



# SERVICE MANUAL



## TR-7

## H. F. TRANSCEIVER

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## SECTION 1

## INTRODUCTION

## 1-1. USING THE TR-7 SERVICE MANUAL

This manual is divided into several sections for clarity and ease of use. Each major section is written with the assumption that the preceding portions of the manual have been read and understood by the user.

Section 1 is introductory in nature, and provides a general discussion of operating theory, module location, troubleshooting techniques and tool requirements.

Section 2 contains complete information in each functional element of the TR-7. This information includes detailed circuit description, parts list, component location and schematic diagram. This section of the manual is divided by functional element such as circuit board, module, chassis, etc. for the purpose of rapid circuit, component and problem identification.

Section 3 is a complete alignment procedure for the TR-7, and includes test equipment requirements, recommendations and test point locations.

## 1-2. LOCATING A MALFUNCTION

The modular design of the TR-7 allows easy exchange of most of the printed circuit boards. All modules are easily removed with the exception of the low-pass and high-pass filter modules, the PTO, and the power amplifier.

The first step in troubleshooting the TR-7 should be isolation of the malfunction to the module or board level. Refer to Section 1-3 for a general discussion of theory of operation and determine which module (or modules) would cause the problem at hand. In most cases, the problem will involve only one board, and substituting a board known to be in good operating condition will easily isolate the problem. Locating problems on the filter modules may require removing these boards from the chassis by removing the bandswitch shaft and unsoldering the harness connections.

Once the problem has been isolated, refer to the appropriate portion of Section 2 for a full scale description of the circuit.

## 1-3. GENERALIZED THEORY OF OPERATION

The following discussion covers the theory of operation of the TR-7 in a general manner. Detailed circuit descriptions are found in Section 2 of this manual. Refer to figure 1-2 (TR-7 Block Diagram) and figure 1-3 (TR-7 Module Locations) for aid in following this discussion. The discussion is divided into three sections (receiver, transmitter and frequency control) for clarity.

## 1-3.1 RECEIVER SECTION

Incoming signals from the antenna pass through a bandswitched low-pass filter module, the transmit/receive antenna switching, and a bandswitched high-pass filter module. These filters create an input bandpass filter, the limits of which are defined by the yellow numerals on the front panel BAND switch. A separate receiver and/or receive antenna can be connected in this path by removing the jumper between the EXT RCVR and EXT ANT jacks on the rear panel and making the appropriate connections.

The output of the high-pass filter is connected to the input of the Up-Converter module, along with the VLF antenna input and the 25 kHz calibrator output. The VLF antenna is connected through a 20 dB attenuator due to the fact that the input antenna filters are bypassed by this input. Signals at the input of the Up-Converter module are mixed with the output of the synthesizer VCO to create a 48.05 MHz intermediate frequency (IF) signal. Conversion is accomplished by a high-level, double balanced mixer to provide a very wide dynamic range. The output of this mixer is amplified by a low-noise, high dynamic range junction FET amplifier to insure adequate receiver sensitivity. This stage is followed by a four-pole monolithic 48.05 MHz crystal filter. The purpose of this filter is to attenuate signals removed more than  $\pm 4$  kHz from 48.05 MHz, thus protecting the remaining stages of the receiver from strong interfering signals. In this manner, optimum receiver dynamic range is preserved while providing excellent sensitivity.

The output of the Up-Converter module is routed to the input of the 2nd mixer module. This module provides additional gain at the 48.05 MHz 1st IF frequency and converts this signal to the 5.645 MHz 2nd IF frequency. Automatic gain control (AGC) voltage is applied to the 1st IF amplifier to supplement the control range supplied by later stages.

The 5.645 MHz signal from the 2nd mixer module is routed through the Noise Blanker module to the IF Selectivity module. When installed, the accessory NB-7 Noise Blanker acts on noise pulses prior to the IF crystal filters to prevent ringing in these filters from stretching the pulses. Maximum noise blanker effectiveness is thus assured. If the accessory NB-7 is not installed, the 2nd IF signal is passed through a jumper board in the same location for interconnection.

The IF Selectivity module contains provisions for 3 accessory crystal filters in addition to the standard 2.3 kHz filter. These filters determine the overall bandwidth of the receiver, and are selected by PIN diode switching controlled from the transceiver front panel. Careful attention has been given to the switching circuit design and physical layout of this module to minimize stray coupling paths which would degrade the ultimate selectivity of the receiver. The result is extremely high rejection of unwanted off-channel signals.

Following the IF Selectivity module, the 5.645 MHz signal is routed to the 2nd IF module. This module amplifies the 5.645 MHz signal and demodulates it using an AM or product detector, depending on mode. The demodulated signal is then amplified to a level sufficient to drive a speaker by an integrated circuit audio amplifier. AGC voltage, developed prior to demodulation, is used to control the gain of the IF stages. The same AGC signal is used to drive the S-meter circuit to provide signal strength indication. AGC decay time constants are selected by the MODE switch and front panel F/S switch.

### 1-3.2 TRANSMITTER SECTION

In the transmit mode, audio signals from the MIC jack are applied to the Transmit Exciter module, where they are amplified and used to drive the balanced modulator and VOX circuits. The VOX section automatically controls the transmit/receive switching in the AM and SSB modes. A push-to-talk (PTT) input is also provided for manual control.

The 5.645 MHz double sideband output of the balanced modulator is routed through the Noise Blanker module to the IF Selectivity module. The signal is passed straight through the noise blanker for interconnection purposes only. The IF selectivity module rejects the undesired sideband, using the 2.3 kHz crystal filter. This is accomplished by correct positioning of the double sideband signal relative to the crystal filter.

The 5.645 MHz single sideband signal from the IF

Selectivity module is connected to a summing amplifier on the 2nd IF module. In the SSB and RTTY modes, the signal is passed through to a variable attenuator. In the AM mode, the signal is summed with the BFO signal to create an AM signal before being passed to the variable attenuator. In the CW mode the balanced modulator is disabled, and a 5.645 MHz crystal oscillator is keyed to create an offset CW signal for application to the variable attenuator.

The variable attenuator consists of a PIN diode which is controlled by the ALC circuitry. The outputs of the forward and reflected wattmeter and the CARRIER control are connected to the ALC module. These signals are summed to create a controlling signal for the attenuator, thus controlling the transmitter drive level. VSWR protection is accomplished in this manner, as well as providing gain control to prevent flat topping and overdrive.

The 5.645 MHz transmit IF signal developed in the 2nd IF module is connected to the 2nd mixer module. The signal is converted to 48.05 MHz and amplified, then routed to the Up-Converter module.

In the Up-Converter module, the transmit signal is filtered by the 4-pole 48.05 MHz crystal filter to remove any spurious content, amplified, and converted to the operating frequency by mixing it with the output of the synthesizer VCO.

The output of the Up-Converter module is filtered by the high-pass filter module, and routed through the transmit/receive switching to the Power Amplifier module, where it is amplified to the final output level. The signal is then routed by the transmit/receive switching to the low-pass filter module to attenuate the harmonics developed in the power amplifier. The transmit signal then passes through the wattmeter to the antenna jack.

### 1-3.3 FREQUENCY CONTROL

The TR-7 features synthesizer control of the operating frequency. This allows the transceiver to cover a wide frequency range without the use of range crystals or other frequency determining circuits.

The reference for the synthesizer is generated by a 40 MHz crystal oscillator on the PBT/Reference Oscillator module. The output of this oscillator is divided by 80 to produce 500 kHz. These two signals (40 MHz and 500 kHz) are routed to the synthesizer modules, which are described later in this section.

When the CAL switch is depressed, the 500 kHz signal is divided by 20 to produce a 25 kHz signal which is rich in harmonics. This signal is connected to the input of the Up-Converter module, and produces calibration marker signals at 25 kHz intervals.

The passband tuning controls are connected to a 13.695 MHz voltage-controlled crystal oscillator (VCXO) through a switching circuit. Control of this oscillator is thus switched between the front panel PBT control and the internal controls which are selected by the MODE switch. Although this oscillator is crystal controlled, it is designed to allow the frequency to be moved over a limited range (approximately  $\pm 3$  kHz) centered on 13.695 MHz. This signal is then mixed with the 40 MHz crystal oscillator signal to produce 53.695 MHz and with an 8.05 MHz crystal oscillator to produce 5.645 MHz.

The 53.695 MHz signal is used for injection to the 2nd mixer module, where it converts the 48.05 MHz IF signal to 5.645 MHz. The 5.645 MHz signal is used as a BFO signal for the generation and demodulation of SSB, CW, and RTTY signals. Since the 13.695 MHz oscillator is used to generate both signals, it can be moved in frequency without changing the receiver operating frequency. Therefore, as the BFO frequency is changed (by changing the PBT control voltage), the 53.695 MHz injection signal is changed by an equal amount. This allows the 2nd IF to be positioned anywhere within a  $\pm 3$  kHz range with respect to the crystal filter passband while the receiver remains tuned to the incoming signal. This technique provides the passband tuning feature in addition to sideband selection.

Injection for the Up-Converter module is supplied by the VCO module. This module includes a voltage-controlled oscillator (VCO) which operates over the range of 48.05 MHz to 78.05 MHz. When mixed with the 0-30 MHz incoming signals, the result is the 48.05 MHz IF frequency. The VCO is tuned by a filtered control voltage derived from a phase detector which compares the frequency and phase of the 500 kHz reference from the PBT/Reference Oscillator module and a 500 kHz signal from the Translator module.

The Translator module combines the 40 MHz reference signal and the 5.05-5.55 MHz output of the permeability-tuned oscillator (PTO) which is controlled by the main tuning dial. The resulting 45.05-45.55 MHz signal is filtered and mixed with the VCO signal to produce a 3.0-33.0 MHz signal,

depending on operating frequency. This signal is filtered, amplified, and applied to a programmable divider ( $\div N$ ) which is programmed by the Digital Control module. The output of the  $\div N$  is exactly 500 kHz when the VCO is tuned to the correct frequency, thus satisfying the phase detector and locking the synthesizer loop.

The Digital Control module generates programming information for the  $\div N$  by processing information from both the BAND switch and the frequency programmer on the DR-7 display module. The BAND switch information generates the proper  $\div N$  load number for the frequency range indicated by the white bandswitch numerals. The DR-7 frequency programmer is then used to increment this load number UP or DOWN by the desired amount.

The following example will help to illustrate the operation of the synthesizer:

Operating Frequency:	14.2835 MHz	
	<u>+48.0500 MHz</u>	
VCO Frequency:		62.3335 MHz
PTO Frequency:		
5.05 MHz + 0.2835 MHz =	5.3335 MHz	
	<u>+40.0000 MHz</u>	
Variable Reference Frequency:		45.3335 MHz
$\div N$ Input Frequency:		
62.3335 MHz - 45.3335 MHz =		17 MHz
$\div N$ Output:		.5 MHz
(Load number = 34)		

It can be seen from the above that each time the  $\div N$  load number is increased or decreased by one, the VCO frequency will be forced to change by 500 kHz to satisfy the phase detector and maintain a locked condition. By the same token, as the PTO is tuned, the VCO must follow exactly to maintain phase lock.

The DR-7 Frequency Display module contains a counter with a six digit LED readout. In the normal mode, this counter is connected to the VCO output and is programmed to subtract 48.05 MHz from the resulting count. In this manner, operating frequency is displayed on the LED readout. In the external mode, the 48.05 MHz subtraction is removed, and the counter input is connected to the rear panel counter input jack, resulting in a 150 MHz six digit counter for test purposes.

#### 1-4. SPECIAL TOOLS AND FIXTURES

A special set of tools and fixtures is available for servicing the TR-7. This set includes all unique board extenders, a Jumper Board, and alignment tools needed to troubleshoot and align the transceiver. This kit is available from the R.L. Drake Company for a nominal fee.

##### 1-4.1 BOARD EXTENDERS

In order to extend a circuit card out of the card cage for servicing, refer to figure 1-1 and select the proper board extenders from the table. Remove the circuit card to be tested, install the board extenders so that

each pin of each circuit card connector is extended, and reinstall the circuit card on the extenders. To service a card located underneath the DR-7 remove the DR-7 and replace it with the Jumper Board included in the service kit.

##### NOTE

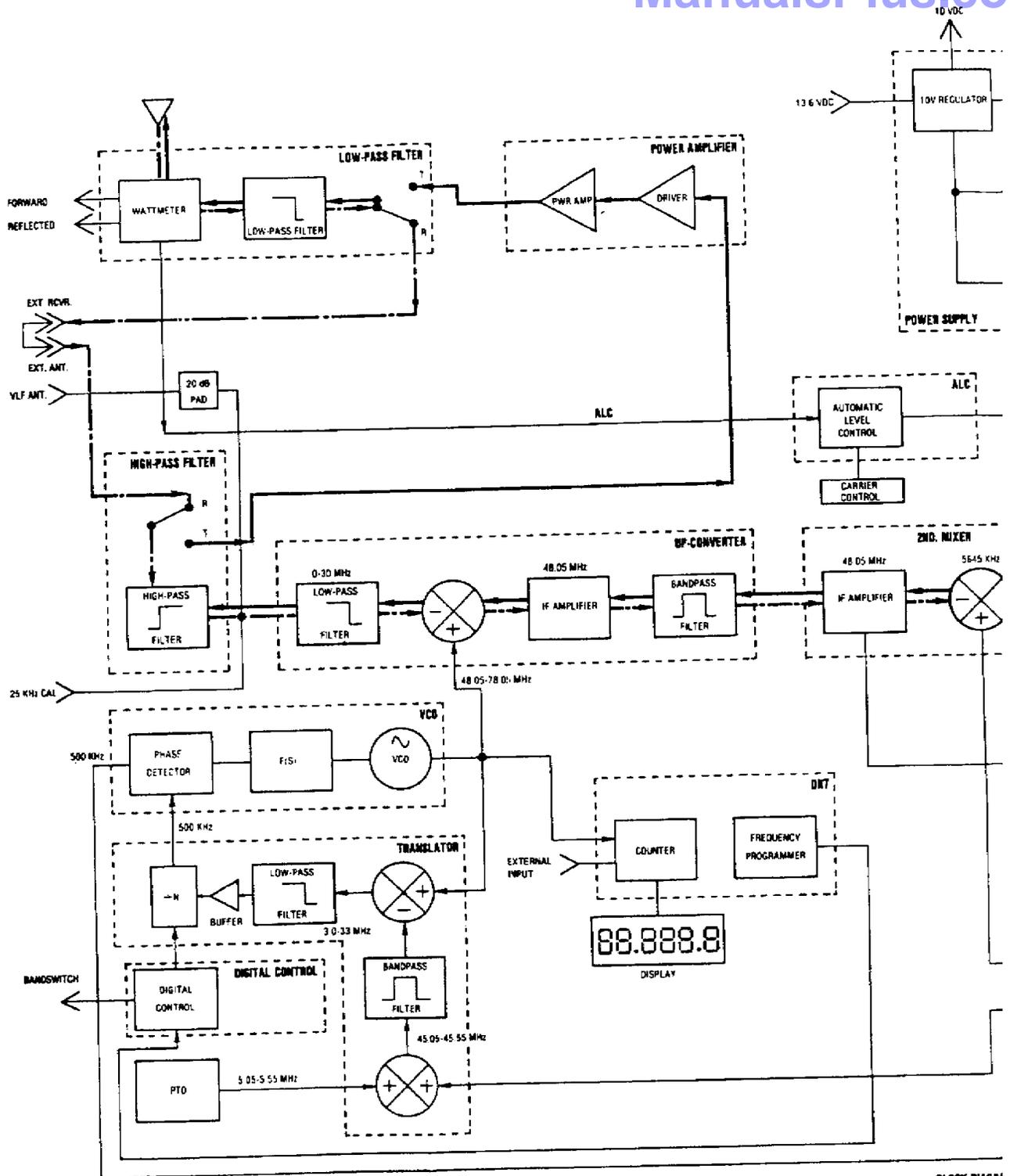
Performance of the TR-7 will be degraded when some cards are extended. After replacing a faulty component or otherwise correcting a problem, the transceiver should be realigned in accordance with Section 3 with all boards in place in the card cage.

CIRCUIT CARD	EXTENDER TYPE & NUMBER REQUIRED				
	3 PIN	4 PIN	5 PIN	6 PIN	9 PIN
Digital Control (See Note 1)		1	1	1	1
Transmit Exciter (See Note 2)	1	2	1	1	
Up Converter	2				
VCO (See Note 2)	1	1			1
Translator (See Note 3)	2				1
2nd Mixer	2	1			
IF Switching or Noise Blanker		1		1	
IF Selectivity	3				
PBT/Reference	1	1		1	2
2nd IF/Audio		1	1	4	
Power Supply (See Note 4)				2	
<b>ACCESSORIES</b>					
DR-7	2			2	1
AUX-7			2	1	1

##### NOTES:

1. Use a 9 pin extender on Translator end of Jumper Board.
2. Extend Jumper Board with (2) 6 pin and (1) 9 pin extenders.
3. Use (2) 6 pin extenders on Digital Control end of Jumper Bd.
4. Limit operating time to 15 minutes due to lack of heat sink.

Fig. 1-1 Board Extender Selection Chart



BLOCK DIAGM  
 DRAK . 1177 SIDEBAND

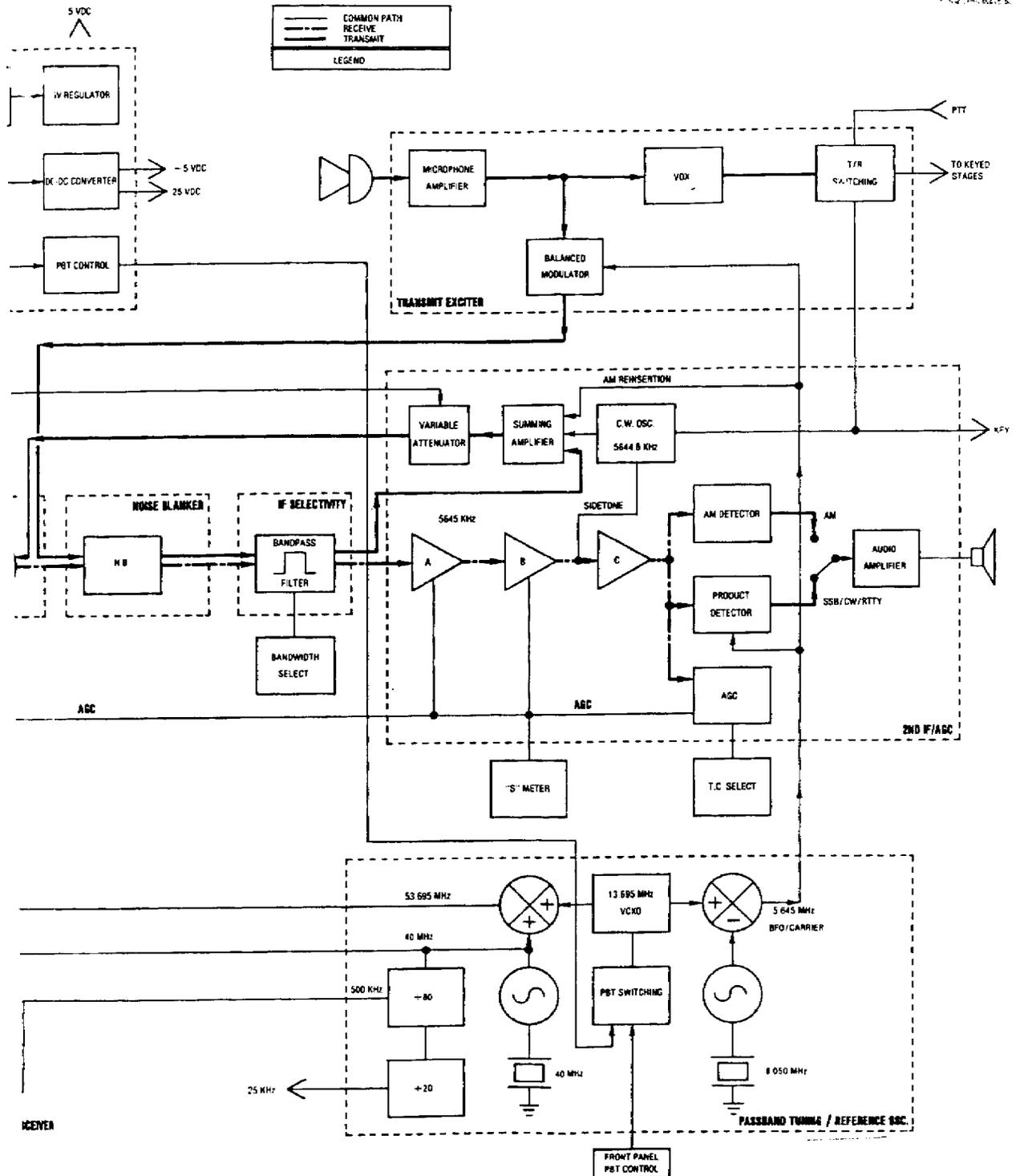
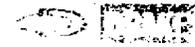
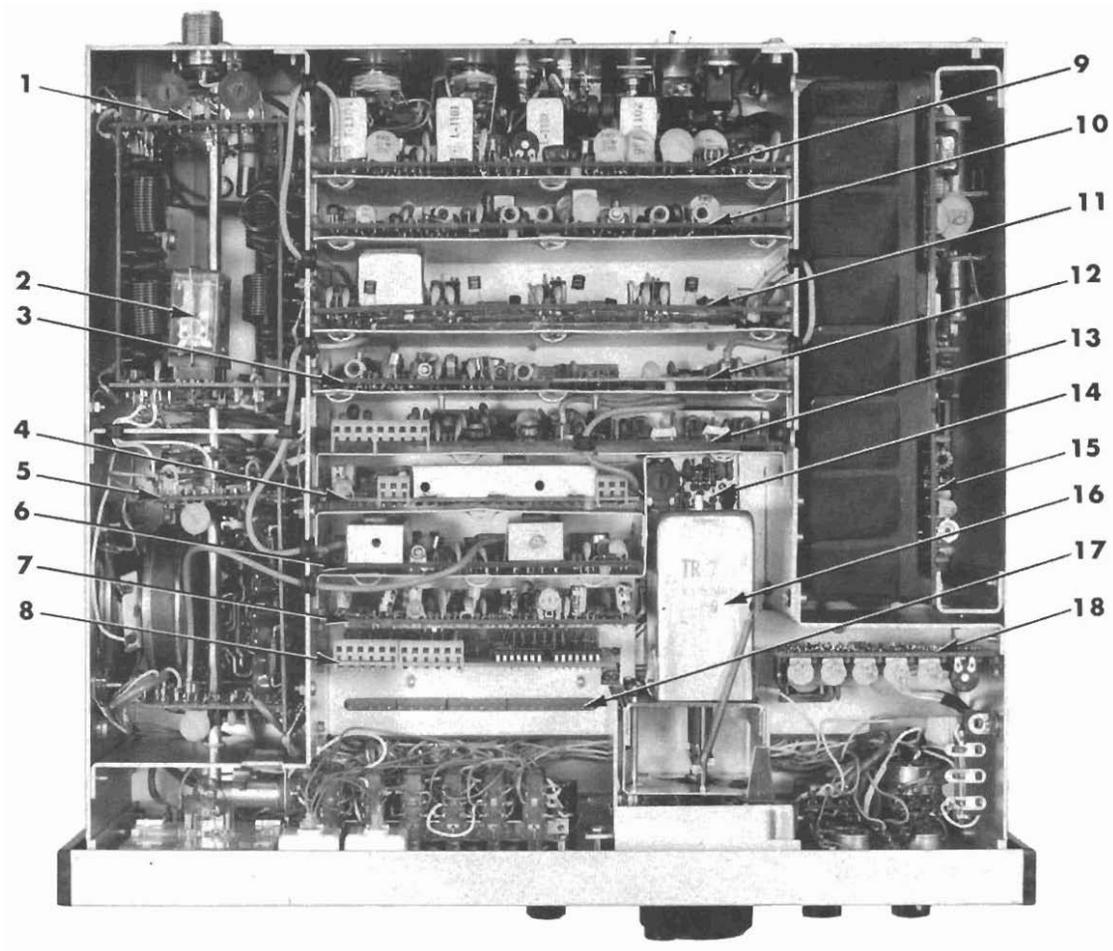


Fig. 1-2 TR7 Block Diagram



BD. #	DESCRIPTION	ASSY. #
1	Low Pass Filter Module	17.18.19.20
2	T/R Relay	Part of Low Pass Filter
3	2nd Mixer	07
4	VCO	05
5	High Pass Filter Module	13, 14, 15, 16
6	Up-Converter	04
7	Transmit Exciter	03
8	Digital Control	02
9	2nd IF/Audio	11
10	Passband Tuning/Reference	10
11	IF Selectivity	09
12	IF Switching or Noise Blanker	08
13	Translator	06
14	RIT & PTO Switching Circuitry	00
15	Power Amplifier Module	23
16	PTO	00
17	AUX-7 Connector	01
18	Power Supply/Regulator	21

Fig. 1-3 TR7 Module Locations

## SECTION 2

## CIRCUIT DESCRIPTION

The following sections describe the circuit of each of the modules and/or circuit cards in detail. Each section contains a schematic diagram, parts location overlay, and parts list. When ordering replacement parts, please refer to the R. L. Drake Company part number listed for the part in question.

### 2-1. PARENT BOARD/CHASSIS

The Parent Board and Chassis (Wiring Harness) combine to interconnect the various circuit cards and modules in the TR-7. Refer to figure 2-2 for schematic and figure 2-1 for parts location information. Figure 2-1 also identifies the major interconnection circuits on the Parent Board as an aid for troubleshooting and alignment.

Each circuit board/module has been assigned an identifying number for circuit description and parts identification purposes in accordance with the following list:

Identification Prefix	Circuit Board/Module
01	Auxiliary Program (Accessory)
02	Digital Control
03	Transmit Exciter
04	Up-Converter
05	VCO
06	Translator
07	2nd Mixer
08	IF Switching or Noise Blanker (Accessory)
09	IF Selectivity
10	Pass Band Tuning/Reference
11	2nd IF/Audio
12	Jumper
13	High Pass Filter
14	High Pass Filter Switch, Front
15	High Pass Filter Switch, Rear
16	ALC
17	Low Pass Filter, Bands 1-4
18	Low Pass Filter, Bands 5-8
19	Low Pass Filter Switch, Front
20	Low Pass Filter Switch, Rear
21	Power Supply/Regulator
22	Predriver
23	Power Amplifier
90	DR-7 (Accessory)

The identification prefix is used whenever referring to a particular circuit card. For example, the designator for resistor number 25 on the 2nd

IF/Audio Board is R1125. Pin 16 of the same card is numbered 11/16. Figures 2-1 and 2-2 include these identification prefixes for reference.

Refer to figure 1-1 to aid in following the signal flow through figure 2-2. Note that several power and/or control lines are identified by function. For example, the notation +10 CAL indicates that +10 VDC is present on this line when the calibrator is enabled. +10T AM indicates that +10 VDC is present in transmit in the AM mode. It is possible to isolate a large number of faults to the board level by making the necessary measurements on the Parent Board, utilizing figures 2-1 and 2-2 for location information.

The PTO switching circuitry selects the frequency controlling signal in the receive and transmit modes and applies this signal to pin 38 of the Translator module. Frequency control can be derived from one of four sources: the internal PTO, the RV-7, the R-7, or the crystal oscillator on the AUX-7 (for fixed frequency operation). PIN diodes CR9 through CR13 select the desired signal and couple it through C2 to the Translator Board. Since R22 is a common return resistor for all of the PIN diode switches, back bias is automatically applied to the unused signal paths. The Spot function is obtained by enabling two signal paths at once. CR16 and CR17 form a detector to provide an audio indication of zero beat. Q1, Q2 and Q3 control the RV-7/TR-7 selection in receive, and Q4, Q5 and Q6 perform the same function in transmit. Selection of the R-7 PTO is accomplished via the RCT switch (S5E) and circuitry in the R-7. The fixed oscillator is selected by the Fixed switches (S4D and S4E) via CR14, CR15 and circuitry on the AUX-7.

The RIT function is controlled by U1, which switches the RIT control line between the front panel RIT control (R10B) and the internal RIT centering control (R24). When the RIT function is not selected, the RIT line is controlled by R24 in both receive and transmit.

## TR-7 PARENT BOARD/CHASSIS

REF DES	DESCRIPTION	PART NO.
C1	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C2	Capacitor, Disc, .01 $\mu$ F + 80%, 25 V	3161500
C3	Capacitor, Disc, 100 pF $\pm$ 10%, 500 V	3161070
C4	Capacitor, Disc, 100 pF $\pm$ 10%, 500 V	3161070
C5	Capacitor, Disc, .01 $\mu$ F + 80%, 25 V	3161500
C6	Capacitor, Disc, .05 $\mu$ F + 80%, 16 V	3161600
C7	Capacitor, Disc, .01 $\mu$ F + 80%, 25 V	3161500
C8	Capacitor, Disc, .01 $\mu$ F + 80%, 25 V	3161500
C9	Capacitor, Electrolytic, 470 $\mu$ F @ 25 WVDC	3180235
CR1	Diode, MR501	3020270
CR2	LED, Green	3472054
CR3	Diode, 1N4148	3020090
CR4	Diode, 1N4148	3020090
CR5	Diode, 1N4148	3020090
CR6	Diode, 1N4148	3020090
CR7	Diode, 1N4148	3020090
CR8	Diode, 1N4148	3020090
CR9	Diode, MPN3404	3020265
CR10	Diode, MPN3404	3020265
CR11	Diode, MPN3404	3020265
CR12	Diode, MPN3404	3020265
CR13	Diode, MPN3404	3020265
CR14	Diode, 1N4148	3020090
CR15	Diode, 1N4148	3020090
CR16	Diode, 1N295	3020020
CR17	Diode, 1N295	3020020
DS1	Lamp, #53	3470053
DS2	Lamp, #53	3470053
DS3	Lamp, Miniature	3471905
DS4	Lamp, Miniature	3471905
DS5	Lamp, Miniature	3471905
DS6	Lamp, Miniature	3471905
F1	Fuse, 5 A., 3AG	3420171
J1	Connector, Coax, SO-239	3280010
J2	Connector, Plug, P404AB	3290512
J3	Connector, Socket, S308AB	3280520
J4	Socket, AC Line	3282010
J5	Connector, Plug, P310AB	3290560
J6	Connector, Socket, S312AB	3280560
J7	Receptacle, 4-Pin	3281735
J8	Jack, Phono	3281000
J9	Jack, Phono	3281000
J10	Jack, Phono	3281000
J11	Jack, Phone, Closed Circuit	3281030
J12	Jack, Phone, Closed Circuit	3281030
J13	Jack, Phono	3281000
J14	Jack, Phono	3281000
J15	Jack, Phone, Open Circuit	3281020
M1	Meter, TR-7	3580260
Q1	Transistor, 2N3904	3030105
Q2	Transistor, 2N4402	3030120

REF DES	DESCRIPTION	PART NO.
Q3	Transistor, 2N3904	3030105
Q4	Transistor, 2N3904	3030105
Q5	Transistor, 2N4402	3030120
Q6	Transistor, 2N3904	3030105
R1	Resistor, Carbon Film, 680 $\Omega \pm 5\%$ , 1/4 W	3220140
R2	Resistor, Variable, Dual Section 10K/10K	3260647
R3	Resistor, Variable, 10 K $\Omega$	3260640
R4	Resistor, Variable, 10 K $\Omega$	3260640
R5	Resistor, Carbon Film, 47 $\Omega \pm 5\%$ , 1/4 W	3220035
R6	Resistor, Variable, Dual Section, 3K/10K	3260646
R7	Resistor, Carbon Film, 3.3 K $\Omega \pm 5\%$ , 1/4 W	3220200
R8	Resistor, Carbon Film, 3.3 K $\Omega \pm 5\%$ , 1/4 W	3220200
R9	Resistor, Carbon Film, 47 $\Omega \pm 5\%$ , 1/4 W	3220035
R10	Resistor, Variable, Dual Section, 10K/10K	3260648
R11	Resistor, Variable, 3 M $\Omega$	3260641
R12	Resistor, Variable, 3 M $\Omega$	3260641
R13	Resistor, Carbon Film, 10 K $\Omega \pm 5\%$ , 1/4 W	3220235
R14	Resistor, Carbon Film, 1 K $\Omega \pm 5\%$ , 1/4 W	3220160
R15	Resistor, Carbon Film, 1 K $\Omega \pm 5\%$ , 1/4 W	3220160
R16	Resistor, Carbon Film, 10 K $\Omega \pm 5\%$ , 1/4 W	3220235
R17	Resistor, Carbon Film, 10 K $\Omega \pm 5\%$ , 1/4 W	3220235
R18	Resistor, Carbon Film, 1 K $\Omega \pm 5\%$ , 1/4 W	3220160
R19	Resistor, Carbon Film, 1 K $\Omega \pm 5\%$ , 1/4 W	3220160
R20	Resistor, Carbon Film, 10 K $\Omega \pm 5\%$ , 1/4 W	3220235
R21	Resistor, Carbon Film, 100 K $\Omega \pm 5\%$ , 1/4 W	3220315
R22	Resistor, Carbon Film, 470 $\Omega \pm 5\%$ , 1/4 W	3220110
R23	Resistor, Carbon Film, 8.2 K $\Omega \pm 5\%$ , 1/4 W	3220230
R24	Resistor, Variable, 10 K $\Omega$	3260180
R25	Resistor, Carbon Film, 4.7 K $\Omega \pm 5\%$ , 1/4 W	3220210
R26	Resistor, Carbon Film, 100 K $\Omega \pm 5\%$ , 1/4 W	3220315
R27	Resistor, Carbon Film, 100 K $\Omega \pm 5\%$ , 1/4 W	3220315
R28	Resistor, Carbon Film, 100 K $\Omega \pm 5\%$ , 1/4 W	3220315
R29	Resistor, Carbon Film, 100 K $\Omega \pm 5\%$ , 1/4 W	3220315
R30	Resistor, Carbon Film, 6.8 K $\Omega \pm 5\%$ , 1/4 W	3220220
R31	Resistor, Carbon Film, 3.3 K $\Omega \pm 5\%$ , 1/4 W	3220200
R32	Resistor, Carbon Film, 3.3 K $\Omega \pm 5\%$ , 1/4 W	3220200
R33	Resistor, Carbon Film, 10 K $\Omega \pm 5\%$ , 1/4 W	3220235
RFC1	Choke, 270 $\mu$ H	3520590
RFC2	Choke, 270 $\mu$ H	3520590
RFC3	Choke, RFC	2512506
S1	Switch, Rotary, Mode	3661005
S2	See Appropriate LPF or HPF Listing	4660000
S3	Switch, Rotary, Aux. Program	3661000
S4	Switch, Pushbutton, 6 Station	3670076
S5	Switch, Pushbutton, 6 Station	3670076
S6	Switch, Slide, DPDT	3670520
U1	I.C., MC14016BCP	3041025

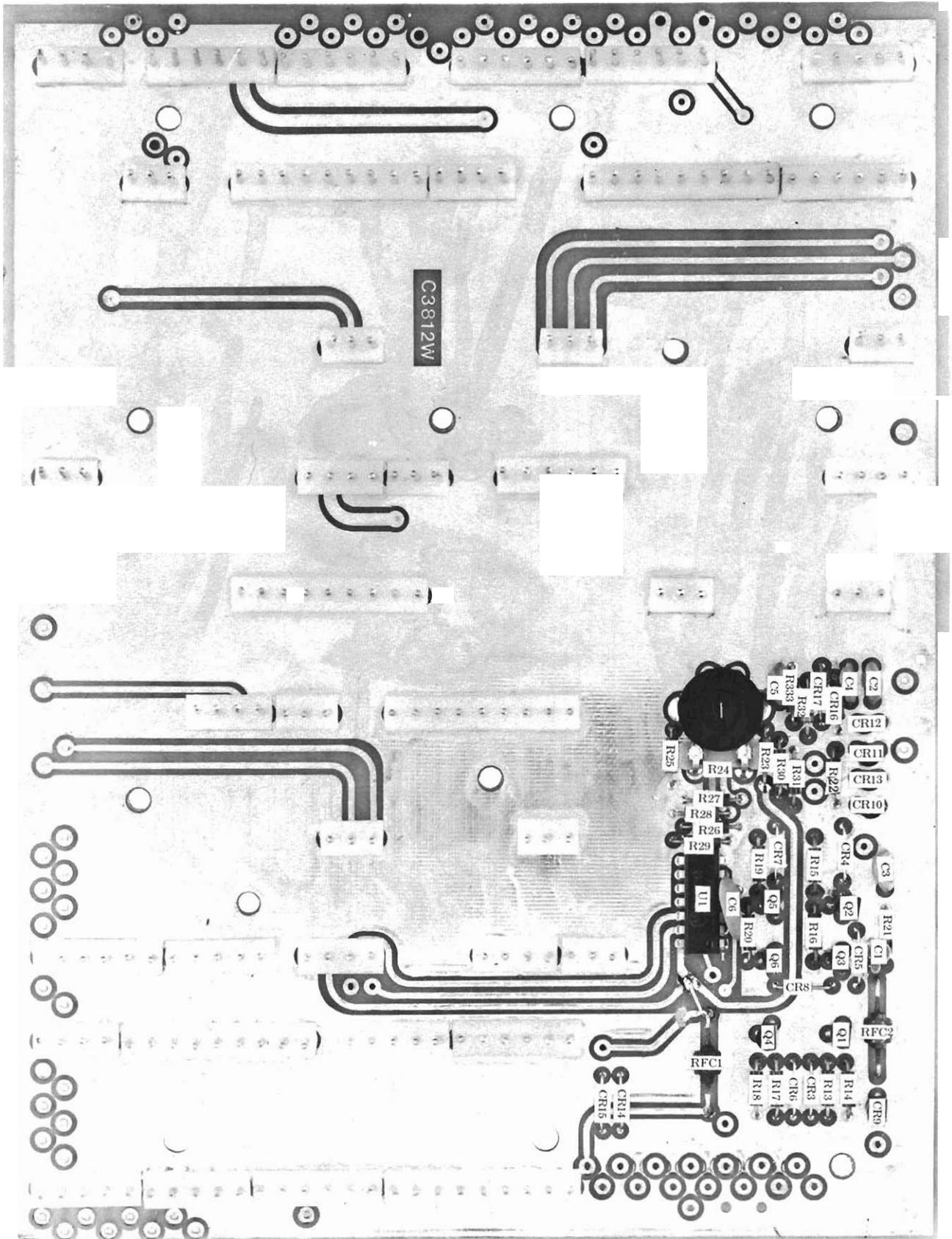
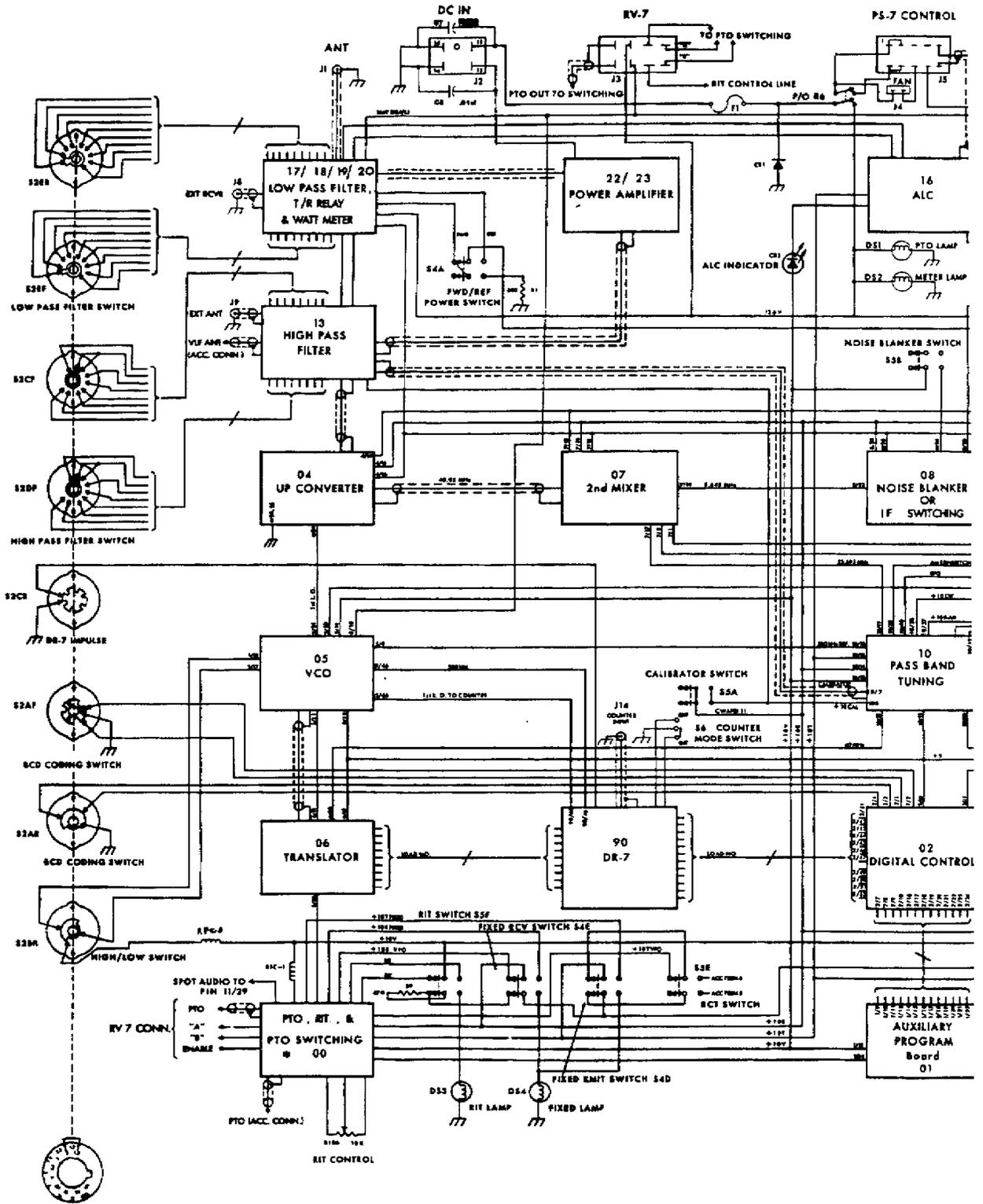
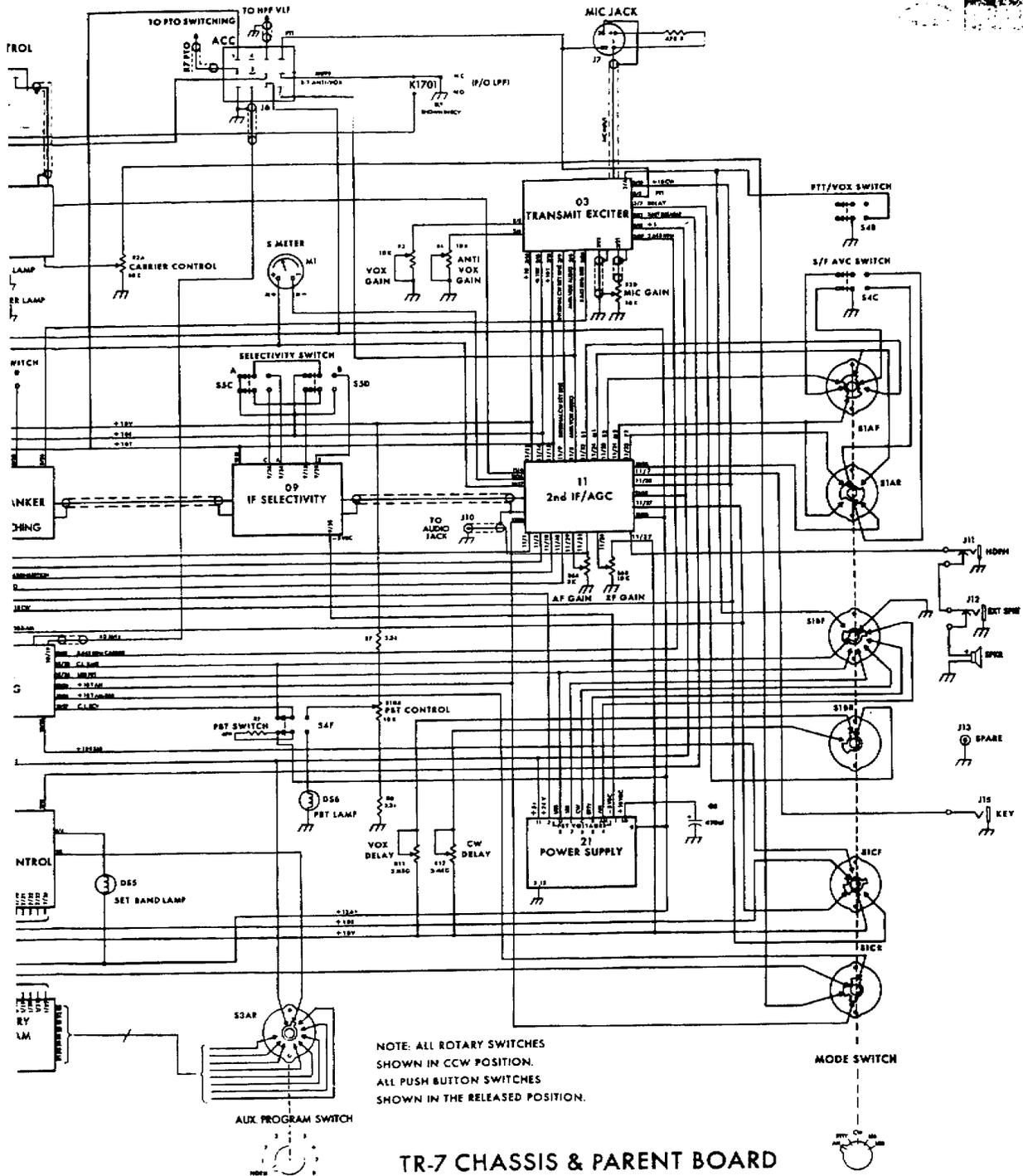


Fig. 2-1 Parent Board Pictorial (Top View)  
(See Page 2-6 for Circuit Side)

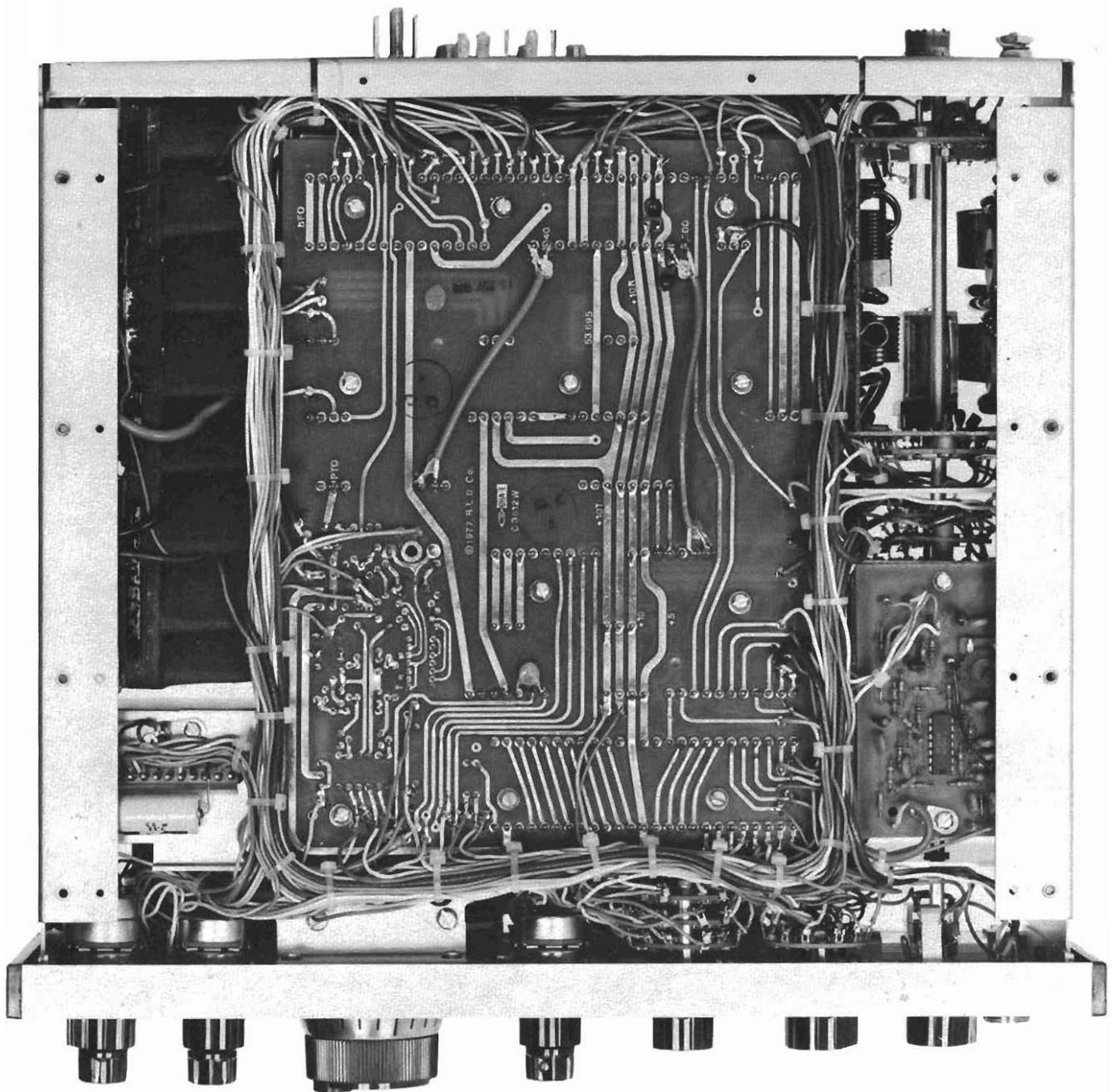




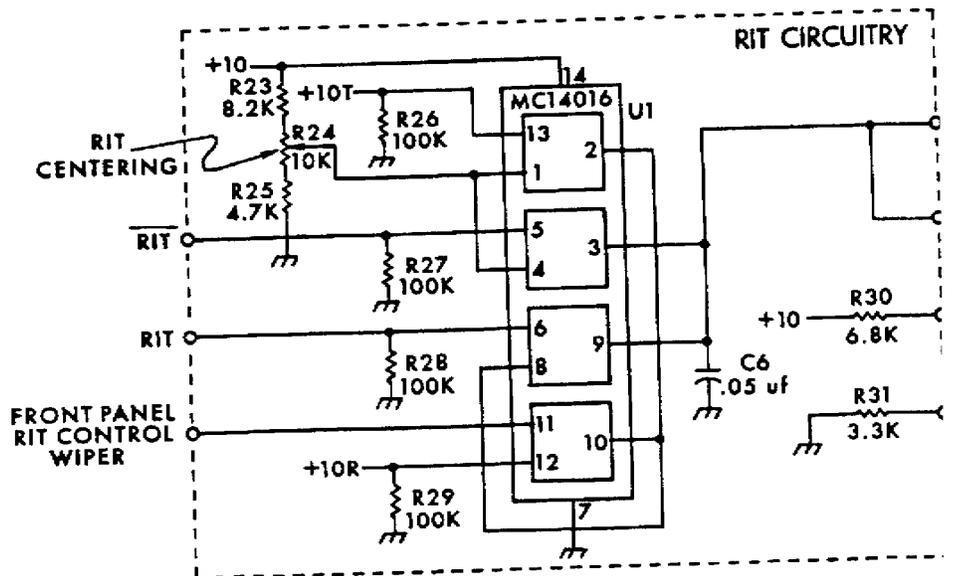
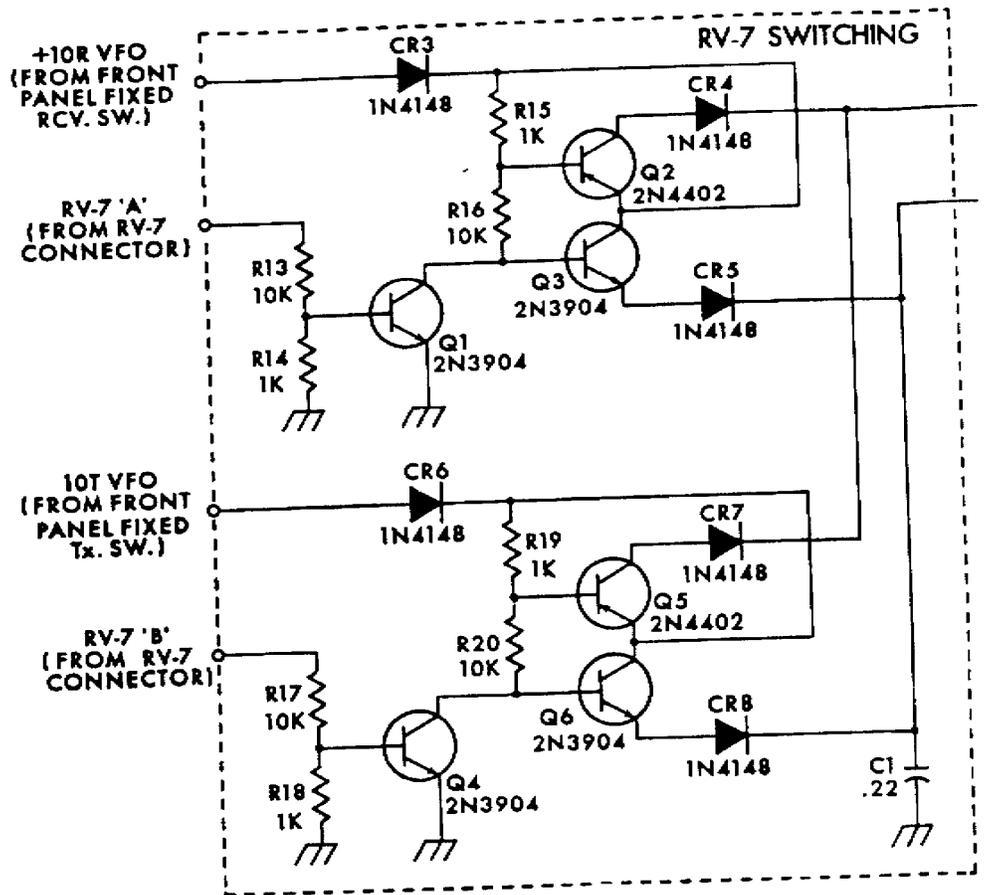
**TR-7 CHASSIS & PARENT BOARD SCHEMATIC DIAGRAM**

\* See Next Page for Detail Drawing

Fig. 2-2 Parent Board Schematic



**Fig. 2-3 Parent Board Pictorial (Bottom View)**



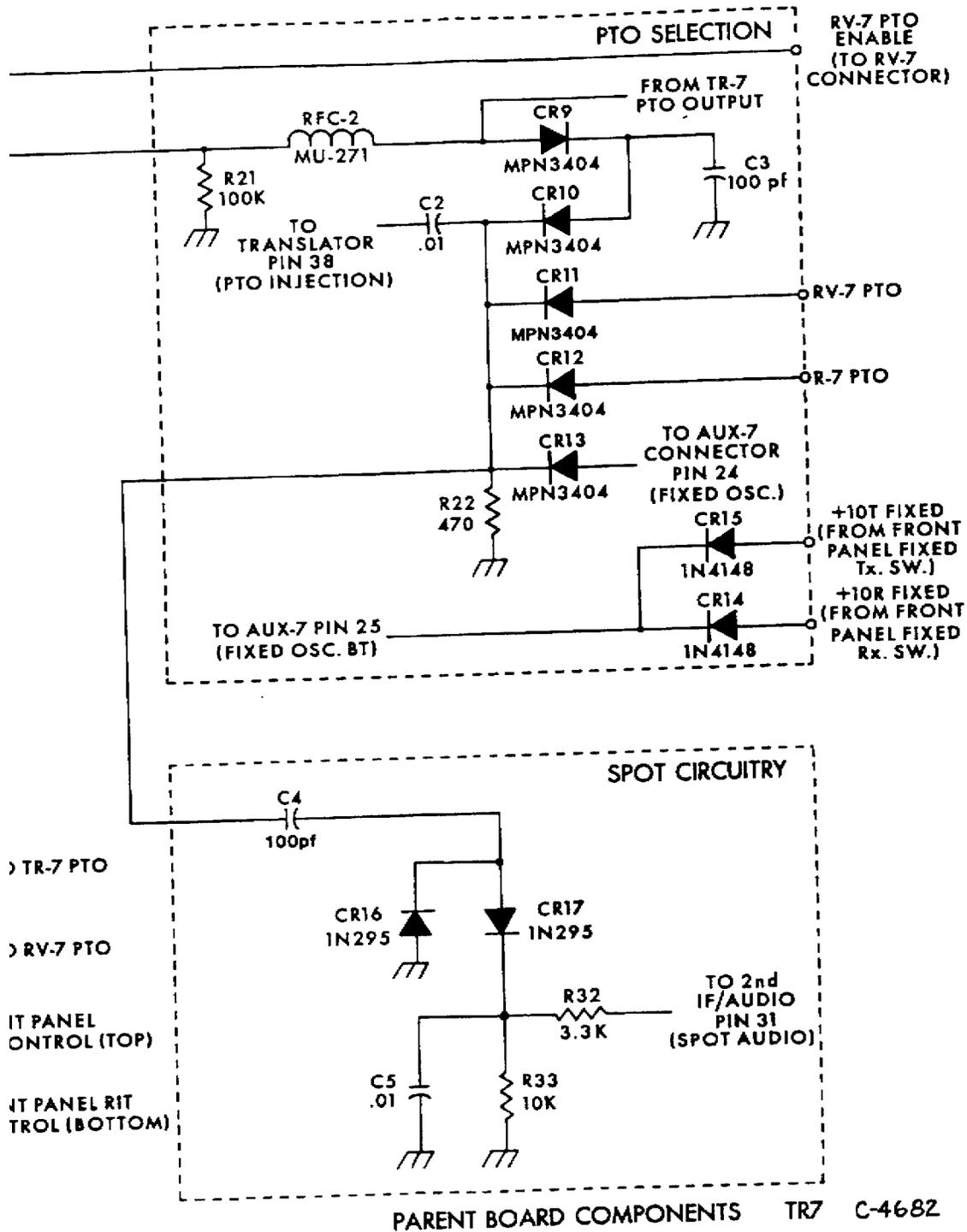


Fig. 2-4 RIT & PTO Switching Schematic

## 2-2. DIGITAL CONTROL BOARD

The Digital Control Board decodes the BCD band-switch information to provide frequency range programming and band control. In addition, it selects between normal and auxiliary frequency range programming and provides transmitter lockout on unauthorized frequencies. Refer to figure 2-6 for schematic and figure 2-5 for parts location information.

BCD band information from the HPF module rear switch board is connected to Digital Control Board pins 1 through 4 via the Parent Board. This information is coded as follows (L=Low, H=High):

BAND	PIN 1	PIN 2	PIN 3	PIN 4	DECIMAL CODE
1.5	L	H	L	L	2
2.5	H	H	L	L	3
3.5	L	L	H	L	4
5.0	H	L	H	L	5
7.0	L	H	H	L	6
14.0	H	H	H	L	7
21.0	L	L	L	H	8
28.5	H	L	L	H	9

This data is connected to the BCD input of a BCD-to-decimal decoder, U201, which converts the data to a one out of ten (decimal) code. The band coding is further processed by quad OR gates U203, U204 and U205 to create the correct synthesizer range programming numbers corresponding to the white numbers on the band switch. This information is connected to the X inputs of 4-bit selectors U206 and U207. Range information from the AUX-7 module is connected to the Y inputs of 4-bit selectors U206 and U207.

When the front panel AUX PROGRAM switch is in the NORM position, 5 volts is applied to module pin 5. This signal is connected to the A control inputs of U206 and U207 allowing the data on the X inputs (from the bandswitch) to program the synthesizer range via the Jumper Board or DR-7. The Y inputs are inhibited in this mode.

When one of the eight AUX PROGRAM channels is selected, module pin 5 is disconnected from 5 volts, and pulled low by R219. This signal is inverted by U209, and a high output appears on U209 pin 3, which is connected to the B control inputs of U206 and U207. This allows the Y inputs (from the AUX-7) to program the synthesizer range.

BCD band information from the bandswitch is compared to BCD band information from the AUX-7 in comparator U202. When the two sets of data are equal, pin 3 of U202 goes high, which causes the output of the NOR gate in U209 (pin 5) to go low. This turns off transistor Q202, causing the SET BAND light to extinguish. In the NORM mode, pin 6 of U209 is held in the high state, forcing the output of the NOR gate to stay low at all times, thus causing the SET BAND light to remain off.

The transmit function of the TR-7 is enabled whenever pin 11 of the Digital Control Module is high (ungrounded). This means that Q201 must be off, which is accomplished by keeping U209, pin 11 in the low state. Pin 11 of U209 will be low when pins 12 and 13 are high, and this condition will exist if pin 14 or pin 15 of U209 is low. Pin 14 enables the transmitter in the NORM mode, and pin 15 enables the transmitter in the AUX mode.

In the NORM mode, pin 14 of U209 will be low if pin 1 of U208 is low, which will be true if all four inputs of the four input NAND gate are high in accordance with the following table:

U208 PIN NO.	CONDITION FOR HIGH STATE
2	Not on 2.5 or 5.0 MHz bands
3	Legitimate Amateur Band (from DR-7)
4	Normal Mode Selected
5	Synthesizer Locked

If all conditions in the above table are satisfied, the transmitter will operate in the NORM mode.

Similarly, in the AUX mode, pin 13 of U208 must be low, which will be true if all four inputs of the NAND gate are high in accordance with the following table:

U208 PIN NO.	CONDITION FOR HIGH STATE
9	Synthesizer Locked
10	AUX Mode Selected
11	BAND Setting Correct
12	RTM-7 Installed

If all these conditions are as listed, the transmitter will operate in the AUX mode.

The Digital Control Board does not require alignment.

## 2-2. DIGITAL CONTROL BOARD

The Digital Control Board decodes the BCD band-switch information to provide frequency range programming and band control. In addition, it selects between normal and auxiliary frequency range programming and provides transmitter lockout on unauthorized frequencies. Refer to figure 2-6 for schematic and figure 2-5 for parts location information.

BCD band information from the HPF module rear switch board is connected to Digital Control Board pins 1 through 4 via the Parent Board. This information is coded as follows (L=Low, H=High):

BAND	PIN 1	PIN 2	PIN 3	PIN 4	DECIMAL CODE
1.5	L	H	L	L	2
2.5	H	H	L	L	3
3.5	L	L	H	L	4
5.0	H	L	H	L	5
7.0	L	H	H	L	6
14.0	H	H	H	L	7
21.0	L	L	L	H	8
28.5	H	L	L	H	9

This data is connected to the BCD input of a BCD-to-decimal decoder, U201, which converts the data to a one out of ten (decimal) code. The band coding is further processed by quad OR gates U203, U204 and U205 to create the correct synthesizer range programming numbers corresponding to the white numbers on the band switch. This information is connected to the X inputs of 4-bit selectors U206 and U207. Range information from the AUX-7 module is connected to the Y inputs of 4-bit selectors U206 and U207.

When the front panel AUX PROGRAM switch is in the NORM position, 5 volts is applied to module pin 5. This signal is connected to the A control inputs of U206 and U207 allowing the data on the X inputs (from the bandswitch) to program the synthesizer range via the Jumper Board or DR-7. The Y inputs are inhibited in this mode.

When one of the eight AUX PROGRAM channels is selected, module pin 5 is disconnected from 5 volts, and pulled low by R219. This signal is inverted by U209, and a high output appears on U209 pin 3, which is connected to the B control inputs of U206 and U207. This allows the Y inputs (from the AUX-7) to program the synthesizer range.

BCD band information from the bandswitch is compared to BCD band information from the AUX-7 in comparator U202. When the two sets of data are equal, pin 3 of U202 goes high, which causes the output of the NOR gate in U209 (pin 5) to go low. This turns off transistor Q202, causing the SET BAND light to extinguish. In the NORM mode, pin 6 of U209 is held in the high state, forcing the output of the NOR gate to stay low at all times, thus causing the SET BAND light to remain off.

The transmit function of the TR-7 is enabled whenever pin 11 of the Digital Control Module is high (ungrounded). This means that Q201 must be off, which is accomplished by keeping U209, pin 11 in the low state. Pin 11 of U209 will be low when pins 12 and 13 are high, and this condition will exist if pin 14 or pin 15 of U209 is low. Pin 14 enables the transmitter in the NORM mode, and pin 15 enables the transmitter in the AUX mode.

In the NORM mode, pin 14 of U209 will be low if pin 1 of U208 is low, which will be true if all four inputs of the four input NAND gate are high in accordance with the following table:

U208 PIN NO.	CONDITION FOR HIGH STATE
2	Not on 2.5 or 5.0 MHz bands
3	Legitimate Amateur Band (from DR-7)
4	Normal Mode Selected
5	Synthesizer Locked

If all conditions in the above table are satisfied, the transmitter will operate in the NORM mode.

Similarly, in the AUX mode, pin 13 of U208 must be low, which will be true if all four inputs of the NAND gate are high in accordance with the following table:

U208 PIN NO.	CONDITION FOR HIGH STATE
9	Synthesizer Locked
10	AUX Mode Selected
11	BAND Setting Correct
12	RTM-7 Installed

If all these conditions are as listed, the transmitter will operate in the AUX mode.

The Digital Control Board does not require alignment.

