

VARIABLE FREQUENCY OSCILLATOR

OPERATING MANUAL

TECHNICAL SPECIFICATIONS

FREQUENCY COVERAGE.....	80M 3.5- 4.00 Mc. 40M 7.0- 7.30 Mc. 20M 14.0-14.35 Mc. 15M 21.0-21.45 Mc. 10M 28.0-29.70 Mc. 6M 50.0-54.00 Mc.
FUNDAMENTAL OSCILLATOR FREQUENCY	3.5 -4.0 Mc for 80M and 10M bands. 3.5 -3.65 Mc for 40M, 20M and 15M bands 4.16-4.50 Mc for 6M band.
OUTPUT FREQUENCY	80M band: 3.5 -4.00 Mc. 40M band: 7.0 -7.30 Mc. 20M band: 7.0 -7.175 Mc. 15M band: 7.0 -7.15 Mc. 10M band: 7.0 -7.425 Mc. 6M band: 8.333-9.00 Mc.
OUTPUT POWER	10-30 volts RMS
OUTPUT IMPEDANCE.....	LOW 52 ohms, HIGH 50K ohms.
TUBE COMPLEMENT	V1 6BA6 Series-tuned Clapp Oscillator. V2 6BA6 Broad-Band Buffer-Amplifier. V3 6AQ5 Output Amplifier. V4 VR150MT/OA2 Voltage Regulator
POWER SOURCE.....	117 volts 50-60 cps AC.
POWER CONSUMPTION	66 VA.
DIMENSIONS.....	Height 7-3/4"; Width 8-3/4"; Depth 10".
WEIGHT (Net).....	13-1/4 lbs.

GENERAL DESCRIPTION

The HE-74 is a rugged Variable Frequency Oscillator designed for dependable, stable operation on all bands from 80 through 6 meters, with sufficient output to drive any multi-stage transmitter of modern design.

For high stability, the VFO employs a series-tuned Clapp oscillator, incorporating special temperature-compensating capacitors. The oscillator uses three fundamental tuning ranges to provide suitable outputs for the six amateur bands. The fundamental tuning ranges are as follows:

- (1) 3.50 - 4.00 Mc.
- (2) 3.50 - 3.65 Mc.
- (3) 4.16 - 4.50 Mc.

The chart below shows how these basic tuning ranges are used:-

FUNDAMENTAL OSCILLATOR TUNING	BAND	VFO OUTPUT
(1) 3.50 - 4.00 Mc	80 M	3.50 - 4.00 Mc (Fundamental used)
(2) 3.50 - 3.65 Mc	40 M	7.00 - 7.30 Mc (2nd Harmonic used)
(2) 3.50 - 3.65 Mc	20 M	7.00 - 7.175 Mc (2nd Harmonic used)
(2) 3.50 - 3.65 Mc	15 M	7.00 - 7.15 Mc (2nd Harmonic used)
(1) 3.50 - 4.00 Mc	10 M	7.00 - 7.425 Mc (2nd Harmonic used)
(3) 4.16 - 4.50 Mc	6 M	8.333 - 9.00 Mc (2nd Harmonic used)

The second stage performs as a broad-band buffer-amplifier on 80 through 6 meters. It offers good isolation between the output and the oscillator and thus prevents any frequency shift due to load variations. A special switch position also permits this stage to function as a crystal oscillator to provide an output for calibrating purposes.

The output stage operates as an amplifier to provide a high output signal level for connection to the transmitter. The plate circuit is arranged to provide optimum tuning to the fundamental oscillator frequency on 80 meters and to the second harmonic on 40 through 6 meters (see table above). The output terminates in two coaxial connectors -- one providing a low impedance output, the other a high impedance output.

The power supply uses a low-heat silicon rectifier in a half-wave circuit with good filtering. A voltage regulator tube maintains stability by eliminating any effect on the oscillator due to line voltage variations.

Rigid mechanical construction has been employed throughout. Double-bearing construction is used on the tuning capacitor. All frequency determining components are enclosed in a separate compartment to maintain rigidity, shielding, and provide isolation from heat-producing elements in the circuit.

