

ASTRO[®] XTL[™] 1500

Digital Mobile Radio

Installation Manual

**MOTOROLA**

Foreword

This manual covers the ASTRO® XTL™ 1500 digital mobile radio with control head. 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 1500 Basic Service Manual (Motorola publication part number 6815853H01).

Computer Software Copyrights

The Motorola products described in this manual may include copyrighted Motorola computer programs stored in semiconductor memories or other media. Laws in the United States and other countries preserve for Motorola certain exclusive rights for copyrighted computer programs, including, but not limited to, the exclusive right to copy or reproduce in any form the copyrighted computer program. Accordingly, any copyrighted Motorola computer programs contained in the Motorola products described in this manual may not be copied, reproduced, modified, reverse-engineered, or distributed in any manner without the express written permission of Motorola. Furthermore, the purchase of Motorola products shall not be deemed to grant either directly or by implication, estoppel, or otherwise, any license under the copyrights, patents or patent applications of Motorola, except for the normal non-exclusive license to use that arises by operation of law in the sale of a product.

Document Copyrights

No duplication or distribution of this document or any portion thereof shall take place without the express written permission of Motorola. No part of this manual may be reproduced, distributed, or transmitted in any form or by any means, electronic or mechanical, for any purpose without the express written permission of Motorola.

Disclaimer

The information in this document is carefully examined, and is believed to be entirely reliable. However, no responsibility is assumed for inaccuracies. Furthermore, Motorola reserves the right to make changes to any products herein to improve readability, function, or design. Motorola does not assume any liability arising out of the applications or use of any product or circuit described herein; nor does it cover any license under its patent rights nor the rights of others.

Trademarks

MOTOROLA, the Stylized M logo, FLASHport, and ASTRO are registered in the US Patent & Trademark Office. All other product or service names are the property of their respective owners.

© Motorola, Inc. 2005.

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 2-8](#) 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/cgiss/index.shtml>.

This Page Intentionally Left Blank

Table of Contents

Foreword	ii
Product Safety and RF Exposure Compliance	ii
Manual Revisions	ii
Parts Ordering	ii
Computer Software Copyrights	ii
Document Copyrights	ii
Disclaimer	ii
Trademarks	ii
 Installation Requirements for Compliance with Radio Frequency (RF) Energy Exposure Safety Standards	 iii
 Mobile Radio Model Numbering Scheme	 x
 Commercial Warranty	 xi
Limited Warranty	xi
MOTOROLA COMMUNICATION PRODUCTS	xi
I. What This Warranty Covers And For How Long	xi
II. General Provisions	xi
III. State Law Rights	xii
IV. How To Get Warranty Service	xii
V. What This Warranty Does Not Cover	xii
VI. Patent And Software Provisions	xiii
VII. Governing Law	xiii
 Chapter 1 Introduction	 1-1
1.1 Mobile Radio Description	1-1
1.1.1 Dimensions	1-1
1.2.1 Dash Mount Configuration	1-2
1.3 Base/Control Stations	1-2
1.4 Tools Required for XTL 1500 Installations	1-3
 Chapter 2 Standard Configurations	 2-1
2.1 Planning the Installation	2-1
2.2 Radio Mounting	2-4
2.2.2 Locking Kit (Optional)	2-6
2.3 Power Cable and Ignition	2-6
2.4 Ignition Sense Cable	2-8
2.5 Antenna Installation	2-8
2.5.1 Selecting an Antenna Site/Location on a Metal Body Vehicle	2-8
2.5.2 Mini-UHF Connection	2-9
2.6 Microphone Hang-Up Clip	2-11
2.6.1 Standard Hang-Up Clip	2-11

2.6.2	Handheld Hang-Up Box	2-11
2.7	Completing the Installation	2-11

Chapter 3 Options and Accessories Installation 3-1

3.1	VIP Overview	3-1
3.1.1	VIP Output Connections	3-1
3.1.2	Emergency Pushbutton, Footswitch, Horn Relay, and Light Relay Installation	3-2
3.1.2.1	Emergency Pushbutton or Footswitch Installation	3-2
3.1.2.2	Horn (External Alarm) Relay Installation	3-2
3.1.2.3	Lights (External Alarm) Relay Installation	3-2
3.2	Dash-Mount Accessory Installation	3-3
3.2.1	MDC Emergency Pushbutton or Footswitch Installation	3-3
3.2.2	Horn and Lights (External Alarms) Relays	3-3
3.2.3	External Speaker (HSN4031_)	3-4
3.3	Accessory Connector Assembly Details (P2)	3-5
3.3.1	Installation into the Vehicle	3-6
3.3.2	Installation onto the Radio	3-6
3.3.3	Disassembly and Assembly	3-7
3.3.3.1	Disassembly	3-7
3.3.3.2	Assembly	3-7
3.3.4	Transceiver Rear Accessory Jack Connection	3-9

Chapter 4 Finishing the Installation: Cable Connection 4-1

Appendix A Replacement Parts Ordering A-1

A.1	Basic Ordering Information	A-1
A.2	Motorola Online	A-1
A.3	Mail Orders	A-1
A.5	Fax Orders	A-2
A.6	Parts Identification	A-2
A.7	Product Customer Service	A-2

Glossary Glossary-1

Index Index-1

Related Publications

ASTRO XTL 1500 User's Guide	6815850H01
ASTRO XTL 1500 CD (User's Guide & Installation Manual).....	6815852H01
ASTRO XTL 1500 Basic Service Manual.....	6815853H01
ASTRO XTL 1500 Detailed Service Manual	6815854H01

