11-92

GE Mobile Communications

m-PD™

136-174 MHz,
PERSONAL TWO-WAY FM RADIO
COMBINATION

INCLUDES

SERVICE SECTION LBI-31677

Maintenance Manual

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SPECIFICATIONS

SYSTEM

Frequency Range	FCC Identification Number
136 MHz to 160 MHz	AXA9WNTR-145-A
150 MHz to 174 MHz	AXA9WNTR-145-B

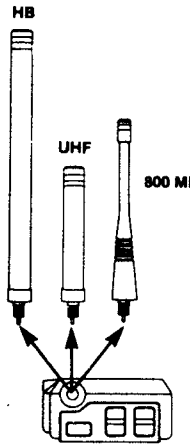
Frequency Stability	5 PPM
Battery Drain (at 7.5 VDC)	
Standby	65 Milliamperes
Receiver (Rated Audio)	195 Milliamperes
Transmitter	1.9 amperes
Dimensions (H x W x D)	
(With Standard Capacity Battery)	183 x 69 x 43 mm
(With High Capacity (short) Battery)	183 x 69 x 43 mm
(With High Capacity (long) Battery)	219 x 69 x 43 mm
(With Extra High Capacity Battery)	219 x 69 x 43 mm
Weight	
(With Standard Capacity Battery)	24 ounces
(With High Capacity (short) Battery)	24 ounces
(With High Capacity (long) Battery)	29 ounces
(With Extra High Capacity Battery)	29 ounces
Operable Temperature Range	-30°C to +60°C

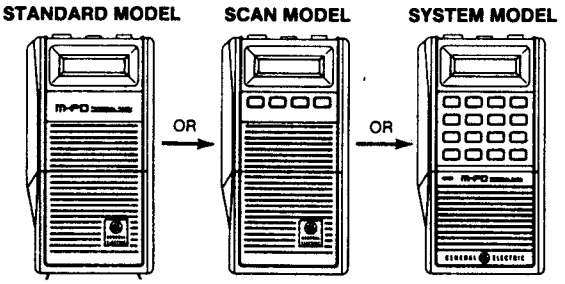
TRANSMIT

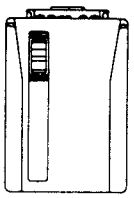
RF Power Output	0.5 to 5 Watts
Spurious Emissions	-37 dBm
Maximum Deviation	5 kHz
FM Hum & Noise (EIA)	-45 dB
Audio Distortion (60% MOD)	3%
Frequency Stability (-30°C to + 60°C)	5 PPM
RF Load Impedance	50 ohms
Microphone Sensitivity (EIA 60% MOD)	Less than 90 dB SPL
Maximum Attack Time (PTT Pushed)	25 milliseconds
Audio Frequency Response	Within +1 and -3 dB of a 6 dB/octave pre-emphasis from 300 Hz to 3000 Hz.

RECEIVE

Sensitivity (12 dB SINAD)	-116 dBm
Spurious Emissions	-57 dBm
Spurious Response Rejection	72 dB (Minimum)
IM Distortion Rejection	70 dB (Minimum)
Adjacent Channel Selectivity	70 dB (30 kHz)
Squelch Sensitivity	6 dB SINAD (Minimum) Adjustable
Distortion (EIA 0.5 Watt)	5% (Maximum)
Audio Frequency Response	Within +1 and -3 dB of a 6 dB/octave de-emphasis from 300 Hz to 3000 Hz.

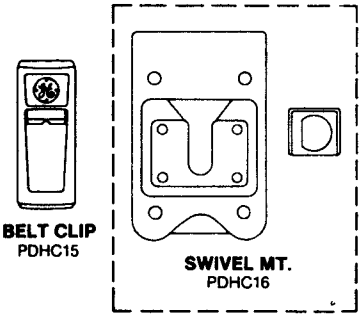






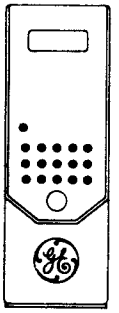
HIGH CAPACITY
BATTERY
(Standard)

STANDARD CAPACITY
PDPA10
(Optional)

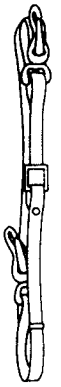


BELT CLIP
PDHC15

SWIVEL MT.
PDHC16

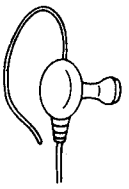


CARRYING CASES
WITH BELT LOOP
PDHC11
PDHC12
WITH SWIVEL MT
PDHC13
PDHC14



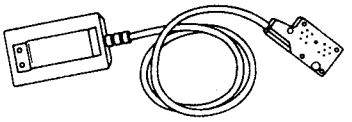
SHOULDER STRAP
PDHC18

HEADSET/MIC
PDAB10

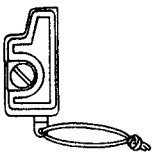


EARPIECE
PDAC10

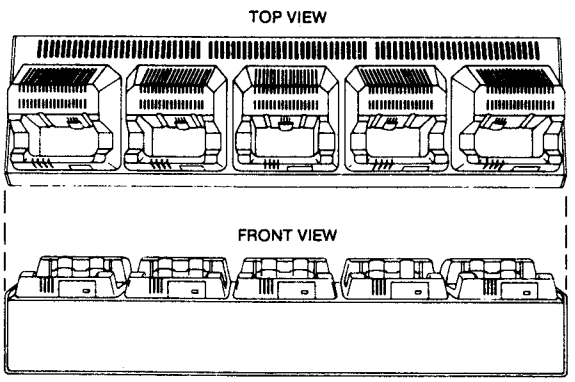
SPKR-MIC
PDAE10



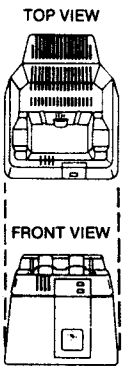
INTERFACE CONNECTOR
(Provided with PDAB10)



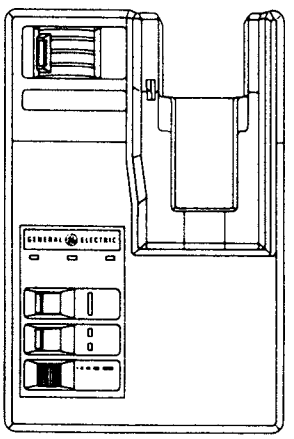
GE-STAR LANYARD
PDAC12



MULTI-CHARGER
H2A2L2A 121 VAC 16 HR
H2A2J1A 121 VAC 1 HR
H2A2M2A 240 VAC 16 HR
H2A2N1A 240 VAC 1 HR



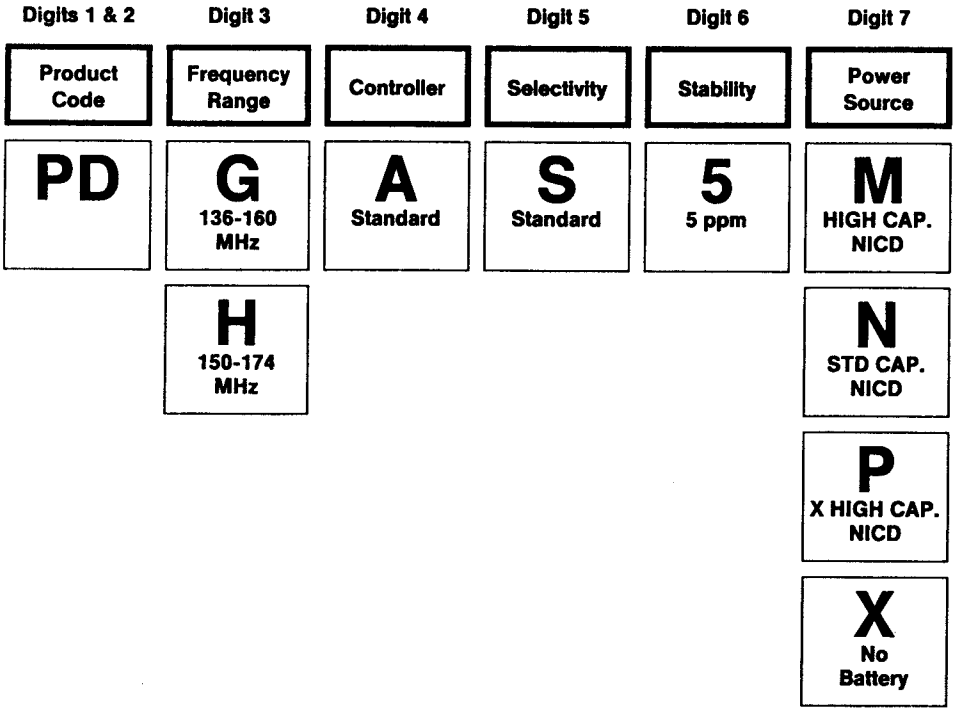
DESK CHARGER
H2A1L2A 121 VAC 16 HR
H2A1J1A 121 VAC 1 HR
H2A1M2A 240 VAC 16 HR
H2A1N1A 240 VAC 1 HR



VEHICULAR CHGR/RPTR
H2V01 - Vehicular Charger
H2V02 - Vehicular Chgr/Rptr Control

RC-7338

COMBINATION NOMENCLATURE



DESCRIPTION

General Electric's M-PD Personal Radio is a high-quality, high-performance, two-way, FM, communications unit consisting of a transmit/receive circuit with a frequency synthesizer controlled by a microprocessor. The M-PD Personal Radio is ideal for use in public services by providing the following features:

- 48 Channel Capability: Channel designation can be a mixture of numerics (0 - 48) and alphanumerics through the eight characters in the LCD display. Channel control can come from either the up/down channel ramping buttons or the "Home" Channel feature.

- Programmable Multi-Tone Channel Guard (CTCSS) Encode/Decode: Channel Guard tone frequencies within the range of 67 Hz to 210.7 Hz, including all of the standard EIA frequencies, may be programmed. Different encode/decode, encode only and with/without Channel Guard frequencies are also programmable into the radio.

  The same channel is used with and without Channel Guard by programming two different radio channels with the same frequency information but only one with Channel Guard capability.

- Programmable Multi-Code Digital Channel Guard Encode/Decode: Similar capability as with Tone Channel Guard is provided.

- Programmable Carrier Control Timer: Personality information includes an optional period of transmit time from 15 to 120 seconds, after which the unit will automatically unkey and provide an alerting tone. This feature is reinitiated on every PTT and the alert tone is removed upon release of the PTT.

- Minimum Volume Level: Personality information includes a minimum volume level below which the radio controls cease to reduce the volume.

- Squelch Tail Elimination: Squelch and audio circuits are designed so that annoying squelch pops which may occur at the end of received messages are minimized, both with and without Channel Guard. This system is compatible with an existing GE system.

- **Programmable Squelch:** The noise squelch opening threshold can be programmed for each channel.

- **Channel Busy Lock Out:** Personality information includes the capability to prevent the transmitter from operating on a channel where carrier activity is present. The "Channel Busy" indicator (BSY) is active during this time.

- **Automatic Power Levels:** The desired power level on each channel can be programmed into the radio personality such that it is automatically selected channel-by-channel.

- **Home Channel Feature:** A "Home" channel can be programmed into the radio which is selected by pressing the "Home" bottom. This allows a user to quickly reach a reference channel.

- **Surveillance Feature:** In addition to the ability to program the display lighting on or off per channel, the sidetone beep related to the operation of a radio control is capable of being disabled on a channel by channel basis.

- **Eight Character Alphanumeric Liquid Crystal Display:** This display is used to exhibit the condition of the radio. It shows: Channel Designation, Channel Guard or Digital Channel Guard ON/OFF, Transmit, Volume Level, Battery Condition, Channel Busy and High/Low Power output.

- **Simple Remote Control Capability:** By connection through the UDC (Universal Devices Connector) a simple speaker/microphone can be operated which can also control PTT and Volume level.

- **Push Button Controls Only:** All control functions on the radio, with the exception of the power ON/OFF switch, are operated through push button controls on the top and sides of the radio.

- **Programmable through UDC:** The entire personality of the radio is programmed into the radio through the UDC through four connections. The General Electric TQ2310 Universal Programmer is one method of programming the radio, while the capability exists to interface to an RS-232 device at a maximum of 1200 baud.

Physically an M-PD radio consists of three printed wire board assemblies and a battery pack as follows:

a. A printed wire board specially shielded with zinc alloy on which the radio assembly (transmit/receive/synthesizer) is assembled.

b. A Logic control board containing the microprocessor.

c. A Display board carrying various display and indicating circuits.

d. A battery pack that fits the M-PD main unit.

e. Light weight metal front and back housing.

Radio Assembly

Transmit:

The transmit circuit is made up of four major circuits as follows:

a. Wideband Hybrid Exciter: Amplifies the signal from the frequency synthesizer with about 21 dB gain.

b. Wideband Power Amplifier: Amplifies the output signal of the exciter (13 dB to 18 dB) to the desired output level for transmission.

c. Wideband Power Control Hybrid IC: Can reduce the transmitter output level by 10 dB.

d. Output Low pass Filter (LPF): Consists of a three stage LPF to eliminate higher harmonics.

The transmitter completely covers the band within the split with no adjustments except for the RF power control voltage from the controller.

Receive Circuit:

The receiver consists of three major circuits as follows:

a. Front End Circuit: Consists of single stage pre-amplifier with about 12 dB gain and the pre-BPFs and the post-BPFs of the pre-amplifier.

b. First Mixer and IF Circuit: A special double balanced mixer provide a 45 MHz first IF, which is coupled through band pass

filter (BPF) and an IF amplifier to get the desired first IF signal.

c. Second IF (455 kHz): Consists of one IC and one BPF, containing the second mixer, second IF amplifier and FM detector. The second IF output provides the Logic section with audio output.

Frequency Synthesizer:

The frequency synthesizer is made up of three major modules as follows:

a. VCO Module: The VHF band frequency synthesizer has two VCO's, one for transmitting and one for receiving. The transmitter is modulated at both the VCO and the VCTCXO.

b. VCTCXO Module: The VCTCXO is a temperature compensated crystal oscillator to provide a 13.2 MHz reference frequency and has modulation capability.

c. Phase Lock Loop: Consists of a frequency divider and a low current drain C-MOS IC for phase comparison.

Logic Circuit

The Logic circuit consists of a LCD board and a control board with an audio IC as follows:

a. LCD Board: Includes LCD driver circuits for the display.

b. Control Board: Carries a microprocessor, a battery backed RAM, audio circuit and I/O interconnections with the frequency synthesizer and the display. Thus, this board commands all the functions and operation of the MPD radio.

c. Audio IC: Includes transmitter and receiver audio circuits.

Power Supply

The M-PD battery pack connects to the bottom of the M-PD radio to supply 7.5 Volts DC to the unit. The battery packs are available in three capacities: standard, high and extra high. To charge these battery packs, charges are available in three different styles: a desk charger, a wall mount multi-charger and a vehicular charger.

OPERATION

The M-PD Personal Radio is delivered disassembled into three parts:

1. M-PD Radio (Main Unit)
2. Antenna
3. Battery Pack

Assemble these parts into one unit according to the following procedure and as shown in Figure 1 - M-PD Operating Controls and Accessories.

NOTE

Either the antenna or the RF connector should be connected to the M-PD radio main unit, as desired. If the RF connector is inserted in the receptacle, located in the side of the unit, the antenna connector circuit will become open.

1. Screw the antenna (2) or the RF test connector (4) in its receptacle. A clockwise turn will insert the antenna or RF test connector, while a counter-clock-wise turn will remove them.

2. Slide the battery pack along the bottom of the M-PD main unit from the arrow-marked direction, shown in Figure 1, until the battery pack locks into place.

Operating Procedure (Refer to Figure 1)

To Receive a Message:

1. Slide the Power switch (8) on the side of the battery pack up to turn on the radio.

2. Select a desired channel by pressing the ▲ mark side or ▼ mark side, as desired, of the CHAN switch (6) while watching the indication in the display window (7).

3. To monitor the channel for idle or busy, watch for the "BSY" symbol to be illuminated in the display or audibly monitor the channel by simultaneously depressing both the ▲ and ▼ volume buttons.

