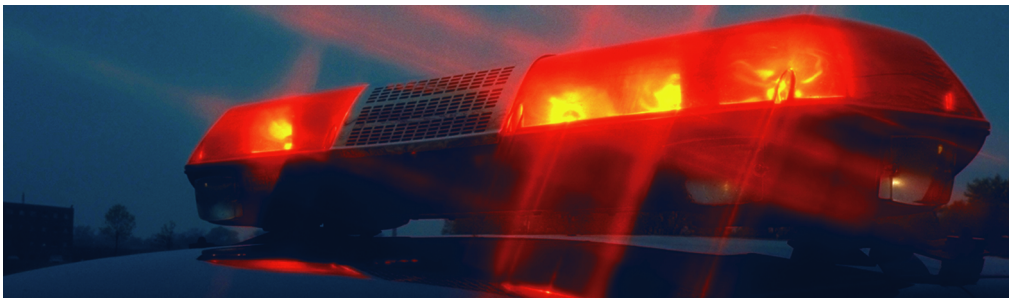
ASTRO® XTL™ 5000

Digital Mobile Radio

03 Control Head

Installation Manual

MOTOROLA



Foreword

This manual covers the O3 model of the ASTRO® XTL™ 5000 digital mobile radios. It includes all the information necessary to maintain peak product performance and maximum working time, using levels 1 and 2 maintenance procedures. This level of service goes down to the board replacement level and is typical of some local service centers, self-maintained customers, and distributors.

For details on radio operation or component-level troubleshooting, refer to the applicable manuals available separately. A list of related publications is provided in the section “Related Publications,” on page vii.

Product Safety and RF Exposure Compliance

See “Installation Requirements for Compliance with Radio Frequency (RF) Energy Exposure Safety Standards,” on page iii.

Manual Revisions

Changes which occur after this manual is printed are described in FMRs (Florida Manual Revisions). These FMRs provide complete replacement pages for all added, changed, and deleted items.
To obtain FMRs, go to https://businessonline.motorola.com.

Parts Ordering

See Appendix A: Replacement Parts Ordering for information on how to obtain replacement parts. For part numbers, refer to the ASTRO XTL 5000 Digital Mobile Radio Basic Service Manual (Motorola publication part number 6881096C73).

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Installation Requirements for Compliance with Radio Frequency (RF) Energy Exposure Safety Standards

ATTENTION!

This radio is intended for use in occupational/controlled conditions, where users have full knowledge of their exposure and can exercise control over their exposure to meet FCC limits. This radio device is NOT authorized for general population, consumer, or any other use.

To ensure compliance to RF Energy Safety Standards:

- Install only Motorola approved antennas and accessories
- Be sure that antenna installation is per “Antenna Installation,” on page 2-18 of this manual
- Be sure that Product Safety and RF Safety Booklet enclosed with this radio is available to the end user upon completion of the installation of this radio

Before using this product, the operator must be familiar with the RF energy awareness information and operating instructions in the Product Safety and RF Exposure booklet enclosed with each radio (Motorola Publication part number 68P81095C99) to ensure compliance with Radio Frequency (RF) energy exposure limits.

For a list of Motorola-approved antennas and other accessories, visit the following web site which lists approved accessories for your radio model: http://www.motorola.com/governmentandenterprise

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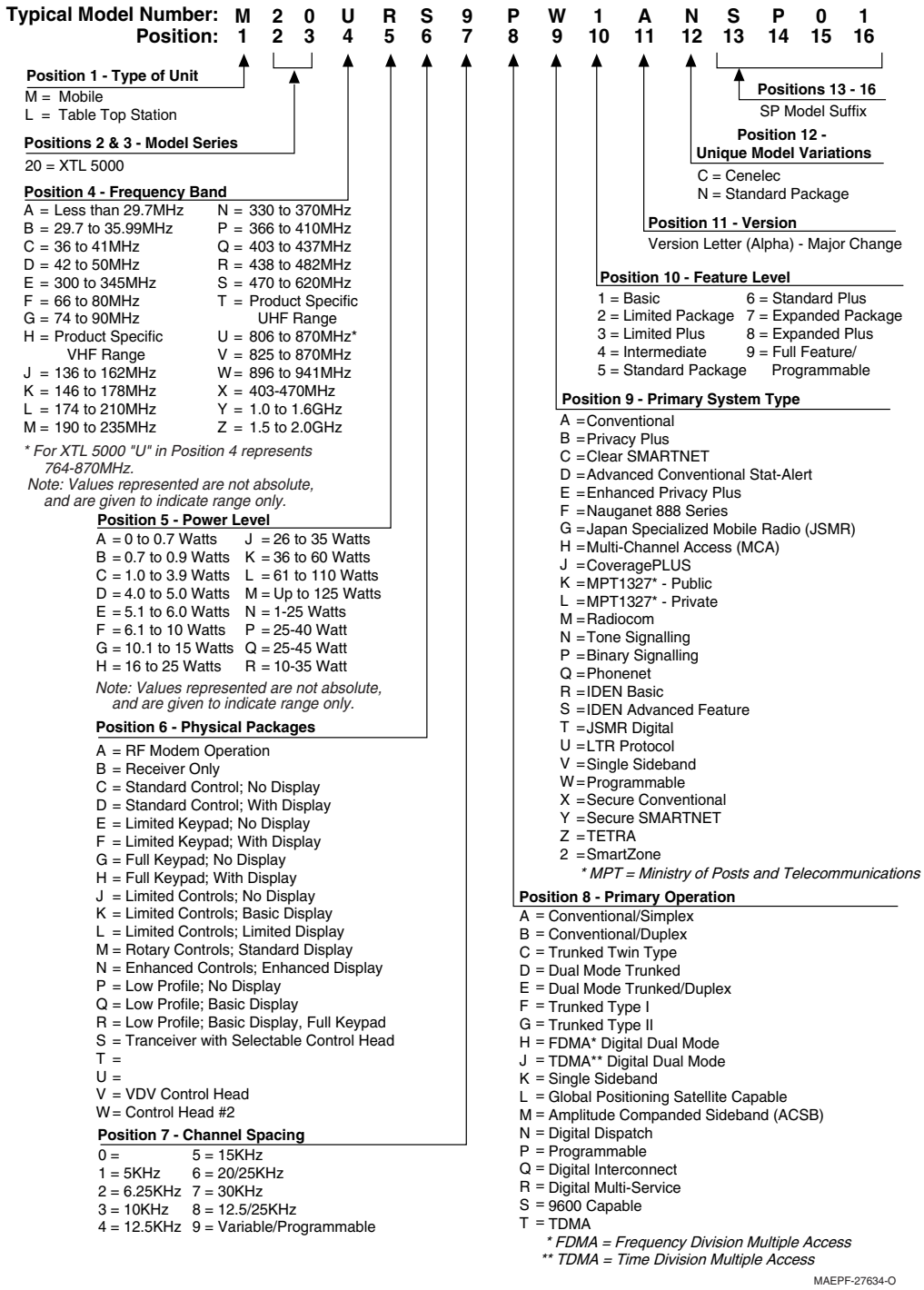
Mobile Radio Model Numbering Scheme



Notes

Commercial Warranty

Limited Warranty

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ASTRO XTL 5000 Digital Mobile Radio	One (1) Year
Product Accessories	One (1) Year

Motorola, at its option, will at no charge either repair the Product (with new or reconditioned parts), replace it (with a new or reconditioned Product), or refund the purchase price of the Product during the warranty period provided it is returned in accordance with the terms of this warranty. Replaced parts or boards are warranted for the balance of the original applicable warranty period. All replaced parts of Product shall become the property of MOTOROLA.

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This warranty gives specific legal rights, and there may be other rights which may vary from state to state.

IV. How To Get Warranty Service

You must provide proof of purchase (bearing the date of purchase and Product item serial number) in order to receive warranty service and, also, deliver or send the Product item, transportation and insurance prepaid, to an authorized warranty service location. Warranty service will be provided by Motorola through one of its authorized warranty service locations. If you first contact the company which sold you the Product, it can facilitate your obtaining warranty service. You can also call Motorola at 1-888-567-7347 US/Canada.

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C. Defects or damage from improper testing, operation, maintenance, installation, alteration, modification, or adjustment.

D. Breakage or damage to antennas unless caused directly by defects in material workmanship.

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- the damage or defect is caused by charging or using the battery in equipment or service other than the Product for which it is specified.

H. Freight costs to the repair depot.

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VII. Governing Law

This Warranty is governed by the laws of the State of Illinois, USA.

Notes

Chapter 1 Introduction

This manual covers the installation procedures for ASTRO XTL 5000 mobile radios with O3 control heads and accessories required to complete the radio system. The radio system consists of a control head, radio, antenna, microphone, speaker, cabling, and accessories.

1.1 Mobile Radio Description

1.1.1 Dimensions

Figure 1-1 and Figure 1-2 show the basic dimensions of the dash mount transceiver trunnion XTL 5000 radio. The transceiver portion of a remote mount XTL 5000 is sized similarly.

When installing the radio, make sure to plan the installation carefully and leave additional room in the rear of the radio for cabling and accessory connections; in the front of the radio for cabling; and to the sides of the radio so that you may access and install the trunnion wing screws.

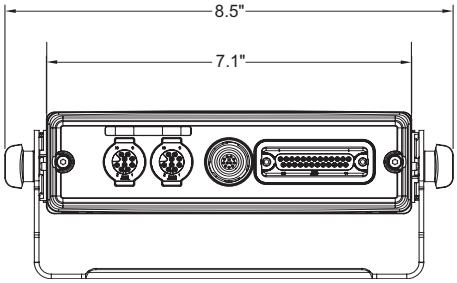


Figure 1-1. Front View of Dash Mount Transceiver Trunnion

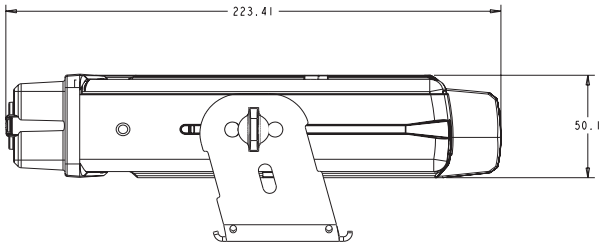


Figure 1-2. Side View of Dash Mount Transceiver Trunnion

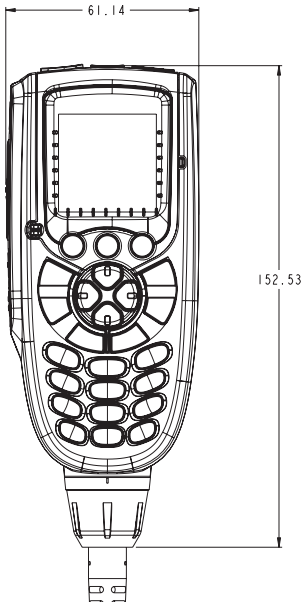


Figure 1-3. Front View of O3 Control Head with Coiled Cable

Figure 1-4. Side View of O3 Control Head with Coiled Cable

NOTE: The rear accessory connector adds 0.75 in. to the overall length.

1.2 Standard Configurations

1.2.1 Dash Mount Configuration

NOTE: The dash mount configuration is not applicable for 100W radios.

In the dash mounting version of the XTL 5000, the control head is connected to the transceiver via a coiled cable which is plugged into the CAN connector on the transceiver.

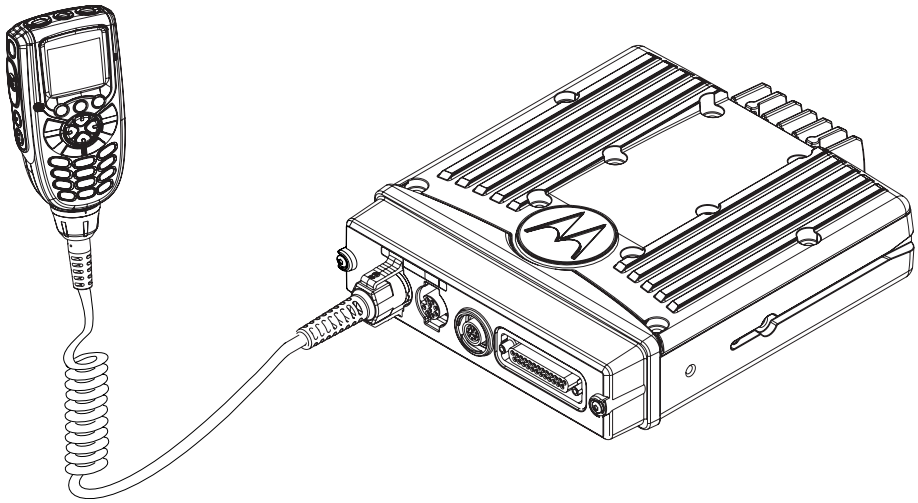


Figure 1-5. Transceiver Interface Board (TIB) & Control Head View

For details on this configuration, see Section 2.2.1 on page 2-6.

1.2.2 Remote Mount Configuration

In the remote control version, the transceiver and the control head are connected via an extension cable from the coiled cable attached to the control head to the CAN connector on the transceiver. The transceiver is mounted by means of a trunnion or other mounting hardware. If the transceiver is located in a car trunk, be sure that secure mounting and sufficient cooling are provided. Do not cover the transceiver with baggage, blankets, etc.

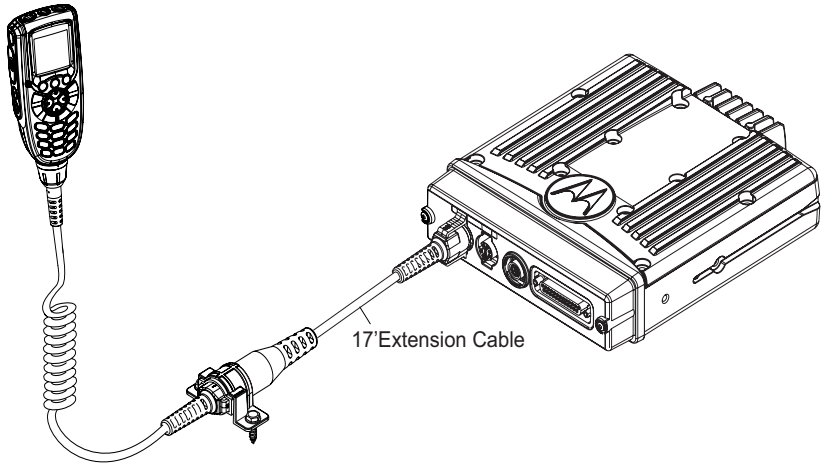


Figure 1-6. Transceiver Interface Board (TIB) & Control Head View

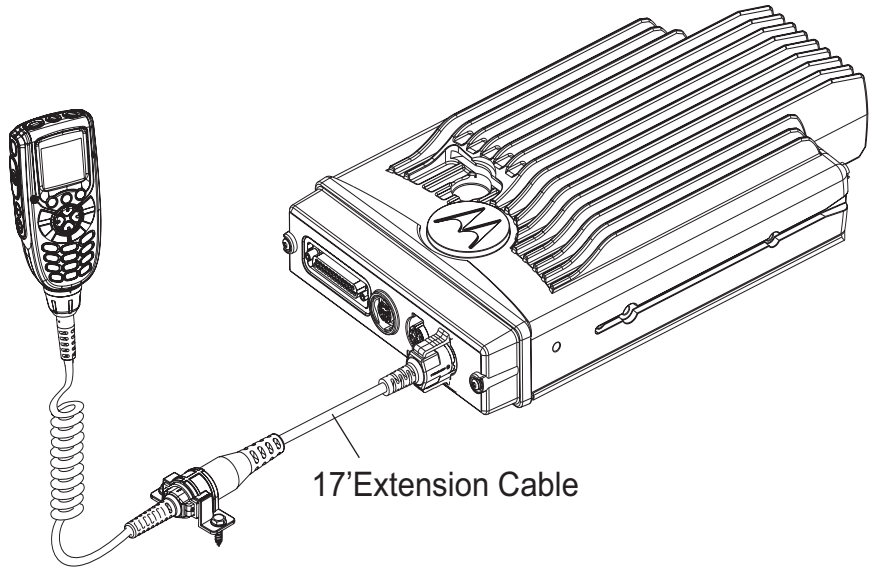


Figure 1-7. Remote Mount Configuration, with 100W transceiver

For details on these configurations, see Section 2.2.2 on page 2-7.

1.2.3 Future Release for Dual Control Head

The dual control head option allows two, separate, remotely operated control heads to operate and control the radio. For example, a fire truck could have a control head located in the cab and on the rear of the truck so that the radio could be operated from outside the vehicle.

For details on this configuration, see the ASTRO Digital Spectra Mobile Radios Dual Control Head Radio System Service Manual (Motorola publication part number 6881091C78).

1.3 Base/Control Stations

NOTE: The base/control station option is not applicable for 100W radios.

If mobile radio equipment is installed at a fixed location and operated as a control station or as a fixed unit, the antenna installation must comply with the following requirements in order to ensure optimal performance and compliance with the RF energy exposure limits in the standards and guidelines listed in the 68P81095C99 manual:

- The antenna should be mounted outside the building on the roof or a tower if at all possible.
- As with all fixed site antenna installations, it is the responsibility of the licensee to manage the site in accordance with applicable regulatory requirements and may require additional compliance actions such as site survey measurements, signage, and site access restrictions in order to ensure that exposure limits are not exceeded.

1.4 Tools Required for XTL 5000 Installations

Tool	Part Number
11/32 Hex Driver	—
RF Cable Tool	HLN6695_
Regular Slot Screwdriver Of Phillips #2	—
Pin Removal Tool	6680163F01
1/4 Hex Driver	—
Wing Screw Torque Tool	HLN6970_

Chapter 2 Standard Configurations

2.1 Planning the Installation

The XTL 5000 radio operates only in negative ground electrical systems. Before starting the radio installation, make sure that the ground polarity of the vehicle is correct. Accidentally reversing the polarity will not damage the radio, but will cause the cable fuses to blow.

Planning is the key to fast, easy radio installation. Before starting the installation, inspect the vehicle and determine how and where you intend to mount the antenna, radio, and accessories. Plan wire and cable runs to provide maximum protection from inching, crushing, and overheating.

CAUTION	Before installing any electrical equipment, check the vehicle manufacturer's user manual. The installation of this device should be completed by an authorized person.

2.1.1 Installation Examples

Your mobile two-way radio offers various methods of installation, including dash or remote mount. Except for 100W radios, all versions of the XTL 5000 can be either dash or remote mounted (see Figure 2-1 through Figure 2-3).100W radios can only be mounted remotely (see Figure 2-3).

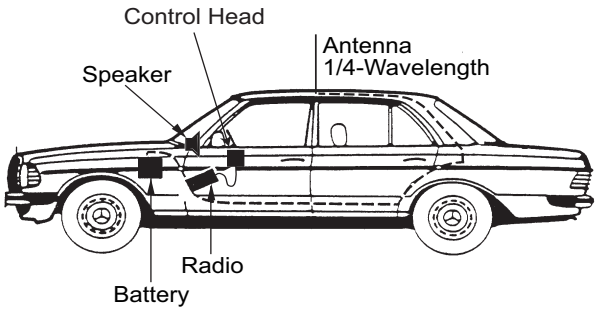


Figure 2-1. Mounting Flexibility in Middle Console (Cannot Be Used for 100W Radios)

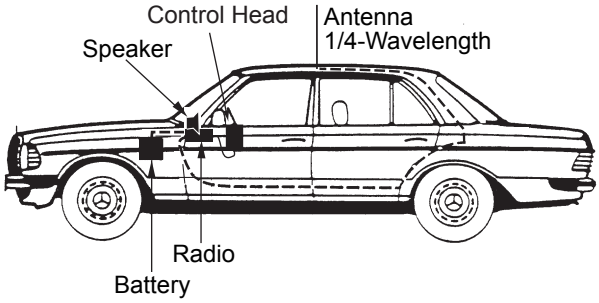


Figure 2-2. In Dash Mounting (Cannot Be Used for 100W Radios)

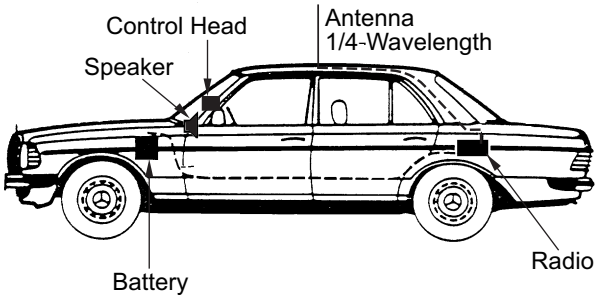


Figure 2-3. Remote Mount

2.1.2 Wiring Diagrams

Figure 2-4 shows the wiring diagrams for a possible configuration. Use the diagram when planning the installation.

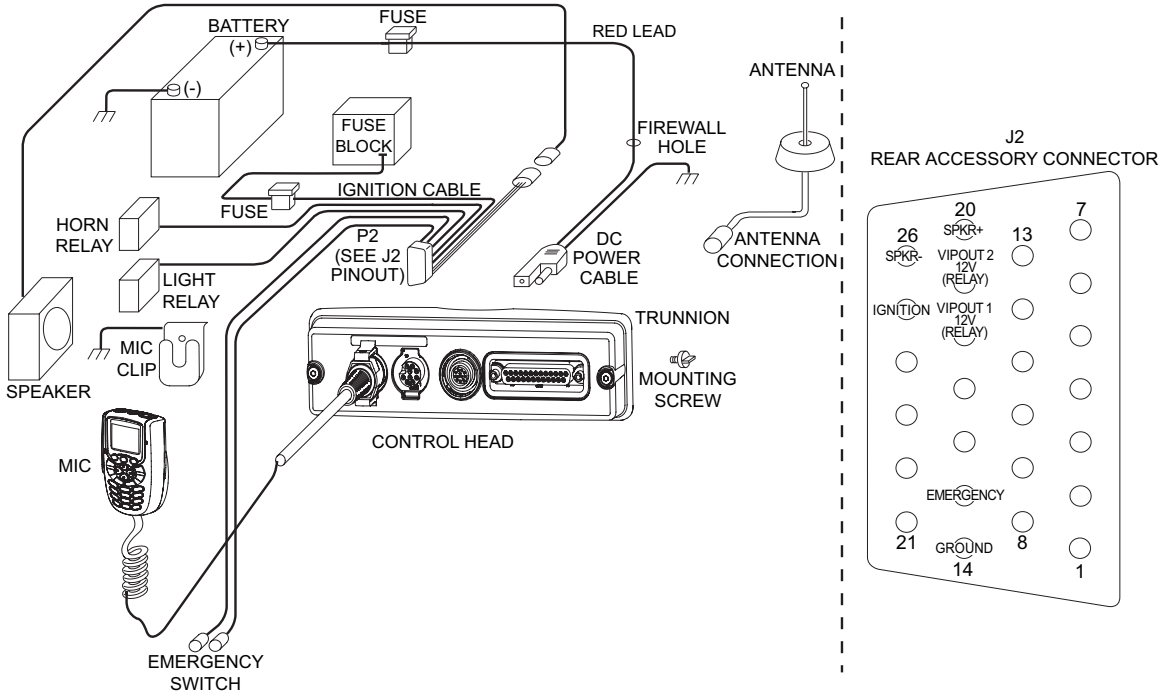


Figure 2-4. Radio Installation (Dash Mount Midpower only)

(For complete pin configuration, see Figure 3-9.)

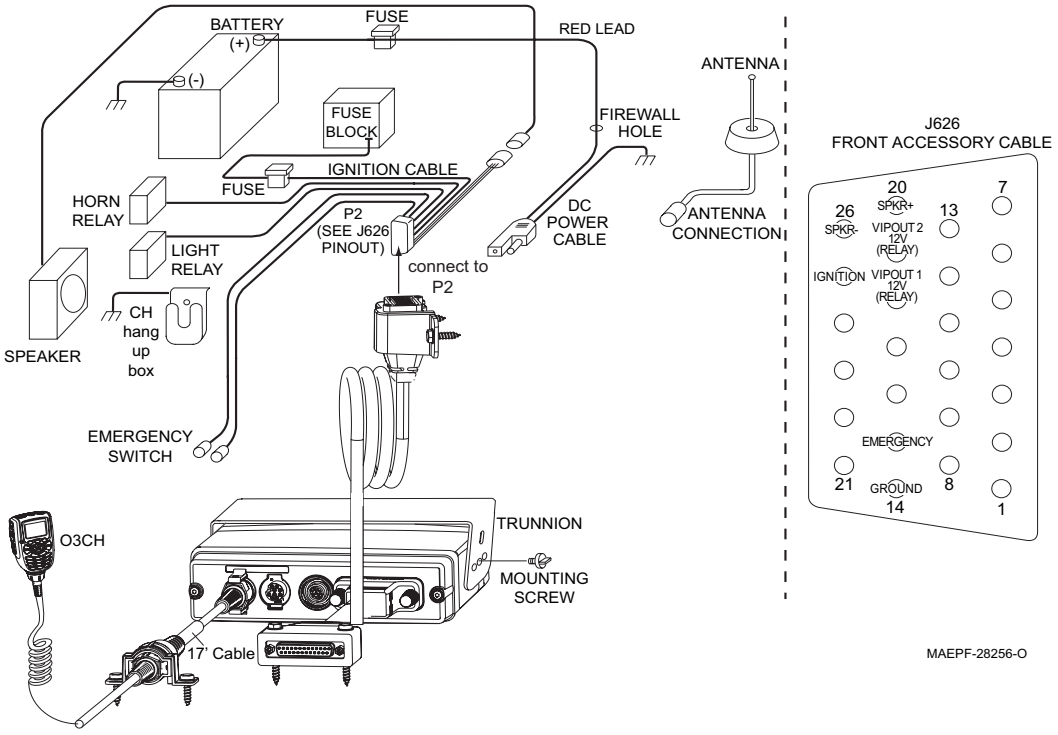


Figure 2-5. Radio Installation (Remote Mount Midpower and 100W)

2.2 Radio Mounting

Caution

CAUTION: DO NOT mount the radio on a plastic dashboard without first reinforcing the dashboard; the weight of the radio may crack or break the dashboard.

CAUTION: DO NOT mount the radio on a flat or concave surface where the radio could be partially submersed in water. This is especially important if the cab area of the vehicle is cleaned by spraying with water. If the radio sits in water for a length of time, moisture may seep inside the radio and damage the electronic components.

CAUTION: DO NOT allow water to stand in recessed areas of vertically mounted radios. Remove any moisture immediately to prevent it from seeping down into the radio.

The mounting location must be accessible and visible. Select a location that will permit routing the RF antenna cable as directly as possible.

The wing screw torque tool (HLN6970_) is designed to securely tighten the trunnion wing-screws while installing the radio. The kit is applicable for both mid-power and high power versions of the XTL2500 and XTL5000 radios. The tool can also be used to loosen the wing screws. Detailed instructions are included later in this section and in the tool packaging.

NOTE: For new or existing installations of all but 100W radios, use only the XTL 5000 trunnion, kit number HLN6861_. For new or existing installations of 100W radios, use only the XTL 5000 trunnion, kit numbers HLN6909_ or HLN6910_.

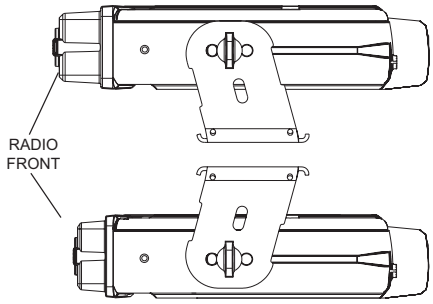


Figure 2-6. Trunnion Orientation (Cannot Be Used for 100W Radios)

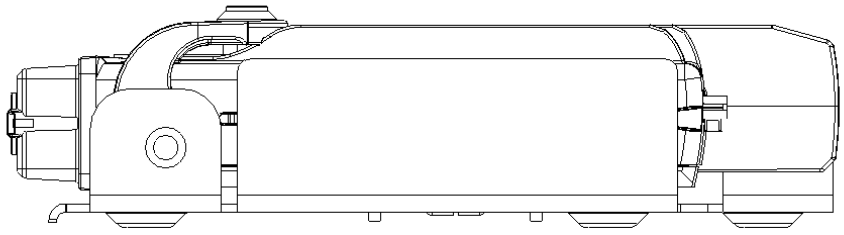


Figure 2-7. Trunnion Orientation for 100W Radios (Quick Release Trunnion)

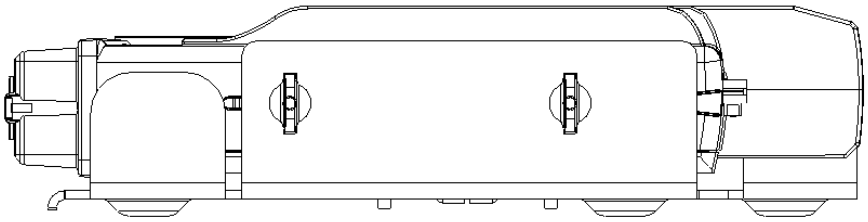


Figure 2-8. Trunnion Orientation for 100W Radios (Screw-Mounted Trunnion)

2.2.1 Dash Mount with Trunnion

NOTE: This configuration is not applicable for 100W radios.

1. Select the location to mount your radio on the transmission hump (see Figure 2-9) or under the dash (see Figure 2-10). When mounting the trunnion on the transmission hump take care the transmission housing is not affected.
2. Using the trunnion mounting bracket as a template, mark the positions of the holes on the mounting surface. Use the innermost four holes for a curved mounting surface such as the transmission hump, and the four outmost holes for a flat surface such as under the dash.
3. Center punch the spots you have marked and realign the trunnion in position.
4. Secure the trunnion mounting bracket with the four self-drilling screws provided (see Figure 2-9 and Figure 2-10).
5. Ensure that the plastic guides are aligned (horizontal) to the grooves of the trunnion. Slide the radio into the grooves until it snaps into place (see Figure 2-9).

