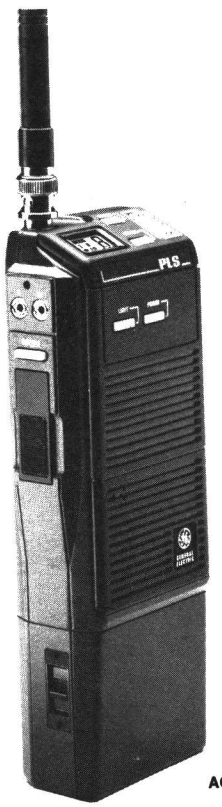
Mobile Communications

PLS™
PERSONAL UHF RADIO
450-470 MHz



ACN-172

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Maintenance Manual

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ILLUSTRATIONS

SPECIFICATIONS

SYSTEM	
FCC Identification Number	AXA9WN PLSUO4
Frequency Range	450 MHz - 470 MHz
Frequency Stability	5 PPM
Battery Drain (at 7.5 VDC)	
Standby	62 Milliamperes
Receive (Rated Audio)	182 Milliamperes
Transmit	1.7 Amperes
Dimensions (H X W X D)	188mm X 68mm X 42mm (With 800 mAh battery pack)
Weight	22 oz (With 800 mAh battery pack)
Operable Temperature Range	-30° C to +60°C
TRANSMIT	
RF Power Output	
High Power	4 Watts
Low Power	1 Watt
Spurious Emissions	-52 dB
Maximum Deviation	5 kHz
FM Hum & Noise (EIA)	-40 dB
Audio Distortion (60% Modulation)	7%
Frequency Stability (PPM) (-30°C to + 60°C)	+5 PPM
RF Load Impedance	50 ohms
Microphone Sensitivity (EIA 60% Modulation)	Less Than 90 dB SPL
Maximum Attack Time (PTT Pushed)	30 milliseconds
Audio Frequency Response	Within +1 and -3 dB of a 6 dB/octave pre-emphasis from 300 Hz to 3000 Hz.

RECEIVER

Sensitivity (12 dB SINAD)	0.4 Microvolts
Spurious Emissions	-57 dBm
Spurious Response Rejection (EIA)	-60 dB (Minimum)
Distortion (EIA 0.35W)	10%
Audio Frequency Response	Within +1 and -8 dB/octave de-emphasis from 300 Hz to 3000 Hz with the following constraints; 0 to 210 Hz -30 dB Maximum. Referenced 1000 Hz.

COMBINATION NOMENCLATURE

Digits 1 & 2	Digit 3	Digit 4	Digit 5	Digit 6
Product Code	Radio Type	Frequency Band	Frequency Split	RF Power Output
PL	**S** Synthesized	**U** 450 - 470 MHz	**O** None	**4** 4 Watts

FIVE-UNIT MULTI-BATTERY CHARGER

1 HOUR UNIT H2A2J1A
16 HOUR UNIT H2A2L2A

OPTIONS AND ACCESSORIES

SINGLE UNIT DESK CHARGER

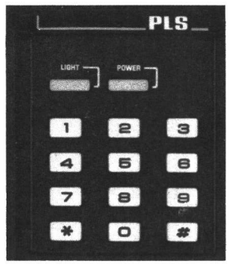
1 HOUR UNIT H2A1J1A
16 HOUR UNIT H2A1J2A

800 mAh BATTERY

OPTION PLPA10
(19A704850P1)

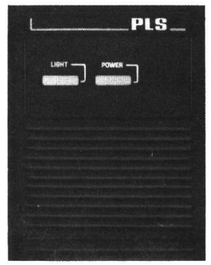
1200 mAh BATTERY

OPTION PLPA11
(19A704860P1)



DTMF PANEL

OPTION PLDT01
(19A704723P11)

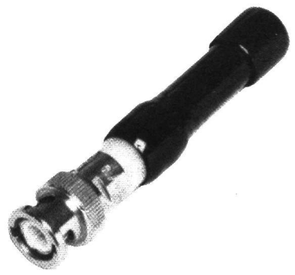


T99 PANEL

OPTION PLSS01
(19A704723P12)

DTMF & T99 PANEL

OPTION PLMK01
(19A704723P13)



TWO INCH ANTENNA (450-470 MHz)

OPTION PLNC12
(19B800763P13)

SPEAKER/MICROPHONE WITH VELCRO MOUNT

OPTION PLAE11
(19D43748364 MIKE)
(19A12979161 BADGE)

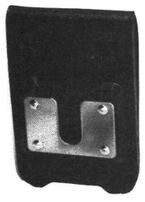
SPEAKER/MICROPHONE WITH CLIP MOUNT

OPTION PLAE12
(19D43748362)

EAR SPEAKER

OPTION PLAC19
(403357066)

SWIVEL MOUNT/CASE BELT LOOP



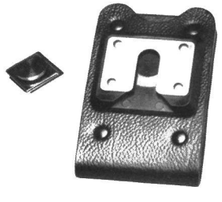
CASE & BELT LOOP

RADIO W/800 mAh BATTERY, OPTION PLHC11
(19D901765P2)
RADIO W/1200 mAh BATTERY, OPTION PLHC12
(19D901765P4)

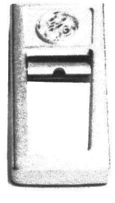
CASE/SWIVEL MOUNT/BELT LOOP

RADIO W/800 mAh BATTERY, OPTION PLHC13
(19D901765P1)
(19B226627G1 LOOP)
RADIO W/1200 mAh BATTERY, OPTION PLHC14
(19D901765P3)
(19B226627G1 LOOP)

SWIVEL MOUNT PLATE & BELT LOOP



BELT CLIP

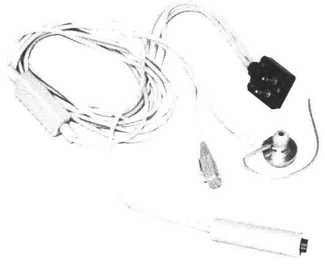


BELT CLIP OPTION PLHC15

(19B233241G1)
(19A144704G1 MOD KIT)

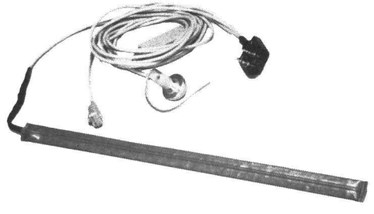
SWIVEL MOUNT PLATE & BELT LOOP

OPTION PLHC16
(19B226627G1 LOOP)
(19B233243 SWIVEL)
(19A144704G1 MOD KIT)



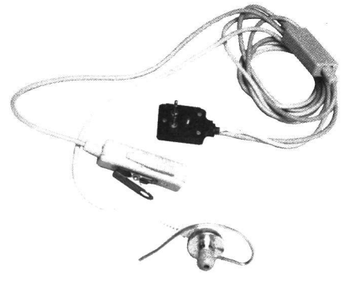
SK-1 SECURITY PACKAGE

OPTION 1226



SK-2 SECURITY PACKAGE

OPTION 1227



SK-3 SECURITY PACKAGE

OPTION 1228

LAPEL SPEAKER

OPTION PLAD10
(19A116502P1 SPEAKER)
(19A116502P2 CABLE)

DESCRIPTION

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

- **16 Channel Capability:** There are two modes of operation and eight channels are selectable for each mode using the "MODE" button. The channels can be selected with or without tone. The transmit and receive frequencies are programmed separately and can be the same. The channel button is used to increment to the next programmed channel. The monitor push button allows the user to monitor the channel before transmitting.

- **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 Carrier Controlled Timer:** Personality information includes an optional period of transit time in thirty second increments after which the unit will automatically unkey and provide an alerting tone. This feature is re-initiated on every PTT and the alert tone is removed upon release of the PTT.

- **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. This system of squelch tail elimination is compatible with an existing GE system.

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

- **Liquid Crystal Display:** This display has one digit and five status displays and is used to exhibit the condition of the radio. It shows: Mode 1 or 2, Channel Number and Power HI or LO. The transmit indication is the flashing of the HI or LO power indicator.

- **Simple Remote Control Capability:** By connection through the jack connectors a simple speaker microphone can be operated which can also control PTT.

- **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. The power ON/OFF switch is part of the battery pack (see Figures 1 & 2).

- **Programmable through jack con-nectors:** The entire personality of the radio is programmed into the radio through the jack connectors using the General Electric Universal Programmer TQ2310.

Physically a PLS radio consists of a plastic control housing, an aluminum back plate assembly, three printed circuit boards and a battery pack as follows:

a. A specially shielded printed wire board radio assembly (transmit/receive/synthesizer)is mounted on the aluminum back plate.

b. A Logic Control Board with the microprocessor. This board is located in the control housing.

c. A key pad providing switches and optional circuits is also mounted in the control housing.

d. A battery pack that fits the PLS main unit.

Radio Assembly

Transmit:

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

a. Wideband Exciter: Amplifies the signal from the frequency synthesizer approxi-mately 21 dB.

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 module : Provides constant control of the transmit output level.

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

The transmit circuit completely covers the band with no adjustments except for the RF power control voltage from the controller.

Receive Circuit:

The receive circuit, like the transmit circuit, consists of three major circuits as follows:

a. Front End Circuit: Consists of a single stage preamplifier with about 12 dB gain and the pre-BPF's and post-BPF's of the preamplifier.

b. First Mixer and IF Circuit: A special double balanced mixer to provide a 45 MHz first IF, which is passed 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 two major modules as follows:

a. VCO Module: The UHF band frequency synthesizer has one VCO for transmitting and for receiving.

b. Phase Lock Loop: Consists of a frequency divider and low current drain CMOS 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 Volume Up/Down switches, mode switch, channel switch and LED for LCD illumination.

b. Control Board: Carries a microprocessor, a RAM, audio circuit and I/O interconnections with the radio board and the display. This board commands all of the functions and operations of the PLS radio.

Power Supply

The PLS battery pack connects to the bottom of the PLS radio to supply 7.5 VDC. The battery pack is available in two types: an 800 mAh capacity and a 1200 mAh capacity. To charge these battery packs, chargers are available in two different types: a standard 16 hour charger and a rapid one hour charger.

OPERATION

The PLS Personal Radio is delivered disassembled into three parts as follows:

1. PLS 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 - PLS Operating Controls and Accessories.

1. Screw the antenna (2) in its receptacle. A clockwise turn will connect the antenna, while a counterclockwise turn will remove it.

2. Slide the battery pack along the bottom of the PLS radio from the arrow marked direction shown in Figure 1 until the battery pack locks into place.

Operating Procedure (Refer to Figures 1 and 2)

To Receive A Message:

1. Slide the Power switch ▲ on the side of the battery pack up to turn on the radio. The display will indicate the current status of the radio, i.e., channel, mode or Hi/Lo power.

2. Select a desired volume level by pressing and holding the VOL ▲ or ▼ arrow while listening to the beeps.

3. Select the desired operating channel by pressing the MODE switch to select the mode (1 or 2) and then press the CHAN switch to select the channel.

4. Your PLS radio is now ready to receive messages.

TYPE 99 TONE

NOTE

Only those channels programmed to decode Type 99 tones may be used to receive your personal messages. When receiving a message, you will first hear a tone and then your message.

1. Select the appropriate channel to receive the message.

2. After answering the message, momentarily press the **MON** push-button to reset the radio for the next call and to avoid hearing nuisance calls.

To Send A Message:

1. Turn the radio on and select the operating channel as instructed in To Receive A Message. The current status of the radio is displayed in the LCD window.

2. Select the transmit power level Hi or Lo.

3. Press the **MON** switch to determine if the channel is in use. **NEVER** interrupt another conversation.

4. While holding the radio so that the antenna is vertical, press the PTT switch and speak directly into the grill or across the face of the radio. If using the external microphone press the PTT switch on the microphone and speak into the microphone. Speak in a normal voice. Release the PTT switch as soon as you stop talking. Messages cannot be received while PTT switch is pressed.

DTMF Signaling:

Your radio may be equipped with a Dual Tone, Multi Frequency (DTMF) encoder key pad. The key pad has 12 keys. The keys are "0" through "9", an asterisk (*) and a pound key (#). These keys are used to gain access to a standard telephone system from a two-way radio DTMF Signaling System.

1. Select the DTMF channel.

2. Simultaneously press the PTT switch and the individual keys on the keypad. A tone is heard each time a key is pressed.

Controls and Indicators:

NOTE

A beep is sounded each time a switch is operated (except **MON** and **PTT**). For repeating switches (**CHAN**nel and **VOL**ume) a beep is heard each time the action occurs.

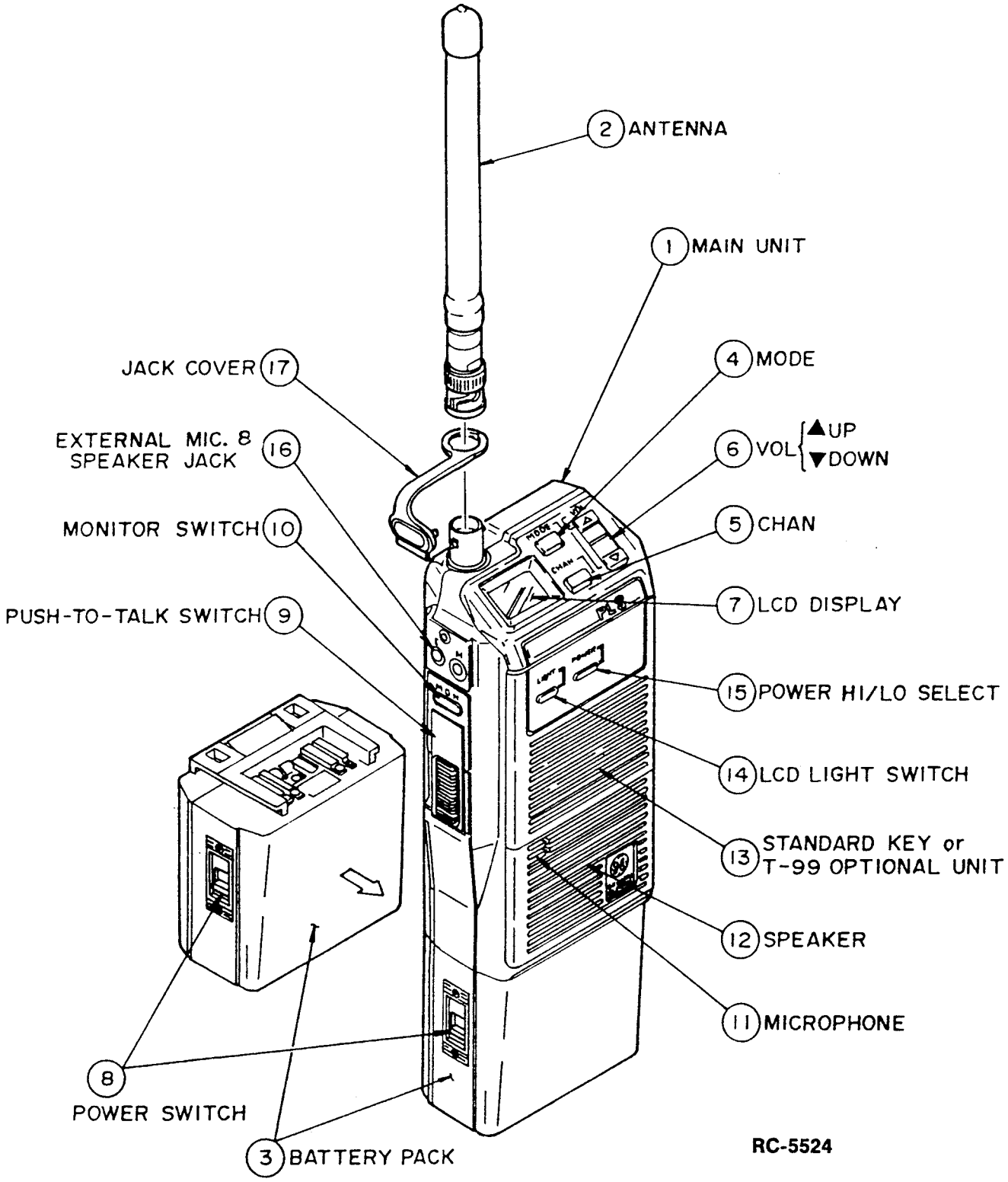


FIGURE 1 - STANDARD PLS OPERATING CONTROLS AND ACCESSORIES

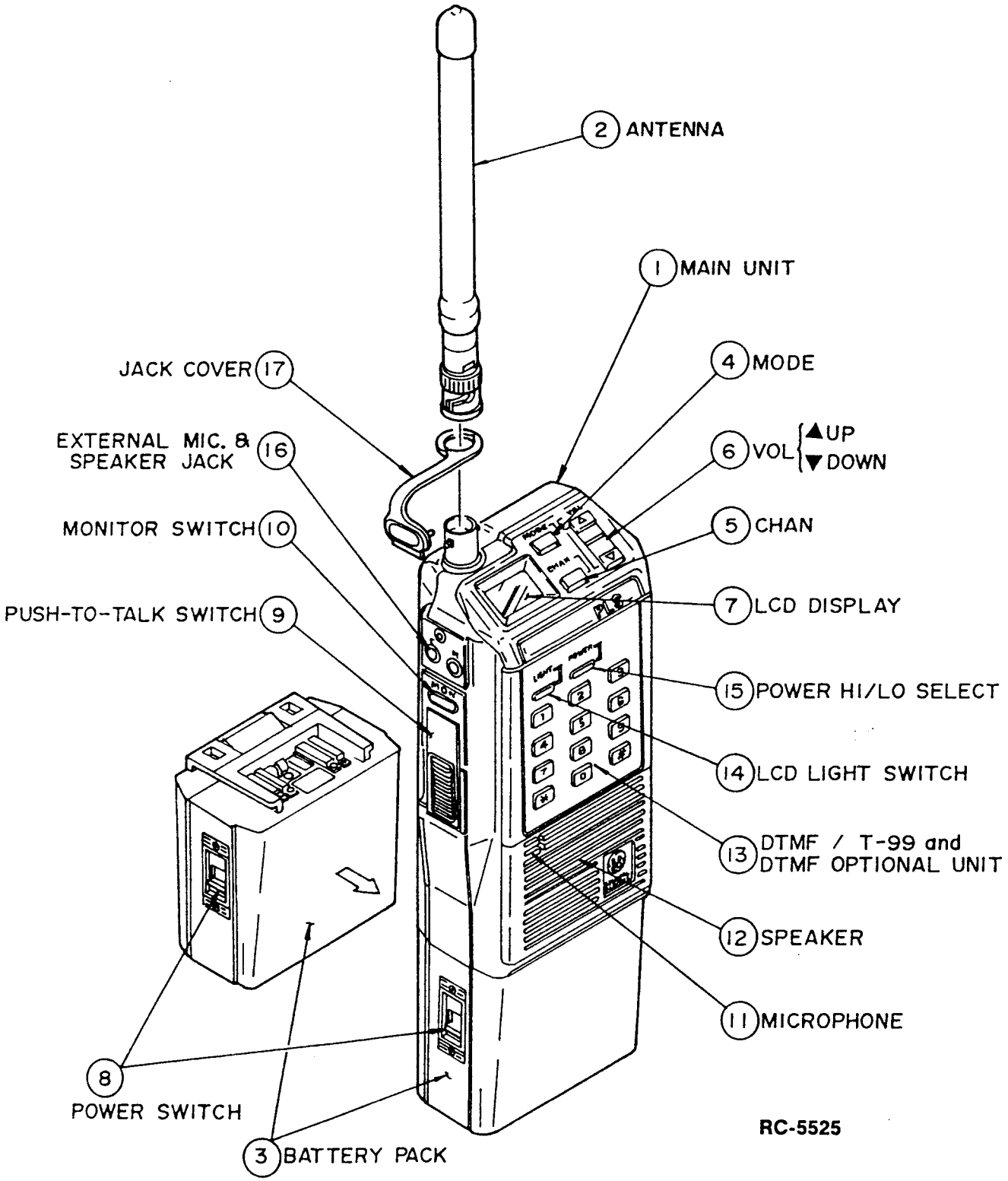


FIGURE 2 - PLS WITH OPTIONAL DTMF AND TYPE 99 OPERATING CONTROLS AN ACCESSORIES

Controls:

WARNING The on/off slide switch on the battery pack controls power from the battery to the radio. When turned on, an audible click of the switch will be heard and a light yellow square will show beneath the switch. The radio will assume its last operating state, i.e., channel and volume. Hi Power level is always selected. This status is displayed in the LCD window, indicating power is applied. BE SURE the power switch is fully on or fully off.

