PROFESSIONAL DIGITAL TWO-WAY RADIOS

MOTOTRBO™ HANDHELD CONTROL HEAD

BASIC SERVICE MANUAL

Foreword

This manual covers all MOTOTRBO™ Handheld control, unless otherwise specified. It includes all the information necessary to maintain peak product performance and maximum working time, using levels 1 and 2 maintenance procedures. This level of service goes down to the board replacement level and is typical of some local service centers, Motorola Authorized Dealers, self-maintained customers, and distributors.

These servicing instructions are for use by qualified personnel only. To reduce the risk of electric shock, do not perform any servicing other than that contained in the Operating Instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.

Product Safety and RF Exposure Compliance

Before using this product, read the operating instructions for safe usage contained in the Product Safety and RF Exposure booklet enclosed with your radio.

ATTENTION!

This radio that comes with the control head is restricted to occupational use only to satisfy ICNIRP/ FCC RF energy exposure requirements. Before using this product, read the RF energy awareness information and operating instructions in the Product Safety and RF Exposure booklet enclosed with your radio to ensure compliance with RF energy exposure limits.

For a list of Motorola-approved antennas, and other accessories, visit the following web site which lists approved accessories: http://www.motorolasolutions.com

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Notes

Document History

The following major changes have been implemented in this manual since the previous edition.

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Warranty and Service Support

Motorola offers long term support for its products. This support includes full exchange and/or repair of the product during the warranty period, and service/ repair or spare parts support out of warranty. MOTOTRBO™ Handheld Control Head One (1) Year.

Warranty Period and Return Instructions

The terms and conditions of warranty are defined fully in the Motorola Dealer or Distributor or Reseller contract. These conditions may change from time to time and the following notes are for guidance purposes only. In instances where the product is covered under a "return for replacement" or "return for repair" warranty, a check of the product should be performed prior to shipping the unit back to Motorola. This is to ensure that the product has been correctly programmed or has not been subjected to damage outside the terms of the warranty.

Prior to shipping any radio back to the appropriate Motorola warranty depot, please contact Customer Resources or your Motorola dealer, distributor or reseller. All returns must be accompanied by a Warranty Claim Form, available from your Customer Service representative or Motorola Online Extranet (MOL) or your Motorola dealer, distributor or reseller. Products should be shipped back in the original packaging, or correctly packaged to ensure no damage occurs in transit.

After Warranty Period

After the Warranty period, Motorola continues to support its products in two ways.

1. Motorola's Managed Technical Services (MTS) offers a repair service to both end users and dealers at competitive prices.
2. MTS supplies individual parts and modules that can be purchased by dealers who are technically capable of performing fault analysis and repair.

Notes

Chapter 1 Introduction

1.1 Notations Used in This Manual

Throughout the text in this publication, you will notice the use of note and caution notations. These notations are used to emphasize that safety hazards exist, and due care must be taken and observed.

NOTE: An operational procedure, practice, or condition that is essential to emphasize.

Caution

CAUTION indicates a potentially hazardous situation which, if not avoided, **might** result in equipment damage.

1.2 Control Head Description

The control head used with the radio has logic circuitry that operates the standard and optional features built into the system.

The following illustration show the handheld control head.

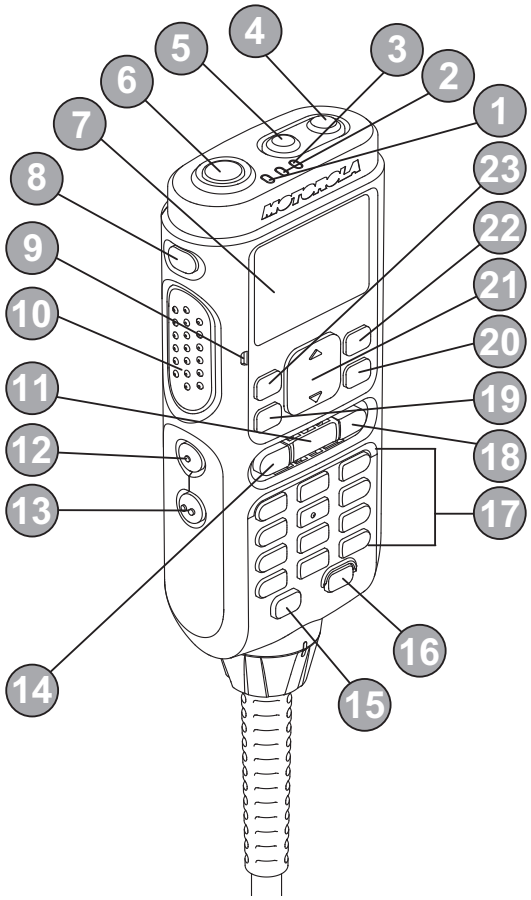


Figure 1-1 MOTOTRBO™ Handheld Control Head

1.2.1 MOTOTRBO™ Handheld Control Head

NOTE: * These buttons are programmable.

Item No.	Description	Function
1	LED INDICATORS - Red	Red light-emitting diodes indicate operating status.
2	LED INDICATORS - Yellow	Yellow light-emitting diodes indicate operating status.
3	LED INDICATORS - Green	Green light-emitting diodes indicate operating status.
4	CHANNEL UP	Press buttons to change channels.
5	CHANNEL DOWN	Press buttons to change channels.
6	POWER BUTTON	Turns the radio on and off.
7	5-LINE COLOR LCD (Liquid Crystal Display) DISPLAY	132x90 display provides visual information about radio features.
8	PROGRAMMABLE SIDE BUTTON 1 *	Buttons are field programmable using the CPS.
9	MICROPHONE	Audio output and input

Item No.	Description	Function
10	PUSH-TO-TALK (PTT) BUTTON	Press to initiate talk.
11	SPEAKER	Audio output and input.
12	PROGRAMMABLE SIDE BUTTON 2*	Buttons are field programmable using the CPS.
13	PROGRAMMABLE SIDE BUTTON 3*	Buttons are field programmable using the CPS.
14	VOLUME BUTTON DOWN	To adjust speaker volume.
15	PROGRAMMABLE FRONT BUTTON P3*	Buttons are field programmable using the CPS.
16	PROGRAMMABLE FRONT BUTTON P4*	Buttons are field programmable using the CPS.
17	FULL KEYPAD	Allows user to input characters for various text base operations.
18	VOLUME BUTTON UP	To adjust speaker volume.
19	MENU/OK BUTTON	One button to provide menu navigation and selection interface.
20	BACK/HOME BUTTON	Press button to navigate to home page.
21	4 WAY NAVIGATION BUTTON	Press buttons to scroll Up/Down/Left/Right.
22	PROGRAMMABLE FRONT BUTTON P2*	Buttons are field programmable using the CPS.
23	PROGRAMMABLE FRONT BUTTON P1*	Buttons are field programmable using the CPS.

Table 1-1 MOTOTRBO™ Handheld Control Head

1.3 Specifications

Military Standards 810C, D, E, F & G										
	MIL-STD 810C		MIL-STD 810D		MIL-STD 810E		MIL-STD 810F		MIL-STD 810G	
	Method	Proc./Cat	Method	Proc./Cat	Method	Proc./Cat	Method	Proc./Cat	Method	Proc./Cat
Low Pressure	500.1	I	500.2	II	500.3	II	500.4	II	500.5	II
High Temperature	501.1	I, II	501.2	I/A1, II/A1	501.3	I/A1, II/AI	501.4	I/HOT, II/HOT	501.5	I/AI, II
Low Temperature	502.1	I	502.2	I/C3, II/C1	502.3	I/C3, II/C1	502.4	I/C3, II/C1	502.5	I/C3, II
Temperature Shock	503.1	–	503.2	I/A1/C2	503.3	I/AI/C2	503.4	I	503.5	I/C
Solar Radiation	505.1	II	505.2	I	505.3	I	505.4	I	505.5	I/A1
Rain	506.1	I, II	506.2	I, II	506.3	I, II	506.4	I, III	506.5	I, III
Humidity	507.1	II	507.2	II	507.3	II	507.4	–	507.5	II - Aggra-vated
Salt Fog	509.1	I	509.2	I	509.3	I	509.4	–	509.5	–
Dust	510.1	I	510.2	I	510.3	I	510.4	I	510.5	I
Vibration	514.2	VIII/F, Curve-W	514.3	I/10, II/3	514.4	I/10, II/3	514.5	I/24, II/5	514.6	I/24, II/3
Shock	516.2	I, III, XI, V	516.3	I, V, VI	516.4	I, V, VI	516.5	I, V, VI	516.6	I, V, VI

Environmental Specifications	
Operating Temperature	-30°C to +60°C
Storage Temperature	-40°C to +85°C
Temperature Shock	Per MIL-STD
Humidity	Per MIL-STD
ESD	IEC 61000-4-2 Level 3
Water and Dust Intrusion	IP54, MIL-STD

Chapter 2 Service Aids

2.1 Service Aids

Table 2-1 lists the service aids recommended for working on the control head. While all of these items are available from Motorola, most are standard workshop equipment items, and any equivalent item capable of the same performance may be substituted for the item listed.

Table 2-1 Service Aids

Motorola Part Number	Description	Application
N/A	Small flat blade screwdriver	To unlatch the flex connector.
6686119B01	Control head dismantling tool	To disengage the transceiver adapter from brick.
RSX4043A	Torque driver (2-36lbs-in or 0.4-4.0 N-m)	To ensure the driver bit is tighten at specified torque as indicated in Table 5-7.
6680387A72	TORX™ T8	To tighten/loosen the T8 screw head.
N/A	TORX Plus™ 6IP	To tighten/loosen the 6IP screw head.
N/A	Phillips no.2	To tighten/loosen the PH2 screw head
30009477001	MOTOTRBO™ Handheld Control Head Front Programming Cable	Connects the radio to a USB port for radio programming and data applications.
N/A	Plastic Tweezer	To remove the PTT Paddle.

2.2 Programming Cables

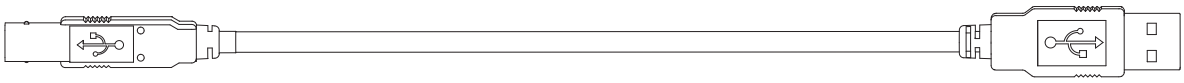


Figure 2-1 MOTOTRBO™ Handheld Control Head Front Programming Cable 30009477001

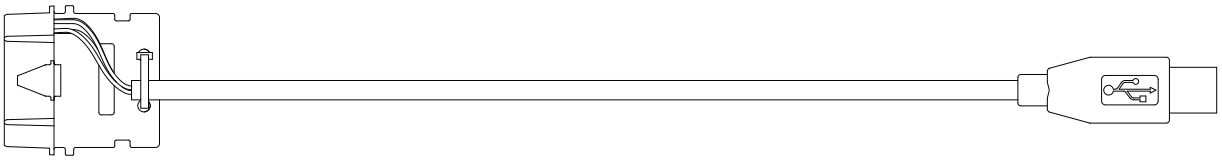


*Figure 2-2 Mobile & Repeater Rear Programming Cable PMKN4010_*

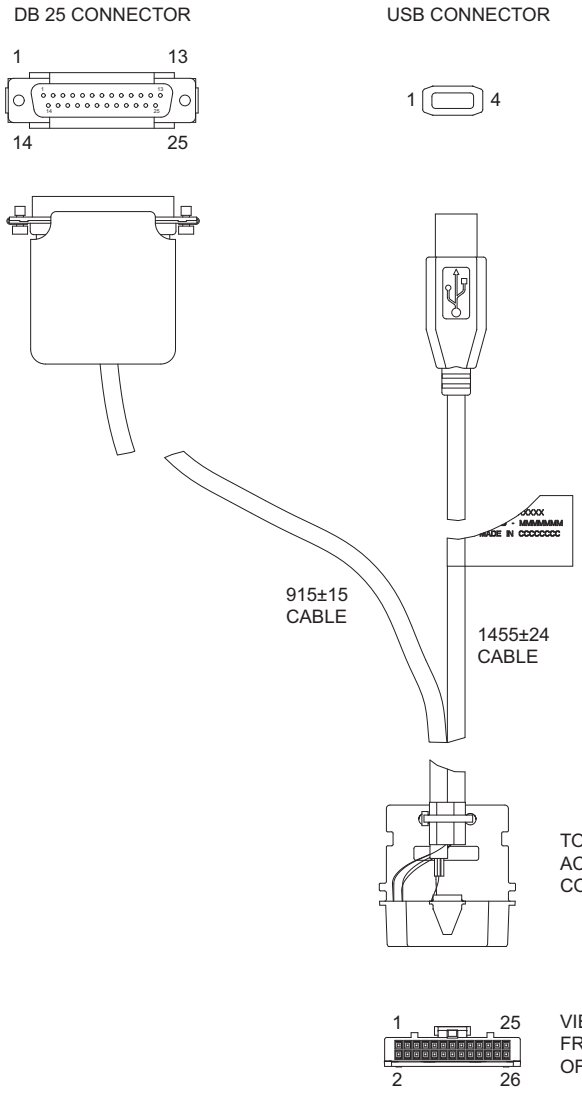


TABLE 2-3: WIRE DIAGRAM

26 PIN ACCESSORY PORT CONNECTOR		USB	DB25P
PIN NO.	DESCRIPTION		
3	VCC (5v)	1	
2	DATA -	2	
1	DATA +	3	
4	GND	4	
	DRAIN WIRE AND BRAID	SHELL	
9	SPEAKER -		7
11	EXT MIC		17
17	DIGI IN I (EXT PTT)		20
16	GND		16
10	SPEAKER +		1

*Figure 2-3 Mobile & Repeater Rear Accessory Programming and Test Cable PMKN4016_*

Notes

Chapter 3 Performance Checking

3.1 Handheld Control Head Test Mode

3.1.1 Entering Display Radio Test Mode

1. Turn the radio on.
2. Within ten seconds after self test is complete, press **button P2**, five times in succession.
3. The radio beeps and will show a series of displays that will give information regarding various version numbers and subscriber specific information. The displays are described in Table 3-1.

Table 3-1 Front Panel Access Test Mode Displays

Name of Display	Description	Appears
Service Mode	The literal string indicates the radio has entered test mode.	Always
Host Version	The version of host firmware.	Always
DSP Version	The version of DSP firmware.	Always
Model Number	The radio's model number as programmed in the codeplug.	Always
MSN	The radio's serial number as programmed in the codeplug.	Always
FLASHCODE	The FLASH codes as programmed in the codeplug.	Always
RF Band	The radio's band.	Always

NOTE: The radio stops at each display for 2 seconds before moving to the next information display. If the information cannot fit into 1 line, the radio display scrolls automatically character by character after 1 second to view the whole information. If the Top Navigation Button (▲) is pressed before the last information display, the radio shall suspend the information display until the user presses Bottom Navigation Button (▼) to resume the information display. The radio beeps for each button press. After the last display, RF Test Mode will be displayed.

3.1.2 Color Display Test Mode

1. Press and hold **button P1** in RF Test Mode. The radio beeps once and momentarily displays '**Display Test Mode**'.
2. On the next button press, the negative image of **Display Test Mode** will appear.
3. With each successive button press, the display background will change from Red, to Green, and then to Blue.
4. With each successive button press, a horizontal bar will increase in size and change color, from Red, to Green, to Blue, to Black, back to Red, to Green, to Blue, to Black, and finally, the entire display background will change to Red.
5. With each successive button press, vertical bars will grow and change color, from Red, to Green, to Blue, to Black, back to Red, and finally, the entire display background will change to Green.

6. On the next button press, the display will clear and 12 icons will appear at the top of the display.

3.1.3 LED Test Mode

1. Press and hold **button P1** after Display Test Mode. The radio beeps once and displays “LED Test Mode”.
2. Upon any button press, the radio lights on the red LED and displays “Red LED On”.
3. Consequently, upon any button press, the red LED is turned off and the radio lights on the green LED and displays “Green LED On”.
4. Consequently, upon any button press, the green LED is turned off and the radio shall light on the yellow LED and displays “Yellow LED On”.

3.1.4 Backlight Test Mode

1. Press and hold **button P1** after LED Test Mode. The radio beeps once and displays “Backlight Test Mode”.
2. The radio lights on both LCD and keypad backlight together.

3.1.5 Speaker Tone Test Mode

1. Press and hold **button P1** after Backlight Test Mode. The radio beeps once and displays “Speaker Tone Test Mode”.
2. The radio generates a 1 kHz tone with the internal speaker.

3.1.6 Earpiece Tone Test Mode

1. Press and hold **button P1** after Speaker Tone Test Mode. The radio beeps once and displays “Earpiece Tone Test Mode”.
2. The radio generates a 1 kHz tone with the earpiece.

NOTE: Not applicable for Handheld. Click next to proceed to Audio Loopback Test Mode.

3.1.7 Audio Loopback Test Mode

1. Press and hold **button P1** after Earpiece Tone Test Mode. The radio beeps once and displays “Audio Loopback Test Mode”.

NOTE: Expect a loud feedback noise.

