

 **MOBILE RADIO**

TPX 8403
TPX 8603

MAINTENANCE MANUAL LBI-31787

SERVICE SECTION LBI-31788



806-871 MHz
PERSONAL
TWO-WAY FM RADIO



GENERAL  **ELECTRIC**

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SYSTEM SPECIFICATIONS

FCC TYPE ACCEPTANCE NO.....AXA9WNTPX-8603
FREQUENCY RANGE
 Transmitter.....806-826 MHz
 Talk-Around.....851-871 MHz
 Receiver.....851-871 MHz
FREQUENCY STABILITY2.5 PPM
BATTERY DRAIN
 Standby90 milliamperes (maximum)
 Receive (rated audio)315 milliamperes (maximum)
 Transmit2.0 amperes (maximum)

SHOCK AND VIBRATION.....EIA & US Forest Service Specifications
DIMENSIONS (H X W X D)207 X 69 X 44mm (with 800 mAh battery)
WEIGHT (WITH 800 mAh BATTERY).....0.73kg (1.6 lbs)
OPERABLE TEMPERATURE RANGE-30° C to +60° C (-22° F TO 140° F)
HUMIDITY95% RH @ 50° C (122° F)

TRANSMITTER

RF POWER OUTPUT3-watts
SPURIOUS EMISSIONS-16dBm
DEVIATION+5kHz
FREQUENCY SEPARATION.....20MHz
FM HUM AND NOISE-40 dB
AUDIO DISTORTION (60% Modulation)7%
RF IMPEDANCE50 OHMS
MICROPHONE SENSITIVITY (EIA 60% MOD)Less Than 94 dB SPL

RECEIVER

CHANNEL SPACING	25kHz
RF IMPEDANCE	50 Ohms
SENSITIVITY	
EIA 12 dB SINAD	0.45 uV
Noise Squelch.....	12 dB Sinad
SELECTIVITY (EIA 2 Signal)	-60 dB
MODULATION ACCEPTANCE	± 7kHz
INTERMODULATION	60 dB
FREQUENCY SEPARATION	20MHz
SPURIOUS EMISSIONS	-53 dBm
SPURIOUS RESPONSE	-60 dBm
SPURIOUS REJECTION (EIA).....	-60 dB (Typical)
SELECTIVITY (EIA).....	60 dB (minimum)
DISTORTION (EIA 0.35 WATT)	10%
AUDIO FREQUENCY RESPONSE	Within +1, -8 dB/octave de-emphasis from 300 to 3000 Hz. with the following constraints:
	1.5 kHz -5 dB
	2.5 kHz -14 dB
	2.918 Hz -30 dB
	3051 Hz -30 dB

**FIVE-UNIT
MULTI-BATTERY CHARGER**
1 HOUR UNIT H2A2J1A
16 HOUR UNIT H2A2L2A



**SINGLE UNIT
DESK CHARGER**
1 HOUR UNIT H2A1J1A
16 HOUR UNIT H2A1J2A



800 mAh BATTERY
OPTION TPPA10
(19A704850P3)



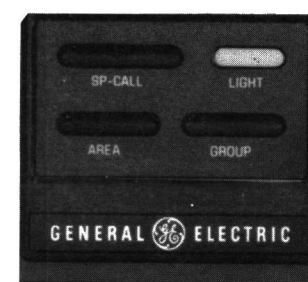
1200 mAh BATTERY
OPTION TPPA11
(19A704860P3)



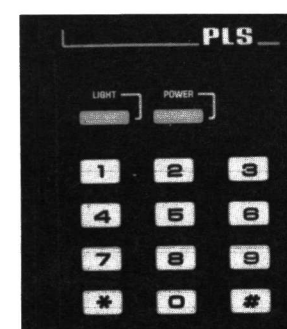
HEADSET/MICROPHONE
OPTION AB10
(19B801508P3)



**COIL CORD
SPEAKER/MICROPHONE**
OPTION AE10
(19B801508P1)



"D" DISPATCH CONTROL PANEL
OPTION CP01
(19A704679P11)



"K" DTMF CONTROL PANEL
OPTION EP02
(19A704679P12)

OPTIONS AND ACCESSORIES

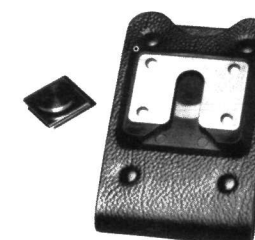
**SWIVEL MOUNT/CASE
BELT LOOP**



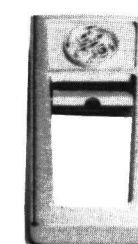
CASE & BELT LOOP
RADIO W/800 mAh BATTERY, OPTION TPHC11
(19D901765P2)
RADIO W/1200 mAh BATTERY, OPTION TPHC12
(19D901765P4)

CASE/SWIVEL MOUNT/BELT LOOP
RADIO W/800 mAh BATTERY, OPTION TPHC13
(19D901765P1)
(19B226627G1 LOOP)
RADIO W/1200 mAh BATTERY, OPTION TPHC14
(19D901765P3)
(19B226627G1 LOOP)

**SWIVEL MOUNT PLATE
& BELT LOOP**

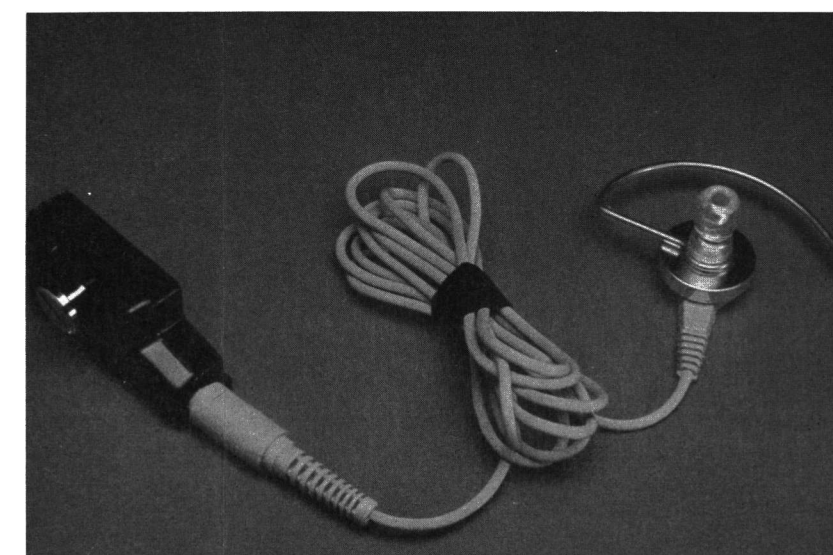


BELT CLIP



BELT CLIP OPTION TPHC15
(19B233241G1)
(19A144704G1 MOD KIT)

SWIVEL MOUNT PLATE & BELT LOOP
OPTION TPHC16
(19B226627G1 LOOP)
(19B233243 SWIVEL)
(19A144704G1 MOD KIT)



EAR PHONE
OPTION TPAC10
(19B801508P2)

COMBINATION NOMENCLATURE

Digits 1&2	Digit 3	Digit 4	Digit 5	Digits 6&7
Product Code	Radio Type	Frequency	Features	RF Power Output
TP	X Wideband	8 800 MHz	4 Limited Feature	03 3 Watts
			6 Full Feature	

DESCRIPTION

The General Electric TPX 8403/TPX 8603 Personal radios are high-quality, high-performance, two way, communications unit consisting of an FM transmitter/receiver with frequency synthesizer and microprocessor control. The radio provides three watts of transmitter power over a 20MHz frequency spread (806-826MHz) including the 800 MHz conventional, USA-1, USA-2, and Mexican border frequencies.

Operation of the TPX 8603 is controlled by the Dispatch or Keypad Control Panel. The Dispatch Control panel allows operation in the Trunked, Trunked Direct, and/or Conventional mode.

In addition to the above, the Keypad Control Panel provides the TPX 8603 with DTMF encode function which allows telephone interconnect and "Dispatch Overdial" (conferencing) capability.

The TPX Personal radio is ideal for use in public service or business applications. It offers the following features:

- **Multi-mode operation:** Trunked, Trunked Direct, or Conventional modes.
- **Trunked mode:** Up to nine areas available with up to nine groups in each area. A Special Call Function is available in each area. The TPX 8403 is limited to two areas with one group each, or two conventional channels, or one area with one group and one conventional channel.
- **Trunked Direct mode:** Same as repeater-talk-around. Allows direct communications with a mobile radio.
- **Conventional Mode (TPX 8603):** Up to 81 individual channels—up to nine in each area.
- **Liquid crystal display (TPX 8603):** Alpha-numeric display allows user to customize Area/Group/Channel identification while displaying real time radio status. A subscript display contains the radio status indicators.
- **Self Check:** Executes a self diagnostic logic test each time the radio is turned on to insure proper operation. It also sounds an alarm when all tests have passed.
- **Out of Range Indicator:** Sounds an alarm if a transmission is attempted when the radio is out of range of the repeater.
- **Carrier Control Timer:** Automatically unkeys the transmitter when it is keyed continuously in excess of the preprogrammed time.
- **Programmable back light:** Turned on and off by keyboard control. Turns off after a preprogrammed time.
- **GE-MARC V and V•E Programmable:** Inter-mix two and four tone signaling.
- **Programmable Multi Tone Channel Guard (CTCSS):** Program Channel Guard tone frequencies within the range of 67 Hz to 210.7 Hz.
- **Programmable Through UDC Connector:** Allows direct use of the General Electric Universal Programmer TQ2310.
- **Low Battery Indicator:** Indicates the battery needs recharged or that the transmitter is disabled due to a low battery.
- **Quick change battery:** Slide on—slide off.
- **Telephone Interconnect (TPX 8603 w/"K" Panel):** Allows you to place or receive calls via radio telephone. Up to 10 numbers containing up to 15 digits each may be dialed directly or stored in memory. Last number redial allows you to instantly recall and transmit the last number dialed.
- **Dispatch overdial:** Allows you to call other radios whose tone numbers are not programmed into your radio and conference them into an ongoing conversation.

MECHANICAL DESCRIPTION

The TPX radio is housed in a contrasting black/gray radio housing with a die cast aluminum back cover. The TPX radio consists of three main assemblies:

- The Control Housing Assembly
- The Rear Cover Assembly
- The Battery Assembly

The TPX 8403 and 8603 are shown in Figures 1 thru 3.

CONTROL HOUSING

The Control Housing forms the front half of the electronics portion of the radio and contains the following hardware:

Controller Board Assembly
 LCD or LED Board Assembly
 Speaker
 Microphone
 PTT switch Pad W/UDC Escutcheon Assembly
 Flexible Interconnection Strips
 "D" or "K" Panel (TPX8603)
 Fuse and Fuse Holder

REAR COVER ASSEMBLY

The Rear Cover Assembly houses the transmitter/receiver /synthesizer board assembly which is enclosed within the die cast rear cover casting. The printed wire board is specially shielded with zinc light alloy.

Transmitter Assembly

The wideband transmitter amplifies the RF signal across the 806-826 MHz frequency band (851-871 MHz in talk-around applications). The only adjustment required is to set the RF power output level. The transmitter consists of four major circuits as follows:

- a. Wideband Exciter: Amplifies the signal from the frequency synthesizer. Provides a gain of 21 dB.
- b. Wideband Power Amplifier: Amplifies the exciter output signal to the desired output level for transmission. It provides a gain of 13 to 18 dB.

- c. Wideband Power Control Module: Provides constant control of the transmitter output power.
- d. Output low pass filter (LPF): Consists of a three stage filter to eliminate higher order harmonics.

Receiver Assembly

The receiver consists of three major circuits:

- a. Front End circuit: Consists of a single stage preamplifier with approximately 12 dB gain. It also contains the pre band pass filter and the post bandpass filter.
- b. First mixer and IF: Consists of a mixer, two band pass filters and two IF amplifiers. A special double balanced mixer provides a 45.0125 MHz first IF. The IF signal is then filtered and amplified before being applied to the second mixer.
- c. Second IF: Consists of one IC and one BPF, containing a second mixer, second IF amplifier and an FM detector. The second IF output provides the logic section with RX Audio.

Frequency Synthesizer

The frequency synthesizer generates the transmit and receive frequencies. Since these frequencies are always 45 MHz apart, only one VCO is used. The transmitter frequency is used as the receiver local oscillator frequency. The frequency synthesizer consists of two major assemblies:

- a. VCO Module
- b. Phase Lock Loop

The Phase lock loop consists of a frequency divider and a low current drain CMOS IC for phase comparison.

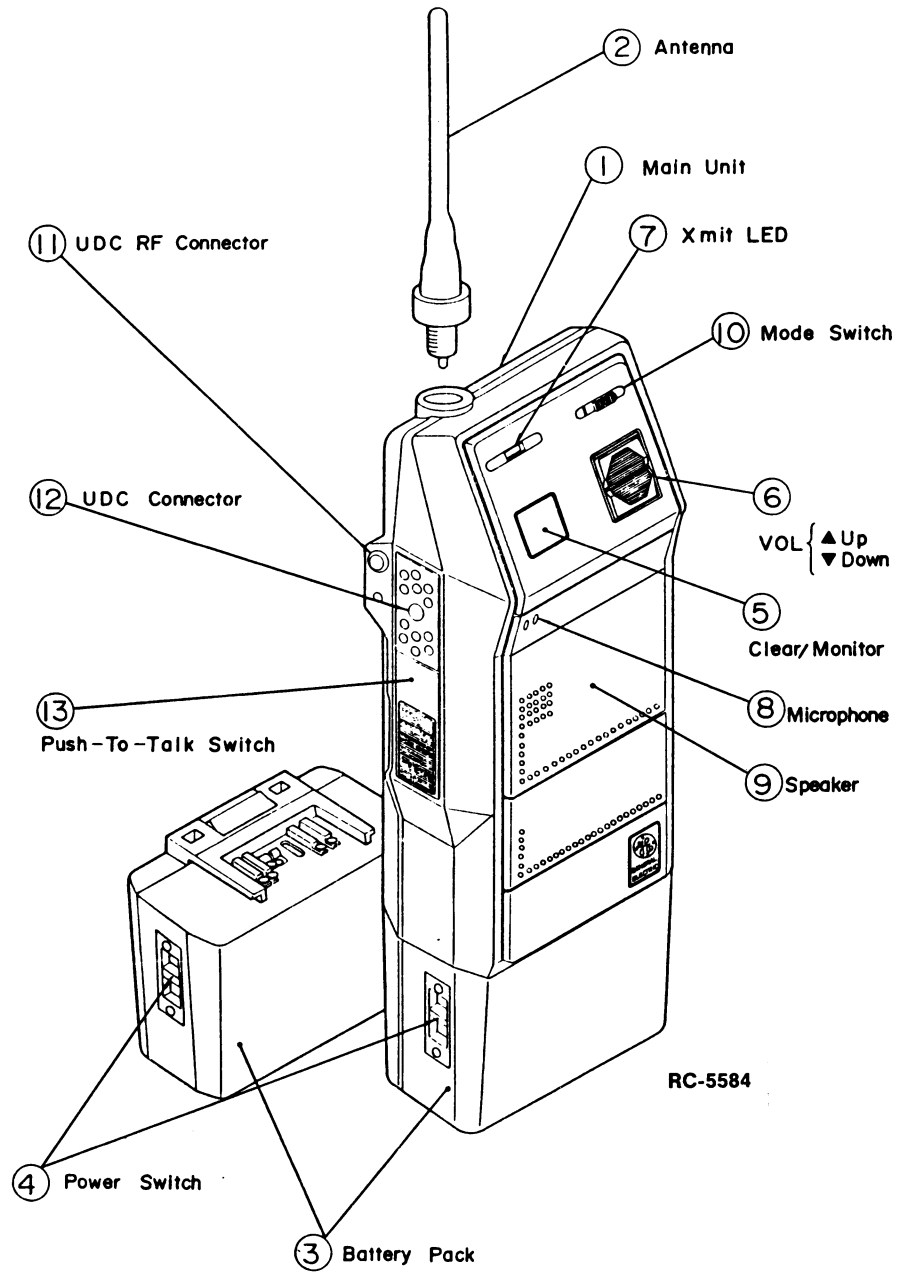
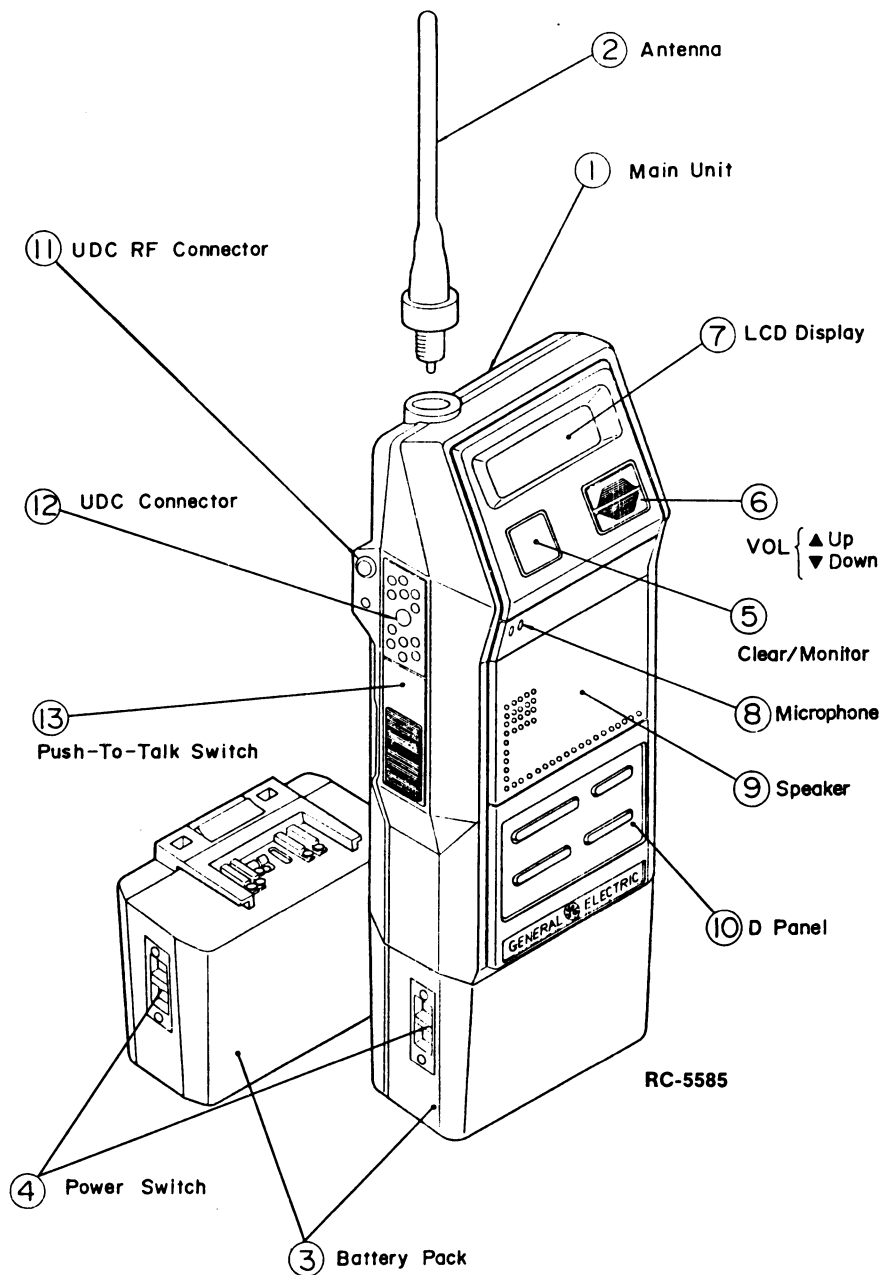
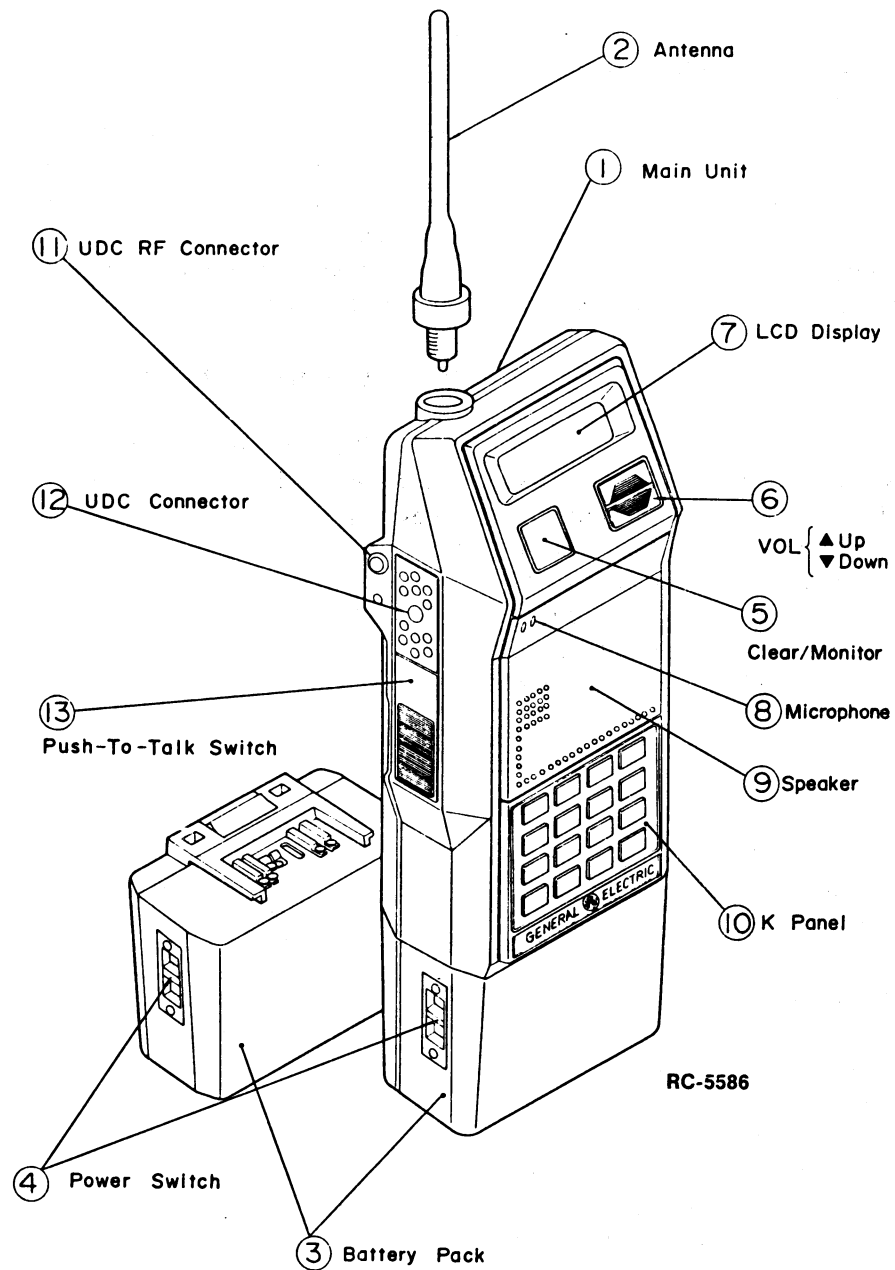
**TPX8403**

FIGURE 1 - TPX8403 ASSEMBLY



TPX8603

FIGURE 2 - TPX8603 ASSEMBLY W/"D" CONTROL PANEL



TPX8603

FIGURE 3 - TPX 8603 ASSEMBLY W/"K" CONTROL PANEL

Logic Circuit

The logic circuit consists of:

- a. LCD board: The LCD board includes the LCD display driver circuits.
- b. Control board: The Control board generates all the commands and controls the operation of the radio. It contains the microprocessor, a ROM, a RAM, audio circuit, and I/O interconnections to the frequency synthesizer and the display.

BATTERY PACK

The battery pack mounts to the bottom of the radio and contains the two position slide on, slide off power switch. The battery pack supplies 7.5 Vdc to the radio. Two types of battery packs are available: a 800 mAh and a 1200 mAh battery. To charge these battery packs, chargers are available in two different types: a standard 16 hour charger and a rapid one hour charger. A vehicular charger is also available.

OPERATIONAL DESCRIPTION

The GE Marc V-E trunked mobile radio system permits improved access to available RF channels, freedom from annoyance by other users' conversations and a degree of privacy for the user. The trunked mobile radio system consists of a repeater for each channel and the user's mobile radio units. The system uses tone signalling with each mobile being assigned two and/or four tone group tone sequences. Groups of mobiles are assigned the same tones, so that any unit can talk to all other units in the same group. To provide quick access to communications channels, the GE-Marc trunked radio system continually monitors the activity on all channels in the selected area.

When originating a call, the mobile identifies an idle repeater channel and interrogates it with a single burst of "busy tone". Upon receipt of the busy tone, the repeater keys its transmitter and sends a burst of "acquisition" tone back to the mobile unit. When the interrogating mobile detects the acquisition tone, it then transmits the collect and group tones which the repeater regenerates for all idle radio units in the system.

The idle mobiles, which continually scan all channels, will stop on the active channel if any of the programmed collect tones are detected and wait for group tone (s).

If the correct tone sequence is detected, the mobiles will alert the operator of an incoming call and open their audio circuits. If the correct sequence is not detected, the idle mobiles will resume scanning the channels. Once the mobile is "locked" on a channel, it will remain there until the repeater times out or the operator terminates the call.

OPERATIONAL STATES

The radio will always be in one of three operational states: idle, wait, or ready. The three operational states and the conditions that cause the radio to switch from one state to another are shown in Figure 4.

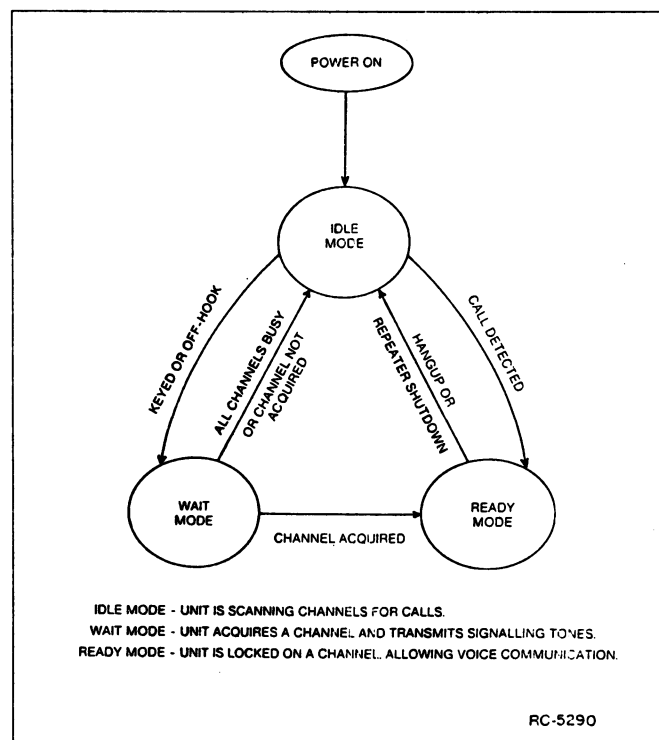


FIGURE 4 - OPERATIONAL STATES

The radio enters the idle state when power is turned on and immediately begins scanning channels for incoming calls. The wait state is entered when the user places a call. The radio remains in the wait state until a channel is acquired, or if no channel is available. The

ready or conversation state is indicated by an alert tone; the indicator on the control panel indicates the state.