VOL Sets receive audio to the desired level while pressing the up or down (arrow) and listening to the beep. Pressing and holding the switch will continue to increment the volume in the direction indicated on the switch.

MON The receiver may be unsquelched by pressing and holding the **MON**itor switch located on the left side of the radio. This allows the user to monitor the channel.

CHAN Selects the transmit/receive operating channel. Channels may be selected one at a time or progressively by pressing and holding the **CHAN** switch. **NOTE:** The next higher channel is always selected (Channel 1 follows Channel 8).

MODE Selects mode 1 or 2. The current operating mode is displayed in the window (Each mode contains up to eight channels). Momentarily press the **MODE** switch to change modes.

NOTE

When changing modes, the channel and channel status are transferred to the new mode. If the channel is not programmed, the next higher programmed channel will automatically be selected.

LIGHT Controls the display backlight. Momentarily press the **LIGHT** switch to turn on. The backlight will automatically turn off when the preprogrammed time elapses. Press-ing the **LIGHT** switch a second time will also turn the light off.

POWER Selects high or low transmit power. The selected power level, "**HI** or **LO**", is displayed in the LCD window.

PTT Keys the radio on the channel and mode displayed. Will not key on channels programmed for receive only, but will sound an alarm (successive beeps and pauses).

E External earphone jack.

M External microphone jack.

Indicators:

The LCD display indicates the channel, mode and power level selected. In addition, the power indicator serves as a transmit indicator.

HI/LO Indicates selected transmit power level for the channel displayed.

TX Transmit mode is indicated by a flashing HI/LO (depending on power level selected) in the display window when the PTT switch is operated.

WARNING An audio alert tone (beeps) is sounded as a warning to the user that a failure associated with the selected channel or radio has occurred. A failure of the frequency synthesizer to lock on frequency or receipt of incorrect channel data will cause the alarm to sound and inhibit the transmit mode for that channel. The user may select another channel or have the unit repaired.

CARRIER CONTROL TIMER This option unkeys the transmitter when the user exceeds the preprogrammed time for continuous transmission and produces a continuous beeping tone until the PTT switch is released. Releasing the PTT switch resets the timer.

OPERATING TIPS

The following conditions tend to reduced the effective range of two-way radios and should be avoided whenever possible.

- Operating the radio in low areas or while under power lines or bridges
- Operating the radio inside of a vehicle or in a metal or steel frame building, unless using an outside antenna
- Obstructions such as mountains or buildings between the person transmitting the message and the person receiving the message
- In areas where transmission or reception is poor, some improvement may be obtained by insuring that the antenna is vertical. Moving a few meters in another direction or moving to a higher elevation may also improve communications.

REPLACEMENT OF BATTERY PACKS

To Remove The Battery Pack From The Radio:

1. Turn the radio off by sliding the on/off switch to the "off" position (refer to Figure 3).
2. Press down on the battery release latch and slide the battery pack out toward the back of the radio.

To Reconnect the Battery Pack to the Radio:

1. Be sure the on/off side switch on the battery pack is in the "off" position (refer to Figure 4).
2. Align the battery pack with the groves in the back of the radio and side the battery pack toward the

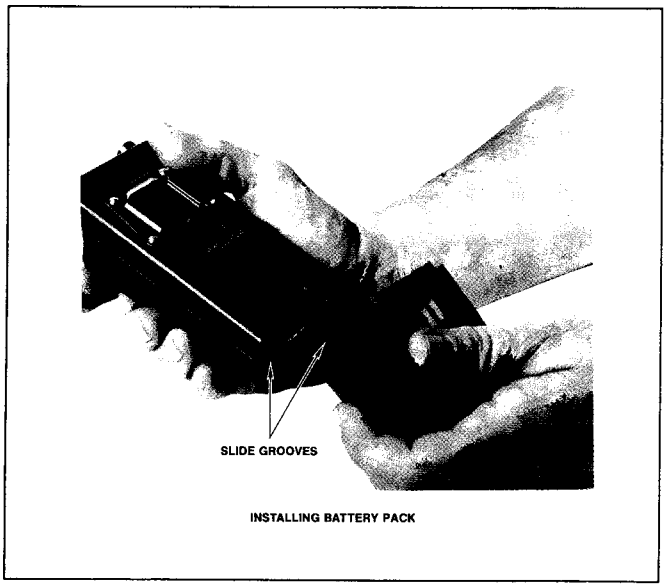


FIGURE 4 - INSTALLING THE BATTERY PACK

FIGURE 3 - REMOVING THE BATTERY PACK

CHARGING BATTERY PACKS

There are several chargers and charge rates available for charging the battery packs. For specific instructions refer to the applicable charger Operating Manual.

SYSTEM ANALYSIS

General Electric PLS Personal radios are two-way, FM radios designed for public communications. The PLS 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.
- Flexible Printed Wire Board: carries LCD Displays and switch
- Key Board: switch with rubber contact.

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 $\overline{PTT}$, means 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 Circuit

The PLS transmit circuit, as shown in Figure 5 -Radio Board Block Diagram, consists of the following circuits and integrated circuit modules:

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

Amplifier Module (TX-Amp):

RF from the synthesizer circuit is applied to the base input of an RF amplifier circuit (TX-Amp) consisting of two discrete transistors, Q204 and Q205. This amplifier circuit with a +2 dBm RF signal on the input produces an RF gain of 23 dBm on the output. This circuit is broadband and does not require tuning. The output is applied through attenuator circuit R-ATT (R223, R224 and R225) to the input of Power Amplifier Module A202 (PA)

Power Amplifier Module (PA):

Power Amplifier A202 is a three stage wide band RF amplifier module with an input and an output impedance of 50 ohms (refer to Figure 6). The first stage of the PA module has the DC power supplied by power control transistor Q206. The RF power output from the TX-Amp circuit is connected to Pin 1 of the PA module where it is applied to the input of the first power amplifier stage in the module. This power amplifier module amplifies the 21 dBm input from the TX-Amp circuit to a typical power output level of 5 watts at Pin 5. The output at Pin 5 connects through power control module A203 and TX-RX switching diode CR201 to a low pass filter network. The low pass filter network consists of capacitors C217, C221 through C227 and inductors L208 through L211. A minimum power level of 4 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 going to the first stage of the PA module (refer to Figure 7). Supply voltage cannot be applied to the first stage of the PA module until the transmit circuit is keyed, applying 5.0 Volts to Pin 11 of the Power Control (PC) module 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 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 Q206 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.

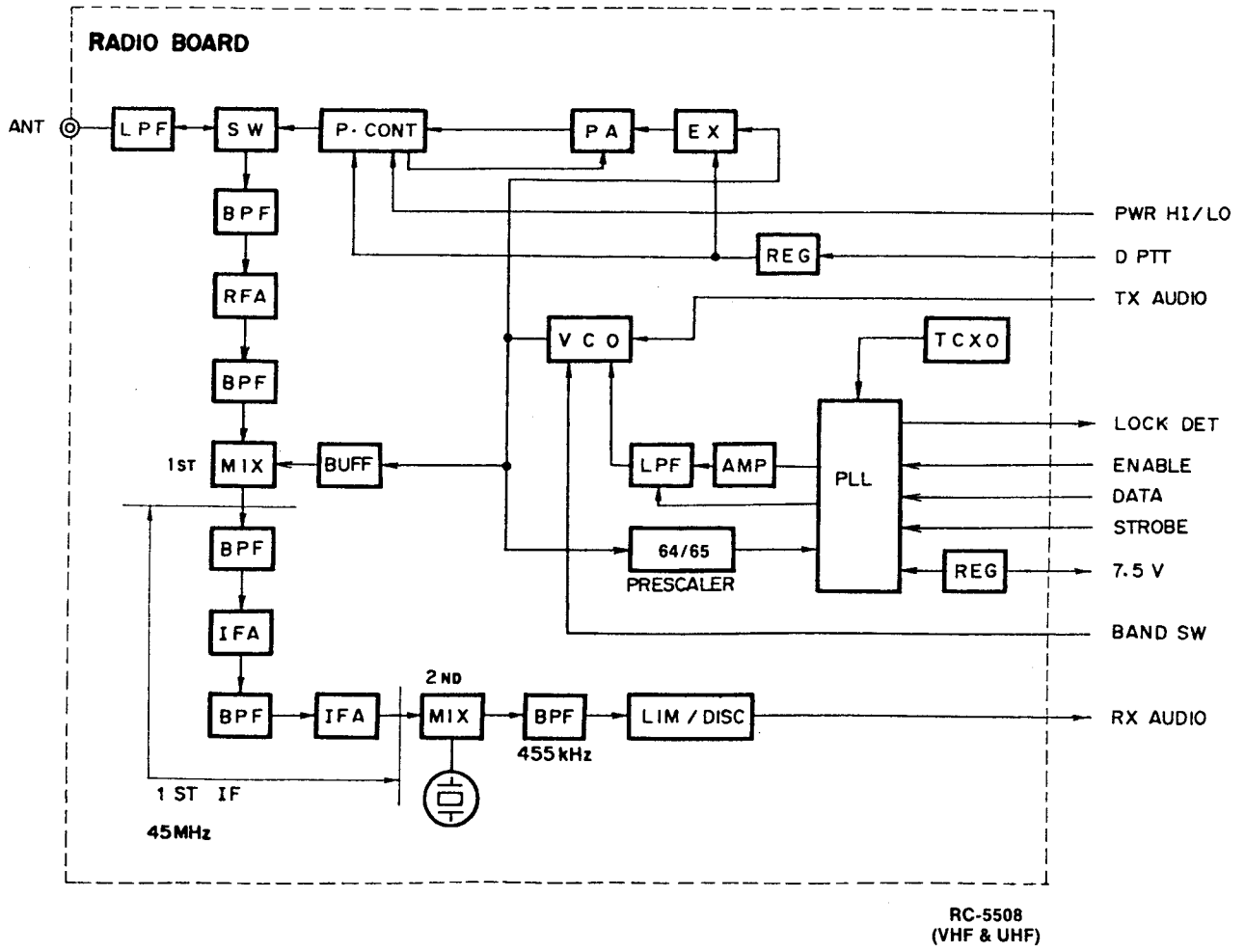


FIGURE 5 - RADIO BOARD BLOCK DIAGRAM

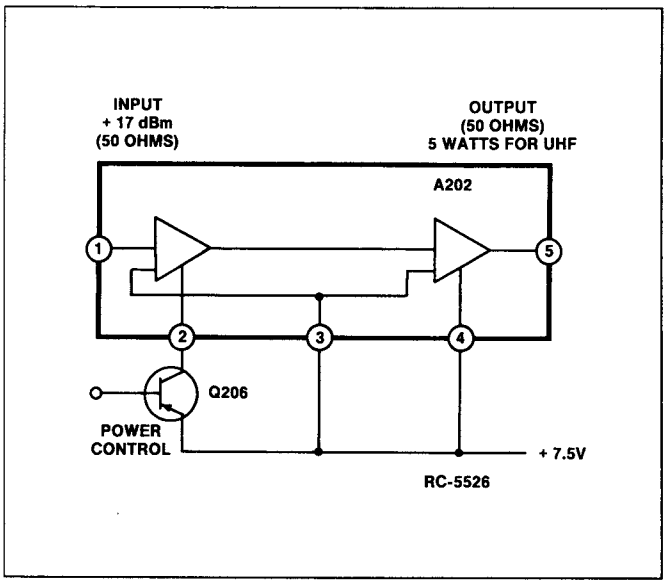


FIGURE 6 - POWER AMPLIFIER MODULE PA

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.

Receive Circuit

The PLS receive circuit, as shown in Figure 5 -- Block Diagram 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 (transistor Q301) and a double balanced diode mixer circuit (A301). Refer to Figure 8 - RF Amplifier/Mixer. RF from the antenna 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.

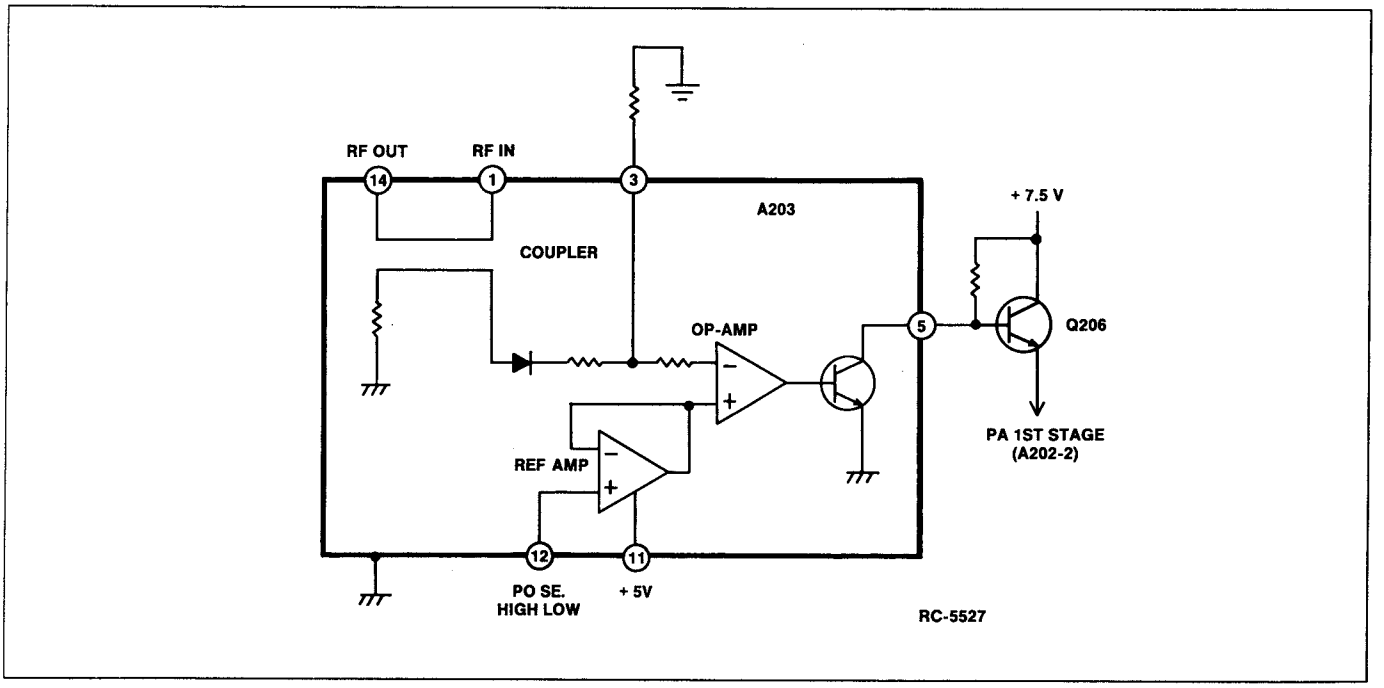


FIGURE 7 - POWER CONTROL MODULE (PC)

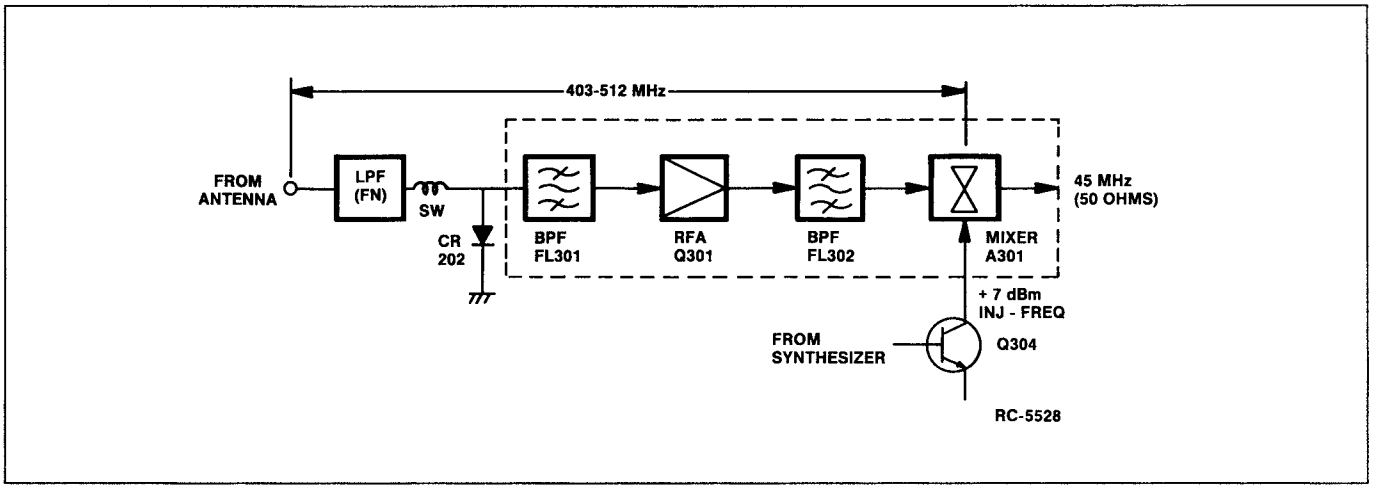


FIGURE 8 - RF AMPLIFIER MIXER

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 +2 dBm injection frequency level, provided by the synthesizer and amplifier circuit transistor Q106, is connected to the injection frequency input through a 50 ohm 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 9). The first IF signal (45 MHz) from the first mixer circuit connects to the input of preamplifier transistor Q302 through pre-crystal filter FL303 with an impedance of approximately 3K ohms. Preamplifier 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 10). 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 A302, Pin 2 and converted to the second IF frequency (455 KHz). The second IF is connected 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 connector J102-4.

