This obsolete manual file is provided as a courtesy to you by Ten-Tec, Inc.

Ten-Tec's service department can repair and service virtually everything we have built going back to our first transceivers in the late 1960's. It is our ability to continue offering service on these rigs that has led to their re-sale value remaining high and has made a major contribution to our legendary service reputation.

Printed and bound copies of all manuals are available for purchase through our service department if you would prefer not to use this copy as your transceiver manual.

We can repair or service your Ten-Tec equipment at our facility in Sevierville, TN. We also offer support via telephone for all products via during usual business hours of 8 a.m. to 5 p.m. USA Eastern time, Monday through Friday. We have a large supply of parts for obsolete products. Repairing a transceiver or amplifier yourself? Contact us for parts pricing information.

Service department direct line: (865) 428-0364
Ten-Tec office line: (865) 453-7172
Service department email: service@tentec.com
Address: 1185 Dolly Parton Parkway, Sevierville, TN 37862 USA

We have found it is most effective for us to help you troubleshoot or repair equipment with a consultation via telephone rather than by email.

Suggested contact methods are:

Troubleshooting or repairing equipment – call (865) 428-0364
Other inquiries – call (865) 428-0364 or email service@tentec.com

THANK YOU AND 73 FROM ALL OF US AT TEN-TEC

TEN - TEC

OPERATOR'S MANUAL

OMNI VI PLUS

MODEL 564

HF TRANSCEIVER

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1st Printing 01/97
Printed in U.S.A.

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INTRODUCTION

The OMNI VI Plus is the culmination of two decades of engineering in high performance HF transceivers.

The OMNI VI Plus features an advanced phase locked loop synthesizer combined with an oven timebase controlled crystal mixed oscillator for superior phase noise performance and stability. A large LED display is used for ease of viewing the operating frequency. Two additional smaller displays for a 12 hour clock and RIT/XIT offset, are included. The OMNI VI Plus also provides 100 duplex memories (stores both VFOs, mode and filter settings), scratch pad memory, band registers, dual VFOs, direct frequency entry as well as single button band change and a built-in iambic keyer (mode A or B).

The OMNI VI Plus covers all amateur bands, 160 through 10 meters, using CW (with full or semi break-in), SSB (with built-in speech processor), RTTY (true FSK or AFSK), and FM.Optional crystal filters can be installed in both the 6.3 MHz pass band tuning and 9 MHz IF's.

The OMNI VI Plus utilizes Digital Signal Processing for several receiver functions. This technology provides an automatic notch filter, noise reduction, programmable CW transmit offset with tracking sidetone and an audio lowpass filter.

Chapter 1 of this manual covers installation and available accessories. Chapter 2 covers basic operation of the transceiver in order to quickly place the OMNI VI Plus in operation. Chapter 3 provides more detailed operating instructions. Chapter 4 provides all of the technical information and schematics. Chapter 5 provides detailed information about the computer interface. Chapter 6 provide some hints for troubleshooting, should a problem arise.

UNPACKING

Examine your OMNI VI Plus for signs of shipping damage. Should any damage be apparent, notify the delivering carrier immediately, stating the full extent of the damage.

Retain all damaged cartons. Liability for shipping damage rests with the carrier. It is recommended you keep the shipping carton and fillers in the event that storage, moving, or reshipment becomes necessary.

The following hardware and accessories are packed with your OMNI VI Plus. Make sure that you have not overlooked anything.

3 - #35003	Phono Plug
1 - #35057	4-Pin Mic Connector
1 - #35263	1/8" Stereo plug for iambic keyer paddles
1 - #38040	.050" Allen Wrench
1 - #38088	.062" Allen Wrench
1 - #38057	4-pin Power Cable Connector
4 - #41020	Female Terminal Pins
1 - #74020	Warranty Card
1 - #74253	Operator's Manual
1 - #74234	OMNI VI Plus Connections Guide
1 - #86055	DC Power Cord
1 - #27045	Spare 25A AGC Fuse

If any of the previous items are missing, contact the repair department at Ten-Tec for replacements:

Repair Department 423-428-0364
Switchboard 423-453-7172
FAX 423-428-4483

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Model 564 SPECIFICATIONS

MODES	USB, LSB, CW, FSK or AFSK, FM.
FREQUENCY RANGE	All ham bands 160 through 10 meters, twelve 500 kHz segments with 30 kHz over-shoot at upper and lower band edges.
DISPLAY	7 digit to 10 Hz resolution, .56" LED, 2 secondary .3" displays for clock, memory channel and offset.
FREQUENCY CONTROL	LO generated with a crystal oscillator mixed with a low noise 4.97 - 5.53 MHz phase locked loop.
OFFSET TUNING	+/- 9.99 kHz, receive and transmit.
DUAL VFO's	with SPLIT mode
MEMORIES	100 duplex memories, one scratch pad memory (battery backup, 2-3 yr. life)
PC INTERFACE	Serial port operation of receive and transmit. RS-232 and ICOM® compatible TTL interface are provided. Runs at 1200, 2400, 4800, 9600, or 19200 baud.
FREQUENCY ACCURACY	+/- 50 Hz @ 25 degrees C. (NOTE: The frequency will shift noticeably for 1-2 minutes while the oven heats up when first turned on. Leave DC power connected to the rear panel to eliminate this turn-on drift).
ANTENNA	50 ohm unbalanced.
REMOTE BAND SWITCHING	Rear panel band outputs for selecting antennas or other station accessories.
POWER REQUIRED	2 A receive, 20A transmit @ 12-15 VDC.
CONSTRUCTION	20 G10 epoxy glass PC boards, most field replaceable. Extruded aluminum front panel, aluminum chassis, texture painted top and bottom, snap up stainless steel bail.
DIMENSIONS	HWD 5.75" x 14.75" x 17" - 14.6 x 37.5 x 43.2 cm.
WEIGHT	16 lbs. - 7.25 kb

TRANSMITTER

RF OUTPUT	0-100 watts, ALC stabilized
DC INPUT	Maximum 250 watts @ 14VDC. 100% duty cycle for up to 20 minutes. Continuous duty with customer supplied air cooling of rear panel heat sink.
MICROPHONE INPUT	200-50K Ohms, accepts microphones with -67dB (0 dB = 1V/microbar) output. Polarizing voltage for electrets provided.
SPEECH PROCESSOR	Adjustable compression level.

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T/R SWITCHING	PTT or VOX on SSB, switchable FAST or SLOW QSK on CW, delay on SLOW is adjustable.
IAMBIC KEYER	Adjustable 10 - 60 WPM, type A or B, weight adjustable from keypad.
CW OFFSET	Programmable 400 - 990 Hz, DSP generated, sidetone automatically matches offset, volume adjustable independent of AF gain control.
FM DEVIATION	+/- 5 kHz
METERING	Switchable to forward power, SWR, collector current or audio processing level on SSB.
SSB GENERATION	Balanced modulator followed by 9 MHz, 8 pole crystal ladder filter.
CARRIER SUPPRESSION	60 dB typical
UNWANTED SIDEBAND SUPPRESSION	60 dB typical at 1.5 kHz tone.
THIRD ORDER INTERMOD	30 dB below two tone at 100 watts PEP.
SPURIOUS OUTPUT	Better than 45 dB below peak power output.

RECEIVER

SENSITIVITY

MODE	
SSB, CW, FSK	0.16 uV for 10 dB SNR @ 2.4 kHz
FM	0.35 uV for 12 dB SINAD

SELECTIVITY

FILTER COMBINATION		TYPICAL SYSTEM BANDWIDTH		Shape Factor
9 MHz IF	PBT IF	@-6 dB	@-60 dB	
2.4 kHz	2.4 kHz	2.4 kHz	3.2 kHz	1.30
2.4 kHz	1.8 kHz*	1.8 kHz	2.7 kHz	1.50
2.4 kHz	500 Hz*	500 Hz	1.3 kHz	2.60
2.4 kHz	250 Hz*	250 Hz	850 Hz	3.40
1.8 kHz*	1.8 kHz*	1.7 kHz	2.4 kHz	1.40
500 Hz*	500 Hz*	350 Hz	900 Hz	2.60
250 Hz*	250 Hz*	190 Hz	550 Hz	2.90

* ***Optional filter is required***

DYNAMIC RANGE	97dB @ 2.4 kHz bandwidth at 20 kHz spacing, 100dB+ with CW filters.
THIRD ORDER INTERCEPT	+10dBm
NOISE FLOOR	-133dBm @ 2.4 kHz bandwidth
PHASE NOISE	-122dBc @ 1 kHz, -138dBc @ 20 kHz
S-METER	Calibrated for S9 = 50 uV

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ATTENUATOR	-20dB
PASSBAND TUNING	+/- 1.5 kHz
IF FREQUENCIES	1st IF 9MHz, 2nd IF 6.3MHz (passband tuning IF), 2nd IF for FM 455KHz.
NOISE BLANKER	Adjustable threshold
AUTOMATIC DSP NOTCH FILTER	Eliminates multiple heterodynes, notch depth automatically selected for each.
MANUAL NOTCH FILTER	200 Hz to 2.5 kHz, greater than 50dB. Adjustable center frequency.
DSP NOISE REDUCTION	Auto-correlation type algorithm. Broadband noise reduction of 5 to 15dB is typical depending on conditions.
DSP FILTER	Lowpass audio filter selectable in 5 steps, 1400 Hz, 1200 Hz, 1000 Hz, 800 Hz, 600 Hz, or may be disengaged.
RECEIVE RECOVERY TIME	less than 20 ms including split mode.
SQUELCH SENSITIVITY	less than .6uV
IMAGE REJECTION	>90dB
I-F REJECTION	>90dB
AUDIO	1.5 watts @ 4 ohms with less than 2 % distortion, built-in speaker, separate fixed output 1 mw @ 600 ohms.
SEPARATE RX ANTENNA INPUT	50 ohm phono jack, front panel selectable.

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CHAPTER 1

INSTALLATION

1-1 POWER SUPPLY The OMNI VI *Plus* requires a source of well filtered and regulated DC voltage. The supply voltage can range from +12.0 to +15.0 VDC but an optimum of +13.8 VDC is recommended. The voltage source must be capable of 22 amps.

The TEN-TEC Model 962 matching power supply is specifically designed for this service. This supply has built-in over current protection and all of the necessary RFI bypassing. The Model 962 also has a front facing speaker. To activate this speaker, plug the 1/4" phone plug from the power supply into the EXTERNAL SPEAKER jack on the rear panel of the OMNI VI *Plus*.

The four pin DC connector on the rear panel of the OMNI VI *Plus* is polarized such that the mating plug will only attach in one direction. With the Model 962, simply determine the correct orientation and plug the power cable into the OMNI VI *Plus*.

If an alternate power source is to be used, we recommend that the preassembled DC power cord (p/n 86055) be used. We have also included spare connector pins (p/n 41020) and a connector shell (p/n 38057) for building your own cord. Be sure to use no less than 14 gauge stranded wire for these connections because of the high current demand during transmit.

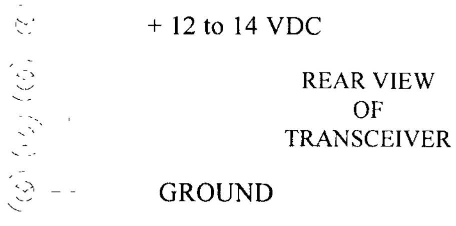

FIGURE 1-1
DC POWER CABLE CONNECTIONS

NOTE: Always enable the power source first and then the transceiver.

If the DC power source is supported by a generator or alternator, always turn off the transceiver before the equipment is started or shut off. These recharging devices can often generate large voltage spikes that might damage the transceiver

1-2 ANTENNAS The transmitter is protected against damage from load impedance mismatches ranging from a dead short to an open circuit. Operation at or near full power is possible with an unbalanced (coax feed) load impedance between 25 and 100 ohms (approximately 2:1 SWR). Antennas with higher SWR, or single wire and balanced feedline types, will require the use of an external antenna tuner for best results.

NOTE: When operating the transmitter into an SWR higher than 2:1, adjust the RF "PWR" control to a collector (Ic) current not to exceed 20 amps as indicated on the front panel meter.

The main antenna connection to the transceiver is through the rear panel SO-239 connector. In most installations, this connection will carry both transmit and receive signals and the front panel receive ANT switch will be set to MAIN. If a separate receive antenna is to be used, connect it to the rear panel AUX RX ANTENNA jack. You can leave both antennas connected at all times and select the desired receive antenna with the ANT selector pushbutton.

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1-3 MICROPHONES Any TEN-TEC microphone, using our four pin connector, may be used without modification. Most dynamic, ceramic, crystal or electret type microphones may also be used. When adapting another microphone, please refer to the connector wiring diagram in FIGURE 1-2. A spare four pin microphone plug (p/n 35057) is included in the packing kit. Be sure to use shielded cable to prevent any RF interference. Electret types and some with built-in preamplifiers will require the DC voltage available at pin 4.

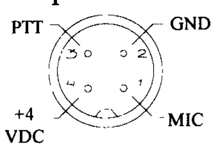

FIGURE 1-2
MICROPHONE CONNECTION

1-4 CW KEY Two methods are available for keying the transceiver in CW mode. The rear panel KEY phono jack can be connected to a straight key, bug, or external keyer. A connection between the center pin and the ground will key the transmitter.

The OMNI VI *Plus* also features a built-in iambic keyer. The rear panel 1/8" stereo jack labeled KEYER allows connection to any style of keyer paddle. Refer to FIGURE 1-3 and use the plug

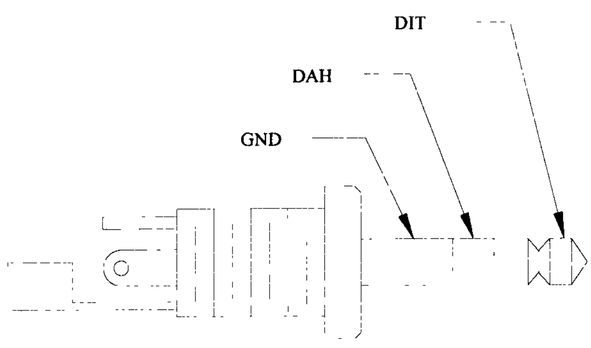

FIGURE 1-3
BUILT-IN ELECTRONIC KEYER

CONNECTION

(p/n 35263) supplied in the packing kit. The keyer speed is controlled by the front panel KEYER SPEED control. See Chapter 3, Sections 3-1.13 and 3-4 for more details regarding the use of the built-in keyer.

1-5 STATION GROUND A good ground system is essential for optimum operation of any transmitter. The best solution is to connect all the station equipment chassis together using a heavy flat ground braid. Use another length of braid to connect to a ground rod. If you are not using a linear amplifier a less ideal ground may suffice. A ground connection to the copper cold water plumbing pipe is usually acceptable.

Antenna type and the proximity to the station are also a factor in choosing ground methods. With good resonant antennas located away from the station, the AC ground in your house wiring may be adequate.

1-6 CONNECTIONS FOR OTHER ACCESSORY EQUIPMENT Connectors have been provided to interface to a variety of station equipment. This includes linear amplifiers, RTTY terminals, computer equipment and phone patches. See the Table of Contents to locate detailed information on how to connect various equipment to the OMNI VI *Plus*.

1-7 TEN-TEC ACCESSORIES FOR THE OMNI VI *PLUS*

Crystal Filters for the 9 MHz IF
216 - 500 Hz 6 pole for FSK
217 - 500 Hz 8 pole for CW
218 - 1.8 kHz 8 pole for SSB
219 - 250 Hz 6 pole for CW
220 - 2.4 kHz 8 pole for SSB

Crystal Filters for the 6.3 MHz IF
282 - 250 Hz 6 pole for CW
285 - 500 Hz 6 pole for CW
288 - 1.8 kHz 8 pole for SSB

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Other Accessories

236 - Remote control cable for Model 420 Amplifier or Model 253 Tuner
238 - 2 Kw antenna tuner
239 - 100 Watt dummy load
257 - Voice Synthesizer Board
259 - ALC Annunciator
264 - 236 expansion cable for connecting Model 420/253 combination
607 - Single Paddle Keyer Assembly
701 - Hand Microphone
705 - Desk Microphone
962 - Matching Power Supply
RM-500 - Rack Mounting Kit
35057 - 4 pin Microphone Connector
80-572 - 4 pin DC Connector with pins

1-8 INSTALLING OPTIONAL FILTERS

All optional filters install either on the 9 MHz IF board or the PBT (Pass Band Tuning) board. Refer to Figures 1-4 and 1-5. These boards are both located on the bottom side of the transceiver. To remove the bottom cover, set the transceiver upside down with the front panel facing forward. Remove two Philips screws from each side of the bottom cover and slide the cover back out from under the edge of the front panel extrusion.

Remove the bottom cover to expose two removable panels. The optional filters plug into circuit boards underneath these panels.

1-8.1 INSTALLING 6.3 MHz IF FILTERS

Remove the panel covering the PBT board. There are three dedicated positions on the board for the three optional filters. Referring to Figure 1-4, plug the filter into the appropriate position. The filters are non polarized and may be installed in either direction. Replace the panel and the bottom cover.

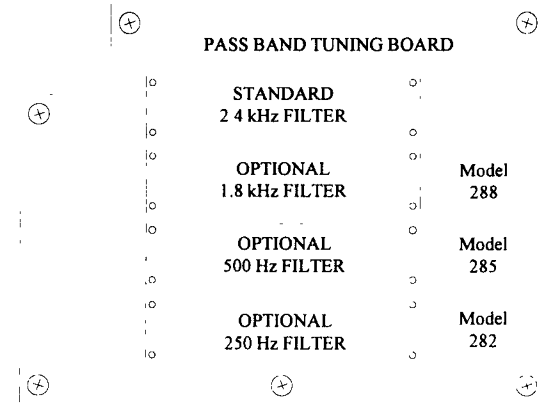

FIGURE 1-4
6.3 MHz IF FILTER INSTALLATION

1.8-2 INSTALLING 9 MHz IF FILTERS

Remove the panel covering the 9 MHz filter board. There are two empty filter positions, Optional Filter 1 and Optional Filter 2 that correspond to the N-1 and N-2 buttons on the front panel. Plug the optional filter into the desired location. Like the passband tuning filters, these are also non-polarized and may be installed in either direction. Because the various filters have different amounts of loss, each position has a selectable gain jumper to compensate. Models 216, 217 and 219 require the high gain setting. Models 218 and 220 use the low gain setting. Position the jumper plug to connect the correct pins on JG1 and JG2 as shown in Figure 1-5.

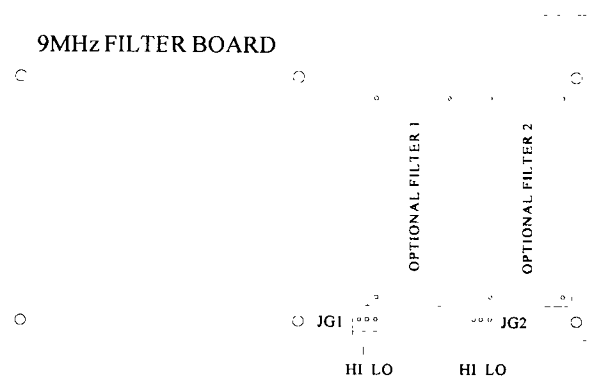

FIGURE 1-5
9 MHz IF FILTER INSTALLATION

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1-9 OPTIONAL VOICE SYNTHESIZER BOARD, MODEL 257 The voice synthesizer will announce the display frequency when the VOICE button is pressed. To install the voice board, remove the two Phillips screws on each side of the top cover. Slide the cover back from under the edge of the front panel extrusion and lift the cover off. The voice board plugs into a card edge connector on the Logic Board. Refer to Figure 1-6. Test the operation of the voice board by powering up the transceiver and pressing the VOICE pushbutton. The speech level can be adjusted with trimmer resistor R13 on the voice board.

NOTE: *If you already own Model 257 and are transferring it from a transceiver other than Model 563 or 564 contact the factory for modification details.*

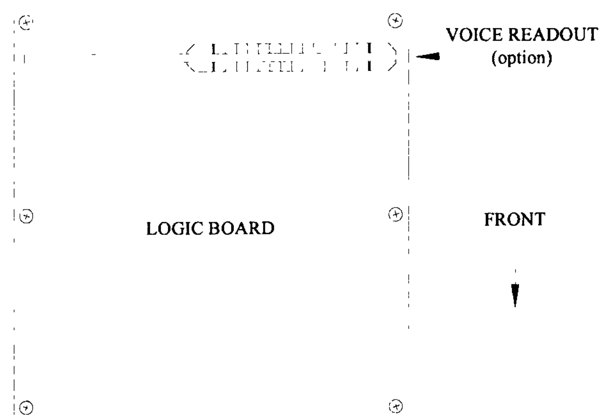

FIGURE 1-6
VOICE BOARD INSTALLATION

1-10 OPTIONAL ALC ANNUNCIATOR MODEL 259 This accessory allows the vision impaired operator to adjust MIC GAIN control properly. Refer to the Model 259 manual for te installation procedure.

1-11 INTERFACING WITH OTHER TEN-TEC EQUIPMENT Two phono connectors on the rear panel of the OMNI VI *Plus* allow access to the keying circuitry in the transceiver. These connectors, labeled TX OUT, and TX EN, are normally connected together with a jumper plug.

To incorporate a TEN-TEC amplifier into the station, remove the plug jumper and use shielded cables to connect to the key lines of the amplifier. These connections are shown in Figures 1-7, 1-8 and 1-9. These connections insure that proper timing is maintained between the transceiver and amplifier during QSK operation.

1-12 INTERFACING WITH NON TEN-TEC AMPLIFIERS Refer to figure 1-10 for connections. You must activate the relay from USER OPTIONS MENU #1 (see Table 3-1). Change LCO from its default position OFF to ON.

1-13 FREQUENCY STABILITY AT TURN-ON OMNI VI *Plus* transceivers incorporate a feature to keep the crystal oven on for improved frequency stability. To utilize this feature, leave the power supply ON, when the radio is OFF. If this feature is not desired turn the power supply OFF.

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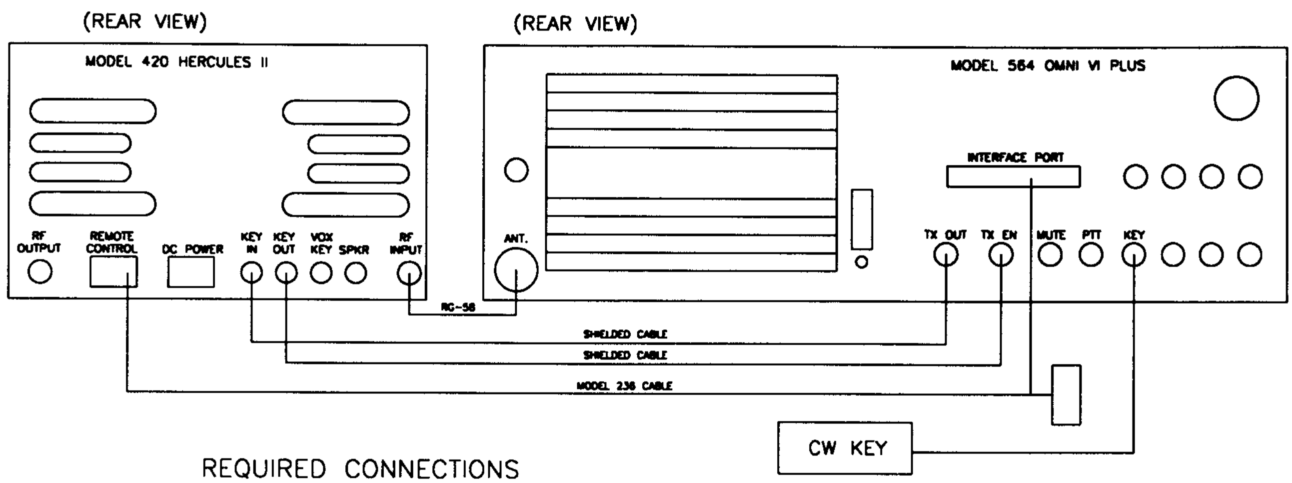
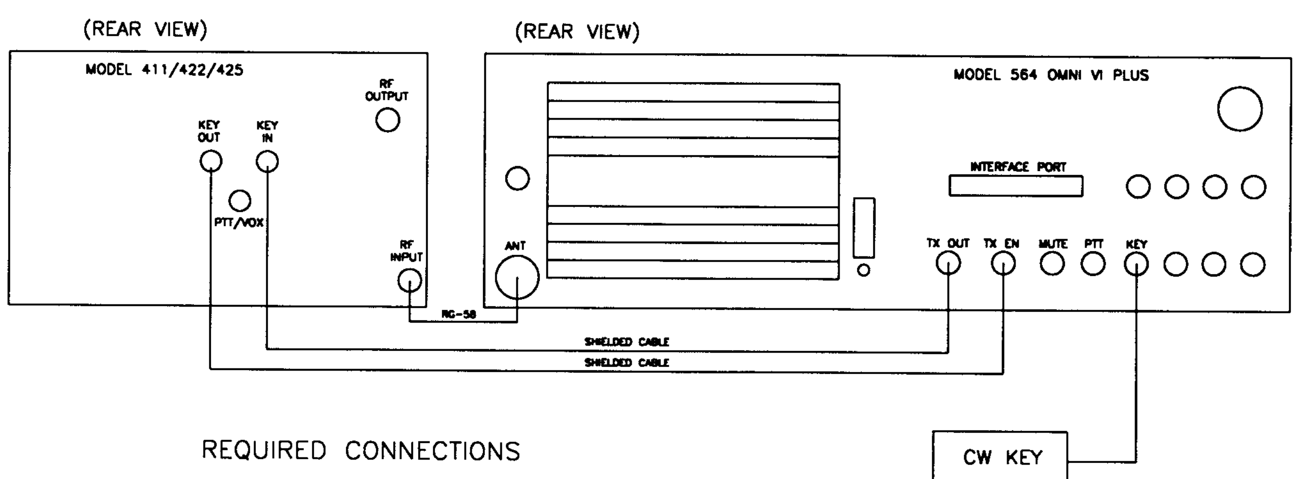


REQUIRED CONNECTIONS

MODEL 420	MODEL 564	USING
KEY IN	TX OUT	SHIELDED CABLE
KEY OUT	TX EN	SHIELDED CABLE
RF INPUT	50 OHM ANTENNA	RG-58/U OR EQUIVALENT
REMOTE CONTROL	INTERFACE PORT	MODEL 236 CABLE

NOTE
PLACE THE MODEL 420 IN THE QSK CONTROL MODE.

FIGURE 1-7. QSK HOOK-UP WITH HERCULES II AMPLIFIER



REQUIRED CONNECTIONS

MODEL 420	MODEL 564	USING
KEY IN	TX OUT	SHIELDED CABLE WITH PHONO PLUGS
KEY OUT	TX EN	SHIELDED CABLE WITH PHONO PLUGS
RF INPUT	50 OHM ANTENNA	RG-58/U WITH PL-256

FIGURE 1-8. QSK HOOK-UP WITH CENTAUR, CENTURION OR TITAN AMPLIFIER

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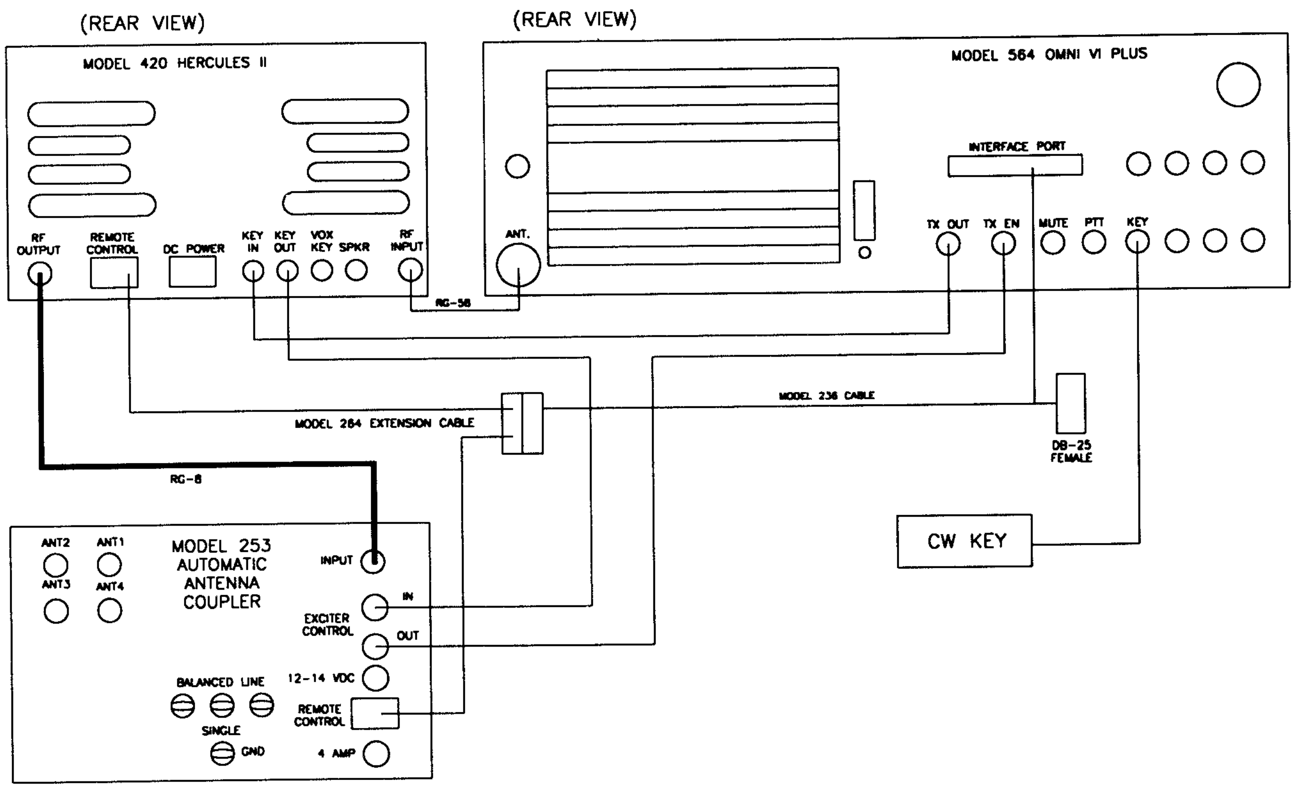

REQUIRED CONNECTIONS

MODEL 420	MODEL 253	MODEL 564	USING
RF INPUT	———	50 OHM ANTENNA	RG-58/U WITH PL-259
KEY IN	———	TX OUT	SHIELDED CABLE WITH PHONO PLUGS
KEY OUT	EXCITER CONTROL IN	———	SHIELDED CABLE WITH PHONO PLUGS
———	EXCITER CONTROL OUT	TX EN	SHIELDED CABLE WITH PHONO PLUGS
REMOTE CONTROL	REMOTE CONTROL	INTERFACE PORT	MODEL 236 + MODEL 264
RF OUTPUT	RF INPUT	———	RG-8/U OR EQUIVALENT

FIGURE 1-9. QSK HOOK-UP WITH HERCULES II AMPLIFIER AND 253 ANTENNA COUPLER

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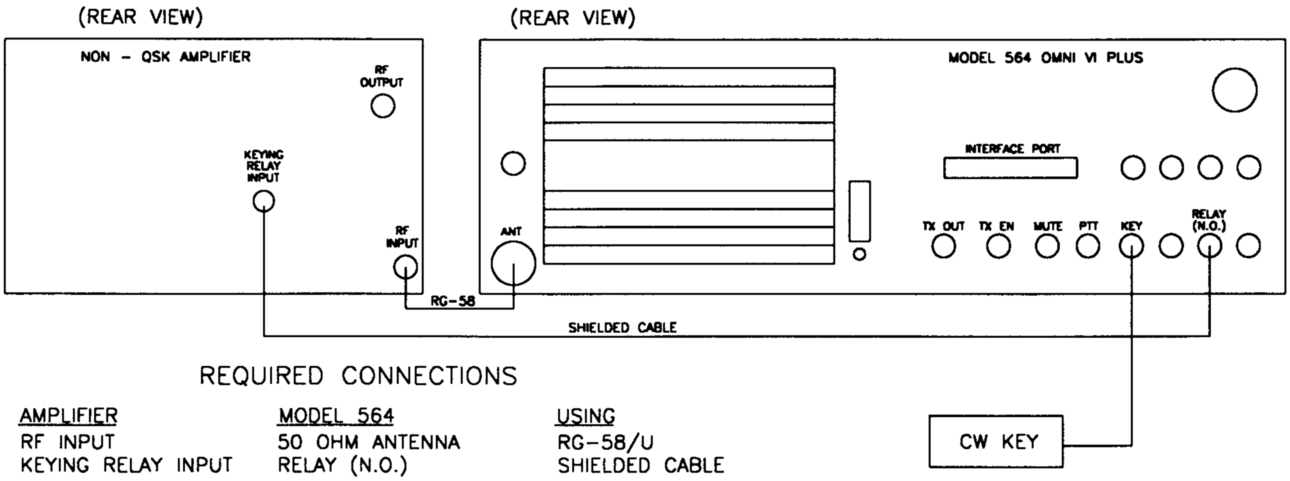

REQUIRED CONNECTIONS

AMPLIFIER	MODEL 564	USING
RF INPUT	50 OHM ANTENNA	RG–58/U
KEYING RELAY INPUT	RELAY (N.O.)	SHIELDED CABLE

NOTE
YOU MUST VERIFY THAT THE AMPLIFIER KEY INPUT REQUIRES ONLY A LOW VOLTAGE DC CONNECTION TO GROUND. SEE PARAGRAPH 3–6.15 REGARDING THE RELAY OUTPUT JACK ON THE MODEL 564.

