

TRANSMITTING CONVERTER

MODEL 2-150

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TRANSMITTING CONVERTER MODEL 2-150

Application

F & H Electronics, pioneer in the field of transmitting converters for the amateur VHF frequencies, has taken advantage of their experience in presenting this new Model 2-150 two meter transmitting converter. Developed primarily for the single sideband VHF enthusiast, it is essentially a linear mixing device followed by a linear RF amplifier. This unit permits the amateur to utilize his existing 20 meter station equipment as a signal source for the 2 meter VHF band. The features of his existing 20 meter equipment are then available on the 2 meter band. For example, if his exciter is SSB, voice controlled, and VFO with .5MC coverage, then he may operate 2 meters with SSB, voice control, VFO and .5MC coverage with similar stability. The owner of existing 20 meter AM equipment with VFO or crystal will be able to operate the 2 meter band, AM, VFO, or crystal controlled.

This concept prevents costly duplication of equipment; for many desirable features on two meters are included in many modern new and used SSB, AM, PM, FM, RTTY, DSB, or CW 20 meter exciters.

A signal from the high stability oscillator circuit may be used to provide the injection for a receiving converter, thus preventing duplication of circuitry and correct correlation between transmitter and receiver calibration.

Description

The Model 2-150 consists of a high stability oscillator and tripler circuit, employing a 6EA8, which will operate on any frequency from 130MC to 133.5MC. This will permit the operator to select any segment of the 2 meter band in which he wants to operate. The unit is normally supplied with a crystal on 130 or 131 MC which, with most exciters, will permit operation within the 144 MC to 144.5 or 145 MC to 145.5 MC band segments.

The 130 MC signal is available at a jack on the rear of the chassis marked Osc. output. This permits the same oscillator signal to be used for a receiving converter.

The 130 MC signal is then link coupled to the push-pull grids of the 6360 balanced mixer stage. By adjusting the injection and grid bias of this stage, compensation is made for small variations in exciter output levels.

The external Pi section pad is used to attenuate the signal from the popular 100 watt class exciters while maintaining the exciter load impedance of 50 ohms. Exciters with outputs from 5 watts to 25 watts may drive the unit at an impedance of 50 ohms when connected directly to the RF IN connector. The 3 DB pad

can be used to correct for large differences in power levels or may be used in conjunction with AM operation as described later in the operating instructions.

No tuning of the 20 meter input signal is required in the transmitting converter. This exclusive passive screen single ended injection circuit thus lends itself to more simplicity of operation, as well as superior performance with respect to mixing product attenuation.

Following the 6360 mixer is a second 6360 used as a Class A buffer amplifier. Reduced mutual coupling between the buffer input and output circuits has been accomplished by shielding and isolation. The buffer plate circuit is overcoupled to the 7854 grid circuit permitting further simplicity of operation. The final amplifier operates in class AB₁ with reasonable efficiency - up to 60%. The quiet operating tube cooling fan delivers up to 200 Cu. Ft./min. of air flow in the area of the amplifier tube envelope and the push-pull plate tank circuits. This air circulation also keeps the cabinet temperature to a low value increasing component life. The high level RF amplifier circuit is completely shielded within the cabinet.

The RF output passes through a harmonic filter to the antenna connector on the rear of the chassis. The RF output is sampled, detected, and filtered for relative RF output readings used in tune up.

Metering of the PA grid current, PA plate current and relative RF output is provided. The meter scale is calibrated accordingly.

The conservatively rated built-in power supply provides all voltages for operation of the transmitting converter. It features separate high voltage, low voltage, and bias rectifiers. Each source is separately filtered. The PA screen voltage is regulated as well as the oscillator voltage. The mixer and PA bias voltages are variable. A terminal strip, normally shorted, on the rear of the chassis provides a PA plate current cut off bias when these terminals are open. These should be connected to a normally open relay contact on the exciter voice control relay if an electronic TR switch is used to switch the antenna from the receiver to the transmitter. This is necessary as the noise generated by the electron flow through the 7854 under the static current conditions of 50 mA can be heard in the receiver.