A tone signaling timing diagram is shown in Figure 5. Sequence flow charts are shown in Figures 6 through 8.

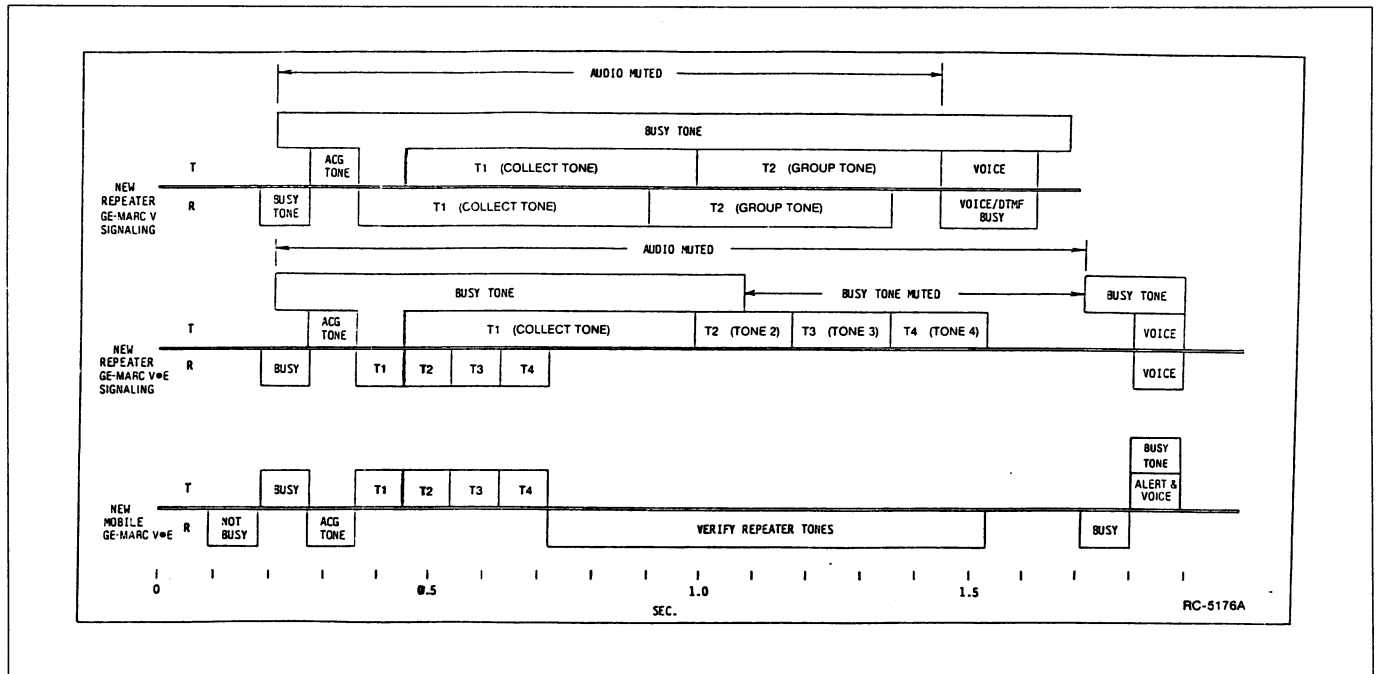


FIGURE 5 - TONE SIGNAL TIMING

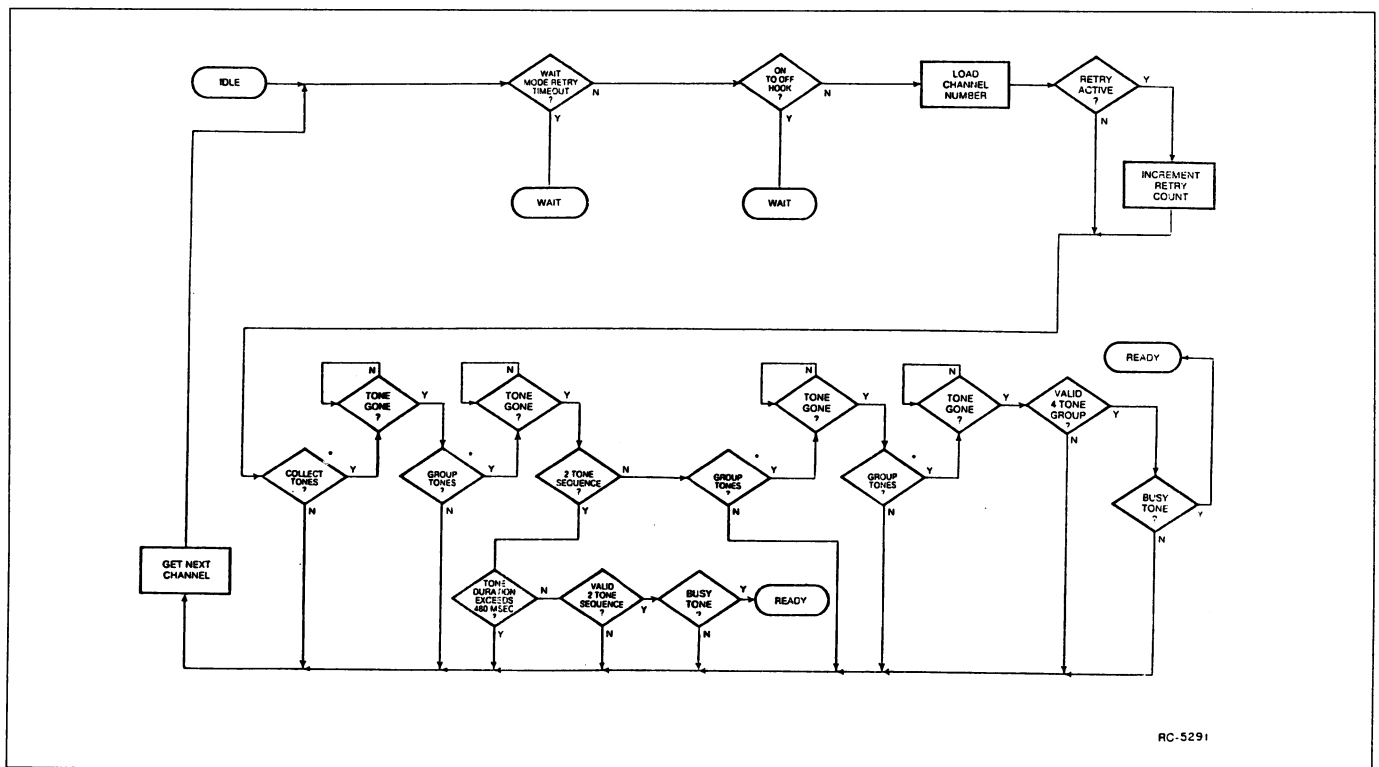
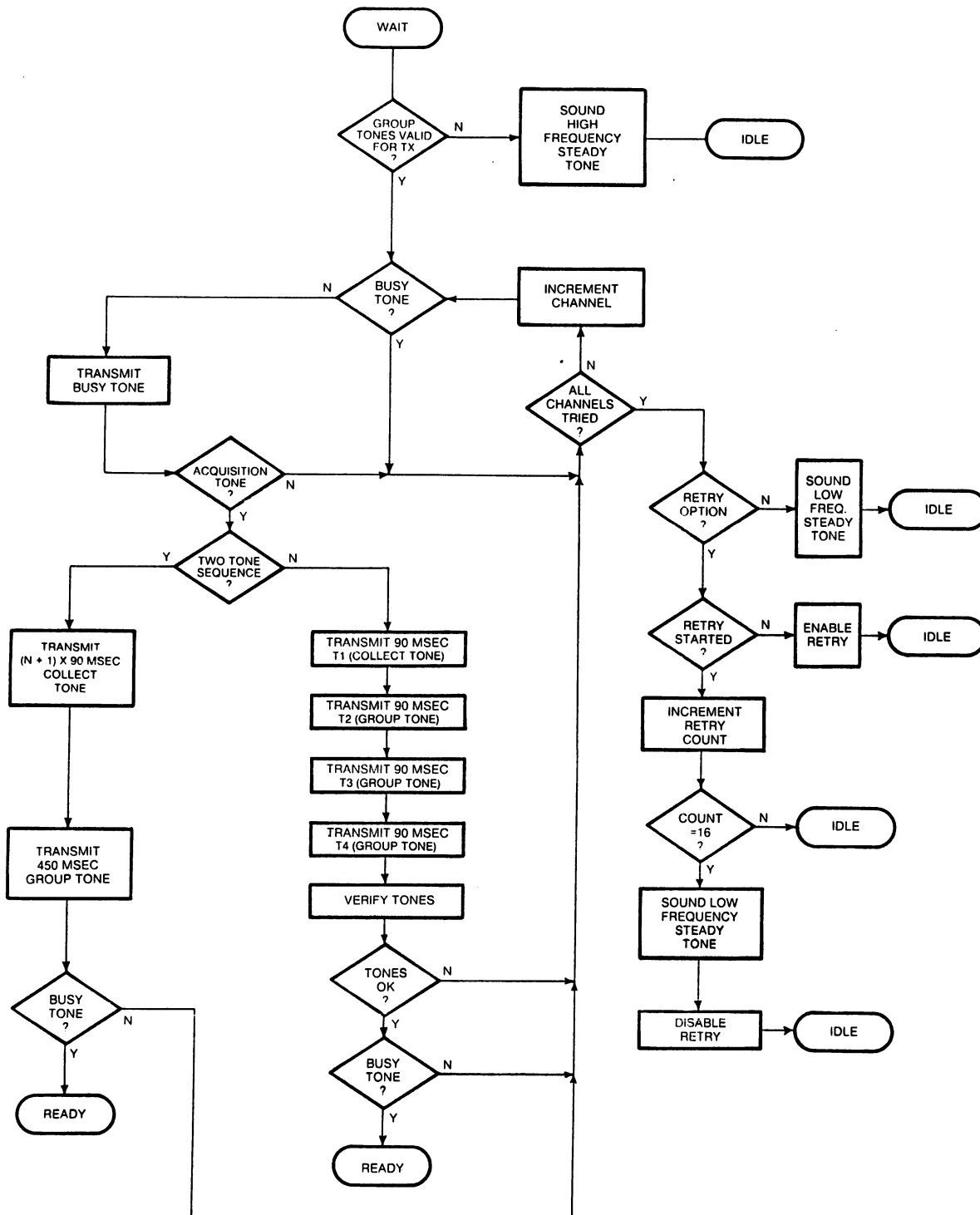


FIGURE 6 - IDLE STATE



RC-5178

FIGURE 7 - WAIT STATE

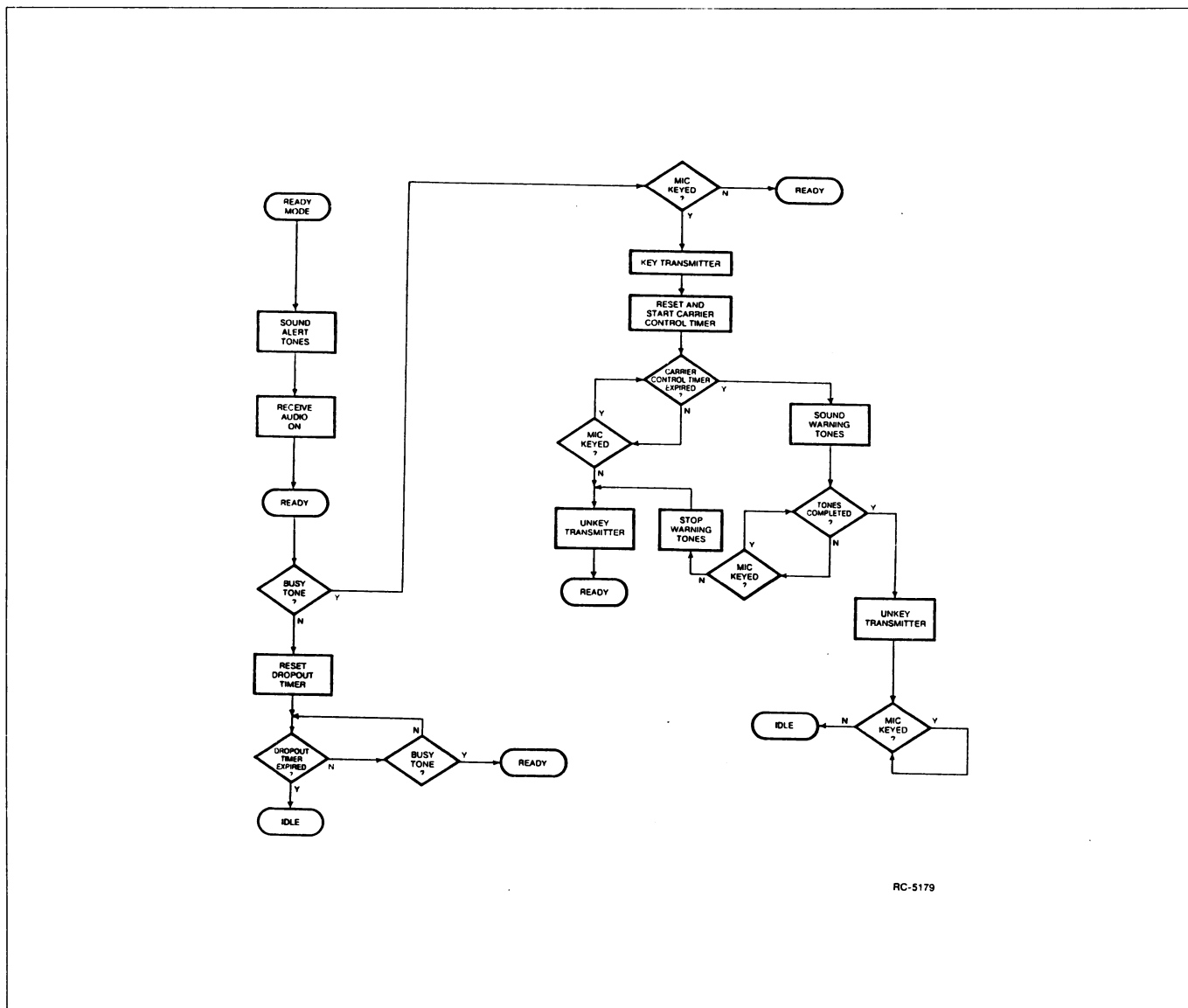


FIGURE 8 - READY STATE

Idle State

When the radio is in the idle state, the audio is muted and all channels programmed for all decode are sequentially scanned for an incoming call. An incoming call is first identified by the presence of a collect tone on one of the channels. Upon receipt of a collect tone, the radio looks for the group or individual tones for a brief interval. If the group or individual tones are not detected, the mobile will advance to the next channel and continue looking for an incoming call.

If a group (or individual decode) tone is detected the radio then looks for busy tone for a 90 millisecond

period. If four tones are properly decoded, the radio will then look for busy tone for 270 milliseconds.

When no valid tones are found, the radio will resume scanning for a call with the next channel. When a busy tone is found, the radio will enter the "Ready" state. If busy tone is not detected, the radio remains in the "idle" state and continues scanning channels looking for an incoming call.

Removing the Handheld Controller or handset from the hanger, pressing the PTT bar or pressing the SEND key on the handset, will cause the radio to enter the "Wait" state.

Wait State

When the user enters the "Wait" state, the group tone is checked to make sure it is a valid call originate group. If it is not valid, a high frequency steady tone is heard in GE-MARC V systems only. If valid, the radio will scan the call originate frequencies for brief intervals until it finds one with no busy tone on it. If no channel is free, the radio will activate the Call Retry state if programmed for this option. This causes the radio to revert to the "idle" state and scan for a call while trying the "Wait" state approximately every 20 seconds for five minutes. If no channel is available at the end of the 5 minute period or the Retry option is not programmed, the radio will sound a low frequency tone, and then return to the "idle" state.

If a channel with no busy tone is found, the radio transmits a burst of busy tone to acquire the repeater. The repeater then responds with a burst of acquisition tone. Upon receipt of the acquisition tone, the radio proceeds to transmit the group tones (either two or four tones). If a four tone sequence is sent, the mobile must detect all four tones and the busy tone before entering the "ready" state.

If a two tone sequence is sent, the busy tone must be present within 90 milliseconds of the last tone in order for the radio to enter the "ready" state. If no busy tone is present, or if the four tone sequence isn't valid, the mobile will jump to the next channel in the call originate set and check for busy tone as described above.

Ready State

When an incoming call has been detected, or an idle channel has been acquired, the radio enters the "ready" state. In this state, the audio and push-to-talk circuits are enabled, the speaker is unmuted, and the operator is signaled by an alert tone. The radio can then be used in the conventional push-to-talk manner with the radio remaining on the channel until the operator hangs up or the repeater drops the busy tone, causing the unit to revert to the "idle" state. If a channel is not used for six seconds or more (PTT switch pressed) it is dropped; i.e., communications are terminated. If this occurs before the conversation is finished, the call must be reinitiated.

CONTROLS AND INDICATORS

NOTE

Become familiar with the operating controls and indicators **BEFORE** attempting operation.

TPX8403: The Control Panel contains the Transmit/Low Battery indicator, Clear/Monitor, Channel Select, and Volume control switches.

TPX8603: The two part control panel consists of an upper and a lower section. The upper section contains the Clear/Monitor and volume control switches, and the LCD status display. The lower section contains the "K" or "D" Control panel.

CONTROLS

ON-OFF

Turns the radio on or off. When turned on, an audible click is heard and a light yellow square shows beneath the switch. "PASSED" is displayed momentarily.

VOLUME

Increments the receive audio to the desired level. Double beeps are sounded in the GE MARC mode and single beeps in the conventional mode.

CLEAR-MONITOR

TRUNKED MODE: A momentary switch that terminates a call (if in progress) and returns the radio to the idle state. It also resets the display to the current area/group.

DIRECT OR CONVENTIONAL MODE: Unsquels the receiver. Press and hold to monitor activity on the selected channel.

PTT Bar

Press to acquire a channel and to transmit messages or numbers. Optionally, may be disabled for the Call Initiate function.

CHANNEL (TPX8403)

Selects the operating channel or area. Two position slide switch

CONTROLS AND INDICATORS

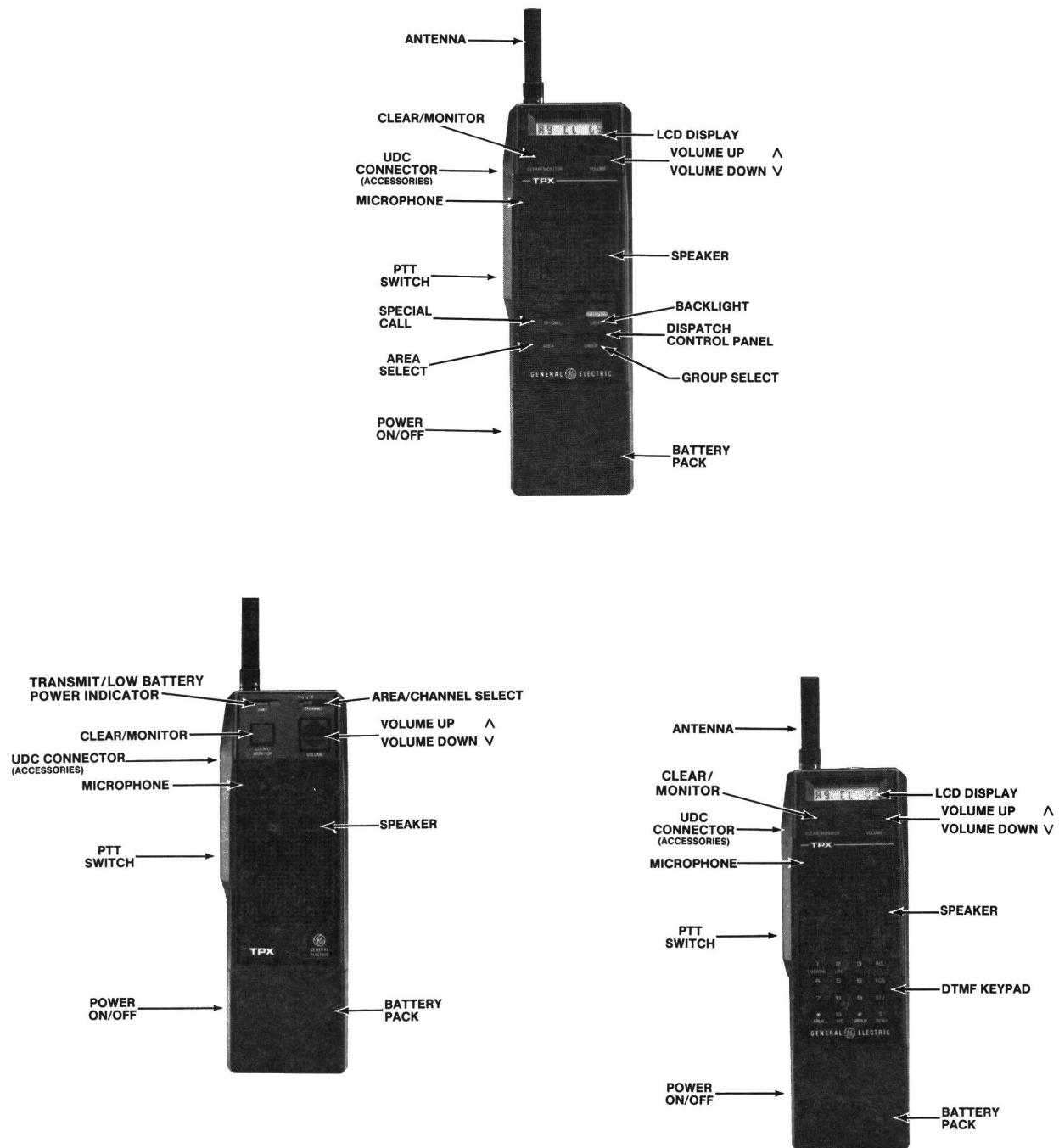


FIGURE 9 - CONTROLS AND INDICATORS

NOTE

The following controls are present only on the TPX8603 model radio

AREA

Press "AREA" to select or increment to the next higher (or lower) programmed area.

GROUP

Press "GROUP" to select or increment to the next channel.

TRUNKED MODE: Increments to the next higher (or lower) group. Inoperative in areas dedicated to direct GE Marc channels.

CONVENTIONAL MODE: Increments to the next higher (or lower) programmed channel.

SPC CALL

Selects the Special Call function.

NOTE

If the current group, channel, or SPC is programmed in succeeding areas, then that group, channel, or SPC will be displayed as you select the areas. If no groups are programmed for an area, then "____ SPC" will be displayed.

Area

NOTE

The following controls apply only to the "K" Panel.

FCN

Selects extended features. (back light, dispatch over dial, keypad disable, number store disable, and special call). Special Call cannot be selected while a call is in progress.

FCN/GROUP

Reverses the order of area and group selection.

FCN/SPC

Selects the special call function (individual communications channel).

FCN/1

Selects dispatch over dial tone entry.

FCN/2

Toggles the LCD back light on or off. If the light remains on longer than the programmed time, the radio will turn the light off. Pressing any key resets the timer.

FCN/7

Disables the keypad. CLEAR/MONITOR, VOL, AND FCN/7 controls remain active. A "2" appears in the subscript display

FCN/8

Disables the STO (store) key so that memory locations cannot be changed. A "1" appears in the subscript display.

RCL/ (0-9)

Recall number from memory location. Push "S" (or PTT) to send.

RCL/RCL

Recall last number dialed. Press "S" (or PTT) to send.

SEND

Transmits numbers displayed or entered (15 digits maximum). Optionally, initiates a call if PTT Call Initiate is disabled.

STO/ (0-9)

Stores up to 10 frequently used numbers (15 digits maximum). Numbers may not be stored while the radio is keyed or the memory is disabled. A "1" in the subscript display indicates the disabled condition.

VISUAL INDICATORS (TPX 8603)

A liquid crystal display (LCD) provides the operational state and status of the radio. The status indicators consist of subscripts that appear in the display.

PASSED

Displayed momentarily after initial power up and successful completion of self diagnostic tests.

**ERROR
1-4**

These messages indicate that the radio is inoperative

ERROR 1 - No areas programmed in the radio
 ERROR 2 - Illegal tones in tone sets
 ERROR 3 - Radio RF hardware
 ERROR 4 - Radio logic hardware

**AREA/
GROUP**

The active Area is displayed on the left side and the Group is displayed on the right side of the LCD display. Up to four characters may be programmed to identify the Area and four for the Group. Alpha numeric characters may be used. For example: POLICE, FIRE or MED CALL. (Only upper case characters are allowed).

**XMT
(TPX8403)**

ON: Indicates that the transmitter is keyed.

FLASHING: Indicates a weaker battery and the transmitter is disabled.

SUBSCRIPT DISPLAY (TPX 8603)

TX RX RDY BAT BSY FCN 1 2

TX

ON: Indicates transmitter is keyed.

RX

FLASHING: Indicates channel acquisition time.

TRUNKED MODE: Flashing indicates incoming call. (Not used in areas programmed for direct communications).

CONVENTIONAL MODE: ON- indicates call received or CLEAR/ MONITOR switch pressed.

RDY

TRUNKED MODE ONLY: indicates radio ready. Begin transmission.

BAT

ON: Indicates a low battery. (Should be charged).

FLASHING: Indicates a weaker battery. The transmitter is disabled.

BSY

ON: Indicates the channel is busy or the GE MARC unit is out-of-range of repeaters (See Out-Of-Range).

FLASHING: Indicates all channels are busy and, if the K panel is used, the Call Retry function is active. Not operative during over dial and autodial functions.

FCN

Indicates extended feature functions may be selected.