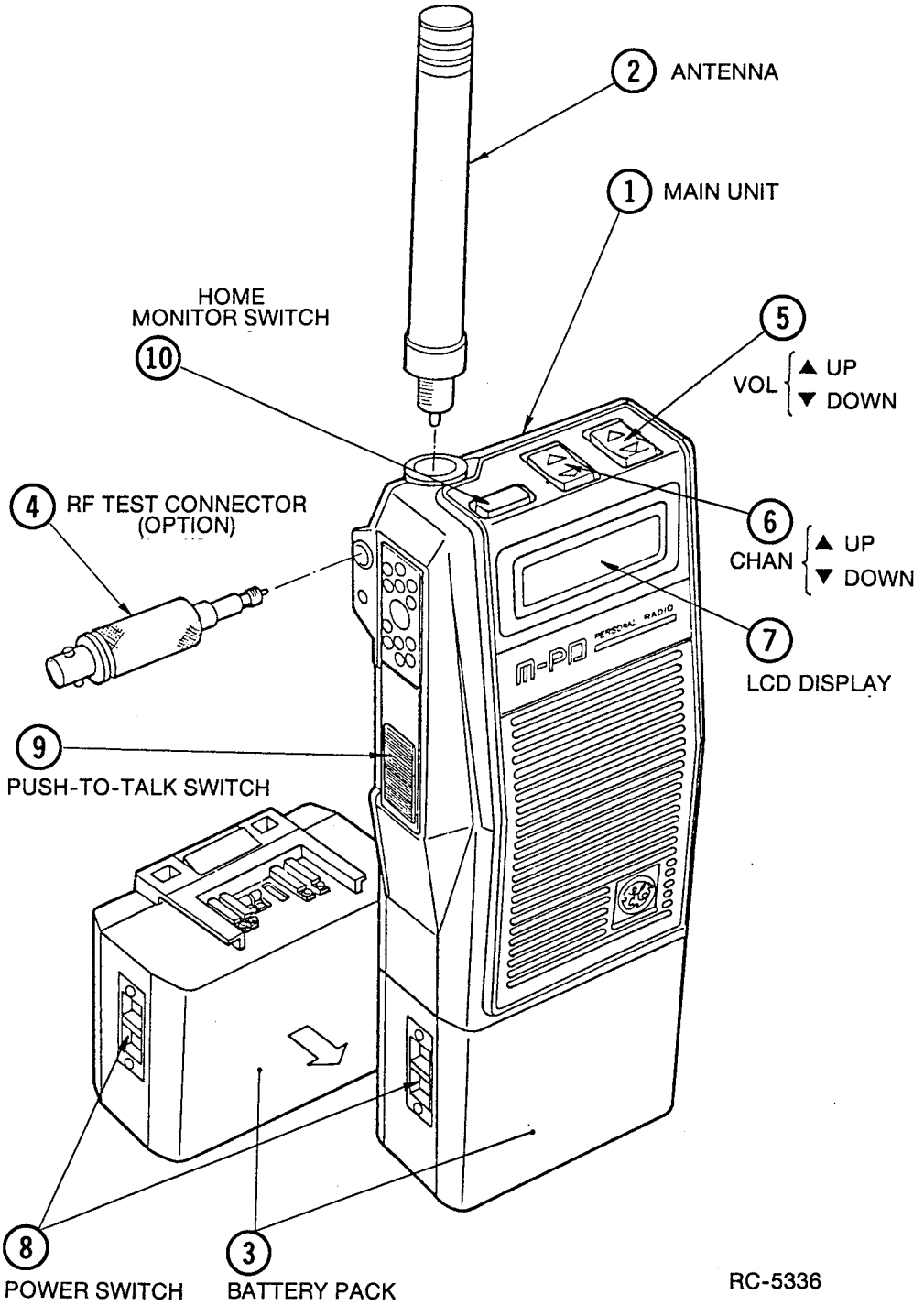


Figure 1 - M-PD Operating Controls and Accessories

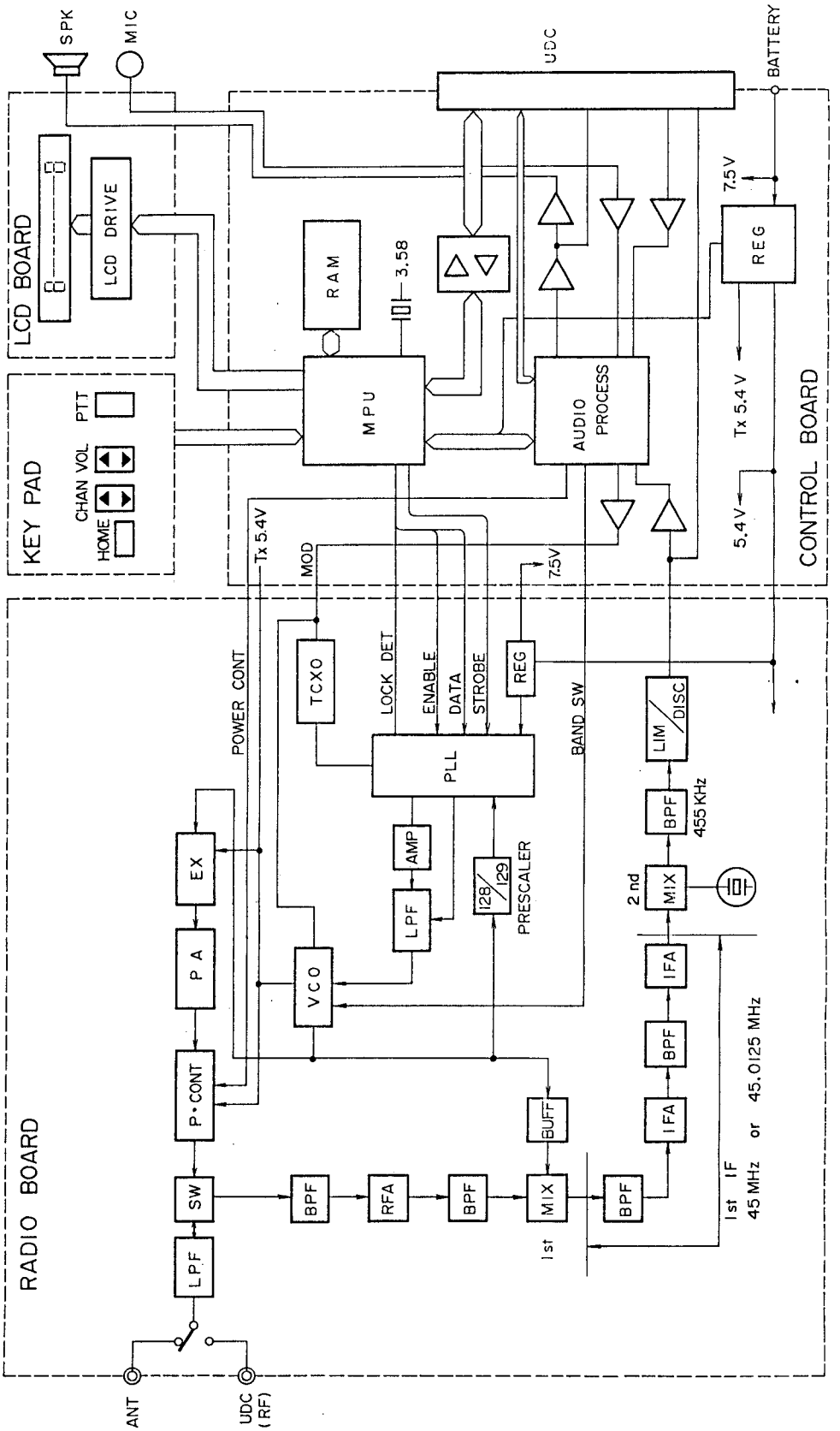
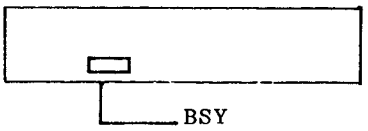


Figure 2 - Block Diagram



Display

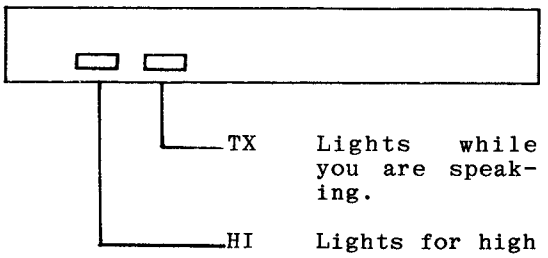
If BSY lights, it means that the channel is busy.

4. Adjust the audio volume to the desired level by pressing the ▲ mark side (to turn the volume up) or the ▼ mark side (to turn the volume down) of the VOL switch (5). As the VOL switch is operated, the indication in the display window changes 1 through 31 (about 45 dB). The volume level cannot be set lower than the level programmed in the minimum volume option.

To Send a Message:

Hold the radio so that the antenna is vertical. Then, press the Push-to-Talk (PTT) bar (9) on the left side of the main unit and speak directly into the microphone in a clear and distinctive voice. Always release the PTT bar as soon as you stop talking.

Upon pressing the PTT bar, an indication will appear in the display window (7).



TX Lights while you are speaking.

HI Lights for high power.

NOTE

The M-PD unit is provided with an optional timer which inhibits continuous transmission beyond about 120 seconds. When transmission is interrupted due to "time-out", you can resume transmission by releasing and then pressing the PTT bar again.

SYSTEM ANALYSIS

General Electric M-PD Personal radios are two-way, FM radios designed for public communications. The M-PD radio consists of three printed wire boards as follows:

- **Radio Board:** carries the transmit, receive and frequency synthesizer circuits
- **Control Board:** supports logic, control and audio processor circuits
- **Display Board:** carries LCD displays

Interconnection of the control board with other boards and control circuits is made with flexible circuit boards and connectors. All control leads which are "barred", such as PTT, mean that the function indicated occurs when the lead is in a low voltage condition.

Circuit illustrations shown in the following text are simplified representatives of actual circuits. They are intended only to illustrate basic circuit functions.

RADIO BOARD

Transmit Circuits

The M-PD transmit circuit, as shown in Figure 2 - Block Diagram, consists of the following integrated circuit modules:

- Amplifier (TX-Amp)
- Power Amplifier (PA)
- Power Controller (PC)
- Antenna Switch (AS)
- Filter Network (FN)

Amplifier Module (A201):

Amplifier module (TX-Amp) A201 is a single stage RF amplifier hybrid IC. A 0 dBm RF signal on the input will produce a +23 dBm signal on the output (refer to Figure 3). This module is broadband and does not require tuning.

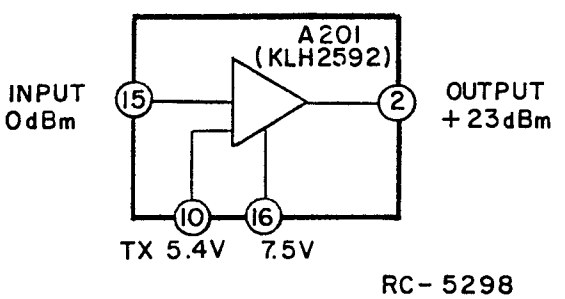


Figure 3 - Amplifier Module (TX-Amp)

Power Amplifier Module (A202):

Power Amplifier (PA) A202 is a three stage, wide band amplifier module with an input and an output impedance of 50 ohms (refer to Figure 4). The first stage of the PA module has the DC power supplied by power control transistor Q202. The RF power output from Pin 2 of the TX-Amp module A201 is connected through a resistor attenuator to Pin 1 of the PA module where it is applied to the input of the RF power amplifier stages. The RF power amplifier stages amplify the input from the TX-Amp module to a typical power output level of 6 watts at Pin 5. The output at Pin 5 is connected through the power control hybrid IC A203 (PC) and TX-RX switching diode CR201 to low pass filter network FN. A minimum power level of 5 watts is on the output of the filter network.

Power Control Module (A203):

The RF power output of the radio is regulated by sensing variations in the RF power output of the transmit PA module to control the supply voltage to the first stage of the PA module (refer to Figure 5). Supply voltage cannot be applied to the first stage of the PA module until the transmit circuit is keyed, applying 5.4 Volts to Pin 11 of Power Control (PC) hybrid IC A203. When the transmit circuit is keyed, the output of a reference amplifier, determined by the High-Low power control, is applied to the positive (+) input of a comparator circuit.

The output of the final PA is connected to Pin 1 of the PC module and to the 50 ohm coupled line. The detected voltage of the CM coupled output is applied to the negative (-) input of the comparator circuit. The amplifier is enabled when the transmit circuit is keyed, until then, the output of the amplifier is low and transistor Q202 is held off. As the PA module begins to increase output power, the detected voltage causes the series regulator circuit to regulate the supply voltage to maintain constant RF output power.

Filter Network (FN):

The output of the PA module is connected to filter network FN through TX-RX switching diode CR201. The FN network is a passive LC low pass filter with an insertion loss of less than 0.5 dB in the pass band. It also has a rejection greater than 45 dB in the stop band. The output of the FN is connected to the system antenna or to the UDC connector.

Receive Circuit

The M-PD receive circuit, as shown in Figure 2, consists of the following circuits:

- RF Amplifier/Mixer
- First IF Amplifier
- Second IF Amplifier/ Discriminator

RF Amplifier/Mixer:

The RF Amplifier/Mixer circuit contains two third order band pass filters (FL301 and FL302), an RF amplifier circuit (Q301) and a double balanced diode mixer circuit (A301). Refer to Figure 6 - RF Amplifier/Mixer. RF from the antenna or UDC connector is coupled through transmit low pass filter FN and RF switching diode CR201 to the input of the RF amplifier circuit. Low pass filter FN is used in the receive circuit to provide additional receive selectivity. The RF signal on the input of the RF amplifier is first coupled through band pass filter FL301 to the input of grounded emitter, broad band RF amplifier transistor Q301. This amplifier provides 12 dB of power gain to reduce thermal noise. The output of the RF amplifier is coupled through band pass filter FL302 to drive double balanced mixer A301.

The RF signal from the RF amplifier and the injection frequency from the synthesizer circuit, provide a difference of 45 MHz IF on the output of the mixer. The double balanced Mixer has a typical conversion loss of 6 dB between the RF input and IF output. All inputs and the output of the RF Amplifier/Mixer are 50 ohms impedance. The +7 dBm injection frequency level, provided by the synthesizer and amplifier circuit transistor Q106, is connected to the injection frequency input through a 50 ohms matching circuit. The output of the Mixer circuit is connected to the input of the first IF Amplifier.

First IF Amplifier:

The first IF amplifier contains two amplifier circuits and two crystal filters of two and four poles respectively (refer to Figure 7). The first IF signal (45 MHz) from the first mixer circuit connects to the input of pre-amplifier transistor Q302 through pre-crystal filter FL303 with an impedance of approximately 3K ohms. Pre-amplifier Q302 provides a 17 dB power gain. The output is connected to the input of IF amplifier transistor Q303 through crystal filter FL304. IF amplifier Q303 has a 13 dB power gain, an input impedance of approximately 3K ohms and an output impedance of approximately 2.2K ohms.

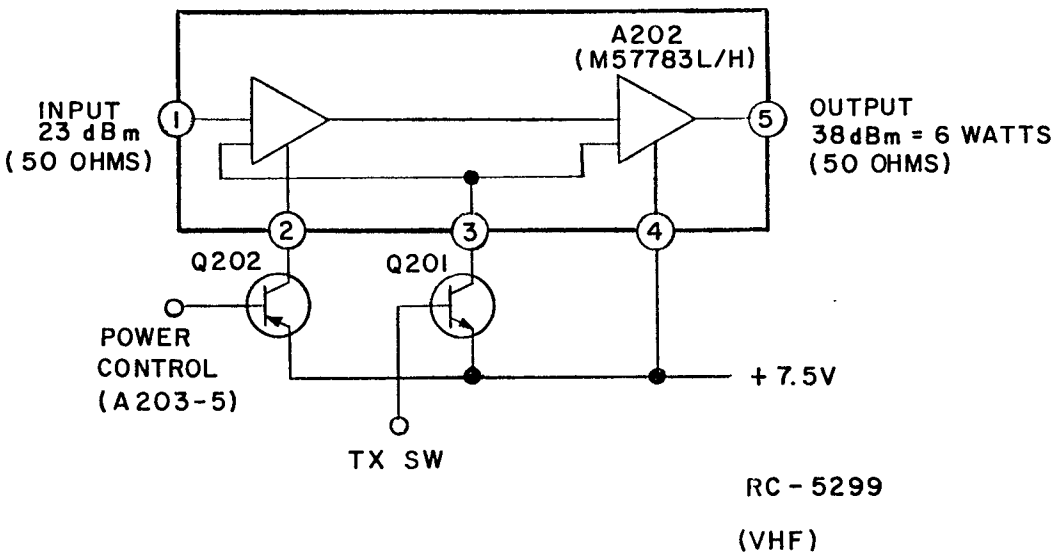


Figure 4 - Power Amplifier (PA)

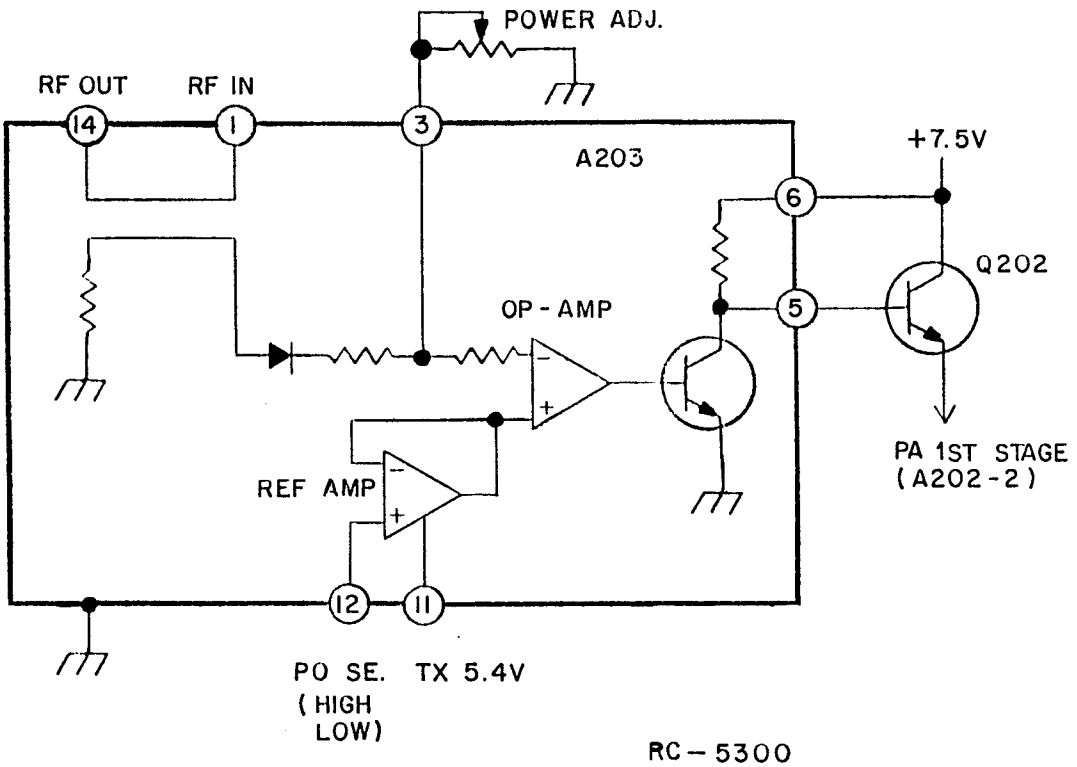


Figure 5 - Power Control Module (PC)

Second IF Amplifier/Discriminator (A302):

The Second IF Amplifier/Discriminator circuit contains FM IF IC A302 (HA12442V) and 455 KHz ceramic filter FL305 (refer to Figure 8). The FM IF IC contains a local oscillator, mixer, IF amplifier, FM detector and an audio amplifier. The 45 MHz IF output from the first IF amplifier is connected to the input of second IF amplifier A302a, Pin 2 of HA12442V and converted to the second IF frequency (455 KHz). The second IF output is connected to Pin 7 of HA12442V through the 455 KHz ceramic filter to the IF amplifier and FM detector circuits. The recovered audio from the FM IF IC is connected to J102-4.

Synthesizer Circuit

The Synthesizer circuit contains Phase-Lock-loop module (PLL) A102, VCTCXO Reference Oscillator module A103, TX/RX Voltage Controlled Oscillator module (VCO) A106 and a Low Pass Filter amplifier (LPF). Refer to Figure 9 - Synthesizer. The VCO used to generate the receive and transmit reference frequencies is phase locked to a stable VCTCXO reference oscillator through the use of the PLL. This feedback loop divides the VCO frequency down to a signal in the range of 7 MHz - 10 MHz; divides this signal with a programmable divider to 5/6.25 KHz and generates a VCO control signal by comparing the 5/6.25 KHz feedback with a 5/6.25 KHz signal derived by dividing a 13.5 MHz VCTCXO by 1056. As the least significant bit in the programming is changed, the VCO is forced to change by 5/6.25 KHz.

The synthesizer circuitry is contained on two modules, the VCO module A106 and the VCTCXO reference Oscillator module A103.

Phase-Lock-Loop Module (A102):

The PLL module A102 contains a reference frequency, divider, phase detector and a programmable divider. The phase detector DC voltage output signal is filtered with a passive low pass filter followed by a 6.25 KHz filter to reduce the level of reference modulation on the VCO. This DC output represents the error between the VCO frequency (phase) and the reference (VCTCXO) and is applied to the VCO on frequency. A lock detect output is developed from Pin 9 output of A102. This output is checked by the microcomputer to prevent transmission before the VCO is on frequency.

Serial data from the microcomputer is shifted into the PLL to set the division parameter which establishes the frequency. A clock signal is provided on another input and the data is latched with the enable input.