## TR-7 DIGITAL CONTROL BOARD

REF DES	DESCRIPTION	PART NO.
Q201	Transistor, 2N3904	3030105
Q202	Transistor, 2N3904	3030105
R201	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R202	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R203	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R204	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R205	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R206	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R207	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R208	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R209	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R210	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R211	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R212	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R213	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R214	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R215	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R216	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R217	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R218	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R219	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R220	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R221	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
U201	I.C., MC14028BCP	3041040
U202	I.C., MC14585BCP	3041160
U203	I.C., MC14071BCP	3041060
U204	I.C., MC14071BCP	3041060
U205	I.C., MC14071BCP	3041060
U206	I.C., MC14519BCP	3041120
U207	I.C., MC14519BCP	3041120
U208	I.C., MC14012BCP	3041015
U209	I.C., MC14572CP	3041150

## DIGITAL CONTROL BOARD

REF DES	DESCRIPTION	PART NO.
C201	Capacitor, Disc, .1 $\mu$ F $\pm$ 20%, Y5V	3161680
Q201	Transistor, 2N3904	3030105
Q202	Transistor, 2N3904	3030105
Q203	Transistor, 2N3904	3030105
R201	Resistor, Carbon Film, 1 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R202	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R203	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R204	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R205	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R206	Resistor, Carbon Film, 1 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R207	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R208	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R209	Resistor, Carbon Film, 3.9 K $\Omega$ $\pm$ 5%, 1/4 W	3220205
R210	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R211	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R212	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R213	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R214	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R215	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R216	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R217	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R218	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R219	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R220	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R221	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R222	Resistor, Carbon Film, 1 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
U201	I.C., 32X8 PROM — Amateur Band Programming	3040082
U202	I.C., MC14070BCP	3041059
U203	I.C., MC14002BCP	3041005
U204	I.C., MC14073BCP	3041062
U205	I.C., MC14070BCP	3041059

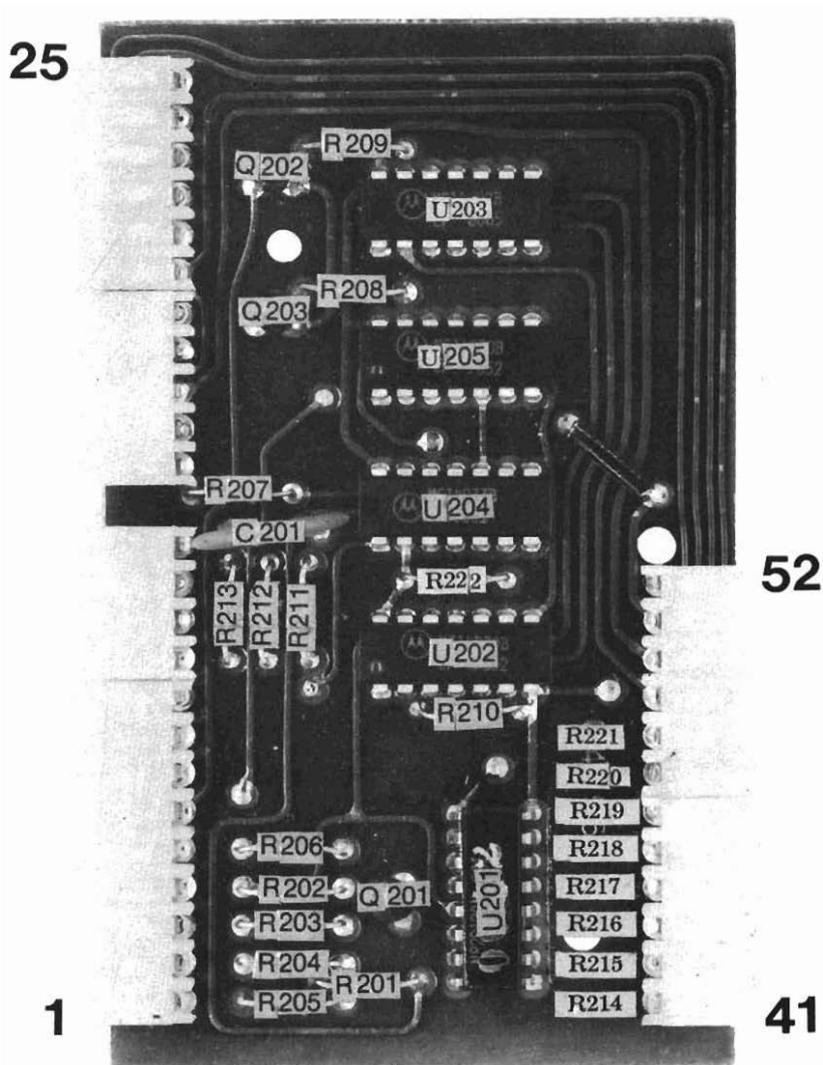
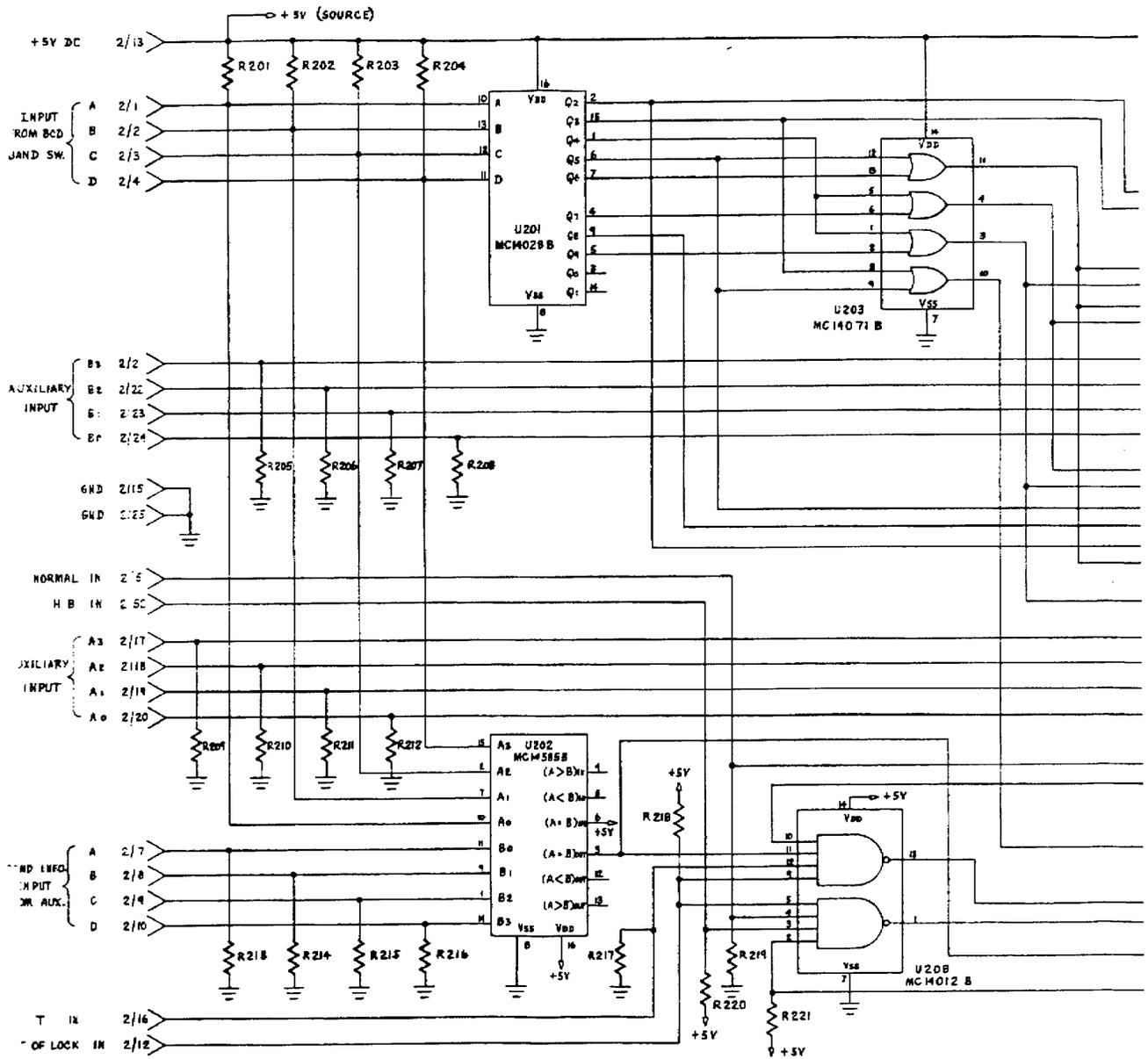


Fig. 2-5 Digital Control Board Pictorial

R	209	201	205	202	206	203	207	204	208	217	218	220	219	221
	213	210	214	211	215	212	216							



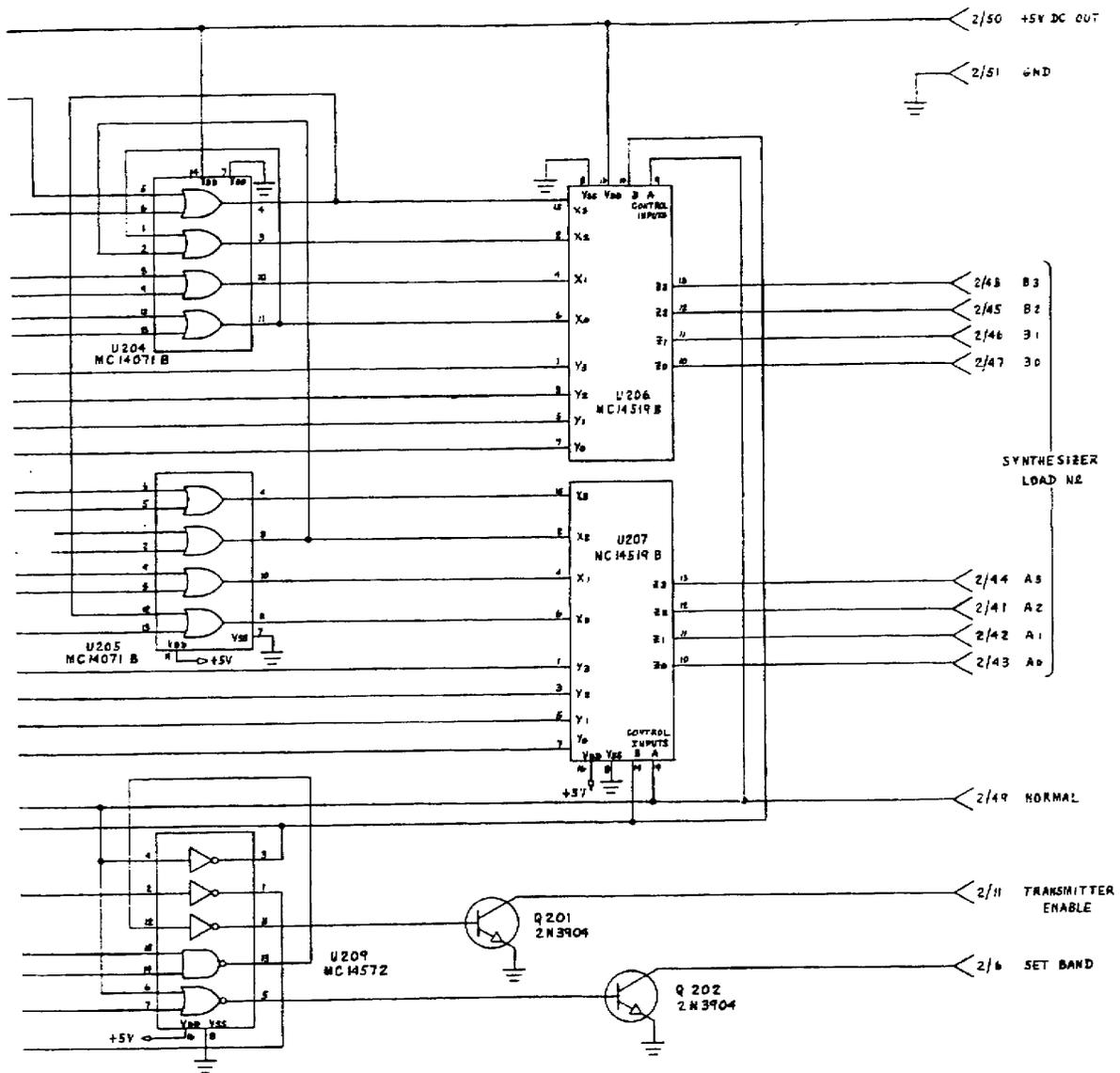
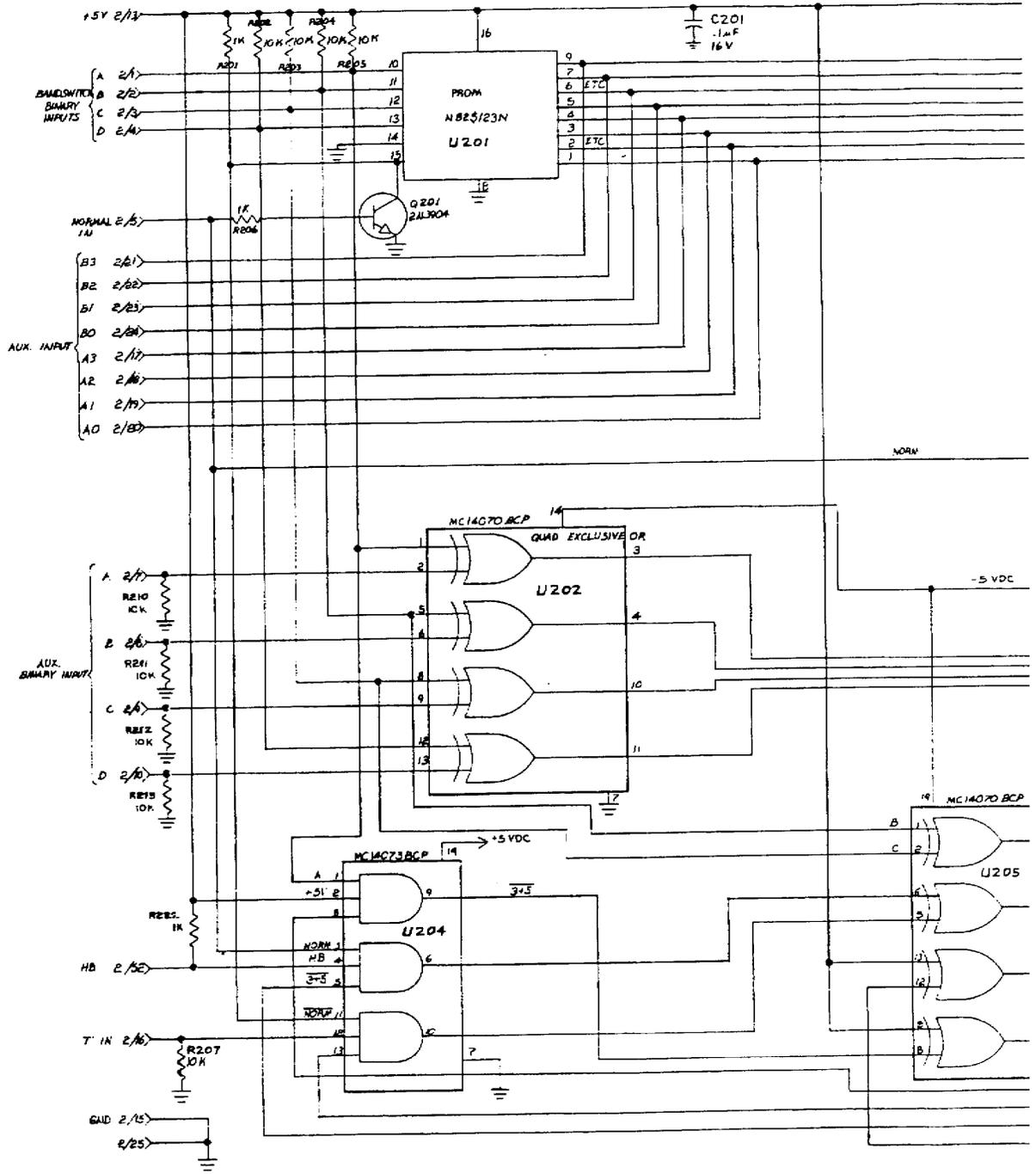


Fig. 2-6 Digital Control Board Schematic



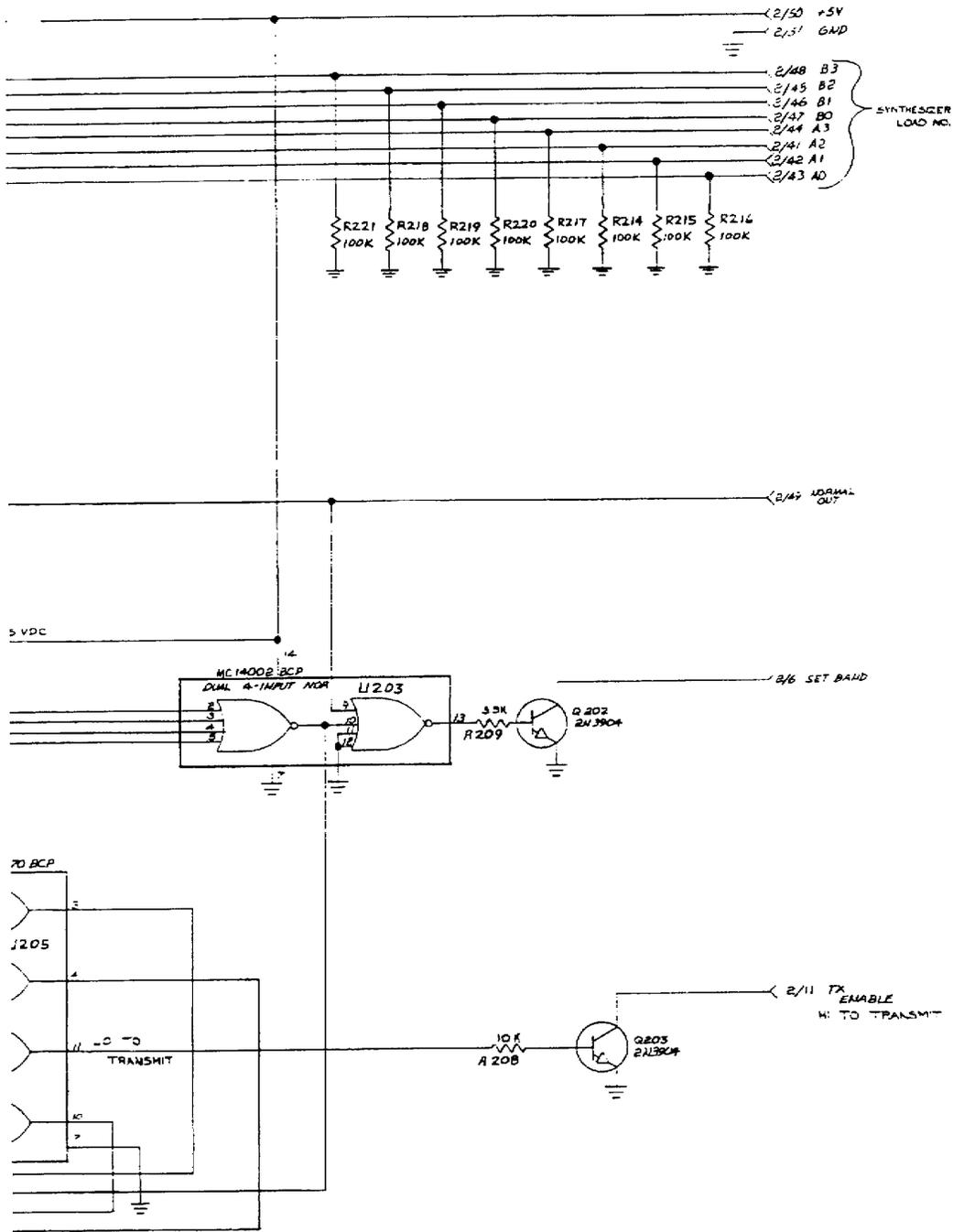


Fig. 2-6 Digital Control Board Schematic

### 2-3. TRANSMIT EXCITER BOARD

The Transmit Exciter Board amplifies the speech audio from the microphone, provides VOX and anti-VOX circuitry, and includes the 10 volt transmit/receive switching. In addition, this module also contains the transmitter balanced modulator. Refer to figure 2-8 for schematic and figure 2-7 for parts location information.

Microphone audio from the front panel connector is applied to pin 1 of the Transmit Exciter via the Parent Board. This signal is amplified by Q301, Q302 and associated components, and is coupled to pin 21 for connection to the top of the front panel MIC GAIN control. Provisions have been made on the board to jumper the free end of R356 to ground for low impedance microphone input, if required. This jumper is not installed at the factory, and is, in fact, seldom required for proper operation.

The wiper of the front panel MIC GAIN control is connected to pin 22, and coupled to an emitter follower consisting of Q304 and associated components. The output of this stage is coupled to pin 1 of the MC-1496P balanced modulator. The 5.645 MHz carrier signal is coupled to pin 10 of the MC-1496P via a diode switch consisting of CR307 and CR308. In transmit, 10 volts is applied to the anodes of these diodes via R351, causing current to flow via R352 and L301, thus allowing the 5.645 MHz carrier signal to pass. In receive, the diodes are turned off, disabling the balanced modulator. Control R349 is the carrier balance adjustment.

The output of the balanced modulator is taken from pin 6 of the MC-1496P and coupled to a buffer stage consisting of Q309 and associated components. This stage is active only in transmit, thus assuring proper transmitter muting in the receive mode. The double sideband (DSB) signal is then coupled to pin 24 of the Transmit Exciter for routing to the IF Selectivity Board for sideband selection.

Microphone audio from Q302 is also coupled to VOX buffer Q303, and detected by CR305 and CR306. The resulting dc voltage is amplified by U301A, the gain of which is set by the front panel VOX GAIN control connected between module pin 5 and ground. VOX operation is enabled via the VOX override line, pin 4. When this pin is grounded, the output of U301A is shorted, disabling the VOX.

Anti-VOX audio from the speaker is connected via

pin 8 to a detector consisting of CR301 and CR302. The dc output of this detector is amplified by U301B, the gain of which is set by the front panel ANTI-VOX GAIN control and connected between module pin 6 and ground.

The VOX signal from U301A is applied to the inverting input of U301C and the ANTI-VOX signal is applied to the non-inverting input of U301C. These signals are compared, and when the VOX signal is greater, the output of U301C is forced low. In the CW mode, a keyed voltage is applied to the inverting input of U301C to achieve the same effect.

The output of U301C is connected to the inverting input of U301D. Thus, when the output of U301C is low, the output of U301D goes high, providing a keying signal. VOX delay is established by C303 and the front panel VOX DELAY control, which is connected between pin 7 and 10 volts. A separate delay control is brought into play on CW, via the MODE switch. R310 is used to establish a minimum delay to insure smooth transmit/receive switching.

The output of U301D is applied to pin 6 of U302. PTT information is applied to pin 1 of U302 via switching transistor Q305. When the transmit enable line (module pin 11) is high, the AND gates in U302 will drive the output switching transistors in this IC to the on state when either the VOX is tripped or the PTT line is grounded.

When either of the output drivers in U302 turn on, base current flows in Q306, thus enabling the 10 volt transmit line (+10T). At the same time, Q308 is turned off, turning off Q307 and disabling the 10 volt receive line (+10R). When the output drivers of U302 are off (caused by the absence of a VOX or PTT signal), exactly the opposite is true. In this manner, pin 15 (+10R) and pin 16 (+10T) are controlled for transmit/receive switching throughout the remainder of the radio. The network consisting of R362, C324, CR309 and CR310 provides a fast turnoff/delayed turn on signal to the base of Q308 to eliminate any possible critical sequencing problems in the T/R switching circuitry.

It should be noted that switches Q306 and Q307 do not have any current limiting protection, since +10R and +10T must be well regulated. As a result, if a short is developed within the radio on either the +10R or +10T lines, the accompanying switching transistor will probably be destroyed. Care should be taken to avoid such shorts when servicing the TR-7.

## TR-7 TRANSMIT EXCITER BOARD

REF DES	DESCRIPTION	PART NO.
C301	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C302	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C303	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C304	Capacitor, Disc, .02 $\mu$ F + 80%, M25 V	3161580
C305	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C306	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C307	Capacitor, Disc, .05 $\mu$ F + 80%, M16V	3161600
C308	Capacitor, Disc, 68 pF, N750	3160990
C309	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C310	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C311	Capacitor, Disc, 470 pF $\pm$ 20%, Z5U	3161350
C312	Capacitor, Electrolytic, 10 $\mu$ F $\pm$ 20%, 25 V	3180062
C313	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C314	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C315	Capacitor, Tantalum, 1 $\mu$ F $\pm$ 20%, 35 V	3183010
C316	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C317	Capacitor, Electrolytic, 22 $\mu$ F $\pm$ 20%, 16 V	3180105
C318	Capacitor, Disc, .005 $\mu$ F $\pm$ 20%, Z5U	3161470
C319	Capacitor, Disc, .005 $\mu$ F $\pm$ 20%, Z5U	3161470
C320	Capacitor, Electrolytic, 22 $\mu$ F $\pm$ 20%, 16 V	3180150
C321	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C322	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C323	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C324	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C325	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C326	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C327	Capacitor, Disc, .005 $\mu$ F $\pm$ 20%, Z5U	3161470
C328	Capacitor, Electrolytic, 10 $\mu$ F $\pm$ 20%, 25 V	3180062
C329	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C330	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
CR301	Diode, 1N270	3020010
CR302	Diode, 1N270	3020010
CR303	Diode, 1N270	3020010
CR304	Diode, 1N270	3020010
CR305	Diode, 1N270	3020010
CR306	Diode, 1N270	3020010
CR307	Diode, 1N4148	3020090
CR308	Diode, 1N4148	3020090
CR309	Diode, 1N4148	3020090
CR310	Diode, 1N4148	3020090
Q301	Transistor, MPS-6521	3030289
Q302	Transistor, 2N3904	3030105
Q303	Transistor, 2N3904	3030105
Q304	Transistor, 2N3904	3030105
Q305	Transistor, 2N3904	3030105
Q306	Transistor, 2N4402	3030120
Q307	Transistor, 2N4402	3030120
Q308	Transistor, 2N3904	3030105
Q309	Transistor, 2N3563	3030060
R301	Resistor, Carbon Film, 510 $\Omega$ $\pm$ 5%, 1/4 W	3220115
R302	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160

REF DES	DESCRIPTION	PART NO.
R303	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R304	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R305	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R306	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R307	Resistor, Carbon Film, 22 K $\Omega$ $\pm$ 5%, 1/4 W	3220260
R308	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R309	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R310	Resistor, Carbon Film, 47 K $\Omega$ $\pm$ 5%, 1/4 W	3220285
R311	Resistor, Carbon Film, 1.0 M $\Omega$ $\pm$ 5%, 1/4 W	3220355
R312	Resistor, Carbon Film, 4.7 K $\Omega$ $\pm$ 5%, 1/4 W	3220210
R313	Resistor, Carbon Film, 6.8 M $\Omega$ $\pm$ 5%, 1/4 W	3220375
R314	Resistor, Carbon Film, 2.2 M $\Omega$ $\pm$ 5%, 1/4 W	3220360
R315	Resistor, Carbon Film, 10 $\Omega$ $\pm$ 5%, 1/4 W	3220005
R316	Resistor, Carbon Film, 3.3 K $\Omega$ $\pm$ 5%, 1/4 W	3220200
R317	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R318	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R319	NOT USED	
R320	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R321	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R322	Resistor, Carbon Film, 1 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R323	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R324	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R325	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R326	Resistor, Carbon Film, 47 $\Omega$ $\pm$ 5%, 1/4 W	3220035
R327	Resistor, Carbon Film, 150 K $\Omega$ $\pm$ 5%, 1/4 W	3220320
R328	Resistor, Carbon Film, 2.2 M $\Omega$ $\pm$ 5%, 1/4 W	3220360
R329	Resistor, Carbon Film, 33 K $\Omega$ $\pm$ 5%, 1/4 W	3220275
R330	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R331	Resistor, Carbon Film, 330 K $\Omega$ $\pm$ 5%, 1/4 W	3220340
R332	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R333	Resistor, Carbon Film, 180 $\Omega$ $\pm$ 5%, 1/4 W	3220070
R334	Resistor, Carbon Film, 18 K $\Omega$ $\pm$ 5%, 1/4 W	3220255
R335	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R336	Resistor, Carbon Film, 1.5 K $\Omega$ $\pm$ 5%, 1/4 W	3220175
R337	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R338	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R339	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R340	Resistor, Carbon Film, 3.3 K $\Omega$ $\pm$ 5%, 1/4 W	3220200
R341	Resistor, Carbon Film, 3.3 K $\Omega$ $\pm$ 5%, 1/4 W	3220200
R342	Resistor, Carbon Film, 820 $\Omega$ $\pm$ 5%, 1/4 W	3220145
R343	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R344	Resistor, Carbon Film, 330 $\Omega$ $\pm$ 5%, 1/4 W	3220090
R345	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R346	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R347	Resistor, Carbon Film, 330 $\Omega$ $\pm$ 5%, 1/4 W	3220090
R348	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R349	Resistor, Variable 25 K $\Omega$	3260670
R350	Resistor, Carbon Film, 330 $\Omega$ $\pm$ 5%, 1/4 W	3220090
R351	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R352	Resistor, Carbon Film, 56 $\Omega$ $\pm$ 5%, 1/4 W	3220040
R353	Resistor, Carbon Film, 330 $\Omega$ $\pm$ 5%, 1/4 W	3220090
R354	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	
R355	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	
R356	Resistor, Carbon Film, 680 $\Omega$ $\pm$ 5%, 1/4 W	

REF DES	DESCRIPTION	PART NO.
R357	Resistor, Carbon Film, 6.8 K $\Omega$ $\pm$ 5%, 1/4 W	3220220
R358	Resistor, Carbon Film, 12 K $\Omega$ $\pm$ 5%, 1/4 W	3220240
R359	Resistor, Carbon Film, 510 $\Omega$ $\pm$ 5%, 1/4 W	3220115
R360	Resistor, Carbon Film, 82 $\Omega$ $\pm$ 5%, 1/4 W	3220050
R361	Resistor, Composition, 180 $\Omega$ $\pm$ 10%, 1/2 W	3230130
R362	Resistor, Carbon Film, 1.5 K $\Omega$ $\pm$ 5%, 1/4 W	3220175
R363	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R364	Resistor, Composition, 180 $\Omega$ $\pm$ 10%, 1/2 W	3230130
RFC301	Choke Assy., 270 $\mu$ H, MUD271	3520590
U301	I.C., MC3302P	3040120
U302	I.C., MC75452P	3040202
U303	I.C., MC1496P	3040112

## NOTES:

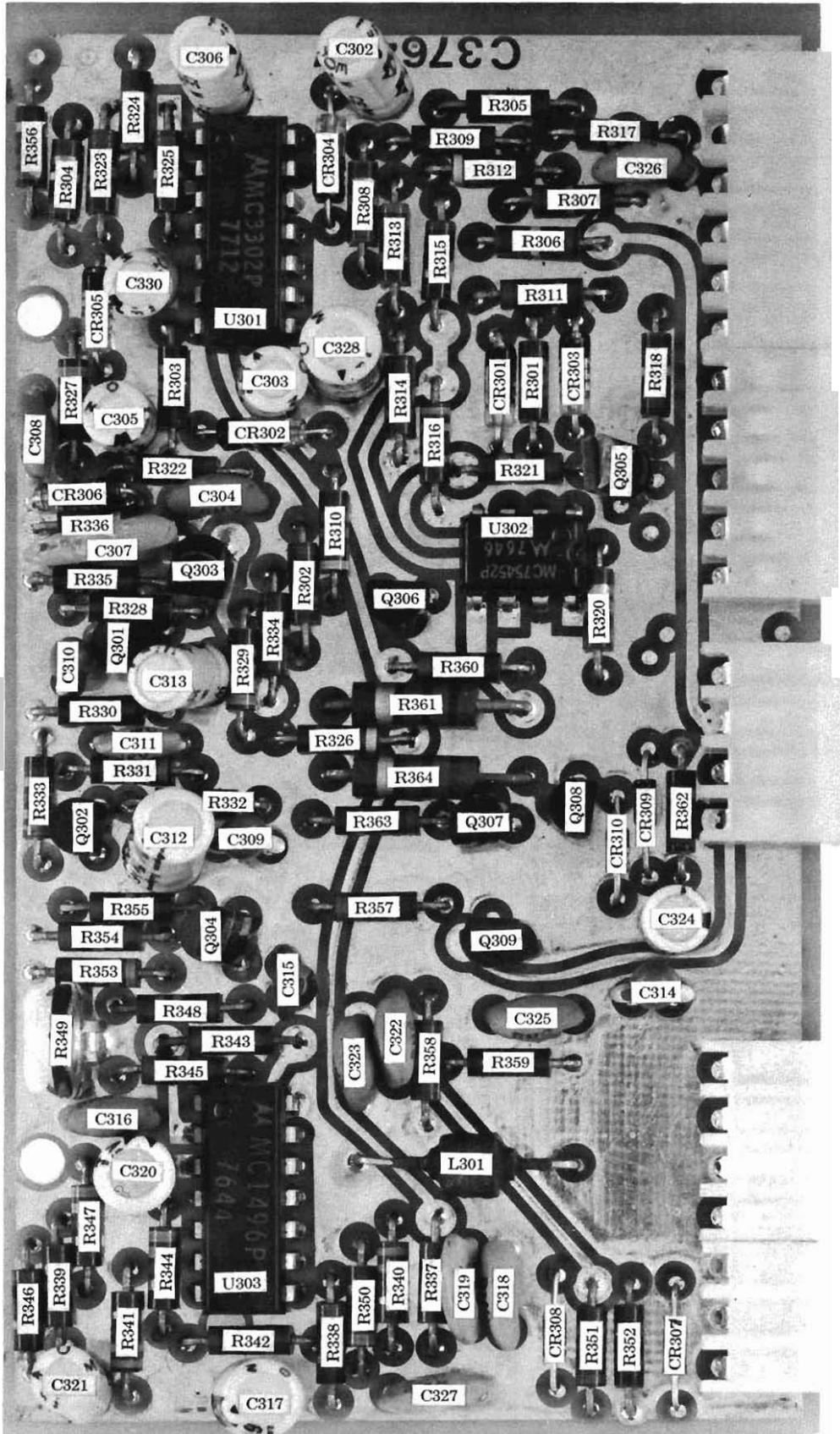


Fig. 2-7 Transmit Exciter Board Pictorial



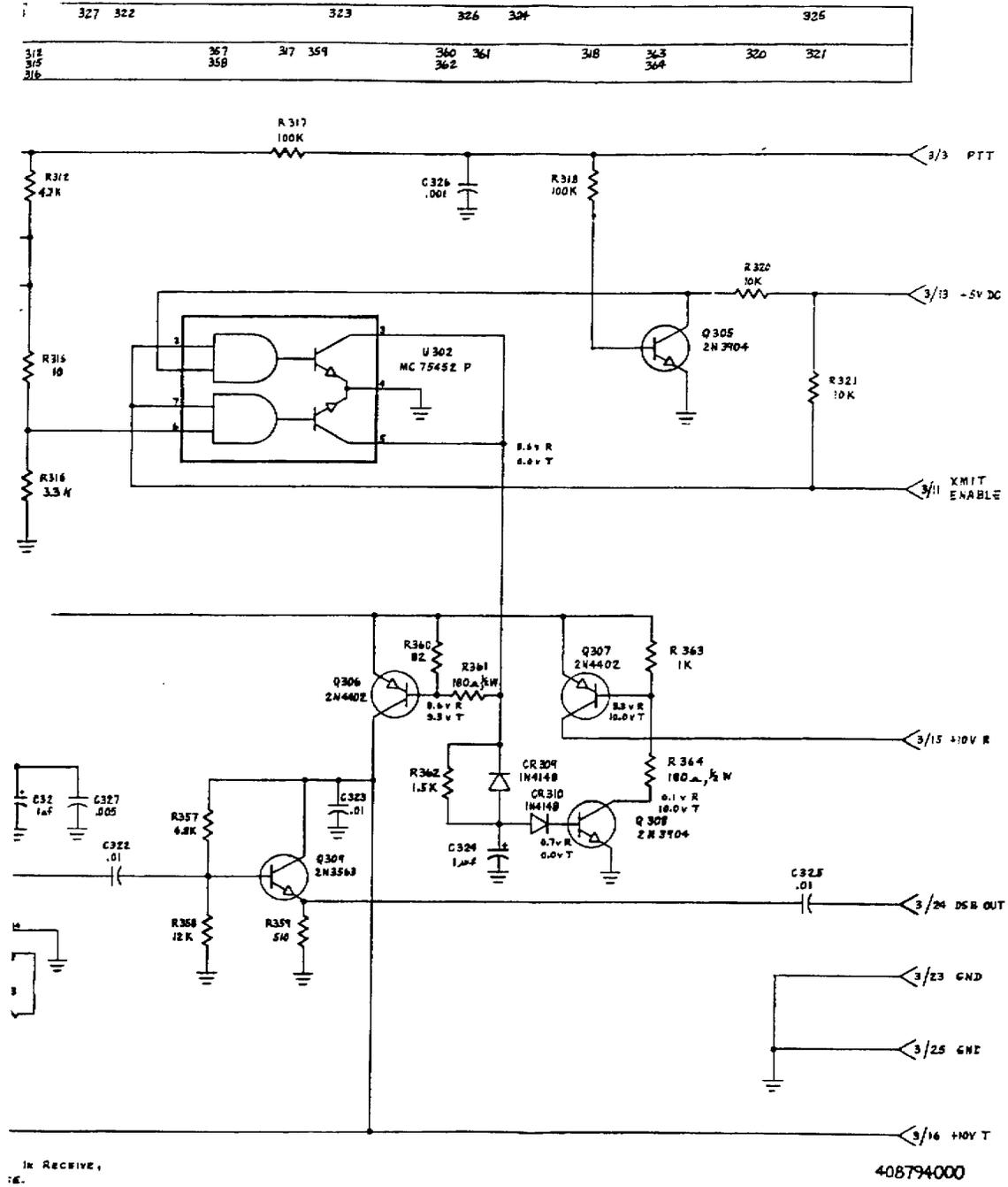


Fig. 2-8 Transmit Exciter Board Schematic

#### 2-4. UP-CONVERTER BOARD

The Up-Converter Board converts incoming received signals to the 1st IF of 48.05 MHz, and converts the transmit 48.05 MHz IF signal to the desired signal frequency, using the output of the synthesizer VCO. Refer to figure 2-10 for schematic and figure 2-9 for parts list information.

Received signals from the antenna are routed to the Up-Converter via the low pass and high pass filter modules. These signals first pass through a master low pass filter consisting of C407-C413 and L402-L404. This filter is employed to improve image and spurious response performance, and has a cut-off frequency of approximately 35 MHz. The output of this filter is connected to the signal input of a high-level double balanced mixer, which is a packaged, diode-ring device. The injection input of this mixer is driven by an amplifier, Q401, whose input is the output of the synthesizer VCO. Q401 is a broadband amplifier, with a flat passband over the 48-78 MHz injection range. R406, R407 and R408 form a pad to insure proper termination of both the amplifier and the mixer.

The 48.05 MHz difference signal is coupled from the IF port of the mixer to the source of IF amplifier Q402 through pin diode CR401, which is turned on by +10R through RFC402. Since CR403 shares a common dc return through R413, it is biased off. C418 and T402 tune the output of Q402, and this signal is coupled to the 48.05 MHz filter through CR404, which is turned on by +10R through RFC406. Since CR402 shares a common dc return through R414, it is biased off.

The 48.05 MHz filter module consists of two monolithic filter elements, each of which is a two-pole filter. Matching is accomplished by C421, C422, and L405 on one end, and C423, C424 and L406 on the other end. L405 and L406 are tuned at the factory using sophisticated equipment, and should not require readjustment unless a filter element is replaced. Nominal bandwidth of this filter is 8-12 kHz.

In transmit, the signal flow is reversed. The 48.05 MHz transmit IF signal is passed through the crystal filter and amplified by Q402. In this case, CR402 and CR403 are turned on by +10T, and CR401 and CR404 are biased off. The output of Q402 is thus connected to the double balanced mixer, which is bilateral, and does not require T/R switching. The 48.05 MHz signal is mixed with the synthesizer injection to create a signal on the desired transmit frequency. This signal is passed through the master low pass filter and routed to the input of the Power Amplifier via the High Pass Filter module.

Due to the high frequencies involved, proper grounding is very important on this module. If any shields are removed for servicing, be sure that they are replaced and soldered as originally produced. In addition, be sure that all four grounding clips are properly installed. These clips may be soldered to the shield if necessary. Proper attention to these details will insure that spurious responses are minimized.

Alignment of this module is covered in Section 3.

## TR-7 UP-CONVERTER BOARD

REF DES	DESCRIPTION	
C401	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C402	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C403	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C404	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C405	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C406	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C407	Capacitor, Disc, 100 pF $\pm$ 5%, N750 DELETED	3161060
C409	Capacitor, Disc, 100 pF $\pm$ 5%, N750	3161060
C410	Capacitor, Disc, 33.0 pF $\pm$ 5%, N750	3160705
C411	Capacitor, Disc, 150 pF $\pm$ 5%, N750	3161150
C412	Capacitor, Disc, 39 pF $\pm$ 5%, NPO	3160760
C413	Capacitor, Disc, 82 pF $\pm$ 5%, N750	3161040
C414	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C415	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C416	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C417	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C418	Capacitor, Variable Trimmer, 5-20 pF	3205375
C419	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C420	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C421	Capacitor, Disc, 9 pF $\pm$ 5%, NPO	3160320
C422	Capacitor, Disc, 3.9 pF, .39, NPO	3160090
C423	Capacitor, Disc, 3.9 pF, .39, NPO	3160090
C424	Capacitor, Disc, 9 pF $\pm$ 5%, NPO	3160320
C425	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C426	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C427	Capacitor, Disc, .05 $\mu$ F + 80%, M16V	3161600
CR401	Diode, MPN3404	3020265
CR402	Diode, MPN3404	3020265
CR403	Diode, MPN3404	3020265
CR404	Diode, MPN3404	3020265
L401	Choke Assy., 5.6 $\mu$ H, L56G	3520510
L402	Inductor, Toroid	2510019
L403	Inductor, Toroid	2510019
L404	Inductor, Toroid	2510019
L405	Inductor, Variable	3524105
L406	Inductor, Variable	3524105
Q401	Transistor, 2N3866	3030095
Q402	Transistor, J-310	3030501
R401	Resistor, Carbon Film, 270 $\Omega$ $\pm$ 5%, 1/4 W	3220085
R402	Resistor, Carbon Film, 2.7 K $\Omega$ $\pm$ 5%, 1/4 W	3220195
R403	Resistor, Carbon Film, 680 $\Omega$ $\pm$ 5%, 1/4 W	3220140
R404	Resistor, Carbon Film, 22 $\Omega$ $\pm$ 5%, 1/4 W	3220015
R405	Resistor, Carbon Film, 10 $\Omega$ $\pm$ 5%, 1/4 W	3220005
R406	Resistor, Carbon Film, 270 $\Omega$ $\pm$ 5%, 1/4 W	3220085
R407	Resistor, Carbon Film, 22 $\Omega$ $\pm$ 5%, 1/4 W	3220015
R408	Resistor, Carbon Film, 270 $\Omega$ $\pm$ 5%, 1/4 W DELETED	3220085
R410	Resistor, Carbon Film, 10 $\Omega$ $\pm$ 5%, 1/4 W	3220005
R411	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R412	Resistor, Carbon Film, 6.8 K $\Omega$ $\pm$ 5%, 1/4 W	3220220

REF DES	DESCRIPTION	PART NO.
R413	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R414	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R415	Resistor, Carbon Film, 10 $\Omega$ $\pm$ 5%, 1/4 W	3220005
RFC401	Choke Assy., VK200	3520600
RFC402	Choke Assy., 5.6 $\mu$ H, L56G	3520510
RFC403	Choke Assy., VK200	3520600
RFC404	Choke Assy., 5.6 $\mu$ H, L56G	3520510
RFC405	Choke Assy., 5.6 $\mu$ H, L56G	3520510
RFC406	Choke Assy., 5.6 $\mu$ H, L56G	3520510
RFC407	Choke Assy., VK200	3520600
RFC408	Choke Assy., VK200	3520600
T401	Transformer, Toroid	2510020
T402	Transformer, Toroid	2510003
U401	Mixer, Double Balanced, CM1-HF	3045010
Y401/Y402	Crystal Filter Set, 48.05 MHz	3140125
C428	Capacitor, Tantalum, 10 $\mu$ F $\pm$ 20%, 25 V	3183030
C429	Capacitor, Disc, 68 pF $\pm$ 5%, N750	3160990

**NOTES:**

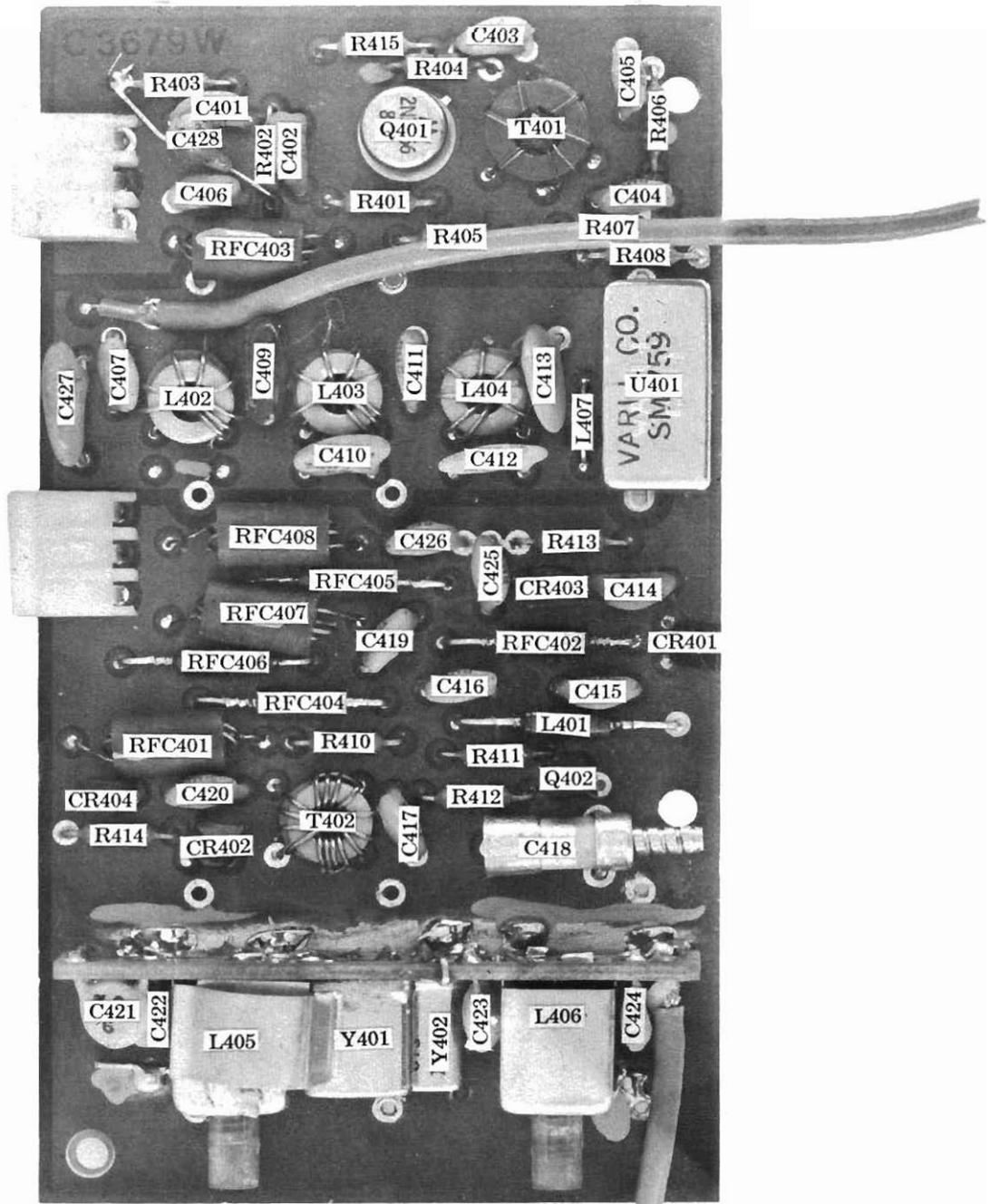
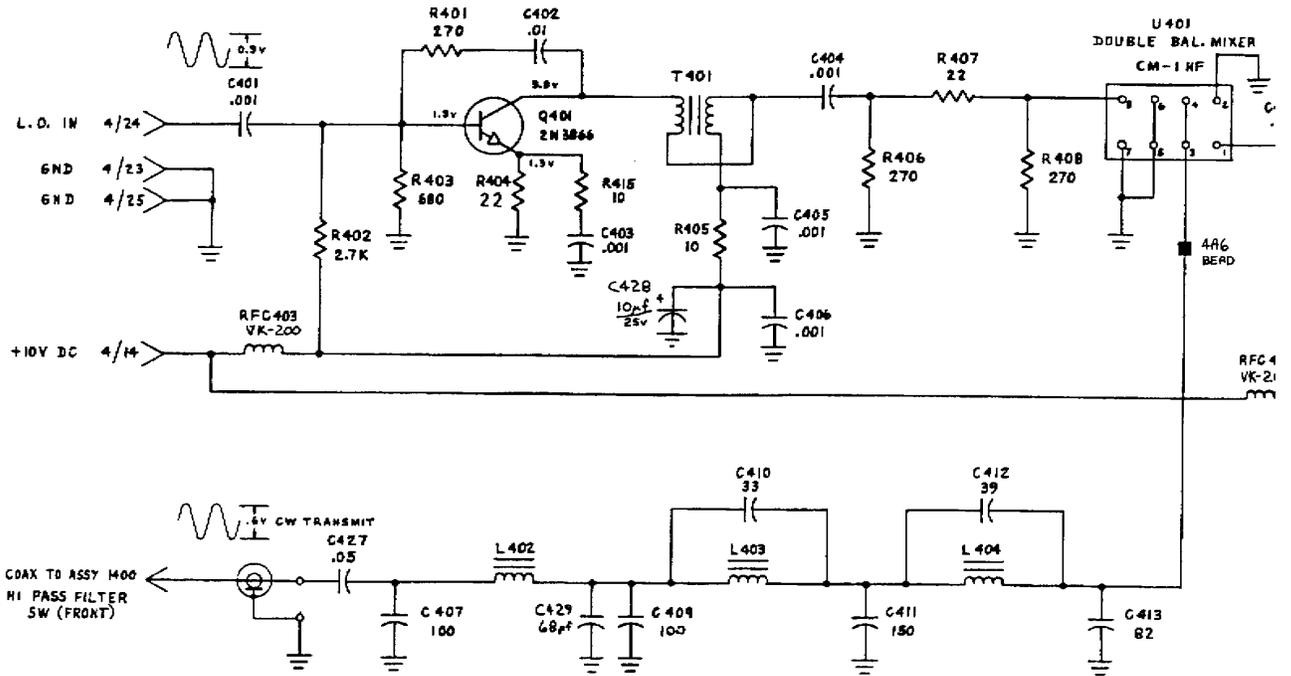


Fig. 2-9 Up-Converter Board Pictorial

R		402	403	401	404	415		405		406	407	408	
C	401	427	407		402	403	409		405	404	411	412	413
L				402				403				404	



**NOTE**  
ALL VOLTAGES MEASURED IN RECEIVE,  
UNLESS NOTED OTHERWISE.

## 2-5. VCO BOARD

The VCO Board provides the injection signal to the Up-Converter Board (Section 2-4.), and includes the phase detector and loop filter portions of the synthesizer. Refer to figure 2-12 for schematic and figure 2-11 for parts list information.

The VCO actually consists of two oscillators: one for low band (0-15 MHz) operation, and one for high band (15-30 MHz) operation. The two oscillators are quite similar in design, and the following discussion of the low band VCO can be applied to the high band VCO as well.

Q501 and Q502 form a push-pull oscillator which is tuned by L501 and varactors CR503-CR506. The high band VCO uses one less varactor, since the operating frequency is higher. Power for the oscillator is obtained from the VCO select line, which comes from the bandswitch. A 5 VDC regulator, U501, is used to insure a well regulated and filtered power source. CR503-CR505 are controlled by the coarse tune line from the phase detector circuitry, and CR506 is controlled by the fine tune line. Two control lines are required to insure that the VCO will always tune to the correct frequency.

The VCO output is coupled through a buffer stage, Q503, and a PIN diode, CR507, to T503, which provides additional isolation between the VCO and other circuits in the transceiver. A sample of the output of T503 is connected through R514 to the DR-7 for frequency readout purposes. T504 splits the output of T503, and the resulting outputs drive the Up-Converter and Translator Boards.

The low band VCO tunes between 48.05 and 63.05 MHz, corresponding to an operating range of 0 to 15 MHz. The high band VCO tunes between 63.05 and 78.05 MHz, corresponding to an operating range of 15 to 30 MHz.

Phase detector U503 compares the 500 kHz reference from the PBT/ Reference Board (Section 2-10) with the output of the programmable divider on the Translator Board (Section 2-6). The phase detector output is filtered by R521, R522 and C538, and amplified, inverted and filtered by U504A and associated components. The output of U504A is the fine tune line.

U504B is biased by R538 and R539 to amplify the fine tune line when it exceeds 15 volts, indicating that it is approaching the end of its range. The output of U504B is the course tune line. Large excursions of this line cause CR515/517 or CR516/518 to conduct to allow a fast slew rate. When the synthesizer loop is locked, the diodes cease to conduct, allowing R533 and C524 to filter the coarse tune line.

When the synthesizer loop is out of lock, pulses are produced by the phase detector at pin 1. These pulses are amplified by Q507, and integrated by R527 and C543 to produce a dc level. C539 is used to filter noise spikes from the output of Q507 during the locked state. The dc level produced by this circuit is used to turn on Q508, thus providing a ground at pin 10 of the circuit board during out-of-lock conditions. This ground is applied to the P.A. disable input of the LPF Module (Section 2-14) to prevent the transmission of spurious signals.

Alignment of the VCO Board consists of setting L501 and L502 for proper oscillator range, and is covered in Section 3. If parts replacement is required, be sure to replace the shield and ground clip exactly as installed at the factory to insure proper synthesizer operation. In addition, note that the oscillator transistors must be replaced in matched pairs in the high and low band VCOs.

## TR-7 VCO BOARD

REF DES	DESCRIPTION	PART NO.
C501	Capacitor, Disc, 15 pF $\pm$ 5%, NPO	3160510
C502	Capacitor, Disc, 15 pF $\pm$ 5%, NPO	3160510
C503	Capacitor, Mica, 390 pF $\pm$ 5%, DM-15	3170370
C504	Capacitor, Mica, 390 pF $\pm$ 5%, DM-15	3170370
C505	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C506	Capacitor, Tantalum, 47 $\mu$ F $\pm$ 20%, 6 V	3183070
C507	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C508	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, 50 V	3161380
C509	Capacitor, Electrolytic, 22 $\mu$ F $\pm$ 20%, 16 V	3180105
C510	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C511	Capacitor, Disc, 51 pF $\pm$ 5%, N750	3160860
C512	Capacitor, Disc, 150 pF $\pm$ 20%, Z5U	3161170
C513	Capacitor, Disc, 470 pF $\pm$ 20%, Z5U	3161350
C514	Capacitor, Disc, 8.2 pF $\pm$ 5%, NPO	3160300
C515	Capacitor, Disc, 8.2 pF $\pm$ 5%, NPO	3160300
C516	Capacitor, Mica, 180 pF $\pm$ 5%, DM-15	3170180
C517	Capacitor, Mica, 180 pF $\pm$ 5%, DM-15	3170180
C518	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C519	Capacitor, Tantalum, 47 $\mu$ F $\pm$ 20%, 6 V	3183070
C520	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C521	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C522	Capacitor, Electrolytic, 22 $\mu$ F $\pm$ 20%, 16 V	3180105
C523	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C524	Capacitor, Tantalum, 1 $\mu$ F $\pm$ 20%, 35 V	3183010
C525	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C526	Capacitor, Disc, 51 pF $\pm$ 5%, N750	3160860
C527	Capacitor, Disc, 150 pF $\pm$ 20%, Z5U	3161170
C528	Capacitor, Disc, 470 pF $\pm$ 20%, Z5U	3161350
C529	Capacitor, Disc, 470 pF $\pm$ 20%, Z5U	3161350
C530	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C531	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C532	Capacitor, Disc, 51 pF $\pm$ 5%, N750	3160860
C533	Capacitor, Disc, .005 $\mu$ F $\pm$ 20%, Z5U	3161470
C534	Capacitor, Tantalum, 10 $\mu$ F $\pm$ 20%, 25 V	3183030
C535	Capacitor, Electrolytic, 10 $\mu$ F $\pm$ 20%, 25 V	3180062
C536	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C537	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C538	Capacitor, Disc, 500 pF $\pm$ 10%, X5F	3161380
C539	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C540	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C541	Capacitor, Film, .01 $\mu$ F	3184040
C542	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C543	Capacitor, Electrolytic, 10 $\mu$ F $\pm$ 20%, 25 V	3180062
C544	Capacitor, Disc, 470 pF $\pm$ 20%, Z5U	3161350
C545	Capacitor, Tantalum, .1 $\mu$ F $\pm$ 10%, 35 V	3183098
C546	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C547	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C548	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C549	Capacitor, Disc, .005 $\mu$ F $\pm$ 20%, Z5U	3161470
C550	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
CR501	Diode, 1N4148	3020090

REF DES	DESCRIPTION	PART NO.
CR502	Diode, 1N4148	3020090
CR503	Diode, MV104	3020274
CR504	Diode, MV104	3020274
CR505	Diode, MV104	3020274
CR506	Diode, MV209	3020278
CR507	Diode, MPN3404	3030265
CR508	Diode, 1N4148	3020090
CR509	Diode, 1N4148	3020090
CR510	Diode, MV104	3020274
CR511	Diode, MV104	3020274
CR512	Diode, MV209	3020278
CR513	Diode, MPN3404	3020265
CR514	Diode, 1N4148	3020090
CR515	Diode, 1N4148	3020090
CR516	Diode, 1N4148	3020090
CR517	Diode, 1N4148	3020090
CR518	Diode, 1N4148	3020090
L501	Inductor, Variable	2513003
L502	Inductor, Variable	2513001
Q501	Transistor, SPF796, Matched FET	3030355
Q502	Transistor, SPF796, Matched FET	3030355
Q503	Transistor, J310	3030501
Q504	Transistor, SPF796, Matched FET	3030355
Q505	Transistor, SPF796, Matched FET	3030355
Q506	Transistor, J310	3030501
Q507	Transistor, 2N4125	3030110
Q508	Transistor, 2N3904	3030105
R501	Resistor, Carbon Film, 1 M $\Omega$ $\pm$ 5%, 1/4 W	3220355
R502	Resistor, Carbon Film, 1 M $\Omega$ $\pm$ 5%, 1/4 W	3220355
R503	Resistor, Carbon Film, 33 $\Omega$ $\pm$ 5%, 1/4 W	3220025
R504	Resistor, Carbon Film, 10 M $\Omega$ $\pm$ 5%, 1/4 W	3220380
R505	Resistor, Carbon Film, 33 $\Omega$ $\pm$ 5%, 1/4 W	3220025
R506	Resistor, Carbon Film, 4.7 K $\Omega$ $\pm$ 5%, 1/4 W	3220210
R507	Resistor, Carbon Film, 1 M $\Omega$ $\pm$ 5%, 1/4 W	3220355
R508	Resistor, Carbon Film, 1 M $\Omega$ $\pm$ 5%, 1/4 W	3220355
R509	Resistor, Carbon Film, 33 $\Omega$ $\pm$ 5%, 1/4 W	3220025
R510	Resistor, Carbon Film, 10 M $\Omega$ $\pm$ 5%, 1/4 W	3220380
R511	Resistor, Carbon Film, 33 $\Omega$ $\pm$ 5%, 1/4 W	3220025
R512	Resistor, Carbon Film, 4.7 K $\Omega$ $\pm$ 5%, 1/4 W	3220210
R513	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R514	Resistor, Carbon Film, 470 $\Omega$ $\pm$ 5%, 1/4 W	3220110
R515	Resistor, Carbon Film, 5.1 $\Omega$ $\pm$ 5%, 1/4 W	3220003
R516	Resistor, Carbon Film, 220 $\Omega$ $\pm$ 5%, 1/4 W	3220075
R517	Resistor, Carbon Film, 220 $\Omega$ $\pm$ 5%, 1/4 W	3220075
R518	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R519	Resistor, Carbon Film, 2.7 K $\Omega$ $\pm$ 5%, 1/4 W	3220195
R520	Resistor, Carbon Film, 2.7 K $\Omega$ $\pm$ 5%, 1/4 W	3220195
R521	Resistor, Carbon Film, 4.7 K $\Omega$ $\pm$ 5%, 1/4 W	3220210
R522	Resistor, Carbon Film, 4.7 K $\Omega$ $\pm$ 5%, 1/4 W	3220210
R523	Resistor, Carbon Film, 22 K $\Omega$ $\pm$ 5%, 1/4 W	3220260
R524	Resistor, Carbon Film, 2.7 K $\Omega$ $\pm$ 5%, 1/4 W	3220195
R525	Resistor, Carbon Film, 8.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220230
R526	Resistor, Carbon Film, 8.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220230

REF DES	DESCRIPTION	PART NO.
R527	Resistor, Carbon Film, 47 K $\Omega$ $\pm$ 5%, 1/4 W	3220285
R528	Resistor, Carbon Film, 3.9 K $\Omega$ $\pm$ 5%, 1/4 W	3220205
R529	Resistor, Carbon Film, 15 $\Omega$ $\pm$ 5%, 1/4 W	3220010
R530	Resistor, Carbon Film, 2.7 K $\Omega$ $\pm$ 5%, 1/4 W	3220195
R531	Resistor, Carbon Film, 4.7 K $\Omega$ $\pm$ 5%, 1/4 W	3220210
R532	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R533	Resistor, Carbon Film, 10 M $\Omega$ $\pm$ 5%, 1/4 W	3220380
R534	Resistor, Carbon Film, 4.7 K $\Omega$ $\pm$ 5%, 1/4 W	3220210
R535	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R536	Resistor, Carbon Film, 5.1 $\Omega$ $\pm$ 5%, 1/4 W	3220003
R537	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R538	Resistor, Carbon Film, 8.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220230
R539	Resistor, Carbon Film, 3.9 K $\Omega$ $\pm$ 5%, 1/4 W	3220205
RFC501	Choke Assy., 5.6 $\mu$ H, L56G	3520510
RFC502	Choke Assy., 5.6 $\mu$ H, L56G	3520510
RFC503	Choke Assy., 5.6 $\mu$ H, L56G	3520510
RFC504	Choke Assy., 5.6 $\mu$ H, L56G	3520510
RFC505	Choke Assy., 5.6 $\mu$ H, L56G	3520510
RFC506	Choke Assy., 5.6 $\mu$ H, L56G	3520510
RFC507	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC508	Choke Assy., 270 $\mu$ H, MUD271	3520590
T501	Transformer, Toroid	2510007
T502	Transformer, Toroid	2510006
T503	Transformer, Toroid	2510003
T504	Transformer, Toroid	2510003
U501	I.C., 78L05A	3040030
U502	I.C., 78L05A	3040030
U503	I.C., MC14046B	3041046
U504	I.C., UA739PC	3020535
C551	Capacitor, Disc, 6.2 pF $\pm$ 5%, NPO	3160240
C552	Capacitor, Disc, 6.2 pF $\pm$ 5%, NPO	3160240

## NOTES:

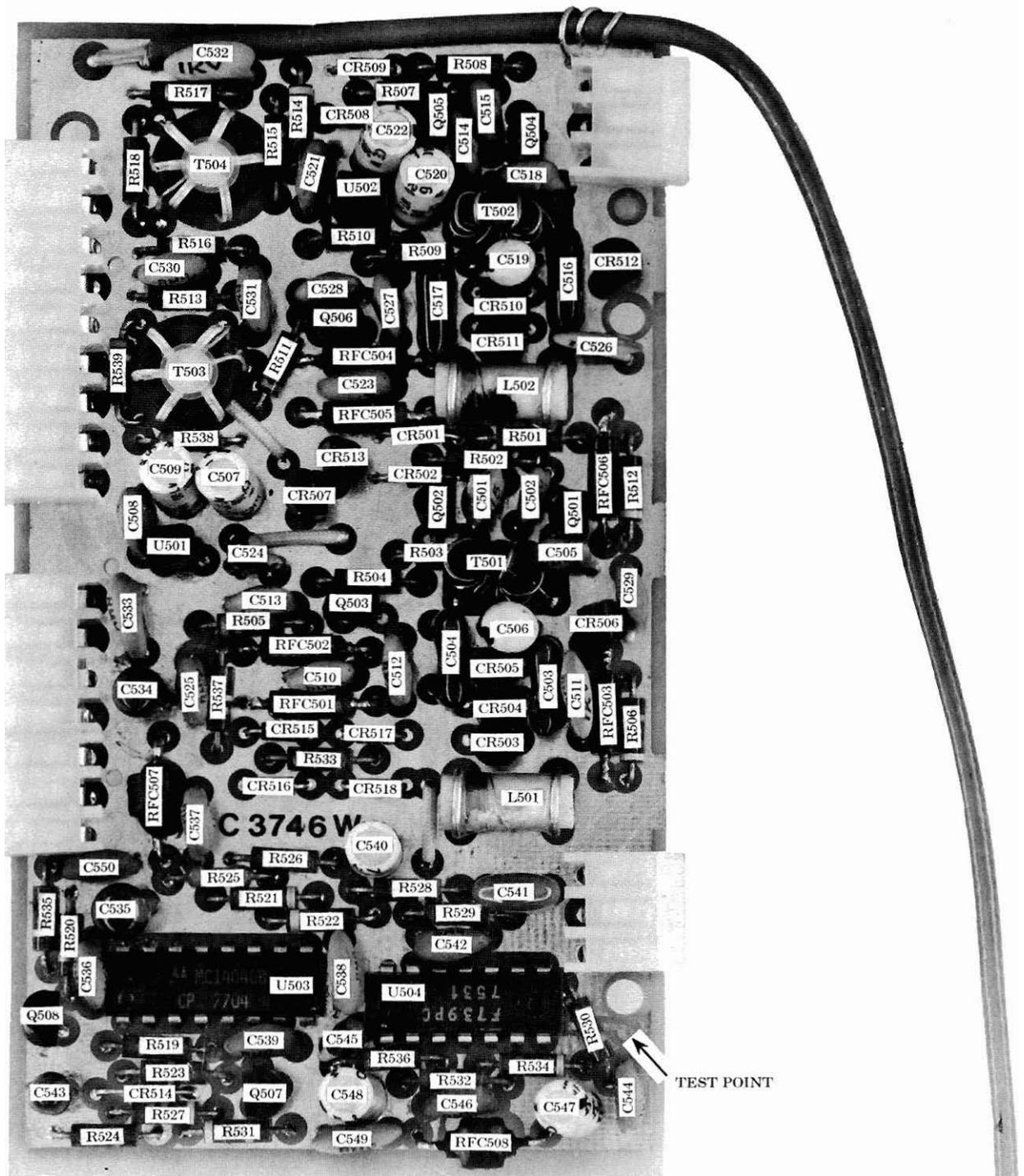
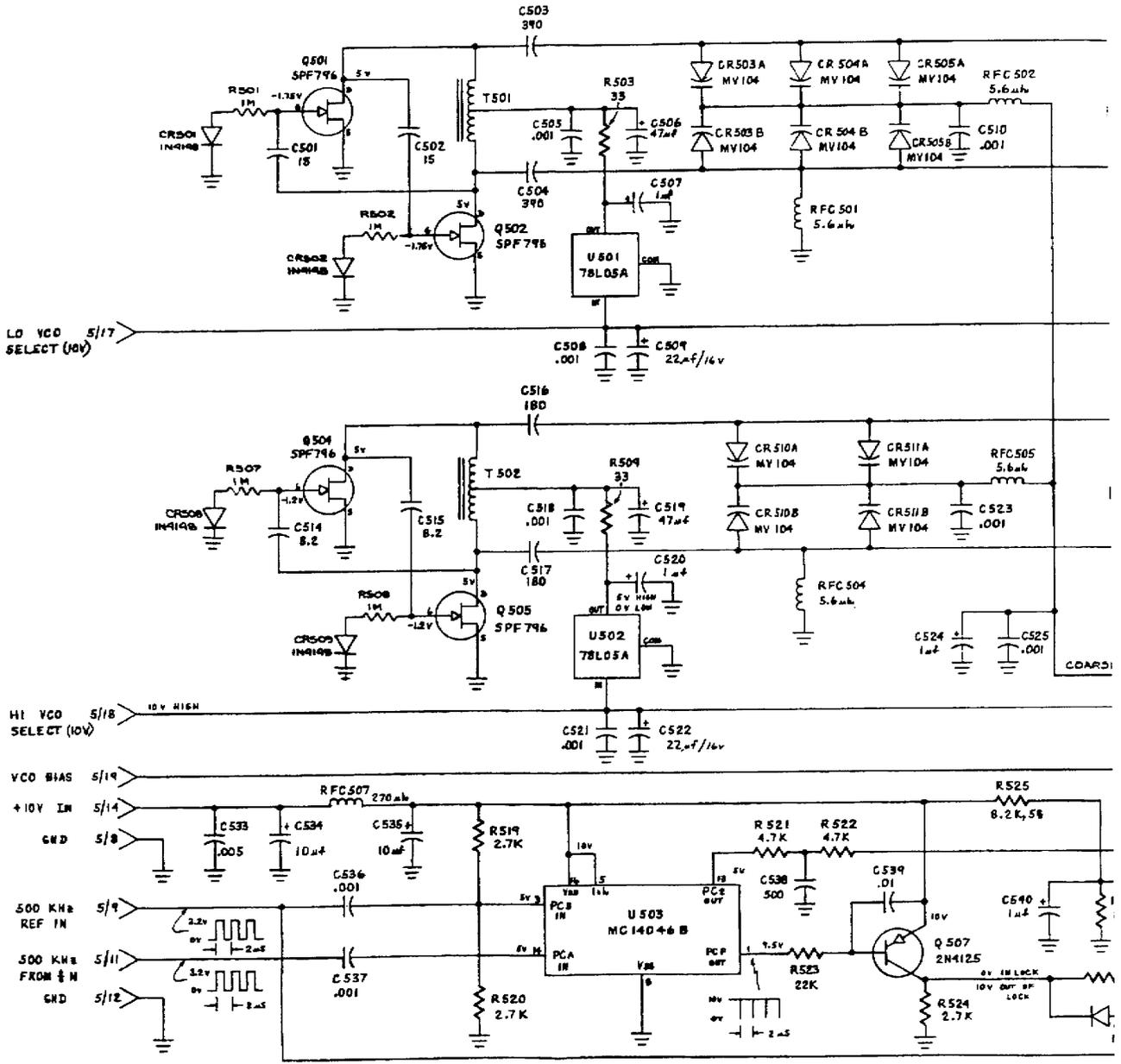


Fig. 2-11 VCO Board Pictorial

C	533	501 514	534 527	502 515 525	503 504 504 517	505 518	506 507 511 507 514 522	538	539	518 523	504	525	540
R	501 507		502 508		519 520		503 509	521	523 522	524		525	526
L													



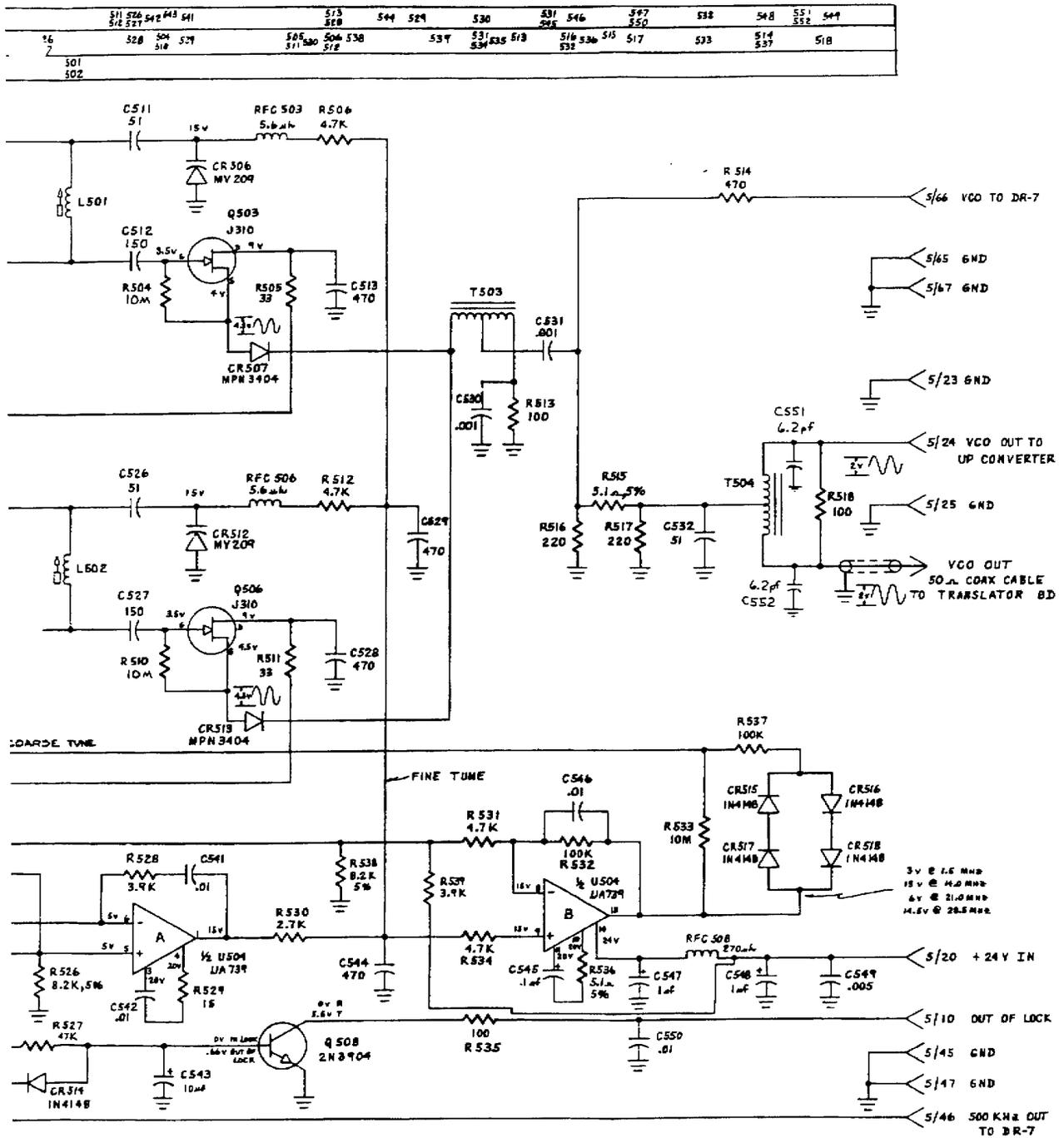


Fig. 2-12 VCO Board Schematic

## 2-6. TRANSLATOR BOARD

The Translator Board combines the 40 MHz signal from the Passband Tuning/Reference Board, the 5.05-5.55 MHz PTO output and the 48.05-78.05 MHz VCO signal to create an input to the programmable divider. The output of this divider is routed to the phase detector on the VCO Board (Section 2-5) for frequency and phase correction of the VCO. Refer to figure 2-14 for schematic and figure 2-13 for parts list information.

