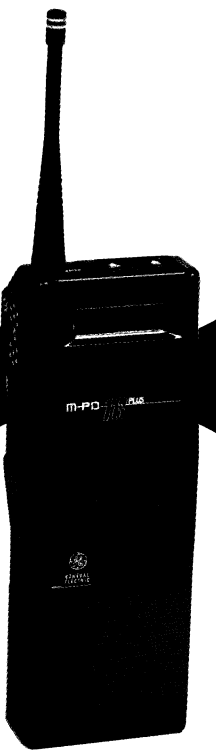
MOBILE RADIO

M-PD 16PLUS

MAINTENANCE MANUAL LBI-31831

SERVICE SECTION LBI-31832



806-870 MHz
PERSONAL
TWO—WAY FM RADIO

GENERAL ELECTRIC

TABLE OF CONTENTS

SPECIFICATIONS

SYSTEM

Frequency Range	FCC Identification Number
806 MHz - 870 MHz (TX) 851 MHz - 870 MHz (RX)	AXA9WNTR-157-A2
Frequency Stability	5 PPM 2.5 PPM
Battery Drain (at 7.5 VDC)	
Standby	105 Milliamperes
Receiver (Rated Audio)	230 Milliamperes
Transmitter	2.0 amperes
Battery Life	
800 mAh	4.3 hours at 5-5-90 duty cycle
1200 mAh	6.7 hours at 5-5-90 duty cycle
Dimensions (H x W x D) (With 800 mAh battery)	183 mm x 68.7 mm x 42.5 mm
Weight (With 800 mAh battery)	24 ounces
Operable Temperature Range	-30°C to +60°C

TRANSMIT

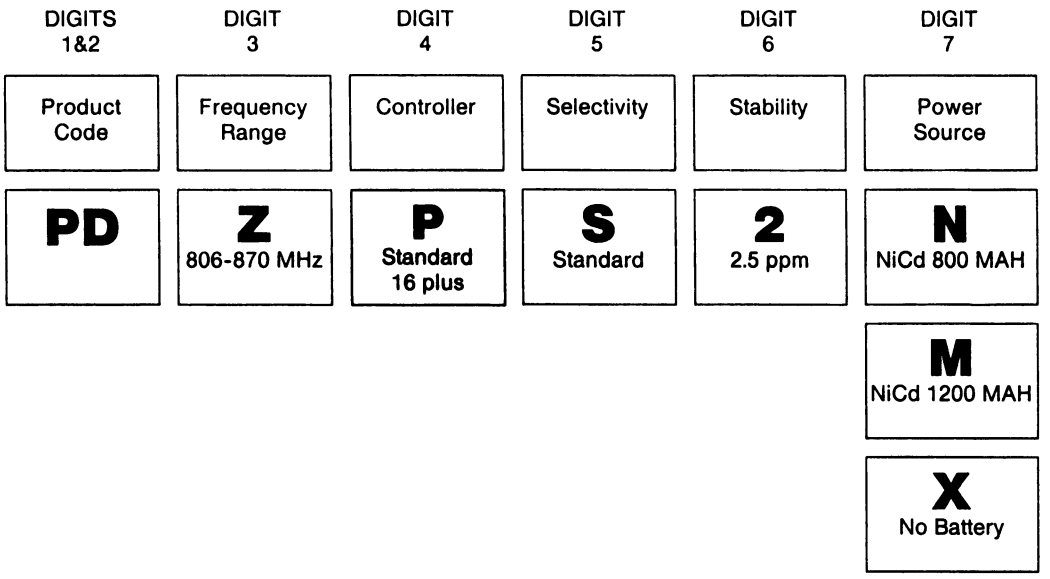
RF Power Output	1 to 3 Watts
Spurious Emissions	-16 dBm
Maximum Deviation	5 kHz
FM Hum & Noise (EIA)	-40 dB
Audio Distortion (60% MOD)	3%
Frequency Stability (-30°C to + 60°C)	2.5 PPM
RF Load Impedance	50 ohms
Microphone Sensitivity (EIA 60% MOD)	Less than 90 dB SPL
Maximum Attack Time (PTT Pushed)	25 milliseconds
Audio Frequency Response	Within +2 and -8 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	72 dBm (Minimum)
Rejection (EIA)	70 dB
Selectivity (EIA)	67 dB (25 kHz)
Squelch Sensitivity	6 dB SINAD
Distortion (EIA 0.5 Watt)	5%
Audio Frequency Response	Within +1 and -3 dB of a 6 dB/octave de-emphasis from 300 Hz to 3000 Hz.

OPTIONS AND ACCESSORIES

COMBINATION NOMENCLATURE



DESCRIPTION

General Electric's M-PD 16 PLUS Personal Radio is a high quality, high performance, synthesized, two-way FM, communications unit which operates in both the 16 PLUS trunked mode and the conventional communications mode. The trunked mode allows the user to select within a system, either a communications group or an individual radio for communication. Both the selected group and the individual radio are secured through digital signaling.

In the conventional mode the user selects a channel and directly communicates on that channel. A channel is a transmit/receive radio frequency pair.

A group consists of several users with a common group identification (ID). A radio may have several groups. The selected group determines who the unit can call at any specific time. In the trunked mode, a set of groups which communicate on a set of channels is called a system. In the conventional mode a system is a set of channels. A system may consists of all trunking groups and channels or all convenetional channels.

The M-PD 16 PLUS Personal Radio is designed to operate in General Electric's 16 PLUS Digital Trunking System or as a conventional radio by providing the following features:

Trunked

- **Programmable Multiple System Capability:** The radio can operate on different trunked sites or on different systems on the same site.
- **Multiple Group Capability:** The radio can communicate on several Groups within one trunked system. The number of Groups within a system is in the order of 1, 8, 16, etc., to some maximum allowable number.
- **Group Call:** The M-PD 16 PLUS has the capability of simultaneously calling all parties within a group.
- **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.

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

- **Receive Mode Lock Out:** In normal trunked operation, the radio will not transmit while in the receive mode.

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

- **Emergency Feature:** An "Emergency" group can be programmed into the radio which is selected by pressing the **EMER** button. This allows a user to quickly reach this group and initiate the 16 PLUS Emergency Signaling.

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

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

- **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 side of the radio.

- **Programmable through UDC:** The entire personality of the radio is programmed through four connections of the UDC. Programming the radio is accomplished by interfacing to an RS-232 device at a maximum of 1200 baud.

- **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 mode, volume level, battery condition, channel busy and high/low power output.

Conventional

- **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/Emergency" 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 Talkaround Capability:** The ability to switch the transmit frequency from a repeater frequency to a direct communication frequency by utilizing another channel designator with the same receive frequencies and a different transmit frequency.

- **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.

Physically an M-PD 16 PLUS radio consists of four 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 system board containing the microcomputer.

c. A speaker board with audio IC.

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

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

f. Light weight metal front and back housing.

Radio Assembly

Transmit:

The transmit circuit consists of four major circuits as follows:

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

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

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 a one 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 is used to convert the incoming signal to 45 MHz first IF, which is put through a bandpass 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, the second IF amplifier and the 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 800 MHz band frequency synthesizer has one common VCO for both transmitting and receiving. The transmitter is modulated at both the VCO and the VCTCXO.

b. VCTCXO Module: The VCTCXO is a voltage controlled, temperature compensated crystal oscillator providing 13.2 MHz as a 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 system board with an audio IC, a speaker board and a LCD board as follows:

a. System Board
Carries two microprocessors, a battery backed RAM, a ROM, 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 16 PLUS radio.

b. Audio IC
Includes transmitter and receiver audio circuits.

c. Speaker Board
Provides an audio processor, operational amplifier, voltage regulator and a comparator circuit.

d. LCD Board
Includes LCD driver circuits for the display.

Power Supply

The M-PD battery pack connects to the bottom of the M-PD 16 PLUS radio to supply 7.5 Volts DC. The battery pack is available in two sizes: 800 mAH and 1200 mAH. To charge these battery packs, chargers are available in three different types: a standard 16-hour charger, a rapid charger and a vehicular charger.

OPERATION

The M-PD 16 PLUS Personal Radio is delivered disassembled into three parts as follows:

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 16 PLUS 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 locks into place.

Operating Procedure (Refer to Figure 1)

To Receive a Message:

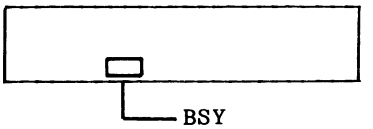
1. Slide the Power switch (8) on the side of the battery pack up to turn on the radio. While searching for a **Control Channel**, the radio will display **CC SCAN**. Once the Control Channel is obtained a communication channel is assigned and the radio LCD will display the last group number used.

2. Select the desired communication group by pressing the ▲ (Up) side or ▼ (Down) side, as desired, of GRP switch (6) while watching the indication in the display window (7).

   Example of Display

G	R	O	U	P		4	

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 ▲ (Up) and ▼ (Down) volume buttons.



Display

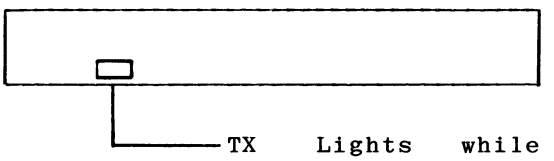
If BSY lights, it means that the channel is busy.

4. Adjust the audio volume to the desired level by pressing the (Up) side (to turn the volume up) or the (Down) side (to turn the volume down) of 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).



Lights while you are speaking.

NOTE

The M-PD unit is provided with an optional timer which inhibits continuous transmission beyond about 4 minutes. 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 16 PLUS Personal radios are two-way, FM radios designed for public communications in digital trunked radio systems as well as in conventional modes. Refer to Figure 2A and 2B - Block Diagrams. The M-PD 16 PLUS radio consists of four printed wire boards as follows:

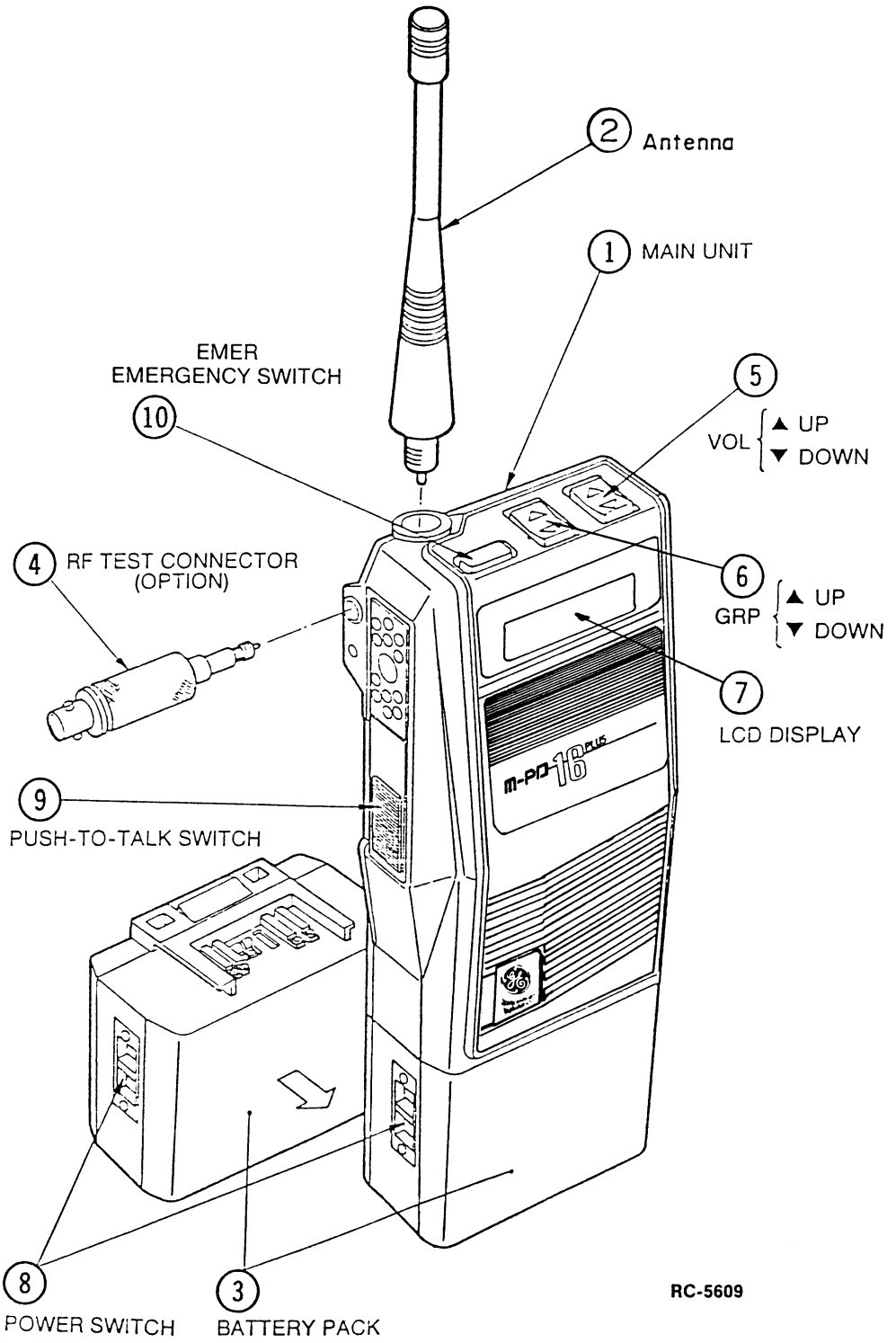


Figure 1 - M-PD 16 PLUS Operating Controls and Accessories

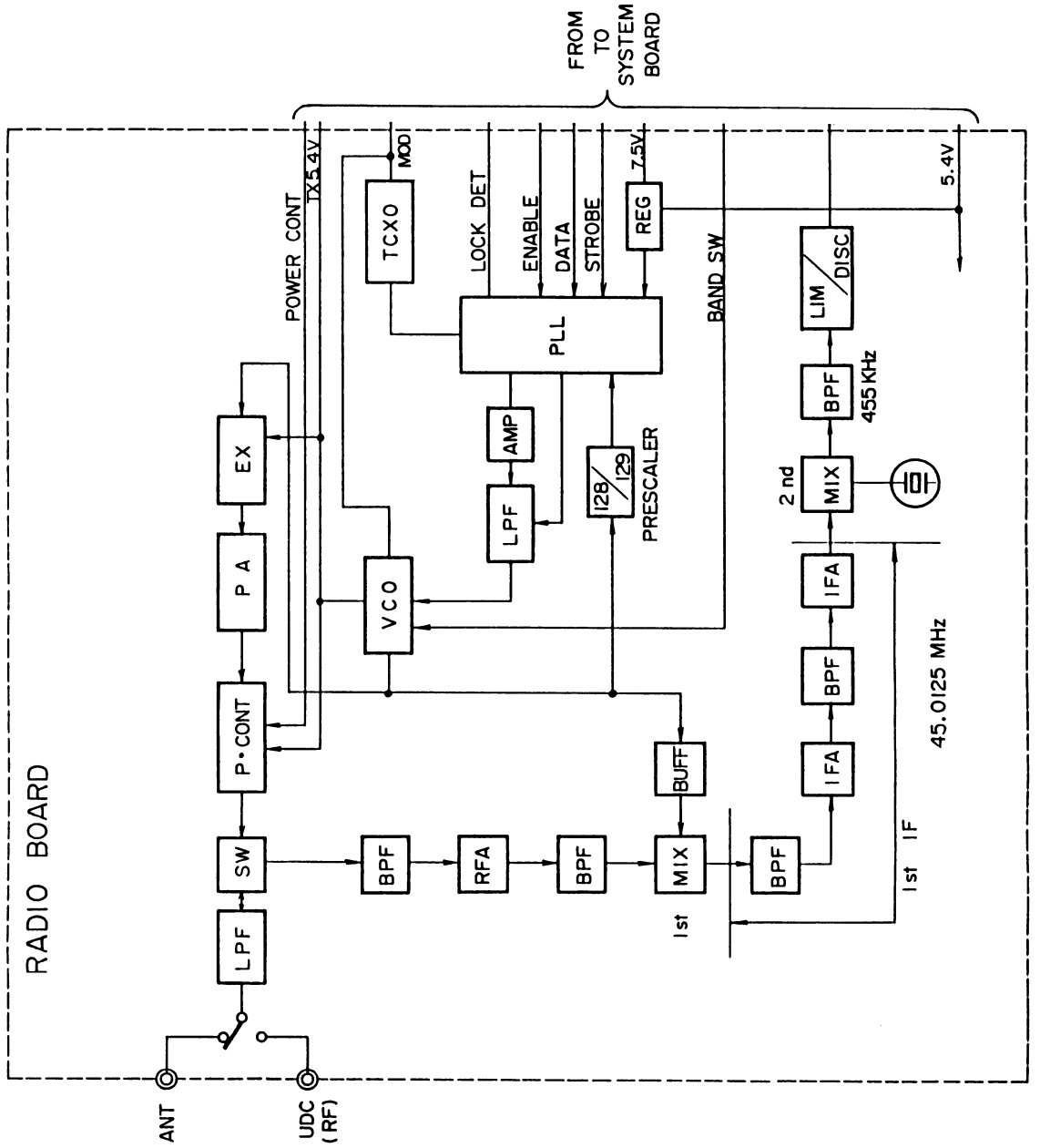


Figure 2A - Radio Block Diagram

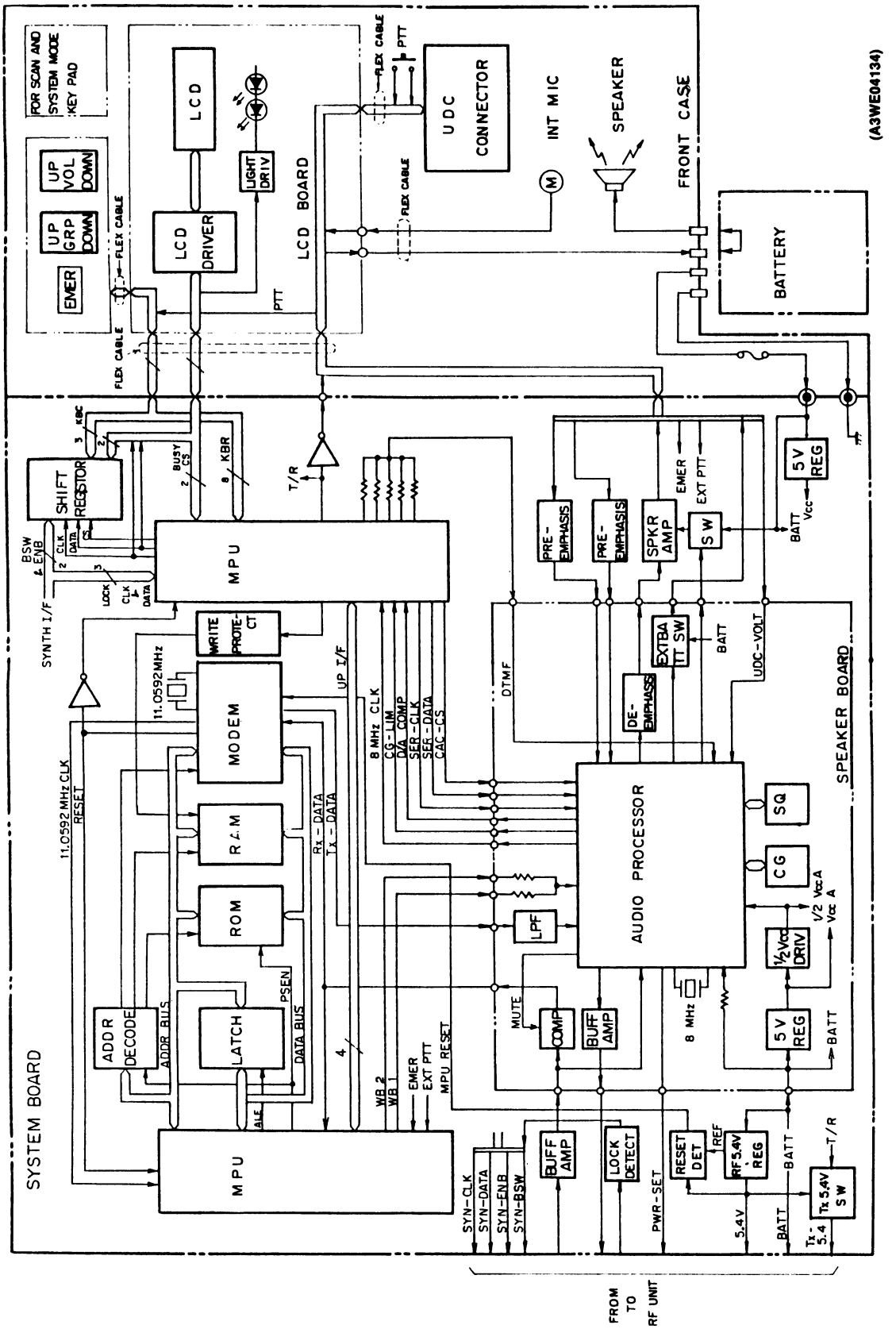


Figure 2B - Control/Logic Block Diagram

- **Radio Board:** carries the transmit, receive and frequency synthesizer circuits.
- **System Board:** support logic control circuits.
- **Speaker Board:** provides an audio processor, a voltage regulator and comparator circuits.
- **Display Board:** carries LCD displays.

