MOTOROLA

GM1200E

Mobile Radio

Basic Service Manual

68P64115B12

European Publications Department (RPG) Fleet, Hampshire, England
Issue: May 1998

CAUTION

ELECTROSTATIC SENSITIVE DEVICES

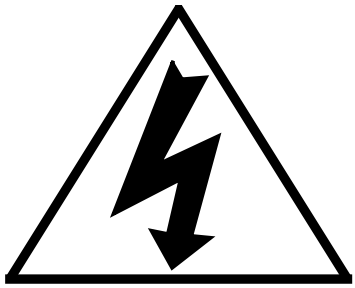
PRECAUTIONS SHOULD BE TAKEN TO MINIMIZE THE RISK OF DAMAGE BY ELECTROSTATIC DISCHARGE TO ELECTROSTATIC SENSITIVE DEVICES (ESDs).

ANY DEVICES EMPLOYING METAL OXIDE SILICON (MOS) TECHNOLOGY ARE PARTICULARLY SUSCEPTIBLE.

CIRCUIT DIAGRAMS MARKED WITH THE ABOVE SYMBOL INDICATE ELECTRONIC CIRCUITS (PECs) FOR WHICH ESD HANDLING PRECAUTIONS ARE NECESSARY.

THE USER SHOULD REFER TO BS5783, 1984: HANDLING OF ELECTROSTATIC SENSITIVE DEVICES. THIS BRITISH STANDARD SUPERSEDES DEF STAN 59-98, ISSUE 2.

WARNING



SAFETY WARNINGS

THE ELECTRICAL POWER USED IN THIS EQUIPMENT IS AT A VOLTAGE HIGH ENOUGH TO ENDANGER LIFE.

BEFORE CARRYING OUT MAINTENANCE OR REPAIR, PERSONS CONCERNED MUST ENSURE THAT THIS EQUIPMENT IS ISOLATED FROM THE ELECTRICAL SUPPLY AND TESTS ARE MADE TO ENSURE THAT ISOLATION IS COMPLETE.

WHEN THE SUPPLY CANNOT BE ISOLATED, MAINTENANCE AND REPAIR MUST BE UNDERTAKEN BY PERSONS WHO ARE FULLY AWARE OF THE DANGERS INVOLVED AND WHO HAVE TAKEN ADEQUATE PRECAUTIONS TO PROTECT THEMSELVES.

COMPONENTS CONTAINING BERYLLIUM OXIDE ARE USED IN THIS EQUIPMENT. DUST FROM THIS MATERIAL IS A HEALTH HAZARD IF INHALED OR ALLOWED TO COME INTO CONTACT WITH THE SKIN.

GREAT CARE MUST BE TAKEN WHEN HANDLING THESE COMPONENTS WHICH MUST NOT BE BROKEN OR SUBJECTED TO EXCESSIVE HEATING. DEFECTIVE COMPONENTS MUST BE DISPOSED OF IN ACCORDANCE WITH CURRENT INSTRUCTIONS.

LEAD ACID BATTERIES MAY BE FITTED AS THE STANDBY BATTERY. CARE MUST BE TAKEN WHEN REMOVING OR INSTALLING THESE BATTERIES TO:

1. ENSURE THAT THE TERMINALS ARE NOT SHORTED TOGETHER.

2. PREVENT SPILLAGE OF THE CORROSIVE ELECTROLYTE.

Basic Service Manual

Contents

Chapter

Appendix

Chapter 1

General

Table of Contents

1.0 Introduction

This chapter outlines the scope and use of the basic service manual and provides an overview of the warranty and service support.

2.0 Scope of Manual

This manual is intended for use by technicians familiar with similar types of equipment. It contains levels 1 and 2 service information required for the equipment described and is current as of the printing date. Changes which occur after the printing date maybe incorporated by a complete Basic Service Manual revision to your Product Manual or alternatively as additionson a chapter basis.

3.0 How to Use This Manual

The basic service manual contains a general chapter giving information on warranty and support, model charts and technical specifications. Chapters 2 and 3 contain level 1 and level 2 service information for the radios and accessories respectively. Chapter 4 contains radio tuning procedures. Refer to the Table of Contents for a general overview of the manual.

4.0 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. Any "return-for-exchange" or "return-for-repair" by an authorised Motorola Dealer must be accompanied by a Warranty Claim Form. Warranty Claim Forms are obtained by contacting an Authorised Motorola Dealer.

4.1 Warranty Period

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. To ensure the product has been correctly programmed or has not been subjected to damage outside the terms of the warranty.

Prior to shipping any radios back to the appropriate Motorola warranty depot, please contact Customer Services. All returns must be accompanied by a Warranty Claim Form, available from your Customer Services representative. Products should be shipped back in the original packaging, or correctly packaged to ensure no damage occurs in transit.

4.2 After Warranty Period

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

Firstly, Motorola's Radio Parts and Service Group (RPSG) offer a repair service to both end users and dealers at competitive prices.

Secondly, RPSG supplies individual parts and modules that can be purchased by dealers who are technically capable of performing fault analysis and repair. To assist in this level of service, a Detailed Service Manual containing level 3 repair information may be purchased separately.

4.3 Piece Parts

Some replacement parts, spare parts, and/or product information can be ordered directly. If a complete Motorola part number is assigned to the part, it is available from Motorola Radio Parts and Service Group (RPSG). If a generic part is listed or only a part description is listed, the part is not normally available from Motorola. If a parts list is not included, this generally means that no user-serviceable parts are available for that kit or assembly.

All orders for parts/information should include the complete Motorola identification number. All part orders should be directed to your local RPSG office.

Head Office
Motorola G.m.b.H.
European Parts Department
65232 Taunusstein
Germany

4.4 Technical Support

Motorola Product Services is available to assist the dealer/distributors in resolving any malfunctions which may be encountered. Initial contact should be by telephone whenever possible. When contacting Motorola Technical Support, be prepared with the product model number and the unit's serial number.

4.5 Associated Documentation

Publication Number	*Description*
68P64115B15	GM1200E Detailed Service Manual (for Level 3 repair only)
68P64117B01	Shared Mobile Radio Systems (SMR) using MPT1327 A System Integrators Cookbook
68P02900X57-A	Data Application Notes for 1200 Series Radios
ELN4683A	1200 Series Product Manual

5.0 Model Chart

GM1200E
403-470 MHz UHF
136-174 MHz VHF

X = Indicates one of each required

Model	M08RHA4CK5_N	M08RHA6CK5_N	M08RHH4CK6_N	M08RHH6CK6_N	M08KHA4CK5_N	M08KHA6CK5_N	M08KHH4CK6_N	M08KHH6CK6_N	Item	Description
Description	GM1200E 403-470MHz 12.5kHz 25W DB	GM1200E 403-470MHz 25kHz 25W DB	GM1200E 403-470MHz 12.5kHz 25W KD	GM1200E 403-470MHz 25kHz 25W KD	GM1200E 136-174MHz 12.5kHz 25W DB	GM1200E 136-174MHz 25kHz 25W DB	GM1200E 136-174MHz 12.5kHz 25W KD	GM1200E 136-174MHz 25kHz 25W KD		
	X	X	X	X	X	X	X	X	GBN6147_	Packaging Kit
	X	X			X	X			GCN6109_	Control Head Model K5 Blank
			X	X			X	X	GCN6110_	Control Head Model K6 Keypad/Display
			X	X			X	X	GMN6146_	Enhanced Compact Microphone
			X	X			X	X	GLN7324_	Low Profile Trunnion Kit
	X		X						GUE1124_	RF & HSG UHF 12.5kHz 5-25W
		X		X					GUE1125_	RF & HSG UHF 25kHz 5-25W
					X		X		GUD1326_	RF & HSG VHF 12.5kHz 5-25W
						X		X	GUD1327_	RF & HSG VHF 25kHz 5-25W
	X	X	X	X	X	X	X	X	GKN6270_	Power Cable
			X	X			X	X	68P64110B08	GM1200E User Guide M/L

5.1 Service Options

Model	M08RHA4CK5_N	M08RHA6CK5_N	M08RHH4CK6_N	M08RHH6CK6_N	M08KHA4CK5_N	M08KHA6CK5_N	M08KHH4CK6_N	M08KHH6CK6_N	Item	Description
Description	GM1200E 403-470MHz 12.5kHz 25W DB	GM1200E 403-470MHz 25kHz 25W DB	GM1200E 403-470MHz 12.5kHz 25W KD	GM1200E 403-470MHz 25kHz 25W KD	GM1200E 136-174MHz 12.5kHz 25W DB	GM1200E 136-174MHz 25kHz 25W DB	GM1200E 136-174MHz 12.5kHz 25W KD	GM1200E 136-174MHz 25kHz 25W KD		
	X								ENUD1061AS	GM1200E UHF 12.5kHz MD534AD
		X							ENUD1062AS	GM1200E UHF 25kHz MD514AD
			X						ENUD1063AS	GM1200E UHF 12.5kHz MD534AE
				X					ENUD1064AS	GM1200E UHF 25kHz MD514AE
					X				ENUE1071AS	GM1200E VHF 12.5kHz MD334AD
						X			ENUE1072AS	GM1200E VHF 25kHz MD314AD
							X		ENUE1073AS	GM1200E VHF 12.5kHz MD334AE
								X	ENUE1074AS	GM1200E VHF 25kHz MD314AE

GM1200E
403-470 MHz UHF
136-174 MHz VHF

X = Indicates one of each required

6.0 Technical Specifications

6.1 General

SPECIFICATION ITEM	TYPICAL VALUE
Frequency Range	UHF: 403-470 MHz VHF: 136-174 MHz
Channel Spacing	12.5 kHz or 20/25kHz
Frequency Stability	±2ppm (UHF) / ±5ppm (VHF)
Power Supply	10.8 to 15.6V dc, negative earth
Dimensions	K5 Model - 44x168x160 mm (HxWxD) K6 Model - 55x185x167 mm (HxWxD)
Weight	1030g
Operational Temperature	- 25°C to + 55°C
Storage Temperature	- 40°C to + 85°C
Antenna Connection	50Ω BNC
Environmental - Mechanical	Vibration IEC 68/2/27 and Shock IEC 28/2/6 European Dust & Water protection IP54
- Electrical	ETS300-086 RF Specifications ETS300-113 Cyclic Keying Requirements ETS300-279 EMC Requirements ETS300-219 Signalling

6.2 Transmitter

SPECIFICATION ITEM	TYPICAL VALUE
Channel Spacing	12.5kHz or 20/25kHz
Output Power	5-25W
Modulation Limiting	<±2.5kHz (12.5kHz); <±4kHz (20kHz); <±5kHz (25kHz)
FM hum & noise (CCITT)	>40dB (12.5kHz); >45dB (20/25kHz) CCITT
Conducted/Radiated Emission	<0.25µW (0.1...1000MHz); <1µW (1...4GHz)
Adjacent Channel Power	<-60dB (12.5kHz); <-70dB (20/25kHz)
Audio Response (300 - 3000 Hz)	Flat or pre-emphasised
Audio Distortion	<5% @ 1kHz, 60% deviation
Transmit turn on time	<25msec

6.3 Receiver

SPECIFICATION ITEM	TYPICAL VALUE
Channel Spacing	12.5kHz or 20/25kHz
Sensitivity @ 12.5kHz or 20/25kHz	< 0.35µV (12dB SINAD)
Intermodulation	>65dB ETS; >70dB with Base Option
Adjacent Channel Selectivity	>60dB (12.5kHz); >70dB (20/25kHz) ETS
Spurious Rejection	>70dB ETS
Audio Distortion @ Rated Audio	<5%
Hum and Noise (CCITT)	>40dB (12.5kHz); >45dB (20/25kHz) CCITT
Audio Response (300 - 3000 Hz)	Flat or De-Emphasised
Co-channel Rejection	<12dB (12.5kHz); <8dB (20/25kHz) ETS
Conducted /Radiated Emission	<2nW (0,1..1000MHz); <20nW (1..4GHz)
Receive after transmit time	<25msec
Audio Output Power	<13W external

6.4 Self-Quieting Frequencies

Self-quieting frequencies are frequencies that are also generated by the radio and cause internal interference. On these frequencies the interference caused by the self-quieter spur is great enough that a radio will not meet its receiver sensitivity specification.

The frequencies are: UHF 403.2, 420, 436.8 and 453.6MHz.
VHF 151.2 and 168MHz.

Chapter 2

Maintenance

Table of Contents

1.0 Overview

This chapter explains, step by step, how to disassemble and assemble the radio, to transceiver board level. The chapter also contains a list of test equipment required to service the radio.

2.0 Disassemble the Radio

2.1 Remove the Control Head

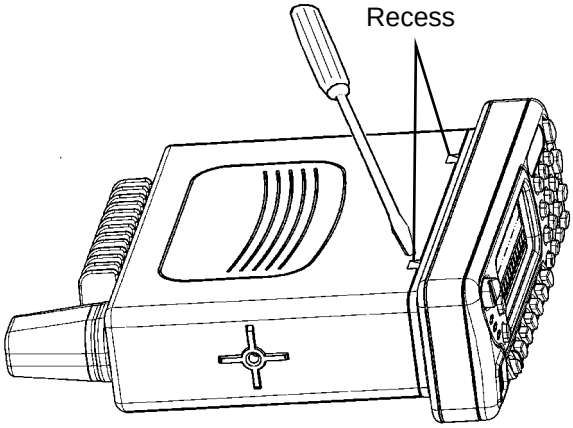


Figure 2-1 Control Head Removal.

1. Insert a small flat blade screw driver, or similar, in the recess between the control head and the transceiver (to minimise cosmetic damage to the radio cover start from the bottom side).
2. Press until the side of the control head releases and then repeat the operation on the opposite side of the radio.
3. Pull the control head away from the transceiver.
4. Remove the flex from the socket on the control head board.

