1. General Description

1.1 Most major functional blocks of the *SYNTOR X* radio are controlled directly by the microcomputer system. This system also performs the functions that give the radio the PL/DPL encode/decode, *Channel Scan*, and time-out timer options. A single-chip, eight-bit, 40-pin microcomputer is the heart of the system.

1.2 The system's circuits are on the HLN4915A personality board that also carries the receive audio circuits of the radio. These boards are accessible from the top of the radio. Instructions for disassembling the personality board, the memory module, and the I/O board are in the Maintenance and Troubleshooting Section of this manual.

2. Theory of Operation

2.1 INTRODUCTION

The microcomputer (U8) must have two major inputs in order to operate: a +5 V input voltage (V_{cc} at U8-40) and a clock source (CLOCK at U8-1 and U8-2). C10 and C11 filter the +5 V input voltage. The clock source is a 3.6000-MHz, fundamental-mode, parallel resonant quartz crystal that is connected, via U8-1 and U8-2, to the internal oscillator circuitry of the microcomputer. This arrangement permits a 2 V peak-to-peak (approximately) sinusoidal waveform to be generated at U8-2.

2.2 MEMORY MODULE

2.2.1 The microcomputer gets the information it needs for defining the operational characteristics of the radio from the memory module. This module is custom-programed at the factory in accordance with the customer's specifications. The mode label on the cover of the transmitter power amplifier shows how the module has been programed.

2.2.2 EEPROM

The memory module (HLN1125A) used in low-band *SYNTOR X* radios is designed around a 5-volt programable 2k-by-eight-bit Electrically Erasable Programable Read Only Memory (EEPROM). The EEPROM may be reprogramed at least 10,000 times. You can use either the Motorola Portable EEPROM Programer (Model Y1069A) or the R1800 or R1801A with version C software (RTL4801C) and adapter (RTL5815A) to program part or all of the EEPROM. Through this reprograming, you can add or change modes and options any time without buying a new memory module. Radios with 8, 16, and 32 modes all use the same module—which, however, can store as many as 64 modes.

2.2.3 The microcomputer accesses the memory module whenever it needs new programing information for controlling its operation. This information may, for example, have to do with a status change generated when the mode selector on the control head is set to a different position, or with the command to continue performing an internal program such as a channel scan.

2.2.4 The memory module is activated when the $\overline{\text{ENABLE}}$ signal at J99-21 goes low, and it stays activated as long as the signal is low. However, the microcomputer's access to the memory module is inhibited when the $\overline{\text{ENABLE}}$ signal switches to a high state. The memory module addresses (A0 through A9) go via Pins 16, 15, 14, 13, 12, 11, 10, 9, 2, and 1 of J99, whereas the data signals (D0 through D7) go via Pins 20, 19, 18, 17, 5, 6, 7, and 8 of J99.

2.2.5 L1800 and C1800 protect the plus-five-volt supply to the module from noise, and HY1800, a 3,500-ohm resistor network, pulls address lines A0 to A7 high when the radio is in standby. The output-

enable line, Pin 3 of P99, is grounded on the personality board. Q1800 acts as an inverter to keep the write-enable, $\overline{WE}$, pin high during radio operation to prevent initiation of a false write cycle to the EEPROM. During reprograming, OE is taken high, thereby activating $\overline{WE}$. Positioning JU2 selects the upper or lower half of memory in the EEPROM. In the power strobed version, HLN1125B, Q1801 is used as a switch to enable power to the EEPROM only when $\overline{CE}$ is active (low).

Note

The instruction manual shows the location of the memory module. The programer manuals contain instructions for programing the EEPROM and other important information.

2.4 MULTIPLEXER OUTPUT DATA LATCH (U2)

2.4.1 The additional input and output lines required by the microcomputer are supplied by the multiplexer output data latch (U2) and the input multiplexer (U3). U2, a CMOS device, supplies the audio control data and transmit power control. The address lines of U2 come out at U8-3, U8-4, and U8-5, whereas the programing data for U2 comes out at U8-6. An active-low latching pulse ($\overline{OUTPUT\ LATCH\ WRITE}$) comes out at U8-33 and goes to U2-4.

2.4.2 U2 sends the following signals: (a) ALERT TONE (U2-11); (b) PL/DPL FILTER SELECT (U2-12), routed to the I/O board to determine the filter input characteristics; (c) XMIT POWER CONTROL (U2-13), which, when held high, is a low-power output; (d) $\overline{PRIORITY\ SAMPLE\ MUTE}$ (U2-14), which controls the priority sample mute switch that gives fast response times during channel scan operation; and (e) $\overline{MUTE}$ (U2-15), which controls the standard audio mute shunt switch.

2.5 INPUT MULTIPLEXER (U3)

2.5.1 U3, a CMOS device, is an 8-bit-to-1-bit programable data selector that comprises the second portion of the microcomputer's I/O expander circuitry. U3 is controlled by three address lines (A0, A1, and A2) that go to U3-11, U3-12, and U3-13 from U8-3, U8-4, and U8-5, respectively. U3 has a single data output (U3-14) that goes to Pin 38 of the microcomputer [MUX INPUT DATA (INTERRUPT)].

2.5.2 U3 receives both internal and external signals as inputs. The external control signals, which come from the control cable, are protected by 10-kilohm resistors that form part of the hybrid-one (HY1) circuit. The input signals consist of: (a) SYN SYNC (synthesizer synchronism) line (U3-1); (b) SQUELCH TAIL line (U3-3) from the squelch circuitry, protected by pull-down resistor R22; (c) fast-responding, active-high CHANNEL ACTIVITY line (U3-4) from the squelch circuit, protected by pull-up resistor R21; (d) CHANNEL SCAN ENABLE line from the control head at J1-31, applied to U3-5; (e) PL/DPL DISABLE line from J1-32, applied to U3-6; and (f) DISPLAY ENABLE line from J1-33, applied to U3-7.

2.6 PTT LINE

The remaining signals brought in from the control cable to permit the radio to operate are the PTT line and the mode switch contents. The PTT line is applied to a dual opto-isolator (U1) via J1-4. U1 combines the PTT signal with the ignition battery line (PTT REF at J1-5) to send an $\overline{ISOLATED\ PTT}$ signal to U8-26. This active-low signal occurs only when both the PTT and ignition lines are active. In the absence of transmission, this signal is pulled to regulated 9.6 V by 47-kilohm resistor R4. (This circuit is also compatible with positive-ground operation.)

2.7 MODE SWITCHING

2.7.1 The mode switch setting inputs go to the microcomputer via four integrated devices (U4, U5, U6, and U7) wired to form 12 microcomputer-controlled bidirectional lines. These 12 bidirectional lines are arranged into two microcomputer-controlled arrays, one of four lines and the other of eight lines. The four-line array is connected to mode lines 9, 10, 11, and 12, whereas the eight-line array is connected to mode lines 1 through 8. U4 and U6 buffer the signals from the control head.

2.7.2 U4 and U6 each have one three-state control line for four of six buffers and a different three-state control line for the remaining two buffers. These CMOS buffers are of the non-inverting type. The U4 and U6 inputs are protected by 10-kilohm resistors when they are connected to mode lines 1 through 12. These protective resistors form part of hybrid circuits 2 through 4 (HY2 through HY4). Mode lines 1, 2, 3, 4, 9, and 10 are buffered by U4, whereas mode lines 5, 6, 7, 8, 11, and 12 are buffered by U6.

2.7.3 U5 and U7 allow mode lines 1 through 12 to drive the microcomputer to write data into latches in the control head. U5 and U7 (non-inverting, tri-stable hex buffer TTL devices) are so arranged that one three-state line controls four of the buffers and another three-state line controls the two remaining buffers. U5 controls mode lines 1, 2, 3, 4, 9, and 10, whereas U7 controls mode lines 5, 6, 7, 8, 11, and 12. Buffered mode lines 1 through 8 are connected to Pins 8 through 15 of the microcomputer, whereas buffered mode lines 9 through 12 are connected to Pins 22 through 25 of the microcomputer.

2.7.4 The three-state control lines for U4, U5, U6, and U7 are at Pins 34, 35, 36, and 37 of U8. The signal at U8-34 controls the input sections of U4 and U6 buffering mode lines 9 through 12; the signal U8-36 controls the input sections of U4 and U6 buffering mode lines 1 through 8; the signal at U8-35 controls the output sections of U5 and U7 buffering mode lines 9 through 12; the signal at U8-37 controls the output section of U5 and U7 buffering mode lines 1 through 8. The signal at U8-35 is also buffered by Q1, R2, and R3 and goes via J1-1 as a CONTROL HEAD STROBE signal to the control head.

2.7.5 Mode lines 9 through 12 of the bidirectional bus form an address system when the CONTROL HEAD STROBE signal is acting as chip enable and mode lines 1 through 8 are acting as a bidirectional data bus.

2.8 FREQUENCY SYNTHESIZER

The microcomputer programs the synthesizer divider (U602) to generate the correct operating carrier frequency for the radio. It does this by connecting three address lines between Pins 12, 13, and 14 of the microcomputer and Pins 7, 8, and 5 of P602 (SYN A0, SYN A1, and SYN A2). An active-low line ($\overline{\text{STROBE}}$) from U8-7 goes to the synthesizer via P601-4 to furnish a latching pulse for each programing data word to the synthesizer. This line is then inverted by Q7, R19, and R20 to become an active-high synthesizer strobe (SYN STROBE) line (at P601-4). There is a wired logic between the collector of Q7 and U8-31. Consequently, a high logic output occurs whenever the signal at U8-7 ($\overline{\text{STROBE}}$) is low and the signal at U8-31 (SYNTHESIZER ENABLE) is high. The SYN STROBE signal is sent to the synthesizer whenever it is being refreshed by the microcomputer system. This signal is also routed to the activity monitor circuit of the microcomputer.

2.9 MICROCOMPUTER ACTIVITY MONITOR

The microcomputer activity monitor circuit consists of U9 (a dual CMOS resettable monostable device) and associated resistors (R24 through R29), capacitors (C12 through C14), and diodes (CR3 through CR5). The SYN STROBE signal is applied to U9A-4 at intervals of not more than 10 milliseconds, thus resetting the monostable and keeping it reset. As long as the monostable is reset within its 33-millisecond time constant, its output at U9A-7 remains low, thus allowing the microcomputer to operate. If the strobe pulse is missed and the 33-millisecond time constant runs out, the monostable output switches to a high state, thus causing the second monostable (U9B) to enter into an oscillatory mode. Under such conditions, U9B generates a high for approximately 4.7 milliseconds. This signal, generated at U9B-9, goes to U8-39, where as an active-low $\overline{\text{RESET}}$ line it causes the microcomputer to reset and to start its operation all over again. The time constants are controlled by the following RC pairs: (a) R25/C12, 33 ms; (b) R28/C14, 4.7 ms; and (c) R27/R29/C13, 34.5 ms.

2.10 TRANSMITTER

The microcomputer gives the transmitter two control lines: $\overline{\text{KEYED 9.4 V ENABLE}}$ (U8-30) and XMIT PA ENABLE (U8-32). The keyed 9.4 V enable signal is activated when it switches to a low state. This signal is applied to the keyed 9.4 V switch circuit, which inverts the signal and applies a KEYED 9.4 V signal to P601-1 and J401-8. The 9.4 V switch circuit is a quasi Darlington circuit consisting of Q4 and Q3 and associated components. The XMIT PA ENABLE signal is generated at U8-32, buffered by the PA enable switch (Q5 and Q6 and associated components), and sent as an active-low signal ($\overline{\text{PA ENABLE}}$) to the power control circuitry in the common circuits board via J401-10. If the synthesizer is in the adapt mode, or the output of the microcomputer activity monitor circuit at U9-7 is high, R26, R14, and R15 buffer the signals from either device,thus causing the output of Q5 to go low and inhibit the PA ENABLE signal.

2.11 I/O BOARD

2.11.1 The I/O board performs the analog-to-digital and digital-to-analog signal conversion for the microcomputer system, and therefore has an analog-to-digital section and a digital-to-analog section.

2.11.2 The analog-to-digital section consists of a low-pass filter that acts on the detected audio (DET AUDIO) signal it receives from P51-4. This low-pass filter is controlled by the PL/DPL SELECT line that is routed via P51-1. In the PL state, the filter is a five-pole, half-dB ripple Chebyshev filter with a 245-Hz cutoff. In the DPL condition, it behaves like a three-pole Butterworth filter with a 140-Hz cutoff. The output of the low-pass filter is applied to the limiter circuit (U54 and associated components). The limiter circuit supplies a 0-to-5 V digital signal (REC PL/DPL) to Pin 27 of the microcomputer via P51-2.

2.11.3 The digital-to-analog section consists of a resistive lattice network that receives four digital signals from the microcomputer via P51-5, P51-6, P51-10, and P51-9 (PL3, PL2, PL1, and PL0, respectively). The digital-to-analog circuit sends its output to a three-pole Butterworth low-pass filter with a 300-Hz cutoff. The filter's output (XMIT PL/DPL) is forwarded to the IDC on the common circuits board via P51-11 and J401-3.

3. Troubleshooting Procedure

3.1 INTRODUCTION

Described below are the following maintenance procedures:

- microcomputer system troubleshooting procedure
- microcomputer (U8) troubleshooting procedure
- mode information troubleshooting procedure
- diagnostic aid mode procedure
- muting circuitry troubleshooting procedure

3.2 REQUIRED TEST EQUIPMENT

The following test equipment is required for these procedures:

- oscilloscope
- RF signal generator
- voltmeter
- test memory module

The Maintenance and Troubleshooting Section of this manual recommends specific types of test equipment.

