ERICSSON

LBI-38460C

Mobile Communications

EDACS® M-PA™ 806-870 MHz PORTABLE RADIO

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FRONT COVER ASSEMBLY (LATER)
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Maintenance Manual

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NOTE

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SPECIFICATIONS*

GENERAL

Frequency Range	806-870 MHz
FCC Type Acceptance Number	AXATR-188-A2
DOC Number	TR-188-D2
Frequency Stability	1.5 ppm
Channel Spacing	25 kHz (12.5 kHz NPSPAC channels)
Operating Temperature Range	-30°C to +60°C
Maximum Relative Humidity	90% at 55°C
Battery Voltage	7.5 Vdc (nominal)
Dimensions (H x W x D)	
less battery, knobs and antenna	140 x 69 x 38 mm (5.52 x 2.72 x 1.50")
with Extra High Cap. Battery	232 x 69 x 40 mm (9.15 x 2.72 x 1.58")
Weight	
less battery	585 grams (20.6 ounces)
with Extra High Cap. Battery	952 grams (33.6 ounces)

TRANSMITTER

Frequency Range	806 - 825 MHz 851 - 870 MHz (repeater talkaround)
High/Low RF Power Output	3 Watts / 1 Watt (programmable on a per system or channel basis)
Maximum Frequency Separation	19 MHz (no degradation)
FM Deviation	±5 kHz
FM Hum and Noise	-40dB (companion receiver)
Spurious and Harmonic Emissions	-51 dBc
Audio Response	+1 to -3dB (6 dB/octave pre-emphasis from 300 Hz to 3 kHz)
Audio Distortion	less than 3% (at 1000 Hz tone, 3 kHz deviation)

RECEIVER

Frequency Range	851 - 870 MHz
Sensitivity (12 dB SINAD)	-116 dBm (0.35 µV)
Maximum Frequency Separation	19 MHz (no degradation)
Selectivity	-67dB at 25 kHz (-20 dB at 12.5 kHz NPSPAC channels)
Critical Squelch	6 dB SINAD
Intermodulation	-67dB
Spurious and Image Rejection	-72dB
Audio Output	500 mW (24-ohm load impedance)
Audio Response	+2 to -8dB (6 dB/octave de-emphasis from 300 Hz to 3 kHz)
Audio Distortion	less than 5% (at 500 mW)

* These specifications are intended primarily for the use of the serviceman. See the appropriate Specifications Sheet for the complete specifications.

INTRODUCTION

The EDACS M-PA radio is a high quality microprocessor-controlled synthesized portable two-way FM radio. The unit complements the EDACS trunked system by providing a small, rugged, easy to operate and easy to program portable radio for the 800 MHz trunking environment. The radio also provides conventional communications in the 800 MHz spectrum. M-PA operation is highlighted by its programming versatility. This allows tailored operation of the portable radio to meet the needs of the radio system and the individual users.

The EDACS M-PA radio meets or exceeds all of the APCO 16 portable radio equipment requirements for digitally trunked and conventional communications. NPSAPC capability is also built-in since the radio will operate in the 6 MHz band of narrow channels in the 800 MHz spectrum.

Three (3) different M-PA radio models are available: Select, Scan and System.

The M-PA Select model radio is the basic version that can be programmed with up to sixteen (16) independent trunked groups and/or conventional channels. This unit features an eight-digit alphanumeric liquid crystal display (LCD) and a 16-position knob for group/channel selection. The display is backlit for nighttime and low-level ambient light operation.

Scan and System model radios have an LCD similar to the Select model radio. A keypad is added to these radios (4-button on Scan model, 16-button on System model) to provide additional features not available on the Select model radio. These radios can be programmed with up to fifty (50) systems with sixteen (16) groups in each, or sixteen (16) systems with fifty (50) groups in each. In addition, up to forty-eight (48) conventional channels and ninety-nine (99) special calls can be programmed. Special calls include individual and telephone interconnect calls. A System model radio also allows storage of ten (10) operator-entered telephone numbers and ten (10) radio ID numbers. These numbers can be recalled at will and initiated. Manually dialled telephone interconnect calls and conventional mode DTMF dialing is also provided by the System model's 16-button keypad. Both the Scan and System model radios provide scan capability.

TRUNKED FEATURES

- **Programmable Multiple System Capability** - The radio can operate on different trunked sites or on different systems on the same site. Scan and System model radios can be programmed with a maximum of fifty (50) systems with a maximum of sixteen (16) groups in each system. A Select model radio can be programmed with a maximum of sixteen (16) systems with one group in each.
- **Programmable Multiple Group Capability** - The radio can communicate with many groups within a system. Scan and System model radios can be programmed with a maximum of fifty (50) groups per system. If the Control Knob is programmed for group selection, up to sixteen (16) groups can be selected and system selection (50 maximum) is accomplished with the STEP button on the keypad. If the Control Knob is programmed for system selection, up to sixteen (16) systems can be selected and then up to fifty (50) groups can be selected via the STEP button. In a Select model radio, a maximum of sixteen (16) groups (from one or more systems) can be programmed and selected with the Control Knob.
- **Programmable Group Call Capability** - The radio can simultaneously call all units within a group.
- **Special Call Mode** - Scan and System model radios can initiate special calls. These calls include individual and telephone interconnect calls. Up to ninety-nine (99) special calls can be programmed into the radio. Special calls cannot be programmed into a Select model radio; therefore, these radios cannot initiate special calls.
- **Remote Dynamic Regrouping Capability** - The dispatch center can regroup radios for multiagency communications.
- **Remote Disable** - If lost or stolen, the radio can be remotely disabled by the System Manager.
- **Wide Area System Scan Capability** - This feature, for multi-site applications, allows the radio to automatically roam from one system to another when the current control channel is lost or on a priority scan timer basis. In the event of a loss of the current system's control channel, the radio can be programmed to automatically scan for control channels of up to six other systems. If a new control channel is found, the radio will switch to the new system and sound an alert tone. Group selection may change upon switching to the new system. The radio can also be programmed for priority wide area system scan. A priority system can be assigned to each system programmed into the radio. Radios programmed in this manner will scan for the priority trunked system's control channel once every one, two, three or four minutes (programmable). This priority scan timer is reset each time the PTT button is pressed.

