DEM Part Number 432-28______

43_____ MHz Transverter, __________ MHz IF, SN__________

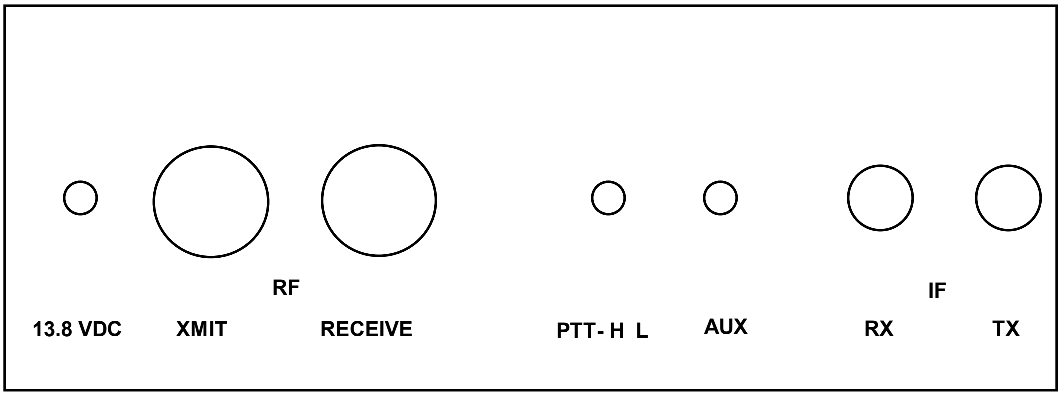
Power Out:	10 Watts 50 Watts Other__________
Noise Figure and Gain:	0.8dB nominal, @ 17dB conversion gain
DC Power Requirement:	11 - 16.5 VDC, 13.8 nominal
IF Option:	Common Split
IF Drive Level Maximum:	-20dBm 10 mW 1-10W Other_____________
Keying Option:	PTT - to ground TTL - Positive Voltage
Aux. Connection Output Option:	TX RX High Low Open
Antenna Option:	Common Separate TX & RX
External preamplifier option:	YES NO
Second Oscillator Installed:	YES NO
Specified Custom Option:	None Option:___________________________________

Operational Overview:

The New DEM 432-28 and 432-28HP is a 70cm to 28 MHz transverter. With the new MOSFET hybrids now available, it is possible to produce two different power output level transverters. The standard 432-28 will produce 10 watts of clean linear power for driving other solid state amplifiers. The 432-28HP will produce +50 watts to drive tube amplifiers direct without the need of a intermediate amplifier. Both models will operate with all 28 MHz. transceivers with transverter ports and with a simple option, it is compatible with any 28 MHz. transceiver with 10 Watts or less output power. The output power can be limited with an internal adjustable attenuator to preset the maximum output power if you require lower drive when using an additional power amplifier.

The other noticeable improvement in the transverter is the use of a PHEMT front end and a more robust inter-stage amplifier between the filters to further increase the IP3 output performance in the receive section. This is again the best receive converter on the market today! Both transverters have a built in transmit / receive relay but provisions have been made to allow separating the transmit and receive ports to add a high power amplifier or to interface the transverters additional receive filtering with a external or mast-mounted preamplifier. Additional options have been included to custom tune your receive gain requirements to obtain the best performance (sensitivity and IMD) possible.

Dual oscillators are provided for operation in the satellite portion of the band. Keying options for +1 to + 15VDC, PTT-H or a closure to ground, PTT-L, have been provided. Auxiliary relay contacts to control external transmit and receive functions are available. A common IF option that will operate at drive levels between -20dBm and 10 watts may be ordered. All IF connections are BNC connectors. The control, and auxiliary connections are RCA jacks, the DC power connector is a AMP circular style with mating cord and the 70cm connectors are Type “N” (2 supplied). Both transverters are housed in a 8.7" x 5.7" x 2.2" aluminum die cast enclosure and the HP model includes an external 7 " x 11" x 1.3" heat sink to provide cool operation under any condition.



Connect your transceiver to the transverter:

Interfacing the transverter to the transceiver is easy. If your transceiver requires a special DEM interface, follow those instructions for interfacing. If the transverter was configured for direct connection to your transceiver, follow the steps listed below.

1. Open lid of transverter by removing 6 screws.
2. Depending on the make and model of your transceiver, it may or may not be necessary to enable the transverter ports. Follow whatever instructions you have in your transceiver's operation manual to enable transverter operation. If it requires a special connector or cable assembly, it should be made now or contact Down East Microwave for assistance.
3. Connect all IF cables. Both receive and transmit are BNC connections on the transverter. Use good quality coax cable to connect the 28 MHz. transverter ports from your transceiver to the TXIF and RXIF connectors on the transverter.
4. Connect the Push to Talk line out of your transceiver to the transverter. It is labeled PTT-H or PTT-L on the transverter and uses a RCA connector. The correct keying type is already configured for your transceiver.
5. Connect the 70cm antenna system or a dummy load with a power meter to the transverter. If one of the "N" connectors is labeled 'Antenna" then the internal transfer relay in the transverter is installed. Both transmit and receive functions will be provided through this connector. If the "N" connectors are labeled "Transmit" and "Receive", the internal transfer relay has been bypassed and the separate ports will provide the labeled functions.
6. Connect the DC power to the transverter. If it is the HP model a power cable will be supplied. 13.8 volts is optimum but the transverter will operate normally from 12 to 15 volts.
7. Preset the TXIF and RXIF gain controls. Turn the TXIF fully counter-clockwise (maximum attenuation) and the RXIF fully clockwise (minimum attenuation).
8. Power your transceiver on and leave it in the Receive mode on 28.100 MHz.
9. Apply DC power to the transverter and turn on the power switch. The power LED should light and the transmit LED should not. Set the local oscillator switch to 432MHz.
10. Adjust the RXIF gain control counter-clockwise until a slight noise increase is heard in the transceiver or just a slight movement in the "S" meter is detected. Power the transverter on and off to verify the change. The RXIF gain may be increased beyond this point, but it will start to degrade the dynamic range of your transceiver. Find a signal on the band or use a signal generator to determine correct frequency, or minimum signal level. Out of band signals such as local repeaters will be attenuated if their output frequency is above 438 MHz or below 430 MHz.

11. To test the transmit section, place your transceiver in the CW mode. It is recommended to test the transverter in the CW mode because most transceivers have carrier level controls in this mode only. If your transceiver has FM, it may be use to test the transverter if it has a power output control. Do not use SSB or AM because it is not possible to obtain maximum output power with a transceiver in these modes. Set the carrier/output power control to minimum or "0" output power. Place the transceiver into transmit. Note the transmit LED on the transverter. It should be on. While observing the power meter on the 70cm system, slowly increase the carrier control (with key down) or power output control to maximum on the transceiver. If the transverter is configured correctly for your transceiver, minimal power may be detected on the 70 cm power meter. Now slowly adjust the TXIF control in the transverter in a clockwise direction while observing the power meter. Set it to obtain the specified maximum output power of your model transverter or any level below that. Un-key the transverter, then switch the transceiver to USB and make a transmission. The power output and current drain should correlate to your speech pattern.
12. You may re-adjust both RXIF and TXIF again if desired. The adjustments of the receive preamplifier and local oscillator frequency do not need to be touched but you may if you wish. Do not adjust any of the helical filters unless you have access to a spectrum analyzer at minimum.
13. Put the top on the enclosure and install the screws. Your transverter system is ready to use. Connect as you wish to use it in your 70cm system and have fun!

Transverter Operation Overview:

Receive signals enter through a type "N" connector and either pass through the TR switch or may be by-passed and enters the RX gain stage/filter combination. The gain stage/filter combination, depending on your desired configuration, is quite versatile. The standard receive line-up is a PHEMT preamplifier and a broad band MMIC amplifier separated by a 2 pole 3dB insertion loss helical filter. The PHEMT has a tuned high pass input circuit and diplexer filter output circuit. It is then biased to utilize its intended IP3 specification of ≅ +31dBm output. Being that the PHEMT is designed for microwave frequencies, it has an inherent low noise figure at the frequency used in this transverter and results in less than 0.8dBNF for the system. This signal passes through a 2 pole helical filter that is quite selective and filters out the out of band signals that may have been amplified by the PHEMT. The second stage is a MMIC with a IP3 output of ≅ + 42dBm that amplifies the filtered signal. In this section, some assembly options may be installed. If you wish to use a mast mounted preamplifier, the PHEMT should be by-passed. There is a provision on the circuit board for the RX signal to be routed directly to the 2 pole helical filter then the MMIC amplifier. Other line-ups may be used such as the PHEMT being the only gain stage in the system before the mixer. With the standard line-up , the signal then passes through a 3 pole, 5 dB insertion loss, helical filter, to further eliminate out of band signals that would cause inter modulation products in the mixer. The high level mixer has a +17dBm local oscillator input which is supplied after passing through a 2 pole helical band pass filter. This mixer has a IP3 output of approximately +30dBm. The mixer is then terminated into a diplexer band pass filter combination to reduce reflections back into the mixer further reducing intermod. The IF signal then may enter the IF amplifier stage and a adjustable attenuator. This IF amplifier stage is optional and will reduce the IP3 input level. If a cascade analysis is done with the standard line up, the math would show that weakest point in the converter system would be the IF gain stage. Without the IF gain stage the receive converter has >+5dBm input IP3 with a > +25dBm output IP3. This is a large signal for anything but some of the newest and/or best receivers on the market. This level for some of the latter day transceivers could be as much as 40 dB into compression. The adjustable attenuator has about 25db of range and could be used to attenuate the IF signal, but will only decrease the IP3 output performance. If a IF gain stage is used to add 10 more dB gain, it will require a IP3 output of +50dBm to maintain the input IP3 performance without the IF gain stage. This could in turn produce a large output signal to your receiver

On transmit, As little as 0dBm will produce the maximum rated output power. If your transceiver has a lower drive level than that, a optional gain stage may be installed on the transmit side. The signal proceeds through an adjustable attenuator, (25db range) then through the same filter diplexer combination as the receive signal. This is done with a pin diode switch which is biased in the transmit position only. Although the mixer can handle up to +14dbm before compressing, that level is never needed or approached. The transmit signal also shares the mixer , 3 pole helical filter, and pin diode switch with the receive side. It then proceeds to a 2 stage amplifier consisting of a MMICs biased in a linear fashion. The 2 stages have a total of approximately 22 dB gain. The signal is then filtered with a 2 pole helical band pass filter with about 3 dB insertion loss. With 0 dBm entering the transverter there should be ≅ 5 mW driving the selected Hybrid module of either 10 watts or 50 watts output. The out put of the hybrid then enters a low pass filter to eliminate the 2nd harmonic and above spurious. The signal then enters the TR switch or exits the transverter using its own TX port.

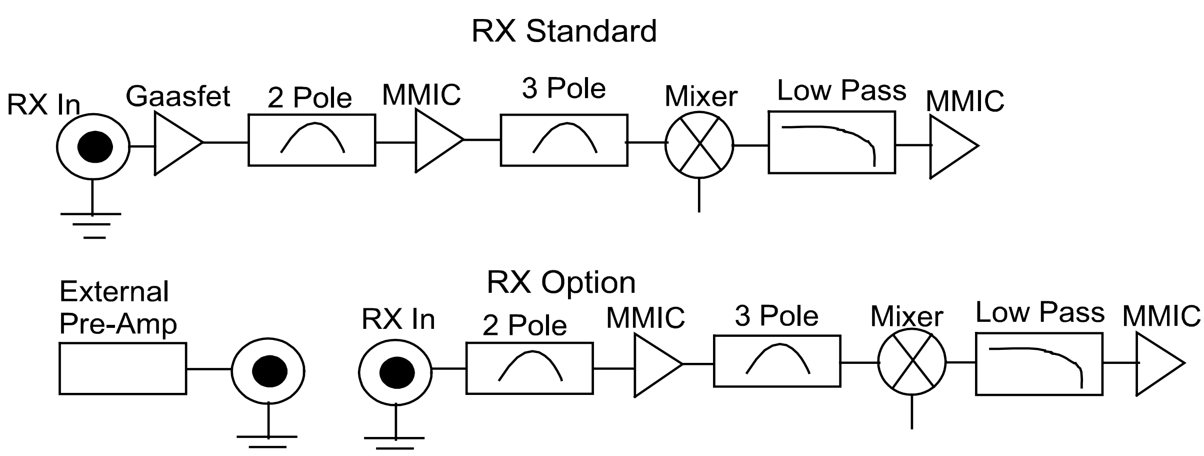
All switching functions are controlled by either a Signal to Ground or a +1.5-15VDC which is provided by a transceiver on transmit. The transverter is in RX mode during standby. Isolated auxiliary contacts are provide for switching external equipment such as mast mounted pre-amps, power-amps, or T/R switches.
Using the supplied schematic, follow this operation overview for a complete circuit description.

<u>Add an external preamplifier and bypass the internal PHEMT:</u>

Below is block diagram of the receive converter. It shows the standard and an option of using an external preamplifier. It is recommended that if you use a external or mast mount preamplifier, you should bypass the internal one. The transverter may be configured this way very easily.

1. Refer to the component placement diagram and remove C83 and R41. The pad that connects to F4 is now the RX input. Remove R42. This removes the DC bias to the PHEMT, Q6.
2. If you do not wish to have the receive signal routed through the T/R relay in the transverter, use a small length of coax to connect the new RX input on the F4 filter to the spare N connector.

If you wish to still use the T/R relay in the transverter, remove L24 and C76 from the PCB. Then run a jumper coax from the L24 pad to the new RX input at F4.

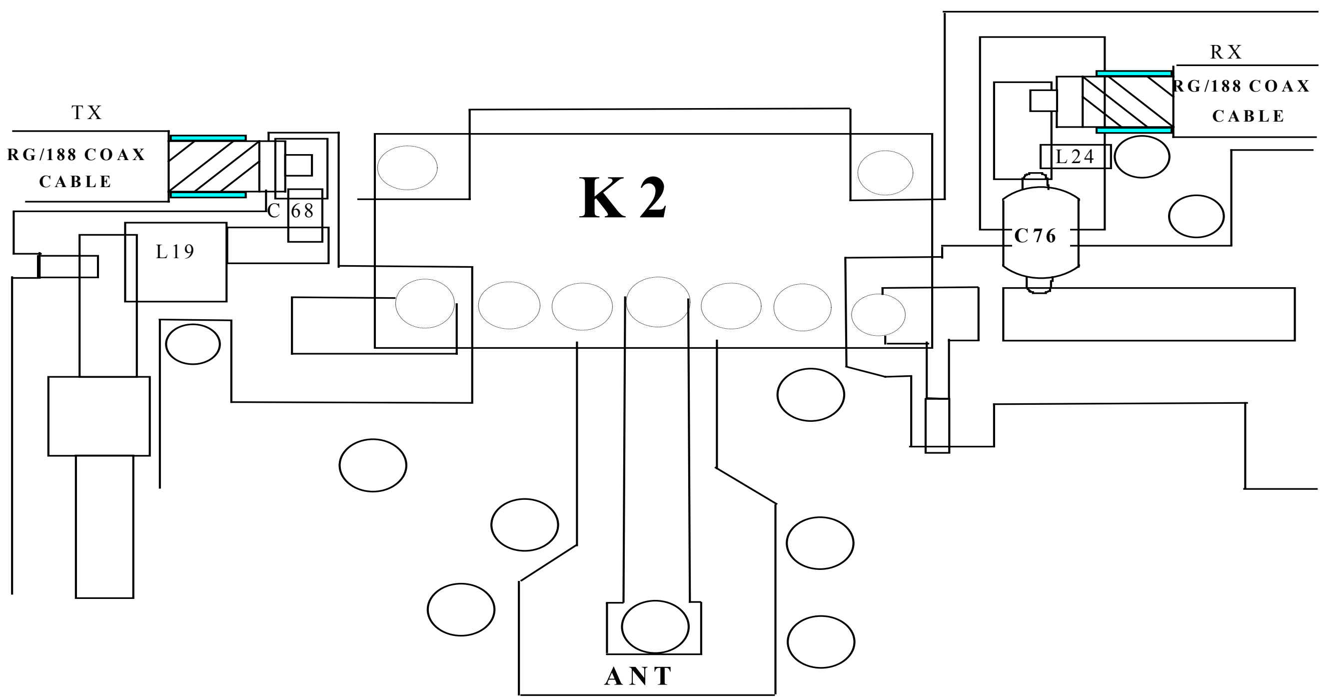


Split RX / TX Ports for high power amplifier use:

1. Remove chip capacitor C68 from original position and place were shown on diagram below.
2. Prepare a 2" piece of RG/188 coax or similar and attach it to the new C68 placement as shown.
3. Attach the other end of the coax to the spare type "N" connector. Use the coax connected to the other connector as a sample.

The RX input can be left assembled the way it is. This will provide additional receiver isolation during transmit. The K2 relay will function normally and will open the circuit to the RX input. But this will not protect an external preamplifier. If you decide to remove the K2 relay from the circuit do step 4 and 5.

4. Remove and replace C76 and L24 as shown in diagram below.
5. Remove the coax from the ANT connection on the PCB and attach it to the new RX IN position shown.



Auxiliary Switching contacts:

The auxiliary contacts in K1 are labeled C (common) NO (normally open) and NC (normally closed). The C connection can be wired to ground or +13.8 VDC. This will then be connected or dis-connected depending on weather the transverter is in transmit or receive. The contacts are marked for the receive mode. The NO or NC can be wired to the AUX connector on the enclosure.

Adding the second oscillator:

To chose the correct frequency crystal for the second oscillator crystal, take the desired frequency and subtract the desired IF frequency from it. This will result in a frequency between 398 and 410 MHz. Divide this number by 4 and this will be the frequency crystal needed. Install the crystal, like the other, in the PCB. It can be installed with out removing the PCB from the enclosure. You may insert pins or leave the leads of the crystal long enough to fit a soldering iron tip under the can. Once it is in place, check for shorts to ground or the can. Testing is then simple. The circuit has be pre-tested so it should just start up. Follow the detailed steps.

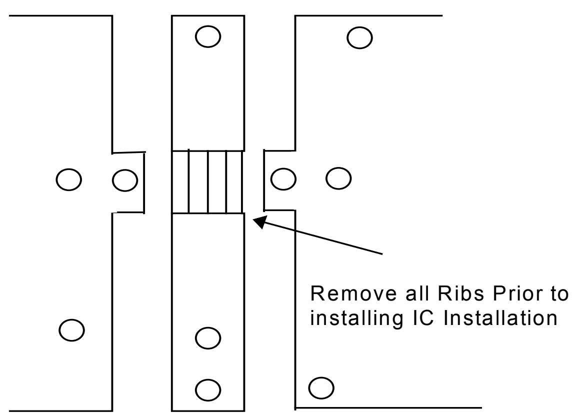
1. With the transverter on, place the LO switch in the second LO position.

2. With a volt meter, place the negative lead in one of the enclosure holes, (ground) and probe TP2 with the positive lead.
3. Adjust C14 with a insulated slotted tool to peak the voltage on your volt meter between 1 and 2 volts.
4. If the adjustable capacitor max.'s or min.'s, stretch or compress L6 to have the voltage peak at TP1 occur when C14 is in mid position.
5. If you have a frequency meter that can measure 500 MHz. or more, probe the junction of M1 and C34 and then tweak C14 for the desired frequency.

Install the TXIF or RXIF gain stages:

You may require additional gain on either the TXIF or RXIF and want to install either IC4 or IC5. If your transceiver has less than 1 mW output on its transverter port, installing IC5 will enable the transverter to produce full output power. All of the associated bias components are installed and tested. Refer to the component placement diagram and locate IC5. Then remove the ribs as shown below. Cut them with a razor knife and heat with a solder iron. They will jump off the board! Then form the leads of the IC5 so that it lays flat on the circuit board. Solder it into place paying attention to the Dot on the IC.

The same thing may be done with RXIF. Note the dot on the IC before installing. **Caution!** Installing this gain stage will increase your IF gain but reduce your systems dynamic range and will not improve your system's noise figure. Refer to the circuit description. This stage should never be installed if you have already installed a external preamplifier.



IC4 & IC5 Installation

Common IF option:

If you have ordered the common IF version, a separate schematic and parts list is supplied. If you wish to change the configuration to a common IF, it can be supplied as a kit. Please consult Down East Microwave Inc. for details. Options with up to 10 watts input power are available. It is easily installed and come s complete with a new component placement diagram.

Component List

All resistors are ¼ watt and in ohms unless noted. All chips "C" are 1206 size and in ohms

R1 1K	R11 1.5K	R21 1K	R32 470
R2 470	R12 100	R22 330	R33 330
R3 680	R13 47	R24 150 ½ W	R34 150 ½ W
R4 1.5K	R14 100	R25 220	R36 12 "C"
R5 100	R15 1K	R26 1K POT	R37 12 "C"
R6 47	R16 150	R27 220	R38 12 "C"
R7 100	R17 5.1K	R28 220	R39 300 "C"
R8 1K	R18 120	R29 1K POT	R40 51 "C"
R9 470	R19 56 ½ W	R30 220	R41 51 "C"
R10 680	R20 47	R31 5.1K	R42 24 "C"

All capacitors values are pF unless otherwise specified. "E" = Tantalum or Electrolytic , "T" = Variable trimmer, "C" = Chip component

C1 1000 (102)	C18 0.1 µF	C34 0.1 µF "C"	C56 100 "C"	C74 0.1 µF "C"
C2 0.1 µF	C19 2.2µF "E"	C35 0.1 µF	C58 120	C75 100 µF
C3 1-8 Piston	C20 0 .1 µF	C36 1000 "C"	C60 0.1µF	C76 3 "C"
C4 0.1 µF	C21 120	C37 39	C61 0.1µF	C77 1-6 "T"
C5 15	C22 0.1 µF	C38 18	C62 120	C78 0.1 µF "C"
C6 39	C23 0.1 µF	C39 120	C63 0.1µF	C79 0.1 µF "C"
C7 0.1 µF	C24 120	C40 1000	C64 120	C80 100 "C"
C8 120	C25 120	C41 270	C65 120	C81 100 "C"
C9 0 .1 µF	C26 0.1 µF	C42 270	C66 6.8 "C"	C82 12 "C"
C10 2.2 µF "E"	C27 2.2 µF "E"	C43 1000	C67 6.8 "C"	C83 4 "C"
C11 0.1 µF	C28 0.1 µF	C44 0 .1 µF	C68 100 "C"	C84 0.1 µF "C"
C12 0.1 µF	C29 0.1 µF	C45 1000	C69 0.1 µF	C85 2.2 µF "E"
C13 0.1 µF	C30 0.1 µF	C51 1000	C70 100 µF "E"	C86 0.1 µF
C14 1-6 "T"	C31 0.1 µF	C53 0.1µF	C71 0.1 µF "C"	C87 100 "C"
C15 0 .1 µF	C32 120	C54 1000	C72 100 "C"	C88 120
C16 15	C33 120	C55 0.1µF	C73 100 "C"	C89 0.1 µF "C"
C17 39				

All molded chokes have GOLD or SILVER multiplier and tolerance bands. Identify desired value by the significant color band combination. Chips “C” are 0603 size. “HW” are wire wound.

L1 9 Turns 1/8" ID #24 “HW”	L15 0.22µH (RED/RED)
L2 0.33µH (ORANGE/ORANGE)	L16 0.33µH (ORANGE/ORANGE)
L3 1.0 µH (Brown/Black)	L19 1.0µH (Brown/Black)
L4 1.0 µH (Brown/Black)	L21 2 Turns 1/8" ID # 18 “HW”
L5 1.0 µH (Brown/Black)	L22 3 Turns 1/8" ID # 18 “HW”
L6 9 Turns 1/8" ID #24 “HW”	L23 2 Turns 1/8" ID # 18 “HW”
L7 0.33µH (ORANGE/ORANGE)	L24 4T 1/16” Blue “HW”
L8 1.0µH (Brown/Black)	L25 39 ηH “C”
L9 1.0µH (Brown/Black)	L26 39 ηH “C”
L10 1.0µH (Brown/Black)	L27 8.2 ηH “C”
L11 1.0µH (Brown/Black)	L28 39 ηH “C”
L12 0.22µH (RED/RED)	L29 4T 1/16” Blue “HW”
L13 0.33µH (ORANGE/ORANGE)	L30 56 ηH “C”
L14 0.22µH (RED/RED)	

All miscellaneous components are as indicated.

M1 SYM-14H	IC5 MAR6 (TXIF Gain, optional)
Q1 2N5179 Metal can	IC6 MAR3
Q2 MPS5179	IC7 MAV11
Q3 2N5179 Metal can	IC8 Hybrid Module
Q4 MPS5179	IC9 AH-31
Q5 PN2222	VR1 78S09
Q6 FPD750 GaAsFET	VR2 78L09
CR1 MPN3404	VR3 78L05
CR2 MPN3404	VR4 7805
CR3 1N4000 type	VR5 78S09
CR4 1N914 or 1N4148 (ORANGE GLASS BODY)	F1 TOKO 1547
CR5 MPN3404	F2 TOKO 1354
CR8 MPN3404	F3 TOKO 2537
CR10 1N4000 type	F4 TOKO 2537
IC1 ERA-3	Y1 Crystal 101 MHz 5th Overtone HC 18/U
IC2 ERA-2	K1 G5V-2
IC3 MAV11	K2 G6Y
IC4 MAV11 (RXIF Gain, optional)	

432-28 Common IF Input Circuit Option

This option is used for common IF input for the 432-28 transverter. There are two versions of this option. High (up to 10 Watts) and Low (less than 250 mW) Power. The Low Power version may be used down to -20 dBm if the TXIF gain stages is installed. This option should not be used if drive level is over 1mW. The High Power version should be used with transceivers that have up to 10 Watts of output. It has a 50 ohm termination mounted on the case for power dissipation. There are 2 parts lists for each version. The components designators are the same for both and only the parts required for the pin switches are listed. This may be assembled after the transverter PC board is completed using the component placement diagram.

Components Parts List - Add to Standard PCB Parts Placement Diagram

Low Power Option

For transceivers with 250mW or less drive.

C46 1000pF	C50 1000pF	CR6 MPN3404
C47 100pF	C52 1000pF	CR7 MPN3404
C48 100pF	C COM-IF 1000pF	L17 10T #28 T25-10
C49 1000pF	R23 1KΩ	L18 1.0µH

High Power Option

For transceivers with greater than 250mW but not to exceed 10 Watts of drive.

C46 1000pF	C50 4.7 pF	CR6 MA4P1200
C47 100pF	C52 1000pF	CR7 MA4P1200
C48 100pF	C COM-IF 1000pF	L17 10T #28 T25-10
C49 1000pF	R23 150Ω 1W	L18 1.0µH
LOAD 50 ohm		

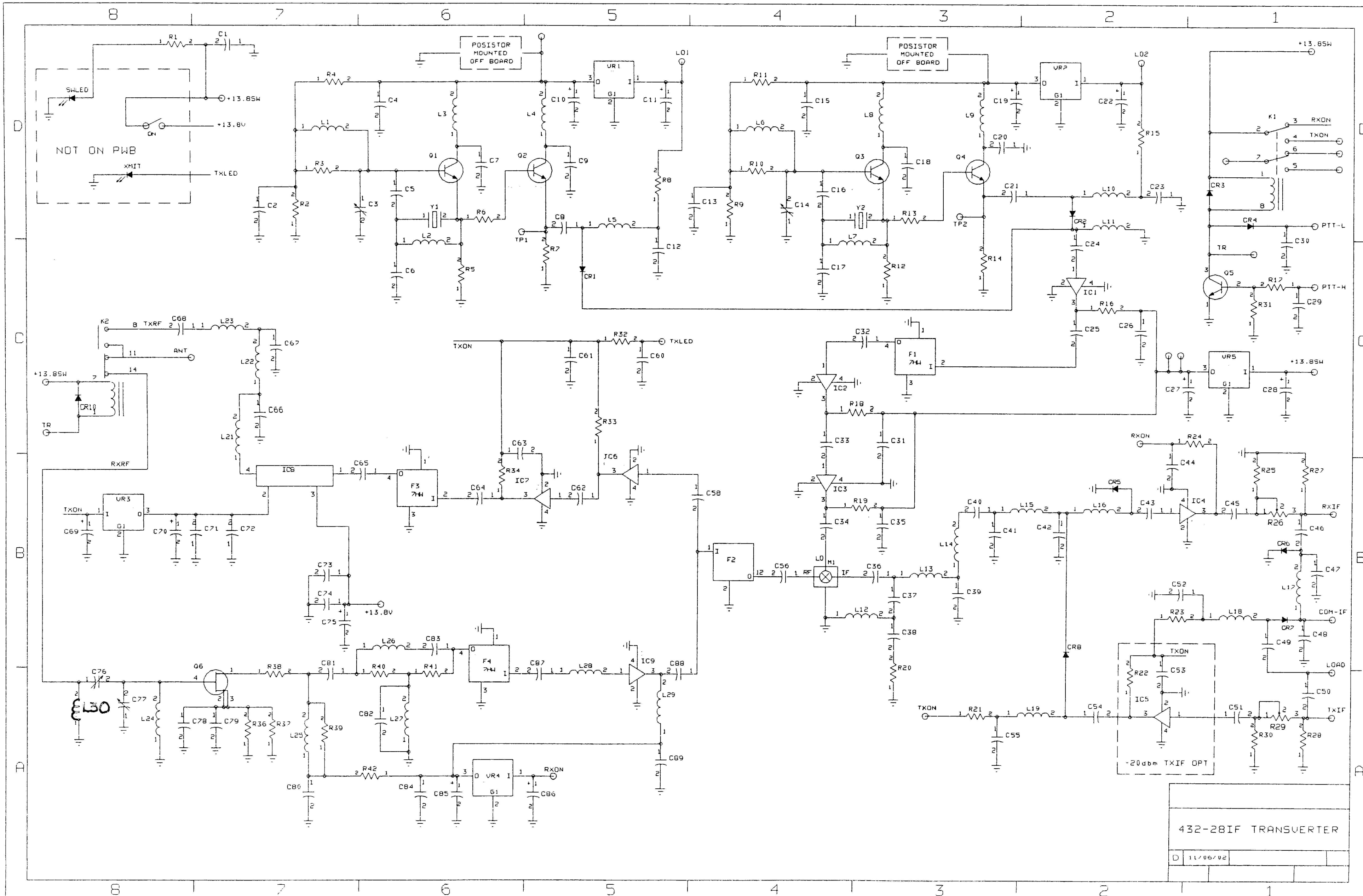
1. Assemble version required by installing components on PCB per component placement diagram. Do not install C COM-IF or 50 ohm THC load

2. Test Transverter PCB per instructions and add the following:

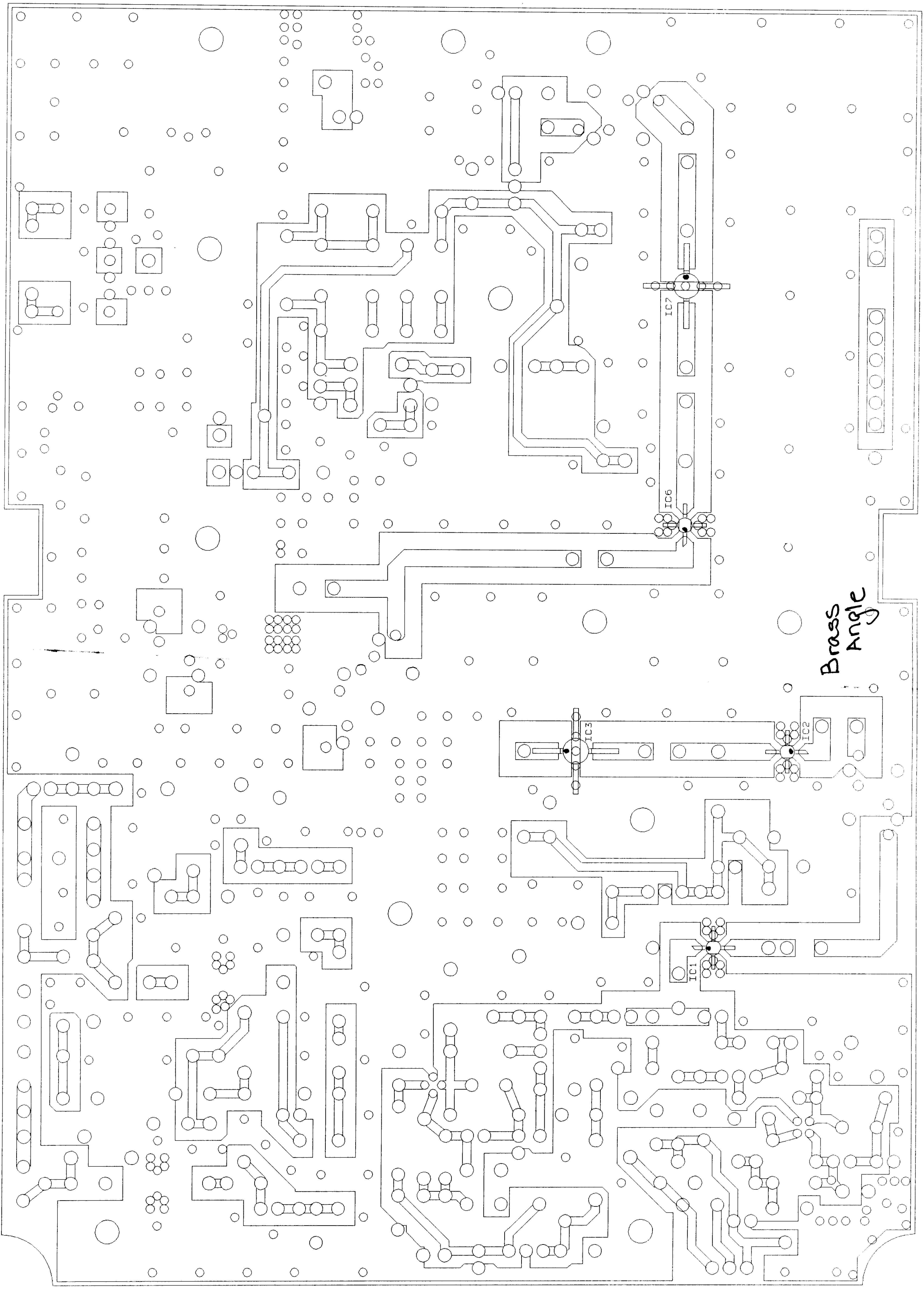
Junction of R23 and C52. 0 volts on Receive
1.5volts +/- 0.5 volts on Transmit

3. Install the C COM-IF capacitor to common IF input connector (labeled RXIF on standard installation) and solder to the position on PC Board between L17 and C48.

4. High power option- Install 50 ohm load by soldering one lead between C50 and C49 and the other to ground. Bolt flange to case. Unit is ready to test.



NOT ON PWB
SWLED
XMIT
TXLED
+13.8SW
+13.8V
ON
POSISTOR MOUNTED OFF BOARD
LO1
LO2
TP1
TP2
RXON
TXON
PTT-L
PTT-H
TR
K1
K2
TXRF
ANT
RXRF
IC8
F1 7HW
F2
F3 7HW
F4 7HW
RF
IF
LO
M1
RXIF
COM-IF
LOAD
TXIF
-20dbm TXIF OPT
432-28IF TRANSVERTER
D
11/06/02


IC7
IC6
IC3
IC2
IC1
Brass Angle

Top Assembly