MOTOROLA
Mobile Products Division

MaraTrac
VHF FM Two–Way Radio
150–174 MHz
75/100 Watts

NOTE: THIS MANUAL COVERS ONLY "BK" SUFFIX RADIOS;
SEE MANUAL 68P80102W18 FOR "AK" SUFFIX RADIOS.

Instruction Manual

68P80102W94–O

MOTOROLA
Mobile Products Division

MaraTrac VHF FM Two–Way Radio 150–174 MHz 75/100 Watts

Contents

* ITEMS OMITTED DUE TO IRRELEVANCY

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Safe Handling of CMOS Integrated–Circuit Devices

Many of the integrated–circuit devices used in communications equipment are of the CMOS (Complementary Metal Oxide Semiconductor) type. Because of their high open–circuit impedance, CMOS IC's are vulnerable to damage from static charges. Everyone involved in handling, shipping, and servicing them must be extremely careful not to expose them to such damage.

CMOS IC's do have internal protection, but it is effective only against overvoltages in the hundreds of volts, such as those that could occur during normal operations. Overvoltages from static discharge can be in the thousands of volts.

When a CMOS IC is installed in a system, the system's circuit elements distribute static charges and load the CMOS circuits. This decreases the vulnerability of the IC's to static discharge, but improper handling will probably cause static damage even when the IC's are so installed.

To avoid damaging CMOS IC's, take the following precautions when handling, shipping, and servicing them.

1. Before touching a circuit module, particularly after having moved around in the service area, touch both hands to a bare metal earth–grounded surface. This discharges any static charge you may have accumulated.

Note

Wear a conductive wrist strap (Motorola Part No. RSX–4015A) to minimize the buildup of static charges on your person while you are servicing CMOS equipment.

WARNING

When wearing a conductive wrist strap, be careful near sources of high voltage. By grounding you thoroughly, the wrist strap also increases the danger of lethal shock from accidental contact with such a source.

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2. Whenever possible, avoid touching any electrically conductive parts of the circuit module with your hands.

3. Check the INSTALLATION and MAINTENANCE sections of the service manual and the notes on the schematic to find out whether or not you can insert or remove circuit modules with power applied to the unit, and act accordingly.

4. When servicing a circuit module, avoid carpeted areas, dry environments, and the wearing of static–generating clothing.

5. Be sure that all electrically powered test equipment is grounded. Attach the ground lead from the test equipment to the circuit module before connecting the test probe. Similarly, disconnect the test probe before removing the ground lead.

6. When you remove a circuit module from the system, lay it on a sheet of aluminum foil or other conductive surface connected to ground through 100,000 ohms of resistance.

WARNING

If the aluminum foil is connected directly to ground, you may get a shock if you touch it and another electrical circuit at the same time.

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7. When soldering, be sure the soldering iron is grounded.

8. Before connecting jumpers, replacing circuit components, or touching CMOS pins (if this becomes necessary during the replacement of an integrated–circuit device), be sure to discharge any static buildup on your person (see Procedure 1, above). Because you can have a voltage difference across your body, you should use only one hand if you must touch the board wiring or any of the pins on the CMOS device.

9. When replacing a CMOS integrated–circuit device, leave the device in its metal rail container or conductive foam until you are ready to insert it into the pronged circuit module.

10. Connect any low–impedance test equipment such as a pulse generator to CMOS device inputs after you have applied power to the CMOS circuitry. Similarly, disconnect such low–impedance equipment before turning off the power.

11. Wrap CMOS modules in conductive material when transporting them from one area to another, even within the same room. Use wrapping material similar to that in which replacement modules are wrapped when they arrive from the factory. (You can also use aluminum foil.) Never use nonconductive material for packaging these modules.

Performance Specifications for Conventional VHF *MaraTrac* Radio

GENERAL

Channel Capability	8 Modes (A3 Model)	16 Modes (A2 Model)	99 Modes (A5, A7 Model)
Primary Power	12 VDC negative ground only		
Dimensions	10.0" H x 14.5" W x 2.5" L		
Weight	16 lb. (7.26 kg)		
Metering	All adjustments and alignments are performed electronically using an IBM Personal Computer, a Radio Interface Box (RIB) and Field Maintenance Software.		
Environmental	Meets MIL–STD 810D environmental specifications for vibration, shock, rain, dust, and salt fog.		

Model	Frequency (MHz)	Minimum RF Power Output	Maximum Battery Current Drain: Off @ 13.8 V	Standby @ 13.8 V	Receiver @ 13.8 V	Transmit @ Rated Power
T73XTA7DA2–K	150–174	75/100 watts	60mA	.7 A	3.0 A	27 A
T73XTA7DA3–K	150–174	75/100 watts	60mA	.7 A	3.0 A	27 A
T73XTA7TA5–K	150–174	75/100 watts	60mA	.7 A	3.0 A	27 A
T73XTA7TA7–K	150–174	75/100 watts	60mA	.7 A	3.0 A	27 A

TRANSMITTER

Output Impedance	50 ohms
Spurious and Harmonic Emissions	More than 70 dB below carrier (for EIA spec. RS152B) except Fc ± 14.4 MHz @ FCC
Frequency Stability	±.0005% of assigned center frequency
Modulation	0 to ±5 kHz
Audio Sensitivity	0.080 V ±4 dB for 60% maximum deviation @ 1000 Hz
Audio Response	EIA
Audio Distortion	Less than 3% @ 1000 Hz, 60% maximum deviation
Maximum Frequency Separation	24 MHz
FM Hum and Noise: EIA Method	–45 dB

RECEIVER

Channel Spacing	30 kHz
Sensitivity: 12 dB EIA SINAD	(per EIA spec. RS204C) .30 uV
Selectivity: EIA SINAD	–80 dB
Spurious & Image Rejection	–75 dB
Intermodulation: EIA SINAD	–75 dB
Input Impedance	50 ohms
Audio Output	10 watts @ less than 5% distortion (into 3.2 ohm load @ 1000 Hz)
Maximum Frequency Separation	24 MHz
Frequency Stability	±.0005% of assigned center frequency

SPEAKER

Dimensions	5.5" x 2.5" (Excluding Mounting Bracket)
Weight	1.5 lbs. (0.7 kg)

CONTROL HEAD

Dimensions (Excluding Mounting Bracket)	Handheld—2.3" H x 4.8" W x 1.5" L Basic—5.2" H x 3.7" W x 1.8" L Basic Plus—6.5" H x 3.4" W x 1.7" L
Weight	.75 lb (0.4 kg)

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

FCC TRANSCEIVER DESIGNATION

ABZ89FT3731

Model Chart for VHF *MaraTrac* Radio 150–174 MHz 75/100–Watts

CODE:

● = ONE ITEM SUPPLIED
∅ = INDICATES BREAKDOWN IN SEPARATE CHART

MODEL	T73XTA7TA5BK	T73XTA7DA3BK	T73XTA7DA2BK	T73XTA7TA7BK		ITEM	DESCRIPTION
DESCRIPTION	HHCH 99–FREQUENCY	BASIC 8–FREQUENCY W/SCAN	BASIC 16–FREQUENCY	ADVANCED 99–FREQUENCY			
	∅	∅	∅	∅		HUD1730A	UNIFIED CHASSIS
		●				HCN4033A	BASIC CONTROL HEAD, 8–MODE W/SCAN
			●			HCN4034A	BASIC CONTROL HEAD, 16–MODE
	●					HCN1051A	HANDHELD CONTROL HEAD (HHCH), 99–MODE
	●	●	●	●		TAD6111A	ANTENNA 136–144 MHz, OR
						TAD6112A	144–152 MHZ, OR
						TAD6113A	152–162 MHZ, OR
						TAD6114A	162–174 MHz
		●	●			HKN4017A	POWER CABLE AND FUSE, BASIC CONTROL HEAD
	●					HKN4319A	POWER CABLE AND FUSE, HHCH
	●	●	●	●		HKN4051A	RED FUSED LEAD
		●	●			HLN4024A/B	MICROPHONE HANGUP BOX
	●					HLN4830A	HHCH HANGUP BOX
	●	●	●	●		HLN5372A	SOFTWARE KIT
	●	●	●	●		HLN4022C	INSTALLATION KIT
	●	●	●	●		HLN4023A	TUNING TOOL KIT
	●	●	●	●		HHN4032A	TOP COVER
	●	●	●	●		HLN4034C	MOUNTING TRAY
		●	●			HMN1015A	MICROPHONE
		●	●			HSN4020A	SPEAKER
	●			●		HSN4021A	SPEAKER
	●	●	●			HKN4007A	ORANGE CABLE
	●	●	●	●		HLN5371A	NAMEPLATE
	●					HLN5381A	ESCUTCHEON W/O "DIR"
				●		HCN1052B	ADVANCED CONTROL HEAD 99–MODE
				●		HLN5404A	CONTROL HEAD HARDWARE
				●		HLN5406B	ADVANCED CONTROL HEAD BOARDS
				●		HKN4321A	POWER CABLE AND FUSE, ADVANCED
				●		HLN5064A	ADVANCED TOOL
				●		HLN5383A	ADVANCED BUTTON PLUG
				●		HMN1061A	MICROPHONE
				●		HLN4921A	TRUNNION
	●					HKN4324A	FUSE KIT

Model Chart for 150–174 MHz Unified Chassis VHF *MaraTrac* Radio 75/100–Watts

CODE:

● = ONE ITEM SUPPLIED

MODEL	DESCRIPTION	ITEM	DESCRIPTION
	HUD1730A UNIFIED CHASSIS, 150–174 MHz		
●		HLN5342B	AUDIO/SQUELCH BOARD
●		HLN5343B	INTERCONNECT BOARD
●		HLN4046A	FEED THRU PLATE
●		HLN4047A	BLACK/RED POWER CABLE
●		HLN5541A	BOTTOM COVER
●		HLD4322B	RF BOARD
●		HLN5402A	LOGIC BOARD
●		HLN5466A	TRANSCEIVER HARDWARE
●		HLD4335A	EXCITER AND POWER CONTROL BOARD
●		HLN5344A	ANTENNA RELAY
●		HLN5543A	HARDWARE KIT
●		HLD4337B	PA BOARD
●		HLD4067A	POWER TRANSISTOR

MaraTrac VHF Two–Way Radio Options Chart

Option	Description	Kit Added	Kit Deleted
W544	3.0 dB Gain Antenna	TAD6170A	TAD611xA (x = 1,2,3, or 4)
B20	DTMF Microphone	HMN1022A	HMN1015A
B42	PL Scan Plant Programmed	Plant Programming	
B70	Omit Antenna	—	TAD611xA (x = 1,2,3, or 4)
B71	Omit Microphone	—	HMN1015A
B87	Omit Speaker	—	HSN4020A or HSN4021A
B90	Omit Accessories	—	Control Head Power Cable Fused Lead Hang–Up Box Microphone Speaker Antenna
B109	Handset	TLN4698A TMN6067A	HLN4024A HMN1015A
B161	Omit Main Radio Cable	—	Fused Power Cable Fused Red Lead Orange Cable
B206	Service Manual	6880102W18 (AK Models) 6880102W94 (BK Models)	
B239	Noise Cancelling Microphone	TMN6116A	HMN1015A
B730	75W Power set Option	Plant Programming	—
B835	DTMF Decoder	HKN4341A HLN5455A HLN5472A 6880102W58 6880102W60	—
B561	*Quik–Call II*	6880102W58 6880102W60 Plant Programming	—
B566	*Single Tone*	HLN5455A HLN5476A HLN5472A 6880102W58 HKN4341A 6880102W60	—
B652	Wide Band Antenna	HAD4002A or HAD4003A	TAD611xA (x = 1,2,3, or 4)
B833	Stat Alert Decode	6880102W58 6880102W60 Plant Programming	—
B995	Zone Mode (32 channel) A5, A7 only	Field Programmable Requires Radio Firmware 4.01	—
XT7601	Spare Accessories A2 Models		
XT7606	Spare Accessories A3 Models		
XT7607	Spare Accessories A5 Models		
XT7608	Spare Accessories A7 Models		

MaraTrac Radio Service Aids

The following service aids are available through Motorola Communications Parts Division to facilitate servicing and programming the *MaraTrac* Mobile Radio. Please contact 1–800–422-4210 for price and delivery.

Model No.	Description
	TEST CABLES AND ADAPTERS
01–855414	TEST CABLE—BNC to BNC cable (4 ft) used with the 58–855270 adapter to connect the *MaraTrac* mobile radio to the RF test instruments.
01–80355A09	TEST ADAPTER—Attaches to the Program/Test cable in place of the RIB; used to manually key the radio and to inject a tone for troubleshooting purposes.
30–80093P01	TEST CABLE—14 pin ribbon cable used to extend the RF board for servicing.
30–80373B41	VCO TEST CABLE—Provides the interface between the mobile's RF board and the test equipment for troubleshooting.
58–855270	TEST ADAPTER—BNC Female to UHF Male adapter used with the 01–855414 Test Cable to connect the *MaraTrac* mobile radio to RF test instruments.
	SERVICE MANUALS
68–80102W39	*MaraTrac* Low Band Radio Instruction Manual (AK Models)
68–80102W95	*MaraTrac* Low Band Radio Instruction Manual (BK Models)
68–80102W18	*MaraTrac* VHF Radio Instruction Manual (AK Models)
68–80102W94	*MaraTrac* VHF Radio Instruction Manual (BK Models)
68–80102W21	*MaraTrac* UHF Radio Instruction Manual (AK Models)
68–80102W87	*MaraTrac* UHF Radio Instruction Manual (BK Models)
68–80102W58	*MaraTrac* Radio Signalling Options and Retrofits Instruction Manual
	OPERATOR CARDS
68–80102W22	*MaraTrac* A2 and A3 Basic Model Radio
68–80102W19	*MaraTrac* A5 Handheld Control Head Model Radio
68–80102W20	*MaraTrac* A7 Advanced Control Head Model Radio
68–80102W60	*MaraTrac* Radio Signalling Options–Decoder
	PROGRAMMING DEVICES
RPX–4719	RADIO SERVICE SOFTWARE LICENSING AND INFORMATION PACKAGE—Provides the necessary software licensing information required to purchase Radio Service Software listed below.
RVN–4023	RADIO SERVICE SOFTWARE ON 5–1/4 INCH DISK—Operates on the IBM PC, XT, AT, or PS/2 family of computers for programming and servicing of *MaraTrac* mobile radios. IBM DOS 3.0 or higher, an RS–232 Asynchronous Serial Communications Adapter and RAM memory of 512K bytes minimum are necessary for the programmer. (Includes users manual 68–80102W24.)
RVN–4024	RADIO SERVICE SOFTWARE ON 3–1/2 INCH DISK—Same as RVN4023 description.
01–80353A74	RADIO INTERFACE BOX (RIB)—Voltage level shifter to enable communications between the radio and the computer's RS–232 Asynchronous Serial Communications Adapter. Requires the Wall Mount Power Supply (01–80357A57).
01–80357A57	WALL MOUNT POWER SUPPLY—Used to supply power to the RIB. For 120 VAC use only.
30–80070N01	PROGRAM/TEST CABLE—Provides the electrical interconnection from the programming receptacle inside the radio to the RIB (01–80353A74) for programming the *MaraTrac* mobile radio.
30–80369B71	COMPUTER INTERFACE CABLE—Used to connect the IBM PC, PC–XT, or PS/2 computer's Asynchronous Serial Communications Adapter to the RIB (01–80353A74). The previously offered 01–80357A74 Computer Interface Cable will provide the proper connections.
30–80369B72	COMPUTER INTERFACE CABLE—Used to connect the IBM PC–AT computer's Asynchronous Serial Communications Adapter to the RIB (01–80353A74). The previously offered 01–80357A64 Computer Interface Cable will provide the proper connections.

VHF Theory of Operation

1. Introduction

The *MaraTrac* radio is a fully synthesized, microprocessor–controlled transceiver. All standard features are performed by software in the radio control processor.

2. Radio Features

2.1 INTERNAL STANDARD FEATURES

The *MaraTrac* radio has the following standard features:

- Remote mount configuration
- High RF power
- Wide bandwidth
- 8, 16, and 99–mode models
- Microprocessor controlled
- Fully synthesized
- MDC–1200 DOS, Unit ID, Radio Check, and Emergency
- 10–watt audio
- Field programmable EEPROM

2.2 CONTROL HEADS

The following control heads are available with the *MaraTrac* radio:

(1) Basic "Clamshell" Control Head

The clamshell control head is available for use with either an 8 or 16 mode *MaraTrac* radio. This allows either 16 separate modes, or 8 modes and mode–programmable scan. An optional TalkAround switch is available for the control head.

(2) Handheld Control Head (HHCH)

A HHCH is available for the *MaraTrac* radio. This unit allows selection of up to 99 modes. Single priority scan is standard with either mode–programmable or operator–select scan lists.

(3) Advanced Control Head

An advanced control head is available for the *MaraTrac* radio. This unit allows selection of up to 99 modes. Single priority scan is standard with either mode–programmable or operator–select scan list. A RCL button "recalls" the scan list for reviewing and a HOME button allows for a pre–programmed "home" mode. Also, the MPL button allows multiple PL access. This control head utilizes an electronic volume attenuator to control radio volume.

3. Electrical Characteristics

3.1 CIRCUIT BLOCKS

The radio is grouped into the following physical blocks:

- Interface board
- Squelch/Audio PA board
- Transceiver RF board
- Transceiver Controller board
- Transmitter Exciter board
- Transmitter PA

3.2 FUNCTIONAL DESCRIPTION (SEE FIGURE 1)

3.2.1 Microcomputer

The *MaraTrac* radio uses the Motorola 68HC11A8 Microcomputer operating in an expanded bus mode to perform all basic radio control functions. The processor is located on the transceiver controller board and operates with a 7.776 MHz clock. User information is stored in both the internal EEPROM and in a separate lithium–battery backed–up RAM IC.

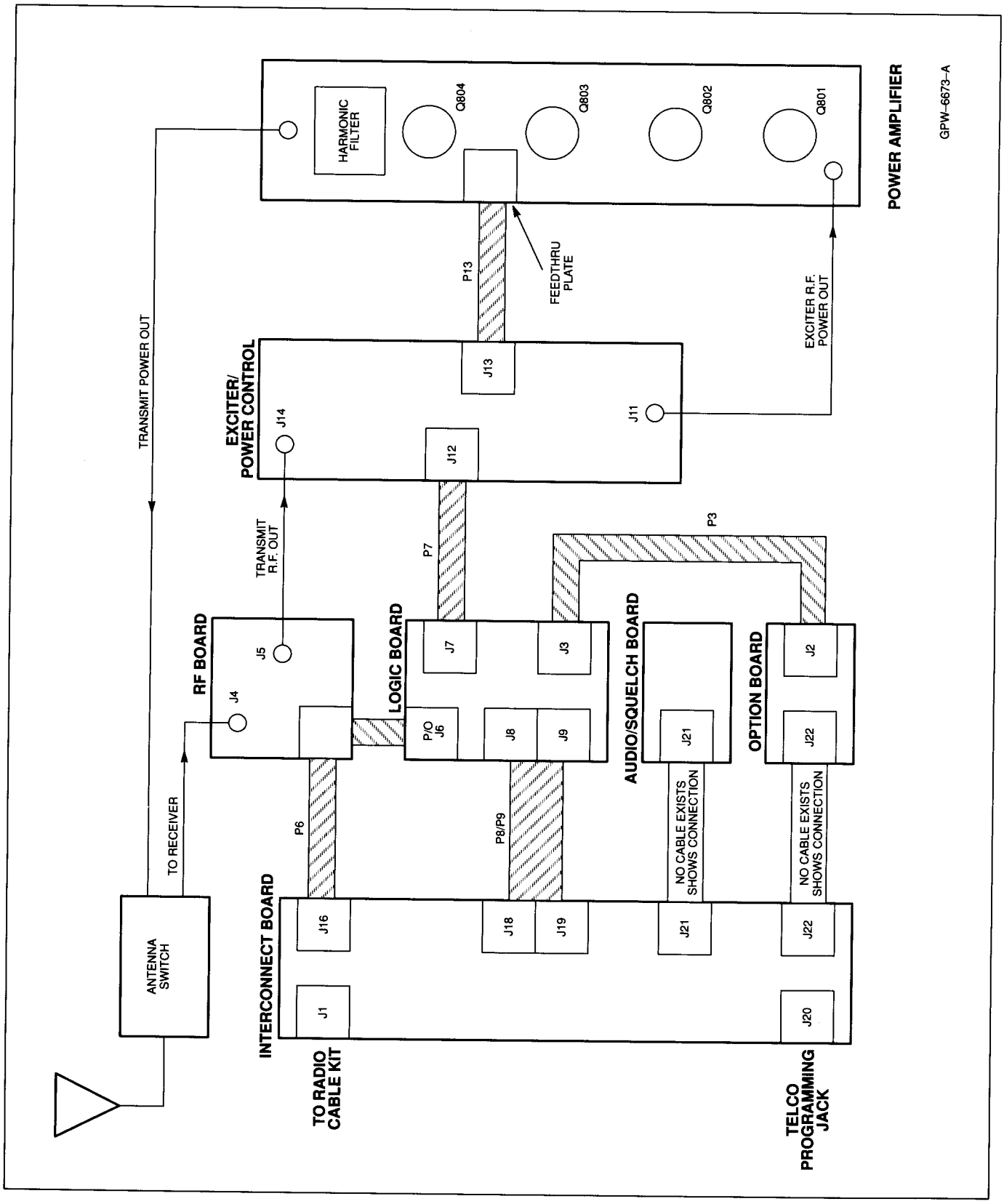


Figure 1. VHF Radio Block Diagram

3.2.2 Frequency Synthesizer

The frequency synthesizer uses a phase–locked loop (PLL) that consists of a reference oscillator, a voltage controlled oscillator (VCO), a variable modulous pre–scaler, a single chip synthesizer (which contains a programmable divider and a phase detector), a charge pump, and a fixed loop filter. The frequency information, carried to the synthesizer IC via the serial clock and data line, is strobed by the synthesizer latch enable line. The reference oscillator is a discrete crystal–controlled oscillator that uses the radio processor to monitor and compensate for temperature variations.

3.2.3 Receiver

Incoming RF signals, directed by the antenna relay, pass into a 4–pole bandpass filter. From that filter, the RF signal passes through one stage of RF amplification, then to a 3–pole bandpass filter. The filtered signal then passes to the first mixer stage. Meanwhile, the synthesizer output is fed to the first mixer as a high side local oscillator. The mixer produces a 45.1 MHz first IF signal which is amplified before it passes through a 4–pole crystal filter. Another stage of amplification occurs before the RF signal passes into the receiver subsystem IC, where the 45.1 MHz signal is mixed with 44.645 MHz to produce a 455 kHz second IF signal. The second IF signal is amplified, filtered, limited, and detected by a quadrature detector.

3.2.4 Transmitter

The frequency synthesizer generates an RF signal at the required transmit frequency. This signal is buffered and fed to the RF exciter board for additional amplification. From the exciter board, which also contains drive and temperature limiting circuitry, the RF signal is fed to the RF PA compartment where it is amplified up to 100 watts. Finally, the antenna relay directs the RF PA output to the antenna connector.

4. Primary Power Source

The *MaraTrac* radio is designed to operate from a negative ground 12–volt DC source. The negative lead is internally connected to the radio chassis.

5. Physical Characteristics

The *MaraTrac* radio's rugged low–profile housing encloses its electronic circuitry. The front end of the radio houses the antenna connector, a mounting tray lock, the main cable connector, and the handle. On the back end are heatsink fins for cooling the RF PA amplifier. Inside the radio, partitions and shielding covers isolate the various radio circuits from each other. The top cover snaps on and off; four screws secure the bottom cover in place. A mounting tray is supplied with the radio.

The radio's electronic circuits are on printed circuit boards that plug together. Test points on the boards allow access to various metering points.

The radio, less control head, occupies 363 cubic inches and weighs 16 pounds (approximate values).

6. Operating Instructions

Note

Refer to the operator card supplied with each radio for information on the general use of the radio.

6.1 RADIO SELF–CHECK

When the radio is first turned on, the software executes a series of internal self–tests to check digital hardware. The following devices are tested in this order: internal RAM, external RAM, external ROM, external EEPROM, and internal EEPROM. The following audible diagnostic tones sound when a device fails:

7 beeps	Watchdog Failure
6 beeps	Internal RAM Failure
5 beeps	External RAM Failure
4 beeps	External ROM Failure
3 beeps	External EEPROM Failure
2 beeps	Internal EEPROM Failure

If one of the EEPROM areas has failed, the radio will sound five groups of error tones and then automatically enter "bootloader" mode to allow radio reprogramming. ROM and RAM failures are treated as critical errors and will not allow radio operation of any kind; the failure tones will be repeated indefinitely.

6.2 *CHANNEL SCAN*

The *Channel Scan* feature allows you to scan a previously defined list of valid channels (modes) for activity. One scan list mode can be assigned as the priority mode and the rest are assigned non–priority modes. The radio can be programmed such that, while scanning, if you take the microphone off–hook, the radio will either continue to scan in carrier squelch mode or it will stop scanning and revert to the selected mode. When the Monitor button is activated, the radio will scan in carrier squelch mode. When you press the PTT to talk, the transmission will take place on the selected mode.

6.3 BASIC CONTROL HEAD SCAN

Activate and deactivate the Basic Control Head Scan by switching the rotary knob to the ON or OFF position. When activity is detected, the BUSY indicator lights solid to indicate the activity is from a non–priority mode, or flashes if the activity is from a priority mode. (A priority alert tone can be field programmed.) The basic control head model supports only a Mode–Slaved Scan list, meaning, the scan list is pre–programmed and requires a field programmer to modify it. The priority mode will always be equal to the selected mode. Also, there is no provision for operator review of the scan list.

6.4 HHCH AND ADVANCED SCAN

Activate and deactivate Scan by momentarily pressing the Scan rocker. The Scan indicator light is on when Scan is

activated. If no activity is detected by *Channel Scan*, the radio displays the selected mode. When activity is detected, the BUSY indicator lights solid to indicate the activity is from a non–priority mode, the active mode number is displayed, and the radio unmutes. If activity is detected on the priority channel, the BUSY indicator comes on, the PRI indicator flashes, the priority mode is displayed, and the radio unmutes. (A priority alert tone can be field programmed.) Using a field programmer, the scan list members (priority and non–priority) can be independently designated as either Mode–Slaved or Operator–Selectable. If designated as mode–slaved, the Scan list modes can only be reviewed by the operator. If designated as operator–selectable, the list can be reviewed and modified by entering the Scan Programming Mode as described below.

6.5 SCAN PROGRAMMING/CONFIGURATION MODE

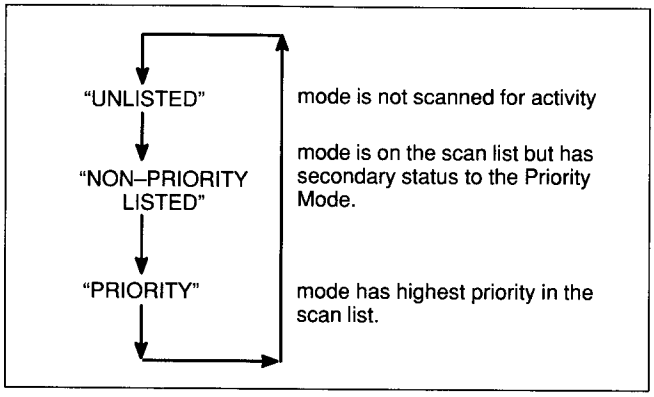
Operator–Selectable Scan lists can be reviewed and modified. Press and hold the SCAN button; an alert tone (if programmed) sounds and the SCAN indicator blinks to enunciate entry into the Scan configuration mode. Use the mode control to scroll to the desired mode. Press SEL to add the displayed mode to the list. Confirming the selection and defining the mode's "non–priority" status in the list, (1) on the handheld control head, the PRI indicator lights, or (2) on the advanced control head, the Non–Pri indicator lights. Raise the mode's status to "priority" by pressing SEL again; the PRI indicator flashes on either control head.

Note

If a different mode was previously selected as "Priority," the above procedure will affect that mode in one of two ways:

- If the non–priority scan list is programmed "operator–selectable," the mode is remove from the "priority" scan list and placed on the "non–priority" scan list.
- If the non–priority scan list is programmed "mode–slaved," the mode is no longer on any scan list.

The SEL button controls an endless loop program—that is, each press of the button changes its status, from:



While in the Scan Programming mode, the radio will sound a "bad–chirp" (if programmed) when one of the following situations occur:

- You try to change the Scan status of a mode–slaved mode (priority or non–priority).
- You try to add a new mode to a non–priority scan list that is full (16 members maximum).

Exit the scan programming mode by momentarily pressing the SCAN button. The radio resumes normal operation. If Scan was activated before entering the configuration mode, the radio will resume scanning.

7. Detailed Theory of Operation

7.1 TRANSMITTER

(1) RF Circuits.

The synthesizer on the RF Board (J5) produces a low–level modulated RF signal at the carrier frequency when the microphone is keyed. The RF output level, between +12 and +16 dBm, is fed to J14 on the Exciter/Power Control board. Buffer transistor Q1601 amplifies the signal to about +16 to +19 dBm. The next stage of amplification, Q1701, amplifies the signal further before it is applied to the base of the controlled stage, Q1702. The power level at J11V can be as high as 2 to 3 watts when controlled B+ is near 8 volts. The output drive from J11V is applied to the VHF RF Power Amplifier (RFPA) deck. The RFPA amplifies the signal up to rated power.

(2) Timing Circuits.

The transmit sequence is as follows: between 4 and 21 milliseconds after the PTT is pressed, the logic board sends frequency information to the RF board and the antenna relay energizes (9.6T). Between 34 and 51 milliseconds after the relay energizes, the synthesizer locks on frequency, and the DAC voltage to U451A–3 rises and brings up controlled B+ to Q1702, driving the RFPA deck and producing output power. When PTT is released, 9.6T and controlled B+ drop off, reducing output power to zero. The antenna relay drops out shortly thereafter, routing the antenna back to the receiver circuit.

(3) Power Control.

As part of the tune–up procedure, the radio transmitter is adjusted for rated output power at 16 points distributed across the band. This process determines the proper DAC voltage versus carrier frequency to apply to U451A–3, in order to obtain rated power. At a given frequency, output power is controlled by maintaining a fixed current to the final amplifiers (Q803,Q804). Current to the finals is monitored from the voltage drop across R801. U451B causes Q454 to conduct a small current which is proportional to the finals current. Q454 maintains a voltage drop across R902 and R911 that is identical to the voltage drop across R801 on the RFPA. U451A compares the output of Q454 to the reference from the DAC (U801). U451 drives Q453, Q452, and Q451 to produce controlled B+ which supplies Q1702 and controls its gain in order to control RF drive to the RFPA stages. Controlled B+ fixes the amount of current that flows to the finals, resulting in a controlled amount of output power.

(4) R.F. Power Trim Potentiometer R911

Normally, potentiometer R911 is left at mid–rotation after TRANSMITTER POWER ALIGNMENT. However,

potentiometer R911 may be used to trim transmitter power while the radio is in the vehicle. Antenna loading may require adjustment of R911 to achieve rated power output. Adjust potentiometer R911 clockwise to increase power output and counter clockwise to decrease power output. Monitor all adjustments with a "thru–line" style wattmeter to measure forward and reflected power flow. If the output power requires adjustment more than ± 10% to achieve rated output power, check the antenna VSWR.

(5) Protection Circuits.

To prevent damage to the RFPA, the temperature of the RFPA and the drive level to the finals are monitored. Temperature is sensed by thermistor RT801 near the final transistors. Its resistance drops to about 5.4K at 97°C. This causes Q901 to conduct, dropping the voltage on the current sense low line to the logic board power control circuit. This makes it appear as if the RFPA deck is drawing too much current, and causes the power control circuit to reduce controlled B+. This reduces the drive to the RFPA deck, which reduces output power enough in extremely hot environments to prevent overheating and damage.

Operation of the drive sense circuit is similar to temperature sense. For high VSWRs at certain phase angles, less current flows through shunt resistor R801. Controlled B+ rises to a high level in an attempt to produce rated power from the finals, causing an abnormally high level of RF drive to be produced by Q802, and possibly damaging the final transistors. Shunt resistor R822, transistor Q805, and associated circuitry monitors the current drawn by driver Q802 and hence the drive to finals Q803 and Q804. As this current increases, the RF drive sense line voltage rises, causing Q901 to conduct, and reducing the drive to a safe level without reducing output power significantly.

Finally, a software controlled form of protection exists. Controlled B+ voltage is monitored by U802–45, an A/D input. When controlled B+ rises above 8 volts, the microprocessor reduces the DAC voltage for the duration of the transmission, dropping the controlled B+ voltage from over 8 VDC down to about 2 to 4 VDC after about 1/2 second. This prevents Q1702 from overheating when the radio is operating at low line voltages or into high VSWRs.

7.2 AUDIO/SQUELCH CIRCUITS

(1) Audio and Squelch

The FM detector output is routed through a low pass filter, a high pass filter, de–emphasis circuitry, and then to the control head for application to the volume control. The adjustable output of this voltage divider is then routed to the audio/squelch board for application to the respective audio circuits.

The bridge audio power amplifier circuit provides a highly efficient audio output. The circuit uses two differential power amplifiers that provide a balanced push–pull output to the speaker.

Audio is applied from the audio buffer amplifier, U1102C, to the non–inverting input of U501. The output of U501 is applied to one side of the speaker and to U500. R504 and R505 form a voltage divider that attenuates the high level output of U501 before it is applied to the inverting input of U502. The output of U502 is equal in amplitude to the output of U501 but 180 degrees out of phase.

