Vertex Standard

Professional Digital Two-Way Radio System

# VXD Series
# Installation Guide

Vertex Standard LMR, Inc

# Foreword

This manual is intended for use by experienced technicians familiar with similar types of equipment. Specifically, it contains installation information required for the VXD Series Mobile Radios.
For information related to the service of the VXD Series Mobile Radios, refer to the list applicable manuals available separately.

## Product Safety and RF Exposure Compliance

See Installation Requirements for Compliance with Radio Frequency (RF) Energy Exposure Safety Standards on next page.

## Manual Revisions

Changes which occur after this manual is printed are described in PMRs (Publication Manual Revisions). These PMRs provide complete replacement pages for all added, changed, and deleted items.
To obtain PMRs, go to: http://www.vertexstandard.com/manuals/

## Parts Ordering

See Appendix: Replacement Parts Ordering for information on how to obtain replacement parts. For part numbers, refer to the VXD Series Mobile Radios Basic Service Manual.

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## Trademarks

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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 Vertex Standard approved antennas and accessories.
- Be sure that antenna installation is per Antenna Installation on page 3-8 of this manual.
- Be sure that Product Safety and RF Energy Exposure chapter in the Operating Manual 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 Energy Exposure chapter in the Operating Manual to ensure compliance with Radio Frequency (RF) energy exposure limits.

WARNING **For radios installed in vehicles fuelled by liquefied petroleum gas, refer to the (U.S.) National Fire Protection Association standard, NFPA58, for storage, handling, and/or container information.**

This radio has a transmitter Time-out Timer that disables the transmitter during a transmission after a predefined time period, which by default is set to 60 seconds.

Caution **It is recommended NOT to change the default 60 seconds time period for the Time-out Timer as the radio is intended for intermittent duty cycle operation.**

# Commercial Warranty

## Limited Warranty

**Vertex Standard Communication Products**

What This Warranty Covers and For How Long

Vertex Standard LMR, Inc. (“Vertex Standard”) warrants the Vertex Standard 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:

Vertex Standard, 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 Vertex Standard.

This express limited warranty is extended by Vertex Standard 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 Vertex Standard. Vertex Standard assumes no obligations or liability for additions or modifications to this warranty unless made in writing and signed by an officer of Vertex Standard.

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# Note

# Chapter 1 Introduction

This manual covers the installation procedures for VXD Series Mobile Radios 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 Overview

VXD-7200: The Display model with 4 programmable buttons and a dot-matrix LCD.

### 1.1.2 Dimensions

Figure 1-1 and Figure 1-2 show the basic dimensions of the dash mount trunnion of the mobile 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 cabling; and to the sides of the radio so that you may access and install the trunnion wing screws.

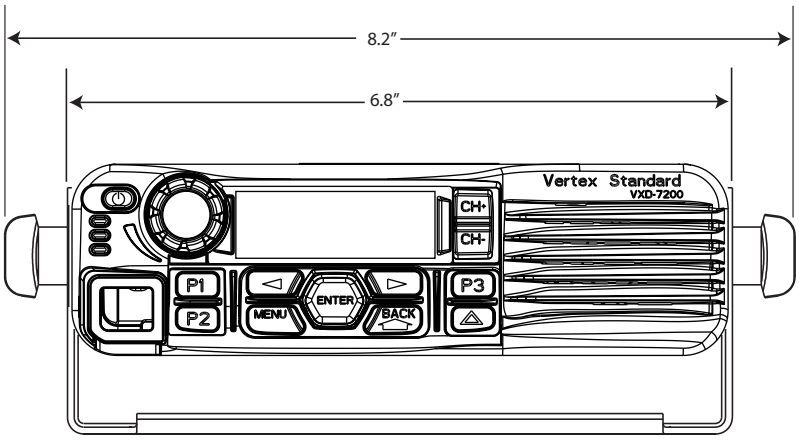



**Figure 1-1** Front View of Dash Mount Trunnion

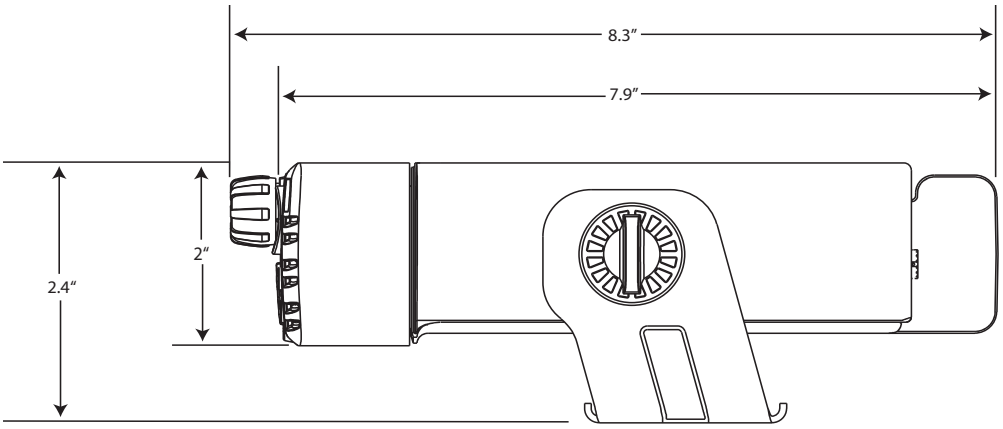



**Figure 1-2** Side View of Dash Mount with Low Profile Trunnion

**NOTE**: The rear accessory connector adds 0.75 in. (1.91 cm) to the overall length.

### 1.1.3 Connections on the Back of the Radio

Figure 1-3 shows the connections that are found on the back of the radio.

For complete pin configuration of the rear accessory connector, see Figure 4-2, on page 4-2.

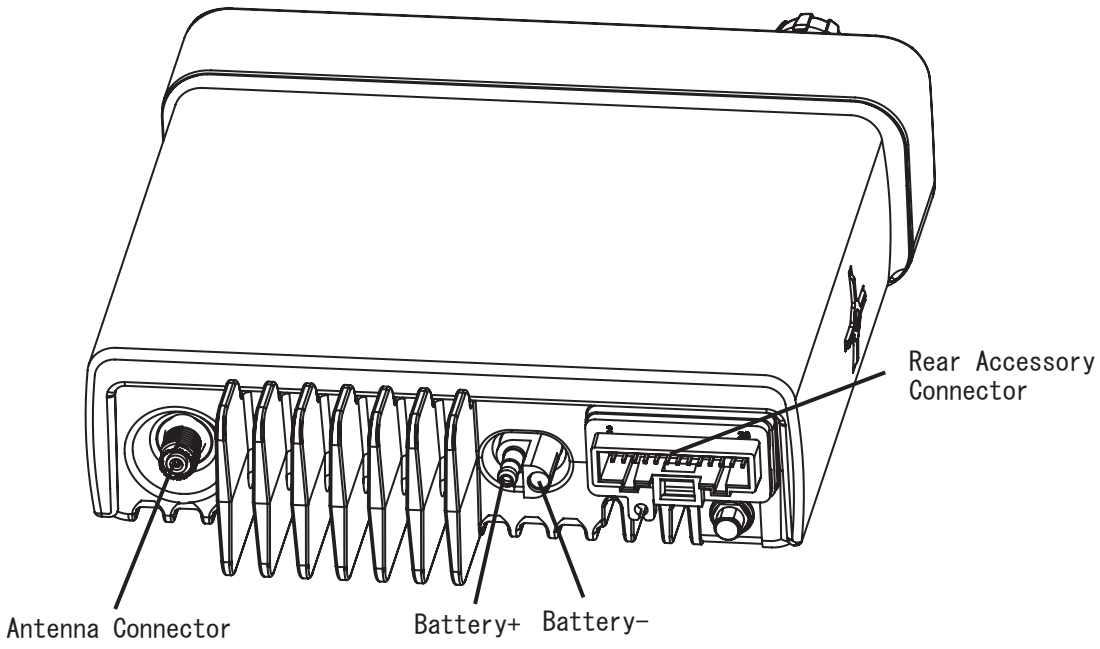



**Figure 1-3** Back View of the Mobile Radio

## 1.2 Standard Configurations

Currently the mobile radio can only be dash-mounted.

### 1.2.1 Dash Mount Configuration

In the dash mount configuration of the mobile radio, 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 cable between the connectors on the front of the transceiver and at the back of the control head.

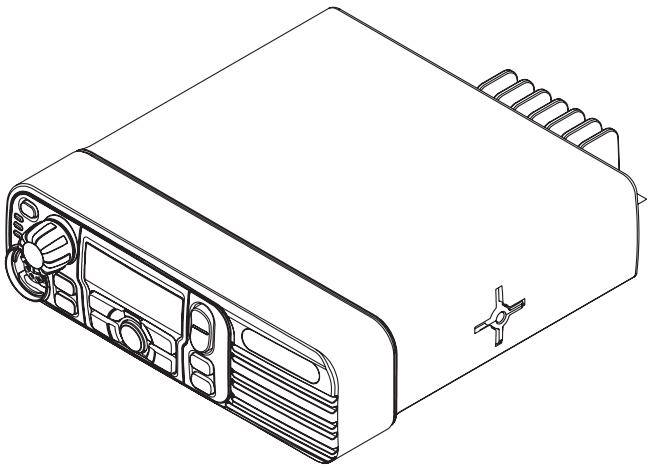


**Figure 1-4** Dash Mount Configuration

For details on this configuration, see Section 3.2.1 on page 3-4.

## 1.3 Base/Control Stations

If the mobile radio equipment is installed at a fixed location and operated as a control station or as a fixed unit, the radio and antenna installation must comply with the following requirements in order to ensure optimal performance and compliance with the Product Safety and RF Energy Exposure chapter in the Operating Manual:

**Caution**

For outdoor antenna installations, proper site grounding and lightning protection are vitally important.
Failure to provide proper lightning protection may result in permanent damage to the radio equipment.

- The antenna should be mounted outside the building on the roof or a tower if at all possible and the antenna cable should be earth grounded.
- The radio chassis must be earth grounded and a lightning surge protector should be used in line with the radio connector and the outdoor antenna. The lightning surge protector should be earth grounded and located at the point where the antenna cable enters the building.
- The line voltage power supply must have a proper ground connection.
- As with all fixed site antenna installations, it is the responsibility of the licensee to manage the site in accordance with applicable regulatory requirements. Also, additional compliance actions such as site survey measurements, signage, and site access restrictions may be required in order to ensure that exposure limits are not exceeded.

Figure 1-5 shows a typical setup of a Base/Control Station configuration.

