DISPLAY MODIFICATIONS FOR 10-METRE RIGS

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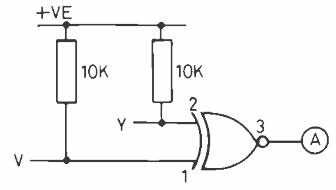
MANY readers now have CB rigs which have been modified to work from 29.31 to 29.70 MHz, with or without repeater offset. These include the Icom ICB1050 and the LCL2740 under various guises. Wouldn't it be nice to have the display giving 31-70 rather than 1-40? I got the idea after reading a modification article by G4MKT for the Icom rig, using transistors and diodes; unfortunately this did not have the facility for changing the display when in repeater Tx or Rx mode. A further complication arises because some rigs shift Tx low, others Rx high in repeater mode (the recent Icom modification by the author in the June issue of *S. W.M.* shifts Rx high), so some sort of design to cater for these differences was needed. Of course this by necessity involves more components, but the total cost is still under £2, and a very compact PCB has been designed so that it may be fitted into almost any rig.

Let us consider a repeater with a 29.55 MHz input frequency. Assuming the rig to be a modified Icom in repeater mode, the rig would be set to channel '25'; but we want the display to read 55 for simplex and repeater Tx, and 65 for repeater Rx. However another rig wishing to operate the same repeater, but shifting Tx low, will be set on channel 35, displaying 65 for simplex and repeater Rx, and 55 for repeater Tx.

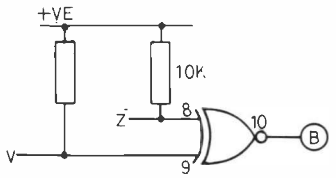
Table 1 shows what switch lines go low when the 'tens' digit is switched. The lines have been labelled T to Z to avoid confusion with the traditional segment labels, and it can be seen that to produce the digit '4', for example, switch lines U, V, Y, Z (corresponding to segments *b, c, f, g*) are earthed by the channel selector switch. These lines are used to control gates to provide a binary coded output. This binary code can then be added to, to give the repeater offset, before being decoded to give a 7-segment display.

Table 2 shows the binary equivalents for figures 2-7 and from here this article splits into two parts: *(a)* for those with a 'shift Rx high' rig, using a 4077, and *(b)* for those with a 'shift Tx low' rig, using a 4070. For readers without a repeater offset facility either circuit should work.



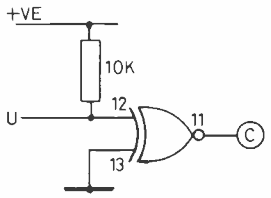
Ⓐ	
"Blank"	1
1	0
2	1
3	0
4	1

Fig. 1



Ⓑ	
"Blank"	1
1	0
2	0
3	1
4	1

Fig. 2



Ⓒ	
"Blank"	0
1	1
2	1
3	1
4	1

Fig. 3

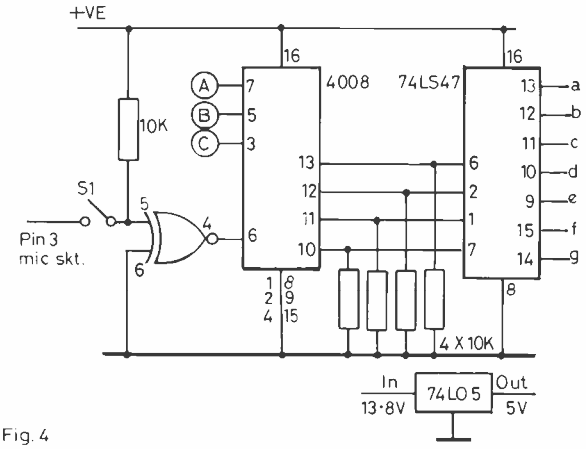


Fig. 4

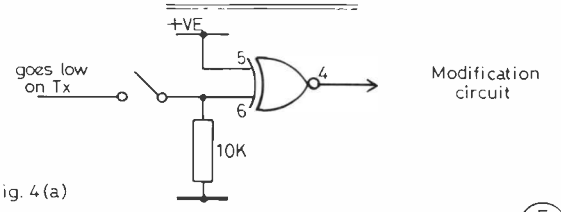


Fig. 4(a)

