Icom ICB1050 Conversion Update

STEPHEN IBBS, G4LBW

Introduction

IN June 1983 a modification was published in *S.W.M.* for the Icom ICB1050 CB rig, to give 40 channel capability, with repeater shift, on 10 metres. In August of the same year this was followed by a modification to the two-digit display to read 31-70 (coresponding to 29.31-29.70 MHz), instead of 1-40, with the display automatically changing when operating in repeater-shift mode. Since then several readers have written and phoned with appreciative comments; however some have requested a slightly different modification.

To explain further . . . the repeater shift design worked by moving the frequency *up* 100 kHz on Rx; this was so that by flicking the repeater switch it was possible to listen on the repeater input. (The 10 metre repeaters in, for example, America have a 100 kHz shift, with the input lower than the output). The suggestion being made was that it would be better to follow normal convention and have the shift operate by *lowering* the transmit frequency by 100 kHz in repeater mode rather than raising the receiver frequency.

Circuit Diagram

Readers interested in building this design, shown in Fig. 1 are advised to refer to the June and August 1983 issues for more details of the principles of operation, particularly concerning the display modification. The channel coding changes basically consist of increasing the binary code inputs to the synthesizer divisor pins, using two CD4008 4-bit adder ICs. To convert the rig to 10 metres requires binary 171 to be added to the inputs generated by the channel switch, and the previous design produced this amount for Tx/Rx (simplex) and Tx (repeater), with 181 for Rx (repeater). What would now be needed to shift 'transit low' is 171 for Tx/Rx (simplex) and Rx (repeater), and 161 for Tx (repeater). By using pin 3 of the mic-socket which, when it has had the earth strap removed from it, goes to 0ve on Rx, it is possible to control one set of inputs to the 4008 to provide the repeater shift.

Table of Values
Figs. 1 and 2

R1 = 47K	TR1 = BC109
R2, R11 to R18 = 10K	IC1, IC2, IC4 = 4008
R3 to R9 = 100K	IC3 = 4070
R10 = 4K7	IC5 = 74LS47
R19 to R25 = 1K5	IC6 = 78L05

Also: PCB, Veropins, small aluminium brackets, and interconnecting wire.

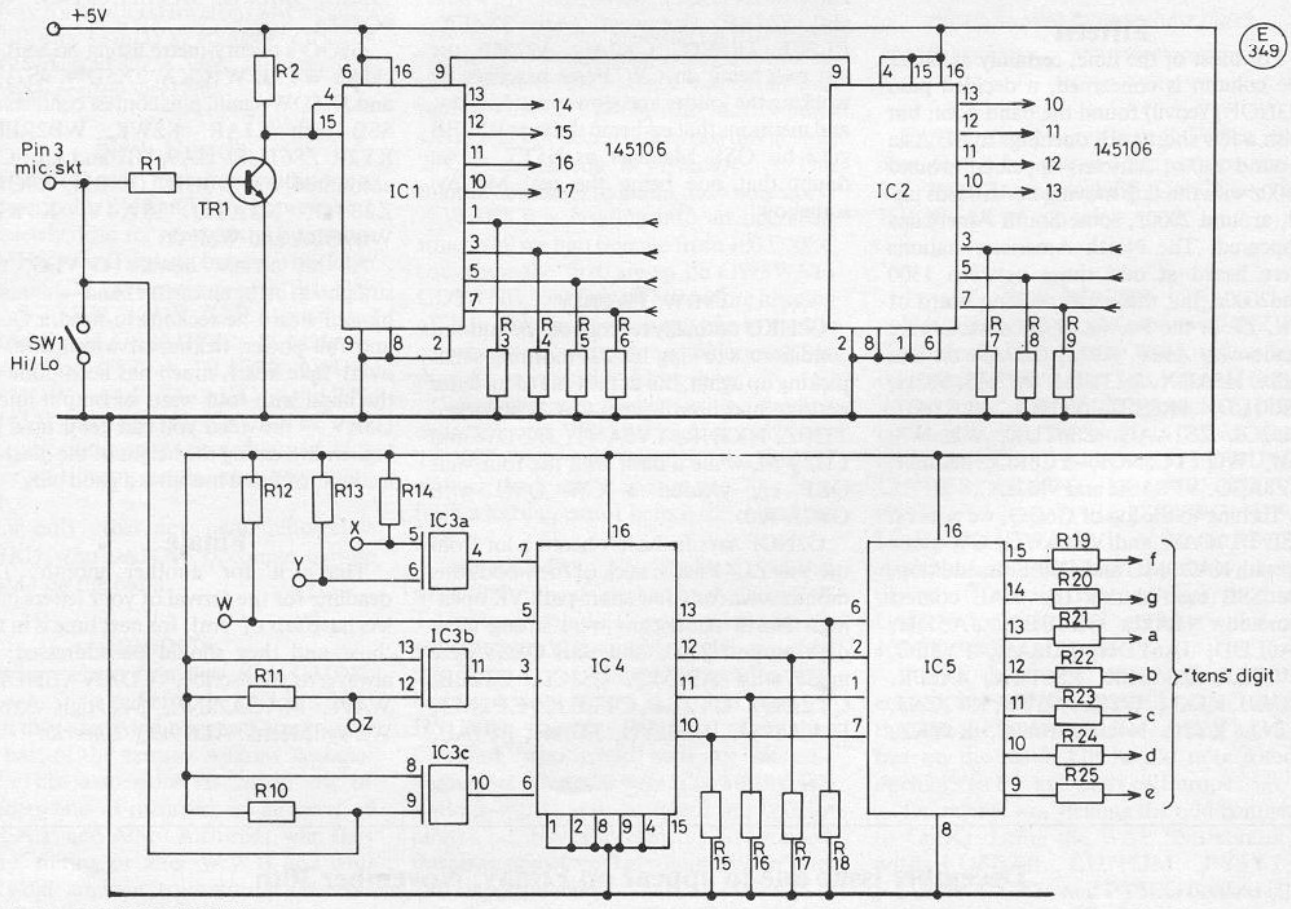


Fig. 1 CIRCUIT DIAGRAM

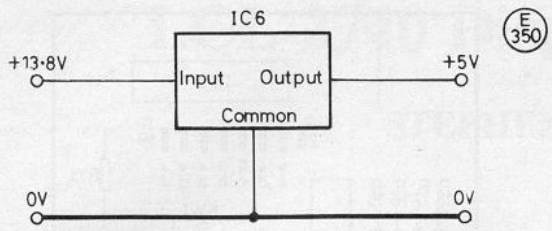


Fig. 2

All this might sound rather confusing, but thankfully the codes themselves are simple, being shown below.

171:	1 0 1 0 1 0 1 1	
161:	1 0 1 0 0 0 0 1	
pin:	15 2 4 6	(IC2)

It can be seen that only two pins, 4 and 15 of the first binary adder, need to change state from 'high' to 'low' This requires just one inverter, easily accomplished by a cheap *npn* transistor. Thus under 'normal' simplex conditions SW1 is closed. TR1 is consequently turned off, causing pins 4 and 15 of IC1 to be pulled 'high' by R2, thereby adding 10 to the 161 already being produced by tying pins 6 and 2 (IC1) and pins 6, 4, 2, and 15 (IC2) to 0ve or +ve as appropriate. This consequently generates output of binary 171 from ICs 1 and 2 (pins 10-13) which goes to the synthesizer IC, an MC145106.

In repeater mode SW1 is opened, and when on receive, the transistor is still turned off, the base being held 'low' by pin 3 of the mic. socket; thus the circuit continues to generate binary 171. However when transmitting, this pin is disconnected from earth and so R1 and R10 pull the base 'high'. Actually, measuring the voltage on the base will reveal approx. 0.6v, caused by the base-emitter diode conducting, but this is sufficient to turn the transistor hard on, pulling pins 4 and 15 low. This causes '10' to be subtracted from the binary code, resulting in 161, and 100 kHz drop in frequency, because each binary code unit equals 10 kHz, the standard CB channel spacing. The inputs from the channel switch all have pull-down resistors because when not held 'high' by the channel switch, the pins would otherwise just be allowed to 'float'

The August '83 modification to the display converted the 1-40 digital readout to 31-70, and this has been incorporated into the design presented here. It also registers the repeater mode when it will display 21-60 on transmit. Only the 'tens' digit needs changing, and a CD4008 is again used, this time to add or subtract one from the binary codes generated by using the switch digit-lines to control some EX OR gates. The final binary output from the 4008 is decoded by a 74LS47 7-segment driver, which drives the 'tens' digit.

Unfortunately the Icom rig has the 'a' and 'd' segments joined together, *see* Figs. 3(a) and 3(b), and the track joining these two (on the small display PCB) needs to be cut, so that they can be driven separately. Looking from the back of the rig, the track that needs to be cut is the 3rd from the left, and the break should be made between the junction of the two boards and the actual digit pin. There are a total of 8 connections on this edge. Readers unwilling to do this surgery can instead just connect the lead from pin 15 (IC5) to the 'a' pin on the switch board *via* a 680-ohm resistor (instead of the 1.5k), and ignore the 'd' output from IC5. The effect of this will be to cause some of the digits to look distinctly odd, but probably recognisable.

A small 3-terminal regulator IC6 has been included (Fig. 2), because the 5ve supply already in the rig may not be able to handle the slightly heavier current demand.

Construction

A single-sided PCB has been designed and is given in Fig. 4. Mount all the components according to Fig. 5, checking the polarity of the ICs, and please note that some of the resistors have to be mounted on end to save space. Insert Veropins for the various interconnections, and don't forget the link wires, necessary to avoid designing a double-sided PCB! After examining the board thoroughly, connect the supply, and check that the regulator is giving the correct output voltage.

If all is well, switch off, and remove, from the main PCB of the transceiver, the switch wires going to the divisor pins (10-17) of the 145106, but leave them attached to the switch PCB. Pin 10 originally had no lead connected to it, and the PCB hole will probably need clearing of solder. This article assumes that the Hi-Lo switch is going to be converted into the repeater switch, so remove the *yellow* wire from this switch and discard. The *orange* wire is soldered to the *red* +ve lead on the volume control.

Part of the component side of the switch PCB should look similar to Fig. 3(a) when viewed from the rear of the rig, and the marked 6 resistors only must be removed. Veropins should be inserted into the holes marked W, X, Y, Z, ready for connection to IC3, and a-g for connection to R19-25. Note that two holes will be left vacant: one just below 'X' and the other between 'Z' and 'e'. Take time with the inter-wiring and check after each group for any errors. Do not be tempted to solder the wires in direct, without terminal pins, as the PCB tracks lift off the backing material very easily. Now proceed as follows:

(a) Connect the 7 switch wires to pins 7, 5, 3 and 1 of IC1 and pins 7, 5 and 3 of IC2 in order, according to the colours shown on the component overlay. They should be in the normal resistor colour coding order, brown to violet. *NB:* the June '83 component overlay showed the green and blue wires mixed up accidentally.

(b) Connect pin 3 of the mic. socket to one terminal of the Hi-Lo switch, and then from the same point run one lead to the base of TR1, and another to pin 9 of IC3. The other terminal is connected to 0ve. (*NB:* the switch has a spare pole which could be used, *e.g.* to light an LED showing that the rig is in repeater mode).

(c) Connect the 8 leads from ICs 1 and 2 to pins 10-17 of the 145106, according to the component overlay.

(d) Connect the 7 leads from the 74LS47 (IC5) to the switch board. The 'd' segment will have to be attached direct to the

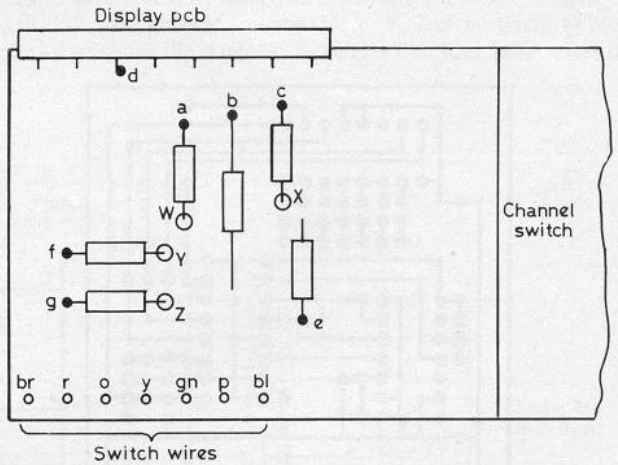
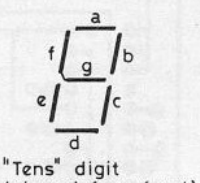


Fig. 3(a)



"Tens" digit (viewed from front)

Fig. 3(b) E 351

display PCB, on the digit pin itself; this is quite fiddly so take time, and don't use a hot poker soldering iron!

(e) Connect the W, X, Y and Z lead from IC3 to the switch board.

(f) Finally, connect the 13.8ve and 0ve lines.

Alignment

Note that the case is floating, as can be seen by the decoupling capacitors by the aerial socket, so a useful place for any probe earth is the screen of the transmit strip. The prototype was mounted in the case, above the 3 crystals, using two small aluminium brackets, after the rig had been tuned up. This was described in *S. W.M.*, February and June '83, but is repeated and much expanded here for convenience. Tune a nearby receiver to 29.6 MHz, and then press the p-t-t whilst on channel 60. *Slowly* unscrew the core of the VCO coil T202 until a signal is heard. If the core is sealed with wax it can be loosened by *very quickly* touching it with a soldering iron, then unscrewing the core. Be careful not to melt the plastic screw-thread in the former! Next tune T208 and T209 for maximum signal.

Some have experienced difficulty hearing the signal on the monitor receiver, and may find it easier to monitor the voltage on pin 7 of the 145106 whilst unscrewing the core. It should read approximately 1v. on receive and 2v. on transmit. Now tweak the transmit strip for maximum output on a power meter, adjusting T207, T208, T209, T301, T303, T305 and T307; 4 watts should be possible. Readers may find it easier to preset the coils. These were almost the same on three rigs aligned by the author, but obviously component tolerances mean that they are only approximate. Set T207, 208, 209 and 301 with the cores approximately 4-5mm. below the top of the former. The core of T303 projects about 2mm. above the former, whilst the cores of T305 and 307 are almost level with the former tops.

Use the most sensitive meter movement possible with a sniffer probe (coax terminated with 2-3 turns of 18-20 s.w.g.) placed over T301. Repeatedly tune T207, 208, 209 and 301 until the meter flickers, then tune for maximum deflection, moving the meter away gradually, until life appears on the power meter. The cores interact, so go through the transmit strip several times. If it appears to be tuning-up but on pressing the p-t-t some weird sounds come through the speaker, then the VCO is probably on the edge of lock. Slightly 'tweak' T202 until it locks securely, when the sounds should hopefully stop. All these adjustments take time, particularly finding that first spark of life, so patience is needed. On receive T101 and T102 are adjusted for best received signal, indicated on the 'S' meter. The Rx performance can also be improved by:

(a) Replacing the ceramic filter CF101 with a 2-pole crystal filter (10.695 MHz) available from *Cirkit*.

(b) Replacing C103 with 33pF and retune.

(c) Replacing C106 with 10pF and retune.

(d) Improving the squelch circuit and one course might be to fit the *Cirkit* noise squelch kit, designed for CB rigs.

(e) The silk-screened overlay of the main PCB shows an extra coil to the right of CF102. In the author's prototype the capacitor and resistor were removed from this position, and the wire link removed from the R118 pads close by. These were replaced with a 10k resistor and a Toko LLC4828 coil *(Cirkit)* in an effort to improve the receiver performance. The difference was marginal, and readers must decide if the effort is worthwhile.

After tuning, reseal the coils by holding an unlit candle over them, and melting the wax with the soldering iron, allowing a few drops to fall onto the coils.

Check final frequencies by adjusting CT202 on transmit for 29.6 MHz on channel 60 with a frequency meter. The receive frequency can be measured at the test point by T202, and should be 18.905 MHz (29.6 minus the IF 10.695 MHz).

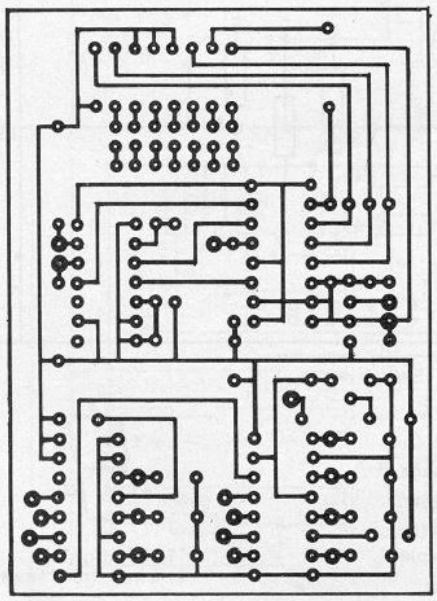


Fig. 4 PCB TRACK LAYOUT

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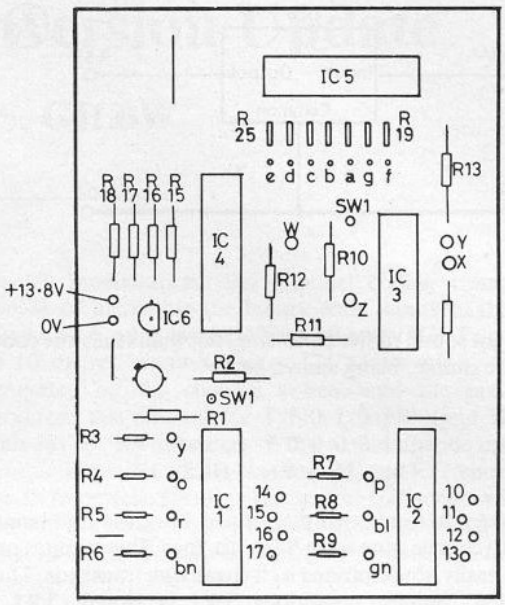

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Fig. 5 Component overlay

Conclusion

With the sunspot cycle now inexorably progressing in the radio amateur's favour, more interest is being shown in 10 metres, and since the initial rush for Icom rigs is now over, it should be possible to purchase one fairly easily, and be on the air for a relatively small financial outlay. CB aerials can usually be converted for 28-30 MHz, and the satisfaction gained from working G4CFH, a friend living a mile away, through the Virgin Islands repeater, made it all worth while for the author!

Cirkit's address is Park Lane, Broxbourne, Herts. EN10 7NQ.