2.2 Remove the Top Cover

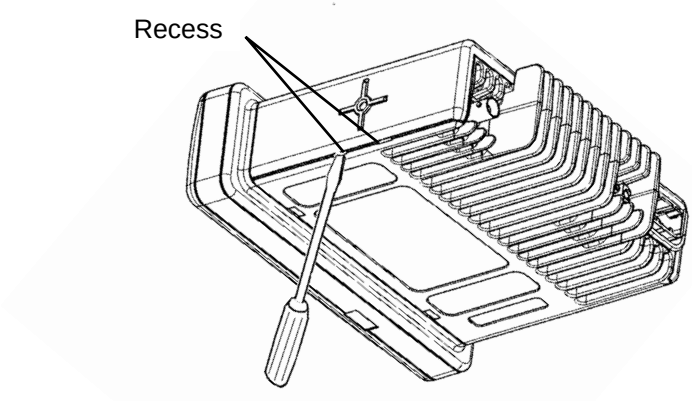


Figure 2-2 Top Cover Removal.

1. Insert a small flat blade screw driver in the side recess of the radio chassis.
2. Lift the top cover over the chassis.

2.3 Remove the Transceiver Board

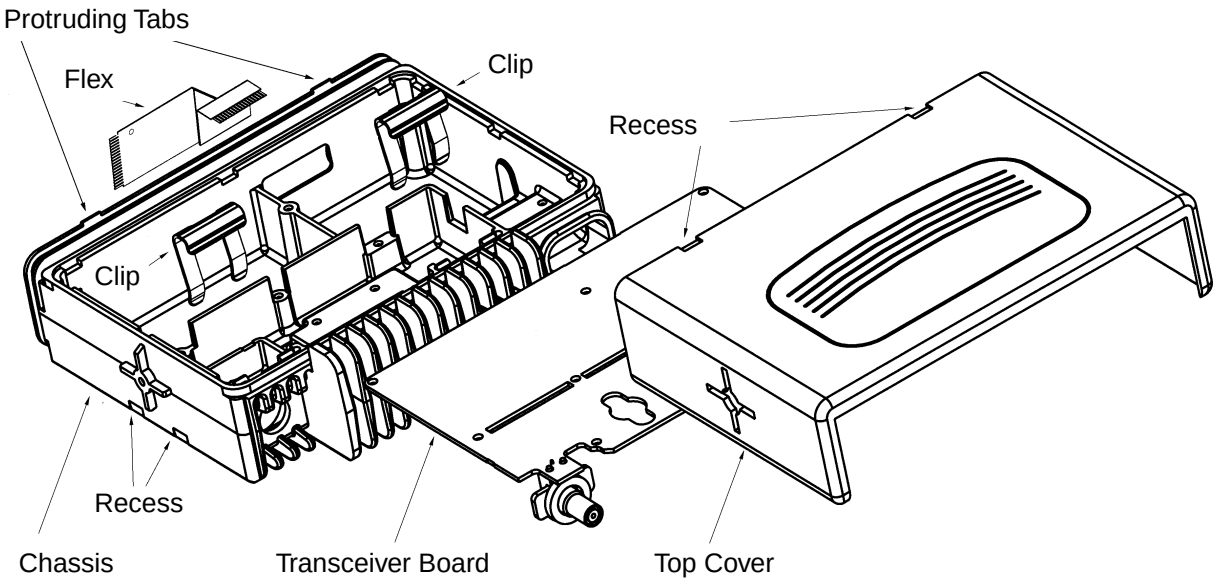


Figure 2-3 Transceiver Board Removal.

1. Remove the power and antenna connector retaining clips by inserting a small flat blade screw driver between the clip and the top of the chassis wall and gently prying the clip upwards.
2. Remove 13 screws from the transceiver board using a T8 TORX driver.
3. Carefully remove the transceiver board by rotating it out of the chassis:

   Slowly lift the board on the front edge, the side with the connector that mates with the control head, and pull gently toward the front of the radio.

CAUTION: The thermal grease can act as an adhesive and cause the leads of the heat dissipating devises to be over stressed if the board is lifted too quickly.

2.4 Disassemble the Control Head

1. To remove the printed circuit board from the control head front housing, first split control head into front and rear housing. In the front housing, insert a small blade screw driver in the side groove near the four protruding tabs of the printed circuit board. Remove the board from the control head front housing.
2. Remove the keypad from the control head housing by lifting up the rubber keypad. Care should be taken not to touch or get other contaminates on the conductive pads on the under side of the keypad or conductive contacts on the printed circuit board.
3. Remove the LCD module fom the LCD frame attached to the PCB.

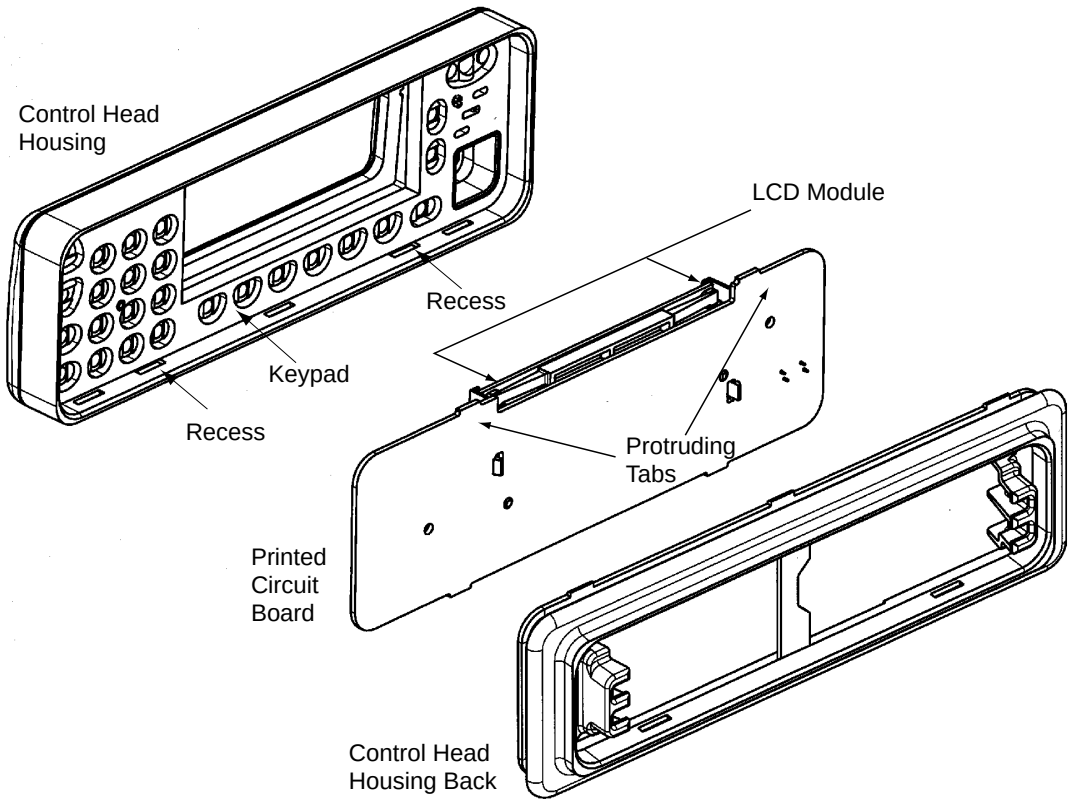


Figure 2-4 Control Head Assembly.

3.0 Assemble Radio

3.1 Assemble the Control Head

1. Ensure that the LCD module and frame are correctly positioned on the PCB.
2. Place the keypad onto the board assembly, making sure the keypad is flush with the board.
3. During the installation of the printed circuit board, ensure the four protruding tabs snap into the recesses.

3.2 Replace the Transceiver Board

1. Inspect and if necessary, reapply thermal grease to the heatsinking pads in the chassis.
2. Before installing the connector retaining clips, ensure that the board is sitting flush on the chassis mounting surface.
3. Install the 13 screws with 0.4 -07 NM (4-6 in lbs) of torque using a T8 TORX driver.

3.3 Replace the Top Cover and Control Head

1. Position the top cover over the chassis and replace. Ensure that the cross snaps into the recesses.
2. Connect the control head to the radio by the flex.

3. Press the control head onto the radio chassis until the protruding tabs on the chassis snap into the recesses inside the control housing, see Figure 2-5.

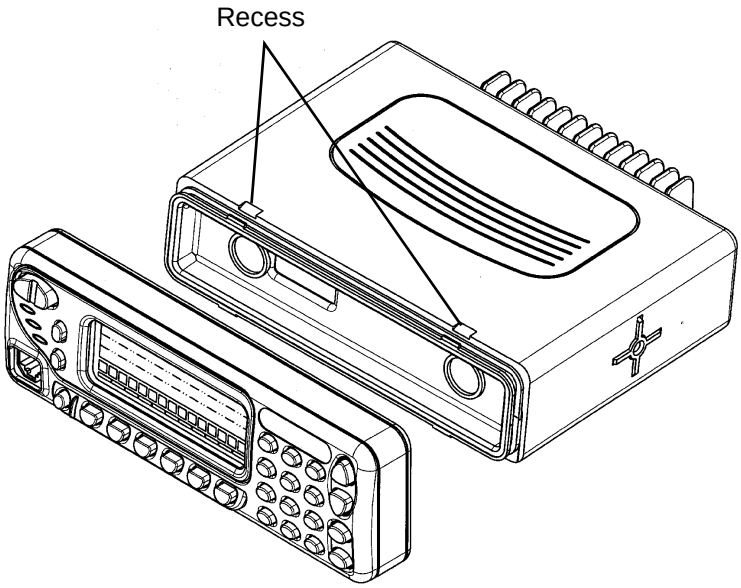


Figure 2-5 Control Head Replacement.

4.0 Exploded View Diagrams and Parts

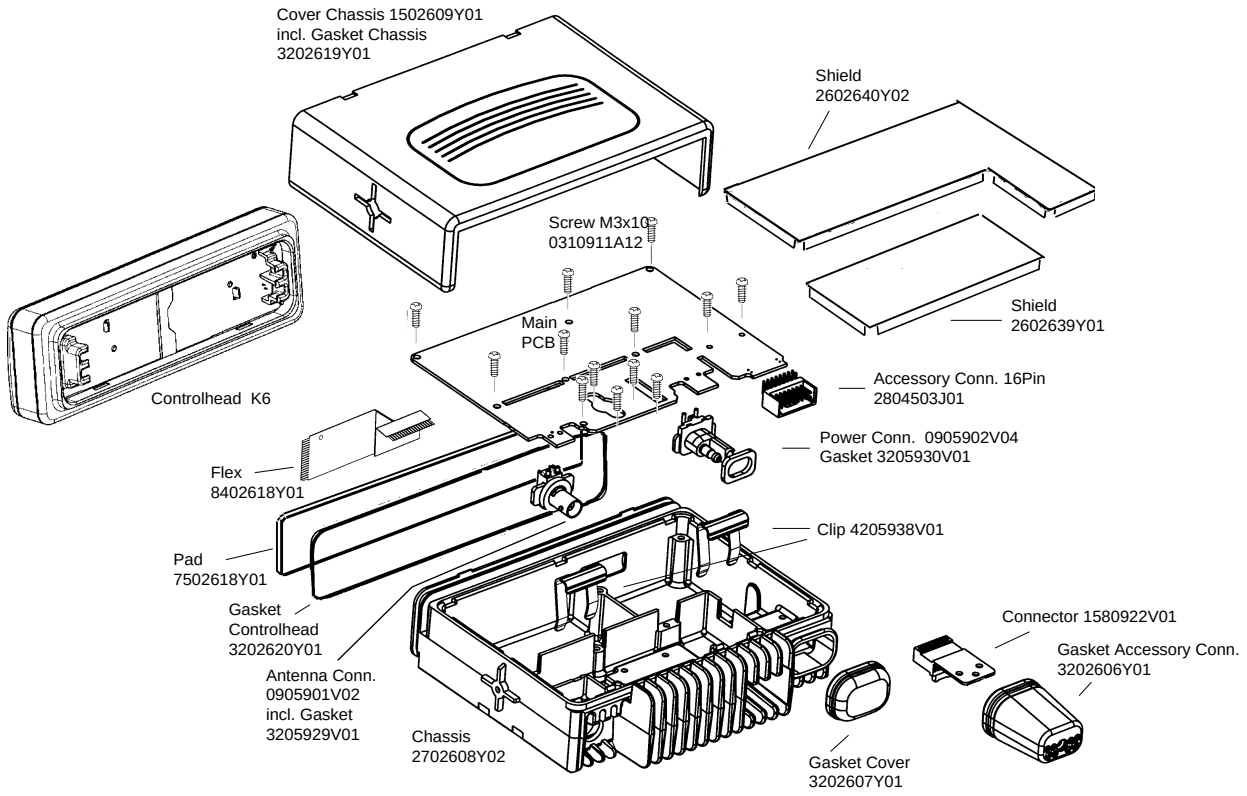


Figure 2-6 Radio Exploded View Diagram.

