C432 UHF RECEIVER CONVERTER

CONSTRUCTION AND ALIGNMENT INSTRUCTIONS

Note -- If you are unfamiliar with this type of kit, it is important to note that the instructions are more on the order of a magazine article than a step-by-step assembly manual. Therefore, it is necessary to read over the explanatory material several times before beginning construction to be sure you are aware of the various techniques involved in completing the kit. It is not difficult, but you will depend on your skills in following the schematic and assembly drawings and a few basic guidelines. Your attention is especially directed to the page entitled "General Construction Notes", which helps you avoid some of the classic construction pitfalls discovered over the years. By not having to constantly read step-by-step instructions, you will be able to enjoy construction of the kit more; and surely you will gain a sense of accomplishment by building your own equipment.

CONSTRUCTION.

Construction is straight-forward and involves a simple soldering of components to the pc board as illustrated in the schematic and component location diagrams. Because of the vhf and uhf circuits involved, be sure to seat components down as close as possible to the pc board. Following are a few notes regarding the less obvious components.

- Ferrite bead Z14 is installed over the top lead of R4 as it comes down to the board.

- Variable capacitors should be installed with the rounded end to ground, as shown.

- TP1 is formed as a small loop in resistor R9.

- TP2 and TP3 are formed by installing R11 and R12 vertically in the board and leaving a 1/4 inch of the top lead protruding to connect a meter. Only one lead of the resistor is connected to the pc board.

- L2 and L6 are formed by winding 6 turns of magnet wire tightly around the shank of a tuning tool or other 1/8 inch diameter forming tool. The ends are then bent at right angles and inserted in the board. These coils are not critical — they are only used as rf chokes.

CRYSTALS are standard HC-25/u, third overtone, series resonant units.

$$\text{Xtal Frequency} = \frac{RF - IF}{9}$$

where RF is the low end of the input frequency band and IF is the low end of the output frequency band. Some examples of crystals for popular frequency schemes are as follows.

RF	IF	CRYSTAL
432	28	44.8889
435	28	45.2222
439.25	61.25	42.0000
427.25	61.25	40.6667

Crystals are available from Hamtronics for any desired frequency scheme.

ALIGNMENT AND TESTING.

The most difficult part of alignment is obtaining a stable test signal. Even with our HP-608 Signal Generator, it takes many hours before it stabilizes enough to stay within the passband of a narrow receiver at uhf frequencies. If you don't have access to a uhf signal generator, it is possible to use a strong signal on the air. Otherwise, a simple crystal controlled signal source, such as our model T15 Alignment Oscillator, may be used.

a. Plug crystal into sockets.

b. Connect a source of +12V (+13.6V) dc to E1. Note that a regulated power supply is recommended for normal operation.

c. Adjust slugs in all coils to the center of their tuning ranges (half inserted in windings).

d. Adjust variable capacitors to the center of their tuning ranges (screwdriver slot aligned with length of capacitor, pointing at leads).

e. Connect signal source to J1, and connect J2 to receiver used as i-f.

f. Connect dc vtvm to TP1.

g. Adjust oscillator coil L3 for a peak. Note that oscillator may stop when tuning far off peak on either side.

Note -- The setting of L3 also affects the oscillator frequency slightly. If you want to adjust the oscillator exactly on frequency, adjust L3 slightly off peak while observing frequency counter connected to Q4 collector. L3 should not be detuned more than 1/4 turn from its peak.

h. Connect dc vtvm to TP2. Alternately adjust L4 and L5 for maximum indication. Repeat several times to work out any interactions.

i. Connect dc vtvm to TP3. Adjust C30 for a peak. If more than one peak, set C30 for the strongest peak.

j. With a strong signal applied to the converter, tune in the signal on the receiver. An S meter or some form of signal strength indicator will be needed for the following step.

k. Adjust C1, C4, and L1 for maximum response.

l. Connect an ac vtvm or oscilloscope across the receiver's speaker. Apply a weak carrier signal, and adjust C1, C4, L1, and C30 for best quieting (minimum noise). This is a fine tuning procedure which has only a minor effect, but which may improve the noise figure slightly. The settings will not be much different from previous peaking settings.

TROUBLESHOOTING.

If some slug tuned coils do not peak within the range of slug adjustment (as may happen if the converter is built for a different i-f frequency, for example), an adjustment in the number of turns on the coil winding may be necesary. However, be careful not to tune to the wrong multiple of the oscillator frequency. If the slug is fully inserted in the winding, more turns are required. If the slug is all the way out, fewer turns are needed.