Interconnection of the system 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 16 PLUS transmit circuit, as shown in Figure 2A - Radio Board 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 two 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.

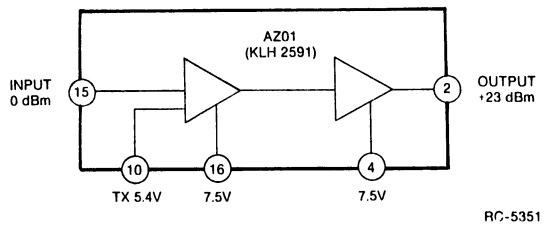


Figure 3 - Amplifier Module (TX-Amp)

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 4 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 3 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.

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. 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 16 PLUS receive circuit, as shown in Figure 2A, consists of the following circuits:

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

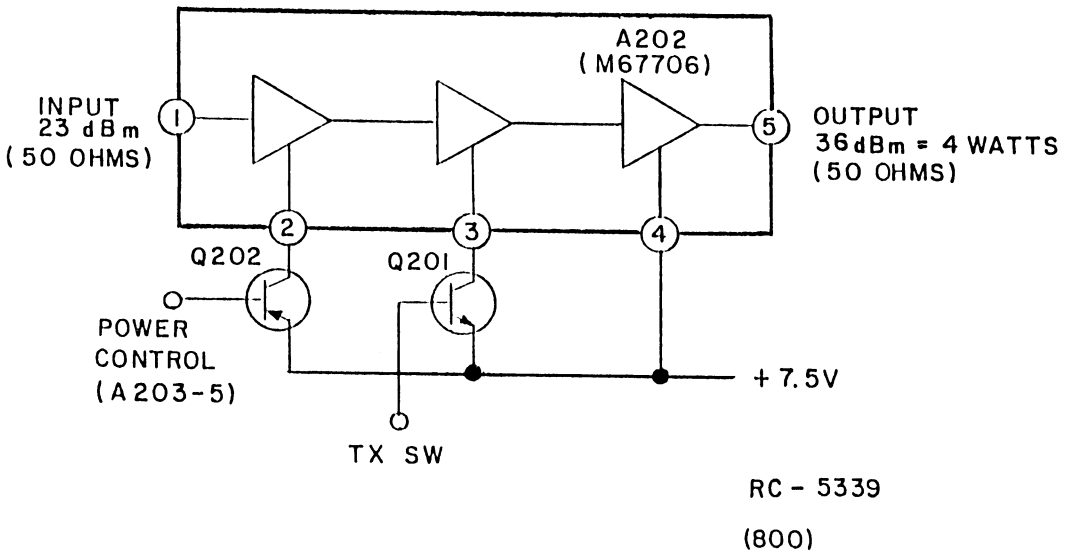


Figure 4 - Power Amplifier (PA)

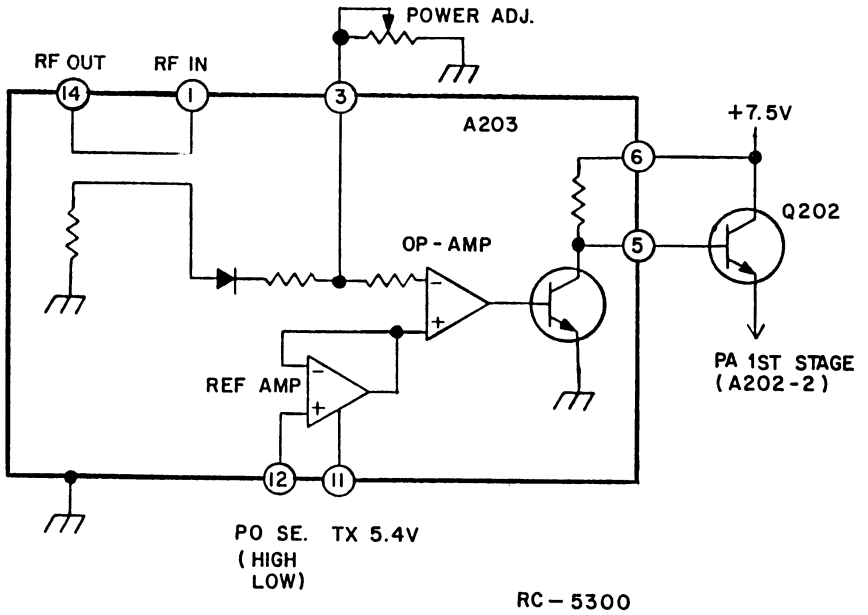


Figure 5 - Power Control Module (PC)

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 circuit 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 have 50 ohms matching 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.

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 (1/2) and converted to the second IF frequency (455 KHz). The second IF output is connected to Pin 7 input, of HA12442V (1/2) 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 "AND" with the TX-PTT output from 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

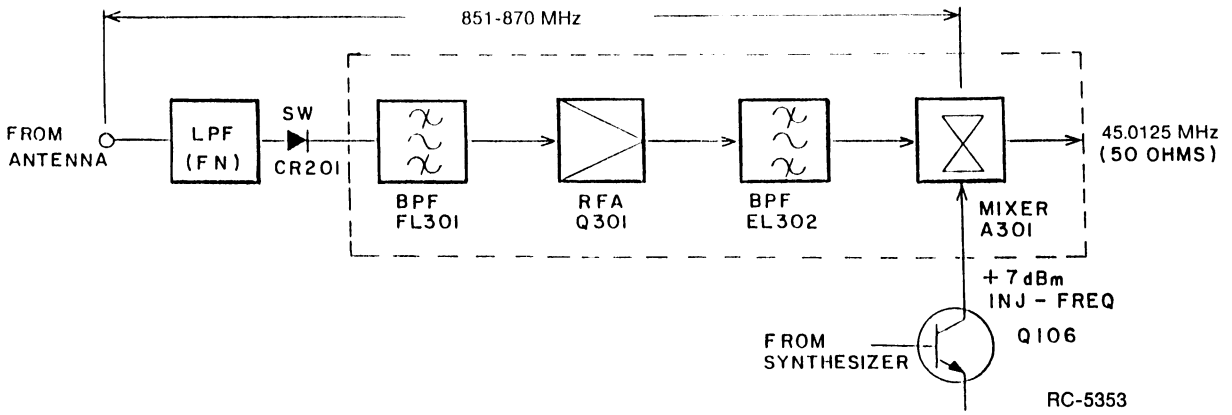


Figure 6 - RF Amplifier/Mixer

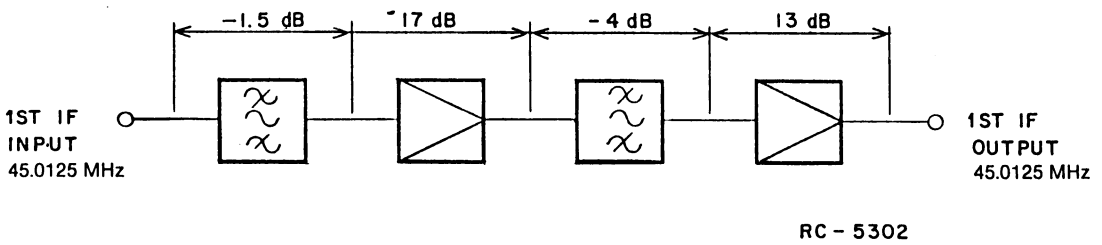


Figure 7 - First IF Amplifier

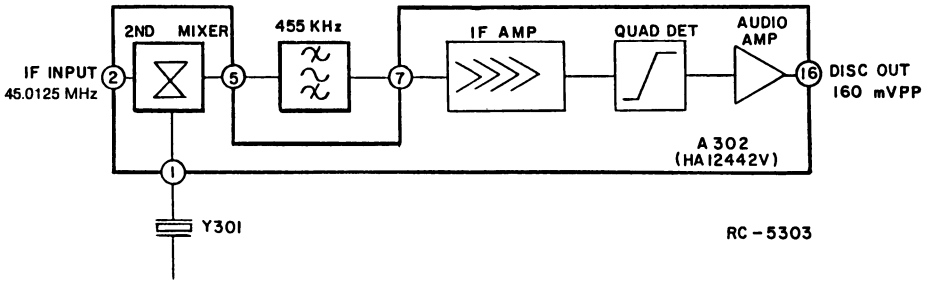


Figure 8 - Second IF Amplifier/Discriminator

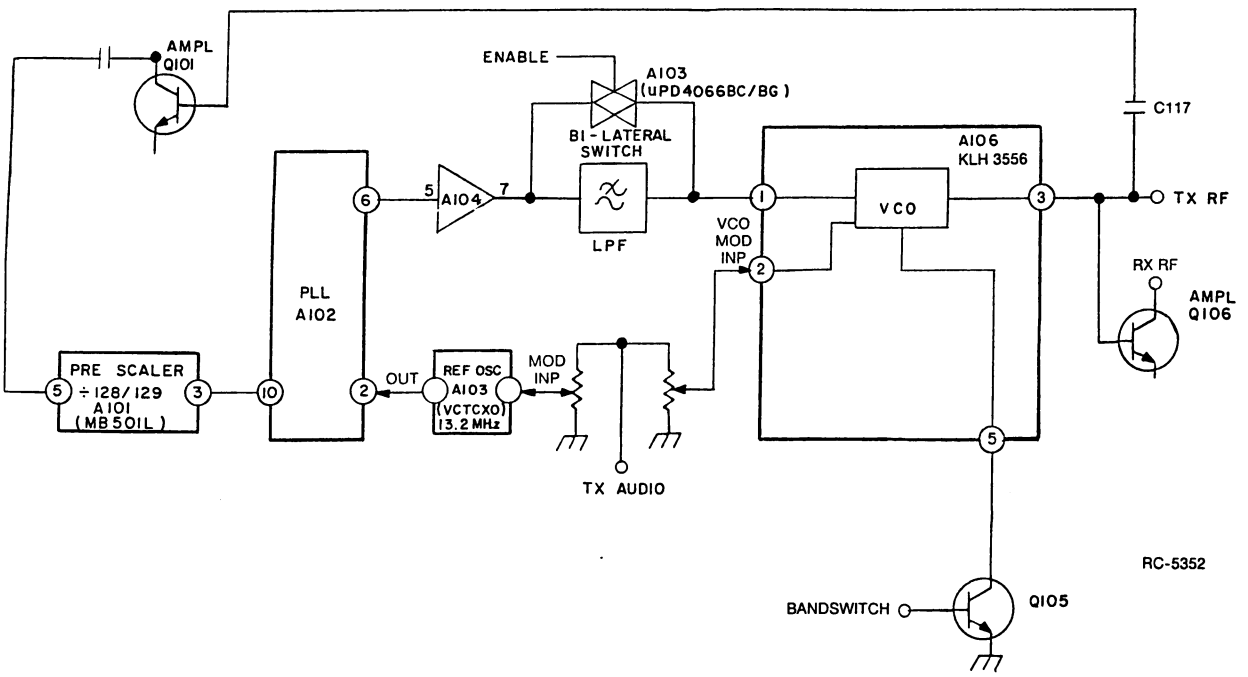


Figure 9 - Synthesizer

High Q coil which is used to set the center frequency at the factory. The output of the VCO 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 VCO amplifier output is also connected to the input of TX-Amp transistor Q107.

VCTCXO Referennce 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.

CONTROL CIRCUIT

This control circuit consists of control circuits and audio circuits (refer to Figure 2B). Physically, this circuit consists of three circuit boards as follows:

- System Board
- Speaker Board
- LCD Board

System Board

The System board consists of the following circuits: (Refer to Figure 2)

- CMOS Microcomputer (A1, A7)
- 74HC373 Latch (A2)
- PROM (A3)
- Custom Modem Chip (A4)
- CMOS Logic (A5)
- Shift Register (A6)
- Inverters (A8)
- CMOS RAM (A10) with Lithium Battery BT1
- Operational Amplifiers (A11 & A13)
- Audio Amplifier (A15)
- 5.0 Volt Regulator (A17)
- Precision Reference Diode Voltage reference (A18)
- De-multiplexer (A19)

Microcomputer:

The main microcomputer circuit in this radio consists of microprocessor 80C31 (A1), Latch (A2), de-multiplexer (A19), 32K X 8 EPROM (A3), 8K X 8 RAM (A10), and custom modem IC (A4). This circuitry runs at a 11.0592 MHz rate determined by crystal Y1 and controls the radio through a second microprocessor 637B05 (A7). This microprocessor (A7) runs at an 8 MHz rate. The 8 MHz rate is determined by crystal Y200 located on the Speaker Board. Shift register A6 is also controlled by A7 to provide additional output pins. Functions of the microcomputer are performed as follows:

- Controlling the Modem, ROM and RAM
- 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)
- Decoding the squelch
- Encoding/decoding the Channel Guard and digital Channel Guard
- Controlling the loading interface for the radio data (channel number and signaling)

Voltage Detector (A11, Q13):

IC A11 and transistor Q13 are used for the microcomputer reset and RAM data save at voltage drop.

Reset Circuitry (CR5, CR8, A11):

The reset circuitry consists of diodes CR5 and CR8 and part of operational amplifier package A11. This circuit generates a reset pulse which is fed into the modem IC (A4) which is passed to microprocessors A1 and A7. The modem also contain a watchdog timer in case the processor becomes erratic.

ROM (A3):

IC A3 contains the software to control the microcomputer.

RAM (A10, A5 & BT1, Q5, CR1):

The RAM circuitry consists of RAM IC A10, CMOS logic A5, lithium battery BT1, transistor Q5 and diode package CR1. This RAM circuit has a storage capacity of 8K bits X 8 for storing up to 6K bits X 8 worth of personality. This personality controls various functions of the radio. The personality data is entered from outside the radio through the UDC connector to the microcomputer and then to the RAM. The data mainly consists of the following:

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

CMOS Logic IC A5 is used to write protect the RAM to keep the 80C31 microprocessor (A1) from accidently overwriting the stored personality data. Lithium Battery BT1 with diode package CR1 and transistor Q5 maintain this personality when power is turned off.

Modem (A4):

Modem A4 provides high speed data (9600 baud) encode to the transmitter in the station and the high speed data decode from the station receiver when used in a trunked system.

CMOS and Latch (A2, A5, A6 and A19):

IC A2 is used as a Data Bus Buffer for the microcomputer. IC A5 is used to write protect microprocessor A3. Shift register A6 is used to latch the data of the microcomputer for LCD interface and the output signal of IC A19 is used to select the address of A3 and A4, A1 and A10.

Voltage Regulator circuits (A17, A18, Q1, Q2, Q9, Q13, Q14, part of A11):

The voltage reference diode A18 provides a 2.5 volt reference for operational amplifier A11. Operational amplifier A11, transistors Q1, Q2 and Q13 in combination generate 5.4 VDC for the radio's RF sections (TX and RX). Transistors Q9 and Q14 in conjunction with voltage regulator A17 provides a regulated 5.0 volts DC for the System Board. Transistors Q9 and Q14 serve to limit the current.

External Data Buffer (A8):

The external data buffer is located between the UDC connector and the microcomputer for converting the level of external signals to match the internal circuits and for protection of the internal circuits.

Audio Amplifier (A15):

The audio amplifier is located between the audio processor and the microphone or the speaker. Amplifier A15 amplifies the output signal of the Speaker Board to the level adequate for driving the speaker and UDC audio output.

Speaker Board

The speaker board consists of the following circuits:

- Audio processor (A201)
- Operational Amplifier (A202)
- Voltage Regulator (A203)
- Comparator (A204)

Audio Processor (A201):

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
- 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 8.00 MHz clock generator.

Operational Amplifier (A202):

The section of operational amplifier A202 with pins 1, 2, 3 is used to provide de-emphasis for the receive audio and drives the audio amplifier on the System Board. The section of A202 with pins 8, 9, 10 provides a 2.7 volt reference to the audio processor and microphone circuits. The section of A202 with pins 5, 6, 7 provides shaping for the 9600 baud digital signal generated by modem IC A4. The section of A202 with pins 12, 13, 14 provides the final shaping of the transmit audio which then drives the TX RF section.

Voltage Regulator (A203 with Q205 and Q206):

Pass transistor Q205 and voltage regulator package A203 generate 5.4 volts for the audio processor. Transistor Q206 is used to limit the current to avoid break down.

Comparator A204:

The section of comparator A204 with pins 1, 2, 3 is used as a limiter to

square up the discriminator audio which is then fed to the modem IC. In trunk mode, when 9600 baud data is being received by the radio, the audio will appear on pin 1 of A204.

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 characters, 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 which upon receiving a signal from the microcomputer is enabled when any of the control switches (VOL, PTT, etc.) are operated.