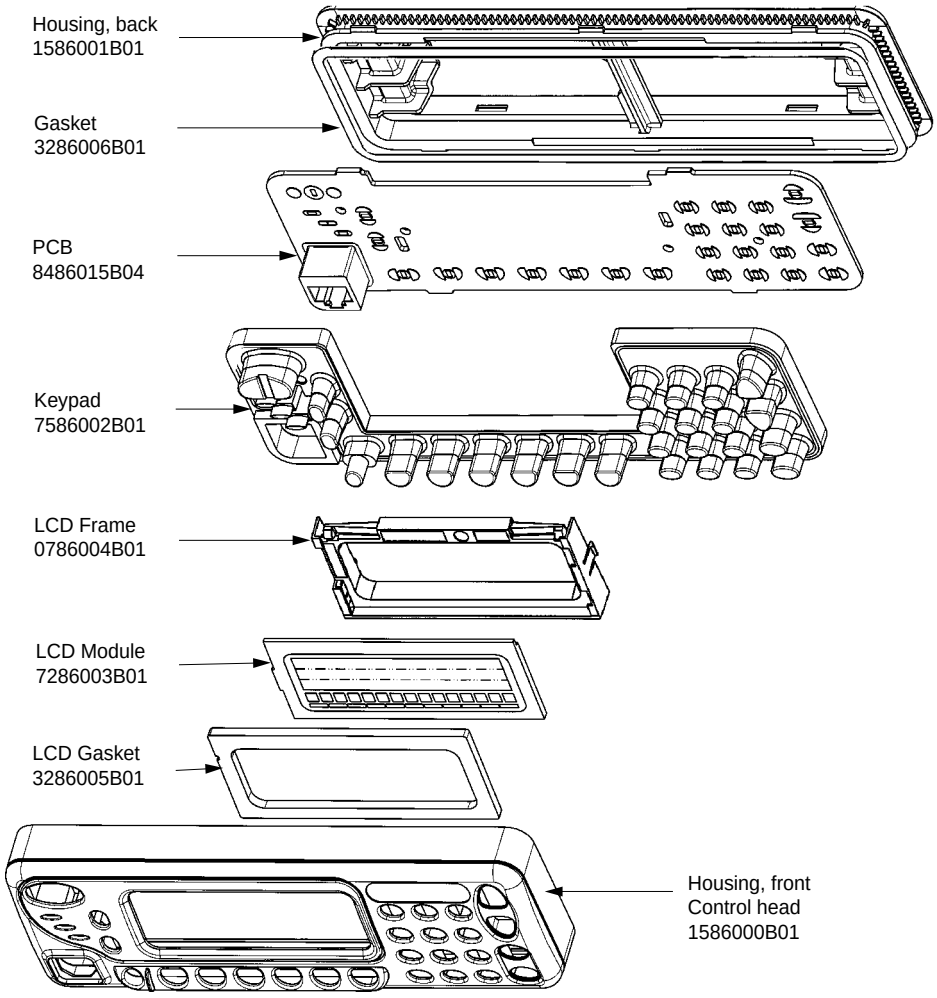


Figure 2-7 Control Head for Display/Keypad Radio Model.

5.0 Service Aids

The list in table 2-1 includes service aids recommended for working on the GM1200E radio.

Table 2-1 Service Aids.

PART No.	DESCRIPTION	APPLICATION
GTF376	Test Box Cable	Connects radio to GTF180 test box.
GTF374	Combined Interface Cable	Connects radio to RLN4008 RIB.
GTF377	Combined Interface Cable	Connects Databox radio to RLN4008 RIB.
GPN6133	Power Supply	Used to supply power to the radio.
GKN6266	DC Power Cable for radio	Interconnects radio to power supply.
GTF180	Test Box	Enables connection to the universal connector. Allows switching for radio testing.
RLN4008	Radio Interface Box	Enables communications between the radio and the computer's serial communications adapter.
EPN4040	Power Supply	Used to supply power to the RIB (240 VAC).
EPN4041	Power Supply	Used to supply power to the RIB (220 VAC).
3080369B72	Computer Interface Cable	Connects the computer's serial communications adapter (9 pin) to the RIB.
3080369B71	Computer Interface Cable	Connects the computer's serial communications adapter (25 pin) to the RIB.
ENVN4001	MPT1327 1200E Series	DPS Dealer Software, 3.5" floppy disks.
ENVN4002	MPT1327 1200E Series	DPS Network Software, 3.5" floppy disks.

6.0 Test Equipment

The list in table 2-2 includes all standard test equipment required for servicing two-way mobile radios, as well as several unique items designed specifically for servicing the GM1200E radio. Battery-operated test equipment is recommended when available. The “Characteristics” column is included so that equivalent equipment may be substituted; however, when no information is provided in this column, the specific Motorola model listed is either a unique item or no substitution is recommended.

Table 2-2 Recommended Test Equipment.

MODEL No.	DESCRIPTION	CHARACTERISTICS	APPLICATION
R2000 Series	System Analyser	This monitor will substitute for items with an asterisk (*)	Frequency/deviation meter and signal generator for wide-range troubleshooting and alignment.
*R1150C	Code Synthesizer		Injection of audio and digital signalling codes
*S1053D *HM-203-7 *SKN6008A *SKN6001A	220 VAC Voltmeter 110 VAC Voltmeter Power Cable for Meter Test Leads for Meter	1mV to 300V, 10MΩ Input impedance	Audio voltage measurements
*S1350C *ST1213B (VHF) *ST1223B (UHF)	Watt Meter Plug-in Element RF Dummy Load	50 ohm, ±5% accuracy 10 Watts, maximum 0-1000 MHz, 300W	Transmitter power o/p measurements
R1065A	Load Resistor	10-watt Broadband	For use with Wattmeter
S1339A	RF Millivolt Meter 10kHz to 1.2 GHz	100µV to 3V RF	RF level measurements
*R1013A	SINAD Meter		Receiver sensitivity measurements
S1347D or S1348D (programmable)	DC Power Supply	0-20Vdc, 0-5 Amps	Bench supply for 13.2Vdc current limited

* Any of the R2000 Series system analysers will substitute for items with an asterisk (*)

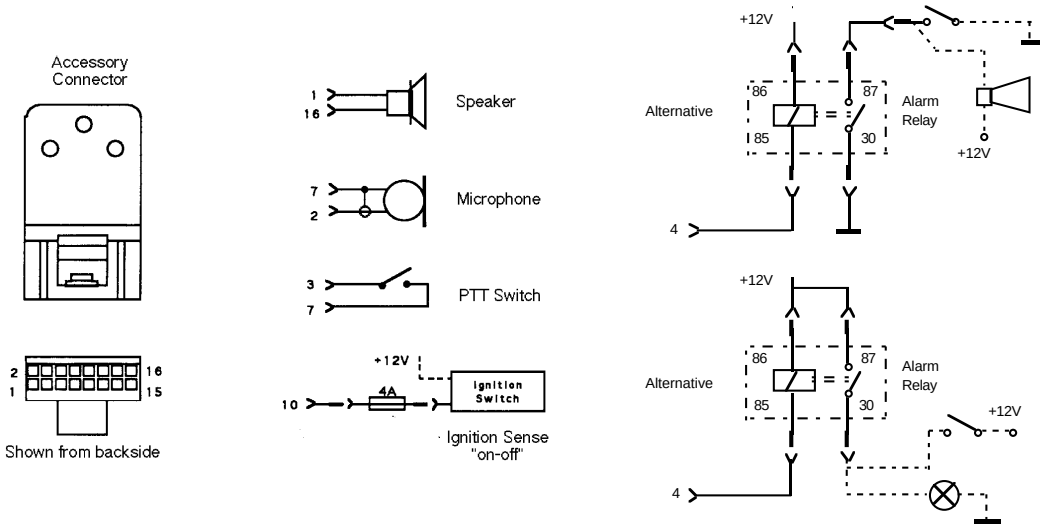
Chapter 3

Accessories

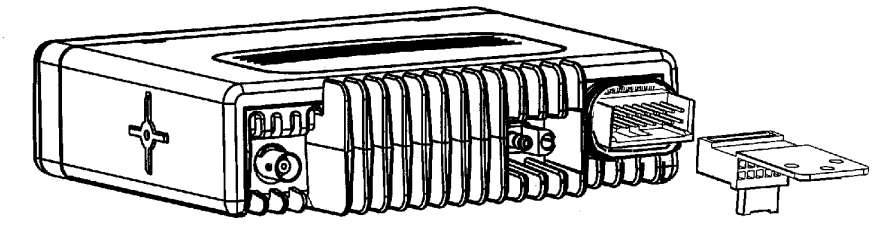
Table of Contents

1.0 GM1200E Accessory Connector Plan

CAUTION: The accessory connections shown are not compatible to some other models of Motorola radios. Check the appropriate accessory or technical manual for further information.



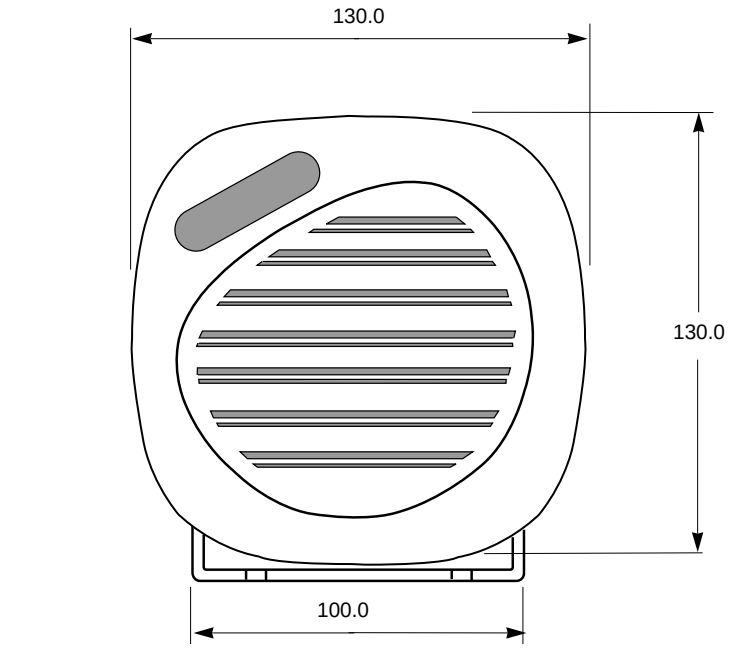
CAUTION: **1. DO NOT** short pin 1 or 16 on the accessory connector to ground, this may damage the radio.

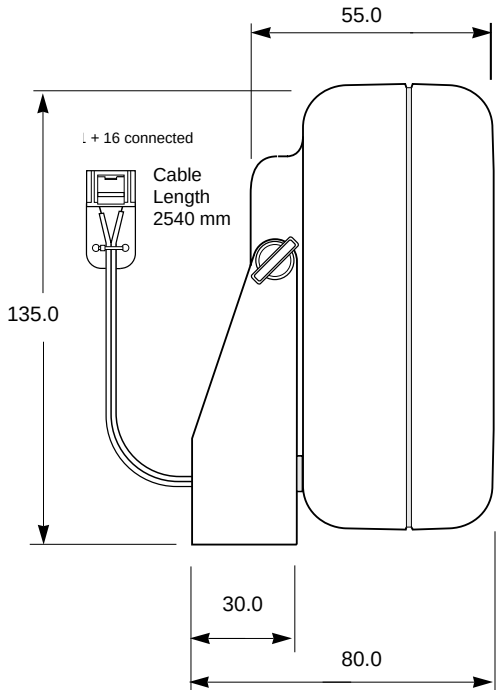


CAUTION: Ensure correct position of the accessory connector.

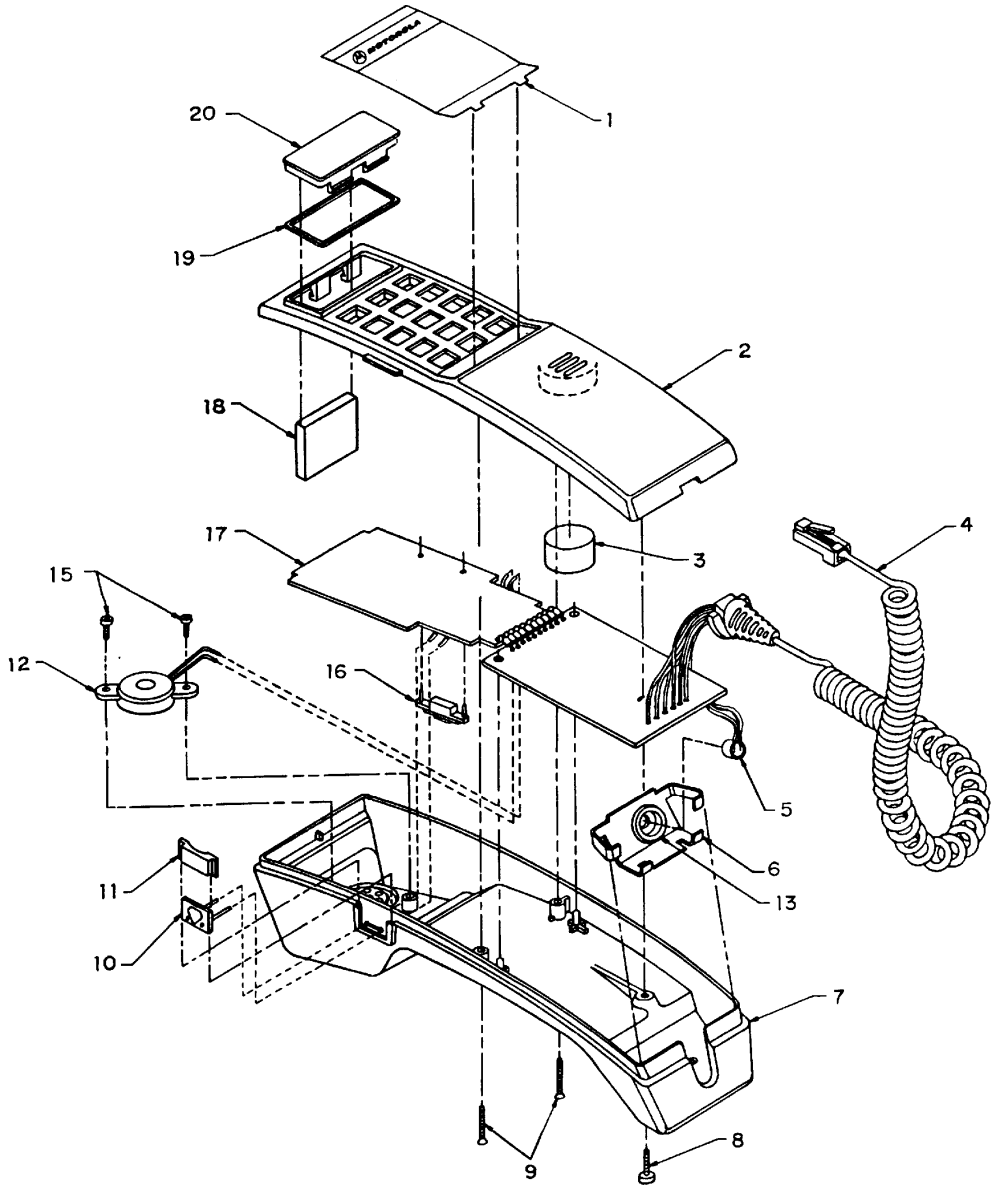
2.0 GM1200E Accessory Diagrams

2.1 Speaker GSN6059 5.5ins/130mm, 13 Watts





2.2 Handset HMN9416 (P/O HMN3141) Mechanical Exploded View



Mechanical Parts List

Ref No.	*Motorola Part No.*	*Description*	*Ref No.*	*Motorola Part No.*	*Description*
1	13-80928W01	Escutcheon	11	38-84658P01	PTT Button
2	15-82281R01	Top Housing	12		Speaker (LS10)
3	75-80927W01	Top Housing Pad	13	32-80272F16	Microphone Gasket
4	30-06418T01	Coil Cord Cable	14		Not used
5		Mic Cartridge (MK101)	15	03-10944A03	Tapping Screw
6	07-80148G02	Mic Gasket Bracket	16	43-84312N01	Reed Switch Spacer
7	15-84795P04	Bottom Housing	17	01-80701Y77	Circuit Board Assembly
8	03-10908A91	Machine Screw	18	75-80926W01	Circuit Board Pad
9	03-10913B37	Tapping Screw	19	32-80282F02	Lens Gasket
10		PTT Dome Switch (S11)	20	61-80266F10	Display Lens

2.2.1 Description

The HMN3141 Handset and hang-up cup is a slimline telephone handset with push to talk (PTT) button. It is used in place of, and operates similar to, the standard mobile microphone.

