

7 ANTENNA(S) INSTALLATION

7.1 MOBILE ANTENNA INSTALLATION

7.1.1 Install the Mobile Antenna

Table 4-2 (page 22) lists the mobile antenna available for M7300 mobile radio motorcycle installations. This antenna is a voltage/end-fed high-impedance antenna that provides the proper VSWR and radiation pattern without the use of a ground plane. Typical antenna gain without a ground plane is 0 dBd.

The following mobile antenna installation procedure is recommended:

1. Review the information presented in Section 1.2 (page 6), taking note on the Recommended Minimum Safe Lateral Distance for Controlled Environments presented in Table 1-1 (page 8).
2. Verify the antenna's mounting location on the triangular-shaped end of the Case/Antenna Bracket places motorcycle operator outside of the Minimum Safe Lateral Distance for Controlled Environments. If it does not, the bracket(s) must be repositioned on the motorcycle. If necessary, contact M/A-COM's Technical Assistance Center. See page 17 for TAC contact information.
3. Mount the antenna in accordance with the instructions supplied with it.
4. Calculate the required antenna coax cable length using the information presented in the following section.



Since the antenna is a high-impedance, voltage/end-fed antenna, the length of the coaxial cable from the base of the antenna to the radio's TNC antenna connector is critical. It cannot be an arbitrary length. To prevent possible extraneous radiation, RFI feedback from the antenna to the radio, high VSWR, or antenna ground currents, select an antenna coaxial cable length that is close to a multiple of an odd quarter-wavelength. Refer to the following information for details on calculating the correct cable length.

7.1.2 Calculating the Antenna Cable Length

Typically, an antenna coax cable length of approximately 32 inches will be required to reach from the base of the antenna, inside the case, to the TNC RF antenna connector at the rear of the radio. This length includes appropriately 6 inches for a service loop inside the case. To calculate the proper antenna coax cable length, proceed as follows:

1. Determine the center frequency of the majority of programmed transmit channel frequencies.
2. Use the following formula to calculate the $\frac{1}{4}$ -wavelength, in inches:

$$\frac{1}{4}\lambda \text{ in inches} = \frac{2805}{\text{Frequency in MHz}}$$

Example: Assume the customer has an M7300 radio with all transmit frequencies between 816 and 821 MHz. Therefore, the center frequency is 818.5 MHz. Applying the above formula results in:

$$\frac{1}{4}\lambda \text{ in inches} = \frac{2805}{818.5} = 3.43 \text{ inches}$$

3. Calculate the $\frac{1}{2}$ -wavelength by multiplying the $\frac{1}{4}$ -wavelength by 2:

$$\text{Example: } = 3.43 \times 2 = 6.86 \text{ inches}$$

- Pick a value of N then use the following formula to calculate an antenna cable length that will result in a cable length long enough for the installation:

$$(N \times \frac{1}{2}\lambda \text{ in inches} + \frac{1}{4}\lambda \text{ in inches}) \times 0.66 = \text{required cable length in inches}$$

Example: Choose N = 7. Therefore, the cable length in inches calculates to be:

$$(7 \times 6.86 \text{ inches} + 3.43 \text{ inches}) \times 0.66 = 33.96 \text{ inches}$$

- Verify the calculated cable length is long enough to route it from the base of the antenna, into the radio's weather-resistant case, to the TNC RF connector on the rear of the radio, and leaving some cable length for service loops. If not, recalculate the length per the formula in the previous step, using a greater value of N.
- Shorten the cable buy cutting it to the calculated length.

7.1.3 Route Cable, Crimp-On TNC RF Connector and Connect It to the Radio

- Route the antenna coax cable from the base of the antenna to the radio's weather-resistant case.
- Route the cable into the case by passing it through the hole in the bottom of the case.
- Outside the case, tie and stow the cable.
- Using an appropriate crimp tool, crimp the supplied TNC RF connector to the end of the antenna cable. For crimping instructions, see Figure 7-1 or the instructions supplied with antenna.

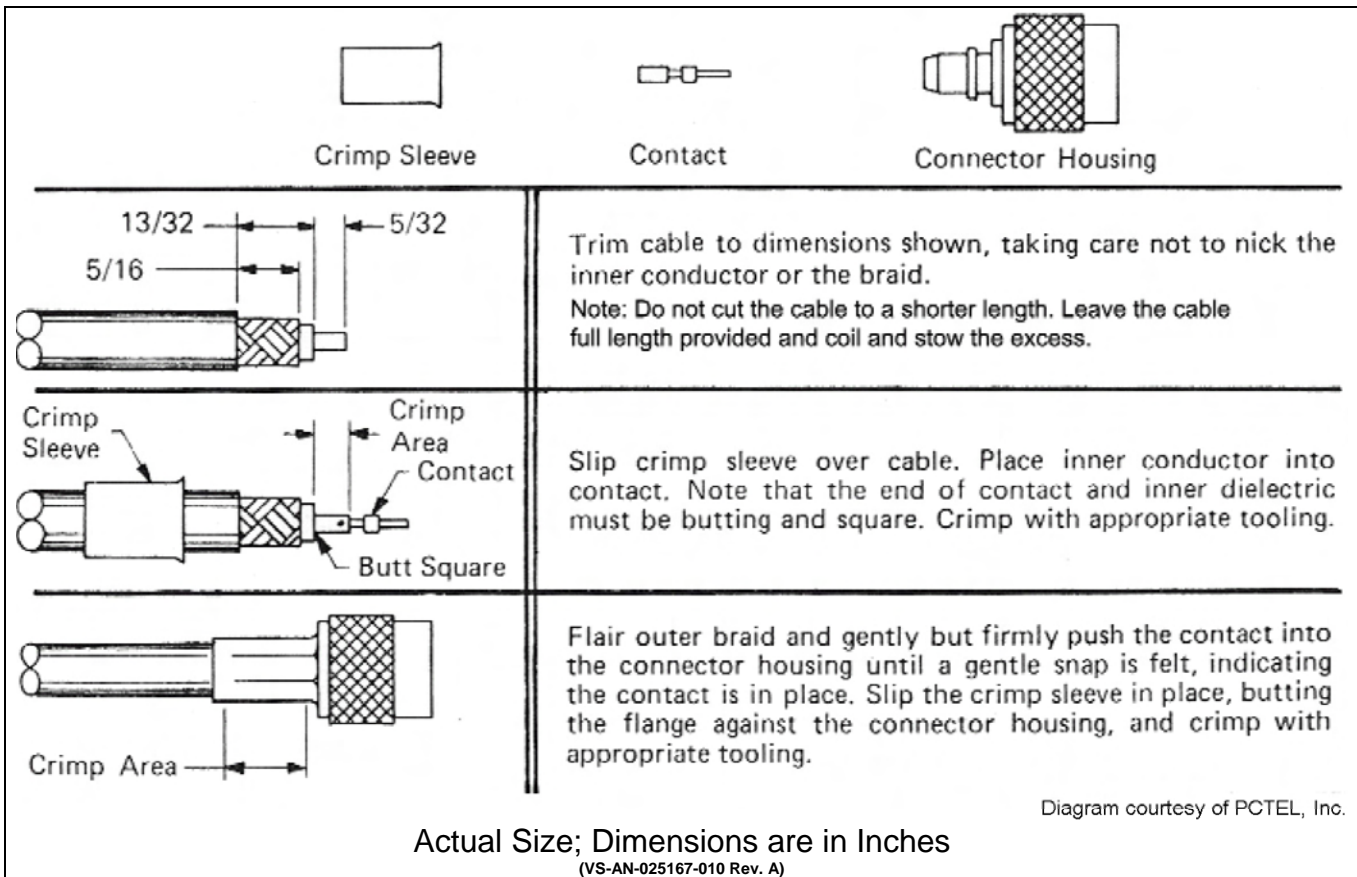


Figure 7-1: Crimping Instructions for TNC RF Connector

- The antenna cable is connected to the radio's TNC receptacle-type (female) RF connector per a procedure presented later in this manual. The cable and its TNC connector must be protected from

damage, dirt, and/or metal shavings which may be generated during the mechanical and electrical installation of the radio. Temporarily tying the connector and cable-end within a small plastic bag is recommended.



To properly use a thru-line wattmeter with a high-impedance voltage/end-fed antenna, one of the following two conditions must be met:

- If the wattmeter is located at the radio and the odd multiple of a quarter-wavelength of coax to the antenna is used, correct readings will result. Any other length of coax will result in improper readings.
- If a length of coax equal to a multiple of a half-wave length is installed between the radio's antenna port (TNC RF connector on rear panel) and the thru-line wattmeter and an odd multiple of a quarter-wavelength of coax to the antenna is used, correct readings will also result. Any other length of coax will result in improper readings.

7.2 GPS ANTENNA INSTALLATION (REQUIRED ONLY FOR GPS RECEIVER OPTION)

If the M7300 mobile radio is equipped with the GPS receiver option, the GPS receiver requires connection to an externally-mounted GPS antenna. The following antenna installation procedure is recommended:

1. Refer to the GPS antenna manufacturer's mounting and testing instructions for installation guidance. Install the antenna in accordance with these instructions. As a general rule, it should be mounted on a mechanically-secure surface where it will have an unobstructed view of the sky, down to 50% view. If necessary, contact M/A-COM's Technical Assistance Center. See page 17 for TAC contact information. **Do not alter the GPS antenna cable length; tie and stow excess cable as necessary.**
2. Route the cable from the antenna to the radio case, and pass it through the square holes in case/antenna bracket and in the bottom of the case. The cable must be kept out of casual contact. Outside the case, tie and stow this cable as necessary to protect it from possible chafing. Nylon (or equivalent) cable/wire ties should be used at least every six (6) inches.
3. Permanently connect the antenna cable from the GPS antenna (or mobile/GPS combo antenna) to the female SMA-type RF connector on the rear panel of the radio. The male SMA-type RF connector on most GPS antenna cables has a 5/16-inch hex collar, so the use of a wrench of this same size is normally required for tightening. However, some may have collars with only knurled surfaces, so a standard wrench or torque wrench cannot be used. In either case, do not over tighten the connector and do not twist the cable when tightening.
4. Loop excess cable length inside the case and tie and stow it at one side of the radio's mounting bracket.

8 CONTROL HEAD MECHANICAL INSTALLATION

8.1 GENERAL INFORMATION

The M7300 mobile radio must be connected to a control head to provide the operator-to-radio interface. Two different control heads are available — the CH-721 Scan model and the CH-721 System model. See Figure 8-1 and Figure 8-2 respectively. The CH-721 Scan model control head features three (3) large menu selection buttons. The System model control head has a 12-button keypad to allow advanced operations without the need of a DTMF-capable microphone.

Figure 8-3 on page 37 illustrates the rear panel of the two control head models. Both models have identical rear panels and rear panel connectors.

