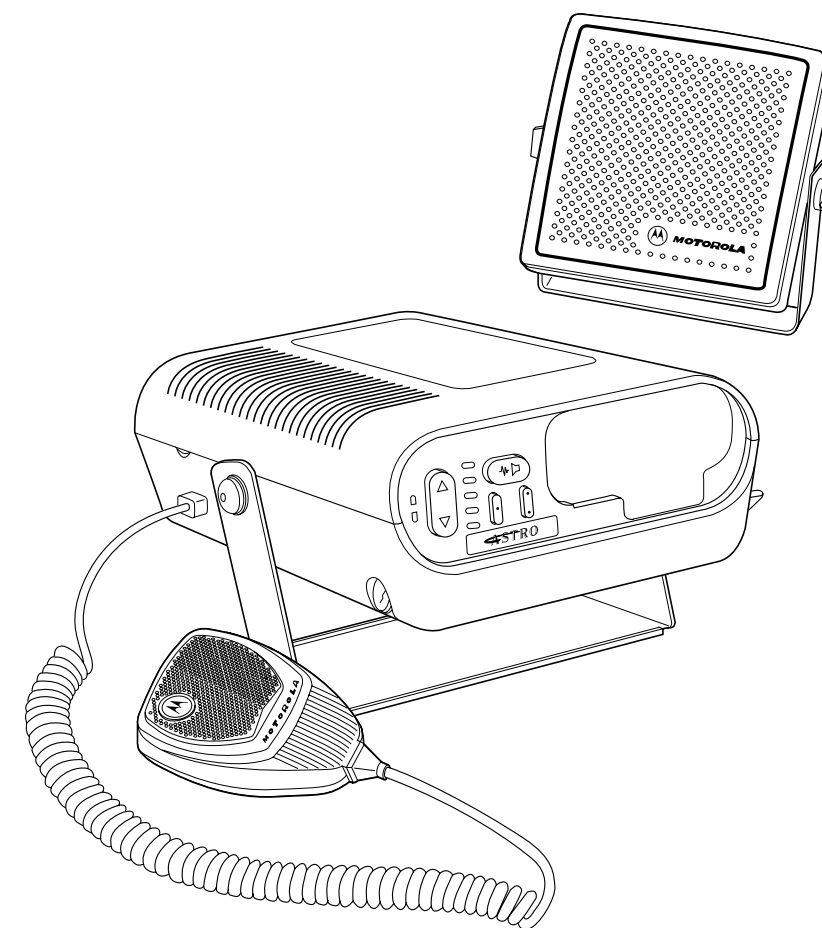




ASTRO™/SABER™

Vehicular Adapter

Service and Theory/Maintenance Manual



68P81078C25-0

Motorola Inc.
Radio Products Group
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CONTENTS

SECTION	PAGE
FOREWORD	<i>inside front cover</i>
SPECIFICATIONS	<i>ii</i>
MODEL CHART	<i>ii</i>
DESCRIPTION	
1. GENERAL	1
2. CONSOLE.....	1
3. EXTERNAL 12-WATT SPEAKER	1
4. MOBILE MICROPHONE	1
5. ROOFTOP ANTENNA.....	1
INSTALLATION	
1. INSTALLATION PLANNING	2
2. CONSOLE INSTALLATION	3
3. MICROPHONE BRACKET INSTALLATION.....	3
4. 12-WATT SPEAKER INSTALLATION	3
5. ANTENNA INSTALLATION	4
6. CONSOLE CABLING.....	4
7. ANTI-SKID BRAKING PRECAUTIONS	5
8. INSTALLATION CHECKOUT.....	6
THEORY OF OPERATION	
1. GENERAL	7
2. CIRCUIT DESCRIPTION	7
MAINTENANCE	
1. PREVENTIVE MAINTENANCE	9
2. CORRECTIVE MAINTENANCE.....	10

RELATED PUBLICATIONS AVAILABLE SEPARATELY

SABER VHF Service Manual	68P81043C90
SABER UHF Service Manual	68P81043C95
SABER SECURENET™ VHF Service Manual	68P81045C70
SABER SECURENET UHF Service Manual	68P81045C75
SABER SECURENET Mid-Band Service Manual.....	68P81063C30
Systems SABER™ SECURENET UHF Service Manual.....	68P81066C95
Systems SABER SECURENET VHF Service Manual.....	68P81067C10
ASTRO™ Digital SABER Basic Service Manual	68P81076C05
ASTRO Digital SABER Detailed Service Manual	68P81076C10
AVA User's Guide	68P81078C15
12-Watt Speaker	68P81108C39
Reducing Noise Interference in Mobile Radios	68P81109E33

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SPECIFICATIONS

UNIT CAPACITY:	One ASTRO Digital SABER Portable Radio (manufactured on or after September 1, 1994); or One SABER I, II, or III Portable Radio (manufactured on or after September 1, 1994); or One Systems SABER I or III Portable Radio (manufactured on or after September 1, 1994)
DIMENSIONS (L x H x W):	9.85" (over RF connector) x 3.03" x 6.64" (over knob) (250 x 76 x 168 mm) 9.59" (without RF connector) x 3.03" x 6.26" (without knob) (243 x 76 x 159 mm)
WEIGHT: (without portable radio)	3.16 lbs. (1434 g)
NOMINAL INPUT VOLTAGE:	13.8 Vdc (negative ground)
CURRENT DRAIN	CHARGED BATTERY DISCHARGED BATTERY
Standby:	0.4A 0.8A
Receive with 12W Audio:	2.3A 2.7A
Transmit:	1.8A 1.8A
CHARGE RATE:	Three hours (Medium-, High-, and Ultra-High-Capacity Batteries)
ANTENNA INPUT IMPEDANCE:	50 Ohms
AUDIO OUTPUT: (at less than 5% distortion)	12 Watts External

Specifications subject to change without notice

MODEL CHART

MOTOROLA TECHNICAL PUBLICATIONS DEPT.

DESCRIPTION				DWG. NO.			
AVA Model Chart				MAEPF-24693			
ILLUSTRATOR	DATE	ENGINEER	DATE	CORRECTED AS MARKED _____		CHECK ONE O.K. AS IS () O.K. AS MARKED ()	
SW	6/14/94						
EDITOR	DATE	CHECKER	DATE	ISSUE	REVISION	RELEASE	RELEASE
RW	7/7/94			O		RW 7/8/94	SW 7/8/94
				A	Deleted References to Control Head	RG 5/4/95	EH 5/4/95

MODEL NUMBER				DESCRIPTION
NTN1143				AVA Package 1 (AVA with Mobile [Palm] Mic)
NTN1144				AVA Package 2 (AVA with Mini-Mobile Mic)
NTN7759				AVA Package 3 (AVA with SABER Display/Keypad Mic)
NTN7760				AVA Package 4 (AVA with Systems SABER Display/Keypad Mic)
ITEM NO.				DESCRIPTION
A	A	A	A	HAD4006 Antenna, 1/4 Wave Rooftop (136-144MHz)
A	A	A	A	HAD4007 Antenna, 1/4 Wave Rooftop (144-150.8MHz)
A	A	A	A	HAD4008 Antenna, 1/4 Wave Rooftop (150.8-162MHz)
A	A	A	A	HAD4009 Antenna, 1/4 Wave Rooftop (162-174MHz)
X				HMN1035 Mobile (Palm) Microphone
	X			HMN1056 Compact (Mini-Mobile) Microphone
		X		NMN6150 Display/Keypad Microphone (SABER)
			X	NMN6169 Display/Keypad Microphone (Systems SABER)
X	X	X	X	NSN6054 12-Watt Speaker

DESCRIPTION

1. GENERAL

The Motorola ASTRO/SABER Vehicular Adapter (AVA) is an accessory designed to adapt one of the following portable radios for mobile operation:

- an ASTRO Digital SABER,
- a SABER I, II, or III, or
- a Systems SABER I or III.