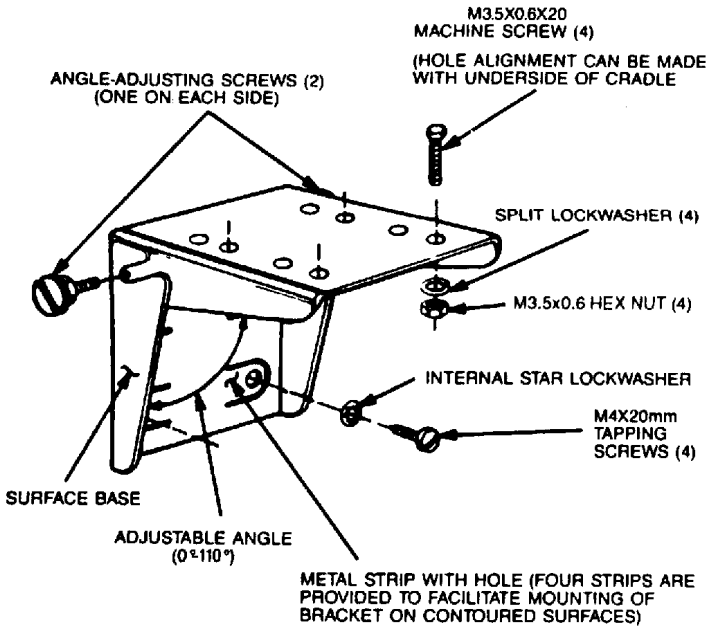
2.2.2 Installation

General

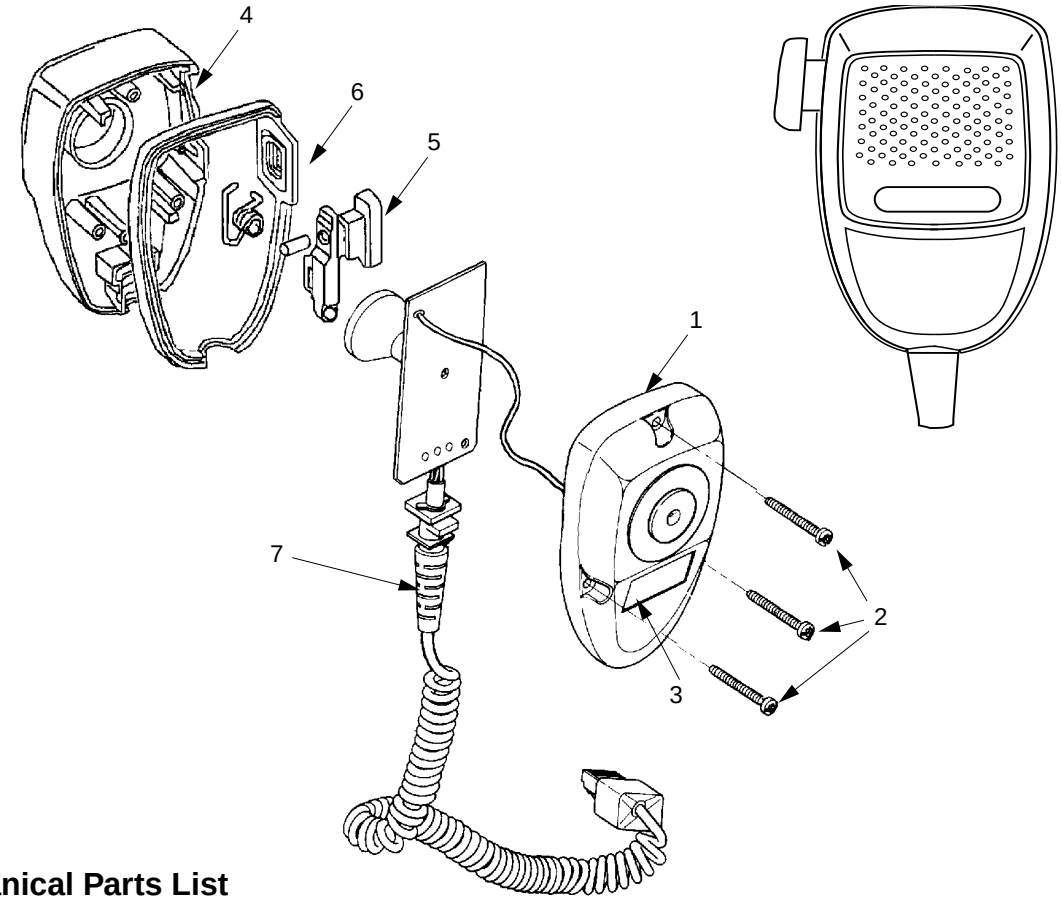
When planning the installation of your handset, it is important that it does not interfere with the operation of the vehicle or its accessories, nor disturb passenger seating or leg space. The handset must be within convenient reach to the user. In general terms, the location of the handset should be similar to the standard mobile microphone.

Adjustable Angle Bracket

1. Verify that the selected mounting surface is strong enough to support the mounting hardware.
2. Use the base of the adjustable angle bracket as a template, then centre punch and drill four 3.4mm diameter holes. Be careful not to damage any wires or other vital vehicle components when drilling the holes.
3. Use the four M4x20mm tapping screws and the internal star lockwashers to mount and secure the bracket.
4. Place the hang-up cup on top of the mounting surface of the mounting bracket and secure it using the four M3.5x0.6x20mm machine screws, lockwashers, and hex nuts provided.
5. Select the angle between the two bases of the adjustable angle bracket (from 0 to 110 degrees) and tighten the two adjusting screws.



2.3 Enhanced Compact Microphone GMN6146 Mechanical Exploded View

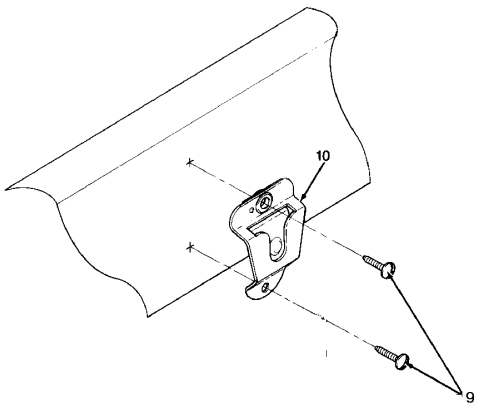


Mechanical Parts List

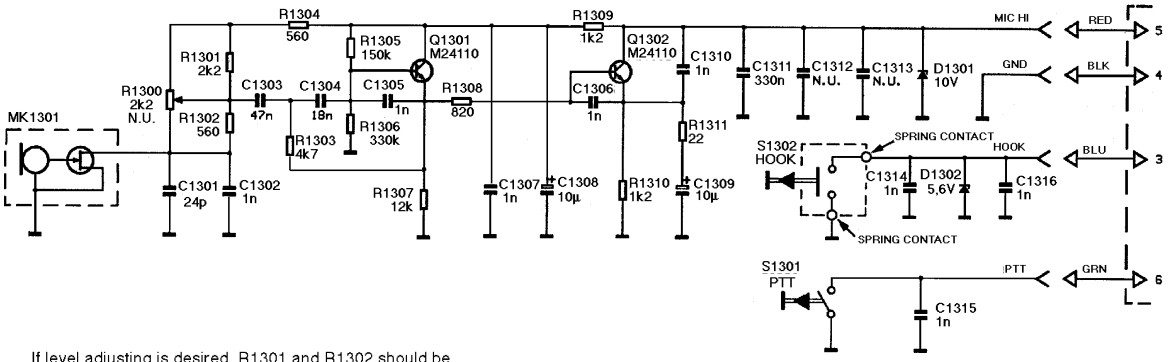
Ref No.	Motorola Part No.	Description	Ref No.	Motorola Part No.	Description
1	0180704Y99	Rear Housing assembly	5	3880568B01	PTT Button
2	0311994A23	Screw (3 used)		7580983Z03	Rubber Spacer
3	5480104R12	Model Label (GMN6146C)		4180150R01	Spring Tension
	5480104R02	Model Label (GMN6146B)	6	3280565B01	Gasket MIC
4	1580566B02	Front Housing	7	3002593Y02	Coiled Cord

Hang-Up Clip Parts List

Ref No.	Motorola Part No.	Description
9	03-00139913	Screw, 8-18x1/2 (3 used)
10	01-80743T91	Hang-up clip



Schematic Diagram



If level adjusting is desired, R1301 and R1302 should be taken out and be replaced by R1300 (p/n 1805500L04).

GEPD 5468

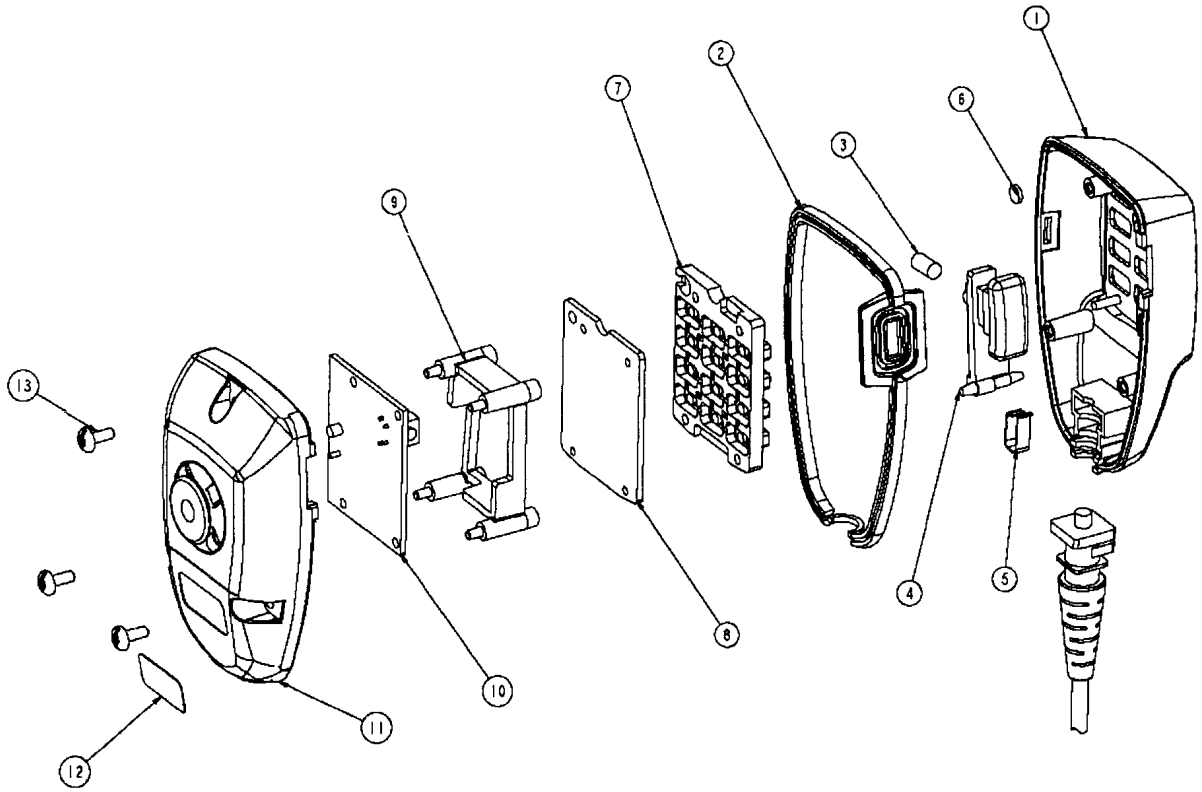
Kit No. GMN6146C

Electrical Parts Lists

Circuit Ref	Motorola Part No.	Description
R1300	1805500L04	RES VAR 2.2k (not used)
R1301	0660076A57	RES CHIP 2.2k 5 1/8
R1302	0660076A43	RES CHIP 560 5 1/8
R1303	0660076A65	RES CHIP 4.7k 5 1/8
R1304	0660076A43	RES CHIP 560 5 1/8
R1305	0660076B05	RES CHIP 150k 5 1/8
R1306	0660076B13	RES CHIP 330k 5 1/8
R1307	0660076A75	RES CHIP 12k 5 1/8
R1308	0660076A47	RES CHIP 820 5 1/8
R1309	0660076A51	RES CHIP 1.2k 5 1/8
R1310	0660076A51	RES CHIP 1.2k 5 1/8
C1301	2113740A38	CAP CHIP CL1 24p
C1302	2113741A21	CAP CHIP CL2 X7R 1n
C1303	2113741A61	CAP CHIP CL2 X7R 47n
C1304	2113741A51	CAP CHIP CL2 X7R 18n
C1305	2113741A21	CAP CHIP CL2 X7R 1n

