70SY25B A New Project

As is our policy with a new product we require feedback and information from you, the constructor, as to errors or lack of information in the kit data. To this extent we are offering the first kits at an introductory price in the hope that you will help us to help others in their hobby. Please ring or write your findings to us at WOOD & DOUGLAS, 9 Hillcrest, TADLEY, Basingstoke, Hants. RG26 6JB, Telephone (after 6pm) 07356-5324 & 0256-24611.

To this extent we apologise for the 'hybrid' nature of the data. This will be reviewed in the light of feedback in a few weeks.

Many thanks.

WOOD & DOUGLAS

Special notes

These apply to early models of the 70SY25B and 70VC05 boards.

Due to a design change in the crystal oscillator on the 70VC05 board the first batch of crystals cannot be pulled on to the intended frequency. However, the circuit changes permit the crystal to be pulled more readily so that it can, in effect, be set up one channel low, i.e. 69.379166MHz. This is readily compensated for by breaking the existing track to pin 11 of IC2 on 70SY25B. Pin 11 is then connected to pin 10 instead, i.e. to +10V instead of 0V. This increases the division ratio N by 1. The only disadvantage this causes is that all the 'VCO' frequencies at the input of IC2 are shifted up in frequency by 8.333KHz.

The VHF output frequencies are unaltered.

The inductor L9 in series with the crystal is normally 0.1uH but 0.22uH is also supplied for use where 0.1uH does not pull the crystal frequency low enough.

70SY25B Synthesiser System

This synthesiser complements the 70FM05 RX and TX to give an all channel equipment for 70cms use. It can also be used with the A-X3U-06F TX board and MOD 1 which replace the 70FM05 TX.

It is a very advanced project and requires care in construction with attention to detail. A good soldering iron with a fine tip is required and solder such as 22swg. A frequency counter is required for the final alignment. The only other test gear needed is a multimeter, an oscilloscope will be helpful but not essential. The testing of the boards could easily take as long as the construction so patience is required for the best results. If you are at all doubtful as to your ability to complete the job successfully then please return it for an assembled version.

The 70SY25B uses CMOS logic which is very reliable and will give low current consumption. A few basic rules must be observed when handling CMOS however.

1) Earth your soldering iron well.

2) Do not handle the devices needlessly, leave them in the protective foil until required.

3) Do not attempt mods with the power on.

4) Use the sockets supplied. We cannot consider servicing a unit without sockets fitted where recommended.

5) The digital board has a voltage stabliser fitted to give 10 volts supply to the CMOS. 10 volts is thus logic! CMOS will not tolerate logic levels higher than its supply rail so always use the 10 volt line and not the 12 volt input supply for any inputs to the logic board except power in.

70SY25B Construction (refer to component layout and parts list)

1) Check the pcb for any obvious faults or errors. This is a conventional double sided pcb. The through linking of tracks is achieved by component leads or by wire links. It is therefore essential to solder both sides where indicated on the layout or told in the notes.

2) Fit all resistors, diodes, capacitors and transistors whose leads pass through a track on the component side on the pcb, noting orientation where applicable. These are:- R12, C18, D4, D20, R18, R1, R2, R25, R17, R5, D5, D26, D27, R50, R33, R46, C3, R4, D22, D11, R28, C2, R22, R15, R6, R10, R57, R29, TR4, R41, C8. Solder track side and component side where appropriate.

3) Fit 4 wire links through board where indicated (3 near IC6, the other between IC3 and IC4) and solder both sides. Note that one link has two possible positions, see bottom of layout diagram. Fit link LK1 (near IC7) and solder.

4) Fit terminal pins from component side where connections to board are shown on layout and solder both sides of board, cut short on track side if required.

5) There should now be only 4 component holes through tracks on the component side of the board, one at IC6 location, another nearby, one at IC1 and one at IC2. Check that you have not missed any components so far as connections on the component side will be more difficult to solder later.

6) Fit IC sockets and solder to track side only - the 3 component side IC connections are already made via R5, D5 and R6. (It will avoid confusion if you make sure the sockets are the right way round - they are normally marked by a notch or similar means adjacent to pin 1) Sockets are not supplied for IC7 and IC9.

7) Fit all remaining components, noting orientation of diodes, transistors, tantalum and electrolytic capacitors and IC's. Do not insert CMOS IC's (IC1 to IC6, IC8) yet - see test procedure. Solder track side.

8) There should now be 4 component holes left with no leads through (3 near IC7, the other near IC6). Check that all leads are soldered and that tracks are not bridged together.

Clean if possible with Iso-propyl alcohol or similar.

Testing

Always disconnect 12 volt supply before inserting or removing IC'S. When checking logic states at an empty IC socket it is preferable to touch a probe to the relevant pin on the track side of the board. Do not insert wires into the socket itself unless they are very thin as the socket may become damaged and cause unreliable connections.

IMPORTANT!
Logic '1' means +10V, do not connect logic i/p's to 12 volt supply or damage may result.

1) Before inserting any CMOS IC's, connect 12 volt supply and check that voltage at +10V outputs pins is approximately correct. The exact voltage is not critical but should remain constant for supply voltages of 10.5V to 16V.

Check voltage at LK1 (wire link) which should be about +5V.

Check voltage at V_c pin, this should be about +8V ($\pm$ 1V)

Connect junction of R42, R44, and R45 to +10V. Voltage at Vc pin should drop to about +1.5V.

Connect junction of R42, R44 and R45 to OV. Voltage at Vc pin should return to previous value of about +8V. Remove connection.

Check that TR4 is oscillating at approximately 4.266MHz.

If pin 9 of socket IC5 is checked with an oscilloscope the level should be about +5V DC with a superimposed 4.266MHz signal of about 4 to 5 volts peak to peak.

2) Insert IC1, check that a logic '1' appears at the relevant pins of socket IC2 as shown in table I for all the various modes. (This may be as low as 8.8V since some pins are driven via two diodes in

TABLE 1—

Truth table for IC1 and IC2:—

		TX				RX			
		RR	R	S	LO	RR	R	S	LO
mode i/p's	M_A	0	1	0	1	0	1	0	1
	M_B	0	0	1	1	0	0	1	1
alternative mode i/p's	R	0	1	0	0	0	1	0	0
	S	0	0	1	0	0	0	1	0
	LO	0	0	0	1	0	0	0	1
i/p	PTT	0	0	0	0	1	1	1	1
o/p's :—									
IC2 pin27	4	1	0	0	1	1	0	0	0
" pin28	8	0	0	0	1	0	1	1	0
" pin5	16	0	0	0	1	0	0	0	0
" pin6	32	0	1	0	0	0	1	1	0
" pin7	64	1	0	1	0	0	0	0	0
" pin8	100	0	1	0	0	1	0	0	0
" pin13	400	1	1	1	1	0	0	0	0
total shift		468	532	468	428	104	40	40	0

The division ratio of IC2 is given by N = 200 + total shift + TW
where TW is the number fed in from the thumb-wheels.
e.g. N = 668 to 767 for TW = 00 to 99 in TX, S mode.

3) Insert IC6, check that pin 22 of socket IC2 is a '1' when T_B is a '1' only if M_B or S or Lo i/p is a '1', repeat for pins 24 and 25 with ^{B}TC and TD i/p's respectively. These can only be '1' if MB or S i/p's only are '1'. Check that pin 3 of IC6 is a '1' only when TE is a '1' and mode is TX, R.

4) Insert IC2, connect signal generator to VCO i/p and inject a signal at about 5MHz of about 5 volts peak to peak. The VCO board itself can be used if set up correctly). Check that ÷N pulses appear at pin 14 of IC2, also pin 14 of socket IC5. (This really requires an oscilloscope and may be difficult to see)

5) Insert IC5, check that 66.666KHZ signal appears at pin 1. If VCO board is correctly set up and all connections are made to the digital board the system should now lock.

6) Insert IC4, If system is fully connected and locked the LED driven by TR3 should be extinguished. Disconnecting Vc output or VCO input should cause the LED to light.

7) Insert IC8 and IC3. Check that toneburst o/p (approx. 1750Hz) appears for about 1 second when TE is a '1' and mode is TX, R. The 'RLY' should turn on in TX modes if the system is fully connected and locked. Connecting either I1 or I2 to 0 volts should make 'RLY' o/p turn off.

70SY25B
Principles of Operation

The synthesiser is essentially a low frequency phase lock loop generating frequencies at 8.333KHz steps in the range 2 to 6MHz approximately. The VCO on the 70VCO5 board actually runs at VHF but is mixed down to a low frequency which the ÷N counter on the 70SY25B can handle. These mean that the 70VCO5 behaves as a low frequency VCO as far as the synthesiser is concerned.

There are two crystals in the system. One is at 4.266MHz which is divided down to provide the 8.333KHz reference frequency on the 70SY25B board. The other is at 69.383MHz which is frequency-doubled and used to mix the VHF VCO signal down to a low frequency on the 70VCO5 board. The frequency of the VHF output from the 70VCO5 board is given by:-

$$(2 \times 69.383\text{MHz}) + (N \times 8.333\text{KHz})$$

This output is frequency-tripled to arrive at 70cms. The 8.333KHz reference frequency is not adjustable since adjustment errors will be much more significant in the 69.383MHz oscillator.