Synthesizer Circuit

The synthesizer circuit contains Phase Lock Loop module (PLL) A102, TCX Reference Oscillator Module A105, TX/RX Voltage Controlled Oscillator module (VCO) A106 and a Low Pass Filter amplifier (LPF). Refer to Figure 11 - Synthesizer. The VCO used to generate the receive and transmit reference frequencies is phase locked to a stable TCX reference oscillator through the use of the PLL. This feedback loop divides the VCO frequency down to a signal in the range of 2 MHz - 7 MHz; divides this signal with a programmable divider to 12.5 KHz and generates a VCO control signal by comparing the 12.5 KHz feedback with a 12.5 KHz derived by dividing a 12.8 MHz VCTCXO by 1024. As the least significant bit in the programming is changed, the VCO is forced to change by 12.5 KHz.

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 12.8 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 (TCX) and is applied to the VCO on frequency

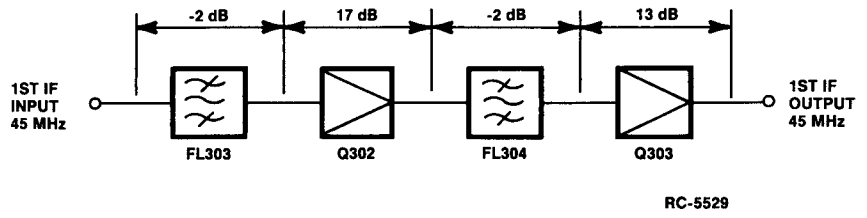


FIGURE 9 - FIRST IF AMPLIFIER

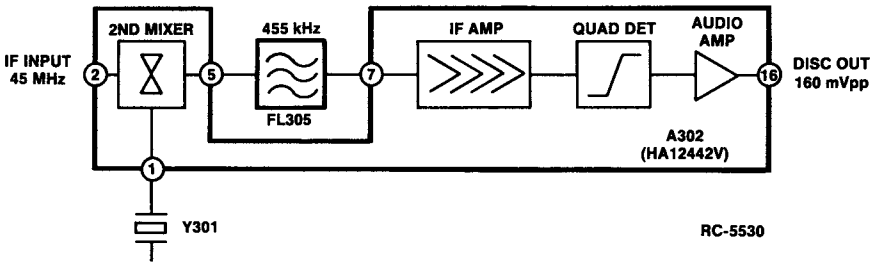


FIGURE 10 - SECOND IF AMPLIFIER/DISCRIMINATOR

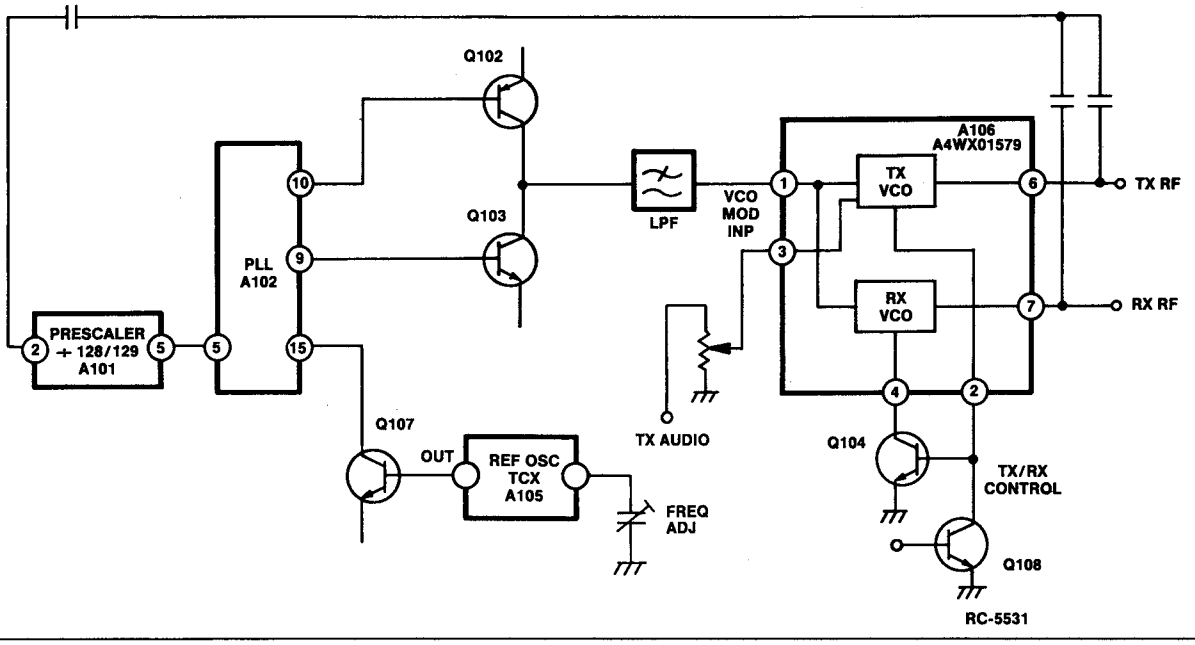


FIGURE 11 - SYNTHESIZER

Serial data from the microprocessor 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 locked 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 dielectric resonator which is used to set the center frequency at the factory. The output of the RX-VCO amplifier is coupled into the receive circuit first double balanced mixer circuit A301 through buffered amplifier Q304/. The TX-VCO amplifier output is directly connected to the TX-Amp circuit input through an attenuator circuit: resistors R209, R210 and R211.

TCX Reference Oscillator (A105):

The A105 oscillator module is self contained, fully temperature compensated and operates at a frequency of 12.8 MHz. Frequency is adjusted by a trimmer while monitoring the transmit circuit output at the antenna connector.

CONTROLLER

This controller circuit consists of control circuits and audio circuits (see Figure 12 - Control Circuit Block Diagram). Physically, this circuit consists of three circuit boards as follows:

- Control Board
- Display and Switch Board
- Key Pad

Control Board

The Control Board consists of the following circuits:

- CMOS Microprocessor (A6)
- RAM With Lithium Battery (A7 plus BT1)
- Audio Processor (A9)
- Audio Amplifier (A4, A5 & A6)
- Voltage Regulator Circuit (A1 & A2)
- External Buffer (A4 (1/4))
- LCD Driver (A8)

Microprocessor A6):

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

- Loading data to the frequency synthesizer
- Fetching and processing the PTT, monitor, channel selection and volume control, etc.
- Loading data to the LCD display
- Controlling the audio circuit (processor).
- Encoding/decoding the squelch, Channel Guard.
- Controlling the load interface for the radio data (channel data, etc.)

RAM (A7):

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

- Channel Frequency Data
- Channel Guard Data
- TX Power, TX Modulation Data
- Squelch Data
- Display Data...etc.

Audio Processor (A9):

Audio processor (A9) consists of a single chip IC accommodating almost all of the audio functions. The audio functions are under control of the microprocessor in compliance with the function of the radio. The functions of the audio processor are as follows:

- Tone Reject Filter
- Limiter Amplifier
- Post Limiter Filter
- Squelch Filter and Rectifier
- Channel Guard Encode/Decode Filter and Limiter
- Digital/Analog Converter and Comparator
- Oscillator Circuit and Digital Interface for the Microprocessor

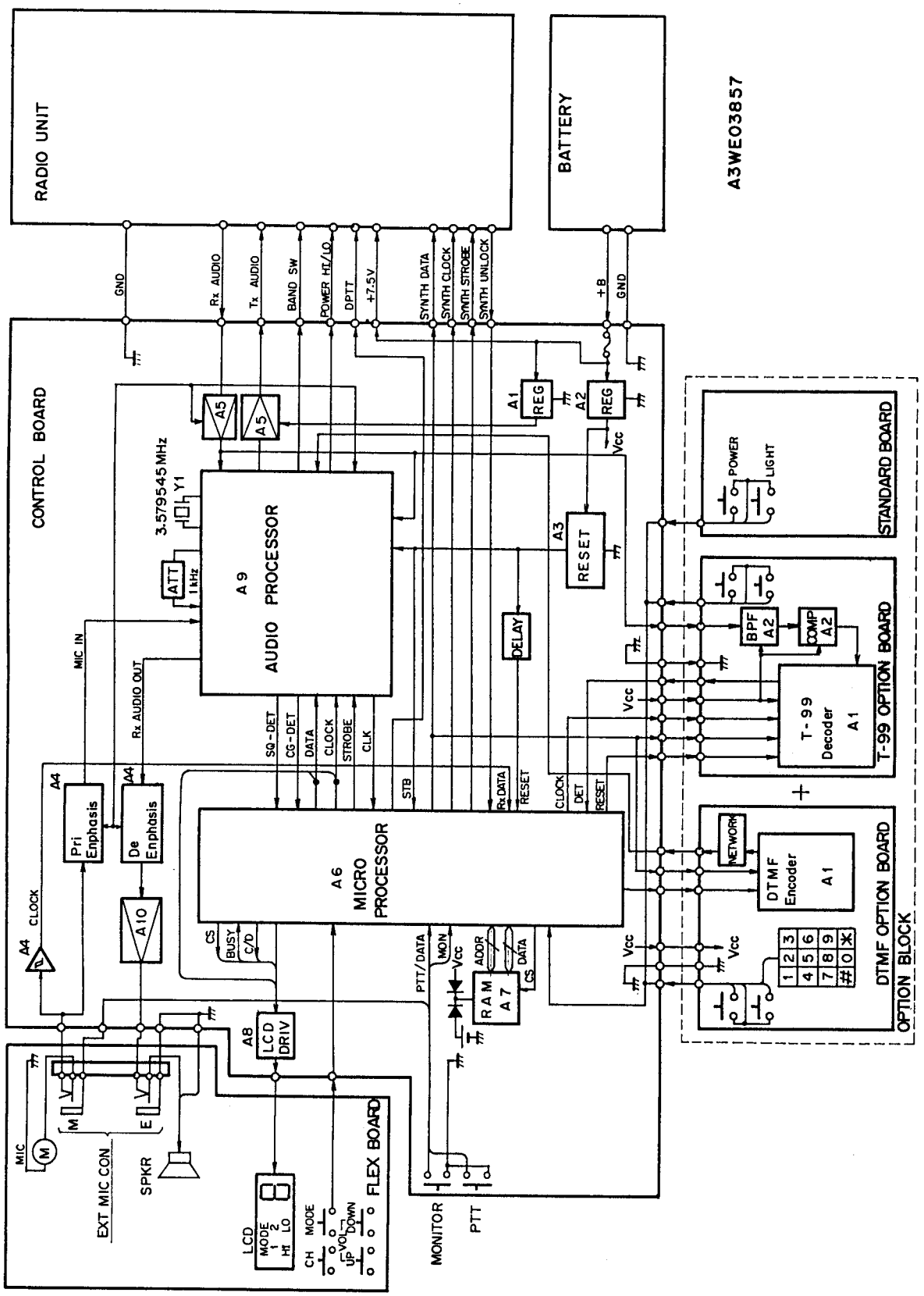


FIGURE 12 - CONTROL CIRCUIT BLOCK DIAGRAM

All of these functions are made up of switched, capacitor filters, amplifiers and timing logic. The timing for this logic is derived from the 3.379545 MHz clock generator. The clock signal is also applied to the microprocessor.

Audio Amplifiers (A4, A5 & A10):

These audio amplifiers are located between the audio processor and the microphone or the speaker. Amplifier A4 provides pre-emphasis for transmit audio and de-emphasis for the receive audio. Amplifier A10 amplifies the output signal of A4 to the level adequate for driving the speaker

Voltage Regulator Circuit (A1, A2):

Voltage Regulator Circuit A1 and A2 provides a regulated +5 VDC supply for the Control Board.

External Data Buffer (A4 (1/4)):

External Data Buffer A4 (1/4) is located between the jack connectors on the side of the radio and the microprocessor. This buffer is used for converting the level of external signals to match the internal circuits. This buffer also provides protection of the internal circuits.

LCD Driver (A8):

LCD Driver A8 converts data from the microprocessor into a signal which can drive the LCD display.

LCD Board

The LCD Board is composed of the following items:

- LCD
- Back Lighting Circuit (CR1)
- Switch (S1, through S4)

The LCD board is equipped with a three segments, one digit and five status display. Microprocessor signals drive the LCD driver, located on the Control Board. The LCD driver turns the LCD on. Also, the LCD board is equipped with a back lighting circuit to light the dark area with LED light upon receiving a signal from the microprocessor. The microprocessor produces this signal by the operation of a switch (VOLume up and down, MODE and CHANnel).

Key Pad

There are two types of key pads. One is a two key pad used with the standard PLS radio and a PLS radio equipped with a Type 99 option. The other key pad is a 16 key pad, used with a PLS radio equipped with a DTMF or a Type 99/DTMF option. The key pads consist of a key pad board and rubber contacts.

Jack Connector

Jack connectors are located on the side of the main frame, so external MIC and external earphone can be supplied. The are also used as TX data and RX data for the suit case programmer. Connecting signals are as follows:

- External MIC/TX data
- External Speaker/RX data
- PTT

Battery Pack

Two battery packs, one with 800 mAh capacity and one with 1200 mAh capacity are available for use with the PLS radio. Both battery packs provide a nominal 7.5 VDC output.

To protect the battery pack from external short circuits, the positive (+) charging contact is diode protected (see Figure 13).

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 pack 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 in to service.

Charger combinations for charging 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 with the capability of charging up to five battery packs simultaneously.

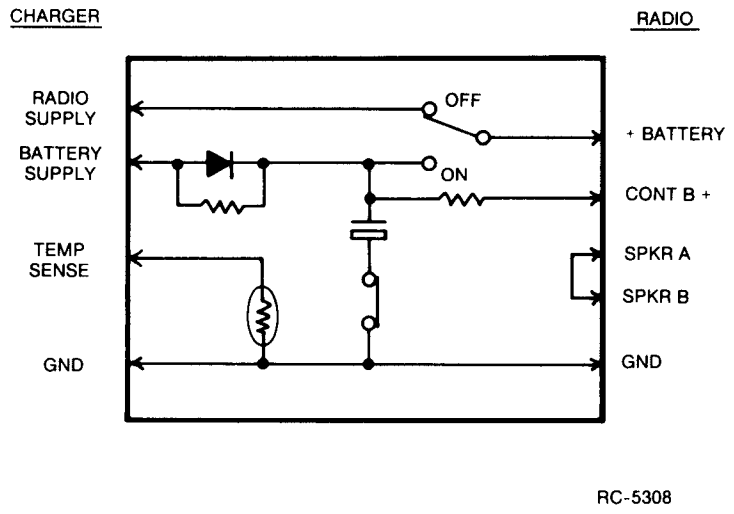


FIGURE 13 - BATTERY PACK

Charge Level

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

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, called for on the front cover of this manual, 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-31745), 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 readjust. 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.

CAUTION

To prevent loss of memory in RAM A2 on the Controller Board, lithium battery BT1 should be replaced at three years. A procedure for changing BT1 is provided in Service Section LBI-31790.

Preventive Maintenance

To ensure a high operating efficiency and to prevent mechanical and electrical failures, routine checks should be performed for 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 irregular shock and vibration, check for loose plugs, nuts, screws and other parts to make sure that nothing is loose or 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 Service Section for the applicable alignment procedure and troubleshooting sheet for typical voltage reading 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, loosen the captive screws and disassemble as follows:

Radio	Step 1 then step 2
Controller Board	Step 3 then step 4

Disassembly Procedure (See Figure 14):

CAUTION

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

Equipment Required:

- Small #1 Phillips-head screwdriver
- Small jeweler's Phillips-head screwdriver
- Small flat-blade screwdriver
- Needlenose pliers
- Special tool for removing jack nuts.
- 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 at (A).

NOTE

Screws are **not** captive, so be careful not to lose them.

Carefully remove the back cover. For normal radio alignment, the back cover is all that need be removed. When tightening the screws, they should be no tighter than 4 + 0.5 inch-pounds (See Figure 15).

Step 2:

To Remove the Radio Board, use the Phillips-head screwdriver and remove the two (8) screws at (B). Remove the RF shield cover at (C) (See Figure 16).

Step 3:

The radio portion can now be detached from the rear cover. Remove the ten (10) screws at (D). Remove the two (2) screws at (E). Unsolder the wire connected to the antenna connector at (F). Remove the radio board from the housing (see Figure 17).

Step 4:

To remove the Controller Board, use the Phillips-head screwdriver and remove the five (5) screws at (G) from the controller board and remove the shield at (H). Remove one (1) screw at (I) (See Figure 18).

Step 5:

Remove the two (2) nuts holding the External Microphone/Speaker Jacks at (J). Remove the four (4) screws at (K). Unsolder the flexible printed wire board from the speaker at (L). Peel out the tape at (M). Remove the flexible printed wiring board from the front housing. The controller Board can now easily be removed from the front housing (see Figure 19).

Step 6:

To remove the Key Board, use the special tool. Using the Phillips-screwdriver, remove the four (4) screws at (N). The speaker can now be removed from the housing.

Replacement of Components

The major components of the PLS Personal Radio are the PA (Power Amplifier Module), PC (power Control Module), VCO (Voltage Controlled Oscillator) and the TCX (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 replace procedure found in the Service Section (LBI-31790).