FIGURE 1-10. HOOK-UP WITH NON TEN-TEC AMPLIFIERS

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CHAPTER 2

GETTING STARTED

2-1 INTRODUCTION Virtually all aspects of the OMNI VI *Plus*' operation are user programmable from the front panel. This includes many "set and forget" features that are accessed through menus using the frequency display and the keypad. All of these operator options are explained in detail in Chapter 3. The default settings, as shipped from the factory, will allow you to get started. You can customize the operation to more closely fit your preferences as you become familiar with the transceiver.

BEFORE YOU POWER UP

The first time you power up the OMNI VI *Plus* we suggest doing a MASTER RESET as explained in Section 2-4.2. This will clear out any memory locations or special settings that were a result of factory burn-in and testing.

When power is first applied, the ovenized crystal timebase will take one or two minutes to stabilize. If you choose to leave the power source to the transceiver on, the oven will run continuously and no turn-on drift will occur. See Section 1-13.

2-2 INITIAL FRONT PANEL SETTINGS:

RF .... Full Clockwise
AF 9:00
POWER .... ON
METER .... FWD
ANT .... MAIN
AGC .... ON
AGC .... FAST
NOTCH .... MANUAL (no light)
QSK .... FAST
ATTN .... OFF (no light)
NB .... Full counter clockwise
SQL .... Full counter clockwise
PBT 12:00
NOTCH .... Full counter clockwise
RIT/XIT .... Ignore for now
PROC .... OFF (no light)
MIC 9:00
PWR 12:00
KEYER SPEED .... Full counter clockwise
PROCESSOR .... Full counter clockwise
VOX....... OFF (no VOX light, upper display)
SELECT DESIRED MODE .... CW, LSB, USB, FSK, FM
SELECT VFO "A" .... use A/B button, if VFO B active
SPLIT .... OFF (no SPLIT light in upper display)
RIT .... OFF (no Numeric offset displayed, no light
XIT .... OFF (no offset displayed, no light)
LOCK .... OFF (no light)
SELECT DESIRED BAND .... Use band buttons
SELECT FREQUENCY...... Use main tuning knob or UP/DOWN Arrow keys
I-F FILTER .... Select 2.4, all filter lights off

See Figure 3-1 for location of the controls referred to in the following paragraphs.

2-3 OPERATION Connect a suitable resonant antenna to the rear panel 50 OHM ANTENNA connector. Check for received signals. Turn to a clear area of the band and press the TUNE button. Adjust the PWR control to the desired output power. Switch the METER switch to the Ic (collector current) position and check for a reading of 20 amps or less. Switch to the SWR position and check for a reading of 2:1 or less.

2-3.1 SSB MODE OPERATION Select either LSB or USB and key the transceiver by

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pressing the microphone's PTT (Push to talk) button. While speaking into the microphone, advance the MIC control until the ALC LED begins to flash. The LED indicates that the transceiver is generating full output power relative to the setting of the PWR control. Try to avoid lighting the ALC light too frequently. This indicates that the transmit circuitry is being overdriven.

Tune the receiver to a SSB signal. If there is bothersome influence, adjust the PBT (Pass Band Tuning) control to position the receiver's crystal filtering on the desired signal. The PBT control can often be manipulated slightly to reduce interference from nearby signals.

To fine tune the receive frequency without changing the transmit frequency, turn on the RIT (Receive Incremental Tuning) function. Use the RIT/XIT knob to adjust the receive frequency. To clear the RIT, press the RIT button again. See Chapter 3 for more detail on offset tuning.

2-3.2 CW OPERATION Select the CW mode. A closure of the rear panel KEY jack to ground will key the transmitter. The built in electronic keyer can also be used. If you do not want fast break-in CW, switch the QSK pushbutton to SLOW. Refer to Chapter 3 for more details on other adjustments such as sidetone volume, CW offset frequency, keyer speed and weighting. If narrow CW filters have been installed, select one and adjust the PBT control for the best reception.

2-3.3 FM OPERATION Select the FM mode. (NOTE: This mode is currently authorized by the FCC for use between 29.0 and 29.7 MHz). Press the microphone PTT button to transmit. In this mode the MIC gain control adjusts the amount of FM deviation rather than the transmit power. With TEN-TEC brand microphones, the MIC control should be set to 12 o'clock. You may find a slightly higher or lower setting is needed with other microphones.

In receive, adjust the SQL (squelch) control for quieting when no signal is present. The narrow IF filters and PBT function are disabled in FM mode. If FM repeater operation is desired, set up the dual VFO's with the transmit and receive frequencies and use SPLIT mode. Detailed information about the dual VFO's is in Chapter 3.

2-3.4 FSK MODE This mode places the receiver in LSB and enables the rear panel MARK/SPACE input. A closure on either the KEY or PTT inputs will transmit a CW carrier. The frequency of this carrier is shifted by 190 Hz depending on the logic level of the MARK/SPACE line. Refer to Chapter 3 for more details on how to connect a modem or terminal unit.

2-4 A FEW WORDS ON MICROPROCESSORS On rare occasions you may find the transceiver will not accept commands from the keypad properly or it is operating in an erratic manner. Spikes or surges on the power supply line or an unforeseen set of circumstances may confuse the microprocessor. This technology has improved dramatically in recent years but it is still possible to have an occasional lockup. If turning POWER off and on does not resolve the problem, the microprocessor must be reset using one of the following methods.

2-4.1 PARTIAL RESET Always try this method first as it will not erase memories or selections from USER OPTIONS MENUS. Turn off POWER. Press and hold the CLEAR button and turn POWER on. Continue to hold CLEAR for several seconds and release. If this does not return the transceiver to normal operation use a MASTER RESET.

2-4.2 MASTER RESET This will erase all memories and return the USER OPTIONS MENUS to factory presets. Turn off POWER. Press and hold ENTER button and turn POWER on. Continue to hold ENTER for several sec-

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onds and release.

2-5 MAIN TUNING KNOB DRAG ADJUSTMENT The main tuning knob has a spring loaded friction pad on the back. To adjust the amount of drag, hold the rear chrome skirt and turn the main knob body. Turn the knob counter clockwise to loosen and clockwise to tighten the amount of drag. If the chrome skirt seems a little off center relative to the keypad bezel after this adjustment, it can be shifted slightly so that it spins evenly within the bezel.

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CHAPTER 3

DETAILED OPERATING INSTRUCTIONS

3-1.00 FRONT PANEL CONTROLS - KEYPAD FUNCTIONS (See Figure 3-1) Single button selections such as band, mode, IF filters, VFO selection and RIT/XIT operations are the ones you will use routinely. All are well marked and supported with status lights. Multi-stroke keypad functions are used for less frequently used features or to customize the transceiver to fit your personal preferences. These options are explained in the following sections. These functions tend to be "set and forget" beyond experimenting during the initial setup. Every effort has been made to allow you to optimize your transceiver whether you operate one mode or enjoy all of them.

When making these initial adjustments, be sure to select the proper mode and frequency. We also recommend the use of a 50 ohm dummy load (Model 239), capable of at least 100 watts, during this setup procedure.

*NOTE: Any of these multiple key command sequences can be aborted before completion by pressing the **CLEAR** button.*

3-1.01 CHANGING FREQUENCY There are four methods of changing frequency or bands:

1) Tune up or down the band with the main tuning knob. The knob tunes at a default rate of 5.00 kHz per revolution.

Other rates are selectable by the user. Refer to Section 3-4.

2) Move up or down a band quickly in 100 kHz steps using the ▲ or ▼ arrows on the keypad.

3) Change from band to band by pressing the desired band button.

4) Move to a particular desired frequency by entering it directly on the keypad as outlined below:

Press ENTER (Display now shows dashes). Key in the desired frequency. It is not necessary to enter every number down to the 10 Hz digit. Pressing ENTER at any point will fill the remaining digits with zero.

Example 1: Desired frequency 14.200.00.
Press ENTER, 1, 4, 2, ENTER.

Example 2: Desired frequency 3.786.55.
Press ENTER, 3, 7, 8, 6, 5, 5. (It is not necessary to hit ENTER after the last digit).

Example 3: Desired frequency 1.890.00.
Press ENTER, 0, 1, 8, 9, ENTER. (NOTE: To enter a frequency on 160M, a "zero" must preceed the "one.")

The numerical keypad functions as a single button bandswitch as shipped from the factory. To enter an exact frequency, you must press ENTER, then the frequency, as explained in the previous examples. This feature may be reversed in the USER OPTIONS MENU with the FEP option (Frequency Entry Priority). If reversed, you must press ENTER to bandswitch and an exact frequency can be typed without the ENTER key to start the sequence. Refer to Section 3-4 for details.

3-1.02 TUNE Pressing the TUNE button keys the transmitter and is equivalent to the "key down" condition in CW. The power output level may be set anywhere between 0 and 100 watts using the PWR control. The MIC gain control has no effect in the TUNE mode. This provides

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a convenient way to set the power level, check SWR and collector current.

3.1-03 CW This button selects the CW mode. First, make sure that the NOTCH pushbutton is in the manual position and that the NOTCH control is fully counterclockwise. This places the audio notch down below 100 Hz where it will not interfere with the passband. The CW mode select button activates a SPOT tone once the transceiver is already in CW mode. Press and hold the CW button and use the audio tone as a reference while you tune in the desired signal. This will position the transmit signal to precisely match the incoming signal frequency.

For transmit, a standard key or an external keyer can be connected to the rear panel KEY jack. The built-in keyer can be activated with either a single or dual paddle connected to the 1/8" stereo KEYER jack.

See 3-5.14 for information on selecting the receiver QSK response. Other sections cover setting the sidetone, adjusting the keyer and selecting filters.

3-1.04 USB/LSB Selects the upper and lower sideband modes. All of the IF filters are selectable in these modes but only the standard 2.4 kHz and optional 1.8 kHz bandwidths are usable for SSB signals. Either PTT or VOX can be used to key the transmitter. See section 3-1.09 for adjusting the VOX operations. In transmit, advance the MIC gain control until the ALC light flashes on voice peaks. This indicates that the output is reaching full power.

3-1.05 FSK Selects operation in the digital modes and enables the built-in frequency shift keying circuit. The FSK circuitry is controlled through the rear panel MARK/SPACE connector. This input is typically connected to the FSK output jack of a modem or terminal unit. The logic levels required at the MARK/SPACE input are less than or equal to 1.0 Vdc for MARK condition and equal to or greater than 2.0 Vdc for SPACE. This input includes its own pull-up resistor with an open circuit voltage of about 3.5 Vdc. Either a standard TTL level or open collector output line will drive the MARK/SPACE input.

The OMNI VI *Plus* receives FSK using lower sideband. The local oscillator however is shifted up by 2120 Hz so that an input at the displayed frequency generates an audio "mark" tone. All optional IF filter positions are available in this mode but the narrow 9 MHz CW filters (Models 217 and 219) are not properly centered to pass the mark/space tones. Use the Model 216 for FSK. The 500 Hz and 250 Hz PBT filters (Models 285 and 282) are usable for FSK by rotating the PBT control clockwise.

3-1.06 USING AFSK ON THE DIGITAL MODES Virtually all available digital systems include an AFSK generator that can be patched into the microphone input of the transceiver, using a SSB mode.

This system works well but there are some extra details in setting up this mode. Most modem equipment anticipates that the transmitter will be operating in LSB mode, otherwise the tone shift will be inverted. In receive, the equipment will often have a "reverse" switch. Set this switch to copy incoming signals with the transceiver in LSB mode.

The level of the AFSK output from the modem equipment is also important. Whether this signal is fed into the front panel microphone jack or the rear panel AUDIO IN connector, the input level should be such that ALC occurs with the MIC control near 11 o'clock. This ensures that the microphone amplifier and balanced mixer are not being over driven.

Do not try to use the speech processor on AFSK. It may cause enough distortion to corrupt the transmitted waveform. Also, be sure to install a PTT line between the modem and transceiver. The VOX circuitry will not be fast enough, especially for AMTOR.

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NOTE: The rear panel audio input and front panel MIC jack operate in parallel. When operating AFSK, make sure the mike is not live. When operating SSB, make certain the AFSK system is turned off or disconnected.

3-1.07 FM Selects the FM Mode. The IF filters and PBT are disabled in this mode. The FM receiver operates with a fixed 15 kHz bandwidth. Adjust the SQL (squelch) for quieting when no signal is present. Press the microphone PTT switch to transmit. In this mode the MIC control adjusts the amount of deviation rather than the transmit power. When using a TEN-TEC microphone, adjust the MIC control to 12 o'clock. Other brands of microphones may require a slightly higher or lower setting. The goal is to use enough microphone gain so that the FM signal reaches a full +/- 5 kHz deviation.

3-1.08 IF FILTER SELECTION Five pushbuttons above the main tuning knob select the IF bandwidth. The first three buttons select one of three optional filter positions in the 6.3 MHz PBT (Pass Band Tuning) IF. A standard 2.4 kHz filter is already installed. To return to the standard bandwidth, press the currently selected filter button again. See section 1-8 for instructions on how to install these filters.

Two more buttons, N1 and N2 select optional filters in the fixed 9 MHz IF. Both IF's are cascaded such that the resulting receiver bandwidth is a combination of both filters. See page vii for a chart of typical bandwidths and shape factors for various combinations of filters.

NOTE: *Any of these multiple key command sequences can be aborted before completion by pressing the clear button.*

3-1.09 VOX ADJUSTMENTS To use the VOX (Voice Operated Transmit) mode, press the VOX button. The VOX light to the right of the meter should come on. Press the GN (Gain) button. The clock display will change to a 2 digit display between 01-15. Use the UP/DOWN buttons to make all VOX adjustments. The system is interactive so adjust the VOX gain for the desired transmitter action while speaking into the mike. Once you have it set, press ENTER. Now press DLY (VOX delay) and adjust for the desired transmitter hang time. Press ENTER. Finally, press AV (Anti-Vox). Tune to an incoming signal and adjust the receive audio level slightly higher than normal. Adjust AV so that the receiver audio does not trip the transmitter. Press ENTER. All adjustments will be stored to memory and the clock display restored to normal operation.

3-1.10 CW SIDETONE VOLUME ADJUSTMENT Press the ST (Sidetone) button. This will activate the audio tone but will not key the transmitter. Use the UP/DOWN keys to adjust the volume of the tone. The upper right-hand display will indicate the relative volume level between 00 and 31. Press ST again to store the selected level and turn off the tone.

3-1.11 SIDETONE PITCH AND CW OFFSET ADJUSTMENT Historically, TEN-TEC has used 700 Hz as the standard offset for CW operation. Some CW operators, however, prefer to use a different offset because of personal preference or as a tool when chasing DX. To change the offset frequency and the corresponding sidetone note, press the ST button and use the RIT/XIT knob to adjust the tone. The clock display will read out the selected offset frequency between 400 to 990 Hz. Press ST again to store the new offset. The sidetone audio frequency automatically matches the offset that is chosen.

3-1.12 CLOCK SET The time shown in the 24 hour clock display can be updated through the numeric keypad. To enter a new time, choose the USER MENU 1 as described in paragraph 3-4. Select item CCd. Enter the hours and minutes, beginning with a zero if neces-

sary. The clock will begin counting when the last digit is entered.

3-1.13 BUILT-IN IAMBIC KEYER Connect the keyer paddle as diagrammed in Figure 1-3. Use the front panel KEYER SPEED control to adjust

speed. The exact speed and weighting can be displayed and set precisely by pressing the (ST) button and then the CW mode button. The small displays now indicate keyer speed on top and weighting on the bottom. The weighting is shown relative to 3:1 dot/dash ratio. This ratio can be adjusted by plus or minus 30 percent using the up and down arrow buttons.

The keyer mode can be set to either CURTIS type A or B using the "I code" menu settings. See the section on the user menus for details on setting this parameter. In mode A, the dot or dash being sent when the paddles are released is completed and nothing else will follow. In mode B, the keyer completes the element being sent as the paddles are released and then sends one of the opposite element. Some dual paddle users prefer this latter style of operation. Single paddle operation behaves the same in either mode.

3-1.14 DSP LOWPASS FILTER Press the LP button to enable the DSP audio lowpass function. This adds a gradual treble cut type response to the audio path. The corner frequency of this filter is selectable by holding the LP button down for about 2 seconds. The frequency choices of 600, 800, 1000, 1200 and 1400 Hz are selectable with the up and down arrow buttons. This feature is usually used to limit the post-detection bandwidth of the audio path in CW mode.

3-1.15 DSP NOISE REDUCTION This button activates the noise reduction algorithm in the DSP system. This system mathematically identifies desired signals and tracks them with a set of adaptive filters. Broadband noise is attenuated by as much as 15 dB depending on conditions.

3-1.16 VOICE If the optional Model 257 Voice Synthesizer has been installed, pressing this button will announce the frequency displayed on the main readout.

3-2.0 TRANSMIT/RECEIVE FREQUENCY CONTROL In addition to normal simplex operation (RX and TX on same frequency) there are three methods of operation that allow independent control of transmit and receive frequencies. All three allow cross band operation, with reduced QSK speeds. You will most likely choose one system that best matches your operating interests and techniques. We encourage you to learn all three systems.

3-2.1 SIMPLEX OPERATION Select VFO A or B (A/B button) and select frequency, mode and filter choice. Make sure that the SPLIT, RIT and XIT are all off.

3-2.2 SPLIT OPERATION Remember that VFO A and VFO B store frequency, mode and filter choice independently. Here is a typical scenario and control sequence. You find a DX station that is listening "up 5". The task will be to transmit 5 kHz above your receive frequency. First, equalize the two VFO's by pressing the A=B button. Now press SPLIT. Switch to the opposite VFO by pressing and holding the REV button. Tune this VFO up 5 kHz to the transmit frequency and then release. You are now set to transmit "up 5."

If you are still in SPLIT mode and hear a simplex operator you want to call, just press SPLIT again. This will return the transceiver to simplex operation.

3-2.3 RIT OPERATION You can use either VFO and each has its own independent RIT value. Select frequency, mode and filter. Press

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RIT. Use RIT/XIT knob to change the receiver frequency. The offset system tuning range is +/- 9.99 kHz. When RIT is on, the transmit frequency is shown in the main display and the offset displayed should be added or subtracted to determine the receive frequency. The main display can be changed to include the RIT/XIT amount in the USER OPTIONS MENU, option ODP (offset display preference). Exercise caution if you select this display option as the actual TX frequency is not immediately obvious when viewing the displays.

There are three methods of quickly returning RIT to zero. Press RIT to turn it off. (The next time your turn RIT on, the same offset will return). The second method is to press RIT and hold for 1 second. This clears offset to zero and leaves RIT on. The third method is to press CLEAR and RIT stays on and returns to 0.00. If you switch to the other VFO, all of the information, including RIT status, is stored.

3-2.4 XIT OPERATION This works the same as RIT except the main and offset displays are reversed. The receiver frequency is shown in the main display. Adding or subtracting the displayed offset value to the main frequency displayed equals the transmit frequency.

3-2.5 SIMULTANEOUS RIT/XIT OPERATION Both functions can be activated. When both are activated, you are operating simplex at the offset displayed. The RIT/XIT knob sets the transceiver frequency to the displayed offset, not the main frequency display. This seems redundant but there is a good application. For example, you are running your own pile-up in a contest using RIT. Another station calls CQ 1 kHz above your transmit frequency. Tune in the station, using RIT. Press XIT. You are now simplex on the interfering station. Ask him to QSY and press XIT off. Your station is now back at your original transmit frequency.

3-2.6 CROSS BAND OPERATION This is most commonly required on 10 meters. An example is listening below 28.5 MHz and transmitting above 28.5 MHz. Although transparent to the operator, each band position covers 500 kHz. These splits can be programmed but the receive/transmit switching time will be longer. You may wish to use PTT (not VOX) on SSB and a manual transmit switch in the MUTE jack on rear panel for CW operation.

3-2.7 CROSS MODE OPERATION Whether operating on one band or cross band, cross mode is permitted. Put the receive setup in VFO A and the transmit setup in VFO B. Then use SPLIT mode to activate the opposite VFO during transmit.

3.3-0 THE MEMORY SYSTEM There are three types of memories:

One scratch pad memory
Band register for each ham band
100 general purpose memories

Each will store mode, filter selection, split frequency information, RIT and XIT. Band registers do not store split. Once a memory is stored, it may be recalled at any time. Memories may be used in one of four ways as described in detail in this section: MS (memory scroll), MT (memory tune), automatic memory tune, automatic band SCAN.

NOTE: Any of these multiple key command sequences can be aborted before completion by pressing the ***CLEAR button.***

3-3.1 USING SCRATCH PAD MEMORY First, make sure that MS and MT are both OFF. To store a displayed frequency in the scratch pad, press VFO ► M and hold for one second. An audible beep will sound when the data is stored (if annunciator feature is activated). To recall this data, press M ► VFO and hold for one second. Scratch pad contents will return to the active VFO.

3-3.2 BAND REGISTERS There is one band register for each ham band. It provides a method of quickly switching between two frequencies on a band. Tune VFO to a desired frequency. Press band button. Tune VFO to a different frequency. Press band button again. The frequency changed back to the first one. Each time band button is pressed, the two frequencies will exchange.

3-3.3 MEMORY STORE Set transceiver to the desired frequency, mode and I-F filter to be stored. Split, RIT and XIT will also be stored if active. Quickly, press VFO ► M . The lower right hand display will change to _ _. Using the numeric keypad, enter a channel number from 00 to 99 and the information will be stored automatically. If you do not wish to assign a channel number, when the "_ _" prompt appears, simply press ENTER and the information will be stored in the next unused channel. In this case, the unused channel number automatically selected will be displayed for a few seconds to allow you to note that channel number, if desired. If all channels are in use, the "_ _" display will remain. You can either enter a channel number to be replaced with the current data or abort by pressing CLEAR.

3-3.4 MEMORY RECALL BY CHANNEL NUMBER Press M ► VFO . The channel display prompt "_ _" will appear. Enter the desired channel number, 00 to 99, using the numeric keys. The data in that memory channel will transfer to the active VFO(s).

3-3.5 USING MEMORY SCROLL Press MS. Note indicator light is now on. Use the main tuning knob to scroll through the memories. Each memory will be displayed but the receiver will remain as set before MS was pressed. To cancel memory scroll, press MS again. To enter a displayed memory into the transceiver while using memory scroll, press M ► VFO . The transceiver will become active using the recalled data.

3-3.6 USING MEMORY TUNE Press MT. Tune through memories with main tuning knob. The transceiver is active on each channel as it is displayed. To cancel memory tune, press MT again. To enter a displayed channel into the VFO(s) while using memory tune, press M ► VFO . You can switch back and forth between MS and MT at random.

3-3.7 AUTOMATIC MEMORY TUNE Press and hold MT for one second. Transceiver will scan through memory channels automatically. The UP/DOWN buttons are used to adjust the scan rate. To enter a displayed channel into the VFO(s), press M ► VFO . To temporarily stop scanning, press and hold MT. To cancel scanning, press clear.

3-3.8 AUTOMATIC BAND SCAN Allows the transceiver to scan between two frequencies within a ham band. The beginning frequency is the currently displayed frequency and the ending frequency is the one stored in the band register. To begin scanning, press and hold the MS button for about one second. The UP/DOWN buttons can be used to change the scanning rate. The scan will continuously repeat from the beginning frequency until it is interrupted. The direction of the frequency scan can be controlled by which limit is chosen at the beginning of the scan.

To stop the scan and stay on that frequency, press ENTER. To cancel the scan and return to the original VFO frequency, press CLEAR.

3-3.9 LOCK Allows user to lock the main tuning knob from tuning only the selected VFO (A or B). The other VFO is still available for tuning. Also provides access to USER OPTION MENUS as explained in next section.

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TABLE 3-1 USER OPTIONS MENU

ITEM NAME	DESCRIPTION	SETTINGS
MENU 1		
Id	Station ID reminder. This activates an audio beep every 10 minutes as a notice to ID the station.	**OFF**, ON
ANC	Audio annunciator selection. This item controls the type of feedback for keypad button closures. ALL sets some buttons to provide a CW character when pressed. bp sets all buttons to report a single beep. OFF turns off the audio report.	**ALL**, OFF, bp
CCd	Continuous Clock Display. This item controls the clock readout. If it is set to OFF, then no clock readout will be shown.	**ON**, OFF
LCO	Linear Control Relay. This item enables the internal relay used for keying non QSK amplifiers.	**OFF**, ON
INt	Readout intensity. The brightness of the readouts and meter backlight can be set with this item.	0 -**15**
MENU 2		
bd	Baud rate selection for both the RS-232 and the "SPORT" serial port.	**1200**, 2400, 4800, 9600, 19200
C-Id	This sets the address byte for the transciever. This setting is checked by your third party logging software so that it can properly route its commands.	**04**, 00-64
CdE	Enable/Disable of the Continuous Date Echo mode. This controls whether the transceiver automatically reports changes from the front panel over the serial port.	**OFF**, ON
I CODE	Selects the operating mode of the built-in keyer.	A, **B**
MENU 3		
FEP	Frequency Entry Priority. This sets the primary function of the numeric keypad. LO sets the keypad to a bandswitch. HI sets the keypad for direct frequency entry.	**LO**, HI
bCP	Band Change Preference. If set to Full, band changes return to the last used frequency. If set to partial, band changes move to the same relative position on the next band. i.e. 21040 to 14040.	**F**, P
OdP	Offset Display Preference. If set to OFF, the main display always shows the transmit frequency. If set ON, the main display follows any RIT offset.	**OFF**, ON
SPD	Sets the tuning rate of the main tuning knob in SSB/FSK/FM modes. In kHz per turn.	**5.0**, 2.5, 1.67, 1.25, 1.0, .83
rSPD	Sets the tuning rate of the offset tuning knob in SSB/FSK/FM modes. In kHz per turn.	**4.8**, 2.4, 1.2, 0.6, 0.3, 0.15
CSP	Sets the rate of the main tuning knob in CW mode. In kHz per turn.	**5.0**, 2.5, 1.67, 1.25 1.0, .83
CrSP	Sets the rate of the offset tuning knob in CW mode. In kHz per turn.	**4.8**, 2.4, 1.2, 0.6, 0.3, .15

*** The selection shown in bold indicates the factory setting or default.**

3-4 USER OPTION MENUS The items in these three hidden menus permit the operator to tailor the transceiver to match their personal preference. To access the menus, press and hold the LOCK button for about 2 seconds. The readout will ask "choose", Press either 1, 2 or 3 on the numeric keypad depending on which items you wish to modify. Once a menu has been selected, use the main tuning knob to scroll through the items. Use the UP/DOWN arrow buttons to modify the status of each item. To switch to another menu, press the LOCK button once then select the new menu. To exit completely, press LOCK twice.

Refer to Table 3-1 for a list of the items in each menu and a description of the settings.

3-5.0 OTHER FRONT PANEL CONTROLS (Refer to Figure 3-1).

3-5.01 RF OUTPUT POWER (PWR) Set METER to FWD (forward power) and turn this control clockwise for the desired power level, up to 100 watts output. NOTE: If full clockwise does not result in 100 watts output, switch the meter to Ic collector current position and adjust the PWR control for an Ic not to exceed 20 amps. Read 3-5.02 below for more information on SWR.

3-5.02 FORWARD AND REFLECTED POWER Anytime 100 watts output is not available, the most likely cause is SWR in the 2:1 range or higher. The transmitter is protected under this condition by a current limit that will not permit it to draw more than 21 amps. The SWR (reflected power) position on the meter reads SWR directly, on the bottom scale. In case of high SWR, the cause should be corrected or an antenna tuner should be used.

3-5.03 MIC GAIN ADJUSTMENT With PTT or VOX activated, speak into your microphone at normal operating voice level and adjust MIC gain control so the ALC light just blinks on voice peaks.

3-5.04 SPEECH PROCESSOR USE Press PROC (processor) switch ON. Switch METER to PROC. Adjust PROCESSOR control until voice peaks are in the heavy black line range just beyond half scale on the bottom PROC scale. Now, check the MIC gain setting and re-adjust, as needed, for ALC light blinks on voice peaks.

NOTE: The processor meter function is active even in receive mode. To prevent this from interferring with the S meter, switch away from the PROC position when it is not being used.

3-5.05 -20dB RECEIVER ATTENUATOR Because of the outstanding selectivity and usable dynamic range of this receiver, you may never need the ATTN feature. Should you experience receiver overload, turn the ATTN on.

3-5.06 NOISE BLANKER This noise blanker is designed for pulse noise such as engine ignition, many common types of power line noise and noise from some common household appliances. When such noise is present, simply adjust the N.B. control for minimum interference. Always leave the N.B. control in the maximum counterclockwise position when not in use. This position is off. NOTE: Voice peaks on a strong SSB signal look like noise pulses to the noise blanker. These peaks will be blanked if the N.B. control is not in the full CCW position and the received signal audio may sound badly distorted.

3-5.07 AUTOMATIC GAIN CONTROL (AGC) ON/OFF The function of AGC is to maintain a relatively constant audio level over a wide range of received signal strengths. Some operators will argue that under extreme weak signal conditions better intelligibility is delivered with the AGC off, the AF gain full clockwise and using the RF gain control for a vol-

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ume control. Use caution when using this setup, keep one hand on the RF gain control. If a strong signal appears nearby, it will be very loud. The more commonly used setup is the AGC on, RF gain full clockwise and using AF gain for the volume control. If AGC is off, "S" meter is not active.

3-5.08 AUTOMATIC GAIN CONTROL, FAST/SLOW This switch selects the decay time constant of the AGC circuit. As a general rule, use FAST AGC on key-down modes such as RTTY, and FM, weak SSB and CW signals. Use SLOW AGC on strong SSB and CW signals. This will minimize the noise level received between voice peaks and CW characters.

