TVRO3 ASSEMBLY AND COMMISSIONING INSTRUCTIONS

PCB. ASSEMBLY

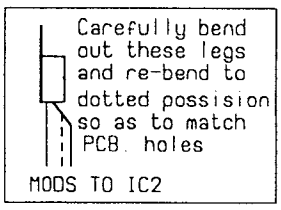
Before inserting component onto the PCB. fit the module to the PCB. and decide on the fixing method to be employed to mount it in an enclosure. The threaded 'F Type' connector on the module is the signal input. It could be arranged to protrude from a hole in the case or, via a short length of co-ax from the 'F' type to a panel connector. Should a securing nut be required the thread on the 'F' connector is 9.5mm. This is the same size as often found on rotary switches and pots.

Due to manufacturing tolerances the module pins may require slight bending to enable it to fit the PCB. This is best achieved with a pair of fine snipe nose pliers. A little perseverance is required to fit it. As no components are fitted do not worry to much about flexing the board though it is recommended that flexing is kept to a minimum. At this point the module may be soldered or left till latter. Solder all the lugs to the board. The wire at the rear of the module should connect to the point marked 'module output'.
Due to the handling of the PCB. during this process natural oils and perspiration from your hands may get on the PCB. It is worthwhile giving the board a clean before soldering.

At each corner of the PCB. is a small hole and a pad. These can be drilled to suit the type of mounting to be employed. The simplest is to employ small nuts, bolts and possibly metal spacers. 2.5mm would be a suitable bolt size. If a metal enclosure is being employed (recommended) ensure that the PCB. is spaced such that there is no chance of the underside shorting out to the case. The outer track of the PCB. is 0v (ground) the use of metal pillars is desirable to give electrical continuity to the case.

There is no specific order, with a couple of exceptions, in which the PCB. needs to be assembled. However it is recommended that resistors and diodes are fitted first. Follow this with IC's, except IC2, 3, and 4 which are best fitted later. Then semiconductors, inductors, connectors and capacitors next, except the large capacitor C7 which is best fitted last. Components should be fitted flush to the PCB. Transistors should stand about 0.25" (6mm) above the PCB. Component positions and values are indicated on the attached component overlay drawing and component listings. Lead outs for the various semiconductors will also be found.
Note C1 must be the 470u 25v cap and not one of the 470u 16v ones used elsewhere.

IC2 and IC3 should be fitted with the heat sinks supplied. These are best fitted to the devices before they are inserted on to the PCB. The flat inside face of the heat sink goes over the metal face of the device. Push the heat sink over the device, with the ramps on the plastic face, until the holes line up and the tab abuts against the stop. Take care not to damage the device leads during this process, particularly with IC2. A useful tip is to lay the heat sink on it's back on the bench and push the device in with a small screwdriver. IC3 and 4 should be inserted on to the PCB. as far as they will go and stand vertically. Insert IC2 only as far as required to allow soldering.



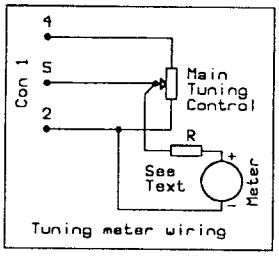
The leads of IC2 require slight modification before insertion. With care and the use of some fine nosed pliers carefully bend out the ends of the three outer leads. Then carefully re-bend back in to give the required lead spacing.

R17 controls the FSD. (full scale deflection) of the signal strength meter which may be fitted if required. It's value is calculated for a 100uA meter movement. Other value movements could be used but it is not advised to go greater than 500uA. To calculate R17 for different movements.
R17 = 2.7 divided by the FSD of the movement.
i.e. For 50uA FSD. R17 = 2.7 divided by 0.00005 = 54K.

Once all the components are mounted double check that the assembly is correct and all connections are correctly soldered.

CONTROLS.