1

Indicates "Store" function is disabled. Press FCN/8.

2

Indicates keypad is locked. Press FCN/7.

ALERT TONES

SELF CHECK TEST

Three beeps are sounded immediately after the radio is turned on to indicate the radio has passed the self diagnostic tests. "PASSED" is displayed momentarily.

CALL RECEIVED

A one or two tone alert sequence is sounded each time a call is received and the RX indicator flashes. A single tone alert indicates a Group call; two tones indicate an individual call. (NOTE: The radio can be programmed to mute the Call Received Alert Tones).

ALL CHANNELS BUSY

If all channels are busy a single beep is sounded. If Call Retry is enabled, a beep is sounded each time an unsuccessful attempt is made.

CALL ORIGINATE

When originating a call a three tone alert signal is sounded to indicate the channel is ready for normal conversation.

OUT OF RANGE/RADIO INOPERATIVE

Five beeps are sounded (4 short—1 long) and the BSY indicator lights for approximately 20 seconds (the radio is disabled during this time) to indicate that the radio is out of repeater range; or, if the beeps are sounded when the radio is within known range of the repeater, it indicates the radio is in need of service.

CARRIER CONTROL TIMER

When the transmitter has been keyed continuously in excess of the preprogrammed time, the carrier control timer sounds a pulsed tone to warn the user that the transmitter is going off the air. After 9 seconds of pulsing, the transmitter is turned off. To avoid going off the air, the user should rekey the microphone. Ranges from 0 to 7.5 minutes in 30 second increments may be programmed. In conventional areas the transmitter is turned off before the pulsed tones are received.

INITIAL ASSEMBLY & OPERATION

The TPX personal radio operates in the GE MARC Trunked and/or Direct mode, Conventional mode, or a combination of these modes, depending upon how the radio is programmed.

The radio is controlled by a two part control panel consisting of an upper section and a lower section. The upper section contains a back lighted LCD display, a CLEAR/MONITOR button, and VOLUME up-down controls. The lower section consists of the "D" or "K" control panel.

The "D" Panel (Dispatch) contains a SP-CALL, LIGHT, AREA, and GROUP/Channel buttons. The "K" Panel, in addition to the controls listed above for the "D" panel, contains the DTMF keypad which provides Telephone Interconnect capability.

Extended features made available by the "K" Control panel are selected by the FCN switch. While most functions are labeled on the keys, some are labeled below the key that enables the function. Extended functions include display back lighting, dispatch override, special call, number store disable, and keypad disable. The extended feature functions are selected by pressing the FCN key and the desired function key.

INITIAL ASSEMBLY

The TPX radio as shipped from the factory is disassembled and consists of three main assemblies: the TPX Radio (Main Unit), antenna, and battery pack.

Assemble these parts into one unit as instructed below. Refer to Figures 1 through 3.

1. Screw the antenna into 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 radio until it locks into place.

TURNING THE RADIO ON

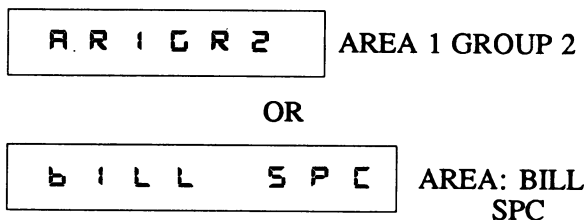
1. Slide the power on/off switch on the battery pack to the ON position. The radio beeps three times indicating it has passed the self diagnostic tests and is ready for use. "PASSED" is displayed for 500 milliseconds. The radio will display the Area and Group (or channel number) which were last selected.
2. The volume will return to the last level selected. To set the audio level, press and hold the VOLUME control while listening to the beeps. Double beeps indicate operation in the GE Marc mode. Single beeps indicate operation in the conventional mode.

TURNING THE RADIO OFF

1. Slide the ON/OFF switch on the battery pack to the OFF position.

RECEIVING A CALL

An alert tone is sounded each time a call is received (unless the Received Call Alert option is disabled). A single tone alert indicates a group call. A two tone alert indicates an individual call. The display (TPX8603 only) will identify the area and group of the received call and will be in one of two formats:



To respond to a received call, simply hold the radio vertically and press the PTT bar while speaking across the grill in a normal voice. Release the PTT bar when finished to enable receipt of messages from the calling party.

NOTE

Normally, the radio will decode the Individual as well as the selected Group tones. If SPC is shown in the display, then the last selected Group and the Individual calls will be received.

CALL ORIGINATE OPERATION

When operating in the GE Marc mode, calls are generally initiated by pressing the PTT bar and acquiring a channel.

Interconnect calls ("K" PANEL) can be originated by first entering the correct digits and pressing the "S" (SEND) key. Optionally, the PTT Call Initiate function may be reassigned to the "S" send key (programmable). This option prevents the user from accidentally pressing the PTT bar and acquiring a channel. The "S" key functions as follows:

PTT Call Initiate Disabled:	Send key used to initiate a call, then PTT bar is used as before to transmit messages.
PTT Call Initiate Enabled:	PTT bar used to initiate a call, however, numbers may be sent using the "S" key or PTT bar.

PLACING A DISPATCH CALL

1. TPX8403: Select the desired Area by sliding the CHANNEL switch to the desired position.
2. TPX8603: Select the desired Area and Group by pressing the Area/Group buttons. The display will show the Area and Group.

NOTE

If the SPECIAL CALL feature is desired (e.g., individual communications to the control station or for interconnect to telephone lines) refer to Page 22.

3. Press the PTT bar on the side of the radio. TX will appear in the subscript display.
4. The radio will sound a three tone alert signal when you may begin the conversation. The RDY indicator will appear in the subscript display as shown below.

A R I C R S RDY

If the call cannot be completed, a steady low frequency tone will sound for one second, indicating all channels are busy. If this happens, press the PTT bar again to retry the call or, if call retry is enabled (programmed) the radio will automatically retry your call every 5 seconds for 15 tries or, until the call is completed.

5. Terminate the call when you are finished by pressing the CLEAR/MONITOR button. **NOTE:** The call will automatically time out after approximately 6 seconds of inactivity.

PLACING A SPECIAL CALL (TPX8603)

1. To select the area programmed for special call, press the AREA key followed by FCN/SPC (K panel) or SP CALL (D panel). If the area has no programmed groups, SPC selection is automatic.

A R I S P C TX RDY

↑ ↑
 ——— Begin communications
 ——— On during channel acquisition and PTT

2. Press the PTT bar and wait for the ready tone (three tone alert) before beginning the conversation.

NOTE

If instead you hear a steady low frequency tone, it indicates that all channels are busy. Press the PTT bar again to reinitiate the call or, if Call Retry is enabled (BSY indicator flashing) the radio will automatically retry your call 15 times or, until the call is completed.

3. Press the PTT bar and speak across grill in a normal voice.
4. Terminate the call by pressing the CLEAR/MONITOR button. A short beep is sounded when the channel is cleared.

USING THE TELEPHONE INTERCONNECT SYSTEM (K PANEL ONLY)

The telephone interconnect system provides the user with easy access to the telephone system. Up to ten frequently used numbers may be stored in memory for quick recall, or any number may be dialed manually. Each dialer number may contain up to 15 digits. The dialer locations can be accessed by pressing RCL and the memory location number 0-9.

Storing A Dialer Number

1. Turn the radio on.
2. Enter the digits to be stored (15 maximum).
3. Press STO (store) on the keypad. (If memory is locked, press FCN/8 before entering the number).
4. Enter the memory location number in which you want to store the dialer number.
5. The display will return to normal Area selection when the number is stored.

Recalling A Dialer Number

1. Select the desired area and group by pressing the AREA and GROUP keys or the FCN/SPC keys.
2. Press RCL.
3. Press the memory location number. The display will show the 8 digits followed immediately by the last 7 digits.

1 4 1 5 7 1 5 1 5 2 8 - 1 2 1 2	(displayed for 1 second)
------------------------------------	-----------------------------

4. Press the PTT bar or "S" (send) key.

NOTE

After entering the Ready Mode, you may send a credit card number or any other number by pressing RCL, the memory location number, and then pressing the PTT bar.

Placing A Telephone Interconnect Call

1. Select the Area and Group (or Special Call) designated for Telephone Interconnect calls.
2. Recall or enter the telephone number from the keypad, observing each number as it is entered. If the number exceeds 8 digits, the first ones entered will roll off the display as others are entered. Up to 15 digits may be dialed but only the last 8 are displayed.

NOTE

If you misdial, press the CLEAR/MONITOR button. This will erase the entire number. You must then reinitiate the call.

If the number is entered manually, the display will show:

S 2 8 0 0 0 0

or, if recalled, the display will blank and show:

S 2 8 - 0 0 0 0

3. Press the PTT bar or "S" (send) key. The display will show:

A U T O D I A L

NOTE

To redial the last number dialed simply press the RCL key twice and then press the PTT bar or "S" (send) key.

NOTE

Observe the display as each key is pressed before entering the next number. Pressing keys too rapidly in succession could result in incomplete or incorrect calls.

NOTE: A call may also be initiated by first acquiring a channel, then entering the digits and pressing the "S" key or the PTT bar. To acquire a channel simply press and release the PTT bar and wait for the ready tones and dial tone. After dialing is complete the display will revert to the selected area/group.

Manual Telephone Dialing

Manual dialing allows the user to dial telephone numbers directly. The user must select the area and group designated for telephone interconnect calls. Refer to "PLACING A TELEPHONE INTERCONNECT CALL".

1. Press and release the PTT bar. The TX subscript will flash indicating channel acquisition. Three alert tones will be heard and the RDY subscript will light indicating the radio is ready to transmit.

NOTE

If already on channel, you may manually dial the number after receiving the alert tone and dial tone.

2. After receipt of the alert tones the RDY indicator will light followed by a dial tone. If the dial tone is not heard, press the PTT bar and "*".

The display will show:

B I L L S P C AREA: BILL SPC
TX RDY

3. After receipt of the dial tone, press the PTT bar and enter the digits on the keypad. A beep is sounded each time a digit is entered and displayed.
4. Release the PTT bar. The ringing tone will be heard.
5. To terminate the call, press the CLEAR/MONITOR button.

NOTE

When dialing manually, you must wait until the previous digit has been sent before entering succeeding digits.

USING THE OVERDIAL SYSTEM

Storing A Dispatch Overdial Number

1. Press FCN/1. The display shows:

O U E R d I A L

2. Enter the 4 or 8 digit number assigned as the individual or group call number. The display will show the digits entered.

< 2 1 0 9

↑
Indicates overdial

3. Press STO (store) on the keypad.
4. Enter the location number in which you want to store the dialer number.
5. Recall to verify that the correct number was stored. If an invalid number is stored, it will not be sent. Instead, the radio will revert to the previous display when keyed. Press RCL and the location. The stored number is displayed.

Dispatch Overdial Calls

Dispatch overdial allows calls to other radios which are not programmed into your radio. All you need to know is the four or eight digit number of the radio you are trying to call.

To Place An Overdial Call From The Keypad

1. Select the Area you wish to contact.
2. Press FCN/1. Display will show:

O U E R d I A L

3. Enter the 4 or 8 digits, as appropriate. The display will show the digits.

< 1 7 1 2

4. Press PTT (or SEND). The display will show the number and "TX". A short low frequency tone will be heard.

2 2 1 8 1 0 2 1
TX RDY

5. Wait for the second tone before proceeding with communications. The display will show the area and group number. The group number displayed has no significance for overdial calls.
6. Press the PTT bar while speaking directly into the grill or the external microphone.

To Place an Overdial Call from A Memory Location

1. Select the desired area. The display will show the area and group number. The group number has no significance for overdial calls.

b i l l c r s

2. Press RCL and the memory location number. The memory location selected must contain the stored overdial number. The display will show:

O U E R d I A L

then the stored number. For example:

2 5 1 2 1 1 1 4

or

< 1 2 0 3

3. Press PTT (or SEND). The display will show the number and "TX". A short low frequency tone will be heard.
4. Wait for the second beep before proceeding with communications. A low frequency tone is heard if not successful. The display will show the area and group number.
5. Press the PTT bar and speak directly into the grill or the external microphone.
6. Terminate the call by pressing the CLEAR/MONITOR button.

Manual Overdial

1. Select the desired area.
2. Press FCN. The display will show:

A	R	I	G	R	I
FCN					

3. Press 1. The display will show:

O	U	E	R	D	I	A	L
---	---	---	---	---	---	---	---

4. Enter the 4 or 8 digit overdial tone number

<	1	2	3	0
---	---	---	---	---

5. Press the "S" key or the PTT bar. A short low frequency tone will sound.
6. Wait for the second beep before proceeding. A low frequency tone is sounded, if not successful. The display will show the area and group number.
7. Press the PTT bar and speak directly into the grill or external microphone.
8. Terminate the call by pressing the CLEAR/MONITOR button.

DIRECT MODETo Receive a Message:

1. Select the desired Area by pressing the AREA key.
2. Set the volume to the desired listening level.

To Send A Message:

1. Press the AREA key to select the area designated for direct communications. The display will show "DIRECT" or other preprogrammed identification.
2. Press the PTT bar and speak directly into the grill or across the face of the external microphone.

CONVENTIONAL MODETo Receive A Message

1. Select the desired Area by pressing the AREA key.
2. Select the desired channel by pressing the GROUP key.
3. Set the volume to the desired listening level.

To Send A Message

1. Turn the radio on and select the operating channel as instructed in TO RECEIVE A MESSAGE.
2. Press the CLEAR/MONITOR button to determine if the channel is in use. Never interrupt another conversation.
3. Press the PTT bar and speak directly into the grill or across the face of the external microphone.

SYSTEM ANALYSIS

General Electric TPX Personal Radios are two-way FM radios designed for operation in the GE MARC V Trunked communication system and the conventional system. The TPX radio consists of three printed wire boards:

Radio Board: contains the transmitter, receiver, and frequency synthesizer,

Control Board: contains the logic control and audio processor circuits

Display Board: contains the LCD or LED displays.

Interconnections between the printed wire boards are made by a flexible circuit board and connectors.

All control leads which are "barred", such as PTT, means that the function indicated is active when the lead is in a low voltage condition.

Circuit illustrations shown within the text are intended only to illustrate the basic functions.

TRANSMIT CIRCUIT

The TPX transmit circuit, shown in Figure 11, consists of the following circuits and integrated circuit modules:

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

Transmit Amplifier Module A201 (TX-Amp)

RF from synthesizer circuit A106 is applied to the base input of RF amplifier Q107. The RF is amplified and applied to Tx-Amp module, A201. A201 is a two stage RF amplifier hybrid IC (refer to Figure10). A "0" dBm RF signal on the input will produce a 23 dBm signal on the output. This module is wideband and does not require tuning. The output of TX-Amp A201 is coupled through resistive attenuator R205 to the input of Power Amplifier Module A202 (PA).

Power Amplifier Module A202 (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 12). DC power is applied to the first stage of the PA module by power control transistor Q202. The RF power output from the TX-Amp circuit is applied through pin 1 of the PA module to the input of the first power amplifier stage. The power amplifier module typically provides a gain of

13 to 18 dB, amplifying the input from the TX-Amp circuit to a power output level of 4 watts at pin 5. The output is then connected through power control module A203 and TX-RX RF switch MD003 to low pass filter network, FL201. A minimum power level of 3 watts is present at the output of the filter network

Power Control Module (A203)

The Power Control Module (PC) provides constant control of the RF output power. The RF power output of the radio is regulated by sensing variations in the output of the PA module and then using these variations to control the DC supply voltage to the first stage of the PA module (refer to Figure 13). When the transmitter is keyed, +5.4 Vdc is applied to the first stage of the power control module through pin 11 and the output of the reference amplifier, determined by the High/Low power control, is applied to the positive input of the comparator circuit.

The output of the final PA is applied to the Power Control Module through pin 1 and to the internal 50 ohm CM coupled line. The detected voltage of the CM coupled output is applied to the negative input of the comparator amplifier. The amplifier is enabled when the transmit circuit is keyed, until then, the output of the amplifier is low and transistor Q202 is held off. As the PA module begins to increase output power, the detected voltage causes the series regulator circuit to regulate the supply voltage to maintain constant RF output power. The output of the Power Control Module is applied to Filter Network FL201 through Antenna RF Switch A204 (MD003).

FIGURE 10 - AMPLIFIER MODULE A201

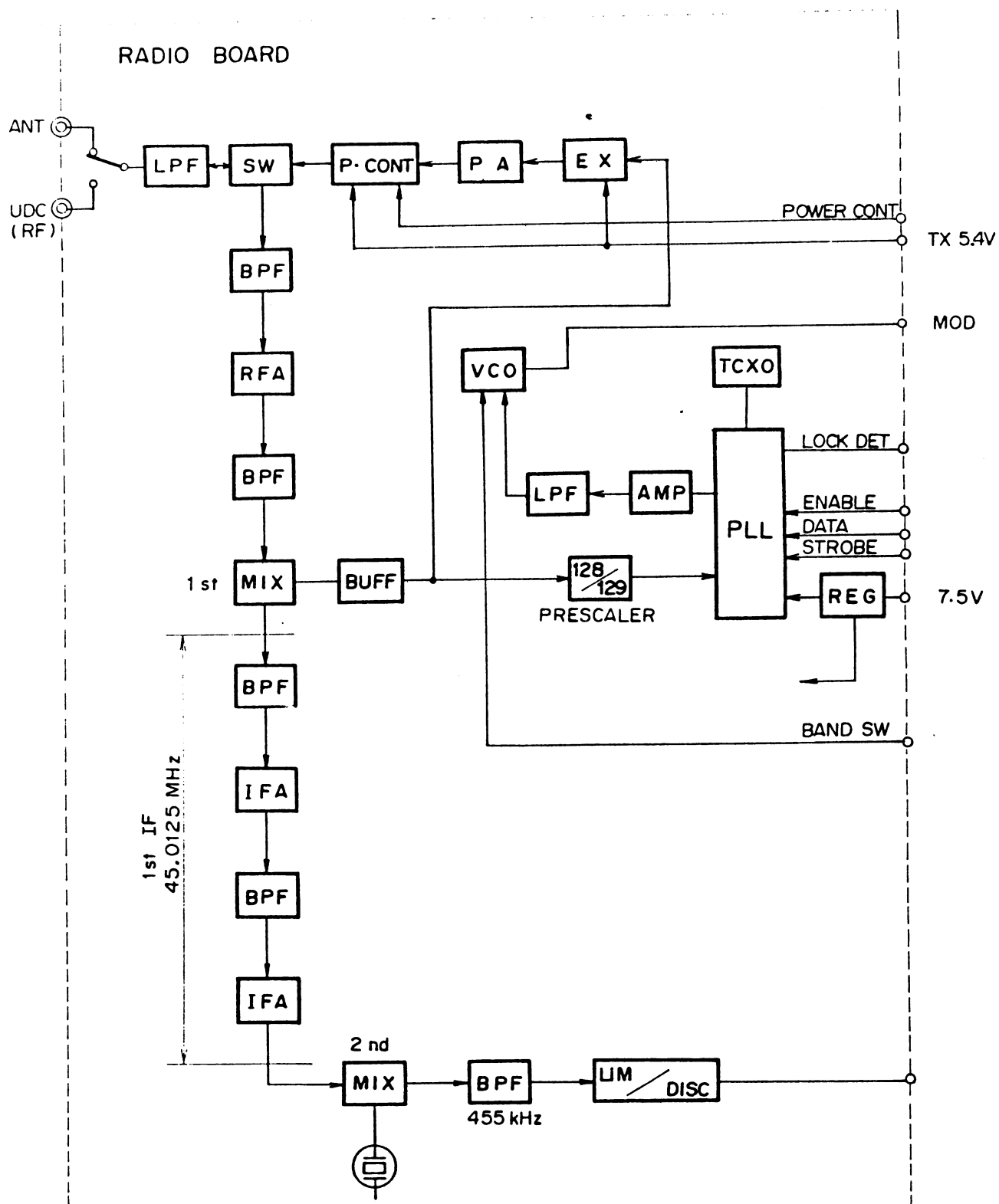


FIGURE 11 - RADIO BLOCK DIAGRAM

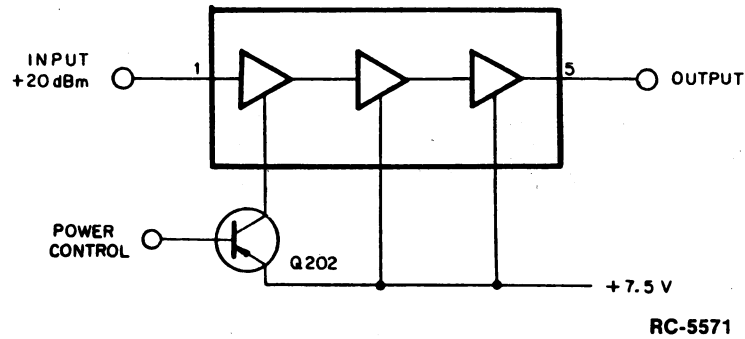


FIGURE 12 - POWER AMPLIFIER MODULE (PA), A202

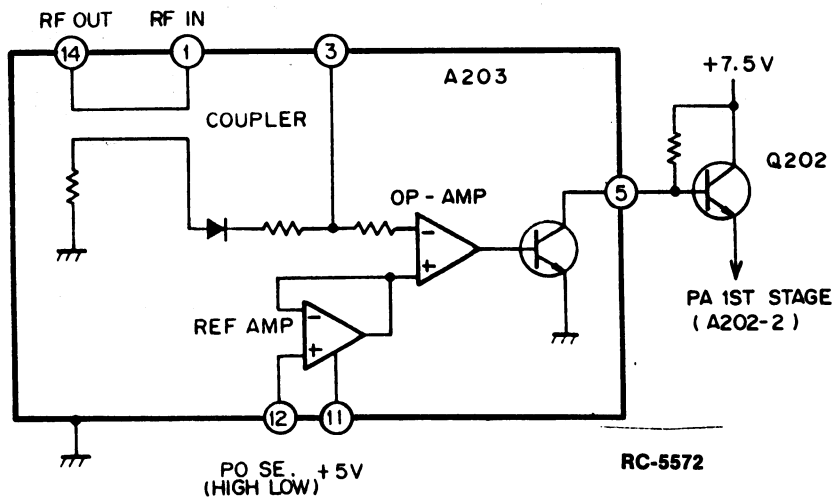


FIGURE 13 - POWER CONTROL MODULE A203 (PC)

Filter Network FL201

The output of the PA module is connected to filter network FL201 through RF switching IC, A204. The filter network is a passive low pass filter consisting of a three stage LC filter to eliminate higher order harmonics. It has an insertion loss of less than 0.5 dB in the pass band and a frequency rejection greater than 45 dB in the stop band. The output of the filter network is connected to the system antenna.

RECEIVER CIRCUITS

The TPX receive circuit shown in Figure 11, Receiver 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 14 - RF Amplifier/Mixer.

RF from the antenna is coupled through transmit low pass filter FL201 and Antenna RF Switch, A204, to the input of the RF amplifier circuit. FL201 provides additional receiver selectivity. The RF input signal from the antenna switching IC is coupled through third order band pass filter FL301 to the input of grounded emitter, broad band RF amplifier Q301. Q301 provides 12 dB gain, thus reducing thermal noise. The output of the RF amplifier is coupled through band pass filter FL302 to drive double balanced mixer circuit A301.

The RF signal from band pass filter FL302 and the injection frequency from the synthesizer circuit, are mixed by a special double balanced mixer A301 to provide a 45 MHz IF frequency. The double balanced mixer has a typical conversion loss of 6 dB between the RF input and IF output. All inputs and outputs of the RF Amplifier/Mixer have an impedance of 50 ohms. The +7 dBm injection frequency level, provided by synthesizer A106 and amplifier 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 2-pole crystal filters (refer to Figure 15). The first IF signal (45 MHz) from the first mixer circuit is applied to the input of preamplifier transistor Q302 through crystal filter FL303 with an impedance of approximately 3K ohms. Preamplifier Q302 provides a 17 dB power gain. The output of Q302 is applied to the input of IF amplifier 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 a 455 kHz ceramic filter FL305 (refer to Figure 16). 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.

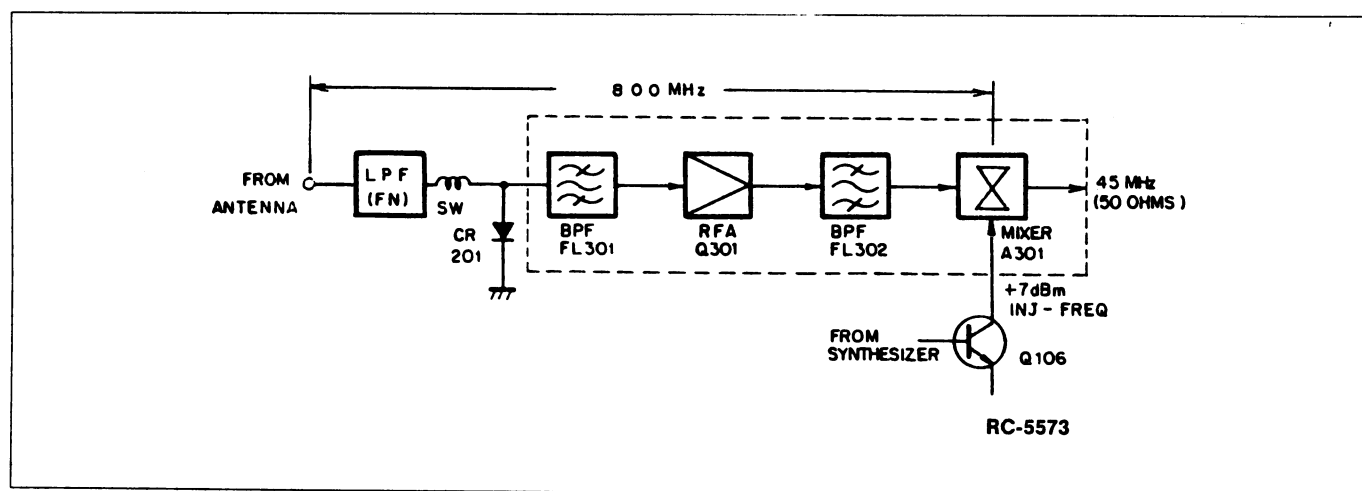


FIGURE 14 - RF AMPLIFIER MIXER

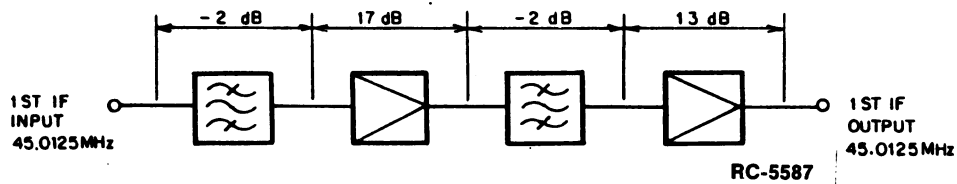


FIGURE 15 - FIRST IF AMPLIFIER

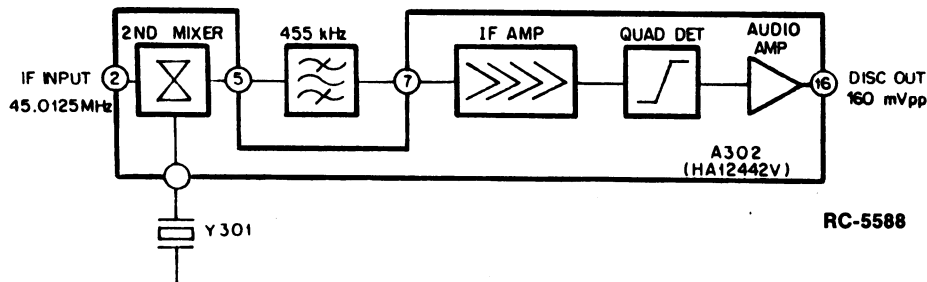


FIGURE 16 - SECOND IF AMPLIFIER/DISCRIMINATOR

SYNTHESIZER CIRCUIT A102, A103

The synthesizer circuitry is located on two modules: the VCO module and the TCXO module. The synthesizer circuit consists of the Phase Lock Loop module (PLL) A102, TCX Reference Oscillator Module A103, TX/RX Voltage Controlled Oscillator module (VCO) A106 and a Low Pass Filter amplifier (LPF). Refer to Figure 17- 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 7 MHz - 10 MHz, then divides this signal down to 12.5 kHz with a programmable divider. A VCO control signal is generated by comparing the 12.5 kHz feedback signal with a second 12.5 kHz signal derived by dividing the 12.8 MHz TCXO frequency by 1024. The VCO is forced to change by 12.5 kHz each time the least significant bit in the programming is changed.

