts aren't snug against the gauge side of the rail, fix this problem before proceeding.
- 13 From under all scanners, remove ballast that could damage the scanner during train passage.
- 14 Remove all obstructions to the scan path of each scanner.
- 15 If the wayside enclosure isn't attached to a properly installed outside grounding system, fix this problem before proceeding.
- 16 At all outlets, check if the AC power is stable and at least 110 volts at 20 amperes.
- 17 If the AC power isn't stable or if it isn't at least 110 volts at 20 amperes, fix this problem before proceeding.
- 18 If there isn't a ground bus inside the wayside enclosure that has been attached to a properly installed outside grounding system, fix this problem before proceeding.



- 19** If the battery is dead, damaged, or emitting a strong sulfurous odor, replace it before proceeding.

**WARNING**

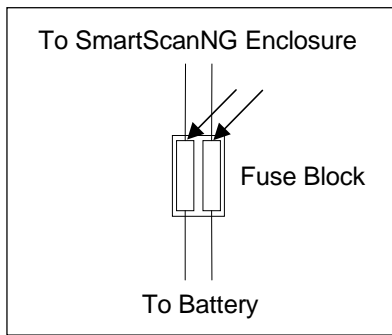
In operation, batteries generate and release flammable hydrogen gas, which, if ignited by a burning cigarette, naked flame, or spark, may cause a battery explosion with a dispersion of casing fragments and corrosive liquid electrolytes. So, carefully follow the manufacturer's instructions for installation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

**WARNING**

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

- 20** If the battery charger hasn't been properly grounded to the ground bus, fix this problem before proceeding.
- 21** If the SmartScanNG enclosure hasn't been properly grounded to the ground bus, fix this problem before proceeding.
- There are vents on the top, bottom, and sides of the charger. Blocking any of these vents could result in damage to the charger or battery.
- 22** Remove anything that is blocking the vents on the battery charger.
- One end of the battery temperature probe cable has a three-pin plug, which plugs into a receptacle on the front of the battery charger. The other end, which has a temperature sensor sealed in it, should be attached to the negative battery post. If the battery temperature probe is defective or not installed, the red defective LED is lit.
- 23** On the front of the battery charger, if the red defective-temperature-probe LED is lit, fix the underlying problem before proceeding.
- 24** Switch the multimeter to the DC volts scale.

**25** Touch the leads from the multimeter to the terminals on the top of the fuse block.



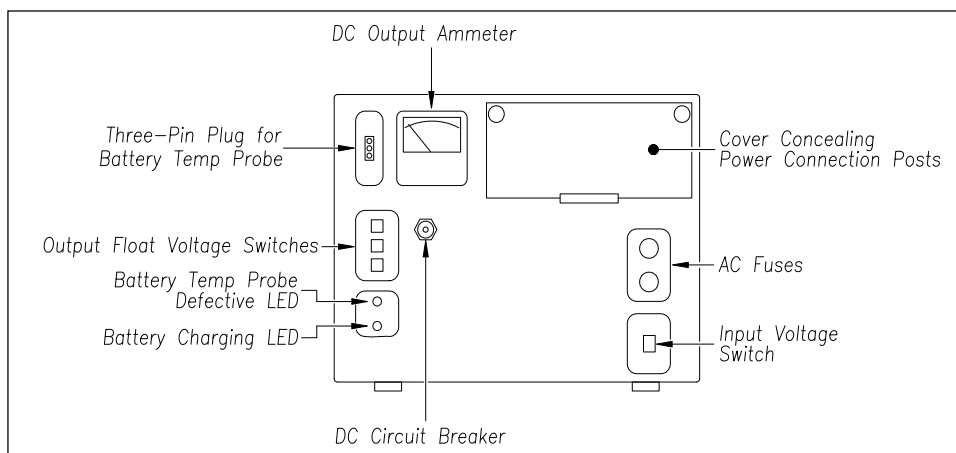
**26** If voltage (on the top of the fuse block) is 12.3-14 VDC, go to step **30**.

**27** If voltage (on the top of the fuse block) is 0 VDC:

- a** Touch the leads to the terminals on the bottom of the fuse block.
- b** If voltage (on the bottom of the fuse block) is greater than 0 VDC, replace each fuse in the fuse block with a BAF-25 (25-amp 250-volt) fast-acting fuse and return to step **25**.
- c** If voltage (on the bottom of the fuse block) is 0 VDC, check the wiring between the fuse block and the battery and between the battery and the charger.

**28** If the voltage is less than 12.3 VDC:

- a** On the battery charger, check the input voltage switch for proper setting.



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

- b** On the battery charger, check the output float voltage switches.
- c** If the switches are set lower than 12.30 VDC, reset them to 12.30-14.00 VDC.

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

- d Open the small door cover on the top-right corner of the front of the charger.

**Do not touch the uninsulated parts of the wires or the charger's binding posts. Doing so could result in sparks, burns, or electric shock.**

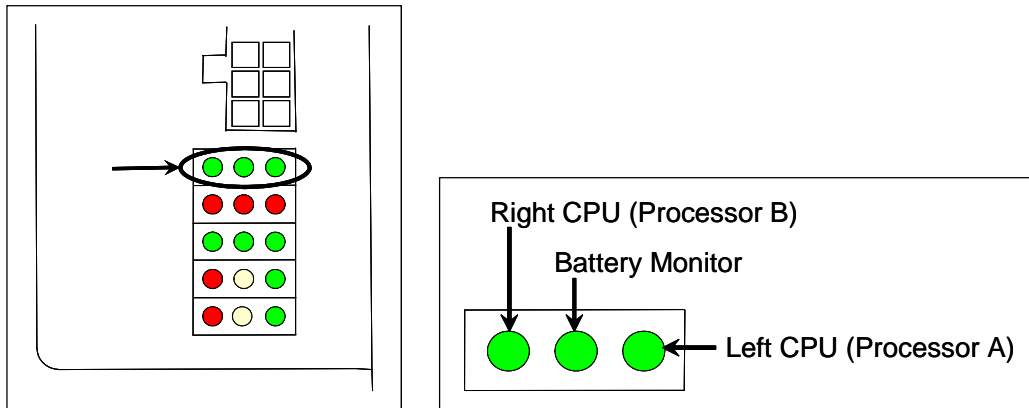
- e Check that all binding posts nuts are tight and that all wiring is correct.
- f On the battery charger, check the AC fuses to see if either is blown.
- g If need be, replace with 4-amp 250-volt fast-acting fuses.
- h On the battery charger, check the DC circuit breaker to see if it is open (tripped).  
When closed, about 0.09 inch (0.23 centimeters) of the breaker's button is seen.  
When open, the button is popped out, showing about 0.25 inch (0.64 centimeters).
- i If open (tripped), push the breaker's button in to reset the DC circuit breaker.
- j Check to see if the battery charger is plugged in.
- k If the battery charger isn't plugged in, plug it in.
- l Check the battery-charging LED.  
If the battery is charging properly, the yellow battery-charging LED is lit solid. If one or more of the output float voltage switches are set between numbers, the yellow battery-charging LED flashes.
- m If the yellow battery-charging LED isn't lit, call STC for help in fixing this problem.
- n If the yellow battery-charging LED is lit solid, monitor the voltage for ten minutes.  
If the voltage is gradually increasing, the battery is probably charging. After the battery has charged for five hours, the battery voltage should be very near the float voltage setting. If the voltage isn't gradually increasing, the battery is probably not charging. This may indicate that the battery is defective and should be replaced.

**29** If voltage is greater than 14 VDC:

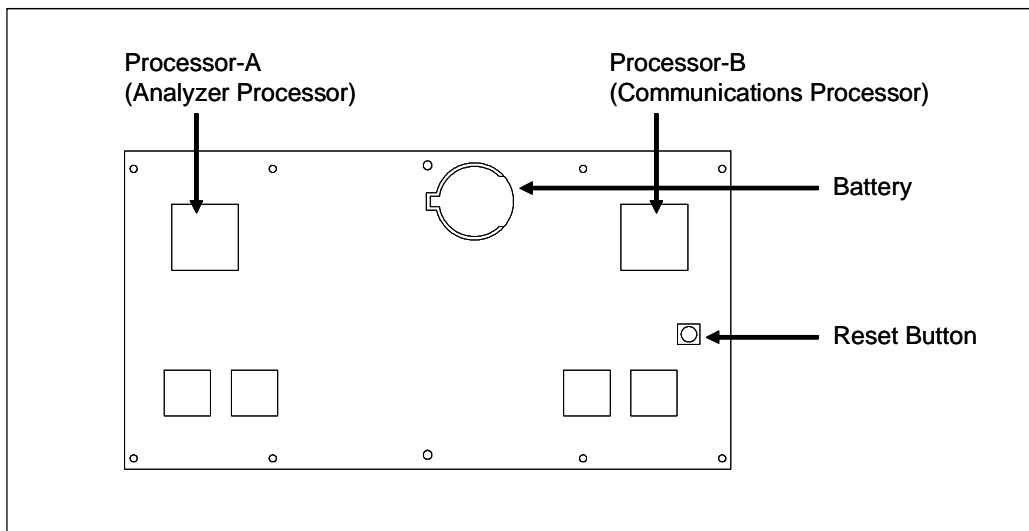
- a Check the output float voltage switches on the center-left edge of the battery charger.
- b Be sure each switch is set on a number and not between numbers.
- c If the switches are set to 14.00 VDC or less, cut all power to the SmartScanNG system and call STC for help in fixing this problem.
- d If the switches are set higher than 14.00 VDC, reset them to 12.30-14.00 VDC and return to step **25**.

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

30 On the status panel, look at the top row (aka first row) of LEDs.



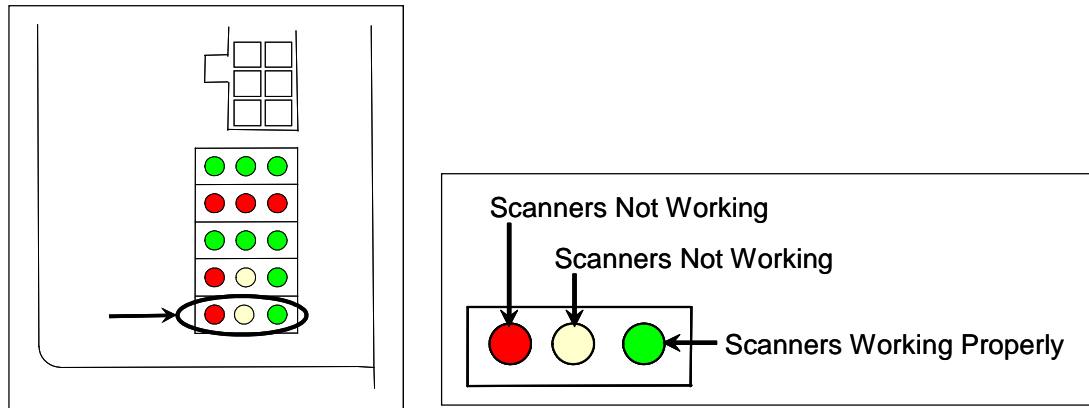
The first row of green LEDs indicates the condition of the CPUs and the battery on the Processor board. If both CPUs are running their programs correctly, their LEDs pulsate (that is, repeat the cycle off, dim, bright, dim). If a program isn't operating as expected, the LED for the affected CPU blinks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



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

- 31 If either or both of the **rightmost** and **leftmost LEDs** (on the first row) blinks on and off, is lit solid, or isn't lit at all, call STC for help in fixing this problem.
- 32 If the **middle LED** (on the first row) is lit, replace the battery on the Processor board.

**33** On the status panel, look at the bottom row (aka fifth row) of LEDs.



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

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

- Insufficient heat from one or both bearing scanners or from one or both wheel scanners was detected. If either bearing scanner records less than 5°F (2.8°C) for an entire train or if either wheel scanner records less than 15°F (8.3°C) for an entire train.
- Shutter resistor check failed. The minimum value expected for the temperature of the resistor wasn't met. To cause the LED to light, this minimum value must be greater than the target resistor heat value that is calculated for each train. These requirements for lighting the LED are the same as for generating a Cold Resistor alarm.
- For any five consecutive trains, the difference between the average recorded temperatures for both bearing scanners was more than a delta temperature of 20°F (11.1°C) or the difference between the average recorded temperatures for both wheel scanners was more than a delta temperature of 120°F (66.7°C).

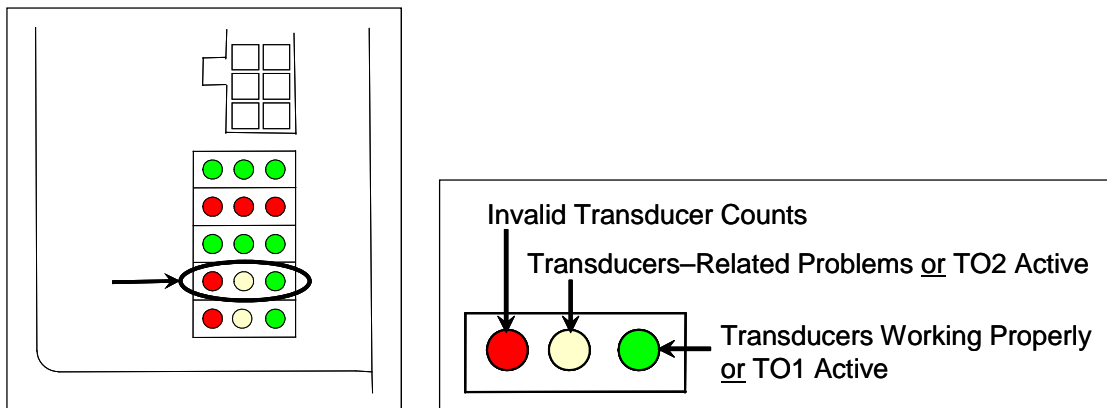
If all of the last 20 trains have passed integrity, the **leftmost red LED** isn't lit. In the last 20 trains, if both bearing scanners or both wheel scanners failed the integrity check, this LED is lit solid. In the last 20 trains, if just one bearing scanner or one wheel scanner failed the integrity check, this LED flashes. The rate and pattern of flashing is different for which rail the scanner was on. For a scanner on the north or east rail, the repeated pattern is on for a half second, off for a full second. For a scanner on the south or west rail, the repeated pattern is on for a half second, off for a half second, on for a half second, off for two seconds.

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

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

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

- 34 If the **rightmost green LED** (on the fifth row) isn't flashing, call STC for help in fixing this problem.
- 35 On the status panel, look at the fourth row of LEDs when no train is present.



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

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

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

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

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

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

- A gating transducer experiences more than 20 filtered pulses on a train. In other words, a gating transducer experiences more than 20 pulses on a train that the SmartScanNG system considers noise.
- The system has a track circuit or advance transducers, but is being activated by the gating transducers.

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

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

**36** When a train isn't present at the site, if the **middle yellow LED** (on the fourth row) isn't lit, go to step **41**.

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

**a** Produce a Last Train report.

**Section 4.0 - Producing Reports** tells how to produce this report.

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

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

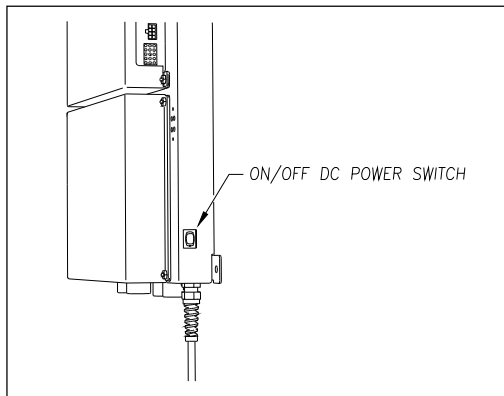
The No Approach Track alarm indicates that the track circuit (or the advance transducers) failed to signal the presence of a train and that the SmartScanNG system started from the train passing over the gating transducers.

**c** If the words "No Approach Track" don't appear, go to step **41**.

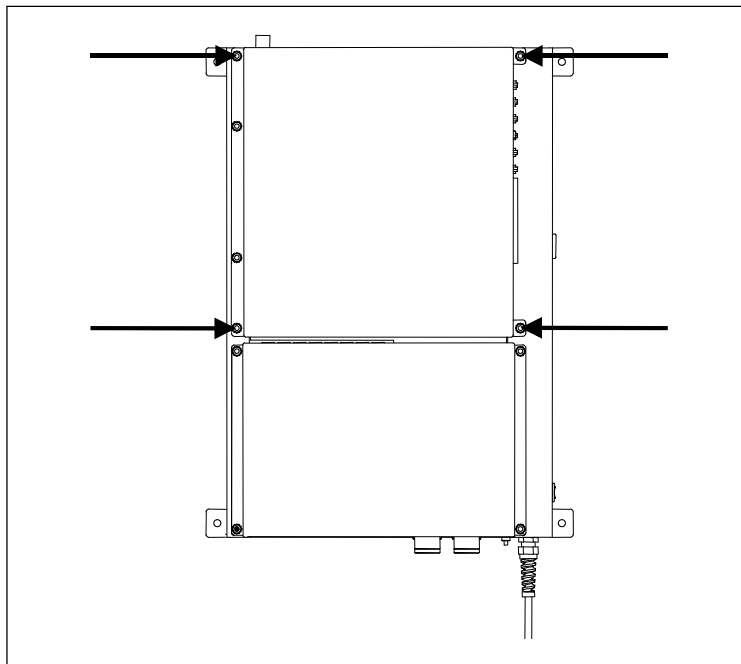
**38** If your system uses advance transducers, go to step **40**.

**39** If your system uses a track circuit:

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



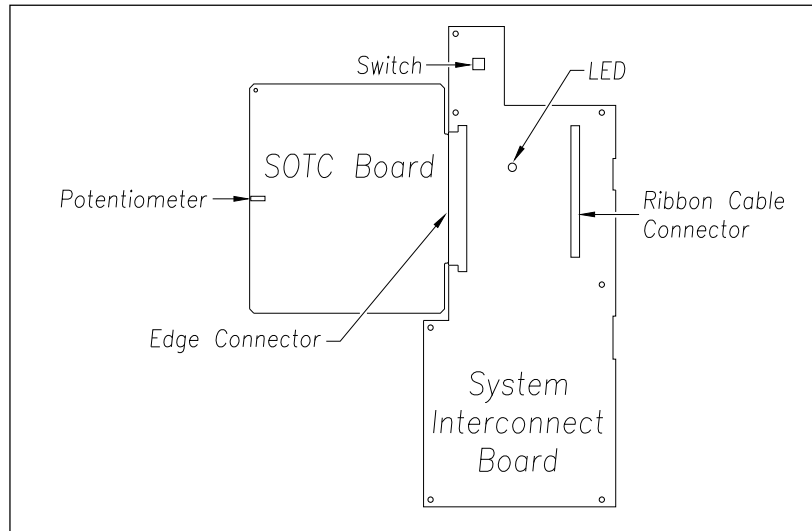
- b** Unplug the Molex and ribbon cables from the Controller module.
- c** Remove the four nuts that hold the Controller module to the rest of the SmartScanNG enclosure.





- d** Detach the Controller module from the rest of the SmartScanNG enclosure.

The SOTC board and the System-Interconnect board are now visible. On some System-Interconnect boards, the LED is to the right of the ribbon cable connector.



