SMARTSCAN | iCUBE

Track-Integrity Detector Reference Guide

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

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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, maintaining, and using the iCube system. Failure to do so could result in damage to the equipment or serious injury to you.

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their phone number is 423-892-3029

Contents

This section lists the headings of this guide in sequential order with their page references.

1.0 — Introduction

This section summarizes the purpose of this guide, describes the iCube Track-Integrity Detector **s**ystem, tells how to comment on this guide, and tells how to order more copies of this guide.

1.1 Purpose of This Guide

The technical staff at Southern Technologies Corporation (STC) created the iCube system. This guide describes that system.

This guide is for those who purchase, install, maintain, manage, or use the iCube system.

1.2 Description of the System

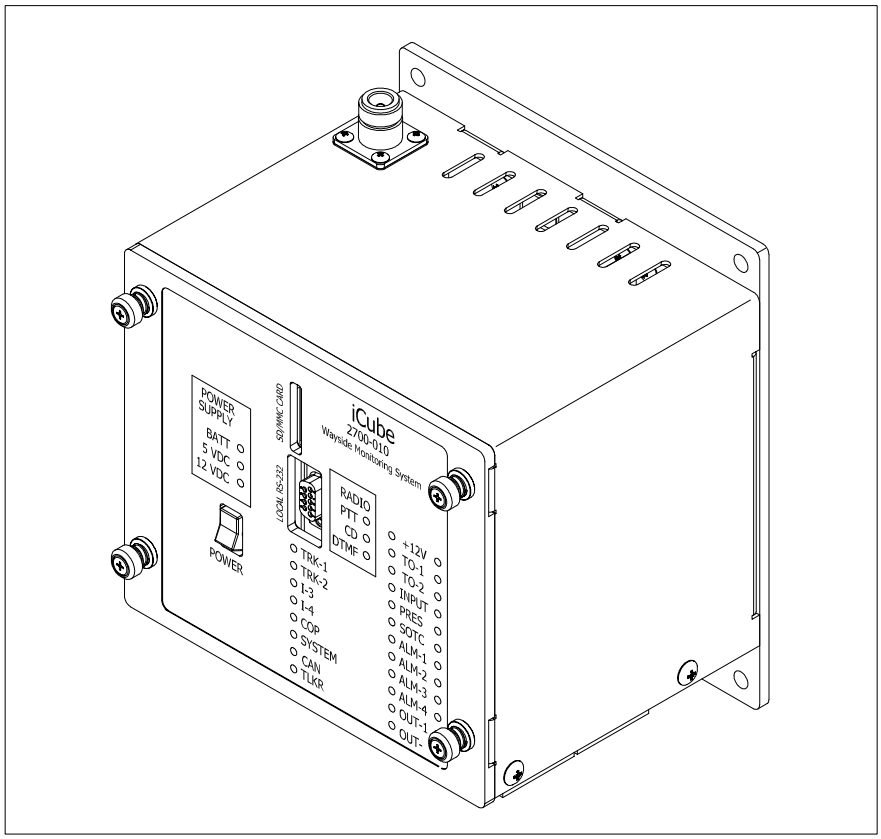
The iCube is installed in an appropriate wayside enclosure. The system is firmware driven. Internal firmware can be changed to meet the unique needs of a given railroad. Some parts of the system, such as track circuits and transducers, are installed on railroad tracks.

Each iCube system consists of:

- One iCube per site
- One temperature probe per site, if used
- One track circuit per track, if used
- Up to two transducers per track, if used
- Up to four alarm inputs for switch-closure-type alarm-generating devices per track

Southern Technologies Corporation (STC) provides the iCube, the transducers, and temperature probe if used. The customer provides the alarm-generating devices and the track circuits, if used.

The figure below shows the iCube module.



During train passage, the iCube:

- Examines the signals from the track-integrity, recall, and transducer inputs.
- Determines with transducer inputs which direction to announce track-integrity status.
- Announces track integrity in a humanlike voice via the radio.

The track-integrity firmware:

- Provides an option to announce track integrity only for a “Down” indication or for both “Ok” and “Down” status.
- Provides options to announce only selected track zones.
- Provides selectable delay to not conflict with track-integrity status change at adjacent locations.
- Provides a recall function which reports the old status (time selectable from 0 through 30 seconds). If over the selected time, it will provide the current status of the inputs.
- Provides an option to repeat a message with a 5-second interval between transmissions.
- Provides an option to announce “Detector Out.”
- Provides an option to announce “Low Battery” when a low-battery condition exists.

1.3 iCube Features

SD Card Operation: The iCube contains a slot for the insertion of an SD memory card. All setup information, operating programs, and train data are written to the SD card. In the event of system failure, the SD card can simply be swapped to the replacement unit, and all required information transferred to the replacement.

Isolated Power Supplies: The iCube has isolated internal power supplies that allow it to be co-located with signal equipment and operate from the signal battery. The battery monitor input works through an isolation amplifier. The radio and CPU power supplies are isolated. The system includes a separate, dedicated power supply that can be used to power external devices up to a capacity of .5 amps @ 12 VDC with isolation.

1.4 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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Technical Publications Department
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Chattanooga, Tennessee 37416-3638
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All comments become the sole property of STC, and none will be returned.

1.5 How to Order More Copies of This Guide

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

1.6 Standard Warranty

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

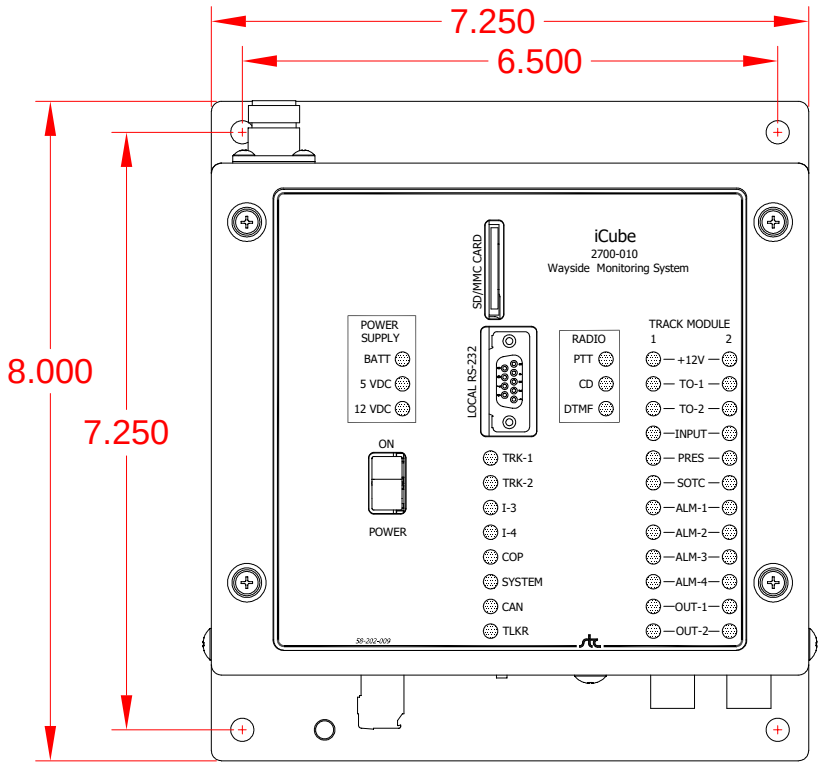
Purchaser is responsible for shipment of the defective product to STC. STC will pay the return shipping charges.

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.

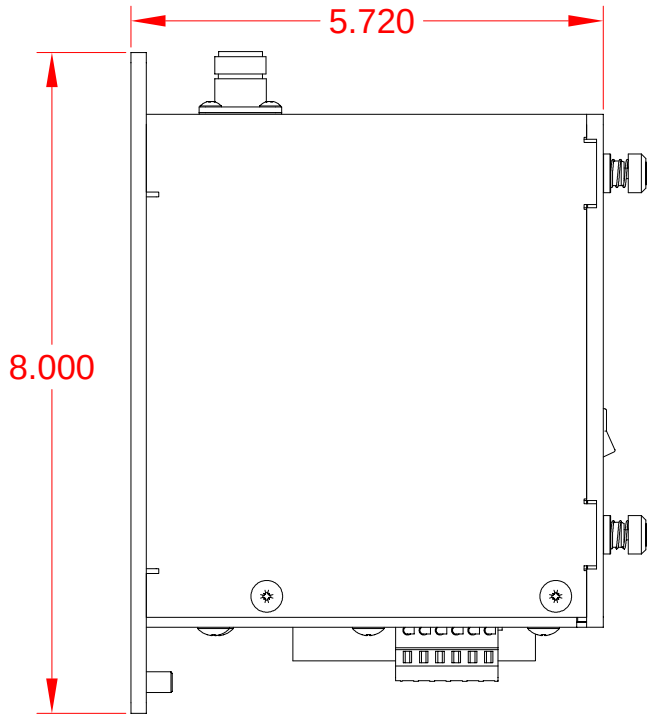
2.0 — iCube Track-Integrity Detector

The iCube monitors, processes, and reports certain conditions detected by the system's track hardware. The iCube's compact enclosure is designed to fit the form factor of a B2 relay and can be mounted on a PTMW Swing Rack. It can also be wall-mounted.

The figure below shows a front view of the iCube with dimensions.



The figure below shows a side view of the iCube with dimensions.



2.1 Technical Specifications

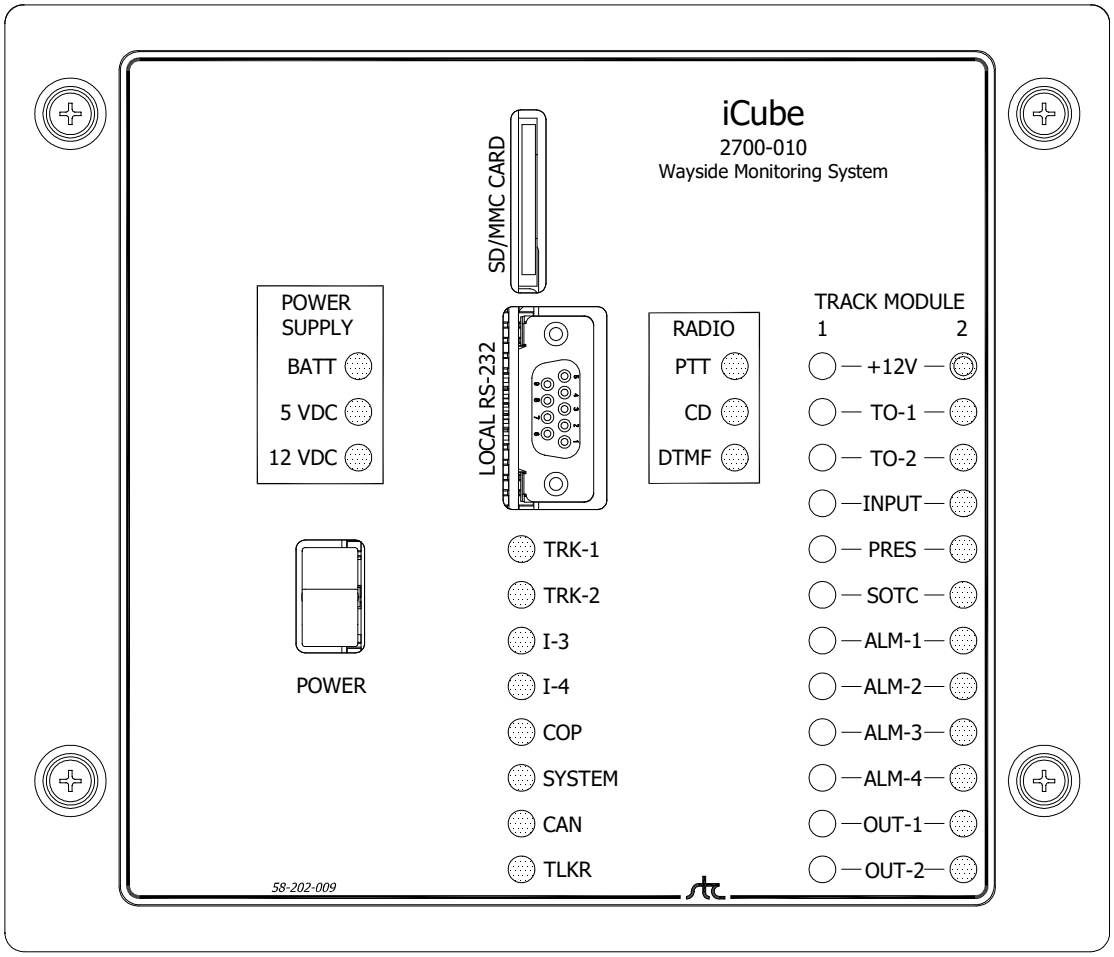
Below are the technical specifications for the Model iCube.

General Specifications	
Operating Input Voltage	9 – 18 VDC @ 0.85 Amps (Standby) / 2.70 Amps (Transmitting)
Input Voltage Protection	Reverse Polarity Diode / Self-Restoring Fuse
Internal Auxiliary Power Supply	12 VDC @ 0.50 Amps – 1600 Volt Isolation
Radio Power Supply	12 VDC @ 4 Amps – 1500 Volt Isolation
CPU Power Supply	5 VDC @ 3 Amps – 1500 Volt Isolation
Communications	Comm 1: External RS 232 Port Comm 2: RS 485 Port Comm 3: RJ45 Ethernet Port - Local Comm 4: RJ45 Ethernet Port – Network
Temperature Specification-Industrial	-40 + 70C fan-less operation.
Size	8.00” H x 7.25” W x 5.72” D
Weight	5.7 lbs.
Finish	White-Powder Coat Over 5052 Aluminum
I/0 Specifications	
Outputs	2 Per Track Module. 12 VDC @ 200 mA
Inputs	Ambient Temperature, Magnetic Transducer (2 per track), Contact Closure Alarm (4 per track), Contact Closure Spare (1 per track), & Track Circuit (1per track)
CPU Module	
Main CPU	Coldfire – MOD 5282
Comms. CPU	Coldfire – MOD 5234
Track Module CPU	Coldfire – MOD 5213
Data Storage	SD Card – Up to 32 GB

2.2 Front Panel

The iCube front panel is secured to the enclosure with four captive fasteners. Slotted holes in the panel provide access to the power switch, a local RS232 port, and an SD/MMC card slot. Labeled LED windows allow viewing of the internal status indicators.

The figure below shows the front panel of the iCube.



2.2.1 Status LEDs

The table below describes LED indicators for the Power Supply.

LED	Meaning when Lit
BATT	Lights when 12 VDC is being supplied from the battery to the input of the power supply.
5 VDC	Lights when 5 VDC is present.
12 VDC	Lights when 12 VDC is present.

The table below describes the LED indicators for the Central Processor.

LED	**Meaning when Lit**
PTT	Push-to-talk. Lights when the radio is transmitting.
CD	Carrier Detect. Lights when the radio is receiving a signal.
DTMF	Lights when valid DTMF code is detected (not supported in Track-Integrity application).
TRK-1	Flashes when this card has a problem.
TRK-2	Flashes when this card has a problem.
I-3	Currently not used.
I-4	Currently not used.
COP	Computer Operating Properly. Flashes when the Processor Card is operating correctly.
SYSTEM	The system warning LED will blink on and off as long as the warning exists. This includes anything that would show up in the System Status Report under “System Warnings” with the exception of “Radio not responding”. In addition to the system warning LED, if the system boots up and recognizes incompatible software versions between the Talker, Central Processor, or Track modules, the iCube will sound 10 audible beeps. These version numbers appear in the System Status Report under “Software Versions”.
CAN	Controller Area Network. Lights to indicate activity on the CAN bus.
TLKR	Lights to indicate communications with Talker Processor.

The table below describes the LED indicators for Track Modules 1 & 2.

LED	Meaning when Lit
+12V	Lights when 12 VDC is present on Track Module Card
TO-1	Lights when transducer TO1 is active. Flickers as each wheel pass over transducer TO1 during train passage.
TO-2	Lights when transducer TO2 is active. Flickers as each wheel pass over transducer TO2 during train passage.
INPUT **(RECALL)**	Lights when there is an open circuit at the spare input.
PRES	Lights when a train is present.
SOTC	Lights when there is a closed-circuit at the SOTC input.
ALM-1 **(NT INPUT)**	Lights when there is an open circuit at the alarm1 input.
ALM-2 **(ST INPUT)**	Lights when there is an open circuit at the alarm2 input.
ALM-3 **(NA INPUT)**	Lights when there is an open circuit at the alarm3 input.
ALM-4 **(SA INPUT)**	Lights when there is an open circuit at the alarm4 input.
OUT-1 **(LED White Indicator)**	Lights when output1 (LED White Indicator) is active. This output will be pulled negative (to ground) when both tracks associated with NT input and ST input are down, as long as there was no train movement (indicated by transducer activity) when the second input (NT or ST) went down. The output will remain negative until either NT input or ST input picks back up.
OUT-2	Lights when output-2 is active.

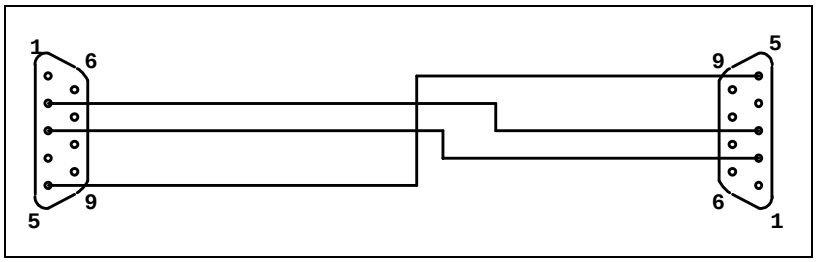
2.2.2 Serial Port

On the front panel is a communications port, which connects the system to an external serial (RS232) device. Use it to retrieve the stored data and set system parameters.

The table below shows which signals are present on the serial port.

PIN Number	I/O	PIN Function
2	I	Receive data (Rxd)
3	O	Transmit data (Txd)
5	--	Signal ground (Gnd)

To access the system through the serial port, you need a computer with an installed communications program, such as ProComm or HyperTerminal. Communications parameters should be set at eight data bits, one stop bit, and no parity. The default baud rate is 115,200 baud. A three-wire cable, which is required, should be wired as shown below.



Only pins 2, 3, and 5 need to be connected for proper operation. However, a standard 9-pin-to-9-pin null-modem serial cable can be used.

2.2.3 SD/MMC Card Slot

The SD (Secure Digital) is a non-volatile memory card. The iCube uses it for storing train data and system logs and for loading new software.

An SD card should be inserted in the SD/MMC slot on the iCube front panel. If no card is present, the system can still scan trains, detect alarms, and make announcements, but it cannot store the data for future reference.