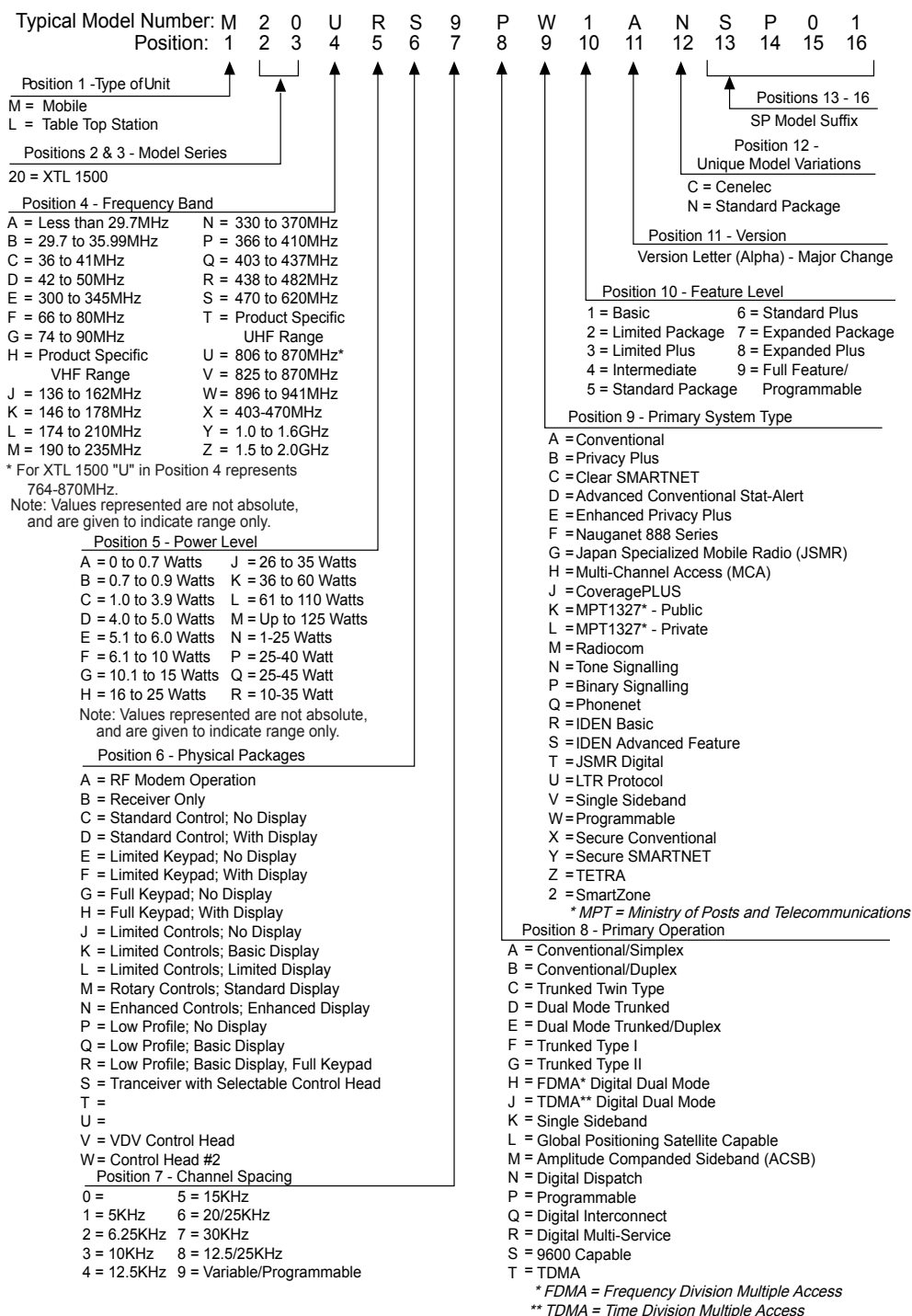
List of Figures

Figure 1-1. Front View of Dash Mount Brick Trunnion	1-1
Figure 1-2. Side View of Dash Mount Brick Trunnion	1-1
Figure 1-3. Dash Mount Configuration	1-2
Figure 2-1. Mounting Flexibility in Middle Console.....	2-2
Figure 2-2. On Top or Under Dash Mounting	2-2
Figure 2-3. In Dash Mounting.....	2-2
Figure 2-4. Radio Installation with transceiver	2-3
Figure 2-5. Trunnion Orientation	2-4
Figure 2-6. Transmission Hump Trunnion Mounting	2-5
Figure 2-7. Below Dash Trunnion Mounting.....	2-5
Figure 2-8. Locking Kit (Optional)	2-6
Figure 2-9. Cabling Interconnect Diagram for Dash Mount.....	2-7
Figure 2-10. Mini-UHF Connection	2-9
Figure 2-11. Mini-UHF Connector Tool	2-10
Figure 3-1. VIP Connector Detail	3-2
Figure 3-2. Emergency Switch Wiring Diagram	3-3
Figure 3-3. Horn/Light Wiring Diagram	3-4
Figure 3-4. Speaker Mounting.....	3-5
Figure 3-5. Exploded View of Accessory Connector Assembly (P2)	3-7
Figure 3-6. Rear Accessory Jack Pin Configuration (J2) (Radio Side)	3-9

List of Tables

Table 3-1.	VIP Output Connections	3-1
Table 3-2.	Rear Accessory Jack Pin Functions	3-10
Table 3-3.	Rear Connector and Front Connector Naming Schemes	3-11
Table 3-4.	How to Connect to a Computer ¹ (DTE Device)	3-11

Mobile Radio Model Numbering Scheme



Commercial Warranty

Limited Warranty

MOTOROLA COMMUNICATION PRODUCTS

I. What This Warranty Covers And For How Long

MOTOROLA INC. ("MOTOROLA") warrants the MOTOROLA manufactured Communication Products listed below ("Product") against defects in material and workmanship under normal use and service for a period of time from the date of purchase as scheduled below:

ASTRO XTL 1500 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.

This express limited warranty is extended by MOTOROLA to the original end user purchaser only and is not assignable or transferable to any other party. This is the complete warranty for the Product manufactured by MOTOROLA. MOTOROLA assumes no obligations or liability for additions or modifications to this warranty unless made in writing and signed by an officer of MOTOROLA. Unless made in a separate agreement between MOTOROLA and the original end user purchaser, MOTOROLA does not warrant the installation, maintenance or service of the Product.

MOTOROLA cannot be responsible in any way for any ancillary equipment not furnished by MOTOROLA which is attached to or used in connection with the Product, or for operation of the Product with any ancillary equipment, and all such equipment is expressly excluded from this warranty. Because each system which may use the Product is unique, MOTOROLA disclaims liability for range, coverage, or operation of the system as a whole under this warranty.

II. General Provisions

This warranty sets forth the full extent of MOTOROLA'S responsibilities regarding the Product. Repair, replacement or refund of the purchase price, at MOTOROLA's option, is the exclusive remedy. THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER EXPRESS WARRANTIES. IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO THE DURATION OF THIS LIMITED WARRANTY. IN NO EVENT SHALL MOTOROLA BE LIABLE FOR DAMAGES IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCT, FOR ANY LOSS OF USE, LOSS OF TIME, INCONVENIENCE, COMMERCIAL LOSS, LOST PROFITS OR SAVINGS OR OTHER INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE SUCH PRODUCT, TO THE FULL EXTENT SUCH MAY BE DISCLAIMED BY LAW.

III. State Law Rights

SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LIMITATION ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION OR EXCLUSIONS MAY NOT APPLY.

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.

V. What This Warranty Does Not Cover

- A. Defects or damage resulting from use of the Product in other than its normal and customary manner.
- B. Defects or damage from misuse, accident, water, or neglect.
- 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.
- E. A Product subjected to unauthorized Product modifications, disassemblies or repairs (including, without limitation, the addition to the Product of non-Motorola supplied equipment) which adversely affect performance of the Product or interfere with Motorola's normal warranty inspection and testing of the Product to verify any warranty claim.
- F. Product which has had the serial number removed or made illegible.
- G. Rechargeable batteries if:
 - any of the seals on the battery enclosure of cells are broken or show evidence of tampering.
 - 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.
- I. A Product which, due to illegal or unauthorized alteration of the software/firmware in the Product, does not function in accordance with MOTOROLA's published specifications or the FCC type acceptance labeling in effect for the Product at the time the Product was initially distributed from MOTOROLA.
- J. Scratches or other cosmetic damage to Product surfaces that does not affect the operation of the Product.
- K. Normal and customary wear and tear.

VI. Patent And Software Provisions

MOTOROLA will defend, at its own expense, any suit brought against the end user purchaser to the extent that it is based on a claim that the Product or parts infringe a United States patent, and MOTOROLA will pay those costs and damages finally awarded against the end user purchaser in any such suit which are attributable to any such claim, but such defense and payments are conditioned on the following:

- A. that MOTOROLA will be notified promptly in writing by such purchaser of any notice of such claim;
- B. that MOTOROLA will have sole control of the defense of such suit and all negotiations for its settlement or compromise; and
- C. should the Product or parts become, or in MOTOROLA's opinion be likely to become, the subject of a claim of infringement of a United States patent, that such purchaser will permit MOTOROLA, at its option and expense, either to procure for such purchaser the right to continue using the Product or parts or to replace or modify the same so that it becomes noninfringing or to grant such purchaser a credit for the Product or parts as depreciated and accept its return. The depreciation will be an equal amount per year over the lifetime of the Product or parts as established by MOTOROLA.

MOTOROLA will have no liability with respect to any claim of patent infringement which is based upon the combination of the Product or parts furnished hereunder with software, apparatus or devices not furnished by MOTOROLA, nor will MOTOROLA have any liability for the use of ancillary equipment or software not furnished by MOTOROLA which is attached to or used in connection with the Product. The foregoing states the entire liability of MOTOROLA with respect to infringement of patents by the Product or any parts thereof.