- e** Store the removed Controller module and nuts in a safe place until you replace them.
- f** Toggle on the DC power switch on the right edge of the SmartScanNG enclosure.
- g** From the center of the gating transducer farthest from the track circuit, measure the furthest 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).
- h** At the point just measured, place a hardwire shunt across both rails.  
When lit, the LED on the System-Interconnect board indicates a received signal from the track circuit.
- i** Using a small slotted screwdriver, turn the potentiometer on the SOTC board until the LED on the System-Interconnect board goes out.  
The potentiometer can be reached through a hole in the side of the SmartScanNG enclosure.
- j** Using a small slotted screwdriver, turn the potentiometer on the SOTC board until the SOTC relay just picks up the signal from the track circuit.  
The relay just picks up the signal when the LED on the System-Interconnect board first lights.
- k** Remove the hardwire shunt.
- l** Place the hardwire shunt across both rails at the point 5 feet (1.5 meters) beyond the measured point (that is, five feet farther from the gating transducer).
- m** If the LED on the System-Interconnect board is still lit, return to step **j**.

- n Remove the hardwire shunt.
- o Toggle off the DC power switch on the right edge of the SmartScanNG enclosure.
- p Reattach the Controller module to the rest of the SmartScanNG enclosure.
- q Plug the Molex and ribbon cables into the Controller module.
- r Toggle on the DC power switch on the right edge of the SmartScanNG enclosure.
- s Go to step 41.

**40** If your system uses advance transducers:

You will next verify that that each advance transducer is functional.

- a Using a metal wrench, stroke the top of one of the advance transducers.  
The scanner shutters should open completely for 10 seconds.
- b On one of the bearing scanners, check to see if the shutter opens.
- c If the shutter didn't open, fix this problem before proceeding.
- d Using a metal wrench, stroke the top of the other advance transducer.  
The scanner shutters should open completely for 10 seconds.
- e On one of the bearing scanners, check to see if the shutter opens.
- f If the shutter didn't open, fix this problem before proceeding.

**41** Produce a Train Summary report.

**Section 4.0 - Producing Reports** tells how to produce this report.

The Train Summary report lists all trains currently stored in the Trains directory. A line of information is shown for each train entry. The report is divided into a header section and a detail section. The header section contains general information about the site. The detail section contains summary information on each train that passed the site.

**42** On the Train Summary report, check the Axles column.

Axle count should be an even number. Odd numbered axle counts are possible indications of gating transducer problems.

**43** If there is an odd axle count and if train speed was always above 7 mph, go to step 45.

If at any time during train passage the train speed was less than or equal to 7 mph (11.3 kph), gating transducer problems probably don't exist. If the train speed was always above 7 mph, gating transducer problems probably do exist.

The Very Slow Train alarm indicates that, at some point during train passage, four consecutive axles crossed the gating transducers at a speed of 7 mph (11.3 kph) or less. This alarm appears on a Train Detail report.

If there are many slow trains (that is, many trains traveling less than 7 mph) at this site, it may be necessary to relocate the scanners and other track hardware to a better location. Deciding to do this should be made in consultation with STC. Relocating a site is beyond the scope of this document.

- 44 If there is an even axle count and the values under "Axles," "TO1," and "TO2" are the same, go to step 49.

If things are working correctly, all three values for a given train should be equal. You will do the next step only if things aren't working correctly.

- 45 Determine which gating transducer is recording incorrect information.

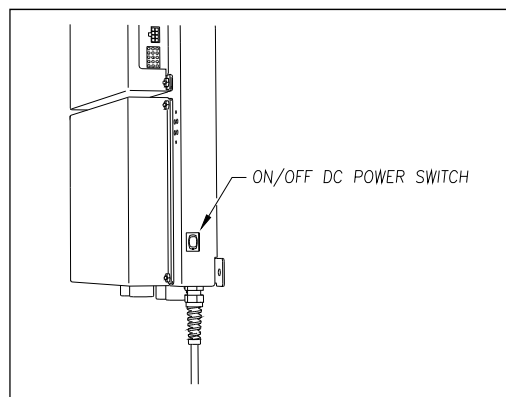
Determine which gating transducer is recording incorrect axle counts and whether it isn't counting all axles or counting extra ones. You may not be able to do this by just looking at the values under the Axles, TO1, and TO2 columns of the Train Summary report. Sometimes, a transducer problem causes the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

After you determine which gating transducer is miscounting, you will need to change a jumper setting on the Interface board. If TO1 is the problem, you will change the setting for J201. If TO2 is the problem, you will change the setting for J202. If both TO1 and TO2 have a problem, both jumpers will need to be changed.

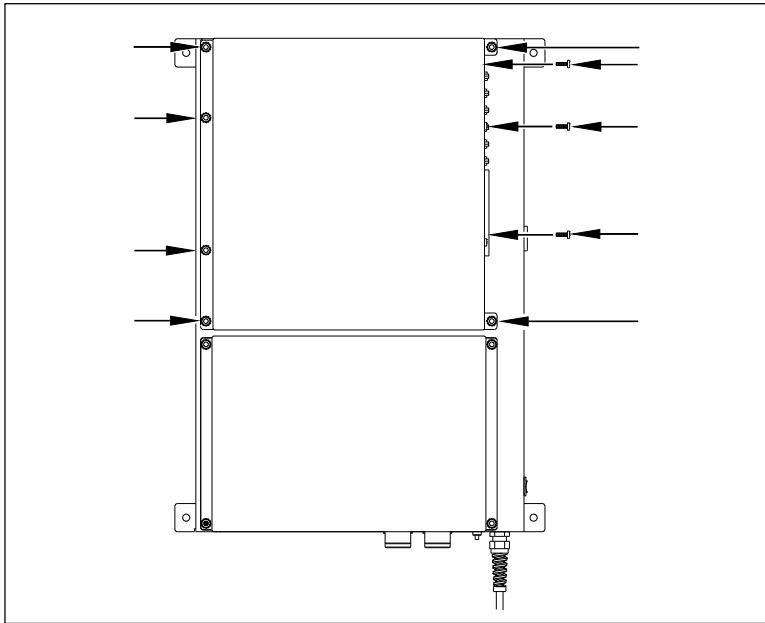
**Changes to the jumpers should be made only after all external conditions that cause transducer miscounts have been corrected.** Some of these external conditions are improperly installed transducers, loose transducer bolts, incorrect transducer heights, damaged transducers, damaged transducer cables, and loose wiring connections. You should have already checked and corrected for these external conditions in steps 4 through 10 above. If you think the corrections you made in those steps fixes gating transducer miscounting, you can skip some of the steps below.

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

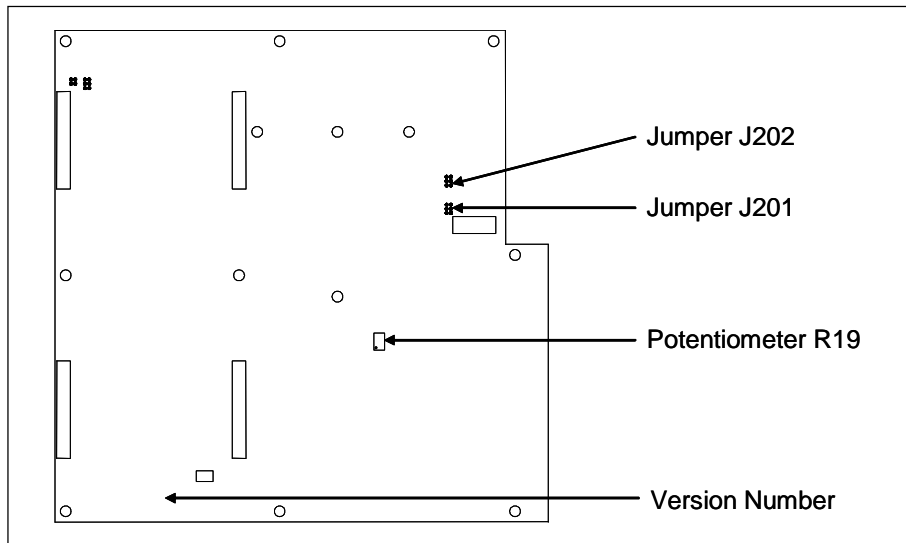
- 46 If you corrected all external conditions that negatively affect gating transducers and you think this fixes gating transducer miscounting, go to step 49.
- 47 If the selected gating transducer appears to be missing axles (that is, the transducer that is showing a number of hits less than the true axle count):
- a Toggle off the DC power switch on the right edge of the SmartScanNG enclosure.



- b** Remove the six nuts and three screws holding the cover over the Interface board.



The Interface board is now visible.



- c** To prevent the base assembly from falling, replace two of the just removed nuts onto the top two mounting studs on the SmartScanNG enclosure.
- d** Store the removed cover, three screws, and remaining four nuts in a safe place until you replace them.

The available loading sensitivities vary depending on which version of Interface board you have and whether resistors are attached to the jumpers or not. The version number is printed on the lower-left edge of the board.

- e** Note the version number of your Interface board.

The table below lists the highest, middle, and lowest sensitivity for transducer loading for current board versions. Highest is the most sensitive. The jumper's top position is the one closest to the external speaker.

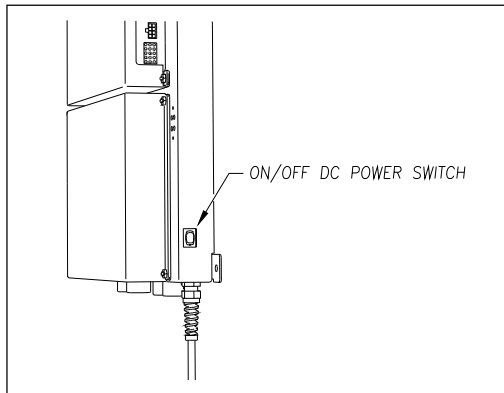
<b>J201 or J202 Jumper Position</b>	<b>Version 1.21 and 1.22 and 1.30 and 1.40 Board</b>
Top	Lowest Sensitivity
Center	Middle Sensitivity
Bottom	Highest Sensitivity

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

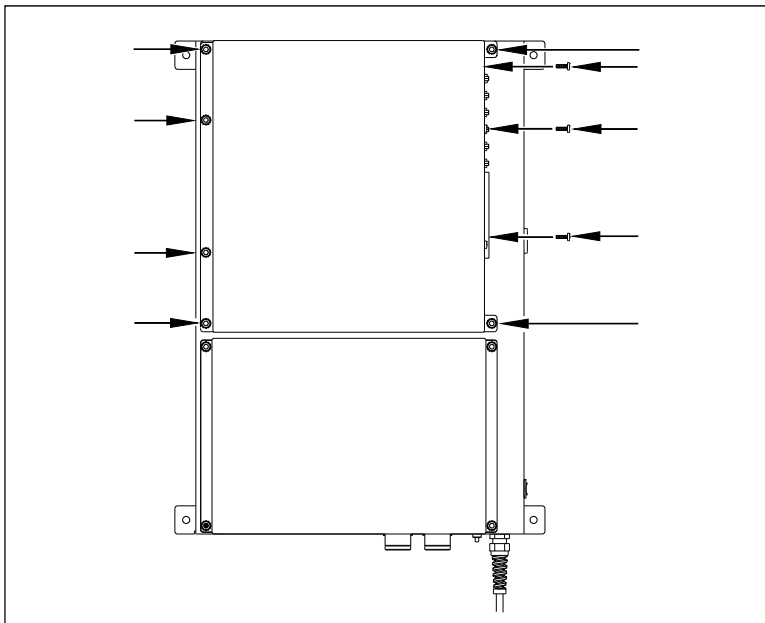
- f** If TO1 is the selected gating transducer and the J201 jumper is currently on the lowest sensitivity position, move it to the middle sensitivity position.
- g** If TO1 is the selected gating transducer and the J201 jumper is currently on the middle sensitivity position, move it to the highest sensitivity position.
- h** If TO1 is the selected gating transducer and the J201 jumper is currently on the highest sensitivity position, call STC for help in fixing this problem.
- i** If TO2 is the selected gating transducer and the J202 jumper is currently on the lowest sensitivity position, move it to the middle sensitivity position.
- j** If TO2 is the selected gating transducer and the J202 jumper is currently on the middle sensitivity position, move it to the highest sensitivity position.
- k** If TO2 is the selected gating transducer and the J202 jumper is currently on the highest sensitivity position, call STC for help in fixing this problem.
- l** Remove the two nuts holding the base assembly to the SmartScanNG enclosure.
- m** Using the saved six nuts and three screws, reattach the cover over the Interface board.
- n** Toggle on the DC power switch on the right edge of the SmartScanNG enclosure.

**48** If the selected gating transducer appears to be counting extra axles (that is, the transducer that is showing a number of hits more than the true axle count):

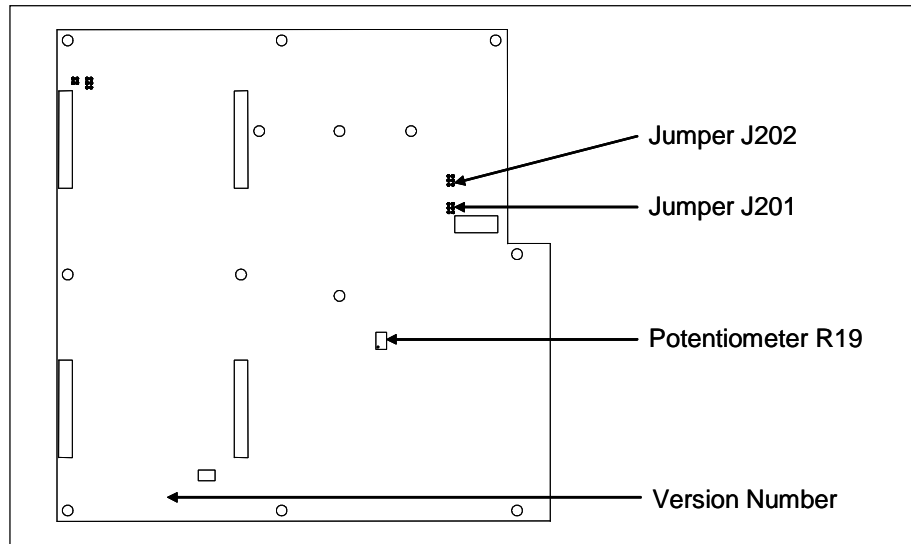
- a** Toggle off the DC power switch on the right edge of the SmartScanNG enclosure.



- b** Remove the six nuts and three screws holding the cover over the Interface board.



The Interface board is now visible.



- c To prevent the base assembly from falling, replace two of the just removed nuts onto the top two mounting studs on the SmartScanNG enclosure.
- d Store the removed cover, three screws, and remaining four nuts in a safe place until you replace them.

The available loading sensitivities vary depending on which version of Interface board you have and whether resistors are attached to the jumpers or not. The version number is printed on the lower-left edge of the board.

- e Note the version number of your Interface board.

The table below lists the highest, middle, and lowest sensitivity for transducer loading for current board versions. Highest is the most sensitive. The jumper's top position is the one closest to the external speaker.

J201 <u>or</u> J202 Jumper Position	Version 1.21 and 1.22 and 1.30 and 1.40 Board
Top	Lowest Sensitivity
Center	Middle Sensitivity
Bottom	Highest Sensitivity

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

- f If TO1 is the selected gating transducer and the J201 jumper is currently on the highest sensitivity position, move it to the middle sensitivity position.
  - g If TO1 is the selected gating transducer and the J201 jumper is currently on the middle sensitivity position, move it to the lowest sensitivity position.
  - h If TO1 is the selected gating transducer and the J201 jumper is currently on the lowest sensitivity position, call STC for help in fixing this problem.
  - i If TO2 is the selected gating transducer and the J202 jumper is currently on the highest sensitivity position, move it to the middle sensitivity position.
  - j If TO2 is the selected gating transducer and the J202 jumper is currently on the middle sensitivity position, move it to the lowest sensitivity position.
  - k If TO2 is the selected gating transducer and the J202 jumper is currently on the lowest sensitivity position, call STC for help in fixing this problem.
  - l Remove the two nuts holding the base assembly to the SmartScanNG enclosure.
  - m Using the saved six nuts and three screws, reattach the cover over the Interface board.
  - n Toggle on the DC power switch on the right edge of the SmartScanNG enclosure.
- 49 To use the serial interface to open the scanner shutters:
- a Using the serial interface, display the Main menu.

**Section 3.0 - Serial Interface** tells how to display the Main menu

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Main Menu
-----
      .
      .
      .

J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
?
```

- b Select the System Functions menu option.
  - c Select the Auto-Calibration option to open the shutters and start autocalibration.
- The protective shutters in all scanners should open and stay open for three minutes. This might not be enough time to check and clean the shutters and optics. If it isn't enough time, select the option again.
- 50 In each scanner, check if its shutter opened.
- 51 If any shutter didn't open, fix this problem before proceeding.



52 In each scanner, check for dirty optics.

53 If dirty, clean the scanner optics with the supplied lens cleaning kit.

**Do not use solvents, ammonia-based cleaning solutions, or isopropyl alcohol on the optics. Use clean water or a mild solution of dishwashing liquid. After the liquid on the optics dries, lightly wipe the optics with a clean dry chamois patch.**

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

**Section 3.0 - Serial Interface** tells how to change the date and time.

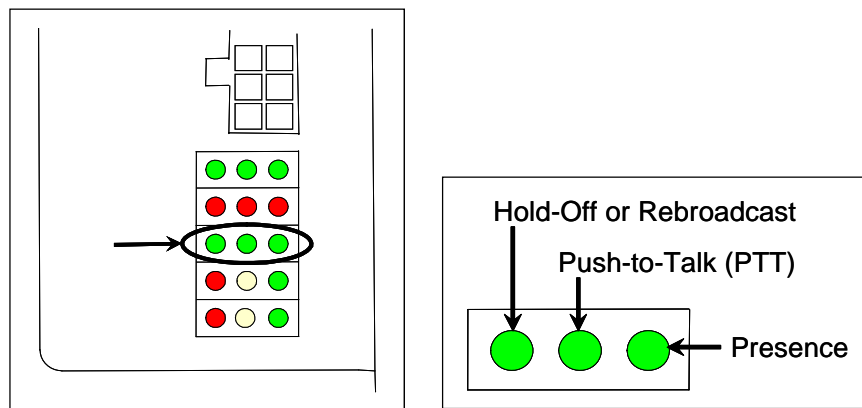
55 To check the operation of the radio:

- a Select Radio Test from the System Functions menu.

During a radio test, the SmartScanNG system outputs phrases through the speaker (on the top of the SmartScanNG enclosure) and through the radio. Alternatively, you can output a 1kHz test tone instead of phrases. To do this, select 1kHz Test Tone option. The system prints a "Starting 1kHz Test Tone" message and then sounds the tone.

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

The middle green LED should be lit.



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

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

**56** To check the integrity of the speech data:

- a** Be sure that the speaker (on top of the SmartScanNG enclosure) is plugged in and its volume knob is turned to the middle position.
- b** Using the serial interface, display the Main menu.

**Section 3.0 - Serial Interface** tells how to display the Main menu.

- c** Select the System Functions menu.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
04/16/2019 21:57
System Functions Menu
-----
A) Radio Test
B) Vocabulary Test
C) Ramp Function
D) Radio Inhibit
E) Manual Test Mode
      :
      :
      :
```

- d** From the System Functions menu, select Vocabulary Test.

