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Maintenance Manual
LBI-38203
Rev. D, Feb/07

TQ0609 TEST BOX

MANUAL REVISION HISTORY

REV	DATE	REASON FOR CHANGE
D	Feb/07	Updated to include use with JAGUAR 700P, P7100/P5100, and P7200 portables and added the audio interconnect cables between a Jaguar/P7100/P5100/P7200 and the Test Box.

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TABLES

1 CONVENTIONS

1.1 SAFETY SYMBOLS

The following conventions are used throughout this manual to alert the user to general safety precautions that must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. Harris Corporation assumes no liability for the customer's failure to comply with these standards.

The WARNING symbol calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING symbol until the conditions identified are fully understood or met.

The **CAUTION** symbol calls attention to an operating procedure, practice, or the like, which, if not performed correctly or adhered to, could result in a risk of danger, damage to the equipment, or severely degrade the equipment performance.

The **NOTE** symbol calls attention to supplemental information, which may improve system performance or clarify a process or procedure.

The **ESD** symbol calls attention to procedures, practices, or the like, which could expose equipment to the effects of **E**lectro-**S**tatic **D**ischarge. Proper precautions must be taken to prevent ESD when handling circuit modules.

1.2 IMPORTANT INFORMATION

M-RK SPEAKER output is only for test equipment and not an external speaker. Connecting a speaker could damage the test box's internal isolation transformer.

2 DESCRIPTION

2.1 GENERAL DESCRIPTION

The TQ0609 test box is the interface for connecting test equipment to the personal radio under test. The connection point on the personal radio is the Universal Device Connector (UDC). Most of the UDC connections are brought out to tip jacks on the top of the box for easy connections to the meter leads of a volt/ohm meter. TX or microphone audio is input to the radio through the standard ¾ inch centered banana jacks. Keying of the radio is accomplished with the center PTT switch. Pressing the switch to either side will key the radio. The lock position of the switch frees the user's hands for operation of test equipment. The most noticeable feature of the test box is the UDC switch. The UDC switch selects different resistors that simulate the different external options that the radio may use.

Whenever the radio is turned on, and periodically during operation, the resistance of the UDC lead to A- is measured. The resistance determines the option that is connected to the radio. The UDC switch of the test box selects the different resistors to simulate the options. Table 2-1 lists the resistors values and the associated options.

Table 2-1: UDC Switch Resistance Options

EXTERNAL OPTION RESISTOR VALUE TABLE		
UDC POSITION	**RESISTOR VALUE Ω 1%**	**OPTION DESCRIPTION***
1	0	Programmer - Radio will go into the programming mode.
2	3740	Speaker Microphone (with or without antenna - SW A+ is used as mute lead)
3	4420	Earphone
4	5360	Vehicular Charger (Standard)
5	6490	Vehicular Charger (Inverted Display)
6	7680	External Microphone
7	9530	Speaker Microphone (SW A+ is on in TX and active RX mode)
8	3160**	Deluxe Vehicular Charger
9	2210**	VGE/DES Keyloader
10	1540**	M-RK Data Applications
11	OPEN	No external options. Switch used for future expansions.
12***	OPEN	No external options. Switch used for future expansions.

* The option descriptions are general statements, because exact operation can vary with the model of the radio and the revision of operation code in the radio.

** The resister is not installed, but can be added if needed.

*** It is advisable to keep one position open to simulate no option attached.

2.2 TQ0609A VERSION

The original design of the test box was limited to the MPD family of radios that used a common UDC connector. The test box contained a hard wired cable and UDC connector. To make the box more versatile, the cable is removed and a D15-M connector is added to the side of the box. The cable to test a particular model of radio is not included with the test box and must be ordered separately. See Section 5 for test cables.

All functions of the UDC are retained, as well as the ability to test the speaker audio of the M-RK radio when the radio is disassembled. The MRK speaker circuit is loaded with an internal 16 Ω resistor (two 32 Ωs in parallel) and isolated with an internal 1:1 transformer. The output of the speaker circuit is available at the M-RK SPEAKER banana jacks on the side of the TQ0609A test box.

M-RK SPEAKER output is only for test equipment and not an external speaker. Connecting a speaker could damage the test box's internal isolation transformer.

2.3 APPLICABLE PERSONAL RADIOS

The compatibility and application of the box to a particular radio is limited mainly by the cable connecting to the radio. Not all personal radios comply with the UDC resistor convention. For a list of the applicable radios, refer to Section 5.

3 TEST POINTS AND CONTROLS

The terminals or leads of the UDC meet certain requirements for input or output. The exact requirements are a function of software and hardware. For exact operation, refer to the software release notes for the radio, the maintenance manual for the radio, and information from Harris. The lead labels on the box may not agree with the lead labels within a particular radio, but agree with the function. The following tables describe the terminals and test points on the test box.