Laws in the United States and other countries preserve for MOTOROLA certain exclusive rights for copyrighted MOTOROLA software such as the exclusive rights to reproduce in copies and distribute copies of such Motorola software. MOTOROLA software may be used in only the Product in which the software was originally embodied and such software in such Product may not be replaced, copied, distributed, modified in any way, or used to produce any derivative thereof. No other use including, without limitation, alteration, modification, reproduction, distribution, or reverse engineering of such MOTOROLA software or exercise of rights in such MOTOROLA software is permitted. No license is granted by implication, estoppel or otherwise under MOTOROLA patent rights or copyrights.

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 1500 mobile and accessories required to complete the radio system. The radio system consists of a control head, radio, antenna, microphone, 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 brick trunnion XTL 1500 radio.

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 access, controls; and to the sides of the radio so that you may access and install the trunnion wing screws.

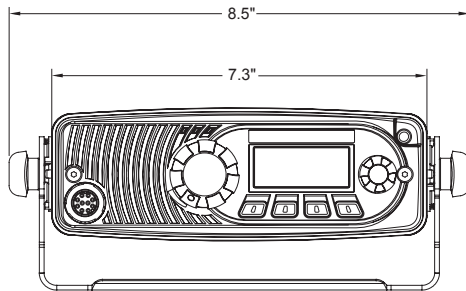


Figure 1-1. Front View of Dash Mount Brick Trunnion

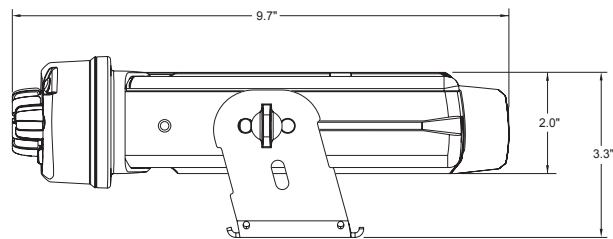


Figure 1-2. Side View of Dash Mount Brick Trunnion

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

1.2 Standard Configurations

1.2.1 Dash Mount Configuration

The control head is mounted on the front of the transceiver housing. Electrical connection between the two takes place within the radio via a flexible circuit board between the connectors on the front of the transceiver and at the back of the control head.

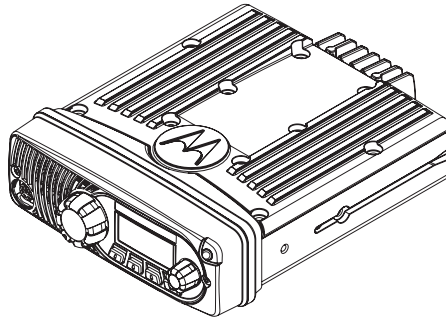


Figure 1-3. Dash Mount Configuration

For details on this configuration, see [Section 2.2.1 on page 2-5](#).

1.3 Base/Control Stations

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 1500 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	—

This Page Intentionally Left Blank

Chapter 2 Standard Configurations

2.1 Planning the Installation

The XTL 1500 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 servicer or installer.
----------------	--

2.1.1 Installation Examples

Your mobile two-way radio offers only dash mount installation. (see [Figure 2-1](#) through [Figure 2-3](#)).

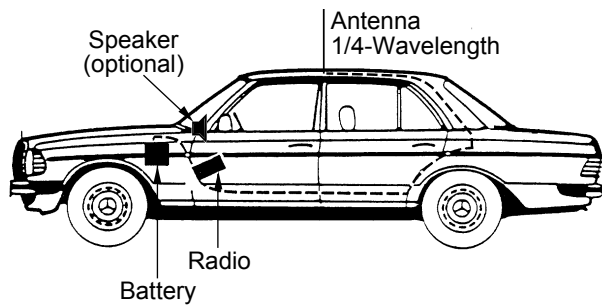


Figure 2-1. Mounting Flexibility in Middle Console

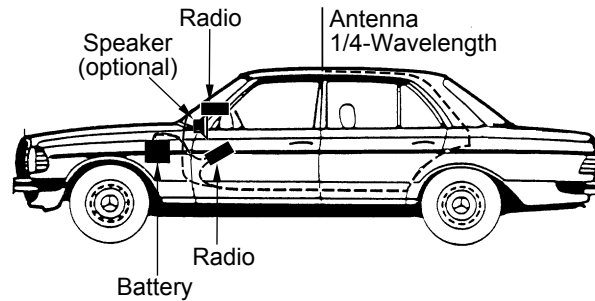


Figure 2-2. On Top or Under Dash Mounting

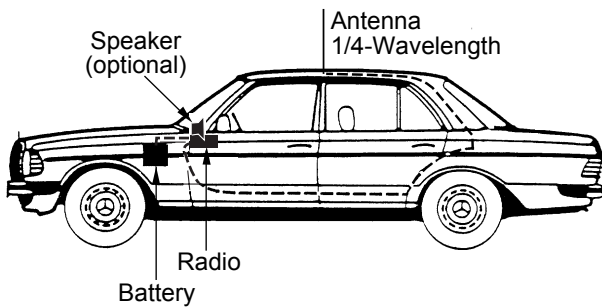


Figure 2-3. In Dash Mounting

Figure 2-4 shows the wiring diagram the possible configurations. The title under the figure identifies the control head configurations. Use the diagram when planning the installation.

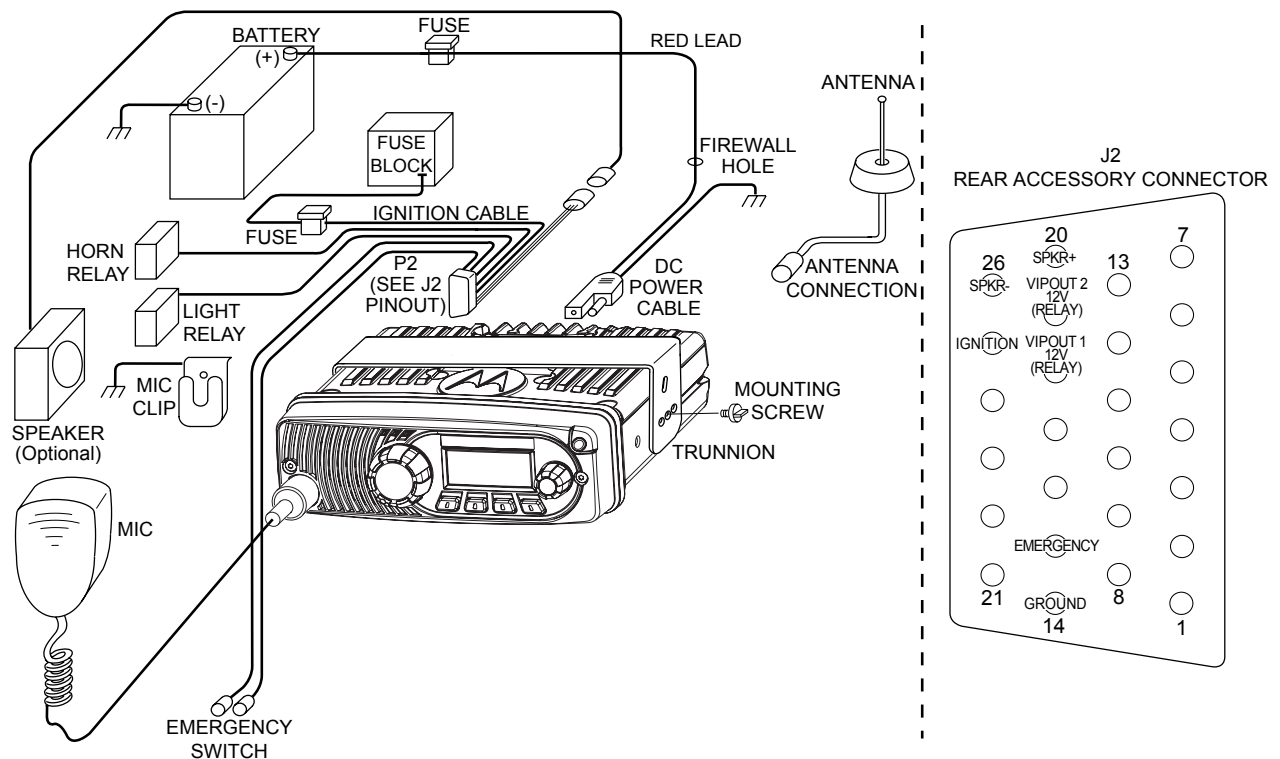


Figure 2-4. Radio Installation with transceiver
(For complete pin configuration, see [Figure 3-6](#).)