This message appears.

```
Starting Vocabulary Test
```

If the system isn't currently making any other voice announcements, it begins the Vocabulary Test announcement. The SmartScanNG system outputs phrases through the speaker (on the top of the SmartScanNG enclosure), but not through the radio. After the announcement finishes, the System Functions menu reappears.

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

- e** If you hear nothing or the speech is too garbled to understand, call STC for help in fixing this problem.

**57** To generate a test train to check simulated alarms:

- a** From the System Functions menu, select Ramp Function.

This prompt appears.

Start Ramp Function?

- b** Type **Y**

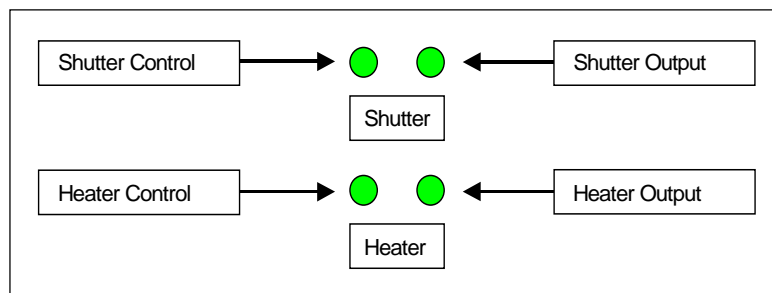
The advance input is made active, gating transducer signals are simulated, and heat values are ramped up (increased) and ramped down (decreased) in a predictable sequence to simulate eight Exception Alarms. **This may take a few minutes.** When finished, this message appears followed by the System Functions menu.

Running Ramp Function...Ramp Function Complete

The Ramp Function simulates two Absolute alarms, two Differential alarms, two Carside Slope alarms, and two Hotwheel alarms. It simulates the Carside and Hotwheel alarms even if detection for those alarms is disabled in the Equipment setup. However, disabled alarms don't appear on the Last Test Train report.

- c** Wait until the two LEDs labeled **Shutter** go out.

There is a group of four status LEDs on the lower right side of the chassis. These LEDs show the operation of the solid-state relays used to control the scanner shutters and heaters. The top two are the LEDs labeled **Shutter**.



- d Produce a Last Test Train report.

**Section 4.0 - Producing Reports** tells how to produce this report.

The Last Test Train report is identical to the Train Detail report. The only difference is the way you specify which train you want reported. In this version of the report, you don't have to specify a train. The most current test train (aka ramp train) is produced.

- e On the report, check for two Absolute alarms and two Differential alarms.
- f If your report doesn't show two Absolute alarms and two Differential alarms, call STC for help in fixing this problem.

**58** To generate a test train to check number of axles:

- a Quickly stroke the top of each gating transducer with a metal wrench, alternating between TO1 and TO2.
- b Repeat step **a** nine more times, for a total of ten simulated axles.
- c Wait for the system to time out and the shutters to close.
- d Produce a Last Train report.

**Section 4.0 - Producing Reports** tells how to produce this report

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

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

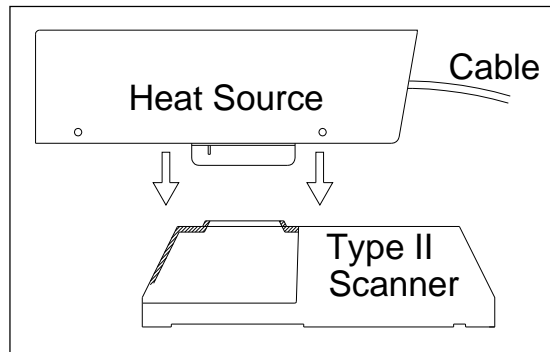
**59** To generate a test train to check hot bearings:

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

- a Ready the calibrated heat source.

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

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



- c** Quickly stroke the top of each gating transducer with a metal wrench, alternating between TO1 and TO2 for a total of **six** simulated axles.
- You should hear the real-time defect message. No matter how many defects are found, the real-time defect message is only announced once.
- d** Wait for the system to time out, which normally takes about 10 seconds.
- You should hear an end-of-train message with three Hotbox alarms. Per train, only the first three Hotbox alarms are ever announced.
- e** Listen to be sure that the Hotbox alarms are announced and that they are announced for the correct side.
- If you do not hear anything, no alarm-level heat was recorded. No measurable heat from a bearing scanner may be due to loose connections, a scanner not being connected to the bottom of the SmartScanNG enclosure, a defective shutter motor in the scanner, or a damaged scanner.
- f** If you do not hear any Hotbox alarms being announced, fix this problem before proceeding.
- g** If the Hotbox alarms are announced for the wrong side, switch the bearing scanner connections on the bottom of the SmartScanNG enclosure.
- h** Repeat the test, this time placing the calibrated heat source on the bearing scanner on the opposite rail
- i** Verify the results as before.
- If the results are correct, your system should function properly when scanning the bearings of real trains.
- j** Remove the calibrated heat source.
- k** Store the calibrated heat source and its cable in the wayside enclosure.

**60** On the Train Summary report, check the column marked "Average."

For each train, the values in the two columns under this heading should be within four degrees of each other.

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

**Appendix E & Appndix F - Calibration of Scanners** tells how to calibrate the scanners.

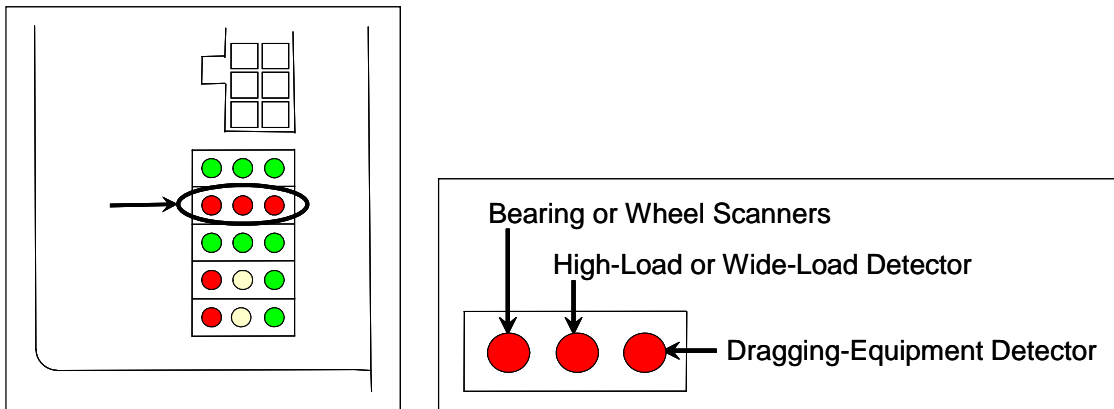
**62** On the Train Summary report, check the last column of the report.

The last column shows the battery voltage at the time each train passed the site. It should show values between 13.0 and 14.5 volts. Values outside this range may be caused by:

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

**63** If the most recent value isn't between 13.0 and 14.5 volts, investigate and fix any problems before proceeding.

**64** On the status panel, look at the second row of LEDs.



The second row of red LEDs indicates stored defect alarms, including those for bearing/wheel scanners, dragging equipment, and clearance equipment. These LEDs are lit when a defect alarm (associated with one of those pieces of equipment) has been recorded in any of the last 40 trains. Each LED remains lit until there isn't a recorded defect alarm (for the equipment associated with it) in any of the last 40 trains. Note, however, since this is a new installation, you might have less than 40 trains listed on the Exception Summary report. Or, you might have no trains listed. Also, you could have a lit LED and no trains listed if you ran a test train and didn't clear the results.

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

- a** Produce an Exception Summary report.

**Section 4.0 - Producing Reports** tells how to produce this report.

The Exception Summary report lists all trains currently stored in the Exceptions directory. A train is stored in the Exceptions directory if either an Exception Alarm or an Integrity Failure was detected on it as it passed the site. A line of information is shown for each train entry.

- b** If any red LED (on the second row) is lit and there are no train entries on the Exception Summary report, call STC for help in fixing this problem.

- c** Produce an extended Exception Detail report for each train that is listed on the Exception Summary report, up to and including the most current 40 trains.

The extended Exception Detail report provides detailed information on a single train. When choosing this report, you'll be prompted for a train number. When prompted, enter a train number from the Exception Summary report. The train number appears under the column titled "Train#" in the detail section of the Exception Summary report.

- d** Looking in the detail section of each of the produced Exception Detail reports, note every recorded defect alarm.
- e** If a red LED (on the second row) is lit and there is no corresponding recorded defect alarm on any of the produced Exception Detail reports, call STC for help in fixing this problem.
- f** If a red LED (on the second row) is lit and there are one or more corresponding recorded defect alarms on half or less and not on the most current five of the produced Exception Detail reports, go to step **66**.
- g** If a red LED (on the second row) is lit and there are one or more corresponding recorded defect alarms on more than half or on the most current five of the produced Exception Detail reports, check the track hardware and the wiring to the wayside enclosure.
- h** If problems are found with the hardware, wiring, or both, fix the problems and then go to step **66**.
- i** If no problems are found with the hardware and wiring, call STC for help in fixing this problem.

**66** If this is a multitrack site, repeat steps **18** through **65** for each track (that is, for each SmartScanNG system).





## 7.0 Customer Service

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

### 7.1 Reaching STC

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

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

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

By telephone, 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.

### 7.2 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 telephone call first. Just ship it directly to the **Repair Department** at the address above.

With the returned equipment, include:

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

## 7.3 Reporting Problems or Suggestions

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

## 7.4 Ordering Spare Parts

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

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

When faxing, include:

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

## 7.5 Checking on Shipments and Orders

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

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

When faxing, include:

- Purchase Order Number for the shipment or order being checked.
- Name and telephone number of the person who should be contacted after the order status is checked.
- Your fax number, if available.

# Appendix A

## System Alarms

---

This appendix describes the conditions and events that the SmartScanNG system flags as System Alarms. These alarms provide data about passing trains and system status. These alarms are listed under the System Alarms section of the Train Detail and Exception Detail reports. **Section 4.0 - Producing Reports** tells how to produce these reports.

### A.1 Advance System Failure Alarm (No Approach Track Alarm)

The Advance System Failure alarm (on some systems, called the No Approach Track alarm) indicates that the track circuit (or the advance transducers) failed to signal the presence of a train and that the SmartScanNG system started from the train passing over the gating transducers.

### A.2 Cold Rail Alarm (Cold Bearing Scanner Alarm)

The Cold Rail alarm (on some systems, called the Cold Bearing Scanner alarm) indicates that the temperatures of all bearings (of the train) on the designated rail were below a given temperature. When no bearing on a given rail generates a delta temperature reading greater than or equal to the temperature set by the Cold Rail Temperature option on the Alarm Limits submenu (aka Alarm Settings submenu), the system generates a Cold Rail alarm. **Section 3.0 - Serial Interface** tells how to view or change the Cold Rail Temperature option.

Alarm Settings, MP/KP-1794.5, Track-Single	
-----	
A	Absolute..... 180
B	Differential..... 130
C	Hot Wheel..... 650
D	Carside Slope..... 1.60
E	Carside Minimum... 300
F	Cold Rails..... 1
G	Cold Rail Temp.... 10
Alarm to change or Esc to quit?	

There is a different Cold Rail alarm for each rail. That is, there is a Cold North Rail alarm and a Cold South Rail alarm (or, depending on track direction, a Cold East Rail alarm and a Cold West Rail alarm).

The maximum number (per rai1side) of consecutive trains, having Cold Rail alarms, allowed before generating a Successive Cold Rails Exceeded alarm is set by the Cold Rails option on the Alarm Limits submenu (aka Alarm Settings submenu). If the number of consecutive trains bearing identical Cold Rail alarms equals or exceeds the cold-rail-alarm limit, the System Alarms section of the Train Detail and Exception Detail reports displays the message "Successive Cold Rails Exceeded." Successive Cold Rails Exceeded alarms are covered in the next appendix. **Section 3.0 - Serial Interface** tells how to change the Cold Rails option.

```
Alarm Settings, MP/KP-1794.5, Track-Single
```

```
-----
A Absolute..... 180
B Differential..... 130
C Hot Wheel..... 650
D Carside Slope..... 1.60
E Carside Minimum... 300
F Cold Rails..... 1
G Cold Rail Temp.... 10
```

```
Alarm to change or Esc to quit?
```

### A.3 Cold Resistor Alarm

A resistor is mounted to the inside of the bearing scanner's shutter. A voltage is applied to this resistor while the shutter is open, causing it to heat up. After a train has left a site and the shutters have closed, the temperature of the resistor is read by the scanner pyrometer. In this way, a check of the system's ability to read heat correctly is made. The Cold Resistor alarm indicates that the minimum value expected for the temperature of the resistor wasn't met. This minimum value is determined by the firmware and is dependent upon the time it takes a train to pass a site.

If the minimum value wasn't met, a second check compares the recorded resistor temperature against the limit that was established using the Absolute option on the Alarm Limits submenu (aka Alarm Settings submenu). (This alarm limit is an offset, in degrees Fahrenheit, above the ambient temperature.) If the recorded resistor temperature meets or exceeds the absolute-alarm limit, the firmware cancels any previously flagged Cold Resistor alarms.

**Section 3.0 - Serial Interface** tells how to change the Absolute option.

```
Alarm Settings, MP/KP-1794.5, Track-Single
```

```
-----
A Absolute..... 180
B Differential..... 130
C Hot Wheel..... 650
D Carside Slope..... 1.60
E Carside Minimum... 300
F Cold Rails..... 1
G Cold Rail Temp.... 10
```

```
Alarm to change or Esc to quit?
```

There is a different Cold Resistor alarm for each rail. That is, there is a Cold North Resistor alarm and a Cold South Resistor alarm (or, depending on track direction, a Cold East Resistor alarm and a Cold West Resistor alarm).

The maximum number (per railside) of consecutive trains, having Cold Resistor alarms, allowed before generating a Successive Cold Resistors Exceeded alarm is set by the Cold Rails option on the Alarm Limits submenu (aka Alarm Settings submenu). Successive Cold Resistors Exceeded alarms are covered in the next appendix. **Section 3.0 - Serial Interface** tells how to view or change the Cold Rails option.

```
Alarm Settings, MP/KP-1794.5, Track-Single
```

```
-----  
A Absolute..... 180  
B Differential..... 130  
C Hot Wheel..... 650  
D Carside Slope..... 1.60  
E Carside Minimum... 300  
F Cold Rails..... 1  
G Cold Rail Temp.... 10
```

```
Alarm to change or Esc to quit?
```

## A.4 Cold Wheel Scanner Alarm

The Cold Wheel Scanner alarm represents the wheel scanner's equivalent of the bearing scanner's Cold Rail alarm. When no wheel on a given rail generates a delta temperature reading greater than or equal to a preset minimum, the system generates a Cold Wheel Scanner alarm. The preset minimum temperature is determined by the firmware and is currently 9°F above ambient (5°C above ambient). The customer can't change this value. Just like Cold Rail alarms, separate Cold Wheel Scanner alarms exist for each railside.

The maximum number (per railside) of consecutive trains, having Cold Wheel Scanner alarms, allowed before generating a Successive Cold Wheels Exceeded alarm is set by the Cold Rails option on the Alarm Limits submenu (aka Alarm Settings submenu). Successive Cold Wheels Exceeded alarms are covered in the next appendix. **Section 3.0 - Serial Interface** tells how to view or change the Cold Rails option.

```
Alarm Settings, MP/KP-1794.5, Track-Single
```

```
-----  
A Absolute..... 180  
B Differential..... 130  
C Hot Wheel..... 650  
D Carside Slope..... 1.60  
E Carside Minimum... 300  
F Cold Rails..... 1  
G Cold Rail Temp.... 10
```

```
Alarm to change or Esc to quit?
```

## A.5 Cold Wheel Scanner Resistor Alarm

The Cold Wheel Scanner Resistor alarm represents the wheel scanner's equivalent of the bearing scanner's Cold Resistor alarm. Evaluation of Cold Wheel Scanner Resistor alarm occurs in two stages. The first stage mimics the same logic used in the evaluation of Cold Resistor alarms. After finishing this check, and possibly flagging a Cold Wheel Scanner Resistor alarm, the firmware compares the recorded resistor temperature against a value of one-third the hot wheel alarm limit. If the recorded resistor temperature meets or exceeds this value, the firmware cancels any previously flagged Cold Wheel Scanner Resistor alarm. In this way, the system confirms the scanner's ability to read alarm level heat. Just like Cold Resistor alarms, separate Cold Wheel Scanner Resistor alarms exist for each railside.

The maximum number (per railside) of consecutive trains, having Cold Wheel Scanner Resistor alarms, allowed before generating a Successive Cold Wheel Resistors Exceeded alarm is set by the Cold Rails option on the Alarm Limits submenu (aka Alarm Settings submenu). Successive Cold Wheel Resistors Exceeded alarms are covered in the next appendix. **Section 3.0 - Serial Interface** tells how to view or change the Cold Rails option.

```
Alarm Settings, MP/KP-1794.5, Track-Single
```

```
-----  
A Absolute..... 180  
B Differential..... 130  
C Hot Wheel..... 650  
D Carside Slope..... 1.60  
E Carside Minimum... 300  
F Cold Rails..... 1  
G Cold Rail Temp.... 10
```

```
Alarm to change or Esc to quit?
```

## A.6 Highrange Transducer Miscounts Alarm

The Highrange Transducer Miscounts alarm indicates that the transducer counts for TO1 and TO2 are off by seven or more. This calculation is made after each axle crosses both gating transducers. When this alarm occurs, the system won't announce axle count, exit speed, length of train, or total number of cars (even if these messages are enabled).

The Highrange Transducer Miscounts alarm can be either a System Alarm or an Integrity Failure, depending on the presence of a Very Slow Train alarm. If a highrange transducer miscount occurs on a train that also contains a Very Slow Train alarm, the firmware treats the miscount condition as a System Alarm. This logic assumes that the train's slow rate of travel likely caused the transducer miscount condition. If a highrange transducer miscount occurs on a train traveling faster than 7 mph (11.3 kph), the firmware treats the miscount condition as an Integrity Failure.

## A.7 Integrity Failure Alarm

The Integrity Failure alarm indicates that the SmartScanNG system determined that a condition exists that could prevent proper scanning of a train. In other words, this alarm indicates the existence of one or more conditions in which the integrity of the system, and its ability accurately to record train data, may be compromised. These unusual conditions, called Integrity Failures, may require train stoppage, later maintenance, or both. They are covered in the next appendix.

## A.8 Low Battery Alarm

The Low Battery alarm indicates a float voltage of at least 11.8 volts, but less than 12.6 volts, on the standby battery. On a solar-powered system, it indicates a regulated voltage of at least 11.8 volts, but less than 11.5 volts, from the solar subsystem.

## A.9 Midrange Transducer Miscounts Alarm

The Midrange Transducer Miscounts alarm indicates that the transducer counts for TO1 and TO2 are off by five or six. This calculation is made after each axle crosses both gating transducers.

## A.10 Reverse Direction Detected Alarm

Trains that are being scanned correctly will have axles whose on times are less than their off times. For each axle of a passing train (except for the first axle), the system checks for an on time that is greater than the off time. If the axle's on time is greater than its off time, the system reverses the direction locked-in by the first gating pulse, reverses the opening and closing gate assignment for TO1 and TO2, and generates a false transducer pulse. The system considers the gate active for the next axle at the time it determines the current axle's opening gate pulse was missed.