Any standard SD card up to 2GB can be used. SDHC cards up to 32 GB can be used. Other types of memory cards such as miniSD, microSD, and CompactFlash cannot be used.

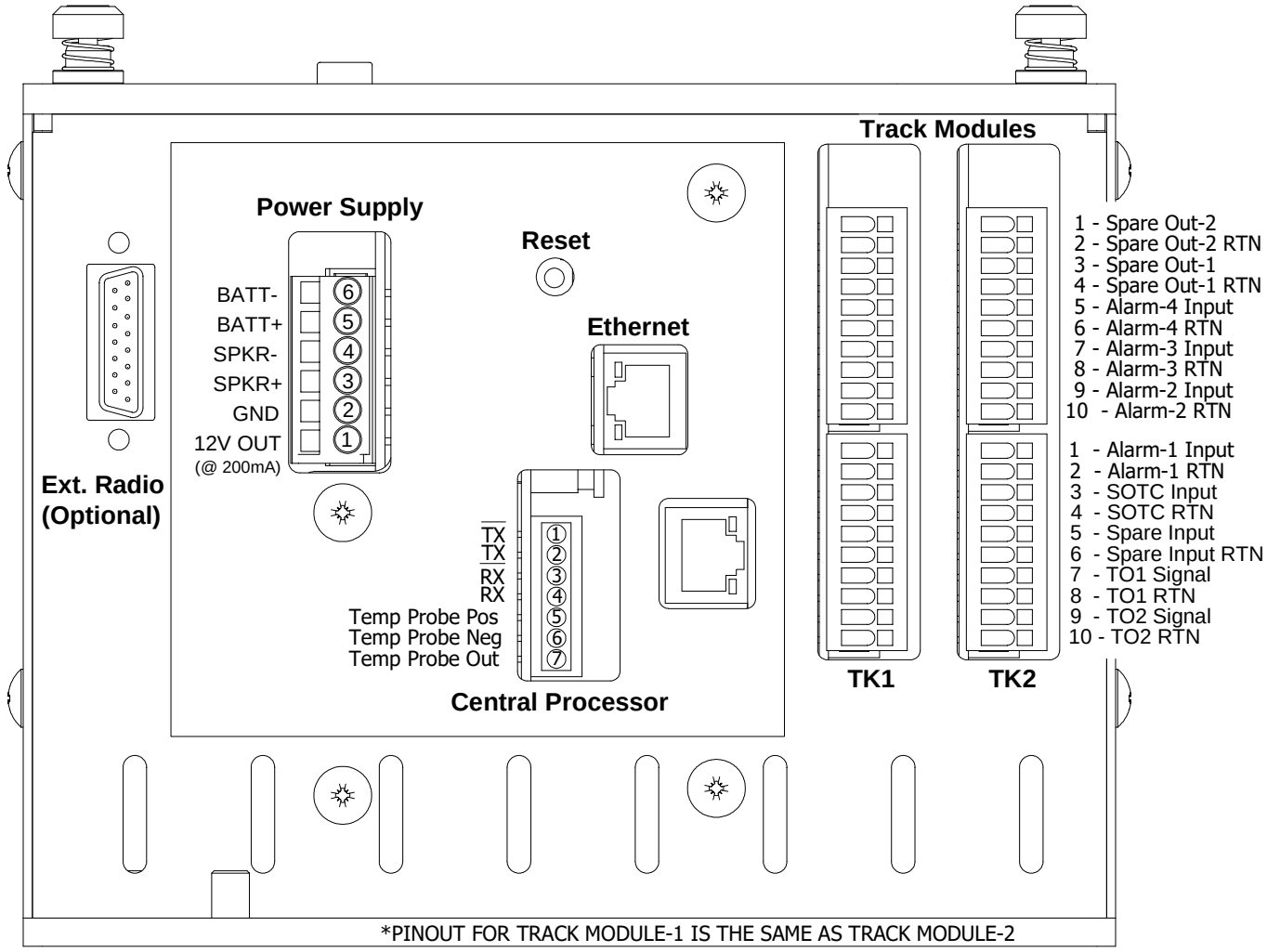
On the left side of some cards is a write-protection notch. If present, the card cannot be written on. If the notch is absent or covered by a sliding write-protection tab, the card can be written on. Before inserting the card into the SD/MMC slot on the iCube front panel, be sure that the card is not write-protected.

The iCube system creates files and folders on the SD card, as it needs them.

2.3 Bottom of iCube

On the bottom of the iCube enclosure are a reset switch, an Ethernet connector, a power connector (6-position), a temperature probe/RS485 connector (7-position), and up to four track module connectors (two 10-position sockets per track). A second RJ45 connector is currently unsupported.

The figure below shows a bottom view of the iCube and its connectors.



2.3.1 Reset Switch

On the bottom of the iCube is a reset switch. Pressing it causes a hardware reset for the entire system, which has the same effect as if power was turned off and back on. You can use it to recover from an apparent microprocessor malfunction. You can also use it to mimic a system startup. Train data isn't lost when the system resets.

2.3.2 Ethernet Connection (RJ45 Jack)

On the bottom of the iCube are two RJ45 jacks. The one nearest to the Reset Switch is used to establish an Ethernet connection. You need a Category 5 (CAT5) 8-wire network cable for basic 10/100 functionality. The second RJ45 connector is not supported at this time.

2.3.3 Power Connector (6-Position)

On the bottom of the iCube is a 6-position socket. Its mating 6-position plug provides all necessary external connections to the Power Supply Card. The table below shows the pinout of this socket.

Pin #	Pin Name	Function
6	BATT-	Battery RTN (Isolated from chassis ground)
5	BATT+	Battery Positive (+12 VDC)
4	SPKR-	Audio Signal RTN
3	SPKR+	Audio Signal to External Speaker (8 Ohm)
2	GND	Ground return for Pin #1 and Internally connected to Chassis Ground.
1	12V OUT	Regulated +12 VDC Output @ 200 mA. Referenced to Pin #2.

2.3.4 Temperature Probe/RS485 Connector (7-Position)

On the bottom of the iCube is a 7-position socket. Its mating 7-position plug provides all necessary external connections to the Processor Card. The table below shows the pinout of this socket.

Pin #	Pin Name	Function
1	$\overline{TX}$	RS485/422 Transmit-
2	TX	RS485/422 Transmit+
3	$\overline{RX}$	RS485/422 Receive-
4	RX	RS485/422 Receive+
5	Temperature Probe Positive	+12 VDC Out to the shielded temperature probe. Red wire connection. Internally fused at 200 mA.
6	Temperature Probe Ground	Ground return from Pin #5. Black wire connection. **(Note 1)**
7	Temperature Probe Out	The signal from the shielded temperature probe. White wire connection. Zero to Five Volts DC represents an outside air temperature of 50°F to +150°F (45.6° to +65.6°C).
Connect one end of the temperature probe shield wire to chassis ground.		

Note 1: Temperature Probe Ground internally connects to chassis ground. You may connect the temperature probe's cable shield to the Pin #6 terminal.

2.3.5 Track Module Connectors (10-Position)

There are two 10-position sockets per Track Module Card designated TB1 and TB2. Their mating plugs provide termination points for various track hardware. These connectors are accessible from the bottom of the iCube.

The table below shows the pinout of the 10-position **TB1** (track1 and/or track2) socket.

Pin #	Pin Name	Function
1	Out-2	*Currently not used.*
2	Out-2 RTN	*Currently not used.*
3	Out-1	LED White Indicator
4	Out-1 RTN	LED White Indicator RTN
5	Alarm-4 Input **(SA)**	One wire from the 4th alarm-generating device is wired here.
6	Alarm-4 Return	Other wire from the 4th alarm-generating device is wired here.
7	Alarm-3 Input **(NA)**	One wire from the 3rd alarm-generating device is wired here.
8	Alarm-3 Return	Other wire from the 3rd alarm-generating device is wired here.
9	Alarm-2 Input **ST)**	One wire from the 2nd alarm-generating device is wired here.
10	Alarm-2 Return	Other wire from the 2nd alarm-generating device is wired here.

The table below shows the pinout of the 10-position **TB2** (track1 and/or track2) socket.

Pin #	Pin Name	Function
1	Alarm-1 Input **(NT)**	One wire from the 1st alarm-generating device is wired here.
2	Alarm-1 Return	Other wire from the 1st alarm-generating device is wired here.
3	SOTC Input	One wire from the track circuit is wired here.
4	SOTC Return	Other wire from track circuit is wired here.
5	Input	Recall
6	Input RTN	Recall RTN
7	TO1 Signal	TO1 magnetic transducer signal.
8	TO1 Return	TO1 magnetic transducer return.
9	TO2 Signal	TO2 magnetic transducer signal.
10	TO2 Return	TO2 magnetic transducer return.

2.3.6 External Radio Connector

The external radio connector allows the use of an external radio in lieu of the standard internal (Ritron) radio. The pinout is exactly the same as the internal radio connector. Pin-6 provides a regulated output of 11.5 volts at 2.5 amps. This is adequate for the Ritron radio, but not for larger radios requiring more power. **It is advisable to use a suitable external supply to power such radios.**

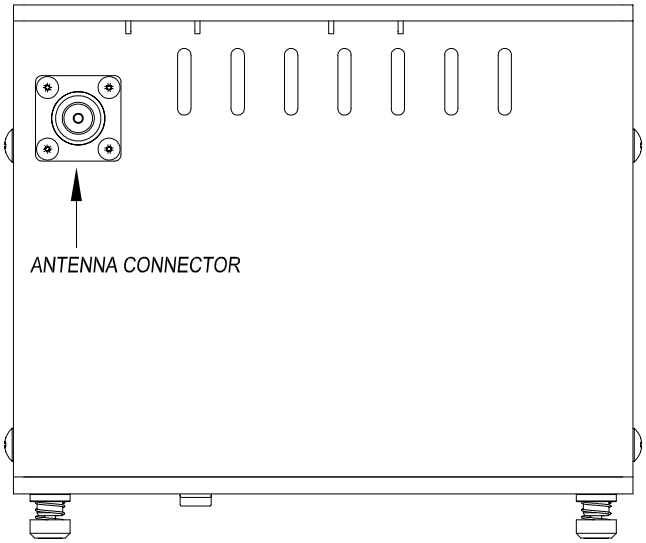
Ext Radio Connector Pinout (DB15)

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

2.4 Top of iCube

On top of the iCube enclosure is a SO-239 RF connector. This connector is the antenna output for the internal radio (if equipped).

The figure below is a top view of the iCube.



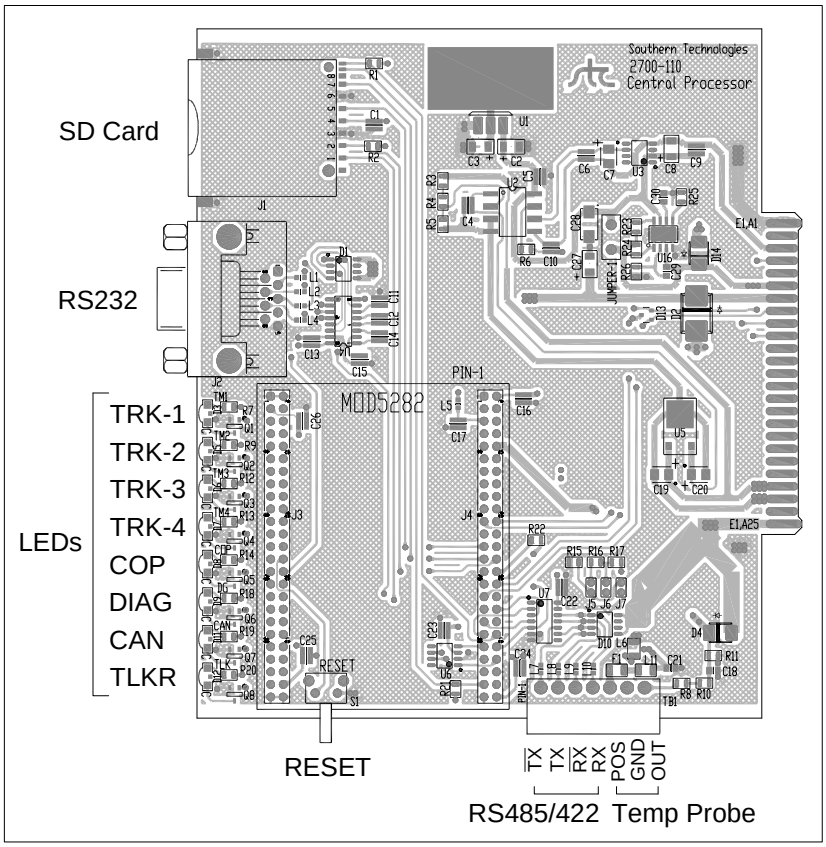
2.5 System Component Cards

The iCube consists of specialized component cards, each of which performs a specific system function. These cards are interconnected via a backplane. A minimum iCube system includes a Power Supply card, a Radio card, a Processor card, a Talker card, and a Track Module Card. An additional Track Module Card may be included to accommodate a second track.

2.5.1 Processor Card

The processor collects data from the Track Module, stores the data on an SD card, and generates speech commands for the talker. On the edge of the Processor Card are eight status LEDs (described in Section 2.2.1) that can be viewed from the iCube front panel. The processor also provides a serial user interface and monitors an ambient temperature input.

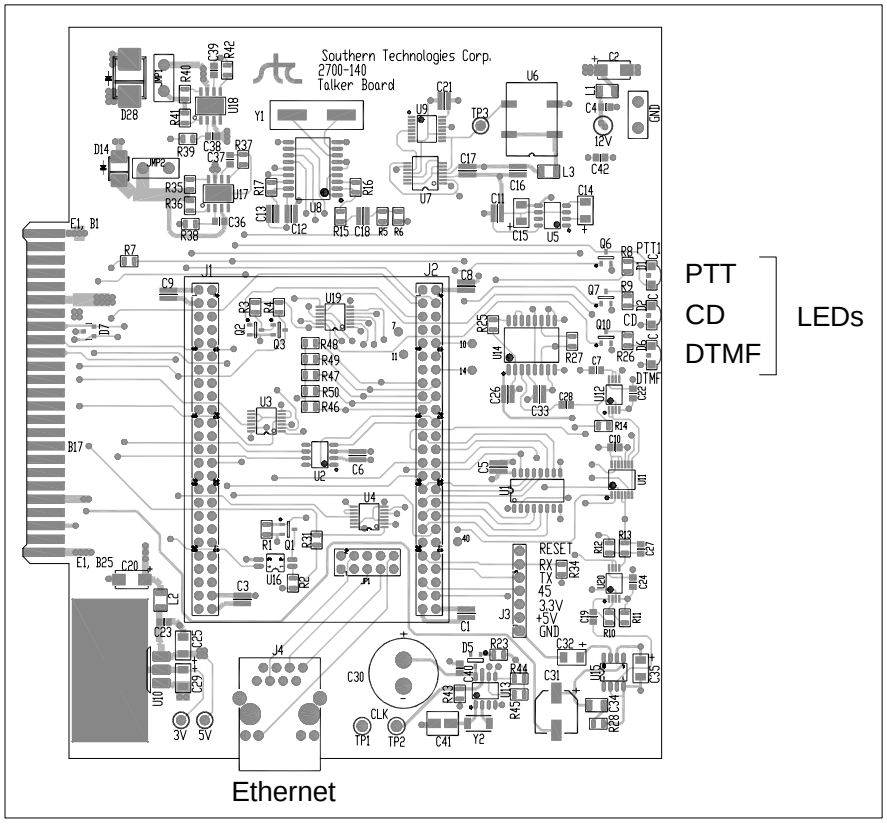
The figure below is a 2700-110 Processor Card.



2.5.2 Talker Card

The Talker card receives speech commands from the Processor Card and generates the appropriate announcement. It maintains system time, handles radio control functions, and listens for any DTMF (dual-tone multi-frequency) rebroadcast requests. On the edge of the talker are three status LEDs (described in Section 2.2.1) that can be viewed from the iCube front panel.

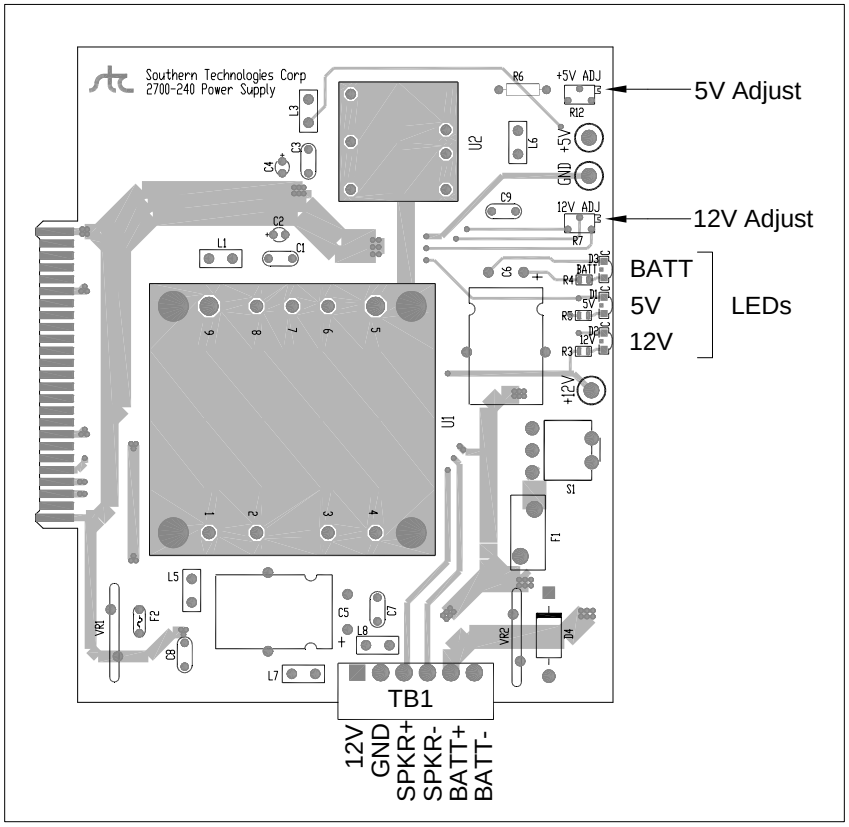
The figure below is a 2700-140 Talker Card.



2.5.3 Power Supply Card

The Power Supply card provides 12 VDC at 5 amperes and 5 VDC at 3 amperes. These voltage output levels are set at the factory but can be adjusted with potentiometers R7 and R12, respectively. Both of these outputs are isolated from the battery input. On the edge of the power supply card are three status LEDs (described in Section 2.2.1) that can be viewed from the iCube front panel.

The figure below is a 2700-240 Power Supply Card.



