SEA®

A UNIT OF DATAMARINE INTERNATIONAL

AMERICAN TECHNOLOGY THAT TALKS TO THE WORLD

222

Donated by AC5XP

A UNIT OF DATAMARINE INTERNATIONAL INC.

# SEA 222

## HF SINGLE SIDEBAND RADIOTELEPHONE

## INSTRUCTION AND MAINTENANCE MANUAL



FOR U.S. VERSION ONLY.
OTHER OPERATING SYSTEMS MAY VARY.
REFER TO YOUR SPECIFIC OPERATOR'S MANUAL.

SEA Inc.
7030 220th St. S.W.
Mountlake Terrace, Washington 98043

(206) 771-2182
FAX: (206) 771-2650



REV. Q4-94
**Re-printed 9-95**

TABLE OF CONTENTS

# LIST OF ILLUSTRATIONS

FIG #

# 1. GENERAL INFORMATION

## 1.1 DESCRIPTION

The SEA 222 is a compact, all solid-state, 150 Watt PEP, HF SSB transceiver for the marine and HF radio service.

The SEA 222 covers the 2 to 23 MHz frequency range with channel restrictions which are determined only by the rules regarding the appropriate radio service. That is, the SEA 222 is equipped with a "mask" which limits the transmitter operation to legally assigned channels for the desired service. The frequency "mask" contains ALL normally assigned (ITU) marine channels and has space available for any additional channels which might be desired.

The SEA 222 is fully synthesized with 100 Hz resolution and the channel frequencies are controlled by a precision crystal housed in a temperature-stabilized holder. The transceiver is designed to operate from a 13.6 Volt, negative ground power system and is controlled by a front panel mounted 4 x 4 keypad. The control computer operating system makes use of an "operator friendly" controller program in conjunction with the eight-character alphanumeric VF (vacuum fluorescent) display.

## 1.2 EQUIPMENT FURNISHED

1.2.1 SEA 222 Radiotelephone

1.2.2 Microphone and Microphone Clip

1.2.3 Mounting Bracket

1.2.4 Power Connector

1.2.5 Instruction/Maintenance Manual

1.2.6 SEA 222 Operator's Manual

## 1.3 MECHANICAL INFORMATION

| | |
|---|---|
| Size | 14"W x 4.66"H x 13"D |

| | |
|---|---|
| Weight | 13 lbs. (5.9 Kilograms) |
| Mounting Positions | Any Orientation |

## 1.4 ELECTRICAL SPECIFICATIONS

### 1.4.1 GENERAL

| | |
|---|---|
| Type Acceptance | FCC Parts 81, 83, 87, 90 |
| Circuitry | Double Conversion, 45 MHz 1st I.F., 6.4 MHz 2nd I.F. |
| Front Panel Controls | Volume ON/OFF, 4 x 4 keypad |
| Channel Capacity | 290 channels in factory-programmed memory, 100 channels in field-programmed memory |
| Operating Temperature Range | -30° to +60° C |
| Frequency Stability | 15 Hz |
| Operating Modes | A3A, A3J, 2182.0 KHz A3H in E0 |
| Primary Voltage | 13.6 DC ± 15%, negative ground |
| Current Drain: | |
| Receive Standby | 2A |
| Receive, Full Audio | 2.5A |
| Transmit, Average Voice | 11A |
| Transmit, Two Tone | 17A |
| RF Impedance | 50 Ohms |

### 1.4.2 TRANSMITTER

| | |
|---|---|
| Power Output | A3A, A3J, 150 Watts PEP |
| Frequency Range | 2-23 MHz |
| Intermodulation | -32 dB below PEP |
| Spurious Emissions | -65 dB below PEP |
| Carrier Suppression | -46 dB below PEP |
| Undesired Sideband Suppression | -50 dB below PEP @ 1000 Hz |
| Audio Response | 300 Hz to 2400 Hz ± 3 dB |

### 1.4.3 RECEIVER

| | |
|---|---|
| Frequency Range | 500 kHz - 25 MHz |
| Sensitivity: SSB | <1 µV for 12 dB SINAD |
| Selectivity: SSB | 300 Hz to 2400 Hz ± 6 dB |
| AGC | Less than 10 dB audio level change from 10 uV to 100 mV, fast attack slow release |
| Intermodulation | At least -80 dB |
| Spurious Responses | At least -60 dB |
| Audio Power | 4 Watts at less than 10% distortion |

# 2. OPERATION

## 2.1 WARM-UP CAUTION

Do not attempt to transmit until the radiotelephone is warmed up for at least 3 minutes. Transmitting before the 3-minute warm-up period has elapsed can cause a violation of FCC regulations.

## 2.2 FCC REQUIREMENTS

"How to Operate Your Radiotelephone Set" is a booklet available from the Radio Technical Commission for Marine Service (RTCM), 655 Fifteenth Street N.W., Ste. 300, Washington, D.C. 20005, and is highly recommended reading material.

## 2.3 FRONT PANEL CONTROLS AND INDICATORS

Figure 2.3 illustrates the front panel of the SEA 222. The function of these controls is as follows:

Volume ON/OFF: This control adjusts the loudness of the receiver and turns the set on and off. To turn the set ON, turn the Volume ON/OFF control knob CLOCKWISE until a click is heard. Turning the control knob further clockwise will increase the receiver volume level.

TRANS indicator: This LED indicates (when lit) that the transmitter is activated. Under zero modulation conditions, the LED is dim, brightening under modulation to indicate proper voice output.

THE 8-DIGIT ALPHANUMERIC DISPLAY: The alphanumeric VF display in the SEA 222 is designed to provide the operator with such things as frequency and/or channel data, operator prompting and some specialized data outputs.

THE 4 x 4 KEYPAD: The 16 keyswitches provided on the SEA 222 allow the operator to communicate with the computer which controls the many functions in the radiotelephone. In order to simplify the operation of the SEA 222, an "operator friendly" software package has been designed which is used in


**SEA 222 FRONT VIEW**

**FIGURE 2.3**

conjunction with the alphanumeric display. All of the keys and the function of each are listed below:

CH/FR: This key allows the operator to display either the channel number or the frequency of operation. Pressing this key when the display reads, "CHAN 801" for example, will, after a short delay, cause the display to indicate the receiver operating frequency which is assigned to channel number 801. Pressing the microphone push-to-talk switch will change the display to read the transmitter frequency assigned to channel number 801. Pressing the CH/FR key again will restore the channel number.

ENT: This key allows the operator to enter a previously-keyed data word into the computer. See examples in ¶ 2.5, "OPERATING YOUR SEA 222 HF/SSB RADIOTELEPHONE".

SQL: This key activates or deactivates the voice-operated SQUELCH system in the SEA 222. When the squelch is activated, the MOST SIGNIFICANT digit in the display will contain the letter, "Q". When the squelch is deactivated, this display digit will remain blank. The operation of the SQL key will "toggle" the squelch status on and off.

EMER: This key allows one-keystroke recall of the international distress frequency, 2182.0 KHz. It also allows the recall of up to 9 other pre-programmed frequencies. See ¶ 2.5, "OPERATING YOUR SEA 222 HF/SSB RADIOTELEPHONE".

UP and DOWN ARROWS: These keys control the RECEIVER frequency in 100 Hz increments. Pressing the UP arrow will cause the frequency to move UP in 100 Hz increments, while pressing the DOWN arrow reverses the direction of tuning. Clarity tuning range is limited to $\pm$ 200 Hz on programmed channels, while "Rx ONLY" channels have unlimited clarity tuning range.

NUMBER KEYS 0 THROUGH 9: These keys allow the operator to enter the required numerical data into the computer. Note that it is necessary to understand the operating system in the computer in order to intelligently enter data. See ¶ 2.5, "OPERATING YOUR SEA 222 HF/SSB RADIOTELEPHONE" for details.

## 2.4 PROPAGATION

HF signals do propagate far beyond the horizon. MF frequencies (2-3 MHz) are generally usable within 300 miles, depending on the time of day, atmospheric conditions, and man-made noise level.

The High-Seas frequencies (4, 6, 8, 12, 16, 18 and 22 MHz) allow communications over thousands of miles, again subject to the above-mentioned limitations. Interference tends to be more of a problem than on VHF.

## 2.5 OPERATING YOUR SEA 222 HF/SSB RADIOTELEPHONE

### 2.5.1 DESCRIPTION OF MEMORY FUNCTIONS

The SEA has TWO memory banks. First, the factory-programmed frequency "mask" contains 290 frequency PAIRS, stored and recalled by CHANNEL NUMBER. Secondly, the internal "scratchpad" memory allows the operator to program and recall 100 frequency pairs. See ¶ 3.4 for ITU channel listing (NOTE: 10 of the 100 field-programmable channels are "EMERGENCY" channels).

### 2.5.2 PUTTING THE SEA 222 IN THE OPERATING MODE

Turn the volume ON/OFF knob on. The radio will go through a self-test procedure, where the display will show "TEST 1", "TEST 2", followed by "2182.0".

To comply with FCC standards, after three minutes, the radio is ready to operate on 2182.0 KHz.

### 2.5.3 DIMMING THE DISPLAY

Enter any desired SINGLE-digit number, followed by the "ENT" command. The single-digit command will be interpreted by the operating system as a level of intensity with 0 being display OFF and 9 being maximum display brightness. Note that when the display is extinguished, the first stroke on ANY key will restore the display to maximum brightness.

2.5.4 TURNING THE AUDIO FEEDBACK OFF/ON

To turn off the beep, enter any even digit and the "ENT" key. Example: Press "6", then "ENT". To turn the beep back on, enter any odd digit and the "ENT" key. Example: Press "7", then "ENT". Note: This function is only available in SEA 222's with serial numbers higher than X2724.

2.5.5 TO ENTER SCAN MODE

Channels 10-19 are reserved for scanning, and you can program up to 10 channels using the program mode. To activate, turn radio off, then on to set coupler in neutral tuning mode (it may be necessary to reprogram squelch threshold for operation). To start scanning, press "CH/FR", then "▲". Scanning stops on active channels, and resumes when channel becomes inactive. To step over an unwanted active channel, press "▲". To stop scanning, press "EMER" (stops on present channel).

2.5.6 SELECTING A FREQUENCY FROM SCRATCHPAD MEMORY

Enter any desired TWO-digit number, followed by the "ENT" command. The two-digit command will be interpreted by the operating system as the number of the desired "BIN" location in scratchpad memory. Note that the scratchpad memory must be programmed in the field.

2.5.7 SELECTING A CHANNEL BY NUMBER

Enter any desired THREE- or FOUR-digit channel number, followed by the "ENT" command. Example: "4, 0, 3, ENT". Verify that the radio has responded by examining the display which should read: "CH 403". Refer to ¶ 3.4 and/or your Frequency Allocation Booklet for channel versus frequency data.

2.5.8 ENTERING A RECEIVE-ONLY FREQUENCY

Enter any desired FOUR-, FIVE- or SIX-digit frequency between 500.0 and 25000.0, followed by the "ENT" command. Example: "1, 0, 0,0, 0, 0, ENT". This will be interpreted by the operating system as a RECEIVE frequency of 10,000.0 KHz.

2.5.9 SIMPLEX FREQUENCY DIRECT ENTRY

Enter the desired frequency within the radio's tuning range. While pressing and holding the microphone key, press the "ENT" key. Your radio will be set to operate on the entered frequency on a simplex basis. The UP/DOWN keys will work on a +/- 200 KHz basis only.

2.5.10 SELECTING AN EMERGENCY CHANNEL

Up to 10 emergency frequencies may be stored in the scratchpad memory of the SEA 222. As already noted, CHANNEL 0 is loaded with 2182.0 KHz, A3H mode. A3H carrier level is adjusted by R30. Any of the emergency channels may be recalled from memory by entering ANY SINGLE DIGIT followed immediately by the "EMER" command.

2.5.11 ACTIVATING THE SQUELCH FUNCTION

The squelch function in the SEA 222 is activated by pressing the "SQL" key on the 4 x 4 keypad. When the squelch system is activated, the MOST SIGNIFICANT (leftmost) digit in the VF display will show the letter "Q". Pressing the "SQL" key a second time will deactivate the squelch function and the "Q" flag will extinguish.

The SEA 222 squelch system makes use of a software analogue of the "voice operated" squelch used in previous SEA products. It is sensitive to the changing frequency components in the human voice, and therefore requires no level control. A momentary tone will open the squelch, but will not hold it open. A moving tone is required to hold the squelch open. When power is initially applied to the SEA 222, the squelch circuitry will be DE-ACTIVATED.

2.5.12 ACTIVATING THE "TUNED" INDICATOR

The SECOND MOST SIGNIFICANT digit in the VF display is reserved for the antenna coupler "tuned status" digit. When an antenna coupler such as the SEA 1612 is used, the "TND" line from the coupler should be connected to the "TND" port on the accessory plug on the SEA 222 rear panel. The antenna coupler will signal that it has successfully tuned the antenna by pulling the "TND" line low. This will activate the "TUNED" indicator on the VF display. This indicator is an asterisk (*) in the SECOND MOST SIGNIFICANT digit of the VF display. When the channel is changed, the "TUNED" indicator will extinguish, since a properly-tuned antenna is no longer assured. Once extinguished, the "TND" line must again be pulled low to activate the indicator.

## 2.6 OPERATING THE TRANSMITTER

The operation of the transmitter is straightforward. Pressing the microphone push-to-talk button will switch the transmitter circuits on. This will be indicated by the VF display changing to the transmitter frequency and the "TRANS" indicator will light dimly. Speak in a normal speaking voice with your lips approximately one eighth of an inch from the microphone. Do NOT shout into the microphone as this may reduce the intelligibility of the transmission. The "TRANS" indicator should modulate with the voice, indicating normal power output. Note that acknowledgment of a message cannot be done by keying the microphone, since no signal is transmitted until the operator actually speaks.

If the SEA 222 is fitted with an antenna coupler such as the SEA 1612, the "antenna tuned" status flag from the coupler will cause the SECOND MOST SIGNIFICANT digit in the VF display to indicate an asterisk (*) when the coupler has properly tuned the antenna system. (See ¶ 2.5.12).

## 2.7 OPERATING OPTIONAL FEATURES

<u>Necode</u>

1. To interconnect the SEA 222NC with a Necode ringer, see Figure 2.7.

2. To configure the SEA 222NC for Necode scan, enter the PROGRAM mode in the normal fashion (See ¶ 3.3.1) and enter up to four desired scan frequencies in scratchpad channels 91 through 94. Exit the PROGRAM mode.

3. Press "9" "9" "ENT" to initiate the scan routine.

4. The frequencies programmed into the Necode scan channels will continue to be scanned until:

   a. The Necode equipment decodes a response. This will cause the scan cycle to be stopped, the receiver audio to be unsquelched, and the transmitter to respond with the "acknowledge" signal.

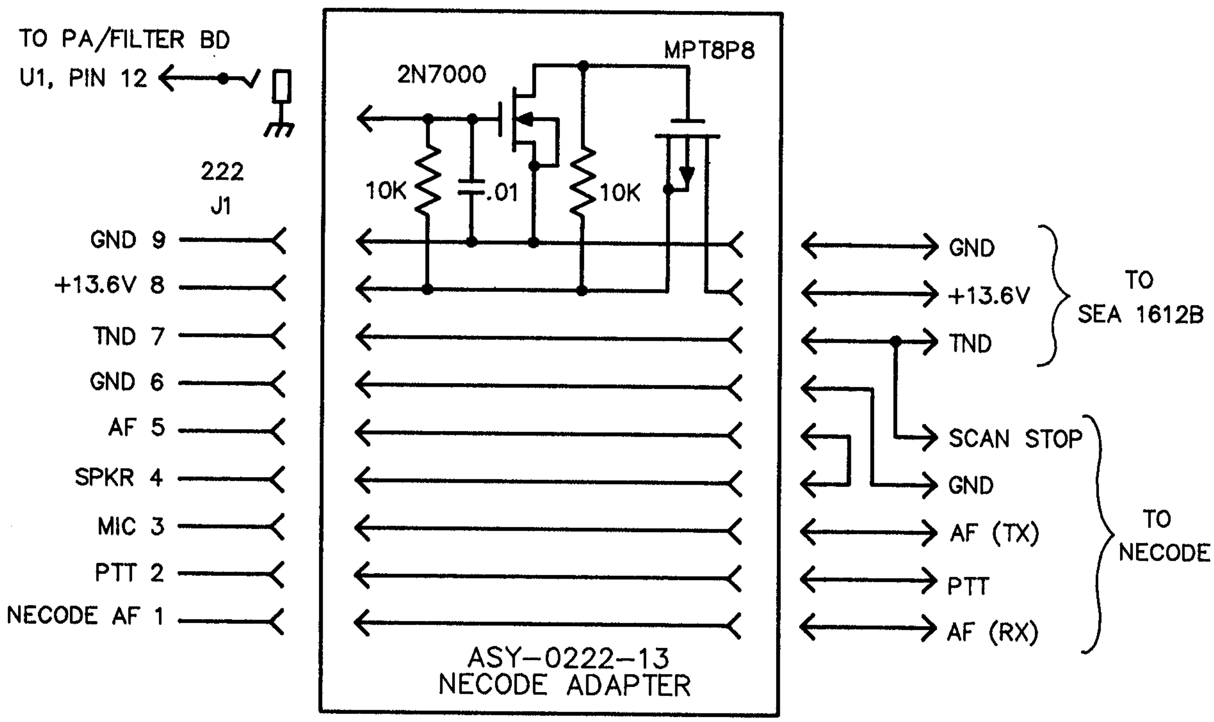
   b. The operator presses any key to exit the Necode scan mode.

   c. The SEA 222 receives a PTT input and enters the transmit mode.

<u>CW</u>

1. Connect CW key to jack provided on radio rear panel.

2. When the CW key is depressed, a tone will be transmitted with a frequency of approximately 1 KHz.




**SEA 222/NECODE**
**INTERCONNECTION DIAGRAM**
**FIGURE 2.7**

# 3. PROGRAMMING

## 3.1 FREQUENCY AND MODE SELECTION

As discussed above, the SEA 222 contains TWO memory systems. The factory-programmed frequencies are listed in ¶ 3.4 and are stored in the operating system ROM. Normal access to these frequencies is through the channel number system described above (see ¶ 2.5.7). In addition to those frequencies contained in the factory-programmed memory, the operator may program up to 100 frequency pairs into the non-volatile EEPROM memory referred to as "scratchpad" memory. This memory is arranged as 100 "bins" or locations and each bin is designed to hold one channel. A channel consists of TWO frequencies, a TRANSMITTER frequency and a RECEIVER frequency.

The frequencies selected for entry into the scratchpad memory must be legally authorized for the desired operating service.

When the SEA 222 is to be used in services other than the Marine Service, it is possible to provide a special program "mask" for the permanent memory. Contact the Factory for information.

## 3.2 BANDWIDTH LIMITATIONS

The only limitation imposed by the SEA 222 is that the desired frequency be inside the operating range of the equipment. Totally unrelated duplex pairs might be employed, since the computer controls the filter bandswitching. In practice, the antenna system will have a great deal to do with dictating the maximum allowable frequency separation. If a wide bandwidth antenna system such as a Conical Monopole is used, it is conceivable that the transmitter could operate in the 22 MHz band while the receiver was operating on 2000.0 KHz. If the companion SEA 1612 automatic antenna coupler is used in conjunction with the normal short whip, the allowable 2 MHz split may be reduced to a few hundred KHz.

## 3.3 FIELD PROGRAMMING THE SEA 222 SCRATCHPAD MEMORY

### 3.3.1 ENTERING THE PROGRAM MODE

The SEA 222 is forced into the PROGRAM mode by entering the number 8888888 (seven # 8s). The operating system should signal the operator that the SEA 222 has shifted to the PROGRAM mode by flashing "PROGRAM" on the VF display. After a short delay, the operating system will signal the operator to proceed by prompting "BIN #?".

### 3.3.2 ENTERING SCRATCHPAD FREQUENCY AND MODE DATA

After the SEA 222 has shifted to the PROGRAM mode, the operator should select and enter the desired BIN number, such as BIN 10. This would be done by keying in the sequence, "1, 0, ENT". If the selected bin location is full, the operating system will respond with the prompt, "BIN FULL". This prompt will be held for approximately 2 seconds. If it is desired to "overwrite" the bin location with new data, simply hit any NUMBER key during the 2-second hold. If the operator does NOT make an entry at this time, the operating system will assume that the data in the chosen bin location is to be saved and will again prompt, "BIN #?". This will allow the operator to choose another bin location number.

Once the desired bin location is selected, the operating system will prompt, "TX FREQ". The operator should then enter the desired TRANSMITTER frequency down to and including the 100 Hz increment. EXAMPLE: 1, 2, 4, 2, 9, 2, ENT. This will enter the frequency of 12,429.2 KHz in the transmitter frequency memory. At this time, the operating system will prompt, "A3A?". If the channel requires -16dB carrier insertion, the operator enters the numeral "1". If normal A3J (no carrier) operation is required, the operator simply hits the "ENT" key.

Following the mode selection sequence, the operating system will prompt, "RX FREQ". If the channel being programmed is a SIMPLEX channel, it is only necessary to hit "ENT" once more. This will put the previously programmed TRANSMITTER frequency into the RECEIVER storage location. If the channel being programmed is a DUPLEX channel, it will be necessary to enter the desired RECEIVER frequency. EXAMPLE: 1, 2, 3, 4, 5, 6, ENT. This will enter the frequency of 12,345.6 KHz in the receiver frequency memory. At this time, the bin location has been fully programmed, so the operating system will indicate this by prompting, "BIN 10" (held for one second) "STORED" (held for one second). The operating system will then be ready to program the next location and will signal the operator by again prompting, "BIN #?".

### 3.3.3 TO REPROGRAM A CHANNEL

To overwrite already-programmed information:

Re-enter Program Mode (press "8888888").

Press desired two-digit BIN #, then "ENT".

Example: "10", "ENT".
Display will read, "BIN FULL".

Press: <u>Any</u> numeral key.

Example: Press "1".
Display will read, "TX FREQ?".

Continue programming as explained in Section 3.3, FIELD PROGRAMMING THE SEA 222 SCRATCHPAD MEMORY.

### 3.3.4 TO ERASE CHANNEL FREQUENCIES:

Enter the program mode and select the channel to be erased. The display will prompt, "BINFULL". Press any numeric key. The display will prompt, "TX FREQ?", press "ENT". The display will prompt, "RX FREQ?", press "ENT". The frequency information for that channel has been erased and the display will prompt, "BIN#?".

### 3.3.5 ADJUSTING THE SQUELCH THRESHOLD

The software SINAD squelch in the SEA 222 has an adjustable threshold which may be reset in the field to compensate for varying levels of noise interference. Normally, this level is set at the factory for proper operation under typical field conditions. Should it be desired to alter the squelch level, proceed as follows:

Force the SEA 222 into the PROGRAM mode (see ¶ 3.3.1), and when the operating system prompts, "BIN #?", the operator should hit the "SQL" key. The operating system will then prompt, "SQ 0-9?", followed by a number indicating the current setting. At this time, the operator can enter any SINGLE number between 0 and 9 by entering the desired number followed by the "ENT" key. Number 0 corresponds to a very LOW squelch threshold, while number 9 corresponds to a very HIGH squelch threshold. Normally, a setting of from 4 to 6 will suit most installations.

### 3.3.6 EXITING THE PROGRAM MODE

If, after a program entry sequence, no further entries are made for a period of 30 seconds, the operating system will exit the PROGRAM mode and come up on the LAST channel entered while in the PROGRAM mode. If NO entry has been made while in the PROGRAM mode, the system will revert to EMER 0. Further, it is possible to exit the PROGRAM mode immediately by pressing, "EMER". PROGRAM mode will also be exited by cycling the main power switch OFF. When the system comes up, it will be back in the normal operating mode.

## 3.4 SEA 222 FREQUENCY PROGRAM

(U.S. version. For other variants, refer to your specific Operator's Manual.)

2 MHz BAND

| CHANNEL | SHIP TRANSMIT | SHIP RECEIVE | USE |
|---|---|---|---|
| 201 | 2003.0 | 2003.0 | Ship-to-Ship, Great Lakes |
| 203 | 2006.0 | 2006.0 | Alaska |
| 209 | 2031.5 | 2490.0 | WFA, Tampa; Sched. Weather |
| 211 | 2054.0 | 2054.0 | British Columbia WX |
| 212 | 2065.0 | 2065.0 | Ship-to-Ship |
| 213 | 2079.0 | 2079.0 | Ship-to-Ship |
| 214 | 2082.5 | 2082.5 | Ship-to-Ship Only |
| 215 | 2086.0 | 2086.0 | Ship-to-Ship; Mississippi River Ltd. Coast |
| 217 | 2093.0 | 2093.0 | Ship-to-Ship Only - Comm. Fish |
| 218 | 2096.5 | 2096.5 | Ship-to-Ship; Ship-to-Ltd. Coast Station |
| 219 | 2115.0 | 2115.0 | Alaska |
| 220 | 2118.0 | 2514.0 | Alaska |
| 221 | 2118.0 | 2514.0 | WOM, Ft. Lauderdale; WLC, Rogers City, MI |
| 223 | 2131.0 | 2309.0 | WOU-23, Kodiak, AK |
| 224 | 2134.0 | 2312.0 | WGG-53, Cold Bay, AK |
| 228 | 2142.0 | 2142.0 | CA Intership |
| 230 | 2158.0 | 2550.0 | WFA, Tampa; WBL, Buffalo; PJC, Curacao |
| 236 | 2203.0 | 2203.0 | Ship-to-Ship, Gulf of Mexico |
| 238 | 2206.0 | 2582.0 | WBL, Buffalo, NY; VCS, Halifax, Canada |
| 239 | 2237.0 | 2397.0 | WDV-26, Cordova; WGG-56, Ketchikan, AK |
| 240 | 2240.0 | 2400.0 | WGG-58, Juneau; WGG-55, Nome, AK |
| 242 | 2366.0 | 2450.0 | WOU, Boston |
| 245 | 2390.0 | 2566.0 | WOM, Ft. Lauderdale |
| 248 | 2406.0 | 2506.0 | KMI, Pt. Reyes, CA; KOE, Eureka, CA |
| 249 | 2419.0 | 2419.0 | Alaska |
| 250 | 2422.0 | 2422.0 | Alaska |

| CHANNEL | SHIP TRANSMIT | SHIP RECEIVE | USE |
|---|---|---|---|
| 251 | 2427.0 | 2427.0 | Alaska |
| 252 | 2430.0 | 2572.0 | WLO, Mobile, AL |
| 254 | 2430.0 | 2430.0 | Alaska |
| 255 | 2447.0 | 2447.0 | Alaska |
| 256 | 2450.0 | 2450.0 | Alaska |
| 257 | 2458.0 | 2506.0 | KGN, Del Cambre, LA |
| 258 | 2479.0 | 2479.0 | Alaska |
| 259 | 2482.0 | 2482.0 | Alaska |
| 261 | 2506.0 | 2506.0 | Alaska |
| 262 | 2509.0 | 2509.0 | Alaska |
| 263 | 2512.0 | 2512.0 | FFP, Ft. DeFrance, Windward Is. |
| 266 | 2535.0 | 2535.0 | |
| 267 | 2538.0 | 2538.0 | Alaska |
| 268 | 2563.0 | 2563.0 | Alaska |
| 269 | 2566.0 | 2566.0 | Alaska |
| 273 | 2616.0 | 2616.0 | Alaska |
| 275 | 2638.0 | 2638.0 | Ship-to-Ship |
| 277 | 2670.0 | 2670.0 | USCG Working |
| 280 | 2738.0 | 2738.0 | Ship-to-Ship, all except Great Lakes and Gulf |
| 282 | 2830.0 | 2830.0 | Ship-to-Ship, Gulf Only |
| 301 | 3023.0 | 3023.0 | |
| 303 | 3201.0 | 3201.0 | Alaska Point-to-Point |
| 304 | 3258.0 | 3258.0 | Alaska |
| 305 | 3261.0 | 3261.0 | Alaska |
| 306 | 3449.0 | 3449.0 | Alaska Aero |

## 4 MHz BAND

| USE | SHIP TRANSMIT | SHIP RECEIVE | USE |
|---|---|---|---|
| 401 | 4065.0 | 4357.0 | KMI, Pt. Reyes, CA; WAH, St. Thomas, VI |
| 402 | 4068.0 | 4360.0 | |
| 403 | 4071.0 | 4363.0 | WOM, Ft. Lauderdale, FL |
| 404 | 4074.0 | 4366.0 | |
| 405 | 4077.0 | 4369.0 | WLO, Mobile, AL; WLC, Rogers City, MI |

| CHANNEL | SHIP TRANSMIT | SHIP RECEIVE | USE |
|---|---|---|---|
| 406 | 4080.0 | 4372.0 | |
| 407 | 4083.0 | 4375.0 | |
| 408 | 4086.0 | 4378.0 | |
| 409 | 4089.0 | 4381.0 | WBL, Buffalo; WMI, Lorain, OH |
| 410 | 4092.0 | 4384.0 | WOO, Manahawkin, NJ |
| 411 | 4095.0 | 4387.0 | WOO, Manahawkin, NJ |
| 412 | 4098.0 | 4390.0 | WOM, Ft. Lauderdale, FL |
| 413 | 4101.0 | 4393.0 | |
| 414 | 4104.0 | 4396.0 | WLO, Mobile, AL |
| 415 | 4107.0 | 4399.0 | |
| 416 | 4110.0 | 4402.0 | KMI, Pt. Reyes, CA; WOO, Manahawkin, NJ |
| 417 | 4113.0 | 4405.0 | KMI, Pt. Reyes, CA; WOO, Manahawkin, NJ |
| 418 | 4116.0 | 4408.0 | WBL, Buffalo, NY; WMI, Lorain, OH |
| 419 | 4119.0 | 4411.0 | WLO, Mobile, AL |
| 420 | 4122.0 | 4414.0 | |
| 421 | 4125.0 | 4417.0 | |
| 422 | 4128.0 | 4420.0 | WOO, Manahawkin, NJ |
| 423 | 4131.0 | 4423.0 | WOM, Ft. Lauderdale, FL |
| 424 | 4134.0 | 4426.0 | NMG, New Orleans, LA; NMN, Portsmouth, VA (weather) |
| 425 | 4137.0 | 4429.0 | |
| 426 | 4140.0 | 4432.0 | |
| 450 | 4125.0 | 4125.0 | |
| 451 | 4146.0 | 4146.0 | 4A LTD Coast/Intership |
| 452 | 4149.0 | 4149.0 | 4B LTD Coast/Intership |
| 453 | 4417.0 | 4417.0 | 4C LTD Coast/Intership |

## 6 MHz BAND

| CHANNEL | SHIP TRANSMIT | SHIP RECEIVE | USE |
|---|---|---|---|
| 601 | 6200.0 | 6501.0 | NMN, Portsmouth, VA; NMG, New Orleans, LA; NMA, Miami |
| 602 | 6203.0 | 6504.0 | |
| 603 | 6206.0 | 6507.0 | |

| CHANNEL | SHIP TRANSMIT | SHIP RECEIVE | USE |
|---|---|---|---|
| 604 | 6209.0 | 6510.0 | |
| 605 | 6212.0 | 6513.0 | |
| 606 | 6215.0 | 6516.0 | |
| 650 | 6215.0 | 6215.0 | 6 MHz Calling Frequency |
| 651 | 6224.0 | 6224.0 | 6A LTD Coast/Intership |
| 652 | 6227.0 | 6227.0 | 6B LTD Coast/Intership |
| 653 | 6230.0 | 6230.0 | 6C LTD Coast/Intership |

## 8 MHz BAND

| CHANNEL | SHIP TRANSMIT | SHIP RECEIVE | USE |
|---|---|---|---|
| 801 | 8195.0 | 8719.0 | |
| 802 | 8198.0 | 8722.0 | WOM, Ft. Lauderdale, FL |
| 803 | 8201.0 | 8725.0 | |
| 804 | 8204.0 | 8728.0 | KMI, Pt. Reyes, CA |
| 805 | 8207.0 | 8731.0 | WOM, Ft. Lauderdale, FL |
| 806 | 8210.0 | 8734.0 | |
| 807 | 8213.0 | 8737.0 | |
| 808 | 8216.0 | 8740.0 | WOO, Manahawkin, NJ |
| 809 | 8219.0 | 8743.0 | KMI, Pt. Reyes, CA |
| 810 | 8222.0 | 8746.0 | WOM, Ft. Lauderdale, FL |
| 811 | 8225.0 | 8749.0 | WOO, Manahawkin, NJ |
| 812 | 8228.0 | 8752.0 | |
| 813 | 8231.0 | 8755.0 | |
| 814 | 8234.0 | 8758.0 | WOM, Ft. Lauderdale, FL |
| 815 | 8237.0 | 8761.0 | WOO, Manahawkin, NJ |
| 816 | 8240.0 | 8764.0 | |
| 817 | 8243.0 | 8767.0 | |
| 818 | 8246.0 | 8770.0 | |
| 819 | 8249.0 | 8773.0 | |
| 820 | 8252.0 | 8776.0 | |
| 821 | 8255.0 | 8779.0 | |
| 822 | 8258.0 | 8782.0 | |
| 823 | 8261.0 | 8785.0 | |
| 824 | 8264.0 | 8788.0 | WLO, Mobile, AL |
| 825 | 8267.0 | 8791.0 | WOM, Ft. Lauderdale, FL |
| 826 | 8270.0 | 8794.0 | WOO, Manahawkin, NJ; WBL, Buffalo, NY; WMI, Lorain, OH |

| | | | |
|---|---|---|---|
| 827 | 8273.0 | 8797.0 | |
| 828 | 8276.0 | 8800.0 | WLO, Mobile, AL |
| 829 | 8279.0 | 8803.0 | WLO, Mobile, AL |
| 830 | 8282.0 | 8806.0 | WLO, Mobile, AL |
| 831 | 8285.0 | 8809.0 | WOM, Ft. Lauderdale, FL |
| 850 | 8291.0 | 8291.0 | |
| 851 | 8294.0 | 8294.0 | 8A LTD Coast/Intership |
| 852 | 8297.0 | 8297.0 | 8B LTD Coast/Intership |

12 MHz BAND

| CHANNEL | SHIP TRANSMIT | SHIP RECEIVE | USE |
|---|---|---|---|
| 1201 | 12230.0 | 13077.0 | KMI, Pt. Reyes, CA |
| 1202 | 12233.0 | 13080.0 | KMI, Pt. Reyes, CA |
| 1203 | 12236.0 | 13083.0 | KMI, Pt. Reyes, CA; WOO, Manahawkin, NJ |
| 1204 | 12239.0 | 13086.0 | |
| 1205 | 12242.0 | 13089.0 | |
| 1206 | 12245.0 | 13092.0 | WOM, Ft. Lauderdale, FL |
| 1207 | 12248.0 | 13095.0 | |
| 1208 | 12251.0 | 13098.0 | WOM, Ft. Lauderdale, FL |
| 1209 | 12254.0 | 13101.0 | WOM, Ft. Lauderdale, FL |
| 1210 | 12257.0 | 13104.0 | WOO, Manahawkin, NJ |
| 1211 | 12260.0 | 13107.0 | WOO, Manahawkin, NJ |
| 1212 | 12263.0 | 13110.0 | WLO, Mobile, AL |
| 1213 | 12266.0 | 13113.0 | |
| 1214 | 12269.0 | 13116.0 | |
| 1215 | 12272.0 | 13119.0 | WOM, Ft. Lauderdale, FL |
| 1216 | 12275.0 | 13122.0 | |
| 1217 | 12278.0 | 13125.0 | |
| 1218 | 12281.0 | 13128.0 | |
| 1219 | 12284.0 | 13131.0 | |
| 1220 | 12287.0 | 13134.0 | |
| 1221 | 12290.0 | 13137.0 | |
| 1222 | 12293.0 | 13140.0 | WOM, Ft. Lauderdale, FL |
| 1223 | 12296.0 | 13143.0 | |
| 1224 | 12299.0 | 13146.0 | |
| 1225 | 12302.0 | 13149.0 | |

| CHANNEL | SHIP TRANSMIT | SHIP RECEIVE | USE |
|---|---|---|---|
| 1226 | 12305.0 | 13152.0 | WLO, Mobile, AL |
| 1227 | 12308.0 | 13155.0 | |
| 1228 | 12311.0 | 13158.0 | WOO, Manahawkin, NJ |
| 1229 | 12314.0 | 13161.0 | KMI, Pt. Reyes, CA |
| 1230 | 12317.0 | 13164.0 | |
| 1231 | 12320.0 | 13167.0 | |
| 1232 | 12323.0 | 13170.0 | |
| 1250 | 12290.0 | 12290.0 | |
| 1251 | 12353.0 | 12353.0 | 12A LTD Coast/Intership |
| 1252 | 12356.0 | 12356.0 | 12B LTD Coast/Intership |
| 1253 | 12359.0 | 12359.0 | 12C LTD Coast/Intership |

## 16 MHz BAND

| CHANNEL | SHIP TRANSMIT | SHIP RECEIVE | USE |
|---|---|---|---|
| 1601 | 16360.0 | 17242.0 | WOM, Ft. Lauderdale, FL |
| 1602 | 16363.0 | 17245.0 | KMI, Pt. Reyes, CA |
| 1603 | 16366.0 | 17248.0 | KMI, Pt. Reyes, CA |
| 1604 | 16369.0 | 17251.0 | |
| 1605 | 16372.0 | 17254.0 | WOO, Manahawkin, NJ |
| 1606 | 16375.0 | 17257.0 | |
| 1607 | 16378.0 | 17260.0 | |
| 1608 | 16381.0 | 17263.0 | |
| 1609 | 16384.0 | 17266.0 | WOO, Manahawkin, NJ |
| 1610 | 16387.0 | 17269.0 | WOO, Manahawkin, NJ |
| 1611 | 16390.0 | 17272.0 | |
| 1612 | 16393.0 | 17275.0 | |
| 1613 | 16396.0 | 17278.0 | |
| 1614 | 16399.0 | 17281.0 | |
| 1615 | 16402.0 | 17284.0 | |
| 1616 | 16405.0 | 17287.0 | WOM, Ft. Lauderdale, FL |
| 1617 | 16408.0 | 17290.0 | |
| 1618 | 16411.0 | 17293.0 | |
| 1619 | 16414.0 | 17296.0 | |
| 1620 | 16417.0 | 17299.0 | WOO, Manahawkin, NJ |
| 1621 | 16420.0 | 17302.0 | |
| 1622 | 16423.0 | 17305.0 | |

| CHANNEL | SHIP TRANSMIT | SHIP RECEIVE | USE |
|---|---|---|---|
| 1623 | 16426.0 | 17308.0 | |
| 1624 | 16429.0 | 17311.0 | KMI, Pt. Reyes, CA |
| 1625 | 16432.0 | 17314.0 | |
| 1626 | 16435.0 | 17317.0 | WOO, Manahawkin, NJ |
| 1627 | 16438.0 | 17320.0 | |
| 1628 | 16441.0 | 17323.0 | |
| 1629 | 16444.0 | 17326.0 | |
| 1630 | 16447.0 | 17329.0 | |
| 1631 | 16450.0 | 17332.0 | WOO, Manahawkin, NJ |
| 1632 | 16453.0 | 17335.0 | |
| 1633 | 16456.0 | 17338.0 | |
| 1634 | 16459.0 | 17341.0 | |
| 1635 | 16462.0 | 17344.0 | |
| 1636 | 16465.0 | 17347.0 | |
| 1637 | 16468.0 | 17350.0 | |
| 1638 | 16471.0 | 17353.0 | |
| 1639 | 16474.0 | 17356.0 | |
| 1640 | 16477.0 | 17359.0 | |
| 1641 | 16480.0 | 17362.0 | WLO, Mobile, AL |
| 1650 | 16420.0 | 16420.0 | |
| 1651 | 16528.0 | 16528.0 | 16A LTD Coast/Intership |
| 1652 | 16531.0 | 16531.0 | 16B LTD Coast/Intership |
| 1653 | 16534.0 | 16534.0 | 16C LTD Coast/Intership |

## 18 MHz BAND

| CHANNEL | SHIP TRANSMIT | SHIP RECEIVE | USE |
|---|---|---|---|
| 1851 | 18840.0 | 18840.0 | LTD Coast/Intership |
| 1852 | 18843.0 | 18843.0 | LTD Coast/Intership |

## 22 MHz BAND

| CHANNEL | SHIP TRANSMIT | SHIP RECEIVE | USE |
|---|---|---|---|
| 2201 | 22000.0 | 22696.0 | WOO, Manahawkin, NJ |
| 2202 | 22003.0 | 22699.0 | |
| 2203 | 22006.0 | 22702.0 | |

| | | | |
|---|---|---|---|
| 2204 | 22009.0 | 22705.0 | |
| 2205 | 22012.0 | 22708.0 | WOO, Manahawkin, NJ |
| 2206 | 22015.0 | 22711.0 | |
| 2207 | 22018.0 | 22714.0 | |
| 2208 | 22021.0 | 22717.0 | |
| 2209 | 22024.0 | 22720.0 | |
| 2210 | 22027.0 | 22723.0 | WOO, Manahawkin, NJ |

| CHANNEL | SHIP TRANSMIT | SHIP RECEIVE | USE |
|---|---|---|---|
| 2211 | 22030.0 | 22726.0 | |
| 2212 | 22033.0 | 22729.0 | |
| 2213 | 22036.0 | 22732.0 | |
| 2214 | 22039.0 | 22735.0 | KMI, Pt. Reyes, CA |
| 2215 | 22042.0 | 22738.0 | WOM, Ft. Lauderdale, FL |
| 2216 | 22045.0 | 22741.0 | WOM, Ft. Lauderdale, FL |
| 2217 | 22048.0 | 22744.0 | |
| 2218 | 22051.0 | 22747.0 | |
| 2219 | 22054.0 | 22750.0 | |
| 2220 | 22057.0 | 22753.0 | |
| 2221 | 22060.0 | 22756.0 | |
| 2222 | 22063.0 | 22759.0 | WOM, Ft. Lauderdale, FL |
| 2223 | 22066.0 | 22762.0 | KMI, Pt. Reyes, CA |
| 2224 | 22069.0 | 22765.0 | |
| 2225 | 22072.0 | 22768.0 | |
| 2226 | 22075.0 | 22771.0 | |
| 2227 | 22078.0 | 22774.0 | |
| 2228 | 22081.0 | 22777.0 | KMI, Pt. Reyes, CA |
| 2229 | 22084.0 | 22780.0 | |
| 2230 | 22087.0 | 22783.0 | |
| 2231 | 22090.0 | 22786.0 | |
| 2232 | 22093.0 | 22789.0 | |
| 2233 | 22096.0 | 22792.0 | |
| 2234 | 22099.0 | 22795.0 | |
| 2235 | 22102.0 | 22798.0 | |
| 2236 | 22105.0 | 22801.0 | KMI, Pt. Reyes, CA; WOO, Manahawkin, NJ |
| 2237 | 22108.0 | 22804.0 | WLO, Mobile, AL |
| 2238 | 22111.0 | 22807.0 | |
| 2239 | 22114.0 | 22810.0 | |
| 2240 | 22117.0 | 22813.0 | |
| 2251 | 22159.0 | 22159.0 | 22A LTD Coast/Intership |

| CHANNEL | SHIP TRANSMIT | SHIP RECEIVE | USE |
|---|---|---|---|
| 2252 | 22162.0 | 22162.0 | 22B LTD Coast/Intership |
| 2253 | 22165.0 | 22165.0 | 22C LTD Coast/Intership |
| 2254 | 22168.0 | 22168.0 | 22D LTD Coast/Intership |
| 2255 | 22171.0 | 22171.0 | 22E LTD Coast/Intership |

## 3.5 CAUTION! FREQUENCY TOLERANCE

Under FCC Rules, the frequency tolerance for the Marine Service is ± 20 Hz. In order to achieve this accuracy a frequency counter with a long-term accuracy of 1-3 Hertz should be used.

All work affecting the transmitter performance must be done by, or under the supervision of, a person holding at least a General Radiotelephone FCC license.

## 3.6 SETTING THE TRANSMITTER FREQUENCIES

### 3.6.1 THE MASTER CLOCK OSCILLATOR

Either of two methods may be used to adjust the Master Clock:

1. Connect a high-stability frequency counter to Pin 8 or Pin 11 of U17 on the Main Board (ASY-0222-01). Signal amplitude is approximately 5 Volts P-P. Adjust trimmer capacitor C151 for a frequency reading of exactly 6400.0 KHz.

2. Select the highest desired transmitter frequency (such as 22171.0 KHz). With the transmitter output connected to an appropriate dummy load and a few watts of re-inserted carrier being generated, connect an appropriate counter to the RF dummy load and adjust trimmer capacitor C151 for the correct carrier frequency. Carrier reinsertion can be activated by programming test frequency into scratchpad memory with "A3A" toggled on (see pp 3.3). NOTE: This technique, when used with a good frequency counter, is generally superior to method #1.

# 4. INSTALLATION

## 4.1 MOUNTING THE TRANSCEIVER

All SEA models are compact enough to allow great flexibility in location, even on smaller vessels. Several options for mounting are available. The mounting bracket fits underneath or on top of the transceiver for bulkhead, overhead or shelf locations. Figure 4.1 shows the outline dimensions of the SEA 222 and mounting holes. When choosing a location for the radio set, take care to avoid areas directly over a heater or lacking adequate ventilation.

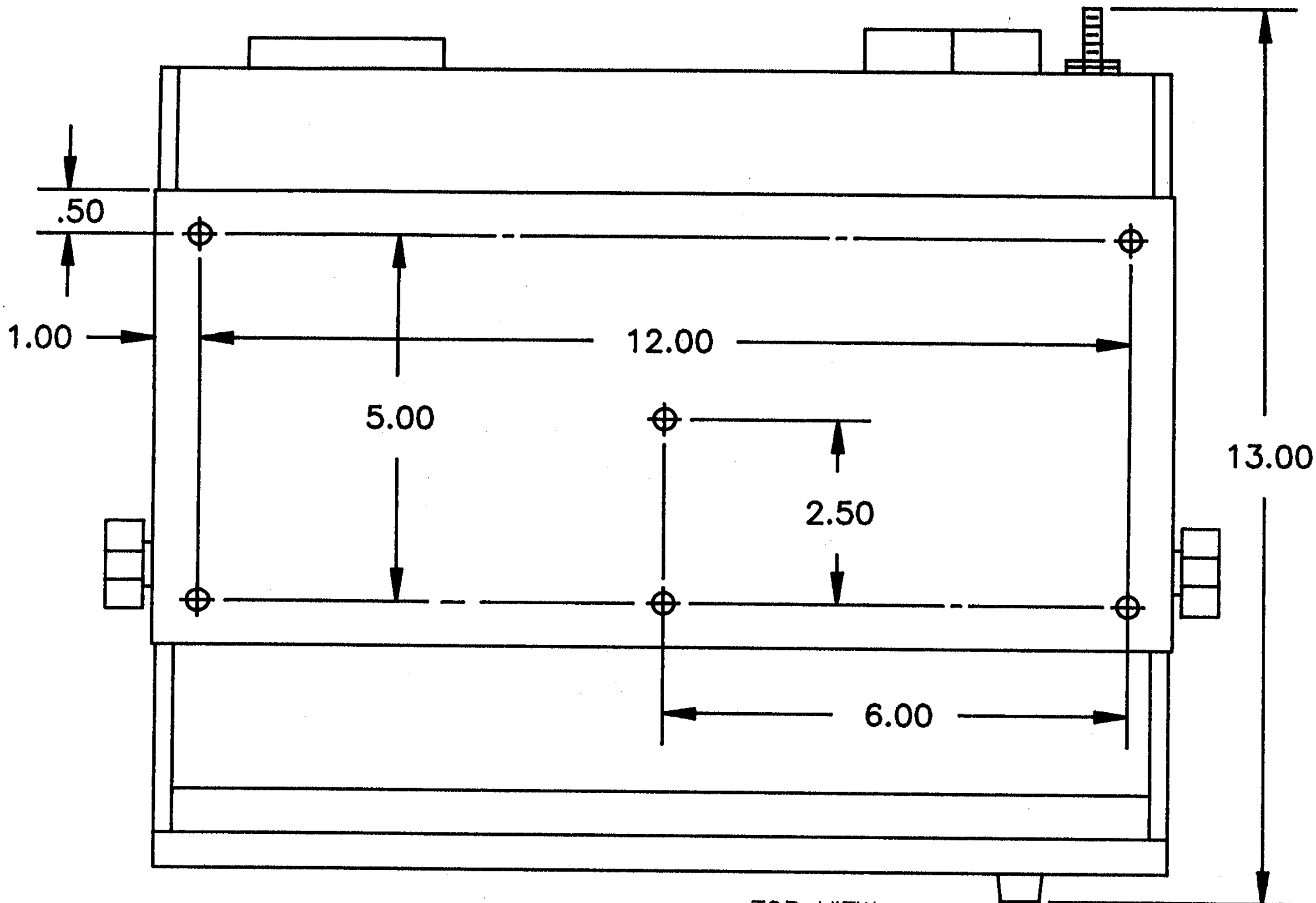
## 4.2 A TYPICAL INSTALLATION

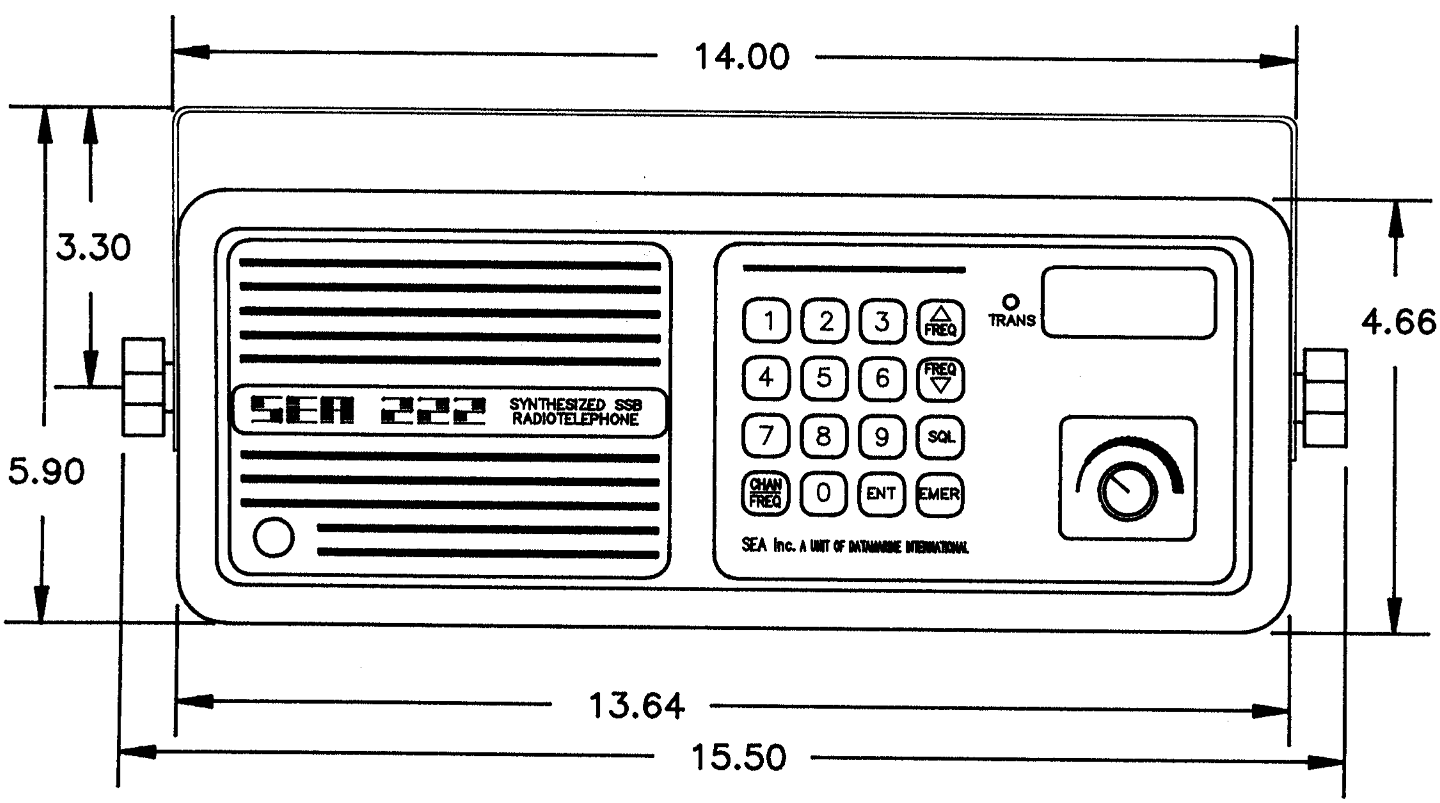
Figure 4.2 shows a typical installation consisting of three parts: (1) The radio equipment; (2) Interconnecting cable; (3) The antenna system.

Any radio communications system operating in the MF-HF spectrum MUST have an adequate ground connection, otherwise the overall efficiency of the radio installation is degraded. In extreme cases, it may be impossible to properly load the radiotelephone into the antenna.

The 50 Ohm output impedance of the SEA 222 makes it necessary to employ an antenna system of the resonant or externally matched type. The use of the SEA 1612 antenna coupler in conjunction with a whip antenna allows an efficient installation, which will cover both the MF and HF bands. The SEA 1612 was designed specifically for marine applications and will easily interface with the transceiver.

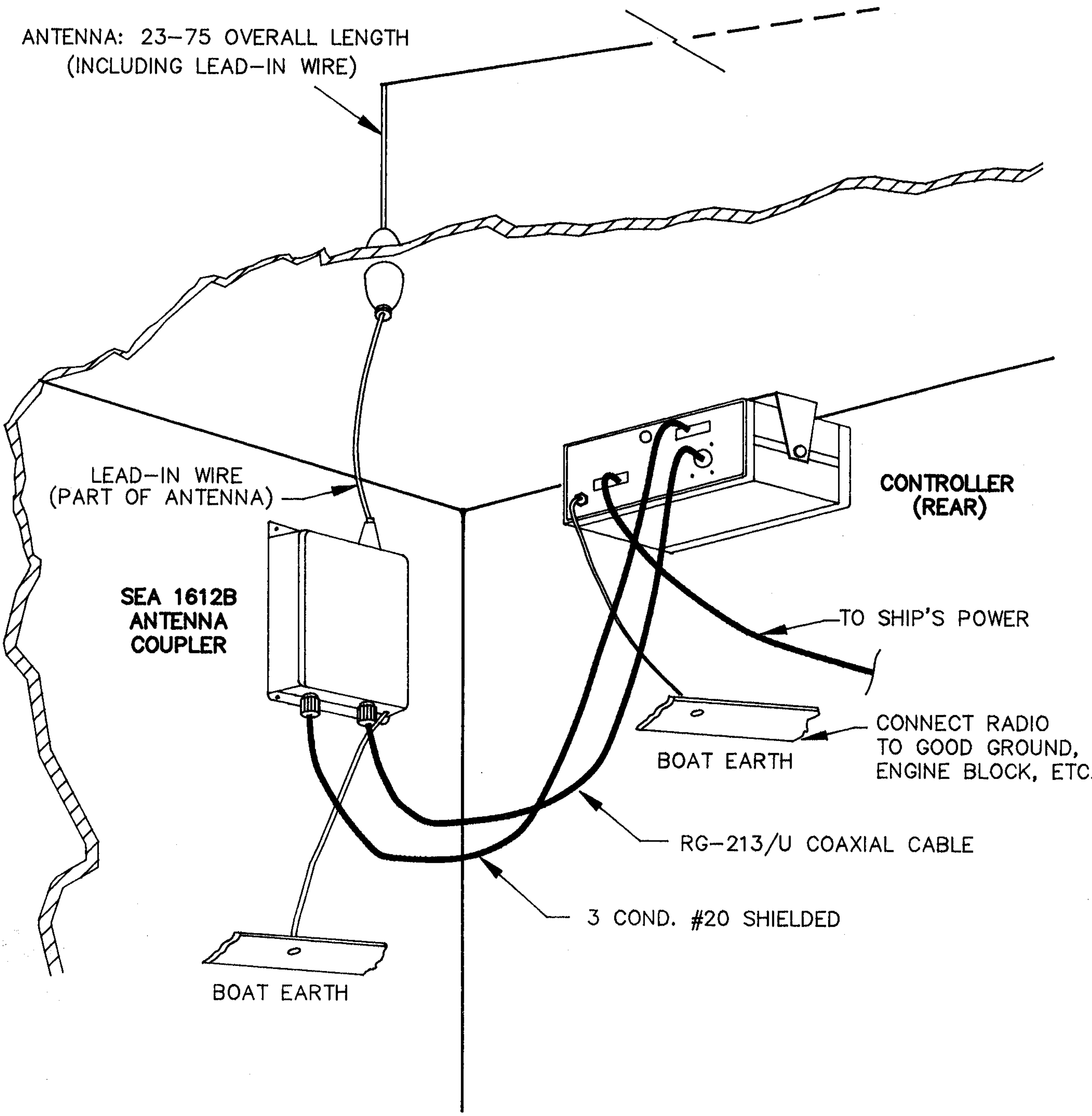
On wooden or fiberglass boats, the use of copper ground plate or the keel on a sailboat perform adequately. The ground system MUST be joined to the antenna coupler with a copper strap, kept to the shortest length possible.



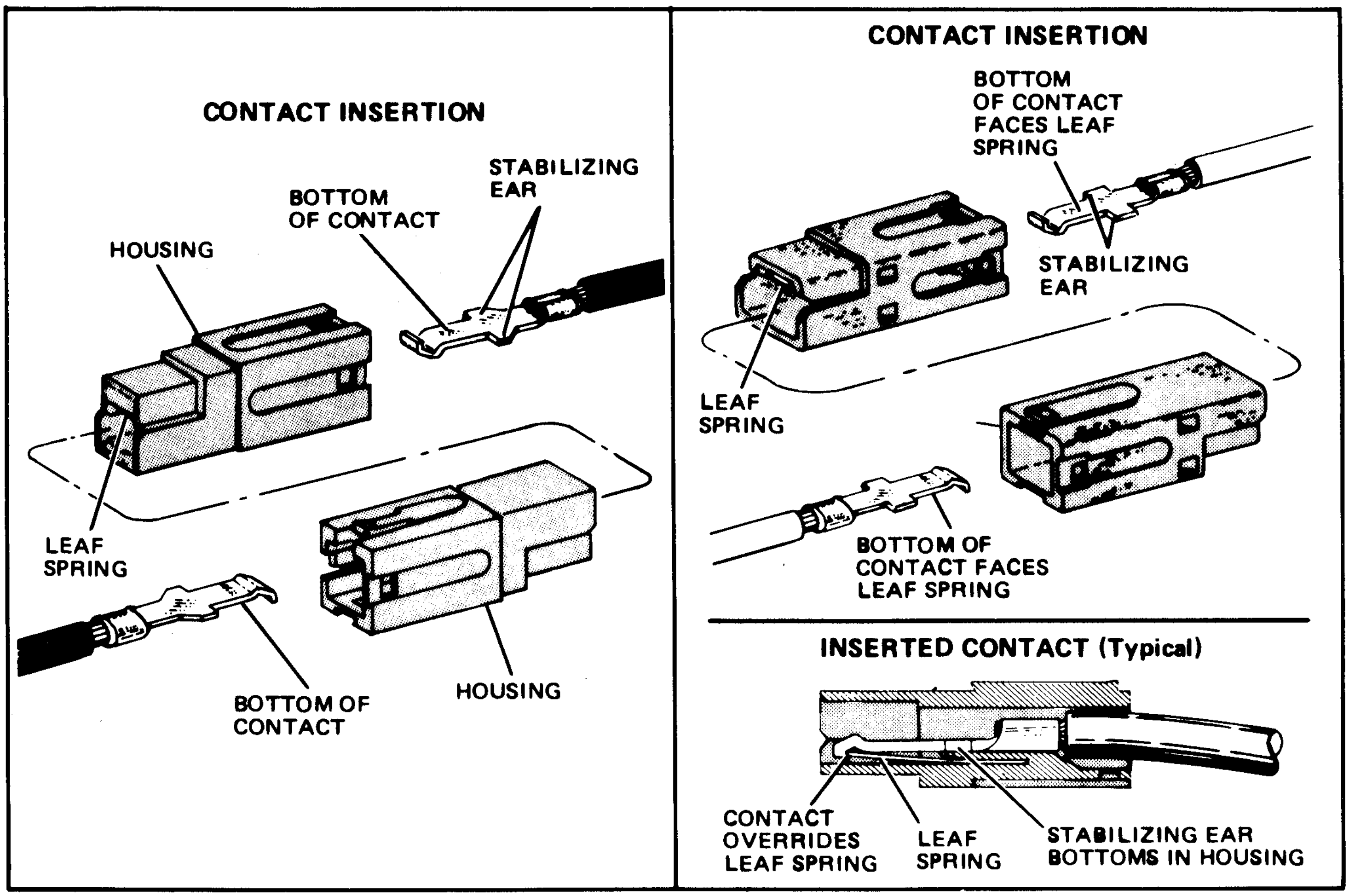




**OUTLINE DIMENSIONS**

**FIGURE 4.1**




**TYPICAL INSTALLATION**
**FIGURE 4.2**




**POWER PLUG ASSEMBLY**

**FIGURE 4.3.1**


**SEA 222 REAR VIEW**

**FIGURE 4.3.3**

fuse for this circuit is the 5 Amp fuse located on the PA/Filter Board, ASY-0222-02.

TND - This terminal allows the connection of an "ALL TUNED" indicator line from an automatic antenna coupler. Grounding this line will cause the "TUNED" indicator in the VF display to light during transmit. (See ¶ 2.5.12)

GND - Access to the negative side (ground) of the primary supply. Also common to the chassis.

DO NOT USE THESE TERMINALS FOR HIGH-CURRENT APPLICATION.

### 4.3.4 FUSING

Three fuses are provided in the SEA 222, all mounted internally on the PA/Filter Board (ASY-0222-02).

Fuses F1 and F2 are 15 Amp, AGC. Each fuse protects one pair of power output transistors, and each fuse is provided with a reverse polarity protection diode.

Fuse F3 is a 5 Amp, AGC. This fuse protects the low-level circuitry in the SEA 222 and also provides a fused 13 Volt power buss for an external antenna coupler. This fuse is also provided with a reverse polarity protection diode.

### 4.3.5 THE GROUND CONNECTION

A stainless steel bolt and nut are provided on the rear panel to allow a low-resistance connection between the radiotelephone chassis and the engine block, keel or similar RF ground system.

# 5. THEORY OF OPERATION

## 5.1 GENERAL

The SEA 222 is a double-conversion HF SSB transceiver. Certain circuits perform the same function in receive and transmit (bilateral design). The first intermediate frequency (I.F.) is 45 MHz and permits the use of low-pass filters to provide excellent image, spurious and harmonic rejection. This type of broad-band design results in a minimum of tuned circuits. The second I.F. of 6.4 MHz allows for good secondary image rejection and the use of relatively inexpensive crystal filters for sideband selection.

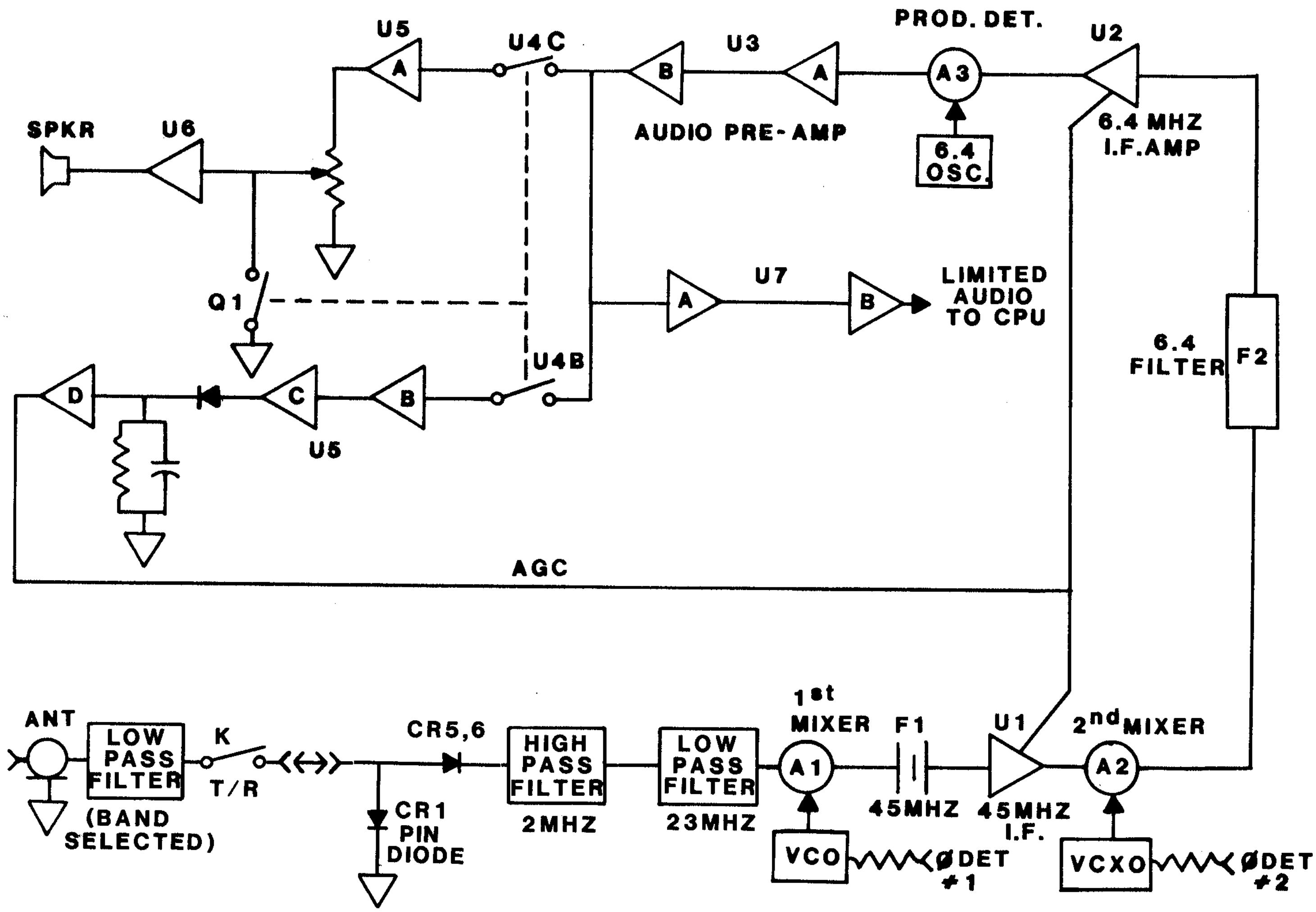
The SEA 222 uses a two-loop PLL local oscillator system to allow complete frequency coverage without the addition of channel control crystals. Since the high-frequency oscillators are all phase-locked to a high stability reference oscillator, the frequency stability is strictly a function of the 6400.00 KHz Master Clock.

Most operating functions of the SEA 222 are controlled through the front panel keyboard. The keyboard is used, along with the eight-character VF display, as a control terminal. This allows the operator to communicate with the small microprocessor-based computer, which actually controls the various transceiver functions.

## 5.2 THE RECEIVER

### 5.2.1 BLOCK DIAGRAM

Figure 5.2.1 shows the block diagram of the receive mode. The received RF signal is routed from the rear panel antenna jack to J3 on the PA/Filter Board. On this PC Board, the signal is routed through a relay selected set of low-pass filters and the T/R antenna relay, to J2. From J2, the signal goes to the RX input jack on the Main Board, J4. From J4, the signal passes first through a P.I.N. Protector circuit and then through a 2 MHz high-pass filter. A second, low-pass filter with a cutoff frequency of 23 MHz completes the "front end" selectivity. No less than two cascaded filters are used, providing excellent image and first I.F. Rejection.




SEA 222

RECEIVER BLOCK DIAGRAM

FIGURE 5.2.1

After filtering, the signal is applied to the mixer, A1, where it is mixed with a signal from the 45.5-70 MHz VCO and up converted to the first I.F. Frequency of 45 MHz. The output from A1 is then passed through F1, a 45 MHz two-pole monolithic filter with a bandwidth of approximately 15 KHz. This provides a comparatively narrow "window" which protects the following circuitry from intermodulation problems. The filtered 45 MHz I.F. Signal is then applied to the first bilateral I.F. Amplifier, U1.

After amplification in U1, the 45 MHz I.F. Signal is combined in A2 with a 38.6 MHz signal from the VCXO, down-converted to the 6.4 MHz second I.F. Frequency and passed through F2, a narrow-band signal sideband filter. The filtered signal is then amplified in bilateral I.F. Amplifier, U2, and combined with the 6.4 MHz BFO frequency in mixer A3. The output from A3 is a low-level audio signal which is then amplified by the low-noise audio preamplifier, U3.

Note that the 6.4 MHz filter selects the LOWER sideband. This is actually the UPPER sideband, because of the frequency inversion which occurred at the first mixer.

After being amplified to a suitable level by the low-noise preamplifier stage, the audio signal is then sent to three different circuits: The squelch limiter/amplifier, U7, provides a hard limited signal to the CPU. This signal is examined by the squelch software routine which determines the presence of voice signals.

The low-level audio is also sent to the audio-derived AGC circuitry, which consists of U5B and U5C. These two operational amplifiers provide amplification and filtering to the audio signal, which is then rectified by CR16. The diode output is a fast attack, slow release AGC voltage, which is then applied to the AGC control buss of the I.F. Amplifier stages through U5D.

The third low-level audio signal is sent to the signal audio pre-amplifier/filter, U5A, where it is approximately doubled in amplitude and band-limited to a cutoff frequency of about 3000 Hz.

After being amplified and filtered, the receiver audio is then passed on to the front panel volume control where the operator can control the audio level applied to the input of the power amplifier stage, U6. The output from U6 provides the loudspeaker signal.

## 5.3 RECEIVE RF CIRCUITRY AND FIRST MIXER

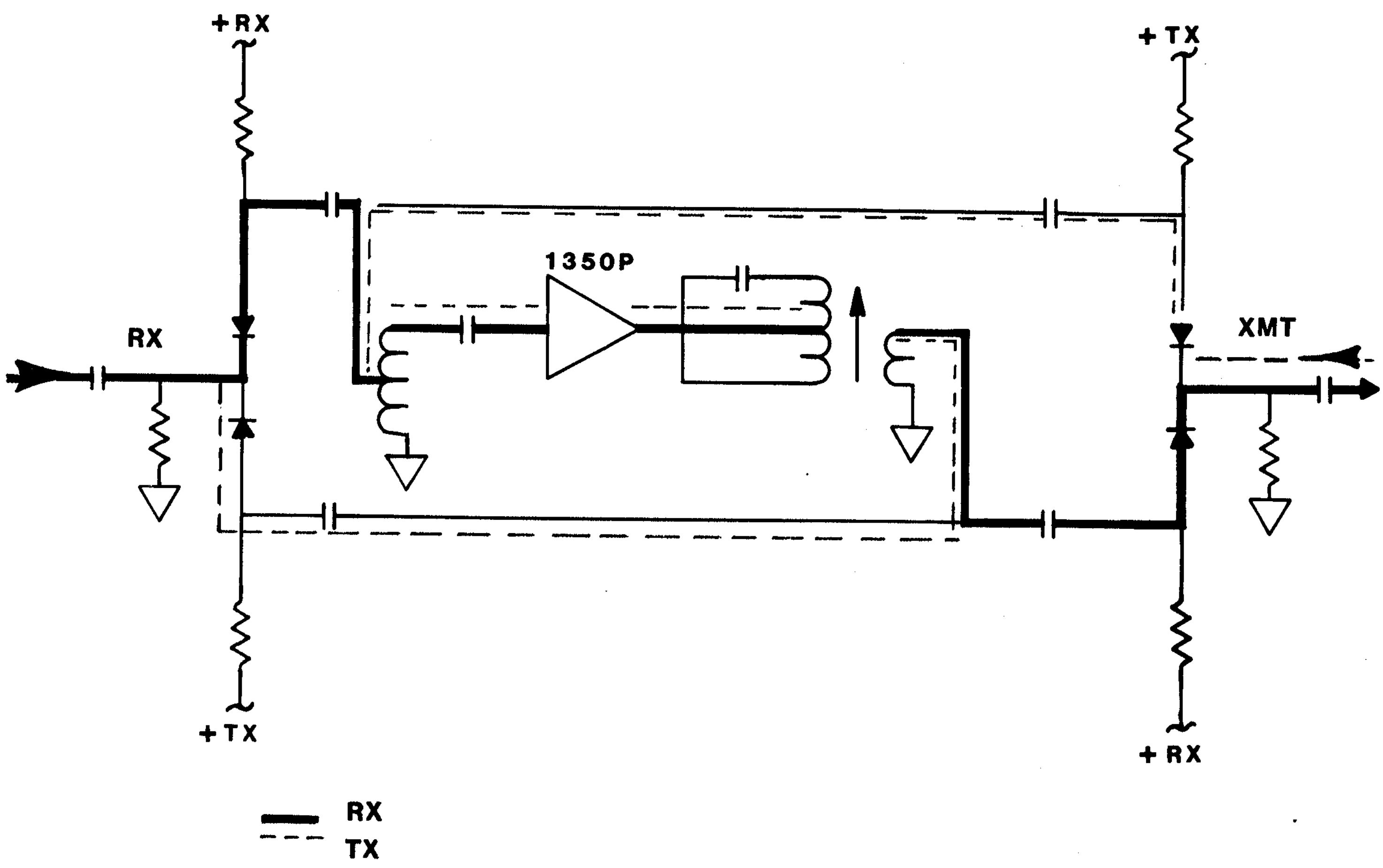
As previously discussed, an incoming signal is first passed through a system of cascaded low- and high-pass filters, a T/R relay and P.I.N. Diode device, which is designed to protect the sensitive input mixer from damage due to high RF overloads. On the main board, switching diodes CR5 and CR6 are forward-biased by the +10V Rx buss, thus passing the received signal to the double-balanced mixer A1. The use of a hot carrier diode double-balanced mixer assures minimal cross-modulation and intermodulation distortion in the receiver front end. The 2 MHz high-pass filter provides some protection from the very large signals generated by nearby standard broadcast transmitters.

### 5.3.1 THE BILATERAL 45 MHz I.F. AMPLIFIER

The output from A1 is the desired signal, upconverted to 45 MHz and filtered by F1, a two-pole monolithic crystal filter with a bandwidth of about 15 KHz. This 45 MHz signal is then amplified by the first I.F. Amplifier. The amplifier stage is somewhat unique, in that it consists of a tuned MC1350P integrated circuit amplifier surrounded by a P.I.N. Diode array, which allows the direction of signal flow through the amplifier to be reversed by properly reversing the switching diodes. (See Figure 5.3.1.) The advantage of this type of amplifier stage is that the direction of signal flow can be reversed at will, allowing the entire receiver system to "double" as a transmitter. This process minimizes the transceiver circuitry and allows considerable simplification in the design.

### 5.3.2 SECOND MIXER AND 6.4 MHz SSB FILTER

Once the 45 MHz I.F. Signal is amplified in U1, it is applied to the second double-balanced mixer, A2, along with the VCXO signal at about 38.6 MHz. The DIFFERENCE frequency output, at 6.4 MHz, is then passed through F2, a narrow bandwidth lower




**SEA 222**

**BI-LATERAL I.F. AMPLIFIER**

**FIGURE 5.3.1**

sideband filter. The LOWER sideband at this point is equivalent to a signal frequency UPPER sideband signal, since the first conversion INVERTS the information band, while the SECOND conversion to 6.4 MHz does not.

### 5.3.3 6.4 MHz I.F. AMPLIFIER AND PRODUCT DETECTOR

The twice-converted, amplified and filtered signal from the 6.4 MHz filter (F2) is then passed through the second I.F. Amplifier. This is another tuned bilateral MC1350P Amplifier, similar to the first I.F. Amplifier except for operating frequency. The output from the second I.F. Amplifier is then applied to A3, the product detector, along with a BFO signal at 6.4 MHz. The product detector is still another double-balanced hot carrier diode mixer, which assures a low-distortion, low-noise detector with good dynamic range.

### 5.3.4 LOW-NOISE AUDIO PREAMPLIFIER

Integrated circuit U3 is a low-noise audio preamplifier, which uses the type LM387 dual preamp chip. The first stage (U3A) is configured as a non-inverting amplifier with a stage gain of approximately 35. The non-inverting configuration is used to assure minimum noise figure.

The second stage (U3B) is configured as an inverting amplifier with a stage gain of approximately 9. The inverting configuration and lower gain assure maximum dynamic range. Overall gain of the preamplifier stage is approximately 315 with a noise contribution equivalent to approximately 0.5 uV. Since the minimum product detector output is normally approximately 20 uV or better, the AUDIO signal to noise floor exceeds 30 dB.

### 5.3.5 AUDIO PREAMPLIFIER/FILTER

U5A is connected as a moderate-gain active low-pass filter with a cutoff frequency of approximately 3000 Hz and a slope of 12 dB/octave. Some additional rolloff is provided in the low-noise preamplifier. The effect of these filters is to remove the high-frequency "hiss" present at the output of the product detector and to enhance the speech signal to noise ratio.

### 5.3.6 AUDIO POWER AMPLIFIER

Power-integrated circuit U6, a type TDA2002, is used to raise the audio power level to about 4 Watts, which drives either the internal 3.2 Ohm loudspeaker or may be used to drive remote speaker systems through use of the rear panel accessory connector.

### 5.3.7 SQUELCH LIMITER/AMPLIFIER

Dual operational amplifier U7 is configured as a cascaded two-stage audio amplifier. Gain per stage is about 22, providing a total gain of about 480. Since the amplifier is powered from the +5 Volt CPU power buss, the maximum output voltage swing is 5 Volts P-P. Thus, the normal output from U7 consists of heavily limited noise and (when present) voice audio. This signal is sent to the control computer where a software analogue of SEA's normal "voice operated" squelch system resides. If a voice is present in the signal, the computer program will unsquelch the receiver if the squelch has been activated. Like the standard SEA "hardware squelch" system, the squelch requires a moving audio tone to remain open. A single tone will momentarily open the squelch, but will not hold it open.

### 5.3.8 THE AUDIO-DERIVED AGC SYSTEM

A sample of the low-noise audio preamplified output is routed to U5B, which is configured as a low-gain inverting amplifier/low-pass filter. The amplified, band-limited output is then applied to the input of U5C, which is configured as an inverting amplifier with a gain of approximately 8. The non-inverting input of U5C is connected to approximately +3.4 Volts from voltage divider R59, R60, and R61. The output of U5C is then applied to the AGC detector diode, CR16. The output of CR16 consists of positive voltage peaks, which are proportional to the offset voltage applied to the non-inverting input of U5C. This voltage charges AGC time-constant capacitor, C81, through resistor R70, which provides an AGC attack time of approximately 25 MSec, while the AGC discharge resistor, R71, provides a release time constant of about 2 seconds. This fast-attack, slow-release AGC voltage is buffered by a non-inverting follower, U5D, and applied to the I.F. Amplifier AGC port through steering diode CR17.

### 5.3.9 THE AUDIO T/R GATES

Integrated circuit U4 and MOSFET Q1 provide T/R gating functions in the audio amplifier circuitry as follows:

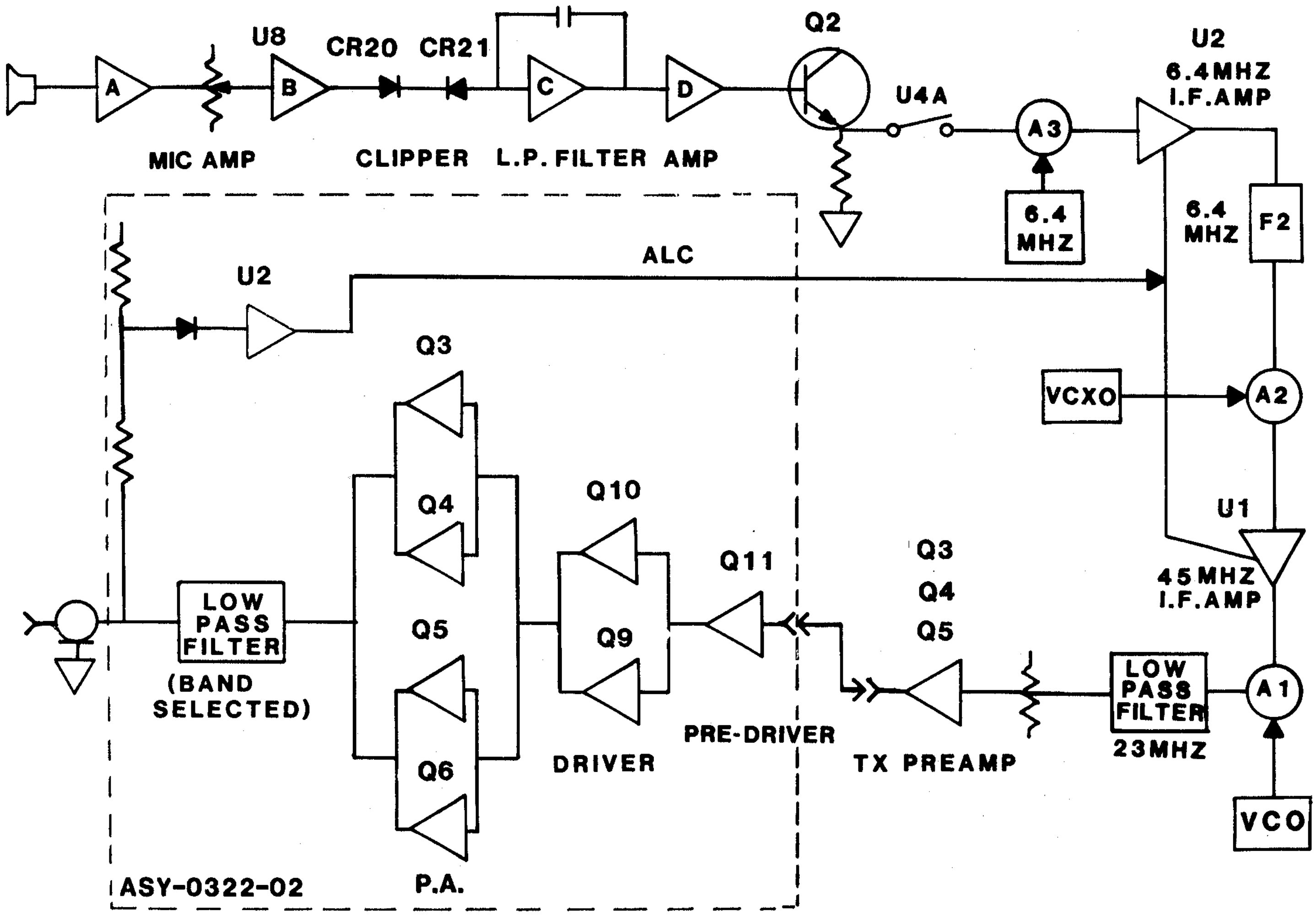
U4B is turned ON in the receive mode, and connects preamplifier audio to the AGC amplifier/detector circuit. Turning this device OFF in the transmit mode prevents the AGC storage capacitor from "pumping up" on transmitter microphone audio from the preamplifier circuit. Similarly, U4A serves to disconnect the microphone audio circuitry from the product detector in the receive mode. This avoids any noise contribution from the microphone amplifier/clipper circuitry.

Q1 and U4C are operated by the squelch signal from the CPU. A positive output from the CPU turns Q1 ON, thus shorting the audio signal across the volume control, while the CPU signal is inverted by U4D, and is then used to turn U4C OFF, greatly attenuating the audio signal applied to U5A from the audio preamplifier. Note that the squelch signal is controlled by the CPU and is positive during transmission periods. The overall function of the gate circuitry is to provide a thumpless squelch gate and a rapid, clickless transition between the transmit and receive modes.

## 5.4 THE TRANSMITTER

### 5.4.1 BLOCK DIAGRAM

Figure 5.4.1 shows the block diagram of the SEA 222 in the transmit mode. The microphone signal is fed to an amplifier/clipper/filter circuit (U8) for speech wave-shaping, and is then applied through emitter follower Q2 to the balanced modulator, A3. The 6.4 MHz carrier oscillator is also applied to A3. The resulting double-sideband suppressed carrier signal is amplified in the bilateral 6.4 MHz I.F. Amplifier, U2, passed through the 6.4 MHz lower sideband filter, F2, where it is converted to a single-sideband suppressed carrier signal and then mixed with a 38.6 MHz signal in mixer A2. The output from A2 at 45 MHz is amplified by U1 and then passed through the




**SEA 222**

**TRANSMIT BLOCK DIAGRAM**

**FIGURE 5.4.1**

45 MHz monolithic filter, F1, and down-converted to the desired signal frequency by mixing with the required VCO frequency in A1. The signal output from A1 is passed through the front-end, low-pass filter, switching diode CR7 and RF Gain Control R101 to the transmitter preamplifier. This amplifier consists of Q3, Q4, and Q5 and serves to boost the level of the signal to approximately 0 dBm.

The 0 dBm signal from J5, the main board transmitter output jack, is then connected by shielded cable to the input jack, J6 on the PA/Filter board, and applied to the transmitter predriver, Q11. Q11, a small power device, provides sufficient drive for the push-pull power driver, which consists of Q9 and Q10. The approximate 10 Watt output from the power driver is then applied to the four-transistor power amplifier, which consists of Q3, Q4, Q5, and Q6 in a dual-amplifier/combiner system.

The output from the power stage is at a level of 150 Watts, and is then passed through an appropriate low-pass filter (relay selected by the control computer) where a voltage sample is detected by CR2 for use as an ALC feedback voltage. The filtered RF output is taken from J3 and connected via coaxial cable to the rear panel RF output jack.

### 5.4.2 MICROPHONE PREAMPLIFIER

The 600 Ohm dynamic microphone output is terminated by R76 and is then amplified by the microphone preamplifier, consisting of U8A and U8B. Both stages are configured as inverting amplifiers. U8A has an approximate gain of 6.5 and the gain U8B is approximately 12. The cascaded gain of approximately 100 can be adjusted to any required level by the microphone gain control potentiometer, R80.

### 5.4.3 SPEECH LIMITER

Biased diodes CR20 and CR21 are configured in a full-wave peak clipper circuit. The output from this clipper is limited to about 0.6 Volts P-P by the action of the diodes. Normally, the input signal level is adjusted to approximately 1.2 Volts P-P, which results in a clipping level of 6 dB. To properly adjust the speech limiter circuit, R80 should be adjusted for a signal level at the cathode of CR20, which is just twice the signal level at the cathode of CR21. This adjustment should be made with normal voice input to the microphone.

### 5.4.4 SPEECH AMPLIFIER/LOW-PASS FILTER BUFFER

U8C is configured as a low-pass filter with a cutoff frequency of approximately 3000 Hz. Band-limiting of the clipped microphone audio is required to avoid intermodulation effects in later circuitry. The output from the low-pass filter is buffered by inverting amplifier U8D and emitter follower Q2. The audio from Q2 is then passed through T/R gate U4A and applied to the balanced modulator, A3. The gain of U8D is preset to supply the correct modulating audio level to A3 to insure good carrier rejection and proper signal level through the I.F. Amplifiers. Note that adjustment of total transmitter gain is accomplished with R101 and NOT R80. R80 should be adjusted for 6 dB clipping as described above. Increasing the audio level into the clipper will only result in distortion and will NOT increase the peak output from the transmitter.

### 5.4.5 TRANSMITTER BALANCED MODULATOR

Double-balanced mixer, A3, is used as the transmitter-balanced modulator. The processed microphone audio is applied to the DC coupled port of A3, while the carrier signal at 6.4 MHz is applied to the L.O. Port. The output from the R.F. Port is a double-sideband suppressed carrier signal, which is then applied to the input of the 6.4 MHz bilateral I.F. Amplifier.

### 5.4.6 CARRIER REINSERTION AMPLIFIER

Carrier is reinserted when desired through amplifier U32. This integrated circuit is a voltage-controlled attenuator, used here to control the level of reinserted carrier. Normally in the A3J mode, the control voltage port of U32 is held at +8 Volts, which cuts off any output signal. When carrier is desired, the control computer switches in a level-control potentiometer, which allows the output signal from U32 to be adjusted to the desired level. Two control potentiometers are provided: The A3A (-16 dB) level pot, R29 and the A3H (-6 dB) level pot, R30. The reinserted carrier signal is routed around F2 and applied to mixer A2.

### 5.4.7 6.4 MHz I.F. AMPLIFIER AND SSB FILTER

From A3, the 6.4 MHz double-sideband suppressed carrier signal is applied to the input of the bilateral 6.4 MHz I.F. Amplifier. This amplifier and the 45 MHz bilateral I.F. Amplifier, U1, are both gain-controlled in the transmit mode by the ALC voltage derived from the power amplifier.

The 6.4 MHz crystal filter, F2, is a LOWER sideband filter with a total passband of approximately 2.1 KHz. Passing the double-sideband suppressed carrier signal through this filter results in a LOWER sideband 6.4 MHz, suppressed carrier signal which is then applied to the up-converter balanced mixer, A2.

### 5.4.8 THE UP-CONVERTER, 45 MHz I.F. AMP AND FILTER

The up-converter mixer is a double-balanced diode ring type mixer with inputs from the 38.6 MHz VCXO and the 6.4 MHz I.F. Amplifier. The 45 MHz mixer output is amplifed by U1. The operation of this amplifier is the same as the 6.4 MHz amplifier except for frequency.

The high-impedance 45 MHz monolithic filter is matched to the low-impedance amplifier and mixer stages by "L" networks to provide for a ripple-free, low-loss filter termination. The filter output is applied to the input of the down-converter or signal mixer.

### 5.4.9 SIGNAL MIXER AND LOW-PASS FILTER

A1 is another double-balanced ring diode mixer which changes the 45 MHz IF frequency to the desired OPERATING frequency by mixing with a signal from the VCO. The use of the DIFFERENCE frequency here results in a frequency inversion. Thus, the output signal is an UPPER sideband SSB signal as required. The mixer output is passed through a seven-section elliptical-function, low-pass filter, which provides some 50 dB of rejection for the image and I.F. Frequencies above 23 MHz.

## 5.4.10 TRANSMITTER SIGNAL PREAMPLIFIER

The signal output from the low-pass filter is switched through CR7 to the input of the transmitter preamplifier. This is a two-stage wide-band amplifier, with the first stage configured as a two-transistor direct-coupled pair. The first transistor, Q3, is connected as a common emitter stage which is directly coupled to Q4. Q4 is an emitter follower which provides power gain and impedance matching for the output signal. DC feedback from the emitter of Q4 to the base of Q3 stabilizes the circuit operating point over a wide temperature range, while the use of VHF transistors provides a very wide frequency response.

Q5 is driven from the output of emitter follower Q4 and is configured as a transformer-coupled ground emitter amplifier. DC feedback is provided by the emitter resistor, R107. The output from this stage is nominally +10 dBm. From J5, the SSB signal goes to the PA/Filter board for further amplification.

## 5.4.11 TRANSMITTER PREDRIVER

The transmitter low-level signal is applied through a 3 dB pad and a wide-band transformer to the base of Q11. Q11 is a 2N3866 connected in the common emitter configuration and is transformer-coupled to the push-pull driver stage. Bias for Q11 is provided by the base resistor network with R41 used to adjust the idling (no signal) current in the device to 60 mA. (0.30 Volts across R43) R43 is used, along with the press-on heat sink, to provide thermal stability.

## 5.4.12 TRANSMITTER DRIVER (FOR RADIOTELEPHONES WITH D OR E SUFFIX SERIAL NUMBERS, SEE PG. 5-17)

Transistors Q9 and Q10 are small, plastic RF power devices, connected as push-pull common emitter amplifiers. Transformer T11 provides push-pull base drive from the collector of Q11, while transformers T9 and T10 provide collector-to-load impedance matching and DC power decoupling, respectively. Gain/bandwidth compensation is provided by the collector/base feedback networks and the various peaking capacitors and terminating resistors. Temperature tracking bias is provided for Q9 and Q10 by bonding a silicon diode, CR9, to the PC-mounted heat sinks for Q9 and Q10. Idling current (no signal) for the driver devices is approximately 100 mA and is adjusted by selecting the correct value for FS3 and/or FS4.

As part of the gain/bandwidth compensation circuitry for the total power amplifier, the output from the transmitter driver is connected to the output power amplifier through a 3 dB pad consisting of R30, R31, and R32.

5.4.13 TRANSMITTER POWER AMPLIFIER

The power amplifier in the SEA 222 is made up of two 75 Watt power amplifier modules, a power splitter and a power combiner. Each amplifier module is a push-pull common emitter design, each is independently fused, and each has its own temperature-stabilized bias source. Each amplifier, like the push-pull driver, has the collector voltage present at all times. The amplifiers are activated by turning on the various bias supplies when in the transmit mode. The power amplifier bias is provided from the +10 Volt TX buss across two silicon diodes, one diode of which is bonded to the heat transfer plate used to heat sink the power devices. This is CR8. CR7, in series with CR8, is used to compensate for the junction voltage drop of the two amplifier bias emitter followers, Q7 and Q8. Each amplifier is normally adjusted to 250 mA idling current (no signal). R26 adjusts the idling current for Q3 and Q4, while R27 adjusts the idling current for Q5 and Q6.

At the input to the power amplifier, T8 is provided as a wide-band hybrid which splits the power driver output into two equal parts. Each of these signals is then independently amplified by a two-transistor push-pull power amplifier module. The amplifier outputs are then recombined in hybrid T1. Resistors are provided to terminate each hybrid in the event of failure of one of the power amplifier modules.

Configuring the power amplifier in this fashion has the advantage of providing for better system redundancy, better heat distribution for the output devices and additionally provides a much wider range of useable output power devices.

5.4.14 OUTPUT LOW-PASS FILTER(S)

Four low-pass filters are provided to cover the frequency range from 2 - 23 MHz. The highest frequency filter, which covers the 16 - 23 MHz spectrum is in the circuit at all times. When lower frequencies are in use, a lower frequency filter is placed in series with the 16 - 23 MHz filter. This provides much greater total VHF stopband rejection than would the use of independent filters. Note that the high-frequency filter is a 5-pole elliptical function design, while the lower frequency filters are 7-pole elliptical function types. This is possible because of the natural drop in spurious outputs from the power amplifier at higher frequencies. Filter selection is through small power relays, which are operated by the control computer through serial relay driver, U1.

5.4.15 ALC CIRCUIT

The ALC circuit provides a DC level which is proportional to the RF output at the antenna connector on the rear panel. This DC level is used to control the gain of the two I.F. Amplifiers on the main board in order to prevent transmitter overload and resultant nonlinearity. An additional function of the ALC circuit is to provide a visual "modulation" indication of the transceiver front panel. This helps the operator determine that (s)he is properly modulating the transceiver.

The voltage across R5 is derived from the actual RF output voltage through a voltage divider and diode detector CR1 and CR2. The output from the detector is applied to R5/C3, which has a time constant of approximately 250 mSec. This fast attack/medium fast release voltage waveform is buffered by emitter follower Q1, routed to the main board through J1 and the interboard cable, and then applied through steering diodes to the ALC control buss and the LED driver circuitry.

Thus, it can be seen that the main board gain control potentiometer, R101, sets the average gain "floor" for the transmitter and the ALC potentiometer adjusts the attack threshold for the ALC feedback voltage. Under normal drive conditions, the instantaneous ALC feedback voltage will not exceed the idling DC level on the ALC buss. Under high drive conditions, when the output attempts to exceed 150 watts, the

ALC feedback will override the DC level and reduce transmitter gain to prevent distortion.

FOR RADIOTELEPHONES WITH D OR E SUFFIX SERIAL NUMBERS (X5537D etc.)

## 5.4.12 TRANSMITTER DRIVER

Transistors Q9 and Q10 are small plastic RF power devices, connected as a push-pull common emitter amplifier. Transformer T11 provides push-pull base drive from the collector of Q11, while transformers T9 and T10 provide collector-to-load impedance matching and DC power decoupling, respectively. Gain/bandwidth compensation is provided by the collector/base feedback networks and the various peaking capacitors and terminating resistors. Temperature tracking bias is provided for Q9 and Q10 by Q15 and Q16. Idling current (no signal) for the driver devices is approximately 130 mA and is adjusted with potentiometer R57. Q15 is an emitter follower, which supplies the high-current, low-impedance bias source for Q9 and Q10.

## 5.4.13 TRANSMITTER POWER AND AMPLIFIER

The power amplifier in the SEA 222 is made up of two 75 watt power amplifier modules, a power splitter and a power combiner. Each amplifier module is a push-pull common emitter design, each is independently fused, and each has its own temperature-stabilized bias source. Each amplifier, like the push-pull driver, has the collector voltage present at all times. The amplifiers are activated by turning on the various bias supplies when in the transmit mode. The power amplifier bias is provided from the +10 Volt Tx buss. This voltage is applied to silicon transistors Q12 and Q13. These transistors are heat sensors, and are bonded to the heat transfer plate which serves as a power amplifier heat sink. The bias generators consist of the two sensor transistors and their buffers Q7 and Q8. The operation of each pair is identical. Bias pair Q12 and Q7 are configured as an amplifier-buffer with the output to the amplifier bias port taken from the emitter follower, Q7. Current through amplifier Q12 is a function of the setting of potentiometer R60 and the heat sink temperature. Each amplifier is normally adjusted to 150 mA idling current (no signal). R60 adjusts the idling current for Q3 and Q4, while R63 adjusts the idling current for Q5 and Q6.

At the input to the power amplifier, T8 is provided as a wide-band hybrid which splits the driver power output into two equal parts. Each of these signals is then independently amplified by a two-transistor push-pull power amplifier module. The amplifier outputs are then recombined in hybrid T1. Resistors are provided to terminate each hybrid in the event of failure of one of the power amplifier modules.

### 5.4.14 OUTPUT LOW-PASS FILTER(S)

Four low-pass filters are provided to cover the frequency range from 2-25 MHz. The ranges of these filters are as follows: Band 4 is 2-3.4 MHz, Band 3 is 3.4-6.8 MHz, Band 2 is 6.8-13.2 MHz, Band 1 is 13.2-25 MHz. Note that the high-frequency filter is a 5-pole elliptical function design, while the lower frequency filters are 7-pole elliptical function types. This is possible because of the natural drop in spurious outputs from the power amplifier at higher frequencies. Filter selection is through small power relays, which are operated by the control computer through serial relay driver, U1.

### 5.4.15 ALC CIRCUIT

The ALC circuit provides a DC level which is proportional to the RF output at the antenna connector on the rear panel. This DC level is used to control the gain of the two IF amplifiers on the main board, preventing transmitter overload and resultant nonlinearity. An additional function of the ALC circuit is to provide a visual "modulation" indication on the transceiver front panel to help the operator to determine that (s)he is properly modulating the transceiver.

The voltage across R69 is derived from the actual RF output voltage through a voltage divider and diode detector CR2. The output from the RF envelope detector is applied through follower U2A and ALC diode CR7 to the fast-attack, slow-release time constant circuitry, consisting of R34, R35, and C5. The attack time constant is a function of R34 and C5, while the release time is controlled by R35 and C5. The ALC voltage is buffered by voltage-follower U2B and combined in non-inverting amplifier U2C with a voltage from the ALC control potentiometer, R38. The output from U2C is an amplified, level-shifted voltage which follows the peaks of the RF envelope faithfully. This voltage is applied to the IF amplifiers on the main board through steering diodes.

In order to provide a modulation indication, the output from U2A is connected through R3 to the base of the LED driver on the main board. Thus, the collector current of Q6 and the front panel LED brilliance is a function of the instantaneous RF output voltage. The ALC voltage cannot be used directly as a modulation indication, since this voltage is conditioned to follow the RF output peaks on a fast-attack, slow-release cycle. This would cause the LED brilliance to appear to "hang" at peak levels under modulation.

## 5.5 THE PHASE-LOCKED LOCAL OSCILLATOR SYSTEM

### 5.5.1 BLOCK DIAGRAM

Figure 5.5.1 shows the block diagram of the phase-locked local oscillator system of the SEA 222.

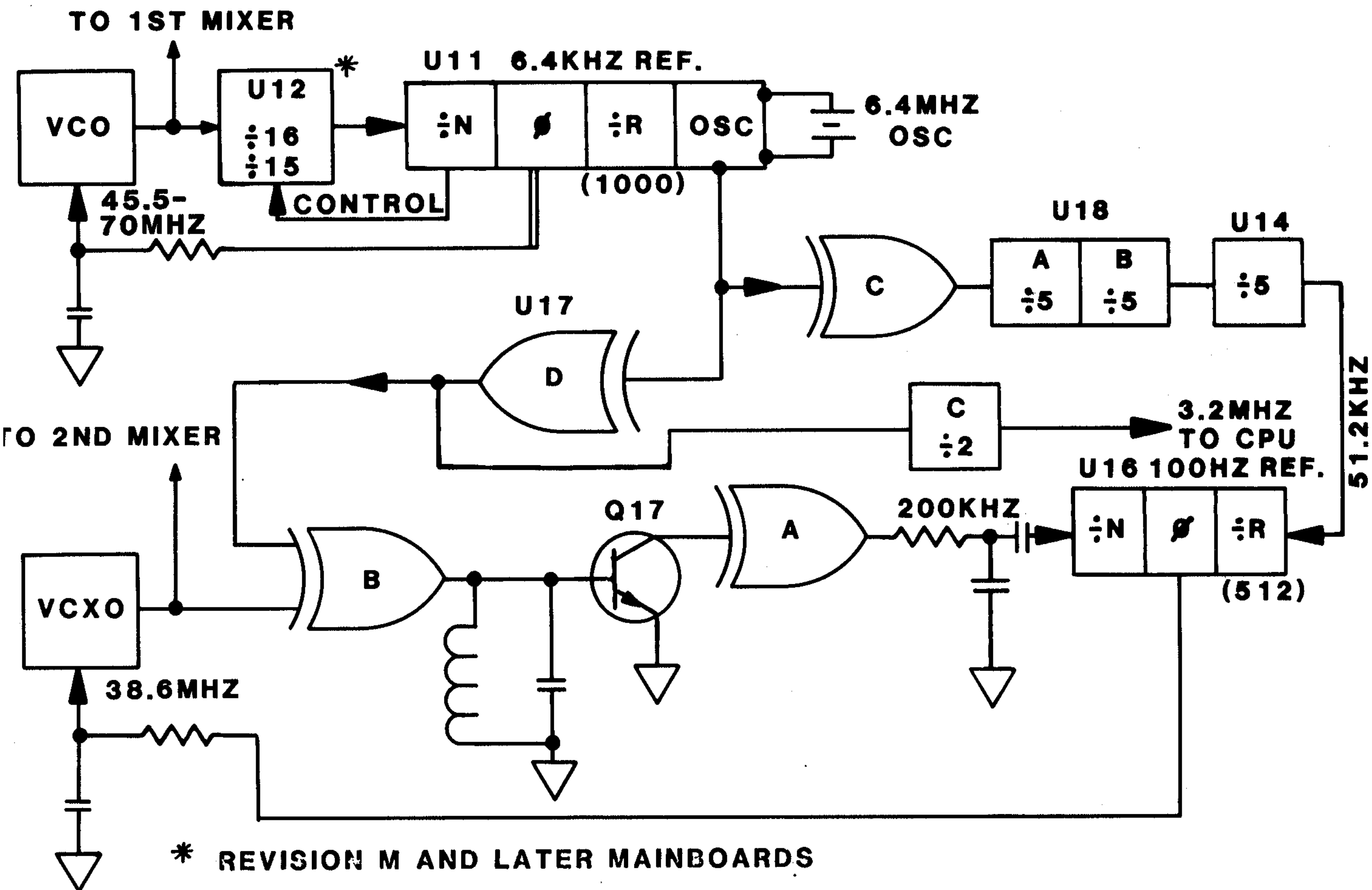
A two-loop system is used in the SEA 222, consisting of the high-frequency loop, operating with a 6.4 KHz reference frequency and the low-frequency loop, which operates with a 100 Hz reference. The combination of two loops provides 100 Hz resolution over the high-frequency spectrum, along with reasonable loop switching and settling times.

The high-frequency loop starts with the VHF VCO (Voltage Controlled Oscillator). This oscillator actually consists of two separate oscillators, where the tuning range is divided into two approximately equal segments. The use of two oscillators, bandswitched by the control computer, provides good VCO spectral purity over the desired tuning range of 45.5-70 MHz. Both VCOs are varactor-tuned by an output voltage from the phase detector in synthesizer chip, U11.

The signal from the selected VCO is buffered and then applied to the first signal mixer, A1. Simultaneously, a sample of the VCO output is applied to the high-speed loop dual modulus prescaler, U12.

The low-speed loop starts with the 38.6 MHz VCXO, Q15. This oscillator operates over the range of 38.5984 to 38.6047 MHz and is varactor-tuned by an output voltage from the phase detector in synthesizer chip U16.

The VCXO signal is buffered by Q16 and then applied to the second signal mixer, A2. Simultaneously, a sample of the VCXO signal is applied to one of the inputs of an HCMOS exclusive OR gate. A buffered 6.4 MHz signal from the master clock oscillator is applied to the second input of the exclusive OR gate which acts as a harmonic mixer. The output signal is the difference between the VCXO signal and the 6th harmonic of the clock signal at 38.4 MHz, or approximately 200 KHz. This 200 KHz signal is filtered, buffered and then applied to the signal input of the low-speed loop synthesizer chip, U16.




* REVISION M AND LATER MAINBOARDS
DIVIDE BY 32 AND 33

**SEA 222**

**PLL BLOCK DIAGRAM**

**FIGURE 5.5.1**

From the above discussion, it may be seen that ALL of the internal conversion oscillator frequencies are phase-locked to the 6400.0 KHz master clock oscillator, that the first conversion oscillator consists of a VCO, which operates as a "coarse tuning" oscillator having a basic resolution of 6.4 KHz and that, finally, the second conversion oscillator operates as a "fine tuning" loop which tunes 6.3 KHz in 100 Hertz steps.

### 5.5.2 THE REFERENCE CLOCK OSCILLATOR

The master clock oscillator operates at a frequency of 6400.0 KHz. This frequency allows the use of a compact, high-stability crystal which is enclosed in a temperature-stabilized holder. The combination of a high-stability crystal, capacitors of the proper temperature coefficient and crystal temperature stabilization provides excellent frequency stability over the environmental temperature range of the equipment. Warm-up time for the clock oscillator is less than three minutes.

The oscillator used is the oscillator portion of synthesizer chip U11. This circuit has been especially designed for use as a stable, high-frequency crystal oscillator and also provides for the high-speed loop reference divider in the form of the built-in divide-by-R counter. This counter is set to 1000 and provides the phase detector with a stable reference of 6.4 KHz.

### 5.5.3 LOW-SPEED LOOP REFERENCE

In order to provide a 100 Hz reference for the low-speed (100 Hz) phase-locked loop, a sample of the 6400.0 KHz master clock signal is divided by 125 in three cascaded quinary counters. Two high-speed quinary counters are provided by U18 and the third by U14. The output from U14 is at a frequency of 51.2 KHz. This 51.2 KHz signal is then applied to the reference divider input of synthesizer chip U16. The internal divide-by-R counter in U16 is set to 512 during fireup initialization, thus providing U16's phase detector with a stable reference of 100 Hz.

### 5.5.4 CPU CLOCK DIVIDER

The CPU clock signal for the control computer is also derived from the master clock oscillator through one of the flip-flops in U18. Dividing the 6400.0 KHz master clock signal by two provides the CPU with a stable clock signal at 3200.0 KHz. This is within the allowed clock range of the CPU and assures that CPU operation will be synchronous with all other counters in the radio, thus minimizing counter-generated noise and spurious signals.

### 5.5.5 THE HIGH-FREQUENCY DIVIDE-BY-N COUNTER

The high-speed divide-by-N function is performed through use of the built-in divide-by-N counter in synthesizer chip U11 in conjunction with the dual modulus prescaler chip, U12.

In practice, the high-frequency signal from the VCO is applied to U12, which normally operates in the divide-by-16 mode until a control signal from the divide-by-A counter in U11 forces it into the divide-by-15 mode. The number of cycles in each prescaler mode, along with the internal divide-by-N counter, determines the actual divide-by-N modulus. The required modulus is calculated by the control computer for each given frequency and then the proper A and N counter register numbers are loaded into the synthesizer chip (U11) by the control computer.

NOTE: Revision M and later main boards U12 divide by 32 and 33.

### 5.5.6 HIGH-FREQUENCY PHASE DETECTOR/LOOP FILTER

Integrated circuit U11 also contains the high-frequency phase detector, whose output is proportional to the phase difference between the clock-derived 6.4 KHz reference frequency and a similar input derived from the dual modulus/divide-by-N counter described in ¶ 5.5.5. The error voltage is filtered through a second order R/C filter and applied to the varactor tuning elements in the VCO circuit.

### 5.5.7 THE VCO SYSTEM AND ASSOCIATED BUFFERS

In the SEA 222, the first conversion oscillator consists of a pair of voltage-controlled oscillators. These oscillators cover the frequency range of 45.5-70 MHz (corresponding to an operating frequency range of 500-25000 kHz) and make use of a UHF low-noise transistor in a Colpitts oscillator circuit. Each oscillator covers approximately one half the overall frequency range and the active oscillator is selected by the control computer through the transistor switches Q4 and Q5.

The frequency-determining inductors are of the high Q toroidal type, while each oscillator uses a matched pair of hyperabrupt junction varactors as the tuning element.

The two oscillators are coupled to the emitter follower buffer, Q3, through small capacitors and the followers' low impedance output is applied to the high-speed prescaler, U12, and the VCO buffer amplifier system. The VCO buffer consists of transistors Q12, Q13, and Q14. Q12 and Q13 are connected as a direct-coupled two-transistor wide-band amplifier, while Q14 is connected as a common emitter, transformer-coupled power buffer. The output from Q14 is terminated with a 3 dB pad and the +7 dBm output from the pad is applied to the LO input port of signal mixer, A1. The purpose of the 3 dB pad is to provide a constant 50 Ohm termination point for the mixer LO port and the buffer transistor output.

The two VCO circuits are essentially identical except for tuning range, and are sufficiently buffered to prevent "pulling" or noise modulation from the counter train or mixer. Typical near field noise sidebands are 60 dB or better below normal output on all channels in the frequency range of the equipment.

### 5.5.8 THE VCXO AND ASSOCIATE BUFFERS

The VCXO (voltage controlled crystal oscillator) serves as the second conversion oscillator for the SEA 222 and operates at approximately 38.6 MHz.

The crystal oscillator is a transistor overtone type, with an inductor in series with the crystal. Coupling varactor CR23 to the series inductor allows the crystal oscillator to be voltage-tuned over the required frequency range. Q16 amplifies the VCXO signal to the level required by the second mixer, A2. A sample of the VCXO signal is also sent to the VCXO down converter, U17.

5.5.9 THEORY OF OPERATION: SECONDARY (VCXO) LOOP

The VCXO signal is down-converted in U17, a HCMOS exclusive OR gate. In this application, the exclusive OR gate operates as a double-balanced harmonic mixer. An input from the VCXO at 38.6 MHz is mixed with a sample of the 6400.0 KHz master clock signal. The mixer output is taken at approximately 200 KHz and is the difference signal between the 38.6 MHz VCXO signal and the sixth harmonic of the master clock signal at 38.4 MHz.

The 200 KHz difference signal is buffered and filtered by the components associated with L16 and Q17, further buffered by another exclusive OR gate (operating as a non-inverting buffer) and then sent to the signal frequency input of synthesizer chip, U16.

In U16, an appropriate divide-by-N number is loaded into the divide-by-N counter by the control computer. This will result in the 200 KHz down-converted VCXO signal being further reduced in frequency to approximately 100 Hz.

The down-converted, down-counted VCXO signal is now applied to the tri-state phase detector in U16 and compared in phase with the 100 Hz signal derived from the master clock. (See ¶ 5.5.3.) The resultant DC error signal is passed through a second order R/C loop filter and applied to the VCXO tuning varactor, CR23.

# 6. MODE AND FREQUENCY CONTROL

## 6.1 GENERAL

In the SEA 222, the frequency of operation is determined by loading a serial bit stream containing a binary number in the two synthesizer chip registers in the frequency synthesizer circuitry.

These binary numbers are calculated through an internal algorithm by the control computer. When the operator loads a desired frequency into the control computer, the computer then calculates all the required binary data streams and inputs the information into the various control registers.

Such data as filter band, VCO band (high or low), VCO loop divide-by-N, VCXO loop divide-by-N, and various control bits are all calculated by the computer, once the desired channel is entered by the operator.

### 6.1.1 TRANSMITTER MODE SELECTION

The primary mode of operation of the SEA 222 is in the A3J (SSB with fully suppressed carrier) mode.

Two auxiliary modes are provided:

A3A: SSB with pilot carrier re-inserted 16 dB below PEP.

A3H: SSB with pilot carrier re-inserted 6 dB below PEP (AM equivalent).

A3J is the basic SSB operating mode and is used for ship-to-ship, base station-to-ship, and point-to-point communications.

A3H is a secondary mode, designed to allow a degree of compatibility between old-style AM equipment and SSB systems. In this mode, the carrier is suppressed only 3 to 6 dB below PEP. Such systems are inherently wasteful of the power capability of any SSB transmitter. As required by law, the "E#0" channel is provided with A3H carrier. (See Page 1-2 Operating Modes.)

In the SEA 222, the normal mode of operation is ALWAYS A3J. On public correspondence channels, the operator may, if desired, insert a -16dB carrier, by entering the desired A3A channel into "scratchpad" memory and inserting the A3A bit (see ¶ 3.3.2 for scratchpad programming information). A3H mode operation on 2182.0 KHz (the international distress and calling frequency) is available by recalling emergency channel E#0. (Note: R30 on the main board may be adjusted for approximately 40 Watts during transmit.)

Two carrier insertion potentiometers are provided on the main board. R29 and R30 control the reinsertion level in the A3A and A3H mode, respectively.

### 6.1.2 RECEIVE MODE SELECTION

Since the SEA 222 as normally supplied always operates as a normal upper-sideband-only SSB receiver, little mention need be made of alternate modes of operation.

AM reception is by the "exhalted carrier" or "zero beat" method. That is, the incoming signal is simply tuned in until the carrier wave is zero beat with the internal BFO. This technique has proven completely adequate for those applications where voice fidelity is desired. For reception of music, the internal I.F. and A.F. filters sharply limit the level of fidelity which may be achieved.

# 7. THE POWER SUPPLY CIRCUIT

## 7.1 GENERAL

The basic supply voltage for the SEA 222 is a negative ground, 13.6 Volt DC source. Line voltage regulation of ± 15% or better is required, with a current capacity of at least 25-30 Amperes.

From this raw source are derived the necessary regulated operating voltages for the SEA 222 circuitry.

### 7.1.1 BLOCK DIAGRAM

Figure 7.1.1 shows a simplified schematic diagram of the power supply circuitry.

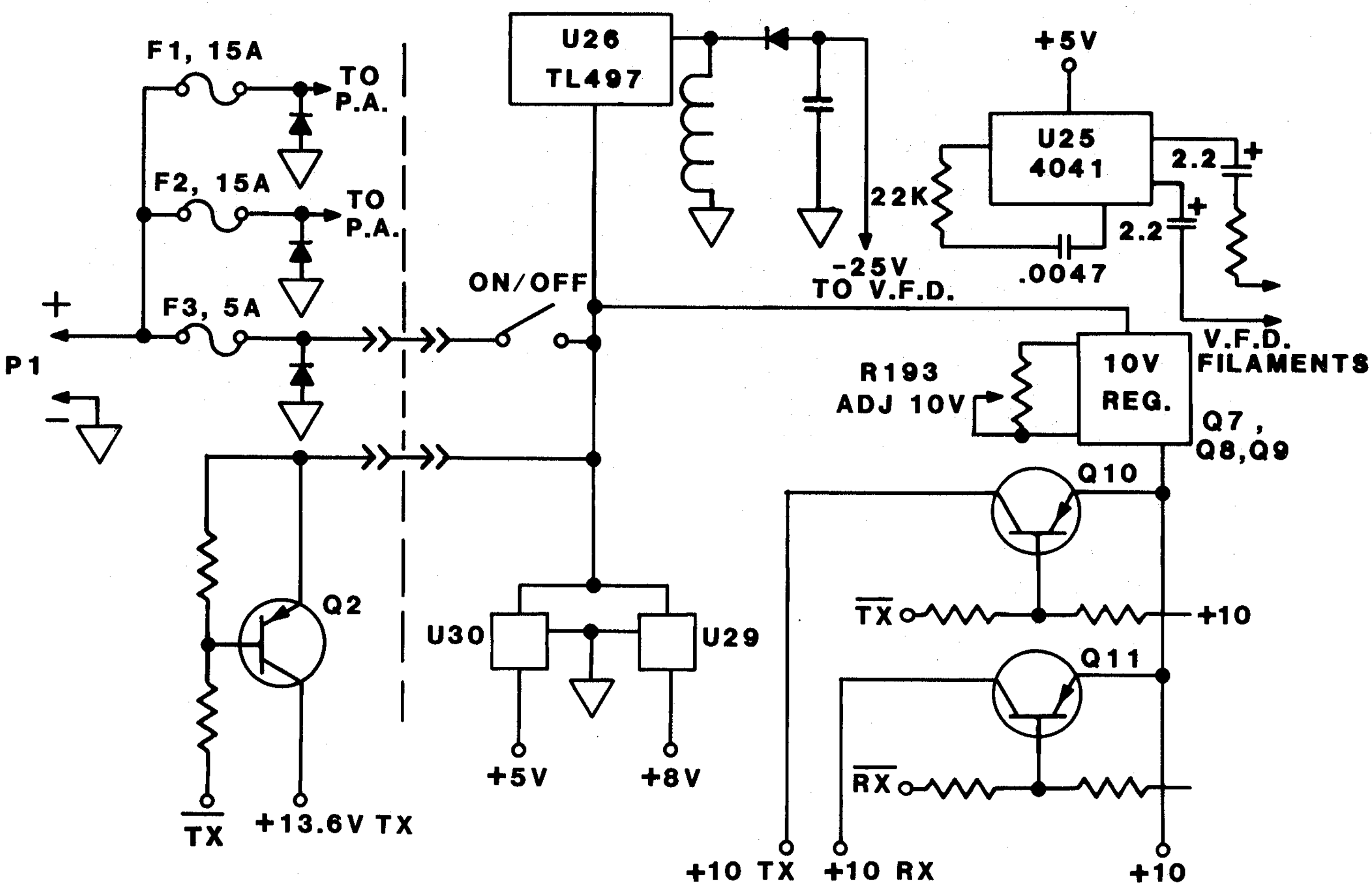
Once the basic 13.6 Volt power is provided, it is connected to the set through the heavy-duty power plug, P1, on the rear panel. Three internally-mounted fuses are provided to protect the set in the event of malfunction. Each fuse has a reverse voltage protection diode, which will blow the fuse in the event of reversed line polarity.

The ON/OFF switch is part of the volume control potentiometer. From this switched 13.6 Volt buss, protected by 5 Amp fuse F3, all other required voltages are derived, EXCEPT the high-current 13.6 Volt buss to the final amplifier transistors.

Several regulators, located throughout the set, distribute the required voltages. All the +10 Volt busses are derived from the 10 Volt regulator on the main board.

The +10 Volt Rx and Tx busses are generated through computer control of inverted transistor switches, Q10 and Q11, while the +13.6 Volt Tx buss is generated on the PA/Filter board through computer control of switching transistor Q2.

The +8 Volt and +5 Volt logic buss voltages are generated from the switched +13.6 Volt buss through the use of standard three-terminal regulators, U29 and U30.




**SEA 222**

**SIMPLIFIED DIAGRAM OF**

**POWER SUPPLY CIRCUITRY**

**FIGURE 7.1.1**

## 7.1.2 +10 VOLT REGULATOR AND THE Tx/Rx SWITCHES

The +10 Volt regulator in the SEA 222 makes use of the PNP power transistor as a series pass device. This transistor, Q7, is connected as an inverted power stage with its base drive derived from a negative feedback amplifier consisting of Q8 and Q9.

In operation, the base of emitter follower Q9 is provided with a sample of the +10 Volt regulator output through resistor network R193, R194. This sample is supplied to the emitter of feedback amplifier Q8.

The base of Q8 is provided with a stable reference voltage from zener diode CR30. This device has a nearly "flat" temperature vs. voltage characteristic, and is further stabilized by obtaining its voltage drive from the +10 Volt buss.

Since the base voltage of Q8 is stabilized by CR30, the collector current in Q8, and thus the base current of the series pass transistor Q7, is inversely proportional to the voltage at the base of Q9. That is, a RISE in the voltage at the base of Q9 causes a REDUCTION in base drive to Q7. This in turn causes the output voltage to be reduced. Similarly, a DROP in the voltage at the base of Q9 will result in an INCREASE in base drive to Q7, which causes the output voltage to be increased.

R189 is shunted across Q7 to provide "start up" voltage for the regulator system. Potentiometer R193 is the +10 Volt adjustment, and allows the regulator to be "trimmed" to exactly +10 Volts by setting the base voltage on Q9. Resistor R190 is provided to limit the base drive to Q7. This provides a degree of short-circuit immunity for the regulator, since the base drive for Q7 tends to "starve off" at about 1 Amp of output current.

The use of the inverted PNP transistor Q7, as the series pass device, has the advantage that the regulator will remain operational under low-line voltage conditions. The low-line limits are primarily a function of the E-C saturation voltage in Q7, which is normally less than 0.5 Volts. Thus, the regulator will provide excellent 10 Volt buss stability, even when the input line voltage has dropped to approximately 10.5 Volts.

Transistors Q10 and Q11 generate the non-overlapping +10 Rx and +10 Tx busses, respectively. These devices are operated as inverted transistor switches and are controlled by the main control computer through the serial relay driver device, U1. U1 is located on the PA/Filter printed circuit board. The use of transistor switches to generate the Tx and Rx buss voltages eliminates any problems with relay contacts or T-R buss timing.

### 7.1.3 +8 VOLT AND +5 VOLT REGULATORS

In the SEA 222, the synthesizer circuitry operates from a regulated +8 Volt buss, while the control computer operates from a regulated +5 Volt buss. These voltages are provided by standard three-terminal voltage regulator integrated circuits, U29 and U30. U29 is a 7808 and provides the +8 Volt buss, while U30 is a 7805 and provides the +5 Volt buss.

### 7.1.4 VF DISPLAY/DISPLAY DRIVER -25 VOLT SUPPLY

The eight-character alphanumeric VF display used in the SEA 222 requires a well-regulated negative power supply for correct operation. This voltage is provided by the components associated with switching regulator integrated circuit, U26. L17 is the "ringing choke" in a standard switching inverter/regulator, with the output voltage being "dumped" into C156 through diode CR28. Resistors R160 and R161 set the output voltage at approximately -25 Volts DC. Zener diodes CR27 and CR32 are used to set the correct operating voltage levels on the display and display driver chip, U24. The -25 Volt inverter operates from the +13.6 Volt switched buss.

### 7.1.5 VF DISPLAY FILAMENT OSCILLATOR

VF displays require an alternating current filament supply in order to avoid "shading" effects. In the SEA 222, this need is supplied by the quad CMOS buffer, U25. This chip operates as a free-running oscillator/buffer, and supplies a 5 Volt P-P square wave output which is capacitively coupled to the display filament circuit through C160 and C161. The frequency of oscillation is controlled by R168 and C159. The frequency of oscillation is chosen to prevent "strobing" of the display.

8. OPTIONS

8.1 C/W HOLD MODULE INSTALLATION

The SEA 222 can be optionally equipped with a semi-breakin CW adapter (SEA PN# ASY-0222-06).

The CW adapter module is located on a PC board which replaces the metal shield over the CPU/display driver circuitry. Three control potentiometers are mounted on the printed circuit board and allow adjustment of the following parameters:

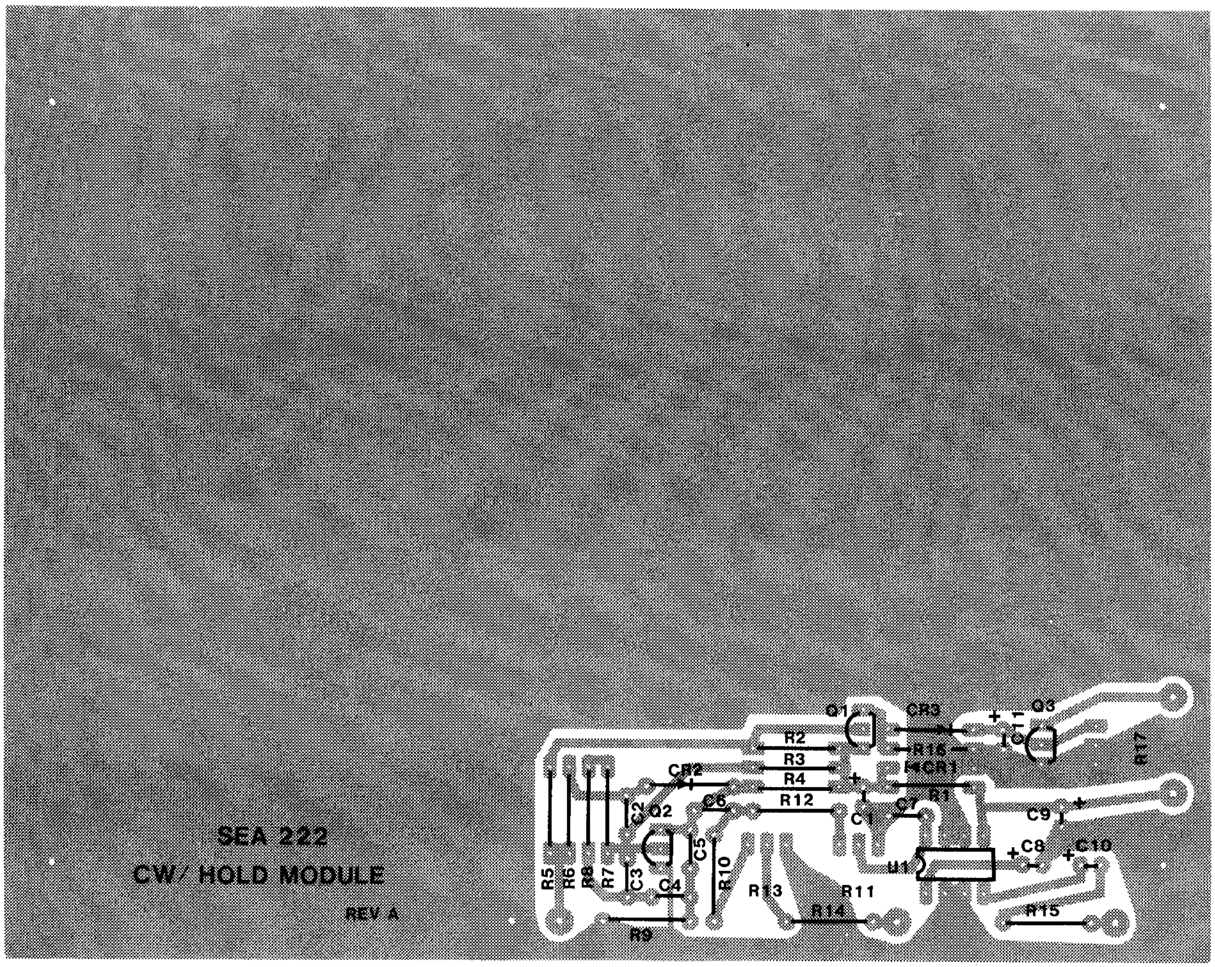
1. R17, the "DELAY" control. This pot is closest to the centerline of the radiotelephone. Using this control, it is possible to adjust the hold in time experienced by the PTT line AFTER the LAST key closure.

2. RII, the "SIDETONE" control. This pot is the center control and is used to adjust the volume level of the sidetone heard in the speaker while the key is down.

3. R13, the "MODULATION" control. This pot is the closest to the right side panel, and is used to adjust the power output level of the transmitter when the key is down. Normally, a power level of 100 watts is correct for the SEA 222. NOTE THAT THE SEA 222 IS NOT A CONTINUOUS DUTY CYCLE TRANSMITTER. KEY DOWN TIME SHOULD BE LIMITED TO NORMAL HAND-KEYED CW MODULATION.

THEORY OF OPERATION:

The CW module consists of a keyed audio oscillator, keyed delay circuit and a sidetone amplifier. When the key line is grounded, transistor Q2 operates as a phase shift oscillator at approximately 1000 Hertz. The resultant audio signal from "MIC" is used to modulate the SSB transmitter. A sample of the audio signal is coupled to buffer amplifier U1 and used to provide a sidetone signal to the radiotelephone loudspeaker. During key down intervals Q1 conducts heavily, charging delay capacitor C11 through diode CR3. This positive voltage causes heavy conduction in MOSFET Q3, which pulls the radiotelephone PTT line low and keys the transmitter. R17, the "DELAY" potentiometer, adjusts the time constant of C11 and thus controls the hold in period. At the end of the hold in period, the transceiver reverts to receive mode.



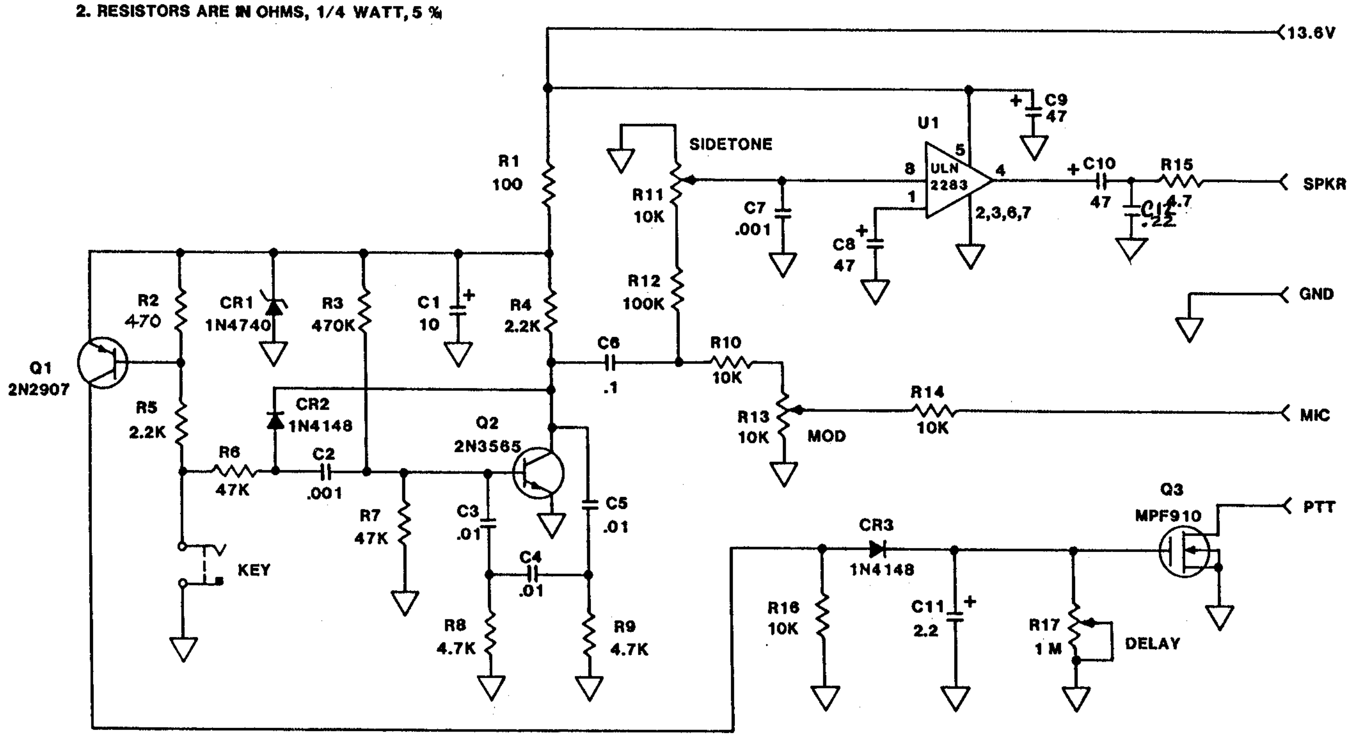

**8.1 OPTIONAL**
**C/W HOLD MODULE BOARD**
**FIGURE 8.1.1**

NOTES:

UNLESS OTHERWISE SPECIFIED

1. CAPACITORS ARE IN MICROFARADS

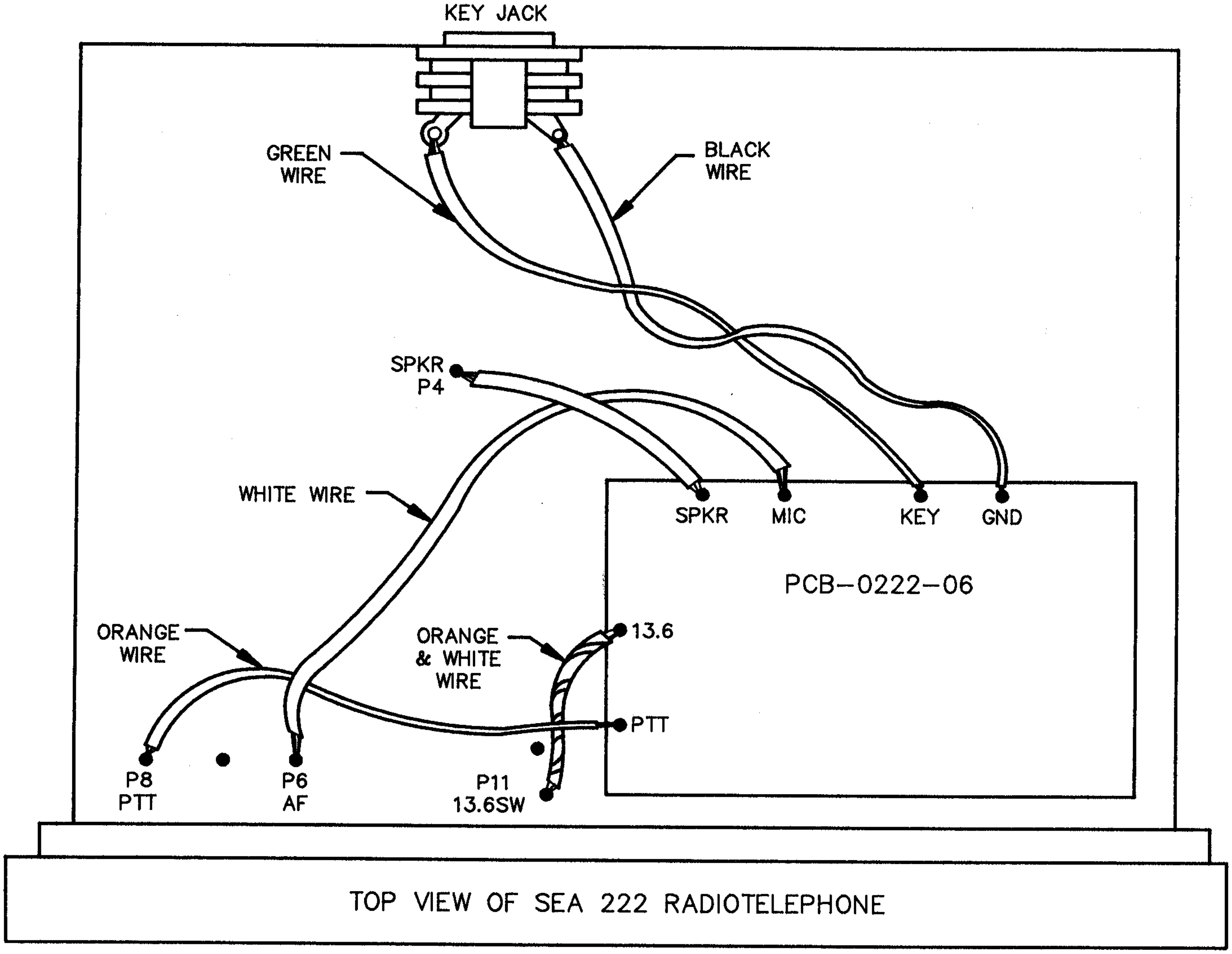
2. RESISTORS ARE IN OHMS, 1/4 WATT, 5 %




# 8.1 OPTIONAL
# C/W HOLD MODULE SCHEMATIC
# ASY-0222-06
# FIGURE 8.1.2

WIRING HARNESS SPECIFICATIONS

| CW BOARD | | RADIOTELEPHONE |
|---|---|---|
| GND | BLK | 10.5"–KEY JACK GND TAB |
| KEY | GRN | 10.5"–KEY JACK TIP |
| MIC | WHT | 10.5"–P6 AF |
| SPKR | BLUE | 2.5"–P4 SPKR |
| 13.6 | WHT/ORG | 4.5"–P11 13.6 SW |
| PTT | ORG | 8.5"–P8 PTT |




**8.1 OPTIONAL**
**SEA 222 CW HARNESS**
**FIGURE 8.1.3**

## 8.2 LOW LEVEL AUDIO CONNECTION

The SEA 222 is capable of being interfaced with weatherfax decoders and Necode ringers. The interface is quite simple, requiring an audio connection at the rear accessory terminal J1 Pin 1 (spare) using a jumper coaxial cable (see Fig. 8.2).

The interfacing wires can act as an antenna, coupling a portion of the transmitted R.F. back into the radio. Symptoms of this include:

1. The coupler won't tune a particular range of frequencies.
2. When the radio is keyed, full power out occurs without modulation.
3. According to the Marine Operator, the transmitter sounds distorted, off frequency, or weak.
4. The radio has low transmit power on some frequencies when connected to the coupler but appears fine into a 50 ohm load.

Should this problem appear, there are several possible remedies, including the installation of a ferrite kit. Contact the SEA service department for guidance.

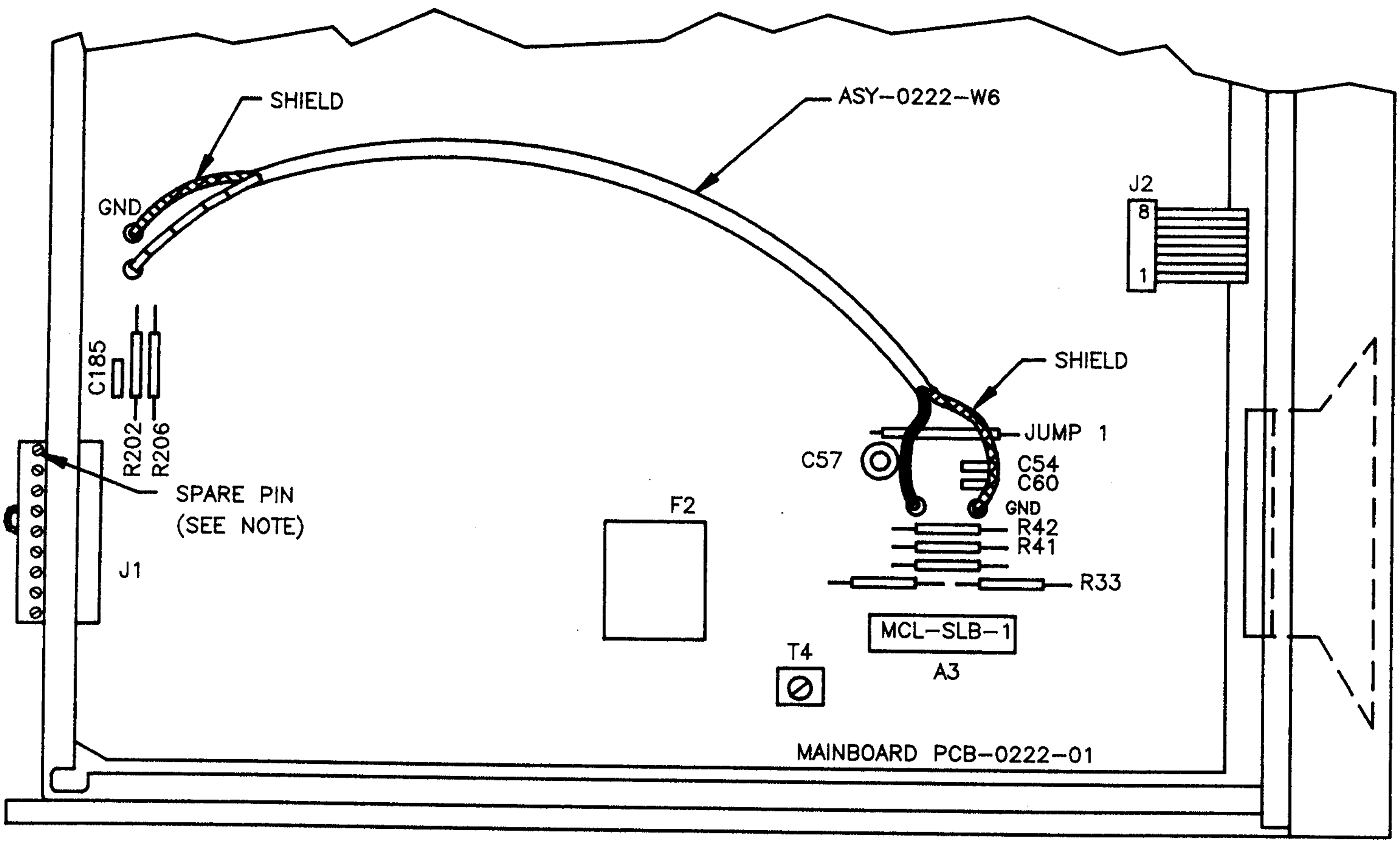
## 8.3 AUTO-ALARM OPTION

### 8.3.1 INSTALLATION

The alarm generator can be interfaced with the SEA 222 either internally or externally.

To install the external version, connect the terminals on the rear panel as follows:

Viewed from the rear, connect the left ground terminal to the negative DC supply wire and the cable shield braid. Connect the positive DC supply wire to the terminal marked +. Connect the MIC terminal to the remote audio input terminal of the transceiver. NOTE: THE SEA MICROPHONE




**8.2 OPTIONAL**
**SEA 222 LOW LEVEL RECEIVER AUDIO OUTPUT FOR NECODE RINGERS OR WEATHERFAX PRINTERS**
**FIGURE 8.2**

INCLUDES A MICROPHONE BREAK CONTACT ENSURING THAT EXTERNAL AUDIO SOURCES ARE NOT LOADED BY THE MICROPHONE BUTTON. THIS FEATURE IS NEEDED TO ENSURE THAT THE SEA ALARM 100 WILL PROVIDE SUFFICIENT AUDIO TO PROPERLY MODULATE THE TRANSMITTER.

Connect the PTT terminal to the push-to-talk terminal of the radiotelephone. The right hand ground terminal should be used for the microphone and PTT ground wire in the cable.

The internally installed alarm generator replaces the aluminum CPU shield in the SEA 222. Install the unit as follows:

1. Remove both the top and bottom covers from the transceiver.
2. Disconnect the microphone terminals and loosen the front bezel retainer screws.
3. Remove the front bezel and microphone.
4. Unplug the ribbon connector from the keypad to the CPU area on the main board.
5. Remove the four front panel retainer screws and remove the front panel, placing the front panel face down immediately in front of the chassis.
6. Remove the loudspeaker and volume control from the old front panel and install them on the new front panel which has the new keypad assembly.
7. Install the new front panel/keypad in place of the original.
8. Plug in the 4x4 keypad ribbon connector into the CPU area on the main board.
9. Remove the four screws which hold the aluminum CPU shield in place and remove the shield.
10. Place the auto-alarm assembly in the area originally occupied by the shield. Board orientation is such that the CPU is toward the FRONT of the radiotelephone and the interface connections to the LEFT.
11. Plug the 4-pin connector from the keypad into the 4-pin terminal on the auto-alarm assembly. Install the wiring harness per the illustration (Fig. 8.3.3).

12. Replace the front panel bezel assembly and reconnect the microphone, using a tie-wrap to help secure the microphone inside the radio. Place the "SEA ALARM 100 installed" label provided with the auto alarm kit on the rear panel of the SEA 222. Installation is now complete except for adjustment of levels.

### 8.3.2 ADJUSTING THE ALARM GENERATOR

Connect the radiotelephone to an appropriate dummy antenna or power meter. If possible, monitor the transmitter output with an oscilloscope. Press the TEST and ALARM ON keys simultaneously and while the alarm signal is being transmitted, adjust R35 to balance the two tones to the same level and R39 for the proper modulation level. Press OFF to terminate test. Press TEST key and adjust R38 for the desired sidetone level.

### 8.3.3 OPERATION

When the radio user has determined that the transmission of the distress alarm is appropriate (announcing that a distress call is to follow, transmission of an urgent cyclone warning, man overboard call), he should select the desired operating frequency on the companion radiotelephone. Then, by depressing BOTH the TEST and the ALARM ON keys SIMULTANEOUSLY (on the external version, the keys are pressed on the alarm unit; on the internal version, the keys are pressed on the radio's keypad), the alarm signal will be generated and the PTT line held low for 45 seconds. The alarm may be terminated at any time by pressing the STOP key.

### 8.3.4 THEORY OF OPERATION

The alarm generator uses a dedicated single chip microprocessor to generate the alternating two tone radiotelephone alarm signal. The microprocessor also controls the alarm timer. All tones and timer loops are based on the crystal controlled time base oscillator, which insures extreme stability. The microprocessor circuitry operates from a +5 volt regulator, further ensuring that the equipment has high immunity from line voltage variations.

The 1300 Hz and 2200 Hz tones are generated by the operating program in the microprocessor. Each tone uses four output ports and a binary weighted resistor array as a piecewise linear sine wave generator. Each "stepped" sine wave is then passed through a low Q bandpass filter to further insure that harmonic distortion is minimal. The filtered outputs are then summed and passed through a modulation level potentiometer.

A sample of the alarm signal is amplified by a small audio power amplifier integrated circuit and used as a sidetone for monitor purposes.

### 8.3.5 ALARM INITIATION SYSTEM

Switch transistor Q1, control transistor Q2 and a software loop are used to apply power to the CPU chip, U1, when an alarm routine is initiated. This is accomplished through steering diodes CR1 and CR2. When either the TEST or ALARM ON keys are pressed, the +5 volt regulated buss voltage is applied through CR1 and/or CR2 to the base of Q2. The conduction of Q2 saturates Q1 which applies power to the CPU chip. The application of power to U1 causes it to intitialize and output a latch signal on pin 15 which holds power on until the alarm sequence timer releases pin 15.

This system insures that the microprocessor is powered down at all times until an alarm signal is actually requested. This minimizes the standby power requirements and further insures that no CPU noise can be generated during receiving periods.

### 8.3.6 BANDPASS FILTERS

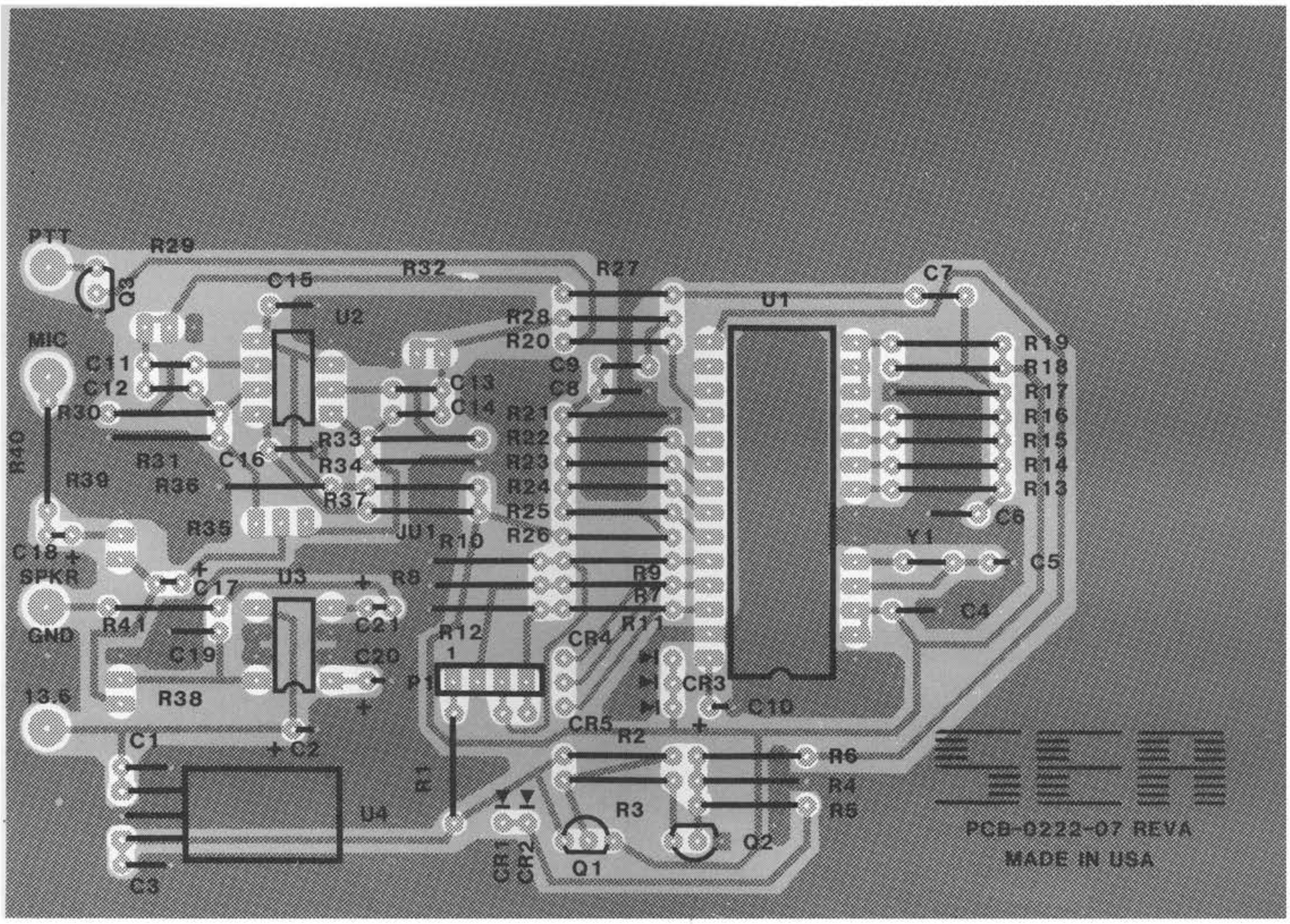
Dual operational amplifier U2 is configured as a pair of multiple feedback bandpass filters. Each is designed for a nominal Q of approximately 5 and provides a small amount of voltage gain at the design center frequency. Fine tuning is accomplished with potentiometers R29 and R32. R29 is used to tune the 1300 Hz filter and R32 tunes the 2200 Hz filter. The two filters are summed in BALANCE potentiometer R35. The BALANCE control, together with the two filter tuning potentiometers, provides sufficient range to allow the tone levels to be balanced under nearly any condition.

### 8.3.7 SIDETONE AMPLIFIER

U3 is a small power audio amplifier integrated circuit. It receives its input signal from the summer output through the SIDETONE level potentiometer. Sufficient audio power is available to drive the transceiver loudspeaker. Normal practice is to adjust the sidetone to a low but clearly audible level. This usually requires only a few milliwatts. Since over a watt of audio is available from U3, sufficient audio is available for any reasonable purpose.

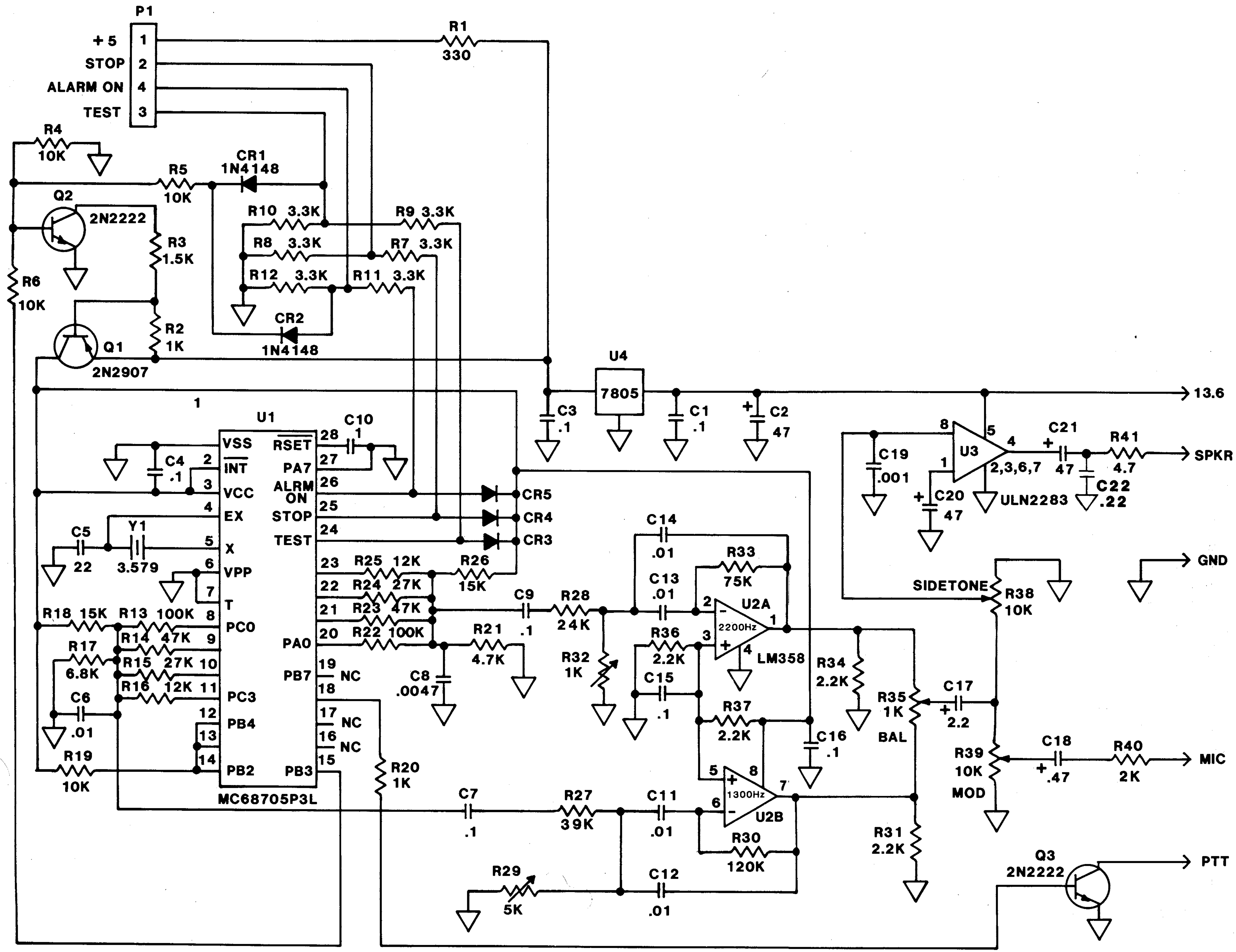
### 8.3.8 THE PTT CIRCUITRY

Q3 is used as an open collector switch to pull the transmitter PTT line to the negative rail when the alarm is running. Base drive is provided by CPU chip U1 in the ALARM ON mode. Q3 is a small power transistor which can switch several hundred milliamperes of current and withstand about 50 volts.




**8.3 OPTIONAL**

**AUTO-ALARM MODULE BOARD**
**ASY-0222-07**
**FIGURE 8.3.1**




| LAST DESIGNATOR USED | | | | |
|---|---|---|---|---|
| C22 | CR5 | Q3 | R41 | U4 |

NOTES: UNLESS OTHERWISE NOTED

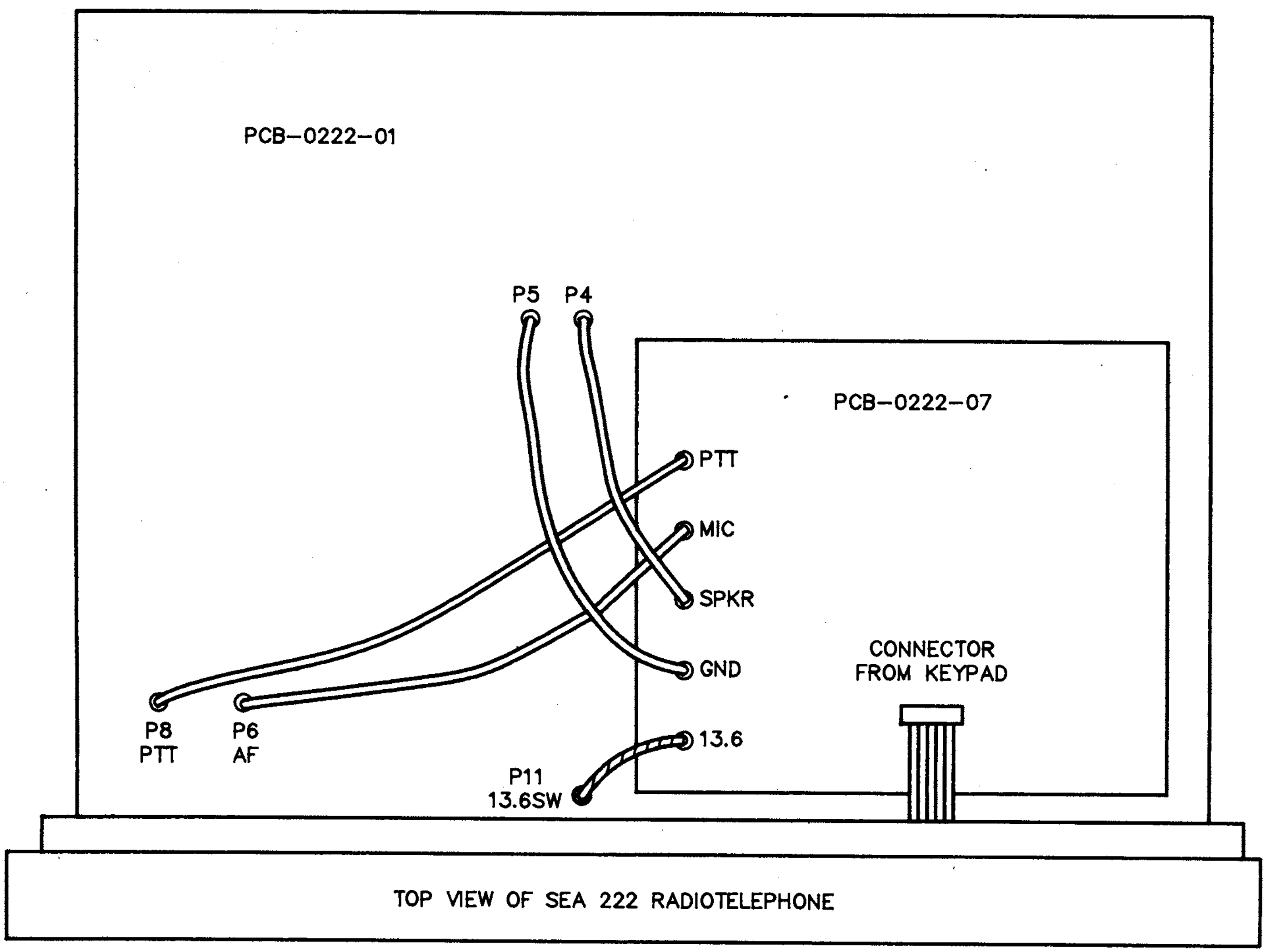
1. RESISTORS ARE 1/4 WATT, IN OHMS.
2. CAPACITORS ARE IN MICROFARADS.
3. DIODES ARE HSCH1001.

## 8.3 OPTIONAL

AUTO-ALARM MODULE SCHEMATIC
ASY-0222-07
FIGURE 8.3.2

## WIRING HARNESS SPECIFICATIONS

| AUTO-ALARM MODULE | | | RADIOTELEPHONE |
|---|---|---|---|
| PTT | ORG | 8.0" | P8-PTT |
| MIC | WHT | 7.0" | P6-AF |
| SPKR | BLU | 5.25" | P4 |
| GND | BLK | 5.5" | P5 |
| 13.6 | WHT/ORG | 2.0" | P11-13.6SW |




**8.3 OPTIONAL**
**SEA 222 AUTO-ALARM MODULE**
**FIGURE 8.3.3**

# 9. TEST POINTS

## 9.1 MAIN BOARD D.C. MEASUREMENTS

Page 9-7 is a list of Transistor and Integrated Circuit Pins and the D.C. voltage measured on those pins under receive and transmit conditions. When the receive/transmit status is not listed, the measurement indicated is the same for both receive and transmit conditions.

These measurements were made with a Fluke Model 8024B High-Impedance Digital Multimeter.

## 9.2 TRANSMITTER SIGNAL LEVELS

Page 9-8 lists test points vs. signal levels for both the Main Board and the PA/Filter Board. Test conditions are noted.

These measurements were made with the Tektronix 465B Oscilloscope equipped with a P6105 Probe.

## 9.3 SEA 222 TROUBLE SHOOTING AID

I. Radio does not turn on:

1. Check input power for +13.6 VDC.
2. Check F3 on the P.A. board.
   a. If F3 is open - measure resistance P1 to ground with P1 - P2 jumper removed. Must be greater than 1.5K ohms. If lower suspect Q9 and Q10.
3. Check voltages on main board:
   a. +13 VDC on P12 all the time.
   b. +13 VDC on P11 with radio turned on.
      if voltage is on P12 but not P11, check on/off switch
   c. +10 VDC on center pin of Q7.
   d. +8 VDC on U29 (out)
   e. +5 VDC on U30 (out)
   f. +5 VDC on pins 1 & 40 of U20 (cpu) - if no voltage on
      pin 1 check anode of CR29 for approximately +6.5 VDC
4. With oscilloscope check pins 38 and 39 of U20 for a 5vp-p frequency of 3.2 MHz.

II. Radio operates but no display:

1. Measure DC resistance of L17 and L18 - typically 6 ohms

2. Measure DC resistance of R159 - should be 2.2 ohms
3. Measure display voltages:
   a. -24 VDC on anode of CR28
   b. 0 VDC on Pin 2 of U26
   c. +5 VDC on Pin 1 of U24
   d. -10 VDC on Pins 18 & 20 of U24
4. Measure AC filament voltage between pins 8 & 9 on U25 - approximately 3 VAC

III. Radio operates, squelch does not work:
1. Check squelch threshold for #4 or #5 (get into program mode and press SQL key when prompt shows BIN#?)
2. With an oscilloscope check for:
   a. +5 VDC on pin 2 of U20 going low every 11 msec for a period of 55 usec.
   b. Limited (5 vp-p) audio on pin 37 of U20.
3. Input signal is changing audio frequency at voice rate. A steady tone will not hold squelch open.

IV. Unlock condition:
1. Check to see which loop is unlocked
   a. Measure dc voltage on cathode of CR24. If low - VCXO unlocked - normally +8 VDC.
   b. Measure dc voltage on cathode of CR25. If low - VCO is unlocked - normally +8 VDC.
   c. Due to complexity of loops, it may be quicker to replace the main board if unlocked.

V. Keypad not responding:
1. When a key shorts:
   a. At turn on display will have background flutter or bypass turn on prompts and go directly to TEST. This depends on the software version in radio. Many cases, the radio will not have receive audio.
   b. If key shorts intermittently, the key that shorted shows on the display ($\Delta$FREQ will cause freq. change).
   c.If key stays shorted, will not be able to enter a channel or transmit. Unplug keypad to have key show on display and test to see if transmit is possible if and when a channel or frequency is displayed.
   d. If keypad opens - no response from keys but other functions work (transmit, receive, and volume).

VI. No transmit (voltages shown are when in TX & modulating):

a. Check that PTT line goes from +5 VDC to ground when mic button is pressed.
b. Have +9.2 VDC on left side of R4 on main board.
c. Pin 5 of U4 should be +10 VDC. Pin 6 of U4 should be 0 VDC.
d. With oscilloscope, typical voltages at test points:
- mic input (P6 main board) = 200 to 300 mvp-p
- emitter of Q2 = 200 mvp-p
- bottom side of R38 = 50 mvp-p
- cathode of CR13 = 325 mvp-p
- left side of R31 = 85 mvp-p
- anode of CR7 = 200 mvp-p
- output of main board (J5) into 50 ohm load = .6 vp-p for 150W PEP. No load = 1.2 vp-p.

5. Check bias (idle) current of P.A. transistors with J6 unplugged.
   a. Q1 emitter voltage = 0.27 VDC in TX
   b. Q9 & Q10 collector current (measure between P1 & P2 stakes with jumper removed) = 130 mA in TX for serial # X5537 and higher; 100 mA in TX for serial # X5536 and lower.
   c. Q3, Q4, Q5, & Q6 collector current (pull F3 for Q3 & Q4 and put ampmeter in place of fuse) = 150 mA in TX for serial # X5537 and higher; 250 mA in TX for serial #X5536 and lower. Do the same for Q5 & Q6 but remove F2.
6. Check K1 for operations and that relays for appropriate filter are completely closing.

VII. No receive:

1. Check that jumper on rear panel plug is in place between AF and SPKR terminals.
2. The squelch is turned off (no "Q" in display window).
3. Left side of R9 on main board is +10 VDC.
4. AGC voltage at cathode of CR17 = 4.8 VDC (no signal). A higher voltage reduces receiver gain.
5. If transmit section tests checked good, assume that IF sections work.
   a. While transmitting you can test U3 with an oscilloscope and should have 1 vp-p on pin 4. Pin 5 should have 4.2 vp-p.

b. With a 0.1 ufd coupling cap, jumper between pin 5 of U3 and pin 2 of U6. You should hear audio even with the volume turned down. With the jumper still in place, you should hear audio in the speaker when transmitting.

6. Check for +10 VDC on pin 6 of U4 and 0 VDC on pin 5 of U4 in RX mode.

## 9.4 SEA 222 FINAL TEST

I. Turn radio on and observe the display. It should read:

SEA 222
BEEP ON
TEST 1 - program area verifies good
TEST 2 - frequency area verifies good

II. Transmitter Test:

1. Connect the output of the radio to a Bird wattmeter which is connected to a 50 ohm dummy load.
2. Connect an oscilloscope using a X10 probe to 'T' on wattmeter (or output of radio). Make sure scope is set at 50v/div. - sweep speed is 2 ms.
3. Turn the ALC control R38 (R5 on older radios) on the PA board fully ccw.
4. Switch to CH 451 - a beep should be heard with each keypress. If no beep is heard check for the audio jumper on rear plug. The 4-6 MHz filter relays should energize.
5. Whistle into the microphone and adjust R101 on the main board up until the wattmeter reads 150 watts.
6. Adjust R38 (R5 on older radios) on the PA board cw until the wattmeter begins to decrease.
7. Short junction of C52 and R28 to ground. (This will allow a carrier for measuring the output frequency). Assuming that a frequency counter is connected to the vertical output of the oscilloscope in use, key radio and adjust C151 for frequency in display (if channel # is showing in display, then press CH/FR key).
8. Perform talk test on each frequency band while watching both the wattmeter and oscilloscope. With a strong voice (FIVE), the wattmeter should show approximately 50 watts if not more. The oscilloscope will show 250 vp-p for 150 watts PEP. Also note that the TRANS LED should

brighten while talking. If a monitor radio is available then listen to transmitted signal.

III. Receive Test:

1. Disconnect coax from radio to wattmeter and connect coax from radio to signal generator. Use caution not to transmit into signal generator.
2. Set signal generator to 1 uV output amplitude and adjust frequency 1 KHz higher than frequency shown in radio display (display reads 4125.0 - set generator to 4126.0).
3. A 1 KHz tone should be heard at the speaker (check rear panel audio jumper if no tone is heard). Set the volume to a comfortable level.
4. Connect an Audio Voltmeter, preferably SINAD meter, between ground and the rear panel jumper (speaker). Set SINEADDER to SINAD position.
5. Meter movement on the SINEADDER should move to the left showing at least 12 dB SINAD (normally 18 dB).
6. Repeat the above steps for each band of frequencies.
7. Set SINEADDER to AC voltage.
   a. Adjust volume control for -10 dB on the meter.
   b. Increase the signal generator by 10 dB.
   c. Meter should increase no more than 10 dB.
   d. Switch sineadder to next higher scale and increase the generator an additional 90 dB.
   e. The meter should increase no more than 10 dB from the previous value.
   f. Decrease the signal generator output to 1 uV.
   g. Turn up the volume control to maximum noting the audio voltmeter. The meter should show a minimum of 2 vrms.
   h. Reset the volume control to a comfortable setting.
8. Press SQL key (turn the squelch on). The radio should mute the speaker in approximately 2 seconds.
9. Increase the signal generator frequency by 1 KHz. The squelch should open for approximately 2 seconds and then close.
10. Decrease the signal generator frequency by 1 KHz. The squelch should again open for 2 seconds and then mute the speaker.

11. Repeating steps 9 and 10 should hold the squelch open.

IV. Chassis Hardware:

1. Check that all chassis hardware is tight.
2. All screws holding the boards are in place and tight.
3. Install both covers and tighten the cover screws.

DC MEASUREMENTS MADE WITH REFERENCE TO CHASSIS GRD.

PCB-0220-01 MAIN BOARD

| | S / E | D / C | G / B | |
|---|---|---|---|---|
| Q1 | 0 | 0 | 10.0 | SQ ON |
| | | | .15 | SQ OFF |
| Q2 | 4.4 | 10 | 5.1 | |
| Q3 | .95 | 4.8 | 1.75 | TX |
| Q4 | 4.1 | 9.2 | 4.8 | TX |
| Q5 | .65 | 8.7 | 1.35 | TX |
| Q6 | 0 | 5.65 | 0 | TX-NO TX PWR |
| Q7 | 13.6 | 10.0 | 12.85 | |
| Q8 | 5.45 | 12.75 | 6.05 | |
| Q9 | 5.45 | 10.0 | 12.85 | |
| Q10 | 10.0 | 9.95 | 9.15 | RX |
| | | 0 | 10.0 | TX |
| Q11 | 10.0 | 0 | 10.0 | RX |
| | | 9.15 | 8.45 | TX |
| Q12 | .6 | 5.1 | 1.35 | |
| Q13 | 4.4 | 7.9 | 3.15 | |
| Q14 | .12 | 7.9 | .75 | |
| Q15 | 1.65 | 7.9 | 2.35 | |
| Q16 | 1.0 | 6.5 | 1.7 | |
| Q17 | 0 | 2.25 | .6 | LOCKED |
| | | 2.55 | .6 | UNLOCKED |

| | ANODE | CATHODE |
|---|---|---|
| CR 27 | -27.5 | -21.5 |
| CR 29 | 13.6 | 13.6 |

PIN #

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U1 | | | | | | | | | | | | | | | | |
| U2 | | | | | | | | | | | | | | | | |
| U3 | | | | | | | | | | | | | | | | |
| U4 | | | | | | | | | | | | | | | | |
| U5 | | | | | | | | | | | | | | | | |
| U6 | | | | | | | | | | | | | | | | |
| U7 | | | | | | | | | | | | | | | | |
| U8 | | | | | | | | | | | | | | | | |

## TRANSMITTER SIGNAL LEVELS
(Reference to Chassis Ground)

MODE - CW/SSB 1000 Hz Tone; USB; 50 mvpp; 2182.0 Displayed; ALC Full CCW

MAIN BOARD

| Test Point | Signal Level |
|---|---|
| P6 | 50mvpp |
| U8 pin 6 | 2mvpp |
| U8 pin 7 | 340mvpp |
| U8 pin 9 | 8mvpp |
| U8 pin 8 | 600mvpp |
| CR21 cathode | 400mvpp |
| U8 pin 12 | 35mvpp |
| U8 pin 14 | 35mvpp |
| U8 pin 2 | 2mvpp |
| U8 pin 1 | 400mvpp |
| Q2 emitter | 380mvpp |
| U4 pin 1 rx | 0 |
| tx | 365mvpp |
| CR15 cathode | 70mvpp mod 6.4mhz |
| U2 pin 4 | 20mvpp mod 6.4mhz |
| U2 pin 8 | 700mvpp mod 6.4mhz |
| CR13 cathode | 380mvpp mod 6.4mhz |
| F2 input | 700mvpp mod 6.4mhz |
| F2 output | 225mvpp 6.399mhz |

PA/FILTER BOARD

| Test Point | Signal Level |
|---|---|
| R40/R42 Junction | 500mvpp |
| Q11 Case | 6vpp |
| Q9/Q10 Base | 1vpp |
| Q9/Q10 Collector | 13vpp |
| Q3-Q6 Base | 3vpp |
| Q3-Q6 Collector | 35vpp |
| R15 -CAUTION- | 300vpp |
| J3 -CAUTION- | 245vpp |

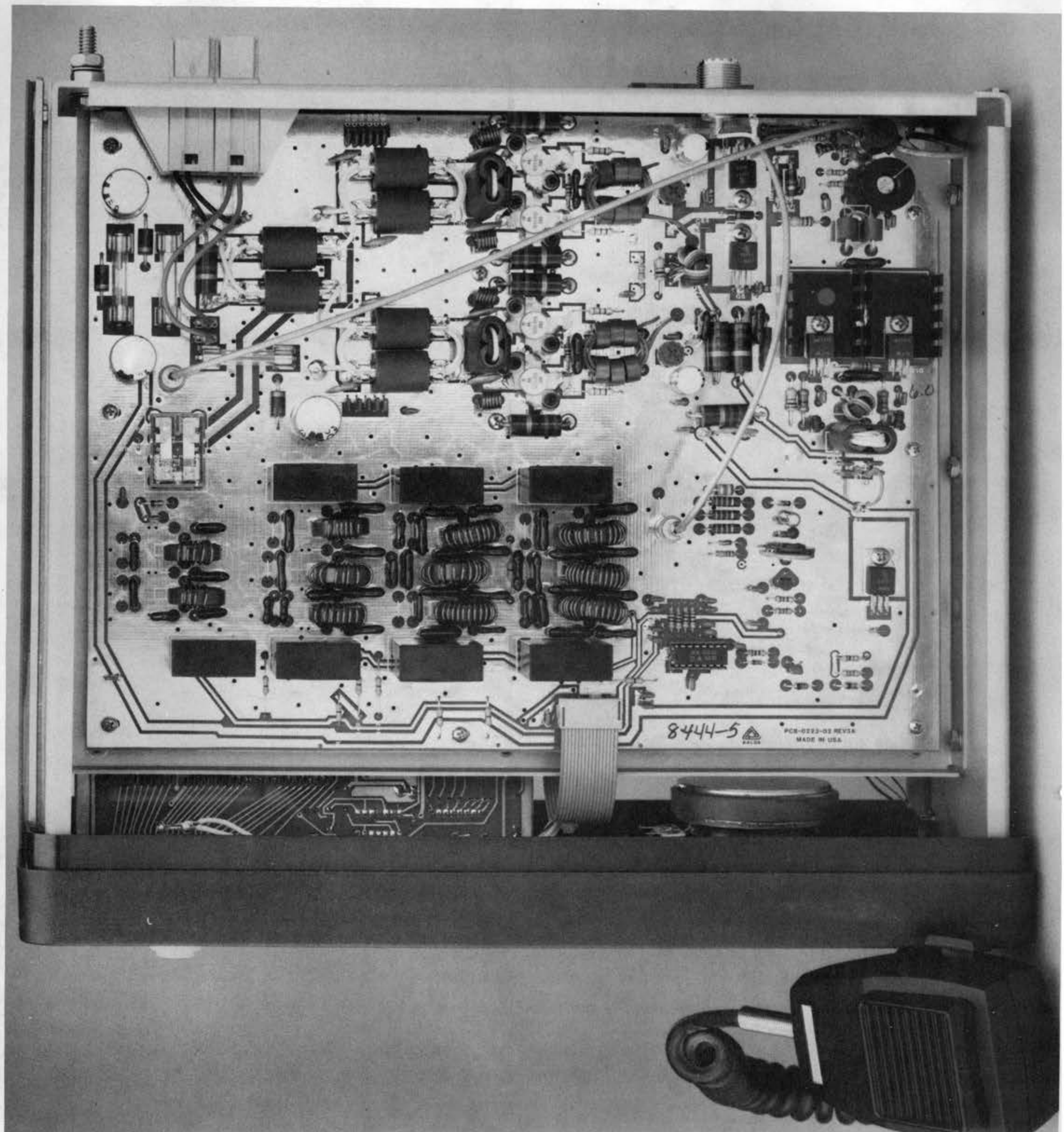
NOTE: 45mhz I.F. SIGNALS VARY WITH TEST EQUIPMENT USED

| | |
|---|---|
| CR11 cathode | 75mvpp 45 mhz |
| U1 pin 4 | Very low - 10mvpp |
| U1 pin 8 | 1.3vpp - noisy |
| CR9 cathode | 300mvpp - noise |
| C15 wiper | 300mvpp + noise |
| C14 wiper | 350mvpp at 44.9978mhz |
| CR7 cathode | 150mvpp at 2.1830mhz |

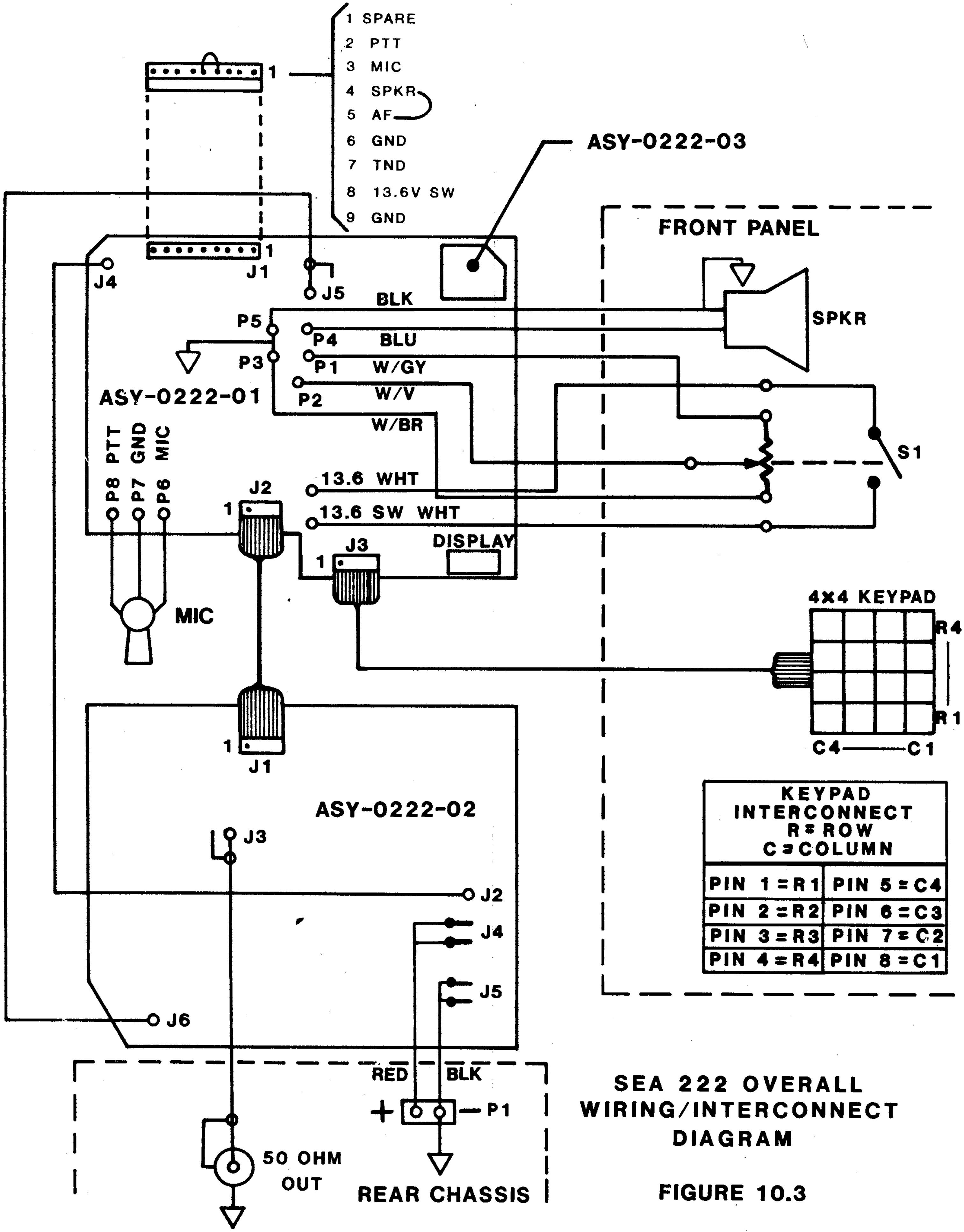
THE FOLLOWING ARE WITH R101 ADJUSTED FOR 150 WATTS - APPROX. 50 OHMS

| | |
|---|---|
| Q3 Base | 60mvpp at 2183.00mhz |
| Q3 Collector | 250mvpp |
| Q4 Emitter | 250mvpp |
| Q5 Collector | 1.9vpp |


**SEA 222 TOP VIEW**
**FIGURE 10.1**



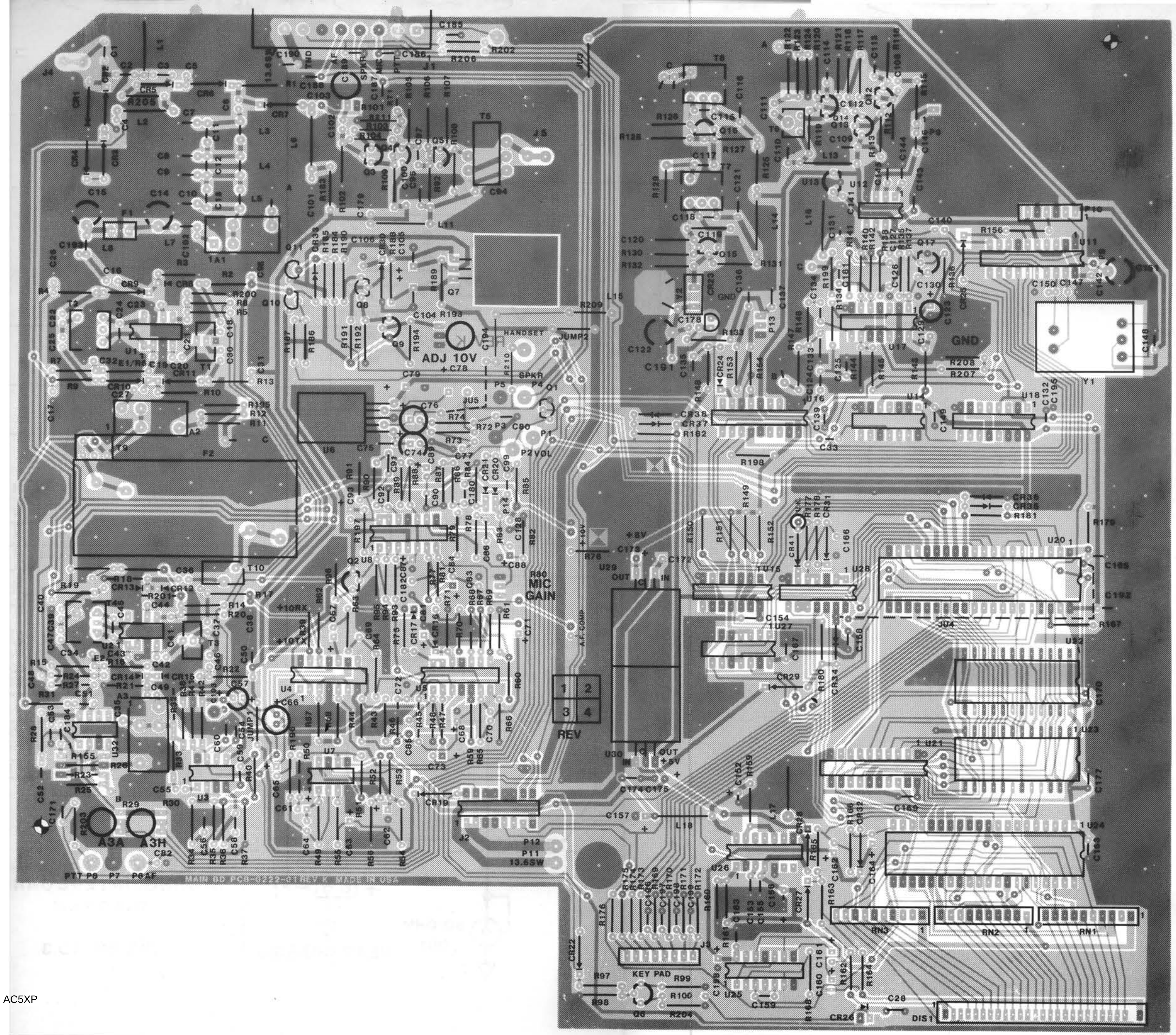

**SEA 222 BOTTOM VIEW**
**FIGURE 10.2**



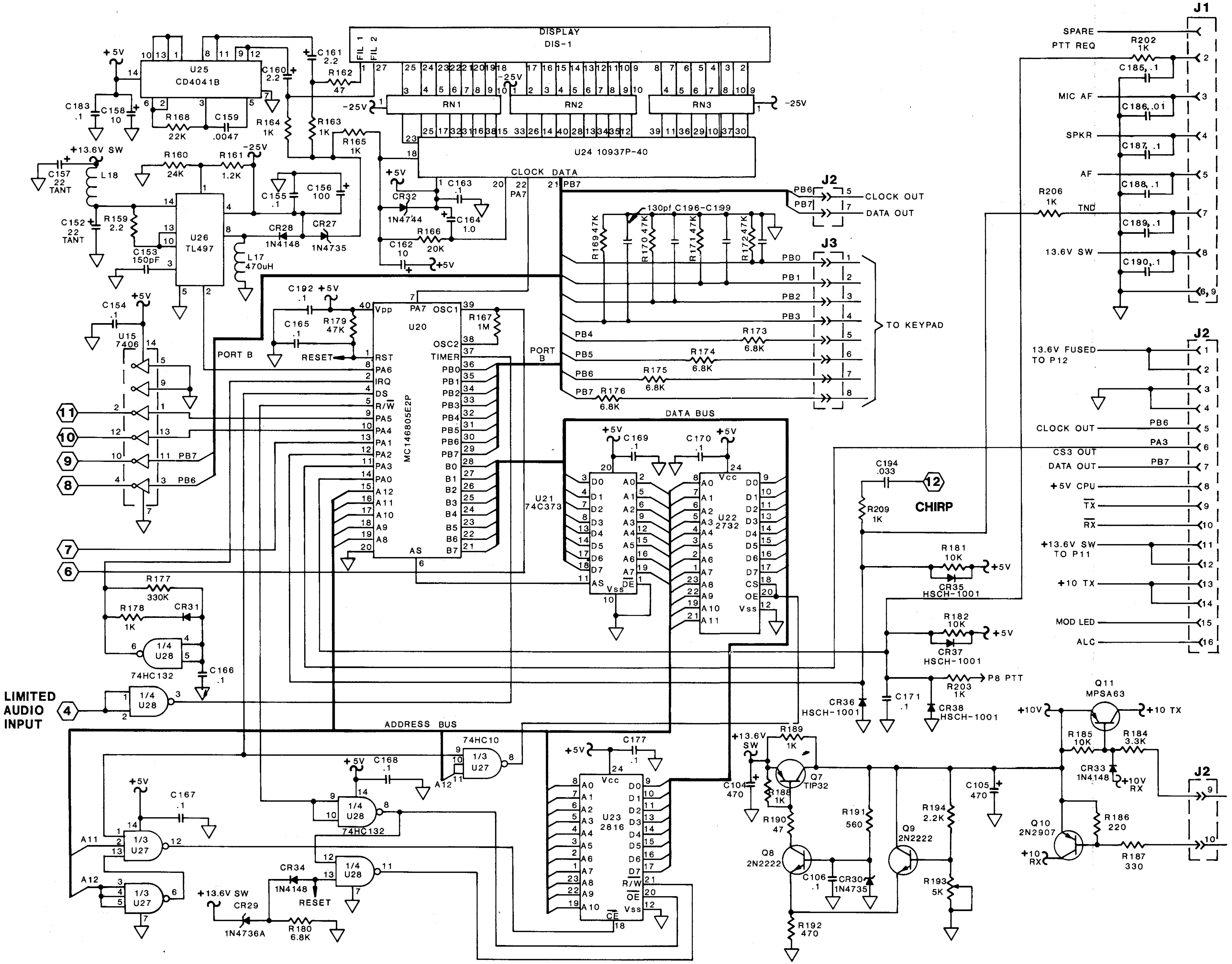

| KEYPAD INTERCONNECT R = ROW C = COLUMN | |
|---|---|
| PIN 1 = R1 | PIN 5 = C4 |
| PIN 2 = R2 | PIN 6 = C3 |
| PIN 3 = R3 | PIN 7 = C2 |
| PIN 4 = R4 | PIN 8 = C1 |

SEA 222 OVERALL WIRING/INTERCONNECT DIAGRAM

FIGURE 10.3




**MAINBOARD**
**ASY-0222-01**
**REVISION L AND PRIOR**
**FIGURE 10.4**



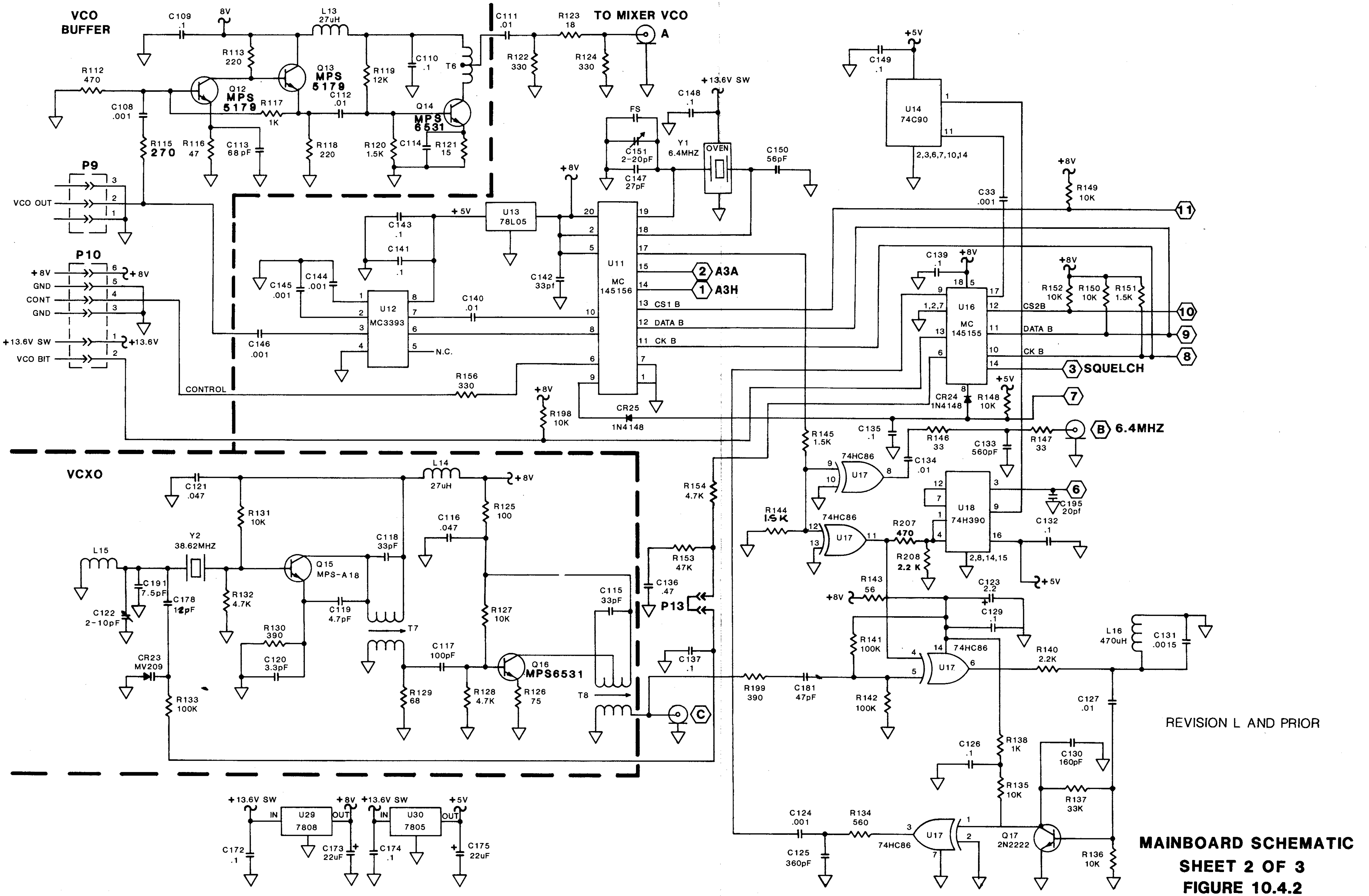

| REFERENCE DESIGNATIONS | | | | | | |
|---|---|---|---|---|---|---|
| HIGHEST USED | | | | | | |
| R211 | C199 | CR38 | Q15 | U32 | T10 | L18 |

NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE 1/4W.
2. ALL RESISTORS VALUES ARE IN OHMS.
3. ALL CAPACITORS ARE IN MICROFARADS.
4. ⬡ INDICATES A CONNECTION POINT ON OTHER PAGE OF SCHEMATIC.

**REVISION L AND PRIOR**

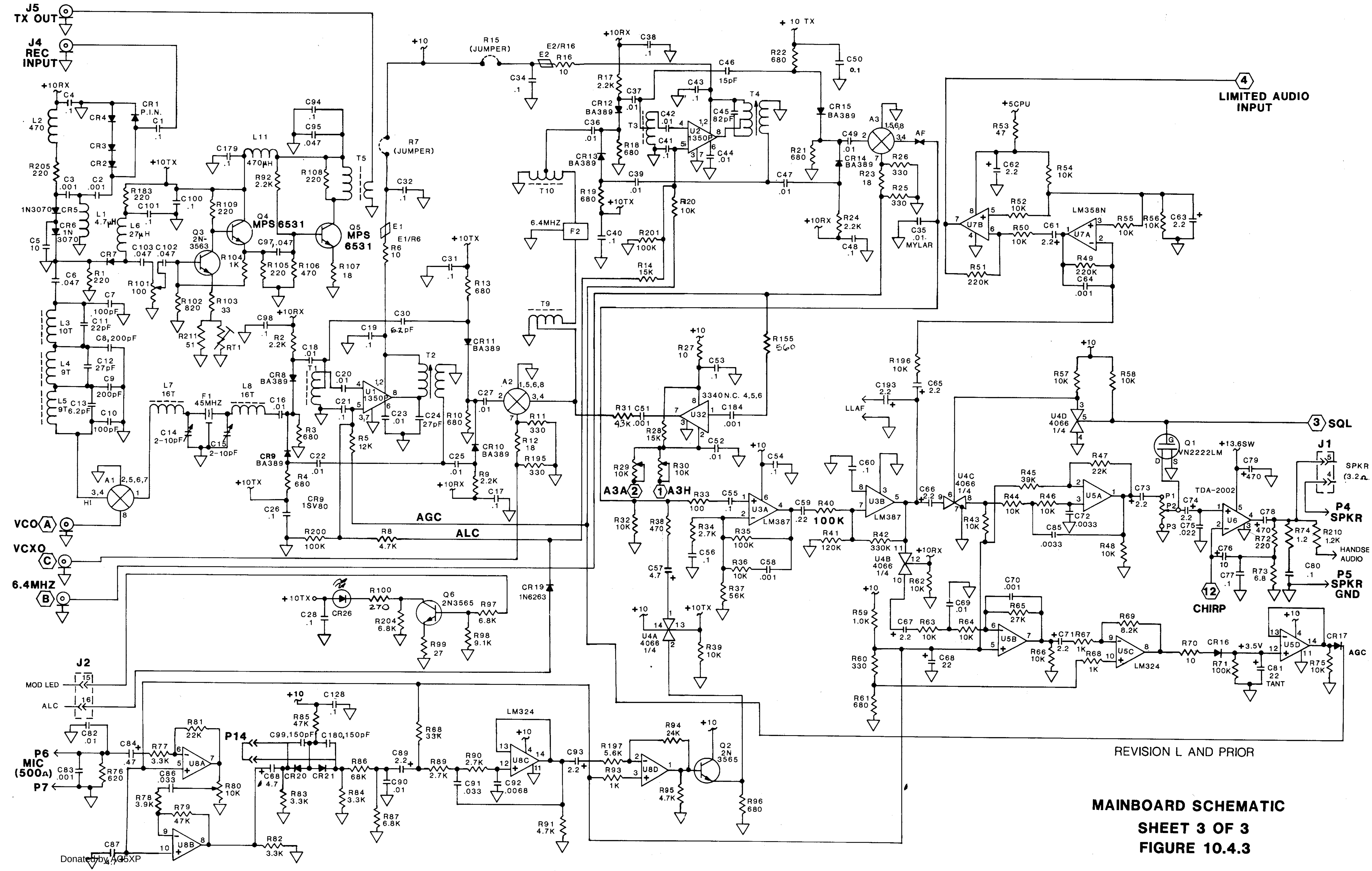
**ASY-0222-01**
**MAINBOARD SCHEMATIC**
**SHEET 1 OF 3**
**FIGURE 10.4.1**

Donated by AC5XP

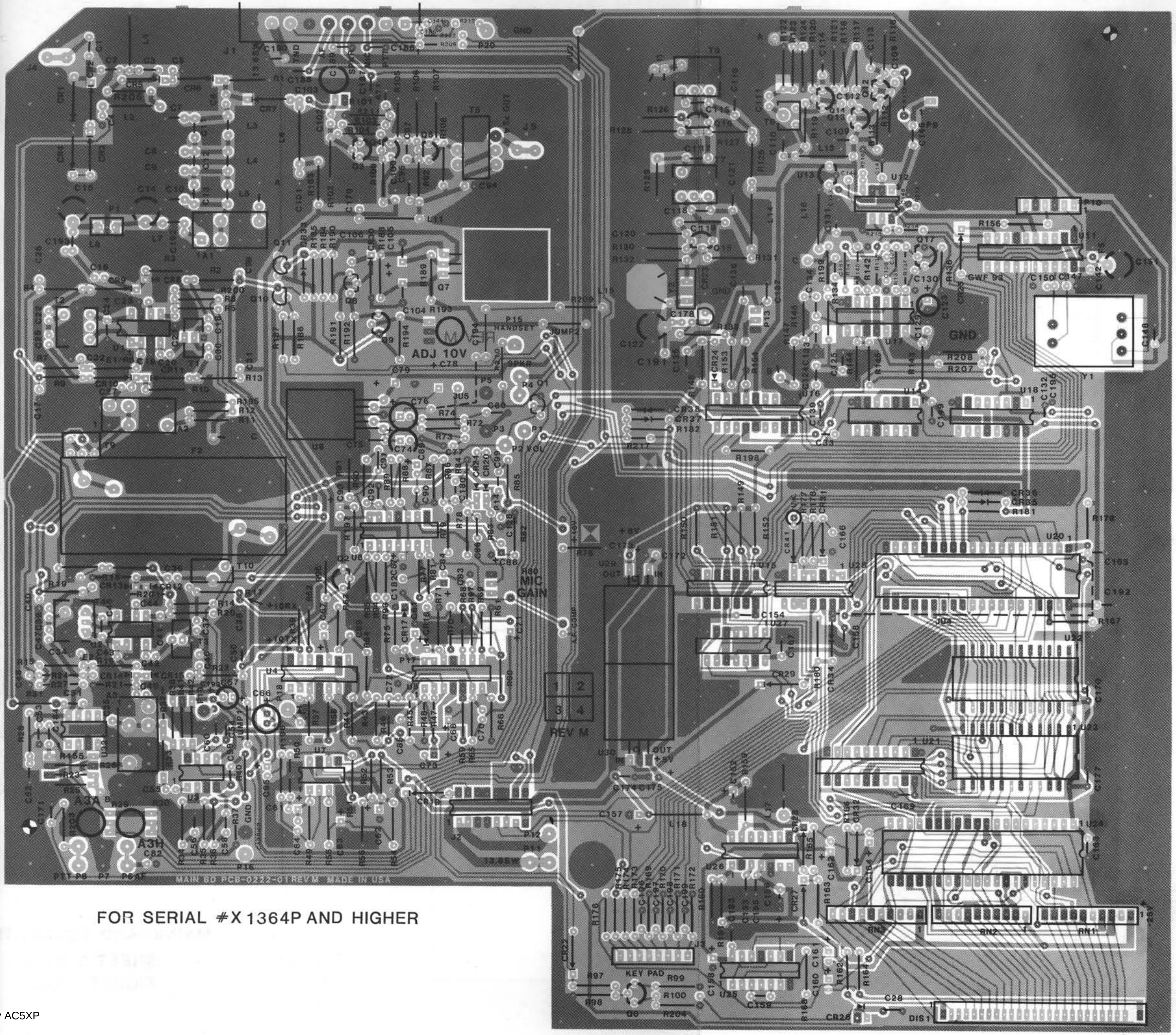



**MAINBOARD SCHEMATIC**
**SHEET 2 OF 3**
**FIGURE 10.4.2**

Donated by AC5XP



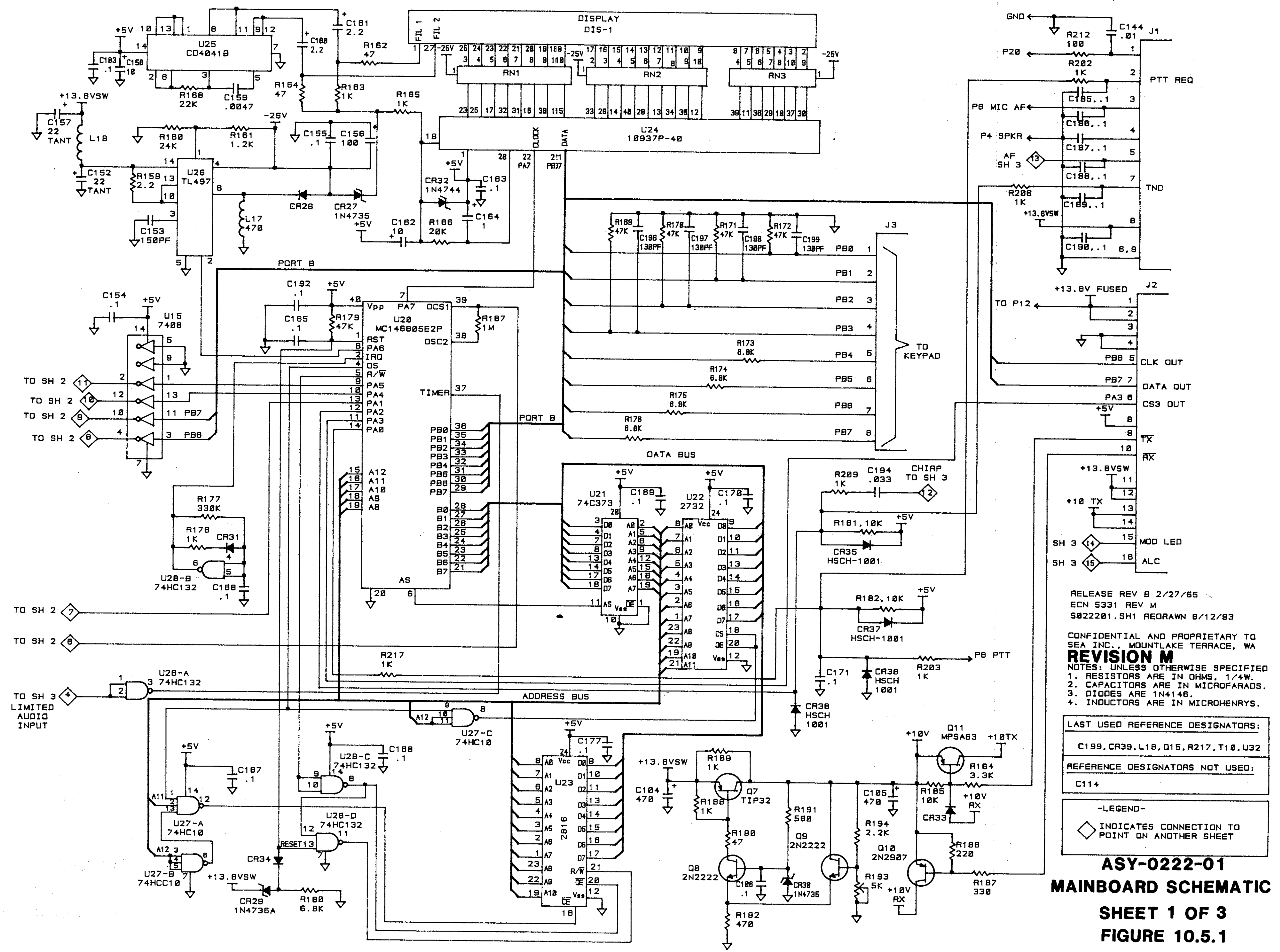

**MAINBOARD SCHEMATIC**
**SHEET 3 OF 3**
**FIGURE 10.4.3**



FOR SERIAL #X 1364P AND HIGHER

**MAINBOARD**
**ASY-0222-01**
**REVISION M**
**FIGURE 10.5**

Donated by AC5XP




RELEASE REV B 2/27/85
ECN 5331 REV M
S022201.SH1 REDRAWN 8/12/93

CONFIDENTIAL AND PROPRIETARY TO SEA INC., MOUNTLAKE TERRACE, WA

**REVISION M**

NOTES: UNLESS OTHERWISE SPECIFIED
1. RESISTORS ARE IN OHMS, 1/4W.
2. CAPACITORS ARE IN MICROFARADS.
3. DIODES ARE 1N4148.
4. INDUCTORS ARE IN MICROHENRYS.

| LAST USED REFERENCE DESIGNATORS: |
| --- |
| C199, CR39, L18, Q15, R217, T10, U32 |
| REFERENCE DESIGNATORS NOT USED: |
| C114 |

-LEGEND-

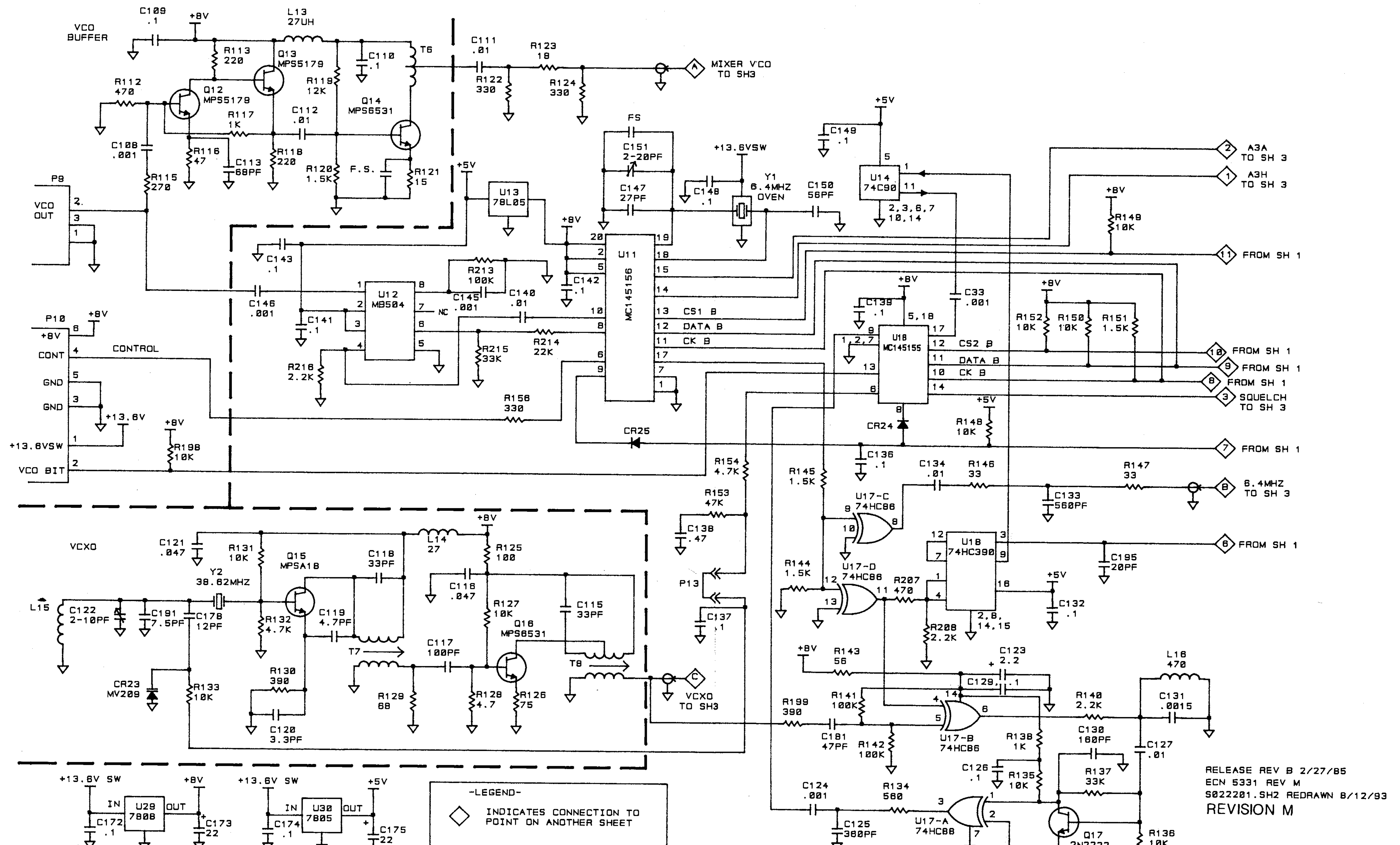
◇ INDICATES CONNECTION TO POINT ON ANOTHER SHEET

**ASY-0222-01**

**MAINBOARD SCHEMATIC**

**SHEET 1 OF 3**

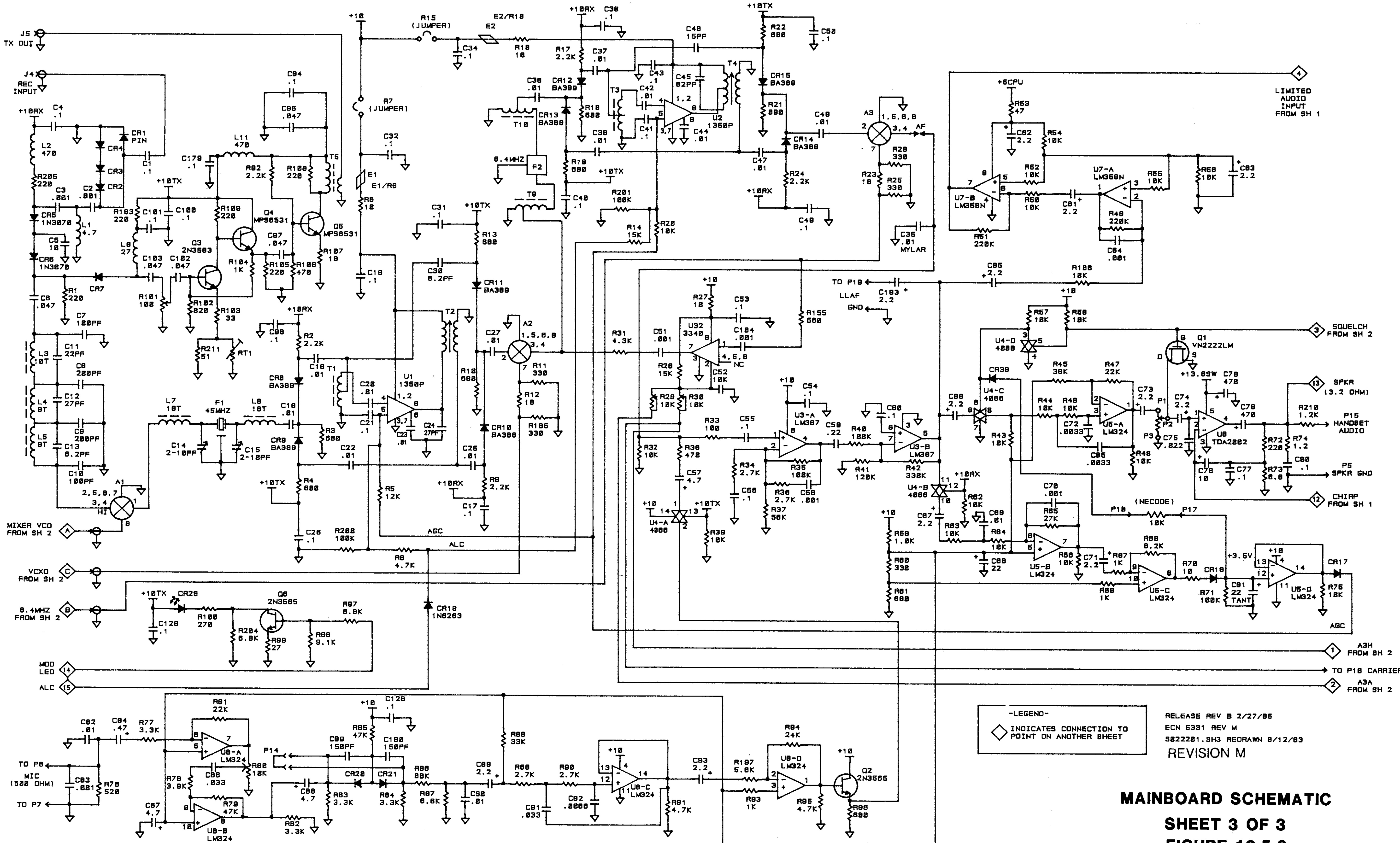
**FIGURE 10.5.1**




**MAINBOARD SCHEMATIC**

**SHEET 2 OF 3**

**FIGURE 10.5.2**

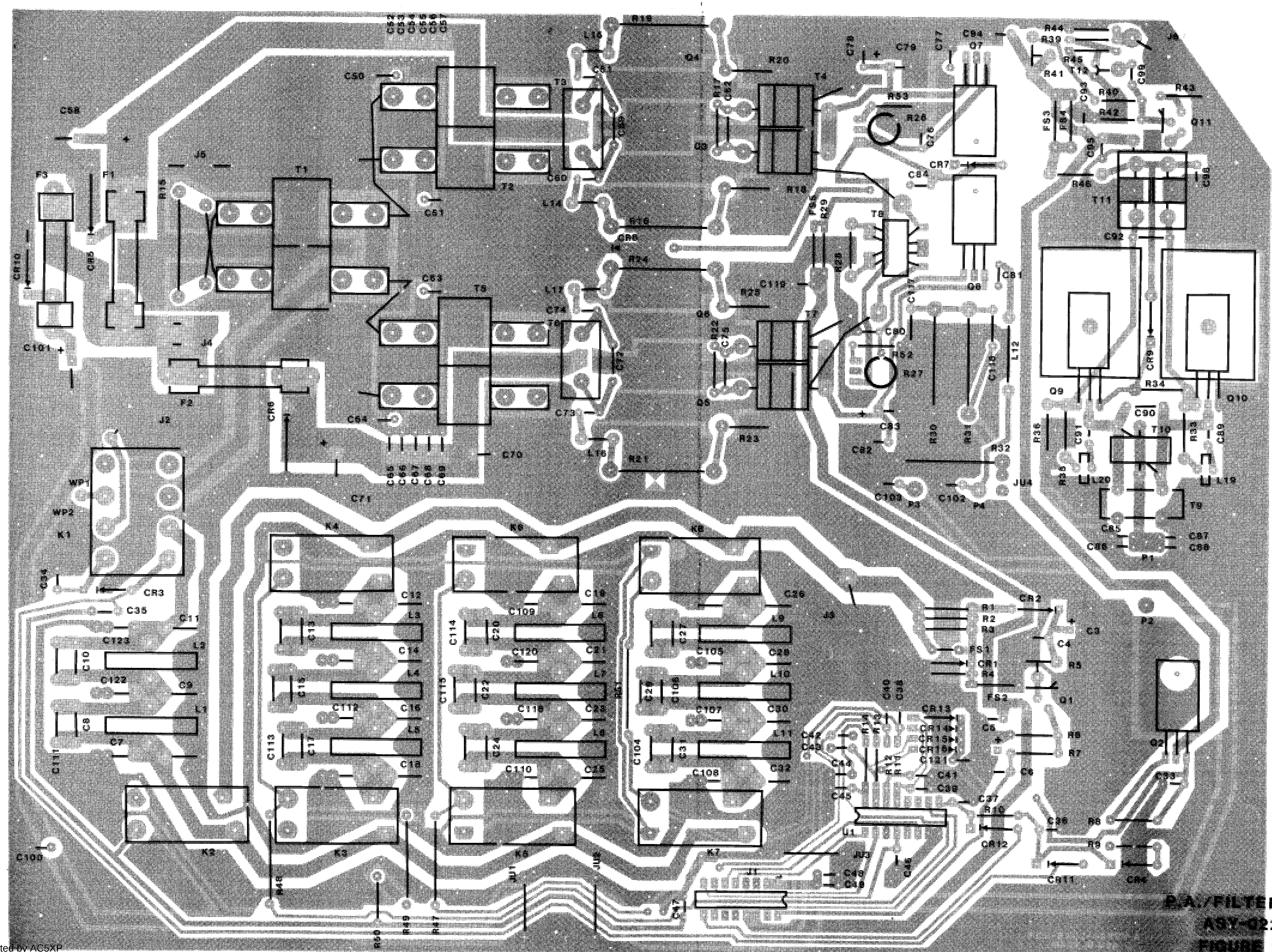



**MAINBOARD SCHEMATIC**

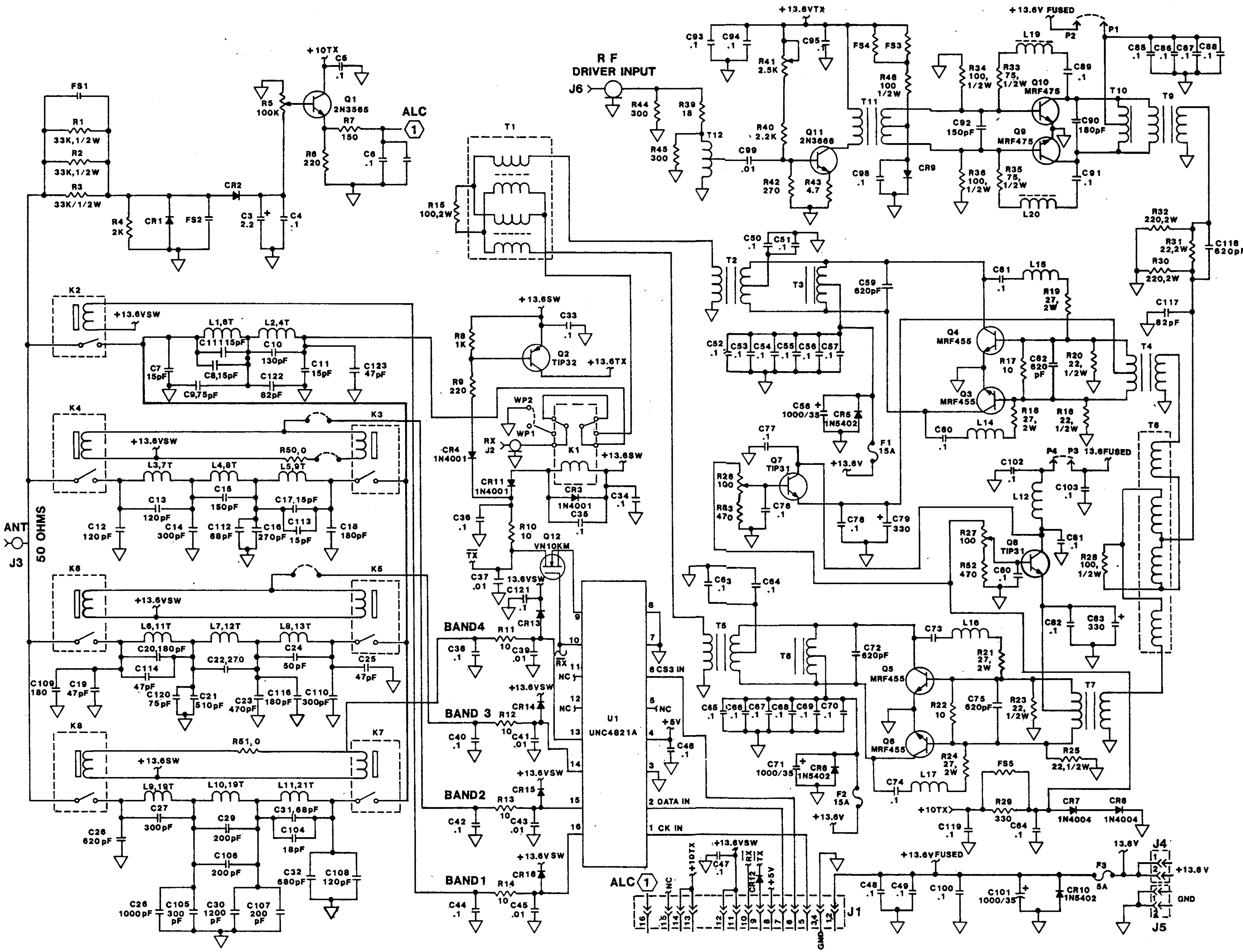
**SHEET 3 OF 3**

**FIGURE 10.5.3**

Donated by AC5XP




**P.A./FILTER BOARD**
**ASY-0222-02**
**FIGURE 10.6.1**




**NOTES** UNLESS OTHERWISE SPECIFIED

1. RESISTORS ARE IN OHMS,1/4W,5%
2. CAPACITORS ARE IN MFD/WVDC
3. DIODES ARE 1N4148

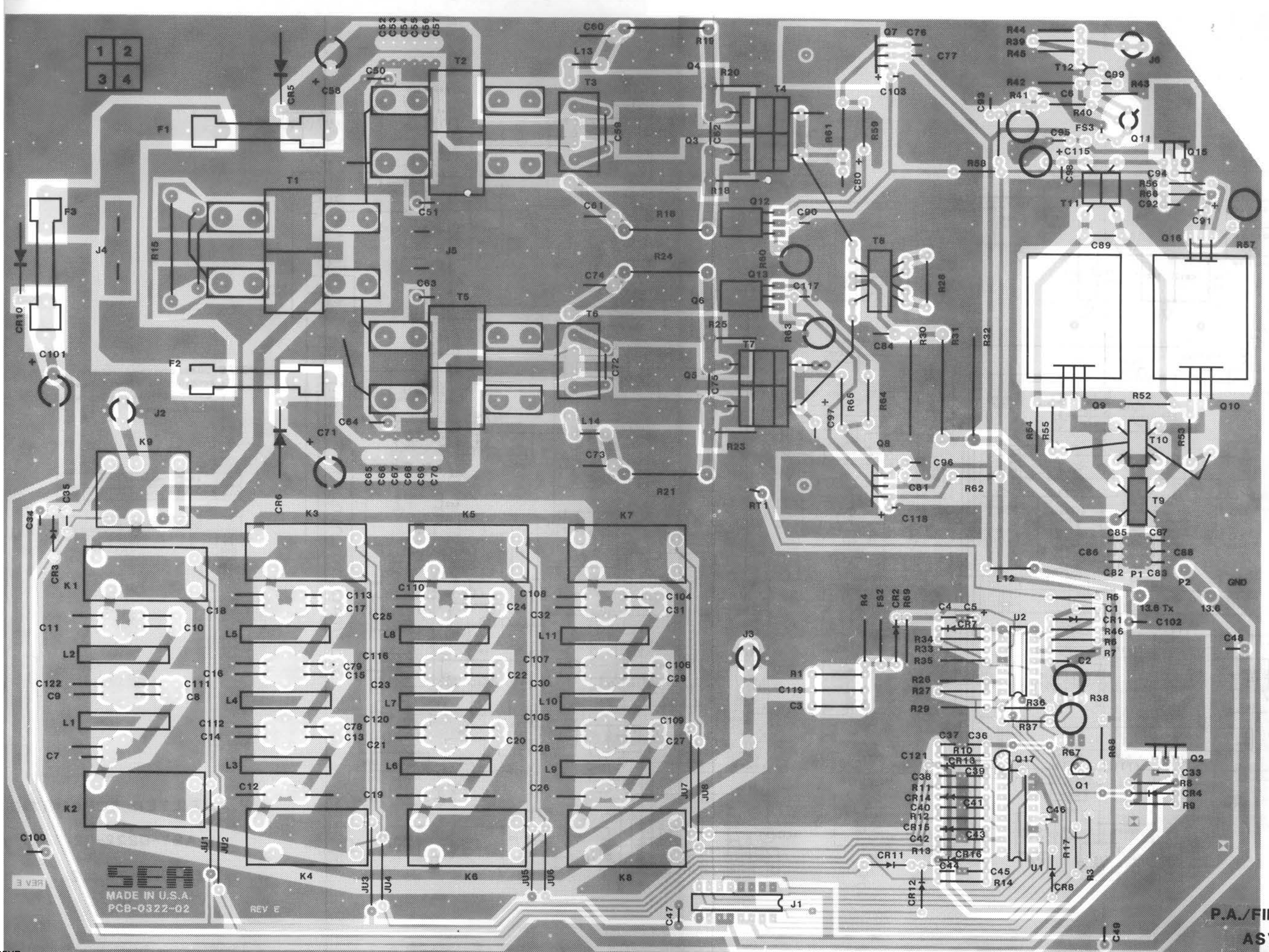
| LAST DESIGNATOR USED | | | | | | |
|---|---|---|---|---|---|---|
| C123 | CR18 | L20 | Q11 | R53 | T12 | U1 |

| DESIGNATORS NOT USED | | | | | | |
|---|---|---|---|---|---|---|
| C1 C2 C96 C97 C115 | | L18 | | R38 R37 | | |

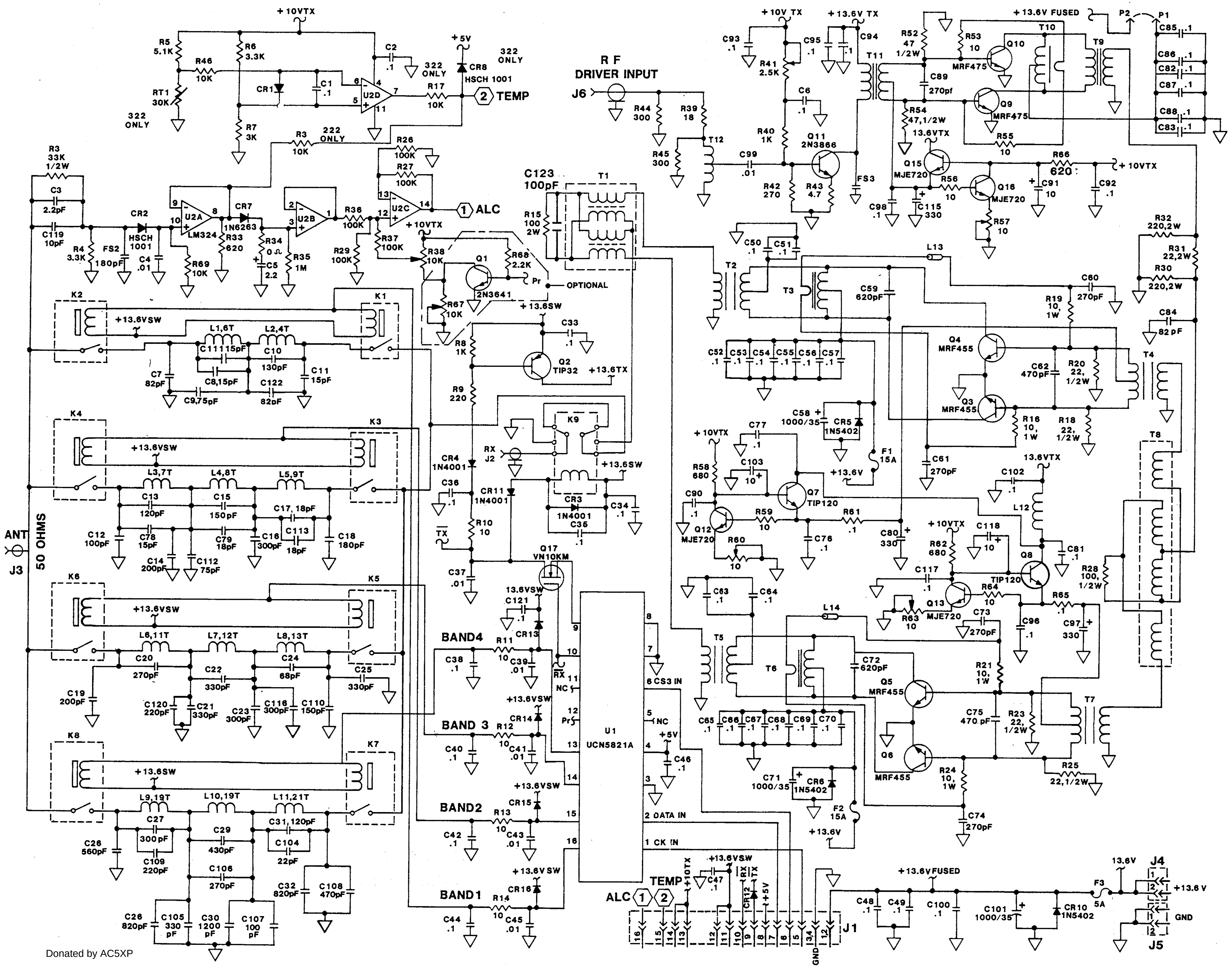
# P.A./FILTER SCHEMATIC

## ASY-0222-02

## FIGURE 10.6.2




**P.A./FILTER BOARD**
**ASY-0322-02**
**FIGURE 10.7.1**






**NOTES** UNLESS OTHERWISE SPECIFIED

1. RESISTORS ARE IN OHMS,1/4W,5%
2. CAPACITORS ARE IN MFD/WVDC
3. DIODES ARE 1N4148

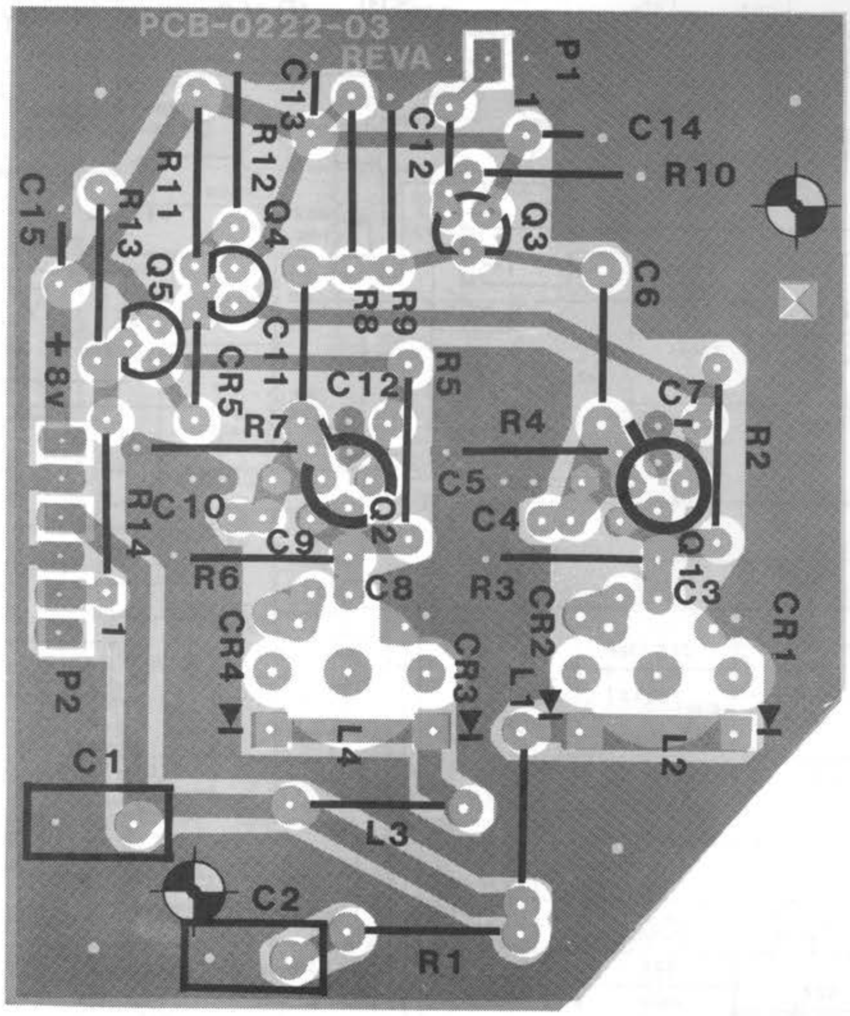
| LAST DESIGNATOR USED | | | | | | | |
|---|---|---|---|---|---|---|---|
| C123 | CR16 | K9 | L14 | Q17 | R69 | T12 | JU8 |

| DESIGNATORS NOT USED | | | | |
|---|---|---|---|---|
| C114 | CR9 | FS1<br>FS4 | R22<br>R47<br>R48<br>R49<br>R50<br>R51<br>R67<br>R68<br>R1<br>R2 | Q14 |

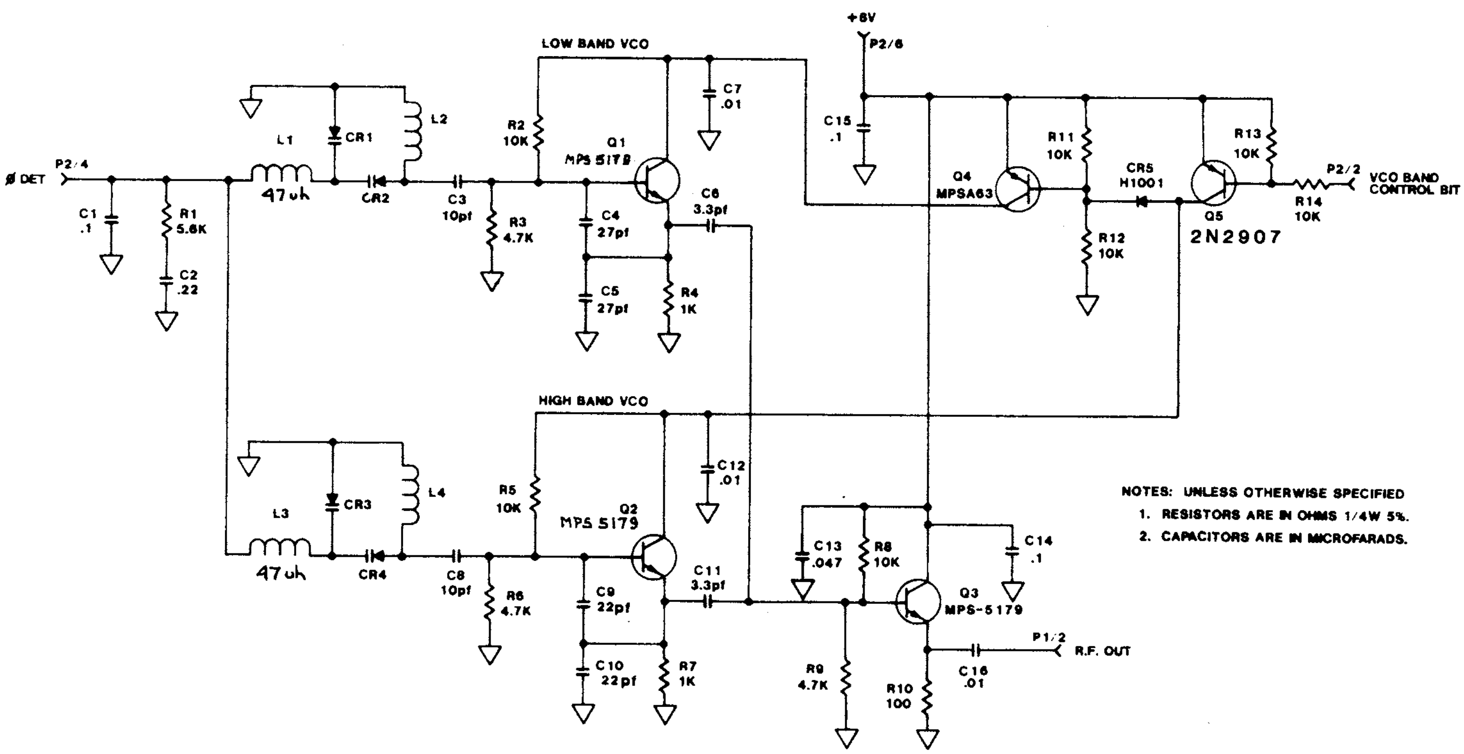
## ASY-0322-02
## P.A./FILTER SCHEMATIC

FOR RADIOTELEPHONES WITH 'D' OR 'E' SUFFIX SERIAL #'S

**FIGURE 10.7.2**

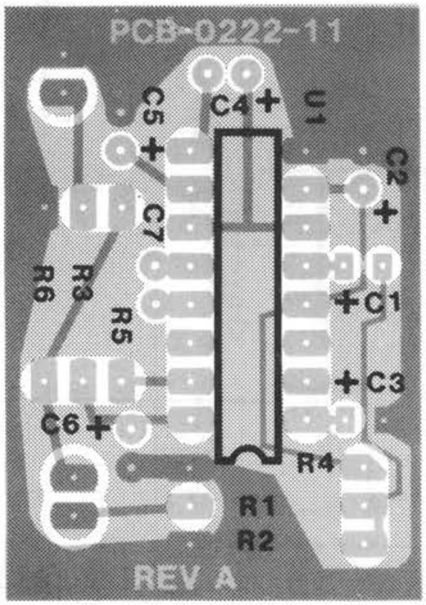



**VCO BOARD**
**FIGURE 10.8.1**



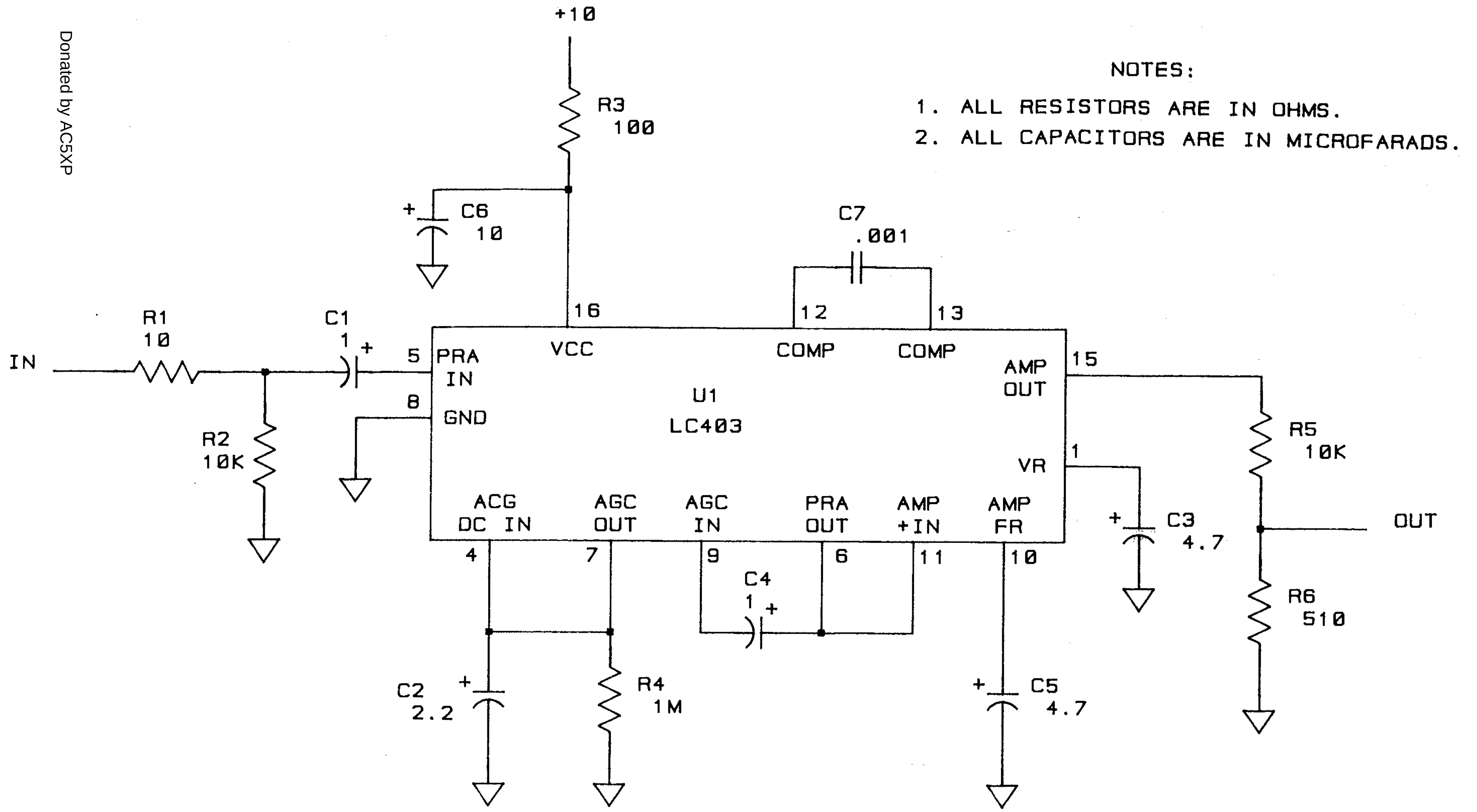

**ASY-0222-03**
**VCO SCHEMATIC**
**FIGURE 10.8.2**

THE FOLLOWING FIGURES (10.9.1, 10.9.2, 10.10.1 & 10.10.2) REFER TO BOARDS THAT ARE CONTAINED IN SEA222 RADIOS TYPE ACCEPTED FOR AUSTRALIA, NEW ZEALAND AND GERMANY.




**AUDIO COMPRESSOR BOARD**

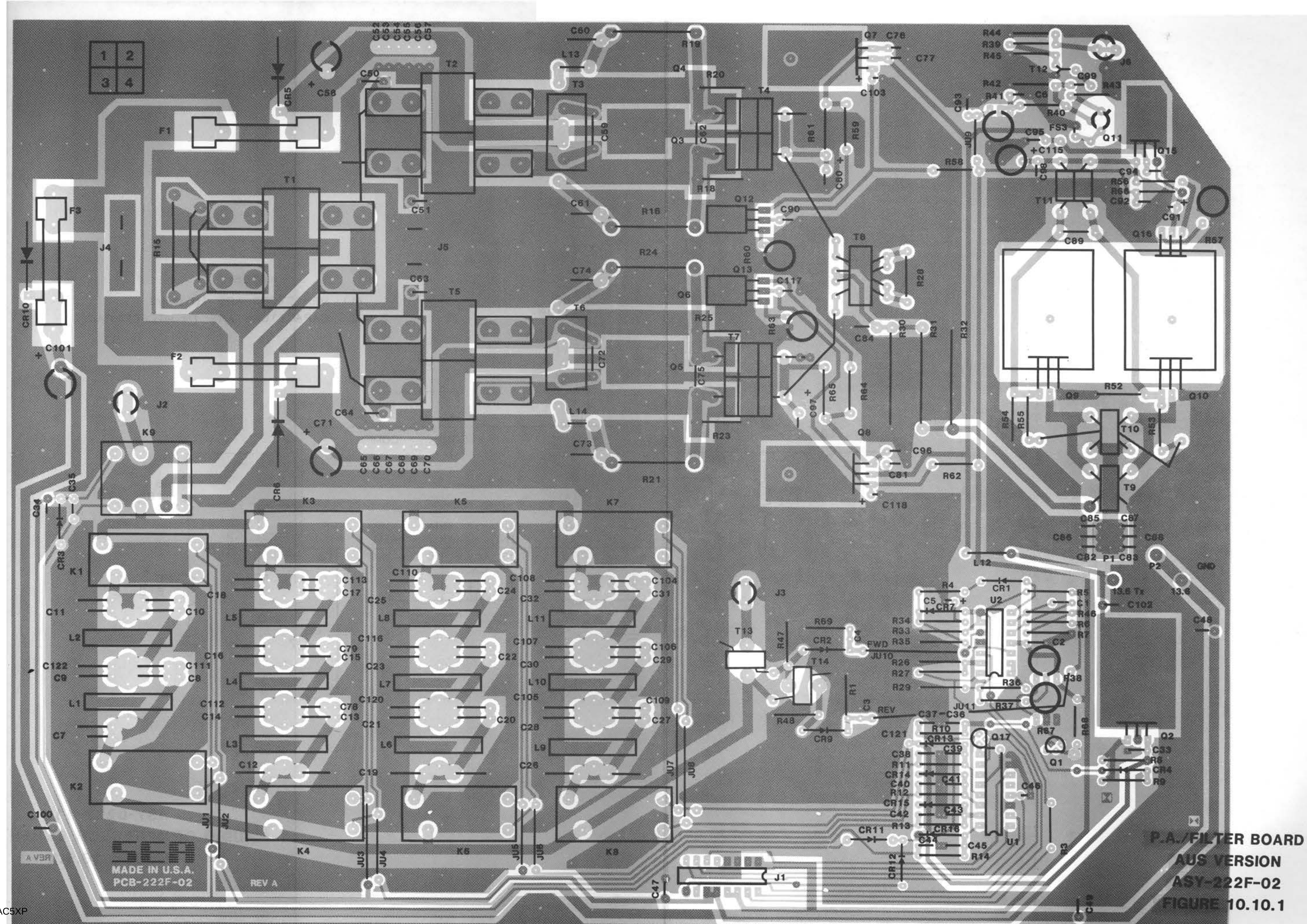
**FIGURE 10.9.1**




NOTES:

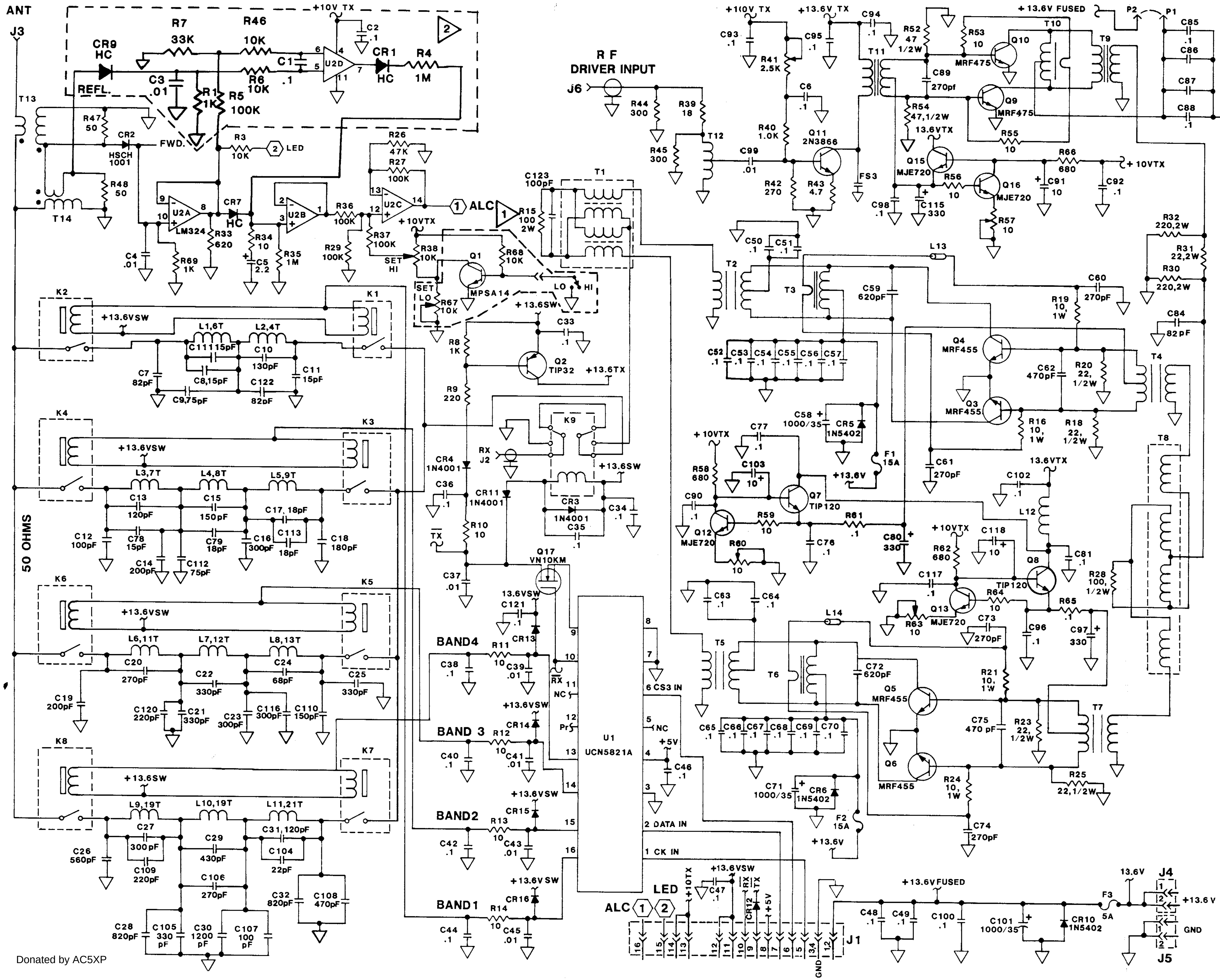
1. ALL RESISTORS ARE IN OHMS.
2. ALL CAPACITORS ARE IN MICROFARADS.

**ASY-0222-11**
**AUDIO COMPRESSOR SCHEMATIC**
**FIGURE 10.9.2**




P.A./FILTER BOARD
AUS VERSION
ASY-222F-02
FIGURE 10.10.1

Donated by AC5XP




1. HI/LO SWITCH ONLY USED ON UNITS REQUIRING A LOW POWER MODE.

2. THIS CIRCUIT USED IN RT2200 ONLY. (VSWR SHUTDOWN)
R4 REMOVED ALL OTHER VERSIONS
R4 SETS SHUTDOWN POWER LEVEL.
R7 SETS VSWR TRIP POINT.

NOTES UNLESS OTHERWISE SPECIFIED
1 RESISTORS ARE IN OHMS,1/4W,5%
2. CAPACAPACITORS ARE IN MFD/WVDC
3 DIODES ARE 1N4148

SYMBOL INDICATES POINT TO CONNECTION ON THIS SHEET

| LAST DESIGNATOR USED | | | | | | | |
|---|---|---|---|---|---|---|---|
| C123 | CR16 | K9 | L14 | Q17 | R69 | T14 | JU8 |

| DESIGNATORS NOT USED | | | | | | |
|---|---|---|---|---|---|---|
| C82<br>C83<br>C114 | CR8 | FS1<br>FS4 | R22 | Q14 | | |

R49
R50
R51
R67
R68

REVISED 9/93 ECN5398

**P.A./FIILTER SCHEMATIC**
**ASY-222F-02**

**FIGURE 10.10.2**

EXP.BILL - SINGLE LEVEL BILL-OF-MATERIAL LISTING EFFECTIVE 03/21/94

| LEVEL | PART | DESCRIPTION | QTY/ASSY | UM |
|---|---|---|---|---|
| 0........ | 222 | HF/SSB RADIOTELEPHONE | | EA |
| 1....... | ASY-0222-02D | PA/FILTER ASSEMBLY | 1 | EA |
| 1....... | ASY-0222-10 | FRONT PANEL ASSY | 1 | EA |
| 1....... | ASY-0222-20 | 222 CHASSIS ASSY | 1 | EA |
| 1....... | FAB-0222-21 | 222 COVER,BLACK | 2 | EA |
| 1....... | FAB-0222-22 | SIDERAIL EXTRUSION, BLACK | 2 | EA |
| 1....... | FAB-0222-23 | BEZEL, BLACK | 1 | EA |
| 1....... | FAB-0222-24 | MOUNTING BRACKET, BLACK | 1 | EA |
| 1....... | HAR-0044-002 | WASHER, FL NY .315 X .141 X . | 4 | EA |
| 1....... | HAR-060D-313 | 6-32x5/16 PAN-L SCREW | 8 | EA |
| 1....... | KIT-0222-99 | SEA 222 HARDWARE KIT | 1 | EA |
| 1....... | OPR-222 | OPERATORS MANUAL | 1 | EA |
| 1....... | OPS-222US-U22 | OPERATING SYSTEM (RED) | 1 | EA |
| 1....... | OPS-222US-U23 | SYSTEM EEPROM (RED) | 1 | EA |
| 1....... | ASY-0222-01 | MAINBOARD | 1 | EA |
| 1....... | BOX-0222-01 | LARGE FOAM RADIO BOX | 1 | EA |
| 1....... | BOX-0222-02 | LARGE FOAM RADIO INSERT | 1 | EA |
| 1....... | FOM-0222-03 | FOAM END CAPS | 2 | EA |
| 1....... | HAR-0029-004 | COR-PAK BREATHABLE POUCHES | 1 | EA |
| 1....... | HAR-0083-001 | 5/8X1/4 UNTHD STANDOFF | 4 | EA |
| 1....... | MIC-0002-010 | MICROPHONE ASSY | 1 | EA |
| 1....... | ASY-0222-28 | PLUG-IN ASSEMBLY | 1 | EA |
| 1....... | W0222000.1F0 | 222 FINAL ASSY | 0 | EA |
| 1....... | ASY-0223-10M | CABLE ASSY 5.0" | 1 | EA |
| 1....... | FAB-0222-08 | R.F. SHIELD | 1 | EA |
| 1....... | MAN-222 | MANUAL FOR SEA 222 | 1 | EA |
| 1....... | WIR-0001-010 | PHONO CABLE 10" | 1 | EA |
| 1....... | WIR-0001-014 | PHONO CABLE 14" | 1 | EA |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAIN BOARD REVISION L AND PRIOR

EFFECTIVE 07-14-93

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| A1 | MIX-0002-001 | DBL BAL MIXER |
| A2 | MIX-0002-001 | DBL BAL MIXER |
| A3 | MIX-0002-001 | DBL BAL MIXER |
| C1 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C10 | CAP-0001-015 | CAPACITOR MICA 100pf |
| C100 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C101 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C102 | CAP-0013-006 | CAP.MONO .047UF |
| C103 | CAP-0013-006 | CAP.MONO .047UF |
| C104 | CAP-0037-010 | CAP.ELECT 470UF RAD |
| C105 | CAP-0037-010 | CAP.ELECT 470UF RAD |
| C106 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C108 | CAP-0013-005 | CAPACITOR MONO ..001 uf |
| C109 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C11 | CAP-0001-003 | CAPACITOR MICA 22pf |
| C110 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C111 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C112 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C113 | CAP-0001-012 | CAPACITOR MICA 68pf |
| C115 | CAP-0001-007 | CAPACITOR MICA 36pf |
| C116 | CAP-0006-004 | CAP,MULTILAYER CER DIP .047 |
| C117 | CAP-0001-015 | CAPACITOR MICA 100pf |
| C118 | CAP-0001-006 | CAPACITOR MICA 33pf |
| C119 | CAP-0002-018 | CAP 4.7PF TUB-CERAMIC 10% |
| C12 | CAP-0001-004 | CAPACITOR MICA 27pf |
| C120 | CAP-0002-016 | CAP 3.3PF TUB-CERAMIC 10% |
| C121 | CAP-0006-004 | CAP,MULTILAYER CER DIP .047 |
| C122 | CAP-0025-002 | CAPACITOR TRIMMER 2-10pf |
| C123 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C124 | CAP-0006-003 | CAP,MULTILAYER CER DIP .001 |
| C125 | CAP-0001-030 | CAPACITOR MICA 360pf |
| C126 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C127 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C128 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C129 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C13 | CAP-0001-040 | CAP,MICA 6.2pf or DISC 6 pf |
| C130 | CAP-0001-018 | CAPACITOR MICA 160pf |
| C131 | CAP-0012-003 | CAP, MYLAR .0015uf/100V |
| C132 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C133 | CAP-0001-024 | CAPACITOR MICA 560pf |
| C134 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C135 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C136 | CAP-0027-474 | CAPACITOR FILM CK05 .47 |
| C137 | CAP-0027-104 | CAPACITOR FILM CK05 .1 |
| C139 | CAP-0006-001 | CAP.MULTILAYER CER DIP .1 |
| C14 | CAP-0025-002 | CAPACITOR TRIMMER 2-10pf |
| C140 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C141 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C142 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C143 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C144 | CAP-0006-003 | CAP,MULTILAYER CER DIP .001 |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAIN BOARD REVISION L AND PRIOR

EFFECTIVE 07-14-93

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| C145 | CAP-0006-003 | CAP,MULTILAYER CER DIP .001 |
| C146 | CAP-0006-003 | CAP,MULTILAYER CER DIP .001 |
| C147 | CAP-0000-000 | FACTORY SELECT |
| C148 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C149 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C15 | CAP-0025-002 | CAPACITOR TRIMMER 2-10pf |
| C150 | CAP-0001-010 | CAPACITOR MICA 56pf |
| C151 | CAP-0025-001 | CAPACITOR TRIMMER 2-20PF |
| C152 | CAP-0030-009 | CAPACITOR TANT 22uf 25V |
| C153 | CAP-0001-017 | CAPACITOR MICA 150pf |
| C154 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C155 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C156 | CAP-0037-007 | CAP.ELECT 100UF RAD |
| C157 | CAP-0030-009 | CAPACITOR TANT 22uf 25V |
| C158 | CAP-0037-006 | CAP.ELECT 10UF RAD |
| C159 | CAP-0027-472 | CAPACITOR FILM CK05 .0047 |
| C16 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C160 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C161 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C162 | CAP-0030-007 | CAPACITOR TANT 10uf |
| C163 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C164 | CAP-0031-008 | CAP TANT 1uf 16-25V |
| C165 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C166 | CAP-0027-104 | CAPACITOR FILM CK05 .1 |
| C167 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C168 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C169 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C17 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C170 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C171 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C172 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C173 | CAP-0037-005 | CAP.ELECT 22UF RAD |
| C174 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C175 | CAP-0037-005 | CAP.ELECT 22UF RAD |
| C177 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C178 | CAP-0001-039 | CAPACITOR,MICA 12pf |
| C179 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C18 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C180 | CAP-0001-017 | CAPACITOR MICA 150pf |
| C181 | CAP-0001-008 | CAPACITOR MICA 47pf |
| C183 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C184 | CAP-0006-003 | CAP,MULTILAYER CER DIP .001 |
| C185 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C186 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C187 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C188 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C189 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C19 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C190 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C191 | CAP-0001-042 | CAP,MICA 7.5pf or DISC 7pf |
| C192 | CAP-0013-001 | CAPACITOR MONO .1uf |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAIN BOARD REVISION L AND PRIOR

EFFECTIVE 07-14-93

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| C193 | CAP-0031-001 | CAP TANT 2.2uf 16-25V |
| C194 | CAP-0024-001 | CAP. MYLAR/FILM .033 25V |
| C195 | CAP-0001-034 | CAPACITOR MICA 20pf |
| C196 | CAP-0001-016 | CAPACITOR MICA 130pf |
| C197 | CAP-0001-016 | CAPACITOR MICA 130pf |
| C198 | CAP-0001-016 | CAPACITOR MICA 130pf |
| C199 | CAP-0001-016 | CAPACITOR MICA 130pf |
| C2 | CAP-0006-003 | CAP,MULTILAYER CER DIP .001 |
| C20 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C21 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C22 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C23 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C24 | CAP-0001-004 | CAPACITOR MICA 27pf |
| C25 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C26 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C27 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C28 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C3 | CAP-0006-003 | CAP,MULTILAYER CER DIP .001 |
| C30 | CAP-0001-040 | CAP,MICA 6.2pf or DISC 6 pf |
| C31 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C32 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C33 | CAP-0006-003 | CAP,MULTILAYER CER DIP .001 |
| C34 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C35 | CAP-0012-005 | CAP, MYLAR .01uf/50V |
| C36 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C37 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C38 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C39 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C4 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C40 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C41 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C42 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C43 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C44 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C45 | CAP-0001-014 | CAPACITOR MICA 82pf |
| C46 | CAP-0001-002 | CAPACITOR MICA 15pf |
| C47 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C48 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C49 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C5 | CAP-0001-001 | CAPACITOR MICA 10pf |
| C50 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C51 | CAP-0006-003 | CAP,MULTILAYER CER DIP .001 |
| C52 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C53 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C54 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C55 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C56 | CAP-0027-104 | CAPACITOR FILM CK05 .1 |
| C57 | CAP-0037-003 | CAP.ELECT 4.7UF RAD |
| C58 | CAP-0027-102 | CAPACITOR FILM CKO5 .001 |
| C59 | CAP-0027-224 | CAPACITOR FILM CK05 .22 |
| C6 | CAP-0013-006 | CAP.MONO .047UF |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAIN BOARD REVISION L AND PRIOR

EFFECTIVE 07-14-93

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| C60 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C61 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C62 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C63 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C64 | CAP-0013-005 | CAPACITOR MONO .001 uf |
| C65 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C66 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C67 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C68 | CAP-0037-005 | CAP.ELECT 22UF RAD |
| C69 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C7 | CAP-0001-015 | CAPACITOR MICA 100pf |
| C70 | CAP-0013-005 | CAPACITOR MONO .001 uf |
| C71 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C72 | CAP-0012-008 | CAP, MYLAR .0033uf/100V |
| C73 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C74 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C75 | CAP-0027-223 | CAPACITOR FILM CK05 .022 |
| C76 | CAP-0031-005 | CAPACITOR TANT 10uf 16V |
| C77 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C78 | CAP-0037-010 | CAP.ELECT 470UF RAD |
| C79 | CAP-0037-010 | CAP.ELECT 470UF RAD |
| C8 | CAP-0001-028 | CAPACITOR MICA 200pf |
| C80 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C81 | CAP-0031-007 | CAPACITOR TANT 22uf 16V |
| C82 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C83 | CAP-0013-005 | CAPACITOR MONO .001 uf |
| C84 | CAP-0030-005 | CAPACITOR TANT .47uf 35V |
| C85 | CAP-0012-008 | CAP, MYLAR .0033uf/100V |
| C86 | CAP-0012-009 | CAP, MYLAR .033uf/100V |
| C87 | CAP-0037-003 | CAP.ELECT 4.7UF RAD |
| C88 | CAP-0037-003 | CAP.ELECT 4.7UF RAD |
| C89 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C9 | CAP-0001-028 | CAPACITOR MICA 200pf |
| C90 | CAP-0012-005 | CAP, MYLAR .01uf/50V |
| C91 | CAP-0012-009 | CAP, MYLAR .033uf/100V |
| C92 | CAP-0027-682 | CAPACITOR FILM CKO5 .0068 |
| C93 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C94 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C95 | CAP-0006-004 | CAP,MULTILAYER CER DIP .047 |
| C97 | CAP-0006-004 | CAP,MULTILAYER CER DIP .047 |
| C98 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C99 | CAP-0001-017 | CAPACITOR MICA 150pf |
| CR1 | SEM-0096-002 | KS1001 |
| CR10 | SEM-0096-007 | DIODE, P.I.N. |
| CR11 | SEM-0096-007 | DIODE, P.I.N. |
| CR12 | SEM-0096-007 | DICDE, P.I.N. |
| CR13 | SEM-0096-007 | DIODE, P.I.N. |
| CR14 | SEM-0096-007 | DIODE, P.I.N. |
| CR15 | SEM-0096-007 | DIODE, P.I.N. |
| CR16 | SEM-0076-001 | DIODE, 1N4148 |
| CR17 | SEM-0076-001 | DIODE, 1N4148 |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAIN BOARD REVISION L AND PRIOR

EFFECTIVE 07-14-93

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| CR19 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| CR2 | SEM-0076-001 | DIODE, 1N4148 |
| CR20 | SEM-0076-001 | DIODE, 1N4148 |
| CR21 | SEM-0076-001 | DIODE, 1N4148 |
| CR23 | SEM-0080-004 | MV209 |
| CR24 | SEM-0076-001 | DIODE, 1N4148 |
| CR25 | SEM-0076-001 | DIODE, 1N4148 |
| CR26 | SEM-0084-001 | LED, RED |
| CR27 | SEM-0083-004 | 1N4735A ZENER 1 W REG |
| CR28 | SEM-0076-001 | DIODE, 1N4148 |
| CR29 | SEM-0170-026 | 1N4736A |
| CR3 | SEM-0076-001 | DIODE, 1N4148 |
| CR30 | SEM-0083-004 | 1N4735A ZENER 1 W REG |
| CR31 | SEM-0076-001 | DIODE, 1N4148 |
| CR32 | SEM-0170-024 | 1N4744 |
| CR33 | SEM-0076-001 | DIODE, 1N4148 |
| CR34 | SEM-0076-001 | DIODE, 1N4148 |
| CR35 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| CR36 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| CR37 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| CR38 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| CR4 | SEM-0076-001 | DIODE, 1N4148 |
| CR5 | SEM-0091-001 | DIODES 1N3070 |
| CR6 | SEM-0091-001 | DIODES 1N3070 |
| CR7 | SEM-0076-001 | DIODE, 1N4148 |
| CR8 | SEM-0096-007 | DIODE, P.I.N. |
| CR9 | SEM-0096-007 | DIODE, P.I.N. |
| DIS1 | DIS-0002-001 | VF DIS, 8 DIGIT ALPHA |
| F1 | FIL-0005-003 | FILTER, 45 MHz PIEZO |
| F2 | FIL-0010-003 | 6.4MHZ WITH GND PINS |
| FS | CAP-0001-001 | CAPACITOR MICA 10pf |
| J1 | CON-0028-002 | HEADER MALE 9 TERM. |
| J2 | SOC-0002-016 | IC SOCKET, 16 PIN DIP |
| J3 | CON-0240-080 | POST HEADER 8 PIN |
| J4 | CON-0004-002 | JACK, PHONO PCB |
| J5 | CON-0004-002 | JACK, PHONO PCB |
| JU1 | JUM-0002-045 | JUMPER, .45" TEFLON |
| JU2 | JUM-0002-045 | JUMPER, .45" TEFLON |
| JU3 | JUM-0002-045 | JUMPER, .45" TEFLON |
| JU4 | JUM-0002-320 | JUMPER, 3.20" #24 TEFLON |
| JU5 | JUM-0002-100 | JUMPER, 1" #24 TEFLON |
| L1 | IND-0021-011 | INDUCTOR, 4.7uh |
| L11 | IND-0020-014 | INDUCTOR, 470uh CRAMER |
| L13 | IND-0021-020 | INDUCTOR, 27uh CRAMER |
| L14 | IND-0021-020 | INDUCTOR, 27uh CRAMER |
| L15 | ASY-0010-11 | VCXO COIL 10TWIR12 ON 11-1 |
| L16 | IND-0020-014 | INDUCTOR, 470uh CRAMER |
| L17 | IND-0020-014 | INDUCTOR, 470uh CRAMER |
| L18 | IND-0020-014 | INDUCTOR, 470uh CRAMER |
| L2 | IND-0020-014 | INDUCTOR, 470uh CRAMER |
| L3 | ASY-0004-10 | IND,TOR 10T18-226on11-1 |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAIN BOARD REVISION L AND PRIOR

EFFECTIVE 07-14-93

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| L4 | ASY-0004-09 | INDUCTOR, TOROID |
| L5 | ASY-0004-09 | INDUCTOR, TOROID |
| L6 | IND-0021-020 | INDUCTOR, 27uh CRAMER |
| L7 | ASY-0002-16 | INDUCTOR |
| L8 | ASY-0002-16 | INDUCTOR |
| OVE1 | OVE-0006-001 | OVEN,CRYSTAL POSISTOR |
| P10 | CON-0240-060 | POST HEADER 6 PIN |
| P13 | CON-0240-030 | POST HEADER 3 PIN |
| P14 | CON-0240-020 | POST HEADER 2 PIN |
| P9 | CON-0240-030 | POST HEADER 3 PIN |
| Q1 | SEM-0021-004 | VN2222LM 60V FET (RED) |
| Q10 | SEM-0004-002 | 2N2907, MPS2907 |
| Q11 | SEM-0015-001 | MPS-A63 |
| Q12 | SEM-0003-002 | MPS5179 |
| Q13 | SEM-0003-002 | MPS5179 |
| Q14 | SEM-0007-002 | MPS6531 |
| Q15 | SEM-0016-002 | MPS-A18 |
| Q16 | SEM-0007-002 | MPS6531 |
| Q17 | SEM-0021-002 | PN2222A |
| Q2 | SEM-0001-001 | 2N3565 |
| Q3 | SEM-0003-001 | 2N3563 |
| Q4 | SEM-0007-002 | MPS6531 |
| Q5 | SEM-0007-002 | MPS6531 |
| Q6 | SEM-0001-001 | 2N3565 |
| Q7 | SEM-0032-002 | TIP 32 SILICON POW TRANS |
| Q8 | SEM-0021-002 | PN2222A |
| Q9 | SEM-0021-002 | PN2222A |
| R1 | RES-0001-221 | RESISTOR 220 1/4W |
| R10 | RES-0001-681 | RESISTOR 680 1/4W |
| R100 | RES-0001-271 | RESISTOR 270 1/4W |
| R101 | RES-0027-101 | TRIMMER, 100 91AR100 |
| R102 | RES-0001-821 | RESISTOR 820 1/4W |
| R103 | RES-0001-330 | RESISTOR 33 1/4W |
| R104 | RES-0001-102 | RESISTOR 1K 1/4W |
| R105 | RES-0001-221 | RESISTOR 220 1/4W |
| R106 | RES-0001-471 | RESISTOR 470 1/4W |
| R107 | RES-0001-180 | RESISTOR 18 1/4W |
| R108 | RES-0001-221 | RESISTOR 220 1/4W |
| R109 | RES-0001-221 | RESISTOR 220 1/4W |
| R11 | RES-0001-301 | RESISTOR 300 1/4W |
| R112 | RES-0001-471 | RESISTOR 470 1/4W |
| R113 | RES-0001-221 | RESISTOR 220 1/4W |
| R115 | RES-0001-271 | RESISTOR 270 1/4W |
| R116 | RES-0001-470 | RESISTOR 47 1/4W |
| R117 | RES-0001-102 | RESISTOR 1K 1/4W |
| R118 | RES-0001-221 | RESISTOR 220 1/4W |
| R119 | RES-0001-123 | RESISTOR 12K 1/4W |
| R12 | RES-0001-180 | RESISTOR 18 1/4W |
| R120 | RES-0001-152 | RESISTOR 1.5K 1/4W |
| R121 | RES-0001-150 | RESISTOR 15 1/4W |
| R122 | RES-0001-301 | RESISTOR 300 1/4W |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAIN BOARD REVISION L AND PRIOR

EFFECTIVE 07-14-93

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| R123 | RES-0001-180 | RESISTOR 18 1/4W |
| R124 | RES-0001-301 | RESISTOR 300 1/4W |
| R125 | RES-0001-101 | RESISTOR 100 1/4W |
| R126 | RES-0001-750 | RESISTOR, 75 1/4W |
| R127 | RES-0001-103 | RESISTOR 10K 1/4W |
| R128 | RES-0001-472 | RESISTOR 4.7K 1/4W |
| R129 | RES-0001-680 | RESISTOR 68 1/4W |
| R13 | RES-0001-681 | RESISTOR 680 1/4W |
| R130 | RES-0001-391 | RESISTOR 390 1/4W |
| R131 | RES-0001-103 | RESISTOR 10K 1/4W |
| R132 | RES-0001-472 | RESISTOR 4.7K 1/4W |
| R133 | RES-0001-104 | RESISTOR 100K 1/4W |
| R134 | RES-0001-561 | RESISTOR 560 1/4W |
| R135 | RES-0001-103 | RESISTOR 10K 1/4W |
| R136 | RES-0001-103 | RESISTOR 10K 1/4W |
| R137 | RES-0001-333 | RESISTOR 33K 1/4W |
| R138 | RES-0001-102 | RESISTOR 1K 1/4W |
| R14 | RES-0001-153 | RESISTOR 15K 1/4W |
| R140 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R141 | RES-0001-104 | RESISTOR 100K 1/4W |
| R142 | RES-0001-104 | RESISTOR 100K 1/4W |
| R143 | RES-0001-560 | RESISTOR 56 1/4W |
| R144 | RES-0001-152 | RESISTOR 1.5K 1/4W |
| R145 | RES-0001-152 | RESISTOR 1.5K 1/4W |
| R146 | RES-0001-330 | RESISTOR 33 1/4W |
| R147 | RES-0001-330 | RESISTOR 33 1/4W |
| R148 | RES-0001-103 | RESISTOR 10K 1/4W |
| R149 | RES-0001-103 | RESISTOR 10K 1/4W |
| R15 | JUM-0002-045 | JUMPER,.45" TEFLON |
| R150 | RES-0001-103 | RESISTOR 10K 1/4W |
| R151 | RES-0001-152 | RESISTOR 1.5K 1/4W |
| R152 | RES-0001-103 | RESISTOR 10K 1/4W |
| R153 | RES-0001-473 | RESISTOR 47K 1/4W |
| R154 | RES-0001-472 | RESISTOR 4.7K 1/4W |
| R155 | RES-0001-561 | RESISTOR 560 1/4W |
| R156 | RES-0001-331 | RESISTOR 330 1/4W |
| R159 | RES-0001-022 | RESISTOR 2.2 1/4 W |
| R16 | RES-0001-100 | RESISTOR 10 1/4W |
| R160 | RES-0001-243 | RESISTOR 24K 1/4W |
| R161 | RES-0001-122 | RESISTOR 1.2K 1/4W |
| R162 | RES-0001-470 | RESISTOR 47 1/4W |
| R163 | RES-0001-102 | RESISTOR 1K 1/4W |
| R164 | RES-0001-102 | RESISTOR 1K 1/4W |
| R165 | RES-0001-102 | RESISTOR 1K 1/4W |
| R166 | RES-0001-203 | RESISTOR 20K 1/4W |
| R167 | RES-0001-105 | RESISTOR 1M 1/4W |
| R168 | RES-0001-243 | RESISTOR 24K 1/4W |
| R169 | RES-0001-473 | RESISTOR 47K 1/4W |
| R17 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R170 | RES-0001-473 | RESISTOR 47K 1/4W |
| R171 | RES-0001-473 | RESISTOR 47K 1/4W |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAIN BOARD REVISION L AND PRIOR

EFFECTIVE 07-14-93

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| R172 | RES-0001-473 | RESISTOR 47K 1/4W |
| R173 | RES-0001-682 | RESISTOR 6.8K 1/4W |
| R174 | RES-0001-682 | RESISTOR 6.8K 1/4W |
| R175 | RES-0001-682 | RESISTOR 6.8K 1/4W |
| R176 | RES-0001-682 | RESISTOR 6.8K 1/4W |
| R177 | RES-0001-334 | RESISTOR 330K 1/4W |
| R178 | RES-0001-102 | RESISTOR 1K 1/4W |
| R179 | RES-0001-473 | RESISTOR 47K 1/4W |
| R18 | RES-0001-681 | RESISTOR 680 1/4W |
| R180 | RES-0001-682 | RESISTOR 6.8K 1/4W |
| R181 | RES-0001-103 | RESISTOR 10K 1/4W |
| R182 | RES-0001-103 | RESISTOR 10K 1/4W |
| R183 | RES-0001-221 | RESISTOR 220 1/4W |
| R184 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R185 | RES-0001-103 | RESISTOR 10K 1/4W |
| R186 | RES-0001-221 | RESISTOR 220 1/4W |
| R187 | RES-0001-331 | RESISTOR 330 1/4W |
| R188 | RES-0001-102 | RESISTOR 1K 1/4W |
| R189 | RES-0001-102 | RESISTOR 1K 1/4W |
| R19 | RES-0001-681 | RESISTOR 680 1/4W |
| R190 | RES-0001-470 | RESISTOR 47 1/4W |
| R191 | RES-0001-561 | RESISTOR 560 1/4W |
| R192 | RES-0001-471 | RESISTOR 470 1/4W |
| R193 | RES-0027-502 | TRIMMER,5K |
| R194 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R195 | RES-0001-301 | RESISTOR 300 1/4W |
| R196 | RES-0001-103 | RESISTOR 10K 1/4W |
| R197 | RES-0001-562 | RESISTOR 5.6K 1/4W |
| R198 | RES-0001-103 | RESISTOR 10K 1/4W |
| R199 | RES-0001-391 | RESISTOR 390 1/4W |
| R2 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R20 | RES-0001-103 | RESISTOR 10K 1/4W |
| R200 | RES-0001-104 | RESISTOR 100K 1/4W |
| R201 | RES-0001-104 | RESISTOR 100K 1/4W |
| R202 | RES-0001-102 | RESISTOR 1K 1/4W |
| R203 | RES-0001-102 | RESISTOR 1K 1/4W |
| R204 | RES-0001-682 | RESISTOR 6.8K 1/4W |
| R205 | RES-0001-221 | RESISTOR 220 1/4W |
| R206 | RES-0001-102 | RESISTOR 1K 1/4W |
| R207 | RES-0001-471 | RESISTOR 470 1/4W |
| R208 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R209 | RES-0001-102 | RESISTOR 1K 1/4W |
| R21 | RES-0001-681 | RESISTOR 680 1/4W |
| R210 | RES-0001-122 | RESISTOR 1.2K 1/4W |
| R211 | RES-0001-510 | 51OHM, 1/4W CARBON FILM |
| R22 | RES-0001-681 | RESISTOR 680 1/4W |
| R23 | RES-0001-180 | RESISTOR 18 1/4W |
| R24 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R25 | RES-0001-301 | RESISTOR 300 1/4W |
| R26 | RES-0001-301 | RESISTOR 300 1/4W |
| R27 | RES-0001-100 | RESISTOR 10 1/4W |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAIN BOARD   REVISION L AND PRIOR

EFFECTIVE 07-14-93

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| R28 | RES-0001-153 | RESISTOR 15K 1/4W |
| R29 | RES-0027-103 | TRIMMER, 10K |
| R3 | RES-0001-681 | RESISTOR 680 1/4W |
| R30 | RES-0027-103 | TRIMMER, 10K |
| R31 | RES-0001-432 | RESISTOR 4.3K 1/4W |
| R32 | RES-0001-103 | RESISTOR 10K 1/4W |
| R33 | RES-0001-101 | RESISTOR 100 1/4W |
| R34 | RES-0001-272 | RESISTOR 2.7K 1/4W |
| R35 | RES-0001-104 | RESISTOR 100K 1/4W |
| R36 | RES-0001-103 | RESISTOR 10K 1/4W |
| R37 | RES-0001-563 | RESISTOR 56K 1/4W |
| R38 | RES-0001-471 | RESISTOR 470 1/4W |
| R39 | RES-0001-103 | RESISTOR 10K 1/4W |
| R4 | RES-0001-681 | RESISTOR 680 1/4W |
| R40 | RES-0001-104 | RESISTOR 100K 1/4W |
| R41 | RES-0001-124 | RESISTOR, 120K 1/4W |
| R42 | RES-0001-334 | RESISTOR 330K 1/4W |
| R43 | RES-0001-103 | RESISTOR 10K 1/4W |
| R44 | RES-0001-103 | RESISTOR 10K 1/4W |
| R45 | RES-0001-393 | RESISTOR 39K 1/4W |
| R46 | RES-0001-103 | RESISTOR 10K 1/4W |
| R47 | RES-0001-223 | RESISTOR 22K 1/4W |
| R48 | RES-0001-103 | RESISTOR 10K 1/4W |
| R49 | RES-0001-224 | RESISTOR 220K 1/4W |
| R5 | RES-0001-123 | RESISTOR 12K 1/4W |
| R50 | RES-0001-103 | RESISTOR 10K 1/4W |
| R51 | RES-0001-224 | RESISTOR 220K 1/4W |
| R52 | RES-0001-103 | RESISTOR 10K 1/4W |
| R53 | RES-0001-470 | RESISTOR 47 1/4W |
| R54 | RES-0001-103 | RESISTOR 10K 1/4W |
| R55 | RES-0001-103 | RESISTOR 10K 1/4W |
| R56 | RES-0001-103 | RESISTOR 10K 1/4W |
| R57 | RES-0001-103 | RESISTOR 10K 1/4W |
| R58 | RES-0001-103 | RESISTOR 10K 1/4W |
| R59 | RES-0001-102 | RESISTOR 1K 1/4W |
| R6 | RES-0001-100 | RESISTOR 10 1/4W |
| R60 | RES-0001-331 | RESISTOR 330 1/4W |
| R61 | RES-0001-681 | RESISTOR 680 1/4W |
| R62 | RES-0001-103 | RESISTOR 10K 1/4W |
| R63 | RES-0001-103 | RESISTOR 10K 1/4W |
| R64 | RES-0001-103 | RESISTOR 10K 1/4W |
| R65 | RES-0001-273 | RESISTOR 27K 1/4W |
| R66 | RES-0001-103 | RESISTOR 10K 1/4W |
| R67 | RES-0001-102 | RESISTOR 1K 1/4W |
| R68 | RES-0001-102 | RESISTOR 1K 1/4W |
| R69 | RES-0001-822 | RESISTOR 8.2K 1/4W |
| R7 | JUM-0002-045 | JUMPER, .45" TEFLON |
| R70 | RES-0001-100 | RESISTOR 10 1/4W |
| R71 | RES-0001-104 | RESISTOR 100K 1/4W |
| R72 | RES-0001-221 | RESISTOR 220 1/4W |
| R73 | RES-0001-068 | RESISTOR, 6.8 1/4W |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAIN BOARD REVISION L AND PRIOR

EFFECTIVE 07-14-93

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| R74 | RES-0001-012 | RESISTOR 1.2 1/4W |
| R75 | RES-0001-103 | RESISTOR 10K 1/4W |
| R76 | RES-0001-621 | RESISTOR 620 1/4W |
| R77 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R78 | RES-0001-392 | RESISTOR 3.9K 1/4W |
| R79 | RES-0001-473 | RESISTOR 47K 1/4W |
| R8 | RES-0001-472 | RESISTOR 4.7K 1/4W |
| R80 | RES-0027-103 | TRIMMER, 10K |
| R81 | RES-0001-223 | RESISTOR 22K 1/4W |
| R82 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R83 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R84 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R85 | RES-0001-473 | RESISTOR 47K 1/4W |
| R86 | RES-0001-683 | RESISTOR 68K 1/4W |
| R87 | RES-0001-682 | RESISTOR 6.8K 1/4W |
| R88 | RES-0001-333 | RESISTOR 33K 1/4W |
| R89 | RES-0001-272 | RESISTOR 2.7K 1/4W |
| R9 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R90 | RES-0001-272 | RESISTOR 2.7K 1/4W |
| R91 | RES-0001-472 | RESISTOR 4.7K 1/4W |
| R92 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R93 | RES-0001-102 | RESISTOR 1K 1/4W |
| R94 | RES-0001-243 | RESISTOR 24K 1/4W |
| R95 | RES-0001-472 | RESISTOR 4.7K 1/4W |
| R96 | RES-0001-681 | RESISTOR 680 1/4W |
| R97 | RES-0001-682 | RESISTOR 6.8K 1/4W |
| R98 | RES-0001-912 | RESISTOR 9.1K 1/4W |
| R99 | RES-0001-270 | RESISTOR 27 1/4W |
| RN1 | RES-0028-473 | RESISTOR NETWORK 47K 10 PIN |
| RN2 | RES-0028-473 | RESISTOR NETWORK 47K 10 PIN |
| RN3 | RES-0028-473 | RESISTOR NETWORK 47K 10 PIN |
| RT1 | THE-0002-001 | THERMISTOR, 100 OHM ,D73,NTC |
| T1 | ASY-0010-07 | 7 TURN TRANSFORMER |
| T10 | ASY-0010-07 | 7 TURN TRANSFORMER |
| T2 | TRA-0011-001 | TRANS VIOLET |
| T3 | ASY-0010-07 | 7 TURN TRANSFORMER |
| T4 | TRA-0005-001 | TRANSFORMER, BLK |
| T5 | ASY-0222-TT5 | INDUCTOR,T TRIFI ON #43 |
| T6 | ASY-0010-07 | 7 TURN TRANSFORMER |
| T7 | TRA-0011-001 | TRANS VIOLET |
| T8 | TRA-0011-001 | TRANS VIOLET |
| T9 | ASY-0209-T1M | TRANSFORMER |
| U1 | SEM-0101-001 | MC1350P |
| U11 | SEM-0170-004 | MC145156 (RED) |
| U12 | SEM-0162-002 | MC3393 (RED) |
| U13 | SEM-0170-015 | LM78L05AWC |
| U14 | SEM-0155-005 | 74C90 (RED0 |
| U15 | SEM-0170-007 | DM7406 |
| U16 | SEM-0170-003 | MC145155 (RED) |
| U17 | SEM-0143-086 | QUAD GATE 74HC86 |
| U17SO | SOC-0002-014 | IC SOCKET, 14 PIN DIP |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAIN BOARD REVISION L AND PRIOR

EFFECTIVE 07-14-93

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| U18 | SEM-0143-390 | HI SPEED CMOS LOGIC |
| U2 | SEM-0101-001 | MC1350P |
| U20 | SEM-0161-001 | 6805E2E(9) |
| U21 | SEM-0143-373 | 74HC373 OCTAL D LATCH |
| U24 | SEM-0170-022 | 10937 (RED) |
| U25A | SEM-0170-013 | CD4041UBF (RED) |
| U25B | SEM-0170-013 | CD4041UBF (RED) |
| U25SO | SOC-0002-014 | IC SOCKET, 14 PIN DIP |
| U26 | SEM-0170-009 | TL497ACN |
| U27 | SEM-0143-010 | 74HC10 (RED) |
| U28 | SEM-0143-132 | 74HC132 (RED) |
| U29 | SEM-0109-004 | 7808 |
| U3 | SEM-0154-007 | LM387 LOW NOISE PREAMP |
| U30 | SEM-0109-001 | UA7805CKC 5V REGULATOR |
| U32 | SEM-0102-001 | MC3340P |
| U4 | SEM-0140-066 | 4066 (RED) |
| U5 | SEM-0154-001 | LM324 QUAD OPAMP |
| U6 | SEM-0153-003 | TDA2002H |
| U7 | SEM-0154-003 | LM358 DUAL OP AMP |
| U8 | SEM-0154-001 | LM324 QUAD OPAMP |
| UK | JUM-0002-045 | JUMPER,.45" TEFLON |
| Y2 | CRY-0006-011 | CRYSTAL 38.618 MHz |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAINBOARD

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| A1 | MIX-0002-001 | DBL BAL MIXER |
| A2 | MIX-0002-001 | DBL BAL MIXER |
| A3 | MIX-0002-001 | DBL BAL MIXER |
| C1 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C10 | CAP-0001-015 | CAPACITOR MICA 100pf |
| C100 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C101 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C102 | CAP-0013-006 | CAP.MONO .047UF |
| C103 | CAP-0013-006 | CAP.MONO .047UF |
| C104 | CAP-0037-010 | CAP.ELECT 470UF RAD |
| C105 | CAP-0037-010 | CAP.ELECT 470UF RAD |
| C106 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C108 | CAP-0013-005 | CAPACITOR MONO .001 uf |
| C109 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C11 | CAP-0001-003 | CAPACITOR MICA 22pf |
| C110 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C111 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C112 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C113 | CAP-0001-012 | CAPACITOR MICA 68pf |
| C115 | CAP-0001-007 | CAPACITOR MICA 36pf |
| C116 | CAP-0006-004 | CAP,MULTILAYER CER DIP .047 |
| C117 | CAP-0001-015 | CAPACITOR MICA 100pf |
| C118 | CAP-0001-006 | CAPACITOR MICA 33pf |
| C119 | CAP-0002-018 | CAP 4.7PF TUB-CERAMIC 10% |
| C12 | CAP-0001-004 | CAPACITOR MICA 27pf |
| C120 | CAP-0002-016 | CAP 3.3PF TUB-CERAMIC 10% |
| C121 | CAP-0006-004 | CAP,MULTILAYER CER DIP .047 |
| C122 | CAP-0025-002 | CAPACITOR TRIMMER 2-10pf |
| C123 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C124 | CAP-0006-003 | CAP,MULTILAYER CER DIP .001 |
| C125 | CAP-0001-030 | CAPACITOR MICA 360pf |
| C126 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C127 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C128 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C129 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C13 | CAP-0001-040 | CAP,MICA 6.2pf or DISC 6 pf |
| C130 | CAP-0001-018 | CAPACITOR MICA 160pf |
| C131 | CAP-0012-003 | CAP, MYLAR .0015uf/100V |
| C132 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C133 | CAP-0001-024 | CAPACITOR MICA 560pf |
| C134 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C135 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C136 | CAP-0027-474 | CAPACITOR FILM CK05 .47 |
| C137 | CAP-0027-104 | CAPACITOR FILM CK05 .1 |
| C139 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C14 | CAP-0025-002 | CAPACITOR TRIMMER 2-10pf |
| C140 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C141 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C142 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C143 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C144 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAINBOARD

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| C145 | CAP-0013-005 | CAPACITOR MONO .001 uf |
| C146 | CAP-0006-003 | CAP,MULTILAYER CER DIP .001 |
| C147 | CAP-0000-000 | FACTORY SELECT |
| C148 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C149 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C15 | CAP-0025-002 | CAPACITOR TRIMMER 2-10pf |
| C150 | CAP-0001-010 | CAPACITOR MICA 56pf |
| C151 | CAP-0025-001 | CAPACITOR TRIMMER 2-20PF |
| C152 | CAP-0030-009 | CAPACITOR TANT 22uf 25V |
| C153 | CAP-0001-017 | CAPACITOR MICA 150pf |
| C154 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C155 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C156 | CAP-0037-007 | CAP.ELECT 100UF RAD |
| C157 | CAP-0030-009 | CAPACITOR TANT 22uf 25V |
| C158 | CAP-0037-006 | CAP.ELECT 10UF RAD |
| C159 | CAP-0027-472 | CAPACITOR FILM CK05 .0047 |
| C16 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C160 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C161 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C162 | CAP-0030-007 | CAPACITOR TANT 10uf |
| C163 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C164 | CAP-0031-008 | CAP TANT 1uf 16-25V |
| C165 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C166 | CAP-0027-104 | CAPACITOR FILM CK05 .1 |
| C167 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C168 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C169 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C17 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C170 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C171 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C172 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C173 | CAP-0037-005 | CAP.ELECT 22UF RAD |
| C174 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C175 | CAP-0037-005 | CAP.ELECT 22UF RAD |
| C177 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C178 | CAP-0001-039 | CAPACITOR,MICA 12pf |
| C179 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C18 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C180 | CAP-0001-017 | CAPACITOR MICA 150pf |
| C181 | CAP-0001-008 | CAPACITOR MICA 47pf |
| C183 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C184 | CAP-0006-003 | CAP,MULTILAYER CER DIP .001 |
| C185 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C186 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C187 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C188 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C189 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C19 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C190 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C191 | CAP-0001-042 | CAP,MICA 7.5pf or DISC 7pf |
| C192 | CAP-0013-001 | CAPACITOR MONO .1uf |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAINBOARD

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| C193 | CAP-0031-001 | CAP TANT 2.2uf 16-25V |
| C194 | CAP-0024-001 | CAP. MYLAR/FILM .033 25V |
| C195 | CAP-0001-034 | CAPACITOR MICA 20pf |
| C196 | CAP-0001-016 | CAPACITOR MICA 130pf |
| C197 | CAP-0001-016 | CAPACITOR MICA 130pf |
| C198 | CAP-0001-016 | CAPACITOR MICA 130pf |
| C199 | CAP-0001-016 | CAPACITOR MICA 130pf |
| C2 | CAP-0006-003 | CAP,MULTILAYER CER DIP .001 |
| C20 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C21 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C22 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C23 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C24 | CAP-0001-004 | CAPACITOR MICA 27pf |
| C25 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C26 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C27 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C28 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C3 | CAP-0006-003 | CAP,MULTILAYER CER DIP .001 |
| C30 | CAP-0001-040 | CAP,MICA 6.2pf or DISC 6 pf |
| C31 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C32 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C33 | CAP-0006-003 | CAP,MULTILAYER CER DIP .001 |
| C34 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C35 | CAP-0012-005 | CAP, MYLAR .01uf/50V |
| C36 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C37 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C38 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C39 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C4 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C40 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C41 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C42 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C43 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C44 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C45 | CAP-0001-014 | CAPACITOR MICA 82pf |
| C46 | CAP-0001-002 | CAPACITOR MICA 15pf |
| C47 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C48 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C49 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C5 | CAP-0001-001 | CAPACITOR MICA 10pf |
| C50 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C51 | CAP-0006-003 | CAP,MULTILAYER CER DIP .001 |
| C52 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C53 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C54 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C55 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C56 | CAP-0027-104 | CAPACITOR FILM CK05 .1 |
| C57 | CAP-0037-003 | CAP.ELECT 4.7UF RAD |
| C58 | CAP-0027-102 | CAPACITOR FILM CKO5 .001 |
| C59 | CAP-0027-224 | CAPACITOR FILM CK05 .22 |
| C6 | CAP-0013-006 | CAP.MONO .047UF |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAINBOARD

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| C60 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C61 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C62 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C63 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C64 | CAP-0013-005 | CAPACITOR MONO .001 uf |
| C65 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C66 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C67 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C68 | CAP-0037-005 | CAP.ELECT 22UF RAD |
| C69 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C7 | CAP-0001-015 | CAPACITOR MICA 100pf |
| C70 | CAP-0013-005 | CAPACITOR MONO .001 uf |
| C71 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C72 | CAP-0012-008 | CAP, MYLAR .0033uf/100V |
| C73 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C74 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C75 | CAP-0027-223 | CAPACITOR FILM CK05 .022 |
| C76 | CAP-0031-005 | CAPACITOR TANT 10uf 16V |
| C77 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C78 | CAP-0037-010 | CAP.ELECT 470UF RAD |
| C79 | CAP-0037-010 | CAP.ELECT 470UF RAD |
| C8 | CAP-0001-028 | CAPACITOR MICA 200pf |
| C80 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C81 | CAP-0031-007 | CAPACITOR TANT 22uf 16V |
| C82 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C83 | CAP-0013-005 | CAPACITOR MONO .001 uf |
| C84 | CAP-0030-005 | CAPACITOR TANT .47uf 35V |
| C85 | CAP-0012-008 | CAP, MYLAR .0033uf/100V |
| C86 | CAP-0012-009 | CAP, MYLAR .033uf/100V |
| C87 | CAP-0037-003 | CAP.ELECT 4.7UF RAD |
| C88 | CAP-0037-003 | CAP.ELECT 4.7UF RAD |
| C89 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C9 | CAP-0001-028 | CAPACITOR MICA 200pf |
| C90 | CAP-0012-005 | CAP, MYLAR .01uf/50V |
| C91 | CAP-0012-009 | CAP, MYLAR .033uf/100V |
| C92 | CAP-0027-682 | CAPACITOR FILM CK05 .0068 |
| C93 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C94 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C95 | CAP-0006-004 | CAP,MULTILAYER CER DIP .047 |
| C97 | CAP-0006-004 | CAP,MULTILAYER CER DIP .047 |
| C98 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C99 | CAP-0001-017 | CAPACITOR MICA 150pf |
| CR1 | SEM-0096-002 | KS1001 |
| CR10 | SEM-0096-007 | DIODE, P.I.N. |
| CR11 | SEM-0096-007 | DIODE, P.I.N. |
| CR12 | SEM-0096-007 | DIODE, P.I.N. |
| CR13 | SEM-0096-007 | DIODE, P.I.N. |
| CR14 | SEM-0096-007 | DIODE, P.I.N. |
| CR15 | SEM-0096-007 | DIODE, P.I.N. |
| CR16 | SEM-0076-001 | DIODE, 1N4148 |
| CR17 | SEM-0076-001 | DIODE, 1N4148 |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAINBOARD

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| CR19 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| CR2 | SEM-0076-001 | DIODE, 1N4148 |
| CR20 | SEM-0076-001 | DIODE, 1N4148 |
| CR21 | SEM-0076-001 | DIODE, 1N4148 |
| CR23 | SEM-0080-004 | MV209 |
| CR24 | SEM-0076-001 | DIODE, 1N4148 |
| CR25 | SEM-0076-001 | DIODE, 1N4148 |
| CR26 | SEM-0084-001 | LED, RED |
| CR27 | SEM-0083-004 | 1N4735A ZENER 1 W REG |
| CR28 | SEM-0076-001 | DIODE, 1N4148 |
| CR29 | SEM-0170-026 | IN4736A |
| CR3 | SEM-0076-001 | DIODE, 1N4148 |
| CR30 | SEM-0083-004 | 1N4735A ZENER 1 W REG |
| CR31 | SEM-0076-001 | DIODE, 1N4148 |
| CR32 | SEM-0170-024 | 1N4744 |
| CR33 | SEM-0076-001 | DIODE, 1N4148 |
| CR34 | SEM-0076-001 | DIODE, 1N4148 |
| CR35 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| CR36 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| CR37 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| CR38 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| CR39 | SEM-0076-001 | DIODE, 1N4148 |
| CR4 | SEM-0076-001 | DIODE, 1N4148 |
| CR5 | SEM-0091-001 | DIODES 1N3070 |
| CR6 | SEM-0091-001 | DIODES 1N3070 |
| CR7 | SEM-0076-001 | DIODE, 1N4148 |
| CR8 | SEM-0096-007 | DIODE, P.I.N. |
| CR9 | SEM-0096-007 | DIODE, P.I.N. |
| DIS1 | DIS-0002-001 | VF DIS, 8 DIGIT ALPHA |
| F1 | FIL-0005-003 | FILTER, 45 MHz PIEZO |
| F2 | FIL-0010-003 | 6.4MHZ WITH GND PINS |
| FS | CAP-0001-001 | CAPACITOR MICA 10pf |
| J1 | CON-0028-002 | HEADER MALE 9 TERM. |
| J2 | SOC-0002-016 | IC SOCKET, 16 PIN DIP |
| J3 | CON-0240-080 | POST HEADER 8 PIN |
| J4 | CON-0004-002 | JACK, PHONO PCB |
| J5 | CON-0004-002 | JACK, PHONO PCB |
| JU1 | JUM-0002-045 | JUMPER,.45" TEFLON |
| JU2 | JUM-0002-045 | JUMPER,.45" TEFLON |
| JU3 | JUM-0002-045 | JUMPER,.45" TEFLON |
| JU4 | JUM-0002-320 | JUMPER, 3.20" #24 TEFLON |
| JU5 | JUM-0002-100 | JUMPER, 1" #24 TEFLON |
| L1 | IND-0021-011 | INDUCTOR, 4.7uh |
| L11 | IND-0020-014 | INDUCTOR, 470uh CRAMER |
| L13 | IND-0021-020 | INDUCTOR, 27uh CRAMER |
| L14 | IND-0021-020 | INDUCTOR, 27uh CRAMER |
| L15 | ASY-0010-10 | VCXO COIL 10TWIR12 ON 11-1 |
| L16 | IND-0020-014 | INDUCTOR, 470uh CRAMER |
| L17 | IND-0023-471 | INDUCTOR,HIGH CURRENT 470UH |
| L18 | IND-0020-014 | INDUCTOR, 470uh CRAMER |
| L2 | IND-0020-014 | INDUCTOR, 470uh CRAMER |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAINBOARD

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| R122 | RES-0001-301 | RESISTOR 300 1/4W |
| R123 | RES-0001-180 | RESISTOR 18 1/4W |
| R124 | RES-0001-301 | RESISTOR 300 1/4W |
| R125 | RES-0001-101 | RESISTOR 100 1/4W |
| R126 | RES-0001-750 | RESISTOR, 75 1/4W |
| R127 | RES-0001-103 | RESISTOR 10K 1/4W |
| R128 | RES-0001-472 | RESISTOR 4.7K 1/4W |
| R129 | RES-0001-680 | RESISTOR 68 1/4W |
| R13 | RES-0001-681 | RESISTOR 680 1/4W |
| R130 | RES-0001-391 | RESISTOR 390 1/4W |
| R131 | RES-0001-103 | RESISTOR 10K 1/4W |
| R132 | RES-0001-472 | RESISTOR 4.7K 1/4W |
| R133 | RES-0001-104 | RESISTOR 100K 1/4W |
| R134 | RES-0001-561 | RESISTOR 560 1/4W |
| R135 | RES-0001-103 | RESISTOR 10K 1/4W |
| R136 | RES-0001-103 | RESISTOR 10K 1/4W |
| R137 | RES-0001-333 | RESISTOR 33K 1/4W |
| R138 | RES-0001-102 | RESISTOR 1K 1/4W |
| R14 | RES-0001-153 | RESISTOR 15K 1/4W |
| R140 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R141 | RES-0001-104 | RESISTOR 100K 1/4W |
| R142 | RES-0001-104 | RESISTOR 100K 1/4W |
| R143 | RES-0001-560 | RESISTOR 56 1/4W |
| R144 | RES-0001-152 | RESISTOR 1.5K 1/4W |
| R145 | RES-0001-152 | RESISTOR 1.5K 1/4W |
| R146 | RES-0001-330 | RESISTOR 33 1/4W |
| R147 | RES-0001-330 | RESISTOR 33 1/4W |
| R148 | RES-0001-103 | RESISTOR 10K 1/4W |
| R149 | RES-0001-103 | RESISTOR 10K 1/4W |
| R15 | JUM-0002-045 | JUMPER,.45" TEFLON |
| R150 | RES-0001-103 | RESISTOR 10K 1/4W |
| R151 | RES-0001-152 | RESISTOR 1.5K 1/4W |
| R152 | RES-0001-103 | RESISTOR 10K 1/4W |
| R153 | RES-0001-473 | RESISTOR 47K 1/4W |
| R154 | RES-0001-472 | RESISTOR 4.7K 1/4W |
| R155 | RES-0001-561 | RESISTOR 560 1/4W |
| R156 | RES-0001-331 | RESISTOR 330 1/4W |
| R159 | RES-0001-022 | RESISTOR 2.2 1/4 W |
| R16 | RES-0001-100 | RESISTOR 10 1/4W |
| R160 | RES-0001-243 | RESISTOR 24K 1/4W |
| R161 | RES-0001-122 | RESISTOR 1.2K 1/4W |
| R162 | RES-0001-470 | RESISTOR 47 1/4W |
| R163 | RES-0001-102 | RESISTOR 1K 1/4W |
| R164 | RES-0001-102 | RESISTOR 1K 1/4W |
| R165 | RES-0001-102 | RESISTOR 1K 1/4W |
| R166 | RES-0001-203 | RESISTOR 20K 1/4W |
| R167 | RES-0001-105 | RESISTOR 1M 1/4W |
| R168 | RES-0001-243 | RESISTOR 24K 1/4W |
| R169 | RES-0001-473 | RESISTOR 47K 1/4W |
| R17 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R170 | RES-0001-473 | RESISTOR 47K 1/4W |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAINBOARD

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| R171 | RES-0001-473 | RESISTOR 47K 1/4W |
| R172 | RES-0001-473 | RESISTOR 47K 1/4W |
| R173 | RES-0001-682 | RESISTOR 6.8K 1/4W |
| R174 | RES-0001-682 | RESISTOR 6.8K 1/4W |
| R175 | RES-0001-682 | RESISTOR 6.8K 1/4W |
| R176 | RES-0001-682 | RESISTOR 6.8K 1/4W |
| R177 | RES-0001-334 | RESISTOR 330K 1/4W |
| R178 | RES-0001-102 | RESISTOR 1K 1/4W |
| R179 | RES-0001-473 | RESISTOR 47K 1/4W |
| R18 | RES-0001-681 | RESISTOR 680 1/4W |
| R180 | RES-0001-682 | RESISTOR 6.8K 1/4W |
| R181 | RES-0001-103 | RESISTOR 10K 1/4W |
| R182 | RES-0001-103 | RESISTOR 10K 1/4W |
| R183 | RES-0001-221 | RESISTOR 220 1/4W |
| R184 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R185 | RES-0001-103 | RESISTOR 10K 1/4W |
| R186 | RES-0001-221 | RESISTOR 220 1/4W |
| R187 | RES-0001-331 | RESISTOR 330 1/4W |
| R188 | RES-0001-102 | RESISTOR 1K 1/4W |
| R189 | RES-0001-102 | RESISTOR 1K 1/4W |
| R19 | RES-0001-681 | RESISTOR 680 1/4W |
| R190 | RES-0001-470 | RESISTOR 47 1/4W |
| R191 | RES-0001-561 | RESISTOR 560 1/4W |
| R192 | RES-0001-471 | RESISTOR 470 1/4W |
| R193 | RES-0027-502 | TRIMMER,5K |
| R194 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R195 | RES-0001-301 | RESISTOR 300 1/4W |
| R196 | RES-0001-103 | RESISTOR 10K 1/4W |
| R197 | RES-0001-562 | RESISTOR 5.6K 1/4W |
| R198 | RES-0001-103 | RESISTOR 10K 1/4W |
| R199 | RES-0001-391 | RESISTOR 390 1/4W |
| R2 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R20 | RES-0001-103 | RESISTOR 10K 1/4W |
| R200 | RES-0001-104 | RESISTOR 100K 1/4W |
| R201 | RES-0001-104 | RESISTOR 100K 1/4W |
| R202 | RES-0001-102 | RESISTOR 1K 1/4W |
| R203 | RES-0001-102 | RESISTOR 1K 1/4W |
| R204 | RES-0001-682 | RESISTOR 6.8K 1/4W |
| R205 | RES-0001-221 | RESISTOR 220 1/4W |
| R206 | RES-0001-102 | RESISTOR 1K 1/4W |
| R207 | RES-0001-471 | RESISTOR 470 1/4W |
| R208 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R209 | RES-0001-102 | RESISTOR 1K 1/4W |
| R21 | RES-0001-681 | RESISTOR 680 1/4W |
| R210 | RES-0001-122 | RESISTOR 1.2K 1/4W |
| R211 | RES-0001-510 | 51OHM, 1/4W CARBON FILM |
| R212 | RES-0010-101 | RESISTOR, 100 OHM |
| R213 | RES-0010-104 | RESISTOR, 100K OHM |
| R214 | RES-0010-223 | RESISTOR, 22K OHM |
| R215 | RES-0010-333 | RESISTOR, 33K OHM |
| R216 | RES-0010-222 | RESISTOR, 2.2K OHM |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAINBOARD

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| R217 | RES-0010-102 | RESISTOR, 1K OHM |
| R22 | RES-0001-681 | RESISTOR 680 1/4W |
| R23 | RES-0001-180 | RESISTOR 18 1/4W |
| R24 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R25 | RES-0001-301 | RESISTOR 300 1/4W |
| R26 | RES-0001-301 | RESISTOR 300 1/4W |
| R27 | RES-0001-100 | RESISTOR 10 1/4W |
| R28 | RES-0001-153 | RESISTOR 15K 1/4W |
| R29 | RES-0027-103 | TRIMMER, 10K |
| R3 | RES-0001-681 | RESISTOR 680 1/4W |
| R30 | RES-0027-103 | TRIMMER, 10K |
| R31 | RES-0001-432 | RESISTOR 4.3K 1/4W |
| R32 | RES-0001-103 | RESISTOR 10K 1/4W |
| R33 | RES-0001-101 | RESISTOR 100 1/4W |
| R34 | RES-0001-272 | RESISTOR 2.7K 1/4W |
| R35 | RES-0001-104 | RESISTOR 100K 1/4W |
| R36 | RES-0001-103 | RESISTOR 10K 1/4W |
| R37 | RES-0001-563 | RESISTOR 56K 1/4W |
| R38 | RES-0001-471 | RESISTOR 470 1/4W |
| R39 | RES-0001-103 | RESISTOR 10K 1/4W |
| R4 | RES-0001-681 | RESISTOR 680 1/4W |
| R40 | RES-0001-104 | RESISTOR 100K 1/4W |
| R41 | RES-0001-124 | RESISTOR, 120K 1/4W |
| R42 | RES-0001-334 | RESISTOR 330K 1/4W |
| R43 | RES-0001-103 | RESISTOR 10K 1/4W |
| R44 | RES-0001-103 | RESISTOR 10K 1/4W |
| R45 | RES-0001-393 | RESISTOR 39K 1/4W |
| R46 | RES-0001-103 | RESISTOR 10K 1/4W |
| R47 | RES-0001-223 | RESISTOR 22K 1/4W |
| R48 | RES-0001-103 | RESISTOR 10K 1/4W |
| R49 | RES-0001-224 | RESISTOR 220K 1/4W |
| R5 | RES-0001-123 | RESISTOR 12K 1/4W |
| R50 | RES-0001-103 | RESISTOR 10K 1/4W |
| R51 | RES-0001-224 | RESISTOR 220K 1/4W |
| R52 | RES-0001-103 | RESISTOR 10K 1/4W |
| R53 | RES-0001-470 | RESISTOR 47 1/4W |
| R54 | RES-0001-103 | RESISTOR 10K 1/4W |
| R55 | RES-0001-103 | RESISTOR 10K 1/4W |
| R56 | RES-0001-103 | RESISTOR 10K 1/4W |
| R57 | RES-0001-103 | RESISTOR 10K 1/4W |
| R58 | RES-0001-103 | RESISTOR 10K 1/4W |
| R59 | RES-0001-102 | RESISTOR 1K 1/4W |
| R6 | RES-0001-100 | RESISTOR 10 1/4W |
| R60 | RES-0001-331 | RESISTOR 330 1/4W |
| R61 | RES-0001-681 | RESISTOR 680 1/4W |
| R62 | RES-0001-103 | RESISTOR 10K 1/4W |
| R63 | RES-0001-103 | RESISTOR 10K 1/4W |
| R64 | RES-0001-103 | RESISTOR 10K 1/4W |
| R65 | RES-0001-273 | RESISTOR 27K 1/4W |
| R66 | RES-0001-103 | RESISTOR 10K 1/4W |
| R67 | RES-0001-102 | RESISTOR 1K 1/4W |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAINBOARD

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| R68 | RES-0001-102 | RESISTOR 1K 1/4W |
| R69 | RES-0001-822 | RESISTOR 8.2K 1/4W |
| R7 | JUM-0002-045 | JUMPER,.45" TEFLON |
| R70 | RES-0001-100 | RESISTOR 10 1/4W |
| R71 | RES-0001-104 | RESISTOR 100K 1/4W |
| R72 | RES-0001-221 | RESISTOR 220 1/4W |
| R73 | RES-0001-068 | RESISTOR, 6.8 1/4W |
| R74 | RES-0001-012 | RESISTOR 1.2 1/4W |
| R75 | RES-0001-103 | RESISTOR 10K 1/4W |
| R76 | RES-0001-621 | RESISTOR 620 1/4W |
| R77 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R78 | RES-0001-392 | RESISTOR 3.9K 1/4W |
| R79 | RES-0001-473 | RESISTOR 47K 1/4W |
| R8 | RES-0001-472 | RESISTOR 4.7K 1/4W |
| R80 | RES-0027-103 | TRIMMER, 10K |
| R81 | RES-0001-223 | RESISTOR 22K 1/4W |
| R82 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R83 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R84 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R85 | RES-0001-473 | RESISTOR 47K 1/4W |
| R86 | RES-0001-683 | RESISTOR 68K 1/4W |
| R87 | RES-0001-682 | RESISTOR 6.8K 1/4W |
| R88 | RES-0001-333 | RESISTOR 33K 1/4W |
| R89 | RES-0001-272 | RESISTOR 2.7K 1/4W |
| R9 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R90 | RES-0001-272 | RESISTOR 2.7K 1/4W |
| R91 | RES-0001-472 | RESISTOR 4.7K 1/4W |
| R92 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R93 | RES-0001-102 | RESISTOR 1K 1/4W |
| R94 | RES-0001-243 | RESISTOR 24K 1/4W |
| R95 | RES-0001-472 | RESISTOR 4.7K 1/4W |
| R96 | RES-0001-681 | RESISTOR 680 1/4W |
| R97 | RES-0001-682 | RESISTOR 6.8K 1/4W |
| R98 | RES-0001-912 | RESISTOR 9.1K 1/4W |
| R99 | RES-0001-270 | RESISTOR 27 1/4W |
| RN1 | RES-0028-473 | RESISTOR NETWORK 47K 10 PIN |
| RN2 | RES-0028-473 | RESISTOR NETWORK 47K 10 PIN |
| RN3 | RES-0028-473 | RESISTOR NETWORK 47K 10 PIN |
| RT1 | THE-0002-001 | THERMISTOR, 100 OHM ,D73,NTC |
| T1 | ASY-0010-07 | 7 TURN TRANSFORMER |
| T10 | ASY-0010-07 | 7 TURN TRANSFORMER |
| T2 | TRA-0011-001 | TRANS VIOLET |
| T3 | ASY-0010-07 | 7 TURN TRANSFORMER |
| T4 | TRA-0005-001 | TRANSFORMER, BLK |
| T5 | ASY-0222-TT5 | INDUCTOR,T TRIFI ON #43 |
| T6 | ASY-0010-07 | 7 TURN TRANSFORMER |
| T7 | TRA-0011-001 | TRANS VIOLET |
| T8 | TRA-0011-001 | TRANS VIOLET |
| T9 | ASY-0209-T1M | TRANSFORMER |
| U1 | SEM-0101-001 | MC1350P |
| U11 | SEM-0170-004 | MC145156 (RED) |

REFERENCE DESIGNATORS FOR ASY-0222-01 MAINBOARD

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| U12 | SEM-0162-003 | MB504P DUAL MOD PRESCALER |
| U13 | SEM-0170-015 | LM78L05AWC |
| U14 | SEM-0155-005 | 74C90 4-BIT DECADE CNTR |
| U15 | SEM-0170-007 | DM7406 |
| U16 | SEM-0170-003 | MC145155 (RED) |
| U17 | SEM-0143-086 | QUAD GATE 74HC86 |
| U17SO | SOC-0002-014 | IC SOCKET, 14 PIN DIP |
| U18 | SEM-0143-390 | HI SPEED CMOS LOGIC |
| U2 | SEM-0101-001 | MC1350P |
| U20 | SEM-0161-001 | MC146805E2 8-BIT MPU |
| U21 | SEM-0143-373 | 74HC373 OCTAL D LATCH |
| U24 | SEM-0170-022 | 10937 (RED) |
| U25A | SEM-0170-013 | CD4041UBF (RED) |
| U25B | SEM-0170-013 | CD4041UBF (RED) |
| U25SO | SOC-0002-014 | IC SOCKET, 14 PIN DIP |
| U26 | SEM-0170-009 | TL497ACN |
| U27 | SEM-0143-010 | 74HC10 (RED) |
| U28 | SEM-0143-132 | 74HC132 (RED) |
| U29 | SEM-0109-004 | 7808 |
| U3 | SEM-0154-007 | LM387 DUAL LO NOISE PREAMP |
| U30 | SEM-0109-001 | UA7805CKC 5V REGULATOR |
| U32 | SEM-0102-001 | MC3340P |
| U4 | SEM-0140-066 | 4066 (RED) |
| U5 | SEM-0154-001 | LM324 QUAD OPAMP |
| U6 | SEM-0153-003 | TDA2002H |
| U7 | SEM-0154-003 | LM358 DUAL OP AMP |
| U8 | SEM-0154-001 | LM324 QUAD OPAMP |
| UK | JUM-0002-045 | JUMPER,.45" TEFLON |
| Y2 | CRY-0006-011 | CRYSTAL 38.618 MHz |

REFERENCE DESIGNATORS FOR ASY-0222-02 P.A./ FILTER

EFFECTIVE 01-31-92

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| C10 | CAP-0003-023 | CAPACITOR DM19 130pf |
| C100 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C101 | CAP-0037-009 | ELECT 1000uf RAD .3 L/S |
| C102 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C103 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C104 | CAP-0003-034 | CAPICITOR DM19 18pf |
| C105 | CAP-0003-028 | CAPACITOR DM19 300pf |
| C106 | CAP-0003-021 | CAPACITOR DM19 200pf |
| C107 | CAP-0003-021 | CAPACITOR DM19 200pf |
| C108 | CAP-0003-029 | CAPACITOR DM19 120pf |
| C109 | CAP-0003-032 | CAPACITOR DM19 180pf |
| C11 | CAP-0007-003 | CAPACITOR DM15 15pf |
| C110 | CAP-0003-028 | CAPACITOR DM19 300pf |
| C111 | CAP-0007-003 | CAPACITOR DM15 15pf |
| C112 | CAP-0003-030 | CAPICITOR DM19 68pf |
| C113 | CAP-0007-003 | CAPACITOR DM15 15pf |
| C114 | CAP-0007-002 | CAPACITOR DM15 47PF |
| C116 | CAP-0003-032 | CAPACITOR DM19 180pf |
| C117 | CAP-0003-033 | CAPICITOR DM19 82pf |
| C118 | CAP-0003-014 | CAPACITOR DM19 620pf |
| C119 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C12 | CAP-0003-029 | CAPACITOR DM19 120pf |
| C120 | CAP-0003-026 | CAPICITOR DM19 75pf |
| C121 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C122 | CAP-0003-033 | CAPICITOR DM19 82pf |
| C123 | CAP-0007-002 | CAPACITOR DM15 47PF |
| C13 | CAP-0003-029 | CAPACITOR DM19 120pf |
| C14 | CAP-0003-028 | CAPACITOR DM19 300pf |
| C15 | CAP-0003-013 | CAPACITOR DM19 150pf |
| C16 | CAP-0003-019 | CAPACITOR DM19 270pf |
| C17 | CAP-0007-003 | CAPACITOR DM15 15pf |
| C18 | CAP-0003-032 | CAPACITOR DM19 180pf |
| C19 | CAP-0007-002 | CAPACITOR DM15 47PF |
| C20 | CAP-0003-032 | CAPACITOR DM19 180pf |
| C21 | CAP-0003-016 | CAPACITOR DM19 510pf |
| C22 | CAP-0003-019 | CAPACITOR DM19 270pf |
| C23 | CAP-0003-004 | CAPACITOR DM19 470pf |
| C24 | CAP-0003-027 | CAPICITOR DM19 50pf |
| C25 | CAP-0007-002 | CAPACITOR DM15 47PF |
| C26 | CAP-0003-014 | CAPACITOR DM19 620pf |
| C27 | CAP-0003-028 | CAPACITOR DM19 300pf |
| C28 | CAP-0003-006 | CAPACITOR DM19 1000pf |
| C29 | CAP-0003-021 | CAPACITOR DM19 200pf |
| C3 | CAP-0037-002 | CAP.ELECT 2.2uf RAD |
| C30 | CAP-0003-007 | CAPACITOR DM19 1200pf |
| C31 | CAP-0003-030 | CAPICITOR DM19 68pf |
| C32 | CAP-0003-005 | CAPACITOR DM19 680pf |
| C33 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C34 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C35 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C36 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |

REFERENCE DESIGNATORS FOR ASY-0222-02 P.A./ FILTER

EFFECTIVE 01-31-92

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| C37 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C38 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C39 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C4 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C40 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C41 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C42 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C43 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C44 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C45 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C46 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C47 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C48 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C49 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C5 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C50 | CAP-0016-001 | CAP DISC .1UF, SEE CAP-6-1 |
| C51 | CAP-0016-001 | CAP DISC .1UF, SEE CAP-6-1 |
| C52 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C53 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C54 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C55 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C56 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C57 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C58 | CAP-0037-009 | ELECT 1000uf RAD .3 L/S |
| C59 | CAP-0003-014 | CAPACITOR DM19 620pf |
| C6 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C60 | CAP-0016-001 | CAP DISC .1UF, SEE CAP-6-1 |
| C61 | CAP-0016-001 | CAP DISC .1UF, SEE CAP-6-1 |
| C62 | CAP-0003-014 | CAPACITOR DM19 620pf |
| C63 | CAP-0016-001 | CAP DISC .1UF, SEE CAP-6-1 |
| C64 | CAP-0016-001 | CAP DISC .1UF, SEE CAP-6-1 |
| C65 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C66 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C67 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C68 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C69 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C7 | CAP-0007-003 | CAPACITOR DM15 15pf |
| C70 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C71 | CAP-0037-009 | ELECT 1000uf RAD .3 L/S |
| C72 | CAP-0003-014 | CAPACITOR DM19 620pf |
| C73 | CAP-0016-001 | CAP DISC .1UF, SEE CAP-6-1 |
| C74 | CAP-0016-001 | CAP DISC .1UF, SEE CAP-6-1 |
| C75 | CAP-0003-014 | CAPACITOR DM19 620pf |
| C76 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C77 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C78 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C79 | CAP-0037-012 | CAP.ELECT 330UF RAD |
| C8 | CAP-0007-003 | CAPACITOR DM15 15pf |
| C80 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C81 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C82 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |

REFERENCE DESIGNATORS FOR ASY-0222-02 P.A./ FILTER

EFFECTIVE 01-31-92

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| C83 | CAP-0037-012 | CAP.ELECT 330UF RAD |
| C84 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C85 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C86 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C87 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C88 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C89 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C9 | CAP-0003-026 | CAPICITOR DM19 75pf |
| C90 | CAP-0003-032 | CAPACITOR DM19 180pf |
| C91 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C92 | CAP-0003-013 | CAPACITOR DM19 150pf |
| C93 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C94 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C95 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C98 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C99 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| CR1 | SEM-0076-001 | DIODE, 1N4148 |
| CR10 | SEM-0089-001 | 1N5402 |
| CR11 | SEM-0078-002 | 1N4001 |
| CR12 | SEM-0076-001 | DIODE, 1N4148 |
| CR13 | SEM-0076-001 | DIODE, 1N4148 |
| CR14 | SEM-0076-001 | DIODE, 1N4148 |
| CR15 | SEM-0076-001 | DIODE, 1N4148 |
| CR16 | SEM-0076-001 | DIODE, 1N4148 |
| CR2 | SEM-0076-001 | DIODE, 1N4148 |
| CR3 | SEM-0078-002 | 1N4001 |
| CR4 | SEM-0078-002 | 1N4001 |
| CR5 | SEM-0089-001 | 1N5402 |
| CR6 | SEM-0089-001 | 1N5402 |
| CR7 | SEM-0087-001 | 1N4004, EPOXY CASE |
| CR8 | SEM-0087-001 | 1N4004, EPOXY CASE |
| CR9 | SEM-0087-002 | DIODE, SELECTED |
| F1 | FUS-0002-015 | FUSE, 15 AMP 3AG |
| F2 | FUS-0002-015 | FUSE, 15 AMP 3AG |
| F3 | FUS-0002-005 | FUSE, 5 AMP 3AG |
| J1 | SOC-0002-016 | IC SOCKET, 16 PIN DIP |
| J2 | CON-0004-002 | JACK, PHONO PCB |
| J3 | CON-0004-002 | JACK, PHONO PCB |
| J4 | TER-0019-002 | TERMINAL, DISCONNECT TAB |
| J5 | TER-0019-002 | TERMINAL, DISCONNECT TAB |
| J6 | CON-0004-002 | JACK, PHONO PCB |
| JU1 | JUM-0002-060 | JUMPER, .60 SPACING |
| JU2 | JUM-0002-060 | JUMPER, .60 SPACING |
| JU3 | JUM-0002-065 | JUMPER |
| K1 | REL-0009-004 | RELAY,PCB |
| K2 | REL-0007-001 | USE REL-0007-007 |
| K3 | REL-0007-001 | USE REL-0007-007 |
| K4 | REL-0007-001 | USE REL-0007-007 |
| K5 | REL-0007-001 | USE REL-0007-007 |
| K6 | REL-0007-001 | USE REL-0007-007 |
| K7 | REL-0007-001 | USE REL-0007-007 |

REFERENCE DESIGNATORS FOR ASY-0222-02 P.A./ FILTER

EFFECTIVE 01-31-92

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| K8 | REL-0007-001 | USE REL-0007-007 |
| L1 | ASY-0003-06M | IND,TOR 6T18-18on8-1 T80-2 |
| L12 | FER-0004-001 | TOROID, TYPE 73 BEAD |
| L2 | ASY-0003-04M | IND,TOR 4T18-18on8-1 T80-2 |
| L3 | ASY-0003-07M | IND,TOR 7T18-18on8-1 T80-2 |
| L4 | ASY-0003-08M | IND,TOR 8T18-18on8-1 T80-2 |
| L5 | ASY-0003-09M | IND,TOR 9T18-18on8-1 T80-2 |
| P1 | TER-0004-002 | BOARD STAKE,TAPE & REEL |
| P2 | TER-0004-002 | BOARD STAKE,TAPE & REEL |
| P3 | TER-0004-002 | BOARD STAKE,TAPE & REEL |
| P4 | TER-0004-002 | BOARD STAKE,TAPE & REEL |
| Q1 | SEM-0001-001 | 2N3565 |
| Q10 | SEM-0068-001 | TRANS, RF POWER (SRF 3733) |
| Q11 | SEM-0063-001 | 2N3866 |
| Q12 | SEM-0170-023 | POWER MOS FET |
| Q2 | SEM-0032-002 | TIP 32 SILICON POW TRANS |
| Q3 | SEM-0057-005 | TRANS, RF POWER (SRF 3748) |
| Q4 | SEM-0057-005 | TRANS, RF POWER (SRF 3748) |
| Q5 | SEM-0057-005 | TRANS, RF POWER (SRF 3748) |
| Q6 | SEM-0057-005 | TRANS, RF POWER (SRF 3748) |
| Q7 | SEM-0032-001 | TIP31 REP/SEM-32-2 |
| Q8 | SEM-0032-001 | TIP31 REP/SEM-32-2 |
| Q9 | SEM-0068-001 | TRANS, RF POWER (SRF 3733) |
| R1 | RES-0002-333 | RESISTOR, 1/2W 33K |
| R10 | RES-0001-100 | RESISTOR 10 1/4W |
| R11 | RES-0001-100 | RESISTOR 10 1/4W |
| R12 | RES-0001-100 | RESISTOR 10 1/4W |
| R13 | RES-0001-100 | RESISTOR 10 1/4W |
| R14 | RES-0001-100 | RESISTOR 10 1/4W |
| R15 | RES-0005-101 | RESISTOR, 100 2W |
| R16 | RES-0005-270 | RESISTOR, 27 2W |
| R17 | RES-0001-100 | RESISTOR 10 1/4W |
| R18 | RES-0002-220 | RESISTOR, 22 1/2W |
| R19 | RES-0005-270 | RESISTOR, 27 2W |
| R2 | RES-0002-333 | RESISTOR, 1/2W 33K |
| R20 | RES-0002-220 | RESISTOR, 22 1/2W |
| R21 | RES-0005-270 | RESISTOR, 27 2W |
| R22 | RES-0001-100 | RESISTOR 10 1/4W |
| R23 | RES-0002-220 | RESISTOR, 22 1/2W |
| R24 | RES-0005-270 | RESISTOR, 27 2W |
| R25 | RES-0002-220 | RESISTOR, 22 1/2W |
| R26 | RES-0027-101 | TRIMMER, 100 91AR100 |
| R27 | RES-0027-101 | TRIMMER, 100 91AR100 |
| R28 | RES-0002-101 | RESISTOR, 100 1/2W |
| R29 | RES-0001-331 | RESISTOR 330 1/4W |
| R3 | RES-0002-333 | RESISTOR, 1/2W 33K |
| R30 | RES-0005-221 | RESISTOR,220 2W |
| R31 | RES-0005-220 | RESISTOR, 22 2W |
| R32 | RES-0005-221 | RESISTOR,220 2W |
| R33 | RES-0002-750 | RESISTOR 75 1/2W |
| R34 | RES-0002-101 | RESISTOR, 100 1/2W |

REFERENCE DESIGNATORS FOR ASY-0222-02 P.A./ FILTER

EFFECTIVE 01-31-92

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| R35 | RES-0002-750 | RESISTOR 75 1/2W |
| R36 | RES-0002-101 | RESISTOR, 100 1/2W |
| R39 | RES-0001-180 | RESISTOR 18 1/4W |
| R4 | RES-0001-202 | RESISTOR 2K 1/4W |
| R40 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R41 | RES-0025-252 | TRIMMER, 2.5K |
| R42 | RES-0001-271 | RESISTOR 270 1/4W |
| R43 | RES-0001-047 | RESISTOR 4.7 1/4W |
| R44 | RES-0001-301 | RESISTOR 300 1/4W |
| R45 | RES-0001-301 | RESISTOR 300 1/4W |
| R46 | RES-0002-101 | RESISTOR, 100 1/2W |
| R47 | JUM-0002-085 | JUMPER |
| R48 | JUM-0002-085 | JUMPER |
| R49 | JUM-0002-085 | JUMPER |
| R5 | RES-0025-104 | TRIMMER, 100K |
| R50 | JUM-0002-045 | JUMPER, .45 SPACING |
| R51 | JUM-0002-085 | JUMPER |
| R52 | RES-0001-471 | RESISTOR 470 1/4W |
| R53 | RES-0001-471 | RESISTOR 470 1/4W |
| R6 | RES-0001-221 | RESISTOR 220 1/4W |
| R7 | RES-0001-151 | RESISTOR 150 1/4W |
| R8 | RES-0001-102 | RESISTOR 1K 1/4W |
| R9 | RES-0001-221 | RESISTOR 220 1/4W |
| T1 | TUB-0004-125 | BRASS TUB .235X.007X1.25LG |
| T11 | FER-0005-001 | TOROID, BEAD 0801 |
| T2 | TUB-0004-125 | BRASS TUB .235X.007X1.25LG |
| T4 | FER-0002-001 | TOROID, TYPE 43 |
| T5 | TUB-0004-125 | BRASS TUB .235X.007X1.25LG |
| T7 | FER-0002-001 | TOROID, TYPE 43 |
| U1 | SEM-0151-002 | 8 BIT LATCH DRIVER |
| U1SOC | SOC-0002-016 | IC SOCKET, 16 PIN DIP |

REFERENCE DESIGNATORS FOR ASY-0322-02 P.A./ FILTER

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| C1 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C10 | CAP-0003-023 | CAPACITOR DM19 130pf |
| C100 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C101 | CAP-0037-009 | ELECT 1000uf RAD .3 L/S |
| C102 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C103 | CAP-0031-005 | CAPACITOR TANT 10uf 16V |
| C104 | CAP-0003-035 | CAPICITOR DM19 22pf |
| C105 | CAP-0003-003 | CAPACITOR DM19 330pf |
| C106 | CAP-0003-019 | CAPACITOR DM19 270pf |
| C107 | CAP-0003-001 | CAPACITOR DM19 100pf |
| C108 | CAP-0003-004 | CAPACITOR DM19 470pf |
| C109 | CAP-0003-002 | CAPACITOR DM19 220pf |
| C11 | CAP-0007-003 | CAPACITOR DM15 15pf |
| C110 | CAP-0003-013 | CAPACITOR DM19 150pf |
| C111 | CAP-0007-003 | CAPACITOR DM15 15pf |
| C112 | CAP-0003-026 | CAPICITOR DM19 75pf |
| C113 | CAP-0003-034 | CAPICITOR DM19 18pf |
| C115 | CAP-0037-012 | CAP.ELECT 330UF RAD |
| C116 | CAP-0003-028 | CAPACITOR DM19 300pf |
| C117 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C118 | CAP-0031-005 | CAPACITOR TANT 10uf 16V |
| C119 | CAP-0002-022 | CAP 10PF TUB-CERAMIC 10% |
| C12 | CAP-0003-001 | CAPACITOR DM19 100pf |
| C120 | CAP-0003-002 | CAPACITOR DM19 220pf |
| C121 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C122 | CAP-0003-033 | CAPICITOR DM19 82pf |
| C123 | CAP-0003-001 | CAPACITOR DM19 100pf |
| C13 | CAP-0003-029 | CAPACITOR DM19 120pf |
| C14 | CAP-0003-021 | CAPACITOR DM19 200pf |
| C15 | CAP-0003-013 | CAPACITOR DM19 150pf |
| C16 | CAP-0003-028 | CAPACITOR DM19 300pf |
| C17 | CAP-0003-034 | CAPICITOR DM19 18pf |
| C18 | CAP-0003-032 | CAPACITOR DM19 180pf |
| C19 | CAP-0003-021 | CAPACITOR DM19 200pf |
| C2 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C20 | CAP-0003-019 | CAPACITOR DM19 270pf |
| C21 | CAP-0003-003 | CAPACITOR DM19 330pf |
| C22 | CAP-0003-003 | CAPACITOR DM19 330pf |
| C23 | CAP-0003-028 | CAPACITOR DM19 300pf |
| C24 | CAP-0003-030 | CAPICITOR DM19 68pf |
| C25 | CAP-0003-003 | CAPACITOR DM19 330pf |
| C26 | CAP-0003-025 | CAPACITOR DM19 560pf |
| C27 | CAP-0003-028 | CAPACITOR DM19 300pf |
| C28 | CAP-0003-020 | CAPACITOR DM19 820pf |
| C29 | CAP-0003-024 | CAPACITOR DM19 430pf |
| C3 | CAP-0002-014 | CAP 2.2PF TUB-CERAMIC 10% |
| C30 | CAP-0003-007 | CAPACITOR DM19 1200pf |
| C31 | CAP-0003-029 | CAPACITOR DM19 120pf |
| C32 | CAP-0003-020 | CAPACITOR DM19 820pf |
| C33 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C34 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |

REFERENCE DESIGNATORS FOR ASY-0322-02 P.A./ FILTER

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| C35 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C36 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C37 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C38 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C39 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C4 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C40 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C41 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C42 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C43 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C44 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C45 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C46 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C47 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C48 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C49 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C5 | CAP-0031-001 | CAP TANT 2.2uf 16-25V |
| C50 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C51 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C52 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C53 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C54 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C55 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C56 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C57 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C58 | CAP-0037-009 | ELECT 1000uf RAD .3 L/S |
| C59 | CAP-0003-014 | CAPACITOR DM19 620pf |
| C6 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C60 | CAP-0003-019 | CAPACITOR DM19 270pf |
| C61 | CAP-0003-019 | CAPACITOR DM19 270pf |
| C62 | CAP-0003-004 | CAPACITOR DM19 470pf |
| C63 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C64 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C65 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C66 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C67 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C68 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C69 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C7 | CAP-0003-033 | CAPICITOR DM19 82pf |
| C70 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C71 | CAP-0037-009 | ELECT 1000uf RAD .3 L/S |
| C72 | CAP-0003-014 | CAPACITOR DM19 620pf |
| C73 | CAP-0003-019 | CAPACITOR DM19 270pf |
| C74 | CAP-0003-019 | CAPACITOR DM19 270pf |
| C75 | CAP-0003-004 | CAPACITOR DM19 470pf |
| C76 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C77 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C78 | CAP-0007-003 | CAPACITOR DM15 15pf |
| C79 | CAP-0003-034 | CAPICITOR DM19 18pf |
| C8 | CAP-0007-003 | CAPACITOR DM15 15pf |
| C80 | CAP-0037-012 | CAP.ELECT 330UF RAD |

REFERENCE DESIGNATORS FOR ASY-0322-02 P.A./ FILTER

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| C1 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C10 | CAP-0003-023 | CAPACITOR DM19 130pf |
| C100 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C101 | CAP-0037-009 | ELECT 1000uf RAD .3 L/S |
| C102 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C103 | CAP-0031-005 | CAPACITOR TANT 10uf 16V |
| C104 | CAP-0003-035 | CAPICITOR DM19 22pf |
| C105 | CAP-0003-003 | CAPACITOR DM19 330pf |
| C106 | CAP-0003-019 | CAPACITOR DM19 270pf |
| C107 | CAP-0003-001 | CAPACITOR DM19 100pf |
| C108 | CAP-0003-004 | CAPACITOR DM19 470pf |
| C109 | CAP-0003-002 | CAPACITOR DM19 220pf |
| C11 | CAP-0007-003 | CAPACITOR DM15 15pf |
| C110 | CAP-0003-013 | CAPACITOR DM19 150pf |
| C111 | CAP-0007-003 | CAPACITOR DM15 15pf |
| C112 | CAP-0003-026 | CAPICITOR DM19 75pf |
| C113 | CAP-0003-034 | CAPICITOR DM19 18pf |
| C115 | CAP-0037-012 | CAP.ELECT 330UF RAD |
| C116 | CAP-0003-028 | CAPACITOR DM19 300pf |
| C117 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C118 | CAP-0031-005 | CAPACITOR TANT 10uf 16V |
| C119 | CAP-0002-022 | CAP 10PF TUB-CERAMIC 10% |
| C12 | CAP-0003-001 | CAPACITOR DM19 100pf |
| C120 | CAP-0003-002 | CAPACITOR DM19 220pf |
| C121 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C122 | CAP-0003-033 | CAPICITOR DM19 82pf |
| C123 | CAP-0003-001 | CAPACITOR DM19 100pf |
| C13 | CAP-0003-029 | CAPACITOR DM19 120pf |
| C14 | CAP-0003-021 | CAPACITOR DM19 200pf |
| C15 | CAP-0003-013 | CAPACITOR DM19 150pf |
| C16 | CAP-0003-028 | CAPACITOR DM19 300pf |
| C17 | CAP-0003-034 | CAPICITOR DM19 18pf |
| C18 | CAP-0003-032 | CAPACITOR DM19 180pf |
| C19 | CAP-0003-021 | CAPACITOR DM19 200pf |
| C2 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C20 | CAP-0003-019 | CAPACITOR DM19 270pf |
| C21 | CAP-0003-003 | CAPACITOR DM19 330pf |
| C22 | CAP-0003-003 | CAPACITOR DM19 330pf |
| C23 | CAP-0003-028 | CAPACITOR DM19 300pf |
| C24 | CAP-0003-030 | CAPICITOR DM19 68pf |
| C25 | CAP-0003-003 | CAPACITOR DM19 330pf |
| C26 | CAP-0003-025 | CAPACITOR DM19 560pf |
| C27 | CAP-0003-028 | CAPACITOR DM19 300pf |
| C28 | CAP-0003-020 | CAPACITOR DM19 820pf |
| C29 | CAP-0003-024 | CAPACITOR DM19 430pf |
| C3 | CAP-0002-014 | CAP 2.2PF TUB-CERAMIC 10% |
| C30 | CAP-0003-007 | CAPACITOR DM19 1200pf |
| C31 | CAP-0003-029 | CAPACITOR DM19 120pf |
| C32 | CAP-0003-020 | CAPACITOR DM19 820pf |
| C33 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C34 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |

REFERENCE DESIGNATORS FOR ASY-0322-02 P.A./ FILTER

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| C81 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C82 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C83 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C84 | CAP-0003-033 | CAPICITOR DM19 82pf |
| C85 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C86 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C87 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C88 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C89 | CAP-0003-019 | CAPACITOR DM19 270pf |
| C9 | CAP-0003-026 | CAPICITOR DM19 75pf |
| C90 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C91 | CAP-0031-005 | CAPACITOR TANT 10uf 16V |
| C92 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C93 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C94 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C95 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C96 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C97 | CAP-0037-012 | CAP.ELECT 330UF RAD |
| C98 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C99 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| CR1 | SEM-0076-001 | DIODE, 1N4148 |
| CR10 | SEM-0089-001 | 1N5402 |
| CR11 | SEM-0078-002 | 1N4001 |
| CR12 | SEM-0076-001 | DIODE, 1N4148 |
| CR13 | SEM-0076-001 | DIODE, 1N4148 |
| CR14 | SEM-0076-001 | DIODE, 1N4148 |
| CR15 | SEM-0076-001 | DIODE, 1N4148 |
| CR16 | SEM-0076-001 | DIODE, 1N4148 |
| CR2 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| CR3 | SEM-0078-002 | 1N4001 |
| CR4 | SEM-0078-002 | 1N4001 |
| CR5 | SEM-0089-001 | 1N5402 |
| CR6 | SEM-0089-001 | 1N5402 |
| CR7 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| CR8 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| F1 | FUS-0002-015 | FUSE, 15 AMP 3AG |
| F2 | FUS-0002-015 | FUSE, 15 AMP 3AG |
| F3 | FUS-0002-005 | FUSE, 5 AMP 3AG |
| FS2 | CAP-0001-019 | CAPACITOR MICA 180pf |
| J2 | CON-0004-002 | JACK, PHONO PCB |
| J3 | CON-0004-002 | JACK, PHONO PCB |
| J4 | TER-0019-002 | TERMINAL, DISCONNECT TAB |
| J5 | TER-0019-002 | TERMINAL, DISCONNECT TAB |
| J6 | CON-0004-002 | JACK, PHONO PCB |
| JISOC | SOC-0002-016 | IC SOCKET, 16 PIN DIP |
| JU1 | JUM-0002-085 | JUMPER, .85" TEFLON |
| JU10 | JUM-0002-045 | JUMPER,.45" TEFLON |
| JU2 | JUM-0002-085 | JUMPER, .85" TEFLON |
| JU3 | JUM-0002-085 | JUMPER, .85" TEFLON |
| JU4 | JUM-0002-065 | JUMPER,.65" TEFLON |
| JU5 | JUM-0002-065 | JUMPER,.65" TEFLON |

REFERENCE DESIGNATORS FOR ASY-0322-02 P.A./ FILTER

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| JU6 | JUM-0002-065 | JUMPER,.65" TEFLON |
| JU7 | JUM-0002-100 | JUMPER, 1" #24 TEFLON |
| JU8 | JUM-0002-100 | JUMPER, 1" #24 TEFLON |
| JU9 | JUM-0002-045 | JUMPER,.45" TEFLON |
| K1 | REL-0007-007 | D/P BASE REL W/ CLEAR COVERS |
| K2 | REL-0007-007 | D/P BASE REL W/ CLEAR COVERS |
| K3 | REL-0007-007 | D/P BASE REL W/ CLEAR COVERS |
| K4 | REL-0007-007 | D/P BASE REL W/ CLEAR COVERS |
| K5 | REL-0007-007 | D/P BASE REL W/ CLEAR COVERS |
| K6 | REL-0007-007 | D/P BASE REL W/ CLEAR COVERS |
| K7 | REL-0007-007 | D/P BASE REL W/ CLEAR COVERS |
| K8 | REL-0007-007 | D/P BASE REL W/ CLEAR COVERS |
| K9 | REL-0009-004 | RELAY, 12 VOLT |
| L1 | ASY-0003-06M | IND,TOR 6T18-18on8-1 T80-2 |
| L10 | ASY-0003-17 | IND,TOR 17T18-18on8-1 T80-2 |
| L11 | ASY-0003-21M | IND,TOR 21T18-18on8-1 T80-2 |
| L12 | ASY-0322-L12 | FERRITE TOROID, 73 BEAD |
| L13 | FER-0002-001 | TOROID, TYPE 43 |
| L14 | FER-0002-001 | TOROID, TYPE 43 |
| L2 | ASY-0003-04M | IND,TOR 4T18-18on8-1 T80-2 |
| L3 | ASY-0003-07M | IND,TOR 7T18-18on8-1 T80-2 |
| L4 | ASY-0003-08M | IND,TOR 8T18-18on8-1 T80-2 |
| L5 | ASY-0003-09M | IND,TOR 9T18-18on8-1 T80-2 |
| L6 | ASY-0003-11M | IND,TOR 11T18-18on8-1 T80-2 |
| L7 | ASY-0003-12M | IND,TOR 12T18-18on8-1 T80-2 |
| L8 | ASY-0003-13M | IND,TOR 13T18-18on8-1 T80-2 |
| L9 | ASY-0003-17 | IND,TOR 17T18-18on8-1 T80-2 |
| Q10 | SEM-0068-001 | TRANS, RF POWER (SRF 3733) |
| Q11 | SEM-0063-001 | 2N3866 |
| Q12 | SEM-0070-001 | MJE720 POWER TRANS |
| Q13 | SEM-0070-001 | MJE720 POWER TRANS |
| Q15 | SEM-0070-001 | MJE720 POWER TRANS |
| Q16 | SEM-0070-001 | MJE720 POWER TRANS |
| Q17 | SEM-0170-023 | POWER MOS FET |
| Q2 | SEM-0032-002 | TIP 32 SILICON POW TRANS |
| Q3 | SEM-0057-005 | TRANS, RF POWER (SRF 3748) |
| Q4 | SEM-0057-005 | TRANS, RF POWER (SRF 3748) |
| Q5 | SEM-0057-005 | TRANS, RF POWER (SRF 3748) |
| Q6 | SEM-0057-005 | TRANS, RF POWER (SRF 3748) |
| Q7 | SEM-0026-001 | TRANSISTOR TIP120W/HDW |
| Q8 | SEM-0026-001 | TRANSISTOR TIP120W/HDW |
| Q9 | SEM-0068-001 | TRANS, RF POWER (SRF 3733) |
| R1 | RES-0002-333 | RESISTOR, 1/2W 33K |
| R10 | RES-0001-100 | RESISTOR 10 1/4W |
| R11 | RES-0001-100 | RESISTOR 10 1/4W |
| R12 | RES-0001-100 | RESISTOR 10 1/4W |
| R13 | RES-0001-100 | RESISTOR 10 1/4W |
| R14 | RES-0001-100 | RESISTOR 10 1/4W |
| R15 | RES-0005-101 | RESISTOR, 100 2W |
| R16 | RES-0006-100 | RESISTOR, 10 1W |
| R17 | RES-0001-103 | RESISTOR 10K 1/4W |

REFERENCE DESIGNATORS FOR ASY-0322-02 P.A./ FILTER

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| R18 | RES-0002-220 | RESISTOR, 22 1/2W |
| R19 | RES-0006-100 | RESISTOR, 10 1W |
| R20 | RES-0002-220 | RESISTOR, 22 1/2W |
| R21 | RES-0006-100 | RESISTOR, 10 1W |
| R23 | RES-0002-220 | RESISTOR, 22 1/2W |
| R24 | RES-0006-100 | RESISTOR, 10 1W |
| R25 | RES-0002-220 | RESISTOR, 22 1/2W |
| R26 | RES-0001-104 | RESISTOR 100K 1/4W |
| R27 | RES-0001-104 | RESISTOR 100K 1/4W |
| R28 | RES-0002-101 | RESISTOR, 100 1/2W |
| R29 | RES-0001-104 | RESISTOR 100K 1/4W |
| R3 | RES-0001-103 | RESISTOR 10K 1/4W |
| R30 | RES-0005-221 | RESISTOR,220 2W |
| R31 | RES-0005-220 | RESISTOR, 22 2W |
| R32 | RES-0005-221 | RESISTOR,220 2W |
| R33 | RES-0001-621 | RESISTOR 620 1/4W |
| R34 | JUM-0002-045 | JUMPER,.45" TEFLON |
| R35 | RES-0001-105 | RESISTOR 1M 1/4W |
| R36 | RES-0001-104 | RESISTOR 100K 1/4W |
| R37 | RES-0001-104 | RESISTOR 100K 1/4W |
| R38 | RES-0027-103 | TRIMMER, 10K |
| R39 | RES-0001-180 | RESISTOR 18 1/4W |
| R4 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R40 | RES-0001-102 | RESISTOR 1K 1/4W |
| R41 | RES-0027-202 | RESISTOR, TRIMPOT 2K |
| R42 | RES-0001-271 | RESISTOR 270 1/4W |
| R43 | RES-0001-047 | RESISTOR 4.7 1/4W |
| R44 | RES-0001-301 | RESISTOR 300 1/4W |
| R45 | RES-0001-301 | RESISTOR 300 1/4W |
| R46 | RES-0001-103 | RESISTOR 10K 1/4W |
| R5 | RES-0001-512 | RESISTOR 5.1K 1/4W |
| R52 | RES-0002-470 | RESISTOR, 47 1/2W |
| R53 | RES-0001-100 | RESISTOR 10 1/4W |
| R54 | RES-0002-470 | RESISTOR, 47 1/2W |
| R55 | RES-0001-100 | RESISTOR 10 1/4W |
| R56 | RES-0001-100 | RESISTOR 10 1/4W |
| R57 | RES-0027-100 | 10 OHM TRIM POT |
| R58 | RES-0001-621 | RESISTOR 620 1/4W |
| R59 | RES-0001-100 | RESISTOR 10 1/4W |
| R6 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R60 | RES-0027-100 | 10 OHM TRIM POT |
| R61 | RES-0037-001 | RESISTOR 1W WIRE W. .1 OHm |
| R62 | RES-0001-621 | RESISTOR 620 1/4W |
| R63 | RES-0027-100 | 10 OHM TRIM POT |
| R64 | RES-0001-100 | RESISTOR 10 1/4W |
| R65 | RES-0037-001 | RESISTOR 1W WIRE W. .1 OHm |
| R66 | RES-0001-621 | RESISTOR 620 1/4W |
| R69 | RES-0001-103 | RESISTOR 10K 1/4W |
| R7 | RES-0001-302 | 3K,1/4WATT 5% CARBON FILM |
| R8 | RES-0001-102 | RESISTOR 1K 1/4W |
| R9 | RES-0001-221 | RESISTOR 220 1/4W |

REFERENCE DESIGNATORS FOR ASY-0322-02 P.A./ FILTER

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| T1 | TUB-0005-125 | .381OD X .012 WALL X 1.25LG |
| T10 | ASY-0223-L2M | INDUCTOR |
| T11 | FER-0005-001 | TOROID, BEAD 0801 |
| T12 | ASY-0010-07 | 7 TURN TRANSFORMER |
| T2 | TUB-0005-125 | .381OD X .012 WALL X 1.25LG |
| T3 | ASY-0222-T2 | INDUCTOR, TOROID |
| T4 | FER-0002-001 | TOROID, TYPE 43 |
| T5 | TUB-0005-125 | .381OD X .012 WALL X 1.25LG |
| T6 | ASY-0222-T2 | INDUCTOR, TOROID |
| T7 | FER-0002-001 | TOROID, TYPE 43 |
| T8 | ASY-0222-T3 | INDUCTOR, TOROID |
| T9 | ASY-0223-L2M | INDUCTOR |
| U1 | SEM-0151-002 | UCN4821A 8 BIT DRIVER (RED) |
| U1SOC | SOC-0002-016 | IC SOCKET, 16 PIN DIP |
| U2 | SEM-0154-001 | LM324 QUAD OPAMP |

## REFERENCE DESIGNATORS FOR ASY-0222-03 VCO

EFFECTIVE 07-14-93

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| C1 | CAP-0027-104 | CAPACITOR FILM CK05 .1 |
| C10 | CAP-0001-031 | CAPACITOR MICA 18pf |
| C11 | CAP-0002-016 | CAP 3.3PF TUB-CERAMIC 10% |
| C12 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C13 | CAP-0006-004 | CAP,MULTILAYER CER DIP .047 |
| C14 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C15 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C16 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C2 | CAP-0027-224 | CAPACITOR FILM CK05 .22 |
| C3 | CAP-0001-001 | CAPACITOR MICA 10pf |
| C4 | CAP-0001-004 | CAPACITOR MICA 27pf |
| C5 | CAP-0001-004 | CAPACITOR MICA 27pf |
| C6 | CAP-0002-016 | CAP 3.3PF TUB-CERAMIC 10% |
| C7 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C8 | CAP-0001-001 | CAPACITOR MICA 10pf |
| C9 | CAP-0001-003 | CAPACITOR MICA 22pf |
| CR1 | SEM-0080-004 | MV209 |
| CR2 | SEM-0080-004 | MV209 |
| CR3 | SEM-0080-004 | MV209 |
| CR4 | SEM-0080-004 | MV209 |
| CR5 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| L1 | IND-0001-470 | INDUCTOR, 47uh WEE |
| L2 | ASY-0004-09M | IND,TOR 9T18-226on11-1 T304 |
| L3 | IND-0001-470 | INDUCTOR, 47uh WEE |
| L4 | ASY-0004-07M | IND, TOR 7T18-226 ON 11-1T304 |
| Q1 | SEM-0003-002 | MPS5179 |
| Q2 | SEM-0003-002 | MPS5179 |
| Q3 | SEM-0003-002 | MPS5179 |
| Q4 | SEM-0015-001 | MPS-A63 |
| Q5 | SEM-0004-002 | 2N2907, MPS2907 |
| R1 | RES-0001-562 | RESISTOR 5.6K 1/4W |
| R10 | RES-0001-101 | RESISTOR 100 1/4W |
| R11 | RES-0001-103 | RESISTOR 10K 1/4W |
| R12 | RES-0001-103 | RESISTOR 10K 1/4W |
| R13 | RES-0001-103 | RESISTOR 10K 1/4W |
| R14 | RES-0001-103 | RESISTOR 10K 1/4W |
| R2 | RES-0001-103 | RESISTOR 10K 1/4W |
| R3 | RES-0001-472 | RESISTOR 4.7K 1/4W |
| R4 | RES-0001-911 | RESISTOR 910 1/4W |
| R5 | RES-0001-103 | RESISTOR 10K 1/4W |
| R6 | RES-0001-472 | RESISTOR 4.7K 1/4W |
| R7 | RES-0001-102 | RESISTOR 1K 1/4W |
| R8 | RES-0001-103 | RESISTOR 10K 1/4W |
| R9 | RES-0001-472 | RESISTOR 4.7K 1/4W |

## REFERENCE DESIGNATORS FOR ASY-0222-11 AUDIO COMPRESSOR

EFFECTIVE 07-14-93

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| C1 | CAP-0031-008 | CAP TANT 1uf 16-25V |
| C2 | CAP-0031-001 | CAP TANT 2.2uf 16-25V |
| C3 | CAP-0031-003 | CAPACITOR TANT 4.7uf 16V |
| C4 | CAP-0031-008 | CAP TANT 1uf 16-25V |
| C5 | CAP-0031-003 | CAPACITOR TANT 4.7uf 16V |
| C6 | CAP-0031-005 | CAPACITOR TANT 10uf 16V |
| C7 | CAP-0013-005 | CAPACITOR MONO .001 uf |
| R1 | RES-0001-100 | RESISTOR 10 1/4W |
| R2 | RES-0001-103 | RESISTOR 10K 1/4W |
| R3 | RES-0001-101 | RESISTOR 100 1/4W |
| R4 | RES-0001-105 | RESISTOR 1M 1/4W |
| R5 | RES-0001-103 | RESISTOR 10K 1/4W |
| R6 | RES-0001-511 | RESISTOR 510 1/4W |
| U1 | SEM-0102-002 | LC403 AGC AMP |

## REFERENCE DESIGNATORS FOR ASY-222F-02 EUROPEAN PA/FILTER

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| C1 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C10 | CAP-0003-023 | CAPACITOR DM19 130pf |
| C100 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C101 | CAP-0037-009 | ELECT 1000uf RAD .3 L/S |
| C102 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C103 | CAP-0031-005 | CAPACITOR TANT 10uf 16V |
| C104 | CAP-0003-035 | CAPICITOR DM19 22pf |
| C105 | CAP-0003-003 | CAPACITOR DM19 330pf |
| C106 | CAP-0003-019 | CAPACITOR DM19 270pf |
| C107 | CAP-0003-001 | CAPACITOR DM19 100pf |
| C108 | CAP-0003-004 | CAPACITOR DM19 470pf |
| C109 | CAP-0003-002 | CAPACITOR DM19 220pf |
| C11 | CAP-0007-003 | CAPACITOR DM15 15pf |
| C110 | CAP-0003-013 | CAPACITOR DM19 150pf |
| C111 | CAP-0007-003 | CAPACITOR DM15 15pf |
| C112 | CAP-0003-026 | CAPICITOR DM19 75pf |
| C113 | CAP-0003-034 | CAPICITOR DM19 18pf |
| C115 | CAP-0037-012 | CAP.ELECT 330UF RAD |
| C116 | CAP-0003-028 | CAPACITOR DM19 300pf |
| C117 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C118 | CAP-0031-005 | CAPACITOR TANT 10uf 16V |
| C12 | CAP-0003-001 | CAPACITOR DM19 100pf |
| C120 | CAP-0003-002 | CAPACITOR DM19 220pf |
| C121 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C122 | CAP-0003-033 | CAPICITOR DM19 82pf |
| C123 | CAP-0003-001 | CAPACITOR DM19 100pf |
| C13 | CAP-0003-029 | CAPACITOR DM19 120pf |
| C14 | CAP-0003-021 | CAPACITOR DM19 200pf |
| C15 | CAP-0003-013 | CAPACITOR DM19 150pf |
| C16 | CAP-0003-028 | CAPACITOR DM19 300pf |
| C17 | CAP-0003-034 | CAPICITOR DM19 18pf |
| C18 | CAP-0003-032 | CAPACITOR DM19 180pf |
| C19 | CAP-0003-021 | CAPACITOR DM19 200pf |
| C2 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C20 | CAP-0003-019 | CAPACITOR DM19 270pf |
| C21 | CAP-0003-003 | CAPACITOR DM19 330pf |
| C22 | CAP-0003-003 | CAPACITOR DM19 330pf |
| C23 | CAP-0003-028 | CAPACITOR DM19 300pf |
| C24 | CAP-0003-030 | CAPICITOR DM19 68pf |
| C25 | CAP-0003-003 | CAPACITOR DM19 330pf |
| C26 | CAP-0003-025 | CAPACITOR DM19 560pf |
| C27 | CAP-0003-028 | CAPACITOR DM19 300pf |
| C28 | CAP-0003-020 | CAPACITOR DM19 820pf |
| C29 | CAP-0003-024 | CAPACITOR DM19 430pf |
| C3 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C30 | CAP-0003-007 | CAPACITOR DM19 1200pf |
| C31 | CAP-0003-029 | CAPACITOR DM19 120pf |
| C32 | CAP-0003-020 | CAPACITOR DM19 820pf |
| C33 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C34 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C35 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |

REFERENCE DESIGNATORS FOR ASY-222F-02 EUROPEAN PA/FILTER

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| C36 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C37 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C38 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C39 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C4 | CAP-0013-003 | CAPACITOR MONO .01uf 100V |
| C40 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C41 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C42 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C43 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C44 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C45 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| C46 | CAP-0013-001 | CAPACITOR MONO .1uf |
| C47 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C48 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C49 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C5 | CAP-0031-001 | CAP TANT 2.2uf 16-25V |
| C50 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C51 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C52 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C53 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C54 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C55 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C56 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C57 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C58 | CAP-0037-009 | ELECT 1000uf RAD .3 L/S |
| C59 | CAP-0003-014 | CAPACITOR DM19 620pf |
| C6 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C60 | CAP-0003-019 | CAPACITOR DM19 270pf |
| C61 | CAP-0003-019 | CAPACITOR DM19 270pf |
| C62 | CAP-0003-004 | CAPACITOR DM19 470pf |
| C63 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C64 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C65 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C66 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C67 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C68 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C69 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C7 | CAP-0003-033 | CAPICITOR DM19 82pf |
| C70 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C71 | CAP-0037-009 | ELECT 1000uf RAD .3 L/S |
| C72 | CAP-0003-014 | CAPACITOR DM19 620pf |
| C73 | CAP-0003-019 | CAPACITOR DM19 270pf |
| C74 | CAP-0003-019 | CAPACITOR DM19 270pf |
| C75 | CAP-0003-004 | CAPACITOR DM19 470pf |
| C76 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C77 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C78 | CAP-0007-003 | CAPACITOR DM15 15pf |
| C79 | CAP-0003-034 | CAPICITOR DM19 18pf |
| C8 | CAP-0007-003 | CAPACITOR DM15 15pf |
| C80 | CAP-0037-012 | CAP.ELECT 330UF RAD |
| C81 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |

REFERENCE DESIGNATORS FOR ASY-222F-02 EUROPEAN PA/FILTER

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| C82 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C83 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C84 | CAP-0003-033 | CAPICITOR DM19 82pf |
| C85 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C86 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C87 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C88 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C89 | CAP-0003-019 | CAPACITOR DM19 270pf |
| C9 | CAP-0003-026 | CAPICITOR DM19 75pf |
| C90 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C91 | CAP-0031-005 | CAPACITOR TANT 10uf 16V |
| C92 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C93 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C94 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C95 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C96 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C97 | CAP-0037-012 | CAP.ELECT 330UF RAD |
| C98 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C99 | CAP-0006-002 | CAP,MULTILAYER CER DIP .01 |
| CR1 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| CR10 | SEM-0089-001 | 1N5402 |
| CR11 | SEM-0078-002 | 1N4001 |
| CR12 | SEM-0076-001 | DIODE, 1N4148 |
| CR13 | SEM-0076-001 | DIODE, 1N4148 |
| CR14 | SEM-0076-001 | DIODE, 1N4148 |
| CR15 | SEM-0076-001 | DIODE, 1N4148 |
| CR16 | SEM-0076-001 | DIODE, 1N4148 |
| CR2 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| CR3 | SEM-0078-002 | 1N4001 |
| CR4 | SEM-0078-002 | 1N4001 |
| CR5 | SEM-0089-001 | 1N5402 |
| CR6 | SEM-0089-001 | 1N5402 |
| CR7 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| CR9 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| F1 | FUS-0002-015 | FUSE, 15 AMP 3AG |
| F2 | FUS-0002-015 | FUSE, 15 AMP 3AG |
| F3 | FUS-0002-005 | FUSE, 5 AMP 3AG |
| J2 | CON-0004-002 | JACK, PHONO PCB |
| J3 | CON-0004-002 | JACK, PHONO PCB |
| J4 | TER-0019-002 | TERMINAL, DISCONNECT TAB |
| J5 | TER-0019-002 | TERMINAL, DISCONNECT TAB |
| J6 | CON-0004-002 | JACK, PHONO PCB |
| JISOC | SOC-0002-016 | IC SOCKET, 16 PIN DIP |
| JU1 | JUM-0002-085 | JUMPER, .85" TEFLON |
| JU10 | JUM-0002-100 | JUMPER, 1" #24 TEFLON |
| JU11 | JUM-0002-255 | JUMPER, 2.55" #24 TEFLON |
| JU2 | JUM-0002-085 | JUMPER, .85" TEFLON |
| JU3 | JUM-0002-085 | JUMPER, .85" TEFLON |
| JU4 | JUM-0002-065 | JUMPER,.65" TEFLON |
| JU5 | JUM-0002-065 | JUMPER,.65" TEFLON |
| JU6 | JUM-0002-065 | JUMPER,.65" TEFLON |

REFERENCE DESIGNATORS FOR ASY-222F-02 EUROPEAN PA/FILTER

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| JU7 | JUM-0002-100 | JUMPER, 1" #24 TEFLON |
| JU8 | JUM-0002-100 | JUMPER, 1" #24 TEFLON |
| JU9 | JUM-0002-045 | JUMPER, .45" TEFLON |
| K1 | REL-0007-007 | D/P BASE REL W/ CLEAR COVERS |
| K2 | REL-0007-007 | D/P BASE REL W/ CLEAR COVERS |
| K3 | REL-0007-007 | D/P BASE REL W/ CLEAR COVERS |
| K4 | REL-0007-007 | D/P BASE REL W/ CLEAR COVERS |
| K5 | REL-0007-007 | D/P BASE REL W/ CLEAR COVERS |
| K6 | REL-0007-007 | D/P BASE REL W/ CLEAR COVERS |
| K7 | REL-0007-007 | D/P BASE REL W/ CLEAR COVERS |
| K8 | REL-0007-007 | D/P BASE REL W/ CLEAR COVERS |
| K9 | REL-0009-004 | RELAY, 12 VOLT |
| L1 | ASY-0003-06M | IND,TOR 6T18-18on8-1 T80-2 |
| L10 | ASY-0003-17 | IND,TOR 17T18-18on8-1 T80-2 |
| L11 | ASY-0003-21M | IND,TOR 21T18-18on8-1 T80-2 |
| L12 | ASY-0322-L12 | FERRITE TOROID, 73 BEAD |
| L13 | FER-0002-001 | TOROID, TYPE 43 |
| L14 | FER-0002-001 | TOROID, TYPE 43 |
| L2 | ASY-0003-04M | IND,TOR 4T18-18on8-1 T80-2 |
| L3 | ASY-0003-07M | IND,TOR 7T18-18on8-1 T80-2 |
| L4 | ASY-0003-08M | IND,TOR 8T18-18on8-1 T80-2 |
| L5 | ASY-0003-09M | IND,TOR 9T18-18on8-1 T80-2 |
| L6 | ASY-0003-11M | IND,TOR 11T18-18on8-1 T80-2 |
| L7 | ASY-0003-12M | IND,TOR 12T18-18on8-1 T80-2 |
| L8 | ASY-0003-13M | IND,TOR 13T18-18on8-1 T80-2 |
| L9 | ASY-0003-17 | IND,TOR 17T18-18on8-1 T80-2 |
| Q1 | SEM-0010-001 | MPS-A14 |
| Q10 | SEM-0068-001 | TRANS, RF POWER (SRF 3733) |
| Q11 | SEM-0063-001 | 2N3866 |
| Q12 | SEM-0070-001 | MJE720 POWER TRANS |
| Q13 | SEM-0070-001 | MJE720 POWER TRANS |
| Q15 | SEM-0070-001 | MJE720 POWER TRANS |
| Q16 | SEM-0070-001 | MJE720 POWER TRANS |
| Q17 | SEM-0170-023 | POWER MOS FET |
| Q2 | SEM-0032-002 | TIP 32 SILICON POW TRANS |
| Q3 | SEM-0057-005 | TRANS, RF POWER (SRF 3748) |
| Q4 | SEM-0057-005 | TRANS, RF POWER (SRF 3748) |
| Q5 | SEM-0057-005 | TRANS, RF POWER (SRF 3748) |
| Q6 | SEM-0057-005 | TRANS, RF POWER (SRF 3748) |
| Q7 | SEM-0026-001 | TRANSISTOR TIP120W/HDW |
| Q8 | SEM-0026-001 | TRANSISTOR TIP120W/HDW |
| Q9 | SEM-0068-001 | TRANS, RF POWER (SRF 3733) |
| R1 | RES-0001-102 | RESISTOR 1K 1/4W |
| R10 | RES-0001-100 | RESISTOR 10 1/4W |
| R11 | RES-0001-100 | RESISTOR 10 1/4W |
| R12 | RES-0001-100 | RESISTOR 10 1/4W |
| R13 | RES-0001-100 | RESISTOR 10 1/4W |
| R14 | RES-0001-100 | RESISTOR 10 1/4W |
| R15 | RES-0005-101 | RESISTOR, 100 2W |
| R16 | RES-0006-100 | RESISTOR, 10 1W |
| R18 | RES-0002-220 | RESISTOR, 22 1/2W |

REFERENCE DESIGNATORS FOR ASY-222F-02  EUROPEAN PA/FILTER

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| R19 | RES-0006-100 | RESISTOR, 10 1W |
| R20 | RES-0002-220 | RESISTOR, 22 1/2W |
| R21 | RES-0006-100 | RESISTOR, 10 1W |
| R23 | RES-0002-220 | RESISTOR, 22 1/2W |
| R24 | RES-0006-100 | RESISTOR, 10 1W |
| R25 | RES-0002-220 | RESISTOR, 22 1/2W |
| R26 | RES-0001-473 | RESISTOR 47K 1/4W |
| R27 | RES-0001-104 | RESISTOR 100K 1/4W |
| R28 | RES-0002-101 | RESISTOR, 100 1/2W |
| R29 | RES-0001-104 | RESISTOR 100K 1/4W |
| R3 | RES-0001-103 | RESISTOR 10K 1/4W |
| R30 | RES-0005-221 | RESISTOR,220 2W |
| R31 | RES-0005-220 | RESISTOR, 22 2W |
| R32 | RES-0005-221 | RESISTOR,220 2W |
| R33 | RES-0001-621 | RESISTOR 620 1/4W |
| R34 | JUM-0002-045 | JUMPER,.45" TEFLON |
| R35 | RES-0001-105 | RESISTOR 1M 1/4W |
| R36 | RES-0001-104 | RESISTOR 100K 1/4W |
| R37 | RES-0001-104 | RESISTOR 100K 1/4W |
| R38 | RES-0027-103 | TRIMMER, 10K |
| R39 | RES-0001-180 | RESISTOR 18 1/4W |
| R4 | RES-0001-105 | RESISTOR 1M 1/4W |
| R40 | RES-0001-102 | RESISTOR 1K 1/4W |
| R41 | RES-0027-202 | RESISTOR, TRIMPOT 2K |
| R42 | RES-0001-271 | RESISTOR 270 1/4W |
| R43 | RES-0001-047 | RESISTOR 4.7 1/4W |
| R44 | RES-0001-301 | RESISTOR 300 1/4W |
| R45 | RES-0001-301 | RESISTOR 300 1/4W |
| R46 | RES-0001-103 | RESISTOR 10K 1/4W |
| R47 | RES-0001-510 | 51OHM, 1/4W CARBON FILM |
| R48 | RES-0001-510 | 51OHM, 1/4W CARBON FILM |
| R5 | RES-0001-104 | RESISTOR 100K 1/4W |
| R52 | RES-0002-470 | RESISTOR, 47 1/2W |
| R53 | RES-0001-100 | RESISTOR 10 1/4W |
| R54 | RES-0002-470 | RESISTOR, 47 1/2W |
| R55 | RES-0001-100 | RESISTOR 10 1/4W |
| R56 | RES-0001-100 | RESISTOR 10 1/4W |
| R57 | RES-0027-100 | 10 OHM TRIM POT |
| R58 | RES-0001-621 | RESISTOR 620 1/4W |
| R59 | RES-0001-100 | RESISTOR 10 1/4W |
| R6 | RES-0001-103 | RESISTOR 10K 1/4W |
| R60 | RES-0027-100 | 10 OHM TRIM POT |
| R61 | RES-0037-001 | RESISTOR 1W WIRE W. .1 OHm |
| R62 | RES-0001-621 | RESISTOR 620 1/4W |
| R63 | RES-0027-100 | 10 OHM TRIM POT |
| R64 | RES-0001-100 | RESISTOR 10 1/4W |
| R65 | RES-0037-001 | RESISTOR 1W WIRE W. .1 OHm |
| R66 | RES-0001-621 | RESISTOR 620 1/4W |
| R67 | RES-0027-103 | TRIMMER, 10K |
| R68 | RES-0001-103 | RESISTOR 10K 1/4W |
| R69 | RES-0001-102 | RESISTOR 1K 1/4W |

REFERENCE DESIGNATORS FOR ASY-222F-02 EUROPEAN PA/FILTER

EFFECTIVE 03-21-94

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| R7 | RES-0001-333 | RESISTOR 33K 1/4W |
| R8 | RES-0001-102 | RESISTOR 1K 1/4W |
| R9 | RES-0001-221 | RESISTOR 220 1/4W |
| T1 | TUB-0005-125 | .381OD X .012 WALL X 1.25LG |
| T10 | ASY-0223-L2M | INDUCTOR |
| T11 | FER-0005-001 | TOROID, BEAD 0801 |
| T12 | ASY-0010-07 | 7 TURN TRANSFORMER |
| T13 | ASY-1630-T1 | XFORMER,1630/330 POWER DET. |
| T14 | ASY-1630-T1 | XFORMER,1630/330 POWER DET. |
| T2 | TUB-0005-125 | .381OD X .012 WALL X 1.25LG |
| T3 | ASY-0222-T2 | INDUCTOR, TOROID |
| T4 | FER-0002-001 | TOROID, TYPE 43 |
| T5 | TUB-0005-125 | .381OD X .012 WALL X 1.25LG |
| T6 | ASY-0222-T2 | INDUCTOR, TOROID |
| T7 | FER-0002-001 | TOROID, TYPE 43 |
| T8 | ASY-0222-T3 | INDUCTOR, TOROID |
| T9 | ASY-0223-L2M | INDUCTOR |
| U1 | SEM-0151-002 | UCN4821A 8 BIT DRIVER (RED) |
| U1SOC | SOC-0002-016 | IC SOCKET, 16 PIN DIP |
| U2 | SEM-0154-001 | LM324 QUAD OPAMP |

REFERENCE DESIGNATORS FOR ASY-0222-06   C/W HOLD MODULE

EFFECTIVE 07-14-93

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| C1 | CAP-0037-006 | CAP.ELECT 10UF RAD |
| C10 | CAP-0037-004 | CAP.ELECT 47UF RAD |
| C11 | CAP-0031-001 | CAP TANT 2.2uf 16-25V |
| C12 | CAP-0013-002 | CAPACITOR MONO .22UF 50V |
| C2 | CAP-0027-102 | CAPACITOR FILM CKO5 .001 |
| C3 | CAP-0027-103 | CAPACITOR FILM CK05 .01 |
| C4 | CAP-0027-103 | CAPACITOR FILM CK05 .01 |
| C5 | CAP-0027-103 | CAPACITOR FILM CK05 .01 |
| C6 | CAP-0027-104 | CAPACITOR FILM CK05 .1 |
| C7 | CAP-0006-003 | CAP,MULTILAYER CER DIP .001 |
| C8 | CAP-0037-004 | CAP.ELECT 47UF RAD |
| C9 | CAP-0037-004 | CAP.ELECT 47UF RAD |
| CR1 | SEM-0083-001 | 1N4740A |
| CR2 | SEM-0076-001 | DIODE, 1N4148 |
| CR3 | SEM-0076-001 | DIODE, 1N4148 |
| Q1 | SEM-0004-002 | 2N2907, MPS2907 |
| Q2 | SEM-0001-001 | 2N3565 |
| Q3 | SEM-0170-023 | POWER MOS FET |
| R1 | RES-0001-101 | RESISTOR 100 1/4W |
| R10 | RES-0001-103 | RESISTOR 10K 1/4W |
| R11 | RES-0027-103 | TRIMMER, 10K |
| R12 | RES-0001-104 | RESISTOR 100K 1/4W |
| R13 | RES-0027-103 | TRIMMER, 10K |
| R14 | RES-0001-103 | RESISTOR 10K 1/4W |
| R15 | RES-0001-047 | RESISTOR 4.7 1/4W |
| R16 | RES-0001-103 | RESISTOR 10K 1/4W |
| R17 | RES-0027-105 | TRIMMER, 1 MEG POT |
| R2 | RES-0001-471 | RESISTOR 470 1/4W |
| R3 | RES-0001-474 | RESISTOR 470K 1/4W |
| R4 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R5 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R6 | RES-0001-473 | RESISTOR 47K 1/4W |
| R7 | RES-0001-473 | RESISTOR 47K 1/4W |
| R8 | RES-0001-472 | RESISTOR 4.7K 1/4W |
| R9 | RES-0001-472 | RESISTOR 4.7K 1/4W |
| U1 | SEM-0153-005 | ULN-2283B LOW PWR AUD AMP |

REFERENCE DESIGNATORS FOR ASY-0222-07 AUTO ALARM MOD FOR SEA 222

EFFECTIVE 07-14-93

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| C1 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C10 | CAP-0031-008 | CAP TANT 1uf 16-25V |
| C11 | CAP-0027-103 | CAPACITOR FILM CK05 .01 |
| C12 | CAP-0027-103 | CAPACITOR FILM CK05 .01 |
| C13 | CAP-0027-103 | CAPACITOR FILM CK05 .01 |
| C14 | CAP-0027-103 | CAPACITOR FILM CK05 .01 |
| C15 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C16 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C17 | CAP-0031-001 | CAP TANT 2.2uf 16-25V |
| C18 | CAP-0030-005 | CAPACITOR TANT .47uf 35V |
| C19 | CAP-0006-003 | CAP,MULTILAYER CER DIP .001 |
| C2 | CAP-0037-004 | CAP.ELECT 47UF RAD |
| C20 | CAP-0037-004 | CAP.ELECT 47UF RAD |
| C21 | CAP-0037-004 | CAP.ELECT 47UF RAD |
| C22 | CAP-0013-002 | CAPACITOR MONO .22UF 50V |
| C3 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C4 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C5 | CAP-0001-003 | CAPACITOR MICA 22pf |
| C6 | CAP-0027-103 | CAPACITOR FILM CK05 .01 |
| C7 | CAP-0027-104 | CAPACITOR FILM CK05 .1 |
| C8 | CAP-0027-472 | CAPACITOR FILM CK05 .0047 |
| C9 | CAP-0027-104 | CAPACITOR FILM CK05 .1 |
| CR1 | SEM-0076-001 | DIODE, 1N4148 |
| CR2 | SEM-0076-001 | DIODE, 1N4148 |
| CR3 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| CR4 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| CR5 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| JU1 | JUM-0002-045 | JUMPER,.45" TEFLON |
| P1 | CON-0240-040 | POST HEADER 4 PIN |
| Q1 | SEM-0004-002 | 2N2907, MPS2907 |
| Q2 | SEM-0021-002 | PN2222A |
| Q3 | SEM-0021-002 | PN2222A |
| R1 | RES-0001-331 | RESISTOR 330 1/4W |
| R10 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R11 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R12 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R13 | RES-0001-104 | RESISTOR 100K 1/4W |
| R14 | RES-0001-473 | RESISTOR 47K 1/4W |
| R15 | RES-0001-273 | RESISTOR 27K 1/4W |
| R16 | RES-0001-123 | RESISTOR 12K 1/4W |
| R17 | RES-0001-682 | RESISTOR 6.8K 1/4W |
| R18 | RES-0001-153 | RESISTOR 15K 1/4W |
| R19 | RES-0001-103 | RESISTOR 10K 1/4W |
| R2 | RES-0001-102 | RESISTOR 1K 1/4W |
| R20 | RES-0001-102 | RESISTOR 1K 1/4W |
| R21 | RES-0001-472 | RESISTOR 4.7K 1/4W |
| R22 | RES-0001-104 | RESISTOR 100K 1/4W |
| R23 | RES-0001-473 | RESISTOR 47K 1/4W |
| R24 | RES-0001-273 | RESISTOR 27K 1/4W |
| R25 | RES-0001-123 | RESISTOR 12K 1/4W |
| R26 | RES-0001-153 | RESISTOR 15K 1/4W |

REFERENCE DESIGNATORS FOR ASY-0222-07 AUTO ALARM MOD FOR SEA 222

EFFECTIVE 07-14-93

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| R27 | RES-0001-393 | RESISTOR 39K 1/4W |
| R28 | RES-0001-243 | RESISTOR 24K 1/4W |
| R29 | RES-0027-502 | TRIMMER,5K |
| R3 | RES-0001-152 | RESISTOR 1.5K 1/4W |
| R30 | RES-0001-124 | RESISTOR, 120K 1/4W |
| R31 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R32 | RES-0027-102 | TRIMMER, 1K |
| R33 | RES-0001-753 | RESISTOR, 75K 1/4W |
| R34 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R35 | RES-0027-102 | TRIMMER, 1K |
| R36 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R37 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R38 | RES-0027-103 | TRIMMER, 10K |
| R39 | RES-0027-103 | TRIMMER, 10K |
| R4 | RES-0001-103 | RESISTOR 10K 1/4W |
| R40 | RES-0001-202 | RESISTOR 2K 1/4W |
| R41 | RES-0001-047 | RESISTOR 4.7 1/4W |
| R5 | RES-0001-103 | RESISTOR 10K 1/4W |
| R6 | RES-0001-103 | RESISTOR 10K 1/4W |
| R7 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R8 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R9 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| U1 | OPS-SEA100-U1 | ALARM SOFTWARE |
| U2 | SEM-0154-003 | LM358 DUAL OP AMP |
| U3 | SEM-0153-005 | ULN-2283B LOW PWR AUD AMP |
| U4 | SEM-0109-001 | UA7805CKC 5V REGULATOR |
| Y1 | CRY-0011-002 | COLORBURST 3.579545 HC/18U |

REFERENCE DESIGNATORS FOR ASY-0222-07A SEA100 AUTO ALARM BOARD

EFFECTIVE 07-14-93

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| 13.6 | TER-0004-004 | TERMINAL PIN |
| C1 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C10 | CAP-0031-008 | CAP TANT 1uf 16-25V |
| C11 | CAP-0027-103 | CAPACITOR FILM CK05 .01 |
| C12 | CAP-0027-103 | CAPACITOR FILM CK05 .01 |
| C13 | CAP-0027-103 | CAPACITOR FILM CK05 .01 |
| C14 | CAP-0027-103 | CAPACITOR FILM CK05 .01 |
| C15 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C16 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C17 | CAP-0031-001 | CAP TANT 2.2uf 16-25V |
| C18 | CAP-0030-005 | CAPACITOR TANT .47uf 35V |
| C19 | CAP-0006-003 | CAP,MULTILAYER CER DIP .001 |
| C2 | CAP-0037-004 | CAP.ELECT 47UF RAD |
| C20 | CAP-0037-004 | CAP.ELECT 47UF RAD |
| C21 | CAP-0037-004 | CAP.ELECT 47UF RAD |
| C22 | CAP-0013-002 | CAPACITOR MONO .22UF 50V |
| C3 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C4 | CAP-0006-001 | CAP,MULTILAYER CER DIP .1 |
| C5 | CAP-0001-003 | CAPACITOR MICA 22pf |
| C6 | CAP-0027-103 | CAPACITOR FILM CK05 .01 |
| C7 | CAP-0027-104 | CAPACITOR FILM CK05 .1 |
| C8 | CAP-0027-472 | CAPACITOR FILM CK05 .0047 |
| C9 | CAP-0027-104 | CAPACITOR FILM CK05 .1 |
| CR1 | SEM-0076-001 | DIODE, 1N4148 |
| CR2 | SEM-0076-001 | DIODE, 1N4148 |
| CR3 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| CR4 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| CR5 | SEM-0170-027 | SMALL SIGNAL SCHOTTKY DIODE |
| GND | TER-0004-004 | TERMINAL PIN |
| JU1 | JUM-0002-045 | JUMPER,.45" TEFLON |
| MIC | TER-0004-004 | TERMINAL PIN |
| PTT | TER-0004-004 | TERMINAL PIN |
| Q1 | SEM-0004-002 | 2N2907, MPS2907 |
| Q2 | SEM-0021-002 | PN2222A |
| Q3 | SEM-0021-002 | PN2222A |
| R1 | RES-0001-331 | RESISTOR 330 1/4W |
| R10 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R11 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R12 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R13 | RES-0001-104 | RESISTOR 100K 1/4W |
| R14 | RES-0001-473 | RESISTOR 47K 1/4W |
| R15 | RES-0001-273 | RESISTOR 27K 1/4W |
| R16 | RES-0001-123 | RESISTOR 12K 1/4W |
| R17 | RES-0001-682 | RESISTOR 6.8K 1/4W |
| R18 | RES-0001-153 | RESISTOR 15K 1/4W |
| R19 | RES-0001-103 | RESISTOR 10K 1/4W |
| R2 | RES-0001-102 | RESISTOR 1K 1/4W |
| R20 | RES-0001-102 | RESISTOR 1K 1/4W |
| R21 | RES-0001-472 | RESISTOR 4.7K 1/4W |
| R22 | RES-0001-104 | RESISTOR 100K 1/4W |
| R23 | RES-0001-473 | RESISTOR 47K 1/4W |

REFERENCE DESIGNATORS FOR ASY-0222-07A SEA100 AUTO ALARM BOARD

EFFECTIVE 07-14-93

| REF DES | PART NUM | DESCRIPTION |
|---|---|---|
| R24 | RES-0001-273 | RESISTOR 27K 1/4W |
| R25 | RES-0001-123 | RESISTOR 12K 1/4W |
| R26 | RES-0001-153 | RESISTOR 15K 1/4W |
| R27 | RES-0001-393 | RESISTOR 39K 1/4W |
| R28 | RES-0001-243 | RESISTOR 24K 1/4W |
| R29 | RES-0027-502 | TRIMMER,5K |
| R3 | RES-0001-152 | RESISTOR 1.5K 1/4W |
| R30 | RES-0001-124 | RESISTOR, 120K 1/4W |
| R31 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R32 | RES-0027-102 | TRIMMER, 1K |
| R33 | RES-0001-753 | RESISTOR, 75K 1/4W |
| R34 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R35 | RES-0027-102 | TRIMMER, 1K |
| R36 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R37 | RES-0001-222 | RESISTOR 2.2K 1/4W |
| R38 | RES-0027-103 | TRIMMER, 10K |
| R39 | RES-0027-103 | TRIMMER, 10K |
| R4 | RES-0001-103 | RESISTOR 10K 1/4W |
| R40 | RES-0001-202 | RESISTOR 2K 1/4W |
| R41 | RES-0001-047 | RESISTOR 4.7 1/4W |
| R5 | RES-0001-103 | RESISTOR 10K 1/4W |
| R6 | RES-0001-103 | RESISTOR 10K 1/4W |
| R7 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R8 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| R9 | RES-0001-332 | RESISTOR 3.3K 1/4W |
| SPKR | TER-0004-004 | TERMINAL PIN |
| U1 | OPS-SEA100-U1 | ALARM SOFTWARE |
| U2 | SEM-0154-003 | LM358 DUAL OP AMP |
| U3 | SEM-0153-005 | ULN-2283B LOW PWR AUD AMP |
| U4 | SEM-0109-001 | UA7805CKC 5V REGULATOR |
| Y1 | CRY-0011-002 | COLORBURST 3.579545 HC/18U |

EXP.BILL - SINGLE LEVEL BILL-OF-MATERIAL LISTING EFFECTIVE 01/08/93

| LEVEL | PART | DESCRIPTION | QTY/ASSY | UM |
|---|---|---|---|---|
| 0........ | ASY-0222-13 | NECODE ADAPTER ASSY | | EA |
| 1....... | ASY-0222-W6 | COAX CABLE | 1 | EA |
| 1....... | CAP-0013-003 | CAPACITOR MONO .01uf 100V | 1 | EA |
| 1....... | CON-0001-005 | JACK,PHONO 2 CON CLOSED | 1 | EA |
| 1....... | CON-0001-008 | PLUG, PHONO 2 CON | 1 | EA |
| 1....... | CON-0028-001 | PLUG-IN 9 TERM FEMALE | 1 | EA |
| 1....... | CON-0028-003 | CONNECTOR, 9 PIN MALE STRAIGH | 1 | EA |
| 1....... | PCB-0222-10 | NECODE ADAPTER BOARD | 1 | EA |
| 1....... | RES-0001-103 | RESISTOR 10K 1/4W | 2 | EA |
| 1....... | SEM-0021-006 | 2N7000 MOSFET SWITCH (RED) | 1 | EA |
| 1....... | SEM-0027-002 | 80V, 8 AMP P CHAN TMOSFET | 1 | EA |

Printed in USA