NOTES

- ASTRO Digital SABER radios must have firmware version 3.0 or later.
- SABER or Systems SABER radios must have the modified control top, Motorola part No. 6405833N03.
- Radios manufactured on or after September 1, 1994, meet the above requirements. These radios can be identified by their serial numbers: the fifth character (the year) must be “U” (1994) or later (“V” [1995], “W” [1996], etc.). If manufactured in 1994, the sixth character (the month) must be “S” or “T” (September) or later (“U” or “V” [October], etc.).
- For radios manufactured prior to this date, please contact Motorola Team Response Action Center (1-800-523-4007) for upgrade details.

The vehicular adapter consists of a console, an external 12-watt speaker/amplifier, a hand-held mobile microphone, a rooftop antenna, mounting hardware, and cables.

When the radio is inserted into the console, the resulting combination acts as a mobile radio, with the following functions occurring automatically:

- The vehicular adapter’s external antenna is connected to the radio, and the radio’s internal antenna is disconnected.
- The vehicular adapter’s mobile microphone is connected to the radio, and the radio’s internal microphone is disconnected.
- The console’s charging circuits are connected to the radio to charge the radio’s battery.
- The radio’s audio output is connected to the external 12-watt speaker/amplifier, and the radio’s internal speaker is disconnected.

NOTE

If an ASTRO Digital SABER radio is turned on and in the receive mode when it is inserted into, or removed from, the console, the radio/AVA speakers will not automatically switch. When the radio exits the receive mode, the audio will be automatically routed to the appropriate speaker. To force the radio to exit from the receive mode, either press and release the PTT switch, or turn the radio off, then on.

2. CONSOLE

The NTN7227A Console is the vehicular adapter’s central unit. The console includes an illuminated front control panel, a radio battery charger, a radio latching mechanism with lock, and circuitry for interconnecting the radio, microphone, 12-watt speaker, and external antenna.

When the radio is mounted in the console, the combined radio/console operates as a mobile two-way radio. The radio must have a battery attached when it is inserted into the console; this battery will be automatically charged when the radio is inserted. A key lock is provided on the console to minimize theft when the vehicle is left unattended. Appropriate mounting hardware is provided with the console to facilitate mounting at any suitable location.

3. EXTERNAL 12-WATT SPEAKER

The NSN6054A 12-Watt Speaker provides 12 watts of audio output power for use in high noise level environments. The audio level of the speaker can be adjusted from the console’s control panel.

4. MOBILE MICROPHONE

Four different types of mobile microphones are available for the ASTRO/SABER Vehicular Adapter: the HMN1056 Compact Microphone; the HMN1035 Palm Microphone; the full-featured NMN6150A Display/Keypad Microphone (for SABER radios); and the full-featured NMN6169A Display/Keypad Microphone (for SYSTEMS SABER radios).

All four mobile microphones are palm-type, weatherproof, cartridge microphones, with transistorized preamplifiers as an integral part of the cartridge. Each microphone is equipped with a push-to-talk (PTT) switch on the side has a coiled cord with an 8-pin connector that plugs into the microphone jack on the left side of the console.

In addition to the above, the NMN6150A and NMN6169A Display/Keypad Microphones, have a keypad and a display which duplicate the functions of the appropriate radio’s keypad and display. The NMN6186A also has a rotary-dial volume control.

5. ROOFTOP ANTENNA

To enable the vehicular adapter to function as a mobile vehicular radio, an external rooftop antenna must be ordered from C & E Parts. This antenna is cut to correspond to the frequency band of the radio used with the vehicular adapter. Refer to the MODEL CHART for specific antenna model numbers and frequencies.

INSTALLATION


1. INSTALLATION PLANNING

a. General


Before starting the installation, determine the location of the console, microphone, and 12-watt speaker. Also, check the mounting penetrations required. On most vehicles, it is necessary to penetrate the firewall to reach the battery. Check the opposite side of the firewall for cable clearance before drilling holes, and protect the cable where it passes through the firewall by using the supplied grommets or other similar protective measures. Because of the wide variations in vehicle design, these instructions may be modified to suit each particular installation.

A properly installed AVA will minimize service calls and equipment downtime. Consider the following guidelines when planning the installation:


- **DO** use all mounting holes provided.
- **DO** use lockwashers where provided
- **DO** ensure that unit cables are not placed under stress, are not weathered, and are not subjected to damage due to engine heat.
- **DO** follow proper A+ and A- connections.
- **DO** tape all splices securely.
- **DON'T** attach the units to any part of the vehicle that is not rigid or is subject to excessive vibration.
- **DON'T** install units in areas where rain or snow can easily get into them, such as next to a vehicle window which may be left open.
- **DON'T** dress cables over sharp edges that could cause wear or tearing of cable insulation.
- **DON'T** install the units in locations where they might interfere with the vehicle operator or operating controls.
- **DON'T** install the units where they will be difficult for the operator to reach.

 WARNING
VEHICLES EQUIPPED WITH AIR BAGS
An air bag inflates with great force. DO NOT place objects, including communications equipment, in the area over the air bag or in the air bag deployment area. If the communication equipment is improperly installed and the air bag inflates, this could cause serious injury.

- Installation of vehicle communication equipment should be performed by a professional installer/technician qualified in the requirements for such installations. An air bag's size, shape, and deployment area can vary by vehicle make, model, and front compartment configuration (for example, bench seat vs. bucket seats).
- Contact the vehicle manufacturer's corporate headquarters, if necessary, for specific air bag information for the vehicle make, model, and front compartment configuration involved in your communication equipment installation.

 WARNING
For vehicles with electronic anti-skid braking systems, refer to the "Anti-Skid Braking Precautions" section of this manual.


b. Console Location

 CAUTION
If possible, avoid mounting the console in a vertical position. This will minimize the danger of foreign substances being dropped or spilled into the console pocket.

The console should be mounted to provide 12 inches of clearance in front of the console for inserting and removing the radio. A 4-inch clearance at the rear and left side of the console is necessary for connection of power, microphone, antenna, and speaker cables; a 1-inch clearance is required above the vents on the top of the console. Consider accessibility to the controls by the operator. When possible, mount the console on the floor near the center of the vehicle.

c. Microphone Bracket Location

When possible, mount the microphone bracket on the dash near the left side of the console. The location should be within easy reach of the operator, and it should be convenient to remove and replace the microphone without interfering with any of the vehicle controls.

 CAUTION
Do not attach the microphone mounting bracket to the console housing.

d. Speaker Location

Select a location for the speaker that will be neither dangerous to the operator nor damaging to the speaker. A trunion bracket is provided for mounting the speaker. The speaker is normally hung under the dash near the right side of the console; however, the trunion bracket permits mounting the speaker against a wall or other vertical surface, if desired.

e. Antenna Location

Complete antenna installation instructions are supplied with each antenna ordered. Refer to those instructions for all information pertaining to the antenna. Also, refer to the SAFETY INFORMATION paragraph in the FOREWORD of this manual for additional information.

f. Battery Connections

Determine the best cable route from the rear of the console to the vehicle battery through the engine firewall. The best route should include the shortest path to the battery terminals, yet provide the cable with protection from engine heat. Cut off any excess cable. Be sure the supplied grommet or similar protective measure is used wherever a cable must pass through a hole in a metal panel, such as a firewall. The power cables must be routed in a way that protects them from being pinched or crushed.

2. CONSOLE INSTALLATION

Referring to Figure 1, install the console using the following procedure, or modify the procedure as necessary to conform to the vehicle type:

- a. Using the trunnion bracket as a template, drill the mounting holes, and mount the bracket with the hardware supplied. If the trunnion bracket is to be mounted on the floor or vehicle console, bend the tabs on the bracket to conform to the shape of the floor or vehicle console (see Figure 1).
- b. Position the console onto the trunnion bracket so that the knurled fittings of the console and trunnion bracket mesh together.
- c. Place the lockwashers on the Allen-head screws, then insert the screws through the trunnion bracket and screw them into the console. Since the console may have to be removed later to connect the cables, do not tighten the screws at this time.

