The HOWES MTX20 is a 20M amateur band CW (Morse) transmitter. NOTE: you must have the relevant licence to operate this equipment on the air.

BRIEF SPECIFICATION

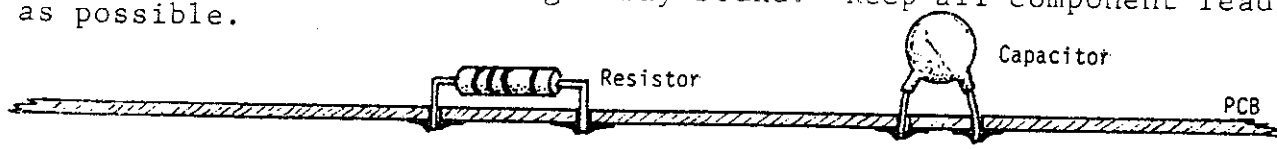
Output power: Adjustable from 2 to 10W RF Approx.
Spurious outputs: Harmonics, better than 50dB down. Key click filter.
Crystal Frequency: QRP calling frequency 14.060 kHz supplied. Provision for VXO, external VFO and two other crystals on PCB.
Output Conditions: 50 Ohm unbalanced output, VSWR better than 1.5:1 recommended. PA will survive severe missmatch.
Power Supply: Nominal 13.8V DC supply capable of 3A is recommended.

TOOLS REQUIRED:

Soldering iron about 30W, small side cutters, long nosed pliers, trimming tools for L1, CV1, CV2 and VR1. A sharp knife for scraping the coil insulation. A reasonable multimeter will be useful for checking the coil windings and the current consumption. You will also need a power/SWR meter and 50 Ohm load for testing the unit.

BUILDING THE KIT

Start by winding the coils, this way you will be able to sit down and assemble the PCB at one go. Refer to the coil winding details on the Parts List 2 sheet. Make sure you do the winding in a quiet spot (turn the sets off f you are in the shack), it is almost impossible to count how many turns you have wound if something distracts you half way through! When you have wound the coils, it is a good idea to coat them with a little clear varnish to hold the windings in place. While this is drying, read the rest of this paperwork through and check that you have all the right parts and tools (the mica washer is in the bag with the wire - look carefully - it's hard to see). It is recomended that you fit the parts in the order they appear in the parts list. The part number given in the parts list corresponds to a part number printed on the circuit board, so assembly is very easy. The crystal can be put in whichever "xtal" position you prefere. Make sure you put the electrolytic capacitors in the right way round. Keep all component leads as short as possible.



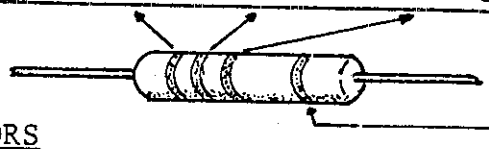
The enamelled coil winding wire is the "self-fluxing" type, but it helps if you scrape off as much as possible before soldering. When the coils are soldered to the tracks, use a multimeter to check that there is a very low sistance between the tracks at the ends of the coil, this will make sure that there is no dry joint on the coil leads. These are the most likely places for soldering problems.

When you have finished assembly of the board, check all the parts are in the right places, the electrolytics are the right way round, and that the soldering looks bright and good. We find that nearly all problems that occur with our kits are due to poor solder joints, or "bridges" across tracks. Component failures are very rare with the quality of parts we supply.

When you are sure all is well, connect up a power meter or SWR bridge and a 50 Ohm dummy load of at least 15W rating. Link the crystal to terminal "B" on the board, and a morse key to the "K" and "E" terminals. Connect the module to a suitable power supply - the right way round please! Negative earth. Set VR1 to half way. Now press the key, and observing your SWR/power meter, adjust L1 for maximum output power. Next adjust CV1 and CV2 for roughly maximum output, then set VR1 for approximately the power level you wish to use, and retune CV1 and CV2 for maximum (these are not very critical in their settings). You can now set VR1 for exactly the desired power level. Do not h ld the key down for more than a few seconds each time you adjust something - otherwise heating effects may affect the settings slightly.

RESISTORS - all .25 Watt

Value	Description			Part Numbers
10R	Brown	Black	Black	R7 R14
27R	Red	Violet	Black	R15
47R	Yellow	Violet	Black	R9
150R	Brown	Green	Brown	R8 R18
270R	Red	Violet	Brown	R11 R12
100R	Brown	Black	Brown	R16
470R	Yellow	Violet	Brown	R10 R19 R20
1k0	Brown	Black	Red	R3 R5 R17
2k2	Red	Red	Red	R4
2k7	Red	Violet	Red	R6
10k	Brown	Black	Orange	R13
47k	Yellow	Violet	Orange	R1 R2



CAPACITORS

Value	Description	Part Numbers
22pF	Disc marked 22	C1
47pF	Disc marked 47	C2 C3
.01uF	Disc marked 103	C4 C5 C8 C9 C10 C14
.1uF	Green marked 104K	C7 C13
22uF	Marked 22uF 25V - see note	C11
100uF	Marked 100uF 25V - see note	C12
.1uF	Disc marked 104	C6 C15
180pF	Silver marked 180	C16 C19
330pF	Silver marked 330	C17
560pF	Silver marked 560	C18

NOTE - C11 and C12 are electrolytic capacitors, and must be fitted the correct way round. The longer lead goes to the hole marked "+", the other lead is indicated by minus signs on the side of the component and goes to the hole marked "-" on the PCB.