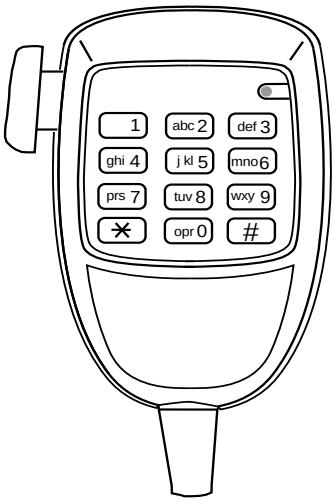
Circuit Ref	Motorola Part No.	Description
C1306	2113741A21	CAP CHIP CL2 X7R 1n
C1307	2113741A21	CAP CHIP CL2 X7R 1n
C1308	2311049J26	CAP TANT CHIP 10uF 16V
C1309	2311049J26	CAP TANT CHIP 10uF 16V
C1310	2113741A21	CAP CHIP CL2 X7R 1n
C1311	2113743F12	CER CHIP CAP 330n
C1314	2113741A21	CAP CHIP CL2 X7R 1n
C1315	2113741A21	CAP CHIP CL2 X7R 1n
C1316	2113741A21	CAP CHIP CL2 X7R 1n
Q1301	4813824A10	XSTR NPN 40V .2A
Q1302	4813824A10	XSTR NPN 40V .2A
D1301	4880140L15	DIODE SOT ZENER 10V
D1302	4880140L07	DIODE SOT ZENER 5.6V
	4080164S01	SWITCH,PTT
	5080258E04	ELECTRET MIC CTRG
	8402571Y01	PCB RENA MIC BLK

2.4 DTMF Microphone GMN6148 Mechanical Exploded View

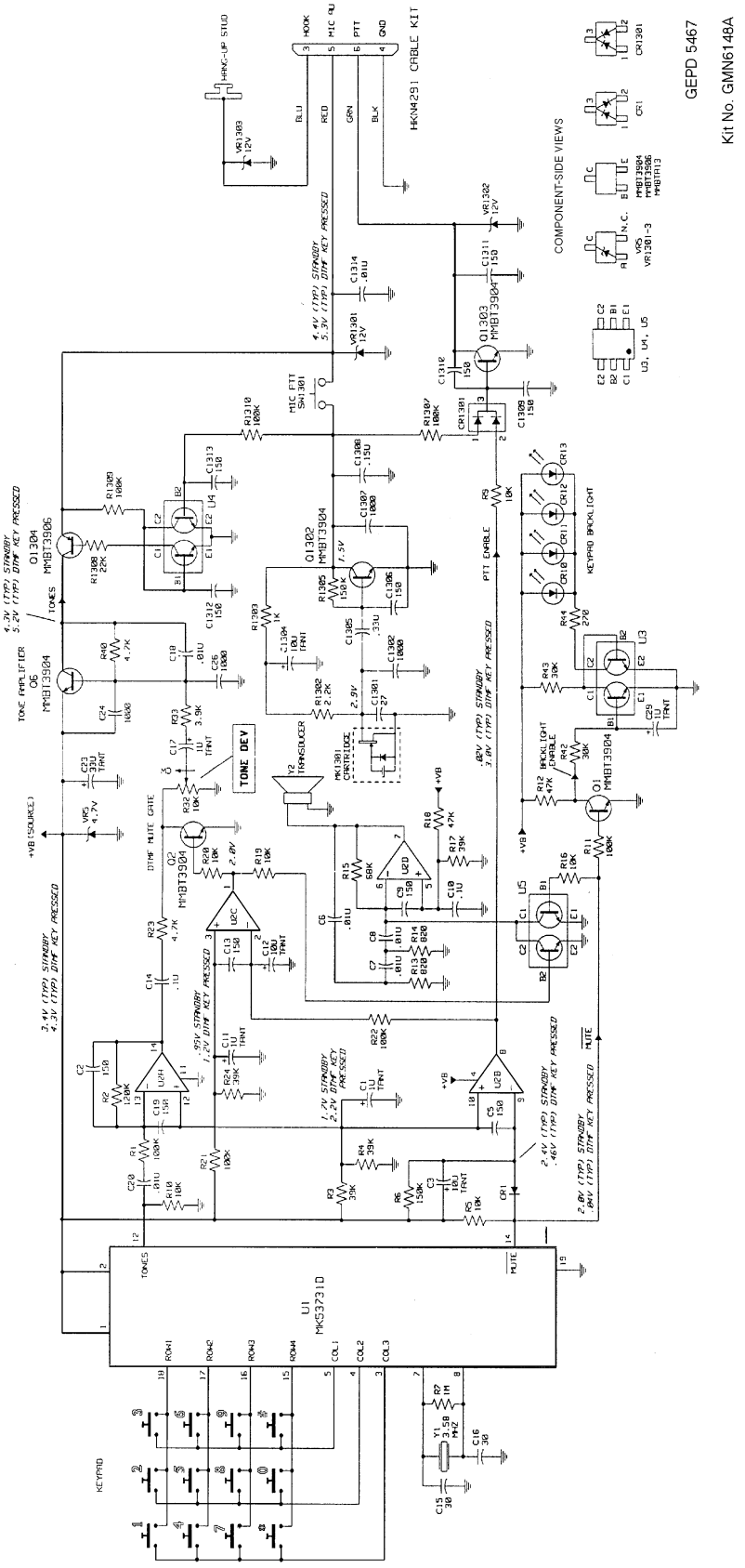


Mechanical Parts List

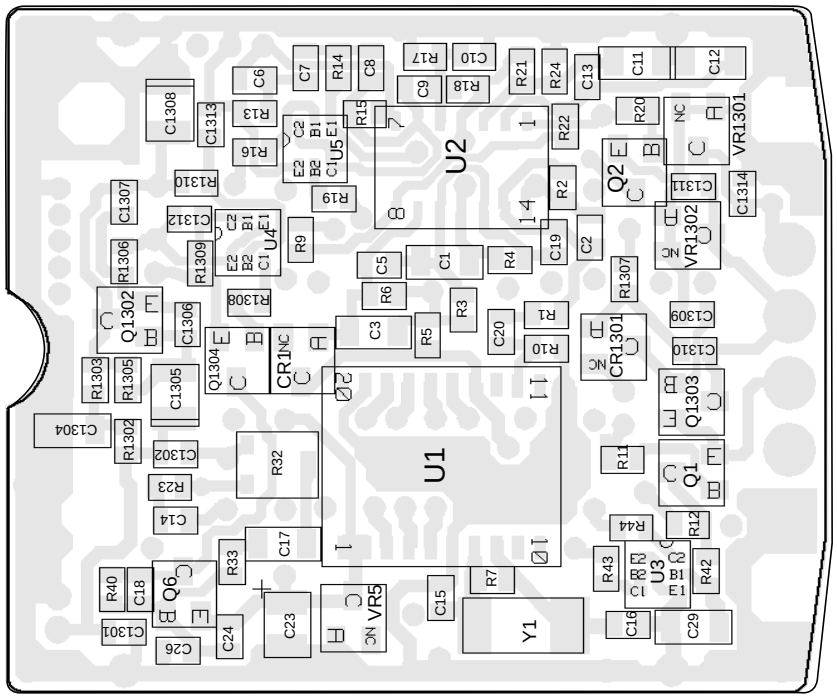
Ref No.	*Motorola Part No.*	*Description*
1	15-80652D02	Microphone front housing
2	32-80565B01	Microphone gasket
3	75-80983Z03	Rubber Spacer, Switch
4	38-80654D01	Button, push to talk
5	41-80658D01	Spring, PTT
6	35-80089D02	Felt baffle
7	75-80655D01	Keypad
8	01-80707Y77	DTMF Encoder board assy
9	42-80656D01	Spacer
10	01-80707Y78	Switch/Sidetone board assy
11	01C80669D01	Microphone rear Housing
12	54-80104R10	Mic label
13	03-139959	Screw, thread forming



Schematic Diagram



PCB Layout



8402685Y01 GEPD 5469

SHOWN FROM COMPONENT SIDE

8402685Y01 GEPD 5470

SHOWN FROM SOLDER SIDE

Electrical Parts List

GMN6148_

Circuit Ref	Motorola Part No.	Description
C1	23-11049A07	1uF; 16V, 10%, TANT
C2	21-13740A73	560pF
C3	23-11049A59	10uF; 6V,10%, TANT
C5	21-13740A59	150pF
C6	21-13741A45	0.01uF
C7	21-13741A45	0.01uF
C8	21-13741A45	0.01uF
C9	21-13740A59	150pF
C10	21-60521G37	0.1uF
C11	23-11049A07	1uF; TANT
C13	21-13740A59	150pF
C14	21-60521G37	0.1uF
C15	21-13740A40	30pF
C16	21-13740A40	30pF
C17	23-11049A07	1uF; TANT
C18	21-13741A45	0.01uF
C19	21-13740A59	150pF
C20	21-13741A45	0.01uF
C23	23-11049A30	33uF, 6V, 10%, TANT
C24	21-13740A79	1000pF
C26	21-13740A79	1000pF
C29	23-11049A07	1uF; TANT
C1301	21-13740A39	27pF, 50V, NPO.
C1302	21-13740A79	1000pF
C1304	23-11049A59	10uF; 6V, 10%, TANT
C1305	21-13743B23	0.330uF
C1306	21-13740A59	150pF
C1307	21-13740A79	1000pF
C1308	21-11032B14	0.15uF
C1309	21-13740A59	150pF
C1310	21-13740A59	150pF
C1311	21-13740A59	150pF
C1312	21-13740A59	150pF
C1313	21-13740A59	150pF
C1314	21-13741A45	0.01µF
CR1	48-84336R03	MMBD 7000
CR10	48-83636N18	LED; GREEN, SMD
CR11	48-83636N18	LED; GREEN, SMD

Circuit Ref	Motorola Part No.	Description
CR12	48-83636N18	LED; GREEN, SMD
CR13	48-83636N18	LED; GREEN, SMD
CR1301	48-13833C04	BAV70LT1
Q1	4880214G02	MMBT 3904
Q2	4880214G02	MMBT 3904
Q6	4880214G02	MMBT 3904
Q1302	48-80214G02	MMBT 3904
Q1303	48-05128M19	MMBTA 13
Q1304	48-05128M16	MMBT 3906
R1	06-60076B01	100K
R2	06-60076B03	120K
R3	06-60076A87	39K
R4	06-60076A87	39K
R5	06-60076A73	10K
R6	06-60076B05	150K
R7	06-60076B25	1Meg
R9	06-60076B01	100K
R10	06-60076A73	10K
R11	06-60076B01	100K
R12	06-60076A89	47K
R13	06-60076A47	820
R14	06-60076A47	820
R15	06-60076A93	68K
R16	06-60076A73	10K
R17	06-60076A87	39K
R18	06-60076A89	47K
R19	06-60076A73	10K
R20	06-60076A73	10K
R21	06-60076B01	100K
R22	06-60076A89	47K
R23	06-60076A65	4.7K
R24	06-60076A87	39K
R32	18-60502A13	10K VAR; SMD
R33	06-60076A63	3.9K
R40	06-60076A65	4.7K
R42	06-60076A84	30K
R43	06-60076A84	30K
R44	06-60076A25	100

GMN6148_ continued,

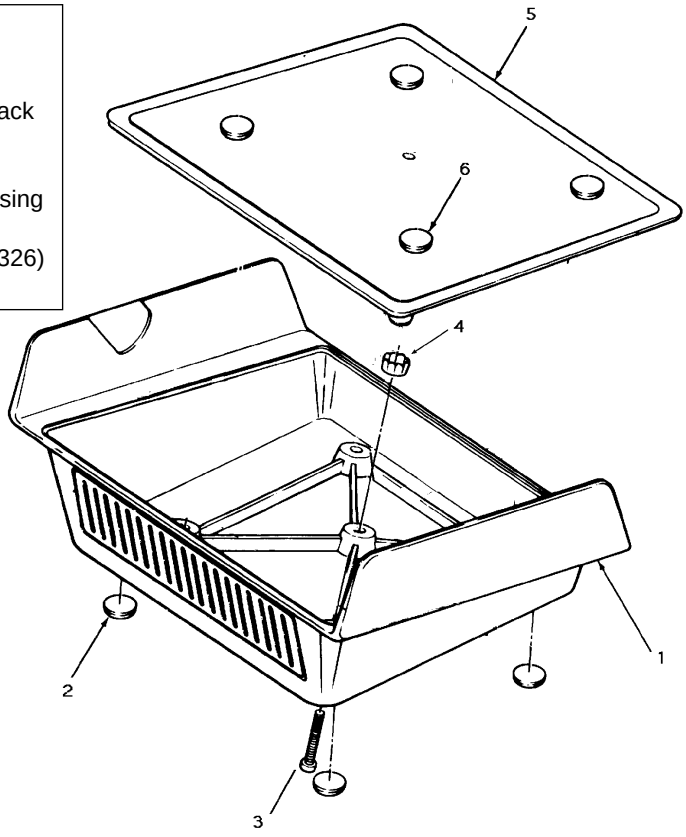
Circuit Ref	Motorola Part No.	Description
R1302	06-60076A57	2.2K; 5%, 1/8W
R1303	06-60076A49	1K; 5%, 1/8W
R1305	06-60076B05	150K; 5%, 1/8W
R1306	06-60076M01	0; RES. JUMPER
R1307	06-60076B01	100K; 5%, 1/8W
R1308	06-60076A81	22K; 5%, 1/8W
R1309	06-60076B01	100K; 5%, 1/8W
R1310	06-60076B01	100K; 5%, 1/8W
SW1301	40-80164S01	SWITCH, PTT
U1	51-80662D01	MK53731D DTMF DIALER I.C.
U2	51-13819A02	LM2902D OPAMP
U3 to U5	51-80159R01	DUAL TRANSISTOR; IMX1