On the 70SY25B board the various IC's perform the following functions:-

IC1 is a decoder which programs in the various fixed frequency shifts depending on the mode selected (i.e. it alters the division ratio N)

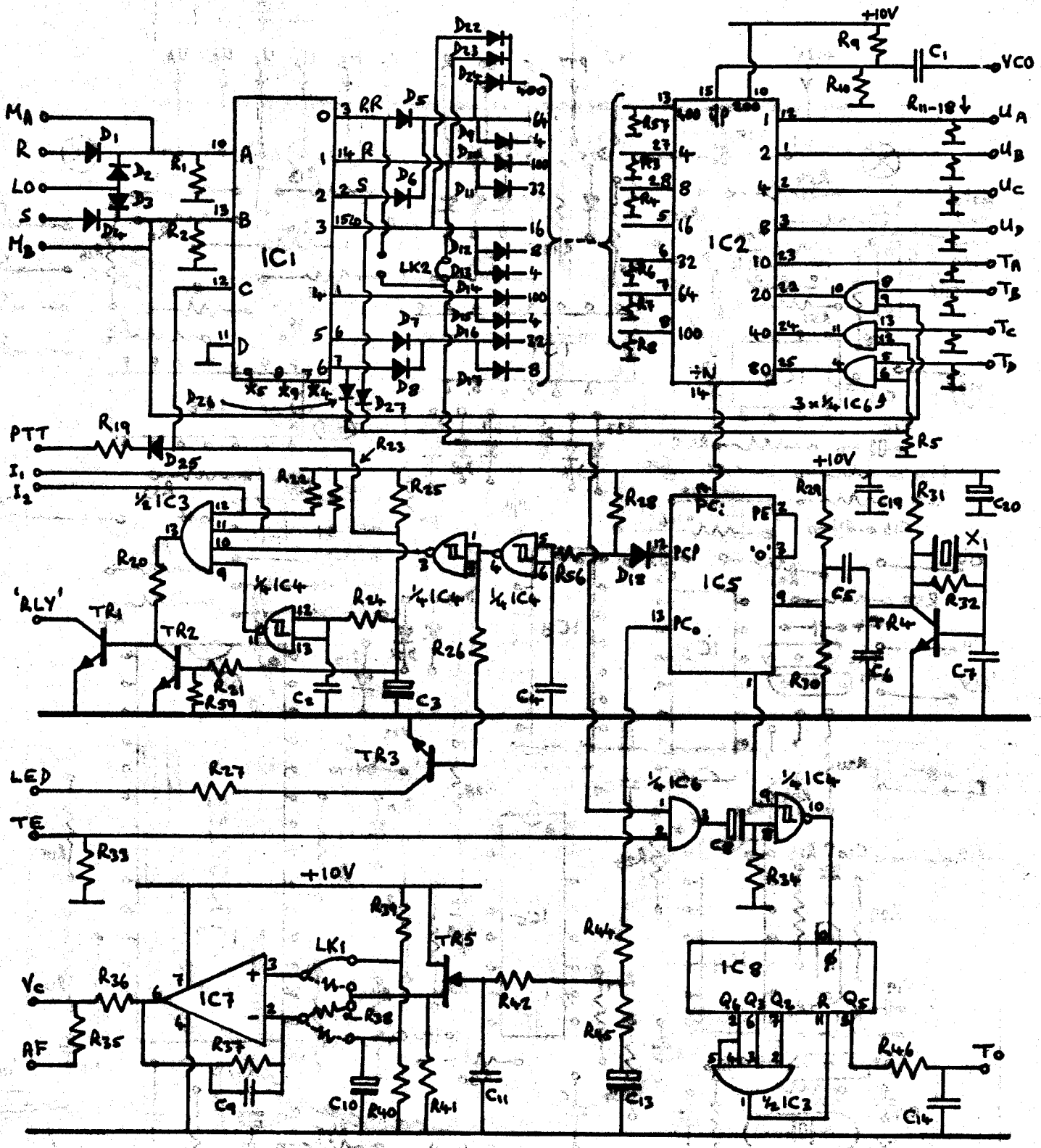
IC2 is the ÷N counter and incorporates internal adders to sum the thumb-wheel inputs and frequency shifts from the decoder IC1.

IC5 incorporates the divider which generates the 8.333KHz reference frequency from the 4.266Mhz crystal oscillator and also an output from which the tone-burst frequency is derived. It also includes the phase comparator whose output passes through a low pass filter and buffer to IC7. This provides the control voltage output Vc which connects to the 70VCO5 board.

IC8 divides the output of IC5 down to the tone-burst frequency.

IC3 and IC4 make up the 'out-of-lock' and 'interlock' circuitry (among other things), using the phase pulses from IC5 to detect an 'out-of-lock' condition.

IC6 gates the thumb-wheels and tone-burst depending on the mode of operation.



70SY25B ©1981

	0V	+10V
IC1	pin 8	pin 16
IC2	" 4	" 19
IC3	" 7	" 14
IC4	" 7	" 14
IC5	" 8	" 16
IC6	" 7	" 14
IC8	" 8	" 16

supply connections, also:

IC2 { pins 9, 11, 13, 26 = 0V
pins 10, 16, 18, 21 = +10V

IC5 { pins 5, 6, 7, 11 = 0V
pins 4, 10, 15 = +10V

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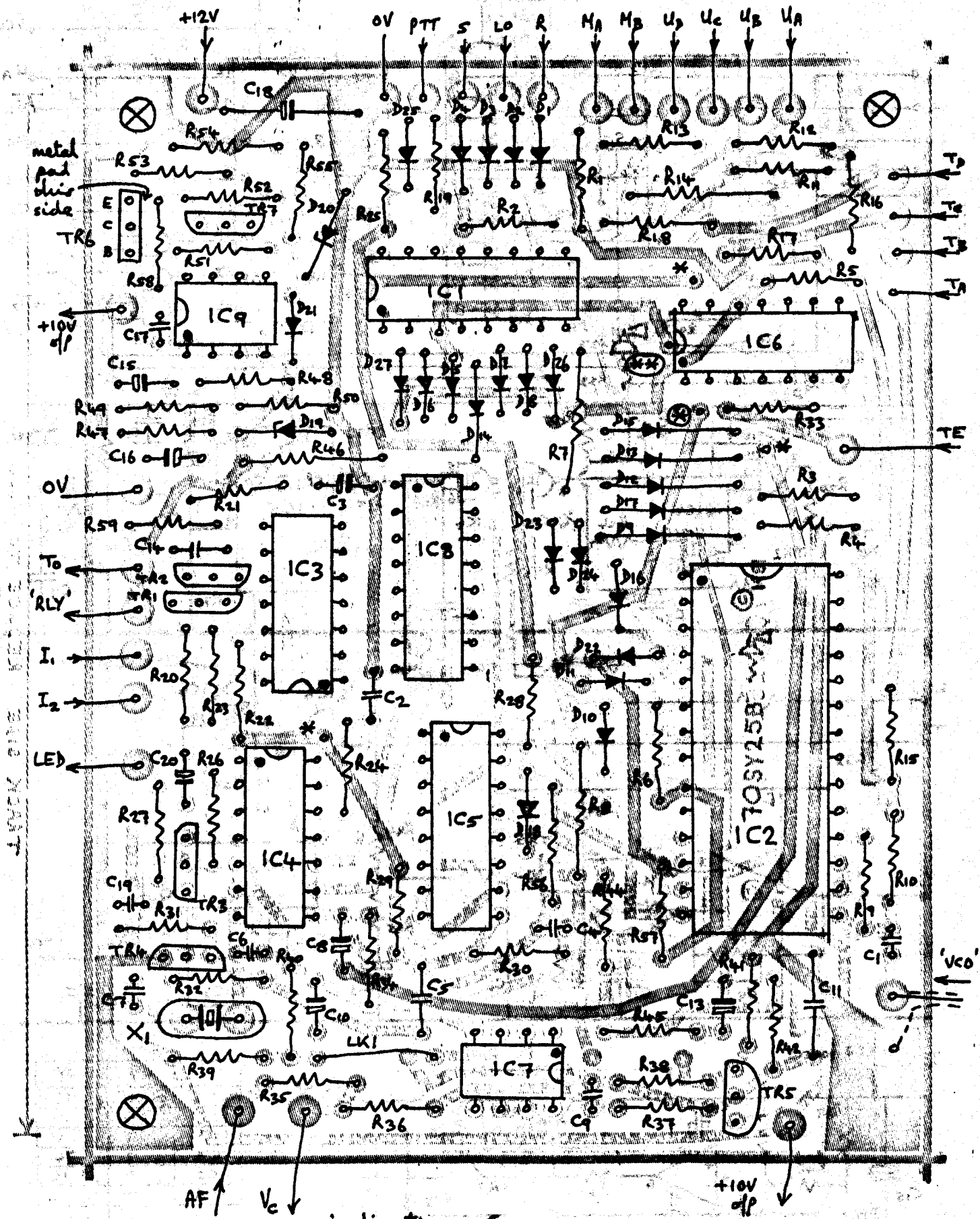

indicates wire link through hole required (4off)