Layout the front panel to suit your own style. A ten turn pot is best for the main tuning control, either with a dial mechanism or simply a knob. Alternatively a standard carbon pot may be used with a reduction drive or simply a large knob



A tuning indicator meter may be fitted if required. It should have a sensitivity of 1mA or greater. A series resistor will be required. The value of which can be calculated by R = 18 divided by the FSD current of meter. Alternatively a 470K pre-set could be used and adjusted for meter FSD. with the main tuning control at max. frequency.
The calibration of a tuning meter is best done in conjunction with a calibrated signal generator or some other signal of known frequency.

Audio tuning, video gain and audio gain are single turn carbon pots. Either of them could, if required, combine a power on/off switch for the 12v supply. A logarithmic pot is best suited for the volume, though not essential.

The LNB. supply selector switch could be a 3 way rotary or a centre off toggle. The signal finder switch needs to be closed to enable the function. Audio squelch needs to be closed to defeat the audio squelch. Video polarity switch is open for positive modulation.

Use miniature screened cable for the video output. Long video cable runs should be in 75Ω co-ax and terminated with 75Ω. The volume control need not be wired in screened cable unless it's length is in excess of about 6" in which case there is a chance of interference being picked up. If screened cable is used for the volume control the screen should connect to pin 12.

It is best if the wiring to the LNB. supply switch is kept separate and not tied in with other cables as under certain circumstances noise spikes from the switch mode power supply may be present on it. These could possibly be induced into cables running in close proximity. Such interference could result in slight patterning. If possible keep cables clear of L1 and L2 which can also induce stray signals.

If a low level audio output is required, it may be obtained from the connection to pin 8 of Con 3 (volume control feed)

If required for peace of mind a 1 amp fuse may be fitted in the supply line. A diode, D2, is fitted across the supply on the PCB. to protect in case of accidental supply reversal.

CONNECTORS.

Three 0.1" Molex connectors housings and crimps are supplied to facilitate easy connection to the PCB. It is recommended, though not essential that they are used.
Connection may be achieved by crimping with small pliers if a crimping tool is not available. Alternatively the wires may be soldered to them. Avoid excessive solder otherwise they will not fit in the housing. A combination of crimping and soldering can result in a very sound connection. As an aid to soldering a pair of pliers with a rubber band around the handles makes a fine miniature vice. The rubber bands also help prevent the pliers sliding about to much.

Strip the wires back about 0.1" (2.5 - 3mm). Twist and crimp under the tabs near the blade. The tabs at the end should be crimped to the insulation to support the wire.
Once the crimp is securely attached push it firmly down into the correct position in the housing such that the small barb on the back of the crimp locates in the slot in the housing. To remove from the housing, press in the barb with a small screwdriver and gently pull out.

Several spare crimps are supplied.

Miniature stranded cable generally proves more satisfactory than solid types.

TESTING.

One of the main design philosophies was to make setting up and testing as simple as possible and avoid any presets or alignment procedures. All that is required is to double check the work done. Connect the video output to a video monitor or a TV with an A/V input. Connect to a nominal 12v DC supply and switch on.

With the squelch off noise should be heard on the loudspeaker and if the video gain is advanced some noise may be seen on the monitor. If a signal meter is fitted it should indicate about half scale deflection. As the main tuning is altered there may be changes of any screen noise and a possible a change of indication on the signal meter. For piece of mind the LNB supply voltage may be tested. With a voltmeter, connect – to the case of the module and with a short piece of stiff wire (the off cut from a resistor lead is ideal) connect the + to the centre of the F connector. Operating the LNB supply switch should result in readings of approximately 18vDC, 13vDC and 0v.

Switch off and connect to the LNB. or aerial via a suitable pre-amp. At switch on a significant increase in on screen noise should be observed and the signal meter, if fitted, should give full scale deflection. Tune for a signal and check the operation of the video gain control.
Check the audio sub carrier tuning and squelch switch. Operating the Signal finder switch will result in a tone on the loudspeaker. The frequency should increase with signal strength. Check the operation of the +/- mod switch.