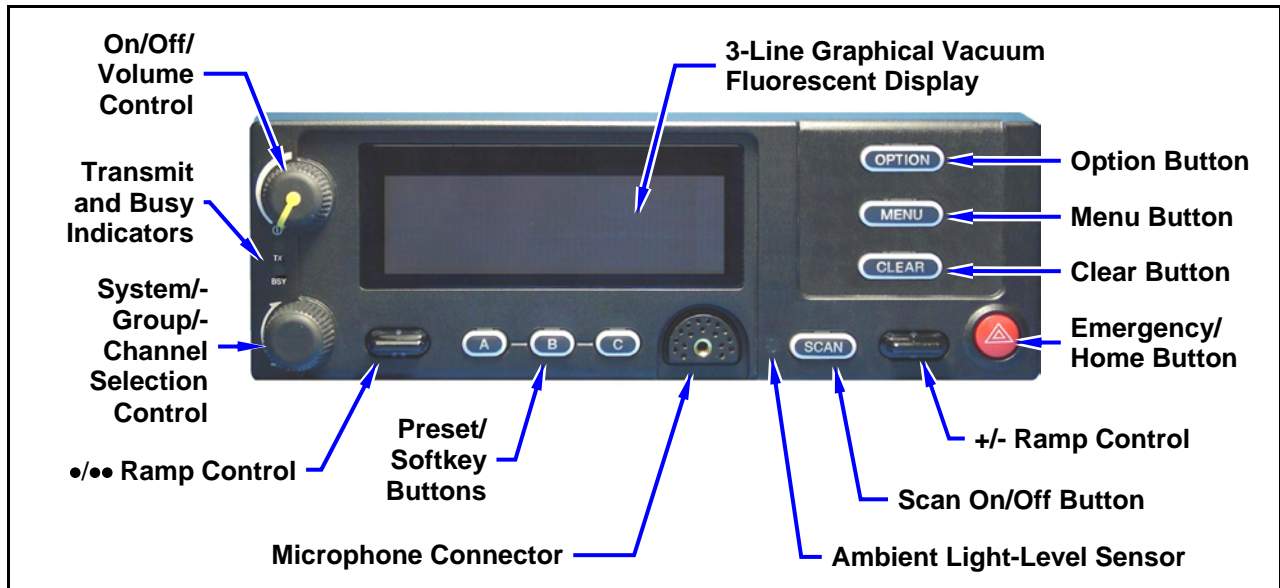


Figure 8-1: CH-721 Scan Model Control Head Front Panel

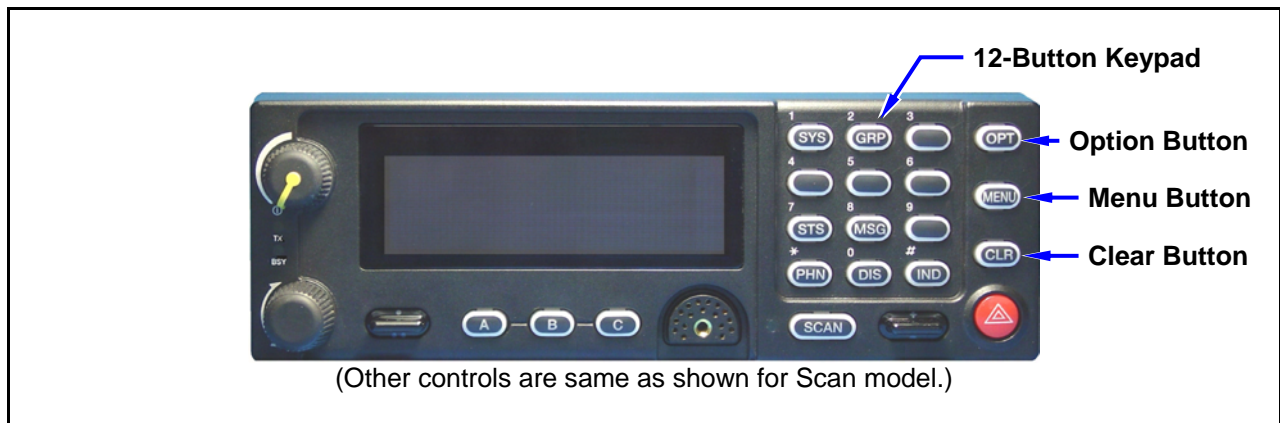


Figure 8-2: CH-721 System Model Control Head Front Panel

The CH-721 control heads feature a large easy-to-read 3-line graphical vacuum fluorescent display, an on/off/volume control knob, menu controls and buttons, trunking mode buttons, an emergency/home button, a scan on/off/volume control, and three (3) preset buttons. Other front panel components include a microphone connector and LED-type indicators. One LED indicator is the busy indicator that lights when

the radio is receiving a call and one is the transmitter-enabled indicator that lights when the radio is transmitting. The front panel also has an ambient light sensor for automatic display dimming.

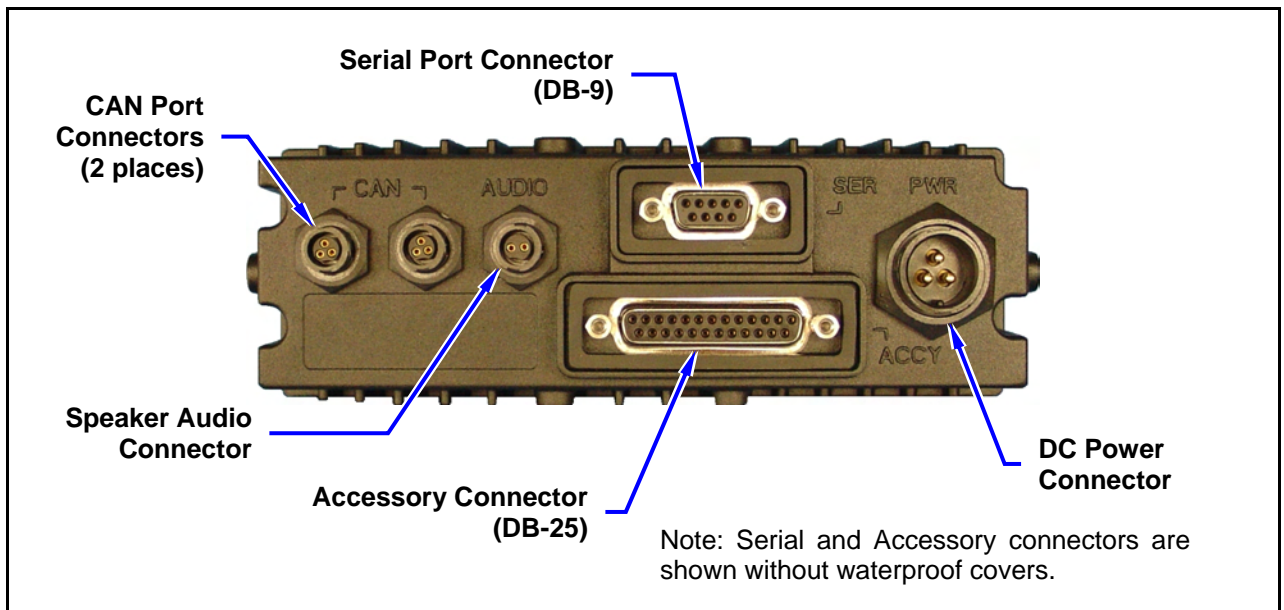


Figure 8-3: CH-721 Rear Panel (both control head models)



NOTE

Prior to installing the control head, verify it has the proper software version installed and verify it has been properly configured for customer use.



NOTE

Because Installation Kit MAMW-NZN7X contains the most complete set of materials for installing the radio and control head, the following instructions make repeated reference to items within this kit. References to item numbers refer to items in the kit as listed in Table 4-1 on page 20.

8.2 MOUNTING THE CONTROL HEAD

8.2.1 Selecting a Mounting Location

Typically, the CH-721 control head is mounted at the centerline of the motorcycle between the steering handlebars, and secured to the handlebars or to the frame just below the handlebars. A typical installation is shown in Figure 8-4. The CH-721 control head can be mounted using either the standard U-shaped mounting bracket or the optional mounting pedestal. See Figure 8-4 and Figure 8-5 respectively. The selected mounting location must:

- Be safe for the motorcycle operator (e.g., the head must be located so it does not interfere with motorcycle steering or any other motorcycle controls);
- Allow convenient access by the operator;
- Be neat;
- Include clearance for the microphone's connector that mates to the mic connector on the front of the head;
- Include clearance for the connectors/cables that mate to the connectors on the rear of the head; and,

- Have a relatively easy access for servicing.

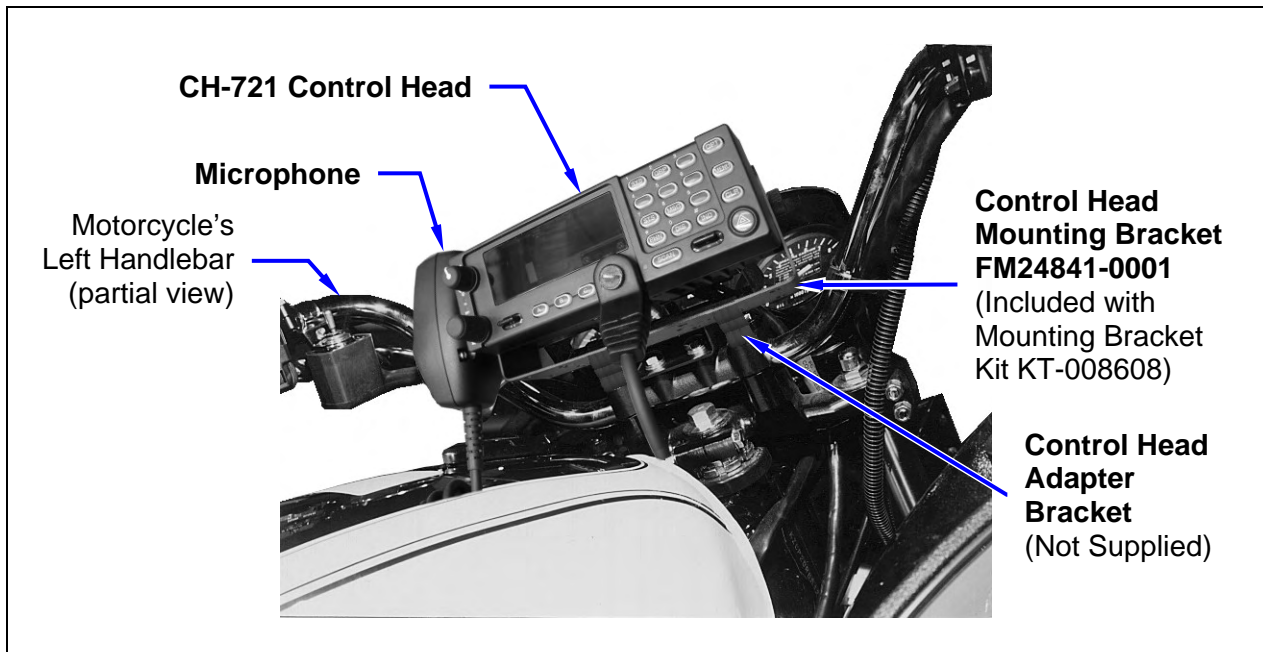


Figure 8-4: Typical CH-721 Control Head Installation on a Motorcycle (Using the Standard U-Shaped Mounting Bracket)

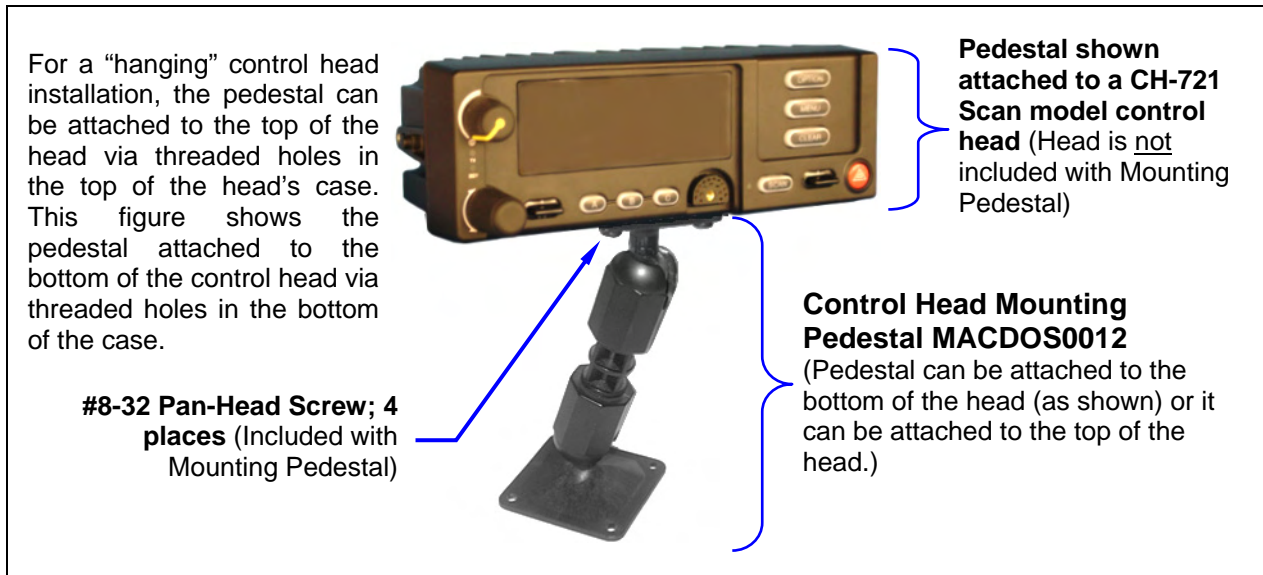


Figure 8-5: Optional Control Head Mounting Pedestal (Part Number MACDOS0012)

Due to the large number of different makes and models of motorcycles, it is the installer's responsibility to determine how to mount the control head and other related equipment such as the microphone hanger and speaker.