Key Pad

The key pad, used with the standard M-PD 16 PLUS 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

} 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 Pack

Two battery packs, one with 800 mAH capacity and one with 1200 mAH capacity, are available for use with the M-PD radio; both batteries provide a nominal 7.5V 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. Both 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 of greater then 7.5V. A fully discharged battery pack should provide a reading of no less than 6V.

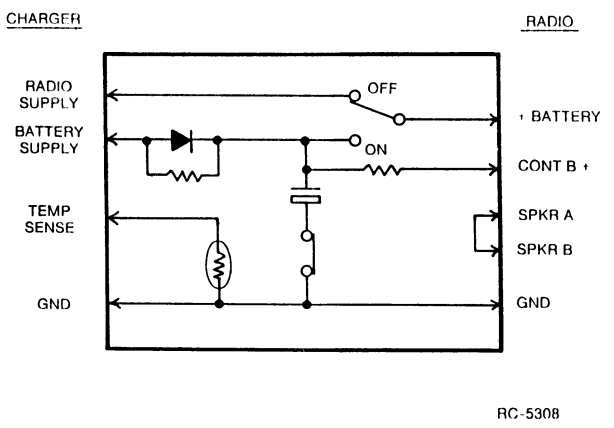


Figure 10 - Battery Pack

Battery Check

One of the best service checks for the rechargeable battery packs can be

easily obtained by measuring the milliampere-hour capacity. The results of the measurement can then be compared with the rated capacity of the battery pack to determine the general condition of the battery.

First, it is necessary to find the percentage of rated capacity. This is obtained by measuring the time it takes to discharge a fully charged battery pack until the terminal voltage drops to 6V. The proper load resistor for each of the battery packs is shown in Table 1.

Then use the formula:

$$\frac{T}{60} = \%$$

Where "T" is the time in minutes required to discharge the battery pack to 6V and % is the percentage of rated capacity the battery delivered to a load. For example: assume the standard battery pack voltage dropped to 6V in 65 minutes:

$$\frac{65}{60} = 108 \text{ (percentage of capacity)}$$

Now multiply the percentage of capacity by its rated capacity (see Table 1):

108 X 800 mA = 864 mAh

The 864 milliampere-hours is the actual capacity of the battery pack.

NOTE

As the voltage drops very fast near the end of the discharge cycle, be very careful to avoid discharging the battery pack below 6V.

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

The method for programming the M-PD 16 PLUS radio is through the use of a personal computer (PC). The procedure is described in Programming Instructions LBI-31883.

After the radio has been programmed, as described in the applicable Programming Instructions 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:

Table 1 - Capacity Measurement Data

Rechargeable Battery Pack	Rated Capacity	Average Discharge Rate (for 60 minutes)	Load Resistor (R & L)	End Voltage
(6 cells)	800 mAh	800 mAh	9.375 ohms 8 Watts	6 VDC
(6 cells)	1200 mAh	1200 mAh	6.25 ohms 12 Watts	6 VDC

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 for typical voltage readings found in the Service Section.

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
Control/Logic 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 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)

NOTE

Screws are not captive. Be careful not to lose them.

Step 2:

To remove the Radio Board, unscrew and remove the antenna at (C) and UDC 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 System Board, remove the five screws at (I) from the System 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 System 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 SPK/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 16 PLUS 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-31832).

Troubleshooting Procedure

Maintenance of the M-PD 16 PLUS 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 component or circuit. These procedures are found in the Service Section.

WEATHERPROOF INTEGRITY

The M-PD 16 PLUS radio is designed to meet MI-810-D specification for Blowing Rain. All access to the M-PD radio are protected from water entry by suitable gaskets and seals. However, degradation due to use, or disassembly during repairs, may affect the integrity of the seals as provided by factory assembly. A maintenance procedure is provided in the Service Section (LBI-31832) to assure that the radio housing will continue to meet the weatherproof features as designed.

GENERAL ELECTRIC COMPANY • MOBILE COMMUNICATIONS DIVISION
WORLD HEADQUARTERS • LYNCHBURG, VIRGINIA 24502 U.S.A.

GENERAL ELECTRIC*
U.S.A.