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.

NOTE: For new or existing installations, use only the XTL 1500 trunnion, kit number HLN6861_.

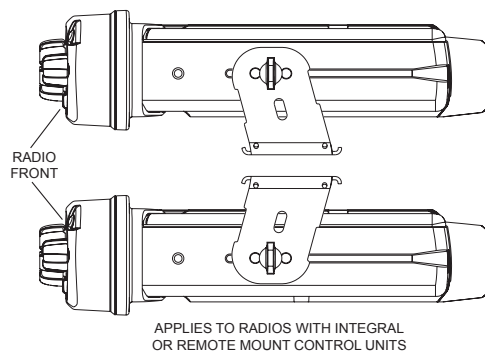


Figure 2-5. Trunnion Orientation

2.2.1 Dash Mount with Trunnion

1. Select the location to mount your radio on the transmission hump (see [Figure 2-6](#)) or under the dash (see [Figure 2-7](#)). 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 2-6](#) and [Figure 2-7](#)).
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 2-6](#)). Secure the radio with the two wing screws provided.

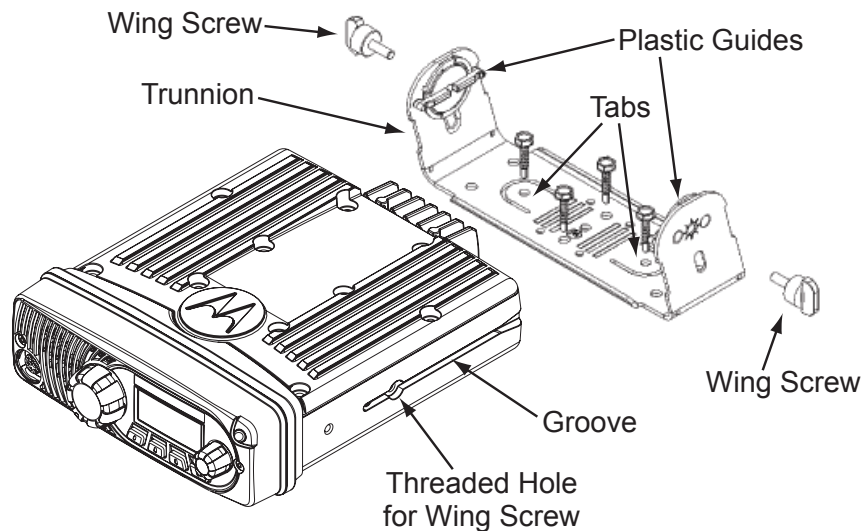


Figure 2-6. Transmission Hump Trunnion Mounting

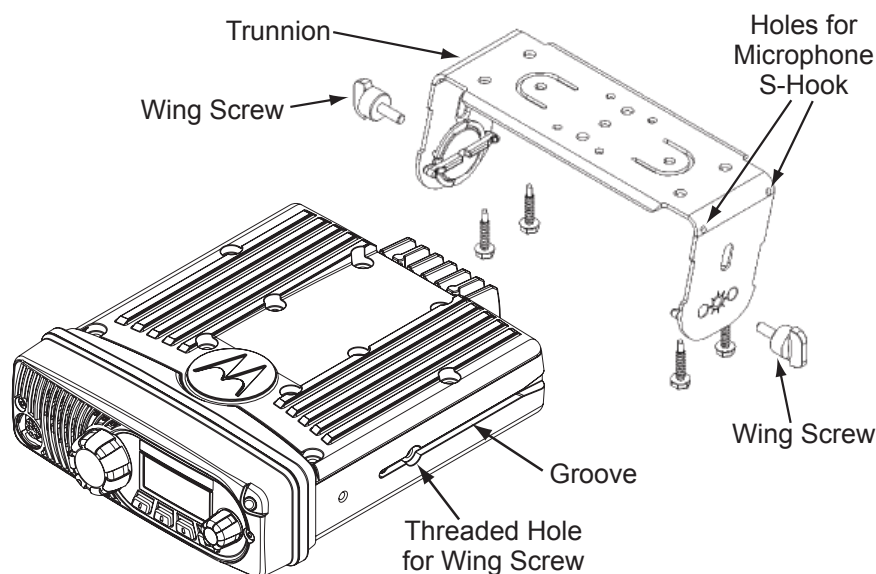


Figure 2-7. Below Dash Trunnion Mounting

2.2.2 Locking Kit (Optional)

If an optional locking kit is used (shown in [Figure 2-8](#)), 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.

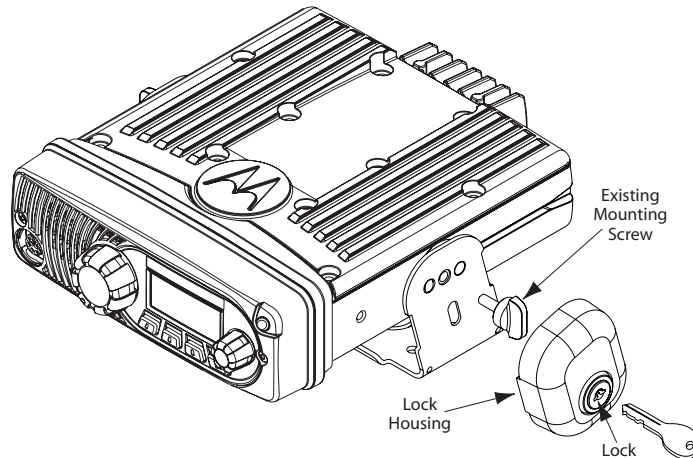
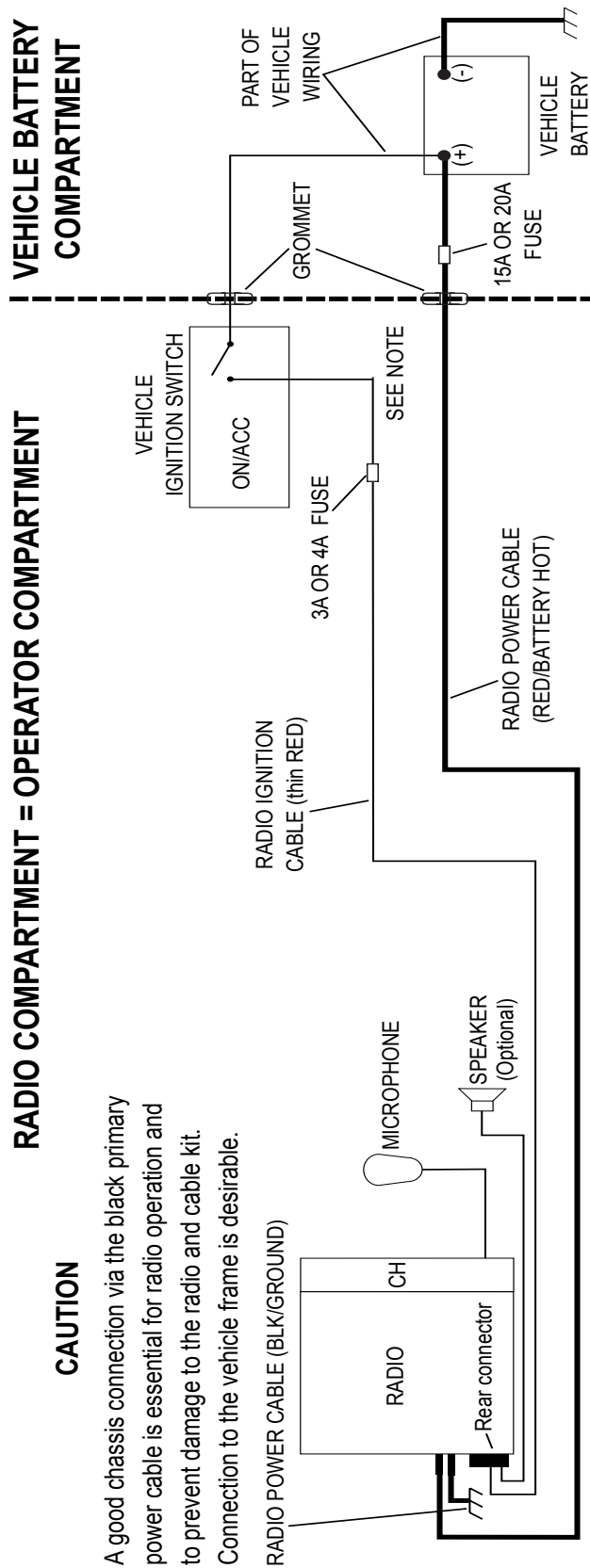