Squelch muting is controlled at two points: at series–connected transistor Q551 and at transistor Q550. Q551 is used for squelch muting as well as for muting in the priority *Channel Scan* mode while the priority channel is being sampled. When AUDIO PA MUTE is low, Q500 turns on, discharging C523 and forward biases CR500 and CR501. This allows internal bias of U501 and U502 to increase and turn off the audio power devices. By turning off the audio power devices, current in standby mode is substantially reduced.

(2) Squelch Operation

The output from the FM detector, a combination of noise and recovered audio, is shaped and amplified by the squelch circuitry. These stages consist of a noise amplifier U1102A, squelch control pot R1132, noise filtering/detection/integration quad operational amplifier U1101, and associated variable squelch–tail–control circuitry. This circuitry has good squelch characteristics because of the following:

- A high–pass filter ahead of the second amplifier, to attenuate the audio frequencies to a specific level;
- Capacitors C1103 and C1104, which attenuate noise at frequencies above 22 kHz, to leave the noise band susceptible to detection;
- An input network to the detector, which further attenuates audio and any harmonics generated by audio, to limit at the output of the third amplifier/limiter.

The filtered noise is routed to a positive–peak detector, which adds negative–going spikes at its output. These spikes are forwarded to the integrator and the variable squelch–tail–control circuitry. The integrator compares the average DC level of the detector's output with a reference level and generates a fast–responding output signal, Vo, as follows: Vo is greater than 4.5 V for squelched, and less than 4.5 V for unsquelched.

The detector's output also goes to Q1102 via a dual–time–constant network consisting of R1116, CR1103, and R1117. If the signal is weak, or in the absence of a signal, the noise spike rate becomes high enough to keep C1110 discharged below the turn–on voltage of Q1102. The collector of Q1102 therefore has a potential of +9.6 V. When the signal level increases, Q1102 turns on and its collector voltage, Vo, begins to decrease. With a strong signal, the collector voltage reaches a minimum level of approximately 4 V. For a given level at the integrator output, the voltage across C1111 varies directly with Vo of Q1102.

Q1105 generates an output signal (SQUELCH DECISION) that is a delayed version of the integrator output. The microcomputer mutes the audio when the SQUELCH DECISION signal goes high (4.5 V) and unmutes the audio when the signal goes low (0 V). The Q1103 turn–on voltage at the node

between R1118 and R1122 is approximately 4.5 V. This voltage is determined by the 9.6 V supply, R1120, C1111, and the dual–time–constant network comprised of R1118, R1119, and CR1104.

With loss of signal, the greater the voltage across C1111, the longer it takes the node voltage (R1118 and R1122) to increase above 4.5 V, and thus the longer the SQUELCH DECISION signal remains high after loss of signal. Since C1111 charges through R1119 and CR1104, the SQUELCH DECISION detect time is very short. The integrator output is inverted by Q1104 and supplied as a CHANNEL ACTIVITY signal. This is a fast responding output signal that is used only in *Channel Scan* operation.

7.3 INTERCONNECT BOARD

The interconnect board contains seven connectors that connect the logic board/RF board subassembly to the audio board, front connector, programming jack, and the internal option board. Connectors labeled J18 and J19 are combined into one cable assembly.

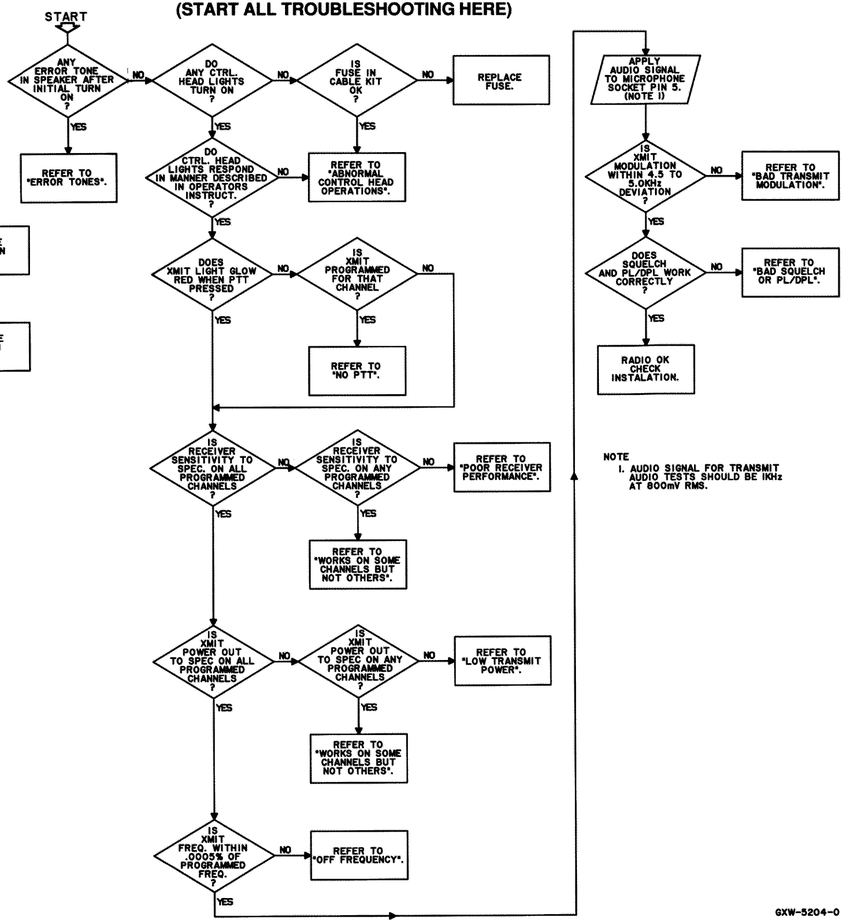
The serial data signal is logically ANDed with the DISPLAY ENABLE signal. Therefore, data out is always low unless DISPLAY ENABLE is high. The line labeled DATA OUT is used to send serial display data to the control head. Switch data is clocked from the control head and is received on the DATA IN line.

7.4 CONTROL HEAD

MaraTrac radios use three types of control heads. The basic model, a non–display control head, uses rotary knobs to control VOLUME, MODE, and ZONE or SCAN selections. Mode selection is indicated by numbers (and zone letters, on some models) on the knob(s). The handheld model, a display–type control head, uses two seven–segment displays to indicate selected mode; it also contains the microphone circuitry. The advanced model, a display type control head, uses two seven segment displays to indicate selected mode.

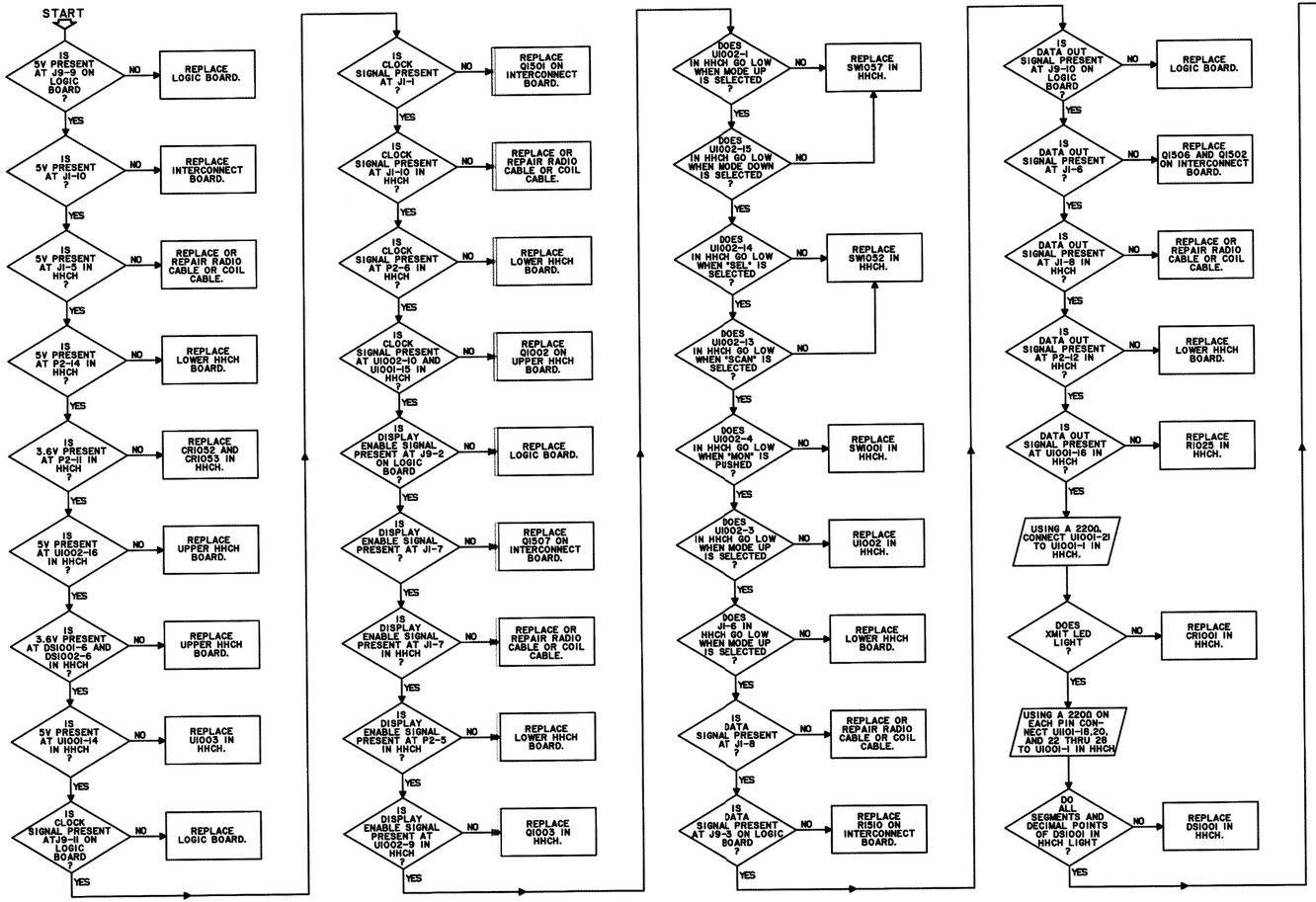
All control heads use the CLOCK, DISPLAY ENABLE, and DATA IN lines to control data transmissions between the control head and the radio. Additionally, the handheld and advanced control heads use the DATA OUT line to receive display data from the radio. Both display data and switch/button data is shifted on the positive clock edge. The DISPLAY ENABLE line is used to control the state of the parallel/serial shift register in the control head. When DISPLAY ENABLE is low, the shift register operates in a parallel mode, reading the switch/button condition. When DISPLAY ENABLE goes high, the shift register latches the current switch condition and allows the data to be shifted serially to the radio.

RADIO SYSTEM TROUBLESHOOTING CHART
(START ALL TROUBLESHOOTING HERE)



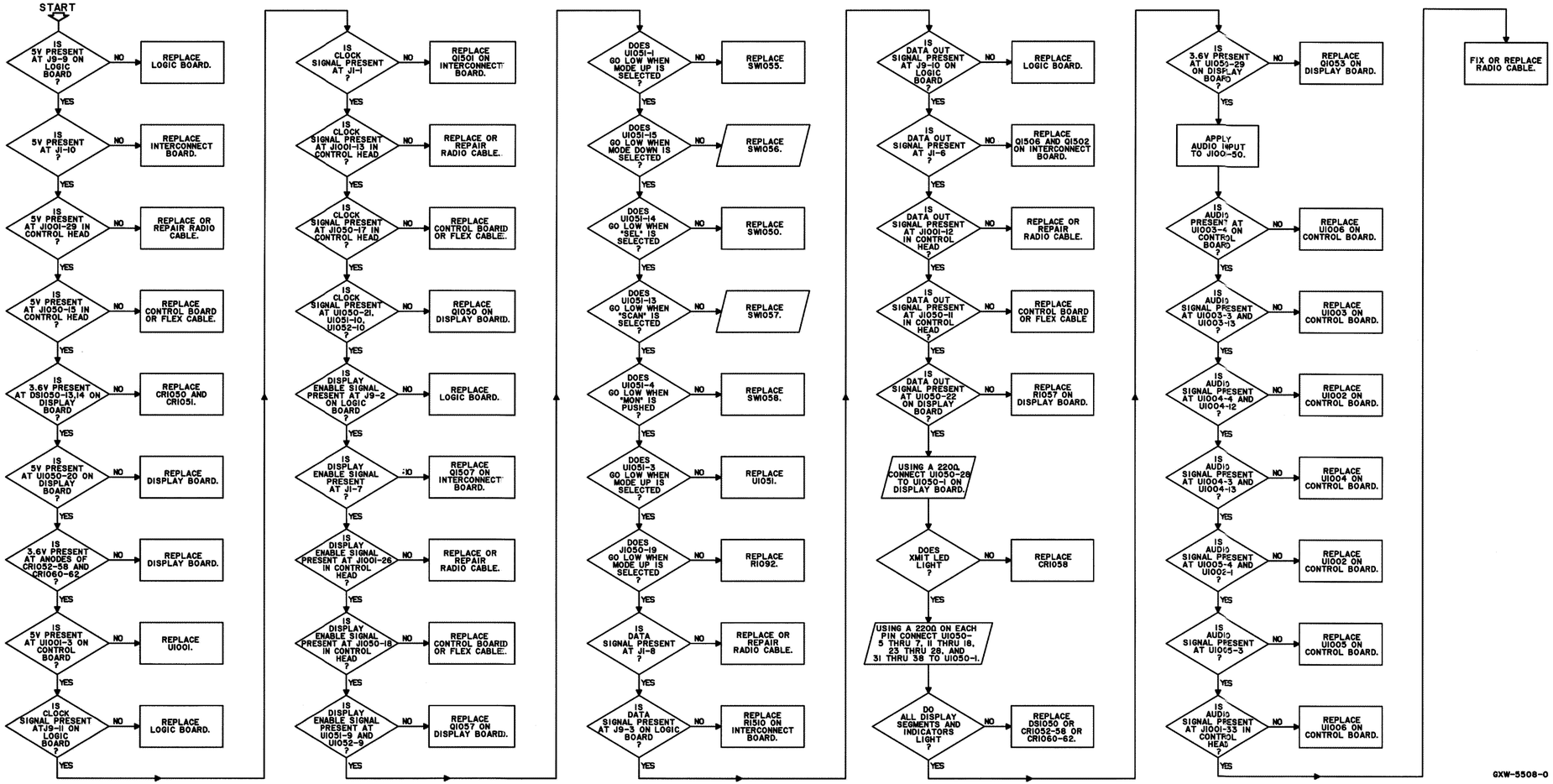
GXW-5204-0

IMPROPER HHCH OPERATION

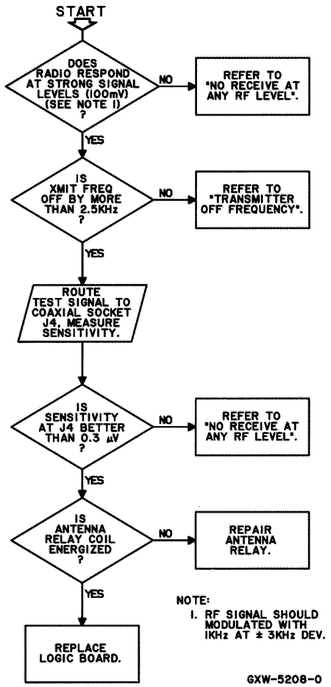


GXW-5206-0

IMPROPER ADVANCED CONTROL HEAD OPERATION



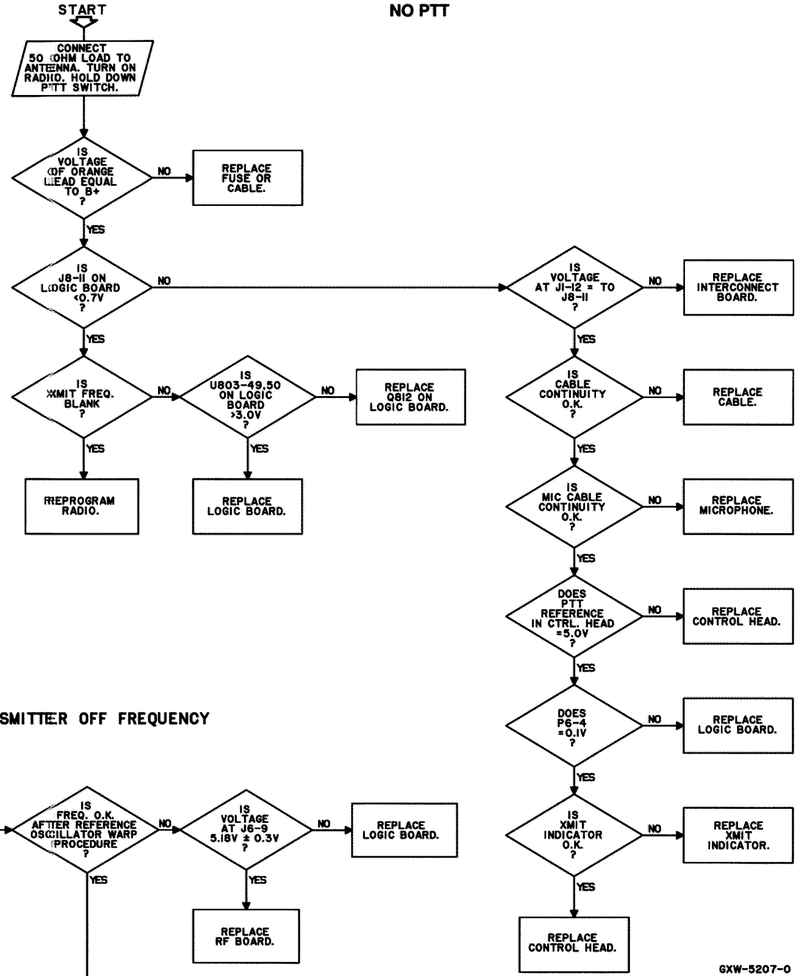
POOR RECEIVER PERFORMANCE



NOTE:
1. RF SIGNAL SHOULD MODULATED WITH 1KHz AT ± 3KHz DEV.

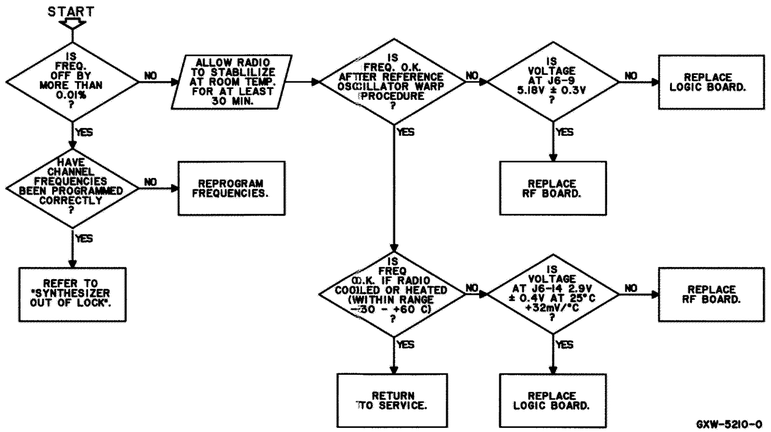
GXW-5208-0

NO PTT



GXW-5207-0

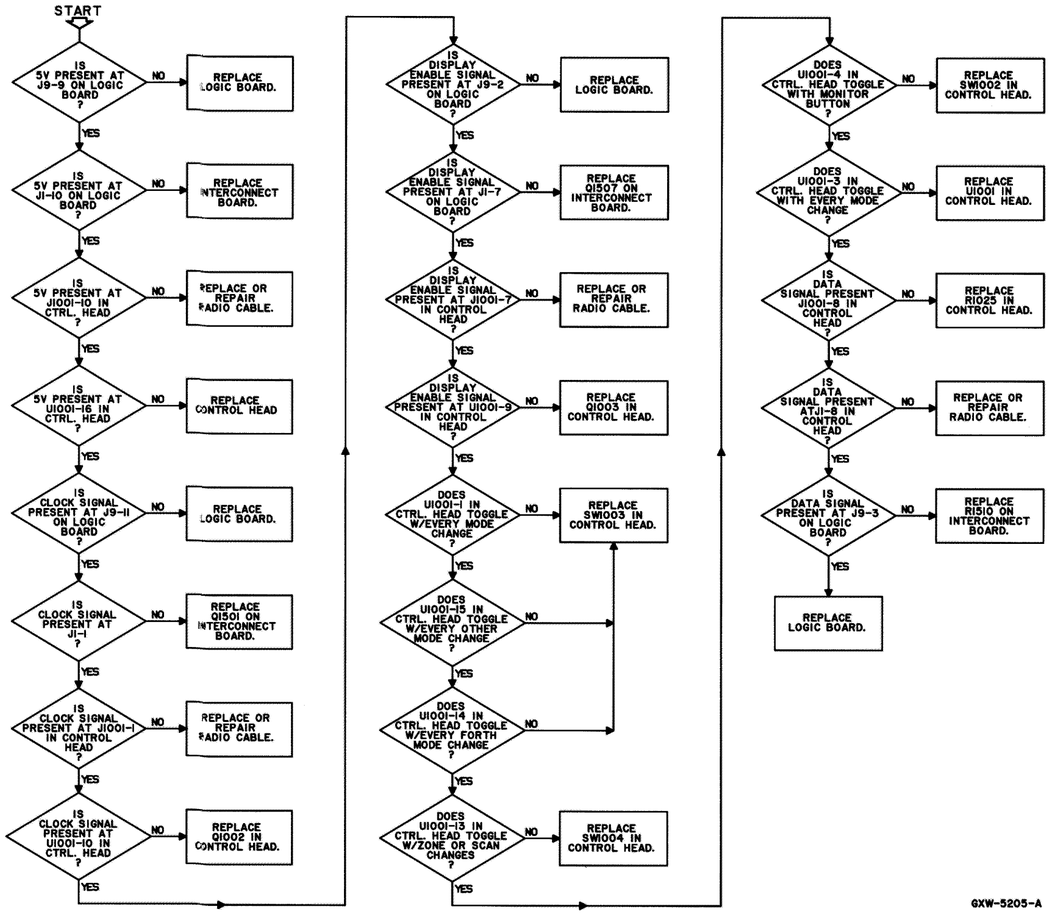
TRANSMITTER OFF FREQUENCY



GXW-5210-0

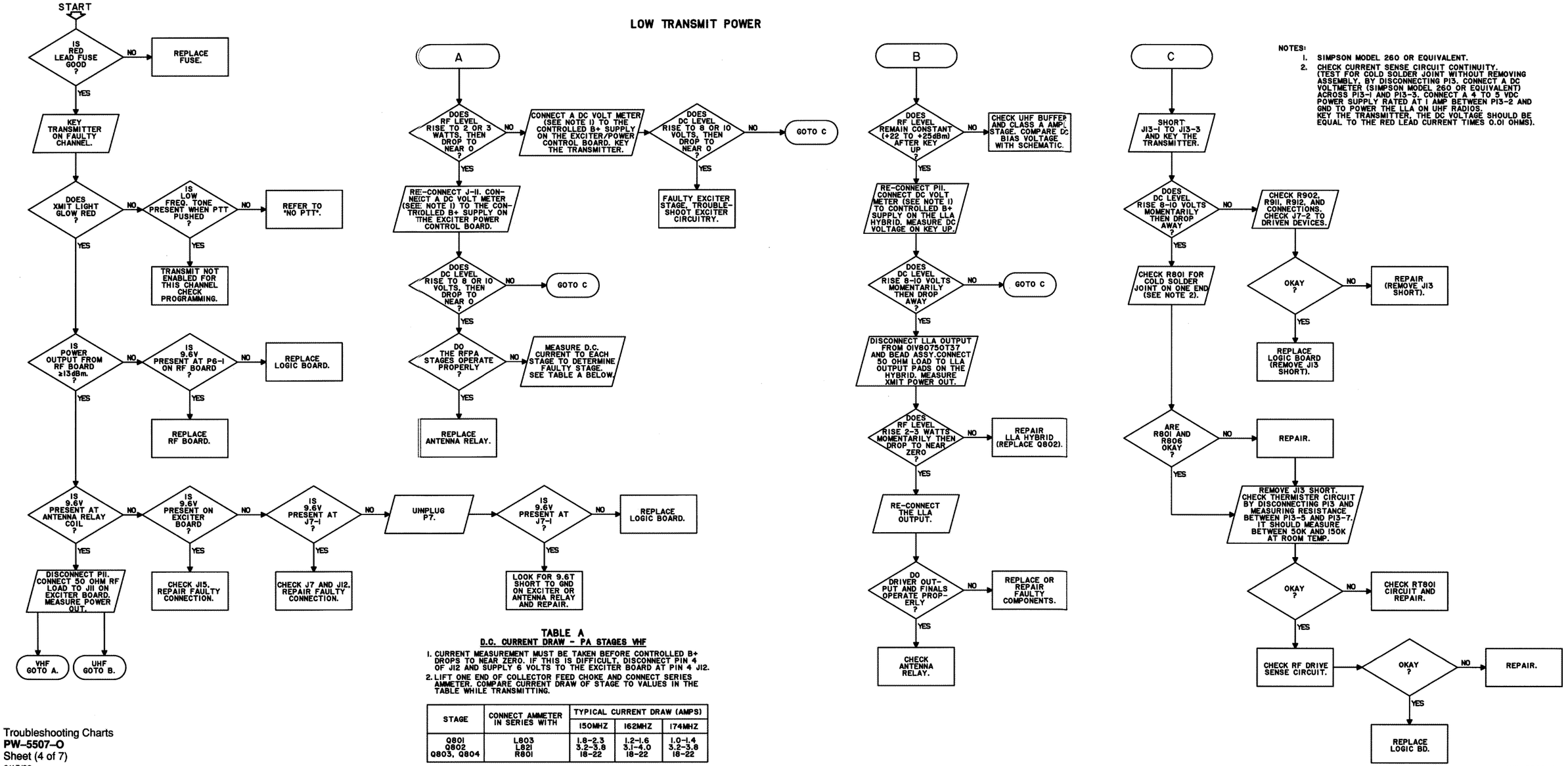
ABNORMAL CONTROL HEAD OPERATION

BASIC CONTROL-SEE SEPERATE CHART FOR HHCH OR ADVANCED CONTROL HEAD



GXW-5205-A

LOW TRANSMIT POWER



NOTES:
1. SIMPSON MODEL 260 OR EQUIVALENT.
2. CHECK CURRENT SENSE CIRCUIT CONTINUITY. (TEST FOR COLD SOLDER JOINT WITHOUT REMOVING ASSEMBLY, BY DISCONNECTING P13. CONNECT A DC VOLTMETER (SIMPSON MODEL 260 OR EQUIVALENT) ACROSS P13-1 AND P13-3. CONNECT A 4 TO 5 VDC POWER SUPPLY RATED AT 1 AMP BETWEEN P13-2 AND GND TO POWER THE LLA ON UHF RADIOS. KEY THE TRANSMITTER. THE DC VOLTAGE SHOULD BE EQUAL TO THE RED LEAD CURRENT TIMES 0.01 OHMS).

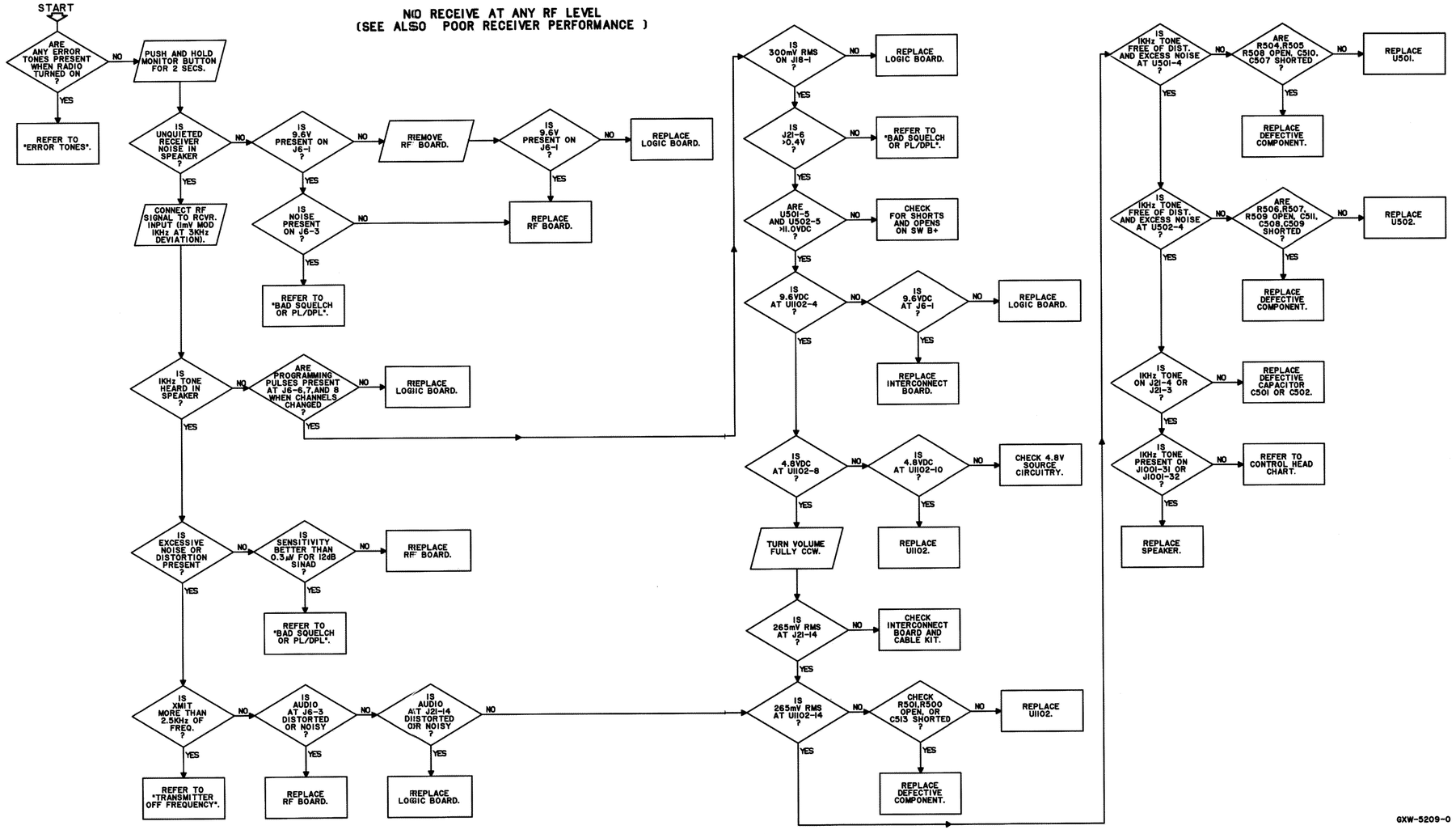
TABLE A
D.C. CURRENT DRAW - PA STAGES VHF

1. CURRENT MEASUREMENT MUST BE TAKEN BEFORE CONTROLLED B+ DROPS TO NEAR ZERO. IF THIS IS DIFFICULT, DISCONNECT PIN 4 OF J12 AND SUPPLY 6 VOLTS TO THE EXCITER BOARD AT PIN 4 J12.
2. LIFT ONE END OF COLLECTOR FEED CHOKE AND CONNECT SERIES AMMETER. COMPARE CURRENT DRAW OF STAGE TO VALUES IN THE TABLE WHILE TRANSMITTING.

STAGE	CONNECT AMMETER IN SERIES WITH	TYPICAL CURRENT DRAW (AMPS)		
		150MHZ	162MHZ	174MHZ
Q801 Q802 Q803, Q804	L803 L821 R801	1.8-2.3 3.2-3.8 18-22	1.2-1.6 3.1-4.0 18-22	1.0-1.4 3.2-3.8 18-22

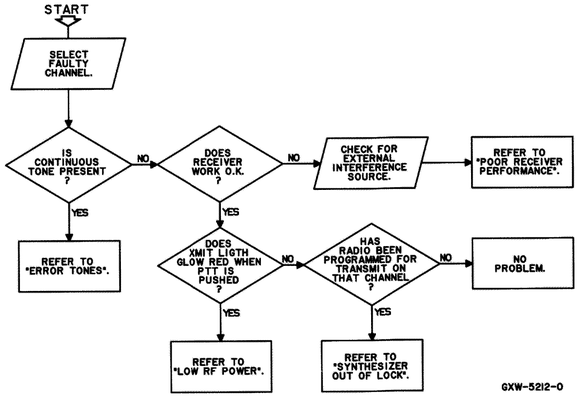
GXW-5509-O

NO RECEIVE AT ANY RF LEVEL (SEE ALSO POOR RECEIVER PERFORMANCE)



GXW-5209-0

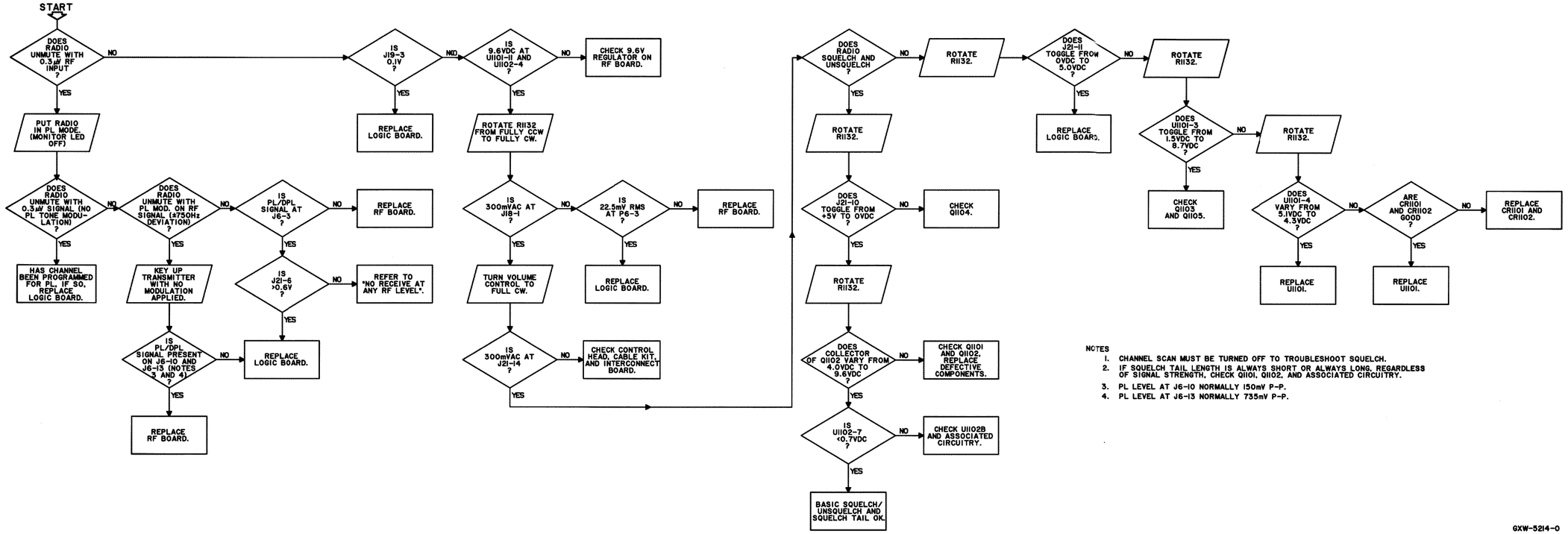
RADIO WORKS ON SOME CHANNELS BUT NOT OTHERS



GXW-5212-0

BAD SQUELCH OR PL/DPL

SEE NOTES 1 AND 2.

