HAMTRONICS LNW-432 MINIATURE GaAsFET RECEIVER PREAMPLIFIER
INSTALLATION AND MAINTENANCE INSTRUCTIONS

FUNCTIONAL DESCRIPTION. The LNW-432 Preamp was designed as a miniature version of the popular LNG-432 GaAs FET preamp, which was the first low-cost GaAs FET preamp on the market. With a size of only 5/8" x 1-5/8", the LNW-432 easily mounts inside many radios and saves the cost and bulk of a case. The LNW-432 uses a low-cost dual-gate GaAs FET for low noise figure and good stability under a wide range of load conditions. The LNW-432 provides about 18dB gain. The 1 dB compression point is about +5dBm, and the noise figure is about 0.8dB.

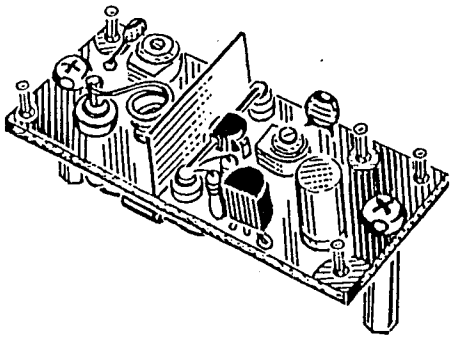

Figure 1. Overall View of LNW-432 Preamp

INSTALLATION. The preamp can be mounted to any flat surface. Simply drill two 1/8 inch holes 1-7/16 inch apart, and attach the preamp with the 4-40 x 1/4-inch screws supplied. Complete shielding of the preamp is not required. However, some care should be given to selection of the mounting location with regard to feedback from adjacent receiver circuits or rf pickup if mounted very close to a high power transmitter circuit. Because the unit is small, make sure that it isn't installed tight against the rf amplifier or first mixer of the receiver to minimize feedback effects.

Connect the input and output terminals in the receive signal path with miniature coax, such as RG-174/u, as shown in fig 2. Be sure to keep the stripped pigtails as short as possible to maintain a 50 ohm path. Pin connections can be made either by wrapping leads around pins and soldering or by filling insides of pins with solder and inserting leads while solder is molten. Don't connect the preamp in the transmit signal path.

Connect power supply lead to E5. The LNW-432 requires filtered +10 to 15 Vdc. Current drain is about 10 to 12 mA. Caution is advised in selecting a power source. Solid state amplifiers can be damaged by large voltage transients and reverse polarity. Although protection is provided in the LNW-432 in the form of a voltage regulator ic, avoid such conditions as a matter of principle. Care should be taken especially to install reverse diodes across any inductive devices such as relays, on the same B+ line to absorb transients. It helps, rather than hurting, to keep power applied to the preamp while transmitting. Although, you cannot transmit through the preamp, the dc voltage applied to the preamp transistor helps to avoid large reverse voltages from being applied to transistor junctions as a result of rectified rf from picked up from the transmitter.

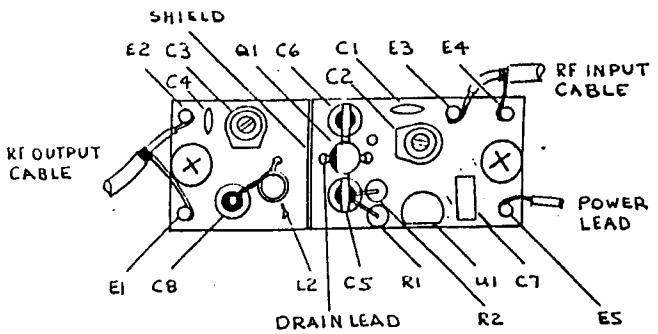

Figure 2. Top View, LNW-432 Preamp

ALIGNMENT. Factory assembled preamps are tuned at 446 MHz. The bandwidth is wide enough so that retuning normally is not critical unless your operating frequency is more than 10 MHz away. If you have a kit or if you want to optimize tuning for your particular frequency, merely tune the variable capacitors in the input and output tuned circuits for best reception of weak signals. No test equipment is necessary. If you happen to have access to a signal generator and sinadder, they may be used; otherwise, just do it by ear.

