Modifying The Cobra 148GTLDX

Do you have a pet Cobra in the cupboard? Well Albert Jolly, GM4JML has devised some modifications that could make it a lot more useful by putting it onto the 28MHz amateur band.

Since this transceiver is a three band multimode including CW, it is worthwhile doing a bit of work to put it onto 10m. This article describes two conversions — a simple and a more complicated one depending on how much of the band you want to cover. The simpler method will cover 1.35MHz of the band (and surrounding area!) allowing you to chose which section you prefer to operate in. The more difficult conversion involves building a diode matrix to give you an extra 80 channels and coverage of the top part of the CB band.

Firstly though the binary count must be altered which ever modification you chose to do. This can be done while you wait for a crystal for one of the other mods. Before doing anything, we need to find out the binary count that needs to be applied to pins 9 to 17 of IC5, the MC145106, to obtain a specific frequency on 10m. To calculate this, we take 29.595 (the operating frequency) minus the IF of 10.695MHz to give a variable crystal oscillator frequency (VCO) of 18.900MHz. From this, subtracting the reference oscillator frequency of 15.000MHz gives the downmix of 3.900MHz. Since our downmix is to be divided into 10kHz steps, our binary count is therefore 390.

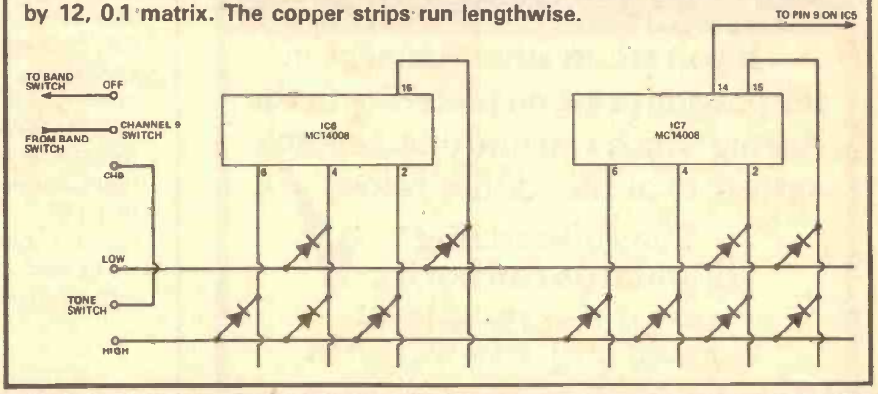
At present the binary count on the rig goes from 82 on channel 1 on the low band to 216 on channel 40 on the high band. The binary count will, therefore, need to be increased. This is attained by "holding up" pin 9 of IC5 and increasing the binary count by 256 which will result in the required binary count of 390 being found in channel 7 of mid band. The holding up of pin 9 is done by removing the link between pin 9 of IC5 and ground. Connect a 10k resistor from pin 9 to pin 16 of IC7 (MC14008) as this is a suitable 8.4V supply. Now switch the rig to channel 7 mid band and set up a receiver on 29.600 MHz. Turn the clarifier control of the Cobra fully clockwise and whilst transmitting into a dummy load and listening on the nearby receiver, retune L18 (the VCO coil) to 18.900MHz where it will lock on frequency.

There are some frequencies missed out on these rigs. These are channels 3 and 4, 7 and 8, 11 and 12, 15 and 16, 19 and 20 and channel 23 is out of sequence. The frequency count goes 22, 24, 25, 23, 26, the rest being in sequence. We can obtain the missing channels on the FM band by moving up one channel in frequency and turning the clarifier fully anti-clockwise.

The Simple Conversion

This is just as easy as the binary count alteration but requires a crystal of 16.845MHz which enables channel 1 of low band to become 28.360MHz and channel 40 of the high band 29.700MHz. Obviously, we cannot use channel 40 as this would put us outside the amateur band but it makes it easier to count the frequencies, ie channel 39=690,

Fig. 1 The diode matrix circuit made on veroboard of dimensions 10 holes by 12, 0.1 matrix. The copper strips run lengthwise.



channel 38=680 etc. If you would rather have the extra 10kHz at the bottom end of the band, use a 16.835MHz crystal. If you prefer the CW section of the band this can be obtained by fitting a 16.490MHz crystal and making full use of the clarifier giving coverage from 28.000MHz to 29.350MHz. Again retune L18 until lock is obtained at both ends of the band.

The Second Method

This is a little more complicated since it involves adding a further 80 channels and changing the crystal to 15.945MHz. However, this will give us coverage from 27.460 to 29.700MHz — although we won't be using it below 27.60125MHz!

The first step is to build a diode matrix shown in **Fig. 1** and **2**. The diodes used were 1N4148's, although almost any small diode will do. The veroboard size is 10 holes by 12, 0.1 matrix, with the copper strips running lengthwise. Mount the diodes vertically with the anodes to the board. There is no need to cut any of the tracks.

Before wiring the new board into circuit, we must first make an alteration to the main printed circuit board. As can be seen from Fig. 1, on the new "high" band we need pin 15 of IC6 (MC14008) and pin 15 of IC7 to be at different logic levels. On the main PCB, these two pins are linked by a printed circuit track. Cut this track and locate and remove the wire link from pin 15 of IC6. This wire is partially underneath the IC, but can be removed from the printed circuit side with a bit of care. We now solder DC blocking diodes between the hole left by the wire link and each pin 15, as in **Fig. 3**. Fit an insulated wire link from the unused pin 14 of IC7 to pin 9 of IC5, which was the subject of our attention when altering the binary count.

Solder six inch (15 cm) lengths of thin insulated wire to each of the ten connections of the vero board, preferably using a different colour for each. Fit the board using double sided tape to the metal side, just behind the channel change switch, place it vertically to clear the hole for the rig's mounting bracket. Now push/pull the wires under the channel change switch and attach to the main board.

The wires to pin 15 on IC6 and IC7 should be soldered directly to

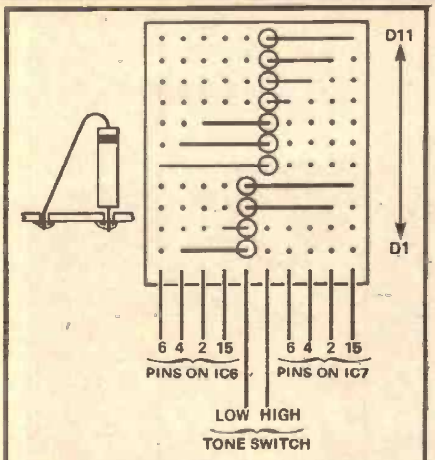


Fig. 2 View of the diodes from above, the anodes are to the board.

the pins. For the rest. we look for the track nearest to the front of the rig which leads to the required pin of the IC. The two remaining wires go to the unused side of the tone switch, on to either end, with the centre tag of the switch connected to the channel 9 position on the unused side of the channel 9 switch. The original wires on the switch can either be soldered together for low tone, or solder the grey wire to the unused tag for high tone.

On the channel 9 switch we must remove and insulate the yellow wire, and solder together the white and pink wires to maintain normal operation.

We now move to the band change switch. There is a yellow wire link across the top with one end soldered to tag 4, the one on the left looking from the rear of the set. Detach this and solder a wire to this end. Take the other end of the wire to the centre tag on the unused side

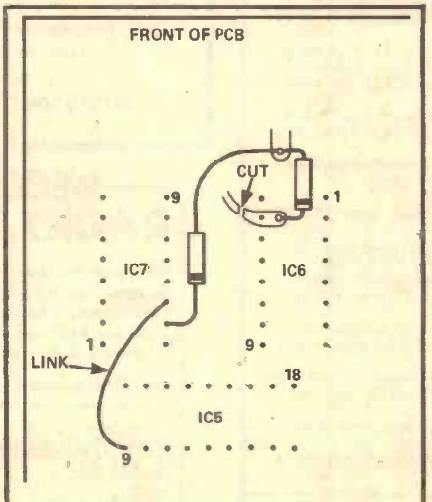


Fig. 3 The layout of the ICs from the solder side of the main PCB.

of the channel 9 switch. Connect a wire between the OFF position of this switch and tag 4 on the band change switch.

If you prefer not to have the CB band included, then the only modification that has to be done to the main PCB is the link from pin 14 of IC7 to pin 9 of IC5. This is no need for the blocking diodes etc. We would only need D1 to D3 on the matrix board and, instead of using the tone switch, we would take the "low" wire from the matrix board straight to the unused channel 9 position on the channel 9 switch, the rest of the wiring being as described. We now need a crystal of 16.395MHz, which will give us coverage from 27.910MHz to 29.700MHz, returning L18 as before.