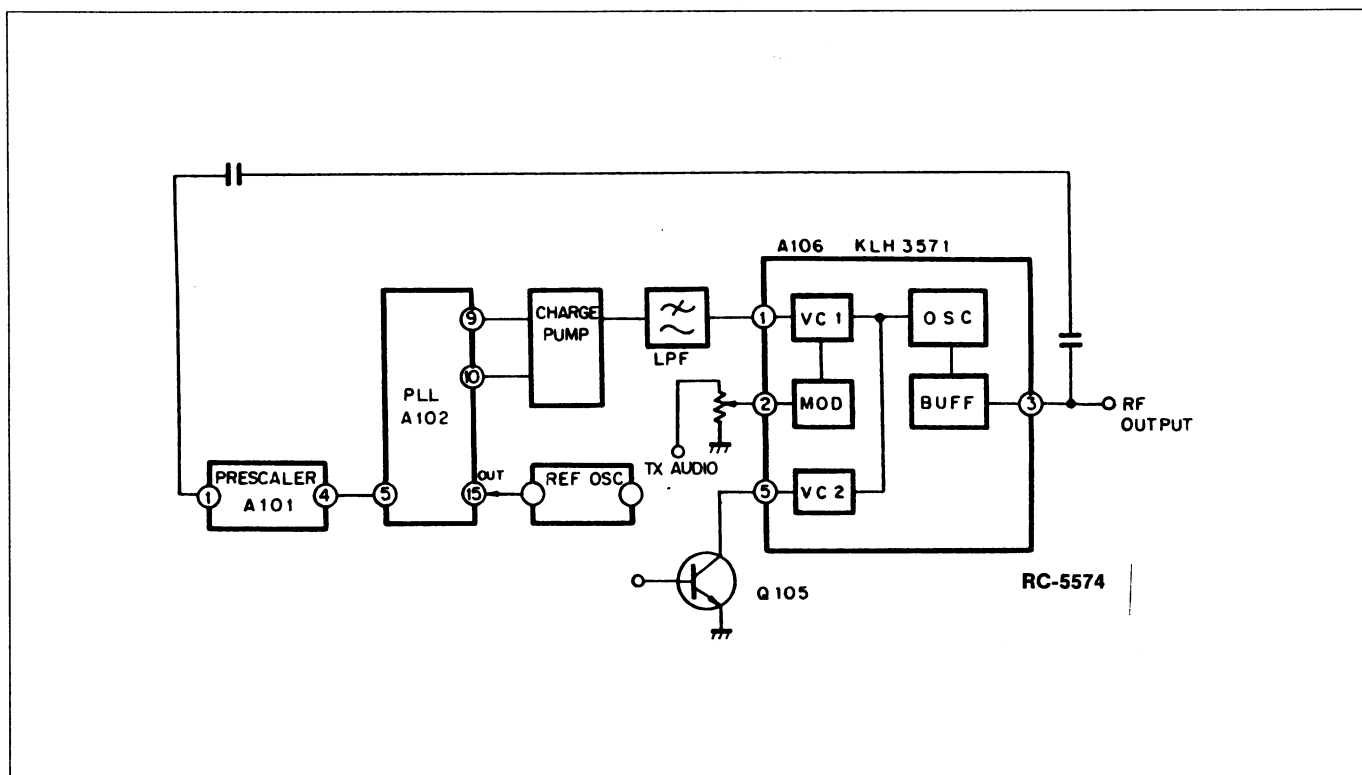


FIGURE 17 - SYNTHESIZER

Phase Lock Loop Module (A102)

The PLL module A102 contains a reference frequency divider, phase detector and a programmable divider. The DC voltage output signal from the phase detector is applied to a charge pump and then 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 resultant DC output represents the error between the VCO frequency (phase) and the reference (TCX) frequency and is applied to the VCO to maintain the correct frequency.

Serial data from the microprocessor is shifted into the PLL to set the division parameter which establishes the operating frequency. A clock signal is provided on a second input and the data is clocked through by 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 and two parallel capacitors, a frequency

control varicap, and a fixed capacitor. The resonant circuit is used to set the center frequency. The output of the RX-VCO amplifier Q106 is coupled to the receiver first double balanced mixer A301 through buffer amplifier Q106. The output of TX-VCO amplifier A106 is coupled directly to the TX-Amp input circuit through C138.

TCX Reference Oscillator (A103)

The A103 oscillator module is a self contained, fully temperature compensated crystal controlled oscillator and operates at a frequency of 12.8 MHz. The transmit frequency is adjusted by a trimmer while monitoring the output at the antenna connector.

CONTROLLER

The controller circuit provides the control for the audio and display circuits and the radio unit. Figure 18 is a block diagram showing the interrelationship between the various functions performed by the Control Board. The controller consists of two printed wire boards, the Control Board and the Display and Switch Board. It also includes the Control panel, "K" or "D".

Control Board

The Control Board includes the following circuits:

- CMOS Microprocessor (A1)
- RAM With Lithium Battery (A4 plus BT1)
- Audio Processor (A9)
- Audio Amplifier (A11-13, & A16)
- Voltage Regulator Circuit (A14 & A17)
- External Buffer (A15)
- Program PROM (A3)
- CMOS IC (A2, A5, A6 ,A10)
- Voltage Detector (A18)

Microprocessor (A1)

The microprocessor controls the following functions for the radio unit. The time base for the microprocessor is established by the 11.0592 MHz clock generator.

- Loading data to the frequency synthesizer
- Fetching and processing the PTT function, monitoring, channel selection, 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 number and signaling)
- Encoding/decoding control of GE MARC V Signaling
- Encoding the DTMF

RAM (A4)

The RAM has a capacity of 8 bits X 2K to store control data for the radio. Input data is entered through the UDC connector and applied to microprocessor A1. It is then stored in the RAM. Data entered consists mainly of the following:

- Channel Frequency Data
- Channel Guard Data
- TX Power, TX Modulation Data
- Squelch Data
- GE Marc V Tone Data
- Display Data...etc.

Audio Processor (A9)

Audio processor (A9) consists of a single chip which provides nearly all of the audio functions. The audio functions are executed under control of the microprocessor. The circuits within the audio processor include:

- Channel Guard 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

Almost all of these functions are accomplished by circuits consisting of switched capacitor filters, amplifiers and timing logic. The timing for the logic is derived from the 3.579545 MHz clock generator.

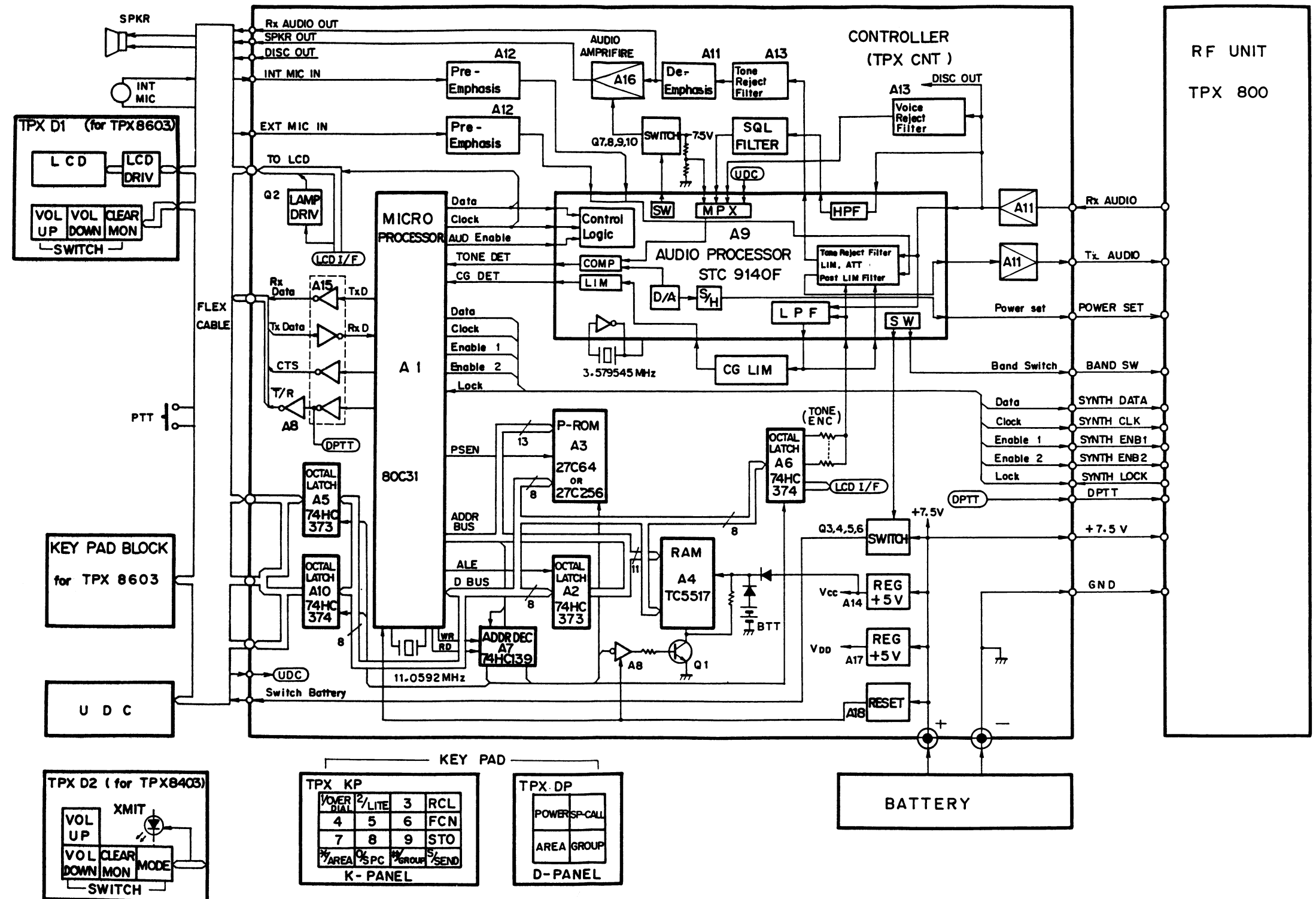


FIGURE 18 - CONTROL BLOCK DIAGRAM

Audio Amplifiers (A11-A13 & A16)

These audio amplifiers are located between the audio processor and the microphone or the speaker. Amplifier A12 provides pre-emphasis for transmit audio and de-emphasis for the receive audio. Audio from the tone reject filter in the Audio Processor is passed through Tone Reject Filter A13 and De-emphasis Network A11. The audio is then amplified by Audio Amplifier A16 before being applied to the speaker.

Voltage Regulator Circuit (A14 & A17)

Voltage Regulator Circuit A14 and A17 provides a regulated +5 VDC supply for the Control Board. A14 provides 4.4 Vdc (VCC) to the microprocessor and logic control circuits and 5.0 Vdc (VCC 1) to the LCD light through Q2. A17 provides 5.0 Vdc (VDD) to the audio circuits.

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.

Programmable PROM A3

Contains software to control the microprocessor.

CMOS IC, Buffer, and Latch (A2, A5, A6, A10)

Data bus buffer A2 provides buffering for Address data bits A0 through A7. A2 is located between the microprocessor (A1) and Programmable ROM (A3).

Voltage Detector A18

Voltage Detector A18 monitors the 7.5Vdc input line and in the event the voltage drops below a predetermined level, it will reset the microcomputer.

LED Board TPX D2 (TPX8403)

The LED Board consists of Transmit LED, CR1, and Function Select switch, S1. The red XMIT indicator turns ON steady when the PTT bar is pressed or

flashes on and off when the battery is low. Switch S1 controls the volume, selects the desired channel/area, and provides the clear/monitor function.

LCD Board TPX D1 (TPX 8603)

The LCD Board contains the following circuits:

- LCD Driver A1
- LCD
- Back Lighting Circuit (Q1, CR1-CR6)
- Switch (S1, through S3)

The LCD board is equipped with 14 segments, eight characters and 8 status displays. Microprocessor signals drive the LCD driver, located on the Control Board. The LCD driver controls the operation of the LCD. The LCD board also is equipped with a back lighting circuit to light the dark area of the display under control of the microprocessor. The microprocessor turns the back light on/off each time the LIGHT switch is operated.

LCD Driver A1 converts data from the microprocessor into information displayed by the LCD display.

CONTROL PANELS

There are two types of Control Panels for the TPX8603 model radio: "D" (Dispatch) and "K" (DTMF). The Control Panels each contain the appropriate switches a flexible cable and rubber contacts. The flexible cable provides the interface between the Control Panel and the microcomputer. The "K" Control Panel contains a DTMF keypad.

UDC CONNECTOR

The UDC connector is located on the side of the main frame, to facilitate external connections to the various options available. The UDC connector also provides the interface connection to the suitcase programmer (TQ2310). When the UDC voltage is set the

computer will control the incoming data. Interface signals are:

- Data Clock
 - Data
 - CTS
 - PTT, T/R, Mute
- For Data Loader
-
- Ext. Mic In
 - Rx Audio Output
 - Disc output
 - +7.5 Vdc Switch output
 - Mode
 - UDC
- For external Mic and Speaker

BATTERY PACK

Two battery packs, one with 800 mAh capacity and one with 1200 mAh capacity are available for use with the TPX 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 19).

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 it in 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.

Charge Level

A fully charged battery pack should provide a terminal voltage greater than 7.5 VDC. A fully discharged battery pack should provide a reading of less than 6 VDC.

Battery Check

One of the best service checks for the series rechargeable battery packs can be easily obtained by measuring the milliampere hour capacity. The results of the measurement can then be compared with the rated capacity of the battery pack to determine the general condition of the rechargeable batteries.

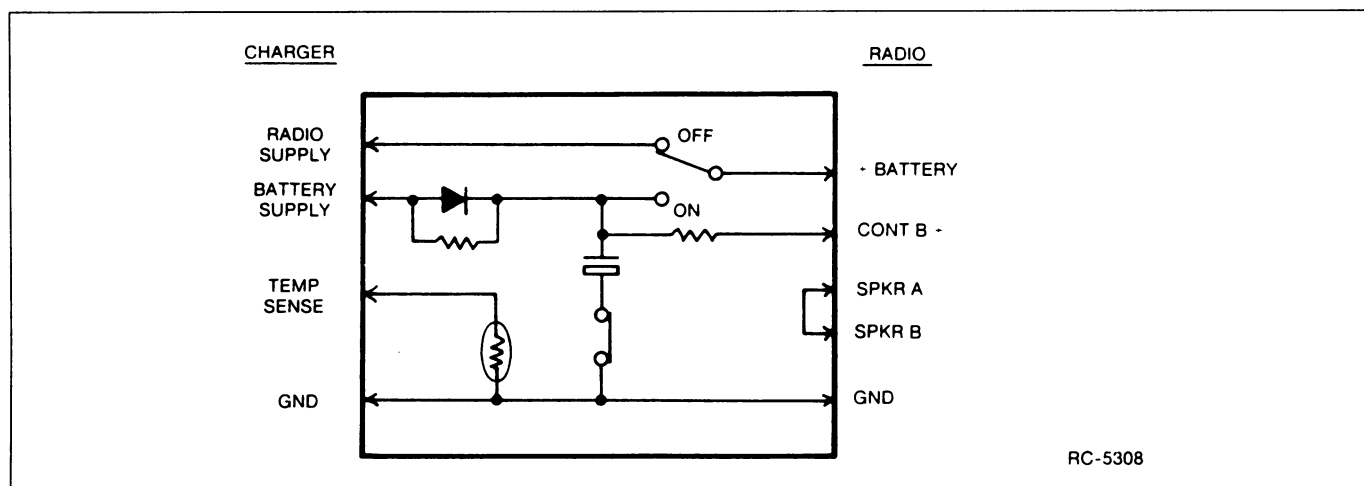


FIGURE 19 - BATTERY PACK

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

Then use the formula

$$T/60 = \%$$

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

$$65/60 = 108 \text{ (percent of capacity)}$$

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

$$108 \times 800 \text{ mA} = 864 \text{ mAh}$$

The 864 milliampere hour is the actual capacity of the battery pack.

NOTE

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

MAINTENANCE

The Maintenance section contains the Initial Adjustments, Preventive Maintenance, and Disassembly and Replacement Procedures for the radio. Information is also provided for removing and replacing chip components and module replacement. The Service Section provides a more complete set of alignment procedures for the radio and also includes a detailed Troubleshooting Procedure.

INITIAL ADJUSTMENT

After the radio has been programmed, as described in Programming Instructions (LBI-31789), 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 further readjustment.
- The frequency and modulation should be measured and recorded for future reference.
- Adjust the antenna length for optimum VSWR

Table 1 - Capacity Measurement Data

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

Receive Circuit

No initial adjustments to the receive circuit are required.

Synthesizer Circuit

No initial adjustments to the synthesizer are required.

PREVENTIVE MAINTENANCE

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

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.

Antenna

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

Alignment

The transmit and receive circuit should be checked periodically and the alignment "touched up" when necessary. Refer to the alignment and troubleshooting procedures in the Service Section for typical voltage readings.

Frequency Check

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

DISASSEMBLY AND REPLACEMENT

To gain access to the Radio Board (transmit, receive and synthesizer circuits) or Control/Logic 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 20):

CAUTION

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

Equipment Required

- Small #1 Phillips head screwdriver
- Small flat blade screwdriver
- Needle nose pliers
- Allen head wrench for removing set screws
- Pencil-type soldering iron (25-40 Watts) with a fine tip

Procedure

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.

2. 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 21).

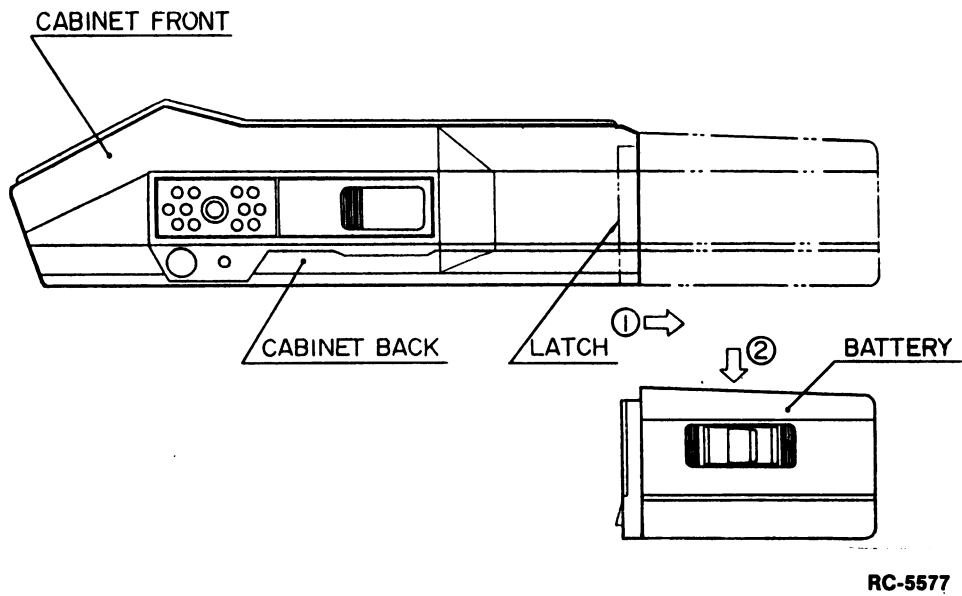


FIGURE 20 - DISASSEMBLY

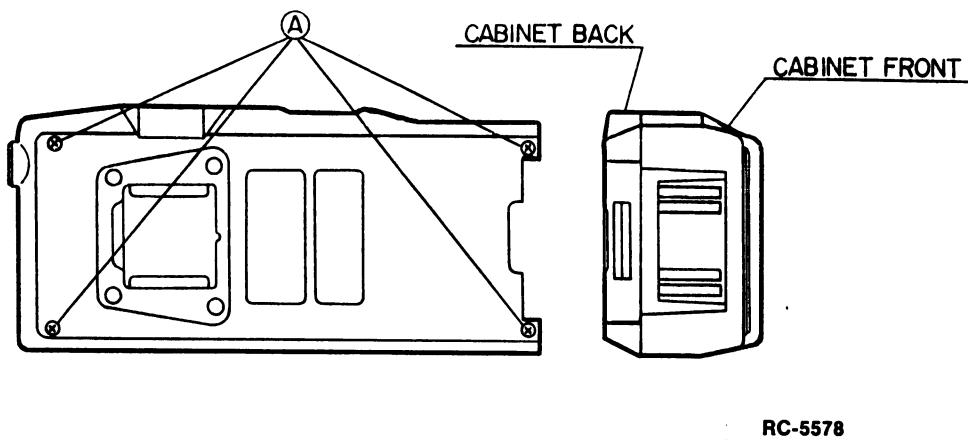


FIGURE 21 - DISASSEMBLY STEP 1

3. To Remove the Radio Board unscrew and remove antenna (B) and UDC RF connector (C). Remove eight (8) screws at (D) using the Phillips head screwdriver. The radio portion can be detached from the rear cover (See Figure 22).
4. Remove the radio shield cover (E) from the radio board. Remove radio board. (See Figure 23)
5. To remove antenna changeover switch, remove self tapping screw (F) using the Phillips head screwdriver. Unsolder the antenna switch lead connection at (G). Then the antenna switch assembly can be readily removed by hand. Remove 3 screws (H) using the Phillips head screwdriver. Then the P.W.W. (egg crate) can be removed. See Figure 24
6. To remove Controller PW Board remove 5 screws (D) from the controller board using the Phillips head screwdriver. Then remove the control board from the front cabinet. See Figure 25
7. To remove the LCD PW Board, unplug the flex circuit (J) from connector (K). Remove 2 screws (N) using the Phillips head screwdriver. Remove the LCD or LED board. See Figure 26
8. To remove the Flexible Board, remove 6 screws (L) using the Phillips head screwdriver. Solder 9 points (M) using the soldering iron. Then remove the Flexible Board from the front cabinet. See Figure 26.