8.2.2 Control Head Adapter Bracket (Not Supplied)

In some cases, a control adapter bracket (not supplied) may be required to attach the supplied U-shaped control head mounting bracket (or the optional mounting pedestal) to the motorcycle. Control head adapter brackets for all makes and models are not available from the factory. Therefore, obtaining or field-fabricating an adapter bracket will be required in some cases. All utilized bracketry:

- Must be mounted in a location that is safe for the motorcycle operator (e.g., so it does not interfere with steering and other motorcycle controls);
- Must not interfere with the motorcycle operator's visibility, including the view of all motorcycle instruments;
- Provide a secure mount for the control head;
- Must utilize rounded corners/edges to the maximum extent possible; and,
- Must not be mounted in a way that compromises the strength of the motorcycle's frame or other key components.



Never compromise the strength of a motorcycle's frame, handlebars, or other key components by drilling or grinding holes in these components. Use clamps or another method approved by the motorcycle manufacturer to attach radio components.



Before drilling holes and/or installing mounting screws, verify these operations will not damage or interfere with any existing vehicle components such as the fuel tank, a fuel line, engine, transmission, wiring, etc. Always check to see how far the mounting screws will extend below the mounting surface prior to installation. Always deburr drilled holes before installing screws.

8.2.3 Mounting the CH-721 Control Head

8.2.3.1 Using the Standard U-Shaped Mounting Bracket

The following CH-721 control head mounting procedure is recommended:

1. Obtain CH-721 Mounting Bracket FM24841-0001 included in Mounting Bracket Kit KT-008608 (item 8 in Table 4-1).
2. Obtain or field-fabricate a suitable adapter bracket. Mount this bracket to the motorcycle according to the manufacturer's instructions and/or industry-standard practices. Observe and follow the requirements listed in Section 8.2.2.
3. Using the CH-721 Mounting Bracket as a template, mark and drill mounting holes into the adapter bracket as required. The round and elliptical holes in the mounting bracket's mounting surface are symmetrical, so forwards/backwards positioning is not important during this step. However, positioning is important in the next step.
4. Position the mounting bracket on the surface of the adapter bracket so the two round holes in its two side "ears" are nearest to the normal location of the operator (towards the rear of the motorcycle) and the two slotted holes are furthest from the normal location of the operator.
5. Attach the mounting bracket to the adapter bracket using suitable mounting hardware (not supplied). The use of #12-24 stainless-steel self-locking hardware (i.e., machine screws with washers and self-locking nuts) is recommended, in at least six (6) locations.

6. Verify the mounting bracket is held firmly mounted. Firm mounting prevents unreasonable vibration, which could damage the control head and/or cause its cable connections to loosen.
7. Slide the control head into the bracket, placing the two pegs protruding from its left and right sides into the respective round holes in the bracket's two side "ears."
8. In each side "ear" of the mounting bracket, start a #8-32 hex-socket-head cap (Allen) head screw with a lockwasher and a flat washer by inserting the screw through the slotted hole in the bracket and then into the threaded hole in the side of the control head. This hardware is included with Mounting Bracket Kit. The lockwasher should be adjacent to the screw head and the flat washer should be adjacent to the bracket. Turn each screw clockwise as observed from the head of the screw.
9. The control head can be positioned at various angles for best display viewing at the normal position of the motorcycle operator. As necessary, turn it on the pegs to a good position and tighten both screws using an 1/8-inch hex key (Allen) wrench until the control head is held firmly in place. Do not over-tighten.

8.2.3.2 Using the Mounting Pedestal (Optional)

An optional Mounting Pedestal, part number MACDOS0012, may be purchased separately to replace the standard U-shaped mounting bracket. This pedestal can be attached to the bottom of the control head as shown in Figure 8-5, and then mounted to a mounting surface below the two. It can also be attached to the top of the head and then mounted to a mounting surface above the two.

9 SPEAKER INSTALLATION

9.1.1 Selecting a Mounting Location

Typically, the radio's speaker is mounted on the motorcycle's steering handlebars. The selected mounting location:

- Must be in a location that is safe for the motorcycle operator (e.g., so it does not interfere with steering and other motorcycle controls);
- Must not interfere with the motorcycle operator's visibility, including the view of all motorcycle instruments;
- Must allow for proper listening range with a moderate volume setting;
- Must be mounted securely; and,
- Must not be mounted in a way that compromises the strength of the motorcycle's frame or other key components.

9.1.2 Mounting the Speaker

The following mounting procedure is recommended:

1. Obtain External Speaker LS102824V10 (item 15 in Table 4-1) included in Motorcycle Installation Kit MAMW-NZN7X.
2. Using the above listed guidelines, select a mounting location for the speaker.
3. Install the speaker using the hardware and mounting bracket supplied with it. In some case, an appropriate adapter bracket will be required (not supplied).
4. Route the speaker cable to the rear of the CH-721 control head.
5. Mate the 6-inch speaker cable (item 16 in Table 4-1) to the 2-pin connector at the rear of the control head by visually aligning the $\frac{3}{4}$ -moon-shaped keys of the connectors, and then pushing and turning the outer locking ring of the cable connector clockwise until it stops. A mild click will be sensed to confirm proper mating.
6. Connect the speaker cable's 2-pin plastic connector to the respective mating connector on the 6-inch speaker cable.
7. Route the cables out of the way of casual contact. Tie and stow as necessary.

10 CABLE CONNECTIONS

10.1 RADIO'S DC POWER INSTALLATION

10.1.1 Overview of On/Off Power Wiring Configurations

Radio on/off power control is accomplished by the control head. In a standard installation, when the control head is turned on, it “wakes-up” the radio via data activity on the CAN link. The following power wiring configurations are supported:

- **Radio turns on and off automatically with vehicle's ignition switch/key** — This configuration allows the on/off state of the vehicle's ignition switch/key to control the on/off power state of the radio. The white wire of the control head's DC Power Cable is connected to a fused switched power source, typically identified as vehicle “Accessory” power. This source must switch on (up to positive (+) battery voltage potential) when the vehicle's ignition switch/key turns on, and it must switch off (to near zero volts) when the ignition switch/key turns off. The required fuse rating is 3 amperes. When using this configuration, the CH-721 control head's on/off/volume control must be left in the on position for automatic power-up/down to function properly.



NOTE

A waterproof (HFB type) fuse holder and a 3-amp AGC fuse are included with the control head's DC Power Cable to fuse this cable's white wire.

- **Radio turns on and off with a manual switch** — This configuration is used when, for example, the radio must remain on even when the ignition key must be removed from the vehicle and a separate on/off switch is acceptable. The white wire of the control head's DC Power Cable is connected to one side of a manually-controlled switch, and the other side of this switch is connected to unswitched and fused vehicle power. The required fuse rating is 3 amperes. When using this configuration, the CH-721 control head's on/off/volume control must be left in the on position for automatic power-up/down to function properly.
- **Radio turns on with control head's on/off/volume control (“hot wired”)** — This configuration allows radio on/off power control only via the control head's on/off/volume control. It may be desired if, for example, the radio must remain on even when the ignition key must be removed from the vehicle and a separate on/off switch is not desired and/or not acceptable. The white wire of the control head's DC Power Cable must be connected to unswitched and fused vehicle power. The required fuse rating is 3 amperes.

In all of the above cases, both the radio's main DC power input (red wire) and the control head's main DC power input (also a red wire) must be connected to unswitched vehicle DC power (12-volts nominal) via an Alternator Whine Reject Filter located in the motorcycle radio case. DC power supplied to this filter is over-current protected by a fuse installed near the DC power source (i.e., near the motorcycle's positive battery terminal). The white ignition wire of the radio's DC Power Cable is not used/not connected in motorcycle applications.

10.1.2 Alternator Whine Reject Filter Installation

Install the Alternator Whine Reject Filter in the weatherproof radio case as follows:

1. Obtain Alternator Whine Reject Filter 19A703965P2.
2. Using a T20 Torx screwdriver, mount the filter to the inside bottom floor of the radio case using the four (4) stainless-steel M4 x 12-millimeter-long screws supplied in Hardware Kit 350A1396G1. As

shown in Figure 5-3, position it so its two positive (+) studs are nearest the square hole in the floor, and its ground stud is furthest from the hole. Tighten the screws securely.

10.1.3 DC Power Cable and Main Fuse Holder Installation

The radio's DC Power Cable has a 3-pin connector, a 20-foot red wire (for the main power connection), a 20-foot white wire (not connected), and a 4-foot black wire (for the ground connection). It is supplied with waterproof fuse holders, two AGC-type fuses, and ring terminals. The following installation procedures are recommended:

10.1.3.1 Black Wire Connection (Ground Wire)

1. Connect the radio's DC Power Cable to the radio by mating its 3-pin connector to the radio's 3-pin power cable connector as follows: Visually align the key and firmly push and turn the outer locking ring clockwise until it stops. A click will be sensed to confirm proper mating.



Do not confuse the radio's DC Power Cable which has a 10-AWG red wire with the control head's DC Power Cable which has a 12-AWG red wire. The radio requires much more DC operating current than the control head. Therefore, it requires the larger wire size of 10-AWG. **The part number of the radio's DC Power Cable is CA-012365-001.**

2. Cut the white wire approximately three (3) inches from the cable's connector, and insulate its end using an approved method.
3. Route the cable's black wire from the connector at the rear of the radio to the Alternator Whine Reject Filter near the square hole in the bottom floor of the radio case. Leaving a service loop at the rear of the radio, cut this wire to a length long enough to reach the ground stud on the filter. Save the excess-length black wire to make the ground connection.
4. Strip approximately ¼-inch of insulation from both the end of the black wire from the cable connector and one end of the excess-length black wire, then crimp a #10-stud ring terminal to each stripped wire end.
5. Remove the nut from filter's ground stud (stud labeled "NEG") and attach both ring terminals to this stud. Reinstall the nut. It is not necessary to tighten the nut at this time, since a control head ground wire will be added to this stud in a later procedure.
6. Route the excess-length black wire out of the square hole in the bottom floor of the radio case.
7. Prepare to connect this end of the black wire to vehicle ground by locating an area of metal within approximately two (2) feet of the radio, and drilling a hole in it if necessary. This surface **must** have a solid and stable connection to vehicle ground. If a new hole must be drilled, it should **not** be in a structural part of the motorcycle's frame, which could weaken the frame and cause it to crack. If possible, use an existing hole to ground the black wire.

If an existing hole cannot be located, locate a non-structural metal area of the motorcycle that has a solid and stable ground connection to the motorcycle's frame. Drill a ⅜-inch hole in this metal area, deburr it, and strip this area of all paint and dirt to expose a bare metal surface, approximately ¾-inch square. A ⅜-inch-stud non-insulated ring terminal is supplied with the cable to make this ground connection. Hole diameter must be appropriate for the utilized grounding screw/bolt size and type used to connect the ring terminal to the bare metal surface. This hardware is not supplied.



Never compromise the strength of a motorcycle's frame, handlebars, or other key components by drilling or grinding holes in these components. Use clamps or another method approved by the motorcycle manufacturer to attach radio components.

8. Cut the excess-length black wire to the required length then strip insulation back approximately ¼-inch.
9. Crimp a ⅜-inch non-insulated ring terminal (supplied with the cable) to the end of the black wire, crimp-on another terminal appropriate for the type of connection hardware being used.
10. Attach the ring terminal and black wire to the bare metal surface using stainless-steel self-locking hardware (i.e., machine screws with washers and locking nuts) or other appropriate hardware to ensure a reliable terminal-to-metal contact. Tighten securely.
11. Apply an approved paint or rust-inhibitor over the remaining exposed bare metal surface and around the ring terminal.