Figure 2-8. Locking Kit (Optional)

2.3 Power Cable and Ignition

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) or 20-amp (part number 6580283E07) 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 2-9](#). Connect the black lead to a convenient solid chassis ground point. DO NOT connect the black lead directly to the battery's negative terminal.

Always connect the IGNITION LINE (thin red wire) located at the rear of the radio to the vehicle's ignition switch (see [Figure 2-9](#)). The radio is programmable through CPS to allow ignition to disallow the radio from powering up without ignition or to power up with ignition.



Caution: Always wire the radio's IGNITION line to the car's ignition switch.

Figure 2-9. Cabling Interconnect Diagram for Dash Mount

MAEPF-27646-B

2.4 Ignition Sense Cable

Motorola supplies an ignition sense cable and recommends that it be used with every *mobile* installation. The ignition sense cable allows the radio to be turned on and off with the vehicle ignition switch, and allows the radio to “remember” the state of the radio on/off switch, even if it is changed while the vehicle is off.

Note that this feature can be turned on/off via Motorola CPS software.

- Always connect the red ignition cable (orange for remote) to “ignition” at the fuse block.

Note that for remote mount installations, the green and orange leads are connected, not the red lead from the rear of the radio.

The ignition sense cable uses either a 3-amp (P/N 6580283E01) or 4-amp (P/N 6580283E02) fuse.

For other considerations when connecting the ignition cable, see the XTL 1500 Basic Service Manual (Motorola publication part number 6815853H01).

2.5 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.

2.5.1 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, 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.

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.

2.5.2 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 2-10](#)):

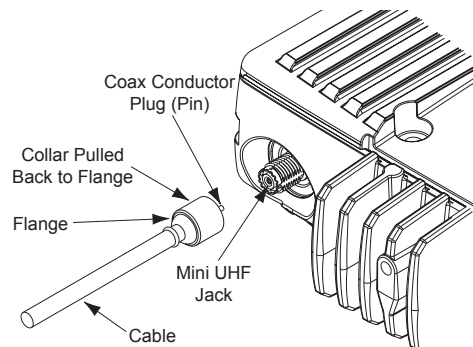


Figure 2-10. Mini-UHF Connection

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. Slip the mini-UHF connector tool over the coaxial cable, using the gap between the tool's legs (see [Figure 2-11](#)). 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.

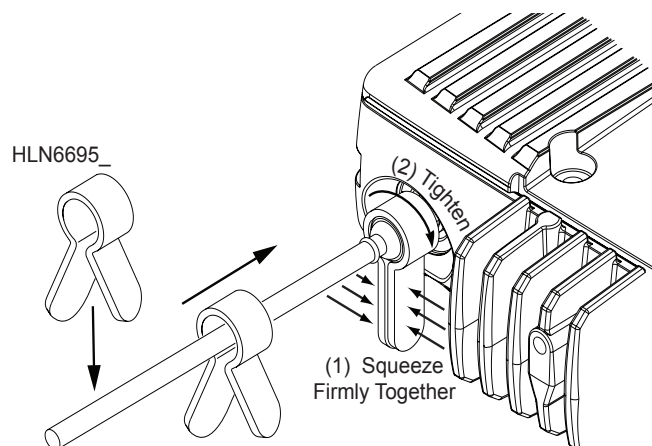


Figure 2-11. Mini-UHF Connector Tool

2.6 Microphone 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 microphone can be mounted in any position. The microphone 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 microphone, install the flathead screw in the top clip hole.

2.6.2 Handheld Hang-Up Box

Use the hang-up box (HUB) as a template to locate the mounting holes. Be sure the HUB will be within easy reach of the operator. Open the accessory cable connector and connect the HUB control wire to location 3 of the accessory connector. Connect the other control wire from the HUB to a convenient solid chassis ground point.

2.7 Completing the Installation

Complete the installation by connecting the power wires and plugging in the microphone cable. Be sure to connect the microphone S-hook to the holes in the trunnion provided (see [Figure 2-7](#)) for strain relief.

This Page Intentionally Left Blank

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 three VIP outputs which are used for relay control. There are also three VIP inputs which accept inputs from switches.

3.1.1 VIP Output Connections

The VIP output pins are on the back or the rear of the accessory panel (J2). The pin information is shown in [Figure 3-6](#). 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

	J2	
VIP Number	SW B+ Pin Number	On/Off Switched Pin Number
1	24	18
2	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.




Caution

CAUTION: XTL 1500 radios equipped with the following features are capable of transmitting automatically, even if the radio is turned off:

- MDC Status/Message
- MDC Emergency
- Trunking Products
- Automatic Vehicle Location
- Other Special Data Products

All XTL 1500 have accessory connector pins 14 and 15 connected together to allow the radio to power down. Opening this connection by REMOVING the accessory connector, or otherwise failing to maintain a normally closed path, could, if left unchecked, drain the vehicle battery, and possibly cause transmissions to occur.

3.1.2 Emergency Pushbutton, Footswitch, Horn Relay, and Light Relay Installation



CAUTION: When connecting the various microphones available, make sure to attach the S-hook provided on the microphone cable (see [Figure 2-7](#) in Chapter 2) to the dash or remote mount trunnion to avoid damage to the microphone control head interconnect.

Caution

Perform the following installation procedure:

1. Select an appropriate place to mount the option or accessory hardware.
2. Connect the male-pin control leads (wires) to the VIP connector in the appropriate location (see [Table 3-1](#)). [Figure 3-1](#) shows how wires are plugged into the connector and how to use an extraction tool to remove wires.
3. Route the accessory-to-control head cables under floor coverings or behind panels so that the vehicle occupants do not snag or break the wires.

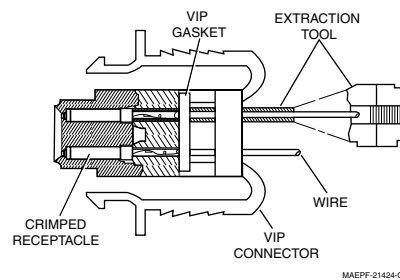


Figure 3-1. VIP Connector Detail

3.1.2.1 Emergency Pushbutton or Footswitch Installation

Mount the switch using the hardware that comes with the kit. Connect the emergency switch wires to a ground pin and a VIP IN pin on the VIP connector.

1. Remove JU1008 (emergency to ground) from the control head remote back housing (HLN6432_).
2. Place JU1007 (emergency to VIP IN 2) on the control head remote back housing (HLN6432_).
3. Remove R84 (if installed) from the control head.
4. Install the emergency switch between pins 3 (VIP IN 2) and 20 (ground) of the control head back connector.

3.1.2.2 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.

3.1.2.3 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 Dash-Mount Accessory Installation

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 3-6](#)). Do not use other generic terminals in the plug. Generic terminals can cause electrical intermittencies and may cause damage to the plug.

3.2.1 MDC 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. 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.

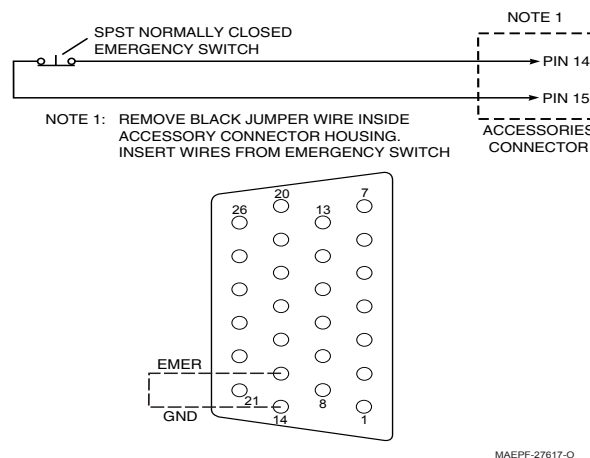


Figure 3-2. Emergency Switch Wiring Diagram

3.2.2 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 3-3](#), perform the following procedure:

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.

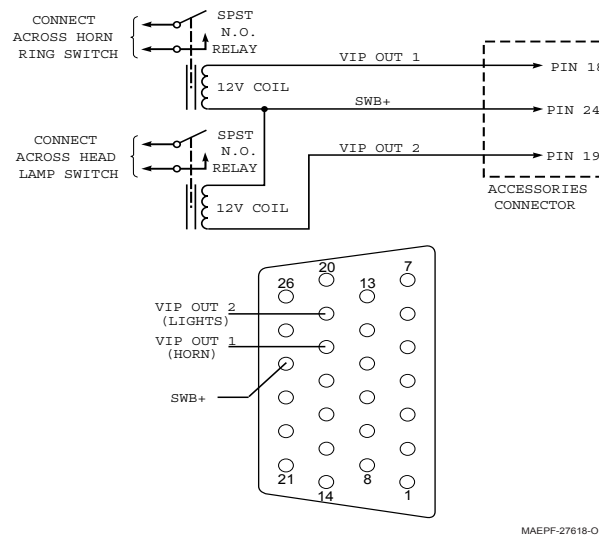


Figure 3-3. Horn/Light Wiring Diagram

3.2.3 External Speaker (HSN4031_)



Caution

CAUTION: DO NOT use an external speaker which exceeds 7.5W or is below 8 Ohm. Use **ONLY** HSN4031_ speaker kit

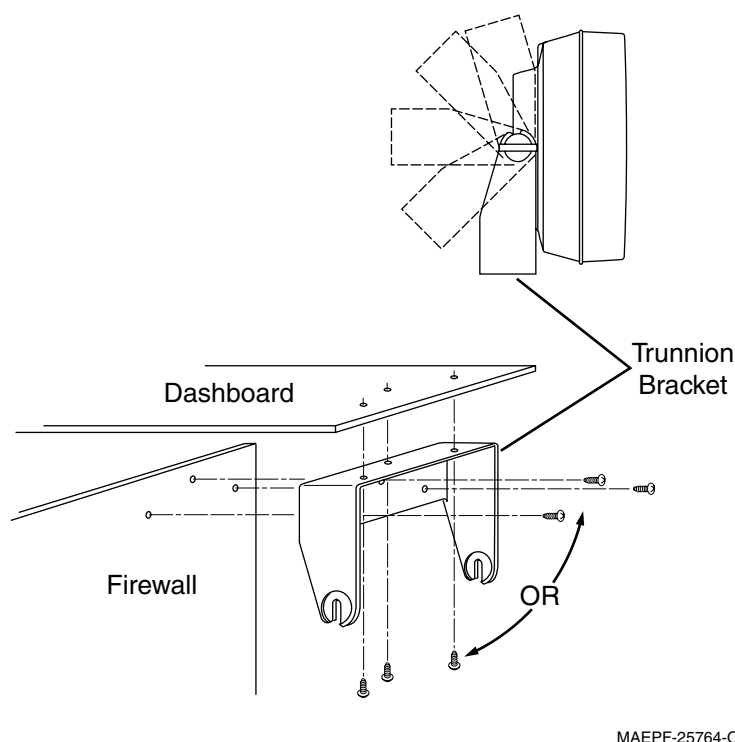


Caution

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.



MAEPF-25764-O

Figure 3-4. Speaker Mounting

3.3 Accessory Connector Assembly Details (P2)

The XTL 1500 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 1500 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 Installation into the Vehicle

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

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.
2. Place the accessory connector assembly in the approximate location for the permanent installation of the radio. Allocate a sufficient service loop for ease of removing and servicing the radio.
3. Route the ignition wire to either an ignition switch circuit or a power source that is always hot (see [Section 2.4 on page 2-8](#)). In either case, verify that the source will be capable of withstanding a load of 4 amps (see the wiring diagrams in the vehicle manufacturer's service manual). Always use the supplied fuse holder to prevent damage to the radio.
4. Secure wires with tie straps or electrical tape to prevent damage to or entanglement of the wire. If wires are passed through drilled holes through firewalls or through any other metal panels within the vehicle, the holes must be fitted with a rubber grommet (not supplied) to prevent shaving of the wire's protective jacket, which could cause electrical shorting.

NOTE: If the speaker pigtail is connected to the speaker assembly (optional), Be sure not to route the speaker pigtail or wires through any areas that could cause potential damage to them. The audio system is a floating ground; therefore, any speaker lines that come into contact with the ground can cause damage to the radio. Check all wires for electrical shorts; properly repair any electrical shorting issues immediately.

5. If there are no issues, reconnect the battery. Follow the vehicle manufacturer's instructions for the proper procedure.

3.3.2 Installation onto the Radio

The accessory connector assembly is fastened to the back of the radio by jackscrews. The radio should be fully mounted and secured in its trunnion prior to connecting the accessory connector assembly to the radio. Be sure when connecting the accessory connector assembly to the radio that there are no foreign materials in the mating surfaces. Do not force the connector on. It should slide on with very little resistance. Be sure that both jackscrews are engaged in their threaded holes before tightening them. Finger tighten the jackscrews securely to prevent loosening.

3.3.3 Disassembly and Assembly

3.3.3.1 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.

3.3.3.2 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.