TEST POINTS	
LABEL	**LEAD DESCRIPTION**
RX-AUD	Audio out of the receiver after the volume control but before the audio power amplifier. It is not de-emphasized and is used to run external amplifiers such as the speaker/mic and vehicular charger. The audio is switched out following the mute lead.
$\overline{T}$/R	This lead is about 5.25 VDC in the receive mode and drops to less than .2 VDC in the transmit mode. This lead will change even with no external option connected.
MUTE	This lead should be labeled MUTE bar because it is low when the receiver is muted and high when the receiver is unmuted. It is an open collector type output, so an external pull-up resistor must be used or use an ohm-meter to measure an open (hi) or short (low). This lead will also change even with no external option connected.
EMER	Emergency is the point that goes to ground when the emergency button is pressed on the external microphone or vehicular charger. It is also the point where the external G-STAR lanyard is connected. **CAUTION** If G-STAR lanyard option is enabled for the radio, this terminal must be shorted to A- with a jumper of wire, before the radio is powered on. If not the radio will sense it is in an emergency and will key and possibly damage your equipment.
DISC	This is the discriminator output of the receiver. Unfiltered audio is always at this terminal. With no signal, there is about 825 mV rms riding on about 2.5 VDC at this terminal. This is only applicable to the MPD and MPA family of radios.
CTS	Clear to Send is used during programming of the radio and the levels at this terminal are also dependent on the type of radio connected. This is only applicable to the MPD and MPA family of radios.
RX-DATA	This lead is used in programming and mobile data applications of the radio. Data enters the radio on this lead.
TX-DATA	This lead is used in programming and mobile data applications of the radio. Data leaves the radio on this lead. This lead must be low or shorted to ground for the radio to read the value of the external resistor connected to the UDC sense lead.

TEST POINTS	
LABEL	**LEAD DESCRIPTION**
BAT-SW (SWA+)	This lead is used to power external options, such as the programming interface box and the speaker/mic options. It is active when an external speaker is connected and the receiver is unmuted. For the M-RK, LPE, JAGUAR 700P, P7100 and P7200 families of radios, this lead is also active in the transmit mode when an external microphone is used. This will supplement the mic/high bias of some external microphone circuits. JAGUAR 700P and P7100 series radios appear to have a charged capacitor on this lead when not active and a digital voltmeter will show some voltage. To get a better reading, use a 20k Ω/V voltmeter for measurement or use a 1k Ω resistor to load the circuit.
A-	This is battery A- and all reference measurements are from this point. This is the same point as the black terminal of the microphone input.

OTHER BOX CONNECTIONS AND CONTROLS	
LABEL	**LEAD DESCRIPTION**
MIC HI	Red banana jack input to apply transmit audio. This input is DC coupled and should have about 2.5 VDC on the terminal from the radio under test. This voltage is used to provide bias for the external microphone. If the test audio generator/oscillator can be damaged by this voltage, one may elect to isolate the circuit from the oscillator by placing about a 10 to 220 µF capacitor in series with the MIC HI line.
Black Banana Jack	This jack is tied to the A- test point and is the ground connection for the audio test equipment.
UDC	This test point is the wiper of the UDC switch and can be used to measure the resistor value that is selected. Measure the resistor when a radio is not connected. When a radio is connected, this point can be used to measure the voltage that the radio is actually measuring.
M-RK SPEAKER	Two Red banana jacks that are used to measure the speaker audio of an M-RK when the radio is disassembled and connected to the test box using the K19/AS00000420 test cable. These leads are the output of an isolation transformer. One side can be grounded, but an impedance load like a speaker should not be connected. The speaker load is internal to the box. CAUTION **M-RK SPEAKER** output is only for test equipment and not an external speaker. Connecting a speaker could damage the test box's internal isolation transformer.
TX-DATA Switch	This switch is located on the front side of the test box and should be placed into the 0 position for normal operation with the radio. The 0 on the TX DATA line will flag the software of the radio that the resistor connected to the UDC line is valid. If the TX DATA switch is in position 1, the radio may ignore the UDC resistor and not go into a mode that supports the correct external option.
UDC Rotary Switch	Use to select the 1% resistor that tells the radio what external option is connected. Some positions are left vacant in manufacture so that specific resistors may be added to meet specific applications.

4 TESTING THE RADIOS

This section provides the general use for each position of the switch or resistor value for testing. Refer to the radio maintenance manual for particular procedures.