Voltage Controlled Oscillator A106:

The VCO uses a low noise, high gain transistor as the basic oscillator. The resonant circuit, which determines the frequency of oscillation, is formed by a High Q coil which is used to set the center frequency at the factory. The output of each VCO (TX and RX) is coupled into a cascade amplifier which produces +3 dBm. The output of the RX-VCO amplifier is coupled into the receive first double balanced mixer circuit A301 through buffered amplifier Q106. The TX-VCO amplifier output is directly connected to the TX-Amp input through attenuator circuit R201, R202 and R203.

VCTCXO Reference Oscillator A103:

The A103 oscillator module is self contained, fully temparature compensated and operates at a frequency of 13.2 MHz. The oscillator also has modulation capability. Frequency is adjusted by a trimmer while monitoring the transmit circuit output at the antenna jack.

CONTROLLER CIRCUIT

This controller circuit consists of control circuits and audio circuits. Physically, this circuit consists of two circuit boards as follows:

- Control Board
- LCD Board

Control Board

The Control board consists of the following circuits (see Figure 2):

- CMOS Microcomputer (A1)
- RAM with Lithium Battery (A2 plus BT1)
- Audio Processor (A3)
- Audio Amplifier (A4, A6)
- Voltage Regulator Circuits (A7, A9, Q2, Q3, Q10 and Q11)
- External Data Buffer (A5)

Microcomputer (A1):

The microcomputer provides various software for controlling the radio unit as follows:

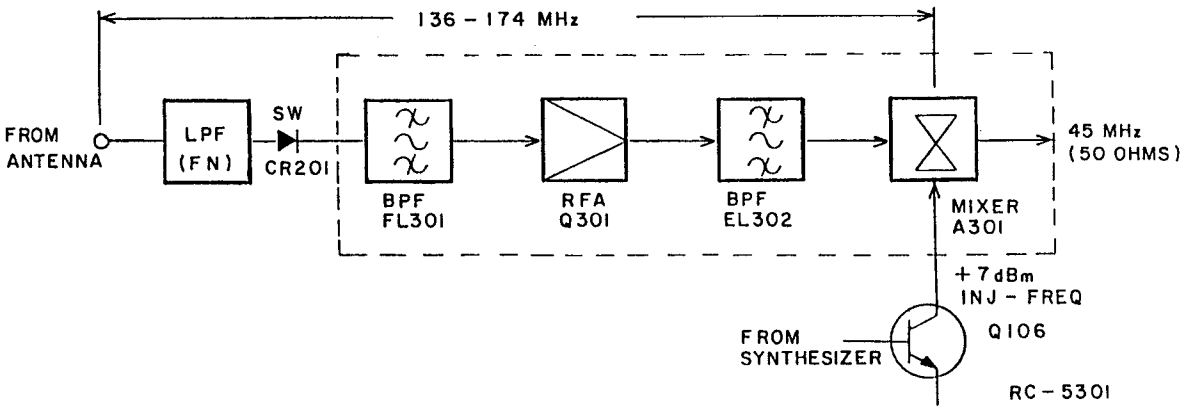


Figure 6 - RF Amplifier/Mixer

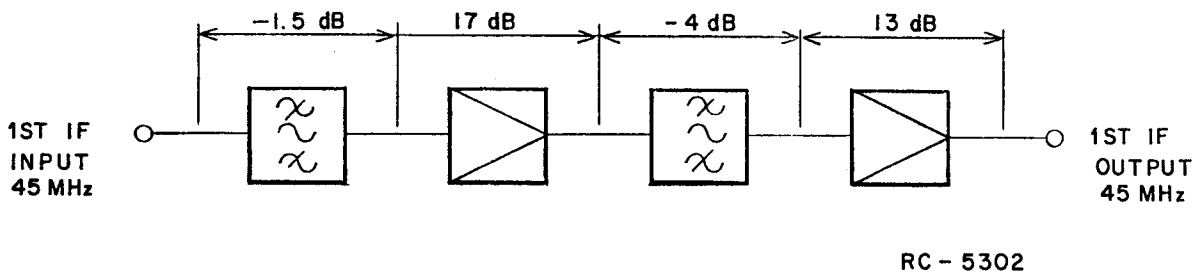


Figure 7 - First IF Amplifier

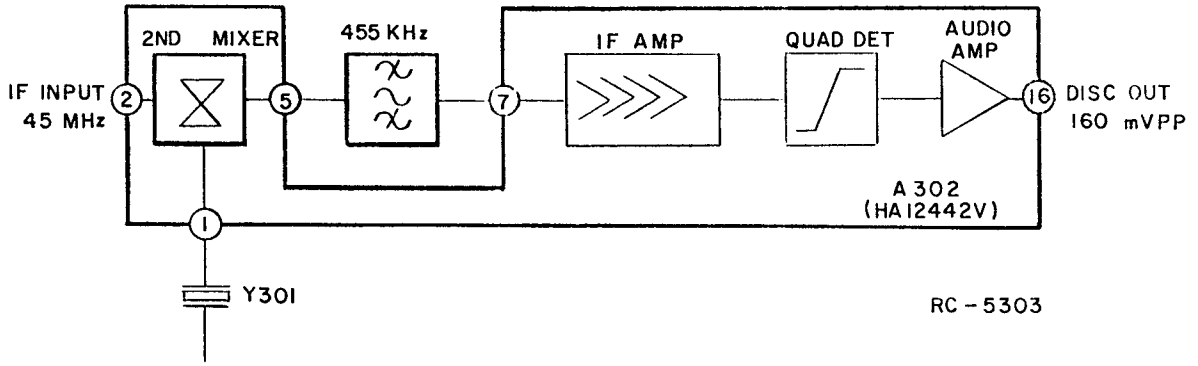


Figure 8 - Second IF Amplifier/Discriminator

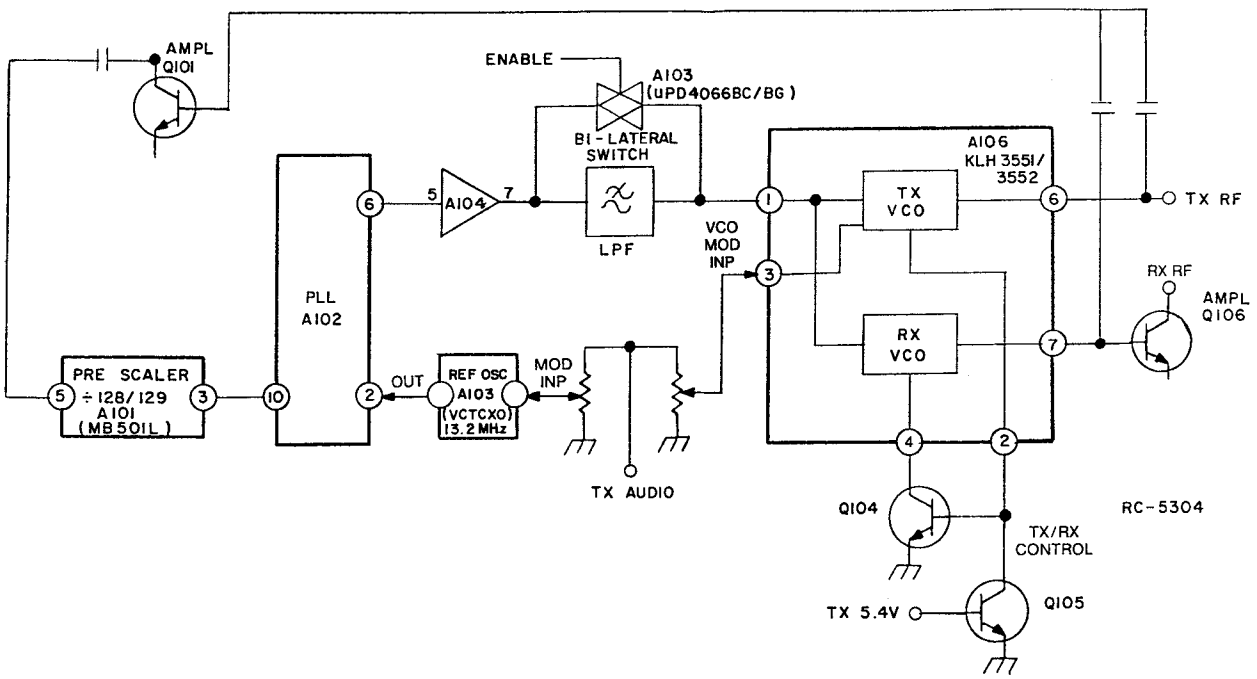


Figure 9 - Synthesizer

- Loading data to the frequency synthesizer
- Fetching and processing the PTT, monitor, channel selection and volume control
- Loading data to the LCD display
- Controlling the audio circuit (Processor)
- Encoding/decoding the Channel Guard and digital Channel Guard
- Controlling the loadind interface for the radio data (channel number and signalling)

RAM (A2):

RAM has a capacity of 2K bits X 8 for storing various data for controlling the radio. The data is entered from the outside to the microcomputer through the UDC connector and then to the RAM. The data mainly consist of the following:

- Channel Frequency Data
- CG/DCG data
- TX Power, TX Modulation Data
- Squelch Data
- Display Data...etc.

Audio Processor (A3):

The Audio processor consists of a one-chip IC accommodating almost all of the audio functions. The audio functions are under control of the microcomputer in compliance with the function of the radio unit. The functions of the audio processor are as follows:

- Tone Reject Filter
- Limiter Amplifier
- Volume and Modulation Level Control
- Post Limiter Filter
- Squelch Filter and Rectifier
- CG/DCG Encode/Decode Filter and Limiter
- D/A Converter and comparator
- OSC Circuit and Digital Interface for Microcomputer

All of these functions are made up of switched, capacitor filters, amplifiers and timing logic. The timing for this logic is derived from the 3.579545 MHz clock generator. The clock signal is also applied to the microcomputer.

Audio Amplifier (A4 and A6):

The audio amplifier is located between the audio processor and the microphone or the speaker. Amplifier A6 provides pre-emphasis and amplification for transmit audio and de-emphasis for the receive audio. Amplifier A4 amplifies the output signal of A6 to the level adequate for driving the speaker and VDC audio output.

Voltage Regulator Circuits (A7, A9, Q2, Q3, Q10 and Q11):

Voltage Regulator Circuit A9 provides a regulated +2.5 VDC. Using the 2.5 VDC as a reference voltage, A9, Q2 and Q3, in combination, generate 5.4 VDC for the radio unit. The control Transistors Q10 and Q11 are used for current-limiting to avoid break down.

External Data Buffer (A5):

The External Data Buffer is located between the UDC connector and the microcomputer for protection of the internal circuits.

LCD Board

The LCD board is composed of the following items:

- LCD Drive IC (A1)
- LCD
- Back Lighting Circuit (Q1, Q2 and CR1 - 6)

The LCD driver converts data from the microcomputer into a signal which can drive the LCD display. The LCD display is equipped with 8 character, 14 segments each and eight status displays. Microcomputer signals drive the LCD driver and the driver turns the LCD on. Also this board has a back lighting circuit enabled upon receiving a signal from the microcomputer when any of the control switches (VOL, PTT,...etc.) are operated.

Key Pad

The key pad, used with the standard M-PD Personal Radio, is located on the top of the housing. This key pad consists of flexible cable and rubber contacts. The cable connects with the microcomputer.

UDC Connector

The UDC connector is located on the side of the radio housing so that various kinds of external equipment connections can be made. External equipment connecting signals are as follows:

- TX Data
- RX Data
- CTS

} For Data Loader

- PTT
- EXT MIC
- RX Audio Out
- T/R
- Mute
- Disc Out
- +7.5 Volts Switch Out

} For External MIC & SPKR

- EMER — GE Star Lanyard
- UDC

The radio control microprocessor senses the value of voltage at the UDC line and switches the appropriate audio circuits to provide proper radio/accessory operation. The UDC voltage is set by two resistors within the UDC connector.

Battery Packs

The battery packs are available in three capacities: standard, high and extra high. All battery packs provide a nominal 7.5 Volt DC output.

To protect the battery pack from external short circuits, the positive (+) charging contact is diode protected.

An internal thermistor senses variations in battery pack temperature to automatically control a charger and provide a maximum charge without overheating the battery pack. All battery packs can be charged in one hour.

The battery is shipped fully charged to the customer, ready for use. However, if the battery pack is stored for any length of time it should be fully charged before placing into service.

Charger combinations for charging the battery packs are available with charge times of 1 hour, 3 hours and 16 hours. A combination can be a single unit desk or a vehicular charger. It can also be a wall mounted multiple charger.

Charge Level

A fully charged battery pack should provide a terminal voltage greater than 7.5V. A fully discharged battery pack should provide a reading of no less than 6V.

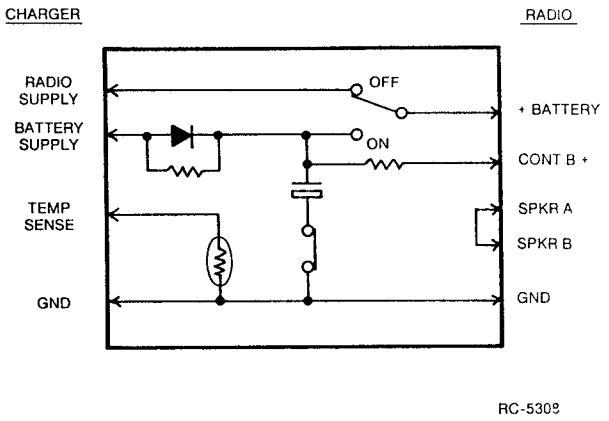


Figure 10 - Battery Pack

MAINTENANCE

This Maintenance section provides information on adjustments of the radio (transmit, receive and synthesizer), preventive maintenance and a Disassembly Procedure. Information is also provided for removing and replacing chip components and module replacement. The Service Section, listed in the Table Of Contents, provides a more complete set of alignment procedures for the radio plus a detailed Troubleshooting Procedure.

Initial Adjustment

After the radio has been programmed, as described in Programming Instructions (LBI-31635), the following adjustments should be made by a certified electronics technician.

Transmit Circuit Alignment:

The transmit circuit is factory tuned and should not require any readjustment. The frequency and modulation should be measured and recorded for future reference.

Receive Circuit:

No initial adjustments to the receive circuit are required.

Synthesizer Circuit:

No initial adjustments to the synthesizer are required.

Preventive Maintenance

To ensure a high operating efficiency and to prevent mechanical and electrical failures, routine checks should be performed of all mechanical and electrical parts at regular intervals. Preventive maintenance should include the following checks:

Antenna:

The antenna and antenna contact should be kept clean, free from dirt or corrosion. If the antenna or contact should become dirty or corroded, loss of radiation and a weak signal will result.

Mechanical Inspection:

Since portable radio units are subject to shock and vibration, check for loose plugs, nuts, screws and other parts to make sure that nothing is working loose.

Alignment:

The transmit and receive circuit meter readings should be checked periodically and the alignment "touched up" when necessary. Refer to the applicable alignment procedure and troubleshooting sheet, found in Service Section LBI-31677, for typical voltage readings.

Frequency Check:

Check transmit frequency and deviation. Normally, these checks are made when the unit is first put into operation. They should be repeated after the first month of operation, then again one time each year.

Disassembly

To gain access to the Radio board (transmit, receive and synthesizer circuits) or Control Board for servicing, disassemble as follows:

Radio Board:	Step 1 through Step 4
Controller Board:	Step 5 through Step 7

Disassembly Procedure (See Figure 11):

CAUTION

ALWAYS remove the battery pack before removing any component board to avoid blowing the fuse.

Equipment Required:

- Small Phillips-head screwdriver
- Small flat-blade screwdriver
- Needlenose pliers
- Allen-head wrench for removing set screws
- Pencil-type soldering iron (25-40 Watts) with a fine tip

Step 1:

To gain access to the radio, loosen, but do not remove, the four captive screws shown at (A) and (B). Carefully remove the back cover. For normal radio alignment, the back cover is all that needs to be removed. When tightening the captive screws, they should be no tighter than 4 ±0.5 inch-pounds. (See Figure 12)

Step 2:

To remove the Radio Board, unscrew and remove the antenna at (C) and RF connector at (D). Remove the six screws at (E) using the Phillips-head screwdriver. The radio portion can now be detached from the rear cover. (See Figure 13)

Step 3:

Remove the shield cover (F) from the eggcrate. (See Figure 14)

Step 4:

To remove the antenna changeover switch, remove the tap screw at (G), using the Phillips-head screwdriver. Unsolder the antenna switch lead connection at (H). The antenna switch assembly can now readily be removed by hand. (See Figure 15)

Step 5:

To remove the Controller Board, remove the five screws at (I) from the Controller board. Use the Phillips-head screwdriver. (See Figure 16)

Step 6:

Unplug the LCD control flex circuit at (J) from the connector at (K). The Controller Board can now readily be removed from the LCD board. (See Figure 17)

Step 7:

To remove the LCD Board, pull the contact Pins at (L) out of the socket in the MIC flex circuit. Remove the seven screws at (M), using the Phillips-head screwdriver. The LCD board can now be readily removed. (See Figure 18)

Replacement

The major components of the M-PD Personal Radio are the PA, TX-AMP (driving amplifier), PC (Power Control Module), VCO (Voltage Controlled Oscillator) and the VCTCXO (Ref. Osc.). These are very reliable devices and will not normally need to be replaced. Before replacing any of these modules, always check out the associated circuitry carefully.

To remove any of these major components, refer to the applicable replacement procedure found in the Service Section (LBI-31677).

Troubleshooting Procedure

Maintenance of the M-PD Personal Radio is faciliated by using the Troubleshooting Procedures and service techniques unique to this radio. The Troubleshooting procedures are designed to quickly lead the serviceman to the defective circuit or component. These procedures are found in the Service Section.