2. The radio shall route any audio on the mic to the internal speaker.

3.1.8 Audio Loopback Earpiece Test Mode

1. Press and hold **button P1** after Audio Loopback Test Mode. The radio beeps once and displays “Audio Loopback Earpiece Test Mode”.
2. The radio shall route any audio on the mic to the accessory earpiece.

NOTE: Not applicable for Handheld. Click next to proceed to Button/Knob/PTT Test Mode.

3.1.9 Button/Knob/PTT Test Mode

1. Press and hold **button P1** after Audio Loopback Earpiece Test Mode. The radio beeps once and displays “Button Test” (line 1).
2. The radio also displays the button/knob/PTT Button Command Opcode (BCO) and state (BCO/state) on the screen (line 2) upon any button state changes.
3. The radio must be powered off to end Test Mode.

Notes

Chapter 4 Control Head Programming

4.1 Introduction

This chapter provides an overview of the MOTOTRBO™ Customer Programming Software (CPS), which is designed for use on a Windows 7/Vista operating system. These programs are available in one kit as listed in Table 4-1. An Installation Guide is also included with the kit.

NOTE: Refer to the appropriate program on-line help files for the programming procedures.

Table 4-1 Radio Software Program Kit

Description	Kit Number
MOTOTRBO™ CPS, Applications CD - (APME)	PMVN4130_
MOTOTRBO™ CPS, Applications CD - (NAG)	RVN5115_
MOTOTRBO™ CPS, Applications CD - (EA)	GMVN5141_

4.2 Customer Programming Software Setup

The Customer Programming Software setups, shown in Figure 4-1 and Figure 4-2, are used to program the radio.

NOTE: Refer to the appropriate program on-line help files for the programming procedures.

CAUTION: Computer USB ports can be sensitive to Electronic Discharge.
Do not touch exposed contacts on cable when connected to a computer.

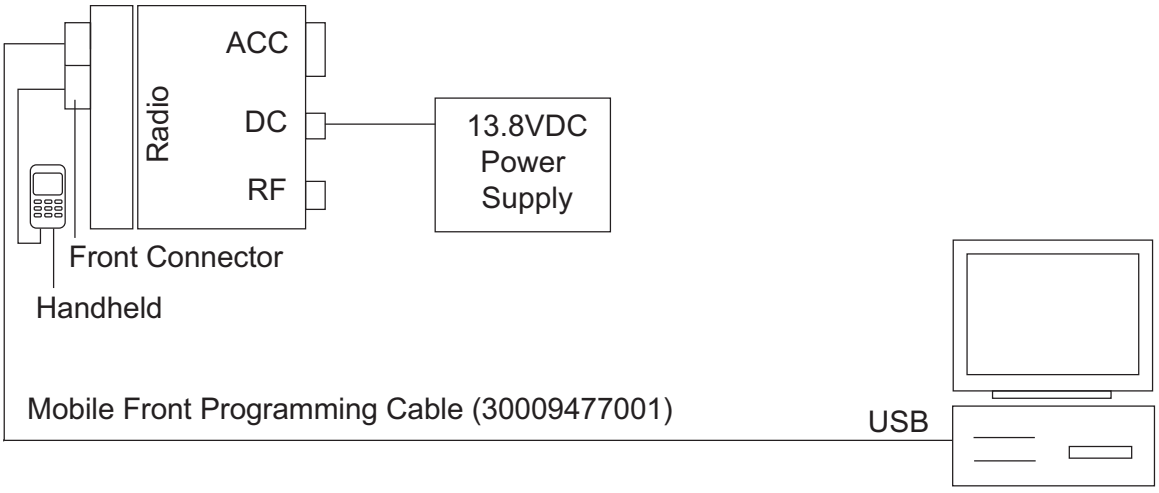


Figure 4-1 Customer Programming Software Setup from Front Connector

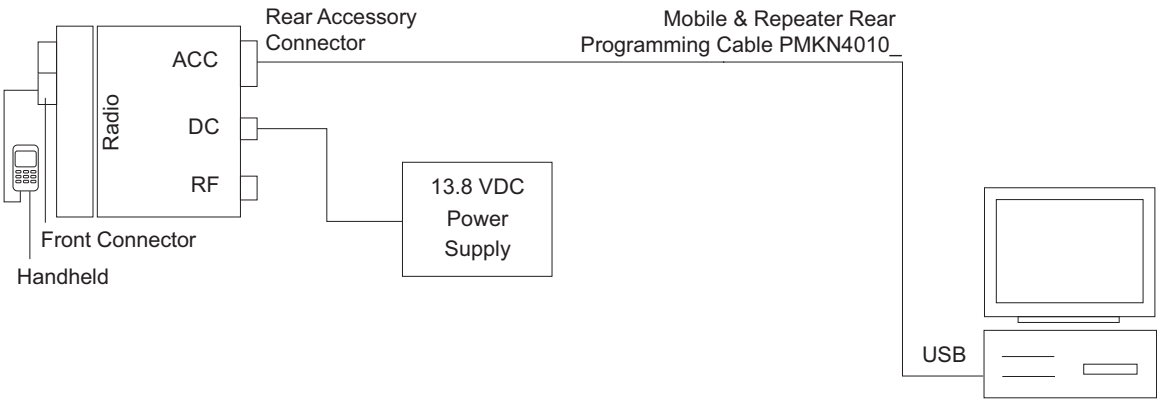


Figure 4-2 Customer Programming Software Setup from Rear Accessory Connector

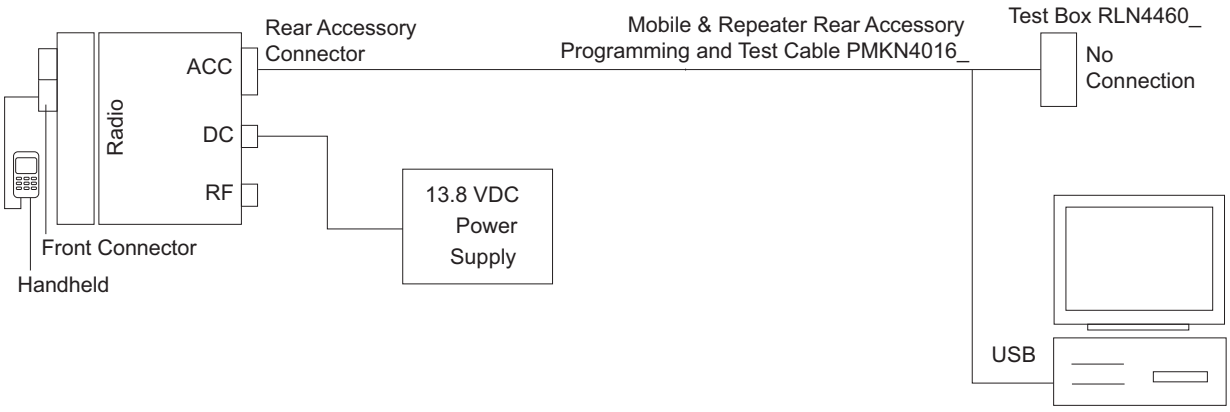


Figure 4-3 Customer Programming Software Setup with Test Box Connection

4.3 Software Version

Firmware version MOTOTRBO™ 2.4 R02.40.00 or later MUST be programmed into the radio for proper operation of the control head configuration. The control head must be attached to the radio to perform firmware upgrade at the same time. This is to ensure that both the control head and radio have the same software version.

Chapter 5 Disassembly/Reassembly Procedures

5.1 Introduction

This chapter provides details about the following:

- Preventive maintenance (inspection and cleaning).
- Safe handling of CMOS and LDMOS devices.
- Repair procedures and techniques.
- Disassembly and reassembly of the Control Head.

5.2 Preventive Maintenance

Periodic visual inspection and cleaning is recommended.

5.2.1 Inspection

Check that the external surfaces of the Control Head are clean, and that all external controls and switches are functional. It is not recommended to inspect the interior electronic circuitry.

5.2.2 Cleaning Procedures

The following procedures describe the recommended cleaning agents and the methods to be used when cleaning the external and internal surfaces of the Control Head. These surfaces should be cleaned whenever a periodic visual inspection reveals the presence of smudges, grease, and/or grime.

NOTE: Internal surfaces should be cleaned only when the Control Head is disassembled for service or repair.

The only recommended agent for cleaning the external Control Head surfaces is a 0.5% solution of a mild dishwashing detergent in water. The only factory recommended liquid for cleaning the printed circuit boards and their components is isopropyl alcohol (100% by volume).

Caution

Use all chemicals as prescribed by the manufacturer. Be sure to follow all safety precautions as defined on the label or material safety data sheet.

The effects of certain chemicals and their vapors can have harmful results on certain plastics. Avoid using aerosol sprays, tuner cleaners and other chemicals.

Cleaning External Plastic Surfaces

Apply the 0.5% detergent-water solution sparingly with a stiff, non-metallic, short-bristled brush to work all loose dirt away from the Control Head. Use a soft, absorbent, lintless cloth or tissue to remove the solution and dry the Control Head. Make sure that no water remains entrapped near the connectors, cracks, or crevices.

Cleaning Internal Circuit Boards and Components

Isopropyl alcohol (100%) may be applied with a stiff, non-metallic, short-bristled brush to dislodge embedded or caked materials located in hard-to-reach areas. The brush stroke should direct the dislodged material out and away from the inside of the Control Head. Make sure that controls or tunable components are not soaked with alcohol. Do not use high-pressure air to hasten the drying process since this could cause the liquid to collect in unwanted places. Once the cleaning process is complete, use a soft, absorbent, lintless cloth to dry the area. Do not brush or apply any isopropyl alcohol to the frame, control head and housing assembly.

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

5.3 Safe Handling of CMOS and LDMOS Devices

Complementary Metal Oxide Semiconductor (CMOS) and Laterally Diffused Metal Oxide Semiconductor (LDMOS) devices are used in this Control Head, and are 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.

Handling precautions are mandatory for CMOS/LDMOS circuits and are especially important in low humidity conditions.

DO NOT attempt to disassemble the Control Head without first referring to the following CAUTION statement.

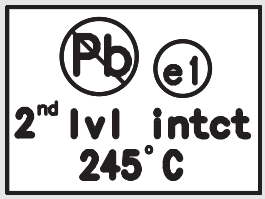
Caution

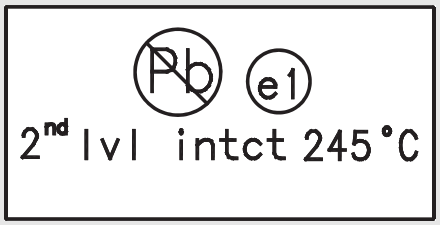
This Control Head contains static-sensitive devices. Do not open the Control Head unless you are properly grounded. Take the following precautions when working on this unit:

- Store and transport all CMOS/LDMOS devices in conductive material so that all exposed leads are shorted together. Do not insert CMOS/LDMOS devices into conventional plastic “snow” trays used for storage and transportation of other semiconductor devices.
- Ground the working surface of the service bench to protect the CMOS/LDMOS device. We recommend using a wrist strap, two ground cords, a table mat, a floor mat, ESD shoes, and an ESD chair.
- Wear a conductive wrist strap in series with a 100k resistor to ground. (Replacement wrist straps that connect to the bench top covering are Motorola part number 4280385A59).
- Do not wear nylon clothing while handling CMOS/LDMOS devices.
- Do not insert or remove CMOS/LDMOS devices with power applied. Check all power supplies used for testing CMOS/LDMOS devices to be certain that there are no voltage transients present.
- When straightening CMOS/LDMOS pins, provide ground straps for the apparatus used.
- When soldering, use a grounded soldering iron.
- If at all possible, handle CMOS/LDMOS devices by the package and not by the leads. Prior to touching the unit, touch an electrical ground to remove any static charge that you may have accumulated. The package and substrate may be electrically common. If so, the reaction of a discharge to the case would cause the same damage as touching the leads.

5.4 Repair Procedures and Techniques – General

NOTE Environmentally Preferred Products (EPP) (refer to the marking on the printed circuit boards – examples shown below) were developed and assembled using environmentally preferred components and solder assembly techniques to comply with the European Union's **Restriction of Hazardous Substances (ROHS) Directive 2002/95/EC** and **Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC**. To maintain product compliance and reliability, use only the Motorola specified parts in this manual.





Any rework or repair on Environmentally Preferred Products must be done using the appropriate lead-free solder wire and lead-free solder paste as stated in the following table:

Table 5-1 Lead Free Solder Wire Part Number List

Motorola Part Number	Alloy	Flux Type	Flux Content by Weight	Melting Point	Supplier Part number	Diameter	Weight
1088929Y01	95.5Sn/3.8Ag/0.7Cu	RMA Version	2.7–3.2%	217°C	52171	0.015"	1lb spool

Table 5-2 Lead Free Solder Paste Part Number List

Motorola Part Number	Manufacturer Part Number	Viscosity	Type	Composition & Percent Metal	Liquid Temperature
1085674C03	NC-SMQ230	900–1000KCPs Brookfield (5rpm)	Type 3 (-325/+500)	(95.5%Sn-3.8%Ag-0.7%Cu) 89.3%	217°C

Parts Replacement and Substitution

Check the parts list for the proper Motorola part number and order the part from the nearest Motorola Radio Products and Solutions Organization listed in Appendix A of this manual.

Rigid Circuit Boards

This Control Head 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, exercise care to avoid pulling the plated circuit out of the hole.

When soldering near a connector:

- Avoid accidentally getting solder in the connector.
- Be careful not to form solder bridges between the connector pins.
- Examine your work closely for shorts due to solder bridges.

5.5 Disassembling and Reassembling the Control Head– General

Since these Control Head may be disassembled and reassembled with the use of only ten screws (board to housing), it is important to pay particular attention to the snaps and tabs, and how parts align with each other.

The following tools are required for disassembling and assembling the Control Head:

- Small Flat Blade Screwdriver
- Control Head Dismantling Tool (Motorola Part No. 6686119B01)
- Torque Driver (2-36 lbs-in or 0.2-4.0 N-m), (Motorola Part No. RSX4043A)
- TORX™ T8 Driver Bit (Motorola Part No. 6680387A72)
- TORX Plus™ 6IP Driver Bit
- Phillips No.2 Screwdriver
- Plastic Tweezer

If a unit requires more complete testing or service than is customarily performed at the basic level, please send Control Head to a Motorola Service Center listed in Appendix A.

The following disassembly procedures should be performed only if necessary.

5.5.1 Cable Disassembly from Transceiver Adapter

1. Unscrew the jack screws counter clockwise by using Phillips no.2 screwdriver and remove the cable from transceiver adapter as shown in Figure 5-1.

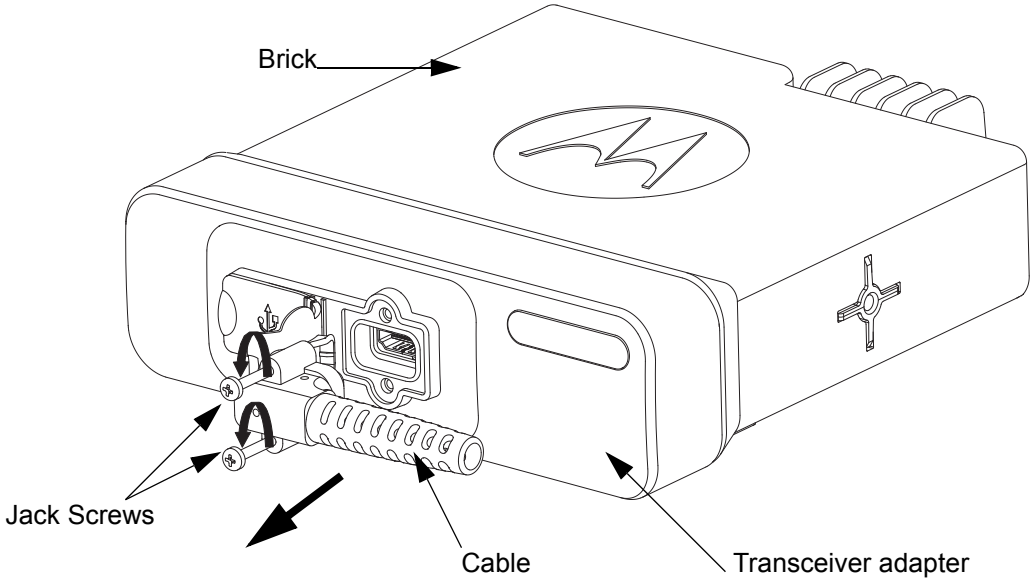


Figure 5-1 Cable Removal

5.5.2 Transceiver Adapter Removal

1. Disengage the transceiver adapter from brick with a dismantle tool as shown in Figure 5-2.

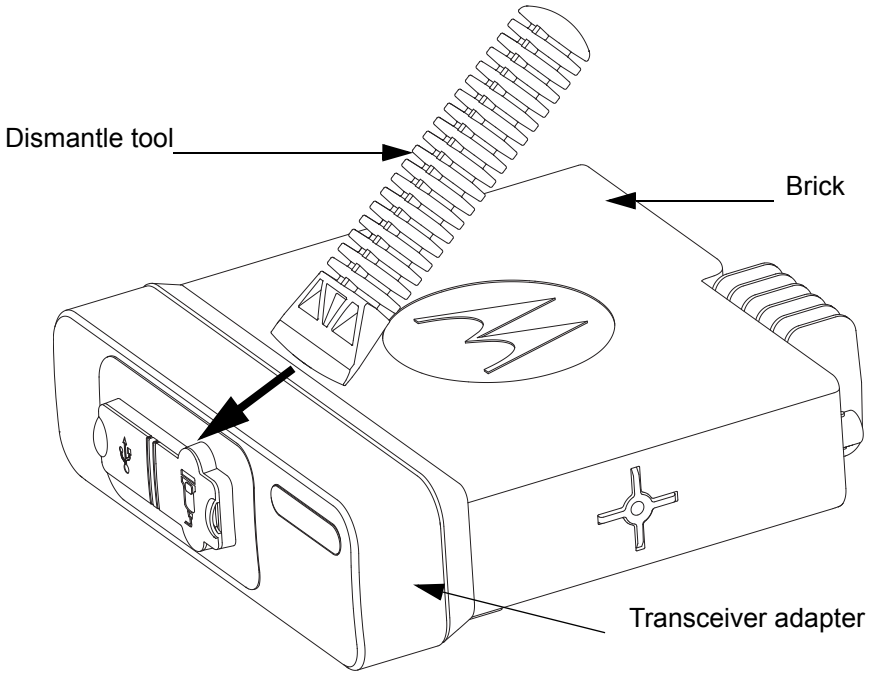


Figure 5-2 Transceiver Adapter Removal

2. Remove the control head flex from brick as shown in Figure 5-3.

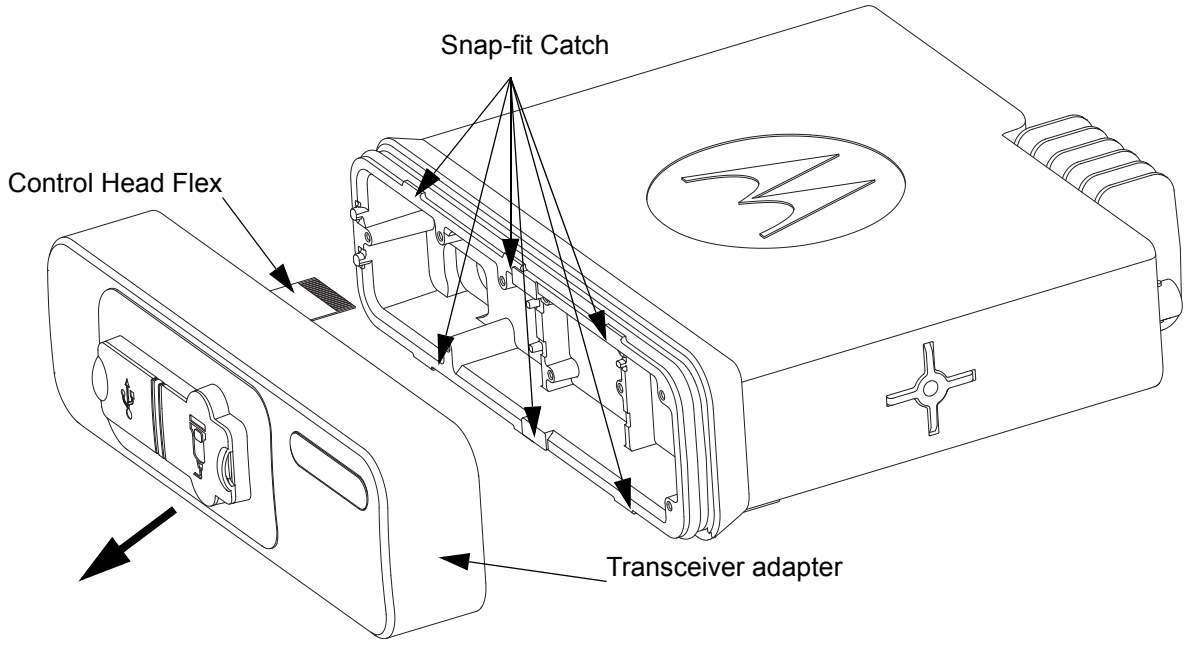


Figure 5-3 Control Head Removal

5.5.3 Cable Disassembly from Handheld Control Head

1. Disassemble the cable from the connector and unlock the cable by twisting the collar clockwise as shown in Figure 5-4.

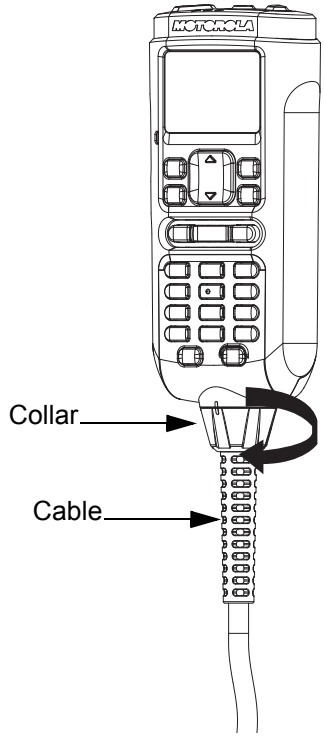


Figure 5-4 Collar twisting

2. Pull the cable downwards as shown in Figure 5-5.

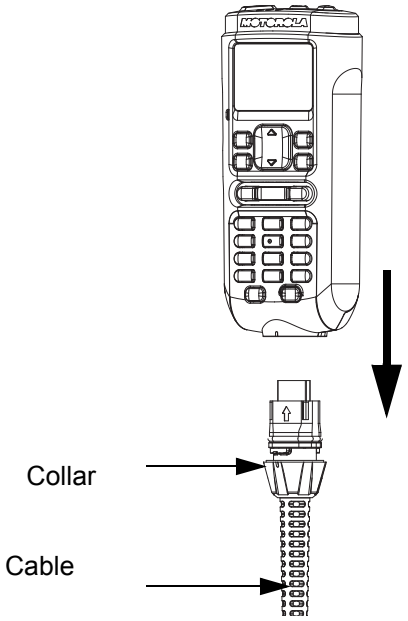


Figure 5-5 Cable Removal

5.5.4 Handheld Control Head Disassembly

1. Remove the two screws from the back housing by using TORX Plus™ 6IP driver as shown in Figure 5-6.

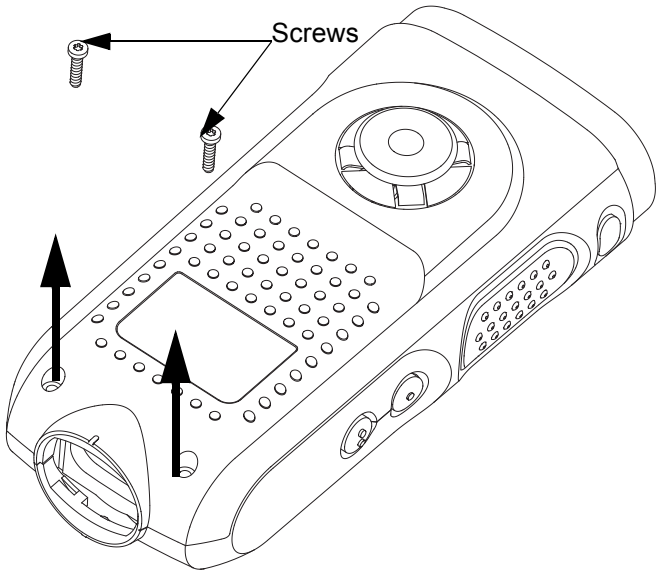


Figure 5-6 Screws Removal

2. Separate the back housing from the front housing by pulling it upwards as shown in Figure 5-7.

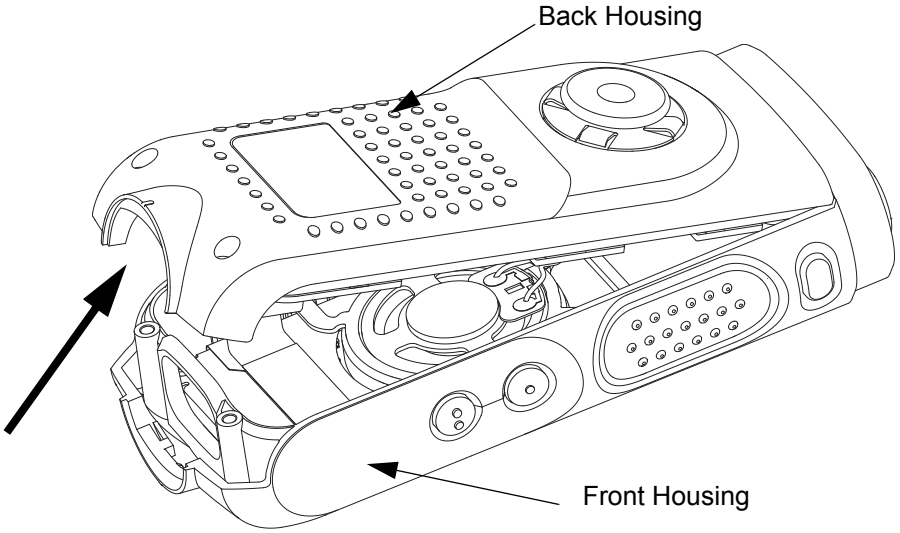


Figure 5-7 Back Housing Removal

3. Disassemble the back housing from the front housing. Unplug the speaker & mic wire from the 4 pin connector. After that, lift the 20 pin connector latch and release the keypad flex as shown in Figure 5-8.

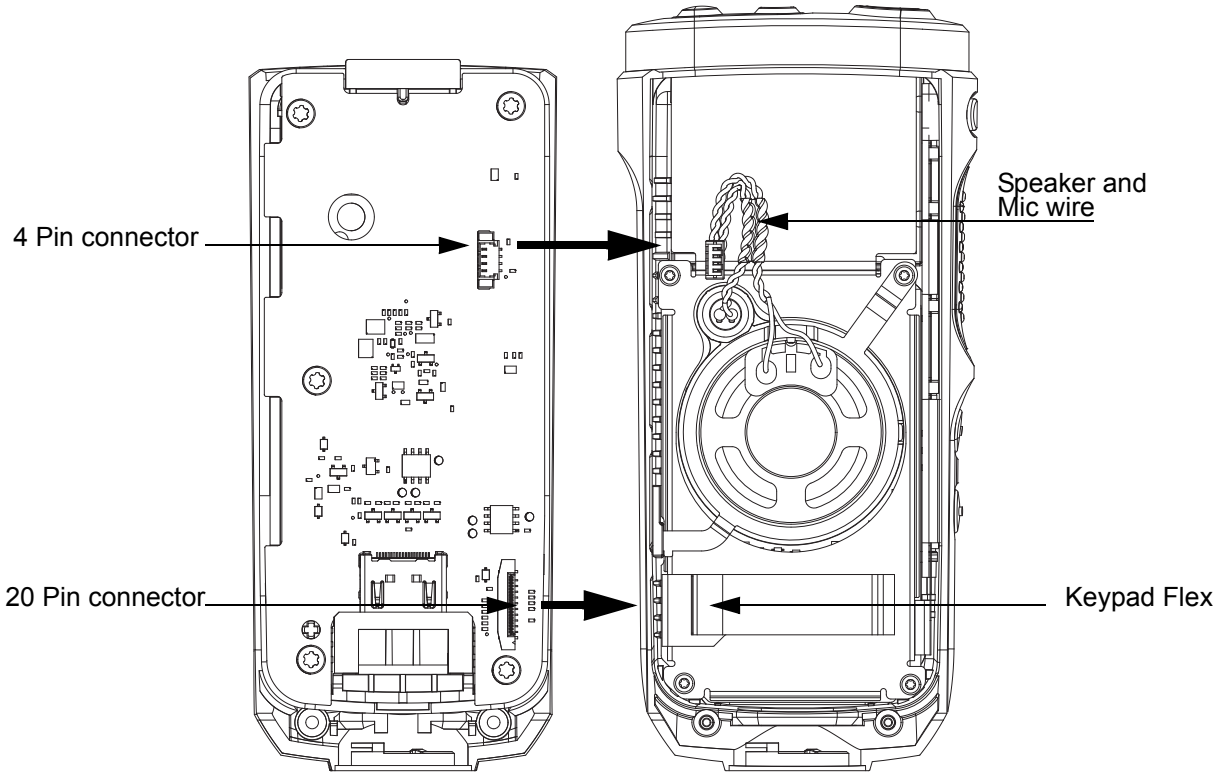


Figure 5-8 Speaker and Mic Wire Removal

5.5.5 Handheld Back Housing Removal

1. Remove the five screws with T8 TORX™ driver to remove the control head main board as shown in Figure 5-9.

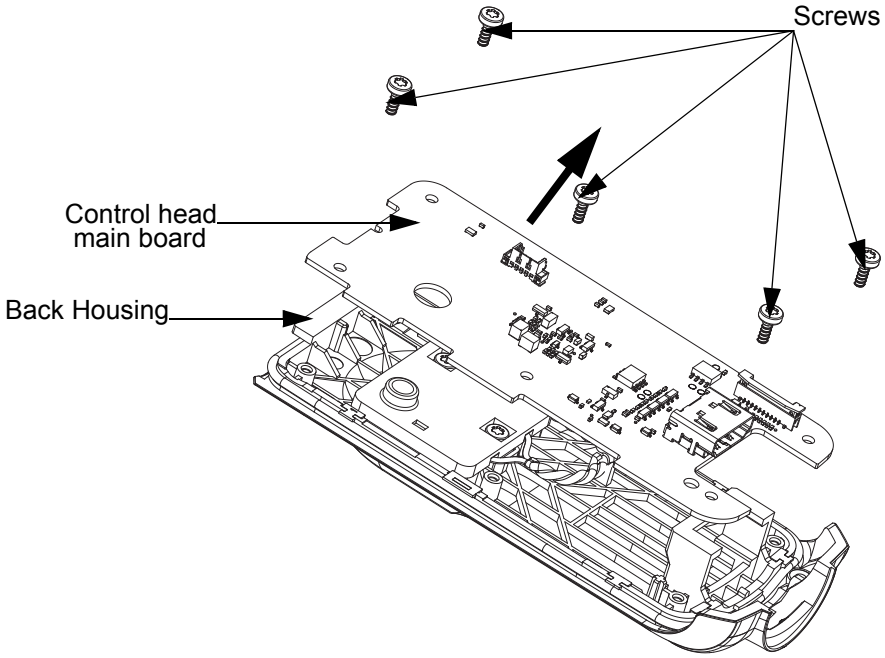


Figure 5-9 Back Housing Screws Removal

2. Disconnect the hang-up board assembly wire from the main board by pulling it downwards as shown in Figure 5-10.

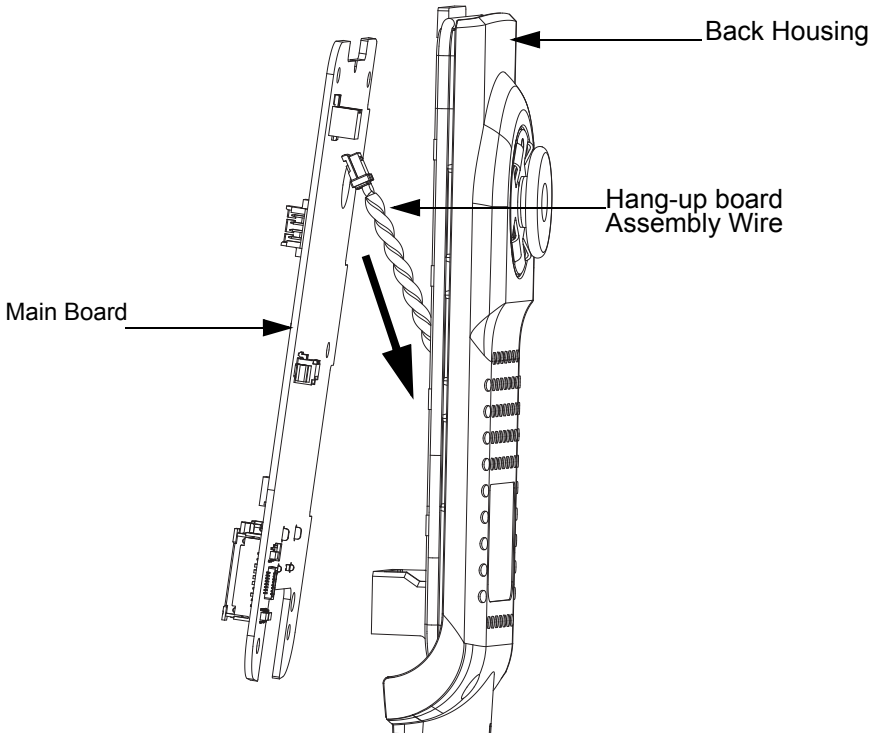


Figure 5-10 Insulation Cap Assembly Removal

3. Remove the O-ring by releasing all the tabs from the catches on the back housing as shown in Figure 5-11

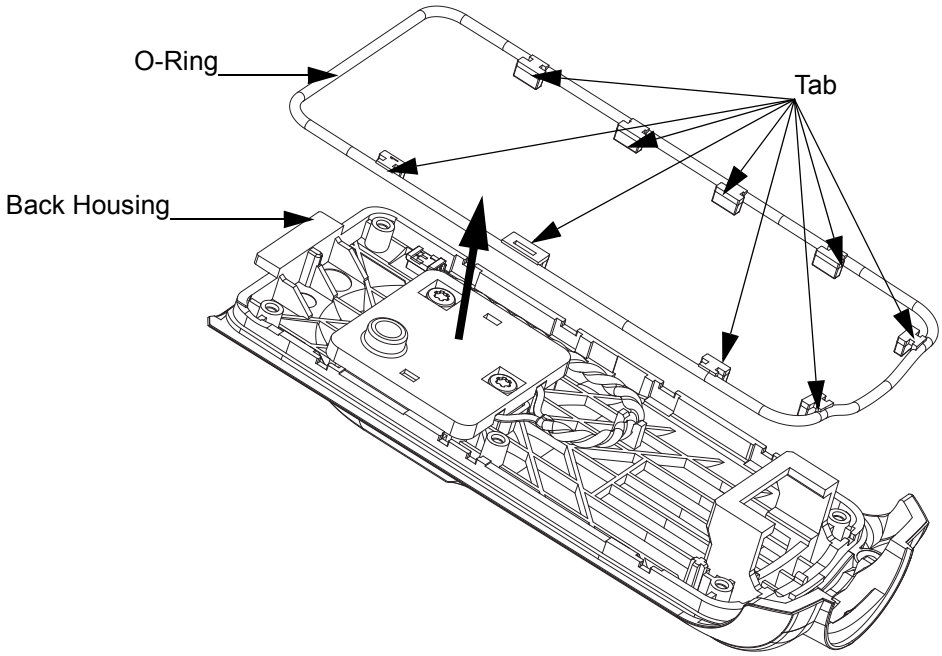


Figure 5-11 O-ring Removal

5.5.6 Handheld Front Housing Removal

1. Remove speaker and mic wire by pulling it to the right. Remove the mic together with mic boot from the speaker tray mic slot as shown in Figure 5-12.

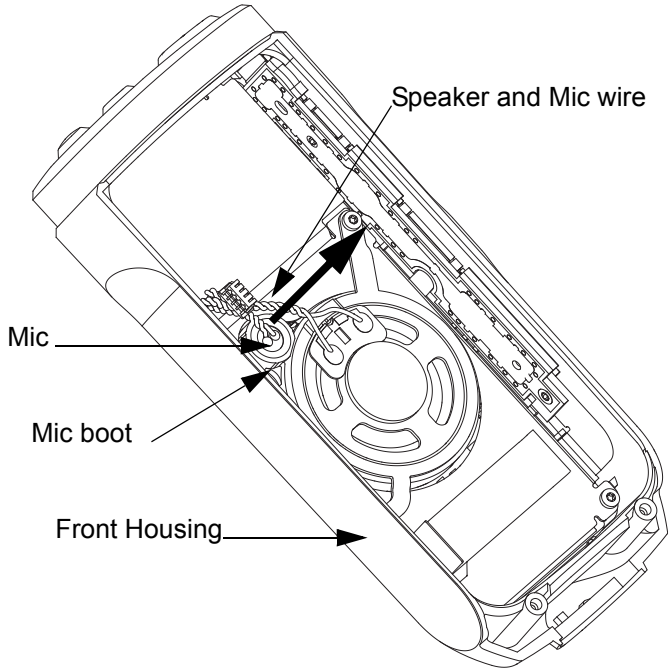


Figure 5-12 Speaker and Mic Wire Removal

2. Remove the screw with TORX Plus™ 6IP driver to remove speaker retainer as shown in Figure 5-13.

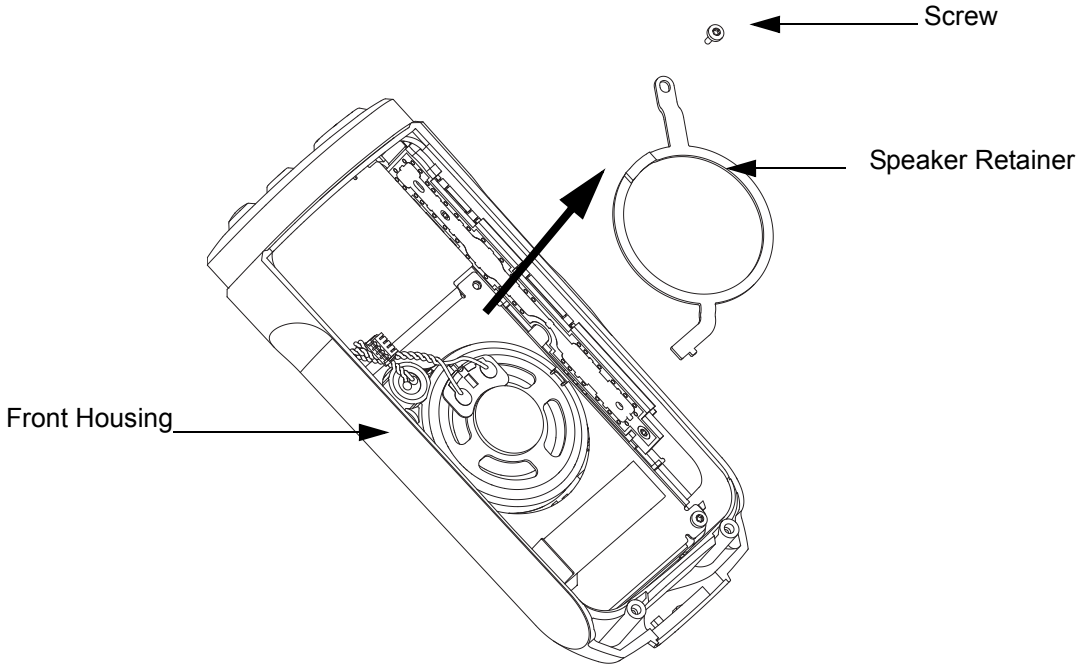


Figure 5-13 Speaker Retainer Removal

3. Remove the speaker and mic wire from speaker tray as shown in Figure 5-14.

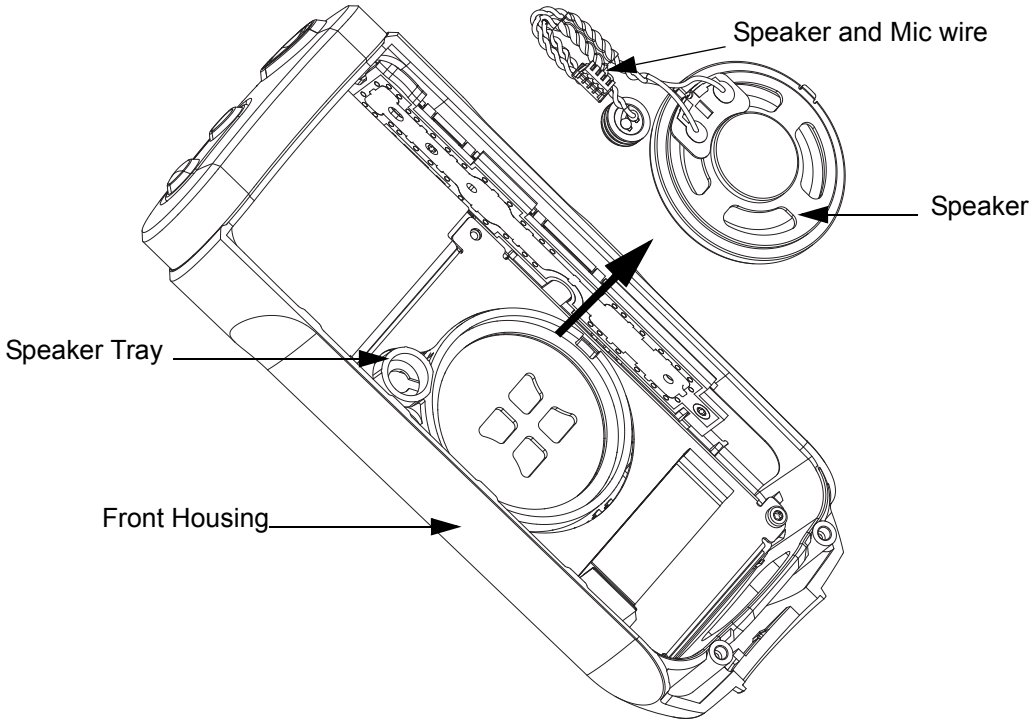


Figure 5-14 Speaker and Mic Boot Removal

4. Remove the three (3) screws with TORX Plus™ 6IP driver and remove the keypad and display retainer from the front housing as shown in Figure 5-15.

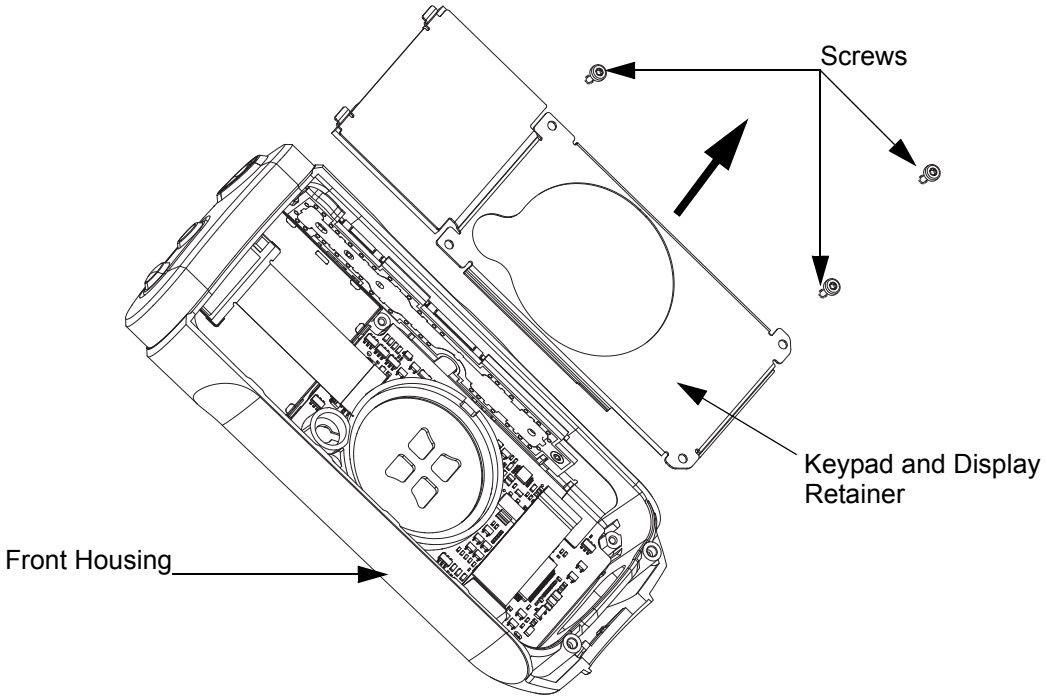


Figure 5-15 Keypad and Retainer Removal

5. Remove the 26 pin connector latch by using the flat-blade screwdriver and release the color display flex from keypad board. After that, remove the color display, then remove the PTT flex from the 20 pin connector as seen in Figure 5-16.

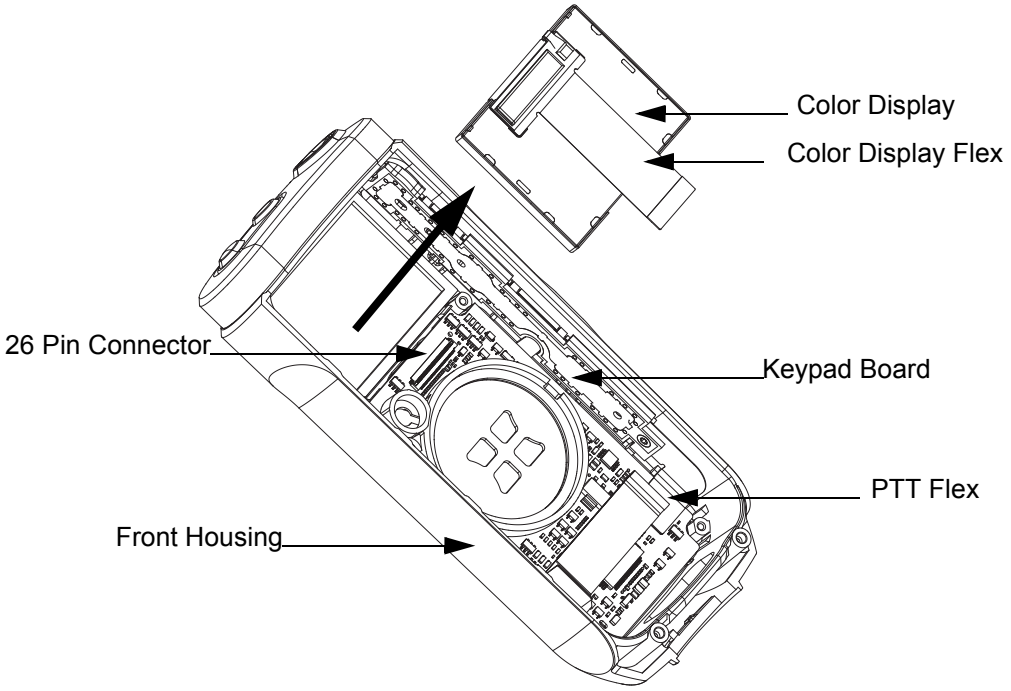


Figure 5-16 Color Display Removal

6. Remove the keypad board (together with speaker tray and keypad flex) from the front housing as shown in Figure 5-17.

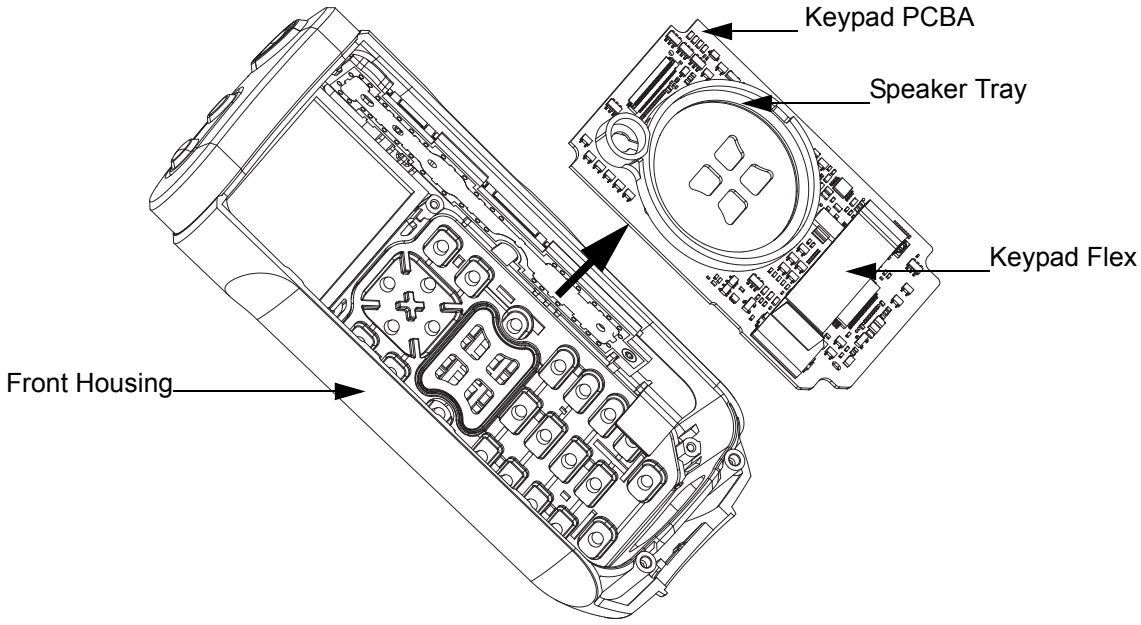


Figure 5-17 Keypad Board Removal

7. Remove keypad from the front housing as shown in Figure 5-18.

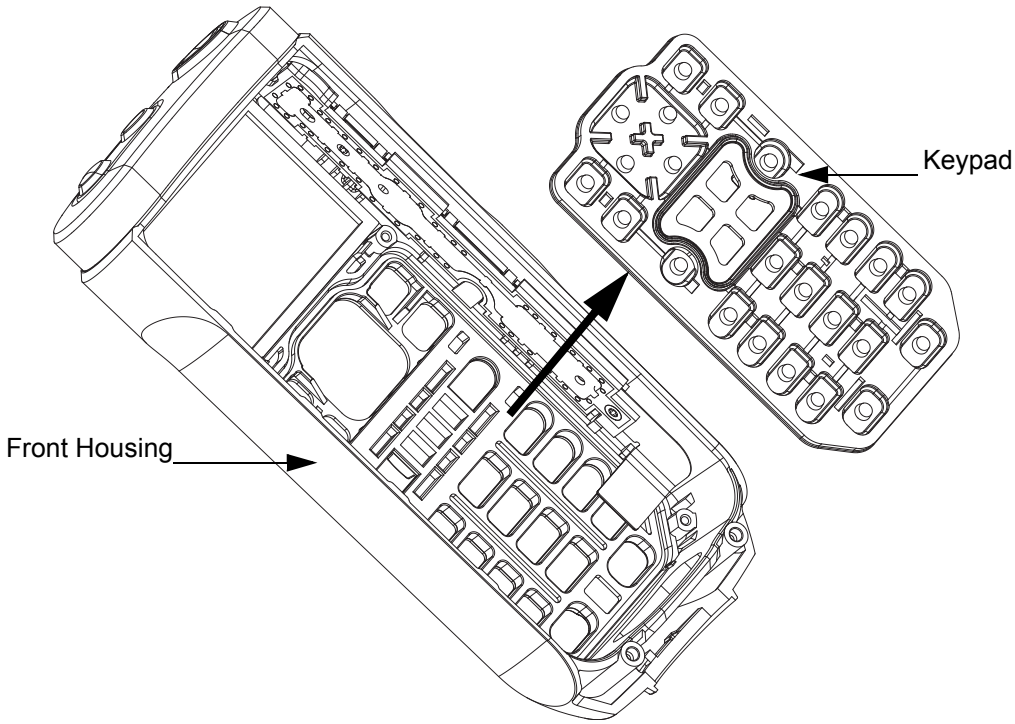


Figure 5-18 Keypad Removal

8. Release the PTT Paddle with the plastic tweezer by inserting it into the middle point of the PTT Paddle as shown in Figure 5-19.

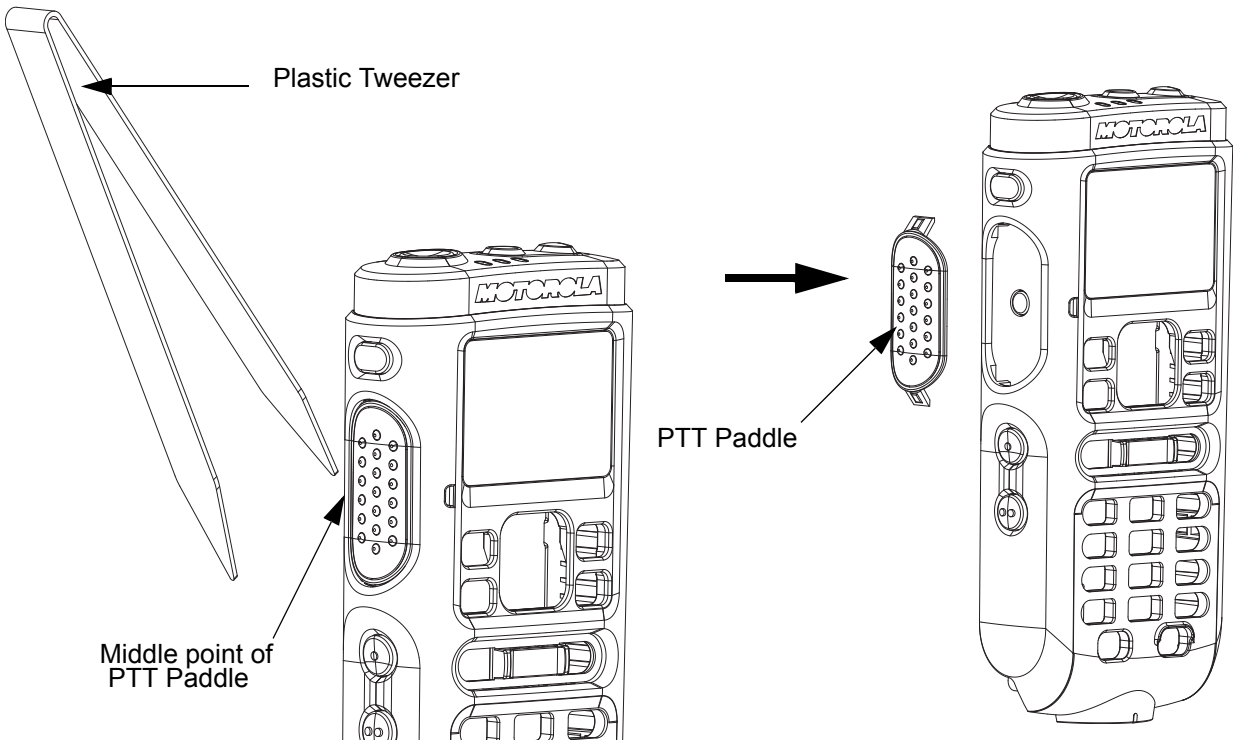


Figure 5-19 PTT Paddle Removal

5.5.7 Handheld Front Housing Reassembly

1. Reassemble the PTT Paddle by inserting the bottom tab (thinner tab) to the bottom of the catch. Then slightly bend the PTT paddle to insert the top tab (wider tab) into the top catch as shown in Figure 5-20.

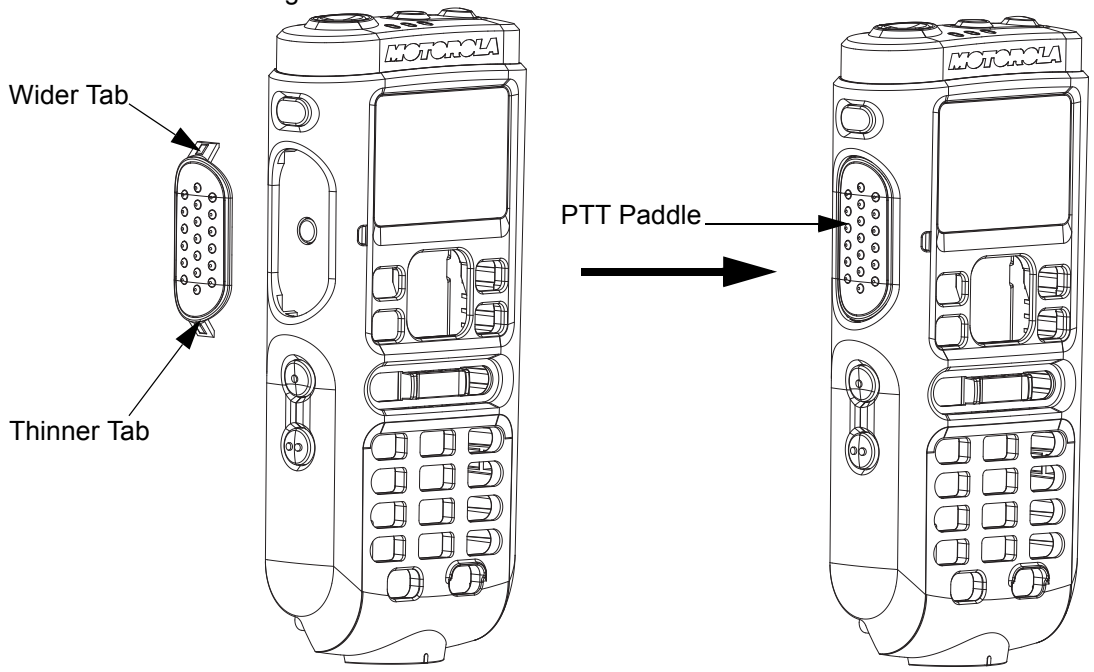


Figure 5-20 PTT Paddle Reassembly

2. Reassemble the keypad to front housing. Ensure that the sealing rib on the keypad is fully inserted into the housing groove at keypad area as show in Figure 5-21.

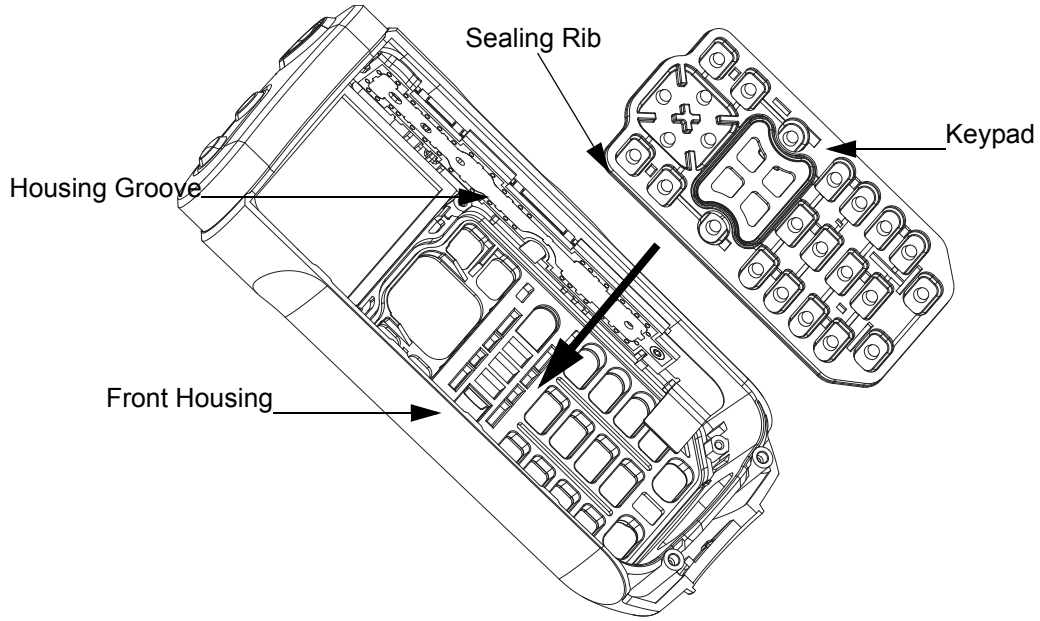


Figure 5-21 Back Housing Reassembly

NOTE: Pinching of sealing rib is not allowed.

3. Reassemble the keypad board (together with speaker tray and keypad flex) to the front housing as shown in Figure 5-22.

NOTE: Please ensure that the PTT Flex is not hidden when reassembling the keypad board.

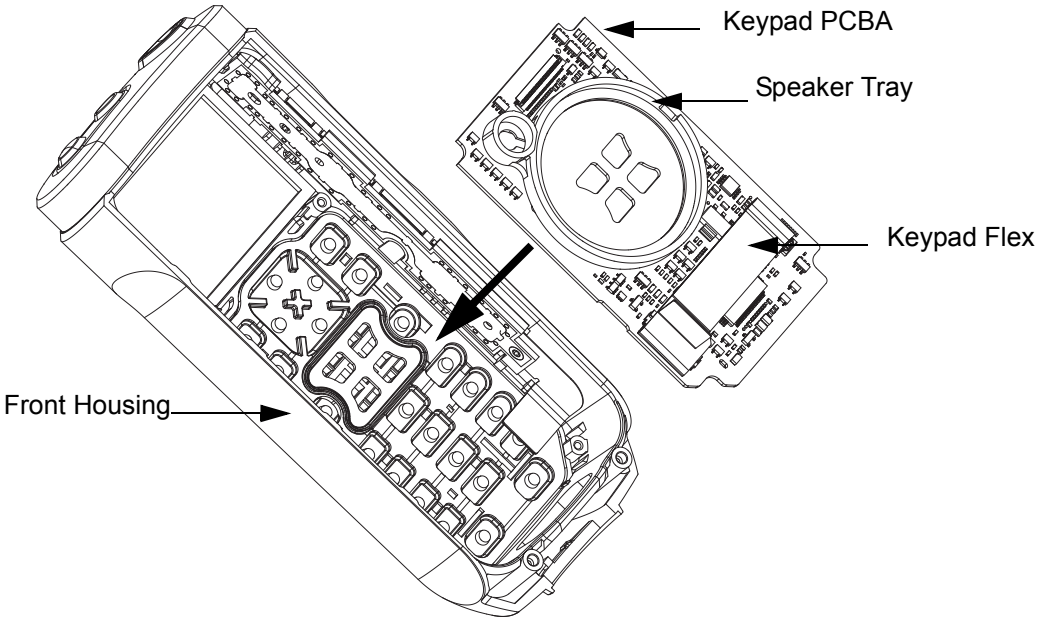


Figure 5-22 Keypad Board Reassembly

4. Reassemble the color display to the front housing. Reconnect the color display flex to the 26 pin connector and PTT flex to 20 pin connector as shown in Figure 5-23.

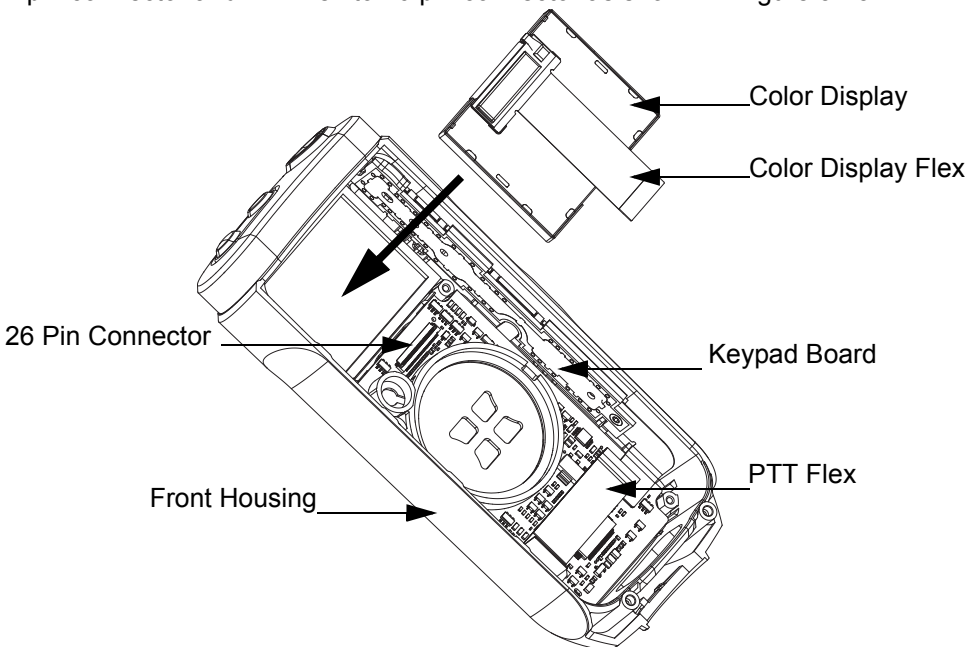


Figure 5-23 Color Display Reassembly

5. Remove keypad flex before assembling the keypad and display retainer to the front housing. Insert the keypad and display retainer onto housing slot and fasten the screws (following the sequence shown) with TORX Plus™ 6IP driver, using torque of 1.5~1.7 lb.in. After the three screws are fasten, ensure that the keypad flex is outside of the keypad and display retainer as shown in Figure 5-24.

NOTE: Please ensure that the Keypad Flex is not hidden when reassembling.

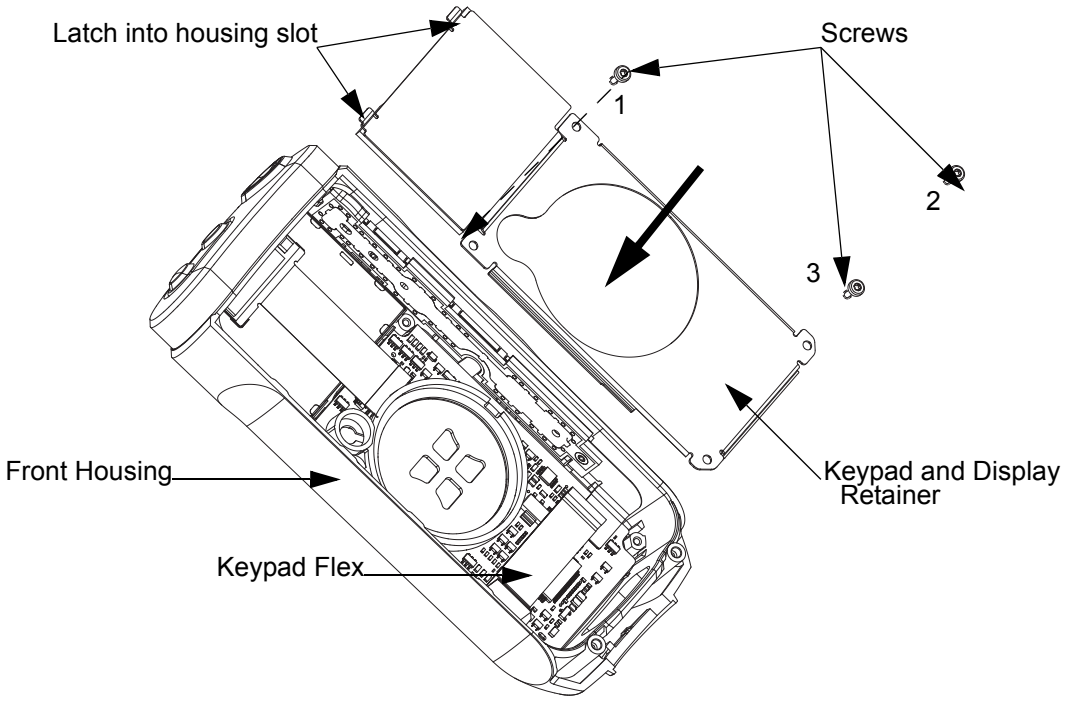


Figure 5-24 Keypad and Retainer Reassembly

6. Reassemble the speaker and cross the mic wire through the internal speaker retainer as shown in Figure 5-25.

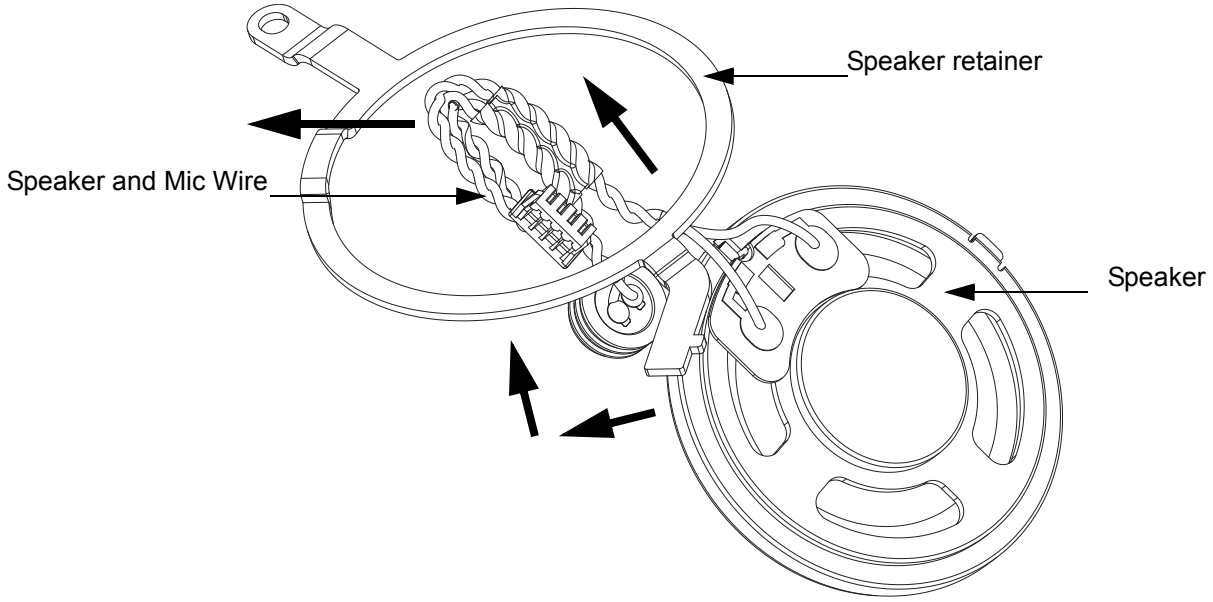


Figure 5-25 Speaker Retainer Reassembly

7. Reassemble the speaker and mic wire together with the speaker retainer onto speaker tray and insert it into the keypad board as shown in Figure 5-26.

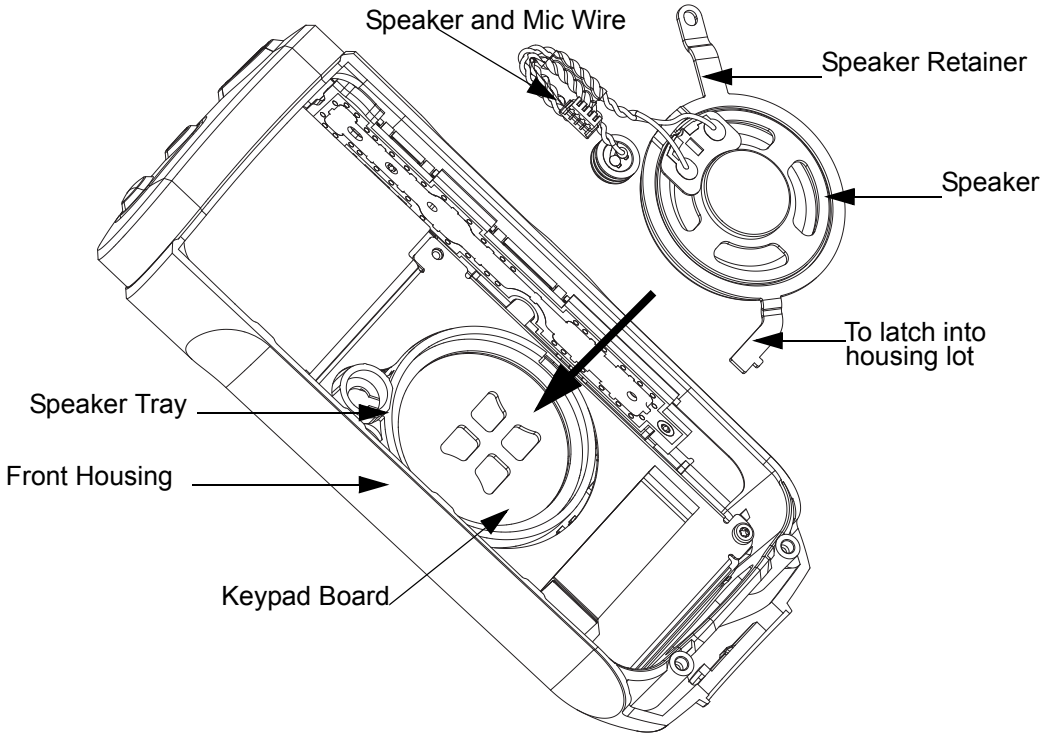


Figure 5-26 Speaker Reassembly

8. Latch in the speaker retainer onto the housing slot. After that, reassemble the mic to the mic slot as shown in Figure 5-27.

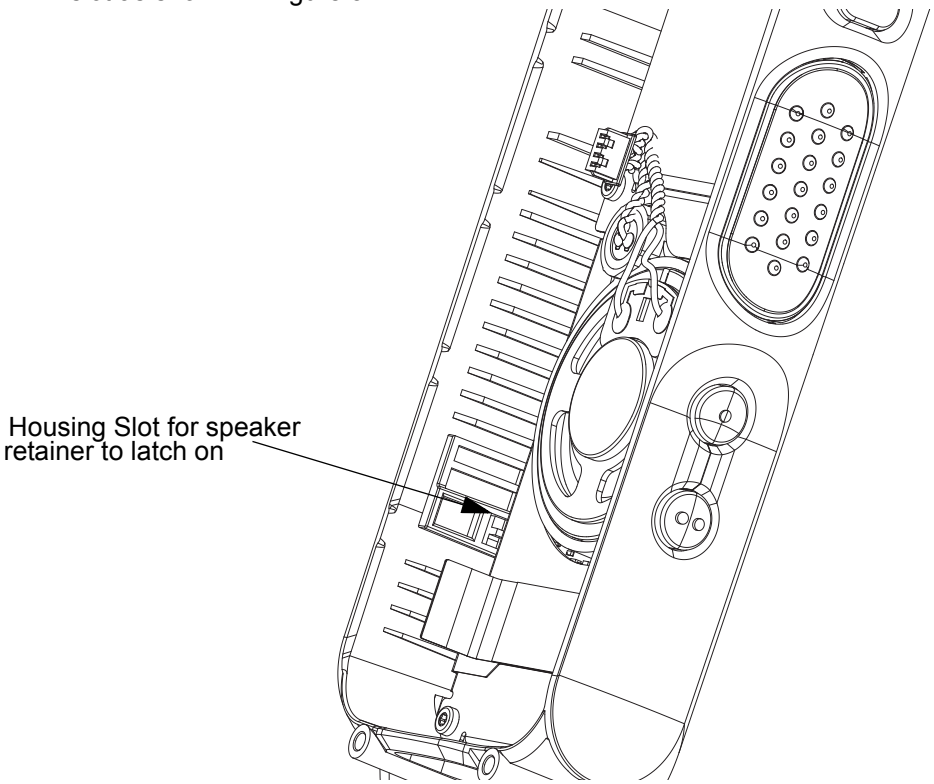


Figure 5-27 Latching Speaker Retainer to Housing Slot

9. Fasten the screw with TORX Plus™ 6IP driver (1.5~1.7 lb.in.) to secure the speaker retainer to the front housing as shown in Figure 5-28.

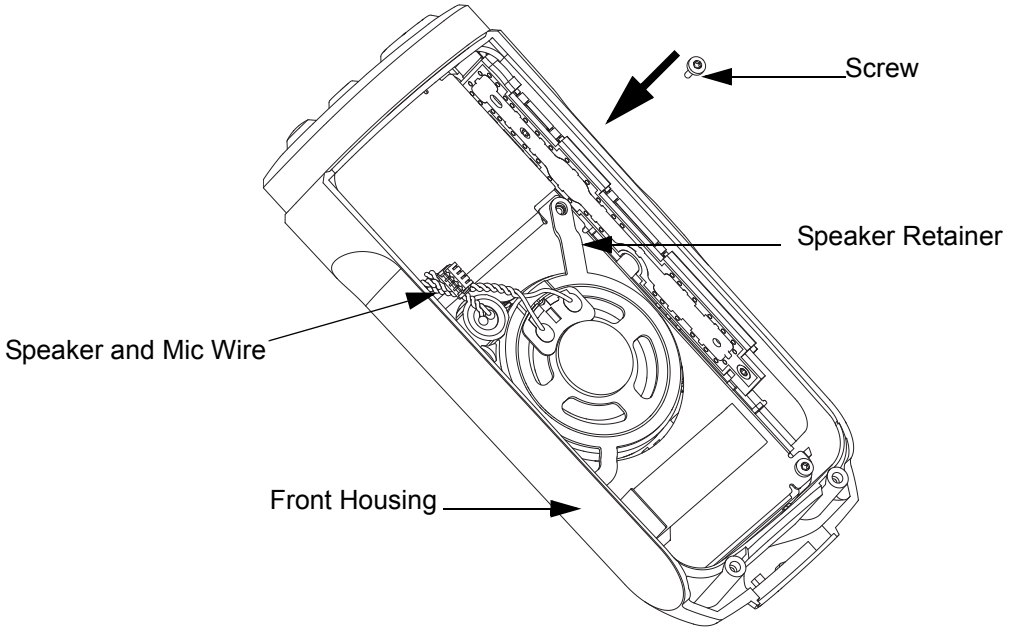


Figure 5-28 Speaker Retainer Reassembly

10. Reassemble the mic by inserting it down the housing mic slot. Ensure that the mic (with mic boot) is totally inserted into the housing slot as shown in Figure 5-31.

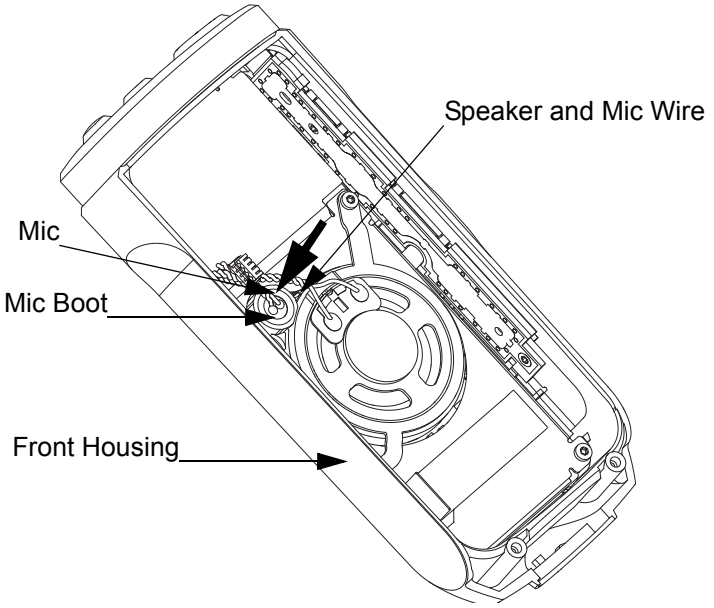


Figure 5-29 Mic Reassembly

5.5.8 Handheld Back Housing Reassembly

1. Reassemble the O-ring by latching all the tabs onto the back housing as shown in Figure 5-30.

NOTE: Pinching and poor assembly is not allowed as this is critical for good sealing performance.

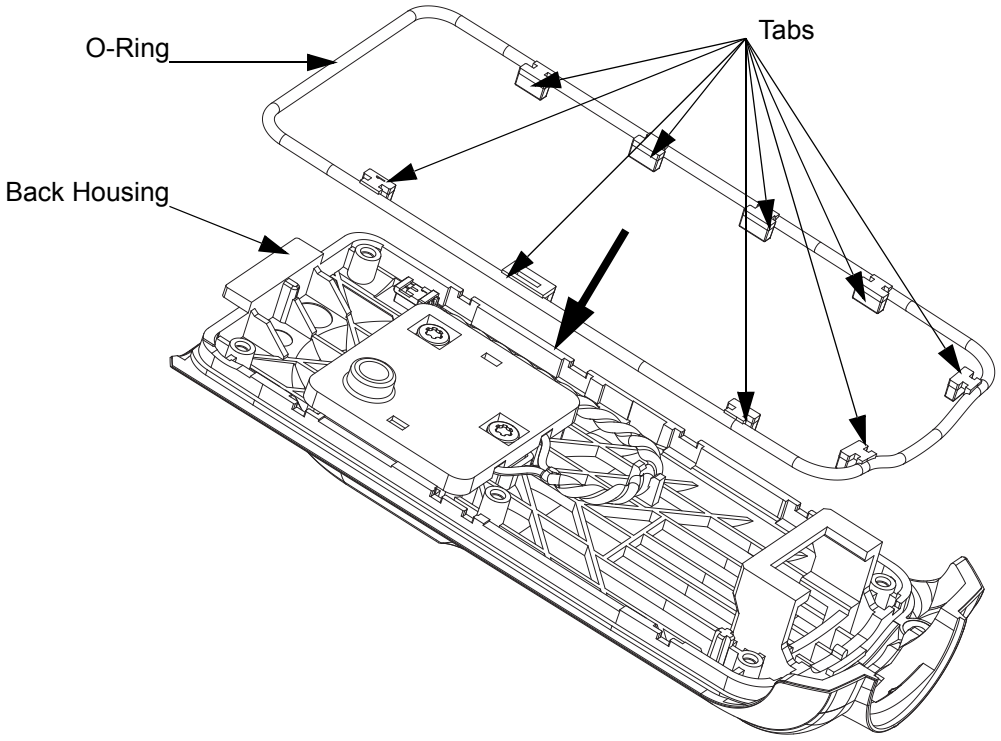


Figure 5-30 O-ring Reassembly

2. Ensure that the hang-up board is connected to the main board as shown in Figure 5-31

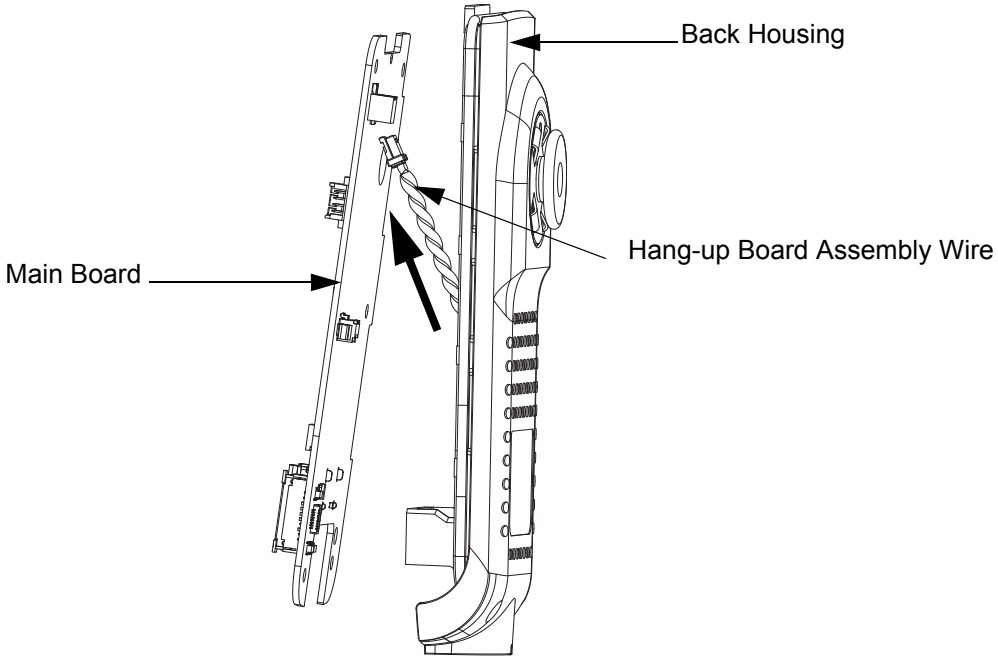


Figure 5-31 Hang-up Board Assembly

3. Fasten the five screws with T8 TORX™ driver (3.6~4.4 lb.in) to reassemble the main board onto the back housing following the sequence shown in Figure 5-32.

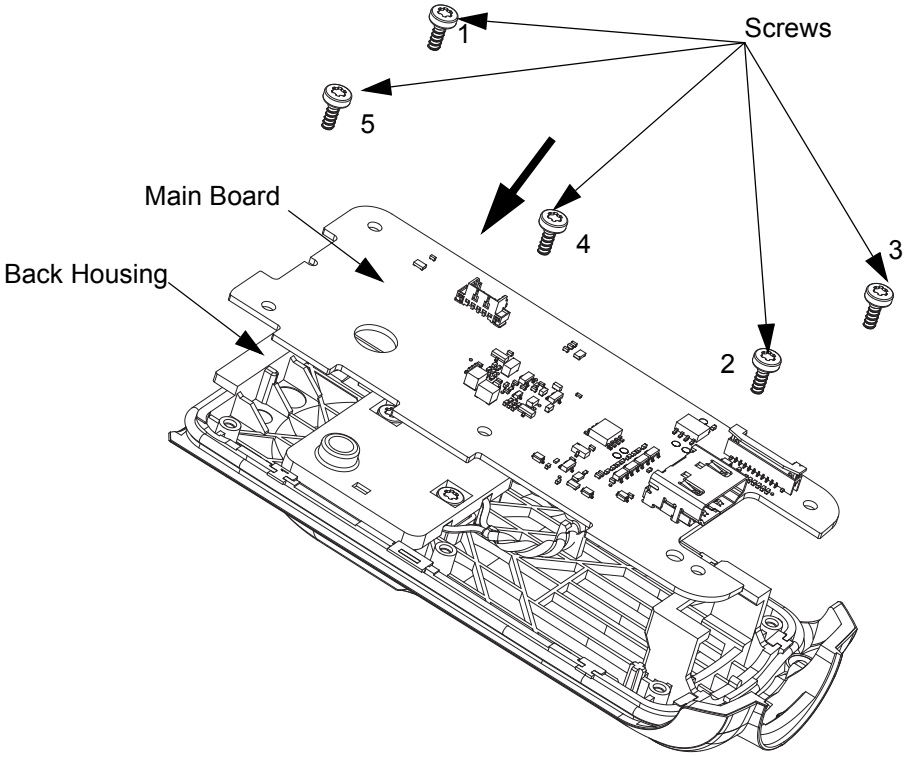


Figure 5-32 Main Board Reassembly

5.5.9 Handheld Control Head Reassembly

1. Reassemble the back housing to the front housing and plug the speaker and mic wire to the 4 pin connector to the board. After that, insert the keypad flex into the 20 pin connector by locking the latch as shown in Figure 5-33.

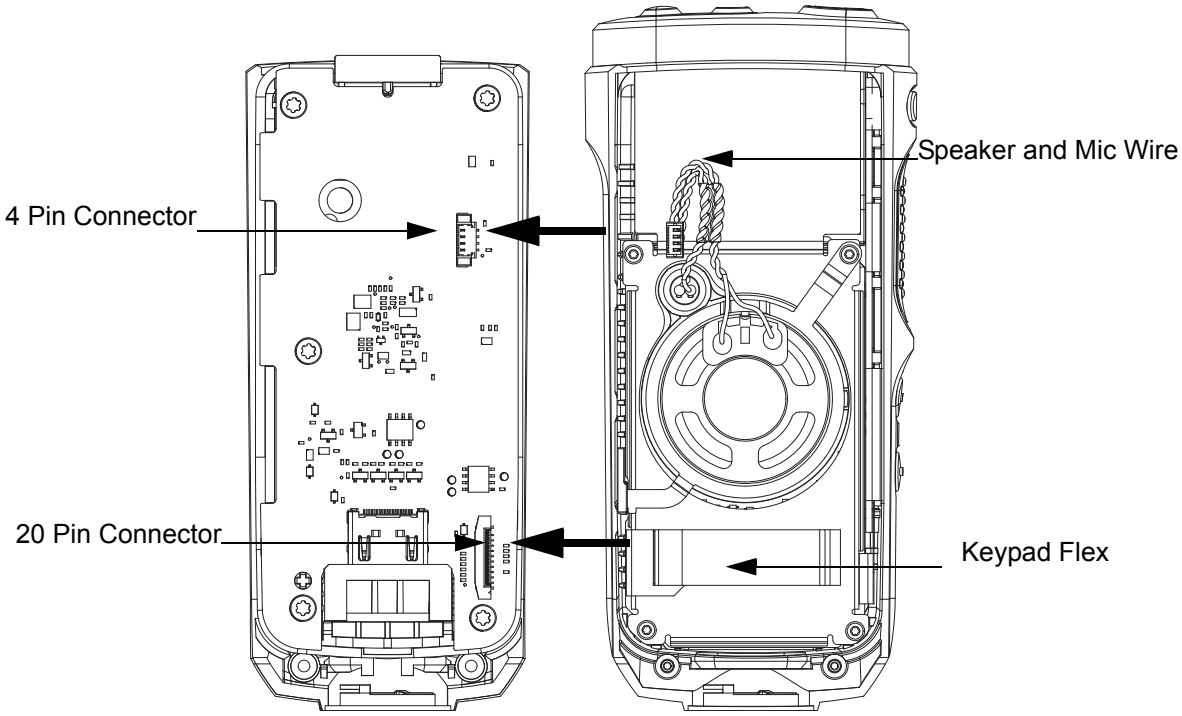


Figure 5-33 Front and Back Housing Reassembly

2. Latch in the back housing onto the front housing as shown in Figure 5-34.

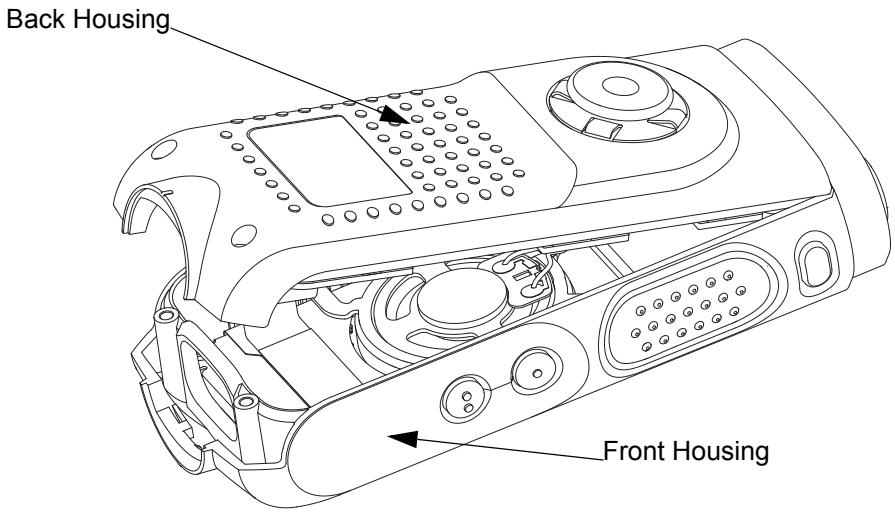


Figure 5-34 Back Housing Reassembly

3. Fasten the two screws with TORX Plus™ 6IP driver with the torque of (2.9~3.1 lb.in) as shown in Figure 5-35.

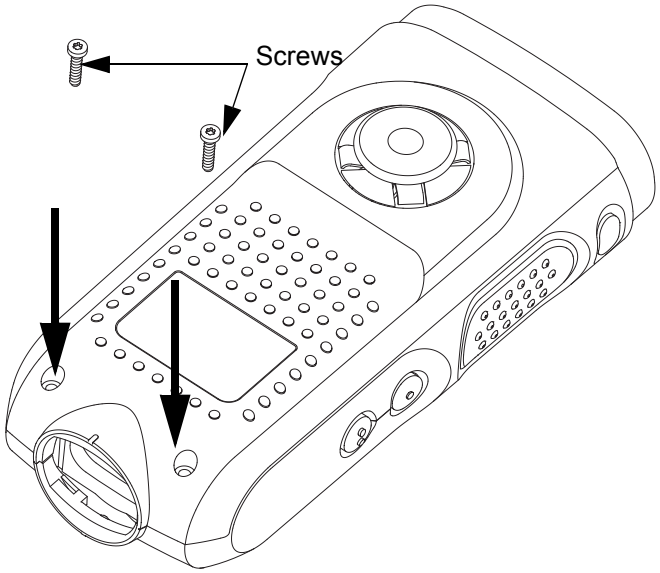


Figure 5-35 Back Housing Reassembly

5.5.10 Cable Reassembly for Handheld Control Head

1. Reassemble the cable to the handheld connector and twist the collar of the cable counter clockwise as shown in Figure 5-36.

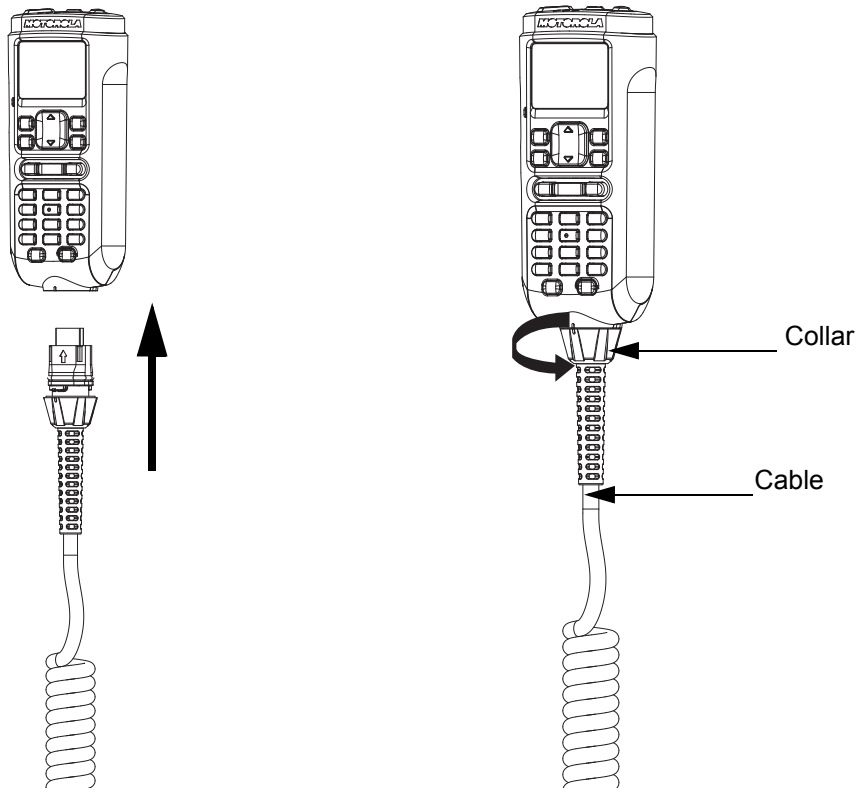


Figure 5-36 Handheld Control Head Cable Installation

5.5.11 Transceiver Adapter Reassembly

1. Reattach the control head flex to chassis as shown in Figure 5-37.

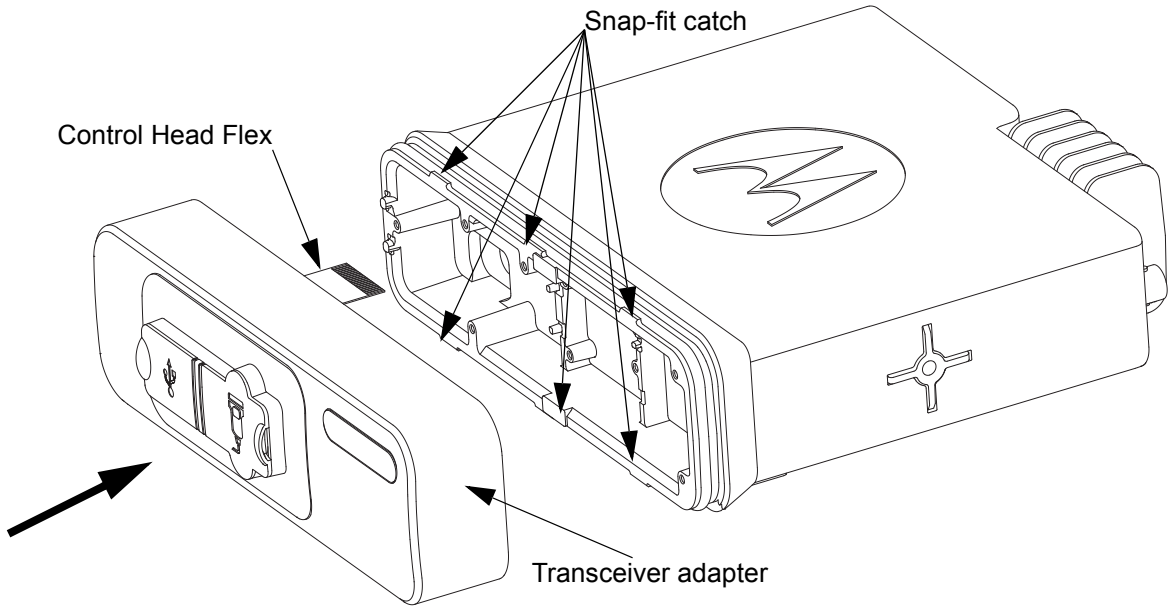


Figure 5-37 Transceiver Adapter Attachment

2. Reattach the transceiver adapter to chassis by snapping the transceiver into the chassis catch as shown in Figure 5-38.

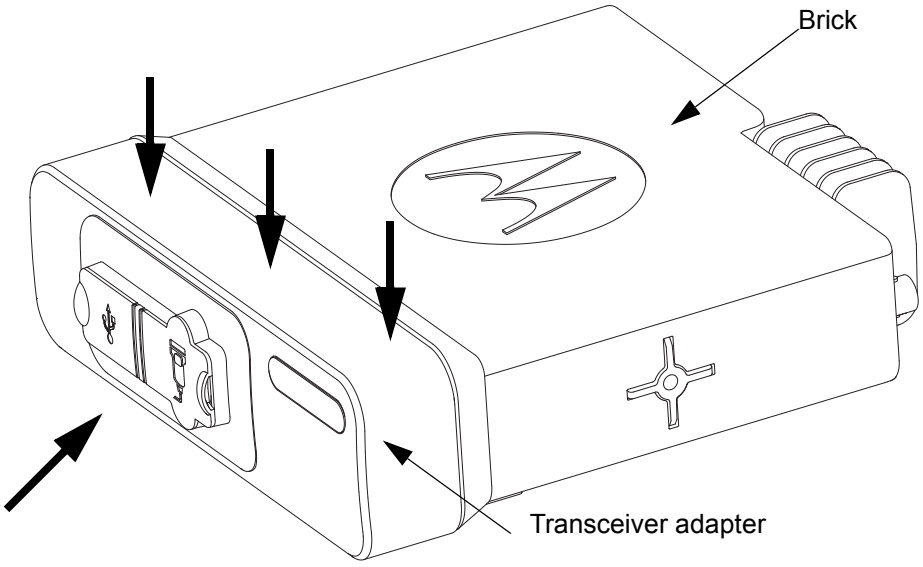


Figure 5-38 Transceiver Adapter to Chassis Attachment

5.5.12 Cable Reassembly to Transceiver Adapter

1. Lift the dust cover before inserting the cable to transceiver adapter and tighten the two jack screws clockwise by using Phillips no.2 screwdriver (1.9~2.1 lb.in) as shown in Figure 5-39.

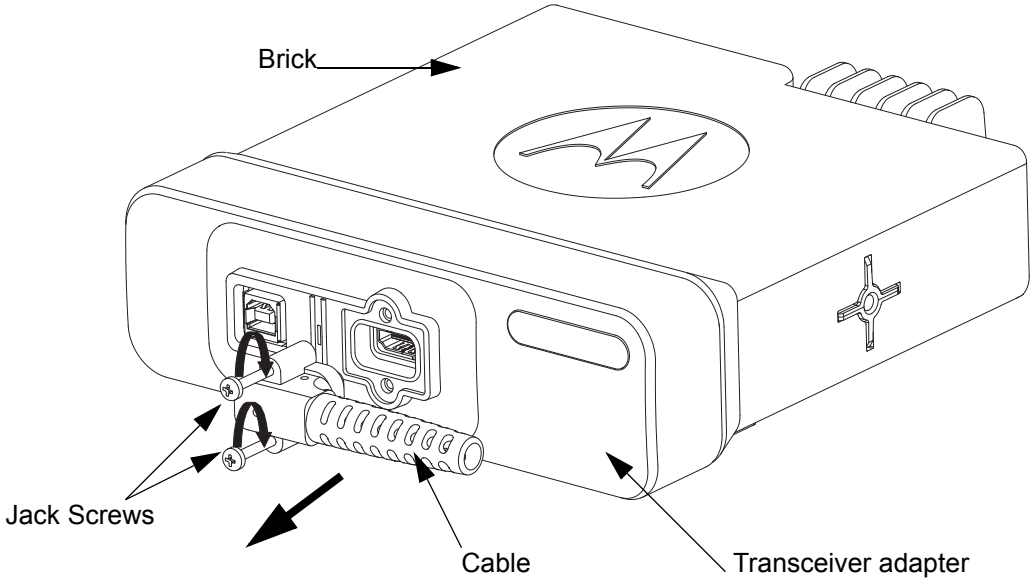


Figure 5-39 Cable Reassembly to Transceiver Adapter

5.6 Exploded Mechanical Views and Parts Lists

5.6.1 Control Head Assembly Exploded View and Parts List

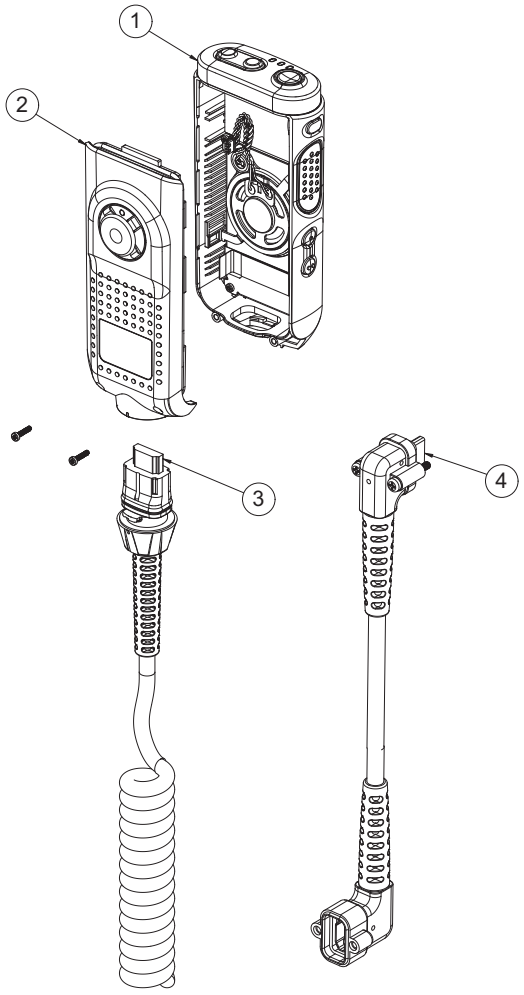


*Figure 5-40 Control Head Assembly Exploded View for PMLN7032_*

Table 5-3 Control Head Exploded View Parts List (PMLN7032_)

Item No.	Description	Part Number
1	Front Housing Assembly	0104063J14
2	Back Housing Assembly	0104063J17
3	3 Meter Main Coiled Cable	PMKN4173_*
4	5 Meter Straight Extension Cable	PMKN4174_*

NOTE:

PMKN4173_* is not structured under PMLN7032_

PMKN4174_* is not structured under PMLN7032_

5.6.2 Control Head Assembly Exploded View and Parts List for Front Housing

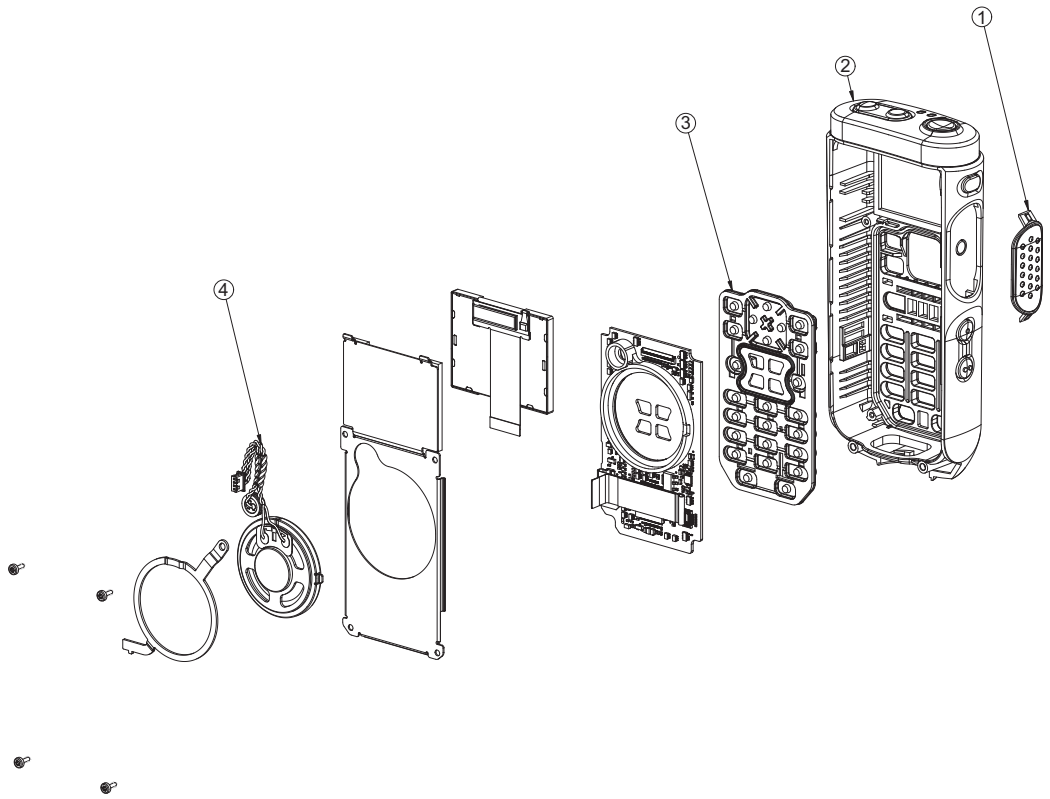


Figure 5-41 Control Head Assembly Exploded View for Front Housing for 0104063J14

Table 5-4 Control Head Exploded View Parts List (0104063J14)

Item No.	Description	Part Number
1	PTT Paddle	HN000328A01
2	Front Housing USW Accessory	0104063J15
3	Keypad	KP000035A01
4	Speaker and Mic Assembly	0104063J16

5.6.3 Control Head Assembly Exploded View and Parts List for Back Housing

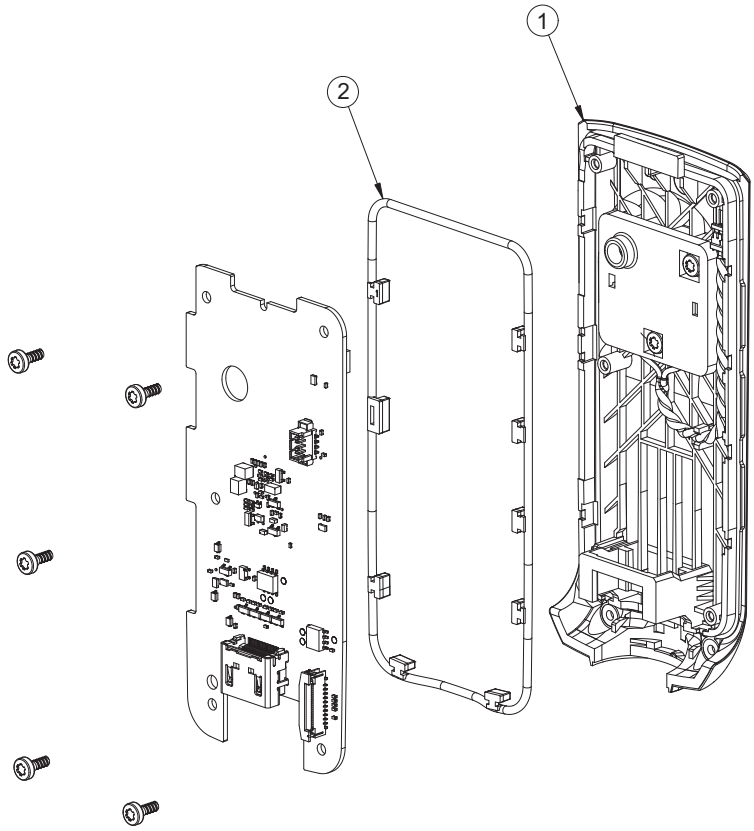


Figure 5-42 Control Head Assembly Exploded View for HCH Back Housing for 0104063J17

Table 5-5 Control Head Exploded View Parts List (0104063J17)

Item No.	Description	Part Number
1	Back Housing Sub-Assembly	0104063J37
2	O-Ring	SL000085A01

5.6.4 Transceiver Adapter Exploded Views and Parts Lists

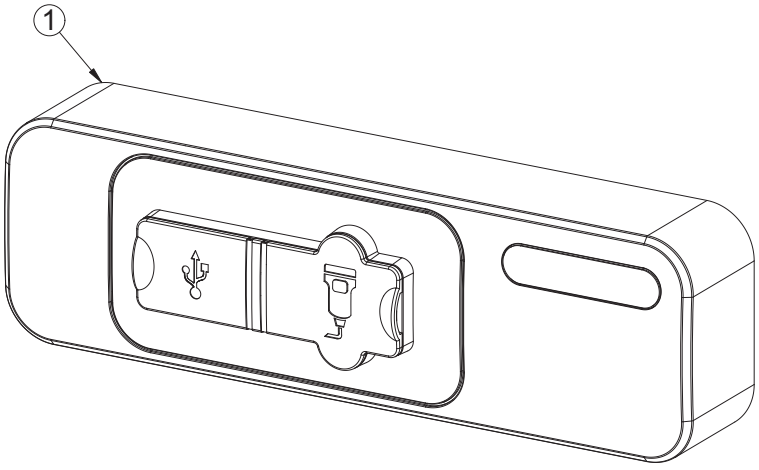


*Figure 5-43 Transceiver Adapter Exploded View for PMLN7033_*

Table 5-6 Transceiver Adapter (PMLN7033_) Exploded View Parts List

Item No.	Description	Part Number
1	Transceiver Adapter	PMLN7033_

5.7 Torque Chart

Table 5-7 lists the various nuts and screws by part number and description, followed by the torque values in different units of measure. Torque all screws to the recommended value when assembling the control head.

Table 5-7 Torque Specifications for Nuts and Screws

Part Number	Description	Driver/Socket	Torque
			lbs-in
0310944A02	Main Board Screw	Torx™ T8	3.6 ~ 4.4
0371370L01	Brick Board Screw	Torx™ T10	6 ~ 7
0375375A01	Back Kit - Front Kit Screw	Torx Plus ™ 6IP	2.9 ~ 3.1
0385273D06	Main Retainer Screw	Torx Plus ™ 6IP	1.5 ~ 1.7
Attached with Cable	Cable Jack Screw	Phillips no.2	1.9 ~ 2.1

Chapter 6 Basic Troubleshooting

6.1 Basic Troubleshooting for Control Head

Table 6-1 Basic Troubleshooting for Control Head

Symptom	Potential Cause
Red LED blinking	1. Control Head software mismatch with radio software.
Corrective Action: 1. If there is no intention to upgrade the radio software, then perform a recovery process using CPS / Depot Tool with the package that has the current firmware of the radio. a. CPS is required to save the current radio codeplug before starting recovery process. b. Recovery process will flash the Control Head with the matching software. 2. If there is any plan to upgrade the radio software, then perform a normal upgrade process. a. The Control Head software will be upgraded via the default upgrade process.	
Audio failure	1. Incorrect speaker installation
Corrective Action: 1. Ensure volume is not muted or at a low volume level. 2. Check all interface cable connections if connected securely. 3. Confirm audio output when attaching external speaker. 4. Disassemble handheld unit to verify speaker/mic assembly connection.	
Unable to turn on Control head	1. Cable attached may be loose. 2. Flexes inside control head may be loose. 3. Fuse F4000M1 may be blown.
Corrective Action: 1. Ensure radio is connected to the power supply according to the specifications specified. 2. Check all interface cable connections if connected securely. 3. Confirm screen activity after pressing power on button, if screen is unresponsive then check fuse F4000M1 connectivity on the radio board. 4. If screen flickers once and remains blank after pressing power on, then verify radio with display model.	

Notes

Appendix A Replacement Parts

A.1 Level 1 and 2 Maintenance

This manual covers Level 1 and 2 Maintenance:

Level 1 maintenance is the assessment and/or repair of fault in terms of faulty accessory or physical aspect of product; not including opening of the unit. Limited to replacement of antenna, battery, handset, external microphones, external knobs, all related frequency programming to customers' and in some cases alignment/tuning, by Customer Programming Software (CPS).

Level 2 maintenance includes all Level I activities plus: Assessment that require opening the Subscriber Product and rectifying a fault by replacement of a board or module, or replacement of major mechanical parts (like Front Housing Kit or Control Head Board), followed by alignment/tuning to ensure the replacement of board/module/major mechanical parts are within Subscriber Product's specifications as per the service manual. It does not incorporate discrete component replacement.

A.1.1 Replacement Parts Ordering

Some replacement parts, spare parts, and/or product information can be ordered directly. While parts may be assigned with a Motorola part number, this does not guarantee that they are available from Motorola Radio Products and Solutions Organization (RPSO). Some parts may have become obsolete and no longer available in the market due to cancellations by the supplier. If no Motorola part number is assigned, the part is normally not available from Motorola, or is not a user-serviceable part. Part numbers appended with an asterisk are serviceable by Motorola Depot only.

Orders for replacement parts, kits, and assemblies should be placed directly on Motorola's local distribution organization or via Motorola Online. For Level 2 maintenance, only Motorola Service Centers or Authorized Motorola Service Dealers can perform these functions. Any tampering by non-authorized Motorola Service Centers voids the warranty of your radio. To find out more about Motorola Service Centers, please visit http://www.motorolasolutions.com

A.2 Level 3 Maintenance

The Level 3 Maintenance can only be done at the Motorola Service Center/Depot since it can deeply affect the performance of the radio. To find out more about Motorola Service Center, please visit http://www.motorolasolutions.com

Notes

Glossary

This glossary contains an alphabetical listing of terms and their definitions that are applicable to portable and mobile subscriber radio products. All terms do not necessarily apply to all radios, and some terms are merely generic in nature.

Term	Definition
Analog	Refers to a continuously variable signal or a circuit or device designed to handle such signals.
Band	Frequencies allowed for a specific purpose.
CMOS	Complementary Metal Oxide Semiconductor.
CPS	Customer Programming Software: Software with a graphical user interface containing the feature set of a radio.
Default	A pre-defined set of parameters.
DM	Refers to Digital Professional Radio model names in the MOTOTRBO™ Professional Digital Two-Way Radio System.
Digital	Refers to data that is stored or transmitted as a sequence of discrete symbols from a finite set; most commonly this means binary data represented using electronic or electromagnetic signals.
DPL	Digital Private-Line: A type of digital communications that utilizes privacy call, as well as memory channel and busy channel lock out to enhance communication efficiency.
FCC	Federal Communications Commission.
Frequency	Number of times a complete electromagnetic-wave cycle occurs in a fixed unit of time (usually one second).
GPIO	General-Purpose Input/Output.
GPS	Global Positioning System.
IC	Integrated Circuit: An assembly of interconnected components on a small semiconductor chip, usually made of silicon. One chip can contain millions of microscopic components and perform many functions.
IF	Intermediate Frequency.
kHz	kilohertz: One thousand cycles per second. Used especially as a radio frequency unit.
LCD	Liquid-Crystal Display: An LCD uses two sheets of polarizing material with a liquid-crystal solution between them. An electric current passed through the liquid causes the crystals to align so that light cannot pass through them.
LDMOS	Laterally Diffused Metal Oxide Semiconductor.
LED	Light Emitting Diode: An electronic device that lights up when electricity is passed through it.

Term	Definition
MDC	Motorola Digital Communications.
MHz	Megahertz: One million cycles per second. Used especially as a radio frequency unit.
Paging	One-way communication that alerts the receiver to retrieve a message.
PC Board	Printed Circuit Board. Also referred to as a PCB.
PL	Private-Line Tone Squelch: A continuous sub-audible tone that is transmitted along with the carrier.
Programming Cable	A cable that allows the CPS to communicate directly with the radio using USB.
Receiver	Electronic device that amplifies RF signals. A receiver separates the audio signal from the RF carrier, amplifies it, and converts it back to the original sound waves.
Repeater	Remote transmit/receive facility that re-transmits received signals in order to improve communications range and coverage (conventional operation).
RF	Radio Frequency: The portion of the electromagnetic spectrum between audio sound and infrared light (approximately 10 kHz to 10 GHz).
RX	Receive.
Signal	An electrically transmitted electromagnetic wave.
Spectrum	Frequency range within which radiation has specific characteristics.
Squelch	Muting of audio circuits when received signal levels fall below a pre-determined value. With carrier squelch, all channel activity that exceeds the radio’s preset squelch level can be heard.
TOT	Time-out Timer: A timer that limits the length of a transmission.
TPL	Tone Private Line.
Transceiver	Transmitter-receiver. A device that both transmits and receives analog or digital signals. Also abbreviated as XCVR.
Transmitter	Electronic equipment that generates and amplifies an RF carrier signal, modulates the signal, and then radiates it into space.
TX	Transmit.
UHF	Ultra-High Frequency.
USB	Universal Serial Bus: An external bus standard that supports data transfer rates of 12 Mbps.
VHF	Very High Frequency.
VIP	Vehicle Interface Port.

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