2.5.4 Track Module Card

The Track Module card handles the task of scanning all track inputs. It looks for train presence, counts axles, and recognizes alarm conditions. Train and alarm data is stored temporarily on the Track Module Card. For longterm storage, that information is sent to the Processor Card via the CAN bus.

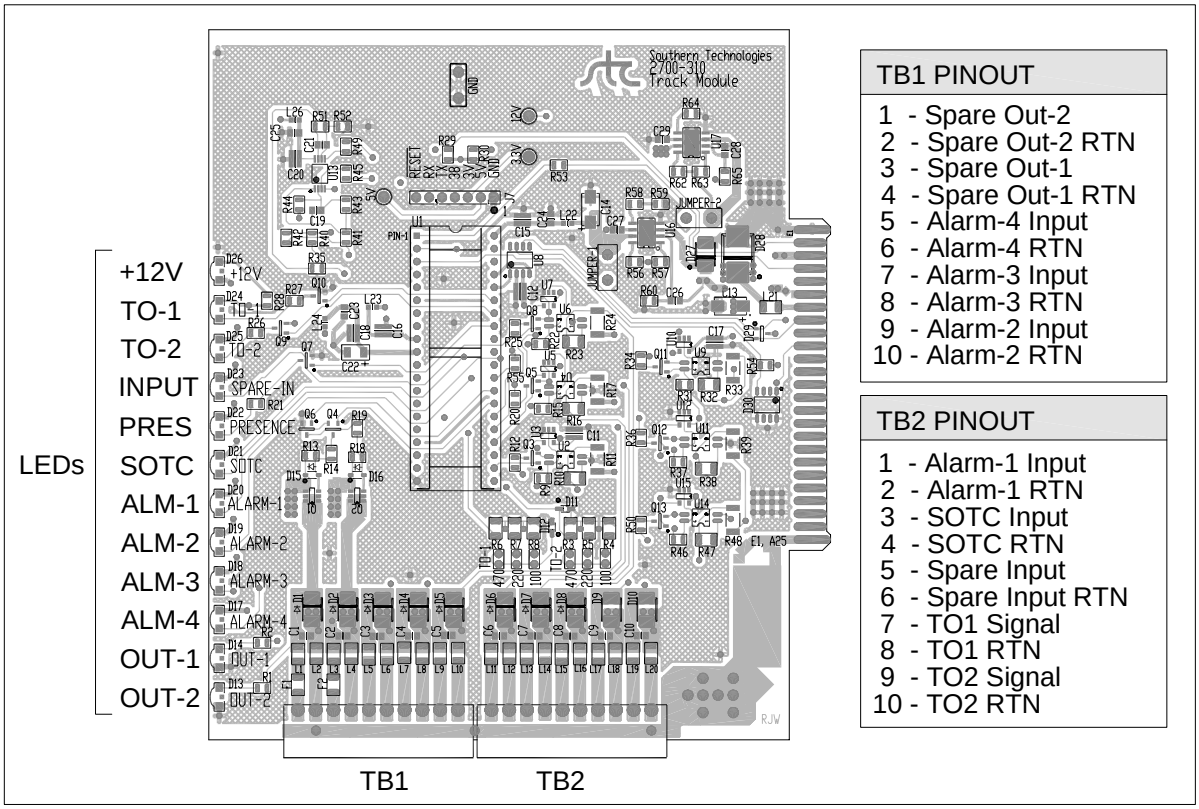
The Track Module Card has inputs for two transducers and four alarm sensors. The alarm inputs accept a normally closed contact that opens to indicate an alarm. The transducer inputs are designed to work with magnetic transducers. There are two outputs capable of driving a relay and one spare input.

There is also a SOTC input that can be used with a track circuit to detect when a train is present. The SOTC input is designed to work with a normally open contact that closes to indicate train presence.

Each Track Module Card can be configured through firmware to activate the alarm inputs from one or both of the transducer inputs or from the SOTC input. If no transducers or track circuits are used, the Track Module Card can be configured to run in continuous-scan mode.

The iCube can be configured with either one or two Track Module Cards. Each Track Module Card provides twelve status LEDs (described in Section 2.2.1), which can be viewed from the iCube front panel. These indicators are arranged in vertical rows on the right side of the front panel and are designated as “Track Module 1” and “Track Module 2”.

The figure below is a 2700-310 Track Module Card.



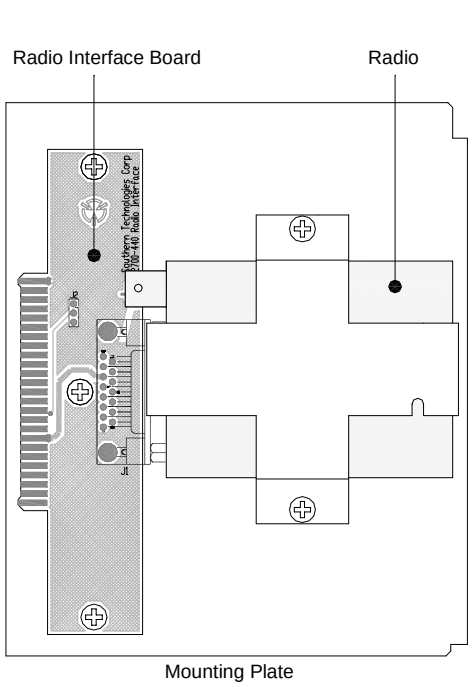
On the bottom of each Track Module Card are two terminal blocks that provide termination points for various track hardware. These pluggable connectors are accessible from the bottom of the iCube. All connections from Track-1 hardware will be terminated on TB1 & TB2 of Track Module-1. Likewise, connections from Track-2 will be terminated on TB1 & TB2 of Track Module-2.

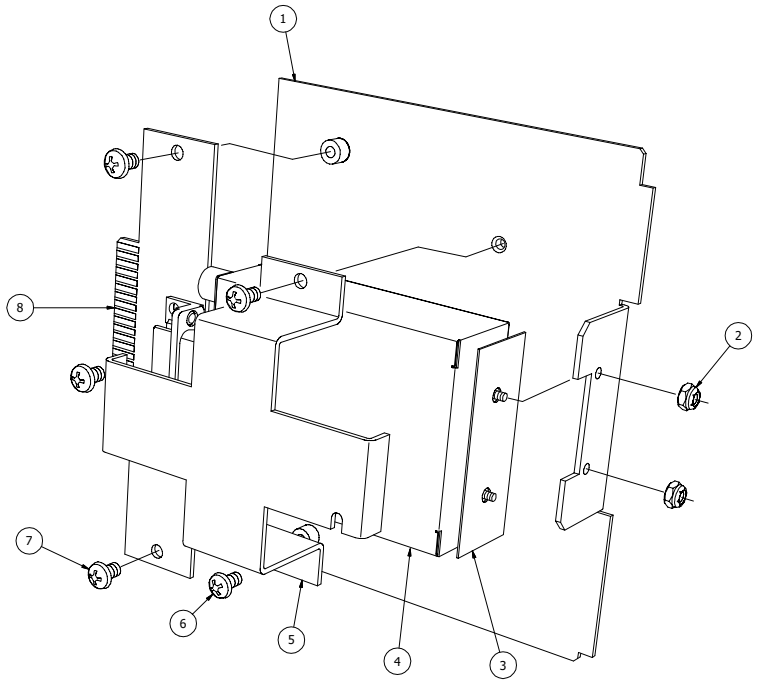
2.5.5 Radio Card

The Radio Card consists of a radio and a radio interface board fastened to an aluminum mounting plate. The interface board provides all necessary connections to the radio via the system's backplane. A coaxial cable connects the radio's antenna output to a UHF connector on the top of iCube.

The radio can be configured to broadcast on only one frequency or sequentially on two different frequencies.

The figure below is a 2700-450 Radio Card.



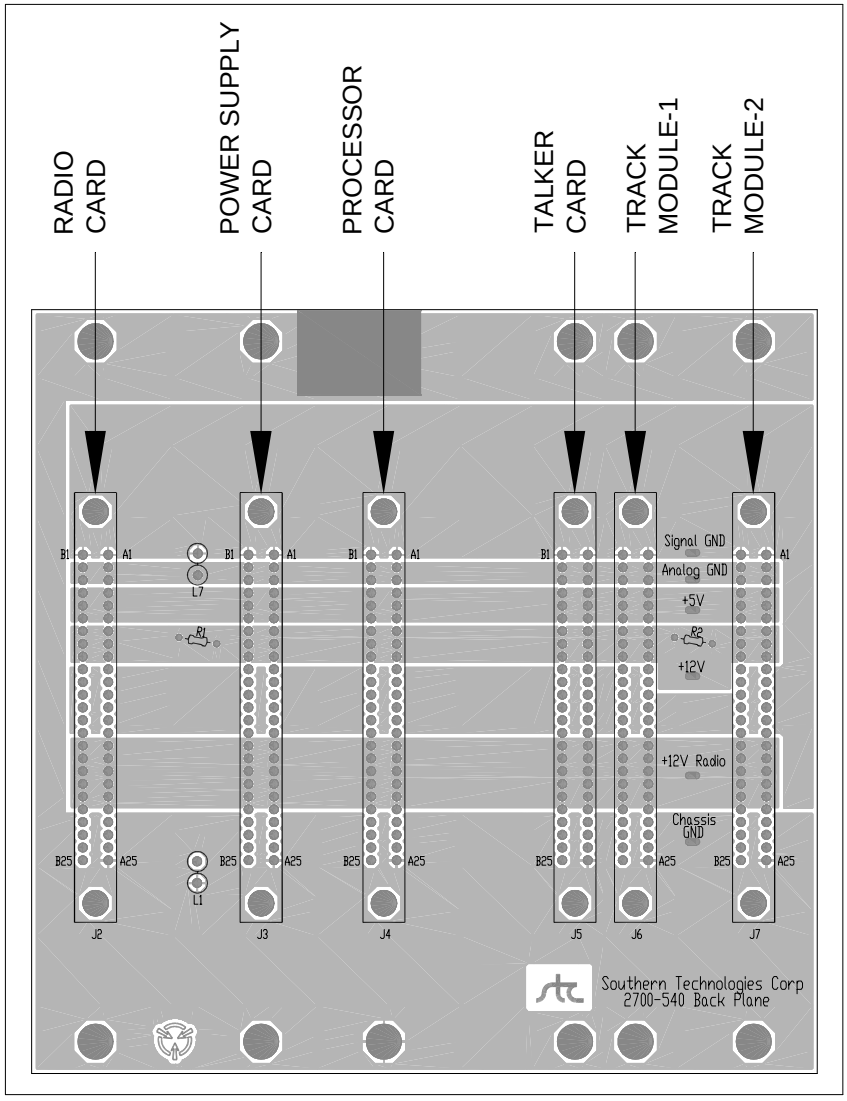


PARTS LIST FOR 2700-450 RADIO MODULE			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	41-123-116	Radio Shield Assembly
2	2	01-118-001	ESNA 4-40
3	1	41-123-117	Thermal Filler Pads
4	1	39-103-021	Ritron DTX-Plus Radio
5	1	41-108-014	Radio Strap
6	2	01-108-016	PPH 6-32 x 1/4" S.Steel
7	3	01-108-023	PPH 8-32 x 1/4" S.Steel
8	1	2700-440	Radio Interface Board Asm.

2.5.6 Backplane

The Backplane is mounted inside the iCube enclosure on the back panel. It distributes power and provides interconnections for each of the six system component cards. The figure below details the designations for the edge connectors of the backplane.

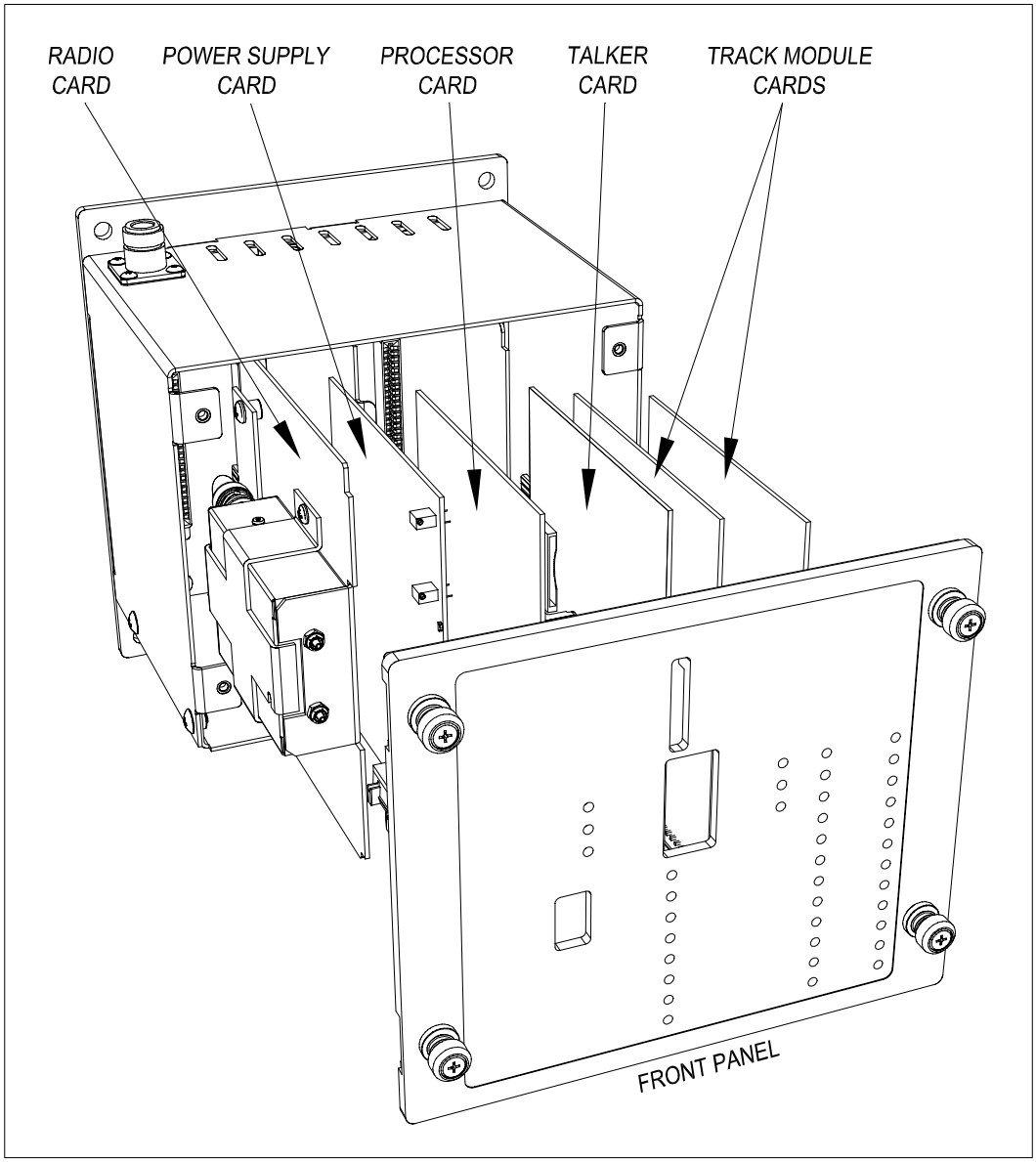
The figure below is a 2700-540 Back Plane.



2.6 Installation or Removal of System Component Cards

CAUTION!
System component cards are electrostatic-sensitive devices (ESD). Special care must be observed while handling these cards during installation or removal.

The figure below shows an exploded view of the iCube.



Each system component card **must** be installed in its designated location on the backplane to ensure proper fit and functionality of the system. See the figure above for assigned locations.

Temporary removal of the front panel provides easy access to the various system component cards. The front panel is secured to the chassis with four captive fasters.

To <u>remove</u> a system component card:

- Power system down. Remove the front panel.
- Disconnect all external mating connectors (if any) from the bottom of the card.
- Gently slide the card backward to uncouple from the edge connector on the backplane. [For Radio Card only – disconnect the antenna cable from the radio.]
- Carefully remove the card from the enclosure and store it in an ESD protective package before transporting.

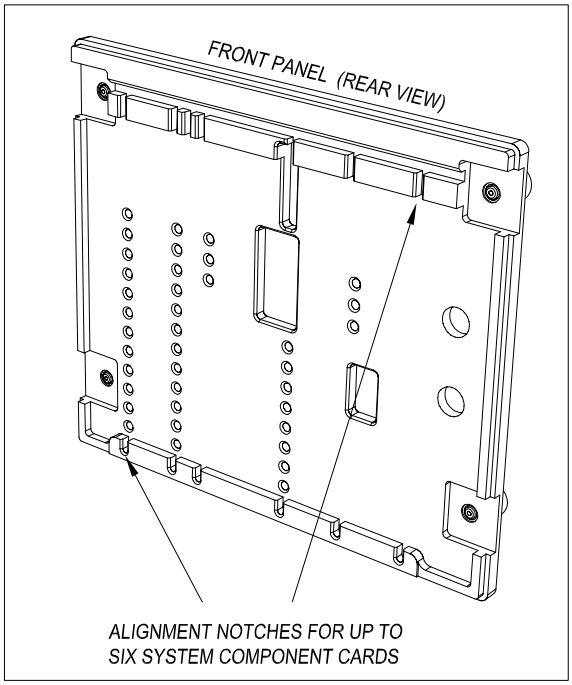
To <u>install</u> a system component card:

- Power system down. Remove the front panel.
- For Radio Card only – connect the antenna cable to the radio output.
- Observing proper orientation, slide the card into its appropriate slot in the enclosure.
- Align the fingered tab on the back edge of the card with its respective edge connector on the backplane. Gently push forward until the card is firmly seated in the connector.
- Connect all external mating connectors (if any) to the bottom of the card.