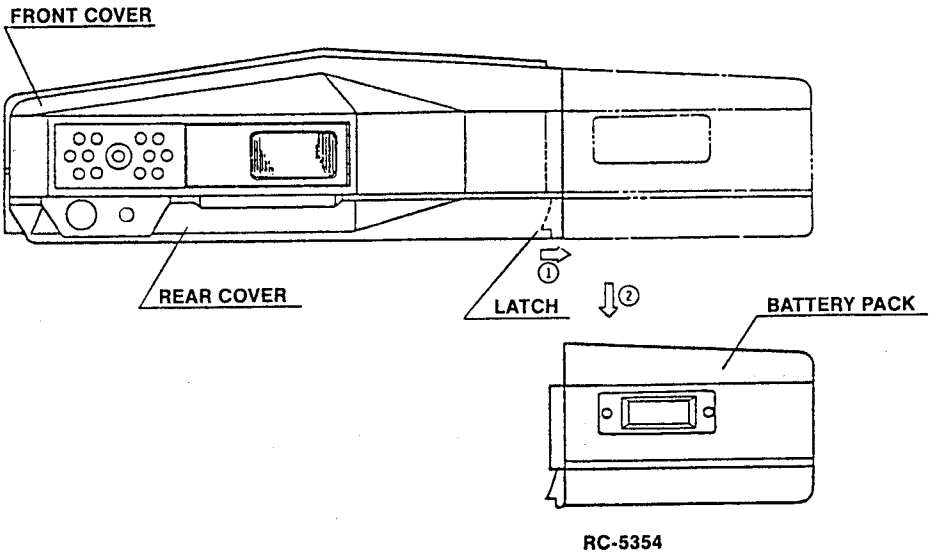


Figure 11 - Disassembly

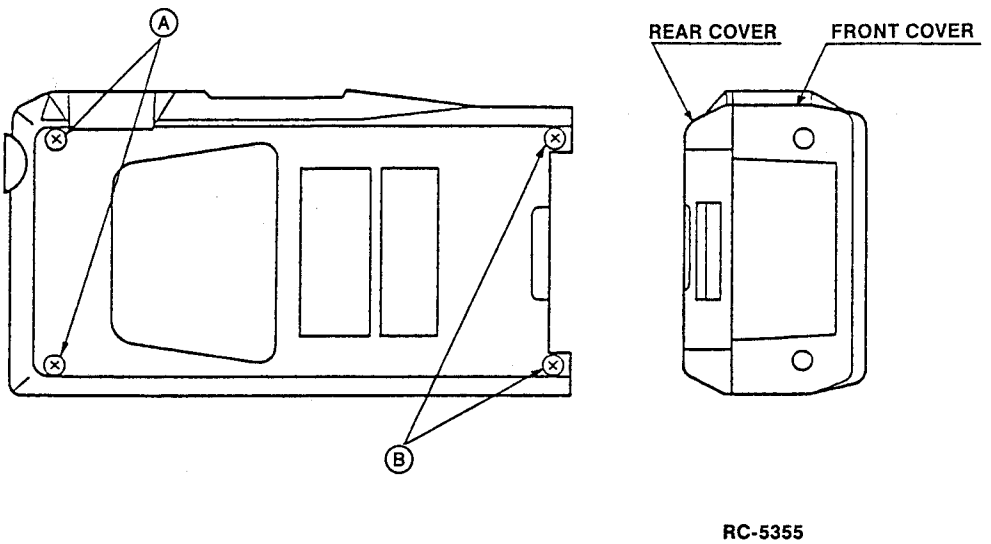


Figure 12 - Disassembly Step 1

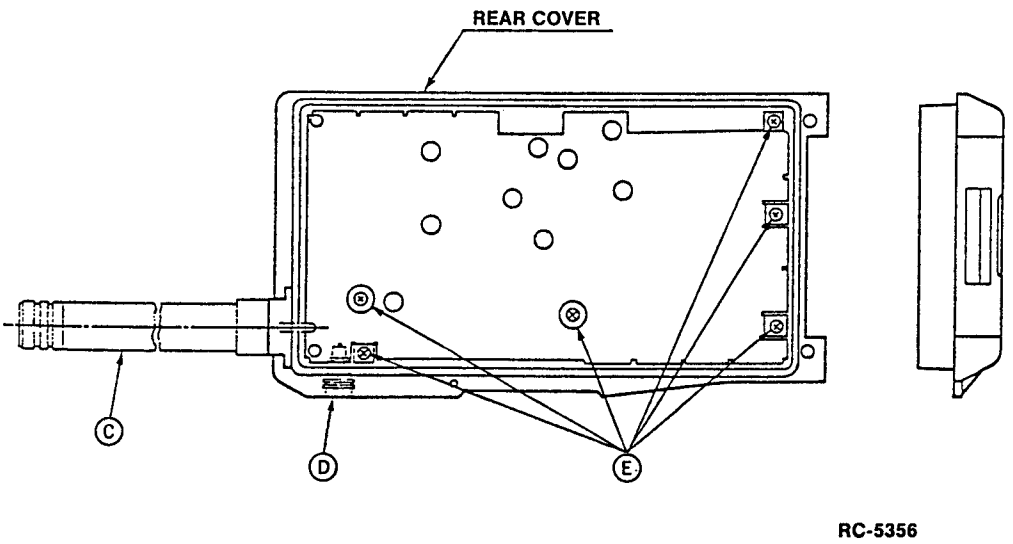


Figure 13 - Disassembly Step 2

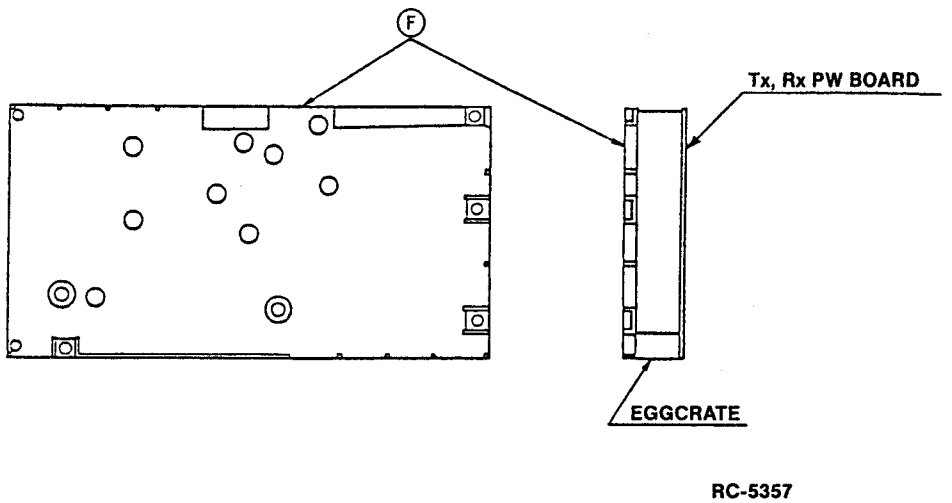


Figure 14 - Disassembly Step 3

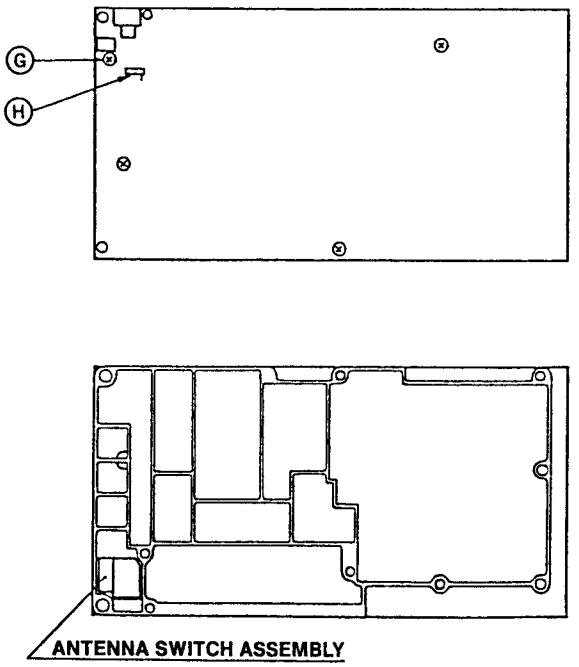


Figure 15 - Disassembly Step 4

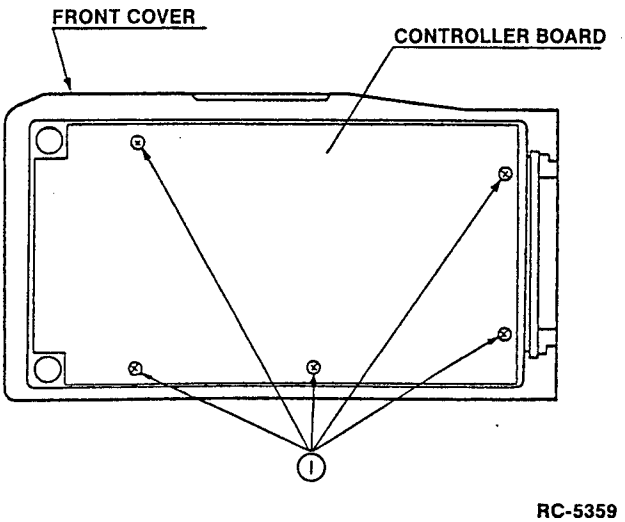


Figure 16 - Disassembly Step 5

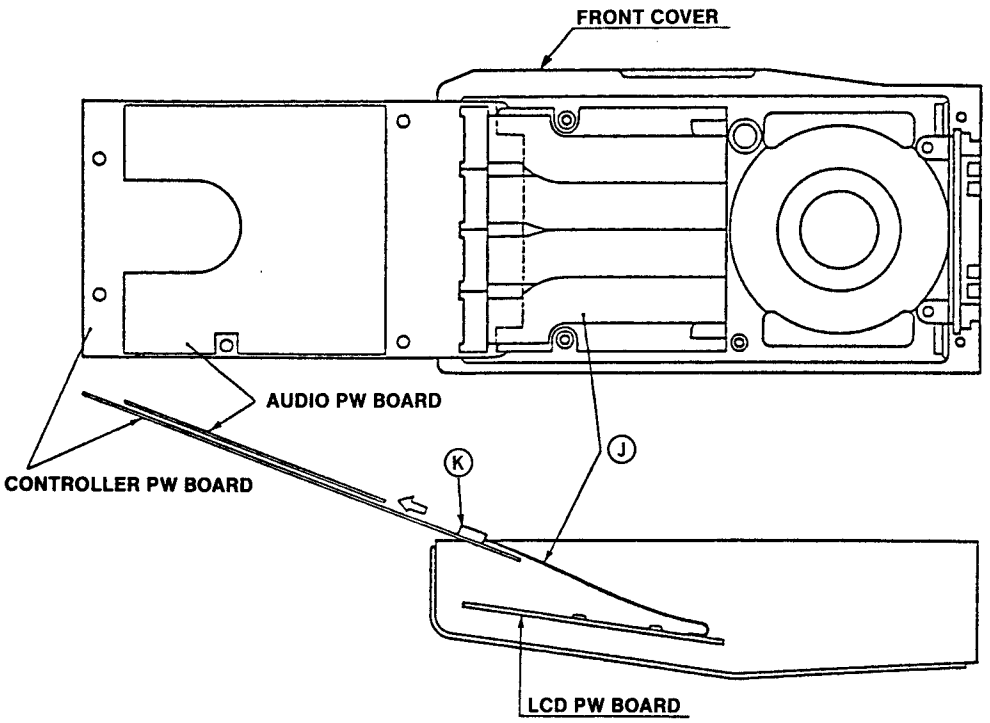


Figure 17 - Disassembly Step 6

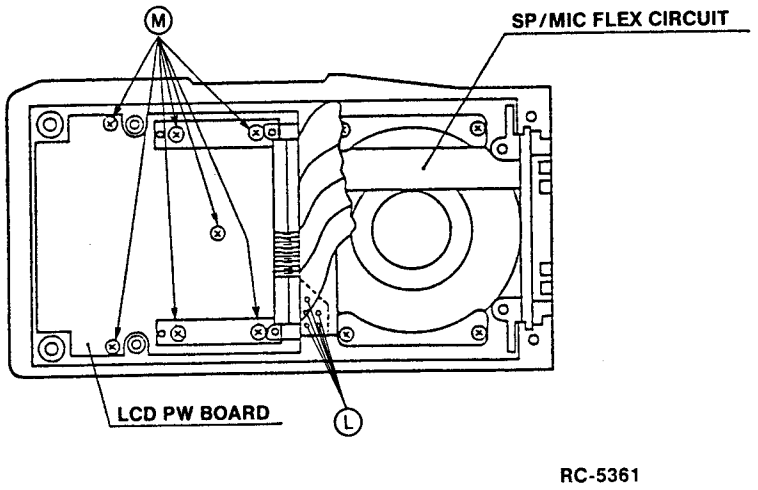


Figure 18 - Disassembly Step 7

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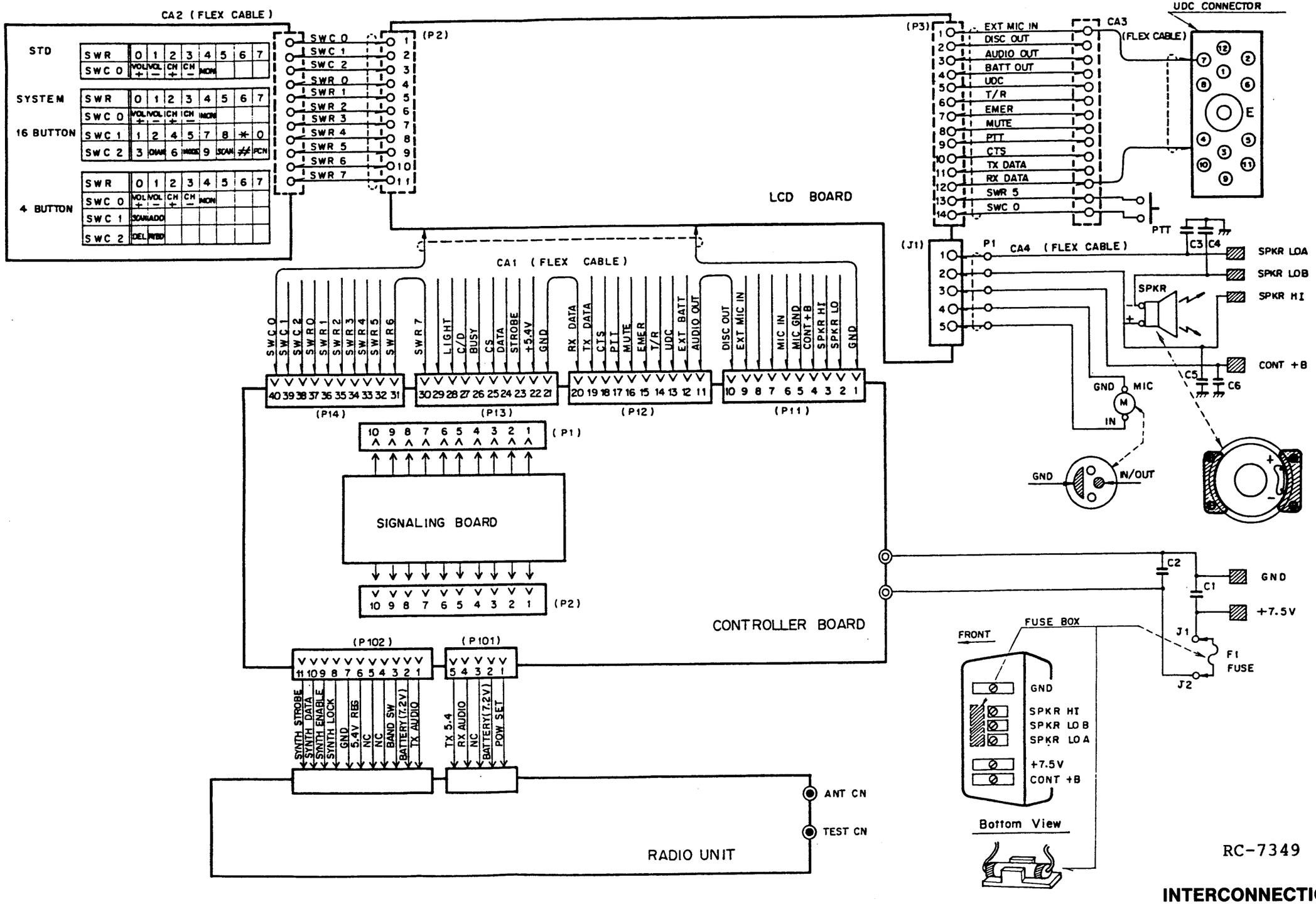
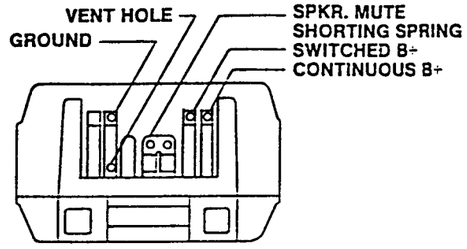
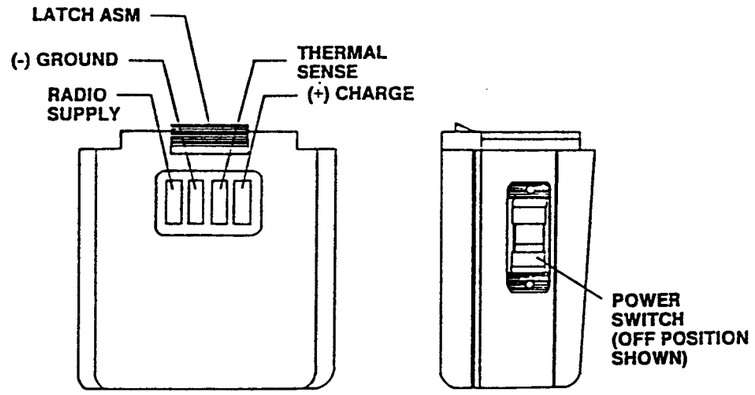


INTERCONNECTION DIAGRAM



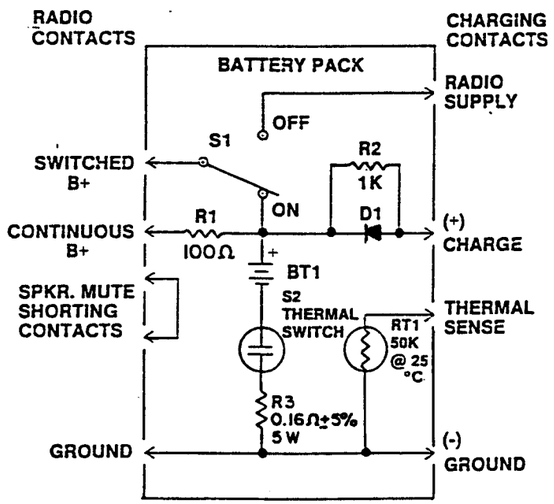
TOP VIEW

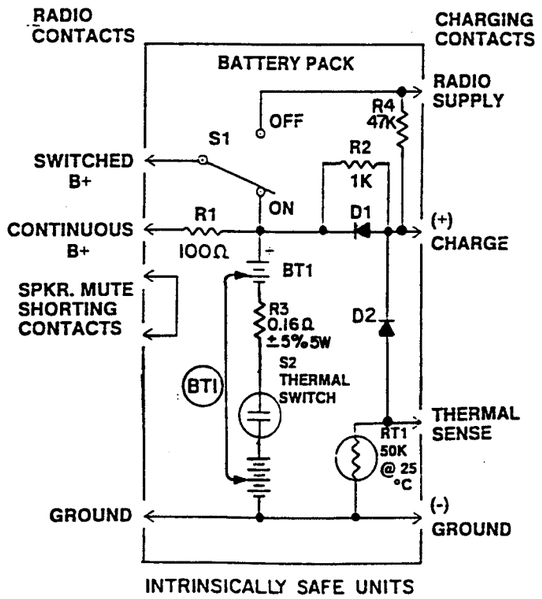


REAR VIEW SIDE VIEW

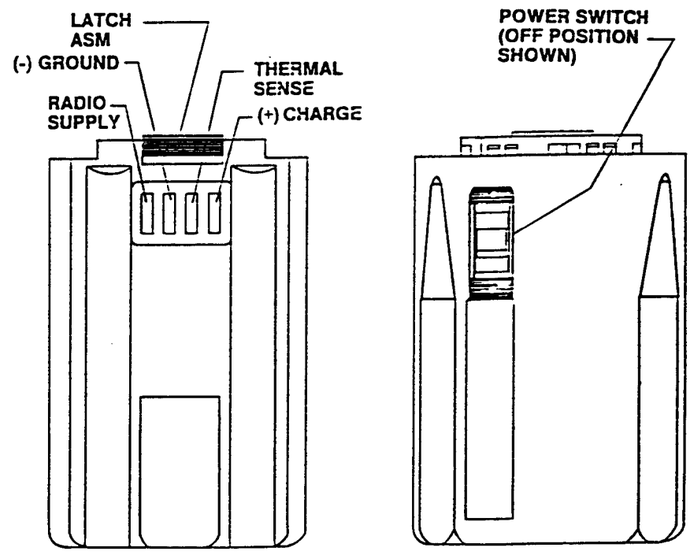
19A704850P5 STANDARD CAPACITY
19A704850P4 STANDARD CAPACITY INTRINSICALLY SAFE
19A704850P7 HIGH CAPACITY (SHORT)
19A704850P6 HIGH CAPACITY INTRINSICALLY SAFE (SHORT)