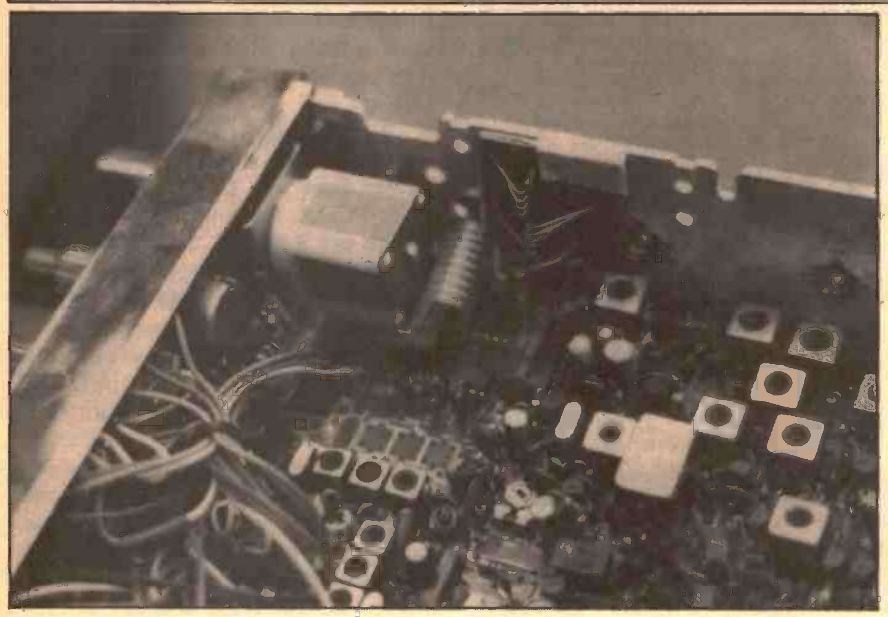
If you still have a spare switch you can connect a 10k resistor between the centre tag of the channel 9 switch, the 8.4 volt supply, and one end of the spare switch. The other end of the switch goes to ground. The centre tag goes to pin 9 of IC6 having first removed its ground link. This will give us a 10kHz up-shift when we operate this switch, to give us the missing frequencies. Finally, we can get rid of the "Roger Beep" by removing the orange wire behind the 'S' meter marked "Peep" on the board.

The crystal that I used was supplied by McKnight Crystal Company Ltd, and on their advice, in order to get the clarifier control to operate fully, they supplied me with a special low inductance crystal on their commercial service at £10 plus VAT. When I fitted the crystal, before retuning, I found that it was exactly 10kHz low, with the clarifier giving me +/− 7.5kHz shift.

Retuning The Rig

So now we get down to the retuning. The figures in brackets are for those only interested in the ten metre band using the three diode matrix. At this point though it is a good idea to fit the top cover.

1. In Rx mode, AM with the clarifier controls in centre position on high band channel 23, 28.650MHz (high band channel 4, 28.850MHz) connect a 'scope or diode probe to TP4, the top bare lead of R124 — 1cm inboard from L17. Tune L17 which is located just behind the channel change switch for maximum indication.



2. Connect a DC voltmeter to TP2, the top bare lead of R126 which is 1cm forward of R124. Adjust L18, the one sealed with wax, for 2.14 volts (2.49 volts).
3. Connect the probe again though this time to TP3, the top bare lead of R84 — found beside L12 and L54. Tune L19 for maximum indication.
4. Remove the probe and connect a frequency counter to TP3. Find L21, 22 and 23 beside the crystal and whilst still on AM, adjust L21 until you get a frequency readout of 17.955 MHz (18.1575MHz). Switch to USB and adjust L22 for 17.9575MHz (18.1575MHz) then go to LSB and adjust L23 for 17.9525MHz (18.1525MHz). Staying on LSB, but in Tx mode with a dummy load fitted or the mic gain off, adjust VR6 at the edge of the board behind the band change switch to get 17.9525MHz (18.1525MHz).
5. Switch to Tx mode, AM, and fit a wattmeter and dummy load. Tune coils L55, L54, L53, L52 and L44 for maximum indication on the meter.
6. Then move to receive but still on AM. If you have a signal generator, set it to 1uV otherwise use a weak off air carrier only signal. Tune coils L7, L8 and L9 for maximum indication on the S meter.
7. Repeat step 6 but with the noise blanker switched on. Adjust L1 and L2 for maximum DC voltage at TP1, the top end of D2 which is located next to L2.

That ends the retuning. Step 7 is optional — I have included it because the noise blanker on my own rig did not work very well as L1 and L2 were off tune. I hope the information will be of some use to those that have a pet Cobra in their cupboard! Hope to hear you on '10' sometime.