3.3 MICROCOMPUTER SYSTEM TROUBLESHOOTING GUIDE

3.3.1 The microcomputer system troubleshooting charts on foldout pages at the end of this section describe procedures you should follow to solve four problems:

- no receive audio
- radio does not squelch
- no PL/DPL modulation output
- no (or low) RF output power

The foldout page also contains a troubleshooting chart for microcomputer U8, to be used in conjunction with the procedure described in Section 3.4, below.

Some of the procedures on these troubleshooting charts cite other charts, and the following list shows where these other charts are:

- synthesizer troubleshooting chart—in the Synthesizer Section of this manual
- squelch troubleshooting chart—in the Common Circuits Board Section of this manual
- audio troubleshooting—voltages and waveforms on the audio schematic diagram in the Microcomputer System Section of this manual
- microcomputer (U8) troubleshooting chart—on the foldout page at the end of this section
- IDC troubleshooting—IDC portion of the synthesizer troubleshooting chart
- power control troubleshooting chart—in the Transmitter Section of this manual
- mode information troubleshooting procedure—on the foldout page at the end of this section

3.3.2 The troubleshooting guide for the general system, Table 1 in the Maintenance and Troubleshooting Section of this manual, correlates the various troubleshooting charts and references with specific symptoms or problems.

3.4 MICROCOMPUTER (U8) TROUBLESHOOTING GUIDE

3.4.1 The troubleshooting chart for microcomputer U8 is on a foldout page at the end of this section of the manual. This chart cites several other charts and references, and the following list shows where they are:

- regulator troubleshooting procedure—in the Common Circuits Board Section of this manual
- synthesizer troubleshooting chart—in the Synthesizer Section of this manual
- mode information troubleshooting procedure—on the foldout page at the end of this section of the manual
- diagnostic aid mode chart—on the foldout page at the end of this section of the manual

3.4.2 Before starting the charted procedure for troubleshooting microcomputer U8, verify that the serial number of the memory module (excluding the suffixes) matches that of the radio. Symptoms of incorrect memory module information include the following:

(1) Synthesizer will not lock on one of more modes: the red LED indicator on the RF board stays lighted and the audio fails to unmute.

(2) Synthesizer locks on an RF frequency, but the audio will not unmute because of wrong PL or DPL information.

Note

If the radio is in a channel scan mode and does not detect channel activity, the LED indicator on the RF board will appear to remain lighted. If the synthesizer is operating properly, you can turn off the lock indicator by unsquelching the radio.

3.5 MODE INFORMATION TROUBLESHOOTING GUIDE

3.5.1 Introduction

3.5.1.1 The troubleshooting guide for either the general system, the microcomputer system, or microcomputer U8 can lead you to this troubleshooting procedure. By this point, you have established that the radio is receiving properly, but the microcomputer is apparently accessing the wrong block of mode information in the memory module. This would also result in an incorrect receive frequency unless, by chance, the two blocks of mode information are programed for the same receive frequency.

3.5.1.2 The problems may be caused by any one of the following conditions, listed in their order of priority:

(1) faulty cable interface IC's (U4, U5, U6, and U7)

(2) faulty cable wiring or faulty control head operation, causing incorrect reading of the mode switch by the microcomputer

(3) use of the wrong memory module

(4) faulty memory module

3.5.2 Faulty Cable Interface IC's

Check the cable interface IC's (U4, U5, U6, and U7) by following the flow chart for the diagnostic aid mode on the foldout page at the end of this section.

Note

This procedure assumes that the control group is the one described in 3.5.3.1, Case 1, below.

3.5.3 Faulty Cable Wiring or Faulty Control Head Operation

3.5.3.1 In this case, the mode information supplied to the microcomputer is presented to the cable-reading IC's (U4 and U6).

(1) The control group is a rotary mode-select (eight modes).

(2) The control group consists of an alternate control module with or without talk-around, but with eight-mode pushbutton operator mode-select option.

(3) The control group has a mode-select with scan lights option (all on a single printed circuit board).

(4) The control group is a rotary mode-select with 16 or more modes.

3.5.3.2 For Case 1, the mode information is presented to the radio when one and only one of the cable's 12 mode lines, connected to Pins 13, 17, 24, 25, 12, 16, 23, 29, 16, 19, 30, and 11 (Modes 1 through 12, respectively) of the radio front plug (J1), is grounded.

3.5.3.3 For Cases 2, 3, and 4, the mode information is represented to the radio in binary-encoded format on the lower six mode lines of the cable (Pins 13, 17, 24, 25, 12, and 16 of the radio front plug) with mode lines 7 and 8 (J1-23 and J-29) grounded.

3.5.3.4 In all cases, if the ordered options require the transmission of data, the mode information is placed on the twelve mode lines only when the microcomputer requests mode information by generating low-level voltage (approximately 0.2 V) on U8-34, thus turning Q1 off and driving the CONTROL HEAD STROBE line high (approximately 2.2 V) at J1-1. Data transmission required by options includes: (a) lights information other than mode, (b) switch banks addresses, and (c) data reading from options such as an operator-select coded squelch switch closure or an operator-select *Channel Scan* switch closure.

3.5.4 Wrong Memory Module

Check the serial number of the memory module against the serial number of the radio.

Note

If *Systems 90•S* options are purchased some time later than the *SYNTOR X* mobile radio, a new memory module may be required. The new module has a new suffix letter on its serial number. Versions of the memory module with earlier suffixes may no longer be usable once the newly purchased options have been wired into the system. The memory module shipped with the radio is coded for the proper operation of all the options that were ordered with the radio.

3.5.5 Faulty Memory Module

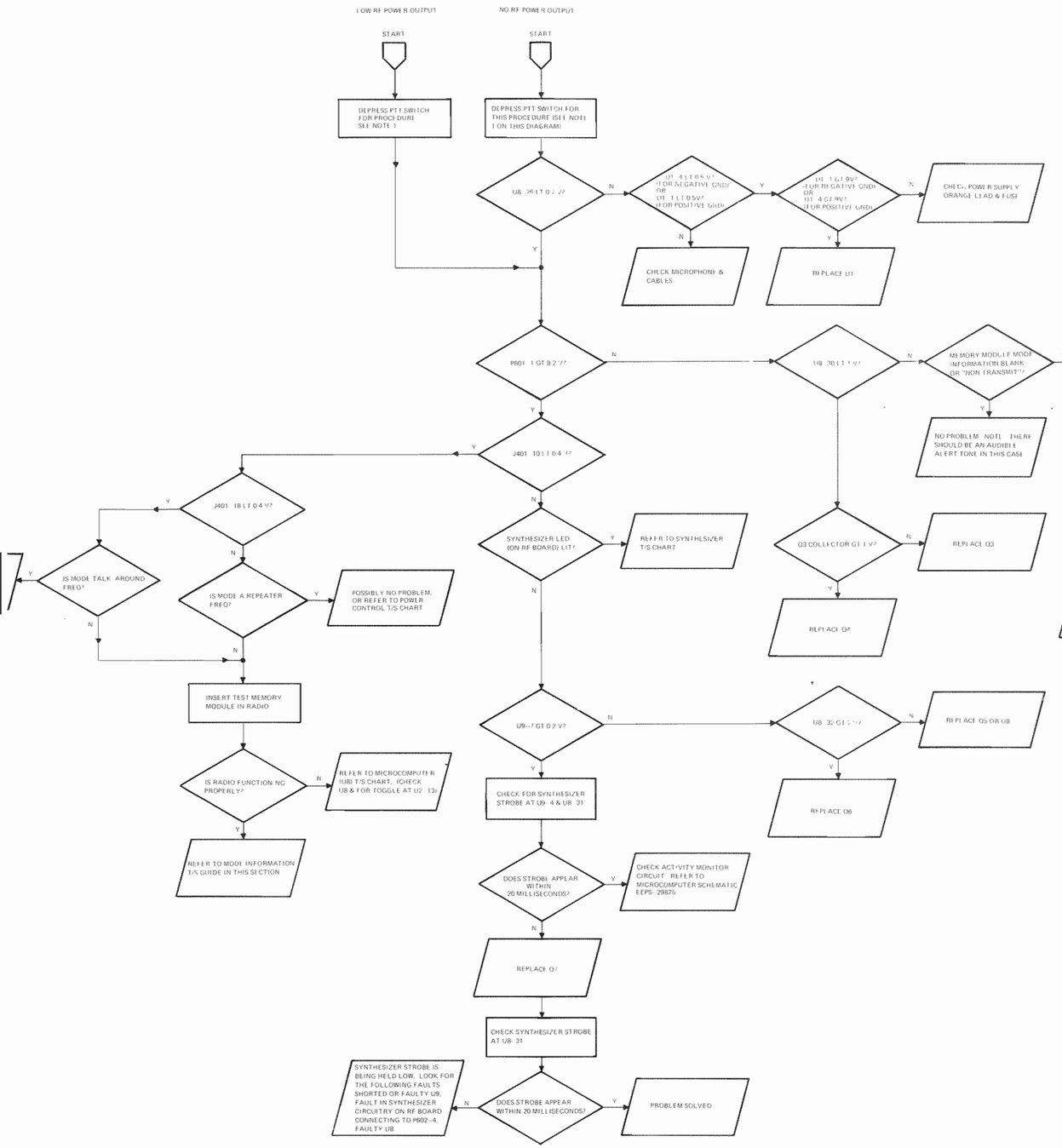
Buy a replacement memory module from an authorized Motorola representative. Since Motorola maintains a record of the information in all the memory modules sold, the company can supply a correctly programed replacement memory module even if the

customer cannot locate the original order information sheet. However, be sure to check Conditions 1 and 2 of 3.5.1.2, above, before assuming that the memory module is faulty. (See Faulty Cable Interface IC's and Faulty Cable Wiring or Faulty Control Head Option.)

3.6 DIAGNOSTIC AID MODE

The flow chart for the diagnostic aid mode is at the end of this section. The troubleshooting chart for microcomputer U8 and procedure for faulty cable interface IC's call for its use.