The 5.05-5.55 MHz PTO signal is applied to one input of a double balanced mixer consisting of T604, T605 and CR605-608. The 40 MHz signal from the PBT/Reference Board is amplified by Q604 and applied to the other input of this mixer. The resulting 45.05-45.55 MHz signal is filtered by a bandpass filter consisting of L609-L611 and C623-C629, and routed to one input of a double balanced mixer consisting of T602, T603 and CR601-CR604. The other input of this double balanced mixer is connected to the output of the VCO Board, which varies from 48.05-78.05 MHz.

The output of this mixer is a signal which varies from 3 to 32.5 MHz, depending on the range of operation. This signal remains at a constant frequency for any selected 500 kHz segment, since the VCO frequency is forced by the phase detector to track the PTO frequency.

The 3-32.5 MHz signal is passed through a low-pass filter to remove undesired mixing products, amplified by Q603 and Q602 and buffered by Q601. This signal processing is required in order to achieve a sufficient level to drive the programmable divider. The programmable divider is comprised of U601 through U604, and is programmed to divide by a whole integer between 6 and 65, depending on the 500 kHz range selected. Programming information comes from the Digital Control Board (Section 2-2) and is modified by the DR-7 frequency programmer when this accessory is installed. Load number information to the Translator Board is present on pins 41-49 (the top connector) and is coded in BCD. The least significant digit of the load number is connected to pins 41-44, and the most significant digit to pins 46-49.

The output of the programmable divider, which is 500 kHz when the synthesizer is locked, is connected via the Parent Board to the phase detector on the VCO Board.

Alignment of the Translator Board consists of aligning the 45.05-45.55 MHz band-pass filter, and is covered in Section 3. Note that the shields on the board need not be removed for alignment. If parts replacement is required, be sure to replace all shields and ground clips to insure proper performance.

## TR-7 TRANSLATOR BOARD

REF DES	DESCRIPTION	PART NO.
C601	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35V	3183100
C602	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C603	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C604	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C605	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C606	Capacitor, Tantalum, 10 $\mu$ F $\pm$ 20%, 25V DELETED	3183030
C608	Capacitor, Disc, 68 pF $\pm$ 5%, N750	3160990
C609	Capacitor, Disc, .005 $\mu$ F $\pm$ 20%, Z5U	3161470
C610	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C611	Capacitor, Mica, 190 pF $\pm$ 5%, DM-15	3170190
C612	Capacitor, Mica, 68 pF $\pm$ 5%, DM-15	3170060
C613	Capacitor, Mica, 120 pF $\pm$ 5%, DM-15	3170130
C614	Capacitor, Mica, 150 pF $\pm$ 5%, DM-15	3170150
C615	Capacitor, Mica, 130 pF $\pm$ 5%, DM-15	3170140
C616	Capacitor, Mica, 90 pF $\pm$ 5%, DM-15	3170090
C617	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C618	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C619	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C620	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C621	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C622	Capacitor, Disc, .005 $\mu$ F $\pm$ 20%, Z5U	3161470
C623	Capacitor, Disc, 12 pF $\pm$ 5%, NPO	3160430
C624	Capacitor, Mica, 68 pF $\pm$ 5%, DM-15	3170060
C625	Capacitor, Tubular, 2.7 pF, NPO	3185060
C626	Capacitor, Disc, 82 pF $\pm$ 5%, N750	3161040
C627	Capacitor, Tubular, 2.7 pF, NPO	3185060
C628	Capacitor, Mica, 68 pF $\pm$ 5%, DM-15	3170060
C629	Capacitor, Disc, 12 pF $\pm$ 5%, NPO	3160430
C630	Capacitor, Mica, 100 pF $\pm$ 5%, DM-15	3170110
C631	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C632	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C633	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C634	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C635	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C636	Capacitor, Disc, 27 pF $\pm$ 5%, NPO	3160650
C637	Capacitor, Mica, 68 pF $\pm$ 5%, DM-15	3170060
C638	Capacitor, Disc, 47 pF $\pm$ 5%, NPO	3160840
C639	Capacitor, Disc, 51 pF $\pm$ 5%, N750	3160860
C640	Capacitor, Disc, 6.2 pF $\pm$ 5%, N750	3160200
CR601	Diode, MBD-101	3020263
CR602	Diode, MBD-101	3020263
CR603	Diode, MBD-101	3020263
CR604	Diode, MBD-101	3020265
CR605	Diode, 1N4148	3020090
CR606	Diode, 1N4148	3020090
CR607	Diode, 1N4148	3020090
CR608	Diode, 1N4148	3020090
L601	NOT USED	
L602	Ferrite Bead	3523207
L603	Inductor, Toroid	2510017

REF DES	DESCRIPTION	PART NO.
L604	Inductor, Toroid	2510016
L605	Inductor, Toroid	2510015
L607	Inductor, Toroid	2510015
L608	NOT USED	
L609	Inductor, Variable	3524100
L610	Inductor, Variable	3524100
L611	Inductor, Variable	3524100
Q601	Transistor, 2N4125	3030110
Q602	Transistor, 2N3563	3030060
Q603	Transistor, 2N3563	3030060
Q604	Transistor, 2N3563	3030060
R601	Resistor, Carbon Film, 47 $\Omega \pm 5\%$ , 1/4 W	3220035
R602	Resistor, Carbon Film, 1 K $\Omega \pm 5\%$ , 1/4 W	3220160
R603	Resistor, Carbon Film, 1 K $\Omega \pm 5\%$ , 1/4 W	3220160
R604	Resistor, Carbon Film, 39 $\Omega \pm 5\%$ , 1/4 W	3220030
R605	Resistor, Carbon Film, 150 $\Omega \pm 5\%$ , 1/4 W	3220065
R606	Resistor, Carbon Film, 470 K $\Omega \pm 5\%$ , 1/4 W	3220160
R607	Resistor, Carbon Film, 470 $\Omega \pm 5\%$ , 1/4 W	3220110
R608	Resistor, Carbon Film, 4.7 K $\Omega \pm 5\%$ , 1/4 W	3220210
R609	Resistor, Carbon Film, 2.2 K $\Omega \pm 5\%$ , 1/4 W	3220190
R610	Resistor, Carbon Film, 150 $\Omega \pm 5\%$ , 1/4 W	3220065
R611	Resistor, Carbon Film, 270 $\Omega \pm 5\%$ , 1/4 W	3220085
R612	Resistor, Carbon Film, 1.8 K $\Omega \pm 5\%$ , 1/4 W	3220180
R613	Resistor, Carbon Film, 8.2 K $\Omega \pm 5\%$ , 1/4 W	3220230
R614	Resistor, Carbon Film, 1.2 K $\Omega \pm 5\%$ , 1/4 W	3220170
R615	Resistor, Carbon Film, 2.2 K $\Omega \pm 5\%$ , 1/4 W	3220190
R616	Resistor, Carbon Film, 68 $\Omega \pm 5\%$ , 1/4 W	3220045
R617	Resistor, Carbon Film, 5.1 $\Omega \pm 5\%$ , 1/4 W	3220003
R618	Resistor, Carbon Film, 10 $\Omega \pm 5\%$ , 1/4 W	3220005
R619	Resistor, Carbon Film, 220 $\Omega \pm 5\%$ , 1/4 W	3220075
R620	Resistor, Carbon Film, 5.1 $\Omega \pm 5\%$ , 1/4 W	3220003
R622	Resistor, Carbon Film, 15 $\Omega \pm 5\%$ , 1/4 W	3220010
R623	Resistor, Carbon Film, 150 $\Omega \pm 5\%$ , 1/4 W	3220065
R626	Resistor, Carbon Film, 22 $\Omega \pm 5\%$ , 1/4 W	3220015
R627	Resistor, Carbon Film, 10 $\Omega \pm 5\%$ , 1/4 W	3220005
R628	Resistor, Carbon Film, 33 $\Omega \pm 5\%$ , 1/4 W	3220025
R629	Resistor, Carbon Film, 8.2 K $\Omega \pm 5\%$ , 1/4 W	3220230
R630	Resistor, Carbon Film, 2.2 K $\Omega \pm 5\%$ , 1/4 W	3220190
RFC601	Choke Assy.	2512506
RFC602	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC603	Choke Assy., 270 $\mu$ H, MUD271	3520590
T601	Transformer, Toroid	2510009
T602	Transformer, Toroid	2510002
T603	Transformer, Toroid	2510002
T604	Transformer, Toroid	2510004
T605	Transformer, Toroid	2510014
U601	I.C., SN74S113N	3040495
U602	I.C., SN74196	3040470
U603	I.C., SN74196	3040470
U604	I.C., SN74S11N	3040485

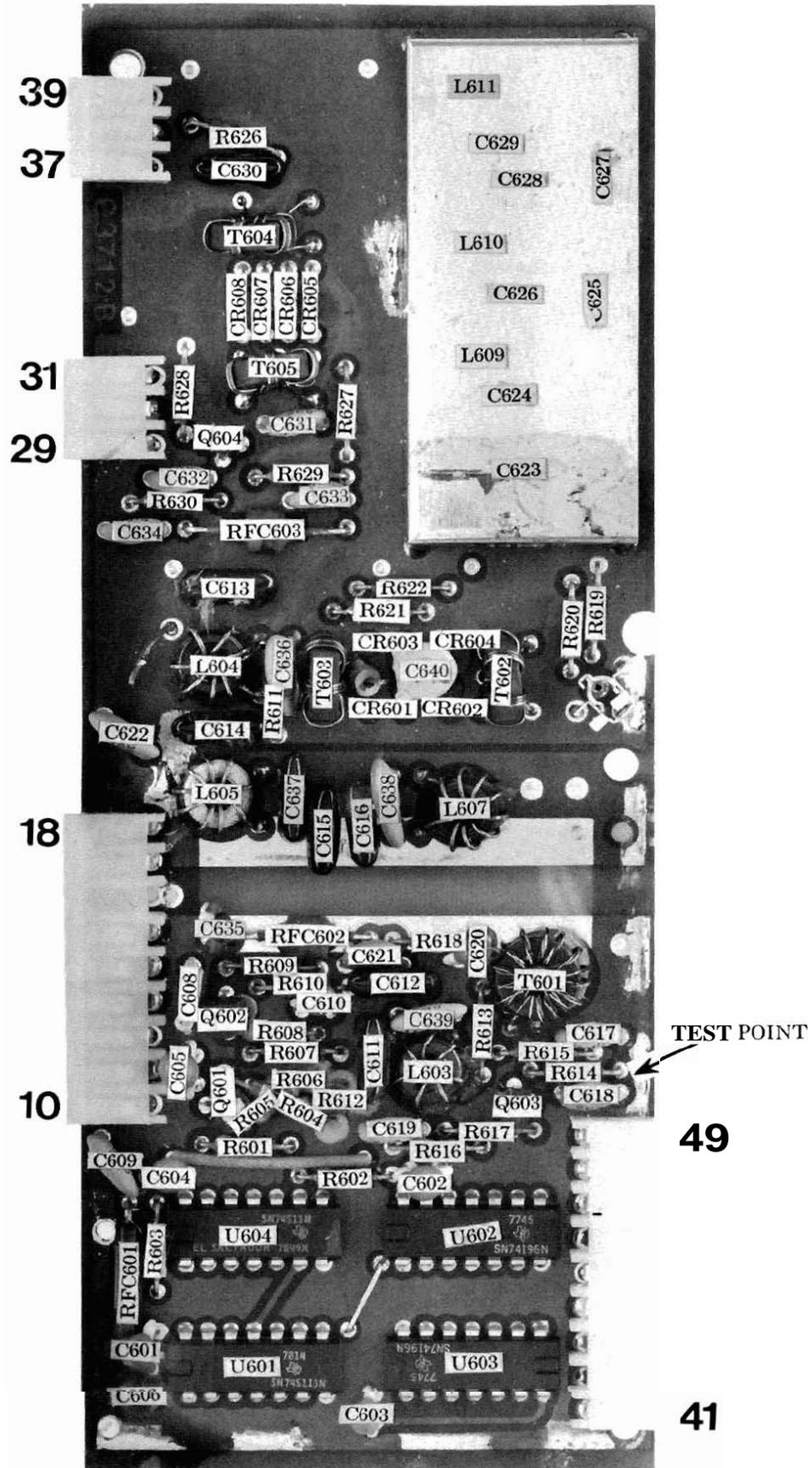
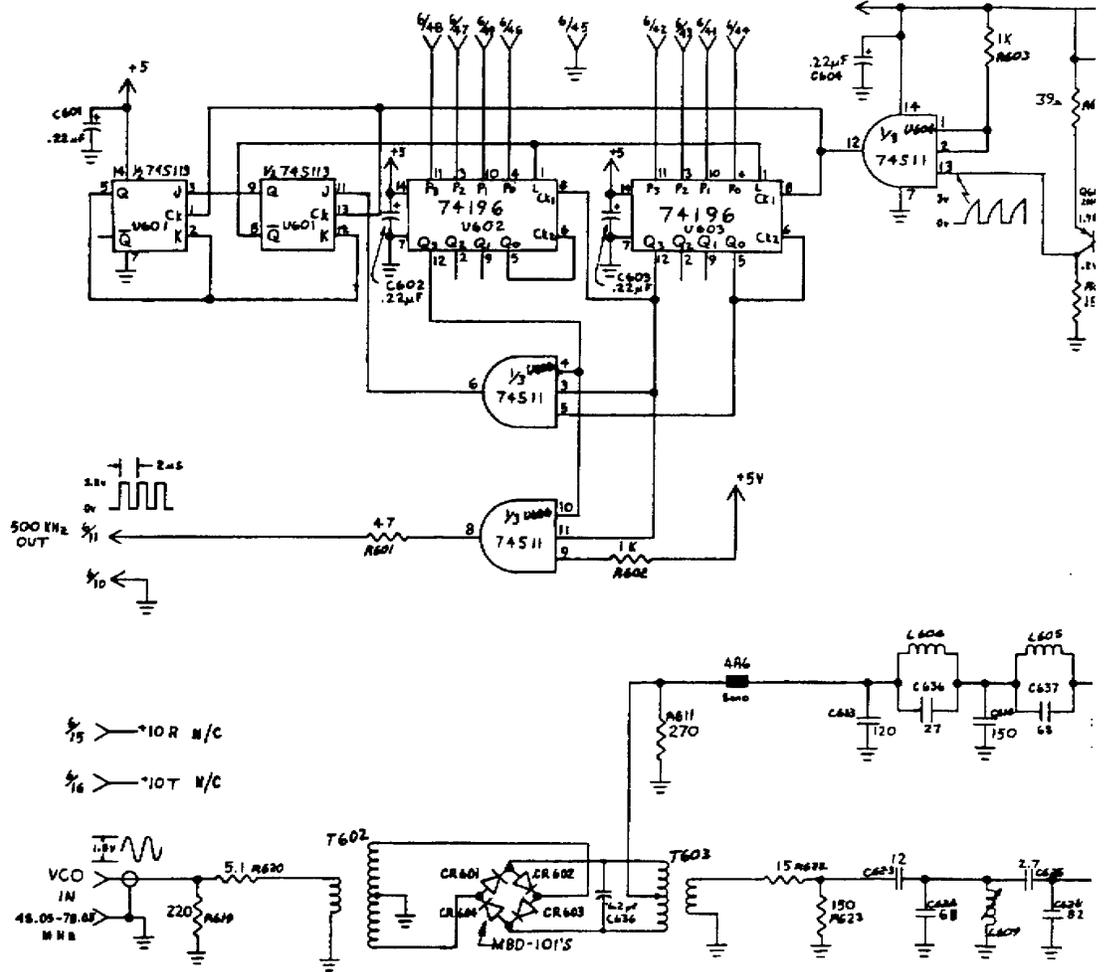


Fig. 2-13 Translator Board Pictorial

C	601	602	603 636	604 613	623 624	636 637	641 625
R	619 620	601	602 611	622 623	603	61	6
L				604	609	605	



604	626	627	628	605	616	629	608	609	610	611	620	612	631	633
625	615	628	628	605	629	608	611	630	619	611	620	621	631	632
604	606	607	608	609	610	617	626	618	627	628	630	622	624	634
605	612	613	615	616	617	626	618	627	628	630	622	624	630	634
605	610	607	611	602	603									

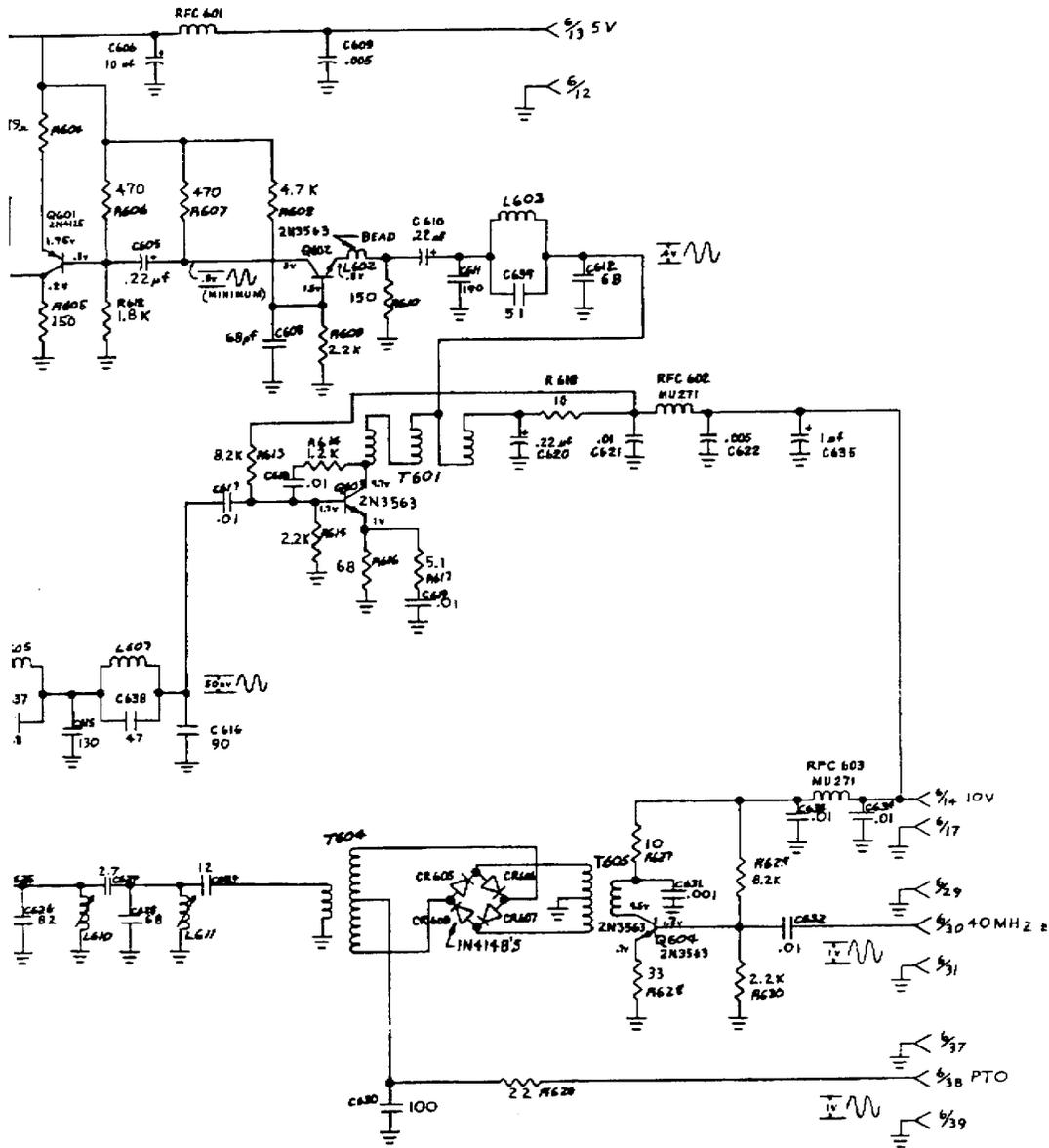


Fig. 2-14 Translator Board Schematic

## 2-7. 2ND MIXER BOARD

In receive, the 2nd Mixer Board boosts the 48.05 MHz 1st IF signal level in a gain-controlled amplifier and converts it to the 5.645 MHz 2nd IF. In transmit, the 5.645 MHz transmit IF signal is converted to 48.05 MHz and amplified for additional conversion in the Up-Converter. Refer to figure 2-16 for schematic and figure 2-15 for parts location information.

48.05 MHz 1st IF signals from the Up-Converter are routed through CR701 to the input of amplifier Q702. CR701 is turned on by +10R via RFC702, RFC703, and R708. CR702 is biased off, since R720 is a common ground return. C710, C711 and L701 form an input matching network. AGC is applied to Q702 via R707. The output of Q702 is tuned by C721 and L703, and coupled to one input of a double balanced mixer via C722 and CR703, which is turned on by +10R via RFC707. CR704 is biased off, since R726 is a common ground return.

The injection for the mixer is a 53.695 MHz (nominal) signal which is developed on the PBT Board (see Section 2-10). This signal is amplified by Q701, the output of which is tuned by C705 and T701, and connected to the injection input of the mixer via C707.

The double balanced mixer is a diode ring type, consisting of CR707, CR709, CR711, CR713, R732, R733, R734, R735 and transformers T703 and T704. A series diode and resistor are used in each leg to increase the dynamic range of the mixer. In receive, the output of the mixer is the difference of the 53.695 MHz injection and the 48.05 MHz IF signal, or 5.645 MHz. This output is coupled to pin 19 via CR705 and C726. CR705 is turned on by +10R via RFC708. The voltage developed across R719, the common ground, back biases CR706.

In transmit, the 5.645 MHz signal from the ALC attenuator on the 2nd IF/Audio Board (Section 2-11) is applied to pin 1. It is coupled to one input of the mixer via CR706, which is turned on by +10T via RFC709. CR705 is biased off by the voltage developed across R719. The difference frequency between the 53.695 MHz injection and the 5.645 MHz IF signal is the 1st IF, or 48.05 MHz. This signal is coupled out of the mixer via CR704, which is turned on by +10T via RFC706. CR703 is biased off by the voltage developed across R726.

The 48.05 MHz transmit IF signal is amplified by Q703 to a level sufficient to drive the Up-Converter. The output of Q703 is tuned and matched by L702, C729, and C730, and coupled to the Up-Converter via CR702, which is turned on by +10T.

Alignment of the 2nd Mixer Board is covered in Section 3 of this manual.

## TR-7 2ND MIXER BOARD

REF DES	DESCRIPTION	PART NO.
C701	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C702	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
	DELETED	
	DELETED	
C705	Capacitor, Variable Trimmer, 5.0-20 pF	3205375
C706	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C707	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C708	NOT USED	
C709	NOT USED	
C710	Capacitor, Disc, 8.2 pF $\pm$ .25, N750	3160290
C711	Capacitor, Disc, 20.0 pF $\pm$ 5%, NPO	3160580
C712	Capacitor, Disc, 470 pF $\pm$ 20%, Z5U	3161350
C713	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C714	Capacitor, Tantalum, 10 $\mu$ F $\pm$ 20%, 25 V	3183030
C715	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C716	Capacitor, Variable Trimmer, 5.0-20 pF	3205375
C717	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 20%, 35 V	3183100
C718	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C719	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C720	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C721	Capacitor, Disc, 25.0 pF $\pm$ 5%, NPO	3160620
C722	Capacitor, Disc, 10.0 pF $\pm$ 5%, NPO	3160360
C723	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C724	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C725	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C726	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C727	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C728	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C729	Capacitor, Mica, 30 pF $\pm$ 2%, DM-15	3170030
C730	Capacitor, Mica, 30 pF $\pm$ 2%, DM-15	3170030
C731	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C732	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C733	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C734	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C735	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C736	Capacitor, Disc, 51 pF $\pm$ 5%, N750	3160860
CR701	Diode, MPN3404	3020265
CR702	Diode, MPN3404	3020265
CR703	Diode, MPN3404	3020265
CR704	Diode, MPN3404	3020265
CR705	Diode, MPN3404	3020265
CR706	Diode, MPN3404	3020265
CR707	Diode, 1N4148	3020090
	DELETED	
CR709	Diode, 1N4148	3020090
	DELETED	
CR711	Diode, 1N4148	3020090
	DELETED	
CR713	Diode, 1N4148	3020090
L701	Inductor, Variable	2513014
L702	Inductor, Variable	2513014

REF DES	DESCRIPTION	PART NO.
L703	Inductor, Variable	2513014
Q701	Transistor, 2N3866	3030095
Q702	Transistor, 3N204	3030230
Q703	Transistor, 2N8563	3030060
Q704	Transistor, J-310	3030501
R701	Resistor, Carbon Film, 4.7 K $\Omega$ $\pm$ 5%, 1/4 W DELETED	3220210
R703	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R704	Resistor, Carbon Film, 22 $\Omega$ $\pm$ 5%, 1/4 W	3220015
R705	Resistor, Carbon Film, 10 $\Omega$ $\pm$ 5%, 1/4 W DELETED	3220005
R707	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R708	Resistor, Carbon Film, 470 $\Omega$ $\pm$ 5%, 1/4 W	3220110
R709	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R710	Resistor, Carbon Film, 47 K $\Omega$ $\pm$ 5%, 1/4 W	3220285
R711	Resistor, Carbon Film, 47 $\Omega$ $\pm$ 5%, 1/4 W	3220035
R712	Resistor, Carbon Film, 68 $\Omega$ $\pm$ 5%, 1/4 W	3220045
R713	Resistor, Carbon Film, 33 $\Omega$ $\pm$ 5%, 1/4 W	3220025
R714	Resistor, Carbon Film, 470 $\Omega$ $\pm$ 5%, 1/4 W	3220110
R715	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R716	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R717	Resistor, Carbon Film, 47 $\Omega$ $\pm$ 5%, 1/4 W	3220035
R718	Resistor, Carbon Film, 470 $\Omega$ $\pm$ 5%, 1/4 W	3220110
R719	Resistor, Carbon Film, 1.8 K $\Omega$ $\pm$ 5%, 1/4 W	3220180
R720	Resistor, Carbon Film, 1.8 K $\Omega$ $\pm$ 5%, 1/4 W	3220180
R721	Resistor, Carbon Film, 10 $\Omega$ $\pm$ 5%, 1/4 W	3220005
R722	Resistor, Carbon Film, 5.1 $\Omega$ $\pm$ 5%, 1/4 W	3220003
R723	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R724	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R725	Resistor, Carbon Film, 8.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220230
R726	Resistor, Carbon Film, 1.8 K $\Omega$ $\pm$ 5%, 1/4 W	3220180
R727	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R728	Resistor, Carbon Film, 22 $\Omega$ $\pm$ 5%, 1/4 W	3220015
R729	Resistor, Carbon Film, 270 $\Omega$ $\pm$ 5%, 1/4 W	3220085
R730	Resistor, Carbon Film, 270 $\Omega$ $\pm$ 5%, 1/4 W	3220085
R732	Resistor, Carbon Film, 15 $\Omega$ $\pm$ 5%, 1/4 W	3220010
R733	Resistor, Carbon Film, 15 $\Omega$ $\pm$ 5%, 1/4 W	3220010
R734	Resistor, Carbon Film, 15 K $\Omega$ $\pm$ 5%, 1/4 W	3220010
R735	Resistor, Carbon Film, 15 K $\Omega$ $\pm$ 5%, 1/4 W	3220010
RFC701	Choke Assy., 5.6 $\mu$ H, L56G	3520510
RFC702	Choke Assy., 5.6 $\mu$ H, L56G	3510510
RFC703	Choke Assy., 5.6 $\mu$ H, L56G	3510510
RFC704	Choke Assy., 5.6 $\mu$ H, L56G	3520510
RFC705	Choke Assy., 5.6 $\mu$ H, L56G	3520510
RFC706	Choke Assy., 5.6 $\mu$ H, L56G	3520510
RFC707	Choke Assy., 5.6 $\mu$ H, L56G	3520510
RFC708	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC709	Choke Assy., 270 $\mu$ H, MUD271	3520590
T701	Transformer, Toroid	2510021
T702	Transformer, Toroid	2510020
T703	Transformer, Toroid	2510002
T704	Transformer, Toroid	2510002
C737	Capacitor, Tantalum, 10 $\mu$ F $\pm$ 20%, 25 V	3183030

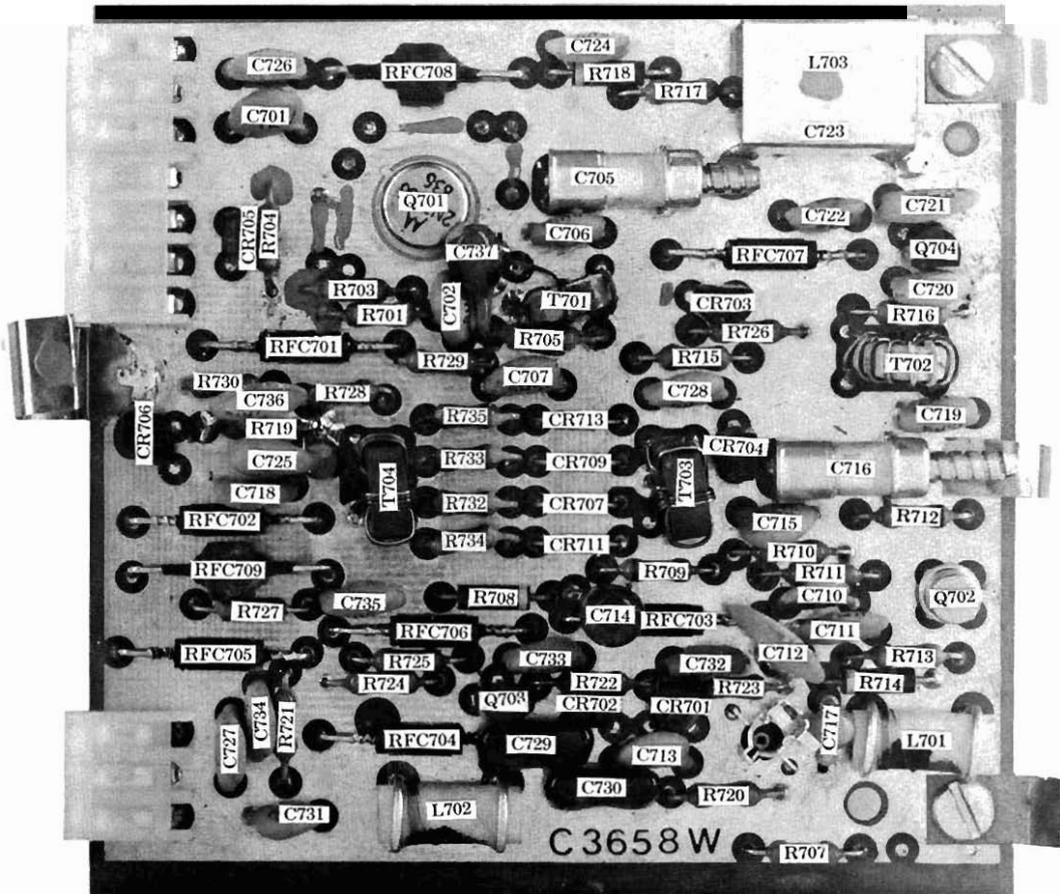
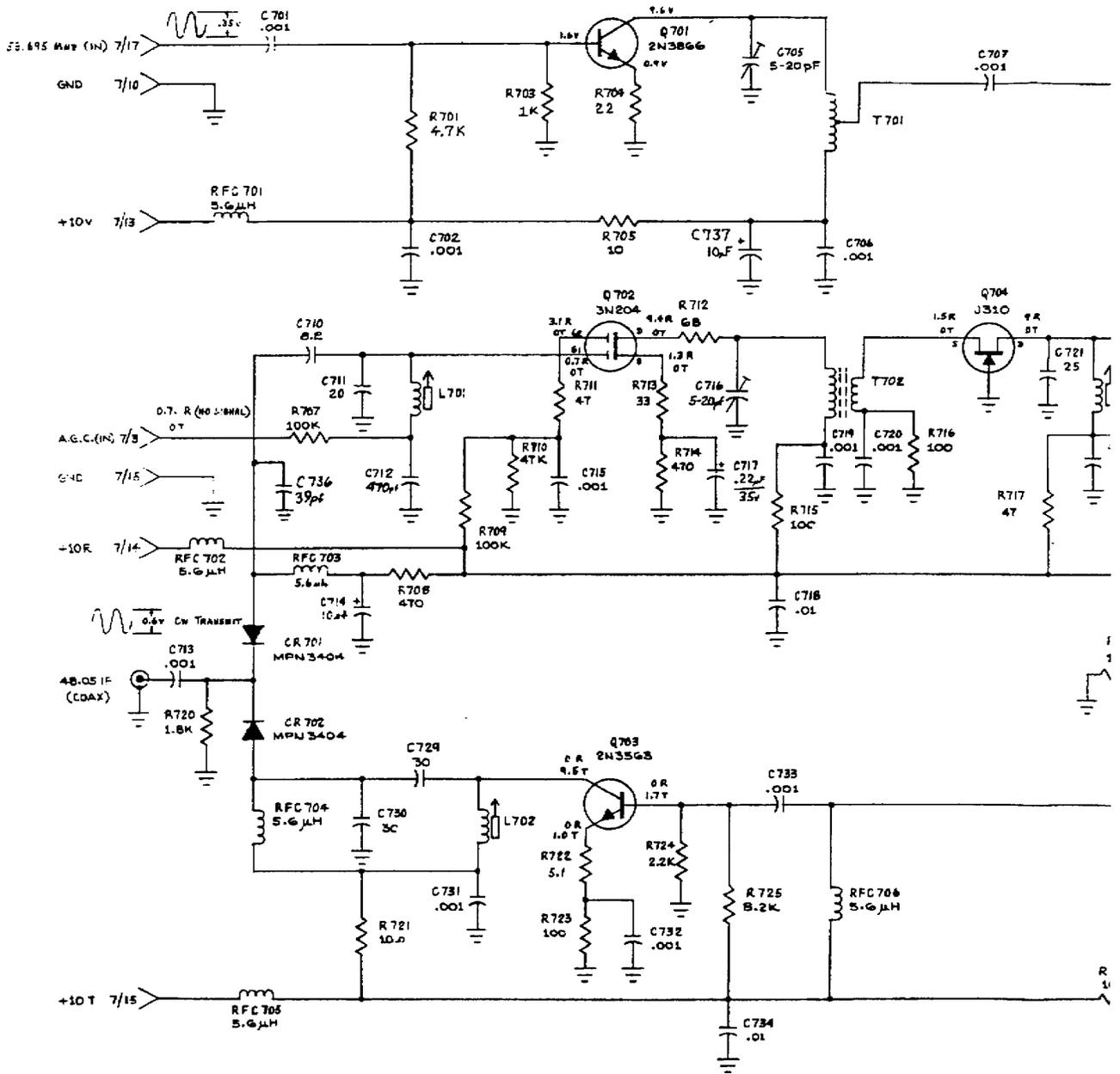


Fig. 2-15 2nd Mixer Board Pictorial

C	71B	704	710	711	730	702	709	731	715	732	717	734	716	733	706	720	707	721	723	
R	720	707	701	701	708	709	710	703	711	722	704	718	712	705	715		716		717	
L					701	702														703



723	722	725	724	734	725	735	726 727
726	729	718	730	732	733*		719
727		728		734	735		
703							

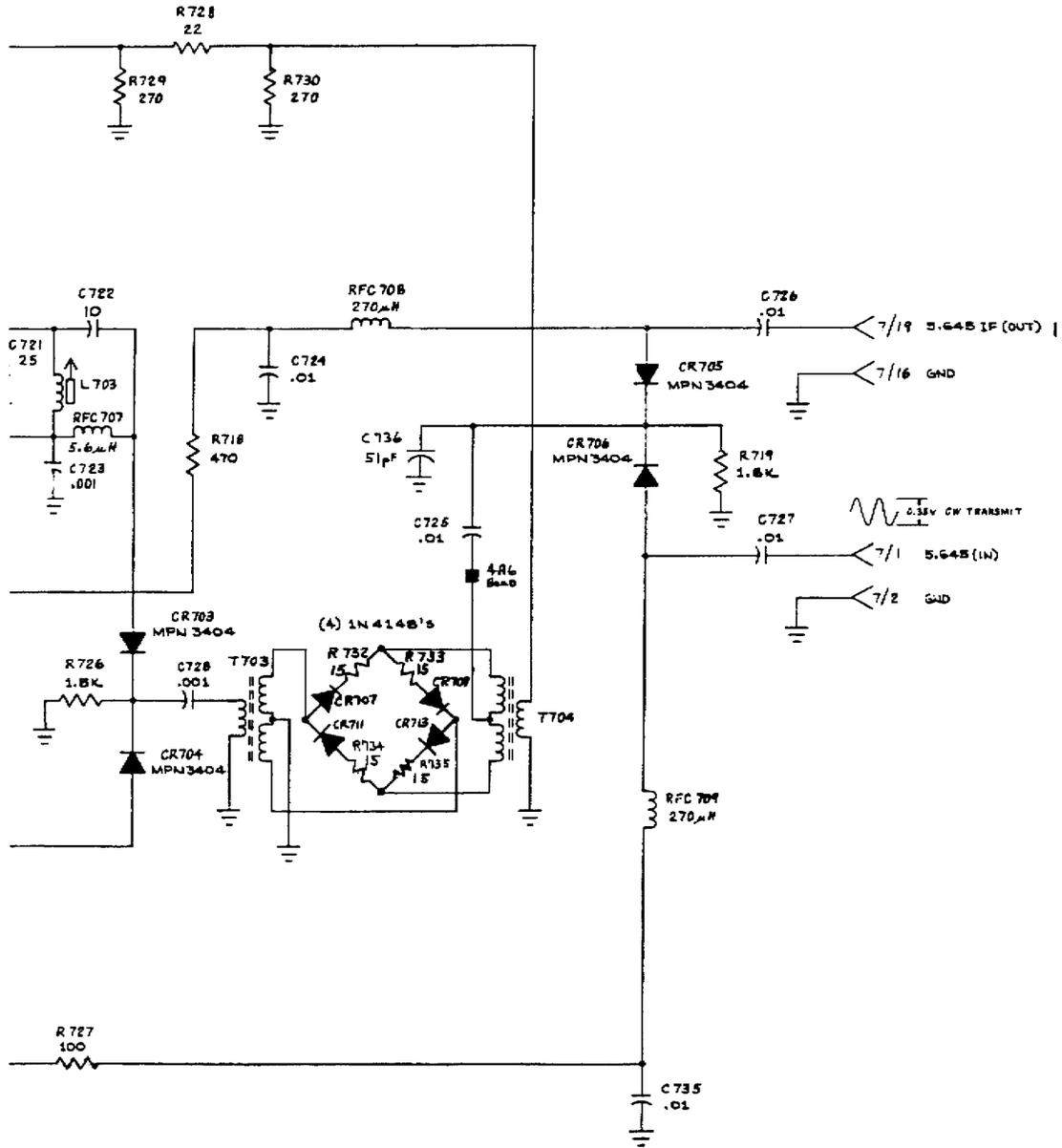


Fig. 2-16 2nd Mixer Board Schematic

## 2-8. IF SWITCHING BOARD

The IF Switching Board provides transmit/receive switching for the 5.645 MHz signal path. Refer to figure 2-18 for schematic and figure 2-17 for parts list information.

In receive, +10 volts is applied to pin 24 which forward biases CR801 and reverse biases CR802. The DC current path is through RFC802, RFC801, CR801 and R801 which supplies the ground return point. At the same time, the receive 5.645 MHz signal is applied to pin 22. The receive signal path is thus from pin 22 through C801, which provides DC blocking, through CR801, C805 (DC blocking) to the

coax connector. In transmit, +10 volts is applied to pin 37 in AM, RTTY, LSB and USB modes. Now, CR802 is forward biased and CR801 is reverse biased. The 5.645 MHz double sideband signal is applied to pin 26 through C803 (DC blocking), CR802 and C805 (DC blocking) to the coax connector. In transmit the DC current path is through RFC804, RFC803, CR802 and R801 again provides the DC ground return point. Pins 40, 39, 27 and 23 are ground pins. Pin 38 provides +10 volts for noise blanker operation when the NB-7 optional noise blanker is installed.

The IF Switching Board does not require alignment.

## NOTES:

## TR-7 IF SWITCHING BOARD

REF DES	DESCRIPTION	PART NO.
C801	Capacitor, Disc. .01 $\mu$ F + 80%, M25V	3161500
C802	Capacitor, Disc. .01 $\mu$ F + 80%, M25V	3161500
C803	Capacitor, Disc. .01 $\mu$ F + 80%, M25V	3161500
C804	Capacitor, Disc. .01 $\mu$ F + 80%, M25V	3161500
C805	Capacitor, Disc. .01 $\mu$ F + 80%, M25V	3161500
CR801	Diode, MPN3404	3020265
CR802	Diode, MPN3404	3020265
R801	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
RFC801	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC802	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC803	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC804	Choke Assy., 270 $\mu$ H, MUD271	3520590

## NOTES:

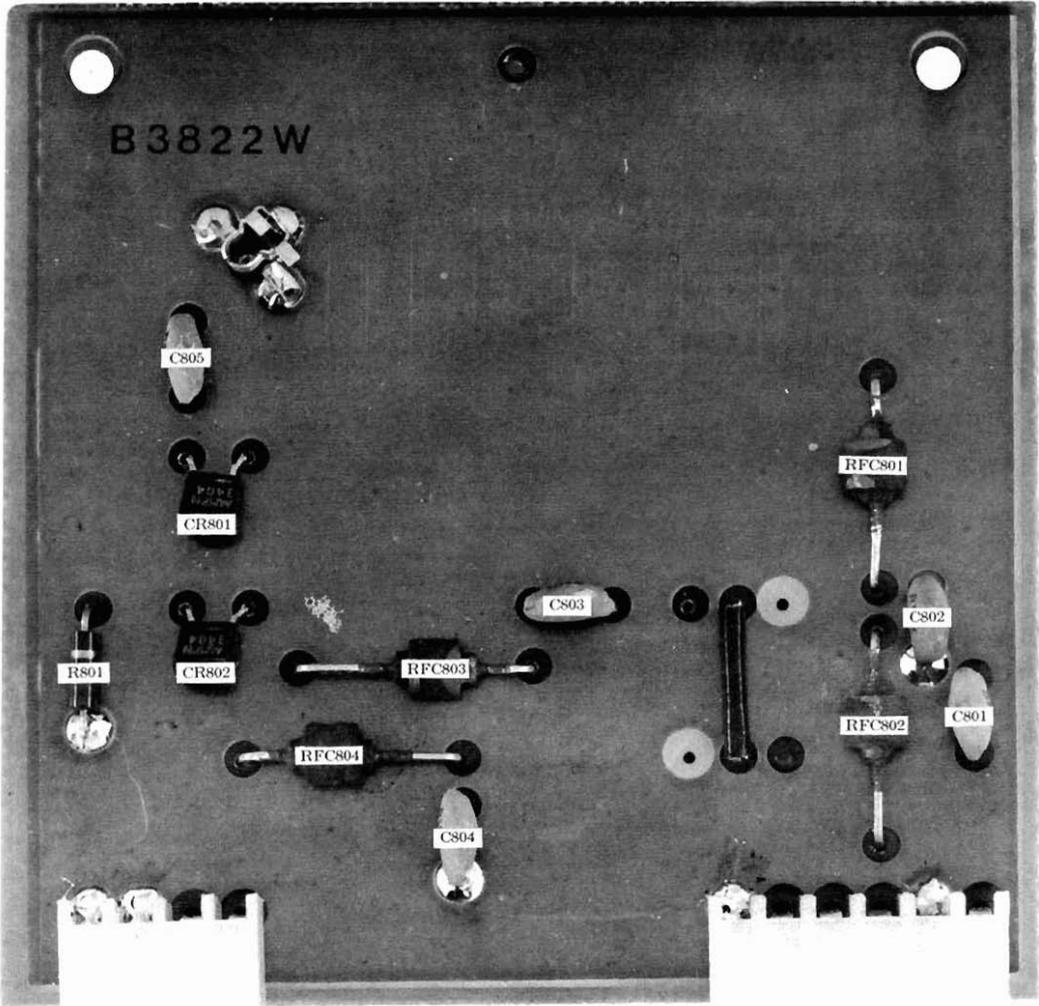
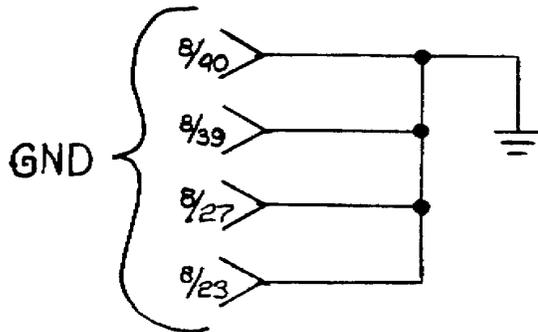
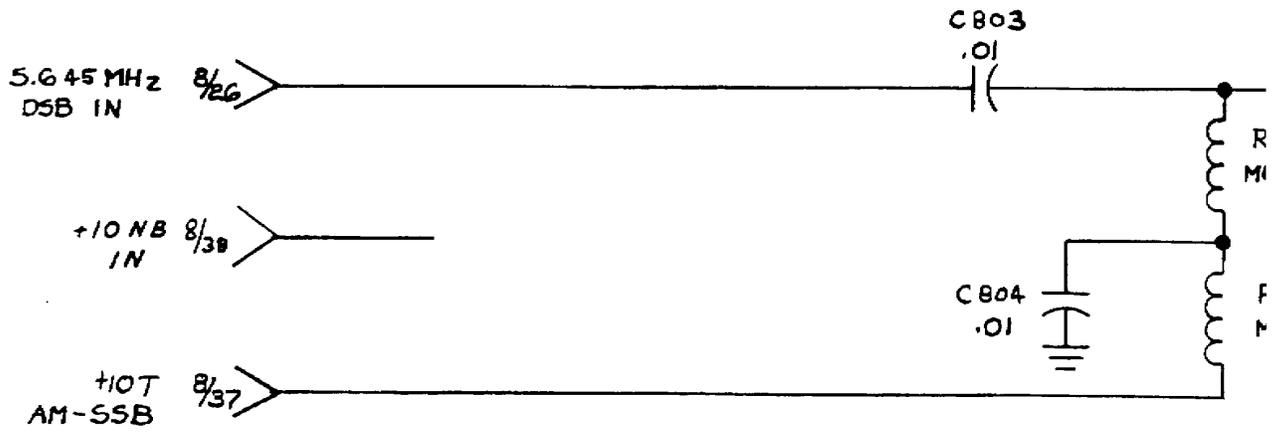
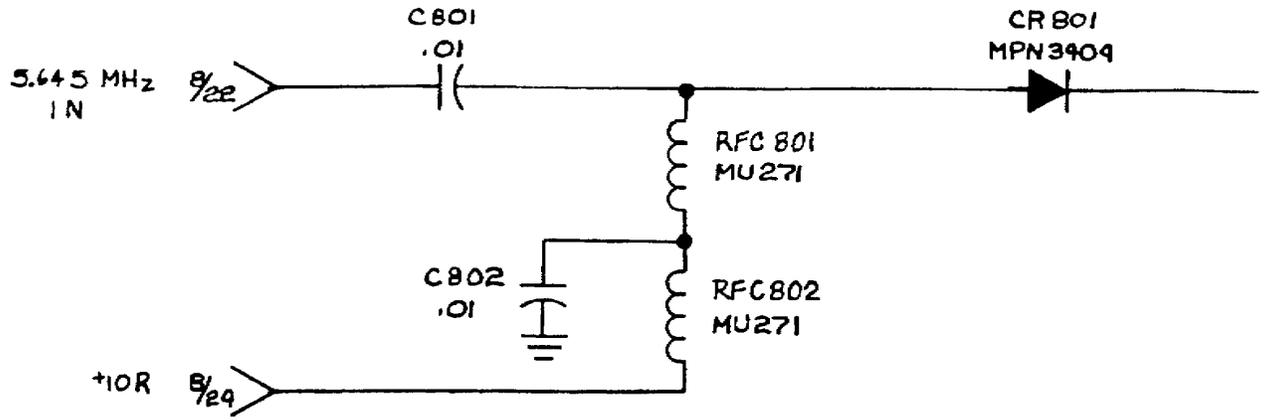


Fig. 2-17 IF Switching Board Pictorial



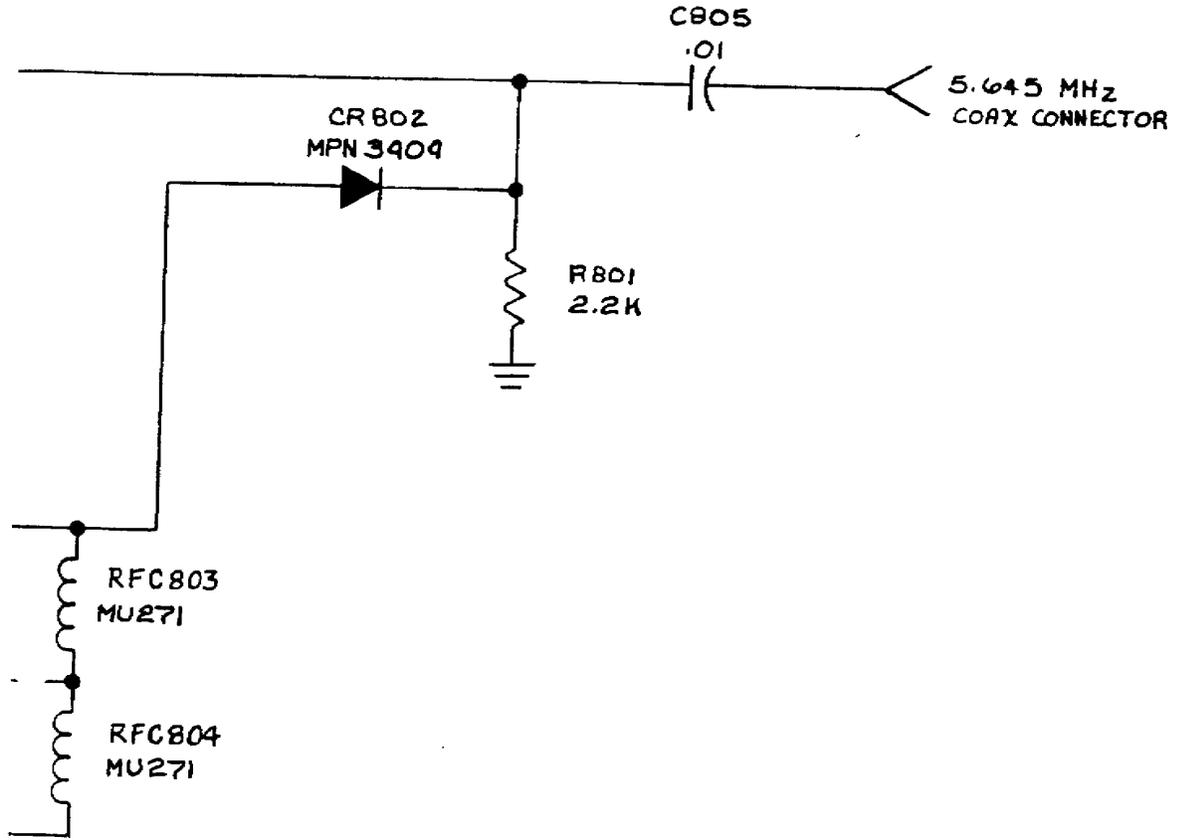


Fig. 2-18 IF Switching Board Schematic

## 2-9. IF SELECTIVITY BOARD

The IF Selectivity Board provides for the installation of up to four 5.645 MHz crystal filters of various bandwidths in the TR-7. One of these filters, which is 2.3 kHz wide at the 6 dB points, is supplied with the unit. The other three filter positions are for accessory filters, which are purchased separately.

Each of the filter positions is identical, with the same circuitry used for selection. Therefore, although the following discussion refers to the standard 2.3 kHz position, it can be applied to positions A, B or C as well. Refer to figure 2-20 for schematic and figure 2-19 for parts location information.

In receive, +10R is routed to pin 15 via the front panel BW switches, which are wired so the +10R is present on pin 15 when both switches are in the 'out' position. This voltage turns on series diodes CR903 (via R903, RFC901, and R901) and CR906 (via R905, RFC902, and R922). The same voltage back biases shunt diodes CR904 and CR905. In the unselected positions (A, B and C in this case), -5 volts from pin 38 causes the shunt diodes to conduct and the series diodes to be back biased. This has the effect of opening and isolating all signal paths except the desired path through the 2.3 kHz filter.

A 5.645 MHz signal from the Noise Blanker or IF Switching Board is coupled through C930 to a common input line. Since the series diodes in positions A, B, and C are back biased, the signal is routed through CR906, C908 and C907 to the 2.3 kHz filter. After filtering, the signal is coupled through C904, C902, CR903 and C901 to the output of the board, a coax to the 2nd IF/Audio Board.

In transmit, +10T is applied to pin 14. This forces the board to select the 2.3 kHz filter, regardless of the position of the front panel switches, which are driven from +10R. The TR-7, therefore, always transmits through the 2.3 kHz filter. It is very important that this filter not be moved to another position or exchanged for a filter with different characteristics, to insure proper transmitter operation.

When servicing the IF Selectivity Board, be sure to replace all shields and grounds, if removed, in the original locations. Failure to do so may seriously degrade the ultimate selectivity of the crystal filter, resulting in signals outside the desired passband 'leaking around' the filters.