SHIFT RX HIGH (4077)

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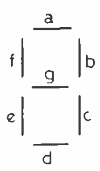
Switch line	T	U	V	W	X	Y	Z
Segment / Switch posn	a	b	c	d	e	f	g
Blank							
1		0	0				
2	0	0		0	0		0
3	0	0	0	0			0
4		0	0			0	0

When not at 0V, the lines are floating

TABLE 1



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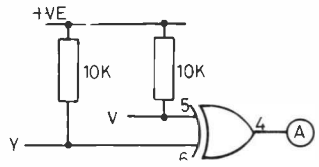
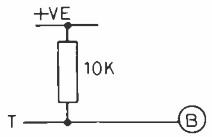
(a) Studying Table 1 again we can combine switch lines V and Y in a 4077 EX NOR gate, the truth table of which is given in Table 3, to generate Ⓐ 10101 for switch positions: 'Blank', 1, 2, 3, 4 (Fig. 1). Similarly combining V and Z will produce Ⓑ 10011 (Fig. 2), and U will give Ⓒ 01111 (Fig. 3). Putting together Ⓐ, Ⓑ and Ⓒ will give the binary equivalents for 3-7. This could now be simply decoded by the 7447, but by feeding it *via* a 4008 4-bit adder (Fig. 4) we can choose whether to add 0 or 1, using IC1*b*, controlled by the mic. socket pin 3 which goes low on Rx, to give a reading of 4-8 when in repeater Rx mode. If SW1 is left open, no shift will take place in the display. Readers who have a rig which does not have such a convenient pin, but have one which goes low on Tx should modify the IC1*b* circuit to that shown in Fig. 4a (SW1 closed for simplex).



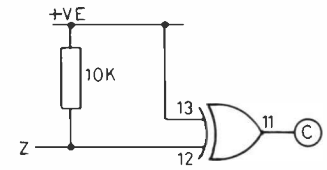
Blank	0
1	1
2	0
3	1
4	0

Fig. 5



Blank	1
1	1
2	0
3	0
4	1

Fig. 6



Blank	0
1	0
2	1
3	1
4	1

Fig. 7

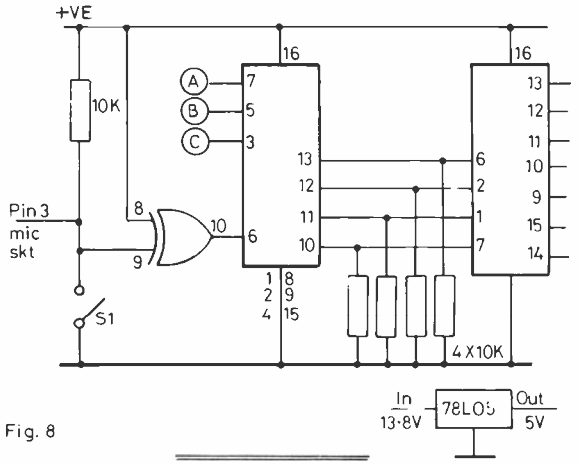


Fig. 8

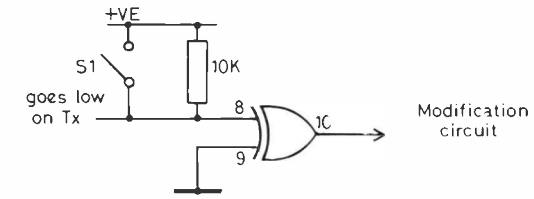


Fig. 8(a)

SHIFT TX LOW (4070)

(b) A problem arises when modifying rigs that shift Tx low because it is very awkward to subtract one in binary. Thus the answer lies in generating 2-6 rather than 3-7, and adding 'one' using a 4008 and IC1*c* for simplex and repeater Rx, then removing this '1' in repeater Tx. Once again the switch lines are decoded, this time T, V, Y, Z, by a 4070 EX OR IC to generate the three binary lines Ⓐ, Ⓑ, Ⓒ (2-6) which are fed into the 4008 (Figs. 5-8). Pin 9 of this IC is connected to pin 3 of the mic. socket, and SW1 should be closed for simplex operation. Readers who have a pin that goes low on Tx should modify this part of the circuit to that shown in Fig. 8a (SW1 closed for simplex).

The 74LS47 in both circuits is used to decode the binary data and control the 'tens' digit. All rigs seen by the author used CA displays, but check yours because otherwise the circuit will need

Binary line / Number	Ⓒ	Ⓑ	Ⓐ
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1

Binary equivalents for 2 – 7

TABLE 2

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modification to cater for CC displays. Current limit resistors have been included, but it may well be possible to use the display resistors already installed. Construction details given below are for an Icom rig modified as per the June issue article. A 3-terminal regulator was included on the PCB, because some rigs may not have a 5v. source available. The Icom rig has a 5v. supply (pin 1 of the 145106) but this was not used in the prototype, preferring a separate 5v. supplied from the 13.8v. line *via* the regulator.

Components List

Nine 10K resistors
4077 or 4070 depending on circuit, *see* text
4008
74LS47
Current limiting resistors, *see* text
PCB, two different designs, *see* text
78LO5 if necessary

Construction

Two PCBs have been designed, Figs. 9 and 10, and readers should make sure they build the correct one! Mount all the components, and insert *veropins* for the various connections. Looking at the display PCB in the rig reveals something like Fig. 11. Remove the resistors shown and insert them onto the new PCB; they should all be 1.5K except for one 680-ohm which goes to pin 13 of the 7447. There is no resistor connected to pin 10. Insert veropins into the holes marked U, V, Y, Z and *a* to *g*. Run leads from these points to the new board, and then mount it using sticky pads or brackets; note that there is no connection for the *d* segment. Icom joined *a* and *d* together, and this only has the effect of generating 3 for the figit 7; whilst niggling, it does serve to show that you are on the band-edge and should not be there. Thus pins

		Ex OR	Ex NOR
IN	IN	4070 OUT	4077 OUT
0	0	0	1
0	1	1	0
1	0	1	0
1	1	0	1

Truth table for Ex OR/Ex NOR

TABLE 3

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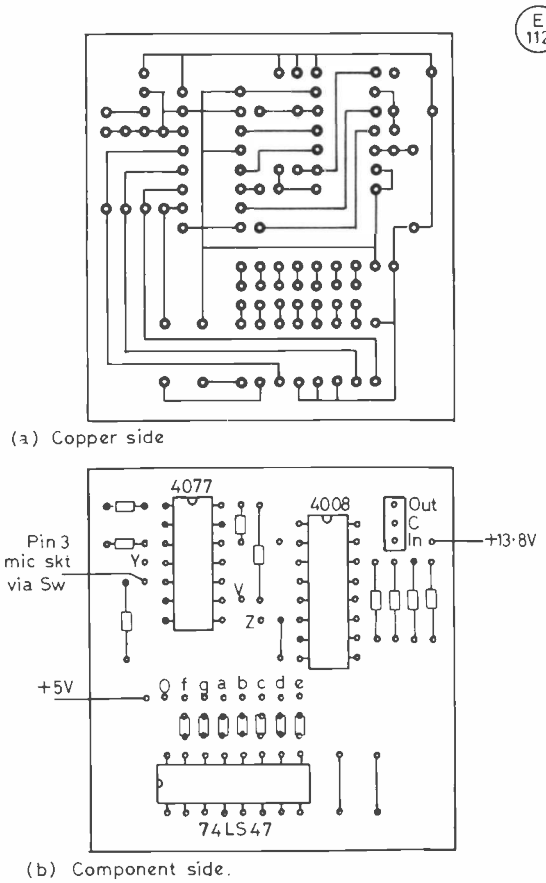
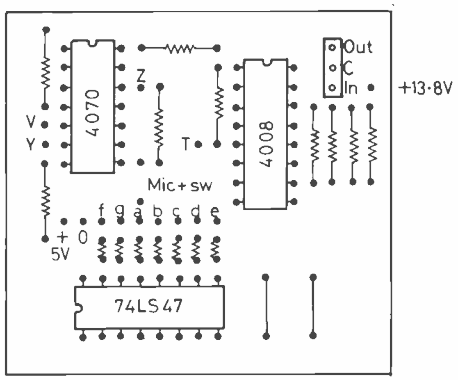


Fig.9 Rx SHIFT HIGH IN REPEATER MODE



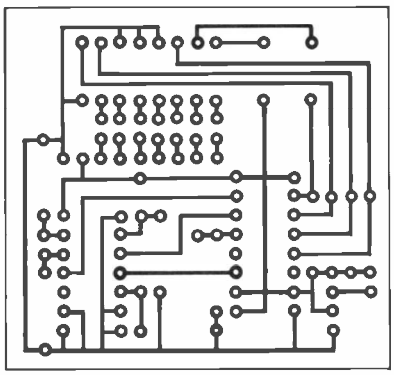


Fig.10 TX SHIFT LOW REPEATER MODE

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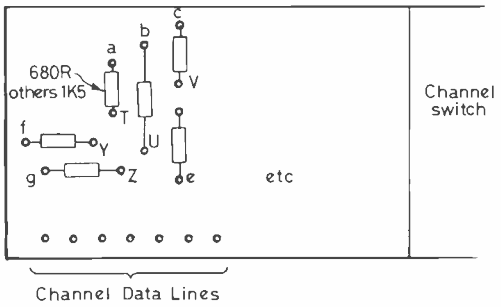

Fig.11 FRONT OF RIG AND DISPLAY

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Fig. 11. View from the component side of the display PCB (the resistors shown should be removed). The labelling shows T, U, V, Y, Z, though only four of these would be used, depending on the circuit; the segment connections go to pins 9 to 15 of the 74LS47. The hole just below 'V' is left vacant.

10 and 13 of the 7447 should be joined together with a small insulated link. However if you are careful it is possible to find the track that joins segments *a* and *d* together, and then sever it. Insert two 1.5K resistors, by the *a* and *d* outputs of the 7447, ignore the 680-ohm resistor and then connect the two segments separately. This was not done on the PCB which was designed to cater for other rigs as well, which have separate *a* and *d* segments. Wire up the switch, which controls the repeater option, and bolt the rig together.

Note on the June Issue ICB1050 Modification

Comments have been received from a few readers who wish that the circuit shifted transmit low, rather than receive high.

Whilst the circuit as published does initially necessitate clicking down ten channels, then operating the repeater switch, it was decided to have it this way round so that the repeater's input frequency could be monitored easily to see if a simplex contact was possible. If however readers wish to have a Tx low shift mod, whilst still retaining all 40 channels, they can obtain one by sending an *s.a.e.* and 50p to S. Ibbs G4LBW, QTHR.

A Word on PA's

There are several re-usuable 'burners' ranging from the good to the amazingly bad and ugly on the market. Try to get one with relays, because the ones I've tried with diode switches, attenuate the Rx signal quite badly.

One that did seem reasonable value was the 'Apollo' which has input and output relays, and more importantly, is very easy to work on. Some have the PA transistor mounted in a very awkward place, which requires a complete dismantle to get at. The 'Apollo', along with many others, uses the MRF475 PA transistor and a cursory glance of its data sheet will show that claims of PA's with the device giving 40+ watts are somewhat optimistic; mine runs at about 15-20, and this represents excellent value for money. If trouble is experienced getting hold of this transistor, the sales dept. of *Celdis*, based in Reading, should be able to supply one.

Warning: Some rigs plus PA's reveal a veritable Christmas tree of sproggies, *spurii*, etc., on the spectrum analyser, so get hold of a low pass filter, or be prepared for a visit from your local GPO interference man. One combination I heard of produced a second harmonic only 16dB down!