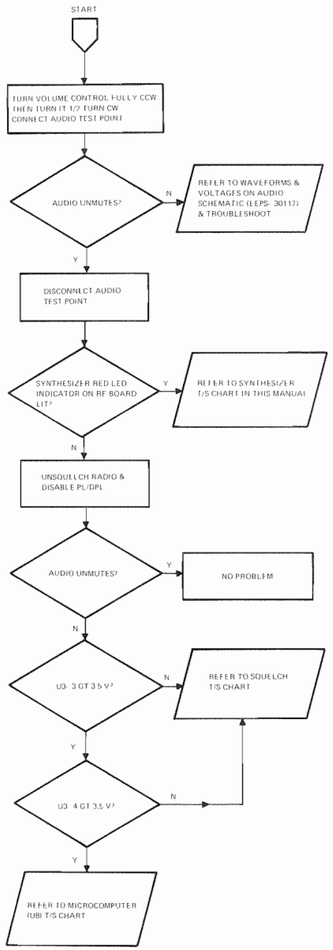
TROUBLESHOOTING CHARTS FOR THE MICROCOMPUTER SYSTEM



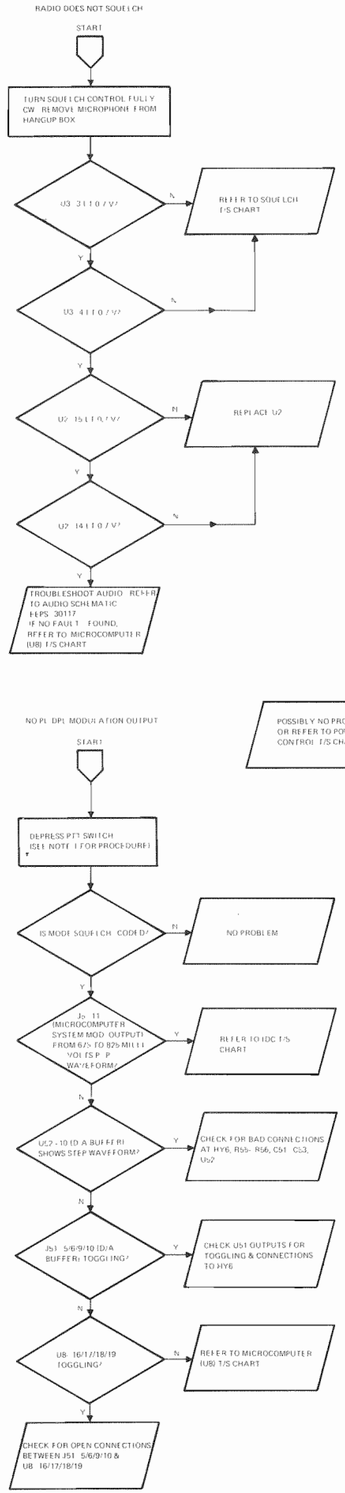
MICROCOMPUTER SYSTEM

Microcomputer System
Troubleshooting Chart
PDW-0780-A
5/16/84

NO RECEIVE AUDIO

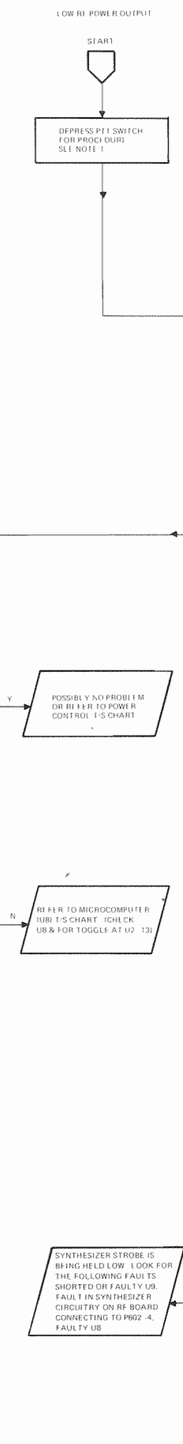


RADIO DOES NOT SQUELCH

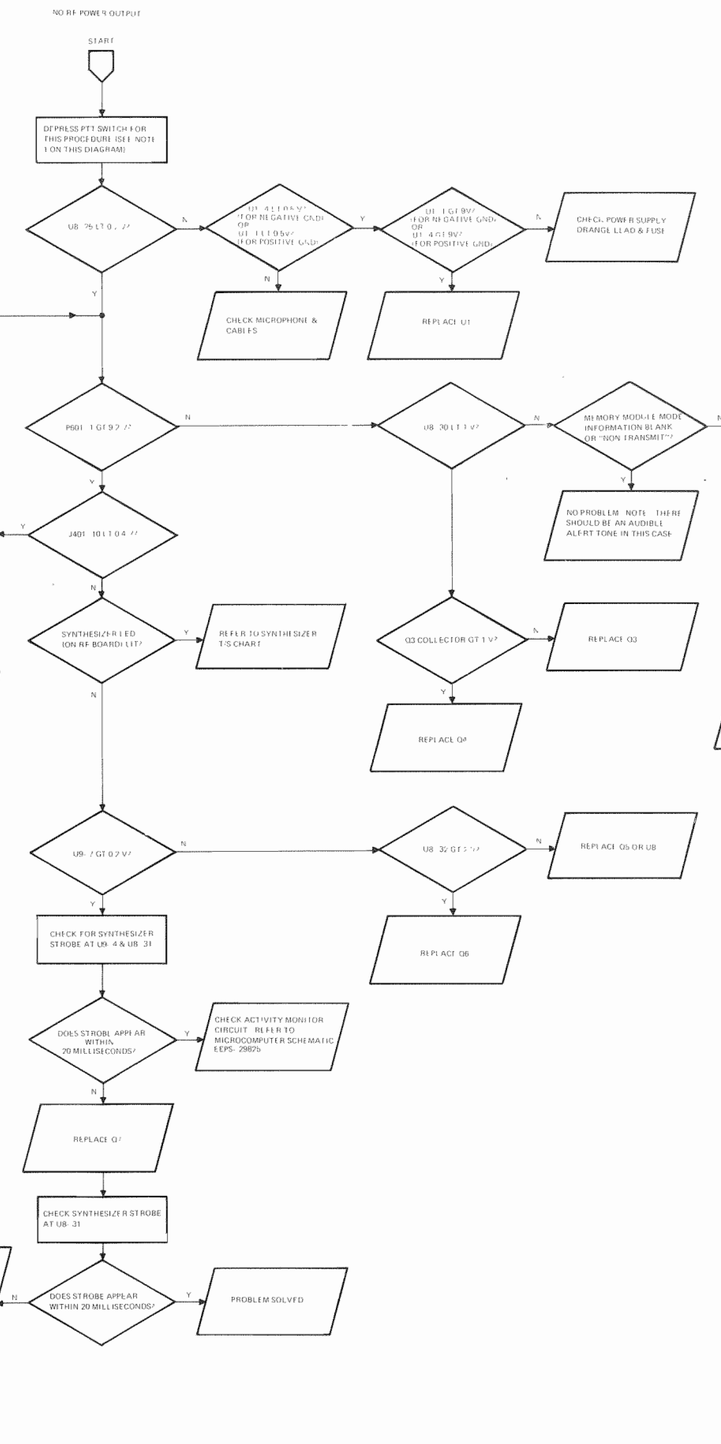


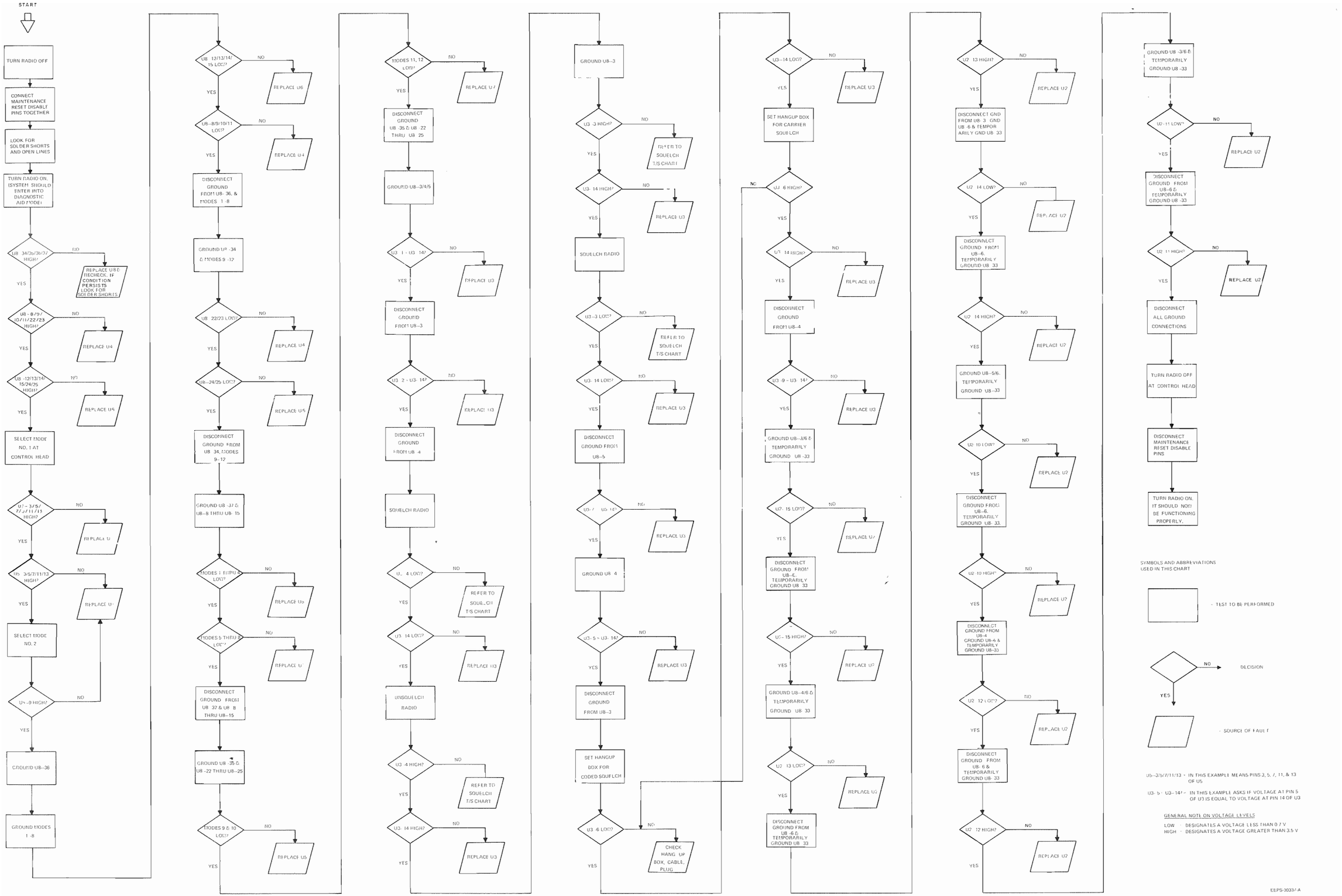
NO PL/DPL MODULATION OUTPUT

LOW RF POWER OUTPUT



NO RF POWER OUTPUT

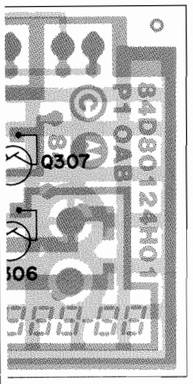



START
TURN RADIO OFF
CONNECT MAINTENANCE RESET DISABLE PINS TOGETHER
LOOK FOR SOLDER SHORTS AND OPEN LINES
TURN RADIO ON. (SYSTEM SHOULD ENTER INTO DIAGNOSTIC AID MODE)
U8 -34/35/36/37 HIGH?
NO
REPLACE U8. RECHECK. IF CONDITION PERSISTS LOOK FOR SOLDER SHORTS.
YES
U8 - 8/9/10/11/22/23 HIGH?
NO
REPLACE U4
YES
U8 -12/13/14/15/24/25 HIGH?
NO
REPLACE U5
YES
SELECT MODE NO. 1 AT CONTROL HEAD
U7 - 3/5/7/11/13 HIGH?
NO
REPLACE U7
YES
U5 -3/5/7/11/13 HIGH?
NO
REPLACE U5
YES
SELECT MODE NO. 2
U3 -9 HIGH?
NO
YES
GROUND U8--36
GROUND MODES 1 -8
U8 -12/13/14/15 LOW?
NO
REPLACE U6
YES
U8--8/9/10/11 LOW?
NO
REPLACE U4
YES
DISCONNECT GROUND FROM U8- 36, & MODES 1 -8
GROUND U8 -34 & MODES 9 -12
U8 -22/23 LOW?
NO
REPLACE U4
YES
U8--24/25 LOW?
NO
REPLACE U5
YES
DISCONNECT GROUND FROM U8 -34, CODES 9--12
GROUND U8 -37 & U8--8 THRU U8- 15
MODES 1 THRU 8 LOW?
NO
REPLACE U5
YES
MODES 5 THRU 8 LOW?
NO
REPLACE U7
YES
DISCONNECT GROUND FROM U8 -37 & U8 -8 THRU U8--15
GROUND U8 -35 & U8 -22 THRU U8--25
MODES 9 & 10 LOW?
NO
REPLACE U5
YES
MODES 11, 12 LOW?
NO
REPLACE U7
YES
DISCONNECT GROUND U8 -35 & U8 -22 THRU U8 -25
GROUND U8--3/4/5
U3 - 1 - U3 -14?
NO
REPLACE U3
YES
DISCONNECT GROUND FROM U8--3
U3 -2 - U3- 14?
NO
REPLACE U3
YES
DISCONNECT GROUND FROM U8 -4
SQUELCH RADIO
U3 -4 LOW?
NO
REFER TO SQUELCH T/S CHART
YES
U3 -14 LOW?
NO
REPLACE U3
YES
UNSQUELCH RADIO
U3 -4 HIGH?
NO
REFER TO SQUELCH T/S CHART
YES
U3 -14 HIGH?
NO
REPLACE U3
YES
GROUND U8--3
U3 -3 HIGH?
NO
REFER TO SQUELCH T/S CHART
YES
U3 -14 HIGH?
NO
REPLACE U3
YES
SQUELCH RADIO
U3 -3 LOW?
NO
REFER TO SQUELCH T/S CHART
YES
U3 -14 LOW?
NO
REPLACE U3
YES
DISCONNECT GROUND FROM U8--5
U3 - 7 - U3- 14?
NO
REPLACE U3
YES
GROUND U8 -4
U3 -5 - U3- 14?
NO
REPLACE U3
YES
DISCONNECT GROUND FROM U8--3
SET HANGUP BOX FOR CODED SQUELCH
U3 -6 LOW?
NO
CHECK HANG UP BOX, CABLE, PLUG
YES
U3--14 LOW?
NO
REPLACE U3
YES
SET HANGUP BOX FOR CARRIER SQUELCH
U3 -6 HIGH?
NO
NO
YES
U3 -14 HIGH?
NO
REPLACE U3
YES
DISCONNECT GROUND FROM U8--4
U3 -9 - U3- 14?
NO
REPLACE U3
YES
GROUND U8--3/6 & TEMPORARILY GROUND U8 -33
U2 -15 LOW?
NO
REPLACE U2
YES
DISCONNECT GROUND FROM U8--6, TEMPORARILY GROUND U8 -33
U2 -15 HIGH?
NO
REPLACE U2
YES
GROUND U8--4/6 & TEMPORARILY GROUND U8 -33
U2 13 LOW?
NO
REPLACE U2
YES
DISCONNECT GROUND FROM U8 -6 & TEMPORARILY GROUND U8 -33
U2 13 HIGH?
NO
REPLACE U2
YES
DISCONNECT GND FROM U8- 3 GND U8 -6 & TEMPOR ARILY GND U8- 33
U2 14 LOW?
NO
REPLACE U2
YES
DISCONNECT GROUND FROM U8--6, TEMPORARILY GROUND U8 -33
U2 14 HIGH?
NO
REPLACE U2
YES
GROUND U8--5/6, TEMPORARILY GROUND U8--33
U2 10 LOW?
NO
REPLACE U2
YES
DISCONNECT GROUND FROM U8--6, TEMPORARILY GROUND U8--33
U2 10 HIGH?
NO
REPLACE U2
YES
DISCONNECT GROUND FROM U8--4 GROUND U8--6 & TEMPORARILY GROUND U8--33
U2 12 LOW?
NO
REPLACE U2
YES
DISCONNECT GROUND FROM U8- 6 & TEMPORARILY GROUND U8- 33
U2 12 HIGH?
NO
REPLACE U2
YES
GROUND U8 -3/6 & TEMPORARILY GROUND U8 -33
U2 11 LOW?
NO
REPLACE U2
YES
DISCONNECT GROUND FROM U8--6 & TEMPORARILY GROUND U8 -33
U2 11 HIGH?
NO
REPLACE U2
YES
DISCONNECT ALL GROUND CONNECTIONS
TURN RADIO OFF AT CONTROL HEAD
DISCONNECT MAINTENANCE RESET DISABLE PINS
TURN RADIO ON. IT SHOULD NOW BE FUNCTIONING PROPERLY.
SYMBOLS AND ABBREVIATIONS USED IN THIS CHART
- TEST TO BE PERFORMED
NO
YES
- DECISION
- SOURCE OF FAULT
U5--3/5/7/11/13 - IN THIS EXAMPLE MEANS PINS 3, 5, 7, 11, & 13 OF U5
U3- 5 - U3--14? - IN THIS EXAMPLE ASKS IF VOLTAGE AT PIN 5 OF U3 IS EQUAL TO VOLTAGE AT PIN 14 OF U3
GENERAL NOTE ON VOLTAGE LEVELS
LOW - DESIGNATES A VOLTAGE LESS THAN 0.7 V
HIGH - DESIGNATES A VOLTAGE GREATER THAN 3.5 V
EEPS-3033-A

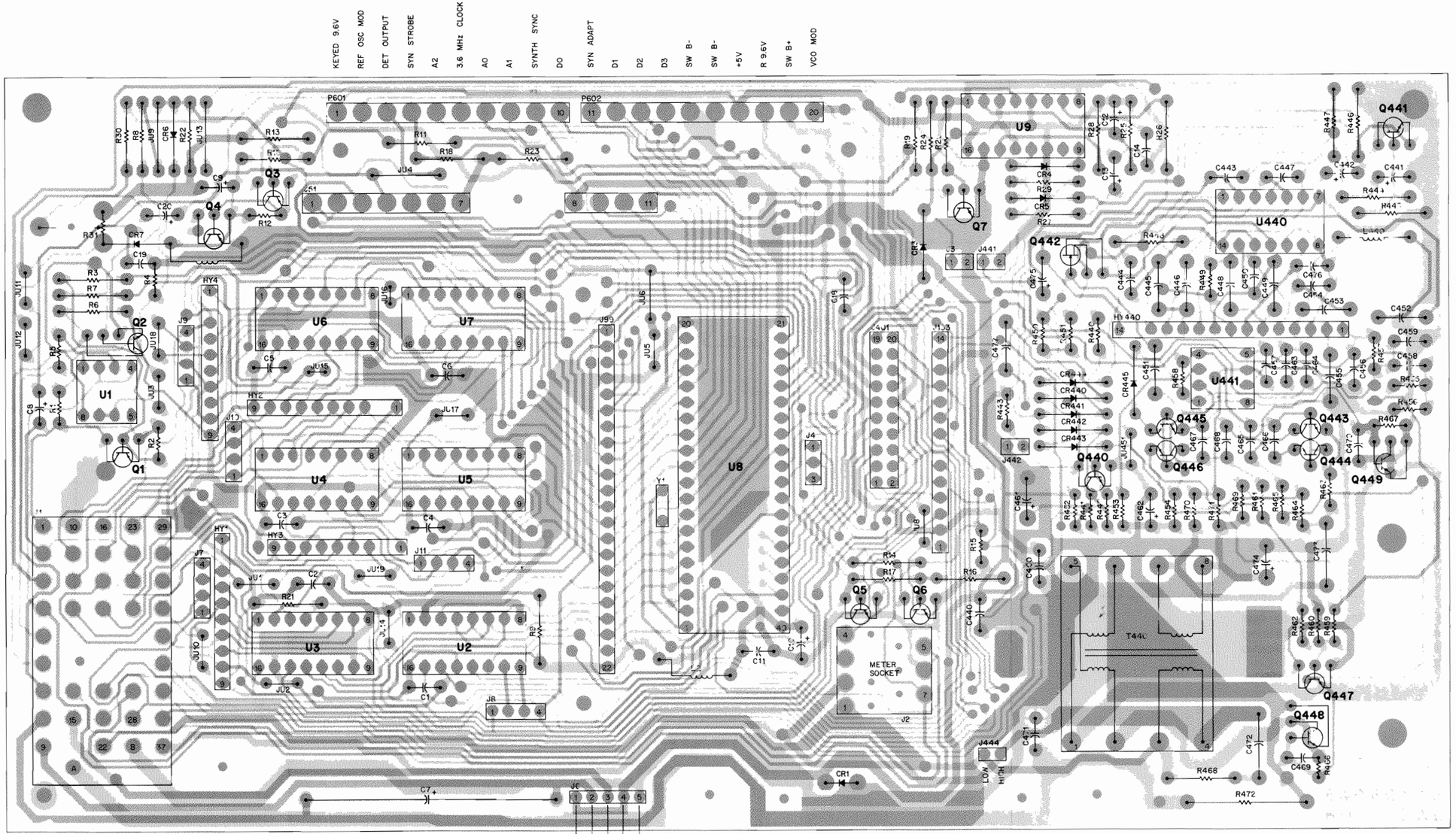
Personality and I/O Board

Circuit Board Diagrams and Schematic

HLN4760A PERSONALITY BOARD



LDER SIDE
VIEW



SHOWN FROM SOLDER SIDE

J401

DATA DISABLE	1	11	REC 9.6 V
DATA	2	12	+5 V
PL/DPL	3	13	SW B-
	4	14	VCO MOD
MIC HI	5	15	SW B+
IDC DISABLE	6	16	SQUELCH
SYN ADAPT	7	17	REF OSC MOD
KEYED 9.6 V	8	18	XMIT PWR CTRL
XMIT IND	9	19	CHAN ACT
PA ENABLE	10	20	SQ TAIL

J99

A9	1	12	A4
A8	2	13	A3
MEM ENABLE	3	14	A2
GND	4	15	A1
D4	5	16	A0
D5	6	17	D3
D6	7	18	D2
D7	8	19	D1
A7	9	20	D0
A6	10	21	MEM ENABLE
A5	11	22	+5 V

J1

CTRL HEAD STROBE	1	21	SP
GATED DET AUD	2	22	SPKR LO
VOL (REC AUD)	3	23	MODE 7
PTT	4	24	MODE 3
IGN/BATT	5	25	MODE 4
BUSY IND	6	26	MODE 9 (FUTURE)
SP	7	27	MIC HI
SW B-	8	28	SQUELCH
SW B+	9	29	MODE 8
CHAS GND	10	30	MODE 11 (FUTURE)
MODE 12 (FUTURE)	11	31	CHAN SCAN
MODE 5	12	32	PL/DPL DISABLE
MODE 1	13	33	SYS 90/X
SHLD GND	14	34	SP
SW B+	15	35	SP
MODE 6	16	36	SP
MODE 2	17	37	SPKR HI
SP	18	A	A+
MODE 10 (FUTURE)	19	B	A-
XMIT IND	20		

SOLDER SIDE — GEW-1038-0
COMPONENT SIDE — GEW-1039-0
OVERLAY — GEW-1040-0

MICROCOMPUTER SECTION

Schematics, Circuit Board Diagrams, and
Parts Lists for Microcomputer System
PEW-1095-A
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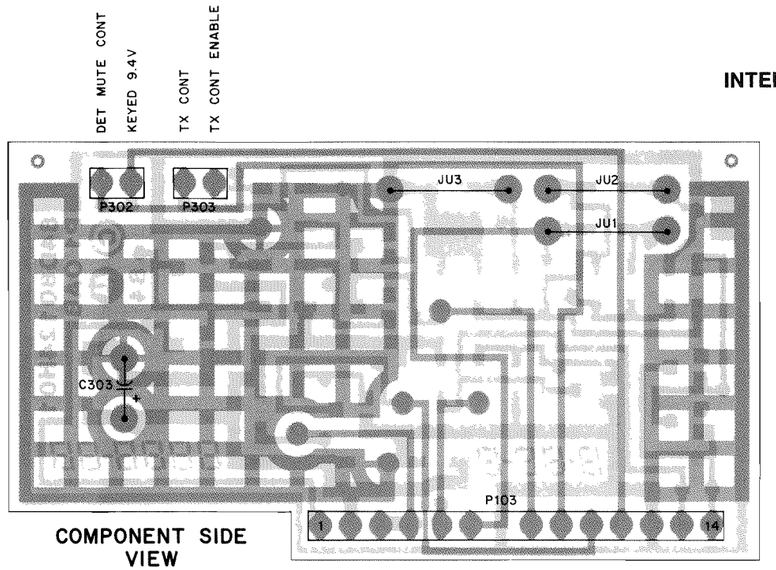
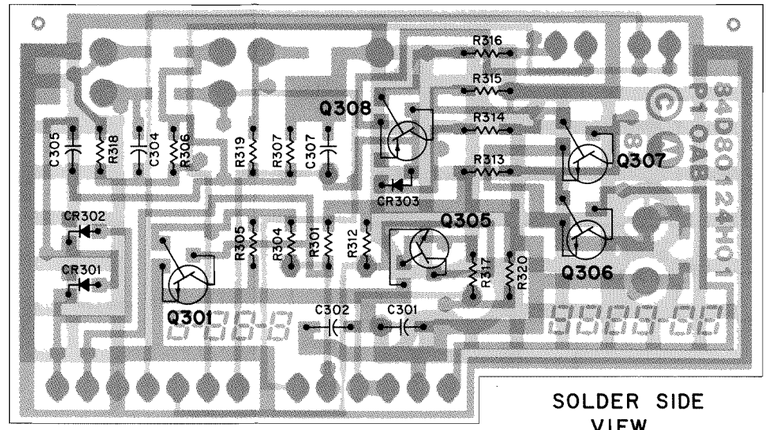
INTERFACE BOARD



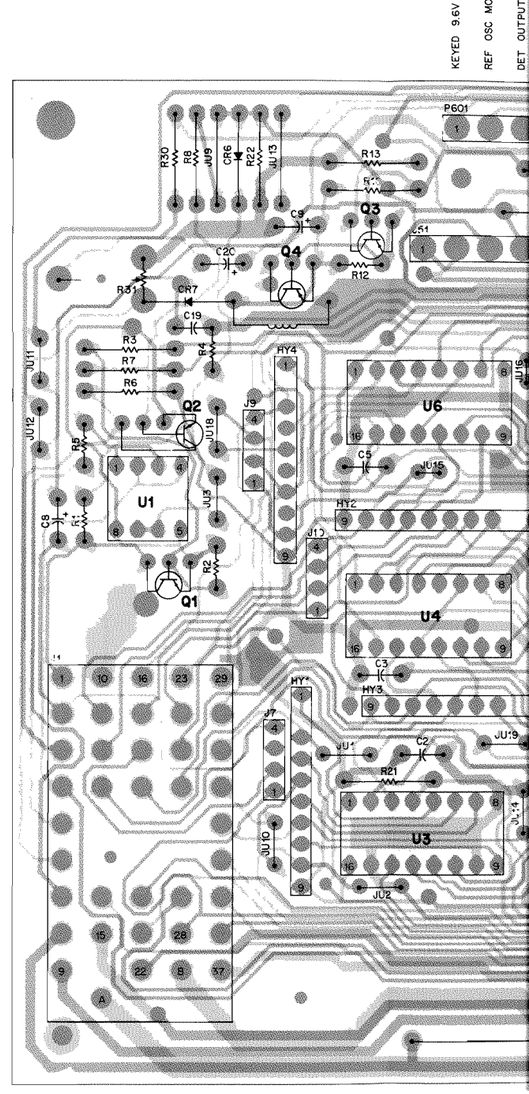
COMPONENT SIDE VIEW

SOLDER SIDE — GCW-1046-O
COMPONENT SIDE — GCW-1047-O
COMPONENT SIDE OVERLAY — GCW-1049-O

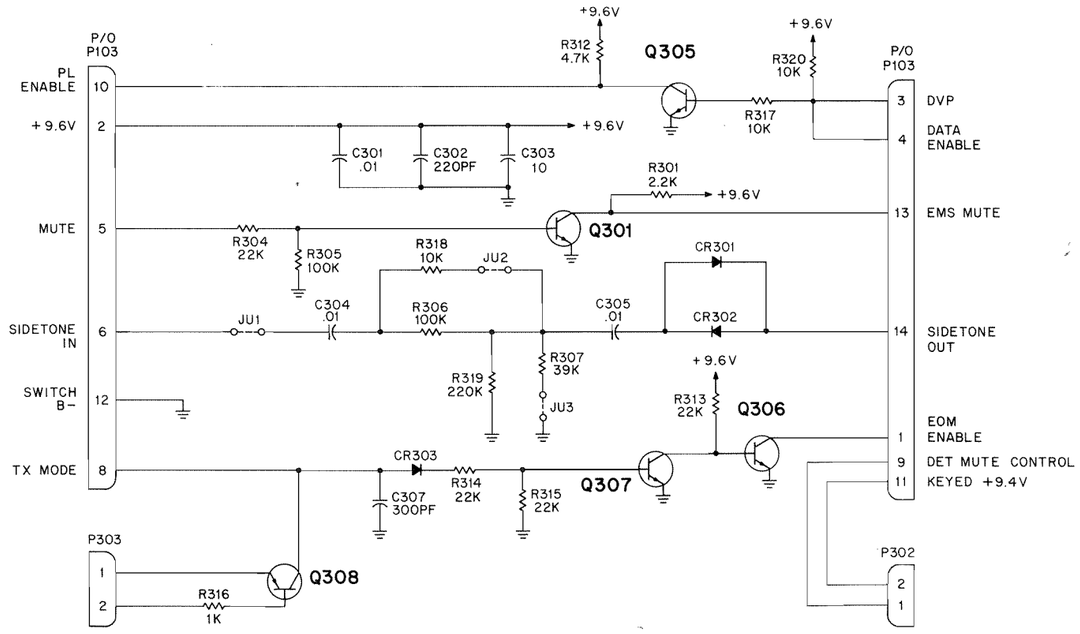


SOLDER SIDE VIEW

SOLDER SIDE — GCW-1046-O
COMPONENT SIDE — GCW-1047-O
SOLDER SIDE OVERLAY — GCW-1048-O



SHOWN FROM SOLDER SIDE



NOTE:

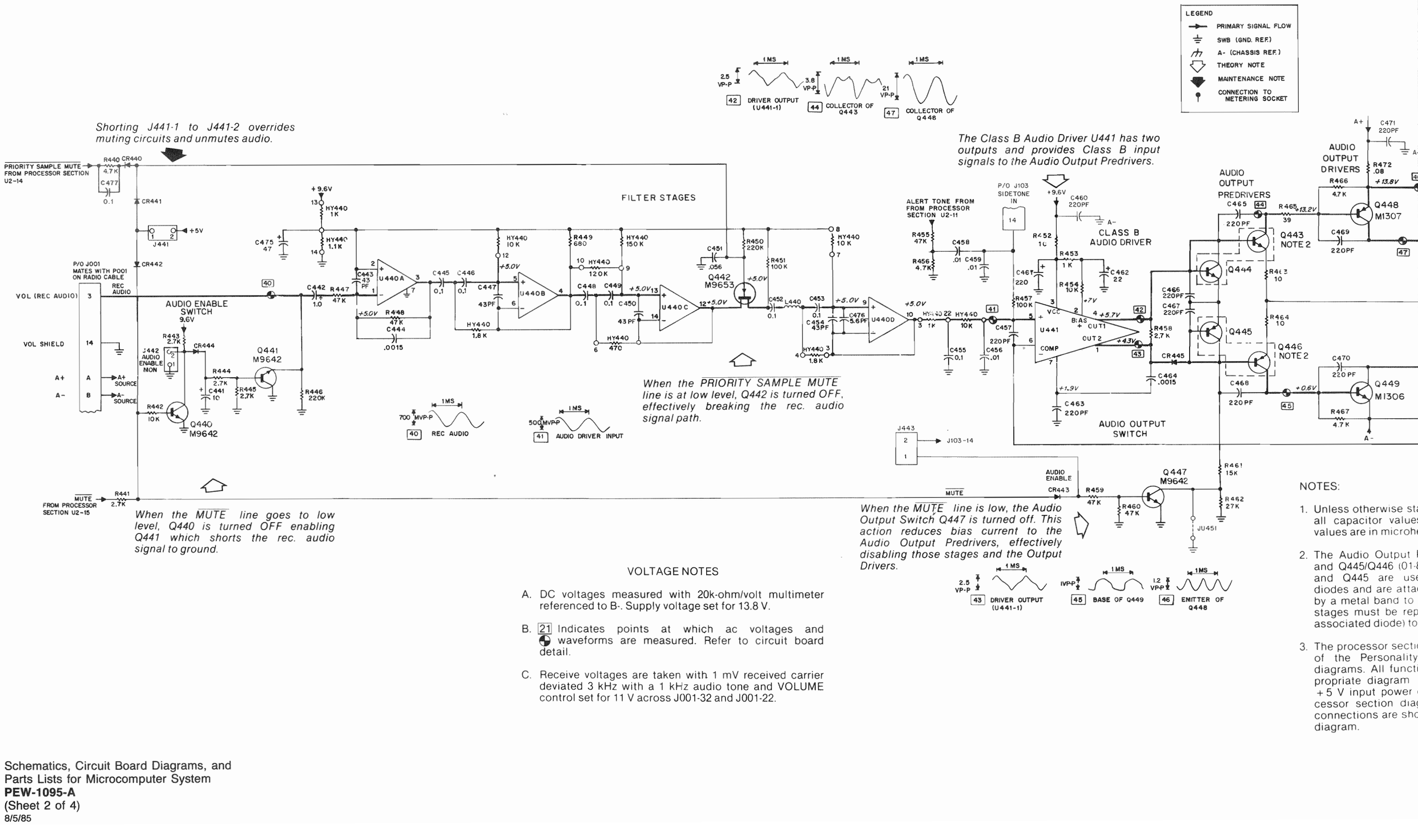
UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, AND ALL CAPACITOR VALUES ARE IN MICROFARADS.

JUMPER	NORMALLY	REMARKS
JU1	IN	OUT FOR SIDETONE
JU2	OUT	IN FOR EMS
JU3	IN	OUT FOR EMS

GCW-1050-A

RECEIVE AUDIO SECTION

Schematic and Parts Lists



VOLTAGE NOTES

A. DC voltages measured with 20k-ohm/volt multimeter referenced to B-. Supply voltage set for 13.8 V.

B. 21 Indicates points at which ac voltages and waveforms are measured. Refer to circuit board detail.

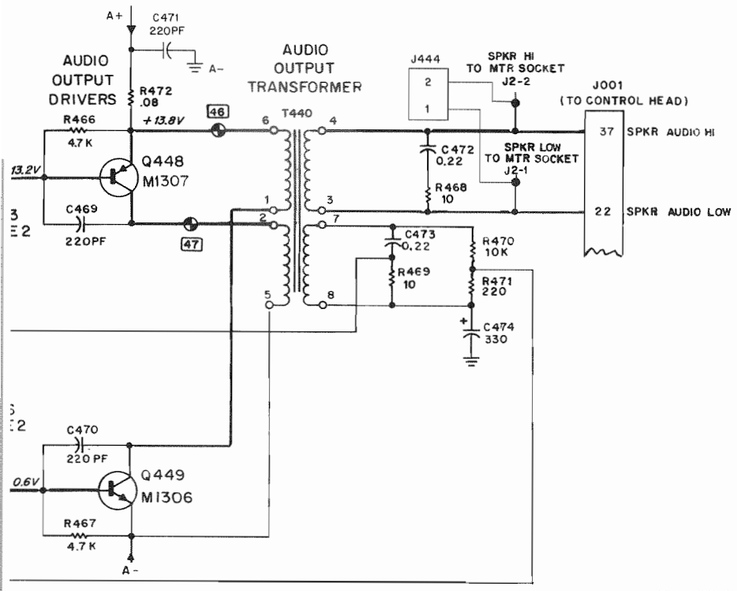
C. Receive voltages are taken with 1 mV received carrier deviated 3 kHz with a 1 kHz audio tone and VOLUME control set for 11 V across J001-32 and J001-22.

NOTES:

1. Unless otherwise sta all capacitor values values are in microfa

2. The Audio Output P and Q445/Q446 (01-8 and Q445 are use diodes and are attac by a metal band to stages must be rep associated diode) to

3. The processor sectio of the Personality diagrams. All functi propriate diagram + 5 V input power cessor section diag connections are sho diagram.



GEW-1069-0

NOTES:

1. Unless otherwise stated, all resistor values are in ohms; all capacitor values are in microfarads; all inductor values are in microhenries.

2. The Audio Output Predrivers Q443/Q444 (01-80726D63) and Q445/Q446 (01-80726D64) are matched pairs. Q444 and Q445 are used as temperature compensation diodes and are attached to their associated transistors by a metal band to insure good thermal contact. These stages must be replaced intact (the transistor and its associated diode) to insure proper operation.

3. The processor section and the rec. audio output section of the Personality Board are shown on separate diagrams. All functional signals are shown on the appropriate diagram. The SW B+, SW B-, +9.6 V and +5 V input power connections are shown on the processor section diagram. The A+ and A- input power connections are shown on the rec. audio output section diagram.

parts list

HLN4760A Audio Section of Personality Board
HLN4915A Audio Section of Personality Board — MXW-1111-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed, µF ±5%, 100V unless otherwise stated
C440	21-11015B05	220 pF ±10%
C441	23-11013E57	10 ±20%, 25V tantalum
C442	23-11013F57	1 ±20%, 35V tantalum
C443	21-11014H40	43 pF
C444	08-11051A02	.0015, 63V
C445, 446	08-84637L37	.1
C447	21-11014H40	43 pF
C448-449	08-84637L37	.1
C450	21-11014H40	43 pF
C451	08-11017A15	.056, 50V
C452, 453	08-84637L37	.1
C454	21-11014H40	43 pF
C455	08-84637L37	.1
C456	08-11051A07	.01, 63V
C457	21-11015B05	220 pF ±10%
C458, 459	08-11051A07	.01, 63V
C460	21-11015B05	220 pF ±10%
C461	23-82747L06	220 ±10%, 25V, electrolytic
C462	23-84538G13	22 ±20%, 20V tantalum
C463	21-11015B05	220 pF ±10%
C464	08-11051A02	.0015, 63V
C465–471	21-11015B05	220 pF ±10%
C472, 473	08-84637L22	.22 ±10%
C474	23-82747L01	330 +100, −10%, 20V, electrolytic
C475	23-84538G06	47 ±20%, 20V tantalum
C476	21-11014H19	5.6 pF ±.5 pF
C477	08-84637L37	.1
		diode (see note)
CR440–445	48-83654H01	silicon
		hybrid (see note)
HY440	51-82142K07	resistor network
		connector receptacle
J401	28-83603M01	20-contact, male
J441, 442	28-84318M06	2-contact, male
		coil
L440	24-83961B07	choke, RF
		transistor (see note)
Q440–442	48-00869642	NPN, type M9642
Q443, 444	48-00869648	NPN, type M9648
Q445, 446	48-00869649	PNP, type M9649
Q447	48-00869642	NPN, type M9642
Q448	48-84413L07	PNP, type M1307
Q449	48-84413L06	PNP, type M1306
		resistor, fixed, Ω ±5%, ¼ W unless otherwise stated
R440	06-11009E45	680
R441	06-11009E59	2.7k
R442	06-11009E73	10k
R443	06-11009E59	2.7k
R444, 445	06-11009C59	2.7k
R446	06-11009B06	220k
R447, 448	06-11009C89	47k
R449	06-11009E45	680
R450	06-11009F06	220k
R451	06-11009E97	100k
R452	06-11009E01	10
R453	06-11009E49	1k
R454	06-11009E73	10k
R455	06-11009E89	47k
R456	06-11009E65	4.7k
R457	06-11009E97	100k
R458	06-11009E59	2.7k
R459, 460	06-11009E89	47k
R461	06-11009E77	15k
R462	06-11009E83	27k
R463, 464	06-11009E01	10
R465	06-11009E15	39
R466, 467	06-11009E65	4.7k
R468	06-11009C01	10
R469	06-11009E01	10
R470	06-11009E73	10k
R471	06-11009E33	220
R472	17-82350A14	.08 ±10%, 1 W
		transformer
T440	25-84083B03	audio output
		integrated circuit (see note)
U440	51-80067C04	quad op-amp, type 67C04
U441	51-83629M02	op-amp, type 29M02
		mechanical parts
	75-80144H01	insulator, (C461–474) 28 used, 2 each
	01-80708T20	heatsink with Q413 and Q414

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

HLN4760A Personality Board (Microcomputer Section)
HLN4915A Personality Board (Microcomputer Section) — MXW-1112-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed, µF ±10% 100V unless otherwise stated
C1–6	08-11051A07	.01 ±5%, 63V
C7	23-83210A08	100 +150, -10%, 25V electrolytic
C8	23-11013F57	1 ±20%, 35V, tantalum
C9–10	23-11013E57	10 ±20%, 25V, tantalum
C11	21-11015B05	220 pF
C12–13	23-11013F57	1 ±20%, 35V, tantalum
C14	08-11017A14	.047 ±5%, 50V
C18	21-11015B05	220 pF
C19	08-11051A07	.01 ±5%, 63V
C20	23-11013E57	10 ±20%, 25V, tantalum
		diode (see note)
CR1	48-82525G02	silicon
CR3	48-82921G01	germanium
CR4-7	48-83654H01	silicon
		hybrid (see note)
HY1–4	51-82142K10	resistor network
		connector receptacle
J2	09-84207B01	7-contact female
J3	28-84318M06	2-contact, male
J4	28-84318M07	3-contact, male
J6	28-84318M23	5-contact, male
J7	28-84318M08	4-contact, male
J15–16	28-84318M06	2-contact, male
J88	09-80269B04	40-contact, female
J99	28-82622L03	22-contact, male
		coil
L1	24-80036A02	choke, .5 turn
L2	24-83977B03 or 06-11009B26	orange, 2.5 turns (HLN4760A) 0 ohm (HLN4915A)
		connector plug
P601	28-82647K02	10-pin
P602	28-82647K02	10-pin
		transistor (see note)
Q1, 2	48-00869642	NPN, type M9642
Q3	48-00869328	PNP, type M9328
Q4	48-00869328 or 48-00869641	PNP, type M9328 (HLN4760A) PNP, type M9641 (HLN4915A)
Q5–7	48-00869642	NPN, type M9642
		resistor, fixed, Ω ±5%, ¼ W unless otherwise stated
R1, 2	06-11009E73	10k
R4	06-11009E83	27k
R5	06-11009E53	1.5k
R6, 7	06-11009C73	10k
R8	06-11009C83	27k
R9	06-11009C73	10k
R10	06-11009C89	47k
R11	06-11009C73	10k
R12	06-11009E89	47k
R13	06-11009C43	560
R14	06-11009C89	47k
R15, 16	06-11009E97	100k
R17	06-11009C89	47k
R18	06-11009C61	3.3k
R19	06-11009C83	27k
R20, 21	06-11009C73	10k
R22	06-11009C89	47k
R23, 24	06-11009C73	10k
R25	06-11009C85	33k
R26	06-11009C89	47k
R27	06-11009C53	1.5k
R28	06-11009C97	100k
R29	06-11009C85	33k
R30	06-11009C65	4.7k
R31	18-80087E08	variable, 10k ±20%
		integrated circuit (see note)
U1	51-84561L25	dual opto-isolator, type M2148
U2	51-82884L73	multiplex output data latch, type M8473
U3	51-82884L75	input multiplexer, type M8475
U4	51-82884L74	hex non-inverting driver, type M8474
U5	51-84561L77	hex non-inverting driver, type M6177
U6	51-82884L74	hex non-inverting driver, type M8474
U7	51-84561L77	hex non-inverting driver, type M6177
U8	51-97009C01	microprocessor, type 3870 4k
U9	51-82884L53	dual monostable, type 84L53
		crystal (see note)
Y1	48-82611M10	3.6-MHz
		mechanical parts
	09-80269B01	16-pin socket, male (5 used)
	09-83893M01	40-pin socket, male
	75-05295B01	crystal base
	46-83821M01	stud guide, PROM (2 used)

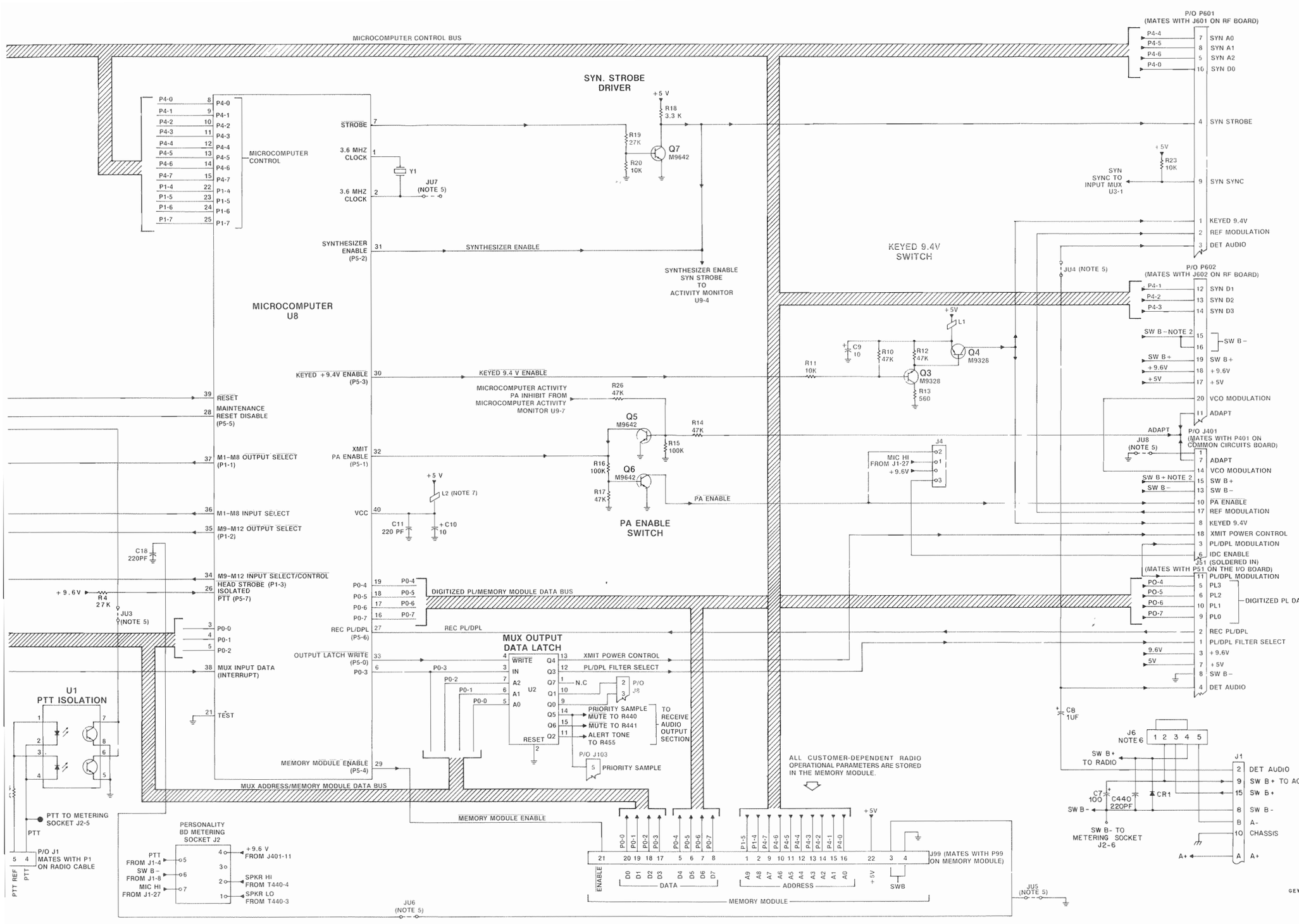
note: For best performance, order diodes, transistors, and integrated circuits by Motorola part number.

p/o HLN4760A Personality Board (Interface Board Section)
p/o HLN4915A Personality Board (Interface Board Section) — MXW-1072-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	01-80735T46	interface board consists of the following:
		capacitor, µF, 50V unless otherwise stated
C301	21-11032B07	.01 +80, −20%
C302	21-11031A47	220 pF ±50%
C303	23-11013E57	10 ±20%, 25 V, tantalum
C304, 305	21-11032B13	.1 +80, −20%
C307	21-11031A50	300 pF ±5%
		diode (see note)
CR301, 302	48-80236E08	silicon rectifier
CR306	48-80236E08	silicon rectifier
		connector
P103	28-80085E14	male header
P302, 303	28-84318M06	2-pin plug
		transistor (see note)
Q301, 305–307	48-82233P13	NPN, type M3313
Q308	48-82233P14	PNP, type M3314
		resistor, Ω ±5%, ⅛ W unless otherwise stated
R301	06-11024A57	2.2k
R304	06-11024A81	22k
R305, 306	06-11024A97	100k
R307	06-11024A87	39k
R312	06-11024A65	4.7k
R313–315	06-11024A81	22k
R316	06-11024A49	1k
R317, 318	06-11024A73	10k
R319	06-11024B06	220k
R320	06-11024A73	10k

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

PERSONALITY BOARD
Schematic



NOTES:

1. UNLESS OTHERWISE STATED, ALL RESISTOR VALUES ARE IN OHMS, ALL CAPACITOR VALUES ARE IN MICROFARADS, AND ALL INDUCTOR VALUES ARE IN MICROHENRIES
2. THE MICROCOMPUTER AND RECEIVE AUDIO OUTPUT SECTIONS OF THE PERSONALITY BOARD ARE SHOWN ON SEPARATE DIAGRAMS. THE SW B+, SW B–, +9.6 V SUPPLY AND THE +5 V SUPPLY INPUT CONNECTIONS ARE SHOWN ON THE MICROCOMPUTER SECTION DIAGRAM AND THE A+ AND A– INPUT CONNECTIONS ARE SHOWN ON THE RECEIVE AUDIO OUTPUT SECTION DIAGRAM.
3. RESISTORS LABELED HY1–HY4 ARE PART OF FOUR HYBRID RESISTOR NETWORKS. THESE RESISTORS ARE NOT INDIVIDUALLY REPLACEABLE. THE ENTIRE HYBRID MUST BE REPLACED IF ANY RESISTOR WITHIN THE HYBRID FAILS
4. CAPACITORS C1 THROUGH C6 (.01 µF 20% DISC CAPACITORS, MOTOROLA PART NO. 21S11015C05) ARE BYPASS CAPACITORS FOR INTEGRATED CIRCUITS U2 THROUGH U7 RESPECTIVELY.
5. REFER TO JUMPER TABLE.
6. NORMAL POSITION OF JUMPER PLUGS CONNECT PIN 1 TO 2 AND PIN 3 TO 4.
7. COMPONENT(S) USED ON SYNTOR X LOWBAND RADIOS ONLY.

JUMPER TABLE

JUMPER	DESCRIPTION	TYPE	STANDARD	HHCH
JU1	SCAN ENABLE	JUMPER	IN	OUT
JU2	PL REVERSE BURST	JUMPER	IN*	IN*
JU3	SPEC CUST APP	JUMPER	IN	IN
JU4	SPEC CUST APP	JUMPER	IN	IN
JU5	OUT FOR < 63 MODES	JUMPER	IN	IN
JU6	IN FOR < 63 MODES	JUMPER	OUT	OUT
JU7	NOT USED	—	—	—
JU8	IDC DATA INPUT	JUMPER	IN*	IN*
JU9	SQUELCH TAIL	JUMPER	IN	IN
JU10	PL/DPL DISABLE	JUMPER	IN	IN
JU11	DET MUTE CTRL	JUMPER	OUT	OUT
JU12	DVP MODULATION	JUMPER	OUT*	OUT*
JU13	DVP MODULATION	JUMPER	IN	IN
JU14	DISPLAY ENABLE	JUMPER	OUT	IN
JU15	CTRL HD STROBE	PLUG	OUT	IN
JU16	INPUT STRB ENABLE	PLUG	OUT	IN
JU17	OUTPUT STRB DISBL	JUMPER	IN	OUT
JU18	HY3 PIN 2 PULLUP	JUMPER	IN	OUT
JU19	HY4 PIN 4 PULLUP	JUMPER	IN	OUT
JU451	PA CURRENT DISABLE	JUMPER	OUT*	OUT*

* = REVERSE FOR DVP SYSTEMS

INTEGRATED CIRCUITS

REF NUMBER	TYPE	DESCRIPTION	V_{CC} (+5 V)	GROUND (SW B–)
U1	D74	OPTO-ISOLATOR	—	—
U2	M8473	8-BIT ADDRESSABLE LATCH	16	8
U3	M8475	8-CHANNEL DATA SELECTOR	16	8
*U4, 6	M8474	HEX BUFFER (TRI-STATE)	16	8
*U5, 7	M6177	HEX BUFFER (TRI-STATE)	16	8
U8	M0756	MICROCOMPUTER	40	20
U9	M8453	DUAL MONOSTABLE MULTIVIBRATOR	16	8

*REMOVE FOR HHCH ACCESSORIES

MICROCOMPUTER SECTION

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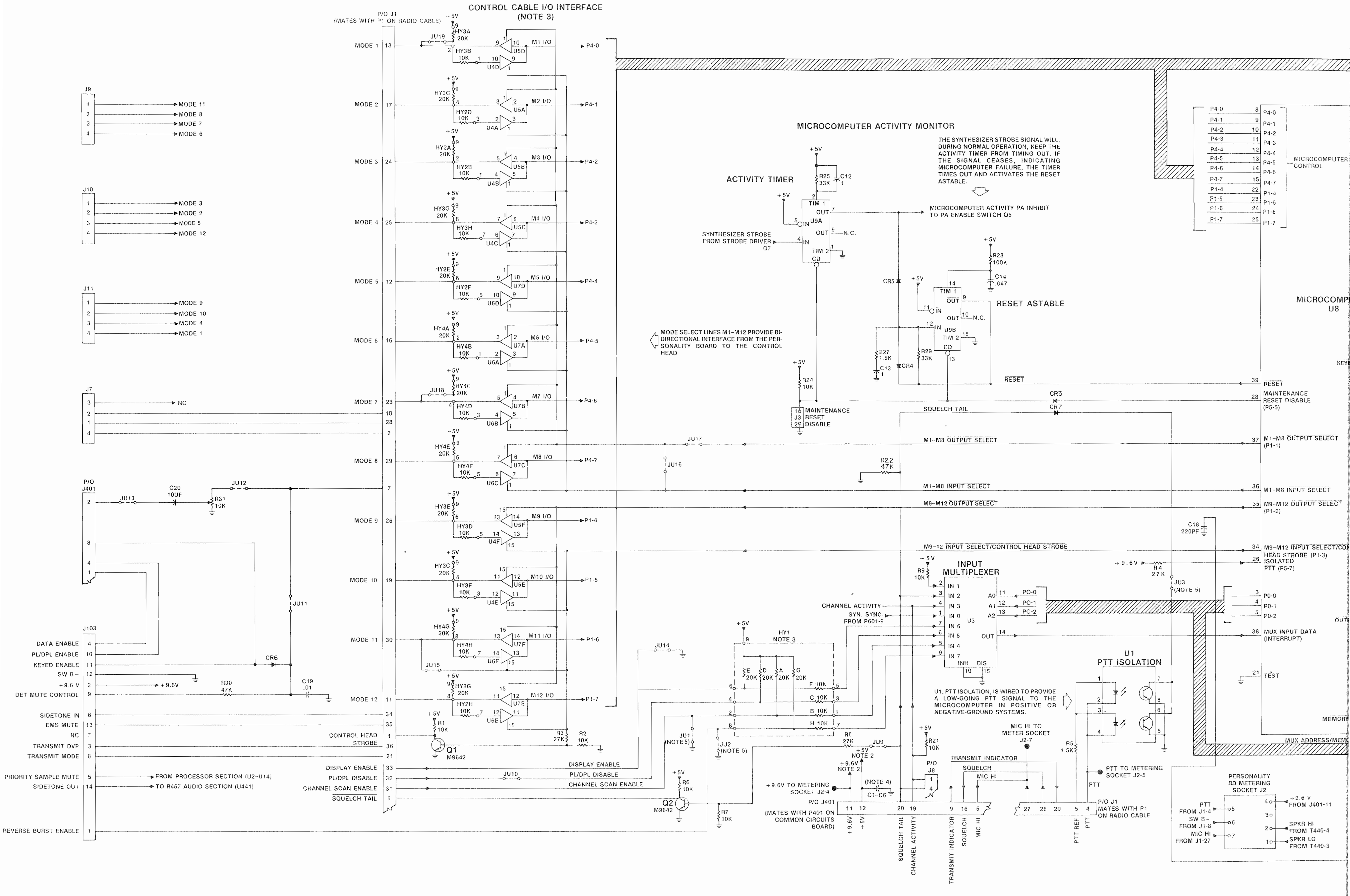
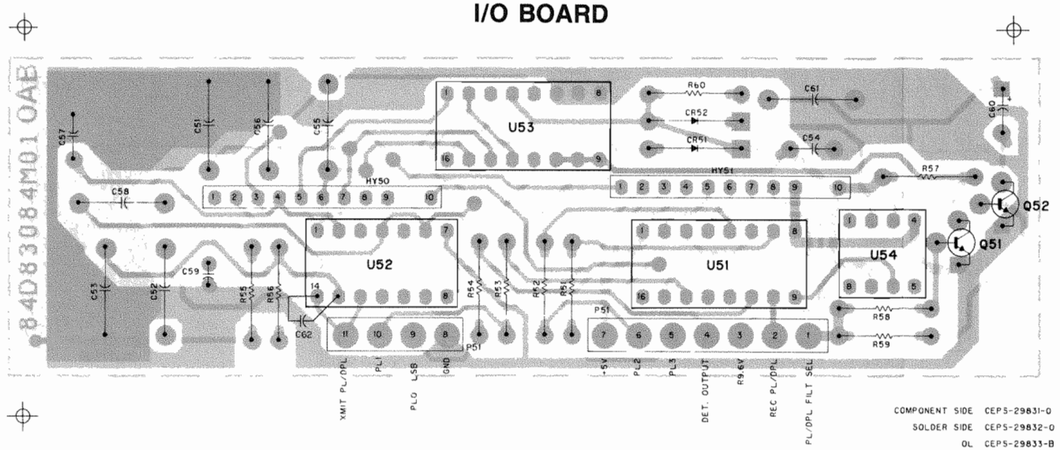


CONTROL CABLE I/O INTERFACE (NOTE 3)
P/O J1 (MATES WITH P1 ON RADIO CABLE)
MODE 1
MODE 2
MODE 3
MODE 4
MODE 5
MODE 6
MODE 7
MODE 8
MODE 9
MODE 10
MODE 11
MODE 12
M1 I/O
M2 I/O
M3 I/O
M4 I/O
M5 I/O
M6 I/O
M7 I/O
M8 I/O
M9 I/O
M10 I/O
M11 I/O
M12 I/O
J9
MODE 11
MODE 8
MODE 7
MODE 6
J10
MODE 3
MODE 2
MODE 5
MODE 12
J11
MODE 9
MODE 10
MODE 4
MODE 1
J7
NC
P/O J401
J103
DATA ENABLE
PL/DPL ENABLE
KEYED ENABLE
SW B−
+9.6 V
DET MUTE CONTROL
SIDETONE IN
EMS MUTE
NC
TRANSMIT DVP
TRANSMIT MODE
PRIORITY SAMPLE MUTE
SIDETONE OUT
REVERSE BURST ENABLE
FROM PROCESSOR SECTION (U2–U14)
TO R457 AUDIO SECTION (U441)
CONTROL HEAD STROBE
DISPLAY ENABLE
PL/DPL DISABLE
CHANNEL SCAN ENABLE
SQUELCH TAIL
MICROCOMPUTER ACTIVITY MONITOR
ACTIVITY TIMER
THE SYNTHESIZER STROBE SIGNAL WILL, DURING NORMAL OPERATION, KEEP THE ACTIVITY TIMER FROM TIMING OUT. IF THE SIGNAL CEASES, INDICATING MICROCOMPUTER FAILURE, THE TIMER TIMES OUT AND ACTIVATES THE RESET ASTABLE.
MICROCOMPUTER ACTIVITY PA INHIBIT TO PA ENABLE SWITCH Q5
SYNTHESIZER STROBE FROM STROBE DRIVER Q7
RESET ASTABLE
MODE SELECT LINES M1–M12 PROVIDE BI-DIRECTIONAL INTERFACE FROM THE PERSONALITY BOARD TO THE CONTROL HEAD
MAINTENANCE RESET DISABLE
RESET
MAINTENANCE RESET DISABLE (P5-5)
SQUELCH TAIL
M1–M8 OUTPUT SELECT
M1–M8 OUTPUT SELECT (P1-1)
M1–M8 INPUT SELECT
M9–M12 OUTPUT SELECT
M9–M12 OUTPUT SELECT (P1-2)
M9–12 INPUT SELECT/CONTROL HEAD STROBE
M9–M12 INPUT SELECT/CONTROL HEAD STROBE (P1-3)
ISOLATED PTT (P5-7)
INPUT MULTIPLEXER
CHANNEL ACTIVITY
SYN. SYNC. FROM P601-9
MUX INPUT DATA (INTERRUPT)
TEST
HY1 NOTE 3
U1 PTT ISOLATION
U1, PTT ISOLATION, IS WIRED TO PROVIDE A LOW-GOING PTT SIGNAL TO THE MICROCOMPUTER IN POSITIVE OR NEGATIVE-GROUND SYSTEMS.
MIC HI TO METER SOCKET J2-7
PTT TO METERING SOCKET J2-5
TRANSMIT INDICATOR
SQUELCH
MIC HI
+9.6V TO METERING SOCKET J2-4
P/O J401 (MATES WITH P401 ON COMMON CIRCUITS BOARD)
P/O J1 MATES WITH P1 ON RADIO CABLE
PERSONALITY BD METERING SOCKET J2
PTT FROM J1-4
SW B− FROM J1-8
MIC HI FROM J1-27
+9.6 V FROM J401-11
SPKR HI FROM T440-4
SPKR LO FROM T440-3
MICROCOMPUTER CONTROL
MICROCOMPUTER U8
MEMORY
MUX ADDRESS/MEMORY

I/O Board

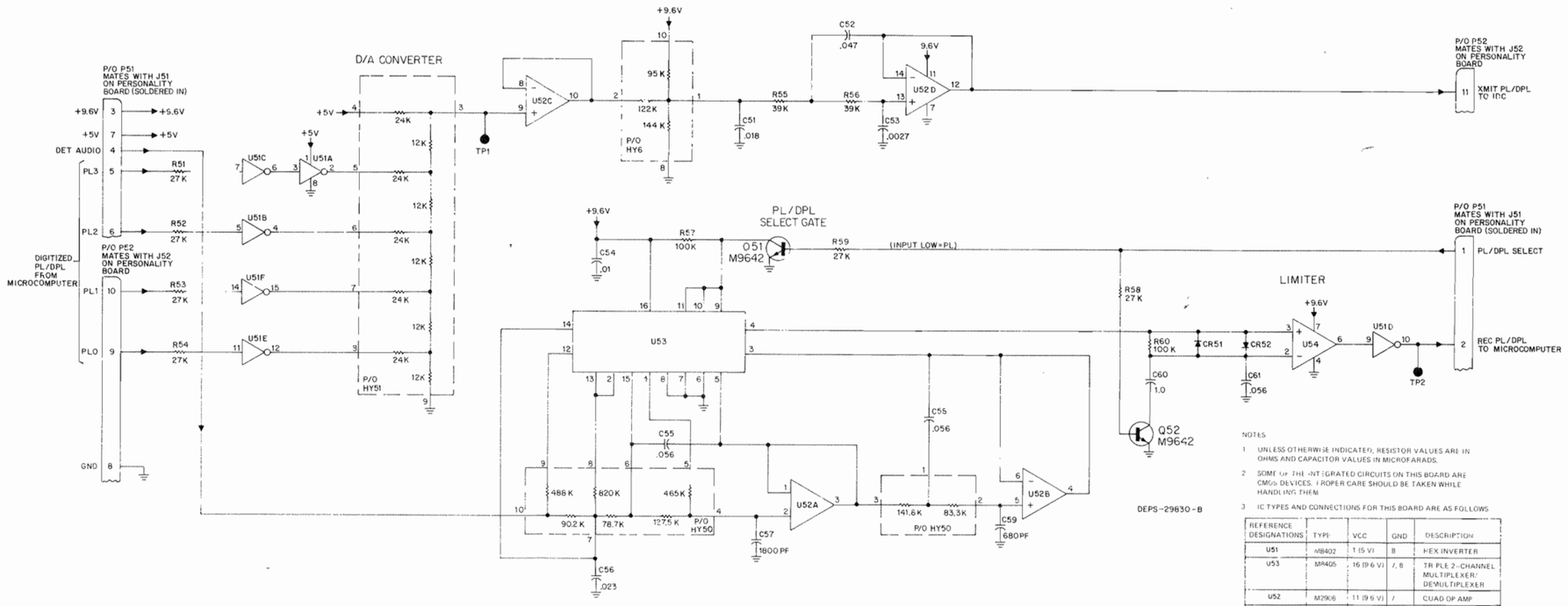
Circuit Board Diagrams and Parts Lists

I/O BOARD



SHOWN FROM SOLDER SIDE

I/O BOARD



NOTES

1. UNLESS OTHERWISE INDICATED, RESISTOR VALUES ARE IN OHMS AND CAPACITOR VALUES IN MICROFARADS.
2. SOME OF THE INTEGRATED CIRCUITS ON THIS BOARD ARE CMOS DEVICES. PROPER CARE SHOULD BE TAKEN WHILE HANDLING THEM.
3. IC TYPES AND CONNECTIONS FOR THIS BOARD ARE AS FOLLOWS

REFERENCE DESIGNATIONS	TYPE	VCC	GND	DESCRIPTION
U51	M8402	1 (5 V)	8	HEX INVERTER
U53	M9405	16 (9.6 V)	7, 8	TRIPLE 2-CHANNEL MULTIPLEXER/ DEMULTIPLEXER
U52	M2906	11 (9.6 V)	7	QUAD OP AMP
U54	M2907	7 (9.6 V)	4	BIPOLAR FET OP AMP

parts list

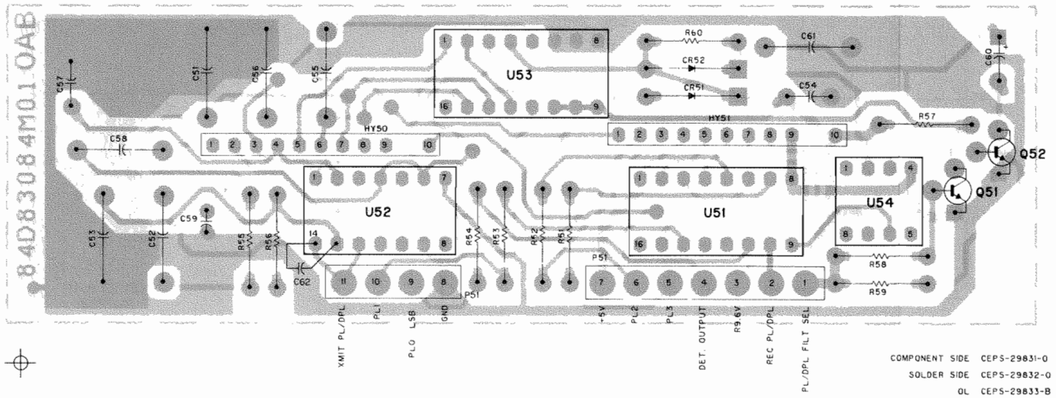
TRN8876A Input/Output Board

REFERENCE SYMBOL	MOTOROLA PART NO.
C51	08-84637L28
C52	08-84637L12
C53	08-84637L50
C54	21-11015A07
C55	08-84637L49
C56	08-84637L09
C57	21-84393M02
C58	08-84637L49
C59	21-84393M01
C60	23-11013D01
C61	08-84637L49
CR51, 52	48-83654H01
HY5	51-82142K08
HY6	51-82142K11
P51	28-84797F09
P52	28-84797F08
Q51, 52	48-00869642
R52–54	06-11009C83
R55, 56	06-11009C87
R57	06-11009C97
R58, 59	06-11009C83
R60	06-11009C97
U51	51-82884L02
U52	51-80067C04
U53	51-82884L65
U54	51-80067C05

note: For best performance, order part number.

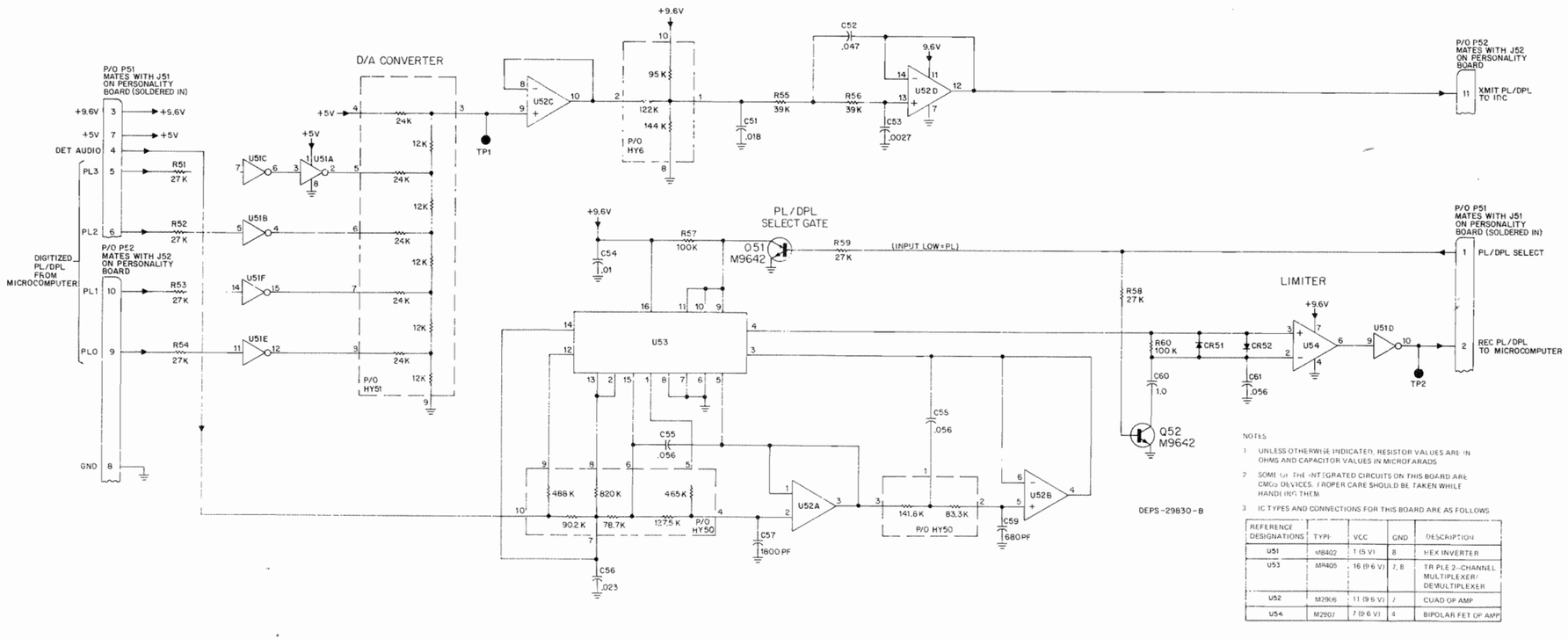
Schematics, Circuit Board Diagrams, and Parts Lists for Microcomputer System
PEW-1095-A
(Sheet 4 of 4)
8/5/85

I/O BOARD



SHOWN FROM SOLDER SIDE

I/O BOARD



NOTES

1. UNLESS OTHERWISE INDICATED, RESISTOR VALUES ARE IN OHMS AND CAPACITOR VALUES IN MICROFARADS
2. SOME OF THE INTEGRATED CIRCUITS ON THIS BOARD ARE CMOS DEVICES. PROPER CARE SHOULD BE TAKEN WHILE HANDLING THEM.
3. IC TYPES AND CONNECTIONS FOR THIS BOARD ARE AS FOLLOWS

REFERENCE DESIGNATIONS	TYPE	VCC	GND	DESCRIPTION
U51	M8402	1 (5 V)	8	HEX INVERTER
U53	MP405	16 (9.6 V)	7, 8	TRIPLE 2-CHANNEL MULTIPLEXER/ DEMULTIPLEXER
U52	M2906	11 (9.6 V)	7	QUAD OP AMP
U54	M2907	7 (9.6 V)	4	BIPOLAR FET OP AMP

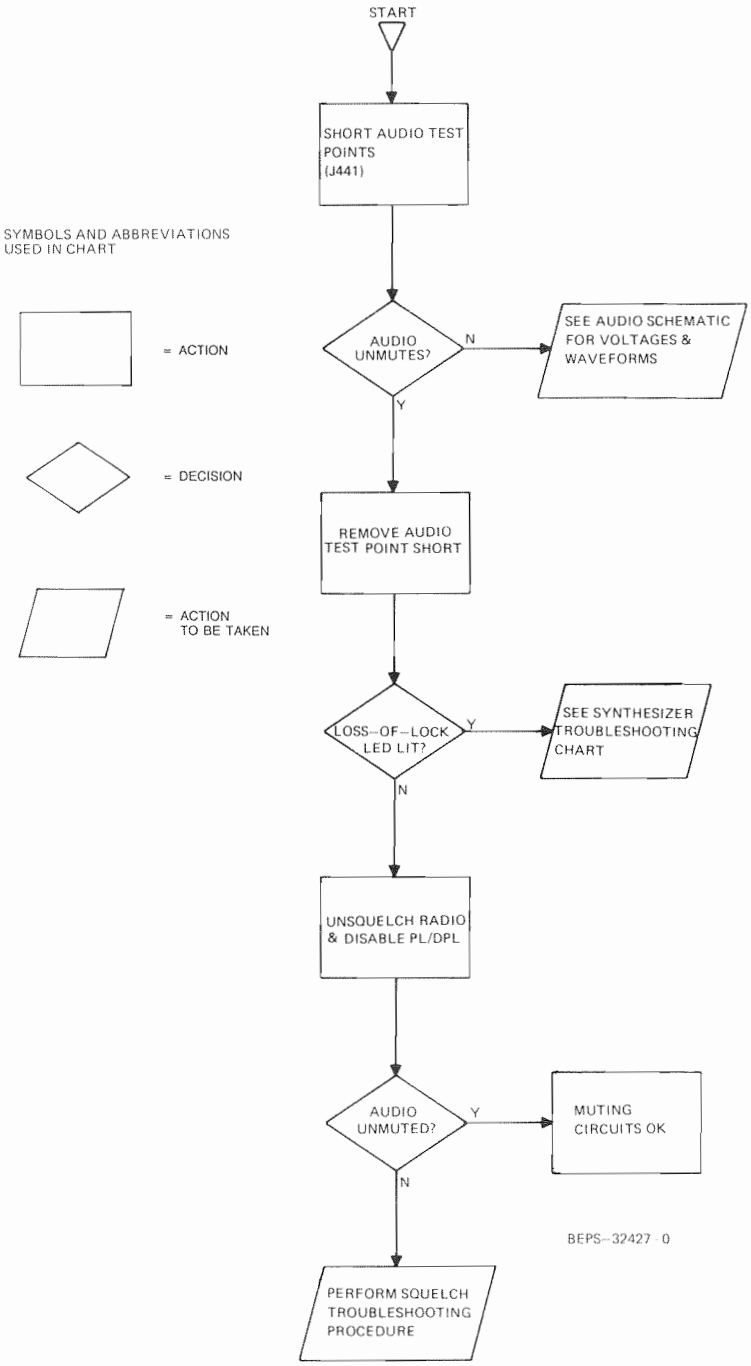
parts list

TRN8876A Input/Output Board — PL-6970-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed, μF ±5%, 250V unless otherwise stated
C51	08-84637L28	.018 ±10%
C52	08-84637L12	.047 ±10%
C53	08-84637L50	.0027 ±10%, 630V
C54	21-11015A07	.01 pF +80, −20%, 100V
C55	08-84637L49	.056, 400V
C56	08-84637L09	.023
C57	21-84393M02	1800 pF, 50V
C58	08-84637L49	.056
C59	21-84393M01	680 pF, 50V
C60	23-11013D01	1 ±10, 20V
C61	08-84637L49	.056
		diode (see note)
CR51, 52	48-83654H01	silicon
		hybrid (see note)
HY5	51-82142K08	resistor network
HY6	51-82142K11	resistor network
		connector plug
P51	28-84797F09	7-contact, male (right angle)
P52	28-84797F08	4-contact, male (right angle)
		transistor (see note)
Q51, 52	48-00869642	NPN, type M9642
		resistor, fixed, Ω ±5%, ¼ watt unless otherwise stated
R52–54	06-11009C83	27k
R55, 56	06-11009C87	39k
R57	06-11009C97	100k
R58, 59	06-11009C83	27k
R60	06-11009C97	100k
		integrated circuit (see note)
U51	51-82884L02	hex inverter, type M8402
U52	51-80067C04	quad op-amp
U53	51-82884L65	triple 2-channel analog multiplex/demultiplex, type M84L65
U54	51-80067C05	bi-field effect op-amp

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

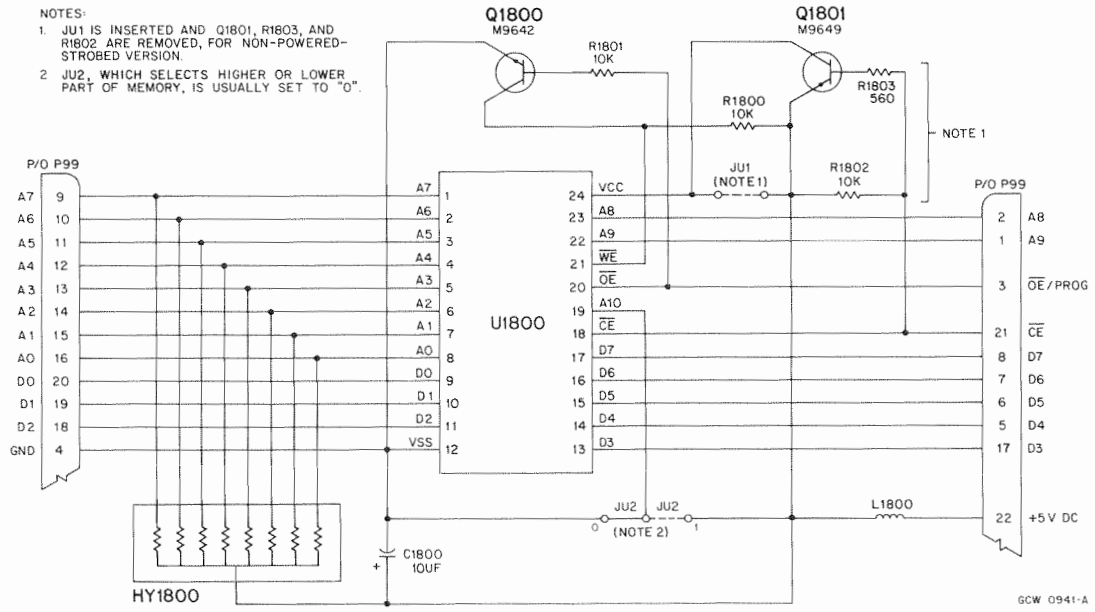
MUTING CIRCUITRY TROUBLESHOOTING CHART
(NO AUDIO)



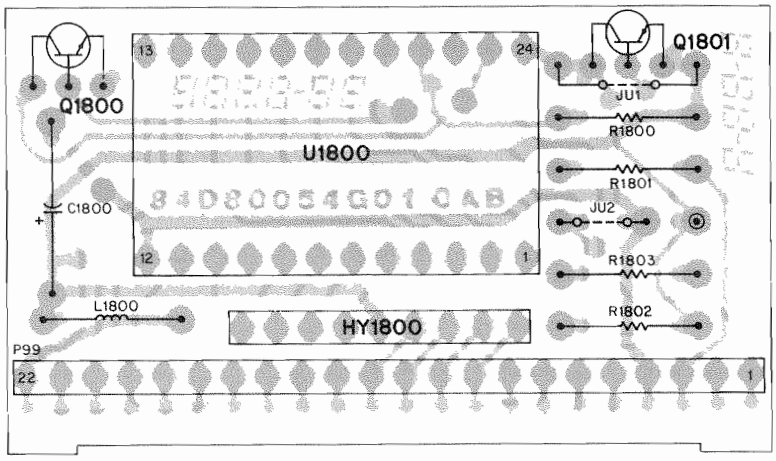
1. ALL REFERENCES TO, AND TEST PROCEEDURES FOR, SQUELCH OPERATION ARE NOT APPLICABLE TO TRUNKED RADIOS.

Muting Circuitry
Troubleshooting Chart
PAW-1650-O
8/5/85

HLN1125A/B EE PROM MEMORY MODULE



SHOWN FROM SOLDER SIDE



⦿ ALTERNATE CONNECTION FOR JU2

SOLDER SIDE — GCW-0938-0
COMPONENT SIDE — GCW-0939-0
OVERLAY — GCW-0940-0

parts list

HLN1125A/B EEPROM Memory Module — MXW-0918-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1800	23-84762H03	10 μF, 20 V capacitor
HY1800	51-82142K09	3.5k ±2% resistor network
J1800	09-80269B02	24-pin socket
JU1	06-11009D23	resistor jumper
L1800	24-80036A01	ferrite bead inductor
P99	09-82846L02	22-pin female connector
Q1800	48-80182D08	NPN, type M9642 transistor (see note 1)
Q1801	48-80182D12	PNP, type M9649 transistor (see note 1)
R1800–1802	06-11009C73	10k ±5% resistor
R1803	06-11009C43	560 ±5% resistor
U1800	51-90013B01	2k x 8 EEPROM, 24 pin (see notes)

notes:

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

2. Power strobed version has JU1 removed, and R1802, R1803, and Q1801 inserted. U1800 is part number 51-97014B01.

Schematic, Circuit Board Diagram, and
Parts List for EEPROM
Memory Module
PAW-0913-B
8/5/85