## NOTES:

## TR-7 IF SELECTIVITY BOARD

REF DES	DESCRIPTION	PART NO.
C901	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C902	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C903	Capacitor, Disc, .02 $\mu$ F $\pm$ 80%, Z5U	3161580
C904	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C905	Capacitor, Disc, .02 $\mu$ F $\pm$ 80%, Z5U	3161580
C906	Capacitor, Disc, .02 $\mu$ F + 80%, Z5U	3161580
C907	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C908	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C909	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C910	Capacitor, Disc, .02 $\mu$ F $\pm$ 80%, Z5U	3161580
C911	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C912	Capacitor, Disc, .02 $\mu$ F $\pm$ 80%, Z5U	3161580
C913	Capacitor, Disc, .02 $\mu$ F $\pm$ 80%, Z5U	3161580
C914	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C915	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C916	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C917	Capacitor, Disc, .02 $\mu$ F $\pm$ 80%, Z5U	3161580
C918	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C919	Capacitor, Disc, .02 $\mu$ F $\pm$ 80%, Z5U	3161580
C920	Capacitor, Disc, .02 $\mu$ F $\pm$ 80%, Z5U	3161580
C921	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C922	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C923	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C924	Capacitor, Disc, .02 $\mu$ F $\pm$ 80%, Z5U	3161580
C925	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C926	Capacitor, Disc, .02 $\mu$ F $\pm$ 80%, Z5U	3161580
C927	Capacitor, Disc, .02 $\mu$ F $\pm$ 80%, Z5U	3161580
C928	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C929	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C930	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
CR901	Diode, 1N4148	3020090
CR902	Diode, 1N4148	3020090
CR903	Diode, MPN3404	3020265
CR904	Diode, MPN3404	3020265
CR905	Diode, MPN3404	3020265
CR906	Diode, MPN3404	3020265
CR907	Diode, MPN3404	3020265
CR908	Diode, MPN3404	3020265
CR909	Diode, MPN3404	3020265
CR910	Diode, MPN3404	3020265
CR911	Diode, MPN3404	3020265
CR912	Diode, MPN3404	3020265
CR913	Diode, MPN3404	3020265
CR914	Diode, MPN3404	3020265
CR915	Diode, MPN3404	3020265
CR916	Diode, MPN3404	3020265
CR917	Diode, MPN3404	3020265
CR918	Diode, MPN3404	3020265
R901	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R902	Resistor, Carbon Film, 3.3 K $\Omega$ $\pm$ 5%, 1/4 W	3220200
R903	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160

REF DES	DESCRIPTION	PART NO.
R904	Resistor, Carbon Film, 3.9 K $\Omega$ $\pm$ 5%, 1/4 W	3220205
R905	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R906	Resistor, Carbon Film, 3.3 K $\Omega$ $\pm$ 5%, 1/4 W	3220200
R907	Resistor, Carbon Film, 3.3 K $\Omega$ $\pm$ 5%, 1/4 W	3220200
R908	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R909	Resistor, Carbon Film, 3.9 K $\Omega$ $\pm$ 5%, 1/4 W	3220205
R910	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R911	Resistor, Carbon Film, 3.3 K $\Omega$ $\pm$ 5%, 1/4 W	3220200
R912	Resistor, Carbon Film, 3.3 K $\Omega$ $\pm$ 5%, 1/4 W	3220200
R913	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R914	Resistor, Carbon Film, 3.9 K $\Omega$ $\pm$ 5%, 1/4 W	3220205
R915	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R916	Resistor, Carbon Film, 3.3 K $\Omega$ $\pm$ 5%, 1/4 W	3220200
R917	Resistor, Carbon Film, 3.3 K $\Omega$ $\pm$ 5%, 1/4 W	3220200
R918	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R919	Resistor, Carbon Film, 3.9 K $\Omega$ $\pm$ 5%, 1/4 W	3220205
R920	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R921	Resistor, Carbon Film, 3.3 K $\Omega$ $\pm$ 5%, 1/4 W	3220200
R922	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
RFC901	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC902	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC903	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC904	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC905	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC906	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC907	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC908	Choke Assy., 270 $\mu$ H, MUD271	3520590
Y901	Crystal Filter, 2.3 kHz	3140280

## NOTES:

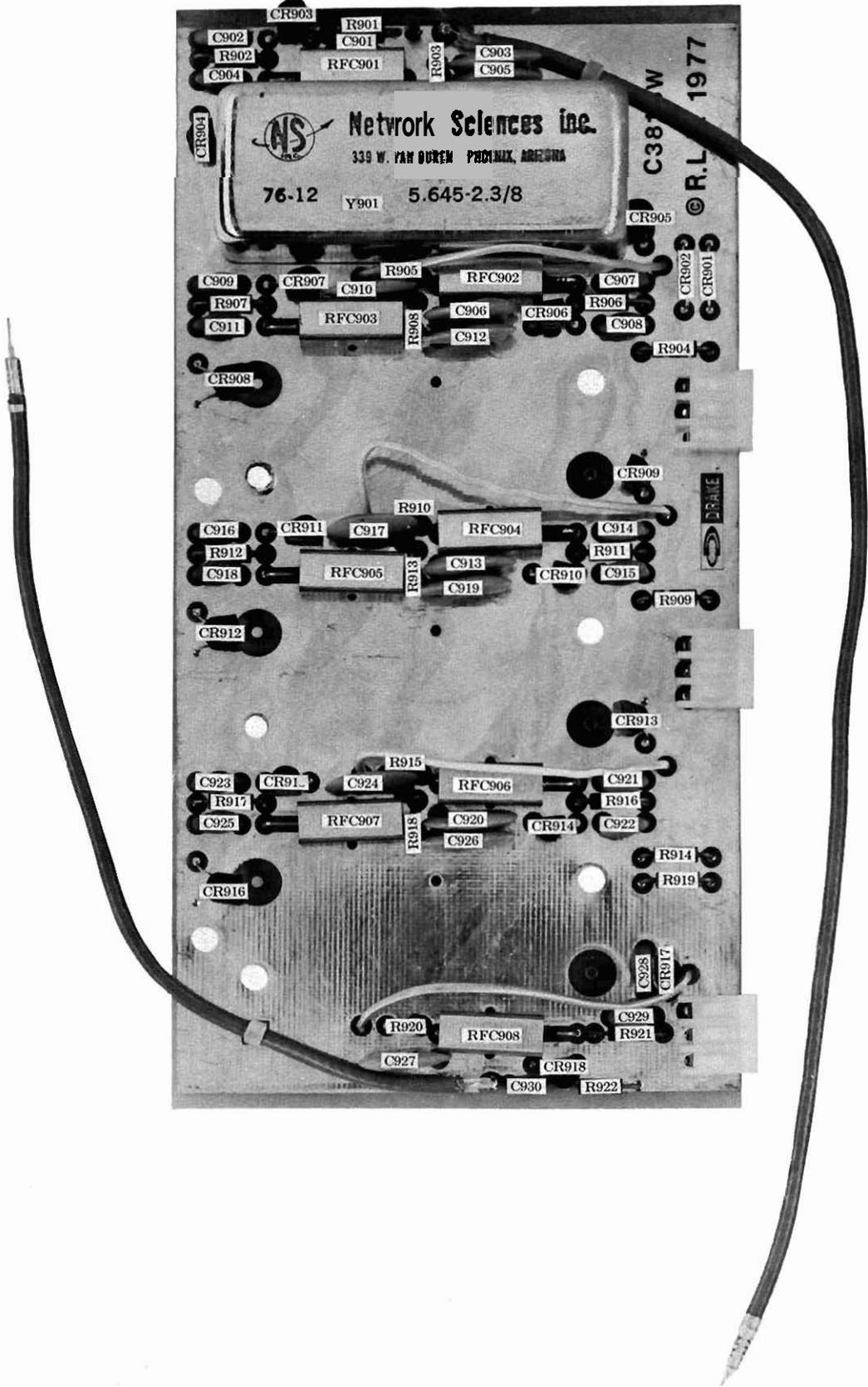
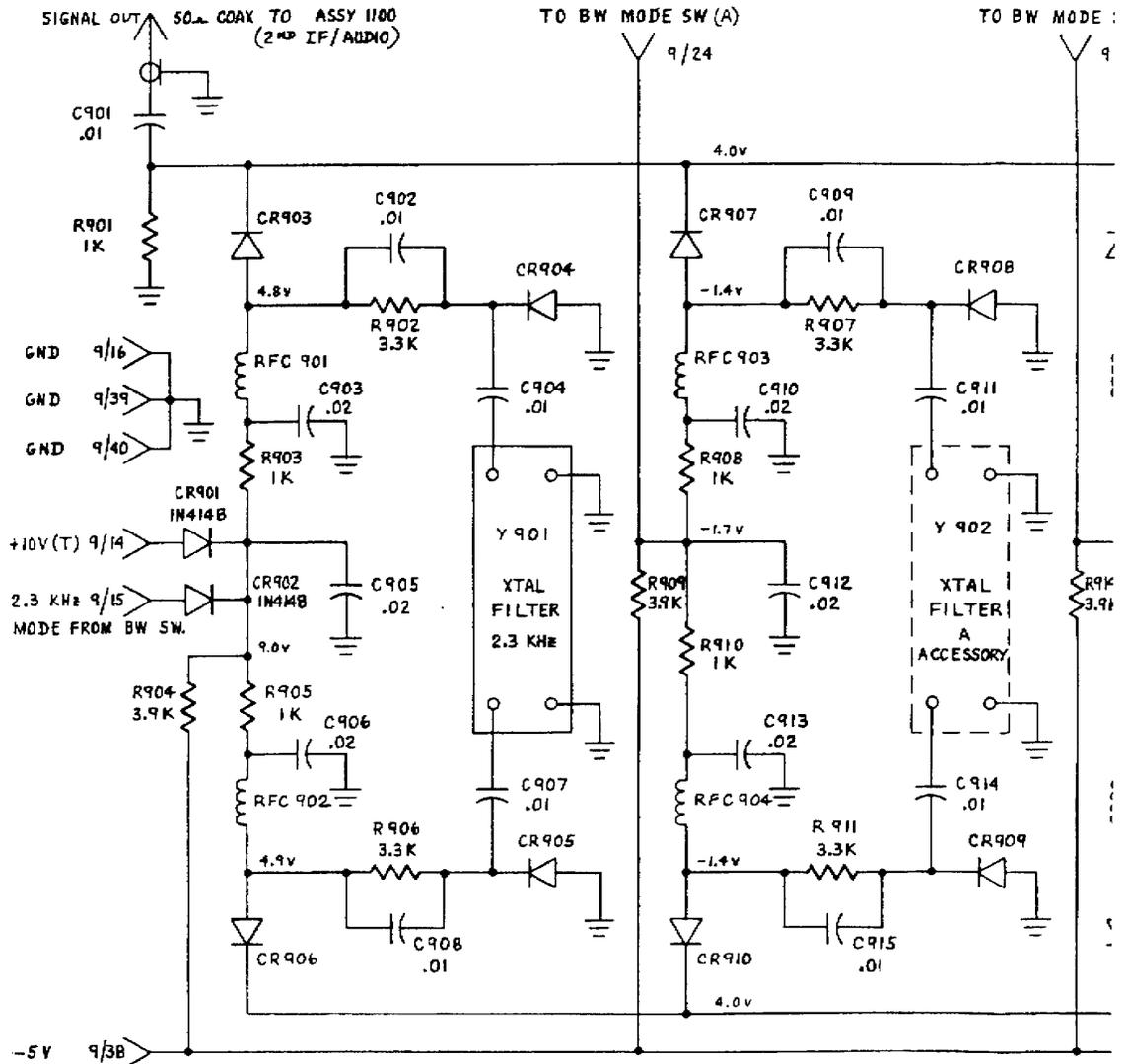


Fig. 2-19 IF Selectivity Board Pictorial

C	901	903 906	905	902 908	904 907	910 913	912	909 915	911 914	914
R	901	904	903 905	902 906		909	908 910	907 911		914
RFC			901 902				903 904			



NOTE  
 DIODES CR903 THRU CR910 ARE TYPE MPN 3404.  
 ALL VOLTAGES MEASURED IN 2.3 KHZ POSITION.

	917	919	916	918		924	923	925
	920	919	922	921		927	926	929 930
914	913		912		919	918	917	921
	915		916			920 922		
	905					907		
	906					908		

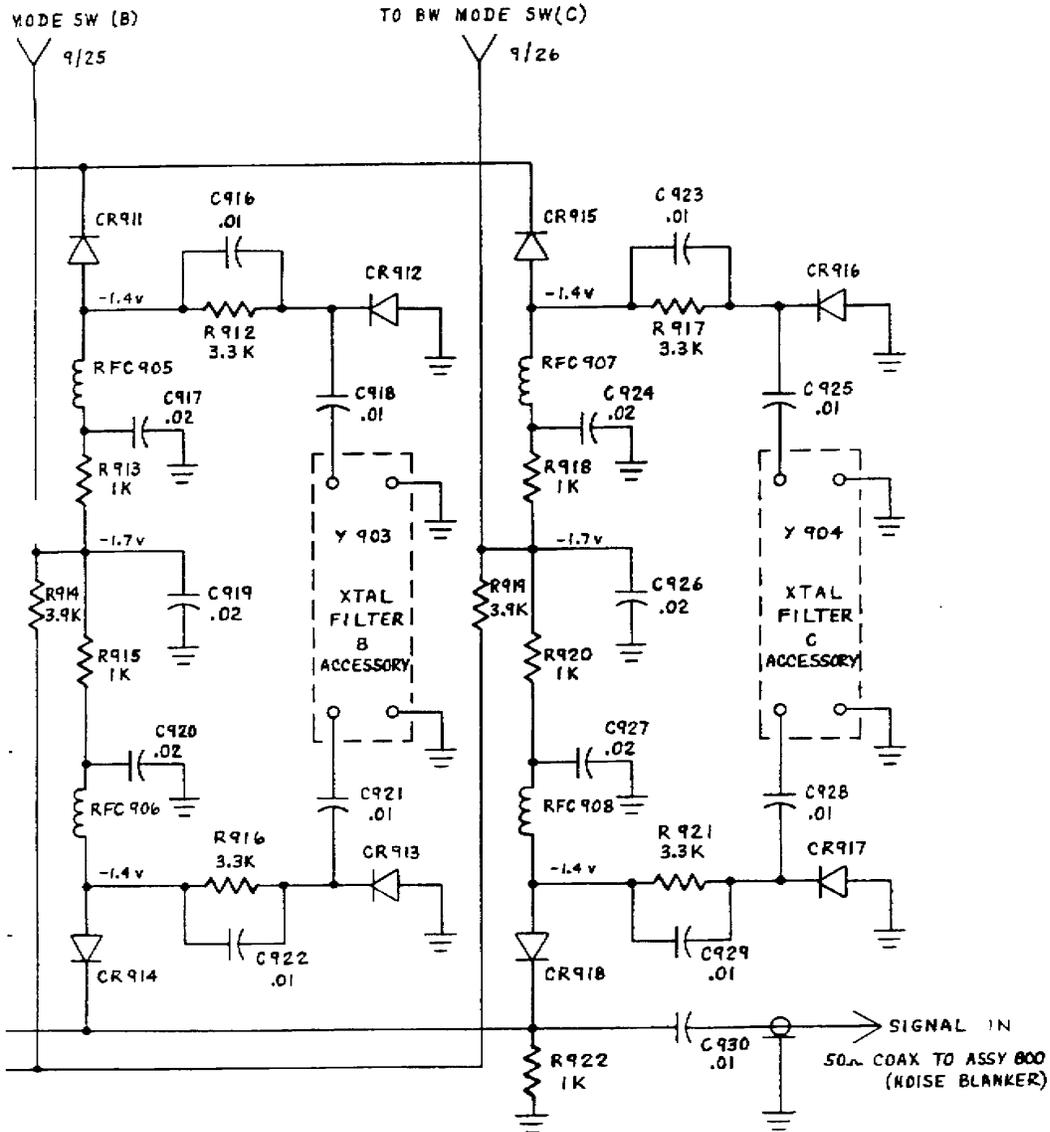


Fig. 2-20 IF Selectivity Board Schematic

## 2-10. PASSBAND TUNING/REFERENCE BOARD

The Passband Tuning/Reference Board contains a 40 MHz crystal oscillator (master reference), dividers to obtain a 500 kHz reference and 25 kHz calibrator signals and a 13.695 MHz (nominal) VCXO. In addition, the board includes mixers to generate the 53.695 MHz 2nd L.O. and 5.645 MHz BFO signals, and circuitry to accomplish mode switching and electronic passband tuning. Refer to figure 2-22 for schematic and figure 2-21 for parts location information.

Q1001 is a high stability 40 MHz crystal oscillator. The oscillator is set to exactly 40 MHz with L1001, and is designed to maintain this adjustment over long periods of time. The output of the oscillator is buffered by Q1002 to reduce the effects of varying load impedance on frequency. The output of the buffer is tuned by L1006, and coupled through C1016 to all associated circuitry.

500 kHz for the synthesizer phase detector (Section 2-6) is derived from the 40 MHz reference by coupling the reference signal to driver transistor Q1006 through C1017. The output of Q1006 drives the +2 section of U1002, which drives the +5 section of U1003A, which drives the +8 section of U1002. The net result is a +80 function at pin 12 of U1002, which results in a 500 kHz signal. This signal is connected to board pin 10 for use in the synthesizer, and is also routed to the +5 input of U1003B.

When the calibrator is activated by applying 10 volts to pin 5, Q1009 grounds the clear input, pin 14, of U1003B. This allows the +5 section of U1003B to drive the +2 section of U1003A, which drives the +2 section of U1003B. The result is a +20 function with a 500 kHz input which generates a 25 kHz signal rich in harmonics. The harmonics of this signal are injected into the antenna input of the receiver when the calibrator is enabled, and produce a calibration marker every 25 kHz.

The 40 MHz reference signal is also coupled to a power splitter, T1001. One output of this splitter is connected to pin 21 for use by the Translator Board (Section 2-6). A sample of this signal is coupled through R1062 for use by accessories. The other output of power splitter T1001 drives buffer stage Q1007, which boosts the signal to a level sufficient to drive one input of a double balanced mixer, consisting of T1002, T1003, and CR1002 through CR1005.

The second input to the mixer is the output of the 13.695-MHz (nominal) VCXO. This oscillator consists of Q1003 and buffer stage Q1005. The frequency is controlled by Y1002, a 13.695 MHz crystal which is pulled approximately  $\pm 3$  kHz by a varactor, CR1001, and L1005. The varactor is controlled by a voltage derived either from the front panel passband tuning control or from the passband controls located on the Power Supply/Regulator Board. The source in use is selected by the front panel PBT switch and/or by the MODE switch, and transmit/receive steering is accomplished by U1001, a quad switch. Actual operating frequencies of the oscillator in transmit or fixed passband receive are:

MODE	FREQUENCY
USB	13.6936 MHz
LSB	13.6964 MHz
CW	13.6942 MHz
RTTY	13.6975 MHz
AM	13.695 MHz (receive) 13.6936 MHz (transmit)

When the front panel PBT switch is on, the PBT control will tune the VCXO from approximately 13.692 to 13.698 MHz.

The output of the double balanced mixer is the sum of the reference and VCXO signals, or 53.695 MHz (nominal). The exact frequency, of course depends on the mode of operation selected. This signal is filtered by L1013 and C1042, and amplified by Q1010. The output of Q1010 is tuned by L1014 and C1050, and coupled through C1055 to pin 17 for connection to the 2nd Mixer Board (section 2-7).

The 5.645 MHz (nominal) BFO signal is also generated from the 13.695 MHz (nominal) VCXO. A portion of the VCXO signal is coupled through C1021, filtered by L1009 and C1024 and coupled through C1026 to one gate of Q1008, an autodyne converter. The other gate of Q1008 forms part of an 8.050 MHz crystal oscillator. C1030 is used to trim the crystal frequency, and C1029 is selected in test to center the trimmer range. The difference between the VCXO and 8.050 MHz is 5.645 MHz (nominal), which appears at the drain of Q1008. This BFO signal is filtered by C1034, C1043, C1038, L1011 and L1012, and coupled through C1037 to diode switching networks. These networks are used to switch the BFO signal to the product detector, balanced modulator and AM reinsertion circuit in the appropriate modes.

In the AM mode, +10R is applied to the base of Q1004 through R1009. This turns Q1004 on in AM receive, which removes the B+ supply to Q1008, thus shutting off the BFO signal. In AM transmit, Q1004 is turned off, allowing the BFO signal to be generated for AM reinsertion.

Troubleshooting the Passband Tuning Reference Board is straight-forward. The 40 MHz oscillator should be checked first, since it affects all outputs. The 13.695 MHz VCXO should be checked next, and then the autodyne converter. In any case, an

analysis of which outputs are missing will isolate any problems to an individual oscillator.

Alignment of the board should be exactly in the sequence given in Section 3, which is:

1. 40 MHz oscillator
2. VCXO
3. 8.050 MHz oscillator

Failure to observe this sequence will almost certainly result in improper TR-7 operation due to frequency error and/or incorrect passband centering.

## NOTES:

## TR-7 PASS BAND TUNING/REFERENCE OSCILLATOR BOARD

REF DES	DESCRIPTION	PART NO.
C1001	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1002	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1003	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1004	Capacitor, Mica, 100 pF $\pm$ 5%, DM-15	3170110
C1005	Capacitor, Disc, .001 $\mu$ F + 80%, M25V	3161380
C1006	Capacitor, Mica, 50 pF $\pm$ 5%, DM-20	3170040
C1007	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1008	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1009	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1010	Capacitor, Mica, 100 pF $\pm$ 5%, DM-15	3170110
C1011	Capacitor, Disc, 330 pF $\pm$ 10%, Y5E	3161300
C1012	Capacitor, Disc, 33.0 pF $\pm$ 5%, N1500	3160715
C1013	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1014	Capacitor, Disc, .005 $\mu$ F $\pm$ 20%, Z5U	3161470
C1015	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1016	Capacitor, Disc, 15.0 pF $\pm$ 5%, NPO	3160510
C1017	Capacitor, Disc, 220 pF $\pm$ 20%, Z5U	3161270
C1018	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1019	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1020	Capacitor, Disc, .005 $\mu$ F $\pm$ 20%, Z5U	3161470
C1021	Capacitor, Disc, 6.2 pF $\pm$ .25 pF, N750	3160200
C1022	Capacitor, Disc, .01 $\mu$ F + 80% M25V	3161500
C1023	Capacitor, Disc, 330 pF $\pm$ 10%, Y5E	3161300
C1024	Capacitor, Disc, 51.0 pF $\pm$ 5%, N750	3160860
C1025	Capacitor, Tantalum, 10 $\mu$ F $\pm$ 20%, 25 V	3183030
C1026	Capacitor, Mica, 150 pF $\pm$ 5%, DM-15	3170150
C1027	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1028	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1029	SELECTED IN TEST	
C1030	Capacitor, Variable Trimmer, 5.0-20 pF	3205375
C1031	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1032	Capacitor, Disc, 82.0 pF $\pm$ 5%, N750	3161040
C1033	Capacitor, Disc, 330 pF $\pm$ 10%, Y5E	3161300
C1034	Capacitor, Mica, 220 pF $\pm$ 5%, DM-15	3170240
C1035	Capacitor, Tantalum, 10 $\mu$ F $\pm$ 20%, 25 V	3183030
C1036	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1037	Capacitor, Disc, 57.0 pF $\pm$ 5%, NPO	3160900
C1038	Capacitor, Mica, 220 pF $\pm$ 5%, DM-15	3170240
C1039	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1040	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1041	Capacitor, Disc, 12.0 pF $\pm$ 5%, NPO	3160430
C1042	Capacitor, Mica, 68.0 pF $\pm$ 5%, DM-15	3170060
C1043	Capacitor, Disc, 10 pF $\pm$ .25 pF, N750	3160110
C1044	Capacitor, Disc, 12.0 pF $\pm$ 5%, NPO	3160430
C1045	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1046	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1047	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1048	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
	DELETED	
C1050	Capacitor, Mica, 68.0 pF $\pm$ 5%, DM-15	3170060
C1051	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380

REF DES	DESCRIPTION	PART NO.
C1052	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1053	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1054	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1055	Capacitor, Disc, 39.0 pF $\pm$ 5%, NPO	3160750
C1056	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1057	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1058	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1059	Capacitor, Disc, 12 pF $\pm$ 5%, N750	3160410
C1060	Capacitor, Disc, 100 pF $\pm$ 10%, 500 V	3161070
CR1001	Diode, MV209	3020278
CR1002	Diode, 1N4148	3020090
CR1003	Diode, 1N4148	3020090
CR1004	Diode, 1N4148	3020090
CR1005	Diode, 1N4148	3020090
CR1006	Diode, 1N4148	3020090
CR1007	Diode, 1N4148	3020090
CR1008	Diode, 1N4148	3020090
CR1009	Diode, 1N4148	3020090
CR1010	Diode, 1N4148	3020090
CR1011	Diode, 1N4148	3020090
CR1012	Diode, 1N4148	3020090
CR1013	Diode, 1N4148	3020090
CR1014	Diode, 1N4148	3020090
L1001	Inductor, Variable	2513001
L1002	Inductor, 1.15 $\mu$ H	2512511
L1003	NOT USED	
L1004	Inductor, Toroid	2510001
L1005	Inductor, Variable	2513007
L1006	Inductor, Variable	2513001
L1007	NOT USED	
L1008	NOT USED	
L1009	Inductor, Toroid	2510003
L1010	NOT USED	
L1011	Inductor, Variable	2513004
L1012	Inductor, Variable	2513004
L1013	Inductor, Variable	2513002
L1014	Inductor, Variable	2513012
L1015	Ferrite Bead	3523207
Q1001	Transistor, 2N3563	3030060
Q1002	Transistor, 2N3563	3030060
Q1003	Transistor, 2N3563	3030060
Q1004	Transistor, 2N3904	3030105
Q1005	Transistor, 2N3563	3030060
Q1006	Transistor, 2N3563	3030060
Q1007	Transistor, 2N3563	3030060
Q1008	Transistor, 3N204	3030230
Q1009	Transistor, 2N3904	3030105
Q1010	Transistor, 2N3563	3030060
R1001	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R1002	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R1003	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R1004	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R1005	Resistor, Carbon Film, 10 $\Omega$ $\pm$ 5%, 1/4 W	3220005
R1006	Resistor, Carbon Film, 3.3 K $\Omega$ $\pm$ 5%, 1/4 W	3220200
R1007	Resistor, Carbon Film, 22 K $\Omega$ $\pm$ 5%, 1/4 W	3220260

REF DES	DESCRIPTION	PART NO.
R1008	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R1009	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R1010	Resistor, Carbon Film, 18 K $\Omega$ $\pm$ 5%, 1/4 W	3220255
R1011	Resistor, Carbon Film, 8.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220230
R1012	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R1013	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R1014	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R1015	Resistor, Carbon Film, 470 $\Omega$ $\pm$ 5%, 1/4 W	3220110
R1016	Resistor, Carbon Film, 68 $\Omega$ $\pm$ 5%, 1/4 W	3220045
R1017	Resistor, Carbon Film, 10 $\Omega$ $\pm$ 5%, 1/4 W	3220005
R1018	Resistor, Carbon Film, 5.6 K $\Omega$ $\pm$ 5%, 1/4 W	3220215
R1019	Resistor, Carbon Film, 470 $\Omega$ $\pm$ 5%, 1/4 W	3220110
R1020	Resistor, Carbon Film, 47 K $\Omega$ $\pm$ 5%, 1/4 W	3220285
R1021	NOT USED	
R1022	Resistor, Carbon Film, 22 $\Omega$ $\pm$ 5%, 1/4 W	3220015
R1023	NOT USED	
R1024	Resistor, Carbon Film, 270 $\Omega$ $\pm$ 5%, 1/4 W	3220085
R1025	Resistor, Carbon Film, 470 $\Omega$ $\pm$ 5%, 1/4 W	3220110
R1026	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R1027	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R1028	Resistor, Carbon Film, 510 $\Omega$ $\pm$ 5%, 1/4 W	3220115
R1029	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R1030	Resistor, Carbon Film, 5.6 K $\Omega$ $\pm$ 5%, 1/4 W	3220215
R1031	Resistor, Carbon Film, 560 $\Omega$ $\pm$ 5%, 1/4 W	3220125
R1032	Resistor, Carbon Film, 8.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220230
R1033	Resistor, Carbon Film, 82 $\Omega$ $\pm$ 5%, 1/4 W	3220050
R1034	Resistor, Carbon Film, 150 K $\Omega$ $\pm$ 5%, 1/4 W	3220320
R1035	Resistor, Carbon Film, 470 K $\Omega$ $\pm$ 5%, 1/4 W	3220345
R1036	Resistor, Carbon Film, 39 $\Omega$ $\pm$ 5%, 1/4 W	3220030
R1037	Resistor, Carbon Film, 10 $\Omega$ $\pm$ 5%, 1/4 W	3220005
R1038	Resistor, Carbon Film, 10 $\Omega$ $\pm$ 5%, 1/4 W	3220005
R1039	Resistor, Carbon Film, 1.0 M $\Omega$ $\pm$ 5%, 1/4 W	3220355
R1040	Resistor, Carbon Film, 470 $\Omega$ $\pm$ 5%, 1/4 W	3220110
R1041	Resistor, Carbon Film, 68 $\Omega$ $\pm$ 5%, 1/4 W	3220045
R1042	Resistor, Carbon Film, 10 $\Omega$ $\pm$ 5%, 1/4 W	3220005
R1043	Resistor, Carbon Film, 220 $\Omega$ $\pm$ 5%, 1/4 W	3220075
R1044	Resistor, Carbon Film, 15 $\Omega$ $\pm$ 5%, 1/4 W	3220010
R1045	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R1046	Resistor, Carbon Film, 8.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220230
R1047	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R1048	Resistor, Carbon Film, 3.3 $\Omega$ $\pm$ 5%, 1/4 W DELETED	3220002
R1050	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R1051	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R1052	Resistor, Carbon Film, 10 $\Omega$ $\pm$ 5%, 1/4 W	3220005
R1053	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R1054	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R1055	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R1056	Resistor, Carbon Film, 68 $\Omega$ $\pm$ 5%, 1/4 W	3220045
R1057	Resistor, Carbon Film, 330 $\Omega$ $\pm$ 5%, 1/4 W	3220090
R1058	Resistor, Carbon Film, 220 $\Omega$ $\pm$ 5%, 1/4 W	3220075
R1059	Resistor, Carbon Film, 15 $\Omega$ $\pm$ 5%, 1/4 W	3220010
R1060	Resistor, Carbon Film, 68 $\Omega$ $\pm$ 5%, 1/4 W	3220045

REF DES	DESCRIPTION	PART NO.
R1061	Resistor, Carbon Film, 330 $\Omega \pm 5\%$ , 1/4 W	3220090
R1062	Resistor, Carbon Film, 470 $\Omega \pm 5\%$ , 1/4 W	3220110
R1063	Resistor, Carbon Film, 10 K $\Omega \pm 5\%$ , 1/4 W	3220235
R1064	Resistor, Carbon Film, 330 $\Omega \pm 5\%$ , 1/4 W	3220090
RFC1001	Choke Assy., 5.6 $\mu$ H, L56G	3520510
RFC1002	Choke Assy., 5.6 $\mu$ H, L56G	3520510
RFC1003	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC1004	Choke Assy., 5.6 $\mu$ H, L56G	3520510
RFC1005	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC1006	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC1007	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC1008	Choke Assy., 270 $\mu$ H, MUD271	3520590
T1001	Transformer, Toroid	2510001
T1002	Transformer, Toroid	2510002
T1003	Transformer, Toroid	2510002
U1001	I.C., MC14016BCP	3041025
U1002	I.C., SN74LS197	3040473
U1003	I.C., SN74LS390	3040478
Y1001	Crystal, 40.0000 MHz	3120283
Y1002	Crystal, 13.6950 MHz	3120282
Y1003	Crystal, 8.0500 MHz	3120281

## NOTES:

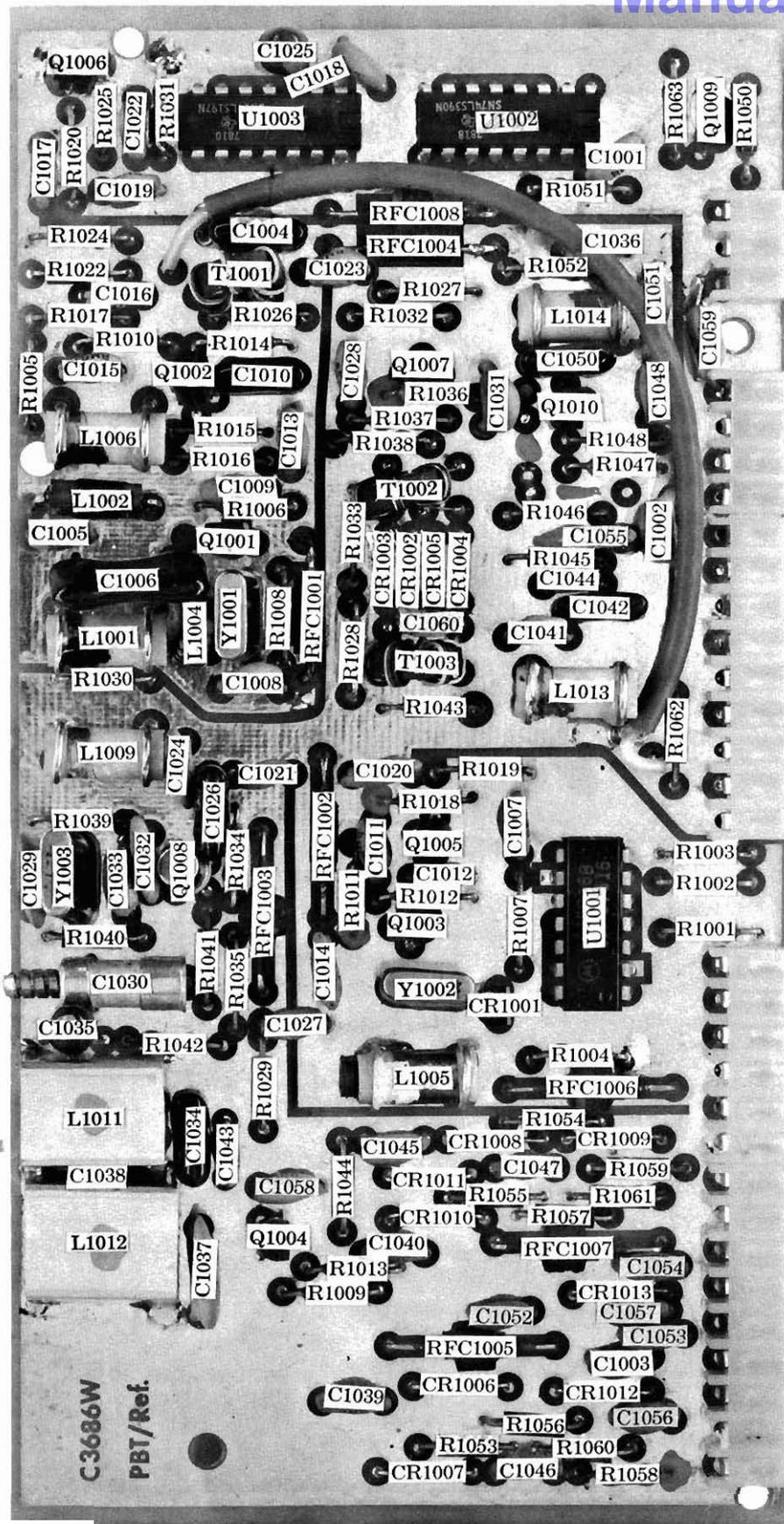
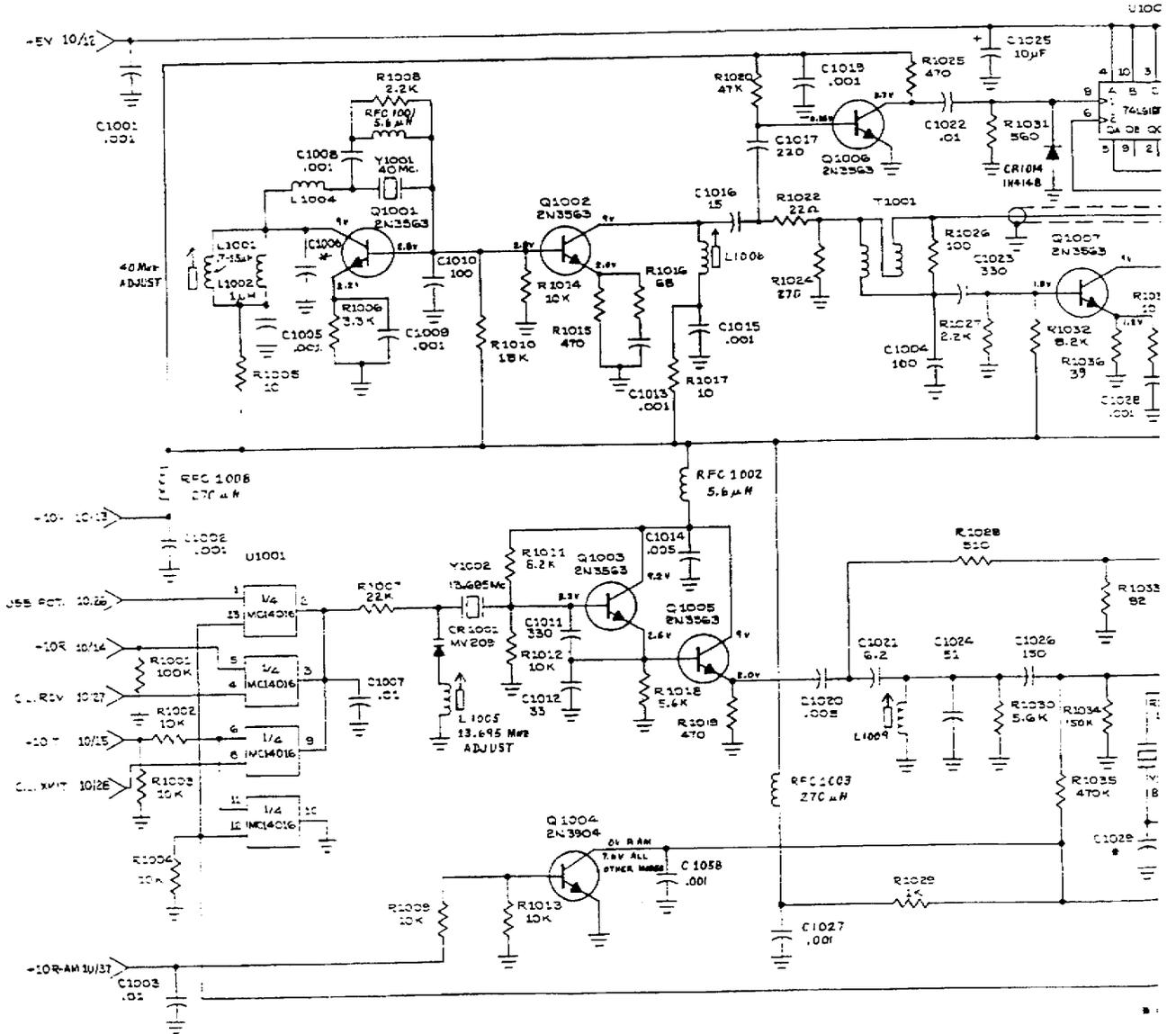


Fig. 2-21 PBT/Reference Board Pictorial

R	1001 1002 1003 1004	1005	1006 1008 1007	1009	1010 1011 1014 1012 1013	1015	1016 1017 1018	1019	1020 1022 1024	1025 1029 1026	1031 1032 1027 1035 1030	1036 1037 1033 1034
C	1001 1002 1003	1005 1006 1007	1008 1009 1010		1011 1012	1013 1015 1014	1016 1017 1019 1020 1027		1021	1024 1025 1023 1024	1026	1028 1019
L		1001 1002 1004		1005			1006			1009		





## 2-11. 2ND IF/AUDIO BOARD

The 2nd IF/Audio Board provides AGC controlled 5.645 MHz gain, signal demodulation, audio amplification and S-meter functions. It also includes a crystal controlled CW oscillator and a transmit IF summing amplifier. Two versions of the board have been used in the TR7. Refer to figures 2-23 and 2-25 to identify your board and for parts location information. The schematic for version 1 is shown in figure 2-24 and figure 2-26 is the schematic for version 2.

In receive, 5.645 MHz 2nd IF signals from the IF Selectivity Board are connected to the input coax connector. This signal is matched to the input of the first stage of amplification, Q1101, by a transformer, T1101. The output of Q1101 is tuned by L1101 and coupled to the input of the second stage of gain, Q1106, through C1118. The output of Q1106 is tuned by L1102 and coupled to the input of the third stage of gain, Q1107, through C1127. The output of Q1107 is tuned by T1102, and coupled through this transformer to both the product and AM detectors.

### *Version 1 Product Detector*

In SSB, CW and RTTY modes, BFO injection is supplied from the PBT/Reference Board (Section 2-10) to the BFO amplifier, Q1112. The output of this amplifier is tuned by L1103, and coupled to the product detector via T1103. Audio is coupled out of the product detector through C1140 to pin 31, where it is routed to the top of the front panel AUDIO GAIN control.

### *Version 2 Product Detector*

In SSB, CW and RTTY modes, BFO injection is supplied from the PBT/Reference Board (Section 2-10) to the product detector, U1102. Audio is coupled out of the product detector through C1170 to pin 31, where it is routed to the top of the front panel AUDIO GAIN control.

In the AM mode, the BFO is disabled, and 10 volts is supplied to the AM detector. +10T is also supplied to reduce T/R switching transients. The output of the AM detector is amplified by Q1101 and coupled by C1146 to the top of the front panel AUDIO GAIN control.

The wiper of the AUDIO GAIN control is connected to pin 29, and routed to the input of audio preamplifier Q1113. This stage receives B+ from either +10R (pin 14), or +10CW (pin 38). As a result, Q1113 is

active only in receive, except in the CW mode. In CW it is on at all times to provide CW sidetone audio. The output of Q1113 is coupled to U1101, the audio output amplifier integrated circuit. The output of this device is coupled through C1159 to pin 27 to drive the loudspeaker or headphones. A sampling of the audio output is coupled through R1181 to pin 8 for use by the anti-VOX circuitry (Section 2-3).

AGC is developed prior to detection by sampling the output of Q1107 through C1141. This signal is applied to the base of Q1108 which is biased to a point just below conduction. As the output of Q1107 increases (with increasing signal input to the receiver), Q1108 starts to conduct, applying AGC voltage to the gates of Q1101 and Q1106. Stronger input signals cause Q1108 to conduct harder, thus developing a higher AGC voltage. This action holds the output of Q1107 essentially constant, which controls the drive to the detectors, holding the audio output of the receiver to a constant level.

AGC release time constants are controlled by selecting capacitors C1102-C1104 and C1156-C1158 via the front panel F/S pushbutton and mode switch. These capacitors are all charged through small series resistors to provide fast attack, and discharge through R1144, with the larger capacitors selected for longer release times. A sample of the AGC voltage is coupled through R1126 to a D.C. amplifier consisting of Q1105 and Q1102. This amplifier provides an output to control the gain of the 1st IF amplifier (see Section 2-7). In addition, the amplifier is used to drive the front panel S-meter in receive. R1105 is used to set full-scale sensitivity, and R1128 is used to establish the S-meter no signal reading. A small pedestal voltage is set by R1129 to allow the receiver to run a maximum gain under no signal conditions. Adjustment of these controls is described in the alignment procedure (Section 3). It is important to follow the exact sequence of adjustment to avoid improper AGC operation.

In the transmit mode, 5.645 MHz signals are summed at the base of Q1104. In CW, the transmit signal is derived from a crystal oscillator, Q1110, and buffer Q1109. These stages are keyed by Q1103. A portion of this signal is coupled through C1124, R1152, and CR1111 to Q1107 for sidetone generation. In the SSB and RTTY modes, the transmit signal is coupled from the IF Selectivity board (Section 2-9) through T1101 and C1108 to the base of Q1104. In AM, the USB signal from this path is summed with the 5.645 MHz carrier to create an AM transmit signal.

The output of Q1104 is coupled to a PIN diode attenuator, CR1102. ALC voltage, developed by the ALC Board (Section 2-15), is used to vary the bias current in this diode, thus regulating the level of

transmitter drive in all modes.

Alignment of the 2nd IF Audio Board is covered in Section 3.

**NOTES:**

## TR-7 2ND IF/AUDIO BOARD, VERSION 1

REF DES	DESCRIPTION	PART NO.
C1101	Capacitor, Disc. .05 $\mu$ F $\pm$ 20%, Z5U	3161630
C1102	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1103	Capacitor, Disc. .05 $\mu$ F $\pm$ 80%, Z5U	3161630
C1104	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C1105	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1106	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1107	Capacitor, Mica, 330 pF $\pm$ 5%, DM-15	3170320
C1108	Capacitor, Disc, 25.0 pF $\pm$ 5%, NPO	3160620
C1109	Capacitor, Disc. .05 $\mu$ F $\pm$ 20%, Z5U	3161630
C1110	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1111	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1112	Capacitor, Disc. .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1113	Capacitor, Mica, 390 pF $\pm$ 5%, DM-15	3170370
C1114	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1115	Capacitor, Disc. .005 $\mu$ F $\pm$ 20%, Z5U	3161470
C1116	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1117	Capacitor, Disc. .05 $\mu$ F $\pm$ 20%, Z5U	3161630
C1118	Capacitor, Disc, 470 pF $\pm$ 20%, Z5U	3161350
C1119	Capacitor, Disc. .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1120	Capacitor, Disc. .05 $\mu$ F $\pm$ 20%, Z5U	3161630
C1121	Capacitor, Mica, 390 pF $\pm$ 5%, DM-15	3170370
C1122	Capacitor, Disc. .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1123	Capacitor, Disc, 25.0 pF $\pm$ 5%, NPO	3160620
C1124	Capacitor, Disc. .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1125	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1126	Capacitor, Disc. .05 $\mu$ F $\pm$ 20%, Z5U	3161630
C1127	Capacitor, Disc, 470 pF $\pm$ 20%, Z5U	3161350
C1128	Capacitor, Disc. .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1129	Capacitor, Disc. .05 $\mu$ F $\pm$ 20%, Z5U	3161630
C1130	Capacitor, Disc. .05 $\mu$ F $\pm$ 20%, Z5U	3161630
C1131	Capacitor, Disc. 10.0 pF $\pm$ 5%, NPO	3160360
C1132	Capacitor, Mica, 390 pF $\pm$ 5%, DM-15	3170370
C1133	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1134	Capacitor, Mica, 68 pF $\pm$ 5%, DM-15	3170660
C1135	Capacitor, Mica, 390 pF $\pm$ 5%, DM-15	3170370
C1136	Capacitor, Variable Trimmer, 4-40 pF	3205150
C1137	Capacitor, Disc, 25.0 pF $\pm$ 5%, NPO	3160620
C1138	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1139	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1140	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C1141	Capacitor, Mica, 180 pF $\pm$ 5%, DM-15	3170180
C1142	Capacitor, Disc. .005 $\mu$ F $\pm$ 20%, Z5U	3161470
C1143	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C1144	Capacitor, Mica, 180 pF $\pm$ 5%, DM-15	3170180
C1145	Capacitor, Mica, 80 pF $\pm$ 5%, DM-15	3170080
C1146	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C1147	Capacitor, Electrolytic, 22 $\mu$ F $\pm$ 20%, 16 V	3180105
C1148	Capacitor, Tantalum, 10 $\mu$ F $\pm$ 20%, 25 V	3183030
C1149	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1150	Capacitor, Disc. .05 $\mu$ F $\pm$ 80%, M16V	3161600
C1151	Capacitor, Electrolytic, 22 $\mu$ F $\pm$ 20%, 16 V	3180105

## TR-7 2ND IF/AUDIO BOARD, VERSION 1

REF DES	DESCRIPTION	PART NO.
C1101	Capacitor, Disc. .05 $\mu$ F $\pm$ 20%, Z5U	3161630
C1102	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1103	Capacitor, Disc. .05 $\mu$ F $\pm$ 80%, Z5U	3161630
C1104	Capacitor, Tantalum. .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C1105	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1106	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1107	Capacitor, Mica. 330 pF $\pm$ 5%, DM-15	3170320
C1108	Capacitor, Disc. 25.0 pF $\pm$ 5%, NPO	3160620
C1109	Capacitor, Disc. .05 $\mu$ F $\pm$ 20%, Z5U	3161630
C1110	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1111	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1112	Capacitor, Disc. .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1113	Capacitor, Mica. 390 pF $\pm$ 5%, DM-15	3170370
C1114	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1115	Capacitor, Disc. .005 $\mu$ F $\pm$ 20%, Z5U	3161470
C1116	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1117	Capacitor, Disc. .05 $\mu$ F $\pm$ 20%, Z5U	3161630
C1118	Capacitor, Disc. 470 pF $\pm$ 20%, Z5U	3161350
C1119	Capacitor, Disc. .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1120	Capacitor, Disc. .05 $\mu$ F $\pm$ 20%, Z5U	3161630
C1121	Capacitor, Mica. 390 pF $\pm$ 5%, DM-15	3170370
C1122	Capacitor, Disc. .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1123	Capacitor, Disc. 25.0 pF $\pm$ 5%, NPO	3160620
C1124	Capacitor, Disc. .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1125	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1126	Capacitor, Disc. .05 $\mu$ F $\pm$ 20%, Z5U	3161630
C1127	Capacitor, Disc. 470 pF $\pm$ 20%, Z5U	3161350
C1128	Capacitor, Disc. .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1129	Capacitor, Disc. .05 $\mu$ F $\pm$ 20%, Z5U	3161630
C1130	Capacitor, Disc. .05 $\mu$ F $\pm$ 20%, Z5U	3161630
C1131	Capacitor, Disc. 10.0 pF $\pm$ 5%, NPO	3160360
C1132	Capacitor, Mica. 390 pF $\pm$ 5%, DM-15	3170370
C1133	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1134	Capacitor, Mica. 68 pF $\pm$ 5%, DM-15	3170660
C1135	Capacitor, Mica. 390 pF $\pm$ 5%, DM-15	3170370
C1136	Capacitor, Variable Trimmer, 4-40 pF	3205150
C1137	Capacitor, Disc. 25.0 pF $\pm$ 5%, NPO	3160620
C1138	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1139	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1140	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C1141	Capacitor, Mica. 180 pF $\pm$ 5%, DM-15	3170180
C1142	Capacitor, Disc. .005 $\mu$ F $\pm$ 20%, Z5U	3161470
C1143	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C1144	Capacitor, Mica. 180 pF $\pm$ 5%, DM-15	3170180
C1145	Capacitor, Mica. 80 pF $\pm$ 5%, DM-15	3170080
C1146	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C1147	Capacitor, Electrolytic, 22 $\mu$ F $\pm$ 20%, 16 V	3180105
C1148	Capacitor, Tantalum, 10 $\mu$ F $\pm$ 20%, 25 V	3183030
C1149	Capacitor, Disc. .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1150	Capacitor, Disc. .05 $\mu$ F $\pm$ 80%, M16V	3161600
C1151	Capacitor, Electrolytic, 22 $\mu$ F $\pm$ 20%, 16 V	3180105

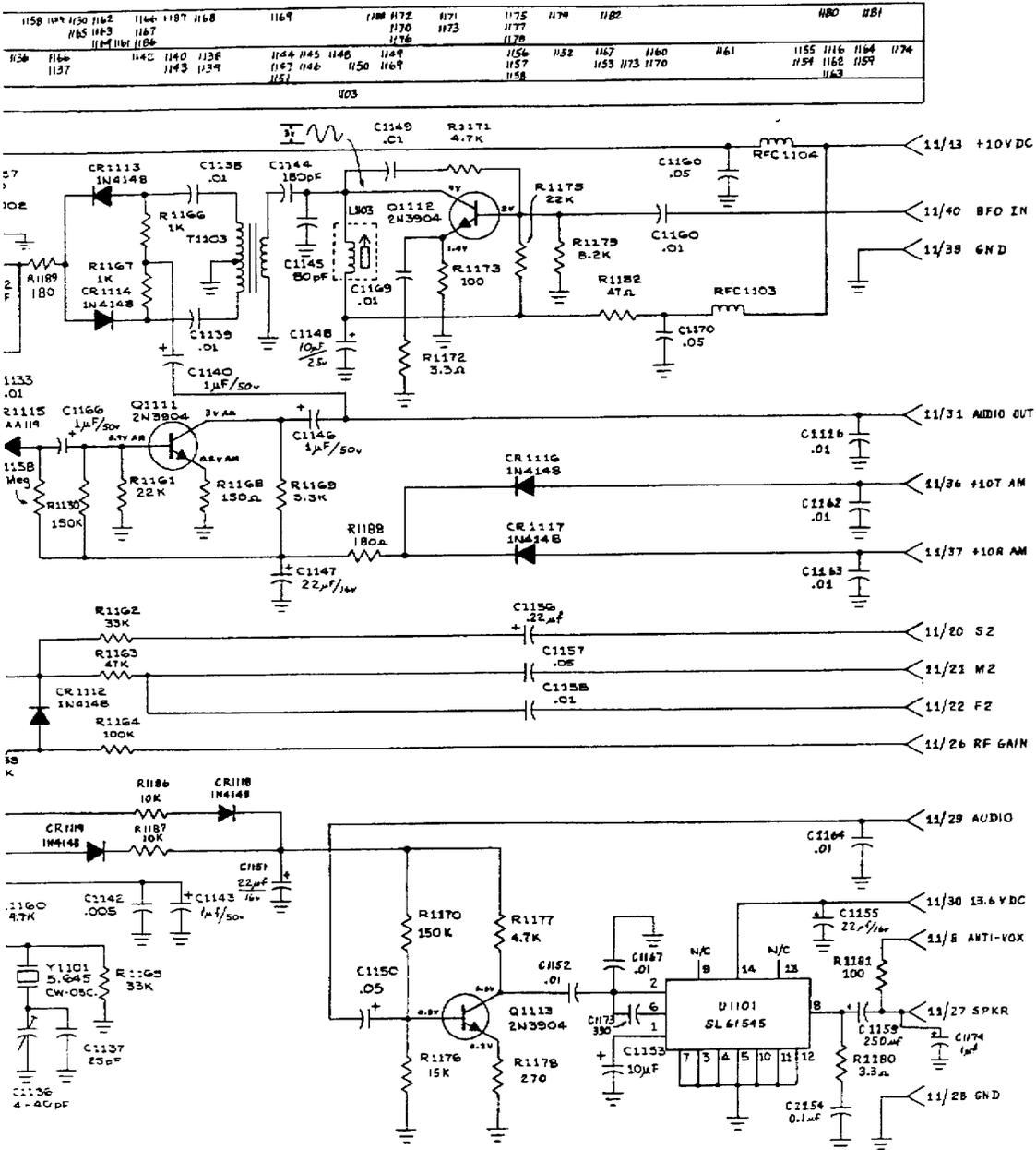
REF DES	DESCRIPTION	PART NO.
C1152	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1153	Capacitor, Tantalum, 10 $\mu$ F $\pm$ 20%, 25 V	3183030
C1154	Capacitor, Disc, .1 $\mu$ F + 80%, Y5T	3161660
C1155	Capacitor, Electrolytic, 22 $\mu$ F $\pm$ 20%, 16 V	3180105
C1156	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C1157	Capacitor, Disc, .05 $\mu$ F + 80%, Z5U	3161630
C1158	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1159	Capacitor, Electrolytic, 250 $\mu$ F, 15 V, Axial	3180220
C1160	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1161	Capacitor, Disc, .05 $\mu$ F $\pm$ 20%, Z5U	3161630
C1162	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1163	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1164	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1165	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1166	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180010
C1167	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1168	Capacitor, Disc, 470 pF $\pm$ 20%, Z5U	3161350
C1169	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1170	Capacitor, Disc, .05 $\mu$ F + 80%, Z5U	3161630
C1171	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1172	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1173	Capacitor, Disc, 330 pF $\pm$ 10%, Y5E	3161300
C1174	Capacitor, Tantalum, 1 $\mu$ F $\pm$ 20%, 35 V	3183010
C1175	Capacitor, Disc, .1 $\mu$ F + 80%	3161660
CR1101	Diode, AA119	3020040
CR1102	Diode, 5082-3379	3020195
CR1103	Diode, 1N4148	3020090
CR1104	Diode, 1N4148	3020090
CR1105	Diode, 1N4148	3020090
CR1106	Diode, 1N4148	3020090
CR1107	Diode, AA119/1N541	3020040
CR1108	Diode, 1N4148	3020090
CR1109	Diode, 1N4148	3020090
CR1110	Diode, 1N4148	3020090
CR1111	Diode, MPN3404	3020265
CR1112	Diode, 1N4148	3020090
CR1113	Diode, 1N4148	3020090
CR1114	Diode, 1N4148	3020090
CR1115	Diode, AA119/1N541	3020040
CR1116	Diode, 1N4148	3020090
CR1117	Diode, 1N4148	3020090
CR1118	Diode, 1N4148	3020090
CR1119	Diode, 1N4148	3020090
CR1120	Diode, 1N4148	3020090
CR1121	Diode, 1N4148	3020090
L1101	Inductor, Variable Can	2511002
L1102	Inductor, Variable Can	2511002
L1103	Inductor, Variable	2513004
R1101	Resistor, Carbon Film, 220 $\Omega$ $\pm$ 5%, 1/4 W	3220075
R1102	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R1103	Resistor, Carbon Film, 47 K $\Omega$ $\pm$ 5%, 1/4 W	3220285
R1104	Resistor, Carbon Film, 33 K $\Omega$ $\pm$ 5%, 1/4 W	3220275
R1105	Resistor, Variable 10 K $\Omega$	3260665
R1106	Resistor, Carbon Film, 22 K $\Omega$ $\pm$ 5%, 1/4 W	3220260

REF DES	DESCRIPTION	PART NO.
R1107	Resistor, Carbon Film, 22 K $\Omega$ $\pm$ 5%, 1/4 W	3220260
R1108	Resistor, Carbon Film, 27 $\Omega$ $\pm$ 5%, 1/4 W	3220020
R1109	Resistor, Carbon Film, 6.8 K $\Omega$ $\pm$ 5%, 1/4 W	3220220
R1110	Resistor, Carbon Film, 330 K $\Omega$ $\pm$ 5%, 1/4 W	3220340
R1111	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R1112	Resistor, Carbon Film, 22 K $\Omega$ $\pm$ 5%, 1/4 W	3220260
R1113	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R1114	Resistor, Carbon Film, 18 K $\Omega$ $\pm$ 5%, 1/4 W	3220255
R1115	Resistor, Carbon Film, 330 $\Omega$ $\pm$ 5%, 1/4 W	3220090
R1116	Resistor, Carbon Film, 68 $\Omega$ $\pm$ 5%, 1/4 W	3220045
R1117	Resistor, Carbon Film, 10 $\Omega$ $\pm$ 5%, 1/4 W	3220005
R1118	Resistor, Carbon Film, 820 $\Omega$ $\pm$ 5%, 1/4 W	3220145
R1119	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R1120	Resistor, Carbon Film, 8.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220230
R1121	Resistor, Carbon Film, 2.2 M $\Omega$ $\pm$ 5%, 1/4 W	3220360
R1122	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R1123	Resistor, Carbon Film, 22 K $\Omega$ $\pm$ 5%, 1/4 W	3220260
R1124	Resistor, Carbon Film, 27 $\Omega$ $\pm$ 5%, 1/4 W	3220020
R1125	Resistor, Carbon Film, 330 K $\Omega$ $\pm$ 5%, 1/4 W	3220090
R1126	Resistor, Composition, 10 M $\Omega$ $\pm$ 10%, 1/4 W	3220380
R1127	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R1128	Resistor, Variable, 500 $\Omega$	3260650
R1129	Resistor, Variable, 5 K $\Omega$	3260660
R1130	Resistor, Carbon Film, 150 K $\Omega$ $\pm$ 5%, 1/4 W	3220320
R1131	Resistor, Carbon Film, 6.8 K $\Omega$ $\pm$ 5%, 1/4 W	3220220
R1132	Resistor, Carbon Film, 27 $\Omega$ $\pm$ 5%, 1/4 W	3220020
R1133	Resistor, Carbon Film, 820 $\Omega$ $\pm$ 5%, 1/4 W	3220145
R1134	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R1135	Resistor, Carbon Film, 8.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220230
R1136	Resistor, Variable, 5 K $\Omega$	3260660
R1137	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R1138	Resistor, Carbon Film, 15 $\Omega$ $\pm$ 5%, 1/4 W	3220010
R1139	Resistor, Carbon Film, 3.3 K $\Omega$ $\pm$ 5%, 1/4 W	3220200
R1140	Resistor, Carbon Film, 560 $\Omega$ $\pm$ 5%, 1/4 W	3220125
R1141	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R1142	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R1143	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R1144	Resistor, Composition, 6.8 M $\Omega$ $\pm$ 10%, 1/4 W	3220375
R1145	Resistor, Carbon Film, 4.7 K $\Omega$ $\pm$ 5%, 1/4 W	3220210
R1146	Resistor, Carbon Film, 1.5 K $\Omega$ $\pm$ 5%, 1/4 W	3220175
R1147	Resistor, Carbon Film, 1.5 K $\Omega$ $\pm$ 5%, 1/4 W	3220175
R1148	Resistor, Carbon Film, 27 $\Omega$ $\pm$ 5%, 1/4 W	3220020
R1149	Resistor, Carbon Film, 680 $\Omega$ $\pm$ 5%, 1/4 W	3220140
R1150	Resistor, Carbon Film, 68 $\Omega$ $\pm$ 5%, 1/4 W	3220045
R1151	Resistor, Carbon Film, 270 $\Omega$ $\pm$ 5%, 1/4 W	3220085
R1152	Resistor, Carbon Film, 330 $\Omega$ $\pm$ 5%, 1/4 W	3220090
R1153	Resistor, Carbon Film, 47 K $\Omega$ $\pm$ 5%, 1/4 W	3220285
R1154	Resistor, Composition, 6.8 M $\Omega$ $\pm$ 10%, 1/4 W	3220375
R1155	Resistor, Carbon Film, 15 K $\Omega$ $\pm$ 5%, 1/4 W	3220245
R1156	Resistor, Carbon Film, 680 $\Omega$ $\pm$ 5%, 1/4 W	3220140
R1157	Resistor, Carbon Film, 150 $\Omega$ $\pm$ 5%, 1/4 W	3220065
R1158	Resistor, Carbon Film, 1 M $\Omega$ $\pm$ 5%, 1/4 W	3220355
R1159	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315

REF DES	DESCRIPTION	PART NO.
R1160	Resistor, Carbon Film, 4.7 K $\Omega$ $\pm$ 5%, 1/4 W	3220210
R1161	Resistor, Carbon Film, 22 K $\Omega$ $\pm$ 5%, 1/4 W	3220260
R1162	Resistor, Carbon Film, 33 K $\Omega$ $\pm$ 5%, 1/4 W	3220275
R1163	Resistor, Carbon Film, 47 K $\Omega$ $\pm$ 5%, 1/4 W	3220285
R1164	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R1165	Resistor, Carbon Film, 33 K $\Omega$ $\pm$ 5%, 1/4 W	3220275
R1166	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R1167	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R1168	Resistor, Carbon Film, 150 $\Omega$ $\pm$ 5%, 1/4 W	3220065
R1169	Resistor, Carbon Film, 3.3 K $\Omega$ $\pm$ 5%, 1/4 W	3220200
R1170	Resistor, Carbon Film, 150 K $\Omega$ $\pm$ 5%, 1/4 W	3220320
R1171	Resistor, Carbon Film, 4.7 K $\Omega$ $\pm$ 5%, 1/4 W	3220210
R1172	Resistor, Carbon Film, 3.3 $\Omega$ $\pm$ 5%, 1/4 W	3220002
R1173	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R1174	Resistor, Carbon Film, 470 K $\Omega$ $\pm$ 5%, 1/4 W	3220110
R1175	Resistor, Carbon Film, 22 K $\Omega$ $\pm$ 5%, 1/4 W	3220260
R1176	Resistor, Carbon Film, 15 K $\Omega$ $\pm$ 5%, 1/4 W	3220245
R1177	Resistor, Carbon Film, 4.7 K $\Omega$ $\pm$ 5%, 1/4 W	3220210
R1178	Resistor, Carbon Film, 270 $\Omega$ $\pm$ 5%, 1/4 W	3220085
R1179	Resistor, Carbon Film, 8.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220230
R1180	Resistor, Carbon Film, 3.3 $\Omega$ $\pm$ 5%, 1/4 W	3220002
R1181	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R1182	Resistor, Carbon Film, 47 $\Omega$ $\pm$ 5%, 1/4 W	3220035
R1183	Resistor, Carbon Film, 270 $\Omega$ $\pm$ 5%, 1/4 W	3220085
R1184	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R1185	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R1186	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R1187	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R1188	Resistor, Carbon Film, 180 $\Omega$ $\pm$ 5%, 1/4 W	3220070
R1189	Resistor, Carbon Film, 180 $\Omega$ $\pm$ 5%, 1/4 W	3220070
RFC1101	Choke Assy., 270 $\mu$ F, MUD271	3520590
RFC1102	Choke Assy., 270 $\mu$ F, MUD271	3520590
RFC1103	Choke Assy., 270 $\mu$ F, MUD271	3520590
RFC1104	Choke Assy., 270 $\mu$ F, MUD271	3520590
T1101	Transformer, Variable Can	2511001
T1102	Transformer, Variable Can	2511003
T1103	Transformer, Toroid	2510004
U1101	I.C., LM380N	3040265
Y1101	Crystal, 5.6450 MHz	3120280







SELECTED IN PRODUCTION

Fig. R1-24 2nd IF/Audio Board Schematic, Version 1

## TR7 2ND IF/AUDIO BOARD, VERSION 2

REF DES	DESCRIPTION	PART NO
C1101	Capacitor, Disc, .05 $\mu$ F + 80%, Z5U	3161630
C1102	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1103	Capacitor, Disc, .05 $\mu$ F + 80%, Z5U	3161630
C1104	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C1105	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1106	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1107	Capacitor, Mica, 330 pF $\pm$ 5%, DM-15	3170320
C1108	Capacitor, Disc, 25 pF $\pm$ 5%, NPO	3160620
C1109	Capacitor, Disc, .05 $\mu$ F + 80%, Z5U	3161630
C1110	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1111	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1112	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1113	Capacitor, Mica, 390 pF $\pm$ 5%, DM-15	3170370
C1114	Capacitor, Disc, .05 $\mu$ F + 80%, Z5U	3161630
C1115	Capacitor, Disc, .005 $\mu$ F $\pm$ 20%, Z5U	3161470
C1116	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1117	Capacitor, Disc, .05 $\mu$ F + 80%, Z5U	3161630
C1118	Capacitor, Disc, 470 pF $\pm$ 20%, Z5U	3161350
C1119	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1120	Capacitor, Disc, .05 $\mu$ F + 80%, Z5U	3161630
C1121	Capacitor, Mica, 390 pF $\pm$ 5%, DM-15	3170370
C1122	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1123	Capacitor, Disc, 25 pF $\pm$ 5%, NPO	3160620
C1124	Capacitor, Disc, .001 $\mu$ F $\pm$ 5%, Z5U	3161380
C1125	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1126	Capacitor, Disc, .05 $\mu$ F + 80%, Z5U	3161630
C1127	Capacitor, Disc, 470 pF $\pm$ 20%, Z5U	3161350
C1128	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C1129	Capacitor, Disc, .05 $\mu$ F + 80%, Z5U	3161630
C1130	Capacitor, Disc, .05 $\mu$ F + 80%, Z5U	3161630
C1131	Capacitor, Disc, 10 pF $\pm$ 5%, NPO	3160360
C1132	Capacitor, Mica, 390 pF $\pm$ 5%, DM-15	3170370
C1133	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1134	Capacitor, Mica, 68 pF $\pm$ 5%, DM-15	3170060
C1135	Capacitor, Mica, 390 pF $\pm$ 5%, DM-15	3170370
C1136	Capacitor, Variable Trimmer, 4-40 pF	3205150
C1137	Capacitor, Disc, 25 pF $\pm$ 5%, NPO	3160620
C1138	Capacitor, Disc, .05 $\mu$ F + 80%, M16V	3161600
C1139	Capacitor, Disc, .05 $\mu$ F + 80%, M16V	3161600
C1140	Capacitor, Disc, .05 $\mu$ F + 80%, M16V	3161600
C1141	Capacitor, Mica, 180 pF $\pm$ 5%, DM-15	3170180
C1142	Capacitor, Disc, .005 $\mu$ F $\pm$ 20%, Z5U	3161470
C1143	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C1144	Capacitor, Disc, .05 $\mu$ F $\pm$ 80%, M16V	3161600
C1145	Capacitor, Disc, .005 $\mu$ F $\pm$ 20%, Z5U	3161470
C1146	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C1147	Capacitor, Electrolytic, 22 $\mu$ F $\pm$ 20%, 16 V	3180105
C1148	Capacitor, Disc, .05 $\mu$ F + 80%, M16V	3161600
C1149	Capacitor, Disc, .005 $\mu$ F $\pm$ 20%, Z5U	3161470
C1150	Capacitor, Disc, .05 $\mu$ F + 80%, Z5U	3161630
C1151	Capacitor, Electrolytic, 22 $\mu$ F $\pm$ 20%, 50 V	3180105