3-5.09 AUDIO (AF) AND RF GAIN CONTROLS As a general rule, the RF gain control will always be set at maximum clockwise and use the AF control for audio volume level adjustments. See 3-5.07 AGC ON/OFF above, for alternate methods.

3-5.10 S-METER When the transceiver is in receive, the RF gain control at the maximum clockwise position, and AGC is ON, the S-meter is functional, regardless of the METER switch position. Each S-unit is 6 dB. S9 is calibrated at 50µV.

3-5.11 SQUELCH This control is in the circuit in the FM mode only. Select FM mode, tune to a clear frequency and adjust the squelch control just into the threshold for receiver quieting.

NOTE: FM operation on the HF bands is presently authorized from 29.0 to 29.7 MHz only.

3-5.12 PASSBAND TUNING (PBT) This is one of the most useful of all of the receiver controls. It allows you to move the passband back and forth across the desired signal. It can be used to "drop" QRM out of one side or the other of the passband or it can simply be used to improve the quality and intelligibility of a signal. Typically the operating position of the control on SSB and CW will stay between 10:00 and 2:00 and will normally be right at 12:00. This may vary depending on which I-F filter is selected. When operating any of the digital modes, such as RTTY, AMTOR or PACKET, the control position will center at about 3:00. Use PBT to balance the amplitude of the mark and space signals and to deal with QRM.

3-5.13 USING THE CARRIER NOTCH Two different notch filters are available for removing interfering carriers. The MANUAL notch is a narrow but deep notch filter that can be tuned from 200 Hz to 2.5 kHz using the front panel NOTCH control. This notch is available at all times and works well with CW and digital mode signals. When not in use, the NOTCH control should be left fully counter clockwise where it will not effect the audio passband.

The AUTOMATIC notch is implemented with a special digital algorithm in the DSP system. The NOTCH pushbutton enables this function. There is no frequency adjustment for the automatic notch, it will seek out and null all constant carriers in the receiver passband. This notch works well for SSB mode but is not useful in CW as it also tends to NOTCH out the desired signal.

3-5.14 QSK FAST/SLOW This pushbutton controls the quickness of the receive audio recovery after key up. The fast QSK setting will allow the CW operator to operate "full break-in" up to about 25 words per minute.

QSK SLOW allows the user to select a slower recover time. This feature is for operators that prefer to keep the receiver muted during short breaks in their CW transmission. To set the QSK delay, select CW mode then press the DLY button. Use the UP/DOWN buttons to select a setting between 01 and 15. This setting also controls the hang time of the linear control relay in CW mode. QSK can be overridden entirely by plugging a hand or foot operated transmit/receive switch into the rear panel MUTE jack.

3-5.15 ANTENNA SWITCH, MAIN/AUXILIARY If a traditional transceiver antenna is connected through the SO-239 coax connector on the rear panel, select MAIN antenna. If a separate receive antenna is connected through the rear panel AUX RX ANTENNA phono jack, select AUX. Both antennas may remain connected to the transceiver. They are switched internally for proper isolation.

3-6 REAR PANEL CONNECTIONS (Refer to Figure 3-2).

3-6.01 EXTERNAL SPEAKER This 1/4" jack supplies audio to an external 4-16 ohm speaker. The level is controlled by front panel AF control. Built-in speaker is muted when this jack is used.

3-6.02 INTERFACE PORT This 25 pin "D" connector allows direct RS-232 interface with a personal computer. See Chapter 5 for pin assignments. This port is also used to interface with TEN-TEC accessories such as the Model 420 Solid State Linear Amplifier. Accessory "Y" and extension cables are available. Use a standard straight thru serial cable to connect to your computer.

3-6.03 MARK/SPACE Controls the FSK circuit on the digital modes and is typically connected to FSK output jack of a modem or terminal unit. Logic levels required are less than or equal to 1.0 Vdc for MARK, equal to or greater than 2.0 Vdc for SPACE. Either a standard TTL level or open collector output will drive this input.

3-6.04 AUDIO IN This input is in parallel with the front panel MIC connector. Input level is adjustable by front panel MIC gain control.

3-6.05 AUDIO OUT Fixed level audio out, 1 mw @ 600 ohms, intended for accessories such as phone patch or digital mode equipment.

3-6.06 SERIAL PORT This 1/8" jack allows 2 wire computer control using TTL logic levels.

3-6.07 POWER A four pin connector is the input for primary dc power. See Chapter 1, Section1-1 for wiring information.

3-6.08 GND Ground post to be attached to the station ground.

3-6.09 TX OUT/TX EN Amplifier control lines for use with TEN-TEC QSK linears. Must be jumpered when not connected through a TEN-TEC amplifier or the OMNI VI *Plus* will not transmit.

3-6.10 MUTE Input for manual transmit/receive switching such as a hand or foot switch used to over-ride QSK on CW mode.

3-6.11 PTT Use for transmitter control on any mode other than CW. This is in parallel with the PTT connections on front panel MIC connector. Generally used for external systems such as digital gear.

3-6.12 KEY Connection for an independent, external, CW key or keyer.

3-6.13 KEYER To connect external paddles to operate built-in electronic keyer. See Chapter 1, Section 1-4 for wiring information.

3-6.14 AUX +13.5 V Any accessory that operates at 13.5 Vdc, less than 2 amps, can be powered from this jack. Turn off power before connecting to or disconnecting from this jack.

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3-6.15 RELAY [N.O.] Used to control non-QSK amplifier requiring heavy relay switching capacity. Delay is adjustable in QSK SLOW. See Section 3-5.14. To enable this relay which is normally turned off, see Section 3-4, USER OPTION MENUS (LCO).

NOTE: *YOU MUST VERIFY THE AMPLIFIER KEY INPUT REQUIRES ONLY A LOW VOLTAGE DC CONNECTION TO GROUND.*

3-6.16 AUX RX ANTENNA Input for separate receive antenna. Selected by front panel antenna switch, AUX position. Antenna may remain connected whether or not it is in use.

3-6.17 50 OHM ANTENNA Connection to the transmitter output and antenna input to the receiver when a single antenna is used for transceive.

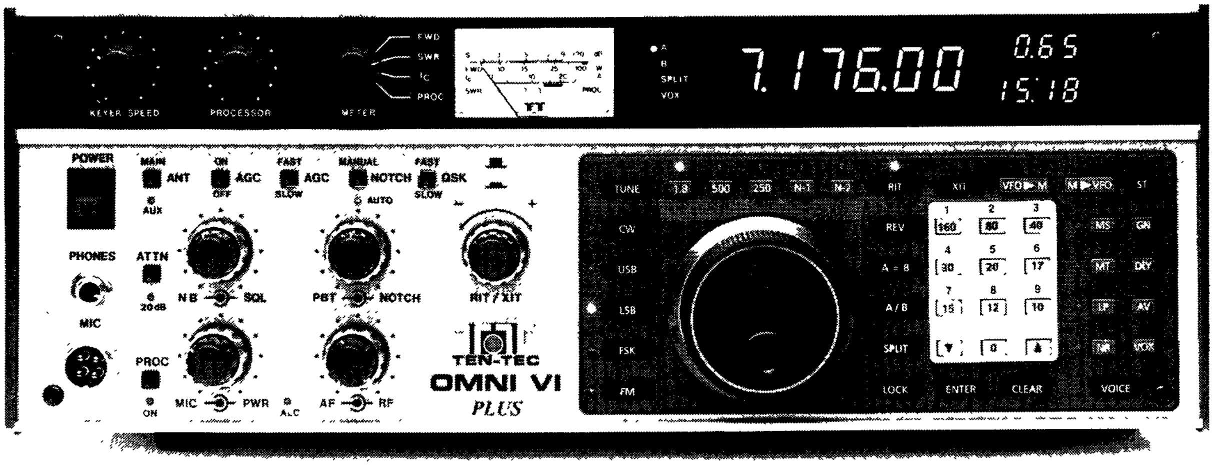

FIGURE 3-1. MODEL 564 FRONT VIEW

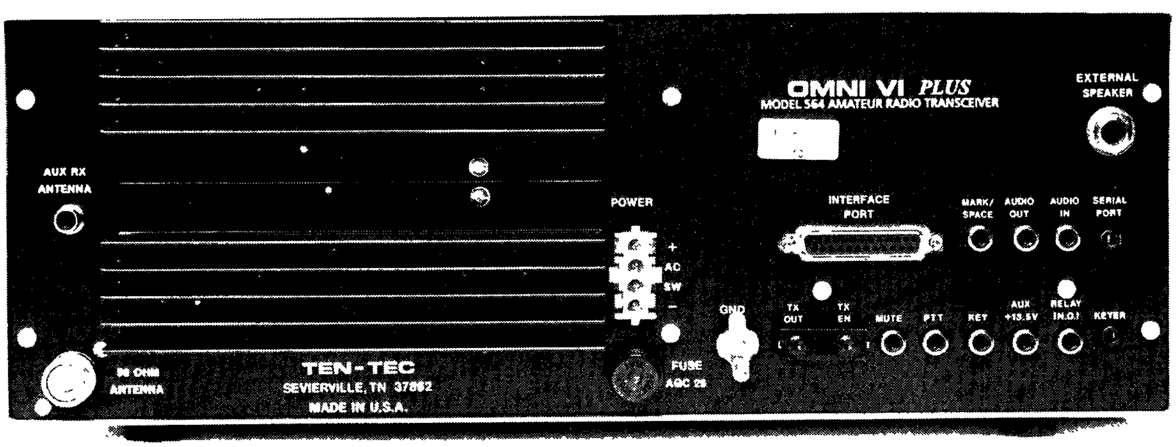

FIGURE 3-2. MODEL 564 REAR VIEW

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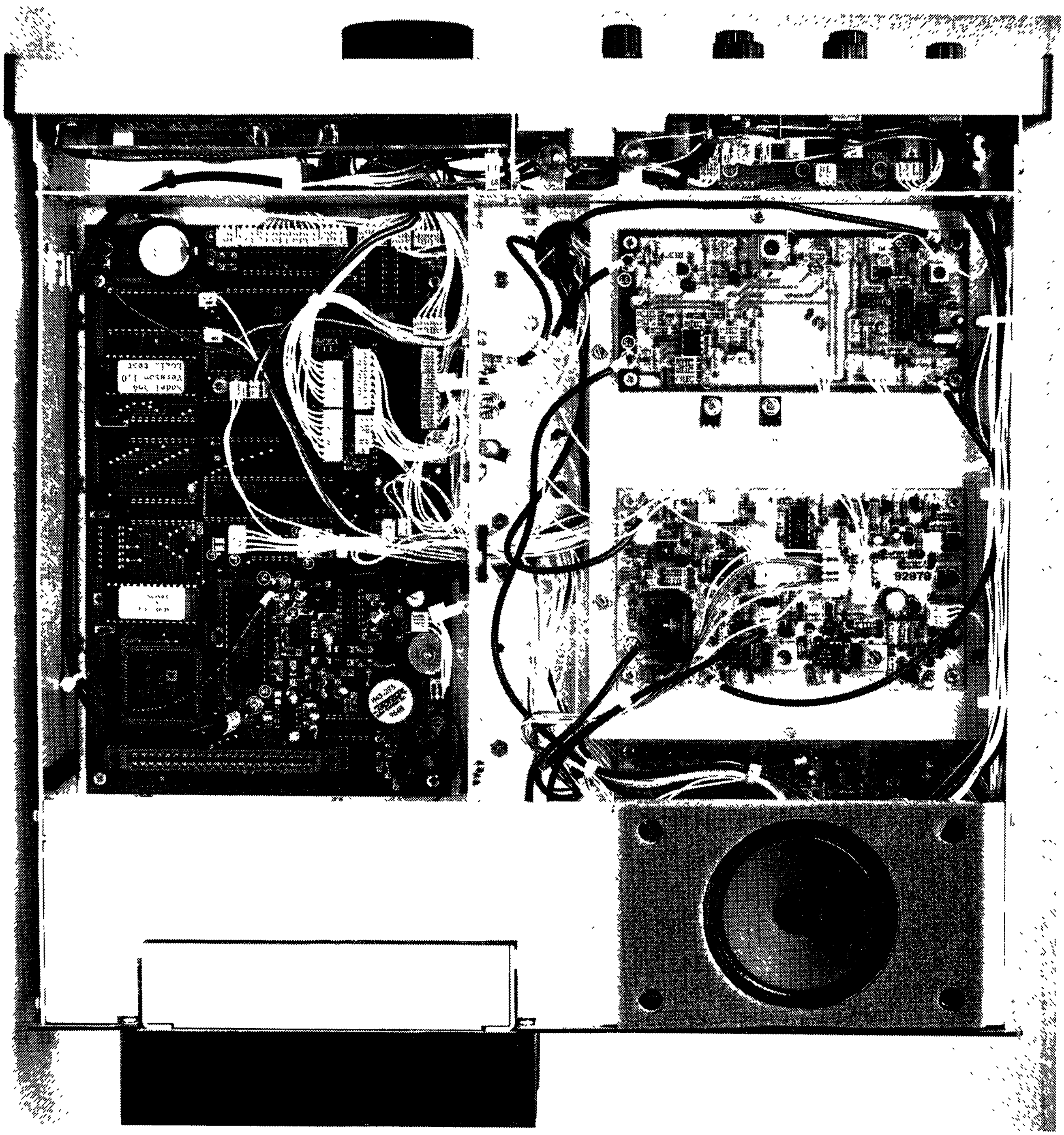

FIGURE 3-3. MODEL 564 TOP VIEW

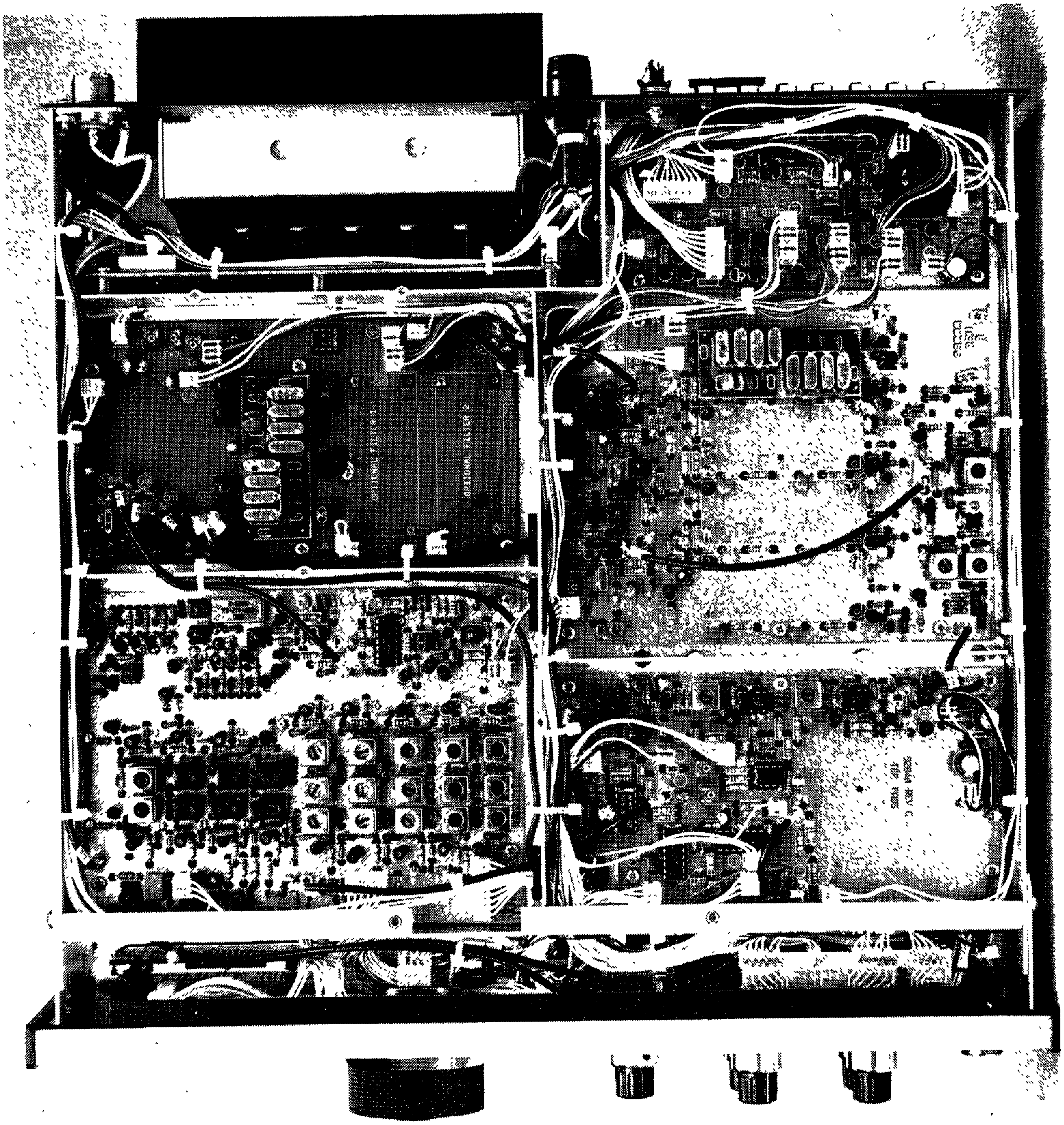

FIGURE 3-4. MODEL 564 BOTTOM VIEW

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CHAPTER 4

CIRCUIT DESCRIPTIONS AND ILLUSTRATIONS

4.1 INTRODUCTION: The following section contains detailed circuit descriptions and schematics for all of the circuit board subassemblies used in the OMNI VI Plus. Also included are outline drawings and photographs that show important components and adjustments.

4-2 DC POWER INPUT BOARDS (81591)

This module is located inside the low pass filter cage at the back of the transceiver. On the rear panel, the DC Power connector brings in +13.5 VDC through fuse F1. Only a fast blow style AGC25 should be used here.

On the DC Power Input board, Q2 controls the power-on relay K1. Q2 is biased on through the front panel POWER switch at connector 1. Over voltage protection is provided by D1 and Q1. If the DC voltage exceeds 16 volts, transistor Q1 will trigger and keep Q2 from closing the relay. Resistor R5 samples the current delivered to the 100W RF amplifier module. This small voltage drop is cabled through connector 5 to the 9 MHz Filter/ALC board where it is monitored by the ALC circuitry. Connectors 3, 4 and 6 distribute +13.5 VDC out to the other boards in the transceiver.

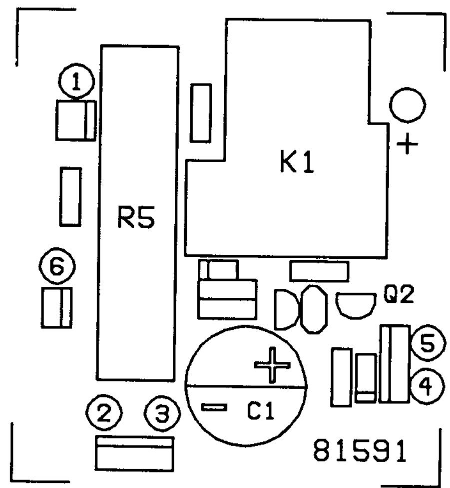

FIGURE 4-1: DC INPUT BOARD (81591)

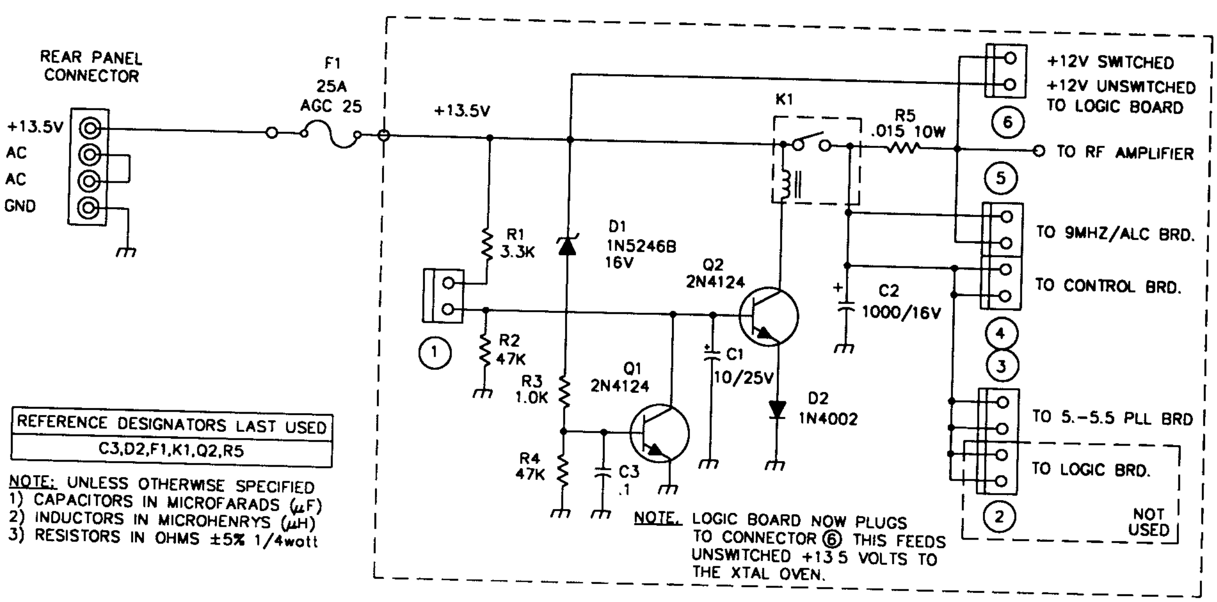

FIGURE 4-2: DC INPUT BOARD SCHEMATIC (81591)

4-3 LOW PASS FILTER BOARD (81592)

This module contains an array of six 5 pole low pass output filters, the T/R switching circuitry, directional coupler for forward power and SWR detection, and diode switched receive antenna circuits.

Six band lines from the BPF/Front End board enter at connector 14 where they pass through rf chokes L6-L11 and energize relays K2 - K13. These band lines also exit at connector 8, where they are routed through the TX Audio board to the 25-pin connector on the rear panel of the OMNI VI. Only one of the six lines is high at any one time based on the operating frequency of the transceiver.

The 100 Watt RF output of the PA passes through one of the selected low pass filters and then through the contacts of relay K1, which is energized by "T" voltage. The output power then proceeds through the primary of the SWR bridge transformer T1 to the rear panel antenna connector. Bridge transformer T1 and associated circuitry discriminate between forward and reflected power to develop drive voltages at connector 12 for the ALC and RF metering circuits on the 9 MHz Mixer/IF board. On receive, K1 is open and "R" voltage is either applied to R24 or R27 through connector 7. The front panel mounted ANTenna switch selects R27 for the main receive antenna and R24 for the AUX receive antenna at connector 13. When the Main Antenna is selected "R" voltage is applied through R24 to the emitter of Q1. This turns on Q1 and forward bias diodes D6, D7 and D8 thus allowing the signals from the Main Antenna connector to pass through to the receiver front end at connector 17. With AUX. Antenna selected "R" voltage is passed through R27 to turn on diodes D4 and D5 allowing the auxiliary receive antenna signals to pass through to the receiver front end.

During transmit, relay K1 is closed and passes the filtered PA output to the Main Antenna connector. A small sample of the transmit signal is passed through C12 to voltage doubler D11 - D14. They develop about 150 volts of reverse bias for diode switch D6, D7 and D8 to protect these diodes and prevent the transmitter signal from leaking into the receiver front end.

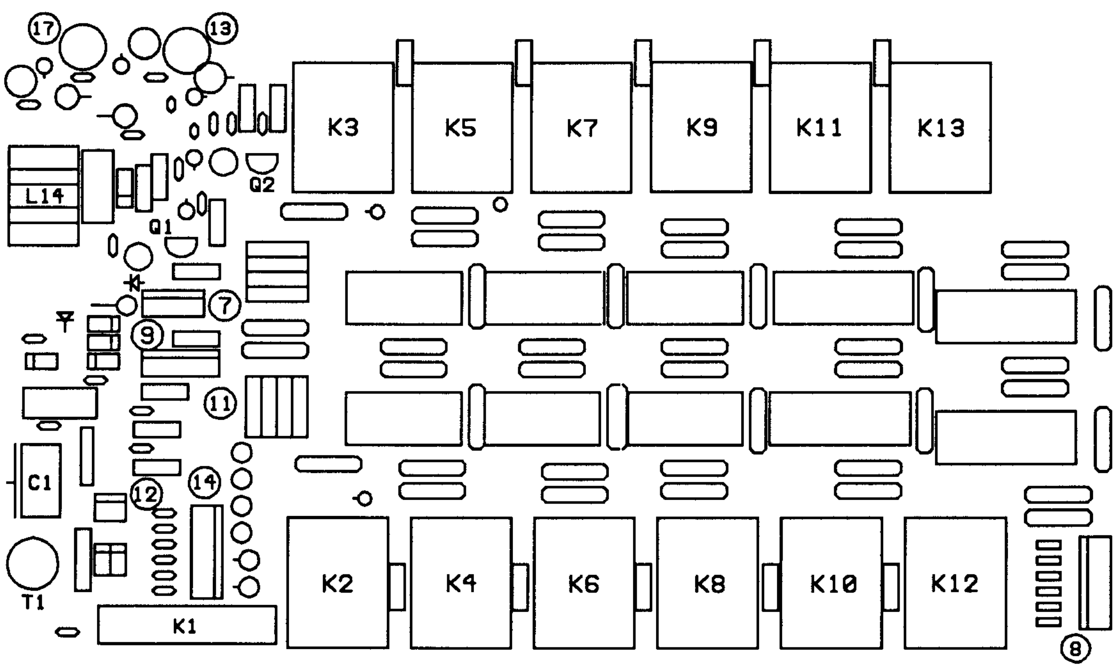

FIGURE 4-3: LOW PASS FILTER BOARD COMPONENT LAYOUT (81592)

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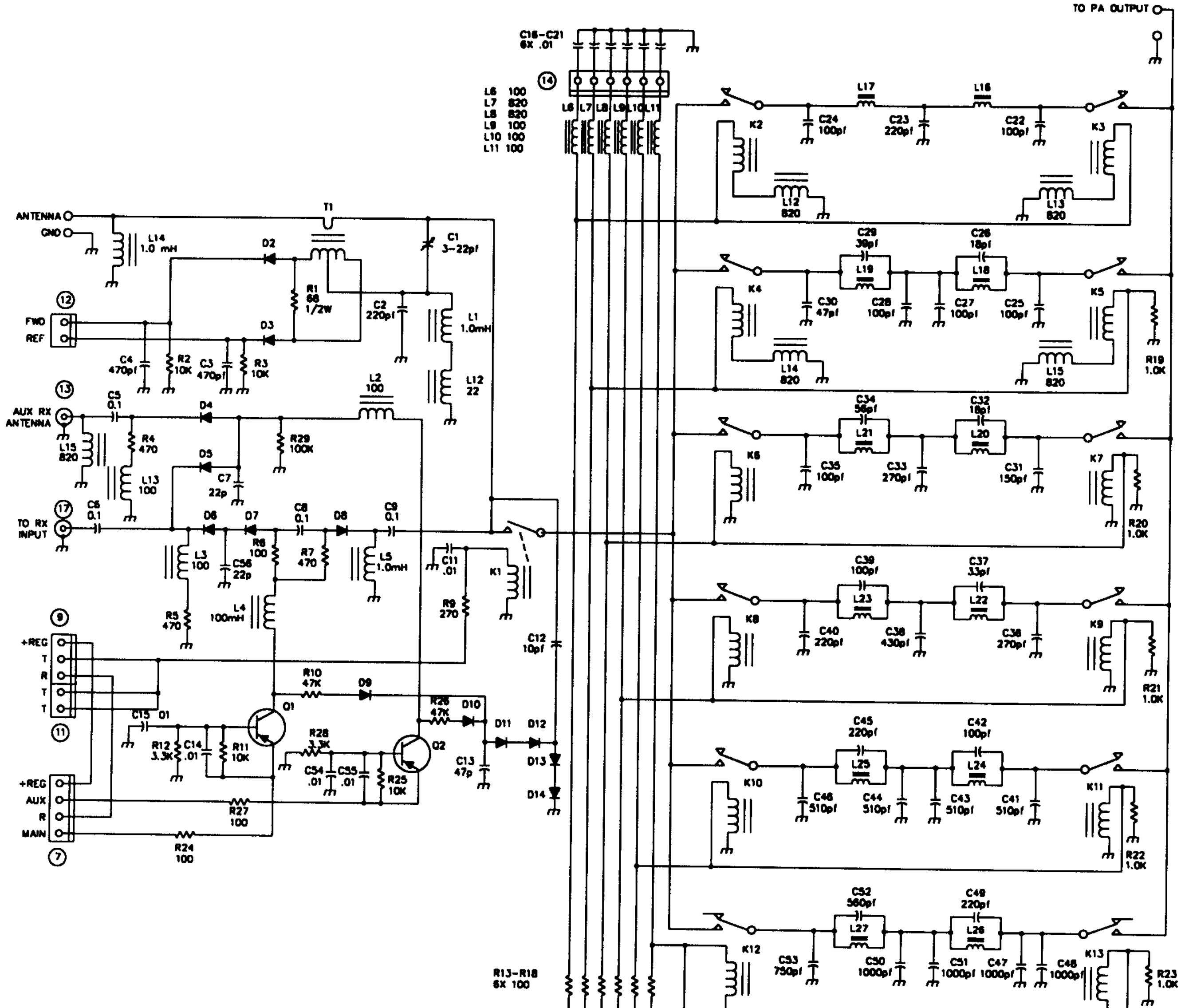

REFERENCE DISIGNATORS LAST USED
C56,D14,K13,L27,Q2,R29,T1

NOTE: UNLESS OTHERWISE SPECIFIED
1) CAPACITORS IN MICROFARADS (uF)
2) INDUCTORS IN MICROHENRYS (uH)
3) RESISTORS IN OHMS ±5% 1/4W

		NOT USED
D2-D3	BAT41	C10
D4-D5	MPN3700	R8
D6-D8	1N4007	D1
D9-D14	1N4148	
Q1-Q2	2N6519	

L16	85332-15	.32 uH
L17	85332-14	.32 uH
L18	85332-12	.43 uH
L19	85332-13	.40 uH
L20	85332-10	.58 uH
L21	85332-11	.43 uH
L22	85332-08	.81 uH
L23	85332-09	.65 uH
L24	85332-03	2.3 uH
L25	85332-04	1.8 uH
L26	85332-01	3.4 uH
L27	85332-02	2.6 uH

FIGURE 4-4: LOW PASS FILTER BOARD SCHEMATIC (81592)

4-4 BPF / FRONT END BOARD (81593)

This module handles the receive functions of band pass filtering, RF preamplifier, receive mixer and mixer post amplifier. Transmit functions include transmit mixer, transmit amplifier and band pass filtering.

On receive, the incoming signals enter at connector 17. Relay K1, R10 and R11 make up the switchable -20 dB attenuator network controlled from the front panel. Following the attenuator is an AM broadcast high pass filter which cuts out everything below about 1.6 MHz. This protects the filter switching diodes from large AM broadcast signals. Transformer T8 and capacitor C4, create a tuneable notch filter which is set to the receiver's IF frequency of 9 MHz. This network helps improve the IF rejection of the receiver, especially on the 40 meter and 30 meter bands where the desired signals are close in frequency to the 9 MHz IF.

Top coupled band pass filters, one for each ham band, are selected from connector 86. These filters protect the front end from unnecessary out of band signals and set the IF and image rejection performance of the receiver.

The grounded gate amplifier stage, Q2-Q5, provides about 9 dB of gain at a very low noise figure. It's output feeds the high level diode mixer D31. LO drive to the mixer is amplified by Q10 and Q11. The mixer output is terminated through matching transformer T6 into another grounded gate stage Q6-Q9. This post mixer amplifier is set for about 6 dB gain and drives the 9 MHz two-pole monolithic filter on the 9 MHz crystal filter board through connector 25.