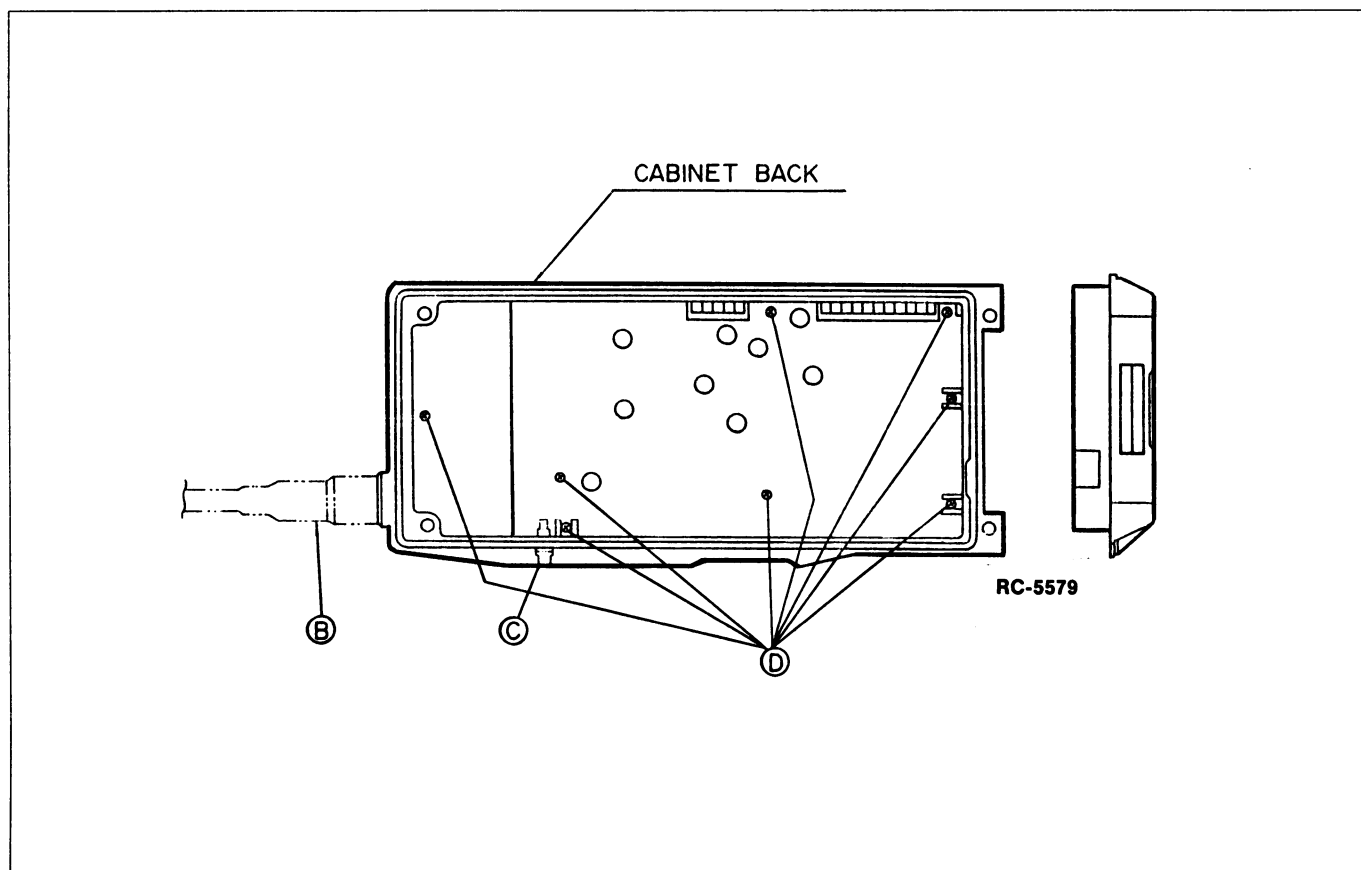


FIGURE 22 - DISASSEMBLY STEP 2

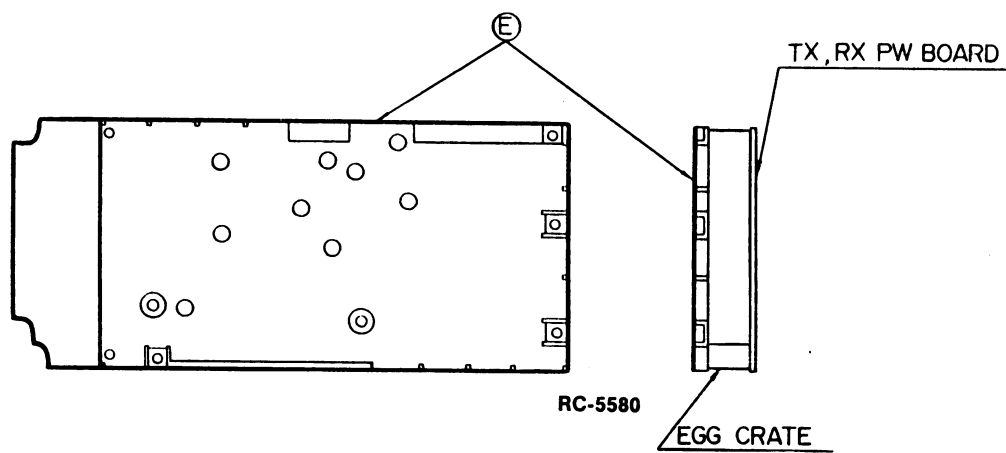


FIGURE 23 - DISASSEMBLY,STEP 3

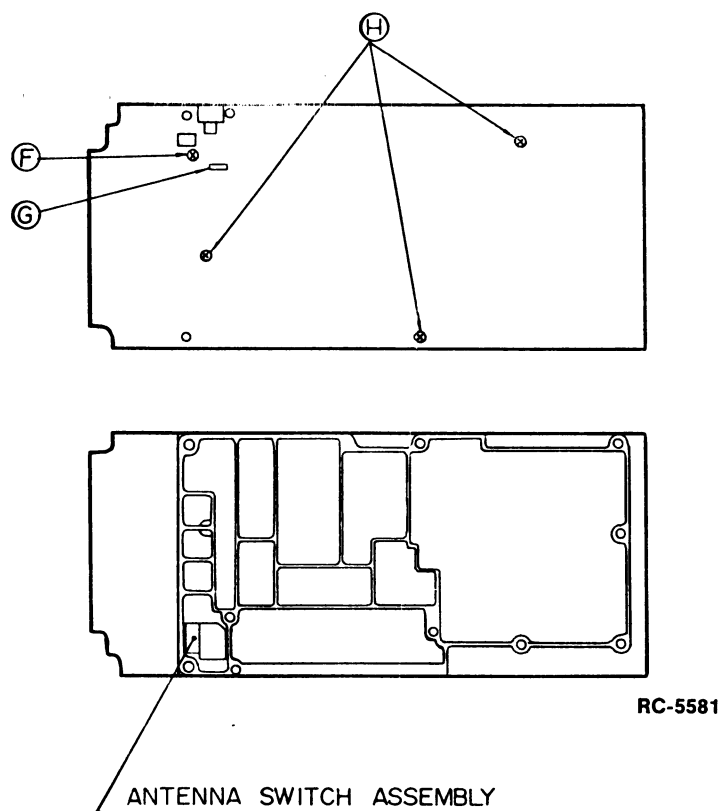


FIGURE 24 - DISASSEMBLY STEP 4

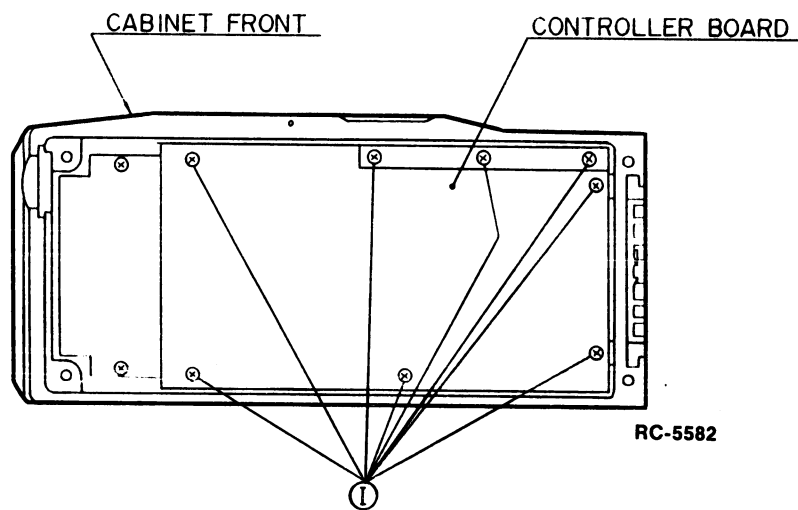


FIGURE 25 - DISASSEMBLY STEP 5

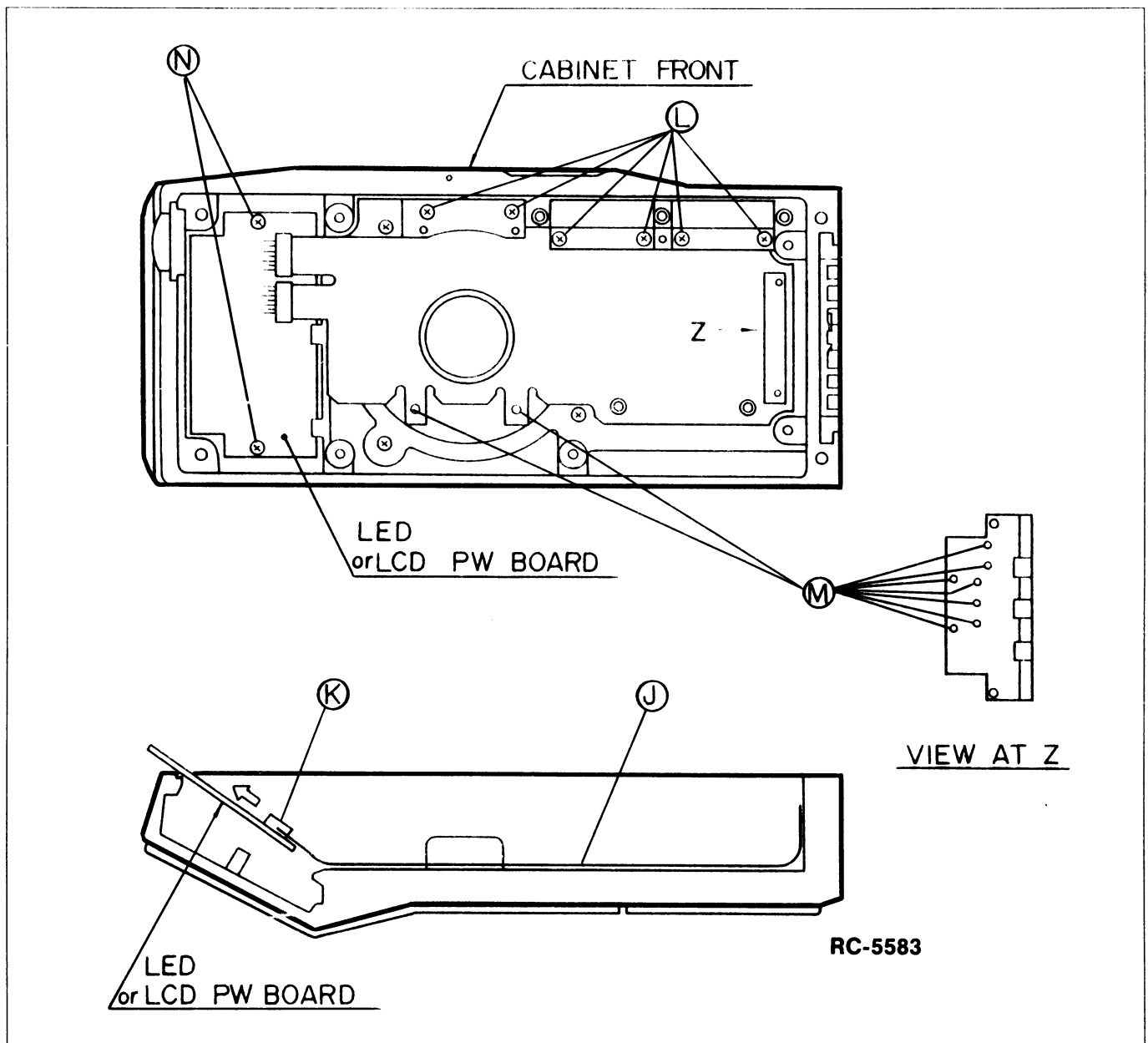


FIGURE 26 - DISASSEMBLY STEP 6

REPLACEMENT OF COMPONENTS

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

To remove any of these major components, refer to the applicable replacement procedures located in the Service Section of this manual.

CONTROL PANEL REPLACEMENT

1. Slide power switch to OFF position.
2. Remove battery.
3. Insert a medium size flat blade screwdriver into two slots on the side of the control panel near the battery and depress the retaining clips to release.
4. Remove faceplate and panel.
5. Use a pair of tweezers when installing the Zebra connector to prevent contamination of contacts with body oils and/or dirt. Use rubbing alcohol and lint free cloth to clean the Zebra connector and printed wire board contacts.
6. Install keypad and faceplate. Apply pressure gently until retaining tabs snap into place.

TROUBLESHOOTING

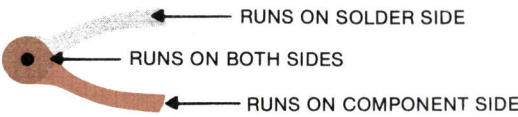
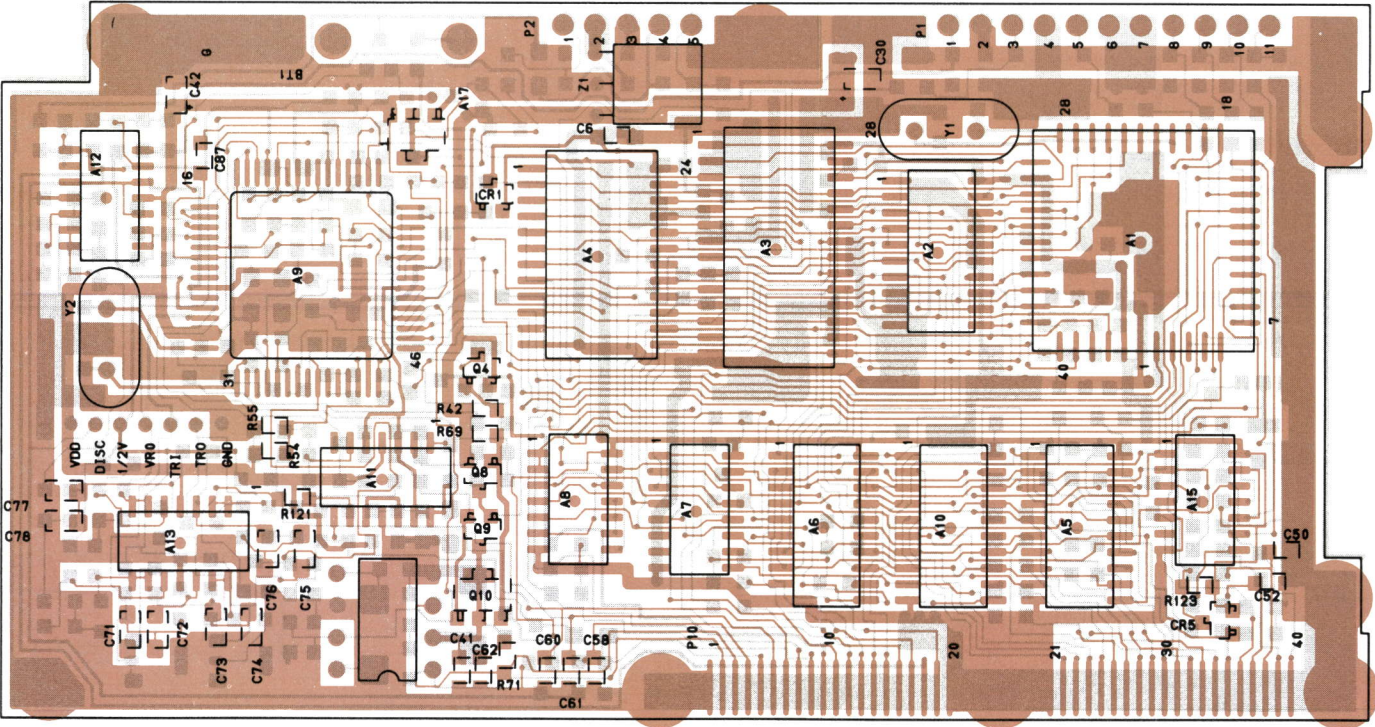
Maintenance of the TPX Personal Radio is facilitated by using the Troubleshooting Procedures and service techniques unique to this radio. The Troubleshooting Procedures are designed to quickly lead the service technician to the defective circuit or component. These procedures are located in the Service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

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

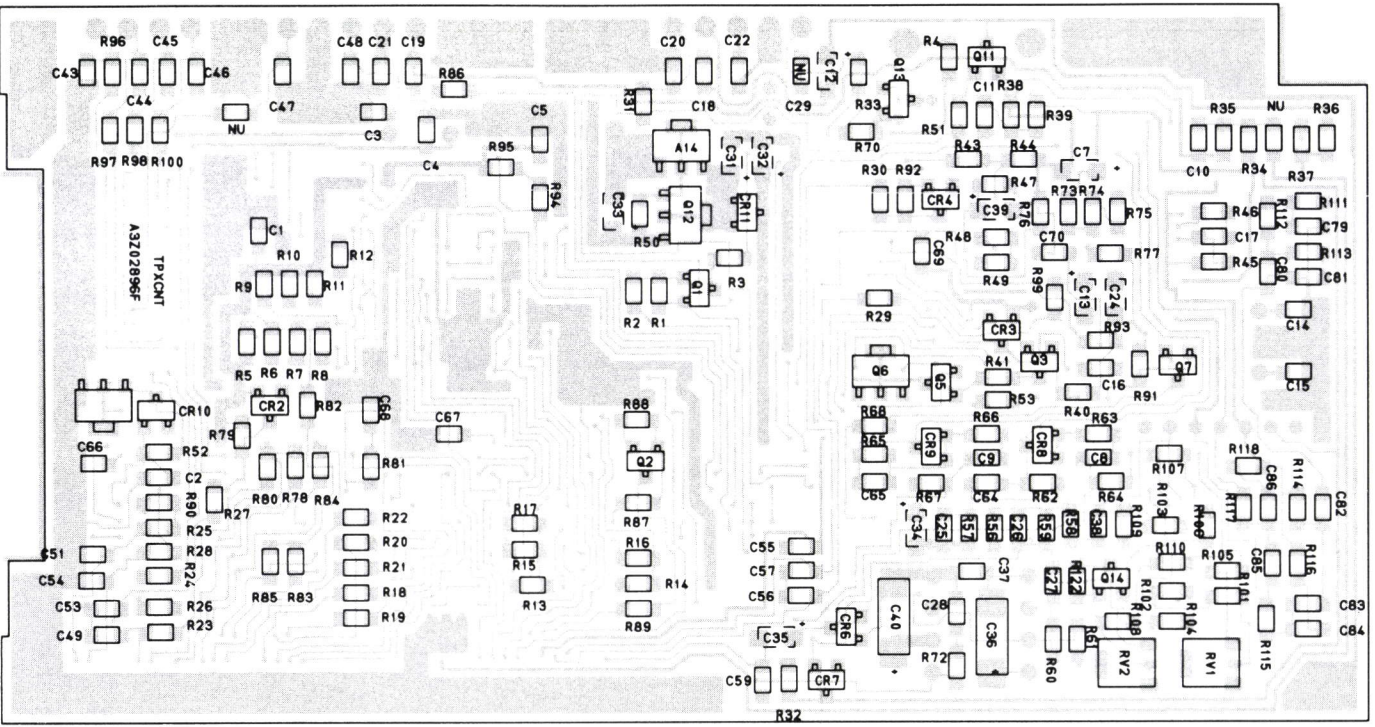
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Printed in U.S.A.

