SIEMENS

INSTRUCTION & SERVICE MANUAL

END-OF-TRAIN DEVICE, MODELS Q3920 & R3930 (DUAL PIPE) & Q3922-14 (ZERO-LEAK)

FEBRUARY 2013, REVISED JANUARY 2022

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DOCUMENT HISTORY

Version	Release Date	Sections Changed	Details of Change
A	12/2011		Initial Release
B	03/2012		• Page 3, paragraph 1.4 DISPLAY – added CHARGING, CHG DONE and PS NG displays to table • Page 4, paragraph 1.5 ORDERING INFORMATION – rewrite to include explanation of new configurations (Q3920-01 – 08, "Smart Charge" and standard models) and added table for same. Rewrite Note 1 below second table for clarification. Added explanation of download adapter and cable part numbers. • Page 8, paragraph 2.2 EOT REMOVAL – rewrite removal steps for added detail and safety. • Page 10, paragraph 3.2 – DEACTIVATING THE EOT – added third paragraph for additional method of EOT deactivation. • Page 11, paragraph 3.4 AIR GENERATOR – modified for clarity. • Page 11, paragraph 3.6 LOCATION AND MOTION SENSOR – changed heading to MOTION SENSOR. • Page 13, paragraph 3.8.2 Recharging the Battery – added text describing the new CHARGING and CHG DONE displays, added charging port connector descriptions and clarified part number references. • Page 16, paragraph 5.3 OPERATIONAL FAILURE REPORTS - added reference to use of download adapter and cable generic. • Page A-4, paragraph A.3.1 – made first bullet generic, second bullet for standard models only. Page A-6, GPS Data, Date/Time (GMT) description – for GMT to EST adjustment changed from "add 5" to "subtract 5".
C	10/2012		• Throughout – references to Q3920 changed to Q3920/R3930 or just EOT as appropriate. • Page 2, paragraph 1.1 OVERVIEW – added figure for R3930 • Page 2, paragraph 1.2 HARDWARE – added note regarding secondary air fitting on R3930 for dual pipe applications.

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			• Page 3, paragraph 1.3 DISPLAY – added MRP=XXXX display for R3930 and note 4. • Page 4, paragraph 1.5 ORDERING INFORMATION, corrected paragraph reference in Note 1 at bottom of table, removed options -05 through -08 from table, added bullet "R3930-0X includes secondary hose fitting on side of unit" for each dash number in table. Page 10, paragraph 3.2 DEACTIVATING THE EOT, changed paragraph reference in first paragraph to 3.8.
D	02/2013		• Incorporate service manual information into instruction manual, global change: Standard to Direct Charge
D.2	05/2014		• Changed to Siemens format
D.3	02/2016		• Added Q3922-14 Zero-Leak EOT (globally). • Changed dwg # from 9000-90360-0001 to 9000-90360-000X. Made many format changes and various minor updates throughout.
D.4	01/2022		Added Appendix B for Q3920 EOT 3G to 4G conversion.

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NOTES, CAUTIONS, AND WARNINGS

Throughout this manual, notes, cautions, and warnings are frequently used to direct the reader's attention to specific information. Use of the three terms is defined as follows:

⚠ WARNING	**WARNING** **INDICATES A POTENTIALLY HAZARDOUS SITUATION THAT, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY. WARNINGS ALWAYS TAKE PRECEDENCE OVER NOTES, CAUTIONS, AND ALL OTHER INFORMATION.**
⚠ CAUTION	**CAUTION** REFERS TO PROPER PROCEDURES OR PRACTICES WHICH IF NOT STRICTLY OBSERVED, COULD RESULT IN A POTENTIALLY HAZARDOUS SITUATION AND/OR POSSIBLE DAMAGE TO EQUIPMENT. CAUTIONS TAKE PRECEDENCE OVER NOTES AND ALL OTHER INFORMATION, EXCEPT WARNINGS.
NOTE	**NOTE** Generally used to highlight certain information relating to the topic under discussion.

If there are any questions, contact Siemens Industry, Inc. Application Engineering.

ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS

Static electricity can damage electronic circuitry, particularly low voltage components such as the integrated circuits commonly used throughout the electronics industry. Therefore, procedures have been adopted industry-wide which make it possible to avoid the sometimes invisible damage caused by electrostatic discharge (ESD) during the handling, shipping, and storage of electronic modules and components. Siemens Industry, Inc. has instituted these practices at its manufacturing facility and encourages its customers to adopt them as well to lessen the likelihood of equipment damage in the field due to ESD. Some of the basic protective practices include the following:

- Ground yourself before touching card cages, assemblies, modules, or components.

- Remove power from card cages and assemblies before removing or installing modules.

- Remove circuit boards (modules) from card cages by the ejector lever only. If an ejector lever is not provided, grasp the edge of the circuit board but avoid touching circuit traces or components.

- Handle circuit boards by the edges only.

- Never physically touch circuit board or connector contact fingers or allow these fingers to come in contact with an insulator (e.g., plastic, rubber, etc.).

- When not in use, place circuit boards in approved static-shielding bags, contact fingers first. Remove circuit boards from static-shielding bags by grasping the ejector lever or the edge of the board only. Each bag should include a caution label on the outside indicating static-sensitive contents.

- Cover workbench surfaces used for repair of electronic equipment with static dissipative workbench matting.

- Use integrated circuit extractor/inserter tools designed to remove and install electrostatic-sensitive integrated circuit devices such as PROM's (OK Industries, Inc., Model EX-2 Extractor and Model MOS-40 Inserter (or equivalent) are highly recommended).

- Utilize only anti-static cushioning material in equipment shipping and storage containers.

For information concerning ESD material applications, please contact the Technical Support Staff at 1-800-793-7233. ESD Awareness Classes and additional ESD product information are also available through the Technical Support Staff.

GLOSSARY

TERM	DESCRIPTION
AAR	Association of American Railroads - An organization that establishes uniformity and standardization among different railroad systems.
AREMA	American Railroad Equipment Manufacturing Association – An organization that supersedes AAR.
ATCS	Advanced Train Control System – A set of standards compiled by the AAR for controlling all aspects of train operation.
EOT	END OF TRAIN - The **end of train device** (ETD), sometimes referred to as an EOT, flashing rear-end device (FRED), or sense and braking unit (SBU) is an electronic device mounted on the end of freight trains in lieu of a caboose
ESD	ElectroStatic Discharge - is the sudden flow of electricity between two electrically charged objects caused by contact, an electrical short or dielectric breakdown. A buildup of static electricity can be caused by tribocharging or by electrostatic induction. The ESD occurs when differently-charged objects are brought close together or when the dielectric between them breaks down, often creating a visible spark.
GNSS	Global Navigation Satellite System
GPS	Global Positioning Satellite - an accurate worldwide navigational and surveying facility based on the reception of signals from an array of orbiting satellites.
HOT	HEAD OF TRAIN - telemetry system on a train that provides a critical link to last-car information, such as brake pipe pressure, motion status, battery condition, and high visibility marker status. Real-time vital information from end of train displayed in locomotive cab.
HVM	HIGH VISIBILITY MARKER
PBT	Polybutylene terephthalate - (*PBT*) is a thermoplastic engineering polymer that is used as an insulator in the electrical and electronics industries.
PC	Polycarbonate - are a group of thermoplastic polymers containing carbonate groups in their chemical structures, used in engineering strong, tough materials, and some grades are optically transparent.
RX	Receive
TX	Transmit
UHF	Ultra-High Frequency
VHF	Very High Frequency

SECTION 1
INTRODUCTION

1 INTRODUCTION

NOTE

> **NOTE**
>
> This manual covers the installation, operation and servicing of the Siemens Q3920, R3930, and Q3922-14 EOT (end-of-train) units. Familiarity with the use and operation of HOT (head-of-train) units is assumed. This manual refers to some HOT functions as required for system operation and functions. Please refer to the corresponding service or instruction manuals for HOT devices, if needed, for complete instructions.

⚠ WARNING

> **WARNING**
>
> **THE Q3920, R3930 AND Q3922-14 END-OF-TRAIN (EOT) DEVICES ARE NON-VITAL PRODUCTS. CAUTION MUST BE TAKEN WHEN INTERFACING THE EOT TO ANY VITAL EQUIPMENT AS THE EOT CAN NOT BE USED TO PERFORM, EITHER DIRECTLY OR INDIRECTLY, ANY VITAL FUNCTIONS. ENSURE THAT THE EOT IS INSTALLED PER MANUFACTURER'S INSTRUCTIONS, AND/OR ALL EQUIPMENT INTER-CONNECTIONS ARE IN COMPLIANCE WITH RAILROAD PROCEDURES AND SPECIFICATIONS.**

1.1 Overview

The Q3920, R3930 or Q3922-14 End-of-Train (EOT) device, when used with a Head-of-Train (HOT) device, provide the Locomotive Engineer with information regarding conditions that are important to the operation of the train. These conditions include brake pipe pressure (in psi) and various status conditions. The status indications include:

- Arming status (emergency feature enabled/disabled)
- Communication status (good/comm-loss, rear-to-front or front-to-rear)
- Motion detection (moving/stopped)
- High Visibility Marker (HVM) (on/off/defective)
- Brake valve (normal/emergency/defective)
- Battery status (good/low/dead)
- Battery charge (percent of Charge Used)
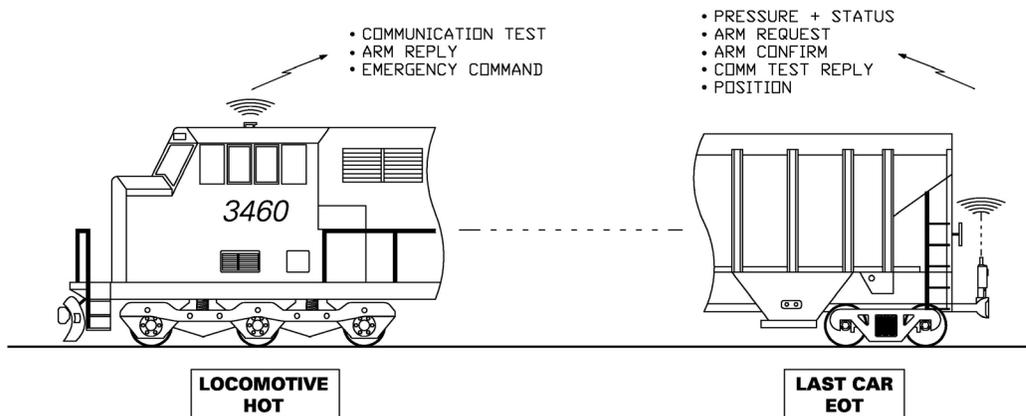
Figure 1-1   HOT / EOT Communications

The Q3920, R3930 and Q3922-14 EOTs also process emergency brake commands from the HOT, arm requests, EOT status (communications test) requests, and position requests.

The Q3920 and R3930 EOTs feature an air generator to keep the battery charged. The Q3922-14 Zero-Leak EOT incorporates all the same general features as the Q3920 EOT, but does not have an air generator, air generator harness or KIP valve. All EOTs include a GPS tracking system, and an event recorder. A single push button is used to re-arm the unit, disable its air generator (if equipped), display/send EOT status and turn the unit off. Events are logged into non-volatile memory and can be downloaded to a computer.

Every EOT has a unique ID number which is clearly marked on a metal nameplate near the carry handle. This ID number is used to link one locomotive to one EOT. Additionally, an AEI (Automatic Equipment Identification) tag with the same number reports the EOT's progress around the rail network via wayside AEI readers. The AEI tag is located beneath the display inside the EOT.
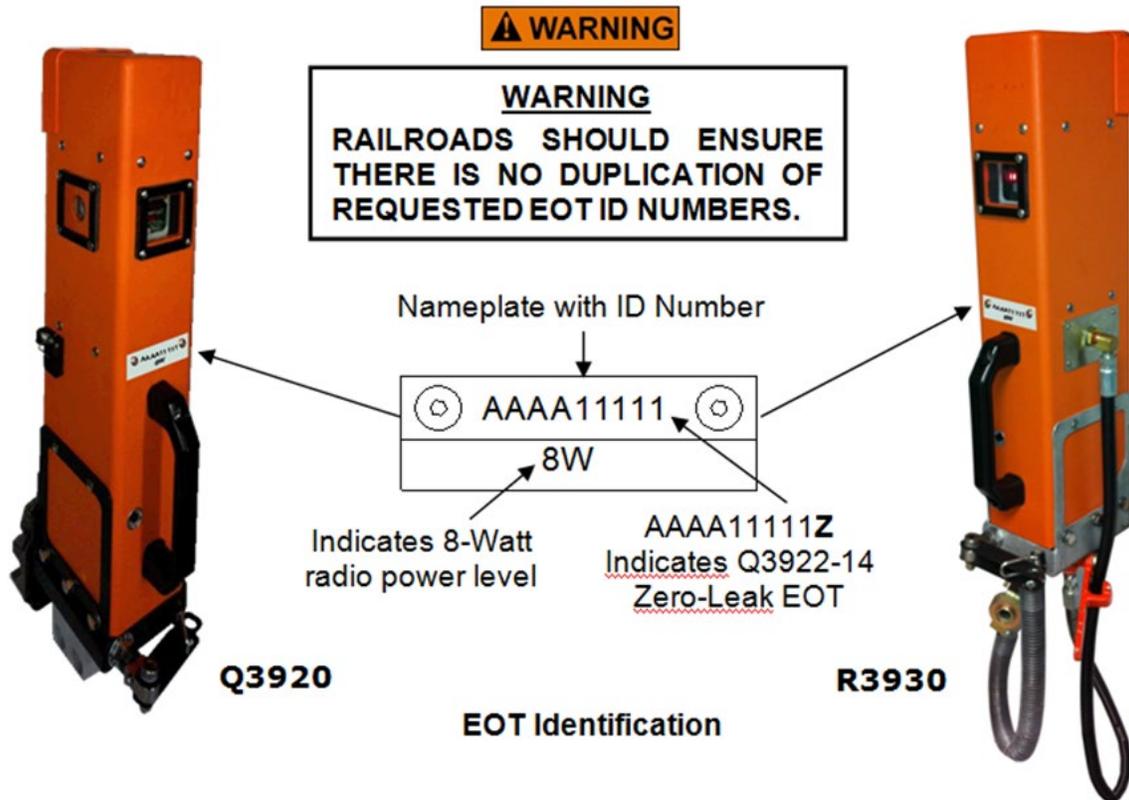
Figure 1-2   EOT Nameplate and ID

1.2   Hardware

The EOT units are housed in a rugged, UV-stabilized polycarbonate/PBT blended resin enclosure equipped with an adjustable mounting mechanism. The mounting mechanism enables the EOT to be securely fastened to Type E or F couplers via the coring holes in the coupler head. An internal radio allows the EOT to communicate with a head-of-train (HOT) device while a GPS receiver determines the EOT geographic location. An optional cell modem is also available. The R3930 EOT has an additional air hose attached which enables the EOT to be used for "dual-pipe" operation.

NOTE	**NOTE** The R3930 version of the EOT is operationally identical to the Q3920 except that it provides a secondary air fitting (1/4-inch NPT, female), located on the side of the unit, to be used for dual-pipe operation.

1.3   Display

The EOT display provides system status indications as described in the following table.

Table 1-1   EOT Display Information

Display	Display Example	Meaning/Comments
********	********	Start of Boot Up
Model Number	Q3920	EOT Model Designation
Software P/N	9VA88-B	Control program Part Number
Software P/N	9VA98-B	Power Module Program Part Number
Charge Percentage	CHG 100%	Percent of Battery Charge Remaining
Railroad ID	ABC	Railroad Reporting Mark
Unit ID	40003	EOT ID Number
Battery Volts/PSI	12.8V 90	Battery Volts and Brake Pipe Pressure
ARMED	ARMED	Unit is connected to an HOT
BATT LOW	BATT LOW	Battery voltage is below 11.0 volts
BRAKING	BRAKING	Emergency braking in progress
GDV NG	GDV NG	Generator disable valve failure
GEN OFF	GEN OFF	The generator is disabled
GEN NG	GEN NG	Air generator failure (N/A on Q3922-14)
GPS NG	GPS NG	GPS module failure
PS NG	PS NG	Internal power supply failure
MRKR NG	MRKR NG	High visibility marker (HVM) failure
MRP=XXXX[4]	MRP=93	Indicates the measured secondary pressure (93 is for example)
NO PGM	*NO PGM*	Program corrupted
PB BAD	PB BAD	Push button failure
PWR OFF?	PWR OFF?	Power off the EOT?
Volts w/ diamond	12.8V ◇	EOT is transmitting
Volts w/ hourglass	12.0V ⧗	EOT is receiving
Volts w/ pound symbol	12.8V #	EOT is attempting a cell phone call
Volts w/ plus symbol	12.8V +	GPS has a GPS fix
Volts w/ minus symbol	12.8V -	EOT is moving
CHARGING [3]	CHARGING	Displayed every 5 seconds at low intensity when connected to external battery charger and charging
CHG DONE [3]	CHG DONE	Displayed when charging is complete

[1] Data and format may vary, appropriate to customer requirements and software version.
[2] If a message not listed above appears, contact Siemens Technical Support for assistance.
[3] Available on Smart Charge units only.
[4] Displayed on R3930 dual pipe unit only

1-4

1.4   Specifications

Operating voltage	Nominal operating voltage 12.5 to 13.0 volts
Power Supply	Internal rechargeable battery, 12 volt, 3.4 Ah with 30 hour capacity (approx.)
Packaging	UV-stabilized polycarbonate/PBT blended resin enclosure
Operating Temperature Range	-40 °F to +158 °F (-40 °C to +70 °C)
Dimensions	27 inches high (68.58 cm) approximate, including clamping mechanism 4.5 inches deep (11.4 cm) approximate 8.4 inches wide (21.3 cm) approximate, including carrying handle
Weight	Q3920 - 26.5 pounds (12.02 kg), R3930 – 27.12 pounds (12.30 kg), Q3922-14 Zero-Leak – 24.4 pounds (11.07 kg)

1.5   Ordering Information

Customers ordering the Q3920 EOT will be assigned a unique orderable kit part number in the format QK-3920-XXXX where XXXX is the railroad identifier. Similarly, the part number format for the R3930 is QK-3930-XXXX and for Q3922 the part number is QK-3922-XXXX. The type of EOT and accessories included under the unique kit part number will be determined beforehand by the customer and Siemens Customer Service.

By default, the customer kit number will include pre-paid EOT Phone Home service which provides customer access to an EOT tracking website where the customer can find the status and location of any of their EOTs. To order *without* the pre-paid service, add a -1 to the end of the customer kit part number (e.g.: QK-3920-XXXX-1).

The following table describes the different EOT configurations available at the time this manual was published that may be included under the unique customer part number. Additional configurations may be added from time to time. Please contact Siemens Customer Service for further information.

Note that the difference in Smart Charge versus Direct Charge is the equipment required to charge the battery when the unit is not deployed on the train.

Table 1-2   EOT Part Numbers and Descriptions

Siemens P/N	Description[1]	Charge Type
Q3920-01 Or R3930-01	Red case, battery charged with external dedicated battery charger, charge port is 10-pin MS3102E-18-1S connector, Includes cell modem, R3930-01 includes secondary hose fitting on side of unit	Direct
Q3920-02 Or R3930-02	Orange case, battery charged with external dedicated battery charger, charge port is 10-pin MS3102E-18-1S connector, Includes cell modem, R3930-02 includes secondary hose fitting on side of unit	Direct
Q3920-03 Or R3930-03	Red case, battery charged with any 10 to 24 volt power supply, charge port is 6-pin MS3112E-10-6S connector, Includes cell modem, R3930-03 includes secondary hose fitting on side of unit	Smart

1-5

Siemens P/N	Description[1]	Charge Type
Q3920-04 Or R3930-04 Or Q3922-14	Orange case, battery charged with any 10 to 24 volt power supply, charge port is 6-pin MS3112E-10-6S connector, Includes cell modem, R3930-04 includes secondary hose fitting on side of unit	Smart

The following table lists the part numbers of accessories available for installation, inter-connection, and servicing of the Q3920, R3930, and Q3922-14 End-Of-Train devices.