Troubleshooting Procedure

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

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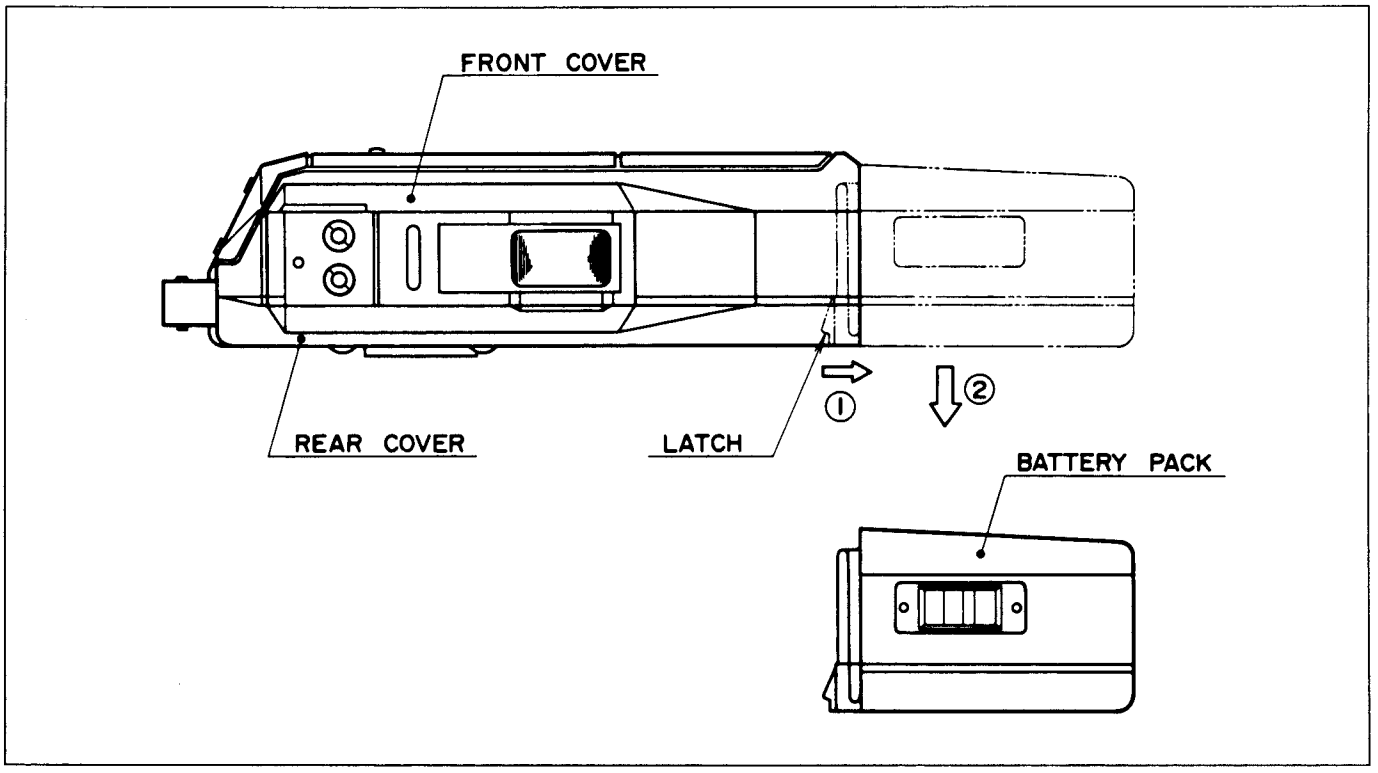