4.1 POSITION 1 – 0 Ω

With radio power off, connect the TQ0609A to the UDC of the radio. Place the UDC switch to position 1. Place the TX-DATA switch into position 0. The TX-DATA switch must be in position 0 for the radio to recognize that an external option is present. Apply power to the radio. The radio should go into the programming mode. About 7V can be measured at the BAT-SW terminal for the radios except for the TPX. This voltage is needed to power the programmer interface while programming and to power the speaker circuits of the speaker microphone option.

4.2 POSITION 2 – 3740 Ω

Remove power from the radio. Place the UDC switch into position 2 and apply power to the radio. The radio now assumes that the speaker microphone is attached. The radio can be keyed by pressing the PTT switch momentarily to the left or locking it into the transmit mode by placing the switch to the right position. Transmit audio can now be applied through the red MIC HI input. Transmitter tests may be performed on the radio. Receive audio power amplifier circuits are not utilized in this test but if a valid signal is received there will be about 7V at the BAT-SW lead and the recovered audio may be seen at the RX AUDIO lead. This is the audio after the volume control but before the audio power amplifier. The level of the audio is varied by the audio control and may go to around .5V rms (noise) at the RX-AUD terminal. While the receiver audio circuits are squelched, there is about a 1 Ω short to ground at the MUTE lead. When a signal is received, the MUTE leads resistance goes to open (above 1 MΩ).

4.3 POSITION 3 – 4420 Ω

Remove power from the radio. Place the UDC switch into position 3 and apply power to the radio. The radio now assumes that the earphone option is attached. Transmitter audio and keying is the normal internal microphone and the PTT bar on the side of the radio. The internal receive audio power amplifier is disabled and RX-AUD lead operates as step 2. But there is no 7 VDC at the BAT-SW lead when the radio is unmuted.

4.4 POSITION 4 – 5360 Ω

Remove power from the radio. Place the UDC switch into position 4 and apply power to the radio. The radio now assumes that the vehicular charger option is attached. The radio should perform the same as when the UDC switch was in position 2. The M-RK radio's display should appear normal.

4.5 POSITION 5 – 6490 Ω

Remove power from the radio. Place the UDC switch into position 5 and apply power to the radio. The radio now assumes that the vehicular charger option is attached. The radio should perform the same as when the UDC switch was in position 2. M-RK radios will display an inverted display in position 5.

4.6 POSITION 6 – 7680 Ω

Remove power from the radio. Place the UDC switch into position 6 and apply power to the radio. The radio now assumes that the external microphone option is attached. The transmitter circuits work as if an external

microphone is connected as in step 1, but now the audio circuits of the receiver are enabled. This is the most convenient position to test the audio and RF portions of the radio.

4.7 POSITION 7 – 9530 Ω

Remove power from the radio. Place the UDC switch into position 7 and apply power to the radio. The radio now assumes that the speaker microphone option is attached. This position works as position 2 but 7 VDC at the BAT-SW lead is always present.

4.8 POSITION 8 – 12

Switch positions 8 through 12 are left open so that resistors may be added for future expansions. Always keep one open so that you can switch to normal mode without an external option.

5 TEST CABLES

TEST CABLES	
CABLE PART NUMBER	**APPLICATION DESCRIPTION**
K19/A4WX01541 	*MPD, TPX, MPA and MTA Personal Radios* Connects the TA0609A to the UDC of the radio. The RF connection of the radio is available through a BNC connection for testing the transmitter and receiver. NOTE Part has been discontinued and is no longer available.
RPM1132472/6 	*M-RK and LPE Personal Radios* Connects the TQ0609A to the UDC of the Radio. Original part number was 19B801971P6.
K19/AS00000420 	*M-RK Personal Radios* Connects the TQ0609A to the System Control Board when the cover is off of the radio.
RPM1132472/24 	*JAGUAR 700P, P7100, P5100 and P7200 Personal Radios* Connects the TQ0609A to the UDC of the Radio

6 MODIFICATIONS

Modifications to the test box are often performed to support the needs of the field technician. While modifications are encouraged, Harris can not be responsible for problems or failures caused by the modification. Be cautious and safe in all modifications.

6.1 ADDING UDC RESISTORS

Add additional UDC resistors by soldering the resistor to an unused terminal of the UDC and the common junction of the resistors. The resistors are metal film ¼ watt, 1% resistors. The resistors can be purchased from an electronics parts supplier.

6.1.1 2210 Ω Resistor

Used to simulate the keyloader cable is connected (2.7 kΩ and 12.0 kΩ resistors in parallel).