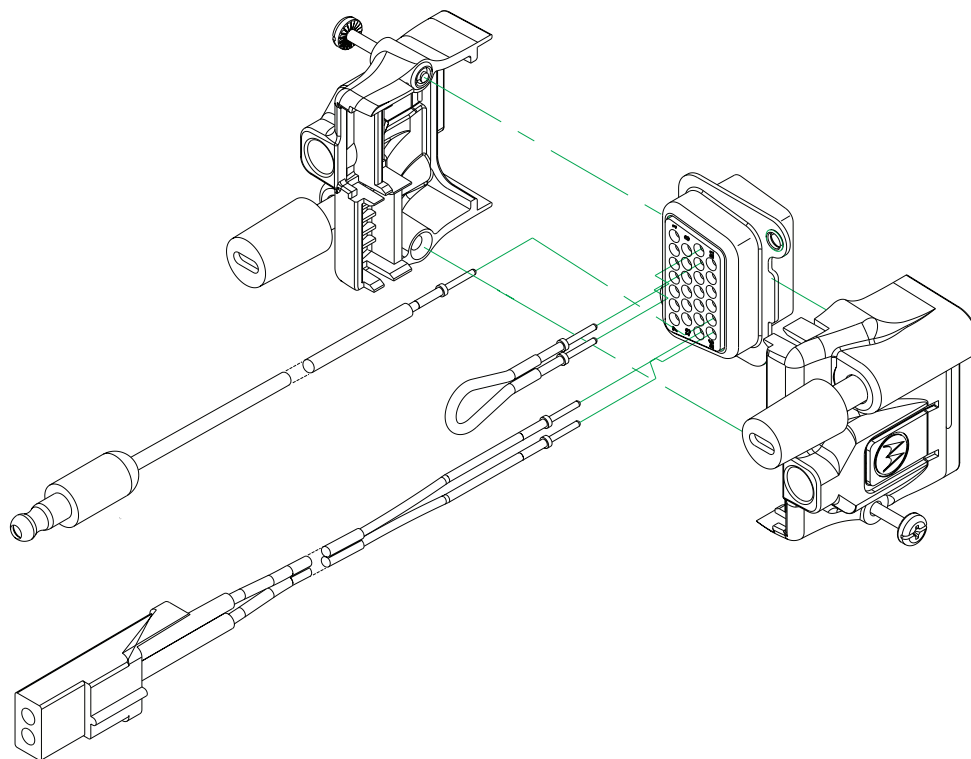
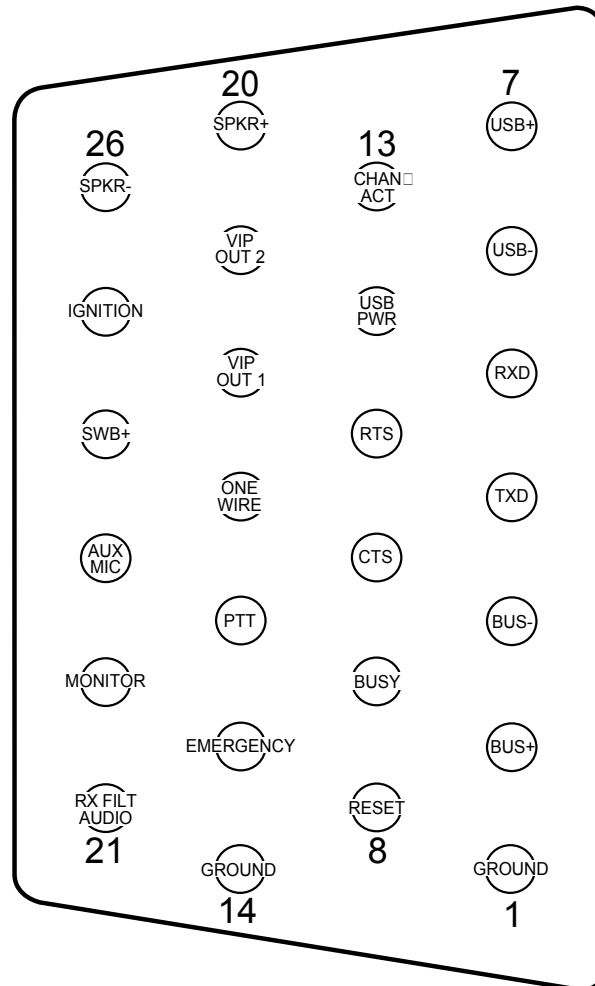


Figure 3-5. Exploded View of Accessory Connector Assembly (P2)

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.

3.3.4 Transceiver Rear Accessory Jack Connection

Figure 3-6 shows the complete pin configuration for the J2 rear accessory jack and Table 3-2 explains the functions of each of the pins.



MAEPF-27619-O

Figure 3-6. Rear Accessory Jack Pin Configuration (J2) (Radio Side)

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 + (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	SPKR-	Speaker - (8 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 accessory connector. The nominal input level is 80mVrms for 60% deviation 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 1500 Basic Service manual (Motorola publication part number 6815853H01) for more detailed descriptions of these pins.

Table 3-3. 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 connectors² Pin function as a true "DCE" device according to EIA standardTable 3-4. How to Connect to a Computer¹ (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 standard² 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).

This Page Intentionally Left Blank

Chapter 4 Finishing the Installation: Cable Connection

Perform the following if it has not been previously done:

1. The microphone can be plugged into the lower left corner of the control head front panel. Connect the microphone cable S-hook (see [Figure 2-7](#) in Chapter 2) into the hole in the cable strain relief bracket on the mounting trunnion.
2. Be sure the control head is 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).
3. 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.
4. 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

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 1500 Digital Mobile Radio Basic Service Manual (Motorola publication part number 6815853H01) 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 ASTRO portable and mobile subscriber radio products.

Term	Definition
A/D	<i>See analog-to-digital conversion.</i>
Abacus IC	A custom integrated circuit providing a digital receiver intermediate frequency (IF) backend.
ADC	<i>See analog-to-digital converter.</i>
ADDAG	<i>See Analog-to-Digital, Digital-to-Analog and Glue.</i>
ALC	<i>See automatic level control.</i>
analog	Refers to a continuously variable signal or a circuit or device designed to handle such signals. <i>See also digital.</i>
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. <i>See also D/A.</i>
analog-to-digital converter	A device that converts analog signals into digital data. <i>See also DAC.</i>
APCO 25	A standard of digital two-way radio communications, developed by the Association of Public-Safety Communications Officials, providing maximum radio spectrum efficiency; competition in system life cycle procurements; effective, efficient and reliable intra-agency and inter-agency communications; and "user friendly" equipment. <i>See also Association of Public-Safety Communications Officials.</i>
Association of Public-Safety Communications Officials	An association dedicated to an industry-wide effort (known as APCO 25 or Project 25) to set the recommended voluntary standards of uniform digital two-way radio technology for public safety organizations. This allows radio interoperability with multiple vendor products which are all APCO 25 compatible. <i>See also APCO 25.</i>
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.

Term	Definition
BBP	<i>See baseband interface port.</i>
baseband interface port	Synchronous serial interface to the transceiver board used to transfer transmit and receive audio data.
BGA	<i>See ball grid array.</i>
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	<i>See coder/decoder.</i>
coder/decoder	A device that encodes or decodes a signal.
CPS	<i>See Customer Programming Software.</i>
Customer Programming Software	Software with a graphical user interface containing the feature set of an ASTRO radio.
D/A	<i>See digital-to-analog conversion.</i>
DAC	<i>See digital-to-analog converter.</i>
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. <i>See also analog.</i>
digital-to-analog conversion	Conversion of a digital signal to a voltage that is proportional to the input value. <i>See also A/D.</i>
digital-to-analog converter	A device that converts digital data into analog signals. <i>See also ADC.</i>
Digital Private-Line	A type of digital communications that utilizes privacy call, as well as memory channel and busy channel lock out to enhance communication efficiency.
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.

Term	Definition
digital signal processor code	Object code executed by the Digital Signal Processor in an ASTRO subscriber radio. The DSP is responsible for computation-intensive tasks, such as decoding ASTRO signaling.
DPL	<i>See Digital Private-Line. See also PL.</i>
DSP	<i>See digital signal processor.</i>
DSP code	<i>See digital signal processor code.</i>
DTE	Data terminal equipment: i.e., a computer.
DTMF	<i>See dual tone multi-frequency.</i>
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	<i>See Electrically Erasable Programmable Read-Only Memory.</i>
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.
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	<i>See frequency generation unit.</i>
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	<i>See Florida Manual Revision.</i>
Florida Manual Revision	A publication that provides supplemental information for its parent publication before it is revised and reissued.