Table 1-3   Accessory Part Numbers

Siemens P/N	Description
TEST EQUIPMENT	
Q3431/R	HOT/EOT Tester
Q3433	HOT/EOT Tester with Antenna Attenuator
Q3431/NB	HOT/EOT Tester (Narrow Band)
Q3433/NB	HOT/EOT Tester with Antenna Attenuator (Narrow Band)
CABLES & ADAPTERS	
Q9239/SW [1, 2]	Serial Download Adapter (use with Direct-Charge model EOTs only)
QP-09654/10	Serial Download Cable, 10 feet
Q9360-1	Laptop/charging adapter for Smart-Charge EOTs
Q9360-2 [2]	Laptop/charging adapter for Direct-Charge EOTs
Q9361	AC Charger for Smart-Charge EOTs
Q9362	Cigarette lighter charger for Smart-Charge EOTs
SOFTWARE	
16390	EOT/HOT Event Log Viewer/Download Program
DOCUMENTATION	
OBE-00-11-14	Installation & Maintenance Manual (this manual) (see Note 3)

Notes:

[1] When the Q9239/SW Serial Download Adapter is connected to the EOT, the 2-position switch on the Q9239/SW should be set to the MODEM position (**NOT** the COMP position) to prevent keying of the radio upon insertion of the adapter.

[2] The Q9360-2 is an enhanced version of the Q9239/SW. The Q9360-2 is the preferred adapter for the Direct-Charge versions of Q3920/R3930 EOTs.

[3] Windows utility used to place the EOT in "Radio Pass-through Mode" so radio can be programmed and configured without having to open the unit.

SECTION 2
INSTALLATION

2   INSTALLATION

2.1   EOT Mechanical Installation

1. Unlatch the crank handle (located on the mounting mechanism of the EOT) from under the spring-loaded "U" locking hook.
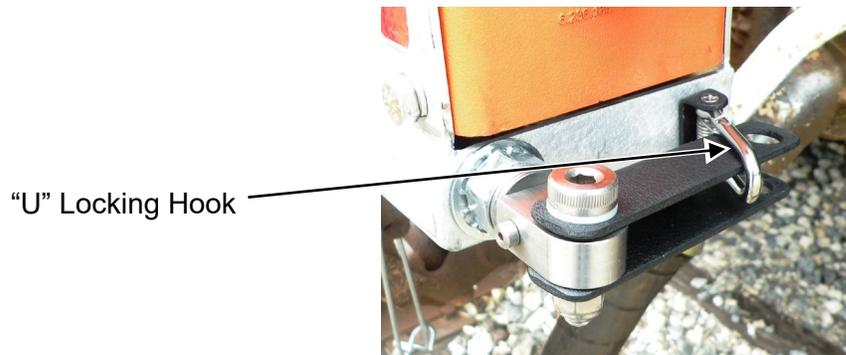
"U" Locking Hook

2. Make sure the locking arm is in the horizontal position. If it is not, use the crank handle to rotate the locking arm to the horizontal position.

Locking Arm
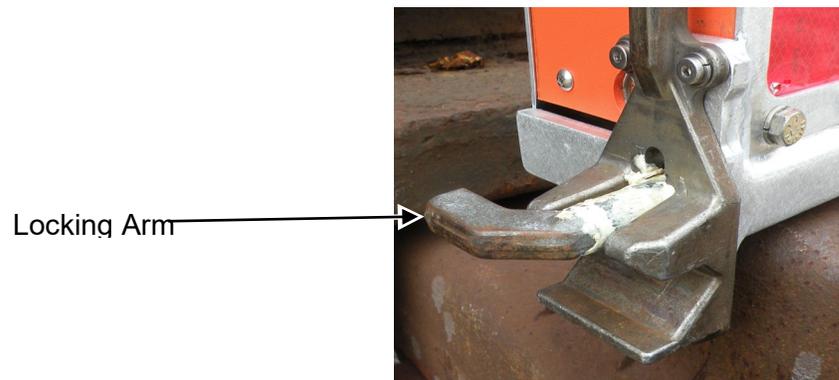
3. Place the groove in the mounting mechanism on the web between the upper and lower forward coring holes in the coupler.

Coupler Web

Mounting Mechanism

2-1
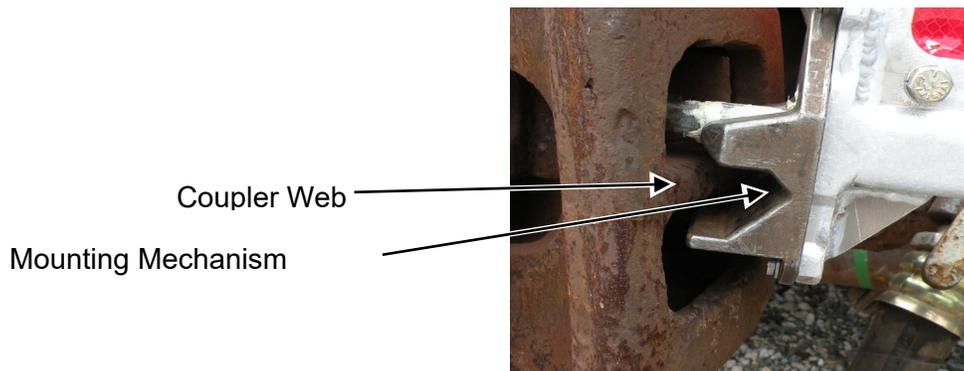
4. Rotate the EOT up until the upper portion of the mounting mechanism makes contact with the coupler body.

Ensure Contact Here
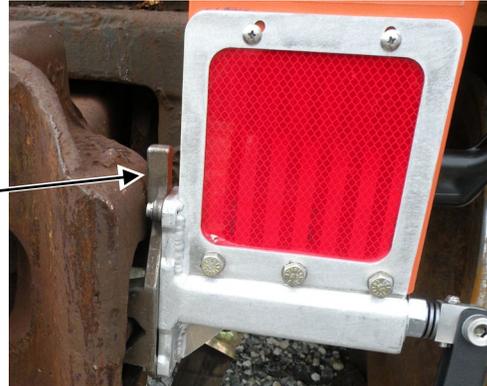
5. Hold the EOT in this position and turn the crank handle clockwise to raise the locking arm into the vertical position.

6. Continue to turn the crank handle clockwise until the EOT is snug against the coupler body. Hand tightening the EOT mount is sufficient to secure the EOT in place. **No tools should be used to tighten the EOT mount.**

7. Once the locking arm is tightly in place, lift the "U" locking hook and slide it over the crank handle. A padlock may be applied, if desired.

"U" Locking Hook

8. Connect the air hose to the brake line and slowly open the angle cock.

2-2

2.2   EOT Removal

To remove the EOT device, use the following procedure:

1. Close the angle cock and bleed the air pressure from the EOT hose by pushing the bleeder valve button on the glad hand.

⚠ WARNING

WARNING

HIGH PRESSURE COMPRESSED AIR IS INSIDE THE HOSE. DO NOT REMOVE THE GLAD HAND UNTIL THE ANGLE COCK IS CLOSED AND PRESSURE IS RELEASED.

2. Disconnect the air hose once pressure is fully released.

3. Release the crank handle from the "U" locking hook.

4. Hold the EOT by the carry handle and rotate the crank handle counter-clockwise to loosen the unit until the locking arm is horizontal.

5. Remove the EOT from the coring holes.

2-3

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SECTION 3
OPERATION

3   OPERATION

3.1   Activating the EOT

Turn on the EOT by pressing the **START/ARM** push button. A string of asterisks (********) will appear on the display for 5 seconds. The display will then show the model number, main application software version, power management software version, percent of battery charge remaining, owner railroad ID, and EOT ID number. The High Visibility Marker (HVM) will then begin to flash.

After the ID number, the display will continuously show the battery voltage (in volts) and air pressure (in psi). After approximately 5 minutes (30 minutes for BNSF models), the display will time out and become blank. However, even though the display is blank, the unit is still active. The High Visibility Marker may continue flashing when the timeout occurs, depending on ambient light; refer to paragraph 3.5 High Visibility Marker (HVM), for details.

I

For Q3922-14 the display will show 9VA98. This is normal.
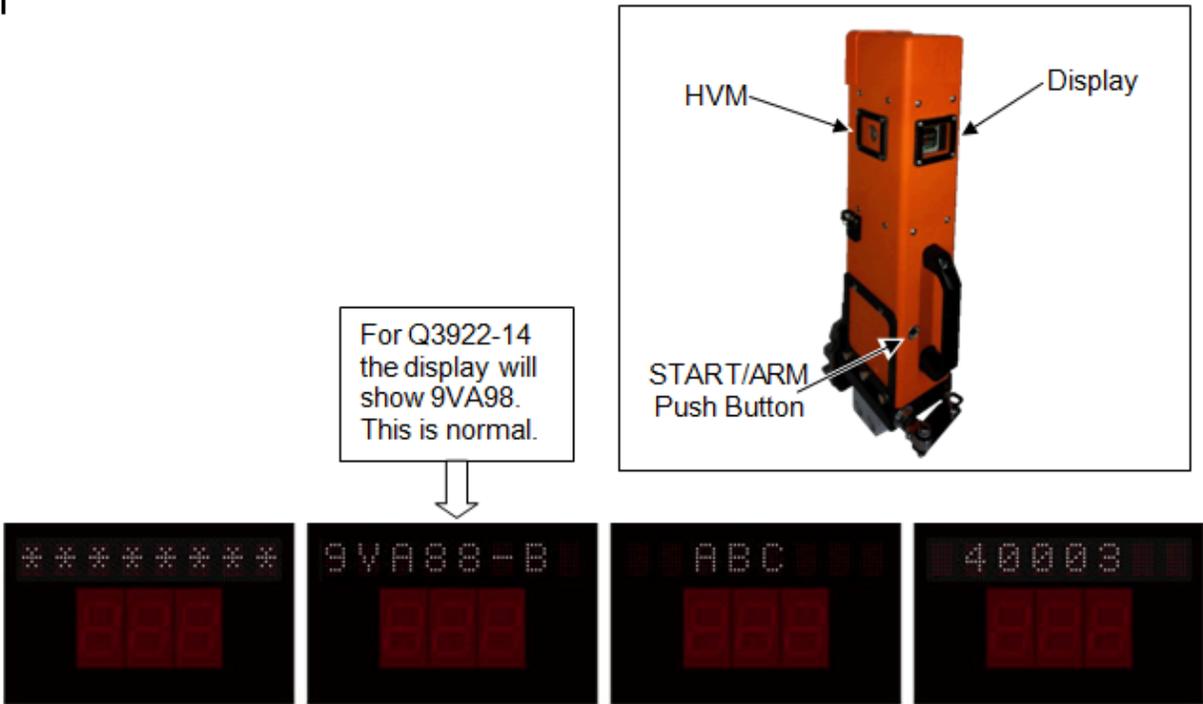
Figure 3-1   Examples of Typical EOT Start-Up Screens

If the display on an active EOT unit is blank, pressing the **START/ARM** push button will cause the display to be visible again (showing the battery voltage and air pressure).

3-1

Figure 3-2   Battery Voltage and Air Pressure

For the R3930 Dual Pipe EOT, a message containing the secondary pressure will cycle on the alphanumeric display along with other information items.

Figure 3-3   R3900 Secondary & Primary Pressure Display

3.2   Deactivating the EOT

The EOT has an accelerometer to monitor the position of the unit. The EOT will remain operational after activation as long as the unit is upright; unless the battery is dead (see paragraph 3.8, Battery, for more details).

If the EOT is placed in a horizontal position for at least 1 minute with no air pressure, the unit will shut down. Once shut down, the unit will not make or receive radio transmissions and can only be reactivated by pressing the **START/ARM** push button. However, while in the shut-down mode the EOT will report its location via cell modem based on the call spacing time (120 minutes is standard) as long as the battery voltage remains above 10.5 volts. The display remains blank when the unit is making the call in the shut-down mode.

The EOT can also be shut down when air pressure is zero PSI by pressing and holding the **START/ARM** push button for 10 seconds until "PWR OFF?" appears on the display. Releasing the push button while this message is displayed will shut down the EOT. If the push button is held in the pressed position until the "PWR OFF?" message disappears from the display (3 seconds), the EOT shut-down command is cancelled, and the unit will continue to operate.

3.3   Radio

While the EOT is active and armed, it will send messages to and receive messages from the HOT. When a message is transmitted, a diamond symbol will appear in the LED display and the red light labeled "**TX**" will illuminate. When a message is received, the green **MSG** light will illuminate, and an hourglass will be displayed. Pressing the **START/ARM** push button once will cause a message to be sent to the HOT.

3-2
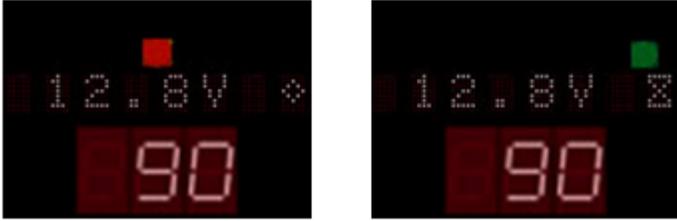
Figure 3-4   Transmitting (Left) and Receiving (Right)

NOTE
NOTE The **TX** and **MSG** labels are located on the EOT case immediately above the LED display.

3.4   Air Generator (Q3920 and R3930 EOTs Only)

The air generator keeps the battery charged while hooked to an air supply.

If needed, the air generator can be temporarily stopped on the Q3920 and R3930 EOTs. To stop the air generator, press the **START/ARM** push button twice in rapid succession. Pressing the button once while the generator is disabled will re-enable it. If the button is not pushed to re-enable the air generator, the air generator will start automatically after 5 minutes. The generator is always enabled when the EOT detects motion (N/A on the Q3922-14 EOT).

NOTE
NOTE Since the Q3922-14 does not have an air generator to constantly recharge the battery, care must be taken to fully charge the battery "manually", prior to departing for the next destination. A fully charged battery should last approximately 30 hours before a recharge is required. Refer to paragraph 3.8.2, Recharging the Battery

Figure 3-5   Generator Disabled[1]

1

3.5   High Visibility Marker (HVM)

The EOT is equipped with a photocell that determines whether it is day or night. During the day, the HVM is not needed, so it will not flash; at night, it will flash. To prevent cycling of the lamp (e.g., interpreting a passing shadow as a nighttime condition), the photocell must sense darkness for approximately 1 minute for the "DARK" state to be activated, and daylight for 3 minutes for the "DAYLIGHT" state to be activated.

When the motion sensor indicates a change from a "stopped" state to a "moving" state, the marker light will flash for 30 seconds. This allows the Engineer to check the HVM on a departing train.

If the battery status is low (between 10.5 and 11 volts), the HVM will not flash.

3.6   Motion Sensor

The Q3920, R3930 and Q3922-14 EOTs contain a Global Positioning Satellite (GPS) receiver to determine their geographic location. When the GPS has a "fix" on the location, a plus sign (+) is shown in the display. After establishing this location fix, motion greater than 2 MPH can be determined. When the EOT has been determined to be in motion, the plus sign changes to a minus sign (-) in the display. The EOT has an accelerometer circuit that provides backup motion detection in the event the GPS signal is lost after motion is detected initially. The EOT will indicate stopped status when both the GPS system and the accelerometer do not detect motion for a period of 10 seconds or more.

The minus sign indicating motion cannot be produced by rocking the EOT or moving it in a circle. The GPS must sense approximate straight line motion above 2 mph for at least 10 seconds to show motion on the display.
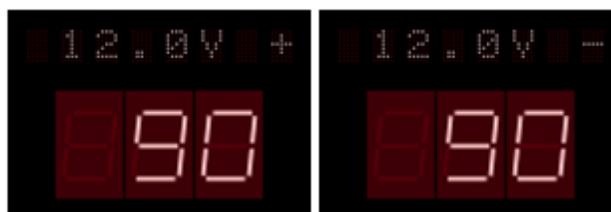
Figure 3-6   GPS Fix (Left) and Moving (Right)

3.7   Locator System

EOT units can be located within radio range using a Siemens Q3430, Q3431 or Q3433 tester. Refer to Siemens instruction manual QIM-3430, QIM-3431 or QIM-3433 for additional details regarding the locator system.

EOT units report position and status to the Web site: `www.eotph.com`. Access to this site is controlled by Siemens Rail Automation and is limited to owner / operators of Siemens Rail Automation EOT devices.

3.8   Battery

The nominal operating voltage for a fully charged EOT is 12.5 to 13.0 volts.

If the battery voltage is at least 10.5 volts but less than 11.0 volts, the battery status is "low", and the EOT will transmit this condition to the HOT. The HVM will not operate.

NOTE

> **NOTE**
>
> Battery status is sent to the HOT as a percentage of Charge Used (CU). Charge Used units indicate the percentage of the total battery capacity that has been used (CU = 0 indicates a fully charged battery, CU = 100 indicates a fully discharged battery).
>
> Conversely, the battery charge information that appears on the EOT display indicates the percent of battery charge remaining (e.g., 100% indicates a fully charged battery).

IMPORTANT: Since the Q3922-14 does not have an air generator to constantly recharge the battery, care must be taken to fully charge the battery "manually", prior to departing for the next destination. A fully charged battery should last approximately 30 hours before a recharge is required. See paragraph 3.8.2, Recharging the Battery.

3.8.1   Battery Installation

The battery is internal to the EOT and can only be replaced by a qualified service technician.

3.8.2   Recharging the Battery

Smart-Charge EOT models **may be charged using any 10 to 24 volt power supply**. Direct-Charge EOT models **must be charged using a dedicated battery charger**. An appropriate EOT connector is required to interface the EOT to the charging device. The EOT should be fully charged prior to deployment. As a rule of thumb, recharge the battery at an initial terminal whenever the voltage is below 11.5 volts. In the Q3922-14 EOT (which does not have an air generator) a fully charged battery should last approximately 30 hours before a recharge is required.

The battery charging port is located below the HVM.

During charging of the Smart-Charge models, **CHARGING** appears on the display every 5 seconds at low intensity and normal operation is stopped. To resume normal operation, press the **START/ARM** push button twice. When charging is complete, **CHG DONE** will appear on the display.

Battery Charging Port

(Located Below the HVM)

Figure 3-7   Recharging the Battery

Pin assignments for the two charging port connectors are shown below along with the connector diagrams.

Charging Port Connectors

MS3112E-10-6S
(Used on **Smart**-
Charge models)

MS3102E-18-1S
(Used on **Direct**-
Charge models)
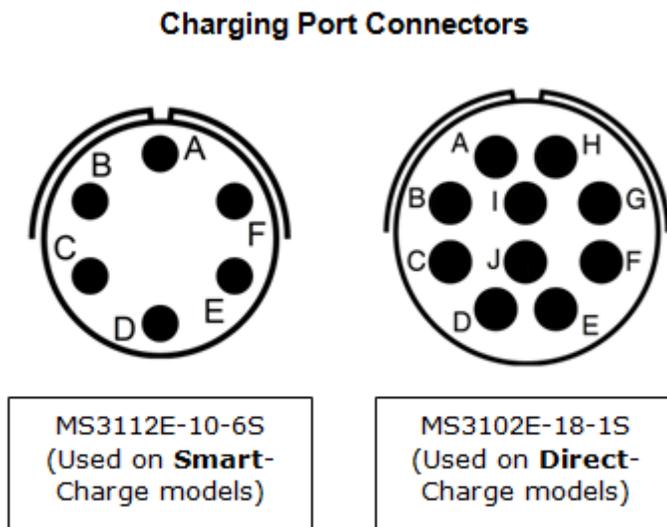
Figure 3-8   Charging Port Connectors

Table 3-1   Connector Pin-Outs

CONNECTOR PIN-OUTS		
SIGNAL / FUNCTION	**MS3112E-10-6S Smart Charge**	**MS3102E-18-1S Direct Charge**
Radio tone transmit request (Connect to BATT- to request tone. Forces EOT to transmit 1200 Hz tone for calibration / testing purposes.)	A	E
EOT TXD data (RS232) to computer	B	F
BATT-	C	C and D
Radio RX Audio output	D	H
CHARGE+	E	A and B
EOT RXD data (RS232) from computer	F	J
Not used		G and I

3-6

SECTION 4
ARMING THE EOT/HOT SYSTEM

4   ARMING THE EOT/HOT SYSTEM

4.1   Arming (General)

Verify that the EOT and HOT are operational. If the display on the EOT is blank, press the **START/ARM** push button to power-up the EOT, or to re-illuminate the display.

4.2   Arming (Standard AAR-Compatible HOT Only)

- On the Head-of-Train device, set the ID number to match that of the Siemens End-Of-Train (EOT) device.
- After verifying that the ID number is correct, press the **START/ARM** push button on the EOT to initiate the arming process.
- Verify that the EOT transmitted by observing that the red **TX** LED blinks (plus a diamond symbol appears on the display). The HOT or computer screen will illuminate "Arm Now".
- Press the **COMM TEST/ARM** push button on the HOT within 5 seconds to complete the arming process.

