THE PYE M2000 RADIOPHONE CONVERSION FOR THE 2m BAND

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The M2000 is a 25W, fifty-five channel (25kHz spacing), VHF radio telephone which operates at around 165MHz. The onboard microcomputer controls the frequency selection and all the Tx/Rx switching in the phone system.

Conversion

This 2m band conversion involves removing the PCB with the micro and the PCB housing the tone circuitry, and provides a means of manual channel selection. You will need a small 12W soldering iron to carry out the work inside the black box, but this only requires a basic knowledge of soldering skills.

The basic layout of the M2000 in **Fig 1** shows the PCB edge connector, the micro PCB and the tone PCB. After removing the retaining screws, these PCBs can be removed and discarded.

Two new xtals need to be fitted to tune the synthesisor oscillator and mixer on to the right frequency and to give Tx/Rx on the same channel. One xtal is a standard 10.7MHz and should present no problem, but the other will depend upon the coverage required (I used a 40.650MHz xtal to give a coverage of 144.400-145.975MHz. This xtal will need to be ordered). **Fig 2** shows both xtals and their positions. The formula for the 40MHz xtal is given as:

(fRX +18.2)/4

The manual channel-change is in the form of a binary bit pattern and replaces the digital signal coming out of the micro PCB. Six bits are required to obtain full coverage on 2m. Fortunately, there are six spare lines in the control box cable once the control box is modified. There are a few component changes required in the radio, mainly replacing several capacitors to lower the oscillators. No additional caps are needed on the Tx or Rx tuned circuits. **Fig 3** shows which capacitors require alteration.

If you are unlucky enough not to have the back-plate housing the voltage regulators and connectors but, simply, the black box ending in the two D way connectors, then a bit of work will be required. **Fig 4** shows what is on the back-plate, but all you basically need to provide is the 5V regulated supply and a few connectors with which to hang the aerial, LS and power input, etc.

In service, the handset came in through the back-plate, but this can be fed down the control box cable with a bit of rewiring, and the LS can still be taken from the back.

After fitting both xtals and replacing the three capacitors, you can start on the control box. Remove the front-plate and discard the contents of the box. Then cut a piece of copper-clad board to size, fit it in place of the front panel and secure the board with four bolts.

The actual configuration of the control box is up to the individual, but the best

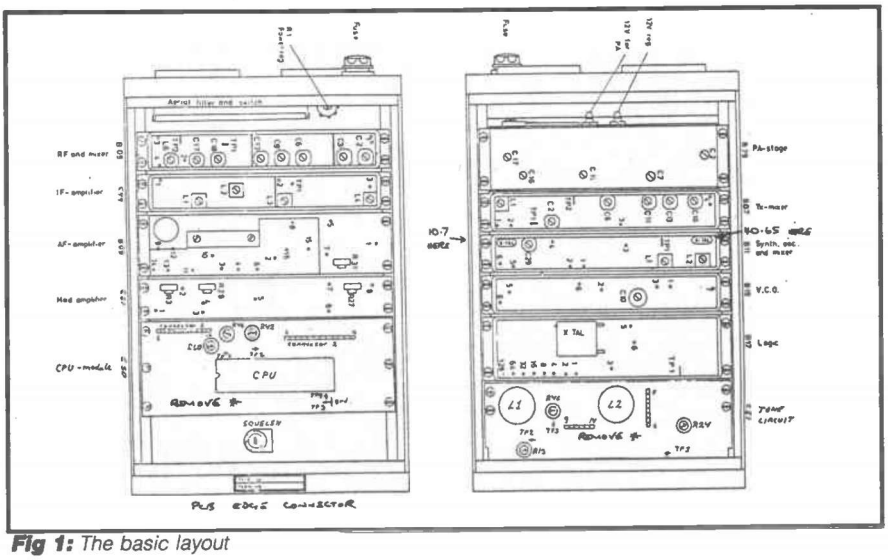
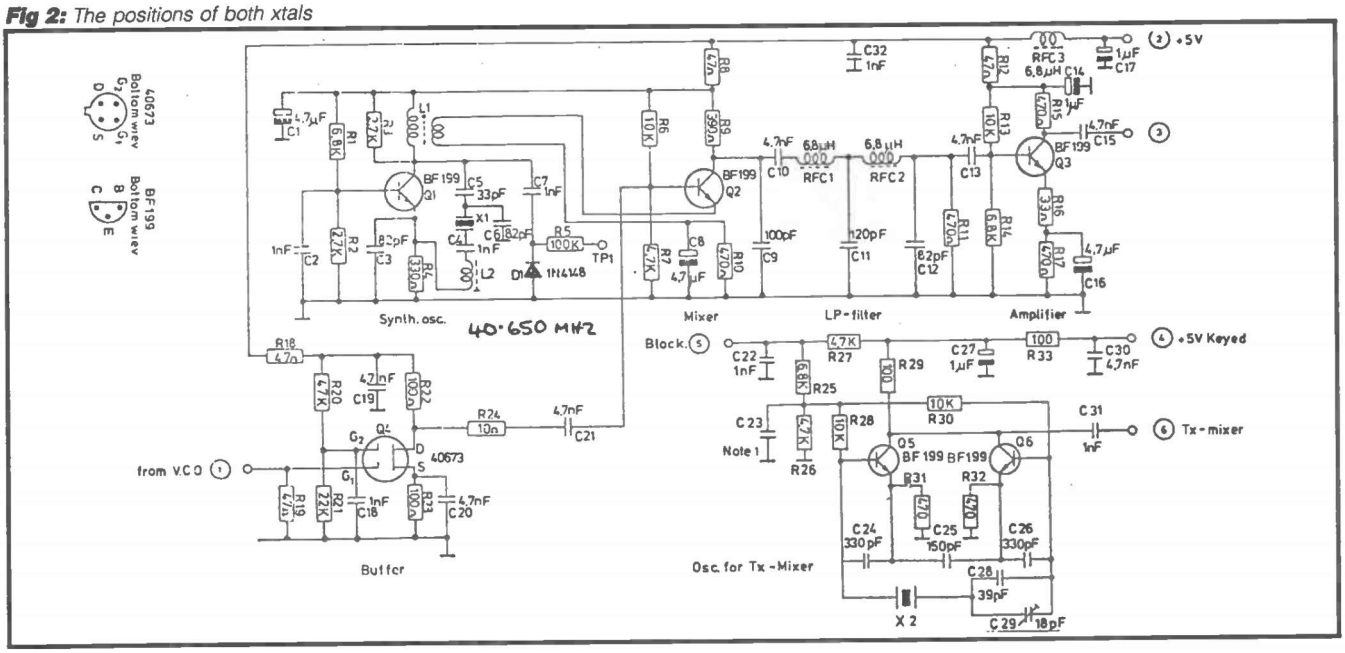


Fig 1: *The basic layout*

Fig 2: *The positions of both xtals*



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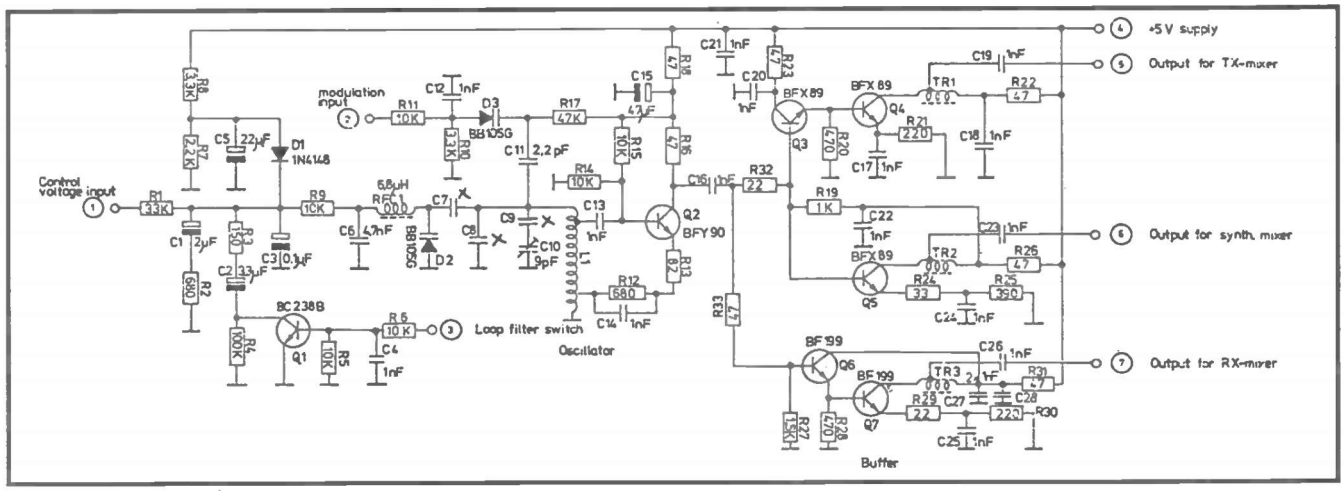


Fig 3: *Schematic diagram showing which capacitors measure alteration*

Bit	32	16	8	4	2	1
144.400	0	0	0	0	0	0
145.975	1	1	1	1	1	1

Table 1

	Bit	32	16	8	4	2	1
145.600 Rx RO		1	1	0	0	0	0
145.000 Tx RO		0	1	1	0	0	0

Table 2

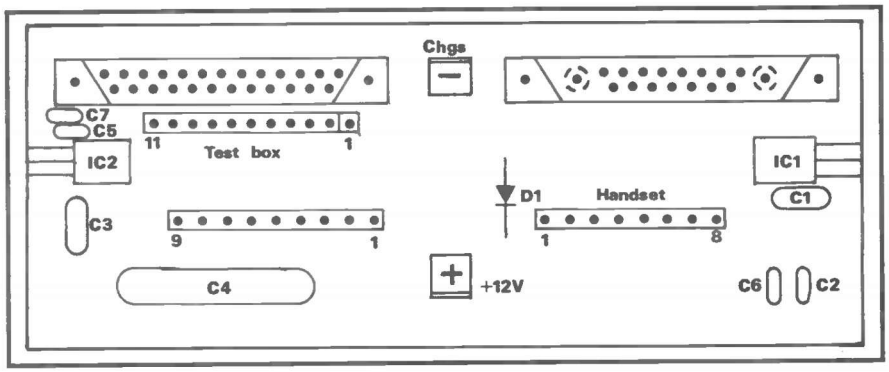


Fig 4: *Rear view of the back-plate*

solution is to keep it as simple as possible. The circuit of the original box is shown in **Fig 5**, and **Fig 6** shows an alternative. Fortunately, enough lines can be obtained to supply the six channel select lines: PTT, volume, squelch, on/off lamp, Tx lamp, mic and ground.

The digital code for selecting the frequency is shown in Table 1.

This code requires certain alterations when a repeater shift is needed. The example in Table 2 shows why.

Bits 32 and 8 need to be reversed on Tx by using a relay which only operates when a shift is needed. A complicated

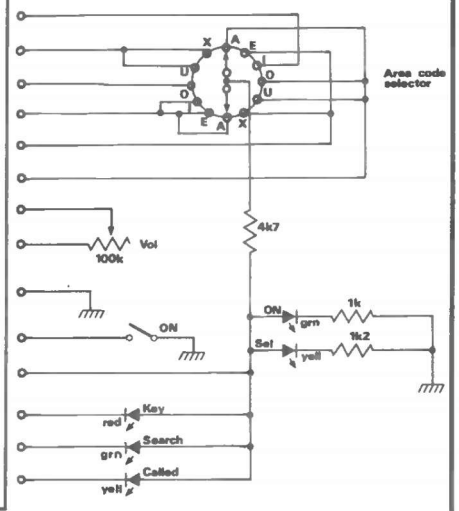
Fig 5: *Print connector plug for the mother board and circuit of the original box*

PRINT CONNECTOR PLUG FOR MOTHER BOARD C53A **FRONT SECTION NR 206-OV2F**

Function	Colour	No	No	Colour	Function
Ground	white/blue	A	1		
On/Off	grey	B	2		
Area code U-X	red/white	C	3		
Area code O	red/green	D	4		
Area code I	red/black	E	5		
Area code F-X	blue/white	F	6	N	
Area code A-O-U	blue/green	H	7	O	
Area code A-E-I	blue/black	J	8	T	
+5V supply	violet	K	9		
Volume	brown	L	10	U	
		M	11	S	
+12V for lamps	light green dark green	N	12	E	
		P	13	D	
Key lamp	pink	R	14		
		S	15		
Search lamp	red	T	16		
Called lamp	yellow	U	17		
Ground	black	V	18		

FACE UPWARDS FACE DOWNWARDS

Function	Colour
Area code I	red/black
Area code U-X	red/white
Area code O	red/green
Area code A-E-I	blue/black
Area code E-X	blue/white
Area code A-O-U	blue/green
+5V supply	violet
Volume	brown
Ground	white blue black
On/Off	grey
+12V for lamps	light green dark green
Key lamp	pink
Search lamp	red
Called lamp	yellow