The Reverse Direction Detected alarm indicates that the system entered a state where it is scanning for bearing temperatures when the axles are outside the scanning gate. In this state, the transducer that should be opening the scanning gate is considered by the system to be the transducer that is closing the gate. Likewise, the transducer that should be closing the scanning gate is considered to be the transducer that is opening the gate.

## A.11 Short Train Alarm

The Short Train alarm indicates that a train had fewer than 50 axles.

## **A.12 Stuck Dragger Recovered Alarm**

The Stuck Dragger Recovered alarm indicates that a stuck dragger was detected during train passage and, at some point later, the dragging-equipment detector returned to its neutral position. After returning to its neutral position, the firmware must scan at least eight consecutive Dragger free axles before flagging this condition again.

## **A.13 Test Train Alarm**

The Test Train alarm indicates that a given train was generated by the SmartScanNG system. These trains are used for testing purposes and don't represent actual trains passing the site.

## **A.14 Unstable SOTC Alarm**

The Unstable SOTC alarm indicates that that upon train arrival, the system was activated by a track circuit and at some point during train passage (and before the end of train is reached) the track circuit deactivated at least once. When this alarm occurs, the track circuit should be examined.

The SmartScanNG is capable of operating without a track circuit or advance transducer. However, when this happens, the heat readings for the first axle may be invalid.

## **A.15 Very Slow Train Alarm**

The Very Slow Train alarm indicates that, at some point during train passage, four consecutive axles crossed the gating transducers at a speed of 7 mph (11.3 kph) or less. When this alarm occurs, the system won't announce axle count, exit speed, length of train, and total number of cars (even if these messages are enabled).



## Appendix B

# Integrity Failures

---

This appendix describes the conditions and events that the SmartScanNG system flags as Integrity Failures. These alarms indicate conditions in which the integrity of the system, and its ability to record train data accurately, may be compromised. These alarms are listed under the System Alarms section of the Train Detail and Exception Detail reports. **Section 4.0 - Producing Reports** tells how to produce these reports.

### B.1 Dead Battery Alarm

The Dead Battery alarm indicates a float voltage of less than 11.8 volts on the standby battery. On a solar-powered system, it indicates a regulated voltage of less than 11.8 volts from the solar subsystem.

### B.2 Dead Resistor Alarm

The bearing scanner's Dead Resistor alarm indicates the presence of two separate conditions. First, the train must contain a Cold Rail alarm on a given rail. Second, the recorded temperature for the bearing scanner's resistor on that rail must fall below the value set by the Cold Rail Temperature option on the Alarm Limits submenu (aka Alarm Settings submenu). **Section 3.0 - Serial Interface** tells how to view or change the Cold Rail Temperature option.

Alarm Settings, MP/KP-1794.5, Track-Single	
-----	
A	Absolute..... 180
B	Differential..... 130
C	Hot Wheel..... 650
D	Carside Slope..... 1.60
E	Carside Minimum... 300
F	Cold Rails..... 1
G	Cold Rail Temp.... 10
Alarm to change or Esc to quit?	

There is a different Dead Resistor alarm for each rail. That is, there is a Dead North Resistor alarm and a Dead South Resistor alarm (or, depending on track direction, a Dead East Resistor alarm and a Dead West Resistor alarm).

## B.3 Dead Wheel Scanner Resistor Alarm

The wheel scanner's Dead Wheel Scanner Resistor alarm indicates the presence of two separate conditions. First, the train must contain a Cold Wheel Scanner alarm on a given rail. Second, the recorded temperature for the wheel scanner's resistor on that rail must fall below the value set by the Cold Rail Temperature option on the Alarm Limits submenu (aka Alarm Settings submenu). **Section 3.0 - Serial Interface** tells how to view or change the Cold Rail Temperature option.

```
Alarm Settings, MP/KP-1794.5, Track-Single
```

```
-----  
A Absolute..... 180  
B Differential..... 130  
C Hot Wheel..... 650  
D Carside Slope..... 1.60  
E Carside Minimum... 300  
F Cold Rails..... 1  
G Cold Rail Temp.... 10
```

```
Alarm to change or Esc to quit?
```

There is a different Dead Wheel Scanner Resistor alarm for each rail. That is, there is a Dead North Wheel Scanner Resistor alarm and a Dead South Wheel Scanner Resistor alarm (or, depending on track direction, a Dead East Wheel Scanner Resistor alarm and a Dead West Wheel Scanner Resistor alarm).

## B.4 Highrange Transducer Miscounts Alarm

The Highrange Transducer Miscounts alarm indicates that the transducer counts for TO1 and TO2 are off by seven or more. This calculation is made after each axle crosses both gating transducers. When this alarm occurs, the system won't announce axle count, exit speed, length of train, or total number of cars (even if these messages are enabled).

The Highrange Transducer Miscounts alarm can be either a System Alarm or an Integrity Failure, depending on the presence of a Very Slow Train alarm. If a highrange transducer miscount occurs on a train that also contains a Very Slow Train alarm, the firmware treats the miscount condition as a System Alarm. This logic assumes that the train's slow rate of travel likely caused the transducer miscount condition. If a highrange transducer miscount occurs on a train traveling faster than 11.3 kph (7 mph), the firmware treats the miscount condition as an Integrity Failure.

## **B.5 Stuck Dragger During Train Passage Alarm**

The Stuck Dragger During Train Passage alarm indicates that the preset maximum number of consecutive axles have had Dragging-Equipment alarms during train passage. The maximum number is determined by the firmware and is currently five.

## **B.6 Stuck Dragger Pretrain Alarm**

The Stuck Dragger Pretrain alarm indicates that the dragging-equipment detector was stuck before the scanners started scanning. That is, between the time of first receiving a pulse from the track circuit (or the advance transducers) and the time of first receiving a pulse from either gating transducer, the SmartScanNG system detected an open circuit from the dragging-equipment detector.

## **B.7 Stuck High-Load Detector Pretrain Alarm**

The Stuck High-Load Detector Pretrain alarm indicates that, before the scanners started scanning, the high-load detector was stuck. That is, between the time of first receiving a pulse from the track circuit (or the advance transducers) and the time of first receiving a pulse from either gating transducer, the SmartScanNG system detected an open circuit from the high-load detector.

## **B.8 Stuck Wide-Load Detector Pretrain Alarm**

The Stuck Wide-Load Detector Pretrain alarm indicates that, before the scanners started scanning, the wide-load detector was stuck. That is, between the time of first receiving a pulse from the track circuit (or the advance transducers) and the time of first receiving a pulse from either gating transducer, the SmartScanNG system detected an open circuit from the wide-load detector.

There is a different Stuck Wide-Load Detector Pretrain alarm for each rail. That is, there is a Stuck Wide-Load Detector Pretrain North Side alarm and a Stuck Wide-Load Detector Pretrain South Side alarm (or, depending on track direction, a Stuck Wide-Load Detector Pretrain East Side alarm and a Stuck Wide-Load Detector Pretrain West Side alarm).

# B.9 Successive Cold Rails Exceeded Alarm

The Successive Cold Rails Exceeded alarm indicates that at least a preset maximum number of consecutive trains, all having Cold Rail alarms (on some systems, called Cold Bearing Scanner alarms) on the same railside, have passed a site. The maximum number (per railside) of consecutive trains having Cold Rail alarms allowed before generating an Integrity Failure alarm is set by the Cold Rails option on the Alarm Limits submenu (aka Alarm Settings submenu). **Section 3.0 - Serial Interface** tells how to view or change the Cold Rails option.

Alarm Settings, MP/KP-1794.5, Track-Single

-----

A	Absolute.....	180
B	Differential.....	130
C	Hot Wheel.....	650
D	Carside Slope.....	1.60
E	Carside Minimum...	300
F	Cold Rails.....	1
G	Cold Rail Temp....	10

Alarm to change or Esc to quit?

Under normal circumstances, Cold Rail conditions represent System Alarms, not Integrity Failures. However, if the number of consecutive trains bearing the same Cold Rail alarm equals or exceeds the cold-rail-alarm limit, this condition becomes an Integrity Failure. If the number of consecutive trains bearing identical Cold Rail alarms equals or exceeds the cold-rail-alarm limit, the System Alarms section of the Train Detail and Exception Detail reports displays the message "Successive Cold Rails Exceeded."

## B.10 Successive Cold Resistors Exceeded Alarm

The Successive Cold Resistors Exceeded alarm indicates that at least a preset maximum number of consecutive trains, all having Cold Resistor alarms on the same railside, have passed a site. The maximum number (per railside) of consecutive trains having Cold Resistor alarms allowed before generating an Integrity Failure alarm is set by the Cold Rails option on the Alarm Limits submenu (aka Alarm Settings submenu). **Section 3.0 - Serial Interface** tells how to view or change the Cold Rails option.

Alarm Settings, MP/KP-1794.5, Track-Single	
-----	
A	Absolute..... 180
B	Differential..... 130
C	Hot Wheel..... 650
D	Carside Slope..... 1.60
E	Carside Minimum... 300
F	Cold Rails..... 1
G	Cold Rail Temp.... 10
Alarm to change or Esc to quit?	

Under normal circumstances, Cold Resistor conditions represent System Alarms, not Integrity Failures. However, if the number of consecutive trains bearing identical Cold Rail alarms equals or exceeds the Cold Rails option on the Alarm Settings submenu, this condition becomes an Integrity Failure. If the number of consecutive trains bearing identical Cold Resistor alarms equals or exceeds the cold-rail-alarm limit, the System Alarms section of the Train Detail and Exception Detail reports displays the message "Successive Cold Resistors Exceeded."

## B.11 Successive Cold Wheels Exceeded Alarm

The Successive Cold Wheels Exceeded alarm indicates that at least a preset maximum number of consecutive trains, all having Cold Wheel Scanner alarms on the same railside, have passed a site. The user determines the number of consecutive trains used in the comparison through the Cold Rails option on the Alarm Limits submenu (aka Alarm Settings submenu). **Section 3.0 - Serial Interface** tells how to view or change the Cold Rails option.

```
Alarm Settings, MP/KP-1794.5, Track-Single
```

```
-----  
A Absolute..... 180  
B Differential..... 130  
C Hot Wheel..... 650  
D Carside Slope..... 1.60  
E Carside Minimum... 300  
F Cold Rails..... 1  
G Cold Rail Temp.... 10
```

```
Alarm to change or Esc to quit?
```

Under normal circumstances, cold-wheel conditions represent System Alarms, not Integrity Failures. However, if the number of consecutive trains bearing identical Cold Wheel Scanner alarms equals or exceeds the Cold Rails option on the Alarm Limits submenu (aka Alarm Settings submenu), this condition becomes an Integrity Failure. When this happens, the System Alarms section of the Train Detail and Exception Detail reports displays the message "Successive Cold Wheels Exceeded."

## B.12 Successive Cold Wheel Resistors Exceeded Alarm

The Successive Cold Wheel Resistors Exceeded alarm indicates that at least a preset maximum number of consecutive trains, all having Cold Wheel Scanner Resistor alarms on the same railside, have passed a site. The user determines the number of consecutive trains used in the comparison through the Cold Rails option on the Alarm Limits submenu (aka Alarm Settings submenu). **Section 3.0 - Serial Interface** tells how to view or change the Cold Rails option.

Under normal circumstances, cold-wheel-resistor conditions represent System Alarms, not Integrity Failures. However, if the number of consecutive trains bearing identical Cold Wheel Scanner Resistor alarms equals or exceeds the Cold Rails option on the Alarm Limits submenu (aka Alarm Settings submenu), this condition becomes an Integrity Failure. When this happens, the System Alarms section of the Train Detail and Exception Detail reports displays the message "Successive Cold Wheel Resistors Exceeded."

## Appendix C

# System Functions

---

This appendix lists the system functions provided by the SmartScanNG system.

To access the system functions:

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

**Section 3.0 - Serial Interface** tells how to display the Main menu. The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Main Menu
```

```
-----
A) Train Summary
B) Train Detail
C) Exception Summary
D) Exception Detail
E) System Status
F) Last Train
G) Last Test Train
H) AEI Diagnostic Detail
I) Replay EOT Announcement
J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
```

```
?
```

## 2 Select the System Functions menu.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
System Functions Menu
-----
```

- A) Radio Test
- B) Vocabulary Test
- C) Ramp Function
- D) Radio Inhibit
- E) Manual Test Mode
- F) 1KHz Test Tone
- G) Auto-Calibration
- H) Reset the COP Counters
- I) Remote System RESET
- J) Delete All Stored Train Data
- K) Clear Event Log
- X) Exit

?

### C.1 Radio Test

Selection of the Radio Test option broadcasts a short message through the speaker (on top of the SmartScanNG enclosure) and through the radio. Using this option lets you verify that the speaker and radio are working properly.

At single-track sites, the text of the message is usually "Testing, detector at milepost (*milepost number*), testing, one, two, three, four, five, four, three, two, one, testing." At double-track sites, the text of the message is usually "Testing, detector at milepost (*milepost number*), track (*track designation*), testing, one, two, three, four, five, four, three, two, one, testing."

### C.2 Vocabulary Test

Selection of the Vocabulary Test option enunciates all of the stored speech phrases. This announcement is broadcast through the speaker (on top of the SmartScanNG enclosure), but not through the radio. Therefore, it isn't affected by the Radio Inhibit option being enabled.

The text of the message is usually "zero, one, two, three, four, five, six, seven, eight, nine, integrity-failure, *beep*, detector-at, milepost, main-3, system-working, no-defects, main-1, main-2, rebroadcast, hotwheel, defect, axle, dragging-equipment-near, north, south, rail, east, west, track, car-I-D, no, hotbox, high-wide-near, you-have-a-defect, testing, train too slow, total axles, speed, temperature, length, minus, point, middle, high-load, wide-load, power-off, excess-alarms, repeat, total-cars, detector-out, A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, first, second, third, fourth, left, right, side, load, scanner resistor test, beginning in, minutes." Not all systems broadcast all the words/letters listed above.



## C.3 Ramp Function

Selection of the Ramp Function option generates a test train. It simulates two Absolute alarms, two Differential alarms, two Carside Slope alarms, and two Hotwheel alarms. It simulates the Carside and Hotwheel alarms even if detection for those alarms is disabled in the Equipment submenu. However, disabled alarms don't appear on the Last Test Train report.

You cannot stop the ramp function by pressing **[Esc]**.

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

## C.4 Radio Inhibit

Selection of the Radio Inhibit option prevents radio activation for three minutes. During this time, any announcements generated by the system are broadcast through the speaker (on top of the SmartScanNG enclosure), but not through the radio. This feature may be overridden by recalling this submenu and then typing **N**.

## C.5 Manual Test Mode

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

The test continues until 486 axles are simulated. You cannot stop this test by pressing **[Esc]**.

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

## C.6 1KHz Test Tone

Selection of the 1KHz Test Tone option generates a continuous tone for about 10 seconds through the speaker and the radio. Using this option lets you verify that the speaker and radio are working properly.

## C.7 Auto-Calibration

Selection of the Auto-Calibration option places the system in autocalibration mode.

The SmartScanNG system self-calibrates its pyrometer interface circuitry. You need only put a preheated calibrated heat source on a scanner and place the system in autocalibration mode. The system then scans all pyrometer inputs until the signal from the calibrated heat source is located. The necessary adjustments to the related interface circuitry are automatically made while the system monitors its own progress by analyzing changes in the heat signals. Once the procedure has been completed, autocalibration mode is disengaged and the calibration results are displayed on your computer. For more details, see **Appendix E & Appendix F - Calibration of Scanners**.

## C.8 Reset the COP Counters

Selection of the Reset the COP Counters option resets each COP counter to zero.

Associated with each microprocessor on the Processor board is a Computer Operating Properly (COP) counter. The SmartScanNG system uses these counters to keep track of every time the system automatically resets itself or the customer manually resets it, via the Remote System Reset option on the System Functions menu. These counters are used for diagnostic purposes only. The current value of these counters appears on the System Status report.

## C.9 Remote System Reset

Selection of the Remote System Reset option forces a system reset through a remote connection. It can also be used locally.

## C.10 Delete All Stored Train Data

Selection of the Delete All Stored Train Data option erases all of the stored train data. This encompasses all of the data on the trains in the Trains directory, Exceptions directory, and Test Train directory. After deleting all the train data, there isn't any way of regenerating it. The data is gone forever.

## C.11 Clear Event Log

Selection of the Clear Event Log option erases all of the events stored in the Event Log and displayed on the Event Log report. After deleting the log, there isn't any way of regenerating it. The data is gone forever.

## Appendix D

# Replacement of Scanner Cover-and-Module Assemblies

---

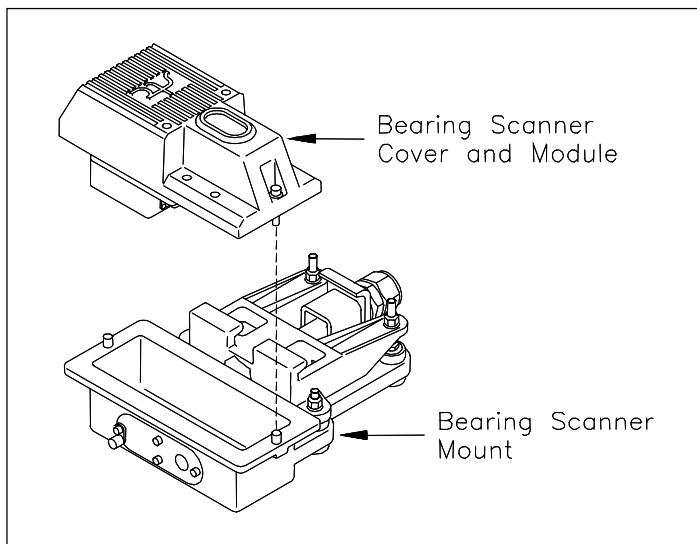
There are **Type II** bearing scanners and **Type II** wheel scanners. Both contain two major parts. The top part is the cover-and-module assembly. The module and its protective cover are tightly integrated and rarely should be taken apart. Except for the addition of a **plastic attenuation plug** on the wheel scanner cover, both types of cover-and-module assemblies are identical and can be used interchangeably. The bottom part is the mount. Bearing scanner mounts and wheel scanner mounts are different in design. They can't be interchanged.

There are also **Type III** bearing scanners and **Type III** wheel scanners. Both contain two major parts. The top part is the cover-and-module assembly. The module and its protective cover are tightly integrated and rarely should be taken apart. Except for the change of **filter frames** in the wheel scanner module, both types of cover-and-module assemblies are identical and can be used interchangeably. The bottom part is the mount. Bearing scanner mounts and wheel scanner mounts are different in design. They can't be interchanged.

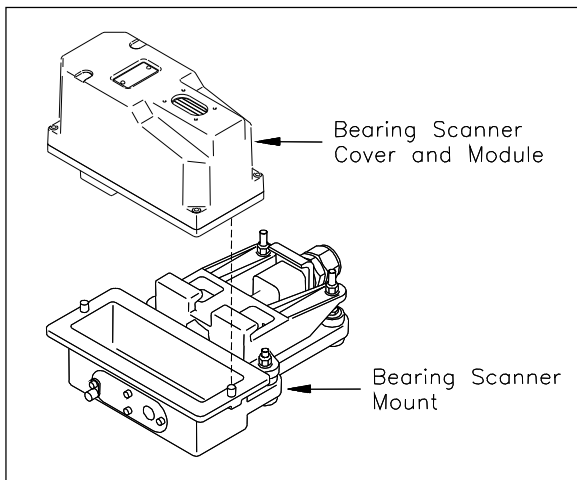
This appendix tells how to replace scanner cover-and-module assemblies. Replacement of scanner mounts isn't covered in this guide.

### D.1 Bearing Scanners

The figure below shows the major parts of a **Type II** bearing scanner.



The figure below shows the major parts of a **Type III** bearing scanner.



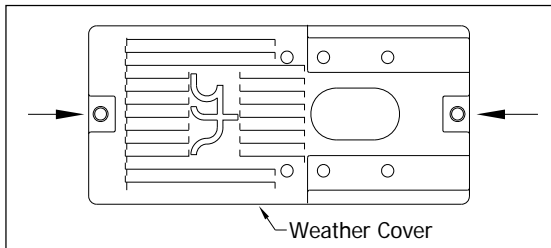
To replace a **Type II/Type III** bearing scanner cover-and-module assembly:

- 1 Be sure that you have on hand a new scanner cover-and-module assembly.
- 2 Be sure that you have on hand a T-handle 1/4-inch hex-wrench.
- 3 Turn off all power to the scanners.

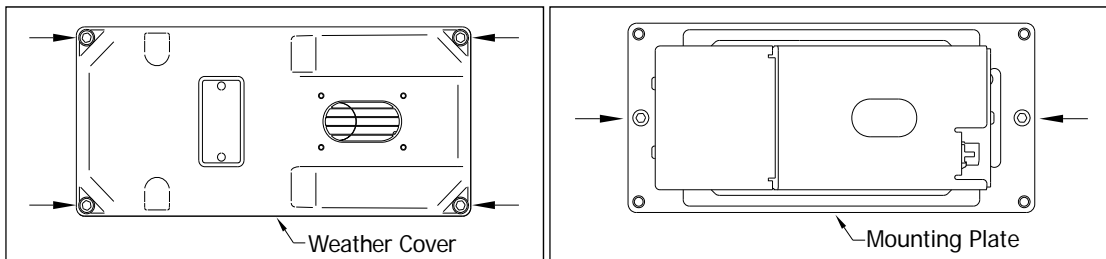
This requires turning off the DC power switch on the SmartScanNG enclosure and unplugging the AC power cord on the bottom of the SmartScanNG enclosure.

- 4 Using a T-handle 1/4-inch hex-wrench, loosen the socket-head-cap screws on the cover of the bearing scanner.

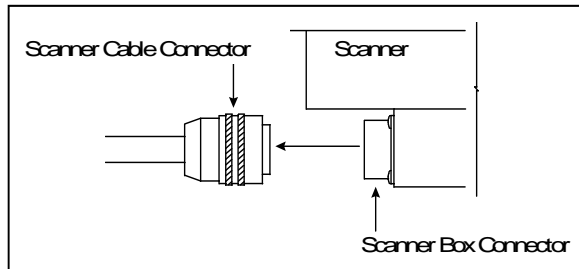
The **Type II** bearing scanner has two socket-head-cap screws that attach the weather cover to the mount.



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

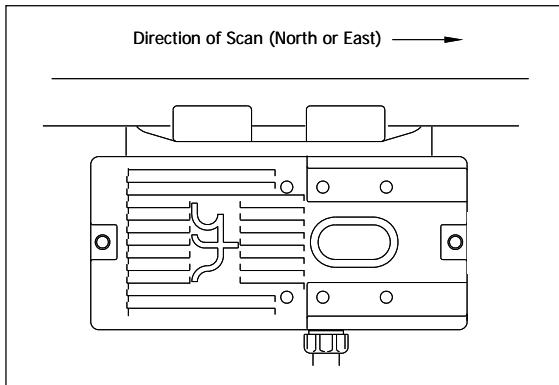


- 5 Separate the bearing scanner cover-and-module assembly from its mount.
- 6 If this is a **Type III** bearing scanner, disconnect the heater wiring plug.
- 7 Disconnect the scanner cable connector from the scanner box connector.

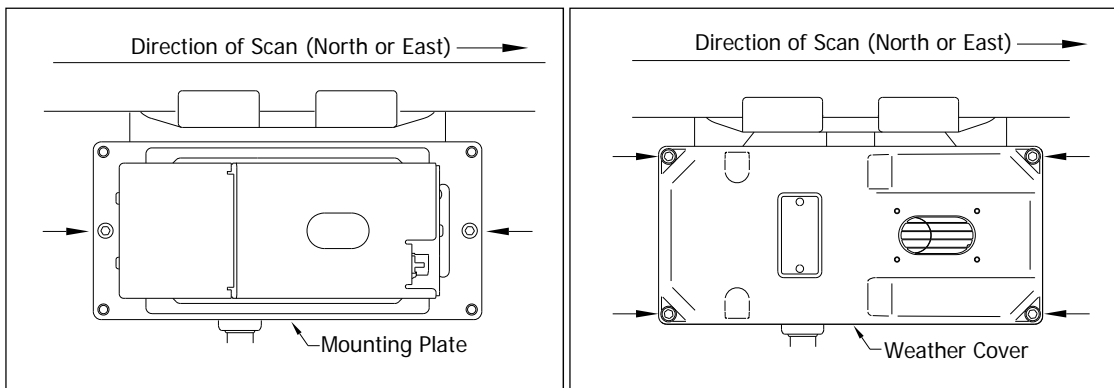


- 8 Store the removed scanner cover-and-module assembly in a safe place until you return it to STC for repair.
- 9 Attach the scanner cable connector to the scanner box connector of the new scanner cover-and-module assembly.
- 10 If this is a **Type II** bearing scanner:
  - a With the hole on top of the bearing scanner cover facing north or east, set the cover-and-module assembly onto its mount.
  - b Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.
- 11 If this is a **Type III** bearing scanner:
  - a With the hole on top of the bearing scanner cover facing north or east, set the mounting plate back onto its scanner mount.
  - b Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.
  - c Reconnect the heater wiring plug.
  - d With the hole on top of the bearing scanner cover facing north or east, set the weather cover back onto its mounting plate.
  - e Using the T-handle 1/4-inch hex-wrench, uniformly tighten the four socket-head-cap screws.

The top view of the **Type II** bearing scanner weather cover is shown below.

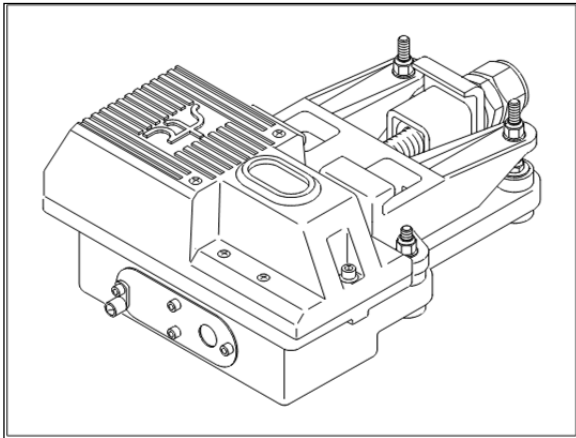


The top view of the **Type III** bearing scanner mounting plate and weather cover are shown below.

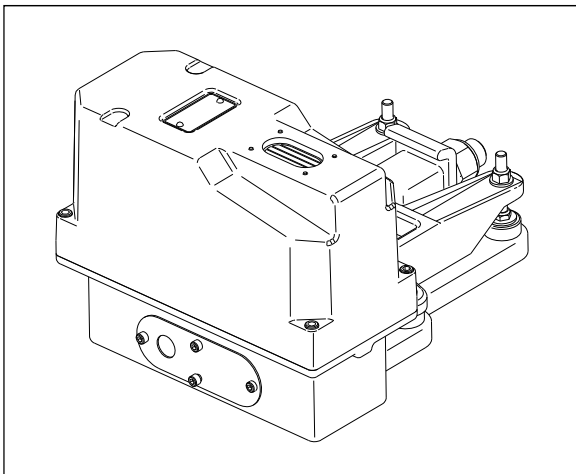


**12** Turn on power to the scanners.

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

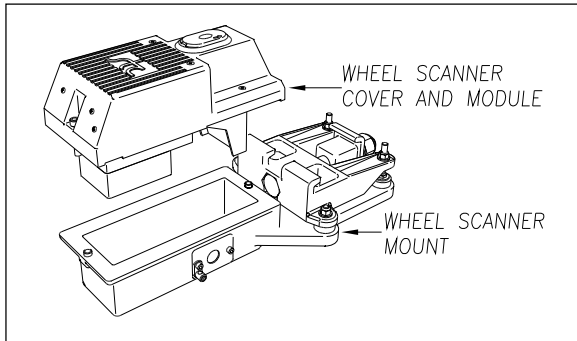


An assembled **Type III** bearing scanner looks like this.

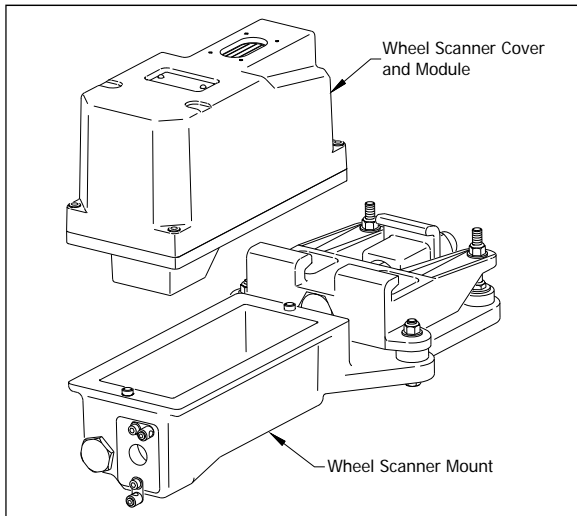


## D.2 Wheel Scanners

The figure below shows the major parts of a **Type II** wheel scanner.



The figure below shows the major parts of a **Type III** wheel scanner.



To replace a **Type II/Type III** wheel scanner cover-and-module assembly:

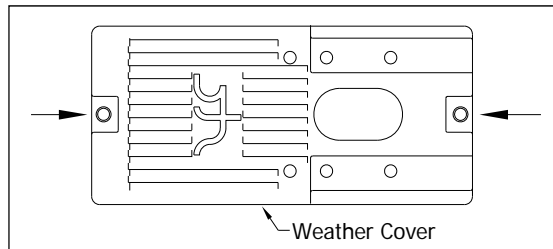
- 1 Be sure that you have on hand a new scanner cover-and-module assembly.
- 2 Be sure that you have on hand a T-handle 1/4-inch hex-wrench.
- 3 Turn off all power to the scanners.

This requires turning off the DC power switch on the SmartScanNG enclosure and unplugging the AC power cord on the bottom of the SmartScanNG enclosure.

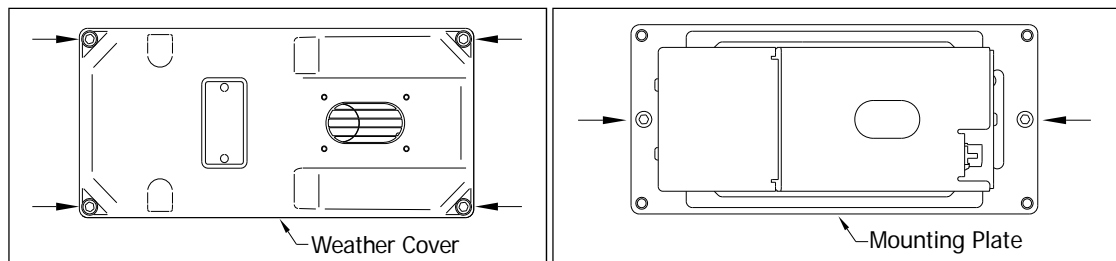


- 4 Using a T-handle 1/4-inch hex-wrench, loosen the socket-head-cap screws on the cover of the wheel scanner.

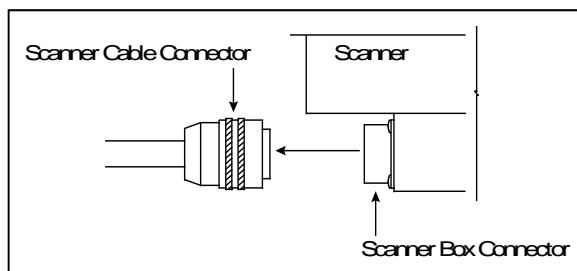
The **Type II** wheel scanner has two socket-head-cap screws that attach the weather cover to the mount.



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



- 5 Separate the wheel scanner cover-and-module assembly from its mount.
- 6 If this is a **Type III** wheel scanner, disconnect the heater wiring plug.
- 7 Disconnect the scanner cable connector from the scanner box connector.



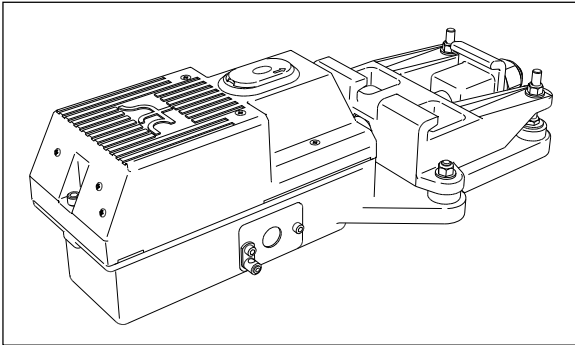
- 8 Store the removed scanner cover-and-module assembly in a safe place until you return it to STC for repair.
- 9 Attach the scanner cable connector to the scanner box connector (on the new scanner cover-and-module assembly).
- 10 If this is a **Type II** wheel scanner:
  - a With the hole on top of the wheel scanner cover facing the center of the track, set the cover-and-module assembly onto its mount.
  - b Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.

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

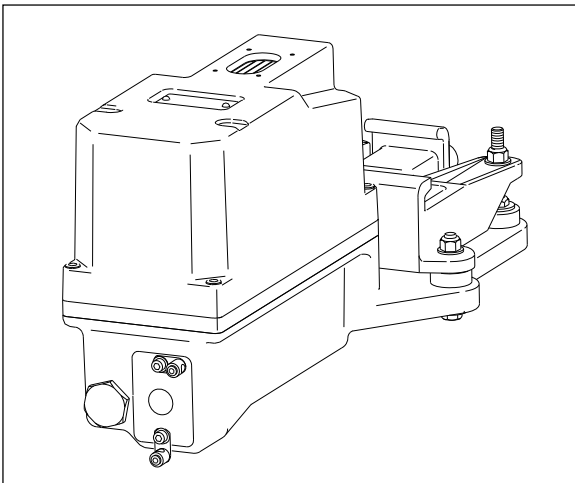
- a** With the hole on top of the wheel scanner cover facing the center of the track, set the mounting plate back onto its scanner mount.
- b** Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.
- c** Reconnect the heater wiring plug.
- d** With the hole on top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

**12** Turn on power to the scanners.

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



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



# Appendix E

## Calibration of Type II Scanners

---

The SmartScanNG<sup>2</sup> system self-calibrates its pyrometer interface circuitry. You need only put a preheated calibrated heat source on a scanner and place the system in autocalibration mode. The system then scans all pyrometer inputs until the signal from the calibrated heat source is located. The necessary adjustments to the related interface circuitry are automatically made while the system monitors its own progress by analyzing changes in the heat signals. Once the procedure has been completed, autocalibration mode is disengaged and the calibration results are displayed on your computer.

This appendix tells how to use the calibrated heat source to calibrate the scanners.

### E.1 Type II Bearing Scanners

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

To calibrate a bearing scanner:

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

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

#### WARNING

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

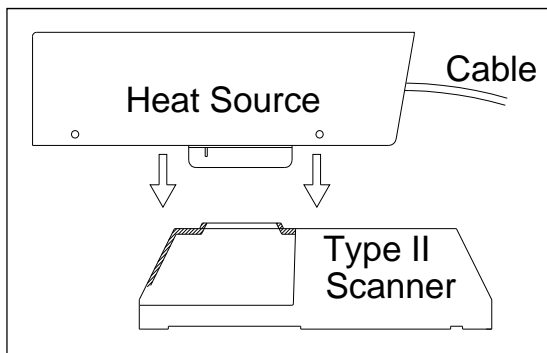
- 4 Using the supplied dust cap, cover the function connector that isn't being used.
- 5 Plug the other end of the power cord into the 120-volt USA socket.

- 6 On the control panel of the calibrated heat source, turn the temperature knob to **180°**.
- 7 Put the heat source in a shady area, out of direct sunlight and out of the wind.
- 8 Wait about 8 minutes for the heat source to reach operating temperature and stabilize.

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

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

- 9 Orient the power cord as depicted and place the calibrated heat source on the bearing scanner.



- 10 To prepare your computer:
  - a Plug your computer into COM1 using a null-modem cable.
  - b Turn on your computer.
  - c Be sure that your computer has installed communications software, that it is set to use full duplex, and that the baud rate is set to the appropriate setting (factory default is 19,200).
- 11 Using the serial interface, display the Main menu. Select **Systems Functions Menu**.

The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Main Menu
-----
      .
      .
      .
J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
?
```

Select **Auto-calibration** to calibrate the system's pyrometer interface circuitry.

The SmartScanNG<sup>2</sup> system will now calibrate itself. **Follow along on your computer screen until you see "Auto-Calibration Disengaged."** This message is an indication that the system is done with the calibration procedure. To abort the process, press **[Esc]** on your computer or remove the heat source from the bearing scanner.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
System Functions Menu
-----
```

- A) Radio Test
- B) Vocabulary Test
- C) Ramp Function
- D) Radio Inhibit
- E) Manual Test Mode
- F) 1KHz Test Tone
- G) Auto-Calibration
- H) Reset the COP Counters
- I) Remote System RESET
- J) Delete All Stored Train Data
- K) Clear Event Log
- X) Exit

?