GENERAL JOTTINGS

During testing, if faint patenting is noted on the screen remove L2, rotate it through 180° and refit. The faint lines are caused by interference generated from mutual coupling between L1 and L2 in the switch mode PSU. Turning one around alters the mutual magnetic phasing.

Due to the design of the sound IF and demodulator (IC6) the audio may be found at two tuning points. One is the true signal and one is it's image. Obviously select the one which gives best quality.
A characteristic of IC6 is that the greater the deviation of the sub carrier the greater the inherent distortion. Some signals (some excessively deviated satellite channels in particular) despite careful tuning, may show some distortion. Operation of the squelch switch can often resolve the possible problem.

The LNB. switch mode power supply will withstand short term overloads or short circuits. Sustained overloads will cause L1 and L2 to overheat. A short circuit or overload of the LNB supply when switched to the 13v position can cause the 5.6v Zener ZD1 to go short or very leaky. This manifests itself by the inability of a satellite LNB. to switch polarity correctly.

The LNB. power supply is designed to deliver up to 175mA which is adequate for most LNB's. Reducing R2 to 0.5Ω (a second 1Ω in parallel) will allow 250mA to be available. However the PSU will be less tolerant of overloads.

Please be aware that unless the LNB. voltage selector switch is in the OFF position supply voltage is present on the module F connector. Do not connect directly to an antenna or other equipment that presents a DC short across the feeder.

When used for 24CMs ATV a high gain low noise RF pre-amp would be required unless the signal is local.

The two pre-sets within the module are factory aliened by the manufactures, please do not adjust.

TVRO3 COMPONENTS

R1	180R	C1	470u 35v	L1	3m3H
R2	1R	C2	100n	L2	3m3H
R3	120K	C3	100n	L3	12uH
R4	1K	C4	1u 63v	L4	4u7H
R5	1K	C5	2n2	L5	33uH
R6	8K2	C6	1u 63v	IC1	Ua78S40
R7	4R7	C7	2200u 25v	IC2	TDA2003V
R8	1R	C8	100n	IC3	78M05
R9	47R	C9	47n	IC4	78M05
R10	47R	C10	470u 16v	IC5	MC1455
R11	2R2	C11	470u 16v	IC6	TDA7000
R12	100K	C12	470u 16v	IC7	CD4066
R13	10K	C13	100n	IC8	NE592
R14	10K	C14	100n	Q1	BC548
R15	10K	C15	100n	Q2	2N3906
R16	3K3	C16	47n	Q3	BC548
R17	27K	C17	100n	Q4	BC548
R18	100R	C18	1n	Q5	2N3702
R19	56K	C19	47n	Q6	BF244B
R20	47R	C20	10n	Q7	BC548
R21	10K	C21	10n	D1	UF4001
R22	22K	C22	not fitted	D2	1N4001
R23	75R	C23	47n	D3	1N4148
R24	75R	C24	180p		
R25	1K	C25	3n3		
R26	470R	C26	47n	ZD1	5V6 1.3W
R27	1K	C27	330p	CD1	BB809
R28	300R	C28	3n3	CD2	BB809
R29	75R	C29	150p	CON 1	6 WAY 0.1
R30	220R	C30	82p	CON 2	8 WAY 0.1
R31	2K2	C31	220p	CON 3	12 WAY 0.1
R32	1K	C32	100n		
R33	1K	C33	47n		
R34	15K	C34	390p		
R35	3K9	C35	220p		
R36	10K	C36	470u 16v		
R37	10K	C37	470u 16v		
R38	180R	C38	100n		
R39	18K	C39	330n		
R40	47R	C40	47n		
R41	8K2	C41	100n		
R42	8K2	C42	100n		
R43	1K	C43	10uF Tant		
R44	300R	C44	1u 63v		
R45	75R	C45	4n7		
R46	75R	C46	82p		
R47	18R	C47	100u 16v		
R48	75R				
R49	10K sub min				
R50	10K sub min				

The method of marking the ceramic capacitors supplied may vary depending on supplier. Below in brackets are alternative markings that may be found.