TYPICAL SCHEMATICS





INTRINSICALLY SAFE UNITS



REAR VIEW FRONT VIEW

19A704860P5 HIGH CAPACITY (LONG)
19A704860P4 HIGH CAPACITY INTRINSICALLY SAFE (LONG)
19A704860P7 EXTA HIGH CAPACITY
19A704860P6 EXTA HIGH CAPACITY INTRINSICALLY SAFE

RC-5493B

SCHEMATIC & OUTLINE DIAGRAM

Battery Packs

PARTS LIST

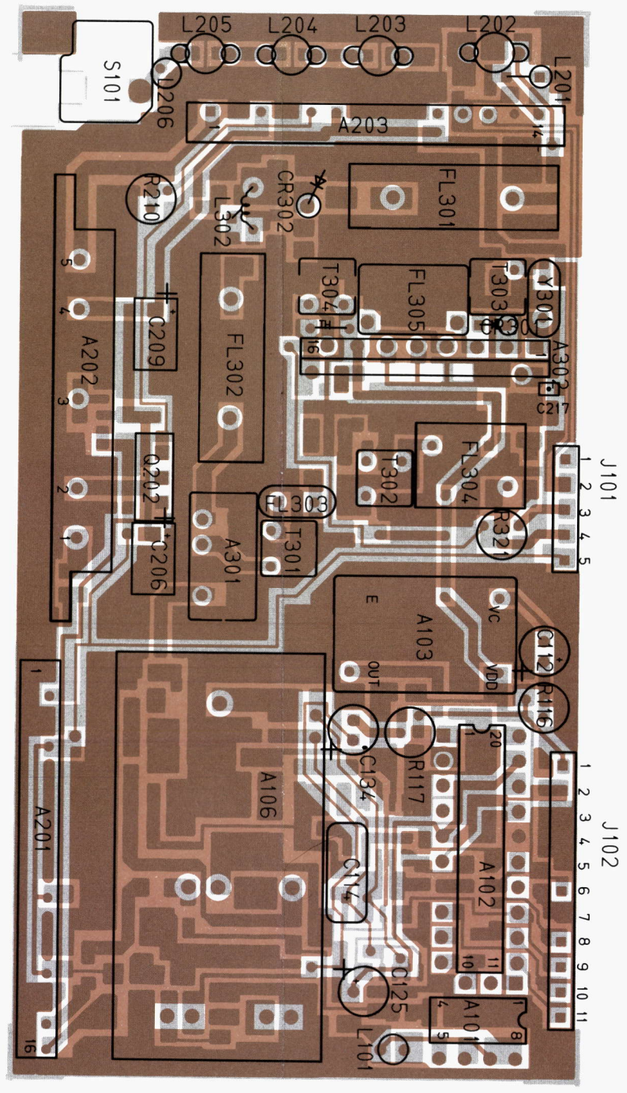
M-PD RADIO CHASSIS
A4WE03614

ISSUE 2

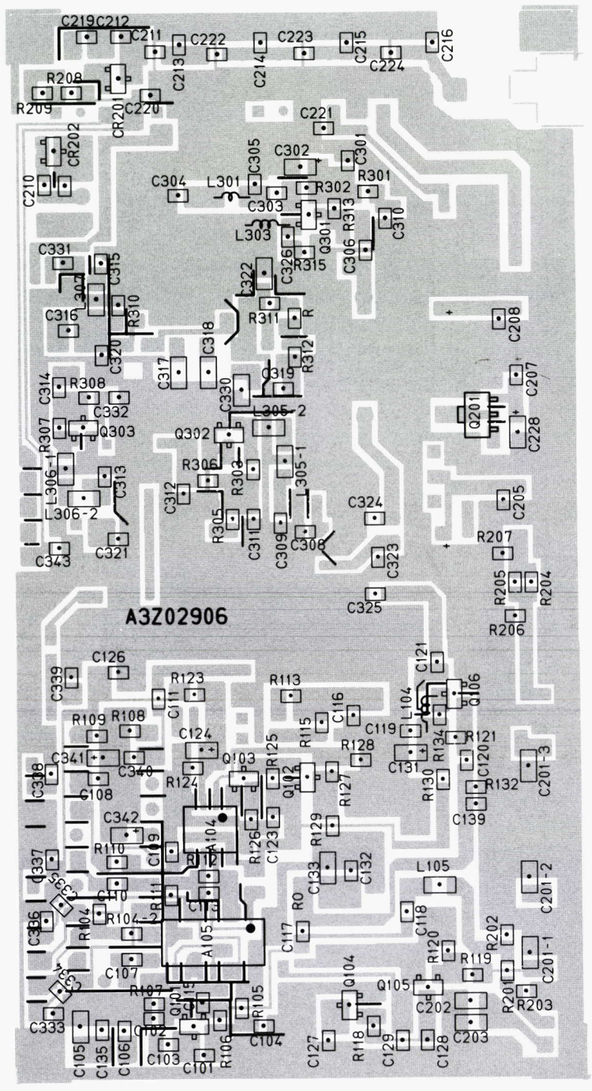
SYMBOL	GE PART NO.	DESCRIPTION
MPDD1	K19/A4WE03737	LCD Board.
MPDC3	K19/A4WE03736	Controller Board.
		- - - - - - - - - - - SOCKETS - - - - - - - - - - -
J1	K19/SL-101-T-12	Socket.
J2	K19/SL-101-T-12	Socket.
		- - - - - - - - - - - FUSES - - - - - - - - - - -
F1	K19/2DDB010043	275005 5A
		- - - - - - - - - - SPEAKER - - - - - - - - - - -
SPKR1	K19/2SDA001286	VS-50W-24ohm 0.5W
		- - - - - - - - - MICROPHONE UNIT - - - - - - - - -
MIC	K19/A4WX01438	EM-78 Microphone
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 thru C5	K19/2CAK011196	Ceramic chip 1000 pF 50WV
		- - - - - - - - - - PINHEADER - - - - - - - - - -
P1	K19/2PDA023150	68908-006P