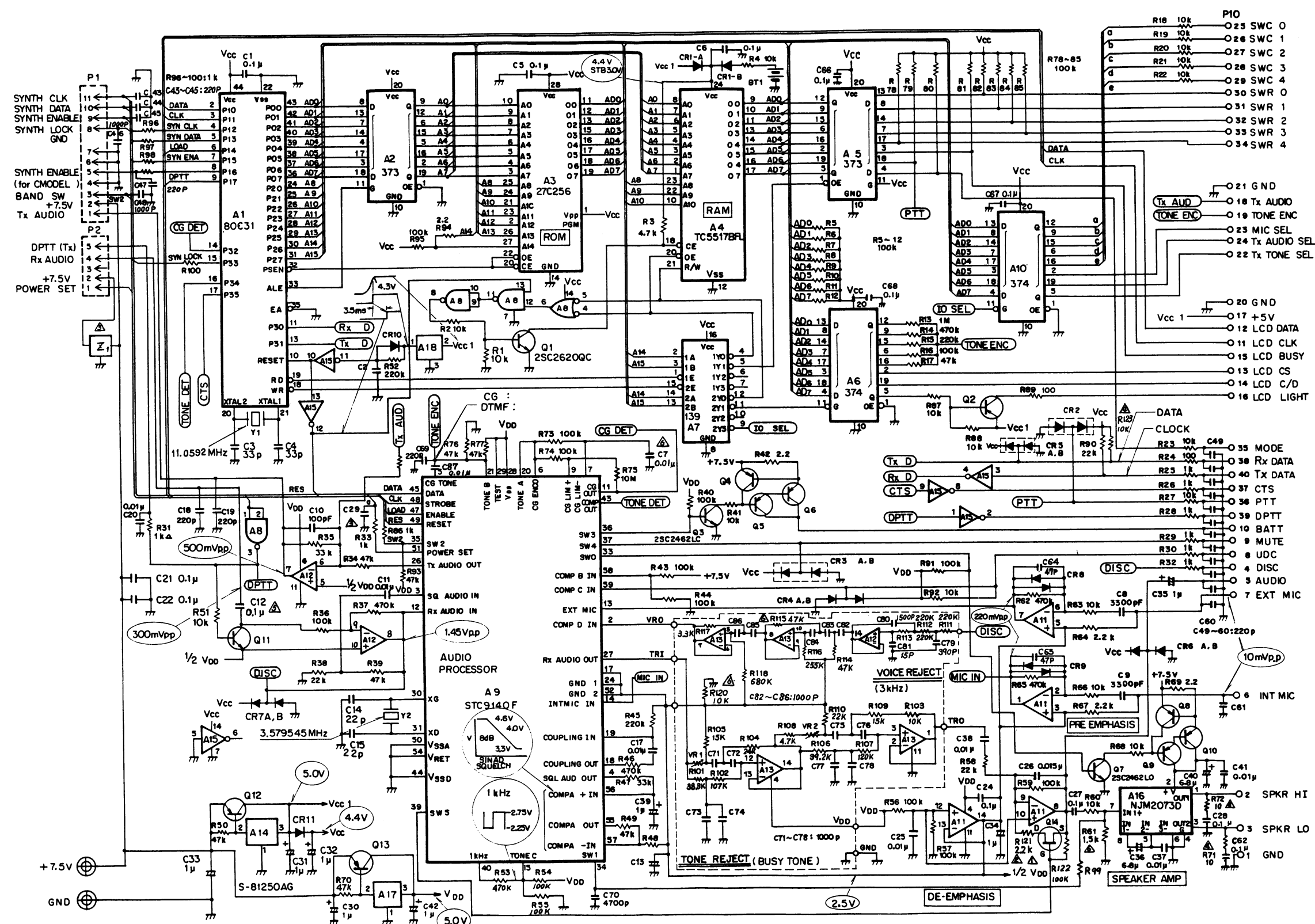
COMPONENT SIDE



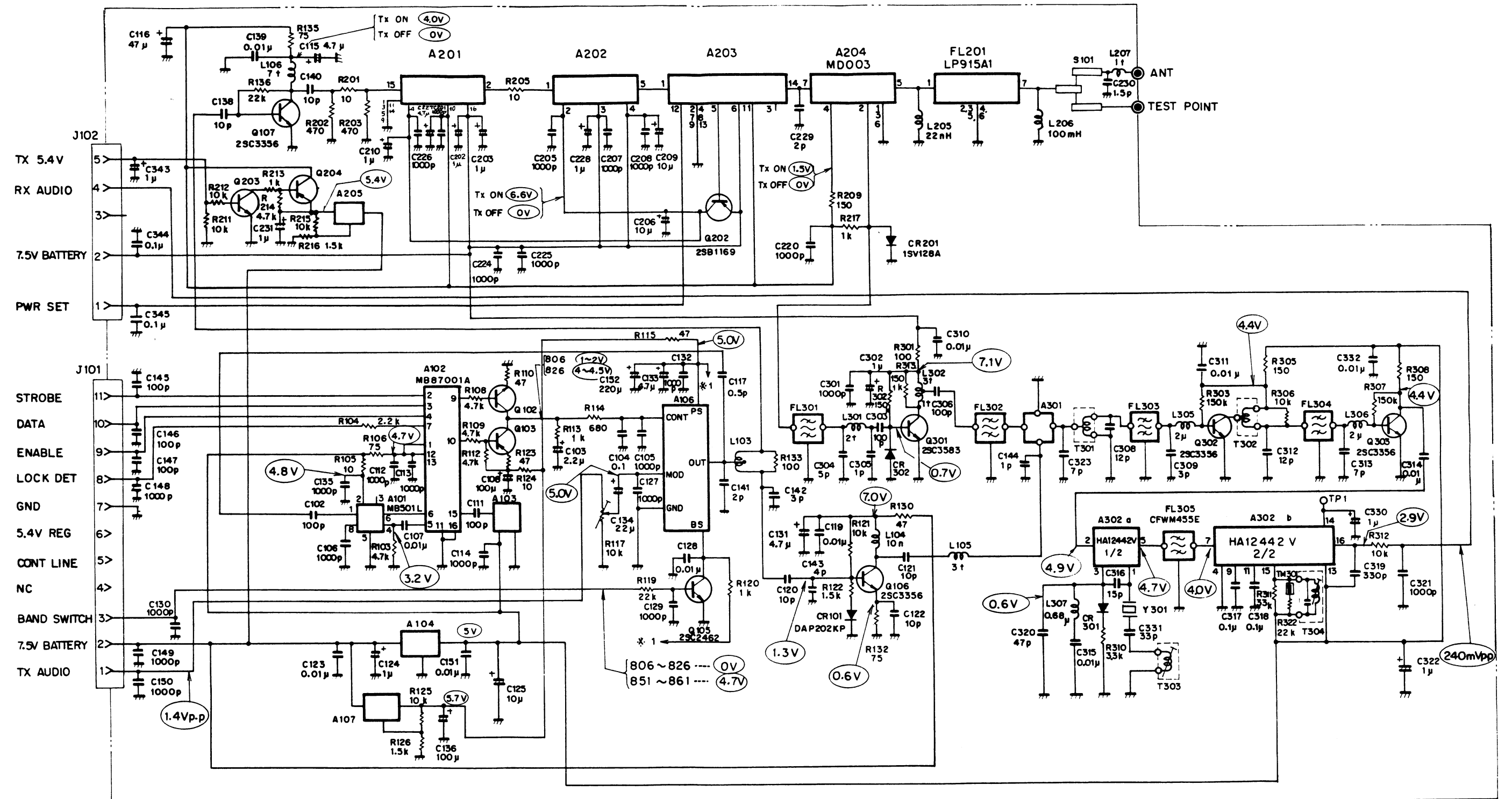
SOLDER SIDE

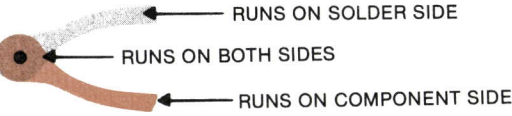
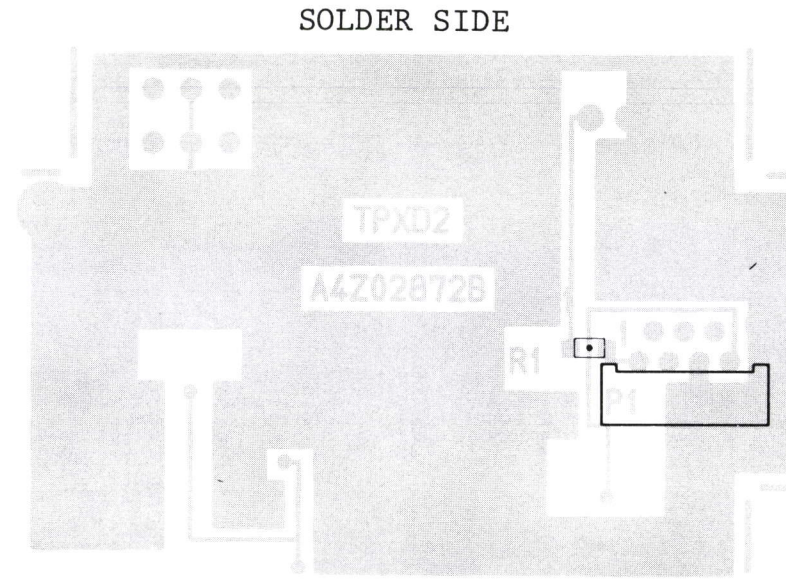
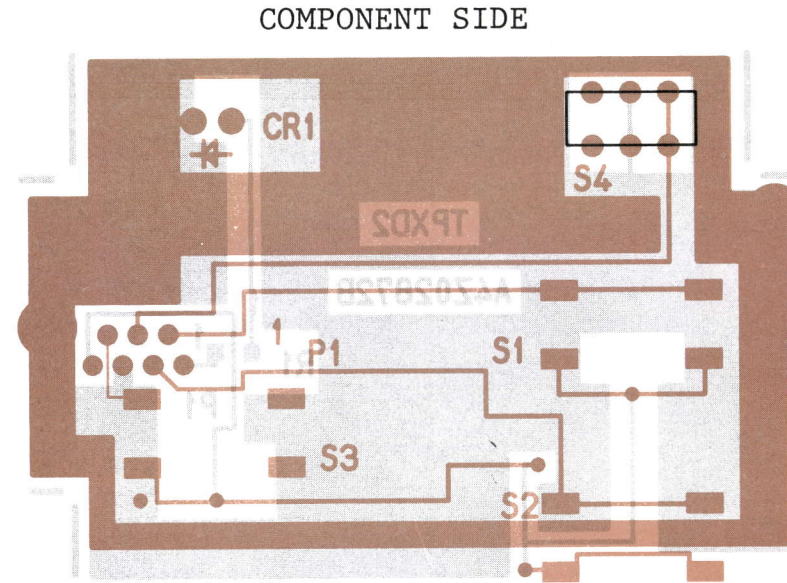
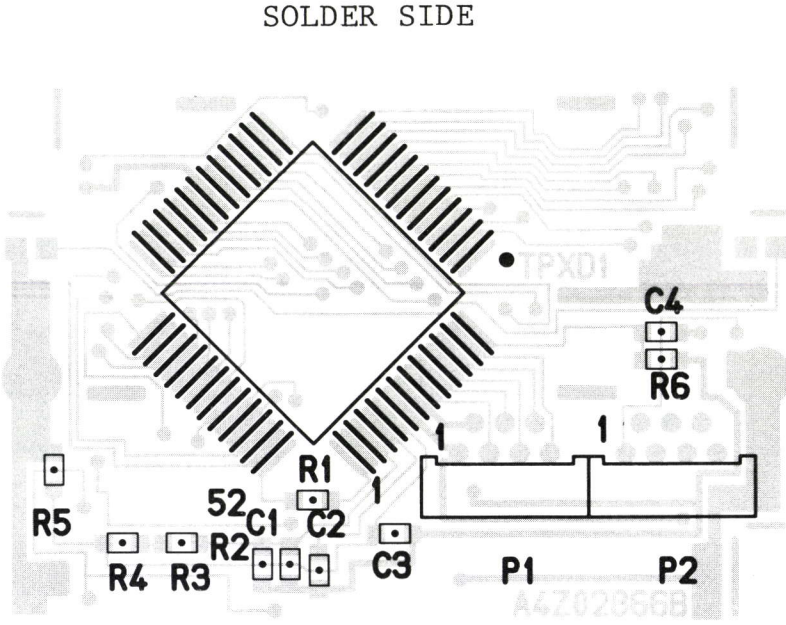
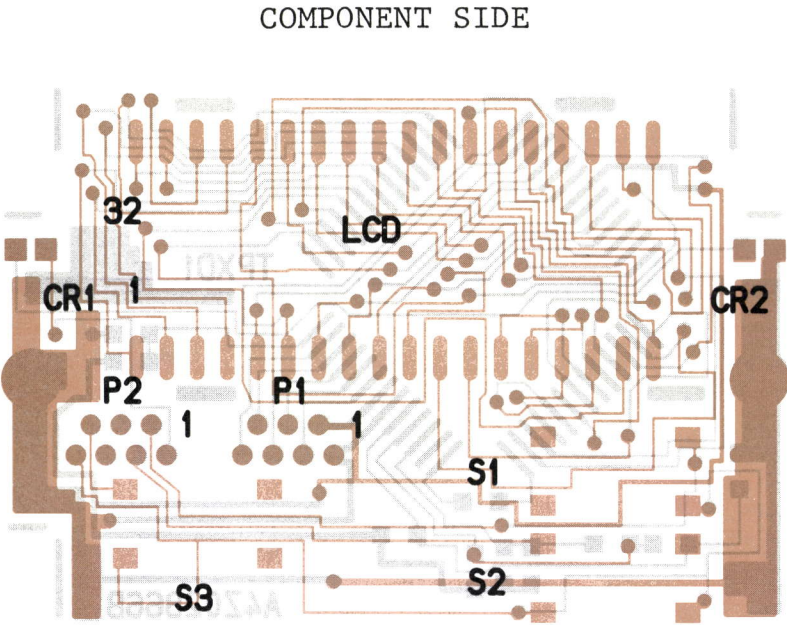


CONTROL BOARD
(A3Z02896F)

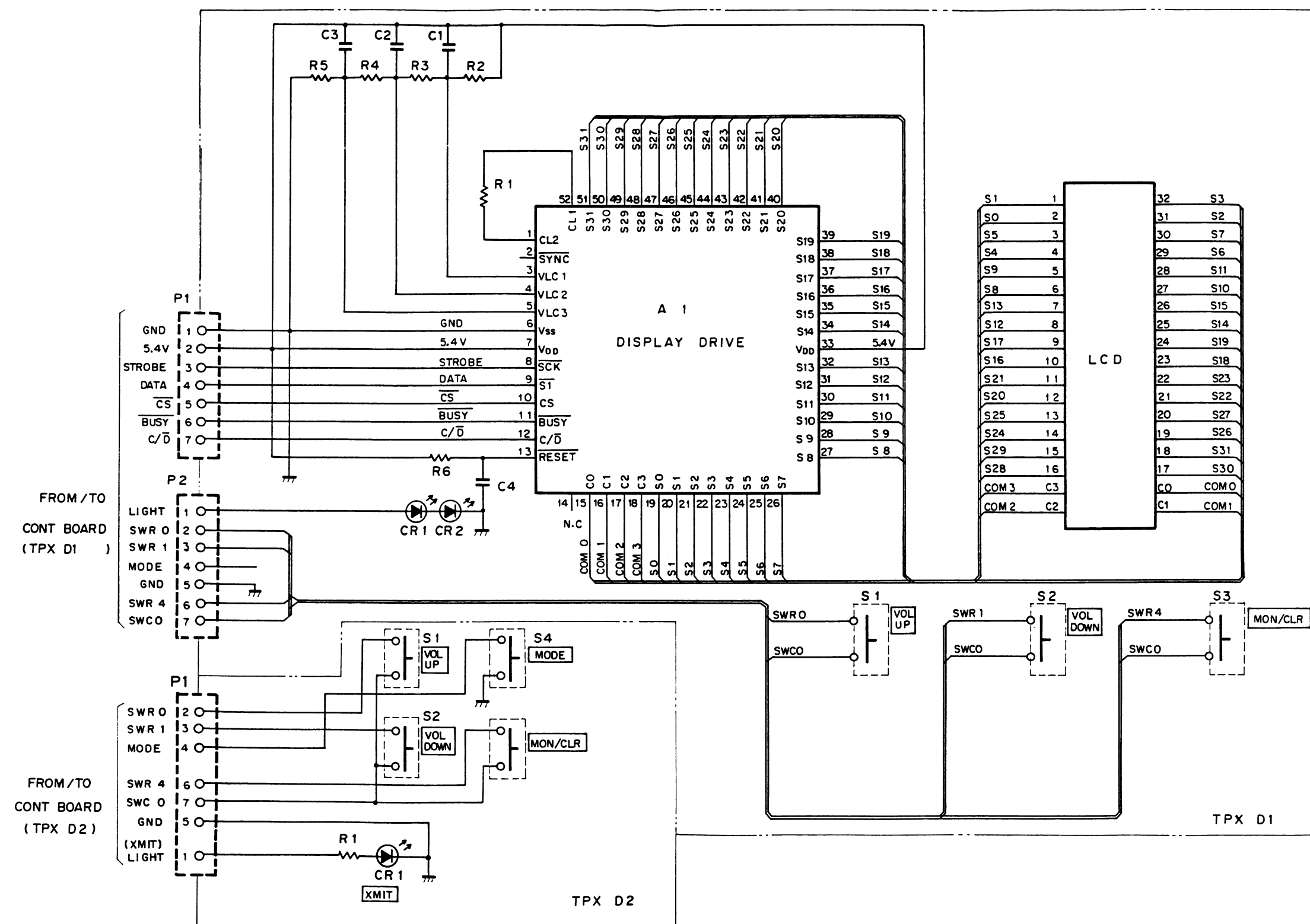


CONTROL BOARD
A3WE 03892





TPX8603 LCD BOARD A4Z02866B
TPX8403 LED BOARD A4Z02872B

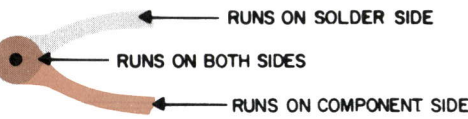
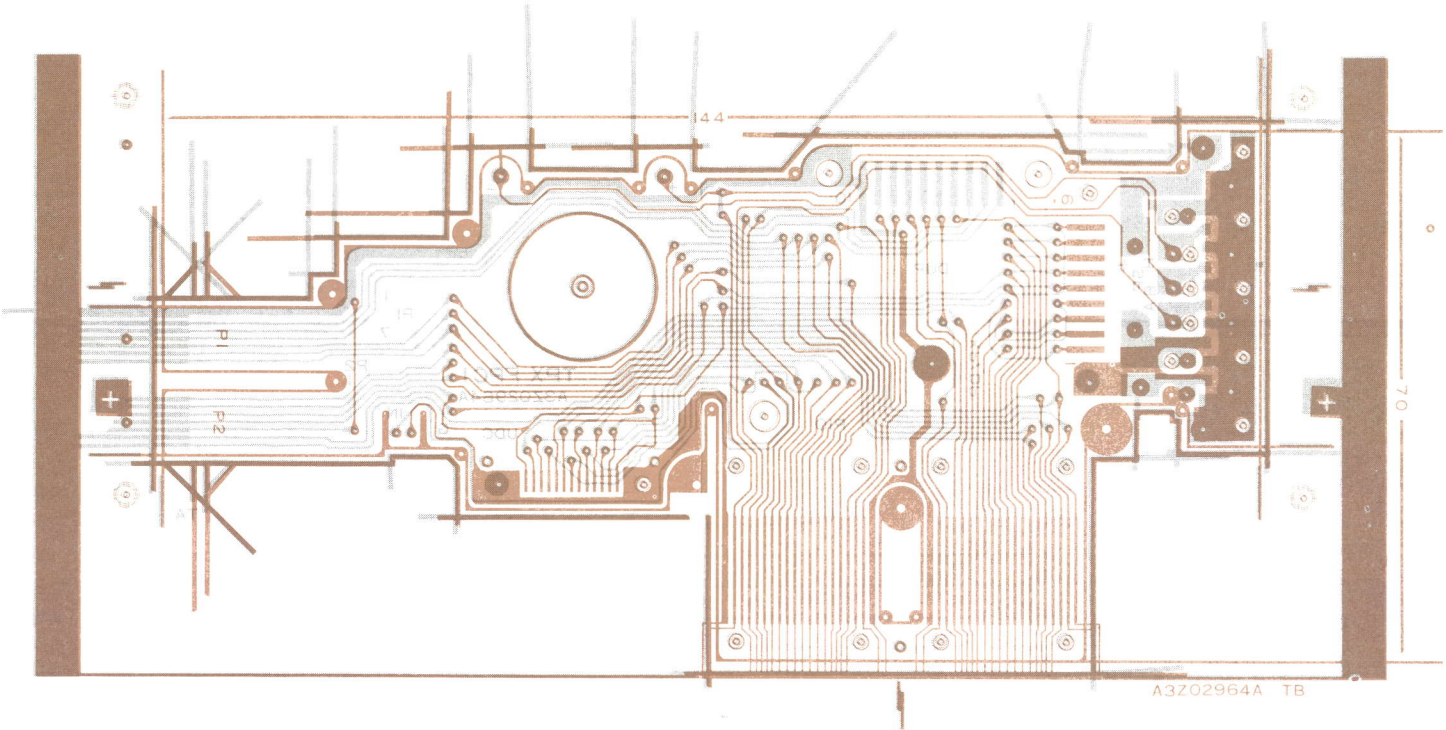


LCD AND LED BOARD

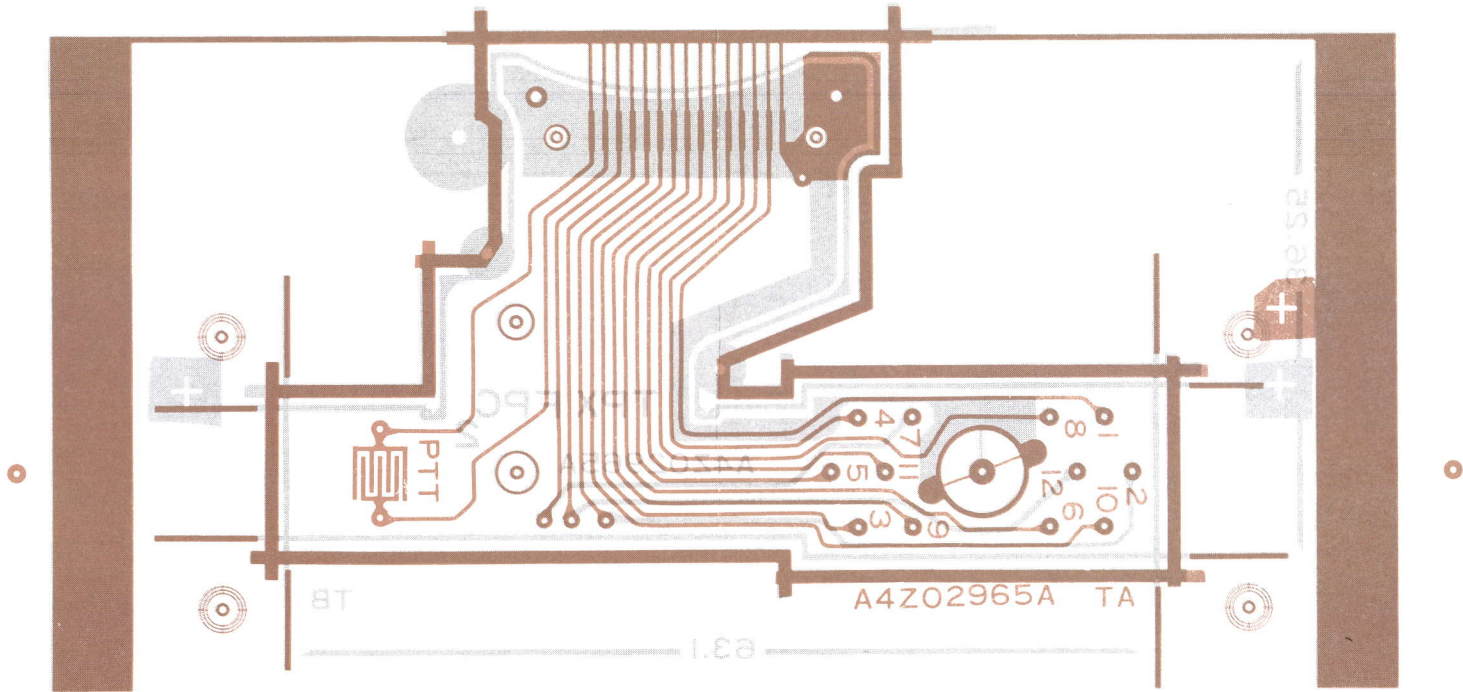
A3WE 03894

Issue 1

TPXFLEX1



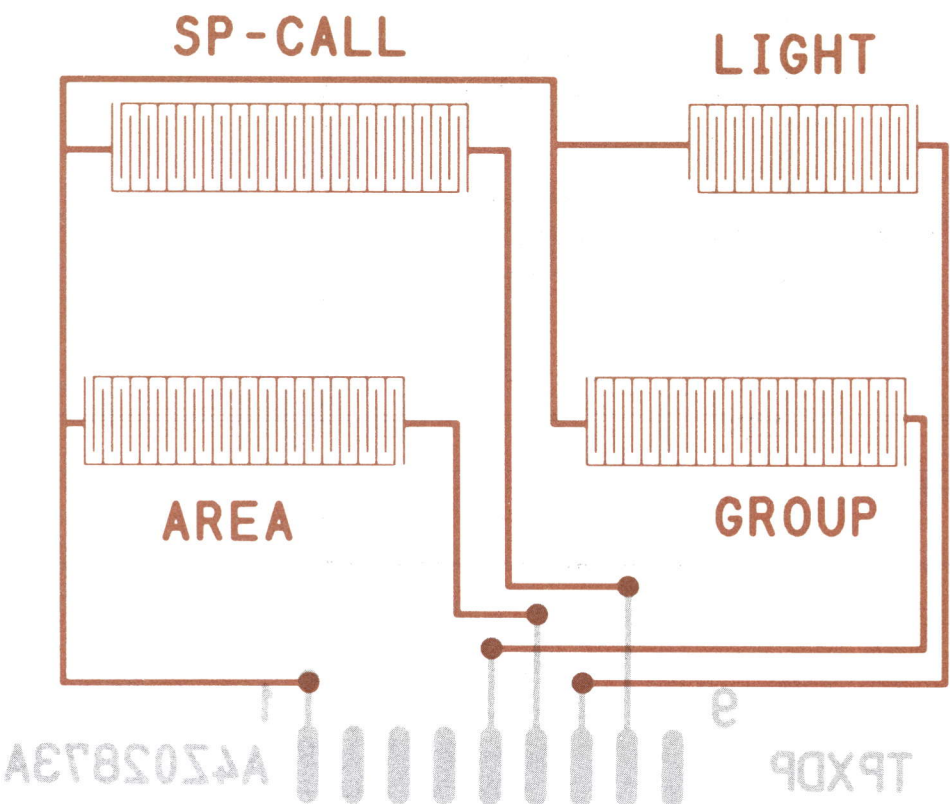
TPXFLEX2



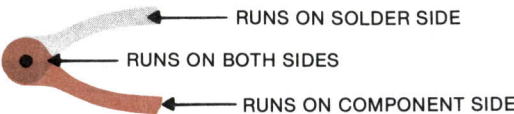
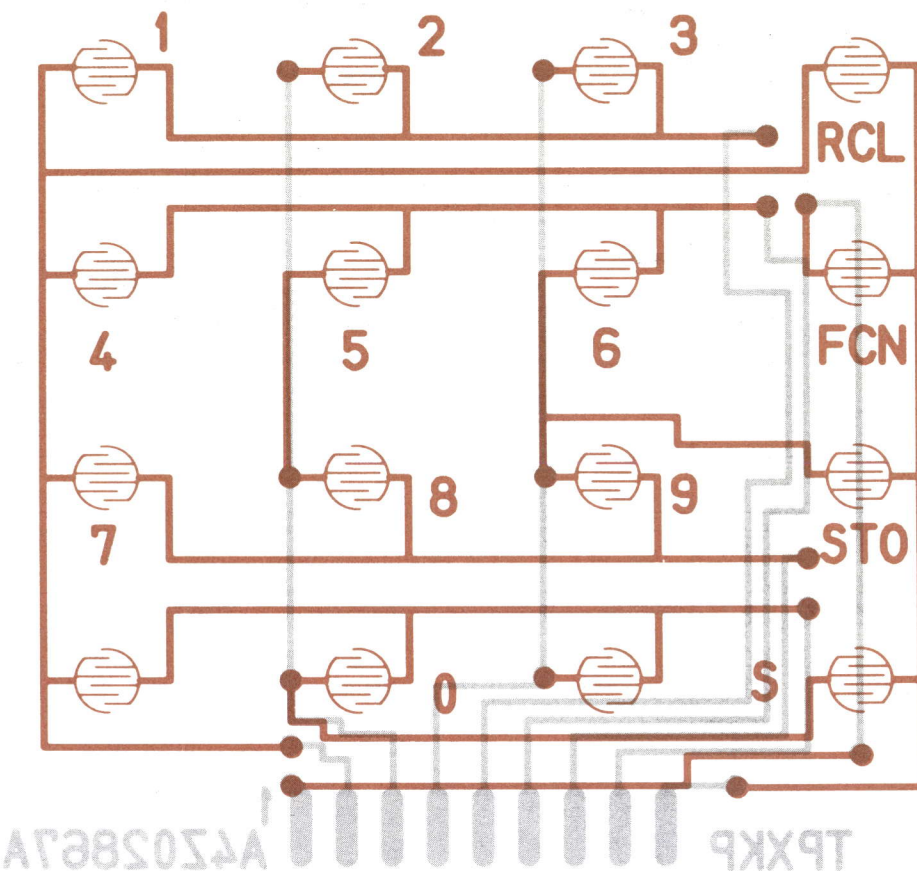
FLEXIBLE PRINTED WIRE BOARD

TPXFLEX1 A3Z02964A
TPXFLEX2 A4Z02965A

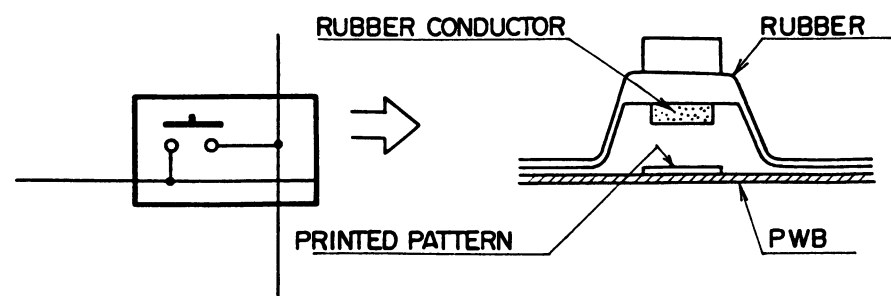
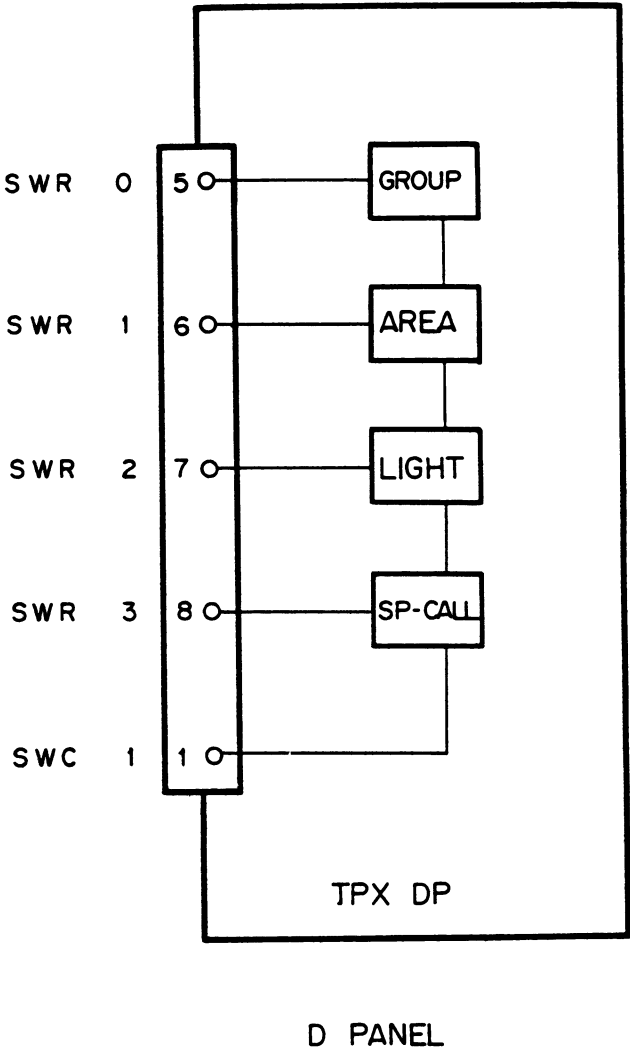
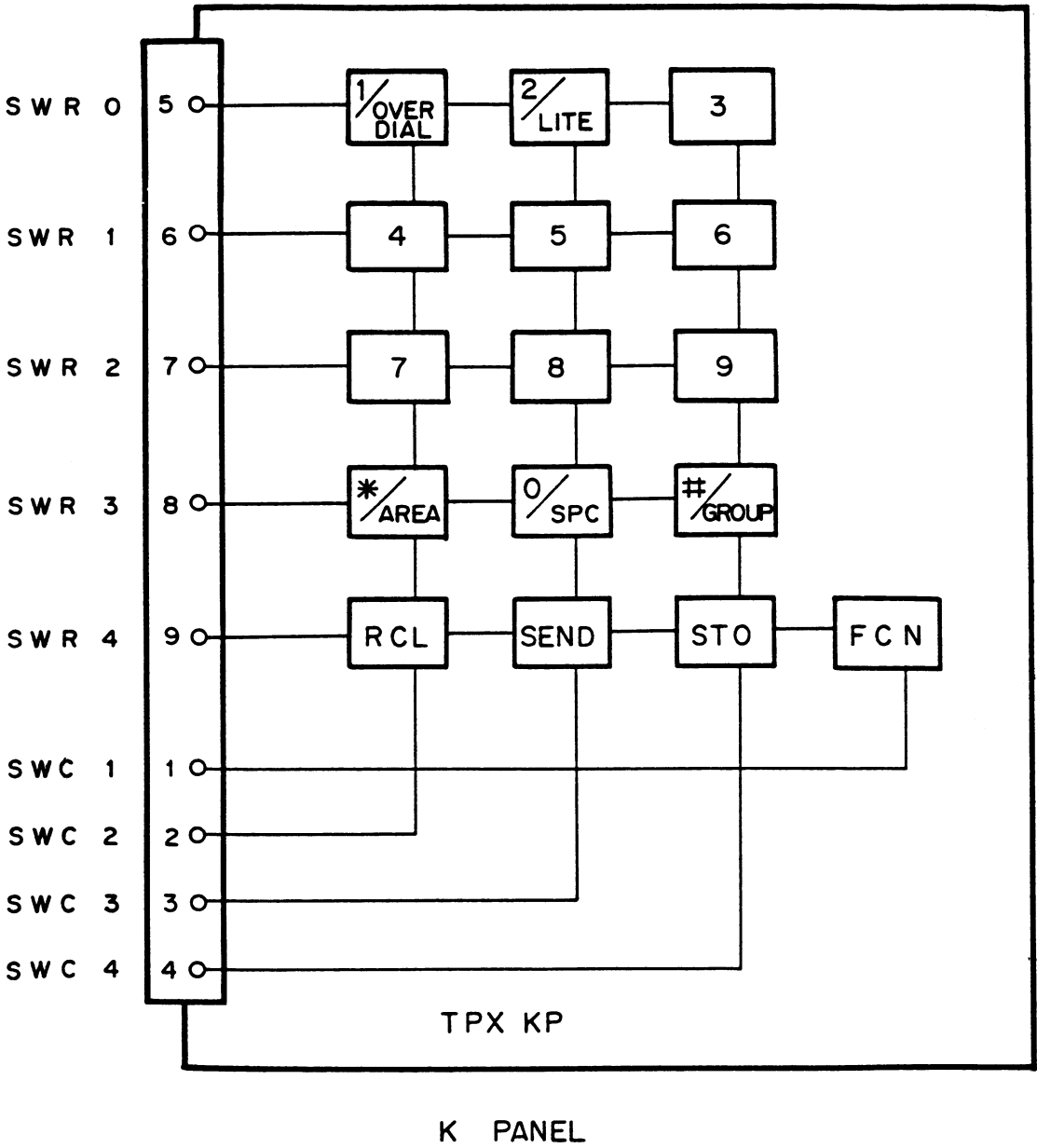
Panel A