* — link for UK use

(*) — do not link for UK use

} LK2

	R	C		TR		IC		D		
1	100K	1000pF	630 cer.	ZTX108		CD4028		1N4148		1
2	100K	.01µF	629 cer.	ZTX108		HCTR0320		1N4148		2
3	100K	1µF	35V tant.	ZTX108		CD4082		1N4148		3
4	100K	.01µF	629 cer.	ZTX108		CD4093		1N4148		4
5	100K	1000pF	630 cer.	2N3819		MC14569		1N4148		5
6	100K	18 pF	632 cer.	BD132		CD4081		1N4148		6
7	100K	100pF	632 cer.	ZTX502		LM741		1N4148		7
8	100K	1µF	35V tant.			CD4040		1N4148		8
9	150K	100pF	632 cer.			LM301		1N4148		9
10	100K	10µF	25V tant.					1N4148		10
11	100K	.01µF	352					1N4148		11
12	100K	not used						1N4148		12
13	100K	10µF	25V tant.					1N4148		13
14	100K	1000pF	630 cer.					1N4148		14
15	100K	10µF	25V tant.					1N4148		15
16	100K	10µF	25V tant.					1N4148		16
17	100K	22pF	632 cer.					1N4148		17
18	100K	10µF	015 Mytic					1N4148		18
19	100R	.01µF	629 cer.					5.6V zener		19
20	10K	10µF	25V tant.					4.7V zener		20
21	220K	41	10K					1N4148		21
22	100K	42	47K			X_1 =	4.2666 MHz	1N4148		22
23	100K	43	not used				(HC18/U)	1N4148		23
24	1MO	44	4K7					1N4148		24
25	10K	45	220R					1N4148		25
26	47K	46	150K					1N4148		26
27	680R	47	2K2					1N4148		27
28	100K	48	47K	R (cont.)						
29	1MO	49	82K							
30	1MO	50	100K							
31	22K	51	1KO							
32	220K	52	3K3							
33	100K	53	100R							
34	1MO	54	4R7							
35	1MO	55	2K2							
36	2K2	56	10K							
37	100K	57	100K							
38	100K	58	680R							
39	10K	59	220K							
40	10K									

70SY25B ©1981

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70VC05

Construction

1) Check pcb for obvious faults or errors.

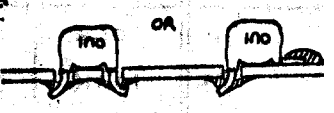
2) Position trimmer capacitors C10, C18, C35, C44 and C49 on board and solder the two earthy pins on each to the ground plane. Avoid touching the plastic bodies of the trimmers with the soldering iron as they melt easily. Cut pins short on track side if required and solder (i.e. all three pins on each trimmer).

3) Position L4 and L7 on board and solder earthy ends to ground plane. Trim leads and solder to track side.

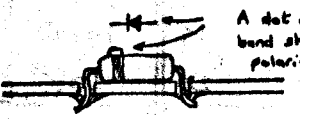
4) Fit wire link through hole near TR9 and solder to both sides of board.

5) Fit C21 and solder earthy lead to ground plane. Solder other lead on track side.

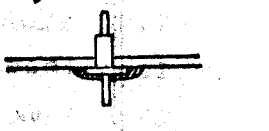
6) Fit D1 and D2, solder to track side then solder earthy ends to ground plane.



7) Fit terminal pins, solder to track side (cut short if required) then solder earthy pins to ground plane as well.



8) The remaining components can be fitted in any order. Many resistors, etc.. are vertically mounted and it is recommended that the orientations shown on the layout diagram be adhered to.



TR5, TR6, TR7 and TR9 are mounted from the track side of the board. These transistors will need their leads cutting short. It is a good idea to cut the collector/drain leads to be slightly longer to avoid possible confusion.

Remember that this is a VHF circuit board. Keep component lead lengths to a minimum.

9) Provision has been made for various screens across the board and in particular along its length. In practise these have proved to be unnecessary provided the board is constructed properly. However, it is recommended that the board be mounted in a metal box (see general components list for suitable diecast box) and the connecting leads brought out through small holes in the box.

Miniature 50Ω coaxial cable should be used for all RF signal connections.

Use metal mounting screws at all four corners of the board. Single point earthing techniques apply to audio circuits but not VHF!

70VC05 - Setting Up

Connect +5V to Vc terminal, e.g. using two 10KΩ resistors, one connected to 0V and the other to +Vcc (10 volts).

Set all trimmers to approximate settings given below.

Trimmer	C2	C4	C10	C18	C35	C39	C44	C49
Percentage in mesh	60%	5%	30%	40%	50%	Not fitted	25%	15%

Connect a 50Ω load or power meter to the 'RX' output and also a frequency counter capable of reading up to 150MHz. With the 'PTT' terminal unconnected (RX mode) connect a 10 volt supply to the +Vcc and 0V terminals (ensure correct polarity).

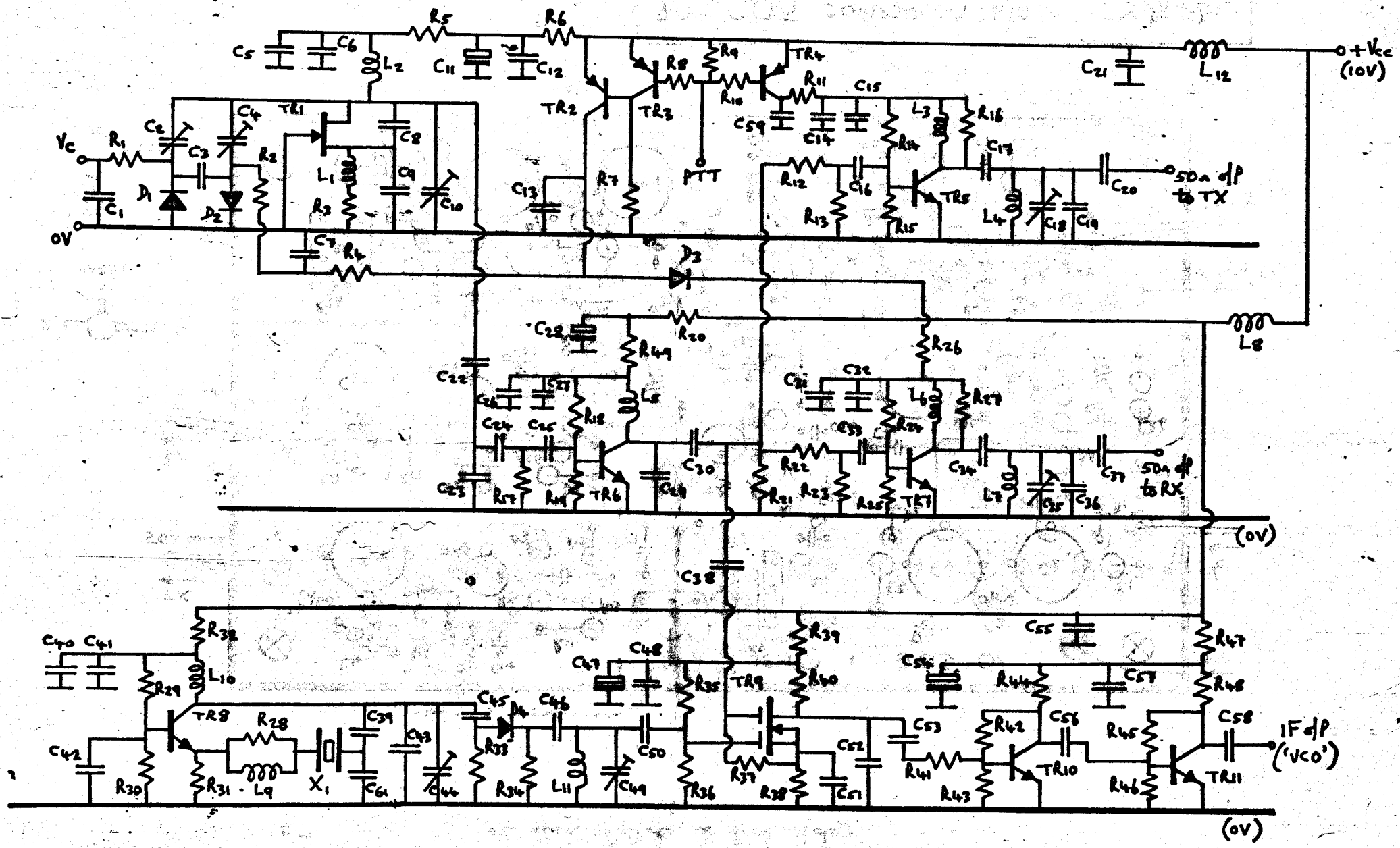
Tune C10 for approximately 141.0MHz output and tune C35 for maximum output (approx. 4mW).

Connect power meter and frequency counter to the 'TX' output. Connect 'PTT' terminal to 0V (TX mode). Tune C10 for approx 144.6MHz output and tune C18 for maximum output (approx. 20mW).

The VCO is set up using C2 (VCO sensitivity), C4 (TX -RX frequency shift) and C10 (main tuning). These three trimmers interact so repeated adjustments are necessary. With Vc terminal at +5V as before the required frequencies are 141.0MHz in RX mode and 144.6MHz in TX mode. Set C2 approx. 60% in mesh and alternately adjust C4 and C10 to give the required frequencies in TX and RX modes. (increasing C4 will increase the frequency shift). A non-metallic trimming tool will be helpful when making these adjustments as the VCO frequency is easily disturbed by stray capacitance.