6.1.2 3160 Ω Resistor

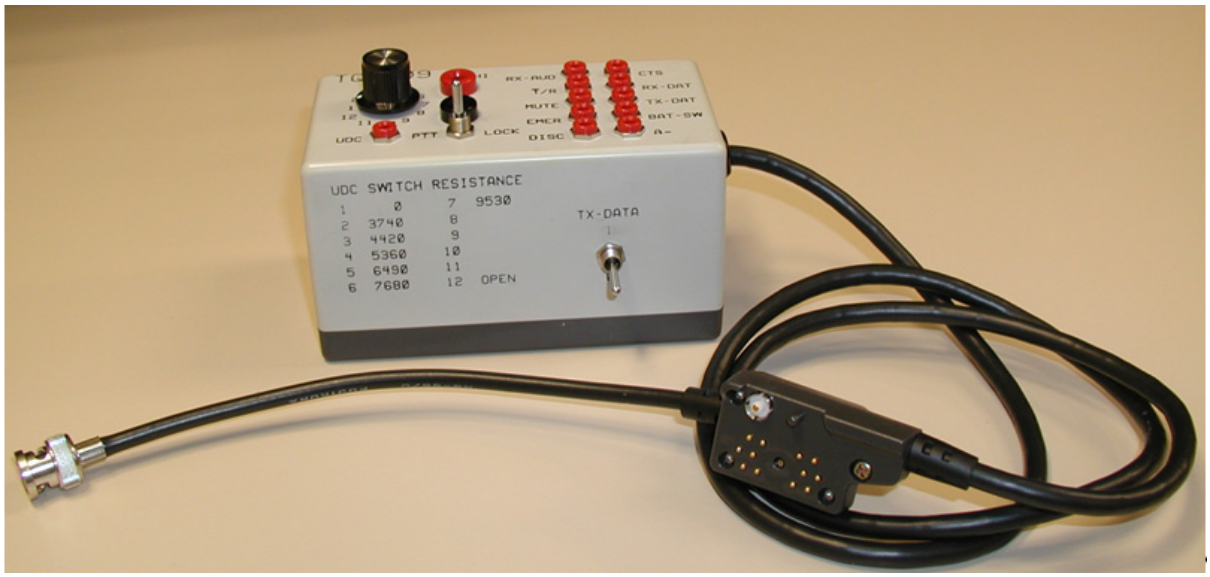
Simulates the Deluxe or enhanced vehicular charger is attached. LPE-200 does not support the Orion style control unit (3.9 kΩ and 16.0 kΩ resistors in parallel).

6.1.3 1540 Ω Resistor

Simulates the mobile data applications cable is attached (2.2 kΩ and 5.1 kΩ resistors in parallel).