Panel B

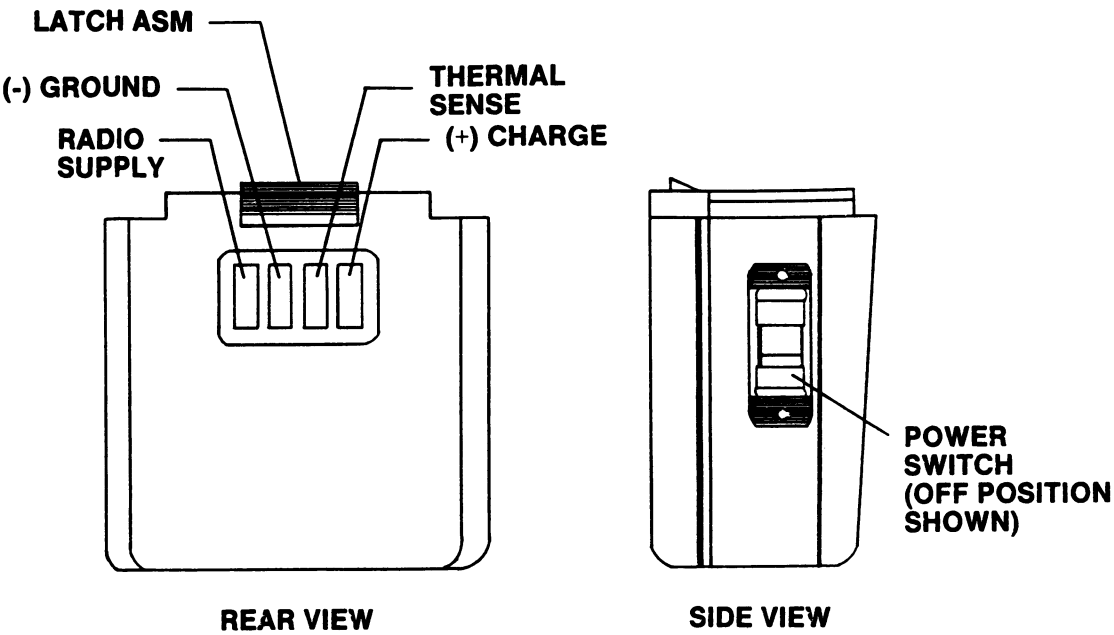
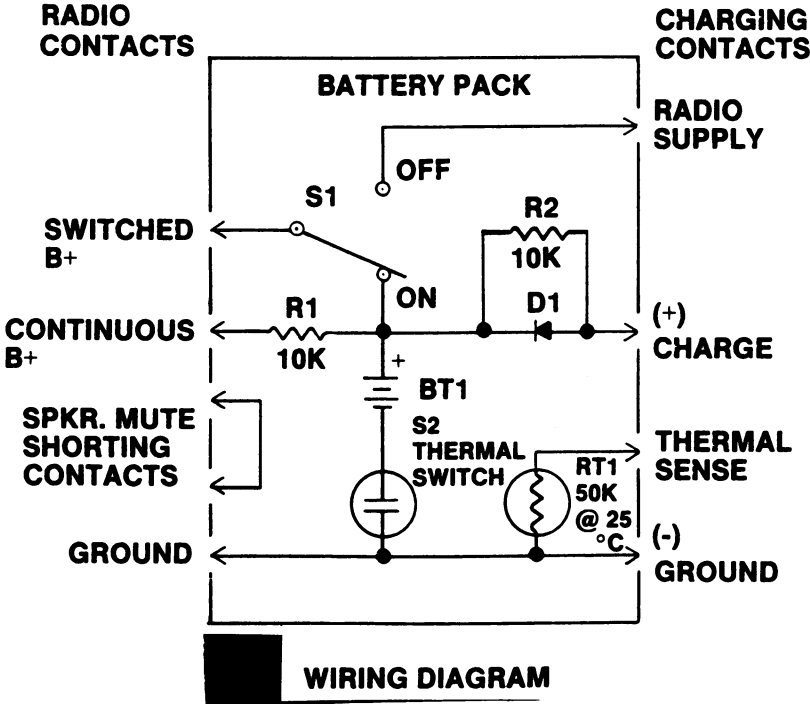
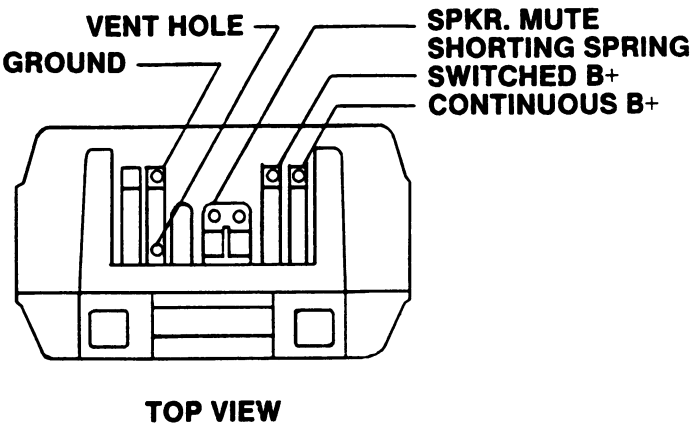


TPX8603 "D" PANEL A4Z02873A
TPX8603 "K" PANEL A4Z02867A

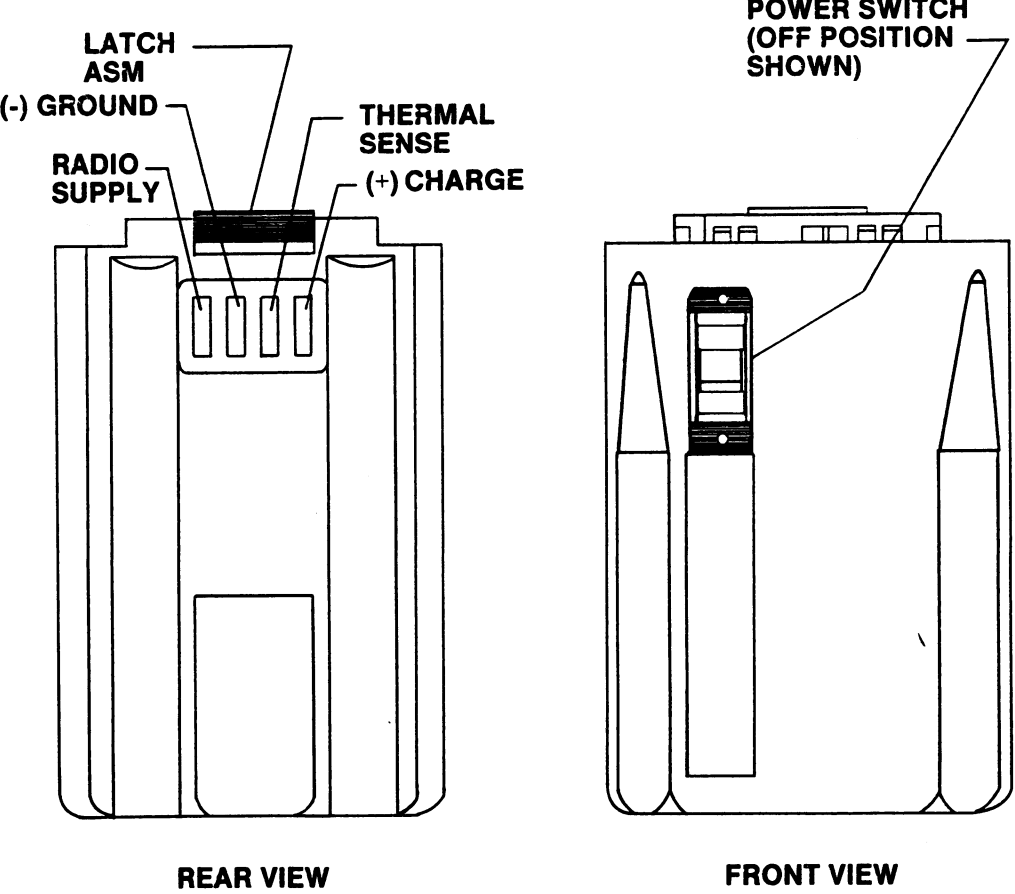


TPX8603 "D" AND "K" PANELS

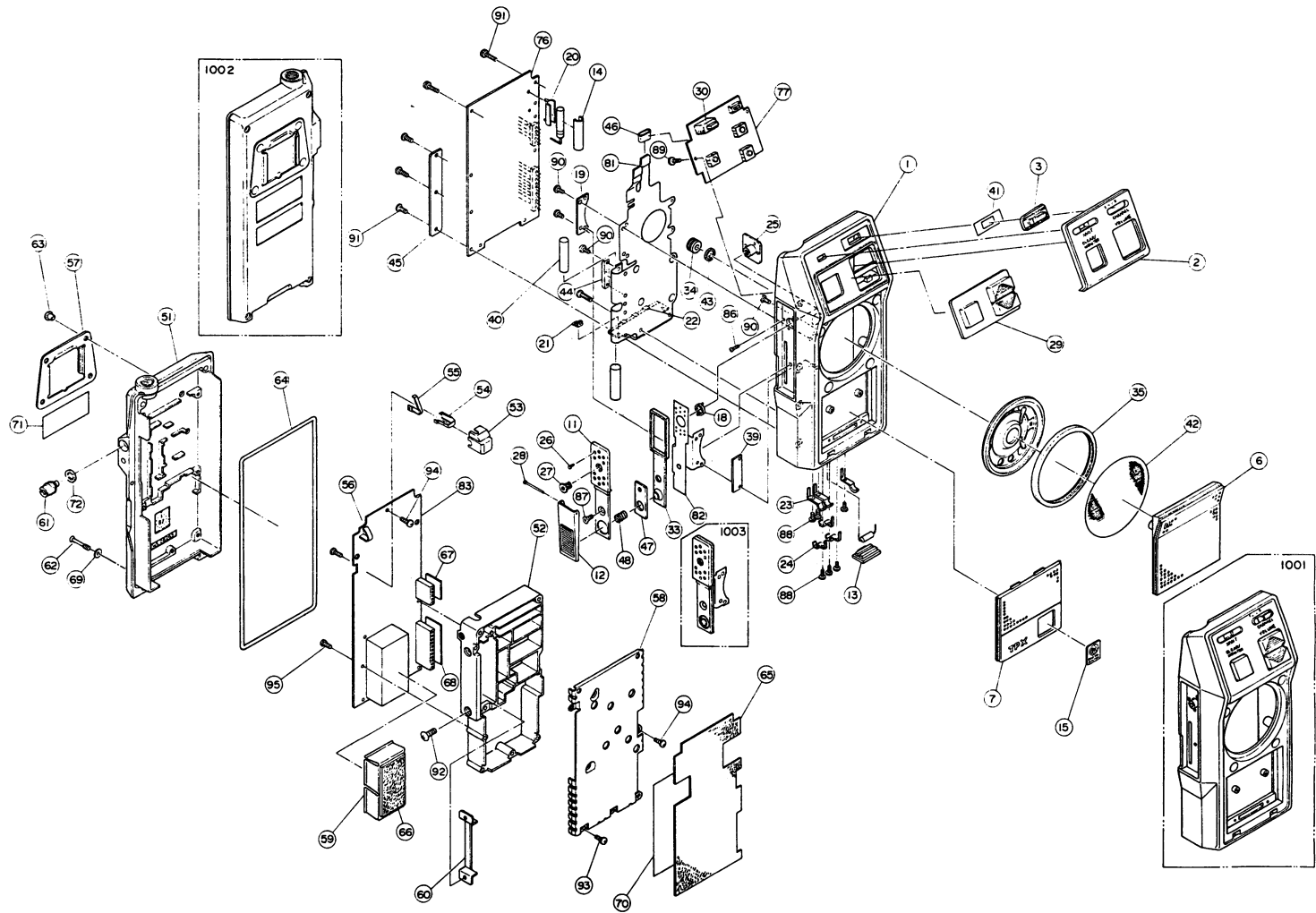
A3WE 03893



19A704850P1 & P3
(800 mAh)



19A704860P1 & P3 800 mAh AND 1200 mAh
(1200 mAh) BATTERY PACKS



TPX8403

Issue 1

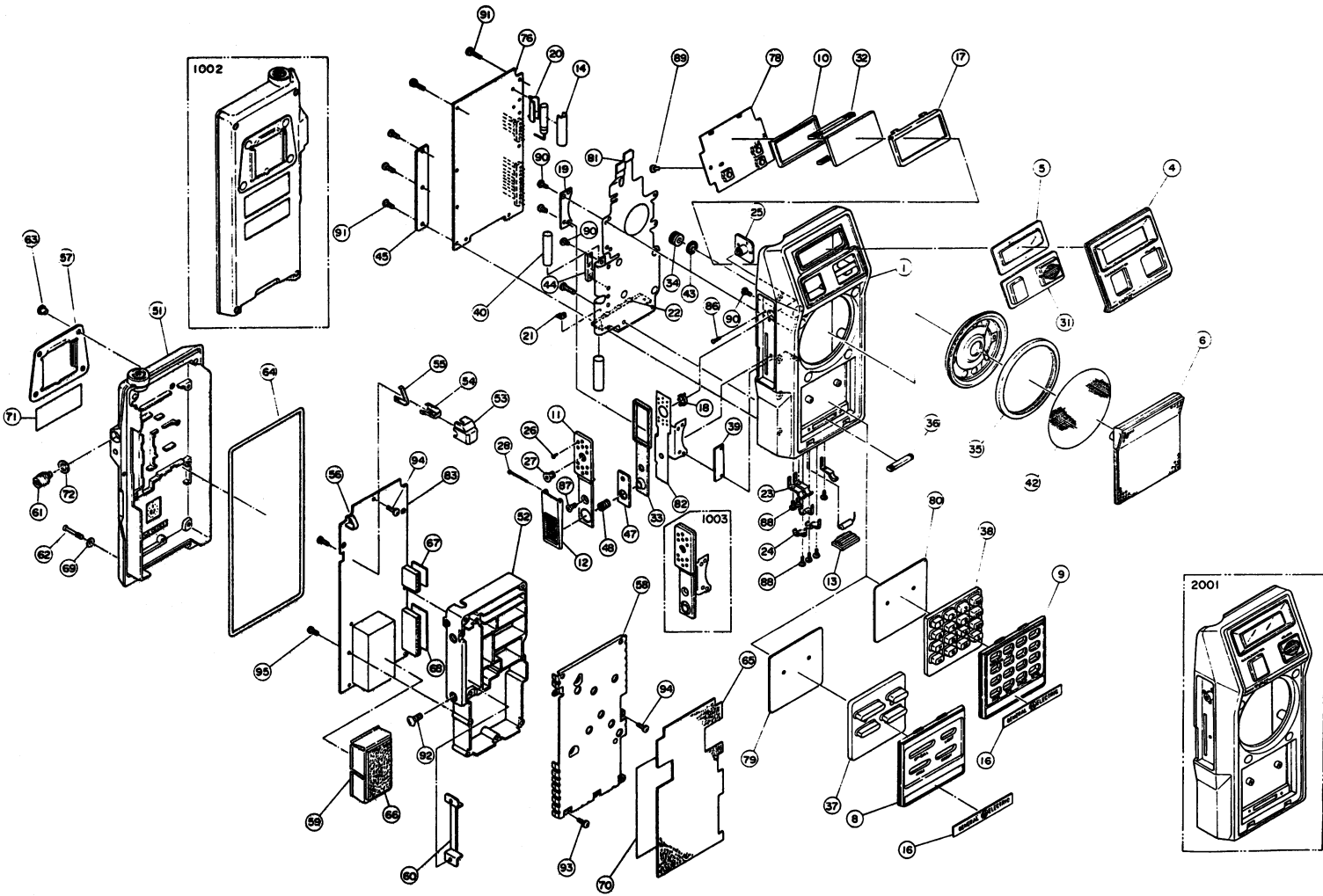
PARTS LIST

LBI-31871
TPX 8403 RADIO
(MECHANICAL PARTS)

SYMBOL	GE PART NO.	DESCRIPTION
1	K19/A1WL08252	CABINET FRONT
2	K19/A2WL08253	TOP CONTROL PANEL
3	K19/A4WL08263	CHANNEL SWITCH CAP
4		NOT USED
5		NOT USED
6	K19/A2WL08255	SPEAKER GRILLE
7	K19/A2WL08256	LOWER GRILLE PANEL
8		NOT USED
9		NOT USED
10		NOT USED
11	K19/A3WL07576	UDC PTT PLATE
12	K19/A3WL07575	PTT LEVER
13	K19/A3WL07577	FUSE COVER
14	K19/A4WL07863	LI-BATTERY COVER
15	K19/A4WL07721	NAMEPLATE (GE)
16		NOT USED
17		NOT USED
18	K19/A4WL08994	EARTH LUG
19	K19/A4WL09077	PLATE
20	K19/A4WL07514	BATTERY HOLDER
21	K19/A4WL08991	BASE CONTACTS
22	K19/A4WL08992	BASE SHIELD SPRING
23	K19/A4WL08456	BATTERY CONNECTOR SPRINGS
24	K19/A4WL08455	SPKR/MUTE CONTACTS
25	K19/A4WL08993	UDC NUT HOLDER
26	K19/A4WL07604	UDC CONTACTS
27	K19/A4WL07605	UDC NUT
28	K19/A4WL07434	PIVOT PIN
29	K19/A2WL08259	VOLUME CLEAR MONITOR KNOB
30	K19/A4WL08449	LED RUBBER
31		NOT USED
32		NOT USED
33	K19/A3WL07580	PTT SWITCH PAD
34	K19/A4WL07594	MIC GASKET
35	K19/A4WL07910	SPKR GASKET
36		NOT USED
37		NOT USED
38		NOT USED
39	K19/A4WL09904	RUBBER SHEET
40	K19/A4WL09903	CUSHION RUBBERS
41	K19/A4WL09902	SPACER
42	K19/A4WL07435	SPKR DUST SCREEN
43	K19/A4WL08385	MIC FILM
44	K19/A4WL09901	FILM
45	K19/A4WL09017	FIXING PLATE
46	K19/A4WL09969	HOLDER
47	K19/A4WL09662	PTT SPACER
48	K19/A4WL09422	COIL SPRING
49		NOT USED
50		NOT USED
51	K19/A1WL08265	CABINET BACK
52	K19/A1WL07570	EGG CRATE/800 MHz
53	K19/A4WL07863	ANT SWITCH COVER
54	K19/A4WL07855	ANT SWITCH SPRING B
55	K19/A4WL07656	ANT SWITCH SPRING A
56	K19/A4WL08354	ANT SPRING
57	K19/A3WL07509	RECEPTACLE PLATE
58	K19/A2WL09002	TX/RX SHIELD COVER
59	K19/A4WL07595	SHIELD COVER
60	K19/A4WL07663	POWER PACK BRACKET
61	K19/A4WL08826	RF CONNECTOR

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
62	K19/A4WL07499P1	CAPTIVE SCREWS
63	K19/A4WL07694	RIVETS
64	K19/A4WL08383	HOUSING GASKET
65	K19/A3WL09970	INSULATOR
66	K19/A4WL08494	VCO RUBBER
67	K19/A4WL08495P1	CONNECTOR SPACER A
68	K19/A4WL08495P2	CONNECTOR SPACER B
69	K19/A4WL08802	NYLON WASHERS
70	K19/A4WL09971	TRACKING DATA LABEL
71	K19/A4WL08694	LABEL
72	K19/	RF CONNECTOR GASKET
73		NOT USED
74		NOT USED
75		NOT USED
76	K19/A3WL08889	CONTROLLER P.W. BOARD
77	K19/A4WL08443	D2 PANEL
78		NOT USED
79		NOT USED
80		NOT USED
81	K19/A3WL08886	FLEXIBLE P.W. BOARD
82	K19/A4WL08887	UDC/PTT FPC
83	K19/A3WL08296	TX/RX P.W. BOARD
84		NOT USED
85		NOT USED
86	K19/	PANHEAD MACHINE SCREWS, M1.4 x 3
87	K19/	COUNTERSUNK HEAD MACHINE SCREW, M2.6 x 3
88	K19/	PANHEAD TAPPING SCREWS/BLACK, M2 x 5
89	K19/	PANHEAD TAPPING SCREWS, M2 x 4
90	K19/	PANHEAD TAPPING SCREWS, M2 x 5
91	K19/	PANHEAD MACHINE SCREWS W/SPRING WASHER, M2 x 8
92	K19/	BINDING HEAD MACHINE SCREWS, M2.6 x 6
93	K19/	PANHEAD MACHINE SCREWS W/SPRING WASHER, M2 x 15
94	K19/	PANHEAD MACHINE SCREWS W/SPRING WASHER, M2 x 4
95	K19/	PANHEAD MACHINE SCREWS, M2 x 4



PARTS LIST

LBI-31872
TPX 8603 RADIO
(MECHANICAL PARTS)

SYMBOL	GE PART NO.	DESCRIPTION
1	K19/A1WL08252	CABINET FRONT
2		NOT USED
3		NOT USED
4	K19/A2WL08254	TOP CONTROL PANEL
5	K19/A3WL08264	WINDOW
6	K19/A2WL08255	SPEAKER GRILLE
7		NOT USED
8	K19/A2WL08257	LOWER CONTROL PANEL "D"
9	K19/A2WL08258	LOWER CONTROL PANEL "K"
10	K19/A3WL07601	LIGHT DIFFUSER
11	K19/A3WL07576	UDC PTT PLATE
12	K19/A3WL07575	PTT LEVER
13	K19/A3WL07577	FUSE COVER
14	K19/A4WL07863	L1-BATTERY COVER
15		NOT USED
16	K19/A4WL07661	NAMEPLATE (GE)
17	K19/A3WL08380	LCD FRAME
18	K19/A4WL08994	EARTH LUG
19	K19/A4WL09077	PLATE
20	K19/A4WL07514	BATTERY HOLDER
21	K19/A4WL08991	BASE CONTACTS
22	K19/A4WL08992	BASE SHIELD SPRING
23	K19/A4WL08456	BATTERY CONNECTOR SPRINGS
24	K19/A4WL08455	SPKR/MUTE CONTACTS
25	K19/A4WL08993	UDC NUT HOLDER
26	K19/A4WL07604	UDC CONTACTS
27	K19/A4WL07605	UDC NUT
28	K19/A4WL07434	PIVOT PIN
29		NOT USED
30		NOT USED
31	K19/A2WL08260	VOLUME CLEAR MONITOR KNOB
32	K19/A4WL07665	ZEBRA CONTACTS
33	K19/A3WL07580	PTT SWITCH PAD
34	K19/A4WL07594	MIC GASKET
35	K19/A4WL07910	SPKR GASKET
36	K19/	ZEBRA CONTACTS
37	K19/A3WL08261	CONTROL KNOB "D"
38	K19/A3WL08262	CONTROL KNOB "K"
39	K19/A4WL09904	RUBBER SHEET
40	K19/A4WL09903	CUSHION RUBBERS
41		NOT USED
42	K19/A4WL07435	SPKR DUST SCREEN
43	K19/A4WL08385	MIC FILM
44	K19/A4WL09901	FILM
45	K19/A4WL09017	FIXING PLATE
46		NOT USED
47	K19/A4WL09862	PTT SPACER
48	K19/A4WL09422	COIL SPRING
49		NOT USED
50		NOT USED
51	K19/A1WL08265	CABINET BACK
52	K19/A1WL07570	EGG CRATE/800 MHz
53	K19/A4WL07863	ANT SWITCH COVER
54	K19/A4WL07655	ANT SWITCH SPRING B
55	K19/A4WL07656	ANT SWITCH SPRING A
56	K19/A4WL08354	ANT SPRING
57	K19/A3WL07509	RECEPTACLE PLATE
58	K19/A2WL09002	TX/RX SHIELD COVER
59	K19/A4WL07595	SHIELD COVER
60	K19/A4WL07663	POWER BACK BRACKET

SYMBOL	GE PART NO.	DESCRIPTION
61	K19/A4WL08826	RF CONNECTOR
62	K19/A4WL07499P1	CAPTIVE SCREWS
63	K19/A4WL07694	RIVETS
64	K19/A4WL08383	HOUSING GASKET
65	K19/A3WL08970	INSULATOR
66	K19/A4WL08494	VCO RUBBER
67	K19/A4WL08495P1	CONNECTOR SPACER A
68	K19/A4WL08495P2	CONNECTOR SPACER B
69	K19/A4WL08802	NYLON WASHERS
70	K19/A4WL08971	TRACKING DATA LABEL
71	K19/A4WL08694	LABEL
72	K19/	RF CONNECTOR GASKET
73		NOT USED
74		NOT USED
75		NOT USED
76	K19/A3WL0889	CONTROLLER P.W. BOARD
77		NOT USED
78	K19/A4WL08906	D1 PANEL
79	K19/A4WL08440	D PANEL
80	K19/A4WL08340	K PANEL
81	K19/A3WL08886	FLEXIBLE P.W. BOARD
82	K19/A4WL08887	UDC/PTT FPC
83	K19/A3WL08296	TX/RX P.W. BOARD
84		NOT USED
85		NOT USED
86	K19/A	PANHEAD MACHINE SCREW, M1.4 x 3
87	K19/A	COUNTERSUNK HEAD MACHINE SCREW, M2.6 x 3
88	K19/A	PANHEAD TAPPING SCREWS/BLACK, M2 x 5
89	K19/A	PANHEAD TAPPING SCREWS, M2 x 4
90	K19/A	PANHEAD TAPPING SCREWS, M2 x 5
91	K19/A	PANHEAD MACHINE SCREWS W/SPRING WASHER, M2 x 8
92	K19/A	BINDING HEAD MACHINE SCREWS, M2.6 x 6
93	K19/A	PANHEAD MACHINE SCREWS W/SPRING WASHER, M2 x 15
94	K19/A	PANHEAD MACHINE SCREWS W/SPRING WASHER, M2 x 4
95	K19/A	PANHEAD MACHINE SCREWS, M2 x 4

