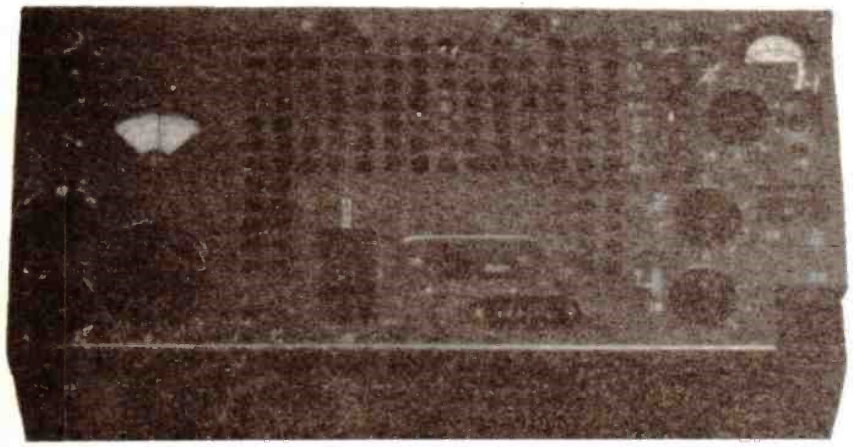
CONVERSION: MARK 123



Ross Bradshaw G4DTD converted his Mark 1-2-3 for fun, but gets some work out of it too.

The Mark 123 was introduced in late 1958. It followed on from the earlier B2, being intended for special forces. The 123 is obsolete, and many are now available as surplus.

The 123 is a portable transmitter/receiver *not a transceiver* able to operate in the range 2.5 to 20MHz in three bands (2.5 to 5MHz, 5 to 10MHz and 10 to 20MHz). It will therefore cover the 3.5, 7, 10, 14 and 18MHz amateur bands. The transmitter is CW only, with a maximum output power of 25W. The receiver will receive AM, CW and SSB, though the latter requires careful tuning.

The Power Supply Unit

The case of the 123 has the transmitter at one side, the receiver at the other, with the power supply in between them. It will run on supplies in the range 100 to 150V and 200 to 250V, and there is a thumb wheel switch to set the voltage in ten volt steps over these ranges.

Two optional extras are available: an inverter to be used with a 12V battery, and a hand cranked generator. In addition, a re-former is provided, to re-form the electrolytics if the set is left unused for several months.

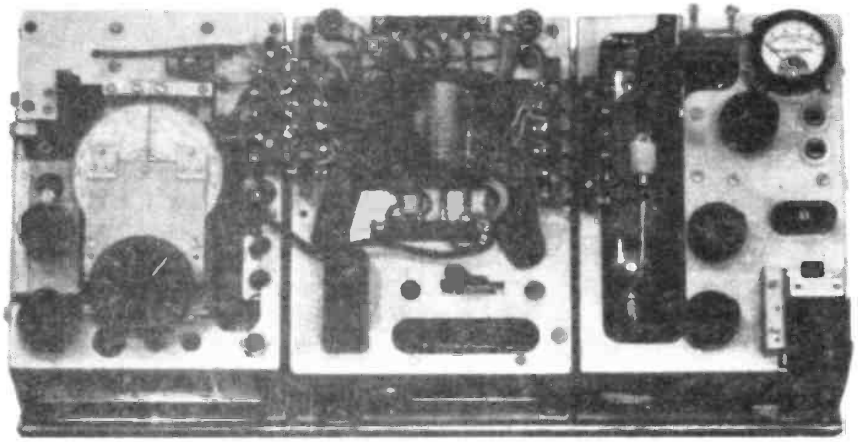
The circuit of the power unit, with the switch in the transmit position, is shown in **Fig. 1**. The configuration of the HT section on transmit is shown in **Fig. 2**, and that on receive in **Fig. 3**. The basic voltage doubler configuration is the same in both cases, but on receive a lower transformer tapping is used. Several other differences are also apparent. In the transmit configuration, the key-up current of the transmitter flows through R3 and R4, providing approximately −125V to the grid of the pa valve and slightly less to the grid of the oscillator. This keeps the valves cut off until the key is pressed. The key, shown in **Fig. 5** (the transmitter circuit) effectively shorts R4, removing the negative voltage on the oscillator grid and reducing that on the pa grid to about −35V. This allows the unit to transmit.

On receive the main output is further decoupled by R1 and C1, while a separate output is provided for the receive oscillator, via R2. This voltage is regulated by V8, shown in the receiver circuit diagram **Fig. 4**. The extra voltage drop in the main receiver ht supply, caused by the current flowing in R1, drops the 180V on the main smoothing capacitors to approximately 155V.

The Receiver

The receiver is a single superheterodyne. Once the Rx/Tx change over switch is put to receive, not only is the HT taken off the transmitter and onto the receiver as described in the PSU section, but the aerial is also switched over. Signals are fed via the aerial into one of three tuned circuits, depending on which band is being used. The output of the relevant tuned circuit is fed into the RF amplifier V1, which is an EF72. The amplified signal is passed from the anode of V1 to one of three tuned anode circuits, again depending on the band. The output of V1 that is fed into one of the primaries enters that circuit along with the local oscillator signal from V5, which is also an EF72.

The local oscillator is of the tuned grid type. Its screen voltage is stabilised by a neon valve, V8, a QS1202. Both the output of V1 and the signal from V5 pass via the tuned anode circuit of V1 into the mixer valve V2 and EF73. After mixing, the IF of



The Mk.123 with its case removed, showing the separate transmitter, PSU and receiver.

465kHz is applied to an IF transformer, the output of which is then fed to the IF amplifier valve V3, an EF72. The output of the IF amplifier is fed via a second IF transformer to the detector valve V7, an EA76.

At the anode of the detector valve, the signal from the BFO EF73 valve V6, an electron-coupled Colpitts oscillator, mixes with the detected signal from V7 to make the CW signal readable. If the BFO is not switched on, AM signals may be received. The required output, be it CW or AM is now passed to the audio amplifier V4, an EF73. The output of V4 is fed to high impedance earphones. The earphone socket has two diodes back to back across, to act as limiters. It is to this point that the output from the sidetone oscillator is fed when the Mark 123 is in transmit mode.

The scale used to read off the received frequency can be used on 3.5MHz, but on other amateur bands it is too cramped to be of much use unless you are listening to a very strong signal. It would therefore be worth considering either broadbanding the receiver and accepting a loss in sensitivity or only using the PSU and transmit parts as the basis of a good crystal controlled 25 watt CW tansmitter, in which case you could choose a modern broadcast Rx in place of the 123's receiver. The 123 can still be used for broadcast listening. However, bear in mind that the original users of the 123 would have been listening for a kilowatt signal, unlike the amateur who is listening for signals of 100 watts or less.

The Transmitter

The transmitter consists of two valves, V1 (5A/163K), a Colpitts oscillator/doubler and V2 (5B/254M) the power amp valve.

In its key-up state, 470 volts is fed to the top cap of V2 via RFC 3. This 470 volts is then dropped by the chain R10 and R16 to apply voltage to the screen of V2, and also by R7 to be sent to the anode of V1 via RFC 3. The voltage applied to the anode of V1 is also dropped by R4 and applied to the screen of V1. Negative bias is applied to the control grids of both V1 and V2, keeping them in a cut-off condition.

When the key is pressed, the negative bias fed to the grid of V1 is

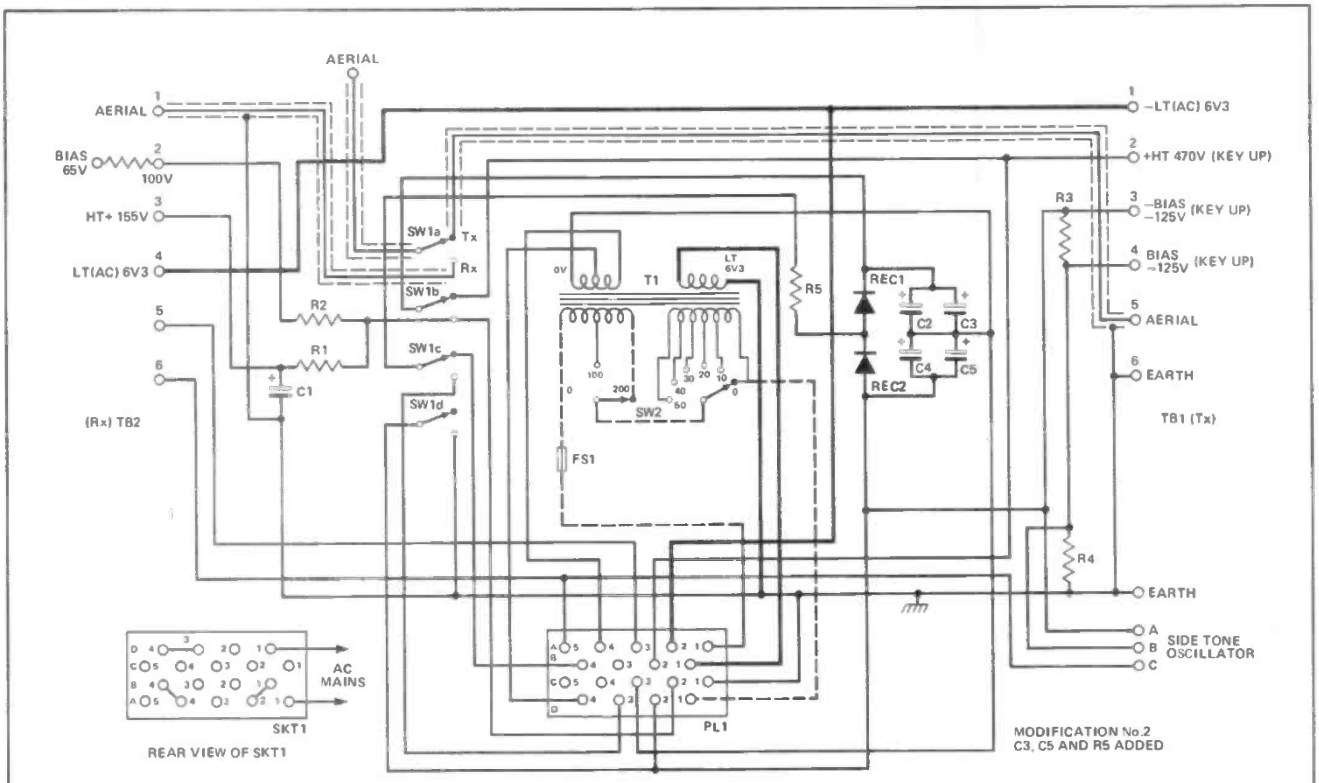


Fig.1. The circuit of the Mk.123 power supply.

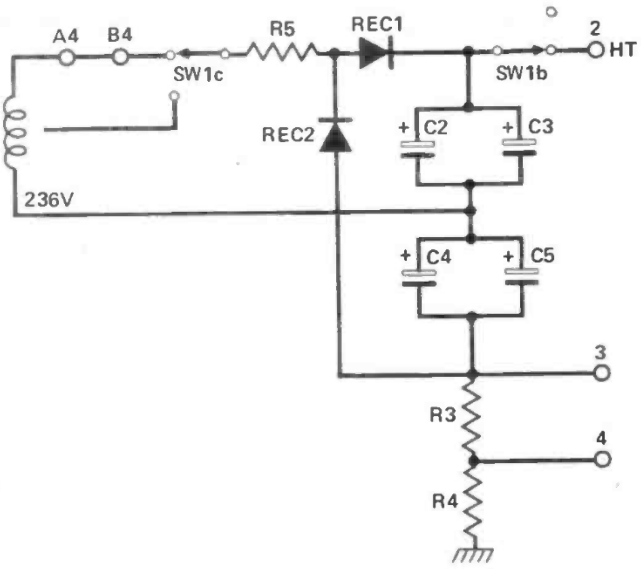


Fig.2. The power supply on transmit (simplified).