The simple operating controls are:

1. Tuning (PA plate circuit)
2. Loading (link reactance)
3. Meter Switch (PA grid, PA plate, Rel. Output)
4. Power ON and OFF switch

SPECIFICATIONS

Input Frequency: 14 to 14.5 MC
Input Impedance: 50 to 70 ohms
Input Power: 5 to 100 watts
Output Frequency: 144 to 148 MC, de-
pendent on crystal
selected and injection
frequency.
Plate Power input to final amplifier: SSB - 175 watts PEP
CW - 165 watts
Linear Am. - 90 watts
Output Impedance: 50 to 70 ohms
AC Requirements: 117 Volts AC 50/60
cycles
Dimensions: 15" wide, 9" high,
11 $\frac{1}{2}$ " deep
Shipping Weight: 45 lbs.

Installation & Operation Instructions

GENERAL

1. Remove the unit from the packing carton and inspect the unit for evidence of any physical damage. If inspection reveals damage in shipment, retain the carton and notify the shipper immediately. P & H Electronics certifies that the unit has been inspected and tested before leaving the factory. P & H Electronics is not responsible for damage due to shipping, careless handling, or failure to operate the unit in accordance with the instructions contained in this manual. A one year warranty on all parts except tubes is provided. All tubes are warranted for 90 days. Any alteration of this unit will invalidate the warranty.
2. Refer to the interconnection diagrams on page 8 for your installation, and make proper connections.
3. With power OFF on the transmitting converter, tune up the exciter on twenty meters. With exciters of the 100 watt class, use the external pad provided between the exciter and the transmitting converter input. Exciters of the 20 watt or less class are connected directly to the input of the model 2-150.
4. Apply power to the model 2-150 and set meter switch to PA Plate position. Allow 3 minutes to warm up, and adjust PA bias control on rear deck so that the PA static plate current is 50 MA.

FOR SSB OPERATION

5.
 - a. Gradually insert a carrier or single tone signal and observe PA plate current.
 - b. Do not exceed 100 MA plate current at this time.
 - c. Resonate the PA plate circuit with the tuning control.
 - d. Switch meter to relative output and adjust tuning and loading controls for maximum output.
 - e. Increase the carrier injection and again adjust the tuning and loading controls.
6. Continue this process until the PA Plate Current is 220 MA and the relative output is a maximum. At this time there should be no indication of grid current flow with the meter switched to the grid current position. Grid current flow is an indication of insufficient loading or a miss-match to the antenna.
7. Another indication of proper loading can be observed by checking the VR tubes when the excitation is applied. They should not be extinguished when 220 MA plate current is reached.
8. In the event that the exciter reaches saturation before the model 2-150 is loaded to the 220 MA level, proceed as follows:

- a. Adjust the excitation to produce a maximum available loaded 7854 plate current. Switch exciter off.
 - b. Place meter switch to PA grid position.
 - c. Switch exciter ON and adjust mixer bias control on rear deck until the 7854 just draws grid current. Then back off to the point where no grid current is seen. Switch exciter OFF.
 - d. Place meter switch in plate current position and apply excitation. Tune and load as in steps 5 and 6 for 220 MA plate current. If necessary, then re-adjust mixer bias for 0 grid current at 220 MA plate current.
9. The object of the tuning and loading procedure is to obtain a maximum relative output reading when the PA plate current is 220 MA and the 7854 is not drawing grid current. This should be accomplished by rapid but careful adjustments in short excitation periods. In addition, PA excitation adjustment is made so that the exciter just reaches saturation at the 0 grid current 220 MA plate current level. Use the mixer bias controls and/or the 3db pad switch to help accomplish this. This is necessary to take advantage of the maximum carrier and sideband suppression capabilities of the exciter.
10. The unit is now ready to operate on SSD. It will be found that with most antenna installations the only retuning required to change frequency from one end of the .5MC band segment to the other will be those on the exciter itself. It would be desirable, if a wide excursion is made, to check the plate tuning for maximum relative output. While operating, a check can be made of grid current. On voice peaks a slight indication of grid current may be noted. Talk the unit up to about 120 MA plate current in actual operation.