10.1.3.2 Red Wire and Main Fuse Holder Connection (Radio's Main Power Wire)

1. Route the cable's red wire from the connector at the rear of the radio to the Alternator Whine Reject Filter near the square hole in the bottom floor of the radio case. Leaving a service loop/slack at the rear of the radio, cut this wire to a length long enough to reach the DC output stud (stud labeled "RADIO +") on the filter. Save the excess-length red wire to make the battery connection.
2. Strip approximately ¼-inch of insulation from both the end of the red wire from the cable connector and one end of the excess-length red wire, then crimp a #10-stud ring terminal to each stripped wire end.
3. Remove the nut from filter's DC output stud (stud labeled "RADIO +") and attach both ring terminals to this stud. Reinstall the nut. It is not necessary to tighten the nut at this time, since a control head power wire will be added to this stud in a later procedure.
4. Route the excess-length red wire out of the square hole in the bottom floor of the radio case.
5. Route the excess-length red wire to the location of the vehicle's battery (or its main DC bus bar or stud). Protect the wire from possible chafing where necessary. Tie and stow the wire as necessary.



Do **not** install any wiring or fuse holders over or in the near vicinity of the motorcycle's engine, or near other hot items such as exhaust pipes and mufflers. Excessive heat can cause permanent damage to these components.



Before making connections to the battery's positive post, carefully disconnect the battery's negative (ground) cable(s). This will prevent tools or other metallic objects which come in contact with the battery's positive terminal from shorting to vehicle ground, causing sparks or even a fire or an explosion! When disconnecting the negative cable(s), cover/insulate the positive post if it is not already so a tool cannot short between the posts.

Radio and control head fuses should **not** be installed until all wiring is complete. This will prevent the radio from powering up prematurely and/or causing an in-rush of current that could lead to shorting of the battery, sparks, or even fire.

6. Obtain one of the waterproof (HFB type) fuse holders included with the DC Power Cable.
7. **Observe and follow the previously presented WARNING!**
8. Cut the red wire to the required length for connection to the battery's positive (+) battery terminal (or to the main DC bus bar or stud).
9. Prepare to splice the waterproof fuse holder into the red wire by cutting it again, at approximately three (3) to six (6) inches from the end.
10. Strip all three (3) wire ends back approximately $\frac{3}{8}$ -inch, place a fuse holder shell on each wire, and securely crimp a fuse holder terminal to each wire end. Before crimping, verify fuse holder shells are oriented in the correct directions (i.e., with each large end towards the wire end).
11. Label this fuse holder and red wire appropriately (e.g., "M7300 Main Power: 15-AMP FUSE").
12. **Do NOT install a fuse into the fuse holder at this time.**
13. Crimp an appropriate electrical terminal to the short red wire. A corrosion-resistant $\frac{3}{8}$ -inch ring terminal is included with the cable for this purpose, but another size corrosion-resistant terminal type (not supplied) may be used if required.
14. Connect the ring terminal directly to the battery's positive post (or if present, to a stud on the battery's main/non-switched power distribution terminal block).



When servicing the radio and/or control head, always manually power-down the radio equipment via the control head's on/off/volume control knob, and then remove the main power fuse near the battery.

10.1.4 Control Head-to-Radio CAN Cable Connections

10.1.4.1 General Information

As illustrated in Figure 10-1 below, the motorcycle radio installation requires a CAN cable between the radio and the control head, a CAN terminator at the radio, and a CAN terminator at the control head. Figure 5-4 on page 27 shows the radio's two CAN port connectors, which are located near the center of the radio's rear panel. Figure 8-3 on page 37 shows the two CAN port connectors on the control head's rear panel.

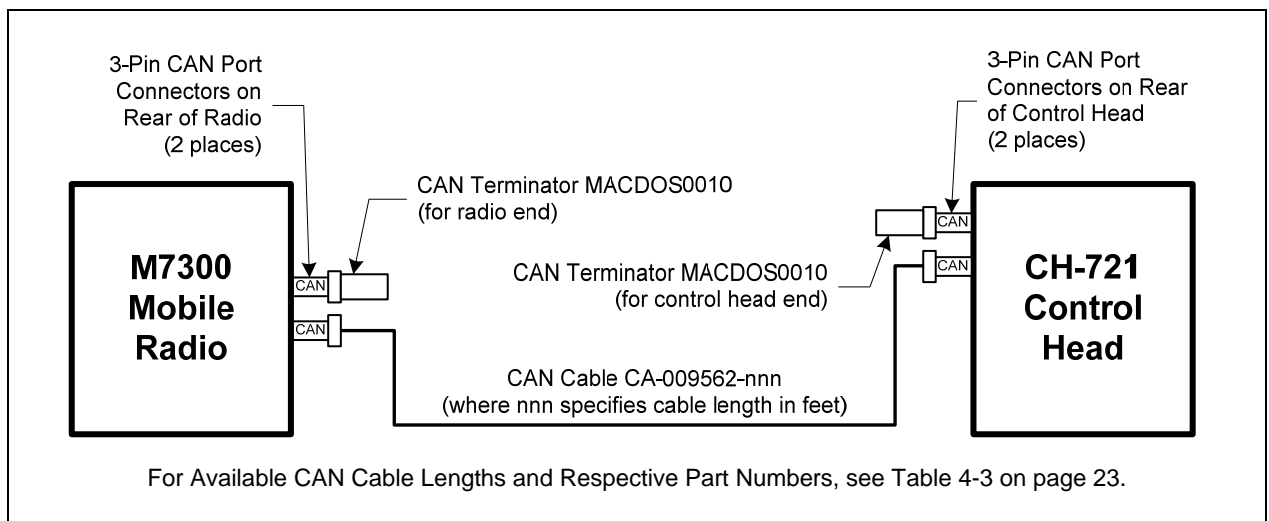


Figure 10-1: CAN Link Connections for a Single Control Head Installation

10.1.4.2 Make CAN Link Terminations and Cable Connection

Follow this procedure to make the CAN line interconnections:

1. Mate a CAN terminator (item 14 in Table 4-1) onto either one of the two smaller 3-pin CAN port connectors on the rear panel of the CH-721. This action makes the CAN termination at the control head end of the CAN link.



When mating any CAN connection (terminators and cables) to a rear panel connector, visually align the $\frac{3}{4}$ -moon-shaped keys of the connectors, and then gently push and turn the outer locking ring of the plug (male) connector clockwise until it stops. A mild click will be sensed to confirm proper mating. Without visual alignment as a guide, it is possible with excessive force to mate the CAN connectors improperly. Damage to the connector(s) may result. Therefore, visual alignment is recommended when mating CAN connectors.

2. Obtain a CAN cable and mate it to the other CAN port connector on the rear panel of the CH-721. Typically, item 13 in Table 4-1 is utilized.
3. Make a service loop in the cable near the back of the control head.
4. Route the cable from the rear of the control head to the weather-resistant motorcycle radio case. If the control head is mounted on the motorcycle's handlebars, leave sufficient slack in the cable to allow for full handlebar steering/travel without any stretching of the cable. Protect the cable from chafing.
5. Route the CAN cable it into the case by passing it through the square hole in the bottom floor case
6. Mate this end of the cable to one of the two CAN port connectors on the rear panel of the radio.
7. Mate another CAN terminator to the other CAN port connector on the rear panel of the radio. This action makes the CAN termination at the radio-end of the CAN link.
8. Loop, tie and stow the excess cable as necessary, leaving a service loop at the back of the radio and at the back of the control head.

10.1.5 Control Head Power Cable Installation

Plan the route of the control head's DC Power Cable carefully. Do not route the cable where it will be damaged by heat sources or by casual contact, and protect it from wire chafe per standard installation methods. The following procedures are recommended:

10.1.5.1 Install DC Power Cable and Make Power and Ground Connections

1. Connect the control head's DC Power Cable (item 10 in Table 4-1) to the large 3-pin connector at the rear of the head. Visually align the key and gently push and turn the outer locking ring clockwise until it stops. A click will be sensed to confirm proper mating.
2. Protect the wires of this cable by inserting them into an appropriate-length high-temperature tubing, loom or wrap (not supplied). Typically, a 4 to 5-foot length of tubing/loom/wrap is required.
3. Make a service loop in the cable near the back of the control head.
4. Route the cable (within the tubing/loom/wrap) to the frame of the motorcycle. If the control head is mounted on the motorcycle's handlebars, leave sufficient slack to allow for full handlebar steering/travel without any stretching of the cable. This length of the cable must be in tubing/loom/wrap. Tie and stow as necessary.

5. Route the cable to the radio case at the rear of the motorcycle and then pass it through the square hole in the bottom floor of the case.



CAUTION

Do **not** install any wiring or fuse holders over or in the near vicinity of the motorcycle's engine, or near other hot items such as exhaust pipes and mufflers. Excessive heat can cause permanent damage to these components.

6. Cut excess length from the red and black wires of the cable, leaving enough length for a service loop inside the radio case, near the Alternator Whine Reject Filter. The red and black wires connect to two (2) studs on the filter. The white wire is connected in the procedure that follows.
7. Strip approximately ¼-inch of insulation from the end of the black wire and crimp a #10-stud ring terminal to it.
8. Remove the nut from the filter's ground stud (stud labeled "NEG") and slip the ring terminal with the black wire onto this stud. Three (3) black wires should be connected to this stud. Reinstall the nut and tighten it securely.
9. Strip approximately ¼-inch of insulation from the end of the red wire and crimp a #10-stud ring terminal to it.
10. Obtain one of the waterproof (HFB-type) fuse holders included with the control head's DC Power Cable.
11. Prepare to splice this waterproof fuse holder into the red wire by cutting it again, approximately three (3) to six (6) inches from the end with the ring terminal.
12. Strip both wire ends back approximately ⅜-inch, place a fuse holder shell on each wire, and securely crimp a fuse holder terminal to each wire end. Before crimping, verify fuse holder shells are oriented in the correct directions (i.e., with each large end towards the wire end).
13. Remove the nut from the filter's DC output stud (stud labeled "RADIO +") and slip the red wire's ring terminal onto the stud. Three (3) red wires should be connected to this stud. Reinstall the nut and tighten it securely.
14. Obtain the 5-amp AGC-type fuse included with the cable, and install it into the fuse holder.
15. Label this fuse holder and red wire appropriately (e.g., "Control Head Main Power: 5-AMP FUSE").



CAUTION

The fuse for the control head's red wire is rated at 5 amperes. The 3-amp fuse included with the cable must **not** be used for fusing the control head's main DC power. It fuses the head's white wire.

10.1.5.2 Connect DC Power Cable's White Wire

A review of the information presented in Section 10.1.1 (page 42) may be beneficial at this time. As required per the chosen power-up configuration, connect the white wire by following one of the three procedures presented in the respective sub-section that follows.

10.1.5.2.1 Control Head and Radio Turn on with Vehicle's Ignition Switch/Key

With this wiring configuration, the control head and radio automatically turn on and off with the vehicle's ignition switch/key. The white wire of the control head's DC Power Cable is sometimes referred to as the "white ignition switch wire" or the "ignition sense input wire." In this configuration, the white wire connects to a switched power source, typically identified as "Accessory" power, that switches on and off

with the vehicle's ignition switch/key. When using this configuration, the CH-721 control head's on/off/volume control must be left in the **on** position for automatic power-up/down to function properly.



The white ignition sense wire must be connected to a fused power source that switches from approximately zero volts to approximately +13.6 volts when the vehicle's ignition switch/key is turned from the OFF position to the ACCESSORY and RUN positions. Use of a switched power source that is subject to voltage changes as a result of other actions may result in undesirable radio operation and/or a degradation of radio performance.

1. Locate the vehicle's switched ignition or "Accessory" power connection point that will be used for the switched ignition 12-volt DC power source. This point is typically located at or near the vehicle's fuse panel. Consult the motorcycle manufacturer's wiring diagram as necessary.
2. Route the white wire of the control head's DC Power Cable to the area near this connection point. Protect the wire from heat and chafing as necessary.
3. Obtain one of the waterproof (HFB-type) fuse holders included with the control head's DC Power Cable.
4. Cut excess length from the white wire and splice the fuse holder into it, near the location of the connection point.
5. Using an appropriate electrical terminal, connect the white wire to the switched power connection point. An open-barrel spade terminal is included with the cable for this purpose, but another type of terminal (not supplied) may be used as required.
6. Obtain the 3-amp AGC-type fuse included with the cable, and install it into the fuse holder.
7. Tie and stow all wiring as necessary so it remains out of the way of casual contact and wire chafe is avoided.