The usual troubleshooting techniques of checking dc voltages at transistor elements and tracing oscillator injection signals with an rf probe and vtvm are appropriate for this converter. A dc voltage chart is given to indicate typical voltages measured on a good converter; although voltages may vary widely from unit to unit without necessarily indicating a problem and measurements taken at points with rf applied will depend on the type of meter used. Current drain of the converter, typically about 30-50 ma, is also a very good indication of any problems on the B+ line.



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GENERAL CONSTRUCTION NOTES

CRYSTAL SOCKETS are usually supplied in a strip. Individual sockets should be cut off the strip just above the round barrel part of the socket and seated in the pc board by pressing down with a blunt tool, such as the side of diagonal cutters. Socket will snap in place when seated. When soldering, use as little solder as possible to avoid loading the socket by capillary action.

FERRITE BEADS look somewhat like tuning slugs, but without threads. They are installed by stringing them on a piece of leftover wire lead from a resistor or capacitor. The wire lead should be bent down to match the holes in the pc board. They may be used individually or in a series of two or three together, as noted on the diagrams. Ferrite beads present an impedance to vhf and uhf signals over a wide range of frequencies, and are therefore effectively used for decoupling in B+ lines.

PHONO JACKS used for rf signal connections consist of an inner contact pressed into an outer shell. They are installed by aligning the lugs with the pc board holes and rocking down into position. It is common for the center contact to pop out of the shell if its lugs aren't started into the center hole properly. If this happens, merely press the center contact back into the shell and try again.

EXTERNAL LEADS for B+ etc. are connected by soldering into large pads on the pc board. If you prefer to have some form of contact to connect leads to, pieces of #20 bus wire can be soldered to the board to act as pins, or the oversize pads may be drilled out to fit other types of pins you may wish to use.

COMPONENT LEADS should be as short as possible in vhf and uhf circuits to minimize lead inductance problems. For this reason, seat all components as closely as possible to the board without stressing components unduly.

PROPERLY POLARITY must be observed when diodes and electrolytic capacitors are installed. The banded end of a diode is the cathode. This corresponds to the bar on the diode schematic symbol used on component location diagrams.

RESISTORS AND DIODES installed vertically on a pc board are shown on component location diagrams as a circle, denoting the position of the body of the component, with a line representing the top lead going over to the other pc board hole. Occasionally, you may be instructed to form the top lead of a component into a small loop to act as a test point for alignment. In such a case, it is only necessary to make a loop large enough to accomodate a test probe.

SEMICONDUCTORS may have different type numbers or different lead configurations. Pc boards are set up to accept various types. Where a pc board has the three holes in a triangular pattern and a transistor is used with three leads in line, the base lead must be bent toward the flat side of the case before installing the transistor, as shown in figure A. This is the case for types 2N4123 and 2N3563.

Figure B shows another type of transistor, which has its leads already molded in a triangular pattern. In such a case, the transistor is installed in the board to match the leads, regardless of the shape of the plastic case. One example of this is a type SC-4 transistor, which is a selected grade of 2N4123 that is often used in the kits in place of the standard "2N4123". The SC-4 has a flat side on its case, but the base lead is molded toward the round side of the case. The SC-4 is installed according to the lead pattern. It is only necessary to be concerned with the shape of the case when all 3 leads are in line and the unit could otherwise be installed either way.

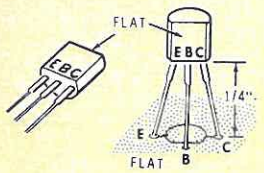


Figure A

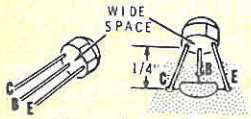


Figure B

COMPONENT MARKINGS can be confusing at times, even to the experienced. Parts may be marked in various ways and have different lead styles. The following supplemental information should be helpful.

Capacitor values may include a tolerance letter or be marked in significant figures and a multiplier, much the same as resistors are color coded. In fact, tubular capacitors, such as a 0.39 pf, are actually marked with a color code. At times, slightly different values may be used. Wherever possible, actions are taken to avoid confusion. E.g., 1.2K resistors are used in place of 1K resistors to avoid any possible confusion with 10K units. Some example of capacitor markings are as follows.

ORN-WHT-GRY = 0.39pf
2.2C = 2.2pf
12J = 12pf
151J = 150pf
102K = .001uf (1000pf)
103M = .01uf (10,000pf)
104 = 0.1uf (100,000pf)

COIL WINDING.

Do not be over concerned with coil winding, as it is a simple process. It is necessary to know a few things, though, before coils are installed. When someone gets in trouble with coil winding, it is generally due to making assumptions that special things must be done which are not required. Example: it is not necessary to space turns out or to use Q dope on coils.

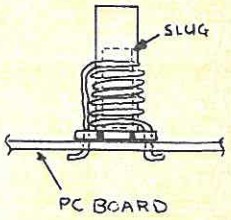
Coils can be wound in either direction, using the solderable wire provided. Do not use wire from another kit, as it may be the wrong size. All turns should be close spaced, starting at the very bottom of the form and winding upwards.

Start by inserting the wire about 1/2 inch through one of the holes in the base. Bend the wire over horizontally at the top of the base and wind the required number of turns. Terminate the coil by inserting the wire through the opposite hole in the base and trimming off the excess wire. Windings are always specified in half turns because the leads are installed in opposite holes in the form. Leave about 1/2 inch leads to insert in the board. The coil wire should be pulled snug, but not so tight to compress the coil form and make the slug tight in the plastic form. The slug should be threaded into the lower part of the form before winding to give support to the area of the winding to help avoid deforming the plastic with the wire.

Some coils requiring many turns are wound in 2 layers. Such cases are marked on the schematic as such, e.g., 8T + 6T, which means 8 turns on the first layer and 6 turns on the second layer. In this case, after finishing the first layer, dress the lead back down to the base of the form and wind back up toward the top on the second layer. All turns are tight spaced; so the second layer sets evenly on the first. The transition from top to bottom in starting the second layer is done over a space of about one turn. It is not necessary to make a bend to go abruptly down to the base in a straight line.

After coils are wound, they are installed on the board by inserting the leads through the holes and pulling leads snug from below. Bend leads over somewhat to hold them in place and trim off excess, leaving 1/16 inch to solder. The wire may be stripped automatically by applying a very hot soldering iron with solder for approx. 10 seconds. If iron isn't hot enough to strip wire promptly, insulation may be scraped off with a knife. Do not solder the leads unless the coil is installed on the pc board, since the leads may pull through the warm plastic base.

A TUNING TOOL of the proper type must be used with the tuning slugs in this kit. The slugs are teflon coated so they will turn easily unless the coil form is damaged. The tool required is a plastic one with a small slot type blade molded in plastic at one end. If you need a tuning tool, they are available from Hamtronics at 50¢ each. Don't take a chance on damaging the coil slugs by using the wrong tool!



The blade must be seated firmly in the slug to avoid damage to the tool. The slug should turn easily without straining the plastic tip on the tool. If not, investigate the possibility that coils are wound too tightly. They can be rewound if necessary, to relieve the tension on the plastic form.

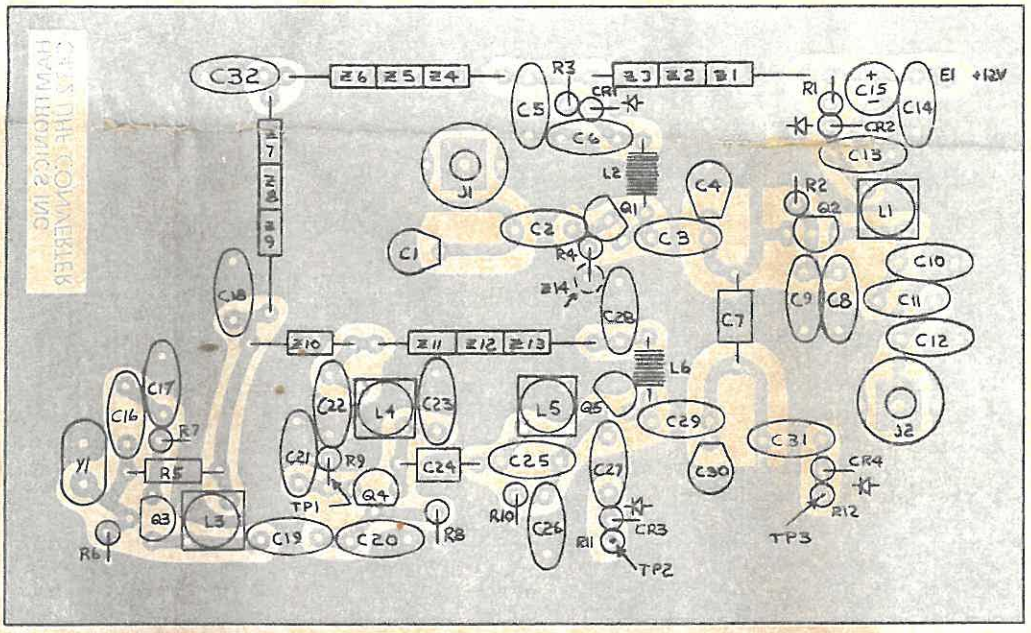
Probably the most common trouble, based on our experience, is interchanged components, cold solder joints, and incorrectly wound coils. The next most common trouble is blown transistors due to reverse polarity or transients on the B+ supply. Any relay coils connected across the B+ line should have a reverse diode connected directly across the relay coil to absorb the reverse transient produced when the relay is unkeyed. Remember, if you encounter any difficulties in initial test, that it is easy to install parts in the wrong place. Don't take anything for granted. Double check everything in the event of trouble.

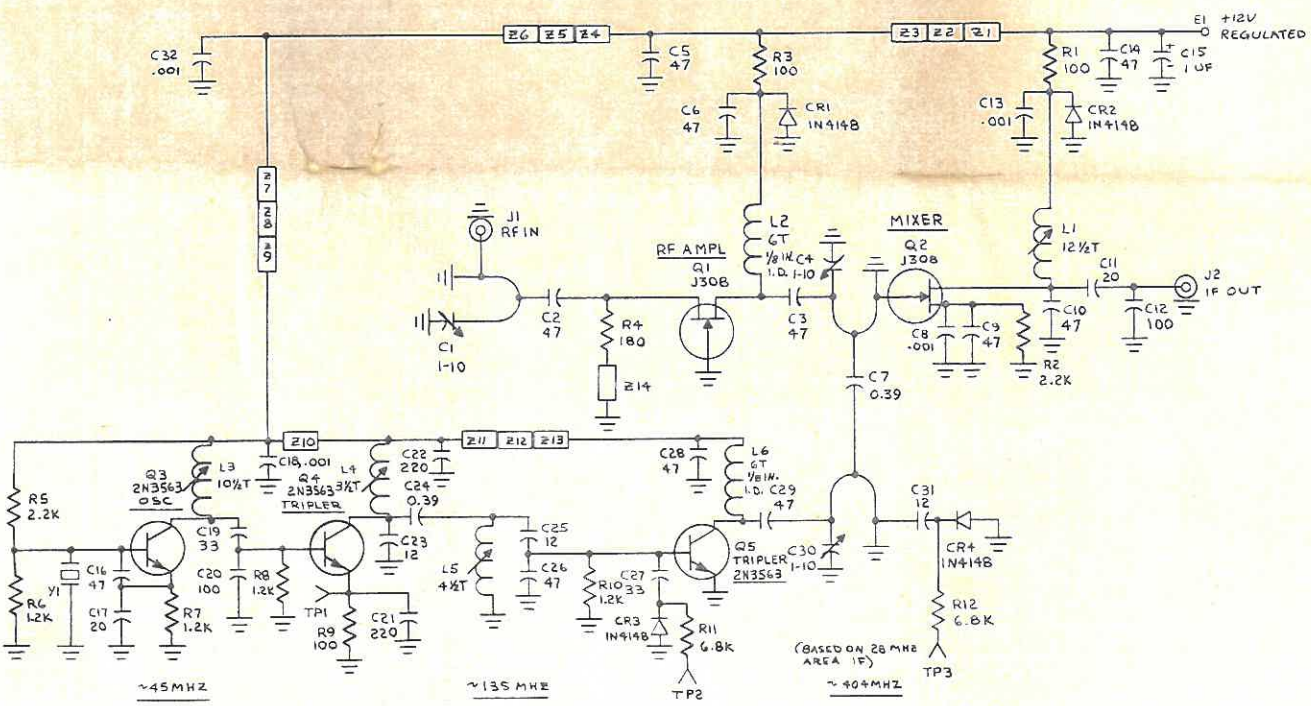
MOUNTING.

The converter is designed to slide into a horizontal groove in the companion aluminum case. Short coax cables should be prepared, with materials supplied, to connect the BNC jacks on the panel with the phono jacks on the pc board. If the case is not used, holes may be drilled in the corners of the converter board to allow the board to be mounted to your chassis with standoffs.

TYPICAL DC VOLTAGES.

XSTR	E (S)	B (G)	C (D)
Q1	+0.5 to 2V	0V	+12V
Q2	+1 to 3V	0V	+12V
Q3	+3.7V	+4.2V	+12V
Q4	+1.2V	-0.3V	+12V
Q5	0V	-0.5V	+12V





C432 UHF CONVERTER, SCHEMATIC DIAGRAM (28 MHZ I-F)

Note -- For 61.25 Mhz i-f, use 4-1/2 turns on L1.