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

COMPONENT SIDE

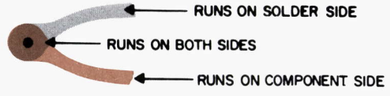


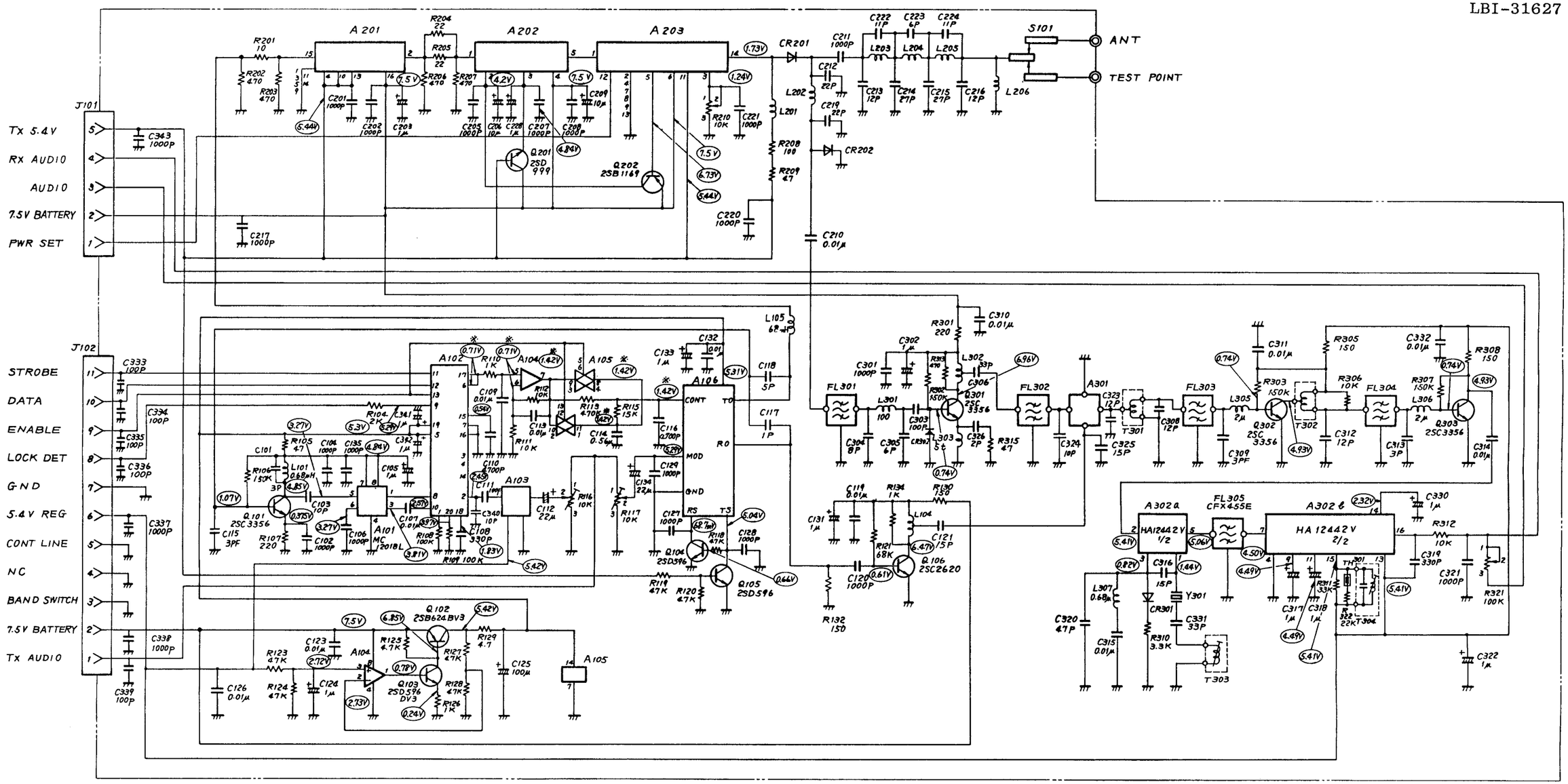
SOLDER SIDE



OUTLINE DIAGRAM

Radio Board
A4WE03739/40





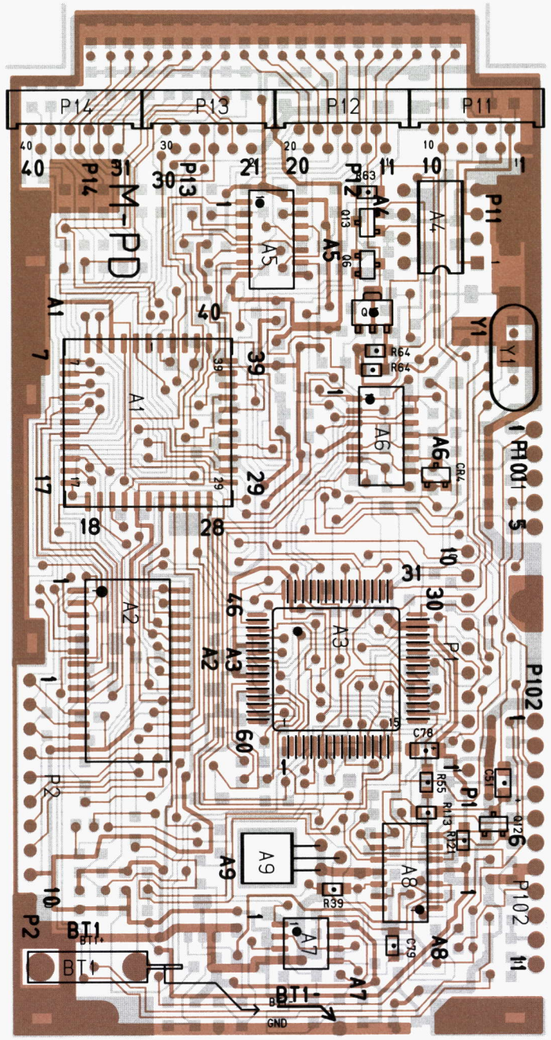
※ ; TYPICAL VOLTAGE AT LOWEST CHANNEL

REV.0 / 860828

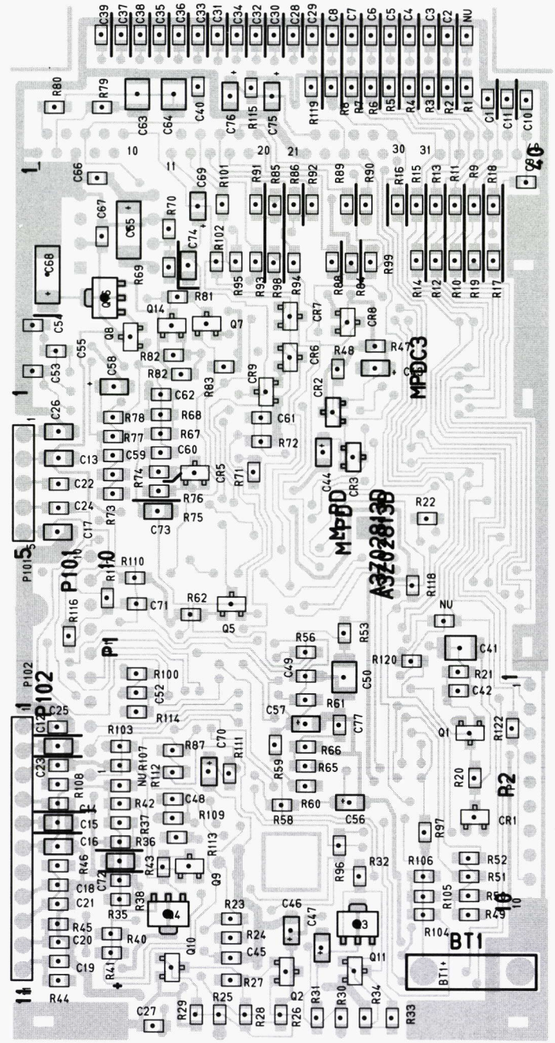
RADIO SCHEMATIC DIAGRAM (VHF)
WITH TYPICAL VOLTAGE

A4WE03739/40

COMPONENT SIDE



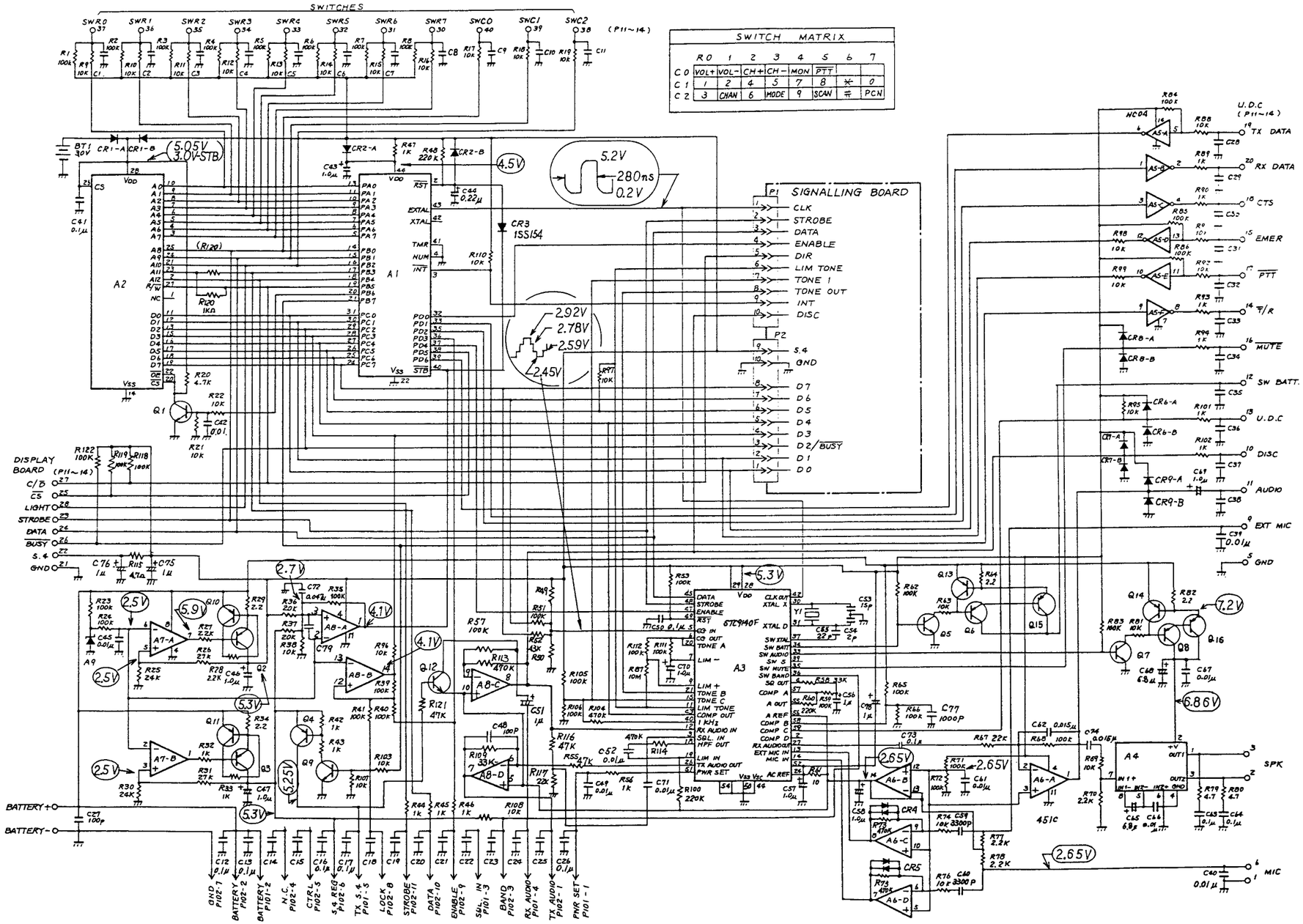
SOLDER SIDE



RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

OUTLINE DIAGRAM

Controller Board
A4WE03736

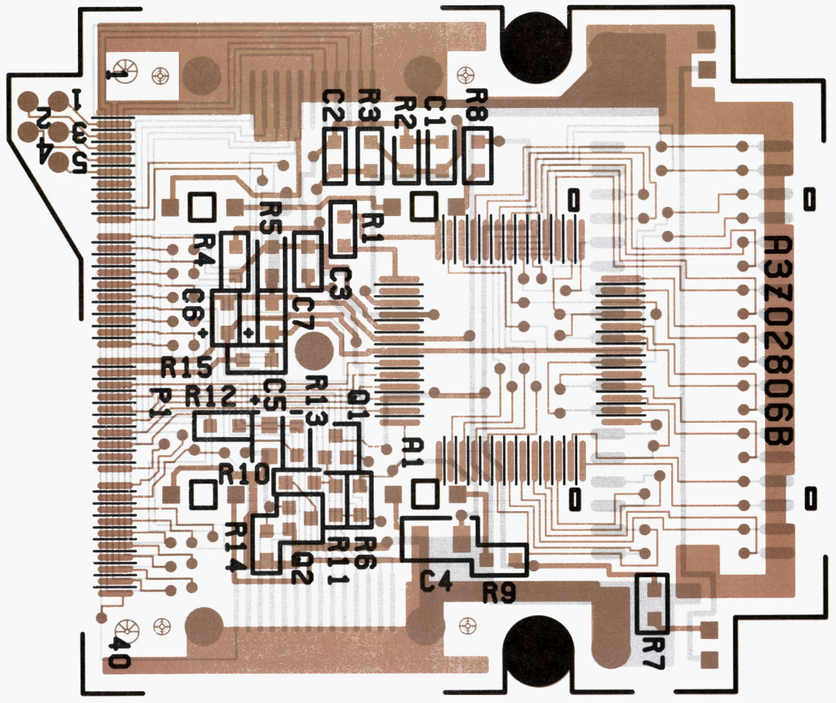


SCHEMATIC DIAGRAM

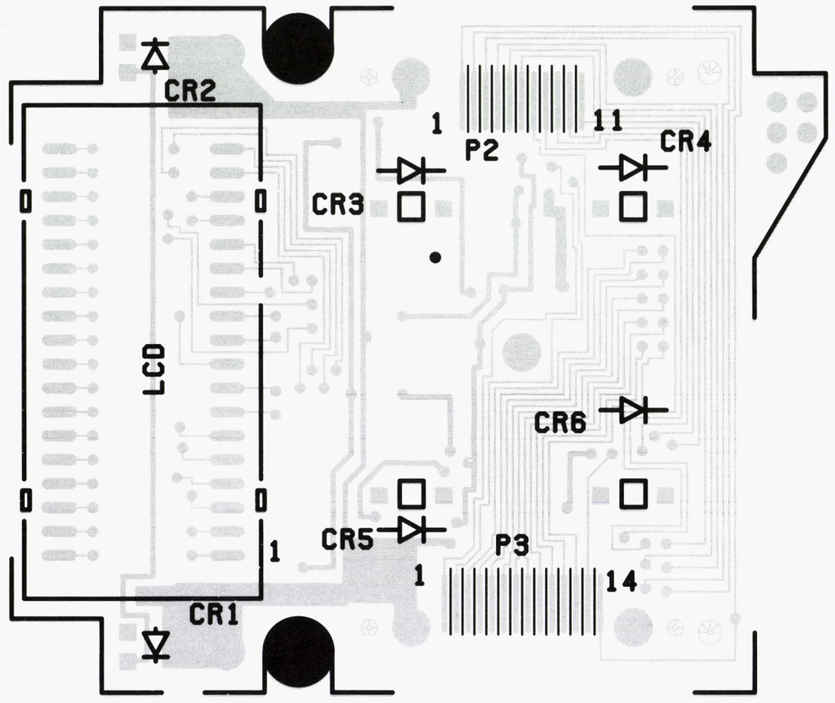
Controller Board

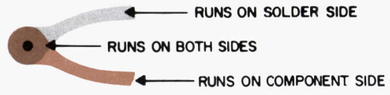
A4WE03736

COMPONENT SIDE



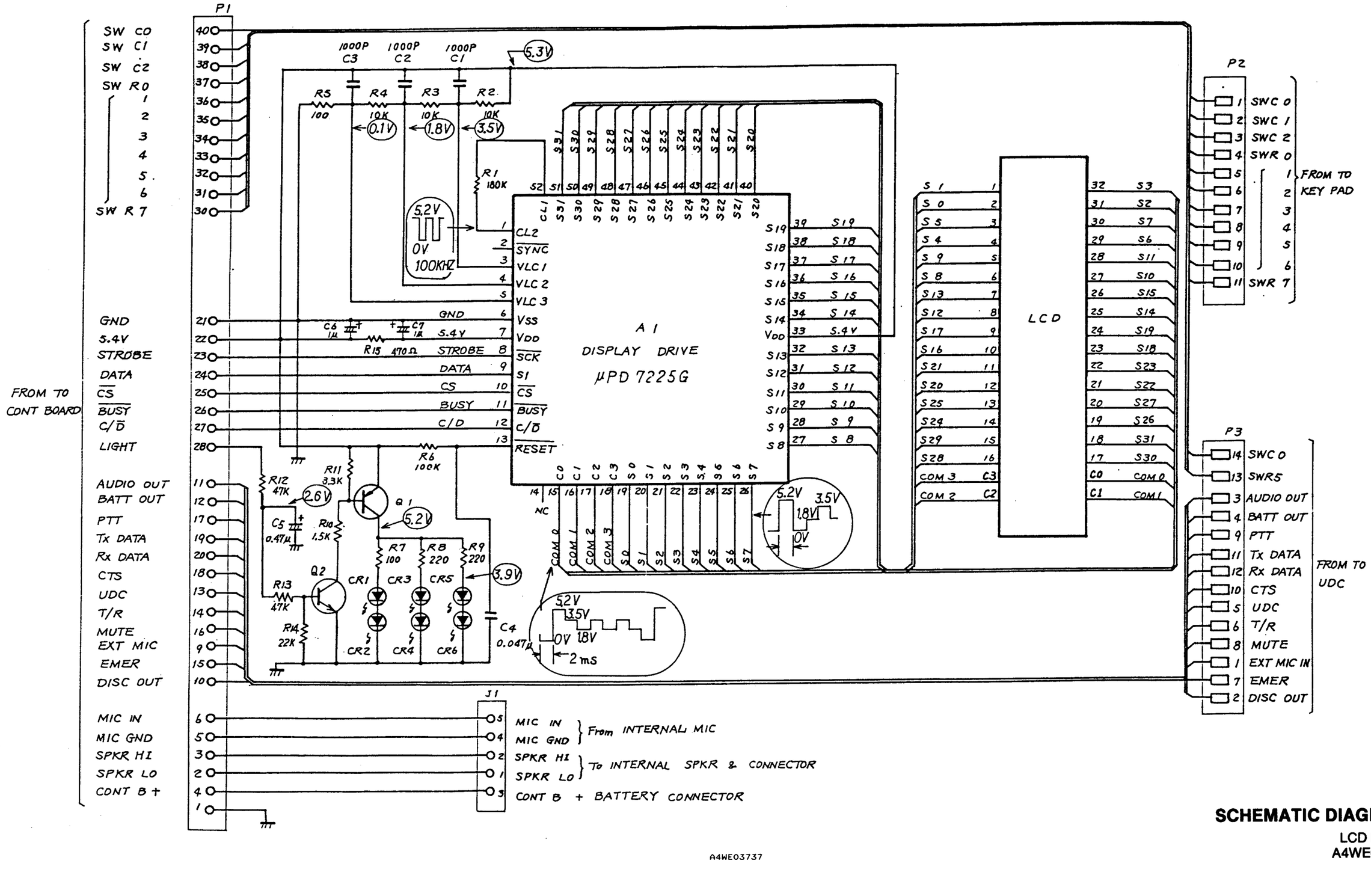
SOLDER SIDE





OUTLINE DIAGRAM

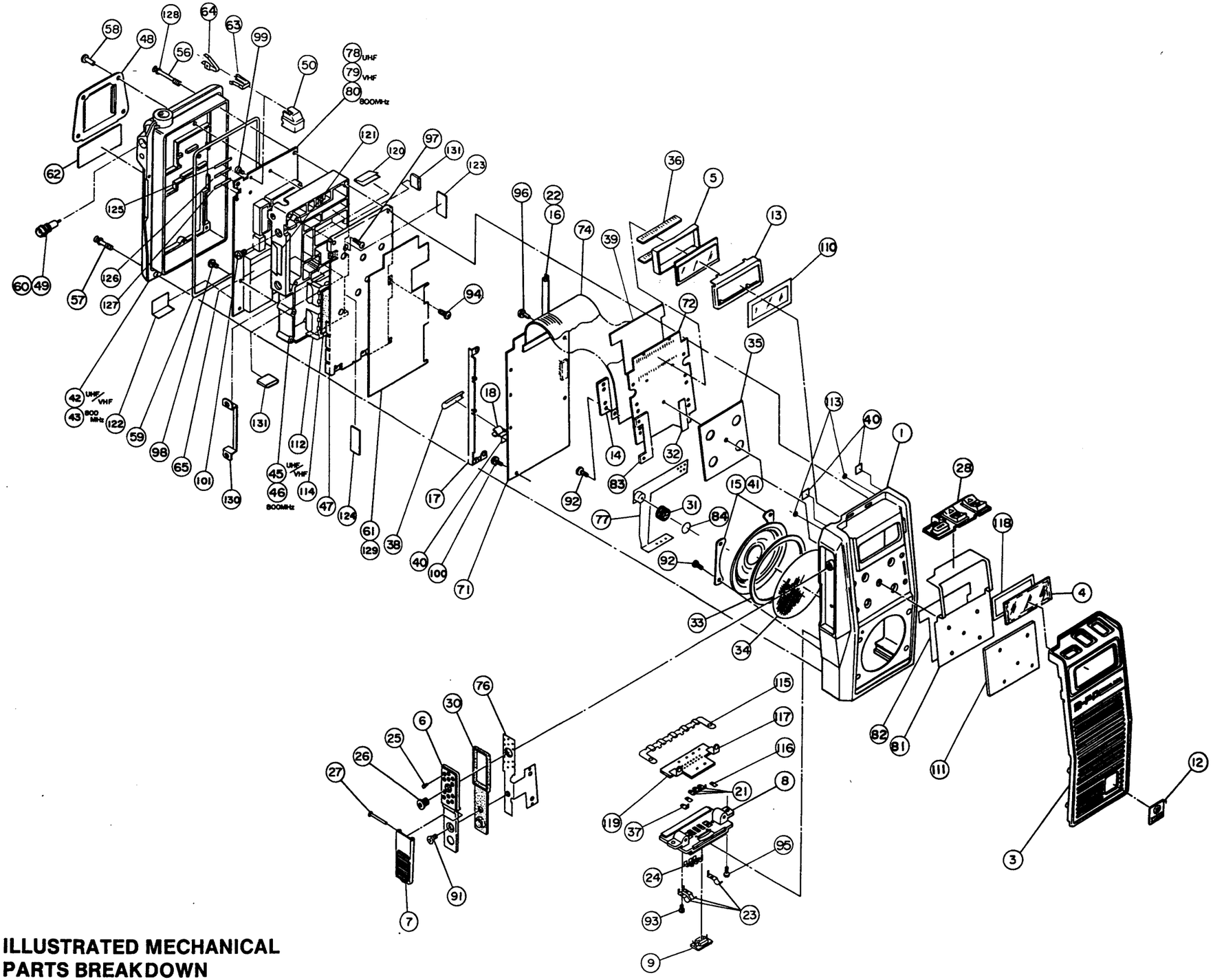
LCD Board
A4WE03737



A4WE03737

SCHEMATIC DIAGRAM

LCD Board
A4WE03737



ILLUSTRATED MECHANICAL PARTS BREAKDOWN

PARTS LIST

M-PD RADIO STANDARD TYPE

(MECHANICAL PARTS)
ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
1	K19/A1WL07558	Front Cover
3	K19/A1WL07569	Front Escutcheon (STD)
4	K19/A3WL07574	Window
5	K19/A3WL07601	Light Diffuser
6	K19/A3WL07576	UDC PTT Plate
7	K19/A3WL07575	PTT Lever
8	K19/A3WL07573	Base Plate
9	K19/A3WL07577	Fuse Cover
12	K19/A4WL07721	Name Plate (GE)
13	K19/A3WL07614	LCD Frame
14	K19/A4WL07881	Plates
15	K19/A4WL07607	SPKR Mounting Brackets
16	K19/A3WL07295	B+ Strap
17	K19/A3WL07296	Ground Strap
18	K19/A4WL07514	Battery Holder
21	K19/A4WL07610	Contact Lugs
22	K19/A4WL08244	B+ Strap Sheet
23	K19/A4WL07611	Battery Connector Springs
24	K19/A4WL07608	SPKR/Mute Contacts
25	K19/A4WL07604	UDC Contacts
26	K19/A4WL07605	UDC Nut
27	K19/A4WL07434	Pivot Pin
28	K19/A3WL07579	Top Switch PAD
30	K19/A3WL07580	PTT Switch PAD
31	K19/A4WL07594	MIC Gasket
32	K19/A4WL07882	Elastic Rubber
33	K19/A4WL07910	SPKR Gasket
34	K19/A4WL07435	SPKR Dust Screen
35	K19/A4WL07606	Insulator (LCD BD.)
36	K19/A4WL07665	Zebra Contacts
37	K19/A4WL08007	Contact Lug B
38	K19/A4WL07863	LI-Battery Cover
39	K19/A4WL08445	LCD Sheet
40	K19/A4WL07664	Insulator Sheet
41	K19/A4WL08708	SPKR Mounting Rubber (Not Used)
42	K19/A1WL07561	Rear Cover, UHF/VHF
43	K19/A1WL07560	Rear Cover, 800 MHz
45	K19/A1WL07571	EGG Crate, UHF/VHF
46	K19/A1WL07572	EGG Crate, 800 MHz
47	K19/A2WL07512	Tx/Rx Shield Cover
48	K19/A3WL07509	Receptacle Plate
49	K19/A4WL08826	RF Connector
50	K19/A3WL07654	Antenna Switch Housing
56	K19/A4WL07499P2	Captive Screws
57	K19/A4WL07499P1	Captive Screws
58	K19/A4WL07694	Rivets
59	K19/A4WL08383	Housing Gasket
60	K19/A4WL07880	RF Connector Gasekt
61	K19/A3WL07513	Insulator
62	K19/A4WL07883	Label
63	K19/A4WL07655	ANT Switch Spring B
64	K19/A4WL07656	ANT Switch Spring A
65	K19/A4WL07727	Shield Plate
71	K19/A3WL07897	Controller P.W. Board
72	K19/A3WL07895	LCD P.W. Board
74	K19/A3WL08833	LCD-Cont Flex. Circuit
76	K19/A3WL08834	UDC/PTT Flex. Circuit
77	K19/A3WL08835	SPRK/MIC Flex. Circuit
78	K19/A3WL08693	Tx/Rx P.W. Board, UHF
79	K19/A3WL08695	Tx/Rx P.W. Board, VHF
80	K19/A3WL08696	Tx/Rx P.W. Board, 800 MHz
81	K19/A3WL08836	Top Flex, Circuit (STD)
82	K19/A4WL08088	Adhesion Sheet
83	K19/A4WL08409	Rubber Sheet
84	K19/A4WL08385	MIC Film
91	K19/A4WL08827P1	Flush Head Screw, M2.6 X 3
92	K19/A4WL08828P2	Pan Head Tapping Screw, M2 X 6
93	K19/A4WL08827P2	Pan Head Screw, M1.7 X 4
94	K19/A4WL08827P3	Pan Head Screw with SW, M2 X 4
95	K19/A4WL08828P3	Pan Head Tapping Screw, M2 X 10
96	K19/A4WL08827P4	Pan Head Screw with SW, M2 X 6
97	K19/A4WL08827P6	Pan Head Screw with SW, M2 X 15
98	K19/A4WL08827P7	Pan Head Screw, M2 X 4 (Not Used)
99	K19/A4WL08828P1	Pan Head Tapping Screw, M2 X 4
100	K19/A4WL08827P5	Pan Head Screw with SW, M2 X 8
101	K19/A4WL08827P8	Pan Head Screw with SW, M2.6 X 6 (Not Used)
110	K19/A4WL08437	Window Sheet
111	K19/A4WL08438	STD Rubber Plate
112	K19/A4WL07595	Shield Cover
113	K19/A4WL08730	Mylor Washer
114	K19/A4WL08494	VCO Rubber
115	K19/A4WL08628	Base Shield Spring
116	K19/A4WL08629	Contact Lug C
117	K19/A4WL08630	Base Contact
118	K19/A4WL08673	Window Gasket
119	K19/A3WL08672	Base P.W. Board
120	K19/A4WL08829	RF Spring A
121	K19/A4WL08830	RF Spring B
122	K19/A4WL08832	RF Shield Plate (Used 800 MHz only)
123	K19/A4WL08495P1	Connector Spacer A
124	K19/A4WL08495P2	Connector Spacer B
125	K19/A4WL08831P1	RF PWB Contact A
126	K19/A4WL08831P2	RF PWB Contact B
127	K19/A4WL08831P3	RF PWB Contact C
128	K19/A4WL08802	Nylon Washer
129	K19/A4WL08698	Tracking Data Label
130	K19/A4WL07663	Power Pack Bracket
131	K19/A4ZL05484	Crystal Protection Tube