10.1.5.2.2 Control Head and Radio Turn On with a Manual Switch

With this wiring configuration, the control head and radio are manually turned on and off via an on/off switch mounted separately from the control head and radio, not through the vehicle's ignition switch/key. This configuration is used when, for example, the radio must remain on even when the ignition key must be removed from the vehicle and a separate on/off switch is acceptable and/or required. In this configuration, the white wire connects to a fused switched power source such as that provided by a toggle switch mounted on the vehicle's instrument panel. When using this configuration, the CH-721 control head's on/off/volume control must be left in the **on** position for automatic power-up/down to function properly.

1. Route the white wire of the control head's DC Power Cable to an area near the location of the panel-mounted on/off switch. Protect the wire from heat and chafing as necessary.
2. Cut a short section (6 to 8 inches) off the end of the white wire and strip the ends.
3. Obtain one of the waterproof (HFB-type) fuse holders included with the control head's DC Power Cable, and crimp one half of it to one end of the short section of wire.
4. Using an appropriate electrical terminal, connect this short white wire to unswitched 12-volt DC power source at or near the vehicle's fuse box.
5. Cut another section of white wire from the cable. This wire must be long enough to reach from this fuse holder to the location of the panel-mounted on/off switch.
6. Strip one end of this wire and crimp the other half of the waterproof fuse holder to this wire end.

7. Strip the other end of this wire and, using an appropriate electrical terminal, connect it to the common terminal of the switch.
8. Connect the white wire of the power cable to the load (switched) side of the switch.
9. If not already, mount the switch to the motorcycle's instrument panel, or other customer-selected location.
10. Obtain the 3-amp AGC-type fuse included with the cable, and install it into the fuse holder.
11. Tie and stow these wires as necessary so they remain out of the way of casual contact and wire chafe is avoided.
12. Label this power switch accordingly. For example: "**RADIO ON/OFF.**"

10.1.5.2.3 Control Head and Radio Are "Hot Wired"

In the "hot-wired" configuration, the control head and radio are turned on and off only by the control head's on/off/volume control located on the front panel of the control head. In this configuration, the control head's white wire must be connected to **unswitched and fused 12-volt** vehicle power. Follow the procedure presented in Section 10.1.5.2.1, **except connect the white wire to unswitched** battery power instead of switched ("Accessory") power.

11 MICROPHONE ATTACHMENT

There are several versions of microphones available for use with the radio. Each has a 17-pin flush-mount type connector that mates with the mic connector on the front panel of the control head. The mic's connector includes a captive thumbscrew that secures it to the mic connector on the front panel of the control head. A microphone clip is included with each microphone. The radio can be configured to provide a monitor function when the microphone is cradled in the clip. Connect the mic to the control head and install the clip as follows:

1. Select a mounting surface location that has clearance for the mic when it is clipped to the clip, and then attach the microphone clip to the surface. The use of self-locking hardware (i.e., machine screws with washers and self-locking nuts) is recommended. Tighten securely.
2. Using the microphone clip as a template, drill mounting holes in the surface of the selected location.
3. The microphone clip must be grounded to the vehicle's chassis. If not mounted to a grounded metal surface, complete this requirement by adding a jumper wire attached from chassis ground to the clip.
4. As illustrated in Figure 11-1, grasp the mic's connector with a thumb and index finger on the sides of the connector just adjacent to the thumbscrew.
5. Position the connector in front of the control head's mic connector so the mic cable's strain relief is hanging down and out at an approximate 45 degree angle.
6. Mate the two connectors by pressing them fully together. Do not apply any force to the thumbscrew when mating the connectors.
7. Tighten the thumbscrew finger-tight. Do not use a screwdriver to tighten it.
8. Clip the microphone to the clip.



Figure 11-1: Attaching the Microphone to the CH-721 Control Head

12 OPTIONAL CABLES

12.1 M5300/M7300 OPTION CABLE CA-012349-001

M5300/M7300 Option Cable CA-012349-001 connects to the 44-pin I/O cable connector on the rear of the radio. It breaks out into several smaller standardized connectors, allowing straightforward access to external I/O interfaces provided by the radio. The cable also shortens radio removal and re-installation time when required. The cable is shown in Figure 12-1 below. Its 44-pin D-subminiature connector that mates with the connector on the rear of the radio is identified P1.

P2, the cable's 2-pin connector, provides connections for an external speaker in a front-mount M7300 mobile radio installation. P2 is not used in motorcycle installations, which employ a remote-mount M5300/M7300 mobile radio. In this case, the speaker connection is made at the rear of the CH-721 control head as the audio amplifier in the control head drives the external speaker.

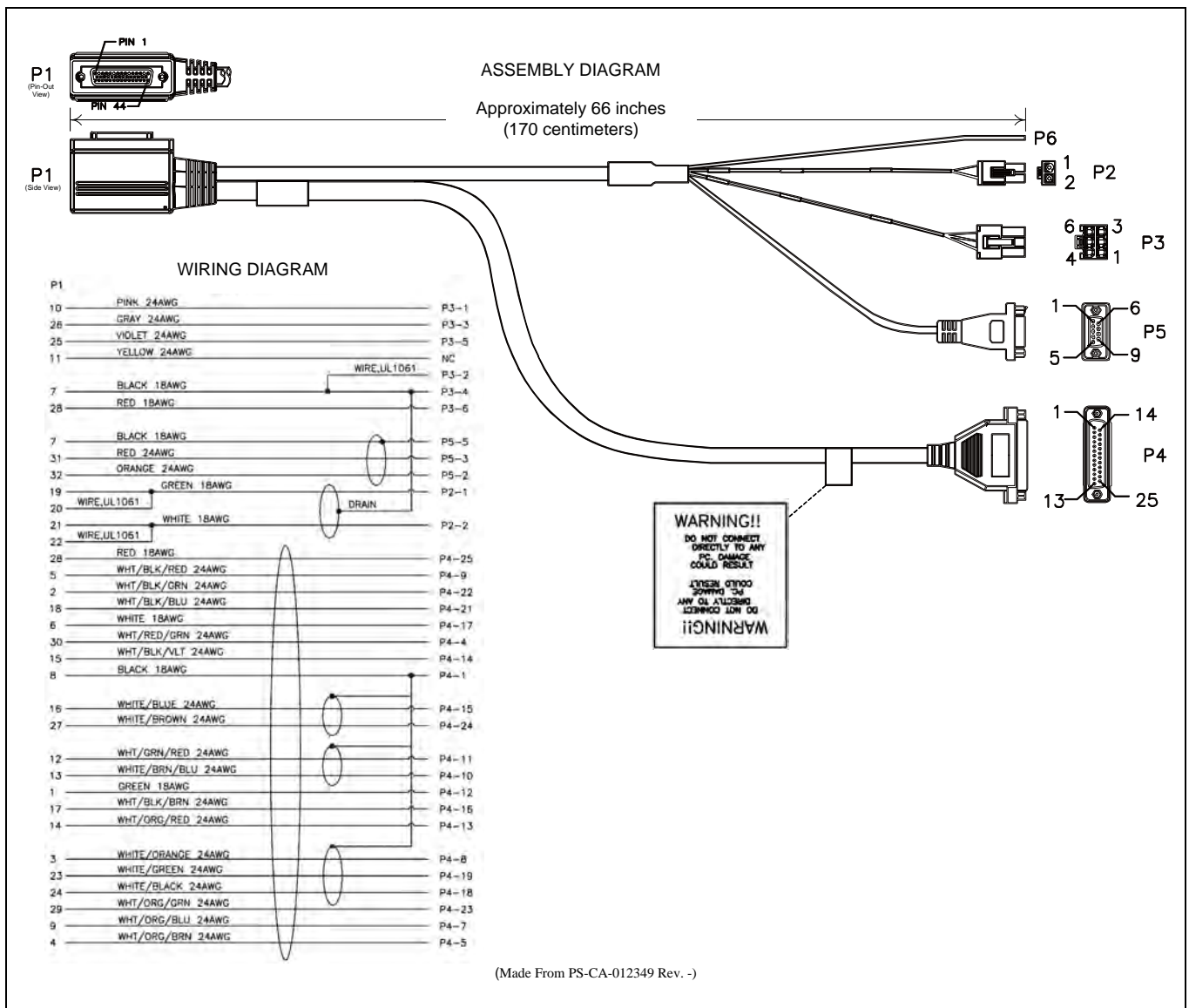


Figure 12-1: M5300/M7300 Option Cable CA-012349-001

P3, the cable’s 6-pin connector, is a connector for basics accessories (e.g., hookswitch, etc.).

P4, the cable’s 25-pin D-subminiature (DB-25) connector, provides audio and data connections for connections to optional equipment such as an external siren and light system (e.g., Federal Signal SS2000 SmartSiren®).

P5, the cable’s 9-pin D-subminiature (DB-9) connector, provides NMEA-formatted GPS serial data connections for the external computer processing the NMEA-formatted GPS data received by the radio’s internal GPS receiver. See Section 13 on page 57 for additional information.

Table 12-1: M5300/M7300 Option Cable CA-012349-001 Interconnections

44-PIN I/O CABLE CONNECTOR P1 PIN	SIGNAL NAME	TO/FROM	DESCRIPTION
19	SPKR1	P2 pin 1	Speaker Audio Outputs 1 and 2 (These outputs are not used in a motorcycle installation, since the audio amplifier in the CH-721 control head drives the external speaker.)
20	SPKR1		
21	SPKR2	P2 pin 2	
22	SPKR2		
10	OUT2	P3 pin 1	Digital Output 2 (open-collector)
7	GND	P3 pins 2 & 4	Chassis Ground (fused on radio’s PK Board at 3.15 amps)
26	HKSW	P3 pin 3	Hookswitch Digital Input. Active = Ground. Inactive = Open
25	INP2	P3 pin 5	Digital Input 2
28	SWA+	P3 pin 6	Switched A+ (DC Power) Output
8	GND	P4 pin 1	Chassis ground (fused on PK Board at 3-amps)
30	DGPS_DATA	P4 pin 4	GPS Serial Data
4	EXTRX	P4 pin 5	External Rx Audio Output (for non-CAN based radio)
9	EXTMOD	P4 pin 7	External Tx Audio Input (for non-CAN based radio)
3	SDATA	P4 pin 8	For a motorcycle installation which employs a remote-mount M5300/M7300 radio, see footnote ² . In a front-mount M5300/M7300 radio installation, this pin for the siren/PA interface is the siren serial data output (open-collector/open-drain) from the radio’s mounted (local) CH-721. It serially transfers siren and light control data from the head/radio to a connected third-party siren and light system (e.g., Federal Signal SS2000 SmartSiren®). Data rate = 1200 bps.
5	FDISC	P4 pin 9	Buffered Discriminator Audio
13	ALO	P4 pin 10	Audio Ground/Reference (fused on radio’s PK Board at 3.15 amps)
12	MICHI	P4 pin 11	For a motorcycle installation which employs a remote-

² In a motorcycle installation, this pin on the radio’s DB-44 connector should not be used. It is not functional. Instead, the respective pin on the CH-721 Option Cable’s female DB-25 pin connector. See Section 12.3 for additional information.