FIGURE 14 - DISASSEMBLY

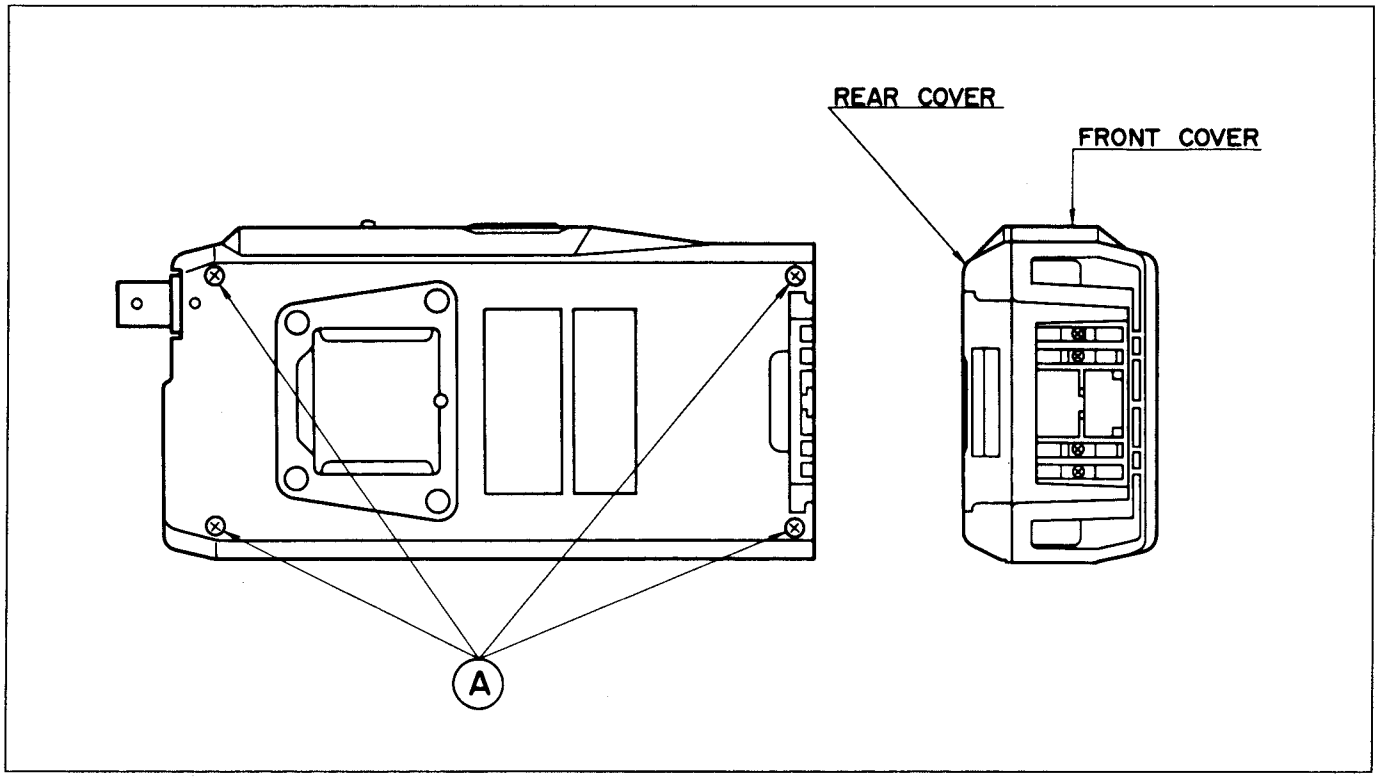


FIGURE 15 - DISASSEMBLY STEP 1

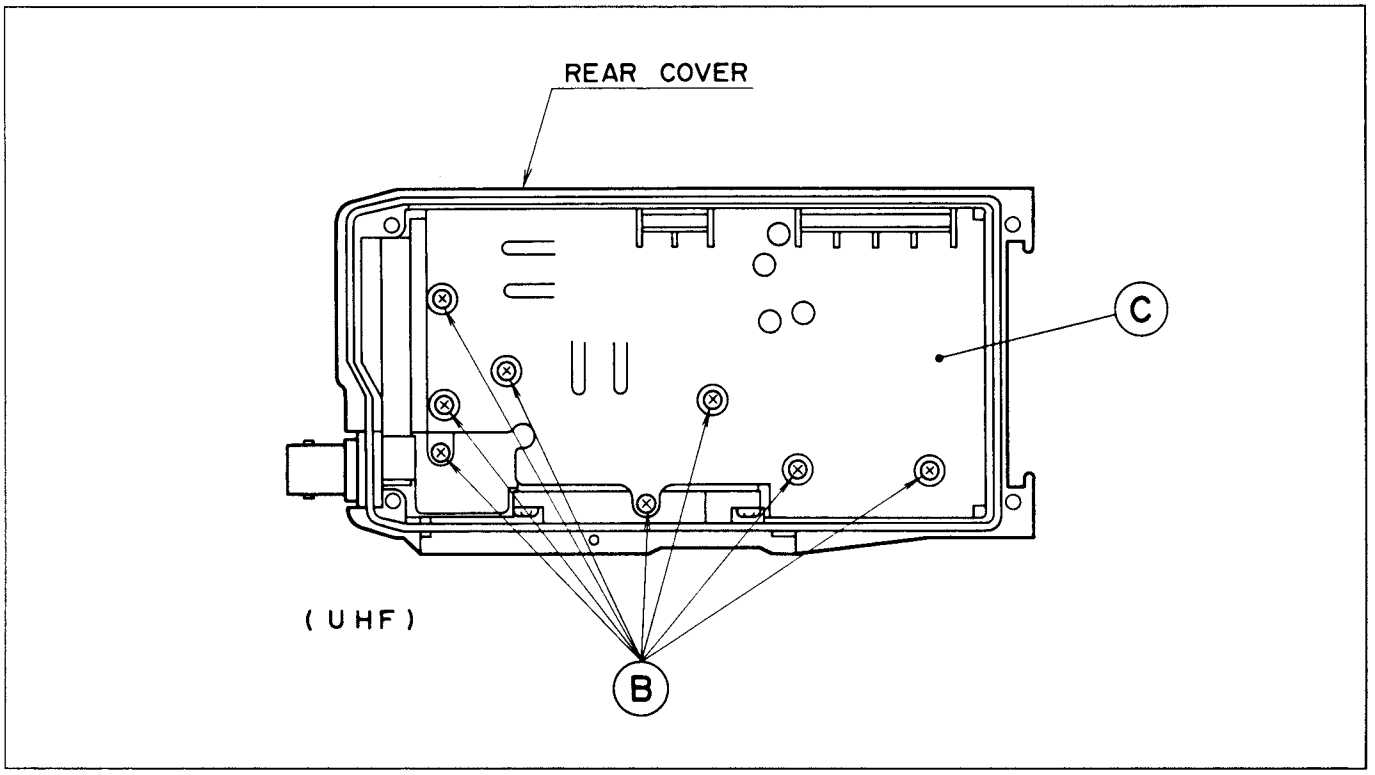


FIGURE 16 - DISASSEMBLY STEP 2

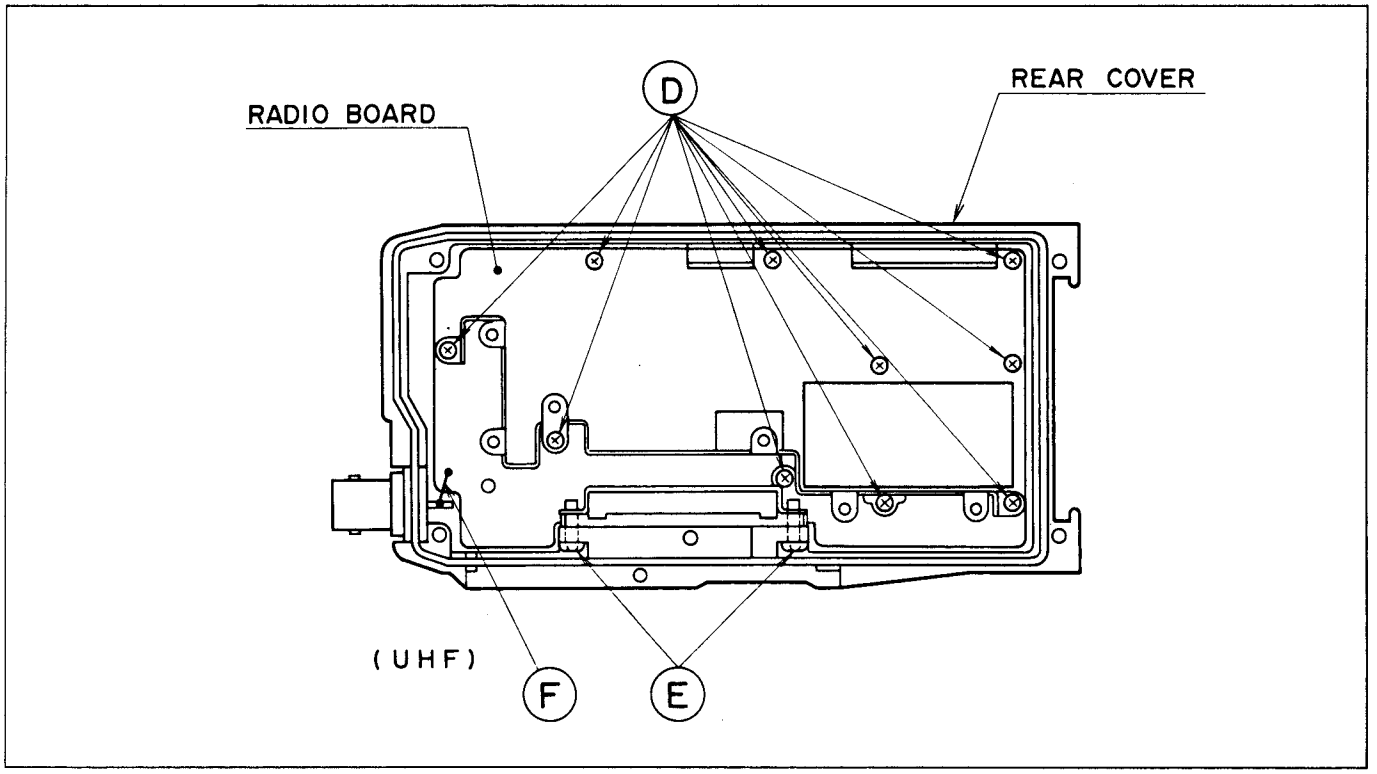


FIGURE 17 - DISASSEMBLY STEP 3

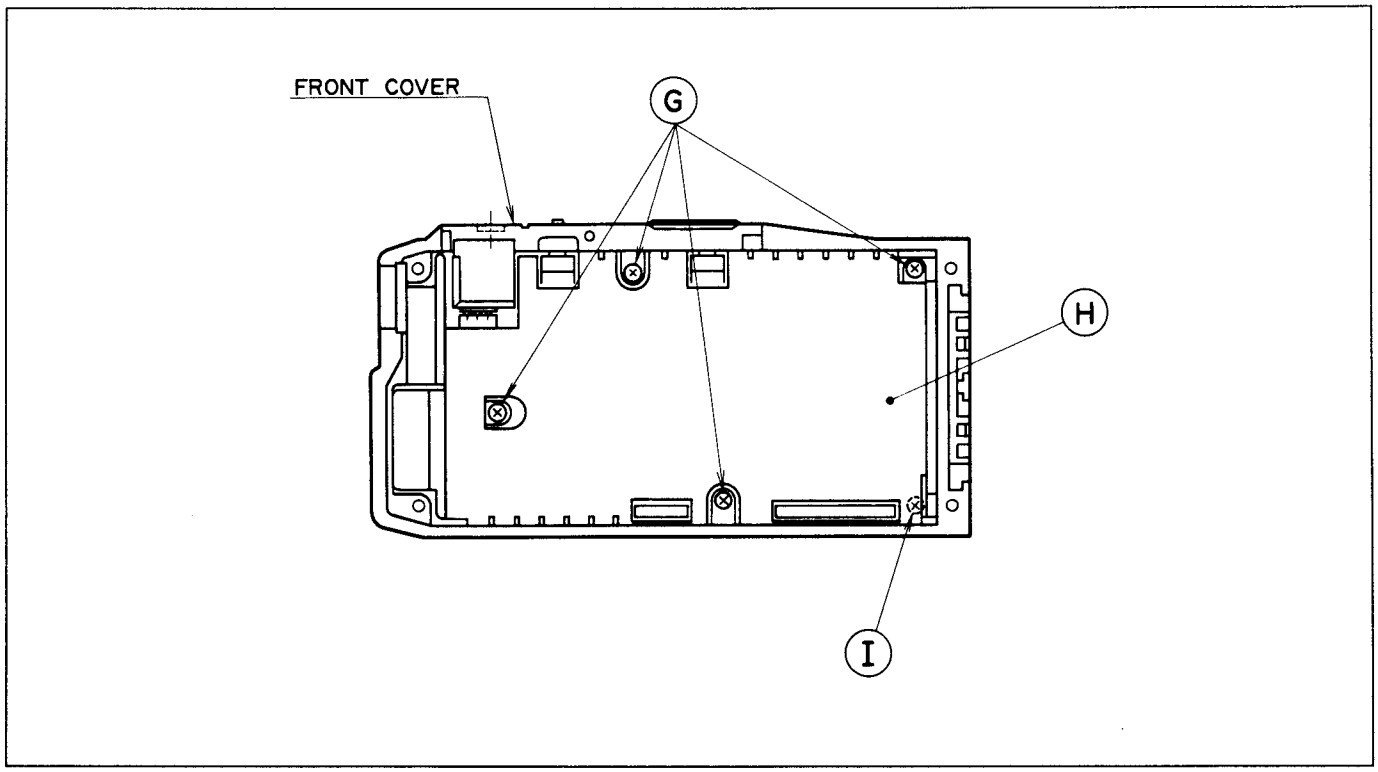


FIGURE 18 - DISASSEMBLY STEP 4

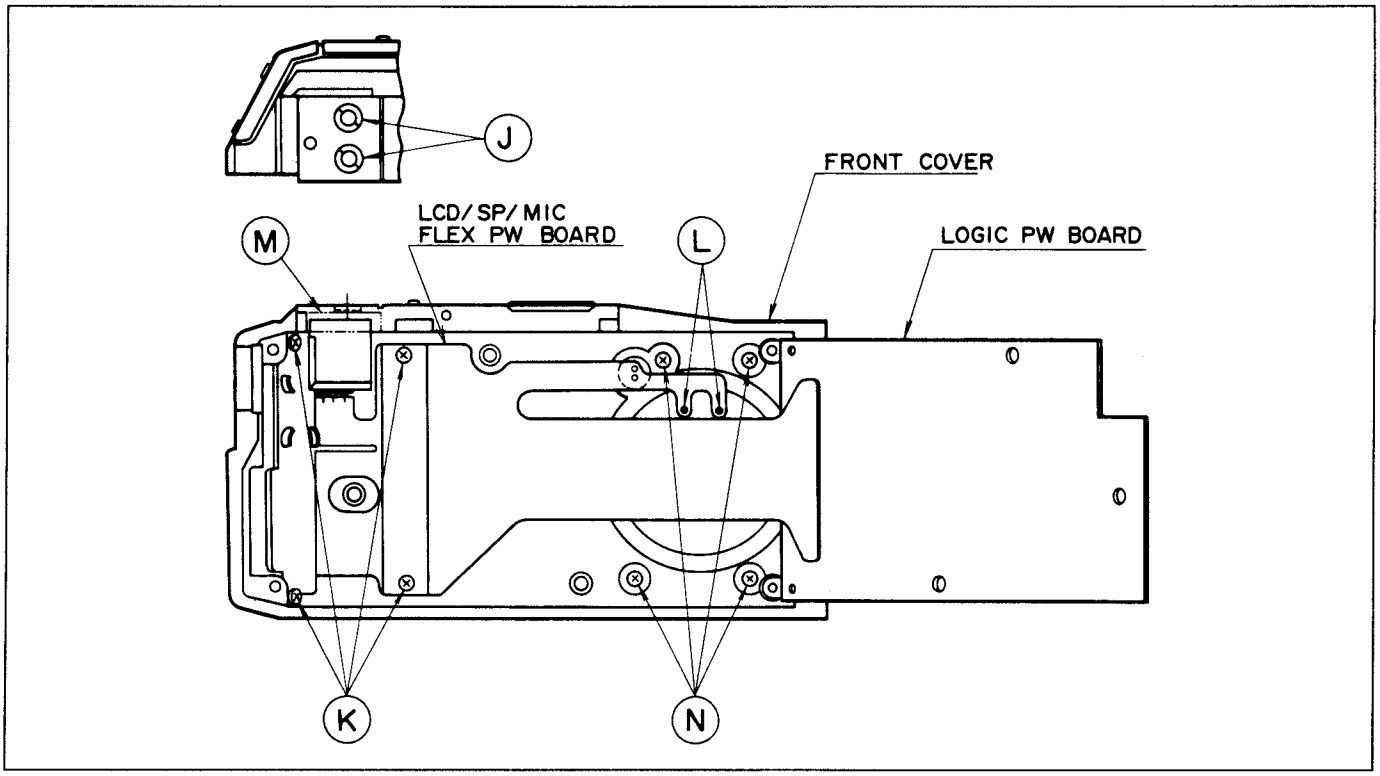
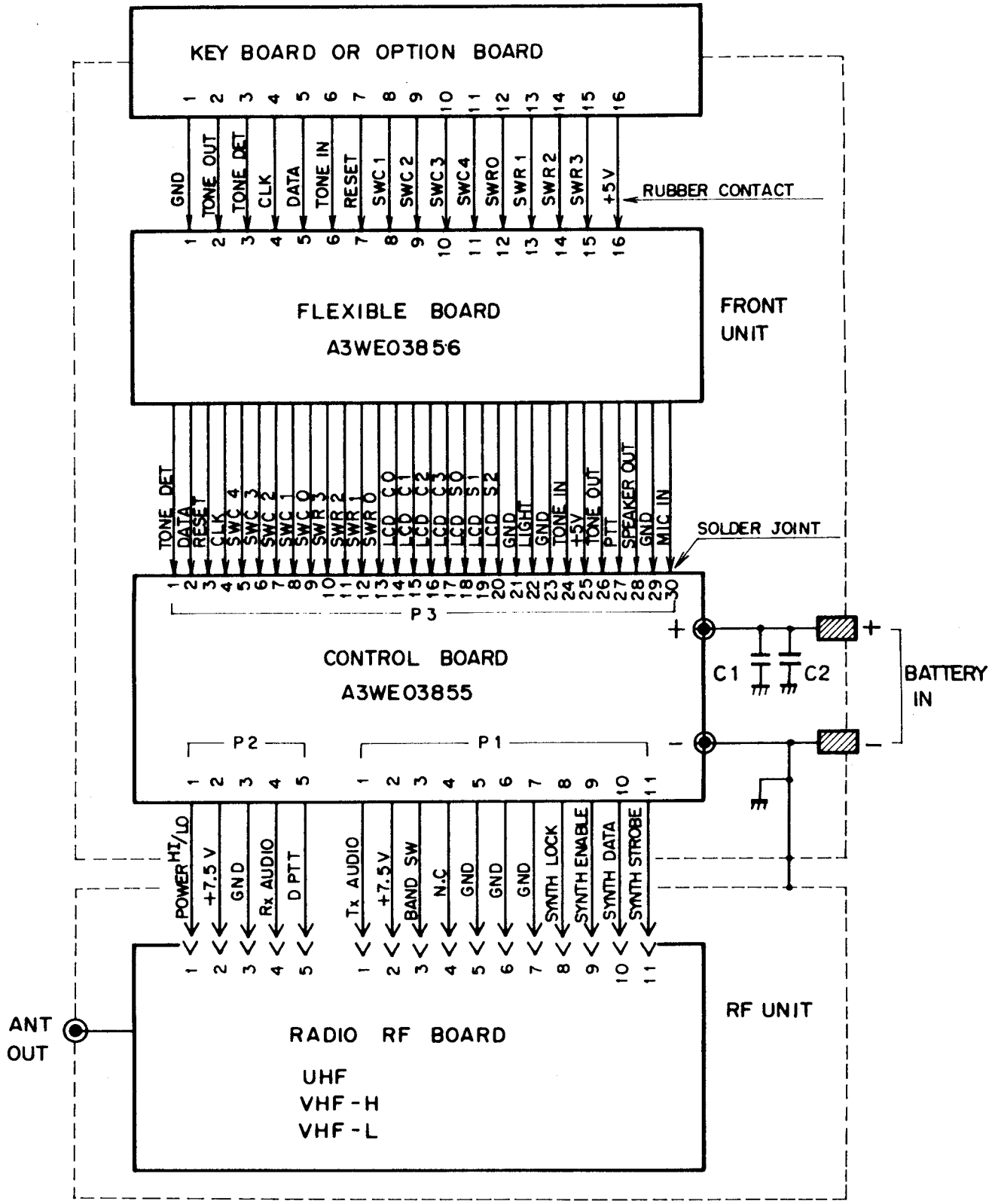
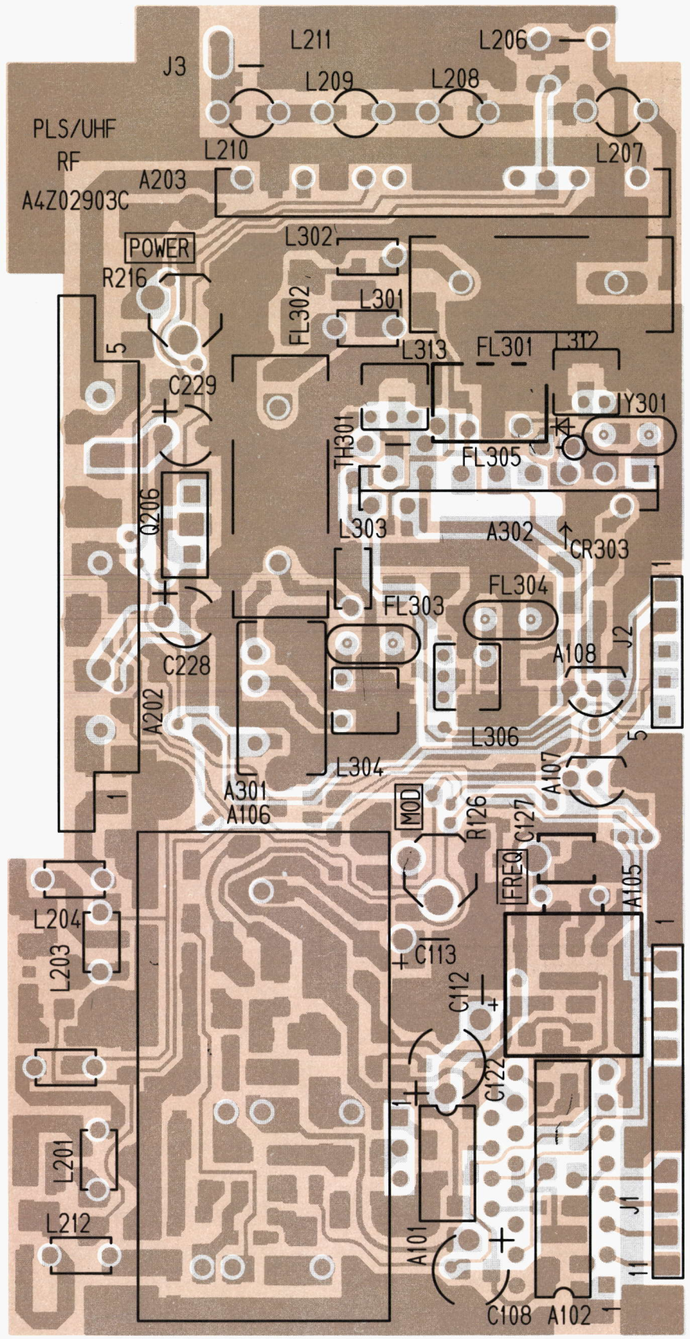


FIGURE 19 - DISASSEMBLY STEPS 5 AND 6



A3WE04059 Issue 1

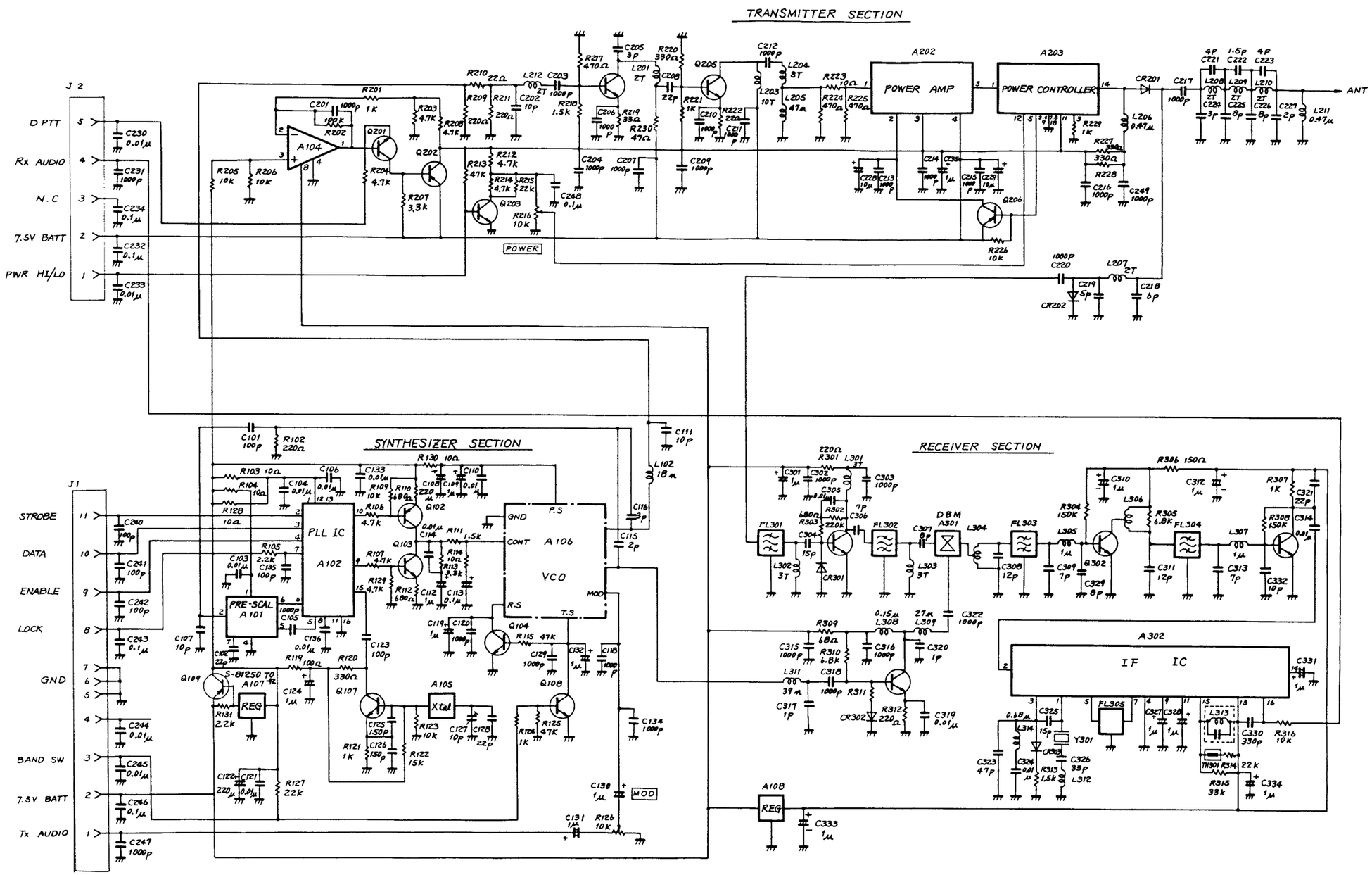
COMPONENT SIDE



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

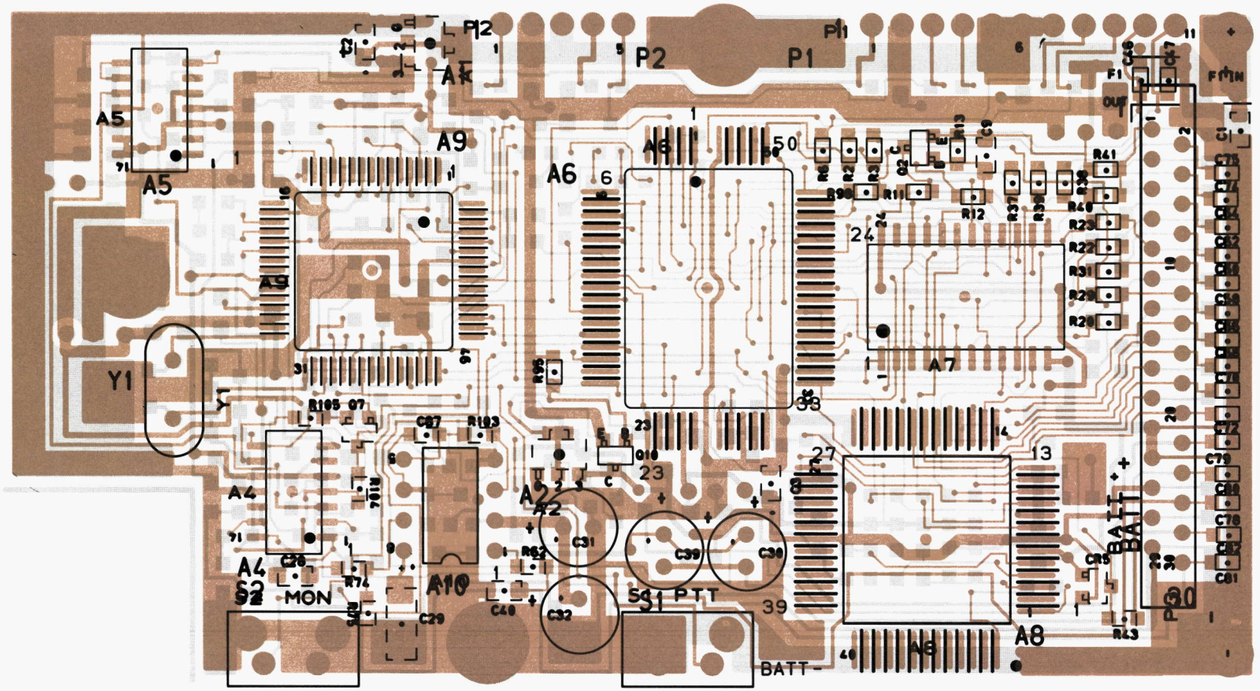
SOLDER SIDE

RADIO BOARD
A4Z02903C



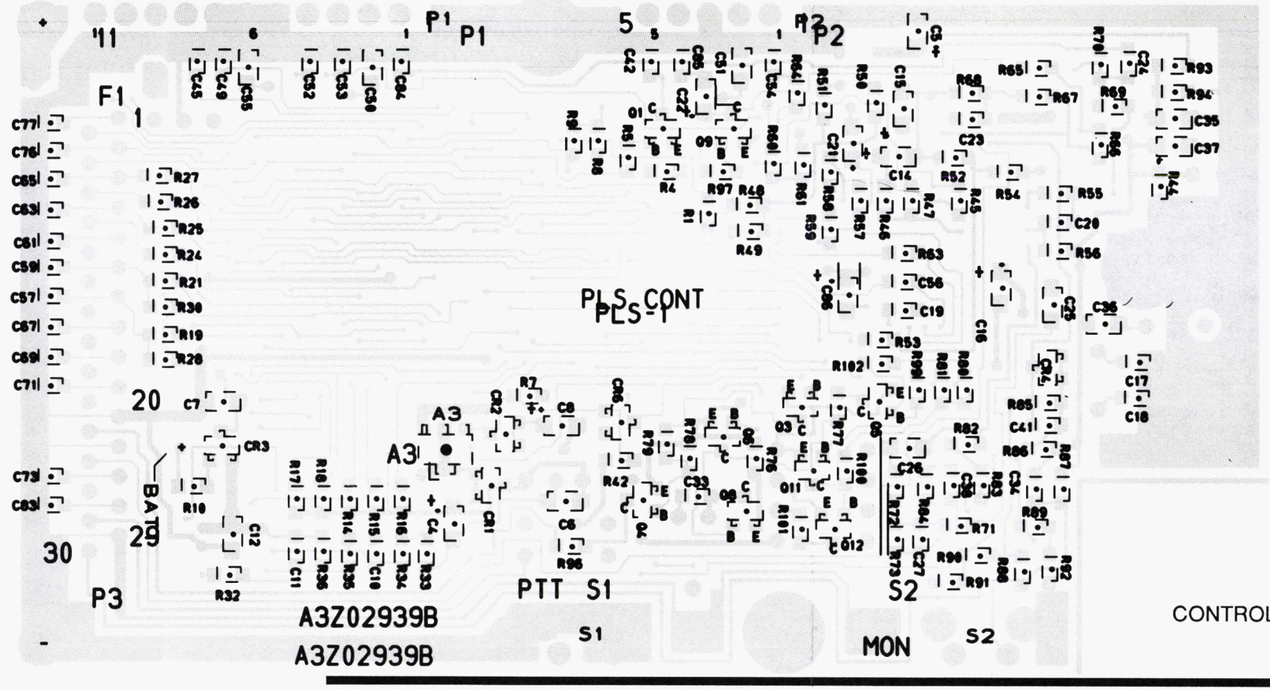
RADIO BOARD
A4Z02903C

COMPONENT SIDE

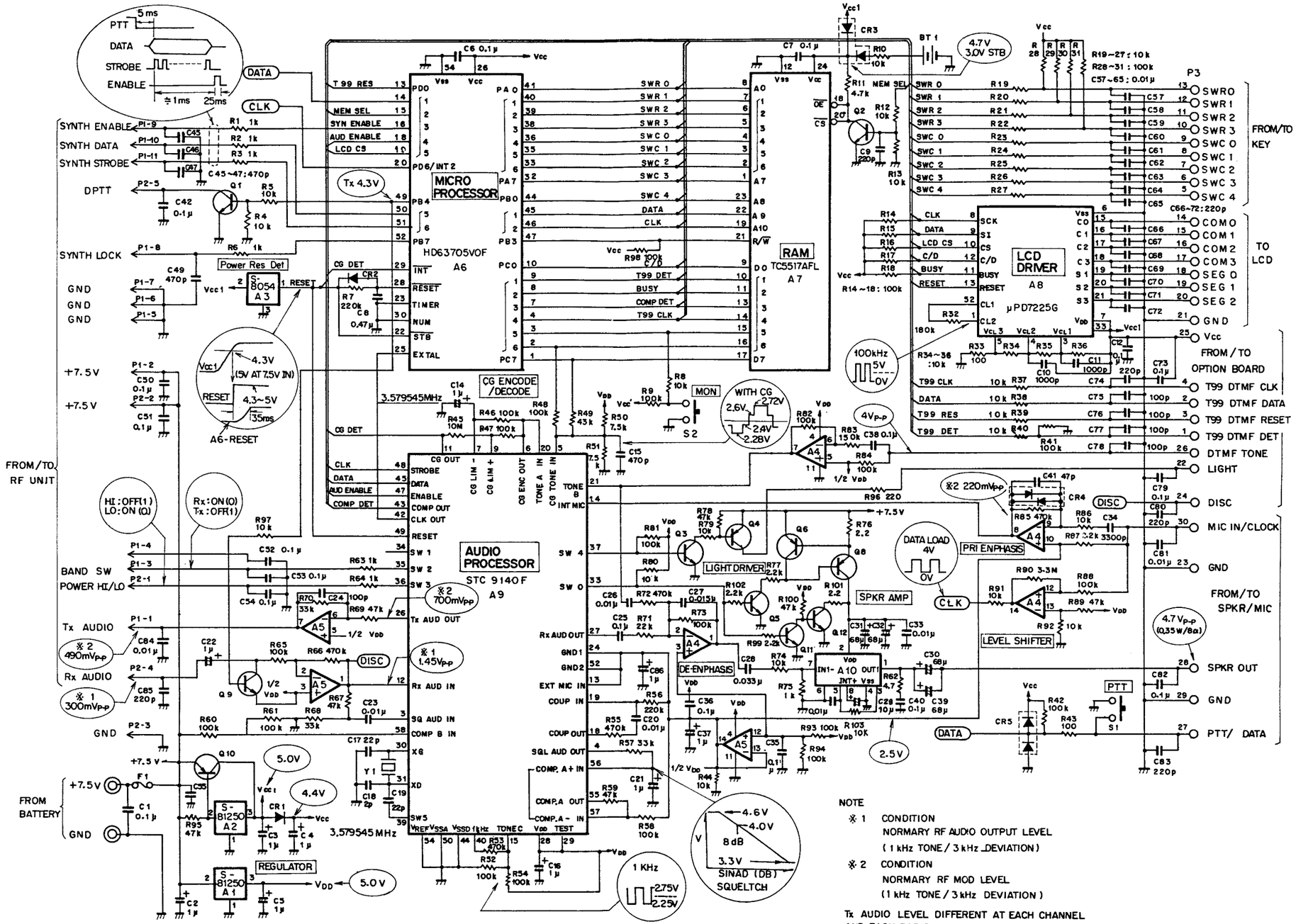


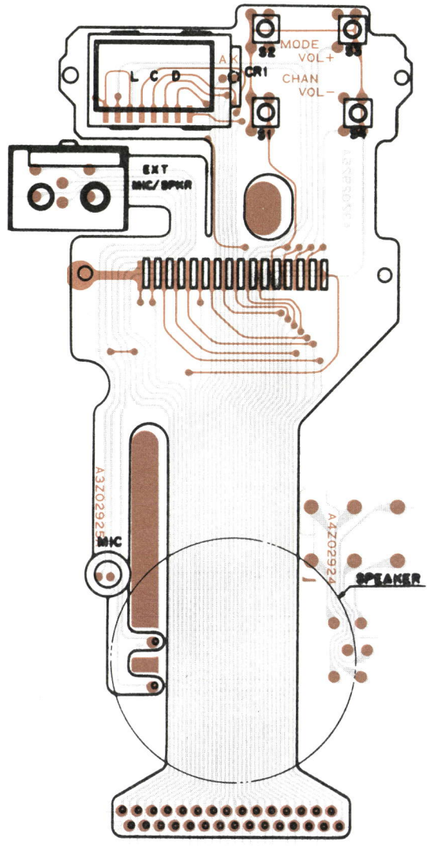
RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