If arming is successful, the green **MSG** LED on the EOT will blink (plus an hourglass symbol appears on the display). Also, the EOT display will read "ARMED", as shown below (actual air pressure reading may vary). The HOT should display a similar message and show "Emergency Enabled". If arming fails after several attempts, please refer to the Troubleshooting Section of this manual.

Figure 4-1   EOT Armed

4.3   Arming (Norfolk Southern Red HOT Only)

- Enter the EOT ID into the Red HOT and press the **COMM TEST/ARM** push button.
- The HOT should display an "ARM NOW" message.
- Within 5 minutes, press the **START/ARM** push button on the EOT to complete the arming process.
- The EOT will display the "ARMED" message shown above, and the NS Red HOT will display "Emergency Enabled". Actual air pressure reading may vary.

4.4   Arming (Norfolk Southern Fire/Ice/IFC Only)

- Set the switch on the HOT to **AAR Mode** and enter the EOT ID.

- Press **Enter Code** or **Enter ID**.

- Within 5 minutes, press the **START/ARM** push button on the EOT to complete the arming process.

- The HOT should display an "Armed" message, and the EOT will display "ARMED" (as shown above). Actual air pressure reading on the EOT may vary.

SECTION 5
BRAKE TEST

5   BRAKE TEST

Upon installing a Siemens EOT, a brake test should be performed in accordance with the carrier's established brake test procedure.

5.1   Brake Test Procedure

NOTE	**NOTE** This test should also be applied to the Q3922-14 Zero-Leak EOT, even though it is not equipped with an air generator.

The EOT must be installed and operating with the air generator operational (if equipped) during the performance of all required air brake inspections.

When a Siemens EOT is used to replace an existing end-of-train device on a train, an air brake leakage test must be satisfactorily performed on the train with the Siemens EOT operating and powered by the air generator (if equipped).

If there is any indication that the battery is dead or has a low charge condition at the time of installation, the EOT should not be used until the battery is charged.

To test the Emergency Valve, the following procedure is recommended:

1. Arm the EOT and HOT.

2. Verify that pressure is above 50 PSI on the display.

3. Verify battery voltage is 11.5 volts or more.

4. Push the **START/ARM** push button twice to temporarily stop the air generator (if equipped).

5. Close the angle cock on the last car.

6. Initiate an Emergency by activating the **Emergency** switch on the HOT.

7. When the Emergency command is received, the display will read "BRAKING" (as shown below) and the air should be depleted from the system. Listen for the valve to open and confirm that the brake pressure reads zero on the LED display.

Figure 5-1   Emergency Braking Display

8. Press the **START/ARM** push button again to cancel the Emergency command. This will close the Emergency valve and re-enable the air generator (if equipped). If the button is not pressed, the valve will be closed automatically after 30 seconds.

9. Slowly, re-open the angle cock.

10. Verify the full brake pipe pressure is again shown on the LED display.

SECTION 6
BASIC TROUBLESHOOTING

6   BASIC TROUBLESHOOTING

6.1   Failure to Arm

If the HOT/EOT system is not armed after several attempts, tests should be run on both the EOT and HOT to determine proper operational status. For this purpose, the Q3430, Q3431, or Q3433 HOT/EOT Tester (or similar device) should be used. If the Tester reports that both units are functioning within their acceptable ranges, contact Siemens Technical Support for additional assistance at (800) 626-2710, prompt #1. If you leave a message for Technical Support, be sure to press the pound (#) key after you leave your message to save the message to the system.

6.2   EOT Will Not Turn On

If the EOT fails to turn on when the **START/ARM** push button is pressed, recharge the battery (see paragraph 3.8.2, Recharging the Battery). If the unit still fails to activate, contact Siemens Technical Support for assistance.

6.3   Operational Failure Reports

Analysis of reported EOT operational failures can be accomplished by downloading the contents of the built-in EOT event recorder. This event recorder logs the last 23,000 messages (average of 14 days) sent or received by the EOT. The download is done through the battery charging port using the 16390 EOT/HOT Event log Viewer Program and the appropriate serial download adapter and cable. Refer to paragraph 1.5 and Ordering Information in this manual for cable / adapter part numbers and instructions on downloading and analyzing this information.

NOTE	**NOTE** If a Q9239/SW Serial Download Adapter is connected to an EOT, the 2-position switch on the Q9239/SW should be set to the **MODEM** position (<u>NOT</u> the **COMP** position) to prevent keying of the radio upon insertion of the adapter.

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FEBRUARY 2013, REVISED JANUARY 2022

Version No.: D.4

SECTION 7
FUNCTIONAL TESTING

7   FUNCTIONAL TESTING

7.1   Required Equipment

- Functional HOT unit or HOT/EOT tester
- Compressed air source (90 PSI min)
- Calibrated air gauge
- Battery Charger (optional)
- Computer running Windows® with an available serial port or USB-to-serial adapter

7.2   Test Procedure

1. Physically inspect the EOT for damage or broken parts. Operate the coupler mount and ensure that there are no defects on the clamp gearing and that the mechanism turns freely.

2. Inspect the air hose assembly for cuts or abrasions. Inspect the filter screen inside the glad hand. If it has been removed or cut, install a new one per railroad policy.

3. Power up the EOT by pressing the **START/ARM** push button. Upon power-up the unit will display ********, followed by the Software Version number, Owner Railroad, ID number, and other status messages. Additionally, Rear Pressure (PSI) will be displayed (for the R3930, the secondary pressure will also be shown periodically on the alphanumeric display). Verify that all displays are complete and legible.

4. Read the battery voltage on the display. If necessary, recharge the internal battery before proceeding.

5. Note the software versions of both Control Module and Power Module programs during boot up and verify they are the current release for your EOT.

6. Verify that the HVM is functional and flashing. It will flash for 30 seconds upon power-up and then will revert to photocell control. To test the photocell, either cover the sensor (located in the upper left corner of the display) or shine a light on the sensor. Note that there is a 1-minute time delay for turning the HVM on and a 3-minute time delay for turning the HVM off.

7. With no air pressure on the EOT, lay the EOT down into a horizontal position. Ensure that the unit powers down within one minute. The HVM and display will go out. The EOT also may be shut down by holding the **START/ARM** push button in for 10 seconds. The display will show "PWR OFF?". Releasing the button while this message is displayed will shut down the unit.

8. Re-power the EOT as in step 3. Apply air pressure to the EOT using a calibrated air gauge in-line with the EOT. If equipped, turn off the air generator (to stop air loss) by pressing the **START/ARM** button twice in succession. Verify that the pressure display on the EOT is within ± 3 PSI of the calibration gauge. If the EOT requires calibration, see paragraph 8.3.

9. Set the HOT unit in the upright position and apply power.

10. On Siemens HOT's, press the **Menu** button once. The status display will show "Enter EOT# nnnnn" (where nnnnn is the current EOT number entered), press the five digits on the keypad that correspond to the EOT number and then press the **ENTER/YES** button to accept. Press the **COMM TEST/ARM** push button. The HOT will communicate with the EOT and should display "Comm Test Passed" message.

11. On non-Siemens HOT's, dial in the five digits on the thumbwheel that correspond to the EOT number. Press the **COMM TEST/ARM** push button.

12. When the **COMM TEST/ARM** push button is pressed on the HOT, the EOT should blink the green **MSG** LED above the display and should also display an hourglass on the eight-character display (when illuminated). If it does not show these indications, either the HOT is not set with an ID code that matches the EOT, or the EOT's receiver does not properly receive and decode the message from the HOT.

13. When a message is transmitted from the Siemens EOT, the red **TX** LED will blink and a diamond symbol will appear on the eight-character display (when illuminated).

14. On the EOT, press the **START/ARM** push button. The HOT should now display "Arm Now". Press the **COMM TEST/ARM** push button on the HOT within 5 seconds. If the EOT and HOT successfully armed to each other, the Emergency Enabled lamp should be illuminated on the HOT. If the arming process does not result in the HOT displaying "Emergency Enabled", repeat this process.

15. When the **COMM TEST/ARM** push button is pressed on the HOT, the EOT's **MSG** and **TX** LEDs should blink one after the other if the RF transmissions are fully functional.

16. Information transmitted by the EOT will be displayed on the HOT. Indicator lamps on the HOT should correspond with the status of the HVM, motion sensor, pressure, etc.

17. Apply air pressure to the EOT. With the EOT now armed to the HOT, activate the **EMERGENCY** switch on the HOT. The Dump Valve should open on the EOT and exhaust the air pressure to zero. The EOT will display "Braking". The brake valve will automatically close in 30 seconds, or you may push the **START/ARM** push button to close it immediately.

18. With the Dump Valve closed, apply 80 PSI to the EOT. The air generator (if equipped) should be running. Press the **START/ARM** push button twice and the air generator solenoid valve should pick up and stop the flow of air through the generator (N/A for Q3922-14). The display should show "GEN OFF" at this time. Press the **START/ARM** push button again and the generator should operate normally (if equipped).

7-2

19. To test the GPS module and motion sensor, place the EOT outdoors with a clear view of the sky. Press the **START/ARM** push button and ensure that the battery voltage is at least 11.2 volts as shown on the EOT display. Within 2 minutes, the display on the EOT should show a plus (+) symbol next to the battery voltage display (see paragraph 1.3, Display, for an example). If you see this symbol, the GPS is functional and has received a usable signal. No further testing is necessary as the motion sensor is software driven from this GPS signal. However, should you need to confirm the motion sensor, the EOT may be picked up and moved in a straight line at a pace of 3 feet/second or faster. Note that there is a 10 second time delay in displaying motion from a stopped state. The display will show a minus (-) symbol when motion is detected.

20. To test the cellular modem, use software QP-16390, EOT/HOT Event Log Viewer Program to initiate an immediate connection with the cellular service provider. Results will be displayed on the host PC computer. Results of past cellular connectivity are logged into the internal event recorder within the EOT. See paragraph 8.1 and Appendix A for additional details of the event recorder.

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SECTION 8
BASIC MAINTENANCE

8   BASIC MAINTENANCE

8.1   Data Download

To download and view the data from the internal event log, use the Quantum QP-16390 EOT/HOT Event Log Viewer program, a QP-09654 serial cable, and one of the available port adapters listed in paragraph 1.5, Ordering Information. For the Smart-Charge EOT use the Q9360-01 adapter. The preferred adapter for the Direct-Charge EOT is the Q9360-02, although the Q9239/SW will work. If using the Q9239/SW, the switch on the adapter should be set to the "MODEM" position. Communications with the EOT is through the battery charger receptacle as shown in Figure 8-1.

Q9360-0X Style Adapter   **Q9239/SW Style Connector**

Figure 8-1   Serial Data Cable Adapter Styles

For detailed information on the port adapters see paragraph 11, CHARGE PORT ADAPTERS.

See Appendix A for instructions on installing and configuring the Quantum QP-16390 EOT/HOT Event Log Viewer program. Insert one end of the QP-09654 cable into the host computer and the other end into the adapter plugged into the EOT. Turn on the host computer, power up the EOT in the vertical position and launch the program. Follow the instructions in paragraph A.3, Downloading and Viewing Data.

The EOT-HOT Viewer program has additional functionality that allows testing and configuration of the EOT. Since most of these functions have the potential to adversely impact EOT operation, they are password-protected. If you need to perform these maintenance and configuration tasks, please contact Siemens Customer Service to request password support.

8-1

8.2 Setting EOT ID Number

The EOT ID number is factory set in accordance with authorized ID numbers issued by the Association of American Railroads. Generally, the ID number will never require changing. However, if a unit is repaired or parts are exchanged between units, the ID number can be set.

<table>
<tr><td>⚠ CAUTION</td><td>

CAUTION

YOU MUST BE SURE, WHEN CHANGING OR SETTING AN ID NUMBER, THAT THE NEW ID NUMBER IS NOT ALREADY IN USE. **IT IS PROHIBITED FOR ANY TWO EOT'S TO HAVE THE SAME ID NUMBER**. ADDITIONALLY, THE AEI TAG NUMBER MAY NEED TO BE CHANGED TO MATCH A NEW EOT ID NUMBER.
</td></tr>
</table>

To set the ID number, follow each step in paragraph 8.1, **Error! Reference source not found.**. Select the menu item **Setup -> EOT**. At this point the program will ask for a password. Enter the password. Click on the **Set EOT ID Code** radio button to select it, and then click **OK**.
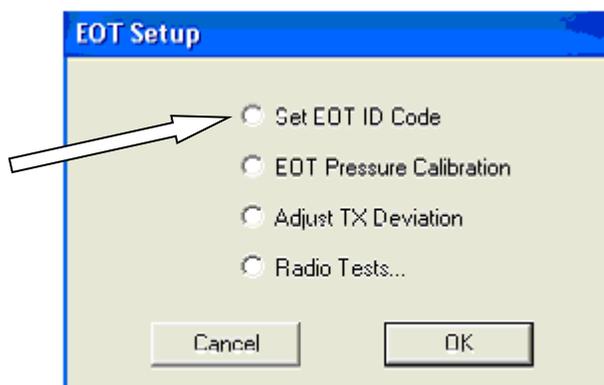
Figure 8-2   EOT Setup Menu Screen

Enter the five-digit ID code that matches the AEI tag on the EOT, and click **OK** to store the new ID code into memory.
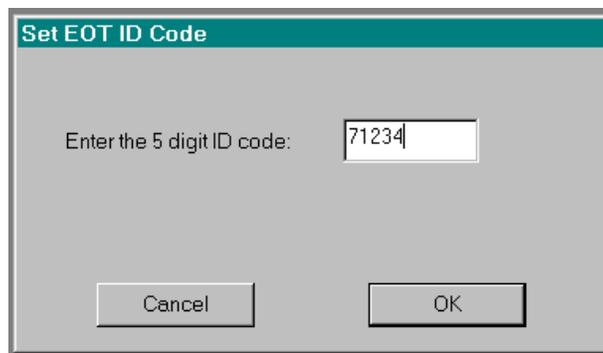
Figure 8-3   Entering 5-Digit ID Code

Shut down the EOT and restart it to verify that the new EOT number is displayed on the boot-up cycle and matches the AEI tag.

8-2

8.3   Adjust Air Transducer Calibration

The air pressure transducer must be checked, and adjusted if required, whenever repairs are made. The calibration is electrically adjustable and is stored in Flash memory. The calibration of the EOT microprocessor module is matched with the pressure transducer located in the lower manifold. If the electronics unit is assembled with another lower manifold, the pressure calibration data is invalid and a new calibration should be made.

To adjust the air pressure calibration follow each step in paragraph 8.1, Data Download. Select the menu item **Setup -> EOT.** At this point the program will ask for a password. Enter the password. Click on the **EOT Pressure Calibration** radio button, and then select **OK**.

Apply air pressure to the EOT using a calibrated air gauge in line with the EOT and located as close to the EOT as possible. The air pressure must be in the range of 60-110 PSI (90 PSI is recommended). Pressure calibration should always be performed with the air generator stopped (if equipped) to prevent air leakage (refer to paragraph Data Download, step 8 for information on stopping the air generator). Enter the applied pressure in the dialog box and then click the **OK** button. The EOT may take several seconds to adjust its pressure to the reading you entered.
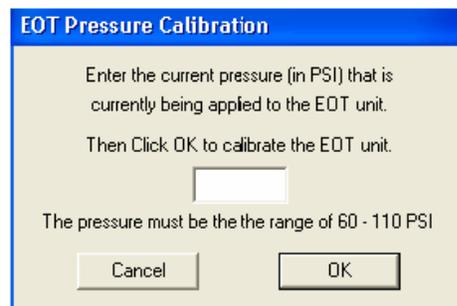
Figure 8-4   EOT Air Pressure Calibration Screen

8.4   Radio Adjustments

The Q3920, R3930 and Q3922-14 EOT are equipped with a Ritron DTX-445 synthesized radio transceiver that is exempt from the requirements for annual testing per FRA-2009-0015 waiver (consult Ritron for details). Furthermore, there are no radio-related adjustable components in the EOT circuitry. All radio-related adjustments are performed directly to the Ritron radio using Ritron's DTXL-PCPS configuration utility for Windows (contact Ritron for further information or to obtain the utility).

The EOTs each provide an easy method for making adjustments to the radio without the need to open the radio compartment. To make radio adjustments, the EOT must be connected to the computer via a charge-port adapter (Q9360-0X recommended), and the EOT-HOT Viewer program must not be running. On the PC, run the DTXL-PCPS configuration utility, interfacing directly to the Ritron radio inside the EOT. Once the Ritron utility starts (version 2.3.3 or later), press the key combination [CTRL]+[SHIFT]+[P] to place the EOT in radio pass-through mode. Refer to Ritron's documentation on the DTXL-PCPS utility for details on how to perform

necessary adjustments. Once all desired radio adjustments have been performed, the EOT must be shut down using the **START/ARM** button as described in paragraph 3.2, Deactivating the EOT in order to exit radio pass-through mode.

The radio transmitter deviation (modulation) should be checked whenever repairs are made to the EOT unit. A calibrated radio service monitor is required to perform this adjustment.

8.4.1 Deviation Check

The easiest way to check deviation is to use one of the specialized charge port adapters (Q9360-0X). Pressing the "Tone Request" push button on the adapter causes the EOT to issue a 1200 Hz tone that can be verified for deviation using a calibrated radio service monitor. Proper deviation is 2.5 KHz +/- 200 Hz. Center frequency accuracy verification can also be easily done at this time. Using a 1200 Hz tone is the best way to check and calibrate deviation since the 1200 Hz tone yields slightly higher deviation than the 1800 Hz tone.

A secondary method for checking deviation and center frequency accuracy is available using the EOT/HOT Viewer program as described here. Connect the computer to the EOT using one of the available charge port adapters and follow each step in paragraph 8.1, Data Download. Select the menu item **Setup \ EOT.** At this point the program will ask for a password. Enter the password. Click on the **Radio Tests...** radio button, and then click **OK**.

Under "UHF Radio tests", select **Send 1200 Hz Tone** and click the **OK** button to start transmitting. On the service monitor read the deviation. It should be 2.5 KHz $\pm$ 0.2 KHz (2.7 KHz ± 0.2 KHz for NS). During deviation measurements do not transmit more than necessary and allow the transmitter to cool for 2 minutes between transmit cycles and adjustments. To stop the transmission click the **Stop** button as shown in the example screen below.

8-4
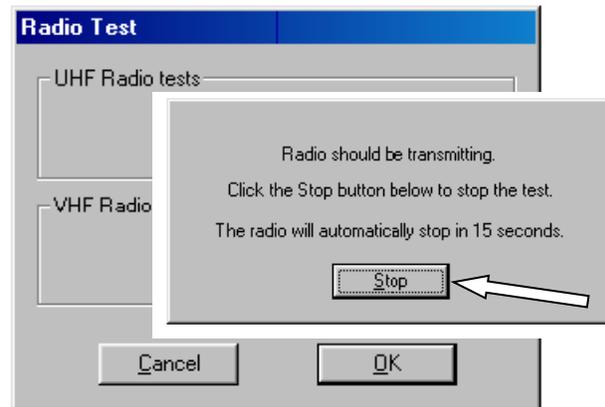
Figure 8-5 Radio Test Screen

As a third alternative, radio transmitter verification may be done on-train with the use of a Quantum Q3430, Q3431, or Q3433 tester. These testers have 3 LED indicators—center frequency, deviation, and RF power level. If the tester shows 3 green (good) indicators upon completion of the test, the EOT has passed and satisfies FRA requirements. This test does not need to be performed by an electronics technician. Failure of any test, as indicated on the tester, requires that the EOT must be serviced by a qualified technician.

If the measured deviation is not within the allowable tolerance, it should be adjusted as described below in paragraph 8.4.2, Deviation Adjustment.

8.4.2   Deviation Adjustment

Deviation calibration is done by placing the EOT in radio pass-through mode and making deviation adjustments directly in the Ritron radio transceiver using the DTXL-PCPS radio configuration utility as described in paragraph 8.4, Radio Adjustments. The radio configuration utility allows the user to make adjustments to all programmable radio parameters via a user-friendly graphical interface. Refer to the DTXL-PCPS manual for information on how to make adjustments to the radio. The manual can be obtained by contacting Ritron directly.