Now check how the frequency varies with the control voltage. (Use a separate variable power supply or a 10KΩ potentiometer across the 10V supply to drive the Vc terminal). The graph on the following page is given as a guide. The VCO sensitivity (MHz/volt) need not be exactly as shown but reasonably close. Increasing C2 will increase the VCO sensitivity - if C2 needs to be adjusted go through the setting up procedure with C4 and C10 again.

Connect an oscilloscope (preferably with at least 10MHz bandwidth and a x10 input probe) to the IF output ('VCO'). Start with board in RX mode and connect +5V to Vc terminal. Tune C44 so that TR8 is oscillating and peak up IF output by tuning C49. The output frequency should be approx. 2.2MHz. Connect PTT terminal to 0V to switch board to TX mode and check peaking of C44 and C49 for maximum IF output which should now be about 5.8MHz. (The output should be at least 5 volts peak-to-peak).



70VCO5 VHF/UHF SYNTHESISER VCO

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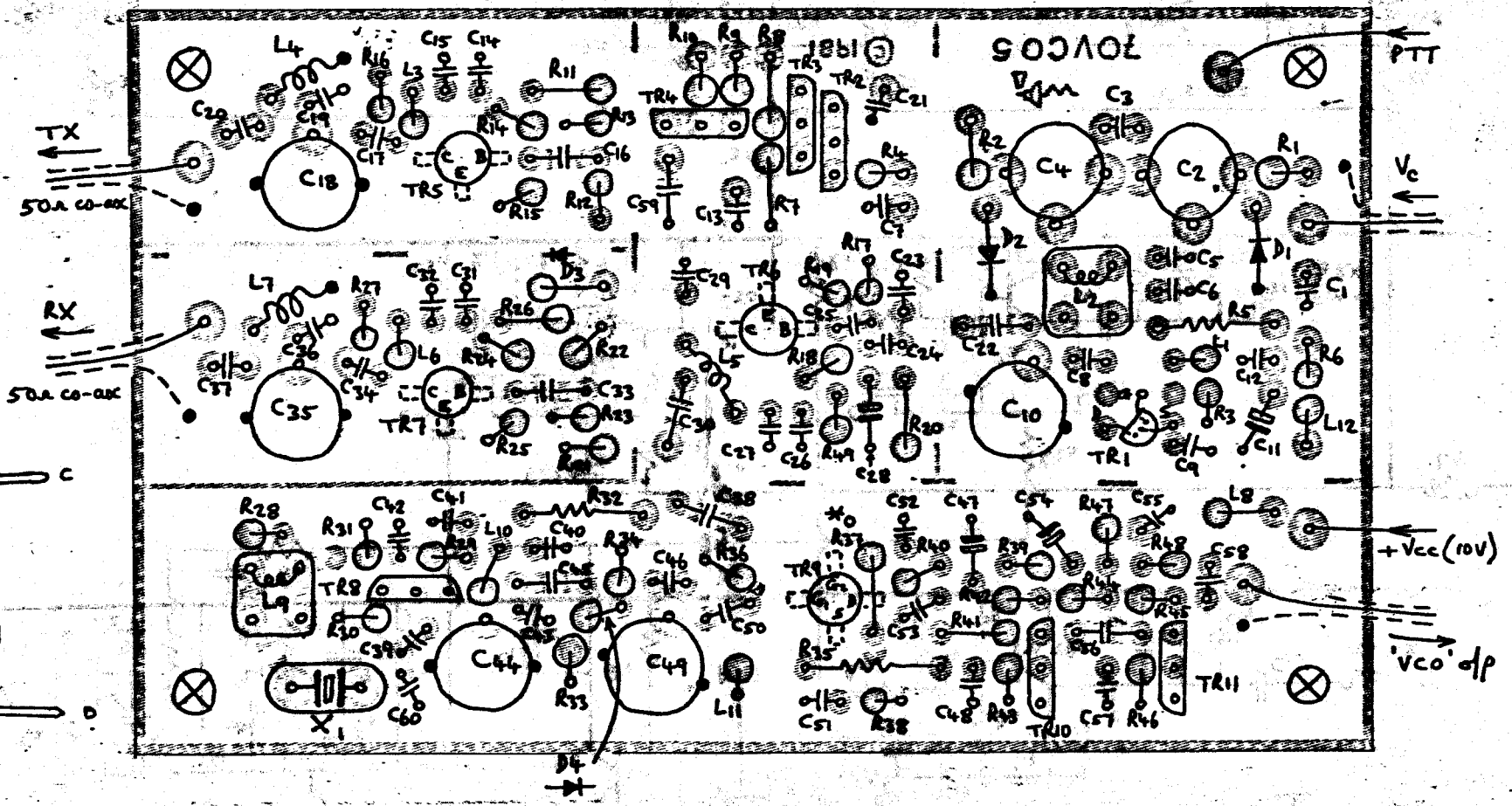
-o- indicates soldered connection to track side

-●- " " " " " ground plane on both sides

o* " wire link soldered to both sides



70VC05 COMPONENT SIDE ©1981

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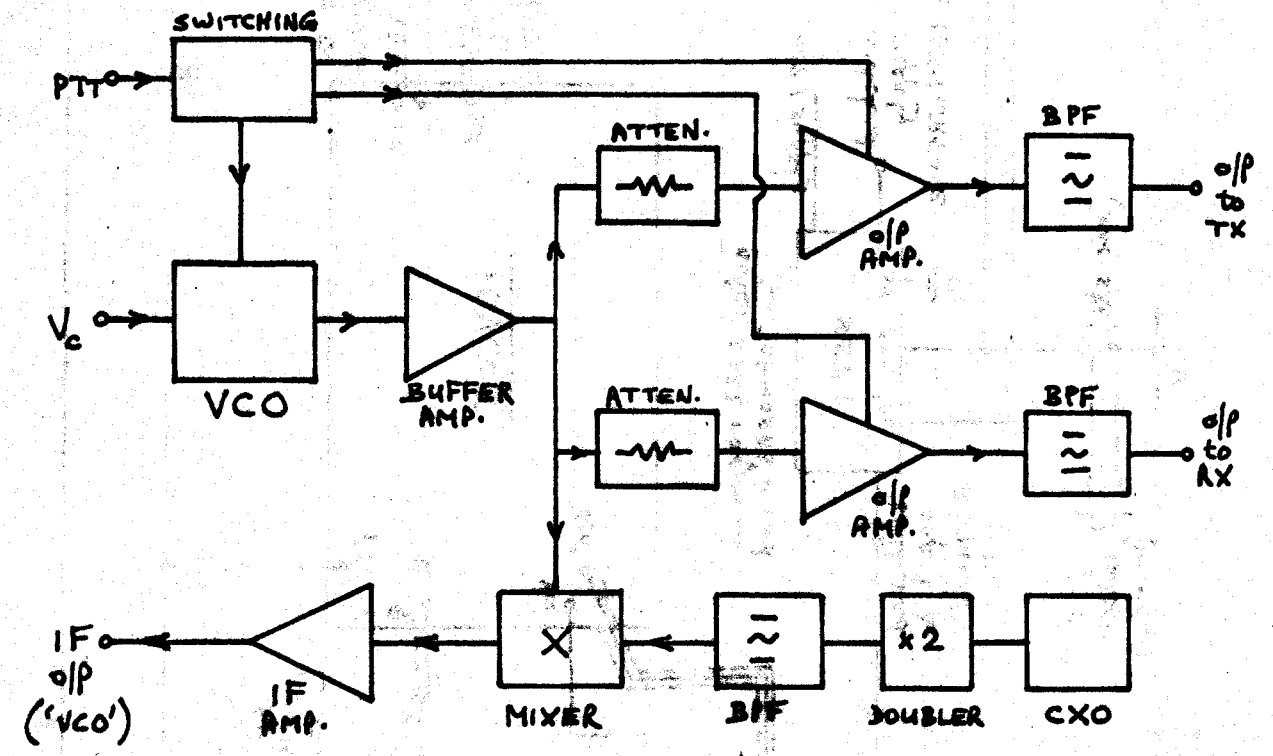
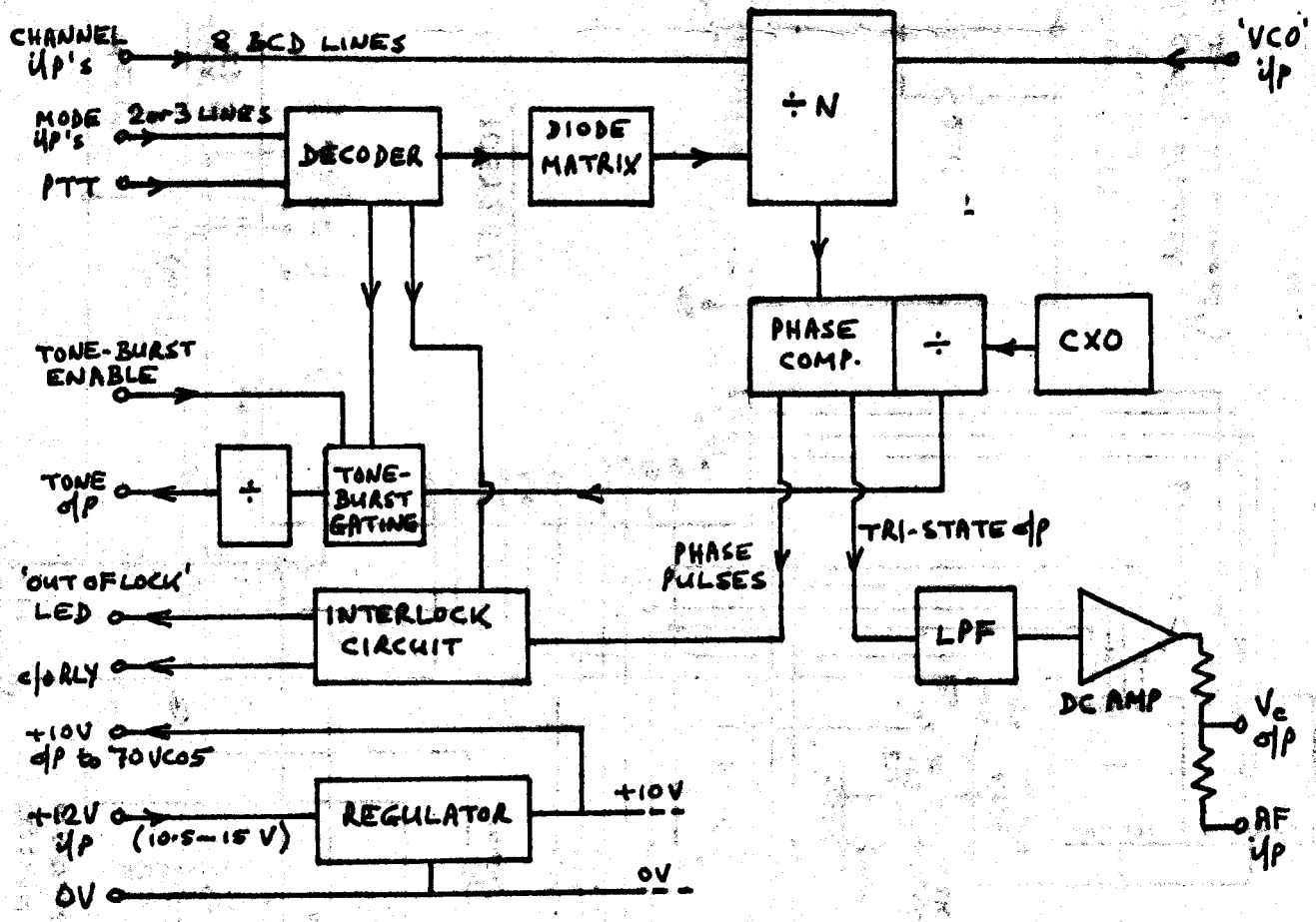