Circuit Ref	Motorola Part No.	Description
VR5	48-80140L05	4.7V; 5%, ZENER
VR1301	48-80140L17	12V; 5%, ZENER
VR1302	48-80140L17	12V; 5%, ZENER
Y1	48-80915W02	3.58 MHZ Resonator
Y2	50-80121L01	Transducer
	50-13920A04	ADHESIVE, MIC SHIELD, DTMF ENCODER
	30-02593Y02	COIL CORD W. IP54 BOOT
	84-02685Y01	Circuit Board EURO DTMF MIC
	84-80661D01	Circuit Board, Switch/sidetone

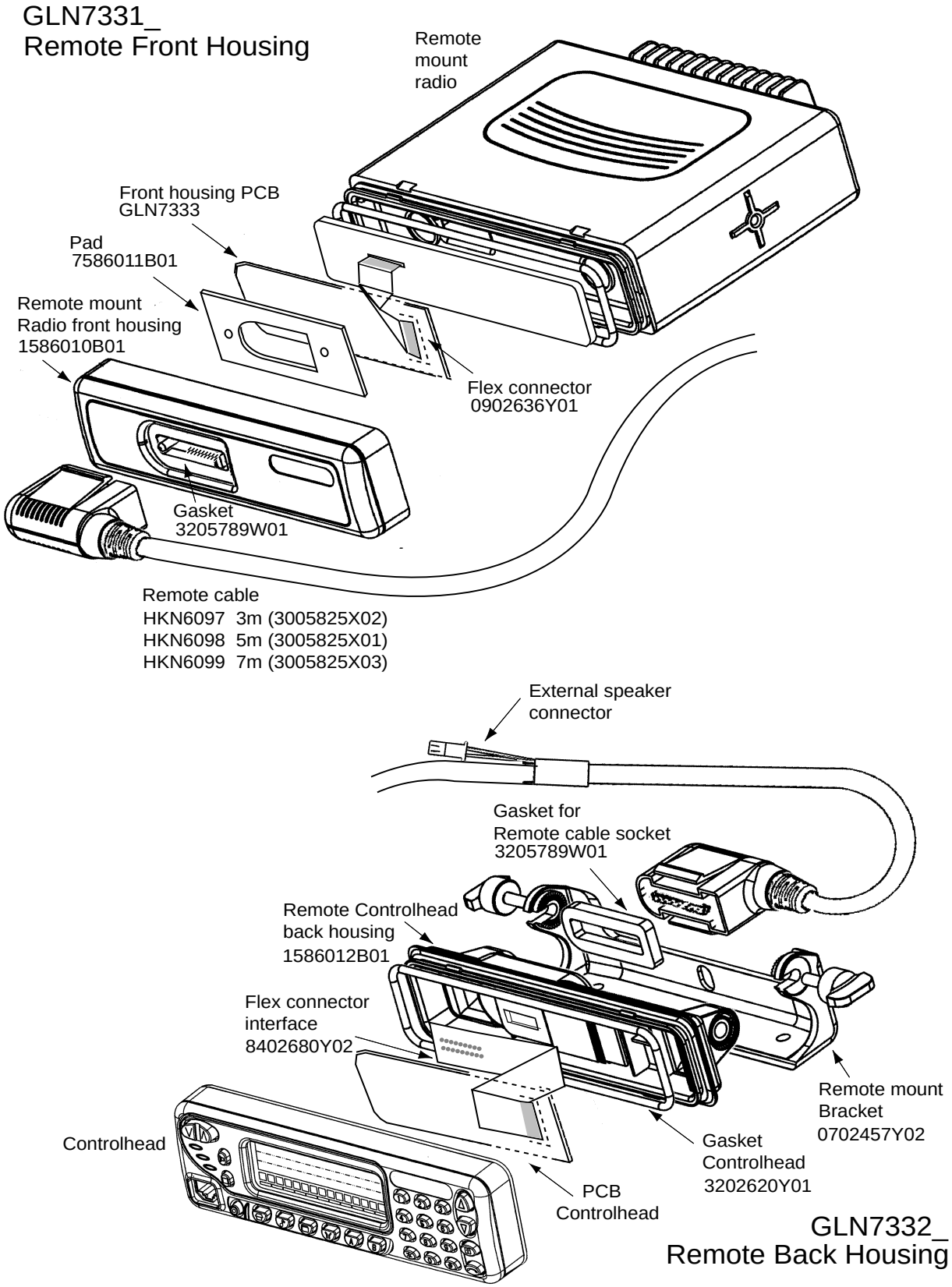
2.5 Base Tray GLN7318/GLN7326

Mechanical Parts List

Ref No.	*Motorola Part No.*	*Description*
1	1580155J02	Base housing
2	7510606A06	Bumper RBR black
3	0384725C09	Screw 4.2x16
4	4205722C02	Clamp fastener
5	1580154J02	Cover base housing
6	7510606A13	Bumper black
	5080085D03	Speaker (GLN7326) *Not shown*

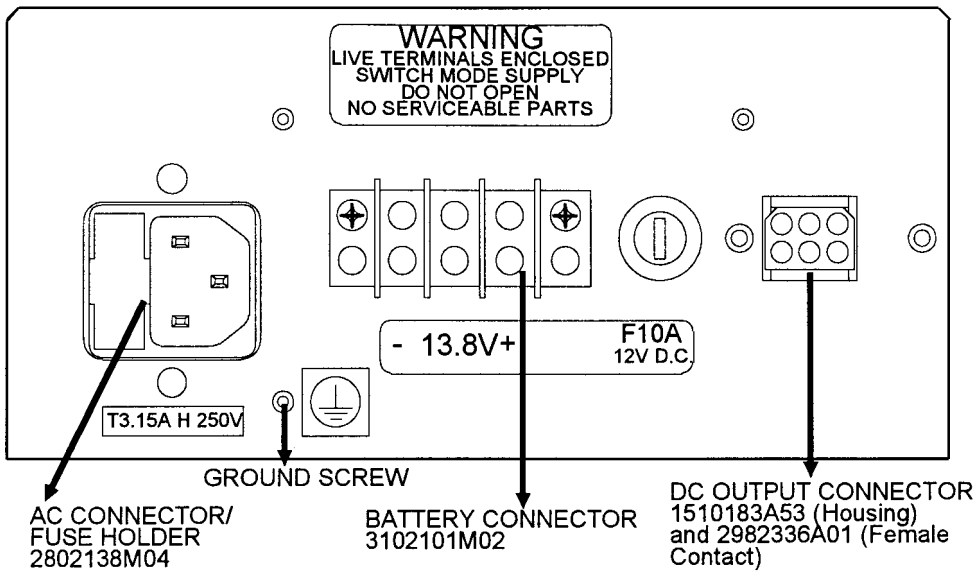


2.6 Remote Mount Front / Rear Housing Kits GLN7331 / GLN7332 Mechanical Exploded View

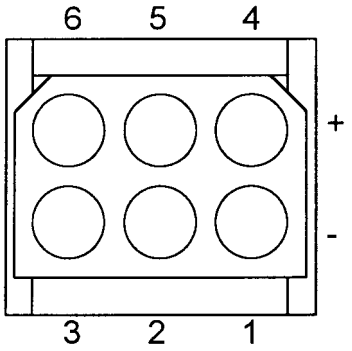


2.7 Power Supply GPN6133 (EMC/CE Approved)

REAR VIEW

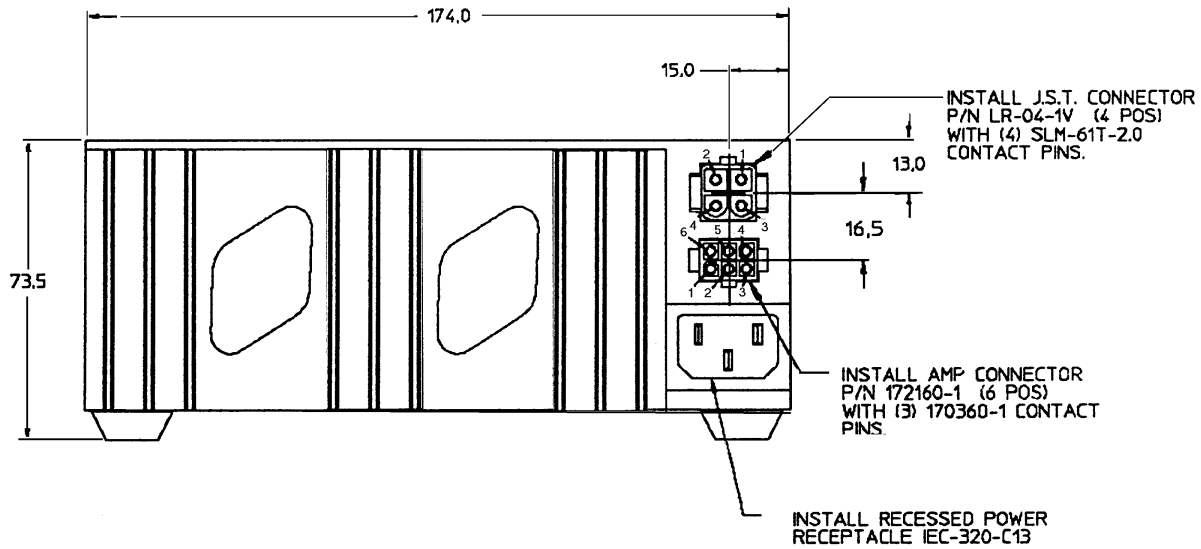


PIN DESCRIPTION OF THE DC OUTPUT MOLEX CONNECTOR:



Pin 1 - 0 VDC
Pin 2 - On Battery
Pin 3 - Not used
Pin 4 - 13.8 VDC
Pin 5 - Low Battery
Pin 6 - Not used

2.8 Power Supply HPN8393 (Not EMC Approved)



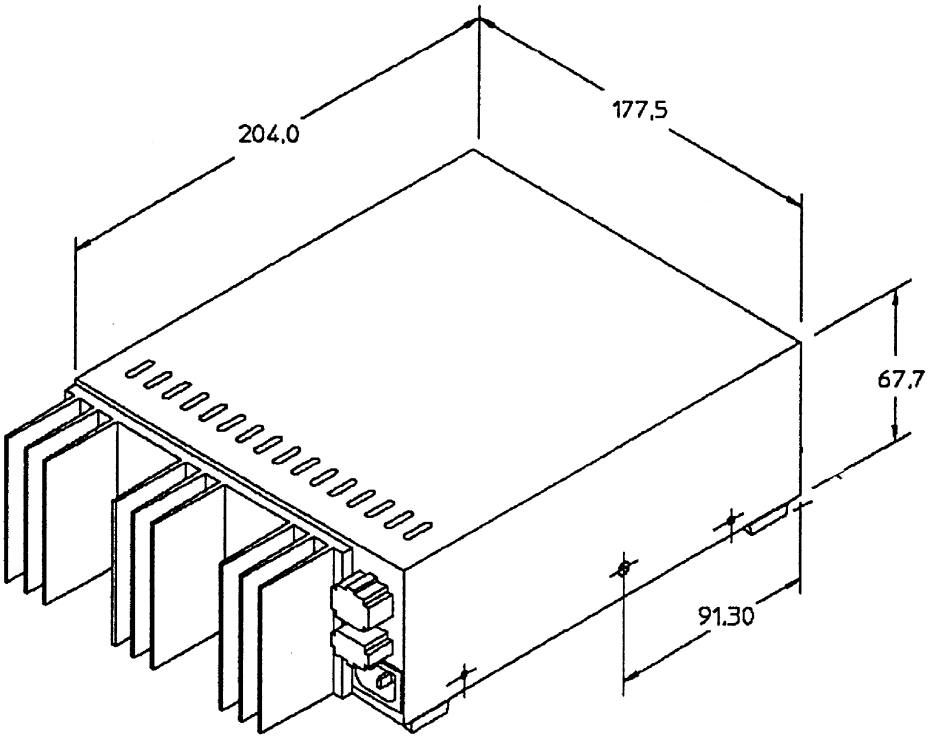
Electrical Characteristics

Input Voltages:	105-125VAC; 210-250VAC, 47-63Hz
Output Voltage:	13.8VDC ±0.1 volts (internally adjustable 11-15VDC)
Ripple:	less than 5mV peak to peak (full load and low line)

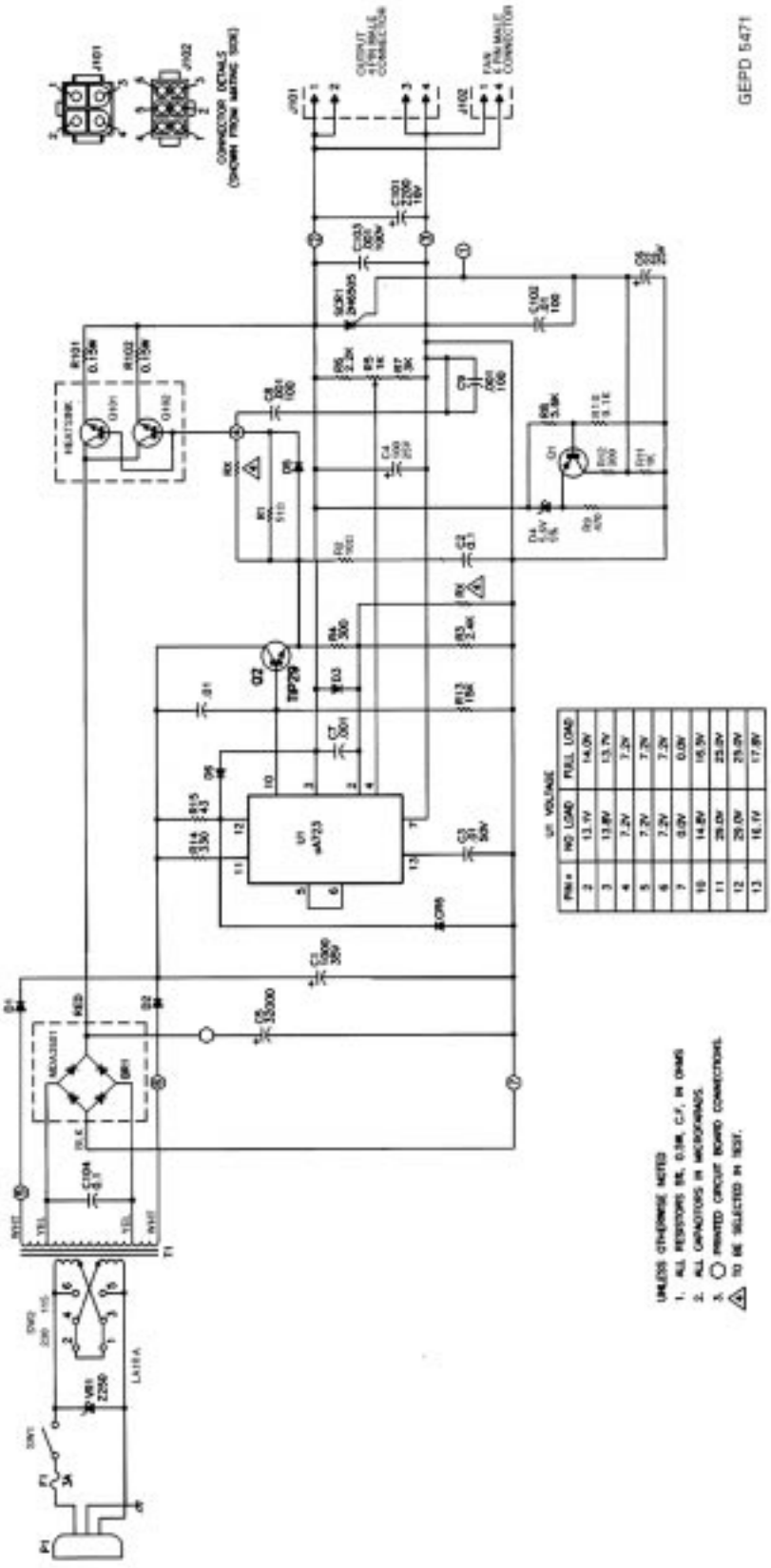
Provides 8 amps continuous duty and 14 amps intermittent duty over an ambient temperature range of -30 to +60°C .