REF DES	DESCRIPTION	PART NO
C1152	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1153	Capacitor, Electrolytic, 10 $\mu$ F $\pm$ 20%, 35 V	3180062
C1154	Capacitor, Disc, .1 $\mu$ F $\pm$ 80%, Y5T	3161660
C1155	Capacitor, Electrolytic, 22 $\mu$ F $\pm$ 20%, 16 V	3180105
C1156	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C1157	Capacitor, Disc, .05 $\mu$ F $\pm$ 80%, Z5U	3161630
C1158	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1159	Capacitor, Electrolytic, 25 $\mu$ F @ 15V, Axial	3180220
C1160	Capacitor, Disc, .05 $\mu$ F $\pm$ 80%, M16V	3161600
C1161	NOT USED	
C1162	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1163	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1164	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1165	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1166	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C1167	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1168	Capacitor, Disc, 470 pF $\pm$ 20%, Z5U	3161350
C1169	Capacitor, Disc, .005 $\mu$ F $\pm$ 20%, Z5U	3161470
C1170	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, Z5U	3180008
C1171	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1172	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C1173	Capacitor, Disc, 330 pF $\pm$ 10%, Y5E, 16 V	3161300
C1174	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C1175	Capacitor, Disc, .1 $\mu$ F $\pm$ 20%, X5U, 16 V	3161680
CR1102	Diode, HP-5082-3379	3020195
CR1103	Diode, 1N4148	3020090
CR1104	Diode, 1N4148	3020090
CR1105	Diode, 1N4148	3020090
CR1106	Diode, 1N4148	3020090
CR1107	Diode, AA119/1N541	3020040
CR1108	Diode, 1N4148	3020090
CR1109	Diode, 1N4148	3020090
CR1110	Diode, 1N4148	3020090
CR1111	Diode, MPN3404	3020265
CR1112	Diode, 1N4148	3020090
CR1113	Diode, 1N4148	3020090
CR1114	Diode, 1N4148	3020090
CR1115	Diode, AA119/1N541	3020040
CR1116	Diode, 1N4148	3020090
CR1117	Diode, 1N4148	3020090
CR1118	Diode, 1N4148	3020090
CR1119	Diode, 1N4148	3020090
CR1120	Diode, 1N4148	3020090
CR1121	Diode, 1N4148	3020090
CR1122	Diode, 1N4148	3020090
L1101	Inductor, Variable Can	2511002
L1102	Inductor, Variable Can	2511002
Q1101	Transistor, 3N204	3030230
Q1102	Transistor, MPS6521	3030289
Q1103	Transistor, 2N4402	3030120
Q1104	Transistor, 2N3904	3030105
Q1105	Transistor, MPS6521	3030289
Q1106	Transistor, 3N204	3030230

REF DES	DESCRIPTION	PART NO.
Q1107	Transistor, 3N204	3030230
Q1108	Transistor, 2N4402	3030120
Q1109	Transistor, 2N3563	3030060
Q1110	Transistor, MPS6521	3030289
Q1111	Transistor, 2N3904	3030105
Q1113	Transistor, 2N3904	3030105
R1102	Resistor, Carbon Film, 10 K $\Omega \pm 5\%$ , 1/4 W	3220235
R1103	Resistor, Carbon Film, 47 K $\Omega \pm 5\%$ , 1/4 W	3220285
R1104	Resistor, Carbon Film, 33 K $\Omega \pm 5\%$ , 1/4 W	3220275
R1105	Resistor, Variable, 10 K $\Omega$	3260665
R1106	Resistor, Carbon Film, 22 K $\Omega \pm 5\%$ , 1/4 W	3220260
R1107	Resistor, Carbon Film, 22 K $\Omega \pm 5\%$ , 1/4 W	3220260
R1108	Resistor, Carbon Film, 27 $\Omega \pm 5\%$ , 1/4 W	3220020
R1109	Resistor, Carbon Film, 6.8 K $\Omega \pm 5\%$ , 1/4 W	3220220
R1110	Resistor, Carbon Film, 330 K $\Omega \pm 5\%$ , 1/4 W	3220340
R1111	Resistor, Carbon Film, 3.3 K $\Omega \pm 5\%$ , 1/4 W	3220200
R1112	Resistor, Carbon Film, 22 K $\Omega \pm 5\%$ , 1/4 W	3220260
R1113	Resistor, Carbon Film, 100 K $\Omega \pm 5\%$ , 1/4 W	3220315
R1114	Resistor, Carbon Film, 18 K $\Omega \pm 5\%$ , 1/4 W	3220255
R1115	Resistor, Carbon Film, 330 $\Omega \pm 5\%$ , 1/4 W	3220090
R1116	Resistor, Carbon Film, 68 $\Omega \pm 5\%$ , 1/4 W	3220045
R1117	Resistor, Carbon Film, 10 $\Omega \pm 5\%$ , 1/4 W	3220005
R1118	Resistor, Carbon Film, 820 $\Omega \pm 5\%$ , 1/4 W	3220145
R1119	Resistor, Carbon Film, 100 $\Omega \pm 5\%$ , 1/4 W	3220055
R1120	Resistor, Carbon Film, 100 $\Omega \pm 5\%$ , 1/4 W	3220055
R1121	Resistor, Carbon Film, 2.2 M $\Omega \pm 5\%$ , 1/4 W	3220360
R1122	Resistor, Carbon Film, 10 K $\Omega \pm 5\%$ , 1/4 W	3220235
R1123	Resistor, Carbon Film, 22 K $\Omega \pm 5\%$ , 1/4 W	3220260
R1124	Resistor, Carbon Film, 27 $\Omega \pm 5\%$ , 1/4 W	3220020
R1125	Resistor, Carbon Film, 330 K $\Omega \pm 5\%$ , 1/4 W	3220340
R1126	Resistor, Composition, 10 M $\Omega \pm 10\%$ , 1/4 W	3220280
R1127	Resistor, Carbon Film, 1 K $\Omega \pm 5\%$ , 1/4 W	3220160
R1128	Resistor, Variable, 200 $\Omega$	3260650
R1129	Resistor, Variable, 5 K $\Omega$	3260660
R1130	Resistor, Carbon Film, 150 K $\Omega \pm 5\%$ , 1/4 W	3220320
R1131	Resistor, Carbon Film, 6.8 K $\Omega \pm 5\%$ , 1/4 W	3220220
R1132	Resistor, Carbon Film, 27 $\Omega \pm 5\%$ , 1/4 W	3220020
R1133	Resistor, Carbon Film, 820 $\Omega \pm 5\%$ , 1/4 W	3220145
R1134	Resistor, Carbon Film, 2.2 K $\Omega \pm 5\%$ , 1/4 W	3220190
R1135	Resistor, Carbon Film, 8.2 K $\Omega \pm 5\%$ , 1/4 W	3220230
R1136	Resistor, Variable, 5 K $\Omega$	3260660
R1137	Resistor, Carbon Film, 100 $\Omega \pm 5\%$ , 1/4 W	3220055
R1138	Resistor, Carbon Film, 15 $\Omega \pm 5\%$ , 1/4 W	3220010
R1139	Resistor, Carbon Film, 3.3 K $\Omega \pm 5\%$ , 1/4 W	3220200
R1140	Resistor, Carbon Film, 560 $\Omega \pm 5\%$ , 1/4 W	3220125
R1141	Resistor, Carbon Film, 100 $\Omega \pm 5\%$ , 1/4 W	3220055
R1142	Resistor, Carbon Film, 100 $\Omega \pm 5\%$ , 1/4 W	3220055
R1143	Resistor, Carbon Film, 100 K $\Omega \pm 5\%$ , 1/4 W	3220315
R1144	Resistor, Composition, 6.8 M $\Omega \pm 10\%$ , 1/4 W	3220375
R1145	Resistor, Carbon Film, 4.7 K $\Omega \pm 5\%$ , 1/4 W	3220210
R1146	Resistor, Carbon Film, 1.5 K $\Omega \pm 5\%$ , 1/4 W	3220175
R1147	Resistor, Carbon Film, 1.5 K $\Omega \pm 5\%$ , 1/4 W	3220175
R1148	Resistor, Carbon Film, 27 $\Omega \pm 5\%$ , 1/4 W	3220020

REF DES	DESCRIPTION	PART NO
R1149	Resistor, Carbon Film, 680 $\Omega \pm 5\%$ , 1/4 W	3220140
R1150	Resistor, Carbon Film, 68 $\Omega \pm 5\%$ , 1/4 W	3220045
R1151	Resistor, Carbon Film, 270 $\Omega \pm 5\%$ , 1/4 W	3220085
R1152	Resistor, Carbon Film, 330 $\Omega \pm 5\%$ , 1/4 W	3220090
R1153	Resistor, Carbon Film, 47 K $\Omega \pm 5\%$ , 1/4 W	3220285
R1154	Resistor, Composition, 6.8 M $\Omega \pm 10\%$ , 1/4 W	3220375
R1155	Resistor, Carbon Film, 15 K $\Omega \pm 5\%$ , 1/4 W	3220245
R1156	Resistor, Carbon Film, 680 $\Omega \pm 5\%$ , 1/4 W	3220140
R1157	Resistor, Carbon Film, 150 $\Omega \pm 5\%$ , 1/4 W	3220065
R1158	Resistor, Carbon Film, 1 M $\Omega \pm 5\%$ , 1/4 W	3220355
R1159	Resistor, Carbon Film, 100 K $\Omega \pm 5\%$ , 1/4 W	3220315
R1160	Resistor, Carbon Film, 4.7 K $\Omega \pm 5\%$ , 1/4 W	3220210
R1161	Resistor, Carbon Film, 22 K $\Omega \pm 5\%$ , 1/4 W	3220260
R1162	Resistor, Carbon Film, 33 K $\Omega \pm 5\%$ , 1/4 W	3220275
R1163	Resistor, Carbon Film, 47 K $\Omega \pm 5\%$ , 1/4 W	3220285
R1164	Resistor, Carbon Film, 100 K $\Omega \pm 5\%$ , 1/4 W	3220315
R1165	Resistor, Carbon Film, 33 K $\Omega \pm 5\%$ , 1/4 W	3220315
R1166	Resistor, Carbon Film, 1 K $\Omega \pm 5\%$ , 1/4 W	3220160
R1167	Resistor, Carbon Film, 1 K $\Omega \pm 5\%$ , 1/4 W	3220160
R1168	Resistor, Carbon Film, 150 $\Omega \pm 5\%$ , 1/4 W	3220065
R1169	Resistor, Carbon Film, 3.3 K $\Omega \pm 5\%$ , 1/4 W	3220200
R1170	Resistor, Carbon Film, 150 $\Omega \pm 5\%$ , 1/4 W	3220320
R1171	Resistor, Carbon Film, 820 $\Omega \pm 5\%$ , 1/4 W	3220145
R1172	Resistor, Carbon Film, 47 $\Omega \pm 5\%$ , 1/4 W	3220035
R1173	Resistor, Carbon Film, 1 K $\Omega \pm 5\%$ , 1/4 W	3220160
R1174	Resistor, Carbon Film, 470 $\Omega \pm 5\%$ , 1/4 W	3220110
R1175	Resistor, Carbon Film, 1 K $\Omega \pm 5\%$ , 1/4 W	3220160
R1176	Resistor, Carbon Film, 15 K $\Omega \pm 5\%$ , 1/4 W	3220245
R1177	Resistor, Carbon Film, 4.7 K $\Omega \pm 5\%$ , 1/4 W	3220210
R1178	Resistor, Carbon Film, 270 $\Omega \pm 5\%$ , 1/4 W	3220085
R1179	Resistor, Carbon Film, 10 K $\Omega \pm 5\%$ , 1/4 W	3220235
R1180	Resistor, Carbon Film, 3.3 $\Omega \pm 5\%$ , 1/4 W	3220002
R1181	Resistor, Carbon Film, 100 $\Omega \pm 5\%$ , 1/4 W	3220055
R1182	Resistor, Carbon Film, 2.7 K $\Omega \pm 5\%$ , 1/4 W	3220195
R1183	Resistor, Carbon Film, 270 $\Omega \pm 5\%$ , 1/4 W	3220085
R1184	Resistor, Carbon Film, 1 K $\Omega \pm 5\%$ , 1/4 W	3220160
R1185	Resistor, Carbon Film, 1 K $\Omega \pm 5\%$ , 1/4 W	3220160
R1186	Resistor, Carbon Film, 10 K $\Omega \pm 5\%$ , 1/4 W	3220235
R1187	Resistor, Carbon Film, 10 K $\Omega \pm 5\%$ , 1/4 W	3220235
R1188	Resistor, Carbon Film, 180 $\Omega \pm 5\%$ , 1/4 W	3220070
R1189	Resistor, Carbon Film, 2.7 K $\Omega \pm 5\%$ , 1/4 W	3220195
R1190	Resistor, Carbon Film, 1 K $\Omega \pm 5\%$ , 1/4 W	3220160
RFC1101	Choke Assy., 270 $\mu$ H, MUD 271	3520590
RFC1102	Choke Assy., 270 $\mu$ H	2055057
RFC1103	NOT USED	
RFC1104	Choke Assy., 270 $\mu$ H, MUD 271	3520590
T1101	Transformer, Variable	2511001
T1102	Transformer, Variable	2511003
U1101	I.C., SL61545	3040265
U1102	I.C., MC1496P	3040112
Y1101	Crystal, 5.645 CW-OSC.	3120280

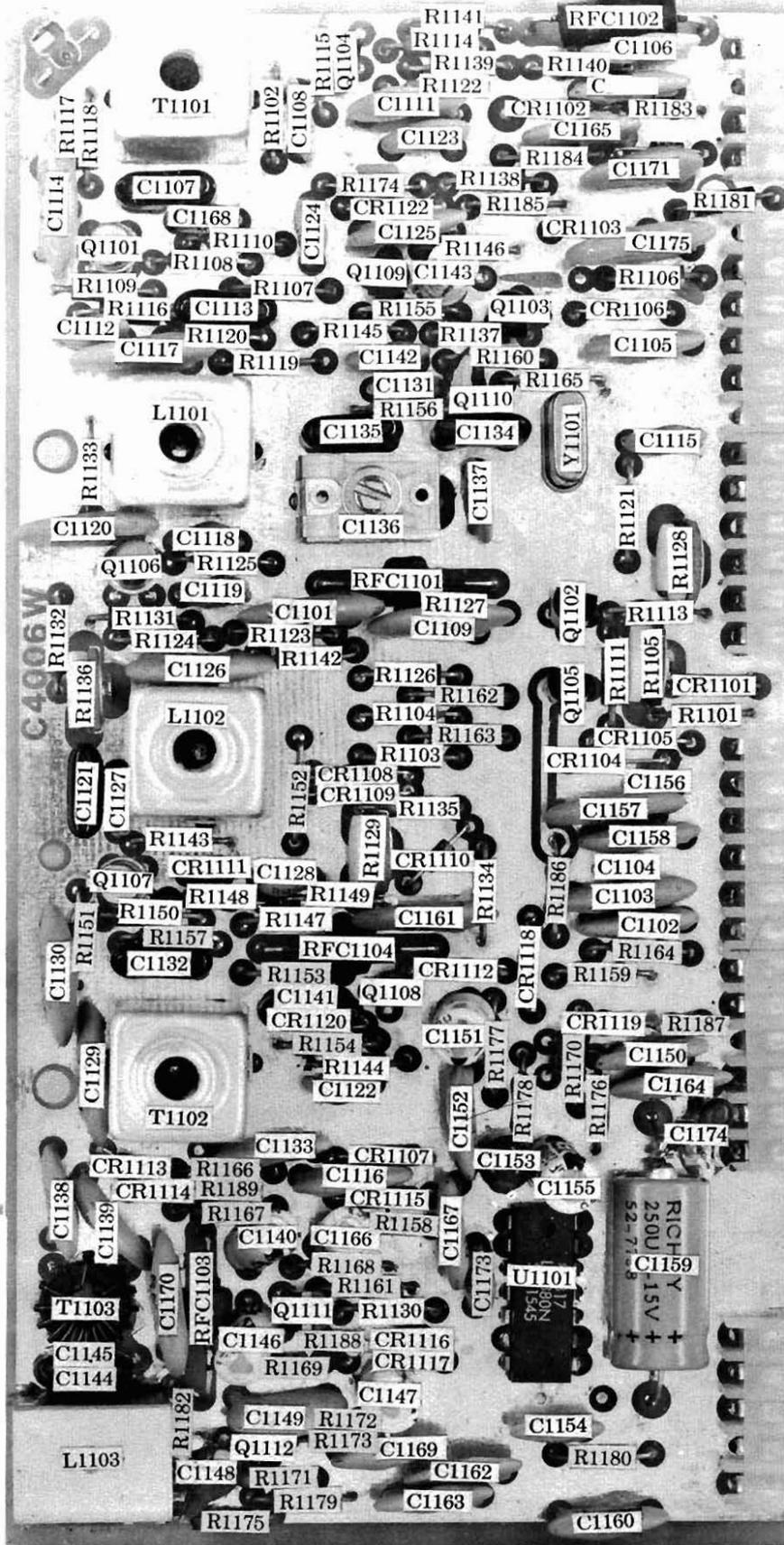
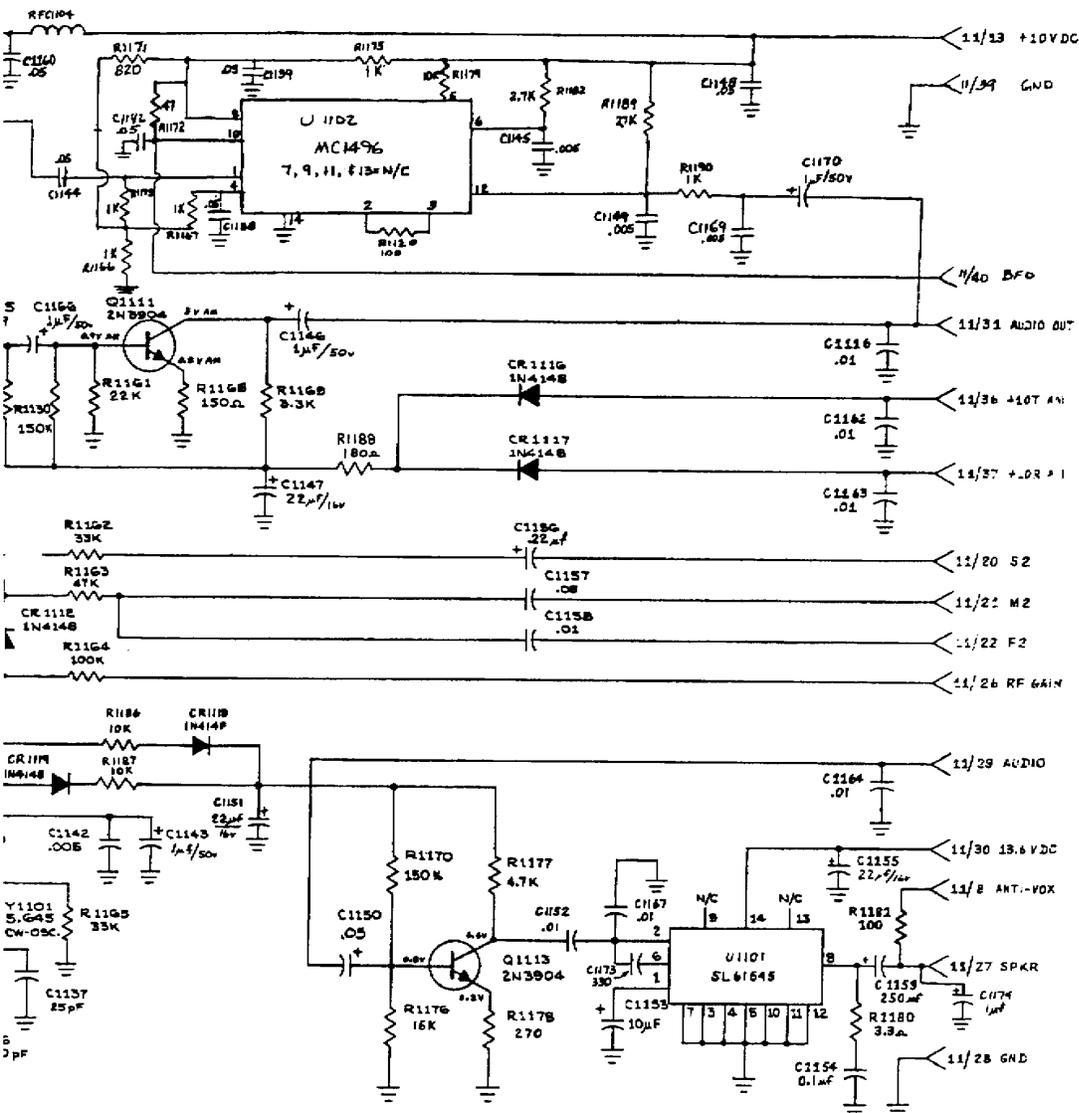


Fig. 2-23 2nd IF/Audio Board Pictorial Version 1



30 1162	1187 1168	1169	1188 1175	1179	1182	1189	1190	1190	1191
1163	1171	1176	1170	1172	1177	1181	1182	1183	1184
1166	1144	1142 1140	1136 1134	1147 1146	1150	1156 1152	1167	1161	1168 1176
1137	1145	1143	1151	1157 1145	1150	1157 1145	1163 1173	1167	1168 1176
				1151	1150	1158	1162	1167	1170 1163



763 IN PRODUCTION

Fig. 2-26 2nd IF/Audio Board Schematic, Version 2

**2-12. JUMPER BOARD**

The Jumper Board consists of 2 CMOS integrated circuits, U1201 and U1202. These IC's are high current hex buffers. They buffer the CMOS output levels of the digital control board which in turn drive the translator board. Note the input code (12 pin connector) should be the same as the output code (9 pin connector). However, the output pin directly across from the input is not necessarily the same code bit. See figure 2-28 for schematic and figure 2-27 for parts list information.

**NOTES:**

## TR-7 JUMPER BOARD

REF DES	DESCRIPTION	PART NO.
C1201	Capacitor, Disc, .01 $\mu$ F + 80%, M25 V	3161500
R1201	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R1202	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R1203	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R1204	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R1205	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R1206	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R1207	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R1208	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
U1201	I.C., MC14050B	3041050
U1202	I.C., MC14050B	3021050

## NOTES:

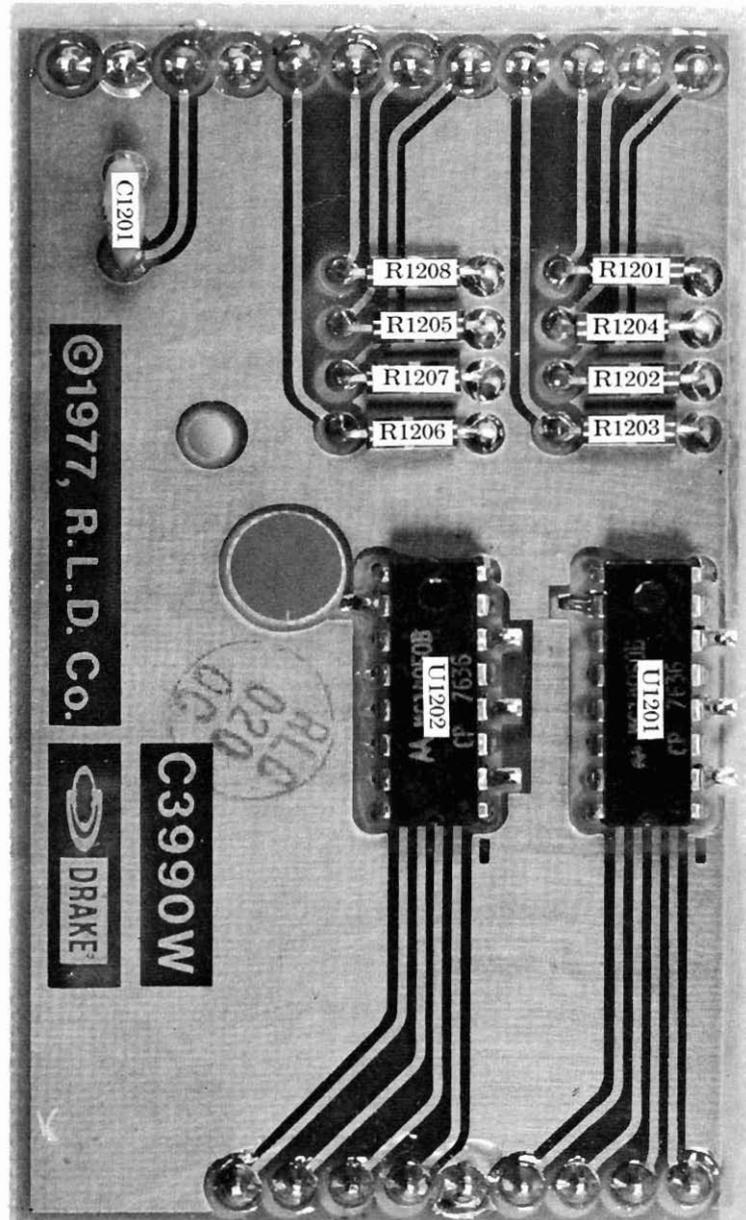
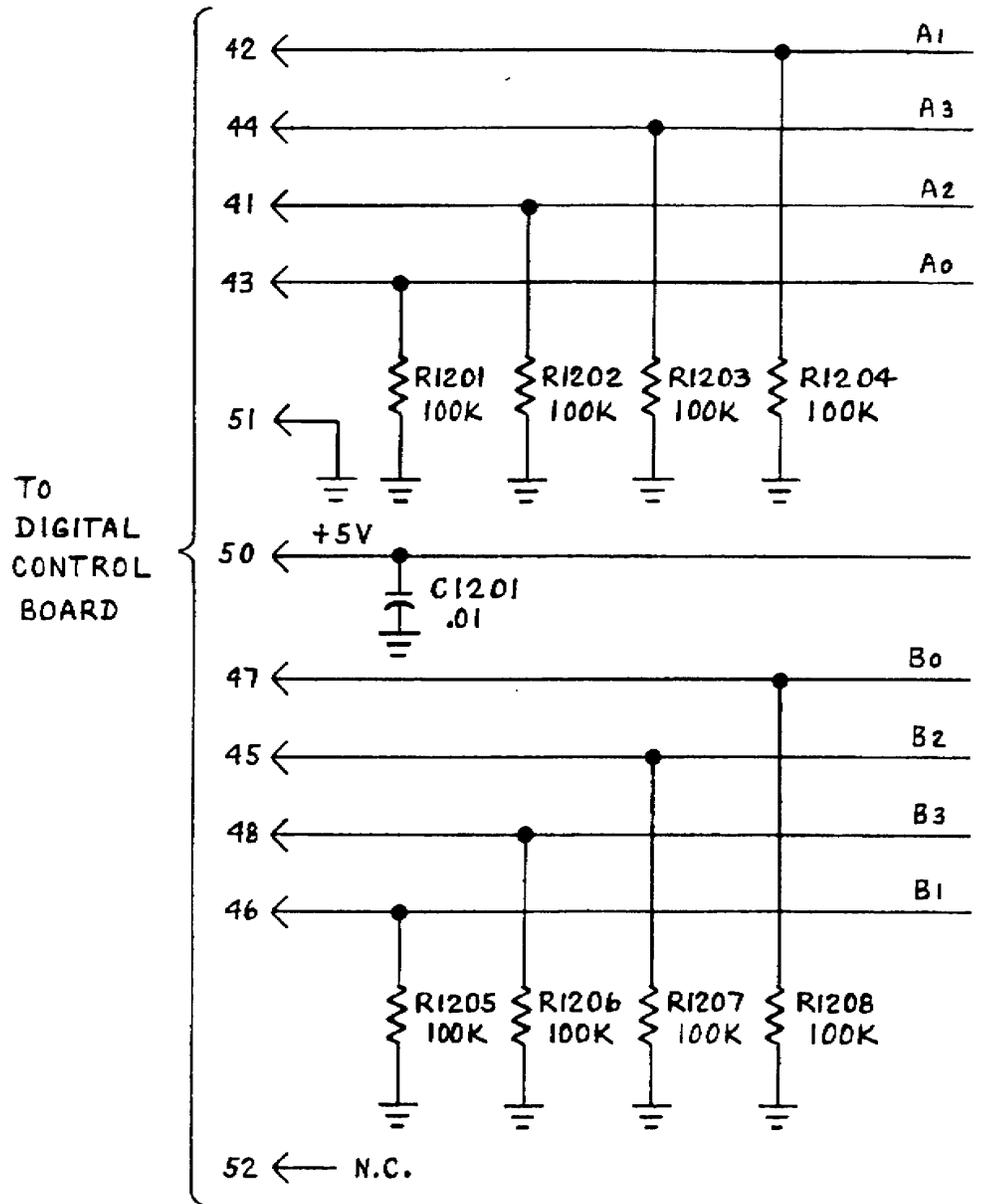


Fig. 2-27 Jumper Board Pictorial



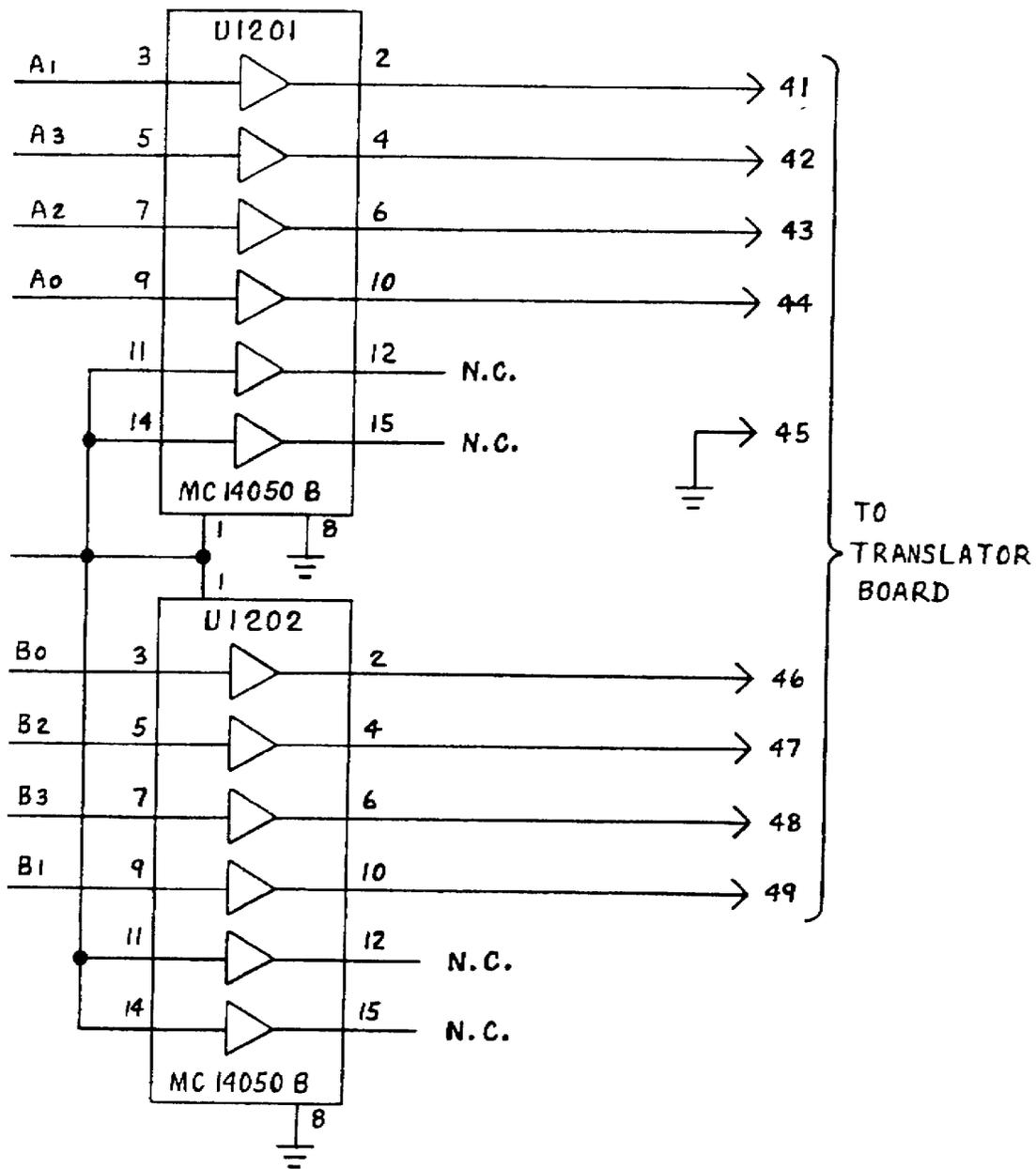


Fig. 2-28 Jumper Board Schematic

### 2-13. HIGH-PASS FILTER MODULE

The High-Pass Filter Module consists of three printed circuit boards: a filter board (assy. 1300), a front switch board (assy. 1400) and a rear switch board (assy. 1500). In addition, the module provides for mounting the ALC Board, which is described in Section 2-15. Refer to figure 2-32 for schematic and figures 2-29 through 2-31 for parts list information.

The front switch board accepts the antenna coax from the Up-Converter Board (Section 2-4). S1401 (front) connects this coax through C1402 to one of seven high pass filters. S1401 is positioned by the bandswitch shaft. The 25 kHz calibrator signal is connected to the Up-Converter input via switching diodes CR1401 and CR1402 in the calibrate mode. The VLF antenna input from rear panel accessory connector is coupled to the Up-Converter input through C1403 and R1404. R1403, R1405 and R1406 are used to lower the transmitter ALC threshold in the 21 and 28.5 MHz bandswitch positions. S1401 (rear) provides a momentary ground impulse for band-change information to the DR-7.

On the rear switch board, S1501 connects one of the seven high pass filters to C1503, which couples to a PIN diode transmit/receive switch. This switch couples the high pass filters to either the rear panel External Antenna jack via CR1502 and CR1503 or to the Power Amplifier Module via CR1501. The PIN diode switch is controlled by 13.6 VDC switched by the relay in the Low-Pass Filter Module (Section 2-14).

The high-pass filter board contains seven filters. Each filter corresponds to one bandswitch position except for the two lowest bands which share one filter. The approximate cut-off frequencies of these filters are:

BAND	FREQUENCY RANGE	CUT-OFF FREQUENCY
1 & 2	1.5-3.0 MHz	1.75 MHz
3	3.0-4.5 MHz	2.7 MHz
4	4.5-7.0 MHz	4.0 MHz
5	7.0-10.0 MHz	6.4 MHz
6	10.0-15.0 MHz	9.0 MHz
7	15.0-22.0 MHz	13.5 MHz
8	22.0-30.0 MHz	20.0 MHz

Note that the cut-off frequency of the band 1 and 2 filter is above the lowest frequency of interest. This is necessary to provide sufficient rejection to strong AM broadcast signals which can create interfering intermodulation products in the 160 meter amateur band. As a result, sensitivity and power output may be degraded below 1.75 MHz.

Removal of the High-Pass Filter Module is accomplished by removing the ALC Board from the bottom (2 screws), removing the bandswitch knob and unsoldering the wires connected to the front and rear switch boards. Be sure to label each lead so that it can be correctly reinstalled. Remove the two screws holding the bandswitch detent in the rear panel and slide the switch shaft straight back until it clears the front and rear switch wafers. The module can then be pulled up out the top of the chassis. Reverse this procedure to install the module. Be sure to orient the notch in the switch wafers in the proper direction when reinstalling the bandswitch shaft.

The above procedure is somewhat time-consuming, and it is recommended only in those cases that absolutely require removal of the module. Note that most repairs can be accomplished in the radio, due to the open construction, especially when the ALC Board is removed.

The High-Pass Filter Module does not require alignment.

## TR-7 TRANSMIT ALC BOARD

REF DES	DESCRIPTION	PART NO.
C1601	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1602	Capacitor, Tantalum, 10 $\mu$ F $\pm$ 20%, 25 V	3183030
C1603	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1604	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1605	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1606	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1607	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1608	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1609	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C1610	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1611	Capacitor, Tantalum, 1 $\mu$ F $\pm$ 20%, 35 V	3183010
C1612	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
CR1601	Diode, 1N4148	3020090
CR1602	Diode, 1N4148	3020090
CR1603	Diode, 1N4148	3020090
CR1604	Diode, 1N4148	3020090
CR1605	Diode, 1N4148	3020090
CR1606	Diode, 1N4148	3020090
Q1601	Transistor, 2N3904	3030105
R1601	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R1602	Resistor, Carbon Film, 33 K $\Omega$ $\pm$ 5%, 1/4 W	3220275
R1603	Resistor, Carbon Film, 47 K $\Omega$ $\pm$ 5%, 1/4 W	3220285
	DELETED	
R1605	Resistor, Carbon Film, 220 K $\Omega$ $\pm$ 5%, 1/4 W	3220330
R1606	Resistor, Carbon Film, 47 K $\Omega$ $\pm$ 5%, 1/4 W	3220285
R1607	Resistor, Carbon Film, 33 K $\Omega$ $\pm$ 5%, 1/4 W	3220275
R1608	Resistor, Carbon Film, 5.6 K $\Omega$ $\pm$ 5%, 1/4 W	3220215
R1609	Resistor, Carbon Film, 1 M $\Omega$ $\pm$ 5%, 1/4 W	3220355
R1610	Resistor, Carbon Film, 3.3 K $\Omega$ $\pm$ 5%, 1/4 W	3220200
R1611	Resistor, Carbon Film, 22 K $\Omega$ $\pm$ 5%, 1/4 W	3220260
R1612	Resistor, Carbon Film, 68 K $\Omega$ $\pm$ 5%, 1/4 W	3220300
R1613	Resistor, Variable, 50 K $\Omega$	3260190
R1614	Resistor, Carbon Film, 1 M $\Omega$ $\pm$ 5%, 1/4 W	3220355
R1615	Resistor, Carbon Film, 33 K $\Omega$ $\pm$ 5%, 1/4 W	3220275
R1616	Resistor, Carbon Film, 22 K $\Omega$ $\pm$ 5%, 1/4 W	3220260
R1617	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R1618	Resistor, Carbon Film, 1 M $\Omega$ $\pm$ 5%, 1/4 W	3220355
R1619	Resistor, Carbon Film, 1 M $\Omega$ $\pm$ 5%, 1/4 W	3220355
R1620	Resistor, Carbon Film, 330 $\Omega$ $\pm$ 5%, 1/4 W	3220090
R1621	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
U1601	I.C., MC3401P	3040130

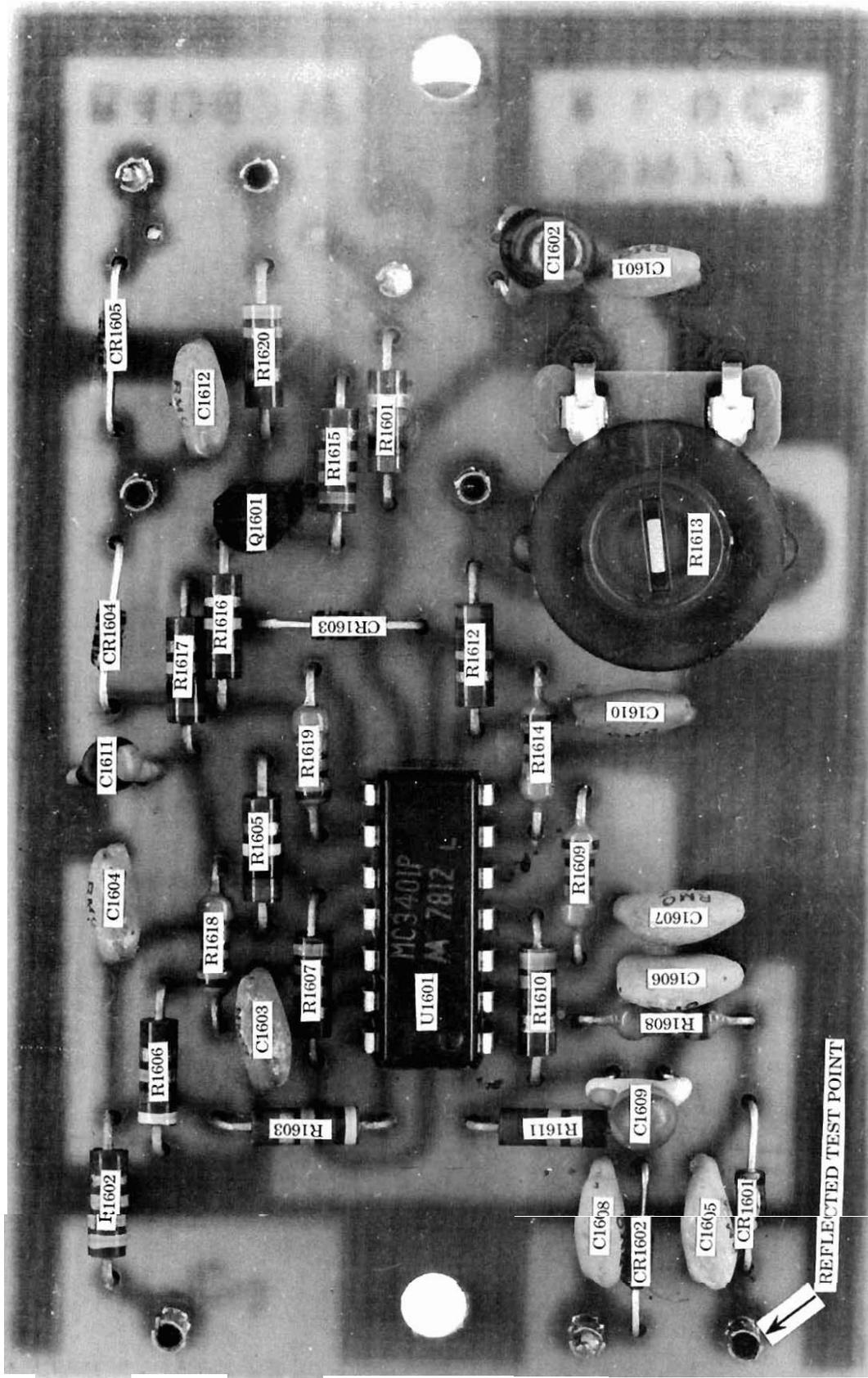


Fig. 2-29 ALC Board Pictorial

## TR-7 HIGH PASS FILTER

REF DES	DESCRIPTION	PART NO.
C1301	Capacitor, Mica, 910 pF $\pm$ 5%, DM-19	3170545
C1302	Capacitor, Mica, 500 pF $\pm$ 5%, DM-19	3170430
C1303	Capacitor, Mica, 500 pF $\pm$ 5%, DM-19	3170430
C1304	Capacitor, Mica, 910 pF $\pm$ 5%, DM-19	3170545
C1305	Capacitor, Mica, 680 pF $\pm$ 5%, DM-15	3170500
C1306	Capacitor, Mica, 490 pF $\pm$ 5%, DM-15	3170410
C1307	Capacitor, Mica, 680 pF $\pm$ 5%, DM-15	3170500
C1308	Capacitor, Mica, 490 pF $\pm$ 5%, DM-15	3170410
C1309	Capacitor, Mica, 300 pF $\pm$ 5%, DM-15	3170300
C1310	Capacitor, Mica, 490 pF $\pm$ 5%, DM-15	3170410
C1311	Capacitor, Mica, 300 pF $\pm$ 5%, DM-15	3170300
C1312	Capacitor, Mica, 190 pF $\pm$ 5%, DM-15	3170190
C1313	Capacitor, Mica, 300 pF $\pm$ 5%, DM-15	3170300
C1314	Capacitor, Mica, 300 pF $\pm$ 5%, DM-15	3170300
C1315	Capacitor, Mica, 190 pF $\pm$ 5%, DM-15	3170190
C1316	Capacitor, Mica, 300 pF $\pm$ 5%, DM-15	3170300
C1317	Capacitor, Mica, 210 pF $\pm$ 5%, DM-15	3170230
C1318	Capacitor, Mica, 180 pF $\pm$ 5%, DM-15	3170180
C1319	Capacitor, Mica, 210 pF $\pm$ 5%, DM-15	3170230
C1320	Capacitor, Mica, 150 pF $\pm$ 5%, DM-15	3170150
C1321	Capacitor, Mica, 80 pF $\pm$ 5%, DM-15	3170080
C1322	Capacitor, Mica, 150 pF $\pm$ 5%, DM-15	3170150
L1301	Inductor, 5.1 $\mu$ H	3524202
L1302	Inductor, 5.1 $\mu$ H	3524202
L1303	Inductor, 5.1 $\mu$ H	3524202
L1304	Inductor, 2.4 $\mu$ H	3524203
L1305	Inductor, 2.4 $\mu$ H	3524203
L1306	Inductor, 1.6 $\mu$ H	3524204
L1307	Inductor, 1.6 $\mu$ H	3524204
L1308	Inductor, 1.1 $\mu$ H	3524205
L1309	Inductor, 1.1 $\mu$ H	3524205
L1310	Inductor, .65 $\mu$ H	3524071
L1311	Inductor, .65 $\mu$ H	3524071
L1312	Inductor, .43 $\mu$ H	3524072
L1313	Inductor, .43 $\mu$ H	3524072
L1314	Inductor, .29 $\mu$ H	3524073
L1315	Inductor, .29 $\mu$ H	3524073



## TR-7 HIGH PASS FILTER SWITCH, FRONT

REF DES	DESCRIPTION	PART NO.
C1401	Capacitor, Disc, .05 $\mu$ F + 80%, M16V	3161600
C1402	Capacitor, Disc, .05 $\mu$ F + 80%, M16V	3161600
C1403	Capacitor, Disc, .05 $\mu$ F + 80%, M16V	3161600
C1404	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
CR1401	Diode, MPN3404	3020365
CR1402	Diode, MPN3404	3020365
R1401	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R1402	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R1403	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R1404	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R1405	Resistor, Carbon Film, 36 K $\Omega$ $\pm$ 5%, 1/4 W	3220280
R1406	Resistor, Carbon Film, 12 K $\Omega$ $\pm$ 5%, 1/4 W	3220240
S1401	Wafer #3, Band Switch, TR-7	4660003

## TR-7 HIGH PASS FILTER SWITCH, REAR

REF DES	DESCRIPTION	PART NO.
C1501	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35V	3183100
C1502	Capacitor, Disc, .05 $\mu$ F + 80%, M16V	3161600
C1503	Capacitor, Disc, .05 $\mu$ F + 80%, M16V	3161600
C1504	Capacitor, Disc, .05 $\mu$ F + 80%, M16V	3161600
C1505	Capacitor, Tantalum, 1 $\mu$ F $\pm$ 20%, 35 V	3183010
C1506	Capacitor, Mica, 100 pF $\pm$ 5%, DM-15	3170110
CR1501	Diode, UM9401	3020330
CR1502	Diode, UM9401	3020330
CR1503	Diode, UM9401	3020330
R1501	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R1502	Resistor, Composition, 82 $\Omega$ $\pm$ 10%, 1 W	3240025
RFC1501	Choke Assy., 270 $\mu$ F, MUD271	3520590
RFC1502	Choke Assy., 270 $\mu$ F, MUD271	3520590
RFC1503	Choke Assy., 270 $\mu$ F, MUD271	3520590
S1501	Wafer #4, Band Switch, TR-7	4660004

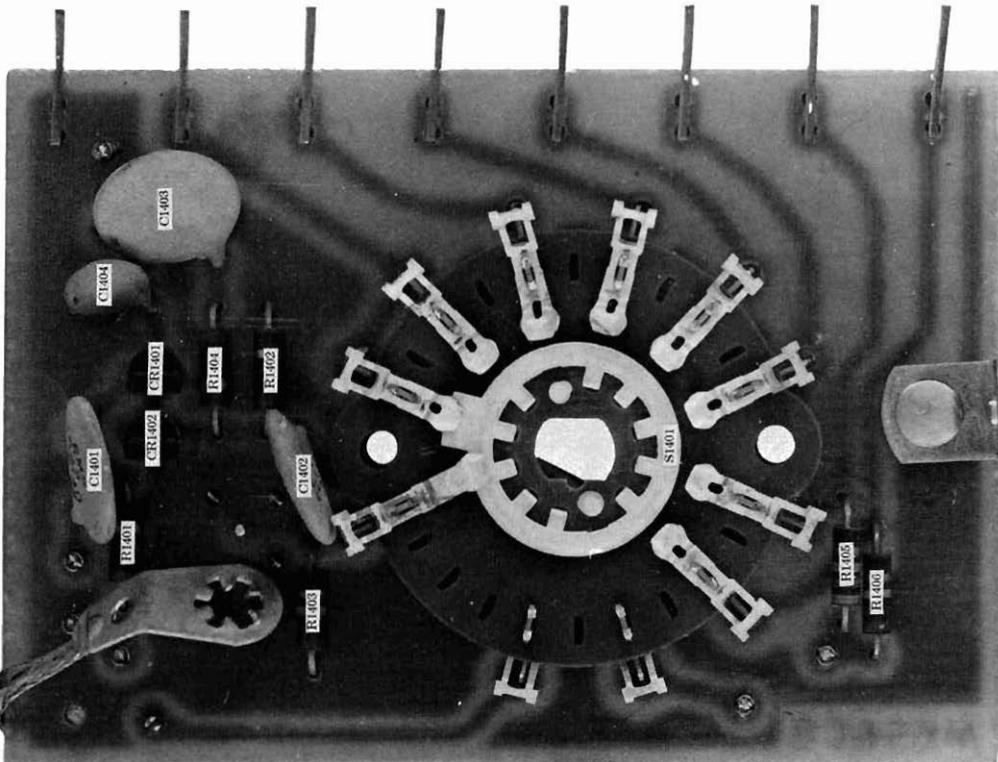
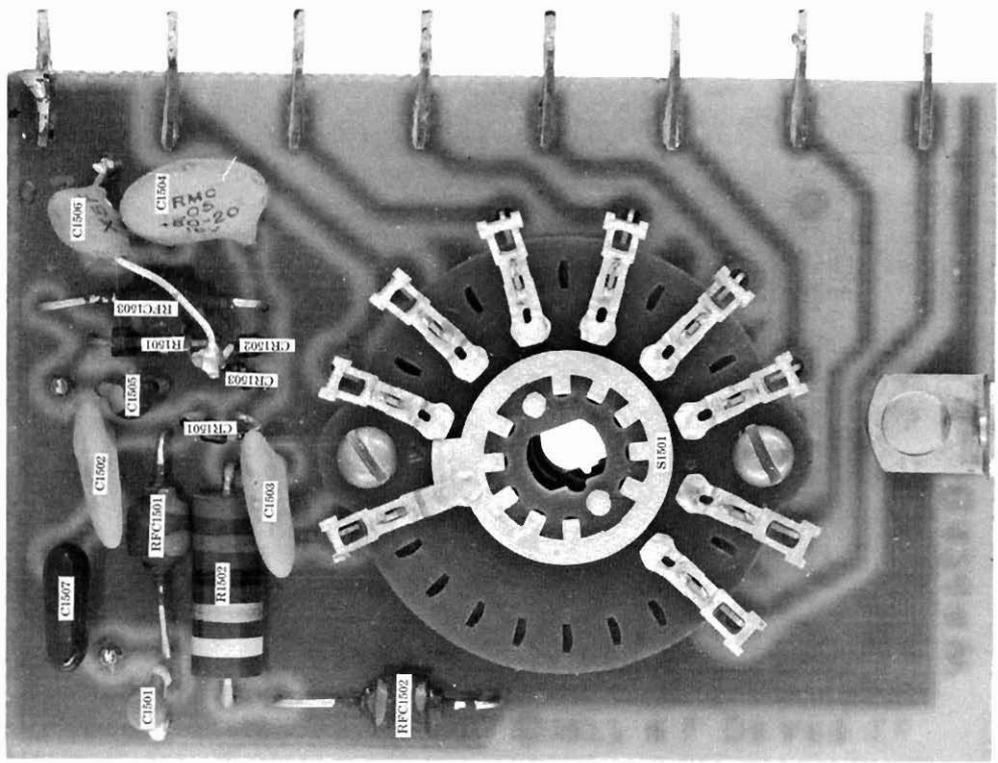
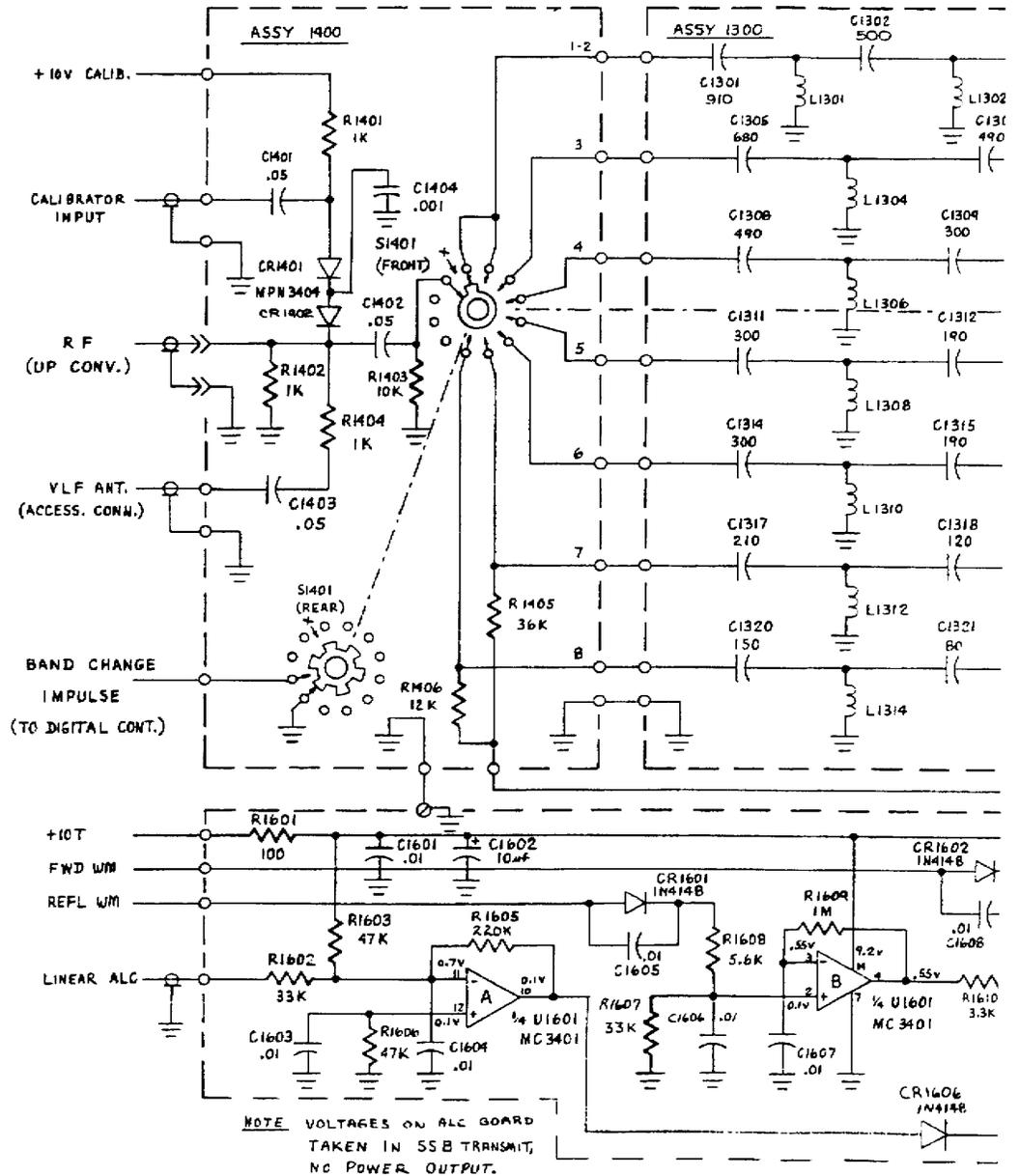


Fig. 2-31 High Pass Filter Switch Pictorial (Front & Rear)

C	1401 1603	1402 1604 1602	1605	1301 1305 1311 1317 1607	1302	1304 1315 1321
R	1402 1601 1401	1402 1404 1405	1607	1606 1306 1314 1320	1608	1312 1318 1608
L	1404 1602 1403 1606	1605		1609		1610
				1301 1306 1310 1314 1302		13
				1304 1304 1312		15



1321	1303	1307	1313	1319	1304	1611	1503	1505	1501	1504	
2. 1318	1605	1306	1609	1310	1316	1322	1610	1506	1502	1612	1507
1610	1611	1621	1612	1614	1615	1616	1617	1618	1619	1502	1504
02	1305	1309	1313	1303	1307	1311	1315	1501	1620	1504	

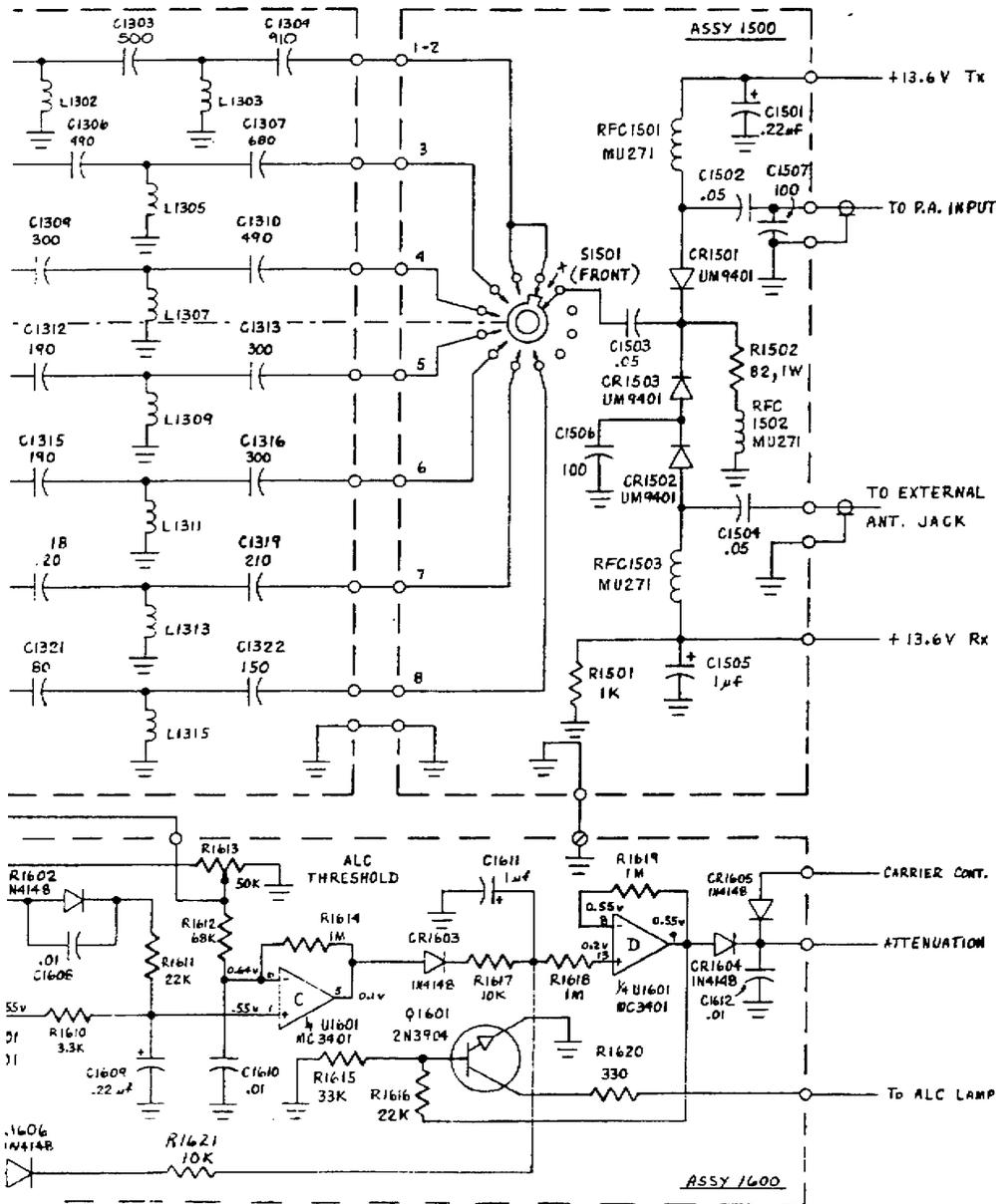


Fig. 2-32 High Pass Filter Module Schematic

#### 2-14. LOW-PASS FILTER MODULE

The Low-Pass Filter Module consists of four printed circuit boards: a front switch board (assembly 1900), a rear switch board (assembly 2000), and two filter boards (assemblies 1700 and 1800). The module provides low-pass filtering, relay switching and wattmeter functions. Refer to figure 2-36 for schematic and figures 2-33 through 2-35 for parts list information.

S1901 on the front switch board selects one of eight low-pass filters and connects the selected filter to the common of one section of K1901, which selects either the Power Amplifier output (in transmit) or the rear panel External Receiver jack (in receive). Other sections of K1901 provide linear amplifier and external receiver T/R switching, 13.6 VDC switching, and transmit-receive antenna isolation. K1901 is controlled by Q1901, which is turned on by +10T through R1901 and R1902. Note that if the P.A. disable connection is grounded, K1901 cannot be enabled. The P.A. disable line is grounded when the synthesizer is out of lock or when the R-7/RV-7 is in the SPOT mode, to prevent the transmission of spurious signals.

The two low-pass filter boards contain two section constant-k low-pass filters for each of eight bands. Each filter corresponds to one bandswitch position. The approximate cut-off frequencies of these filters are:

BAND	FREQUENCY RANGE	CUT-OFF FREQUENCY
1	1.5-2.0 MHz	2.2 MHz
2	2.0-3.0 MHz	3.3 MHz
3	3.0-4.5 MHz	5.0 MHz
4	4.5-7.0 MHz	7.8 MHz
5	7.0-10.0 MHz	11.0 MHz
6	10.0-15.0 MHz	16.5 MHz
7	15.0-22.0 MHz	24.0 MHz
8	22.0-30.0 MHz	40.0 MHz

On the rear switch board, S2001 selects one of the eight low-pass filter positions and routes the signal through wattmeter transformer T2001 to the rear panel ANT connector. Piston trimmer C1901 allows the wattmeter to be nulled into a 50 ohm non-reactive load. R2001 and R2002 are used to calibrate the forward and reflected wattmeter scales. Alignment of the wattmeter is covered in Section 3.

Note that the band one filter is not installed in a standard TR-7. Instead, the band one position is jumpered to the band two filter, which has an adequately low cut-off frequency to suppress the second harmonic of 1.8 MHz. If operation below 1.8 MHz is required, the band one filter must be installed to insure good harmonic suppression.

Removal of the Low-Pass Filter Module is accomplished in a manner similar to that described for the High-Pass Filter (Section 2-13). When reinstalling the bandswitch shaft, be sure to position the shaft grounding spring (located on the shield between the HPF and LPF) in such a manner to insure positive contact with the bandswitch shaft. In addition, do not force the switch shaft into the rotor or damage will result.