Trimmer Capacitors

CV1 and CV2 are 65pF trimmers.

Crystal (marked "xtal" on PCB)

VR1 is a 100k pre-set resistor.

Diode D1 - ~~BZY88.~~ BZX55C This has its type number marked on it (small!) - make sure you fit this the right way round. The lead indicated by the band goes to the hole marked "+"

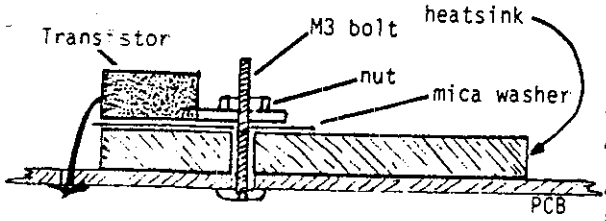
diode

TR1 and TR2 are BSX20 devices and have their type number marked on them.

TR3 and TR4 are 2N1711 and are marked as such.

t the clip-on heatsink to TR4

TR5 is a 2SC2098 or MRF475



Cut-away side view.

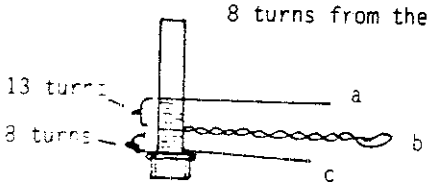
Fit this to the board on top of the large heatsink as shown in the diagram. The mica washer is used to insulate the transistor from the heatsink. You can use a thin smear of thermal paste to help heat conductivity if you have some, but this is not essential.
TR5 is rated at a maximum power of 13W output and should withstand severe missmatch without any problem at 13.8V DC.

INDUCTORS

These are quite simple to wind, but do make sure that you make a neat job and use the exact number of turns stated for each coil. The two hole balun cores are wound with the plastic insulated wire. L4 and L7 are wound with the thicker enamelled wire, the remainder are wound with the thin enamelled wire.

L1 This is the most trouble to wind, a method of holding the wire in place as you go is needed. You can glue or tape the first turn at the bottom of the former to hold it in place, or you can make a small jig as shown in the diagram. This is the best solution. The windings can then be held in place with a coat of clear varnish. L1 needs about 22" (560mm) of the thin enamelled wire, if you are using the jig as shown.

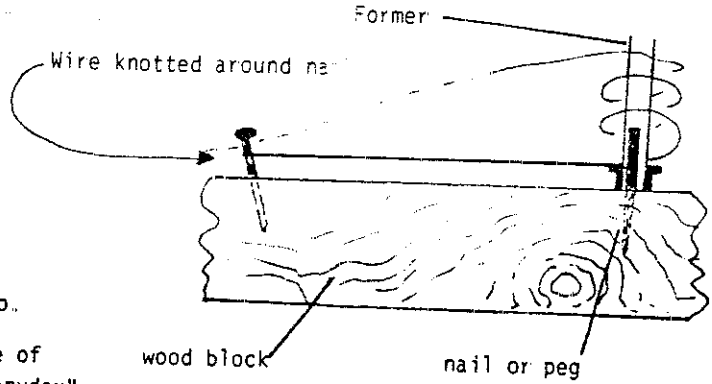
There are 21 turns in all for L1. The tap is 8 turns from the bottom of the coil.



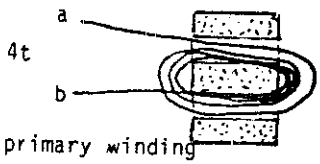
The letters indicate the leads that have to be fitted to the lettered holes on the PCB

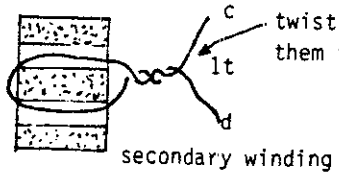
Twist the wires together for about 1" to form the tap.