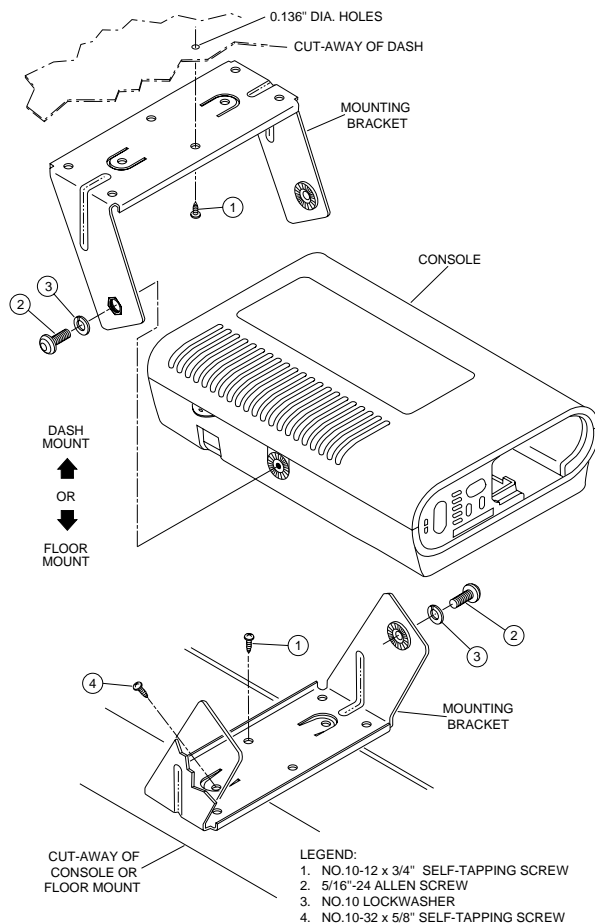


Figure 1. Console Installation Detail

3. MICROPHONE BRACKET INSTALLATION

Referring to Figure 2, use the microphone mounting bracket as a template and drill two 1/8-inch holes. Attach the microphone bracket to the mounting surface with the two self-tapping screws provided. Be sure to leave sufficient room above the bracket for insertion and removal of the microphone.

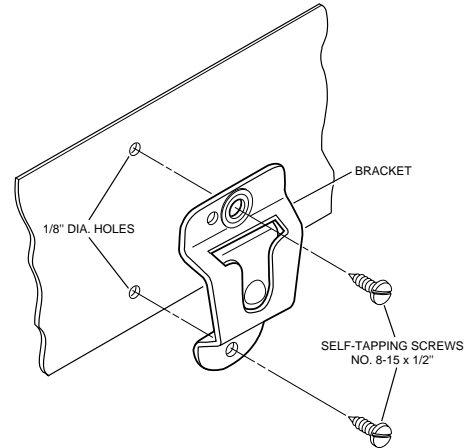


Figure 2. Microphone Bracket Installation Detail

4. 12-WATT SPEAKER INSTALLATION

The 12-watt speaker includes a trunnion bracket, a hanger bracket, and a wall-mount bracket, permitting the speaker to be mounted in a variety of ways.

- The trunnion bracket is used to permanently mount the speaker on the dashboard or accessible firewall areas, while permitting the speaker to be tilted to a desired angle.
- The hanger bracket permits temporary mounting, such as on an automobile window. The speaker must be removed from the trunnion bracket to use the hanger bracket.
- The wall-mount bracket can be used for permanent mounting if the trunnion bracket is too large to fit in the desired area. In this case, the trunnion bracket is removed, and the speaker is attached to the wall-mount bracket by the hanger bracket. Referring to Figure 3 for installation information, perform the following procedure:
 - a. Using the trunnion bracket as a template, drill the necessary mounting holes and secure the bracket with the self-tapping screws provided.
 - b. Position the 12-watt speaker onto the trunnion bracket, and secure it using the wing screws provided.

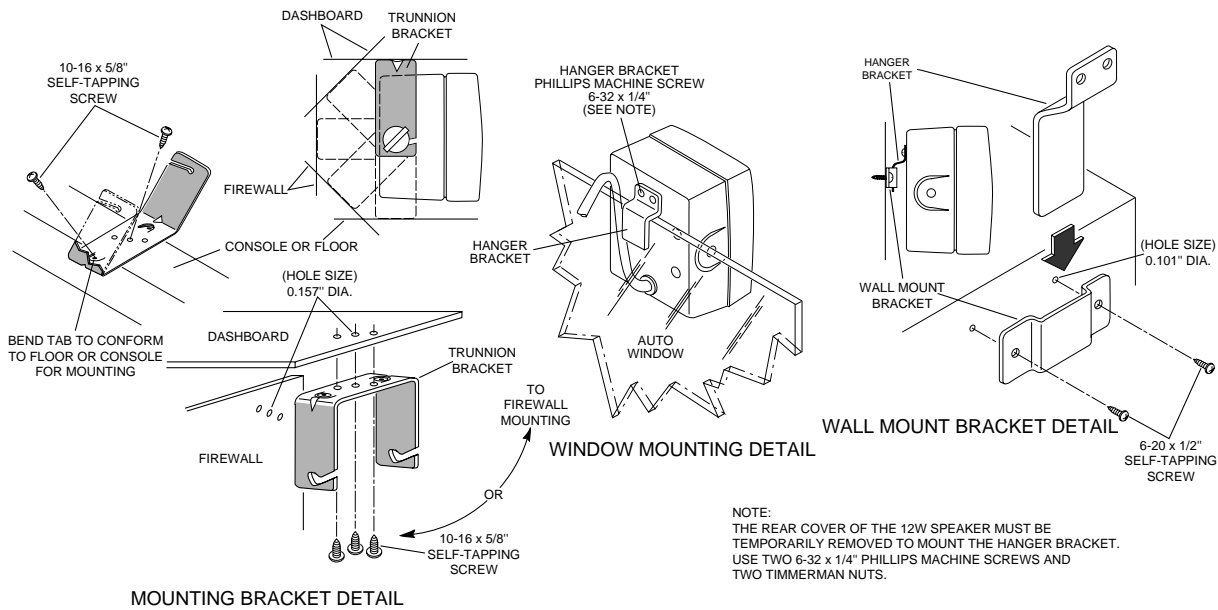


Figure 3. 12-Watt Speaker Installation Detail

5. ANTENNA INSTALLATION

Install the antenna and antenna cable as outlined in the installation instructions supplied with the antenna. Pertinent information on frequency matching, and mounting details are also provided with each antenna.

NOTE

The RF connector (J3) on the AVA console is a mini-UHF jack, and must be mated with either a mini-UHF plug (P3) or a UHF-to-mini-UHF adapter (Motorola part number 5880367B22).

6. CONSOLE CABLING

Refer to Figures 4 and 5 before routing or connecting any console cable. The console should be used with a negative ground system only. The console should be cabled using the following procedure:

	CAUTION
<p>Remove the 5-ampere fuses from the power cable (red, green, and yellow wires) before proceeding.</p>	

NOTE

Due to space restrictions, it may be necessary to remove the console before making connections to the connectors at the back of the console. If this is the case, make the connections and remount the console before replacing the 5-amp fuse.

- a. After setting the 2-foot section of the main power cable's red lead aside for later use, route the main power cable through the firewall and into the battery

compartment. Use an existing opening or, if necessary, drill a 3/4-inch hole through the firewall. Insert the grommet provided with the mounting kit into the hole to prevent damage to the power cable.

- b. Cut the black lead to the desired length, then connect it to the chassis of the vehicle.