Although the HE-74 is compatible with most amateur transmitters having a VFO input, it was designed primarily to match the LAFAYETTE KT-390 Transmitter, both electrically and in styling. Any questions regarding the compatibility of this VFO with units which do not have a VFO input should be directed to the transmitter manufacturer, who is best qualified to give such information.

INSTALLATION

POWER

The VFO operates from 105-120 volts, 50-60 cycles AC. Do not use on any other power source.

OUTPUT CONNECTIONS

The VFO is equipped with two outputs. One is a high impedance output, while the other is a low impedance output. In cases where it is necessary to use a connecting cable longer than 36 inches between the VFO and transmitter, use the low impedance output. For cable lengths of 36 inches or less, use the high impedance output. Note, however, that when using the low impedance output, it will be necessary to add a decoupling capacitor of about 2000 μf in series with the VFO input on the transmitter.

In order to connect the VFO to your transmitter, you will need coaxial cable and terminating plugs, as indicated below:

- RG-62/U coaxial cable.
- PL-259 type connector.
- UG-175/U type adaptor.
- RCA-type phono plug (for VFO input on transmitter).

Instructions for attaching a coaxial connector to one end of coaxial cable, and a phono-type plug to the other end (if your transmitter VFO input has a phono jack), have been included for your convenience.

LOCATION

Install the VFO as close to the transmitter as possible. Avoid very warm locations and allow at least one inch between the rear of the VFO and a wall.

DIAL CALIBRATIONS

The VFO dial uses six calibrated scales for tuning on 80, 40, 20, 15, 10 and 6 meters. The calibration indicate the RF carrier frequency of the transmitter output stage, not the VFO output.

The table below shows how each scale is calibrated:

VFO Scale	Major Calibrations Every	Minor Calibrations Every
80 M	100 Kc	20 Kc
40 M	50 Kc	10 Kc
20 M	100 Kc	20 Kc
15 M	100 Kc	20 Kc
10 M	500 Kc	100 Kc
6 M	500 Kc	100 Kc

OPERATING INSTRUCTIONS

1. Set the VFO Function switch to STANDBY and set the Band switch to the desired band of operation.
2. Place the transmitter in the Standby position and allow both units to warm up for 30 minutes.
3. Tune the VFO to the desired frequency as indicated on the calibrated dial. Refer to the chart below which shows the actual VFO output frequencies for various dial settings. Also indicated is the transmitter multiplication necessary in each case to produce an RF carrier output which matches the VFO dial tuning. If operation on 14.00 Mc were desired, for example, the VFO band switch should be set to 20M and the VFO tuned to 14.00 on the 20M scale. The output frequency of the VFO would actually be 7.00 Mc. However, setting the band switch on the transmitter to 20M operation will normally provide a doubling action and thus produce a 14.00 Mc RF carrier output.

CHART

AMATEUR BAND	VFO DIAL SCALE	ACTUAL VFO OUTPUT FREQ.	MULTIPLICATION REQUIRED BY TRANSMITTER
80 M	3.50 - 4.00 Mc*	3.50 - 4.00 Mc	None
40 M	7.00 - 7.30 Mc	7.00 - 7.30 Mc	None
20 M	14.00 - 14.35 Mc*	7.00 - 7.175 Mc	X2
15 M	21.00 - 21.45 Mc*	7.00 - 7.15 Mc	X3
10 M	28.00 - 29.70 Mc*	7.00 - 7.425 Mc	X4
6 M	50.00 - 54.00 Mc	8.333 - 9.00 Mc	X6

* The VFO calibrations actually extend beyond these band limits. However, the range shown covers only the amateur band in each case.

4. Set the VFO to SEND.
5. Switch the transmitter to its operating position and follow the manufacturers recommended tuning procedure.

VFO CALIBRATION

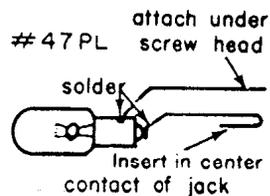
The VFO has been carefully aligned at the factory and should therefore offer accurate calibration at all dial settings. Remember, however, that it is always the operator's responsibility to guard against operation outside of the amateur band limits. A procedure for checking and adjusting the calibration is provided in the section headed "VFO CALIBRATION".

VFO CALIBRATION

The HE-74 was accurately calibrated at the factory before shipment. However, with prolonged use or after servicing, it may become necessary to readjust to VFO for accurate calibration.

OUTPUT ADJUSTMENT

1. Connect a #47 pilot lamp across the LOW output jack as indicated below.



2. Turn the VFO function switch to SEND, band switch to 80M and set tuning pointer to 3.50 Mc.
3. Adjust TC4 for maximum brilliance of the pilot lamp. See bottom of VFO for adjustment points.
4. Disconnect the pilot lamp.

CALIBRATING ADJUSTMENTS

The calibrating procedure is a relatively simple one which can be carried out using a 3.5 Mc and an 8.333 Mc crystal. As an example, the procedure for checking calibration on the 80M band is given below.

1. Closely couple the VFO output to the receiver antenna. Do not make a direct connection, however. All adjustment points are indicated on the underside of the VFO. Make adjustments through the holes provided, using a non-metallic alignment tool.
2. Insert a 3.50 Mc crystal into the socket in the VFO.
3. Set the VFO Function switch to STAND BY and allow the VFO and your receiver to warm up for about 30 minutes.
4. Set the VFO Function switch to CAL, band switch to 80M. Detune the VFO -- away from the crystal frequency or any of its harmonics.
5. Tune the receiver to the crystal oscillator signal on 3.5 Mc.
6. Set the VFO tuning pointer (exactly) to 3.50. If VFO tuning is precisely on frequency, the signals of the main VFO oscillator and the crystal oscillator will produce a "zero beat" in the receiver. Check this by slightly detuning the VFO. If a "zero beat" is not obtained when the VFO pointer is set exactly to 3.50, the calibration is slightly off and you should adjust TC1 as indicated in the VFO Calibration Chart.

7. Follow this same general procedure on 80, 40 and 6M bands (as shown in the chart) to check calibration and make adjustments where necessary.

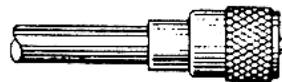
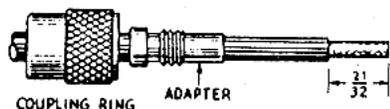
VFO CALIBRATION CHART

Function Switch to	Crystal in VFO	Band Switch	VFO Pointer Set to	Receiver Tuned to	Adjust Trimmer	Remarks
CAL	3.50 Mc	80 M	3.50	3.50 Mc	TC1 *	
CAL	3.50 Mc	40 M	7.00	7.00 Mc	TC2 **	Adjust for "zero beat" in receiver
CAL	8.333 Mc	6 M	50.00	8.333 Mc	TC3	

* This adjustment also brings the 10M band into line.

** This adjustment also brings the 20 and 15M bands into line.

ATTACHING COAXIAL CONNECTOR & ADAPTOR TO COAX CABLE (RG-58/U, 59/U, 62/U)



1. Cut end of cable even. Remove vinyl jacket $2\frac{1}{32}$ " -- don't nick braid. Slide coupling ring and adaptor on cable.

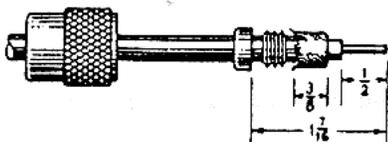
6. Screw coupling ring on assembly.



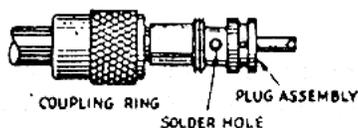
2. Fan braid slightly and fold back over cable.



3. Compress braid around cable. Position adaptor to dimension shown. Press braid down over body of adaptor to dimension shown. Press braid down over body of adaptor and trim.



4. Bare $\frac{1}{2}$ " of center conductor -- don't nick conductor. Pre-tin exposed center conductor.



5. Screw the plug assembly on cable. Solder plug assembly to braid through solder holes. Solder conductor to contact sleeve.

ATTACHING PHONO-TYPE PLUG TO COAX CABLE



Remove 1" of outer insulation. It may be necessary to slit the insulation lengthwise to remove. Take care not to cut shield wires.



Push the shield back as far as it will go and strip off $\frac{3}{4}$ " of insulation from the inner conductor.



Place phono connector on cable firmly against inner insulation. Solder inner conductor.

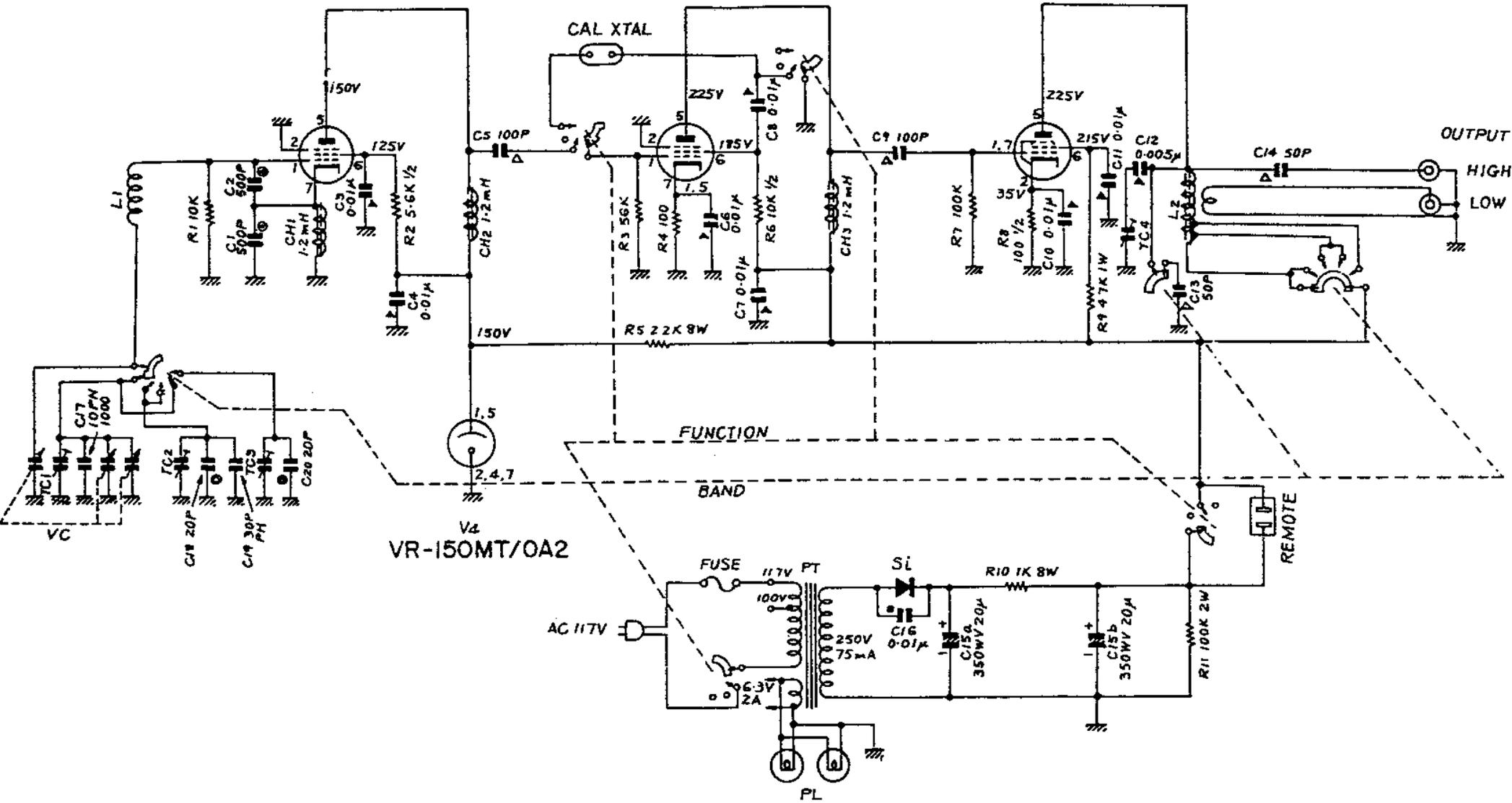


Dress shield up on base of connector and solder. Then trim inner conductor from tip.

V1 6BA6

V2 6BA6

V3 6AQ5



SCHEMATIC DIAGRAM