## TR-7 LOW PASS FILTER, BANDS 1 - 4

REF DES	DESCRIPTION	PART NO.
C1707	Capacitor, Mica, 910 pF $\pm$ 5%	3170545
C1708	Capacitor, Mica, 910 pF $\pm$ 5%	3170545
C1709	Capacitor, Mica, 910 pF $\pm$ 5%	3170545
C1710	Capacitor, Mica, 910 pF $\pm$ 5%	3170545
C1711	Capacitor, Mica, 330 pF $\pm$ 5%, DM-15	3170320
C1712	Capacitor, Mica, 330 pF $\pm$ 5%, DM-15	3170320
C1713	Capacitor, Mica, 360 pF $\pm$ 5%, DM-15	3170350
C1714	Capacitor, Mica, 910 pF $\pm$ 5%	3170545
C1715	Capacitor, Mica, 330 pF $\pm$ 5%, DM-15	3170320
C1716	Capacitor, Mica, 330 pF $\pm$ 5%, DM-15	3170320
C1717	Capacitor, Mica, 390 pF $\pm$ 5%, DM-15	3170370
C1718	Capacitor, Mica, 195 pF $\pm$ 5%, DM-20	3170200
C1719	Capacitor, Mica, 600 pF $\pm$ 5%, DM-19	3170480
C1720	Capacitor, Mica, 390 pF $\pm$ 5%, DM-15	3170370
L1703	Inductor, Toroid	2510011
L1704	Inductor, Toroid	2510011
C1705	Inductor, Toroid	2510012
L1706	Inductor, Toroid	2510012
L1707	Inductor, 1.99 $\mu$ H	3524051
L1708	Inductor, 1.99 $\mu$ H	3524051

## NOTES:

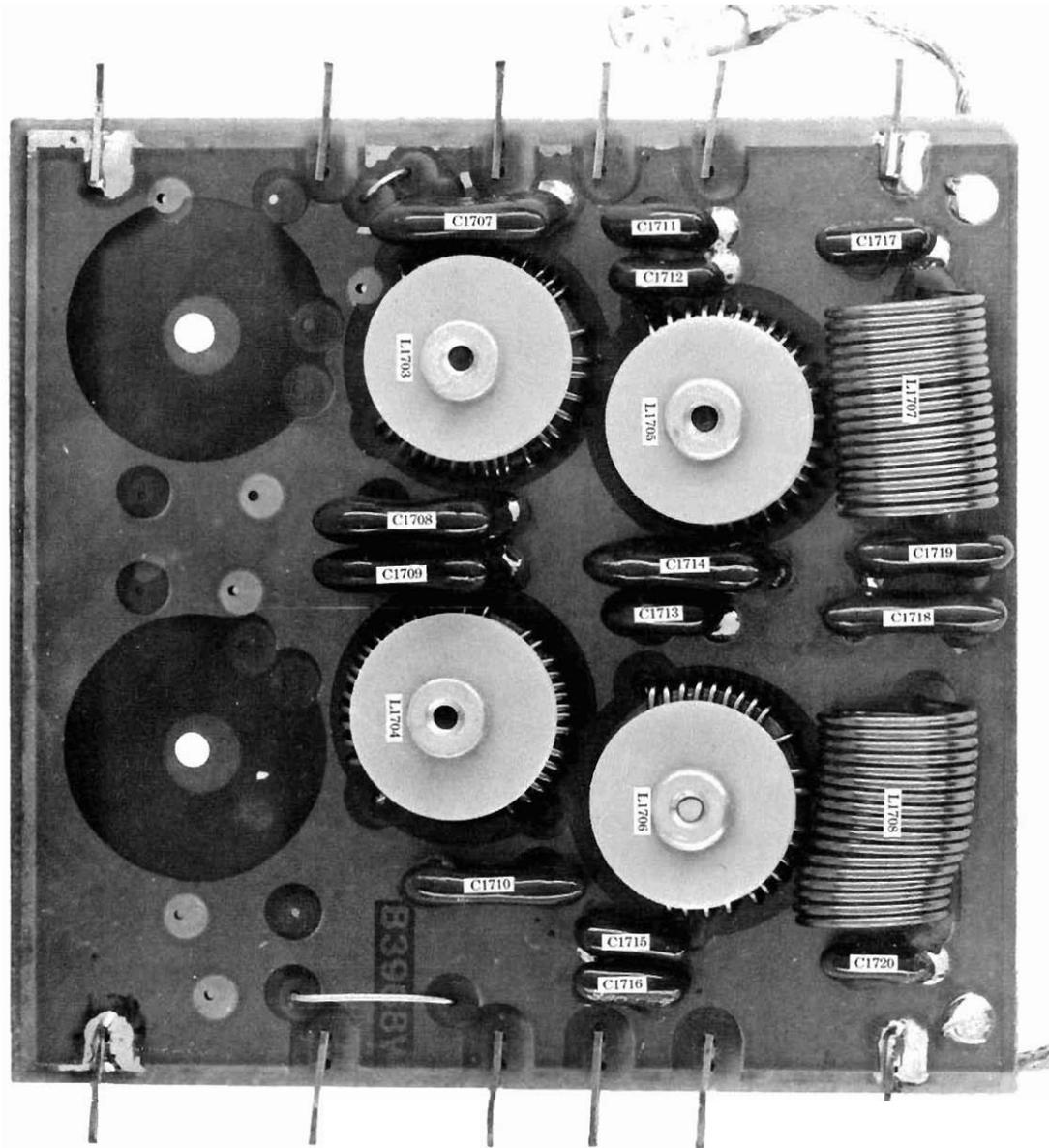


Fig. 2-33 Low Pass Filter Board Pictorial (Bands 1-4)

## TR-7 LOW PASS FILTER, BANDS 5 - 8

REF DES	DESCRIPTION	PART NO.
C1801	Capacitor, Mica, 130 pF $\pm$ 5%, DM-15	3170140
C1802	Capacitor, Mica, 165 pF $\pm$ 5%, DM-15	3170170
C1803	Capacitor, Mica, 330 pF $\pm$ 5%, DM-15	3170320
C1804	Capacitor, Mica, 250 pF $\pm$ 5%, DM-20	3170270
C1805	Capacitor, Mica, 165 pF $\pm$ 5%, DM-15	3170170
C1806	Capacitor, Mica, 130 pF $\pm$ 5%, DM-15	3170140
C1807	Capacitor, Mica, 190 pF $\pm$ 5%, DM-15	3170190
C1808	Capacitor, Mica, 180 pF $\pm$ 5%, DM-15	3170180
C1809	Capacitor, Mica, 190 pF $\pm$ 5%, DM-15	3170190
C1810	Capacitor, Mica, 190 pF $\pm$ 5%, DM-15	3170190
C1811	Capacitor, Mica, 125 pF $\pm$ 5%	3170135
C1812	Capacitor, Mica, 195 pF $\pm$ 5%, DM-20	3170200
C1813	Capacitor, Mica, 125 pF $\pm$ 5%	3170135
C1814	Capacitor, Mica, 80 pF $\pm$ 5%, DM-15	3170080
C1815	Capacitor, Mica, 165 pF $\pm$ 5%, DM-15	3170170
C1816	Capacitor, Mica, 80 pF $\pm$ 5%, DM-15	3170080
L1801	Inductor, 1.45 $\mu$ H	3524052
L1802	Inductor, 1.45 $\mu$ H	3524052
L1803	Inductor, .83 $\mu$ H	3524053
L1804	Inductor, .83 $\mu$ H	3524053
L1805	Inductor, .63 $\mu$ H	3524054
L1806	Inductor, .63 $\mu$ H	3524054
L1807	Inductor, .39 $\mu$ H	3524055
L1808	Inductor, .39 $\mu$ H	3524055

## NOTES:

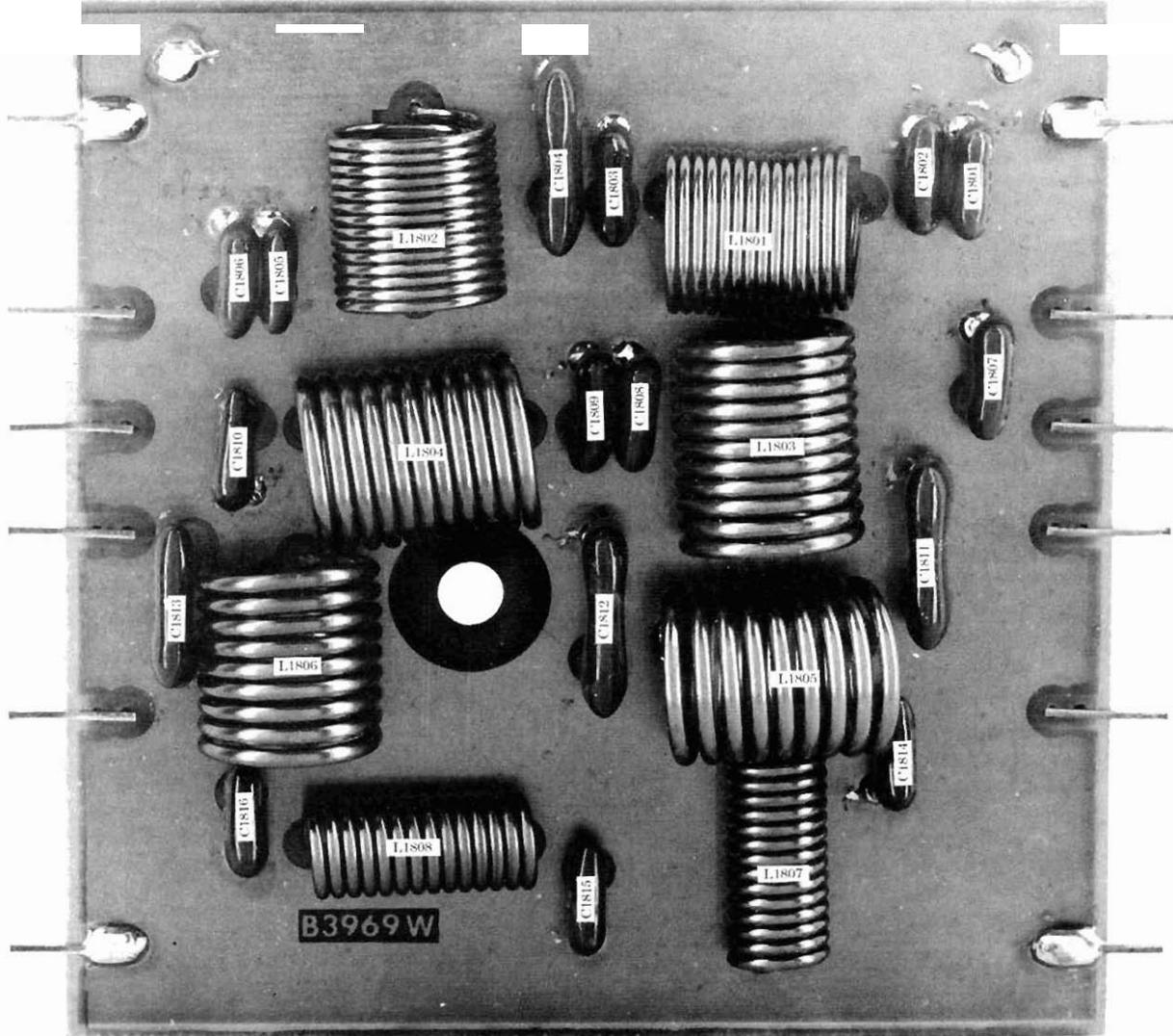


Fig. 2-34 Low Pass Filter Board Pictorial (Bands 5-8)

## TR-7 LOW PASS FILTER SWITCH, FRONT

REF DES	DESCRIPTION	PART NO.
C1903	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C1902	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
CR1901	Diode, 1N4005/8565	3020220
K1901	Relay VP4CAB/12, TRM	3620060
Q1901	Transistor, 2N3904	3030105
R1901	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R1902	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R1903	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
S1901	Wafer #5, Band Switch, TR-7	4660005

## TR-7 LOW PASS FILTER SWITCH, REAR

REF DES	DESCRIPTION	PART NO.
C2001	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2002	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2003	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2004	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C1901	Capacitor, Variable Trimmer, .5 - 5 pF	3205250
C2006	Capacitor, Disc, Solderin, 10%	3163070
CR2001	Diode, AA119/1N541	3020040
CR2002	Diode, AA119/1N541	3020040
R2001	Resistor, Variable, 30 K $\Omega$	3260145
R2002	Resistor, Variable, 30 K $\Omega$	3260145
R2003	Resistor, Carbon Film, 68 $\Omega$ $\pm$ 5%, 1/4 W	3220045
RFC2001	Choke Assy., 270 $\mu$ F, MUD271	3520590
S2001	Wafer #6, Band Switch, TR-7	4660006
T2001	Transformer, Toroid	2510041

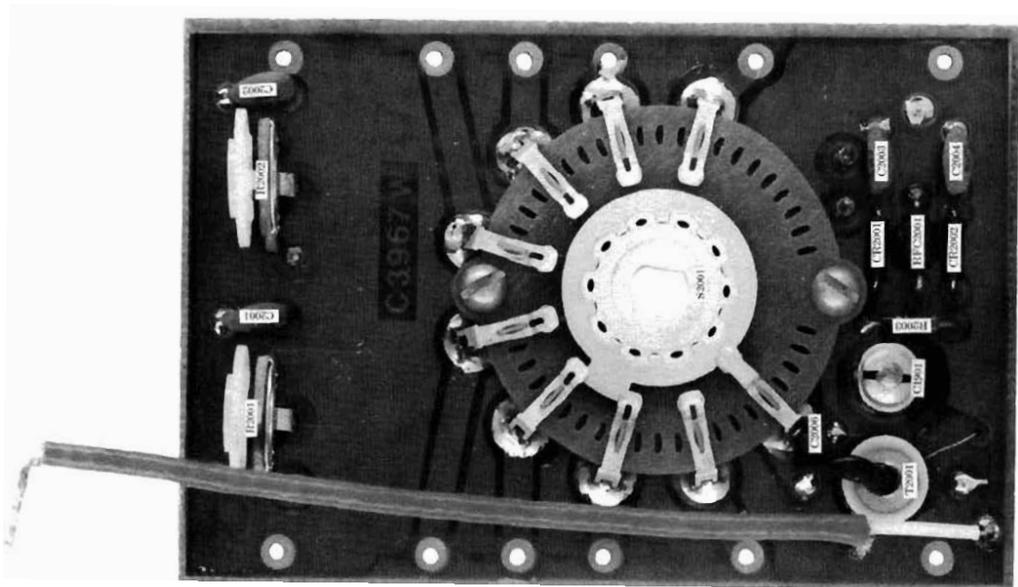
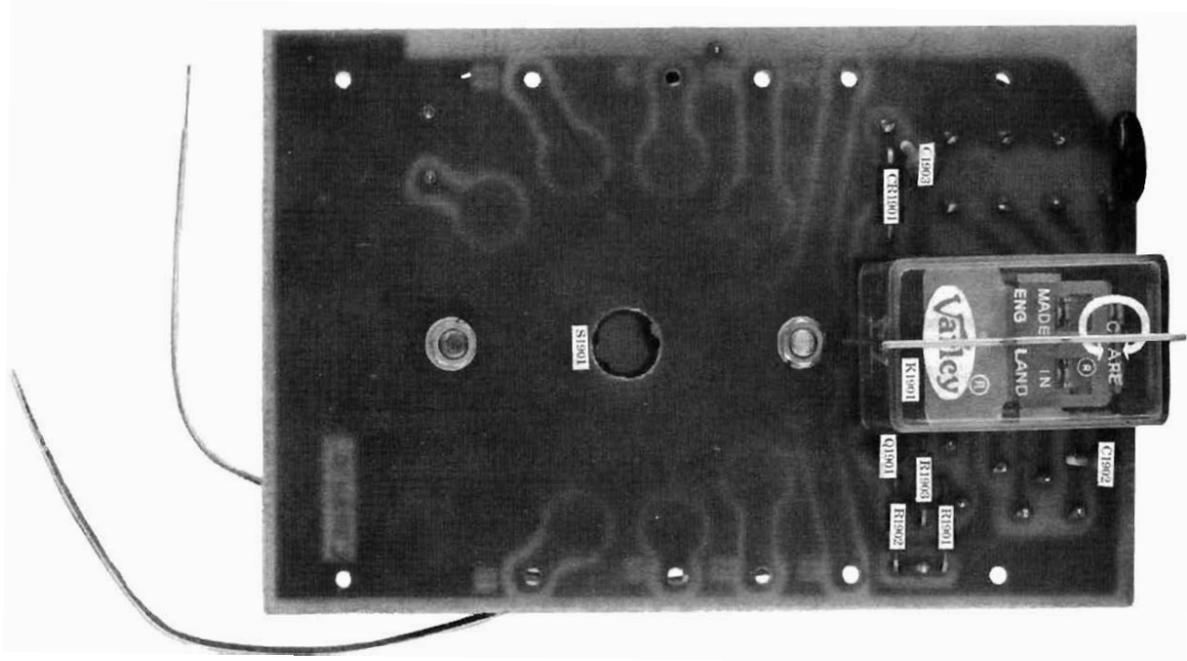
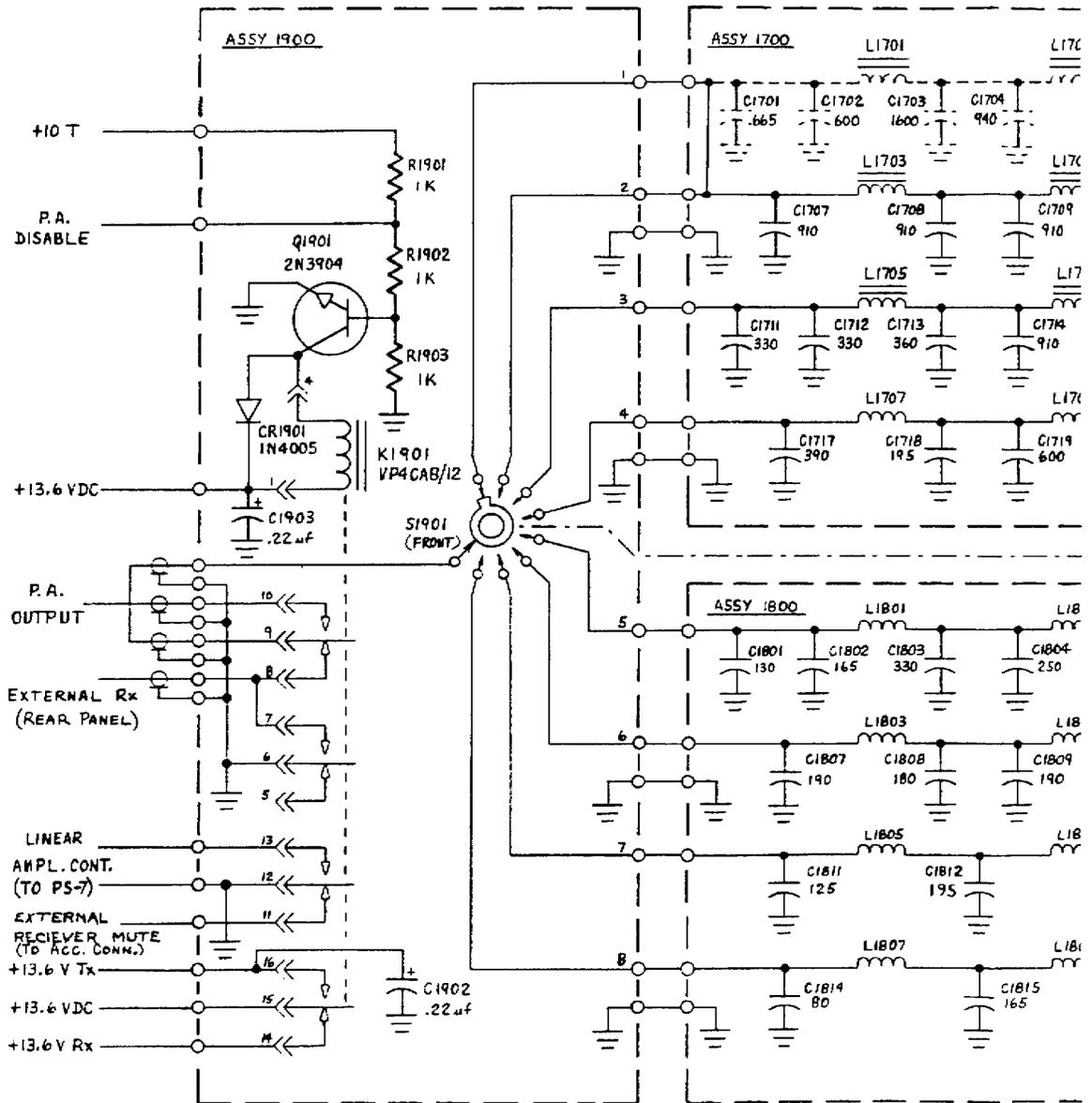


Fig. 2-35 Low Pass Filter Switch Pictorial (Front & Rear)

C	1903	1902	1701 1707 1702 1801 1811 1802 1703 1713 1704 1714 1803 1812 1804 1711 1717 1712 1807 1808	1701 1705 1801 1805	1702 1706 1703 1707 1803 1807	1704 1708 1709 1719 1808 1815 1809 1712
R		1901 1903				
L						

NOTE: BAND 1 FILTER IS OPTIONAL FOR OPERATION BELOW 1.8MHz.



41705 1710 1706 1805 1813 1806	2003	2004	1901	2001
A 1115 1720 1716 1810 1816			2006	2002
	2004		2003	2001
				2002

NAL  
8MHz.

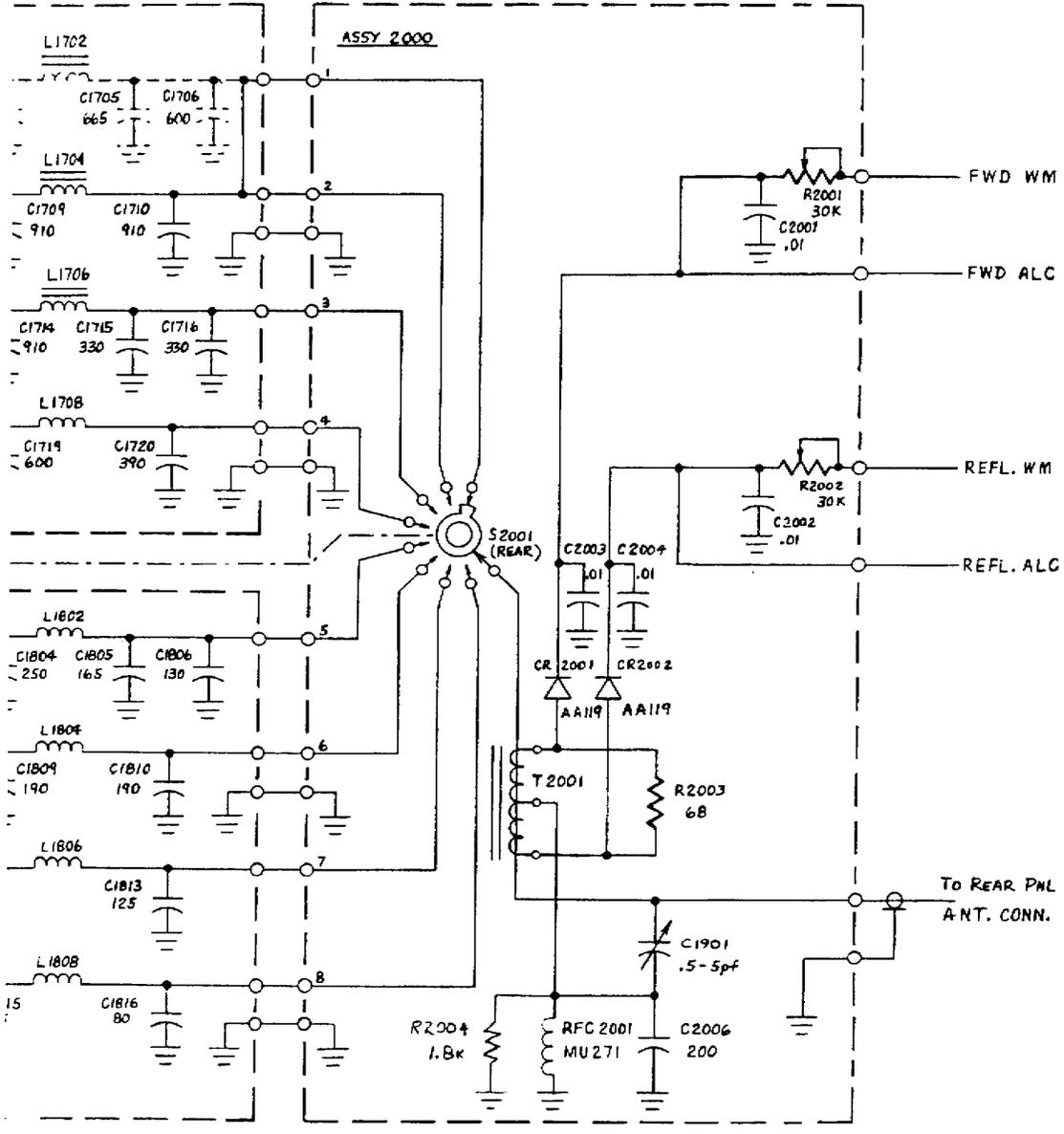


Fig. 2-36 Low Pass Filter Module Schematic

## 2-15. ALC BOARD

The ALC Board amplifies and combines the forward wattmeter, reflected wattmeter and linear amplifier ALC outputs, and provides an output for controlling the variable attenuator on the 2nd IF/Audio Board (Section 2-11). This circuitry thus controls the drive to the final amplifier, preventing flattopping and providing VSWR protection. Refer to Section 2-13 for schematic and parts list information.

In transmit, the forward wattmeter output is routed through CR1602 and R1611 to the non-inverting input of section C of the quad comparator U1601. Sections A and B of U1601 are operated as amplifiers, and are used to amplify and sum the reflected wattmeter and linear amplifier ALC outputs. Note that the linear amplifier ALC input is inverted to accommodate the conventional negative-going control voltage developed by most amplifiers.

The output of U1601B is summed with the forward wattmeter output through R1610. The result is a gain control signal representing forward power, VSWR (reflected power) and linear amplifier drive level at the non-inverting input of section C of U1601. R1613 sets a threshold on the inverting

input of this comparator, and when the drive controlling signal exceeds this threshold, a positive voltage is developed at the output. The threshold is set for the desired power output into a non-reactive 50 ohm load (the adjustment procedure is detailed in Section 3). Thus, as the reflected power increases (VSWR increases) or as the linear amplifier develops ALC output, the output of comparator U1601C becomes higher.

CR1603, R1617 and R1618, and C1611 form a fast attack, slow decay time constant to smooth rapid variations in the control voltage due to speech waveform variations. U1601D is used as a buffer, the output of which is routed through CR1604 to the variable attenuator. Voltage from the front panel CARRIER control is routed to this same point via CR1605 in the AM and CW modes. This arrangement allows the highest voltage to control the drive level, thus making the CARRIER control ineffective once ALC threshold has been reached.

Q1601 samples the ALC control voltage through R1616, and turns on the front panel ALC LED when the ALC system is in operation.

## NOTES:

**2-16. POWER SUPPLY BOARD**

The Power Supply Board provides +10, +5, +24 VDC regulated and -5 VDC unregulated. In addition, it provides the fixed passband tuning DC voltages for AM, RTTY, CW, LSB and USB. Refer to figure 2-38 for schematic and figure 2-37 for parts list information.

Unregulated 11-16 volts DC is applied to pin 9. Q2101, Q2102 and U2101 create the 10 volt regulator circuit from which all other voltages are derived. Q2101 is the pass transistor while Q2102 provides the base drive boost from U2101 to Q2101. R2109 and R2110 provide short circuit sensing. If the +10 VDC buss is shorted to ground the voltage drop across R2109 and R2110 increases. At 0.7 VDC, Q2103 turns on which forces U2101 to clamp the drive to Q2102 which in turn holds Q2101 at a fixed output of 5 amperes maximum short circuit current.

R2111, R2103, CR2101, and R2102 provide the error voltage feedback path to allow U2101 to maintain +10 VDC out. CR2101 is for temperature compensation. As the output line changes, the above components form a voltage divider network which allows U2101 to compare an internal reference of

approximately 7 VDC to the error voltage from R2103. +10 VDC output is on pin 10. +5 VDC regulated is provided by U2102 and is derived from the +10 VDC line. +5 VDC output is on pin 11.

The +24 VDC regulated and -5 VDC unregulated supplies are created by a DC to DC inverter circuit. Q2104 and Q2105 comprise an astable multivibrator which drives T2101 at approximately 23 kHz. Approximately 35 VDC is formed from the full wave bridge of CR2102 through CR2105. This DC voltage is filtered and applied to U2103 which provides regulated +24 VDC at pin 2. Simultaneously, -5 VDC is generated by a half wave rectifier CR2106, filtered and applied to pin 1.

The power supply board also contains voltage divider networks for the fixed passband tuning control lines. An adjustable divider is provided for each mode as follows:

MODE	DIVIDER NETWORK	OUTPUT PIN
AM	R2112, R2113, R2114	4
RTTY	R2115, R2116, R2117	5
CW	R2118, R2119, R2120	6
LSB	R2121, R2122, R2123	7
USB	R2124, R2125, R2126	8

Proper adjustment of these divider networks is covered in Section 3.

**NOTES:**

## TR-7 POWER SUPPLY ASSEMBLY

REF DES	DESCRIPTION	PART NO.
C2101	Capacitor, Electrolytic, 22 $\mu$ F $\pm$ 10%, 16 V	3180105
	DELETED	
C2103	Capacitor, Electrolytic, 10 $\mu$ F $\pm$ 10%, 25 V	3180062
C2104	Capacitor, Electrolytic, 10 $\mu$ F $\pm$ 10%, 25 V	3180062
C2105	Capacitor, Film, .022 $\mu$ F $\pm$ 5%, 100 V	3184042
C2106	Capacitor, Film, .022 $\mu$ F $\pm$ 5%, 100 V	3184042
C2107	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2108	Capacitor, Electrolytic, Axial, 220 $\mu$ F & 16	3180212
C2109	Capacitor, Tantalum, 1 $\mu$ F $\pm$ 10%, 35 V	3183010
C2110	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 10%, 50 V	3180008
C2111	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2112	Capacitor, Electrolytic, 10 $\mu$ F $\pm$ 10%, 25 V	3180062
C2113	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2114	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2115	Capacitor, Disc, .05 $\mu$ F + 80%, Z5U	3161630
C2116	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2117	Capacitor, Disc, .05 $\mu$ F + 80%, Z5U	3161630
CR2101	Diode, 1N4148	3020090
CR2102	Diode, 1N4148	3020090
CR2103	Diode, 1N4148	3020090
CR2104	Diode, 1N4148	3020090
CR2105	Diode, 1N4148	3020090
CR2106	Diode, 1N4148	3020090
Q2101	Transistor, 2N5986	3030205
Q2102	Transistor, 2N3904	3030105
Q2103	Transistor, 2N4125	3030110
Q2104	Transistor, TIP31	3030369
Q2105	Transistor, TIP31	3030369
R2101	Resistor, Carbon Film, 1.5 K $\Omega$ $\pm$ 5%, 1/4 W	3220175
R2102	Resistor, Carbon Film, 3.3 K $\Omega$ $\pm$ 5%, 1/4 W	3220200
R2103	Resistor, Variable, 1 K $\Omega$	3260655
R2104	Resistor, Carbon Film, 220 $\Omega$ $\pm$ 5%, 1/4 W	3220075
R2105	Resistor, Composition, 68 $\Omega$ $\pm$ 10%, 1/2 W	3230105
R2106	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R2107	Resistor, Composition, 100 $\Omega$ $\pm$ 10%, 1/2 W	3230115
R2108	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R2109	Resistor, Wire Wound, .27 $\Omega$ $\pm$ 5%, 1 W	3250025
R2110	Resistor, Wire Wound, .27 $\Omega$ $\pm$ 5%, 1 W	3250025
R2111	Resistor, Carbon Film, 1.5 K $\Omega$ $\pm$ 5%, 1/4 W	3220175
R2112	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R2113	Resistor, Variable, 10 K $\Omega$	3260666
R2114	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R2115	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R2116	Resistor, Variable, 10 K $\Omega$	3260666
R2117	Resistor, Carbon Film, 18 K $\Omega$ $\pm$ 5%, 1/4 W	3220255
R2118	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R2119	Resistor, Variable, 10 K $\Omega$	3260666
R2120	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R2121	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R2122	Resistor, Variable, 10 K $\Omega$	3260666
R2123	Resistor, Carbon Film, 12 K $\Omega$ $\pm$ 5%, 1/4 W	3220240
R2124	Resistor, Carbon Film, 12 K $\Omega$ $\pm$ 5%, 1/4 W	3220240

REF DES	DESCRIPTION	PART NO.
R2125	Resistor, Variable, 10 K $\Omega$	3260666
R2126	Resistor, Carbon Film, 8.2 K $\Omega$ $\pm$ 5%	3220230
R2127	Resistor, Composition, 1.0 K $\Omega$ $\pm$ 5%, 1/2 W	3230180
R2128	Resistor, Composition, 1.0 K $\Omega$ $\pm$ 5%, 1/2 W	3230180
R2129	Resistor, Composition, 15 K $\Omega$ $\pm$ 10%, 1/2 W	3230070
R2130	Resistor, Composition, 15 $\Omega$ $\pm$ 10%, 1/2 W	3230070
R2131	Resistor, Carbon Film, 2.7 K $\Omega$ $\pm$ 5%, 1/4 W	3220195
R2132	Resistor, Carbon Film, 510 $\Omega$ $\pm$ 5%, 1/4 W	3220115
RFC2101	Choke Assy.	2512506
RFC2102	Choke Assy., 5.6 $\mu$ H, L56G	3520510
T2101	Transformer	2512001
U2101	I.C., MC1723CP	3040100
U2102	I.C., MC7805CP	3040160
U2103	I.C., MC78L24AC	3040103

## NOTES:

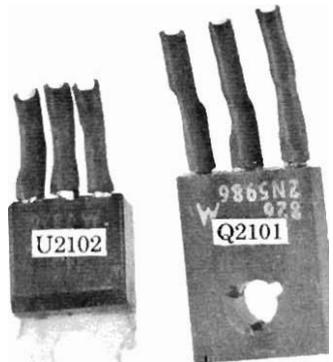
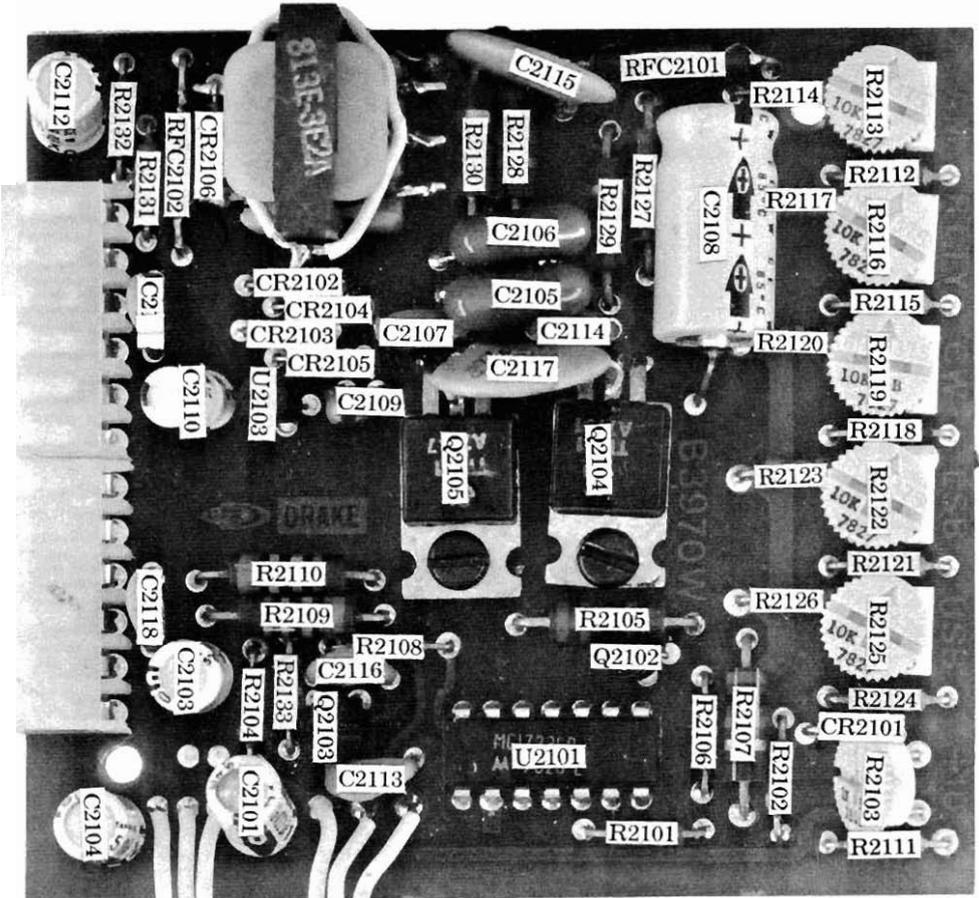
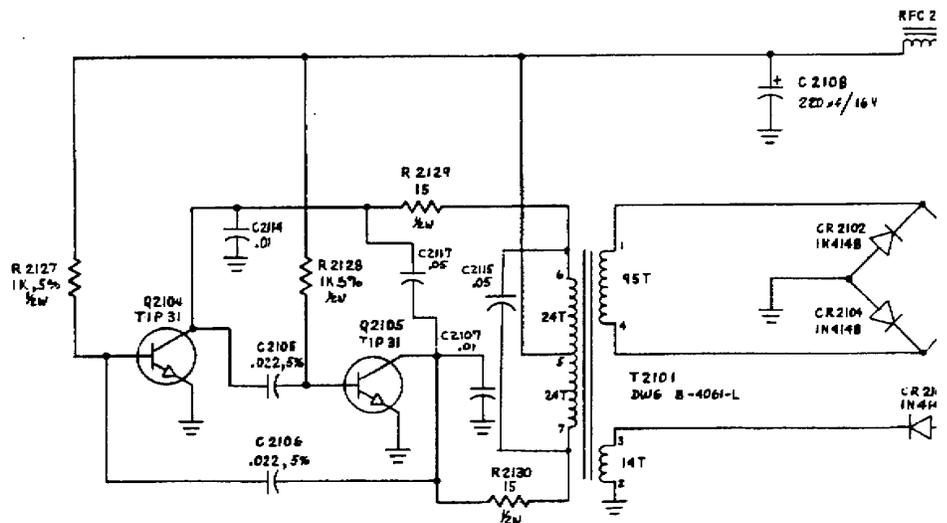
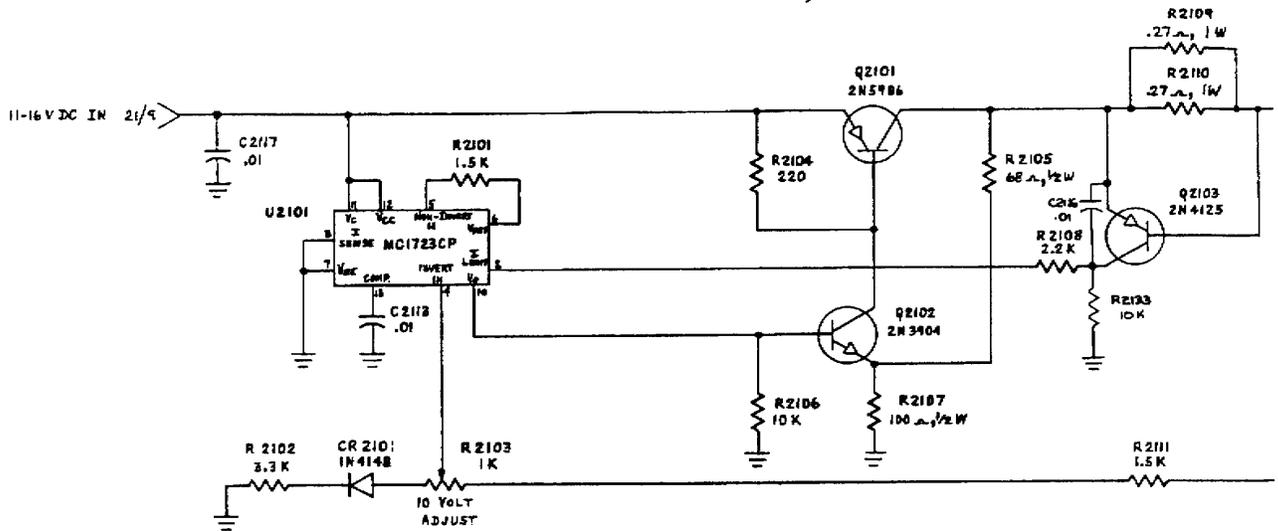


Fig. 2-37 Power Supply Board Pictorial

C	2117	2113	2104	2105	2106	2117	2107	2115	2108	2116	2104	2110
R	2102	2127	2103	2101	2128	2104	2106	2129	2105	2108	2133	2111



NOTE

ALL RESISTORS 1/2 W, ± 10% UNLESS NOTED OTHERWISE.

2109	2101	2110	2111	2103
2112	2115	2118	2121	2124
2113	2116	2119	2122	2125
2114	2117	2120	2123	2126

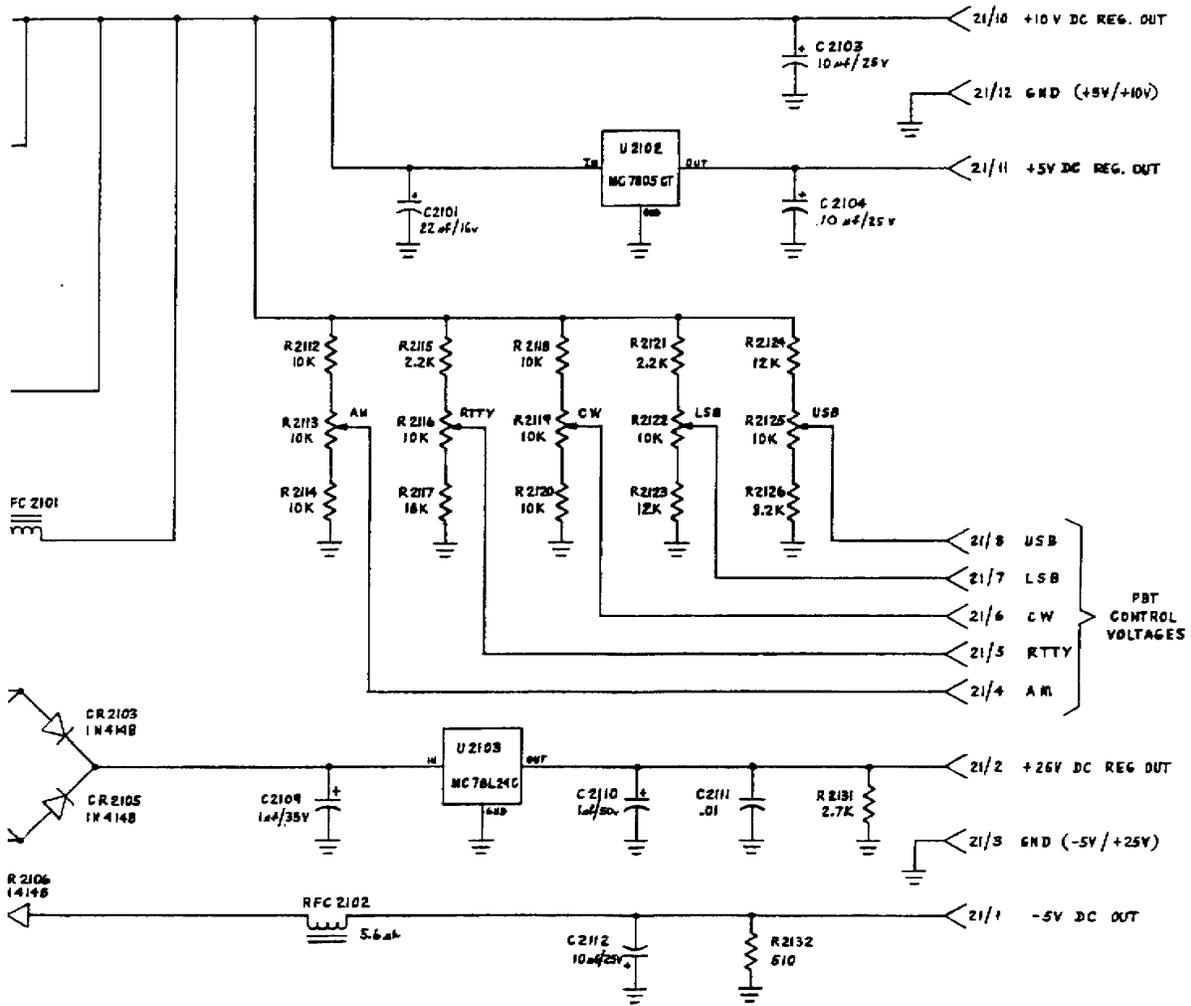


Fig. 2-38 Power Supply Board Schematic

## 2-17. POWER AMPLIFIER MODULE

The Power Amplifier Module consists of two printed circuit boards; a predriver board (assembly 2200) and a power amplifier board (assembly 2300). The module will be equipped with one of two different predriver boards. Refer to figures 2-39 and 2-40 to identify the version installed in the unit being serviced. For predriver board #1, refer to figures 2-39 and 2-41 for schematic and parts identification information. This data is contained in figure 2-40 for predriver board #2. Power amplifier board schematic and parts identification information is shown in figures 2-39 and 2-42.

In the case of predriver board #1, transmit signals from the HPF Module are applied to Q2201 via an impedance stabilizing pad consisting of R2204, R2205 and R2206. R2227 allows the gain of Q2201 to be adjusted, providing gain control for the PA Module. The output of Q2201 is matched by trifilar transformer T2201 to the base of Q2202. The output of Q2202 drives Q2203, the collector of which is connected to the output of the predriver board. U2201, a 5 VDC regulator, is biased by R2201 and R2202 to provide a regulated 8 VDC source for biasing Q2201, Q2202 and Q2203 for class A operation to insure linearity. All B+ for the predriver board is obtained from the switched 13.6 VDC line, which is generated by the relay on the LPF Module (Section 2-14).

For predriver board #2, transmit signals from the HPF Module are applied to Q2201 via an impedance stabilizing pad consisting of R2205, R2207 and R2208. R2210 adjusts the gain of this stage, thus providing gain control for the PA Module. The output of Q2201 is matched by bifilar transformer T2201 to the base of Q2202. This stage amplifies the transmit signal to a level sufficient to drive the power amplifier. Q2202 is biased by CR2203, which is mounted on the heat sink for Q2202 to prevent

thermal runaway. All B+ for the predriver board is obtained from the switched 13.6 VDC line, which is generated by the relay on the LPF Module (Section 2-14).

The output of the predriver board is connected to T2301 on the power amplifier board. C2301, L2301 and R2301 form a frequency compensation network to provide gain flatness across the operating range. T2301 matches the input of the power amplifier board to the bases of driver transistors Q2301 and Q2302. The driver stage operates in push-pull, and is matched to the power amplifier stage by T2303. B+ is fed to the driver collectors through bifilar transformer T2302 to insure good balance. Q2303 and Q2304 form the push-pull power output stage. Each transistor is heavily swamped at the input and provided with low frequency inverse feedback to insure low frequency stability. The output of the power amplifier is matched to the 50 ohm input of the LPF Module by T2304.

Bias for the driver and power amplifier stages is derived from the switched 13.6 VDC line via 5 VDC regulator U2301. Driver bias is determined by the network consisting of Q2305, Q2306 and associated components. Both bias networks track the temperature of the power amplifier to prevent thermal runaway. B+ is present at all times on the collectors of the drivers and power amplifiers because the high currents involved are difficult to switch. No current is drawn in receive, however, because the bias for these stages is switched off.

Adjustment of the Power Amplifier Module is covered in Section 3. It is very important to note that the power amplifier board must be mounted on the heat sink for even the briefest periods of test or operation. Operation without the heat sink will result in damage to the power devices on this board.

## TR-7 PREDRIVER BOARD #1

REF DES	DESCRIPTION	PART NO.
C2201	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C2202	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C2203	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2204	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2205	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2206	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2207	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C2208	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C2209	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C2210	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C2211	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2212	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2213	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2214	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2215	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2216	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C2217	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2218	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2219	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2220	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2221	Capacitor, Disc, .0015 $\mu$ F $\pm$ 20%, Z5U	3161420
CR2201	Diode, 1N4005	3020220
CR2202	Diode, 1N4005	3020220
L2201	Ferrite Bead - 3 on #22 Solid Tinned Wire	3523205
L2202	Ferrite Bead - 3 on #22 Solid Tinned Wire	3523205
L2203	NOT USED	
L2204	Inductor, Toroid	2510008
L2205	Ferrite Bead - 3 on #22 Solid Tinned Wire	3523205
L2206	NOT USED	
L2207	Inductor, Toroid	2510008
Q2201	Transistor, 2N3563	3030060
Q2202	Transistor, SRF2281	3030295
Q2203	Transistor, SRF2281	3030295
R2201	Resistor, Carbon Film, 150 $\Omega$ $\pm$ 5%, 1/4 W	3220065
R2202	Resistor, Carbon Film, 330 $\Omega$ $\pm$ 5%, 1/4 W	3220090
R2203	Resistor, Carbon Film, 5.6 K $\Omega$ $\pm$ 5%, 1/4 W	3220215
R2204	Resistor, Carbon Film, 10 $\Omega$ $\pm$ 5%, 1/4 W	3220005
R2205	Resistor, Carbon Film, 470 $\Omega$ $\pm$ 5%, 1/4 W	3220110
R2206	Resistor, Carbon Film, 470 $\Omega$ $\pm$ 5%, 1/4 W	3220110
R2207	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R2208	Resistor, Carbon Film, 330 $\Omega$ $\pm$ 5%, 1/4 W	3220090
R2209	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R2210	Resistor, Carbon Film, 5.1 $\Omega$ $\pm$ 5%, 1/4 W	3220003
R2211	Resistor, Carbon Film, 10 $\Omega$ $\pm$ 5%, 1/4 W	3220005
R2212	Resistor, Carbon Film, 22 $\Omega$ $\pm$ 5%, 1/4 W	3220015
R2213	Resistor, Carbon Film, 270 $\Omega$ $\pm$ 5%, 1/4 W	3220085
R2214	Resistor, Carbon Film, 270 $\Omega$ $\pm$ 5%, 1/4 W	3220085
R2215	Resistor, Carbon Film, 4.7 K $\Omega$ $\pm$ 5%, 1/4 W	3220210
R2216	Resistor, Carbon Film, 5.6 K $\Omega$ $\pm$ 5%, 1/4 W	3220215
R2217	Resistor, Carbon Film, 330 $\Omega$ $\pm$ 5%, 1/4 W	3220090
R2218	Resistor, Carbon Film, 39 $\Omega$ $\pm$ 5%, 1/4 W	3220030

REF DES	DESCRIPTION	PART NO.
R2219	Resistor, Carbon Film, 5.1 $\Omega \pm 5\%$ , 1/4 W	3220003
R2220	Resistor, Carbon Film, 820 $\Omega \pm 5\%$ , 1/4 W	3220145
R2221	Resistor, Carbon Film, 820 $\Omega \pm 5\%$ , 1/4 W	3220145
R2222	Resistor, Carbon Film, 820 $\Omega \pm 5\%$ , 1/4 W	3220145
R2223	Resistor, Carbon Film, 330 $\Omega \pm 5\%$ , 1/4 W	3220090
R2224	Resistor, Carbon Film, 560 $\Omega \pm 5\%$ , 1/4 W	3220125
R2225	Resistor, Carbon Film, 330 $\Omega \pm 5\%$ , 1/4 W	3220145
R2226	Resistor, Carbon Film, 5.1 $\Omega \pm 5\%$ , 1/4 W	3220003
R2227	Resistor, Variable, 500 $\Omega$	3260650
RFC2201	Choke Assy.	2512506
RFC2202	Choke Assy.	2512506
T2201	Inductor, Toroid	2510009
U2201	I.C., 78L05ACP	3040030

## NOTES:

## TR-7 PREDRIVER BOARD #2

REF DES	DESCRIPTION	PART NO.
C2201	Capacitor, Electrolytic, 10 $\mu$ F @ 25 V, Axial	3180060
C2202	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2203	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2204	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2205	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2206	Capacitor, Disc, 68 pF $\pm$ 5%, N750	3160990
C2207	Capacitor, Electrolytic, 10 $\mu$ F $\pm$ 20%, 25 V	3180062
C2208	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2209	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2210	Capacitor, Disc, .01 $\mu$ F + 80%, M25V	3161500
C2211	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
CR2201	Diode, 1N4148	3020090
CR2202	Diode, 1N4148	3020090
CR2203	Diode, 1N4005/B5G5	3020220
Q2201	Transistor, MPSH20	3030293
Q2202	Transistor, MRF476	3030301
R2201	Resistor, Carbon Film, 3.3 K $\Omega$ $\pm$ 5%, 1/4 W	3220200
R2202	Resistor, Carbon Film, 330 $\Omega$ $\pm$ 5%, 1/4 W	3220090
R2203	Resistor, Carbon Film, 510 $\Omega$ $\pm$ 5%, 1/4 W	3220115
R2204	Resistor, Carbon Film, 1.5 $\Omega$ $\pm$ 5%, 1/2 W	3230005
R2205	Resistor, Carbon Film, 10 $\Omega$ $\pm$ 5%, 1/4 W	3220005
R2206	Resistor, Carbon Film, 1 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R2207	Resistor, Carbon Film, 430 $\Omega$ $\pm$ 5%, 1/4 W	3220105
R2208	Resistor, Carbon Film, 430 $\Omega$ $\pm$ 5%, 1/4 W	3220105
R2209	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R2210	Resistor, Variable, 100 $\Omega$	3260685
R2211	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R2212	Resistor, Carbon Film, 270 $\Omega$ $\pm$ 5%, 1/4 W	3220085
R2213	Resistor, Carbon Film, 270 $\Omega$ $\pm$ 5%, 1/4 W	3220085
R2214	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
RFC2201	Choke Assy., L56G, 5.6 $\mu$ H	3520510
RFC2202	Choke Assy., L56G, 5.6 $\mu$ H	3520510
RFC2203	Choke Assy., L56G, 5.6 $\mu$ H	3520510
T2201	Inductor, Toroid	2510032

## TR-7 POWER AMPLIFIER BOARD

REF DES	DESCRIPTION	PART NO.
C2301	Capacitor, Mica, 100 pF $\pm$ 5%, DM-15	3161680
C2302	Capacitor, Mica, 500 pF $\pm$ 10%, DM-15	3170420
C2303	Capacitor, Mica, 100 pF $\pm$ 5%, DM-15	3161680
C2304	Capacitor, Mica, 500 pF $\pm$ 10%, DM-15	3170420
C2305	Capacitor, Mica, 100 pF $\pm$ 5%, DM-15	3161680
C2306	Capacitor, Mica, 810 pF $\pm$ 1%, DM-19	3170520
C2307	Capacitor, Disc, .05 $\mu$ F + 80%, Z5U	3161630
C2308	Capacitor, Disc, .05 $\mu$ F + 80%, Z5U	3161630
C2309	Capacitor, Mica, 500 pF $\pm$ 10%, DM-15	3170420
C2310	Capacitor, Mica, 500 pF $\pm$ 10%, DM-15	3170420
C2311	Capacitor, Electrolytic, 10 $\mu$ F $\pm$ 20%	3180062
C2312	Capacitor, Electrolytic, 10 $\mu$ F $\pm$ 20%	3180062
C2313	Capacitor, Disc, .05 $\mu$ F + 80%, Z5U	3161630
C2314	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C2315	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C2316	Capacitor, Electrolytic, 10 $\mu$ F $\pm$ 20%, 25 V	3180065
C2318	Capacitor, Disc, .05 $\mu$ F + 80%, Z5U	3161630
C2319	Capacitor, Electrolytic, 220 $\mu$ F, 16 V	3180212
C2320	Capacitor, Mica, 300 pF $\pm$ 5%, DM-20	3170310
C2321	Capacitor, Mica, 300 pF $\pm$ 5%, DM-20	3170310
C2322	Capacitor, Disc, .05 $\mu$ F + 80%, Z5U	3161630
C2323	Capacitor, Disc, .1 $\mu$ F $\pm$ 20%, 16 V	3161680
C2325	Capacitor, Disc, .05 $\mu$ F + 80%, Z5U	3161630
C2326	Capacitor, Electrolytic, 100 $\mu$ F, 16 V	3180148
C2327	Capacitor, Mica, 500 pF $\pm$ 10%, DM-15	3170420
C2328	Capacitor, Mica, 1000 pF $\pm$ 2%, DM-20	3170570
L2301	Inductor, Toroid	2510001
L2302	2 Ferrite Beads	3523205
L2303	NOT USED	
L2304	3 Ferrite Beads	3523205
L2305	3 Ferrite Beads	3523205
L2306	NOT USED	
L2307	Inductor, Toroid	2510001
L2308	Inductor, Toroid	2510001
Q2301	Transistor, SRF2338	3030299
Q2302	Transistor, SRF2338	3030299
Q2303	Transistor, SRF2337	3030298
Q2304	Transistor, SRF2337	3030298
Q2305	Transistor, EP487	3030260
Q2306	Transistor, EP487	3030260
R2301	Resistor, Carbon Film, 22 $\Omega$ $\pm$ 5%, 1/4 W	3220015
R2302	Resistor, Wire Wound, .15 $\Omega$ $\pm$ 10%, 2 W	3250010
R2303	Resistor, Composition, 47 $\Omega$ $\pm$ 10%, 1/2 W	3230090
R2304	Resistor, Wire Wound, .82 $\Omega$ $\pm$ 10%, 2 W	3250030
R2305	Resistor, Composition, 82 $\Omega$ $\pm$ 10%, 1/2 W	3230110
R2306	Resistor, Wire Wound, 3.9 $\Omega$ $\pm$ 5%, 5 W	3250090
R2307	Resistor, Carbon Film, 33 $\Omega$ $\pm$ 5%, 1/4 W	3220025
R2308	Resistor, Composition, 100 $\Omega$ $\pm$ 10%, 1/2 W	3230115
R2309	Resistor, Composition, 10 $\Omega$ $\pm$ 10%, 1/2 W	3230065
R2310	Resistor, Composition, 100 $\Omega$ $\pm$ 10%, 1/2 W	3230115
R2311	Resistor, Composition, 10 $\Omega$ $\pm$ 10%, 1/2 W	3230065

REF DES	DESCRIPTION	PART NO.
R2312	Resistor, Composition, $15 \Omega \pm 10\%$ , 2 W	3240300
R2313	Resistor, Carbon Film, $100 \Omega \pm 5\%$ , 1/4 W	3220055
R2314	Resistor, Carbon Film, $100 \Omega \pm 5\%$ , 1/4 W	3220055
R2315	Resistor, Composition, $2 \Omega \pm 5\%$ , 1/2 W	3230010
R2316	Resistor, Composition, $2 \Omega \pm 5\%$ , 1/2 W	3230010
R2317	Resistor, Composition, $15 \Omega \pm 10\%$ , 1 W	3240010
R2318	Resistor, Composition, $150 \Omega \pm 10\%$ , 2 W	3240320
R2319	Resistor, Composition, $150 \Omega \pm 10\%$ , 2 W	3240320
RFC2301	Choke Assy., Wide Band	2512525
RFC2302	Choke Assy., Wide Band	2512525
RFC2303	Choke Assy.	3524080
T2301	Transformer, PA Input	2512109
T2302	Transformer, Toroid	2510013
T2303	Transformer, PA Driver	2512108
T2304	Transformer, PA Output	2512107
U2301	I.C., MC7805CP	3040160

**NOTES:**

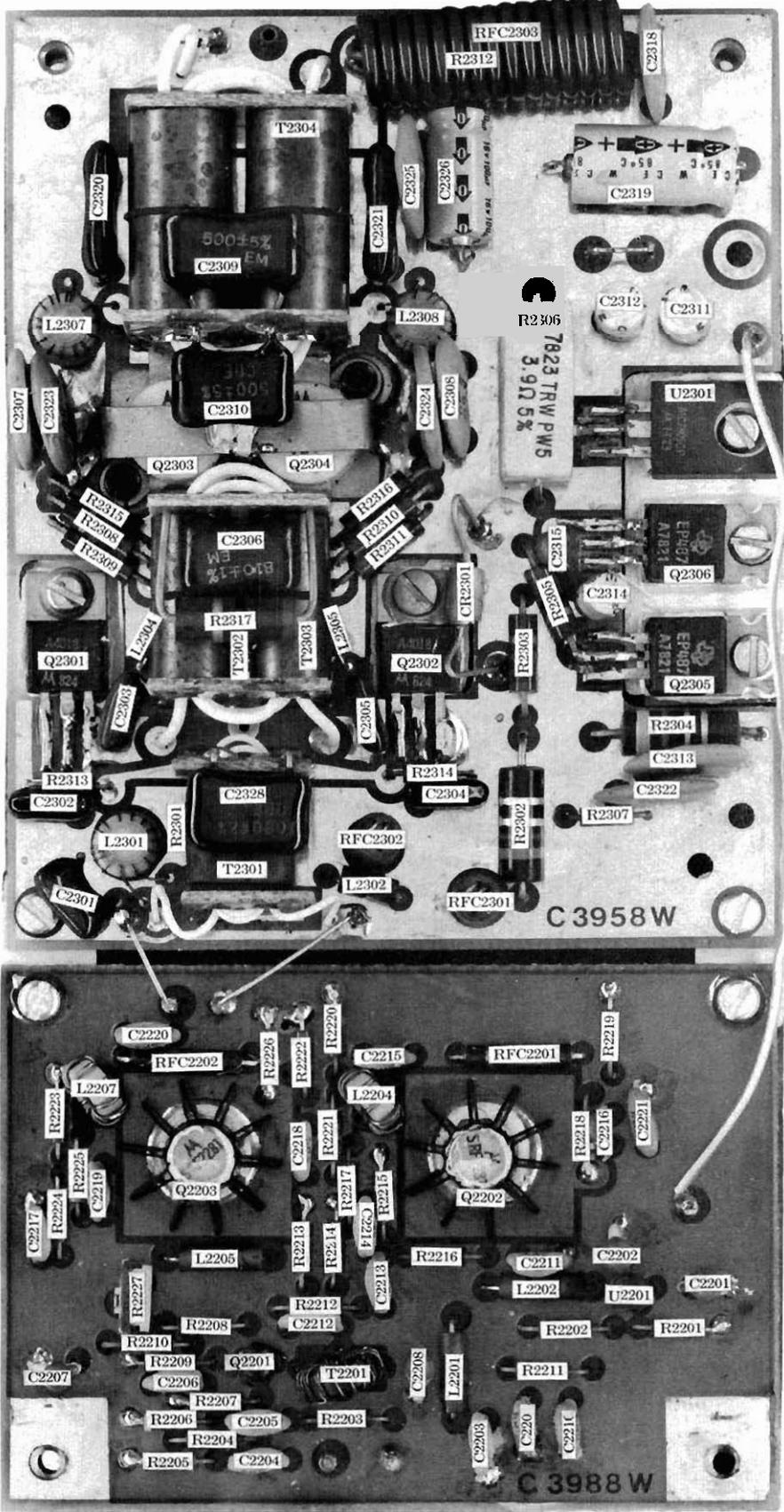
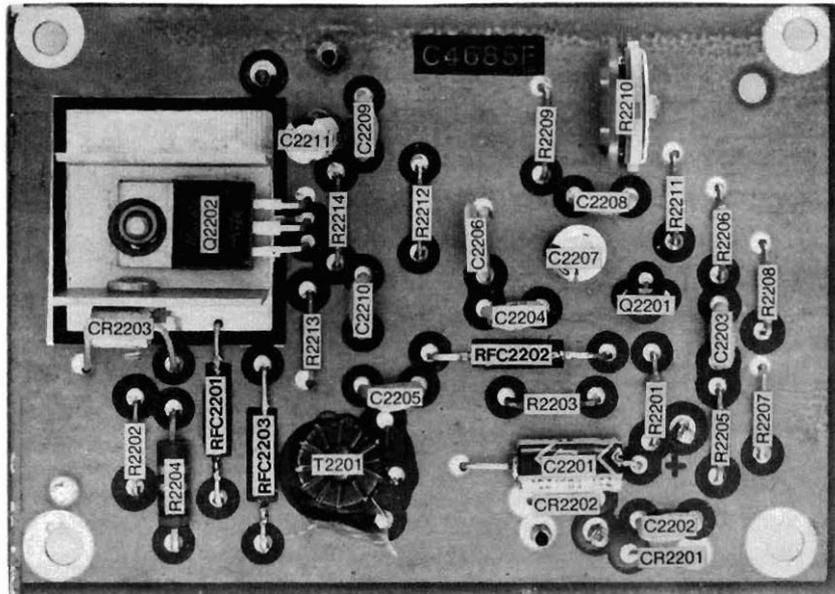


Fig. 2-39 Power Amplifier Module Pictorial (w/Predriver Bd. #1)



R	2205 2207	2201 2208	2203 2206	2209	2210	2211	2214 2213	2202 2204	2212
C	2201 2202	2203	2207	2208	2204	2211	2205 2210	2209	2209