FOR CW, FM, PM, FSK OPERATION

11. Tune and load the unit as described above but load for maximum output at 220 MA plate current.

FOR LINEAR AM OPERATION USING AM EXCITER

12. Load exciter into transmitting converter input as described in steps 1 through 4.
13. Adjust mixer bias with 3db pad in the 'out' position so that the loaded resonant PA plate current is 200-210 MA with AM exciter carrier only.
14. Switch 3db pad in; plate current should drop to 100-110 MA. If the current is higher than this value, the 7854 is probably not loaded sufficiently. Repeat step 13 by increasing loading and resonating the PA plate tuning.
15. With the 3db pad in, modulate the exciter. The plate current of the 2-150 will remain constant if the exciter is not overmodulated. However, a slight fluctuation is normal.

FOR LINEAR AM OPERATION USING SSB EXCITER

16. Tune and load unit as previously described for SSB exciters in steps 5 and 6.
17. Reduce carrier so that PA plate current is 100-110 MA and modulate the exciter. The plate current will remain constant. However, a slight fluctuation is normal.

Alignment Instructions

The model 2-150 is completely wired and tested when it leaves the factory. The normal oscillator frequency supplied with the unit is either 130 MC or 131 MC. When mixed with a 14 to 14.5 MC signal the 130 MC will produce an output on 144 to 144.5 MC. When mixed with a 14. to 14.5 MC signal, the 131 will produce an output on 145 to 145.5 MC. For other segment coverage, consult the frequency and coverage chart on page 8.

The alignment procedure for other frequencies is essentially the same as for 130 MC alignment; therefore the alignment instructions herein cover the steps for the standard units normally supplied.

WARNING: Exercise extreme care when handling unit when cabinet is removed. Lethal High Voltage is used in this unit.

1. Remove transmitting converter from cabinet by removing 2 each #10-32 screws at the rear of the cabinet.
2. Make interconnections as described in the operating instructions and adjust PA bias to obtain a static current reading of 50 MA plate current.
3. Loosely couple a grid dip meter or other indicating device operating as a wave meter at 130 MC to L-2, L-3 and adjust L-1 and C-14 for maximum output starting with the slug of L₁ all the way out and working into the coil. Then turn slug $\frac{1}{4}$ turn counter clockwise or until a slight drop in output is noticed.
4. Adjust C-14 for maximum output as seen on the wave meter.
5. Apply a small amount of excitation from the 14.250 Kc exciter and resonate plate circuit of 8117, if an indication of plate current rise is apparent on the plate meter.
6. Set wave meter to 144 MC, and loosely couple to L-4. Adjust C-17 for maximum output. Reduce excitation from 20 meter exciter if necessary to keep PA plate current below 100 MA.

7. Loosely couple wavemeter (still set to 144 MC) to L-6. Adjust C-27 and C-25 for maximum output.
8. Remove wave meter from circuit.
9. Re-touch C-14, C-17, C-25, and C-27 for peak output as indicated on the plate current meter of the 2-150
10. Remove 20 meter excitation from 2-150.
11. Re-install unit in cabinet and refer to operating instructions before operation.

CRYSTAL FREQUENCY AND COVERAGE CHART

When used with exciters covering 14.0 to 14.5 MC.