Table 12-1: M5300/M7300 Option Cable CA-012349-001 Interconnections

44-PIN I/O CABLE CONNECTOR P1 PIN	SIGNAL NAME	TO/FROM	DESCRIPTION
1	EXTALO	P4 pin 12	mount M5300/M7300 radio installation, see footnote ² . In a front-mount M5300/M7300 radio installation, these two pins provide the public address (PA) mic audio from the mounted (local) CH-721 to the siren and light system (e.g., Federal Signal SS2000 SmartSiren [®]).
14	VOLHI	P4 pin 13	Volume High
15	CTLON	P4 pin 14	Control On Digital Output (for non-CAN based radio)
16	XTONEENC	P4 pin 15	External Tone Encode Audio (for non-CAN based radio)
17	XTONEDEC	P4 pin 16	External Tone Decode Audio (for non-CAN based radio)
6	EXTALO	P4 pin 17	External Audio Output (Balanced, Low; for non-CAN based radio)
24	HORNRING	P4 pin 18	For a motorcycle installation which employs a remote-mount M5300/M7300 radio, see footnote ² . In a front-mount M5300/M7300 radio installation, this pin for the siren/PA interface is the horn/ring logic input to the radio's mounted (local) CH-721. When a connected third-party siren and light system (e.g., Federal Signal SmartSiren [®] SS2000) has its horn/ring function active, this input is used to signal the head/radio as such.
23	SONOFF	P4 pin 19	For a motorcycle installation which employs a remote-mount M5300/M7300 radio, see footnote ² . In a front-mount M5300/M7300 radio installation, this pin for the siren/PA interface is the siren on/off logic output (open-collector) from the radio's mounted (local) CH-721. It is the signal that powers the connected third-party siren and light system (e.g., Federal Signal SmartSiren [®] SS2000) on and off.
18	INP1	P4 pin 21	Digital Input 1 (for non-CAN based radio)
2	OUT1	P4 pin 22	Digital Output 1 (open-collector; for non-CAN based radio)
29	TXENB+	P4 pin 23	Transmit Enable B+ (for non-CAN based radio)
27	EXTMIC	P4 pin 24	External Mic Audio Input
28	SWA+	P4 pin 25	Switched A+ DC Power Output (for non-CAN based radio)
32	GPS_NMEA_RX	P5 pin 2	Serial Rx Input for GPS NMEA-Formatted Serial Data
31	GPS_NMEA_TX	P5 pin 3	Serial Tx Output for GPS NMEA-Formatted Serial Data
7	GND	P5 pin 5	Ground for GPS Serial Data Signals (fused on radio's PK Board at 3.15 amps)
11	IGNITION	(no connection)	Unused/Spare ignition sense input.
33 through 44	—	(no connections)	These pins of P1 are not used/not connected.

12.2 SERIAL PROGRAMMING CABLE CA-013671

Serial Programming Cable CA-013671-010 (10 feet long) and CA-013671-020 (20 feet long) can be used to program and configure the M7300 mobile radio via a Personal Computer. This cable has a female DB-9 connector on one end for connection to the PC's serial port and a male DB-9 connector on the other end for connection to the serial port on the rear of the radio. The cable's assembly and wiring diagrams are shown in Figure 12-2 below.

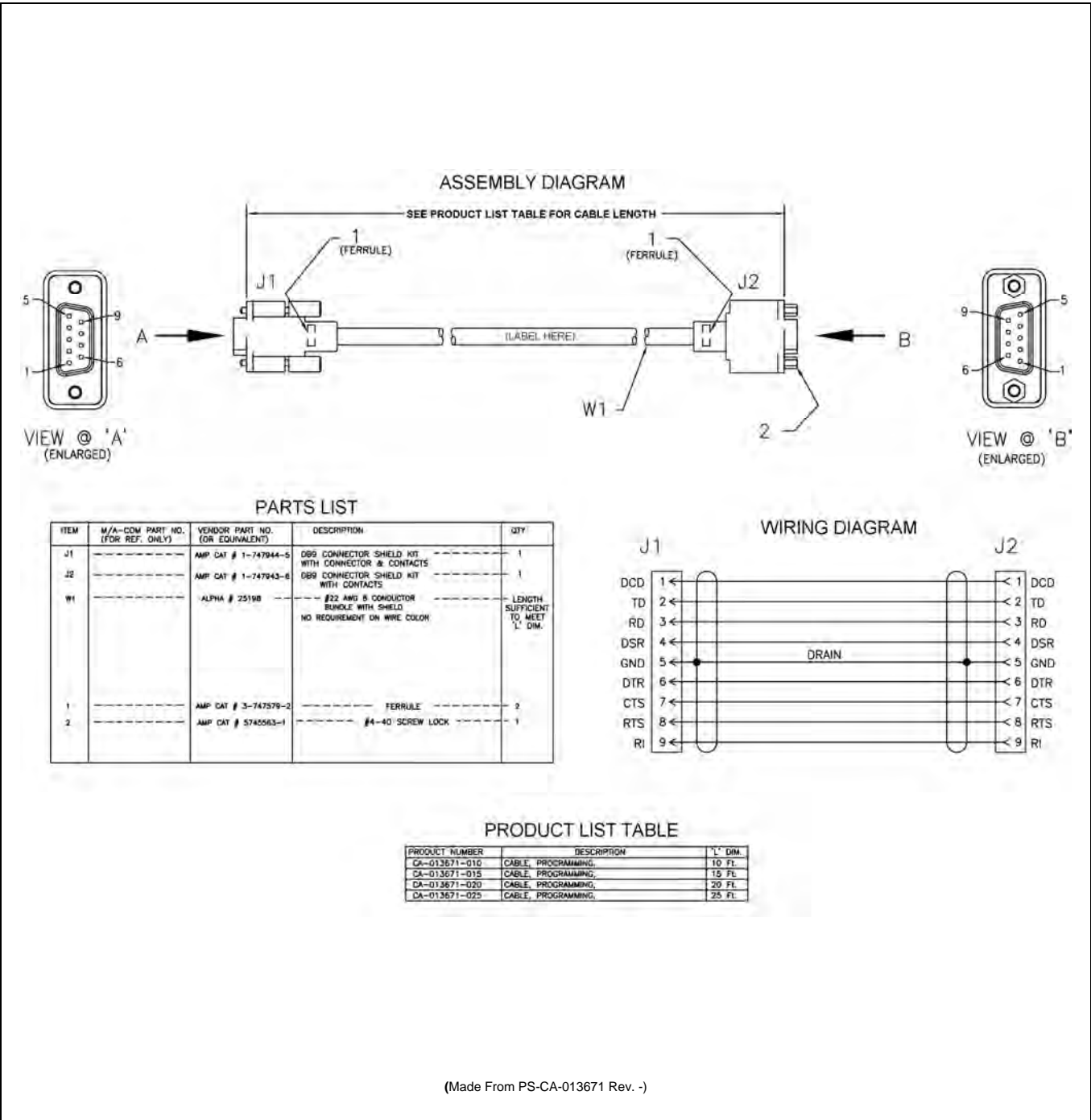
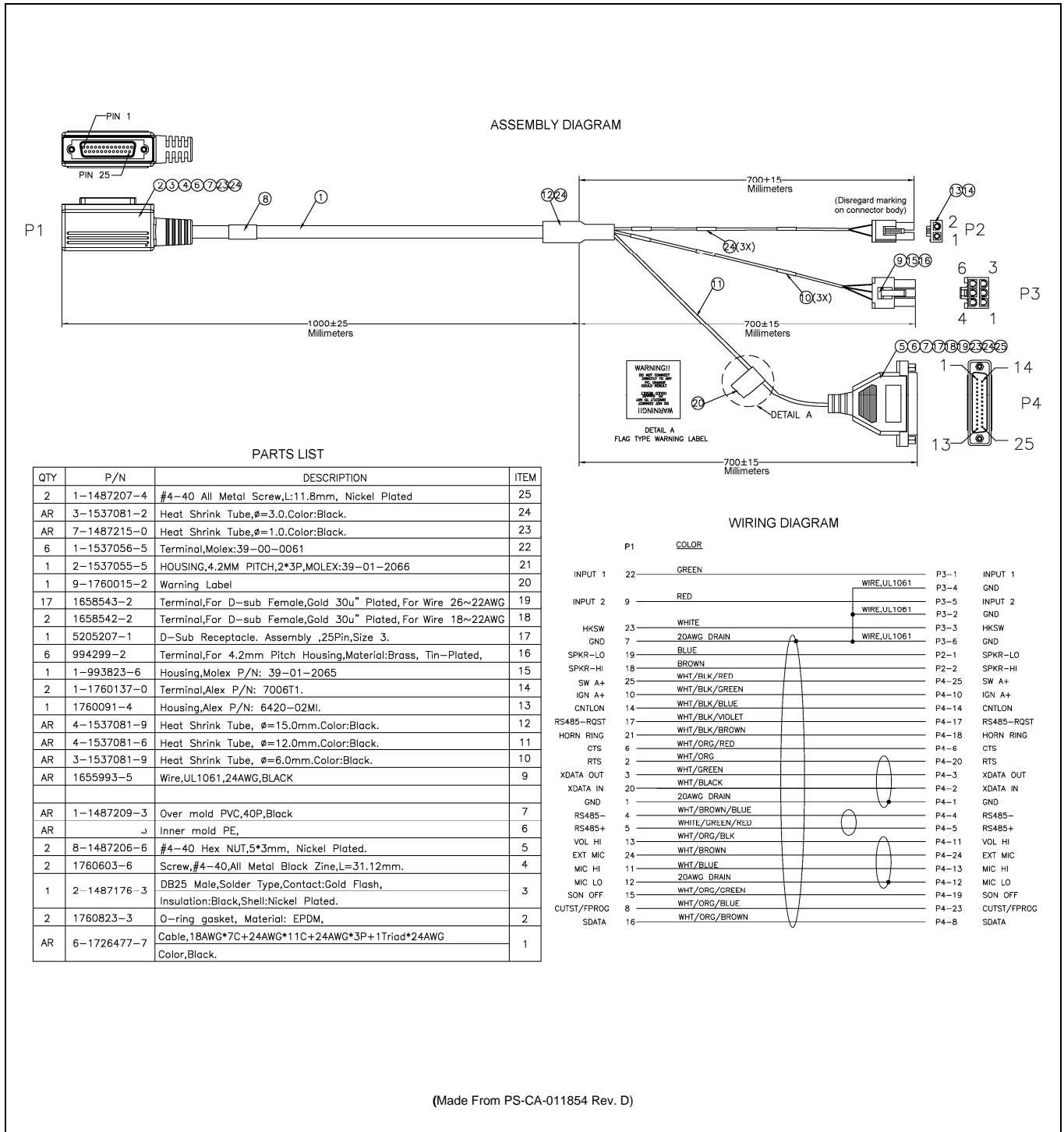


Figure 12-2: Programming Cables CA-013671-010 and -020

12.3 CH-721 OPTION CABLE CA-011854-001

CH-721 Option Cable CA-011854-001 can be used to connect optional equipment to the 25-pin D-subminiature (DB-25) connector on the rear of the CH721. This cable expands the connections available at the 25-pin connector to three (3) separate connectors. The cable's assembly and wiring diagrams are shown in Figure 12-3 below.



(Made From PS-CA-011854 Rev. D)

Figure 12-3: CH-721 Option Cable CA-011854-001

12.4 CH-721 SERIAL PROGRAMMING CABLE CA-104861

Serial Programming Cable CA-104861 (5 feet) can be used to program and configure the CH-721 control head via a Personal Computer. This cable has a female DB-9 connector on one end for connection to the PC's serial port and a male DB-9 connector on the other end for connection to the serial port on the rear of the head. The cable's assembly and wiring diagrams are shown in Figure 12-4 below.