(4 Pos) Positions 1 and 2 are positive power output terminals and positions 3 and 4 are for negative power output terminals for 14 amp max. current.

(6 Pos) Position 1 is negative power output terminal for 3 amp max current. Positions 2,3,6 are empty. Position 4 is positive 13.8VDC power output terminal. Position 5 is positive trickle charge output terminal.



Schematic Diagram



PIN #	NO LOAD	FULL LOAD
2	13.1V	14.0V
3	13.8V	13.7V
4	7.2V	7.2V
5	7.2V	7.2V
6	7.2V	7.2V
7	0.0V	0.0V
10	14.6V	16.5V
11	29.0V	23.0V
12	29.0V	29.0V
13	16.1V	17.8V

3.0 List of Accessories

Mechanical Hardware Kits:

GLN7324	Low Profile Trunnion Kit (Standard)
GLN7317	High Profile Trunnion Kit
GLN7320	In-Dash Mount, DIN install. Kit
GLN7325	IP54 seal, accessory connector
HLN9457	Accessory Connector Facility Kit

Microphones:

GMN6146	Enhanced Compact Microphone (Standard)
GMN6148	DTMF Microphone
HMN3141	Handset with Hang-up cup
HMN3000	Desk Microphone

Speakers:

Speaker connecting cables are provided with a 16-pin accessory connector plug.

GSN6059	13 W External Speaker, square

Cables:

GKN6270	Battery power cable 3m, 10A fuse (Standard)
GKN6271	Ignition switch cable
ENKN4000	MAP27 Interface Cable

Other

GKN6272	Alarm, Relay and Cable Kit
GLN7323	External PTT
GLN7326	Base Tray (with internal speaker)
GPN6126	24/12V DC Converter, 6A
GPN6127	24/12V DC Converter, 15A
GPN6133	EMC approved Power Supply
HPN4002	Non-EMC approved Power Supply
HPN8393	Non-EMC approved Power Supply

Chapter 4

Radio Tuning Procedure

Table of Contents

1.0 GM1200E Tuning Procedure

1.1 General

The recommended hardware platform is a 386 or 486 DX 33 PC (personal computer) with 8 Mbytes RAM, MS DOS 5.0™, Windows 3.1™, and DPS (Dealer Programming Software). These are required to align the radio. Refer to your DPS Installation Manual for installation and setup procedures for the required software; the user manual is accessed (and can be printed if required) via the DPS.

To perform the alignment procedures, the radio must be connected to the PC, RIB (Radio Interface Box), and Universal Test Set as shown in figure 4-1.

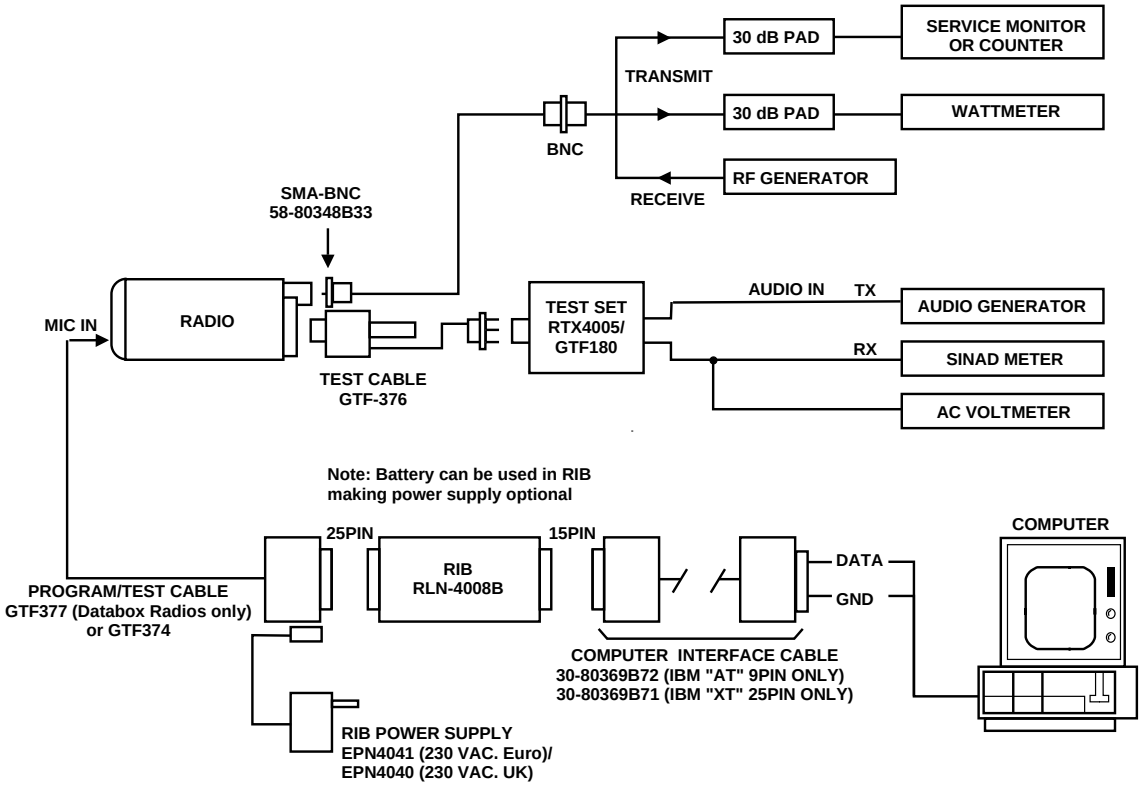


Figure 4-1 Radio Alignment Test Setup

All tuning procedures are performed from the Service menu.

Before going into the Service menu, the radio must first be read using the File / Read Radio menu (if the radio has just been programmed with data loaded from disk or from a newly created codeplug, then it must still be read so that the DPS will have the radio's actual tuning values).

All Service windows read and program the radio codeplug directly; you do NOT have to use the DPS Read Radio / Write Radio functions to program new tuning values.

CAUTION:

DO NOT switch radios in the middle of any Service procedure. Always use the Program or Cancel key to close the tuning window before disconnecting the radio. Improper exits from the Service window may leave the radio in an improperly configured state and result in seriously degraded radio or system performance.

The Service windows introduce the concept of the “Softpot”, an analog SOFTware controlled POTentiometer used for adjusting all transceiver alignment controls. A softpot can be selected by clicking with the mouse at the value or the slider or by hitting the TAB key until the value or the slider is highlighted.

Each Service window provides the capability to increase or decrease the ‘softpot’ value with the mouse, the arrow keys or by entering a value with the keyboard. The window displays the minimum, maximum, and step value of the softpot. In addition transmitter tuning windows indicate the transmitter frequency and whether the radio is keyed.

Adjusting the softpot value sends information to the radio to increase (or decrease) a DC voltage in the corresponding circuit. For example, increasing the value in the Reference Oscillator tune window instructs the radio microprocessor to increases the voltage across a varactor in the reference oscillator to increase the frequency. Pressing the Program button stores all the softpot values of the current window permanently in the radio.

In ALL cases, the softpot value is just a relative number corresponding to a D/A (Digital-to-Analog) generated voltage in the radio. All standard measurement procedures and test equipment are similar to previous radios.

Refer to the DPS on-line help for information on the tuning software.

Perform the following procedures in the sequence indicated.

Note: All tuning procedures must be performed at a supply voltage of 13.2V unless otherwise stated.
The Modulation Analyzer to measure the deviation should be set to frequency modulation with de-emphasis switched off and all high pass filters switched off.

1.2 PA Bias Voltage

Adjustment of the PA Bias is critical for proper radio operation. Improper adjustment will result in poor operation and may damage the PA FET device. For this reason, the PA bias must be set before the transmitter is keyed the first time.

Note: For certain radio models there are two bias voltage settings. For these radios both ‘ Bias 1 Voltage ’ and ‘ Bias 2 Voltage ‘ need to be adjusted when aligning the PA Bias. For models that only have one bias voltage setting, the ‘ Bias 2 Voltage ‘ will be shown in grey on the service menu.

1. From the Service menu, select Transmitter Alignment.
2. Select Bias Voltage Tuning to open the bias voltage tuning window. If the control voltage is out of range, an error message will be displayed. In this case the radio hardware has a problem and tuning must be stopped immediately.
3. Click the button labelled “0” to set the quiescent current temporarily to 0 mA
4. Measure the DC current of the radio. Note the measured value and add the specified quiescent current shown in table 4-1. The result is the tuning target.
5. Adjust the current per the target calculated in step 4.
6. Click the Program button to store the softpot value.

Table 4-1 Quiescent Current Alignment

RF-Band	Target
UHF VHF / 300-390MHz	440mA±10% 150mA±15%

1.3 Battery Threshold

The radio uses 2 battery threshold levels Tx High and Tx Low to determine the battery condition.

The Program buttons must only be activated when the power supply is set to the indicated voltage. If the DPS detects that the voltage is not within the expected range for the threshold in question then a message will be displayed to warn that the radio may not be set up correctly for the alignment operation.

CAUTION: Inadvertant use of the program buttons may result in radio failure.

1. From the Service menu, select Transmitter Alignment.
2. Select Battery Threshold to open the battery threshold tuning window. The current softpot values are displayed for information only and cannot be edited.
3. Set the supply voltage to the value indicated for TX High.
4. Click the TX High Program button to store the softpot value for TX High.
5. Set the supply voltage to the value indicated for TX Low.
6. Click the TX Low Program button to store the softpot value for TX Low.
7. Close the window by clicking Cancel.

1.4 Transmitter Power

The radio has two power level settings, a high power level setting, and a low power level setting. **IMPORTANT**: To set the transmitter power for customer applications use the Common Radio Parameters window under the Edit menu and set the “Low Power Level” and “High Power Level” powers to the desired values. Only if the transmitter components have been changed or the transmitter does not transmit with the power set in the Common Radio Parameters window the following procedure should be performed.

CAUTION: When setting the Transmitter Power DO NOT EXCEED THE RECOMMENDED POWER SET LIMITS of 25W.

The advanced power setting technology employed in the radio makes use of two reference power level settings along with parameters describing the circuit behaviour. To determine these parameters the DPS requires the power values measured for two different settings.

1. From the Service menu, select Transmitter Alignment.
2. Select RF Power Tuning to open the RF power tuning window. The window will indicate the transmit test frequencies to be used.
3. Select Point 1 value of the first frequency.
4. Click Toggle PTT to key the radio. The status bar will indicate that the radio is transmitting.
5. Measure the transmitter power on your power meter.
6. Enter the measured value in the box Point 1.
7. Select Point 2 value of the first frequency.
8. Measure the transmitter power on your power meter.
9. Enter the measured value in the box Point 2.
10. Click Toggle PTT to dekey the radio.
11. Repeat steps 3 - 10 for all test frequencies shown in the window.
12. Click Program to store the softpot values.

1.5 Reference Oscillator

Adjustment of the reference oscillator is critical for proper radio operation. Improper adjustment will not only result in poor operation, but also a misaligned radio that will interfere with other users operating on adjacent channels. For this reason, the reference oscillator should be checked every time the radio is serviced. The frequency counter used for this procedure must have a stability of 0.1 ppm (or better).

1. From the Service menu, select Transmitter Alignment.
2. Select Reference Oscillator to open the reference oscillator tuning window. The tuning window will indicate the target transmit frequency.
3. Click Toggle PTT to key the radio. The status bar will indicate that the radio is transmitting.
4. Measure the transmit frequency on your frequency counter.
5. Adjust the reference oscillator softpot in the tuning window to achieve a transmit frequency within the limits shown in table 4-2.
6. Click Toggle PTT again to dekey the radio and then press Program to store the softpot value.

Table 4-2 Reference Oscillator Alignment

RF-Band	Target
All bands	±150 Hz

1.6 Front-End Pre-Selector

Alignment of the front-end pre-selector is normally not required on these radios. Only if the radio has poor receiver sensitivity or the pre-selector parts has been replaced the following procedure should be performed. The softpot value sets the control voltage of the pre-selector. Its value needs to be set at 7 frequencies across the frequency range.