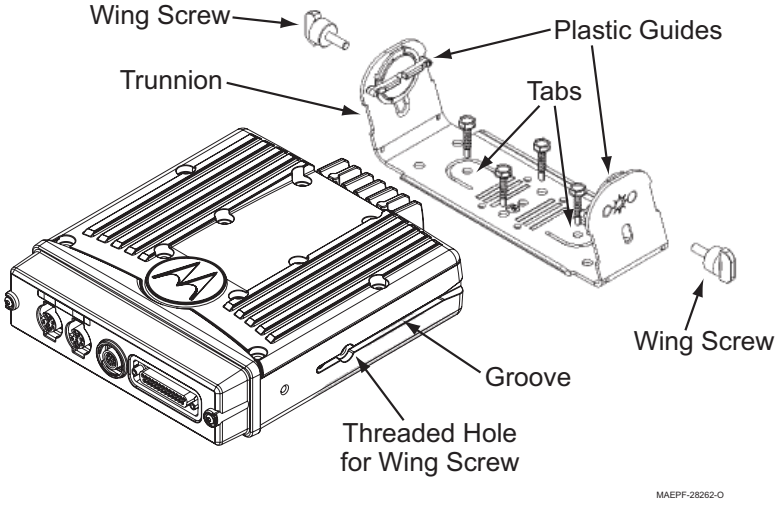


Figure 2-9. Transmission Hump Trunnion Mounting

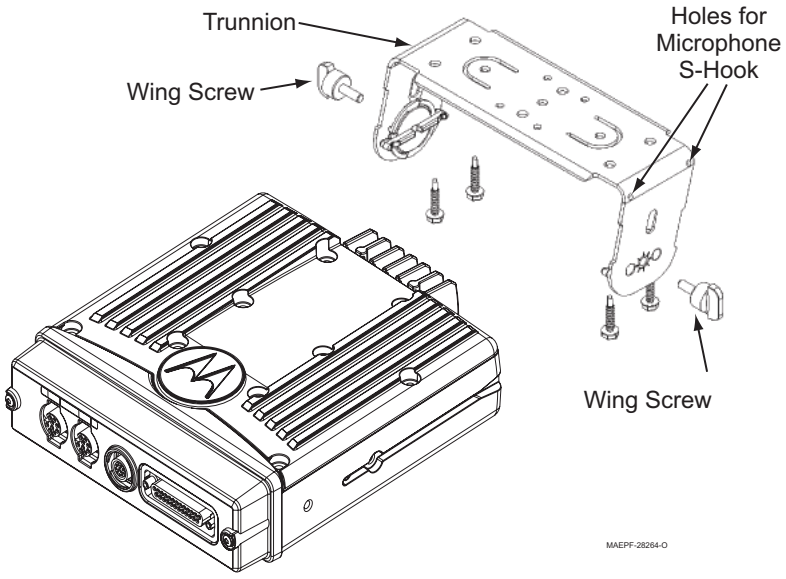


Figure 2-10. Below Dash Trunnion Mounting

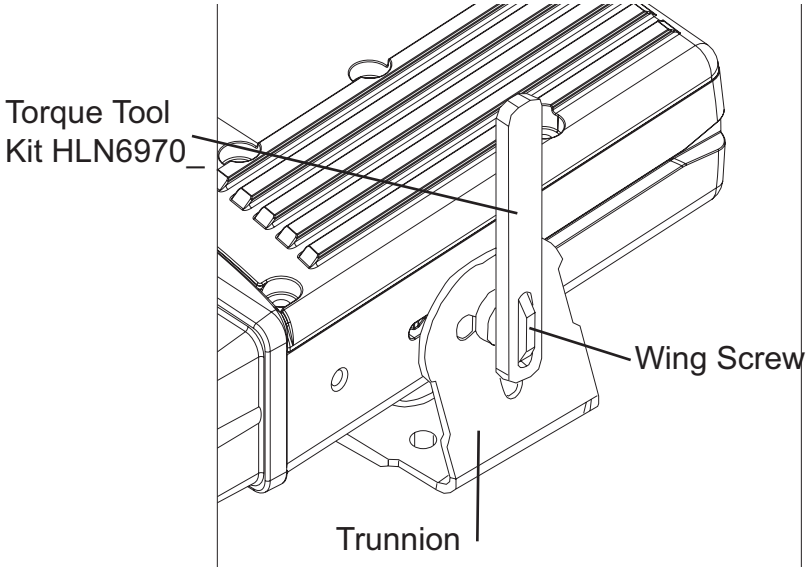


Figure 2-11. Wing Screw Torque Tool

6. Hand-tighten the two wing screws.
7. Using the torque tool HLN6970_, tighten the wing screw an additional 1/4 to 1/2 turn. (see)

NOTE: Do NOT tighten the wing screws beyond 1/2 turn with the tool. The system has been designed to achieve the proper screw engagement without overtightening.

2.2.2 Remote Mount with Trunnion

2.2.2.1 Transceiver

CAUTION	Before installing any electrical equipment, check the vehicle manufacturer's user manual. The installation of this device should be completed by an authorized person. Before making any holes in the trunk for radio mounting, check the vehicle manufacturer's user manual for restrictions (e.g. due to the gas tank location).

For a remote mount installation, the transceiver may be mounted anywhere in the vehicle, provided that the installation location is safe, follows the cautions mentioned at the beginning of this section, and is accessible for servicing/maintenance as well as cabling. A typical mounting location recommended by Motorola is in the vehicle's trunk. The trunnion provided may still be used to mount the transceiver, and the mounting process is the same as for the dash mount installation (Section 2.2.1 on page 2-6). However, for 100W radios you must follow the procedure detailed below in Section 2.2.2.1.1.

2.2.2.1.1 100W Radios Only

1. After selecting the mounting location, use the trunnion mounting bracket as a template and mark the positions of the holes on the mounting surface.
2. Center-punch the spots you have marked and realign the trunnion in position.
3. Secure the trunnion mounting bracket with the five self-drilling screws provided (see Figure 2-7 and Figure 2-8).

4. A. *Quick release trunnion (HLN6909_):* See Figure 2-12. Two keys were packaged with the radio and are needed for proper radio installation. After the trunnion has been mounted in the vehicle using the screws provided, insert the rear of the radio into the rear catches of the trunnion at an angle of approximately 20º, and push it into the trunnion until it contacts a hard stop. With the handle rotated toward the front of the radio, rotate the radio down into the horizontal position. If the radio is not completely inserted, it cannot be rotated to this position. With the key in the unlocked position (3 and 9 o'clock), rotate the handle towards the back of the radio to secure it. Using the keys provided, lock the handle in place and remove the keys. The handle must be locked in place with the keys removed for proper installation. The keys can only be removed from the lock when it is in the locked position.

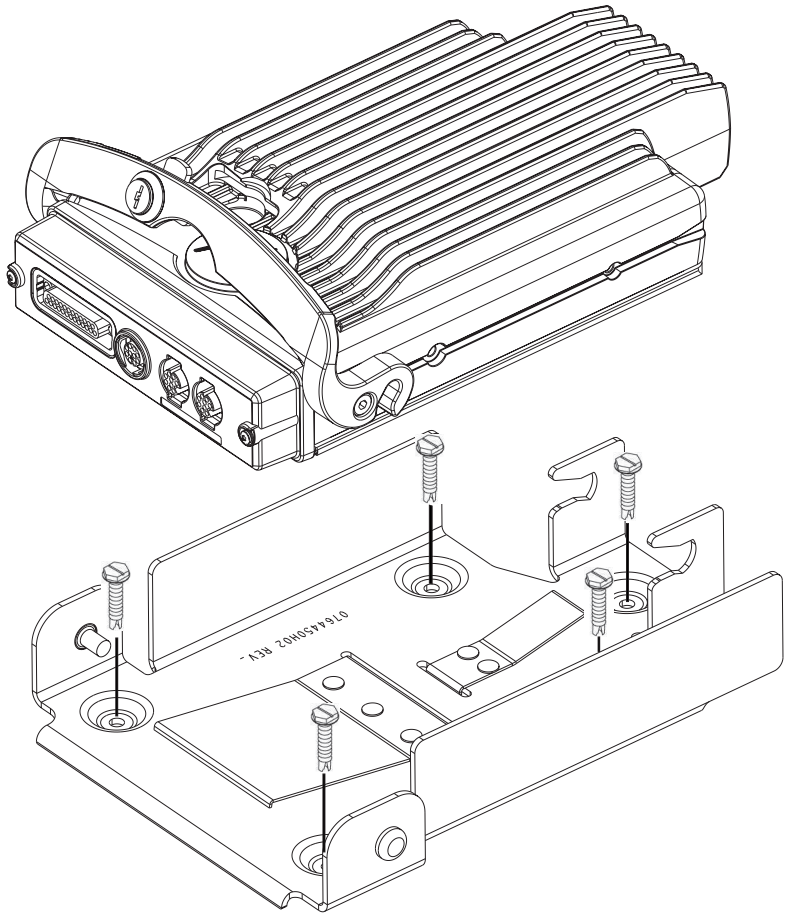


Figure 2-12. 100W Radio Mounting into Quick Release Trunnion

B. *Screw-mounted trunnion (HLN6910_):* See Figure 2-13. After mounting the trunnion to the vehicle using the screws provided, insert the rear of the radio into the rear catches of the trunnion and rotate the radio down into place. Secure the radio by firmly installing the four wing screws provided.

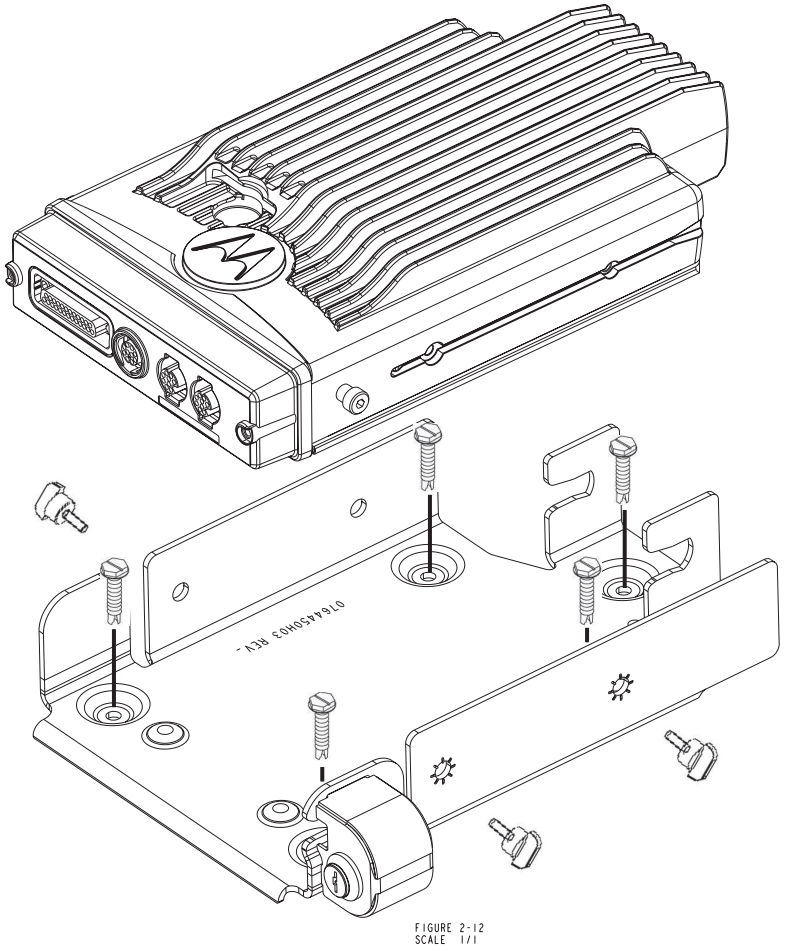


Figure 2-13. 100W Radio Mounting into Screw-Mounted Trunnion

2.2.2.2 Control Head and Remote Mount Cabling

Choose a mounting location for the radio, considering accessibility, and control and antenna cable lengths.

2.2.2.2.1 Remote Model Control Head Installation

Figure 2-14 shows the control head model.

Figure 2-14. O3 Control Head

The recommended mounting surface for the control unit is on the center console. Figure 2-15 shows how the hang-up clip control head, and cables should be installed for the O3 control head.

NOTE: Connector-protective covers are provided with the radio. They should be used for added environmental robustness.

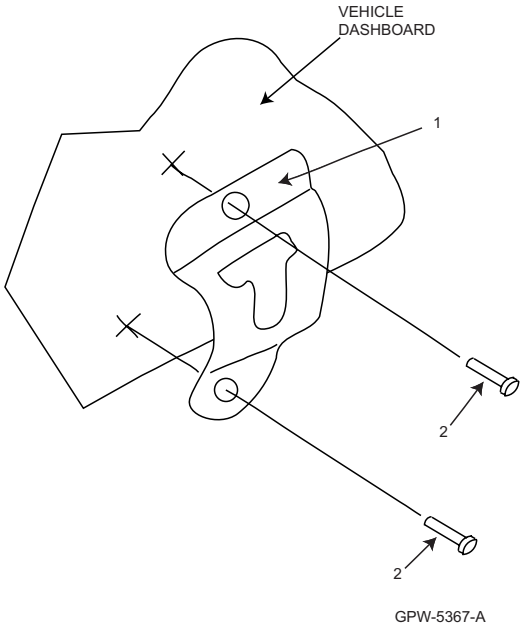
A mounting clip, which allows the control head to be mounted, is supplied together with the control head. The installation must not interfere with the operation of the vehicle or its accessories, nor disturb the passenger seating. The control head must be within convenient reach and viewing of the user.

Install the mounting clip as follows:

1. Use the provided mounting clip to determine the location of the two screw holes.
2. Drill 7/16” deep holes for upper and lower screws.
3. Use the tapping screw provided to install the mounting clip.

Caution

CAUTION: Care must be taken to shield the control head (front and back) from direct exposure to pressurized water. The pressurized water from a hose, in most cases, is more severe than the stated test and conditions in typical environments.



ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1	01-80743T91	mic hang-up clip assembly
2	03-07644M19	Screw, machine, 8-32 x 7/16

Figure 2-15. Control Head Installation Exploded View

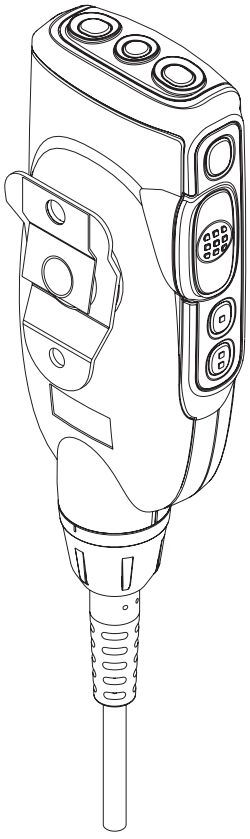


Figure 2-16. Control Head Rear View

2.2.2.2.2 Remote Radio Control Cable Installation

The control head extension cable and the accessories cable should be installed and routed properly to avoid complications. Route the cables in the vehicle's wiring troughs (where available) or route the cables where they are protected from pinching, sharp edges, or crushing. One suggested route is along one side of the driveshaft hump under the carpet. Use grommets in any holes where the cable passes through metal panels. Figure 2-20 shows how the cables and components are connected.

2.2.2.2.3 O3 Ignition Sense Wiring

Determine from Table 2-1 the radio functionality you wish to achieve, which is controlled by the vehicle ignition switch state, the physical wiring of the radio's ignition wire, and the CPS setting. For additional radio functionality as determined by the programming of the ignition switch in CPS, refer to the HELP menu in your CPS (i.e. Ignition as: Required, Blank, Soft Power Off, TX inhibit, PTT TX inhibit, Ignition Only Power Up).

NOTE: Route the ignition wire to either an ignition switch circuit or a power source that is always hot. In either case, choose a point that is isolated from potential sources of voltage transients (relays, lights, air horn, etc.).

CAUTION: DO NOT connect any wires to the battery terminals until after you have finalized the entire installation of the radio as either a Dash mount or Remote Mount configuration.

CAUTION: ENSURE that the Control Head Power cable wire (RED) is always attached to the battery terminal, NOT to the ignition switch.

CAUTION: ENSURE that the Transceiver Power cable wire (RED) is always attached to the battery terminal, NOT to the ignition switch.

2.2.2.2.3.1 Mid Power (Dash and Remote) Ignition and Emergency Cable Installation

The ignition cable HLN6863 is attached at the back of the mid power brick at J2, and contains a thin RED wire which is the IGNITION wire. Refer to table below as to where to attach this thin RED wire. NOTE: If you plan to attach the emergency footswitch inside HLN6862 and attach at J2, then the TIB must have the emergency jumper JU344 REMOVED in order the footswitch to be detected. Otherwise, the emergency footswitch will not be detected at J2.

2.2.2.2.3.2 High Power (Dash and Remote) Ignition and Emergency Cable Installation

The ignition cable HLN6863 is attached at J626 on the accessory cable. The accessory cable attaches at J600 on the High power brick's TIB. The thin RED wire is the IGNITION wire. Refer to table below as to where to attach this thin RED wire.

NOTE: If you plan to attach the emergency footswitch inside HLN6862 and attach at J626, then the TIB must have the emergency jumper JU344 REMOVED in order the footswitch to be detected. Otherwise, the emergency footswitch will not be detected at J626.

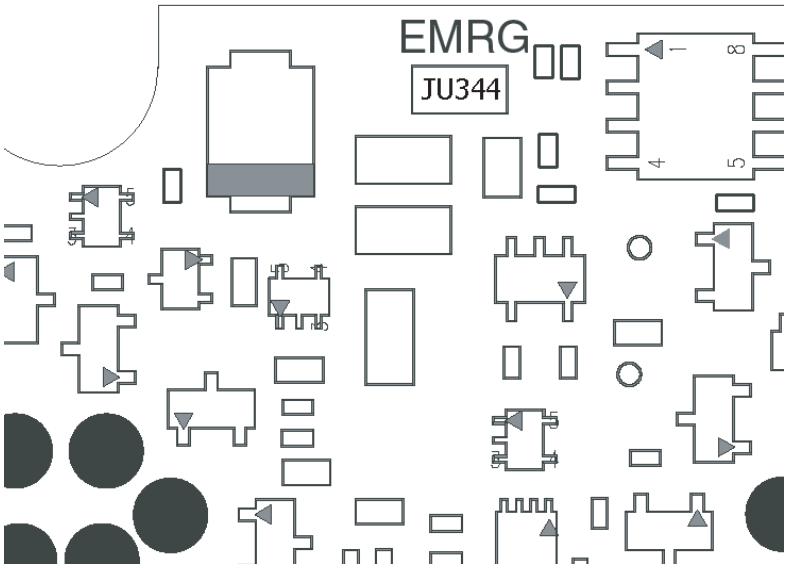


Figure 2-17. Emergency Jumper

1. De-attach the TIB from the XTL5000 brick.
2. De-attach the TIB flex.
3. Located JU344, See diagram
4. Carefully remove JU344 from the TIB PCB.
5. Attach the TIB flex.
6. Re-attach the TIB.
7. Install TIB screws(2) onto the XTL5000 Brick.

Table 2-1. Radio functions Dependent upon A+ and Ignition Connections

Mid Power Dash or Remote	**Transceiver RED Power Wire**	**HLN6863 thin RED wire at J2**	**Transceiver RED Power Wire**	**HLN6863 thin RED wire at J2**	**Transceiver RED Power Wire**	**HLN6863 thin RED wire at J2**
High Power Dash or Remote		**HLN6863 thin RED wire at J626**		**HLN6863 thin RED wire at J626**		**HLN6863 thin RED wire at J626**
Connected to battery	**X**	**X**	**X**			
Connected to the ignition switch				**X**	**X**	**X**
Ignition switch controls	No ignition switch control		Enables ignition switch functionality as programmed in the codeplug		Illegal wiring configuration	

2.2.3 Locking Kit (Optional)

2.2.3.1 All Radios Except 100W

If an optional locking kit is used (shown in Figure 2-18), position the lock bottom housing on the trunnion before installing the radio mounting screws. Then slip the top lock housing on and remove the key. You can install the lock on either side of the radio, and by rotating it 180°, you can also install it on dash installations.

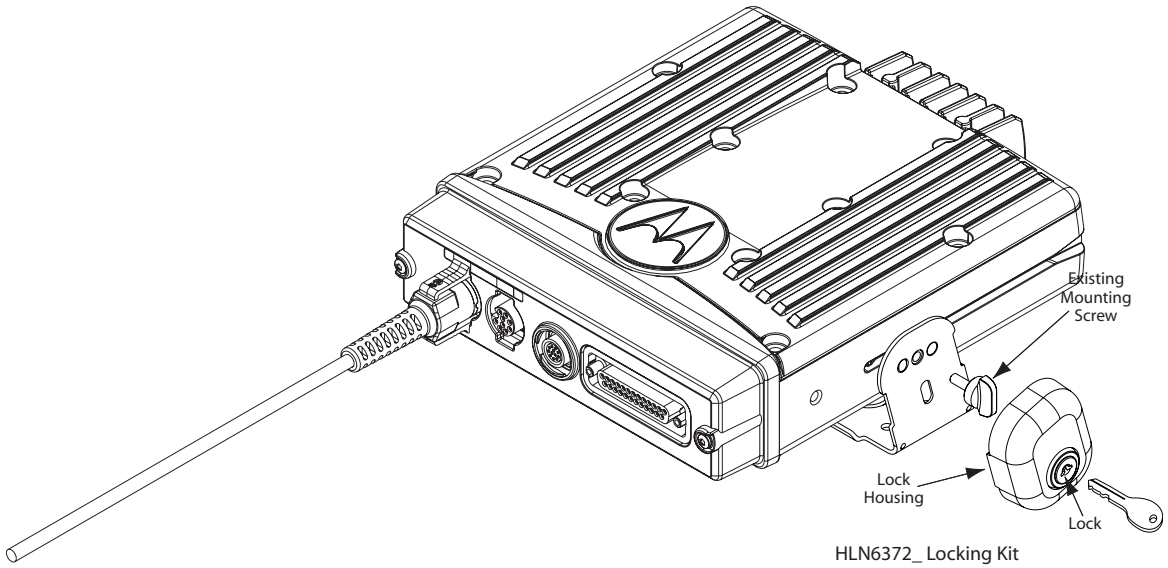


Figure 2-18. Locking Kit (Optional) (Cannot Be Used for 100W Radios)

2.2.3.2 100W Radios

An integral lock is included in the quick release trunnion (HLN6909_). The use of this lock is required for proper operation (see Figure 2-19).

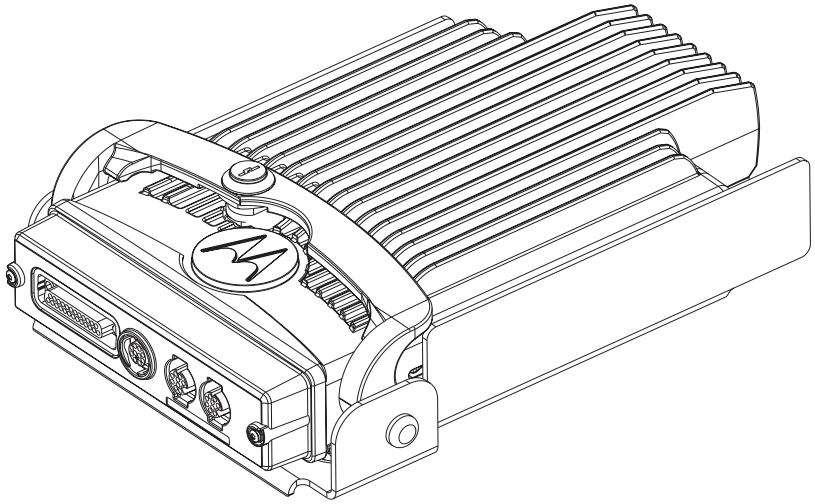


Figure 2-19. Lock Supplied with 100W Quick Release Trunnion

2.3 Power Cable

Route the red radio power cable from the radio to the vehicle's battery compartment, using accepted industry methods and standards. Be sure to grommet the firewall hole to protect the cable. Remove the 15-amp (part number 6580283E06), 20-amp (part number 6580283E07) or 30-amp (for 100W) fuse from the fuseholder and connect the red lead of the radio power cable to the positive battery terminal using the hardware provided as shown in Figure 2-20 and Figure 2-21. Connect the black lead to a convenient solid chassis ground point. DO NOT connect the black lead directly to the battery's negative terminal.

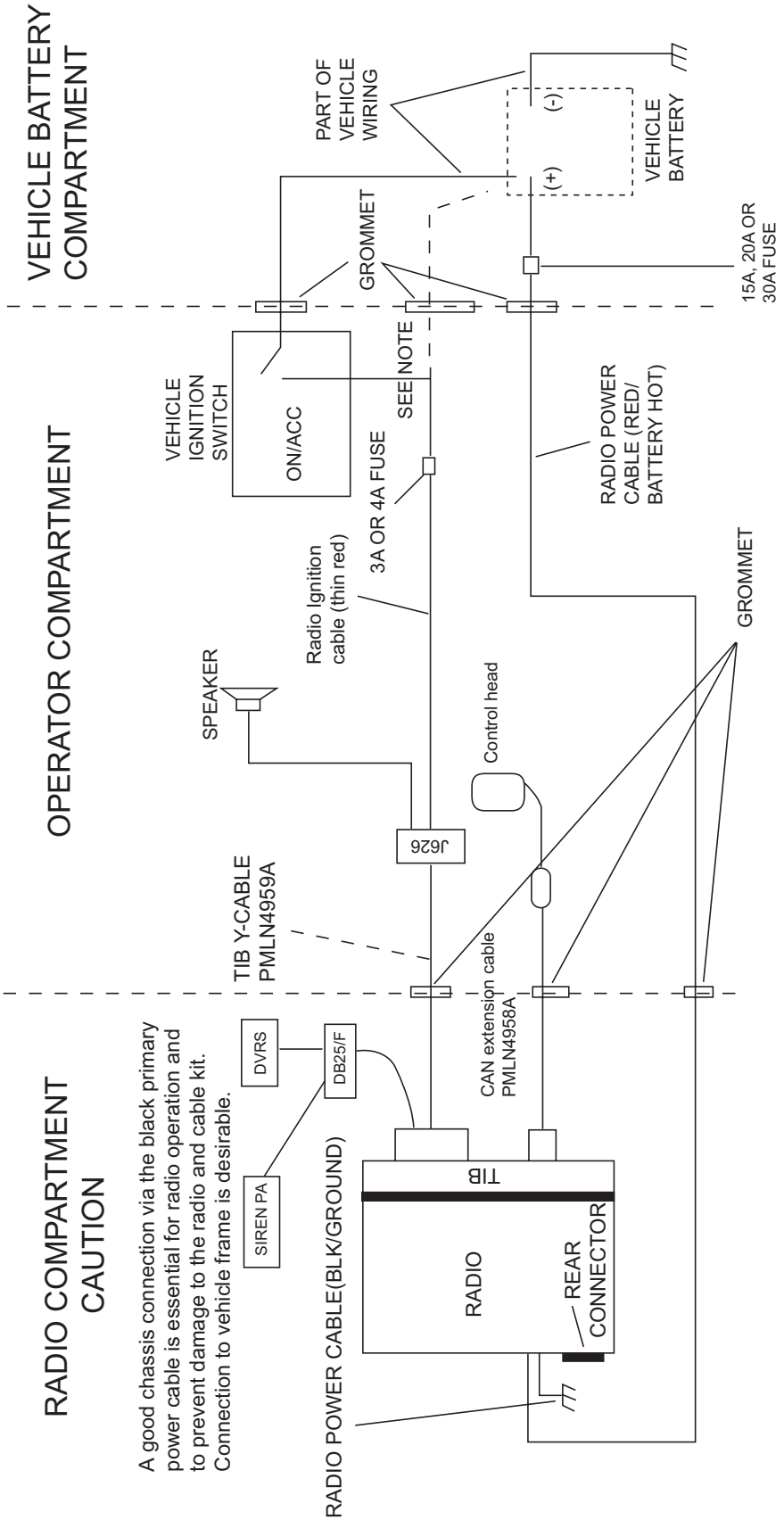
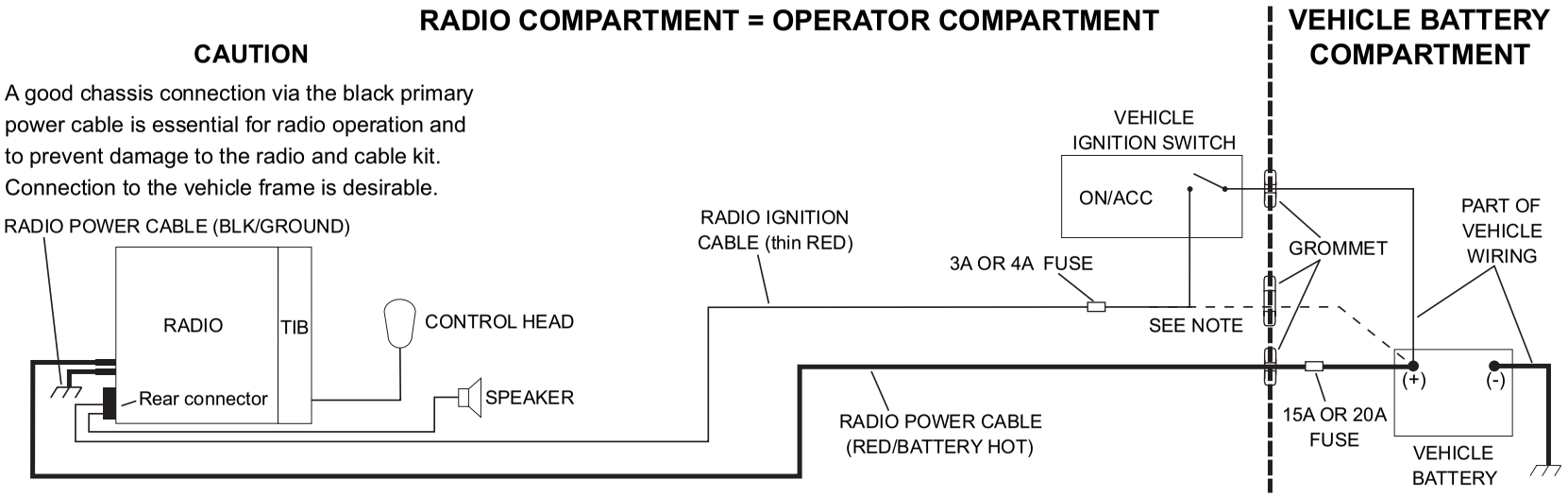


Figure 2-20. Cabling Interconnect Diagram for RemoteMount



NOTE:
Caution: if you choose to connect the radio's IGNITION line directly to the car's battery, excess use of the radio when the car's ignition is not running (i.e. alternator running) could result in a slow discharge of the car's battery. This configuration allows the radio to operate with the car's ignition switch ON or OFF.

If the radio's IGNITION line is wired to the car's ignition switch, the radio will only function when the car's ignition switch is turned ON.

MAEPF-27646-O

Figure 2-21. Cabling Interconnect Diagram for Dash Mount Midpower only

2.4 Antenna Installation

IMPORTANT NOTE: To assure optimum performance and compliance with RF Energy Safety standards, these antenna installation guidelines and instructions are limited to metal-body vehicles with appropriate ground planes and take into account the potential exposure of back seat passengers and bystanders outside the vehicle.

NOTE: For mobile radios with rated power of 7 watts or less, the only installation restrictions are to use only Motorola approved antennas and install the antenna externally on metal body vehicles. For mobile radios with rated power greater than 7 Watts, always adhere to all the guidelines and restrictions in section 2.5.1 below.

2.4.1 Selecting an Antenna Site/Location on a Metal Body Vehicle

1. **External installation –** Check the requirements of the antenna supplier and install the vehicle antenna external to a metal body vehicle in accordance with those requirements.
2. **Roof top –** For optimum performance and compliance with RF Energy Safety standards, mount the antenna in the center area of the roof.
3. **Trunk lid –** On some vehicles with clearly defined, flat trunk lids, the antennas of some radio models (see restrictions below) can also be mounted on the center area of the trunk lid. For vehicles without clearly defined, flat trunk lids (such as hatchback autos, sport utility vehicles, and pick-up trucks), mount the antenna in the center area of the roof.

   Before installing an antenna on the trunk lid,

   - Be sure that the distance from the antenna location on the trunk lid will be at least 85 cm (33 inches) from the front surface of the rear seat-back to assure compliance with RF Energy Safety standards.
   - Ensure that the trunk lid is grounded by connecting grounding straps between the trunk lid and the vehicle chassis.

   IF THESE CONDITIONS CANNOT BE SATISFIED, THEN MOUNT THE ANTENNA ON THE ROOF TOP!

4. **Mounting restrictions for certain radio models**

   For 40 Watt UHF models and all 100W models, the 1/4 wave antenna should be mounted **only in the center area of the roof**, not on the trunk lid, to assure compliance with **RF Energy Safety standards**.
5. Ensure that the antenna cable can be easily routed to the radio. Route the antenna cable as far away as possible from any vehicle electronic control units and associated wiring.
6. Check the antenna location for any electrical interference.
7. Ensure that any other mobile radio antenna on this vehicle is at least one foot (30.48 cm) away from this antenna.
8. The minimum distance between the antenna and the radio/accessories should be at least three feet (91.44 cm).

NOTE: Any two metal pieces rubbing against each other (such as seat springs, shift levers, trunk and hood lids, exhaust pipes, etc.) in close proximity to the antenna can cause severe receiver interference.

2.4.2 Mini-UHF Connection

To ensure a secure connection of an antenna cable's mini-UHF plug to a radio's mini-UHF jack, their interlocking features must be properly engaged. If they are not properly engaged, the system will loosen. Using a tool (pliers or wrench) will not overcome a poor engagement, and is not recommended.

NOTE: Applying excessive force with a tool can cause damage to the antenna or the connector (e.g., stripping threads, deforming the collar or connector, or causing the connector to twist in the housing opening and break).

The mini-UHF connector tool (Motorola part number HLN6695_) is designed to securely tighten the antenna plug–radio jack connection without damaging either the plug or the jack.

Motorola recommends the following sequence to ensure proper attachment of the system (see Figure 2-22 and Figure 2-23):

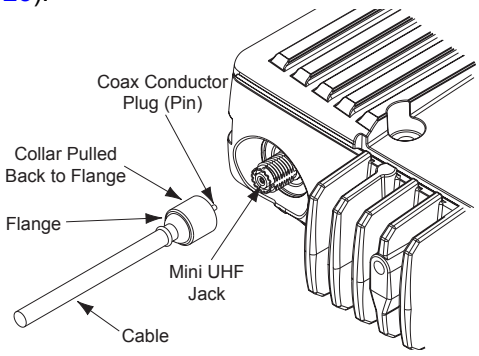


Figure 2-22. Mini-UHF Connection (as shown on mid-power)

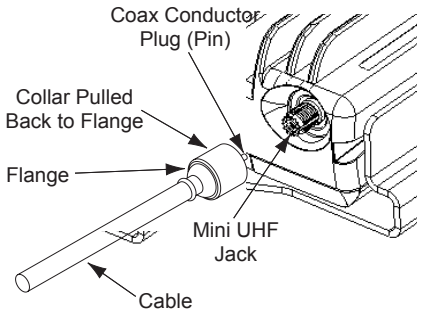


Figure 2-23. Mini-UHF Connection (100W Radios only)

1. Make sure that there is sufficient slack in the antenna cable.
2. Make sure that the collar of the antenna cable plug is loose and does not bind.
3. Make sure that the mini-UHF jack is tight in the radio housing.
4. Slide the collar back against the flange. Insert the antenna cable plug's pin fully into the radio jack, but do not engage the threads.
5. Ensure that the plug's and jack's interlocking features are fully seated. Check this by grasping the crimp on the cable jack, rotating the cable, and noting any movement. If the features are seated correctly, there should be NO movement.
6. Finger-tighten the antenna cable plug's collar onto the radio's jack.
7. Give a final tug, by hand, to the collar, and retighten by hand as firmly as possible.
8. The minimum distance between the antenna and the radio/accessories should be at least three feet (91.44 cm).

9. Slip the mini-UHF connector tool over the coaxial cable, using the gap between the tool's legs (see Figure 2-24). Then, slide the tool up onto the plug's knurled collar. Squeeze the two straight legs of the tool firmly together between your thumb and index finger and turn clockwise (as shown) to tighten the collar. It should take 1/4 turn or less. When you feel the tool slipping on the collar, the connection has been properly tightened. The tool can also be used to loosen a tight collar.

NOTE: DO NOT use pliers or any other device to grip the tightening tool. It has been designed to allow you to achieve the proper torque on the collar without overtightening. Overtightening the collar can damage the connector and the radio.

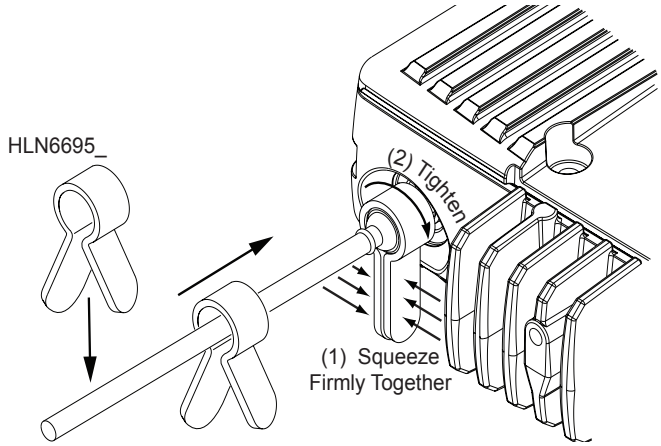


Figure 2-24. Mini-UHF Connector Tool (as shown on mid-power)

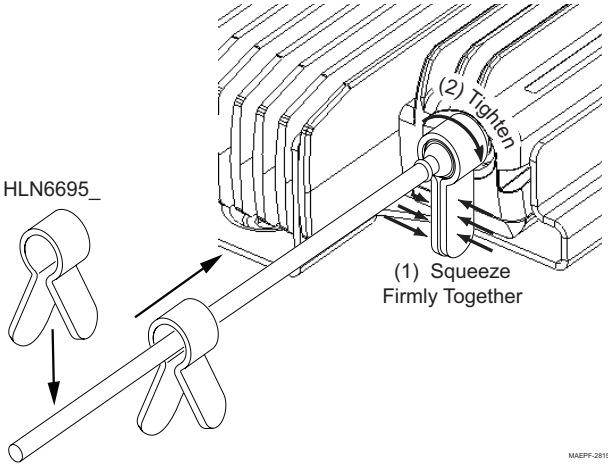


Figure 2-25. Mini-UHF Connector Tool (100W Radios Only)

2.5 Speaker

> **Caution**
>
> **CAUTION:** DO NOT ground the radio's speaker leads. This system has a floating speaker output (dc voltage on both leads); damage to the audio circuit will result if either lead is grounded or if they are shorted together.

The speaker kit includes a trunnion bracket that allows the speaker to be mounted in a variety of ways. With the trunnion bracket, the speaker can mount permanently on the dashboard or in accessible firewall areas. The trunnion allows the speaker to tilt for best operation. Mount the speaker out of the way so that it will not be kicked or knocked around by the vehicle occupants. Mount the speaker as follows:

1. Use the speaker mounting bracket as a template to mark the mounting hole locations.
2. Use the self-drilling screws provided to fasten the trunnion.
3. Attach the speaker and fasten to the trunnion with two wing screws.
4. Route the speaker wires under the carpet or floor covering, or behind the kick panels. Be sure the wires are out of the way and will not be snagged and broken by the occupants of the vehicle.

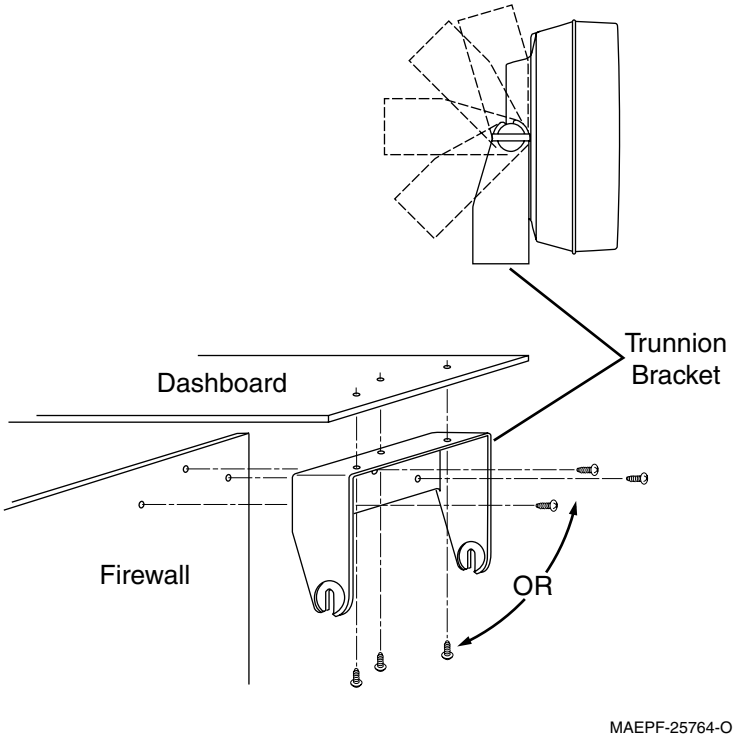


Figure 2-26. Speaker Mounting

2.6 Control Head Hang-Up Clip

2.6.1 Standard Hang-Up Clip

The hang-up clip must be within reach of the operator(s). Measure this distance before actually mounting the bracket. Since the bracket has a positive-detent action, the control head can be mounted in any position. The control head hang-up clip must be grounded.

Use the hang-up clip as a template to locate the mounting holes. To avoid interference when removing the control head, install the flathead screw in the top clip hole.

2.7 Completing the Installation

Complete the installation by connecting the speaker to the accessory cable; verify the ignition wire is attached according to planned ignition sense; attach the accessory cable into J600; verify the O3 control head is attached to either the TIB or the CAN extension cable; and then attach the power cable to the back of the transceiver.

Chapter 3 Options and Accessories Installation

3.1 VIP Overview

The vehicle interface port (VIP) allows the control head to operate outside circuits and to receive inputs from outside the control head. There are two VIP outputs which are used for relay control.

3.1.1 VIP Output Connections

The VIP output pins are on the radio front TIB DB25 connector (J600), or on the rear accessory panel (J2). The pin information is shown in Figure 2-4 and Figure 3-9, respectively. Use these connections to wire control relays. One end of the relay should connect to switched B+ voltage, while the other side connects to a software controlled ON/OFF switch inside the control head. The relay can be normally on or normally off depending on the configuration of the VIP outputs. There are two VIP output connections, as follows:

Table 3-1. VIP Output Connections

	J626		J2	
VIP OUT #	**SW B+ Pin Number**	**On/Off Switched Pin Number**	**SW B+ Pin Number**	**On/Off Switched Pin Number**
1	24	18	24	18
2	24	19	24	19

The function of these VIP outputs can be field programmed in the control head. Typical applications for VIP outputs are external horn/lights alarm and horn ring transfer relay control. For further information on VIP outputs, see the control head programming manual.

When installing relays to the VIP OUT lines, a diode is necessary to prevent damage to the transistor or MOSFET, due to “back EMF” when the field collapses on the relay coil. Some vendor relays already come with this diode built-in, and other relays require the customer to install it.

Figure 3-1 shows the proper placement of the diode across the relay coil. The transistor or MOSFET is located inside the radio or the D.E.K. box.

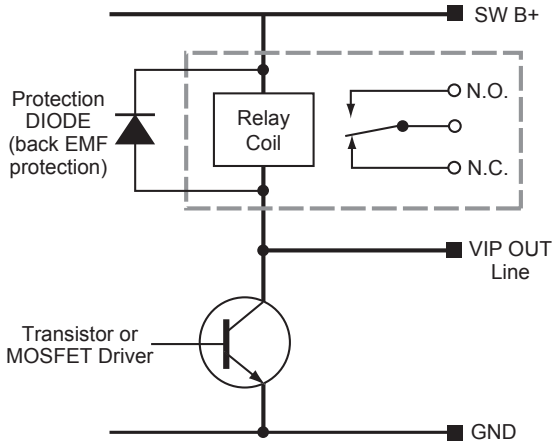


Figure 3-1. Relay Coil

NOTE: See Appendix A: Replacement Parts Ordering to order relay's for your VIP OUT applications. Example relays used are TLN4533 and HKN4258.

3.2 Dash-Mount Accessory Installation

NOTE: This configuration is not applicable for 100W radios.

For dash-mounted configurations, the accessories must be installed through the accessory connector assembly that is located on the rear of the radio, adjacent to the power connector. Motorola-approved accessories are supplied with male terminals crimped to a 20-gauge wire specifically designed to fit the plug of the accessory connector assembly.

Insert the male terminal into the accessory connector assembly in the appropriate location and connect the accessory connector assembly in the rear accessory port (see Figure 3-9). Do not use other generic terminals in the plug. Generic terminals can cause electrical intermittence and may cause damage to the plug.

3.2.1 Emergency Pushbutton or Footswitch Installation

Mount the footswitch using the hardware that comes with the kit. Open the accessory cable connector housing; remove the jumper wire and remove also the jumper JU344 found on the Transceiver Interface Board (TIB). Connect the emergency switch wires to pins 14 and 15 (see Figure 3-2). Close the connector housing; route the finished cable from the switch location to the control head location.

In order for Emergency footswitch to function in remote mount configuration, the emergency jumper must be removed from the TIB (see Figure 3-2). The jumper is grounding the emergency signal line for radio usage without an emergency switch attached. Once an emergency switch is attached to your system, either at the J2 or an accessory cable at J600, the switch itself shall provide the short to GND, and the radio will able to detect an emergency switch depression. If the jumper is not removed, the line will remain grounded at all times, and the switch will not be detected by the radio.

If the HLN6863_ accessory cable is used at both the J2 and at the J626 connectors, the emergency jumper must be removed from both cables if emergency footswitch operation is to function. Under normal installation, only one HLN6863 cable would be in use, and in installation of the emergency footswitch would remove the jumper that comes default in this cable.However, if two cables are used, the jumper must be removed from both.

NOTE: The emergency footswitch should be attached with A+ unattached.
A+ should be attached after successfully securing the screws in the connector.

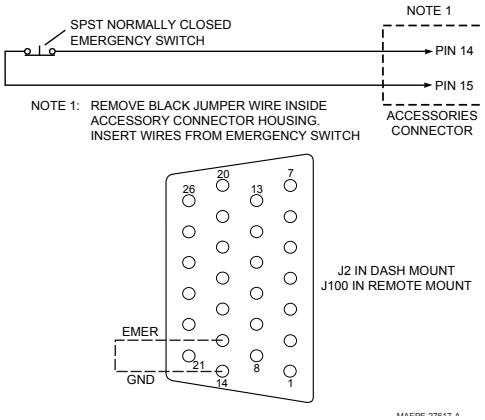


Figure 3-2. Emergency Switch Wiring Diagram

3.2.1.1 Installation of Emergency Pushbutton or Footswitch with Siren/PA

When using emergency footswitch or pushbutton with siren/pa configuration, REMOVE pin #8 (emergency) from the siren connector of the HKN4363 siren cable as follows:

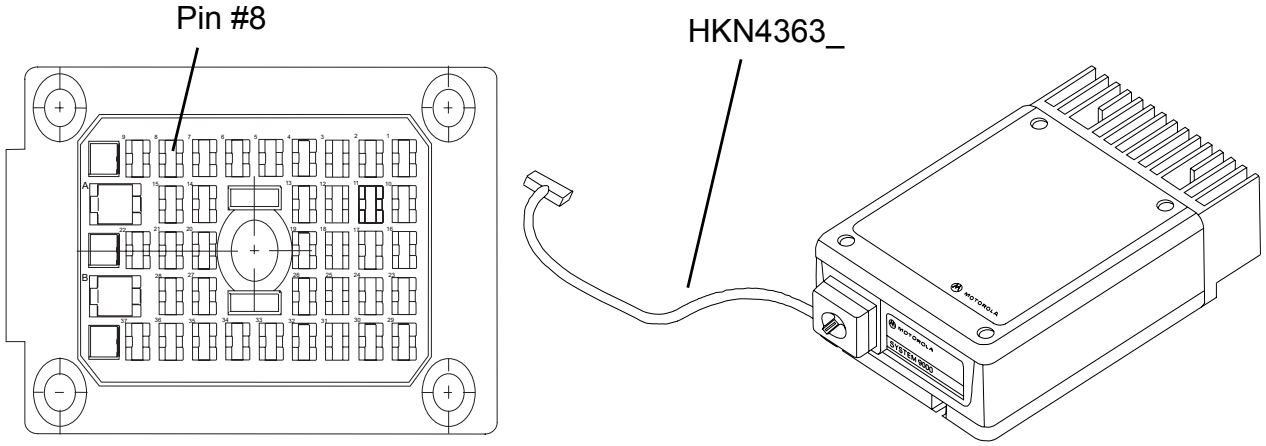


*Figure 3-3. Removing pin #8 from HKN4363_*

i. Remove the knob from the siren/pa cable connector.

ii. Remove all four screws from the connector in the siren/pa cable.

iii. Open the connector cap and locate pin #8.

iv. Using the contact removal tool (p/n: 6684690C02), remove pin#8 from the connector.

v. Put the connector cap in place and proceed to reinstall the four screws and the knob.

3.2.2 Horn (External Alarm) Relay Installation

Mount the horn relay in a suitable location (normally under the dash). Connect the relay contacts across the horn ring switch, typically found in the steering column. Connect the two control wires to a SW B+ pin and a VIP OUT pin on the VIP connector.

3.2.3 Lights (External Alarm) Relay Installation

Mount the light relay in a suitable location (normally under the dash). Connect the relay contacts across the headlamp ON/OFF switch. Connect the two control wires to a SW B+ pin and a VIP OUT pin on the VIP connector.

3.2.4 HORN RING INSTALLATION chapter:

Configure the Horn Relay for either "Negative Contact" or "Positive Contact" as shown on page 11 of the Siren/PA manual (6880101W10).

Program the designated VIP OUT line for Horn-Ring Transfer and program the designated VIP IN line for Horn-Ring.

3.2.5 Horn and Lights (External Alarms) Relays

For installations that use the horn/lights option, select a suitable location for mounting (normally under the dash) and, referring to Figure 3-4, perform the following procedure:

NOTE: The handheld control head can have a horn or light option, but not both. Control wires for either option should be connected to pins 18 and 24 of the accessory connector.

1. Horn Relay—Connect the relay contacts across the horn ring switch, typically found in the steering column. Open the accessory cable connector and connect the two control wires (male pins) into locations 18 and 24 of the connector.
2. Lights Relay—Connect the relay across the headlamp ON/OFF switch, typically found in the steering column. Open the accessory cable connector and connect the two control wires (male pins) into locations 19 and 24 of the accessory connector.

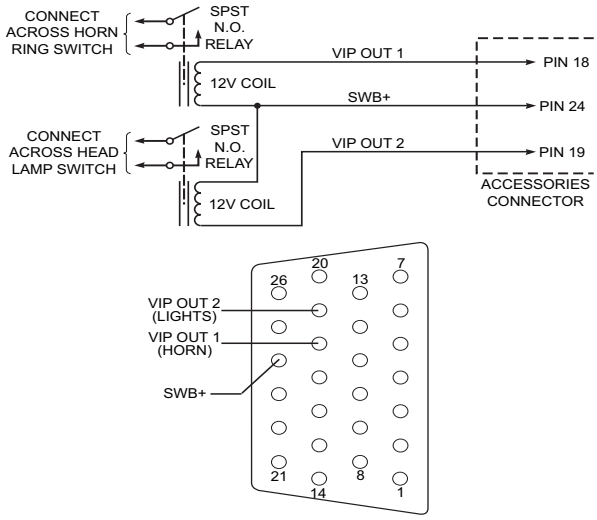


Figure 3-4. Horn/Light Wiring Diagram

3.3 Accessory Connector Assembly Details (P2) (All Models Except 100W)

The XTL 5000 accessory connector assembly is mounted on the right rear of the radio, opposite the antenna and adjacent to the power connector. It is fastened to the radio via jackscrews and held together by the two cover screws. It is a multi-functional connector that allows for many different types of adaptations. All approved accessory wires are securely strain-relieved through the exiting slots at the back of the accessory connector assembly. The terminations that are supplied with all accessories are designed to be fully engaged and locked into the plug connector (P/N 6680163F01). They can also be detached for service with the assistance of a terminal removal tool. The accessory connector assembly can be serviced multiple times for future installation upgrades.

The accessory connector assembly, supplied with every XTL 5000 dash-mounted radio, is equipped with a 26-pin plug assembly, two covers, two jackscrews, two cover screws, one emergency jumper, one ignition sense cable assembly, and one speaker pigtail. The jumper is provided to complete the circuit for emergency mode. If this circuit becomes open, the radio will be set to emergency mode.

3.3.1 Disassembly and Assembly

3.3.1.1 Disassembly

1. Disconnect the negative terminal from the vehicle's battery. Make sure that the battery cable is secured such that it will not power the vehicle's electrical system. See Figure 3-5.
2. Unscrew both jackscrews completely.
3. Pull the accessory connector assembly out from the radio.
4. Loosen both cover screws, but do not remove them completely.
5. Pull the jackscrews away from the plug and hold them back.
6. Pry apart the accessory connector assembly covers.
7. Attach any new wire to its proper location by pushing in the male terminal. When you hear a pop, the wire is engaged. To verify that the wire is engaged, tug gently on the wire and be sure it does not come out. Do not overload the wire: severe damage will result to the plug.

3.3.1.2 Assembly

1. Place the plug in one cover. Be sure that the flange of the plug is in the slot of the cover. See Figure 3-5.
2. Push the jackscrew through the plug to hold it in.
3. Position each wire across the strain-relief features in the cover. Avoid damaging loads on the plug by allowing some slack in each wire in the accessory connector assembly's wire chamber.
4. Place the second cover onto the plug. Be sure that the flange is protruding through both covers.

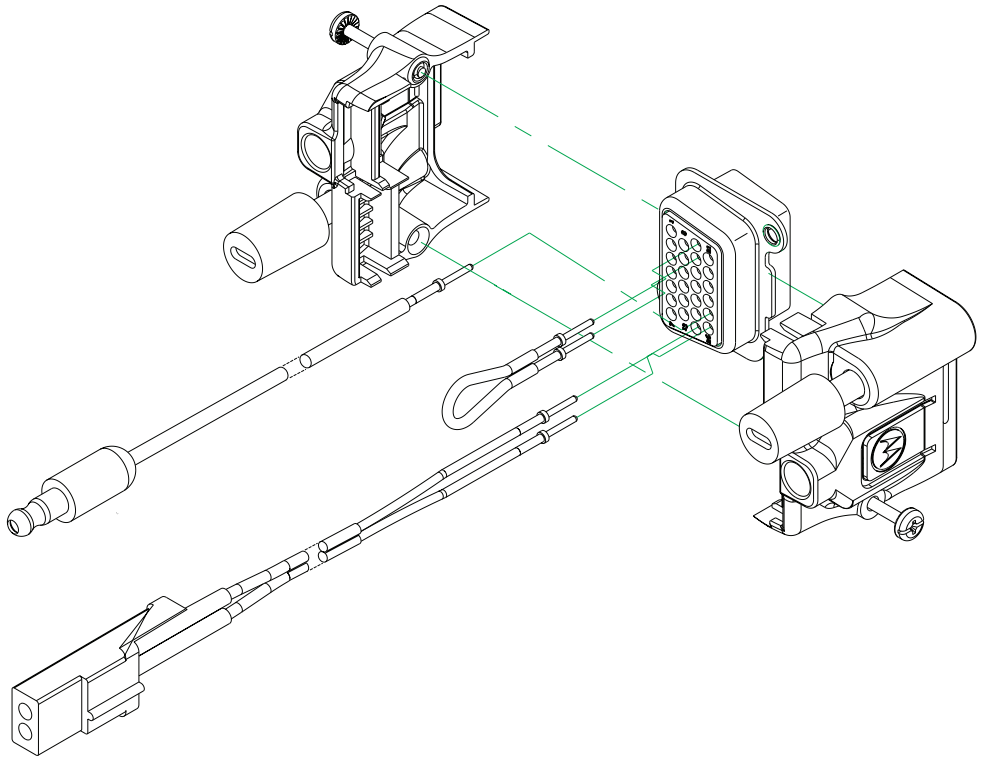


Figure 3-5. Exploded View of Accessory Connector Assembly (P2)

5. Squeeze the covers together bending the wires in the strain-relief features. You may need a pair of pliers to seat the assembly covers.
6. Once the covers are fully seated, fasten them with the cover screws. Tighten the screws firmly but do not over-tighten them. Be sure none of the wires are pinched.
7. Reattach the accessory connector assembly to the back of the radio and fasten it by finger-tightening the jackscrews to prevent any loosening.

3.3.2 Adapter Cable

If you are planning on installing an XTL 5000 radio as a replacement for an ASTRO Spectra radio, the following adapter cables are available:

HKN6158_	Cable, Audio Adapter Kit
HKN6159_	Cable, Data Adapter Kit

NOTE: The adaptor cables can only be connected to J2 in the rear of the transceiver.

Use the HKN6158_ audio adapter kit cable if your vehicle was formerly wired for an ASTRO Spectra or ASTRO Spectra Plus radio, and used the rear cable pins as shown in Figure 3-6:

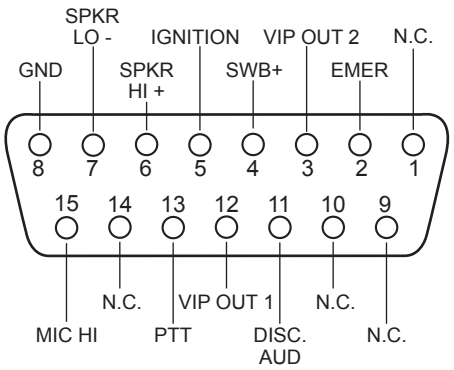


Figure 3-6. Rear Accessory Connector Audio Configuration

Use the HKN6159_ data adapter kit cable if your vehicle was formerly wired for an ASTRO Spectra or ASTRO Spectra Plus radio, and used the rear cable pins as shown in Figure 3-7:

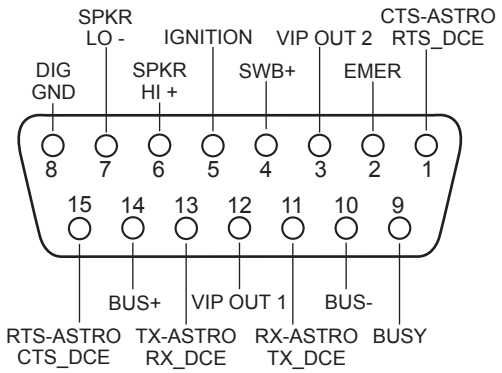


Figure 3-7. Rear Accessory Connector Data Configuration

It is highly recommended that you attach the correct adapter. Installing the wrong adapter may cause damage to the data communication circuitry inside your radio. If you are unsure of the pinout of your former wiring harness, please consult your ASTRO radio installation technician.