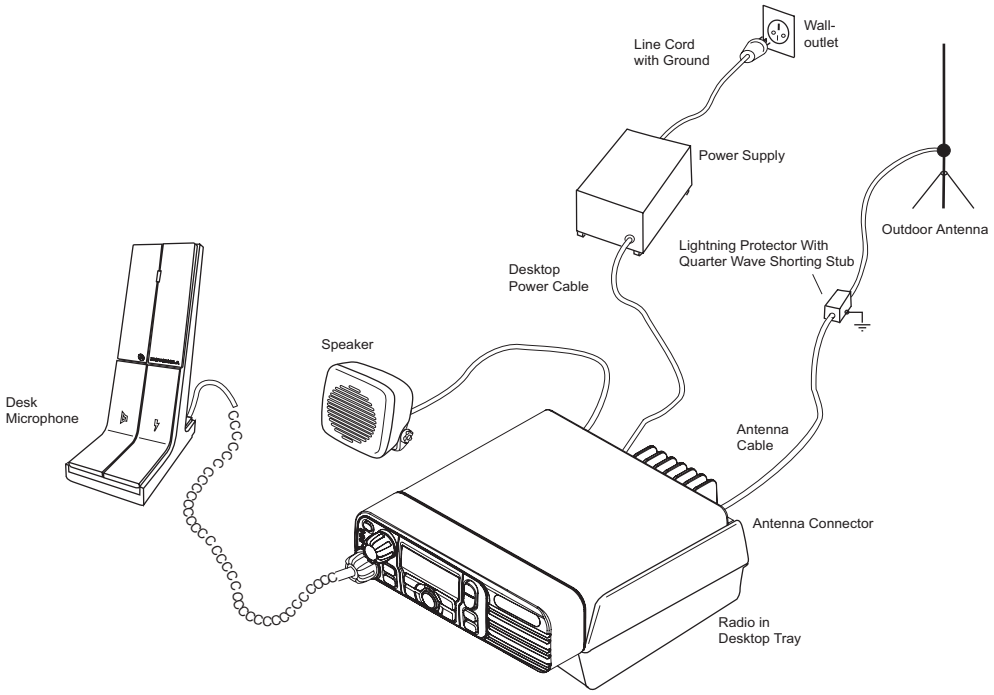



**Figure 1-5** Example of a Base/Control Station Configuration

# Chapter 2 Reducing Noise Interference

## 2.1 Introduction

Electrical noise generated by the electrical system of a vehicle, as well as local ambient noise, can interfere with normal operation of mobile radios. Satisfactory operation of a mobile radio may require slight or heavy noise reduction, depending upon the relative strength of the radio signal, and upon the ability of the radio to reject undesired noise. These requirements vary from one vehicle to another, depending upon the vehicle type and required coverage area. When operating in a strong signal area, a certain amount of noise interference can be tolerated. In weak signal areas, however, noise reduction becomes very important. As a rule of thumb, noise levels create greatest interference in the 25-50MHz band and reduce with increasing frequency.

Before attempting any noise reduction procedures, determine the noise source(s). Then, follow a logical, systematic method of elimination until the interference is eliminated or reduced to an acceptable level.

**Caution**

DO NOT add interference elimination equipment to vehicles equipped with electronic ignition systems before obtaining advice from the vehicle manufacturer. Addition of some noise suppression components may interfere with proper operation of electronic ignition systems and could seriously damage them.

Care and patience must be exercised in locating and eliminating noise sources. There may be several sources of noise, each slightly stronger or weaker than the other. Elimination of one source may seem ineffective because another noise source remains active at a barely discernible difference in level. Consult a service manual for the vehicle to determine what noise reduction provisions the manufacturer applies when AM, AM/FM, or CB radios are installed as original equipment. These radios are also subject to electrical noise interference, and the manufacturer may install noise suppression components only upon those vehicles which require radio equipment at the time of manufacture. These noise suppression components should be added in any first attempt to suppress noise.

### 2.1.1 Noise Sources

The three major noise sources affecting mobile radio systems are: (1) radiated noise, (2) conducted noise, and (3) induced noise. (See Figure 2-1 for typical vehicular noise sources.)

### 2.1.2 Radiated Noise

Radiated noise enters the radio through the antenna along with the desired signal and can block or degrade desired communication. It can be generated by power lines, fluorescent lights, or by electrical discharges from static build-up, ignition systems, or electrical motors. Radiated noise is the most common cause of mobile radio interference.

When a spark discharge or arc takes place through air, energy is radiated at frequencies from a few kilohertz to hundreds of megahertz. This spurious radiation may have some energy radiated at a frequency near or even identical to the desired radio signal. The standard receiver may be unable to distinguish between the two signals (desired and noise). Therefore they both enter the receiver, resulting in degradation of the desired signal.

It is impractical to prevent all arcing in the standard vehicle electrical system. In an 8-cylinder engine running at 2,000 RPM, arcing occurs across the spark plugs at a rate of 8,000 sparks per minute or 133 sparks per second. Electrical motors and generators also produce arcs.

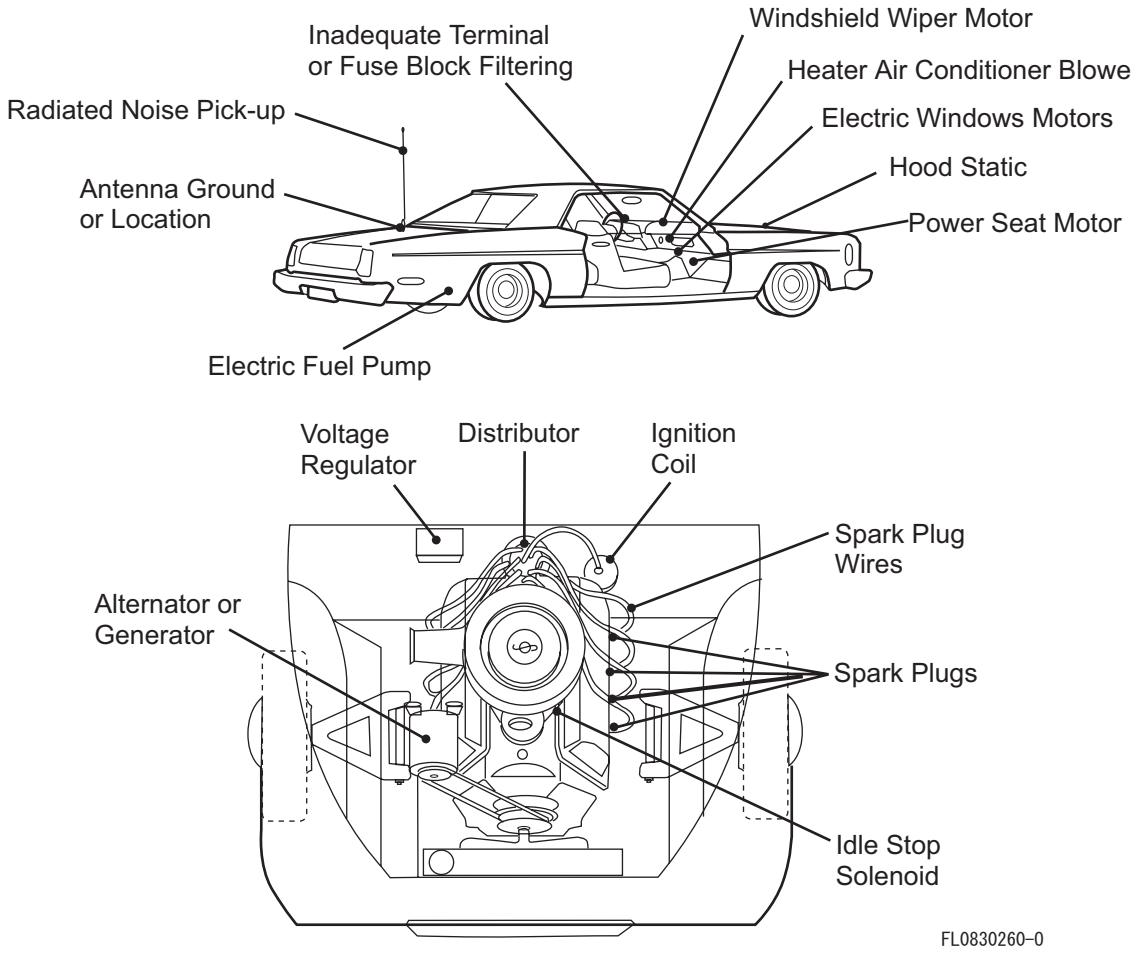



**Figure 2-1** Noise Sources

### 2.1.3 Conducted Noise

Conducted noise enters the radio through the points where the radio is attached to the vehicle's electrical system such as battery cables, ignition switch, chassis ground etc. It can be generated by electrical transients, electrical motors, poor grounding points, or inadequate electrical system filtering (from alternators, generators, voltage regulators, or weak batteries). Conducted noise can degrade both transmit and receive performance of a mobile radio.

### 2.1.4 Induced Noise

Induced noise enters the radio through the proximity of radio wiring to other wiring in the vehicle.

Electrical currents through the standard vehicular wiring can induce undesirable noise signals into the radio cabling. Communication is degraded simply because the wiring provides a transformertype coupling action without any actual physical connection. Induced noise can degrade both transmit and receive performance of a mobile radio.

## 2.2 Operation of a Conventional Ignition System

### 2.2.1 Introduction

To effectively reduce ignition interference in a vehicle, it is well to understand the operation of an automobile ignition system.

Ignition is necessary in a gasoline engine to ignite the gasoline vapor and the air mixture in its cylinders. The system is made up of the battery, distributor, breaker points, coil, condenser, and spark plugs. The battery is the only electrical source of power in an automobile, so the lower battery voltage must be stepped up to the high voltage necessary to arc across the spark plug electrodes.
This arc ignites the gas mixture.

### 2.2.2 Sources of Ignition Interference

In the conventional ignition system (Figure 2-2) a mechanical circuit breaker (the cam and points in the distributor) opens the primary circuit of the ignition coil, and high voltage is developed at the secondary. This high voltage is synchronized and applied to each spark plug by the distributor.