82p (82J) 150p (151 n15) 180p(181 n18) 220p(221 n22)

330p(331 n33) 390p(391 n39) 1n(102) 2n2(222) 3n3(332)

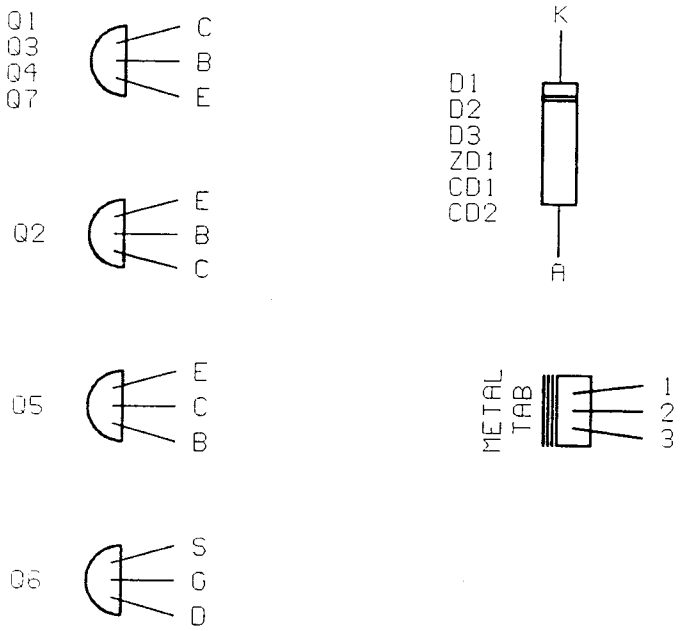
4n7(472) 10n(103) 47n(473) 100n(104) 330n(334)

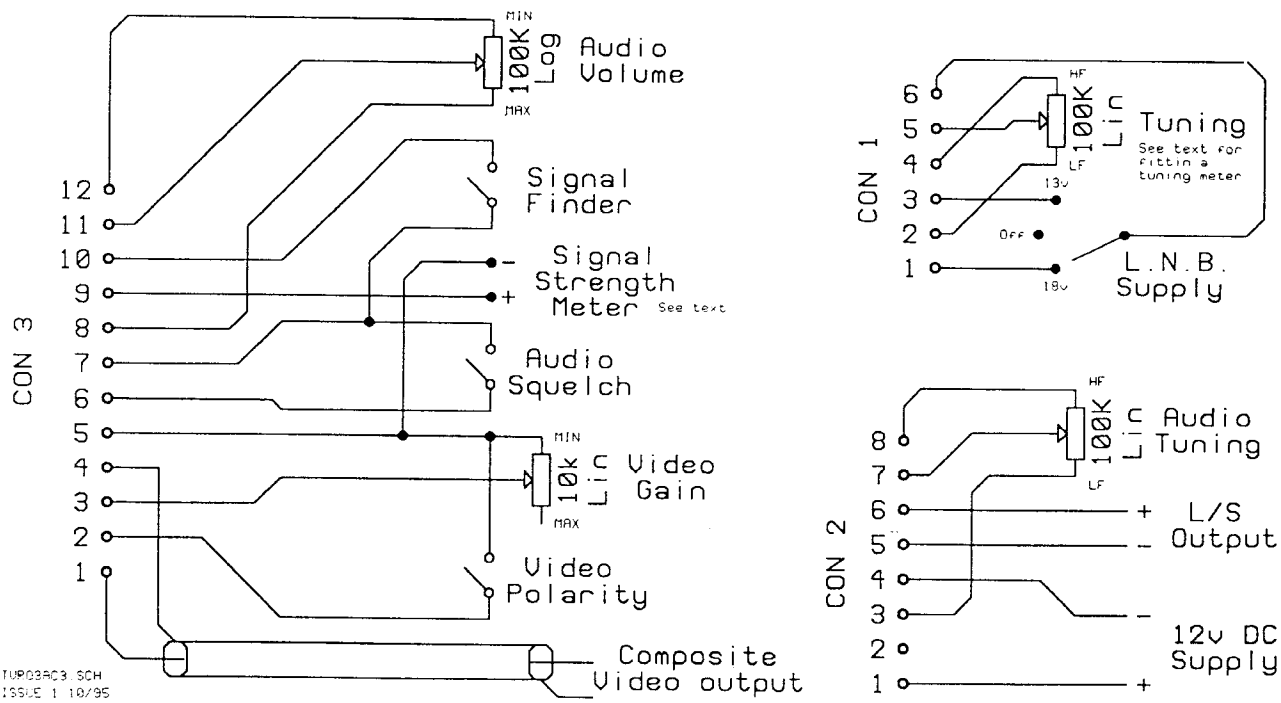
Inductors are marked. 3m3H(332J) 33uH(330J) 12uH(120J) 4u7H(4R7K)