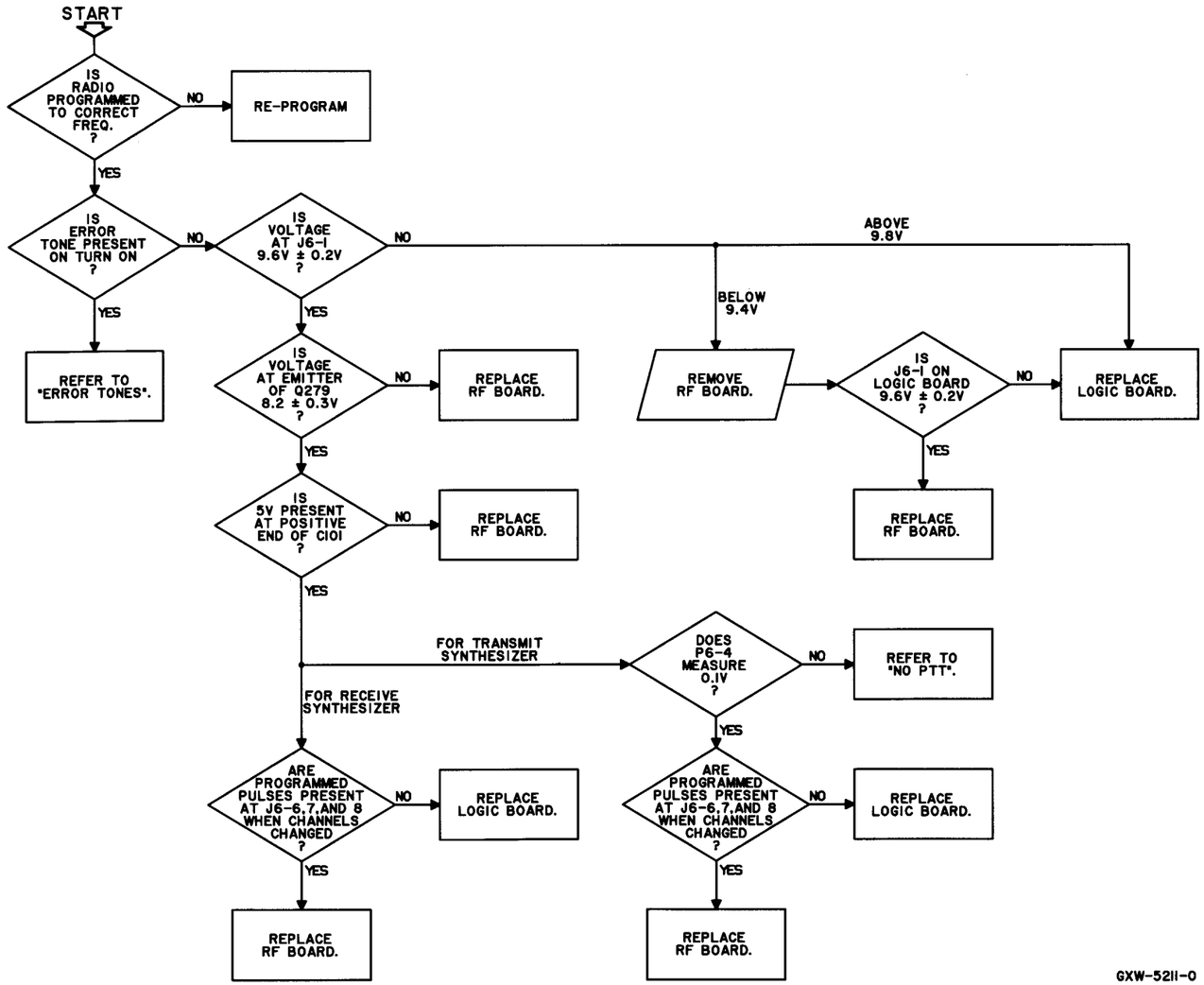


NOTES

1. CHANNEL SCAN MUST BE TURNED OFF TO TROUBLESHOOT SQUELCH.
2. IF SQUELCH TAIL LENGTH IS ALWAYS SHORT OR ALWAYS LONG, REGARDLESS OF SIGNAL STRENGTH, CHECK Q1101, Q1102, AND ASSOCIATED CIRCUITRY.
3. PL LEVEL AT J6-10 NORMALLY 150mV P-P.
4. PL LEVEL AT J6-13 NORMALLY 735mV P-P.

GXW-5214-O

SYNTHESIZER OUT OF LOCK



GXW-5211-0

BAD TRANSMIT MODULATION

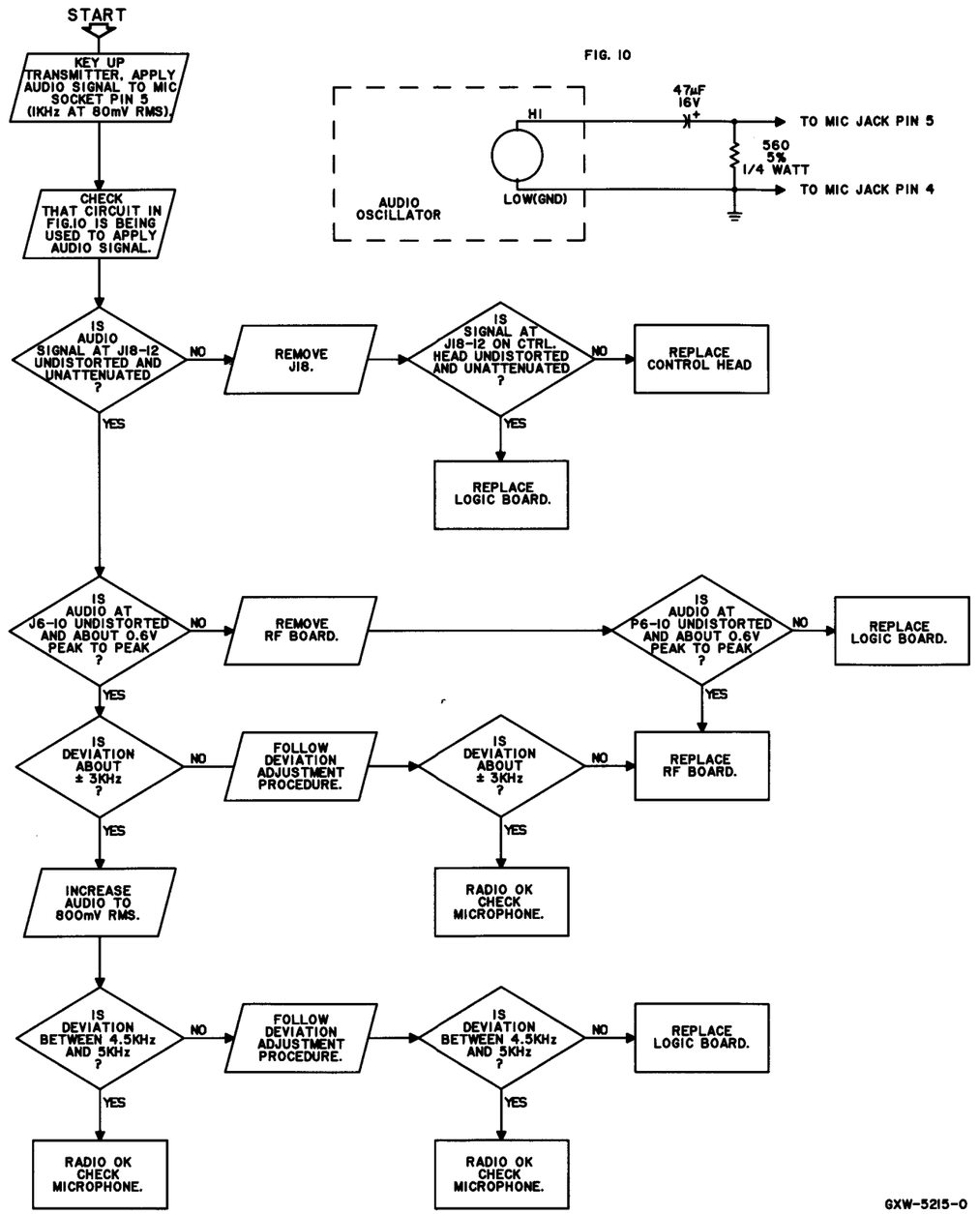
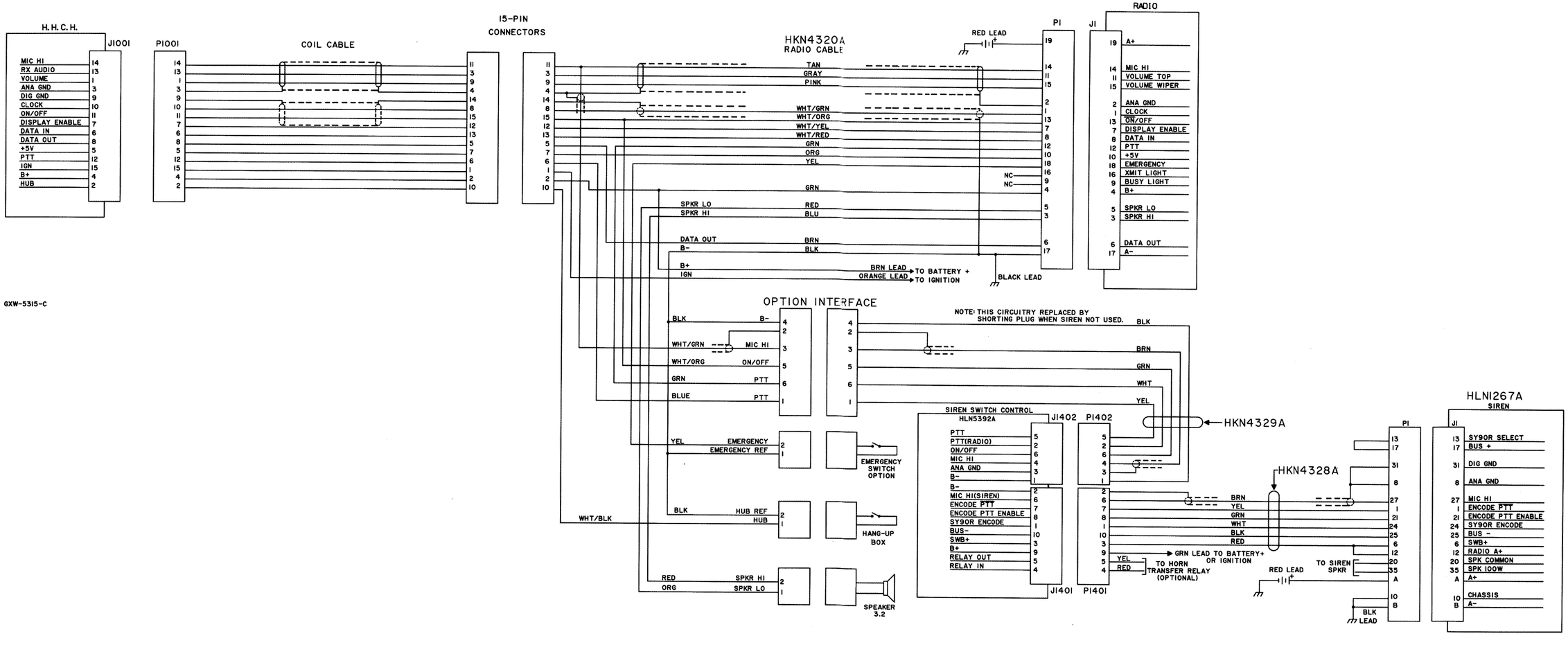
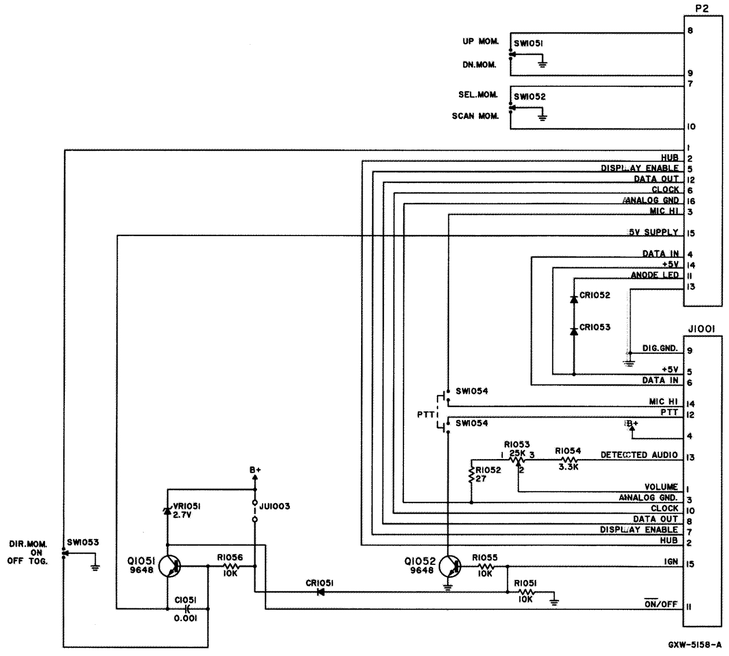


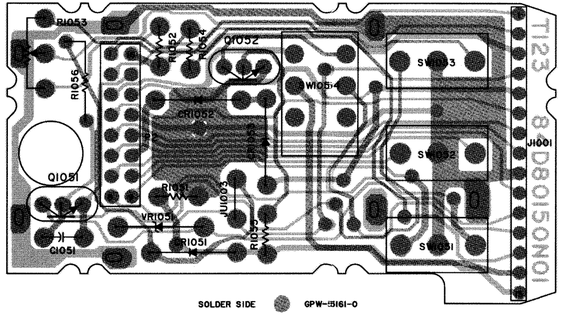
FIG. 10

GXW-5215-0



Schematics, Circuit Boards Diagrams,
and Parts List for HCN1051A Control Head
(Handheld) Lower/Upper Boards
PW-5272-C
(Sheet 1 of 3)
8/31/89





SOLDER SIDE GPW-5161-O
COMPONENT SIDE GPW-5162-O
OVERLAY GXW-5163-A

LOWER BOARD

Schematics, Circuit Boards Diagrams, and Parts List for HCN1051A Control Head (Handheld) Lower/Upper Boards
PW-5272-C
(Sheet 2 of 3)
8/31/89

parts list

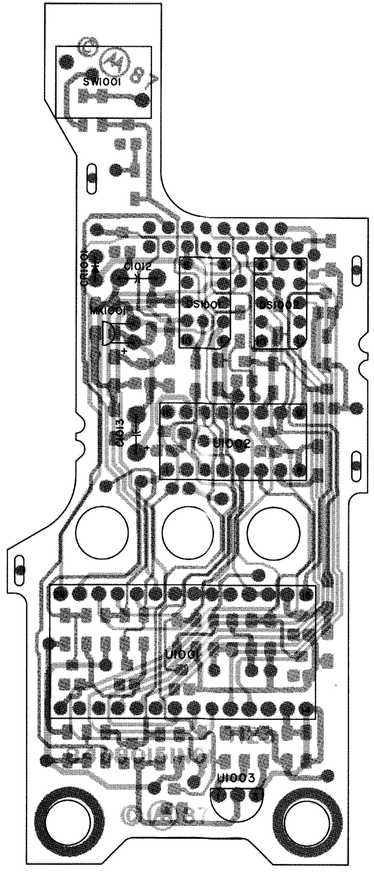
HCN1051A Handheld Control Head (99F) MXW-5160-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, uF, ±10%, 50V (unless otherwise stated)		
C1001–1007	21–13741N69	.100
C1008,1009	21–13741N21	.001
C1010	21–13741N69	.100
C1011	21–13741N21	.001
C1012	23–84539G05	10, 25V, tantalum
C1013	23–84539G03	.1, ±20%, 35V, tantalum
C1014–1017	21–13741N21	.001
C1018,1019	21–13741N69	.100
C1051	08–11051A01	.001, ±5%, 63V
diode (see note)		
CR1001	48–05504C01	LED
CR1051	48–11034A01	silicon
CR1052,1053	48–82468H18	silicon
indicator		
DS1001,1002	48–80187G05	LED, 7 segment
connector receptacle		
J1	28–80195N01	male, 15–pin right angle
J2	09–80196N01	male, 16–pin
MK1001	50–80258E04	mic cartridge
jumper		
JU1003	06–11009F23	o ohm resistor
connector plug		
P2	28–80085E32	male, 16–pin
transistor (see note)		
Q1001–1003	48–80141L04	NPN
Q1051,1052	48–11043C07	NPN
resistor, fixed, ohm, ±5%, 1/8 watt (unless otherwise stated)		
R1001–1010	06–11077A98	10k
R1011	06–11077A90	4.7k
R1012–1013	06–11077A98	10k
R1014	06–11077A90	4.7k
R1015,1016	06–11077A74	1k
R1017	06–11077A90	4.7k
R1018	06–11077A98	10k
R1019	06–11077A90	4.7k
R1020	06–11077A74	1k
R1021	06–11077A82	2.2k
R1022	06–11077A74	1k
R1023	06–11077B23	100k
R1024	06–11077A38	33
R1025	06–11077A74	1k
R1051	06–11009E73	10k
R1052	06–11009E11	27
R1054	06–11009E61	3.3k
R1055,1056	06–11009E73	10k
switch		
SW1001	40–80067H01	push button
SW1051,1052	40–80123H01	toggle
SW1053	40–80123H06	toggle
SW1054	40–80065E01	push button
integrated circuit (see note)		
U1001	51–80135C08	LED display driver
U1002	51–84887K36	shift register, 8 BIT static
U1003	51–84621K27	regulator, 5V
voltage regulator (see note)		
VR1001–1007	48–80140L06	5.1V zener
VR1008	48–80140L07	5.6V zener
VR1009,1011	48–80140L06	5.1V zener
VR1012	48–80140L17	12V zener
VR1051	48–11034A23	2.7V zener

6/30/89

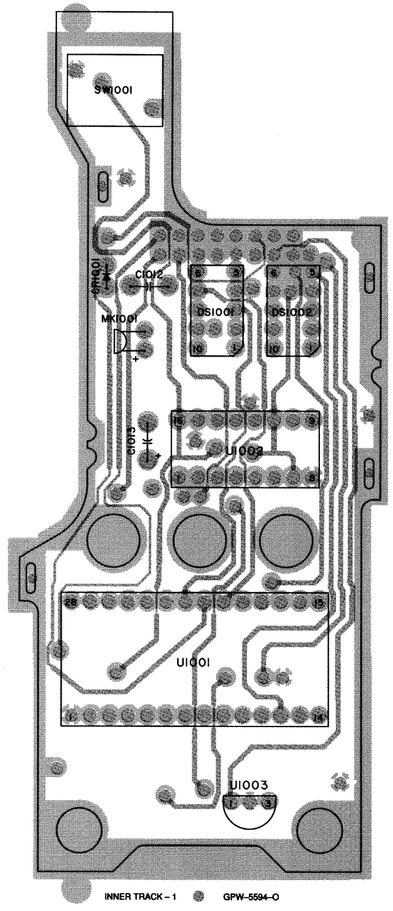
note: For best performance, order diodes, transistors, and intergrated–circuit devices by Motorola part number.

UPPER BOARD



SOLDER SIDE GPW-5164-O
COMPONENT SIDE GPW-5165-O
OVERLAY GXW-5166W01-O

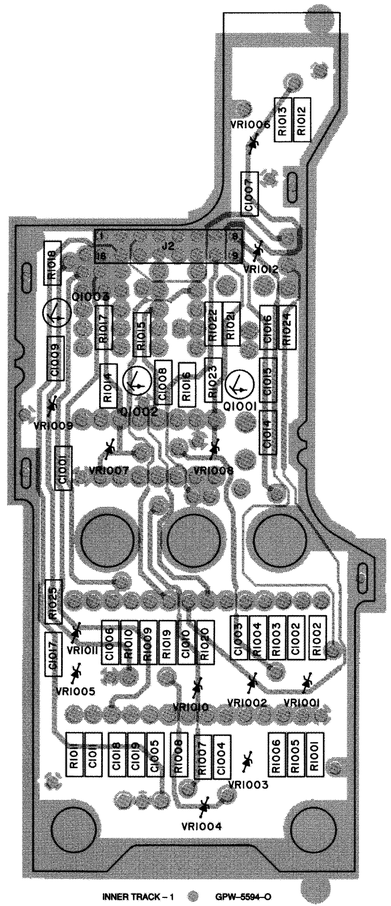
COMPONENT SIDE



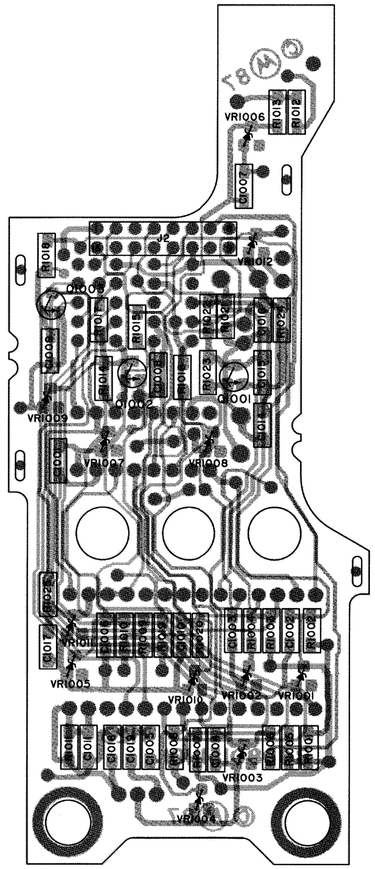
INNER TRACK – 1 GPW-5594-O
INNER TRACK – GND GPW-5595-O
OVERLAY GXW-5166W01-O

COMPONENT SIDE

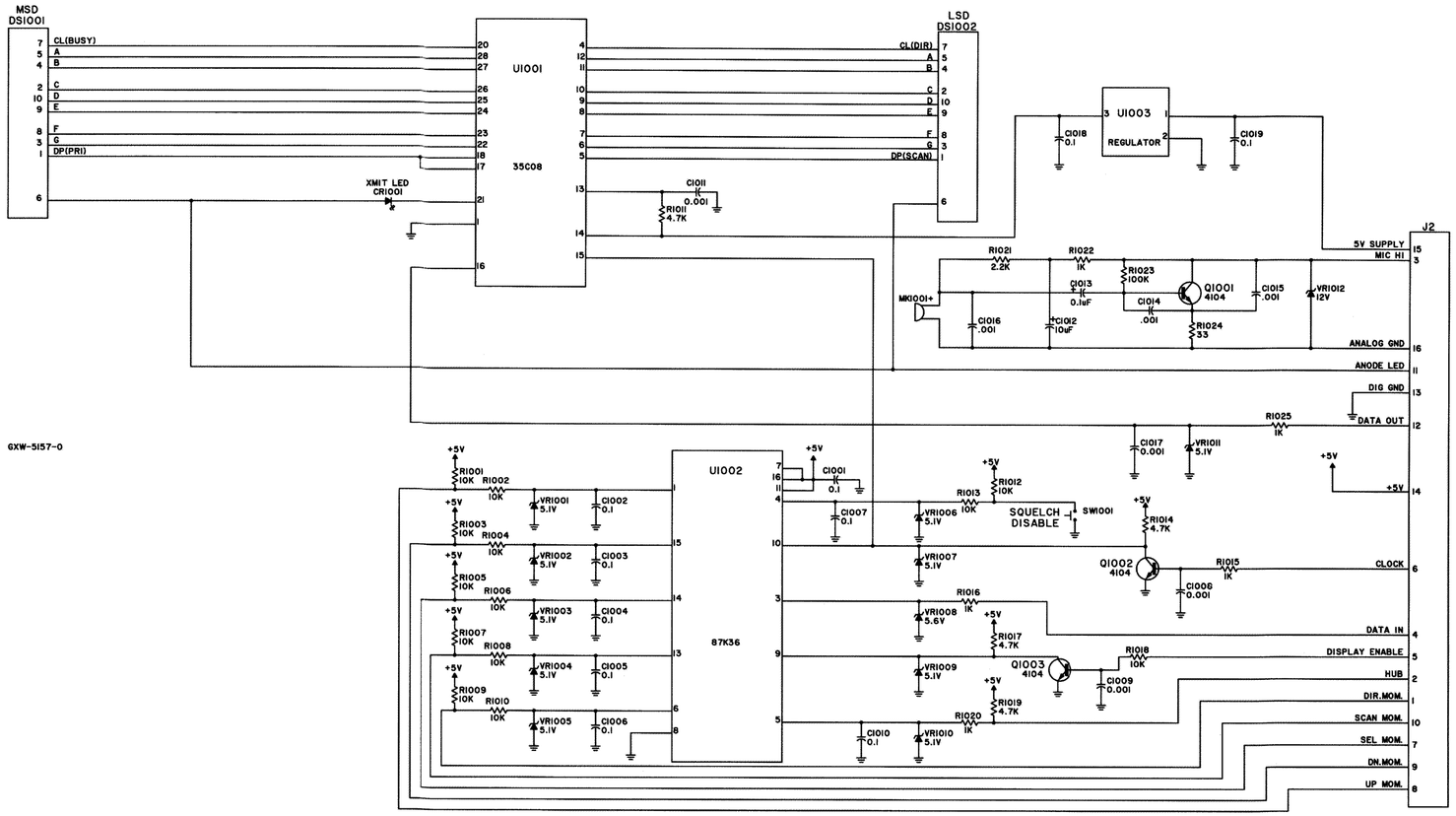
UPPER BOARD



SOLDER SIDE



SOLDER SIDE



Schematics, Circuit Boards Diagrams,
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(Handheld) Lower/Upper Boards
PW-5272-C
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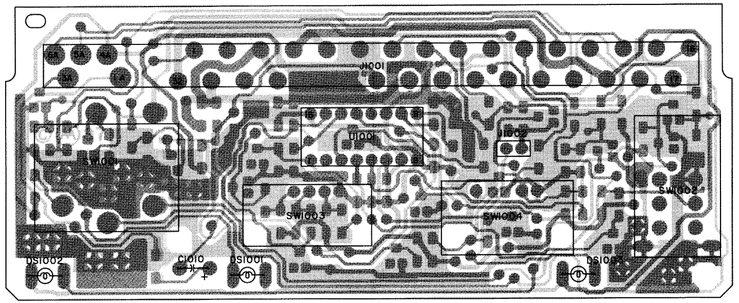
parts list

HCN4037A Basic Control Head w/Talkaround (16F)
HCN4038A Basic Control Head w/Scan & Talkaround (8F)
HCN4033A Basic Control Head w/Scan (8F)
HCN4034A Basic Control Head (16F) MXW-5150-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, uF ±10% 50V (unless otherwise stated)		
C1003–1009	21–13741N69	.100
C1010	23–11019A20	10, ±20%, 25V electrolytic
C1011	21–13741N69	.100
C1012,1013	21–13741N21	.001
C1014,1015	21–13741N69	.100
indicator		
DS1001–1003	65–80284N01	incandescent lamp
connector receptacle		
J104–106	09–80051B01	female, 2–contact, lamp socket
J1002	28–84324M01	male, 2–pin
jumper		
JU1001,1003	06–11077A01	0 ohm
translator (see note)		
Q1001–1006	48–80141L04	NPN
resistor, fixed, ohm, ± 5%, 1/8 watt (unless otherwise stated)		
R1002	06–11077A86	3.3k
R1003–1004	06–11077A98	10k
R1005	06–11077A90	4.7k
R1006	06–11077A74	1k
R1007,1008	06–11077A98	10k
R1009	06–11077A36	27
R1010	06–11077A90	4.7k
R1011–1020	06–11077A98	10k
R1021	06–11077A74	1k
R1022	06–11077A98	10k
R1023	06–11077A74	1k
R1024	06–11077A98	10k
R1025,1026	06–11077A74	1k
R1027	06–11077A90	4.7k
R1028	06–11077A98	10k
R1029	06–11077A60	270
R1030,1031	06–11077A98	10k
switch		
SW1001	18–80126A03	potentiometer, 25k, ±30%, .16W
SW1002	40–80127A03	push button
SW1003	40–80166N01	rotary 8 position
SW1004	40–80166N02	rotary 2 position
integrated circuit (see note)		
U1001	51–84887K36	8 bit shift register
voltage regulator (see note)		
VR1001	48–80140L06	1.5V zener
VR1002	48–80140L07	5.6V zener
VR1003–1010	48–80140L06	5.1V zene

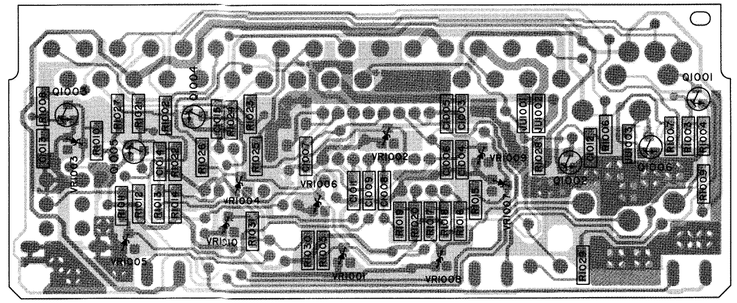
6/30/89

note: For best performance, order diodes, transistors, and intergrated circuit devices by Motorola part number.



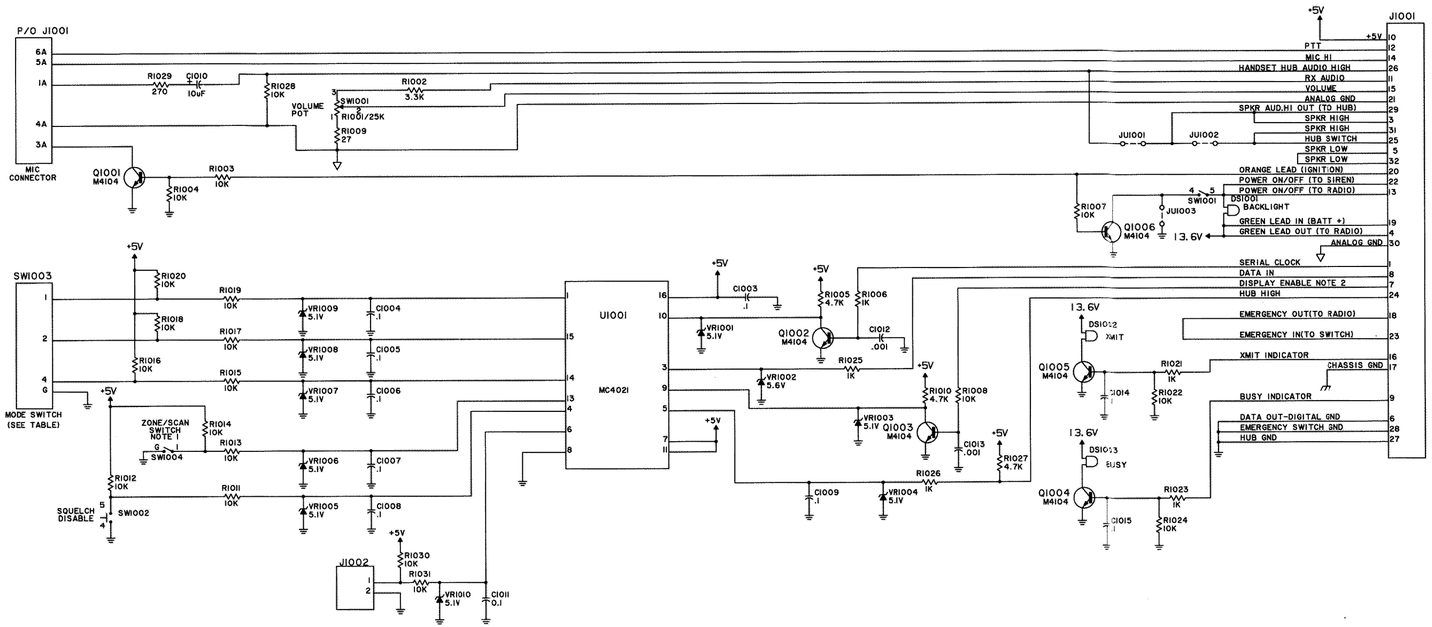
SOLDER SIDE GPW-5154-0
COMPONENT SIDE GPW-5155-0
OVERLAY GXW-5156W01-0

COMPONENT SIDE



SOLDER SIDE GPW-5154-0
COMPONENT SIDE GPW-5155-0
OVERLAY GXW-5156W02-0

SOLDER SIDE



JUMPER TABLE

JU1001	JU1002	JU1003	SYSTEM OPERATION
IN	IN	*	RECEIVE AUDIO IS ROUTED TO BOTH EXTERNAL SPEAKERS AND HANDSET.
IN	OUT	*	RECEIVE AUDIO IS ROUTED TO HANDSET AND AUDIO TO EXTERNAL SPEAKER IS SWITCHED VIA HANG UP BOX.
OUT	IN	*	RECEIVE AUDIO IS ROUTED TO EXTERNAL SPEAKER AND AUDIO TO HANDSET IS SWITCHED VIA HANG UP BOX.
OUT	OUT	*	RECEIVE AUDIO IS SWITCHED BETWEEN EXTERNAL SPEAKER AND HANDSET VIA HANG UP BOX.
*	*	OUT	IGNITION LEAD IS ENABLED AND CONTROLS BOTH RX AND TX.
*	*	IN	IGNITION LEAD ONLY CONTROLS TX.