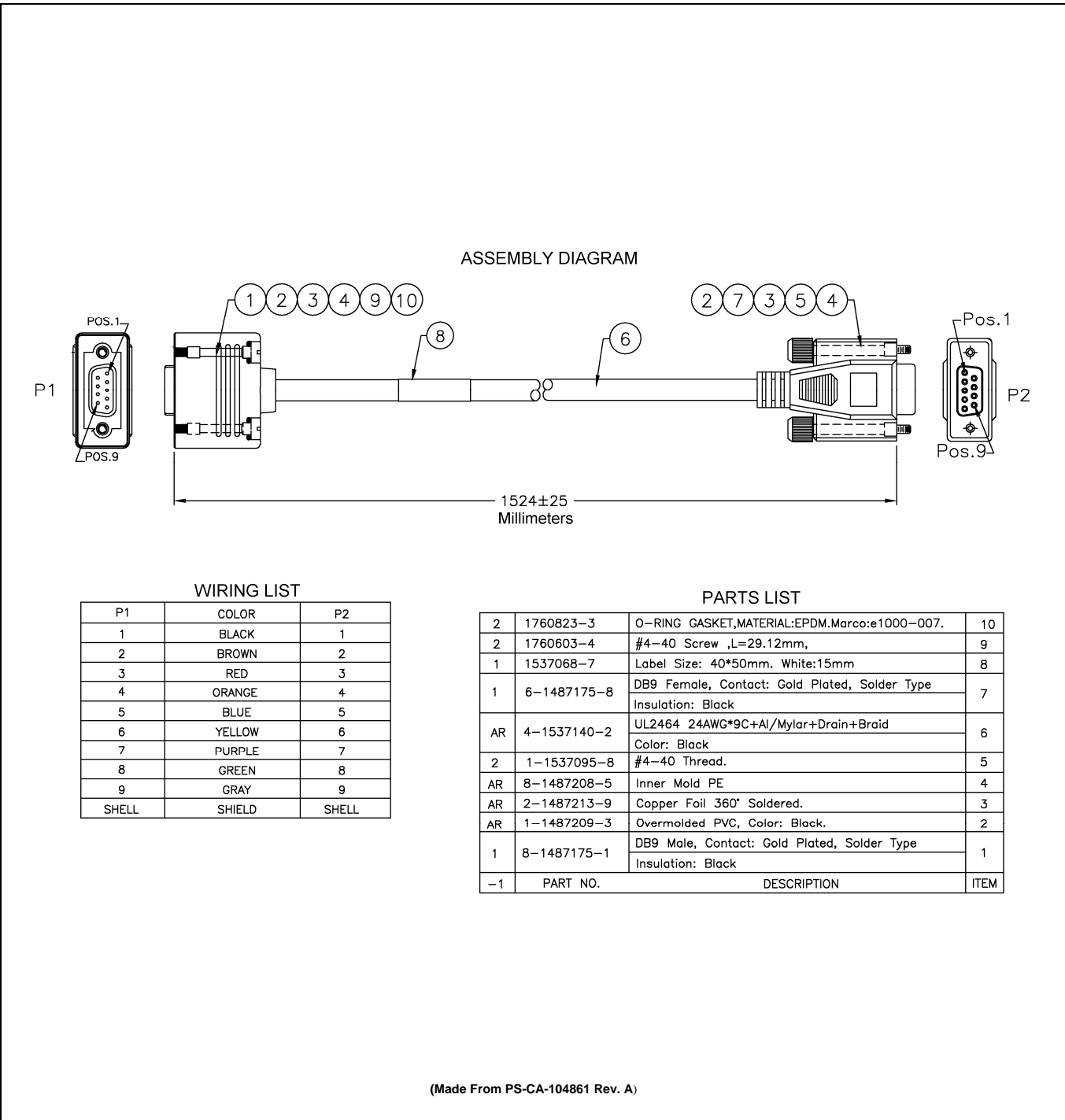


Figure 12-4: Programming Cable CA-104861

13 GPS NMEA-FORMATTED SERIAL DATA CONNECTION

To obtain GPS NMEA-formatted serial data from the radio, use of the M5300/M7300 Option Cable CA-012349-001 is required. Follow this procedure to complete the GPS NMEA-formatted serial data connections:

1. Obtain M5300/M7300 Option Cable CA-012349-001. Each “leg” of this cable is approximately 65 inches long (166 centimeters).
2. Connect the cable’s 44-pin D-subminiature (DB-44) male connector to the DB-44 female connector on the rear panel of the radio. Tighten the two jackscrews with a small flathead screwdriver. Do not over-tighten.
3. Connect the cable’s DB-9 female connector to the computer’s serial port DB-9 male connector — either directly or with an optional MAMROS0055 serial cable — and tighten the screws until firm. Route the cabling as required.
4. Follow the manufacturer’s instructions on processing the NMEA-formatted GPS data from the radio.



NOTE

If the M5300/M7300 Option Cable is not available, a 3-wire serial cable can be field-fabricated. On the radio end, this cable must interface to the three GPS-related signals of the radio’s 44-pin I/O Cable connector (pins 7, 31 and 32). See Table 12-1 for additional information.



NOTE

Industry software to process GPS information through this interface is not supported by M/A-COM.

14 INITIAL POWER-UP TEST

1. At the radio's main waterproof (HFB-type) fuse holder installed near the vehicle battery, insert the 15-amp AGC-type fuse that was included with the radio's DC Power Cable.
2. Tie and stow all fuse holders at this location to prevent excess vibration/movement.
3. Carefully reconnect the vehicle's battery ground cable.
4. If not already, temporarily connect the mobile antenna cable from the vehicle-mounted mobile antenna to the female TNC RF connector on the rear panel of the radio. This is a temporary connection until test procedures in Section 15 are complete.
5. If the installation is wired so the vehicle's ignition key/switch turns the radio on and off, turn the switch to the Accessory or Run position.
6. If the control head is not already powered up, do so by rotating its on/off/volume control clockwise out of the detent position.
7. Verify the control head has powered-up by observing its display. If the display is not lit, refer to Section 10.1.1 as necessary.



NOTE

Unlike many mobile radio products, the radio powers-up to the **state of last control**.

As long as the software configuration parameters have been loaded, successful installation is almost immediately realized:

- After a short boot-up sequence, the control head displays login information and/or a talk group.
- If no errors are displayed, the installation is most-likely properly wired.
- If an error is displayed, recheck all cable connections, verify all fuses are properly installed, and verify battery power on the load side of the fuses, etc. If problems persist, contact M/A-COM's Technical Assistance Center (see page 17).
- Consult the Operator's Manual for operational information.

Refer to the following section for performance test information.

15 PERFORMANCE TESTS

This section includes procedures to verify the performance of the installation's mobile antenna system. There are three (3) procedures in this section:

- Changing Operating Mode for Tests
- Testing by Transmitting into a Dummy Load (a 50-Ohm RF Terminator)
- Testing by Transmitting into the Mobile Antenna



CAUTION

The accuracy of test results depends upon a DC power source in the range of 13.8 to 16 volts DC, with a current capacity of greater than 8 amps. Make sure the vehicle's battery is fully charged by running the engine for a few minutes before the test, and keep the engine running during the test procedures. **Abide by the following WARNING!**



WARNING

If the vehicle's engine must remain running, the vehicle location should be well ventilated so exhaust fumes from the engine do not cause harm!



CAUTION

If a vehicle equipped with this radio requires jump-starting, the radio installation's main AGC fuse (15-amp) should be removed from the holder prior to jump-starting. Doing so will prevent damage to the radio system.



NOTE

Prior to installation, the radio's power level should be configured appropriately. The wide range of power levels indicated in the following procedures takes into account such things as: customer's requirements; measurement errors, especially to include uncalibrated equipment; cabling losses; and voltage and temperature variations. By no means should the result from Performance Testing in this section be construed as the exact value of power level output from the radio, as the value is set and more accurately measured in the factory. The values obtained in these test procedures determine a successful installation only.

15.1 CHANGING OPERATING MODE FOR TESTS

To complete tests in this section, placing the radio in a conventional mode and using an average-responding wattmeter to measure RF transmit power is recommended. However, if the radio is not programmed for conventional mode operations (i.e., OTP mode is available but ECP mode is not), tests will require a peak-reading RF wattmeter to measure RF transmit power. To select either conventional or OpenSky mode, use one of the following procedures:

15.1.1 Changing from OpenSky to Conventional

1. If necessary, apply power to the radio and turn it on.
2. Use the control head's **•/•• Ramp Control** to scroll through the menu until **Mode Menu** appears in the middle line of the display. This control is shown in Figure 8-1 and in Figure 8-2 on page 36.
3. Use the **+/- Ramp Control** to select an available conventional channel/system.

4. Confirm the selection by pressing the **MENU** button, then toggling the **Ramp Control** once (to select **Y** for Yes), followed by pressing the **MENU** button again. The radio will enter the selected mode as indicated by the display.
5. Select a conventional channel for test transmissions using either the **•/• Ramp Control** or the **System/Group/Channel Selection Control** (required control per programming).

15.1.2 Changing from Conventional to OpenSky

1. If necessary, apply power to the radio and turn it on.
2. Use the control head's **•/• Ramp Control** to scroll through the menu until an OpenSky system's name is displayed.
3. After a few seconds, the radio will automatically transition to OTP mode for operations on the selected OpenSky system.
4. If the radio is not programmed for auto-login, login to the OpenSky system. For login instructions, refer to the Operator's Manual (publication MM-014716-001) or the respective Quick-Guide (publication MM-014368-001) as necessary. The Quick-Guide is included with the radio when it shipped from the factory.
5. Select a talk group for test transmissions using either the **•/• Ramp Control** or the **System-/Group/Channel Selection Control** (required control per programming).

15.2 REQUIRED TEST EQUIPMENT

Table 15-1: Required Test Equipment

TEST EQUIPMENT	MODEL / PART NUMBER & DESCRIPTION
Average-Responding Wattmeter (for conv. measurements) or	Bird Electronic Corp. Model 43 (or equivalent) with Type N female connectors at input and output ports, and with wattmeter slugs appropriate for the radio's transmit RF output power capability.
Peak-Reading Wattmeter (for OpenSky measurements)	Bird Electronic Corp. Model 4314B (or equivalent) with Type N female connectors at input and output ports.
RF Coaxial Jumper Cable	Pasternack Enterprises PE3661-36 (or equivalent) 50-Ohm Coaxial Cable with TNC male connector and Type N male connector, approximately three (3) feet in length. The utilized cable must have VSWR below 1.5:1 within the RF passband.
N-to-TNC RF Adapter	Pasternack Enterprises PE9090 (or equivalent) Type N male to TNC female adapter. Required to connect the cable of the vehicle-mounted 800 MHz antenna to the wattmeter.
50-Ohm RF Terminator ("Dummy Load")	Pasternack Enterprises PE6106 (or equivalent) 50-ohm RF terminator rated at greater than 50 watts power, with Type N male connector.
Vehicle-Mounted Antenna	Tests are performed with the vehicle-mounted 800 MHz antenna per the installation described in Section 7 of this manual.

15.3 TRANSMITTING INTO A DUMMY LOAD

1. Using the Type N male to TNC male RF coaxial jumper cable, connect the radio's antenna connector to the wattmeter's input connector. Refer to Figure 15-1 as necessary.

2. Connect the 50-ohm dummy load to the wattmeter's output connector, in place of the antenna cable from the mounted mobile antenna.



NOTE

As previously stated, if conventional mode is not available per radio programming (i.e., OTP mode is available but ECP mode is not), a peak-reading RF wattmeter is required to measure RF transmit power. Otherwise, the use of an average-responding wattmeter is recommended. Recommended wattmeter types are listed in Table 15-1.

3. If not already, turn the radio on and set it to the required operating mode (based upon available radio programming and test equipment). Refer to Section 15.1 as necessary.
4. Set the radio to a test talk group or conventional channel, if available.



NOTE

It is recommended that a test talk group/channel be allocated for this testing. This same group should be used during the antenna test procedure which is presented in the subsequent section.

