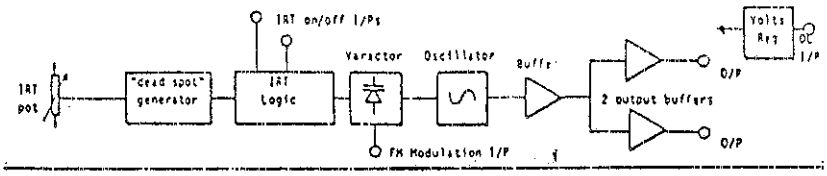
C.M.HOWES
COMMUNICATIONS

CVF20

20M VFO FOR USE WITH MTX20

* Stable FET oscillator.
* 11 to 15V DC operation.
* Dual buffered outputs.
* Onboard Voltage regulator.
* Gives transceive operation when used with DcRx and MTX20
* Easy to build.
* Full instructions, PCB and all board mounted components plus IRT control.



Made in England

C.M.HOWES COMMUNICATIONS, EYDON, DAVENTRY,
NORTHANTS NN11 6PT ENGLAND Tel: 0327 60178

The CVF20 is a VFO module for use with the MTX10 transmitter and many othe applications where a VFO is required for the 20M band. The tuning range of the VFO can be easily modified for other frequency ranges if desired. IRT facilities are built in for offseting the frequency of the VFO when using the CVF20 to drive a receiver as well as a transmitter. The CVF20 ca be FM modulated if required.

BRIEF SPECIFICATION:

Tuning range: 14.0 to 14.350 band can be tuned with a 50pF tuning capacito The VFO can be set anywhere between 9.0 and 14.5 MHz.
IRT range: typicaly 4kHz total variation, at least +/- 1.5kHz.
Outputs: Iwo independently buffered outputs. Load Z >1k ohm. approx 2V P-P.
Modulation input. High impedance, frequency response flat from 60Hz to 6kHz.
Supply voltage: 11 to 15V.
FSK is possible by keying IRT switching circuit.

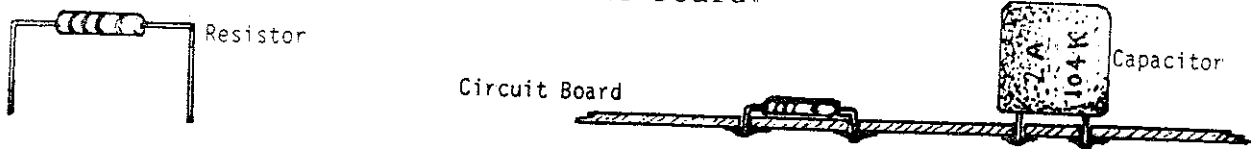
TOOLS REQUIRED:

Soldering iron about 30W (with a fine pointed tip). Small side cutters, long-nosed pliers, and a trimming tool for L1.

BUILDING THE KIT.

The CVF20 has a fairly compact circuit board to enable it to be mounted in a small screened box inside other equipment without taking up a disproportionate amount of space. Because of this the parts, and hence the circuit tracks, are quite close together. It is essential that care is taken when soldering not to "bridge" solder across the tracks causing them to be shorted together.

Start by reading all the paperwork through at least once BEFORE you plug in the soldering iron. When you have done this, start construction by fitting the resistors. Refer to the parts list and select R1. Bend its leads as shown in the picture and insert it into the circuit board.



The leads can now be soldered to the tracks, and then cut off close to the joint. Now fit R2 in the same way and work your way down the parts list until all the resistors have been fitted. Next fit the capacitors as detailed in the parts list. The next parts to fit are the semiconductors. MAKE SURE YOU FIT THESE THE RIGHT WAY ROUND. The outline of the shape of the transistors is printed on the board, so this is quite easy. The diodes all have a band at one end of them, this indicates the lead that goes to the hole marked with a "+" sign on the circuit board.

Use an off-cut component lead to make the wire link shown by a dotted line on the circuit board, near C3. The link should connect from the hole closest to C3 to the hole furthest away along the dotted line.

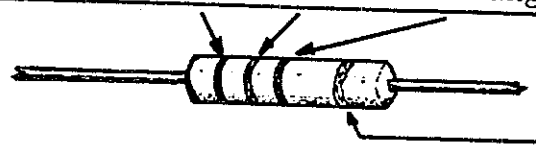
You should now be left with just the coil, L1, to fit. Take care as you push this into the mounting hole on the board that you do not snap the former as this is a little fragile. Only press it in far enough just to hold it firmly in place. Now solder the leads to the holes as indicated by the letters marked on the board - these correspond with the lettered leads in the parts list picture.

Your CVF20 module should now be finished and ready for checking. Please do not rush into wiring the board up to a power supply, give all the solder joints a thourough inspection and check all the parts are in the right places first. It is a good idea to hold the board up to a bright light so that you are looking at the tracks in silhouette. Check that there are no splashes of solder or bridges across the tracks. If you can see daylight through a joint, resolder i

You are now ready to wire up the CVF20 module on the test bench and check that it works OK. Refer to the wiring diagram sheet for this. Do make sure you connect the power the right way round! Negative earth.

RESISTORS

Part No.	Value	Description	Fitted	Checked
R1	47R	Yellow Violet Black		
R2	1k0	Brown Black Red		
R3	1k0	Brown Black Red		
R4	1k0	Brown Black Red		
R5	47k	Yellow Violet Orange		
R6	47k	Yellow Violet Orange		
R7	100k	Brown Black Yellow		
R8	27R	Red Violet Black		
R9	100k	Brown Black Yellow		
R10	10k	Brown Black Orange		
R11	100k	Brown Black Yellow		
R12	27R	Red Violet Black		
R13	47R	Yellow Violet Black		
R14	33k	Orange Orange Orange		
R15	2k7	Red Violet Red		
R16	82k	Grey Red Orange		
R17	10k	Brown Black Orange		
R18	47k	Yellow Violet Orange		
R19	82k	Grey Red Orange		
R20	56k	Green Blue Orange		
R21	47k	Yellow Violet Orange		
R22	47k	Yellow Violet Orange		
R23	56k	Green Blue Orange		
R24	470R	Yellow Violet Brown		
R25	1k0	Brown Black Red		
R26	1k0	Brown Black Red		
R27	1k0	Brown Black Red		
R28	1k0	Brown Black Red		
R29	22k	Red Red Orange		



Gold or Red band.

CAPACITORS

Part No.	Value	Description	Fitted	Checked
C1	.01uF	Marked 103		
C2	.1uF	" 104k		
C3	5.6pF	" 5.6 or 5p6		
C4	1nF	" 102 or .001		
C5	100pF	" 100		
C6	-	Not fitted to CVF20		
C7	.1uF	Marked 104k		
C8	22pF	" 22		
C9	.1uF	" 104k		
C10	.01uF	" 103		
C11	1nF	Marked 102 or .001		
C12	1nF	" 102 or .001		
C13	.1uF	" 104k		
C14	.1uF	" 104k		
C15	.01uF	" 103		

CONTINUED NEXT SHEET.

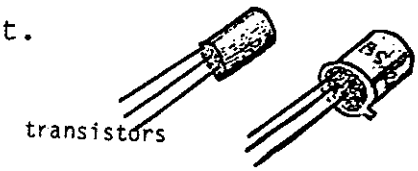
CAPACITORS (CONTINUED)

Part No.	Value	Description	Fitted	Checked
C16	.01uF	Marked 103		
C17	.1uF	" 104k		
C18	.01uF	" 103		
C19	.01uF	" 103		
C20	22pF	" 22		

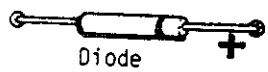
SEMICONDUCTORS - TAKE CARE TO PUT THESE IN THE RIGHT WAY ROUND

The transistors (Tr1 etc.), should be put in the board as the outline printed on the board indicates.

TR1, TR5, TR6, & TR9 are all BC183A devices and have their type numbers marked on them. Sometimes we may supply BC237 devices instead of the BC183A types.
TR2 is a BC307 and has its type number printed on it.
TR3 is a 2N3819 device and is marked as such.
TR4, TR7 & TR8 are BSX20, they have metal cans and have their type numbers marked on them.

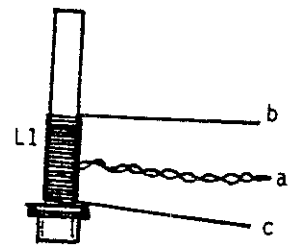

transistors

The diodes all have a band at one end that indicates the lead that must go to the hole marked with a "+" sign on the circuit board.
D1 is a 1N4004 and has its type number marked on it. It has a black body.
D2 is a 1N4148. These tend to come with various markings. Sometimes they have their part number printed on them (very small print!), sometimes they are a plain orange colour with a black band at one end marking the "+" lead Some 1N4148s have multi-coloured bands on them, the wide band indicates the "+" lead.
D3 is a BZY88 and has its type number marked on it.



L1

Fit this to the board as shown in the diagram.
Be carefull not to break the rather fragile former when you push it into the circuit board.



NOTES ON SOLDERING

To solder properly, you must use the correct type of iron and the right quality of solder. Use a small tipped iron which has a bit that is almost pointed at the end. The iron should be about 30 Watts (if it is not thermostatically controlled). Only use electronic type multi-cored solder. NEVER use any extra flux.
You should hold the hot iron in contact with both the lead and track for about a second or so to heat them up. Then, keeping the iron in place, touch the solder onto the junction of lead and track and wait a further second or so for the solder to flow along the lead and track to form a good joint. Now remove the iron. The iron should have been in contact with the work peice for a total time of about 4 seconds in all. It is a good idea to drag the tip of the iron up the component lead as you remove it from the joint, this helps to pull any excess solder up with it and encourages good flow along the component lead.

Using your CVF20

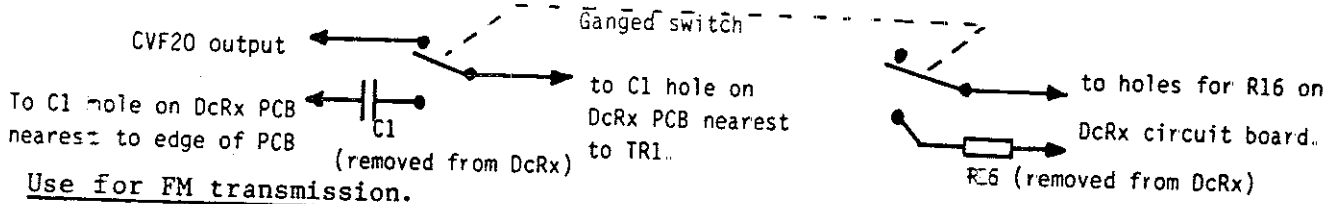
Use with MTX20.

Connect one output of the CVF20 (marked "op" on the board) via coax to the "E" input of the MTX20. The screen of the coax going to "E". Adjust L1 of the MTX20 for maximum output in the centre of the VFO tuning range (if you are not going to use crystal control on the MTX20). If you are going to use crystals and the VFO, then simply leave L1 of the MTX20 set as per the MTX20 instructions. With L1 aligned for crystal use, there may be a slight fall in drive to the TX at one end of the band. Wire the "D" connection of the CVF20 via screened cable to the TX/RX switch. This terminal should only have power switched to it in TX mode. This disables the IRT on switching to transmit. Note that the CVF20 must run all the time, both when transmitting and receiving, to keep the output frequency stable. This can mean that when using a receiver other than the DcRx in transceive mode, that the oscillator can be heard whilst receiving, this is not a problem however because you simply use the CVF20's IRT control to shift its frequency out of the receivers passband. The CVF20 will return to the correct transmit frequency automatically when terminal "D" goes to +12V, or "C" goes to 0V on transmit.

NOTE the MTX20 should have power applied to its "+ve" terminal at all times when the CVF20 is being used to drive it. If this is not done there will be a small frequency shift going from RX to TX. The key connection to the MTX20 should be switched off during receive by the TX/RX switch to prevent accidental use of the key causing transmission whilst receiving.

Use with DcRx receiver.

The VFO of the DcRx has to be disabled and the output of the CVF20 fed in to it in its place. The simple way to do this is to remove C1 and R16 of the DcRx. Now feed one output (op) of the CVF20, via coax, to the connection for the removed C1 nearest to TR1. The outer of the coax goes to "E". The CVF20 will now drive the DcRx. If you wish to be able to switch from the DcRx VFO to the CVF20 external VFO (for split frequency working for example, then you will need to add a switch to the DcRx as shown:



Use for FM transmission.

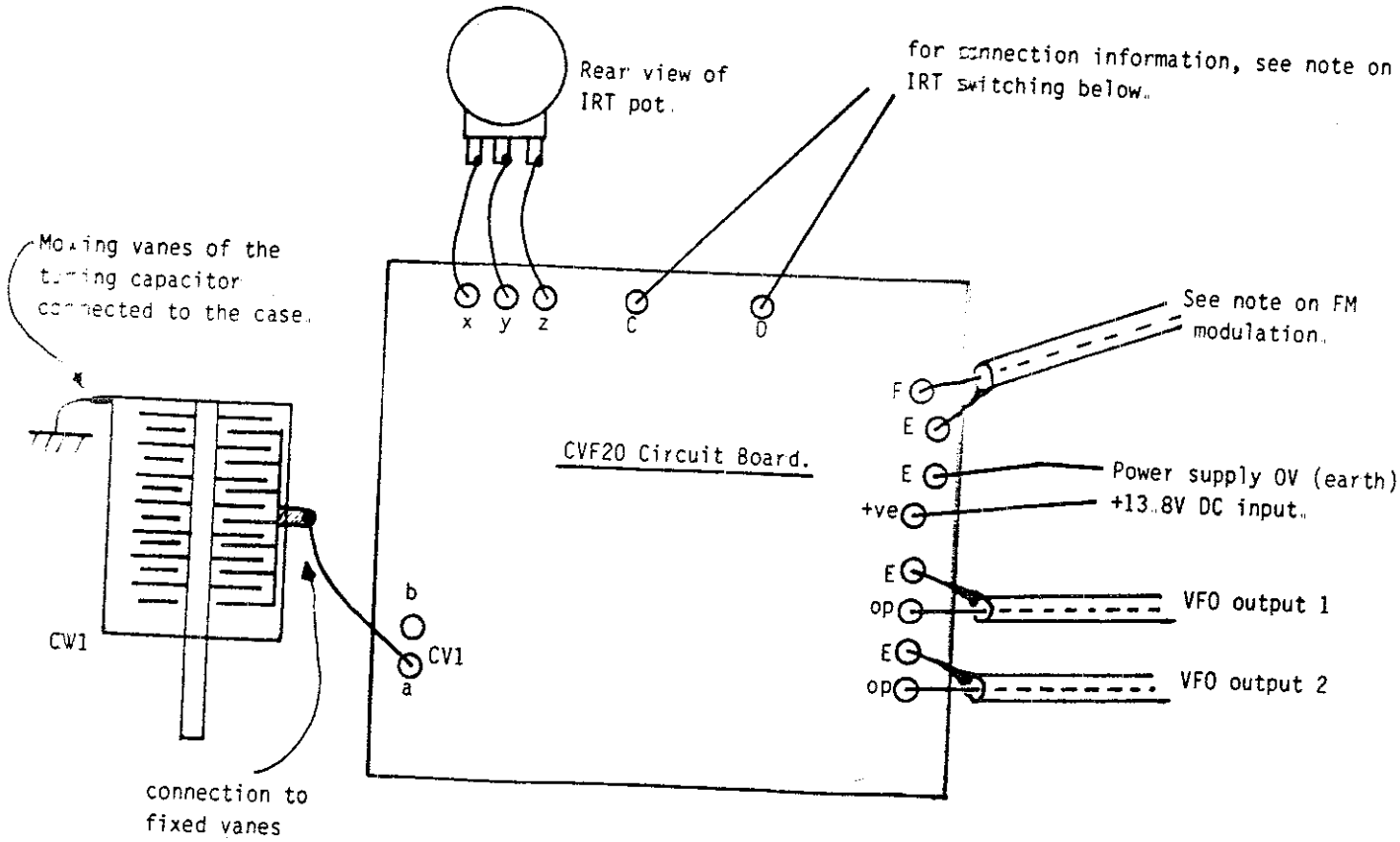
The CVF20 can be FM modulated. This facility is provided for when the CVF20 is modified for other frequencies, it is unlikely that you will wish to use FM on 20M ! However there is nothing in the UK Class A amateur license to say you can't! We will not encourage you though.

The deviation is not very large with the value of C3 as supplied. However you can change C3 to 10pF and then the CVF20 will deviate rather more. You can use up to 8V P-P modulating audio, but linearity will not be too good. It is better to keep the modulating voltage to under 2V P-P, then the deviation should be reasonably linear. If larger amounts of deviation are required, then a change of diode (D1) to a varactor diode with a larger capacitance swing than a 1N4004 should do the trick. Any change of value for C3, or change of diode type, will require L1 to be reset to give correct tuning range.

Aligning the CVF20

This is a straightforward job and should be left until it is fully installed and connected up. Simply adjust the core of L1, so that you have the required tuning range. Check this with a calibrated receiver or frequency counter. This will normally be 14.0 to 14.35MHz with a 50pF tuning capacitor. You can now seal the core of L1 to hold it in place with a drop of rubber solution glue, or wax.

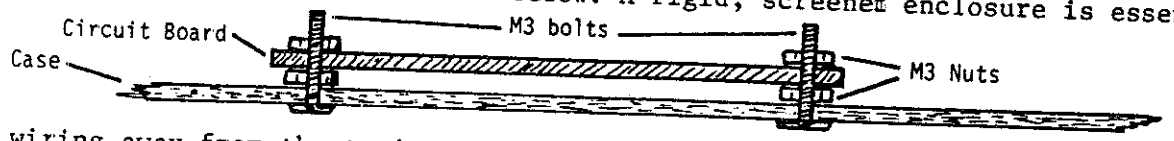
The other alignment job is to set the IRT pot's knob so that its pointer points straight up at the centre of the "dead spot". This is the segment of the pots rotation where the frequency does not change. This is the frequency that the CVF20 returns to when the IRT is switched off. Check for this with a receiver or counter. It's easy to net onto a station, simply set the IRT pointer to the centre and tune CV1 for zero-beat with the incoming signal. You are now netted, and can retune the IRT control for best reception, leaving CV1 alone.



Notes on connecting the CVF20

Use minature coax cable for all leads that are wired out to other equipment. Keep the VFO output leads as short as possible, preferably less than a foot long. If the IRT pot is not going to inside the same screened enclosure as the CVF20, wire this in screened cable.

You will note that we have not given a specification for frequency stability of the CVF20. The performance of this module is very good, but it will be dependent on how good a job you make of installing it. Mechanical stability is a must. Use all four mounting holes and fix the board securely to the case as shown below. A rigid, screened enclosure is essential.



Keep all wiring away from the tuning capacitor, L1 and other components of the oscillator itself. Use stiff wire for the connection to CV1. You will find termination of the coax cables much easier if you fit terminal pins to the relevant holes on the PCB.

IRT switching. Either wire point "D" to a connection that has +ve volts on it on transmit, or wire point "C" to a connection that has a earth on it on transmit. Either of these connections will switch the IRT off whilst transmitting.

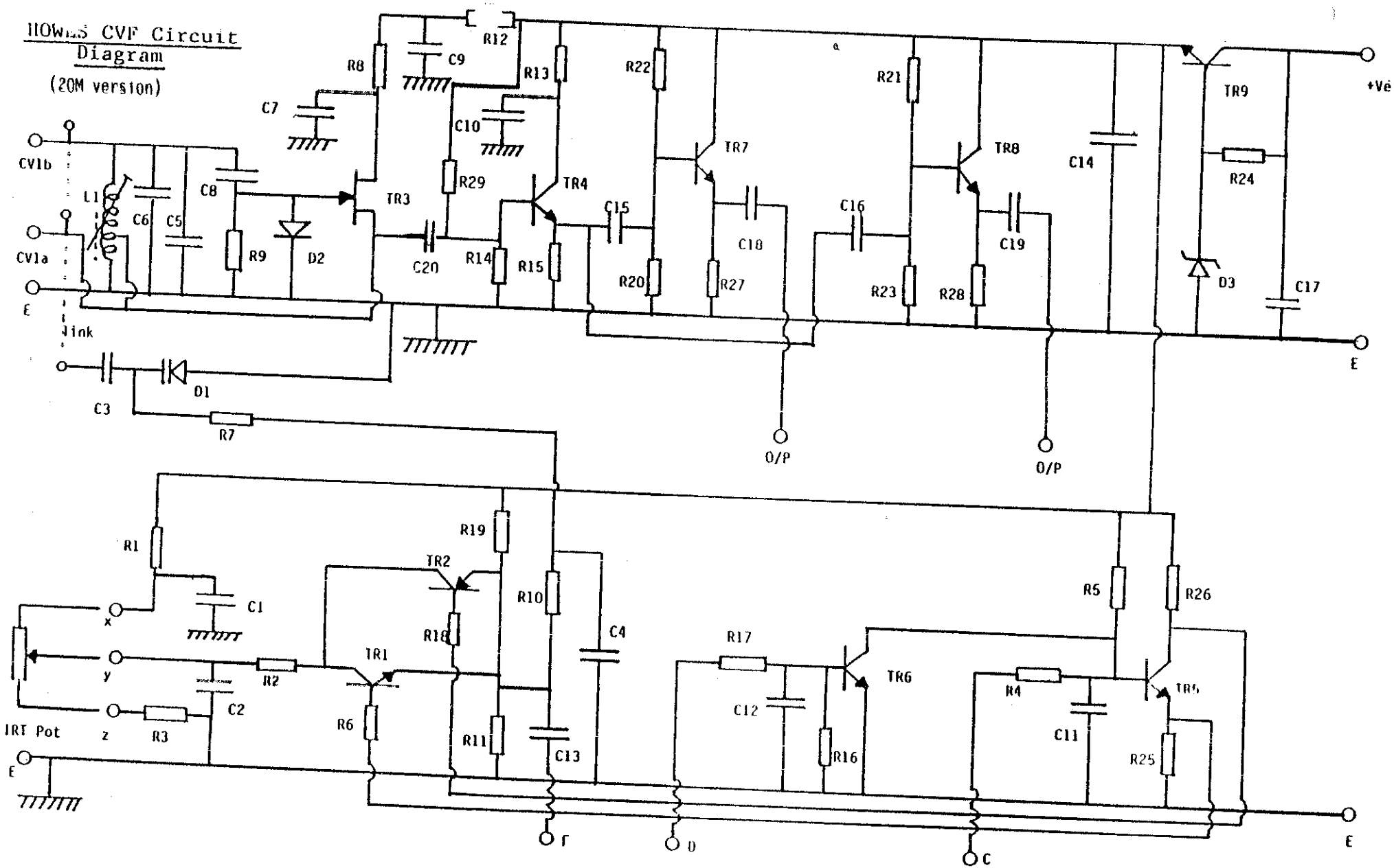
FM Modulation. Apply audio of about 2V P-P to point "F". IRT must be off whilst transmitting.

Driving a Frequency Counter. Because the VFO runs at signal frequency, all you have to do is to connect an ordinary frequency counter, and you have digital readout. Simply feed the counter from one of the outputs (in parallel with the MTX20 feed if you are using both outputs already), but use a series resistor to help isolate the counter. Use as high a value as you can (try 10k), consistant with reliable counter operation.

Connecting a tuning capacitor of about 50pF to point "CV1 a" will allow full band coverage from 14.0 to 14.35MHz. Use a smaller capacitance if you wish to bandspread the CW end of the band, rather than having full coverage.

HOWES CVF Circuit Diagram

(20M version)



C - Earth this connection to turn IRT off

D - +12V on this terminal turns IRT off

F - modulation can be fed to this terminal to FM modulate the VFO.

link C3 in parallel with CV1b for a large IRT range, or in parallel with CV1a for a normal IRT tuning range.