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

```
Auto Calibration Selected
Scanner Types
-----
Rail-1..... Type-II   Rail-2..... Type-III
Wheel-1..... Type-III  Wheel-2..... Type-II

Is this correct ?

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

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

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

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

      :

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

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

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

```
Auto Calibration Selected

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

      :
      :
      :
```

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

- 12 When "Auto-Calibration Disengaged" is displayed on your computer, remove the calibrated heat source.
- 13 To return to the Main menu, type **X**.
- 14 To exit the serial interface and return the system to normal operation, type **X**.
- 15 Store the calibrated heat source and its power cord in the wayside enclosure.

**NOTE:**

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

Covering the apertures of all four scanners during the baseline acquisition routine should result in a more accurate baseline measurement because the reference for the scanner is stable when covered.

## E.2 Type II Wheel Scanners

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

To calibrate a wheel scanner:

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

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

### WARNING

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

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

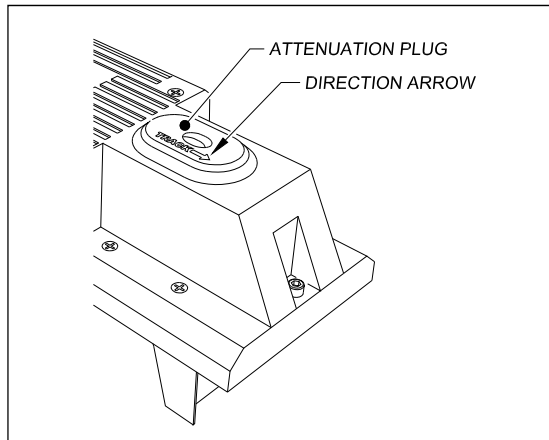
The heat source has reached operating temperature and stabilized when the temperature meter needle remains centered.

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

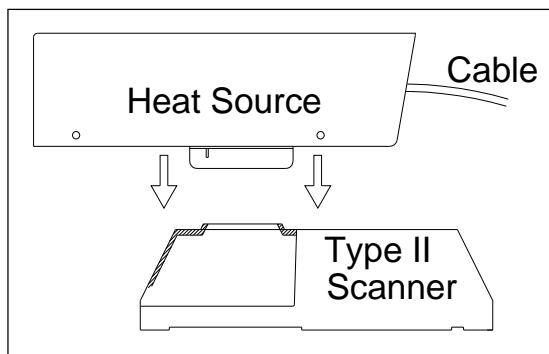
You'll need to remove the weather cover before you can replace the filter frame. Four socket-head-cap screws attach the weather cover to the mounting plate. Before continuing, be sure that the black filter frame is securely in place and that the four socket-head-cap screws on the weather cover are completely tight.



- 9** Remove the attenuation plug from the wheel scanner.



- 10** Orient the power cord as depicted and place the calibrated heat source on the wheel scanner.



- 11** To prepare your computer:

- a** Plug your computer into COM1 using a null-modem cable.
- b** Turn on your computer.
- c** Be sure that your computer has installed communications software, that it is set to use full duplex, and that the baud rate is set to the appropriate setting (factory default is 19,200).

**12** Using the serial interface, display the Main menu.

The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Main Menu
-----
      .
      .
      .
J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
?
```

**13** Select the **Auto-Calibration option** to calibrate the system's pyrometer interface circuitry.

The SmartScanNG<sup>2</sup> system will now calibrate itself. **Follow along on your computer screen until you see "Auto-Calibration Disengaged."** This message is an indication that the system is done with the calibration procedure. To abort the process, press **[Esc]** on your computer or remove the heat source from the wheel scanner.

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

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
System Functions Menu
-----
A) Radio Test
B) Vocabulary Test
C) Ramp Function
D) Radio Inhibit
E) Manual Test Mode
F) 1KHz Test Tone
G) Auto-Calibration
H) Reset the COP Counters
I) Remote System RESET
J) Delete All Stored Train Data
K) Clear Event Log
X) Exit
?
```

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

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

- 15 Replace the attenuation plug.

The attenuation plug has a direction arrow molded into the top of the plug. This arrow should be pointing toward the rail.

- 16 To return to the Main menu, type **X**.

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

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

#### **NOTE:**

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

Covering the apertures of all four scanners during the baseline acquisition routine should result in a more accurate baseline measurement because the reference for the scanner is stable when covered.

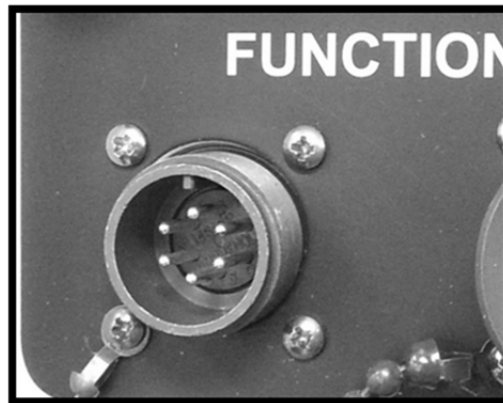
### E.3 Heat Source: Power Cable Warning

**Warning - Caution**  
**PLEASE – ONLY USE THE POWER**  
**CORD THAT WAS SHIPPED WITH**  
**THIS HEAT SOURCE.**  
USE OF THE OLD CORD WITH PINS IN  
THE CONNECTOR WILL DAMAGE THIS  
HEAT SOURCE

The old style power cord is a shock hazard because the connector is not “finger safe”. As a result, the connectors on both the power cord and the heat source were changed.



Old style plug with pins.



New heat source with pins.

If an old style cable is forcibly connected to a new heat source, the reverse polarity of the mating connector pins will damage the heat source.

## Appendix F

# Calibration of Type III Scanners

---

The SmartScanNG<sup>2</sup> system self-calibrates its pyrometer interface circuitry. You need only put a preheated calibrated heat source on a scanner and place the system in autocalibration mode. The system then scans all pyrometer inputs until the signal from the calibrated heat source is located. The necessary adjustments to the related interface circuitry are automatically made while the system monitors its own progress by analyzing changes in the heat signals. Once the procedure has been completed, autocalibration mode is disengaged and the calibration results are displayed on your computer.

This appendix tells how to use the calibrated heat source to calibrate the scanners.

### F.1 Bearing Scanners

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

To calibrate a bearing scanner:

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

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

#### WARNING

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

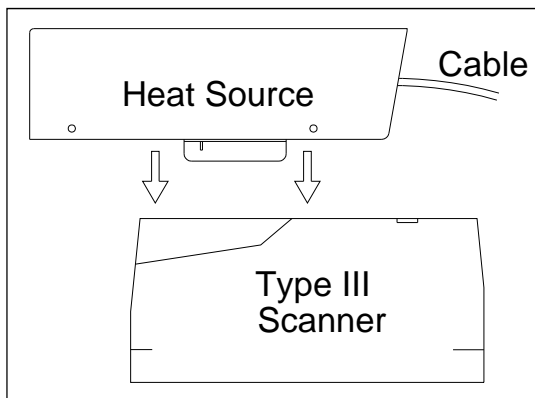
- 4 Using the supplied dust cap, cover the function connector that isn't being used.
- 5 Plug the other end of the power cord into the 120-volt USA socket.

- 6 On the control panel of the calibrated heat source, turn the temperature knob to **180°**.
- 7 Put the heat source in a shady area, out of direct sunlight and out of the wind.
- 8 Wait about 8 minutes for the heat source to reach operating temperature and stabilize.

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

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

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



- 10 To prepare your computer:
  - a Plug your computer into COM1 using a null-modem cable.
  - b Turn on your computer.
  - c Be sure that your computer has installed communications software, that it is set to use full duplex, and that the baud rate is set to the appropriate setting (factory default is 19,200).
- 11 Using the serial interface, display the Main menu.

The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Main Menu
-----
      .
      .
      .
J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
?
```

- 12 Select **Auto-calibration** to calibrate the system's pyrometer interface circuitry.

The SmartScanNG<sup>2</sup> system will now calibrate itself. **Follow along on your computer screen until you see "Auto-Calibration Disengaged."** This message is an indication that the system is done with the calibration procedure. To abort the process, press **[Esc]** on your computer or remove the heat source from the bearing scanner.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
System Functions Menu
```

- ```
-----
A) Radio Test
B) Vocabulary Test
C) Ramp Function
D) Radio Inhibit
E) Manual Test Mode
F) 1KHz Test Tone
G) Auto-Calibration
H) Reset the COP Counters
I) Remote System RESET
J) Delete All Stored Train Data
K) Clear Event Log
X) Exit
```

```
?
```

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

```

Auto Calibration Selected
Scanner Types
-----
Rail-1..... Type-II   Rail-2..... Type-III
Wheel-1..... Type-III  Wheel-2..... Type-II

Is this correct ?

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

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

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

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

      :

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

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

```

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

```

Auto Calibration Selected

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

```



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

- 13 When "Auto-Calibration Disengaged" is displayed on your computer, remove the calibrated heat source.
- 14 To return to the Main menu, type **X**.
- 15 To exit the serial interface and return the system to normal operation, type **X**.
- 16 Store the calibrated heat source and its power cord in the wayside enclosure.

**NOTE:**

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

Covering the apertures of all four scanners during the baseline acquisition routine should result in a more accurate baseline measurement because the reference for the scanner is stable when covered.

## F.2 Wheel Scanners

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

To calibrate a wheel scanner:

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

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

### WARNING

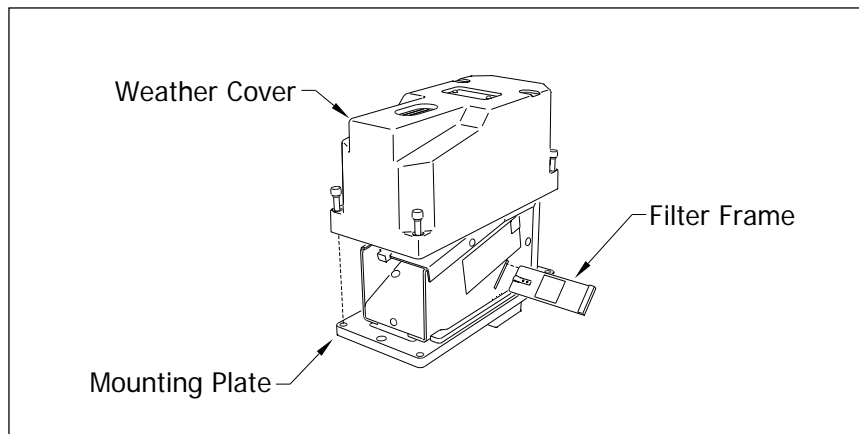
Once plugged in, both function connectors will have live AC present.

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

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

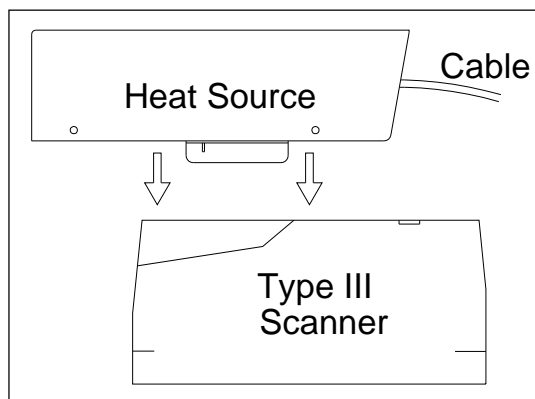
Once the temperature stabilizes, calibration may begin. Once stabilized, the temperature will change less than plus-or-minus one degree Fahrenheit.

- 9 Replace the red filter frame with the black one during calibration.



You'll need to remove the weather cover before you can replace the filter frame. Four socket-head-cap screws attach the weather cover to the mounting plate. Before continuing, be sure that the black filter frame is securely in place and that the four socket-head-cap screws on the weather cover are completely tight.

- 10** Re With the power cord to the front of the scanner, place the calibrated heat source on the wheel scanner



- 11** To prepare your computer:
  - a** Plug your computer into COM1 using a null-modem cable.
  - b** Turn on your computer.
  - c** Be sure that your computer has installed communications software, that it is set to use full duplex, and that the baud rate is set to the appropriate setting (factory default is 19,200).

**12** Using the serial interface, display the Main menu.

The Main menu looks like this.

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
Main Menu
-----
      .
      .
      .
J) Setup
K) Enter Pass-Thru Mode
L) System Functions
M) Event Log
X) Exit
?
```

**13** Select the **Auto-Calibration option** to calibrate the system's pyrometer interface circuitry.

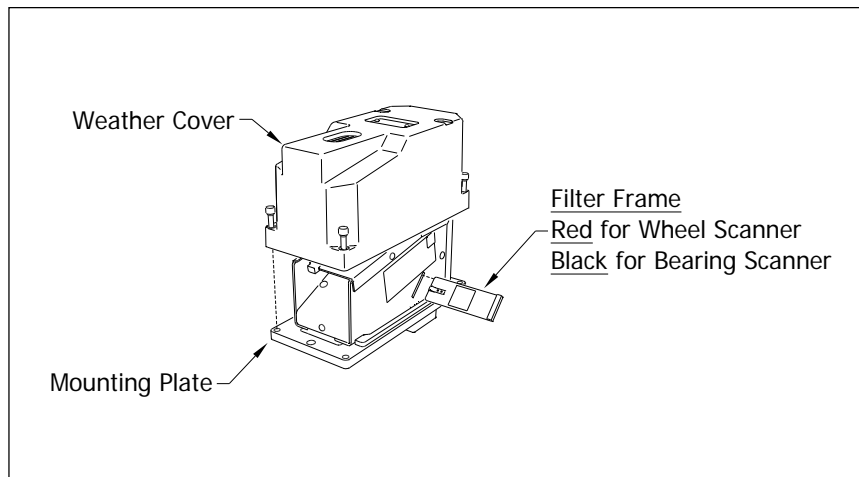
The SmartScanNG<sup>2</sup> system will now calibrate itself. **Follow along on your computer screen until you see "Auto-Calibration Disengaged."** This message is an indication that the system is done with the calibration procedure. To abort the process, press **[Esc]** on your computer or remove the heat source from the wheel scanner.

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

```
STC SmartScanNG, MP/KP-1794.5, Track-Single
09/30/2019 21:57
System Functions Menu
-----
A) Radio Test
B) Vocabulary Test
C) Ramp Function
D) Radio Inhibit
E) Manual Test Mode
F) 1KHz Test Tone
G) Auto-Calibration
H) Reset the COP Counters
I) Remote System RESET
J) Delete All Stored Train Data
K) Clear Event Log
X) Exit
?
```

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

- 14 When "Auto-Calibration Disengaged" is displayed on your computer, remove the calibrated heat source.
- 15 To return to the Main menu, type **X**.
- 16 To exit the serial interface and return the system to normal operation, type **X**.
- 17 Replace the black filter frame with the red one immediately following the successful completion of the auto-calibration function.



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

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

#### **NOTE:**

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

Covering the apertures of all four scanners during the baseline acquisition routine should result in a more accurate baseline measurement because the reference for the scanner is stable when covered.

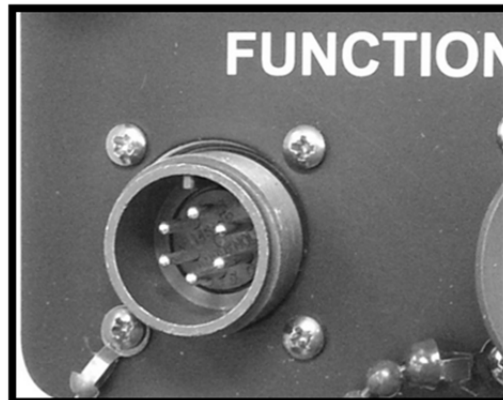
### F.3 Heat Source: Power Cable Warning

**Warning - Caution**  
**PLEASE – ONLY USE THE POWER**  
**CORD THAT WAS SHIPPED WITH**  
**THIS HEAT SOURCE.**  
USE OF THE OLD CORD WITH PINS IN  
THE CONNECTOR WILL DAMAGE THIS  
HEAT SOURCE

The old style power cord is a shock hazard because the connector is not “finger safe”. As a result, the connectors on both the power cord and the heat source were changed.



Old style plug with pins.



New heat source with pins.

If an old style cable is forcibly connected to a new heat source, the reverse polarity of the mating connector pins will damage the heat source.

## Appendix G

### Lens Cleaning of Scanners

---

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

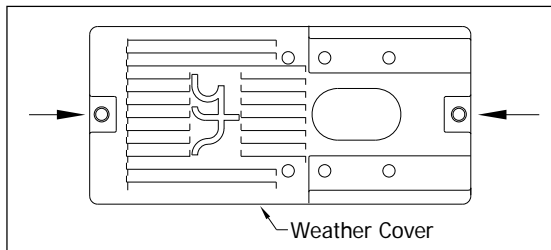
#### G.1 Type II Scanners

To clean the optics in the **Type II** scanners:

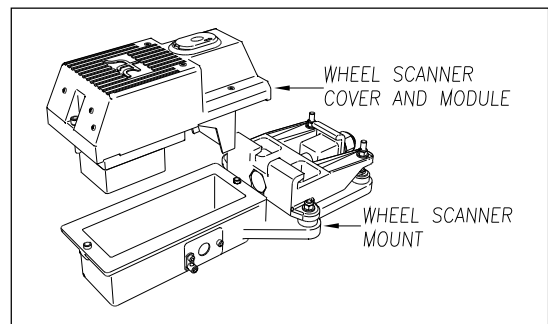
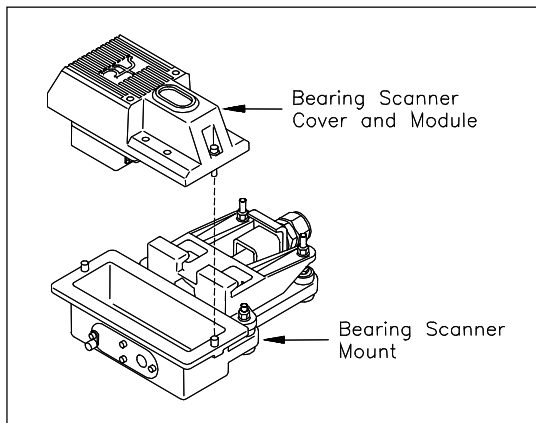
- 1 Be sure that you have on hand a T-handle 1/4-inch hex-wrench and a 9/64-inch Allen wrench.
- 2 Turn off all power to the scanners.

This requires turning off the DC power switch on the SmartScanNG enclosure and unplugging the AC power cord on the bottom of the SmartScanNG enclosure.

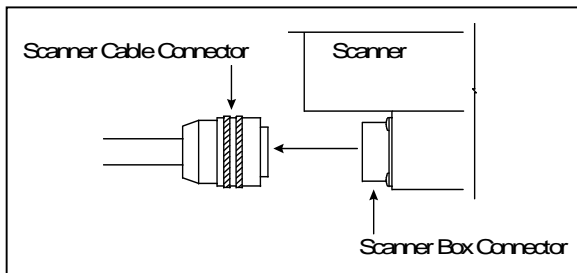
- 3 Using the T-handle 1/4-inch hex-wrench, loosen the two socket-head-cap screws that attach the weather cover to the mount.



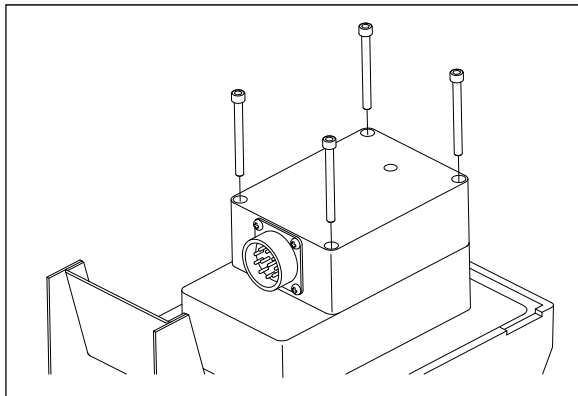
- 4 Separate the scanner cover-and-module assembly from its mount.



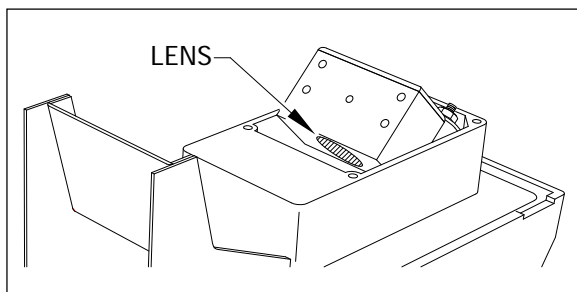
- 5 Disconnect the scanner cable connector from the scanner box connector.