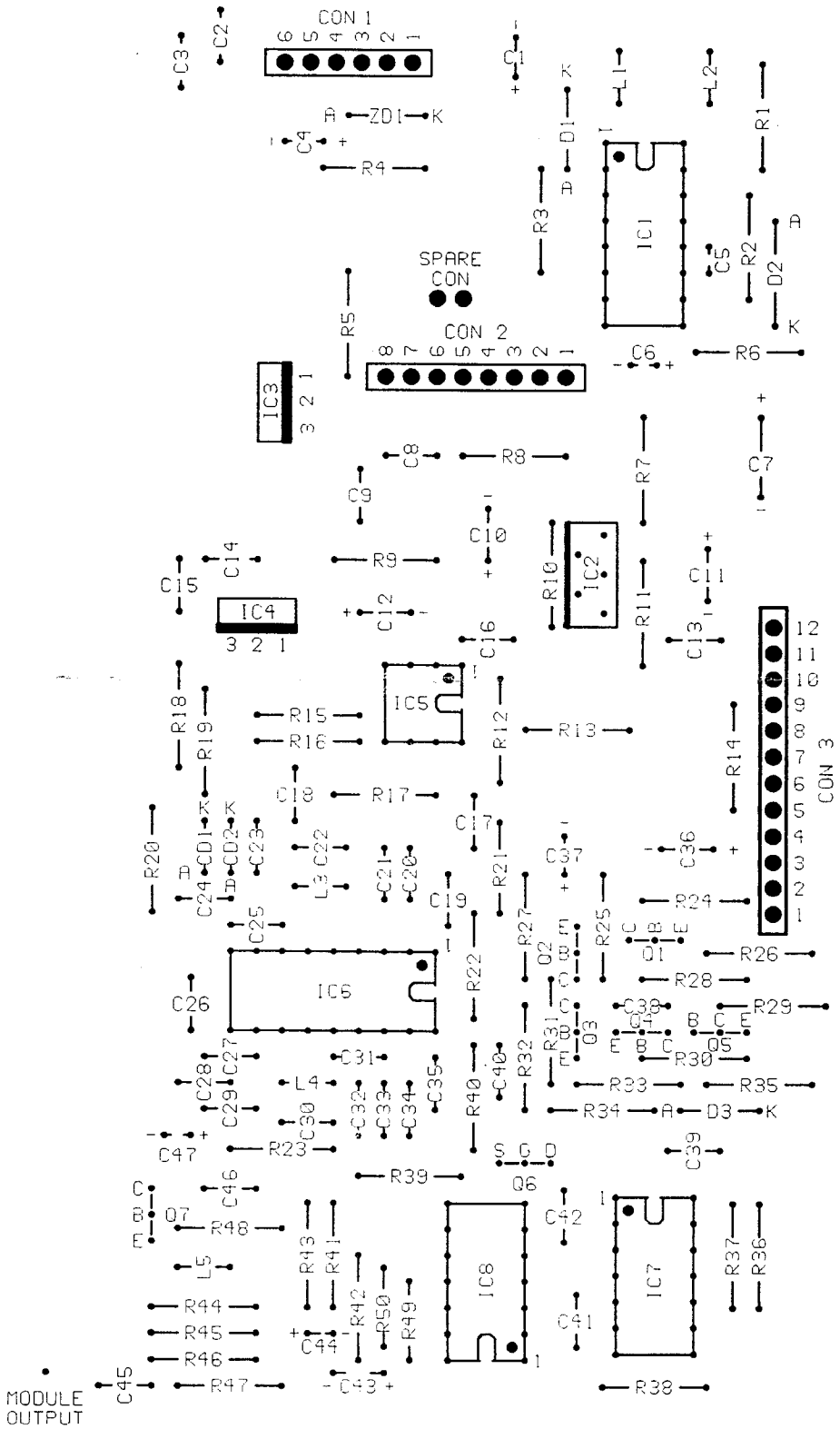
IC5 (MC1455) may be NE555 or LM555 which are equivalents.