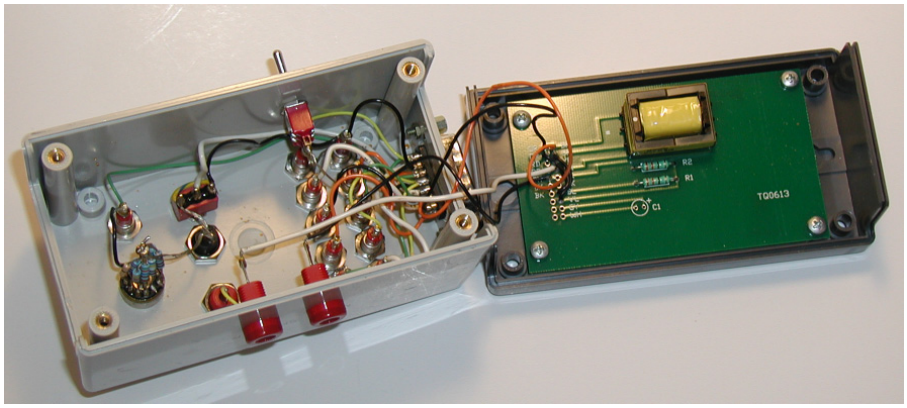
7 PICTURES AND DRAWINGS

7.1 TQ0609A FRONT VIEW

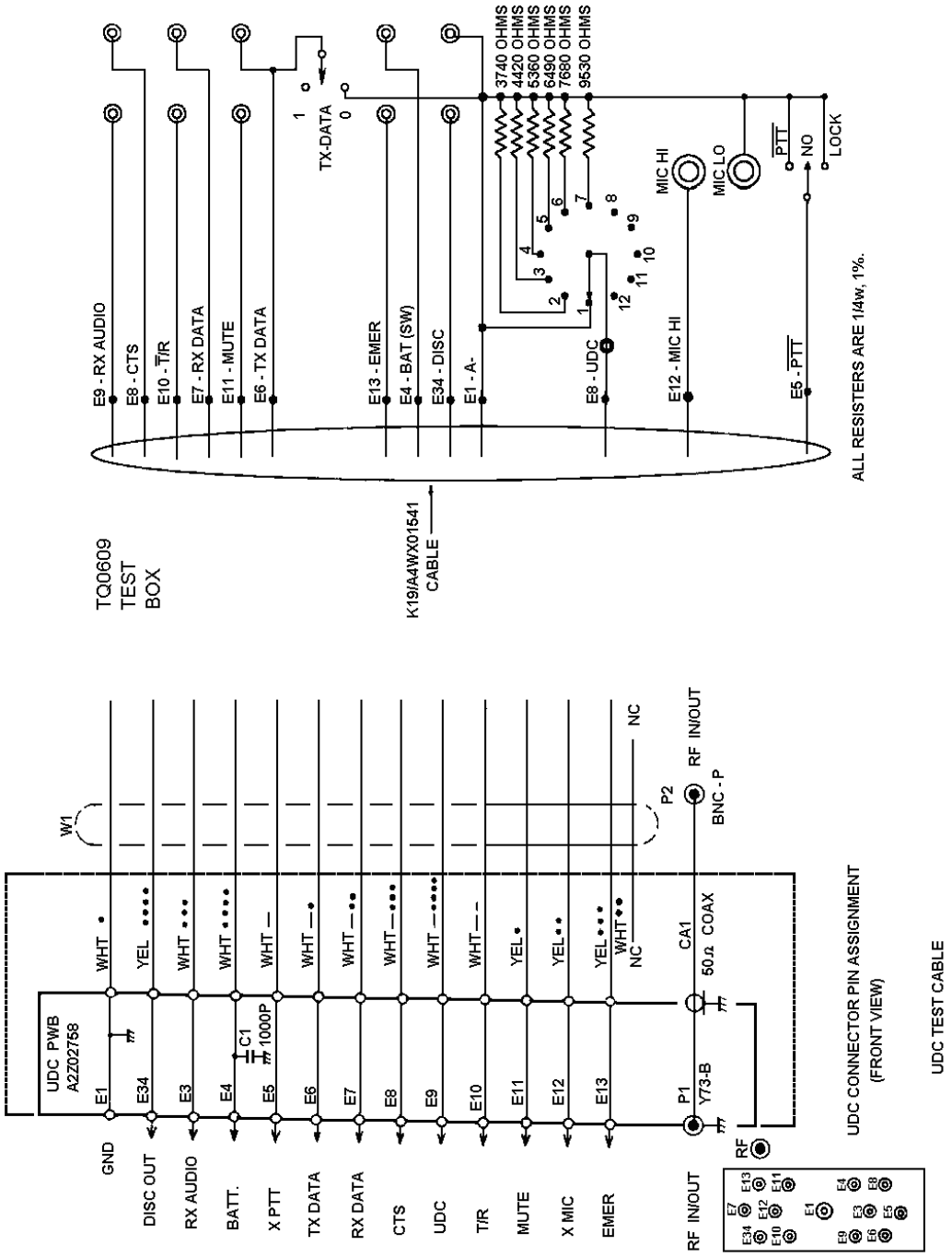


7.2 TQ0609A TOP AND REAR SIDE VIEW

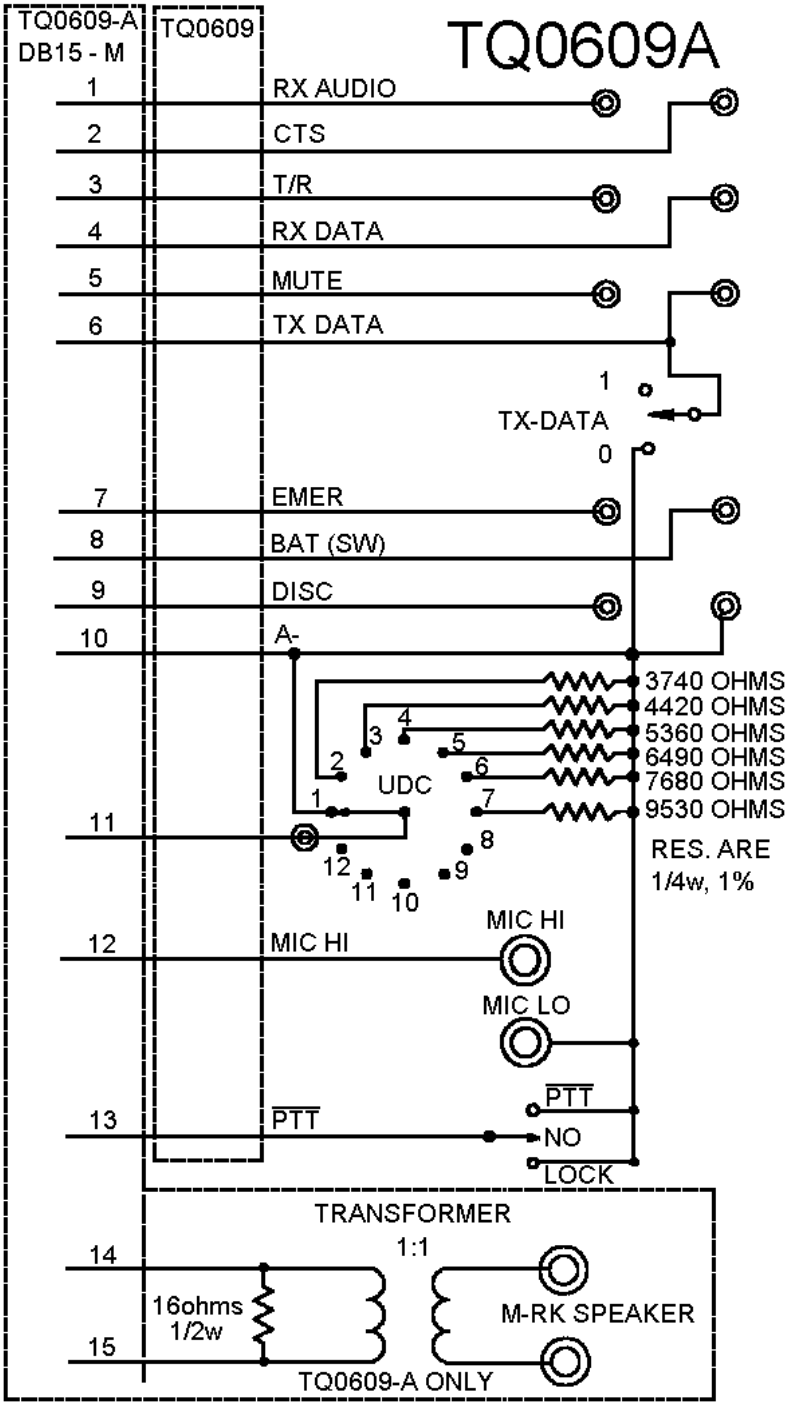