SOLDER SIDE

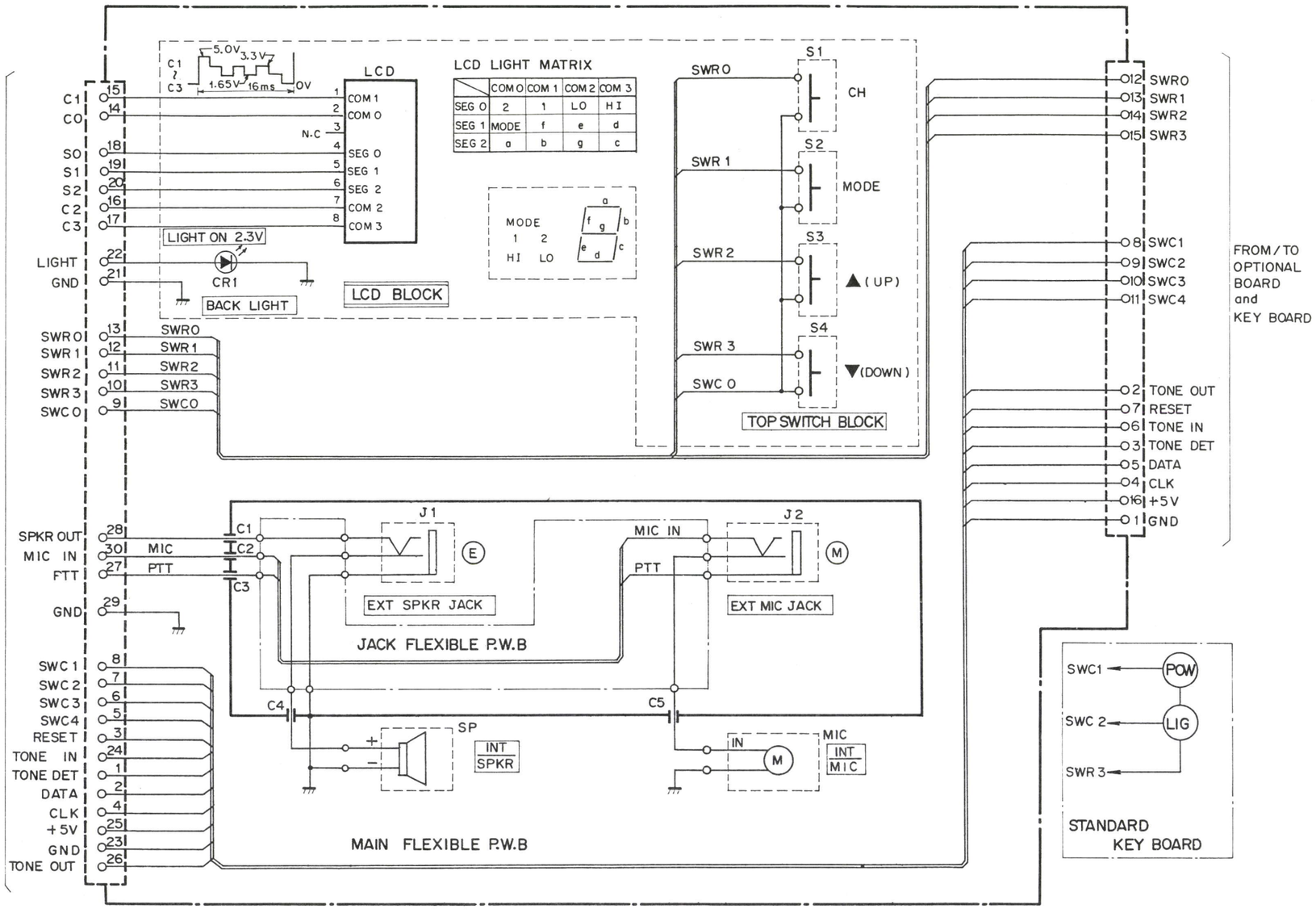


CONTROLLER BOARD


MICRO PROCESSOR
HD63705V0F
A6
RAM
TC5517AFL
A7
LCD DRIVER
μPD7225G
A8
AUDIO PROCESSOR
STC 9140F
A9
CG ENCODE /DECODE
REGULATOR
LIGHT DRIVER
SPKR AMP
PRI ENPHASIS
DE-ENPHASIS
LEVEL SHIFTER
FROM/TO KEY
TO LCD
FROM / TO OPTION BOARD
FROM/TO RF UNIT
FROM/TO SPKR/MIC
FROM BATTERY
CONTROLLER BOARD
AWE03855
NOTE
※1 CONDITION
NORMARY RF AUDIO OUTPUT LEVEL
(1 kHz TONE / 3 kHz DEVIATION)
※2 CONDITION
NORMARY RF MOD LEVEL
(1 kHz TONE / 3 kHz DEVIATION)
Tx AUDIO LEVEL DIFFERENT AT EACH CHANNEL AND EACH RADIO

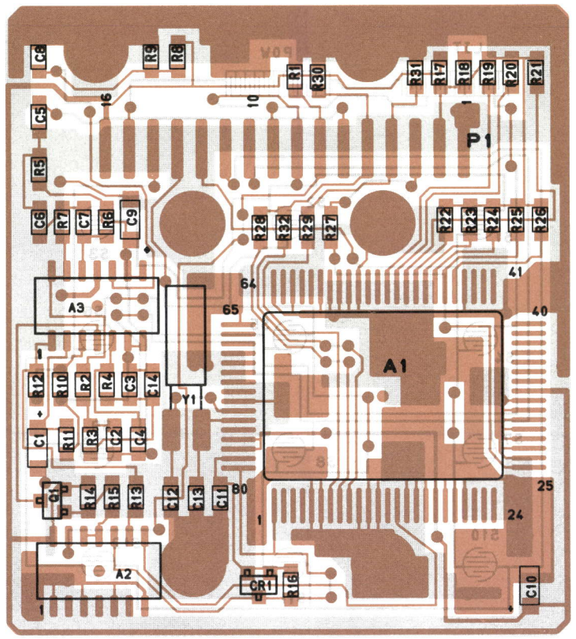


RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE



FLEXIBLE PRINTED WIRE BOARD
(A3Z02925A)

COMPONENT SIDE



SOLDER SIDE

RUNS ON SOLDER SIDE

RUNS ON BOTH SIDES

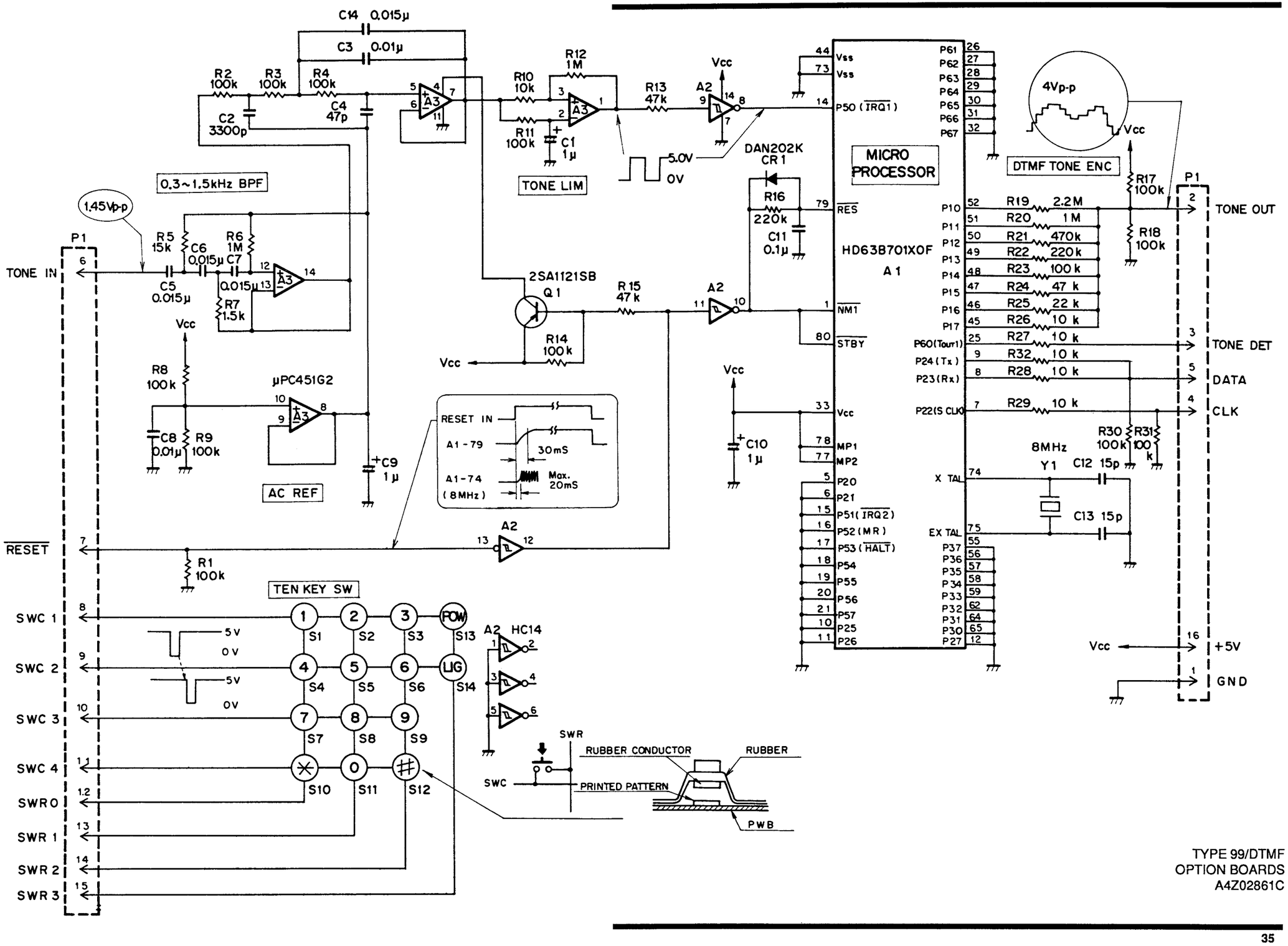
RUNS ON COMPONENT SIDE

CAUTION

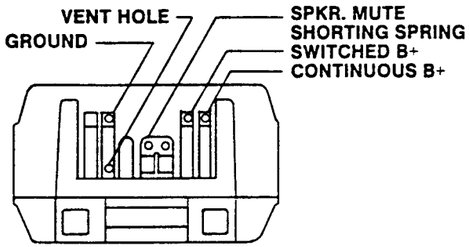
OBSERVE PRECAUTIONS FOR HANDLING

ELECTROSTATIC SENSITIVE DEVICES

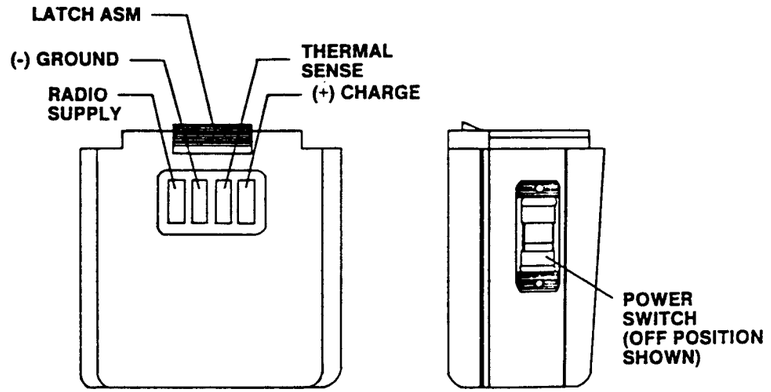
TYPE 99/DTMF
OPTION BOARDS
A4Z02861C



TYPE 99/DTMF
OPTION BOARDS
A4Z02861C



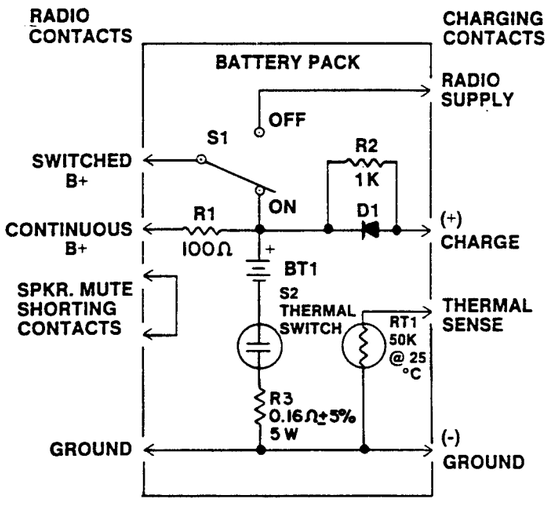
TOP VIEW

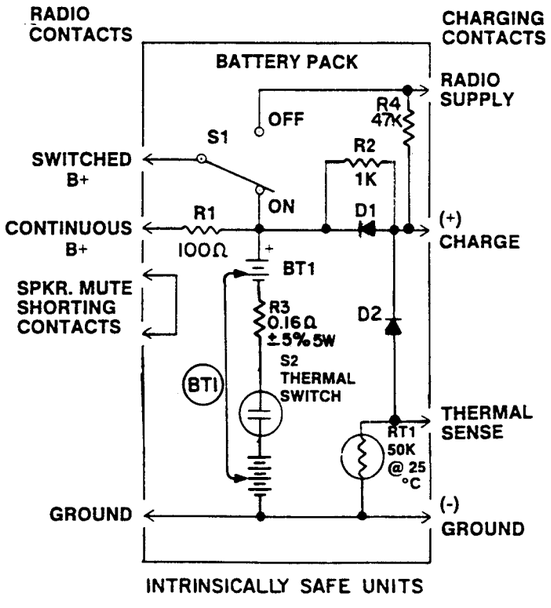


REAR VIEW SIDE VIEW

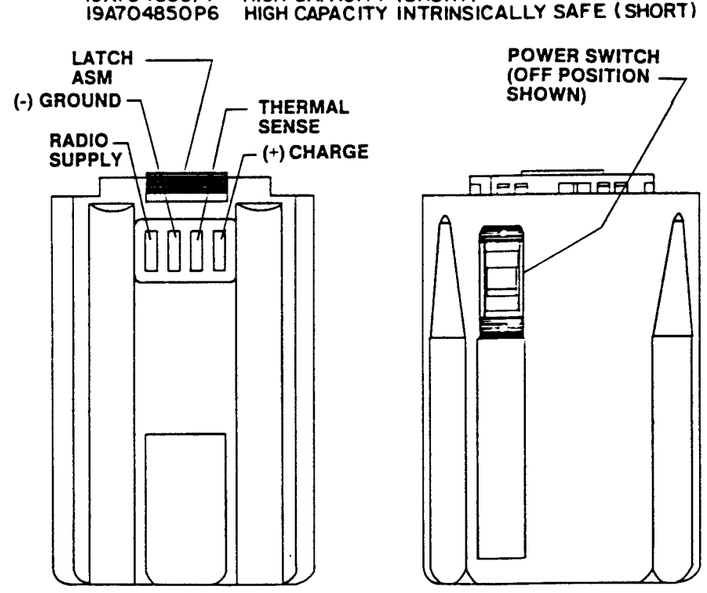
19A704850P5	STANDARD CAPACITY
19A704850P4	STANDARD CAPACITY INTRINSICALLY SAFE
19A704850P7	HIGH CAPACITY (SHORT)
19A704850P6	HIGH CAPACITY INTRINSICALLY SAFE (SHORT)

TYPICAL SCHEMATICS





INTRINSICALLY SAFE UNITS

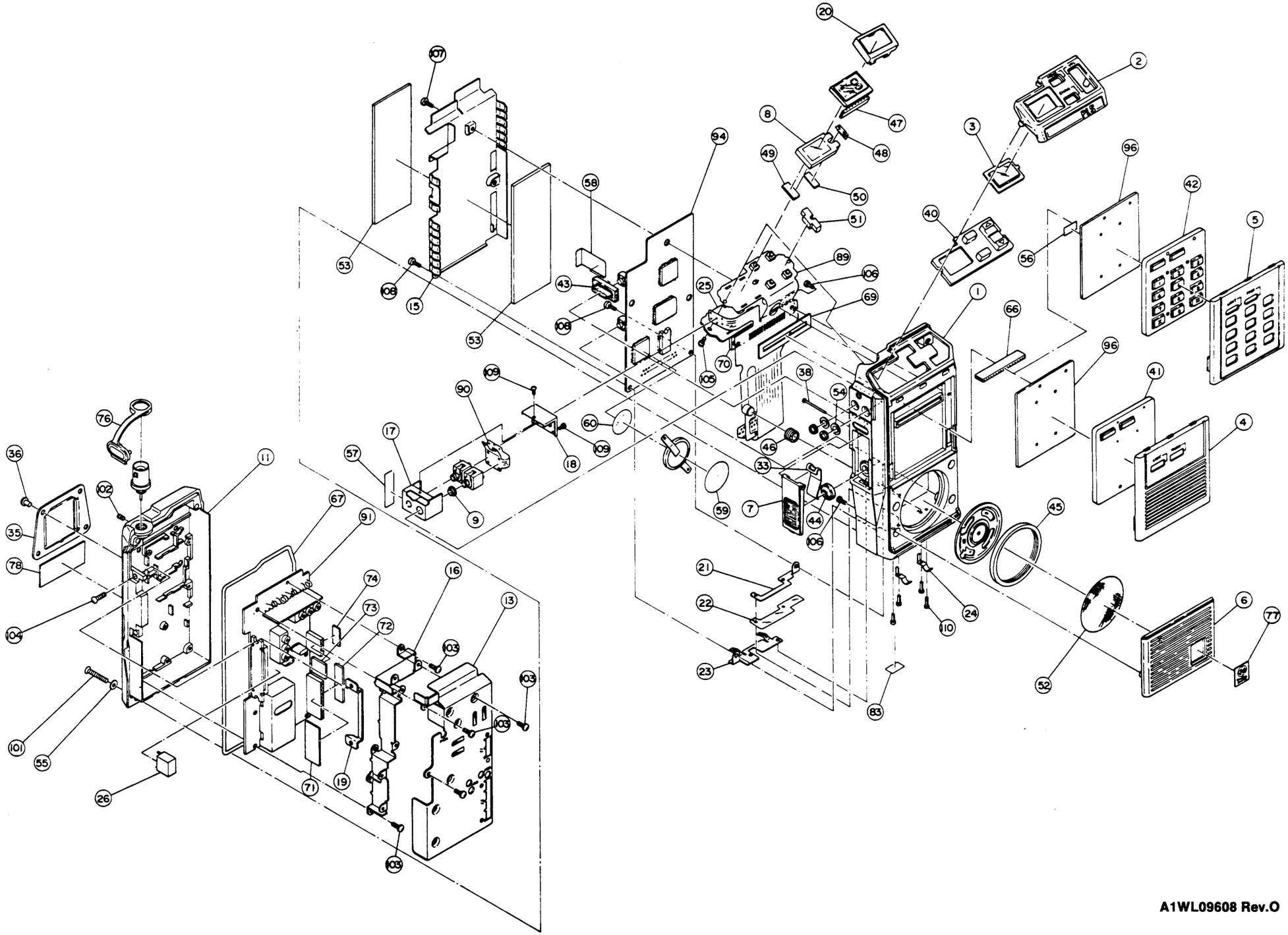


REAR VIEW FRONT VIEW

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

RC-5493B

800 mAh AND 1200 mAh
BATTERY PACKS



A1WL09608 Rev.O

PARTS LIST

LBI-31759

PLS UHF BAND
(MECHANICAL PARTS)

SYMBOL	GE PART NO.	DESCRIPTION
1	K19/A1WL08209	Frame.
2	K19/A2WL08165	Top Cover.
3	K19/A4WL08170	LCD Crystal.
4	K19/A2WL08167	Non-Keyset Insert.
5	K19/A2WL08166	Keyset Insert.
6	K19/A2WL08168	Speaker Escutcheon.
7	K19/A3WL08169	PTT Lever.
8	K19/A3WL08142	Lighting Board.
9	K19/A4WL08406	Spacer.
10		NOT USED
11	K19/A1WL08177	Cabinet Back.
12		NOT USED
13	K19/A3WL09555	RF Shield.
14		NOT USED
15	K19/A3WL08626	Logic Shield.
16	K19/A3WL09549	Shield Plate.
17	K19/A4WL08404	Jack Shield.
18	K19/A4WL08405	Jack Shield Cover.
19	K19/A4WL08715	Power Pack Bracket.
20	K19/A4WL08141	LCD Frame.
21	K19/A3WL08215	Positive Strap.
22	K19/A4WL08561	Insulator Sheet.
23	K19/A3WL08214	Negative Strap.
24	K19/A4WL08213	Battery Connector Spring.
25	K19/A3WL08598	Protector.
26	K19/A4WL09039	DBM Case.
27		NOT USED
28		NOT USED
29		NOT USED
30		NOT USED
31		NOT USED
32		NOT USED
33	K19/A4WL09379	PTT Spring.
34		NOT USED
35	K19/A3WL07509	Receptacle Plate.
36	K19/A4WL07694	Rivet.
37		NOT USED
38	K19/A4WL08175	Pivot Pin.
39		NOT USED
40	K19/A3WL08171	Top Key Pad.
41	K19/A2WL08130	Key Pad B.
42	K19/A2WL08129	Key Pad A.
43	K19/A3WL08172	Monitor Control Key.
44	K19/A4WL08173	PTT Pad.
45	K19/A4WL08153	Speaker Gasket.
46	K19/A4WL07594P1	MIC Gasket.
47	K19/A4WL08144	Inter Connector.
48	K19/A4WL08149	Himelon.
49	K19/A4WL08146	LCD Sponge A.
50	K19/A4WL08147	LCD Sponge B.
51	K19/A4WL08888	Top Sponge.
52	K19/A4WL08155	Speaker Dust Screen.
53	K19/A4WL09161	Sponge for Logic Shield.
54	K19/A4WL08205	Washer.
55	K19/A4WL08928	Washer.
56	K19/A4WL09189	Tape for Crystal.
57	K19/A4WL09190	Tape A.
58	K19/A4WL09191	Tape B.
59	K19/A4WL09192	Insulator for Battery.
60	K19/A4WL09193	Battery Tape.
61		NOT USED
62		NOT USED
63		NOT USED
64		NOT USED
65		NOT USED
66	K19/A4WL08154	Inter Connector L.
67	K19/A4WL09303	Housing Gasket.
68		NOT USED
69	K19/A4WL08563	Spacer.
70	K19/A4WL08595	Plate.
71	K19/A4WL09185	CN Spacer A.
72	K19/A4WL09186	CN Spacer B.
73	K19/A4WL09187	CN Spacer C.
74	K19/A4WL09188	CN Spacer D.
75		NOT USED
76	K19/A4WL09349	Jack Cover.
77	K19/A4WL07721	STD Nameplate (GE).
78	K19/A4WL08415	FCC Label (U04).
79		NOT USED
80		NOT USED
81		NOT USED
82		NOT USED
83	K19/A4WL09603	Serial Number Label.
84		NOT USED
85		NOT USED
86		NOT USED
87		NOT USED
88		NOT USED
89	K19/A2WL08896	Flexible P.W.B.
90	K19/A4WL08900	Jack Flexible P.W.B.
91	K19/A3WL08408	PLS UHF P.W.B.
92		NOT USED
93		NOT USED
94	K19/A3WL08741	Logic P.W.B. (2 Layer)
95		NOT USED
96	K19/A3WL08191	Option P.W.B.
97		NOT USED
98		NOT USED
99		NOT USED
100		NOT USED
101	K19/A4WL08543	Screw.
102	K19/3NAC026033	Screw.
103	K19/3NAX001116	Screw.
104	K19/3NAA009056	Screw.
105	K19/3NAD049034	Screw.
106	K19/3NAD049042	Screw.
107	K19/3NAD049026	Screw.
108	K19/3NAA405056	Screw.
109	K19/3NAA502134	Screw.
110	K19/3NAA502142	Screw.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

PLS UHF PERSONEL RADIO
A4WE04058

ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		UHF Radio Board
	A4WE04030	Control Board
	A4WE04031	Flexible Board
	A4WE04032	Key Board
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1 and C2	K19/2CAJ023094	Ceramic, 1000 pF.

PARTS LIST

PLS UHF RADIO BOARD
A4Z02903C

ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
A101	K19/2AAH025069	uPB571C
A102	K19/2AAH040027	MB87001P
A104	K19/2AAB004292	UPB1251BG2
A105	K19/2YAA181772	Crystal TCX-(1) A4WX01472
A106	K19/5UAD001115	VCO A4WX01579
A107	K19/2AAE053015	S-81250 TO-92
A108	K19/2AAE053015	S-81250 TO-92
A202	K19/2AAA013138	Hybrid IC A4WX01442-2M
A203	K19/2AAA021646	Hybrid IC KLH8514
A301	K19/2EDG002036	DBM UST-2L-LO A4WX01451
A302	K19/2AAJ008089	HA12442V
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C101	K19/2CAK005909	Ceramic chip: 100 pF ±5%, 50V.
C102	K19/2CAK005818	Ceramic chip: 22 pF ±5%, 50V.
C103 and C104	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C105	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C106	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C107	K19/2CAK005768	Ceramic chip: 10 pF ±0.5 pF, 50V.
C108	K19/2CBB033180	Electrolytic: 220 uF, 10V.
C109	K19/2CCF002072	Tantalum: 1 uF, 16V.
C110	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C111	K19/2CAK005768	Ceramic chip: 10 pF ±0.5 pF, 50V.
C112	K19/2CCF026173	Tantalum: 1 uF, 35V.
C113	K19/2CCC026157	Tantalum: 0.1 uF, 35V.
C114	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C115	K19/2CAK005685	Ceramic chip: 2 pF ±0.25%, 50V.
C116	K19/2CAK005693	Ceramic chip: 3 pF ±0.25%, 50V.
C117		NOT USED
C118 and C119	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C120	K19/2CCF002072	Tantalum: 1 uF, 16V.
C121	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C122	K19/2CBB033180	Electrolytic: 220 uF, 10V.
C123	K19/2CAK005909	Ceramic chip: 100 pF ±5%, 50V.
C124	K19/2CCF002072	Tantalum: 1 uF, 16V.
C125 and C126	K19/2CAK013309	Ceramic chip: 150 pF ±5%, 50V.
C127	K19/2CGD013064	Variable: TZB04N100BC
C128	K19/2CAK005818	Ceramic chip: 22 pF ±5%, 50V.
C129	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C130 thru C132	K19/2CCF002072	Tantalum: 1 uF, 16V.
C133	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C134	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C135	K19/2CAK005909	Ceramic chip: 100 pF ±5%, 50V.
C136	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C201	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C202	K19/2CAK005768	Ceramic chip: 10 pF ±0.5 pF, 50V.
C203 and C204	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C205	K19/2CAK005693	Ceramic chip: 3 pF ±0.25 pF, 50V.
C206 and C207	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C208	K19/2CAK005818	Ceramic chip: 22 pF ±5%, 50V.
C209 thru C217	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C218	K19/2CAK005727	Ceramic chip: 6 pF ±0.5 pF, 50V.
C219	K19/2CAK005719	Ceramic chip: 5 pF ±0.5 pF, 50V.
C220	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C221	K19/2CAK005701	Ceramic chip: 4 pF ±0.25 pF, 50V.
C222	K19/2CAK005669	Ceramic chip: 1.5 pF ±0.25 pF, 50V.
C223	K19/2CAK005701	Ceramic chip: 4 pF ±0.25 pF, 50V.
C224	K19/2CAK005693	Ceramic chip: 3 pF ±0.25 pF, 50V.
C225 and C226	K19/2CAK005743	Ceramic chip: 8 pF ±0.5 pF, 50V.
C227	K19/2CAK005685	Ceramic chip: 2 pF ±0.25 pF, 50V.
C228 and C229	K19/2CCC026264	Tantalum: 10 uF, 16V.
C230	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C231	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C232	K19/2CAK013010	Ceramic chip: 0.1 uF +80/-20%, 25V.
C233	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C234	K19/2CAK031010	Ceramic chip: 0.1 uF +80/-20%, 25V.
C235	K19/2CCF002072	Tantalum: 1 uF, 16V.
C240 thru C242	K19/2CAK005909	Ceramic chip: 100 pF ±5%, 50V.
C243	K19/2CAK013010	Ceramic chip: 0.1 uF +80/-20%, 25V.
C244 and C245	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C246	K19/2CAK013010	Ceramic chip: 0.1 uF +80/-20%, 25V.
C247	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C248	K19/2CAK013010	Ceramic chip: 0.1 uF +80/-20%, 50V.
C249	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C301	K19/2CCF002072	Tantalum: 1 uF, 16V.
C302 and C303	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C304	K19/2CAK005792	Ceramic chip: 15 pF ±5%, 50V.
C305	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C306	K19/2CAK005375	Ceramic chip: 7 pF ±0.5 pF, 50V.
C307	K19/2CAK005743	Ceramic chip: 8 pF ±0.5 pF, 50V.
C308	K19/2CAK005784	Ceramic chip: 12 pF ±5%, 50V.
C309	K19/2CAK005735	Ceramic chip: 7 pF ±0.5 pF, 50V.
C310	K19/2CCF002072	Tantalum: 1 uF, 16V.
C311	K19/2CAK005784	Ceramic chip: 12 pF ±5%, 50V.
C312	K19/2CCF002072	Tantalum: 1 uF, 16V.
C313	K19/2CAK005375	Ceramic chip: 7 pF ±0.5 pF, 50V.
C314	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C315 and C316	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C317	K19/2CAK005669	Ceramic chip: 1 pF ±0.25 pF, 50V.
C318	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C319	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C320	K19/2CAK005669	Ceramic chip: 1 pF ±0.25 pF, 50V.
C321	K19/2CAK005818	Ceramic chip: 22 pF ±5%, 50V.
C322	K19/2CAK013127	Ceramic chip: 1000 pF ±10%, 50V.
C323	K19/2CAK005867	Ceramic chip: 47 pF ±5%, 50V.
C324	K19/2CAK013119	Ceramic chip: 0.01 uF ±10%, 50V.
C325	K19/2CAK005792	Ceramic chip: 15 pF ±5%, 50V.
C326	K19/2CAK005842	Ceramic chip: 33 pF ±5%, 50V.
C327 and C328	K19/2CCF002072	Tantalum: 1 uF, 16V.
C329	K19/2CAK005743	Ceramic chip: 8 pF ±0.5 pF, 50V.
C330	K19/2CAK005925	Ceramic chip: 330 pF ±10%, 50V.
C331	K19/2CCF002072	Tantalum: 1 uF, 16V.
C332	K19/2CAK005768	Ceramic chip: 10 pF ±0.5 pF, 50V.
C333 and C334	K19/2CCF002072	Tantalum: 1 uF, 16V.
		- - - - - - - - - - DIODES - - - - - - - - - -
CR201 and CR202	K19/2QBE004035	MA57-TX
CR301	K19/2QBE005016	DAN202K T-96
CR302	K19/2QBE005024	DAP202K T-96
CR303	K19/2QBA006166	1S2075K
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL301 and FL302	K19/2FBD001620	BPF 450-470 MHz A4WX01577
FL303 and FL304	K19/2FAA103082	Crystal Filter A4WX01449 45 MHz
FL305	K19/2FAD001572	Ceramic Filter CFWMA455E
		- - - - - - - - - - JACKS - - - - - - - - - -
J101	K19/2PDA023044	69775-011
J102	K19/2PDA023036	69775-005
		- - - - - - - - - - COILS - - - - - - - - - -
L101		NOT USED
L102	K19/2LAD001203	Inductor NL322522T-018M
L201	K19/2LAB013044	Inductor 0.5 UEW ø 2 2T A4WX00027-2
L202		NOT USED
L203	K19/2LAB013127	Inductor 0.5 UEW ø 2 10T A4WX00027-2
L204	K19/2LAB013051	Inductor 0.5 UEW ø 2 3T A4WX00027-2
L205	K19/2LAD001161	Inductor NL322522T-047M A4WX00027-2
L206	K19/2LAA001743	Inductor LAL02KR R47M
L207	K19/2LAB015106	Coil 3 ø 2T A4WX01582
L208	K19/2LAB015098	Coil 2 ø 2T
L209	K19/2LAB015106	Coil 3 ø 2T
L210	K19/2LAB015098	Coil 2 ø 2T
L211	K19/2LAA001743	Inductor LAL02KR R47M
L212	K19/2LAB013044	Inductor 0.5 UEW ø 2 2T A4WX00027-2
L301 thru L303	K19/2LAB013051	Inductor 0.5 UEW ø 2 3T A4WX00027-2

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
L304	K19/2LAB015072	Coil A4WX01456
L305	K19/2LAD001229	Inductor MLF321606A1ROM
L306	K19/2LAB015072	Coil A4WX01456
L307	K19/2LAD001229	Inductor MLF321606A1ROM
L308	K19/2LAD001260	Inductor MLF322522T-R15M
L309	K19/2LAD001302	Inductor MLF322522T-027M
L310		NOT USED
L311	K19/2LAD001195	Inductor MLF322522T-039M
L312	K19/2LAB015064	Coil A4WX01457
L313	K19/2LAB015080	Coil A4WX01458
L314	K19/2LAD001211	Inductor MLF3216DR68K
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q101		NOT USED
Q102	K19/2QAD001026	2SA1121SBTL
Q103	K19/2QAD001042	2SC2618SBTL
Q104	K19/2QAD005076	2SD1781KT-96
Q105		NOT USED
Q106		NOT USED
Q107	K19/2QAD004020	2SC3356-T2B
Q108	K19/2QAD005076	2SD1781KT-96
Q109	K19/2QAD005084	2SB1188-T101
Q201	K19/2QAD005076	2SD1781KT-96
Q202	K19/2QAD005084	2SB1188-T101
Q203	K19/2QAD005076	2SD1781KT-96
Q204	K19/2QAD004020	2SC3356-T2B
Q205	K19/2QAD004038	2SC3357-T1B
Q206	K19/2QAB015077	2SB1169
Q301 thru Q304	K19/2QAD004020	2SC3356-T2B
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R101		NOT USED
R102	K19/2RGC001544	Square chip: 220 ohms ±5%, 1/10W.
R103 and R104	K19/2RGC001502	Square chip: 10 ohms ±5%, 1/10W.
R105	K19/2RGC001593	Square chip: 2.2K ohms ±5%, 1/10W.
R106 and R107	K19/2RGC001619	Square chip: 4.7K ohms ±5%, 1/10W.
R108	K19/	Square chip: 0 ohms ±5%, 1/10W.
R109	K19/2RGC001627	Square chip: 10K ohms ±5%, 1/10W.
R110	K19/2RGC001577	Square chip: 680 ohms ±5%, 1/10W.
R111	K19/2RGC001700	Square chip: 1.5K ohms ±5%, 1/10W.
R112	K19/2RGC001577	Square chip: 680 ohms ±5%, 1/10W.
R113	K19/2RGC001601	Square chip: 3.3K ohms ±5%, 1/10W.
R114	K19/2RGC001502	Square chip: 10 ohms ±5%, 1/10W.
R115	K19/2RGC001726	Square chip: 47K ohms ±5%, 1/10W.
R116		NOT USED
R117		NOT USED
R118		NOT USED
R119	K19/2RGC001528	Square chip: 100 ohms ±5%, 1/10W.
R120	K19/2RGC001551	Square chip: 330 ohms ±5%, 1/10W.
R121	K19/2RGC001585	Square chip: 1K ohms ±5%, 1/10W.
R122	K19/2RGC004126	Square chip: 15K ohms ±5%, 1/10W.

SYMBOL	GE PART NO.	DESCRIPTION
R123	K19/2RGC001627	Square chip: 10K ohms ±5%, 1/10W.
R124	K19/2RGC001585	Square chip: 1K ohms ±5%, 1/10W.
R125	K19/2RGC001726	Square chip: 47K ohms ±5%, 1/10W.
R126	K19/2RFB017063	Variable: RGS6-FAN 10K ohms.
R127	K19/2RGC001635	Square chip: 22K ohms ±5%, 1/10W.
R128	K19/2RGC001502	Square chip: 10 ohms ±5%, 1/10W.
R129	K19/2RGC001619	Square chip: 4.7K ohms ±5%, 1/10W.
R130	K19/2RGC001502	Square chip: 10 ohms ±5%, 1/10W.
R131	K19/2RGC001593	Square chip: 2.2K ohms ±5%, 1/10W.
R201	K19/2RGC001585	Square chip: 1K ohms ±5%, 1/10W.
R202	K19/2RGC001643	Square chip: 100K ohms ±5%, 1/10W.
R203 and R204	K19/2RGC001619	Square chip: 4.7K ohms ±5%, 1/10W.
R205 and R206	K19/2RGC001627	Square chip: 10K ohms ±5%, 1/10W.
R207	K19/2RGC001601	Square chip: 3.3K ohms ±5%, 1/10W.
R208	K19/2RGC001619	Square chip: 4.7K ohms ±5%, 1/10W.
R209	K19/2RGC001544	Square chip: 220 ohms ±5%, 1/10W.
R210	K19/2RGC001957	Square chip: 22 ohms ±5%, 1/10W.
R211	K19/2RGC001544	Square chip: 220 ohms ±5%, 1/10W.
R212	K19/2RGC001619	Square chip: 4.7K ohms ±5%, 1/10W.
R213	K19/2RGC001726	Square chip: 47K ohms ±5%, 1/10W.
R214	K19/2RGC001619	Square chip: 4.7K ohms ±5%, 1/10W.
R215	K19/2RGC001635	Square chip: 22K ohms ±5%, 1/10W.
R216	K19/2RFB017063	Variable: RGS6-FAN 10K ohms.
R217	K19/2RGC001569	Square chip: 470 ohms ±5%, 1/10W.
R218	K19/2RGC001700	Square chip: 1.5K ohms ±5%, 1/10W.
R219	K19/2RGC004266	Square chip: 33 ohms ±5%, 1/10W.
R220	K19/2RGC001551	Square chip: 330 ohms ±5%, 1/10W.
R221	K19/2RGC001585	Square chip: 1K ohms ±5%, 1/10W.
R222	K19/2RGC001957	Square chip: 22 ohms ±5%, 1/10W.
R223	K19/2RGC001502	Square chip: 10 ohms ±5%, 1/10W.
R224 and R225	K19/2RGC001569	Square chip: 470 ohms ±5%, 1/10W.
R226	K19/2RGC001627	Square chip: 10K ohms ±5%, 1/10W.
R227 and R228	K19/2RGC001551	Square chip: 330 ohms ±5%, 1/10W.
R229	K19/2RGC001585	Square chip: 1K ohms ±5%, 1/10W.
R230	K19/2RGC001809	Square chip: 47 ohms ±5%, 1/10W.
R301	K19/2RGC001544	Square chip: 220 ohms ±5%, 1/10W.
R302	K19/2RGC001825	Square chip: 220K ohms ±5%, 1/10W.
R303	K19/2RGC001577	Square chip: 680 ohms ±5%, 1/10W.
R304	K19/2RGC004449	Square chip: 150K ohms ±5%, 1/10W.
R305	K19/2RGC001718	Square chip: 6.8K ohms ±5%, 1/10W.
R306	K19/2RGC001536	Square chip: 150 ohms ±5%, 1/10W.
R307	K19/2RGC001585	Square chip: 1K ohms ±5%, 1/10W.
R308	K19/2RGC004449	Square chip: 150K ohms ±5%, 1/10W.
R309	K19/2RGC001650	Square chip: 68 ohms ±5%, 1/10W.
R310	K19/2RGC001718	Square chip: 6.8K ohms ±5%, 1/10W.
R311	K19/2RGC001551	Square chip: 330 ohms ±5%, 1/10W.
R312	K19/2RGC001544	Square chip: 220 ohms ±5%, 1/10W.
R313	K19/2RGC001700	Square chip: 1.5K ohms ±5%, 1/10W.
R314	K19/2RGC001635	Square chip: 22K ohms ±5%, 1/10W.

SYMBOL	GE PART NO.	DESCRIPTION
R315	K19/2RGC001817	Square chip: 33K ohms ±5%, 1/10W.
R316	K19/2RGC001627	Square chip: 10K ohms ±5%, 1/10W.
		- - - - - - - - - - THERMISTORS - - - - - - - - - -
TH301	K19/2QBD016139	NTCDS3018 3HG103HC
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
Y301	K19/2YAA181723	44.545 MHz A4WX01448

PARTS LIST

PLS CONTROL BOARD
A4WE04030

ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
A1 and A2	K19/2AAE053023	Voltage Regulator, S-81250HG-RD-T1
A3	K19/2AAE053049	Voltage Detector, S-8054ALR-LN-T1
A4 and A5	K19/2AAB004284	OP AMP, uPC451G2-T1
A6	K19/2ADA004404	MICRO PROCESSOR, HD63705VOF
A7	K19/2ACA017382	S-RAM, TC5517AFL-2
A8	K19/2ADC003107	LCD Driver, uPD7225G
A9	K19/2AAJ016017	Audio Processor, STC 9140F
A10	K19/2AAJ010036	Audio IC, NJM2073D
		- - - - - - - - - - LITHIUM BATTERY - - - - - - - - -
BT1	K19/5PBA002052	CR2032-T4
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	K19/2CAK013010	Ceramic chip, 0.1 uF
C2 thru C5	K19/2CCF002072	Tantalum, 1 uF
C6 and C7	K19/2CAK013010	Ceramic chip, 0.1 uF
C8	K19/2CCF002122	Tantalum, 0.47 uF
C9	K19/2CAK005917	Ceramic chip, 220 pF
C10 and C11	K19/2CAK013127	Ceramic chip, 1000 pF
C12	K19/2CAK013010	Ceramic chip, 0.1 uF
C14	K19/2CCF002072	Tantalum, 1 uF
C15	K19/2CAK005933	Ceramic chip, 470 pF
C16	K19/2CCF002072	Tantalum, 1 uF
C17	K19/2CAK005818	Ceramic chip, 22 pF
C18	K19/2CAK005685	Ceramic chip, 2 pF
C19	K19/2CAK005818	Ceramic chip, 22 pF
C20	K19/2CAK013119	Ceramic chip, 0.01 uF
C21 and C22	K19/2CCF002072	Tantalum, 1 uF
C23	K19/2CAK013119	Ceramic chip, 0.01 uF
C24	K19/2CAK005909	Ceramic chip, 100 pF
C25	K19/2CAK013010	Ceramic chip, 0.1 uF
C26	K19/2CAK013119	Ceramic chip, 0.01 uF
C27	K19/2CAK013135	Ceramic chip, 0.015 uF
C28	K19/2CAK013176	Ceramic chip, 0.033 uF
C29	K19/2CCF006024	Tantalum, 6.8 uF
C30 thru C32	K19/2CBJ001577	Electrolytic, 68 uF
C33	K19/2CAK013119	Ceramic chip, 0.01 uF
C34	K19/2CAK013143	Ceramic chip, 3300 pF
C35 and C36	K19/2CAK013010	Ceramic chip, 0.1 uF
C37	K19/2CCF002072	Tantalum, 1 uF
C38	K19/2CAK013010	Ceramic chip, 0.1 uF
C39	K19/2CBJ001577	Electrolytic, 68 uF
C40	K19/2CAK013010	Ceramic chip, 0.1 uF
C41	K19/2CAK005867	Ceramic chip, 47 pF
C42	K19/2CAK013010	Ceramic chip, 0.1 uF
C45 thru C47	K19/2CAK005933	Ceramic chip, 470 pF
C49	K19/2CAK005933	Ceramic chip, 470 pF
C50 thru C55	K19/2CAK013010	Ceramic chip, 0.1 uF
C57 thru C65	K19/2CAK013119	Ceramic chip, 0.01 uF
C66 thru C72	K19/2CAK005917	Ceramic chip, 220 pF
C73	K19/2CAK013010	Ceramic chip, 0.1 uF
C74	K19/2CAK005917	Ceramic chip, 220 pF
C75 thru C77	K19/2CAK005909	Ceramic chip, 100 pF
C78	K19/2CAK013127	Ceramic chip, 1000 pF
C79	K19/2CAK013010	Ceramic chip, 0.1 uF
C80	K19/2CAK005917	Ceramic chip, 220 pF
C81	K19/2CAK013119	Ceramic chip, 0.01 uF
C82	K19/2CAK013010	Ceramic chip, 0.1 uF
C83	K19/2CAK005917	Ceramic chip, 220 pF
C84	K19/2CAK013119	Ceramic chip, 0.01 uF
C85	K19/2CAK005917	Ceramic chip, 220 pF
C86	K19/2CCF002072	Tantalum, 1 uF
C87	K19/2CAK013119	Ceramic chip, 0.01 uF
		- - - - - - - - - - DIODES - - - - - - - - - -
CR1 thru CR3	K19/2QBE005016	DAN202KT-96
CR4 and CR5	K19/2QBE005032	DA204KT-96
CR6	K19/2QBE005016	DAN202KT-96
		- - - - - - - - - - - FUSES - - - - - - - - - - -
F1	K19/2DDB010183	251005
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P1	K19/2PDA023101	65646-211
P2	K19/2PDA023093	65646-205
P3	K19/2PDA023192	68907-110
	K19/2PDA023184	68907-105
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1 thru Q3	K19/2QAD001034	NPN, 2SC2462LCTL
Q4	K19/2QAD001026	PNP, 2SA1121SBTL
Q5	K19/2QAD001034	NPN, 2SC2462LCTL
Q6	K19/2QAD001026	PNP, 2SA1121SBTL
Q8	K19/2QAD001026	PNP, 2SA1121SBTL
Q9	K19/2QAD001034	NPN, 2SC2462LCTL
Q10	K19/2QAD001026	PNP, 2SA1121SBTL
Q11 and Q12	K19/2QAD001034	NPN, 2SC2462LCTL
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1 thru R3	K19/2RGC001585	Square chip, 1/10W, 1K ohm ±5%
R4 and R5	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R6	K19/2RGC001585	Square chip, 1/10W, 1K ohm ±5%
R7	K19/2RGC001825	Square chip, 1/10W, 220K ohm ±5%
R8	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R9	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R10	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R11	K19/2RGC001619	Square chip, 1/10W, 4.7K ohm ±5%
R12 and R13	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R14 thru R18	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R19 thru R27	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R28 thru R31	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R32	K19/2RGC001734	Square chip, 1/10W, 180K ohm ±5%
R33	K19/2RGC001528	Square chip, 1/10W, 100 ohm ±5%
R34 thru R40	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R41 and R42	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R43	K19/2RGC001528	Square chip, 1/10W, 100 ohm ±5%
R44	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R45	K19/2RGC001791	Square chip, 1/10W, 10M ohm ±5%
R46 thru R48	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R49	K19/2RGC004464	Square chip, 1/10W, 43K ohm ±5%
R50 and R51	K19/2RGC004381	Square chip, 1/10W, 7.5K ohm ±5%
R52	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R53	K19/2RGC001759	Square chip, 1/10W, 470K ohm ±5%
R54	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R55	K19/2RGC001759	Square chip, 1/10W, 470K ohm ±5%
R56	K19/2RGC001825	Square chip, 1/10W, 220K ohm ±5%
R57	K19/2RGC001817	Square chip, 1/10W, 33K ohm ±5%
R58	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R59	K19/2RGC001726	Square chip, 1/10W, 47K ohm ±5%
R60 and R61	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R62	K19/2RGC001841	Square chip, 1/10W, 4.7 ohm ±5%
R63 and R64	K19/2RGC001585	Square chip, 1/10W, 1K ohm ±5%
R65	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R66	K19/2RGC001759	Square chip, 1/10W, 470K ohm ±5%
R67	K19/2RGC001726	Square chip, 1/1-W, 47K ohm ±5%
R68	K19/2RGC001817	Square chip, 1/10W, 33K ohm ±5%
R69	K19/2RGC001726	Square chip, 1/10W, 47K ohm ±5%
R70	K19/2RGC001817	Square chip, 1/10W, 33K ohm ±5%
R71	K19/2RGC001635	Square chip, 1/10W, 22K ohm ±5%

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

SYMBOL	GE PART NO.	DESCRIPTION
R72	K19/2RGC001759	Square chip, 1/10W, 470K ohm ±5%
R73	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R74	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R75	K19/2RGC001585	Square chip, 1/10W, 1K ohm ±5%
R76	K19/2RGC001833	Square chip, 1/10W, 2.2 ohm ±5%
R77	K19/2RGC001593	Square chip, 1/10W, 2.2K ohm ±5%
R78	K19/2RGC001726	Square chip, 1/10W, 47K ohm ±5%
R79 and R80	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R81 and R82	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R83	K19/2RGC004449	Square chip, 1/10W, 150K ohm ±5%
R84	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R85	K19/2RGC001759	Square chip, 1/10W, 470K ohm ±5%
R86	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R87	K19/2RGC001593	Square chip, 1/10W, 2.2K ohm ±5%
R88	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R89	K19/2RGC001726	Square chip, 1/10W, 47K ohm ±5%
R90	K19/2RGC001783	Square chip, 1/10W, 3.3M ohm ±5%
R91 and R92	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R93 and R94	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R95	K19/2RGC001726	Square chip, 1/10W, 47K ohm ±5%
R96	K19/2RGC001544	Square chip, 1/10W, 220 ohm ±5%
R97	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R98	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R99	K19/2RGC001593	Square chip, 1/10W, 2.2K ohm ±5%
R100	K19/2RGC001726	Square chip, 1/10W, 47K ohm ±5%
R101	K19/2RGC001833	Square chip, 1/10W, 2.2 ohm ±5%
R102	K19/2RGC001593	Square chip, 1/10W, 2.2K ohm ±5%
R103	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R104	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R105	K19/2RGC001825	Square chip, 1/10W, 220K ohm ±5%
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1 and S2	K19/2KJA001042	B3F-3120
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
Y1	K19/2YAA181665	AT-41 3.579545 MHz A4WX01429
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
XY1	K19/2YYZ001062	NB-0252-0.5t

PARTS LIST

PLS FLEX BOARD
A4WE04031

ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 thru C5		uDF4Y102
		- - - - - - - - - - - - LED - - - - - - - - - - - -
CR1	K19/2HAA005343	GL-1EG1
		- - - - - - - - - - - - JACKS - - - - - - - - - - - -
J1 and J2	K19/2PFA001128	S-G8512
		- - - - - - - - - - LCD DISPLAY - - - - - - - - - -
LCD	K19/2DCA005111	T164009
		- - - - - - - - - ELECTRIC MICROPHONE - - - - - - - - -
MIC	K19/2SAA006109	EM-78
		- - - - - - - - - - KEY BOARD SWITCH - - - - - - - - - -
S1 thru S4	K19/2KJA018053	JPM 1990-0101
		- - - - - - - - - - - - SPEAKER - - - - - - - - - - - -
SP1	K19/2SDA005147	T040S13

PARTS LIST

PLS TYPE 99/DTMF BOARD
A4WE03822

ISSUE 1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
A1	K19/2ADA004412	Micro Processor, HD637B01X0F
A2	K19/2ABD025020	N-H-CMOS, uPD74HC14G-T1
A3	K19/2AAB004284	OP AMP, uPC451G2-T1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	K19/2CCF002072	Tantalum, 1 uF
C2	K19/2CAK013143	Ceramic chip, 3300 pF
C3	K19/2CAK013119	Ceramic chip, 0.01 uF
C4	K19/2CAK005867	Ceramic chip, 47 pF
C5 thru C7	K19/2CAK013135	Ceramic chip, 0.015 uF
C8	K19/2CAK013119	Ceramic chip, 0.01 uF
C9 and C10	K19/2CCF002072	Tantalum, 1 uF
C11	K19/2CAK013010	Ceramic chip, 0.1 uF
C12 and C13	K19/2CAK005792	Ceramic chip, 15 pF
C14	K19/2CAK013135	Ceramic chip, 0.015 uF
		- - - - - - - - - - DIODES - - - - - - - - - -
CR1	K19/2QBE005016	DAN202KT-96
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	K19/2QAD001026	PNP 2SA1121SBTL
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1 thru R4	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R5	K19/2RGC004126	Square chip, 1/10W, 15K ohm ±5%
R6	K19/2RGC001775	Square chip, 1/10W, 1M ohm ±5%
R7	K19/2RGC001700	Square chip, 1/10W, 1.5K ohm ±5%
R8 and R9	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R10	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R11	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R12	K19/2RGC001775	Square chip, 1/10W, 1M ohm ±5%
R13	K19/2RGC001726	Square chip, 1/10W, 47K ohm ±5%
R14	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R15	K19/2RGC001726	Square chip, 1/10W, 47K ohm ±5%
R16	K19/2RGC001825	Square chip, 1/10W, 220K ohm ±5%
R17 and R18	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R19	K19/2RGC003305	Square chip, 1/10W, 2.2M ohm ±5%
R20	K19/2RGC001775	Square chip, 1/10W, 1M ohm ±5%
R21	K19/2RGC001759	Square chip, 1/10W, 470K ohm ±5%
R22	K19/2RGC001825	Square chip, 1/10W, 220K ohm ±5%
R23	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R24	K19/2RGC001726	Square chip, 1/10W, 47K ohm ±5%
R25	K19/2RGC001635	Square chip, 1/10W, 22K ohm ±5%
R26 thru R29	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
R30 and R31	K19/2RGC001643	Square chip, 1/10W, 100K ohm ±5%
R32	K19/2RGC001627	Square chip, 1/10W, 10K ohm ±5%
		- - - - - - - - - - CRYSTALS - - - - - - - - - -
Y1	K19/2YAA181749	SAT-310, 8 MHz, A4WX01728

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES