

HAMTRONICS® HRG-(VHF) HELICAL RESONATOR AMPLIFIERS: INST MANUAL

FUNCTIONAL DESCRIPTION.

The HRG-() series Helical Resonator Amplifiers are a new, GaAsFET version of our popular HRA-() series. They consist of a three section helical resonator and a GaAsFET preamplifier to add sharp selectivity to the front-end of receivers without reducing gain. The effect of the helical resonator is to reduce intermod and cross-band interference in critical receiver locations and in repeater installations.

Typical gain of the unit is about 15 dB. Output 1 dB compression point is +8 dBm. Typical noise figure of the amplifier is about 1 dB.

Note that the 7 to 8 dB insertion loss of the helical resonator ahead of the amplifier does not allow the full potential of the low noise amplifier to be realized. While the preamplifier itself is a low-noise amplifier, the insertion loss of the helical resonator ahead of the amplifier adds to the noise figure; so the overall effect is not a low-noise preamp in the ordinary sense, but rather a filter for reducing intermodulation products. The amplifier is used merely to make up for the loss in gain.

The effect on the sensitivity of the receiver depends on how good the receiver is to begin with. The sensitivity of the receiver with the HRG unit installed may be slightly higher or lower than the receiver by itself. The primary function of the HRG unit is to reduce interference; so the useable sensitivity in critical applications will be improved by eliminating desense and crossmod interference.

Limits of tuning for the helical resonators are shown in the following table along with the frequency the factory normally tunes them to.

Selectivity curves on page 2 show typical response when tuned at band center. Resonators can be retuned to center at any frequency within the stated range. *There is no easy way to modify the filters to tune outside of the specified ranges.*

HRG-()	TUNING RANGE	FACTORY
FREQ		
144	142-150	146
156	150-162	156
166	162-174	166
220	213-233	223

INSTALLATION.

The amplifier is designed to be mounted next to the receiver. Three mounting holes are provided to allow the unit to be mounted with standoffs to a chassis. In repeater service, the

HRG unit should be mounted in the same rf tight box as the receiver.

Antenna and receiver connections are made with RCA plugs to the jacks on the board. We do not recommend that you substitute another type of connector. The connector type was chosen to provide the most direct connection to the PC board, and other types are sure to add inductance. The *input* and *output* jacks are identified on the board. 50 ohm cable should be connected with good phono plugs having cable clamps (see catalog).

B+ for the unit must be filtered +12 to +14 Vdc. Current demand is 5 to 10 mA. Connect B+ by soldering wire to terminal E1 on the board. Either insert in center of pin or wrap pin, and then solder.

CAUTION: The GaAsFET is static sensitive. Use normal static-handling procedures in handling the unit.

CAUTION: Solid state low noise amplifiers can be damaged by large voltage transients and reverse polarity. Although zener protection is provided in the unit, avoid such conditions as a matter of principle. Care should be taken especially to install reverse diodes across such inductive devices as relays operating on the same B+ line to absorb transients at the source.

ALIGNMENT.

The unit was factory aligned at the frequency indicated in the table. You should repeak the helical resonator screws and the two red coils after installation, using a weak signal. Alternately tune the three screws on the resonator and the two slug-tuned coils until all interactions are worked out. *Note that there are small interactions between the three resonator screws and a substantial interaction between the third section of the helical resonator and the adjacent red coil.*

The resonators are tuned at the factory with a sweep generator for a flat response at the top. However, if it is to be used only at one frequency, such as in repeater service, all screws can be adjusted for peak at the one frequency.

Be careful not to tune any screw on the helical resonator more than 6 to 8 turns either way, as the metal slug inside the resonator can be unthreaded from the lead screw. (If that happens, you may be able to carefully remove the affected section and reinstall the tuning slug.)

TROUBLESHOOTING.

Troubleshooting is fairly simple. First, be sure that cables are connected properly and not reversed or shorted. Then, check the dc voltages on the GaAsFET.

The drain should measure approx. +9V, gate-2 should be about +4.5V, and the source should be about +1.5Vdc. You can identify the elements by the location of the chip capacitors on the bottom view diagram.

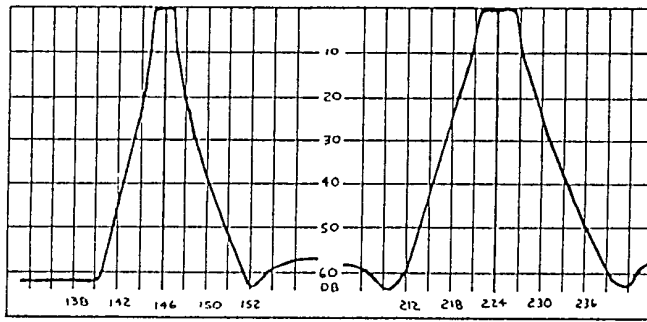
It is possible to damage a GaAsFET in either of two ways. First, despite the zener protection diode, you might damage the FET with a high voltage or reverse voltage transient on the power wiring. You need to be concerned about lightning and about inductive devices like relays operating on the same power source and generating spikes. Such damage probably would show up as a short or open affecting the dc test voltage on the FET. The other general failure mode is from excess rf applied to the input from a transmitter. This causes a burn through in the input gate (gate-1) of the FET. Because gate-1 normally is dc grounded in the circuit, this usually does **not** show up as a change in dc test voltages.

If it is necessary to replace the FET, be sure to ground yourself before handling the new one, and use a grounded soldering iron. Also, be careful not to apply excessive heat when soldering. Simply solder each lead quickly to the foil on the pc board, without leaving the iron in place for a long time, and you should not have any problem with overheating. The fet is mounted with the lettering side toward the board, and the drain is the long lead (see diagram.)

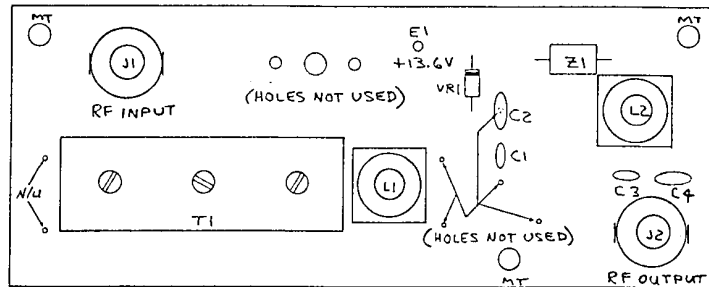
PARTS LIST.

Note: Values for 220 MHz are shown in parentheses ().

Ref #	Value
C1	20 pf (4 pf) disc cap
C2	62 pf (15 pf) disc cap
C3	20 pf (6 pf) disc cap
C4	82 pf (27 pf) disc cap
C5-C7	.01 uf chip cap
C8	.047 uf chip cap
J1-J2	RCA jacks
L1-L2	2-1/2 turn red coils
Q1	FET, 3SK174 (3SK122)
R1-R2	86K chip resistor
R3	200 ohm chip resistor
R4	620 ohm chip resistor
T1	Helical Resonator #1008 (#1080) <i>Com'l band units have been modified</i>
VR1	9.1V zener diode 1N5239B
Z1	Ferrite bead



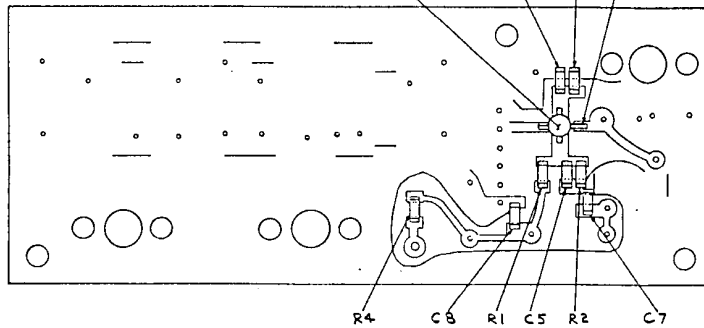
TYPICAL RESPONSE CURVES



HRG-144, 156, 166, 220 TOP SIDE

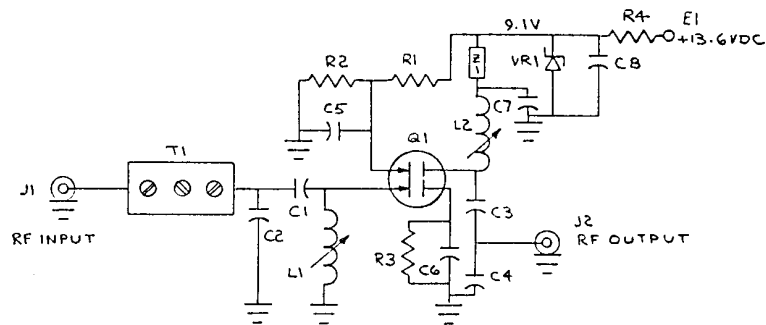
Note: * XSTR IS MOUNTED WITH PRINTED SIDE TOWARD BOARD & BLANK SIDE OUT IN VIEW.

Note: Q1*
C6 R3 DRAIN LEAD IS LONG



HRG-144, 156, 166, 220, 432 UNDERSIDE VIEW

COMPONENT LOCATION DIAGRAMS



SCHEMATIC DIAGRAM