BLOCK DIAGRAM OF 70VC05 BOARD



BLOCK DIAGRAM OF 70SY25B BOARD

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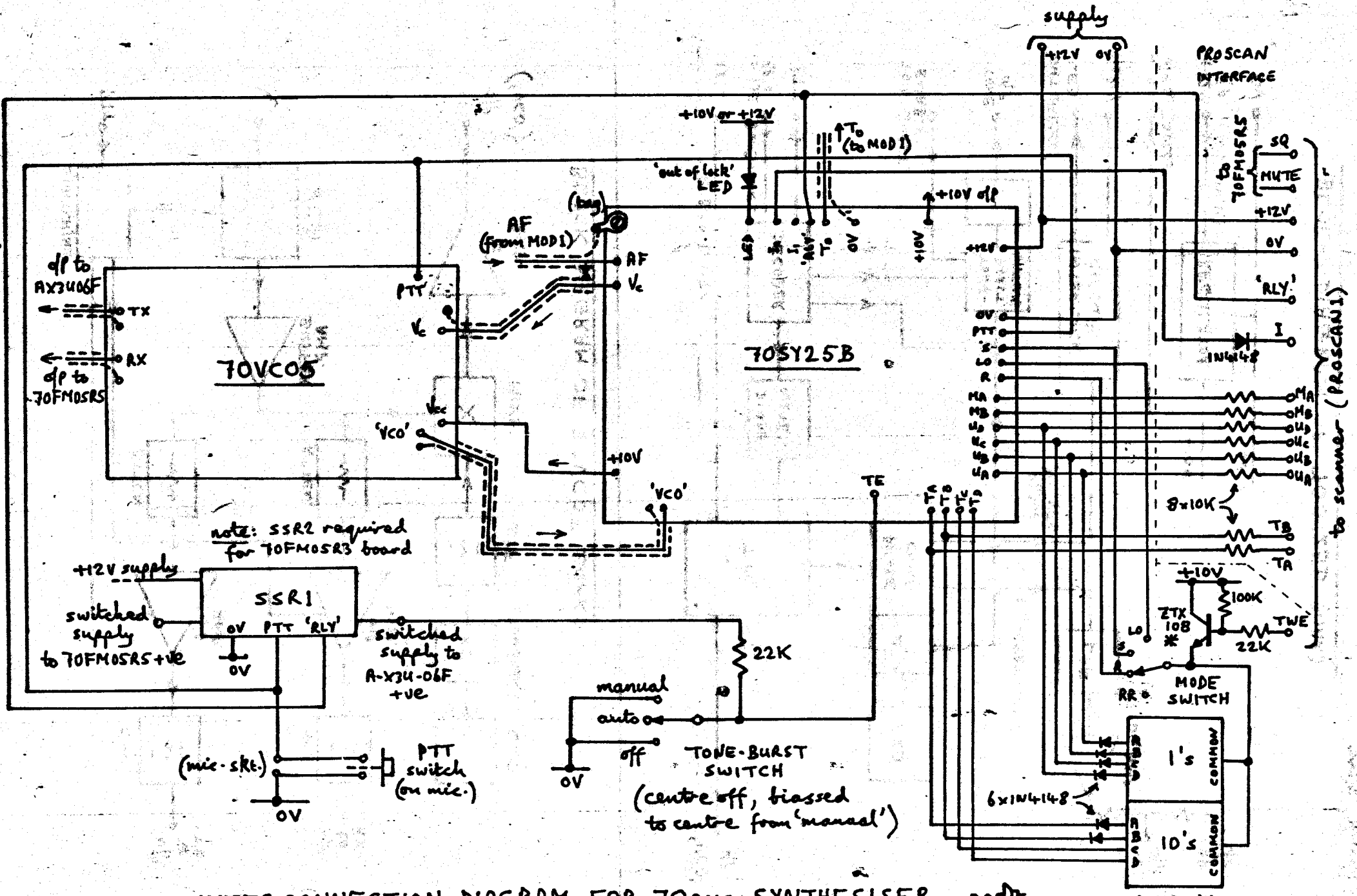
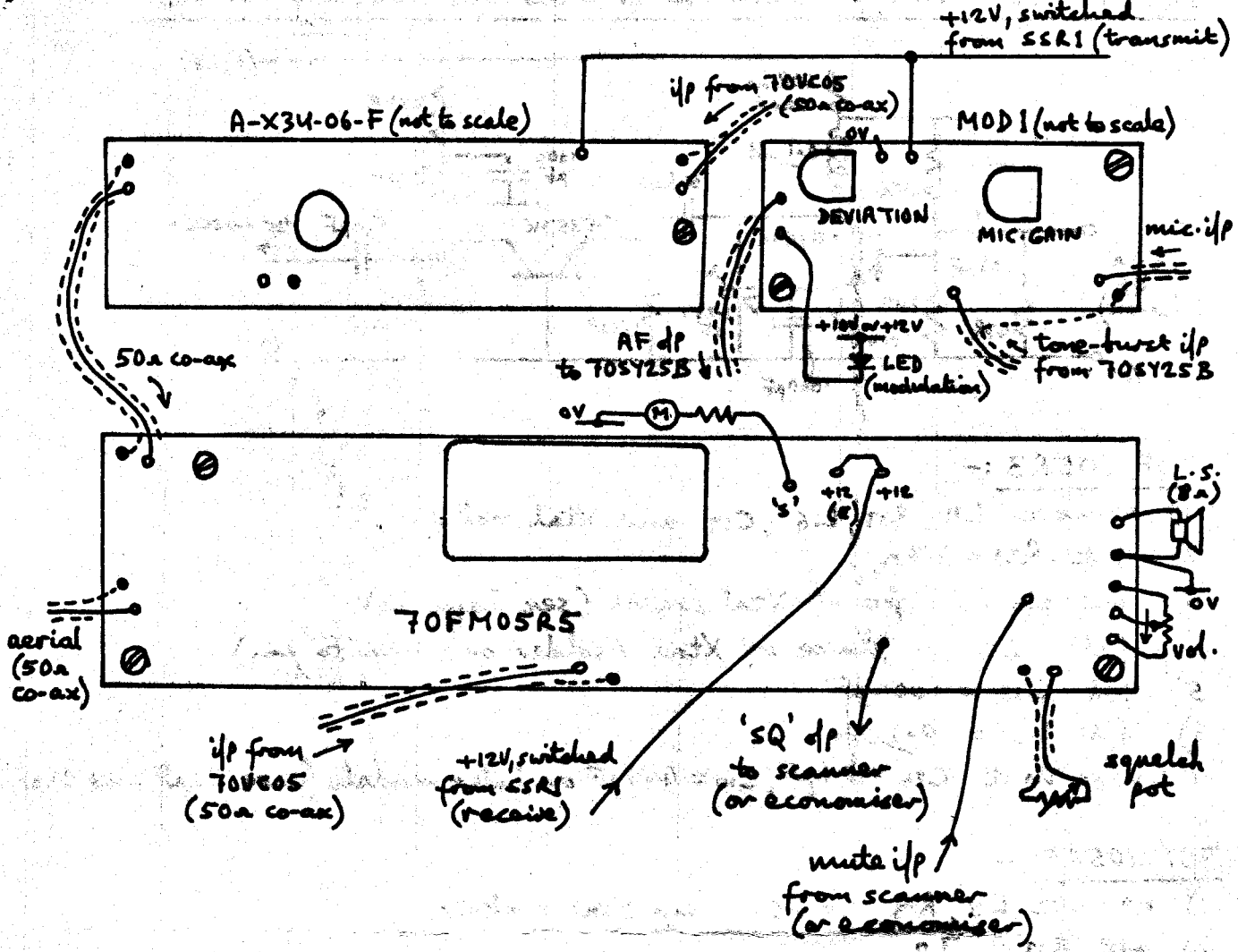