* = DON'T CARE

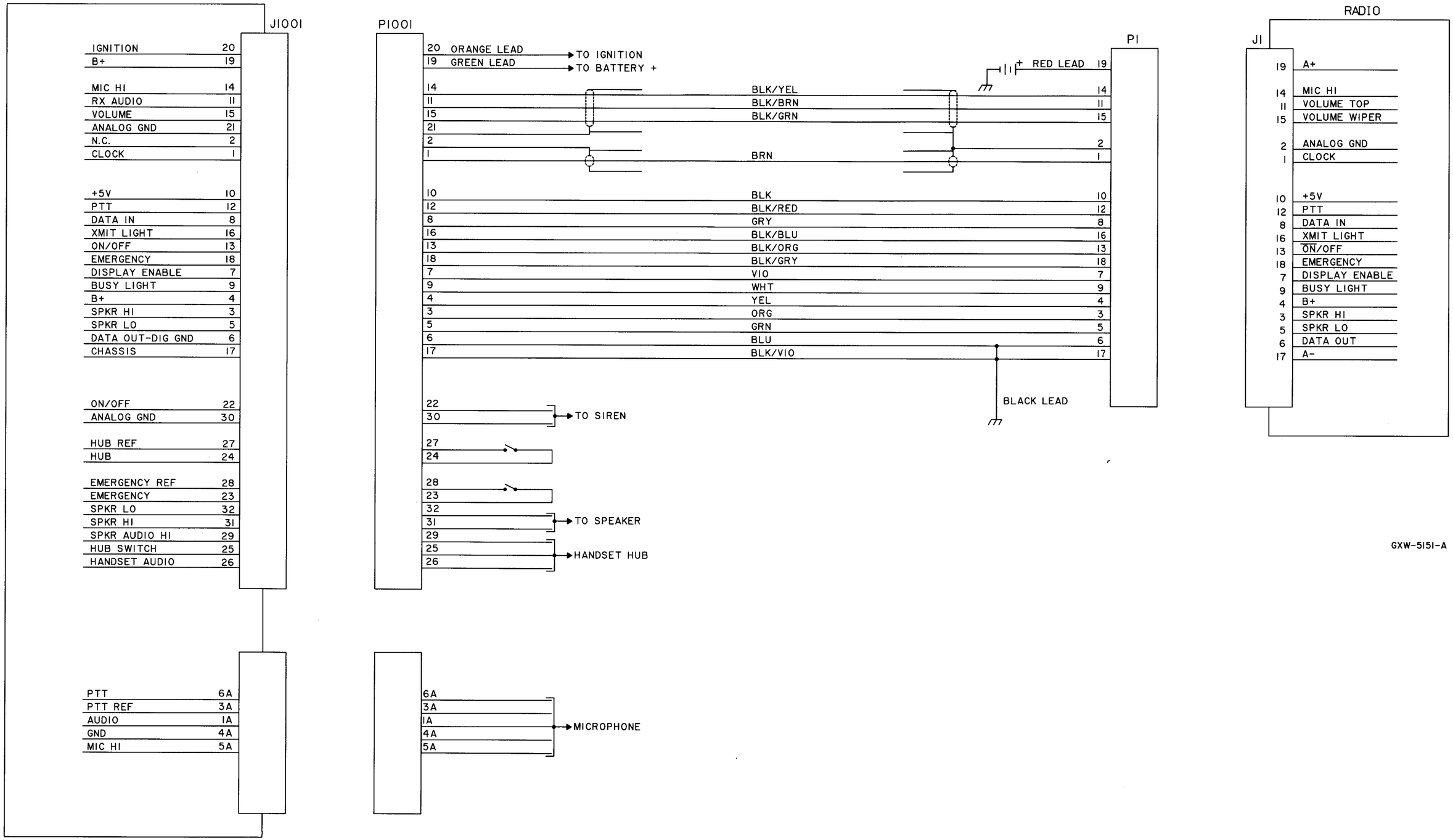
SW1003

MODE SWITCH POSITION	U1001 PIN 1	PIN 15	PIN 14
1	5V	5V	5V
2	0V	5V	5V
3	5V	0V	5V
4	0V	0V	5V
5	5V	5V	0V
6	0V	5V	0V
7	5V	0V	0V
8	0V	0V	0V

NOTES:
1. THE ZONE SWITCH IS USED FOR SCAN ON/OFF ON THE SCAN CONTROL HEAD.
2. WHEN DISPLAY ENABLE (PIN 7 OF J1001) IS HIGH (>3.5V) THEN U1001 OPERATES AS A SHIFT REGISTER AND THE LATCHED DATA IS SHIFTED ON THE POSITIVE EDGES AT PIN 10 OF U1001.
   WHEN DISPLAY ENABLE IS LOW, U1001 READS THE CURRENT SWITCH POSITIONS.
3. UNLESS OTHERWISE INDICATED CAPACITOR VALUES ARE EXPRESSED IN uF; RESISTOR VALUES ARE EXPRESSED IN OHMS.

GXW-5149-0

Schematic, Circuit Board Diagram, and Parts List for HCN4033A, HCN4034A, HCN4037A, HCN4038A for Control Head (Clam Shell)
PW–5271–C
(Sheet 1 of 2)
6/30/89



GXW-5151-A

Schematic, Circuit Board Diagram, and Parts List for
HCN4033A, HCN4034A, HCN4037A, HCN4038A for
Control Head (Clam Shell)
PW-5271-C
(Sheet 2 of 2)
6/30/89

parts list

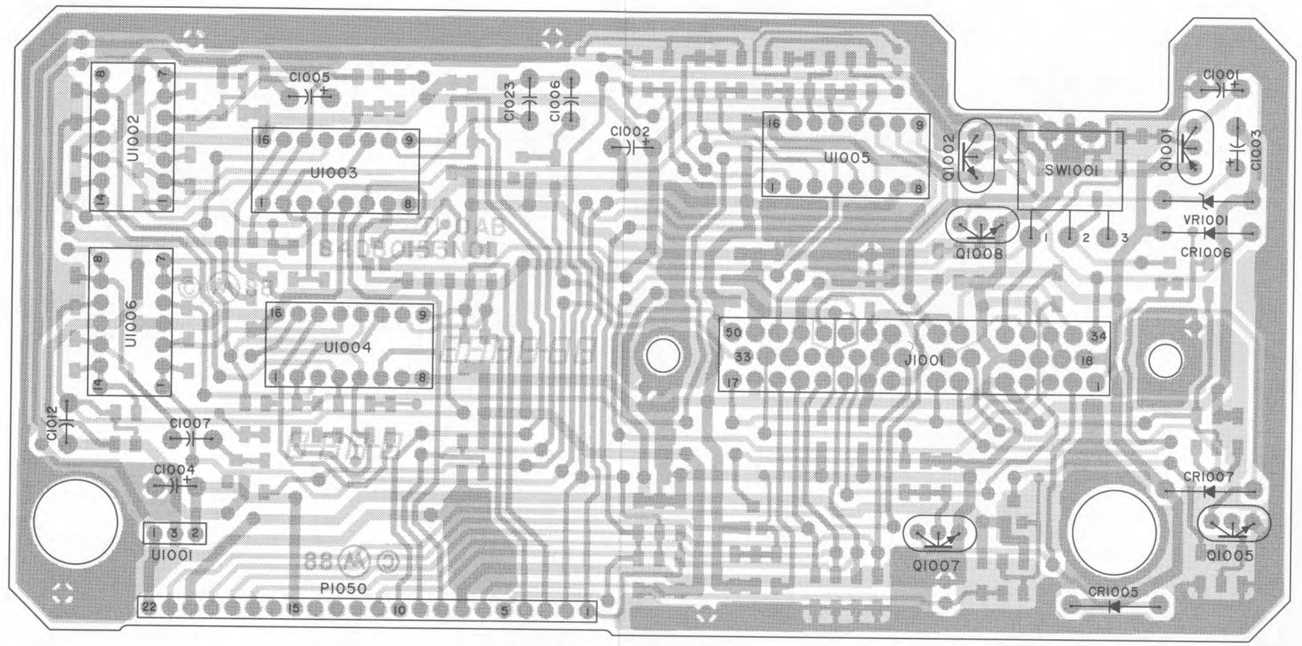
HLN5406B Advanced Control Head, 99F (Control Board) MXW–5584–C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, uF, ±5%, 50V (unless otherwise stated)		
C1001	23–11048C11	10, ±20%, 35V, electrolytic
C1003–1005	23–11048C11	10, ±20%, 35V, electrolytic
C1006,1007	08–11051A17	0.47, 63V
C1008–1011	21–13740B57	220 pF
C1012	08–11051A17	0.47, 63V
C1013,1014	21–13741N21	.001
C1015–1021	21–13741N45	0.01, ±10%
C1022	21–13741N21	.001
C1023	08–11051A11	0.047, 63V
C1024	21–11032A09	.001
C1025–1028	21–11031A47	220
C1029–1045	21–11032A21	0.01, ±10%
diode (see note)		
CR1001,1002	48–80236E08	rectifier, silicon
CR1004	48–80236E08	rectifier, silicon
CR1005–1007	48–82466H18	rectifier, silicon
CR1010	48–80060M01	rectifier, silicon
connector receptacle		
J1001	28–80228J01	connector, 50 position
jumper		
JU1003	06–11077A01	0–ohm resistor
JU1005	06–11077A01	0–ohm resistor
transistor (see note)		
Q1001	48–11043C08	PNP
Q1002	48–11043C07	NPN
Q1004	48–80141L03	PNP, type 41L03
Q1005	48–11043C07	NPN
Q1006	48–80141L04	NPN, type 41L04
Q1007,1008	48–11043C07	NPN
Q1009	48–80141L04	NPN
resistor, fixed, ohm, ±5%, 1/8 watt (unless otherwise stated)		
R1001	06–11077A98	10k
R1002	06–11077A90	4.7k
R1003	06–11077A74	1k
R1004,1005	06–11077A98	10k
R1006–1012	06–11077B11	33k
R1013	06–11077A98	10k
R1014,1015	06–11077A98	10k
R1017	06–11077B07	22k
R1018	06–11077A82	2.2k
R1019	06–11077A62	330
R1020	06–11077A42	47
R1021	06–11077A82	2.2k
R1022	06–11077A86	3.3k
R1023	06–11077A74	1k
R1024	06–11077A54	150
R1025,1026	06–11077A78	1.5k
R1027	06–11077A74	1k
R1028	06–11077A70	680
R1029	06–11077A74	1k
R1030	06–11077A68	560
R1031,1032	06–11077A74	1k
R1033	06–11077A58	220
R1034	06–11077A98	10k
R1035	06–11077A62	330
R1036–1038	06–11077A98	10k
R1039	06–11077A28	12
R1040	06–11077A74	1k
R1041	06–11077A82	2.2k
R1042	06–11077A74	1k
R1043	06–11077A62	330
R1044	06–11077A86	3.3k
R1045,1046	06–11077A74	1k
R1047	06–11077A68	560
R1048	06–11077A58	220
R1049	06–11077A68	560
R1050	06–11077B07	22k
R1051	06–11077A58	220
R1052	06–11077A28	12
R1053	06–11077A58	220
R1054	06–11077A98	10k
R1101	06–11027A98	10k
R1102	06–11077B07	22k
switch		
SW1001	40–80033K01	toggle
integrated circuit (see note)		
U1001	51–84621K27	voltage regulator
U1002	51–84621K32	quad op amp
U1003,1004	51–80073C06	analog multiplexer, CMOS
U1005	51–84887K26	analog multiplexer/demultiplexer
U1006	51–84621K32	quad op amp
voltage regulator (see note)		
VR1001	48–11034A19	zener, 10V, 25 mA
VR1002,1003	48–80140L15	zener, 10V, 5 mA

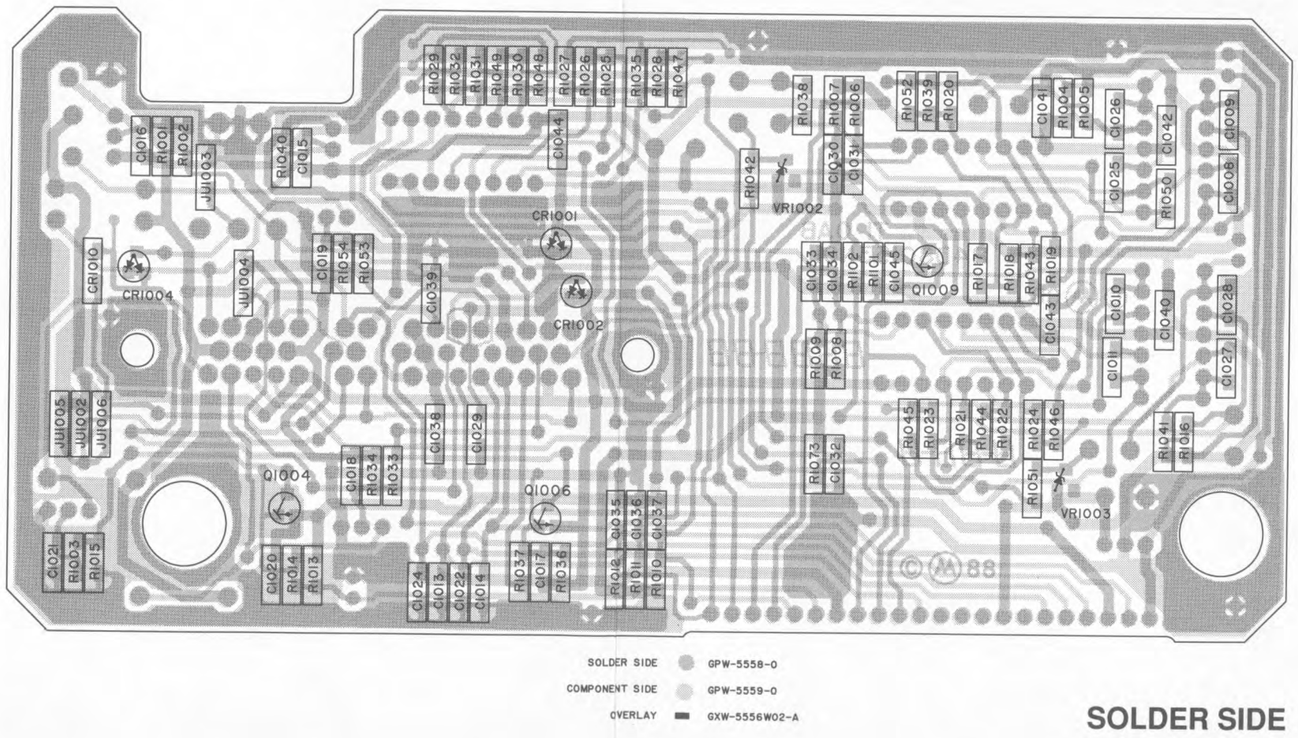
6/30/89

note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

CONTROL BOARD



COMPONENT SIDE

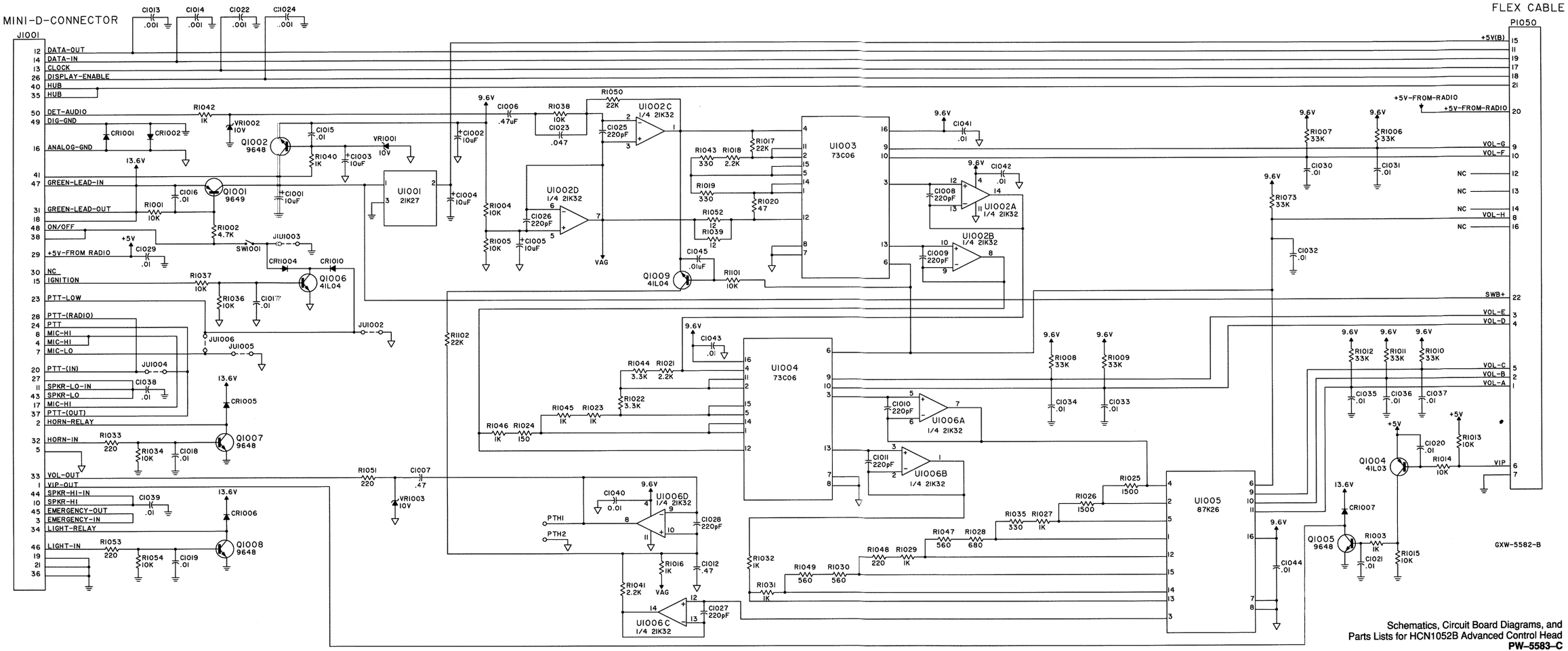


SOLDER SIDE

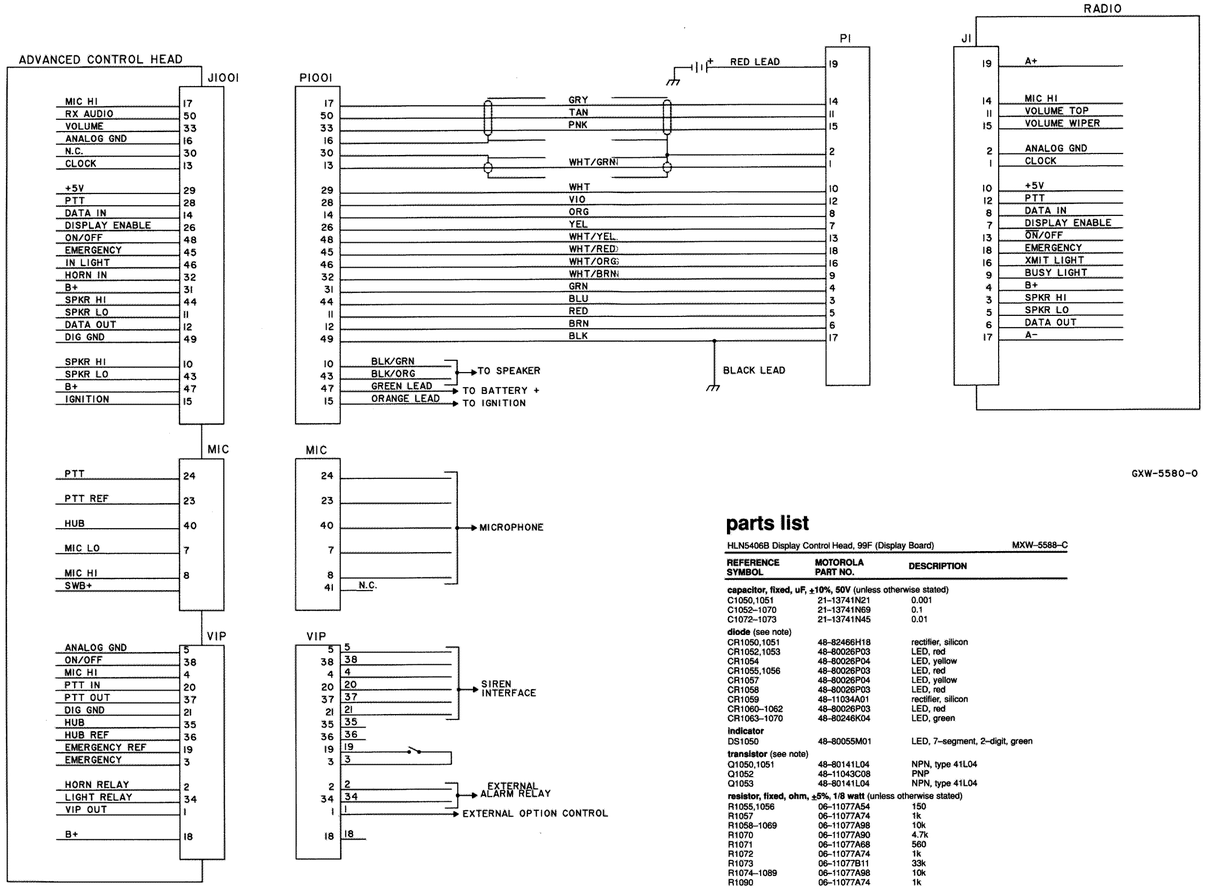
JUMPER CONFIGURATION	
JUMPER	**FUNCTION**
CR1010	CONNECTS PTT LOW TO IGNITION SENSE WHICH PREVENTS TRANSMITTING WHEN IGNITION IS OFF.
JU1002	CONNECTS PTT LOW TO ANALOG GROUND TO ALLOW TRANSMITTING REGARDLESS OF IGNITION SENSE.
JU1003	CONNECTS ON/OFF SWITCH TO DIGITAL GROUND ALLOWING RECEIVER OPERATION REGARD–LESS OF IGNITION SENSE.
JU1004	CONNECTS PTT TO PTT IN WHICH ALLOWS REMOVAL OF EXTERNAL VIP JUMPER PLUG.
JU1005	CONNECTS MIC LO TO ANALOG GROUND WHEN HANDSET IS NOT USED.
JU1006	CONNECTS MIC LO TO PTT LOW WHEN HANDSET IS USED.

NORMALLY, THE FOLLOWING JUMPERS ARE INSTALLED, JU1001, JU1003, AND JU1005.

CONTROL BOARD



Schematics, Circuit Board Diagrams, and
Parts Lists for HCN1052B Advanced Control Head
PW-5583-C
(Sheet 2 of 4)
6/30/89



GXW-5580-O

Schematics, Circuit Boards Diagrams, and
Parts Lists for HCN1052B Advanced Control Head
PW-5583-C
(Sheet 3 of 4)
6/30/89

parts list

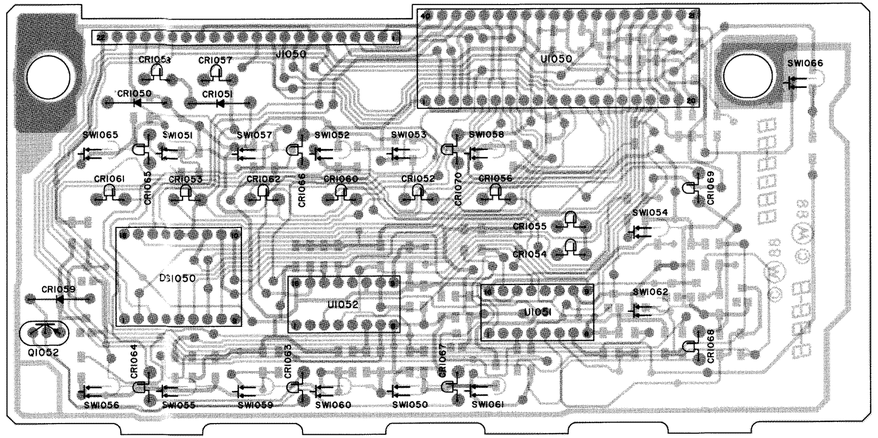
HLN5406B Display Control Head, 99F (Display Board) MXW-5588-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, uF, ±10%, 50V (unless otherwise stated)		
C1050,1051	21-13741N21	0.001
C1052–1070	21-13741N69	0.1
C1072–1073	21-13741N45	0.01
diode (see note)		
CR1050,1051	48-82466H18	rectifier, silicon
CR1052,1053	48-80026P03	LED, red
CR1054	48-80026P04	LED, yellow
CR1055,1056	48-80026P03	LED, red
CR1057	48-80026P04	LED, yellow
CR1058	48-80026P03	LED, red
CR1059	48-11034A01	rectifier, silicon
CR1060–1062	48-80026P03	LED, red
CR1063–1070	48-80246K04	LED, green
indicator		
DS1050	48-80055M01	LED, 7-segment, 2-digit, green
transistor (see note)		
Q1050,1051	48-80141L04	NPN, type 41L04
Q1052	48-11043C08	PNP
Q1053	48-80141L04	NPN, type 41L04
resistor, fixed, ohm, ±5%, 1/8 watt (unless otherwise stated)		
R1055,1056	06-11077A54	150
R1057	06-11077A74	1k
R1058–1069	06-11077A98	10k
R1070	06-11077A90	4.7k
R1071	06-11077A68	560
R1072	06-11077A74	1k
R1073	06-11077B11	33k
R1074–1089	06-11077A98	10k
R1090	06-11077A74	1k
R1091	06-11077A98	10k
R1092	06-11077A74	1k
R1093–1100	06-11077A98	10k
integrated circuit (see note)		
U1050	51-80236C01	driver, LED display
U1051,1052	51-84887K36	shift register, CMOS
voltage regulator (see note)		
VR1051,1052	48-80140L06	zener, 5.1V
VR1053	48-80140L07	zener, 5.6V
VR1054	48-80140L06	zener, 5.1V
VR1058	48-80140L06	zener, 5.1V

6/30/89

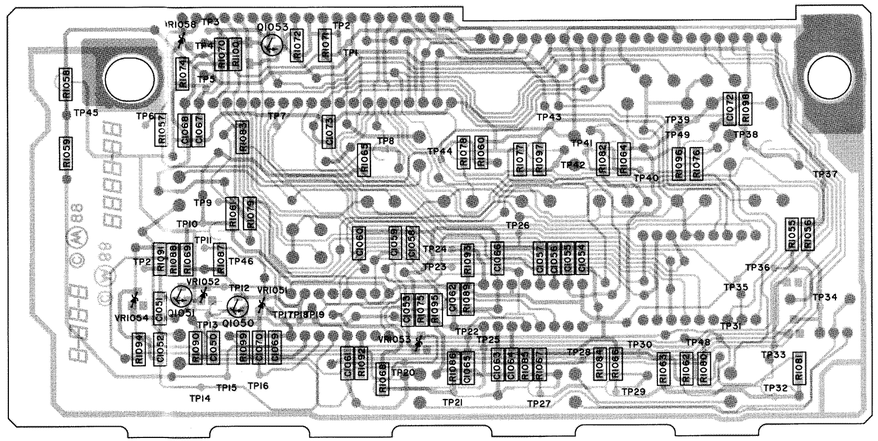
note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

DISPLAY BOARD



SOLDER SIDE GPW-5560-O
COMPONENT SIDE GPW-5561-O
OVERLAY GXW-5557W01-A

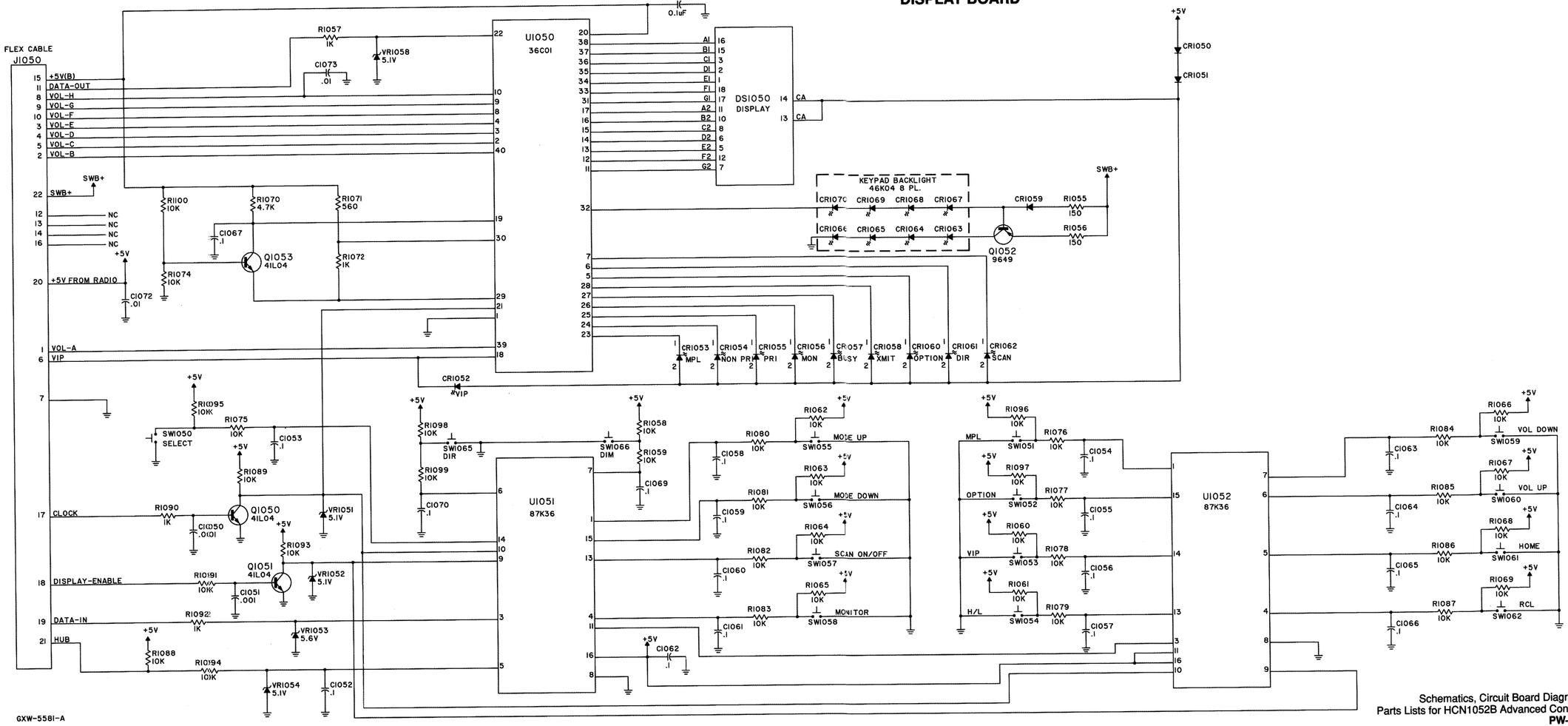
COMPONENT SIDE



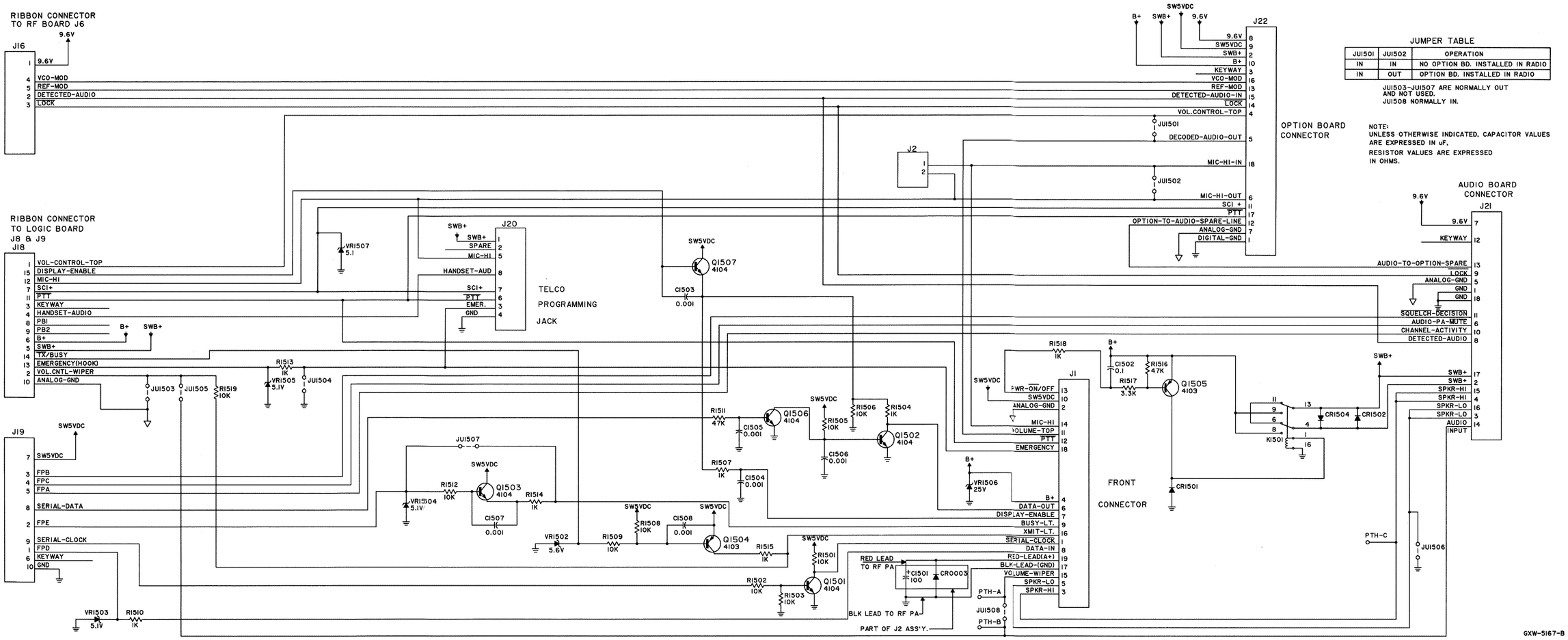
SOLDER SIDE GPW-5560-O
COMPONENT SIDE GPW-5561-O
OVERLAY GXW-5557W02-A

SOLDER SIDE

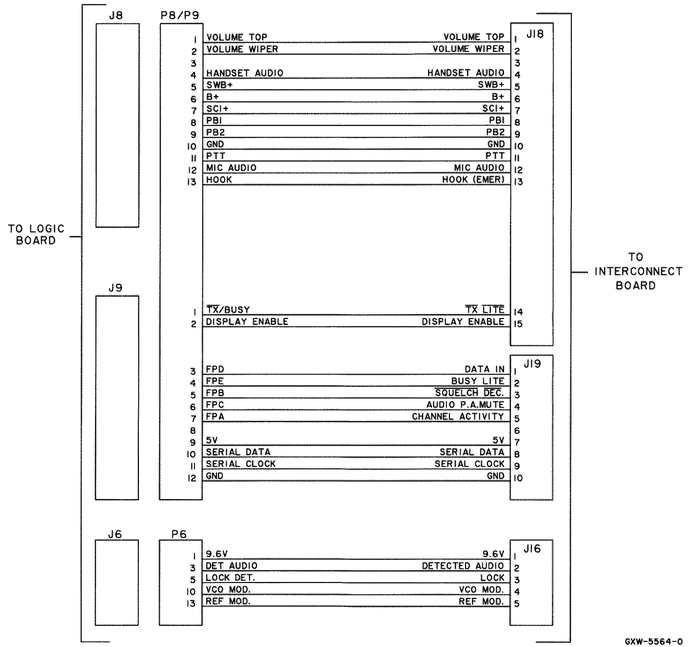
DISPLAY BOARD



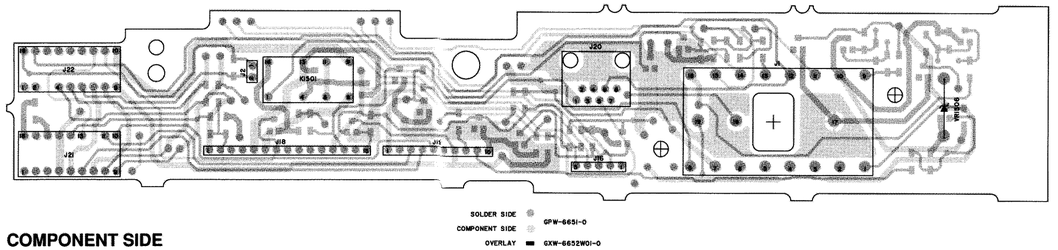
Schematics, Circuit Board Diagrams, and
Parts Lists for HCN1052B Advanced Control Head
PW–5583–C
(Sheet 4 of 4)
6/30/89



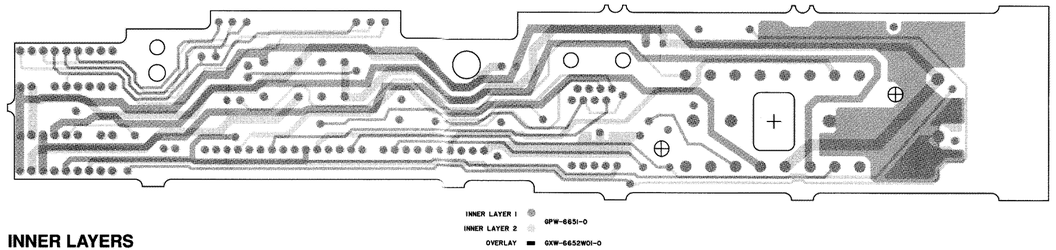
Schematic, Circuit Board Diagram, and
Parts List for HLN5343B Interconnect Board
PW-5273-D
(Sheet 1 of 2)
3/31/90



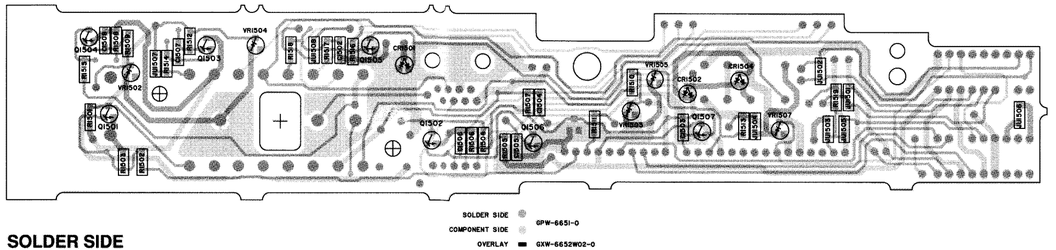
INTERCONNECT RIBBON DIAGRAM



COMPONENT SIDE



INNER LAYERS



SOLDER SIDE

parts list

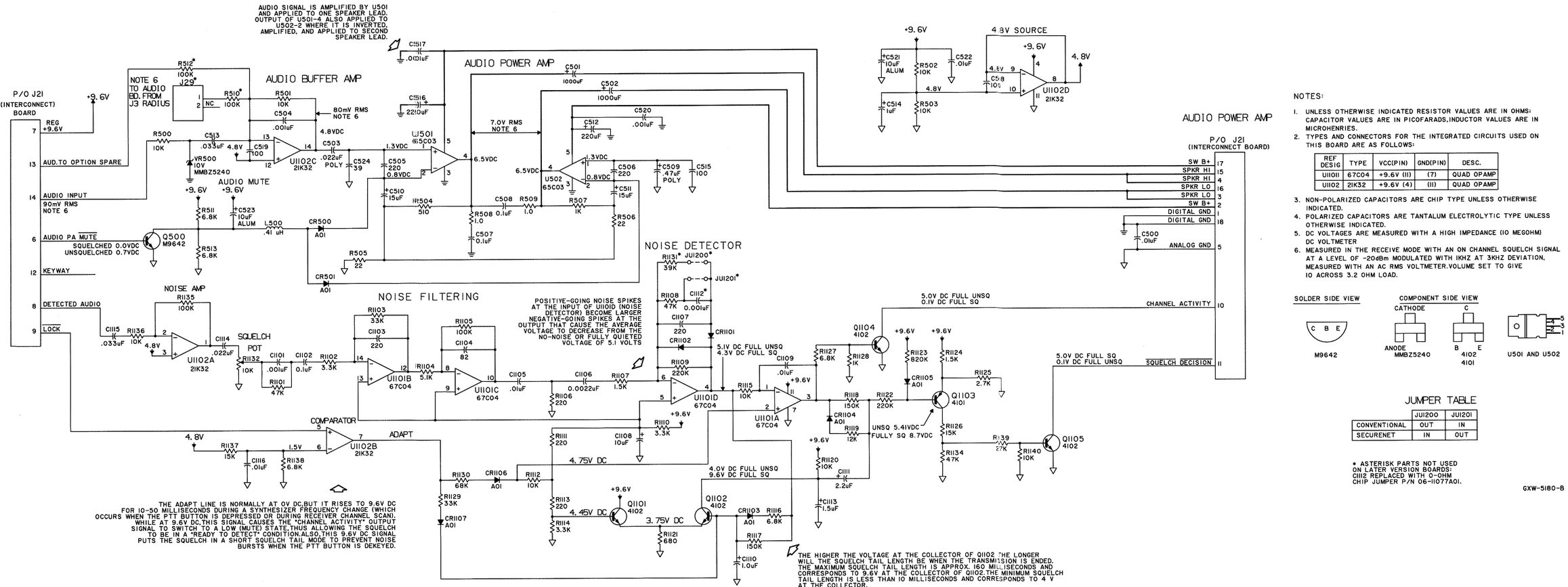
HLN5343B *MaraTrac* Interconnect Board — MXW-6593-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, pF, ±10%, 50V (unless otherwise stated)		
C11–28	21–84874K01	470 pF, ±20%, 250V
C1501	23–80167C03	1000 uF, ±20%, 25V, electrolytic
C1502	21–13741N69	0.1
C1503–1508	21–13741N21	0.001
diode (see note)		
CR3	48–80153A01	silicon
CR1501,1502	48–80236E08	silicon
CR1504	48–80236E08	silicon
connector receptacle		
J1	28–80011A01	male, 19–pin
J20	09–80132M01	telco, 8–pin
J21,22	09–80103M05	female, 18–contact
jumper		
JU1501,1502	06–11077A01	0–ohm resistor
JU1508	06–11077A01	0–ohm resistor
relay		
K1501	80–80075G03	220V, 2 amps
transistor (see note)		
Q1501–1503	48–80141L04	NPN
Q1504,1505	48–80141L03	PNP
Q1506,1507	48–80141L04	NPN
resistor, fixed, ohm, ±5%, 1/8 watt (unless otherwise stated)		
R1501–1503	06–11077A98	10k
R1504	06–11077A74	1k
R1505,1506	06–11077A98	10k
R1507	06–11077A74	1k
R1508,1509	06–11077A98	10k
R1510	06–11077A74	1k
R1511	06–11077B15	47k
R1512	06–11077A98	10k
R1513–1515	06–11077A74	1k
R1516	06–11077B15	47k
R1517	06–11077A86	3.3k
R1518	06–11077A74	1k
voltage regulator (see note)		
VR1502	48–80140L07	zener, 5.6V
VR1503–1505	48–80140L06	zener, 5.1V
VR1506	48–80236E07	zener, 28V
VR1507	48–80140L06	zener, 5.1V
non–referenced parts		
	26–80191P01	heatsink (2 used)
MP101	64–80264A01	cable plug
	03–10904A02	screw, machine M3.5 x 0.6 x 6 (2 used)

3/31/90

note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

Schematic, Circuit Board Diagram, and Parts List for HLN5343B Interconnect Board
PW–5273–D
(Sheet 2 of 2)
3/31/90



NOTES:

1. UNLESS OTHERWISE INDICATED RESISTOR VALUES ARE IN OHMS: CAPACITOR VALUES ARE IN PICOFARADS,INDUCTOR VALUES ARE IN MICROHENRIES.
2. TYPES AND CONNECTORS FOR THE INTEGRATED CIRCUITS USED ON THIS BOARD ARE AS FOLLOWS:

REF DESIG	TYPE	VCC(PIN)	GND(PIN)	DESC.
U1101	67C04	+9.6V (11)	(7)	QUAD OPAMP
U1102	2IK32	+9.6V (4)	(11)	QUAD OPAMP

3. NON-POLARIZED CAPACITORS ARE CHIP TYPE UNLESS OTHERWISE INDICATED.
4. POLARIZED CAPACITORS ARE TANTALUM ELECTROLYTIC TYPE UNLESS OTHERWISE INDICATED.
5. DC VOLTAGES ARE MEASURED WITH A HIGH IMPEDANCE (10 MEGOHM) DC VOLTMETER
6. MEASURED IN THE RECEIVE MODE WITH AN ON CHANNEL SQUELCH SIGNAL AT A LEVEL OF -20dBm MODULATED WITH 1KHZ AT 3KHZ DEVIATION, MEASURED WITH AN AC RMS VOLTMETER.VOLUME SET TO GIVE 10 ACROSS 3.2 OHM LOAD.

SOLDER SIDE VIEW

M9642

COMPONENT SIDE VIEW

MMBZ5240 4102 4101

U501 AND U502

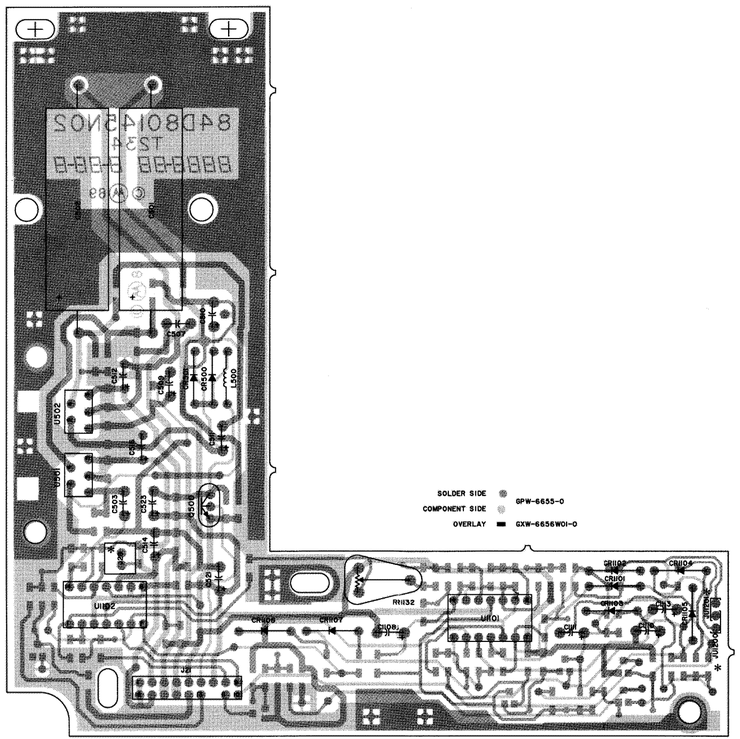
JUMPER TABLE

	JUI200	JUI201
CONVENTIONAL	OUT	IN
SECURENET	IN	OUT

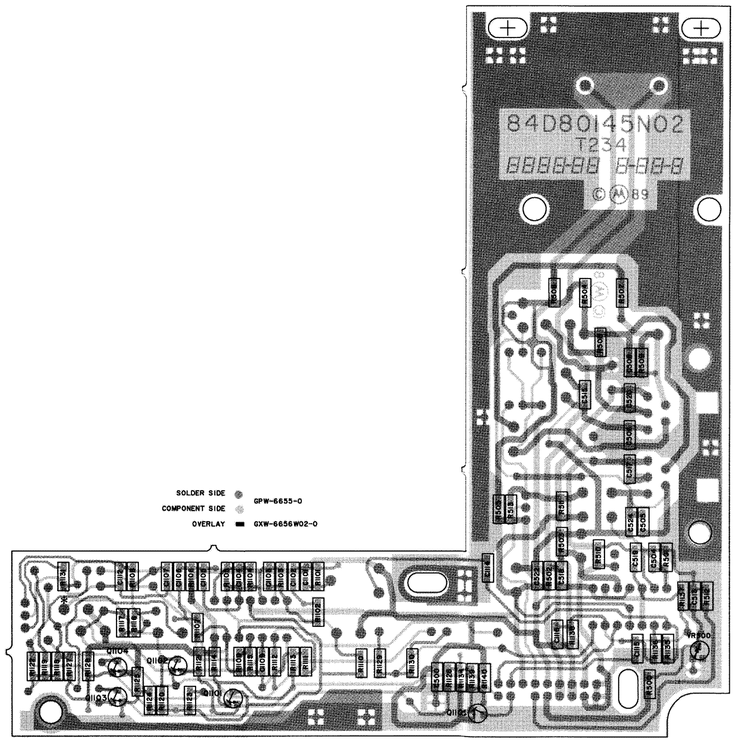
* ASTERISK PARTS NOT USED ON LATER VERSION BOARDS: C1112 REPLACED WITH 0-OHM CHIP JUMPER P/N 06-11077A01.

GXW-5180-B

Schematic, Circuit Board Diagram, and
Parts List for HLN5342B/C Audio Squelch Board
PW-5275-D
(Sheet 1 of 2)
3/31/90



COMPONENT SIDE



SOLDER SIDE

parts list

HLN5342B/C *MaraTrac* Audio Squelch Board — MXW–6653–A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, uF, ±10%, 50V (unless otherwise stated)		
C500	21–13741N45	0.01
C501,502	23–80167C02	1000, ±20%, 35V, electrolytic
C503	08–11051A09	0.022, ±5%, 63V
C504	21–13741N21	0.001
C505,506	21–13740B57	220 pF, ±5%
C507	08–11051A13	0.1, ±5%, 63V
C508	21–13741N69	0.1
C509	08–11051A17	0.47, ±5%, 63V
C510,511	23–13749L27	15, tantalum
C512	23–84665F06	220, –10+150%, 25V, electrolytic
C513	21–13741N57	0.033
C514	23–13749D51	1, 35V, tantalum
C515	21–13740B49	100 pF, ±5%
C516	23–84665F06	220, –10+150%, 25V, electrolytic
C517	21–13741N21	0.001
C518,519	21–13740B49	100 pF, ±5%
C520	21–13741N21	0.001
C521	23–11048C11	10, ±20%, 44V, electrolytic
C522	21–13741N45	0.01
C523	23–11048C11	10, ±20%, 44V, electrolytic
C524	21–13740B39	39 pF, ±5%
C1101	21–13741N21	0.001
C1102	21–13741N69	0.1
C1103	21–13740B57	220 pF, ±5%
C1104	21–13740B47	82 pF, ±5%
C1105	21–13741N45	0.01
C1106	21–13741N29	0.0022
C1107	21–13740B57	220 pF, ±5%
C1108	23–13749L23	10, 25V, tantalum
C1109	21–13741N45	0.01
C1110	23–13749D51	1, 35V, tantalum
C1111	23–13749M35	2.2, tantalum
C1112	06–11077A01	0–ohm jumper resistor
C1113	23–13749M31	1.5, 35V, tantalum
C1114	21–13741N53	0.022
C1115	21–13741N57	0.033
C1116	21–13741N45	0.01
diode (see note)		
CR500,501	48–11034A01	silicon
CR1101–1107	48–11034A01	silicon
connector, receptacle		
J21	28–80085E31	male, 12 pin
coil, RF		
L500	24–82723H36	0.41 uH
transistor (see note)		
Q500	48–11043C05	NPN
Q1101,1102	48–80141L02	NPN
Q1103	48–80141L01	PNP
Q1104,1105	48–80141L02	NPN
resistor, fixed, ohm, ±5%, 1/8 watt (unless otherwise stated)		
R500–503	06–11077A98	10k
R504	06–11077A67	510
R505,506	06–11077A34	22
R507	06–11077A74	1k
R508,509	06–11077A02	1.0
R511	06–11077A94	6.8k
R513	06–11077A94	6.8k
R1101	06–11077B15	47k
R1102	06–11077A86	3.3k
R1103	06–11077B11	33k
R1104	06–11077A91	5.1k
R1105	06–11077B23	100k
R1106	06–11077A58	220
R1107	06–11077A78	1.5k
R1108	06–11077B15	47k
R1109	06–11077B31	220k
R1110	06–11077A86	3.3k
R1111	06–11077A58	220
R1112	06–11077A98	10k
R1113	06–11077A58	220
R1114	06–11077A86	3.3k
R1115	06–11077A98	10k
R1116	06–11077A94	6.8k
R1117,1118	06–11077B27	150k
R1119	06–11077B01	12k
R1120	06–11077A98	10k
R1121	06–11077A70	680
R1122	06–11077B31	220k
R1123	06–11077B45	820k
R1124	06–11077A78	1.5k
R1125	06–11077A84	2.7k
R1126	06–11077B03	15k
R1127	06–11077A94	6.8k
R1128	06–11077A74	1k
R1129	06–11077B11	33k
R1130	06–11077B19	68k
R1132	18–84944C03	variable, 10k, ±20%, .10W
R1134	06–11077B15	47k
R1135	06–11077B23	100k
R1136	06–11077A98	10k
R1137	06–11077B03	15k
R1138	06–11077A94	6.8k
R1139	06–11077B09	27k
R1140	06–11077A98	10k
integrated circuit (see note)		
U501,502	51–80065C03	audio PA
U1101	51–80067C04	quad op–amp

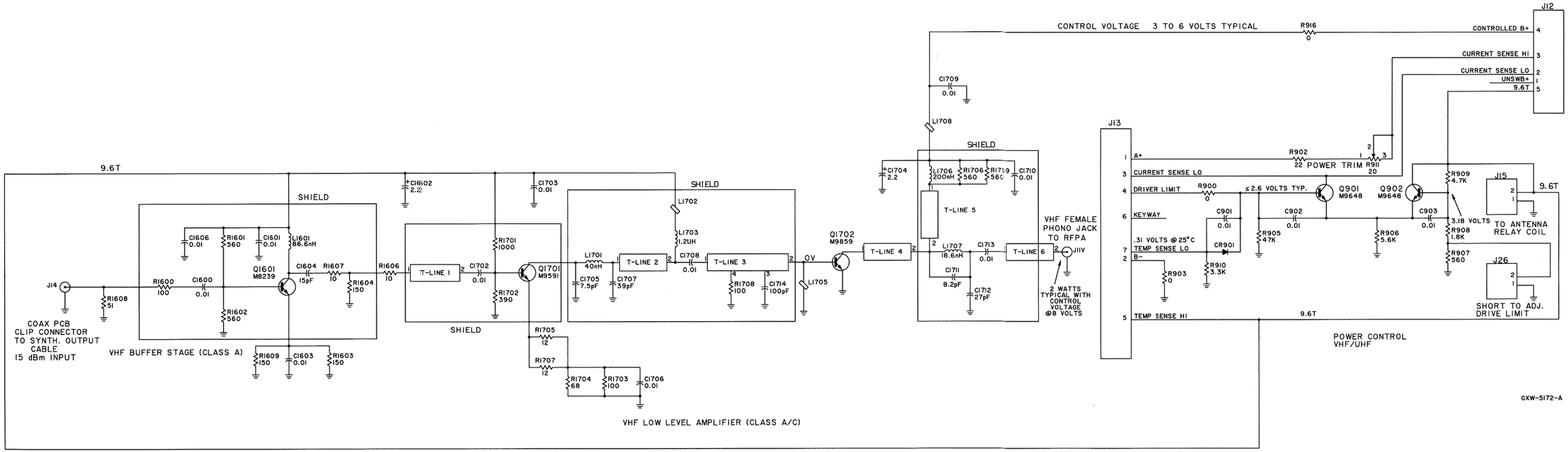
MXW–6653–A (2)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
U1102	51–84621K32	quad op–amp
voltage regulator (see note)		
VR500	48–80140L15	zener, 10V
non–referenced parts		
	26–80129P01	heatsink, audio final (HLN5342C only)
	03–10908A18	M3 x .5 x .6 (2 used) (HLN5342C only)

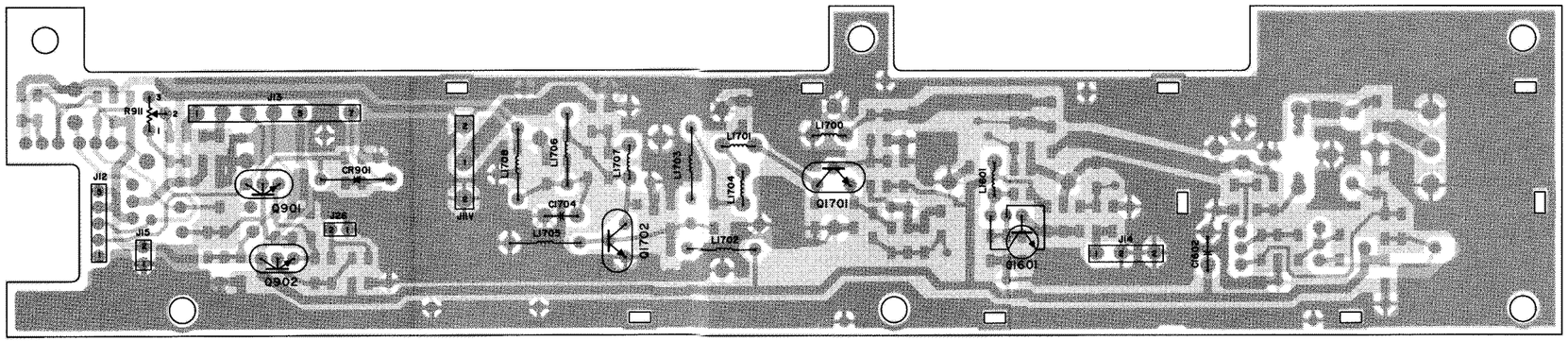
3/31/90

note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number

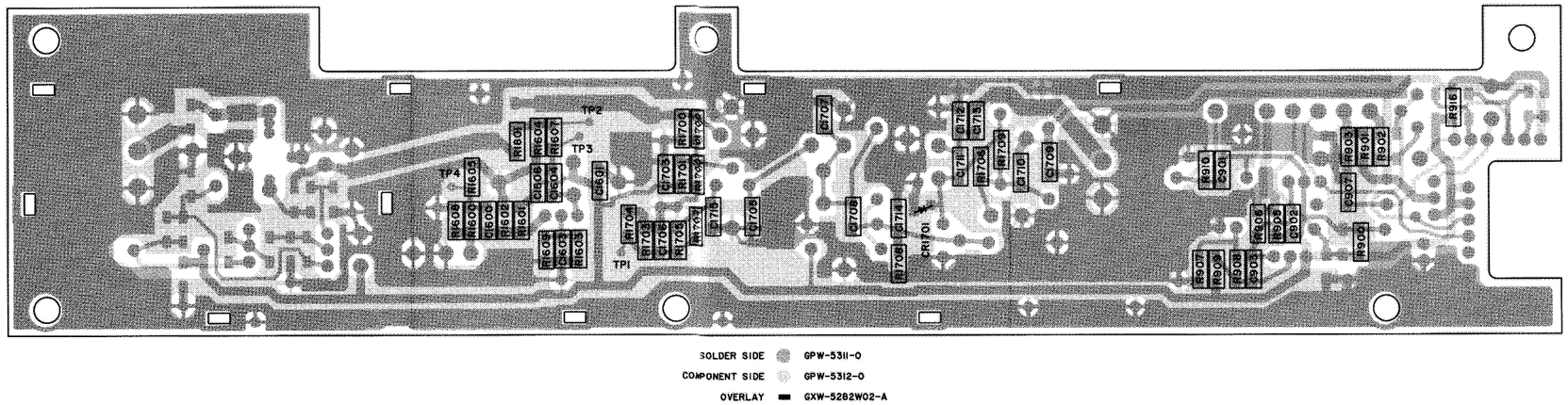
Schematic, Circuit Board Diagram, and
Parts List for HLN5342B/C Audio Squelch Board
PW–5275–D
(Sheet 2 of 2)
3/31/90



Schematic, Circuit Board Diagram, and Parts List
for HLD4335A VHF Exciter/Power Control Board
PW-5274-B
(Sheet 1 of 2)
8/31/89



COMPONENT SIDE



SOLDER SIDE

parts list

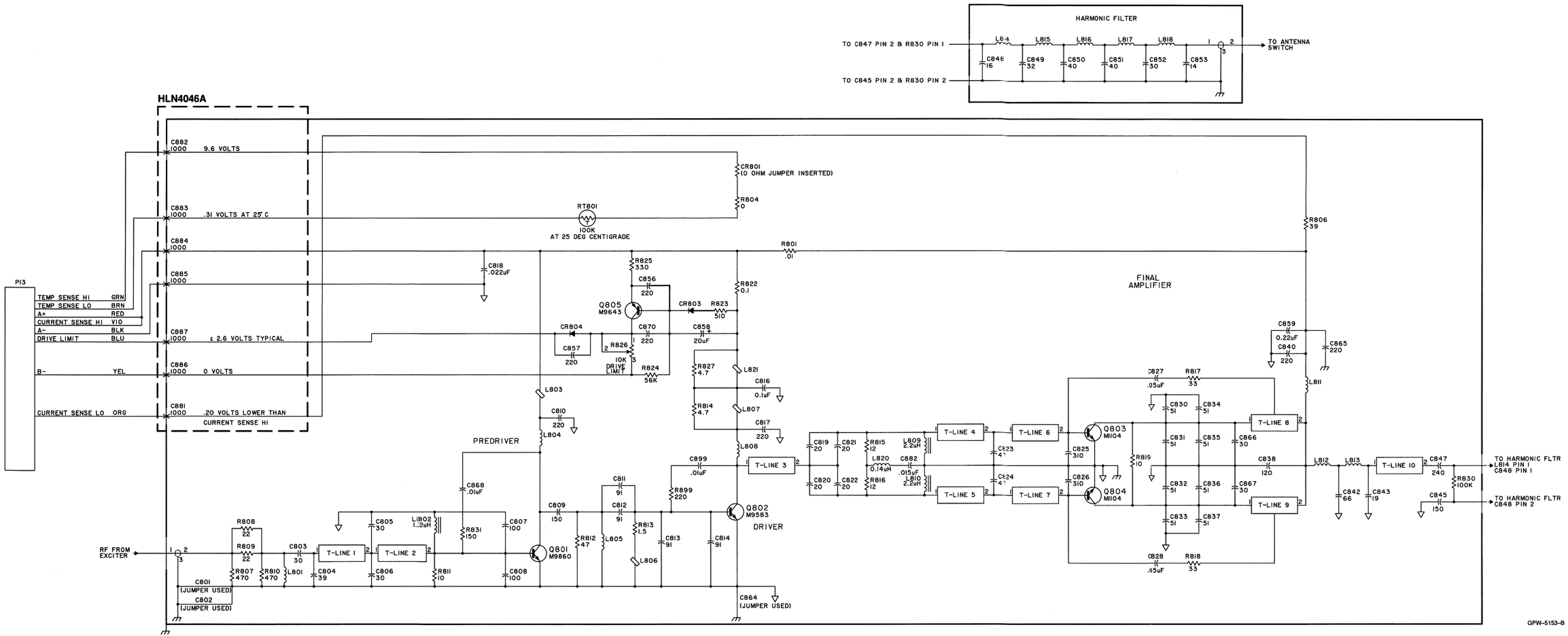
HLD4335A *MaraTrac* Exciter and Power Control — MXW–5173–B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, uF, ±10%, 50V (unless otherwise stated)		
C901–903	21–13741N45	0.01
C1600,1601	21–13741N45	0.01
C1602	23–13749M35	2.2, 35V, tantalum
C1603	21–13741N45	0.01
C1604	21–13740B29	15 pF, ±5%
C1606	21–13741N45	0.01
C1702,1703	21–13741N45	0.01
C1704	23–13749M35	2.2, 35V, tantalum
C1705	21–13740B22	7.5 pF, ±.25 pF
C1706	21–13741N45	0.01
C1707	21–13740B39	39 pF, ±5%
C1708–1710	21–13741N45	0.01
C1711	21–13740B23	8.2 pF, ±.25 pF
C1712	21–13740B35	27 pF, ±5%
C1713	21–13741N45	0.01
C1714	21–13740B49	100 pF, ±5%
diode (see note)		
CR901	48–11034A01	silicon
connector receptacle		
J11	09–80001F01	female, 1–contact
J12	28–80164N01	5–pin
J13	28–80071H06	6–contact, keyed
J14	29–80014A01	female
J15	28–84324M01	male, 2–pin
J26	28–84318M06	male, 2–pin
coil, RF		
L1601	24–11030D06	86.6 nH
L1701	24–11030B09	33.9 nH
L1702	24–80293D02	ferrite bead
L1703	24–80002E01	1200 nH
L1705	24–80293D02	ferrite bead
L1706	24–82723H11	200 nH
L1707	24–11030B05	18.6 nH
L1708	24–80293D02	ferrite bead
transistor (see note)		
Q901,902	48–11043C07	NPN
Q1601	48–11043C49	NPN
Q1701	48–00869591	NPN
Q1702	48–00869859	NPN
resistor, fixed, ohm, ±5%, 1/8 watt (unless otherwise stated)		
R900	06–11077A01	jumper
R902	06–11077A34	22
R903	06–11077A01	jumper
R905	06–11077B15	47k
R906	06–11077A92	5.6k
R907	06–11077A68	560
R908	06–11077A80	1.8k
R909	06–11077A90	4.7k
R910	06–11077A86	3.3k
R911	18–80205N02	20, 10%, 1/2W, potentiometer
R916	06–11077A01	0–ohm jumper
R1600	06–11077A50	100
R1601,1602	06–11077A68	560
R1603,1604	06–11077A54	150
R1606,1607	06–11077A26	10
R1608	06–11077A43	51
R1609	06–11077A54	150
R1701	06–11077A74	1k
R1702	06–11077A64	390
R1703	06–11077A50	100
R1704	06–11077A46	68
R1705	06–11077A28	12
R1706	06–11077A68	560
R1707	06–11077A28	12
R1708	06–11077A50	100
R1709	06–11077A68	560
mechanical parts		
	14–80001C01	insulator, transistor (2 used)
	26–80003M02	shield, high IF (3 used)
	26–80006M01	shield, second VCO

8/31/89

note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

Schematic, Circuit Board Diagram, and Parts List for
HLD4335A for VHF Exciter/Power Control Board
PW–5274–B
(Sheet 2 of 2)
8/31/89



Schematic, Circuit Board Diagram, and Parts Lists for VHF Power Amplifier
PW-5276-C
(Sheet 1 of 2)
8/31/89

parts list

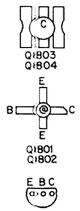
HLD4337B PA Board 100W Range 2 — MXW-5216-C

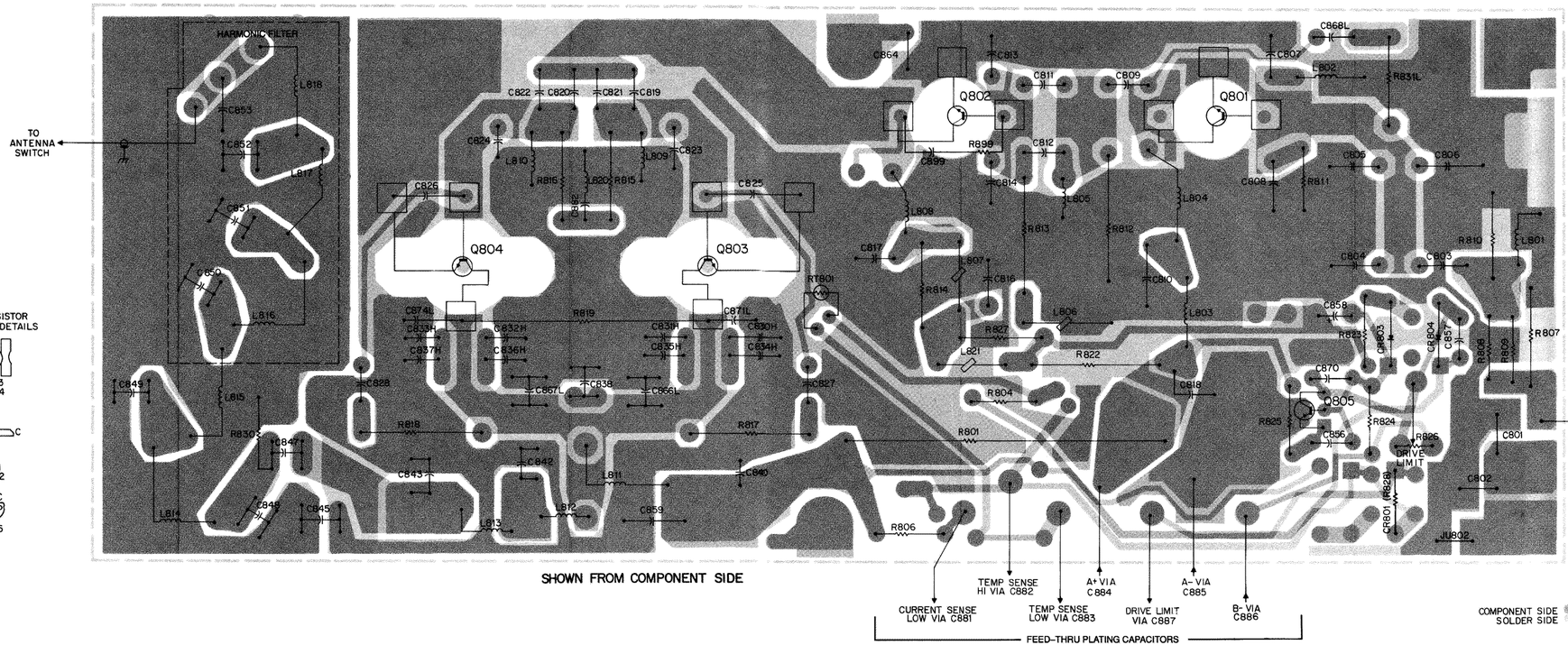
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, pF, ±5%, 500V (unless otherwise stated)		
C801,802	—	(jumper used)
C803	21-83406D77	30
C804	21-84493B59	39
C805,806	21-83406D77	30
C807,808	21-84493B65	100
C809	21-84493B66	150
C810	21-83596E10	220, ±20%
C811-814	21-84493B64	91
C816	08-82096J18	0.1 uF, ±10%, 250V
C817	21-83596E10	220, ±20%
C818	08-82096J08	0.022, ±10%, 250V
C819-822	21-82610C13	20, 200V
C823,824	21-84493B56	47, 100V
C825,826	21-80069B01	310, 350V
C827,828	21-82372C10	0.05 uF, ±20%, 25V
C830-837	21-80169A53	51, 200V
C838	21-84395B04	120, 250V
C840	21-83596E10	220, ±20%
C842	21-84395B48	68, 250V
C843	21-84395B41	19, 350V
C845	21-84395B46	150, 250V
C847	21-84395B35	240, ±10%, 350V
C848	21-84395B51	16, 250V
C849	21-84395B28	32, 350V
C850,851	21-84395B36	40, 350V
C852	21-84395B39	30, 350V
C853	21-84395B30	14, 250V
C856,857	21-83596E10	220, ±20%
C858	23-84538G04	15 uF, ±20%, 20V, tantalum
C859	08-82096J20	0.22 uF, ±10%, 250V
C864	—	(jumper used)
C866,867	21-84395B39	30, 350V
C868	21-83596E21	0.01 uF, +80-20, 200V
C870	21-83596E10	220, ±20%
C882	08-11051A08	0.015 uF, 63V
C899	08-11051A07	0.01 uF, 63V
diode (see note)		
CR801	—	(see R828)
CR803,804	48-82466H13	silicon
coil, RF		
L801	24-83884G01	50 uH
L802	24-82723H27	1.2 uH
L803	24-80036A02	ferrite bead, 1/2 turn
L804	24-80277A10	airwound, 12.5 turns
L805	07-80062B02	bracket
L806	24-80036A01	ferrite bead, 1/2 turn
L807	24-80036A02	ferrite bead, 1/2 turn
L808	24-80277A14	airwound, 1.5 turns
L809,810	24-82549D48	2.2 uH
L811	24-80277A13	airwound, 7.5 turns
L812	24-80277A17	airwound, 1.5 turns
L813	24-80277A18	airwound
L814	24-80277A11	airwound, 6.5 turns
L815-818	24-82723H41	0.14 uH
L820	24-80036A02	1/2 turn
L821		
transistor (see note)		
Q801	48-00869860	NPN
Q802	48-00869583	NPN
Q803,804	48-84411L04	NPN
Q805	48-11043C06	PNP
thermistor		
RT801	06-83600K09	100k
resistor, fixed, ohm, ±5%, 1/4 watt (unless otherwise stated)		
R801	17-80165C02	shunt
R804	06-11009D23	0-ohm jumper
R806	06-11009C15	39
R807	06-11045A41	470, 1/2W
R808,809	06-11009C09	22
R810	06-11045A41	470, 1/2W
R811	06-11045A01	10, 1/2W
R812	06-11086C27	47, 2W
R813	17-82036J07	1.5, ±10%, 2W
R814	06-11045B26	4.7, 1/2W
R815,816	06-11045A03	12, 1/2W
R817,818	17-82036J11	33, ±10%, 2W
R822	17-82291B24	0.1, 3W
R823	06-11009C42	510
R824	06-11009C91	56k
R825	06-11009C37	330
R826	18-80087E08	potentiometer, 10k
R827	06-11045B26	4.7, 1/2W
R828	06-11009D23	0-ohm jumper (in place of CR801)
R830	06-11009C97	100k
R831	06-11045A29	150, 1/2W
	non-referenced parts	
	29-80014A01	clip, coax
	26-80052B01	shield, filter

8/31/89

note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

TRANSISTOR BASE DETAILS





SHOWN FROM COMPONENT SIDE

COMPONENT SIDE BD- GEW-3110-A
SOLDER SIDE BD- GEW-3111-A
OL- GEW-5104-B

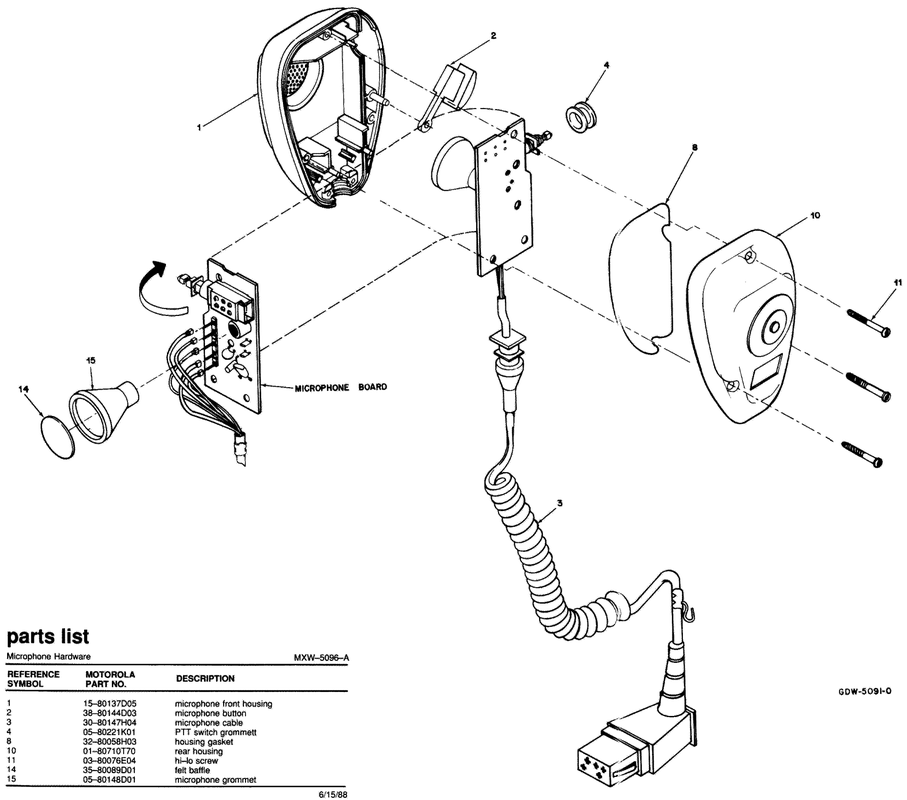
parts list

HLN4046A Feed Thru Plate — MXW-4502-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, pF, 500V (unless otherwise stated)		
C881-887	21-82812H03	1000, +100-0%
	non-referenced parts	
	64-80005A01	plate, feed thru

8/31/89

Schematic, Circuit Board Diagram, and Parts Lists for VHF Power Amplifier
PW-5276-C
(Sheet 2 of 2)
8/31/89



BASIC CONTROL HEAD MICROPHONE

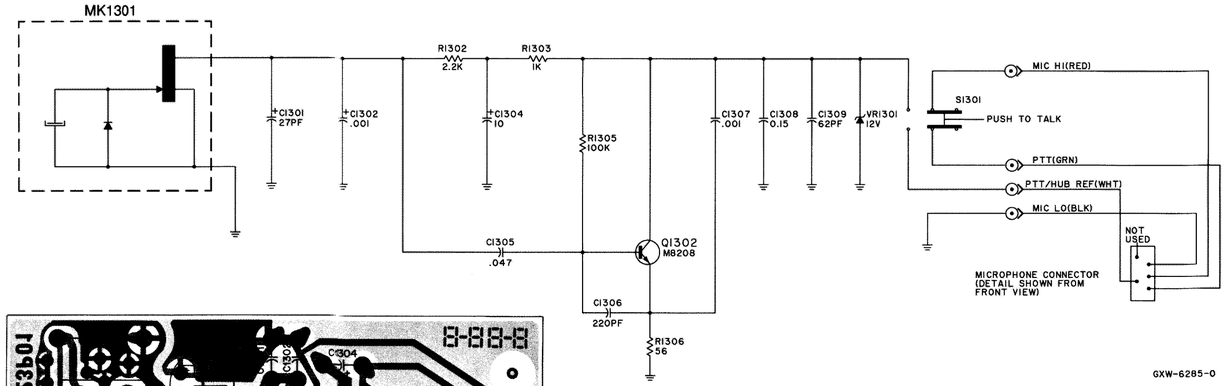
parts list

Microphone Hardware — MXW–5096–A

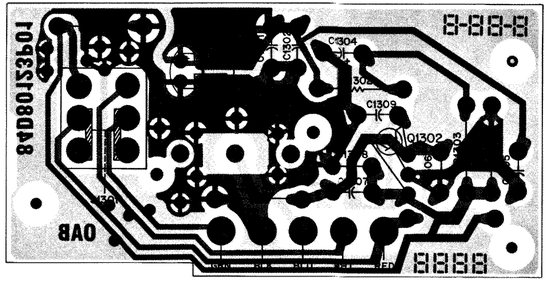
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	15–80137D05	microphone front housing
2	38–80144D03	microphone button
3	30–80147H04	microphone cable
4	05–80221K01	PTT switch grommett
8	32–80058H03	housing gasket
10	01–80710T70	rear housing
11	03–80076E04	hi–lo screw
14	35–80089D01	felt baffle
15	05–80148D01	microphone grommet

6/15/88

Schematics, Circuit Board Diagram, Exploded Views, and Parts Lists for *MaraTrac* Accessories
PW–5220–D
(Sheet 1 of 2)
5/15/89



BASIC CONTROL HEAD MICROPHONE SCHEMATIC



SOLDER SIDE ● GBW–6287–O
COMPONENT SIDE ○ GBW–6288–O
OVERLAY — GBW–6289–O

parts list

HLN5459A Microphone Circuit Board — MXW–6186–O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed uF, ±5%, 50V (unless otherwise stated)		
C1301	21–11038H35	24 pF
C1302	21–11039B13	.001 ±10%
C1304	29–11019A20	10 ±20% 25V, electrolytic
C1305	08–11051A11	.047
C1306	21–11038P50	220 pF
C1307	21–11039B13	.001 ±10%
C1308	08–11051A14	.15 63V
C1309	21–11014H44	62pF, 100V
diode (see note)		
CR1301	48–11034A36	12V zener ±5% 400mW
microphone		
MK1301	50–80258E04	electret cartridge
transistor (see note)		
Q1302	48–11043C05	NPN
resistor, fixed ohm, ±5%, 1/4 watt (unless otherwise stated)		
R1302	06–11009A57	2.2k
R1303	06–11009A49	1k
R1305	06–11009A97	100k
R1306	06–11009A19	56
switch		
S1301	40–80065E02	momentary switch
mechanical part		
	14–80652E01	switch insulator

2/15/89

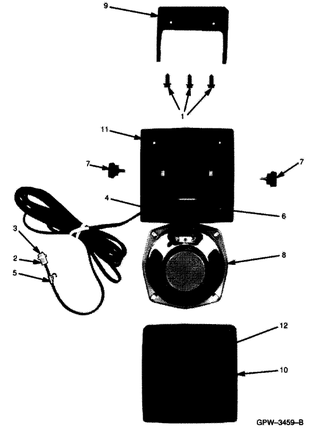
note: For best performance, order diodes, transistors, and integrated circuits by Motorola part number.

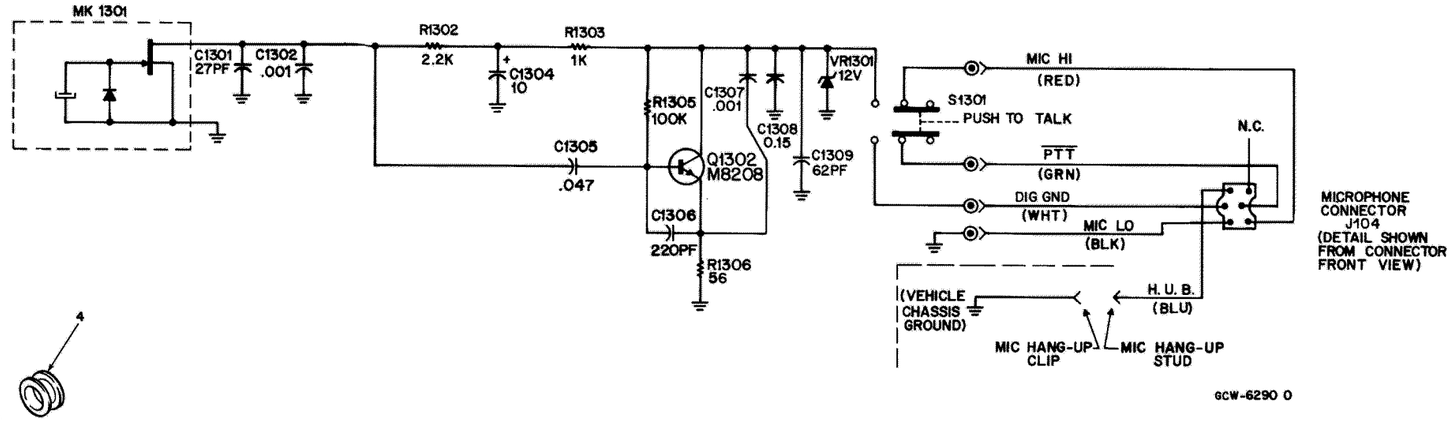
parts list

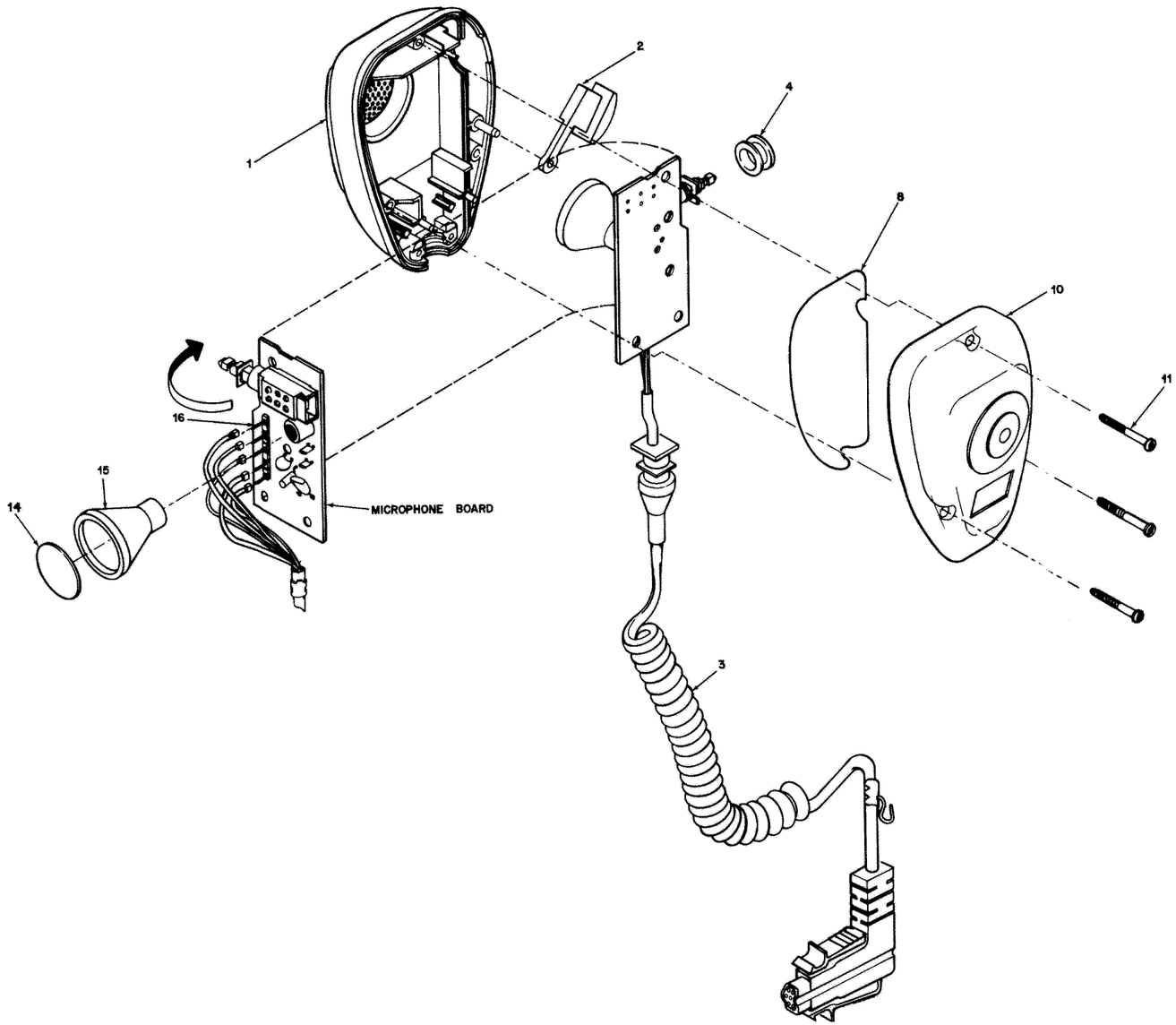
HSN4020A External Speaker
HSN4021A External Speaker — MXW–5223–B

ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1	03–00136756	tapping screw, 10–16 x 5/8 (3 used)
2	15–10183A18	connector housing, 2– contact
3	39–10184A45	contact
4	42–82018H05	cable retainer
5	42–84081A03	wire clamp
6	03–00140001	tapping screw 6–19 x 7/8 (4–used)
7	03–84244C01	wing screw (2 used)
8	50–84561B08	speaker, 5", 30W
9	07–80200E02	trunnion bracket
10	13–82671M08	bezel
11	15–84981B09	cover
12	32–80195A01	gasket

5/15/89







ADVANCED CONTROL HEAD MICROPHONE SCHEMATIC

parts list

HLN5389A Microphone Hardware — MXW–5475–A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	15–80137D05	front housing
2	38–80144D03	mic button
3	30–80223J01	6 conductor cable
4	05–80221K01	PTT switch grommet
8	32–80058H03	housing gasket
10	15–80137D03	rear housing (p/o housing assembly)
11	03–80076E04	hi–lo metric screw, 3 used
14	35–80089D01	felt baffle
15	05–80148D01	mic cartridge grommet
16	39–10184A10	contact plug, 5 used
	non referenced items	
	03–10943M09	tapping screw (3 x 0.5 x 6)
	54–84962K01	safety tag
	33–80016P01	nameplate
	04–80093E01	flat washer (p/o housing assembly)
	46–80297N01	hang–up stud (p/o housing assembly)
	46–80281G01	mic weight (p/l housing assembly

8/30/88

ADVANCED CONTROL HEAD MICROPHONE

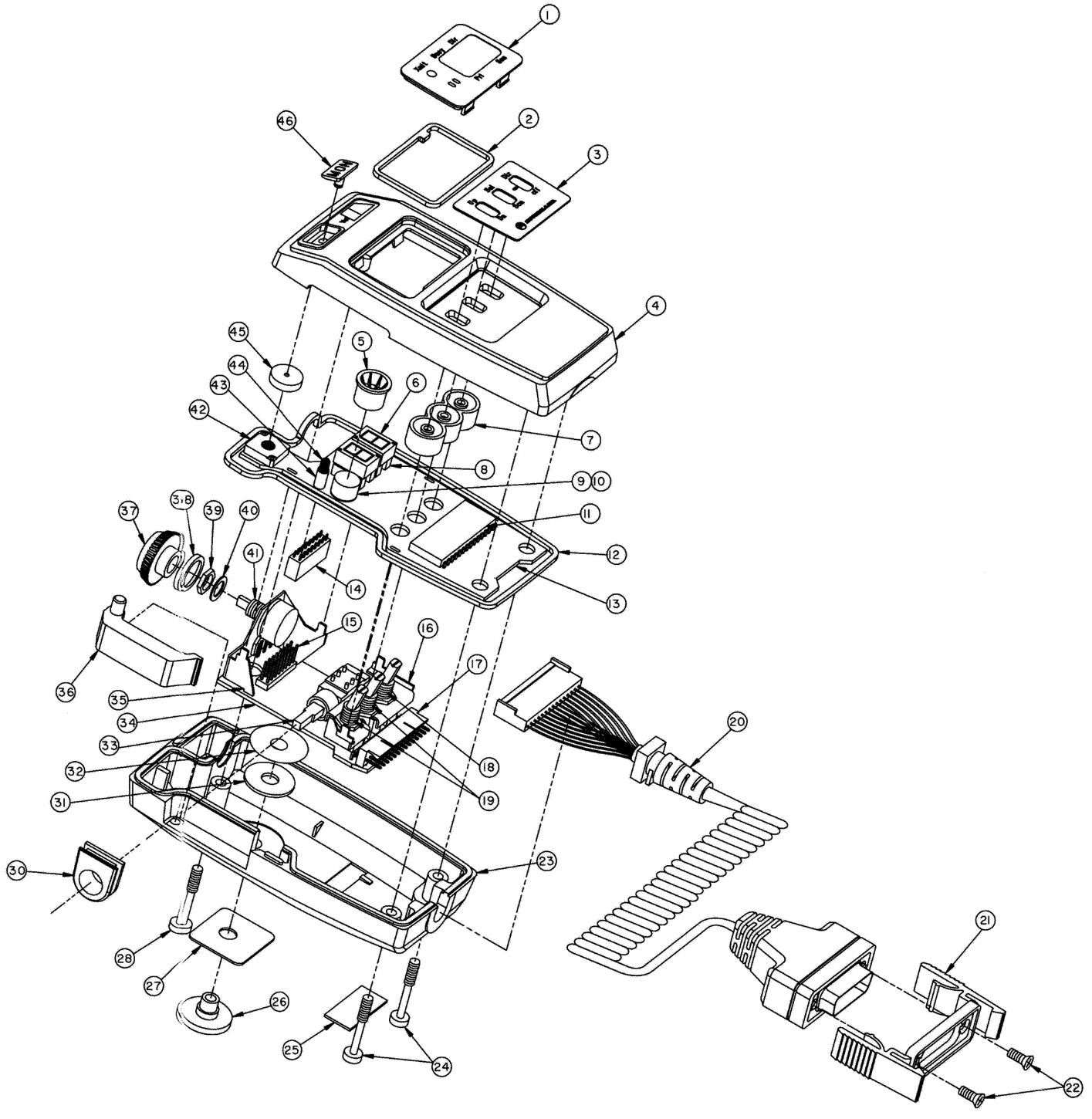
parts list

Handheld Control Head Exploded View — MXW–5227–B

ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1	61–80052H07	lens
2	32–80059H01	gasket, lens
3	13–80020H09	escutcheon (for talkaround)
3	13–80020H10	escutcheon (for non–talkaround)
4	15–80047H02	housing, front
5	32–80061H01	seal, microphone
6	48–80187G05	diode, common anode
7	32–80063H01	seal, switch
8	09–80197N01	receptacle, LED
9	50–80258E04	electret, microphone cartridge
10	14–80065H01	insulator, microphone
11	51–80135C08	IC display, driver MM5480
12	32–80058H02	gasket, housing
13	01–80749T73	circuit board, upper
14	09–80196N01	receptacle, vertical
15	28–80085E32	connector, male header
16	07–80050H01	bracket, switch
17	28–80195N01	plug, right angle
18	40–80123H06	switch, toggle
19	40–80123H01	switch, toggle
20	30–80227N01	cable, coiled
21	42–80253N01	clip, coiled cord
22	03–00140287	screw
23	15–80048H02	housing, back
24	03–80076E02	screw, metric, hi–lo
25	33–80025H21	nameplate, HHCH
26	05–00855939	rivet
27	04–80072H01	washer
28	03–80076E06	screw, metric, hi–lo
30	32–80060H01	seal, PTT
31	04–00139386	washer, flat
32	14–80258N01	insulator, microphone
33	40–80065E01	switch, momentary PTT
34	01–80749T68	circuit board, lower
35	07–80002J01	bracket, potentiometer
36	38–80131P01	button, PTT
37	36–80053H01	knob
38	42–84591A03	o–ring
39	02–80188H01	nut, hex, machine
40	04–00124629	washer, flat
41	18–80095D07	resistor, variable, squelch
42	40–80067H01	switch, momentary
43	43–80064H01	spacer, LED
44	48–05504C01	LED
45	32–80062H01	seal, button
46	38–80054H02	squelch button
47	32–80291N01	gasket retainer

5/15/89

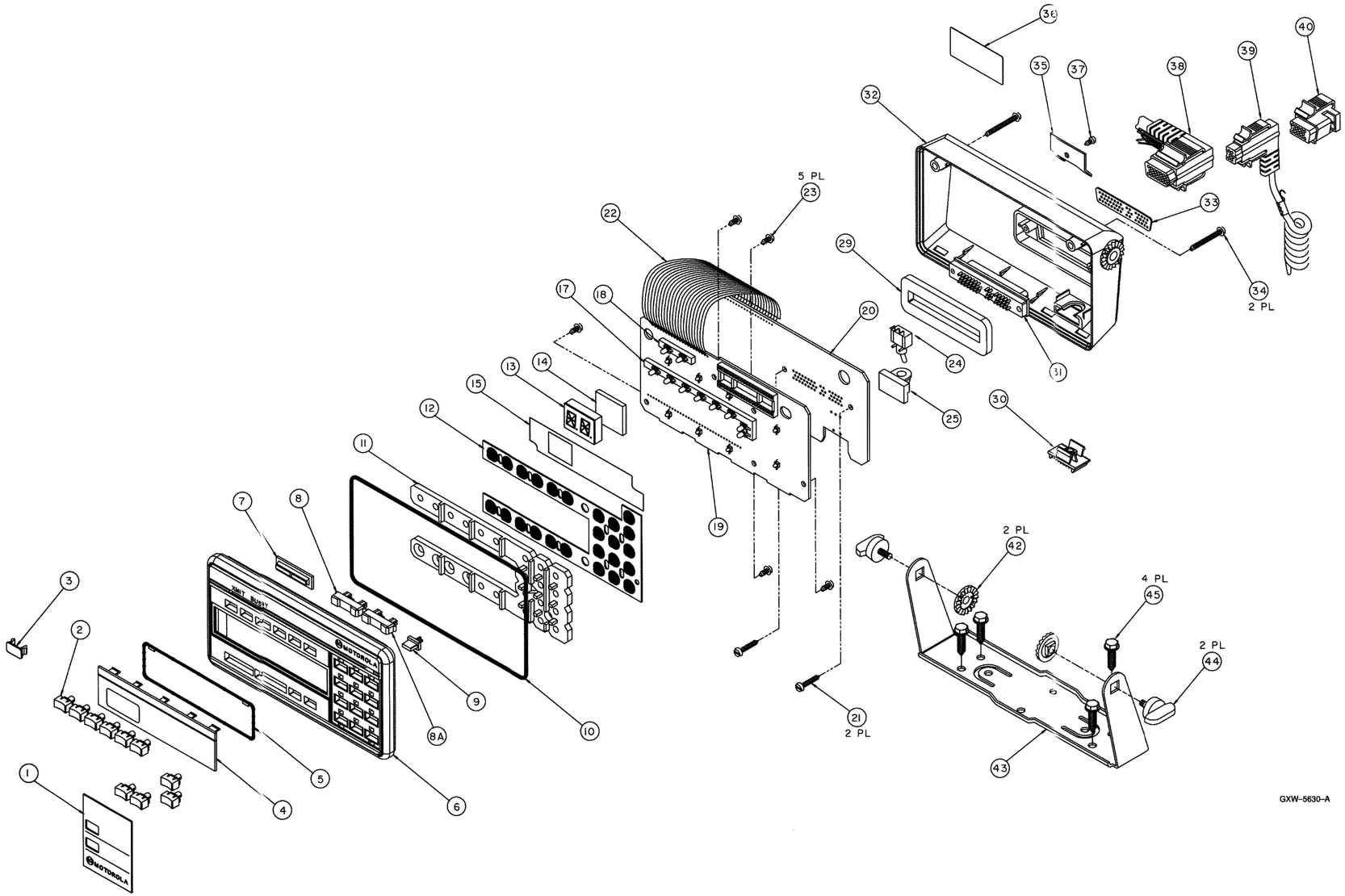
HANDHELD CONTROL HEAD



GXW–5226–A

Exploded Views and Parts Lists
for *MaraTrac* Control Heads
PW–5590–C
(Sheet 1 of 3)
8/31/89

ADVANCED CONTROL HEAD



parts list

Advanced Control Head Hardware — MXW–5585–B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	13–80087J04	escutcheon
2	38–80197P02	pushbutton, MPL
2	38–80197P03	pushbutton, SCAN
2	38–80197P14	pushbutton, RCL
2	38–80197P18	pushbutton, SEL
2	38–80197P19	pushbutton, MON
2	38–80197P39	pushbutton, HOME
2	38–80197P10	pushbutton, H/L
3	38–80253K02	plug
4	61–80095J03	lens, vacuum fluorescent
5	32–80057K02	gasket, lens
6	15–80088J04	housing, front
7	61–80097J01	lens, LED
8	38–80195P03	rocker button, MODE
8A	38–80195P04	rocker button, VOL
9	38–80092J01	pushbutton, DIM
10	32–80180J02	gasket, housing
11	61–80185J02	light pipe, keypad
12	75–80098J01	keypad
13	—	LED display (see Control Heads display board)
14	75–80184J01	shock pad
15	14–80240N01	insulator
16	—	(not used)
17	43–80011L01	spacer, LED, 8–position
18	43–80012L01	spacer, LED, 2–position
19	—	display circuit board (see Control Heads)
20	—	control circuit board (see Control Heads)
21	03–10945A14	screw, tapping, M3.12 x 1.27 x 16
22	30–80034K01	flex cable
23	03–10945A11	screw, tapping, M3.12 x 1.27 x 8
24	—	toggle switch (see Control Heads control board)
25	32–80178J01	gasket, ON/OFF switch
26–28	—	(not used)
29	32–80179J01	gasket, D–connector
30	38–80128J01	topper, ON/OFF switch
31	—	D–connector (see Control Heads control board)
32	15–80089J02	housing, rear
33	32–80181J01	gasket, connector face
34	03–10908A33	screw, machine, M3.5 x 0.6 x 30
35	07–84323C01	bracket, strain relief
36	33–80178M03	nameplate
37	03–10908A18	screw, machine, M3 x 0.5 x 6
38	30–80184N02	radio cable
39	—	microphone cable (see Accessories Section)
40	15–80221J01	VIP connector
42	43–80127J01	spacer, trunnion
43	07–80263L01	bracket, trunnion
44	03–80160E01	screw, wing, M5.0 x .8 x 10
45	03–00136756	screw, tapping, 10–16 x 5/8