On transmit, the active mixer circuit, U1, translates the transmit IF signal from connector 27 to the desired operating frequency. The mixer output is amplified by Q1 and applied to the band pass filters which remove unwanted mixer components from the transmit carrier. Once filtered, the transmit signal is routed from connector 24 to the Low Level Driver Board.

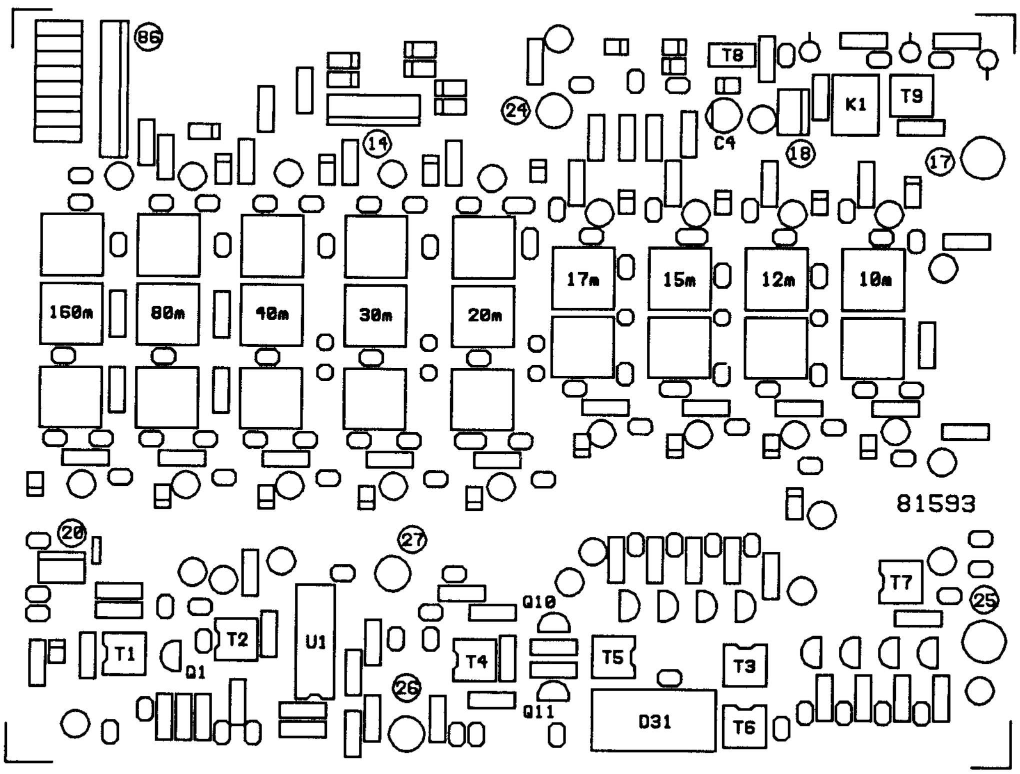

FIGURE 4-5: BPF / FRONT END BOARD COMPONENT LAYOUT (81593)

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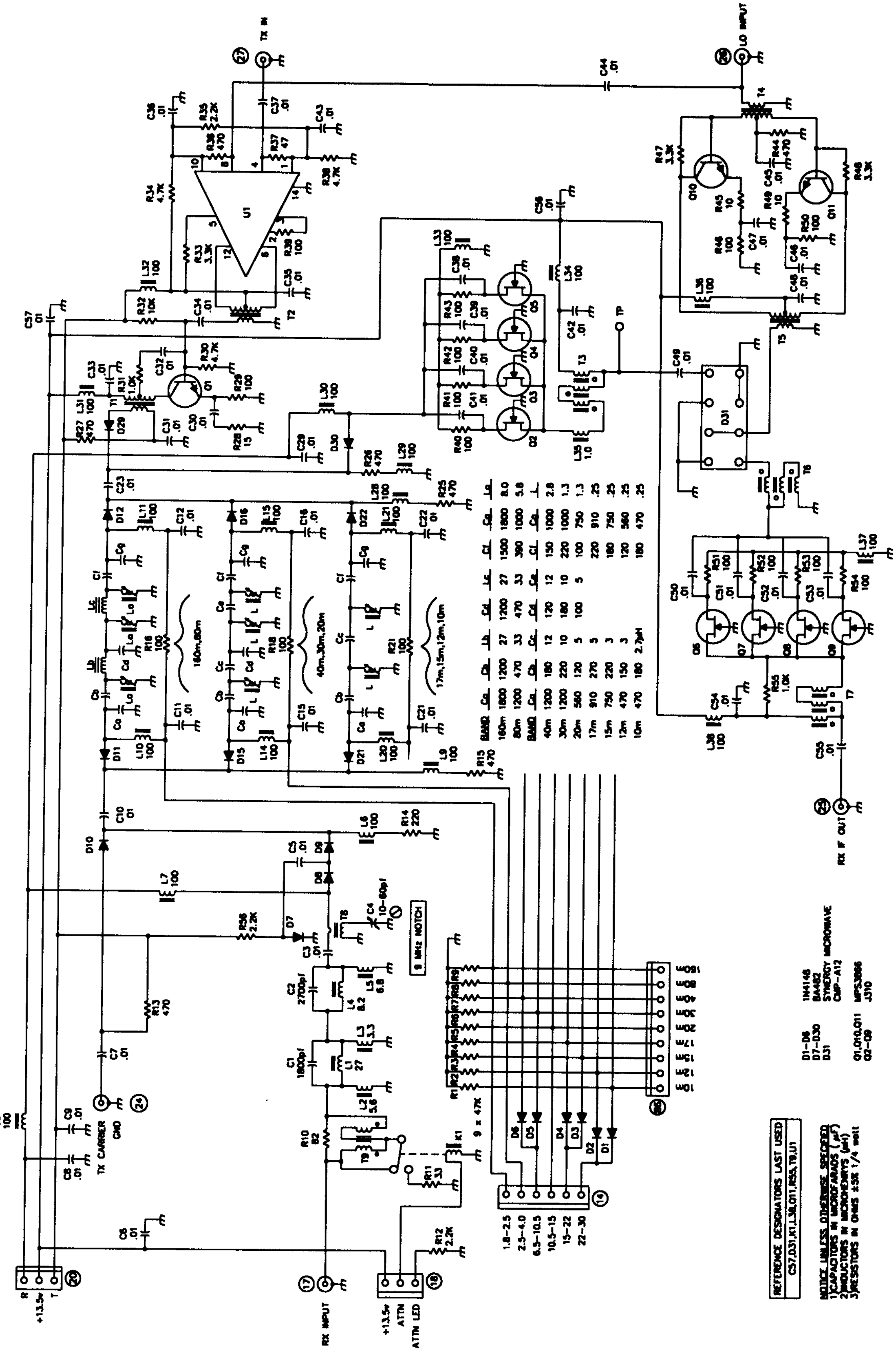

FIGURE 4-6: BPF / FRONT END BOARD SCHEMATICS (81593)

4-5 9 MHz CRYSTAL FILTER BOARD (81782)

The 9 MHz Crystal Filter module integrates transmit and receive functions. On receive this board performs the first narrow filtering for both FM and SSB/CW. Noise banker sampling and noise gate circuitry are also included and all the metering circuitry is included.

Receive signals from the Front / End 1st Mixer enter at connector 25. Two tuneable networks match a 2 pole monolithic filter, Y1, into the 50 ohm system. This 15 kHz bandwidth filter protects circuits further down from strong out of band signals. This is especially important to the operation of the noise blanker and FM detector.

The band limited signals are amplified by Q1, which drives buffer stage Q2 and the band pass filter of T2, T3 and C10-C12. This filter adds the slight amount of group delay needed to get the noise blanker's output pulse ahead of the offending noise pulse. The noise gate T4, T5 and diodes D1-D4, can then open in time to prevent noise spikes from reaching the narrow filter Y2. This eight pole 2.4 kHz ladder filter is the first stage of SSB/CW selectivity. Two additional filter positions can be selected with the front panel N1 and N2 buttons. These optional filters are positioned in series with the standard filter so that the two responses add. A low noise amplifier stage, Q4 between the two filters preserves the receiver noise figure and can be set to compensate for the loss of several different filters.

On transmit, single sideband generation is accomplished by using the standard 9 MHz filter to strip off one half of the double sideband signal at connector 37. This SSB signal is then amplified by Q7 and Q8. A voltage controlled attenuator, constructed from pin diodes D18 and D19, regulates the level of the transmit carrier at the output connector 27.

The control voltage for the attenuator is derived from the forward power voltage at connector 12. This arrangement provides negative feedback to hold the peak transmit output power constant under changing amounts of microphone drive. A separate circuit with U2 and Q14 monitors the Final Amplifier current consumption. The transmit carrier is cut back if the current drain exceeds a safe level. This feature gives the amplifier some tolerance to badly matched loads.

Alignment

In the receive path there are four tuned circuits to peak. C3 and C4 optimize the matching of monolithic filter Y1. C10 and C12 resonate the LC bandpass filter. These adjustments should be made using a signal generator and an audio level meter. Tune in the test signal and adjust each trimmer for peak output.

The transmitter alignment requires a 50 ohm dummy load, an accurate rf watt meter and a DC ammeter with 20 to 30 amperes full scale. Hook the ammeter in series with the DC supply to the transceiver. Using the 20M band, key the transceiver through the watt meter and into the dummy load. With the front panel RF PWR knob completely clockwise, adjust R46 for 100 watts. Set the Meter Switch to FWD and adjust R52 for a 100W indication. Set the meter switch to Ic and note the reading on the DC ammeter. Adjust R57 until the panel meter indicates 2 amperes less than the DC current measurements.

To set the current limiting, first turn back the RF PWR knob to about the 12 o'clock position. Now unplug cable #12. Slowly advance the RF PWR control while watching the DC ammeter. Adjust R54 so that the transceiver draws 22 amperes with the RF PWR control turned fully clockwise. Reconnect cable #12 and check that the output power returns to about 100 watts.

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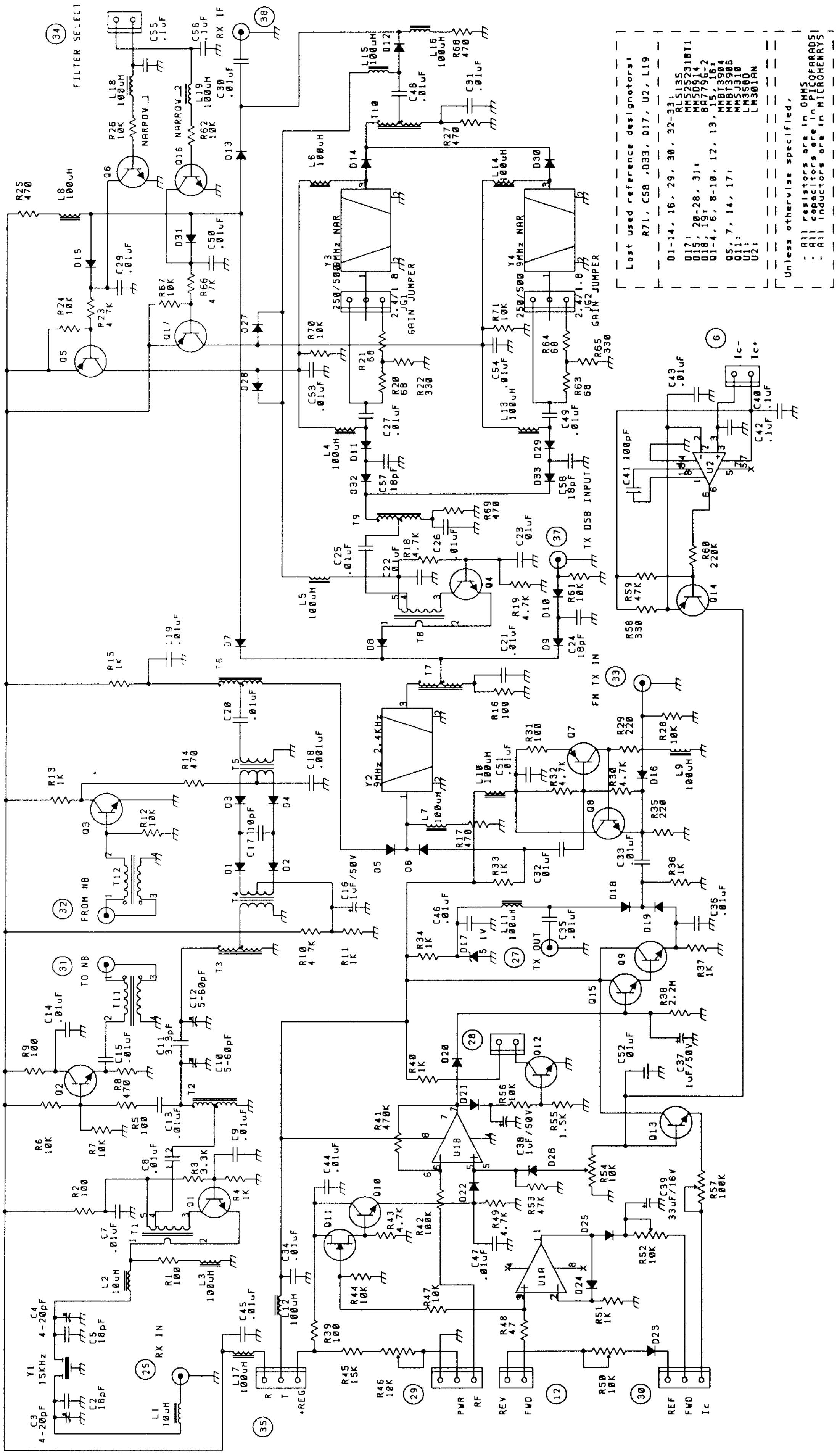

FIGURE 4-7: 9 MHz FILTER BOARD SCHEMATIC (81782)

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4-6 PASS BAND TUNING BOARD (81781)

The Pass Band Tuning module enables the operator to position a crystal filter passband relative to incoming receive signals. By adjusting the front panel PBT control, the receiver band width can be manipulated to reject interference. The standard 2.4 kHz 8 pole or one of three optional filters can be selected with the Bandwidth buttons above the main tuning knob.

Noiseless feedback amplifier Q1 takes receive signals from the 9 MHz filter board at connector 38. This stage feeds the diode ring mixer D1-D4. L.O. for the mixer comes from the 15.3 MHz voltage controlled crystal oscillator Q4. The mixer translates the 9 MHz input signal down to the 6.3 MHz passband of the crystal filters. The exact position of the receive signals relative to the crystal filter is set by the voltage on varactor D5. Two alignment steps set the tuning range to +\- 1.5 kHz.

One of the four filters is selected by the Logic board through connector 41. Each filter is preceded by a resistor pad to equalize the signal loss regardless of bandwidth and three pin diodes at each position help maintain the 90 dB ultimate rejection. Following the filters is the second mixer stage Q9. The dual gate MOSFET translates the receive signals back up to 9 MHz for the IF/AF board. Three tuned circuits with L17, L19 and L21 peak the response of the mixer.

Alignment

To set the tuning of the voltage controlled crystal oscillator, hook a frequency counter to the test point adjacent to the coax jumper cable. With the front panel PBT knob fully clockwise, adjust C24 for 15.3015 MHz. Now with the PBT knob centered, adjust R18 for a reading of 15.300 MHz.

To peak the three adjustable coils, tune in a test signal and watch either the S-meter or use an audio level meter to adjust the output for maximum.

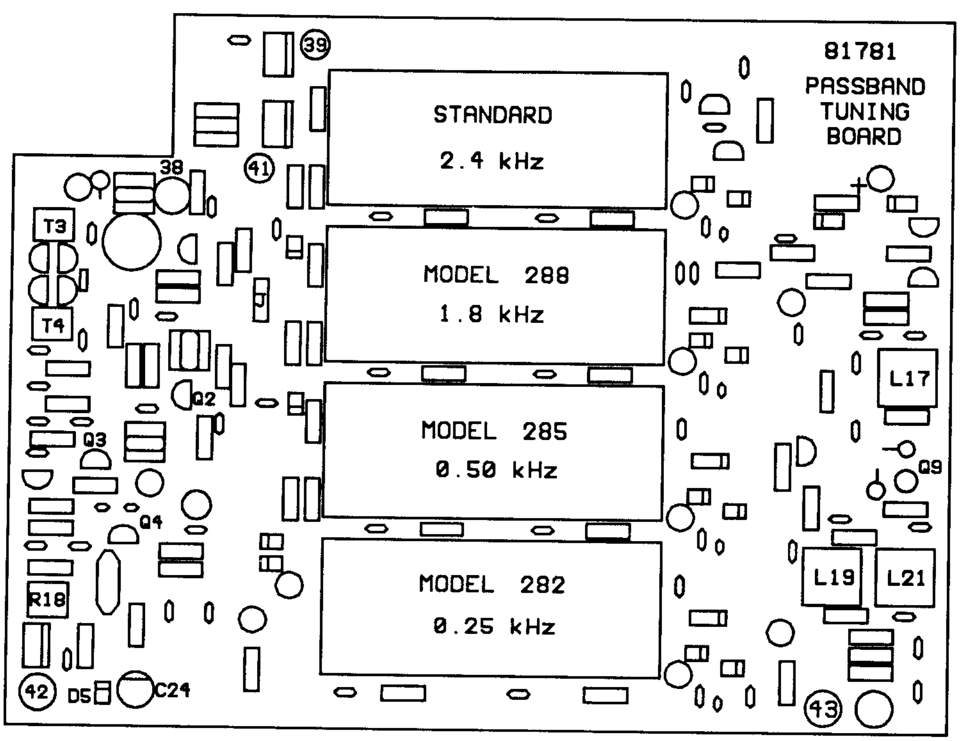

FIGURE 4-9: PBT BOARD COMPONENT LAYOUT (81781)

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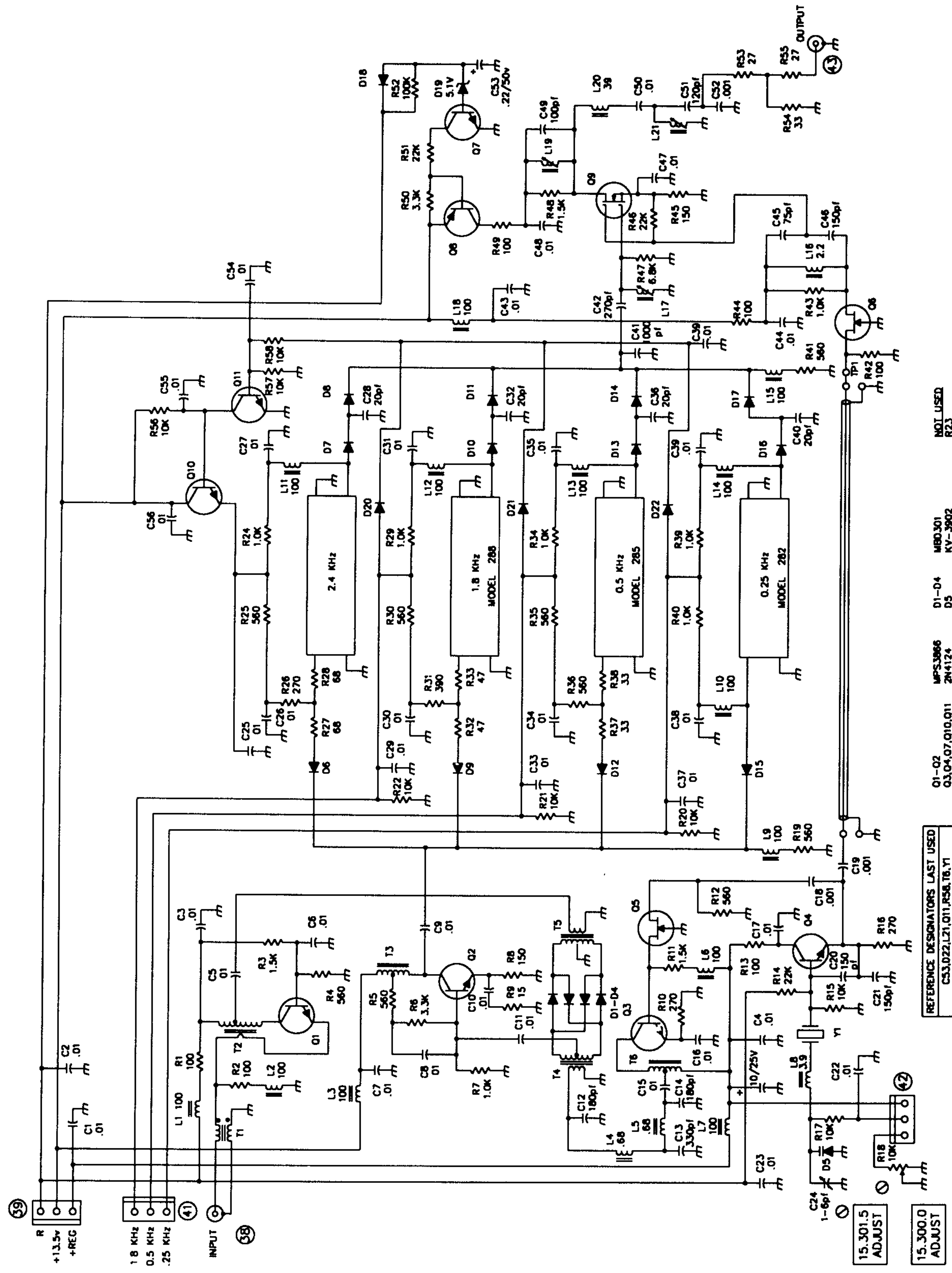

FIGURE 4-10: PASS BAND TUNING BOARD SCHEMATIC (81781)

4-7 IF/AF BOARD (81602)

The IF/AF module consists of three stages of IF gain, the AGC system, product detector and the audio circuitry.

Receiver IF signals from the Pass Band Tuning board enter at connector 43. Grounded gate JFET Q1 forms the first amplifier stage. The AGC voltage fed back to Q2 controls PIN attenuator diode D1 which limits the peak - to - peak signal level at the input of U1. Integrated circuit IF amplifiers U1 and U2 contribute most of the gain in the entire receiver. These two amplifiers are also controlled by the AGC voltage. Q3 buffers the output of the last amplifier and drives the product detector U3 and the AGC rectifiers D6 and D7. The AGC constants are set by R21, C30, R22 and C 27. The AGC FAST/SLOW/OFF switch connects at terminal 49.

The product detector U3 mixes the IF signal with the BFO from connector 46. The audio output at pin 6 is then filtered and applied to a switched capacitor notch filter U5. The notch frequency is determined by the clock rate from VCO chip U6. This is set by the control voltage from the front panel NOTCH knob at connector 53.

Analog switch U7A and U7C form a SPDT switch under the control of the Logic board. Audio from either the FM detector at connector U or the notch filter is selected and routed to the DSP interface chip through connector 54. Processed audio from the DSP circuitry then returns at connector 56.

The volume is set by the front panel AF GAIN knob at connector 55. A separate path around the AF GAIN control is provided by U7B. This switch is used to make the CW sidetone independent of the knob setting. Audio amplifier U8 provides up to 1.5 Watts to either the internal or an external speaker.

Alignment

Adjustable coils L3 and L5 peak the gain of the two IF amplifiers. Use either a steady off the air CW carrier or a signal generator and peak the S-Meter reading.

S-Meter alignment should be performed only after all the other receiver adjustments have been made, and will require a calibrated amplitude signal source.

Two trimmers, R29 and R25, adjusts the S-Meter offset and full scale. Start with a 50 uV signal into the antenna jack and adjust R25 for an S9 meter indication. Next lower the input to 1.60 uV and adjust R19 to read S3. Repeat these two steps several times until there is no interaction.

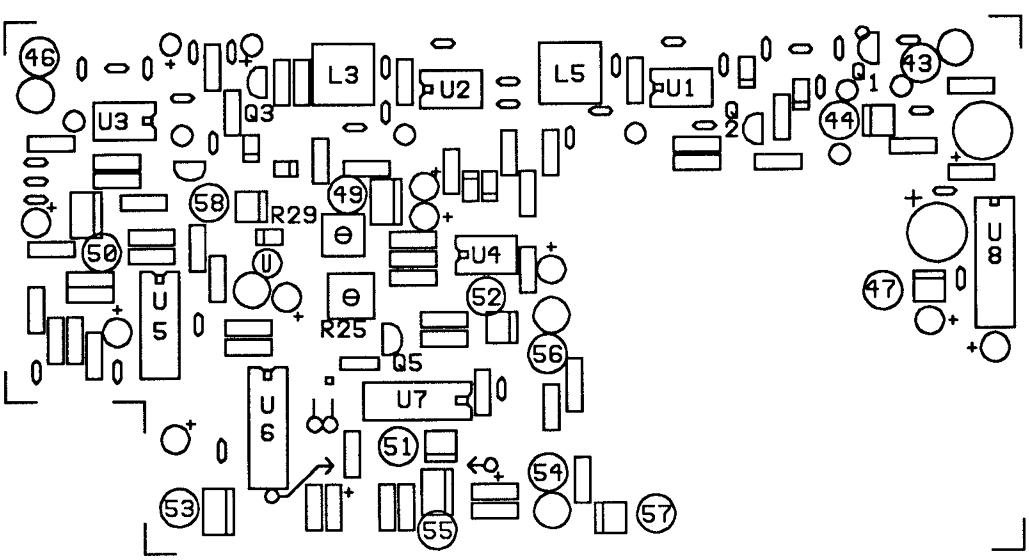

FIGURE 4-11: IF/AF BOARD COMPONENT LAYOUT (81602)

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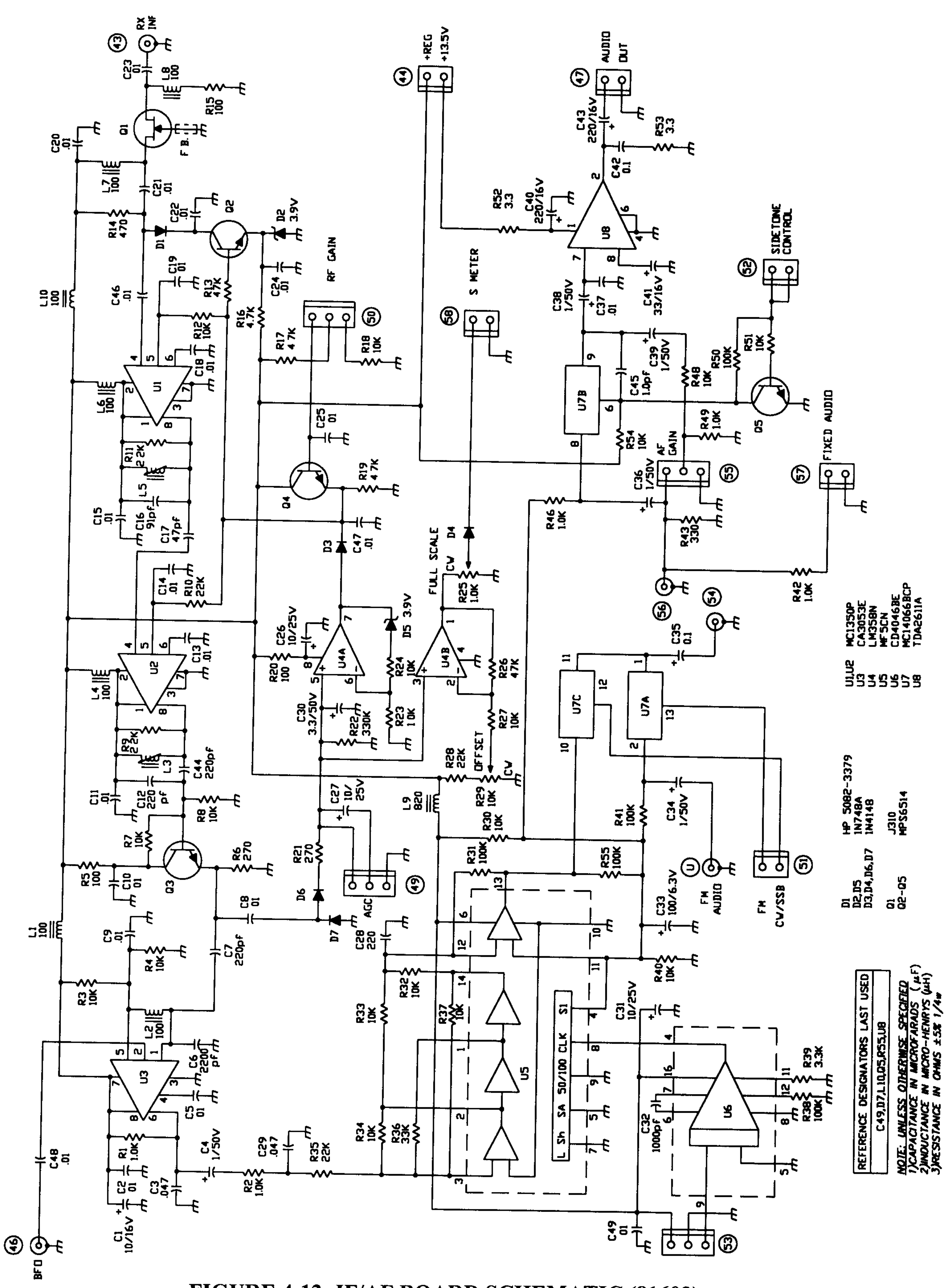

FIGURE 4-12: IF/AF BOARD SCHEMATIC (81602)

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4-8 5.0 - 5.55 MHZ PLL BOARD (81599)

The phase noise characteristics of the OMNI VI depend entirely on the design of the 5.0 - 5.5 MHz synthesizer. The synthesizer is actually a two loop system that operates at 200 ti 220 MHz and tunes in 400 Hz steps. Its output is then divided by 40 to produce the desired 5.0 to 5.5 MHz output. This division by 40 not only reduces the output frequency but also reduces the phase noise and spurious levels by a factor of 32 dB.

The synthesizer's 10 Hz tuning resolution is derived from a voltage controlled crystal oscillator (VXCO) Y1, Q2. Digital information from the microprocessor is clocked in serially t connector 87 and loads the shift register chip U3. The 8 bit output of U3 is applied to an R-2R resistor network, R23, which is used to provide digital-to-analog conversion of the outputs of U3. U4A and U4B buffer the analog output from the resistor network and provide gain and offset adjustments (R27 and R31) to align the frequency of VCXO.

The VCXO output from Q2 is doubled by T2, D1 and D2, and then heavily filtered before it drives the diode mixer in the feedback path of the main loop. The mixer D3-D6 subtracts the VCXO frequency from the main loop's output which has been buffered by Q4. This difference signal becomes the feedback for the main loop. Q3 is a filtered amplifier stage which boosts the mixer output to a level sufficient to drive the prescaler chip U5. Since the loop works to keep this feedback signal constant in frequency, the small steps from the VCXO are imposed onto the main loop output.

Reference and divide-by-N dividers in PLL chip U6 are programmed serially from the microprocessor through connector 87. The 10.0 MHz reference signal applied to connector 88 is divided internally in U6 by 1000 to generate a 10 kHz step size. Phase errors from the PLL's phase detector steer the charge pump circuit Q6-Q9. The VCO control voltage from the charge pump is low pass filtered and biases varicap diodes D9 and D10. The VCO output is applied to a two way splitter comprised of T5 and R49, and drives both the mixer buffer stage Q4 and the high speed divide-by-ten chip U7. The output of U7, a square wave of 20-22 MHz, clocks a divide-by-four circuit in U8. The 5.0 to 5.5 MHz signal from U8 is then filtered to remove harmonics and exits to the LO mixer board.