INTERCONNECTION DIAGRAM FOR 70CMS SYNTHESISER

* FOR USE WITHOUT PROSCAN OMIT ZTX108 AND LINK TW COMMON TO +10V LINE

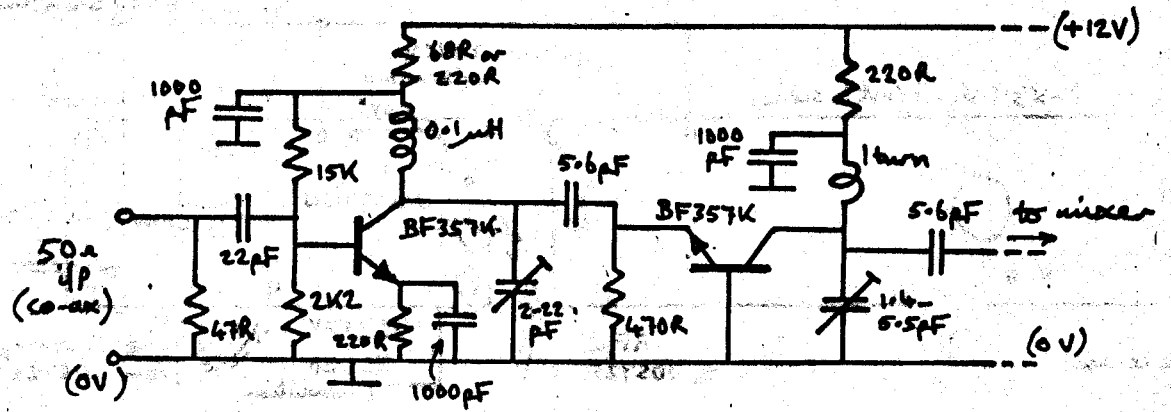


note: with earlier receiver board (i.e. 70FM05R3) the SSR2 board is required — '+12V RX' on the receiver board connects to the extra terminal on the SSR2 while '+12V TX' connects to the switched supply to the A-X34-06-F and MOD1 boards. (The SSR2 takes the place of the SSR1 in the synthesiser interconnection diagram.)

See separate sheet for details of conversion of receiver board for external oscillator drive.

INTERCONNECTION DIAGRAM FOR RECEIVER, TRANSMITTER & MODULATOR IN 70CMS SYNTHESISED TRANSCEIVER

70FM05R series — conversion to external oscillator drive



70FM05R3 :-

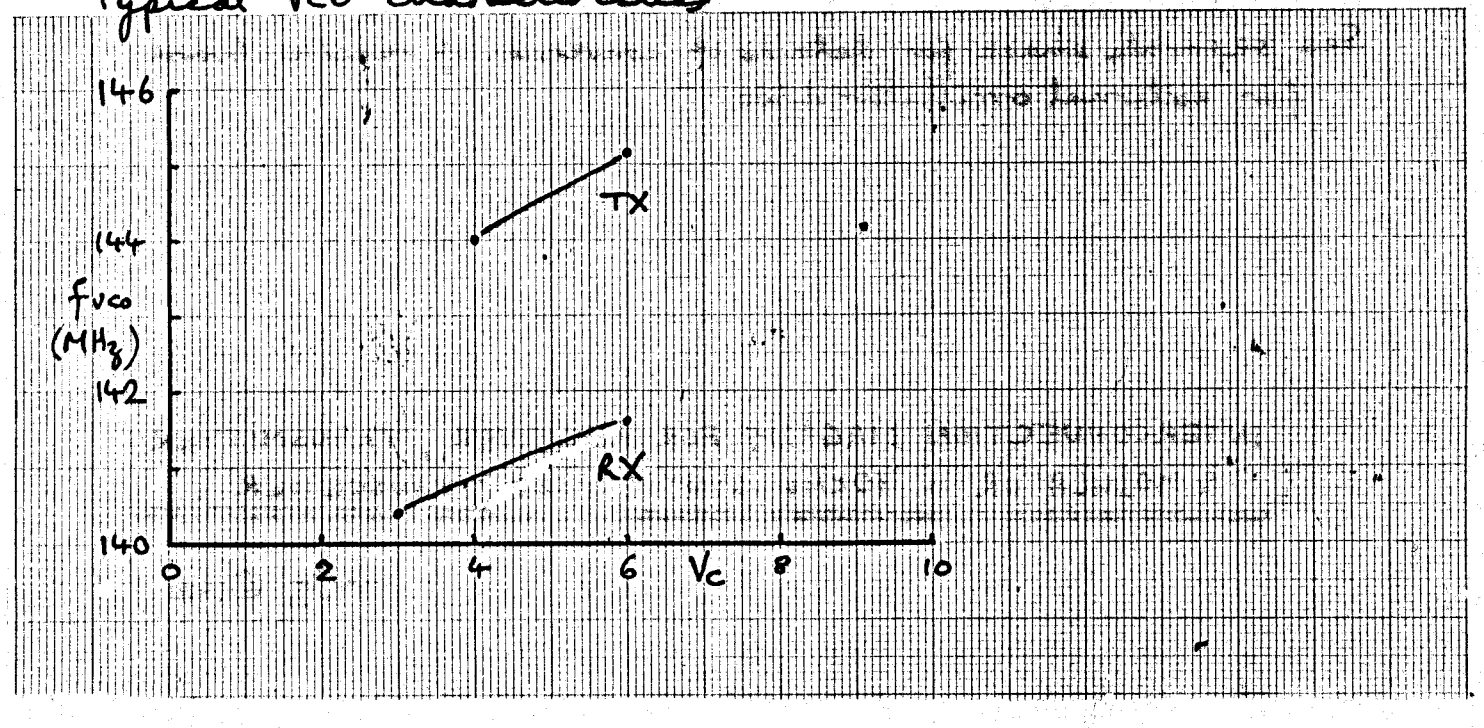
1) remove L9, R33, L6, C19 and Xtal sockets.
2) fit R33 = 47Ω
3) fit pin in place of Xtal socket (see layout)
4) fit 22pF in place of Xtal (solder one end to pin)
5) fit C19 = 1000pF
6) fit L6 = 0.1μH

note also that C24 = 5.6pF, C10 = 4.7pF on later models (were 15pF and 33pF)

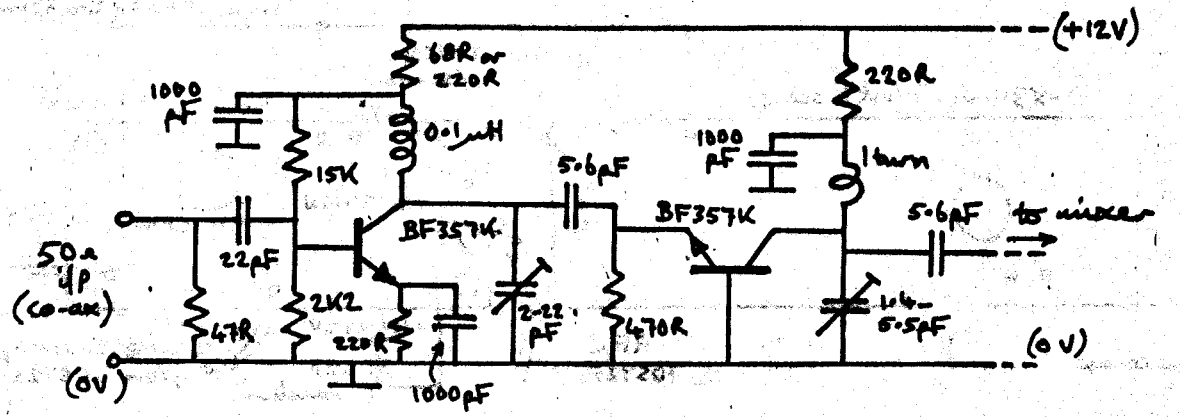
70FM05R5 :-

1) remove L8, R13, L9, C19 and Xtal sockets.
2) fit R13 = 47Ω
3) fit pin in place of Xtal socket (see layout)
4) fit 22pF in place of Xtal (solder one end to pin)
5) fit C19 = 1000pF
6) fit L9 = 0.1μH