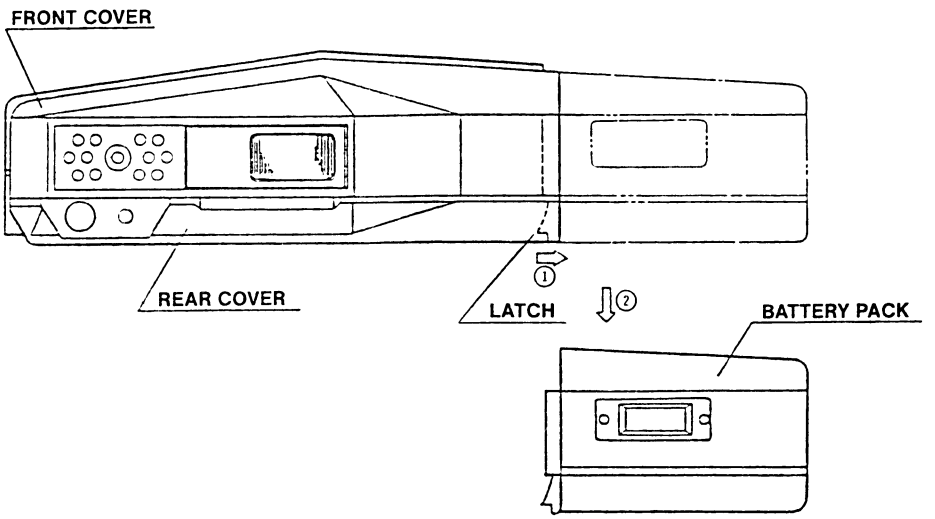


Figure 11 - Disassembly

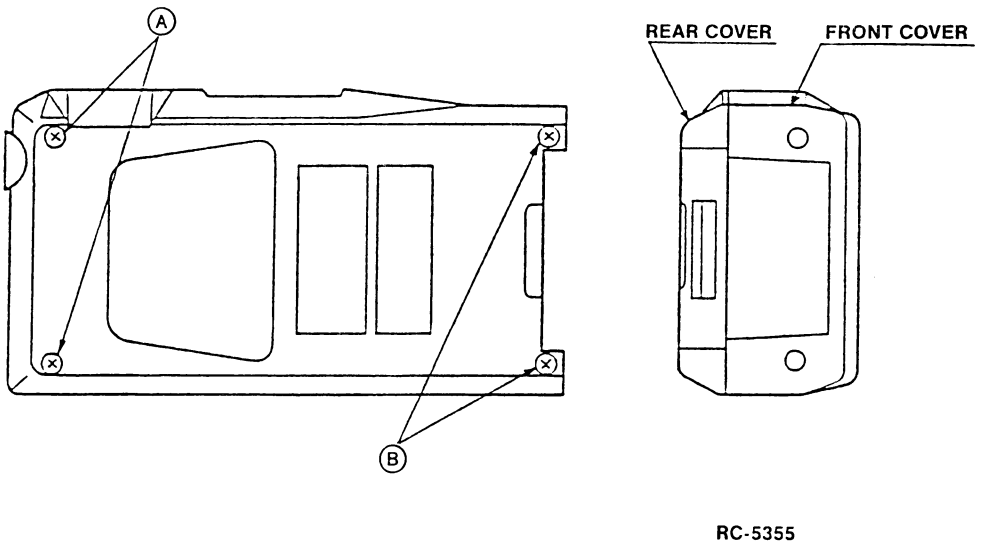


Figure 12 - Disassembly Step 1

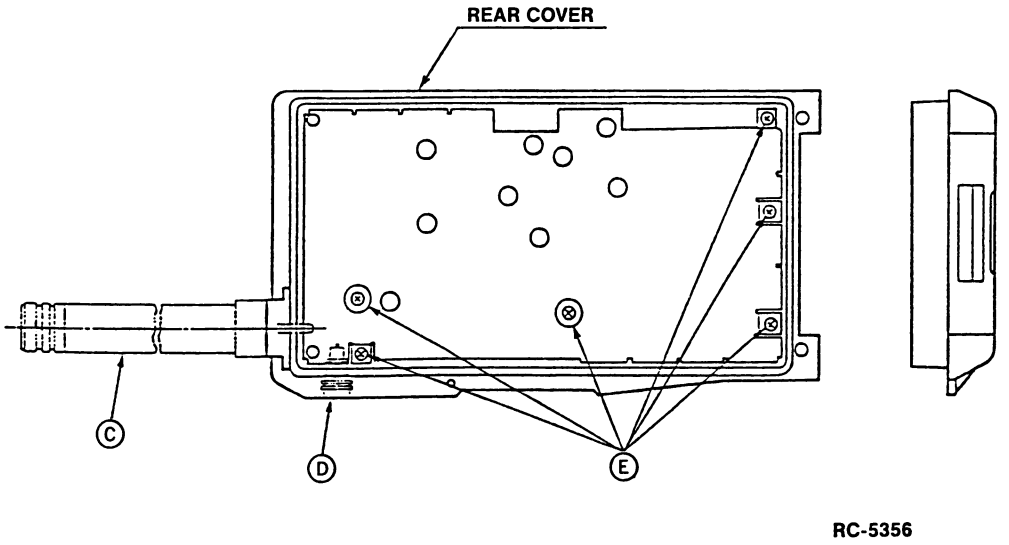


Figure 13 - Disassembly Step 2

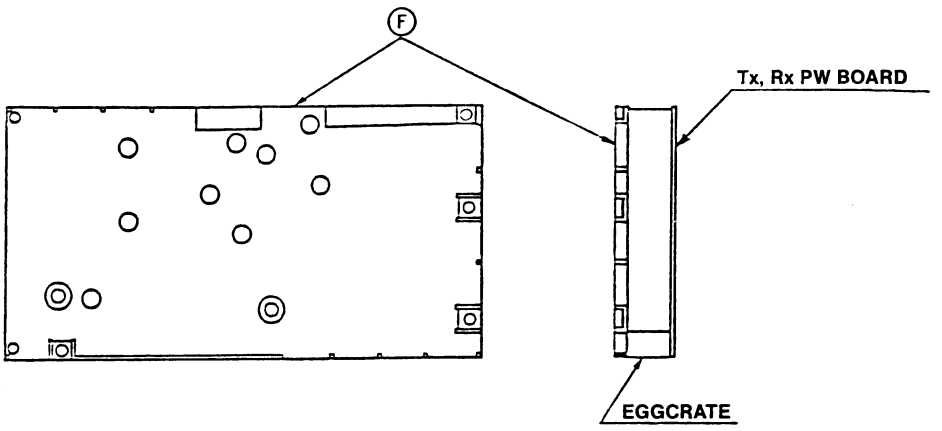


Figure 14 - Disassembly Step 3

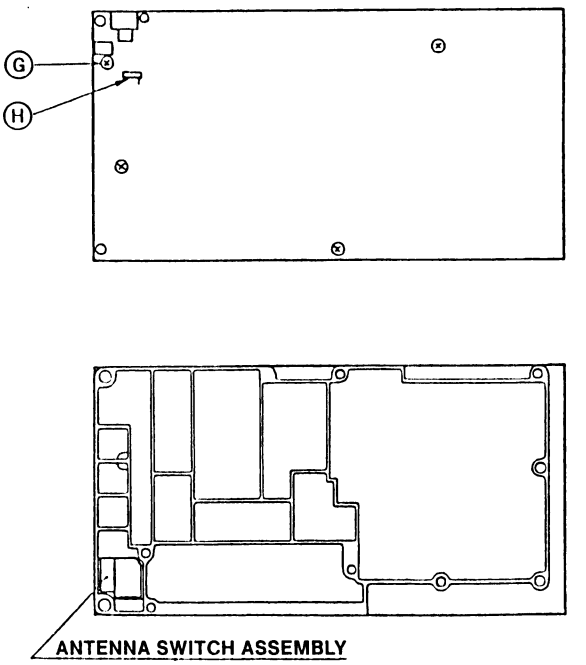


Figure 15 - Disassembly Step 4

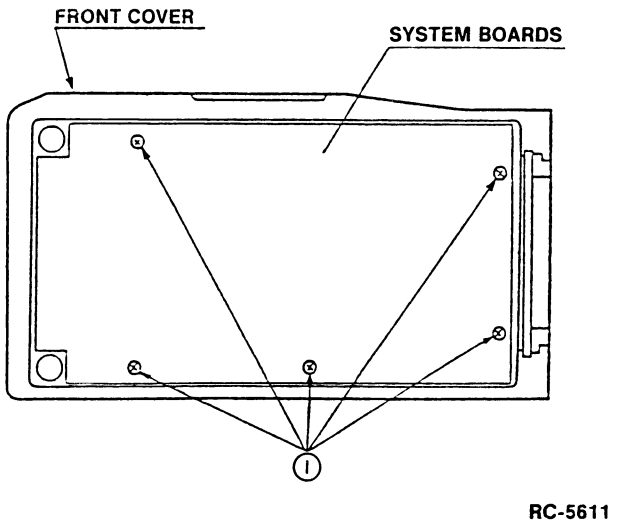


Figure 16 - Disassembly Step 5

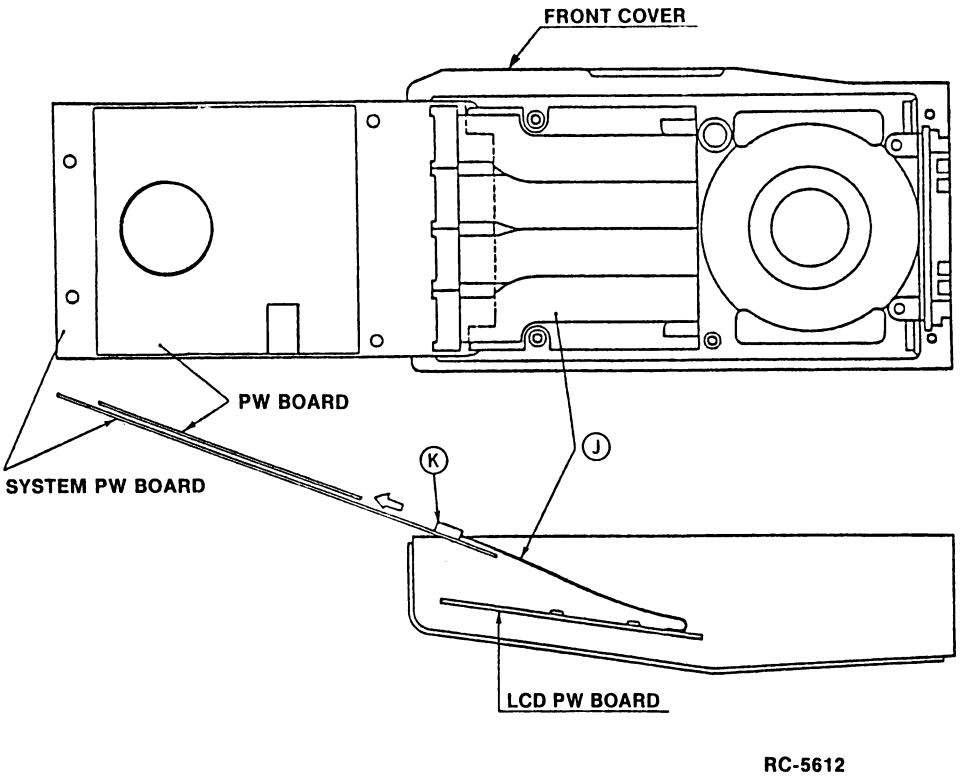


Figure 17 - Disassembly Step 6

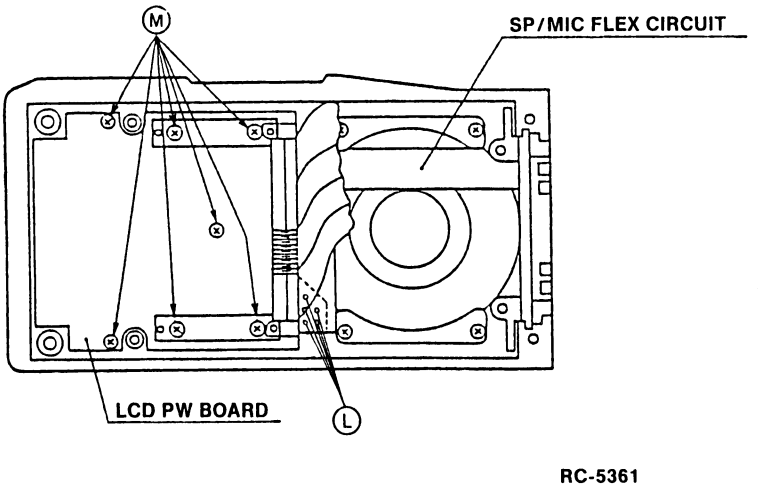
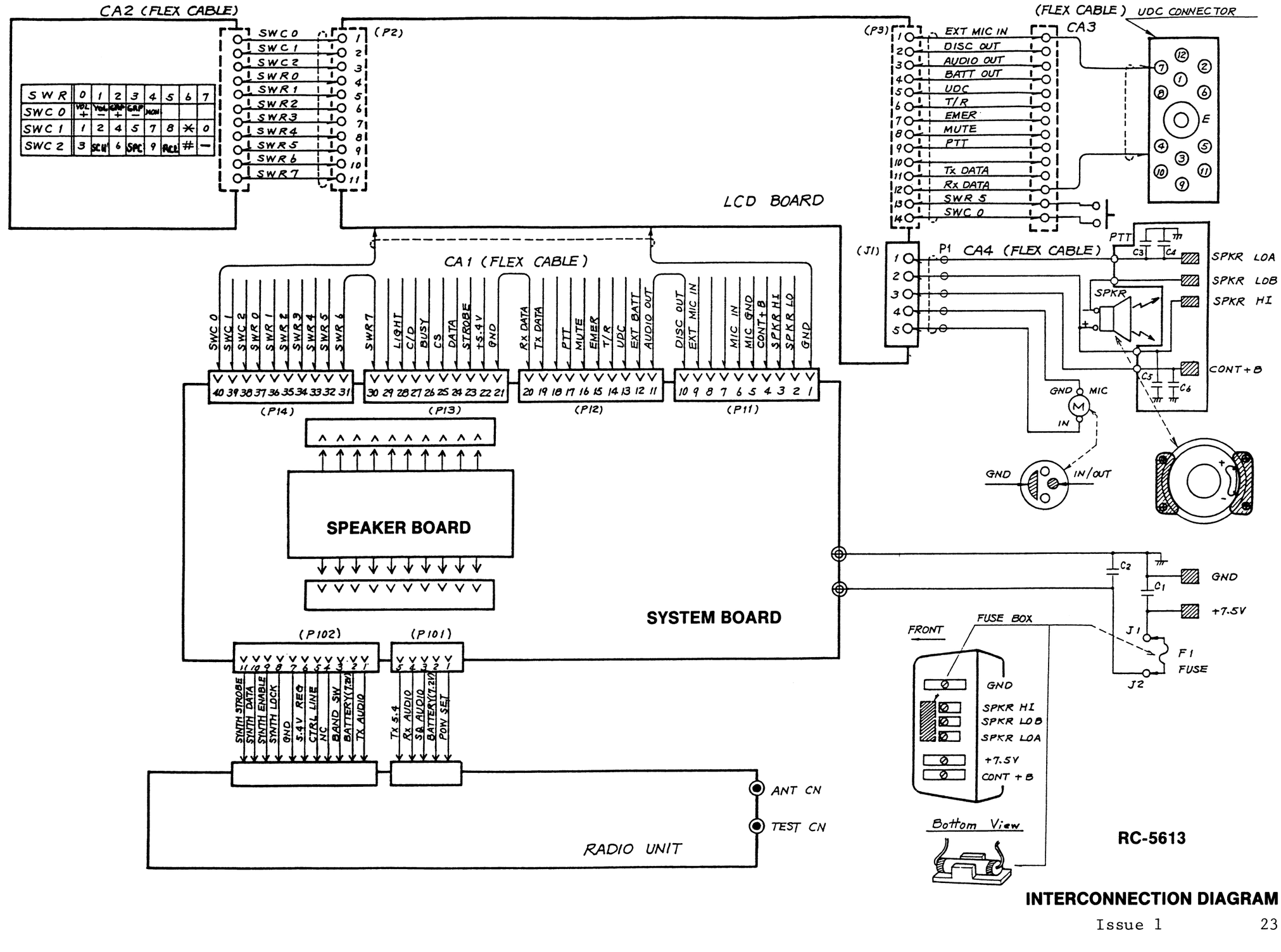
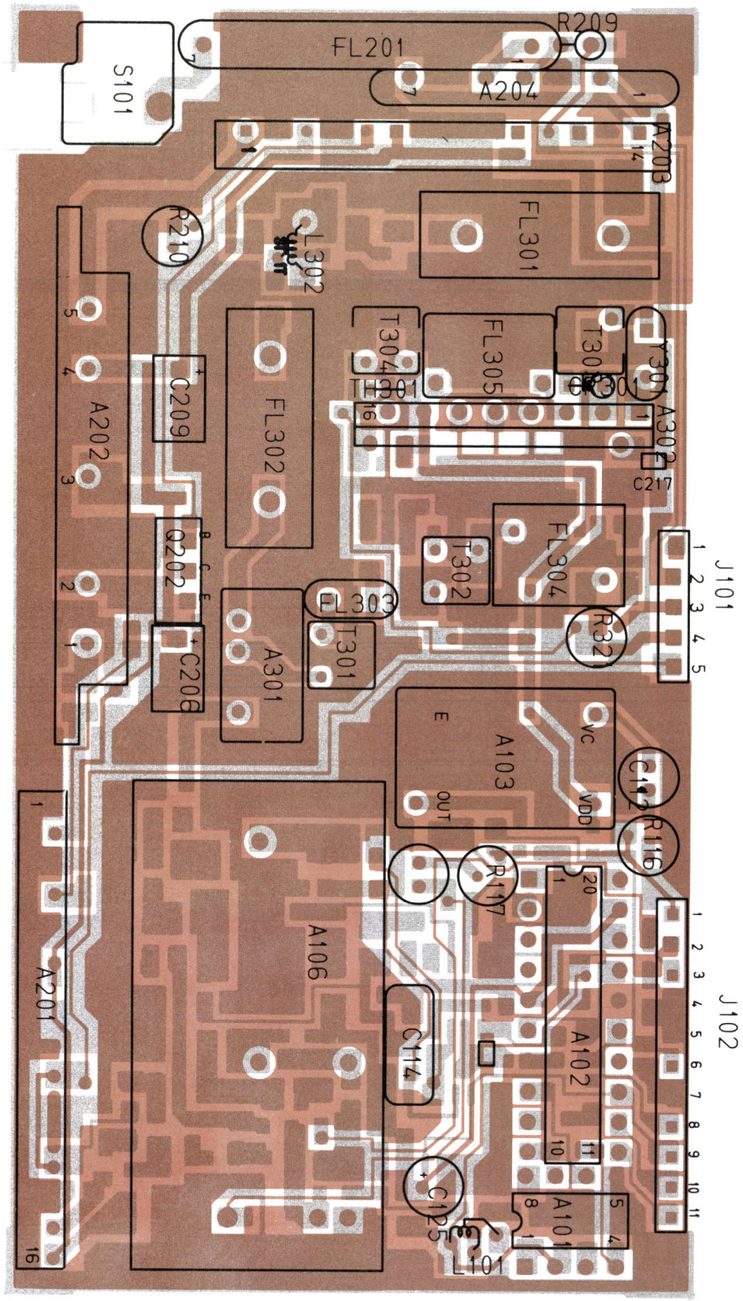


Figure 18 - Disassembly Step 7

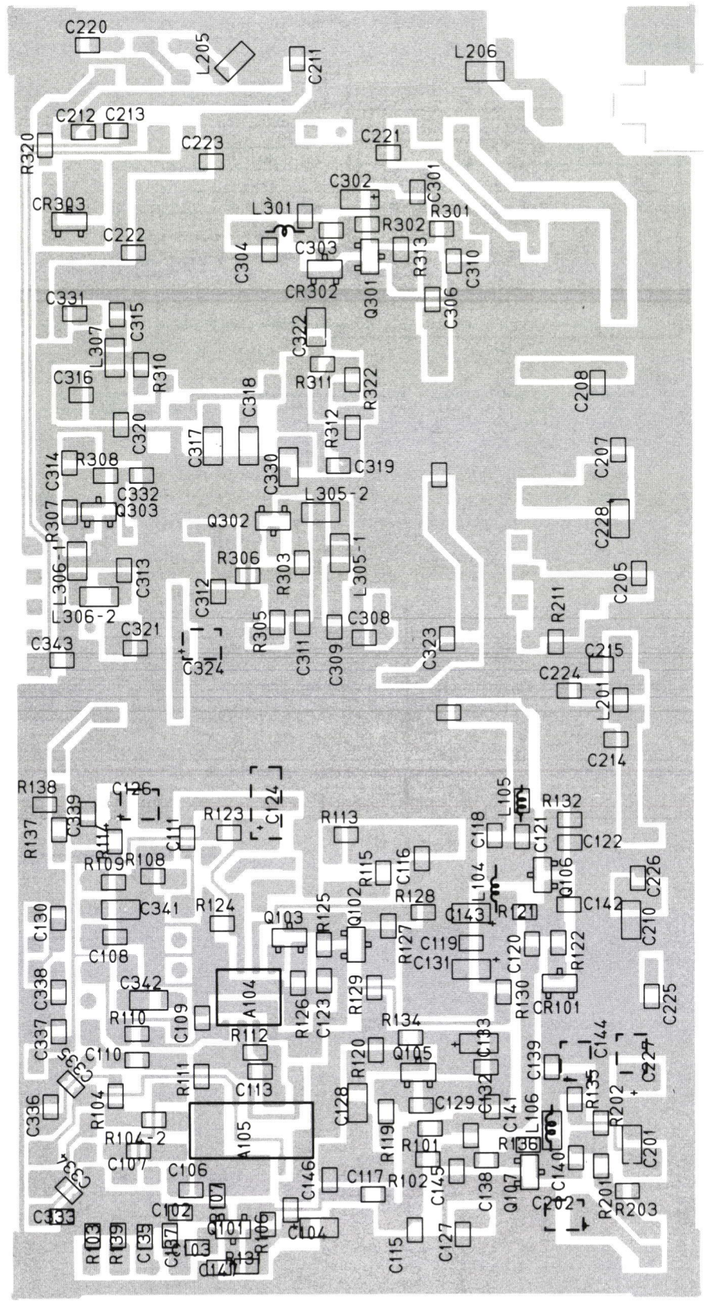


INTERCONNECTION DIAGRAM

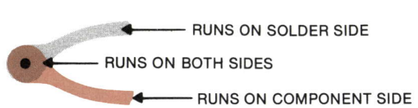
COMPONENT SIDE



SOLDER SIDE



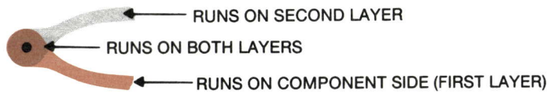
OUTLINE DIAGRAM
RADIO BOARD



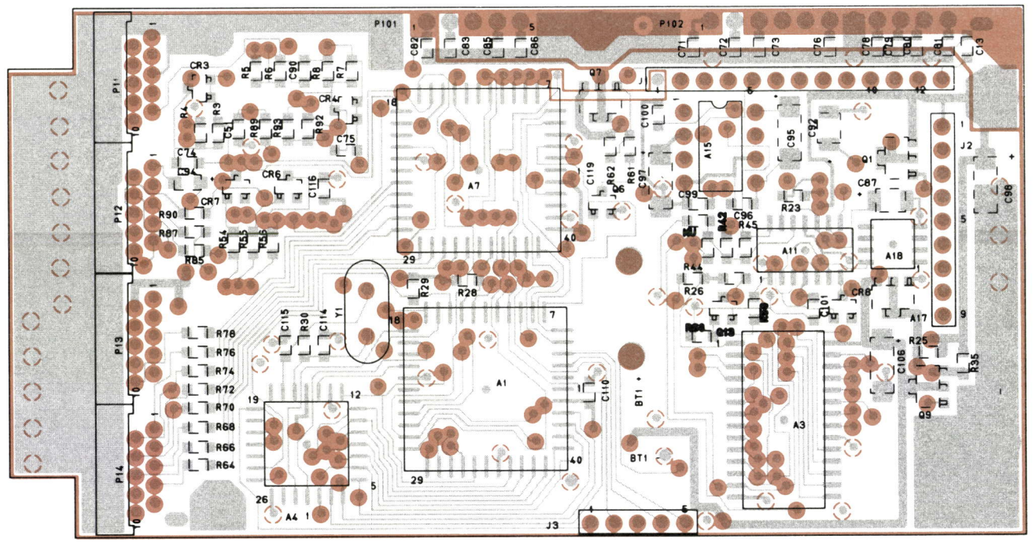
※ ; TYPICAL VOLTAGE AT MIDDLE CHANNEL

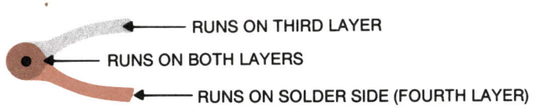
(A2WE03707, REV.0/870202)

SCHEMATIC DIAGRAM
RADIO BOARD WITH TYPICAL VOLTAGE

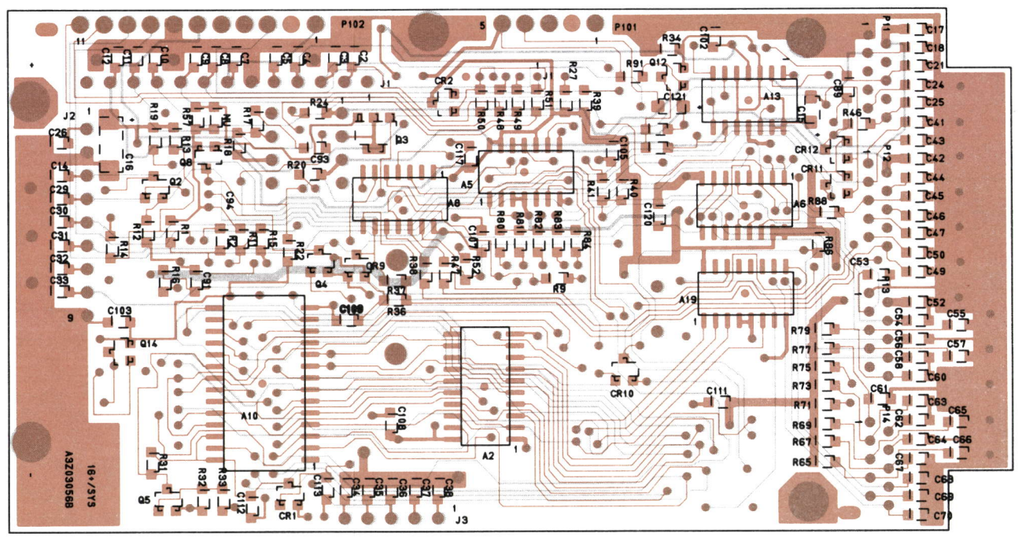


COMPONENT SIDE

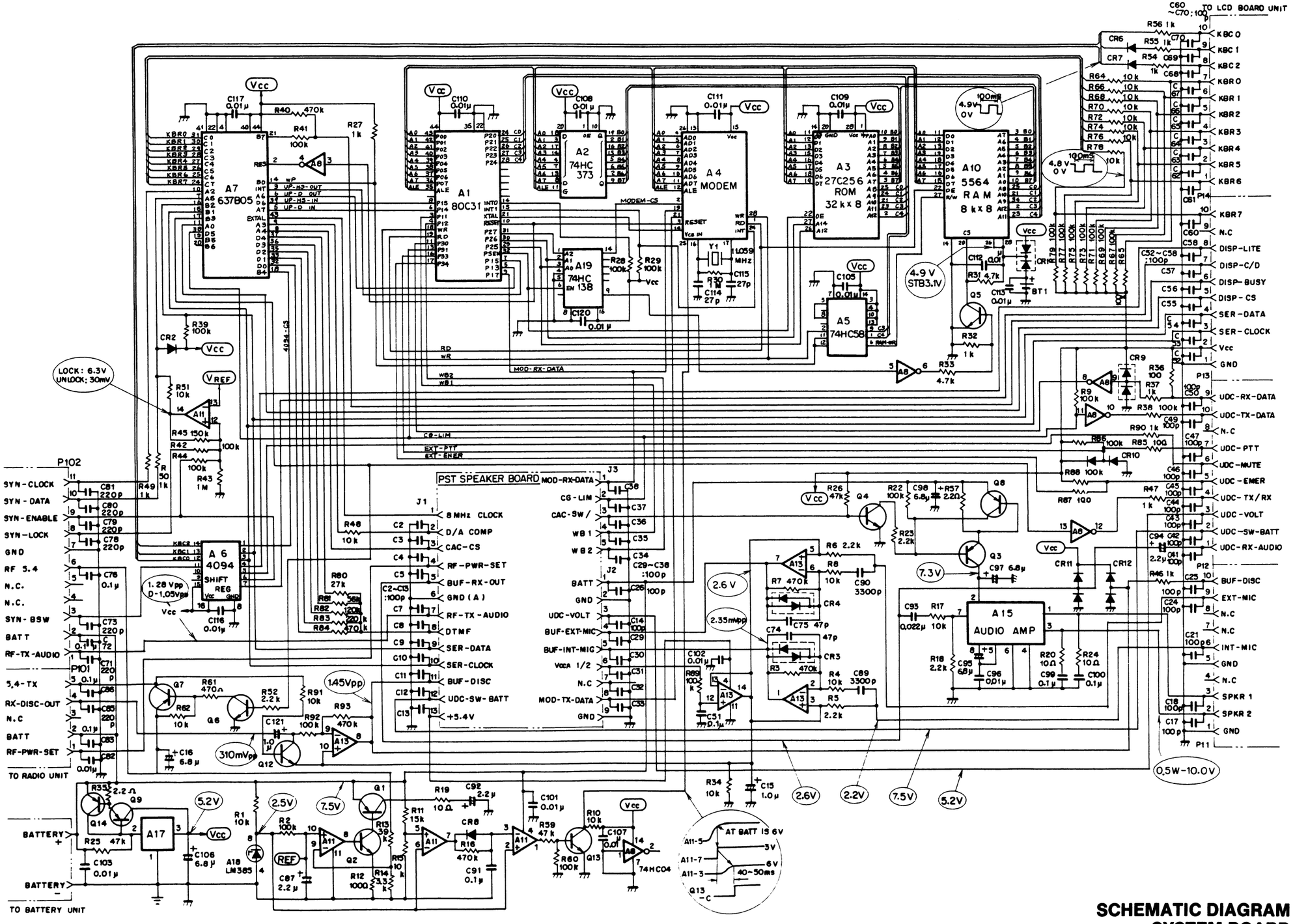




SOLDER SIDE

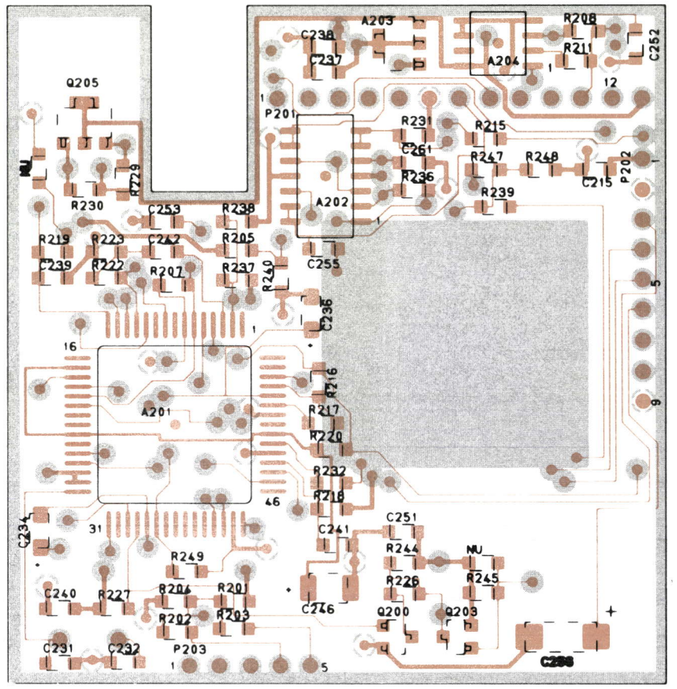


OUTLINE DIAGRAM
SYSTEM BOARD

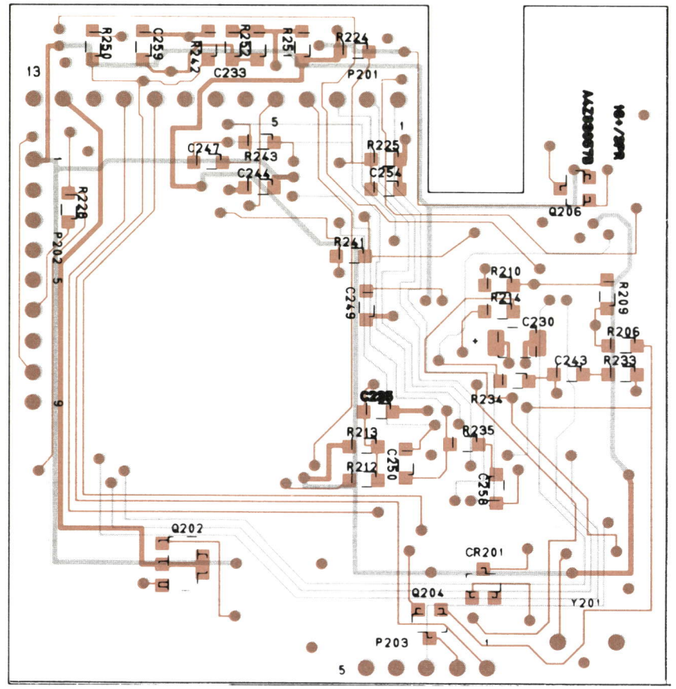

A7 637B05
A1 80C31
A2 74HC 373
A3 27C256 ROM 32kx8
A4 MODEM
A5 74HC58
A10 5564 RAM 8kx8
A15 AUDIO AMP
A19 74HC EN 138
A6 4094 SHIFT REG
A11
A13
A17
A18 LM385
A8
Vcc
VREF
REF
MODEM-CS
MOD-RX-DATA
MOD-TX-DATA
EXT-PTT
EXT-ENER
CG-LIM
CAC-SW/
WB1
WB2
BATT
GND
UDC-VOLT
BUF-EXT-MIC
BUF-INT-MIC
Vcc 1/2
N.C
+5.4V
8 MHz CLOCK
D/A COMP
CAC-CS
RF-PWR-SET
BUF-RX-OUT
GND (A)
RF-TX-AUDIO
DTMF
SER-DATA
SER-CLOCK
BUF-DISC
UDC-SW-BATT
PST SPEAKER BOARD
TO LCD BOARD UNIT
KBC0
KBC1
KBC2
KBR0
KBR1
KBR2
KBR3
KBR4
KBR5
KBR6
KBR7
DISP-LITE
DISP-C/D
DISP-BUSY
DISP-CS
SER-DATA
SER-CLOCK
UDC-RX-DATA
UDC-TX-DATA
UDC-PTT
UDC-MUTE
UDC-EMER
UDC-TX/RX
UDC-VOLT
UDC-SW-BATT
UDC-RX-AUDIO
BUF-DISC
EXT-MIC
INT-MIC
SPKR 1
SPKR 2
SYN-CLOCK
SYN-DATA
SYN-ENABLE
SYN-LOCK
RF 5.4
SYN-BSW
RF-TX-AUDIO
5,4-TX
RX-DISC-OUT
RF-PWR-SET
TO RADIO UNIT
BATTERY +
BATTERY -
TO BATTERY UNIT
LOCK: 6.3V
UNLOCK: 30mV
1.28 Vpp
0-1.05Vpp
145Vpp
310mVpp
2.6 V
2.35mVpp
7.3V
4.9V
0V
4.8V
0V
4.9 V
STB3.1V
0.5W-10.0V
2.6V
2.2V
7.5V
5.2V
AT BATT IS 6V
3V
6V
40~50ms

(A3WE 04350)

COMPONENT SIDE



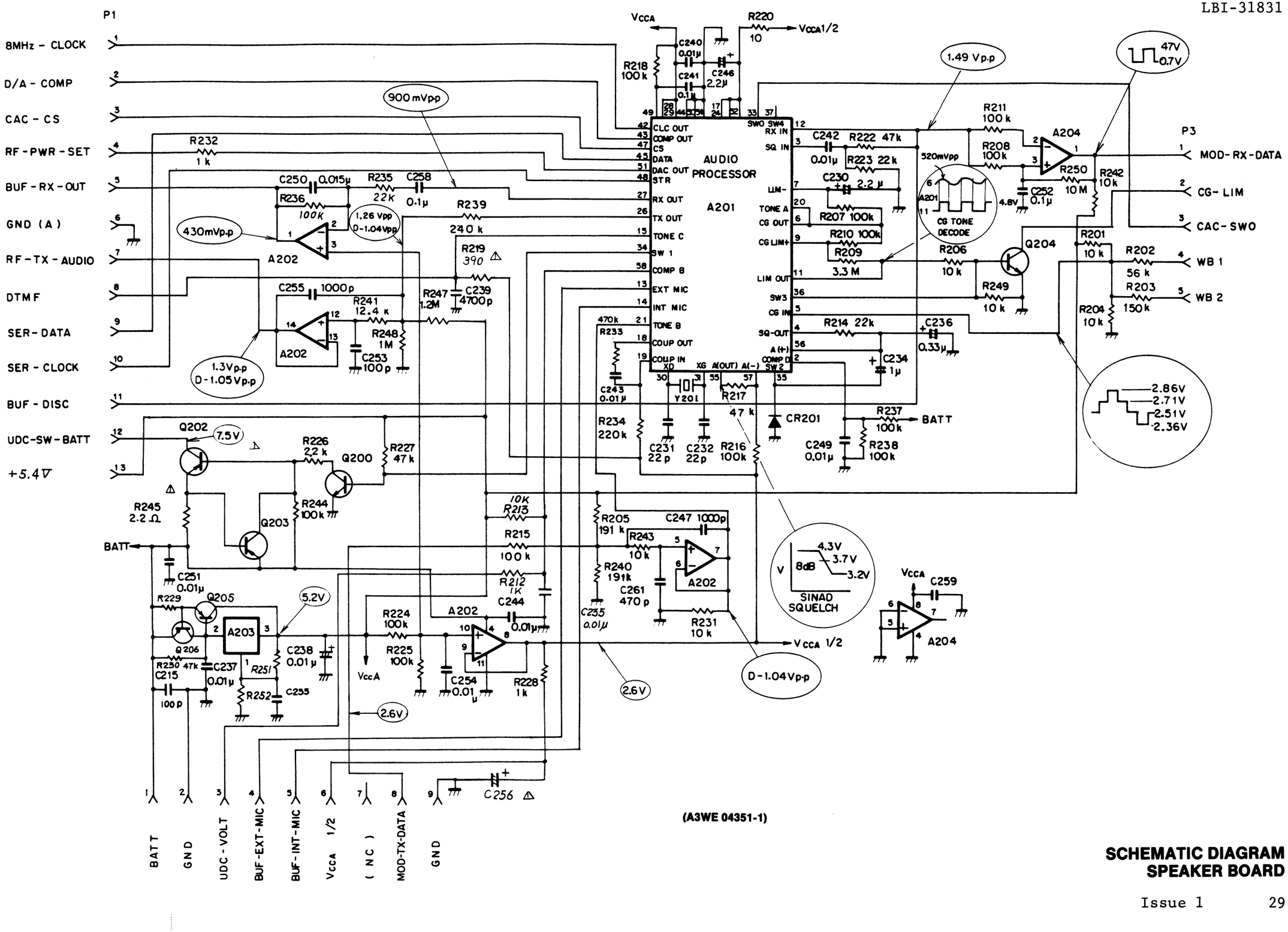
SOLDER SIDE



RUNS ON SECOND LAYER
RUNS ON BOTH LAYERS
RUNS ON COMPONENT SIDE (FIRST LAYER)

RUNS ON THIRD LAYER
RUNS ON BOTH LAYERS
RUNS ON SOLDER SIDE (FOURTH LAYER)

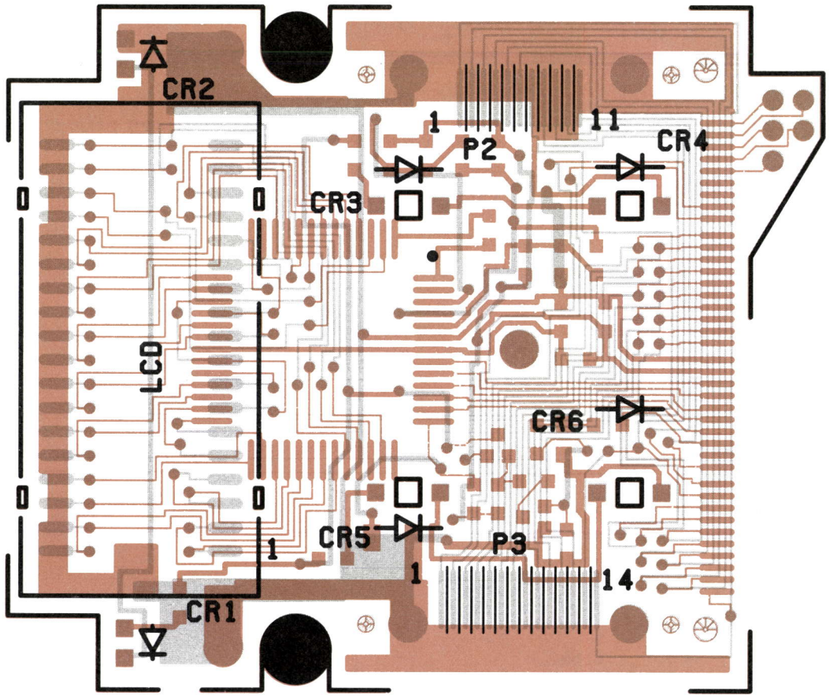
OUTLINE DIAGRAM
SPEAKER BOARD



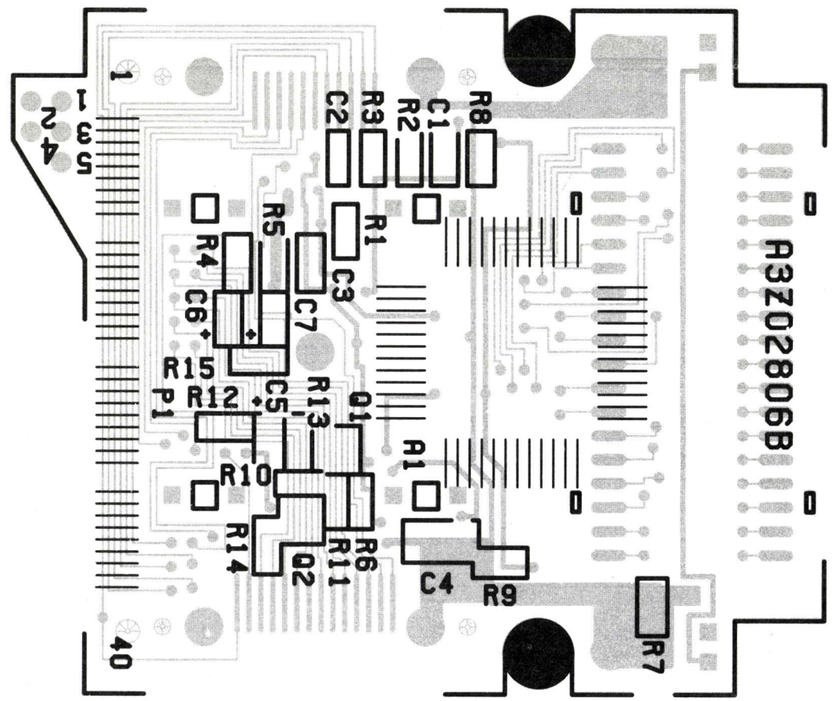
(A3WE 04351-1)

SCHEMATIC DIAGRAM
SPEAKER BOARD

COMPONENT SIDE



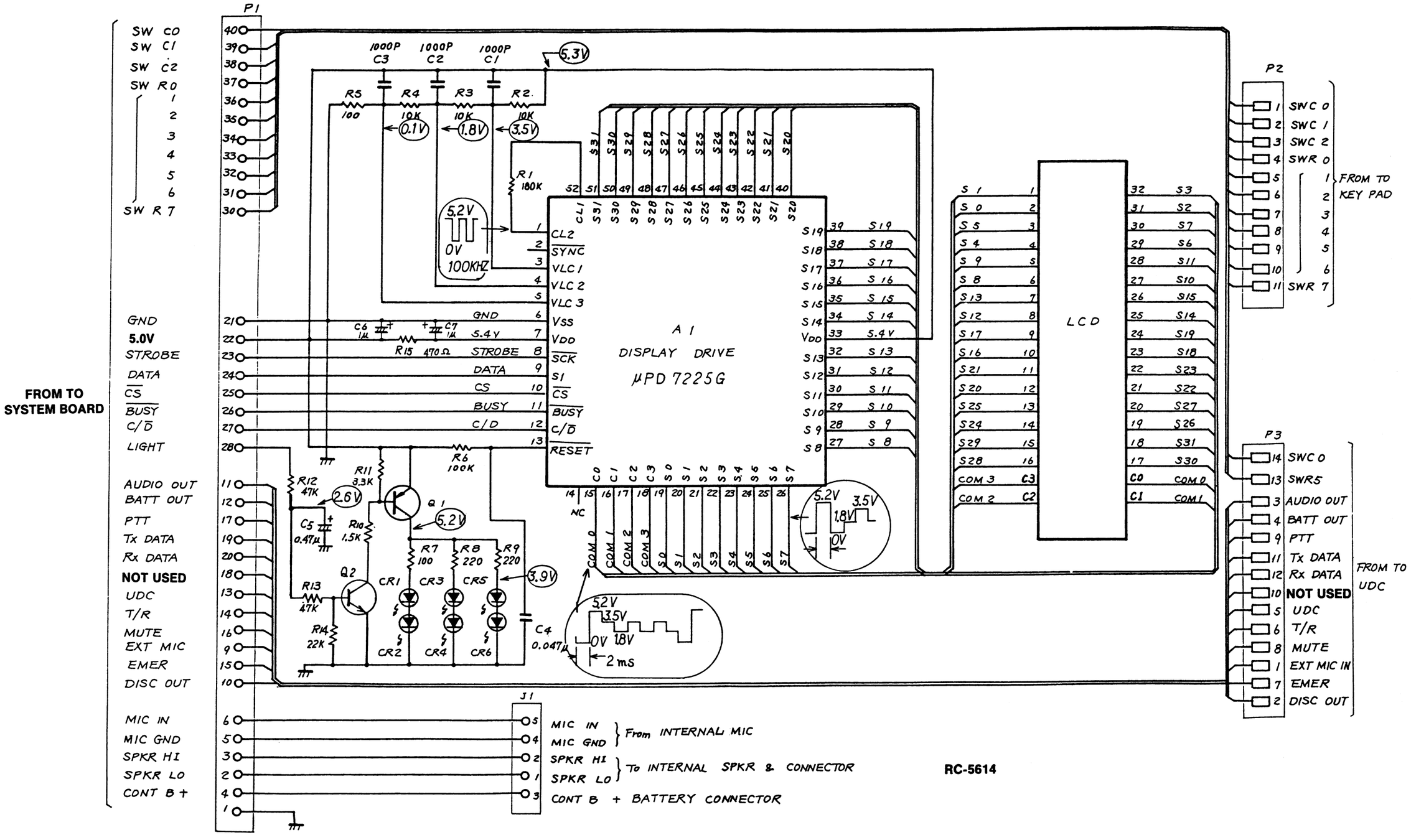
SOLDER SIDE



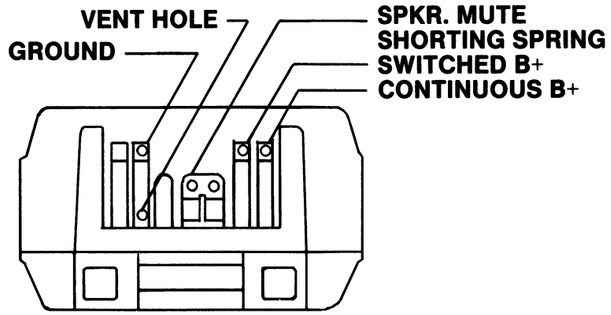
RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

OUTLINE DIAGRAM

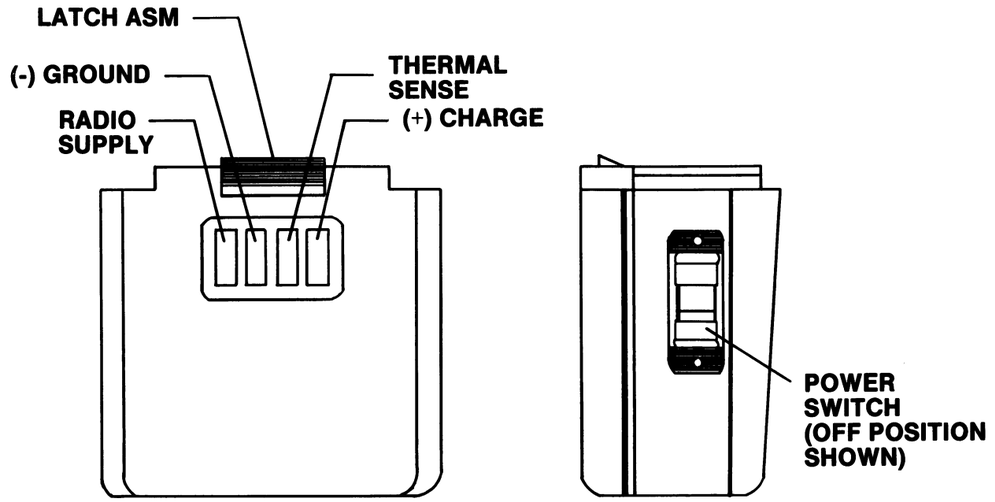
LCD BOARD



SCHEMATIC DIAGRAM
LCD BOARD



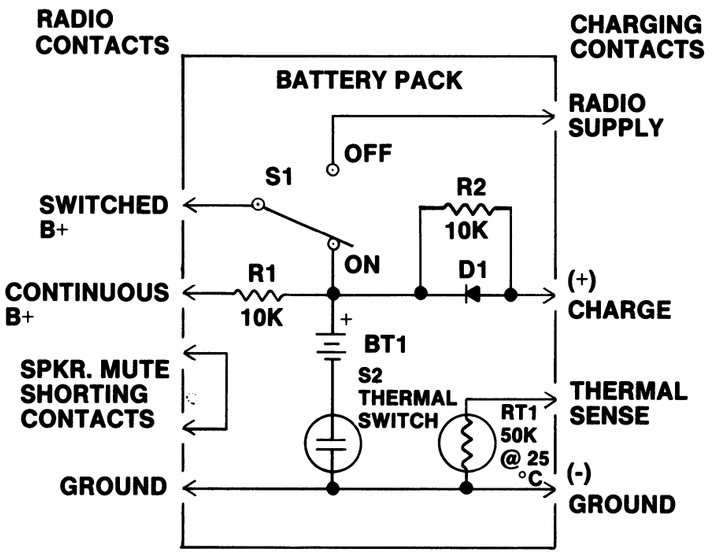
TOP VIEW



REAR VIEW

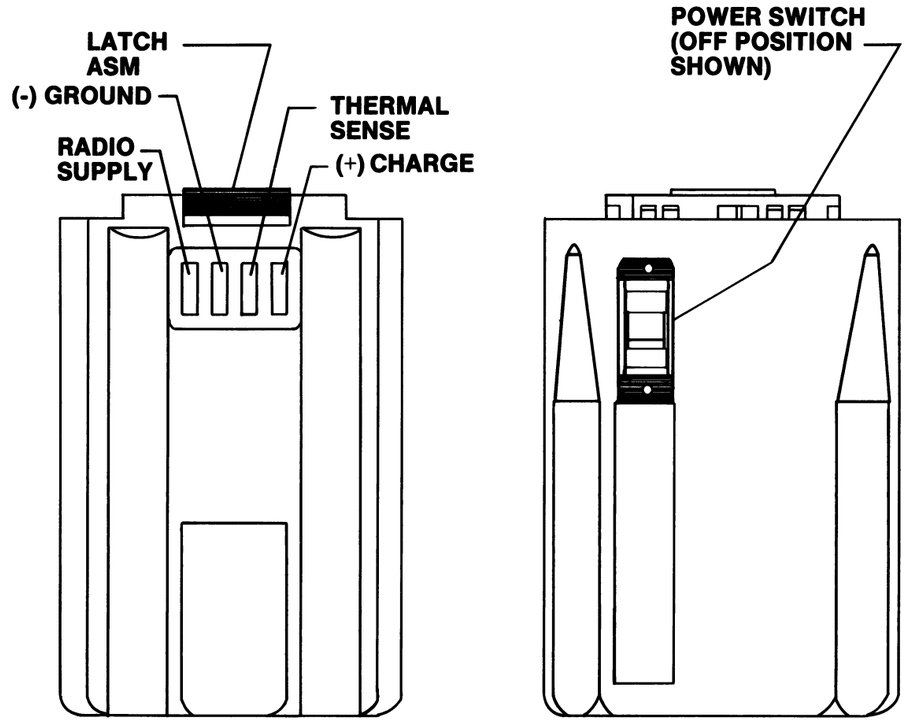
SIDE VIEW

19A704850P1 & P3
(800 mAh)