7.3 TQ0609A INSIDE VIEW



7.4 TQ0609 TEST BOX SCHEMATIC DIAGRAM

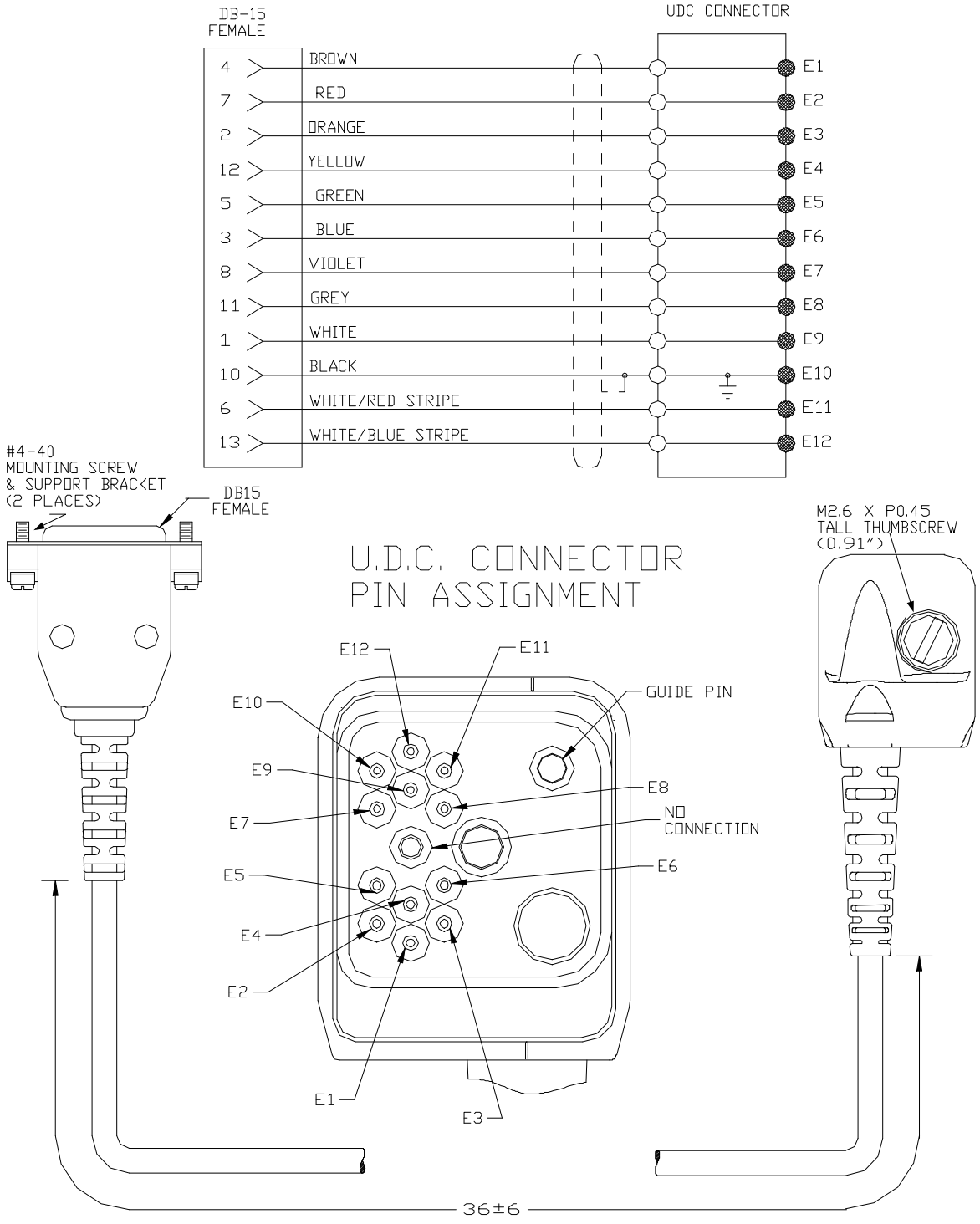


7.5 TQ0609A SCHEMATIC DIAGRAM

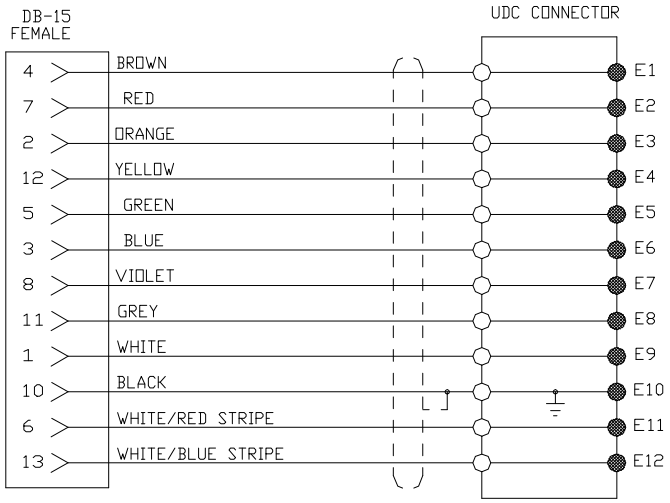


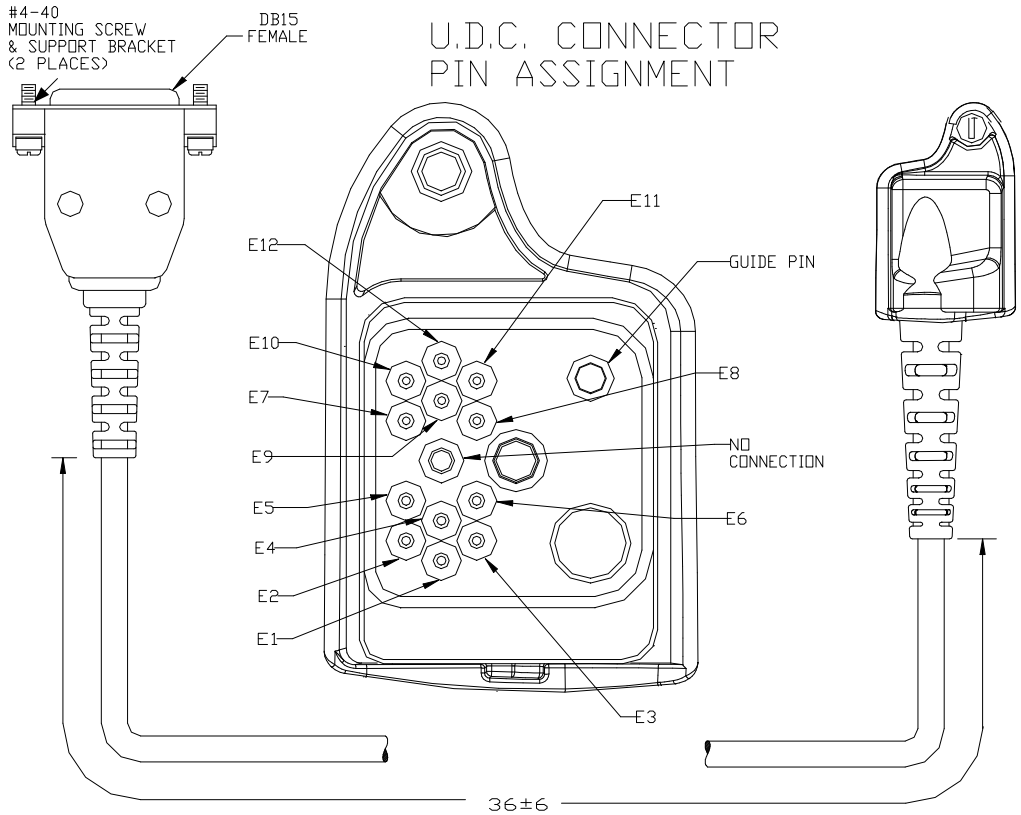
Rev-A: Transformer and load added to test M-RK radios. DB15M connector added and test cable for M-PD/M-PA families changed to have a DB15-F connector on the cable rather wired into the test box. Box changed to TQ0609-A.