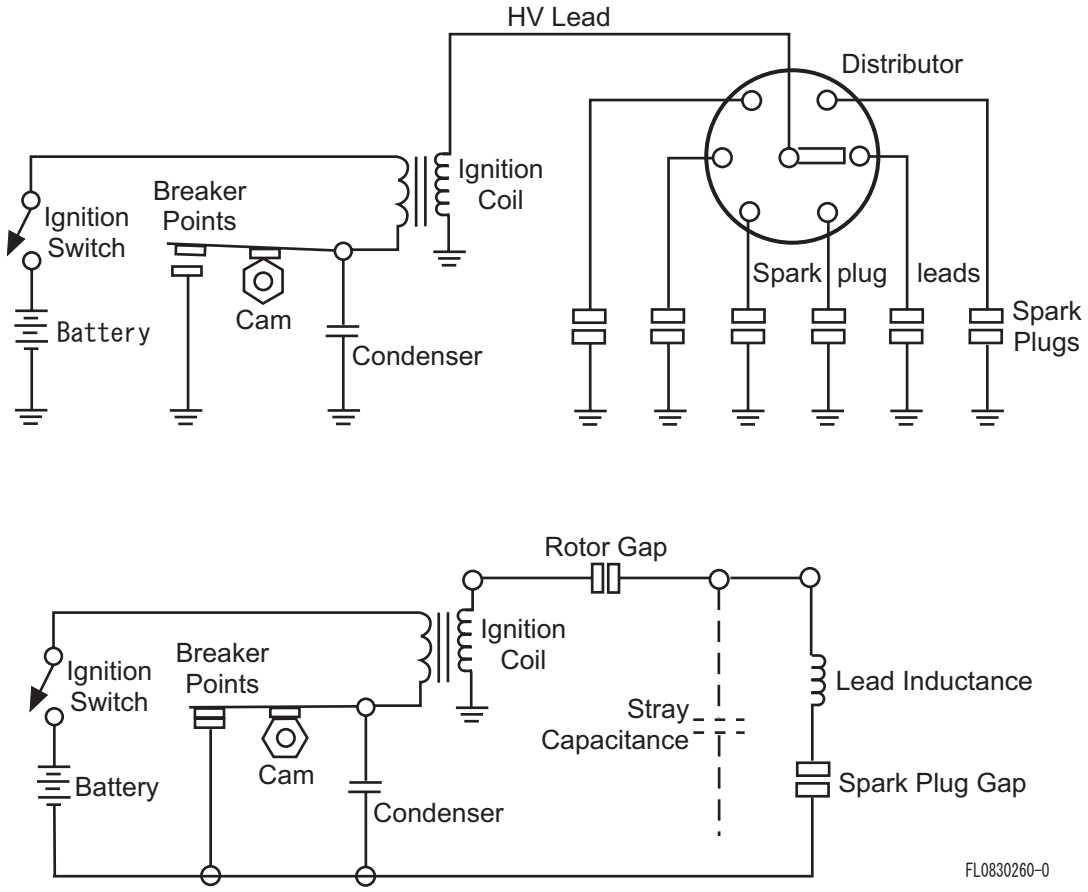



**Figure 2-2** Typical Vehicular Ignition System, Simplified Schematic Diagram

The battery is connected to the primary winding of the coil through the ignition switch. The primary circuit is returned to the battery through the breaker points, which are bypassed by the condenser.
The points are normally closed. As the cam shaft is rotated by the engine, its lobes or corners open and close the points in proper synchronization with the piston in each cylinder.

With the ignition switch on and the breaker points closed, coil primary current builds up at a rate etermined by the coil inductance.

When the breaker points open, primary current decreases and, by self-induction, an electromotive force is induced in the primary which is many times greater than the battery voltage. The high voltage inducted in the coil secondary causes a spark across the distributor rotor-to-spark plug wire gap and then across the spark plug gap for a short interval of time when the breaker points open. The condenser reduces arcing of the points.

The secondary circuit of the ignition coil, including the distributor rotor gap and the spark gap, is the main source of ignition interference. The lead inductance and stray capacitance provide a tuned circuit. Because the discharge of the circuit is through a low resistance (ionized spark gap), the circuit tends to oscillate. The frequency and amplitude of oscillation vary as current changes in the spark gap.

## 2.3 Detection of Noise Sources

### 2.3.1 Noise Detection Procedure

Detection of offending noise sources is the heart of noise suppression because, after the noise source is identified, the solution becomes obvious. A logical methodical procedure is basic to the effective noise suppression.

Use your available equipment to best advantage. A pick-up loop, about one inch in diameter, can be connected to a portable CB radio or a mobile radio being operated at a frequency similar to the installed radio frequency but from an isolated supply voltage. The pick-up loop can be moved throughout the vehicle with the radio used as a radiated noise detector. Be sure the pick-up loop has sufficient insulation to prevent the input of the radio from coming into direct contact with high voltage points in the vehicle ignition system.

A non-polarized bypass capacitor, which has alligator clips firmly attached, can be used on a trial-and-error basis to locate wiring which needs additional filtering. Keep capacitor lead lengths short for best suppression. Ceramic disc capacitors are not as suitable or effective as automotive coaxial capacitors.

### 2.3.2 Sources of Noise

Some interference is due to geographic location. This interference does not need to be eliminated since it is possible for the vehicle to be moved away from the interfering noise source. Noise from power lines, fluorescent lights, and other vehicles (emitting high levels of radiated noise) are examples of noise which depends upon location. Make certain that you are not attempting to suppress noise in a vehicle while it is in a noisy location. If you suspect that your location is noisy, simply turn off everything in the vehicle except the radio and listen to the remaining ambient noise. If the noise level is objectionable, you may have to noise suppress the vehicle during a less noisy time of day or in a different, quieter location.

Check the installed radio for conducted and inducted noise by using an unmodulated signal generator to supply a clean RF signal through a coaxial cable directly to the antenna connector on the radio set. This should prevent radiated noise from entering the receiver and masking conducted and induced noise. Ensure that the signal generator is not microphonic and is placed away from the noise of the engine and exhaust.

Operate the controls for fans, blowers, power windows, headlamps, turn signals, windshield wipers, and other electrical accessories. Listen for the presence of noise in the received radio signal. This will allow the source of the interference to be determined. Some noise sources cannot be turned on and off at will. These sources will need to be attacked piecemeal on a trial and error basis: alternator whine, voltage regulators, electric fuel pump, and other possible sources. Remember that induced noise can result from radio wiring being too close to other vehicle wiring. This problem is most easily solved by proper cable routing at the time of installation.

Radiated noise must be attacked after conducted and induced noise has been satisfactorily suppressed. The vehicle ignition system is usually the primary source of this interference. Antenna placement can be critical in some installations. Remember that static discharge generates static or radiated noise and will probably be generated only when the vehicle is in motion. Since radiated noise interference is most noticeable in weak signal areas, it is suggested that suppression be finalized while listening to a weak “on frequency” signal. (The squelch should be “open” so that even marginal signals can be heard.)

## 2.4 Noise Reduction Techniques

### 2.4.1 General

There are three basic ways to suppress noise. The first is the addition of resistance in circuits subject to ringing. This method is used for the ignition coil HV cable, spark plug wires, and spark plugs. The second is to filter noise from low voltage wiring using coaxial bypass capacitors. The third is to control static charge build-up using wipers for movable parts such as automobile hoods and trunk lids, or flexible bonding leads for fixed members. Static in wheels may also be controlled using collector rings. Applications of each of these techniques are discussed below.

The vehicle manufacturer’s service manual also may provide noise suppression information which is valuable in any first attempt at noise suppression.

### 2.4.2 Ignition System Interference

2.4.2.1 Engine Maintenance and Tune-Up

The most important step in reducing ignition noise is insuring that the engine is in proper tune. Pay particular attention to the following points if the noise interference from the ignition system is severe:

1. Be sure the spark plugs distributor points, and condenser are in good condition.
2. Be sure ignition timing is properly adjusted.
3. Be sure the distributor cap and rotor are in good condition. They should be replaced at least every 30,000 miles.
4. Be sure that spark plug wires make good, solid contact at each end and are routed as far as possible from low voltage leads.
5. Many late-model automobiles are equipped with a shield over the distributor points. Check to see that this shield is properly positioned and securely attached.

2.4.2.2 Noise Reduction Kits

Most auto parts dealers can supply 0.05 µF bypass capacitors (condensers), resistive ignition wires, and resistor spark plugs. The type of spark suppression used in noise reduction should always be in accordance with the recommendations of the vehicle manufacturer, that is, if spark plugs are to be replaced with built-in suppressor types, they should be in the proper heat ranges and thread sizes for the particular engine. In each ignition system, there is a maximum amount of resistance that may be connected between the distributor and a spark plug. If resistance-type ignition wire is used, the length of each wire must be limited so that its resistance does not exceed the allowable maximum.

2.4.2.3 Ignition Coil Interference

This type of interference is characterized by a popping sound which is most noticeable when the engine is running slowly. To suppress the noise, connect a 0.1 µF coaxial capacitor from the battery side of the ignition coil to vehicle ground (see Figure 2-3). This keeps the distributor noise from being conducted through the battery lead into the electrical system of the vehicle. Note that some electronic ignition systems do not route the battery lead to the ignition coil; proper operation of the ignition system can be impaired if the”input” terminal is bypassed.

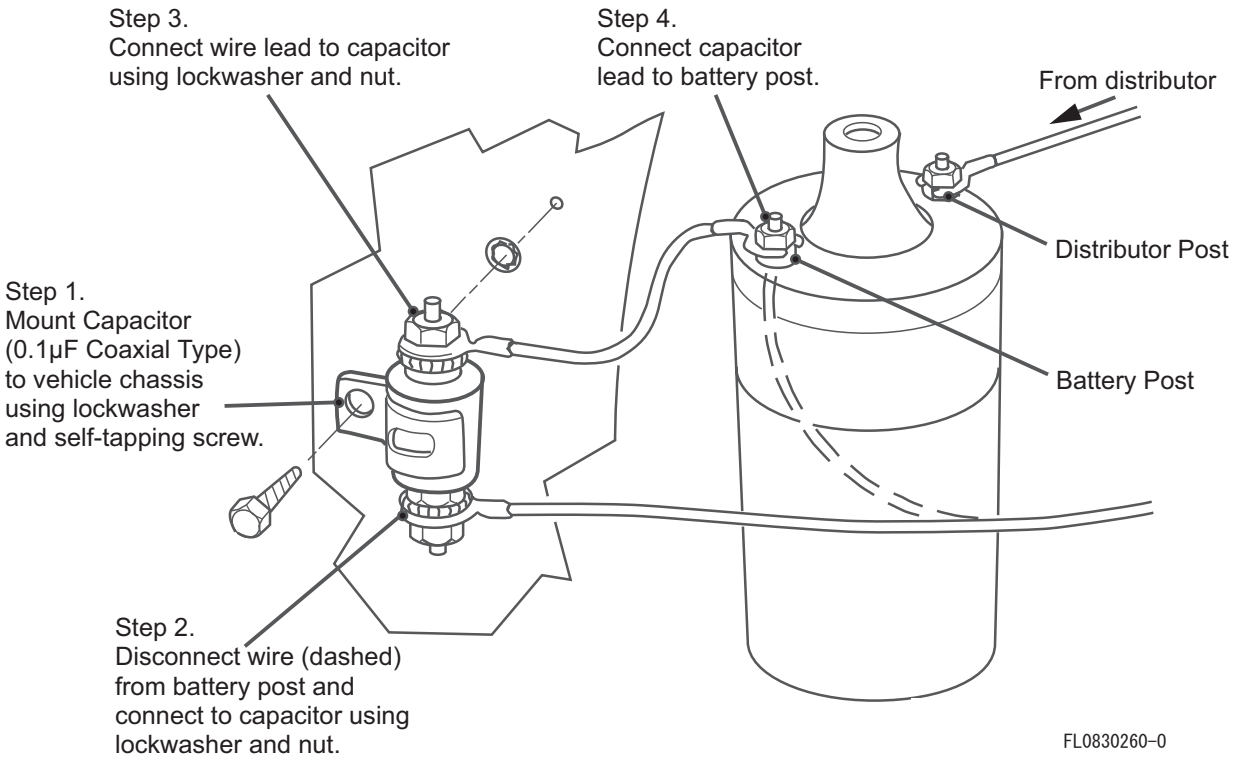



**Figure 2-3** Ignition Coil Nose Suppression

2.4.2.4 Distributor Interference

This type of interference is characterized by popping sounds which are present at all engine speeds. It is caused by sparking between the rotor and the distributor cap inserts as the rotor turns. To suppress this noise, use resistance ignition wire to connect the ignition coil to the distributor cap.