CONVENTIONAL FEATURES

- **48-Channel Capability** - Scan and System model radios can be programmed with up to forty-eight conventional channels.
- **Programmable Multi-Tone Channel Guard (CTCSS)** - Channel Guard tone frequencies within the range of 67 Hz to 210.7 Hz, including all of the standard E1A frequencies, can be programmed for encoded/decoded operation.
- **Programmable Multi-Code Digital Channel Guard** - Similar capability as with tone Channel Guard is provided.
- **Two-Tone Sequential (T99) Decode** - Selective calling decode is enabled or disabled on each individual channel. Two (2) sets of unique decodes are programmable to allow large systems individual and group call capability. Sets are selectable on a system basis.
- **Channel Busy Lockout** - Personality information includes transmit disable capability on a channel where carrier activity is present. This feature is selectable on an overall radio basis.
- **Repeater Talkaround** - Allows communication with another portable or mobile radio when out of range of the repeater.

GENERAL FEATURES

- **Rotary Control Knob** - The 16-position top-mounted Control Knob allows easy selection of systems, groups or conventional channels according to how the radio is programmed. A stop-plate may be installed under the knob to limit the maximum number of position to less than sixteen (16). It is normally factory installed for fifteen (15) positions.
- **Volume Control Knob** - This rotatable control provides quick and easy adjustments to the volume level. Minimum volume levels can be programmed into the unit. This feature prevents missed calls due to a low volume setting.
- **Backlit Liquid Crystal Display** - The 8-digit alphanumeric LCD provides programmable customization and feedback to the operator of various operating conditions. Status flags located above and below the digits alert the operator to various radio conditions such as no control channel, conventional mode enabled, transmitter in operation and a low battery condition. Scan and System model radios have additional status flags for scan and special call operation. LCD backlighting can be enabled or disabled on a per group or channel basis.
- **Keypad** - A Scan model radio has a 4-button keypad on its front panel that provides special call and scan control. A System model radio has a 16-button keypad. The top four buttons on a System model keypad are identical to the Scan model keypad, providing special call and scan control. The lower twelve (12) buttons form a numeric keypad that allows enhanced special call control, manual dialing of telephone inter-connect calls and control of various other features of the System model radio. Select model radios do not have a keypad.
- **Scan Operation** - Scan and System model radios can scan the trunked groups and conventional channels programmed into the radio. Groups which have been previously added to the scan list (via the keypad) can be scanned. In conventional mode, the radio can be configured for a keypad entered scan list, a fixed (programmed) scan list, a fixed priority-one scan channel, or the selected channel as the priority-one scan channel. Dual-priority scan is supported in conventional mode. The Select model radio does not support scan operation.
- **Telephone Interconnect** - When operating in trunked mode, the special call mode (Scan and System models only) allows operator selection and transmission of telephone calls (numbers) programmed into the radio. Telephone inter-connect is performed by the site. The numeric keypad on a System model radio permits manual dialing of telephone numbers. Conventional mode DTMF operation is also supported by this numeric keypad on the front panel. A Select model radio cannot initiate telephone interconnect calls.
- **Programmable via the Universal Device Connector (UDC)** - The entire operation of the radio can be field customized by programming the unit using an IBM PC or compatible computer. The programmed personality is stored in non-volatile memory within the radio.
- **Simple Remote Control Capability** - External accessories can be connected to the UDC such as a headset, a speaker-mic or a lanyard. Connection of the speaker-mic allows the operator to remotely control PTT operation and audio level of the external speaker. An antenna jack is located on the UDC for the connection of a remote mounted antenna such as when the radio is used in a vehicular charger or repeater.
- **Emergency Signalling Feature** - Pressing a single recessed button instantly sends an alert message on a preprogrammed channel. The radio ID number is

transmitted and the unit is given top priority in the system. Emergency signalling can also be enabled by a lanyard connected to the UDC. The radio supports GE-STAR emergency signalling for conventional mode operations.

- **Programmable Carrier Control Timer** - A programmable transmit timer will automatically disable the transmitter and provide an alerting tone after time-out. This feature prevents radio damage and unnecessary channel traffic in the event of a "stuck" mic. The CCT is reset on every PTT.
- **Programmable Transmit Power Level** - Transmitter power level is PC programmable into the radio (high or low) on a per channel basis.
- **Automatic Squelch** - Squelch operation in trunked mode is automatically controlled. In conventional mode, squelch threshold can be programmed on a per channel basis. Squelch circuits are designed so that annoying squelch pops, which may occur at the end of a received message, are minimized.
- **Alert Tones** - Alert tones prompt the operator of various radio conditions such as channel access, CCT time-out or a low battery.
- **Power-Up Self-Test** - At power-up the radio automatically performs a diagnostic test on itself and reports any found errors via the LCD.

DESCRIPTION

Two major assemblies form an M-PA radio. The Front Cover Assembly contains all of the microprocessor circuitry, audio circuitry and the operating controls. The Rear Cover Assembly houses the RF circuitry which includes the transmitter, receiver and the frequency synthesizer. The assemblies are electrically interconnected by two single-in-line type connectors. When mated together, the assemblies form a weather resistant die-cast aluminum case that protects the radio's circuitry from harsh outside environments.

Power is provided by a battery pack that slides and locks on to the bottom of the radio. The radio's on/off switch is located on the battery pack. Battery packs are available in several different sizes and capacities.

The antenna screws on to the top of the unit. A side antenna connection is also provided at the UDC for an external antenna or for test purposes. This UDC antenna connection is also utilized for external antenna operation when the radio is locked in the vehicular charger or repeater.