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

VHF M-PD PERSONAL RADIO RF BOARDS

K19/A4WE03739 136-160 MHz RF Board
K19/A4WE03740 150-174 MHz RF Board

ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
A101	K19/2ABD004124	Prescaler MC12018L
A102	K19/2AAJ004062	PLL MC145159P1
A103	K19/2YBA106090	VCTCXO A4WX01328-2.5 ppm
	K19/2YBA106082	VCTCXO A4WX01328-5 ppm
A104	K19/2AAB004243	OP AMP UPC1251BG
A105	K19/2ABC039105	Analog Switch UPD4066BG
A106	K19/200KLH3551	VCO A4WX01391 #4-1 KLH3552, 150-174 MHz
	K19/200KLH3552	VCO A4WX01391 #4-2 KLH3551, 136-160 MHz
A201	K19/200KLH2592	Gain Hybrid KLH2592
A202	K19/2AAA013112	PA Pack A4WX01422-1H, 150-174 MHz
	K19/2AAA013104	PA Pack A4WX01422-1L, 136-160 MHz
A203	K19/200KLH8516	PWR-Cont KLH8516
A301	K19/2EDG002028	Mixer UST-2L A4WX01376
A302	K19/2AAJ008089	IF HA12442V
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C101	K19/2CAK009034	Ceramic chip 3 pF ±0.25 pF 50V
C102	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C103	K19/2CAK009257	Ceramic chip 10 pF ±0.5 pF 50V
C104	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C105	K19/2CCF004086	Tantalum 1 uF 16V
C106	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C107	K19/2CAK009216	Ceramic chip 0.01 uF ±10% 50V
C108	K19/2CAK009190	Ceramic chip 330 pF ±5% 50V
C109	K19/2CAK009216	Ceramic chip 0.01 uF ±10% 50V
C110	K19/2CAK009331	Ceramic chip 4700 pF ±10% 50V
C111	K19/2CAK009182	Ceramic chip 100 pF ±5% 50V
C112	K19/2CBB034121	Electrolytic 22 uF 16V
C113	K19/2CAK009216	Ceramic chip 0.01 uF ±10% 50V
C114	K19/2CDA055016	MET POLY-PROP Film 0.56 uF 50V
C115	K19/2CAK009034	Ceramic chip 3 pF ±0.25 pF 50V
C116	K19/2CAK009331	Ceramic chip 4700 pF ±10% 50V
C117	K19/2CAK009018	Ceramic chip 1 pF ±0.25 pF 50V
C118	K19/2CAK009059	Ceramic chip 5 pF ±0.25 pF 50V
C119	K19/2CAK009216	Ceramic chip 0.01 uF ±10% 50V
C120	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C121	K19/2CAK009125	Ceramic chip 15 pF ±5% 50V
C123	K19/2CAK009216	Ceramic chip 0.01 uF ±10% 50V
C124	K19/2CCF004086	Tantalum 1 uF 16V
C125	K19/2CBB062171	Electrolytic 100 uF 16V
C126	K19/2CAK009216	Ceramic chip 0.01 uF ±10% 50V
C127 thru C129	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C131	K19/2CCF004086	Tantalum 1 uF 16V
C132	K19/2CAK009216	Ceramic chip 0.01 uF ±10% 50V
C133	K19/2CCF004086	Tantalum 1 uF 16V
C134	K19/2CBB034121	Electrolytic 22 uF 16V
C135	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
C201 and C202	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C203	K19/2CCF004086	Tantalum 1 uF 16V
C205	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C206	K19/2CCB026018	Tantalum 10uF 16V
C207 and C208	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C209	K19/2CCB026018	Tantalum 10 uF 16V
C210	K19/2CAK009216	Ceramic chip 0.01 uF ±10% 50V
C211	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C212	K19/2CAK009141	Ceramic chip 22 pF ±5% 50V
C213	K19/2CAK009109	Ceramic chip 12 pF ±5% 50V
C214 and C215	K19/2CAK009372	Ceramic chip 27 pF ±5% 50V
C216	K19/2CAK009109	Ceramic chip 12 pF ±5% 50V
C217	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C219	K19/2CAK009141	Ceramic chip 22 pF ±5% 50V
C220 and C221	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50v
C222	K19/2CAK009398	Ceramic chip 11 pF ±5% 50V
C223	K19/2CAK009281	Ceramic chip 6 pF ±0.5 pF 50V
C224	K19/2CAK009398	Ceramic chip 11 pF ±5% 50V
C228	K19/2CCF004086	Tantalum 1 uF 16V
C301	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C302	K19/2CCF004086	Tantalum 1 uF 16V
C303	K19/2CAK009182	Ceramic chip 100 pF ±5% 50V
C304	K19/2CAK009307	Ceramic chip 8 pF ±0.5 pF 50V
C305	K19/2CAK009281	Ceramic chip 6 pF ±0.5 pF 50V
C306	K19/2CAK009158	Ceramic chip 33 pF ±5% 50V
C308	K19/2CAK009109	Ceramic chip 12 pF ±5% 50V
C309	K19/2CAK009034	Ceramic chip 3 pF ±0.25 pF 50V
C310	K19/2CAK009216	Ceramic chip 0.01 uF ±10% 50V
C311	K19/2CAK009216	Ceramic chip 0.01 uF ±10% 50V
C312	K19/2CAK009109	Ceramic chip 12 pF ±5% 50V
C313	K19/2CAK009034	Ceramic chip 3 pF ±0.25 pF 50V
C314 and C315	K19/2CAK009216	Ceramic chip 0.01 uF ±10% 50V
C316	K19/2CAK009125	Ceramic chip 15 pF ±5% 50V
C317 and C318	K19/2CCF004086	Tantalum 1 uF 16V
C319	K19/2CAK009190	Ceramic chip 330 pF ±5% 50V
C320	K19/2CAK009166	Ceramic chip 47 pF ±5% 50V
C321	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C322	K19/2CCF004086	Tantalum 1 uF 16V
C323	K19/2CAK009109	Ceramic chip 12 pF ±5% 50V
C324	K19/2CAK009257	Ceramic chip 10 pF ±0.5 pF 50V
C325	K19/2CAK009125	Ceramic chip 15 pF ±5% 50V
C326	K19/2CAK009026	Ceramic chip 2 pF ±0.25 pF 50V
C330	K19/2CCF004086	Tantalum 1 uF 16V
C331	K19/2CAK009158	Ceramic chip 33 pF ±5% 50V
C332	K19/2CAK009216	Ceramic chip 0.01 uF ±10% 50V
C333 thru C336	K19/2CAK009182	Ceramic chip 100 pF ±5% 50V
C337 and C338	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C339	K19/2CAK009182	Ceramic chip 100 pF ±5% 50V
C340	K19/2CAK009257	Ceramic chip 10 pF ±0.5 pF 50V

SYMBOL	GE PART NO.	DESCRIPTION
C341 and C342	K19/2CCF004086	Tantalum 1 uF 16V
C343	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
		- - - - - - - - - - DIODES - - - - - - - - - -
CR201 and CR202	K19/2QBA012024	MA57
CR301 and CR302	K19/2QBA006166	1S2075K
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL301	K19/2FBD001471	A3FX01829 #1, 136-160 MHz
	K19/2FBD001489	A3FX01829 #2, 150-174 MHz
FL302	K19/2FBD001471	A3FX01829 #1, 136-160 MHz
	K19/2FBD001489	A3FX01829 #2, 150-174 MHz
FL303	K19/2FAA103041	A4WX01306
FL304	K19/2FAA103058	A4WX01307
FL305	K19/2FAD001242	CFX455E
		- - - - - - - - - - JACKS - - - - - - - - - -
J101	K19/2PDA023036	69775-005
J102	K19/2PDA023044	69775-011
		- - - - - - - - - - COILS - - - - - - - - - -
L101	K19/2LAA001149	FL3HR68M
L104	K19/2EDE001014	A4WX01364
L105	K19/2LAD001112	NL322522T-068M
L201	K19/2LAA001743	LAL02KRR47M
L202	K19/2LAB014943	A4WX01369-4.5t
L203	K19/2LAB014935	A4WX01340-39nH
L204	K19/2LAB014943	A4WX01369
L205	K19/2LAB014935	A4WX01340
L206	K19/2LAA001743	LAL02KRR47M
L301	K19/2LAD001070	NL322522T-R10M
L302	K19/2EDE001014	A4WX01364
L303	K19/2LAB024140	A4FX01878 #5
L305 and L306	K19/2LAD001062	MLF3216D1R0K
L307	K19/2LAD001021	MLF3216DR68K
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q101	K19/2QAD004020	2SC3356R22
Q102	K19/2QAD004087	2SB624BV3
Q103 thru Q105	K19/2QAD004046	2SD596DV3
Q106	K19/2QAD001133	2SC2620QC
Q201	K19/2QAD004053	2SD999
Q202	K19/2QAB015077	2SB1169
Q301 thru Q303	K19/2QAD004020	2SC3356R22
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R104-1 and R104-2	K19/2RGC003110	Square chip 1/16W 1K ohms ±5%
R105	K19/2RGC003383	Square chip 1/16W 47 ohms ±5%
R106	K19/2RGC003243	Square chip 1/16W 150K ohms ±5%
R107	K19/2RGC003060	Square chip 1/16W 220 ohms ±5%
R108 and R109	K19/2RGC003227	Square chip 1/16W 100K ohms ±5%
R110	K19/2RGC003110	Square chip 1/16W 1K ohms ±5%

SYMBOL	GE PART NO.	DESCRIPTION
R111 and R112	K19/2RGC003177	Square chip 1/16W 10K ohms ±5%
R113	K19/2RGC003276	Square chip 1/16W 470K ohms ±5%
R115	K19/2RGC003185	Square chip 1/16W 15K ohms ±5%
R116 and R117	K19/2RFB003253	Variable GF04W 10K ohms
R118 thru R120	K19/2RGC003219	Square chip 1/16W 47K ohms ±5%
R121	K19/2RGC003409	Square chip 1/16W 68K ohms ±5%
R123 and R124	K19/2RGC003219	Square chip 1/16W 47K ohms ±5%
R125	K19/2RGC003151	Square chip 1/16W 4.7K ohms ±5%
R126	K19/2RGC003110	Square chip 1/16W 1K ohms ±5%
R127 and R128	K19/2RGC003219	Square chip 1/16W 47K ohms ±5%
R129	K19/2RGC003383	Square chip 1/16W 4.7 ohms ±5%
R130	K19/2RGC003045	Square chip 1/16W 150 ohms ±5%
R132	K19/2RGC003045	Square chip 1/16W 150 ohms ±5%
R134	K19/2RGC003110	Square chip 1/16W 1K ohms ±5%
R201	K19/2RGC003326	Square chip 1/16W 10 ohms ±5%
R202 and R203	K19/2RGC003094	Square chip 1/16W 470 ohms ±5%
R204 and R205	K19/2RGC003334	Square chip 1/16W 22 ohms ±5%
R206 and R207	K19/2RGC003094	Square chip 1/16W 470 ohms ±5%
R208	K19/2RGC003037	Square chip 1/16W 100 ohms ±5%
R209	K19/2RGC003342	Square chip 1/16W 47 ohms ±5%
R210	K19/2RFB003253	Variable GF04W 10K ohms
R301	K19/2RGC003060	Square chip 1/16W 220 ohms ±5%
R302 and R303	K19/2RGC003243	Square chip 1/16W 150K ohms ±5%
R305	K19/2RGC003045	Square chip 1/16W 150 ohms ±5%
R306	K19/2RGC003177	Square chip 1/16W 10K ohms ±5%
R307	K19/2RGC003243	Square chip 1/16W 150K ohms ±5%
R308	K19/2RGC003045	Square chip 1/16W 150 ohms ±5%
R310	K19/2RGC003144	Square chip 1/16W 3.3K ohms ±5%
R311	K19/2RGC003201	Square chip 1/16W 33K ohms ±5%
R312	K19/2RGC003177	Square chip 1/16W 10K ohms ±5%
R313	K19/2RGC003094	Square chip 1/16W 470 ohms ±5%
R315	K19/2RGC003342	Square chip 1/16W 47 ohms ±5%
R321	K19/2RFB003261	Variable GF04W 100K ohms
R322	K19/2RGC003193	Square chip 1/16W 22K ohms ±5%
		- - - - - - - - - - TRANSPORMERS - - - - - - - - -
T301 and T302	K19/2LAB014893	A4WX01333
T303	K19/2LAB014901	A4WX01334
T304	K19/2LAB014919	A4WX01335
		- - - - - - - - - - THERMISTOR - - - - - - - - -
TH301	K19/2QBD016139	NTCDS30183HG103HC
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
Y301	K19/2YAA181657	44.545 MHz A4WX01304
		- - - - - - - - - ANTENNA SWITCH - - - - - - - -
S101	K19/2A3WL07654	VHF Antenna

PARTS LIST

M-PD STANDARD CONTROLLER BOARD

A4WE03736
ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - INTEGRATED CIRCUITS - - - - - - - - -
A1	K19/2ADA004313	Micro Processor HD63705V0CP
A2	K19/2CAA017382	RAM TC5517AFL-2
A3	K19/86041901A0	Audio Processor STC9140F
A4	K19/2AAJ010036	NJM2073D
A5	K19/2ABD025012	uPD74HC04G-T1
A6	K19/2AAB004250	uPC451G2-T1
A7	K19/2AAB004243	uPC1251G2-T1
A8	K19/2AAB004250	uPC451G2-T1
A9	K19/2AAZ001060	LM385Z-2.5
		- - - - - - - - - - LITHIUM BATTERY - - - - - - - - -
BT1	K19/5PBA004058	BR425
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1 thru C11	K19/2CAK011253	Ceramic chip 100 pF 50 WV
C12 and C13	K19/2CAK005511	Ceramic chip 0.1 uF 25 WV
C14 and C15	K19/2CAK09265	Ceramic chip 220 pF 50 WV
C16 and C17	K19/2CAK005511	Ceramic chip 0.1 uF 25 WV
C18 thru C26	K19/2CAK009265	Ceramic chip 220 pF 50 WV
C29	K19/2CAK005511	Ceramic chip 0.1 uF 25 WV
C27 thru C28	K19/2CAK011253	Ceramic chip 100 pF 50 WV
C39 and C40	K19/2CAK011188	Ceramic chip 0.01 uF 50 WV
C41	K19/2CAK005511	Ceramic chip 0.1 uF 25 WV
C42	K19/2CAK011188	Ceramic chip 0.01 uF 50 WV
C43	K19/2CCF004102	Tantalum 1 uF 15 WV
C44	K19/2CCF004185	Tantalum 0.22 uF 50 WV
C45	K19/2CAK011188	Ceramic chip 0.01 uF 50 WV
C46 and C47	K19/2CCF004102	Tantalum 1 uF 15 WV
C48	K19/2CAK011253	Ceramic chip 100 pF 50 WV
C49	K19/2CAK011188	Ceramic chip 0.01 uF 50 WV
C50	K19/2CAK005511	Ceramic chip 0.1 uF 25 WV
C51	K19/2CCF004102	Tantalum 1 uF 15 WV
C52	K19/2CAK011188	Ceramic chip 0.01 uF 50 WV
C53	K19/2CAK011261	Ceramic chip 15 pF 50 WV
C54	K19/2CAK011055	Ceramic chip 2 pF 50 WV
C55	K19/2CAK011220	Ceramic chip 22 pF 50 WV
C56 thru C58	K19/2CCF004102	Tantalum 1 uF 15 WV
C59 and C60	K19/2CAK011360	Ceramic chip 3300 pF 50 WV
C61	K19/2CAK011188	Ceramic chip 0.01 uF 50 WV
C62	K19/2CAK011295	Ceramic chip 0.015 uF 50 WV
C63 and C64	K19/2CAK005511	Ceramic chip 0.1 uF 25 WV
C65	K19/2CCF006024	Tantalum 6.8 uF 10 WV
C66 and C67	K19/2CAK011188	Ceramic chip 0.01 uF 50 WV
C68	K19/2CCF006024	Tantalum 6.8 uF 10 WV
C69 and C70	K19/2CCF004102	Tantalum 1 uF 15 WV
C71	K19/2CAK011188	Ceramic chip 0.01 uF 50 WV
C72	K19/2CAK005586	Ceramic chip 0.047 uF 50 WV
C73	K19/2CAK005511	Ceramic chip 0.1 uF 25 WV
C74	K19/2CAK011295	Ceramic chip 0.015 uF 25 WV
C75 and C76	K19/2CCF004102	Tantalum 1 uF 15 WV
C77	K19/2CAK011196	Ceramic chip 1000 pF 50 WV
C78	K19/2CCF004102	Tantalum 1 uF 15 WV
C79	K19/2CAJ023037	Ceramic chip 330 pF 50 WV
		- - - - - - - - - - DIODES - - - - - - - - - -
CR1	K19/2QBE005016	DAN202KT-96
CR2	K19/2QBE005032	DA204KT-96
CR3	K19/2QBE005127	155154
CR4 thru CR8	K19/2QBE005032	DAN204KT-96
CR9	K19/2QBE005032	DA204KT-96
		- - - - - - - - - - PINHEADER - - - - - - - - - -
P101	K19/2PDA023093	65646-205
P102	K19/2PDA023101	65646-211
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	K19/2QAD001133	NPN, 2SC2620QCTL
Q2	K19/2QAD004095	PNP, 2SB624T1BBV3
Q3 and Q4	K19/2QAD004103	PNP, 2SB798T1DL
Q5	K19/2QAD001034	NPN, 2SC2462LCTL
Q6	K19/2QAD004095	PNP, 2SB624T1BBV3
Q7	K19/2QAD001034	NPN, 2SC2462LCTL
Q8	K19/2QAD004095	PNP, 2SB624T1BBV3
Q9	K19/2QAD001034	NPN, 2SC2462LCTL
Q10 and Q11	K19/2QAD004095	PNP, 2SB624T1BBV3
Q12	K19/2QAD001034	NPN, 2SC2462LCTL
Q13 and Q14	K19/2QAD004095	PNP, 2SB624T1BBV3
Q15	K19/2QAD004103	PNP, 2SB798T1DL
Q16	K19/2QAD004095	PNP, 2SB624T1BBV3
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1 thru R8	K19/2RGC001643	Square chip 1/10W 100 K ohm ±5%
R9 thru R19	K19/2RGC001627	Square chip 1/10W 10 K ohm ±5%
R20	K19/2RGC001619	Square chip 1/10W 4.7 K ohm ±5%
R21 and R22	K19/2RGC001627	Square chip 1/10W 10 K ohm ±5%
R23 and R24	K19/2RGC001643	Square chip 1/10W 100 K ohm ±5%
R25	K19/2RGC001908	Square chip 1/10W 24 K ohm ±1%
R26	K19/2RGC001916	Square chip 1/10W 27 K ohm ±1%
R27 and R28	K19/2RGC001593	Square chip 1/10W 2.2 K ohm ±5%
R29	K19/2RGC001833	Square chip 1/10W 2.2 ohm ±10%
R30	K19/2RGC001908	Square chip 1/10W 24 K ohm ±1%
R31	K19/2RGC001916	Square chip 1/10W 27 K ohm ±1%
R32 and R33	K19/2RGC001585	Square chip 1/10W 1 K ohm ±5%
R34	K19/2RGC001833	Square chip 1/10W 2.2 ohm ±10%
R35	K19/2RGC001643	Square chip 1/10W 100 K ohm ±5%
R36 and R37	K19/2RGC001890	Square chip 1/10W 20 K ohm ±1%
R38	K19/2RGC001874	Square chip 1/10W 10 K ohm ±1%
R39 thru R41	K19/2RGC001643	Square chip 1/10W 100 K ohm ±5%
R42 thru R47	K19/2RGC001585	Square chip 1/10W 1 K ohm ±5%
R48	K19/2RGC001825	Square chip 1/10W 220 K ohm ±5%
R49 and R50	K19/2RGC004019	Square chip 1/10W 8.2 K ohm ±1%
R51	K19/2RGC001932	Square chip 1/10W 100 K ohm ±1%
R52	K19/2RGC001924	Square chip 1/10W 43 K ohm ±1%
R53	K19/2RGC001643	Square chip 1/10W 100 K ohm ±5%
R55	K19/2RGC001726	Square chip 1/10W 47 K ohm ±5%
R56	K19/2RGC001585	Square chip 1/10W 1 K ohm ±5%
R57	K19/2RGC001643	Square chip 1/10W 100 K ohm ±5%
R58	K19/2RGC001817	Square chip 1/10W 33 K ohm ±5%
R59	K19/2RGC001643	Square chip 1/10W 100 K ohm ±5%
R60	K19/2RGC001825	Square chip 1/10W 220 K ohm ±5%
R61	K19/2RGC001502	Square chip 1/10W 10 ohm ±5%
R62	K19/2RGC001643	Square chip 1/10W 100 K ohm ±5%
R63	K19/2RGC001627	Square chip 1/10W 10 K ohm ±5%
R64	K19/2RGC001833	Square chip 1/10W 2.2 ohm ±10%
R65 and R66	K19/2RGC001932	Square chip 1/10W 100 K ohm ±1%
R67	K19/2RGC001635	Square chip 1/10W 22 K ohm ±5%
R68	K19/2RGC001932	Square chip 1/10W 100 K ohm ±1%
R69	K19/2RGC001627	Square chip 1/10W 10 K ohm ±5%
R70	K19/2RGC001585	Square chip 1/10W 1 K ohm ±5%
R71 and R72	K19/2RGC001932	Square chip 1/10W 100 K ohm ±1%
R73	K19/2RGC004076	Square chip 1/10W 470 K ohm ±1%
R74	K19/2RGC001874	Square chip 1/10W 10 K ohm ±1%
R75	K19/2RGC004076	Square chip 1/10W 470 K ohm ±1%
R76	K19/2RGC001874	Square chip 1/10W 10 K ohm ±1%
R77 and R78	K19/2RGC001858	Square chip 1/10W 2 K ohm ±1%
R79 and R80	K19/2RGC001841	Square chip 1/10W 4.7 ohm ±10%
R81	K19/2RGC001627	Square chip 1/10W 10 K ohm ±5%
R82	K19/2RGC001833	Square chip 1/10W 2.2 ohm ±10%
R83 thru R86	K19/2RGC001643	Square chip 1/10W 100 K ohm ±5%
R87	K19/2RGC001791	Square chip 1/10W 10 M ohm ±10%
R88	K19/2RGC001627	Square chip 1/10W 10 K ohm ±5%
R89 and R90	K19/2RGC001585	Square chip 1/10W 1 K ohm ±5%
R91 and R92	K19/2RGC001627	Square chip 1/10W 10 K ohm ±5%
R93 and R94	K19/2RGC001585	Square chip 1/10W 1 K ohm ±5%
R95	K19/2RGC001874	Square chip 1/10W 10 K ohm ±1%
R96 thru R99	K19/2RGC001627	Square chip 1/10W 10 K ohm ±5%
R100	K19/2RGC001825	Square chip 1/10W 220 K ohm ±5%
R101 and R102	K19/2RGC001585	Square chip 1/10W 1 K ohm ±5%
R103	K19/2RGC001627	Square chip 1/10W 10 K ohm ±5%
R104	K19/2RGC001759	Square chip 1/10W 470 K ohm ±5%
R105 and R106	K19/2RGC001643	Square chip 1/10W 100 K ohm ±5%
R107 and R108	K19/2RGC001627	Square chip 1/10W 10 K ohm ±5%
R109	K19/2RGC001817	Square chip 1/10W 33 K ohm ±5%
R110	K19/2RGC001627	Square chip 1/10W 10 K ohm ±5%
R111 and R112	K19/2RGC001643	Square chip 1/10W 100 K ohm ±5%
R113 and R114	K19/2RGC001759	Square chip 1/10W 470 K ohm ±5%
R115	K19/2RGC001841	Square chip 1/10W 4.7 ohm ±10%
R116	K19/2RGC001726	Square chip 1/10W 47 K ohm ±5%
R117	K19/2RGC001635	Square chip 1/10W 22 K ohm ±5%
R118 and R119	K19/2RGC001643	Square chip 1/10W 100 K ohm ±5%
R120	K19/2RGC001585	Square chip 1/10W 1 K ohm ±5%
R121	K19/2RGC001726	Square chip 1/10W 47 K ohm ±5%
R122	K19/2RGC001643	Square chip 1/10W 100 K ohm ±5%
		- - - - - - - - - - RUBBER BUMPER - - - - - - - - - -
XY1	K19/2YYZ001062	NB-0252-0.5t
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
Y1	K19/2YAA181665	AT-41 3.579545 MHz