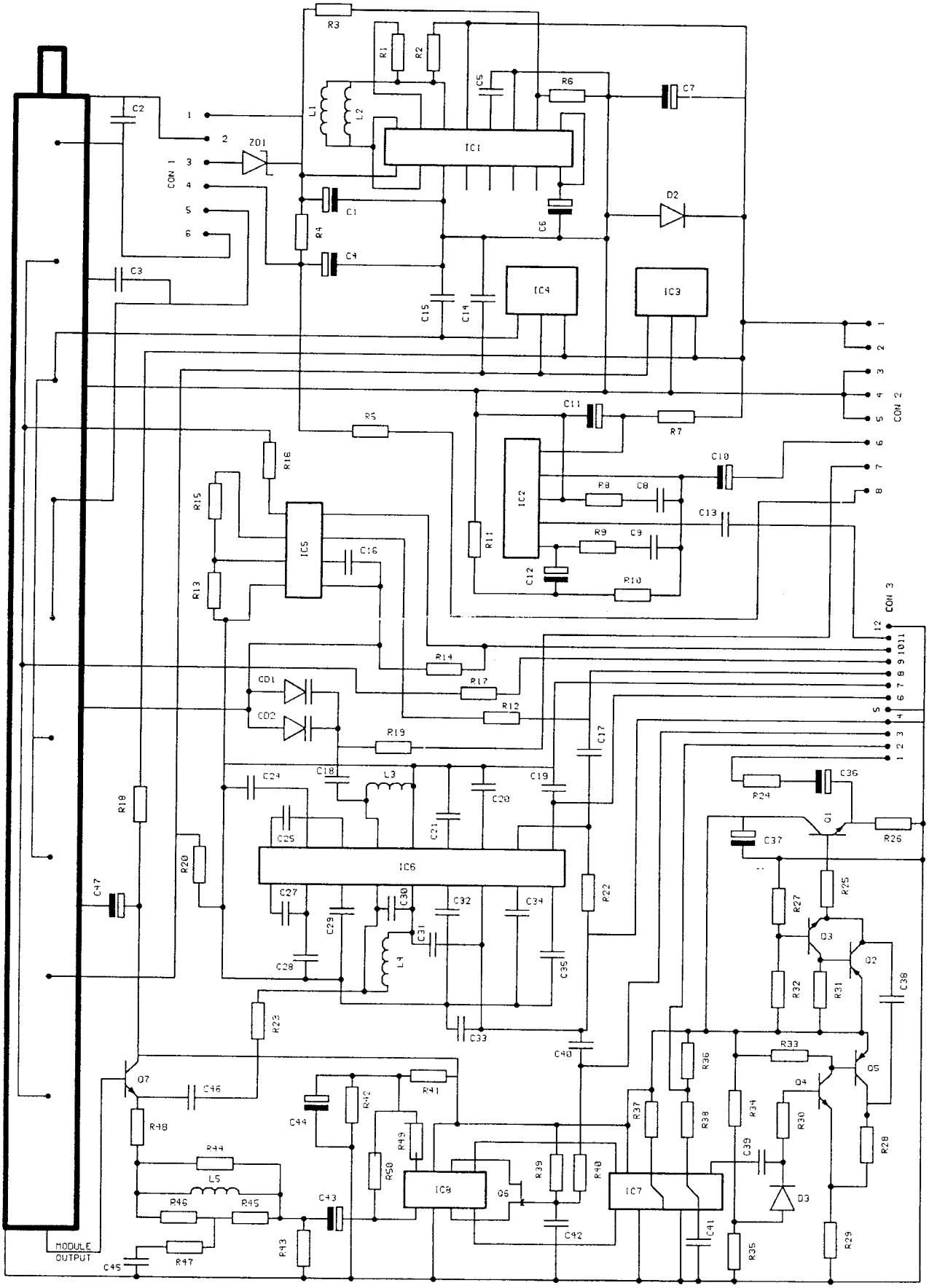
IC3, 4 (78M05) may be marked AN78M05, 7805 or LM340T