REAR COVER ASSEMBLY

The Rear Cover Assembly houses the RF Board in the die-cast aluminum case. The complete assembly consists of the 800 MHz RF Board, aluminum case, top antenna jack, side (UDC) antenna jack and various hardware.

The RF Board's circuitry includes the transmitter, receiver and the frequency synthesizer. This FM circuitry is under complete control of the microprocessor circuits. Controlling data sent to this assembly from the Control Board includes serial synthesizer data loading, band switch data, transmitter/receiver enabling and a transmitter power level signal. The RF Board outputs the demodulated audio/data and a synthesizer lock status line to the Control Board. During transmitter operation, the RF power appears at the top antenna jack (or the UDC jack if the appropriate adapter plug is inserted). The Rear Cover Assembly maintenance manual contains a detailed circuit analysis, mechanical, outline and schematic diagrams for this assembly.

FRONT COVER ASSEMBLY

The Front Cover Assembly houses all of the operating controls and the digital control circuitry for the radio. Board assemblies used in this assembly include the Control and LCD Boards and flex circuits include the Keypad, UDC and Speaker Flex circuits. The speaker, microphone and Battery Plate are also a part of this assembly. The complete assembly is housed in the die-cast aluminum front cover. Scan and System model radios are equipped with a keypad on the front panel.

The Control Board located in the Front Cover Assembly is the largest and most complex board in the Front Cover Assembly. It contains all microcomputer and audio circuitry which controls the radio. See the maintenance manuals specific to the Control Board or the Front Cover Assembly for service information on the related assembly.

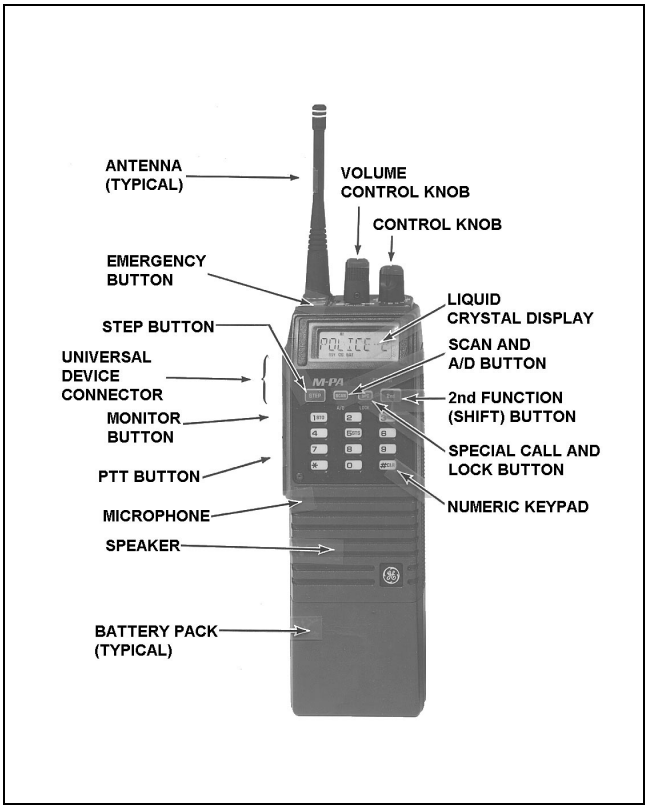


Figure 1 - System Model

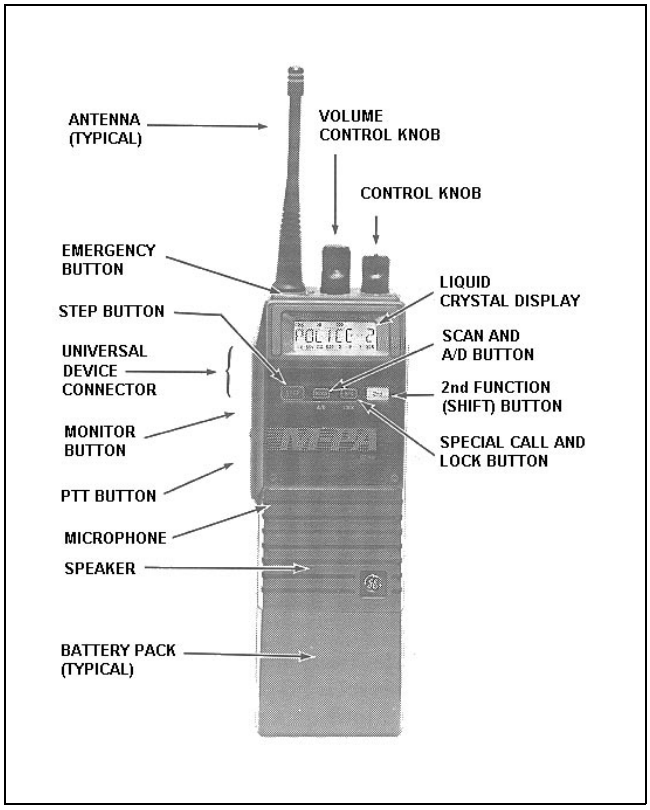


Figure 2 - Scan Model

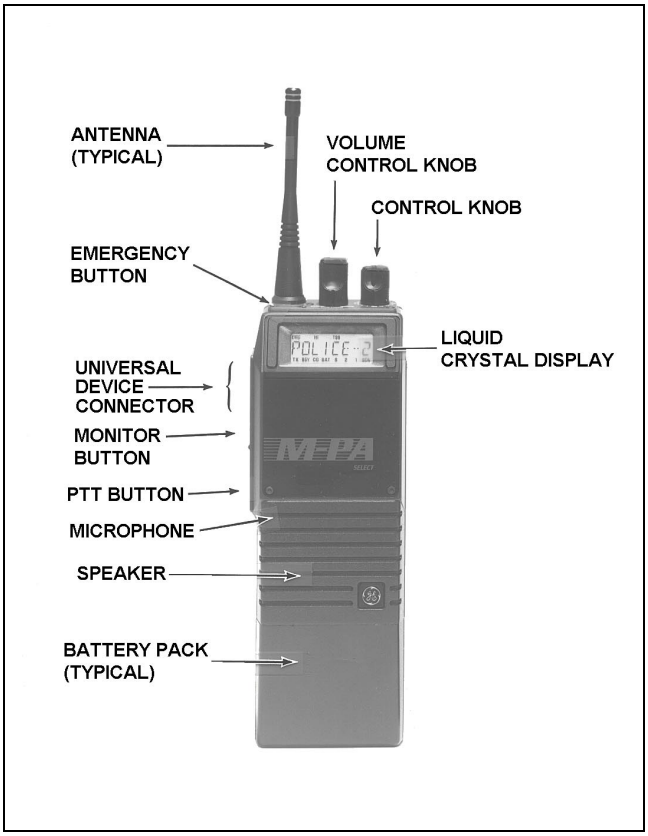


Figure 3 - Select Model

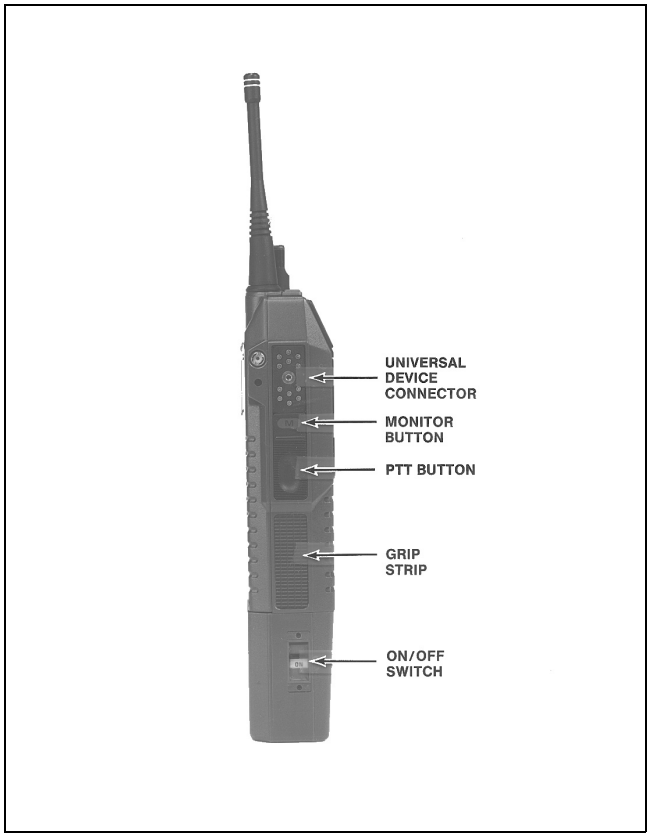
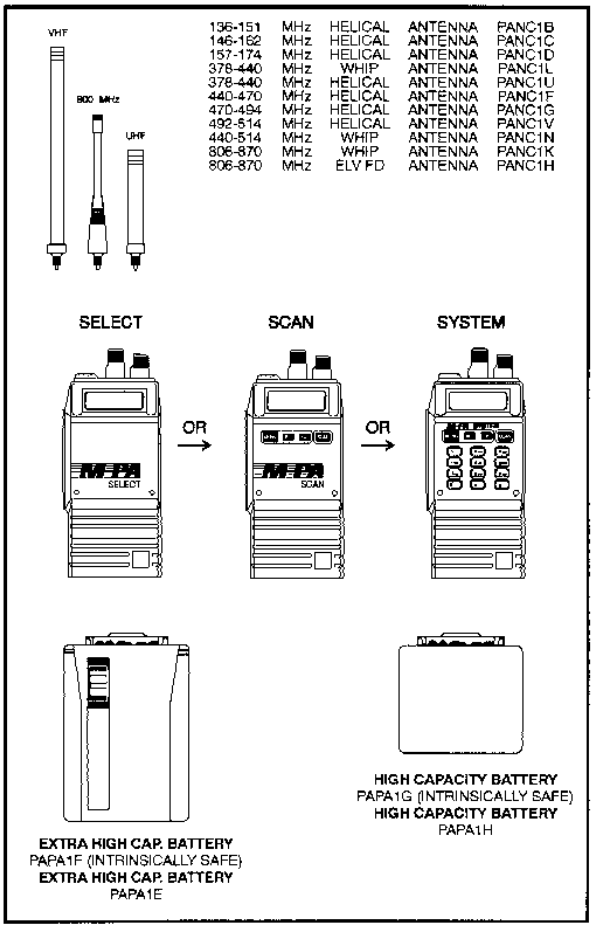
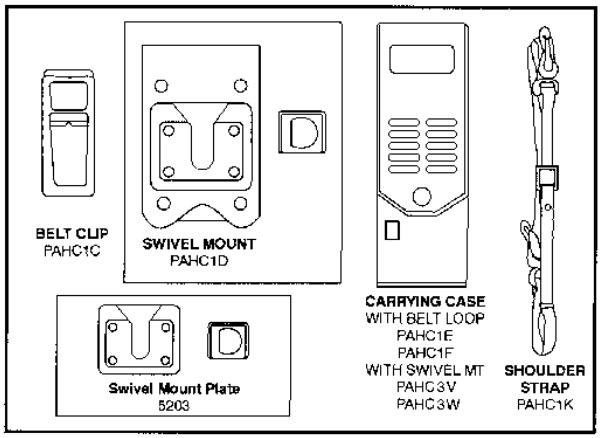