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST			PARTS LIST			PARTS LIST			SYMBOL	GE PART NO.	DESCRIPTION
CPR TPX 8403 CHASSIS A4WE03666 ISSUE 1			CPR TPX 8603 CHASSIS A4WE03667 ISSUE 1			TPX CONTROLLER BOARD A4WE03649 ISSUE 3			C27 and C28	K19/2CAK013010	Ceramic chip: 0.1 uF, 25V
									C29		NOT USED
									C30 thru C35	K19/2CCF002072	Tantalum: 1 uF, 15V
									C36	K19/2CCF006024	Tantalum: 6.8 uF, 10V
									C37 and C38	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
									C39	K19/2CCF002072	Tantalum: 1 uF, 15V
									C40	K19/2CCF006024	Tantalum: 6.8 uF, 10V
									C41	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
									C42	K19/2CCF002072	Tantalum: 1 uF, 15V
									C43 thru C45	K19/2CAK005917	Ceramic chip: 220 pF, 50V
									C46	K19/2CAK013127	Ceramic chip: 1000 pF, 50V
									C47	K19/2CAK005917	Ceramic chip: 220 pF, 50V
									C48	K19/2CAK013127	Ceramic chip: 1000 pF, 50V
									C49 thru C61	K19/2CAK005917	Ceramic chip: 220 pF, 50V
									C62	K19/2CAK013010	Ceramic chip: 0.1 uF, 50V
									C63		NOT USED
									C64 and C65	K19/2CAK005867	Ceramic chip: 47 pF, 50V
									C66 thru C68	K19/2CAK013010	Ceramic chip: 0.1 uF, 50V
									C69	K19/2CAK005917	Ceramic chip: 220 pF, 50V
									C70	K19/2CAK013192	Ceramic chip: 4700 pF, 50V
									C71 thru C78	K19/2CAK013200	Ceramic chip: 1000 pF, 50V
									C79	K19/2CAK013101	Ceramic chip: 390 pF, 50V
									C80	K19/2CAK013184	Ceramic chip: 1500 pF, 50V
									C81	K19/2CAK005792	Ceramic chip: 15 pF, 50V
									C82 thru C86	K19/2CAK013127	Ceramic chip: 1000 pF, 50V
									----- DIODES -----		
									CR1	K19/2QBE005016	DAN202KT-96
									CR2 thru CR9	K19/2QBE005032	DA204KT-96
									CR10 and CR11	K19/2QBE005016	DAN202KT-96
									----- PINHEADER -----		
									P1	K19/2PDA023101	65646-211
									P2	K19/2PDA023093	65646-205
									----- TRANSISTORS -----		
									Q1	K19/2QAA012802	NPN, 2SC2620-(C)
									Q2	K19/2QAD001026	PNP, 2SA1121SRTL
									Q3	K19/2QAD001034	NPN, 2SC2462LCTL
									Q4 and Q5	K19/2QAD001026	PNP, 2SA1121SRTL
									Q6	K19/2QAD004103	PNP, 2SB798T1DL
									Q7	K19/2QAD001034	NPN, 2SC2462LCTL

PARTS LIST			PARTS LIST			PARTS LIST			SYMBOL	GE PART NO.	DESCRIPTION
CPR TPX 8403 CHASSIS A4WE03666 ISSUE 1			CPR TPX 8603 CHASSIS A4WE03667 ISSUE 1			TPX CONTROLLER BOARD A4WE03649 ISSUE 3			A1	K19/2ADA015145	Micro Processor, MSM80C31FJS
									A2	K19/2ABD025269	N-H-CMOS, uPD74HC373G-T1
									A3	K19/2ACA055036	P-ROM, HN27C256FP-25
									A4	K19/2ACA017432	S-RAM, TC5517CFL-20
									A5	K19/2ABD025269	N-H-CMOS, uPD74HC373G-T1
									A6	K19/2ABD025277	N-H-CMOS, uPD74HC374G-T1
									A7	K19/2ABD025251	N-H-CMOS, uPD74HC139G-T1
									A8	K19/2ABD025244	N-H-CMOS, uPD74HC00G-T1
									A9	K19/2AAJ016017	Audio Processor, STC9140F
									A10	K19/2ABD025277	N-H-CMOS, uPD74HC374G-T1
									A11 thru A13	K19/2AAB004284	OP Amp, uPC451G2-T1
									A14	K19/2AAE053023	Voltage Regulators, S-81250HG-RD-T1
									A15	K19/2ABD025020	N-H-CMOS, uPD74HC14G-T1
									A16	K19/2AAJ010036	Audio IC, NJM2073D
									A17	K19/2AAE053023	Voltage Regulators, S-81250HG-RD-T1
									A18	K19/2AAR053049	Voltage Detector, S-8054ALR-LN-T1
									BT	K19/5PBA004058	BR425
									----- CAPACITORS -----		
									C1	K19/2CAK013010	Ceramic chip: 0.1 uF, 25V
									C2	K19/2CCF002062	Tantalum: 0.22 uF, 16V
									C3 and C4	K19/2CAK005842	Ceramic chip: 33 pF, 50V
									C5 and C6	K19/2CAK013010	Ceramic chip: 0.1 uF, 25V
									C7	K19/2CAK013119	Ceramic chip:: 0.01 uF, 50V
									C8 and C9	K19/2CAK013143	Ceramic chip: 3300 pF, 50V
									C10	K19/2CAK005909	Ceramic chip: 100 pF, 50V
									C11	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
									C12	K19/2CAK013150	Ceramic chip 0.1 uF, 25V
									C13	K19/2CCF002072	Tantalum: 1 uF, 15V
									C14 and C15	K19/2CAK005818	Ceramic chip: 22 pF, 50V
									C16		NOT USED
									C17	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
									C18 and C19	K19/2CAK005917	Ceramic chip: 220 pF, 50V
									C20	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
									C21 and C22	K19/2CAK013010	Ceramic chip: 0.1 uF, 25V
									C23		NOT USED
									C24	K19/2CAK013010	Ceramic chip: 0.1 uF, 25V
									C25	K19/2CAK013119	Ceramic chip: 0.01 uF, 50V
									C26	K19/2CAK013135	Ceramic chip: 0.015 uF, 50V

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SYMBOL			GE PART NO.			DESCRIPTION			SYMBOL			GE PART NO.			DESCRIPTION			SYMBOL			GE PART NO.			DESCRIPTION			PARTS LIST					
Q8 and Q9			K19/2QAD001026			PNP, 2SA1121SBTL			R62			K19/2RGC001759			Square chip: 1/10W, 470 KohmJ			VR1 and VR2			K19/2RGC002021			EVM-6PSW00B14, 10 Kohm			LBI-31894 TPX8403/TPX8603 RF RADIO K19/A3WE03889					
Q10			K19/2QAD004103			PNP, 2SB798T1DL			R63			K19/2RGC001627			Square chip: 1/10W, 10 KohmJ																	
Q11			K19/2QAD001034			NPN, 2SC462LCTL			R64			K19/2RGC001593			Square chip: 1/10W, 2.2 KohmJ																	
Q12			K19/2QAD004103			PNP, 2SB798T1DL			R65			K19/2RGC001759			Square chip: 1/10W, 470 KohmJ																	
Q13			K19/2QAD001026			PNP, 2SA1121SBTL			R66			K19/2RGC001627			Square chip: 1/10W, 10 KohmJ																	
Q14			K19/2QAC001043			Nch PET 2SK94-X4			R67			K19/2RGC001593			Square chip: 1/10W, 2.2 KohmJ																	
						- - - - - RESISTORS - - - - -			R68			K19/2RGC001627			Square chip: 1/10W, 10 KohmJ																	
									R69			K19/2RGC001833			Square chip: 1/10W, 2.2 ohmK																	
									R70			K19/2RGC001726			Square chip: 1/10W, 47 KohmJ																	
									R71 and R72			K19/2RGC001502			Square chip: 1/10W, 4.7 KohmJ																	
									R73 and R74																							
									R75			K19/2RGC001791			Square chip: 1/10W, 10 MohmK																	
									R76 and R77			K19/2RGC001726			Square chip: 1/10W, 47 KohmJ																	
									R78 thru R85			K19/2RGC001643			Square chip: 1/10W, 100 KohmJ																	
									R86			K19/2RGC001585			Square chip: 1/10W, 1 KohmJ																	
									R87 and R88			K19/2RGC001627			Square chip: 1/10W, 10 KohmJ																	
									R89			K19/2RGC001528			Square chip: 1/10W, 100 ohmJ																	
									R90			K19/2RGC001635			Square chip: 1/10W, 22 KohmJ																	
									R91			K19/2RGC001643			Square chip: 1/10W, 100 KohmJ																	
									R92			K19/2RGC001874			Square chip: 1/10W, 10 KohmF																	
									R93			K19/2RGC001726			Square chip: 1/10W, 47 KohmJ																	
									R94			K19/2RGC001833			Square chip: 1/10W, 2.2 ohmK																	
									R95			K19/2RGC001643			Square chip: 1/10W, 100 KohmJ																	
									R96 thru R98			K19/2RGC001585			Square chip: 1/10W, 1 KohmJ																	
									R99						NOT USED																	
									R100			K19/2RGC001585			Square chip: 1/10W, 100 KohmJ																	
									R101			K19/2RGC004753			Square chip: 1/10W, 38.8 KohmF																	
									R102			K19/2RGC004779			Square chip: 1/10W, 107 KohmF																	
									R103			K19/2RGC001874			Square chip: 1/10W, 107 K ohmF																	
									R104			K19/2RGC001908			Square chip: 1/10W, 6.8 KohmF																	
									R105			K19/2RGC004605			Square chip: 1/10W, 28.7 KohmF																	
									R106			K19/2RGC004761			Square chip: 1/10W, 39.2 KohmF																	
									R107			K19/2RGC004621			Square chip: 1/10W, 39.2 KohmF																	
									R108			K19/2RGC001619			Square chip: 1/10W, 4.7 KohmJ																	
									R109			K19/2RGC004605			Square chip: 1/10W, 15 KohmF																	
									R110			K19/2RGC004613			Square chip: 1/10W, 22 KohmF																	
									R111 thru R113			K19/2RGC001825			Square chip: 1/10W, 220 KohmJ																	
									R114 and R115			K19/2RGC001726			Square chip: 1/10W, 47 KohmJ																	
									R116			K19/2RGC004746			Square chip: 1/10W, 255 KohmJ																	
									R117			K19/2RGC001601			Square chip: 1/10W, 3.3 KohmJ																	
									R118			K19/2RGC004639			Square chip: 1/10W, 680 KohmJ																	
									R119						NOT USED																	
									R120			L19/2RGC001627			Square chip: 1/10W, 10KohmJ																	
									R121			K19/2RGC001593			Square chip: 1/10W, 2.2 KohmJ																	
									R122			K19/2RGC001643			Square chip: 1/10W, 100 KohmJ																	

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION	SYMBOL	GE PART NO.	DESCRIPTION	SYMBOL	GE PART NO.	DESCRIPTION	SYMBOL	GE PART NO.	DESCRIPTION
C133	K19/2CCF004086	Tantalum: 1 uF, 16V	C316	K19/2CAK009125	Ceramic chip: 15 pF ±5%, 50V			----- TRANSISTORS -----	R205	K19/2RGC003334	Square chip: 1/16W, 22 ohms ±5%
C134	K19/2CBB034121	Electrolytic: 22 uF, 16V	C317 and C318	K19/2CAK005503	Ceramic chip: 0.1 uF, 50V	Q101		NOT USED	R206 thru R208		NOT USED
C135	K19/2CAK009208	Ceramic chip: 1000 pF ±10%, 50V				Q102	K19/	2SC2618 (RC)	R209	K19/2RAA001861	RD25S 1/4W 150 ohms ±5%
C136	K19/2CBB062171	Electrolytic: 100 uF, 16V	C319	K19/2CAK009190	Ceramic chip: 330 pF ±5%, 50V	Q103	K19/	2SA1121 (SC)	R217	K19/2RGC003110	Square chip: 1/16W, 1K ohms ±5%
C137		NOT USED	C320	K19/2CAK009166	Ceramic chip: 47 pF ±5%, 50V	Q104		NOT USED	R301	K19/2RGC003037	Square chip: 1/16W, 100 ohms ±5%
C138	K19/2CAK009158	Ceramic chip: 33 pF ±5%, 50V	C321	K19/2CAK009208	Ceramic chip: 1000 pF ±10%, 50V	Q105	K19/2QAD001034	2SD598DV3	R302 and R303	K19/2RGC003243	Square chip: 1/16W, 150K ohms ±5%
C139	K19/2CAK009216	Ceramic chip: 0.01 uF ±10%, 50V	C322	K19/2CCF004086	Tantalum: 1 uF, 16V	Q106 and Q107	K19/2QAD004020	2SC3356R22	R304		NOT USED
C140	K19/2CAK009182	Ceramic chip: 100 pF ±5%, 50V	C323	K19/2CAK009299	Ceramic chip: 7 pF ±0.25 pF, 50V	Q202	K19/2QAB015077	2SB1169	R305	K19/2RGC003045	Square chip: 1/16W, 150 ohms ±5%
C141	K19/	Ceramic chip: 2 pF ±0.25 pF, 50V	C324		NOT USED	Q301	K19/2QAD004079	2SC3583R32	R306	K19/2RGC003177	Square chip: 1/16W, 10K ohms ±5%
C142 thru C144		NOT USED	C329		NOT USED	Q302 and Q303	K19/2QAD004020	2SC3356R22	R307	K19/2RGC003243	Square chip: 1/16W, 150K ohms ±5%
C145 thru C147	K19/2CAK009182	Ceramic chip: 100 pF ±5%, 50V	C330	K19/2CCF004086	Tantalum: 1 uF, 16V			----- RESISTORS -----	R308	K19/2RGC003045	Square chip: 1/16W, 150 ohms ±5%
C148 thru C150	K19/2CAK009208	Ceramic chip: 1000 pF ±10%, 50V	C331	K19/2CAK009158	Ceramic chip: 33 pF ±5%, 50V	R101		NOT USED	R309		NOT USED
C151	K19/2CAK009216	Ceramic chip: 0.01 uF ±10%, 50V	C332	K19/2CAK009216	Ceramic chip: 0.01 uF ±10%, 50V	R102		NOT USED	R310	K19/2RGC003144	Square chip: 1/16W, 3.3K ohms ±5%
C152	K19/2CBB062171	Electrolytic: 100 uF, 16V	C343	K19/2CCF004086	Tantalum: 1 uF, 16V	R103	K19/2RGC003151	Square chip: 1/16W, 4.7K ohms ±5%	R311	K19/2RGC003201	Square chip: 1/16W, 33K ohms ±5%
C201	K19/2CAK009208	Ceramic chip: 1000 pF ±10%, 50V	C344 and C345	K19/	Ceramic chip: 0.1 uF ±10%, 50V	R104	K19/2RGC003136	Square chip: 1/16W, 2.2K ohms ±5%	R312	K19/2RGC003177	Square chip: 1/16W, 10K ohms ±5%
C202 and C203	K19/2CCF004086	Tantalum: 1 uF, 16V			----- DIODES -----	R105	K19/2RGC003326	Square chip: 1/16W, 33 ohms ±5%	R313	K19/2RGC003110	Square chip: 1/16W, 1K ohms ±5%
C204		NOT USED	CR101	K19/2QBE005024	DAP202KP	R106	K19/2RGC003359	Square chip: 1/16W, 75 ohms ±5%	R322	K19/2RGC003193	Square chip: 1/16W, 22K ohms ±5%
C205	K19/2CAK009208	Ceramic chip: 1000 pF ±10%, 50V	CR201	K19/	1S128A	R107		NOT USED			----- TRANSFORMERS -----
C206	K19/2CCB026018	Tantalum: 10 uF, 16V	CR202		NOT USED	R108	K19/2RGC003151	Square chip: 1/16W, 4.7K ohms ±5%	T301 and T302	K19/2LAB014893	A4WX01333
C207 and C208	K19/2CAK009208	Ceramic chip: 1000 pF ±10%, 50V	CR301	K19/2QBA006166	1S2075K	R109	K19/2RGC003177	Square chip: 1/16W, 10K ohms ±5%	T303	K19/2LAB014901	A4WX01334
C209	K19/2CBB026018	Tantalum: 10 uF, 16V	CR302	K19/2QBA012024	MA57	R110	K19/2RGC003342	Square chip: 1/16W, 47 ohms ±5%	T304	K19/2LAB014919	A4WX01335
C210	K19/2CCF004086	Tantalum: 1 uF, 16V			----- FILTERS -----	R111		NOT USED			----- THERMISTORS -----
C211 thru C213		NOT USED	FL201	K19/2FBB002117	LP915A1A	R112	K19/2RGC003177	Square chip: 1/16W, 10K ohms ±5%	TH301	K19/2ABD016139	NTCDS3018-3HG103HC
C220	K19/2CAK009208	Ceramic chip: 1000 pF ±10%, 50V	FL301 and FL302	K19/	800 MHz BPF	R113	K19/2RGC003128	Square chip: 1/16W, 1.5K ohms ±5%			----- ANTENNA SWITCH -----
C221 thru C223		NOT USED	FL303 and FL304	K19/2FAA103041	A4WX01306	R114	K19/2RGC003037	Square chip: 1/16W, 680 ohms ±5%	S101	K19/	
C224 thru C226	K19/2CAK009208	Ceramic chip: 1000 pF ±10%, 50V	FL305	K19/		R115	K19/2RGC003037	Square chip: 1/16W, 100 ohms ±5%			----- CRYSTALS -----
C227 and C228	K19/2CCF004086	Tantalum: 1 uF, 16V			----- JACKS -----	R116		NOT USED	Y301	K19/2YAA	44.545 MHz
C229	K19/2CAK009026	Ceramic chip: 2 pF ±0.25 pF, 50V	J101	K19/2PDA023036	69775-005	R117	K19/2RFB003253	Variable: GF04W, 10K ohms			
C230	K19/	Ceramic chip: 1.5 pF ±0.25 pF, 50V	J102	K19/2PDA023044	69775-011	R118		NOT USED			
C301	K19/2CAK009208	Ceramic chip: 1000 pF ±10%, 50V			----- COILS -----	R119	K19/2RGC003193	Square chip: 1/16W, 22K ohms ±5%			
C302	K19/2CCF004086	Tantalum: 1 uF, 16V	L101		NOT USED	R120	K19/2RGC003110	Square chip: 1/16W, 1K ohms ±5%			
C303	K19/2CAK009182	Ceramic chip: 100 pF ±5%, 50V	L102		NOT USED	R121	K19/2RGC003177	Square chip: 1/16W, 10K ohms ±5%			
C304	K19/2CAK009059	Ceramic chip: 5 pF ±0.25 pF, 50V	L103	K19/2EDE001022	A4WX01365	R122	K19/2RGC003128	Square chip: 1/16W, 1.5K ohms ±5%			
C305	K19/2CAK009018	Ceramic chip: 1 pF ±0.25 pF, 50V	L104	K19/2LAD001088	NL322522T-010M	R123	K19/2RGC003342	Square chip: 1/16W, 47 ohms ±5%			
C306	K19/2CAK009182	Ceramic chip: 100 pF ±5%, 50V	L105	K19/2LAB024124	A4FX01878#3	R124	K19/2RGC003326	Square chip: 1/16W, 10 ohms ±5%			
C307		NOT USED	L106	K19/2LAB024165	A4FX01878#7	R125	K19/2RGC003177	Square chip: 1/16W, 10K ohms ±5%			
C308	K19/2CAFO09109	Ceramic chip: 12 pF ±5%, 50V	L107		NOT USED	R126	K19/2RGC003144	Square chip: 1/16W, 3.3K ohms ±5%			
C309	K19/2CAK009034	Ceramic chip: 3 pF ±0.25 pF, 50V	L201 thru L204		NOT USED	R127 thru R129		NOT USED			
C310 and C311	K19/2CAK009216	Ceramic chip: 0.01 uF ±10%, 50V	L205	K19/2LAD001096	NL322522-022M	R130	K19/2RGC003342	Square chip: 1/16W, 47 ohms ±5%			
C312	K19/2CAFO09109	Ceramic chip: 12 pF ±5%, 50V	L206	K19/2LAD001070	NL322522-R10M	R131		NOT USED			
C313	K19/2CAK009299	Ceramic chip: 7 pF ±0.25 pF, 50V	L301	K19/2LAB024116	A4FX01878#2	R132	K19/2RGC003359	Square chip: 1/16W, 75 ohms ±5%			
C314 and C315	K19/2CAK009216	Ceramic chip: 0.01 uF ±10%, 50V	L302	K19/2EDE001030	A4WX01426	R133	K19/2RGC003037	Square chip: 1/16W, 100 ohms ±5%			
			L303 and L304		NOT USED	R134		NOT USED			
			L305 thru L307	K19/2LAD001062	MLF3216D1ROK	R135	K19/2RGC003359	Square chip: 1/16W, 75 ohms ±5%			
						R136	K19/2RGC003151	Square chip: 1/16W, 47K ohms ±5%			
						R137		NOT USED			
						R201	K19/2RGC003326	Square chip: 1/16W, 10 ohms ±5%			
						R202 and R203	K19/2RGC003094	Square chip: 1/16W, 470 ohms ±5%			
						R204		NOT USED			

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter," which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV A - CONTROLLER BOARD A4WE03649

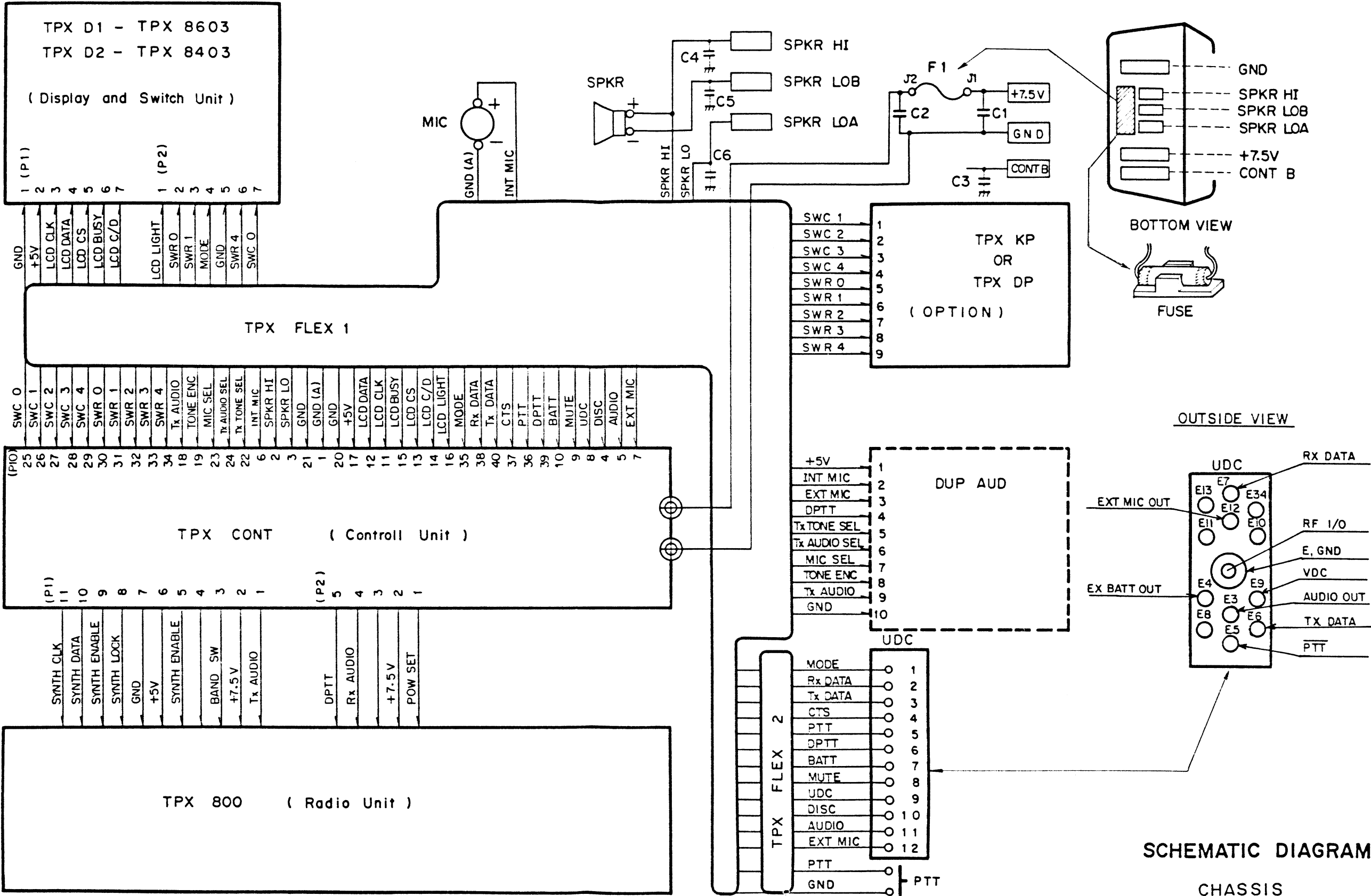
To enhance the operation of the Trunk Mode Tone Decoder, changed C12. C12 was K19/2CCF002072 Tantalum: 1uF, 15V.

REV B - To further improve Trunk Mode Tone Decode operation, changed C7, R61, R115, and R120.

REV C - Made changes to the circuit board to improve system operation.

This addendum adds a corrected interconnection diagram for page 45 of this publication.

ADDENDUM NO 1 TO LBI-31787
(PCTP)



CHASSIS
A3WE 03891
REV. 1