Typical VCO characteristics



70FM05R series — conversion for external oscillator drive



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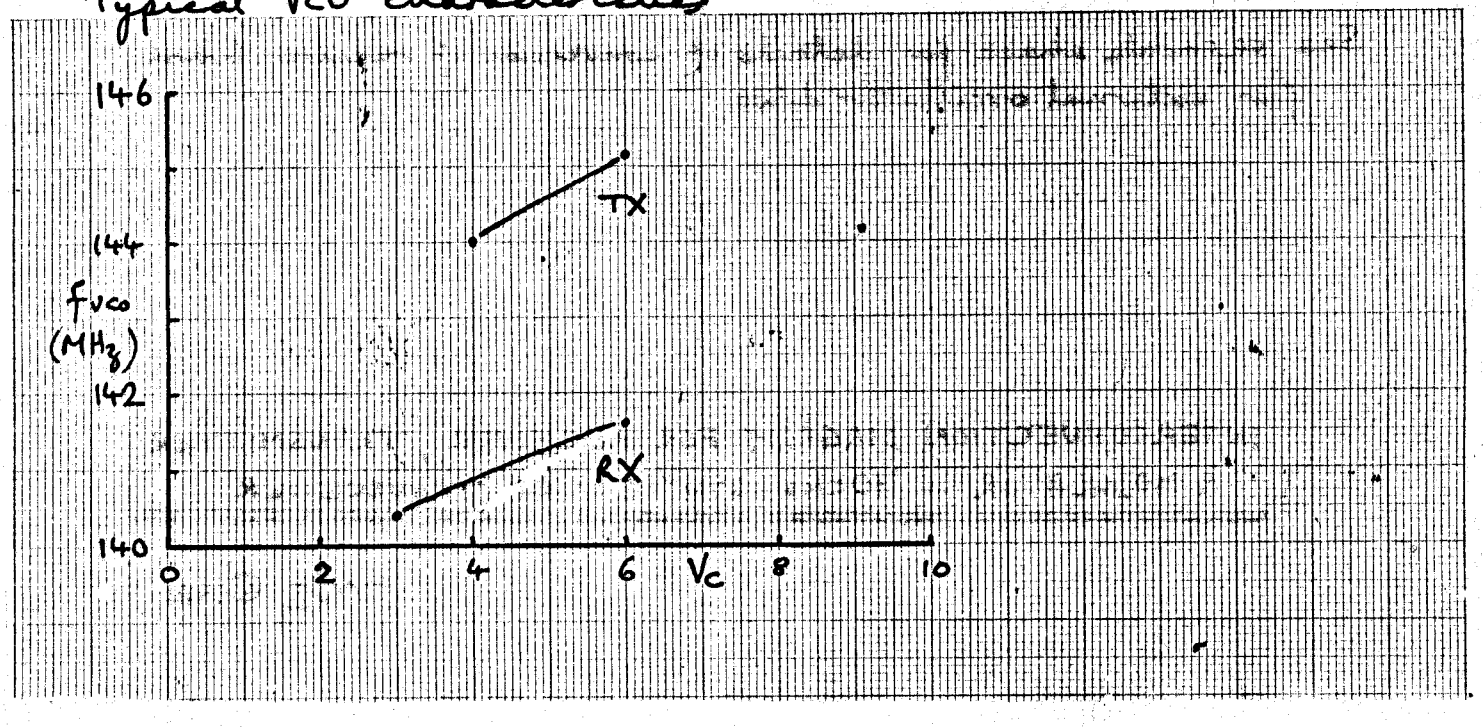


70FM05T3/70FM05T4: modifications for synthesiser use.

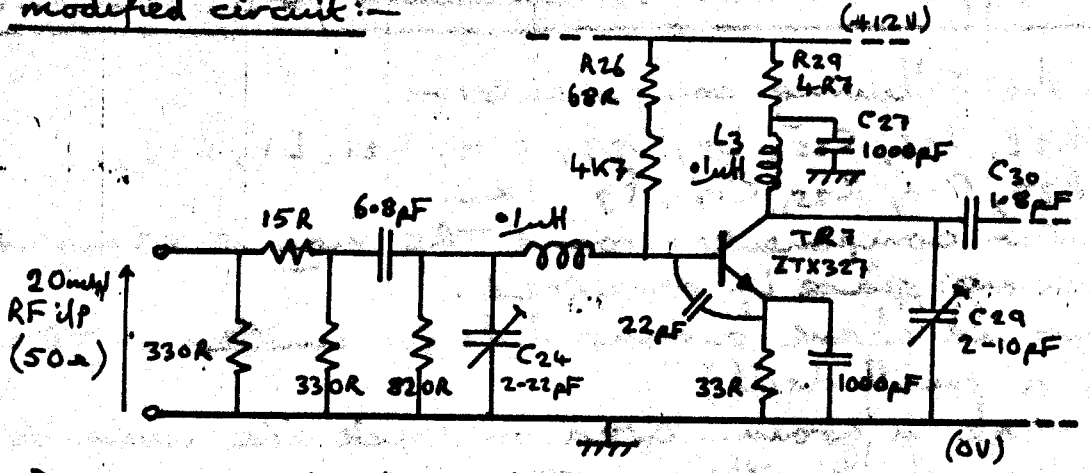
1) Remove the following components:—
   TR7, R_{28}, C_{26}, C_{25}, L_2, C_{23}, C_{22}, C_{21}, L_1, C_{18},
   TR6, R_{27}, C_{20}, R_{25}, C_{17}, P_3, TR4.
   Oscillator components around TR5 may be removed to create more space if required.
2) Clear ground plane around hole for emitter of TR7 (use a small drill.)
3) Make break in ground area on track side where it connects to the emitter of TR7
4) Refit TR7 in its original position.
5) Fit 5 resistors and 1 inductor on component side (see layout.)
6) Fit 3 capacitors, 1 resistor, wire link and 2 pins on track side (see layout.) Solder earthy pin to ground plane as well.

Testing:

Connect drive source to input (20 mW nominal) at 144MHz and adjust trimmer C24 for maximum output power into a 50Ω load. This should be 500 mW or more. Check adjustment of all other trimmers.

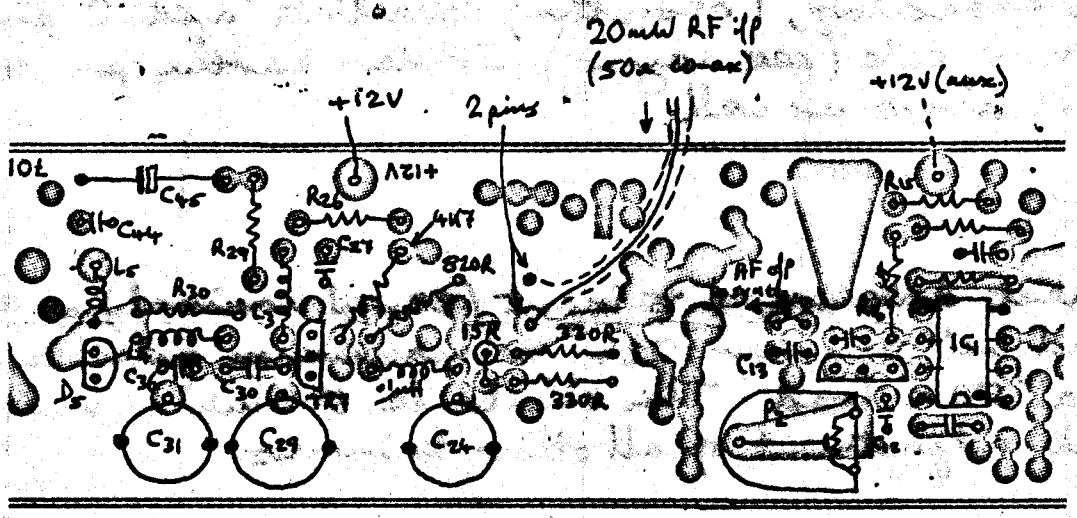
Note: The AF output is taken from P_2 via C13. R17 is normally a wire link which makes a convenient point for connecting an audio output lead. This output drives the AF input on the 70SY25B board.

modified circuit:—



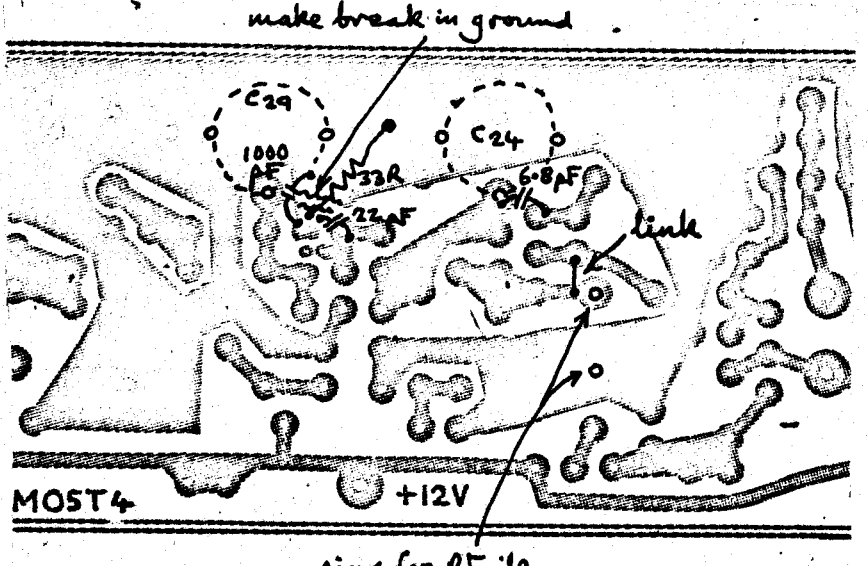
P_3 and TR4 should be removed from circuit (see text for full list of modifications.)