shorted, allowing it to oscillate. The key also reduces the negative bias to the control grid of V2. The signal from V1 is applied to the control grid of V2 via C5.

There are three switched tuned circuits connected to the anode of V1. L1 and C9 are for the 2.5 to 5MHz range, L2 and C9 for the 5 to 10MHz range and L3 and C9 are for the 10 to 20MHz range. By tuning the required circuit, one can select the fundamental crystal frequency or the second harmonic. In some cases one might be lucky and get a third harmonic, but it is not recommended in the manual.

This means that a crystal for 3505kHz can be used for 7010kHz as well as for 3505kHz.

The output of the pa valve is tuned by one of three circuits. This final tuning is in fact a built-in ATU, consisting of C13 and L5 for 2.5 to 5MHz, C13 and L6 for 5 to 10MHz and C13 and L7 for 10 to 20 MHz

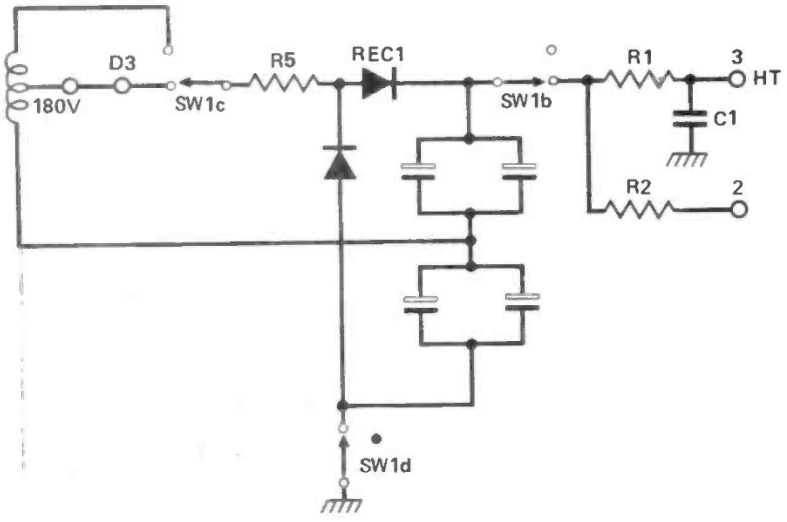


Fig.3. The power supply on receive (simplified).

band. To assist in tuning the output of the oscillator valve, a small neon bulb, LP1, is provided. Tune for the brightest glow, using the drive control C9. To assist in tuning the aerial tuning unit a small amount of RF is tapped off and rectified by the circuit C14, C15, rect 1, rect 2, R11, R12, C16, R13/R15 and fed to the small built-in meter, where one tunes for the highest reading. In the control grid circuit of V1, the components C1, R2, C18 are the key click filter.

Transmitting

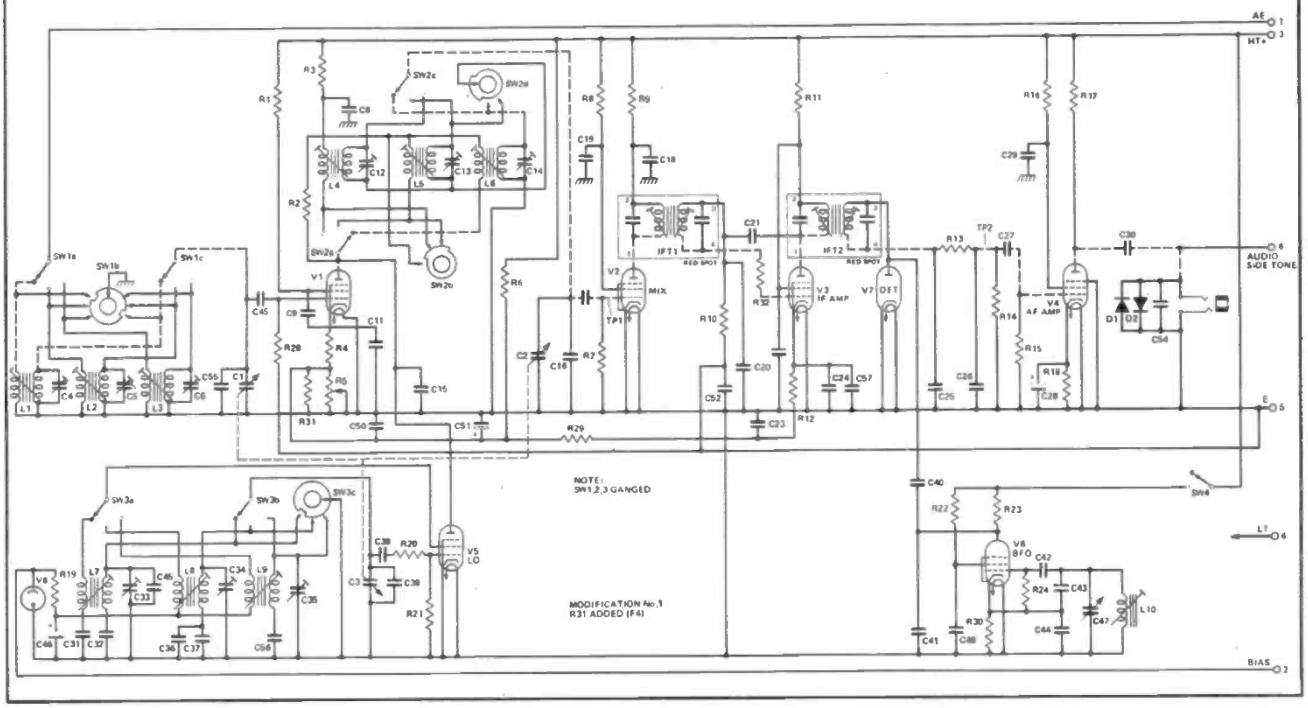
To transmit, connect an earth lead to the 123 and take it to earth. Connect an aerial, which can be a long wire as supplied, or you can do as I often do, and use coax with the braid to the earth socket of the 123, the inner to the aerial socket and the other end to a PL259 plug.

Using coax, I would plug the 123 into my KW107 Supermatch and switch to dummy load, tune into the dummy load and then switch to my aerial (in my case an indoor trap dipole). I would then use the KW107 as my ATU and tune into the dipole, using the ATU controls and built-in SWR meter. If you are not sure what to do, stick to a long wire.

Let's assume you are using a long wire. Connect up the proper voltage supply and switch on, allowing five minutes to warm up. Take a crystal, an A, C or FT, or any crystal that will stand up to 60 milliamps. Assume in our case it is a 3.5MHz crystal: plug it in and set the changeover switch to transmit. Set the band switch to the 2.5 to 5MHz position. Press the key — either an external one or the built-in one. Tune the crystal tuning control for maximum neon brightness. If you get two tuning points, take the lowest dial reading of the adjusting control as the correct one. Release the key. Set the aerial matching control to position one. Press the key and adjust the aerial tune control for the highest reading in the meter. Release the key. Try tuning the aerial tune control again with the aerial selector switch in position number two (if necessary three or four) for the best reading. You are now tuned to 3.5MHz.

To transmit on 7MHz, tune as before, but change the band switch to the 5 to 10MHz range. If you get two tuning points on the neon, take the highest reading as correct in this instance.

Fig.4. The circuit of the receiver module.



Receiving

Assume that you are still connected up for transmit, but switch the changeover switch to receive. Select the band you wish to listen to. If you select AM switch off the BFO. If you select for CW, switch the BFO on and rotate the control to the centre position. Ensure the phones are plugged in and adjust the gain for a suitable level. Use the tuning control to tune to a desired station. Adjust the BFO as (or if) necessary.

Conclusion

Although it is a 'fun' rig, the 123 cannot be used seriously in its original state. However, the transmit side will make a good 25 watt transmitter. I bought mine three years ago. It's still in use.

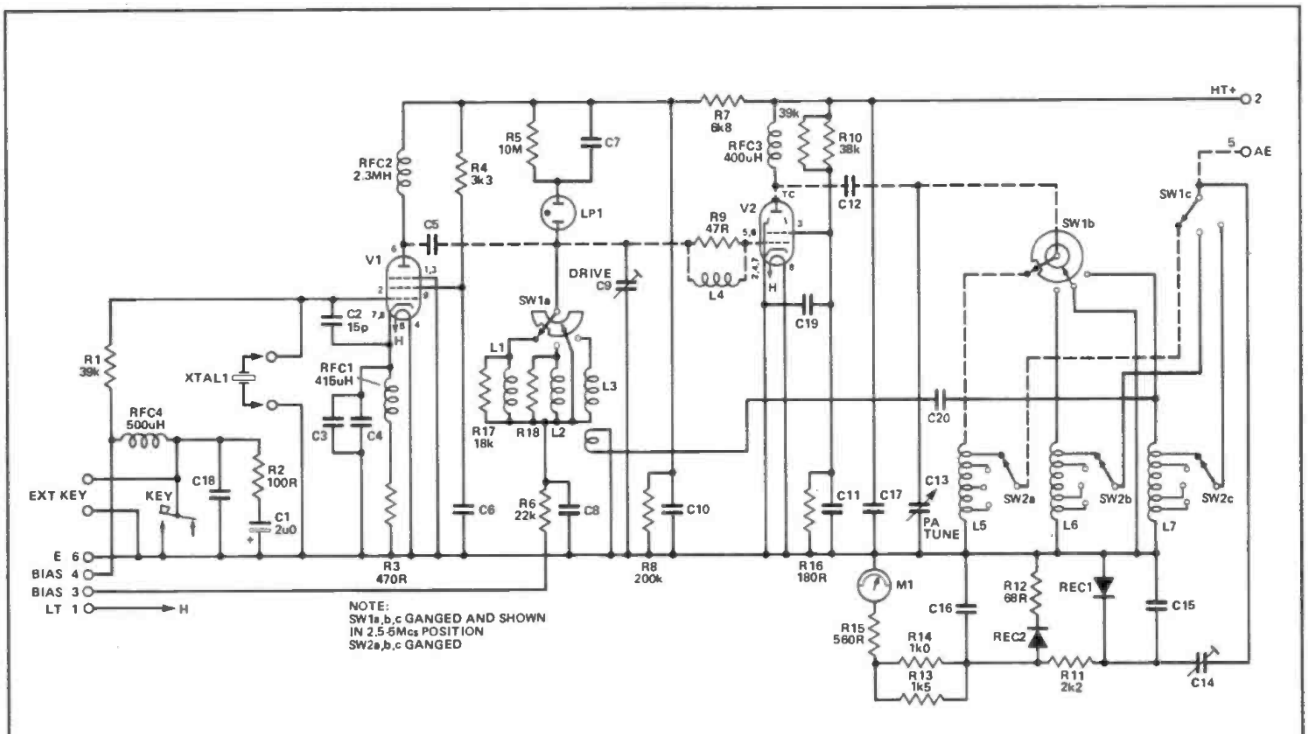


Fig.5. The circuit of the transmitter module.