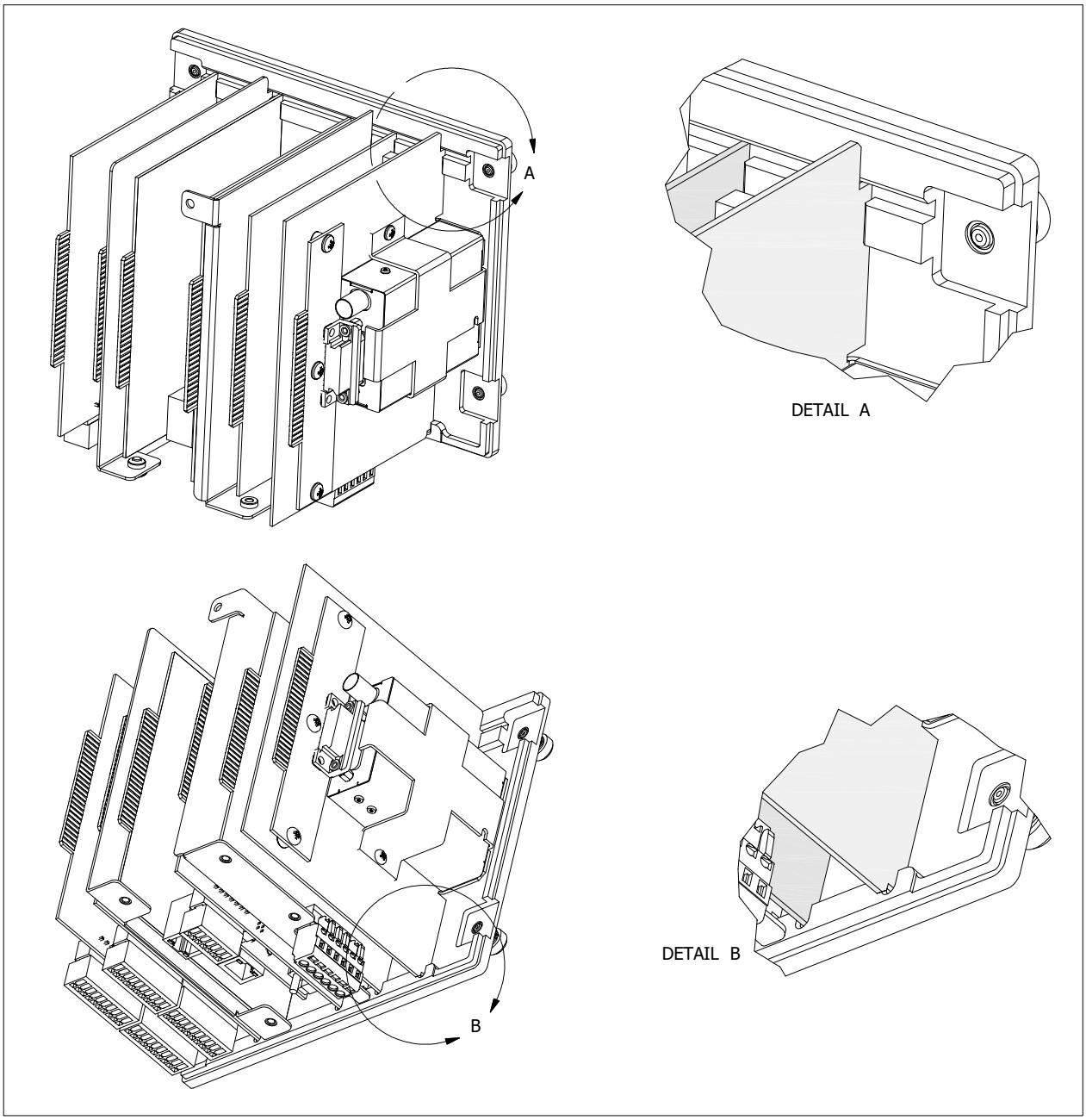
Installation of Front Panel

The front edge of each system component card is held securely in place by aligned, indexed notches on the backside of the front panel. There are two notches for each card installed (see figure below). One captures and secures the top-front edge of the card, the other the bottom-front edge. Verify all system component cards are properly aligned with their respective indents before securing the front panel with captive fasteners.

The figure below shows a rear view of the front panel.



The figure below depicts the front panel as it contacts the front edge of the system component cards. Note how each card is secured by notches in the panel. Improper alignment could result in damage to system cards.

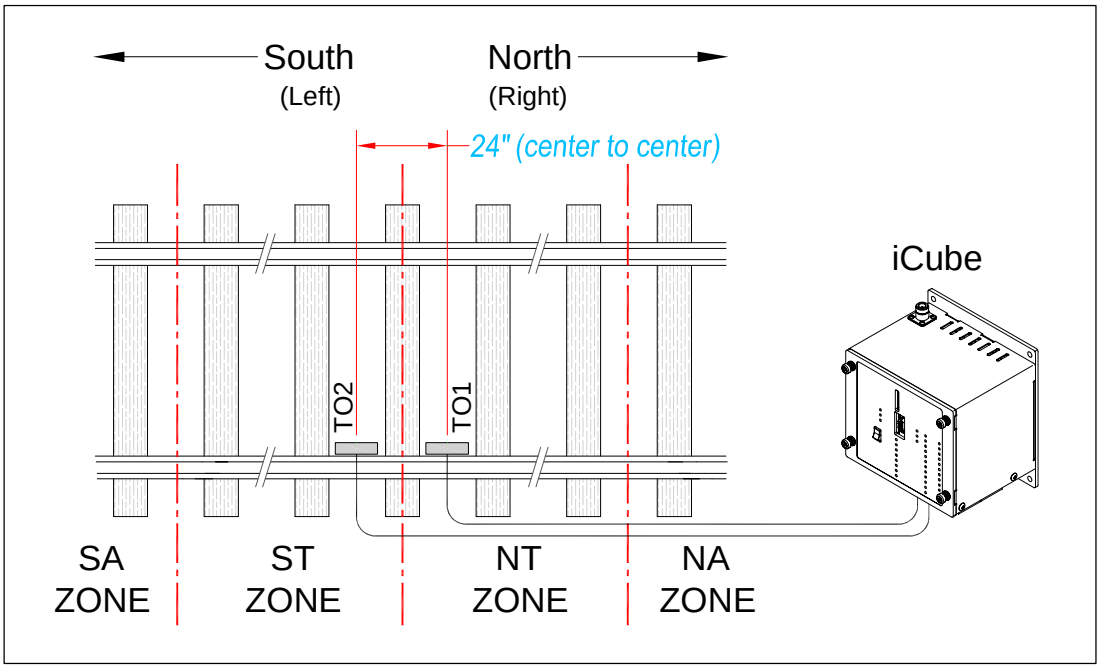


3.0 — Track Hardware & Auxiliary Equipment

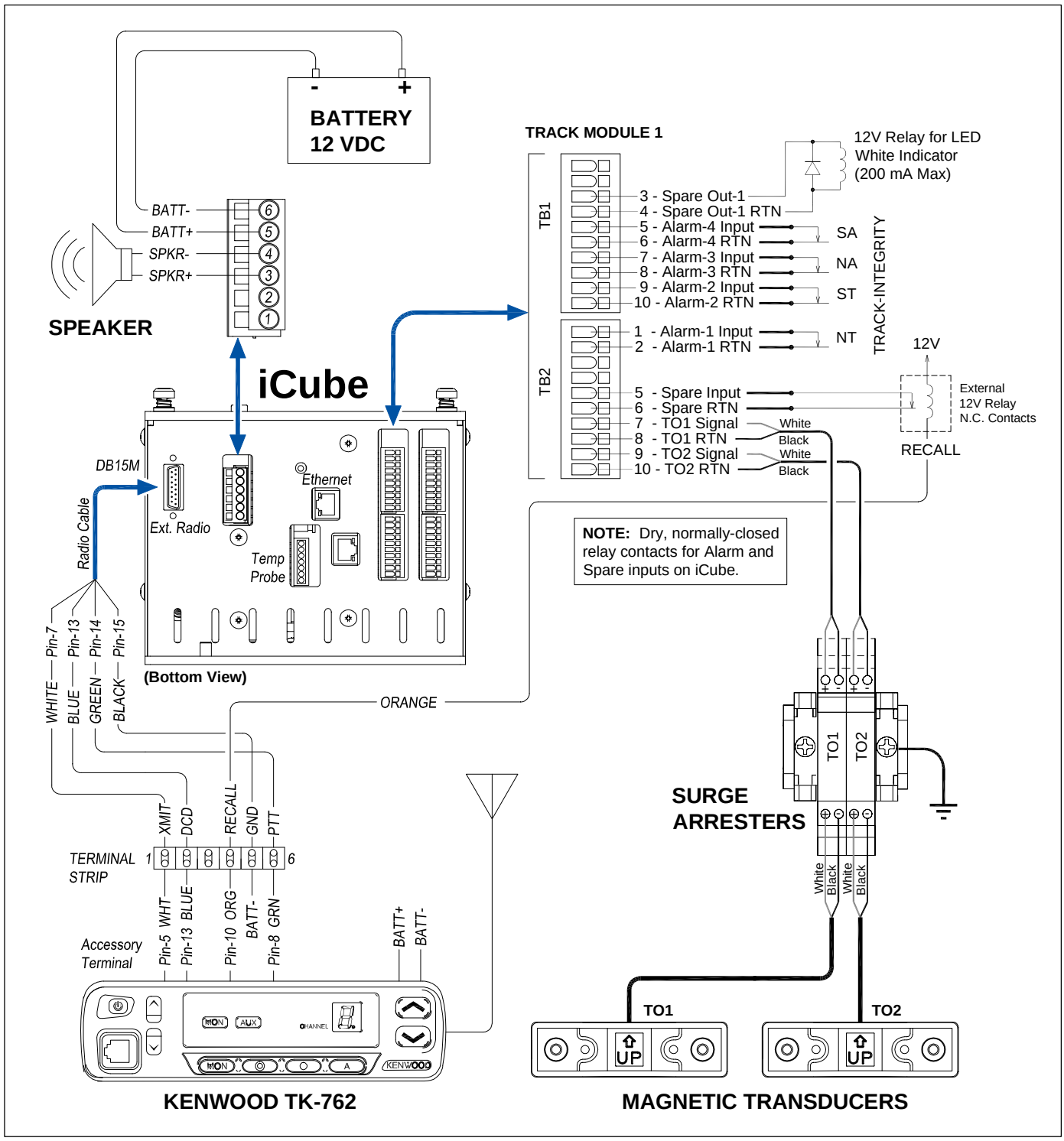
This section describes the installation and setup of various hardware components utilized by the iCube to perform specific monitoring functions.

3.1 Track-Integrity Detector Site Layout

A typical site layout is shown below. SA is the leftmost (southmost) zone, and NA is the rightmost (northmost) zone. One transducer is installed in zone ST. The other is installed in zone NT.



3.2 Track-Integrity Detector System Wiring



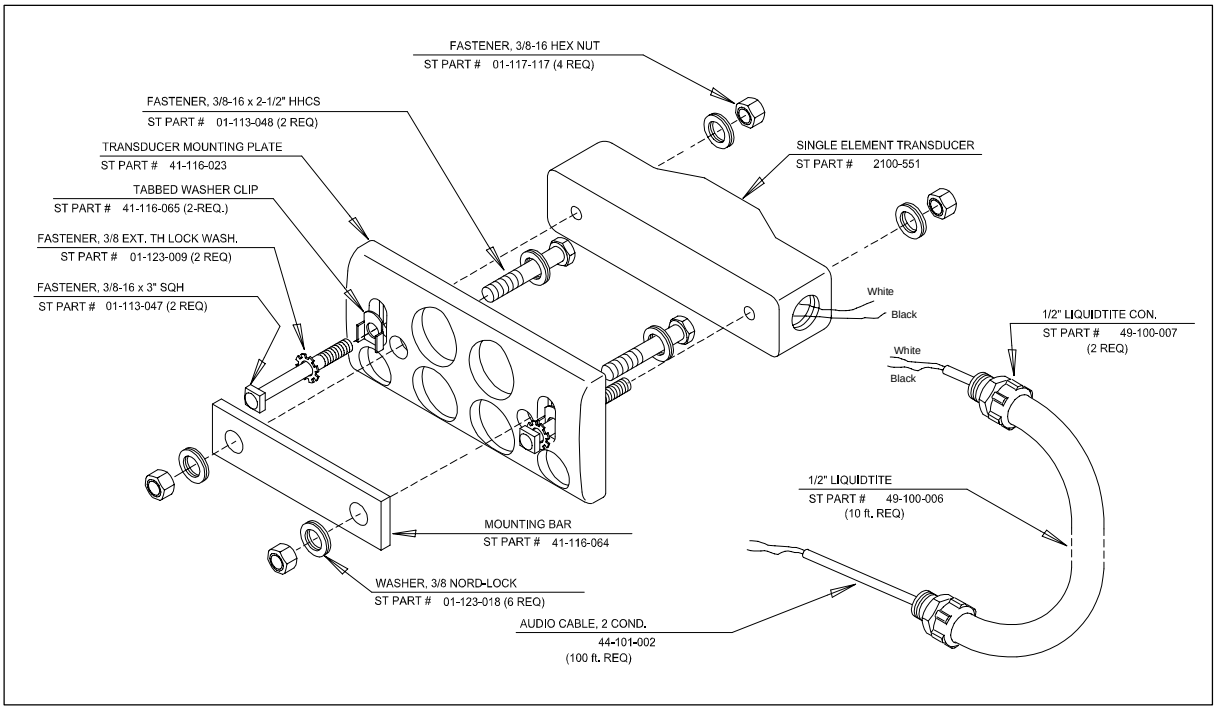
The figure above depicts the wiring for a typical Track-Integrity Detector System.

3.3 Transducers

STC Magnetic Transducers are rail-mounted devices that provide the timing signals that allow the system to determine a train's direction and calculate exit speed. STC transducers consist of a horseshoe magnet with a tightly wound coil, encapsulated in a rigid epoxy potting compound.

Each transducer pair is mounted 1-9/16 inches (3.97 centimeters) below the crown of the rail and spaced 24” center-to-center. TO1 is always the northmost or eastmost transducer.

As the wheels of a railcar pass over the transducer, the wheel flange disturbs the flux field of the magnet, causing the output of a sinusoidal type waveform of varying amplitude. The depth of the flange and the speed at which the wheel is moving determines amplitude.
The figure below shows the parts of an STC Magnetic Transducer.



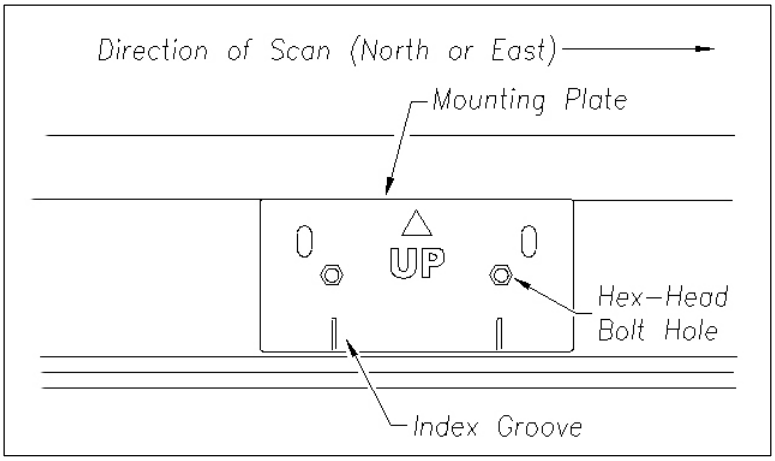
3.3.1 Mounting magnetic transducers (drill method):

1 If using track clamps, skip ahead to the next section.

2 Be sure that you have on hand a track drill, a 3/8-inch bit, a 9/16-inch torque wrench, a tape measure, and the alignment fixture.

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

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



5 Hold the mounting plate against the rail and as high against the crown as possible.

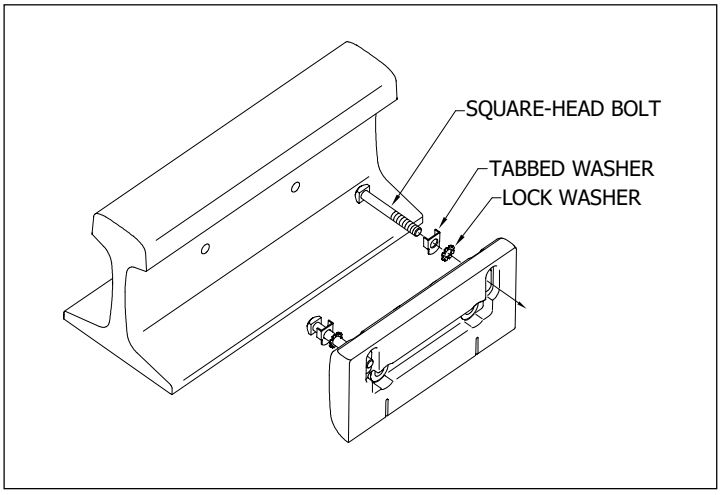
6 Using the hex-head bolt holes as your guide, mark the two places on the rail where you'll later drill holes.

7 Remove the mounting plate.

8 Using a 3/8-inch bit, drill the two holes.

9 Place one tabbed washer and one external-tooth lock washer on each square-head bolt.

10 Insert the two square-head bolts with tabbed washers and external-tooth lock washers into the slotted holes of the mounting plate.

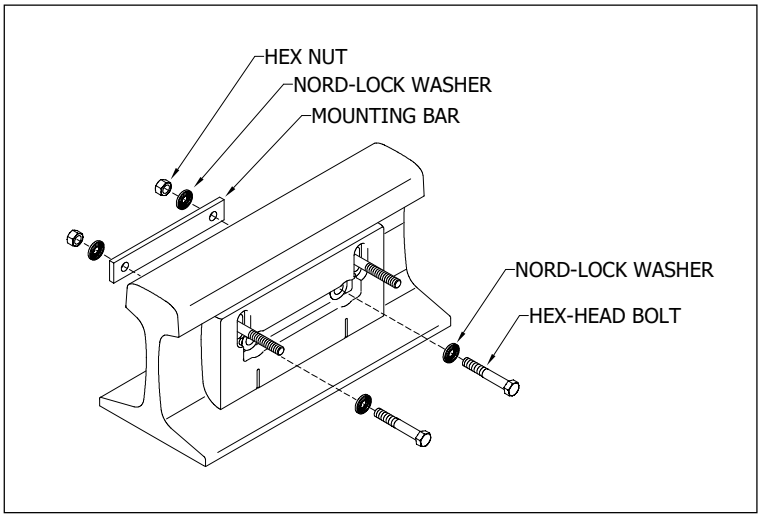


11 With the arrow on the plate pointing up and the heads of the bolts against the gauge side of the rail, align the hex-head bolt holes in the plate with the drilled holes in the rail.

12 Place one Nord-Lock washer on each hex-head bolt.

13 Insert the two hex-head bolts with Nord-Lock washers through the aligned holes.

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

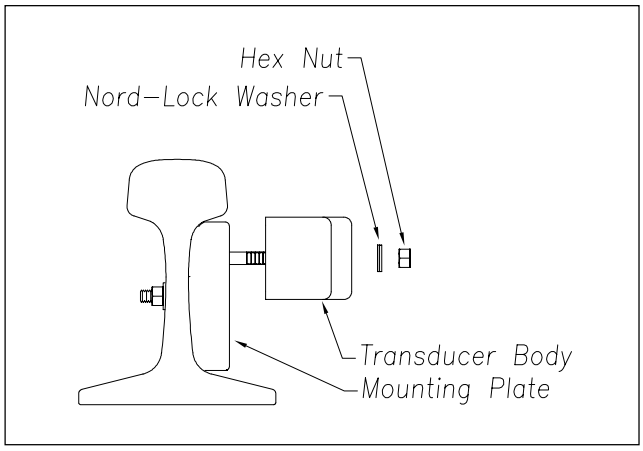


15 Tighten each hex-lock nut with a 9/16-inch torque wrench to a **torque of 12 to 15 foot-pounds (16.3 to 20.3 newton-meters)**.

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

16 With the transducer body's magnetic side up (that is, with the arrow on the transducer body pointing up), slide it onto the square-head bolts.

17 Loosely place the Nord-Lock washers and hex-lock nuts onto the square-head bolts.

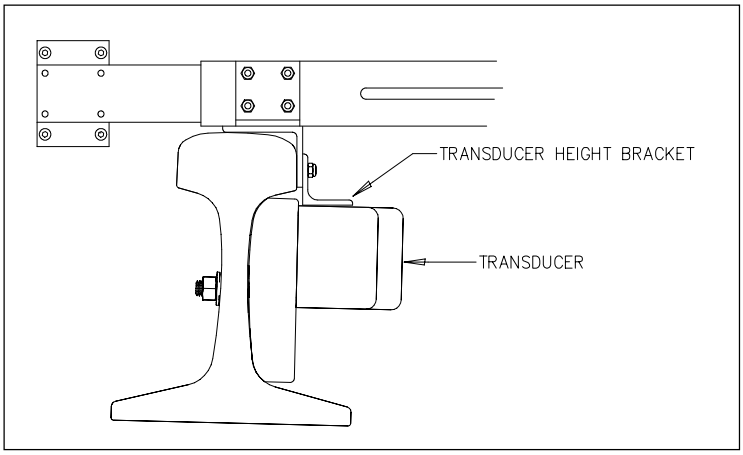


The installed transducer body should be 1-9/16 inches (3.97 centimeters) below the top of the rail and parallel to it. You can meet this requirement by using the transducer height bracket on the bottom of the alignment fixture.

18 Place the alignment fixture across both rails, centered over the transducer.

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

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



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

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

The transducer body is now attached to the mounting plate.

21 Label the end of the cable TO1.

22 Repeat the mounting procedure for TO2 transducer. TO2 should be mounted to the south of the TO1 transducer and spaced exactly 24 inches center-to-center. Label the end of this cable TO2.

3.3.2 Mounting magnetic transducers (track clamp method):

To <u>install</u> the **2100-596**:

1 Be sure that you have all the required tools on hand – (see below).

2 The 2100-596 is to be installed on the rail <u>nearest</u> to the wayside enclosure.

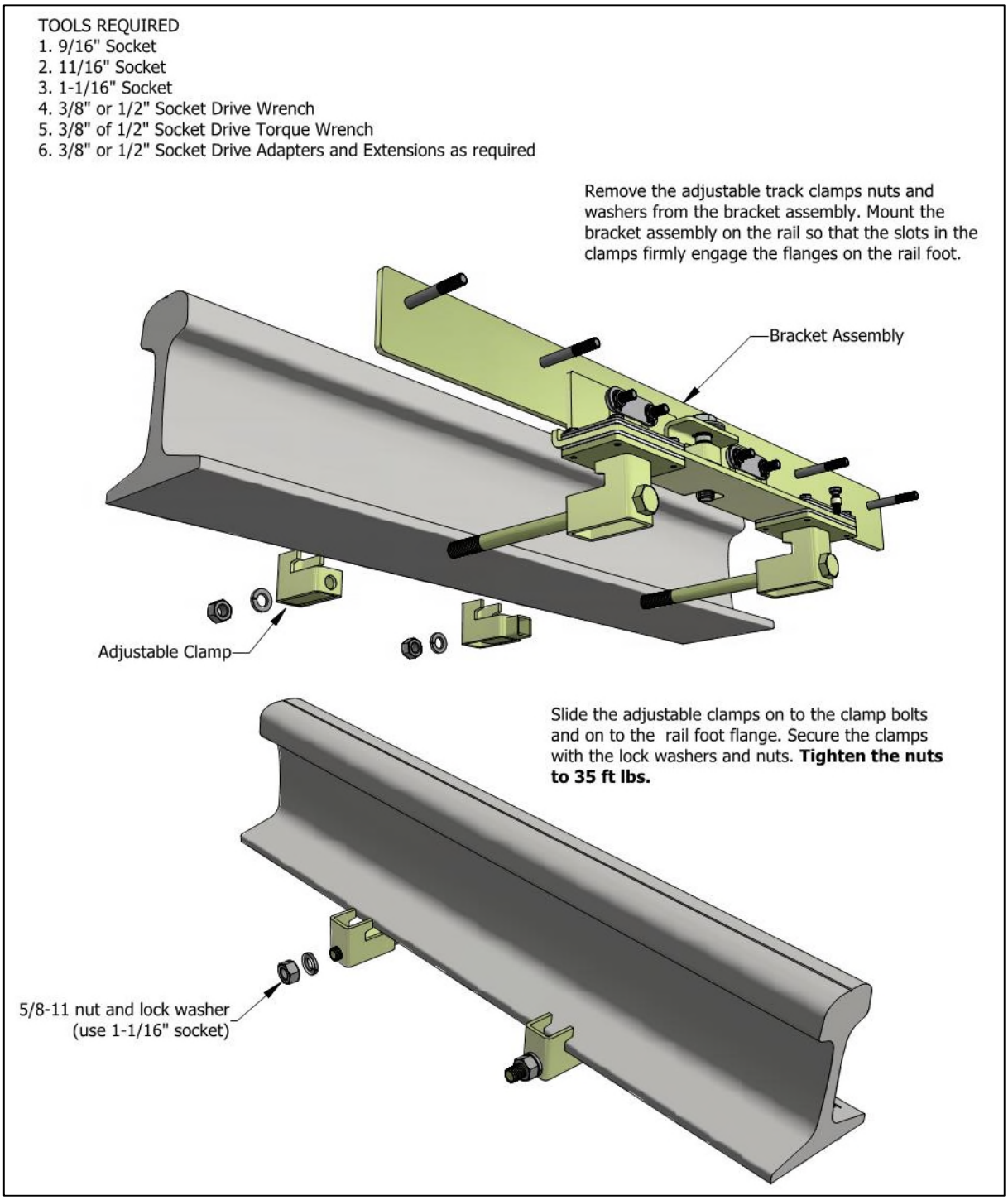


Figure 1

3 Per figure 1, mount the clamp bracket against the gauge side of the rail. Tighten the nuts to 35 ft lbs.

4 To complete the installation, follow the assembly instructions as detailed in figures 2 through 6.

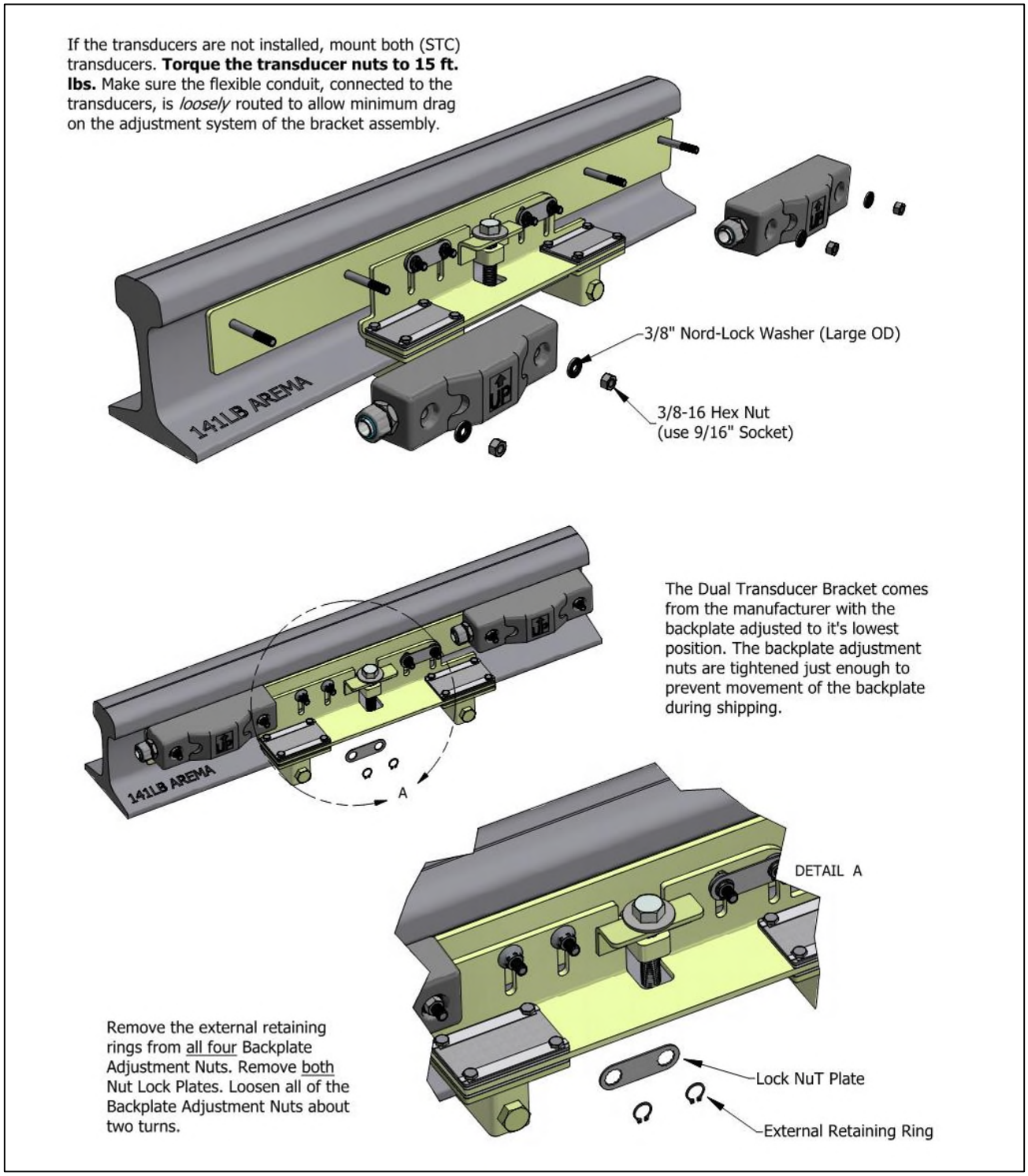
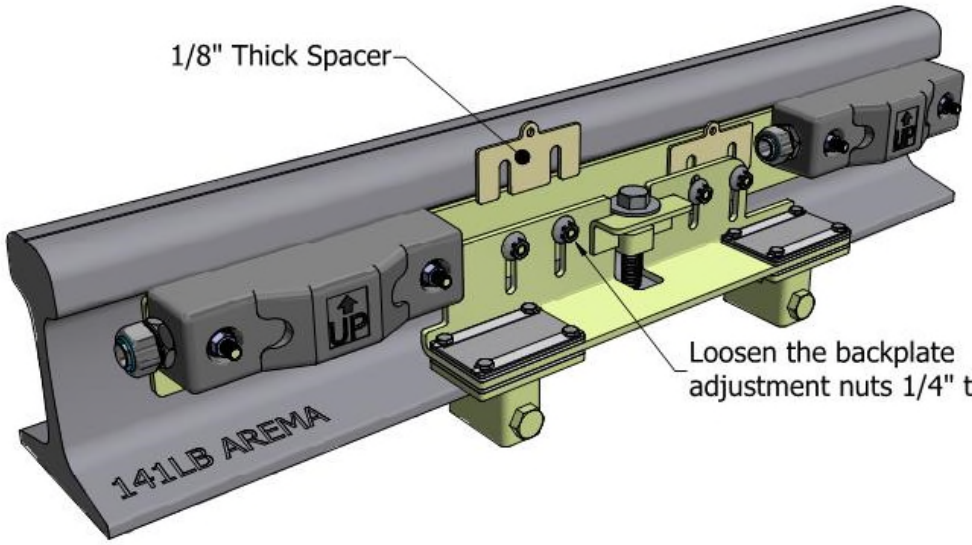
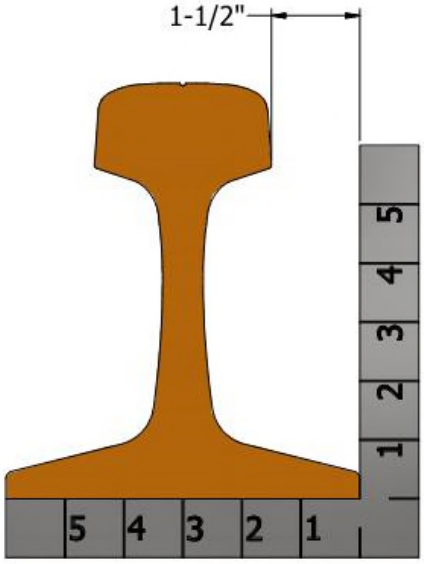


Figure 2

HORIZONTAL TRANSDUCER ADJUSTMENT (IF REQUIRED)



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



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

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

Figure 3

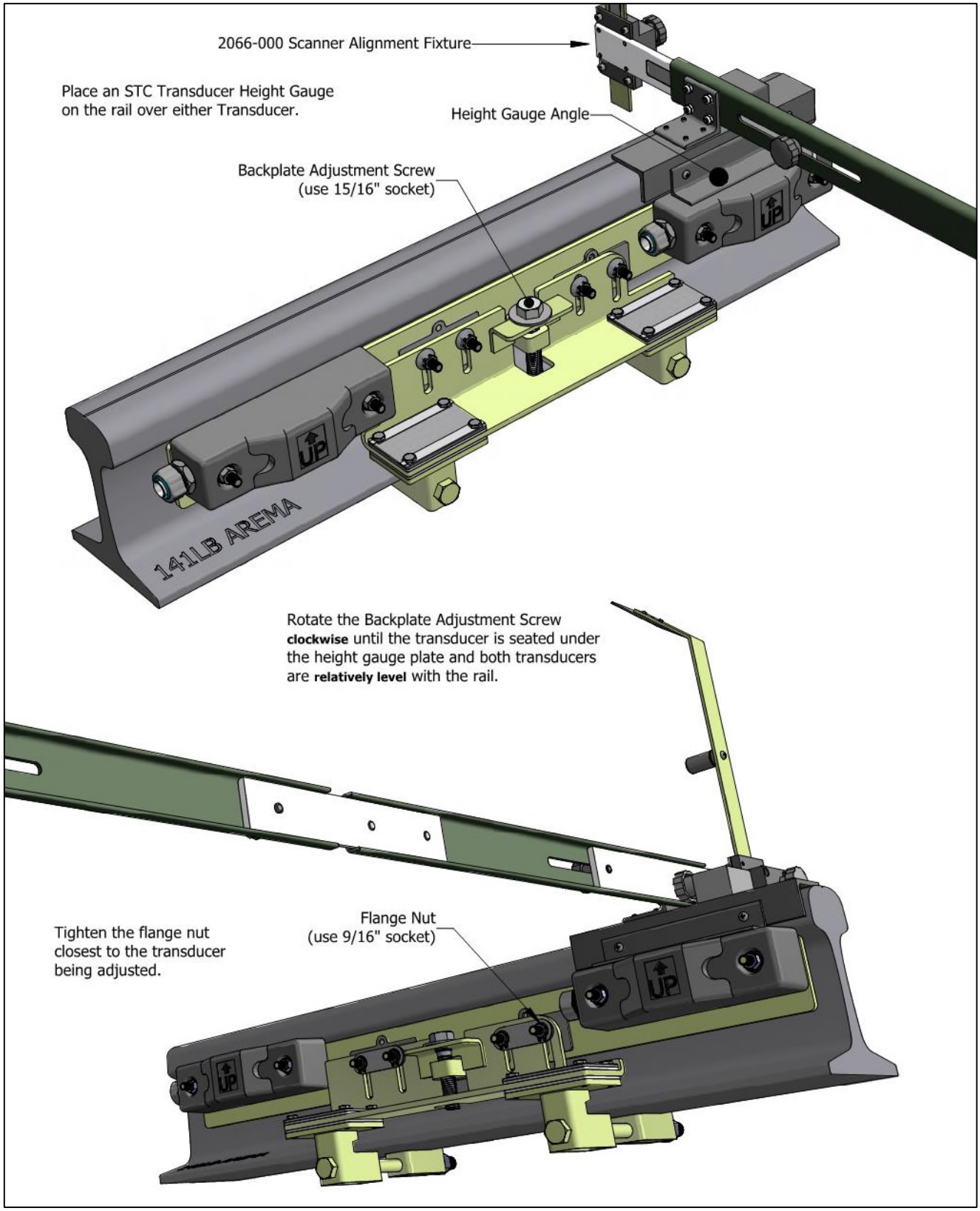

2066-000 Scanner Alignment Fixture
Place an STC Transducer Height Gauge on the rail over either Transducer.
Height Gauge Angle
Backplate Adjustment Screw (use 15/16" socket)
UP
141LB AREMA
Rotate the Backplate Adjustment Screw **clockwise** until the transducer is seated under the height gauge plate and both transducers are **relatively level** with the rail.
Tighten the flange nut closest to the transducer being adjusted.
Flange Nut (use 9/16" socket)

Figure 4

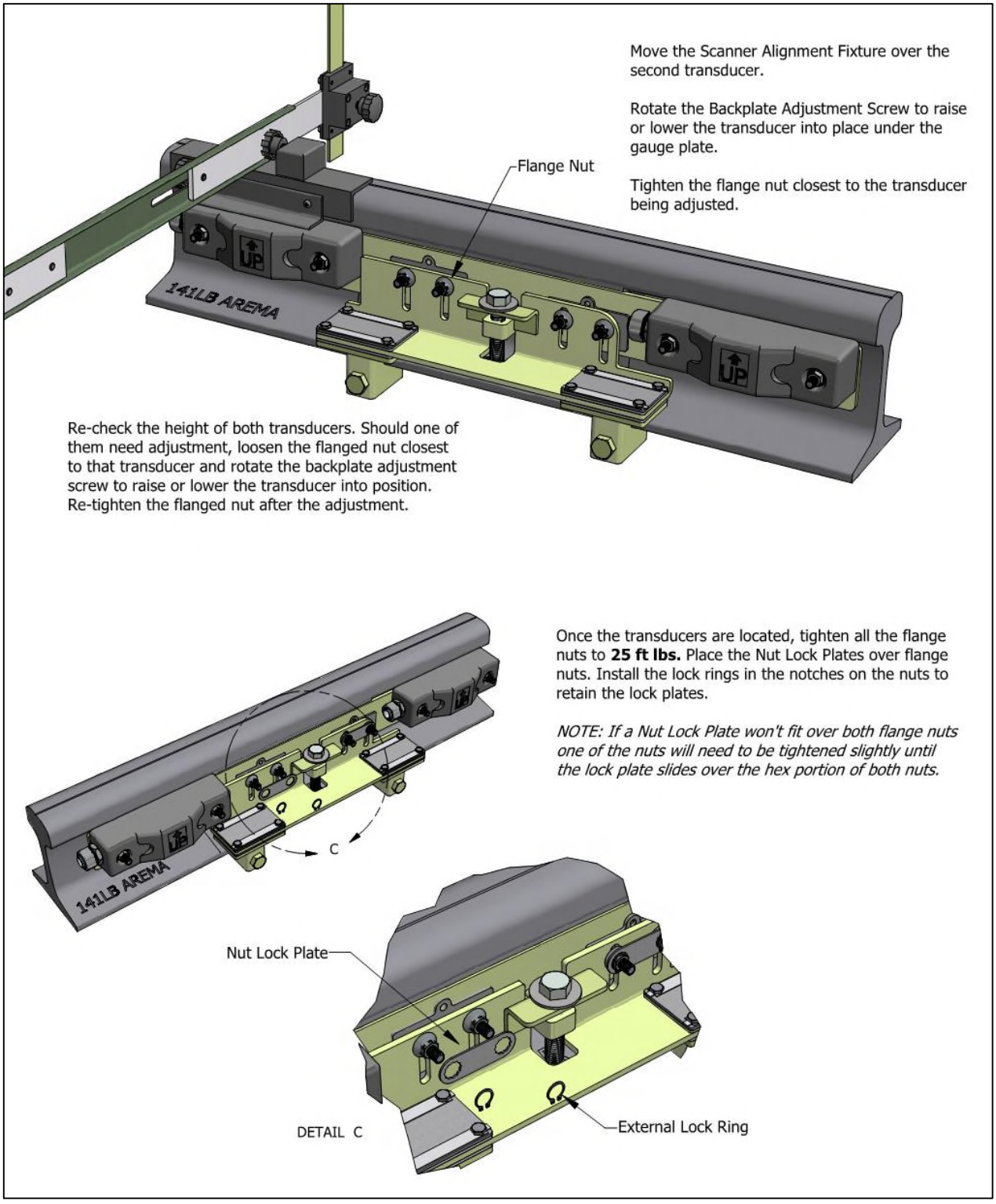

Move the Scanner Alignment Fixture over the second transducer.
Rotate the Backplate Adjustment Screw to raise or lower the transducer into place under the gauge plate.
Tighten the flange nut closest to the transducer being adjusted.
Flange Nut
141LB AREMA
UP
Re-check the height of both transducers. Should one of them need adjustment, loosen the flanged nut closest to that transducer and rotate the backplate adjustment screw to raise or lower the transducer into position. Re-tighten the flanged nut after the adjustment.
Once the transducers are located, tighten all the flange nuts to 25 ft lbs. Place the Nut Lock Plates over flange nuts. Install the lock rings in the notches on the nuts to retain the lock plates.
NOTE: If a Nut Lock Plate won't fit over both flange nuts one of the nuts will need to be tightened slightly until the lock plate slides over the hex portion of both nuts.
C
Nut Lock Plate
DETAIL C
External Lock Ring

Figure 5

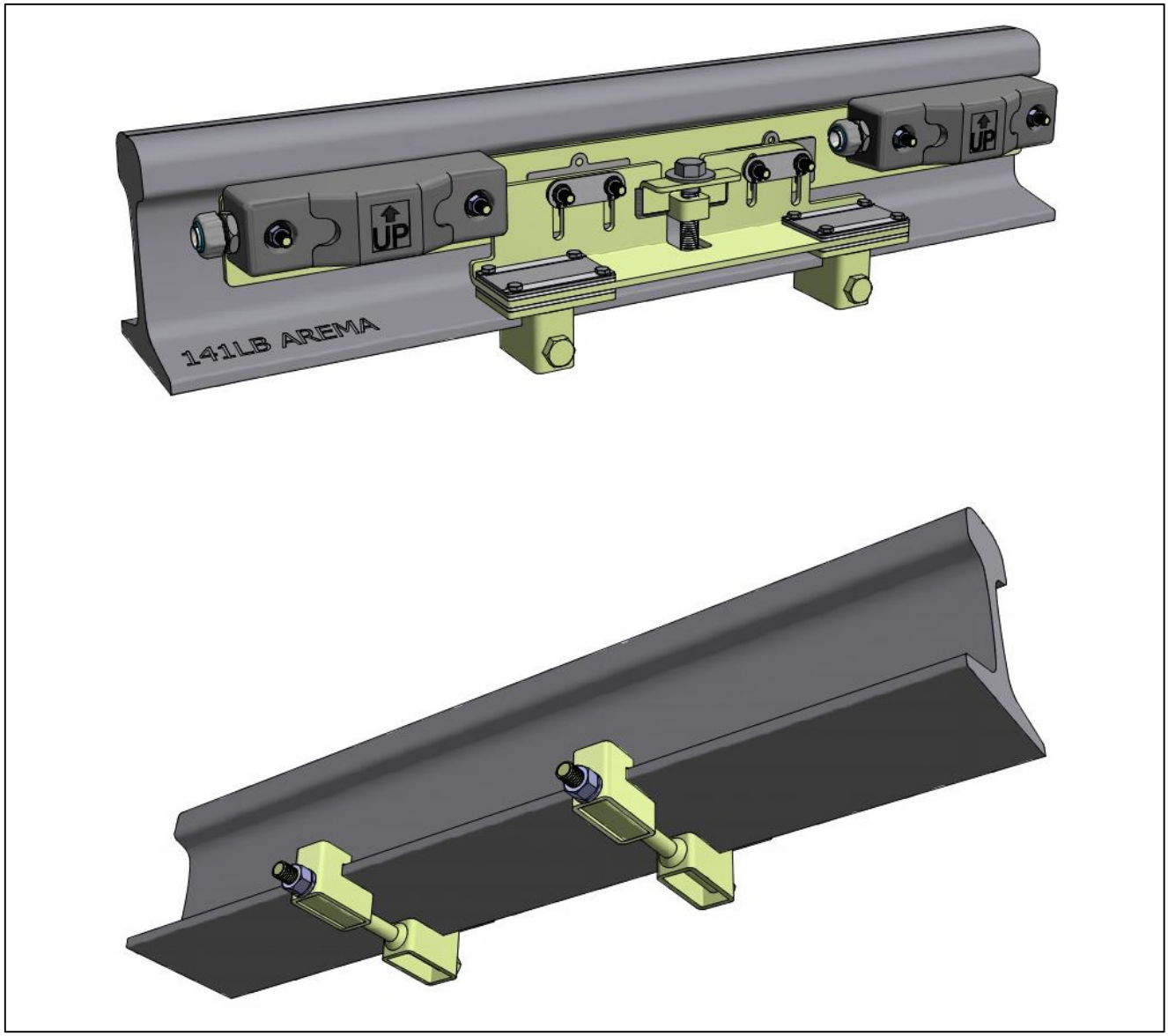


Figure 6

5 Label the northmost transducer cable **TO1**. Label the southmost transducer cable **TO2**.

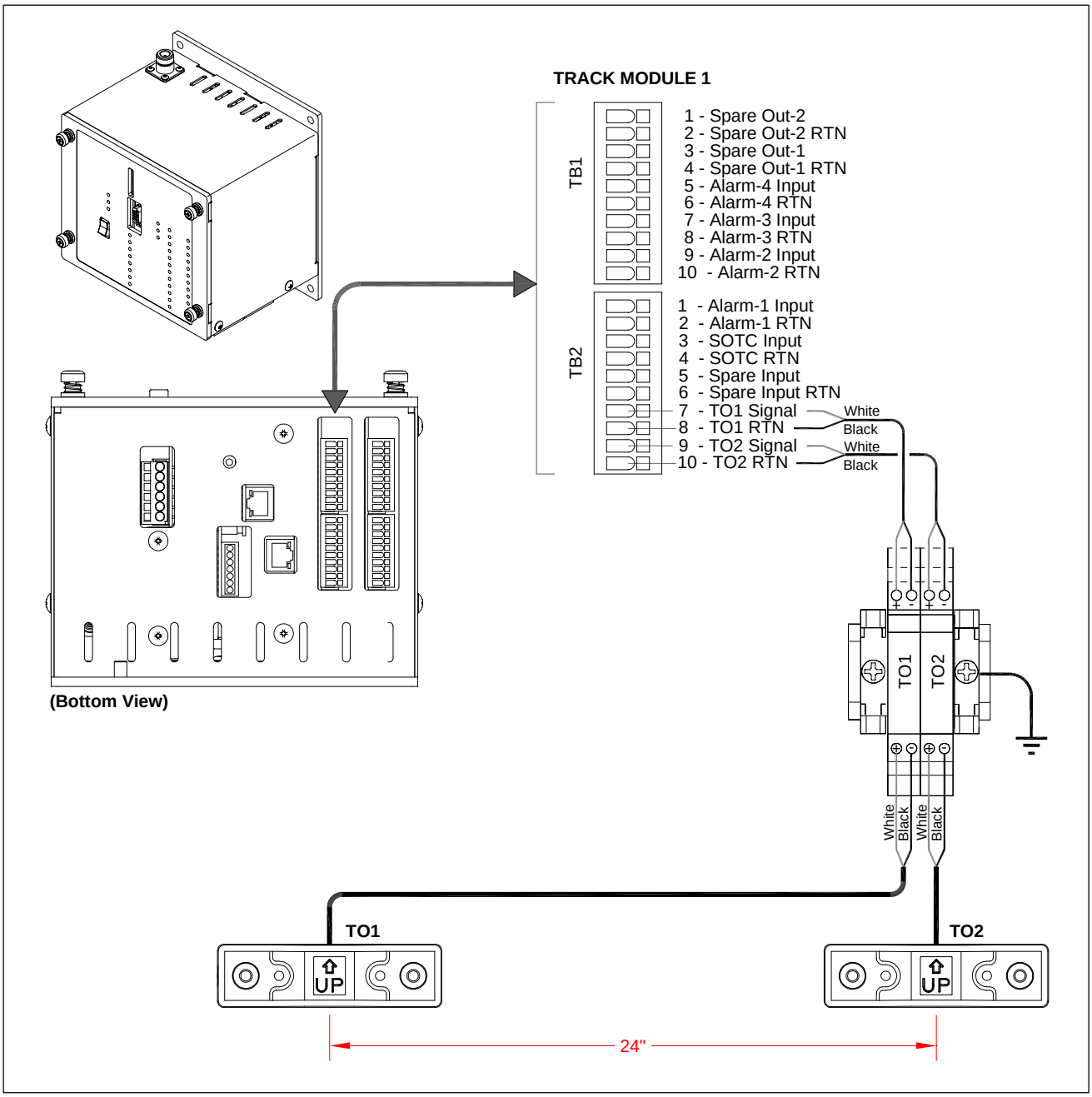
6 If this is a double-track site, include the track designation on the label (example: **TO1-TRACK1** or **TO1-TRACK2**).

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

8 If this is a double-track site, repeat steps **1** through **8** on the second track.

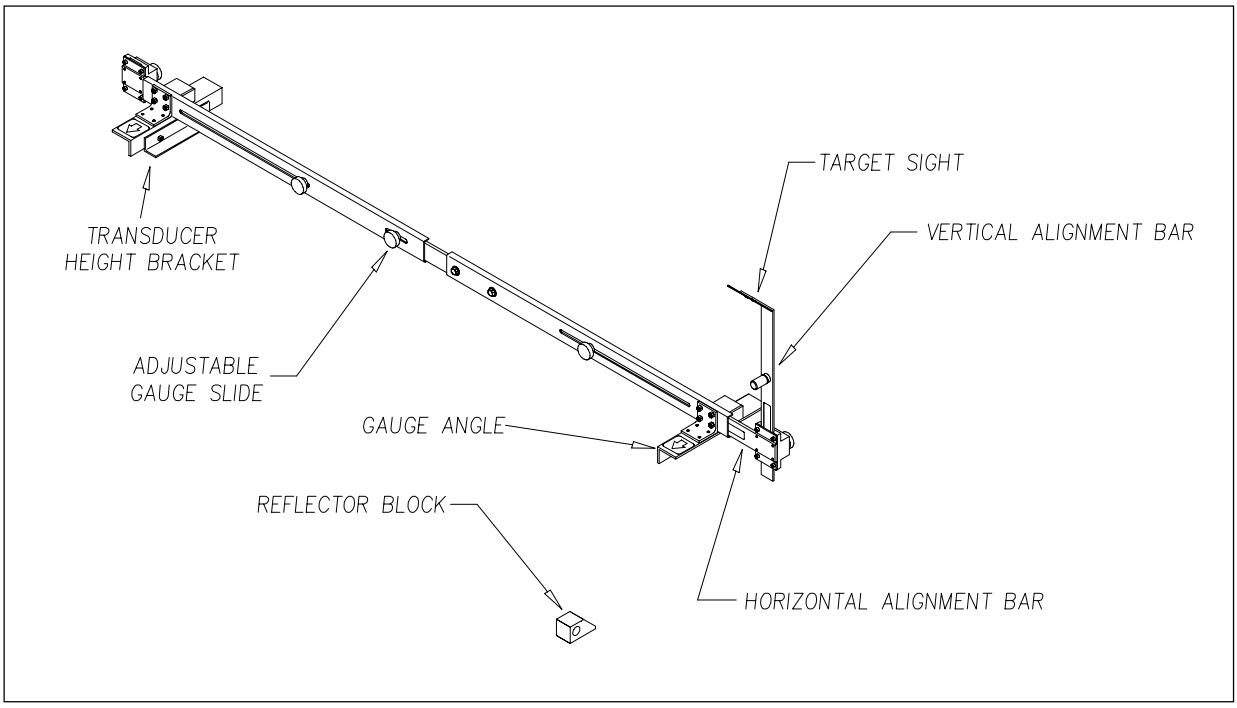
3.3.3 Connecting Transducers to the iCube:

Signal wires from the transducer should go through a UTB (Universal Transient Barrier) or other suitable surge protectors before connecting to the iCube inputs. Track Module pinouts are listed below. Connect the White transducer wire to signal positive and the Black wire to signal return.

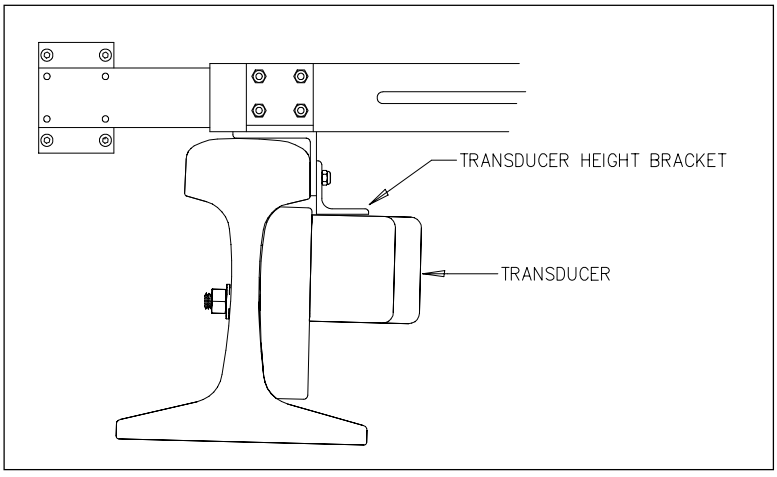


3.3.4 Transducer Alignment Tools

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



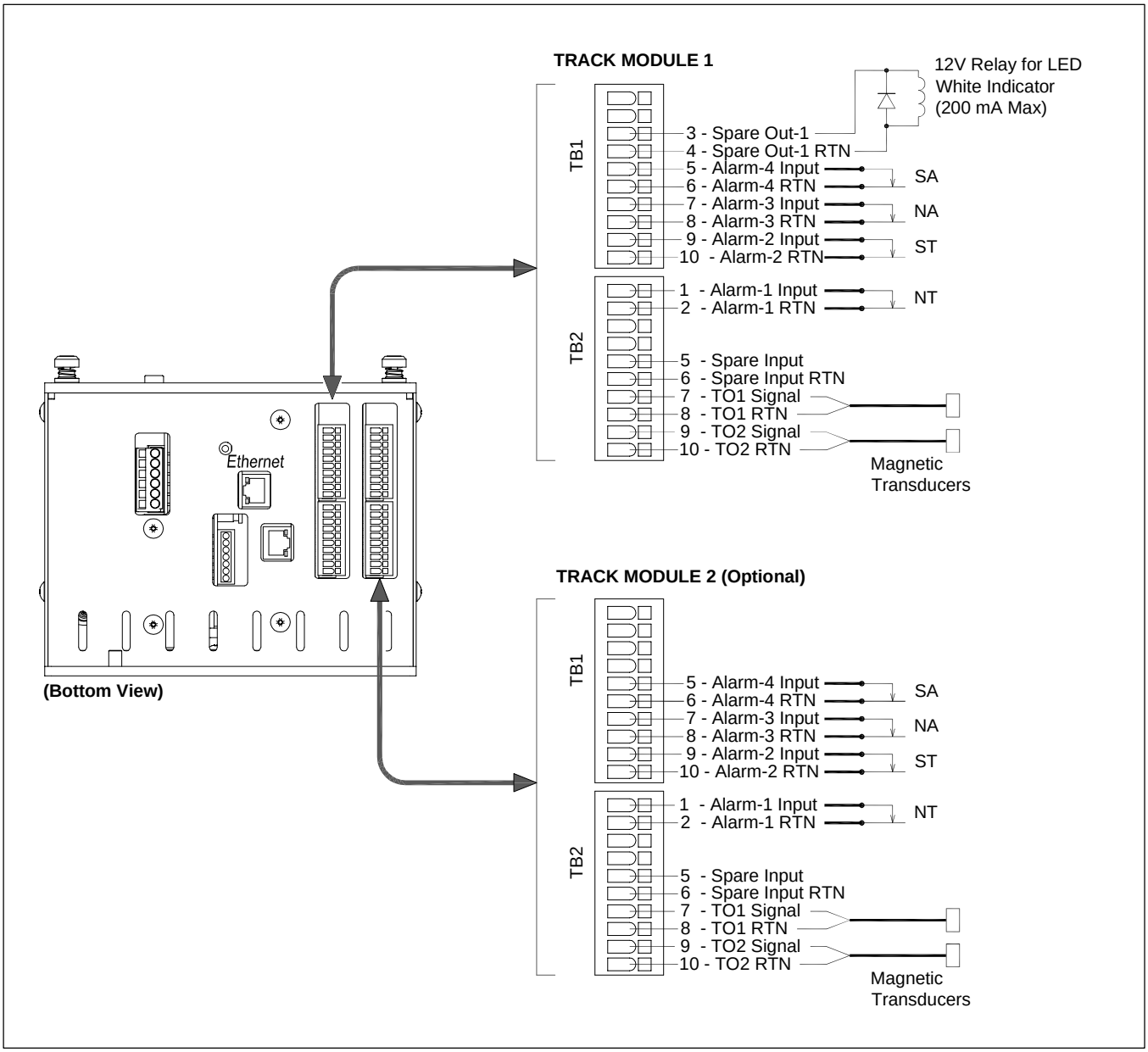
The transducer height bracket on the bottom of the alignment fixture can be used to ensure the proper installation of the transducers. When the transducer body touches the bracket, the transducer body is 1-9/16 inches (3.97 centimeters) below the top of the rail and parallel to it.



3.4 Auxiliary Equipment

The iCube Track Module provides inputs that can monitor the status of various wayside condition detectors - all that is required are a set of dry contacts from the detection device. Examples include the Track-Integrity Detector, Draggers, Clearance Sensors, Slide Fence, High Water Sensor, Bridge Out, and Wheel Down Sensor.

For the Track-Integrity Detector application, Alarm-1 through Alarm-4 are designated for the Track-Integrity inputs, and the Spare input is designated for the Recall input. For proper operation, each iCube input used must be appropriately configured and enabled via the User Interface (see section 6). Available iCube inputs are depicted below.



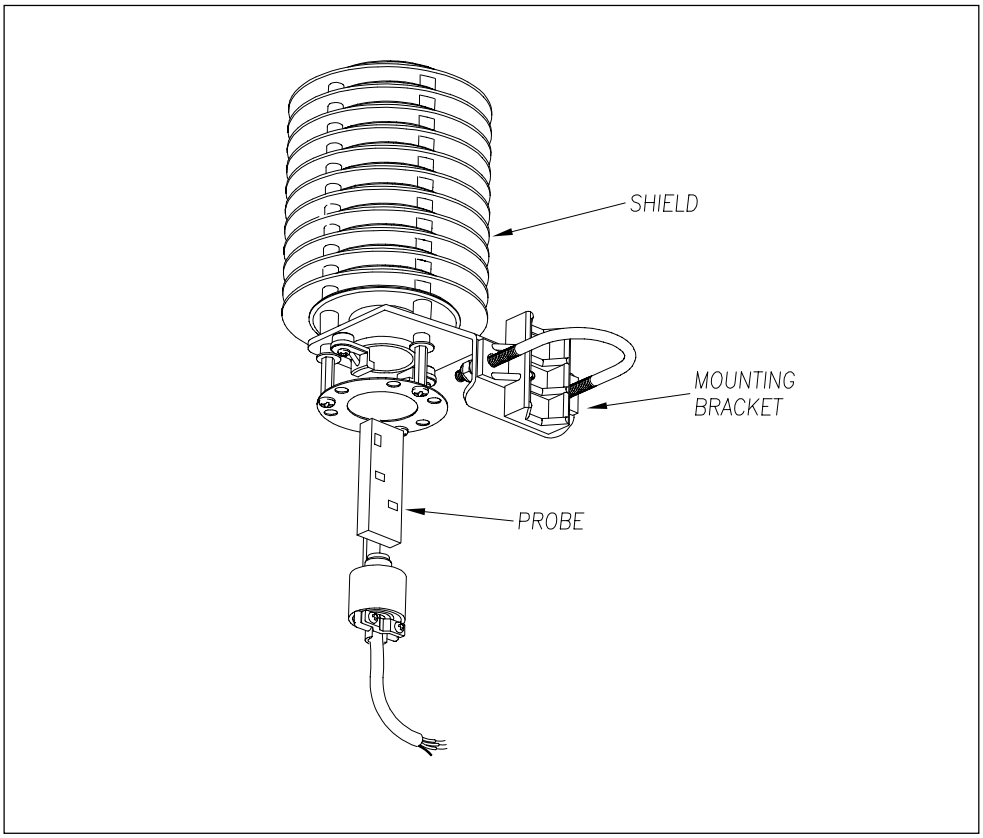
Connect the track integrity inputs to a relay contact that is closed to indicate an “OK” condition and open to indicate a “Down” condition. The relay contact must be open for at least ten milliseconds before a “Down” condition will be recognized, and it must be closed for at least 100 milliseconds before an “OK” condition will be recognized.

3.5 Temperature Probe

Not all iCube sites use a temperature probe. If yours doesn't, skip ahead to the next section.

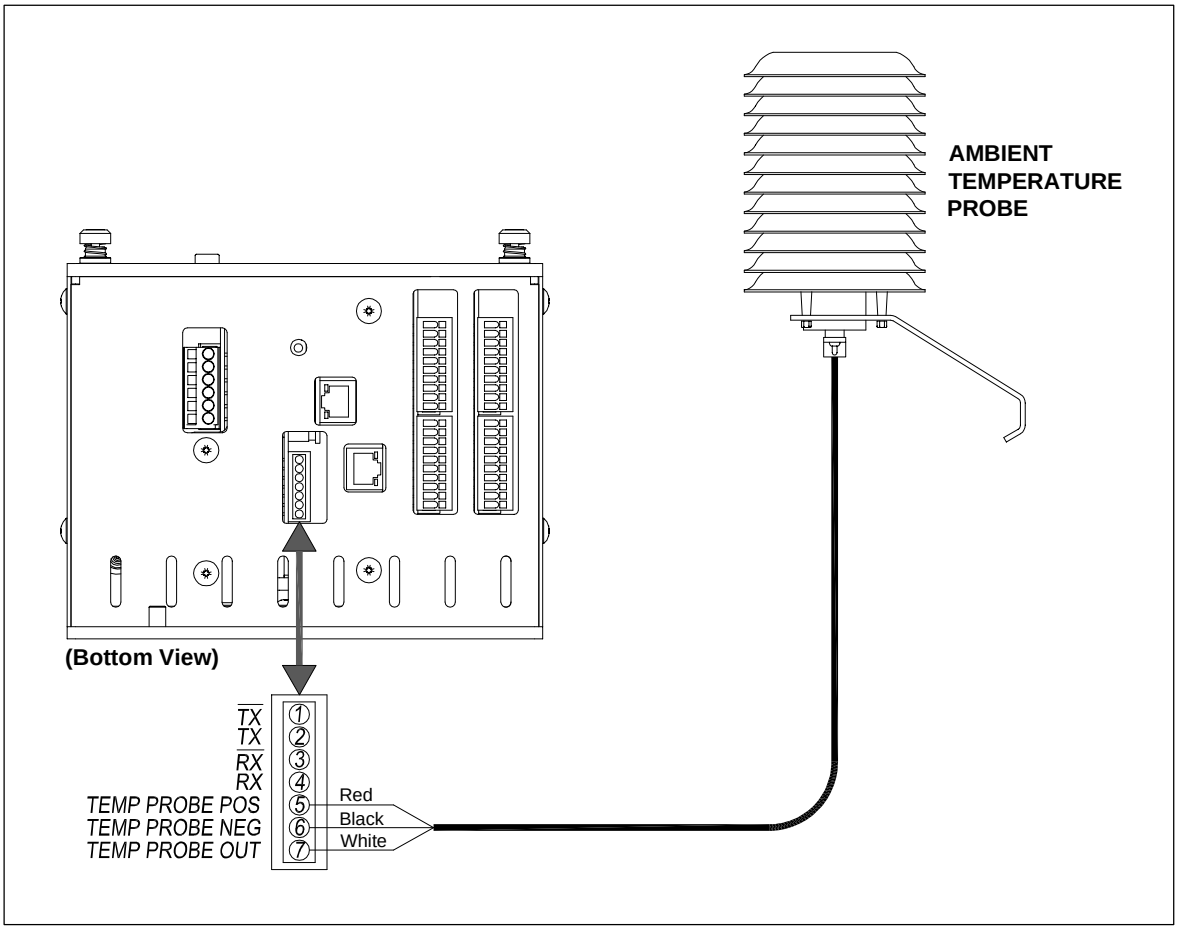
The temperature probe is encased in a radiation shield that shields it from direct sunlight and allows ambient air to flow through and around it. The probe mounts to the outside wall of the bungalow (aka wayside enclosure) and provides accurate temperature indications over a range of -49°F to +149°F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

The figure below shows the major parts of a shielded temperature probe (2090-100).



The iCube supplies 12 volts to the shielded temperature probe. The probe returns 0 to 5 volts. Zero volts indicates a -49°F (-45°C) reading. Five volts indicate a +149°F (+65°C) reading. During normal operation, you should probably never get either reading. Therefore, if you get a -49°F (-45°C) reading, the probe could be malfunctioning, the cable from the probe to the iCube enclosure could be cut or disconnected. If you get a +149°F (+65°C) reading, the probe could be malfunctioning, or the ground wire from the probe to the iCube enclosure could be cut.

Temperature Probe Wiring:



4.0 — System Operation

This section describes the operation of an iCube system. Covered are train detection, axle counting, alarm detection, data storage, and speech generation.

4.1 Overview

The iCube can monitor up to two tracks with four alarm-generating devices on each track. Detected alarms are transmitted to affected train crews via radio road channel.

The iCube houses specialized component cards designed to perform various system functions. Each system includes a Radio Card, a Power Supply Card, a Processor Card, a Talker Card, and up to two Track Module Cards. These component cards interconnect via a backplane.

The Processor Card monitors the Track Modules via the CAN bus, and it communicates with the Talker Card via an RS232 connection. The processor collects train data from the Track Module when it is available, stores the data on an SD card, and generates speech commands for the Talker Card. The Processor Card provides a serial user interface. It monitors the system's battery voltage. It also determines ambient temperature and wind speed by monitoring external sensors.

The Talker Card stores all of the digitized speech required for voice announcements. Commands received from the Processor Card initiate the appropriate announcement from the talker. The Talker Card also handles all radio control functions. When no announcement is in progress, the talker listens for any Recall request. Also, system time is maintained on the Talker Card.

The Track Module Card handles the task of scanning all track inputs. It looks for train presence, counts axles, and recognizes alarm conditions. Messages are sent to the Processor Card when a train arrives and when it leaves. If an alarm occurs during train passage, a message is sent to the processor, which sends the correct commands to the talker to cause a real-time announcement. Train and alarm data is stored temporarily on the Track Module Card. After a train has passed, the data is sent to the Processor Card for longterm storage.

4.2 Train Presence Detection

Any positive-going pulse at the transducer input causes the system to start scanning all alarm inputs that are enabled for that track. Scanning continues as long as transducer pulses occur at intervals less than 10 seconds. An absence of a transducer pulse for more than nine seconds is considered the end of the train. Anything generating at least four transducer pulses is considered a valid train. Anything generating a total axle count of two or three is logged as a test train. Anything generating a total axle count of one is ignored.

4.3 Axle Counting

Any positive-going pulse greater than 30 millivolts at a transducer input causes the pulse count for that transducer to be incremented. The transducer inputs must return to less than 30 millivolts between axle pulses. The axle count is incremented when two transducer pulses, one from each transducer, are received.

4.4 Track-Integrity Detection

Each Track Module Card has four alarm inputs labeled ALM-1, ALM-2, ALM-3, and ALM-4. Each input can be configured as one of four Track-Integrity inputs. The track-integrity inputs are designed to work with a normally closed contact. A closed-circuit at the input causes an “OK” indication. An open circuit at a track-integrity input for more than ten milliseconds causes a “Down” indication for that track zone. Once a “Down” indication exists, a closed-circuit must be present at the input for more than 100 milliseconds to cause a return to an “OK” status.

4.5 Stopped-Train Detection

If a train stops so that both tracks are occupied, the direction will be locked and won’t change when the train restarts. No radio announcement will be made when the train restarts. The direction will remain locked as long as both tracks are occupied. The direction is released if either track-integrity input clears and the presence timeout has expired.

If both tracks are not occupied, the direction is determined by the transducer that is active first.

4.6 Memory Log

All train movements, recall events, and track-integrity input changes are stored in a directory on the SD card on the iCube. This directory is organized as a circular buffer. In this scheme, data is added until the directory is full. Once the directory is full, the oldest data is overwritten as new data is recorded.

For each record, the time and date, total axles and direction (if applicable), and track-integrity input status are saved. Each record will be identified as:

- Train, for a train movement
- Input, for a track-input change
- Recall, for a recall request

If it becomes necessary, you can clear all data stored in the memory log with the Clear Report Data option of the Main menu. ***Section 6 – User Interface*** tells how to do this.

4.7 Speech Generation

The iCube not only controls train scanning but also generates the phrases to be spoken. All the needed vocabulary is stored in flash storage on the talker as digitized phrases. The information stored is the binary equivalent of the digitized voltage samples taken at a nine-kilohertz rate while the desired phrase was being spoken. The microprocessor has in its memory the specific memory locations of all digitized phrases. Generating audible speech is achieved by converting each of the stored digital samples to analog voltages at the same rate that they were digitized. The net effect is a machine that converts a series of codes from the microprocessor to human speech with the correct phonics and tempo. ***Section 5 - Radio Announcements*** describes the message formats and the announcement criteria.

4.8 Train and Event Data Storage

Train and event data is saved to log files on the SD card. Each log can store a limited amount of records. As log space reaches capacity, the newest records overwrite the oldest. If no SD card is installed, the system can still scan trains, detect alarms, and make announcements, but it can't store the data for future reference.

For each train, the arrival time, date, total axles (if transducers are used), speed, and status are saved. For each alarm that occurs during train passage, the time, date, type of alarm, and axle count (if transducers are used) at which the alarm first occurred are saved. If the number of alarms during one train exceeds the maximum number of alarms, data is stored only for the alarms up to and including the maximum number.

4.9 Low-Battery Detection

Terminals 5 and 6 of the six-position socket on the bottom of the iCube are the battery input. The processor samples the voltage at the battery input once a minute. If the battery voltage falls below 10.5 volts, that is considered a low battery condition. The low battery condition exists as long as the battery voltage remains below 11.0 volts. If the battery voltage becomes greater than 11.0 volts, the low-battery condition is cleared.

In the Announcement Menu is an option labeled "Announce Low Battery." While a low-battery condition exists and the Announce Low Battery option is enabled, any end-of-train report has "low battery" added to the last repeat of the message after "total axles" and before "detector out." Note that on power-up or after a reset, the battery is assumed good.

5.0 — Radio Announcements

This section describes radio announcements, which consist of predefined spoken messages with each message triggered by a particular event or set of events. Covered are the message formats and the announcement criteria.

5.1 Startup Announcements

When the iCube system is powered, or the reset button (on the bottom of the iCube) is pressed, the current status of the track-integrity inputs is broadcast. The format of this announcement is:

B-N-S-F Milepost *nnnn.n*	
Zone *nn* Integrity (OK or Down)	(if Alarm-4 input is enabled)
Zone *nn* Integrity (OK or Down)	(if Alarm-3 input is enabled)
Detector Out	(if enabled)

This announcement isn't affected by the setting of the Talk on Track Integrity Down Only option.

5.2 Track-Integrity Announcements

When train movement is detected, the iCube system announces the status for the track zones in the direction the train is moving. Four axles must be counted before this announcement is made.

Direction is determined by which transducer detects a wheel first. If transducer TO1 is first, the format of the announcement is:

B-N-S-F Milepost *nnnn.n*	
Zone *nn* Integrity (OK or Down)	(if Alarm-3 input is enabled)
Zone *nn* Integrity (OK or Down)	(if Alarm-1 input is enabled)
Detector Out	(if enabled)

If transducer TO2 is first, the format of the announcement is:

B-N-S-F Milepost *nnnn.n*	
Zone *nn* Integrity (OK or Down)	(if Alarm-4 input is enabled)
Zone *nn* Integrity (OK or Down)	(if Alarm-2 input is enabled)
Detector Out	(if enabled)

If the track input is "down," the approach track won't be announced. So, if Alarm-4 input is down, Alarm-2 input won't be announced. Likewise, if Alarm-3 input is down, Alarm-1 input won't be announced.

If the setting of the Announce Low Battery option is Yes and a low-battery condition exists, the words “Low Battery” are added to the announcement before “Detector Out.”

If the setting of the Talk on Track Integrity Down Only option is Yes, no track-integrity announcement is made for trains of four axles or more unless there is a “Down” condition.

5.3 Hi-Rail Announcements

For an axle count of two or three, the iCube system broadcasts the current status of the track-integrity inputs (Alarm-4 input and Alarm-3 input). This announcement is the same format as that described for the startup announcement except that “Low Battery” is added to the message if it is enabled and a low-battery condition exists.

If two axles are counted, and no track-integrity inputs are down, the announcement is given immediately. If either track input is down and two or three axles are counted, the announcement is delayed 20 seconds for train presence timeout.

The hi-rail announcement isn’t affected by the settings of the Talk on Track Integrity Down Only option, the Broadcast Delay - Left (South) option, or the Broadcast Delay - Right (North) option.

5.4 Recall / Current Status Announcements

A repeat of the track-integrity announcement can be requested for the number of seconds specified by the Recall Repeat Time option. This time is measured from the end of the original message. If a recall is requested within the specified time, the previous track-integrity message as described above is repeated. If a recall is requested after the time expires, the current status of the track-integrity inputs is broadcast. The current status announcement will be the same format as that described for the startup announcement with one exception. The current status will have “Low Battery” added to the message if it is enabled and a low-battery condition exists.

The current status announcement is not affected by the setting of the Talk on Track Integrity Down Only option.

This section describes radio announcements, which consist of predefined spoken messages with each message triggered by a particular event or set of events. Covered are the message formats and the announcement criteria.

6.0 — User Interface

This section describes the user interface for the iCube system. It covers how to set the system parameters and how to display stored train data.

Connecting a computer directly to the system accesses the user interface. To do this, you will need a computer with an RS232 serial port and a null-modem cable. The computer should be running communications software set to eight data bits, one stop bit, no parity, and full-duplex. If there is a terminal emulation setting, use ANSI.

The baud rate of the iCube system is adjustable from 300 to 115200 using the Setup Equipment option on the Main menu. You should set the baud rate of your computer to match the baud rate setting of the iCube system.

To access the system:

1. Be sure your computer has appropriate communications software installed.
2. Be sure your communications software is set to use full-duplex.
3. Connect your computer to the RS232 connector on the iCube front panel.
4. Press **[Esc]**.

   The Main menu appears. The contents of your screen will be different.

```
STC SmartScan iCube 2700-009BN
BNSF Track Integrity Detector
Main Menu                  04/17/2020 16:32:47
-----------------------------------------------
[A] - Set Time and Date
[B] - Set System Parameters
[C] - Enter Test Mode
[D] - Radio Menu
[E] - Display Report Data
[F] - Clear Report Data
[G] - System Functions Menu
[X] – Exit
```

5. Type the letter that corresponds to the desired option.

   For example, if you want to display the report data, press **[E]**.
6. Repeat step **5** until you are done.