2.4.2.5 Battery Connections

The radio set power cable can pick up noise generated in the vehicle. This can be minimized by connecting the power cable directly to the battery instead of the fuse block. The battery acts like a large capacitor (about one Farad for a 50 Amp/hour battery), which bypasses induced noise. The battery ground lead should be securely bonded to the vehicle frame. Undesirable parallel ground currents can be minimized by using the vehicle frame as a common ground point. If ignition switch control of the radio is desired, the radio power leads may be connected to the battery through a relay which is controlled by the ignition switch.

### 2.4.3 Alternator/Generator Whine

This type of interference is characterized by a high-pitched whine which varies with engine speed. A 0.5 µF coaxial capacitor can be used to bypass the whine. For generators, the capacitors is connected in the armature lead. Never use a capacitor in the field lead. For alternators, the capacitor is connected in the lead to the battery post (see Figure 2-4 and Figure 2-5).

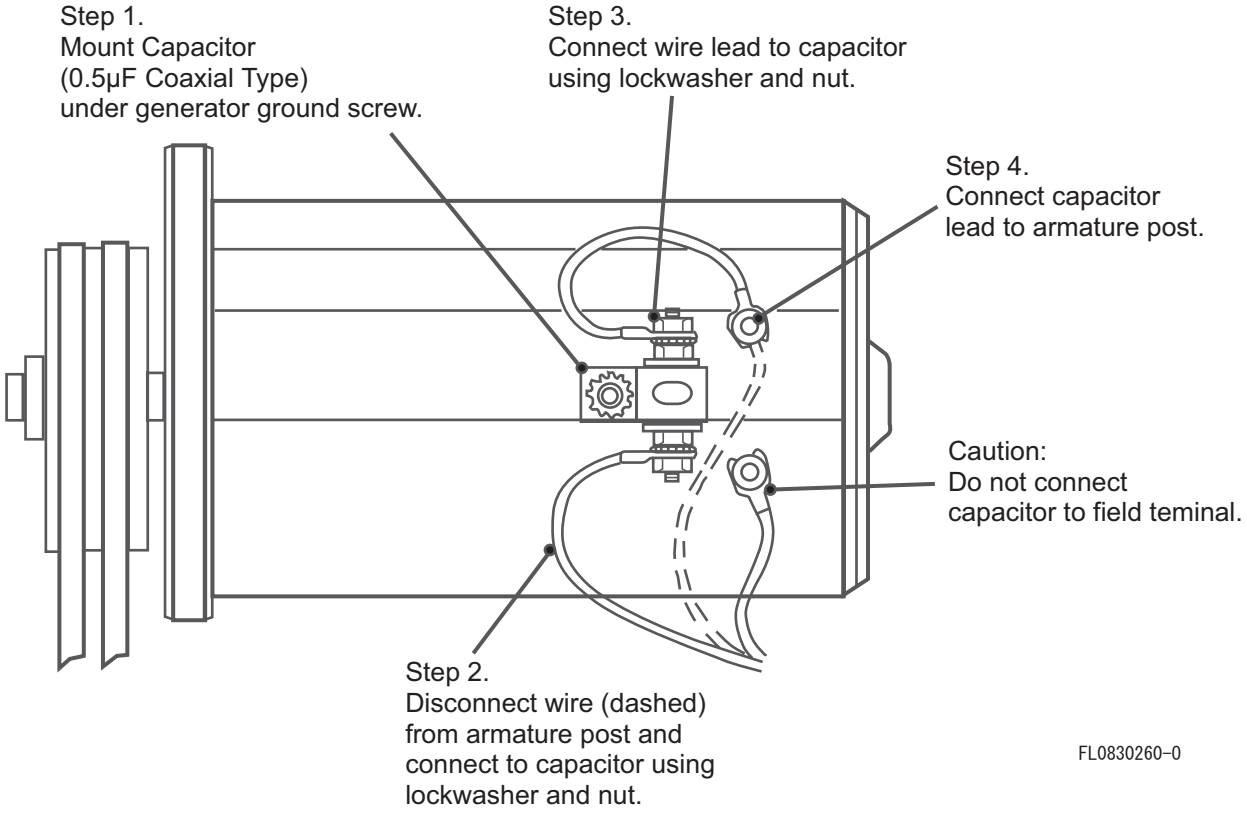



**Figure 2-4** Generator Whine Suppression

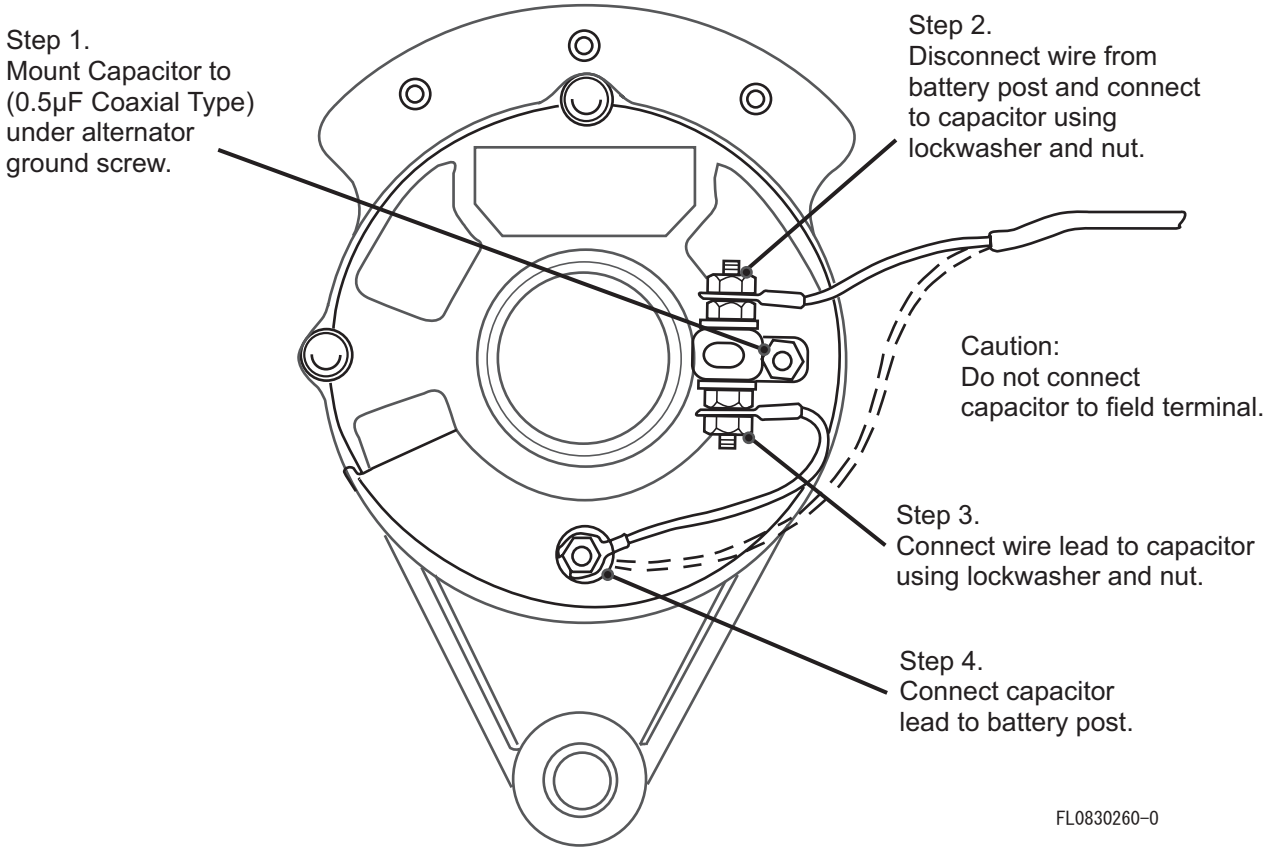



**Figure 2-5** Alternator Whine Suppression

### 2.4.4 Voltage Regulator Noise

This type of interference is characterized by erratic popping noises which change only slightly with changes in engine speed. The noise is generated by arcing in the vibrating breaker contacts of the voltage regulator. It can be suppressed by connecting a 0.5 µF coaxial capacitor in the battery and armature leads of the voltage regulator (see Figure 2-6).

Caution

Disconnect the battery ground terminal before attempting to connect components to the voltage regulator.