8.5   Annual Tests

FRA Code of Federal Regulations, 49CFR232.409 (d), as of February 2013, requires that:

> **"The telemetry equipment shall be tested for accuracy and calibrated if necessary according to the manufacturer's specifications and procedures at least every 368 days. The 368 days shall not include a shelf-life of up to 92 days prior to placing the unit in service. This test shall include testing radio frequencies and modulation of the device. The date and location of the last calibration or test as well as the name of the person performing the calibration or test shall be legibly displayed on a weather-resistant sticker or other marking device affixed to the outside of both the front unit and rear unit; […]"**

There are no components in the Q3920, R3930 or Q3922-14 that require annual calibration. In fact, other than the Ritron transceiver, the EOTs do not contain any adjustable circuitry that can influence the performance of the radio. Radio modules themselves are subject to FCC requirements, but do not explicitly require annual inspection. Additionally, the Ritron radio transceiver inside this product was granted an FRA waiver (FRA- 2009-0015) and is therefore exempt from the requirements of 49CFR232.409 (d) listed above. There is no required periodic maintenance or calibration required for these EOTs.

SECTION 9
SERVICE AND REPAIRS

9   SERVICE AND REPAIRS

9.1   Overview

The Q3920, R3930 and Q3922-14 EOT devices are composed of five modular subassemblies as listed below.

- 9000-90365-000X – Battery Module
- 160000-X1   – Mount Assembly
- 9000-90360-000X – Power Manifold Module Assembly
- 9000-90350-000X - Electronics Box Assembly (includes antenna array)
- 9000-90346-X00X – Case Assembly (X's designate case color and charging format)

The electronics box assembly contains the control module (including displays, cell modem and GPS receiver), the radio transceiver, the High Visibility Marker (HVM), the AEI tag, and all antennas. Damaged or broken units can have individual modules removed from the EOT and only the damaged module shipped for repair. In the meantime, replacement module(s) or board(s) may be installed into the damaged EOT and the EOT immediately returned to service.

9.1.1   Tools Required

Proper servicing of the EOT can be accomplished with commonly used hand tools in the categories below. Additional tools will be required if circuit board or radio repairs are needed.

Table 9-1   Required Tools List

Phillips head screwdrivers	10-80 Ft Lb. Torque wrench
Nut driver set	Loctite #242, blue thread coat
3/8" socket and ratchet set	Loctite #248 solid stick
Allen wrench set	Loctite #425 purple thread coat
Combination wrenches up to 1½"	Loctite #262, red thread coat
Feeler gauge set	Safety Lock
Silicone fluid (Wacker Chemical Corp. P/N APF-125/M2926000 or equivalent - www.wackersilicones.com)	

NOTE

> **NOTE**
>
> The EOT contains several Tyco "Slim-Seal" series sealed connectors, with 9 found in the Power & Manifold Assembly, and 1 in the Electronics Box Assembly. The plugs of this connector series are equipped with blue silicone rubber seals (as seen in the picture to the right). Special attention must be taken to insure proper alignment and handling of the seals whenever the plugs are inserted in the corresponding headers on the printed circuit boards. For proper sealing performance, and to prevent cracking of the connector headers, lubrication must be applied to the silicone seals before mating plugs to headers. Without proper lubrication, instead of sliding smoothly into the header cavity, the seals may bunch up and apply excessive pressure to the walls of the header, potentially leading to stress cracks. Therefore, every time the connectors are unplugged during maintenance tasks, proper lubrication with the recommended silicone fluid is required (refer to silicone fluid listed in previous table under Tools Required). Apply a light coating of silicone fluid to the seals (outer surface only), fluid should not be allowed between seals and plug body.
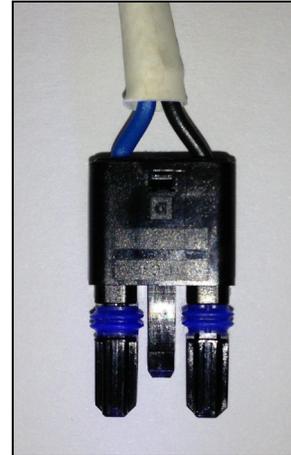
9.2   Case Assembly

9.2.1   Description

Refer to drawing 9000-90346-X00X in the drawing section of this manual for a list of part numbers and details of the case assembly. The Siemens EOTs covered in this manual have a one piece, Xenoy enclosure with a back cover. This enclosure is a high strength material that is unlikely to dent or deform. Should an enclosure require replacement, the housing and the cover should be replaced at the same time. To service the EOT as described in the following paragraphs, remove the back cover by removing the seven screws holding the cover in place (see drawing Q3920-0X). The bolts holding the mounting assembly at the base of the EOT case may need to be loosened to remove the cover. Remove the plastic pin at the top of the cover. Pry the top of the cover out and slide the cover up to disengage from the mounting assembly.

With the cover removed, access to the main subassemblies is straightforward. The electronics box is held by 12 screws (4 on each face of the main case) that attach to the upper and lower mounting brackets. All control module electronics are located inside the box. All antennas are located on the top bracket. The electronics box has a single connector at the bottom which must be unmated before full removal. To unplug the main harness connector from the electronic box, the CONNECTOR LATCH (as indicated in the following picture) must be carefully pried open with the help of a small screwdriver or Allen wrench. The slack in the main harness allows the electronics box to be partially removed prior to unplugging the connector for easy access to the connector latch.

9-2
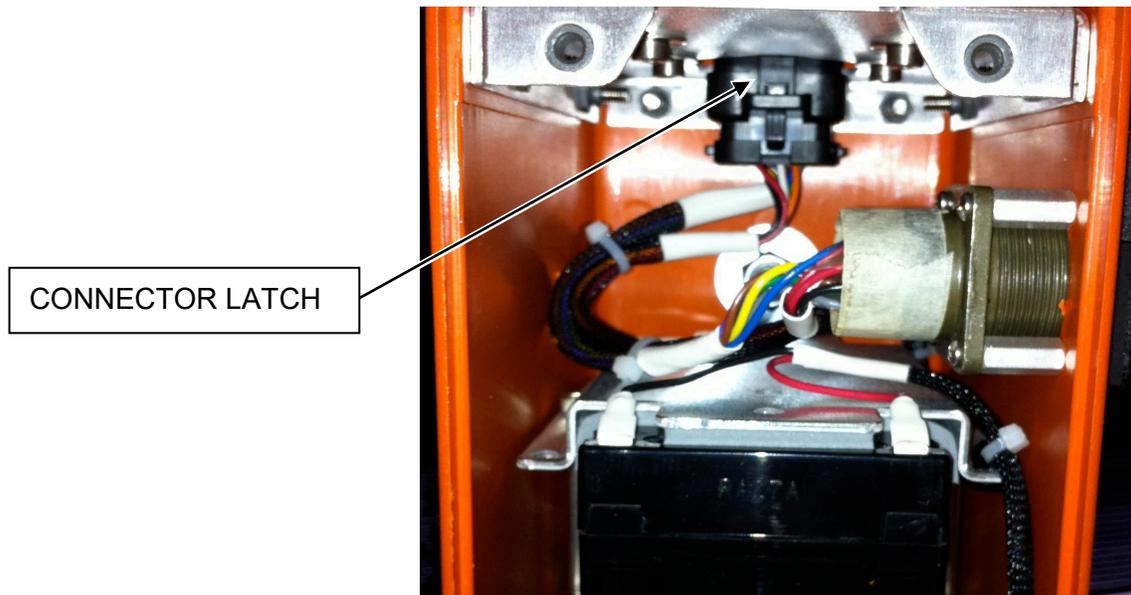
CONNECTOR LATCH

Figure 9-1   Connector Latch Assembly

The battery subassembly is held by 4 screws (2 on each side), and the manifold subassembly is held by the 6 mounting assembly screws (3 on each side) at the bottom of the case.

9.3   Antenna Service

All of the antennas on the Siemens EOT are inside the enclosure (see drawing Q3920-0X), and should seldom if ever need to be serviced. However, the following instruction describes the process for removing the antennas.

The UHF antenna is attached to the top of the antenna array via a female SMA connector. To remove the UHF antenna, just unscrew it from the SMA connector. Installation is the reverse order.

The GPS antenna and the cell modem antenna are a "combo" antenna that is part of the antenna array (see drawing 9000-90355-0001). To replace the combo antenna, remove the antenna array as described in paragraph 9.6.1, Removal. Using an open end wrench, carefully disconnect the cables from the GPS board and the modem board if used. The combo antenna is held in place by a large lock nut. Remove the lock nut and pull the combo antenna cables up through the hole in the electronics box top mounting bracket. The GPS and modem antenna cables are permanently attached to the combo antenna.

9.4   Battery Removal or Replacement

⚠ WARNING

> ### WARNING
>
> ### POTENTIAL FIRE OR EXPLOSION!
> **BATTERIES ARE CAPABLE OF DELIVERING HUNDREDS OF AMPS IF SHORTED. DO NOT ALLOW THE BATTERY OR LEAD WIRES TO TOUCH THE CASE. DO NOT ALLOW TOOLS TO CAUSE A SHORT CIRCUIT ACROSS THE TERMINALS.**

The battery is part of the battery module assembly (9000-90365-000X). To replace the battery, first remove the battery module assembly by removing the four truss head screws securing the battery module assembly to the sides of the EOT case, and then disconnect the battery harness from the Power and Manifold Module (PMM) board. Once the battery module assembly is removed from the EOT case, unscrew the two cap screws securing the top bracket and upper padding plate to the battery module assembly. Remove the battery and be sure to protect the connectors after the battery is removed from the module. Do not reassemble the battery assembly without the padding plate in place.

Figure 9-2   Battery Module Assembly

To reinstall the battery, place the battery on the lower padding plate of the battery module assembly. Install the top bracket with the upper padding plate on top of the battery and screw in the cap screws using red Loctite® on the threads. Do not over tighten the cap screws. Place the battery module assembly back in the EOT housing so that the two mounting holes in the upturned edge of the bottom bracket face out of the housing (see orientation of item 4 on drawing Q3920-0X and in the photo to the right). Fasten the battery module in place with the four truss head screws using purple Loctite® (89999) on the threads. Reconnect the wires to the battery terminals.

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9.5 Air Manifold

NOTE

The Q3922-14 "Zero-Leak" EOT is not equipped with an Air Generator or the valve that controls air flow to the generator.

9.5.1 Description

Refer to drawing 9000-90360-000X (Power Manifold Module Assembly) in the drawing section of this manual for a list of part numbers and details of the manifold assembly. The air manifold consists of the emergency dump valve assembly, dump valve solenoid, air motor-generator assembly, power manifold electronics module, and pressure transducer. All air channels are machined into the base of the module and the manifold block resulting in a compact, precision assembly with minimal external parts.

The air motor-generator consists of a compact 3-phase AC generator which is spun at a high RPM by the exhaust of Brake Pipe air past a saw-tooth shaped turbine wheel. The air spins the wheel, which in turn rotates the generator. The output of the AC generator is rectified and regulated within the power manifold electronics module. The AC generator provides current to run the EOT and recharge the battery. The air generator alone cannot provide all the power the EOT needs to operate during radio transmissions. However, on average, the generator outputs more than enough power to maintain the battery fully charged under most operating conditions. The air supply to the turbine first passes through a filter screen and a solenoid valve. The solenoid, when energized, blocks the flow of air into the motor-generator. This allows the emergency feature of the EOT to be tested without depleting air from the brake hoses when the angle cock of the last car is closed.

The Emergency dump valve is a conventional pressure-differential valve. Brake Pipe pressure is applied to an inlet port which has an adjacent exhaust port. Both ports are covered by one side of a rubber diaphragm. Normally, the pressure of the inlet air would cause the diaphragm to move, exposing the outlet port, and allowing the flow of air. However, the inlet air is also ported to the opposite side of the diaphragm through a restricting orifice. This air, coupled with the force of a return spring, slightly exceeds the force of the inlet air. This keeps the diaphragm seated across both the inlet and outlet ports and the valve is thus "closed". In the emergency dump position, a solenoid valve is energized which exhausts the restricted air on the opposite side of the diaphragm. The diaphragm then has pressure only on one side and the Brake Pipe air pressure is sufficient to push the diaphragm outward to expose the exhaust port. Air then flows through the valve out to atmosphere. The bottom of the exhaust port is protected with a slit cover to keep debris out of the valve.

9.5.1.1 Coupler Mount Assembly

Reference drawing 160000-X1 in the drawing section of this manual for a list of part numbers and details of the coupler mount assembly. The coupler mount consists of a stationary mounting mechanism with a "V" groove and an adjustable locking arm. This mounting arrangement is designed to provide a solid, secure attachment of the EOT to any E or F type coupler with

coring holes. This mounting arrangement allows the EOT to be installed securely on the coupler without the use of tools. Tightening by hand and securing the handle with the latch is sufficient to keep this EOT in place. If the shaft is hard to turn, check for any bending in the screw shaft or moveable portion of the assembly.

9.5.2   Manifold Assembly Removal

To remove the manifold assembly, first remove the mounting assembly by removing the six 3/8" bolts on the base of the mount bracket and the four truss head screws at the top of the bracket. Be careful when removing the mount assembly because the six bolts at the bottom of the mount assembly bracket also hold the manifold assembly in place. Reference drawing 9000-90360-000X in the drawing section of this manual for a list of part numbers and details of the manifold equipment.

The manifold assembly consists of a valve cap and a manifold. The valves, transducer and air generator are mounted to the valve cap. The emergency dump valve diaphragm is between the valve cap and the manifold. The air filter, exhaust port, and hose swivel mount are on the manifold.

9.5.3   Pressure Transducer

The pressure transducer has a removable wiring connector. To disconnect, pry the plastic locking fingers of the connector away from the body of the transducer. Pull the connector up and away from the transducer. The pressure transducer may be removed from the air manifold using a 9/16" wrench but should only require replacement if the air pressure cannot be adjusted properly. Before condemning the pressure transducer, be sure the filter is clean.

9.5.4   Air Motor Cut-off Solenoid (N/A for Q3922-14 EOTs)

Adjacent components may have to be removed before removing the air motor cut-off solenoid. Grip the knurled portion of the body of the solenoid with pliers and rotate counter-clockwise. The solenoid has two O-ring seals on the base which must be installed in the grooves upon reassembly.

9.5.5   Emergency Valve and Solenoid

To service the emergency valve diaphragm, the valve cap must be removed from the manifold. The diaphragm is between the cap and the manifold. Note the orientation of the diaphragm before removing and be sure to install the replacement diaphragm in the same manner. Be careful to replace the spring and the O-ring seals when reassembling this part. When the diaphragm is removed, inspect the seating portion for wear and the flexible portion for cuts or tears. Be sure the diaphragm lies flat in the groove when reinstalling.

To remove the dump valve, adjacent components will have to be removed first. If the dump valve is not operating properly, check the screen filter for debris and make sure the passage is clear. If the valve must be replaced, note the orientation of the wires when placing the pipe

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nipple on the valve. This valve is a three way valve and must not be mounted upside down. Be sure the wires are coming out of the top of the valve when it is mounted on the valve cap.

9.5.6   Air Generator Service (N/A for Q3922-14 EOTs)

The air generator is a 3-phase AC generator assembly consisting of the air generator and rotor. The rotor is attached to the shaft by two set screws 180 degrees apart in the side of the rotor. The air generator is electrically connected to the power manifold module, which rectifies the air generator output to DC and regulates the voltage. To remove the air generator, remove the four 8-32 x 1-1/2" Allen head cap screws on the air motor cover plate and disconnect the connector from the power manifold module.

The electronics on the Q3920/R3930 senses battery charging voltage and will show the message **GEN NG** if the system is not providing enough power to charge the battery with a minimum of 50 psi air supply. This message may appear on the display temporarily and clear itself after a short time. This is not indicative of a problem. In general, if the display still shows **GEN NG** after 1 minute of continuous operation under pressure greater than 50 PSI, then the air generator should be removed and serviced or replaced.

Two other conditions which would require removing the air generator are a stuck rotor and noisy or bad bearings. If the air generator rotor is stuck, the air will sound like it is blowing through the device with nothing happening. Be sure the air pressure applied is 50 psi or more. If this is the case, remove the air generator and check the gap between the rotor and the cover plate. This gap should be 0.010". If the gap is too small, the rotor will contact the cover plate, and if it is too large, the rotor will contact the housing. To set the gap, remove the two set screws and apply blue, stick Loctite to the threads. Replace the set screws and use a 0.010" feeler gauge to set the gap. Tighten both set screws evenly when the gap is correct.

Noisy or bad bearings are relatively easy to detect. When the air generator is operating properly, the air generator will make a smooth high-pitched whine. If the bearings are bad or going bad, the air generator will have an uneven sound and / or a high frequency rattle. With a little experience, bad bearings will not be hard to detect. On the other hand, an air generator should not be condemned simply because it sounds "strange". The air generator will produce diverse sounds with varying pitches depending on environmental, actual battery charge and load (system current demand) conditions. The air generator assembly cannot be repaired. If the bearings are bad, the output too low, or the gap cannot be set, the air generator assembly must be replaced.

9.5.7   Air Motor-generator Test (N/A for Q3922-14 EOTs

Any time the air generator is changed out, the air generator should be tested in the assembled manifold before reassembling the EOT. Monitor the voltage across a 50 ohm / 50 Watt load resistor connected to the battery charging output of the PMM board (pins 1 and 4 of connector J3). Refer to the PMM board (9000-90361-0001) assembly drawing found in the drawing section of this manual. Apply compressed air and listen to air motor-generator. It should turn freely and spin without binding. Increase the air pressure to 70 PSI. The voltage output of the module should be 12.0 to 14.8 volts. If the voltage is low, double check the electrical connections on the output of the motor or re-gap the turbine wheel.

9.6   Electronics Modules

9.6.1   Removal

The electronics package is housed in an electronics box (9000-90350-000X) and consists of a control module (9000-90351-0001), a radio module (06928-01), the GPS board (9000-90353-0001), an optional modem board (9000-90352-0001), the antenna array and the HVM assembly (9000-90354-0001). The radio module is mounted to the inside of the electronics box cover and is connected to the control module via a cable (9000-26756-0001). The HVM is mounted to one side of the electronics box and is connected to the control module via a cable (9000-26761-0001). The antenna array is part of the electronics box top bracket (9000-90355-0001). The electronics package is held in the EOT housing by 16 truss head screws; 4 from the front and each side and 4 from the removable back cover. To remove the electronics package, the back cover of the EOT must be removed first. Next, remove the remaining truss head screws from the front and sides of the EOT case. Disconnect the main cable from the bottom of the electronics box and remove the electronics box from the EOT case.

9.6.2   Circuit Description

The Q3920/R3930/Q3922-14 EOTs are sophisticated microprocessor-based devices. The electronics are split into two microprocessor boards that are in constant communication with each other. All of the high level user interface, system control and communications functions are implemented in the Control Module. All pneumatics control and battery charging functions are implemented in the Power Manifold Module.

9.6.2.1   90351 Control Module

This module provides all EOT functions including local user interface (pressure display, alphanumeric message display, LEDs), cell modem and GPS, communications functions, event logging, and HVM control. The Control Module interfaces with the radio and with an external computer via the charging port. The main application program, device memory and event recorder are on this module. This module contains no serviceable parts.

9.6.2.2   06928-01 Radio Module

The Ritron UHF transceiver is attached to the inside of the electronics box cover. To access the electronics on this module, remove the four Philips head cover screws and lift off the cover. There is no expected or periodic maintenance that requires access to the UHF radio hardware. All radio programming, alignment and configuration tasks are performed externally to the Electronics Box without need to access the radio transceiver circuitry.

In case low level maintenance is required for some reason, please refer to specific documentation on the DTX-445 UHF transceiver available from Ritron. After working on the radio module, be sure the DB-15 connector on the module is tight.

9.6.2.3   90352 Modem Board

The modem board is an optional item and when used is mounted on the control module.

The schematic for this board (S90352) as well as the assembly drawing (A90352) can be found in the drawing section of this manual.

9.6.2.4   90361 Power Manifold Module

The power manifold module is located at the base of the EOT and is mounted on the manifold. This module provides voltage regulation of the air motor-generator (if equipped), power for the pressure transducer, and interconnections for the solenoids and main wiring harness. The PMM processes all pneumatic status, passing it to the Control Module. All pneumatic control commands are received from the Control Module and are executed by the PMM. The PMM controls all battery charging functions (N/A for Q3922-14 EOTs) and receives input from the **START/ARM** push button.

9.6.3   Re-installation

Reconnect the main harness to the base of the electronics box. Place the electronics box back into the EOT housing and secure it in place with the 12 truss head screws from the front and sides of the case.

9.7   Radio Alignment

9.7.1   Required Equipment

- A radio service monitor with SINAD meter
- DTX 145/445 MRM   Ritron DTX-445 Maintenance Manual
- DTXL-PCPS   Ritron DTX-445 Programming Kit
- Computer running Windows® with an available serial port
- 9VC44 EOT Radio Pass-Through utility

9.7.2   Ritron Telemetry Radio

The radio used in the Q3920/R3930/Q3922-14 is a variation of the DTX-445 transceiver manufactured by Ritron and is proprietary to Siemens. Replacement radios may be ordered from Siemens. Service manuals and general documentation may be obtained from Ritron as follows:

> Ritron Inc.
> Attn: sales department
> 505 West Carmel Drive
> Carmel, IN 46032
> Phone: 800-872-1872
> Fax: 800-251-7329
> Website: www.ritron.com

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The DTX-445 radio is a synthesized telemetry radio. All settings and calibration parameter adjustments, including frequency, power, deviation, and sensitivity are made through the use of a software program which is available from Ritron (part number DTXP-PCPS).

9.7.3   Ritron Radio Adjustments

Radios obtained from Siemens are factory set for the required operating parameters, including frequency, transmit deviation limit and audio output level. These settings are preset and only need to be verified when the radio is serviced.

NOTE

NOTE

These radio adjustment procedures are a summary only. For complete instructions, troubleshooting, and alignment, refer to the Ritron Maintenance Manual.

NOTE

NOTE

There is no expected or periodic maintenance that requires access to the UHF radio hardware. All radio programming, alignment and configuration tasks are performed externally to the Electronics Box, without need to access the radio transceiver circuitry. In case low level maintenance is required for some reason, please refer to specific documentation on the DTX-445 UHF transceiver, available from Ritron.

Setup

1. To make radio adjustments, connect the appropriate Q3960-0X port adapter to the EOT charge port, and connect the computer to the serial connector on the adapter. Remove the EOT back cover (necessary only when performing power and SINAD measurements).

2. On the computer, start the Ritron radio programmer software (DTXL-PCPS) to perform radio adjustment tasks.

3. After the program starts, type the key combination [CTRL]+[SHIFT]+[P] to place the EOT in radio pass-through mode.

4. Select **Radio \ Read Radio**. The programmer will update with current radio data. Verify under "Description" all channels read "Rx: 452.9375, 00 None, Tx: 457.9375, 00 None, WB". (Note that the transmitter is set to wide-band, but operates within the confines of FCC narrow-band regulations.)

Transmitter

5. Remove the EOT UHF antenna and connect a coaxial cable between the SMA connector on the antenna plate and the Service Monitor RF input (ensure the Service Monitor RF input is capable of handling at least 10 Watts of power). Set the Service Monitor to receive at 457.9375 MHz. During transmitter testing, observe the 20 seconds-ON and 2 minutes-OFF guideline.

6. Press the push button on the port adapter (**TONE REQUEST**) to force the EOT to transmit a 1200 Hz tone. Verify that the output power measured by the Service Monitor is between 7.5 and 8.5 Watts (this will vary with battery voltage, so insure the battery is fully charged prior to performing this test). If the power is too low or too high, adjust the output power setting on the radio using the DTXL-PCPS utility.

7. Press the push button on the port adapter. Verify on the Service Monitor that the frequency error is within +/- 200 Hz. If the center frequency error is outside this range, adjust the center frequency setting on the radio using the DTXL-PCPS utility.

8. Press the push button on the port adapter. While monitoring the deviation reading on the Service Monitor, adjust the transmit deviation setting on the radio using the DTXL-PCPS utility.

Receiver

9. Remove the EOT UHF antenna and connect a coaxial cable between the SMA connector on the antenna plate and the Service Monitor RF output. Set the Service Monitor to transmit at 452.9375 MHz. Adjust the tone generator on the Service Monitor to 1 kHz with 3.0 kHz deviation. Adjust the output level to -119 dBm (0.25 µV).

10. Connect a coaxial cable between the AUX-OUT BNC jack on the port adapter and the audio frequency input jack on the Service Monitor.

11. On the Service Monitor, verify that SINAD reads ≥12dB.

12. To exit radio pass-through mode, press and hold the **START/ARM** button for 8-10 seconds, and release it when the display shows "PWR OFF?". This will place the EOT in the sleep state. Disconnect and remove all cables, reinstall the UHF antenna in the EOT and replace the back cover.

GENERAL SPECIFICATIONS	UHF DTX-445	VHF DTX-145
FCC ID:	AIERIT17-445	AIERIT17-145
Industry Canada ID:	1084A-RIT17445	1084A-RIT17145
FCC Rule Parts:	90	
Industry Canada Rule Parts:	RSS-119	
Frequency Range:	400.6 – 416.5†, 411 – 429†, or 450 - 470 MHz	136 to 162 MHz, 148-174MHz
RF Channels:	8 Independent TX/RX frequencies	
Synthesizer Step:	6.25kHz	2.5kHz
Channel Spacing:	12.5kHz	
Frequencies unusable:	TBD	
Frequency Stability:	+/-1.5 PPM (-30° to +60° C)	+/-2.5 PPM (-30° to +60° C)
Tone/Code Signaling:	CTCSS (Quiet Call) and DCS	
Power Supply:	9 to 17 VDC	
Dimensions & weight:	Board only version: 4.75" x 2.8"x .625" / 2.1 oz	
	Encased version: 5.7"x 3"x 1.375" / 7.3 oz.	
Antenna Fitting:	BNC female with encased version. Other options available on board only version.	

† pending model

RECEIVER	25 kHz Wide band	12.5 kHz Narrow band	25 kHz Wide band	12.5 kHz Narrow band
Sensitivity (12 dB SINAD):	0.25 µV	0.25 µV	.25uV	.25uV
Adjacent channel:	-67 dB	-60 dB	-67dB	-60dB
Spurious rejection:	-70 dB	-70 dB	-65dB	-65dB
Image rejection:	-75 dB	-75 dB	-70dB	-70dB
Intermodulation:	-67 dB	-67 dB	-67dB	-67dB
FM hum and noise:	-43 dB	-37 dB	-43dB	-37dB
Conducted spurious:	-57 dBm	-57 dBm	-57dB	-57dB
Receiver attack time (TX to RX):	< 10 ms	< 10 ms	< 10 ms	< 10 ms
Noise squelch attack time: (for 20 dB quieting)	< 15 ms	< 15 ms	< 15 ms	< 15 ms
RSSI squelch attack time:	< 5 ms	< 5 ms	< 5 ms	< 5 ms
RSSI squelch sensitivity:	PC adjustable; factory set for –106 dBm			
Noise squelch sensitivity:	PC adjustable; factory set for –121 dBm			
AUX OUT frequency response:	12 - 2500 Hz @ +1 / -3 dB			
AUX OUT level range:	0 to 3 Volts peak-to-peak			
Audio Speaker Output:	>700 mW into 8 Ω, with less than 5 % THD (0 to 2.5 Vrms)			
Audio Speaker freq response:	de-emphasized 6 dB/octave from 400 to 2500 Hz			
Current Drain:	Receive Standby: 25 mA at 12.5 VDC			

TRANSMITTER				
Voice Emission Designator:	15K0F3E	10K0F3E	15K0F3E	10K0F3E
RF Power Output:	2.0 Watts @ 12.5 VDC < .9 A		2.0 Watts @ 12.5 VDC < .9 A	
	8.0 Watts @ 12.5 VDC < 1.8 A		5.0 Watts @ 12.5VDC < .9 A	
	10.0 Watts @ 14 VDC < 1.8 A			
Transmitter Duty Cycle:	With supply below 13.5 volts:			
	8 W board only model - 100 % with added heat sink** maintained at 25° C			
	8 W encased model - 33 % with case end cap*** maintained at 25° C			
	5 W encased model - 50 % with case end cap*** maintained at 25° C			
	(with heat sink or case end cap above 25° C, degrades linearly to 0% at 60° C)			

† pending model
** a heatsink can be added to the board only versions using the two holes next to the RF PA shield.
*** case end cap refers to aluminum extrusion end cap on opposite side from connectors.

Data Emissions Designator for external modem:		9K8F1D		
Deviation:	+/- 5.00 kHz	+/- 2.50 kHz	+/- 5.00 kHz	+/- 2.50 kHz
Transmitter attack time:		< 10 ms		
FM Hum and Noise:	-45 dB	-40 dB	-45 dB	-40 dB
Audio Distortion:		< 5 %		
Spurious and Harmonics:	-25 dBm max		-20 dBm max	
Aux In frequency response:	8 Hz to 2500 Hz @ +1 / -3 dB			
Aux In level range:	0.1 to 5 V peak-to-peak			
Microphone freq response:	pre-emphasized 6 dB/octave from 300 to 2500 Hz			
Microphone level:	25 mV rms for nominal +/- 3 kHz deviation on wideband channel			
Current Drain:	2.0 Watts @ 12.5 VDC < .9 A		2.0 Watts @ 12.5 VDC < .9 A	
	8.0 Watts @ 12.5 VDC < 1.8 A		5.0 Watts @ 12.5VDC < 1.2 A	
	10.0 Watts @ 14 VDC < 1.8 A			

MADE IN THE USA

SECTION 10
WARRANTY

10   WARRANTY

To obtain expedited warranty claim service, expedited repair service, or if special shipping arrangements are required for the return of any Siemens product, please contact Siemens to obtain a Return Material Authorization (RMA#).

10.1   Warranty Policy

All Siemens equipment, excluding credit card memory or other similar devices that already carry a manufacturer's warranty, is warranted against failure, due to materials or workmanship, for a period of two (2) years commencing on the month of manufacture. Replacement parts are warranted for a period of one (1) year, excluding customer-supplied material. Siemens will repair or replace, at our discretion, all defective material returned to our factory in Marion, Kentucky prepaid. The equipment will be fully repaired and tested to the original equipment specifications. Equipment will be returned at the equipment owners' expense with the existing warranty in effect.

Refer to the date on the "accepted by" sticker located on the unit to be repaired to determine the initiation of the warranty period for Siemens equipment. However, if the unit has been repaired, the "accepted by" sticker is replaced by a "repaired by" sticker. In that case the warranty would be one year from the date of repair.

The serial number code is as follows:

M1XXXXXXXXX…

Where M1 indicates manufactured in Marion, KY and the number is a sequential serial number assignment.

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10.2   Repair Policy

Equipment must be shipped to the address listed below. Equipment which has exceeded the warranty period must be shipped freight pre-paid to our factory unless other arrangements have been previously negotiated. Repair charges will be estimated and charged upon determination of the extent of damage, current costs of parts, and labor. Return shipping is the responsibility of the equipment owner and will be charged accordingly.

Return all equipment to:

Siemens Industry, Inc.
Rail Automation
Field Repair Department
939 S. Main St
Marion, KY 42064, USA

SECTION 11
CHARGE PORT ADAPTERS

11   CHARGE PORT ADAPTERS

To download and view the data from the EOT internal event log, one of the available port adapters will be required. For the Smart-Charge EOT use the Q9360-01 adapter. The preferred adapter for the Direct-Charge EOT is the Q9360-02. The difference between adapters is in the interface connector.

11.1   Q9360-01 Adapter

Q9360-01 Adapter Assembly
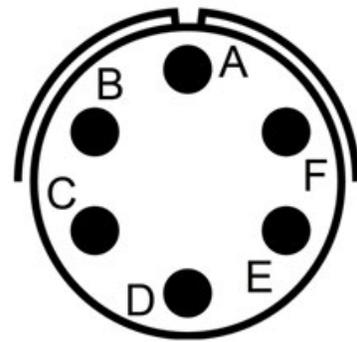
Q9360-01 Connector Pin-Out

Figure 11-1   Q9360-01 Adapter

11.2   Q9360-02 Adapter

Q9360-02 Adapter Assembly
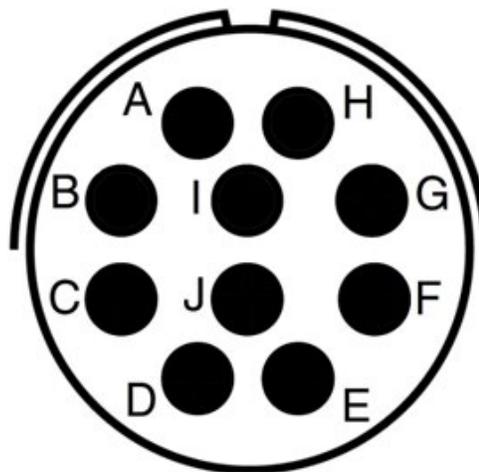
Q9360-02 Connector Pin-Out

Figure 11-2   Q9360-02 Adapter

SECTION 12
DRAWINGS

12   DRAWINGS

The following lists all applicable Siemens drawings and their corresponding revision levels (at time of publication) for the Siemens EOTs (End-of-Train) units described in this manual. These drawings are included in this manual.

Mech Drawing	Description	Revision
Q3920-0X	EOT Final Assy	C3
9000-90346-X00X	EOT Case Assy	B
9000-90350-000X	Electronics Box Assy	B2
9000-90355-0001	Bracket Assy, Top for E-Box	A2
9000-90360-000X	Power Manifold Module Assy	A3
9000-90365-000X	Battery Module	A2
160000-X1	EOT Clamp Assy	F
PCB Drawing	**Description**	**Revision**
9000-90351-0001 (S90351)	Schematic, Control Module	D2
9000-90351-0001 (A90351)	Control Module PCB	D2
9000-90361-0001 (S90361)	Schematic, Power Manifold Module	D
9000-90361-0001 (A90361)	Power Manifold Module PCB	D
9000-90352-0001 (S90352)	Schematic, Cellular Modem	A2
9000-90352-0001 (A90352)	Cellular Modem PCB	A2
9000-90353-0001 (S90353)	Schematic, GPS Module	A1
9000-90353-0001 (A90353)	GPS Module PCB	A1
9000-90354-0001 (S90354)	Schematic, High Visibility Marker	A1
9000-90354-0001 (A90354)	High Visibility Marker PCB	A1
Harness Drawing	**Description**	**Revision**
9000-26751-000X (A26751)	Main Harness	D
9000-26752-000X (A26752)	Start/Arm Button Harness	C
9000-26753-000X (A26753)	Pressure Transducer Harness	B
9000-26754-000X (A26754)	Kip Valve Harness	C
9000-26755-0001 (A26755)	MAC valve Harness	V
9000-26756-0001 (A26756)	Radio to Control Module Harness	A
9000-26758-000X (A26758)	Over-speed Resistor Harness	B
9000-26759-000X (A26759)	Air Generator Harness	B
9000-26761-0001 (A26761)	HVM Board Harness	A1
9000-90366-000X (A90366)	Battery Pack Harness	B1

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APPENDIX A
EOT/HOT EVENT LOG VIEWER

APPENDIX A   EOT/HOT EVENT LOG VIEWER

A.1   Installation

The 16390 program is installed by running the SETUP.EXE program. During the installation you will be asked to accept the software license agreement and enter the serial number that is shown on a sticker applied to Disk 1. The installation program also allows you to select a different installation directory and to select a different program folder for the program's shortcut to reside in. **It is recommended that you accept the defaults given for these options.**

A.2   Program Description

Once installed, the program will be listed in the Start Menu program list in the Quantum Engineering Folder (if the default was selected). The installation also installs a Shortcut icon on the desktop which appears as:

EOT – HOT
Event Log Viewer

Run the program by double clicking the desktop icon or by finding it on the Start Menu tree. From the main program menu, you have the choice of the following menu items: **File**, **Download**, **Setup**, **View**, and **Help**. The underlined letters indicate the hot key for each menu item. To use the hot key, hold down the <**Alt**> button and then press the hot key.

The menu choices are described below.

File
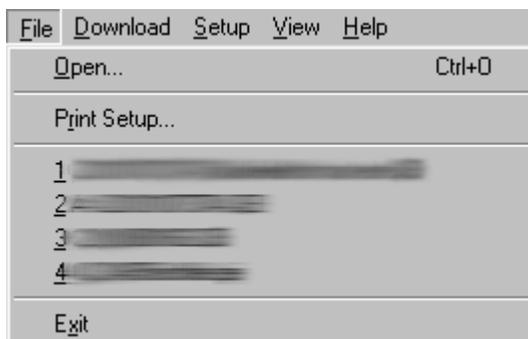
Open...	Opens a data file from disk
Print Setup...	Printer setup and selection
1	List of the last 4 files opened by the program
2	
3	
4	
Exit	Program exit

A-1

Download

For downloading the event log you must select the unit type first. Select **Download -> AAR Types** choice and then select **Download EOT (Q390X).**

The program setup is shown below.
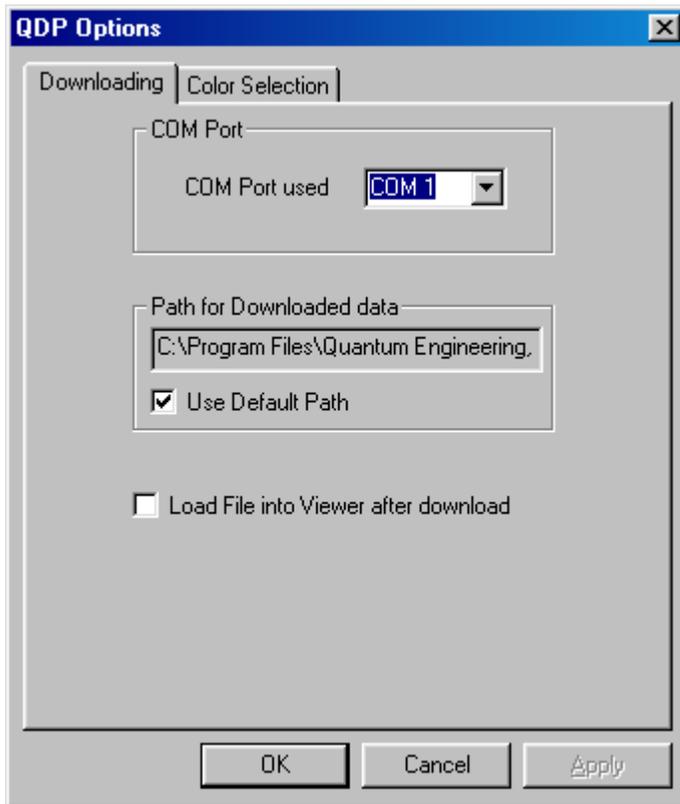
COM Port selects the serial port used to connect to the EOT or HOT.

This COM port should match the port assigned by the computer.

Path for downloaded data points to the directory where the file will be created for downloaded data. Check the **Use Default Path** checkbox to point the data to the location expected by the program.

Check the **Load File into Viewer after Download** checkbox to automatically view the downloaded data upon completion of a download.

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Color selection is done with the dialog below.
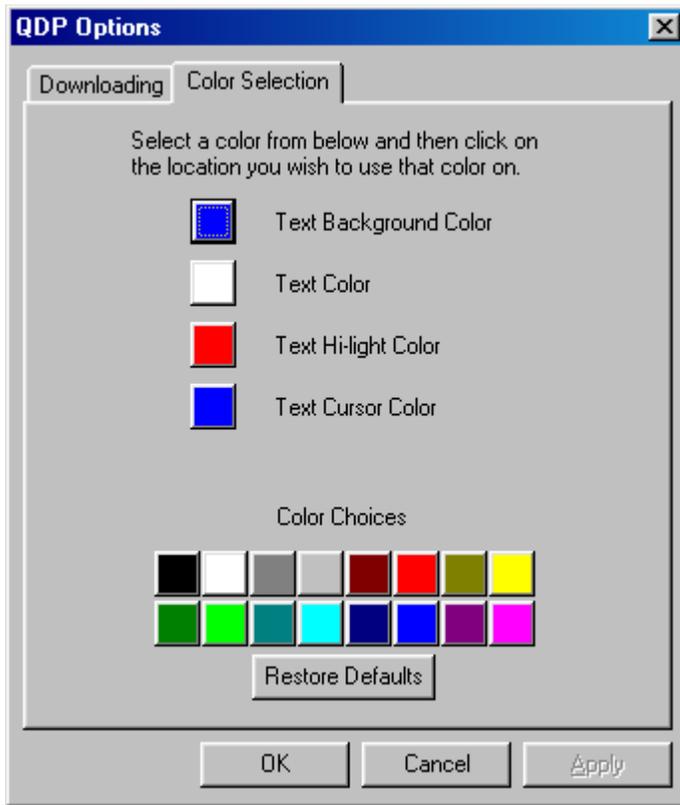
To change the colors, click on a color selection in the **Color Choices** at the bottom of the dialog. Then click on the location that you wish to use this color.

User protection against selecting white text on a white background is <u>not</u> provided by the software. The **Restore Defaults** button can be used to restore the color selections as originally set when the software was installed.

<u>View</u>

With this menu choice, the user can select to either show (checked state) or hide (uncheck) the status bar at the bottom of the window.

<u>Help</u>

Help Topics displays the online program help topic list.

About EOT/HOT viewer… menu choice provides information on the current software version installed.

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A.3 Downloading and Viewing Data

A.3.1 Download a Data File

- Connect a computer to the EOT using the appropriate charge port adapter and download cable.
- If using Q9239/SW port adapter, set the MODEM/COMP switch to the MODEM position. The recommended port adapter for these EOTs is the Q9360-0X.
- Ensure that the EOT is turned on.
- Start the Event Log Viewer program (see paragraph **Error! Reference source not found.**)
- On the program menu select **Download -> Download AAR Types -> Download EOT (Q348X, Q390X)**.
- The program will prompt for the connection to the EOT unit. If the EOT unit is connected and operational, click **OK** to proceed.
- The program will now start the download process. The program will display a packet count as the download progresses. Data will be saved in a file created in the directory specified in the program setup (**Setup -> Program**). If the default directory is used, this will be a **\DATA** directory created under the program directory. The filename is created using the ID number of the EOT and date (mm/dd/yy) and an extension of **.QEI** (e.g., 77048_011604.qei). If a file exists of the same name at the time of download, a single letter character (starting with A) will be appended to the filename (e.g., 77048_011604A.qei).
- When the download is complete, the program will display the complete file name of the file created. Exit the download process by clicking the **OK** button in the dialog. If the **Load File into Viewer after Download** option was selected, the downloaded file will automatically be loaded into the program for viewing. If this option had not been selected, the program will return to the main window.

A.3.2 Loading a Data File for Viewing

- On the program menu select **File -> Open**.
- A standard Windows™ file open dialog will be displayed (see example below). Find the file in the dialog box listing and click on the file name. The file name should then be displayed in the **File name:** edit box at the bottom of the dialog. Click the **Open** button to complete the process.
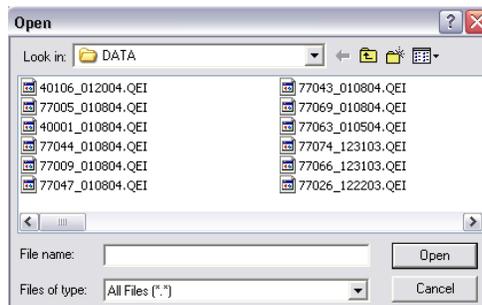
File Open Dialog

<table>
<tr><td>NOTE</td></tr>
</table>

NOTE

After download, data files can be converted to text format for viewing in Microsoft Excel. Select **Convert .QEI to text** from the **File** drop-down menu. Follow the on-screen instructions.

A.3.3   Data Display

The data is displayed in text format in a scrollable window, a portion of which is shown in the example below. The oldest data is at the top of the window and the newest data is at the bottom.

Quantum EOT and HOT Viewer - [40106_012004.QEI]

File   View   Set   Help

DAY	TIME	REASON	BPP	Mov	HVM	Bulb	V	Emerg	Batt	Volts	Date/Time(GMT)	Speed	Latitude	Longitude	Pwr
01	07:10:51	Sent a standard status message	087	1	0	1	1	N	OK	13.6 VDC	12/18 15:45:37	39	29.2019	-82.4366	on
01	07:11:55	Sent a standard status message	087	1	0	1	1	N	OK	13.6 VDC	12/18 15:46:41	40	29.2116	-82.4385	on
01	07:12:47	Received a status request message	087	1	0	1	1	N	OK	13.6 VDC	12/18 15:47:33	44	29.2202	-82.4391	on
01	07:12:47	Sent a reply to a communication test	087	1	0	1	1	N	OK	13.6 VDC	12/18 15:47:33	44	29.2202	-82.4391	on
01	07:13:51	Sent a standard status message	087	1	0	1	1	N	OK	13.6 VDC	12/18 15:48:37	41	29.2311	-82.4377	on
01	07:14:48	Received a status request message	087	1	0	1	1	N	OK	13.6 VDC	12/18 15:49:34	39	29.2404	-82.4371	on
01	07:14:48	Sent a reply to a communication test	087	1	0	1	1	N	OK	13.6 VDC	12/18 15:49:34	39	29.2404	-82.4371	on
01	07:15:49	Sent a standard status message	087	1	0	1	1	N	OK	13.6 VDC	12/18 15:50:35	40	29.2500	-82.4374	on
01	07:16:50	Received a status request message	087	1	0	1	1	N	OK	13.6 VDC	12/18 15:51:36	43	29.2603	-82.4377	on
01	07:16:50	Sent a reply to a communication test	087	1	0	1	1	N	OK	13.6 VDC	12/18 15:51:36	43	29.2603	-82.4377	on
01	07:17:51	Sent a standard status message	087	1	0	1	1	N	OK	13.6 VDC	12/18 15:52:37	41	29.2708	-82.4379	on
01	07:18:48	Sent a standard status message	087	1	0	1	1	N	OK	13.6 VDC	12/18 15:53:34	37	29.2793	-82.4394	on
01	07:18:51	Received a status request message	087	1	0	1	1	N	OK	13.6 VDC	12/18 15:53:37	37	29.2797	-82.4397	on
01	07:18:52	Sent a reply to a communication test	087	1	0	1	1	N	OK	13.6 VDC	12/18 15:53:37	37	29.2797	-82.4397	on
01	07:19:51	Sent a standard status message	087	1	0	1	1	N	OK	13.6 VDC	12/18 15:54:37	41	29.2882	-82.4443	on
01	07:20:49	Received a status request message	087	1	0	1	1	N	OK	13.6 VDC	12/18 15:55:35	40	29.2974	-82.4473	on
01	07:20:49	Sent a reply to a communication test	087	1	0	1	1	N	OK	13.6 VDC	12/18 15:55:35	40	29.2974	-82.4473	on
01	07:21:49	Sent a standard status message	087	1	0	1	1	N	OK	13.6 VDC	12/18 15:56:35	00	29.3073	-82.4474	on

Sample Data Chart

The following events are displayed:

DAY, **TIME**   Time is reported in days, hours, minutes, and seconds <u>since either power-up or reset</u>. A maximum of approximately 24 hours can be reported, at which point the time will rollover to zero. As a maximum of approximately 14 days can be recorded, the Day field displays an accumulation of how many days it has run, overwriting the older (lesser) number of days. [See also GPS Data – Date/Time (GMT)]

REASON   This is the reason this event has been recorded in the event log. Reason codes for the Q3920/R3930/Q3922-14 EOTs are:

- Sent a standard message, due to timer, change in pressure, or status
- Sent a reply to a communication test
- Sent an arm request message
- Sent an arm confirm message
- Sent a position message (GPS latitude/longitude)

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- Received a status request message
- Received an emergency command
- Received a position request message
- EOT ID code was archived (user entered a new EOT ID number)
- Start of emergency
- End of emergency
- GPS unit turned on or off
- Log has been erased
- EOT powering down, due to dead battery
- Power up reset

BPP   This is the Brake Pipe Pressure as reported to the HOT unit or shown on the display.

EOT Status This is the status of the Q3920/R3930/Q3922-14 EOT at the time of the sample. The following status conditions are reported:

Mov	EOT moving	1 = moving, 0 = stopped
HVM	EOT light	1 = ON, 0 = OFF
Bulb	HVM bulb status	1 = OK, 0 = Defective
V	Valve status	1 = OK, 0 = Defective
Emerg	Valve position	N = normal, Y = Emergency
Batt	battery status	OK = OK, L = low, D = dead, GB=Gen Bad
Volts	battery voltage of the EOT's internal battery	

GPS Data This is data obtained from the GPS receiver:

Date/Time (GMT) - Greenwich Mean Time as received from the satellites. To adjust for local time zone, subtract the appropriate number of hours from GMT. For example to adjust from GMT to EST, subtract 5 hours from the time reported on the chart.

Speed - This is the speed that the EOT is moving, in MPH.

Latitude/Longitude - These are the map coordinates at the location that the record was made. See below for instructions to put the coordinates in a readable form.

Power – No meaningful data on Q3920/R3930 units.

The Q3920/R3930/Q3922-14 EOTs are capable of logging several other event types, which are not recognized by the EOT-HOT Viewer program at this time. These events are listed in the Viewer window as "Unknown reason code", followed by a numeric identifier.

A.3.4   Location Display

Any data record on the Data Display can have the location mapped for easy viewing. To do this, you must have a computer that has internet access. The program launches a browser and uses a free mapping web site.

To map the location, the record must display that the GPS module is turned on and has current latitude and longitude coordinates. If GPS was not available at the time a record was made, the message "No GPS fix available" or "No current GPS fix" will be displayed. This indicates that GPS was either turned off to conserve power, or geographic conditions did not provide a usable signal.

To launch the browser, left click the mouse to highlight the line of the data record of interest; then, right-click on the line. A box labeled "Map GPS coordinates" will appear. Click on this box and a browser window will be launched displaying the map position using the Google maps web site. The actual position will be marked by a small green arrowhead on the displayed map (see example on following page).
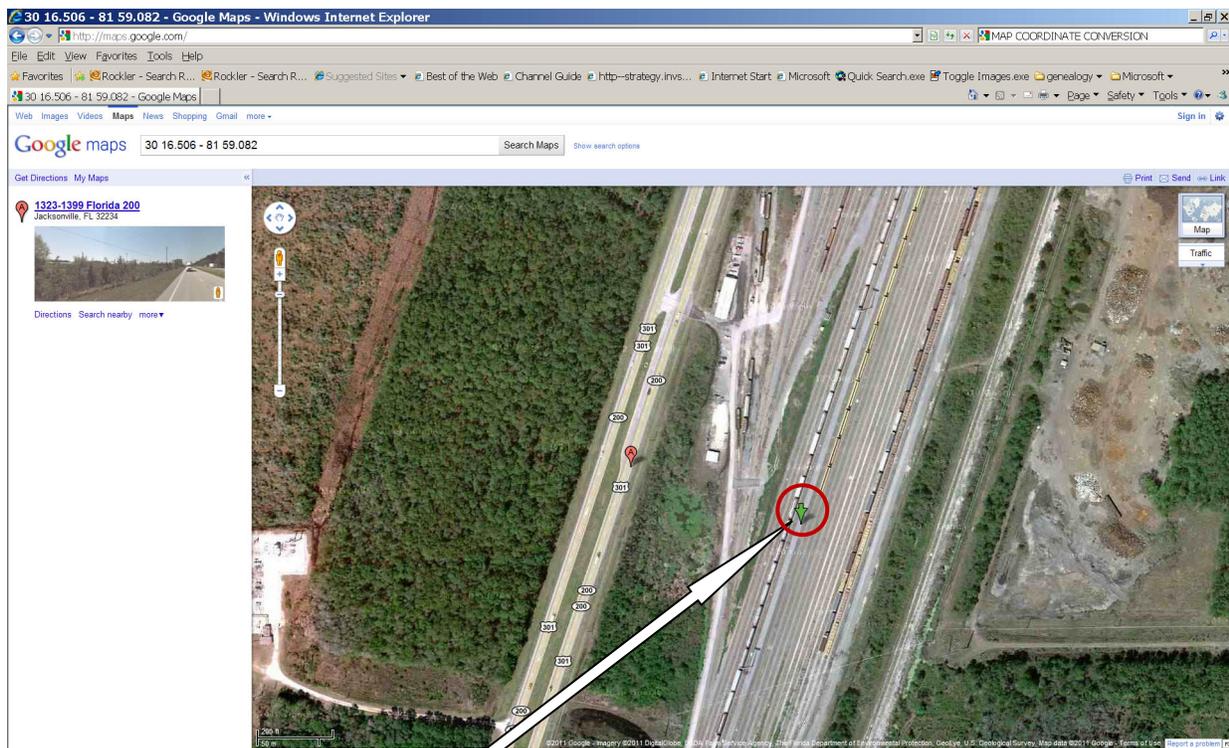
Green arrow marking location

Sample GPS location

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APPENDIX B
Q3920 EOT 3G TO 4G CONVERSION

APPENDIX B   Q3920 EOT 3G TO 4G CONVERSION

The following procedure provides step-by-step instructions to convert the Q3920 EOT from 3G to 4G operation.

NOTE

NOTE	**NOTE** After installing the 4G Antenna Assembly kit, the user must upgrade the MCM firmware to the latest version (Z224-9VA88-A01 Revision S). Refer to Section B.3 of this document for instructions. Contact Siemens Technical Support to request the latest version of this software.

B.1   Components Required

B.1.1   Materials

The 3G to 4G conversion uses the Siemens part number: Z927-01145-0000.

B.1.2   Tools

Standard electronic hand tools will be used to perform the conversion procedure.

B.2   Procedure to Perform Q3920 EOT 3G to 4G Conversion

The 3G to 4G conversion is a simple procedure which should take approximately 15 minutes to perform. The steps to complete the conversion are as follows:

STEP 1

Remove the rear eight (8) cover screws, as shown in Figure B-1, to gain access to the antenna assemblies and the modem circuit board.

STEP 2

Remove the eight (8) mounting screws holding the Electronic Box assembly to the EOT chassis as shown in Figure B-1.
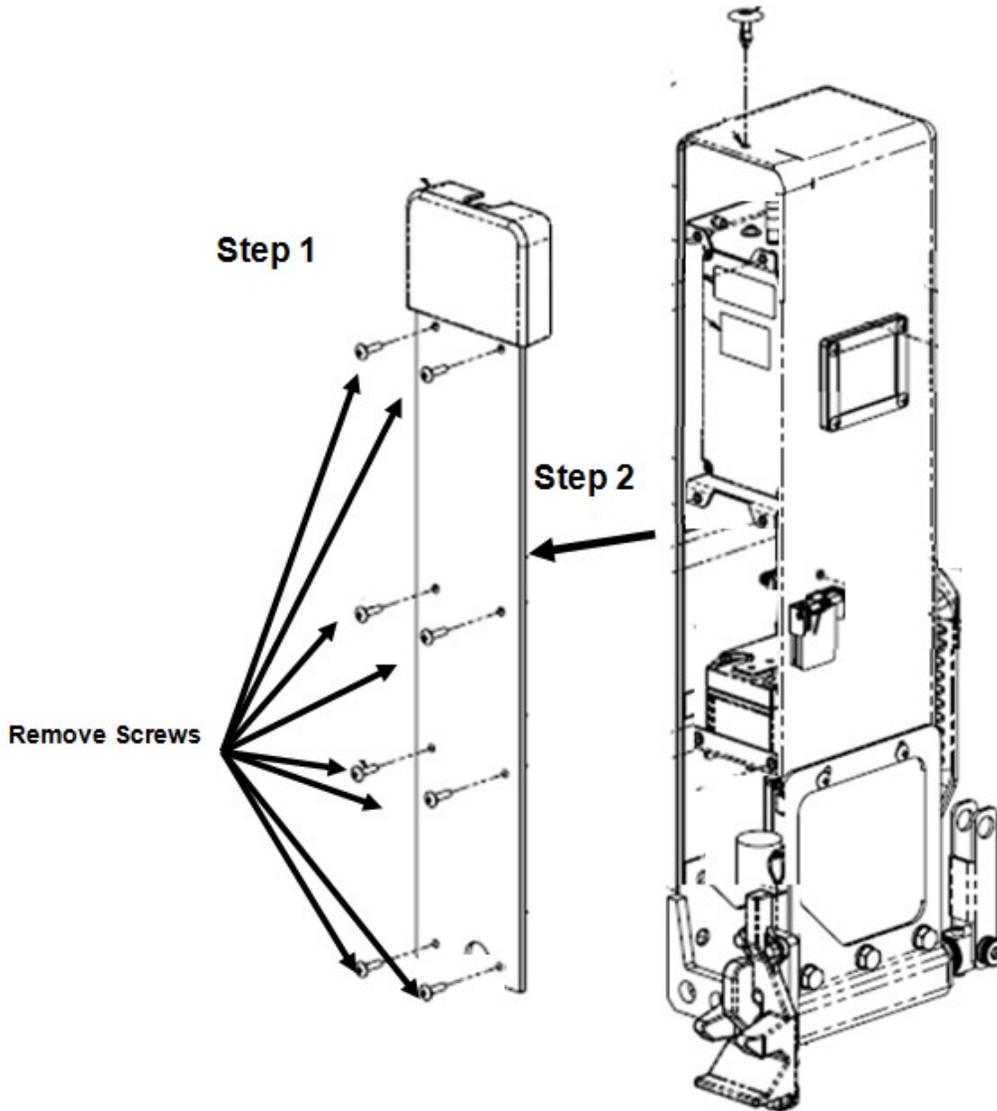
Figure B-1   Open EOT Rear Panel

STEP 3

Remove the twelve (12) screws holding the Electronic Box assembly to the EOT chassis as shown in Figure B-2.
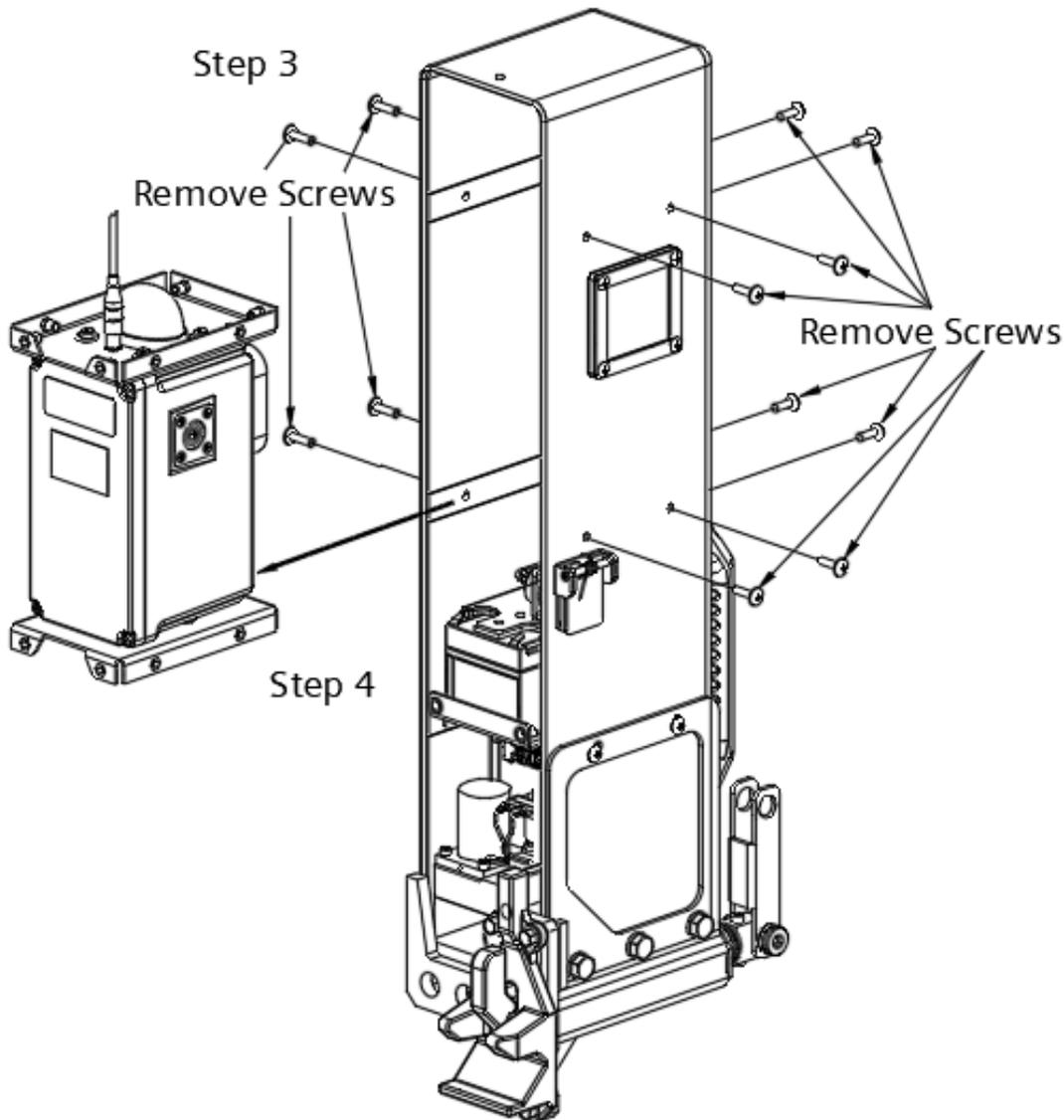
Figure B-2   Remove Electronic Box Assembly from EOT Chassis

STEP 4

Remove the Electronic Box assembly from the EOT as shown in Figure B-2.

STEP 5

Remove the rear panel from the Electronic Box assembly, as shown in Figure B-3, to gain access to the components to be replaced.
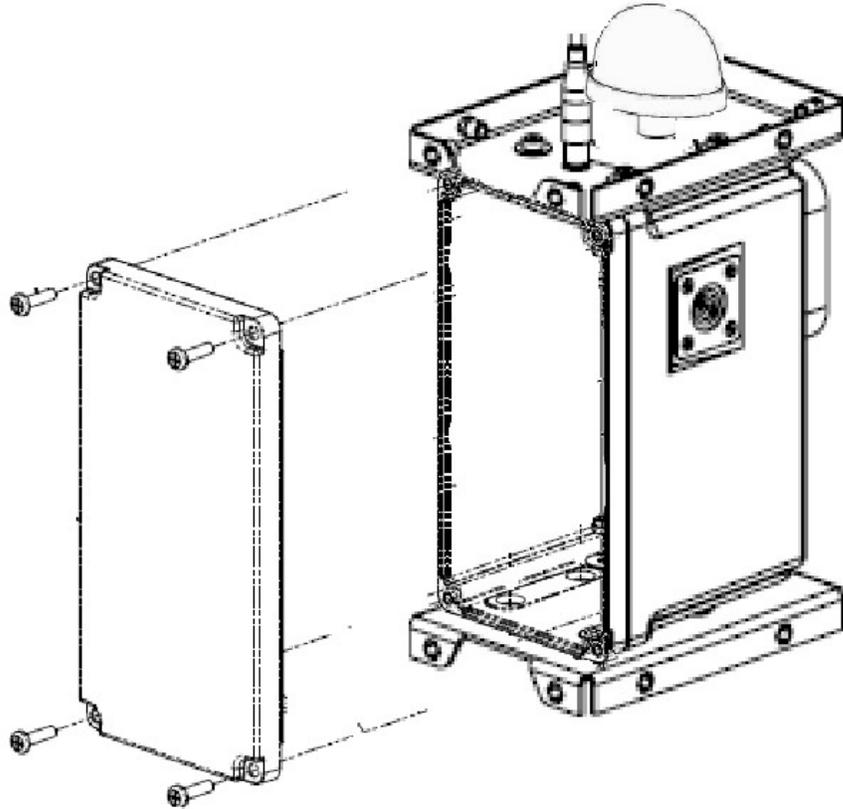
Figure B-3   Open Electronic Box Assembly Rear Panel

STEP 6

Remove the 3G Antenna assembly from the module by loosening the Antenna and removing the assembly as shown in Figure B-4.

STEP 7

Remove the mounting hardware, shown in Figure B-4, that will be used to install the new 4G Antenna Assembly.
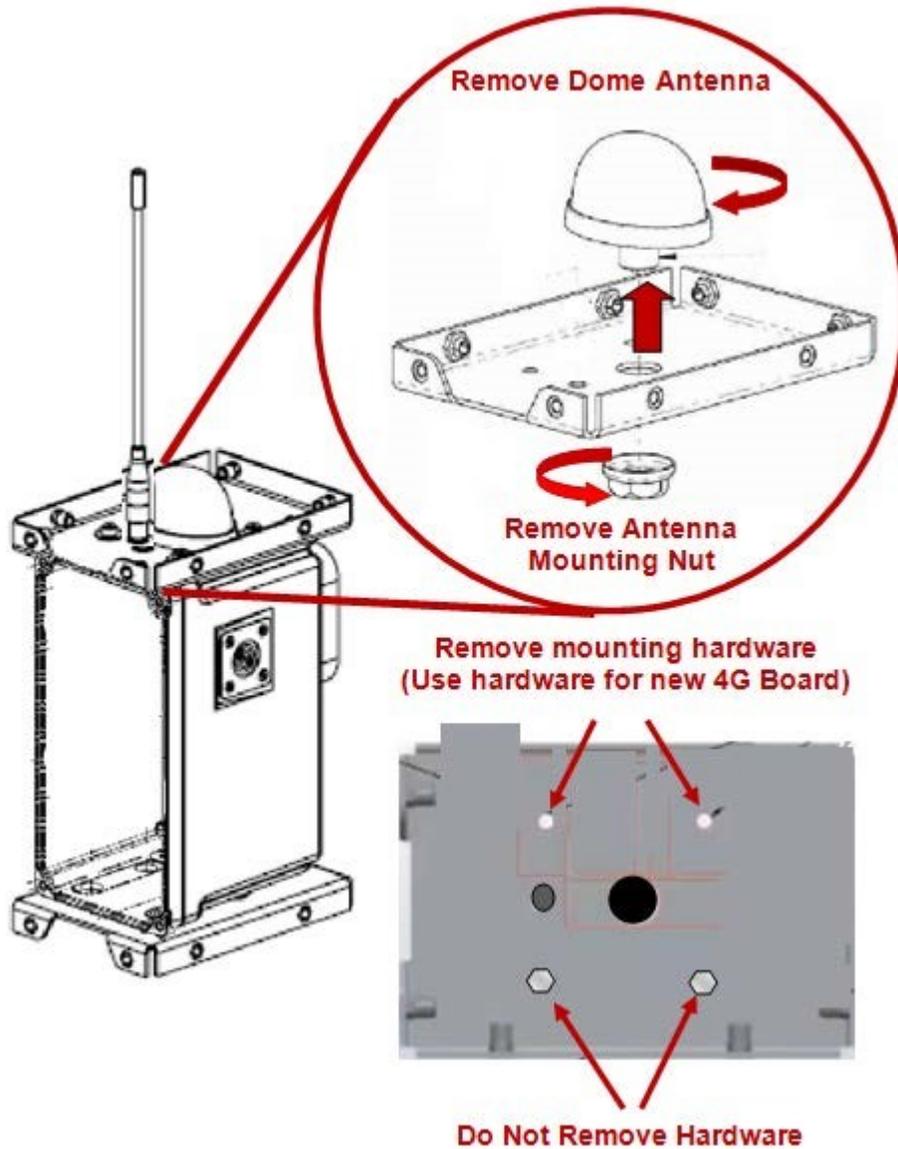
Figure B-4   Removing 3G Antenna Assembly

STEP 8

Remove the entire PCBA assembly from the electronic box, in order to remove and replace the 3G module, as shown in Figure B-5.

STEP 9

Install the new 4G board using the same hardware from the 3G assembly as shown in Figure B-5.
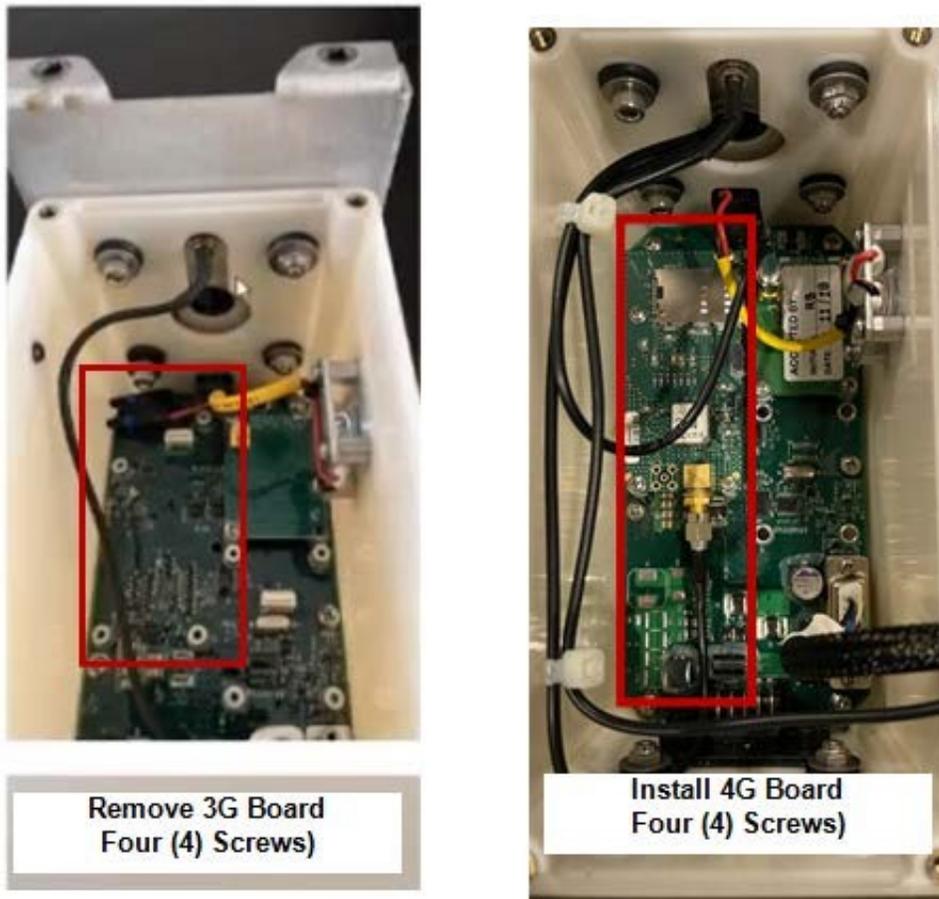
Figure B-5   Remove entire PCBA to replace the 3G Board with the 4G Board

STEP 10

Mount the new 4G antenna assembly kit on the Radio Assembly by reversing the hardware mounting and securing the new assembly from the inside of the box, as shown in Figure B-6.

STEP 11

Route the antenna wires through the hole used to mount the dome antenna as shown in Figure B-6.

STEP 12

Fold the radio antenna and slide the antenna into the clamp to hold the antenna in place, as shown in Figure B-6.
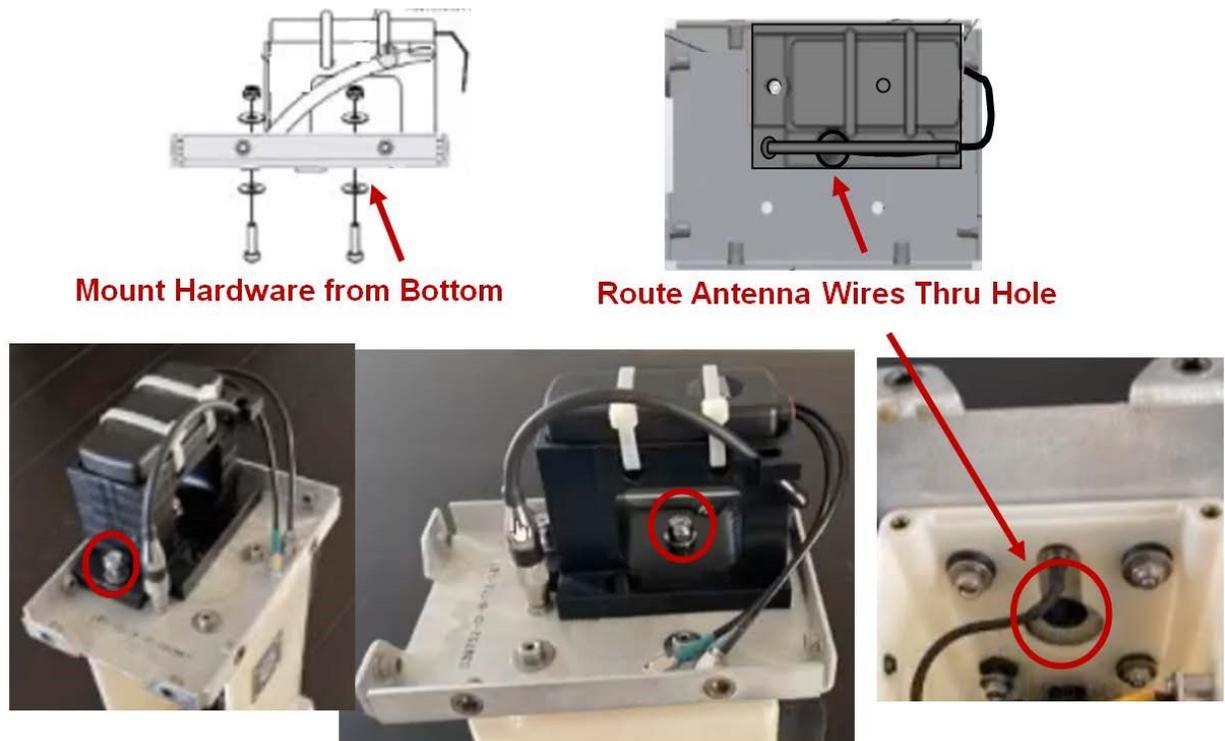
Figure B-6   Installing the 4G Antenna Assembly

STEP 13

Reassemble the Electronic Box assembly into the EOT chassis, securing the twelve (12) screws holding the assembly, as shown in Figure B-7.
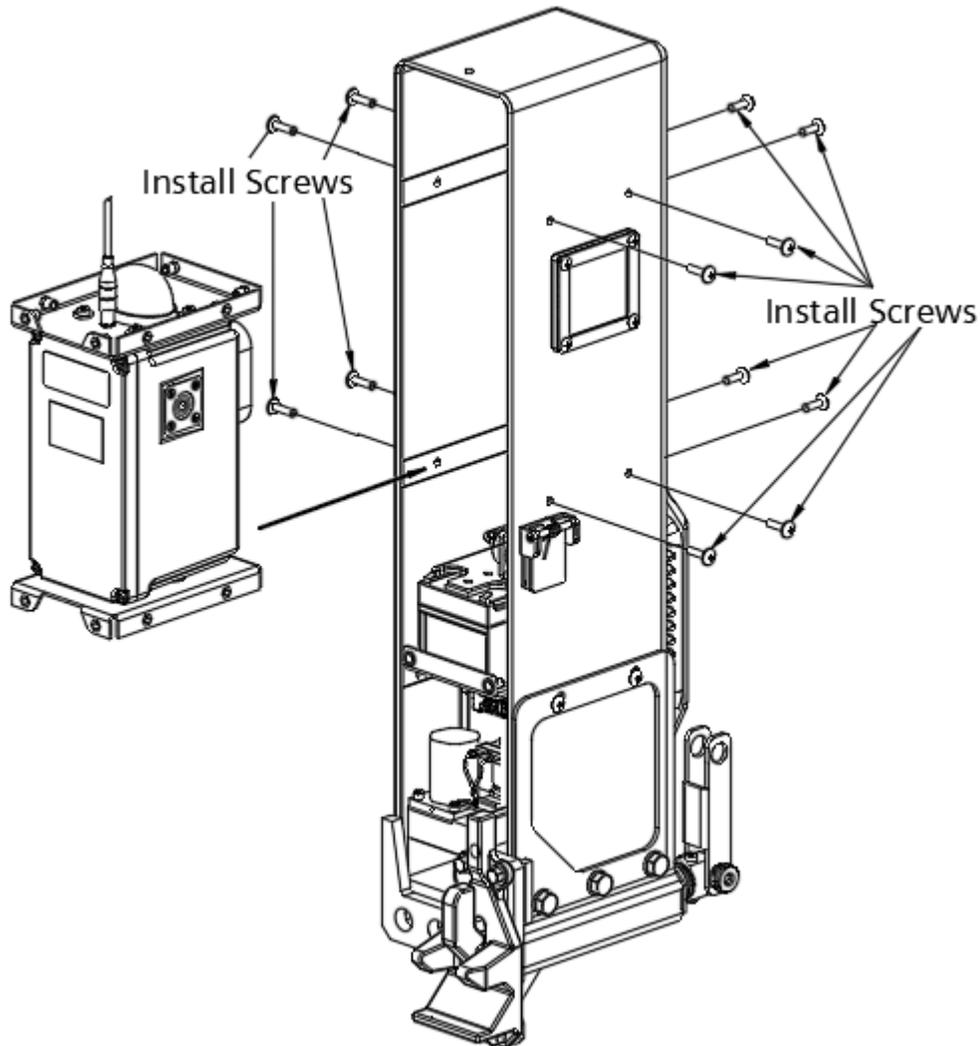
Figure B-7   Installing the Electronic Box Assembly into the EOT Chassis

STEP 14

Reinstall the EOT Chassis Rear Panel Assembly as shown in Figure B-8.

B-8
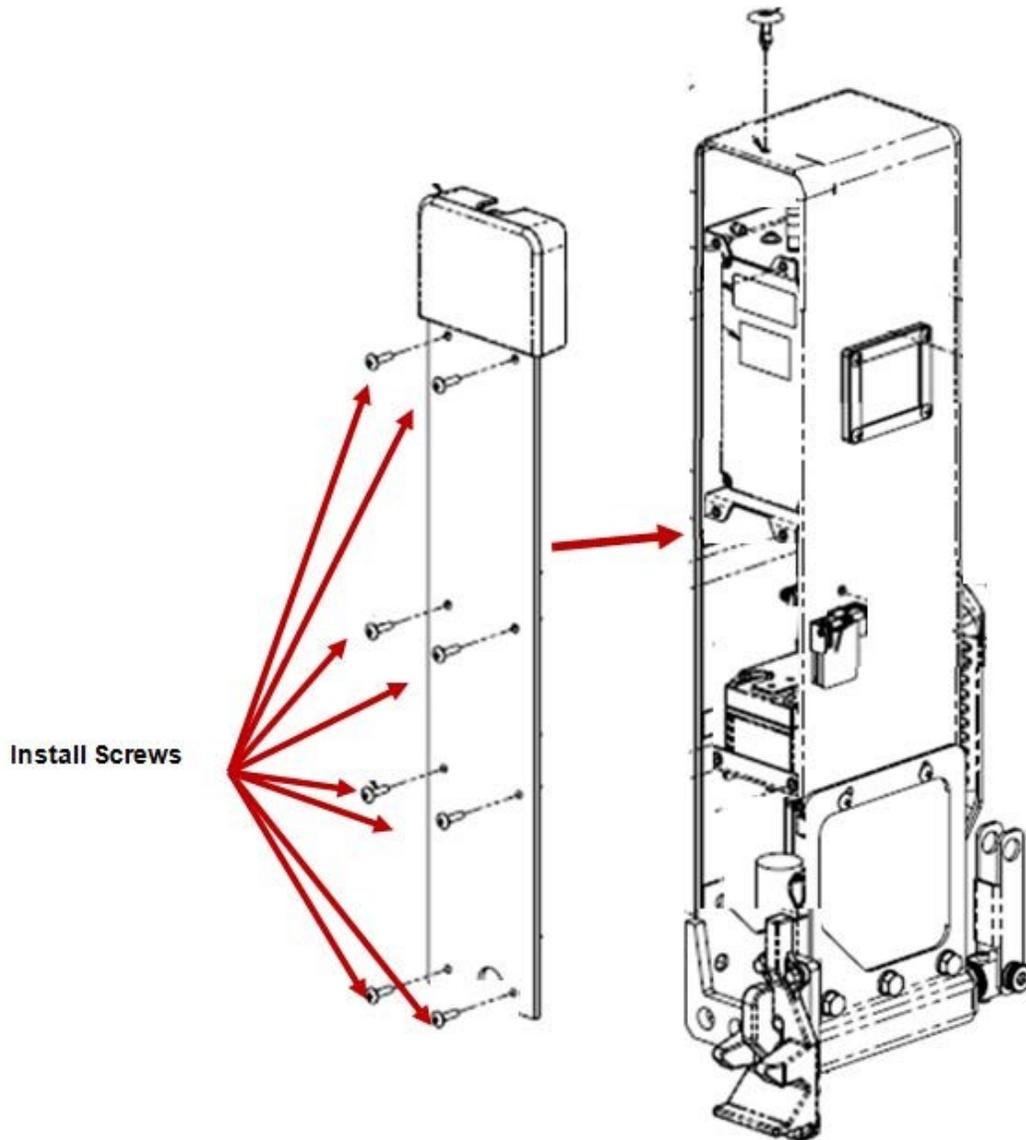
Figure B-8   Reinstalling the EOT Chassis Rear Panel

NOTE

NOTE
After installing the 4G Antenna Assembly kit, the user must upgrade the MCM firmware to the latest version (Z224-9VA88-A01 Revision S). Refer to Section B.3 of this document for instructions.
Contact Siemens Technical Support to request the latest version of this software.

STEP 15

Test EOT and verify proper operation per Railroad and/or Agency standards.

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APPENDIX B – EOT 3G TO 4G CONVERSION

B.3   Procedure to Upgrade 9VA88 Software in the Q3920 EOT

B.3.1   PUMP Utility Configuration

Open the 16371 Product Upgrade Monitor Program (PUMP) utility on the test PC.
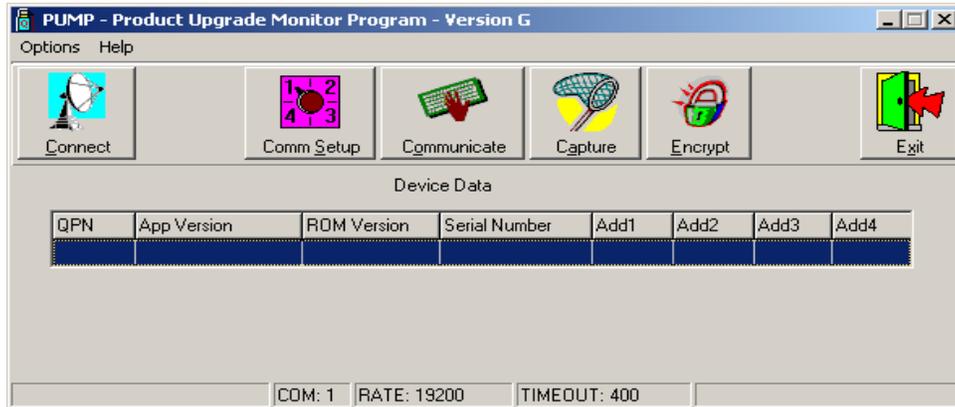
Figure B-9   Product Upgrade Monitor Program (PUMP) Utility Screen

Upon opening, if all the buttons shown in the above screenshot are not displaying on the 16371 screen, then the user will need to perform the following steps to enable the extra functions.

1. Exit the 16371 program.
2. Go to the Windows start menu and select "run". The window below should display.
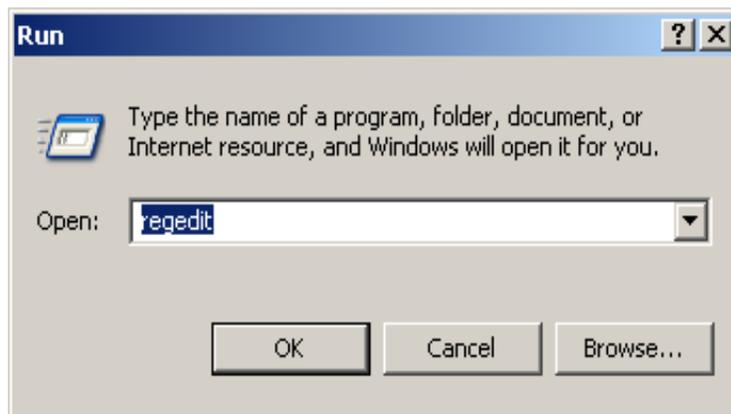
Figure B-10   Run Window

3. In the Run window type "regedit". The registry editor should display.

FEBRUARY 2013, REVISED JANUARY 2022
Version No.: D.4
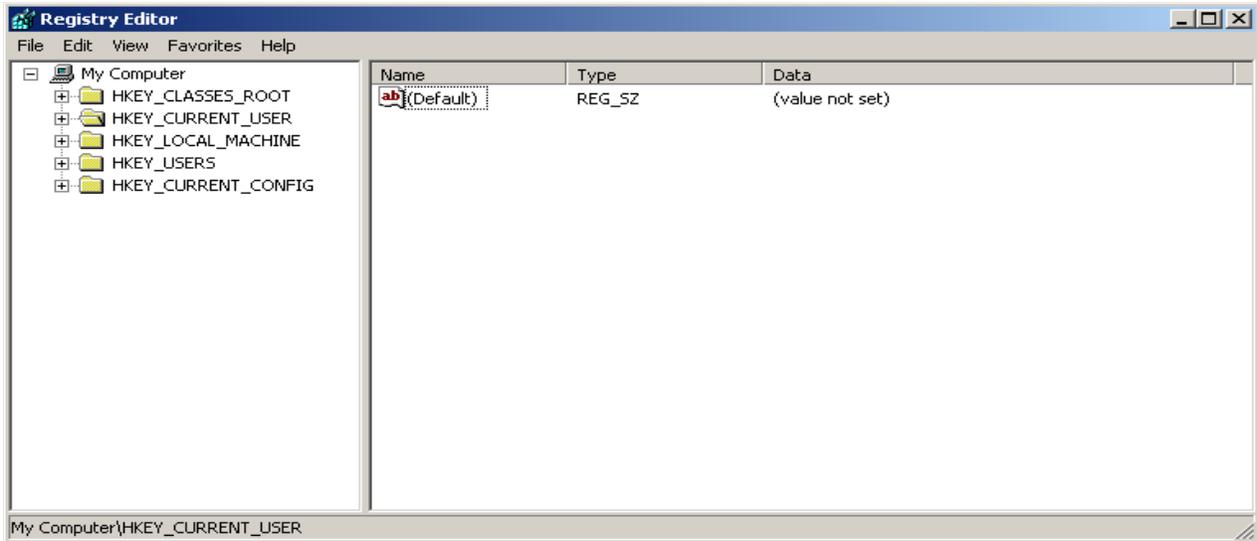
Figure B-11   Registry Editor Window

4. In the registry editor, navigate to HKEY_CURRENT_USER>Software>Quantum Engineering>Pump.
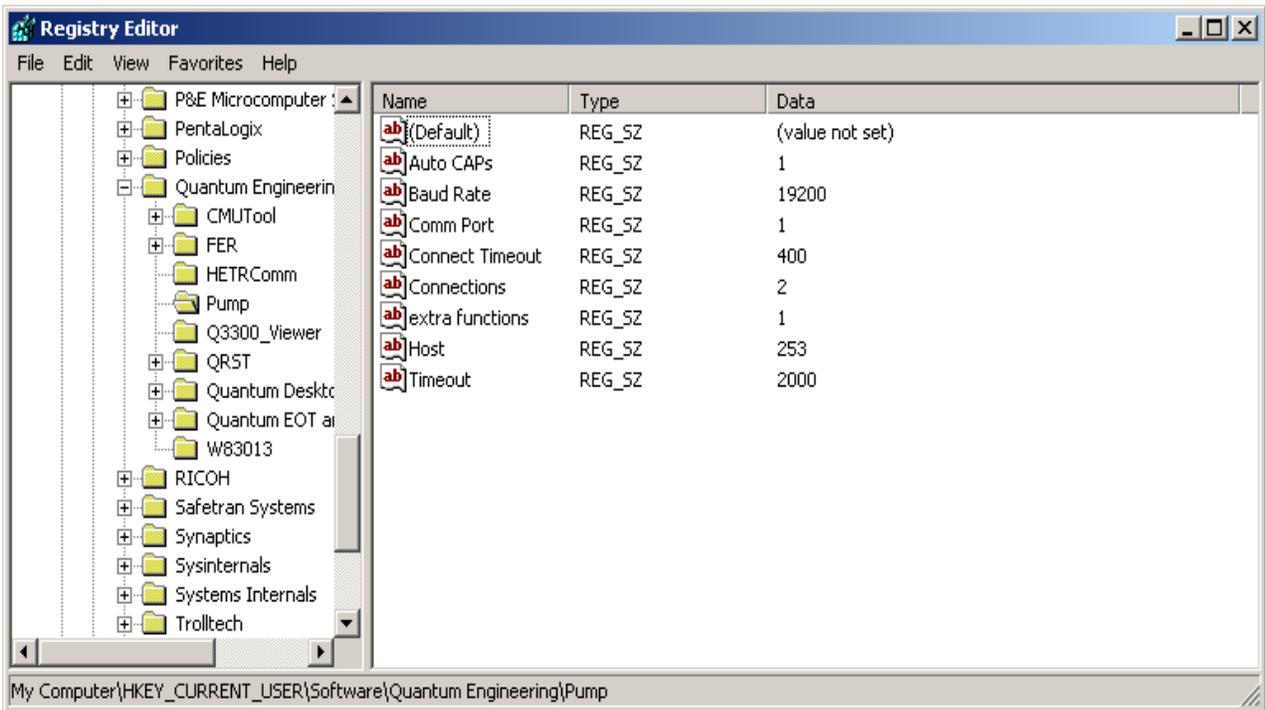
Figure B-12   Registry Editor Navigation

5. Using the mouse, right click and select "New> String Value". Name the new string "extra functions". Using the mouse, right click and select "Modify". The window below will display.
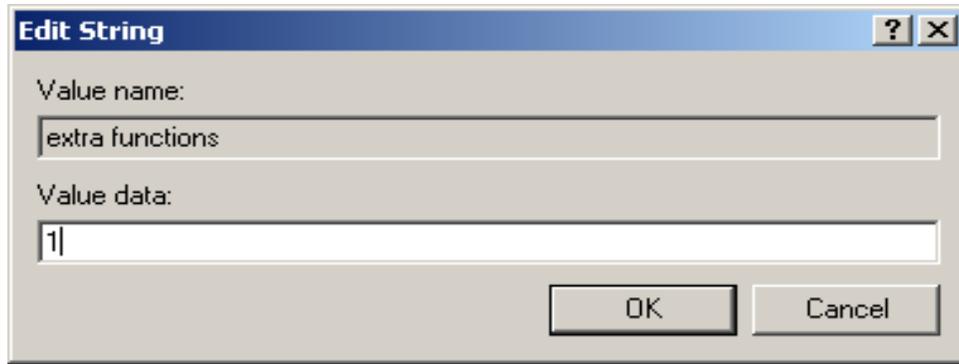
Figure B-13   Edit String Window

6. Enter a "1" for the value data and select "OK".
7. Now close the Registry Editor and open the 16371 utility. The extra buttons should now display.
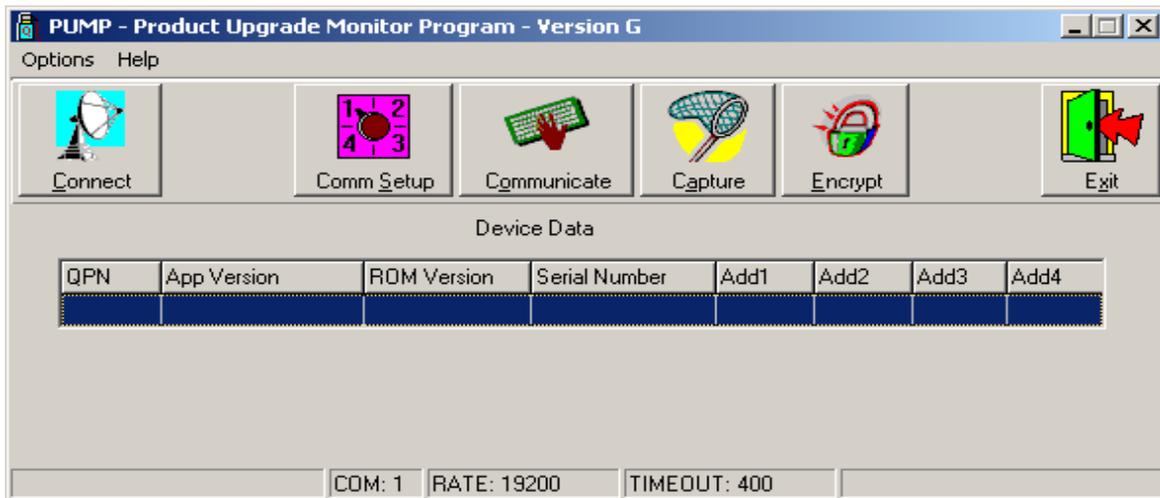
Figure B-14   PUMP Utility Screen with all Functions Displaying

B.3.2 Set EOT to "True Colors" to Load New Software

1. Click on the "Comm_Setup" button in the PUMP utility window.
2. Configure the communication settings as shown below and then exit the Comm_Setup window.

NOTE

NOTE
The Comm Port should be set to the communication port of the PC being used. The setting may differ from COM1.

B-12
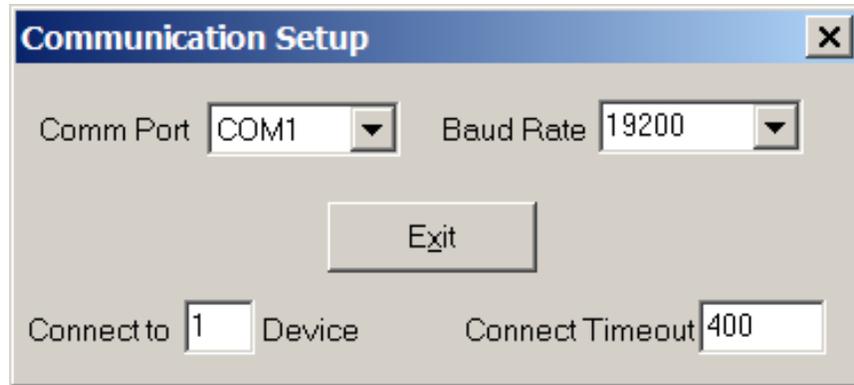
Figure B-15   Communication Setup Window

3. Next, click on the Connect button on the PUMP Utility to connect to the UUT. Once the QPN, App version, ROM version, and serial number fields are populated with data on the PUMP Utility screen, the UUT is connected.
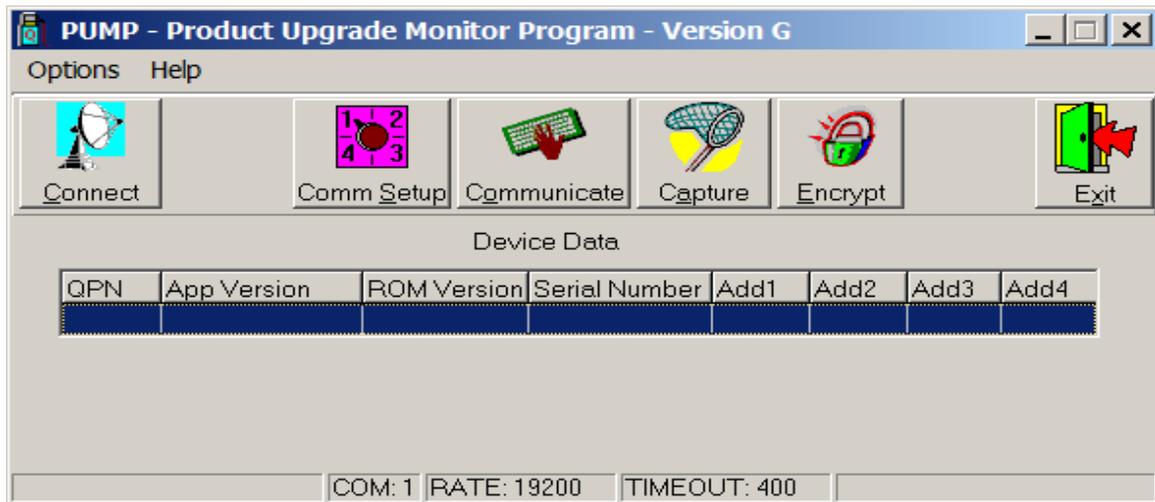
Figure B-16   PUMP Utility Screen Fields to Populate Data

4. Once connected to the UUT, click on the "Communicate" button in the PUMP Utility screen to open the communicate window. The communicate window will display as shown below.

B-13
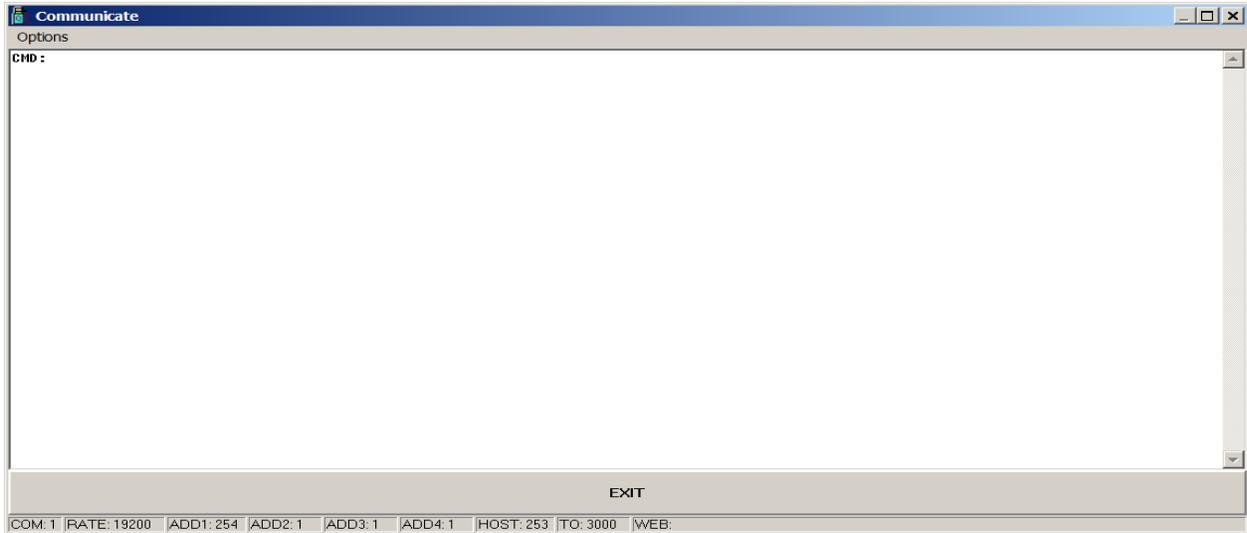
Figure B-17   Communicate Window

5. At the "cmd:" prompt type 1,S,E and press <ENTER> to enable true colors. Verify a reply of "true colors enabled".

    Exit out of the "Communicate" window.

6. In the PUMP utility click on the "Communication Setup" button.

    Change the "Baud Rate" to 115200 and exit.
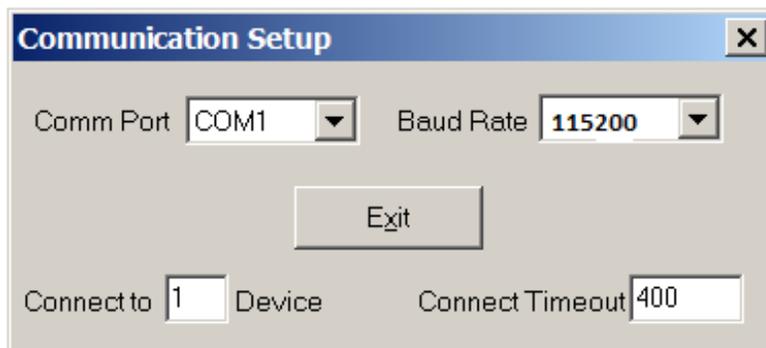
Figure B-18   Communication Setup Window

7. In the PUMP Utility click on the "Connect" button.

8. Verify the PUMP Utility connects to the UUT. The App Version displayed now should be the 9VA88.

9. In the PUMP utility select Options> Upload. Navigate to the location of the new version of the 9VA88 software. Select the 9VA88 file and Click on "OPEN".

    The program should now display a "gas" gauge showing the progress of the software upload.

    Once the software is uploaded the EOT should reboot. Once the unit reboots the baud rate defaults back 19200.

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B.3.3 Verify Successful Software Upload

1. Configure the PUMP utility "Communication Setup" as shown in the figure below.

Figure B-19   Communication Setup Window

2. In the PUMP utility, click on the "Connect" button. Verify the PUMP utility connects to the UUT.
3. In the PUMP utility, click on the "Communicate" button. Verify a text window with a "cmd:" prompt appears.

    At the "cmd:" prompt type 1,S,E and press <ENTER> to enable true colors. Verify a reply of "true colors enabled".
4. Exit out of the "Communicate" window.
5. In the PUMP utility, click on the "Communication Setup" button. Change the "Baud Rate" to 115200 and exit.
6. In the PUMP utility, click on the "Connect" button. Verify the PUMP utility connects to the UUT.
7. In the PUMP utility, click on the "Communicate" button. Verify a text window with a "cmd:" prompt appears.

    At the "cmd:" prompt type V and press <ENTER> to verify the revision level of the application and bootloader loaded on the UUT. Verify a reply of 9VA88-X; 9VA87-X, where X is the software revision.

    The version of the 9VA88 software should match the version just loaded. This completes the procedure.

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