After a power-up or reset, the user interface starts at 115200 baud and then switches to the programmed baud rate after 5 seconds. If you don't know the baud rate of a system you are trying to connect to, set your computer to 115200 baud and either cycle power or press the reset button on the bottom of the iCube module. You should see the following message.

```
Press spacebar to keep the default baud rate of 115200
Loading the programmed rate of 9600 in 5 seconds
```

If you press the spacebar within 5 seconds, the baud rate will remain at 115200, and you can access the system with your computer set to 115200 baud. Alternatively, you could let the system switch to its programmed rate (in this case, 9600) by not pressing any keys. Then change your computer to that baud rate and wait a few seconds for the system to finish booting. Then press the Esc key, and you should see the Main menu.

6.1 Set Time and Date

On the Main menu, option-A is the Set Time and Date option. To select this option, press **[A]**. Doing so displays the current time and date with a prompt for a new time.

```
Time: 09:56:08  Date: 04/09/20
Enter Time  HHMMSS  (Press ESC to exit)
```

Enter the time with no spaces between digits. Entry format is **hhmmss**, where **hh** is hours, **mm** is minutes, and **ss** is seconds. Time is in 24-hour format, where 8 a.m. is 08:00, noon is 12:00, 8 p.m. is 20:00, and midnight is 00:00. Thus, for 26 seconds past 3:49 p.m., enter **154926**. To exit without changing the time, press **[Esc]**. After either typing six digits or pressing **[Esc]**, the iCube prompts for the date as shown below:

```
Enter Date  MMDDYY  (Press ESC to exit)
```

Enter the date with no spaces between digits. Entry format is **mmddyy**, where **mm** is the month, **dd** is the day, and **yy** is the year. For days, months, or years from 1 through 9, enter leading zeros. Thus, for 9 April 2020, enter **040920**. To exit without changing the date, press **[Esc]**. After either typing six digits or pressing **[Esc]**, the Main menu reappears.

6.2 Set System Parameters

On the Main menu, select the Set System Parameters option. The following prompt appears:

```
Which track? (1/2)
```

Select Track 1 or 2. Doing so displays the Setup Options menu and other information.

```
Track 1 Settings
-----------------------------------------
[A] - Milepost ..................... 1234.5x
[B] - Zone Number for Input ALM-1 (NT) .... 63
[C] - Zone Number for Input ALM-2 (ST) .... 40
[D] - Zone Number for Input ALM-3 (NA) .... 79
[E] - Zone Number for Input ALM-4 (SA) .... 18
[F] - Talk On Integrity Down Only ........ Yes
[G] - Recall Reported For Hi-Rail ........ Yes
[H] - Repeat Track Integrity ............. No
[I] - Announce Detector Out .............. Yes
[J] - Broadcast Delay - Left (South) ..... 0
[K] - Broadcast Delay - Right (North) ..... 0
[L] - Recall Repeat Time ................. 30
[M] - Announce Low Battery ............... Yes
[N] - Load Defaults
[X] - Exit
```

On the left of the above screen is the option number, followed by its name. For example, the Milepost option is option-A. On the right are the current settings of the options. For example, the current setting of the Milepost option is 1234.5.

6.2.1 Milepost

On the Settings menu, select the Milepost option. Doing so displays the current milepost (that is announced with each message) with a prompt for a new one.

```
BNSF Milepost 1234.5x
Enter new Milepost as 5 digits (----.-) then the optional character.
The optional character may be X, Y, Z, or SPACE (if not used).
Press ESC to exit without changing the Milepost.
```

Enter the milepost with no spaces between characters. The entry format is **nnnn.nx**, where **n** is a digit 0 through 9, and **x** is a space or a letter X through Z. If the desired milepost has less than five digits, enter leading zeros. If the desired milepost is an integer, enter a trailing zero. Thus, for milepost 87, enter **00870**. The system automatically inserts the decimal point. After the last digit, you may enter an X, Y, or Z. If no letter is desired, press the spacebar. To exit without changing the milepost, press **[Esc]**. After either typing in six characters or pressing **[Esc]**, the Setup Options menu reappears.

6.2.2 Zone Number for Alarm-1 Input (NT)

On the Setup Options menu, select the zone number for Alarm-4 (NT) Input option. Doing so allows you to enter a two-digit zone number that is announced for Alarm-4 input. Alarm-1 Input is the north track (NT).

```
Zone Number for ALM-1 Input = 63
Enter New Value: 00 - 99 (00 = disabled)
(or Press ESC to exit)
```

Enter a two-digit value representing the zone number to be announced for Alarm-4 input. The value may range from 1 to 99. For values less than ten, enter a leading zero. To disable the input so that its status isn't announced, enter 00. To exit without changing the zone number, press **[Esc]**. After either typing two digits or pressing **[Esc]**, the Setup Options menu reappears.

6.2.3 Zone Number for Alarm-2 Input (ST)

On the Setup Options menu, select the zone number for Alarm-2 Input (ST) option. Doing so allows you to enter a two-digit zone number that is announced for Alarm-2 input. Alarm-2 Input is the south track (ST).

```
Zone Number for ALM-2 Input = 40
Enter New Value: 00 - 99 (00 = disabled)
(or Press ESC to exit)
```

Enter a two-digit value representing the zone number to be announced for Alarm-2 input. The value may range from 1 to 99. For values less than ten, enter a leading zero. To disable the input so that its status isn't announced, enter 00. To exit without changing the zone number, press **[Esc]**. After either typing two digits or pressing **[Esc]**, the Setup Options menu reappears.

6.2.4 Zone Number for Alarm-3 Input (NA)

On the Setup Options menu, select the zone number for Alarm-3 Input (NA) option. Doing so allows you to enter a two-digit zone number that is announced for Alarm-3 input. Alarm-3 Input is the north approach (NA) track. NA is the rightmost (northmost) zone.

```
Zone Number for ALM-3 Input = 79
Enter New Value: 00 - 99 (00 = disabled)
(or Press ESC to exit)
```

Enter a two-digit value representing the zone number to be announced for Alarm-3 input. The value may range from 1 to 99. For values less than ten, enter a leading zero. To disable the input so that its status isn't announced, enter 00. To exit without changing the zone number, press **[Esc]**. After either typing two digits or pressing **[Esc]**, the Setup Options menu reappears.

6.2.5 Zone Number for Alarm-4 Input (SA)

On the Setup Options menu, select the zone number for the Alarm-4 Input (SA) option. Doing so allows you to enter a two-digit zone number that is announced for Alarm-4 input. Alarm-4 Input is the south approach (SA) track. SA is the leftmost (southmost) zone.

```
Zone Number for ALM-1 Input = 18
Enter New Value: 00 - 99 (00 = disabled)
(or Press ESC to exit)
```

Enter a two-digit value representing the zone number to be announced for Alarm-4 input. The value may range from 1 to 99. For values less than ten, enter a leading zero. To disable the input so that its status isn't announced, enter 00. To exit without changing the zone number, press **[Esc]**. After either typing two digits or pressing **[Esc]**, the Setup Options menu reappears.

6.2.6 Talk on Track Integrity Down Only

On the Setup Options menu, select the Talk on Track Integrity Down Only option. Doing so lets you select if track integrity is announced for only a “Down” indication or for both “OK” and “Down” indications.

```
Talk on Track Integrity Down Only = No
Select New Setting or Press ESC to exit:
(Y) - Yes
(N) - No
```

To cause the iCube to announce track integrity for both “OK” and “Down” indications, press **[N]**. To announce track integrity only for a “Down” indication, press **[Y]**. To exit without making any changes, press **[Esc]**. After pressing **[Y]**, **[N]**, or **[Esc]**, the Setup Options menu reappears.

6.2.7 Recall Reported for Hi-Rail

On the Setup Options menu, select the Recall Reported for Hi-Rail option. Doing so lets you select if track integrity is announced for hi-rail vehicles. Any “train” with an axle count of two or three is considered a hi-rail vehicle. Any “train” with an axle count of one is ignored.

```
Recall Reported for Hi-Rail = No
Select New Setting or Press ESC to exit:
(Y) - Yes
(N) - No
```

To cause the iCube to announce track integrity for hi-rail vehicles, press **[Y]**. To prevent the announcement of track integrity for hi-rail vehicles, press **[N]**. To exit without making any changes, press **[Esc]**. After pressing **[Y]**, **[N]**, or **[Esc]**, the Setup Options menu reappears.

6.2.8 Repeat Track Integrity

On the Setup Options menu, select the Repeat Track Integrity option. Doing so lets you select if the track-integrity announcement is repeated after a five-second delay.

```
Repeat Track Integrity = No
Select New Setting or Press ESC to exit:
(Y) - Yes
(N) - No
```

To cause the iCube to repeat the track-integrity announcement, press **[Y]**. To cause the track integrity to be announced only once, press **[N]**. To exit without making any changes, press **[Esc]**. After pressing **[Y]**, **[N]**, or **[Esc]**, the Setup Options menu reappears.

6.2.9 Announce Detector Out

On the Setup Options menu, select the Announce Detector Out option. Doing so lets you select if the words “Detector Out” are added to the end of each track-integrity announcement.

```
Announce Detector Out = No
Select New Setting or Press ESC to exit:
(Y) - Yes
(N) - No
```

To cause the iCube to add “Detector Out” to the end of the last announcement when no more messages are waiting in the speech buffer, press **[Y]**. To prevent the “Detector Out” announcement, press **[N]**. To exit without making any changes, press **[Esc]**. After pressing **[Y]**, **[N]**, or **[Esc]**, the Setup Options menu reappears.

6.2.10 Broadcast Delay - Left (South)

On the Setup Options menu, select the Broadcast Delay - Left (South) option. Doing so lets you set the broadcast-delay time for the left or south direction.

```
Broadcast Delay for Left Direction = 10
Enter New Value (00 - 15) seconds
(or Press ESC to exit)
```

Enter a two-digit value representing the number of seconds to delay the track integrity message for trains moving left or in the south direction. The broadcast-delay time may be set from 0 to 15 seconds, but for values less than ten, enter a leading zero. A value of 0 means the announcement will not be delayed. To exit without changing the time, press **[Esc]**. After either typing two digits or pressing **[Esc]**, the Setup Options menu reappears.

6.2.11 Broadcast Delay - Right (North)

On the Setup Options menu, select the Broadcast Delay - Right (Left) option. Doing so lets you set the broadcast-delay time for the right or north direction.

```
Broadcast Delay for Right Direction = 10
Enter New Value (00 - 15) seconds
(or Press ESC to exit)
```

Enter a two-digit value representing the number of seconds to delay the track integrity message for trains moving right or in the north direction. The broadcast-delay time may be set from 0 to 15 seconds. For values less than ten, enter a leading zero. A value of 00 means the announcement won't be delayed. To exit without changing the time, press **[Esc]**. After either typing two digits or pressing **[Esc]**, the Setup Options menu reappears.

6.2.12 Recall Repeat Time

On the Setup Options menu, select the Recall Repeat Time option. Doing so lets you set the amount of time after a train has passed to allow a repeat of the track-integrity message. If a recall is requested after this time expires, the current status of the track-integrity inputs will be announced.

```
Recall Repeat Time = 15
Enter New Value (00 - 30) seconds
(or Press ESC to exit)
```

Enter a two-digit value representing the number of seconds to allow repeats of the track integrity message. The Recall Repeat Time may be set from 0 to 30 seconds. For values less than ten, enter a leading zero. To exit without changing the time, press **[Esc]**. After either typing two digits or pressing **[Esc]**, the Setup Options menu reappears.

6.2.13 Announce Low Battery

On the Setup Options menu, select the Announce Low Battery option. Doing so lets you select if the words “Low Battery” are added to the end of each track-integrity announcement when a low-battery condition exists.

```
Announce Low Battery = No
Select New Setting or Press ESC to exit:
(Y) - Yes
(N) - No
```

To cause the iCube system to announce “Low Battery” when a low-battery condition exists, press **[Y]**. To prevent the low-battery announcement, press **[N]**. To exit without making any changes, press **[Esc]**. After pressing **[Y]**, **[N]**, or **[Esc]**, the Setup Options menu reappears.

6.2.14 Load Defaults

On the Setup Options menu, select the Load Defaults option. Doing so returns all system parameters to their default settings.

6.3 Enter Test Mode

On the Main menu, select the Enter Test Mode option. Doing so allows you to verify the proper operation of the track-integrity inputs and transducer inputs.

```
              Press ESC to exit
ALM  4      ALM  3        ALM  2      ALM  1
 ----        ----          ----        ----
```

The header labels the columns for each track input by pin number. The next line shows the initial status of each input. Four dashes mean that an input isn't active (that is, the contacts aren't open). A new status line is added to this screen every time one or more track-integrity inputs changes. For example, if the contact attached to pin 12 opens and then closes, the screen is updated as shown below.

```
              Press ESC to exit
ALM  4      ALM  3        ALM  2      ALM  1
 ----        ----          ----        ----
 ----        ----          ----        ----
 OPEN        ----          ----        ----
 ----        ----          ----        ----
```

The second and third lines verify that the contact on pin 12 was activated and then returned to its normal state.

Transducer operation can be verified by activating either transducer. If the transducer is operating properly, the display is updated with the message Transducer Active as follows:

```
              Press ESC to exit
ALM  4      ALM  3        ALM  2      ALM  1
 ----        ----          ----        ----
 OPEN        ----          ----        ----
 ----        ----          ----        ----
>>> Transducer Active <<<
```

The iCube then temporarily leaves the test mode and begins scanning for a train. If four or less transducer pulses are detected, the board determines that no train was present, and returns to test mode after a 20-second timeout. Once the board has returned to test mode, the other transducer's operation may be verified.

The iCube exits test mode when you press **[ESC]** or when no activity occurs through the serial port for 30 minutes.

6.4 Radio Menu

On the Main menu, select the Radio Menu option. Doing so allows you to setup and test transmitter functions.

```
Radio Transmit Audio Adjustment Menu
------------------------------------------------
[A] - Generate Test Tone
[B] - Radio Test
[C] - Increase Transmit Audio Deviation Level
[D] - Decrease Transmit Audio Deviation Level
[E] - Load Default Transmit Audio Setting
[X] - Exit
```

Select the Generate Test Tone option to activate the PTT for the radio and output a 1000-hertz tone through the transmit audio line. At the same time, the following appears.

```
Now generating test tone...
Press [Esc] to exit
```

Press **[Esc]** to stop the test tone and release the PTT. The test tone continues for five minutes if there is no activity through the serial port.

Other Radio Menu options include a radio test, increase/decrease deviation, and load default transmit audio settings.

6.5 Display Report Data

On the Main menu, select the Display Report Data option. Doing so produces a report of the data stored in the memory log. Below is a sample of this report.

```
For the following report, pressing `H' will pause printing
Any other key will resume printing.
Press ESC to end printing.

Memory Log                                                  Zone (Input)
Event      Date      Time      Axles    Direct     0(12)  5(16)  6(18)  0(14)
-------------------------------------------------------------------------------
Input    03/26/20  11:04:41                          OK     OK     OK     OK

Input    03/26/20  11:03:39                          OK    Down    OK     OK

Input    03/26/20  11:02:27                          OK    Down   Down    OK

Train    03/26/20  11:02:26     110      Left        OK     OK    Down    OK
Message:
BNSF Milepost 123.4, Zone 5 Integrity OK,
Zone 4 Integrity OK, Detector out

Input    03/26/20  11:01:25                          OK     OK    Down    OK

Recall   03/26/20  11:00:50                          OK     OK     OK     OK
Message:
BNSF Milepost 123.4, Zone 6 Integrity OK,
Zone 5 Integrity OK, Detector out

End of Data
```

As shown in the sample report above, three types of records can be stored. The type of record is listed in the Event column and can be

- Input (for an input status change)
- Train (for a train movement)
- Recall (for a requested repeat of a message or current status).

For each record the time and date are shown. For train movements the total axles and direction are also shown. The last four columns show the status (OK or Down) of all four track-integrity inputs. If a voice message was broadcast, it will be printed below the record.

In the sample report, a recall was requested at 11:00 a.m. on 26 March 2020. Since no train had passed previously, the current track status was announced.

A train did pass the site at 11:02 a.m. on 26 March 2020. The train had 110 axles and was moving to the left (south) direction. The four Input records shown in the report are associated with the train movement. Inputs 12 (SA) and 14 (NA) were disabled so no records were generated for those inputs.

6.6 Clear Report Data

On the Main menu, select the Clear Report Data option. Doing so allows you to clear the train data in non-volatile SRAM.

```
All Train Data will be erased...
Press [Shift-y] to continue
Press [N]o or any other key to exit
```

Press **[Shift][Y]** to clear all train data out of memory. If any other key is pressed or five minutes elapses without a key being pressed, the system returns to the Main menu without erasing any train data.

6.7 Systems Functions Menu

On the Main menu, select the Systems Functions Menu option.

```
System Functions Menu
---------------------------------------------
[A] - Radio Test
[B] - Network Settings
[C] - Load New Software
[D] - Speaker Volume Up
[E] - Speaker Volume Down
[F] - Track 2: Disabled
[G] - Reboot
[X] – Exit
```

On the left of the above screen is the option number, followed by its name. Select the appropriate option to perform the desired function.

7.0 — Customer Service

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

7.1 Reaching STC

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

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

Mail and shipments are replied to as soon as possible, normally within one working day. Equipment repair may take longer. By phone, you can reach STC at 423-892-3029, Monday through Friday, from 8:00 a.m. until 5:00 p.m. Eastern time. After business hours, a machine answers the calls. These calls are returned promptly the next business day. By fax, you can reach STC at 423-499-0045. The fax machine can receive faxes at all times. Faxes are replied to as soon as possible, normally within one working day. By email, you can reach STC at stcemail@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 phone call first. Just ship it directly to the **Repair Department** at the address above.

With the returned equipment, include:

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

7.3 Reporting Problems or Suggestions

If you have any problems, suggestions, or questions related to STC equipment, phone the **Engineering Department** at the phone number above. When calling, state the equipment about which you are calling. 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, phone or fax the **Sales Department** at the phone numbers above.

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

When faxing, include:

- Purchase Order Number for the order or credit card number (to be charged) with its expiration date.
- Complete address where the parts are to be shipped.
- Complete address where the invoice is to be mailed.
- Name and phone number of the person who should be contacted to answer questions about the order.
- Your fax number and email address, 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, phone or fax the **Sales Department** at the phone numbers above.

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

When faxing, include:

- Purchase Order Number for the shipment or order being checked.
- Name and phone number of the person who should be contacted after the order status is checked.
- Your fax number and email address, if available.

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