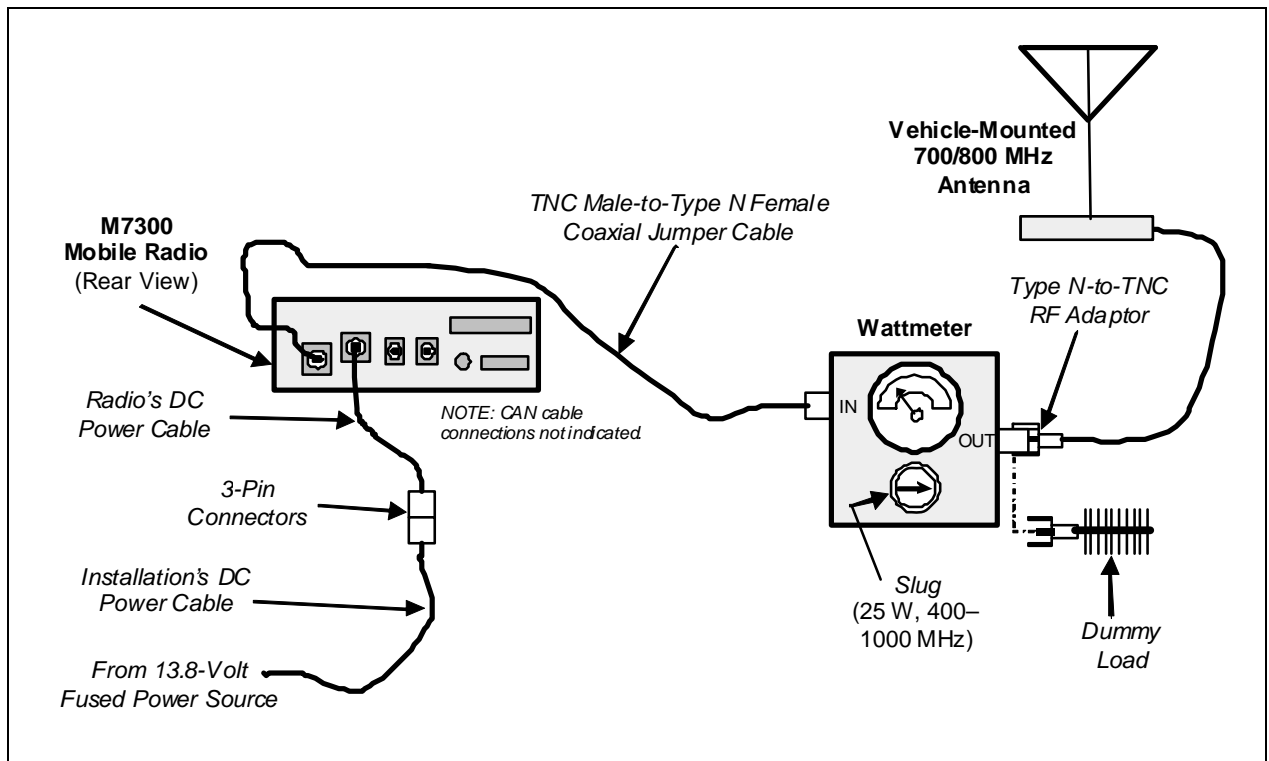


Figure 15-1: Wattmeter Connections for Antenna System Tests

5. Position the wattmeter's slug to measure forward RF output power. Rotate it if necessary. The arrow on the face of the slug must point away from the radio and towards the dummy load for forward power measurements.
6. **For conventional mode transmissions**, set the wattmeter to measure average RF power.
For OpenSky mode transmissions, set the wattmeter to measure peak RF power.
7. Key the radio's transmitter via the microphone's PTT button.

8. For an OpenSky mode transmission, compare the wattmeter's reading with the target RF output power range of between **11.8 and 18.9 watts** (15 watts \pm 1 dB). This transmit output power range assumes the radio is currently configured for high-power transmit.

For a conventional mode transmission, compare the wattmeter's read with the target RF output power range of between **27.7 and 44.2 watts** (35 watts \pm 1 dB). This transmit output power range assumes the radio is currently configured for the high-power transmit.



NOTE

Transmit only for as long as needed to take the measurement, then immediately disable the transmission.

9. **If the wattmeter reading is within the range**, record the measured value in the appropriate space on the data collection form near the end of this manual.

If the wattmeter reading is outside the range, verify the radio's power supply voltage (i.e., battery voltage) is within the specified range, recheck all connections and measure the RF output power again. If this fails to produce a reading within the range, replace it and repeat this procedure. If problems persist, contact M/A-COM's Technical Assistance Center (see page 17).

15.4 TRANSMITTING INTO THE MOBILE ANTENNA

1. Connect the antenna cable from the vehicle-mounted 800 MHz antenna to the wattmeter as shown in Figure 15-1.
2. If not already, turn the radio on and set it to the required operating mode (based upon available radio programming and test equipment). Refer to Section 15.1 as necessary.
3. Set the radio to a test talk group or conventional channel, if available.



NOTE

It is recommended that a test talk group/channel be allocated for this testing. Otherwise, interference with other radio users in the system may occur. **Also, during transmissions, always observe the RF exposure-related safety information presented in Section 1.2 (begins on page 6).**

4. Position the wattmeter's slug to measure forward RF output power. Rotate it if necessary. The arrow on the face of the slug must point away from the radio and towards the antenna for forward power measurements.
5. **For conventional mode transmissions**, set the wattmeter to measure average RF power.
For OpenSky mode transmissions, set the wattmeter to measure peak RF power.
6. Key the radio's transmitter via the microphone's PTT button.
7. For an OpenSky mode transmission, compare the wattmeter's reading with the target RF output power range of between **11.8 and 18.9 watts** (15 watts \pm 1 dB). This transmit output power range assumes the radio is currently configured for high-power transmit.

For a conventional mode transmission, compare the wattmeter's read with the target RF output power range of between **27.7 and 44.2 watts** (35 watts \pm 1 dB). This transmit output power range assumes the radio is currently configured for the high-power transmit.



NOTE

Transmit only for as long as needed to take the measurement, then immediately disable the transmission.

8. **If the wattmeter reading is within the range**, record the value in the appropriate space on the data collection form near the end of this manual.

If the wattmeter reading is outside the range, verify the radio's power supply voltage (i.e., battery voltage) is within the specified range, recheck all connections, and measure the forward power again. If these checks/corrections fail to produce a reading within the range, check all cabling and connections and repeat the testing procedure to this point. In the event the wattmeter reading still falls outside the range, replace the antenna, make sure all connections are seated firmly, and repeat the testing procedure. If problems persist, contact M/A-COM's Technical Assistance Center (see page 17).

9. Position the wattmeter's slug to measure reverse (reflected) RF power from the antenna. The arrow on the face of the slug must point away from the antenna and to the radio to measure reverse power.
10. Key the radio's transmitter via the microphone's PTT button.
11. Compare the wattmeter reading with the RF power output range of **2 watts or less**.



NOTE

Transmit only for as long as needed to take the measurement, then immediately disable the transmission.

12. **If the wattmeter reading is within the range**, record the value in the appropriate space on the data collection form near the end of this manual.

If the wattmeter reading is outside the range, make sure the antenna is consistent with the specified frequency range of the radio. Recheck all antenna connections, and measure the reverse power again. If the installation employs a 1/4-wave unity-gain antenna, observe the **NOTE** that follows step 8. If these checks/corrections fail to produce a reading within the range, replace the antenna and repeat the entire antenna test procedure. Any value exceeding the maximum allowable reflected power value will result in a diminished RF output signal. If problems persist, contact M/A-COM's Technical Assistance Center (see page 17).

13. Disconnect the coaxial cable jumper and wattmeter.
14. Permanently connect the cable from the vehicle-mounted 800 MHz antenna to the radio's antenna cable by mating the two TNC connectors together. Use two pairs of soft-jaw pliers to gently tighten this connection. Do not over tighten and do not twist either cable.
15. Make several test calls on the radio system to verify operation of the mobile radio. Before making the calls, select other talk groups or conventional channels, as required to verify operation.



NOTE

To prevent RF leakage and ensure peak performance, make sure the RF connectors are tight, but do not over-tighten so connector damage will not occur.



WARNING

Improper installation of the RF cables may lead not only to poor radio performance but also to harmful exposure to RF electromagnetic energy.

Testing is complete. The radio is now ready for normal communications.

15.5 TEST PERFORMANCE DATA FORM

Clip  Here

Enter the information requested on this data collection form. Clip this form and file it as a permanent record of the tested performance of the M7300 mobile radio installation.

Mobile Radio Serial Number

Antenna Make and Model Numbers

*Date of Test
(mm/dd/yyyy)*

Company Performing Installation

Technician Performing Test



Watts
<i>Power into a Dummy Load</i>

Watts
<i>Forward Power with Antenna</i>

Watts
<i>Reflected Power with Antenna</i>

16 COMPLETE THE INSTALLATION

Double-check the following items before considering the installation completed:

- Verify all newly installed mechanical hardware is mounted securely and all respective mounting hardware is tight.
- Verify all electrical interconnections are connected properly and the associated connector attachment hardware is tight. Pay special attention to all RF antenna cables!
- Verify all related fuses are correctly installed and properly rated.
- Verify all electrical cables and wiring are tied, stowed, and protected so they are out of the way of casual contact, away from sources of extreme heat, and wire chafing cannot occur. Pay special attention to all RF antenna cables!
- To prevent fumes from entering the vehicle's passenger compartment, seal the hole/grommet/wire combination at the firewall with a silicon-based sealer.
- Verify all vehicle components are properly reinstalled such as kick panels, headliners, and seats.
- If the installation includes a separately-mounted on/off power switch for manually turning the radio (and possibly others systems) on and off, verify it is labelled accordingly. For example: “**Radio ON/OFF.**”
- Remove all tools and unused hardware from the vehicle.
- Verify the test performance data has been recorded on the data collection form shown in this manual.

17 WARRANTY

- A. M/A-COM, Inc. (hereinafter "Seller") warrants to the original purchaser for use (hereinafter "Buyer") that Equipment manufactured by or for the Seller shall be free from defects in material and workmanship, and shall conform to its published specifications. With respect to all non-M/A-COM Equipment, Seller gives no warranty, and only the warranty, if any, given by the manufacturer shall apply. Rechargeable batteries are excluded from this warranty but are warranted under a separate Rechargeable Battery Warranty (ECR-7048).
- B. Seller's obligations set forth in Paragraph C below shall apply only to failures to meet the above warranties occurring within the following periods of time from date of sale to the Buyer and are conditioned on Buyer's giving written notice to Seller within thirty (30) days of such occurrence:
1. for fuses and non-rechargeable batteries, operable on arrival only.
 2. for parts and accessories (except as noted in B.1) sold by Seller's Service Parts Operation, ninety (90) days.
 3. for P7200, P7100^{IP}, P5400, P5300, P5200, P5100, P3300, PANTHER™ 405P and 605P, M7300, M7200 (including V-TAC), M7100^{IP}, M7300 and M3300 radios, two (2) years, effective 10/01/2007.
 4. for all other equipment of Seller's manufacture, one (1) year.
- C. If any Equipment fails to meet the foregoing warranties, Seller shall correct the failure at its option (i) by repairing any defective or damaged part or parts thereof, (ii) by making available at Seller's factory any necessary repaired or replacement parts, or (iii) by replacing the failed Equipment with equivalent new or refurbished Equipment. Any repaired or replacement part furnished hereunder shall be warranted for the remainder of the warranty period of the Equipment in which it is installed. Where such failure cannot be corrected by Seller's reasonable efforts, the parties will negotiate an equitable adjustment in price. Labor to perform warranty service will be provided at no charge during the warranty period only for the Equipment covered under Paragraph B.3 and B.4. To be eligible for no-charge labor, service must be performed at a M/A-COM factory, by an Authorized Service Center (ASC) or other Servicer approved for these purposes either at its place of business during normal business hours, for mobile or personal equipment, or at the Buyer's location, for fixed location equipment. Service on fixed location equipment more than thirty (30) miles from the Service Center or other approved Servicer's place of business will include a charge for transportation.
- D. Seller's obligations under Paragraph C shall not apply to any Equipment, or part thereof, which (i) has been modified or otherwise altered other than pursuant to Seller's written instructions or written approval or, (ii) is normally consumed in operation or, (iii) has a normal life inherently shorter than the warranty periods specified in Paragraph B, or (iv) is not properly stored, installed, used, maintained or repaired, or, (v) has been subjected to any other kind of misuse or detrimental exposure, or has been involved in an accident.
- E. The preceding paragraphs set forth the exclusive remedies for claims based upon defects in or nonconformity of the Equipment, whether the claim is in contract, warranty, tort (including negligence), strict liability or otherwise, and however instituted. Upon the expiration of the warranty period, all such liability shall terminate. The foregoing warranties are exclusive and in lieu of all other warranties, whether oral, written, expressed, implied or statutory. **NO IMPLIED OR STATUTORY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE SHALL APPLY. IN NO EVENT SHALL THE SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, SPECIAL, INDIRECT OR EXEMPLARY DAMAGES.**

This warranty applies only within the United States.

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