D1 (UF4001) Large black with white band
D2 (1N4001) " " " " "
D3 Small red glass body. Black band
ZD1 Large red glass body. Black band.
CD1,2. Small black body. Yellow band.






CON 1
6 5 4 3 2 1
SPARE
CON
CON 2
8 7 6 5 4 3 2 1
IC3
3 2 1
IC4
3 2 1
IC1
IC2
IC5
IC6
IC7
IC8
CON 3
12 11 10 9 8 7 6 5 4 3 2 1
MODULE
OUTPUT


R3
R1
R2
C5
R6
C7
C2
L1
L2
IC1
ZD1
CON 1
C1
R4
C6
D2
C4
C3
C15
C19
IC4
IC9
CON 2
C11
R7
R5
R16
C10
R15
IC2
R8
C8
C13
IC5
C16
R11
R9
C9
C12
R10
R13
CON 3
R14
CD1
R17
CD2
R12
R19
C17
C24
C18
L3
C19
C20
R18
C25
C21
IC6
R20
C47
C27
C30
C32
C34
R22
C29
C31
C28
L4
C35
R23
C33
C40
Q7
C46
R41
C44
R42
R48
R49
R50
R44
L5
R46
R45
C43
IC8
Q6
R39
R40
IC7
C42
C41
R43
C45
R47
MODULE OUTPUT
C36
R24
Q1
C37
R26
R27
R25
Q3
Q2
R32
R31
C38
R33
Q5
Q4
R36
R37
R38
R34
R30
C39
R28
D3
R35
R29

TVRO3 POSSIBLE MODIFICATION

POSSIBLE SLIGHT FINE PATTERNING FROM THE SWITCH MODE POWER SUPPLY.

There may be instances when despite turning round L2 slight fine patterning may still be visible on the screen.

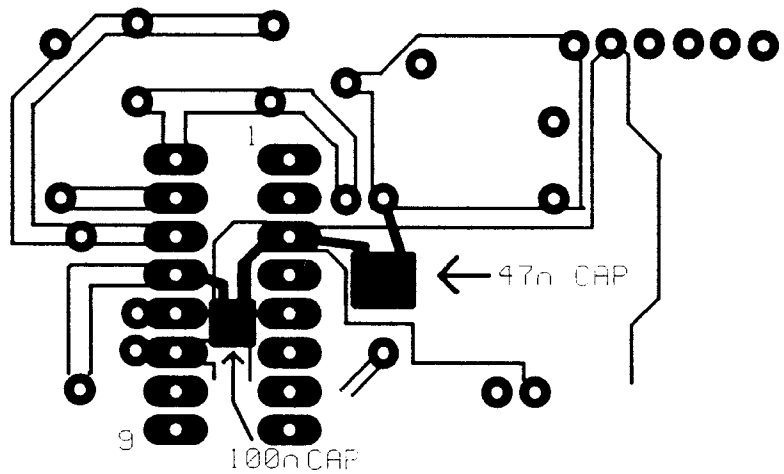
Should this be the case fit two extra capacitors should be fitted to the underside of the PCB in the area of IC1.