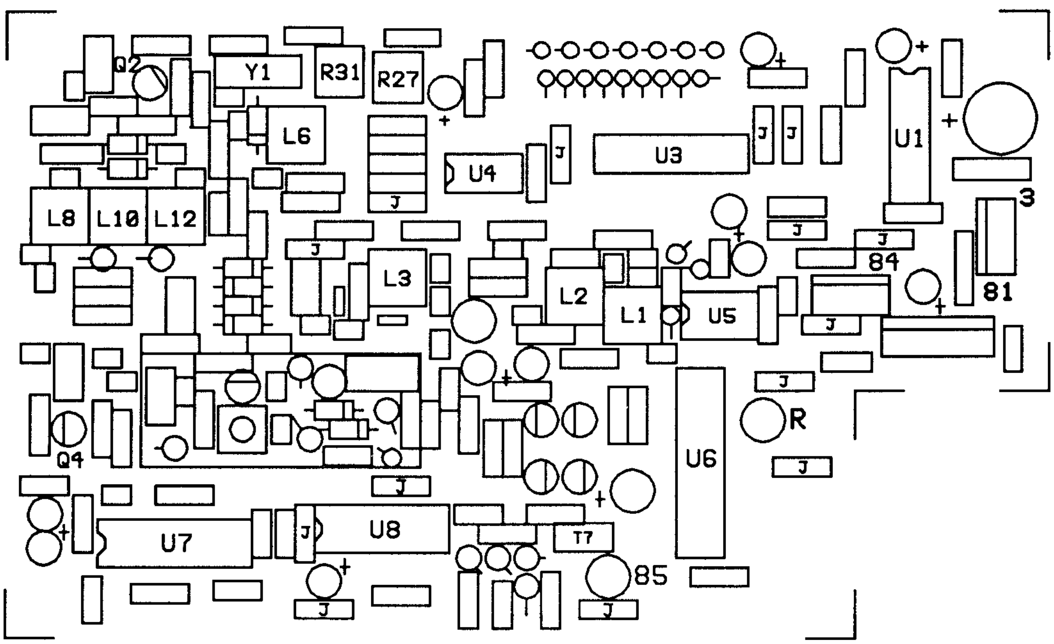

FIGURE 4-13: 5.0 - 5.5 MHZ PLL BOARD COMPONENT LAYOUT (81599)

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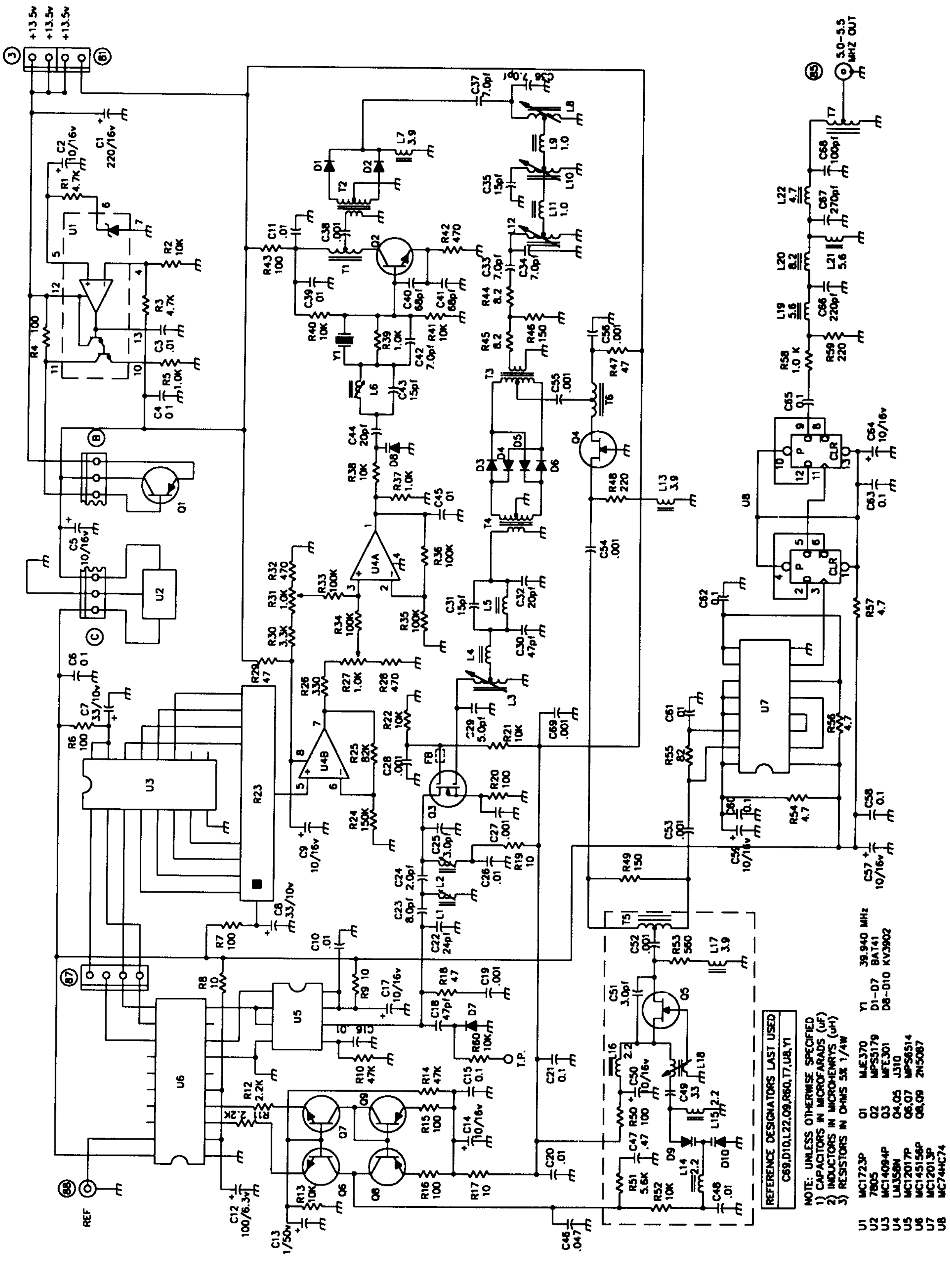

FIGURE 4-14: 5.0 - 5.5 MHZ PLL BOARD SCHEMATIC (81599)

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4-9 XTAL OSC. - L.O. MIXER BOARD (81595)

This module generates the main local oscillator signal which is applied to the transmit and receive mixers in the front end. Band switching information from the Logic board enters via connectors 82 and 83. One of the ten crystals is pin diode switched into oscillator stage Q1. Buffer stage Q2 drives one side of the LO mixer through a low pass filter and also drives the oscillator level detector D25, Q3. Transistor Q3 sets the bias point of the oscillator stage to stabilize the oscillator output level and to limit the drive in the crystals for better aging. Part of the crystal oscillator signal is fed through buffer transistor Q9 to the Logic board via connector 84. A PLL circuit on the Logic board compares this signal to a precision reference frequency and sends a d.c. correction voltage back to the oscillator via connector 84, through R26, R20 to varactor diode D26. This ensures that the crystal oscillator is always locked to a precision reference for improved frequency stability and accuracy.

The synthesized 5.0 to 5.5 MHz signal at connector 85 is mixed with the crystal oscillator signal by active mixer U1. The desired mixer product id filtered by one of five band pass filters and then amplified by transistors Q6, Q7 and Q8. The L.O. output is then taken off through a 9 MHz trap, T5 and C63, which helps eliminate undesired products from the mixer which could leak into the receiver IF.

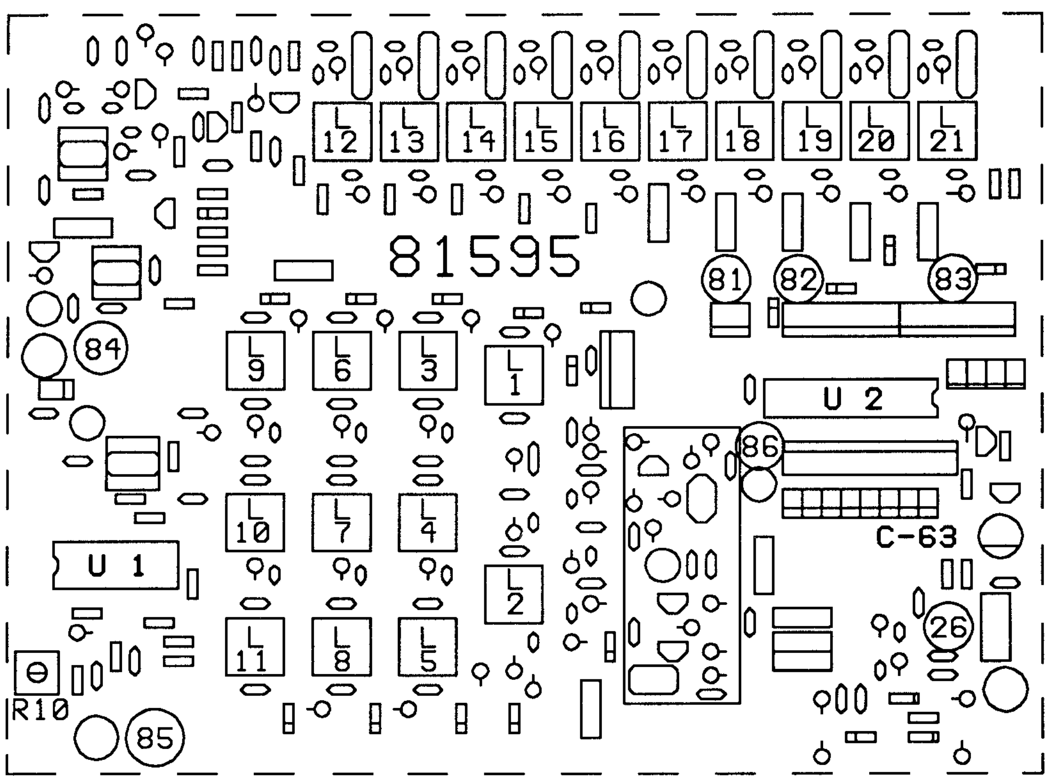

FIGURE 4-15 XTAL OSC. - L.O. MIXER BOARD COMPONENT LAYOUT (81595)

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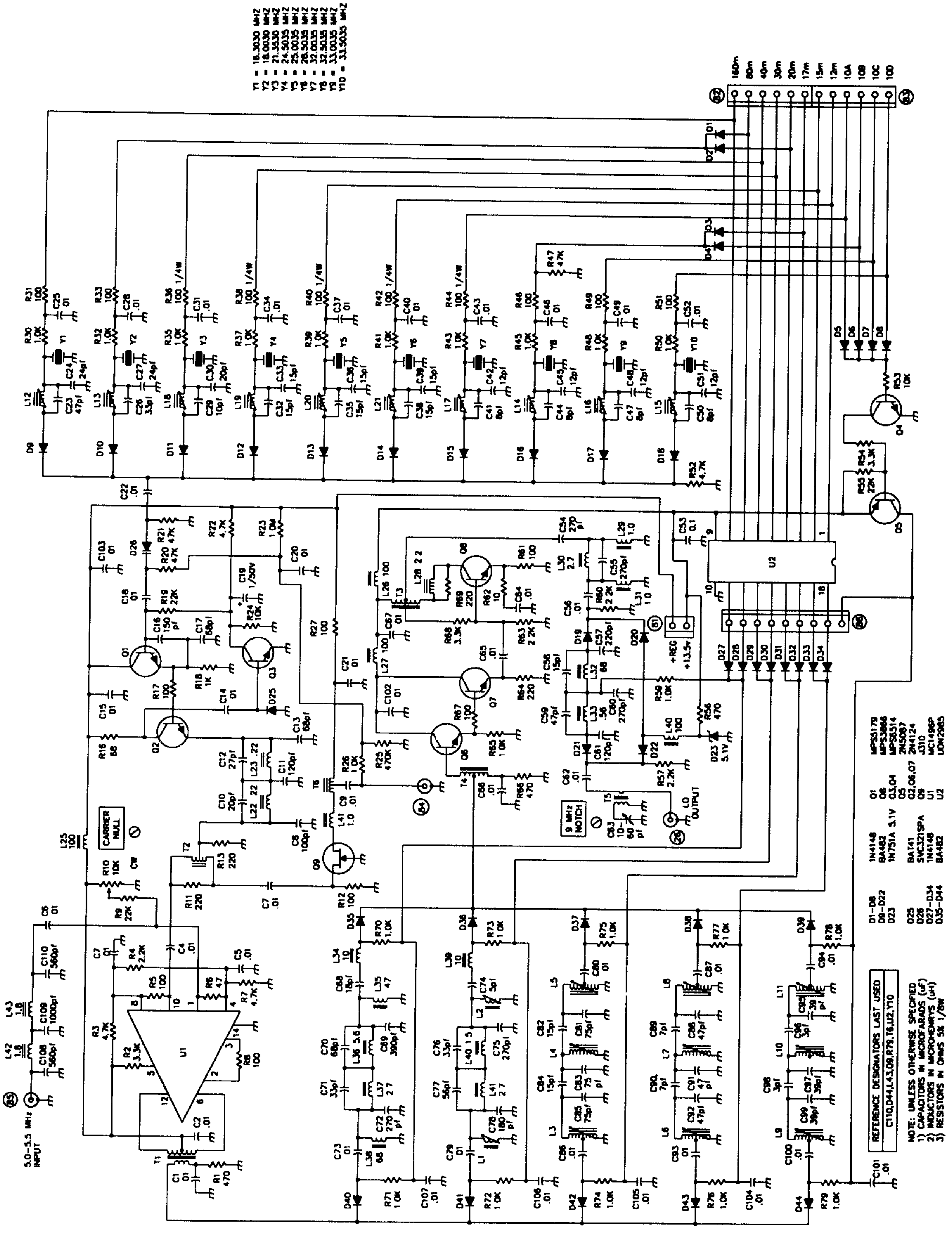

FIGURE 4-16 XTAL OSC. - L.O. MIXER BOARD SCHEMATIC (81595)

4-10 CONTROL BOARD (81596)

Based on inputs from the Logic board, rear panel jacks and front panel switches, this module develops the control voltages that power various stages throughout the transceiver. This board also features an adjustable wave shaping circuit that sets the rise and fall times of the transmitted CW envelope.

The main mode information from the Logic board enters at connector 59. Diode and transistor switching circuits combine these mode lines with "T" voltage (indicating a key-down) to manipulate the BFO frequency through connector 60.

A request to key the transmitter is generated by grounding either the rear panel or mic connector PTT lines, or the rear panel CW KEY. Any of these inputs will turn on transistor Q9 which sends a transmit request signal to the Logic board via connector 66. The microprocessor calculates the transmit frequency based on RIT, CW offset, etc. and reprograms the phase lock loop. After a short delay of about 10 milliseconds, the Logic board generates a transmit acknowledge voltage at connector 63. This signal becomes the external keying loop that is normally jumpered on the rear panel. If an external amplifier is to be used, it can be included within the keying loop so that the amplifier can control the timing of the keying and prevent hot switching.

A separate MUTE input on the rear panel can be used to mute the receiver and key the linear relay if it is enabled in the user menu. No transmitter output is generated however until either the KEY or PTT lines are grounded. This method is generally used with non-QSK amplifiers.

The rise and fall times of the CW rf envelope are controlled by the integrator circuit of Q12-Q15. Resistor R24 sets the slope of the "TD" signal which is used to bias the double balanced mixer on the TX audio board. This adjustment will set the transmitter rise time between about 2 and 4 milliseconds.

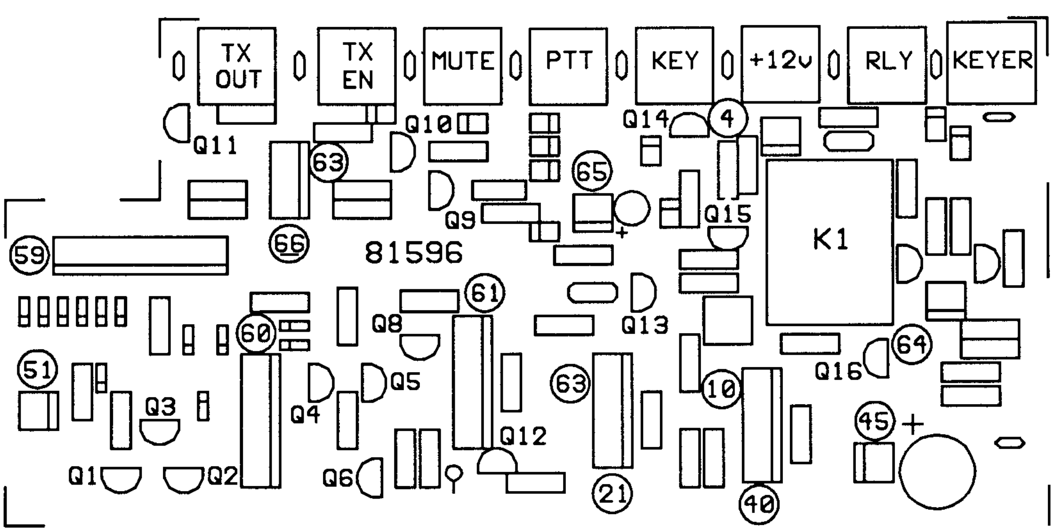

FIGURE 4-17: CONTROL BOARD COMPONENT LAYOUT (81596)

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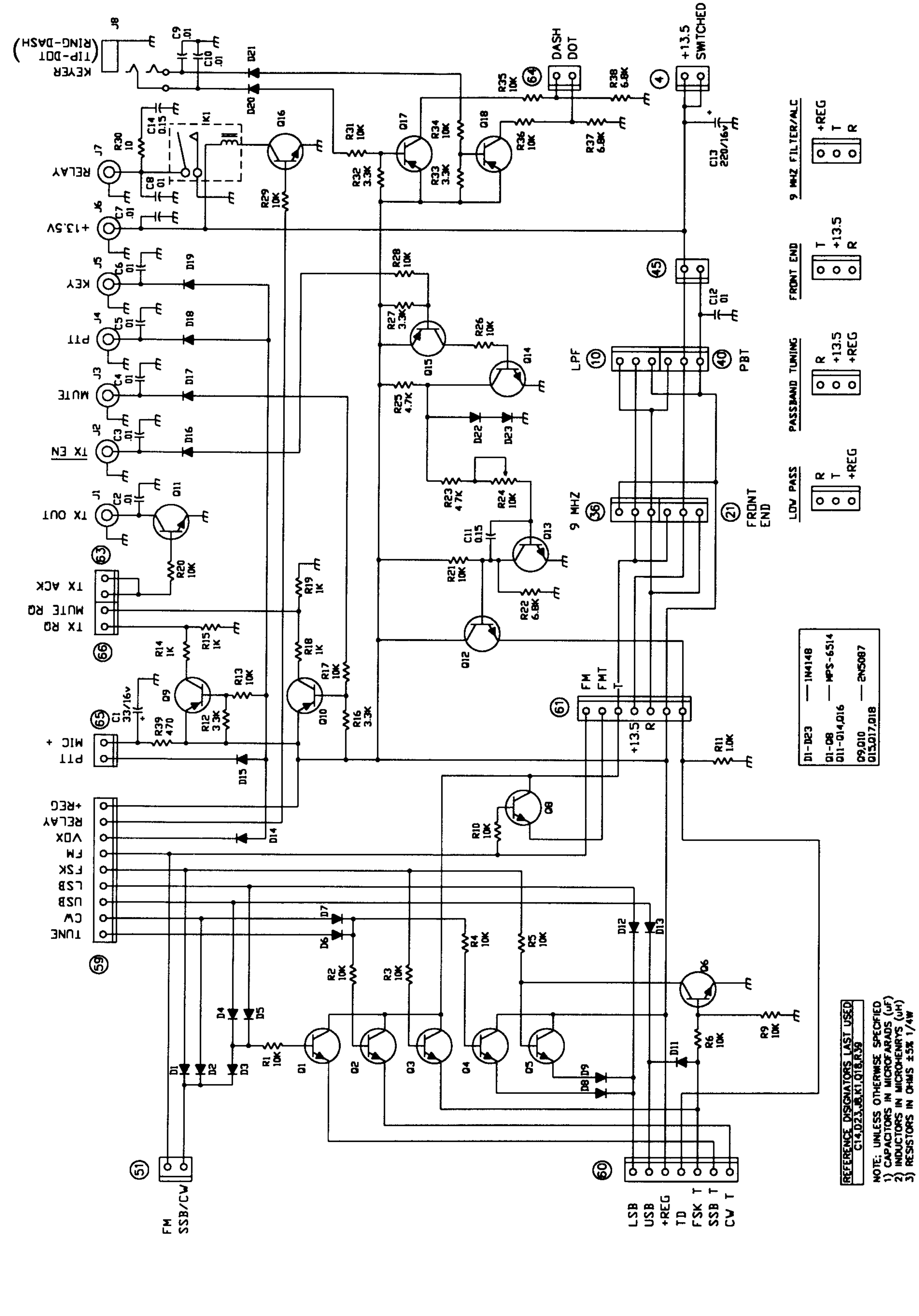

FIGURE 4-18: CONTROL BOARD SCHEMATIC (81596)

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4-11 LOGIC BOARD (81606)

This module integrates the LOGIC< DSP and CRYSTAL LOCKING subsystems onto a single pc board. An 80C32 microprocessor (UI) operating at 20 MHz, a 32k EPROM (U4) and 8K of battery backed RAM (U5) from the core of the logic system. The 80C32 processor is a member of the 80C51 family of processors and contains 256 bytes of on-chip ram, two 16 bit counter/timers, full duplex serial interface and multiple interrupt capability. A 74HC573 latch (U2) performs and address demultiplexing and a 74HC138 (U3) provides address decoding for the bus-oriented peripherals. In addition to the EPROM (ROM space $0000-$7FFF) and RAM chip (RAM space $4000-$5FFF), the logic system core also includes a real time clock (U6 RAM space $E000), an Analog to Digital converter (U7 RAM space $2000) and 82C55 I/O expander (U20 RAM space $000). The DSP subsystem is memory mapped into the microprocessor RAM space at address $A000 and the Optional Voice Board is memory mapped to $C000. Also included on the Logic board are a serially programmed 32 bit high current driver (U22) which provides bands switching signals for the transceiver and controls the front-panel keypad indicators. The DSP subsystem is comprised of integrated circuits U8, U9, U10, U11, U16 and U23. The DSP subsystem is based on the ANALOG DEVICES ADSP 2105 DSP PROCESSOR with a cycle time of 100 nanoseconds. A 27C64 EPROM (U9) contains the DSP program which is loaded into the 2105's internal ram during system power-up. A serial CODEC (U11) provides the Analog to Digital and Digital to Analog functions of the DSP system and anti-alias filtering with a pass band of 200 Hz - 3400 Hz. U23 and transistor Q13, and diodes D4, D5 provide the 5V required by the CODEC. Receiver audio reaches the DSP sub-system via coax connector 54 and exits the DSP sub-system via connector 56. The DSP processor RESET line, is connected to the main microprocessor via U20 which allows the microprocessor to perform DSP sub-system reset during power-up.

IC U16, a 7400 NAND GATE and IC U8, an 8 bit LATCH provides the interface to the DSP PROCESSOR bus with the Main microprocessor bus. The interface provides a one-way (MICROPROCESSOR to DSP) interface. The write signal from the microprocessor also provides an interrupt to the DSP processor to inform the DSP subsystem that a new command has been received.

IC's U17, U18, U19 are used to interface the MAIN, REMOTE and OFFSET encoders to the Microprocessor. U19 is used to ensure smooth operation of the offset encoder by cleaning-up the encoder pulses before they reach the microprocessor. IC's U17 and U18 in conjunction with resistor R30, R31, capacitors C25, C26 and diodes D2, D3 operate to provide an interrupt pulse for each phase change generated by the encoders. When the microprocessor receives this interrupt request signal, the software tuning routines analyze the encoder signals to determine which encoder is moving and in which direction by reading the encoder positions via the 82C55 I/O expander. IC U21 interfaced via U20 to the microprocessor, provides the keyboard scan for reading keypad status. Serial interface circuitry based on U14 and TRANS??? provides level Q18-Q11 translation for RS-232 and TTL levels via connectors 72 and 69. Transistors Q1 and Q2 form a 20 MHz oscillator which provides the 20 MHz processor clock and after dividing down the 5 MHz clock to the DSP CODEC. U13, a serially programmed PLL IC provides the Crystal Locking control. A sample of the selected Band crystal is fed to the PLL via connector 84, an error signal is generated by the PLL chip and the crystal frequency is adjusted as necessary via the charge pump circuit which feeds a DC correction voltage back over the RF sampling line. A varactor diode located on the crystal board provides the necessary crystal adjustments.

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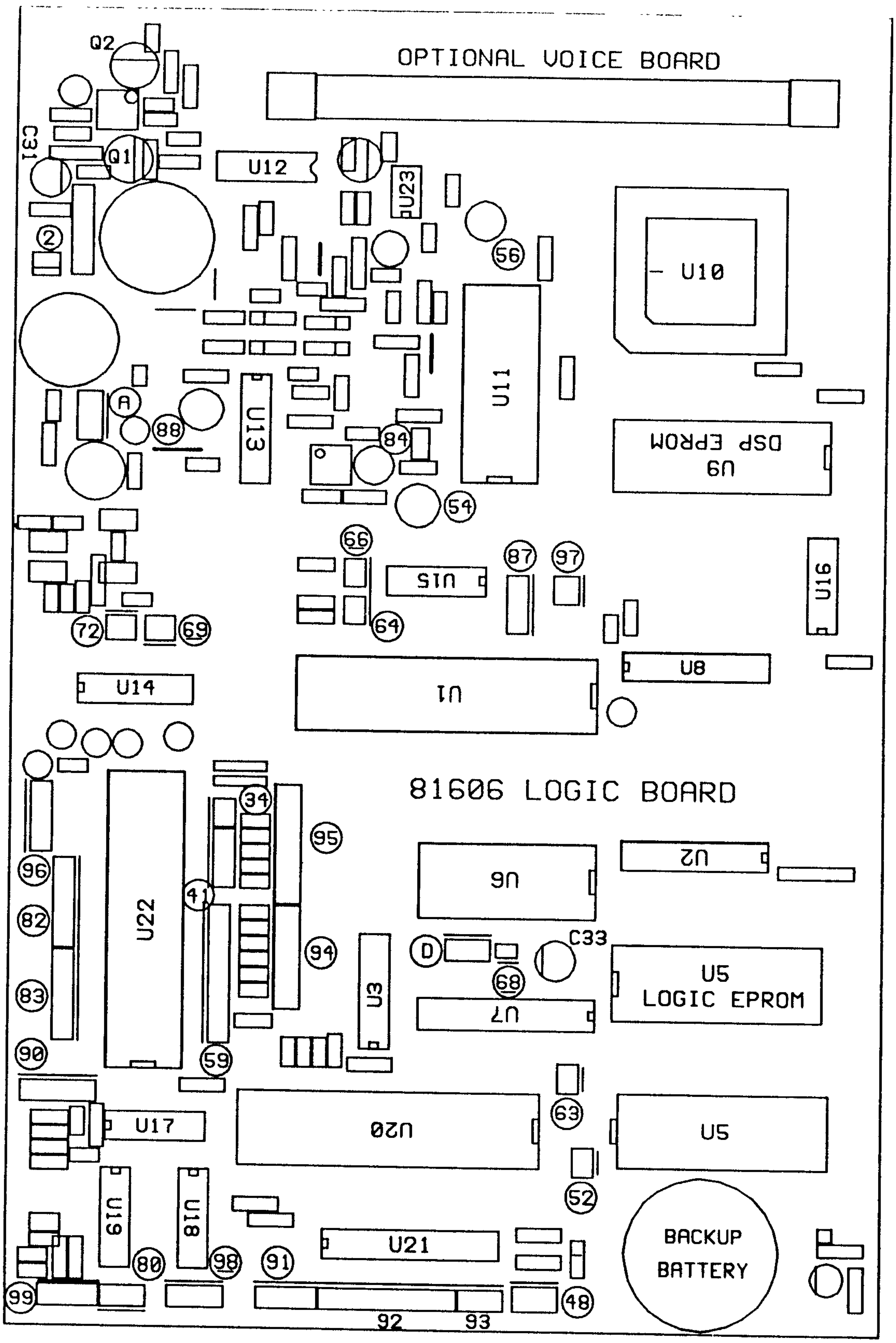


FIGURE 4-19: LOGIC BOARD COMPONENT LAYOUT (81606)

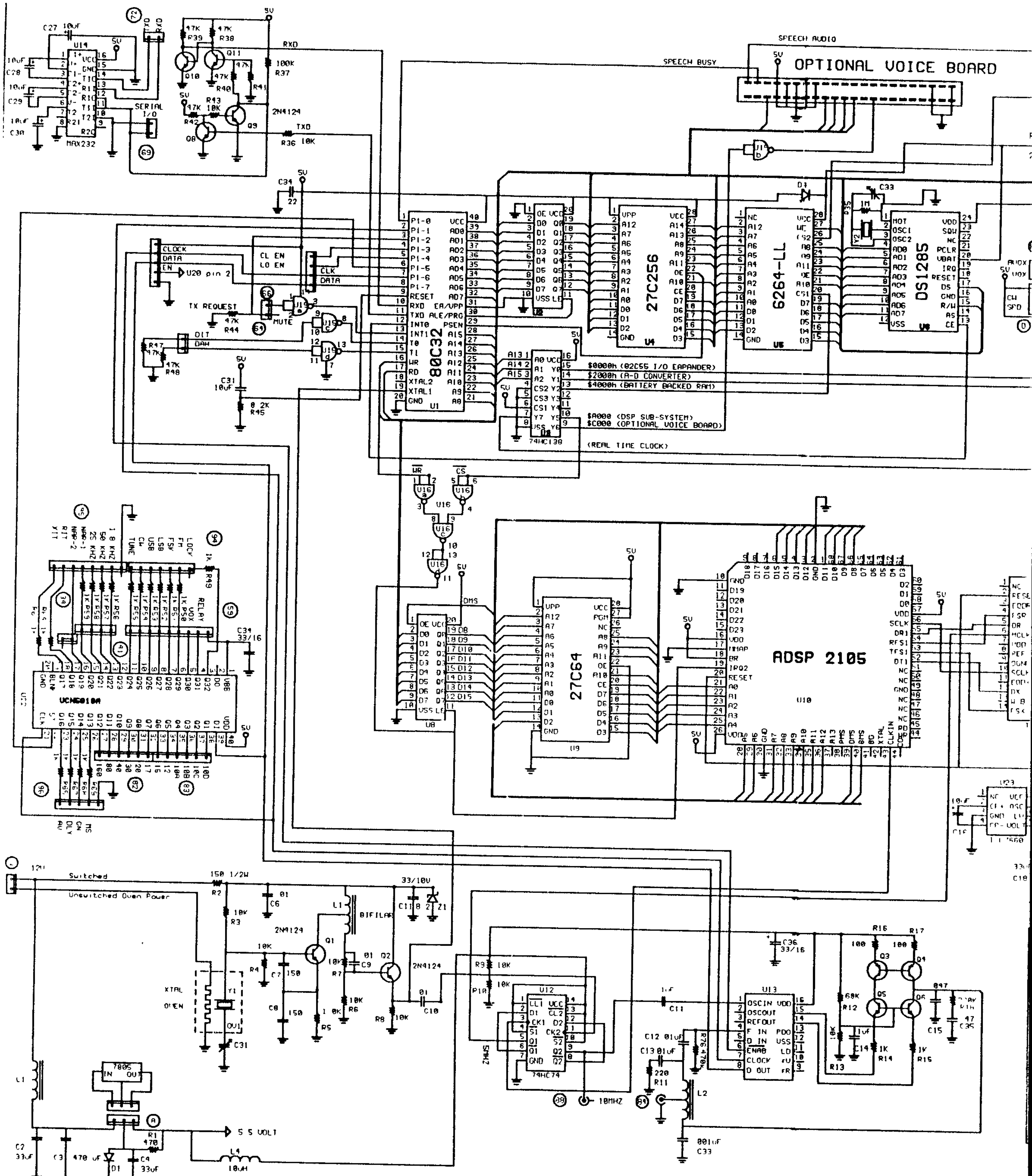
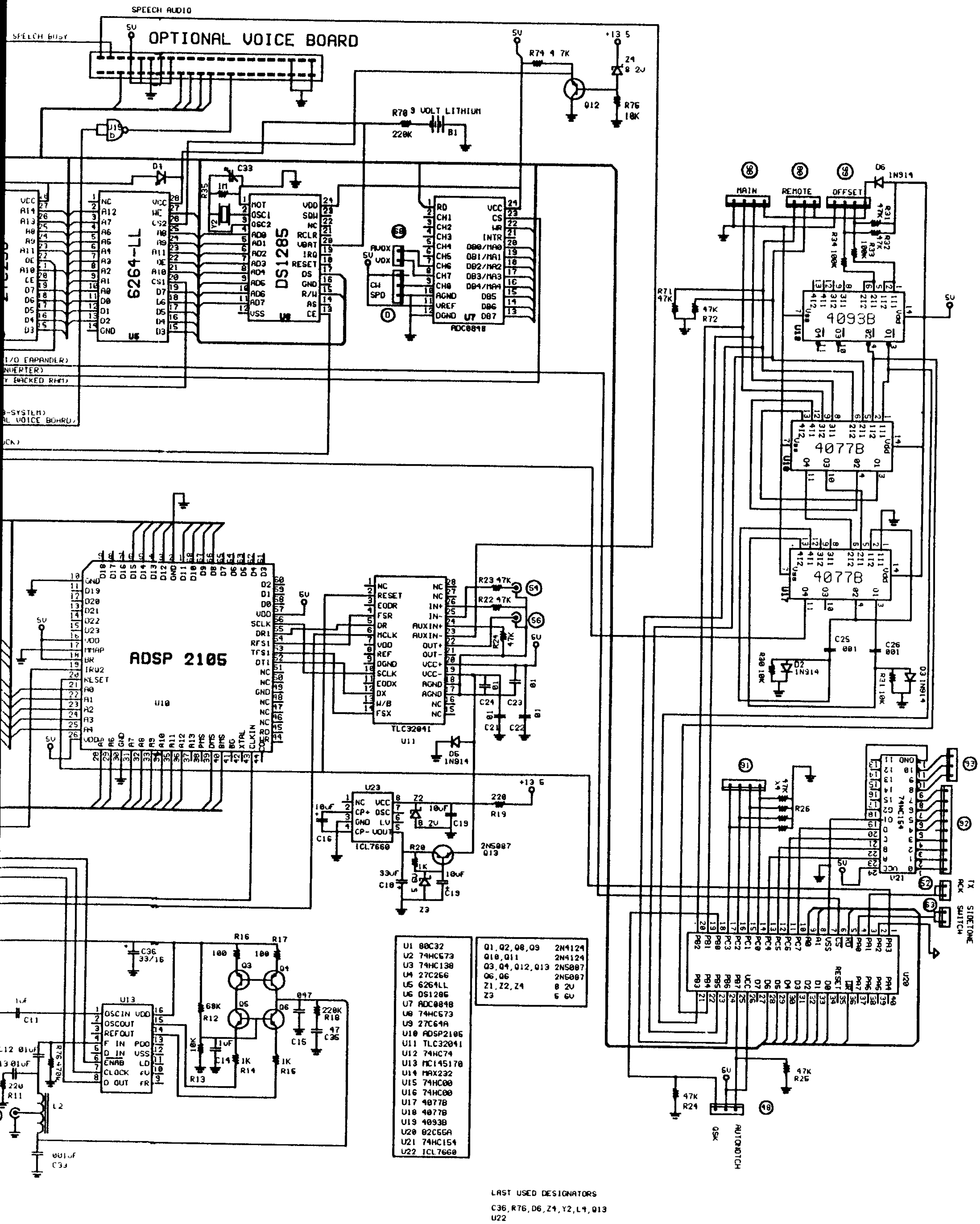


FIGURE 4-20: LOGIC BOARD SCHEMATIC (81606)



GIC BOARD SCHEMATIC (81606)

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4-12 LED DISPLAY BOARD (81587)

This module contains three groups of 7-segment LED displays. Also on this module is an array of 4 LED's used to annunciate various display modes currently in use.