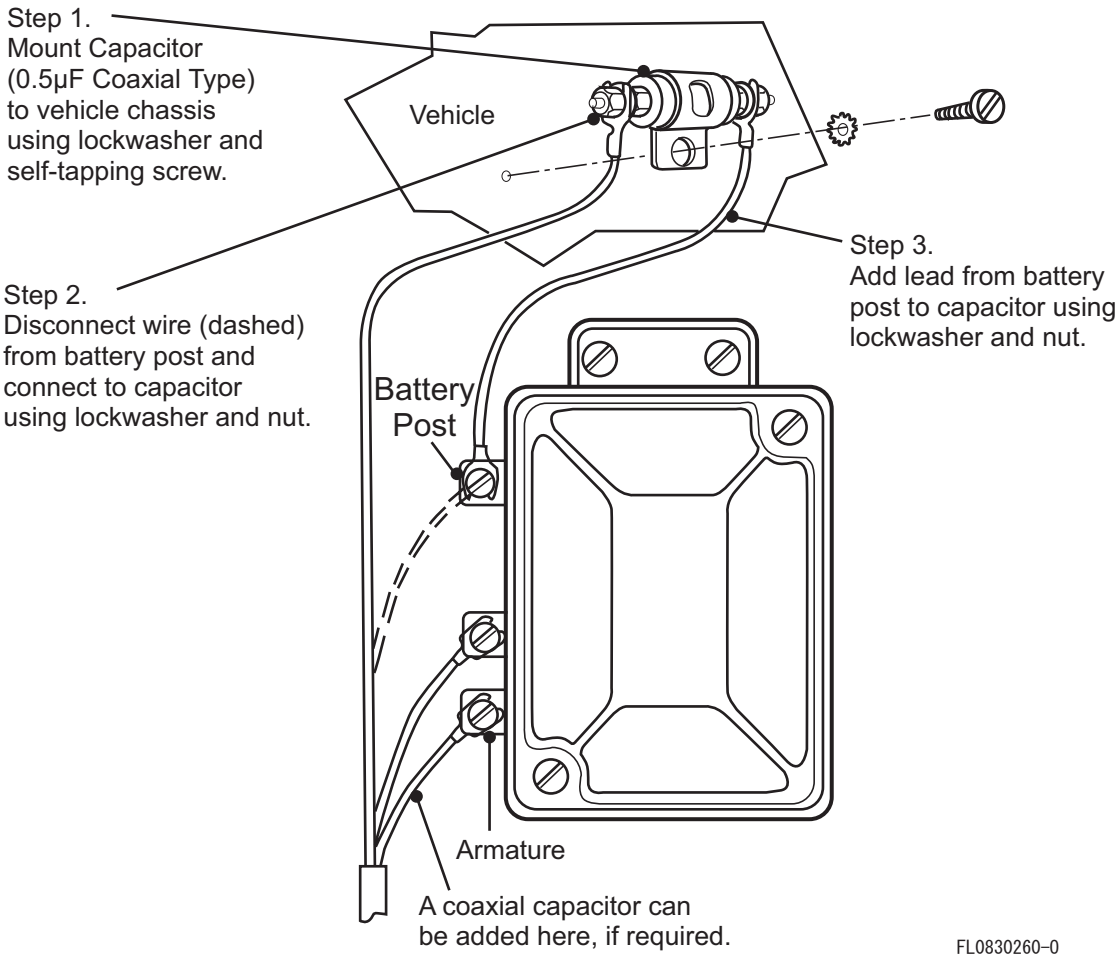



**Figure 2-6** Voltage Regulator Noise Suppressions

### 2.4.5 Other Electrical Noises

Other elements of the electrical system which can generate noise are listed below. These can be suppressed by connecting a 0.5 µF bypass capacitor between the noise source and ground.

1. Ammeter-to-battery lead
2. Gauges (oil, fuel, temperature)
3. Ignition Switch
4. Lamp bulbs (headlamps, tail lamps, dome lamps, etc.)
5. Accessory wiring (electrical fuel pump, electric windshield wipers, heater fan motor, window openers, etc.)

### 2.4.6 Ground Bonding

If a vehicle is not properly bonded to ground, static charges can increase. This increase can cause noise from electrical arcing. This type of noise is suppressed by bonding the part using one-inch wide ground straps (keep them as short as possible). Some common points where bonding may be helpful are listed below (see Figure 2-7).

A. From engine block to the firewall.
B. From engine block to vehicle frame at points where the engine is shock-mounted.
C. From the battery ground terminal to the vehicle body.
D. From top of front wheel “A” frames to chassis, particularly in cases where rubber-mounted members are used.

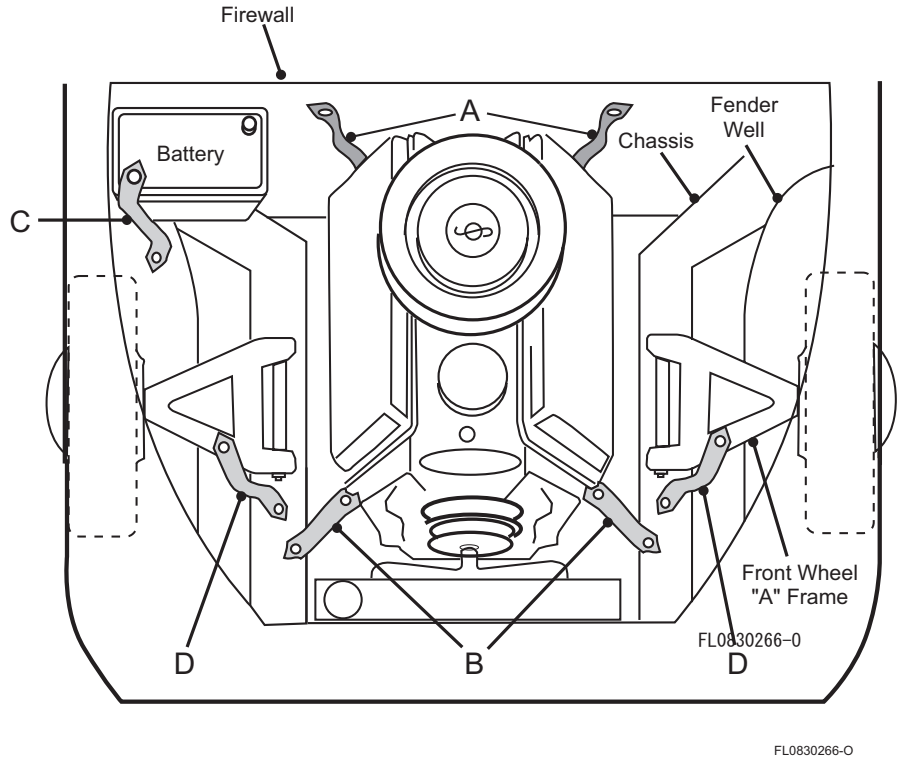



**Figure 2-6** Ground Bonding

# Chapter 3 Installation Details for Standard Configurations

## 3.1 Planning the Installation

The mobile 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.

### 3.1.1 Tools Required for Installation

- ❒ 11/32 hex driver
- ❒ Rubber-coated pliers
- ❒ Regular slot screwdriver or Phillips #2
- ❒ 1/4 hex driver

### 3.1.2 Installation Example

Currently your mobile radio can only be dash-mounted (see Figure 3-1).

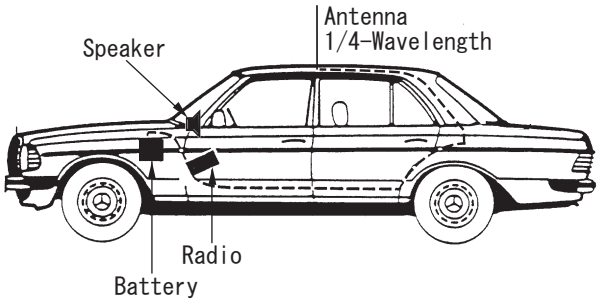



**Figure 3-1** Typical Dash Mount Configuration

### 3.1.3 Wiring Diagrams

Figure 3-2 shows the wiring diagrams for some of the possible configurations. Identify the configuration that you are installing, and use the diagram when planning the installation.

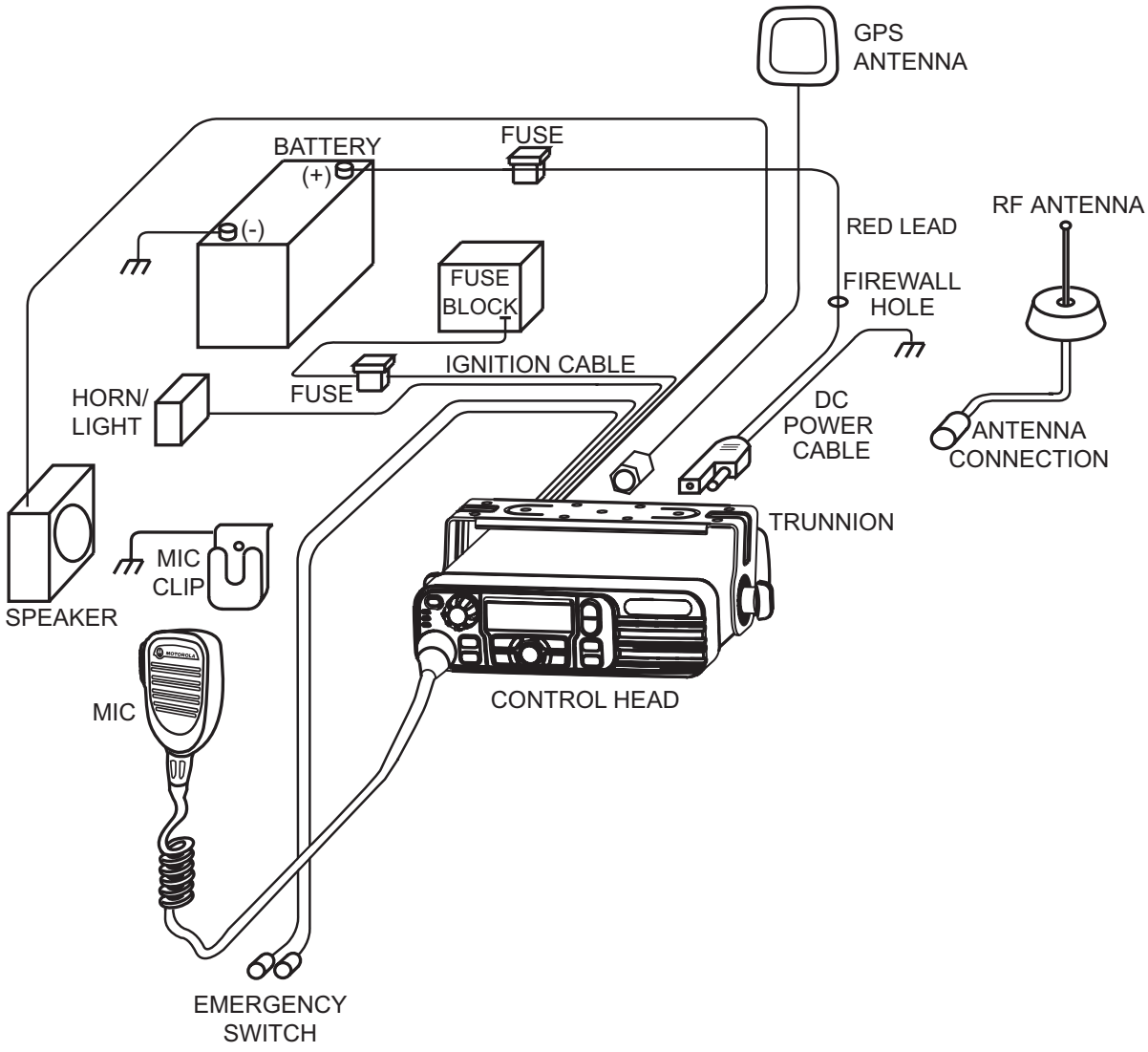



**Figure 3-2** Radio Installation (Dash Mount)

(For complete rear accessory connector pin configuration, see Figure 4-2.)

## 3.2 Radio Mounting

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.

For new or existing installations, use one of the mounting kits as specified in Table 3-1. Orient the mounting trunnion as shown in Figure 3-3.