3.3.3 Transceiver Rear Accessory Jack Connection

Figure 3-9 shows the complete pin configuration for the J2 rear accessory jack, Figure 3-9 shows the complete pin configuration for the for the J100 control head rear accessory jack and Table 3-2 explains the functions of each of the pins.

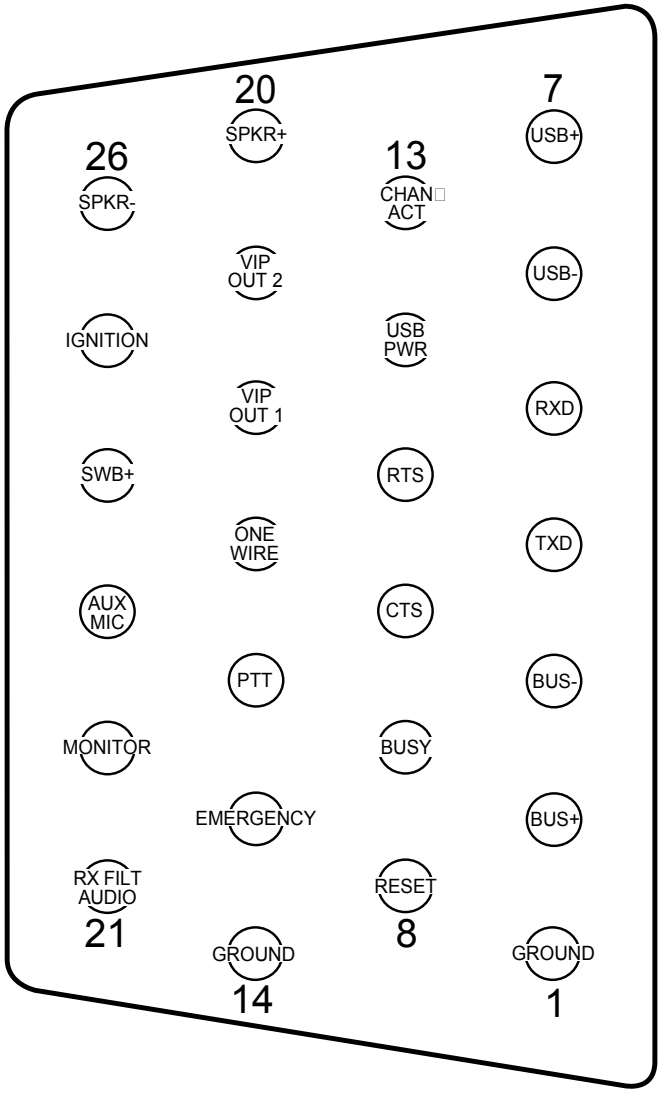


Figure 3-8. Rear Accessory Jack Pin Configuration (J2) (Radio Side)

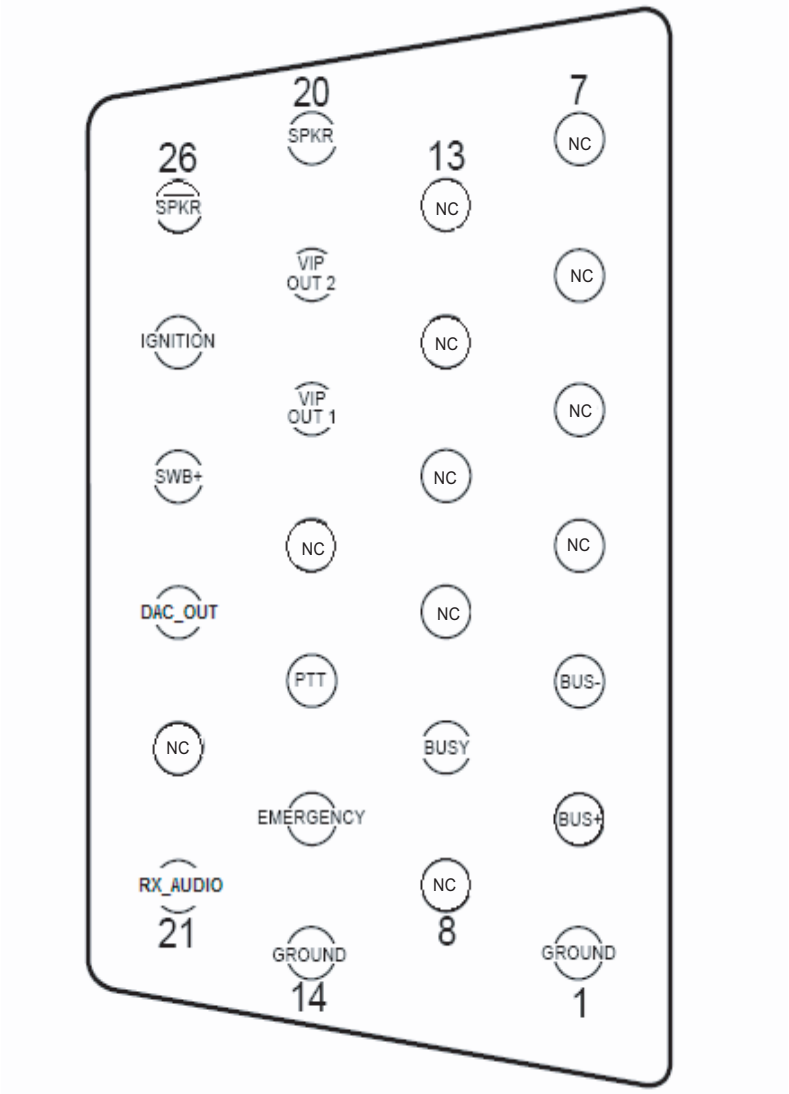


Figure 3-9. Accessory Cable (J626) connector side (branched from TIB front DB25 J600 connector)

Table 3-2. Rear Accessory Jack Pin Functions

Pin No.	Pin Name	Pin Function	Pin No.	Pin Name	Pin Function
1	GND	Ground	14	GND	Ground
2	BUS+	SB9600 BUS+ Data	15	EMERGENCY	Emergency[1]
3	BUS-	SB9600 BUS- Data	16	PTT*	Push To Talk[2]
4	TXD	RS232 Transmit Data	17	ONE WIRE	One-Wire Data
5	RXD	RS232 Receive Data	18	VIP OUT 1	Vehicular Interface Output
6	USB-	USB - (Data)	19	VIP OUT 2	Vehicular Interface Output
7	USB+	USB + (Data)	20	SPKR	Speaker Hi (3.2 ohm minimum impedance)
8	RESET	SB9600 RESET	21	RX FILT AUDIO	Receive Filtered Audio Out[3]
9	BUSY	SB9600 BUSY	22	MONITOR	Monitor Overrides PL[4]
10	CTS	RS232 Clear-To-Send	23	AUX MIC	Rear Microphone Input[5]
11	RTS	RS232 Request-To-Send	24	SW B+	Switched Battery Voltage
12	USB PWR	USB Power (5V from USB accessory/cable)	25	Ignition	Ignition Sense
13	CHAN ACT	Channel Activity (qualified received signal)	26	$\overline{\text{SPKR}}$	Speaker invert (3.2 ohm minimum impedance)

[1] *This pin must be connected to ground by jumper on accessory cable if emergency is disabled, even if disabled by CPS. If enabled, this line must be grounded via a switch, which is normally closed. The emergency debounce time is programmable via CPS.*

[2] *Pulling this line to ground will activate PTT function, activating the AUX_MIC input.*

[3] *Fixed level (independent of volume level) received audio signal, including alert tones. Flat or de-emphasis are programmed by CPS. Output voltage is approximately 100 mVrms per 1kHz of deviation. The DC offset is 1.4V.*

[4] *This output is used to detect when a rear microphone accessory is taken off-hook, to override PL to alert the user to busy traffic prior to transmitting.*

[5] *This microphone signal is independent of the microphone signal on the front microphone connector. The nominal input level is 80mVrms for 60% deviation when used for motorcycle, but can also support 300 mVrms for future APCO accessories. The DC impedance is 660 ohms and the AC impedance is 560 ohms.*

Note: *Please see the XTL 5000 Basic Service manual (Motorola publication part number 6881096C73) for more detailed descriptions of these pins.*

Table 3-3. Accessory Cable J626 Connector Pin Functions

Pin No.	Pin Name	Pin Function	Pin No.	Pin Name	Pin Function
1	GND	Ground	15	EMERGENCY	Emergency
2	BUS+	SB9600 BUS+ Data	16	AUX_PTT	Push To Talk
3	BUS-	SB9600 BUS- Data	17	NO CONNECT	Not connected
4	NO CONNECT	Not connected	18	VIP_OUT1	Vehicular Interface Output 1
5	NO CONNECT	Not connected	19	DCE_RTS/ VOUT_2	RS-232 Request-to-send/ Vehicular Interface Output 2
6	NO CONNECT	Not connected	20	SPKR HI	Speaker Hi (3.2 ohm minimum impedance)
7	NO CONNECT	Not connected			
8	NO CONNECT	Not connected	21	RX_AUDIO	Receive Audio Out
9	BUSY	SB9600 bus busy	22	NO CONNECT	Not connected
10	NO CONNECT	Not connected	23	DAC_OUT	Digital-to-analog converted audio output
11	NO CONNECT	Not connected	24	SWB+	Switched Battery Voltage
12	NO CONNECT	Not connected	25	IGNITION	Ignition Sense
13	NO CONNECT	Not connected	26	SPKR INV	Speaker invert (3.2 ohm minimum impedance)
14	GND	Ground			

Table 3-4. Rear Connector and Front Connector Naming Schemes

J2 Pin Number	J2 Pin Name[1]	Pin Alternate Name	EIA Compatible Name at Rear Connector J2[2]
J2-4	UARTA_TX	No change	TX_DCE
J2-5	UARTA_RX	No change	RX_DCE
J2-10	UARTA_CTS	Becomes RTS	RTS_DCE
J2-11	UARTA_RTS	Becomes CTS	CTS_DCE

1 *As indicated for front and rear connectors*

2 *Pin function as a true "DCE" device according to EIA standard*

Table 3-5. How to Connect to a Computer[1] (DTE Device)

Radio Pin Direction	DB9 (Female) Serial Port Connector[2] = DCE Interface	DB9 (Male) Serial Port Connector = DTE Interface	Data Device Pin Direction
Output	TX_DCE = pin 2	pin 2 = RX_DTE	Input
Input	RX_DCE = pin 3	pin 3 = TX_DTE	Output
Output	RTS_DCE = pin 8	pin 8 = CTS_DTE	Input
Input	CTS_DCE = pin 7	pin 7 = RTS_DTE	Output

1 *EIA standard*

2 *The DB9 (female) serial port cable can be added to the P2 rear accessory cable (Figure 3-5).*

Note: *TX to RX and RTS to CTS, not "same to same" (e.g., not TX to TX).*

Chapter 4 Finishing the Installation: Cable Connection

Perform the following if it has not been previously done:

1. Unplug the CAN coiled cable connector on the Transceiver Interface. Plug in the connector again. A “click” sound should be heard. Ensure location of CAN connector is correct i.e. J800L or J800R on the transceiver interface.
2. Connect the plug from the speaker lead to the mating connector of either J2 or J626 (refer cabling diagram for detail).

NOTE: Connector-protective covers are provided with the radio. They should be used for added environmental robustness.

3. Be sure the control head PTT switches are OFF. Install the 15- or 20-amp fuse in the radio power cable fuseholder and the 3- or 4-amp fuse(s) in the ignition cable fuseholder(s).
4. Turn the radio **ON** at the control head and verify proper operation of all controls and indicators. Radio operation in some installations require turning on the ignition. Perform a complete operational check of the radio.
5. Dress the control and power cables out of the way to prevent damage (pull any excess cable into the trunk area) securing with clamps and tie wraps where necessary.

Notes

Chapter 5 Recommended Practices for Installing and Troubleshooting Mobile Radios in a Vehicular Environment

5.1 Typical Problems

- Radio/Accessories "lock up"
- Radio/Accessories change state/lock-up when radio PTT is depressed
- Radio powers up in the FL 01/90 state (general communication error code)
- Radio intermittently resets
- Radio loses secure key
- Transmit audio distortion on motorcycle radio when engine is running
- Keypad buttons become inoperative for motorcycle radios when engine is running.
- Alternator whine present when transmitting with engine running.
- Radio/Accessories turn themselves on/off.

5.2 Ignition Use versus Ignition Defeat

Typically, the A+ lead (red) is connected directly to the positive terminal of the battery and the ground lead (black) is connected to the vehicle's chassis using as short of a length of wire as is practical. If it is desired to turn the radio on and off via the ignition switch, in addition to the control head's on/off switch, connect the ignition lead to one of the vehicle's ignition points (usually under the dashboard of the vehicle on the fuse panel). If it is desired to have the radio power up only though the control head's on/off switch, then connect the ignition lead directly to the positive terminal of the battery. This will mean that the ignition will always be ignored and a re-wiring will be necessary in the future if you need to choose any ignition-sense CPS setting.

5.3 General precautions

1. If the ignition switch is to be used, make sure that there is not a large voltage drop between the A+ point (usually the positive terminal of the battery) and the ignition point. In general, the voltage difference between these two points should not be greater than 1.5 volts when all accessories/air-conditioner, etc. are turned on.
2. Take care to scrape away paint on the chassis at the place where the ground connection is to be made, and try to keep the ground lead as short as is reasonably possible.
3. For vehicles that use electromechanical relays to control external devices (lights, motors, switchboxes, etc.), these relay circuits should be isolated as best as possible from the mobile radio equipment. Also, diode suppression should be used across the relay contacts to minimize the noise produced by the collapsing magnetic field.
4. For vehicles that have other types of electronic equipment installed (lights, flashers, computers, siren/PA, etc.), use a separate ground for the mobile radio equipment.
5. Make sure that the mobile radio antenna is the minimum required distance (three feet) from the mobile radio equipment to prevent radio frequency interference (RFI) from interfering with the radio and/or accessories.