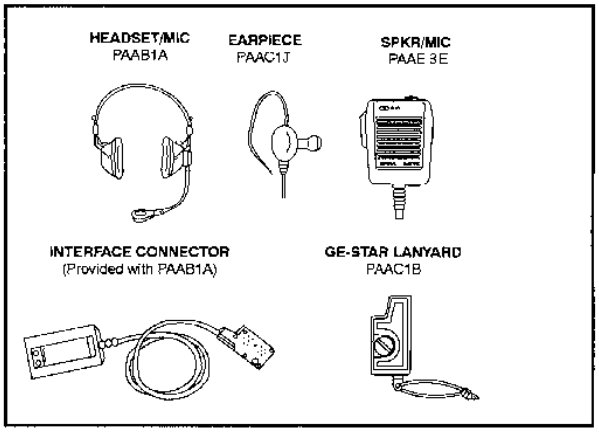
Figure 4- Side View (All Models)

Radio, Antennas, Batteries



Carrying Accessories





Chargers

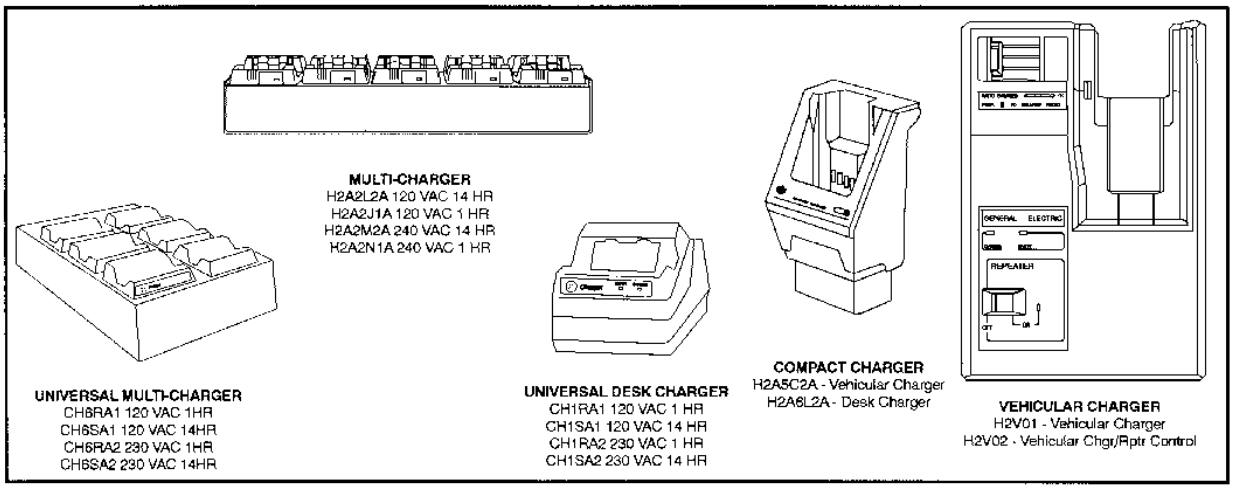


Figure 5 - Options And Accessories

ANTENNAS

There are two (2) antennas available for the 800 MHz M-PA radios. Antenna styles include standard whip (19A149061P1, Option PANC1K) and elevated feed (19B235043P1, Option PANC1H) antennas. Both antennas mount into the antenna jack on the top of the radio. An external antenna can be mounted to the unit via the UDC. When an antenna is connected to the UDC, the antenna on the top of the radio is disabled.

BATTERY PACKS

The battery pack connects to the bottom of the unit and delivers a nominal 7.5 Volts dc to the radio. A recessed on/off switch for the radio is located on the battery pack. An internal fuse located in the radio's Battery Pack protects the radio and battery from excessive current draw. The battery packs are available in several different capacities and sizes.

Radio contacts located on the top of the pack include switched power, ground, the speaker enabling contacts and a continuous power contact. In addition, four contacts are located on the rear of the battery pack. These four contacts provide connections to the slip-in type chargers or vehicular chargers/repeaters while the battery pack is still connected to the unit. The battery charging contacts are diode protected from external shorts.

The chargers utilize an internal thermistor in the battery pack to sense temperature and automatically control charge rate of the battery. This allows for a maximum charge rate without overheating the battery pack. All battery packs can be charged in less than 1-1/2 hours with the rapid type chargers. Nominal full charge time in a standard charger is 14 hours. The Service Section contains a detailed outline and schematic diagram of a typical battery pack. Further service information for the battery packs is also presented in the Service Section.

Chargers are available with nominal charge times of one hour (rapid) and fourteen hours (standard). Combinations include single (1) and multi (5 or 6) position, standard and rapid charge units. In addition, the vehicular chargers/repeaters simultaneously charge the battery while the radio is operating.

The battery packs should be fully charged in an appropriate charger before they are placed into service. This applies to new battery packs received from the factory and to battery packs that have been stored for long periods of time. A fully charged battery pack should have an open-terminal voltage greater than 7.5 Volts (typically 9.0 Vdc). A battery pack in need of a charge will cause the low battery "BAT" status flag on the radio to turn on. This flag will turn on when the battery pack's voltage drops below approximately 6.8 Volts. The low battery alert tone will also be heard when the battery pack needs charging.

RECHARGEABLE BATTERY PACK DISPOSAL

The product that you have purchased contains a rechargeable battery. The battery is recyclable. At the end of its useful life, under various state and local laws, it may be illegal to dispose of this battery into the municipal waste stream. Check with your local solid waste officials for details in your area for recycling options or proper disposal. Call Toll Free 1-800-822-9362 for information and /or procedures for returning rechargeable batteries in your state.

UNIVERSAL DEVICE CONNECTOR

The UDC is located on the side of radio just above the PTT and Monitor Buttons. Various equipment such as the audio accessories can be connected to the radio via the UDC. The programming equipment is also connected to it when the personality is programmed into the radio. The UDC furnishes an excellent first-check-point for initial bench checks without the need to disassemble the radio. Table 1 lists all pins and their appropriate function. When the radio is turned on it senses the resistance value between UDC pins 9 and 1 and switches the appropriate circuits to provide proper radio-to-accessory operation.