Table 3-1. Mounting Kits

| Parts Number | Mounting Kit |
|---|---|
| MMB-93 | Low Profile Trunnion Kit (ships as part of mobile radio package) |
| MMB-94 | High Profile Trunnion Kit |
| MMB-95 | Key Lock Trunnion Kit |
| MMB-93 | DIN Mount Kit |

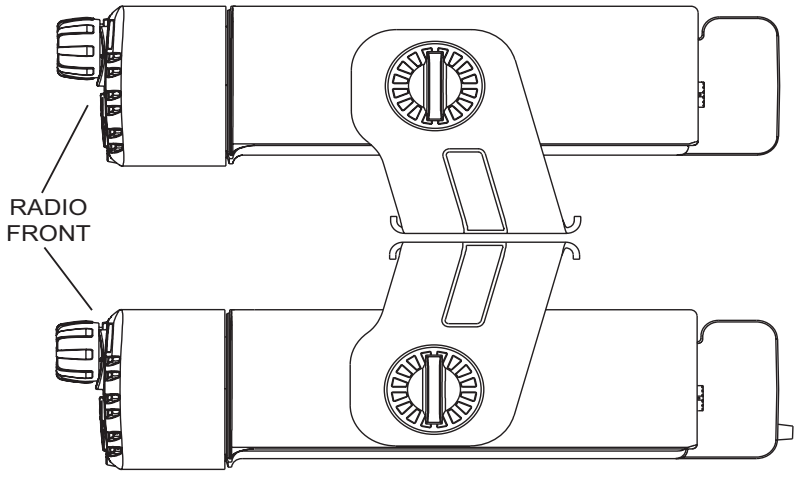



**Figure 3-3** Trunnion Orientation for Above or Below Mobile

### 3.2.1 Dash Mount with Trunnion

1. Select the location to mount your radio on the transmission hump (see Figure 3-4) or under the dash (see Figure 3-5). 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 outermost 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 self-drilling screws provided. The number of screws used will depend on how the radio is mounted (see Figure 3-4 and Figure 3-5).
5. Position the radio to align the trunnion with the trunnion mounting features on the radio (see Figure 3-4). Secure the radio with the two wing screws and lock washers provided.

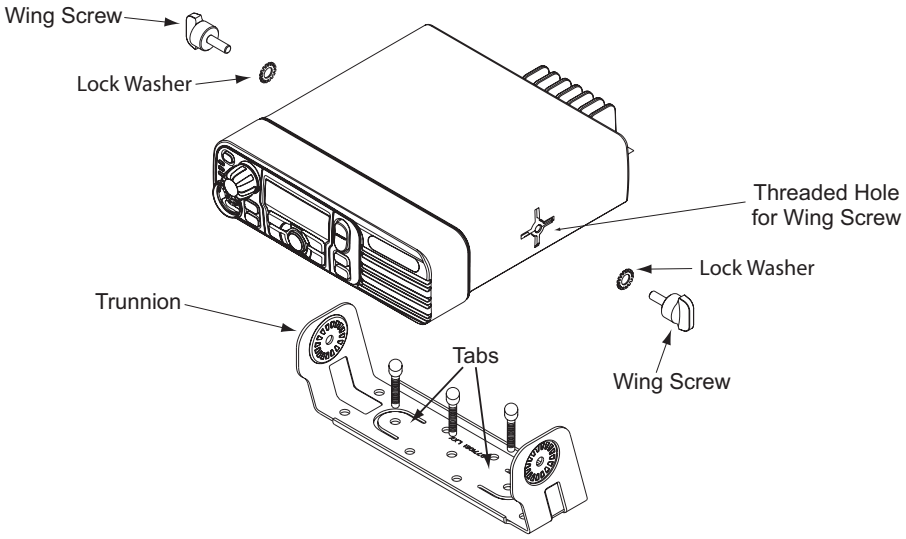



**Figure 3-4** Transmission Hump Trunnion Mounting

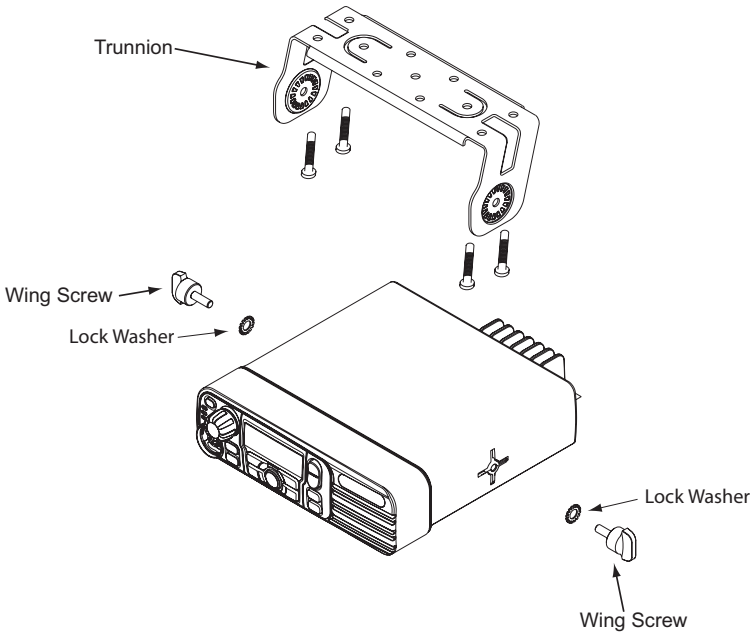



**Figure 3-5** Below Dash Trunnion Mounting

### 3.2.2 Locking Kit (Optional)

3.2.2.1 All Radios

If an optional locking kit is used (shown in Figure 3-6), 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.

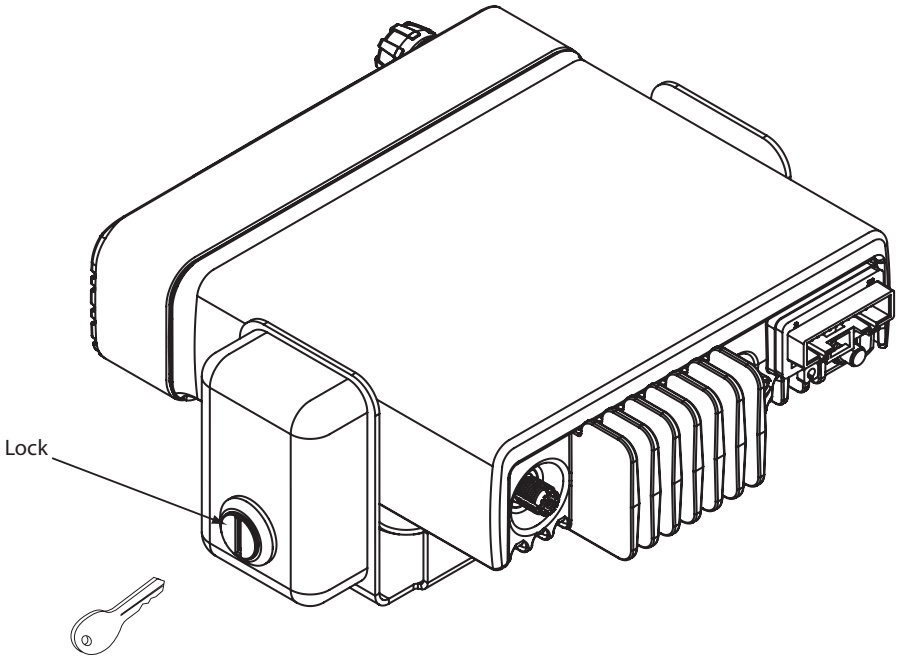



**Figure 3-6** Locking Kit (Optional)

### 3.2.3 DIN Mount

3.2.3.1 To install the frame into the dashboard

1. Open up the radio cut-out in the dashboard to ISO7736 specification (182 mm x 53 mm).
2. Insert the mounting frame into the cut-out and retain it by bending back the relevant fixing tabs (using all 6 where possible). Check the orientation of the frame is correct by ensuring that the word “TOP” is uppermost.

NOTE: The tabs are easily bent back by twisting a large flat-head screwdriver in the slot behind the tabs.

NOTE: For a more secure installation the frame should also be secured with the appropriate number of screws to the mounting conditions (min. 1).

NOTE: The demounting tool can be used as an aid to mounting as well as demounting.

3.2.3.2 To Mount the radio in the frame

1. Provide the electrical connections for the radio (power, antenna, accessories).
2. Plug in all the connectors and push the radio firmly into the mounting frame until the two springs snap into place (shown in Figure 3-7).

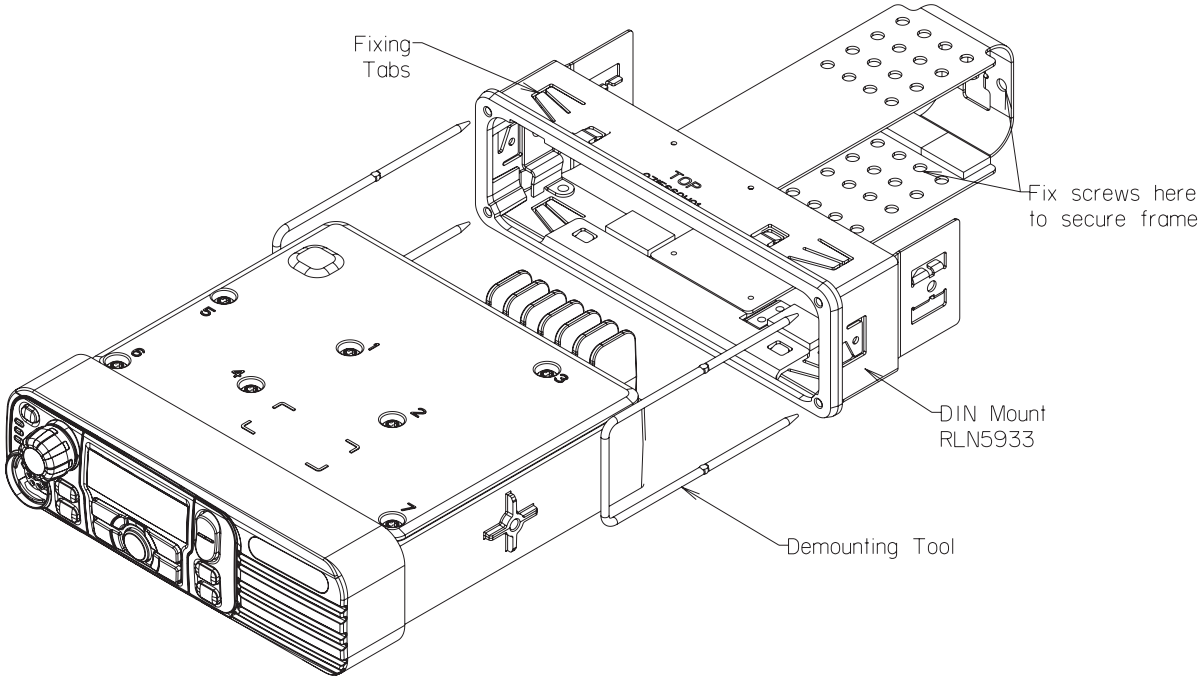



**Figure 3-7** Dashboard Mounting

3.2.3.3 To Remove the radio from the frame

1. Push the two demounting tools through the openings in the frame until the two springs release the radio.
2. Slide out the radio.