Term	Definition
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	<i>See General-Purpose Input/Output.</i>
host code	Object code executed by the host processor in an ASTRO subscriber radio. The host is responsible for control-oriented tasks such as decoding and responding to user inputs.
IC	<i>See integrated circuit.</i>
IF	Intermediate Frequency.
IMBE	A sub-band, voice-encoding algorithm used in ASTRO digital voice.
inbound signaling word	Data transmitted on the control channel from a subscriber unit to the central control unit.
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.
ISW	<i>See inbound signaling word.</i>
key-variable loader	A device used to load encryption keys into a radio.
kHz	<i>See kilohertz.</i>
kilohertz	One thousand cycles per second. Used especially as a radio-frequency unit.
KVL	<i>See key-variable loader.</i>
LCD	<i>See liquid-crystal display.</i>
LED	<i>See light emitting diode.</i>
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.
low-speed handshake	150-baud digital data sent to the radio during trunked operation while receiving audio.

Term	Definition
LSH	<i>See low-speed handshake.</i>
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	<i>See microcontroller unit.</i>
MDC	Motorola Digital Communications.
MDI	MCU/DSP Interface internal to the Patriot IC.
MHz	<i>See Megahertz.</i>
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	<i>See Master In Slave Out.</i>
MOSI	<i>See Master Out Slave In.</i>
multiplexer	An electronic device that combines several signals for transmission on some shared medium (e.g., a telephone wire).
MUX	<i>See multiplexer.</i>
NiCd	Nickel-cadmium.
NiMH	Nickel-metal-hydride.
OMPAC	<i>See over-molded pad-array carrier.</i>
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.
OSW	<i>See outbound signaling word.</i>
OTAR	<i>See over-the-air rekeying.</i>
outbound signaling word	Data transmitted on the control channel from the central controller to the subscriber unit.
over-molded pad-array carrier	A Motorola custom IC package, distinguished by the presence of solder balls on the bottom pads.
over-the-air rekeying	Allows the dispatcher to remotely reprogram the encryption keys in the radio.
PA	Power amplifier.

Term	Definition
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	<i>See private-line tone squelch.</i>
PLL	<i>See phase-locked loop.</i>
private-line tone squelch	A continuous sub-audible tone that is transmitted along with the carrier. <i>See also DPL.</i>
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.
Project 25	<i>See APCO 25.</i>
PROM	<i>See Programmable Read-Only Memory.</i>
PTT	<i>See Push-to-Talk.</i>
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.
Radio Interface Box	Not used with XTL 5000. The radio communicates directly to the computer via a single programming cable. <i>See programming cable.</i>
Radio Service Software	Not used with XTL 5000. <i>See Customer Programming Software.</i>
RAM	<i>See random access memory.</i>
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.

Term	Definition
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	Remote transmit/receive facility that re-transmits received signals in order to improve communications range and coverage (conventional operation).
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	<i>See radio frequency.</i>
RF PA	<i>See radio frequency power amplifier.</i>
RIB	<i>See Radio Interface Box.</i>
ROM	<i>See read-only memory.</i>
RPCIC	Regulator/power control IC.
RPT/TA	<i>See repeater/talkaround.</i>
RS232	A common interface standard for data communications equipment.
RSS	<i>See Radio Service Software.</i>
RTC	<i>See real-time clock.</i>
RX	Receive.
RX DATA	Recovered digital data line.
SAP	<i>See Serial Audio CODEC Port.</i>
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	<i>See Serial Communication Interface Input Line.</i>

Term	Definition
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	<i>See software potentiometer.</i>
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	<i>See Serial Peripheral Interface.</i>
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	<i>See static RAM.</i>
SRIB	Smart Radio Interface Box. <i>See RIB.</i>
SSI	<i>See Synchronous Serial Interface.</i>
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 (<i>See ISW and OSW</i>).
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	<i>See time-out timer.</i>
transceiver	Transmitter-receiver. A device that both transmits and receives analog or digital signals. Also abbreviated as XCVR.

Term	Definition
transmitter	Electronic equipment that generates and amplifies an RF carrier signal, modulates the signal, and then radiates it into space.
TSOP	<i>See thin small-outline package.</i>
TX	Transmit.
UART	<i>See also Universal Asynchronous Receiver Transmitter.</i>
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	<i>See Universal Serial Bus.</i>
VCO	<i>See voltage-controlled oscillator.</i>
vector sum excited linear predictive coding	Not used with XTL 5000. Replaced with the APCO 25 standard. <i>See APCO 25.</i>
VHF	Very-High Frequency.
VIP	Vehicle Interface Port.
VOCON	<i>See vocoder/controller.</i>
vocoder	An electronic device for synthesizing speech by implementing a compression algorithm particular to voice. <i>See also voice encoder.</i>
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. <i>See also vocoder.</i>
voltage-controlled oscillator	An oscillator in which the frequency of oscillation can be varied by changing a control voltage.
VSELP	<i>See vector sum excited linear predictive coding.</i>

Notes

Index

A

accessories	
connector assembly	3-3, 3-5
assembly	3-7
disassembly	3-7
exploded view	3-7
installing	3-6
connector pins	3-1
installing	
dash mount	3-3
emergency pushbutton	3-2
footswitch	3-2
horn relay	3-2
light relay	3-2
rear jack connection	3-9
antenna	
cable, see Cables, antenna	
connection	2-9
diagrams	2-9, 2-10
installing	2-8
mounting	2-8
site	2-8

B

base stations	1-2
black lead	2-6

C

cables	
accessory	3-2, 3-3, 3-11
antenna	2-4, 2-10
battery	3-6, 3-7
connection	4-1
diagrams	2-3, 2-7, 2-9
ignition	3-5
ignition sense	2-8
microphone	3-2
power	2-6
programming	A-6
serial port	3-11
tools	1-3
configurations	
dash mount	1-2
control head	3-1
dash mount	1-2
handheld	3-3
see also specific model names	
control stations	1-2

D

dash mount	
------------	--

accessories installations	3-3
configuration	1-2
installation	2-3
installation examples	2-2
radio dimensions	1-1
trunnion	2-5

E

emergency footswitch	3-2, 3-3
emergency pushbutton	3-2, 3-3
external alarm	
see also Horn relay or Light relay	

F

footswitch, emergency	3-2, 3-3
-----------------------	----------

G

green lead	2-8
------------	-----

H

horn relay	3-2, 3-3, 3-4
------------	---------------

I

ignition	
cable	2-8, 3-5
installation	
examples	2-2

J

J2	3-1, 3-11
pin configuration	2-3, 3-9

L

leads	
black	2-6
green	2-8
orange	2-8
light relay	3-2, 3-3, 3-4
locking kit, installing	2-6

M

microphone	
cable, see Cables, microphone	
hang-up box	2-11
hang-up clip, standard	2-11
S-hook	2-5, 2-11, 4-1
mounting configurations	2-4
dash	1-2, 2-5

mounting, antenna	
restrictions	2-9
roof top	2-8
trunk lid	2-8

O

orange lead	2-8
ordering replacement parts	A-1

P

parts, ordering replacement	A-1
pin	
functions	3-10
ground	3-2
naming schemes	3-11
removal tool	1-3
SW B+	3-2
VIP out	3-1, 3-2
pin configurations	
J2	2-3, 3-9
pushbutton, emergency	3-2, 3-3

R

rear accessory jack, see J2	
relays	
horn	3-2, 3-3, 3-4
light	3-2, 3-3, 3-4
remote mount	

installation examples	2-2
replacement parts, ordering	A-1

S

speaker	
mounting	3-4, 3-5
pigtail	3-6

T

tools, required	1-3
trunnion	
below dash mounting	2-5
bracket for speaker	3-4
dash mount	2-5
locking kit	2-6
mounting bracket	2-5
orientation	2-4
transmission hump mounting	2-5

V

VIP	
connector	3-2
output connections	3-1

W

wiring diagrams	2-3
-----------------------	-----



Motorola, Inc.
8000 West Sunrise Boulevard
Ft. Lauderdale, FL 33322

MOTOROLA, the Stylized M Logo, and ASTRO are registered
in the U.S. Patent and Trademark Office. All other product or
service names are the property of their respective owners.
© Motorola, Inc. 2005.
All rights reserved. Printed in Malaysia.



6815851H01-O