- 6 Turn the cover-and-module assembly upside down.
- 7 Using the 9/64-inch Allen wrench, remove the four socket-head-cap screws from the bottom panel.



- 8 Store the socket-head-cap screws in a safe place until you replace it.
- 9 To expose the internal scanner module and lens assembly, separate the bottom panel of the scanner from the main body.



- 10 Using a soft dry cloth, remove any accumulated dirt or grit.  
Be careful not to abrade or scratch the surface of the lens.
- 11 Using a soft clean cloth, apply a mild cleaning solution such a Vallen V8L or any similar solution that would typically be used for cleaning eyeglasses.
- 12 Gently wipe the lens surface.  
Pay close attention to the area around the perimeter of the lens. It is important that the entire surface of the lens is clean.

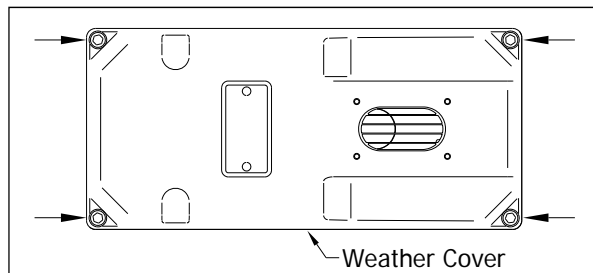


- 13 To restore a uniform surface, gently polish the lens surface with a clean dry cloth.
- 14 Reposition the bottom panel.
- 15 Replace the four socket-head-cap screws and tighten by hand.
- 16 Using the 9/64-inch Allen wrench, tighten the four socket-head-cap screws until they are completely tight.  
Be sure that the screws are uniformly tightened.
- 17 Attach the scanner cable connector to the scanner box connector.
- 18 If this is a **Type II bearing scanner**:
  - a With the hole on top of the bearing scanner cover facing north or east, set the cover-and-module assembly onto its mount.
  - b Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.
- 19 If this is a **Type II wheel scanner**:
  - a With the hole on top of the wheel scanner cover facing the center of the track, set the cover-and-module assembly onto its mount.
  - b Using the T-handle 1/4-inch hex-wrench, uniformly tighten the two socket-head-cap screws.
- 20 Turn on power to the scanners.

## G.2 Type III Scanners

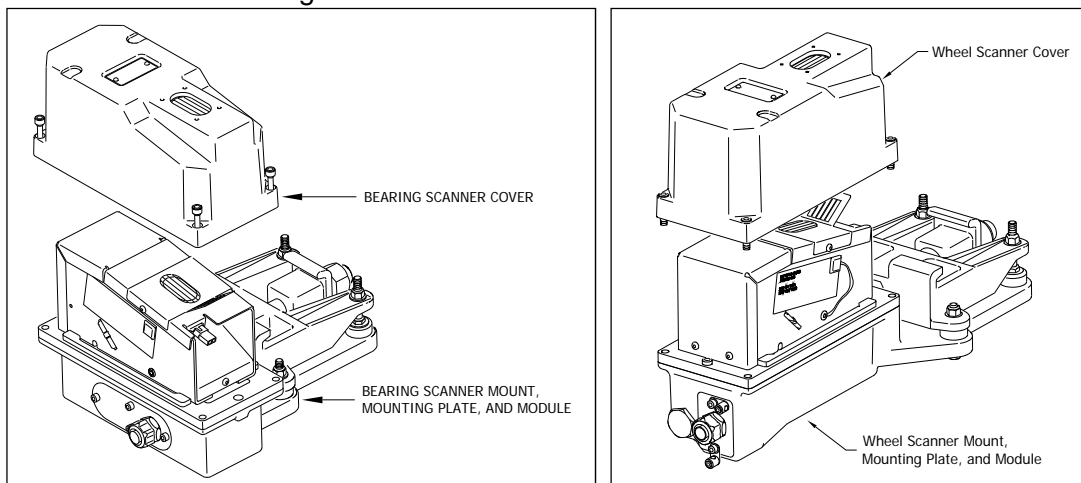
To clean the optics in the **Type III** scanners:

- 1 Be sure that you have on hand a T-handle 1/4-inch hex-wrench.
- 2 Turn off all power to the scanners.  
This requires turning off the DC power switch on the SmartScanNG enclosure and unplugging the AC power cord on the bottom of the SmartScanNG enclosure.
- 3 Using the T-handle 1/4-inch hex-wrench, loosen the four socket-head-cap screws that attach the weather cover to the mounting plate.



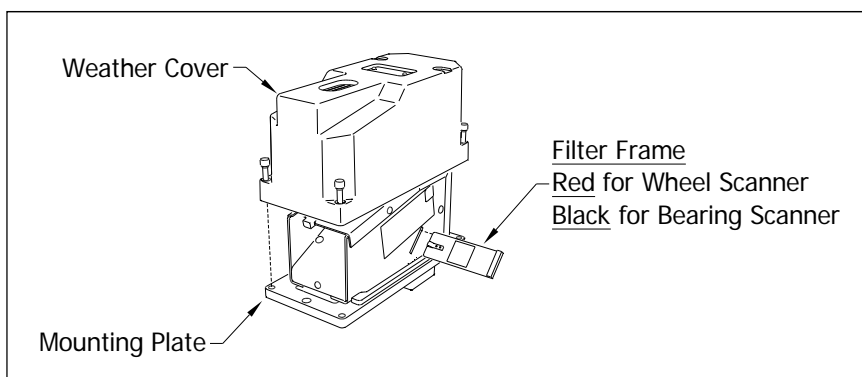
- 4 Remove the weather cover from its mounting plate.

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



- 5 Disconnect the heater wiring plug.

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



- 6 Grasp the tab and pull the filter frame out of the scanner module.
- 7 Using a soft dry cloth, remove any accumulated dirt or grit.  
Be careful not to abrade or scratch the surface of the lens.
- 8 Using a soft clean cloth, apply a mild cleaning solution such as a Vallen V8L or any similar solution that would typically be used for cleaning eyeglasses.
- 9 Gently wipe the lens surface.  
Pay close attention to the area around the perimeter of the lens. It is important that the entire surface of the lens is clean.

- 10 To restore a uniform surface, gently polish the lens surface with a clean dry cloth.
- 11 Insert the filter frame back in its receptacle.

Be sure that the frame is inserted correctly. To assure proper insertion, look at the glass portion of the filter. The reflective side should be facing toward the opening in the top of the module.
- 12 Reconnect the heater wiring plug.
- 13 If this is a **Type III bearing scanner**:
  - a With the hole on top of the bearing scanner cover facing north or east, set the weather cover back onto its mounting plate.
  - b Using the T-handle 1/4-inch hex-wrench, uniformly tighten the four socket-head-cap screws.
- 14 If this is a **Type III wheel scanner**:
  - a With the hole on top of the wheel scanner cover facing the center of the track, set the weather cover back onto its mounting plate.
  - b Using the T-handle 1/4-inch hex-wrench, uniformly tighten the four socket-head-cap screws.
- 15 Turn on power to the scanners.



# Appendix H

## Predictive Gate Scanning

---

This appendix describes predictive gate scanning of bearings.

### F.1 Overview

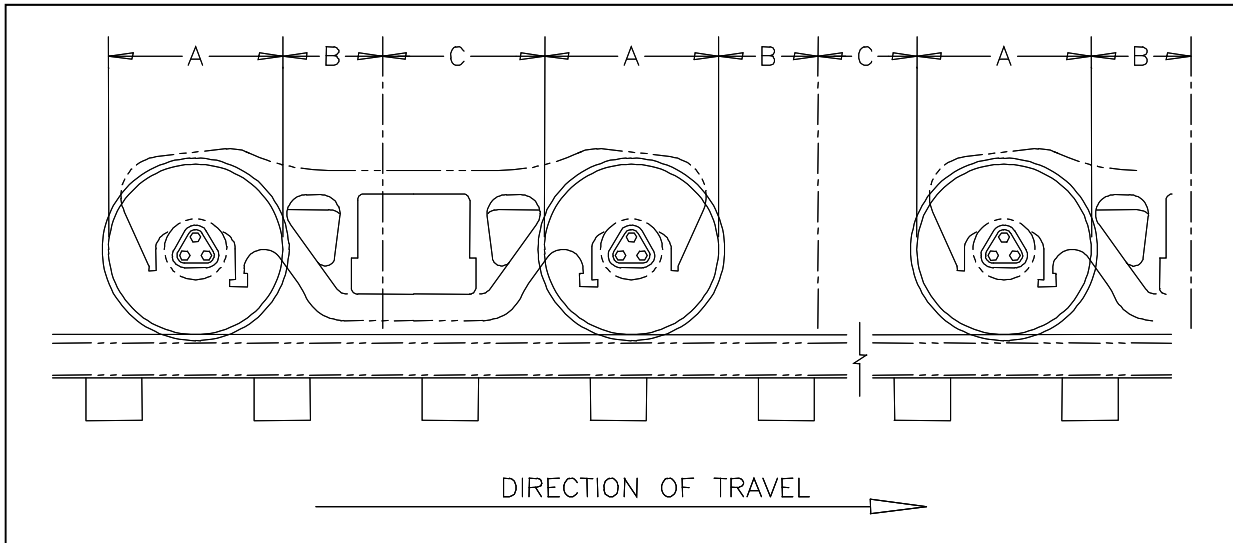
If a pyrometer is exposed to extreme infrared energy emission, the device itself can be driven into a saturated state. When this happens, it is blinded to subsequent changes in infrared energy emission. This blinded state can last up to 1-1/2 seconds.

Under certain circumstances, a pyrometer may be driven into saturation before the opening of the gate for a given axle. If the open-gate period was the only time during which pyrometer readings were sampled and processed, the system might miss an overheated bearing due to a device that was blinded before the opening of the gate. This can happen when a bearing is so overheated that it gives off infrared energy that can be seen by the pyrometer long before the bearing enters the pyrometer's field of view.

To compensate for this, the SmartScanNG system includes special logic for processing heat seen by the pyrometers as they scan between the axle gates. The interval between axles has been divided into two parts.

The first part of this interval is the 16 inches (40.6 centimeters) that immediately precede the axle as it approaches the bearing scanners. This interval is treated as a "predictive gate" region in which the actual gate period (the time a bearing is physically in the pyrometer's field of view) is extended by 16 inches. The remainder of the "between gate" interval forms the second part. Heat values read during this second interval are ignored.

The figure below depicts the three distinct scanning intervals (the in-gate period plus the two between-gate intervals).



The table below defines the intervals.

| Interval | Description                                                                                                    |
|----------|----------------------------------------------------------------------------------------------------------------|
| A        | The normal bearing scanning interval of about 24 inches (61 centimeters), depending on the transducer spacing. |
| B        | A distance of about 16 inches (40.6 centimeters) before a given wheel.                                         |
| C        | The distance between wheels that doesn't fall within interval-B.                                               |

## F.2 Scanning Process

Interval-A is the normal bearing scanning interval. Interval-B is an extension of interval-A. The greatest value read in either of these two intervals is recorded as the temperature for the axle. This value is checked for alarm levels in the same manner that scanned bearing temperatures are normally handled.

For interval-A: Heat values read during interval-A are processed normally.

For interval-B: Heat values read during interval-B that don't meet or exceed the Absolute alarm threshold are ignored. Values that meet or exceed the Absolute alarm threshold are handled as follows:

- If the interval-A heat value meets or exceeds the Absolute alarm threshold, it is processed normally and the interval-B heat reading is ignored.
- If the interval-A heat value doesn't meet or exceed the Absolute alarm threshold, but interval-B heat value does, a Pyrometer Saturation alarm is flagged and the interval-B heat value is stored and reported for the alarmed axle.

For interval-C: Heat values read during interval-C are ignored.

The Very Slow Train alarm indicates that, at some point during train passage, four consecutive axles crossed the gating transducers at a speed of 7 mph (11.3 kph) or less. The firmware doesn't check for Pyrometer Saturation alarms if the train has been flagged with a Very Slow Train alarm.

### F.3 Reporting the Pyrometer Saturation Alarm

If a Pyrometer Saturation alarm is detected and assigned to an axle, a printed message will appear on Detail reports.

The figure below shows a Train Detail report with a Pyrometer Saturation alarm. The contents of your report will be different.

|                                   |      |              |              |               |               |    |     |     |     |                                 |
|-----------------------------------|------|--------------|--------------|---------------|---------------|----|-----|-----|-----|---------------------------------|
| Southern Technologies Corporation |      |              |              |               |               |    |     |     |     |                                 |
| Next Generation Detector System   |      |              |              |               |               |    |     |     |     |                                 |
| TRAIN DETAIL                      |      |              |              |               |               |    |     |     |     |                                 |
| =====                             |      |              |              |               |               |    |     |     |     |                                 |
| .                                 |      |              |              |               |               |    |     |     |     |                                 |
| .                                 |      |              |              |               |               |    |     |     |     |                                 |
| .                                 |      |              |              |               |               |    |     |     |     |                                 |
| Car                               | Axle | East<br>Rail | West<br>Rail | East<br>Wheel | West<br>Wheel | ON | OFF | PW1 | PW2 | Alarms                          |
| -----                             |      |              |              |               |               |    |     |     |     |                                 |
| 1                                 | 1    | 58°          | 22°          | 176°          | 154°          | 25 | 0   | 17  | 18  |                                 |
|                                   | 2    | 58°          | 22°          | 176°          | 186°          | 25 | 59  | 14  | 14  |                                 |
|                                   | 3    | 210°         | 22°          | 176°          | 186°          | 25 | 59  | 14  | 14  | East Rail Pyro Saturation Alarm |
|                                   | 4    | 58°          | 22°          | 186°          | 176°          | 25 | 562 | 14  | 14  |                                 |
|                                   | 5    | 58°          | 22°          | 186°          | 172°          | 25 | 60  | 14  | 14  |                                 |
|                                   | 6    | 58°          | 22°          | 186°          | 176°          | 25 | 59  | 14  | 14  |                                 |
| 2                                 | 7    | 60°          | 22°          | 172°          | 186°          | 25 | 162 | 14  | 14  |                                 |
|                                   | 8    | 58°          | 22°          | 176°          | 186°          | 25 | 59  | 14  | 14  |                                 |
| .                                 |      |              |              |               |               |    |     |     |     |                                 |
| .                                 |      |              |              |               |               |    |     |     |     |                                 |
| .                                 |      |              |              |               |               |    |     |     |     |                                 |

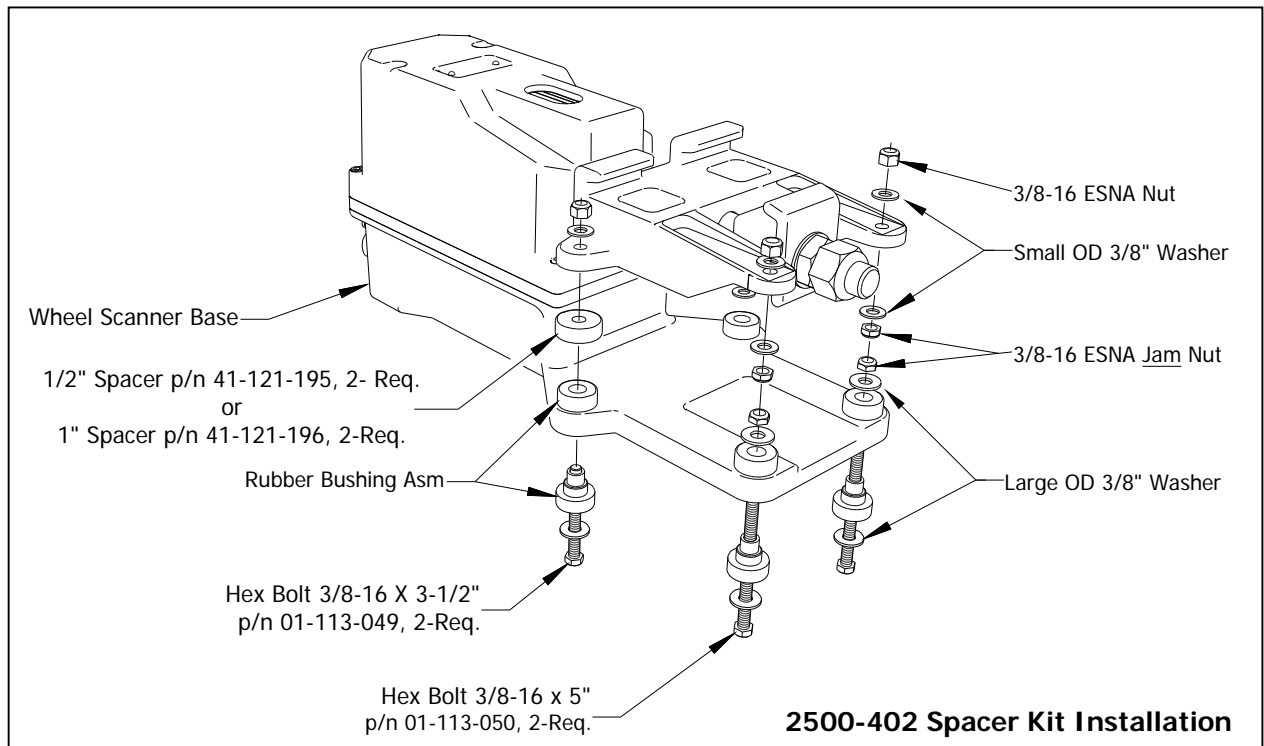
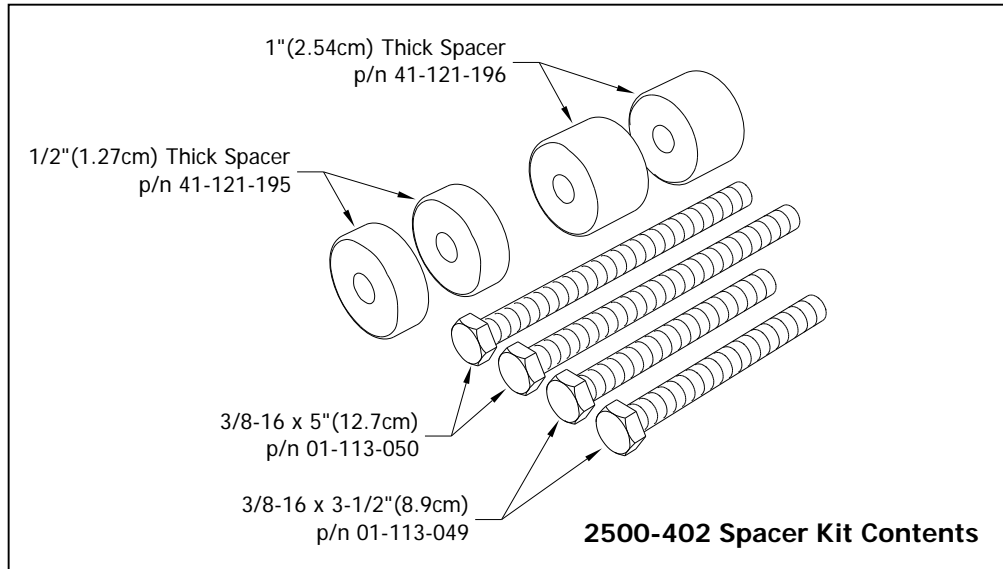


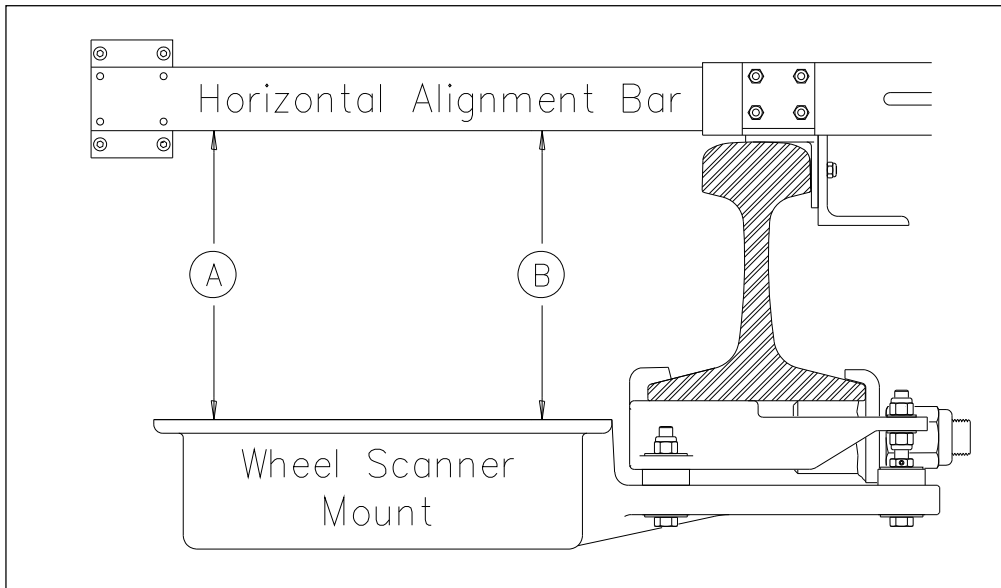


# Appendix I

## 2500-402 Spacer Kit Installation

The 2500-402 Spacer Kit provides hardware necessary to lower the Type III Hot Wheel Scanner assembly by either ½" or 1" for those applications that require additional rail clearance.