NOTE: The fixing tabs should be checked for tightness each time the radio is removed. The tabs are easily tightened by twisting a large flat-head screwdriver in the slot behind the tabs.

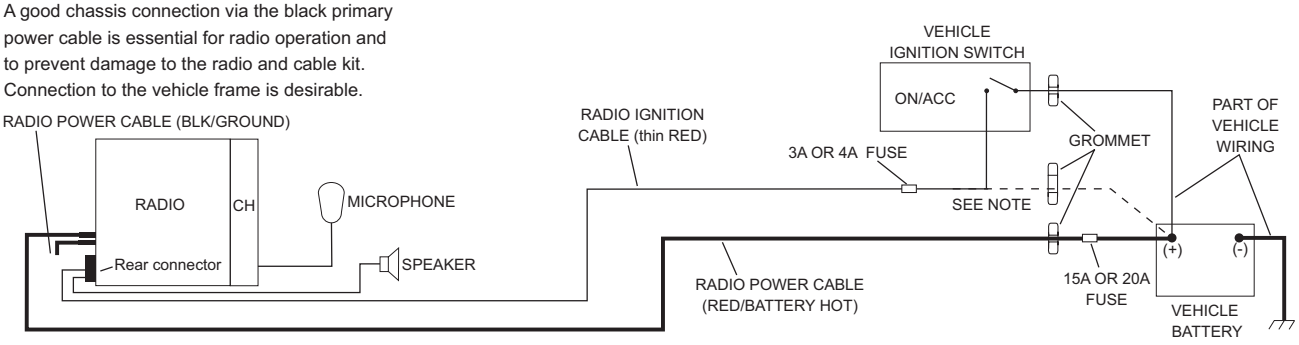
NOTE: The frame is not designed for regular mounting and demounting.

## 3.3 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 or 20-Amp 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 3-8. Connect the black lead to a convenient solid chassis ground point. DO NOT connect the black lead directly to the battery's negative terminal.

**CAUTION**

A good chassis connection via the black primary power cable is essential for radio operation and to prevent damage to the radio and cable kit. Connection to the vehicle frame is desirable.




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.

**Figure 3-8** Cabling Interconnect Diagram for Dash Mount

## 3.4 Ignition Sense Cable

Vertex Standard 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.

- For radio ON/OFF control independent of the ignition switch, connect the red ignition cable (pin 25 of accessory connector) to "battery hot" at the vehicle fuse block (dash mount only).
- For radio ON/OFF control via the ignition switch, connect the red ignition cable to "ignition" at the fuse block.

The ignition sense cable uses either a 3-Amp or 4-Amp fuse.

For other considerations when connecting the ignition cable, see the Vertex Standard VXD Series Mobile Radios Basic Service Manual.

## 3.5 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 Vertex Standard 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 3.5.1 below.

### 3.5.1 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 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 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.

NOTE: If these conditions cannot be satisfied, then mount the antenna on the roof top.

4. Ensure the antenna cable can be easily routed to the radio. Route the antenna cable as far away as possible from the vehicle electronic control units and associated wiring.
5. Check the antenna location for any electrical interference.
6. Make sure the mobile radio antenna is installed at least 30 centimeters (1 foot) away from any other antenna on the vehicle.
7. Any mobile radio antenna should be at least 30 centimeters (1 foot) away from the RF 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.

### 3.5.2 Antenna Installation Procedure

1. Mount the antenna according to the instructions provided with the antenna kit. Run the coaxial cable to the radio mounting location. If necessary, cut off the excess cable and install the cable connector.
2. Connect the antenna cable connector to the radio antenna connector on the rear of the radio.
3. In case of a GPS model, connect the GPS antenna to the GPS antenna connector on the rear of the radio.

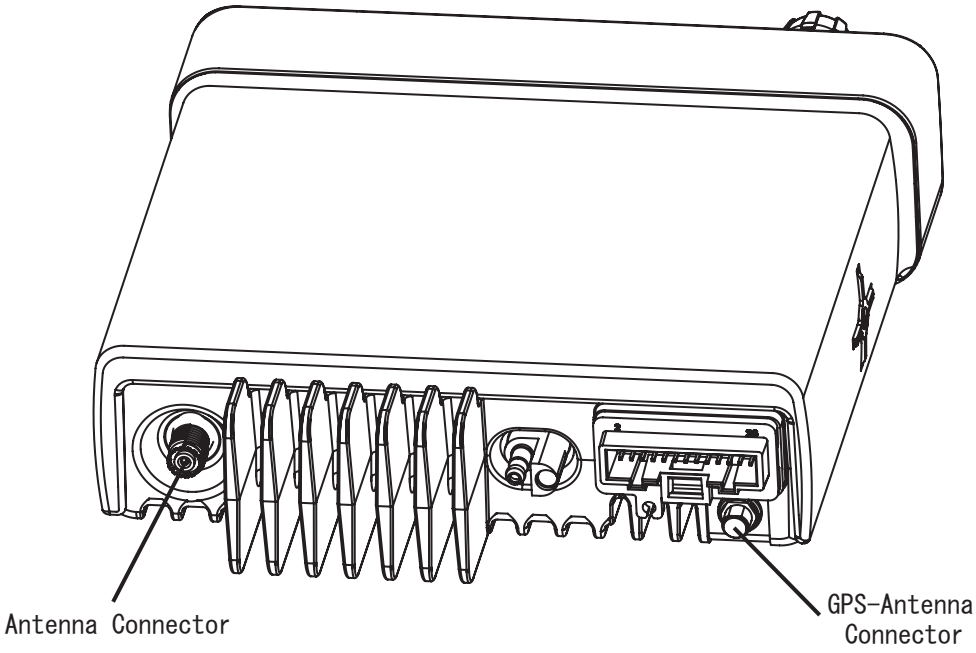



**Figure 3-9** Antenna connections on the back of the radio

### 3.5.3 Antenna 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.

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).

Vertex Standard recommends the following sequence to ensure proper attachment of the system (see Figure 3-10):

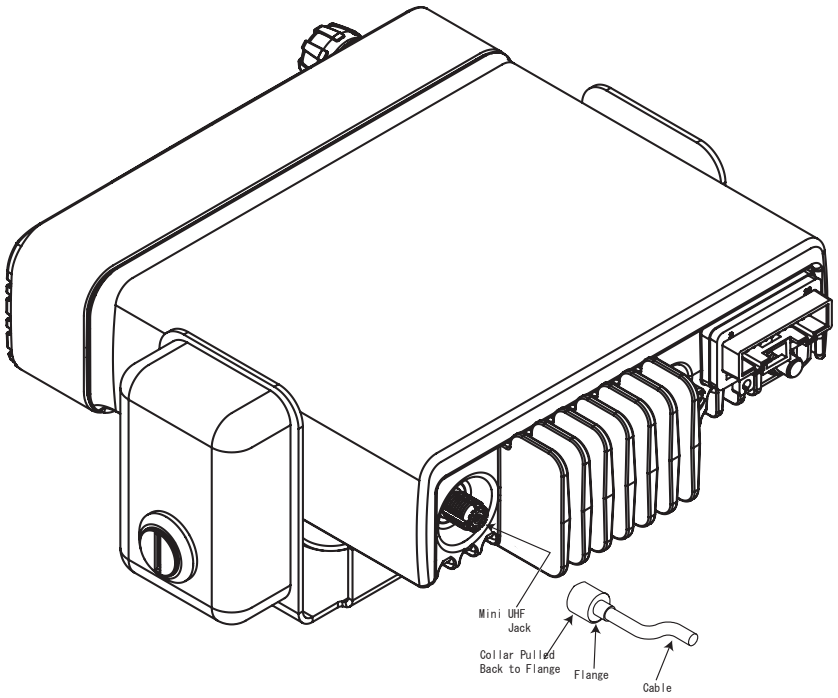



**Figure 3-10** Mini-UHF Connection

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. 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.
4. 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.
5. Finger-tighten the antenna cable plug's collar onto the radio's jack.
6. Give a final tug, by hand, to the collar, and retighten by hand as firmly as possible.
7. Use the rubber-coated pliers to grip the plug's knurled collar, then turn clockwise to tighten the collar. It should take 1/4 turn or less. Turning counterclockwise loosens the collar.

NOTE: Overtightening the collar can damage the connector and the radio.

## 3.6 Microphone Hang-Up Clip

### 3.6.1 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.

## 3.7 Completing the Installation

Complete the installation by connecting the power wires and plugging in the microphone cable to the mobile.

# Note

# Chapter 4 Options and Accessories Installation

## 4.1 Accessory Installation

The accessories must be installed through the rear accessory connector that is located on the rear of the radio, adjacent to the power connector. Most of the Vertex Standard-approved accessories are supplied with female terminals crimped to a 20-gauge wire specifically designed to fit the plug of the rear accessory connector.

Insert the female terminal into the accessory connector assembly in the appropriate locations. The accessory connector assembly is provided together with the accessory. Connect the accessory connector assembly to the rear accessory connector on the back of the mobile. Do not use other generic terminals in the plug. Generic terminals can cause electrical intermittences and may cause damage to the plug.