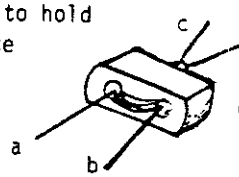
When the module has been aligned and tested, the core of L1 should be fixed in place with a drop of wax or "Copydex"



L2 and L3 These are both the same, and are wound on the two hole balun cores. The primary windings have four turns of the plastic insulated wire, and the secondary windings are one turn. The two windings are shown on separate diagrams for clarity - wind both on the same core!







completed transformer

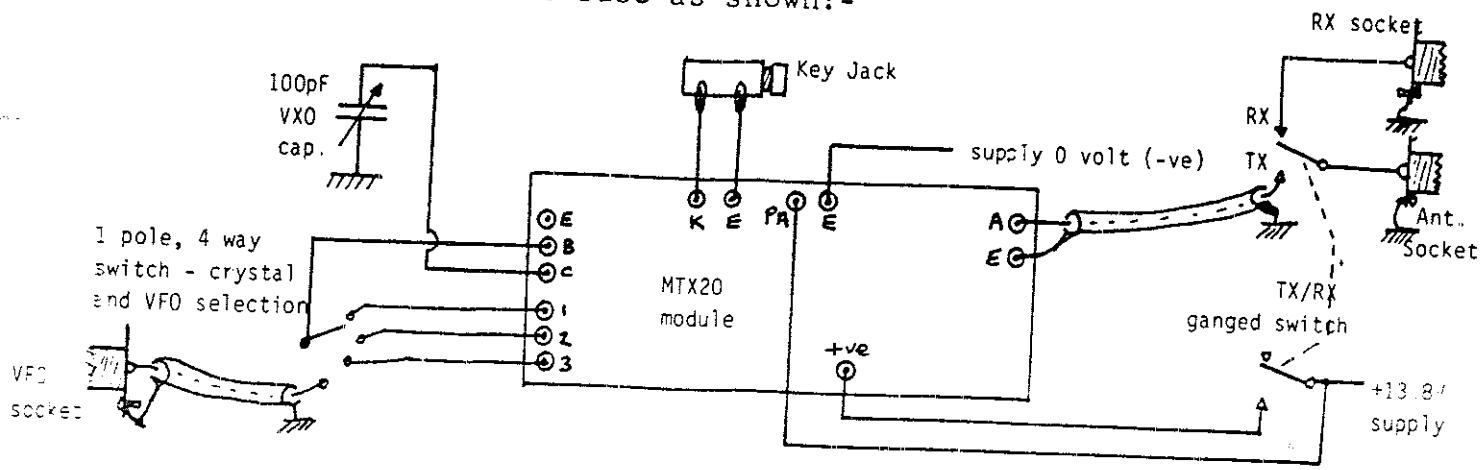
L4 This is wound on the black toroid core. There are 8 turns of the thicker enamelled wire. Be carefull not to scrape the insulation as you wind the coil. Use 7" (180mm) of wire. Varnish the coil when you have wound it.

L5 and L6

These are both the same. Wind 12 turns of the thin enamelled wire on two of the green and white toroid cores. Use 9" (230m) of wire and varnish the finished coils to keep the wires in place.

L7 This has 20 turns of the thicker enamelled wire wound on the remaining green/white toroid. Use 15" (380mm) of wire. The inductor does not need to be varnished, the wire is thick enough to stay in place without help.

Wire up the MTX20 in a metal case as shown:-



You could add a HOWES ST2 side-tone unit to monitor your transmitted morse, and an external VFO to enable you to tune a wider frequency range, if you wish. The use of a VXO tuning capacitor is not essential, but it is usefull to be able to tune the crystal over a few kHz. If you are going to use VXO, then C1 should be removed from the PCB. C1 is provided so that the crystal will operate on about it's marked frequency, when no VXO capacitor is connected. With C1 removed and a VXO tuning capacitor in use, the crystal will operate several kHz high of the nominal frequency at minimum pacitance, and tune down to a little below the nominal frequency at 100pF. If the capacitance is too great for the crystal, the oscillation will stop altogether. You could experiment with additional series inductance with the crystal to see how much you can extend the VXO range.

The heatsinking provided on the MTX20 is intended for normal CW use, they key should not be held down for extended periods at full power. When wiring the module into a case, it is very important to use screened cable for the output wiring, and keep all wiring to do with the crystals and VXO capacitor well away from the key, power and antenna wiring. Instability and "chirp" could occur if the input wiring picks up signals from the antenna or output circuits.

BRIEF CIRCUIT DESCRIPTION.

TR1 acts as a crystal oscillator, or a buffer amplifier if driven from an external VFO. L1 is tuned to resonate at the centre of the operating range. The signal is then coupled from L1 into TR2 where it is amplified if the key is closed. R7, R11 and C11 shaping the keying waveform to prevent clicks. The keyed signal is then fed to TR3 where it is amplified further, t' amount of gain being dependant on the bias fed to the stage via VR1. This preset resistor adjusts the gain, and hence output power level of the MTX20. The signal is amplified further by TR4, and then by the PA transistor, TR5. L7, CV1, CV2, C19 and C18 match the power into the low-pass filter network, L5, L6, C16 and C17. The matching network also helps to filter the desired signal, so the result is a very clean, well filtered output.

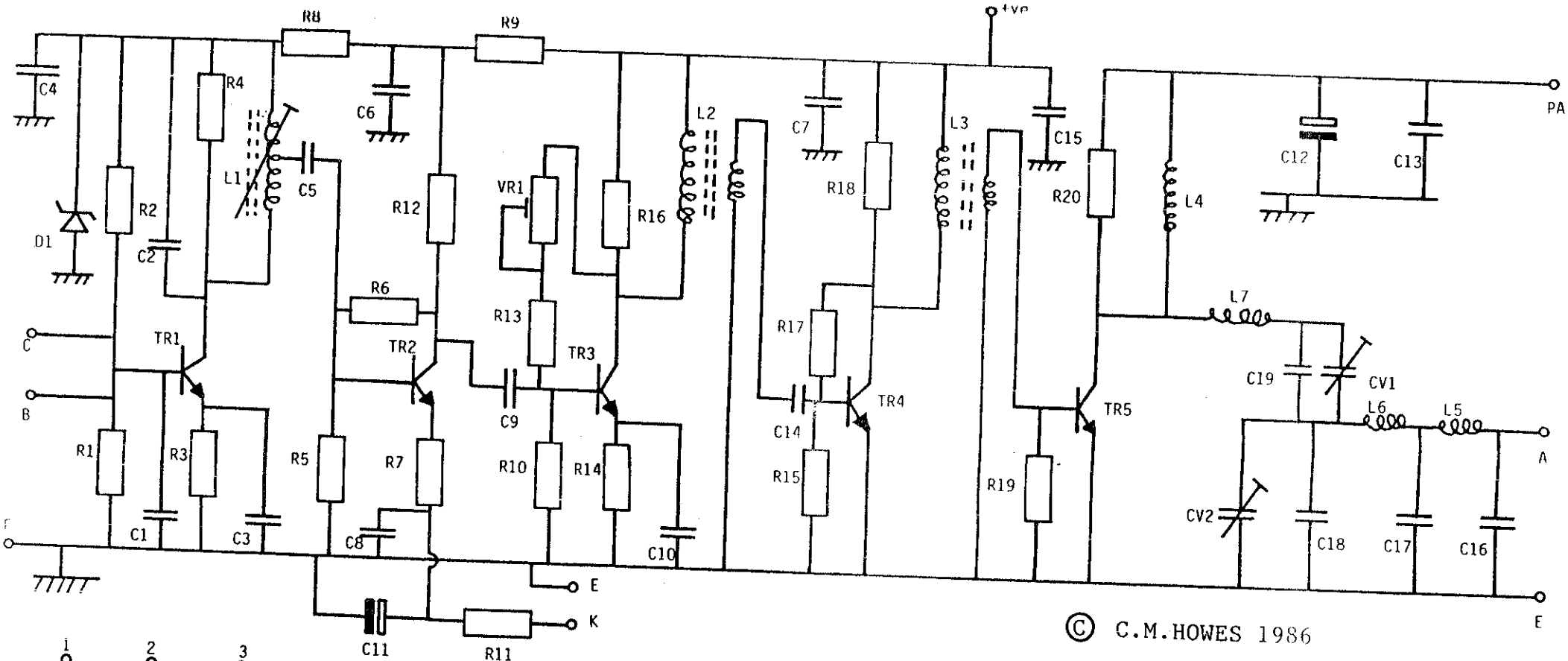
The key shaping circuit in TR2's emitter is designed for best results at 10W RF output. If you wish to use the MTX20 at much lower powers, then a change to these components is advised to give best wave shaping at these levels - the key down to key up transition becomes "harder" as the power level is reduced. An increase in the value of R7 will soften this edge, try a 47 Ohm resistor in place of the 10 Ohm one. This will also enable you to reduce the power further if you wish.

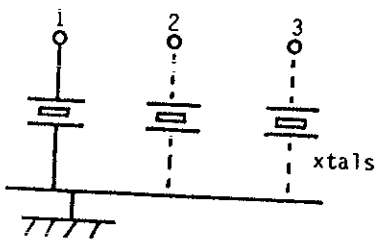
We hope that you will be pleased with your HOWES MTX20, and that it gives you many enjoyable QSOs. 73 es gd DX de G4KQH!

C.M.HOWES COMMUNICATIONS

MTX20 CIRCUIT DIAGRAM

Issue 1





Connection	Use
A	Antenna connection 50 Ohms
B	Input for VXO or crystal
C	Connection for VXO cap. max. 100pF
E	Earth connections and supply -ve
K	Key +ve terminal.
PA	+13.8V DC for PA transistor
+ve	+13.8V DC for driver stages.