Frequency information is displayed on DSP1 through DSP4. These LED's are .56" high, common cathode displays driven by multiplexed segment and digit signals from the LED Display Driver board via connector strip P1. This connector also provides drive signal for the annunciator LED1 through LED4.

Offset, time, and memory channel information is displayed on two groups of smaller .3" high LEDs consisting of DSP5 through DSP12. Multiplexed drive signals from the LED Display Driver board are connected to these displays via connector strip P2.

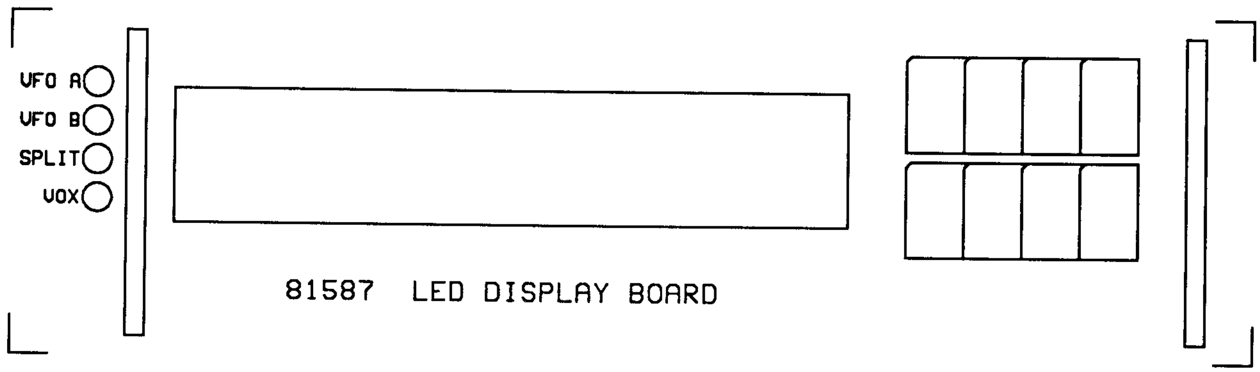

FIGURE 4-21: LED DISPLAY BOARD COMPONENT LAYOUT (81587)

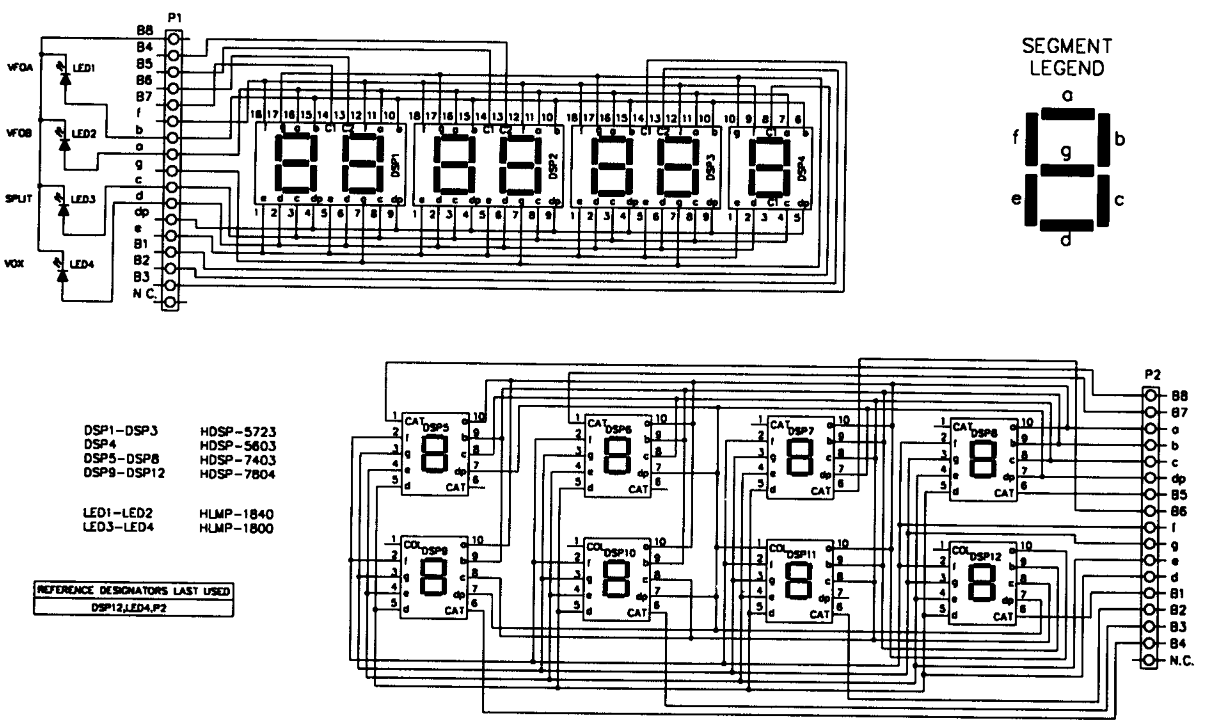

FIGURE 4-22: LED DISPLAY BOARD SCHEMATIC (81587)

Part No. 74253
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4-13 LED DISPLAY DRIVER BOARD (81588)

This module contains two intelligent LED display driver chips, IC1 and IC2. Display data from the Logic board is clocked in serially to IC1 via connector 90. The LOAD line is initially set low, then each driver chip receives 16 bits of serial data. Since the chip's data lines are cascaded (DOUT of IC1 goes into DIN of IC2), a continuous string of 32 bits is clocked into DIN of IC1. The LOAD line is then pulsed high to latch the data in the driver chips Each chip contains its own internally generated multiplex clock and LED driving circuits. IC1 controls the larger .6" high frequency readout and the four small LED annunciators, while IC2 controls the two smaller groups of .3" high LED displays used to display offset, time and memory information. Display brightness is user selectable and controlled by commands from the Logic board. Digit drive signal DG7 from IC1 is routed via connector 89 to the Low Level Driver/N.B. board where it is used to adjust the brightness of the meter lamp.

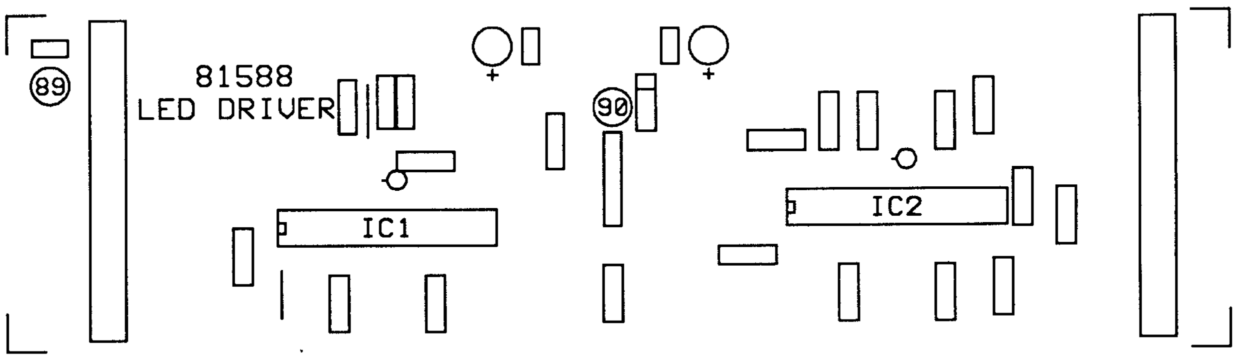

FIGURE 4-23: LED DISPLAY DRIVER BD. COMPONENT LAYOUT (81588)

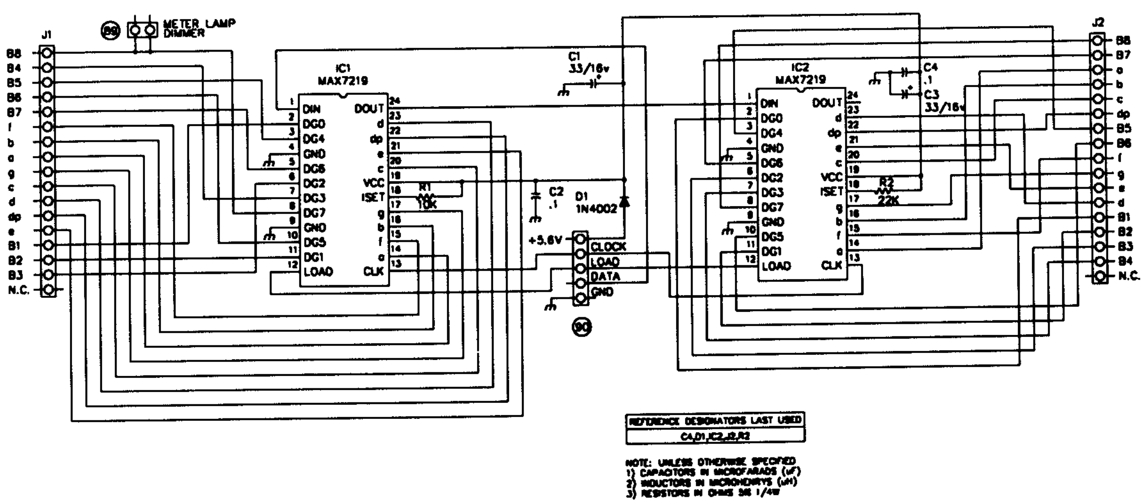

FIGURE 4-23: LED DISPLAY DRIVER BOARD SCHEMATIC (81588)

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4-14 TX AUDIO BOARD (81597)

This module contains the transmit audio amplifiers, speech processor, 9 MHz BFO and balanced modulator. It is located at the left rear of the chassis, on top of the chassis deck behind the PLL shield box. There are board mounted connectors for AUDIO IN, AUDIO OUT, MARK/SPACE. SERIAL PORT and INTERFACE PORT accessible through the rear panel.

Microphone audio from connector 73 or transmit audio from the rear panel AUDIO IN jack is amplified by U2A. The output of U2A splits three ways to drive the anode of diode switch D21, the speech PROCESSOR control pot. at connector 74, and the VOX amplifier U3A. Diode D21 is normally forward biased through connector 70 when the PROCESSOR switch on the Lower Pot. board is in the OFF position, connecting the amplified audio signal to the MIC gain control at connector 71.

The speech processor input at connector 74 is amplified to a nominal 1.2 Volts peak by U1A and again by U1B to approximately 1.8 Volts peak. One output of U1B drives rectifier D14 and compressor transistor Q13. Q13 clamps part of the original input to ground effectively maintaining a constant audio level at the output of U1A. Another output of U1B drives the processor level meter through emitter follower Q12 and connector 78.

Half the output of U1A appears across clipper diodes D18 and D19, but no clipping occurs at the normal level of 0.6 Volts. The clipper diodes limit fast audio transients, for which the compressor circuit is less effective, to 0.65-0.7 Volts. The compressed and limited speech processor output level is set by R65, and U2B buffers the output to the anode of diode switch D20. When the PROCessor switch is in the ON position, D21 is reverse biased, D20 is forward biased, and processed audio is passed to the MIC gain control via connector 71. R65 is adjusted so that the peak levels of the processed and the unprocessed audio signals at connector 71 remain equal as the PROCESSOR switch is toggled between OFF and ON.

The output of the MIC gain control at the center pin of connector 71 is fed to the balanced modulator U4. The balanced modulator mixes the transmit audio signal with the BFO carrier to produce a 9 MHz double sideband suppressed carrier output. U4 is enabled on pin 7 by "TD" voltage from the Control board connector 60. The balanced modulator gain is increased in SSB mode by grounding bypass network C4 - R10 through Q1. Q2 unbalances the modulator in CW and FSK modes. Tuned transformer T1 performs the match to the 20 Ohm DSB input of the 9 MHz Mixer/IF board at connector 37. R3 and R4 trim the AC and DC balance of U4 for maximum carrier null.

Part of the transmit audio signal is fed through VOX amplifier U3A and emitter follower Q11 and appears at connector 68. Likewise, a portion of the speaker audio is fed through amplifier U3B and emitter follower Q10 to connector 68. These two signals (VOX and ANTI VOX) are sent to the Logic board for processing by the DSP circuits, which provide a software controlled VOX system.

The BFO oscillator/amplifier is formed by transistor Q6-Q8, and its frequency of operation is determined by crystals Y1-Y2, diode switches D8-D12, and capacitors C10-C13, C16, C18. Based on the mode of operation, transistor switches Q3-Q5, Q9 drive the diodes which select trimmer capacitors to set the BFO frequency at the proper place with respect to the IF filter response. Mode information from the Control board enters at connector 60. The trimmers can be set with a high resolution counter at connector 46 by switching modes in the order listed below and adjusting the corresponding trimmer for the frequency indicated:

CW transmit or TUNE, adjust C10 for 9.000400 MHz.

LSB receive, adjust C16 for 9.000000 MHz.

USB receive, adjust C12 for 9.003000 MHz.

FSK SPACE, adjust C13 for 9.002295 MHz.

FSK MARK, adjust C18 for 9.002125 MHz.

NOTE: FSK MARK input voltage can be in the range of 0 to -15 Vdc. FSK SPACE input voltage should be in the range of +2.5 to +15 Vdc for proper operation.

Because of a slight interaction between the trimmers, these adjustments should be repeated at least once.

The BFO output from Q7 splits three ways. One output drives ALC transistor Q8 which controls the bias of oscillator transistor Q6 to maintain a constant output level. Another output serves as the carrier input to balanced modulator U4. The third BFO output drives the product detector on the IF/AF board through connector 46.

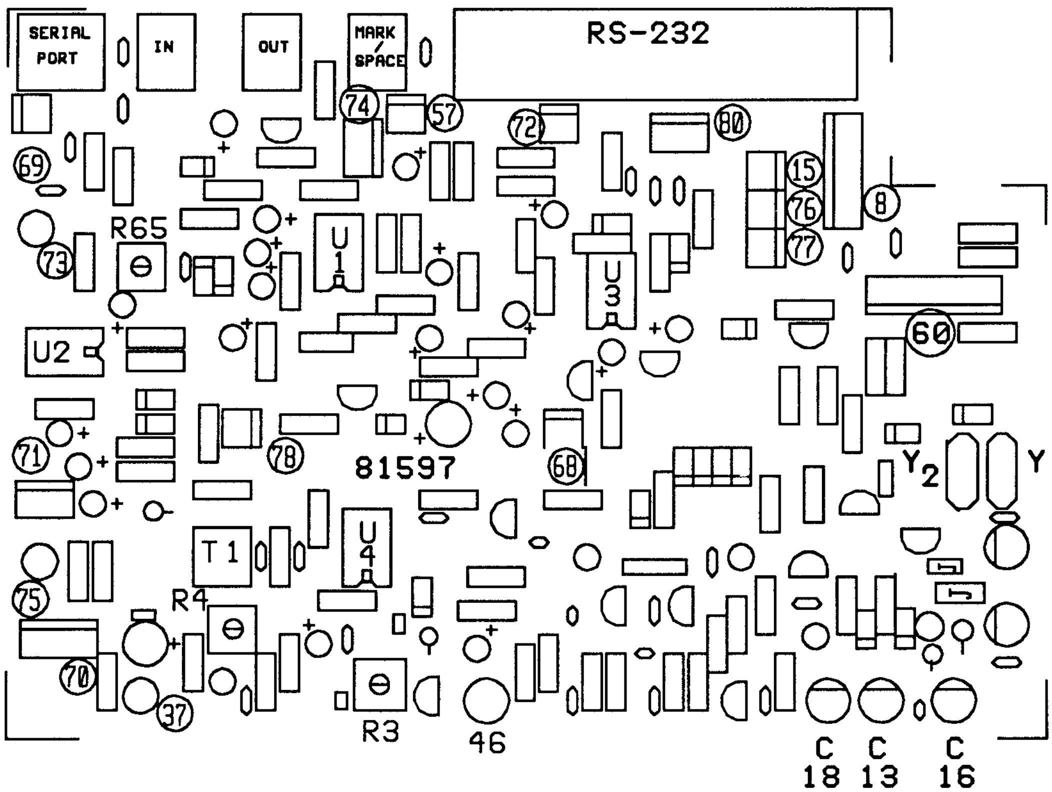

FIGURE 4-25: TX AUDIO BOARD COMPONENT LAYOUT (81597)

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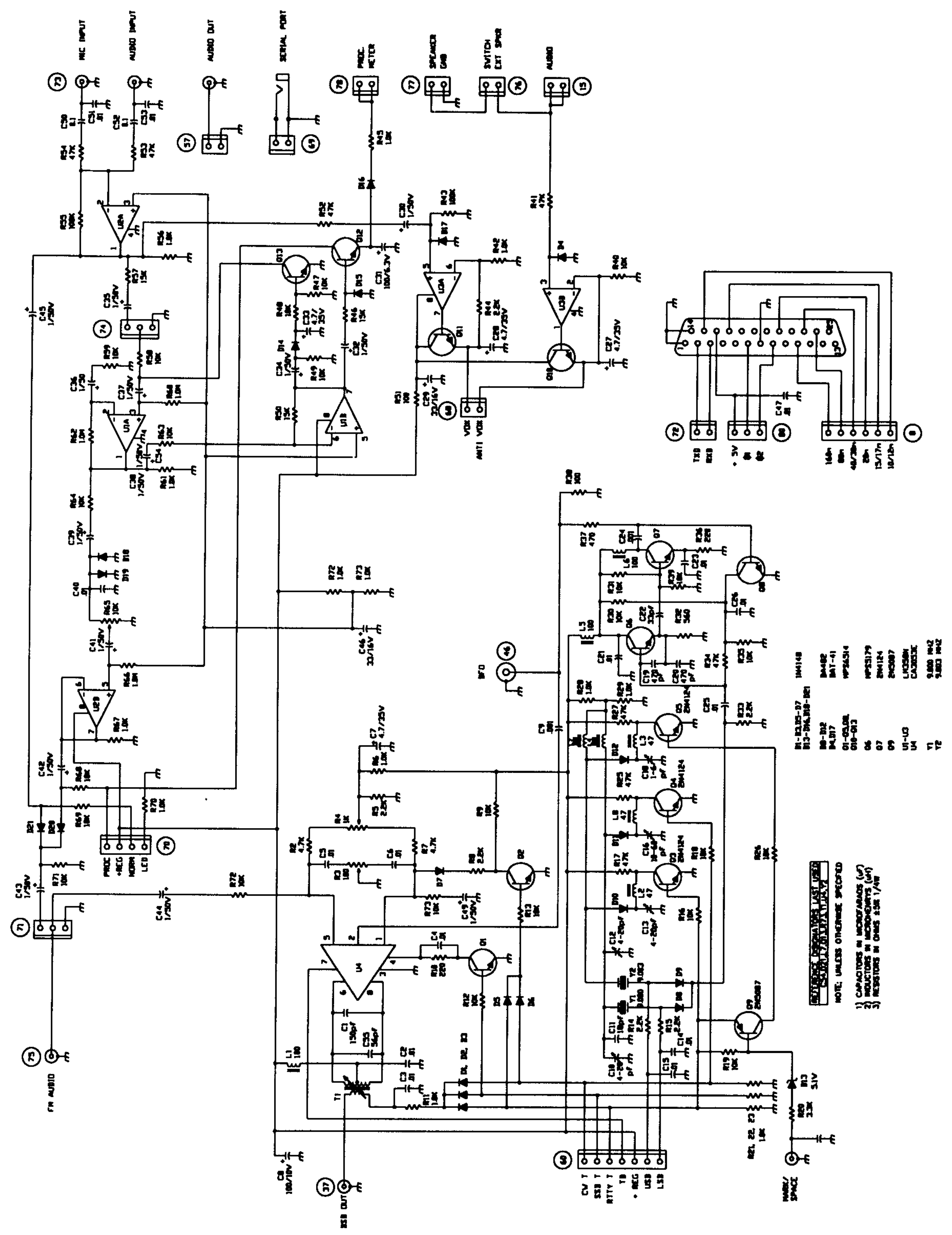

FIGURE 4-26: TX AUDIO BOARD SCHEMATIC (81597)

4-15 LOW LEVEL DRIVER / N.B. BOARD (81608)

This module contains the low level wide band amplifier for the transmitter, the receiver noise blanker, "T" and "R" voltage generator and the "+REG" and meter lamp regulators. It is located on the left upper chassis on top of the PLL shield.

The operating frequency transmit signal from the BPF/Front End board enters on connector 24, is amplified by class A amplifier transistors Q9 and Q10, and exits to the Final Power Amplifier at connector 79. During transmit, "T" voltage supplies bias to both stages through R18 and R21.

"T" and "R" voltages are developed by Q1-Q8 based on the level of the "TD" pin from Control board connector 62. In transmit "TD" is high and Q5 sources approximately 12.5Volts to the "T" line through R7, while Q7 holds the "R" line low. In receive "TD" is low and Q8 sources approximately 8.5 Volts to the "R" line through R13, while Q4 holds the "T" line low.

At connector 31, a sample of the 9 MHz receive IF signal from the 9 MHz Mixer/IF board is input to noise blanker amplifiers U1 and U2. The output of U2 is split two ways. Part of the signal is fed through C31 to Q13 which provides AGC control of U2. This helps to maintain a constant output level from U2 when there is no noise present or when the noise pulse widths are long. The N.B. pot., located on the Upper Pot. board, controls the emitter voltage of Q11 through connector 67. The output of Q11 is summed with the AGC voltage from Q12 and sets the noise threshold of the noise blanker system. The other output of U2 foes to pulse amplifiers Q14 and Q15 whose output appears at connector 32. This output signal consists of noise pulse components with fast rise and fall times, which are applied to a noise gate circuit on the 9 MHz Mixer/IF board to blank the receiver during noise pulse intervals. A regulator composed of U1 and Q19 supplies +8.5 Volts "+REG" voltage to all boards via connector 62 and the Control board. Q11 is mounted on the PLL shield plate and connected with cable Q.

Meter lamp control transistor Q18 is likewise mounted to the PLL shield and connected with cable P.. Digit driving pulses are applied to connector 89 from the LED display Driver board. These pulses are amplified and buffered by U3B, integrated by capacitor C18 and applied to regulator control amplifier U3A. Output of U3A drives Q18 whose output goes to the meter lamps via connector O. The duty cycle of the pulses at connector 89 can be varied under software control using the DIM function on the front panel keypad. As this pulse width is varied from minimum to maximum, the meter lamp voltage varies from about +2.7 volts up to a maximum of about +5.7 Volts.

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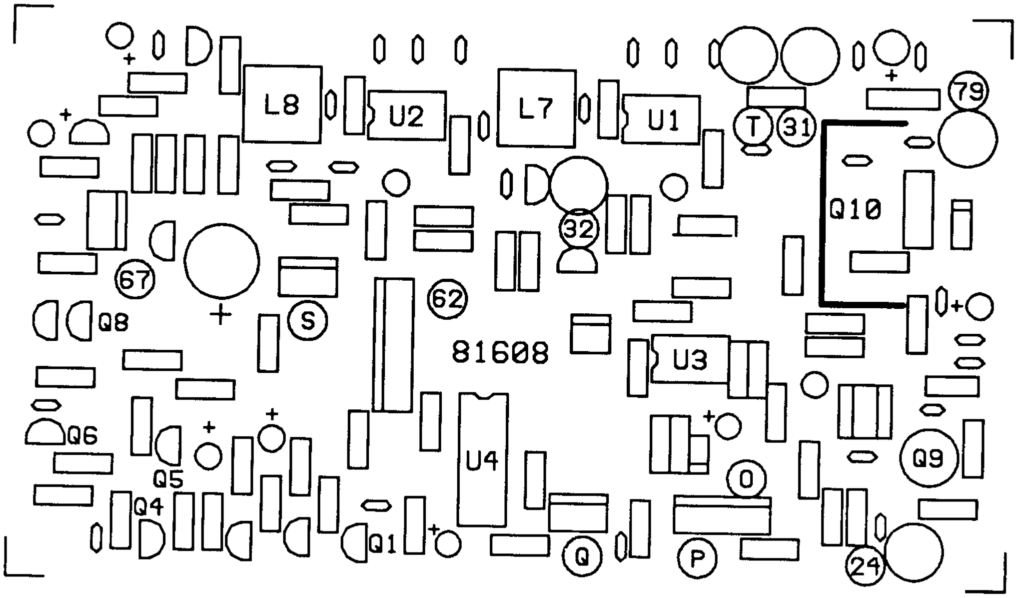

FIGURE 4-27: LOW LEVEL DRIVER/N.B. BOARD COMPONENT LAYOUT (81608)

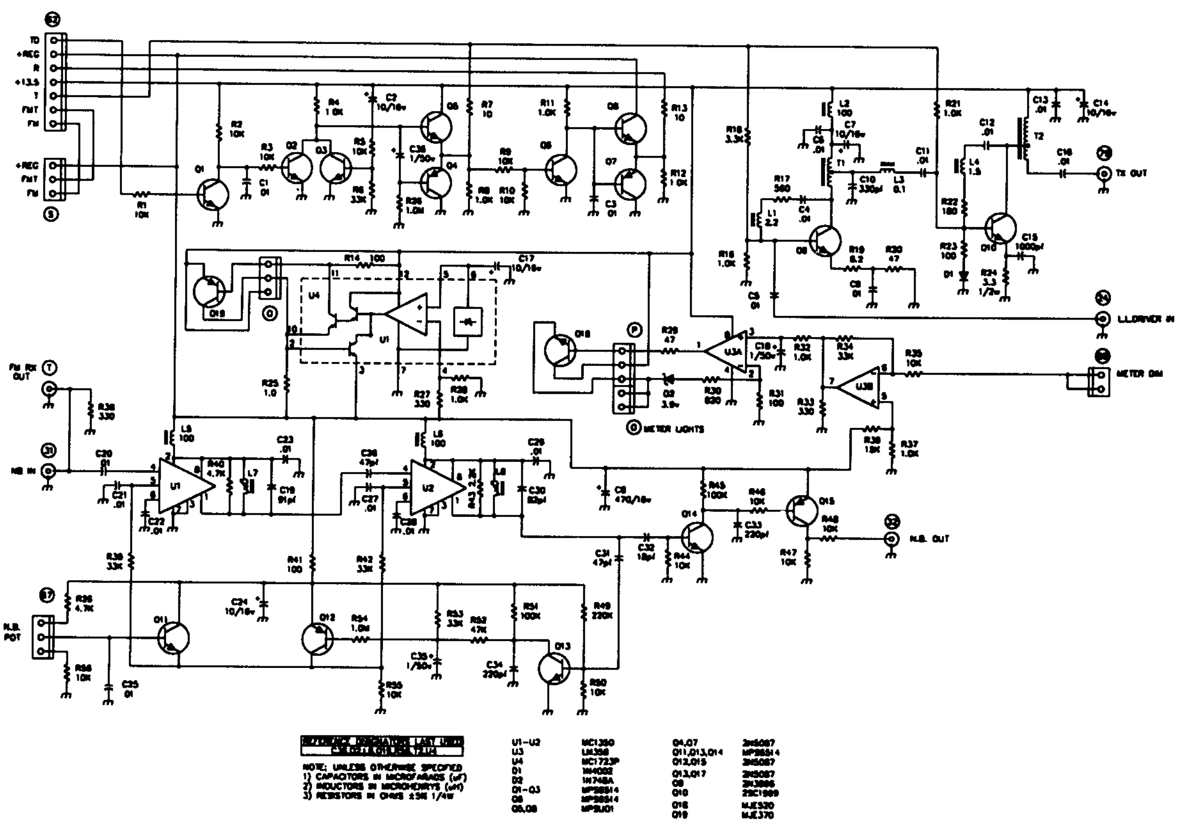

FIGURE 4-28: LOW LEVEL DRIVER/N.B. BOARD SCHEMATIC (81608)

4-16 POWER AMPLIFIER (81611)

The high power RF amplifier, its push-pull driver stage, and the PA bias circuits are housed in a metal box which is an integral part of the heatsink assembly. The unit is attached to the rear panel with four hex head screws. Input is received through connector 79 on the Low Level Driver board, and the 100 Watt output is through a miniature coaxial cable soldered to pins on the Low Pass Filter board. "T" voltage enters the unit on the small blue wire from connector 11 on the Low Pass Filter board, and +13.5 Volts dc enters on the large red wire from the DC Input board.

Q1 and Q2 form a wideband class AB linear driver stage with input and output impedance matching accomplished by broadband transformers T1 and T3. RC networks R1-C1 and R5-C2, in conjunction with feedback networks R3-L3-C4, R6-L4-C5, control the input impedance and flatten the gain variation of the transistors over the frequency range of 1.6-30 MHz. Regulated bias is fed to this stage from Q5-U1A.

Q3 and Q4 form the high power broadband output stage of the transmitter. This stage is also biased to linear class AB operation by regulator circuit Q6-U1B. Input impedance and gain variation with frequency are controlled by RC input networks and RF feedback similar to the driver stage. Broadband transformer T4 matches the output stage to 50 ohms for driving the transmit low pass filters.

Bias for both stages is temperature compensated to maintain a relatively constant operating point by mounting the bias reference diodes D2 and D3 in thermal contact to the heatsink. The temperature dependent voltage across each reference diode is added to a portion of the "T" voltage and the sum is used as a reference voltage for the respective bias regulator U1A-Q5 or U1B-Q6 in the PA bias circuit. In receive ,"T" voltage is low and both regulators are cut off, removing bias from both PA stages. When "T" goes high, capacitor C25 delays the rise of the bias reference voltages, reducing the gain of the PA until the rest of the transceiver settles into a stable transmit mode.

The bias adjustment potentiometers R19 and R15 are accessible through the bottom shield of the transceiver. To adjust PA bias, a dc amp meter must be inserted in series with the large +13.5 Vdc lead coming from the DC Input board. Unplug connector 79 from the Low Level Driver/N.B. board to remove drive from the PA. Key the transmitter in USB mode. While watching the meter, rotate first the final bias pot. R15 and then the driver bias pot. R19 to produce minimum current. Now rotate the driver bias pit. R15 to produce and additional increase of 500 milliamperes on the meter. Remove the meter and reconnect the red wire to the DC Input board and connector 79 to Low Level Driver/N.B. board.

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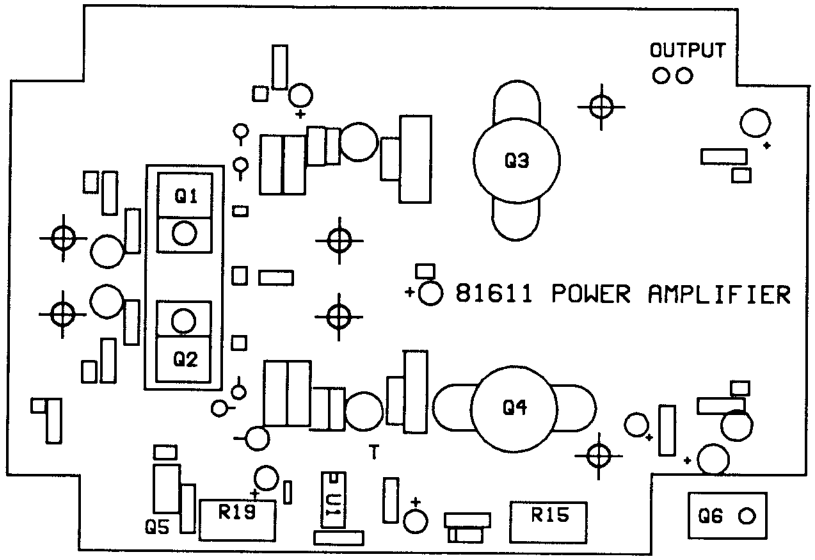

FIGURE 4-29: POWER AMPLIFIER COMPONENT LAYOUT (81611)

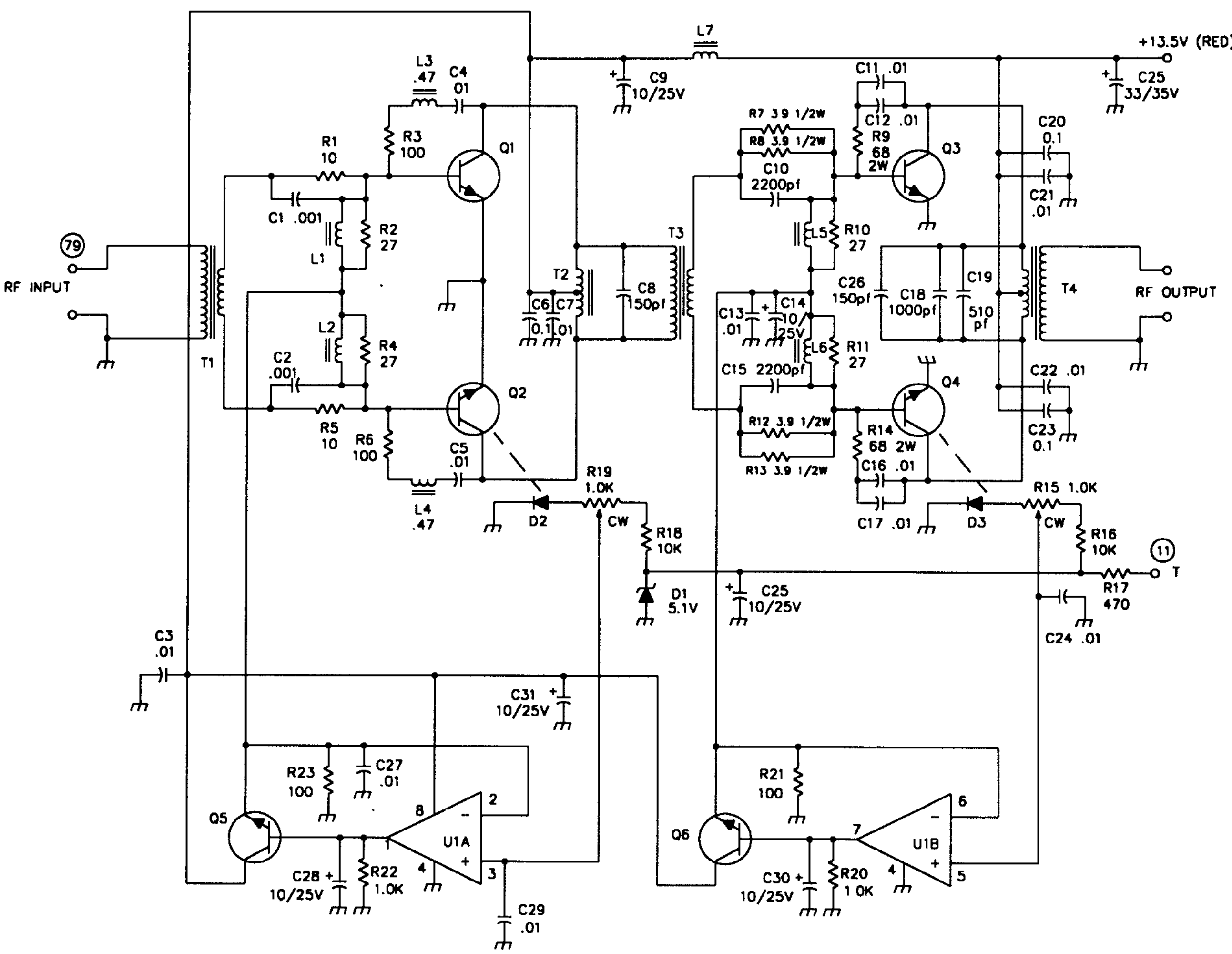

FIGURE 4-30: POWER AMPLIFIER SCHEMATIC (81611)

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4-17 FM BOARD (81598

This module contains circuitry for two separate signal paths.

On transmit, connector 75 receives an amplified microphone signal from the TX Audio/BFO board. Amplifier U2A provides preemphasis with a high pass response of typically +6 dB/octave over the 300 to 3000 Hz audio range. Diodes D4 and D5 limit the peak to peak amplitude of the processed audio to prevent over deviation of the FM carrier. Low pass filter U2B filters harmonic distortion from the limiter and adjusts the amplitude of the audio for varactor D6. the varactor performs the voltage to frequency conversion in the Colpitts oscillator Q2. L2 is adjusted to center the oscillator at 9.003 MHz with no audio bias. Buffer transistor Q3 isolates the oscillator and provides about -5 dBm carrier to the next transmitter stage on the 9 MHz Mixer/IF board via connector 33. At this point the transmitter treats the FM carrier as if it were CW.

In receive, the FM receive signal is tapped off the 9 MHz IF of the noise blanker circuit on the Low Level Driver/N.B. board and enters the FM board at connector T. The signal feeds U1, an MC3371P FM receiver chip, which converts down to a 455 kHz IF frequency. Ceramic filter FL1 sets the receive bandwidth for the on-chip quadrature detector. T1, the quadrature coil, is adjusted for maximum recovered audio and minimum distortion. The audio signal is deemphasized by the low pass network of R6, C5 and C6 and is carried on to the IF/AF board through connector U. The wideband audio signal is also fed through R5-C4, to pin 10 of U1, which contains an internal opamp used as a noise triggered squelch. Output of the internal opamp at pin 11 is routed through C2 to D1 and through connector R to the front panel mounted SQUELCH control. When the amplitude of the audio is below the level set by the squelch control diode D1 conducts and pulls pin 12 low, allowing U1 to mute the audio output.

U1 also provides an S-meter output control current at pin 13. This current is proportional to the logarithm of the IF input signal amplitude, and is fed to buffer transistor Q1. Diode D2 is used to compensate for the base-emitter voltage drop of Q1, and potentiometer R8 is used to calibrate the S-meter reading. S-meter output from Q1 is sent through connector V to the front panel meter switch.

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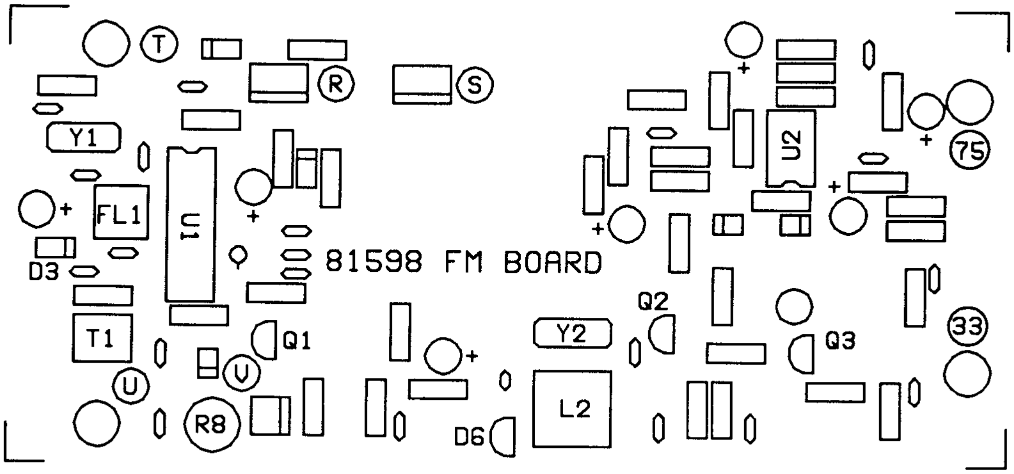

FIGURE 4-31: FM BOARD COMPONENT LAYOUT (81598)

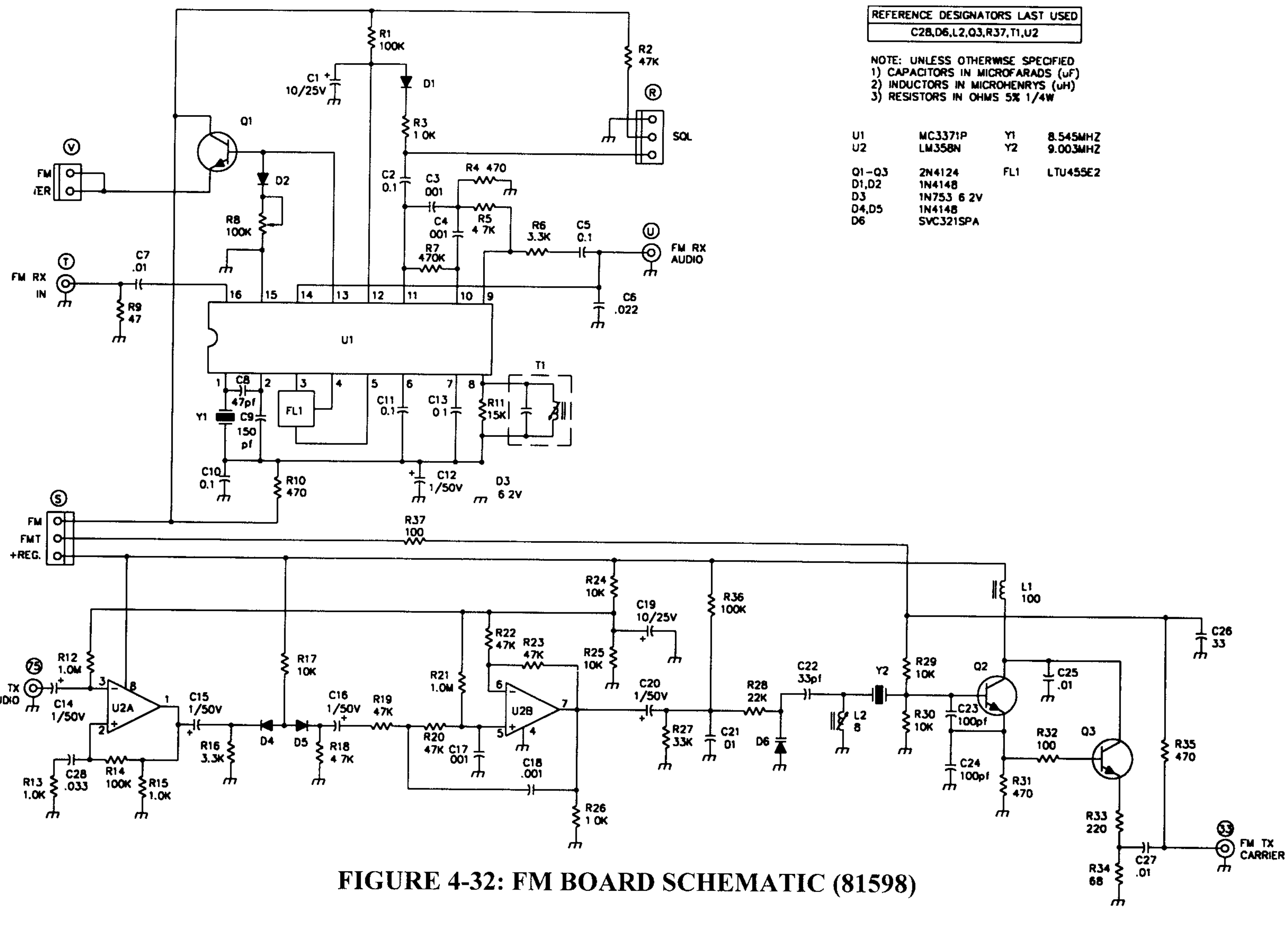

FIGURE 4-32: FM BOARD SCHEMATIC (81598)

4-18 KEYPAD/ENCODER BOARD (81589)

This module contains an array of 44 key switches, 18 LED indicators and a rotary shaft encoder. The circuit board is mounted to the rear of the front panel keypad bezel and is connected to the Logic board through seven connectors which are accessible through the sub panel at the rear of the fold down front panel assembly.

The keypad switches are arranged electrically in an array of eleven columns and four rows. The columns are scanned through connectors 92 and 93, and the rows are read through connector 91. The microprocessor detects a key closure by strobing each column line low in sequence, while watching for a low to appear on any of the row lines. The location of the closure is defined by the intersection of the column and row lines that are simultaneously low.

The Logic board drives the indicator LEDs through connectors 94, 95 and 96. The LEDs are illuminated by a positive drive voltage and all cathodes are returned to ground through connectors 95 and 95.

A rotary encoder is mounted to the keypad assembly and its output is routed to connector 98, located on the Logic board.

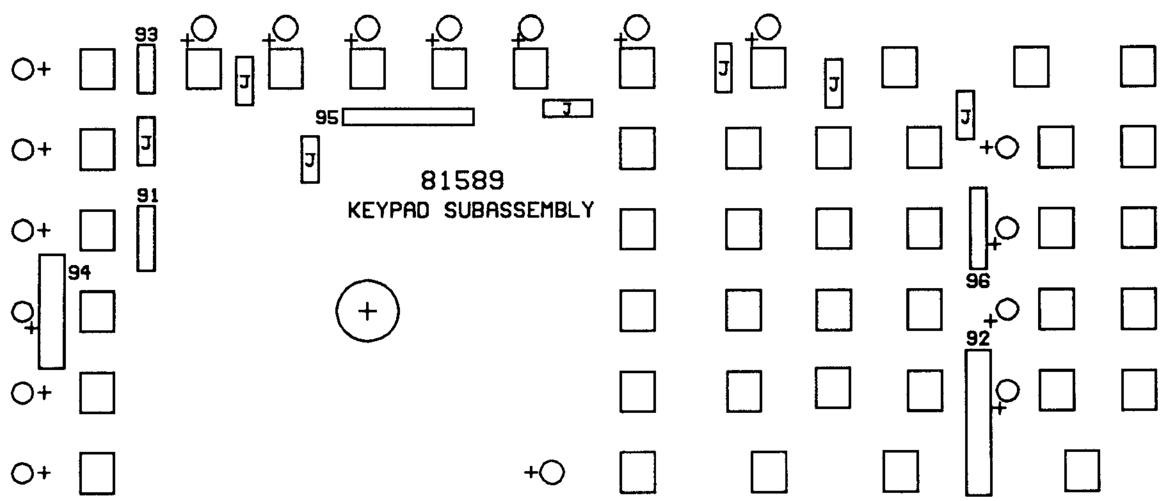

FIGURE 4-33 KEYPAD/ENCODER BOARD COMPONENT LAYOUT (81589)

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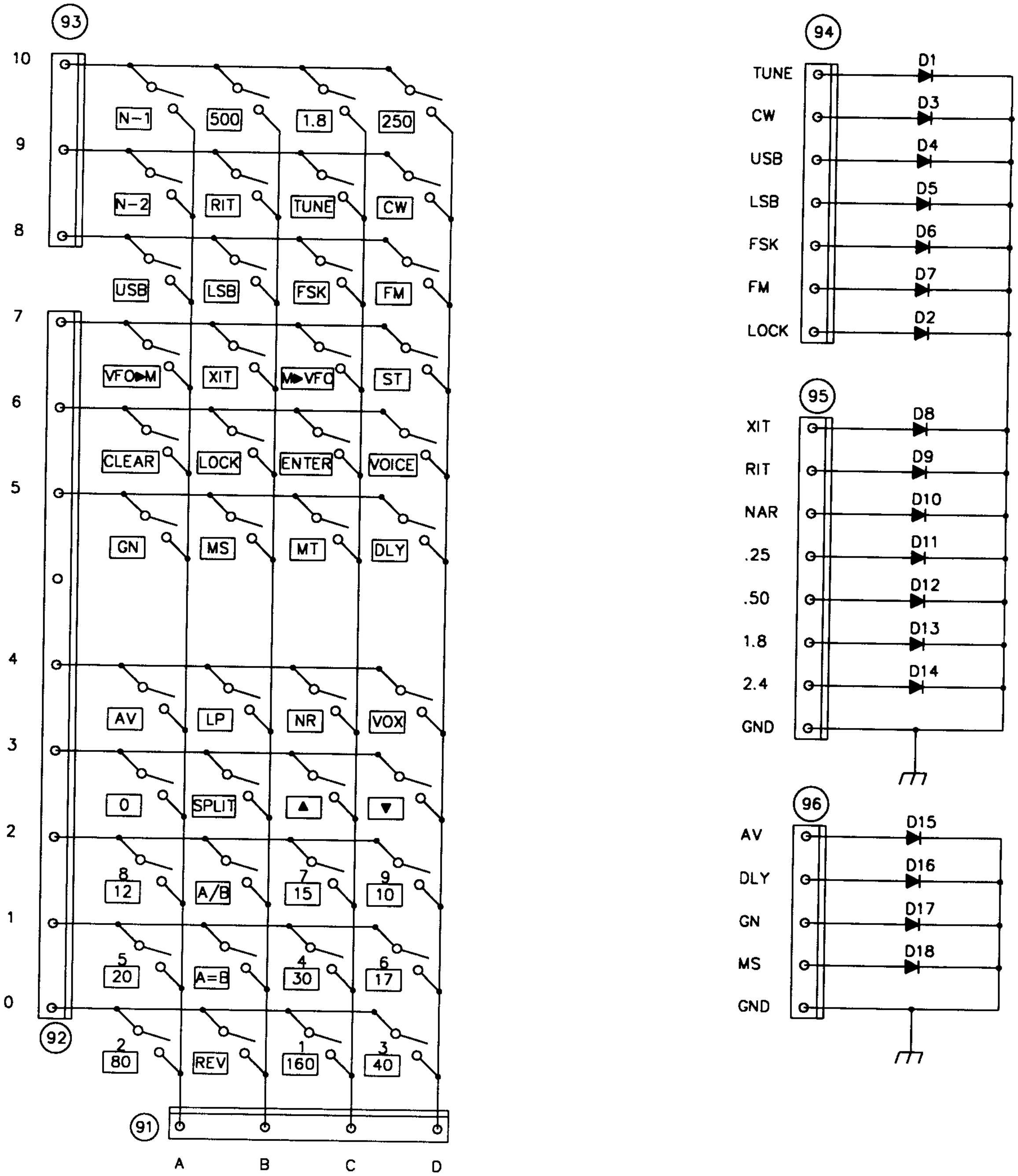

FIGURE 4-34 KEYPAD/ENCODER BOARD SCHEMATIC (81589)

4-19 SWITCH BOARD (81603)

This module contains two LED indicators and five latching push button switches which control the functions of ANTENNA main/aux, AGC on/off, AGC fast/slow, NOTCH auto/manual, and QSK fast/slow. This assembly is mounted on the left front subpanel just inboard of the main POWER switch.

Switch S1 is connected to the Low Pass Filter board by connector 7 and selects either the main or auxiliary antenna for use during receive. LED D1 is turned on when S1 is set to the AUX position.

AGC on/off switch S2 disables the AGC circuit on the IF/AF board by grounding the AGC amplifier input through connector 49.

AGC fast/slow switch S3 increases the AGC decay time in the slow position by grounding the bottom end of an additional integrating capacitor in the AGC circuit.

NOTCH auto/manual switch S4 connects to the Logic board through connector 48. When in the AUTO position LED D2 is turned on and the automatic notch function, implemented in the DSP processing circuits, is enabled along with the front panel manual notch control. When in MANUAL position only the front panel manual notch is active.

QSK fast/slow switch S5 also connects to the Logic board through connector 48. The setting of this switch is monitored by the microprocessor which adjusts the software controlled keying accordingly.

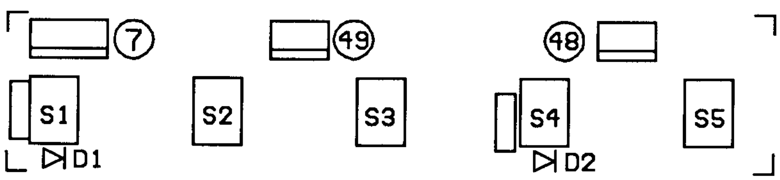

FIGURE 4-35 SWITCH BOARD COMPONENT LAYOUT (81603)

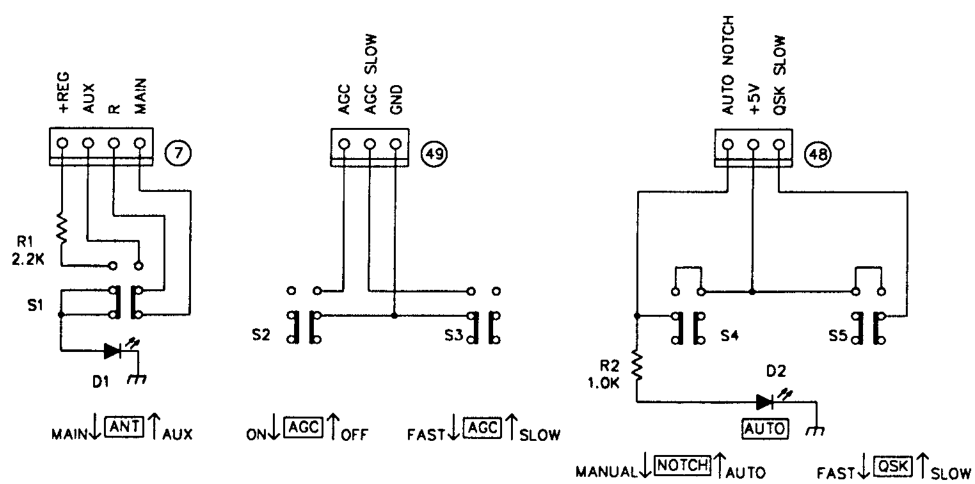

FIGURE 4-36 SWITCH BOARD SCHEMATIC (81603)

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4-20 UPPER POT. BOARD (81604)

This module contains two dual concentric controls, a latching pushbutton switch and an LED indicator. The board mounts on the left front sub panel at the control positions of N.B. and SQL, PBT and NOTCH, and the ATTN switch.

The ATTN switch S1 is wired to the BPF/ Front End board by connector 18 where it controls the insertion of the receiver attenuator pad. When the pad is inserted, S1 applied +13.5 Volts to the anode of -20dB indicator LED D1 and also to the attenuator switching circuit on the BPF/Front End board.

The N.B. control R1A connects to the Low Level Driver/N.B. board through connector 67. This control adjusts the input threshold level of the noise blanker amplifier.

The SQL control R1B is connected to the FM board through connector R, and adjusts the squelch noise threshold of the FM receiver chip.

NOTCH control R2B, through connector 53 to the IF/AF board, varies a dc voltage to a clock oscillator which determines the frequency of the manual audio notch filter. Clockwise rotation of R2B increases the voltage at the wiper, increasing the notch frequency.

The PBT control R2A connects to the Pass Band Tuning board through connector 42, where it controls the dc bias to the 15.3 MHz pass band tuning VCXO. Clockwise rotation of R2A increases the voltage on the wiper, increasing the frequency of the VCXO.

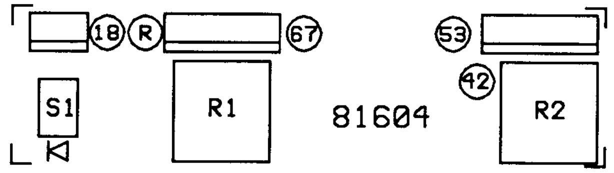

FIGURE 4-37: UPPER POT. BOARD COMPONENT LAYOUT (81604)

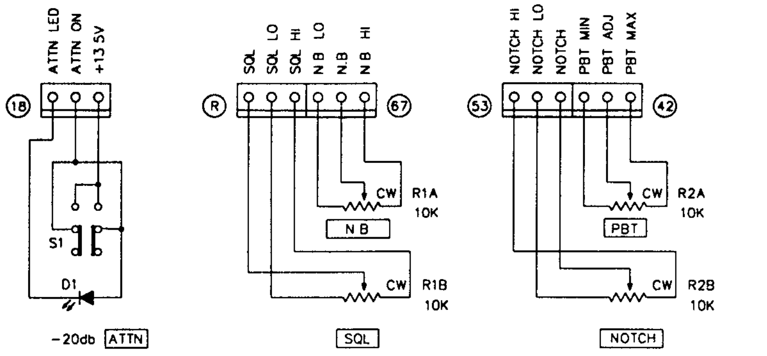

FIGURE 4-38: UPPER POT. BOARD SCHEMATIC (81604)

4-21 LOWER POT. BOARD (81605)

This module contains two dual concentric controls, a latching pushbutton switch, and two LED indicators. The board mounts on the left front panel at the control positions of MIC and PWR, AF and RF, ALC indicator, and the PROC on/off switch and indicator.

When PROCessor on/off switch S1 is in the "on" position, "+REG" voltage is applied to the anode of LED D1 and, through connector 70, to a diode on the TX Audio board which routes processed audio to MIC gain control R1A via cable 71. R1A sets the level of the signal returning on cable 71 to the balanced modulator. When S1 is in the "off" position, indicator D1 is extinguished, and unprocessed transmit audio is routed though R1A to the balanced modulator.

PWR control R1B forms a voltage divider, through connector 29 to the 9 MHz Mixer/IF board, which sets the ALC threshold. ALC action develops a current through connector 28 which illuminates ALC indicator D2.

AF gain and RF gain controls, R2A and R2B, form voltage dividers, through connectors 55 and 50 to the IF/AF board, which determine respectively audio output level and AGC resting voltage.

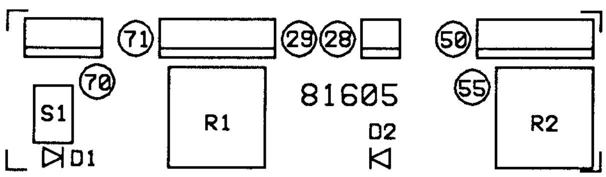

FIGURE 4-39: LOWER POT. BOARD COMPONENT LAYOUT (81605)

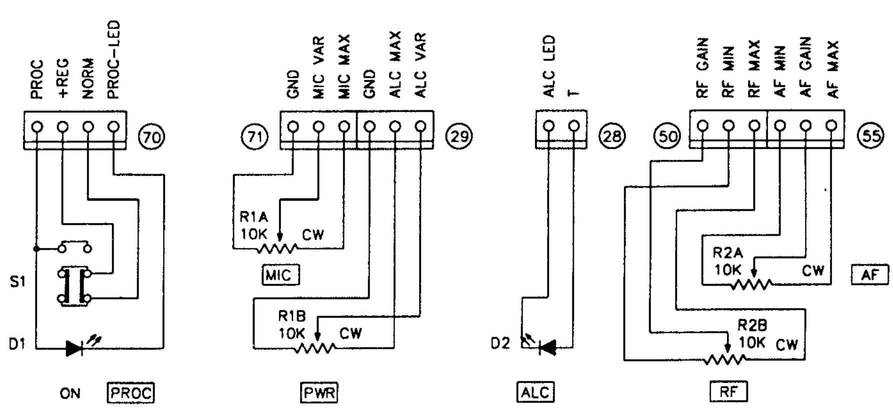

FIGURE 4-40: LOWER POT. BOARD SCHEMATIC (81605)

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CHAPTER 5

OMNI VI PLUS COMPUTER INTERFACE

5.1 INTRODUCTION

The OMNI VI *Plus* transceiver features a comprehensive computer control interface. With the addition of a Personal Computer and third party logging/control software, computer control of nearly every transceiver function is possible. The computer interface provides the operator with many additional conveniences and flexibility.

The control interface in the OMNI VI *Plus* was designed to be compatible with many existing contest and logging software packages. Choose the OMNI VI setup in your software if it is available., If your software does not have an entry for the OMNI VI, then choose the ICOM Model 735. You may use this setting but the logging/control software will not take advantage of the many extended functions and features available in the OMNI VI *Plus*.

In order to connect your transceiver to the computer, you must first obtain the appropriate cable. Determine the type of serial port available on your computer, it will either be a 9 pin or 25 pin. The transceiver requires a 25 pin male connector on its end. If you wish to construct your own cable, refer to Figure 5-2.

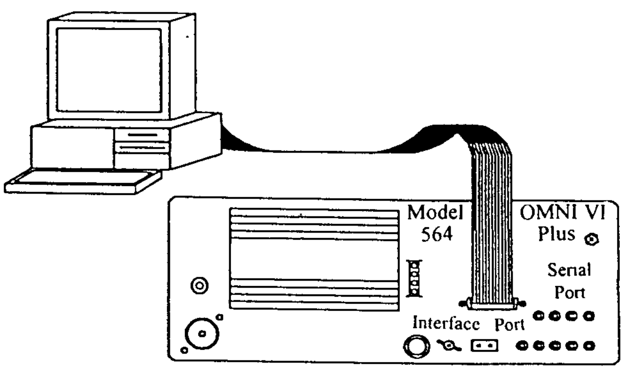

FIGURE 5-1
CONNECTION OF OMNI VI PLUS TO COMPUTER

5.2 SETTING UP THE SOFTWARE

Several parameters at both the computer and transceiver must be defined before communication is possible over the serial interface. Check your software package to determine which serial baud rates are available. The OMNI VI *Plus* will accommodate 1200, 2400, 4800, 9600 and 19200 baud. This selection is made in the User Menu #2. Generally you will want to select the highest rate supported by both the software package and the transceiver.

There will also be a transceiver address that must be established. Check your software setup to see what address it expects for the transceiver. For the OMNI VI *Plus* or the ICOM 735 it will normally be "04". The default value of the OMNI VI *Plus* is preset 04 but it is selectable in the User Menu #2. Make sure these addresses match so that the transceiver will know to respond to the computer commands.

The final parameter to be set is the "CdE" item in the User Menu. This setting controls whether the transceiver automatically reports changes made from the front panel over the serial port. The proper setting of this parameter (either ON or OFF) depends on your particular software package. If you experience interfacing difficulties, try changing this setting.

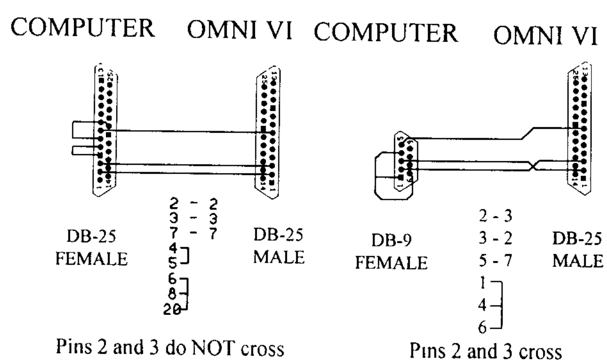

FIGURE 5-2
RS-232 CABLE WIRING CONNECTIONS

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5-3 OMNI VI Plus Serial Interface Technical Documentation:

There are many software packages available to control the OMNI VI *Plus* and no knowledge of the technical details of the Serial Interface are necessary to use these packages, but the details may be useful if you are writing your own software. The technical details have been included here for reference.

Generally, operation involves sending a command to the transceiver and then waiting for the transceiver to respond. Depending on the command, the transceiver may respond with a string of characters indicating "OK", meaning that the requested command has been processed. Alternately, the transceiver may respond with a string of characters indicating "NO GOOD" to the computer, meaning that the transceiver was unable to process the request. Some commands may result in the transceiver returning some operational information from the radio such as current frequency or mode. If a transceiver responds with a NO GOOD code, it was either because the command was not in the proper format or because the requested operation was not available on that transceiver. Garbled or unrecognized commands will cause no reply at all.

One other command type is the Matrix Mode. Matrix-mode commands are sent by the transceiver every time the frequency or mode is changed from the front panel of the radio if matrix-mode is enabled. (CdE "On" in menu 2) The matrix-mode commands are designed to allow the Omni VI Plus to control other radios. Units receiving the matrix-mode request do not reply to avoid overloading the bus. These commands are also useful, for example, to allow a logging program to track the transceiver frequency without needing to constantly poll the transceiver.

COMMAND FORMATS:

Each message sent on the bus contains several characters (bytes), and each character is sent as 1 start bit, 8 data bits, 1 stop bit and no parity. Each byte sent to the radio is echoed back to the computer. (full duplex) An optional TTL-level port labelled "SERIAL PORT" is included for compatibility with other models of transceivers.

The General format of a command is shown below (sent left to right) and is composed of a header, address field, command field, data field and a terminator. Please note that the data is not ASCII text, and messages are described here in hexadecimal format; the notation "FEh" means FE hex or decimal 224, not the text string "FE".

FE FE	RECEIVER ADDRESS	SENDER ADDRESS	COMMAND CODE	SUB COMMAND	DATA	FD

The FE FE at the beginning of the string is the two byte code that tells the transceiver a command is to follow. The transceiver will prepare itself to check the command to determine if it contains its address, which tells the transceiver that it is to process the command that will follow. If the RECEIVER address in the command string, does not match the transceiver's address, the command is ignored by the transceiver. (There are a few exceptions to this rule to be discussed later). The SENDER address is a code that represents the address of the computer that is sending the command. This address will be used later by the transceiver when it responds to the command request. Because the serial interface allows multiple computers to be used as well as multiple transceivers, each computer must have a unique address just as each transceiver is required to have a unique address. The default computer address used most is E0 Hex. The COMMAND CODE tells the transceiver which operation to perform. All command codes are in Hexadecimal format. Some commands contain additional Sub Commands that further clarify to the transceiver the specific operation that is to be performed. Specific codes may be found in the following pages.

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The DATA portion of the command string is required by some commands. It will contain frequency or mode information if such commands are issued. The FD Hex. at the end of the command string, informs the transceiver that the end of the command has been reached. After a transceiver receives a complete command string, it will process the command.

5.4 RESPONSE STRINGS - RADIO TO COMPUTER

After a transceiver has processed a command sent from a computer, it will send a response back to the computer that originated the command. This insures that the computer knows how the transceiver handled the command and also provides a method of pacing the commands because the computer knows not to send additional commands until it has received a response from the transceiver concerning the last command sent. If a computer sends a command to a transceiver that is not a status requesting command (a command that requests data to be sent back) the transceiver will respond either with a code indicating OK (FB Hex.) or NO GOOD (FA Hex.). The returned string will have the following format. The same general structure as described above is maintained but the transceiver is now the sender and the computer is now the receiver.

FEh FEh	**RECEIVER ADDRESS**	**SENDER ADDRESS**	**FAh or FBh**	**FDh**

5.5 DATA FORMATS

When a computer sends frequency or mode setting commands to a transceiver, the command string will necessarily contain the requested frequency data or mode code. Frequency data must be encoded as a string of BCD digits in the order shown below. Each Hexadecimal number contains 2 BCD digits and must be properly encoded for the transceiver to process them. When frequency data is requested from a transceiver, it will also be in this format.

1st byte	2nd byte	3rd byte	4th byte	5th byte
10Hz 1Hz	1Khz 100hz	100Khz 10Khz	10Mhz 1Mhz	1GHz 100MHz

FOR EXAMPLE: The frequency 14.03567 Mhz would be encoded as follows:

70 56 03 14 00

Since the TEN-TEC Model 563 has a tuning resolution of 10 Hz, and an upper frequency limit of 30 Mhz, the 1Hz digit is ignored and attempting to go beyond 30 Mhz will generate a 'NO GOOD' response from the transceiver.

When a mode selection command is sent, the mode must be encoded according to the following table:

LSB	00
USB	01
CW	03
FSK	04
FM	05

When a transceiver returns its current operating mode to a computer, it will also be encoded in this format.

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When a filter selection command is sent, the filter must be encoded according to the following table:

2.4 kHz	02
1.8 kHz	03
.5 kHz	04
.25 kHz	05

When a transceiver returns its current operating filter to a computer, it will also be in this format.

The narrow filters are not supported through the serial interface.

5.6 COMMANDS

Specific transceiver control commands can be found on the following pages. In use, each command must adhere to the structure discussed earlier. Included with the commands is a brief discussion of the possible transceiver response.

Here is a command/reply example:

The command to change modes via the serial interface is 06h, so to change the mode to USB with a 1.8 kHz filter, the message from the computer to the transceiver is:

FEh FEh 04h E0h 06h 01h 03h FDh

This string is sent as 8 bytes of data with no carriage return or linefeed.

The transceiver will respond with:

FEh FEh E0h 04h FBh FDh

The FBh is the "good" code, and no data follows it. If the command to change modes contained an incorrect mode number, for example, the transceiver would have responded with:

FEh FEh E0h 04h FAh FDh

Which is the "no good" code.

03h QUERY TRANSCEIVER FREQUENCY

This command sends the transceiver's current operating frequency to the requesting computer. The frequency data is returned as a string of BCD digits encoded as discussed previously.

COMMAND STRING SENT TO THE TRANSCEIVER:

FEh FEh RA SA 03h FDh

FEh FEh	Command Prefix
RA	Receiver Address (transceiver's address)
SA	Sender Address (computer E0h)
03h	Command code for frequency query
FDh	Command String Terminator

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RESPONSE STRING SENT TO THE COMPUTER:

The transceiver will respond by sending a return string that contains a data segment with the transceiver's frequency encoded in BCD format. The returned frequency represent the frequency of the currently active VFO.

FEh FEh RA SA DATA FDh

FEh FEh	Command Prefix
RA	Receiver Address (computer E0h)
SA	Sender Address (Transceiver's address)
03h	Command echo
DATA	Transceiver's frequency in BCD format
FDh	Command string terminator

04h QUERY TRANSCEIVER MODE

This command sends the transceiver's current operating mode and filter to the requesting computer.

COMMAND STRING SENT TO THE TRANSCEIVER:

FEh FEh RA SA 04h FDh

FEh FEh.	Command Prefix
RA	Receiver Address (transceiver's address)
SA	Sender Address (computer E0h)
04h	Command code for mode query
FDh	Command String Terminator

RESPONSE STRING SENT TO THE COMPUTER:

The transceiver will respond by sending a return string that contains a data segment with the transceiver's mode and filter encoded. The data returned is from the displayed VFO.

FEh FEh RA SA DATA FDh

FEh FEh	Command Prefix
RA	Receiver Address (computer E0h)
SA	Sender Address (Transceiver's address)
04h	Command echo
DATA	Transceiver's mode and filter encoded
FDh	Command String Terminator

This command updates the frequency of the currently selected VFO to data contained in the command string. Frequency data must be encoded.

COMMAND STRING SENT TO THE TRANSCEIVER:

FEh FEh RA SA 05h DATA FDh

FEh FEh	Command Prefix
RA	Receiver Address (transceiver's address)

SA	Sender Address (computer E0h)
05h	Command code for set frequency
DATA	BCD encoded frequency data
FDh	Command String Terminator

RESPONSE STRING SENT TO THE COMPUTER:

The transceiver will send a string that contains either the OK code (FBh) or a NO GOOD code (FAh) if the operation failed. The operation will fail if the frequency data indicates a frequency that is beyond the capabilities of the transceiver.

FEh FEh RA SA FAh or FBh FDh

FEh FEh	Command Prefix
RA	Receiver Address (computer E0H)
SA	Sender Address (transceiver's address)
FAh or FBh	NO GOOD CODE or OK CODE
FDh	Command String Terminator

06h SET TRANSCEIVER MODE

This command changes the mode of the currently selected VFO to data contained in the command string. Mode data must be encoded.

COMMAND STRING SENT TO THE TRANSCEIVER:

FEh FEh RA SA 06h DATA FDh

FEh FEh	Command Prefix
RA	Receiver Address (transceiver's address)
SA	Sender Address (computer E0h)
06h	Command code for mode and filter selection
DATA	Desired mode encoded: one byte for mode only or two bytes for mode and filter selection.
FDh	Command String Terminator

RESPONSE STRING SENT TO THE COMPUTER:

The transceiver will respond by sending a string containing either the OK code (FBh) if the operation was performed, or a NO GOOD (FAh) code if the operation failed. The operation will fail if the requested mode is not available on the transceiver.

FEh FEh RA SA FAh or FBh FDh

FEh FEh	Command Prefix
RA	Receiver Address (computer E0h)
SA	Sender Address (Transceiver's address)
FAh or FBh	NO GOOD CODE or OK CODE.
FDh	Command String Terminator

07h VFO SELECTION

This command provides for selection of a particular VFO. Besides the VFO selection code 07h, a sub command must be specified that indicates which VFO operation to perform.

COMMAND STRING SENT TO THE TRANSCEIVER:

FEh FEh RA SA 07h SC FDh

FEh FEh	Command Prefix
RA	Receiver Address (transceiver's address)

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SA	Sender Address (computer E0h)
07h	Command code for VFO selection
SC	Sub-Command:
00h	Select VFO A
01h	Select VFO B
A0h	Copies selected VFO to other VFO. ie VFO A = VFO B.
B0h	Swaps VFO contents. ie VFO A to VFO B and VFO B to VFO A
FDh	Command String Terminator

RESPONSE STRING SENT TO THE COMPUTER:

The transceiver responds by sending a string containing either the OK code (FBh) if the operation was performed, or a NO GOOD code (FAh) if the operation failed. The operation will fail if the requested mode is not available on the transceiver.

FEh FEh RA SA FAh or FBh FDh

FEh FEh	Command Prefix
RA	Receiver Address (computer E0h)
SA	Sender Address (Transceiver's address)
FAh or FBh	NO GOOD CODE or OK CODE.
FDh	Command String Terminator

08h SELECT MEMORY CHANNEL

This command informs the transceiver which memory channel is to be used for subsequent memory operations. The memory channel number, in BCD format, must be within the memory channel limits of the transceiver or a NO GOOD will be returned.

COMMAND STRING SENT TO THE TRANSCEIVER:

FEh FEh RA SA 08h MC FDh

FEh FEh	Command Prefix
RA	Receiver Address (transceiver's address)
SA	Sender Address (computer E0h)
08h	Command code for channel select
MC	Memory channel number in BCD format
FDh	Command String Terminator

RESPONSE STRING SENT TO THE COMPUTER:

The transceiver responds by sending a string containing either the OK code (FBh) if the operation was performed, or a NO GOOD code (FAh) if the operation failed. The operation will fail if the memory channel is not available on the transceiver.

FEh FEh RA SA FAh or FBh FDh

FEh FEh	Receiver Address (computer E0h)
SA	Sender Address (Transceiver's address)
FAh or FBh	NO GOOD CODE or OK CODE.
FDh	Command String Terminator

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09h TRANSFER ACTIVE VFO TO MEMORY CHANNEL

This command transfers contents of the active VFO to the pre-specified memory channel. The memory channel should have been previously set using command 08h. If not, the last accessed memory channel will be used for the operation.

COMMAND STRING SENT TO THE TRANSCEIVER:

FEh FEh RA SA 09h FDh

FEh FEh	Command Prefix
RA	Receiver Address (transceiver's address)
SA	Sender Address (computer E0h)
09h	Command code for VFO save
FDh	Command String Terminator

RESPONSE STRING SENT TO THE COMPUTER:

The transceiver responds by sending a string containing either the OK code (FBh) if the operation was performed, or a NO GOOD code (FAh) if the operation failed.

FEh FEh RA SA FAh or FBh FDh

FEh FEh	Command Prefix
RA	Receiver Address (computer E0h)
SA	Sender Address (Transceiver's address)
FAh or FBh	NO GOOD CODE or OK CODE.
FDh	Command String Terminator

0Ah COPY MEMORY CHANNEL TO ACTIVE VFO

Transceiver to copy data from the pre-specified memory channel into the currently active VFO. The memory channel should have been previously set using command 08h. If not, the last accessed memory channel will be used for the operation.

COMMAND STRING SENT TO THE TRANSCEIVER:

FEh FEh RA SA 0Ah FDh

FEh FEh	Command Prefix
RA	Receiver Address (transceiver's address)
SA	Sender Address (computer E0h)
0Ah	Command code for memory recall
FDh	Command String Terminator

RESPONSE STRING SENT TO THE COMPUTER:

Transceiver responds by sending a string containing either the OK code (FBh) if the operation was performed, or a NO GOOD code (FAh) if the operation failed.

FEh FEh RA SA FAh or FBh FDh

FEh FEh	Command Prefix
RA	Receiver Address (computer E0h)
SA	Sender Address (Transceiver's address)
FAh or FBh	NO GOOD CODE or Ok CODE.
FDh	Command String Terminator

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0Fh SET/CANCEL SPLIT OPERATION

This command activates or cancels split operation of the transceiver. In addition to the SET/ CLEAR SPLIT command code 0Fh, a sub command must be specified to indicate which operation to perform.

COMMAND STRING SENT TO THE TRANSCEIVER:

FEh FEh RA SA 0Fh SC FDh

FEh FEh	Command Prefix
RA	Receiver Address (transceiver's address)
SA	Sender Address (computer E0h)
0Fh	Command code for split operation
SC	Sub-command:
00h	Cancel split operation
01h	Set split operation
FDh	Command String Terminator

RESPONSE STRING SENT TO THE COMPUTER:

Transceiver responds by sending a string containing either the OK code (FBh) if the operation was performed, or a NO GOOD code (FAh) if the operation failed.

FDh FDh RA SA FAh or FBh FDh

FD FD	Command Prefix
RA	Receiver Address (computer E0h)
SA	Sender Address (Transceiver's address)
FAh or FBh	NO GOOD CODE or OK CODE.
FD	Command String Terminator

SPECIALIZED COMMAND MODES:

Some transceivers, such as TEN-TEC models 563, 564, 535 and 536 provide an additional mode referred to as MATRIX MODE. MATRIX MODE allows a transceiver to operate as a controller for other transceivers connected to the serial interface. When the transceiver is placed in MATRIX MODE it will generate and accept MATRIX MODE COMMANDS. These commands are sent from any transceiver placed in MATRIX MODE and are in a format unique to MATRIX MODE. Other MATRIX MODE transceivers will accept the matrix mode commands but will not generate response. MATRIX MODE commands are generated from a MATRIX MODE transceiver when ever its operating status is changed (ie frequency or mode). By sending MATRIX MODE commands that contain this information, other MATRIX MODE transceivers will automatically track the transceiver that generated the commands. "M.Lock" will appear in display. To activate MATRIX mode on Model 563: in USER'S MENU, turn CdE "ON".

00h MATRIX MODE COMMAND
TRANSFER CURRENT OPERATING FREQUENCY TO ALL TRANSCEIVERS IN MATRIX MODE

This command, generated by a transceiver in MATRIX MODE, causes any other MATRIX MODE transceiver to mimic the operation of the transceiver that generated this command.

COMMAND STRING SENT TO THE TRANSCEIVER:

FEh FEh 00h SA 00h DATA FDh

FEh FEh Command Prefix

RA 00h Receiver Address that any MATRIX MODE transceiver will accept.
SA Sender Address (transceiver address)
00h Command code for frequency transfer
DATA Transceiver frequency, encoded in BCD format
FDh Command String Terminator

RESPONSE STRING SENT TO THE COMPUTER: No transceiver replies to this transceiver generated command.

01h MATRIX MODE COMMAND
TRANSFER CURRENT OPERATING MODE TO ALL TRANSCEIVERS IN MATRIX MODE

This command, generated by a transceiver in MATRIX MODE, causes any other MATRIX MODE transceiver to mimic the operation of the transceiver that generated this command.

COMMAND STRING SENT TO THE TRANSCEIVER:

FEh FEh 00h SA 00h DATA FDh

FEh FEh	Command Prefix
RA	00h Receiver Address that any MATRIX MODE transceiver will accept.
SA	Sender Address (transceiver address)
01h	Command code for transfer
DATA	mode and filter codes, encoded in BCD: one byte for mode only or two bytes for mode and filter selections.
FDh	Command String Terminator

RESPONSE STRING SENT TO THE COMPUTER: No transceiver responds to this transceiver generated command.

5.7 EXPANDED COMMANDS FOR MODELS 563 AND 564 ONLY

0C HEX.: READ OFFSET FREQUENCY

This command queries the transceivers current offset frequency.

Transceiver's response: The transceiver will respond by returning the current offset frequency in BCD format (2 bytes). Negative offset frequencies are returned in 9's compliment form.

Data: Transceiver's current offset frequency in BCD format.

Note: The command code is not echoed.

0D HEX: WRITE OFFSET FREQUENCY

This command sets the transceivers current offset frequency.

Data: Offset frequency in BCD format. For negative values of offset, the format should be 9' compliment.

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13 HEX: ANNOUNCE FREQUENCY OF CURRENT VFO (OPTIONAL VOICE BOARD REQUIRED)

This command will activate the optional voice board and announce the frequency of the current VFO.

Transceiver's response: Returns NO GOOD if the voice board is not installed.

16 HEX: SET/CLEAR TRANSMIT MODE

This command and associated sub-commands control the transmitter.

These commands provide remote control of the transmit/receive functions but cannot override local control functions. Thus, if the PTT line is depressed, sending a RETURN TO RECEIVE command cannot override the PTT action.

SUB-COMMAND 01h	GO TO TRANSMIT
SUB-COMMAND 02h	RETURN TO RECEIVE

Transceiver's response: If the transceiver was able to perform the indicated operation, it will return the OK code.

COMMAND 17h: RETURN TRANSCEIVER STATUS

This command queries the transceiver's extended status information.

Transceiver's response: The transceiver will return the extended status information encoded in a 1 byte code encoded as listed below.

FE FE RA SA DATA FD

BIT POSITION		
0	SPLIT STATUS	(0=SPLIT OFF, 1=SPLIT ON)
1	VFO SELECTED	(0=VFO A, 1=VFO B)
2	TX STATUS	(0=RX, 1=TX)
3	RIT STATUS	(0=OFF, 1=ON)
4	XIT STATUS	(0=OFF, 1=ON)
5	VOX STATUS	(0=OFF, 1=ON)
6	LOCK STATUS	(0=OFF, 1=ON)
7	NOT USED	

Note: The command code is not echoed.

18h: RETURN TRANSMIT FREQUENCY

This command returns the true transmit frequency of the transceiver. Any transmit offset or split status will be included in the returned frequency.

COMMAND STRING SENT TO THE TRANSCEIVER:

FEh FEh RA SA 18h FDh

FEh FEh	Command Prefix
RA	Receiver Address (transceiver's address)
SA	Sender Address (computer E0h)
18h	Command code for frequency query
FDh	Command String Terminator

RESPONSE STRING SENT TO THE COMPUTER:

The transceiver will respond by sending a return string that contains a data segment with the transceiver's frequency encoded in BCD format. The returned frequency represents the frequency of the currently active VFO.

FEh FEh RA SA DATA FDh

FEh FEh	Command Prefix
RA	Receiver Address (computer E0h)
SA	Sender Address (Transceiver's address)
DATA	Transceiver's frequency in BCD format
FDh	Command string terminator

Note: Command 03h is echoed as if this were a 03h query.

19h: RETURN RECEIVE FREQUENCY

This command returns the true receive frequency of the transceiver. Receive offset and split operation are included in the returned frequency.

COMMAND STRING SENT TO THE TRANSCEIVER:

FEh FEh RA SA 19h FDh

FEh FEh	Command Prefix
RA	Receiver Address (transceiver's address)
SA	Sender Address (computer E0h)
03h	Command code for frequency query
FDh	Command String Terminator

RESPONSE STRING SENT TO THE COMPUTER:

The transceiver will respond by sending a return string that contains a data segment with the transceiver's frequency encoded in BCD format. The returned frequency represent the frequency of the currently active VFO.

FEh FEh RA SA DATA FDh

FEh FEh	Command Prefix
RA	Receiver Address (Computer E0h)
SA	Sender Address (Transceiver's address)
DATA	Transceiver's frequency in BCD format
FDh	Command string terminator

Note: Command code 03h is echoed as if this were a 03h query.

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CHAPTER 6

TROUBLE SHOOTING PROCEDURES

If the transceiver should fail to operate normally, use the following chart as an aid in determining the problem. Often the cause of the problem is an overlooked switch / control or a mistake in entering information into the keypad. Of course, you may call the Service Department (1-423-428-0364) and ask for assistance should you need it.

SYMPTOM	POSSIBLE CAUSE
Transceiver dead, no meter lamp, no display	- Quickly Reset microprocessor with Master Reset (2-4.2) - Check power switches on radio and power supply - Check power cable to radio - Check fuses on radio and power supply - Check polarity and correct voltage of power supply - Check wall outlet for power supply - Be sure Ten-Tec power supply is not tripping off due to high SWR (1-2)
Transceiver OK, no meter lamp or	- IN+ function (in USER MENU 1) set to display (or very low) minimum (3-1.16)
Receiver dead, meter lamp and display on	- Check AF and RF GAIN controls (3-5.09) - Check headphone and EXTERNAL SPKR jacks. (3-6.01) - Check to be sure radio is not in TRANSMIT - Check CRYSTAL FILTER SELECTION. Be sure filter is installed. (1-8) (3-1.08) - Check MAIN / AUX Antenna switch for proper antenna selection (3-5.15) - Check Antenna coax and associated items. - Check PBT control (should be centered) (3-5.12) - If in FM, check SQUELCH (3-5.11) - Check MUTE jack, if used (3-6.10)

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TROUBLE SHOOTING PROCEDURES (Cont.)

SYMPTOM	POSSIBLE CAUSE
Weak Receive	- Check MAIN / AUX Antenna switch for proper antenna selection (3-5.15) - Check RF GAIN control (3-5.09) - Check ATTN switch (3-5.05) - Check for proper CRYSTAL FILTER selection (3-1.08) - Check PBT control (should be centered) (3-5.12) - Check Antenna coax and accociated items
Distorted Received CW / AMTOR / PACKET / RTTY signals	- Check AUTO NOTCH switch (should be off) (3-5.13) - Check AGC ON / OFF switch (should be on) (3-5.07)
Distorted Received SSB Signals	- Check AGC ON / OFF switch (should be on) (3-5.07) - May need to activate -20 dB ATTENUATOR (3-5.05) - Check for proper mode selection (3-1.02)
Transmit frequency different from Receive frequency	- Check SPLIT function (3-2.2) (normally OFF) - Check RIT / XIT (3-2.3, 3-2.4)
Distorted Transmit signals	- Check ground system - Check antenna system SWR - Check for strong RF field in shack - Reset microprocessor - PROCESSOR level turned up too high (3-5.04)
Frequencies will not store in memories	- Be sure to press M>VFO key quickly. If button held too long, frequency will go to SCRATCH PAD MEMORY (3-3.3)
Main or remote tuning knob will not change frequency	- Check LOCK (normally OFF) - Be sure you are not in VOX SETUP routine (3-1.09) - Be sure you are not in SIDETONE SETUP routine (3-1.11)

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TROUBLE SHOOTING PROCEDURES (Cont.)

SYMPTOM	POSSIBLE CAUSE
Keypad will not respond to input, main tuning knob will not change frequency No readout, audio present Readout present, can not enter commands	- Reset microprocessor with PARTIAL RESET. If radio still does not respond, use a MASTER RESET. (2-4) - USER OPTIONS MENU activated (3-4)
Clock resets to 12:00 when radio turned off Memories and USER Options clear out when radio turned off	- Replace 3 volt Lithium battery (CR-2032;DL-2032) on Logic Board (81606). See pg 4-18 & 4-19.
Beep heard every 10 - minutes	- ID timer turned on in USER OPTIONS MENU (3-4)
Linear amplifier will not key using RELAY N. O. jack on rear panel	- LCO option in USER OPTIONS MENU not turned ON (3-4)
Linear amplifier will not key using TX OUT / TX EN jacks (TEN-TEC LINEARS)	- Be sure TX OUT / TX EN cables are not swapped. (3-6.09) - Check TX OUT / TX EN cable continuity
Radio stays in Transmit when turned on	- Check CW KEY / KEYER PADDLE cable for short - Check PTT line (cable) for short - Check mic cable for short on PTT wire (pin 3) - Check computer terminal unit for short on PTT line. - Check VOX GAIN, if used (3-1.09)

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TEN-TEC, Inc.
1185 Dolly Parton Parkway
Sevierville, TN 37862

CUSTOMER SERVICE TELEPHONE
423-428-0364

LIMITED WARRANTY AND SERVICE POLICY, U.S.A.

TEN-TEC, Inc. warrants this product to be free from defects in material and workmanship for a period of one year from the date of purchase, under these conditions:

1. THIS WARRANTY APPLIES ONLY TO THE ORIGINAL OWNER. It is important that the warranty registration card be sent to us promptly to establish you as the owner of record. This will also insure that any bulletins pertaining to this equipment will be sent to you.

2. READ THE MANUAL THOROUGHLY. This warranty does not cover damage resulting from improper operation. Developing a thorough understanding of this equipment is your responsibility.

3. IF TROUBLE DEVELOPS we recommend that you contact our customer service group direct. The selling dealer is not obligated by us to perform service in or out of warranty. It has been our experience that factory direct service is expeditious and usually results in less down-time on the equipment. Some dealers do offer warranty service and of course, have our complete support.

4. WE ENCOURAGE SELF HELP. Taking the covers off does not void the warranty. In many cases our customer service technicians, with your help, can identify a faulty circuit board. In these cases we will send you a replacement board which you can change out. This will be shipped on a 30 day memo billing and when the defective board is returned, we will issue credit.

5. EQUIPMENT RETURNED TO THE FACTORY must be properly packaged, preferably in the original shipping carton. You pay the freight to us and we prepay surface freight back to you.

6. EXCLUSIONS. This warranty does not cover damage resulting from misuse, lightning, excess voltages, polarity errors or damage resulting from modifications not recommended or approved by Ten-Tec. In the event of transportation damage a claim must be filed with the carrier. Under no circumstances is Ten-Tec liable for consequential damages to persons or property caused by the use of this equipment.

7. TEN-TEC RESERVES the right to make design changes without any obligation to modify equipment previously manufactured.

8. THIS WARRANTY is given in lieu of any other warranty, expressed or implied.

SERVICE OUTSIDE OF THE U.S.A.

Many of our dealers provide warranty service on the equipment they sell. Many of them also provide out of warranty service on all equipment whether they sold it or not. If your dealer does not provide service or is not conveniently located, follow the procedure outlined above. Equipment returned to us will be given the same attention as domestic customers but all freight expense, customs and broker fees will be paid by you.

Part No. 74244

This obsolete manual file is provided as a courtesy to you by Ten-Tec, Inc.

Ten-Tec's service department can repair and service virtually everything we have built going back to our first transceivers in the late 1960's. It is our ability to continue offering service on these rigs that has led to their re-sale value remaining high and has made a major contribution to our legendary service reputation.

Printed and bound copies of all manuals are available for purchase through our service department if you would prefer not to use this copy as your transceiver manual.

We can repair or service your Ten-Tec equipment at our facility in Sevierville, TN. We also offer support via telephone for all products via during usual business hours of 8 a.m. to 5 p.m. USA Eastern time, Monday through Friday. We have a large supply of parts for obsolete products. Repairing a transceiver or amplifier yourself? Contact us for parts pricing information.

Service department direct line: (865) 428-0364
Ten-Tec office line: (865) 453-7172
Service department email: service@tentec.com
Address: 1185 Dolly Parton Parkway, Sevierville, TN 37862 USA

We have found it is most effective for us to help you troubleshoot or repair equipment with a consultation via telephone rather than by email.

Suggested contact methods are:

Troubleshooting or repairing equipment – call (865) 428-0364
Other inquiries – call (865) 428-0364 or email service@tentec.com

THANK YOU AND 73 FROM ALL OF US AT TEN-TEC