SCHEMATIC & OUTLINE DIAGRAM

800 mAh & 1200 mAh
Battery Packs



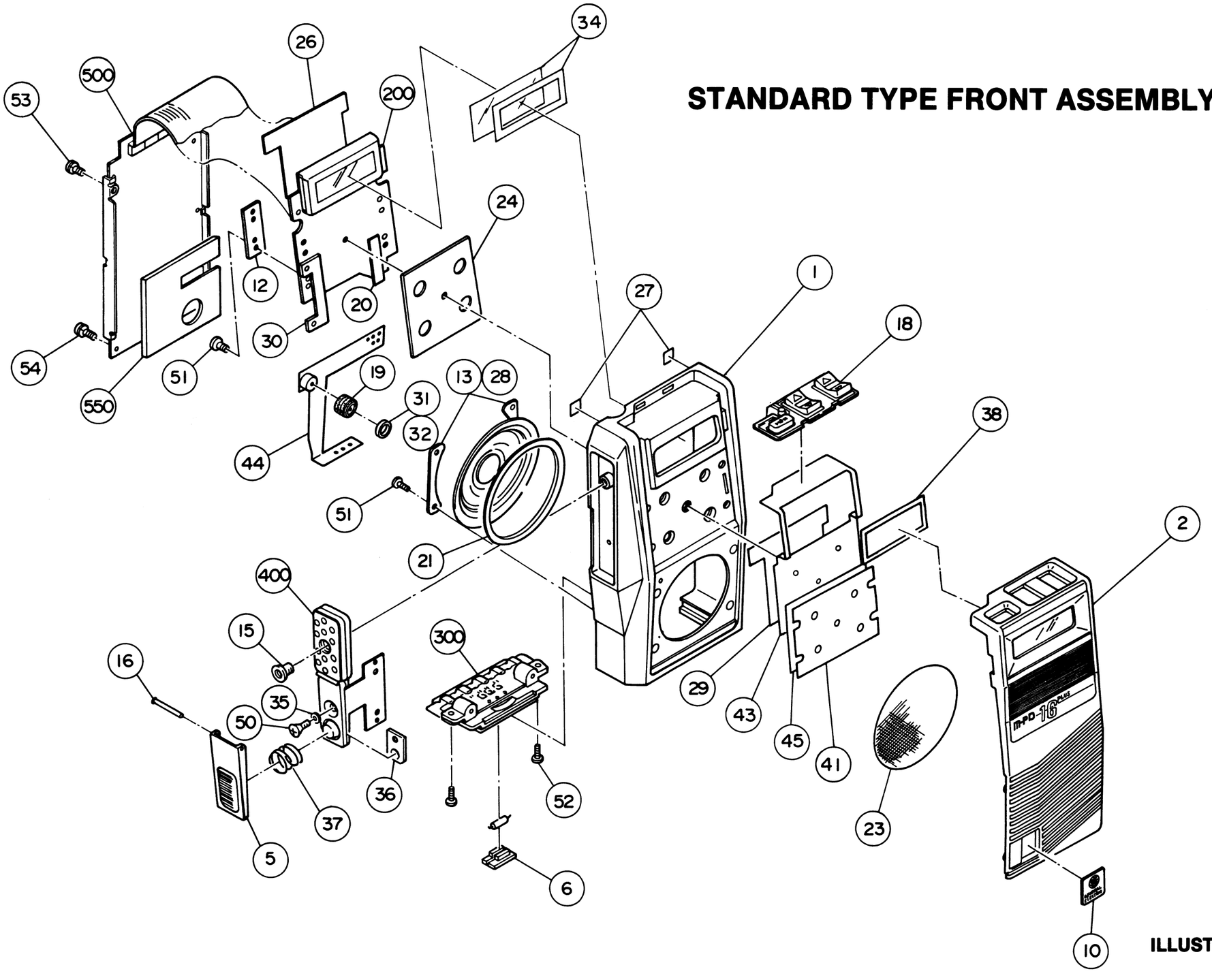
REAR VIEW

FRONT VIEW

19A704860P1 & P3
(1200 mAh)

RC-5493

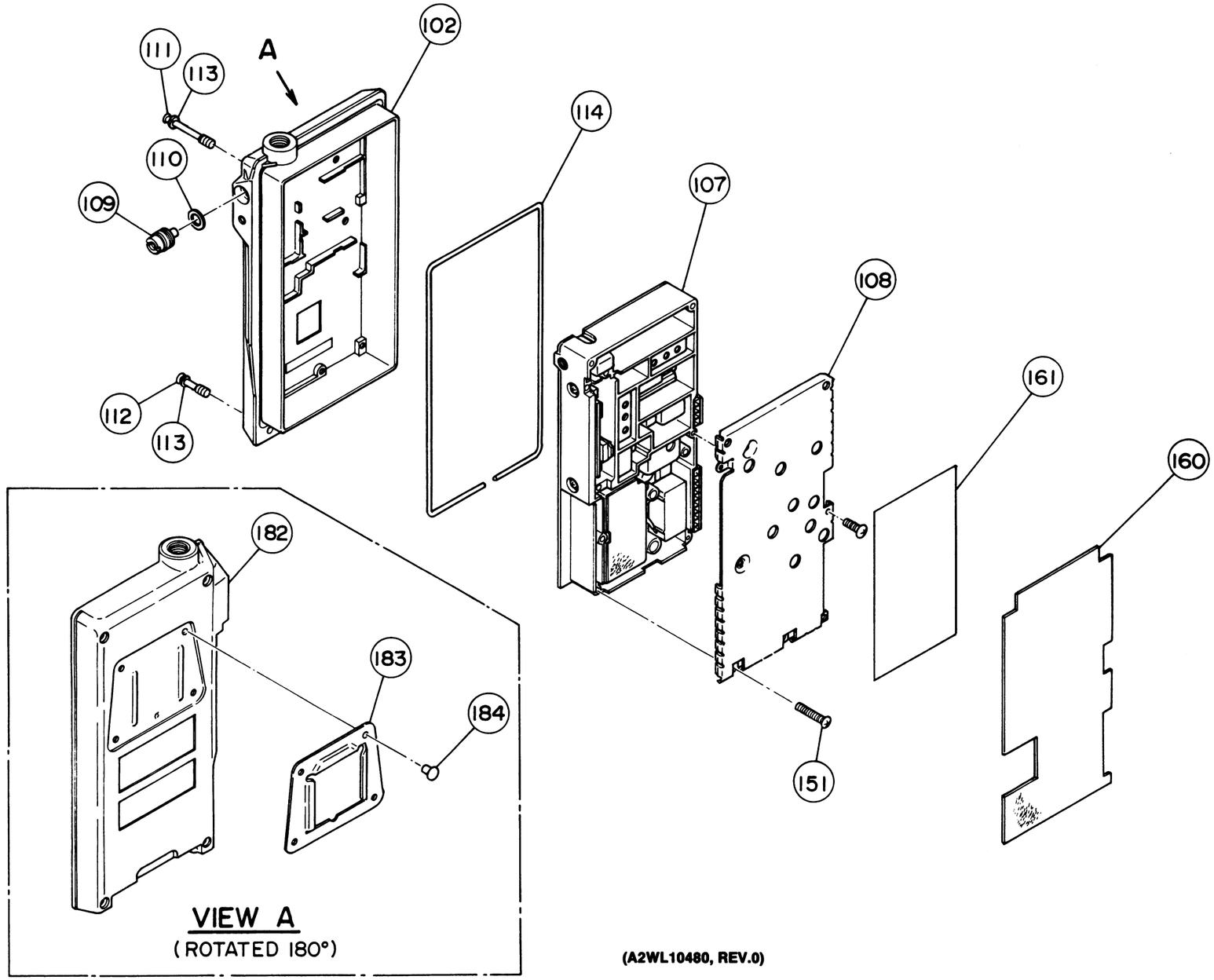
STANDARD TYPE FRONT ASSEMBLY



(A2WL10472, REV.0)

ILLUSTRATED MECHANICAL PARTS BREAKDOWN SHEET 1

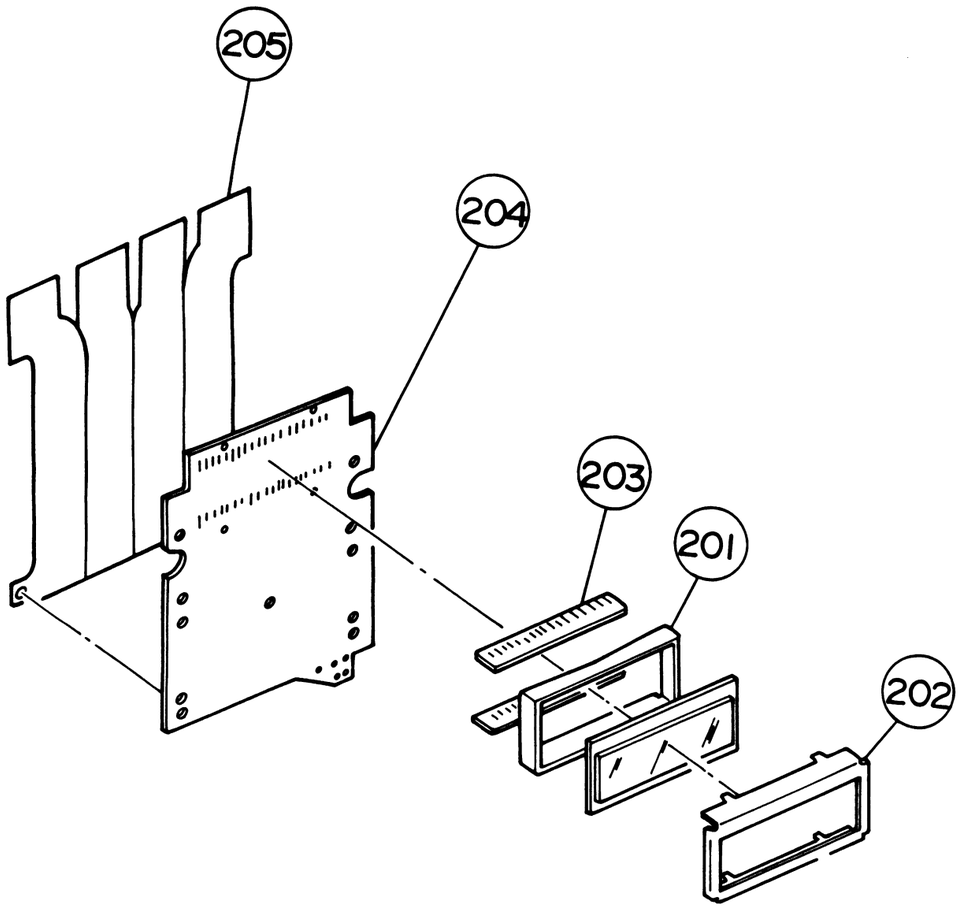
RF UNIT WITH REAR COVER



(A2WL10480, REV.0)

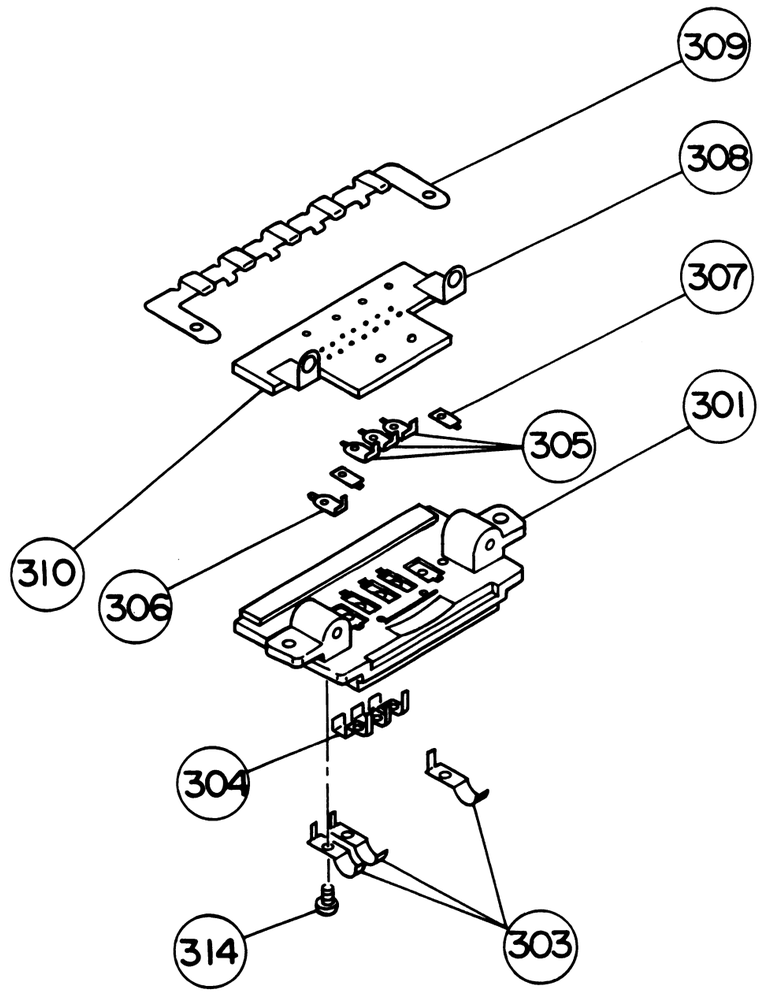
ILLUSTRATED MECHANICAL PARTS BREAKDOWN SHEET 2

LCD BOARD SUB ASSEMBLY
(PART NUMBER 200)



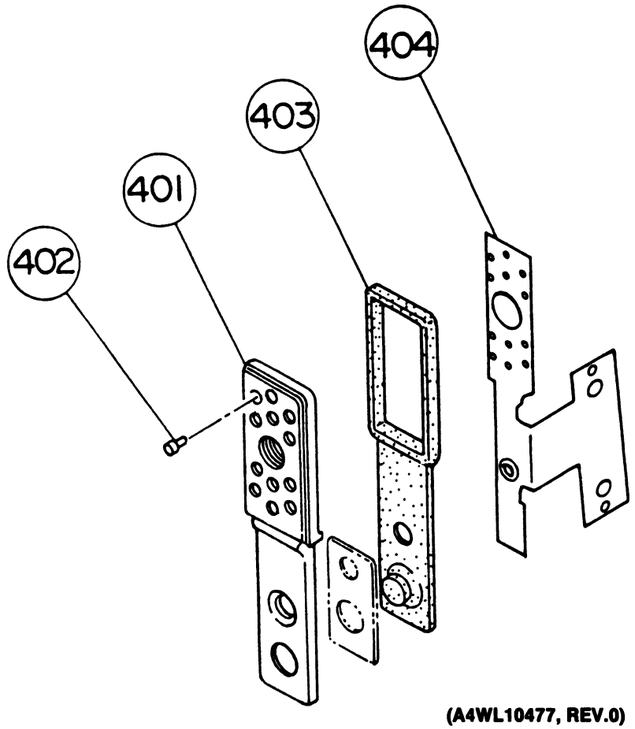
(A4WL10475, REV.0)

BASE PLATE SUB ASSEMBLY
(PART NUMBER 300)



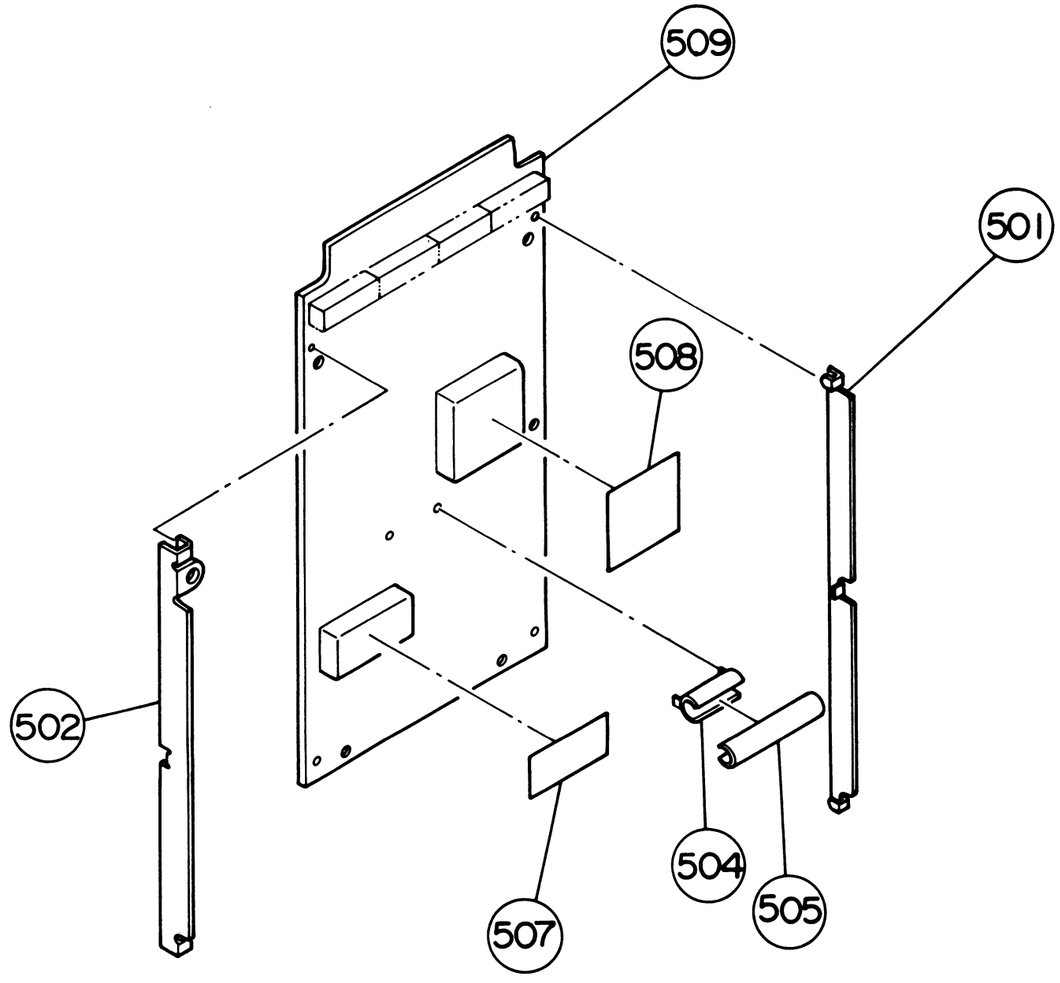
(A4WL10298, REV.0)