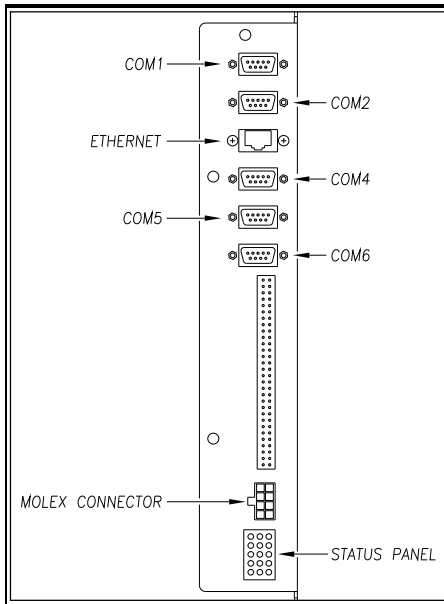
### Wheel Scanner Alignment:

Place the Alignment Fixture on the rails so that the adjustable gauge slide is over both wheel scanners. Extend the horizontal alignment bar of the fixture as far as it will go. At both ends of the scanner mount, measure from the bottom of the extended bar to the top surface of the mount.

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

NOTE: Alignment is the same regardless of spacers.

## Appendix J Communications Ports



**COM1 or COM2** – To use the serial interface, connect a local computer (DTE) using a crossover (null-modem) cable and set the communications software to use full duplex with a baud rate of 19,200.

Note: Leave STC ports at 19,200 baud.

**These are the standard local access ports.**

**ETHERNET** – To establish an Ethernet connection, you need a network interface card (NIC) in your computer and a Category 5 (CAT5) 8-wire network cable for basic 10/100 functionality.

**COM4** - At double-track sites, to communicate remotely with system 2, attach a crossover (null-modem) cable from COM4 of system1 (DTE) to COM1 (DTE) of system2,

**COM5** – At systems with AEI, attach a crossover (null-modem) cable from the AEI (DTE) Interface Module to COM5 (DTE) of the Controller module.

**COM6** – Used to communicate with the Velocity Modem board's instruction set and database. COM6 is connected to Port 2 on the Velocity Modem board..

| DCE (Data Circuit-Terminating Equipment) Modem |     |                        |           | Connecting Cable                             | DTE (Data Terminal Equipment) Computer |                      |      | Connecting Cable                                  | DTE (Data Terminal Equipment) Computer |                      |     |
|------------------------------------------------|-----|------------------------|-----------|----------------------------------------------|----------------------------------------|----------------------|------|---------------------------------------------------|----------------------------------------|----------------------|-----|
| Pins on the Modem                              |     | Name and Abbreviation  |           | Inside the Straight-Through Connecting Cable | Abbr.                                  | Pins on the Computer |      | *Inside the Crossover Null-Modem Connecting Cable | Abbr                                   | Pins on the Computer |     |
| Female DB25                                    | DB9 |                        |           |                                              |                                        | Male DB25            | D B9 |                                                   |                                        | Male DB25            | DB9 |
| 1                                              | -   | Frame Ground (Chassis) | FG        | —————                                        | FG                                     | 1                    | -    | —————                                             | FG                                     | 1                    | -   |
| 2                                              | 3   | Transmitted Data (TD)  | TxD       | ←————                                        | TxD                                    | 2                    | 3    | —————X—————                                       | TxD                                    | 2                    | 3   |
| 3                                              | 2   | Received Data (RD)     | RxD       | ————→                                        | RxD                                    | 3                    | 2    | —————X—————                                       | RxD                                    | 3                    | 2   |
| 4                                              | 7   | Request to Send        | RTS       | ←————                                        | RTS                                    | 4                    | 7    | —————X—————                                       | RTS                                    | 4                    | 7   |
| 5                                              | 8   | Clear to Send          | CTS       | ————→                                        | CTS                                    | 5                    | 8    | —————X—————                                       | CTS                                    | 5                    | 8   |
| 6                                              | 6   | Data Set Ready         | DSR       | ————→                                        | DSR                                    | 6                    | 6    | —————X—————                                       | DSR                                    | 6                    | 6   |
| 7                                              | 5   | Signal Ground          | SG        | —————                                        | SG                                     | 7                    | 5    | -----X-----                                       | SG                                     | 7                    | 5   |
| 8                                              | 1   | Data Carrier Detect    | DCD or CD | ————→                                        | DCD or CD                              | 8                    | 1    | -----X-----                                       | DCD or CD                              | 8                    | 1   |
| 20                                             | 4   | Data Terminal Ready    | DTR       | ←————                                        | DTR                                    | 20                   | 4    | —————X—————                                       | DTR                                    | 20                   | 4   |
| 22                                             | 9   | Ring Indicator         | RI        | —————                                        | RI                                     | 22                   | 9    | —————                                             | RI                                     | 22                   | 9   |

\*Note: DB25 wires 7 and 8 are straight through.

Note: The DTE to DTE interface cable is also called a null-modem, modem eliminator, or crossover cable.

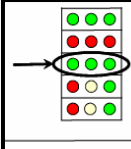
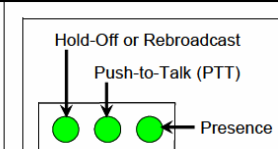
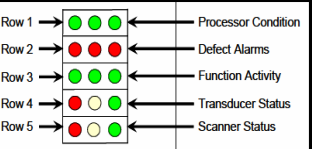


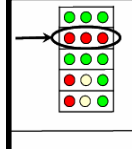
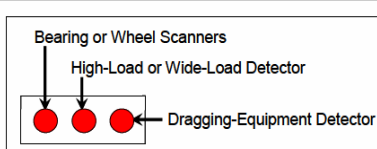
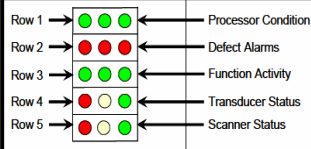
## Appendix K System Diagnostic Indicators

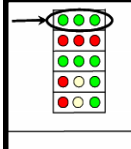
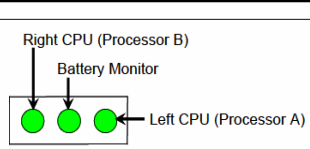
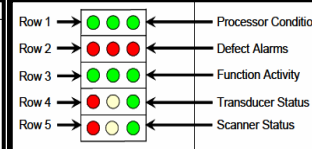
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                               |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|--|
| <b>Scanner Status</b> - The bottom row of LEDs indicates the operational condition of the scanners when a train isn't present at the site.                                                                                                                                                                                                                                                                                                                     |                                                                                                                               |  |
| <b>Left Red LED</b>                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Integrity Check Passed or Failed</b>                                                                                       |  |
| Not lighted                                                                                                                                                                                                                                                                                                                                                                                                                                                    | The last 20 trains have passed integrity                                                                                      |  |
| Lighted solid                                                                                                                                                                                                                                                                                                                                                                                                                                                  | In the last 20 trains, if both bearing scanners or both wheel scanners failed the integrity check                             |  |
| Flashing                                                                                                                                                                                                                                                                                                                                                                                                                                                       | In the last 20 trains, if just one bearing scanner or one wheel scanner failed the integrity check                            |  |
| Flashing on for 0.5 sec, off for 1.0 sec. - For a scanner on the north or east rail                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                               |  |
| Flashing on for 0.5 sec, off for 0.5 sec, on for 0.5 sec, off for 2.0 sec. - For a scanner on the south or west rail                                                                                                                                                                                                                                                                                                                                           |                                                                                                                               |  |
| Failed integrity test would result from:                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                               |  |
| <ul style="list-style-type: none"> <li>Insufficient heat from one or both bearing scanners or from one or both wheel scanners was detected.</li> <li>Shutter resistor check failed. The minimum value expected for the temperature of the resistor wasn't met.</li> <li>For any five consecutive trains, the difference between the average recorded temperatures for both bearing scanners or for both wheel scanners was more than a delta limit.</li> </ul> |                                                                                                                               |  |
| <b>Middle Yellow LED</b>                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Average Temperature Imbalance for 20 Consecutive Trains</b>                                                                |  |
| Not lighted                                                                                                                                                                                                                                                                                                                                                                                                                                                    | No trains, or less than 20 consecutive trains have a temperature imbalance between two bearing scanners or two wheel scanners |  |
| Flashing                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 20 or more consecutive trains have a temperature imbalance between two bearing scanners or two wheel scanners                 |  |
| Flashing on for 0.5 sec, off for 1.0 sec. - For a scanner on the north or east rail                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                               |  |
| Flashing on for 0.5 sec, off for 0.5 sec, on for 0.5 sec, off for 2.0 sec. - For a scanner on the south or west rail                                                                                                                                                                                                                                                                                                                                           |                                                                                                                               |  |
| Within the scanner pairs, the scanner with the lower temperatures is considered the problem scanner. The flashing LED can indicate a problem with either the bearing or the wheel scanner on the indicated rail or a problem with both of them.                                                                                                                                                                                                                |                                                                                                                               |  |
| <b>Right Green LED</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Average Temperature Imbalance for 20 Consecutive Trains</b>                                                                |  |
| Not lighted                                                                                                                                                                                                                                                                                                                                                                                                                                                    | One or more scanners aren't performing as they should be                                                                      |  |
| Flashing                                                                                                                                                                                                                                                                                                                                                                                                                                                       | All the bearing and wheel scanners worked properly during passage of the last 20 trains.                                      |  |
| Lighted solid                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Never                                                                                                                         |  |

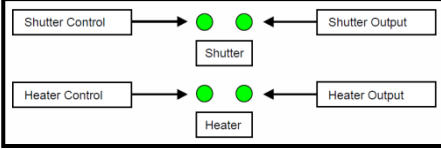
  

|                                                                                                                       |                                                                                                                                                                                                                                                                           |  |
|-----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>Transducer Status</b> - The fourth row of LEDs operates differently when a train is at the site and when it isn't. |                                                                                                                                                                                                                                                                           |  |
| <b>Right Green LED</b>                                                                                                | <b>Transducer Status</b>                                                                                                                                                                                                                                                  |  |
| Flashing                                                                                                              | When a train is present at the site, as a wheel travels over transducer TO1.                                                                                                                                                                                              |  |
| Flashing                                                                                                              | When a train isn't present at the site, when the count between TO1 and TO2 varies by three or less. Under those conditions, this LED will still flash even when the axle count is odd or the train speed falls below 10 mph (16 km/h).                                    |  |
| <b>Middle Yellow LED</b>                                                                                              | <b>Transducer Status</b>                                                                                                                                                                                                                                                  |  |
| Flashing                                                                                                              | When a train is present at the site, as a wheel travels over transducer TO2.                                                                                                                                                                                              |  |
| Lighted                                                                                                               | When a train isn't present at the site, when a gating transducer has generated more than 20 pulses on a train that the SmartScanNG system considers to be noise, OR the gating transducers are activating the system.                                                     |  |
| <b>Left Red LED</b>                                                                                                   | <b>Transducer Status</b>                                                                                                                                                                                                                                                  |  |
| Not lighted                                                                                                           | Normal, when a train is present at the site.                                                                                                                                                                                                                              |  |
| Lighted                                                                                                               | When a train is present at the site, when both transducers fail integrity tests.                                                                                                                                                                                          |  |
| Lighted solid                                                                                                         | When a train isn't present at the site, for any train in the last 20 trains, if the count between TO1 and TO2 varies by four or more, the speed of the train remains above 10 mph (16 km/h) <b>AND</b> the train has an odd axle count. The 3 conditions must be present. |  |
| Lighted solid                                                                                                         | When a train isn't present at the site, in the last 20 trains, if there's a possible fault with TO1 on one train and TO2 on another train                                                                                                                                 |  |
| Flashing                                                                                                              | When a train isn't present at the site, in the last 20 trains, if there's a possible fault with just one gating transducer on a given train                                                                                                                               |  |
| Flashing on for 0.5 sec, off for 1.0 sec. - For transducer T01                                                        |                                                                                                                                                                                                                                                                           |  |
| Flashing on for 0.5 sec, off for 0.5 sec, on for 0.5 sec, off for 2.0 sec. - For transducer T02                       |                                                                                                                                                                                                                                                                           |  |
| The gating transducer with fewer hits is considered the bad one.                                                      |                                                                                                                                                                                                                                                                           |  |

|                                                                                                                                                                 |                                                                                                                                            |                                                                                                                                                                      |                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <b>Function Activity</b> - The middle row of green LEDs indicates system activities, including train presence, push-to-talk (PTT), and hold-off or re-broadcast |                                                                                                                                            |   |  |
| Left Hold-off LED                                                                                                                                               | Lights during the reception of radio traffic. It will blink when there is radio traffic and the system is waiting to make an announcement. |                                                                                                                                                                      |                                                                                     |
| Middle PTT LED                                                                                                                                                  | Lights during radio transmissions made by the system.                                                                                      |                                                                                                                                                                      |                                                                                     |
| Right train presence LED                                                                                                                                        | Lights when the system senses the presence of a train. Turns off after the train leaves the site.                                          |                                                                                                                                                                      |                                                                                     |

|                                                                                                                                                                                                     |                                                                                                         |                                                                                   |                                                                                    |                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <b>Defect Alarms</b> - The second row of red LEDs indicates stored defect alarms, including those for bearing scanners, wheel scanners, dragging-equipment detectors, and high wide load detectors. |                                                                                                         |  |  |  |
| Left – HBD or HWD                                                                                                                                                                                   | Lighted when a bearing or wheel scanner defect alarm has been recorded in any of the last 40 trains.    |                                                                                   |                                                                                    |                                                                                     |
| Middle - HWLD                                                                                                                                                                                       | Lighted when a high wide load detector defect alarm has been recorded in any of the last 40 trains.     |                                                                                   |                                                                                    |                                                                                     |
| Right - DED                                                                                                                                                                                         | Lighted when a dragging-equipment detector defect alarm has been recorded in any of the last 40 trains. |                                                                                   |                                                                                    |                                                                                     |
| Each LED remains lighted until there isn't a recorded defect alarm for the equipment associated with it in any of the last 40 trains.                                                               |                                                                                                         |                                                                                   |                                                                                    |                                                                                     |

|                                                                                                                                    |                                                                                                                                                                                                       |                                                                                                                                                                      |                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <b>Processor Condition</b> - The top row of green LEDs indicates the condition of the CPUs and the battery on the Processor board. |                                                                                                                                                                                                       |   |  |
| Left LED - Right CPU Processor B                                                                                                   | Pulsates (repeats the cycle off, dim, bright, dim) when CPU is running its programs correctly. Blinks on and off, is lighted solid, or isn't lighted at all if a program isn't operating as expected. |                                                                                                                                                                      |                                                                                     |
| Middle LED - Battery                                                                                                               | Lighted if the processor board coin-cell battery is low or dead. Replace with the system powered up to avoid losing train data. Otherwise, it isn't lighted.                                          |                                                                                                                                                                      |                                                                                     |
| Right LED - Left CPU Processor A                                                                                                   | Pulsates (repeats the cycle off, dim, bright, dim) when CPU is running its programs correctly. Blinks on and off, is lighted solid, or isn't lighted at all if a program isn't operating as expected. |                                                                                                                                                                      |                                                                                     |

| <b>Chassis Mounted LEDs</b> - There are four green status LEDs on the lower right side of the chassis (located between the DC power switch and the status panel LEDs). These LEDs show the operation of the solid-state relays used to control the scanner shutters and heaters, and indicate problems with the relays if they fail to operate. |                             |                                 |                               |                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Shutter Control LED Top Right                                                                                                                                                                                                                                                                                                                   | Shutter Output LED Top Left | Heater Control LED Bottom Right | Heater Output LED Bottom Left | Explanation                                                                                                                               |
| On                                                                                                                                                                                                                                                                                                                                              | Off                         | Off                             | Off                           | Invalid. The shutters are being commanded to open, but the relay isn't responding with shutter voltage.                                   |
| On                                                                                                                                                                                                                                                                                                                                              | On                          | Off                             | Off                           | Normal if a train is present. Invalid if a train isn't present.                                                                           |
| Off                                                                                                                                                                                                                                                                                                                                             | On                          | Off                             | Off                           | Invalid. No shutter signal, but shutter voltage is present.                                                                               |
| Off                                                                                                                                                                                                                                                                                                                                             | Off                         | On                              | On                            | Normal if a train isn't present and the outside temperature is cold. Invalid if a train is present or if the outside temperature is warm. |
| Off                                                                                                                                                                                                                                                                                                                                             | Off                         | On                              | Off                           | Invalid. The heaters are being commanded to turn on, but the relay isn't responding with heater voltage.                                  |
| Off                                                                                                                                                                                                                                                                                                                                             | Off                         | Off                             | On                            | Invalid. No heater signal, but heater voltage is present.                                                                                 |
| Off                                                                                                                                                                                                                                                                                                                                             | Off                         | Off                             | Off                           | Normal if a train isn't present and the outside temperature is warm. Invalid if a train is present or if the outside temperature is cold. |
| <b>Note:</b> A shaded area means that a LED is not lighted. Any time the shutters are open, the heaters should be off.                                                                                                                                                                                                                          |                             |                                 |                               |                                                                                                                                           |
| Two of the LEDs are wired directly to the relays input terminals to indicate when a control signal has been sent from the controller. The other two LEDs are wired to the relay output to indicate when power is being applied to the scanner.                                                                                                  |                             |                                 |                               |                                                                                                                                           |

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