1. Set the test box (GTF180) meter selection switch to the "Audio PA" position and connect a SINAD meter to the "METER" port.
2. From the Service menu, select Receiver Alignment.
3. Select Front End Filter to open the pre-selector tuning window. The window will indicate the receive test frequencies to be used.

4. Select the first test frequency shown, and set the corresponding value to the start value shown in table 4-4.
5. Set the RF test generator to the receive test frequency, and set the RF level to 10µV modulated with a 1 kHz tone at the normal test deviation shown in table 4-3.
6. Measure the RSSI voltage at accessory connector pin 15 with a dc voltmeter capable of 1 mV resolution.
7. Change the softpot value by the stepsize shown in table 4-4 and note the RSSI voltage.The target softpot value is achieved when the measured RSSI voltage change between step 6 and step 7 is lower than the tuning target for the first time. The tuning target, shown in table 4-4, is expressed as the percentage of the measured RSSI voltage and must be recalculated for every tuning step. If the measured RSSI voltage decreases before the target value has been achieved, approximation should be stopped and the current softpot value should be used as target value. Set test box (GTF180) audio switch to the “SPKR” position. The 1 kHz tone must be audible at the target value to make sure the radio is receiving.
8. Repeat steps 4 - 7 for all test frequencies shown in the window.
9. Click the Program button to store the softpot values.

Table 4-3 Normal Test Deviation.

Channel Spacing	Deviation
12.5 kHz	1.5 kHz
20 kHz	2.4 kHz
25 kHz	3 kHz

Table 4-4 Start Value for Front-End Pre-selector Tuning.

RF-Band	Target	Stepsize	Start Value
UHF	0.42%	-2	Maximum
VHF	0.5%	+2	Minimum
300-350MHz	0.84%	-2	Maximum
336-390MHz	0.31%	-2	Maximum

1.7 Rated Volume

The rated volume softpot sets the volume at normal test modulation.

1. Set test box (GTF180) meter selection switch to the “AUDIO PA” position and the speaker load switch to the "MAXAR" position. Connect an AC voltmeter to the test box meter port.
2. From the Service menu, select Receiver Alignment.
3. Select Rated Volume to open the rated volume tuning window. The screen will indicate the receive test frequency to be used.
4. Set the RF test generator to the receive test frequency, and set the RF level to 1mVolt modulated with a 1 kHz tone at the normal test deviation shown in table 4-3. Set test box (GTF180) audio switch to the “SPKR” position. The 1 kHz tone must be audible to make sure the radio is receiving.
5. Adjust the value of the softpot to obtain rated audio volume (as close to 3.87 Vrms).

Note: The voltage at the meter port of the testbox GTF180 is only half the voltage at the speaker.

6. Click the Program button to store the softpot value.

1.8 Squelch

The squelch softpots set the signal to noise ratio at which the squelch opens. The squelch value needs to be set at 7 frequencies across the frequency range.

1. Set the test box (GTF180) meter selection switch to the "Audio PA" position and connect a SINAD meter to the "METER" port.
2. From the Service menu, select Receiver Alignment.
3. Select Squelch Attenuation to open the squelch attenuation tuning window. The window will indicate the receive test frequencies to be used.
4. Select the first test frequency shown, and set the corresponding value to 0.
5. Set the RF test generator to the test frequency and modulate the signal generator at the normal test deviation shown in table 4-3, with 1 kHz tone. Adjust the generator for a 8-10 dB SINAD level (weighted with psophometric filter).
6. Adjust the softpot value until the squelch just closes.
7. Monitor for squelch chatter; if chatter is present, repeat step 6.
8. When no chatter is detected, select the next softpot and repeat steps 4 - 7 for all test frequencies shown in the window.
9. Click the Program button to store the softpot values.

1.9 Transmit Voltage Limit

The transmit control voltage limit softpot sets the maximum power control voltage. All 7 voltage limit softpots are tuned and programmed automatically when the Program button is clicked.

1. From the Service menu, select Transmitter Alignment.
2. Select Voltage Limit to open the voltage limit tuning window.
3. Set the Power Factor to 1.3.
4. Click the Program button to store the softpot values.

1.10 Transmit Deviation Balance (Compensation)

Compensation alignment balances the modulation sensitivity of the VCO and reference modulation (synthesiser low frequency port) lines. Compensation algorithm is critical to the operation of signalling schemes that have very low frequency components (e.g. DPL) and could result in distorted waveforms if improperly adjusted. The compensation value needs to be set at 7 frequencies across the frequency range.

1. From the Service menu, select Transmitter Alignment.
2. Select Modulation Attenuation to open the deviation balance tuning window. The window will indicate the transmit test frequencies to be used.
3. Set the Test Box (GTF180) meter selector switch to the “GEN” position, and inject a 80 Hz tone at 200 mVrms into the "Audio In" port. (The deviation measured at step 6 should be about 1-4kHz.) Connect an AC meter to the meter port to insure the proper input signal level.
4. Select the first test frequency shown in the window.
5. Click Toggle PTT to key the radio. The status bar will indicate that the radio is transmitting.
6. Measure the transmitter deviation.

7. Change the input tone to 3 kHz, 200 mVrms.
8. Adjust the deviation to within ±2% of the value recorded in step 6.
9. Check the deviation at 80 Hz again and repeat step 7-8, if it has changed since step 6.
10. Click the Toggle PTT to dekey the radio.
11. Repeat steps 3 - 10 for the remaining test frequencies.
12. Click the Program button to store the softpot values.

Note: The step size change for step 8 is approximately 2.5% softpot value.

1.11 Transmit Deviation Limit

The transmit deviation limit softpot sets the maximum deviation of the carrier. The deviation value needs to be set at 7 frequencies across the frequency range.

1. From the Service menu, select Transmitter Alignment.
2. Select Reference Attenuation to open the reference attenuation tuning window.
3. Set the maximum value and press Program to store the softpot value.
4. From the Service menu, select Transmitter Alignment.
5. Select VCO Attenuation to open the deviation limit tuning window. The window will indicate the transmit test frequencies to be used.
6. Set the Test Box (GTF180) meter selector switch to the “GEN” position, and inject a 1 kHz tone at 800 mVrms into the "Audio In" port. Connect an AC meter to the meter port to ensure the proper input signal level.
7. Select the first test frequency shown in the window.
8. Click the Toggle PTT to key the radio. The status bar will indicate that the radio is transmitting.
9. Adjust the transmitter deviation to the value shown in table 4-5.
10. Click the Toggle PTT to dekey the radio.
11. Repeat steps 8 - 10 for the remaining test frequencies.
12. Click the Program button to store the softpot values.

Table 4-5 Transmitter Deviation

Channel Spacing	Deviation
12.5 kHz	2.2-2.3 kHz
20 kHz	3.4-3.6 kHz
25 kHz	4.3-4.6 kHz

1.12 Signalling Alignments

1.12.1 MPT RSSI Threshold Level

The Program buttons must only be activated when the required signal is input to the radio and the radio is receiving. If the DPS detects that the input signal is not within the expected range for the RSSI level in question then a message will be displayed to warn that the radio may not be set up correctly for the alignment operation.

CAUTION: Inadvertant use of the program buttons may result in radio failure.

1. Set test box (GTF180) meter selection switch to the “AUDIO PA” position and the speaker load switch to the "MAXAR" position.
2. From the Service menu, select Receiver Alignment.
3. Select RSSI to open the RSSI tuning window. The screen will indicate the receive test frequency to be used.
   The softpot values are displayed for information only and cannot be edited.
4. Set the RF test generator to the receive test frequency, and set the RF level to the value indicated for RSSI Level 0, modulated with a 1 kHz tone at the normal test deviation shown in table 4-3. Set test box (GTF180) audio switch to the “SPKR” position. The 1 kHz tone must be audible to make sure the radio is receiving.
5. Click the Program button to store the softpot value for RSSI Level 0.
6. Repeat steps 4 - 5 for the remaining RSSI levels.
7. Click the Cancel button to close the window.

1.12.2 MPT1327 Transmit Deviation / DTMF Transmit Deviation

The MPT1327 Deviation Softpot is used to tune the FFSK signalling deviation. Tuning is performed at one frequency. The radio generates an alternating bit pattern for tuning. Values for other frequencies are calculated by the radio software.

The DTMF Deviation Softpot is used to tune the DTMF signalling deviation. Tuning is performed at one frequency. The radio generates a DTMF signal for tuning. Values for other frequencies are calculated by the radio software.

1. From the Service menu, select Transmitter Alignment.
2. Select Signalling Deviation to open the signalling deviation tuning window.
3. Select the MPT value and click the Toggle PTT to key the radio. The status bar will indicate that the radio is transmitting.
4. Adjust the transmitter deviation to the value shown in table 4-6.
5. Click the Toggle PTT to dekey the radio.
6. Repeat steps 3 - 5 for DTMF deviation.
7. Click the Program button to store the softpot value.

Table 4-6 Signalling Deviation

Channel Spacing	MPT 1327	Deviation
12.5 kHz	1.4-1.6 kHz	1.5-1.8 kHz
20 kHz	2.2-2.6 kHz	2.4-2.8 kHz
25 kHz	2.8-3.2 kHz	3.0-3.4 kHz

Appendix A

PL/DPL Codes

Table of Contents

1.0 PL Codes and Digital PL (DPL) Codes

The following have been tested and are acceptable for programming into any transmit or receive frequency.

1.1 PL Codes

GROUP A		GROUP B		GROUP C	
Code	**Freq**	**Code**	**Freq**	**Code**	**Freq**
XZ	67.0	XA	71.9	WZ	69.3
XB	77.0	YZ	82.5	WA	74.4
YB	88.5	ZA	94.8	WB	79.7
1Z	100.0	1A	103.5	YA	85.4
1B	107.2	2Z	110.0	ZZ	91.5
2A	114.8	2B	118.8	ZB	97.4
3Z	123.0	3A	127.3	5B	162.2
3B	131.8	4Z	136.5	8Z	206.5
4A	141.3	4B	146.2		
5Z	151.4	5A	156.7		
6A	173.8	6Z	167.9		
7Z	186.2	6B	179.9		
M1	203.5	7A	192.8		
M3	218.1	M2	210.7		

1.2 Digital PL (DPL) Codes:

023	025	026	031	032	036
043	047	051	053	054	065
071	072	073	074	114	115
116	122	125	131	132	134
143	145	152	155	156	162
165	172	174	205	212	223
225	226	243	244	245	246
251	252	255	261	263	265
266	271	274	306	311	315
325	331	332	343	346	351
356	364	365	371	411	412
413	423	431	432	445	446
452	454	455	462	464	465
466	503	506	516	523	526
532	546	565	606	612	624
627	631	632	654	662	664
703	712	723	731	732	734
743	754				

Appendix B

NPD Application Notes

Table of Contents

1.0 Non Prescribed Data (NPD) Calls

Non Prescribed Data calls utilising external Data Terminal Equipment (DTE) can be made using the GM1200E Databox radio as the carrier.

Call protocol is by a combination of control line handshakes, the complexity of which depends on the intelligence of the DTE.

2.0 Calls with DTE connected to External Data Connector (Radio Accessory Connector)

2.1 DTE Initiated Call (Outgoing Calls)

- ❑ Call set-up is initiated on ‘Call 1’ which should be programmed with an address including the ‘Non Prescribed Data’ (NPD) call modifier (*31*).
- ❑ When the traffic channel data path is set up, the radio will enable the audio input and output lines (with the microphone and loudspeaker lines disabled) and then signal that the DTE is Clear to Send (CTS).
- ❑ The DTE will send and receive audio signals using the PTT line as direction control.
- ❑ Call clear can be from either DTE or radio.
  DTE will remove the signal from ‘Call 1’ or signal on ‘Call Clear’.
  Radio will remove the CTS line signal.

2.2 Calls Initiated by another Radio Unit (Incoming Calls)

- ❑ Incoming calls will be indicated by a signal on the CTS.
- ❑ The call will be “answered” by the DTE signalling on ‘Call 1’.
- ❑ The call will continue and clear as described above in section 2.1

3.0 Calls with DTE connected to Internal Data Connector (Radio Option Connector)

3.1 DTE Initiated Call (Outgoing Calls)

It is possible for the radio to call up to 3 different destinations (addresses) by using a combination of Call 1 and Call 2 lines to signal one of three possibilities (Call N).

- ❑ Call set-up is initiated on ‘Call N’ which should be programmed with an address including the ‘Non Prescribed Data’ (NPD) call modifier (*31*).
- ❑ When the traffic channel data path is set up, the radio will enable the audio input and output lines (with the microphone and loudspeaker lines disabled) and then signal that the DTE is Clear to Send (CTS).
- ❑ The DTE will send and receive audio signals using the PTT line as direction control.
- ❑ Call clear can be from either DTE or radio.
  DTE will remove the signal from ‘Call N’ or signal on ‘Call Clear’.
  Radio will remove the CTS line signal.

3.2 Calls Initiated by another Radio Unit (Incoming Calls)

- ☐ Incoming calls will be indicated by a signal on the CTS.
- ☐ The call will be “answered” by the DTE signalling on ‘Call 3’ (i.e.Call 1 and Call 2 lines both enabled).
- ☐ The call will continue and clear as described above in section 3.1

4.0 Other Calls

4.1 Voice Calls

It is possible to set up voice calls internally or externally using the procedures described above by omitting the NPD call modifier from the called address. In this case the audio paths will be set up to use the external microphone and loudspeaker with the volume pre-set. It is not possible to adjust the volume from inside the radio.

4.2 Status Calls

It is possible to signal status calls internally or externally.

- ☐ Status is sent by signalling on ‘Call N’ to a pre-set address using the Status call modifier.
- ☐ The radio will send the pre-set status call to the pre-programmed address.
- ☐ Call “success” will be signalled with a pulse on the CTS line.

4.3 Mixed Calls

Due to the ambiguity necessarily introduced by the very simple handshaking techniques employed, users should only consider mixing Data/Voice/Status calls if they are confident that their DTE is capable of correctly interpreting the handshakes under all conditions for all incoming and outgoing call types likely to be encountered.