8/31/89

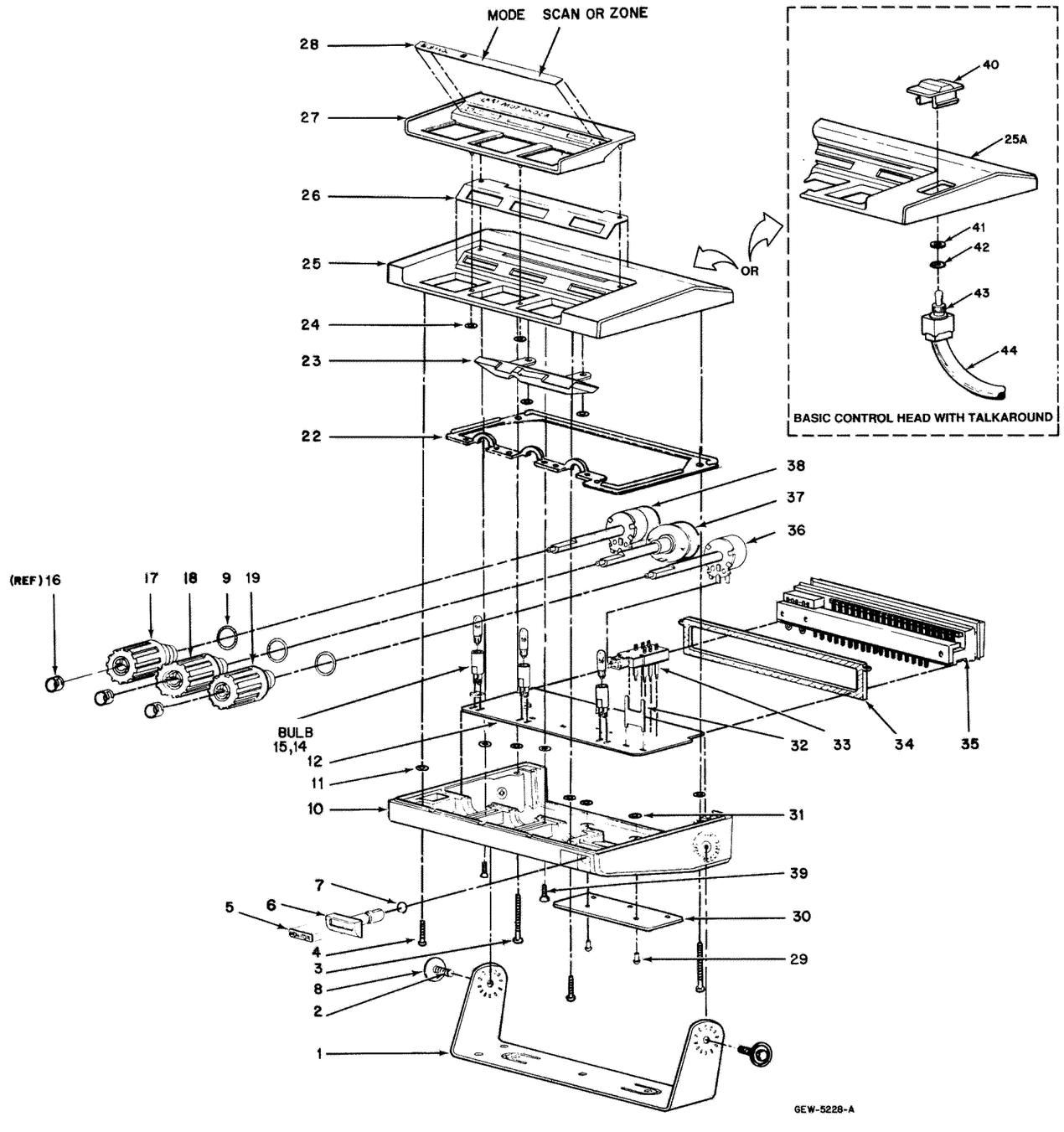
parts list

Basic Control Head Mechanical Parts — MXW–5229–A

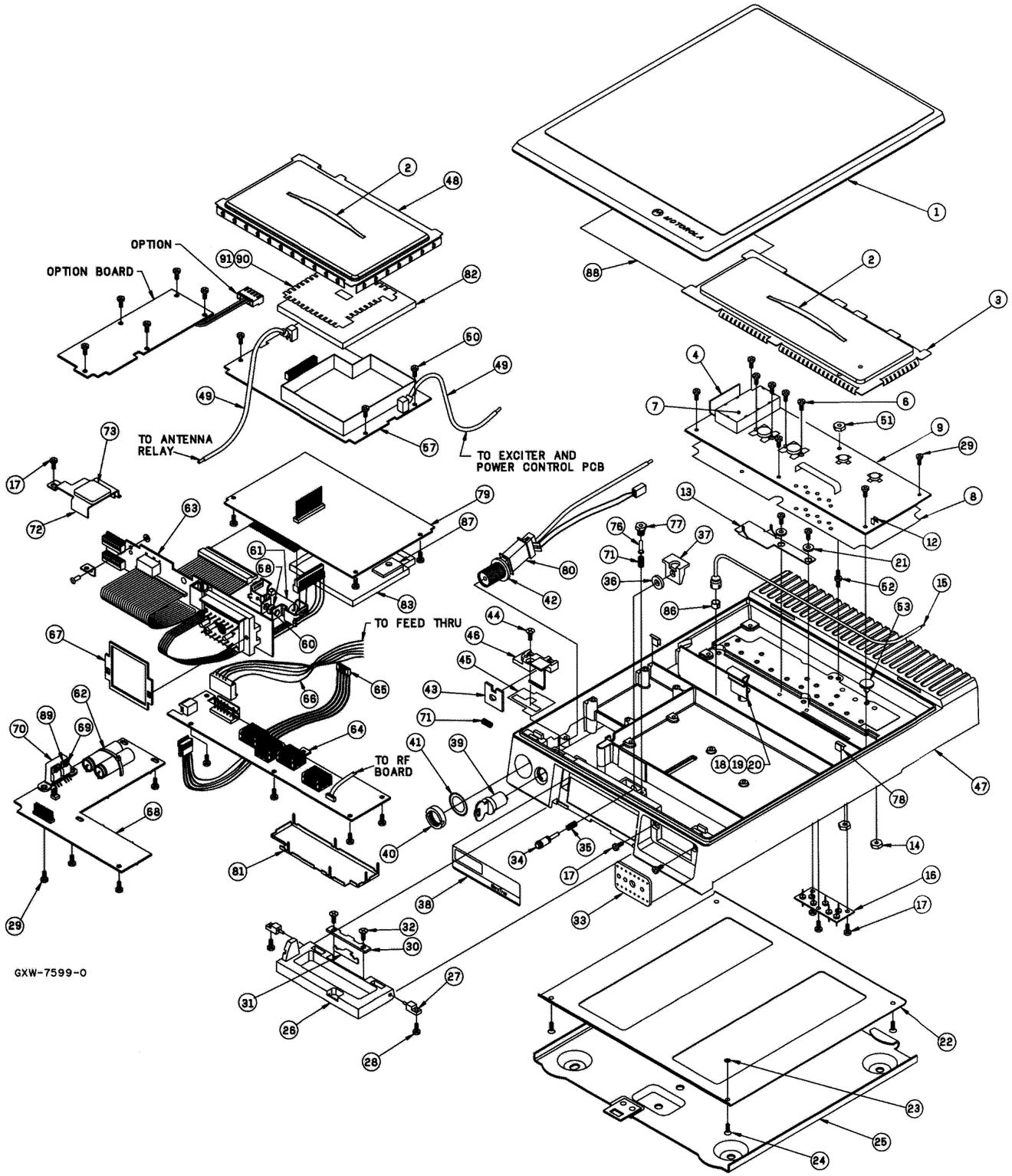
ITEM NO.	MOTOROLA PART NO.	DESCRIPTION
1	07–80101A01	bracket, trunnion
2	03–00135726	screw, trunnion (2 used)
3	03–10908A33	screw, machine (M3.5x0.6x30)(2 used)
4	03–10908A29	screw, machine housing (2 used)
5	33–80117A01	nameplate "MONITOR"
6	36–80102A01	pushbutton
7	42–10128A22	"O" ring
8	04–00135784	washer, trunnion 2–used
9	42–10128A23	"O" ring (3–used)
10	15–80109A01	housing, bottom
11	04–80149A01	washer, captice (6–used)
12	84–80148N01	printed circuit board
14	09–80051B01	light socket (3–used)
15	65–80284N01	light bulb (3–used)
16	42–10082A14	retainer, knob (3–used) (for Ref. vendor installed)
17	36–80107A01	knob, volume squelch
18	36–80107A05	knob, mode
19	36–80107A06	knob, zone
		or
	36–80107A07	knob, scan
22	32–80203B01	gasket, housing
23	61–80119A01	lens
24	42–10113A31	retainer ring (6–used)
25	15–80108A01	housing, top (for non–talkaround)
25A	15–80221N01	housing, top (talkaround)
26	32–80140B03	gasket, bezel
27	13–80114A04	bezel
28	33–80116A09	nameplate (overlay) (8–mode)
		or
	33–80116A10	nameplate (16–mode)
29	05–00132475	rivet (2–used)
30	07–80100A02	bracket, strain relief
31	04–00007555	washer, flat (2–used)
32	07–80159A01	bracket, switch
33	40–80127A03	switch, pushbutton
34	32–80038C01	gasket, connector
35	01–80749T24	connector assembly
36	40–80166N02	switch, rotary 2–P
37	40–80166N01	switch, rotary 8–P
38	18–80126A03	potentiometer, rotary
39	03–10913A29	screw, machine (2–used)(M3.5x0.6x1x3)
	03–00136756	screw, tapping, 10–16 x 5/8" (3–used) (for trunnion mounting)
40	38–80202N01	repeat/direct button
41	02–82653D01	nut, spanner
42	15–80201N01	switch, housing (p/o 25A)
43	32–05082E20	o–ring
44	40–05680K03	toggle switch
45	01–80749T20	cable, talkaround

6/15/88

BASIC CONTROL HEAD



Exploded Views and Parts Lists
for *MaraTrac* Control Heads
PW–5590–C
(Sheet 3 of 3)
8/31/89



parts list

MaraTrac VHF Radio Exploded View — MXW–7672–O

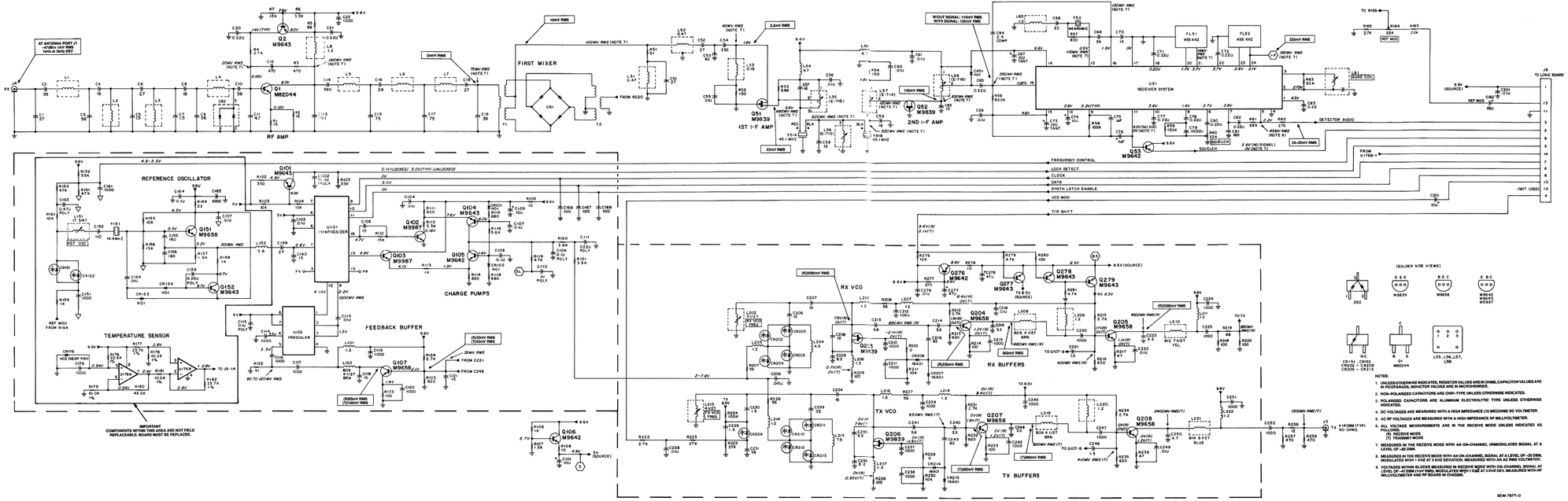
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	—	top cover assembly
2	55–84300B04	handle, nylon (2 used)
3	26–80070B01	shield, PA compartment
4	26–80019C01	heatsink, harmonic filter
5	—	not used
6	03–10911A11	machine screw, 3 x 0.5 x 8 (4 used)
7	15–80053B01	cover shield
8	14–80143A04	insulator, PA
9	—	100W PA circuit board assembly
10–11	—	not used
12	29–80014A01	clip coax (HLD4337) (2 used)
13	26–80205C01	heatsink
14	02–00119913	nut 8–32 x 11/32 x 1/8 hex (2 used)
15	01–80750T31	coax cable assembly
16	—	pre–amp feedthru plate assembly
17	03–10908A26	machine screw, 3.5 x 0.6 x 6 (6 used)
18	02–00007005	nut 6–32 x 1/4 x 8/32 hex
19	26–80254A01	heatsink, LL AMP
20	26–80238N01	heatsink, TO5
21	04–80207C01	washer shoulder (2 used)
22	—	bottom cover assembly
23	04–80149A01	washer, captivating (4 used)
24	03–10913A29	machine screw, 3.5 x 0.6 x 13 (4 used)
25	—	mounting tray assembly
26	55–80002A01	handle
27	47–80176P01	pin, pivot (2 used)
28	03–10943R55	tapping screw 3 x 0.5 x 8 (2 used)
29	03–10943M16	tapping screw 3.5 x 0.6 x 10 (19 used)
30	64–80019A01	plate, backup
31	07–80113B01	bracket, latch
32	03–80001P01	screw, 3.5 x 0.6 x 6 (2 used)
33	32–80020C01	gasket, front cable connector
34	47–80027A01	pushbutton
35	41–80029A01	spring, latch
36	32–80295C01	gasket
37	07–80030A01	bracket, latch
38	33–80028N03	nameplate, radio (HLN5371)
39	55–80370A01	lock
40	02–80006A01	nut, spanner
41	04–00114522	lockwasher, 5/8"
42	32–80080A01	gasket, antenna connector
43	07–80016A02	bracket, lock slide
44	03–10936E14	tapping screw, B3.5 x 1.27 x 13
45	32–80000P01	gasekt, lock support
46	07–80015A02	support, lock slide
47	27–80003P01	chassis
48	26–80092P01	shield, RF
49	30–80231N01	cable, coaxial
50	03–10943M10	tapping screw, 3.5 x 0.6 x 8 (12 used)
51	02–10971A63	nut, hex
52	43–80013B01	stand off
53	32–80084A02	gasket, stud device
54–56	—	not used
57	—	RF circuit board
58	48–80153A01	diode, pellet
59	—	not used
60	26–80191P01	heatsink (2 used)
61	23–80167C03	capacitor, electrolytic
62	42–10217A32	strap, cable harness (2 used)
63	—	interconnect circuit board
64	—	exciter/power control circuit board
65	30–80159N01	cable, power control
66	30–80234N01	cable, feedthru
67	32–80074A02	gasket, cable plug
68	—	audio/squelch circuit board
69	03–10908A18	screw, 3 x 0.5 x 6 (2 used) (HLN5342)
70	26–80129P01	heatsink (HLN5342)
71	41–80022A01	lock, spring (2 used)
72	07–80126P01	bracket, relay
73	75–82200H01	pad
74–75	—	not used
76	46–80151A01	stud, cover release
77	43–80150A01	sleeve, cover release
78	42–80013A01	clip, coaxial (2 used)
79	—	logic circuit board
80	—	antenna relay assembly
81	26–80163N01	shield, solder side
82	15–80953T01	cover, VCO shield
83	15–80124M01	cover, logic shield
84–85	—	not used
86	42–84733F04	ring, compression
87	75–80202C01	pad, compression
88	54–80166K01	label
89	51–80065C03	IC audio (2 used) (HLN5342)
90	11–80924T01	adhesive pad
91	26–80923T01	shield, RF to chassis
	non–referenced items	
	30–10286A06	cable, 14 gage red
	30–10286A04	cable, 14 gage black
	42–10217A02	tie strap

03/28/90

VHF Radio Exploded View
PW–7680–O
3/30/90

VHF RF Board Transistor D.C. Voltage Table

Transistor Ref. No.	VOLTAGE			VOLTAGE		
	BASE	EMITTER	COLLECTOR	GATE	SOURCE	DRAIN
Q1	.83	.12	8.5	—	—	—
Q2	7.9	8.5	1.1	—	—	—
Q51	—	—	—	0	1.8	9.6
Q52	—	—	—	0	1.8	9.6
Q53	4.2	3.6	9.6	—	—	—
Q101	5.0	5.0	.1 (LOCKED)	—	—	—
Q102	0.7	0	0	—	—	—
Q103	4.8	4.1	9.6	—	—	—
Q104	8.1	7.6	2-8v	—	—	—
Q105	1.4	1.9	2-8v	—	—	—
Q106	5.7	4.9	9.6	—	—	—
Q107	2.1	1.4	9.6	—	—	—
Q151	5.5	5.2	9.5	—	—	—
Q152	8.7	9.5	6.7	—	—	—
Q203	—	—	—	-2.1(R)	.7(R)	7.9
Q204	1.9(R)	1.2(R)	8.5	—	—	—
Q205	1.7(R)	1.1(R)	9.6	—	—	—
Q206	—	—	—	-1.9(T)	.95(T)	7.9
Q207	1.8(T)	1.2(T)	8.5	—	—	—
Q208	1.7(T)	1.2(T)	9.6	—	—	—
Q276	9.5	8.6	9.6	—	—	—
Q277	9.6	8.5(T)	8.5	—	—	—
Q278	9.6(R)	8.5	8.5	—	—	—
Q279	7.6(R)	8.5	8.5	—	—	—

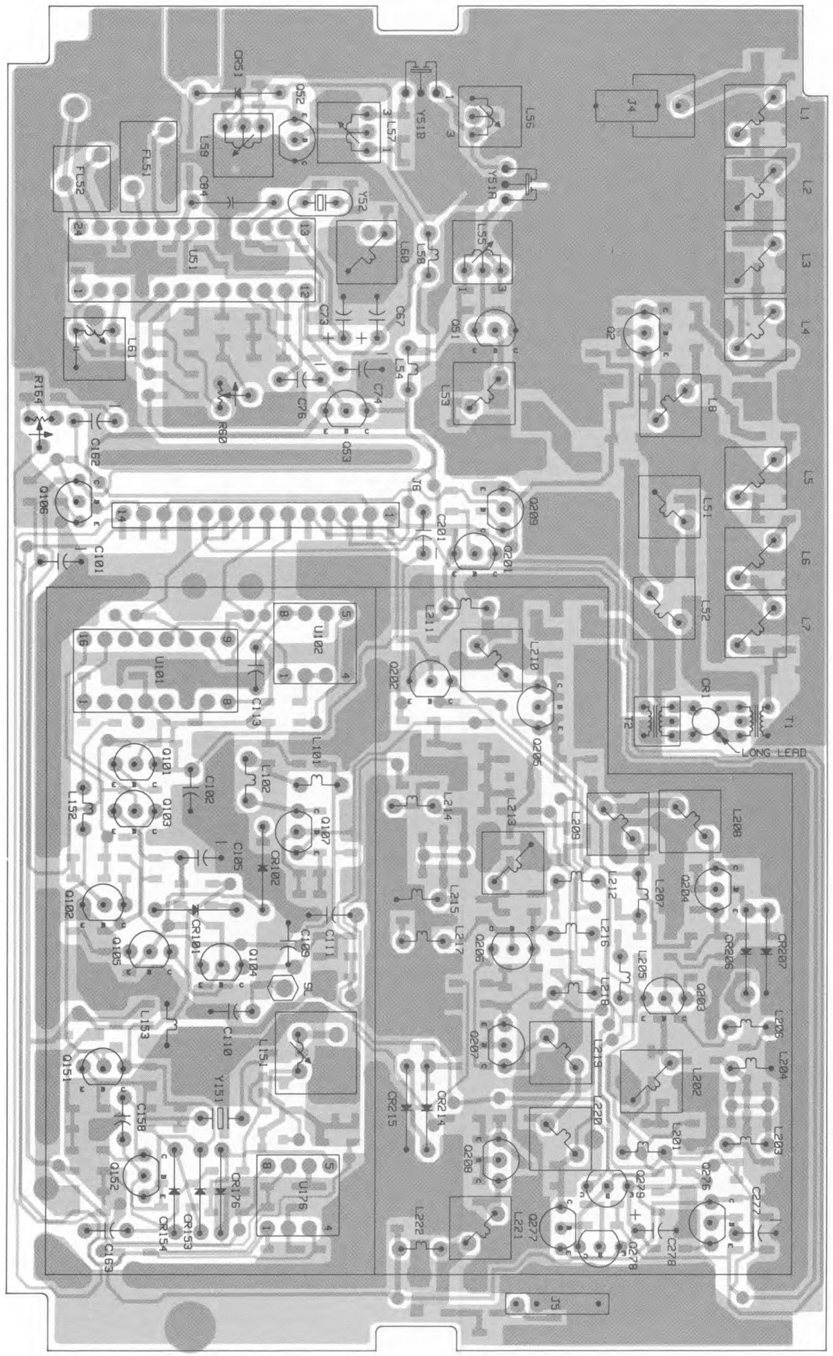


NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTOR VALUES ARE IN OHMS, CAPACITOR VALUES ARE IN PICOFARADS, INDUCTOR VALUES ARE IN MICROHENRIES.
2. NON-POLARIZED CAPACITORS ARE CHIP-TYPE UNLESS OTHERWISE INDICATED.
3. POLARIZED CAPACITORS ARE ALUMINUM ELECTROLYTIC TYPE UNLESS OTHERWISE INDICATED.
4. DC VOLTAGES ARE MEASURED WITH A HIGH IMPEDANCE (10 MEGOHM) DC VOLTMETER.
5. AC RF VOLTAGES ARE MEASURED WITH A HIGH IMPEDANCE RF MILLIVOLTMETER.
6. ALL VOLTAGE MEASUREMENTS ARE IN THE RECEIVE MODE UNLESS INDICATED AS FOLLOWS:
   (R) RECEIVE MODE
   (T) TRANSMIT MODE
7. MEASURED IN THE RECEIVE MODE WITH AN ON-CHANNEL UNMODULATED SIGNAL AT A LEVEL OF +20 DBM.
8. MEASURED IN THE RECEIVE MODE WITH AN ON-CHANNEL SIGNAL AT A LEVEL OF -20 DBM, MODULATED WITH 1 KHZ AT 3 KHZ DEVIATION. MEASURED WITH AN AC RMS VOLTMETER.
9. VOLTAGES WITHIN BLOCKS MEASURED IN RECEIVE MODE WITH ON-CHANNEL SIGNAL AT LEVEL OF -47 DBM (141MV RMS), MODULATED WITH 1 KHZ AT 3 KHZ DEV. MEASURED WITH RF MILLIVOLTMETER AND RF BOARD IN CHASSIS.

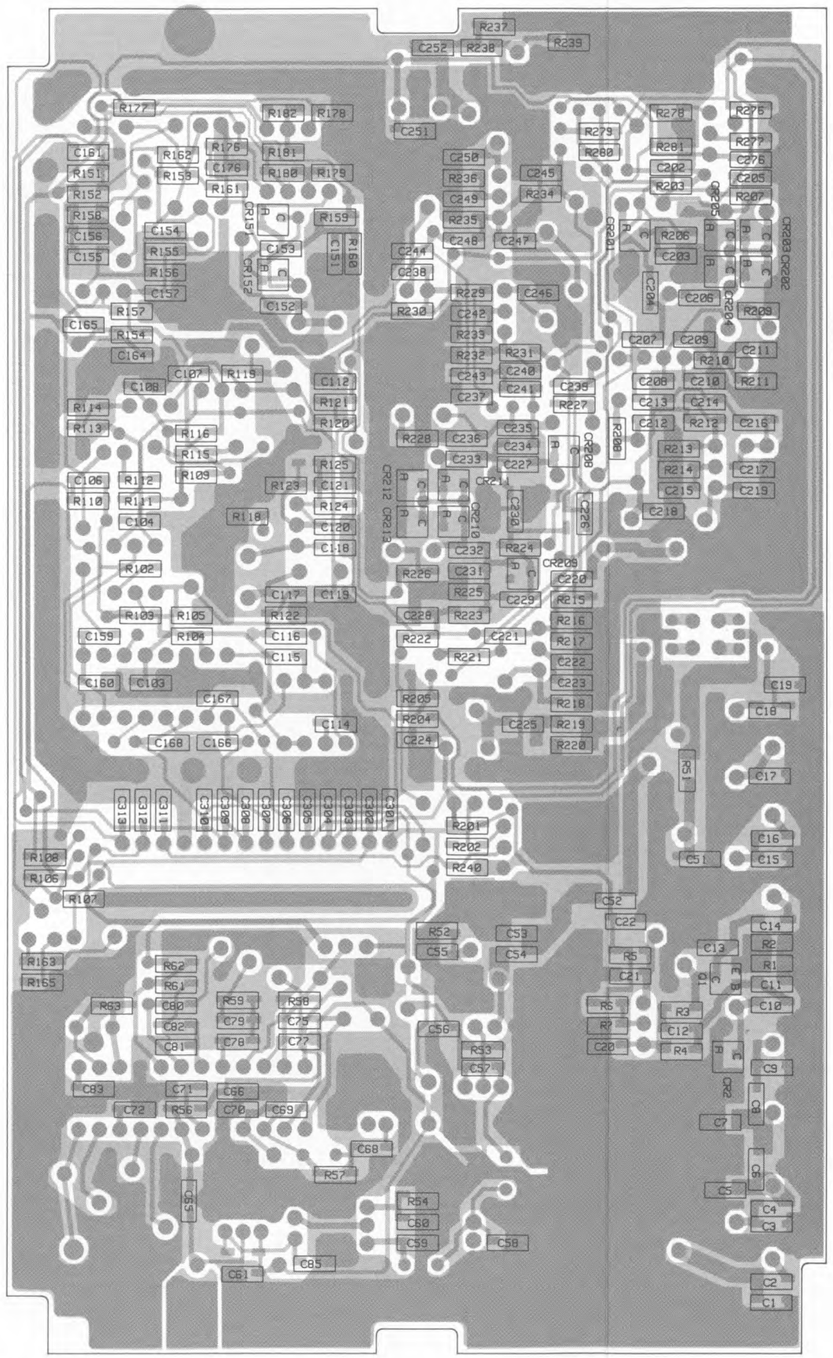
6EW-7577-O

Schematic, Circuit Board Diagrams, and Parts List for HLD4322B VHF RF Board
PW–7576–O
(Sheet 1 of 3)
3/31/90



COMPONENT SIDE VIEW

SOLDER SIDE	RED	GAW–7702–O
COMPONENT SIDE	GREY	GAW–7701–O
OVERLAYS	BLACK	GDW–7703–O



SOLDER SIDE VIEW

Schematic, Circuit Board Diagrams, and
Parts List for HLD4322B VHF RF Board
PW–7576–O
(Sheet 2 of 3)
3/31/90

parts list

HLD4322B *MaxTrac* VHF RF Board — MXW–7404–O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed (unless otherwise stated)		
C0001	21–13740B35	27 pF, ±5%, 50V
C0002	21–13740B39	39 pF, ±5%, 50V
C0003	21–13740B43	56 pF, ±5%, 50V
C0004	21–13740B29	15 pF, ±5%, 50V
C0005	21–13740B05	1.5 pF, ±5%, 50V
C0006	21–13740B11	2.7 pF, ±5%, 50V
C0007	21–13740B05	1.5 pF, ±5%, 50V
C0008	21–13740B29	15 pF, ±5%, 50V
C0009	21–13740B43	56 pF, ±5%, 50V
C0010	21–13740B39	39 pF, ±5%, 50V
C0011	21–13740B17	4.7 pF, ±5%, 50V
C0012	21–13740B65	470 pF, ±5%, 50V
C0013	21–13740B24	9.1 pF, ±5%, 50V
C0014	21–13740B63	390 pF, ±5%, 50V
C0015	21–13740B46	75 pF, ±5%, 50V
C0016	21–13740B34	24 pF, ±5%, 50V
C0017	21–13740B46	75 pF, ±5%, 50V
C0018	21–13740B35	27 pF, ±5%, 50V
C0019	21–13740B39	39 pF, ±5%, 50V
C0020,0021	21–11032B15	.22 uF, +80, –20%, 50V
C0022	21–13740B73	.001 uF, ±5%, 50V
C0051,0052	21–13740B35	27 pF, ±5%, 50V
C0053	21–13740B47	82 pF, ±5%, 50V
C0054	21–13740B61	330 pF, ±5%, 50V
C0055,0056	21–13741B45	.01 uF, ±5%, 50V
C0057	21–13740B31	18 pF, ±5%, 50V
C0058	21–13740B27	12 pF, ±5%, 50V
C0059	21–13740B31	18 pF, ±5%, 50V
C0060,0061	21–13741B45	.01 uF, ±5%, 50V
C0065	21–11032B15	.22 uF, +80, –20%, 50V
C0066	21–13741B45	.01 uF, ±5%, 50V
C0067	23–13749C39	10 uF, ±10%, 50V, tantalum
C0068	21–13740B33	22 pF, ±5%, 50V
C0069	21–13740B39	39 pF, ±5%, 50V
C0070	21–13740B29	15 pF, ±5%, 50V
C0071,0072	21–11032B15	.22 uF, +80, –20%, 50V
C0073	23–13749C39	10 uF, ±10%, 50V, tantalum
C0074	23–11048B13	10 uF, ±20%, 16V, electrolytic
C0075	21–13741B69	.1 uF, ±5%, 50V
C0076	23–11048B05	1 uF, ±20%, 50V, electrolytic
C0077,0078	21–11032B15	.22 uF, +80, –20%, 50V
C0079	21–13741B29	.0022 uF, ±5%, 50V
C0080	21–11032B15	.22 uF, +80, –20%, 50V
C0081	21–13740B55	180 pF, ±5%, 50V
C0082,0083	21–11032B15	.22 uF, +80, –20%, 50V
C0084	21–82450B14	2.4 pF, ±5%, 500V
C0085	21–13740B27	12 pF, ±5%, 50V
C0101	23–11048B13	10 uF, ±20%, 16V, electrolytic
C0102	08–11051A13	.1 uF, ±5%, 63V
C0103,0104	21–13741B45	.01 uF, ±5%, 50V
C0105	23–11048B13	10 uF, ±20%, 16V, electrolytic
C0106	21–13740B29	15 pF, ±5%, 50V
C0107,0108	21–13741B69	.1 uF, ±5%, 50V
C0109	08–11051A13	.1 uF, ±5%, 63V
C0110	08–11051A19	1 uF, ±5%, 63V
C0111	08–11051A09	.022 uF, ±5%, 63V
C0113	08–11051A13	.1 uF, ±5%, 63V
C0114	21–13740B73	.001 uF, ±5%, 50V
C0115	21–13741B45	.01 uF, ±5%, 50V
C0116,0117	21–13740B73	.001 uF, ±5%, 50V
C0118	21–13740B29	15 pF, ±5%, 50V
C0119,0120	21–13740B73	.001 uF, ±5%, 50V
C0121	21–13740B29	15 pF, ±5%, 50V
C0151	21–13740B73	.001 uF, ±5%, 50V
C0152	21–13740B50	110 pF, ±5%, 50V
C0154	21–13741B45	.01 uF, ±5%, 50V
C0155,0156	21–13740B55	180 pF, ±5%, 50V
C0157	21–13741B45	.01 uF, ±5%, 50V
C0158	08–11051A15	.22 uF, ±5%, 63V
C0159	21–13740B35	27 pF, ±5%, 50V
C0160	21–13740B29	15 pF, ±5%, 50V
C0161	21–13740B73	.001 uF, ±5%, 50V
C0162	23–11048B13	10 uF, ±20%, 16V, electrolytic
C0163	08–11051A17	.47 uF, ±5%, 63V
C0164	21–13741B69	.1 uF, ±5%, 50V
C0165	21–13740B73	.001 uF, ±5%, 50V
C0166–0168	21–13740B49	100 pF, ±5%, 50V
C0176	21–13740B73	.001 uF, ±5%, 50V
C0201	23–11048B13	10 uF, ±20%, 16V, electrolytic
C0205	21–13741B49	.015 uF, ±5%, 50V
C0206	21–13740B27	12 pF, ±5%, 50V
C0207	21–13740B29	15 pF, ±5%, 50V
C0208	21–13740B27	12 pF, ±5%, 50V
C0209	21–13740B23	8.2 pF, ±5%, 50V
C0210–212	21–13740B73	.001 uF, ±5%, 50V
C0213	21–13740B19	5.6 pF, ±5%, 50V
C0214	21–13740B13	3.3 pF, ±5%, 50V
C0215	21–13740B73	.001 uF, ±5%, 50V
C0216	21–13740B47	82 pF, ±5%, 50V

MXW–7404–O (2)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C0218	21–13741B45	.01 uF, ±5%, 50V
C0219	21–13740B13	3.3 pF, ±5%, 50V
C0220	21–13740B73	.001 uF, ±5%, 50V
C0221	21–13740B05	1.5 pF, ±5%, 50V
C0222	21–13741B45	.01 uF, ±5%, 50V
C0223	21–13740B13	3.3 pF, ±5%, 50V
C0224,0225	21–13740B73	.001 uF, ±5%, 50V
C0228	21–13741B45	.01 uF, ±5%, 50V
C0229,0230	21–13740B05	1.5 pF, ±5%, 50V
C0231	21–13740B38	36 pF, ±5%, 50V
C0233	21–13740B37	33 pF, ±5%, 50V
C0234	21–13740B29	15 pF, ±5%, 50V
C0235,0236	21–13740B23	8.2 pF, ±5%, 50V
C0237–0239	21–13740B73	.001 uF, ±5%, 50V
C0240	21–13740B13	3.3 pF, ±5%, 50V
C0241	21–13740B19	5.6 pF, ±5%, 50V
C0242	21–13740B73	.001 uF, ±5%, 50V
C0243	21–13740B47	82 pF, ±5%, 50V
C0245	21–13740B73	.001 uF, ±5%, 50V
C0246	21–13740B13	3.3 pF, ±5%, 50V
C0247	21–13740B73	.001 uF, ±5%, 50V
C0248	21–13740B05	1.5 pF, ±5%, 50V
C0249	21–13741B45	.01 uF, ±5%, 50V
C0250	21–13740B17	4.7 pF, ±5%, 50V
C0251,0252	21–13740B73	.001 uF, ±5%, 50V
C0253	21–13740B29	15 pF, ±5%, 50V
C0276	21–13741B45	.01 uF, ±5%, 50V
C0277,0278	23–11048B19	47 uF, ±20%, 16V, electrolytic
C0301	21–13741B45	.01 uF, ±5%, 50V
diode (see note)		
CR0001	48–80236E16	Schottky
CR002	48–80154K03	Schottky
CR0051	48–83654H01	silicon
CR0101,0102	48–83654H01	silicon
CR0151,0152	48–80006E10	silicon
CR0153,0154	48–83654H01	silicon
CR0176	48–83654H02	silicon
CR0202–0205	48–80006E10	silicon
CR0206,0207	48–84616A01	hot carrier
CR0209–0213	48–80006E10	silicon
CR0214,0215	48–84616A01	hot carrier
filter		
FL0051	91–80097D06	6 element, ceramic
FL0052	91–80098D06	3 wire, ceramic
connector receptacle		
J0004,0005	09–80135M01	2 pin coax
J0006	09–80130M03	14 position socket
RF coil		
L0001–0007	24–80148M06	82 nH, 4.5 turns
L0008	24–80063M14	1.2 uH
L0051,0052	24–80063M09	.47 uH
L0053	24–80063M04	.18 uH
L0054	24–80063M21	4.7 uH
L0055	24–80164M02	1.8 turns, variable
L0056	24–80164M01	1:6 ratio, variable
L0057	24–80164M04	5.2 turns, variable
L0058	24–80063M21	4.7 uH
L0059	24–80164M03	4.3 turns, variable
L0060	24–80063M14	1.2 uH
L0061	25–80000E01	transmformer
L0101	24–80063M14	1.2 uH
L0102	24–11030B09	4.5 turns, brown
L0151	24–80299D01	17.75 turns, orange
L0152	24–80063M22	5.6 uH
L0202	24–80148M05	62 nH, 3.5 turns
L0203	24–80063M14	1.2 uH
L0204	24–11030B08	4.5 turns, brown
L0205–0207	24–80063M14	1.2 uH
L0208	24–11030B09	4.5 turns, brown
L0209	24–80063M14	1.2 uH
L0210	24–11030B12	7.5 turns, yellow
L0211	24–80063M14	1.2 uH
L0213	24–80148M08	82 nH, 4.5 turns
L0214	24–80063M14	1.2 uH
L0215	24–11030B12	7.5 turns, yellow
L0216–0218	24–80063M14	1.2 uH
L0219	24–11030B09	4.5 turns, brown
L0220	24–80063M14	1.2 uH
L0221	24–11030B14	9.5 turns, blue
L0222	24–80063M14	1.2 uH
transistor (see note)		
Q0001	48–80182D44	NPN
Q0002	48–00869643	N–channel
Q0051,0052	48–00869839	NPN
Q0053	48–00869642	NPN
Q0101	48–00869643	PNP
Q0102,0103	48–80182D20	NPN

MXW–7404–O (3)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R0053	06–11077A88	3.9k
Q0104	48–00869643	PNP
Q0105,0106	48–00869642	NPN
Q0107	48–00869658	NPN
Q0151	48–00869658	NPN
Q0152	48–00869643	PNP
Q0203	48–00869839	N–channel
Q0204,0205	48–00869658	NPN
Q0206	48–00869839	NPN
Q0207,0208	48–00869658	NPN
Q0276	48–00869642	NPN
Q0277–0279	48–00869643	PNP
resistor, fixed, ohm, ±5%, 1/8 watt (unless otherwise stated)		
R0001,0002	06–11077A30	15
R0003	06–11077A66	470
R0004	06–11077A84	2.7k
R0005	06–11077A46	68
R0006	06–11077A86	3.3k
R0007	06–11077B03	15k
R0051	06–11077A43	51
R0052	06–11077A54	150
R0054	06–11077A54	150
R0056	06–11077B45	820k
R0057	06–11077A72	820
R0058	06–11077B31	220k
R0059	06–11077B27	150k
R0060	18–05500L08	22k, +20%, potentiometer
R0061	06–11077B19	68k
R0062	06–11077B09	27k
R0063	06–11077B21	82k
R0102	06–11077A62	330
R0103,0104	06–11077A98	10k
R0105	06–11077B11	33k
R0106	06–11077A74	1k
R0107	06–11077A78	1.5k
R0108,0109	06–11077A26	10
R0110	06–11077B03	15k
R0111	06–11077A72	820
R0112	06–11077A86	3.3k
R0113	06–11077A74	1k
R0114	06–11077A72	820
R0115	06–11077A70	680
R0116	06–11077A92	5.6k
R0118	06–11077A70	680
R0119	06–11077A90	4.7k
R0120,0121	06–11077A88	3.9k
R0122	06–11077A43	51
R0123	06–11077A50	100
R0124	06–11077A84	2.7k
R0125	06–11077A72	820
R0151	06–11077B15	47k
R0152	06–11077B11	33k
R0153	06–11077B15	47k
R0154	06–11077A34	22
R0155	06–11077A98	10k
R0156	06–11077B03	15k
R0157	06–11077A78	1.5k
R0158,0159	06–11077A74	1k
R0161	06–11077A98	10k
R0163	06–11077B07	22k
R0164	18–05500L08	22k, ±20%, potentiometer
R0165	06–11077B09	27k
R0176	06–11077G26	22.6k, ±1%
R0177	06–11077G28	23.7k, ±1%
R0178,0179	06–11077F91	10k, ±1%
R0180	06–11077G52	42.2k, ±1%
R0181	06–11077F91	10k, ±1%
R0182	06–11077G28	23.7k, ±1%
R0207,0208	06–11077A44	56
R0209	06–11077A52	120
R0210	06–11077A01	0 ohm
R0211	06–11077A98	10k
R0212	06–11077A84	2.7k
R0213	06–11077A72	820
R0214	06–11077A50	100
R0215	06–11077A84	2.7k
R0216	06–11077A72	820
R0217	06–11077A42	47
R0218	06–11077A50	100
R0219	06–11077A46	68
R0220	06–11077A50	100
R0222	06–11077A84	2.7k
R0223	06–11077B09	27k
R0224	06–11077B23	100k
R0225	06–11077B09	27k
R0226,0227	06–11077A44	56
R0228	06–11077A50	100
R0229	06–11077A01	0 ohm
R0230	06–11077A98	10k

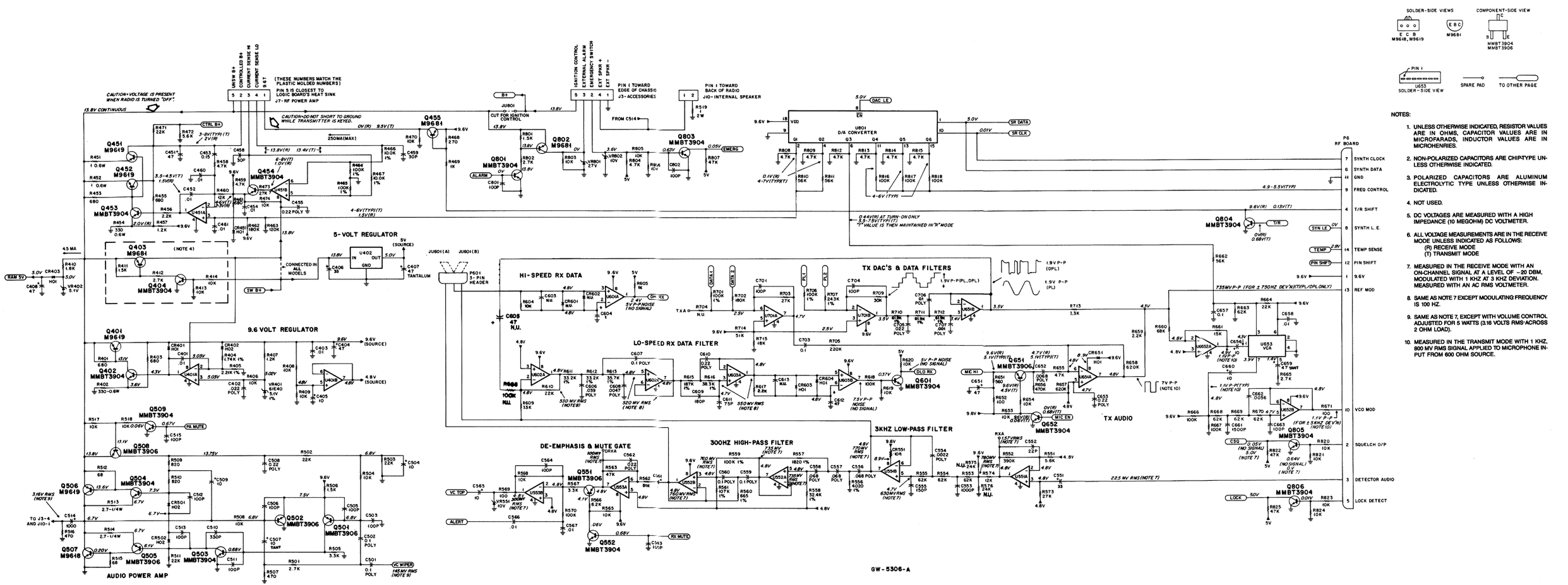
MXW–7404–O (4)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R0231	06–11077A84	2.7k
R0232	06–11077A72	820
R0233	06–11077A50	100
R0234	06–11077A84	2.7k
R0235	06–11077A72	820
R0236	06–11077A42	47
R0237	06–11077A66	470
R0238	06–11077A28	12
R0239	06–11077A66	470
R0241	06–11077B23	100k
R0276	06–11077A98	10k
R0277	06–11077A60	270
R0278	06–11077A26	10
R0279	06–11077A90	4.7k
R0280	06–11077A98	10k
R0281	06–11077A90	4.7k
transformer		
T0001,0002	25–80163M02	500 MHz balance transformer
integrated circuits (see note)		
U0051	51–05479G05	linear
U0101	51–84704M75	synthesizer
U0102	51–84810F66	dual divider
U0176	51–84621K89	dual opamp
crystal (see note)		
Y0051	91–80022M02	45.1 MHz
Y0052	48–80008K02	44.645 MHz
Y0151	48–80174D05	14.4 MHz
non–referenced parts		
	14–05160A01	insulator
M0201–0211	26–80098M01	coil can shield
	26–80097M01	coil can shield
M0004	26–80228L01	coax connector shield
M0005	26–80228L01	coax connector shield
M0002	26–80229L03	VCO shield
M4016	26–80256L02	coax connector bottom shield
	30–10286A72	24 strand wire, white
	54–80111F01	PROM label
	75–05295B07	crystal base pad, 2 used
	84–80927T01	circuit board

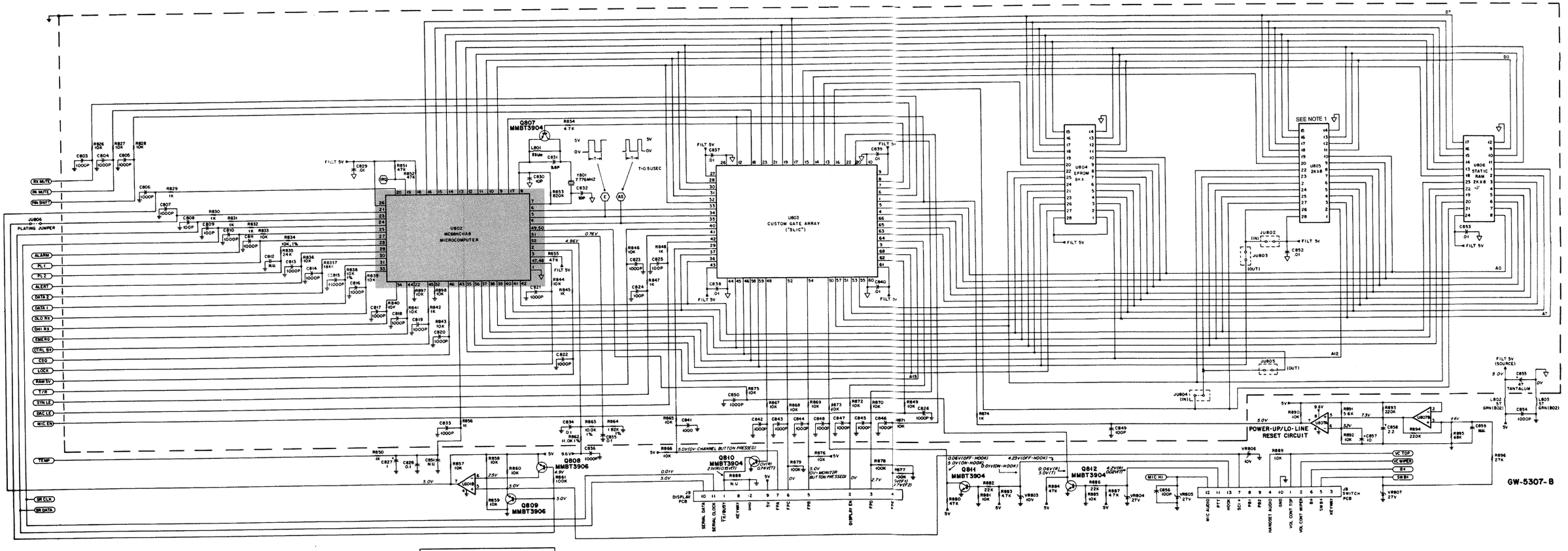
2/28/90

note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

Schematic, Circuit Board Diagrams, and Parts List for HLD4322B VHF RF Board
PW–7576–O
(Sheet 3 of 3)
3/31/90



Schematics, Circuit Board Diagrams, and
Parts List for Logic Board
PW–5285–D
(Sheet 1 of 4)
5/15/89

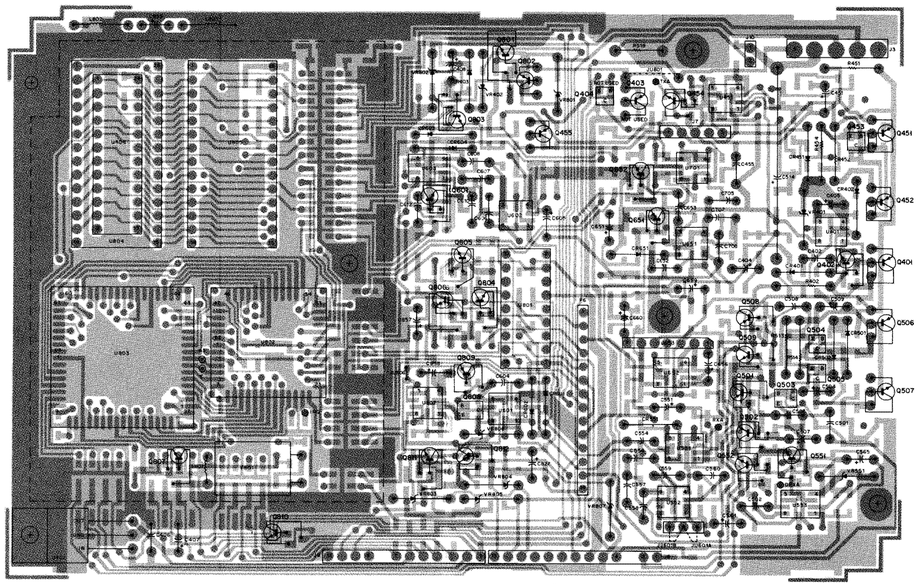


IMPORTANT

COMPONENTS WITHIN SHADED AREA ARE NOT FIELD-SERVICEABLE. IF SERVICING IS REQUIRED, THE ENTIRE BOARD MUST BE REPLACED.

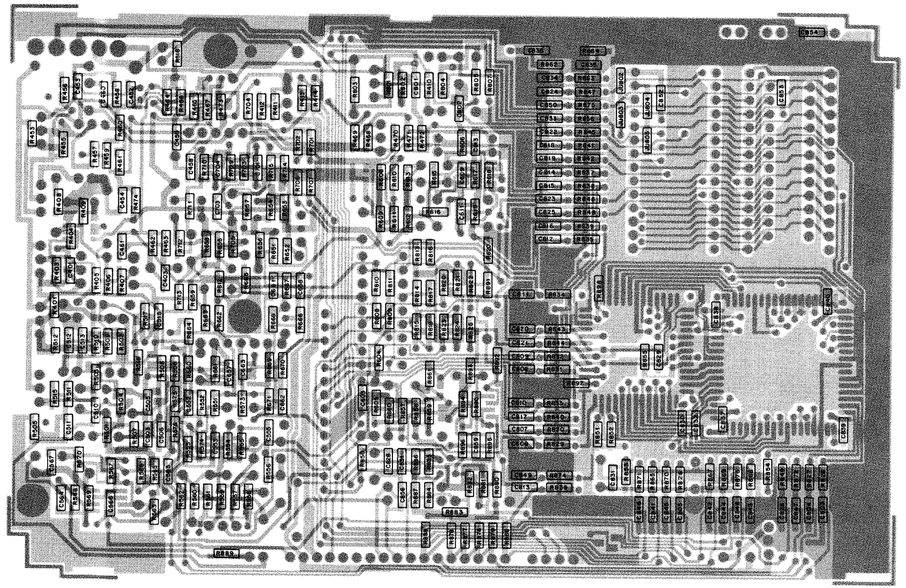
NOTE 1: EARLY MODEL USE 2K8 NOVRAM.
LATE MODELS USE 2K8 EEPROM.

Schematics, Circuit Board Diagrams, and
Parts List for Logic Board
PW–5285–D
(Sheet 2 of 4)
5/15/89



COMPONENT SIDE GW-5299-0
SOLDER SIDE GW-5298-0
OVERLAY — GW-5300-A

SHOWN FROM COMPONENT SIDE



COMPONENT SIDE GW-5302-0
SOLDER SIDE GW-5301-0
OVERLAY — GW-5303-0

SHOWN FROM SOLDER SIDE

Schematics, Circuit Board Diagrams, and
Parts List for Logic Board
PW-5285-D
(Sheet 3 of 4)
5/15/89

parts list

HLN5402A Logic Board — MXW–5310–D

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
capacitor, fixed, pF, ±5%, 50V (unless otherwise indicated)		
C401	21–13741B45	0.01 uF, ±10%
C402	08–11051A09	0.022 uF, 63V
C403	21–13741B45	0.01 uF, ±10%
C404	23–11048B19	47 uF, ±20%, 16V, electrolytic
C405	23–11048B13	10 uF, ±20%, 16V, electrolytic
C406	23–11048A17	33 uF, ±20%, 16V, electrolytic
C407	23–11013A56	47 uF, ±20%, 6V, tantalum
C408	23–11048B19	47 uF, ±20%, 16V, electrolytic
C451	23–11048B19	47 uF, ±20%, 16V, electrolytic
C452	21–13741B45	0.01 uF, ±10%
C453	21–13741B69	0.1 uF, ±80–20%
C454	21–13741B45	0.01 uF, ±10%
C455	08–11051A15	0.22 uF, 63V
C458,459	21–13740B36	30
C460,461	21–13741B45	0.01 uF, ±10%
C501,502	08–11051A13	0.1 uF, 63V
C503	21–13740B49	100
C504	23–11048B13	10 uF, ±20%, 16V, electrolytic
C505,506	21–13740B49	100
C507	23–11013D13	10 uF, ±10%, 20V, tantalum
C508	08–11051A15	0.22 uF, 63V
C509	23–11048B13	10 uF, ±20%, 16V, electrolytic
C510	21–13740B61	330
C511–513	21–13740B49	100
C514	23–02308M01	1000 uF, ±20%, 16V, electrolytic
C515	21–13740B49	100
C551	23–11048A17	33 uF, ±20%, 16V, electrolytic
C552	21–13740B33	22
C553	21–13740B73	1000
C554	08–11051A03	0.0022 uF, 63V
C555	21–13740B53	150
C556–558	08–11051A12	0.068 uF, 63V
C559,560	08–11051A13	0.1 uF, 63V
C561	23–11048B05	1 uF, ±20%, electrolytic
C562	08–11051A09	0.022 uF, 63V
C563,564	21–13740B49	100
C565	23–11048B13	10 uF ±20%, 16V, electrolytic
C566,567	21–13741B45	0.01 uF, ±10%
C604	23–11048B05	1 uF, ±20%, electrolytic
C606	08–11044A22	0.039 uF, 63V
C607	08–11051A13	0.1 uF, 63V
C608	08–11051A05	0.0047 uF, 63V
C609	21–13740B55	180
C610	08–11051A15	0.22 uF, 63V
C611	21–13740B46	75
C612	23–11048B19	47 uF, ±20%, 16V, electrolytic
C651	23–11048B19	47 uF, ±20%, 16V, electrolytic
C652	08–11051A06	0.0068 uF, 63V
C653	08–11051A15	0.22 uF, 63V
C656	23–11048B13	10 uF, ±20%, 16V, electrolytic
C657	21–13741B69	0.1 uF, ±80–20%
C658	21–13741B45	0.01 uF, ±10%
C659	23–11013A56	47 uF, ±20%, 6V, tantalum
C660	23–11048B13	10 uF, ±20%, 16V, electrolytic
C661	21–13740B76	1500
C662	21–13741B39	0.0056
C663	21–13740B49	100
C701	21–13740B78	1800
C703	21–13741B69	0.1 uF, ±80–20%
C704	21–13740B49	100
C705	08–11051A09	0.022 uF, 63V
C706	08–11051A13	0.1 uF, 63V
C707	08–11051A01	0.001 uF, 63V
C801,802	21–13740B49	100
C803–807	21–13740B73	1000
C808,809	21–13740B49	100
C810,811	21–13740B73	1000
C813–823	21–13740B73	1000
C824,825	21–13740B49	100
C826	21–13740B73	1000
C827	23–11048B05	1 uF, ±20%, electrolytic
C828	21–13741B69	0.1 uF, ±80–20%
C829	21–13741B45	0.01 uF, ±10%
C830	21–13740B25	10, ±.5 pF
C831	21–11031F10	5.6, ±.5 pF
C832	21–13740B25	10, ±.5 pF
C833	21–13740B73	1000
C834,835	21–13741B69	0.1 uF, ±80–20%
C836	21–13740B73	1000
C837–840	21–13741B45	0.01 uF, ±10%
C841–848	21–13740B73	1000
C849	21–13740B49	100
C850	21–13740B73	1000
C852,853	21–13741B45	0.01 uF, ±10%
C854	21–13740B73	1000
C855	23–11054A09	47 uF, ±20%, 6V, tantalum
C856	21–13740B49	100
C857	23–11048B13	10 uF, +20%, 16V, electrolytic
C858	08–11051A15	0.22 uF, 63V
C868	21–13740B49	100
diode (see note)		
CR401	48–83654H01	silicon
CR402	48–83654H02	silicon
CR403	48–83654H01	silicon
CR451	48–83654H01	silicon
CR501,502	48–83654H02	silicon
CR551	06–11009B23	jumper resistor
CR603	48–83654H01	silicon

MXW–5310–D (2)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
CR604	48–83654H01	silicon
CR651	48–83654H01	silicon
connector, receptacle		
J3	28–80129M01	5–pin, accessories
J7	28–80128M01	5–pin, RF power amplifier
J8	28–80126M01	23–pin
J10	28–80128M02	2–pin, internal speaker jumper
J601	09–84181L01	2–pin push–on
J801	06–11009B23	0–ohm resistor
J802	06–11024B23	0–ohm resistor
J804	06–11024B23	0–ohm resistor
coil		
L801	24–82723H35	23 uH
L802,803	24–83961B02	5 turns, green
connector, plug		
P6	28–80127M02	14–pin, RF board
P601	28–80250B02	3–pin, for JU601
transistor (see note)		
Q401	48–00869619	PNP
Q402	48–80214G02	NPN
Q451,452	48–00869619	PNP
Q453,454	48–80214G02	NPN
Q455	48–11043C10	PNP
Q501,502	48–05128M16	PNP
Q503,504	48–80214G02	NPN
Q505	48–05128M16	PNP
Q506	48–00869619	PNP
Q507	48–00869618	NPN
Q508	48–05128M16	PNP
Q509	48–80214G02	NPN
Q551	48–05128M16	PNP
Q552	48–80214G02	NPN
Q601	48–80214G02	NPN
Q651	48–05128M16	PNP
Q652	48–80214G02	NPN
Q801	48–80214G02	NPN
Q802	48–11043C10	PNP
Q803–807	48–80214G02	NPN
Q808,809	48–05128M16	PNP
Q810–812	48–80214G02	NPN
resistor, fixed, ohm, +5%, 1/8 watt (unless otherwise specified)		
R401	06–11077A70	680
R402	06–02369M31	330, 0.6W, metal film
R403	06–11077A70	680
R404	06–11077F18	1.74k, ±1%
R405	06–11077F28	2.21k, ±1%
R406	06–11077A98	10k
R407	06–11077A76	1.2k
R408,409	06–11077A98	10k
R410	06–11077A80	1.8k
R451,452	06–02369M01	1, 0.6W, metal film
R453	06–11077A70	680
R454	06–02369M31	330, 0.6W, metal film
R455	06–11077A70	680
R456	06–11077A82	2.2k
R457	06–11077A76	1.2k
R458,459	06–11077A90	4.7k
R460	06–11077B01	12k
R461	06–11077A70	680
R462	06–11077B29	180k
R463	06–11077B25	120k
R464,465	06–11077G88	100k, ±1%
R466,467	06–11077F91	10k, ±1%
R468	06–11077A60	270
R469	06–11077A74	1k
R470	06–11077A98	10k
R471	06–11077B07	22k
R472	06–11077A92	5.6k
R473	06–11077B09	27k
R474	06–11077A98	10k
R501	06–11077A84	2.7k
R502,503	06–11077B07	22k
R504	06–11077A98	10k
R505	06–11077A86	3.3k
R506	06–11077A78	1.5k
R507	06–11077A66	470
R508	06–11077A98	10k
R509,510	06–11077A72	820
R511	06–11077B07	22k
R512	06–11077A46	68
R513,514	06–11009B23	2.7, 1/4W, carbon
R515	06–11077A46	68
R516	06–11077A66	470
R517,518	06–11077A98	10k
R519	06–80185M01	1, 2W, metal plate
R551	06–11077B01	12k
R552	06–11077B37	390k
R553	06–11077B19	68k
R554–555	06–11077B18	62k
R556	06–11077F53	4.02k, ±1%
R557	06–11077F20	1.82k, ±1%
R558	06–11077G41	32.4k, ±1%
R559	06–11077G88	100k, ±1%
R560	06–11077E77	665, ±1%
R561	06–11077G91	107k, ±1%
R562	06–11077B11	33k
R563	06–11077B15	47k

MXW–5310–D (3)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R565	06–11077A98	10k
R566	06–11077A96	8.2k
R567	06–11077A86	3.3k
R568	06–11077A98	10k
R569	06–11077A42	47
R570	06–11077B17	56k
R573	06–11077B09	27k
R574	06–11077A01	0
R604	06–11077A98	10k
R605	06–11077A74	1k
R609	06–11077B11	33k
R610	06–11077B07	22k
R611,612	06–11077G42	33.2k, ±1%
R613	06–11077G45	35.7k, ±1%
R615	06–11024J15	187k, ±1%
R616	06–11077G48	38.3k, ±1%
R617	06–11077A82	2.2k
R618	06–11077B23	100k
R619,620	06–11077A98	10k
R651	06–11077A68	560
R652	06–11077A50	100
R653,654	06–11077A98	10k
R655	06–11077A90	4.7k
R656	06–11077B39	470k
R657	06–11077B42	620k
R658	06–11077H65	619k
R659	06–11077A82	2.2k
R660	06–11077B19	68k
R661	06–11077B03	15k
R662	06–11077B17	56k
R663	06–11077B18	62k
R664	06–11077B07	22k
R665	06–11077A84	2.7k
R666,667	06–11077B23	100k
R668–670	06–11077B18	62k
R671	06–11077A50	100
R701	06–11077G88	100k, ±1%
R702	06–11077H13	178k
R703	06–11077G31	25.5k
R705	06–11077H13	178k
R706	06–11077G88	100k, ±1%
R707	06–11024J26	243k, ±1%
R709	06–11077B10	30k
R710–712	06–11077G68	61.9k, ±1%
R713	06–11077A86	3.3k
R714	06–11077B16	51k
R715	06–11077B05	18k
R801	06–11077A78	1.5k
R802	06–11077A84	2.7k
R803	06–11077A98	10k
R804	06–11077A90	4.7k
R805,806	06–11077A98	10k
R807	06–11077B15	47K
R808,809	06–11077A90	4.7k
R810,811	06–11077B17	56k
R812–815	06–11077A90	4.7k
R816–818	06–11077B23	100k
R820,821	06–11077A98	10k
R822	06–11077B15	47k
R823,824	06–11077A98	10k
R825	06–11077B15	47k
R826–828	06–11077A98	10k
R829–832	06–11077A74	1k
R833	06–11077A98	10k
R834	06–11077F91	10k, ±1%
R835	06–11077B08	24k
R836	06–11077A98	10k
R837	06–11077B05	18k
R838	06–11077F91	10k, ±1%
R839–841	06–11077A98	10k
R842	06–11077A74	1k
R843,844	06–11077A98	10k
R845	06–11077A74	1k
R846	06–11077A98	10k
R847,848	06–11077A74	1k
R849	06–11077A98	10k
R850	06–11077A74	1k
R851,852	06–11077B15	47k
R853	06–11077B45	820k
R854	06–11077A90	4.7k
R855	06–11077B15	47k
R856	06–11077A74	1k
R857–860	06–11077A98	10k
R861	06–11077B23	100k
R862	06–11077F95	11k, ±1%
R863	06–11077F91	10k, ±1%
R864	06–11077F20	1.82k, ±1%
R865–873	06–11077A98	10k
R874	06–11077A74	1k
R875,876	06–11077A98	10k
R877–879	06–11077B23	100k
R880	06–11077B15	47k
R881	06–11077A98	10k
R882	06–11077B07	22k
R883	06–11077A90	4.7k
R884	06–11077B15	47k
R885	06–11077A98	10k
R886	06–11077B07	22k
R887	06–11077A90	4.7k
R889,890	06–11077A98	10k

MXW–5310–D (4)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R891	06–11077A92	5.6k
R892	06–11077A98	10k
R893,894	06–11077B31	220k
R895	06–11077B19	68k
R896	06–11077B09	27k
R897,898	06–11077A98	10k
integrated circuit (see note)		
U401	51–80056M04	dual op–amp
U402	51–80068C06	regulator
U451	51–80056M04	dual op–amp
U551–553	51–80056M04	dual op–amp
U601	51–80056M01	dual comparator
U602,603	51–80056M04	dual op–amp
U651,652	51–80056M04	dual op–amp
U653	51–80059M01	voltage–controlled attenuator
U701	51–80056M04	dual op–amp
U801	51–80135C10	D/A converter
U802	51–80960T01	microcomputer
U803	51–82862N09	logic array
U804	51–99003D02	EPROM 8KX8
U805	51–80057M01	NOVRAM, 2KX8, early models
U805	51–80901W01	EEPROM, 2KX8, late models
U806	51–80914V01	static RAM, 2KX8
U807	51–80056M01	dual comparator
voltage regulators (see note)		
VR401	48–83461E40	zener, 5.1V
VR402	48–82256C15	zener, 5.1V
VR551	48–82256C11	zener, 10V
VR801	48–82256C20	zener, 27V
VR802,803	48–82256C11	zener, 10V
VR804,805	48–82256C20	zener, 27V
VR806	48–82256C11	zener, 10V
VR807	48–82256C20	zener, 27V
crystal (see nore)		
Y151	48–80173D09	7.776 MHz

non–referenced items

	03–10943M04	screw, M2.5 X 8 (5 used)
	04–00001718	washer (4 used)
	07–80925T01	bracket, heat sink
	09–82071K09	14–pin socket (2 used)
	14–80145M01	insulator, accessory
	14–82369E13	insulator, accessory connector
	14–83820M05	insulator, head conductive
	15–80076M01	plastic housing
	26–80123M01	shield frame, high speed logic
	26–80125L02	heat sink, audio/regulator
	42–80940T01	ring, retaining

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note: For best performance, order diodes, transistors, and integrated circuit devices by Motorola part number.

END OF DOCUMENT

Schematics, Circuit Board Diagrams, and Parts List for Logic Board
PW–5285–D
(Sheet 4 of 4)
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