TROUBLESHOOTING. Since the unit is fairly simple, troubleshooting usually is limited to checking the dc voltages on the transistor. These will vary somewhat; however, in general, the source voltage should be about 1.5 to 2 Vdc, the gate-2 voltage should be about 3.0 to 3.5 Vdc, and the drain should be at about 8 Vdc.

If the dc voltages are ok but the unit is no longer amplifying, assuming there are no problems in the coax cabling, the transistor may have been damaged by transmitter rf or lightning discharge at the antenna. Such damage often does not cause a change in the dc characteristics of the transistor.

If the unit is amplifying ok but you are experiencing intermod, you may be overloading your receiver by adding gain ahead of the rf stage. Low noise preamps are effective in improving sensitivity of receiver systems in weak signal areas. However, it is normally considered inadvisable to use a preamp, even with a well designed receiver, in very strong signal areas, such as the center of a large city or other locations with high powered transmitters abounding on all sorts of frequencies. Adding gain ahead of a receiver degrades the selectivity of a receiver by an equivalent amount by boosting undesirable signals as well as desirable ones. In severe cases, strong signals which do not cause intermod by themselves will create intermod in the rf stage or mixer of your receiver after being amplified an additional 20 dB. If you use a preamp with a repeater receiver, you will need to have additional rejection in your duplexer to attenuate your transmit signal that much more to prevent desense. In severe cases of interference to repeaters, you may even want to use a crystal filter at the carrier frequency ahead of the receiver preamp, but after the duplexer.

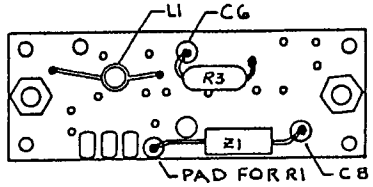

Figure 3. Bottom View, LNW-432 Preamp

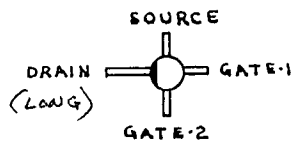

Figure 4. Detail of Transistor Lead Configuration

HAMTRONICS LNW-432 MINIATURE GaAsFET RECEIVER PREAMPLIFIER
ASSEMBLY INSTRUCTIONS

The following instructions will help you build your preamp with a minimum of effort. It is a miniature unit; so precise construction is necessary to get all the parts in the proper positions. The following steps are meant to serve as a general guide as to construction sequence and critical operations. It is assumed that you are an experienced vhf/uhf kit builder and don't need basic kit-building instructions. If this is not the case, consider having someone more experienced help you. Note that not all holes are used for this model; other frequency ranges use slightly different circuitry. The illustrations clearly show the locations of the parts to be installed.

a. Fasten two 4-40 x 3/8 inch hex standoffs using 4-40 x 1/4 inch screws. The side of the pc board which has mostly ground plane is the top of the board where the screw heads should be. Standoffs can be gripped in a bench vise to hold the board during construction.

b. Install the three feedthrough capacitors from the top of the board. Run a ring of solder around the base of the feedthru, and when the solder on the capacitor melts, press the capacitor down slightly with pliers, and hold it in vertical alignment while solder is cooling.

c. Flush cut the tops of feedthru caps C5 & C6 as close as possible to the bodies of the capacitors so the transistor leads can lay on top of the metal that is left. Don't cut off the top of C8. Cut the bottom leads of the ft caps to 1/8" so they won't short to chassis.

CAUTION: The small geometry and high impedances make GaAsFET's heat and static sensitive; so be careful. Discharge your hand to a grounded metal object just before picking up the transistor, and use a grounded soldering iron. A heat sink is not necessary, but be careful not to apply more heat than necessary. You should not be overly anxious about the fet if you observe the precautions above. The transistors are wrapped in foil to ensure that they arrive in good condition. There is no warranty coverage for damage which occurs in construction or handling; but replacement transistors are inexpensive.

d. Figure 2 shows the placement of Q1 on the board and identifies the drain lead. Pick up the transistor and orient as shown with lettering up. Gently bend drain lead and gate-1 lead (the opposite lead) down at a 90 degree angle so those leads can go into the pc board pads.

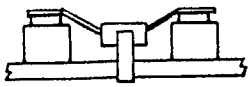

Figure A. View of Transistor Lead Formation

e. Set the transistor in place on the board with the drain and gate-1 leads in the holes provided and the source and gate-2 leads laying on the top of ft caps C5 and C6. Gently press the transistor down until the gate-1 lead is flush with the bottom of the board so that it can be soldered. This will result in the source and gate-2 leads angled just a little so the body of the transistor can be a little lower than would be the case if the leads were level with the tops of the ft caps.

f. Use a grounded soldering iron to carefully solder the drain and gate-1 leads in the board. The pc board has plated-through holes; so the solder will wick into the holes to bond to the leads even though the gate-1 lead does not extend beyond the bottom of the board. Be careful not to use excessive heat, as that could damage the transistor. Trim off end of drain lead below board.

g. Press the source and gate-2 leads down flat and solder them to the tops of the ft caps.

h. Solder metal shield to ground plane of pc board in position shown. Keep it as close as possible to the transistor to leave room for output coil L2.

i. Output coil L2 is 3-1/2 turns of #22 bus wire wound on 7/64" inside diameter. The shank of a drill bit makes a good tool for accurate coil winding. The coil turns should be barely spaced apart. The coil is mounted vertically, as shown in fig 2, with the bottom lead soldered to a pc board pad, and the bottom of the coil spaced just a little away from the ground plane. Wrap the other lead around the lower part of the pin on ft cap C8 and solder. Trim off extra length of ft cap.

j. Install solder terminals E1-E5. Cut them from the metal flashing strip and press them into the board, gripping one wall carefully with needle-nose pliers to avoid crushing. Rock them slightly while applying pressure to help to seat them. When properly installed, they will snap in place. Then, solder them lightly to the pc board foil.

k. Install C1-C4. C2 and C3 should have the rounded ends oriented as shown. Keep the leads of C1 and C4 as short as possible.

l. Install U1, C7,and vertical resistors R1 and R2 in the holes shown. The top leads of R1 and R2 are formed down and tack soldered to feedthrough cap C5 over the transistor leads. U1 must be oriented with flat side as shown.

m. Turn the preamp over and orient it as shown in fig 3. Solder one lead of R3 to the pin on ft cap C6. Form the resistor down on an angle toward board, and tack solder the other lead to the ground plane as shown. There is no hole for the ground lead. Do not lay the resistor along the conductor strip carrying the transistor drain signal. Keep the resistor off the board a little to avoid loading effects. Although not shown in the view of fig 3, the resistor body is angled down from the ft cap to the board, and that prevents loading and keeps resistor leads short.

n. Coil L1 is a 2-3/8 inch length of #22 bus wire wound as 2-1/2 turns on 7/64 inch inside diameter with turns barely spaced apart so they don't short together. A drill bit can be used as a forming tool. The coil is mounted horizontally under the board, as shown in fig 3, with the lead closest to the board soldered to the ground plane pad and the other lead soldered to the pad connected to transistor gate-1. The coil should be spaced just a little away from the board so the bottom of the coil isn't shorted to ground.

o. Position ferrite bead Z1 as shown in fig 3. Solder one lead to the pin on ft cap C8, and tack solder the other lead to the pad for resistor R1.

p. This completes construction. Look over all components and solder connections. Check for shorts or parts in the wrong places. Then, refer to installation instructions on the Installation and Maintenance Instruction Sheet.

TRANSISTOR REPLACEMENT. Transistor replacement is complicated a little by the fact that the pc board has plated-through holes. You must be sure to remove all the solder from the drain and gate-1 leads before trying to pull the transistor off the board. This can be done with solder-wick or a vacuum desoldering tool, as long as you remove all the solder within the holes. Then, melt the solder on the tops of ft caps C5 and C6, and lift the leads of resistors R1 and R2 and the source and gate-2 leads of the transistor.

CAUTION: The small geometry and high impedances make GaAsFET's heat and static sensitive; so be careful. It is good to discharge your hand to a grounded metal object just before picking up the transistor, and the use of a grounded soldering iron is mandatory. A heat sink is not necessary while soldering, but be careful not to apply any more heat than necessary.

You should not be overly anxious about blowing out the fet if you observe the precautions above. The transistors are all factory tested and wrapped in foil to ensure that they arrive in good condition. There is no warranty coverage for damage which occurs in handling.

Figure 2 shows the placement of Q1 on the board and identifies the drain lead. Pick up the transistor and orient it as shown in fig. 2 with lettering up. Gently bend the drain lead and the gate-1 lead (which is the opposite lead) down at a 90 degree angle so those leads can go into the pads in the board.

Set the transistor in place on the board with the drain and gate-1 leads in the holes provided and the source and gate-2 leads laying on the top of ft caps C5 and C6. Gently press the transistor down until the gate-1 lead is flush with the bottom of the board so that it can be soldered. This will result in the source and gate-2 leads angled just a little so the body of the transistor can be a little lower than would be the case if the leads were level with the tops of the ft caps.

Use a grounded soldering iron to carefully solder the drain and gate-1 leads in the board. The pc board has plated-through holes; so the solder will wick into the holes to bond to the leads even though the gate-1 lead does not extend beyond the bottom of the board. Be careful not to use excessive heat, as that could damage the transistor. Trim off end of drain lead below board. Press the source and gate-2 leads down flat and solder them to the tops of the ft caps.

REMOVING OTHER PARTS. Because the pc board uses plated through holes, all of the solder within the holes must be removed before a lead can be removed from the board. This can be done with solder-wick or a vacuum desoldering tool, as long as you remove all the solder within the holes.

PARTS LIST.

Desig	Description	Desig	Description
C1	2 pf disc	L1	2-1/2 T #22 7/64"ID
C2	4.5 pf cer variable	L2	3-1/2 T #22 7/64"ID
C3	4.5 pf cer variable	Q1	NEC 41137 GaAsFET
C4	7 pf disc	R1	100K
C5,C6	.001 uF feedthru cap	R2	100K
C7	0.1 uF monolithic cap (104)	R3	180 ohms
C8	.001 uF feedthru cap	U1	78L08 8V regulator
E1-E5	Solder Pins	Z1	Ferrite bead

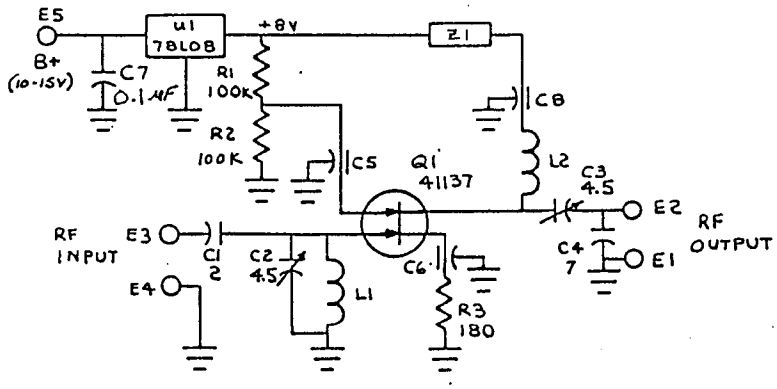

Figure 5. LNW-432 Preamp, Schematic Diagram

ADDENDUM FOR ASSEMBLY OF HAMTRONICS® LNW PREAMPS

Since the assembly instructions were written, the style of feedthru capacitor has been changed to allow easier assembly. The old style used a pin through the center of the feedthru which had to be cut off in order to solder the transistor flush. The new style has no pin in the center; instead, it has a hollow center which is metalized through from end to end. Therefore, wherever the assembly instructions say to attach a lead to the center of the feedthru capacitor, now simply insert a short length of the lead into the hollow center of the feedthru and solder to the metalization. It is not necessary for the lead to go all the way to the other end because there is metalization to conduct from one end to the other.

Also note that the feedthru capacitors are not used as feedthru caps in the normal sense; they are merely used as a very good vhf/uhf bypass capacitor and tie point. Do not be confused by the fact that C5 has connections only at one end of the feedthru.

 Manual revised: 06/12/91