UDC PTT PLATE SUB ASSEMBLY
(PART NUMBER 400)



(A4WL10477, REV.0)

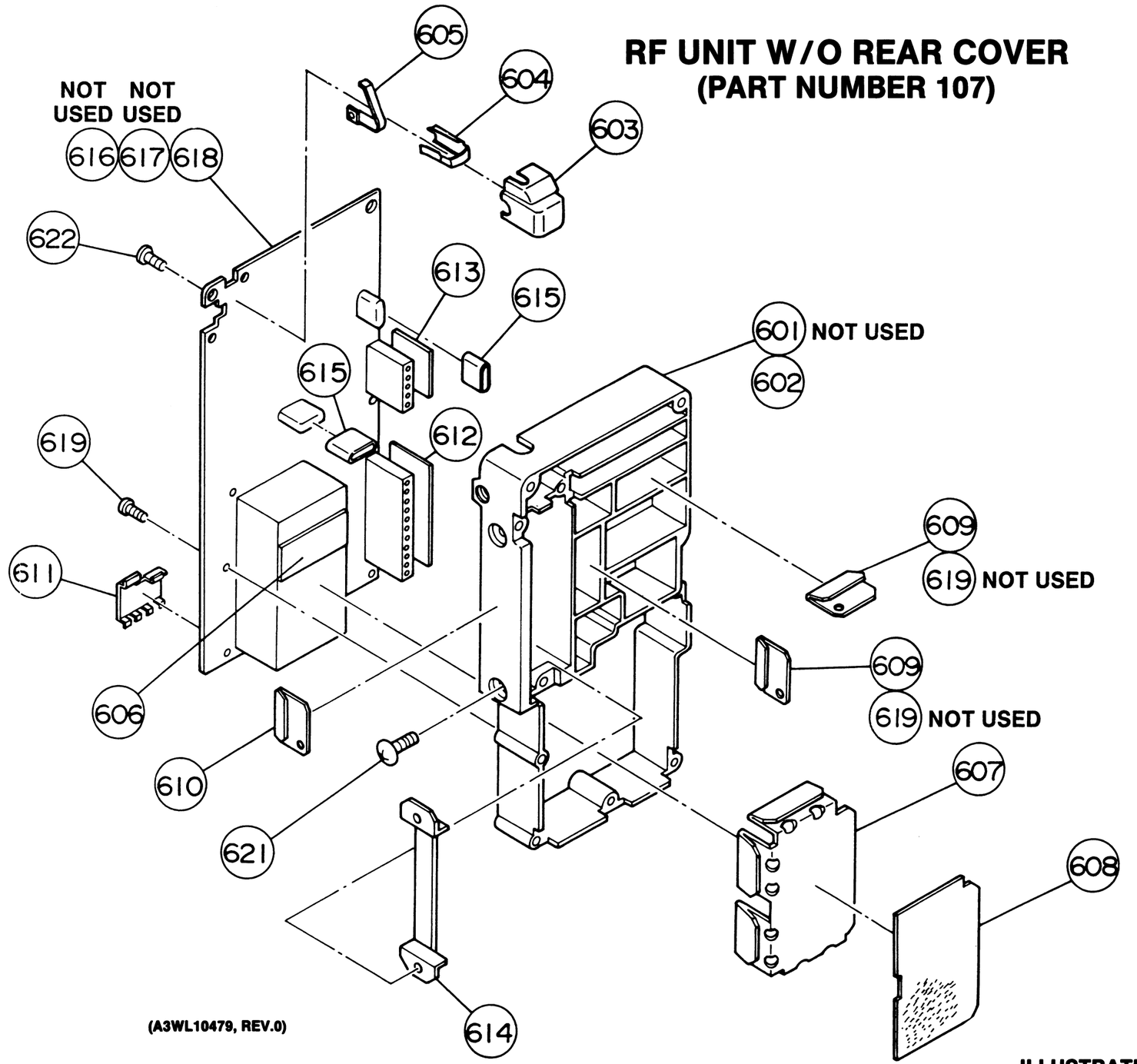
SYSTEM BOARD ASSEMBLY
(PART NUMBER 500)



(A4WL10478, REV.0)

ILLUSTRATED MECHANICAL
PARTS BREAKDOWN
SHEET 4

RF UNIT W/O REAR COVER
(PART NUMBER 107)



(A3WL10479, REV.0)

ILLUSTRATED MECHANICAL PARTS BREAKDOWN SHEET 5

PARTS LIST

LBI-31910
M-PD 16 PLUS
FRONT ASSEMBLY K19/A4WE04129
(MECHANICAL PARTS)

SYMBOL	GE PART NO.	DESCRIPTION
1	K19/A1WL09501	Front Cover (A1)
2	K19/A1WL10437	Front Escutcheon (STD), w/window (K19/A3WL07574)
3		NOT USED
4		NOT USED
5	K19/A3WL07575	PTT Lever
6	K19/A3WL07577	Fuse Cover
7 thru 9		NOT USED
10	K19/A4WL07721	Nameplate (GE)
11		NOT USED
12	K19/A4WL07892	Plate
13	K19/A4WL07607	SPKR Mounting Bracket
14		NOT USED
15	K19/A4WL07605	UDC Nut
16	K19/A4WL07434	Pivot Pin
17		NOT USED
18	K19/A3WL10436	Top Switch Pad
19	K19/A4WL07594P2	MIC Gasket
20	K19/A4WL07882	Elastic Rubber
21	K19/A4WL07910	SPKR Gasket
22		NOT USED
23	K19/A4WL07435	SPKR Dust Screen
24	K19/A4WL07606	Insulator (LCD BD)
25		NOT USED
26	K19/A4WL08445	LCD Sheet
27	K19/A4WL07664	Insulator Sheet
28	K19/A4WL08708	SPKR Mounting Rubber
29	K19/A4WL08088	Adhesion Sheet
30	K19/A4WL08409	Rubber Sheet
31	K19/A4WL08385	MIC Film
32	K19/A4WL09037	Adhesion Ring
33		NOT USED
34	K19/A4WL08437	Window Sheet
35	K19/A4WL08802	Nylon Washer
36	K19/A4WL09662	PTT Spacer
37	K19/A4WL09422	Coil Spring
38	K19/A4WL08673	Window Gasket
39		NOT USED
40		NOT USED
41	K19/A3WL08438	STD Rubber Plate
42		NOT USED
43	K19/A3WL08836	Top Flex. Circuit (STD)
44	K19/A3WL08835	SPKR/MIC Flex. Circuit
45 thru 49		NOT USED
50	K19/A4WL08827P1	Flat Head Screw, M2.6x4
51	K19/A4WL08828P2	Pan Head Tapping Screw, M2x6
52	K19/A4WL08828P3	Pan Head Tapping Screw, M2x10
53	K19/A4WL08827P4	Pan Head Screw with SW, M2x6
54	K19/A4WL08827P5	Pan Head Screw with SW, M2x8
55		NOT USED
		RF ASSEMBLY (800 MHz)
101		NOT USED
102	K19/A2WL10432	Rear Cover Sub Assembly. Consists of:
181		NOT USED
182	K19/A1WL09199	Rear Cover, A1
183	K19/A3WL07509	Receptacle Plate
184	K19/A4WL07694	Rivets

SYMBOL	GE PART NO.	DESCRIPTION
103 thru 106		NOT USED
107	K19/A4WE03902P11	RF UNIT W/O REAR COVER (800 MHz). SEE 600 SERIES NUMBERS
108	K19/A2WL07512	TX/RX Shield Cover
109	K19/A4WL08826	RF Connector
110	K19/A4WL07880	RF Connector Gasket
111	K19/A4WL10041P1	Captive Screws (Stainless)
112	K19/A4WL10041P2	Captive Screws (Stainless)
113	K19/A4WL08802	Nylon Washer
114	K19/A4WL08383	Housing Gasket
150	K19/A4WL08827P3	Pan Head Screw with SW, M2x4
151	K19/A4WL08827P6	Pan Head Screw with SW, M2x15
152	K19/A4WL08828P1	Pan Head Tapping Screw, M2x4
153	K19/A4WL08828P8	Pan Head Screw, M2.6x6
160	K19/A3WL10190	Insulator
161	K19/A4WL10433	Tracking Data Label
162	K19/A4WL10353P2	FCC Label (for STD)
163		NOT USED
164		NOT USED
200		LCD BOARD K19/A4WE03737
201	K19/A3WL07601	Light Diffuser
202	K19/A3WL07614	LCD Frame
203	K19/A4WL07665	Zebra Contacts
204	K19/A3WL07895	LCD P.W. Board
205	K19/A3WL08833	LCD-Cont Flex. Circuit
300		BASE PLATE K19/A3WL08781
301	K19/A2WL07573	Base Plate
302		NOT USED
303	K19/A4WL07611	Battery Connector Springs
304	K19/A4WL07608	SPKR/MUTE Contacts
305	K19/A4WL07610	Contact Lug
306	K19/A4WL08007	Contact Lug B
307	K19/A4WL08629	Contact Lug C
308	K19/A4WL08630	Base Contact
309	K19/A4WL08628	Base Shield Spring
310	K19/A3WL08672	Base P.W. Board
311 thru 313		NOT USED
314	K19/A4WL08827P2	Pan Head Screw
315 thru 317		NOT USED
400		UDC PTT K19/A3WL10435
401	K19/A3LW07576	UDC PTT Plate
402	K19/A4LW07604	UDC Contacts
403	K19/A3LW07580	PTT Switch Pad
404	K19/A3LW08834	UDC PTT Flex. Circuit
500		SYSTEM BOARD K19/A4WE04130
501	K19/A3WL07295	B + Strap
502	K19/A3WL07296	Ground Strap
503	K19/A4WL08244	B + Strap Sheet
504	K19/A4WL07514	Battery Holder
505	K19/A4WL07863	LI-Battery Cover
506	K19/A4WL07664	Insulator Sheet
507	K19/A4WL10182	Yellow Label A
508	K19/A4WL10431	Yellow Label B
509	K19/A3WL09726	System Board
550	K19/A4WE04131	Speaker Board Assembly
551	K19/A3WL09728	Speaker Board

SYMBOL	GE PART NO.	DESCRIPTION
107		RF UNIT W/O REAR COVER (800 MHz) K19/A4WE03902P11
601		NOT USED
602	K19/A1WL07570P1	Egg Crate
603	K19/A3WL07654	Antenna Switch Housing
604	K19/A4WL09765	Antenna Switch Spring A
605	K19/A4WL07655	Antenna Switch Spring B
606	K19/A4WL07727	Shield Plate
607	K19/A4WL07595	Shield Cover
608	K19/A4WL08494	VCO Rubber
609	K19/A4WL08829	RF Spring A
610	K19/A4WL08830	RF Spring B
611	K19/A4WL08832	RF Shield Plate
612	K19/A4WL08495P1	Connector Spacer A
613	K19/A4WL08495P2	Connector Spacer B
614	K19/A4WL07663	Power Pack Bracket
615	K19/A4WL05484	Crystal Protection Tube
616		NOT USED
617		NOT USED
618	K19/A3WL08696	TX/RX P.W. Board
619		NOT USED
620	K19/A4WL08827P7	Pan Head Screw, M2x4

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

PARTS LIST

800 MHz M-PD
PERSONAL RADIO
A4WE03713
ISSUE 3

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
A101	K19/2AAH040019	Prescaler MB501LP
A102	K19/2AAJ004062	PLL MC145159P1
A103	K19/2YBA106090	VCTCXO A4WX01328-2.5 ppm
A104	K19/2AAB004243	OP AMP UPC1251BG
A105	K19/2ABC039105	Analog Switch UPD4066BG
A106	K19/200KLH3556	VCO A4WX01393 KLH3556
A201	K19/200KLH2591	Gain Hybrid KLH2591
A202	K19/2AAA013161	PA Pack A4WX01422-40
A203	K19/200KLH8515	PWR-Cont KLH8515
A204	K19/2AAH038047	MD003
A301	K19/5UAY001054	Mixer UST-3L A4WX01377
A302	K19/2AAJ008089	IF HA12442V
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C102	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C103	K19/2CAK009257	Ceramic chip 10 pF ±0.5 pF 50V
C104	K19/2CCF004086	Tantalum 1 uF 16V
C105	K19/2CAK005669	Ceramic chip 1 pF ±0.25 pF 50V
C106	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C107	K19/2CAK009216	Ceramic chip 0.01 uF ±10% 50V
C108	K19/2CAK009273	Ceramic chip 470 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	K19/2CAK009349	Ceramic chip 1.5 pF ±0.25 pF 50V
C116	K19/2CAK009323	Ceramic chip 3300 pF ±10% 50V
C117	K19/2CAK009026	Ceramic chip 2 pF ±0.25 pF 50V
C118	K19/2CAK009240	Ceramic chip 0.5 pF ±0.25 pF 50V
C119	K19/2CAK009216	Ceramic chip 0.01 uF ±10% 50V
C120 thru C122	K19/2CAK009257	Ceramic chip 10 pF ±0.5% 50V
C123	K19/2CAK009216	Ceramic chip 0.01 uF ±10% 50V
C124	K19/2CCF006024	Tantalum 6.8 uF 10V
C125	K19/2CBB062098	Electrolytic 220 uF 16V
C126	K19/2CCF007022	Tantalum 4.7 uF 16V
C127	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C128	K19/2CCF004086	Tantalum 1 uF 16V
C129 and C130	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C131	K19/2CCF007022	Tantalum 4.7 uF 16V
C132	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C133	K19/2CCF004086	Tantalum 1 uF 16V
C134	K19/2CBB034121	Electrolytic 22 uF 16V
C135	K19/2CCF004086	Tantalum 1 uF 16 V
C137	K19/2CAK009034	Ceramic chip 3 pF ±0.25 pF 50V
C138	K19/2CAK009257	Ceramic chip 10 pF ±0.5% 50V
C139	K19/2CAK009216	Ceramic chip 0.01 uF ±10% 50V
C140	K19/2CAK009257	Ceramic chip 10 pF ±0.5% 50V
C141	K19/2CAK009059	Ceramic chip 5 pF ±0.25 pF 50V
C142	K19/2CAK009042	Ceramic chip 4 pF ±0.25 pF 50V
C143	K19/2CCF007022	Tantalum 4.7 uF 16V
C201	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C202 and C203	K19/2CCF004086	Tantalum 1 uF 16V
C205	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C206	K19/2CCB026018	Tantalum 10 uF 16V
C207 and C208	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C209	K19/2CCB026018	Tantalum 10 uF 16V
C210	K19/2CCF004086	Tantalum 1 uF 16V
C211 and C212	K19/2CAK009026	Ceramic chip 2 pF ±0.25 pF 50V
C213	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C214 and C215	K19/2CAK005669	Ceramic chip 1 pF ±0.25 pF 50V
C217	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C220 thru C226	K19/2CAK009208	Ceramic chip 1000 pF ±10% 50V
C227 and 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	K19/2CAK009059	Ceramic chip 5 pF ±0.25 pF 50V
C306	K19/2CAK009182	Ceramic chip 100 pF ±5% 50V
C308	K19/2CAK009109	Ceramic chip 12 pF ±5% 50V
C309	K19/2CAK009034	Ceramic chip 3 pF ±0.25 pF 50V
C310 and 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	K19/2CAK009299	Ceramic chip 7 pF ±0.5% 50V
C324	K19/2CCF007022	Tantalum 4.7 uF 16V
C329	K19/2CAK009208	Ceramic chip 1000 pF ±10% 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
C341 and C342	K19/2CCF004086	Tantalum 1 uF 16V
C343	K19/2CAD009208	Ceramic chip 1000 pF ±10% 50V
		- - - - - - - - - - DIODES - - - - - - - - - -
CR101	K19/2QBE005024	DAP202KP
CR102	K19/2QBA006166	1S2075K
CR301	K19/2QBA006166	1S2075K
CR302	K19/2ABA012024	MA57
CR303	K19/2QBA005135	1SV128-A
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL201	K19/2FBB002117	LP915A1A
FL301 and FL302	K19/2FBD001463	A4FX01849-1
FL303	K19/2FAA103066	A4WX01612
FL304	K19/2FAA103074	A4WX01613
FL305	K19/2FAD001242	CFX455E
		- - - - - - - - - - JACKS - - - - - - - - - -
J101	K19/2PDA023036	69775-005
J102	K19/2PDA023044	69775-011
		- - - - - - - - - - COILS - - - - - - - - - -
L101	K19/2EDE001022	A4WX01365
L104	K19/2LAD001088	NL322522T-010M
L105	K19/2LAB024140	A4FX01878 #5
L106	K19/2LAB024165	A4FX01878 #7
L201	K19/2LAB024116	A4FX01878 #2
L205	K19/2LAD001104	NL322522T-033M
L206	K19/2LAD001070	NL322522T-R10M
L301	K19/2LAB024116	A4FX01878 #2
L302	K19/2EDE001030	A4WX01426
L305 and L306	K19/2LAD001062	MLF3216D1R0K
L307	K19/2LAD001021	MLF3216DR68K
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q101	K19/2QAD004020	2SC3356R22
Q102	K19/2QAD004087	2SB624BV3
Q103	K19/2QAD004046	2SD596DV3
Q105	K19/2QAD004046	2SD596DV3
Q106	K19/2QAD004079	2SC3583R32
Q107	K19/2QAD004020	2SC3356R22
Q202	K19/2QAB015077	2SB1169
Q301	K19/2QAD004079	2SC3583R32
Q302 and Q303	K19/2QAD004020	2SC3356R22
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R101 and R102	K19/2RGC003326	Square chip 1/16W 10 ohms ±5%
R103	K19/2RGC003136	Square chip 1/16W 2.2K ohms ±5%