CRYSTAL FREQ.	COVERAGE
*43.333 MC (130 MC)	144 to 144.5 MC
43.5 MC (130.5 MC)	144.5 to 145 MC
*43.666 MC (131 MC)	145 to 145.5 MC
43.833 MC (131.5 MC)	145.5 to 146 MC
44 MC (132 MC)	146 to 146.5 MC
44.166 MC (132.5 MC)	146.5 to 147 MC
44.333 MC (133 MC)	147 to 147.5 MC
44.5 MC (133.5 MC)	147.5 to 148 MC

* Units normally supplied with one of these crystals.

Exciters with more than 500 KC coverage of the 20 meter band will provide similarly greater coverage on the 2 meter band.

MODEL 2-150

Transmitter Section:

- 14 MC RF IN:** Connected to a **FUSE 117 V. 60 CY.**
- 130 MC OUT:** Connected to a **3 DB PAD**.
- 144 MC RF OUT:** Connected to a **TS-1** component.
- IF 8 TO 20 W EXCITER. IS USED REMOVE PAD:** A switchable connection to a **3 DB PAD** (labeled R41, R42).
- 100 W. 20 W. EXCITER AUX. RELAY CONTACT:** A switchable connection to the **100 W. 20 W. EXCITER** section.

Receiver Section:

- RECEIVING CONVERTER:** The input stage of the receiver.
- COAX RELAY:** A relay that switches between the **TO 500 ANT.** and the **RECEIVING CONVERTER**.
- RG-58 U:** A coaxial cable connecting the **RECEIVING CONVERTER** to the **100 W. 20 W. EXCITER** section.
- RG-8 U:** A coaxial cable connecting the **100 W. 20 W. EXCITER** section to the **144 MC RF OUT** of the transmitter.

Antennas:

- TO 500 ANT.:** A 500-ohm antenna connected to the **COAX RELAY**.
- RECEIVER ANT.:** An antenna connected to the **RECEIVING CONVERTER**.

Other Components:

- R9 MIX. BIAS** and **R12 PA BIAS** are connected to the transmitter section.
- RG-58 U** and **RG-8 U** are coaxial cables used for signal transmission.

MODEL 2-J50

FUSE 117 V.
6A. 60 CY.

14MCRF IN

144MCRF OUT

130 MC OUT

IN OUT

TS-1

R9 MIX. BIAS

R12 PA BIAS

RG-8U

TR SWITCH

TO 50Ω ANT.

PRE-AMPLIFIER & MIXER

RG-59U

8-20W. 20M. EXCITER

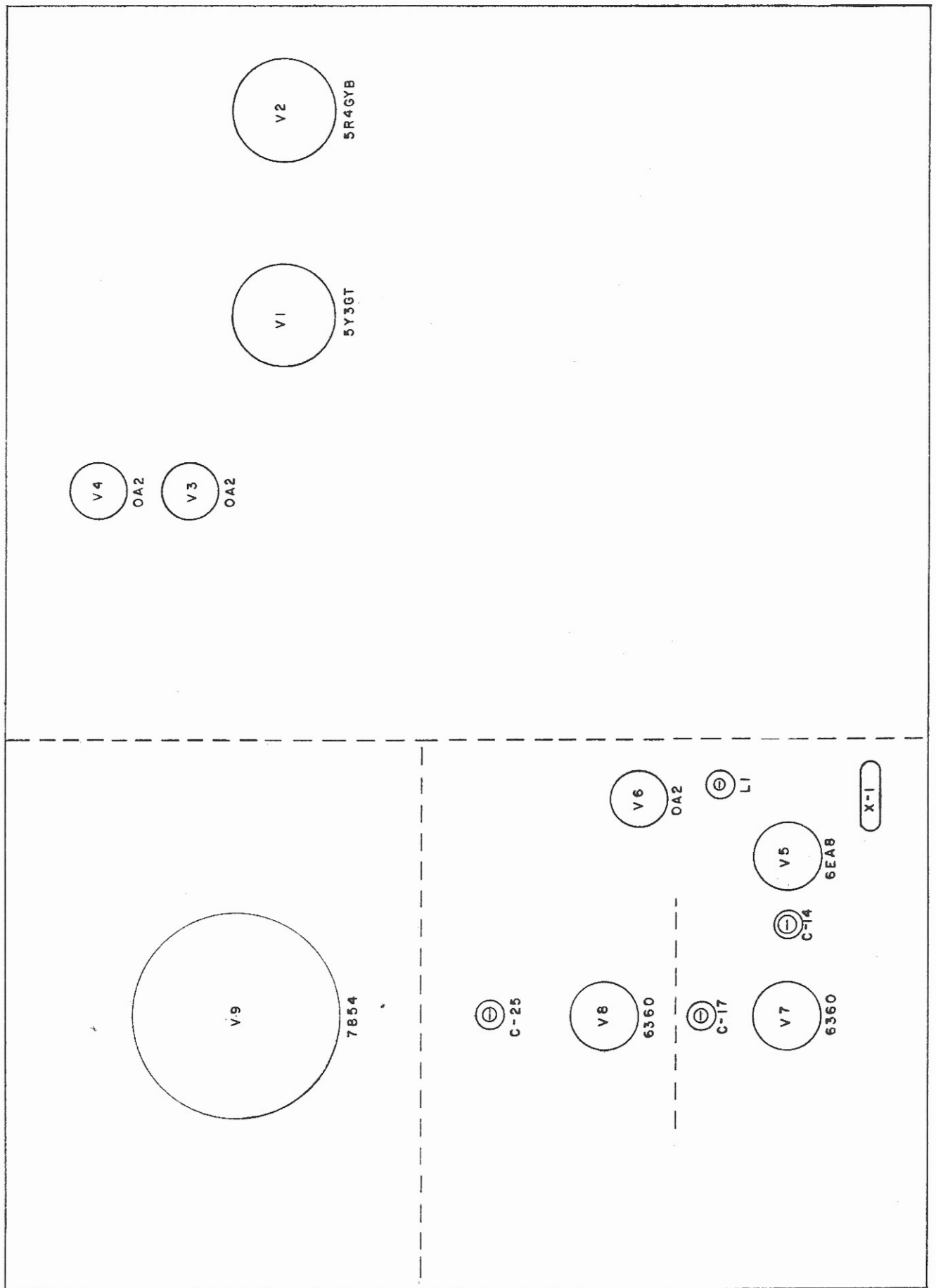
AUX. RELAY CONTACTS
OPEN ON REC.

RECEIVER

ANT.

The diagram illustrates the antenna system of a 100W, 20W transceiver. Key components and connections include:

- Antenna Section (Left):** Features an antenna (ANT.) and a relay. The relay is controlled by 63V AC and is normally open to auxiliary components, grounded on transmit.
- Power Section (Top):** Includes a 100W, 20W transceiver, a 144MCRF 1N tube, a 130 MC OUT, and a 144MCRF OVT. It also features a 117V, 6A, 60CYL. fuse and a TS-1 switch. Biasing is provided by R9 MIX BIAS and R12 PA BIAS.
- Intermediate Section (Middle):** Contains a 6.3V AC transformer, a 6.3V AC rectifier, and a 6.3V AC filter. It also includes a 6.3V AC transformer and a 6.3V AC filter.
- Output Section (Right):** Features a 6.3V AC transformer, a 6.3V AC rectifier, and a 6.3V AC filter. It also includes a 6.3V AC transformer and a 6.3V AC filter.
- Connections:** The antenna is connected to the relay, which is in turn connected to the 144MCRF 1N tube. The 144MCRF 1N tube is connected to the 130 MC OUT, which is connected to the 144MCRF OVT. The 144MCRF OVT is connected to the 6.3V AC transformer, which is connected to the 6.3V AC rectifier, which is connected to the 6.3V AC filter. The 6.3V AC filter is connected to the 6.3V AC transformer, which is connected to the 6.3V AC rectifier, which is connected to the 6.3V AC filter.

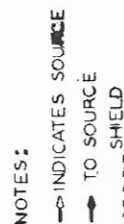


PARTS LIST FOR 2-150

Part No.	Description
T-1	BE8968 Power Transformer
CH-1	306303 Low Voltage Filter Choke
CH-2	BE8931 High Voltage Filter Choke
RFC-1	22 Micro Henry RF Choke
RFC-2	1 Micro Henry RF Choke
RFC-3	3.3 Micro Henry RF Choke
RFC-4	Z-144 RF Choke
RFC-5	2.2 Micro Henry RF Choke
L-1	Oscillator Coil
L-2	Tripler Plate Coil
L-3	Mixer Grid Coil
L-4	Mixer Plate Coil
L-5	Buffer Plate Coil
L-6	PA Grid Coil
L-7	PA Plate Coil
L-8	PA Output Link Coil
L-9,10	Harmonic Filter Coil
R-1,2	10K 10 watt resistor
R-3,5	5K 10 watt resistor
R-4	560 ohm 2 watt resistor
R-6,10	33K $\frac{1}{2}$ watt resistor
R-7	12 K $\frac{1}{2}$ watt resistor
R-8,22,32	22K $\frac{1}{2}$ watt resistor
R-9	25K Pot.
R-11	5.6 K 2 watt resistor
R-12	1K Pot.
R-13	2.7K 2 watt resistor
R-14,15,16	100K 2 watt resistor
R-17	16.5K 30 watt resistor
R-18,19	270 ohm $\frac{1}{2}$ watt resistor
R-20	100K $\frac{1}{2}$ watt resistor
R-21,27,28,31,35	1K $\frac{1}{2}$ watt resistor
R-23,30	10 ohm 1 watt resistor
R-24	70 ohm 16 watt N.I. (8-560-ohm 2 watt)
R-25	330 ohm 2 watt resistor
R-26	1K 2 watt resistor
R-29	47K 1 watt resistor
R-33	68 ohm 2 watt resistor
R-34	4.7K $\frac{1}{2}$ watt resistor
R-36	Meter Shunt
R-37,39	180 ohm $\frac{1}{2}$ watt resistor
R-38	47 ohm $\frac{1}{2}$ watt resistor
R-40	600 ohm 10 watt resistor
R-41	100 ohm 20 watt N.I. (10-1K-2 watt)
R-42	70 ohm 80 watt N.I. (40-2700 ohm-2 watt)

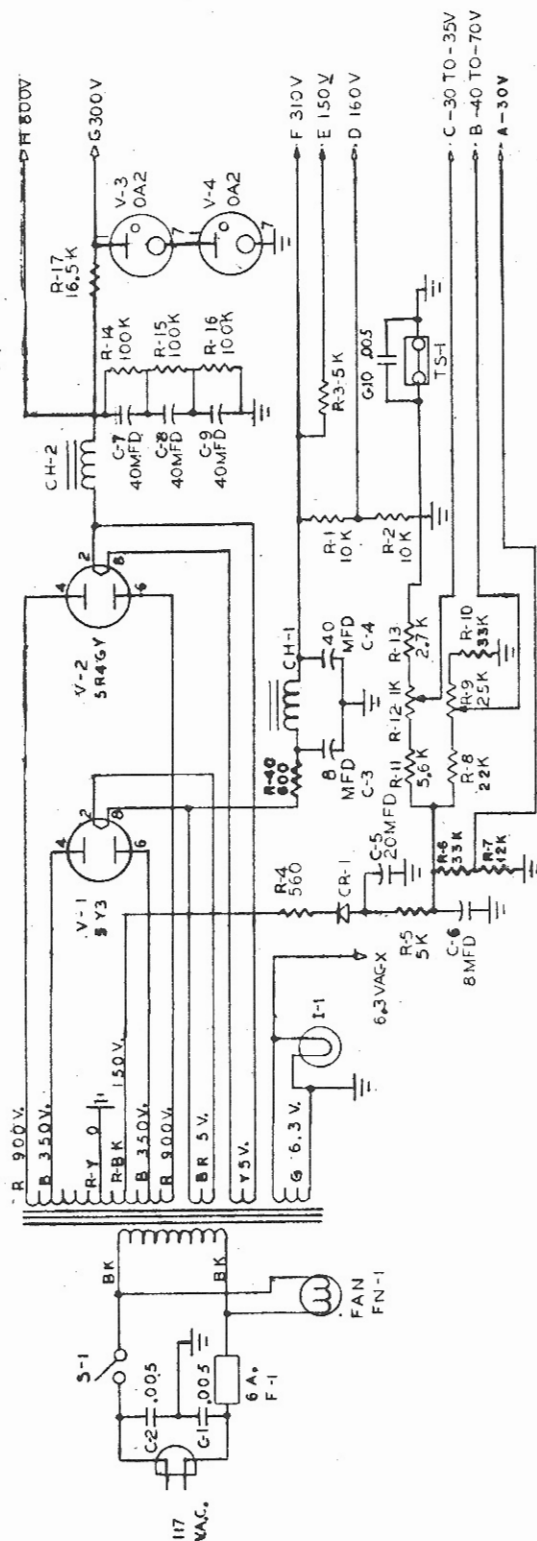
PARTS LIST FOR 1-150

Part No.	Description
C-1,2,10,20,41	.005 MF Disc Ceramic Condenser
C-3,6	8 MFD 450 Volt Condenser
C-4,7,8,9	40 MFD 450 Volt Condenser
C-5	20 MFD 450 Volt Condenser
C-11,42	500 MMF Mica Condenser CH-15
C-12	51 MMF Ceramic Condenser
C-13,15,16,29,33,43,44,45,62	.001 Disc Ceramic Condenser
C-14,32	1.5 to 5 MMF Variable Condenser
C-17	2.2 to 8 MMF Variable Condenser
C-18,24,61	.001 MF Ceramic Feed Thru Condenser
C-19,23,26,28,30,31,39,40,46,47 48,49,50,51,52,53,54,55,56 57,58,59	500 MF Ceramic Feed Thru Condenser
C-21,22	10 MF Ceramic Condenser
C-25	8 MMF Variable Condenser
C-27	1.5 to 7 MMF Variable Condenser
C-34	30 MMF Variable Condenser
C-35,36,37,38	6 MMF Ceramic Condenser
X-1	Crystal 43.33 to 44.5 MC
S-1	SEST Switch
S-2	1 Pole 2 Position Switch
S-3	2 Pole 3 Position Switch
M-1	Meter
PN-1	Tube Cooling Fan
I-1	Pilot Light Assembly
F-1	5 Amp. Fuse
TS-1	Terminal Strip
OR-1	Silicon Rectifier
OR-2	Meter Rectifier
V-1	5Y3GT Low Voltage Rectifier
V-2	5R4GT High Voltage Rectifier
V-3,4,6	0A2 Voltage Regulator
V-5	6EA8 Oscillator Tripler
V-7	6360 Balance Mixer
V-8	6360 Buffer Amplifier
V-9	7854 Power Amplifier



MODEL 2-150 SCHEMATIC
DATE 5-10-62 REVISION
DRAWN BY RLP & GW
CHECKED BY *ELH*

**D & H ELECTRONICS
LAFAYETTE - IND.**



WITH SERIAL #1518 AND HIGHER



If complete re-alignment is done in the field, L-1A should be adjusted for maximum signal measured at L2-L3 as covered in step #3 of the alignment instructions. L-1A is located next to C-14. This adjustment is very broad and will not need to be peaked when crystals are changed.