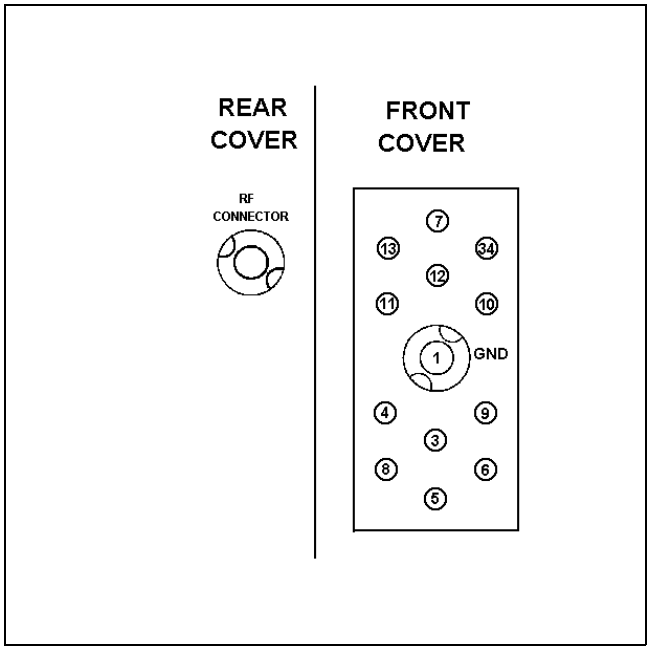


Figure 6 - UDC Pin-Out

Table 1 - UDC Pin Functions

PIN	NAME	INPUT OR OUTPUT	USE
1	GROUND	-----	Case Ground
3	UDC RX AUDIO	Output	Test Point For Speaker Audio
4	SW BATT	Output	Switched Accessory Power
5	EXT PTT	Input	External Microphone PTT Input
6	TX DATA	Input	For Programming
7	RX DATA	Output	For Programming
8	SPARE		
9	UDC VOLT	-----	Option/Accessory Sense Pin
10	T/R	Output	Low = Transmit, High = Receive
11	UDC MUTE	Output	Low = Audio Muted
12	EXT MIC HI	Input	External Microphone Audio Input
13	EXT EMER	Input	Lanyard Connection
34	UDC DISCR	Output	Test Point For RX Audio

PROGRAMMING

The radio's personality is programmed using an IBM PC or compatible computer. A full-screen portable PC can be used for field programming. The Programming Manual and Software is TQ-3364. This package includes both 5-1/4 floppy and 3-1/2 inch disks. The programming software uses a series of screens and windows to guide you through a programming session. See TQ-3364 for further programming details. PC Programming Adapter TQ-3370 and Programming Cable TQ-3311 will also be required. These items provide interface and connection between the PC and the radio when the personality is transferred from the PC into the radio.

OPERATOR MANUAL

Complete operating details for the EDACS M-PA radios are included in LBI-38407. This operator's manual contains detailed trunked mode and conventional mode operating procedures for the Select, Scan and System model radios.

OPERATING TIPS

Antenna location and condition is critical when using an 800 MHz radio. Operating the radio in low areas of terrain, under power lines or bridges, inside of a vehicle or in a metal or steel framed building can severely reduce the range of the unit. Mountains and buildings can also reduce the range of the unit.

In areas where transmission or reception is poor, some improvement may be obtained by insuring that the antenna is vertical. Moving a few yards in another direction or moving to a higher elevation may also improve communication. Vehicular operation can be aided with the use of an externally mounted antenna.

Battery condition is another critical factor in the trouble free operation of a portable radio. Observe the procedures listed in the Service Section to insure the battery packs do not develop the "Memory Effect".

Always observe all of the Federal Communication Commission's rules and regulations during any service or operating procedure.

INTRINSICALLY USAGE

Selected portable radios with appropriate factory installed F4 Options are certified as Intrinsically Safe by the Factory Mutual Research Corporation. Intrinsically Safe approval includes Class I, II, III, Division 1 hazardous locations in the presence of Groups C, D, E, F and G atmospheres. Non-Incendive approval includes Class I, Division 2 hazardous locations in the presence of Groups A, B, C and D atmospheres.

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

BATTERY PACKS

Only battery packs identified with a green latch shall be used with a portable radio that is rated and labeled as Factory Mutual Intrinsically Safe. Use of nonspecified battery packs voids Factory Mutual approval. The following battery pack options are approved for use in intrinsically safe radios:

PAPA1F (19A704860P6)	Rechargeable Battery Pack, Extra High Capacity (Tall Case)
PAPA1G (19A704850P6)	Rechargeable Battery Pack, High Capacity (Short Case)

ACCESSORIES

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

PAAB1A (19B801508P3)	Headset/Microphone
PAAC1A (19B801508P2)	Earpiece Kit
PAAC1B (19B801 508P8)	GE-STAR Lanyard
PAAE1A (19B801508P1)	Speaker/Microphone
PAAE1B (19B801508P4)	Speaker/Microphone with GE-STAR Lanyard
PAAE1C (19B801508P6)	Speaker/Microphone/Antenna
PANC1H (19B235043P1)	Antenna, 806 - 870 MHz, Elevated Feed
PANC1K (19A149061P1)	Antenna, 806 - 870 MHz, Flex
PAHC1C	Belt Clip
PAHC1D	Swivel Mount with Belt Loop
PAHC1E	Case, Leather, with Belt Loop (Short Case)
PAHC1F	Case, Leather, with Belt Loop (Tall Case)
PAHCIG	Case, Leather, with Swivel Mount and Belt Loop (Short Case)
PAHC1H	Case, Leather, with Swivel Mount and Belt Loop (Tall Case)
PAHC1K	Shoulder Strap, Leather, with Mounting Plate
PAHC5R	Holster, Plastic.

MAINTENANCE

The EDACS M-PA radio is a very reliable unit and will normally provide many years of trouble-free service. The recommended Preventive Maintenance procedures that follow should be performed when a technician comes in contact with a unit. Component level trouble-shooting information is contained in the manual associated with the particular assembly and in the Service Section.

PREVENTIVE MAINTENANCE

Antenna

The antenna and antenna contact should be kept clean and free from dirt or corrosion. If the antenna contact should become dirty or corroded, communication range could be reduced.

Battery Packs

Insure the battery packs are properly maintained. Do not over or under charge them on a regular basis. Verify the contacts are clean and free of corrosion.

Mechanical

Since portable radio units are subject to shock and vibration, check for loose plugs, knobs, screws, etc.

Transmitter 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 annually.

Receiver Check

Receiver sensitivity should be checked periodically as an indication of overall receiver operation.

Cleaning

If the unit requires an external cleaning use mild soap and a damp cloth. Avoid abrasive cleaners or chemicals which may damage the plastic or rubber surfaces on the unit.

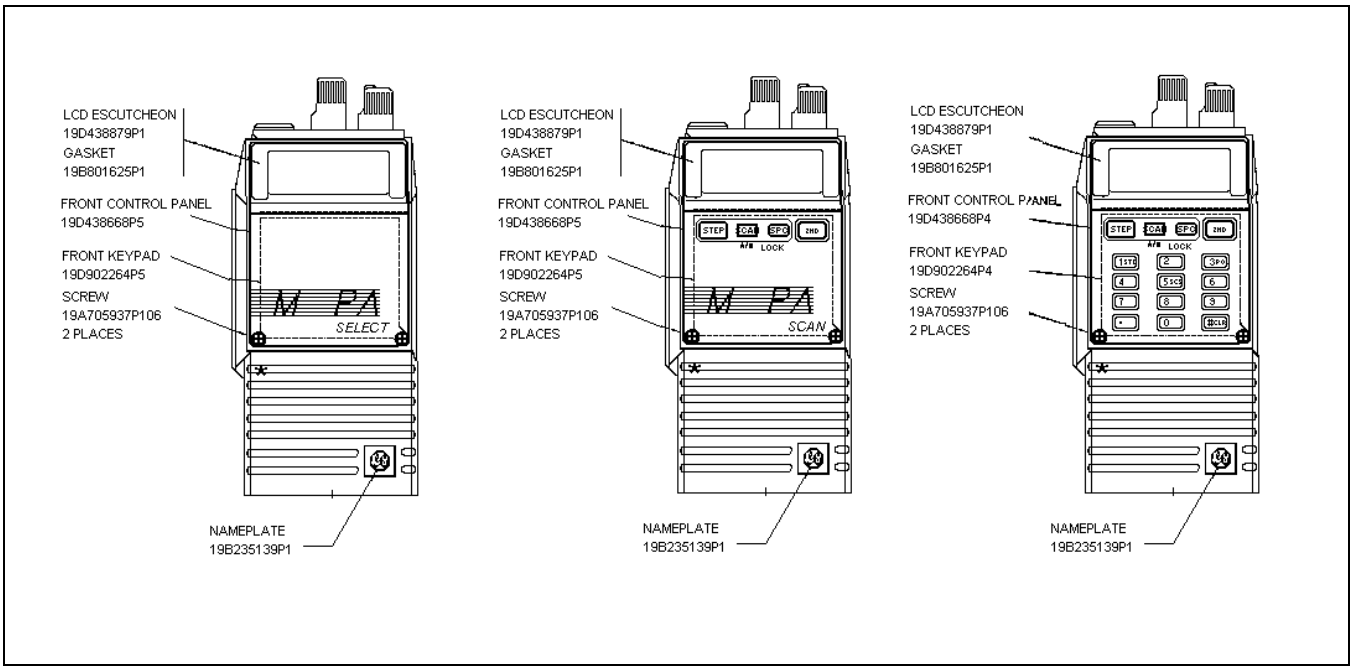


Figure 7 - Front Panel Parts

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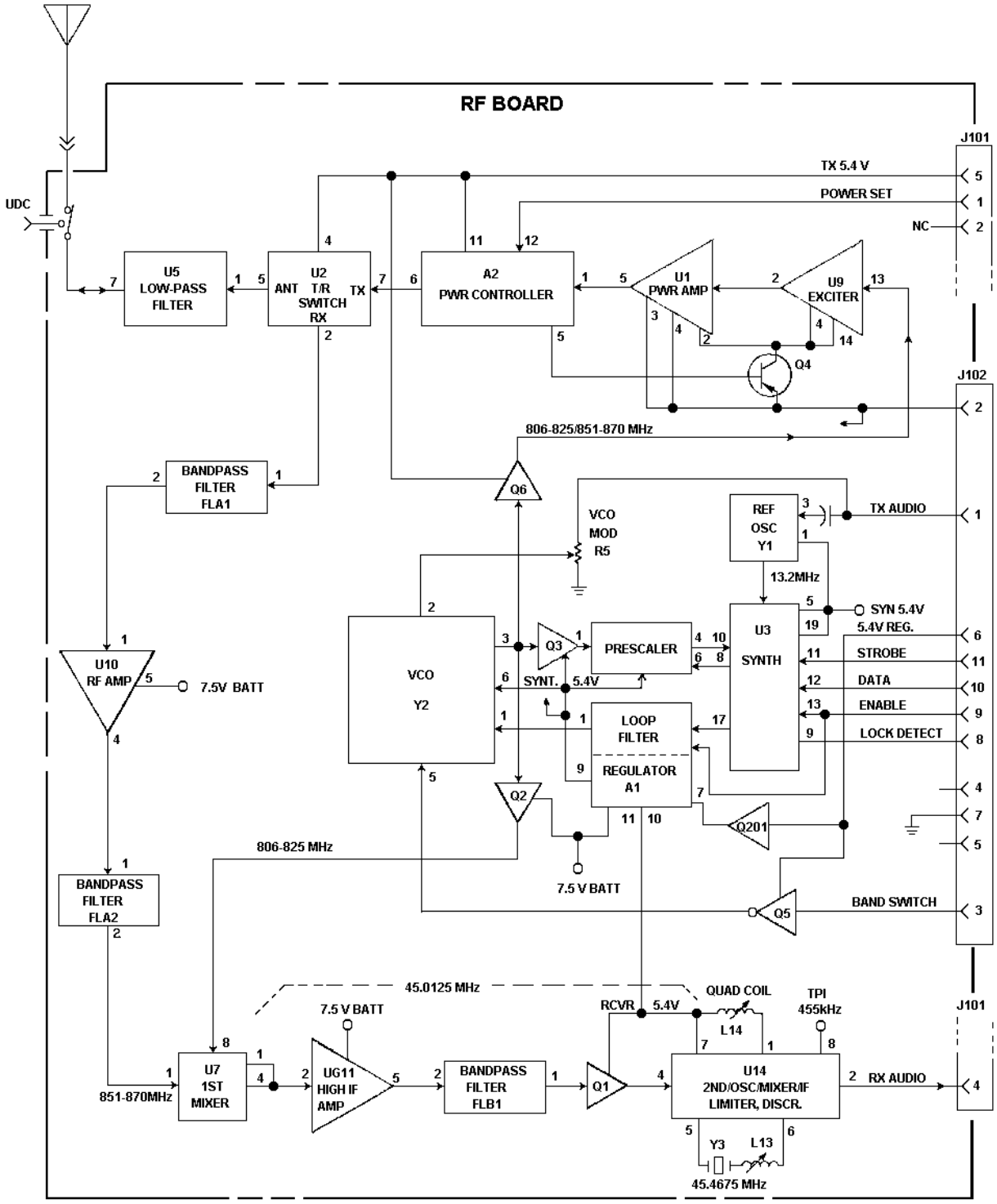

Figure 8 - Rear Cover Assembly Block Diagram

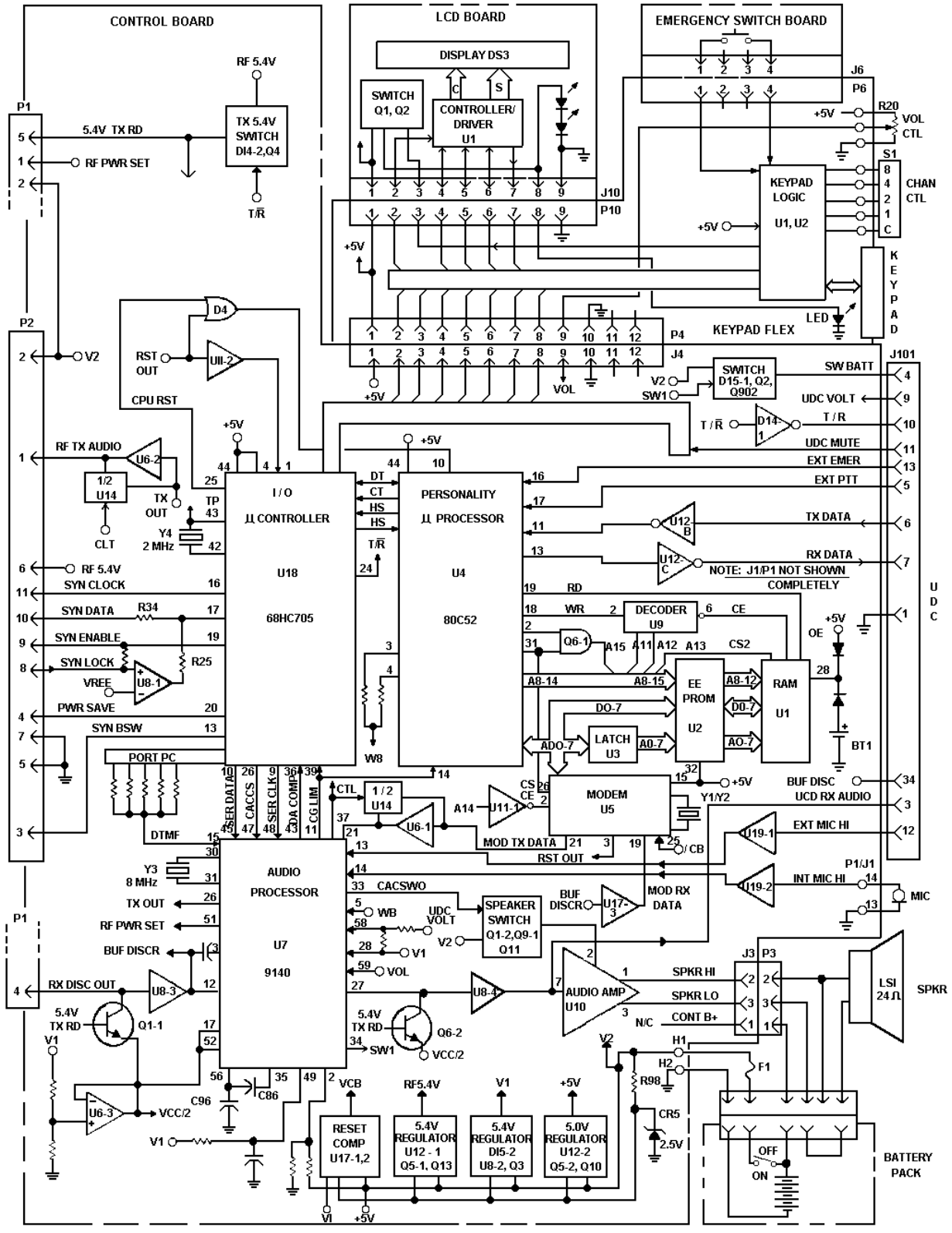

Figure 9 - Front Cover Assembly (Earlier) And Control Board Block Diagram