7.6 RPM1132472/6 CABLE DIAGRAM (M-RK AND LPE-200 RADIOS)



7.7 RPM1132472/24 CABLE DIAGRAM (JAGUAR 700P, P7100, P5100 AND P7200 PERSONAL RADIOS)





8 REPLACEABLE PARTS

The parts used in the manufacture of the TQ0609 are generic and considered to be common parts. Common parts can be purchased from your preferred electronic components supplier. A parts list is provided giving the description of the part for easier ordering or substitution.

8.1 PARTS LIST

TQ0609 PARTS LIST		
NOMENCLATURE	**DESCRIPTION**	
Red Tip Jacks	Pin Jack; Red; 10 A; 1500 V (RMS); Nylon 6/6 per ASTM D4066; 115 deg C; 0.080 in	
Red Banana Jack	Banana Jack; Red, 7000 V (RMS) (Min.); 15 A; Nylon 6/6 per ASTM D4066	
Black Banana Jack	Banana Jack; Black, 7000 V (RMS) (Min.); 15 A; Nylon 6/6 per ASTM D4066	
UDC Switch	Switch, SINGLE Rotary, Solder Terminal, 1/2 IN DIAMETER, 1 POLE, 2-12 Position >Similar to Grayhill 56D30-01-1-AJN	
PTT Switch	Switch, miniature toggle, SPDT (On - Off, - Mom) >Similar to C&K 7107	
Data Switch	Switch, miniature toggle, SPDT (On – None - On) >Similar to C&K 7101	
UDC Resistors	Resistor Metal Film Epoxy Coated, ¼ watt, 1%	
Installed	Installed	Not Installed
3740Ω	3740Ω	2210Ω
4420Ω	4420Ω	3160Ω
5360Ω	5360Ω	1540Ω
6490Ω	6490Ω	
7680Ω	7680Ω	
9530Ω	9530Ω	
TQ0609 ONLY		
W1	Test Cable – K19/A4WX01572	
C1	Capacitor, Ceramic 1000 pF	
TQ0609A ONLY		
	Board from TQ0613	
T1	Transformer, Audio 1:1 Similar to Tamura TTC-142	
R1 & R2	Resistor , Composite ¼ watt, 5%, 16 Ω	
Test Connector	DB15-M solder connector	

8.2 SERVICE PARTS

If any part of the Harris equipment is damaged on arrival, contact the shipper to conduct an inspection and prepare a damage report. Save the shipping container and all packing materials until the inspection and the damage report are completed. In addition, contact the Harris Customer Resource Center to make arrangements for replacement equipment. Do not return any part of the shipment until you receive detailed instructions from a Harris representative.

Replaceable assemblies and component items listed in the Service Parts section of maintenance manuals may be ordered through the Harris Customer Resource Center. These items are also listed in the Harris Service Parts and Accessories Catalog.

To order replacement parts from the Harris Customer Resource Center, fax, email, or call our resource center at the following:

U.S. & Canada:

Phone Number: 1-800-368-3277 (toll free)

Fax Number: 1-800-833-7592 (toll free)

E-mail: PSPC_CustomerFocus@harris.com

International:

Phone Number: 1-434-455-6403

Fax Number: 1-434-455-6676

E-mail: PSPC_InternationalCustomerFocus@harris.com

Service Parts

C100650

Thumbscrew for RPM1132472/6 test cable

SPK0203

¼ Turn Screw for RPM1132472/24 Test Cable – Includes instructions, screw and E-ring.

9 TECHNICAL ASSISTANCE

The Technical Assistance Center's (TAC) resources are available to help with overall system operation, maintenance, upgrades and product support. TAC is the point of contact when answers are needed to technical questions.

Product specialists, with detailed knowledge of product operation, maintenance and repair provide technical support via a toll-free (in North America) telephone number. Support is also available through mail, fax and e-mail.

For more information about technical assistance services, contact your sales representative, or contact the Technical Assistance Center directly at:

North America:	1-800-528-7711
International:	1-434-385-2400
Fax:	1-434-455-6712
E-mail:	PSPC_tac@harris.com

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