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
R104	K19/2RGC003110	Square chip 1/16W 1K ohms ±5%
R106	K19/2RGC003243	Square chip 1/16W 150K ohms ±5%
R107	K19/2RGC003060	Square chip 1/16W 220 ohms ±5%
R108	K19/2RGC003227	Square chip 1/16W 100K ohms ±5%
R109	K19/2RGC003219	Square chip 1/16W 47K ohms ±5%
R110	K19/2RGC003110	Square chip 1/16W 1K ohms ±5%
R111	K19/2RGC003151	Square chip 1/16W 4.7K ohms ±5%
R112	K19/2RGC003177	Square chip 1/16W 10K ohms ±5%
R113	K19/2RGC003284	Square chip 1/16W 680K ohms ±5%
R114	K19/2RGC003326	Square chip 1/16W 10 ohms ±5%
R115	K19/2RGC003177	Square chip 1/16W 10K ohms ±5%
R116 and R117	K19/2RPB003253	Variable GF04W 10K ohms
R119	K19/2RGC003193	Square chip 1/16W 22K ohms ±5%
R120	K19/2RGC003110	Square chip 1/16W 1K ohms ±5%
R121	K19/2RGC003177	Square chip 1/16W 10K ohms ±5%
R122	K19/2RGC003425	Square chip 1/16W 1.5K 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	K19/2RGC003342	Square chip 1/16W 47 ohms ±5%
R131	K19/2RGC003060	Square chip 1/16W 220 ohms ±5%
R132	K19/2RGC003359	Square chip 1/16W 75 ohms ±5%
R134	K19/2RGC003326	Square chip 1/16W 10 ohms ±5%
R135	K19/2RGC003359	Square chip 1/16W 75 ohms ±5%
R136	K19/2RGC003193	Square chip 1/16W 22K ohms ±5%
R137	K19/2RGC003177	Square chip 1/16W 10K ohms ±5%
R138	K19/2RGC003136	Square chip 1/16W 2.2K ohms ±5%
R140	K19/2RGC003334	Square chip 1/16W 22 ohms ±5%
R201	K19/2RGC003326	Square chip 1/16W 10 ohms ±5%
R202 and R203	K19/2RGC003094	Square chip 1/16W 470 ohms ±5%
R209	K19/2RAA001861	RD25S 1/4W 150 ohms ±5%
R210	K19/2RFB003253	Variable GF04W 10K ohms
R211	K19/2RGC003136	Square chip 1/16W 2.2K ohms ±5%
R301	K19/2RGC003037	Square chip 1/16W 100 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	K19/2RGC003110	Square chip 1/16W 1K ohms ±5%
R320	K19/2RGC003110	Square chip 1/16W 1K ohms ±5%
R321	K19/2RFB003261	Variable GF04W 100K ohms
R322	K19/2RGC003193	Square chip 1/16W 22K ohms ±5%

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - TRANSFORMERS - - - - - - - - -
T301 and T302	K19/2LAB014893	A4WX01333
T303	K19/2LAB014901	A4WX01334
T304	K19/2LAB014919	A4WX01335
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S101	K19/2A3WL07654	Antenna Switch.
		- - - - - - - - - - THERMISTOR - - - - - - - - -
TH301	K19/2ABD016139	NTCDS3018-3HG103HC
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
Y301	K19/2YAA181657	45.0125 MHz A4WX01304

PARTS LIST

LBI-31908

M-PD 16 PLUS SYSTEM BOARD

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
A1	K19/2ADA015145	Micro Processor, MSM80C31FJS
A2	K19/2ABD025269	CMOS, uPD74HC373G-T1
A3	K19/2ACA055036	P-ROM, HN27C256FP-25
A4	19A704727P2	MODEM IC, 28 pin "J HOOK"
A5	K19/2ABD034014	CMOS, NJU74HC58M
A6	K19/2ABD025335	CMOS, uPD74HC4094G-T1
A7		PROM, HD637B05VOCP
A8	K19/2ABD025012	CMOS, uPD74HC04G-T1
A9		NOT USED
A10	K19/2ACA041358	RAM, TC5564AFL-15
A11	K19/2AAB004284	OP Amp, uPC451G2-T1
A12		NOT USED
A13	K19/2AAB004284	OP Amp, uPC451G2-T1
A14		NOT USED
A15	K19/2AAJ010036	Audio IC, NJM2073D
A16		NOT USED
A17	K19/2AAE053023	Voltage Regulators, S-81250HG-RD-T1
A18		VTG-REF, LM385M-2.5
A19	K19/2ABD025327	CMOS, uPD74HC138G-T1
		- - - - - - - - - - - BATTERIES - - - - - - - - -
BT1	K19/5PBA004058	BR425, Lithium
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1		NOT USED
C2 thru C14	K19/2CAK005909	Ceramic chip: 100 pF, 50V
C15	K19/2CCF002072	Tantalum: 1 uF, 10V
C16	K19/2CCF006024	Tantalum: 6.8 uF, 10V
C17 and C18	K19/2CAK005909	Ceramic chip: 100 pF, 50V
C19 and C20		NOT USED
C21	K19/2CAK005909	Ceramic chip: 100 pF, 50V
C22 and C23		NOT USED
C24 thru C26	K19/2CAK005909	Ceramic chip: 100 pF, 50V
C27 and C28		NOT USED
C29 thru C38	K19/2CAK005909	Ceramic chip: 100 pF, 50V
C39 and C40		NOT USED

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

SYMBOL	GE PART NO.	DESCRIPTION
C41 thru C47	K19/2CAK005909	Ceramic chip: 100 pF, 50V
C48		NOT USED
C49 and C50	K19/2CAK005909	Ceramic chip: 100 pF, 50V
C51	K19/2CAK013010	Ceramic chip: 0.1 uF, 50V
C52 thru C58	K19/2CAK005909	Ceramic chip: 100 pF, 50V
C59		NOT USED
C60 thru C70	K19/2CAK005909	Ceramic chip: 100 pF, 50V
C71	K19/2CAK005917	Ceramic chip: 220 pF, 50V
C72	K19/2CAK013010	Ceramic chip: 0.1 uF, 25V
C73	K19/2CAK005917	Ceramic chip: 220 pF, 50V
C74 and C75	K19/2CAK005867	Ceramic chip: 47 pF, 50V
C76	K19/2CAK013010	Ceramic chip: 0.1 uF, 25V
C77		NOT USED
C78 thru C81	K19/2CAK005917	Ceramic chip: 220 pF, 50V
C82	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
C83	K19/2CAK013010	Ceramic chip: 0.1 uF, 25V
C84		NOT USED
C85	K19/2CAK005917	Ceramic chip: 220 pF, 50V
C86	K19/2CAK013010	Ceramic chip: 0.1 uF, 25V
C87	K19/2CCF002080	Tantalum: 2.2 uF, 16V
C88		NOT USED
C89 and C90	K19/2CAK013143	Ceramic chip: 3300 pF, 50V
C91	K19/2CAK013010	Ceramic chip: 0.1 uF, 50V
C92	K19/2CCF002080	Tantalum: 2.2 uF, 16V
C93	K19/2CAK013341	Ceramic chip: 0.022 uF, 50V
C94	K19/2CCF002080	Tantalum: 2.2 uF, 16V
C95	K19/2CCF006024	Tantalum: 6.8 uF, 10V
C96	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
C97 and C98	K19/2CCF006024	Ceramic chip: 6.8 uF, 10V
C99 and C100	K19/2CAK013010	Ceramic chip: 0.1 uF, 25V
C101 thru C103	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
C104		NOT USED
C105	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
C106	K19/2CCF006024	Tantalum: 6.8 uF, 10V
C107 thru C113	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
C114 and C115	K19/2CAK005834	Ceramic chip: 27 pF, 50V
C116 and C117	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
C118		NOT USED
C119	K19/2CAK005933	Ceramic chip: 470 pF, 50V
C120	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
C121	K19/2CCF002072	Ceramic chip: 1 uF, 16V

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - - DIODES - - - - - - - - - -
CR1 and CR2	K19/2QBE005016	DAN202KT-96
CR3 and CR4	K19/2QBE005032	DA204KT-96
CR5		NOT USED
CR6 thru CR8	K19/2QBE005016	DAN202KT-96
CR9 thru CR12	K19/2QBE005032	DA204KT-96
		- - - - - - - - - - - SOCKETS - - - - - - - - - -
J1	K19/	SL-113-T-11
J2	K19/	SL-109-T-11
J3	K19/	SL-105-11
		- - - - - - - - - - - PINHEADERS - - - - - - - - - -
P11 thru P14	K19/2PDA018085	10FM-STG
P101	K19/2PDA023093	65646-205
P102	K19/2PDA023101	65646-211
		- - - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	K19/2QAD004103	2SB798T1DL
Q2	K19/2QAD001034	2SC2462LCTL
Q3	K19/2QAD004103	2SB798T1DL
Q4	K19/2QAD001034	2SC2462LCTL
Q5	K19/2QAD001133	2SC2620QCTL
Q6	K19/2QAD001034	2SC2462LCTL
Q7	K19/2QAD004103	2SB798T1DL
Q8 and Q9	K19/2QAD001026	2SA1121SBTL
Q10		NOT USED
Q11	K19/2QAD001026	2SA1121SBTL
Q12 and Q13	K19/2QAD001034	2SC2462LCTL
Q14	K19/2QAD001026	2SA1121SBTL
		- - - - - - - - - - - RESISTORS - - - - - - - - - -
R1	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R2	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R3	K19/2RGC001759	Square chip: 1/10W, 470 KohmJ
R4	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R5 and R6	K19/2RGC001593	Square chip: 1/10W, 2.2 KohmJ
R7	K19/2RGC001759	Square chip: 1/10W, 470 KohmJ
R8	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R9	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R10	K19/2RGC001502	Square chip: 1/10W, 10 KohmJ
R11	K19/2RGC004126	Square chip: 1/10W, 15 KohmJ
R12	K19/2RGC001528	Square chip: 1/10W, 100 ohmJ
R13	K19/2RGC004647	Square chip: 1/10W, 3.9 KohmJ
R14	K19/2RGC001601	Square chip: 1/10W, 3.3 KohmJ
R15	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R16	K19/2RGC001759	Square chip: 1/10W, 470 KohmJ

SYMBOL	GE PART NO.	DESCRIPTION
R17	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R18	K19/2RGC001593	Square chip: 1/10W, 2.2 KohmJ
R19 and R20	K19/2RGC001502	Square chip: 1/10W, 10 ohmJ
R21		NOT USED
R22	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R23	K19/2RGC001593	Square chip: 1/10W, 2.2 KohmJ
R24	K19/2RGC001502	Square chip: 1/10W, 10 ohmJ
R25 and R26	K19/2RGC001726	Square chip: 1/10W, 47 KohmJ
R27	K19/2RGC001585	Square chip: 1/10W, 1 KohmJ
R28 and R29	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R30	K19/2RGC001775	Square chip: 1/10W, 1 MohmJ
R31	K19/2RGC001619	Square chip: 1/10W, 4.7 KohmJ
R32	K19/2RGC001585	Square chip: 1/10W, 1 KohmJ
R33	K19/2RGC001619	Square chip: 1/10W, 4.7 KohmJ
R34	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R35	K19/2RGC001833	Square chip: 1/10W, 2.2 ohmK
R36	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R37	K19/2RGC001585	Square chip: 1/10W, 1 KohmJ
R38	K19/2RGC001528	Square chip: 1/10W, 100 ohmJ
R39	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R40	K19/2RGC001759	Square chip: 1/10W, 470 KohmJ
R41 and R42	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R43	K19/2RGC001775	Square chip: 1/10W, 1 MohmJ
R44	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R45	K19/2RGC004449	Square chip: 1/10W, 150 KohmJ
R46 and R47	K19/2RGC001585	Square chip: 1/10W, 1 KohmJ
R48	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R49 and R50	K19/2RGC001585	Square chip: 1/10W, 1 KohmJ
R51	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R52	K19/2RGC001593	Square chip: 1/10W, 2.2 KohmJ
R53		NOT USED
R54 thru R56	K19/2RGC001585	Square chip: 1/10W, 1 KohmJ
R57	K19/2RGC001833	Square chip: 1/10W, 2.2 ohmK
R58		NOT USED
R59	K19/2RGC001726	Square chip: 1/10W, 47 KohmJ
R60	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R61	K19/2RGC001569	Square chip: 1/10W, 470 ohmJ
R62	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R63		NOT USED
R64	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R65	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R66	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R67	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R68	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R69	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R70	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ

SYMBOL	GE PART NO.	DESCRIPTION
R71	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R72	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R73	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R74	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R75	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R76	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R77	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R78	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R79	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R80	K19/2RGC001916	Square chip: 1/10W, 27 KohmJ
R81	K19/2RGC004035	Square chip: 1/10W, 56 KohmJ
R82	K19/2RGC004621	Square chip: 1/10W, 120 KohmF
R83	K19/2RGC001825	Square chip: 1/10W, 220 KohmJ
R84	K19/2RGC001759	Square chip: 1/10W, 470 KohmJ
R85	K19/2RGC001528	Square chip: 1/10W, 100 ohmJ
R86	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R87	K19/2RGC001528	Square chip: 1/10W, 100 ohmJ
R88 and R89	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R90	K19/2RGC001585	Square chip: 1/10W, 1 KohmJ
R91 and R92	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R93	K19/2RGC001759	Square chip: 1/10W, 470 KohmJ
		- - - - - - - - - - RUBBER DAMPER - - - - - - - - - -
XY1	K19/2YYZ001062	NB-0252-0.5t
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
Y1	K19/2YAA181756	11.0592 MHz, A4WX01730

PARTS LIST

LBI-31909

M-PD 16 PLUS SPEAKER BOARD

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
A201	K19/2AAJ016017	Audio Processor, STC9140F
A202	K19/2AAB004284	OP Amp, uPC451G2-T1
A203	K19/2AAE053023	VTG-REG, S-81250HG-RD-T1
A204	K19/2AAC004135	OP Amp, uPC393G2-T1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C215	K19/2CAK005909	Ceramic chip: 100 pF, 50V
C230	K19/2CCF002072	Tantalum: 1 uF, 16V
C231 and C232	K19/2CAK005818	Ceramic chip: 22 pF, 50V
C233	K19/2CAK013127	Ceramic chip: 1000 pF, 50V
C234	K19/2CCF002072	Tantalum: 1 uF, 16V
C235	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
C236	K19/2CCF002163	Tantalum: 0.33 uF, 25V
C237 and C238	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
C239	K19/2CAK013192	Ceramic chip: 4700 pF, 50V
C240	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
C241	K19/2CAK013010	Ceramic chip: 0.1 uF, 25V
C242 thru C244	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
C245		NOT USED
C246	K19/2CCF002080	Tantalum: 2.2 uF, 16V
C247	K19/2CAK013127	Ceramic chip: 1000 pF, 50V
C248		NOT USED
C249	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
C250	K19/2CAK013135	Ceramic chip: 0.015 uF, 50V
C251	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
C252	K19/2CAK013010	Ceramic chip: 0.1 uF, 25V
C253	K19/2CAK005909	Ceramic chip: 100 pF, 50V
C254	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
C255	K19/2CAK013127	Ceramic chip: 1000 pF, 50V
C256	K19/2CCF006024	Tantalum: 6.8 uF, 10V
C257		NOT USED
C258	K19/2CAK013010	Ceramic chip: 0.1 uF, 25V
C259	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
C260		NOT USED
C261	K19/2CAK013226	Ceramic chip: 470 pF, 50 V
		- - - - - - - - - - DIODES - - - - - - - - - -
CR201	K19/2QBE005024	DAP202KT-96
		- - - - - - - - - - PINHEADERS - - - - - - - - - -
P1	K19/	BBL-113-G-E
P2	K19/	BBL-109-G-E
P3	K19/	BBL-105-G-E

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q200	K19/2QAD001034	2SC2462LCTL
Q201		NOT USED
Q202	K19/2QAD004103	2SB798T1D1
Q203	K19/2QAD001026	2SA1121SBTL
Q204	K19/2QAD001034	2SC2462LCTL
Q205	K19/2QAD004103	2SB798T1D1
Q206	K19/2QAD001026	2SA1121SBTL
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R201	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R202	K19/2RGC004035	Square chip: 1/10W, 56 KohmJ
R203	K19/2RGC004449	Square chip: 1/10W, 150 KohmJ
R204	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R205	K19/	Square chip: 1/10W, 191 KohmF
R206	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R207 and R208	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R209	K19/2RGC001783	Square chip: 1/10W, 3.3 MohmJ
R210 and R211	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R212	K19/2RGC004670	Square chip: 1/10W, 1 KohmF
R213	K19/2RGC001874	Square chip: 1/10W, 10 KohmF
R214	K19/2RGC001635	Square chip: 1/10W, 22 KohmJ
R215	K19/	Square chip: 1/10W, 105 KohmF
R216	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R217	K19/2RGC001726	Square chip: 1/10W, 47 KohmJ
R218	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R219	K19/2RGC004308	Square chip: 1/10W, 390 ohmJ
R220	K19/2RGC001502	Square chip: 1/10W, 10 ohmJ
R221		NOT USED
R222	K19/2RGC001726	Square chip: 1/10W, 47 KohmJ
R223	K19/2RGC001635	Square chip: 1/10W, 22 KohmJ
R224 and R225	K19/2RGC001932	Square chip: 1/10W, 100 KohmF
R226	K19/2RGC001593	Square chip: 1/10W, 2.2 KohmJ
R227	K19/2RGC001726	Square chip: 1/10W, 47 KohmJ
R228	K19/2RGC001585	Square chip: 1/10W, 1 KohmJ
R229	K19/2RGC001833	Square chip: 1/10W, 2.2 ohmK
R230	K19/2RGC001726	Square chip: 1/10W, 47 KohmJ
R231	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R232	K19/2RGC001585	Square chip: 1/10W, 1 KohmJ
R233	K19/2RGC001759	Square chip: 1/10W, 470 KohmJ
R234	K19/2RGC001825	Square chip: 1/10W, 220 KohmJ
R235	K19/2RGC001635	Square chip: 1/10W, 22 KohmJ
R236	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R237 and R238	K19/2RGC001932	Square chip: 1/10W, 100 KohmF
R239	K19/2RGC004688	Square chip: 1/10W, 240 KohmF
R240	K19/	Square chip: 1/10W, 191 KohmF
R241	K19/	Square chip: 1/10W, 12.4 KohmF
R242 and R243	K19/2RGC001874	Square chip: 1/10W, 10 KohmF

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

SYMBOL	GE PART NO.	DESCRIPTION
R244	K19/2RGC001643	Square chip: 1/10W, 100 KohmJ
R245	K19/2RGC001833	Square chip: 1/10W, 2.2 ohmK
R246		NOT USED
R247	K19/2RGC004696	Square chip: 1/10W, 1.2 MohmJ
R248	K19/2RGC001775	Square chip: 1/10W, 1 MohmJ
R249	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R250	K19/2RGC001791	Square chip: 1/10W, 10 MohmK
R251	K19/2RGC001627	Square chip: 1/10W, 10 KohmJ
R252	K19/2RGC001577	Square chip: 1/10W, 680 ohmJ
		- - - - - - - - - - RUBBER DAMPER - - - - - - - - - -
XY201	K19/2YYZ001062	NB-0252-0.5t
		- - - - - - - - - - - CRYSTALS - - - - - - - - - - -
Y201	K19/2YAA181814	8.00 MHz, A4WX01733

PARTS LIST

M-PD LCD BOARD

A4WE03617
ISSUE 2

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/	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	K19/2RGC001569	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