6. Do not coil up any excess length of the A+ (red) lead. Doing this may cause a large transient voltage to be produced when there is a high current drain (e.g. during transmit). This could cause the radio to reset when the push-to-talk (PTT) is depressed.
7. For motorcycle mounted radios, make sure that the antenna ground connection is solid. An intermittent ground connection can cause the transmission to be distorted when the motorcycle's engine is running.
8. Do not coil up any excessive length of antenna cable, if possible. It may be affect the radio's receive performance.

Optional precautions that may also be taken:

1. Use a relay to isolate the ignition switch lead from the ignition point in the vehicle. Trigger the relay from the ignition point of the vehicle and have the relay connect the ignition lead to the positive terminal of the battery.
2. Install a Power Line Filter between the A+ lead and the positive terminal of the battery. This is intended to filter the battery power applied to the transmitter power amplifiers. Be careful of this, however, because the series filter will introduce a negative spike when the radio transmits that may cause problems with radio operation. Lock-up issues have been seen with the dual control head MCS 2000 configuration.
3. If an extra length of cable is used to extend the microphone, make sure that the added capacitance does not interfere with the operation of the radio.

Appendix A Replacement Parts Ordering

A.1 Basic Ordering Information

When ordering replacement parts or equipment information, the complete identification number should be included. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part, and sufficient description of the desired component to identify it.

Crystal orders should specify the crystal type number, crystal and carrier frequency, and the model number in which the part is used.

The ASTRO XTL 5000 Digital Mobile Radio Basic Service Manual (Motorola publication part number 6881096C73) includes complete parts lists and parts numbers.

A.2 Motorola Online

Motorola Online users can access our online catalog at

https://www.motorola.com/businessonline

To register for online access:

- Domestic customers: please call 800-814-0601 (U.S. and Canada).
- International customers: please go to https://www.motorola.com/businessonline and click on "Sign Up Now."

A.3 Mail Orders

Send written orders to the following addresses:

Replacement Parts/ Test Equipment/Manuals/ Crystal Service Items:

Motorola Inc.
Radio Products and Services Division*
Attention: Order Processing
2200 Galvin Drive
Elgin, IL 60123
U.S.A.

Federal Government Orders:

Motorola Inc.
U.S. Federal Government Markets Division
Attention: Order Processing
7230 Parkway Drive
Landover, MD 21076
U.S.A.

International Orders:

Motorola Inc.
Radio Products and Services Division*
Attention: Order Processing
2200 Galvin Drive
Elgin, IL 60123
U.S.A.

A.4 Telephone Orders

Radio Products and Services Division*
(United States and Canada)
7:00 AM to 7:00 PM (Central Standard Time)
Monday through Friday (Chicago, U.S.A.)
1-800-422-4210
1-847-538-8023 (International Orders)

U.S. Federal Government Markets Division (USFGMD)
1-800-826-1913 Federal Government Parts - Credit Cards Only
8:30 AM to 5:00 PM (Eastern Standard Time)

A.5 Fax Orders

Radio Products and Services Division*
(United States and Canada)
1-800-622-6210
1-847-576-3023 (International)

USFGMD
(Federal Government Orders)
1-800-526-8641 (For Parts and Equipment Purchase Orders)

A.6 Parts Identification

Radio Products and Services Division*
(United States and Canada)
1-800-422-4210, menu 3

A.7 Product Customer Service

Customer Response Center
(Non-technical Issues)
1-800-247-2346
FAX:1-800-247-2347

*The Radio Products and Services Division (RPSD) was formerly known as the Customer Care and Services Division (CCSD) and/or the Accessories and Aftermarket Division (AAD).

Glossary

This glossary contains an alphabetical listing of terms and their definitions that are applicable to PM1500 mobile radio products.

Term	Definition
A/D	*See analog-to-digital conversion.*
Abacus IC	A custom integrated circuit providing a digital receiver intermediate frequency (IF) backend.
ADC	*See analog-to-digital converter.*
ADDAG	*See Analog-to-Digital, Digital-to-Analog and Glue.*
ALC	*See automatic level control.*
analog	Refers to a continuously variable signal or a circuit or device designed to handle such signals. *See also digital.*
Analog-to-Digital, Digital-to-Analog and Glue	An integrated circuit designed to be an interface between the radio's DSP, which is digital, and the analog transmitter and receiver ICs.
analog-to-digital conversion	Conversion of an instantaneous dc voltage level to a corresponding digital value. *See also D/A.*
analog-to-digital converter	A device that converts analog signals into digital data. *See also DAC.*
automatic level control	A circuit in the transmit RF path that controls RF power amplifier output, provides leveling over frequency and voltage, and protects against high VSWR.
band	Frequencies allowed for a specific purpose.
BBP	*See baseband interface port.*
baseband interface port	Synchronous serial interface to the transceiver board used to transfer transmit and receive audio data.
BGA	*See ball grid array.*
ball grid array	A type of IC package characterized by solder balls arranged in a grid that are located on the underside of the package.
CODEC	*See coder/decoder.*
coder/decoder	A device that encodes or decodes a signal.

Term	Definition
CPS	*See Customer Programming Software.*
Customer Programming Software	Software with a graphical user interface containing the feature set of an ASTRO radio.
D/A	*See digital-to-analog conversion.*
DAC	*See digital-to-analog converter.*
DCE	Data communication equipment: The EIA definition for device (i.e., radio) data communications using the RS232 protocol. The correct data communication wiring requires the device's TX pins (output) to connect to the RX pins (input) and the RTS pins (output) to connect to the CTS pins (input). It is incorrect to attach the "same name" to "same name".
default	A pre-defined set of parameters.
digital	Refers to data that is stored or transmitted as a sequence of discrete symbols from a finite set; most commonly this means binary data represented using electronic or electromagnetic signals. *See also analog.*
digital-to-analog conversion	Conversion of a digital signal to a voltage that is proportional to the input value. *See also A/D.*
digital-to-analog converter	A device that converts digital data into analog signals. *See also ADC.*
digital signal processor	A microcontroller specifically designed for performing the mathematics involved in manipulating analog information, such as sound, that has been converted into a digital form. DSP also implies the use of a data compression technique.
DSP	*See digital signal processor.*
DTE	Data terminal equipment: i.e., a computer.
DTMF	*See dual tone multi-frequency.*
dual tone multi-frequency	The system used by touch-tone telephones. DTMF assigns a specific frequency, or tone, to each key so that it can easily be identified by a microprocessor.
EEPOT	Electrically Programmable Digital Potentiometer.
EEPROM	*See Electrically Erasable Programmable Read-Only Memory.*
Electrically Erasable Programmable Read-Only Memory	A special type of PROM that can be erased by exposing it to an electrical charge. An EEPROM retains its contents even when the power is turned off.
FCC	Federal Communications Commission.

Term	Definition
firmware	Code executed by an embedded processor such as the Host or DSP in a subscriber radio. This type of code is typically resident in non-volatile memory and as such is more difficult to change than code executed from RAM.
FGU	*See frequency generation unit.*
flash	A non-volatile memory device similar to an EEPROM. Flash memory can be erased and reprogrammed in blocks instead of one byte at a time.
FLASHcode	A 13-digit code which uniquely identifies the System Software Package and Software Revenue Options that are enabled in a particular subscriber radio. FLASHcodes are only applicable for radios which are upgradeable through the FLASHport process.
FLASHport	A Motorola term that describes the ability of a radio to change memory. Every FLASHport radio contains a FLASHport EEPROM memory chip that can be software written and rewritten to, again and again.
FMR	*See Florida Manual Revision.*
Florida Manual Revision	A publication that provides supplemental information for its parent publication before it is revised and reissued.
frequency	Number of times a complete electromagnetic-wave cycle occurs in a fixed unit of time (usually one second).
frequency generation unit	This unit generates ultra-stable, low-phase noise master clock and other derived synchronization clocks that are distributed throughout the communication network.
General-Purpose Input/Output	Pins whose function is programmable.
GPIO	*See General-Purpose Input/Output.*
IC	*See integrated circuit.*
IF	Intermediate Frequency.
integrated circuit	An assembly of interconnected components on a small semiconductor chip, usually made of silicon. One chip can contain millions of microscopic components and perform many functions.
kHz	*See kilohertz.*
kilohertz	One thousand cycles per second. Used especially as a radio-frequency unit.
LCD	*See liquid-crystal display.*
LED	*See light emitting diode.*

Term	Definition
light emitting diode	An electronic device that lights up when electricity is passed through it.
liquid-crystal display	An LCD uses two sheets of polarizing material with a liquid-crystal solution between them. An electric current passed through the liquid causes the crystals to align so that light cannot pass through them.
LO	Local oscillator.
Master In Slave Out	SPI data line from a peripheral to the MCU.
Master Out Slave In	SPI data line from the MCU to a peripheral.
MCU	*See microcontroller unit.*
MDC	Motorola Digital Communications.
MDI	MCU/DSP Interface internal to the Patriot IC.
MHz	*See Megahertz.*
Megahertz	One million cycles per second. Used especially as a radio-frequency unit.
microcontroller unit	Also written as µC. A microprocessor that contains RAM and ROM components, as well as communications and programming components and peripherals.
MISO	*See Master In Slave Out.*
MOSI	*See Master Out Slave In.*
multiplexer	An electronic device that combines several signals for transmission on some shared medium (e.g., a telephone wire).
MUX	*See multiplexer.*
open architecture	A controller configuration that utilizes a microprocessor with extended ROM, RAM, and EEPROM.
oscillator	An electronic device that produces alternating electric current and commonly employs tuned circuits and amplifying components.
PA	Power amplifier.
paging	One-way communication that alerts the receiver to retrieve a message.
Patriot IC	A dual-core processor that contains an MCU and a DSP in one IC package.
PC Board	Printed Circuit Board. Also referred to as a PCB.
phase-locked loop	A circuit in which an oscillator is kept in phase with a reference, usually after passing through a frequency divider.
PL	*See private-line tone squelch.*

Term	Definition
PLL	*See phase-locked loop.*
private-line tone squelch	A continuous sub-audible tone that is transmitted along with the carrier.
Programmable Read-Only Memory	A memory chip on which data can be written only once. Once data has been written onto a PROM, it remains there forever.
programming cable	A cable that allows the CPS to communicate directly with the radio using RS232.
PROM	*See Programmable Read-Only Memory.*
PTT	*See Push-to-Talk.*
Push-to-Talk	The switch or button usually located on the left side of the radio which, when pressed, causes the radio to transmit. When the PTT is released, the unit returns to receive operation.
radio frequency	The portion of the electromagnetic spectrum between audio sound and infrared light (approximately 10 kHz to 10 GHz).
radio frequency power amplifier	Amplifier having one or more active devices to amplify radio signals.
RAM	*See random access memory.*
random access memory	A type of computer memory that can be accessed randomly; that is, any byte of memory can be accessed without touching the preceding bytes.
read-only memory	A type of computer memory on which data has been prerecorded. Once data has been written onto a ROM chip, it cannot be removed and can only be read.
real-time clock	A module that keeps track of elapsed time even when a computer is turned off.
receiver	Electronic device that amplifies RF signals. A receiver separates the audio signal from the RF carrier, amplifies it, and converts it back to the original sound waves.
registers	Short-term data-storage circuits within the microcontroller unit or programmable logic IC.
repeater/talkaround	A conventional radio feature that permits communication through a receive/transmit facility, which re-transmits received signals in order to improve communication range and coverage.
RESET	Reset line: an input to the microcontroller that restarts execution.
RF	*See radio frequency.*
RF PA	*See radio frequency power amplifier.*

Term	Definition
ROM	*See read-only memory.*
RPCIC	Regulator/power control IC.
RPT/TA	*See repeater/talkaround.*
RS232	A common interface standard for data communications equipment.
RTC	*See real-time clock.*
RX	Receive.
RX DATA	Recovered digital data line.
SAP	*See Serial Audio CODEC Port.*
SCI IN	Serial Communications Interface Input line.
Serial Audio CODEC Port	SSI to and from the GCAP II IC CODEC used to transfer transmit and receive audio data.
Serial Communication Interface Input Line	A full-duplex (receiver/transmitter) asynchronous serial interface.
SCI IN	*See Serial Communication Interface Input Line.*
Serial Peripheral Interface	How the microcontroller communicates to modules and ICs through the CLOCK and DATA lines.
signal	An electrically transmitted electromagnetic wave.
Signal Qualifier mode	An operating mode in which the radio is muted, but still continues to analyze receive data to determine RX signal type.
softpot	*See software potentiometer.*
software	Computer programs, procedures, rules, documentation, and data pertaining to the operation of a system.
software potentiometer	A computer-adjustable electronic attenuator.
spectrum	Frequency range within which radiation has specific characteristics.
SPI	*See Serial Peripheral Interface.*
squelch	Muting of audio circuits when received signal levels fall below a pre-determined value. With carrier squelch, all channel activity that exceeds the radio’s preset squelch level can be heard.
SRAM	*See static RAM.*
SRIB	Smart Radio Interface Box.
SSI	*See Synchronous Serial Interface.*

Term	Definition
Standby mode	An operating mode in which the radio is muted but still continues to monitor data.
static RAM	A type of memory used for volatile, program/data memory that does not need to be refreshed.
Synchronous Serial Interface	DSP interface to peripherals that consists of a clock signal line, a frame synchronization signal line, and a data line.
system central controllers	Main control unit of the trunked dispatch system; handles ISW and OSW messages to and from subscriber units.
system select	The act of selecting the desired operating system with the system-select switch (also, the name given to this switch).
thin small-outline package	A type of dynamic random-access memory (DRAM) package that is commonly used in memory applications.
time-out timer	A timer that limits the length of a transmission.
TOT	*See time-out timer.*
transceiver	Transmitter-receiver. A device that both transmits and receives analog or digital signals. Also abbreviated as XCVR.
transmitter	Electronic equipment that generates and amplifies an RF carrier signal, modulates the signal, and then radiates it into space.
TSOP	*See thin small-outline package.*
TX	Transmit.
UART	*See also Universal Asynchronous Receiver Transmitter.*
UHF	Ultra-High Frequency.
Universal Asynchronous Receiver Transmitter	A microchip with programming that controls a computer's interface to its attached serial devices.
Universal Serial Bus	An external bus standard that supports data transfer rates of 12 Mbps.
USB	*See Universal Serial Bus.*
VCO	*See voltage-controlled oscillator.*
VHF	Very-High Frequency.
VIP	Vehicle Interface Port.
VOCON	*See vocoder/controller.*
vocoder	An electronic device for synthesizing speech by implementing a compression algorithm particular to voice. *See also voice encoder.*

Term	Definition
vocoder/controller	A PC board that contains an ASTRO radio's microcontroller, DSP, memory, audio and power functions, and interface support circuitry.
voice encoder	The DSP-based system for digitally processing analog signals, and includes the capabilities of performing voice compression algorithms or voice encoding. *See also vocoder.*
voltage-controlled oscillator	An oscillator in which the frequency of oscillation can be varied by changing a control voltage.

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Motorola Inc.
1301 E. Algonquin Rd.
Schaumburg, IL 60196-1078 USA

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