AF output is taken from junction of C_{13}, R_{17} (wire link) and R_{18}. (R_{18} need not be removed.)



COMPONENT SIDE

NOTE: Ground plane must be cleared around emitter lead of TR7



70SY25B o/p FREQUENCIES

TRANSMIT	RR	R	S	LO	RECEIVE	RR	R	S	LO	
0	144·3333	144·8667	144·3333	144·0000	0	144·3000	140·7667	140·7667	140·4333	0
1	·3417	·8750	·3417	·0083	1	·3083	·7750	·7750	·4417	1
2	·3500	·8833	·3500	·0167	2	·3167	·7833	·7833	·4500	2
3	·3583	·8917	·3583	·0250	3	·3250	·7917	·7917	·4583	3
4	·3667	·9000	·3667	·0333	4	·3333	·8000	·8000	·4667	4
5	·3750	·9083	·3750	·0417	5	·3417	·8083	·8083	·4750	5
6	·3833	·9167	·3833	·0500	6	·3500	·8167	·8167	·4833	6
7	·3917	·9250	·3917	·0583	7	·3583	·8250	·8250	·4917	7
8	·4000	·9333	·4000	·0667	8	·3667	·8333	·8333	·5000	8
9	·4083	·9417	·4083	·0750	9	·3750	·8417	·8417	·5083	9
10	·4167	·9500	·4167	·0833	10	·3833	·8500	·8500	·5167	10
11	·4250	·9583	·4250	·0917	11	·3917	·8583	·8583	·5250	11
12	·4333	·9667	·4333	·1000	12	·4000	·8667	·8667	·5333	12
13	·4417	·9750	·4417	·1083	13	·4083	·8750	·8750	·5417	13
14	·4500	·9833	·4500	·1167	14	·4167	·8833	·8833	·5500	14
15	·4583	·9917	·4583	·1250	15	·4250	·8917	·8917	·5583	15
16	·4667	145·0000	·4667	·1333	16	·4333	·9000	·9000	·5667	16
17	·4750	·0083	·4750	·1417	17	·4417	·9083	·9083	·5750	17
18	·4833	·0167	·4833	·1500	18	·4500	·9167	·9167	·5833	18
19	·4917	·0250	·4917	·1583	19	·4583	·9250	·9250	·5917	19
20	·3333	144·8667	·5000	·1667	20	·3000	·7667	·9333	·6000	20
21	·3417	·8750	·5083	·1750	21	·3083	·7750	·9417	·6083	21
22	·3500	·8833	·5167	·1833	22	·3167	·7833	·9500	·6167	22
23	·3583	·8917	·5250	·1917	23	·3250	·7917	·9583	·6250	23
24	·3667	·9000	·5333	·2000	24	·3333	·8000	·9667	·6333	24
25	·3750	·9083	·5417	·2083	25	·3417	·8083	·9750	·6417	25
26	·3833	·9167	·5500	·2167	26	·3500	·8167	·9833	·6500	26
27	·3917	·9250	·5583	·2250	27	·3583	·8250	·9917	·6583	27
28	·4000	·9333	·5667	·2333	28	·3667	·8333	141·0000	·6667	28
29	·4083	·9417	·5750	·2417	29	·3750	·8417	·0083	·6750	29
30	·4167	·9500	·5833	·2500	30	·3833	·8500	·0167	·6833	30
31	·4250	·9583	·5917	·2583	31	·3917	·8583	·0250	·6917	31
32	·4333	·9667	·6000	·2667	32	·4000	·8667	·0333	·7000	32
33	·4417	·9750	·6083	·2750	33	·4083	·8750	·0417	·7083	33
34	·4500	·9833	·6167	·2833	34	·4167	·8833	·0500	·7167	34
35	·4583	·9917	·6250	·2917	35	·4250	·8917	·0583	·7250	35
36	·4667	145·0000	·6333	·3000	36	·4333	·9000	·0667	·7333	36
37	·4750	·0083	·6417	·3083	37	·4417	·9083	·0750	·7417	37
38	·4833	·0167	·6500	·3167	38	·4500	·9167	·0833	·7500	38
39	·4917	·0250	·6583	·3250	39	·4583	·9250	·0917	·7583	39
40	·3333	144·8667	·6667	·0000	40	·3000	·7667	·1000	·4333	40
	RR	R	S	LO		RR	R	S	LO	

7054258 I.F. FREQUENCIES MODIFIED — SEE SPECIAL NOTES

TRANSMIT	RR	R	S	LO	RECEIVE	RR	R	S	LO	
0	5.5750	6.1083	5.5750	5.2417	0	2.5417	2.0083	2.0083	1.6750	0
1	5.5833	6.1167	5.5833	5.2500	1	2.5500	2.0167	2.0167	1.6833	1
2	5.5917	6.1250	5.5917	5.2583	2	2.5583	2.0250	2.0250	1.6917	2
3	5.6000	6.1333	5.6000	5.2667	3	2.5667	2.0333	2.0333	1.7000	3
4	5.6083	6.1417	5.6083	5.2750	4	2.5750	2.0417	2.0417	1.7083	4
5	5.6167	6.1500	5.6167	5.2833	5	2.5833	2.0500	2.0500	1.7166	5
6	5.6250	6.1583	5.6250	5.2917	6	2.5917	2.0583	2.0583	1.7250	6
7	5.6333	6.1667	5.6333	5.3000	7	2.6000	2.0667	2.0667	1.7333	7
8	5.6417	6.1750	5.6417	5.3083	8	2.6083	2.0750	2.0750	1.7417	8
9	5.6500	6.1833	5.6500	5.3167	9	2.6167	2.0833	2.0833	1.7500	9
10	5.6583	6.1917	5.6583	5.3250	10	2.6250	2.0917	2.0917	1.7583	10
11	5.6667	6.2000	5.6667	5.3333	11	2.6333	2.1000	2.1000	1.7667	11
12	5.6750	6.2083	5.6750	5.3417	12	2.6417	2.1083	2.1083	1.7750	12
13	5.6833	6.2167	5.6833	5.3500	13	2.6500	2.1167	2.1167	1.7833	13
14	5.6917	6.2250	5.6917	5.3583	14	2.6583	2.1250	2.1250	1.7917	14
15	5.7000	6.2333	5.7000	5.3667	15	2.6667	2.1333	2.1333	1.8000	15
16	5.7083	6.2417	5.7083	5.3750	16	2.6750	2.1417	2.1417	1.8083	16
17	5.7167	6.2500	5.7167	5.3833	17	2.6833	2.1500	2.1500	1.8167	17
18	5.7250	6.2583	5.7250	5.3917	18	2.6917	2.1583	2.1583	1.8250	18
19	5.7333	6.2667	5.7333	5.4000	19	2.7000	2.1667	2.1667	1.8333	19
20	5.5750	6.1083	5.7417	5.4083	20	2.5417	2.0083	2.1750	1.8417	20
21	5.5833	6.1167	5.7500	5.4167	21	2.5500	2.0167	2.1833	1.8500	21
22	5.5917	6.1250	5.7583	5.4250	22	2.5583	2.0250	2.1917	1.8583	22
23	5.6000	6.1333	5.7667	5.4333	23	2.5667	2.0333	2.2000	1.8667	23
24	5.6083	6.1417	5.7750	5.4417	24	2.5750	2.0417	2.2083	1.8750	24
25	5.6167	6.1500	5.7833	5.4500	25	2.5833	2.0500	2.2167	1.8833	25
26	5.6250	6.1583	5.7917	5.4583	26	2.5917	2.0583	2.2250	1.8917	26
27	5.6333	6.1667	5.8000	5.4667	27	2.6000	2.0667	2.2333	1.9000	27
28	5.6417	6.1750	5.8083	5.4750	28	2.6083	2.0750	2.2417	1.9083	28
29	5.6500	6.1833	5.8167	5.4833	29	2.6167	2.0833	2.2500	1.9167	29
30	5.6583	6.1917	5.8250	5.4917	30	2.6250	2.0917	2.2583	1.9250	30
31	5.6667	6.2000	5.8333	5.5000	31	2.6333	2.1000	2.2667	1.9333	31
32	5.6750	6.2083	5.8417	5.5083	32	2.6417	2.1083	2.2750	1.9417	32
33	5.6833	6.2167	5.8500	5.5167	33	2.6500	2.1167	2.2833	1.9500	33
34	5.6917	6.2250	5.8583	5.5250	34	2.6583	2.1250	2.2917	1.9583	34
35	5.7000	6.2333	5.8667	5.5333	35	2.6667	2.1333	2.3000	1.9667	35
36	5.7083	6.2417	5.8750	5.5417	36	2.6750	2.1417	2.3083	1.9750	36
37	5.7167	6.2500	5.8833	5.5500	37	2.6833	2.1500	2.3167	1.9833	37
38	5.7250	6.2583	5.8917	5.5583	38	2.6917	2.1583	2.3250	1.9917	38
39	5.7333	6.2667	5.9000	5.5667	39	2.7000	2.1667	2.3333	2.0000	39
40	5.5750	6.1083	5.9083	5.2417	40	2.5417	2.0083	2.3417	1.6750	40
	RR	R	S	LO		RR	R	S	LO	