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

M-PD LCD BOARD

A4WE03737B
ISSUE 3

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
A1	K19/2ADC003107	uPD7225G
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 thru C3	K19/2CAK011196	Ceramic chip 1000 pF
C4	K19/2CAK005586	Ceramic chip 0.047 uF
C5	K19/2CCF004193	Tantalum 0.47 uF
C6 and C7	K19/2CCF004102	Tantalum 1 uF
		- - - - - - - - - - - - LED - - - - - - - - - - - -
CR1 thru CR6	K19/2HAA010202	HLMP-6500
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	K19/2QAD001026	Silicon, 2SA1121SBTL
Q2	K19/2QAD001034	Silicon, 2SC2462LCTL
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	K19/2RGC001734	Square chip 1/10W 180 K ohm ±5%
R2 thru R4	K19/2RGC001627	Square chip 1/10W 10 K ohm ±5%
R5	K19/2RGC001528	Square chip 1/10W 100 ohm ±5%
R6	K19/2RGC001643	Square chip 1/10W 100 K ohm ±5%
R7	K19/2RGC001528	Square chip 1/10W 100 ohm ±5%
R8 and R9	K19/2RGC001544	Square chip 1/10W 220 ohm ±5%
R10	K19/2RGC001700	Square chip 1/10W 1.5 K ohm ±5%
R11	K19/2RGC001601	Square chip 1/10W 3.3 K ohm ±5%
R12 and R13	K19/2RGC001726	Square chip 1/10W 47 K ohm ±5%
R14	K19/2RGC001635	Square chip 1/10W 22 K ohm ±5%
R15	K19/2RGC001589	Square chip 1/10W 470 ohm ±5%
		- - - - - - - - - - LCD DISPLAY - - - - - - - - - -
LCD	K19/2DCA005020	T164003A
		- - - - - - - - - - PINHEADER - - - - - - - - - -
J1-1 thru J1-5	K19/2PDA023143	Minisert 76693-001

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

This addendum provides installation instructions for Friction Pad Kit 19A705585G1, that are not yet included in this publication.

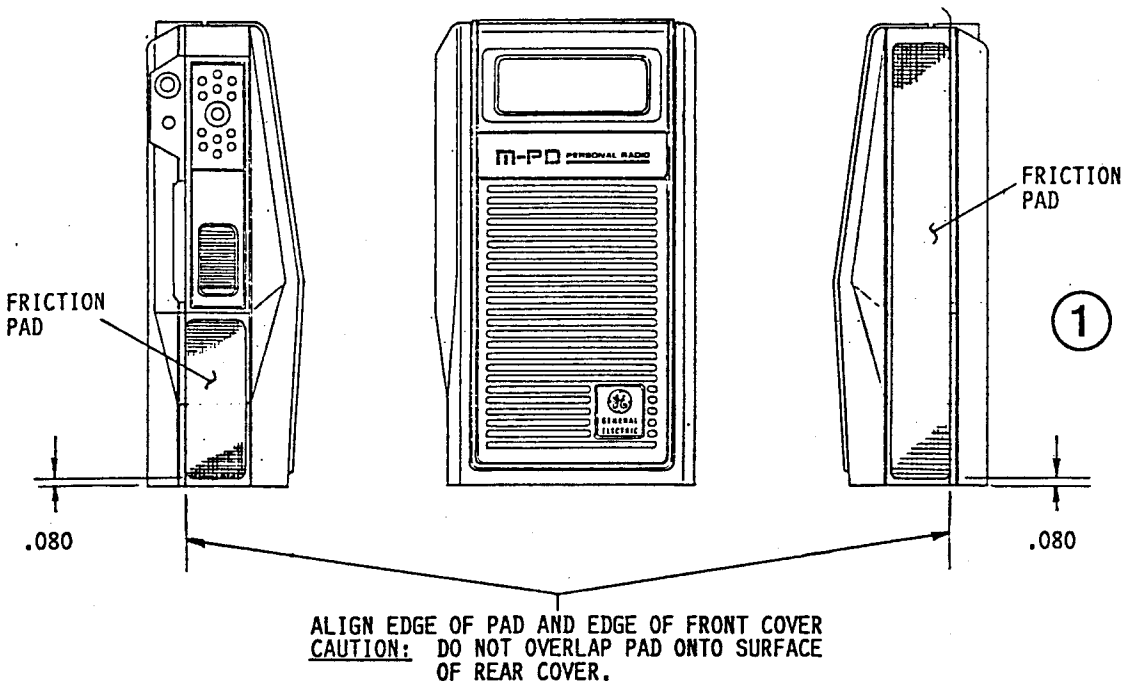
—IMPORTANT NOTICE—

DO NOT USE FRICTION PAD KIT ON RADIO UNITS WHICH WILL BE USED IN VEHICULAR CHARGERS.

APPLICATION OF PADS AS SPECIFIED MAKES THE RADIO HOUSING UNSUITABLE FOR USE IN VEHICULAR CHARGERS DUE TO LIMITED CLEARANCE IN CHARGER POCKET.

THESE INSTRUCTIONS COVER THE INSTALLATION OF FRICTION PAD KIT 19A705585G1

1. MOUNTING SURFACES OF HOUSING TO BE CLEAN, DRY AND FREE OF GREASE. SURFACE MAY BE WIPED CLEAN WITH ISOPROPYL ALCOHOL.
   CAUTION: AVOID CONTACT OF CLEANING LIQUIDS WITH PLASTIC PARTS OF RADIO ASSEMBLY.
2. REMOVE PROTECTIVE LINER AND APPLY FRICTION PADS IN POSITION SHOWN.
3. APPLY PRESSURE TO PAD TO SQUEEZE OUT ALL TRAPPED AIR AND ASSURE ALL EDGES ARE IN FULL CONTACT WITH CASE.



(19B801541, Rev. 0)

This addendum provides information on Intrinsically Safe Usage of selected M-PD personal radios and presents information on "Memory Effect" in nickel-cadmium batteries.

INTRINSICALLY SAFE USAGE

Selected personal radios with appropriate factory installed F4 Options are certified as Intrinsically Safe by the Factory Mutual Research Corporation for use in Class 1, Division 1 or 2, hazardous locations in the presence of Groups C and D atmospheres; Non-incendive Class 1, Division 2, hazardous locations in the presence of Groups A, B, C and D atmospheres.

Hazardous locations are defined in the National Electrical Code. Useful standards NFPA 437A and NFPA 437M for the classifications of hazardous areas may be ordered from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

BATTERIES

Only batteries with a green latch shall be used with a personal radio that is rated and labeled as Factory Mutual Intrinsically Safe. Use of non-specified batteries voids Factory Mutual approval. The following battery options are approved for use in intrinsically safe radios:

o	PDPA1C (19A704850P4)	Rechargeable battery, standard capacity
o	PDPA1D (19A704860P4)	Rechargeable battery, high capacity
o	PDPA1F (19A704860P6)	Rechargeable battery, extra high capacity

ACCESSORIES

The accessories listed below are approved for use with intrinsically safe radios. Use of accessories other than those listed voids Factory Mutual approval.

o	PDAB1A (19B801508P3)	Headset/Microphone
o	PDAC1A (19B801508P2)	Earpiece Kit
o	PDAC1B (19B801508P8)	GE-STAR Lanyard
o	PDAE1A (19B801508P1)	Speaker/Microphone
o	PDAE1B (19B801508P4)	Speaker/Microphone with GE-STAR Lanyard
o	PDAE1C (19B801508P6)	Speaker/Microphone/Antenna
o	PDNC1A (19B234804P21)	Antenna, 150-174 MHz, Helical, WB
o	PDNC1B (19B234804P1)	Antenna, 136-151 MHz, Helical

o	PDNC1C (19B234804P2)	Antenna, 150-162 MHz, Helical
o	PDNC1D (19B234804P3)	Antenna, 162-174 MHz, Helical
o	PDNC1E (19B234804P11)	Antenna, 403-440 MHz, Helical
o	PDNC1F (19B234804P12)	Antenna, 440-470 MHz, Helical
o	PDNC1G (19B234804P13)	Antenna, 470-512 MHz, Helical
o	PDNC1L (19A149061P10)	Antenna, 403-440 MHz, Whip
o	PDNC1M (19A149061P11)	Antenna, 440-470 MHz, Whip
o	PDNC1N (19A149061P12)	Antenna, 470-512 MHz, Whip
o	PDNC1H (19B235043P1)	Antenna, 806-870 MHz, Elevated Feed
o	PDNC1J (19A149061P2)	Antenna, 806-870 MHz, Short Flex
o	PDNC1K (19A149061P1)	Antenna, 806-870 MHz, Flex
o	PDHC1C (19A144704G1) (19B233241G1)	Belt Clip
o	PDHC1D (19B226627G2) (19A144704G1) (19B233243G1)	Swivel Mount
o	PDHC1P (19D901765P2) (19D901765P5) (19D901765P13)	Case & Belt Loop
o	PDHC1R (19D901765P4) (19D901765P5) (19D901765P13)	Case & Belt Loop for radio w/high capacity battery
o	PDHC1S (19D901765P1) (19D901765P5) (19D901765P13) (19B226627G2)	Case/Swivel Mount/Belt Loop
o	PDHC1T (19D901765P3) (19D901765P5) (19D901765P13) (19B226627G2)	Case/Swivel Mount/Belt Loop for radio w/high capacity battery
o	PDHC1K (19B233236G1) (19B216496P3)	Shoulder Strap

MEMORY EFFECT IN NICKEL-CADMIUM BATTERIES:

Nickel-Cadmium batteries can develop a condition called "Memory Effect" or reduced battery capacity. This condition occurs when:

1. The battery is continuously overcharged for long periods of time.

2. A regularly performed duty cycle which allows the battery to expend only a limited portion of its capacity.

If the nickel-cadmium battery is only sparingly or seldom used and is left on continuous charge for one or two months at a time, it could develop the **"Memory Effect."** On the first discharging cycle, the output voltage could be sufficiently lowered to reduce the battery's hours of useful service.

The most common method of causing the **"Memory Effect"** is regularly performing short duty cycles. This is when the battery is operated so that only a portion (50%) of its capacity is expended. This type of operation can cause the battery to become temporarily inactive and show a severe decrease in the ability to deliver at full rated capacity.

Any nickel-cadmium battery showing signs of reduced capacity should be checked for the **"Memory Effect"** before being returned under warranty or scrapped. If the **"Memory Effect"** is a fact, a procedure for reconditioning it should be performed as follows:

1. A complete discharge (deep discharge). This can be accomplished by turning the radio on and allowing the battery to discharge overnight.

2. A full charge cycle using an appropriate Ericsson GE charger.

3. This procedure should be repeated again. Performing the deep discharge and charge cycle at least twice should sufficiently restore the battery.

This addendum provides updated information on nickel-cadmium battery reduced capacity and replaces charge/discharge information contained in ADDENDUM NO. 2 TO LBI-31627B relating to "Memory Effect".

REDUCED CAPACITY IN NICKEL-CADMIUM BATTERIES:

Nickel-Cadmium batteries in some applications can develop a condition of reduced capacity, sometimes called "Memory Effect". This condition may occur when:

1. The battery is continuously overcharged for long periods of time.

2. A regularly performed duty cycle which allows the battery to expend only a limited portion of its capacity.

If the nickel-cadmium battery is only sparingly or seldom used and is left on continuous charge for one or two months at a time, it could experience reduced capacity. On the first discharging cycle, the output voltage could be sufficiently lowered to reduce the battery's hours of useful service.

The most common method of causing this limited capacity is regularly performing short duty cycles; when the battery is operated so that only a portion (< 50%) of its capacity is expended. This type of operation can cause the battery to become temporarily inactive and show a severe decrease in the ability to deliver at full rated capacity.

Any nickel-cadmium battery showing signs of reduced capacity should be carefully checked before being returned under warranty or scrapped. If reduced capacity is a fact, the following procedure may restore capacity:

1. Discharge the multicell battery at the normal discharge rate until the output voltage is approximately 1 Volt per cell. This equals 6 Volts output for current Ericsson GE M-PD personal radio batteries.

   Refer to the typical Ni-Cd cell discharge curve in Figure 1. Note the flatness of the discharge voltage. Discharging below the knee of the curve does not give added service. Experience shows discharging below 1.0 Volt is not necessary for reconditioning a cell.

2. A full charge cycle using an appropriate Ericsson GE charger.

3. This procedure should be repeated again. Performing the rated discharge and charge cycle at least twice should sufficiently restore the battery.

NOTE: The above procedure is easily done when using the discharge analyzer (19B801506P9) with the Ericsson GE Rapid Multi-Charger (19B801506P16 or P18).

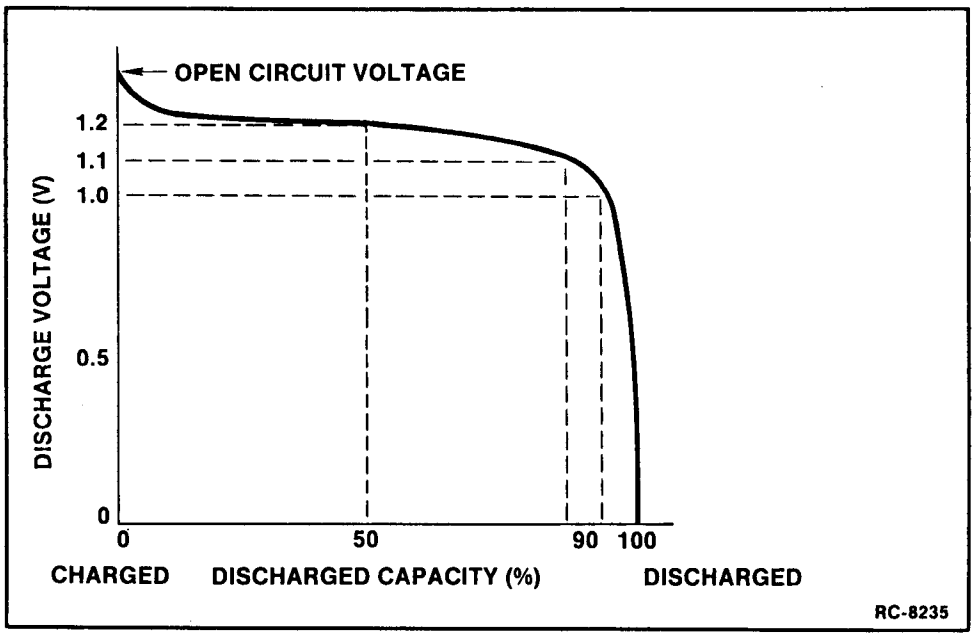


Figure 1 - Typical Ni-Cd Cell Voltage Discharge Curve