The drawing below indicates the correct position of these two caps.

On the underside of the board fit a 47nF ceramic or monolithic capacitor from pin 3 of IC1 to the end of R3 nearest to C1 (470uF 35v).

The second 100nF ceramic or monolithic cap should be fitted again to the underside, from pin 13 to pin 3 of IC1

If required a 47nF 100nF capacitors are available free of charge from Bob Platts G8OZP.



UNDERSIDE VIEW OF PCB IN THE AREA OF IC1

HOW IT WORKS

Incoming RF. in the frequency range of approximately 750 to 1750MHz is mixed within the front section of the module with the signal from the internal local oscillator. This oscillator is tuned by an internal varicap diode supplied with voltage from the main tuning control. The intermediate frequency of 479.5MHz from the mixer is amplified, filtered by a SAW filter and fed to the rear module.

The signal is further amplified and then demodulated to recover the composite video with sound sub carrier. The noise level and the signal level is rectified and used to produce an AGC output. This is fed back to an AGC. attenuator in the front module and via R16 to control the frequency of the signal finder oscillator IC5 and via R17 to drive the signal meter. The voltage on the AGC line reduces with increasing signal. Video output from the module is buffered by Q7.

Video is fed by R48 through a de-emphasis network and via C43 into video amplifier IC8. The potential divider R41 / R42, provide bias for IC8. A varying voltage from R39 / R40 and the video gain control varies the on resistance of Q6. This is connected across the gain select pins of IC8, thereby controlling the gain. The two equal amplitude but anti phase outputs of IC8 are fed to IC7.

IC7 is an analogue switch which selects either of the two inputs depending on the voltage at the junction of R36 / 38. This voltage will be either about 9.5v or 0v depending on the position of the video polarity select switch. The selected video output is fed via C39 to the video amp Q4 / Q5. Potential divider R34 / R35 and D3 provide DC restoration to the signal. The output of Q5 feeds video via C38 to the video clamp Q2 / Q3. This clamps the video syncs to a DC level set by R27 / R32. Q1 is a 75Ω output buffer.

Sound sub carrier is fed via C46 / R23 to the filter C30 / L4 and into IC6. Within IC6 the sub carrier is mixed with a local oscillator, the frequency of which is determined by L3 and the voltage applied to the varicap diodes CD1 / CD2. This voltage is derived from the audio sub carrier tuning control. IC6 contains IF. amplifiers and active filters, a demodulator and a squelch circuit. The output audio from IC6 is fed via C17 to the volume control.

The signal finder oscillator IC5 produces an audio signal the frequency of which depends on C16 / R13 / R15 and the voltage fed from the module AGC line via R16. As this voltage reduces the audio frequency increases The oscillator is enabled or by applying about 4.5v to pin 10 of connector 3 Audio from the oscillator is fed via R12 to the volume control.

Audio from the volume control is fed via C13 to the audio amplifier IC2 which amplifies the signal and feeds it via C10 to the loudspeaker.

The incoming nominal 12v supply is fed via R18 to power the video amplifier stages. IC3 generates a 5v supply for the module and via R20 to power the audio demodulator and signal finder oscillator. The same 5v supply provide a reference for IC4 which provides 10v for the module. R7 feeds the supply voltage to the audio amplifier IC2. The switch mode power supply IC1 and associated components generates 18v. across C1. R4 feeds this voltage to the main tuning control. R5 feeds the audio tuning control. The 18v supply can be fed directly to the module 'F' connector to power LNB's, pre-amps ect. Or it can be fed through ZD1 which drops it to about 13v for polarity switching of LNB's or powering 12v pre-amps ect.