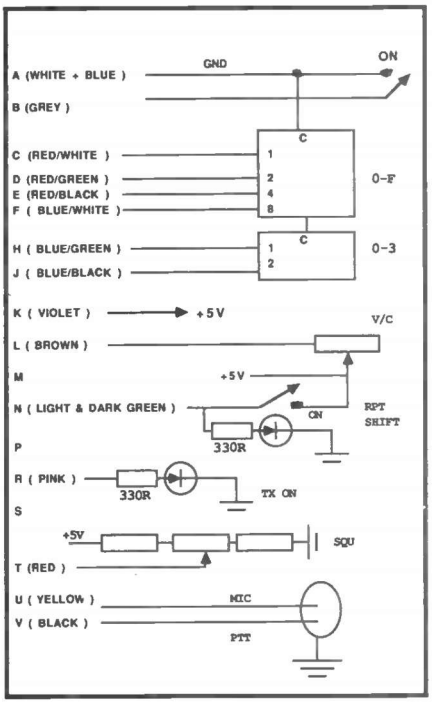


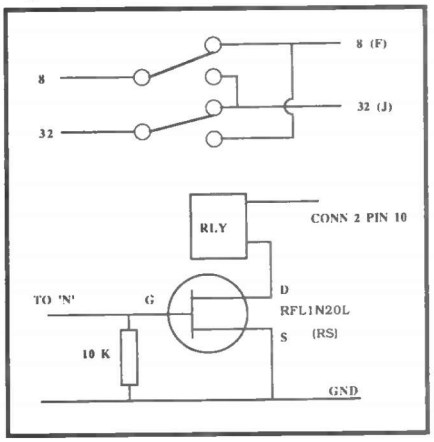
Fig 6: *Alternative circuit (see **Fig 5**)*

CCT could be used which automatically gives RPT shift when the code falls on an RPT channel, but the easier option of manual switching should be used (**Fig 7** shows the wiring). Originally, the relay was wired so that the switch on the control box supplied the volts and the other end of the relay was wired to the PTT line, but this upset the PTT switching too much, so an alternative CCT was devised.

One of the pins on connector 1 goes +12V on Tx. The switch in the control box now feeds 5V to the gate of a FET which has the relay coil in the drain; this gives no problems at all. Again, a complicated CCT could be devised to obtain a more realistic display of the actual frequency in use, but two hex thumb-wheel counters, each giving a 4 bit binary pattern, should be used; the code representing the channel soon becomes familiar with use (see Table 3).

In the main box the two transistors and their associated caps and resistors are

Fig 7: *Repeater shift CCT*



Channel	Code
145.500	2C
145.525	2D
145.600	30
145.700	34
ETC	

Table 3

located near the front of the box on the micro side; these being the driver CCT for the searching and called lamps in the old control box. Connections 'U' and 'T' on the edge strip (see **Fig 8**) can now be removed; this gives a few copper pads to hang other wires on. The end pin on the edge connector goes to ground. This track is cut because pin 5 is used for the PTT line.

The multipin plug that used to feed the code signals to the tone PCB can now be used to get the 6 bit channel select across to the synthesisor (see **Fig 8**) by using the old connector 2 on the micro PCB. On the PCB C61 (mod amp), remove the capacitor connected to pin 5 and link a wire from pin 5 to pin 1; this gets the new mic connection from the edge strip.

Tuning

Having changed the xtals, inserted the new capacitors and completed the new control box, the final task is to tune the set for use on the 2m band.

Synthesisor: Connect high res dc VM to TP1 on B11. Tune L1 for approx 3V. Coil L2 is for frequency adjustment.

PLL: Dc VM to TP1 on B17. Oscilloscope (1V/DIV) to TP1 on B17. Adjust the VCO trimmer for 'lock'. Lock is a stable 25kHz which 'ripples' as the dc volts increase while adjusting the trimmer (adjust for 3V). Set channel select to the highest and lowest setting and ensure that the lock remains.

Rx mix: Dc VM to TP2 on B08. Tune C17 and C18 for maximum. Connect the signal generator to the aerial socket. Dc VM to pin 4 on C49. Tune the following trimmers and coils on B08: C2, C3, C6, C9, C10 and L6. Tune L1 on C49 to maximum. Decrease the signal generator output to help get the CCTS right on peak. If a signal generator is not available, then use a local repeater. Finally, fine-tune L6 (B08) and L1 (C49).

Tx mix and amp (B07): Dc VM to TP1 (B07) and tune L1 for maximum. Set caps C2, 6, 11, 13 and 18 to maximum. Dc VM to can of transistor 2 (the middle one) and tune C2 and C6 for maximum. Use an RF probe on the output coax link, tune C11, C13 and C18 and readjust C2 and C6 for maximum output (150mW).

Tx PA: Turn pot R1 (B57) counter-clockwise. Use an SWR bridge into a dummy load on the aerial socket. Tune all PA trimmers to maximum output, with a final tweek on C18 (B07). Adjust the pot R1 to set the output power level.

Frequency: If the xtal is set correctly, the set should be on the 25kHz step channels. Frequency adjustment for the Rx is via coil L2 on B11. Set the Tx frequency using C29 on B11.

The set will now receive and transmit on 2m. The 25W Tx/Rx has a quoted sensitivity of 0.4mV for 20dB sinad, and the RF and mixer transistors can be replaced with more active devices later.

Fig 8: *Directing the 6 bit channel select across to the synthesisor*