INSTRUCTION MANUAL

HEAD OF TRAIN DEVICE, MODELS Q3452/R2 & V3452/R2

NOVEMBER 2016

DOCUMENT NO.  OBE-00-12-01
VERSION B
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2400 NELSON MILLER PARKWAY
LOUISVILLE, KENTUCKY 40223
TELEPHONE: (502) 618-8800
FAX: (502) 618-8810
SALES & SERVICE: (800) 626-2710
WEB SITE: www.siemens.com/rail-automation

SIEMENS INDUSTRY, INC.RAIL AUTOMATION
939 S. MAIN STREET
MARION, KENTUCKY 42064
TELEPHONE: (270) 918-7800
CUSTOMER SERVICE: (800) 626-2710
TECHNICAL SUPPORT: (800) 793-7233
FAX: (270) 918-7830

FCC RULES COMPLIANCE

The equipment covered in this manual has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense.
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<td>3/22/2012</td>
<td>SO</td>
<td>Branding change to Invensys Rail. The following changes were made to QSM-3452:</td>
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<td>Quantum P/N Q3452/R on page 3 was revised to P/N Q3452R2 due to a circuit board revision.</td>
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<td>1.) Drawings list was revised to correct C3452-WIR from revision A to revision B.</td>
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<td>2.) All references to Quantum and Quantum Engineering were changed to Invensys Rail.</td>
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<td>3.) General document formatting was updated to the current Invensys Rail format.</td>
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<td>4/2013</td>
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<td>TP</td>
<td>Rebrand content</td>
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<td>3/25/2016</td>
<td>TP</td>
<td>Add text Page 7 Radio Tests - Transmitting</td>
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<tr>
<td>B</td>
<td>11/15/2016</td>
<td>TP</td>
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<td>Page 7 Changed SINAD meter connection points</td>
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SECTION 1 - INTRODUCTION

INTRODUCTION AND PRODUCT FEATURES

The Siemens Q3452/V3452 Head-of-Train Device (HOT or HTD), when used with an End-of-Train Device (EOT or ETD), provides the Locomotive Engineer with information regarding conditions that are important to the operation of the train. These conditions include brake pipe pressure (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]
- Highly visible marker (HVM) [on/off/defective]
- Brake valve [normal/emergency/defective]
- Battery status [good/low/dead]
- Battery charge [percent depleted, in charge units]

The Q3452/V3452 also processes EOT/HOT communications tests, Arm requests, and emergency brake commands resulting from an Emergency switch activation or external Emergency input.

The Siemens Head-of-Train device is a single band unit intended for application to integrated cab electronics locomotives such as General Electric's IFC systems or EMD/Rockwell's ICE or FIRE systems. The unit supports the AAR standard protocol on the frequency pairs of 457.9375 MHz and 452.9375 MHz. Mode selection between EMD and GE is accomplished via a jumper in the power cable.
Features of the Q3452/V3452 Head-of-Train Device

- Interchangeability – The Q3452/V3452 is a direct mechanical and electrical replacement for HOT equipment from other manufacturers.

- Modular Design – The Q3452/V3452 is designed using modular components that allow maintenance personnel to quickly make routine inspections, test the radio, and effect repairs.

- The V3452 is functionally and mechanically identical to the Q3452 but is based on new hardware architecture.

PARTS LIST

The following lists all components available from Siemens for the installation, interconnection, and servicing of the Q3452/V3452 Head-of-Train Device.

<table>
<thead>
<tr>
<th>Siemens Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q3452/R2 or V3452/R2</td>
<td>Head-of-Train Device</td>
</tr>
<tr>
<td>Q9199</td>
<td>Test Cable</td>
</tr>
<tr>
<td>QP-16371</td>
<td>PUMP® Software Update Host Program</td>
</tr>
<tr>
<td>QP-16373</td>
<td>HOTCOMM Software Program</td>
</tr>
<tr>
<td>QP-36053</td>
<td>Enclosure handle</td>
</tr>
<tr>
<td>QP-59019/RIT</td>
<td>UHF Radio module</td>
</tr>
<tr>
<td>OBE-00-12-01</td>
<td>Service Manual (this manual)</td>
</tr>
</tbody>
</table>
SECTION 2 – INSTALLATION

Installation is dependent on the locomotive configuration. Commonly, the unit is either mounted on the electrical cabinet door (IFC) or in the electronics rack (ICE) in the nose of the locomotive. Power and communication to the locomotive computer is supplied by a single connector. Connections are made to the UHF antenna via a type-N connector.

The unit has three LED indicators: a green "OK" LED, a yellow "Push-to-Talk" (PTT) LED, and a red "Fault" LED. Approximately 5 seconds after power is applied, all the LED's should come on for 3 seconds. At this point, the green OK LED should remain on dimly. The Fault and PTT LED's should not be lit.

In operation, the OK LED will blink brightly when a transmission is received, the PTT LED will light when the unit is transmitting, and the Fault LED should remain out. In the event of a systems failure, the Fault LED will light. In order to aid troubleshooting, the Fault LED can flash to indicate the detected fault. The LED will flash once a second and will pause for two seconds between patterns. See Table 1 for the fault codes.

<table>
<thead>
<tr>
<th>Number of Flashes</th>
<th>Detected Fault</th>
<th>Possible Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No Host Communication</td>
<td>No communication from ICE or IFC</td>
</tr>
<tr>
<td>2</td>
<td>Bad EOT ID Code</td>
<td>Corrupted memory; rearm</td>
</tr>
<tr>
<td>3</td>
<td>Bad Link Code</td>
<td>Corrupted memory; rearm</td>
</tr>
<tr>
<td>4</td>
<td>Bad EOT Flags</td>
<td>Corrupted memory; rearm</td>
</tr>
<tr>
<td>Solid On</td>
<td>All other faults</td>
<td>HOT defective</td>
</tr>
<tr>
<td>Solid Off</td>
<td>No faults detected</td>
<td>Normal Status</td>
</tr>
</tbody>
</table>

Table 1 – Red LED Fault Codes

An additional fault code involves the use of the green OK LED. A Front-to-Rear communication fault will cause the LED to be on for 5 seconds and then go off for 1 second. This fault can be caused by poor communication at either end.

<table>
<thead>
<tr>
<th>Number of Flashes</th>
<th>Condition</th>
<th>Possible Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F&gt;R No Communication</td>
<td>Poor HOT Tx, or Poor EOT Rx</td>
</tr>
<tr>
<td>Bright LED</td>
<td>RF Message Received</td>
<td>Message from EOT</td>
</tr>
<tr>
<td>Dim LED</td>
<td>Power On</td>
<td>Normal Status</td>
</tr>
<tr>
<td>Solid Off</td>
<td>No Power</td>
<td>Check 12 volt supply</td>
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</tbody>
</table>

Table 2 – Green LED Conditions
SECTION 3 – FUNCTIONAL TESTING

Familiarity with IFC and ICE display screens is required for these tests, as well as a functional EOT.

ON THE LOCOMOTIVE

- Set up the EOT unit.
- Check the LED status lights on the Q3452/V3452 HOT. The OK (green) LED should be lit dimly with possible bright flashes now and again. The Fault (red) LED should be off. The PTT (yellow) LED should be off most of the time and lit no more than a few seconds at any time.
- Using the locomotive control screens, enter the EOT number.
- Arm to the EOT. The EOT “ARM” button must be pressed to start the arming sequence. Once the “Arm Now” indicator is illuminated on the control screen, press the ARM button on the screen to complete the arming process.
- When the EOT is armed, the locomotive control screens should display "ARMED" for the EOT Status, as well as "Emergency Enabled".
- Information transmitted by the EOT will be displayed on the HOT. There is no need to test all the display combinations. The Q3452/V3452 communicates digitally with the IFC or ICE computer. The appropriate display will light when an EOT status message is received by the unit.
- If possible, verify that the locomotive is receiving the EOT pressure. Vary the air pressure to the EOT and compare that pressure to the pressure displayed on the locomotive screen.
- With the EOT now armed to the Q3452/V3452, activate an EMERGENCY. Verify that the EOT opens the exhaust valve. After the EOT system recovers from this emergency application, test the external EIM input to the Q3452/V3452, if used. Usually, the EIM input can be tested by placing the train brake handle in the EMERGENCY position.
- Using the locomotive control screens, enter EOT code 00000, or use the “disarm” key.
BENCH TEST

Required Equipment

- A 15 VDC power supply
- A radio service monitor with SINAD meter
- Siemens program QPN 16373 (HOTCOMM)
- Siemens test cable Q9199 or similar
- Desktop or laptop computer running Windows® with an available serial port
- A functional EOT unit or EOT simulator

Test Procedure

- Connect the Q9199 test cable to 15 VDC power and then connect the test cable to the unit under test. Connect a suitable antenna to the unit.

- Apply power and note the action of the LED's on the unit under test. Approximately 5 seconds after power is applied, all LED's should light for 3 seconds. The PTT LED should go out and the OK LED should remain lit dimly. In the Bench mode, the FAULT LED may occasionally blink.

- Connect the test cable serial connector to the computer and start the HOTCOMM program. The HOTCOMM screen will be displayed as shown in Figure 9.

![Figure 9 - HOTCOMM Screen](image-url)
• If required by first time use, set the COM port used by the HOTCOMM program to match the computer's available serial port. The COM Port setting is configurable under the Options… menu item.

• Click the RUN button in the lower left of the screen to connect the HOTCOMM program to the unit under test. When the connection is made, HOTCOMM will display the Siemens part number (QPN), serial number (SN), Application Version (App Ver), and ROM version (ROM Ver) at the top of the window, similar to that shown in Figure 10. Verify that the application version is the current intended version. If a newer application is required, upload the new application as described in Appendix A.

![HOTCOMM - Q3451 Communications - Version 16373-H](image)

**Figure 10 - HOTCOMM - Connected State**

• Setup the EOT unit you are using as a test unit.

• Using HOTCOMM, click the mouse cursor in the EOT Code box and enter the EOT number you are using.

• Click the Set Code button once the EOT number has been entered.

• The unit should receive the next EOT transmission, which will occur within 60 seconds. You can force this transmission to occur sooner by changing the EOT pressure by more than 2 PSI or by pressing the EOT button. Verify that the HOTCOMM display receives the correct EOT signal and pressure.

• Arm to the EOT. The “ARM” button on the EOT must be pressed to start the arming sequence. Once the “Arm Now” indicator is illuminated on the screen, click the “ARM” button on the screen to complete the arming process.

• Click the COMM Test button and verify the success of the test by the HOTCOMM display.
RADIO TESTS

Transmitting

Connect the Radio Service Monitor to the UHF antenna connector on the unit under test. Set the Service Monitor to 452.9375 MHz and prepare it to measure power, frequency error, and deviation.

Perform the following checks:

1. Select Tone 1 (1800 Hz) from the Tone drop-down list on the HOTCOMM window.
   a) Click on the Start Tx Test button.
   b) Verify the unit is transmitting on 452.9375 MHz, +/-100 Hz
   c) Verify the transmit deviation is 2.4 KHz +/- 100 Hz
   d) Verify transmit power is a minimum of 1.9W. (Note: The V3452/R2 operates in high power only.)
   e) Click on the Stop Tx Test button.
   f) Allow the radio to cool for 2 minutes. (Note: The radio has a built-in 20-second timeout for transmit duration.)
   g) Click on the High Pwr checkbox. (Note: The V3452/R2 operates in high power only. Checking the High Pwr checkbox has no effect on output power.)
   h) Click on the Start Tx Test button.
   i) Verify a power measurement of 7.0 Watts nominal, not to exceed 9 Watts.
   j) Click on the Stop Tx Test button.
   k) Allow the radio to cool for 2 minutes.

2. Select Tone 2 (1200 Hz) from the Tone drop-down list.
   a) Click on the Start Tx Test button.
   b) Verify the unit is transmitting on 452.9375 MHz, +/-100 Hz
   c) Verify the transmit deviation is 2.4 KHz +/- 100 Hz
   d) Verify transmit power is a minimum of 1.9W. (Note: The V3452/R2 operates in high power only.)
   e) Click on the Stop Tx Test button.
   f) Allow the radio to cool for 2 minutes.
   g) Click on the High Pwr checkbox. (Note: The V3452/R2 operates in high power only. Checking the High Pwr checkbox has no effect on output power.)
   h) Click on the Start Tx Test button.
   i) Verify a power measurement of 7.0 Watts nominal, not to exceed 9 Watts.
   j) Click on the Stop Tx Test button.
   k) Allow the radio to cool for 2 minutes.

Transmit deviation can be set by adjusting a potentiometer:
- For the Q3452/R2 – R43 on the 60235/R PCB
- For the V3452/R2 – R9 on the 90400 PCB

If any parameters do not pass, perform radio alignment (see Appendix C).
Receiving

- For the Q3452/R2, Connect the SINAD meter to TP1 (radio Rx Audio) as shown on drawing C60235, found in the Drawings Section of this manual.

- For the V3452/R2, connect the SINAD meter to C5 (radio RX audio) as shown on drawing A90400, found in the Drawings Section of this manual.

- Set the Service Monitor to transmit on 457.9375 MHz using an internal tone of 1 kHz with 2.5 kHz modulation. Set the generator level to -116 dBm (0.35 µV).

- Verify that the SINAD reads >12dB.

- Verify the RX audio level is 354 mV RMS ± 5%.

- If any parameters do not pass, perform radio alignment (see Appendix C).
SECTION 4 – SERVICING

REQUIRED EQUIPMENT
The following equipment will be necessary for proper servicing of the Q3452/V3452.

- A 15 VDC power supply, capable of 2 amp or higher output
- A radio service monitor with SINAD meter
- Bird Watt meter, or equivalent
- Signal generator
- Oscilloscope
- A multi-meter for both ohms and volts
- Siemens program QPN 16373 (HOTCOMM)
- Siemens program QPN 16371 (PUMP)
- Siemens test cable Q9199 or similar
- The maintenance manual for the Ritron radio model used in the product
- The programming kit for the Ritron radio model used in the product
- Desktop or laptop computer running Windows® with an available serial port
- A functional EOT unit or EOT simulator

CIRCUIT DESCRIPTION
Refer to the schematics and assembly drawings available in Section 7.
TESTING

If replacing the main circuit board or any other major component of the Q3452/V3452 (such as a radio module), the unit must be retested to insure it will function properly.

If installing a new circuit board, you must upload the application program into the unit. New application software can be loaded into the Q3452/V3452 through the use of the Siemens software utility QP-16371 (PUMP). Software updates may be distributed in response to customer requests for new features. Likewise, if board level repairs have been made, it may be necessary to reload the application software. See the Appendix A for the operation of the PUMP software. For the Q3452, the application software P/N is 16973. For the V3452, the application software P/N is 9VC20, and the bootloader P/N is 9VC19. If bootloader installation is required, consult the factory.

• Connect the Q3452/V3452 to a 15 VDC power supply using the Siemens Q9199 cable.
• If installing a new circuit board, the radio module should not be connected to the circuit until the power supplies are checked.
• Apply 15 VDC to the unit.
• For the Q3452/R2:
  Measure +5.00 VDC (+/- 0.25 V) at TP3 to ground.
  Measure +12.0 VDC (+/- 0.6 V) at TP5 to ground.
  Measure +5.00 VDC (+/- 0.25 V) between TP6 (+) and TP7 (-).
• For the V3452/R2:
  Measure +12.0 VDC (+/- 0.25 V) at the screw holding U17 to the heat sink, with reference on any mounting screw.
  Measure +5.00 VDC (+/- 0.25 V) across C46.
  Measure +3.30 VDC (+/- 0.25 V) across C57.
  Measure +5.00 VDC (+/- 0.1 V) - across C37.
• If installing a new circuit board, you must upload the application program into the unit at this time.
• Remove power from the unit and connect the radio module if required.

RITRON TELEMETRY RADIOS

The radio used in the Q3452/V3452 is a DTX-Plus radio transceiver (original part number DTX-454-0BN9L, or 2nd generation radio part number DTX-460-0BN9L) manufactured by Ritron, Inc. Ritron may be reached at:

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

The DTX-Plus radio is a synthesized telemetry radio. Frequency settings are made through the use of a software program and cable which are available from Ritron.
SECTION 5 – MAINTENANCE

There are no components in the Q3452/V3452 which require annual calibration. 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).

Verification of radio transceiver performance may be done on-locomotive with the use of an Siemens Q3430, Q3431 or Q3433 tester. This verification does not need to be performed by an electronics technician. Failure of any verification step, as indicated on the Q3430 or Q3431 tester, requires that the Q3452/V3452 HOT be serviced by a qualified technician.
SECTION 6 – WARRANTY AND REPAIR

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#).

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 prepaid to our factory in Marion, Kentucky. 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.

To determine the duration of the warranty period for Siemens equipment, refer to the warranty sticker on the product, or consult the factory.

REPAIR POLICY

Equipment must be shipped to the address provided 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.
Field Repair Department
939 S. Main St
Marion, KY 42064, USA
SECTION 7 – DRAWINGS

The following lists all applicable Siemens drawings and their corresponding revision levels for the Siemens Q3452/V3452 Head-of-Train Device. These drawings are included in this manual.

For Q3452:

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<th>Drawing</th>
<th>Description</th>
<th>Revision</th>
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<td>C3452</td>
<td>HTD Installation</td>
<td>B</td>
</tr>
<tr>
<td>C3452-WIR</td>
<td>Chassis Wiring</td>
<td>B</td>
</tr>
<tr>
<td>C60235/R</td>
<td>PCB Assembly</td>
<td>A</td>
</tr>
<tr>
<td>CS1235</td>
<td>Schematic</td>
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<td>C62127R</td>
<td>Chassis Assembly</td>
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For the V3452 the following additional drawings apply:

<table>
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<td>62127</td>
<td>Chassis Assembly</td>
<td>L</td>
</tr>
<tr>
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<td>PCB Assembly</td>
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<tr>
<td>S90400</td>
<td>Schematic</td>
<td>B1</td>
</tr>
<tr>
<td>A90410</td>
<td>PCB Assembly</td>
<td>A1</td>
</tr>
<tr>
<td>S90410</td>
<td>Schematic</td>
<td>A1</td>
</tr>
</tbody>
</table>
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NOTES:

1) LED'S OPERATE AS FOLLOWS:
   - PTT (YELLOW) - WHEN UHF TRANSMITTER IS KEYED.
   - OK (GREEN) - UNIT POWERED
     - ON (DIM) - RECEIVED VALID MESSAGE
     - BLINKING - FRONT TO REAR COMM LOSS.
   - FAULT (RED) - 1 BLINK - NO COMMUNICATION WITH 7F
     - 2 BLINKS - INTERNAL FAILURE.

2) GE PART NUMBER 84A212859P4

DIMENSIONS AND TOLERANCES

LESS UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES AND INCLUDE PLATED
AND/OR CHEMICALLY APPLIED FINISHES. ALL ITEMS TO BE FREE FROM BURRS AND
SHARP EDGES. ALL BEND RADIUS - MINIMUM REQUIRED FOR MATERIAL USED.
NOTES:
3) JUMPER FOR ICE OPEN FOR IFC.
4) ANTENNA CONNECTION IS TYPE "N".
5) HOT3 POWER CONNECTOR IS MS2102A-20-29P.
(SNAP WITH CABLE MS2106F-20-29S).
6) SYSTEM IS NEGATIVE GND VIA ANTENNA LEAD.

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MODULAR HOTD

Quantum Engineering, Inc.

16
DOCUMENT No.: OBE-00-12-01          Version: B

HOTD CHASSIS WIRING

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NOTES: UNLESS OTHERWISE SPECIFIED:

1. LIST SUB-ASSEMBLY P/N'S AND REVISIONS.
2. SEE CONFIGURATION.
3. USE BLUE LOGITEC 900001 OR EQUIVALENT.
4. DO NOT REMOVE PAPER BACKING FROM TAPE.
5. CRIMP PINS (P/N 330105) DIRECTLY ONTO LED WIRE BEFORE MOUNTING LED TO ENCLOSURE.
6. APPLY 50 OHM STICKER INSIDE ENCLOSURE.
7. APPLY ACCEPTANCE STICKER AFTER PANEL INSTALL.
8. USE LATEST REVISION.

DRAWING CHANGE HISTORY:

<table>
<thead>
<tr>
<th>Change No.</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C01</td>
<td>03/15/2023</td>
<td>REVISED</td>
</tr>
</tbody>
</table>
DRAWING CHANGE HISTORY

<table>
<thead>
<tr>
<th>QTY REQD</th>
<th>ITEM NO</th>
<th>EDP NO.</th>
<th>PART OR IDENTIFYING NO.</th>
<th>NOMENCLATURE OR DESCRIPTION</th>
<th>DATA: SPECS, REF DES, ETC.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37</td>
<td>2442-0100R-0861</td>
<td>CRCW2512-1000FT</td>
<td>RESISTOR R40</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>22</td>
<td>Z341-00.1U-0264</td>
<td>CO805C104K5RACTU</td>
<td>CAPACITOR</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>58</td>
<td>Z746-00001-0000</td>
<td>5015</td>
<td>TEST POINT C5</td>
<td></td>
</tr>
</tbody>
</table>

CHANGE TO 1K ohms Z442-00001K-0861

Populate with Z746-00001-0000
### DRAWING CHANGE HISTORY

<table>
<thead>
<tr>
<th>Drawing Name:</th>
<th>Integrated Locomotive CPU Common Module, A90410</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing Number:</td>
<td>A/S90410</td>
</tr>
<tr>
<td>Revision:</td>
<td>A1</td>
</tr>
<tr>
<td>Reason For Change:</td>
<td>Remove pull-down resistor R90 (10 K) on pin 1 of Q5 (not necessary)</td>
</tr>
<tr>
<td>Drawing Changes:</td>
<td>See below for details</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>QTY REQU</th>
<th>ITEM NO</th>
<th>EDP NO.</th>
<th>PART OR IDENTIFYING NO.</th>
<th>NOMENCLATURE OR DESCRIPTION</th>
<th>DATA: SPECS, REF DES, ETC.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>23</td>
<td>Z442-0010K-0111</td>
<td>CRCW0603-1002FRT1</td>
<td>RESISTOR</td>
<td>(R1 R2 R21 R22 N/U) R24 R29 R30 R31 R32 R33 R35 R45 R46 R90</td>
</tr>
</tbody>
</table>

**CHANGE TO:**

<table>
<thead>
<tr>
<th>QTY REQU</th>
<th>ITEM NO</th>
<th>EDP NO.</th>
<th>PART OR IDENTIFYING NO.</th>
<th>NOMENCLATURE OR DESCRIPTION</th>
<th>DATA: SPECS, REF DES, ETC.</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>23</td>
<td>Z442-0010K-0111</td>
<td>CRCW0603-1002FRT1</td>
<td>RESISTOR</td>
<td>(R1 R2 R21 R22 N/U) R24 R29 R30 R31 R32 R33 R35 R45 R46 (R90 N/U)</td>
</tr>
</tbody>
</table>


APPENDIX A – PUMP PROGRAM

INSTALLATION
The PUMP program is installed by running the SETUP.EXE application found on Disk 1. Using the installation defaults is recommended.

OPERATION
If default installation is used, the program will appear as PUMP in the Start Menu under Quantum. Upon execution, the program screen will appear as shown in Figure 2.

If this is the first time that you have run this program, use the Options menu choice and check the Communications Setup for the correct settings. The COM Port will depend upon your computer configuration, Baud Rate should be 9600 and the program should be set to Connect to 1 Device.

Make connections to the device you wish to PUMP and power up the device. After the device has powered up, click the Connect button on the PUMP screen. A dialog, as shown in Figure 3, will appear while the program is attempting to connect to the unit.

Once connected to the device, PUMP will display the device data as show in Figure 4 and display the Upload button.
To upload the new application, select the *Upload* button. A standard Windows™ file load dialog will appear. Select the application file supplied to you by Siemens and click the *Open* button. The dialog box as shown in Figure 5 will appear showing the selected file.

![Figure 4 - PUMP connected](image)

![Figure 5 - PUMP file selected](image)

Click the *Upload* button to begin the application update. PUMP will upload the application and, when completed, will display a dialog similar to Figure 6.

![Figure 6 - PUMP Complete](image)

Select the *Exit* button and then *Exit* on the main screen to end the program.
APPENDIX B – HOTCOMM PROGRAM

INSTALLATION
The QP-16373 HOTCOMM program is installed by running the SETUP.EXE application found on the program disk.

OPERATION
If the user did not change the default installation, the program will appear as HOTCOMM in the Start Menu under Quantum.

Connect the Q3452/V3452 unit to your computer and power up the unit. Wait for the unit to "boot up" before starting the HOTCOMM program. Once started, the HOTCOMM program will display its main screen as shown in Figure 7.

![Figure 7 – HOTCOMM](image)

If this is the first time you have run this program, check the Comm Setup under the Options menu and select the correct COM Port for your computer connection. Click the Run button to connect to the unit under test. When HOTCOMM establishes communication with the unit, the screen will display unit information similar to that as shown in Figure 8.

![Figure 8 – HOTCOMM](image)
At this point, HOTCOMM can be used to simulate the locomotive communication that the unit would normally receive in service. The following is a list of the fields and functions on the HOTCOMM screen:

<table>
<thead>
<tr>
<th>Field</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>QPN:</td>
<td>Siemens Part Number</td>
</tr>
<tr>
<td>SN:</td>
<td>Serial Number of the connected unit</td>
</tr>
<tr>
<td>App Ver:</td>
<td>Application version</td>
</tr>
<tr>
<td>ROM Ver:</td>
<td>Boot ROM version</td>
</tr>
<tr>
<td>Host</td>
<td>Host mode of the unit</td>
</tr>
<tr>
<td>EOT Type</td>
<td>Position of EOT protocol switch</td>
</tr>
<tr>
<td>1-Way</td>
<td>Shows COM mode 1-Way or 2-Way</td>
</tr>
<tr>
<td>No RTF</td>
<td>Shows COM errors</td>
</tr>
<tr>
<td>Emerg N/A</td>
<td>Shows if emergency is enabled</td>
</tr>
<tr>
<td>EOT Code</td>
<td>Enter the EOT code to be received here then click the Set Code button</td>
</tr>
<tr>
<td>Set Code</td>
<td>Button to click to set the entered EOT code</td>
</tr>
<tr>
<td>Brake Pressure</td>
<td>Brake Pressure from EOT</td>
</tr>
<tr>
<td>Arm Status</td>
<td>Armed status of EOT</td>
</tr>
<tr>
<td>Battery</td>
<td>Battery status of EOT</td>
</tr>
<tr>
<td>HVM</td>
<td>Marker status of EOT</td>
</tr>
<tr>
<td>Valve</td>
<td>EOT Valve status</td>
</tr>
<tr>
<td>Motion</td>
<td>Motion status of EOT</td>
</tr>
<tr>
<td>Proto</td>
<td>External input for ICE or IFC</td>
</tr>
<tr>
<td>Prog</td>
<td>Unused external input</td>
</tr>
<tr>
<td>Rem</td>
<td>Unused external input</td>
</tr>
<tr>
<td>UDE</td>
<td></td>
</tr>
<tr>
<td>Arm</td>
<td>Arm button</td>
</tr>
<tr>
<td>Brake</td>
<td>Emergency brake button</td>
</tr>
<tr>
<td>Disarm</td>
<td>Disarm button</td>
</tr>
<tr>
<td>COMM Test</td>
<td>COM Test button</td>
</tr>
<tr>
<td>Run / Stop</td>
<td>Starts and stops HOTCOMM</td>
</tr>
<tr>
<td>Tone</td>
<td>Selects the transmitted tone</td>
</tr>
<tr>
<td>High Pwr.</td>
<td>Check this box to transmit high power in AAR mode</td>
</tr>
<tr>
<td>NS FSK</td>
<td></td>
</tr>
<tr>
<td>Start TX Test / Stop Tx Test</td>
<td>Starts and stops the transmit test</td>
</tr>
<tr>
<td>Error List</td>
<td>List of current errors from Q3452 unit</td>
</tr>
<tr>
<td>Quit</td>
<td>Quits the HOTCOMM program</td>
</tr>
</tbody>
</table>

**Table 3 - HOTCOMM Fields**
APPENDIX C – ALIGNMENT

WARNING
ALIGNMENT MUST ONLY BE PERFORMED BY QUALIFIED AND TRAINED SERVICE PERSONNEL.

The DTX module is aligned at the factory before shipment and should need no further adjustment. It is possible that the gain settings for the audio input and output signal paths may need optimized. The frequency trim, deviation, and balance should not need adjustment. The procedure for performing all of the alignment steps is detailed below. The unit should not be opened for alignment; all adjustments are electronic and effected through the programmer software.

REQUIRED TEST EQUIPMENT

Depending upon which alignment steps are to be performed, some or all of the following pieces of test equipment may be required:

DC Power Supply - capable of operating at the correct voltage for the module and capable of 2.5 Ampere minimum current.

RF Signal Generator - capable of operating at the carrier frequency of the module with an output level adjustment and able to be frequency modulated.

FM Demodulator/Deviation Meter - capable of operating at the carrier frequency of the module.

RF Frequency Counter - must operate at the RF frequency of the unit with a resolution of 10 Hz or better and an accuracy of +/-1 ppm (+/-150 Hz at VHF, +/-450 Hz at UHF) or better.

Audio Oscillator - must have sine wave output allow for output frequency and amplitude adjustment.

Oscilloscope

RF Power Attenuator or Dummy Load with coupled output - must be 50 ohms impedance at the operating frequency and rated for the output power of the module and have an output which can drive the FM demodulator at the correct level and the frequency counter.

RF Power Meter - capable of accurately indicating the RF output power of the module.

NOTE

Except for the power supply, a two-way radio test set may include most, if not all, of the required equipment.
ALIGNMENT PROCEDURE

It is not absolutely necessary to perform all of the alignment steps detailed below. However, some adjustments interact with others e.g. balance affects deviation, deviation affects AUX IN gain, and the output power AUX IN gain have a slight effect on TX frequency trim. It may be prudent to spot check all of the adjustments which interact. These will be indicated in the particular alignment step.

The programmer must be connected to the unit via the programming interface cable and the alignment screen selected. During alignment, the channel may be selected via the channeling control lines on the module or through the programmer. A channel pull-down menu allows for the selection. Also, the unit can be keyed through the programmer, if desired.

NOTE

Interrupting the power supply to the unit while the programmer software is open will require exiting the software and re-opening it.

RX FREQUENCY TRIM

The RX Frequency Trim trims the unit frequency during receive. This setting, if incorrect, may degrade receive sensitivity, distortion, and possible recovered audio level, which in turn affects AUX OUT (RX) Gain and Audio PA Gain. The receive frequency trim is not affected by any other alignment step.

To determine if the receiver is correctly trimmed to frequency, the 1st local oscillator frequency must be measured.

WARNING

DO NOT KEY THE UNIT DURING THIS PROCEDURE AS SERIOUS DAMAGE TO THE COUNTER MAY RESULT!

A channel with a receive frequency programmed into it should be selected. The correct local oscillator will be displayed on the programmer channel box. The frequency on the counter should be observed and the RX Frequency Trim value adjusted for least error. Because of the very low local oscillator level at the antenna terminals, the frequency counter may not be able to read the frequency. If so, perform the TX Frequency Trim adjustment detailed later and set the RX Frequency Trim value to match that of the proper TX Frequency Trim value.
AUX OUT GAIN

To set the AUX OUT gain, an RF signal generator must be connected to the DTX module. Its frequency should be set to that of a programmed channel. The generator should be modulated at the desired deviation, typically 60 % of maximum, with a 1 kHz tone. The RF output level is not critical, but should be above any squelch threshold which may have been set. –70 dBm should be sufficient. If not, squelch can be disabled via the settings menu of the programmer for this procedure.

With an oscilloscope connected to the AUX OUT output, the AUX OUT Gain setting should be set to value which produces the desired output level.

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>The output impedance of the AUX OUT is about 600 ohms. If the load impedance of the load that will be connected to this output is less than 10 kΩ or so, a resistor of a value equal to the load impedance should be connected to the AUX OUT output when making the adjustment.</td>
</tr>
</tbody>
</table>

AUDIO PA GAIN

To set the Audio PA gain, an RF signal generator must be connected to the DTX module. Its frequency should be set to that of a programmed channel. The generator should be modulated at the desired deviation, typically 60 % of maximum, with a 1 kHz tone. The RF output level is not critical, but should be above any squelch threshold which may have been set. A –70 dBm level should be sufficient. If not, squelch operation can be disabled via the settings menu of the programmer.

With an oscilloscope connected to the AUDIO OUT output, the AUDIO OUT Gain setting should be set to value which produces the desired output level.

CARRIER DETECT ON AND CARRIER DETECT OFF

The Carrier Detect On and Carrier Detect Off settings control the RF level (or Signal-to-noise ratio) at which the DCD output goes true and what level at which it goes false. To prevent chattering on noise, these two settings are not normally the same. 3 to 5 dB of hysteresis is usually provided i.e. if the RF signal level is increased from zero, at some point, the DCD output will go from false to true. The RF level may then have to be decreased by several dB before the DCD output goes false again. This prevents chattering with signal levels near the carrier detect level. If squelch is enabled, the receive audio muting will follow the DCD output. The desired carrier detect levels can be directly entered via the alignment screen in dBm and then fine-tuned with a high quality signal generator, if necessary.

To determine the state of the DCD output, connect a DC coupled oscilloscope or DVM to the DCD output. It may help to disable the squelch via the Monitor input or Monitor button on the programmer so that the receive audio signal can be continuously observed i.e. not squelched when DCD is false.
TX LOW POWER AND HIGH POWER

The transmitter output power level can be programmed on a per channel basis via the alignment page of the programmer. If RNet Compatibility has not been programmed on the settings page, both the low and high power levels can be set. If RNet Compatibility has been programmed, only high power can be set. The TX High Power and TX Low Power settings in the TX Power box act to select a common value for all channels. Individual values for each channel can be entered in the per channel boxes at the bottom of the screen. Power is set in watts with a resolution of 0.1 watt. The power level can be confirmed and fine-tuned, if desired, by connecting the radio to an accurate wattmeter.

AUX IN GAIN

To set the Aux In gain, an audio oscillator or appropriate signal source (e.g. modem) should be connected to the Aux In input at the desired input level. An FM deviation meter should be connected to the antenna connector through a suitable attenuator or coupler. The unit should be keyed for transmit and the Aux In gain should be adjusted for the desired deviation, typically 60% of rated deviation.

TX FREQUENCY TRIM

This setting is used to trim the transmitter to frequency. This value should not normally need adjustment. However, as the unit ages and/or if the transmitter power or the Aux In gain is changed significantly, slight corrections may be prudent.

NOTE

Any adjustments must be made at a unit temperature of 25 ±2 °C (77 ±1.8 °F). Due to internal heating, this adjustment must not be made after the unit has been transmitting unless it has been allowed to cool to the correct temperature. Likewise, the adjustment itself should be made as quickly as possible.

The unit should be set to a channel which is at an output power which is close to what will be used the majority of the time. The RF output of the unit should be coupled to a frequency counter through a suitable attenuator or coupler. Ensure that no modulation source is connected to the MIC IN or AUX IN. The PTT should be activated and the TX Frequency Trim value adjusted for the correct frequency. The value can be changed while the unit is transmitting.
DEVIAITION AND BALANCE

The deviation adjustments are used to set the maximum limiting deviation of the transmitter. This must be set properly to ensure that the unit will meet the regulatory spurious emissions requirements, in particular, occupied bandwidth. The balance adjustment is used to ensure a proper relationship between the modulating signal to the reference and to the VCO. If the ratio i.e. balance is not correct, the transmit audio frequency response will not be correct which could result in a distorted data waveform.

The optimum values for deviation and balance vary in a predictable manner as a function of carrier frequency. In order to relieve the user of having to adjust deviation and balance each time a transmit frequency is entered or changed the radio calculates the required values based upon the correct values for two special alignment frequencies. These required values have already been determined at the factory and are stored in the unit. As transmit frequencies are entered or changed, new calculated values will appear in the per channel boxes at the bottom of the screen. These values can be changed on a channel by channel basis, if desired.

The procedure detailed here is for setting the deviation and balance at the special alignment frequencies so that the deviation and balance will be correct at any programmed frequency. This same procedure can be used to set any given channel values in the per channel boxes.

An FM demodulator should be connected to the RF output of the module through a suitable power attenuator or coupler. The demodulator filters should be set for no de-emphasis, as low a high pass cutoff as possible (<50 Hz, preferably down to DC), and a low pass cutoff of approximately 15 kHz. The demodulator output should be connected to an oscilloscope so that it can be observed.

An audio oscillator should be connected to the AUX IN input. The output waveform should be sine, the level at zero, and at a frequency of 500 Hz. Confirm that the Aux In Gain value is at least 10.

On the channel drop-down menu, select lower band edge. Activate the PTT, and while observing the demodulated waveform on the oscilloscope, begin increasing the audio oscillator’s output level or the Aux In setting. The waveform should begin as a sine wave and at some point show clipping. The clipped portion may not necessarily be flat. The audio oscillator level should be set so that a substantial portion of the waveform is clipped, at least 50%. Adjust the balance value so that the clipped portion is flat i.e. horizontal rather than tilted. Although the programmer can change values while transmitting, it is better to unkey between value entries. After the balance is set, the deviation should be set to a value of 1.2 kHz for a very narrow channel, 2.3 kHz for a 12.5 kHz channel or 4.6 kHz for a 25/30 kHz channel. Select the upper band edge on the channel menu and repeat. As a result of this procedure, the per channel balance and deviation values may have changed.