	CAUTION
<p>It is not good practice to connect the black lead to the negative (-) battery terminal; the AVA could be damaged if there were to be a malfunction in the vehicle's electrical system.</p>	

- c. On the engine side of the firewall, connect the red (A+) lead to the vehicle's battery as follows:

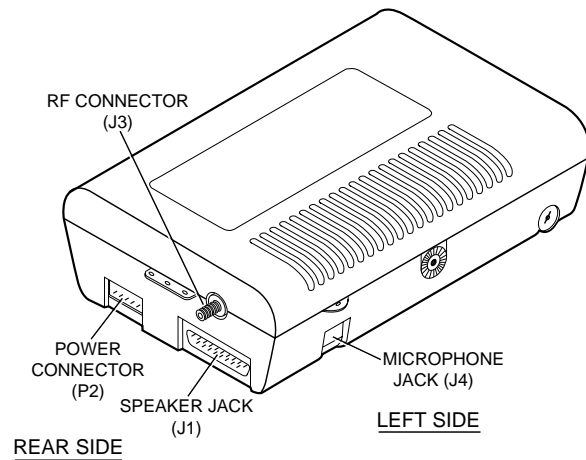
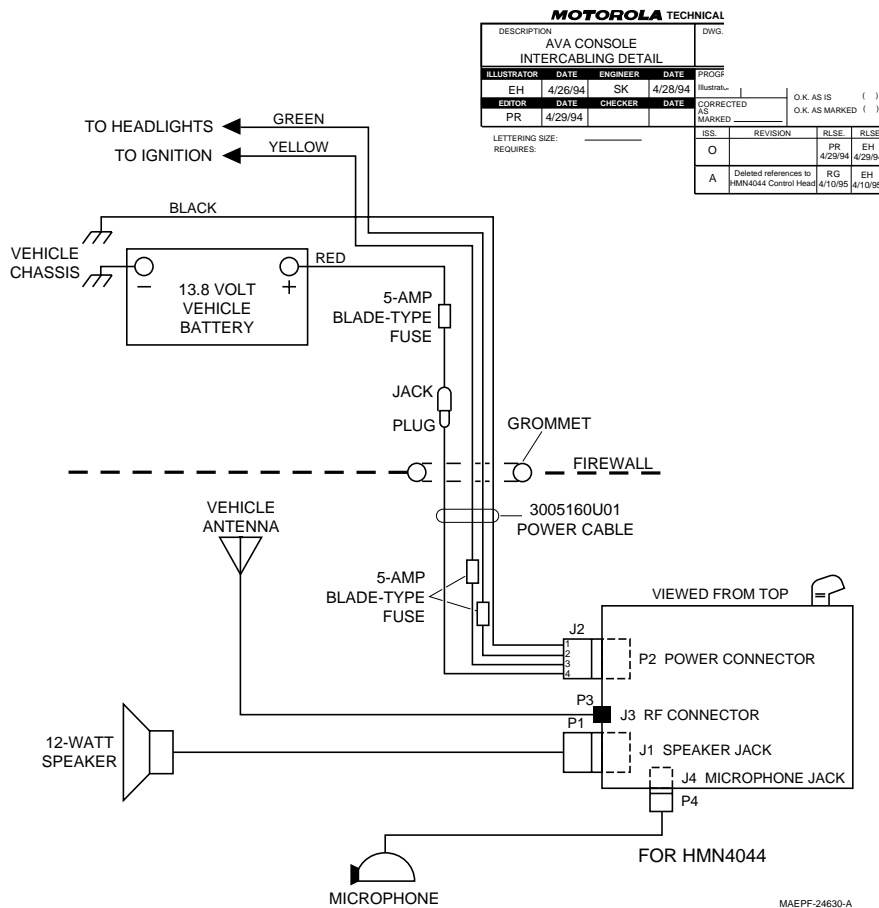


Figure 4. Console Connector Locations



MAEPF-24630-O

Figure 5. Console Intercabling Detail

- (1) Cut the long red lead to the desired length, then connect (crimp) it to the plug on the 2-foot red lead section which was set aside in step a. Make sure that the plug and jack in the lead are connected securely together.
 - (2) Connect the red lead to the positive (+) terminal on the vehicle's battery.
- d. Cut the yellow lead to the desired length, then connect it to the fused, switched side of the ignition circuit.
 - e. Cut the green lead to the desired length, then connect it to the fused, switched side of the headlight circuit.
 - f. Dress the cable so that it does not obstruct any vehicle controls or touch any hot or moving parts of the engine.
 - g. Connect power cable jack J2 to console plug P2. Attach the strain-relief hook to the baseplate.
 - h. Connect speaker cable plug P1 to console jack J1, applying three in. lb. of torque to each screw. Attach the strain-relief hook to the console.
 - i. Connect external antenna cable plug P3 to console jack J3.
 - j. Connect microphone cable plug P4 to console jack J4. Attach the strain-relief hook to the console.
 - k. Make certain that no radio is installed in the console, then replace the three 5-amp fuses.

7. ANTI-SKID BRAKING PRECAUTIONS

a. General

The following transmitter installation suggestions and test procedures are recommended for vehicles with electronic anti-skid braking systems.

b. Installation Suggestions

Determine the location of the braking modulator box in the vehicle. This box is located in the trunk of Chrysler Corporation cars, and either in the trunk or under the dash in General Motors and Ford Corporation automobiles. A service manual may be helpful in finding the location of the braking modulator box.

Install the AVA console in accordance with the following recommended guidelines:

- If the braking modulator box is mounted in the right side of the vehicle, mount the console on the left side to give as much space as possible between the box and the console. If the box is mounted on the left side of the vehicle, mount the console on the right side.
- Use the shortest practical length of Motorola coaxial cable.
- Mount the antenna on the side of the car trunk opposite from the braking modulator box.
- Route all cables along the side of the vehicle opposite from the braking modulator box.
- **DO NOT** operate the transmitter while the vehicle is in motion with the trunk lid open.


c. Test Procedure

This test is divided to cover several different types of interference. Disturbance of the electronic anti-skid device can usually be detected in several different ways in the vehicle's braking system: by the lights, by any irregular audible sounds, or by any change in the performance of the braking system itself.

NOTE


During procedure steps (1) through (6), however, none of the above conditions should be observed.

- (1) With the car gear selector in NEUTRAL or PARK, your foot off the brake pedal, and the engine running at a fast idle, key (turn the carrier on and off) the transmitter with and without modulation. Refer to the note above.
- (2) Repeat step (1) with your foot gently pressing the brake pedal. Refer to the preceding note.
- (3) When performing this step, allow at least two car lengths of clear area in front of the vehicle while it is stationary. Press your foot on the brake pedal with just enough pressure to keep the vehicle from moving. Put the car in a forward gear with the engine running at a fast idle, then key the transmitter with and without modulation.

	WARNING
Disruption of the anti-skid braking system may cause the vehicle to move forward in addition to the lights and audible sounds mentioned above.	

- (4) Drive at a moderate speed (15-25 mph) with your foot off the brake pedal, and have an assistant key the transmitter with and without modulation. Refer to the above warning.

- (5) Repeat step (4) with your foot lightly on the brake pedal to turn off the brake lights. Refer to the above warning.

	WARNING
Severe disruption of the electronic anti-skid braking system may cause loss of control of the vehicle in steps (6), (7), and (8).	

- (6) Increase the vehicle speed to 25-30 mph. Decelerate slowly and come to a stop. As you are doing this, have an assistant key the transmitter with and without modulation. Refer to the above warning.
- (7) While making abrupt stops from 20 mph, have an assistant key the transmitter with and without modulation. Refer to the above warning.
- (8) If no interference or disruption is noticed, repeat step (7), making abrupt stops from 30 mph. Refer to the above warning.

If no malfunctions are observed in performing the above steps, it can be assumed that no apparent problem exists and the car can be released to the customer.

If any of the above steps results in a brake malfunction, contact the car manufacturer's service department as soon as possible, and remove the radio from the vehicle. **DO NOT** complete the installation.

8. INSTALLATION CHECKOUT

a. General

After completing the installation of the vehicular adapter, check all electrical wiring for tight connections. Also, check all mechanical parts for tight and secure mounting.

Check for proper operation of the console, microphone, speaker, and radio as described in the user's guide, Motorola publication 68P81078C15. Before placing the radio in the AVA, check to see that the universal connector cover has been removed from the radio's universal connector.

NOTE

If alternator or other vehicular noise is present in the received signal or in the transmission, refer to "Reducing Noise Interference in Mobile Two-Way Radios," Motorola publication 68P81109E33. This publication may be ordered separately from Motorola Communications Sector National Parts Department.

THEORY OF OPERATION

1. GENERAL

The Motorola ASTRO/SABER Vehicular Adapter (AVA) is designed to work in conjunction with only an ASTRO Digital SABER, a SABER, or a SYSTEMS SABER portable FM two-way radio *manufactured after August, 1994*.

NOTE

When the AVA is used with a radio in the trunked mode, the "busy channel" indicator (bottom volume LED) will flash continuously, indicating the presence of a carrier signal on the radio control channel.

Connection between the radio battery and the AVA console is made through the charger contacts (P8) at the rear of the console pocket. Through these contacts, the console's charger circuitry automatically charges the radio battery.

Other connections between the AVA console and the radio are made via the universal and RF connectors on the back of the radio.

When the radio is inserted into the console pocket, and the radio is latched in place by rotating the knob on the side of the console 90° clockwise, the contacts of the console's universal connector assembly are automatically mated with the

radio's universal and RF connectors. This makes control of all the basic radio functions available to the AVA. The hand-held microphone, external speaker, and rooftop antenna are also automatically connected to the radio when it is latched into the console.

NOTE

If an ASTRO Digital SABER radio is turned on and in the receive mode when it is inserted into, or removed from, the console, the radio/AVA speakers will not automatically switch. When the radio exits the receive mode, the audio will be automatically routed to the appropriate speaker. To force the radio to exit from the receive mode, either press and release the PTT switch, or turn the radio off, then on.

With the exception of the volume control, all controls on the top of the radio can be used. The radio's volume control is disabled by the AVA, and the volume control buttons on the front of the AVA console must be used instead. The volume can also be controlled by the ASTRO Hand-Held Control Microphone.

2. CIRCUIT DESCRIPTION

When reading the following circuit descriptions, refer to the console functional block diagram, Figure 6, and the schematic diagram at the back of this manual.

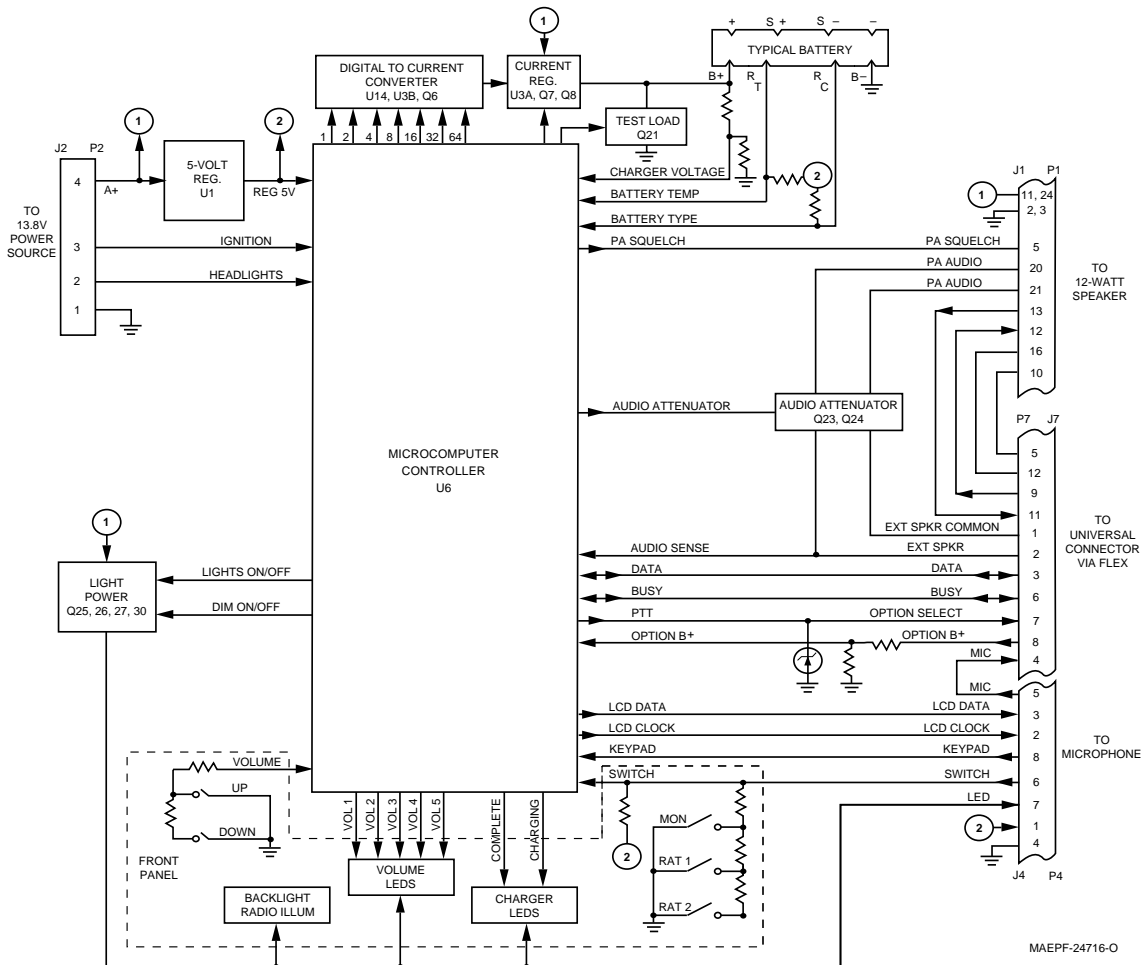


Figure 6. Console Functional Block Diagram

a. Battery Charger Circuitry

Operating A+ for the console is obtained from a 13.8-volt source, such as a car battery. The A+ is applied to a 5-volt regulator (U1) which provides regulated +5Vdc power to the microcomputer.

The AVA is designed to operate with only the following radio/battery combinations:

Radio Type	Battery		
	Size	Capacity	Type
ASTRO Digital SABER	Medium (3.1")	Medium	NiCd
	Medium (3.1")	High	NiMH
SABER/Systems SABER	Medium (3.1")	Medium	NiCd
	Medium (3.1")	High	NiMH
	Large (3.9")	High	NiCd
	Large (3.9")	Ultra-High	NiCd

Once the radio/battery combination is latched into place in the console pocket, the battery sensing, battery charging, and radio sensing begin.

b. Battery Sensing and Charging

NOTE

To ensure proper battery contact, remove all labels and residual adhesive material from the battery before inserting it into the AVA.

The microcomputer (U6) scans for the insertion of a radio/battery combination by monitoring the voltage at the R_C and R_T battery contacts. The valid R_C values identifying the designated battery type are as follows:

R _C Resistance	Battery Type
5.1 kΩ	Medium- or High-Capacity
10 kΩ	High-Capacity
18 kΩ	Ultra-High-Capacity

The microcomputer also reads the voltage at the R_T contact to determine whether the battery may be safely charged at the three-hour rate. The battery temperature must be between 10°C and 40°C. If a valid R_C value is recognized, and the battery is determined to be within the charge window, charging at the three-hour rate will begin, and the red "charging" LED will light.

If the battery temperature is outside the charge window, but is less than 60°C, the battery will be charged at its 20-hour rate until the battery temperature falls within the window. During this time period the red "charging" LED will be on.

After approximately three hours or when the battery temperature reaches 45°C (whichever occurs first), the microcomputer (U6) will reduce the charge rate to the 20-hour rate; this rate will be maintained until the battery is removed. The change to this rate is signalled by the red "charging" LED turning off and the green "charge complete" LED turning on.

The microcomputer compensates for current consumed by the radio while the radio is in standby or receive modes. When the microcomputer senses the presence of a radio in the console pocket, it increases the battery charge current by the appropriate amount. When the radio transmits, the charge current is increased to 1.5 amps for the transmit duration.

NOTE

If a totally discharged battery is placed into the AVA console, the radio receiver will begin to function normally within a few seconds. Transmission should not be attempted for about 30 seconds when using a high-power radio and should be kept to a minimum for the first few minutes. Low-power radios will allow normal operation sooner.

c. Radio Sensing

The microcomputer (U6) determines whether the radio is turned on by measuring the voltage from the radio at pin 8 of the universal connector (P7). When the radio is turned on, the microcomputer will sense approximately 7.5V on the pin. When this occurs, the microprocessor senses the microphone line (pin 4 of universal connector P7) to determine which radio family is in the AVA (high for ASTRO; low for SABER/System SABER) in order to use the proper protocol for communication. The AVA's microcomputer (U6) will then attempt to establish communication with the radio's microprocessor via the serial bus (U6, pin 20).

Once communication has been established, control of radio volume control, monitor, and PTT functions are transferred to the AVA:

- The volume level can be changed via the up/down volume buttons on the console's front panel; five red LEDs indicate the volume level.
- The monitor function can be accomplished by pressing either the monitor button on the console's front panel or the monitor button on the display microphone.
- The PTT function can be accomplished by pressing the PTT button on the external microphone.

Channel selection remains a radio function and can be accomplished via the channel selector knob on the radio. ASTRO, SABER, and Systems SABER radio displays are echoed on the display microphone.

During transmit, the RF signal from the radio is routed to the mini-UHF RF connector, J3, at the back of the console, where it can be either further amplified by an external rf power amplifier, or hooked directly to the rooftop antenna.

When the radio detects an on-channel signal, the lowest "volume" LED will blink to indicate that the radio is in the receive mode. The AVA routes the recovered audio to an external 12-watt power amplifier/speaker through 25-pin connector J1.

d. RS-232 Interface

The AVA "Y" cable, which contains a level shifter, allows data transmission to and from an ASTRO radio while the radio is latched into the AVA console. This cable splits the AVA's 25-pin speaker connector (J1) into an RS-232 port and a speaker port.

MAINTENANCE

1. PREVENTIVE MAINTENANCE

a. Periodic Inspections

Slow degradation of equipment performance, if left uncorrected, can lead to costly equipment downtime and repair. Preventive maintenance (PM) differs from corrective maintenance in that minor equipment operating deficiencies can be corrected before breakdown occurs. Periodic and systematic PM inspection schedules should be set up to keep the equipment operational and failure free. The frequency of PM schedules will be determined by the environment in which the equipment is being used.

The periodic inspections should include:

- Visual inspection of cables for frayed or oxidized leads.
- Ensuring that battery connections are free from oxidation or corrosion.
- Checking the external rooftop antenna for clean and rust-free mounting.
- Checking for tight connection of the console-to-antenna cable connectors.
- Checking the system ground lead (black) for clean and proper electrical contact.
- Checking all jack and plug connections for tightness and good electrical pin contact. Pins should be visually checked for wear.
- Checking for loose components. Checking component assemblies and mechanical assemblies for tight and secure installation. The majority of AVA failures is directly related to poor installation.
- Inspecting all mounting brackets and associated mounting screws for secure and tight mounting.
- Checking for overheated or discolored components.
- Checking for proper (13.8Vdc) vehicular alternator charging. Vehicular voltage can vary from as low as 12.9Vdc to as high as 18Vdc without being evident to the operator; however, it can affect AVA operation.

b. Cleaning Procedures

In areas of high dust or salt conditions, periodically check the mechanical operation of the console's battery contacts. If contact movement requires excessive effort, clean any dust or salt deposits from the moving parts as described below. Cleaning may be accomplished by performing the following procedure:

- (1) Remove the console from the vehicle and place it right-side-up on a flat working surface. The working surface should offer protection from scratching to the console's surfaces.

- (2) Referring to the "Disassembly/Reassembly Procedures" (paragraph d) in the "CORRECTIVE MAINTENANCE" section of this manual, disassemble the unit for cleaning.
- (3) Clean the external surfaces of the console using the recommended cleaning agent. These surfaces should be cleaned whenever a periodic visual inspection reveals the presence of excessive dust, grease, and/or grime.

The only recommended agent for cleaning the internal and external plastic AVA surfaces is a 0.5% solution of a mild dishwashing detergent in water (one teaspoon of detergent per gallon of water).



CAUTION

The effects of certain chemicals and their vapors can be harmful to some types of plastics. Aerosol sprays, tuner cleaners, and other such chemicals should be avoided.

- (4) The internal circuit boards and components should ordinarily be cleaned when the console must be disassembled for servicing or repair. The only factory recommended liquid for cleaning the circuit boards and their components is *isopropyl alcohol* (70% by volume).

NOTE

When the AVA is used under adverse marine conditions, the circuit board must be cleaned of salt deposits at least twice a year.

Isopropyl alcohol may be applied with a stiff, non-metallic, short-bristled brush to dislodge embedded or caked-on materials located in hard-to-reach areas. The brush stroke should direct the dislodged material out and away from the inside of the console.

Alcohol is a high-wetting liquid and can carry contamination into unwanted places if an excessive quantity is used. Make sure that the controls are not soaked with the liquid. Upon completion of the cleaning process, use a soft, absorbent, lintless cloth to dry the area.

NOTE

Always use a fresh supply of alcohol and a clean container to prevent contamination by dissolved material from previous usage.

- (5) Reassemble the console, reversing the disassembly procedure.

2. CORRECTIVE MAINTENANCE

a. Introduction

Efficient corrective maintenance requires an orderly and logical troubleshooting procedure for localizing malfunctions in the AVA's internal or external circuits. Troubleshooting and repair will be greatly simplified by becoming familiar with the overall AVA and radio operation.

This section provides detailed information required to isolate malfunctions to the AVA's internal or external circuits. The troubleshooting chart at the end of this section provides information on possible circuit failures, related symptoms, and suspected malfunctioning stages.

Generally it may be assumed that, if the AVA is totally inoperative, then the vehicle's battery is completely discharged, the fuse is blown, or the power lead is opened. However, if the AVA is partially operative, it may be assumed that the batteries are serviceable and that one or more internal or external functional AVA circuits are defective or marginal. Using diagrams, the troubleshooting chart, the voltage table, and deductive reasoning, the defective circuit may readily be found.

To further aid in analyzing the symptoms and possible causes of the malfunction, check: RF power output using an in-line wattmeter, audio deviation, and current drain. Once the general problem area of the AVA is identified, careful use of a dc voltmeter, ohmmeter, and/or oscilloscope should help isolate the problem to a defective component.

b. Test Equipment and Service Aids

The "RECOMMENDED TEST EQUIPMENT" chart lists the test equipment recommended to properly service the AVA. Refer to the service manual for the associated radio for the recommended radio test equipment. For field servicing, the vehicle's battery is an adequate power source. Battery-operated test equipment is recommended when available.

See your Motorola sales representative for aid in ordering test equipment. The sales representative will analyze your requirements and help you select the latest available equipment and service aids to suit your individual needs.

(1) MAV-PACK 3 (VID-952)

The VID-952 Motorola Audio/Visual Package (MAV-PACK) is a videotape training program on leadless component repair techniques. This VHS format video cassette and supplemental literature describe the removal and replacement of leadless components using the following specialized equipment:

RECOMMENDED TEST EQUIPMENT

MODEL NO.	NAME	CHARACTERISTICS	APPLICATION
R-2001, R-2002, or R-2200	Service Monitor	-----	Audio circuit, testing, frequency/deviation, power output.
S-1347	DC Power Supply	0-20Vdc, 0-5 Amps; current limited	Power supply for bench testing.
S-1053	AC Voltmeter	1mV to 300mV RMS, -72dB to +52dB; 10MΩ input impedance	Audio voltage measurements
R-1028	Solid-state Oscilloscope	-----	Waveform measurements
R-1001	Digital Multimeter	High input impedance	DC voltage, resistance measurements
REX-4063	Test Fixture	-----	Troubleshooting AVA

- RRX-4033 Laurier Hot Gas Bonder
- RPX-4234] Regulator and Hardware Kit
- 0180386A62 Heated Tweezers
- RSX-1002 Desoldering Station
- RSX-1008 Weller Soldering Station

This MAV-PACK is strongly recommended for technicians who intend to service this and other Motorola products using leadless components. This VHS videotape is in standard half-inch format. This MAV-PACK, as well as others, is available from:

Motorola C&E, Inc.
National Service Training Center
1300 N. Plum Grove Road
Schaumburg, Illinois 60173

c. Troubleshooting

Refer to the troubleshooting and voltage charts at the back of this section to isolate a malfunction to a defective circuit. Follow the flow through the chart, check each observation, and answer each question. As an aid in understanding the operation and functioning of a particular circuit, refer to the appropriate paragraphs in the "THEORY OF OPERATION" section of this manual.

If a circuit board must be tested, it may be necessary to remove it from the chassis and test it outside of the enclosure. In this case, leave all wires connected to the board, and use care to protect the board from being accidentally shorted out. Use heat sinks with insulators on transistors Q7 and Q25 while the board is removed from the chassis.

d. Disassembly/Reassembly Procedures

(1) Disassembly Procedure

Disassemble the console by performing the following procedure:

Refer to the exploded view, exploded view parts list, and Figure 7 for steps a through e.

- Turn off and unlock the AVA, remove the radio from the console, and disconnect all cables (including the microphone). Remove the key from the AVA lock. Place the console on a flat working surface with the rear of the console facing you.
- Using a rubber mallet, lightly tap the rear surface of the top housing to allow the snaps to release and the top housing to move toward the front of the console. Make sure to hold the bottom of the unit securely by placing your free hand on the front of the console to prevent the bottom from moving. Continue tapping the top housing until it slides forward approximately 1/2 inch. If the top fails to slide forward, make certain that the coaxial connector (J3) is not restricting the top housing's movement.
- Lift off the top housing and put it aside.
- Remove the knob on the side of the console by grasping the extended portion of the blade and pulling it away from the console. The knob is made of a urethane material that can be deformed to allow the knob to be removed.

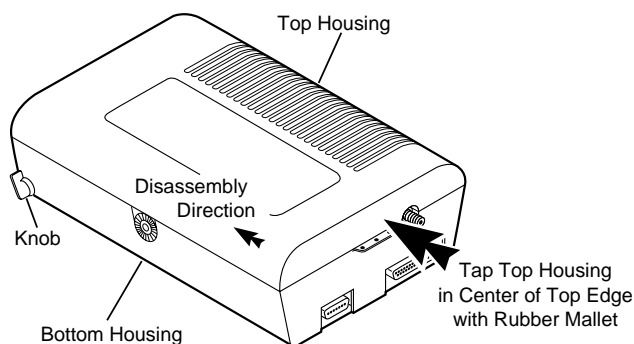


Figure 7. Removing the Top Housing

Refer to the exploded view, exploded view parts list, and Figure 8 for steps f through j.

- Locate the two ribbon cables (one originates at the front housing assembly, and the other originates at the universal connector assembly), and follow them to their circuit board connection points (J5/P5 and J7/P7). Unsnap the hold-down clips at the sides of P5 and P7 by pulling them sideward. Then, disconnect the jacks from the plugs by grasping the jacks (J5 and J7) and pulling them directly away from the plugs.
- Remove the hood by locating the four hold-down snaps which extend through the chassis. Place your thumb and index finger around the hood (Figure 8, locations A) and squeeze the hood. This will enable you to pivot the front portion of the hood away from the chassis, clearing the snaps in the middle of the part.
- Insert the small flat-bladed screwdriver through the rear-most opening in the hood (Figure 8, location B), wedge the blade between the hood and the chassis, and twist the screwdriver slightly while pulling upward on the hood in that area. Repeat this step for the remaining snap.
- While gently squeezing the transistor clip against the heat sink fins on the chassis, loosen the clip (Figure 8, location C) by prying and lifting the clip away from the heat sink fins' retaining tab.

NOTE

Do not attempt to remove the transistor clip at this time.

- Separate the remaining assembly from the bottom housing and shield by locating the six hold-down snaps (Figure 8, locations D) which are molded into the bottom housing and hang over the sides of the chassis walls. Pull the bottom housing away from the chassis in the areas where the snaps are located, and pull the chassis upward and away from the bottom housing.

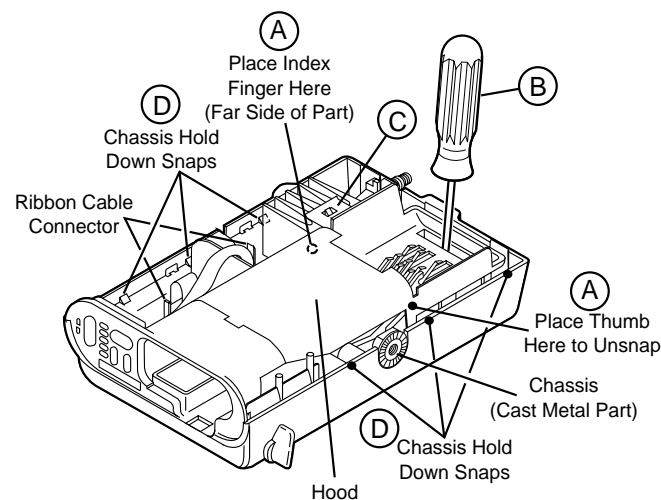


Figure 8. Removing the Insides of the Console

Refer to the exploded view and exploded view parts list for the remaining disassembly steps.

- (j) Remove the transistor clip by sliding the bottom of the clip toward the heat fins and lifting upward on the clip.
- (k) While lifting gently on the lightpipe, slide the front housing assembly forward away from the chassis. When reassembling the console, the front housing assembly can be snapped in place vertically after the chassis is positioned in the bottom housing.
- (l) Remove the lightpipe by lifting it up and away from the chassis.
- (m) Remove the universal connector assembly by pivoting its end upward 90° to vertical and lifting the assembly out.
- (n) Unsnap and remove the actuator arm from the chassis
- (o) Remove the actuator arm spring from the chassis.
- (p) Remove the camshaft from the chassis.
- (q) Remove the printed circuit board assembly by lifting it up and away from the bottom housing. This assembly is not held in place by any clips, but is oriented to the bottom housing by four pins which line up with four holes in the board.
- (r) Remove the lock by lifting it up and away from the bottom housing. When reassembling the console, make certain that the lock is in its unlocked position, then place the flat side of the lock parallel to the bottom of the housing with the bottom housing standoffs cradled in the lock slots.
- (s) Only if it is necessary, remove the bottom shield by locating the four snaps molded into the inside walls of the bottom housing, deflect the sheet metal tabs of the shield away from the four snaps, and lift the shield up and away from the bottom housing.

When reassembling the console, align the pad over the four housing snaps and place it in position on the bottom housing. Then, align the shield over the four housing snaps and place it in position on the pad. Press downward on the shield, compressing the pad, until the shield securely engages all four snaps.

(2) Reassembly Procedure

Reassemble the console by reversing the disassembly procedure. Pay particular attention to the reassembly information in steps (l), (s), and (t).

When the console is completely reassembled, snap the top housing closed by placing the rear side of the bottom housing against the edge of a desk or table and tapping the top housing with a rubber mallet as shown in Figure 9.

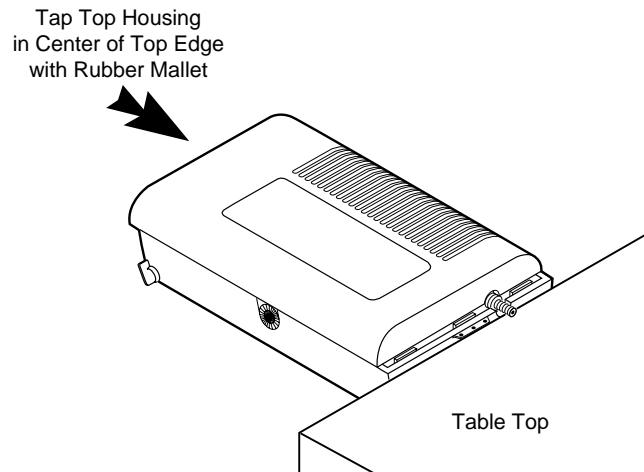


Figure 9. Snapping the Console Closed

e. Safe Handling of CMOS Devices

Complementary metal-oxide semiconductor (CMOS) devices are used in the AVA. While the attributes of CMOS are many, their characteristics make them susceptible to damage by electrostatic or high voltage charges. Damage can be latent, resulting in failures occurring weeks or months later. Therefore, special precautions must be taken to prevent device damage during disassembly, troubleshooting, and repair. The following handling precautions are mandatory for CMOS circuits, and are especially important in low humidity conditions.

- (1) All CMOS devices must be stored or transported in conductive material so that all exposed leads are shorted together. CMOS devices must not be inserted into conventional plastic "snow" or plastic trays of the type that are used for storage or transportation of other semiconductor devices.

- (2) All CMOS devices must be placed on a grounded bench surface and the technicians must ground themselves prior to handling the devices. This is done most effectively by having the technician wear a conductive wrist strap in series with a 100k-ohm resistor to ground.
- (3) Do not wear nylon clothing while handling CMOS circuits.
- (4) Do not insert or remove CMOS devices with power applied. Check all power supplies to be used for testing CMOS devices, and be certain that there are no voltage transients present.
- (5) When straightening CMOS device leads, provide ground straps for the apparatus used.
- (6) Use a grounded soldering iron.
- (7) All power must be turned off in a system before printed circuit boards containing CMOS devices are inserted, removed, or soldered.

f. Parts Replacement and Substitution

When defective parts or components must be replaced, identical parts should be used. If the identical replacement part is not locally available, check the electrical and exploded view parts lists for the correct Motorola part number. Order the part from the nearest Motorola Communications Parts office as listed under "Replacement Parts Ordering" on the inside back cover of this manual.

If, for any reason, substitutions must be made, reinstall the exact replacement part as soon as possible to ensure optimum performance. The substituted part must have identical electrical characteristics and must have equal or higher voltage and current ratings.

If it is necessary to replace any of the transistors that mate against the heat sink fins on the chassis, be sure to form the new transistor's leads like those of the original part so that the transistor lies flat against the insulator when clamped by the transistor clip against the heat sink fins.

g. Soldering



CAUTION

Leadless component technology requires the use of specialized equipment and procedures for repair and servicing of the AVA. If you are not totally familiar with leadless component repair techniques, it is strongly recommended that you either defer maintenance to qualified service personnel and service shops, or take the recommended video-taped component repair training program, MAV-PACK 3 (VID-952). This is of paramount importance as irreparable damage to the AVA can result from service by unauthorized persons. Unauthorized attempts to remove or repair parts may void any existing warranties or extended performance agreements with the manufacturer.

Special care must be taken to be as certain as possible that a suspected component is actually at fault. This special care will eliminate unnecessary unsoldering and removal of parts, which could damage or weaken other components or the printed circuit board itself.

Rigid Circuit Boards

The AVA uses bonded multi-layer printed circuit boards. Since the inner layers are not accessible, some special considerations are required when soldering and unsoldering components. The printed-through holes may interconnect multiple layers of the printed circuit. Therefore, care should be exercised to avoid pulling the plated circuit out of the hole. Closely examine your work for shorts due to solder bridges.

Exploded View Parts List

TPLF-4215-O

ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1	3305183R19	LABEL
2	1505159T01	HOUSING, Top
3	1505157T01	HOOD, AVA
4	0105951T05	ASSEMBLY, Front Housing
5	3305409X09	LABEL
6	0105951T22	ASSEMBLY, RF Connector (part of item 8)
7	0905925S03	FLEX (part of item 8)
8	0105951T01	ASSEMBLY, Universal Connector (includes items 6, 7, and 9)
9	4105169T02	SPRING, Connector (part of item 8)
10	4205294T01	CLIP, Transistor
11	1405329Q03	INSULATOR
12	4505165T01	CAMSHAFT
13	2705172T03	CHASSIS
14	4105170T01	SPRING, Actuator Arm
15	4505164T02	ARM, Actuator
16	7505934Q02	PAD, RF Shield
17	6105357T01	LIGHTPIPE
18	2605471T01	SHIELD, RF Cover
19	0105960S14	ASSEMBLY, Printed Circuit Board
20	2605167T01	SHIELD, Bottom
21	5505173T01	LOCK
22	1505158T02	HOUSING, Bottom
23	3605163T01	KNOB, Snap-On
24	3305409X01	LABEL
25	7505715U02	PAD
26	1405182M14	INSULATOR
27	7582154D39	PAD
28	0905925S04	FLEX
29	7505410Y01	PAD

INSERT DEPF-24720-O

REPLACEMENT PARTS ORDERING

ORDERING INFORMATION

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

Crystal and channel element orders should specify the crystal or channel element type number,

crystal and carrier frequency, and the model number in which the part is used.

Orders for active filters, Vibrasender and Vibrasponder resonant reeds should specify type number and frequency, should identify the owner/operator of the communications system in which these items are to be used, and should include any serial numbers stamped on the components being replaced.

MAIL ORDERS

Send written orders to the following addresses:

Replacement Parts/
Test Equipment/Manuals
Crystal Service Items:

Motorola Inc.
Americas Parts Division
Attention: Order Processing
1313 E. Algonquin Road
Schaumburg, IL 60196

Federal Government Orders:

Motorola Inc.
Americas Parts Division
Attention: Order Processing
7230 Parkway Drive
Landover, MD 21076

International Orders:

Motorola Inc.
Americas Parts Division
Attention: International Order Processing
1313 E. Algonquin Road
Schaumburg, IL 60196

TELEPHONE ORDERS

Replacement Parts/Test Equipment/Crystal Service:
Call: 1-800-422-4210
1-800-826-1913 (For Federal Government Orders)
1-708-538-8023 (International Orders)

Field Assist Service Training
(FAST VHS Video Tapes):
Call: 708-576-8012

TELEX/FAX ORDERS

Replacement Parts/Test Equipment/
Manuals/Crystal Service Items:
FAX: 708-538-8198 (Domestic)
708-576-3023 (International)
Telex: 280127 (Domestic)
403305 (International)

Federal Government Orders:

FAX: 410-712-4991

PARTS CUSTOMER SERVICE

Crystals/Replacement Parts/Test Equipment/Manuals:
Call: 1-800-422-4210

Parts Identification:
Call: 708-538-0021

PRODUCT CUSTOMER SERVICE

Customer Response Center
(Sales and Service Assistance):

Call: 1-800-247-2346
FAX: 1-800-232-9272