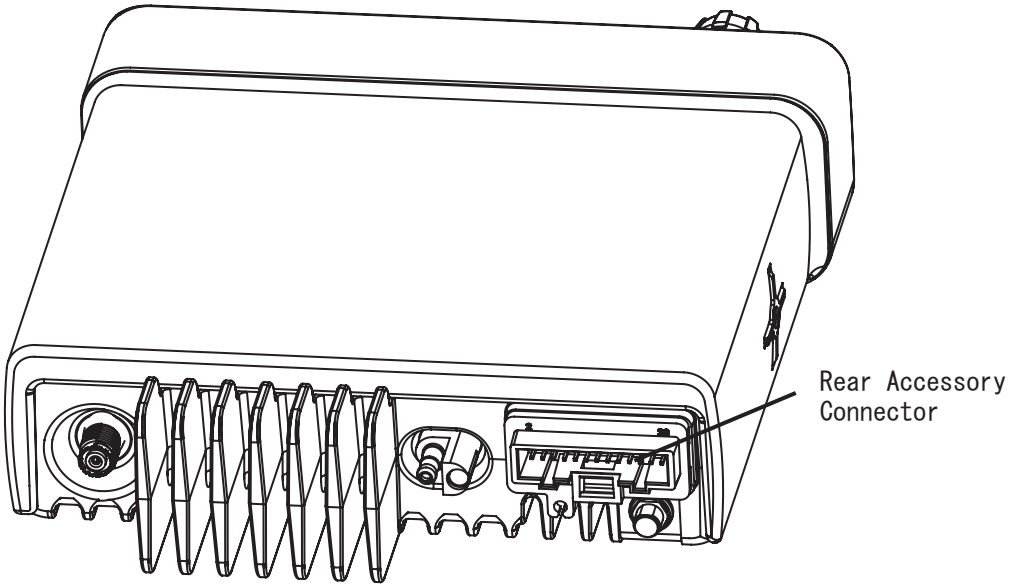



**Figure 4-1** Location of the Rear Accessory Connector

**Table 4-1** Rear Accessory Connector Pin Functions

| Pin No. | Pin Name | Pin Function | Pin No. | Pin Name | Pin Function |
|---|---|---|---|---|---|
| 1 | USB+ | USB+ (Data) | 14 | Rx Audio | Receive Live Audio[2] |
| 2 | USB− | USB− (Data) | 15 | AUX Audio 2 | PUBLIC Address 2 |
| 3 | VBUS | USB Power (5V from USB accessory/cable) | 16 | GND | Ground |
| 4 | USB/MAP_ID GND | USB/MAP_ID Ground | 17 | GP5-1 (PTT) | 5V Level GPIO, PTT Input[1] |
| 5 | MAP_ID_2 | Accessory Identifier | 18 | GND | Ground |
| 6 | MAP_ID_1 | Accessory Identifier | 19 | GP5-2 (Monitor) | 5V Level GPIO, Monitor Input[3] |
| 7 | SW B+ | Switched Battery Voltage | 20 | GP5-6 | 5V Level GPIO |
| 8 | PWRGND | Ground | 21 | GP5-3 | 5V Level GPIO, Channel Activity Function |
| 9 | SPKR− | Speaker − (3.2 ohm minimum impedance) | 22 | GP5-7 | 5V Level GPIO |
| 10 | SPKR+ | Speaker + (3.2 ohm minimum impedance) | 23 | EMERGENCY | Emergency Switch Input |
| 11 | Tx Audio | Rear External Microphone Input[4] | 24 | GP5-8 | 5V Level GPIO |
| 12 | Audio GND | Audio Ground | 25 | IGN SENSE | Ignition Sense[5] |
| 13 | AUX Audio 1 | PUBLIC Address 1 | 26 | VIP-1 | 12V Tolerant, 5V GPIO, External Alarm |

1 Pulling this line to ground will activate PTT function, activating the AUX_MIC input.

2 Fixed level (independent of volume level) received audio signal, including alert tones. Flat or de-emphasis are programmed by programming software. Output voltage is approximately 330 mVrms per 1kHz of deviation.

3 This input 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.

4 This microphone signal is independent of the microphone signal on the front microphone connector. The nominal input level is 80mVrms for 60% deviation. The DC impedance is 660 ohms and the AC impedance is 560 ohms.

5 See Figure 3-2 and Figure 3-8 for wiring information.

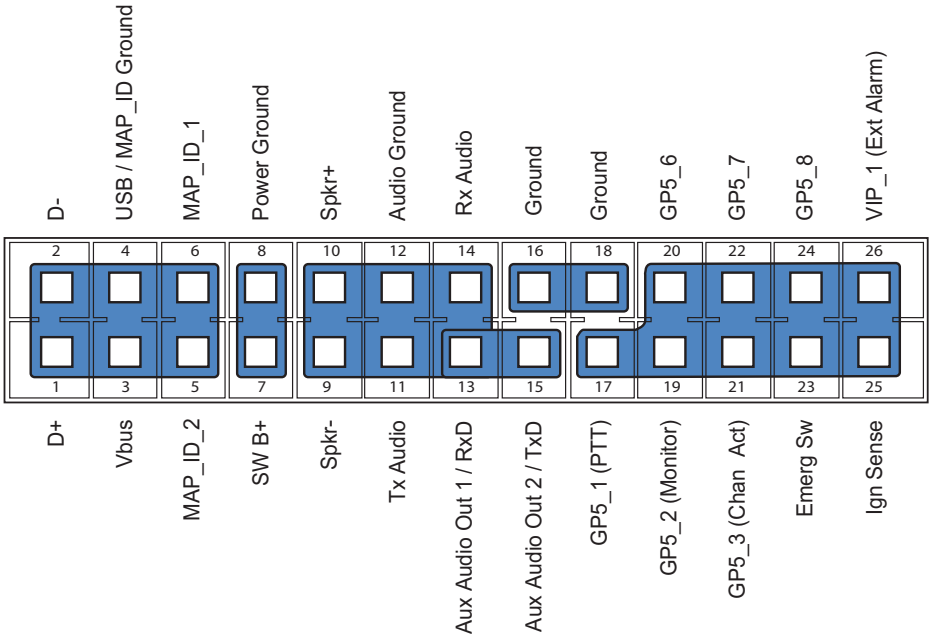



**Figure 4-2** Pin Configuration of Rear Accessory Connector (as viewed from the rear of the radio)

### 4.1.1 Horn and Lights (External Alarm) Relay

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

1. Horn Relay – Connect the relay contacts across the horn ring switch, typically found in the steering column. Connect the two control wires (female pins) into locations 26 and 18 of the connector.
2. Lights Relay – Connect the relay across the headlamp ON/OFF switch, typically found in the steering column. Connect the two control wires (female pins) into locations 26 and 18 of the accessory connector.

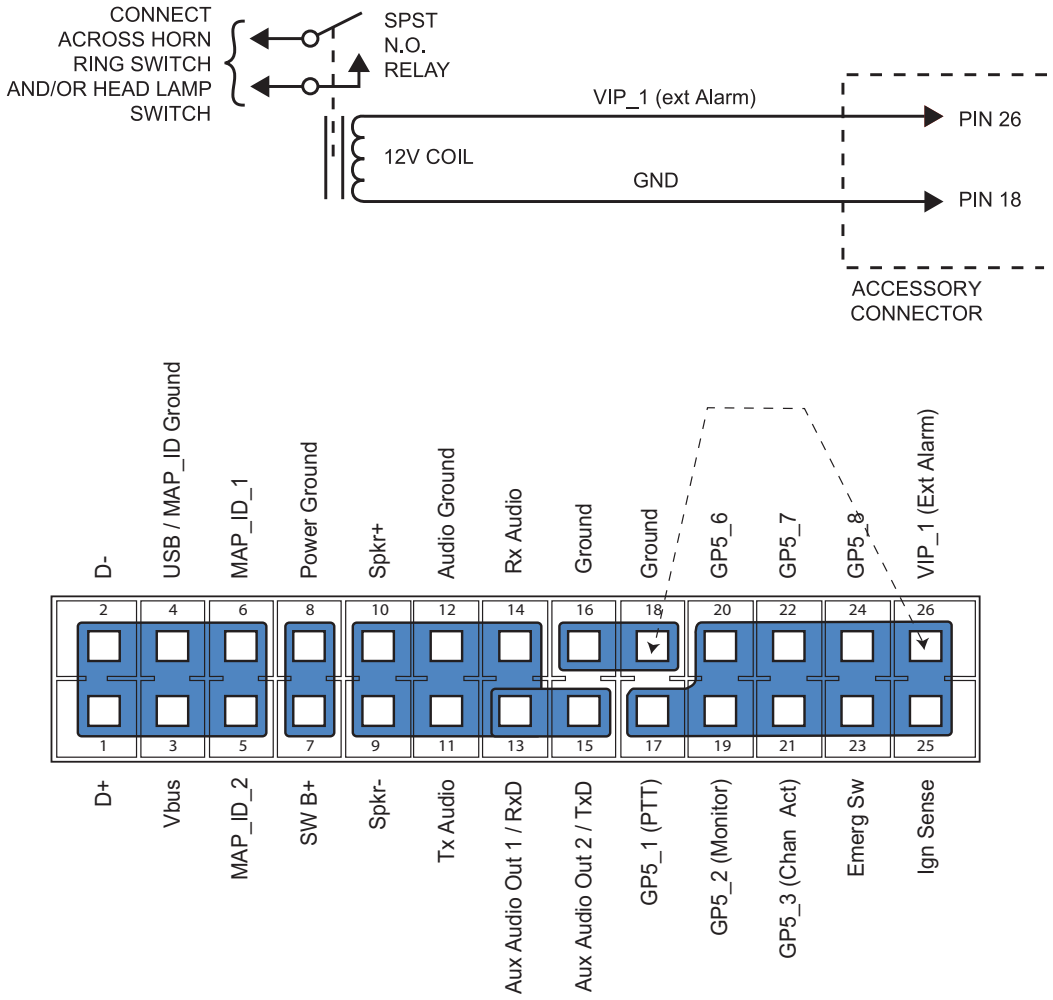



**Figure 4-3** Horn and Lights Wiring Diagram

### 4.1.2 External Speaker

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

1. Use the external 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 external 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.

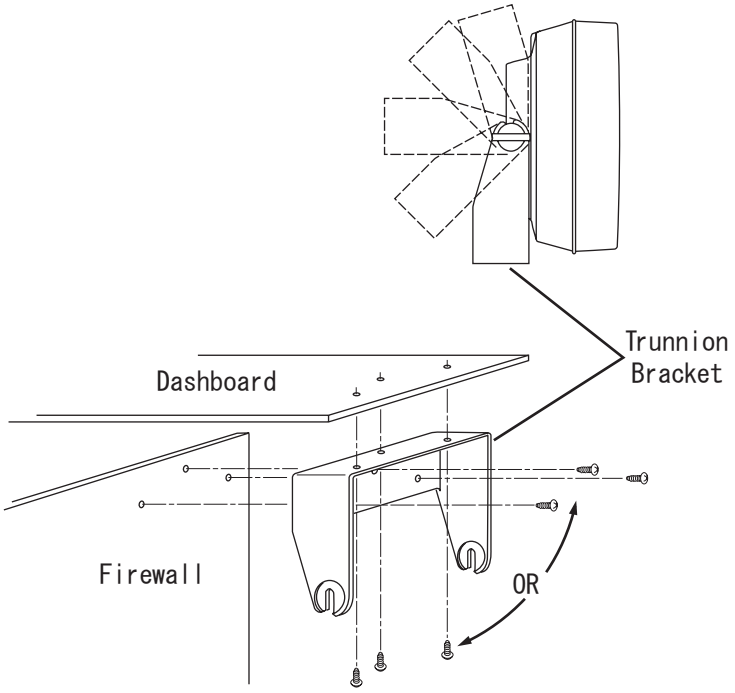



**Figure 4-4** External Speaker Mounting

# Appendix

## Replacement Parts Ordering

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.

The Vertex Standard VXD Series Mobile Radios Basic Service Manual includes complete parts lists and parts numbers.

## Servicing Information

If a unit requires further complete testing, knowledge and/or details of component level troubleshooting or service than is customarily performed at the basic level, please contact your Vertex Standard dealer.

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