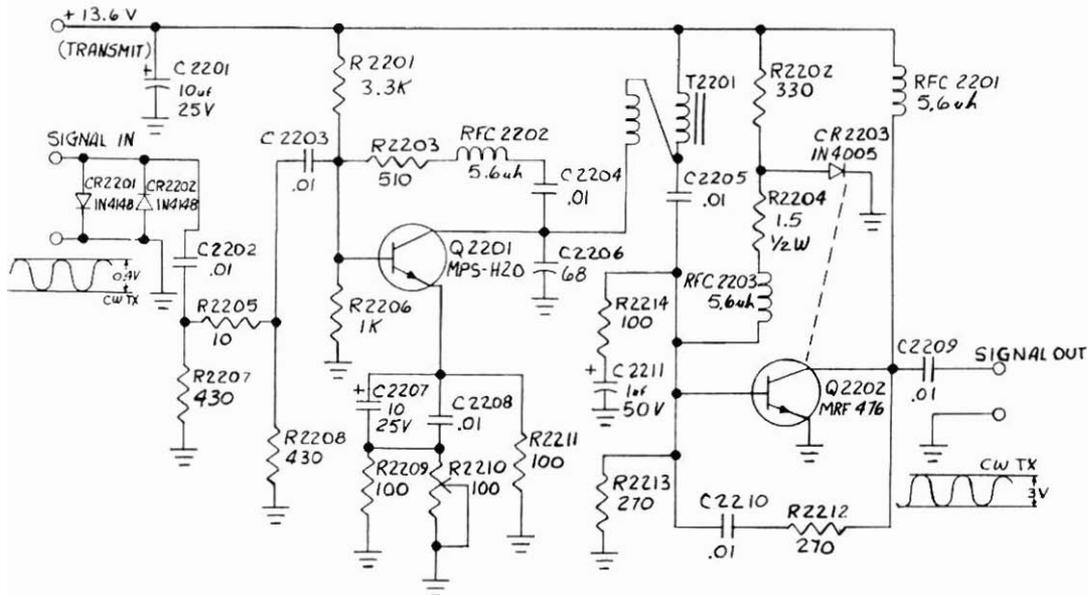
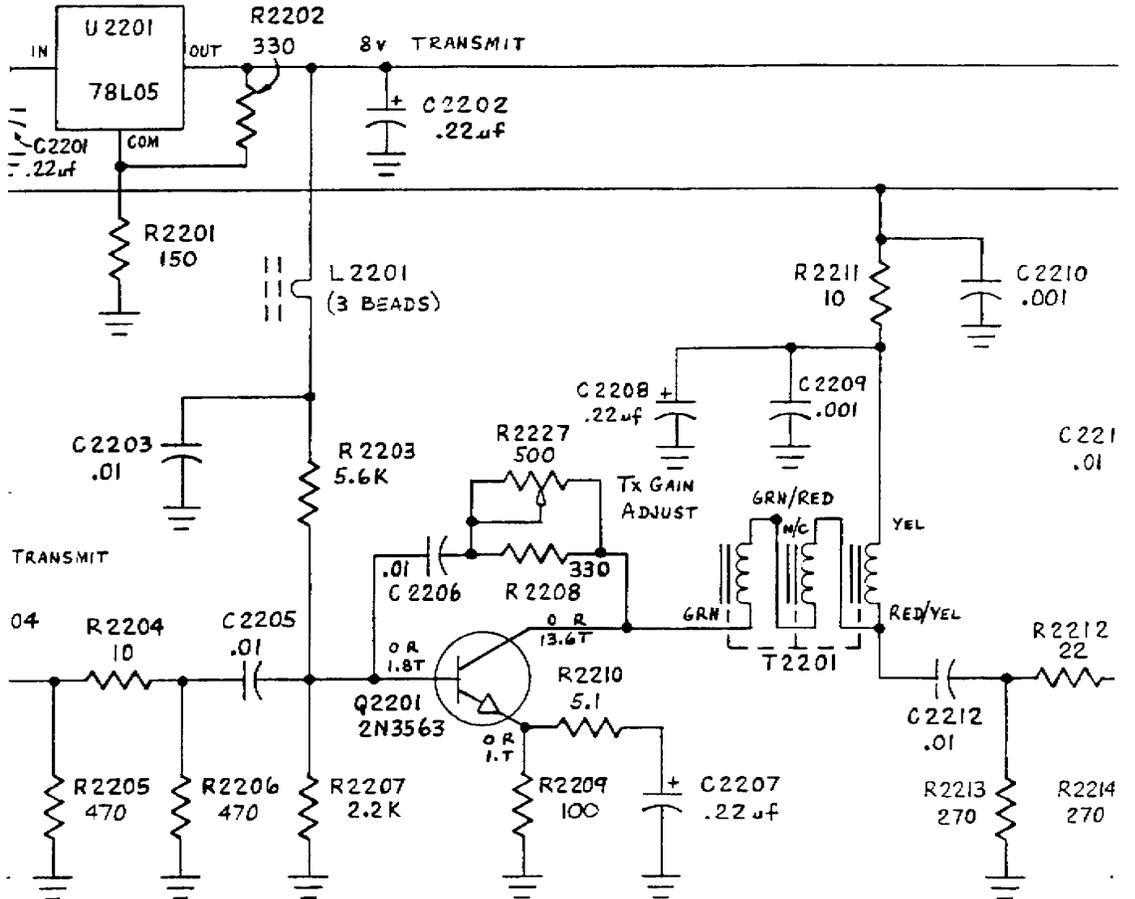


Fig. 2-40 Predriver Board #2 Pictorial & Schematic

01	2203	2205	2202	2206	2207	2209	2212	2210	
04					2208	2210		2211	2213
	2205	2201	2206	2202	2203				2212
		2204		2207		2209	2227		
				2201					



	2211	2213	2214	2215	2221	2217	2219	2220
				2216		2218		
2	2214	2215	2217	2218	2220	2221	2222	2223
		2216		2219			2224	2225
			2202	2204			2205	2207

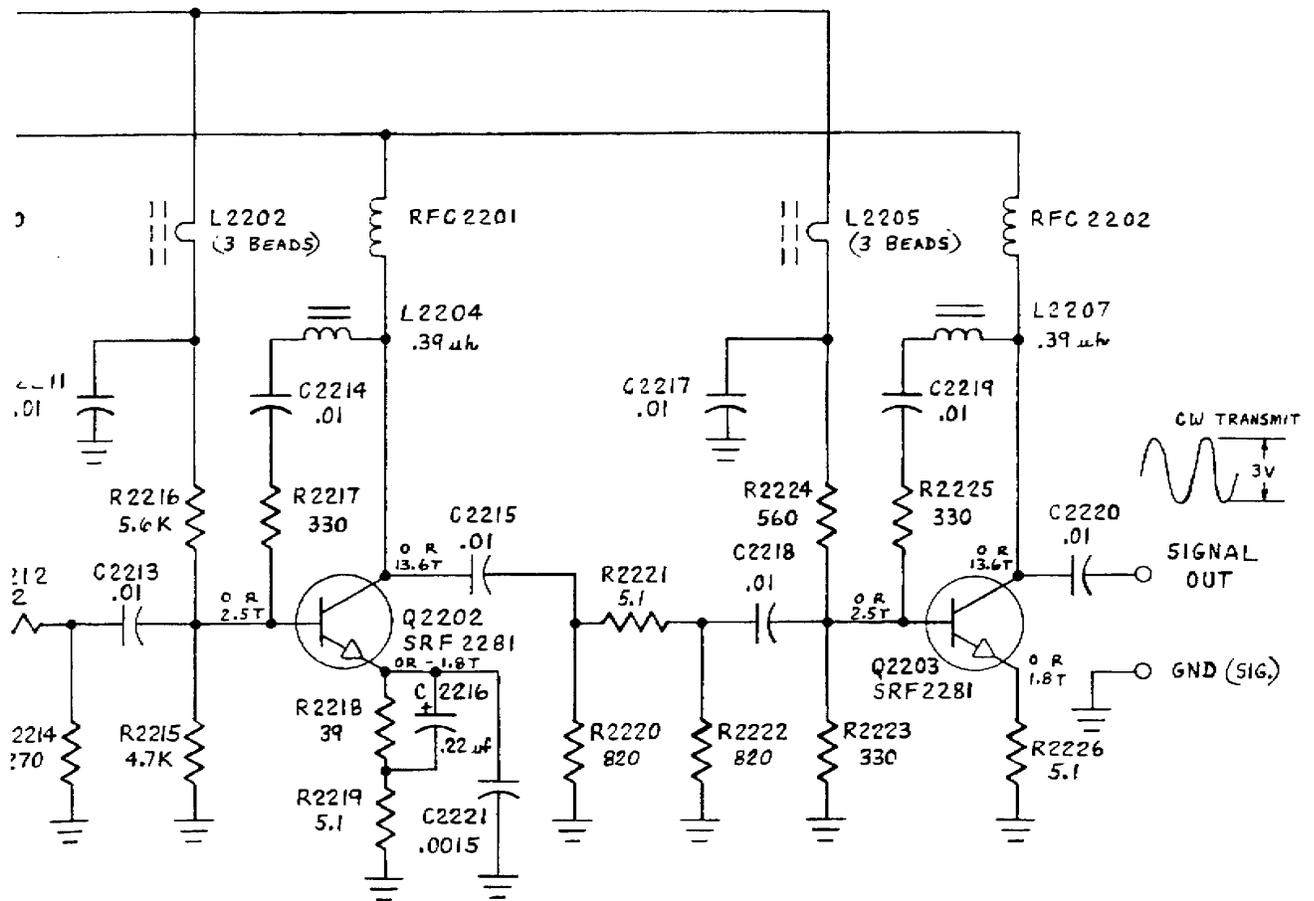
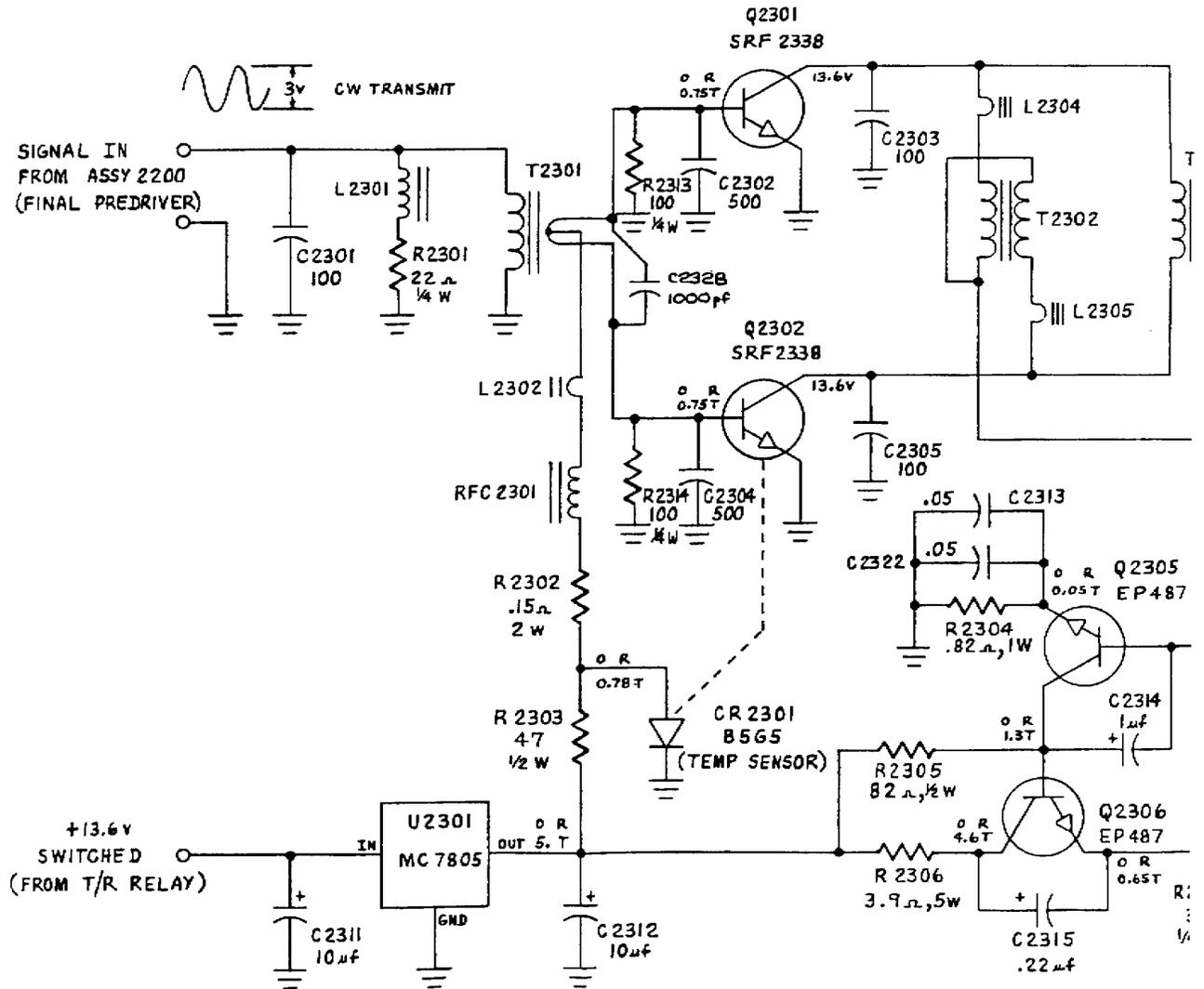


Fig. 2-41 Predriver Board #1 Schematic

C	2301 2311	2312	2302 2304	2328	2303 2305	2313 2322	2315	2314
R	2301	2302 2303	2313 2314		2305 2306	2304		
L	2301	2302				2304	2305	



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		2307	2323	2327	2320	2317	2310	2309	2325
	2306	2308	2324		2321	2318	2319		2326 2329
2307	2317	2308	2310	2315		2318	2312		
		2309	2311	2316		2319			
			2307						
			2308						

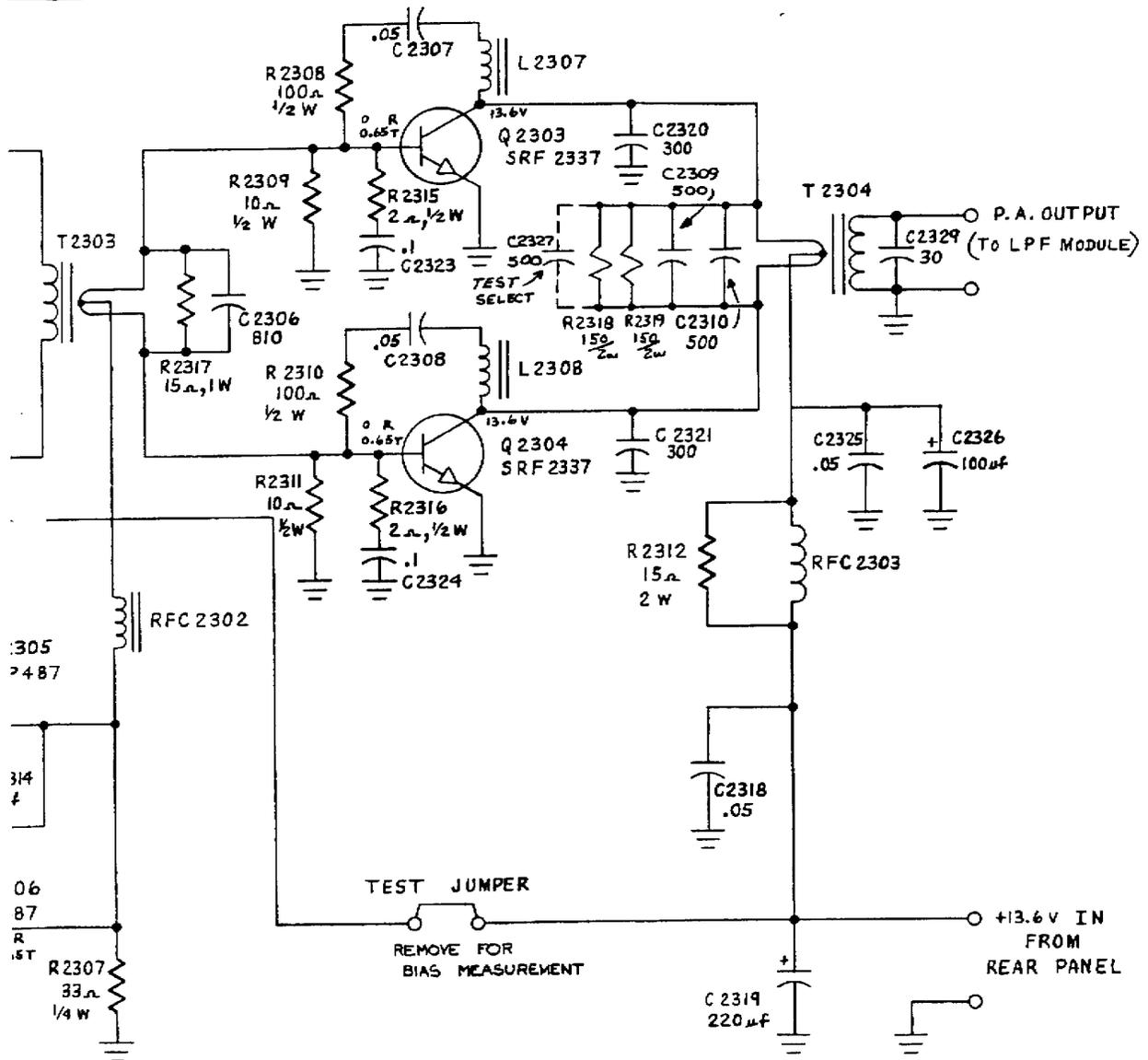


Fig. 2-42 Power Amplifier Schematic

## 2-18. PTO

The Permeability-Tuned Oscillator (PTO) provides a 5.05-5.55 MHz injection signal to the synthesizer circuitry of the TR-7. The VCO (Section 2-5) tracks the frequency of the PTO, thus allowing the operator to tune through any 500 kHz range via the front panel tuning control. The PTO has been very carefully calibrated and temperature compensated at the factory, and any **attempt** at **repair** or **replacement** of components **will very likely** destroy the calibration **and/or** compensation. It is highly **recommended**, therefore, that any PTO which requires **attention** be returned to the factory for proper repair.

It is possible to adjust the knob torque required to tune the PTO, should this become necessary. This is accomplished as follows:

1. Remove the two plastic end caps from the sides of the front panel. Note that these caps are not identical: there is a right and a left end cap.
2. Remove the **DR7**, if installed. (See Section 4-1).
3. Remove the top two screws on each side holding the front panel to the side rails, and loosen the bottom screws.
4. Remove the bandswitch knob.
5. Remove the two screws holding the **bandswitch** shaft detent to the rear panel and slide the bandswitch to the rear just enough to clear the front panel.
6. The front panel will now hinge down, exposing **the PTO**.
7. Refer to figure 2-43 and identify the wrench access hole in the rear of the PTO cover. Insert a long (at least 3") 3/32" ALLEN wrench straight through this hole, seating the wrench in the ALLEN set screw which serves as the shaft bearing. The proper wrench is available from the factory. Be sure to insert the wrench straight through the access hole, to avoid damaging any components inside the PTO.
8. Carefully adjust the set screw for the desired knob torque. Overtightening the adjustment screw must be avoided to prevent bearing damage.
9. Reverse the above procedure to reassemble the TR-7.

Wrench Access Hole

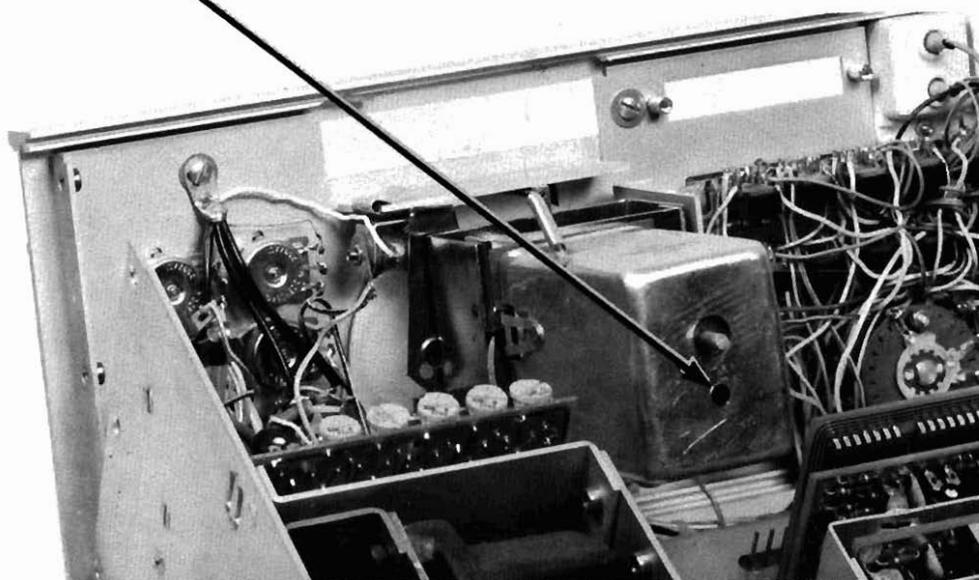


Fig. 2-43 PTO Torque Adjustment

**3-5. 8.05 MHz OSCILLATOR ADJUSTMENT**

Before adjusting this oscillator, be sure that the 40 MHz and 13.695 MHz oscillators are on frequency. Failure to do so will result in improperly adjusted BFO frequencies and undesirable operating characteristics.

- a) Depress the front panel PBT button.
- b) Position the front panel PBT control at mid-range.
- c) Select any mode except AM (BFO must be on).
- d) Connect a frequency counter to pin 40 of the PBT/Reference Board and adjust C1030 for exactly 5.645 MHz. If additional range is required, C1029 may be changed to obtain the proper results.

**3-6. FIXED PASSBAND ADJUSTMENT**

Before attempting the following adjustments, be sure that the 40 MHz, 13.695 MHz and 8.05 MHz oscillators are properly adjusted. If any of these signals are off frequency, improper operation will result.

The fixed passband adjustments are located along the top of the Power Supply/Regulator Board. Refer to Section 2-16 for parts location data.

Connect a frequency counter to pin 40 of the PBT/Reference Board and make the following adjustments with the front panel PBT control off:

- a) In the USB mode, adjust R2125 for 5.6436 MHz.
- b) In the LSB mode, adjust R2122 for 5.6464 MHz.
- c) In the CW mode, adjust R2119 for 5.6442 MHz.
- d) In the RTTY mode, adjust R2116 for 5.6475 MHz.

Move the counter to pin 17 of the PBT/Reference Board, select the AM mode, and adjust R2113 for 53.695 MHz.

**3-7. VCO ALIGNMENT**

The alignment of the high and low VCO can be checked very quickly if the DR-7 is installed. Set the AUX PROGRAM switch to NORM, the BAND to 14 MHz, and press the FIXED RCV button. The display should count up in frequency, and go to approximately 17 MHz. Set the BAND to 21 and press the FIXED RCV button. The display should

go to approximately 32 MHz. If these results are obtained, the VCO does not require alignment.

If alignment is indicated, or if the DR-7 is not available for the above test, perform the following steps to align the VCO. Refer to Section 2-5 for parts location.

- a) Attach a VTVM to the alignment test point shown in figure 2-9.
- b) Set BAND switch to 14 MHz and set the PTO to 500.
- c) The VTVM should indicate  $16.0 \pm 0.5$  VDC. If not, adjust L501 for exactly 16 VDC.
- d) Set BAND switch to 28.5 MHz (leave PTO at 500).
- e) The VTVM should indicate  $15.0 \pm 0.5$  VDC. If not, adjust L502 for exactly 15 VDC.

In order to gain access to L501 and L502, the DR-7 and front circuit card shield cover must be removed. The Jumper Board must be installed in place of the DR-7, using the appropriate board extenders.

**3-8. TRANSLATOR ALIGNMENT**

Translator alignment should be necessary only when parts on the circuit board have been replaced. Remove the DR-7 and front circuit card shield cover, and install the Jumper Board (on board extenders) in place of the DR-7. Perform the following steps in the order listed to insure correct alignment:

- a) Set BAND switch to 1.5 MHz and set PTO to 500.
- b) Connect an RF voltmeter to the alignment test point indicated in figure 2-11.
- c) Back out the slug in L610 two turns, or until RF voltage decreases by 50%.
- d) Peak L609 and L611 for maximum.
- e) Peak L610 for maximum—do not retune L609 and L611.

**3-9. RECEIVER ALIGNMENT**

The receiver must be aligned with all shields fastened in place. All adjustments are accessible through the shields and they are labelled with the appropriate designators. Perform each step of the following procedure in the order listed:

- a) Select the USB mode.
- b) Depress the PBT pushbutton.

- c) Center the PBT control.
- d) Select the 28.5 MHz band.
- e) Depress the CAL pushbutton and tune the receiver to zero beat with the calibrate signal.
- f) Select fast AGC.
- g) Peak C418 on the Up-Converter for maximum S-meter reading.
- h) Peak L701, C716, and L703 on the 2nd Mixer for maximum S-meter reading (may be labelled L801, C818 and L803 on early units).
- i) Peak T1101, L1101, L1102 and T1102 on the 2nd IF/Audio Board for maximum S-meter reading.
- j) Turn off the calibrator and rotate the PBT control through its range while watching the S-meter. If any movement is detected, adjust R1136 to eliminate it.

A properly aligned receiver should read approximately S-9 on the calibrator signal on 10 meters. If a calibrated signal generator is available, check to see that S-9 is approximately  $30 \mu V$  on all bands.

### 3-10. TRANSMITTER ALIGNMENT

Proper adjustment of the transmitter is important to insure stable operation. Carefully follow the sequence of adjustments below, and be sure to complete the next two sections (3-11 and 3-12). Note that the rear shield cover must be removed in order to make some of the following adjustments. Be sure to replace this cover after alignment.

- a) Select the AM mode.
- b) Select the 28.5 MHz band.
- c) Key the transmitter into a 50 ohm dummy load, using the PTT.
- d) Adjust the carrier for 30 watts or less. Keep the carrier below 30 watts during the following adjustments.
- e) On the 2nd Mixer, peak C705 and L702 for maximum power.
- f) On the PBT/Reference Board, peak L1013, L1014, L1009, L1011 and L1012 for maximum power.

### 3-11. WATTMETER NULL ADJUSTMENT

Proper adjustment of the wattmeter null requires a 50 ohm nonreactive dummy load. Failure to use such a load will result in erroneous wattmeter readings and improper ALC action.

Select the 14 MHz band, and set the mode switch to CW. Remove the bottom cover and attach a VTVM to the reflected power input of the ALC board (see

Section 2-15). Connect the dummy load and key the transceiver. Adjust the carrier to approximately 100 watts output, making sure the ALC light is not indicating. Adjust C1901 (through the rear panel) for minimum VTVM reading; typically less than 0.5 VDC.

### 3-12. ALC ADJUSTMENT

The ALC and transmitter gain must be set as outlined below to insure proper transmitter operation and to provide protection to the final amplifier.

- a) Select the 14 MHz band.
- b) Select the CW mode.
- c) Connect a 50 ohm non-reactive dummy load and, if available, an accurate wattmeter.
- d) Key the transceiver and turn the carrier control fully CW.
- e) Set R1613 on the ALC Board (Section 2-15) for 140-150 watts output power.
- f) Unkey the transceiver and select the 28.5 MHz band.
- g) Key the transceiver and adjust R2227 on the Predriver Board (Section 2-17) to the point where the ALC light just comes on.

#### NOTE

Do not set R2227 any higher than necessary, or transmitter instability will result.

- h) Check all bands to be sure that the ALC light comes on at full power output. If a two-tone generator is available, check for flattopping on all bands. If any is noted, slightly decrease the setting of R1613 to eliminate it.

### 3-13. WATTMETER CALIBRATION

An accurately calibrated wattmeter and a 50 ohm non-reactive dummy load are required to complete this procedure.

- a) Select the 14 MHz band.
- b) Select CW mode and key the transceiver.
- c) Adjust the carrier control for 100 watts output into the 50 ohm load as measured on the external wattmeter.
- d) Adjust R2001 on the LPF module (Section 2-14) for 100 watts indicated on the internal (front panel) wattmeter.
- e) Remove the coax from the TR-7 antenna connector.
- f) Adjust R2002 on the LPF module so that the wattmeter reads the same in the forward and

reflected wattmeter positions. This adjustment is most accurate if the carrier control is reduced to the point where the ALC light just extinguishes.

**NOTE**

The following adjustments can be made without any regard to prior alignment or order, since they are independent of other circuitry in the TR-7.

**3-14. CW SIDETONE FREQUENCY ADJUSTMENT**

Adjust C1136 on the 2nd IF Audio Board for an 800 Hz sidetone in CW when the TR-7 is keyed. C1136 is accessible through the rear panel key jack, and a metal screwdriver can be used to key the radio while making this setting.

**3-15. CARRIER BALANCE ADJUSTMENT**

Adjust R349 on the Transmit Exciter Board (Section 2-3) for minimum output in LSB and USB with the TR-7 keyed and the microphone gain at minimum. A separate receiver is recommended as a sensitive indicator for this adjustment. An RF Voltmeter or sensitive oscilloscope connected to the antenna terminal may also be employed.

**3-16. RIT CENTERING ADJUSTMENT**

Zero beat the calibrate signal with the RIT on and set to the center of its range (indicator straight up). Turn off the RIT and adjust R-24 on the Parent Board for zero beat. On early radios, the DR-7 must be removed and replaced with the Jumper Board to make this setting. Later radios have an access hole on the bottom of the Parent Board.

**4-1. DR-7 DIGITAL READOUT**

The DR-7 provides two major functions for the TR-7 — full receiver coverage from 1.8-30 MHz and digital frequency display. The two sections are completely independent. A failure in one section will usually not affect the other. A careful observation of the symptoms and a few measurements will isolate the fault to a major section. See table 4-1 before removing DR-7. Refer to figure 4-2 for the parts location and figure 4-3 for the schematic.

All waveforms on the schematic are taken with the TR-7 tuned to 1.9500 MHz. All waveforms are taken with the oscilloscope set to AC trigger on the first edge shown on the schematic, i.e.: rising or falling edge. An oscilloscope with at least a 100 MHz bandwidth is required to faithfully reproduce some signals. Some signals, especially in the counter and display section, may be displayed with jitter when viewed on an oscilloscope without trigger hold-off. All levels are 0V and 5V high unless noted otherwise.

Section 4-1.1 contains the detailed theory of operation for the full coverage section and 4-1.2 for the digital frequency display. U9001 (6) refers to

I.C. #9001, pin 6. Ground and supply connections are #7 and #14 for 14 pin I.C.'s, #8 and #16 for 16 pin I.C.'s, and #12 and #24 for 24 pin I.C.'s, unless noted otherwise.

If trouble is suspected with the full coverage section, remove the DR-7 and replace it with the Jumper Board for verification. If a component must be removed, **USE CARE**. Wicking braid and a low wattage, grounded soldering iron are recommended for component removal.

LED displays are matched for brightness. If a failure is determined to be in the display, replacement of both is advised. The recommended procedure to remove the display is to cut the connector pins close to the DR-7 P.C. Board. Remove the pins and clear the holes of solder. To replace the display, solder the displays to a new connector. The displays should be flush with the connector. The two digit and four digit displays are spaced apart one pin. Insert the display and connector assembly into the DR-7 board. Space the connector body .1 inch (.254 cm) using a drill bit or other spacer. Solder the connector to the DR-7 board and remove the spacer.

**TABLE 4-1  
TROUBLESHOOTING GUIDE**

**Check For:**

- Proper DR-7 installation.
- Loose or improperly installed connectors.
- Proper function of NORM/EXT switch.
- Proper operation of STORE pushbutton.

Symptom — digits and decimal point blanked

Check — U9019, U9028, Q9013, Q9011

Symptom — digits blanked but decimal point on

Check — U9031, U9029, U9016, U9032, Q9002, Q9003

Symptom — random counting, synthesizer unlocked

Check — full coverage section or TR-7

Symptom — random counting, synthesizer locked

Check — U9016, U9012, U9011

Symptom — one segment on or off in all digits

Check — U9032, U9029, LED Display

Symptom — one digit incorrect

Check — counter and latch for that digit

#### 4-1.1 FULL COVERAGE SECTION

The major functions of the full coverage section are to take the synthesizer load number provided by the digital control board and increment or decrement the load number with the UP or DOWN front panel switches within the limits of the input low pass and high pass filters and to enable the transmitter on the amateur bands. When the bandswitch is changed from one band to another, U9002 (1) is momentarily grounded via the wire going to the high pass filter module. If the AUX PROGRAM switch is in NORM, U9002 (3) will go high and trigger U9004, a one shot. The negative pulse out of the one shot will cause U9002 (4) to go high, latching the BCD load number present at pins 2/41 through 2/48 into the programmable up-down counters U9005 and U9006. The one shot insures that the data from the band switch is valid before latching the number. In AUX PROGRAM switch positions 1-8 U9002 (6) is held low, causing U9002 (4) to stay high. This allows any load number at the counter inputs to be fed directly to the outputs. The outputs of the counters are buffered by the high current drivers U9007 and U9008 and applied to the divide by N inputs of the translator board. When the UP or DOWN pushbutton is depressed, a negative pulse is generated at the output of one shot U9004 (7) and applied to the clock inputs of the counters. When the DOWN pushbutton is depressed U9002 (11) remains low, the counters will decrement by one and the VCO frequency will increase. The load number is fed to the inputs of READ ONLY MEMORY U9003. When a load number corresponding to a band edge is programmed, U9003 (12) and/or U9003 (11) will go low and disable the UP or DOWN latches. Refer to paragraph 1-3.3 to determine the proper load number for a particular 500 kHz segment.

#### 4-1.2 COUNTER SECTION

The counter circuit can be divided into three major sections: the time base divider, the counter, and the display. The time base divider generates the signals required to gate the input signal into the counter, store the contents of the counters, and control the multiplexed information to the display section. The display section decodes and buffers the multiplexed information from the counter section and drives the LED display.

The **TIME BASE DIVIDER** is comprised of U9014, U9015, U9019, U9022, U9026, U9028 and

U9016. The 500 kHz synthesizer reference signal is divided by 5 by U9014 producing 10  $\mu$ S pulses. The 10  $\mu$ S pulses are applied to the divide by 10,000 circuit consisting of U9017, U9019, and U9022, and to flipflop U9026. After 100 mS, U9016 (13) will go low. At the next pulse from U9014, U9026 (1) will go low and U9026 (2) and U9015 (2) will go high, generating a strobe pulse at U9015 (10). On the second pulse from U9014 after the strobe pulse, a reset/load pulse is generated at U9016 (3). On the second pulse from U9014 after the reset pulse, a time base reset pulse is generated at U9016 (1). This pulse resets the dividers and sets U9026 (13) high. On the next pulse, U9026 (1) goes high and the sequence starts again. During the 100 mS gate time, the BCD output of U9019 is fed to 1 of 10 decoder U9028. The outputs of U9028 are used to multiplex the BCD information stored in the latches to the display section.

The **COUNTER CIRCUIT** consists of input amplifiers U9009 and U9010, gating circuits U9011 and U9012, and counting circuits U9013, U9017 through U9021, U9023 through U9025, U9027, and U9030. The VCO signal is amplified by U9010. The external input signal is amplified by U9009. U9011 selects which signal is applied to the gate circuit. When U9012 (7) goes high, U9012 (3) will go low on the next rising edge of the selected input signal allowing the signal to be passed to decade divider U9013. The outputs of U9013 are buffered and applied to Q9002, which amplifies the ECL level signal to a TTL level. The TTL signal is applied to decade counter U9017 and then to U9019. The output of U9019 is applied to the programmable decade counter chain U9020, U9023, U9024, and U9027. The outputs of all of the counters feed latches. At the end of the gate time the BCD information is stored in latches U9018, U9021, and U9025 by the strobe signal from the time base divider section. After the strobe signal, the counters are either reset to all zeroes or loaded with an offset number by the reset/load pulse. When the DR-7 is operating in the NORMAL mode, the reset/load pulse is applied to pin 1 of the programmable counters and U9016 (5). U9016 (6) is grounded by the NORM/EXT switch preventing the load reset pulse from resetting the counters. The counters will be preset to 5195, which will subtract the 48.05 MHz First IF from the VCO frequency. In the EXT mode the reset/load pulse is applied to both pin 1 and pin 9 of the programmable counters setting them to zero. When operating in the EXT mode and the

input frequency exceeds 99.9999 MHz, U9030 (13) will go high and U9030 (1) will be latched high by the strobe pulse. When the STORE pushbutton is depressed, the strobed pulse is grounded and the information in the latches is not updated by the counters.

The **DISPLAY SECTION** is comprised of U9028, U9029, U9031, U9032, Q9005 through Q9013, and the LED display. When U9028 (2) goes low, the BCD information stored in latch U9025B is applied to the BCD to 7-segment decoder U9029. The outputs of U9029 are applied to U9032. The outputs of U9032 sink current from the common anode LED display. At the same time, the outputs of U9025B are enabled, Q9005 is turned on by U9028 (2) supplying current to the left-most digit of the display. After D1 has been lit for 100 mS, U9028 (2) will go high and U9028 (3) will go low,

turning on Q9006 and enabling the information stored in U9028A to be decoded and applied to the cathodes. Each digit will be enabled sequentially for 100  $\mu$ S at a 1 kHz rate. Q9012 is turned on at D5 to illuminate the decimal point. If D1 is zero, U9029 (4), U9031 (1) and, if the counter has not exceeded 99.9999 MHz, U9029 (5) will go low and the leading zero will be blanked. U9031 (1) will remain low until a number other than BCD "0" is applied to the inputs of U9029. When the counter is operating in EXT and the frequency exceeds 99.9999 MHz, leading zeroes are not blanked. 100 MHz will display 00000.0 kHz. If power is applied without the 500 kHz input or if a failure should occur in the time base divider circuitry, the pulse at U9028 (1) will go away, causing Q9013 to turn off. When Q9013 turns off, Q9011, which supplies the ground to the display driver, will turn off preventing damage to the display.

#### NOTES:

**DR7 REMOVAL (Refer to Pictorial Fig. 4-1)**

1. Unplug (5) five connectors (P1 through P5) from the DR7 board. Position cables carefully so that they will be free of the DR7 Board when it is lifted out. Remove the retaining screw and lockwasher (adjacent to U9006).
2. Unplug the coax and blue wire from the filter module. Slide the grommet off of the coax and wire.
3. Using the card puller supplied with the radio, hook one end under the front edge of the large hole adjacent to U9008 (shown in figure 4-1). Grasp the tool and pull upwards firmly, but slowly, to disengage one 12 pin, one 9 pin and two 3 pin connectors. Once the connectors have been disengaged, remove the card puller.
4. Grasping the board along both sides, tilt the rear portion of the board upwards at an angle sufficient to fully disengage the connectors and slide the board toward the rear of the radio. As this is done, note that the LEDs should slide out of the aluminum bezel at the front panel. NOTE: Do not tilt the board excessively before the display LEDs are free of the locating aluminum bezel, or damage will result to either the displays or the DR7 board.
5. Once the display and connectors are free, lift the DR7 board straight up, allowing the coax to slide out of the clearance hole provided for it.
6. Now either the DR7 or Jumper Board can be plugged in on extender cards and the coax plugged into the filter module to service the radio.

**DR7 INSTALLATION**

1. Position (5) five connectors (P1 through P5) and associated cables to be free of DR7 board during the installation. Check that all 27 connector pins on the DR7 board are straightened and perpendicular to the board.
2. Thread the Up-Converter coax through the hole (adjacent to C9015). Tilt the display LED portion of the DR7 board downward and slide the LEDs into the locating aluminum bezel at the front panel.
3. Start the 12 pin connector on the DR7 board (adjacent to U9006) into the receptacle on the Digital Control Board, noting visually that the connector pins are aligned properly with the receptacle.
4. With the 12 pin connector sufficiently engaged, start the 9 pin connector (adjacent to U9003) into the receptacle in the Translator board, again noting visually that the connector pins are aligned properly with the receptacle. Note that even though the alignment of the two 3 pin connectors cannot be visually inspected, their alignment will be proper if the pins were straightened and the 12 and 9 pin connectors are properly aligned.
5. Press down firmly, but carefully, on the DR7 board to fully seat all connectors.
6. Install the retaining screw and lockwasher (adjacent to U9006). Plug in all (5) five connectors (P1 through P5). Slide the grommet over the coax and blue wire. Plug the coax and blue wire into the filter module, position the grommet in the chassis wall cutout.

## SECTION 3

## ALIGNMENT PROCEDURE

The following alignment procedure can be accomplished with a VTVM, RF Voltmeter, 60 MHz frequency counter and an accurate wattmeter. In addition, a good high-frequency (30-50 MHz) oscilloscope, two-tone generator, monitor scope and signal generator are recommended, but not required.

The procedure is structured in such a manner that it may be entered at any point and followed to conclusion. That is, if you are sure that all adjustments preceding those of interest are correct, you may start at the section which addresses the problem at hand. However, all sections following the starting point must be completed to insure proper operation. If any doubt exists, it is recommended that the entire procedure be executed.

It is not necessary to use the board extenders for any of the following adjustments. In fact, use of the extenders will distort the alignment settings. The board extenders should be used only for troubleshooting and repair.

### 3-1. 10 VOLT ADJUSTMENT

Using an accurate voltmeter, adjust R2103 on the Power Supply/Regulator Board (Section 2-16) for exactly 10 VDC, measured on the 10 volt trace of the Parent Board (Section 2-1). Note that adjusting the 10 volt regulator will affect all circuits in the transceiver, thus requiring a full alignment.

### 3-2. S-METER ADJUSTMENT

The S-meter adjustments are located on the 2nd IF/Audio Board (Section 2-11). These adjustments must be made in the AM mode (to prevent errors due to BFO leakage), and must be made in the order outlined below. Failure to do so will result in improper S-meter and AGC operation.

- a) Remove the rear card cage top cover.
- b) Select the AM mode, and remove any antennas.
- c) Turn the zero adjust, R1128, fully CW.
- d) Turn the AGC pedestal adjust, R1129, fully CW.
- e) Rotate R1129 CCW until the S-meter reading increases 2 S-units.
- f) Adjust R1128 for an S-meter reading between 0 and 1. Be sure that the S-meter is slightly above 0.
- g) Turn the front panel RF Gain control fully CCW.

- h) Adjust the sensitivity control, R1105, for a full scale S-meter reading of 80 dB over S-9.
- i) Rotate the RF Gain control fully CW and check to be sure the S-meter reads between 0 and 1. If not, repeat steps c through i.

### 3-3. 40 MHz OSCILLATOR ALIGNMENT

Adjust L1006 on the PBT/Reference Board (Section 2-10) for maximum 40 MHz output on pin 21. Use an RF voltmeter, and measure this level on the Parent Board.

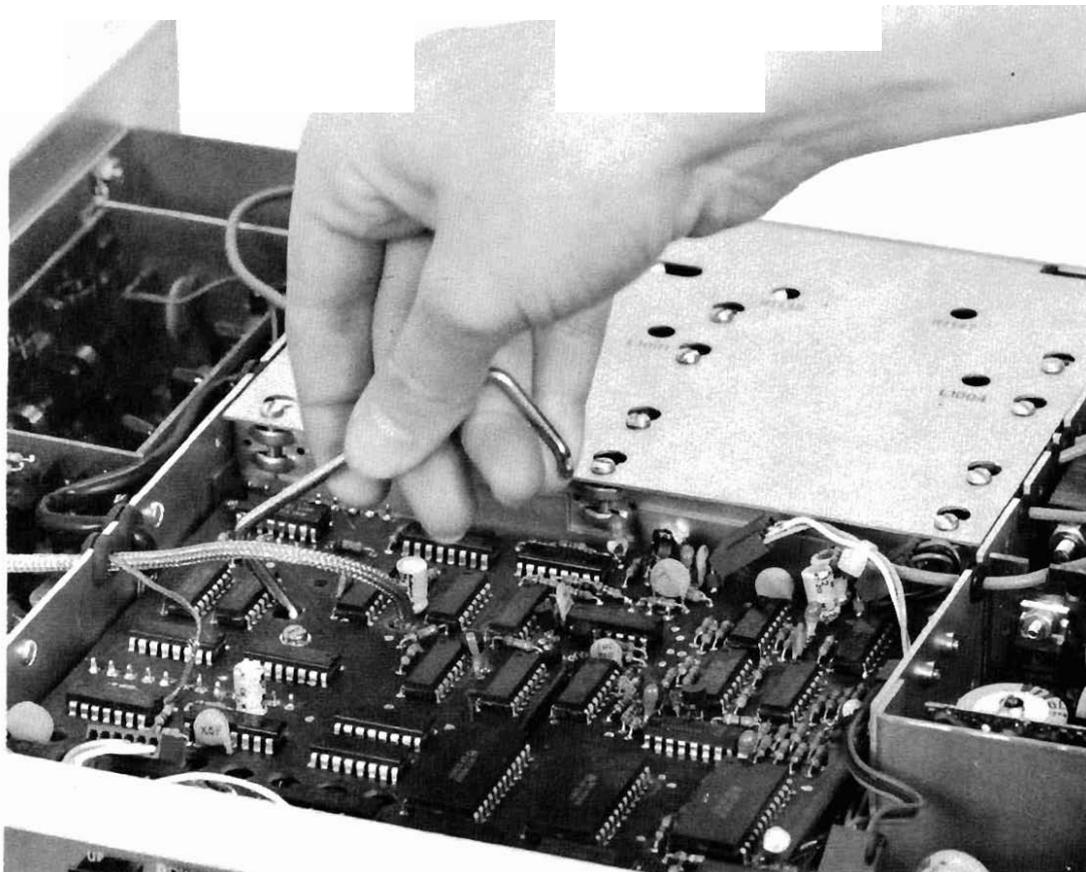
Connect an accurate frequency counter to pin 19 of the PBT/Reference Board and adjust L1001 for exactly 40 MHz. Note that any error in this adjustment will result in a calibration and readout accuracy discrepancy. Do not use pin 21 for this adjustment, since the load of the counter may cause the 40 MHz oscillator to shift frequency slightly.

Although adjustment with a frequency counter is preferred, it is possible to set the 40 MHz oscillator using WWV. Peak L1006 as described above, and tune to the strongest available WWV signal in your area. Place the radio in the AM mode, and wait until WWV is transmitting an unmodulated carrier. Enable the calibrator and carefully adjust L1001 for exact zero beat with WWV. This method requires that WWV be of comparable signal strength with the calibrator. As such, it may be necessary to select the proper time of day as well as frequency for your area to achieve the desired results.

### 3-4. 13.695 MHz VCXO ADJUSTMENT

This adjustment should be performed accurately and exactly as outlined below to insure that the passband is correct in the various modes of operation. Be sure that the 40 MHz oscillator is on frequency before attempting this adjustment.

- a) Depress the front panel PBT button.
- b) Position the front panel PBT control at the center of rotation (indicator straight up).
- c) Connect a frequency counter to pin 17 of the PBT/Reference Board and adjust L1005 for exactly 53.695 MHz. This is the 2nd L.O. frequency, which is the sum of the 40 MHz and 13.695 oscillators, thus it is important that the 40 MHz oscillator be on frequency.



*Fig. 4-1 DR7 Removal*

## DR-7 DIGITAL READOUT

REF DES	DESCRIPTION	PART NO.
C9001	Capacitor, Disc, .1 $\mu$ F $\pm$ 80%, Y5T	3161660
C9002	Capacitor, Disc, .1 $\mu$ F $\pm$ 80%, Y5T	3161660
C9003	Capacitor, Disc, 100 pF $\pm$ 10%, X5F	3161070
C9004	Capacitor, Electrolytic, 10 $\mu$ F $\pm$ 20%, 25 V	3180062
C9005	Capacitor, Disc, .005 $\mu$ F $\pm$ 20%, Z5U	3161470
C9006	Capacitor, Disc, .005 $\mu$ F $\pm$ 20%, Z5U	3161470
C9007	Capacitor, Disc, .005 $\mu$ F $\pm$ 20%, Z5&	3161470
C9008	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C9009	Capacitor, Electrolytic, 10 $\mu$ F $\pm$ 20%, 25 V	3180062
C9010	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C9011	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 25 V	3183100
C9012	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 25 V	3183100
C9013	Capacitor, Electrolytic, 10 $\mu$ F $\pm$ 20%, 25 V	3180062
C9014	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 50 V	3180008
C9015	Capacitor, Electrolytic, 10 $\mu$ F $\pm$ 20%, 25 V	3180062
C9016	Capacitor, Disc, 220 pF $\pm$ 20%, Z5U	3161270
C9017	Capacitor, Tantalum, 10 $\mu$ F $\pm$ 20%, 25 V	3183030
C9018	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
C9019	Capacitor, Tantalum, 47 $\mu$ F $\pm$ 20%, 6 V	3183070
C9020	Capacitor, Tantalum, 47 $\mu$ F $\pm$ 20%, 6 V	3183070
C9021	Capacitor, Tantalum, 10 $\mu$ F $\pm$ 20%, 25 V	3183030
C9022	Capacitor, Disc, 220 pF $\pm$ 20%, Z5U	3161270
C9023	Capacitor, Disc, 51 pF $\pm$ 5%, N750	3160860
C9024	Capacitor, Electrolytic, 10 $\mu$ F $\pm$ 20%, 25 V	3180062
C9025	Capacitor, Electrolytic, 1 $\mu$ F $\pm$ 20%, 25 V	3180008
C9026	Capacitor, Electrolytic, 10 $\mu$ F $\pm$ 20%, 25 V	3180062
C9027	Capacitor, Electrolytic, 1000 $\mu$ F, 16 V	3180292
CR9001	Diode, 1N270	3020010
CR9002	Diode, 1N270	3020010
CR9003	Diode, 1N270	3020010
CR9004	Diode, 1N270	3020010
CR9005	Diode, 1N270	3020010
CR9006	Diode, 1N270	3020010
CR907	Diode, 1N4148	3020090
P9001	Connector, Rt. Angle, 4 Circuit	3290714
P9002	Connector, Rt. Angle, 4 Circuit	3290714
P9003	Connector, Rt. Angle, 4 Circuit	3290714
P9004	Connector, Rt. Angle, 4 Circuit	3290714
P9005	Connector, Rt. Angle, 6 Circuit	3290716
Q9001	Transistor, 2N3904	3030105
Q9002	Transistor, 2N4125	3030110
Q9003	Transistor, 2N3904	3030105
Q9004	Transistor, 2N3904	3030105
Q9005	Transistor, 2N4402	3030120
Q9006	Transistor, 2N4402	3030120
Q9007	Transistor, 2N4402	3030120
Q9008	Transistor, 2N4402	3030120
Q9009	Transistor, 2N4402	3030120
Q9010	Transistor, 2N4402	3030120
Q9011	Transistor, 92PU01	3030323
Q9012	Transistor, 2N3904	3030105

REF DES	DESCRIPTION	PART NO.
Q9013	Transistor, 2N4402	3030120
R9001	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R9002	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R9003	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R9004	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R9005	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R9006	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R9007	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R9008	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R9009	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R9010	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R9011	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R9012	Resistor, Carbon Film, 1 M $\Omega$ $\pm$ 5%, 1/4 W	3220355
R9013	Resistor, Carbon Film, 560 $\Omega$ $\pm$ 5%, 1/4 W	3220125
R9014	Resistor, Carbon Film, 560 $\Omega$ $\pm$ 5%, 1/4 W	3220125
R9015	Resistor, Carbon Film, 560 $\Omega$ $\pm$ 5%, 1/4 W	3220125
R9016	Resistor, Carbon Film, 150 $\Omega$ $\pm$ 5%, 1/4 W	3220065
R9017	Resistor, Carbon Film, 470 $\Omega$ $\pm$ 5%, 1/4 W	3220110
R9018	Resistor, Carbon Film, 330 $\Omega$ $\pm$ 5%, 1/4 W	3220090
R9019	Resistor, Carbon Film, 560 $\Omega$ $\pm$ 5%, 1/4 W	3220125
R9020	Resistor, Carbon Film, 560 $\Omega$ $\pm$ 5%, 1/4 W	3220125
R9021	Resistor, Carbon Film, 560 $\Omega$ $\pm$ 5%, 1/4 W	3220125
R9022	Resistor, Carbon Film, 560 $\Omega$ $\pm$ 5%, 1/4 W	3220125
R9023	Resistor, Carbon Film, 560 $\Omega$ $\pm$ 5%, 1/4 W	3220125
R9024	Resistor, Carbon Film, 560 $\Omega$ $\pm$ 5%, 1/4 W	3220125
R9025	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R9026	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R9027	Resistor, Carbon Film, 560 $\Omega$ $\pm$ 5%, 1/4 W	3220125
R9028	Resistor, Carbon Film, 560 $\Omega$ $\pm$ 5%, 1/4 W	3220125
R9029	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R9030	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R9031	Resistor, Carbon Film, 220 $\Omega$ $\pm$ 5%, 1/4 W	3220075
R9032	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R9033	Resistor, Carbon Film, 560 $\Omega$ $\pm$ 5%, 1/4 W	3220125
R9034	Resistor, Carbon Film, 560 $\Omega$ $\pm$ 5%, 1/4 W	3220125
R9035	Resistor, Carbon Film, 560 $\Omega$ $\pm$ 5%, 1/4 W	3220125
R9036	Resistor, Carbon Film, 560 $\Omega$ $\pm$ 5%, 1/4 W	3220125
R9037	Resistor, Carbon Film, 1 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R9038	Resistor, Carbon Film, 47 $\Omega$ $\pm$ 5%, 1/4 W	3220035
R9039	Resistor, Carbon Film, 150 $\Omega$ $\pm$ 5%, 1/4 W	3220065
R9040	Resistor, Carbon Film, 47 $\Omega$ $\pm$ 5%, 1/4 W	3220035
R9041	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R9042	Resistor, Carbon Film, 1 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R9043	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R9044	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R9045	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R9046	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R9047	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R9048	Resistor, Carbon Film, 15 K $\Omega$ $\pm$ 5%, 1/4 W	3220245
R9049	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R9050	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R9051	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R9052	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R9053	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315

REF DES	DESCRIPTION	PART NO.
R9054	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R9055	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R9056	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R9057	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R9058	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R9059	Resistor, Carbon Film, 22 K $\Omega$ $\pm$ 5%, 1/4 W	3220260
R9060	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R9061	Resistor, Carbon Film, 22 K $\Omega$ $\pm$ 5%, 1/4 W	3220260
R9062	Resistor, Carbon Film, 22 K $\Omega$ $\pm$ 5%, 1/4 W	3220260
R9063	Resistor, Carbon Film, 22 K $\Omega$ $\pm$ 5%, 1/4 W	3220260
R9064	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R9065	Resistor, Carbon Film, 47 $\Omega$ $\pm$ 5%, 1/4 W	3220035
R9066	Resistor, Carbon Film, 1 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R9067	Resistor, Carbon Film, 47 $\Omega$ $\pm$ 5%, 1/4 W	3220035
R9068	Resistor, Carbon Film, 1 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R9069	Resistor, Carbon Film, 47 $\Omega$ $\pm$ 5%, 1/4 W	3220035
R9070	Resistor, Carbon Film, 1 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R9071	Resistor, Carbon Film, 47 $\Omega$ $\pm$ 5%, 1/4 W	3220035
R9072	Resistor, Carbon Film, 1 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R9073	Resistor, Carbon Film, 47 $\Omega$ $\pm$ 5%, 1/4 W	3220035
R9074	Resistor, Carbon Film, 1 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R9075	Resistor, Carbon Film, 47 $\Omega$ $\pm$ 5%, 1/4 W	3220035
R9076	Resistor, Carbon Film, 1 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R9077	Resistor, Carbon Film, 33 $\Omega$ $\pm$ 5%, 1/4 W	3220025
R9078	Resistor, Carbon Film, 33 $\Omega$ $\pm$ 5%, 1/4 W	3220025
R9079	Resistor, Carbon Film, 33 $\Omega$ $\pm$ 5%, 1/4 W	3220025
R9080	Resistor, Carbon Film, 33 $\Omega$ $\pm$ 5%, 1/4 W	3220025
R9081	Resistor, Carbon Film, 33 $\Omega$ $\pm$ 5%, 1/4 W	3220025
R9082	Resistor, Carbon Film, 33 $\Omega$ $\pm$ 5%, 1/4 W	3220025
R9083	Resistor, Carbon Film, 33 $\Omega$ $\pm$ 5%, 1/4 W	3220025
R9084	Resistor, Carbon Film, 1 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R9085	Resistor, Carbon Film, 22 $\Omega$ $\pm$ 5%, 1/4 W	3220260
R9086	Resistor, Carbon Film, 220 $\Omega$ $\pm$ 5%, 1/4 W	3220075
R9087	Resistor, Carbon Film, 33 $\Omega$ $\pm$ 5%, 1/4 W	3220025
R9088	Resistor, Carbon Film, 22 K $\Omega$ $\pm$ 5%, 1/4 W	3220260
R9089	Resistor, Carbon Film, 1 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R9090	Resistor, Carbon Film, 1 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R9091	Resistor, Carbon Film, 820 $\Omega$ $\pm$ 5%, 1/4 W	3220145
R9092	Resistor, Wire Wound, 5 $\Omega$ , 5 W	3250100
T9001	Transformer	2510014
U9001	Integrated Circuit, 14023 CMOS	3041035
U9002	Integrated Circuit, 14011 CMOS	3041010
U9003	Integrated Circuit, PROM TTL	3040015
U9004	Integrated Circuit, 14528 CMOS	3041130
U9005	Integrated Circuit, 14510 CMOS	3041105
U9006	Integrated Circuit, 14510 CMOS	3041105
U9007	Integrated Circuit, 14050 CMOS	3041050
U9008	Integrated Circuit, 14050 CMOS	3041050
U9009	Integrated Circuit, 10116 ECL	3040610
U9010	Integrated Circuit, 10116 ECL	3040610
U9011	Integrated Circuit, 10102 ECL	3040600
U9012	Integrated Circuit, 10131 ECL	3040620
U9013	Integrated Circuit, 10138 ECL	3040630
U9014	Integrated Circuit, 14017 CMOS	3041030

REF DES	DESCRIPTION	PART NO.
U9015	Integrated Circuit, 14017 CMOS	3041030
U9016	Integrated Circuit, 14081 CMOS	3041070
U9017	Integrated Circuit, 74LS390 TTL	3040478
U9018	Integrated Circuit, 14508 CMOS	3041100
U9019	Integrated Circuit, 14518 CMOS	3041115
U9020	Integrated Circuit, 14510 CMOS	3041105
U9021	Integrated Circuit, 14508 CMOS	3041100
U9022	Integrated Circuit, 14518 CMOS	3041115
U9023	Integrated Circuit, 14510 CMOS	3041105
U9024	Integrated Circuit, 14510 CMOS	3041105
U9025	Integrated Circuit, 14508 CMOS	3041100
U9026	Integrated Circuit, 14013 CMOS	3041020
U9027	Integrated Circuit, 14510 CMOS	3041105
U9028	Integrated Circuit, 74LS145 TTL	3040509
U9029	Integrated Circuit, 14558 CMOS	3041138
U9030	Integrated Circuit, 14013 CMOS	3041020
U9031	Integrated Circuit, 14013 CMOS	3041020
U9032	Integrated Circuit, ULN2003A	3040539
U9033	Integrated Circuit, Linear, 7805C	3040160
U9034	Integrated Circuit, Linear, 7805C	3040160
	2-Digit LED Display	3080021
	4-Digit LED Display	3080022
	25 Pin Connector	3290715

## NOTES:

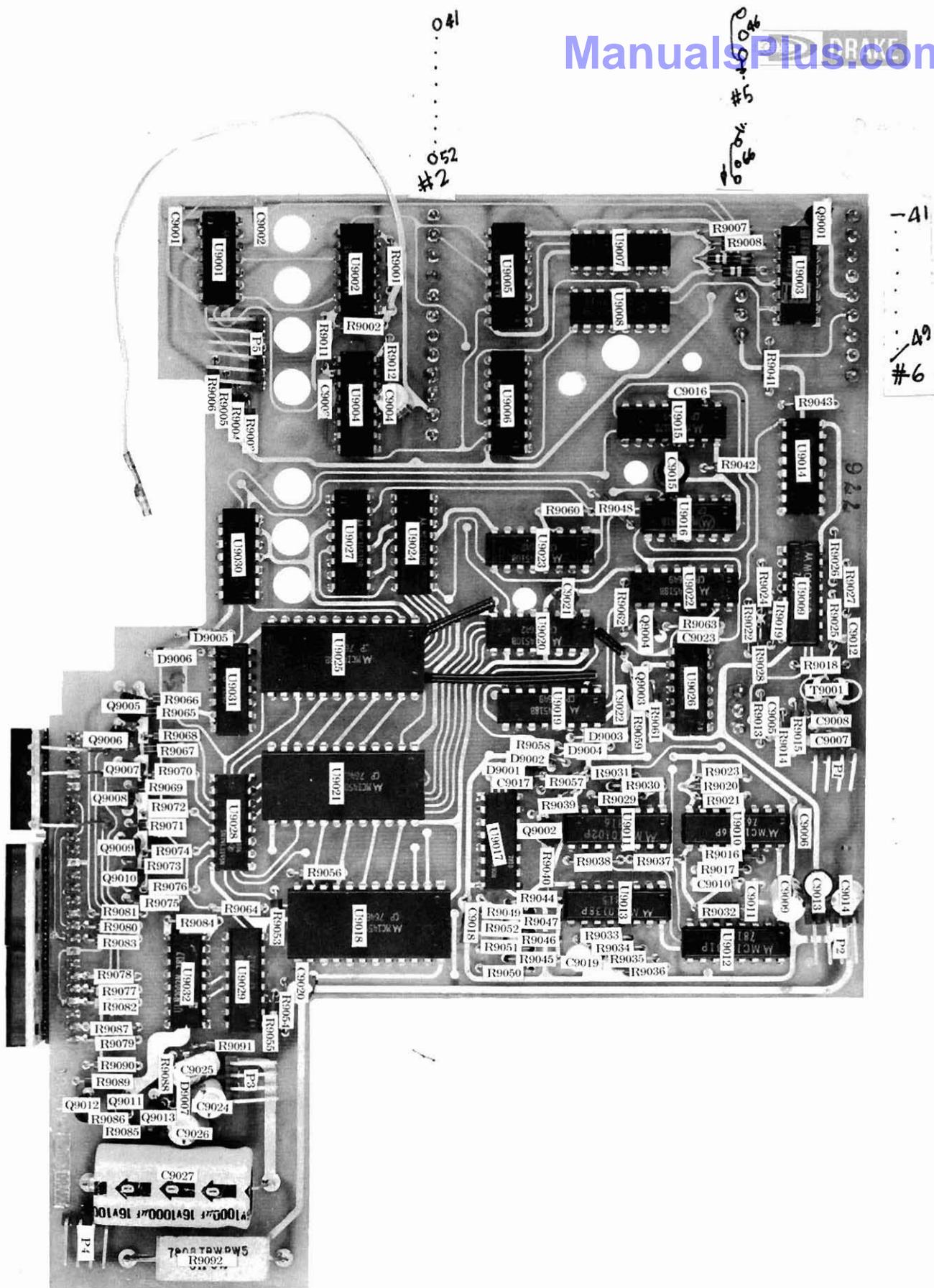
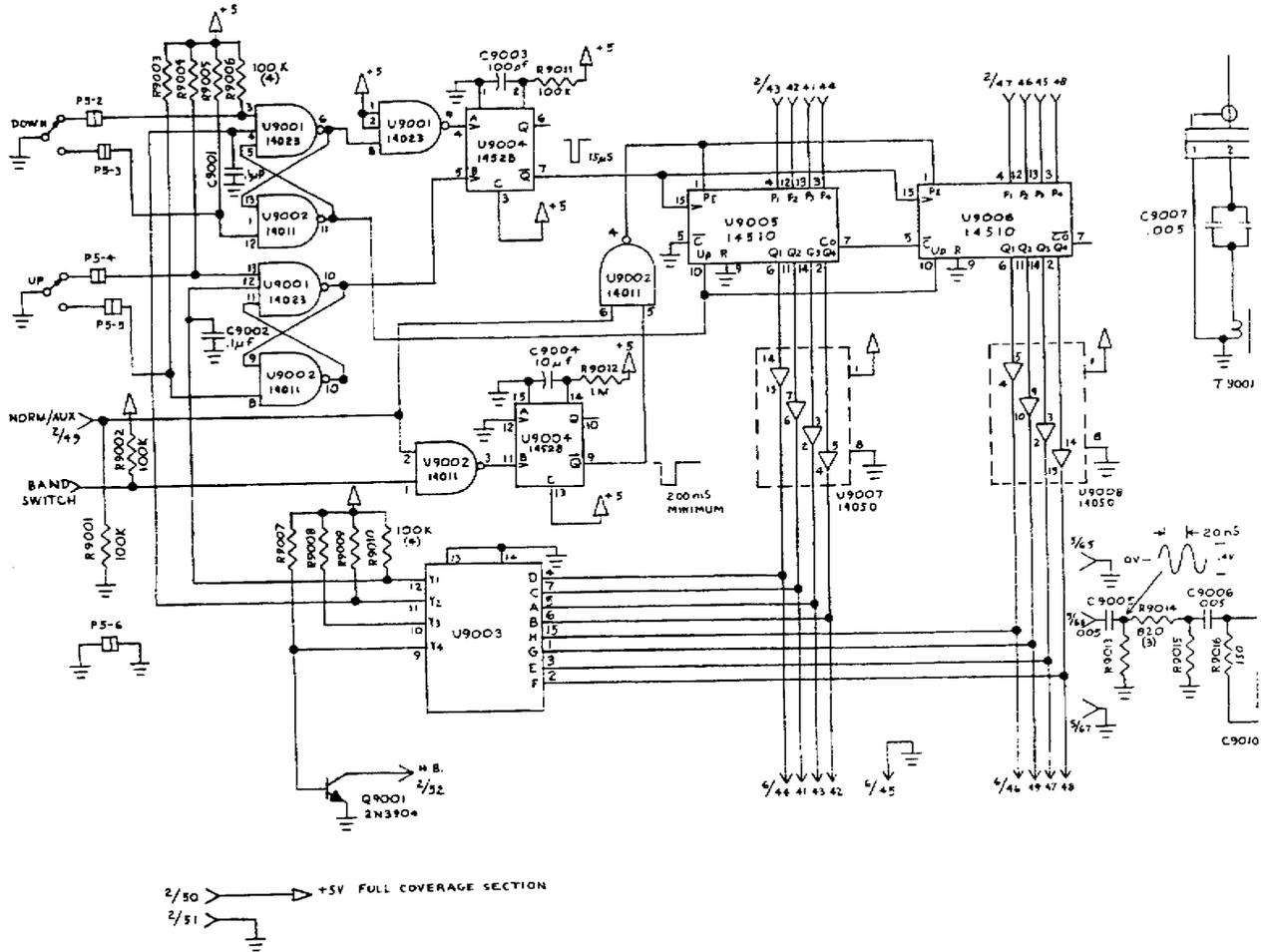
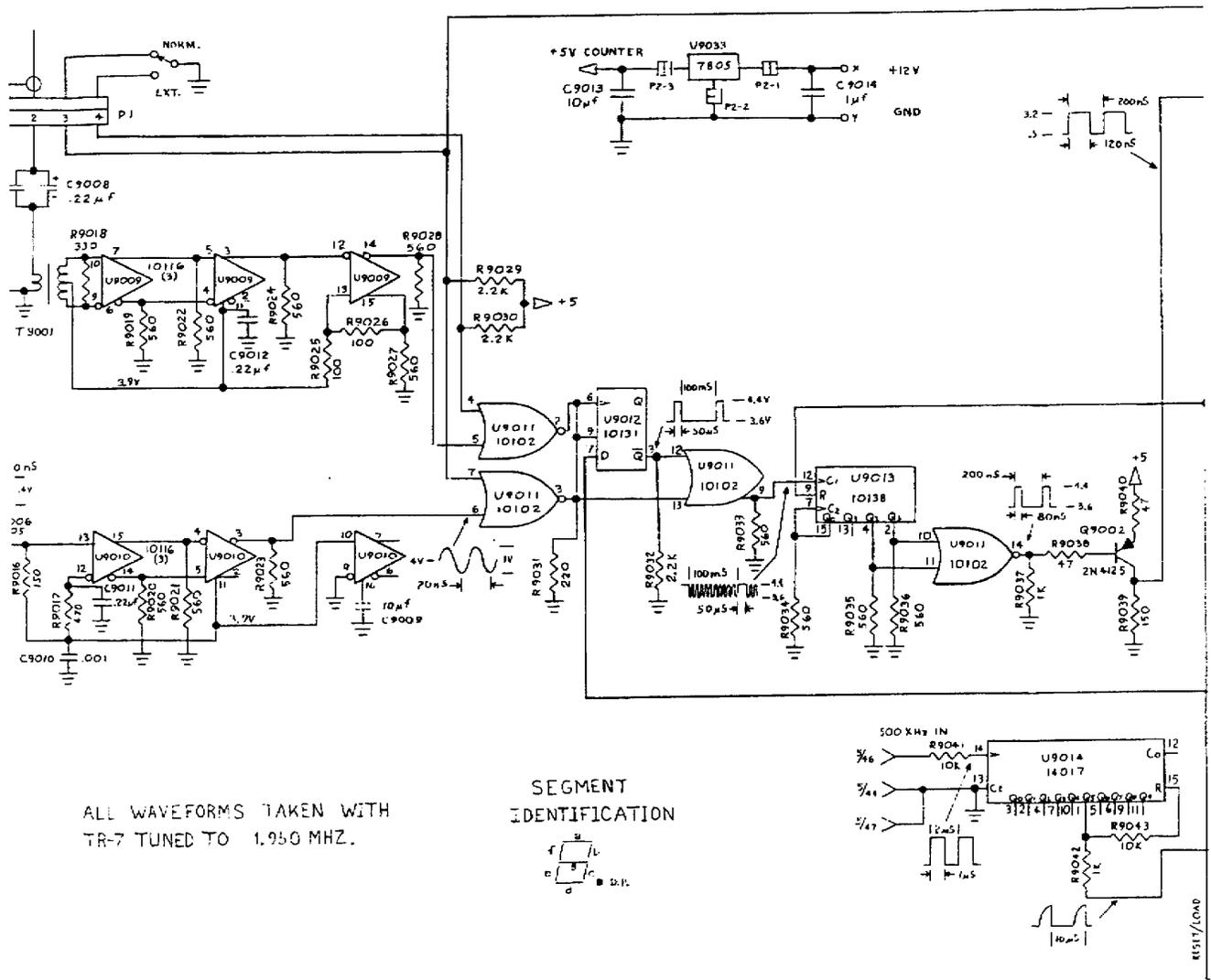


Fig. 4-2 DR7 Board Pictorial

R	9001 9002	9003 9004 9005	9006 9007 9008 9009 9010	9011 9012	9013 9014 9015 9016	9017 9018 9019 9020
C	9001 9002	9003 9004	9005 9006 9007	9008 9009 9010	9011 9012 9013	9014 9015 9016
U	9001 9002	9003 9004	9005 9006 9007	9008 9009 9010	9011 9012 9013	9014 9015 9016

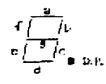


9016	9017	9018	9019	9020	9021	9022	9023	9024	9025	9026	9027	9028	9029	9030	9031	9032	9033	9034	9035	9036	9037	9038	9039	9040	9041	9042	9043	9044	9045
9016	9017	9018	9019	9020	9021	9022	9023	9024	9025	9026	9027	9028	9029	9030	9031	9032	9033	9034	9035	9036	9037	9038	9039	9040	9041	9042	9043	9044	9045
9016	9017	9018	9019	9020	9021	9022	9023	9024	9025	9026	9027	9028	9029	9030	9031	9032	9033	9034	9035	9036	9037	9038	9039	9040	9041	9042	9043	9044	9045



ALL WAVEFORMS TAKEN WITH TR-7 TUNED TO 1.950 MHZ.

SEGMENT IDENTIFICATION



ES117/1040



9064	9065	9066	9067	9068	9069	9070	9071	9072	9073
9027	9028	9029	9030	9031				9032	
9025									

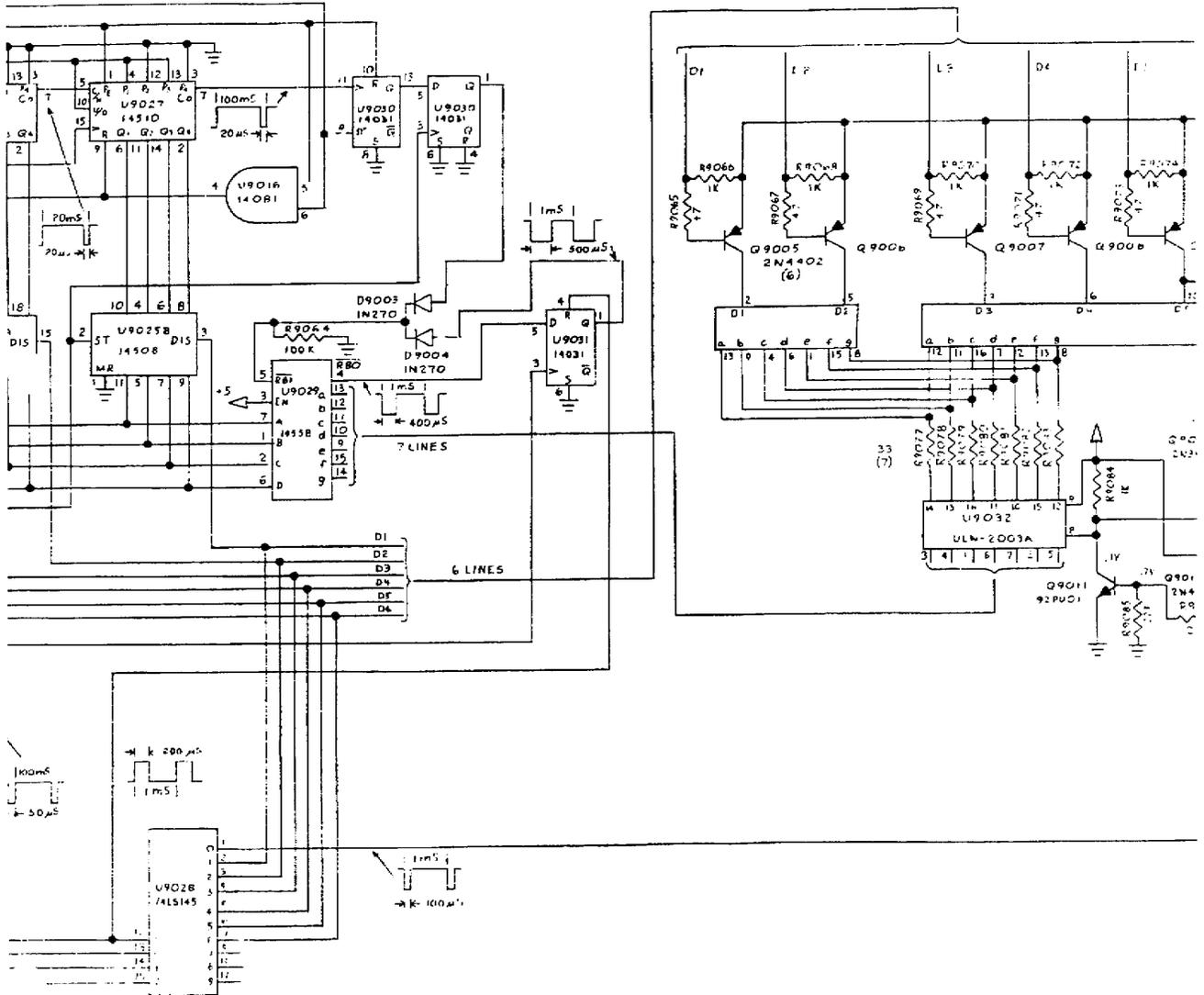


Fig. 4-3 DR7 Board Schem



#### 4-2. AUX-7 AUXILIARY PROGRAM BOARD

The AUX-7 Auxiliary Program Board is an accessory which allows the programming of up to eight 500 kHz ranges and/or eight fixed channels. These channels are selected by the front panel AUX PROGRAM switch, which applies 5 volts to pins 1-8 of the board for channel selection. All eight channels are identical in operation, so the following discussion for channel 1 can be applied to any channel.

Channel 1 is selected by applying 5 volts to pin 1 of the AUX-7 via the front panel AUX PROGRAM switch. This voltage is applied to pin 1 of the channel range module and to the anode of CR101 through R101. R101 sets the current through CR101, while R101 and C101 form an rf decoupling network. The current through CR101 effectively grounds one end of C102 and C103, thus enabling the channel 1 crystal (if installed).

The RTM-7 and RRM-7 range modules are diode arrays arranged in such a manner that pin 1 is connected to the anode of all diodes. The cathodes of the diodes are connected to module pins 2 through 14. Thus, when 5 volts is applied to pin 1,

approximately 4.3 volts will appear at all other pins of the module which have not been removed during range programming. In this manner, BCD data is supplied to the Digital Control Module for band and range control. Band information is present on AUX7 pins 9 through 12, and range information is found on pins 15 through 22.

When the TR-7 is placed in the FIXED mode, 10 volts is applied to pin 25 of the AUX-7. This voltage is applied through L101 (for rf decoupling) to the anode of CR109 thus enabling the fixed oscillator output, pin 24. At the same time, 10 volts is supplied to Q101, the fixed crystal oscillator stage, and Q102, the fixed output buffer stage, allowing these stages to operate. The output of the buffer (Q102) is routed through an attenuator consisting of R115, R116, and R117 to the anode of CR109, from which it is connected through the switching network on the parent board to the translator module in place of the PTO signal.

The only alignment required in the AUX-7 is the setting of C103, C106, C109, C112, C115, C118, C121, and C124, which are provided to set the eight fixed channel crystals exactly on frequency.

#### NOTES:

## AUX-7 AUXILIARY PROGRAM BOARD

REF DES	DESCRIPTION	PART NO.
C101	Capacitor, Disc, .01 $\mu$ F + 80%, 25 V	3161500
C102	Capacitor, Disc, 27 pF $\pm$ 5%, NPO	3160650
C103	Capacitor, Variable, 5-20 pF	3205375
C104	Capacitor, Disc, .01 $\mu$ F + 80%, 25 V	3161500
C105	Capacitor, Disc, 27 pF $\pm$ 5%, NPO	3160650
C106	Capacitor, Variable, 5-20 pF	3205375
C107	Capacitor, Disc, .01 $\mu$ F + 80%, 25 V	3161500
C108	Capacitor, Disc, 27 pF $\pm$ 5%, NPO	3160650
C109	Capacitor, Variable, 5-20 pF	3205375
C110	Capacitor, Disc, .01 $\mu$ F + 80%, 25 V	3161500
C111	Capacitor, Disc, 27 pF $\pm$ 5%, NPO	3160650
C112	Capacitor, Variable, 5-20 pF	3205375
C113	Capacitor, Disc, .01 $\mu$ F + 80%, 25 V	3161500
C114	Capacitor, Disc, 27 pF $\pm$ 5%, NPO	3160650
C115	Capacitor, Variable, 5-20 pF	3205375
C116	Capacitor, Disc, .01 $\mu$ F + 80%, 25 V	3161500
C117	Capacitor, Disc, 27 pF $\pm$ 5%, NPO	3160650
C118	Capacitor, Variable, 5-20 pF	3205375
C119	Capacitor, Disc, .01 $\mu$ F + 80%, 25 V	3161500
C120	Capacitor, Disc, 27 pF $\pm$ 5%, NPO	3160650
C121	Capacitor, Variable, 5-20 pF	3205375
C122	Capacitor, Disc, .01 $\mu$ F + 80%, 25 V	3161500
C123	Capacitor, Disc, 27 pF $\pm$ 5%, NPO	3160650
C124	Capacitor, Variable, 5-20 pF	3205375
C125	Capacitor, Mica, 500 pF $\pm$ 10%, DM-15	3170420
C126	Capacitor, Mica, 210 pF $\pm$ 5%, DM-15	3170230
C127	Capacitor, Disc, .01 $\mu$ F + 80%, 25 V	3161500
C128	Capacitor, Disc, .01 $\mu$ F + 80%, 25 V	3161500
C129	Capacitor, Disc, .01 $\mu$ F + 80%, 25 V	3161500
C130	Capacitor, Disc, .01 $\mu$ F + 80%, 25 V	3161500
C131	Capacitor, Disc, 100 pF $\pm$ 10%, X5F	3161070
C132	Capacitor, Tantalum, .22 $\mu$ F $\pm$ 10%, 35 V	3183100
CR101	Diode, 1N4148	3020090
CR102	Diode, 1N4148	3020090
CR103	Diode, 1N4148	3020090
CR104	Diode, 1N4148	3020090
CR105	Diode, 1N4148	3020090
CR106	Diode, 1N4148	3020090
CR107	Diode, 1N4148	3020090
CR108	Diode, 1N4148	3020090
CR109	Diode, MPN3404	3020265
L101	Choke, 270 $\mu$ H, MUD271	3520590
Q101	Transistor, 2N3563	3030060
Q102	Transistor, 2N3563	3030060
R101	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R102	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R103	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R104	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R105	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R106	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R107	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R108	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160

REF DES	DESCRIPTION	PART NO.
R109	Resistor, Carbon Film, 18 K $\Omega$ $\pm$ 5%, 1/4 W	3220255
R110	Resistor, Carbon Film, 47 K $\Omega$ $\pm$ 5%, 1/4 W	3220285
R111	Resistor, Carbon Film, 1.0 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R112	Resistor, Carbon Film, 2.7 K $\Omega$ $\pm$ 5%, 1/4 W	3220195
R113	Resistor, Carbon Film, 2.7 K $\Omega$ $\pm$ 5%, 1/4 W	3220195
R114	Resistor, Carbon Film, 180 $\Omega$ $\pm$ 5%, 1/4 W	3220070
R115	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R116	Resistor, Carbon Film, 10 $\Omega$ $\pm$ 5%, 1/4 W	3220005
R117	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R118	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
	Socket, Crystal	3282020
	Socket, I.C.	3282104

**NOTES:**

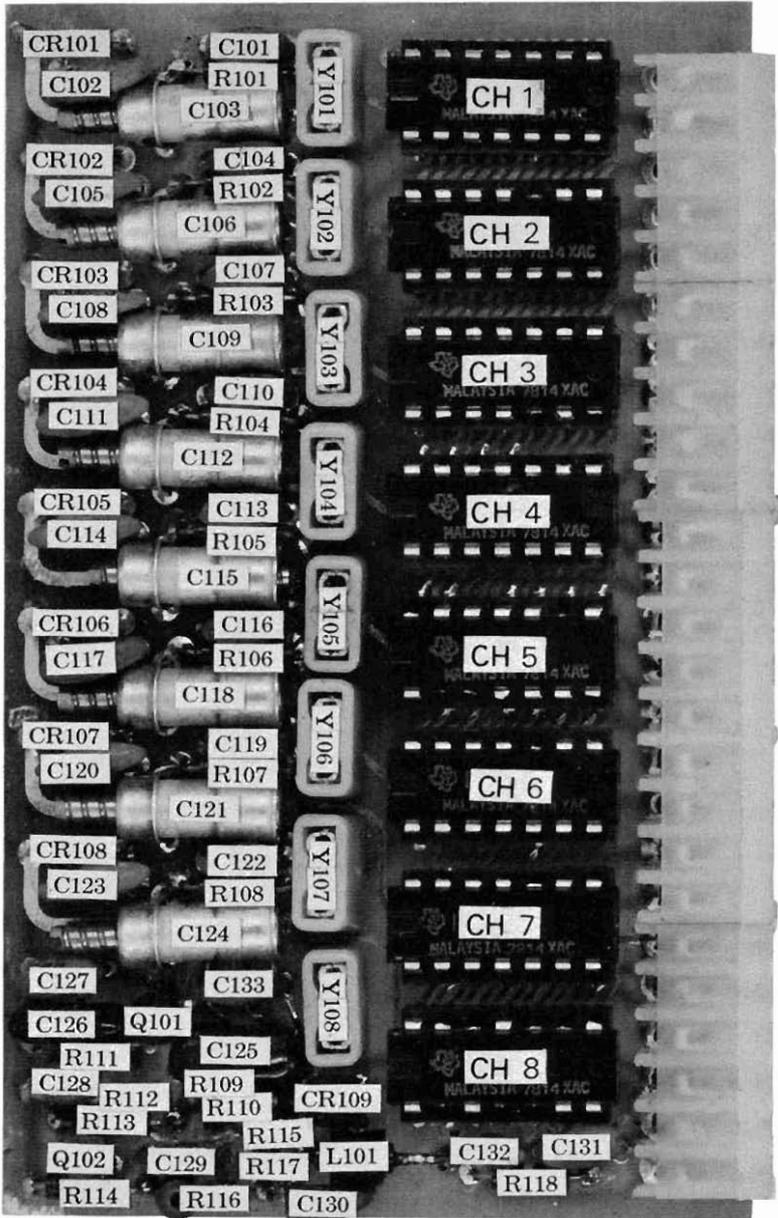
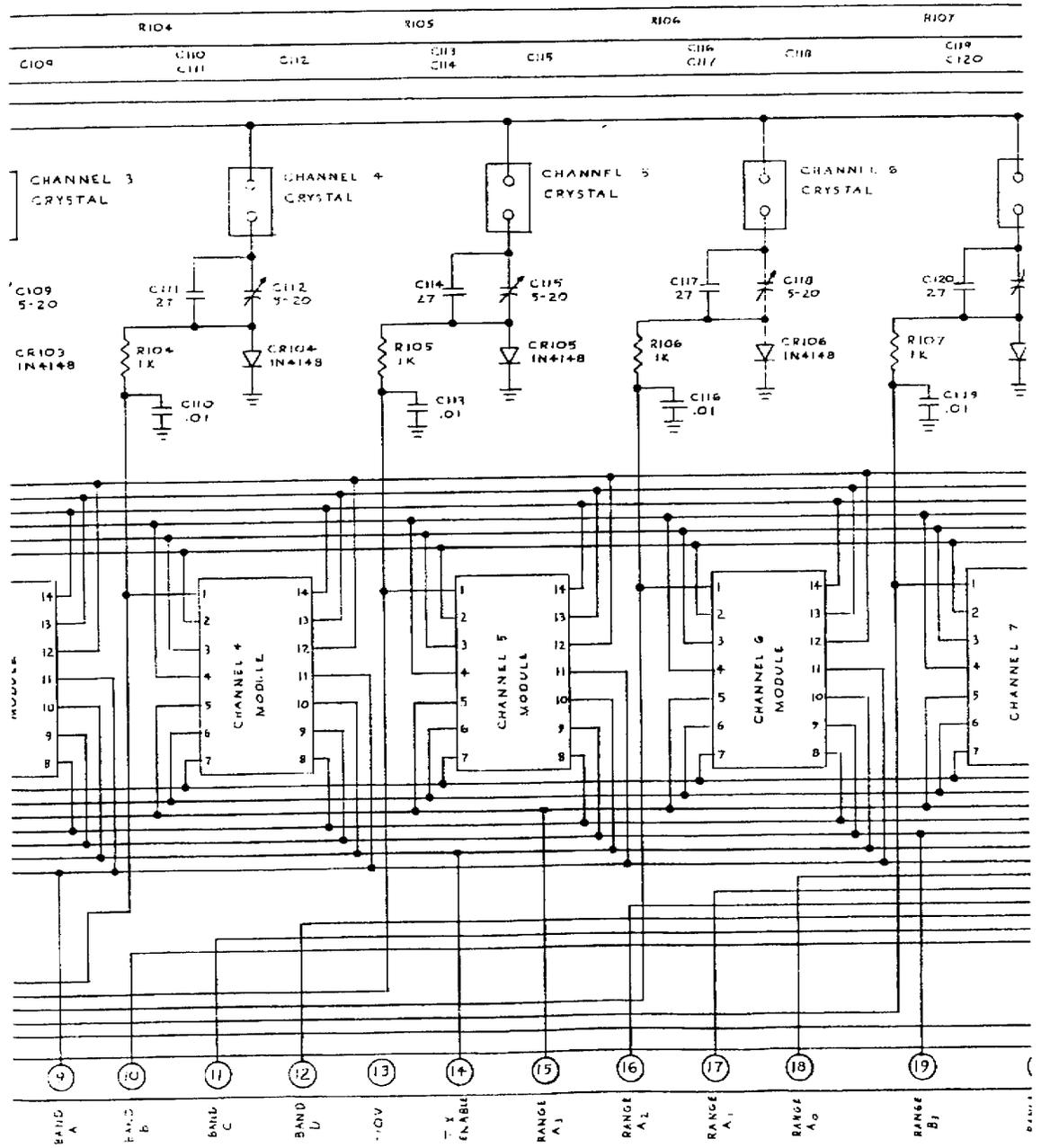


Fig. 4-4 AUX7 Board Pictorial



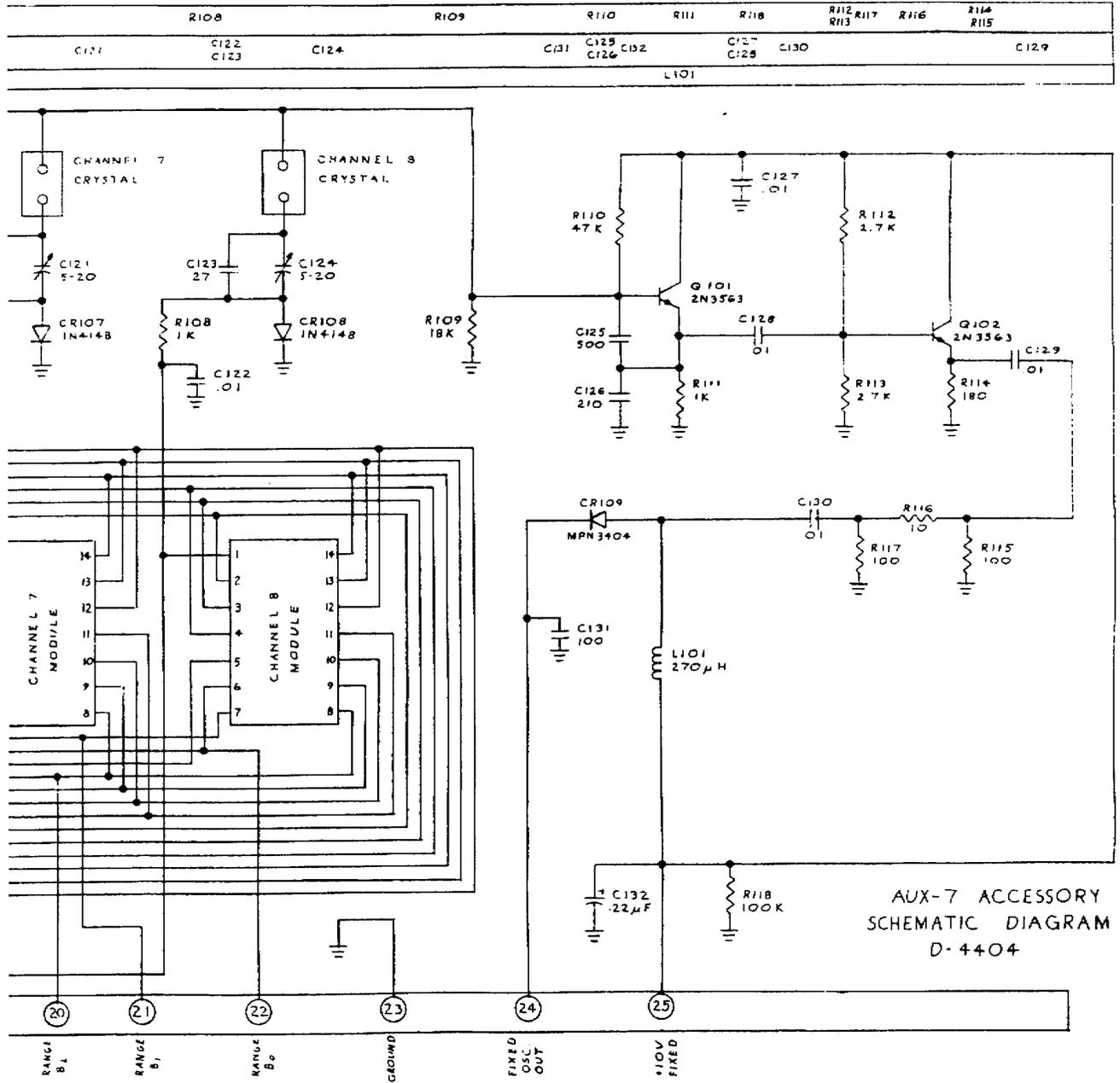
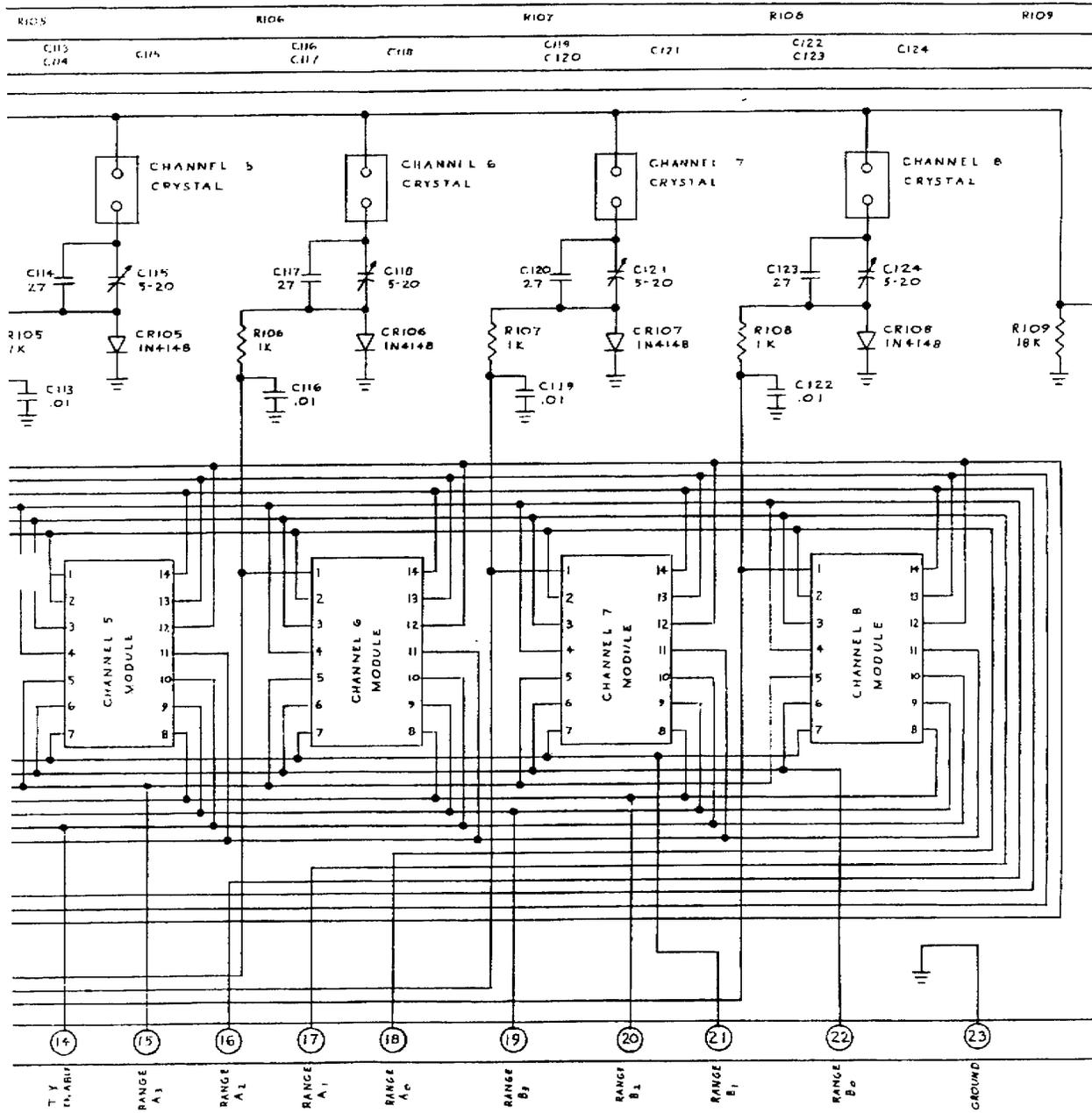


Fig. 4-5 AUX7 Board Schematic



## 4-3. NB-7 NOISE BLANKER

## NOTE:

The NB7 Noise Blanker option may be supplied as one of two boards. If your board matches the picture shown in figure 4-6, refer to section 4-3.1 for schematic, parts list and alignment procedure. If, on the other hand, your board matches the picture shown in figure 4-8, refer to section 4-3.2 for schematic, parts list and alignment procedure. The following circuit description and theory of operation pertain to both units. Where necessary, differences between version 1 and version 2 will be noted.

## CIRCUIT DESCRIPTION

This noise blanker system is comprised of the three major networks described below. Refer to the proper schematic for your particular version to follow this description.

**Transmit Path**

In transmit, diode CR815 is turned on with +10T via RFC812 and RFC813 from pin 37. The 5.645 MHz double sideband transmit signal is fed to the output coax connector through C833, CR815 and C838. When CR815 is on, CR814 will be reverse biased, thus holding the receive path off.

**Receive Path**

In receive, diode CR814 is turned on with +10T via RFC810 and RFC811 from pin 24. In version 1, the receive signal is applied to pin 22 and coupled directly to the blanking gate, comprised of T810, CR812, CR813, and T811, then through C830, CR814 and C838 to the output coax connector. In version 2, the receive signal again enters from pin 22, however, then passed through a matching amplifier consisting of Q816 and associated circuitry. The output of Q816 is then coupled to the blanking gate of T811, CR812, CR813 and T811, passes through C830, CR814 and C838 to the output coax.

**Noise Processor**

The Noise Amplifiers consist of Q810, Q811, and U810 cascaded and tuned to 5.645 MHz by L810, L811 and L812 respectively. The output of the noise amplifier string is split by C828 to the pulse detector and C827 to the noise amplifier AGC circuit. Q812 and associated circuitry comprise the noise amplifier AGC detector and amplifier. The AGC voltage is applied to gate 1 of Q810 and Q811 via R826 and R829 respectively.

The pulse detector, CR811, responds only to the positive half of the amplified bipolar input pulse. The network of R839, C831 and C835 waveshape the pulse at the base of the pulse amplifier Q813. Again, the output pulse of Q813 is shaped by R847 and C840 and is applied to the gate driver, Q814. Resistor network R842 and R843 provide fixed reverse bias for the blanking gate. Q815 is a DC switch for +10R and +10NB.

**Theory of Operation**

The 5.645 MHz receive signal, with noise pulses, is applied to pin 22. In version 1 this signal is coupled directly to the blanking gate. In version 2, amplifier Q816 amplifies the signal and noise pulses to drive the blanking gate. Tuned amplifiers Q810, Q811 and U810 amplify this low level signal up to a high level to drive the pulse detector CR811.

This detector responds only to the positive going portion of each noise pulse from the output of U810. Following the detector is an RC network which shapes the pulses for driving the level shifter Q813. Again, on the output of Q813 is still another RC network for waveshaping. The gate driver transistor Q814 responds to the negative going pulse from Q813 which allows the blanking gate to turn off, thus muting the receive path and blanking the noise pulse.

Since the noise amplifiers run such high gain, Q812 and associated circuitry comprise an AGC loop to maintain a near constant output level to the detector. This allows detection and processing of very weak as well as very strong noise pulses without degrading the blanking action.

## 4-3.1 NB7, VERSION 1

**Alignment**

The NB7 is easily aligned via the following procedures:

Equipment Required: High Input Impedance VTVM

The following parts from the TR7 Maintenance Kit:

1 6-pin extender card

1 4-pin extender card

1 tuning tool: small white blade #SK-462

1) Remove NB7 per Installation instructions 1 through 4.

- 2) Carefully install extender cards making sure they properly match the connectors on the NB7 and the pins in the TR7 card cage.
- 3) Connect coax from IF Selectivity card to the coax receptacle on top of the NB7. Note if coax will not reach - Remove IF Selectivity card and cut wire tie on coax to facilitate connection of coax.
- 4) Turn TR7 on and depress calibrator switch. Tune in calibrator signal. Put Mode switch in CW, Band switch at 14 MHz.
- 5) Refer to figure 1 and connect VTVM to test pad. Depress NB switch to activate Noise Blanker.
- 6) Tune L810, L811 and L812 for maximum DC voltage.
- 7) Remove VTVM and turn off TR7.
- 8) Remove NB7 and extender cards.
- 9) Reinstall NB7 as per Installation steps 5 through 9.

## NOTES:

## NB7 NOISE BLANKER - VERSION I

REF DES	DESCRIPTION	PART NO.
C810	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C811	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C812	Capacitor, Mica, 390 pF $\pm$ 5%, DM-15	3170370
C813	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C814	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C815	Capacitor, Mica, 390 pF $\pm$ 5%, DM-15	3170370
C816	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, M25V	3161500
C817	Capacitor, Tantalum, 10 $\mu$ F $\pm$ 20%, 25 V	3183030
C818	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, M25V	3161500
C819	Capacitor, Mica, 390 pF $\pm$ 5%, DM-15	3170370
C820	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, M25V	3161500
C821	Capacitor, Disc, .0024 $\mu$ F $\pm$ 20%, Z5U	3161440
C822	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C823	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C824	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, M25V	3161500
C825	Capacitor, Tantalum, 1 $\mu$ F $\pm$ 20%, 35 V	3183010
C826	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C827	Capacitor, Mica, 180 pF $\pm$ 5%, DM-15	3170180
C828	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C829	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, M25V	3161500
C830	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, M25V	3161500
C831	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C832	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, M25V	3161500
C833	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, M25V	3161500
C834	Capacitor, Tantalum, 1 $\mu$ F $\pm$ 20%, 35 V	3183010
C835	Capacitor, Mica, 270 pF $\pm$ 5%, DM-15	3170280
C836	Capacitor, Tantalum, 1 $\mu$ F $\pm$ 20%, 35 V	3183010
C837	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, M25V	3161500
C838	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C839	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C840	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C841	Capacitor, Tantalum, 10 $\mu$ F $\pm$ 20%, 25 V	3183030
C842	Capacitor, Disc, 470 pF $\pm$ 20%, Z5U	3161350
C843	Capacitor, Disc, 470 pF $\pm$ 20%, Z5U	3161350
C844	Capacitor, Disc, 47 pF $\pm$ 5%, Z5U	3160840
C844	Capacitor, Disc, 47 pF $\pm$ 5%, Z5U	3160840
CR810	Diode, 1N4148	3020090
CR811	Diode, AA119/1N541	3020040
CR812	Diode, AA119/1N541	3020040
CR813	Diode, AA119/1N541	3020040
CR814	Diode, MPN3404	3020265
CR815	Diode, MPN3404	3020265
CR816	Diode, 1N4148	3020090
L810	Coil, B4408-1	B4408-1
L811	Coil, B4408-1	B4408-1
L812	Coil, B4408-1	B4408-1
Q810	Transistor, 3N204	3040110
Q811	Transistor, 3N204	3040110
Q812	Transistor, 2N4402	3030120
Q813	Transistor, 2N3904	3030105
Q814	Transistor, 2N3904	3030105
Q815	Transistor, 2N4402	3030120

REF DES	DESCRIPTION	PART NO.
R810	Resistor, Carbon Film, 6.8 K $\Omega$ $\pm$ 5%, 1/4W	3220220
R811	Resistor, Carbon Film, 22 K $\Omega$ $\pm$ 5%, 1/4W	3220260
R812	Resistor, Carbon Film, 27 $\Omega$ $\pm$ 5%, 1/4 W	3220020
R813	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R814	Resistor, Carbon Film, 22 K $\Omega$ $\pm$ 5%, 1/4W	3220260
R815	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R816	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R817	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R818	Resistor, Carbon Film, 68 $\Omega$ $\pm$ 5%, 1/4 W	3220045
R819	Resistor, Carbon Film, 47 K $\Omega$ $\pm$ 5%, 1/4W	3220285
R820	Resistor, Carbon Film, 27 $\Omega$ $\pm$ 5%, 1/4 W	3220020
R821	Resistor, Carbon Film, 6.8 K $\Omega$ $\pm$ 5%, 1/4W	3220220
R822	Resistor, Carbon Film, 820 $\Omega$ $\pm$ 5%, 1/4 W	3220145
R823	Resistor, Carbon Film, 27 $\Omega$ $\pm$ 5%, 1/4 W	3220020
R824	Resistor, Carbon Film, 1.5 K $\Omega$ $\pm$ 5%, 1/4W	3220175
R825	Resistor, Carbon Film, 5.6 K $\Omega$ $\pm$ 5%, 1/4W	3220215
R826	Resistor, Carbon Film, 330 K $\Omega$ $\pm$ 5%, 1/4W	3220340
R827	Resistor, Carbon Film, 10 $\Omega$ $\pm$ 5%, 1/4 W	3220005
R828	Resistor, Carbon Film, 820 $\Omega$ $\pm$ 5%, 1/4 W	3220145
R829	Resistor, Carbon Film, 330 K $\Omega$ $\pm$ 5%, 1/4W	3220340
R830	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4W	3220315
R831	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4W	3220190
R832	Resistor, Carbon Film, 8.2 K $\Omega$ $\pm$ 5%, 1/4W	3220230
R833	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4W	3220315
R834	Resistor, Carbon Film, 330 K $\Omega$ $\pm$ 5%, 1/4W	3220340
R835	Resistor, Composition, 6.8 M $\Omega$ $\pm$ 10%, 1/4 W	3220375
R836	Resistor, Carbon Film, 1 K $\Omega$ $\pm$ 5%, 1/4W	3220160
R837	Resistor, Carbon Film, 470 K $\Omega$ $\pm$ 5%, 1/4W	3220345
R838	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4W	3220315
R839	Resistor, Carbon Film, 1 M $\Omega$ $\pm$ 5%, 1/4W	3220355
R840	Resistor, Carbon Film, 1 M $\Omega$ $\pm$ 5%, 1/4W	3220355
R841	Resistor, Carbon Film, 1 M $\Omega$ $\pm$ 5%, 1/4W	3220355
R842	Resistor, Carbon Film, 15 K $\Omega$ $\pm$ 5%, 1/4W	3220245
R843	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4W	3220190
R844	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4W	3220190
R845	Resistor, Carbon Film, 36 K $\Omega$ $\pm$ 5%, 1/4W	3220280
R846	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4W	3220235
R847	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4W	3220315
R848	Resistor, Carbon Film, 330 $\Omega$ $\pm$ 5%, 1/4 W	3220090
R849	Resistor, Carbon Film, 1.5 K $\Omega$ $\pm$ 5%, 1/4W	3220175
R850	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4W	3220235
R851	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4W	3220315
R852	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4W	3220235
RFC810	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC811	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC812	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC 813	Choke Assy., 270 $\mu$ H, MUD271	3520590
T810	Toroid, 266CT125/4C4	3522110
T811	Toroid, 266CT125/4C4	3522110
U810	Integrated Circuit, MC1350P	3040110

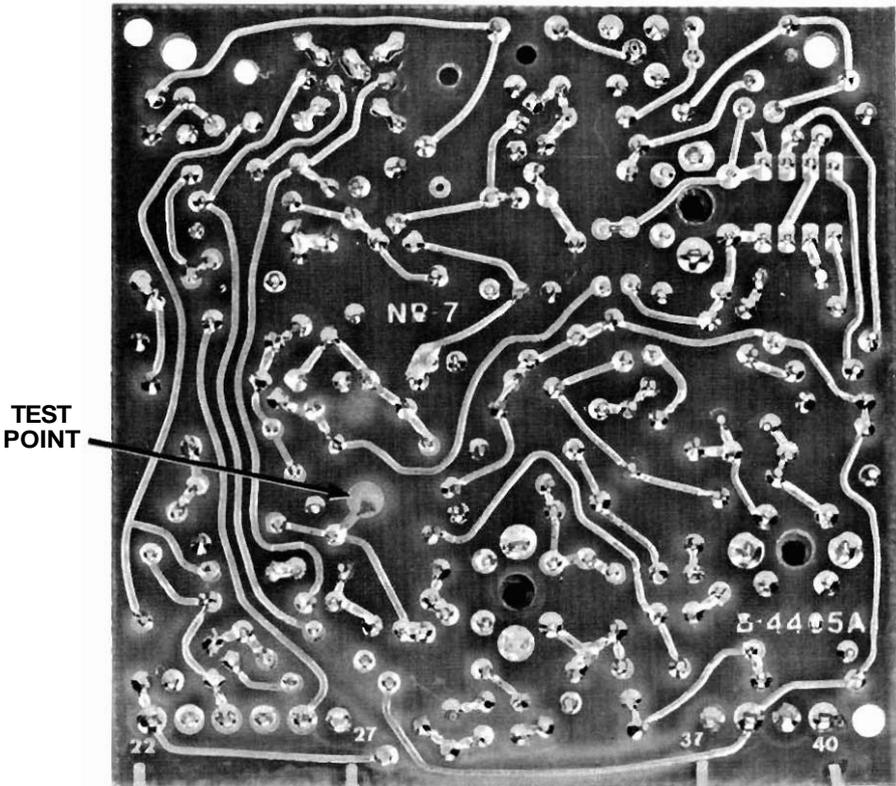
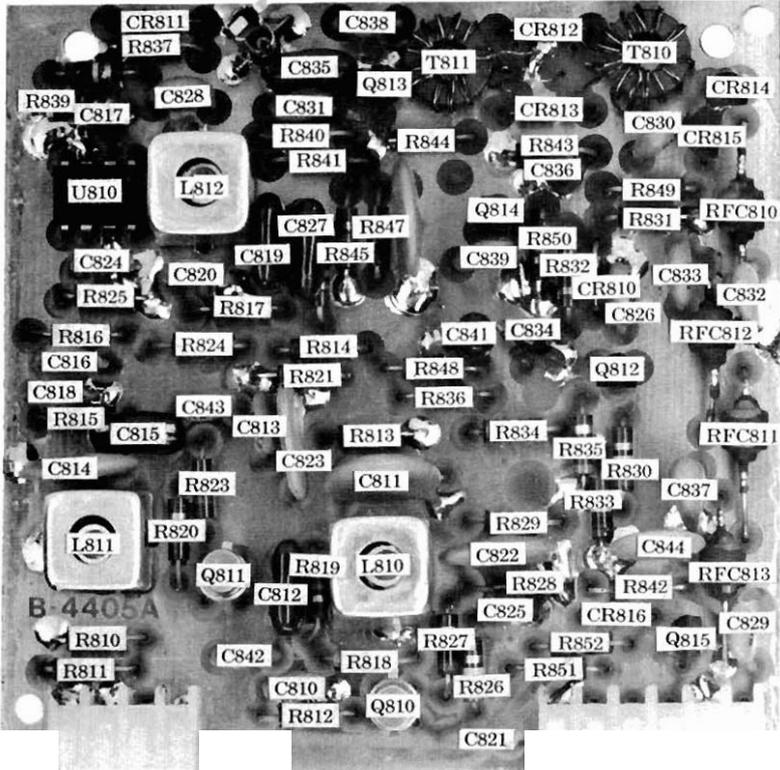


Fig. 4-6 NB-7 Board Pictorial, Version 1



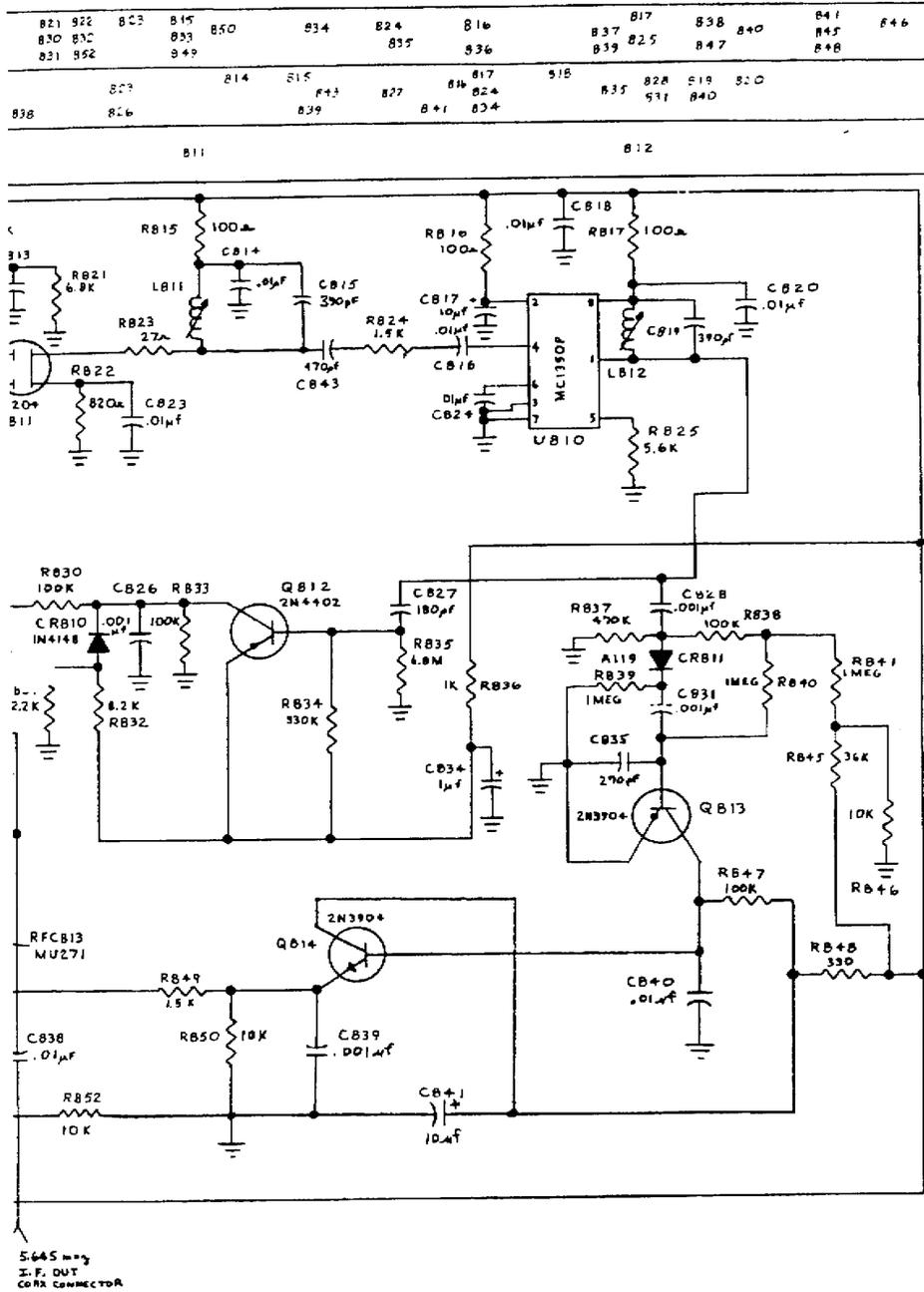


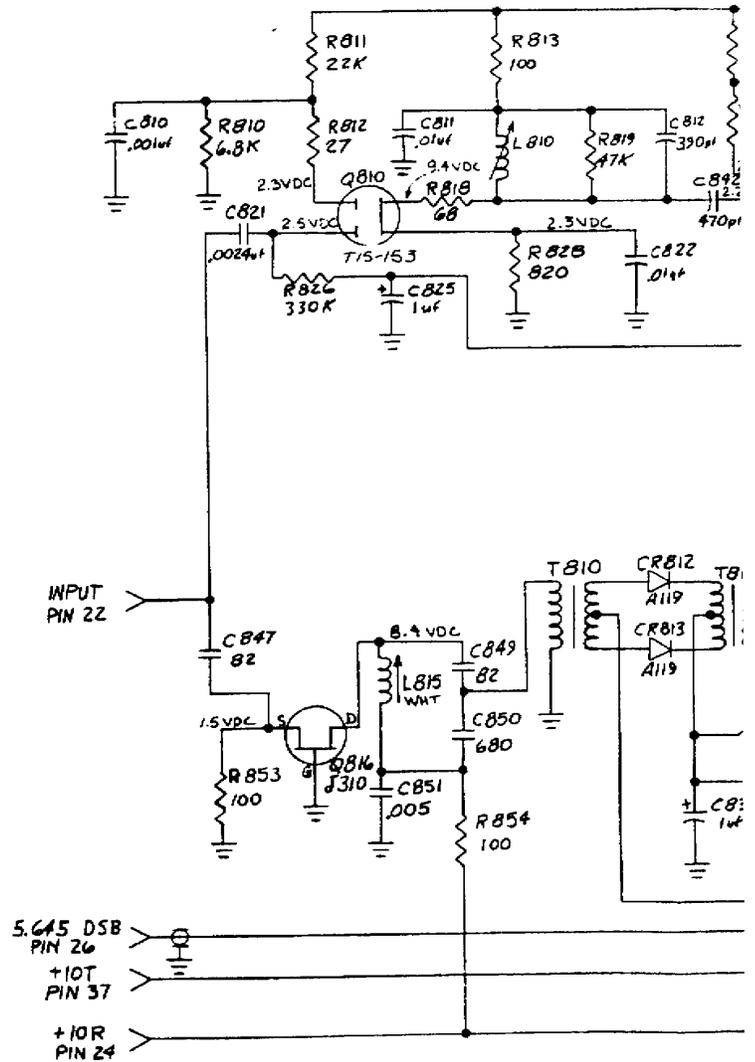
Fig. 4-7 NB-7 Board Schematic, Version 1

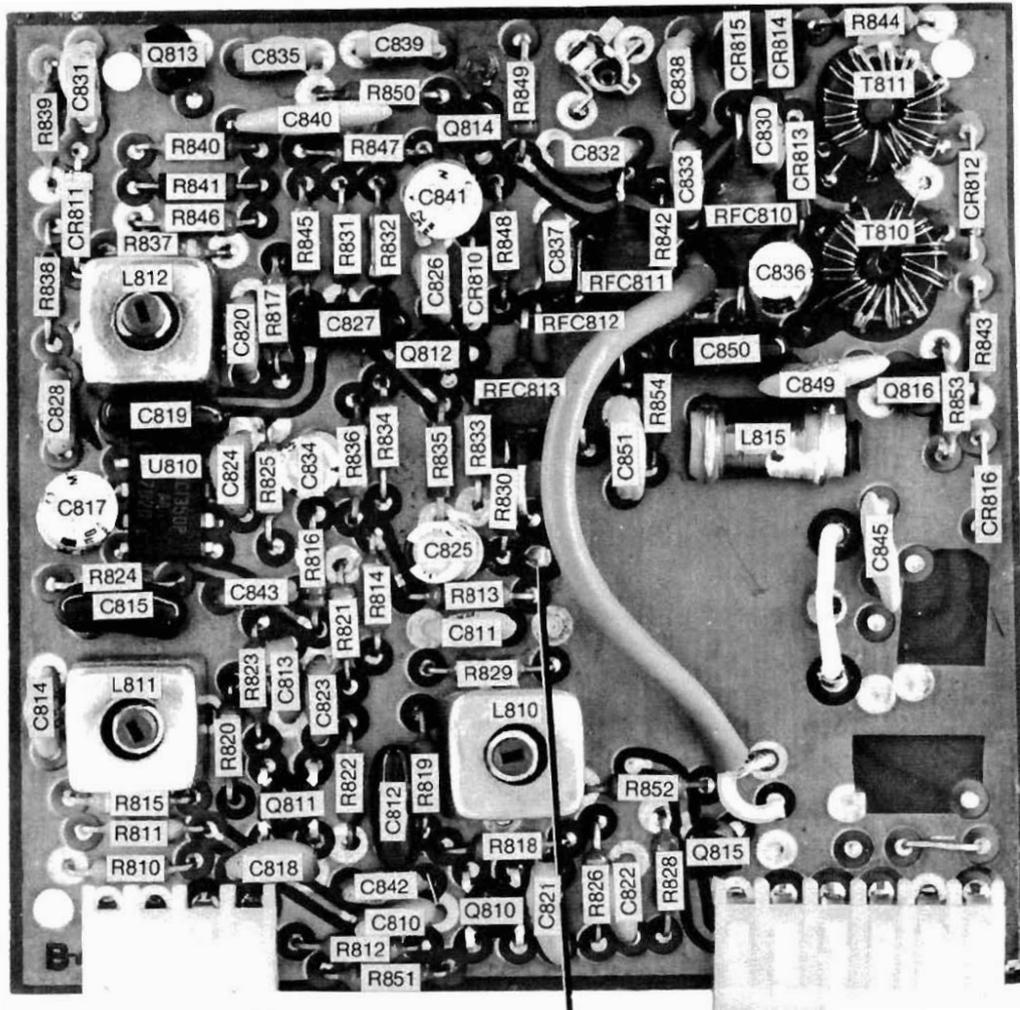
## NB7 NOISE BLANKER - VERSION 2

REF DES	DESCRIPTION	PART NO.
C810	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C811	Capacitor, Disc, .01 $\mu$ F $\pm$ 20%, Z5U	3161520
C812	Capacitor, Mica, 390 pF $\pm$ 5%, DM-15	3170370
C813	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C814	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C815	Capacitor, Mica, 290 pF $\pm$ 5%, DM-15	3170370
C817	Capacitor, Tantalum, 10 $\mu$ F $\pm$ 20%, 25 V	3183030
C818	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C819	Capacitor, Mica, 390 pF $\pm$ 5%, DM-15	3170370
C820	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C821	Capacitor, Disc, .0024 $\mu$ F $\pm$ 20%, Z5U	3161440
C822	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C823	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C824	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C825	Capacitor, Tantalum, 1 $\mu$ F $\pm$ 20%, 35 V	3183010
C826	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C827	Capacitor, Mica, 180 pF $\pm$ 5%, DM-15	3170180
C828	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161480
C830	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C831	Capacitor, Disc, .05 $\mu$ F/16 V P.T.	3161600
C832	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C833	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C834	Capacitor, Tantalum, 1 $\mu$ F $\pm$ 20%, 25 V	3183010
C835	Capacitor, Disc, 330 pF $\pm$ 10%, Y5E	3161300
C836	Capacitor, Tantalum, 1 $\mu$ F $\pm$ 20%, 35 V	3183010
C837	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C838	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C839	Capacitor, Disc, .001 $\mu$ F $\pm$ 20%, Z5U	3161380
C840	Capacitor, Disc, .01 $\mu$ F $\pm$ 80%, M25V	3161500
C841	Capacitor, Tantalum, 10 $\mu$ F $\pm$ 20%, 25 V	3183030
C842	Capacitor, Disc, 470 pF $\pm$ 20%, Z5U	3161350
C843	Capacitor, Disc, 470 pF $\pm$ 20%, Z5U	3161350
C845	Capacitor, Disc, 82 pF $\pm$ 5%, N750	3161040
C849	Capacitor, Disc, 82 pF $\pm$ 5%, N750	3161040
C850	Capacitor, Mica, 680 pF $\pm$ 5%, DM-15	3170500
C851	Capacitor, Disc, .005 $\mu$ F $\pm$ 20%, Z5U	3161460
CR810	Diode, 1N4148	3020090
CR811	Diode, AA119/1N541	3020040
CR812	Diode, AA119/1N541	3020040
CR813	Diode, AA119/1N541	3020040
CR814	Diode, MPN3404	3020265
CR815	Diode, MPN3404	3020265
CR816	Diode, 1N4148	3020090
L810	Inductor, Variable Can	2511021
L811	Inductor, Variable Can	2511021
L812	Inductor, Variable Can	2511021
L815	Inductor, Variable, wht.	2513007
Q810	Transistor, TIS-153	3030480
Q811	Transistor, TIS-153	3030480
Q812	Transistor, 2N4402	3030120
Q813	Transistor, 2N3904	3030105
Q814	Transistor, 2N3904	3030105

REF DES	DESCRIPTION	PART NO
Q815	Transistor, 2N4402	3030120
Q816	Transistor, 2N4402	3030501
R810	Resistor, Carbon Film, 6.8 K $\Omega$ $\pm$ 5%, 1/4 W	3220220
R811	Resistor, Carbon Film, 22 K $\Omega$ $\pm$ 5%, 1/4 W	3220260
R812	Resistor, Carbon Film, 27 $\Omega$ $\pm$ 5%, 1/4 W	3220020
R813	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R814	Resistor, Carbon Film, 22 K $\Omega$ $\pm$ 5%, 1/4 W	3220260
R815	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R816	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R817	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R818	Resistor, Carbon Film, 68 $\Omega$ $\pm$ 5%, 1/4 W	3220045
R819	Resistor, Carbon Film, 47 K $\Omega$ $\pm$ 5%, 1/4 W	3220285
R820	Resistor, Carbon Film, 27 $\Omega$ $\pm$ 5%, 1/4 W	3220020
R821	Resistor, Carbon Film, 6.8 K $\Omega$ $\pm$ 5%, 1/4 W	3220220
R822	Resistor, Carbon Film, 820 $\Omega$ $\pm$ 5%, 1/4 W	3220145
R823	Resistor, Carbon Film, 27 $\Omega$ $\pm$ 5%, 1/4 W	3220020
R824	Resistor, Carbon Film, 1.5 K $\Omega$ $\pm$ 5%, 1/4 W	3220175
R825	Resistor, Carbon Film, 5.6 K $\Omega$ $\pm$ 5%, 1/4 W	3220215
R826	Resistor, Carbon Film, 330 K $\Omega$ $\pm$ 5%, 1/4 W	3220340
R828	Resistor, Carbon Film, 820 K $\Omega$ $\pm$ 5%, 1/4 W	3220145
R829	Resistor, Carbon Film, 330 K $\Omega$ $\pm$ 5%, 1/4 W	3220340
R830	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R831	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R832	Resistor, Carbon Film, 8.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220230
R833	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R834	Resistor, Carbon Film, 330 K $\Omega$ $\pm$ 5%, 1/4 W	3220340
R835	Resistor, Composition, 6.8 M $\Omega$ $\pm$ 10%, 1/4 W	3220375
R836	Resistor, Carbon Film, 1 K $\Omega$ $\pm$ 5%, 1/4 W	3220160
R837	Resistor, Carbon Film, 470 K $\Omega$ $\pm$ 5%, 1/4 W	3220345
R838	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R839	Resistor, Carbon Film, 1 M $\Omega$ $\pm$ 5%, 1/4 W	3220355
R840	Resistor, Carbon Film, 1 M $\Omega$ $\pm$ 5%, 1/4 W	3220355
R841	Resistor, Carbon Film, 680 K $\Omega$ $\pm$ 5%, 1/4 W	3220350
R842	Resistor, Carbon Film, 15 K $\Omega$ $\pm$ 5%, 1/4 W	3220245
R843	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R844	Resistor, Carbon Film, 2.2 K $\Omega$ $\pm$ 5%, 1/4 W	3220190
R845	Resistor, Carbon Film, 36 K $\Omega$ $\pm$ 5%, 1/4 W	3220280
R846	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R847	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R848	Resistor, Carbon Film, 330 $\Omega$ $\pm$ 5%, 1/4 W	3220090
R849	Resistor, Carbon Film, 1.5 K $\Omega$ $\pm$ 5%, 1/4 W	3220175
R850	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R851	Resistor, Carbon Film, 100 K $\Omega$ $\pm$ 5%, 1/4 W	3220315
R852	Resistor, Carbon Film, 10 K $\Omega$ $\pm$ 5%, 1/4 W	3220235
R853	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
R854	Resistor, Carbon Film, 100 $\Omega$ $\pm$ 5%, 1/4 W	3220055
RFC810	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC811	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC812	Choke Assy., 270 $\mu$ H, MUD271	3520590
RFC813	Choke Assy., 270 $\mu$ H, MUD271	3520590
T810	Inductor, Toroid	2510023
T811	Inductor, Toroid	2510023
U810	I.C., MC1350P	3040110

R	B10 B53	B26	B11 B12	B18 B54	B13 B20	B17	B1
C	B10 B47 B48	B21	B25 B51	B11 B45	B49 B50	B22 B12	B4
L	B13		B15 B14		B10		





TEST POINT

Fig. 4-8 NB-7 Board Pictorial, Version 2

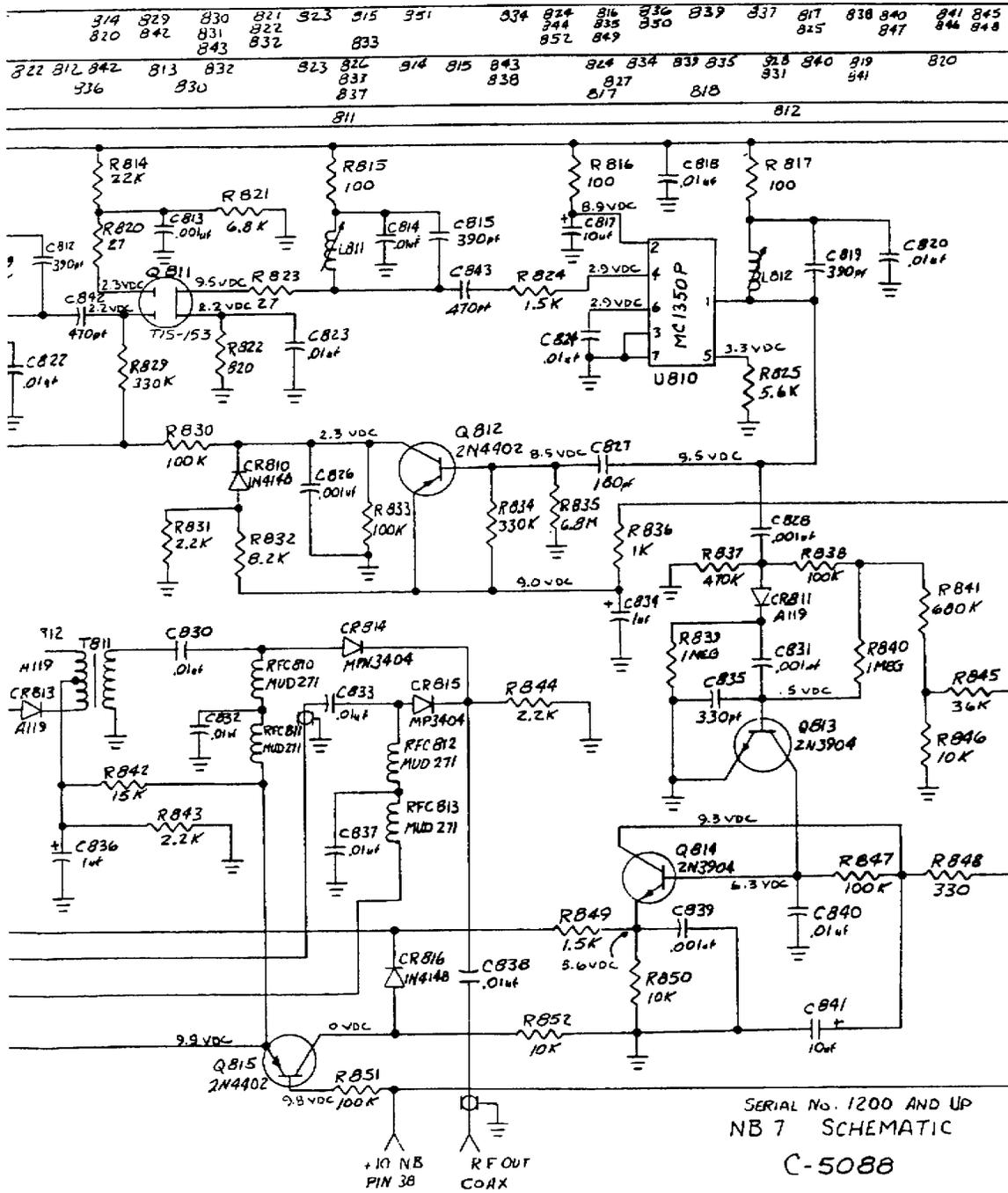


Fig. 4-9 NB-7 Board Schematic, Version 2

## 4-3.2 NB7, VERSION 2

The NB7 is easily aligned via the following procedures:

Equipment Required: High Input Impedance VTVM (11 megohms or greater)

The following parts from the TR7 Maintenance Kit:

- 1 6-pin extender card
- 1 4-pin extender card
- 2 tuning tools: small white Hex #SK-55  
Small White blade #SK-462

- 1) Remove NB7 per installation instructions 1 through 4.
- 2) Carefully install extender cards making sure they properly match the connectors on the NB7 and the pins in the TR7 card cage.
- 3) Connect coax from IF Selectivity card to the coax receptacle on top of the NB7. Note: If coax will not reach - Remove IF Selectivity card and cut wire tie on coax to facilitate connection of coax.
- 4) Turn TR7 on the depress calibrator switch. Tune in calibrator signal, band switch at 14 MHz, USB mode. Set PBT control in center and retune for maximum S-meter reading. This will be approximately zero beat. Peak L815 for maximum S-meter reading.
- 5) Refer to figure 4-7, and connect VTVM to test pad. Depress NB switch to activate noise blanker.
- 6) Peak L810, L811, and L812 for maximum DC voltage.
- 7) Remove VTVM and turn off TR7.
- 8) Remove NB7 and extender cards.
- 9) Reinstall NB7 as per Installation Instruction steps 5 through 9.

## NOTES: