Microvision MTV1

Service Manual and Schematic Diagrams

Compiled in July 2009 by Peter Wisniewski using info provided by Steve Niechcial and Jon Evans

Further material and photos added December 2021 by Giles Read

CONTENTS

GENERAL NOTES

This version of the Service Manual was compiled in December 2021, based squarely on the 2009 work of Peter Wisniewski, Steve Niechcial and Jon Evans, to whom I owe a huge debt of gratitude.

The Sinclair MTV1 (also written MTV-1) was designed and manufactured in the late 1970s. It was a remarkable achievement, being the world's first 'pocketable' TV and also the world's first multi-standard TV that would work just about anywhere. Unfortunately it proved to be a hard sell, perhaps due to its cost. Production soon ceased, to be replaced by the MTV1B (MTV-1B), a cost-reduced, single standard, UHF-only set that used a number of the same parts but retailed for half the price of the MTV1.

The MTV1 had tuners for VHF (bands I and III) and UHF, sound demodulators for 4.5, 5.5 and 6MHz and would work with 50Hz or 60Hz TV systems. Power was supplied by a non-user-replaceable integral 5V nickel-cadmium (Ni-Cd) rechargeable battery (comprising four AA cells crammed into odd nooks and crannies).

At the time of writing, all Sinclair MTV1s are approaching 50 years of age. The fact that any of them still work at all is remarkable. The internal Ni-Cd batteries have all long since ceased to function and, in many cases, have leaked corrosive chemicals that have damaged the circuit board(s). In some cases this can be sufficiently bad that the set is really a write-off, but in others the damage is relatively minor. Either way, it is probably a good idea to remove the Ni-Cd batteries, handing them with care and disposing of them according to local regulations, remembering that they contain toxic cadmium. Although it is possible to replace the batteries with Ni-MH equivalents, this may not be a wise action. The internal charging circuit is somewhat primitive – a string of resistors – and there is no overcharge prevention mechanism. This was fine for Ni-Cd cells, which weren't particularly troubled by prolonged overcharging, but Ni-MH cells are noticeably less forgiving in this respect. Given that the MTV1 is a strictly analogue-only set, predating digital transmissions by decades, there is very little chance of a refurbished set being taken out and used as originally intended, ie to receive off-air signals while out and about.

The cramped construction necessitated by the small case meant that some of the clearances between parts wasn't as good as one might prefer. Ordinary PVC insulating tape was used to mitigate this and there is a surprising amount of it inside each set. Additionally, two areas received plastic insulation sheet (notably beneath the EHT section) and this must be put back when reassembling the set.

With the passage of time, the adhesive on the insulation tape has deteriorated. As the design depends on its insulating properties it is sensible to renew it when refurbishing a set. You may want to consider using Kapton® or similar high performance tape instead of PVC.

TECHNICAL DESCRIPTION

System

The Sinclair Microvision MTV1 uses conventional television superheterodyne conversion to convert RF signals into video. Intercarrier sound is taken off after video detection. All circuitry was designed by Sinclair Radionics Ltd staff in England.

Power

The Microvision is powered by four internal nickel cadmium (Ni-Cd) 500mAh rechargeable cells giving approximately 4 hours viewing time. The set can be recharged using the adaptors supplied in about 14 hours. The set can also be powered by the mains adaptor/charger an external 6V source, or an external 12V source eg automobile cigar lighter socket.

Dismantling Instructions

Remove the UHF aerial by unscrewing the two clips securing it to the inner aerial arms.

Remove the VHF aerial by pulling gently upwards vertically. Be very careful of the VHF aerial plastic trim, which can easily be damaged. With sets now uniformly over 40 years old, the aerial can be very reluctant to come out. It can be started by inserting something matchstick-size between the bottom of the rod by the hinge and pressing the aerial rod down, thus levering its base out of the socket. Once it has started moving it can normally be removed by straightening the hinge and pulling the assembly by hand.

The aerial rod’s black plastic surround (where it enters the chassis) must be removed. Gently prise it out, remembering that it was considered fragile even in 1977.

Remove the two screws from the back cover (over the controls) and remove this cover. Remove the two screws to the external VHF aerial input and the 6V – 12V sliding cover.

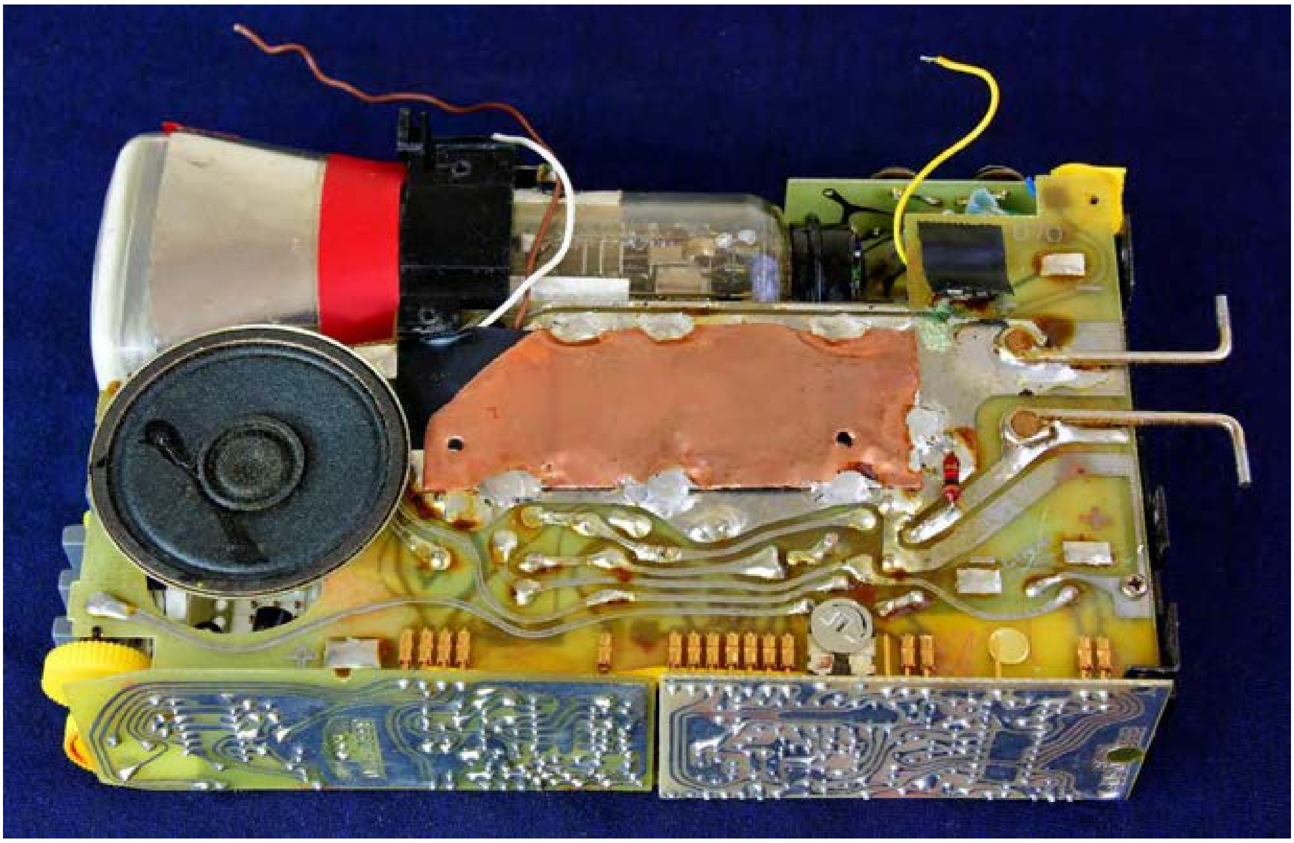
Remove the two screws from the rear casing (above controls) and the two screws underneath the case at the front. There are two more screws to remove, under the FCC label. The adhesive on the label has become less effective with time. If the label is intact it is worth gently peeling it to reveal the screw heads, rather than just shoving a screwdriver through the label.

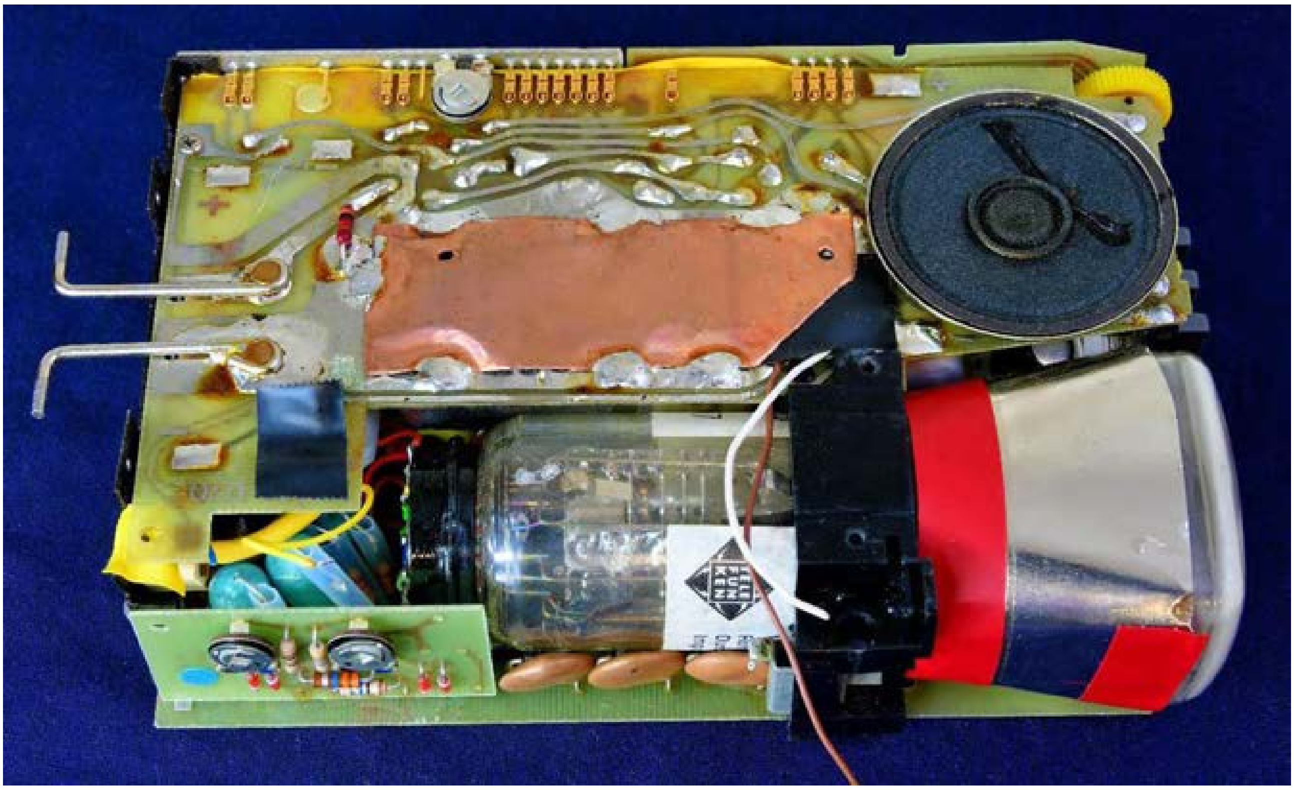
The outer case will now slide back, leaving the chassis exposed. Remove the two screws from the top and two from the bottom of the metalwork holding the front panel in place. In some models there is a screw securing the audio board to this metalwork, which also has to be removed. This panel and metalwork can now be slid forward.

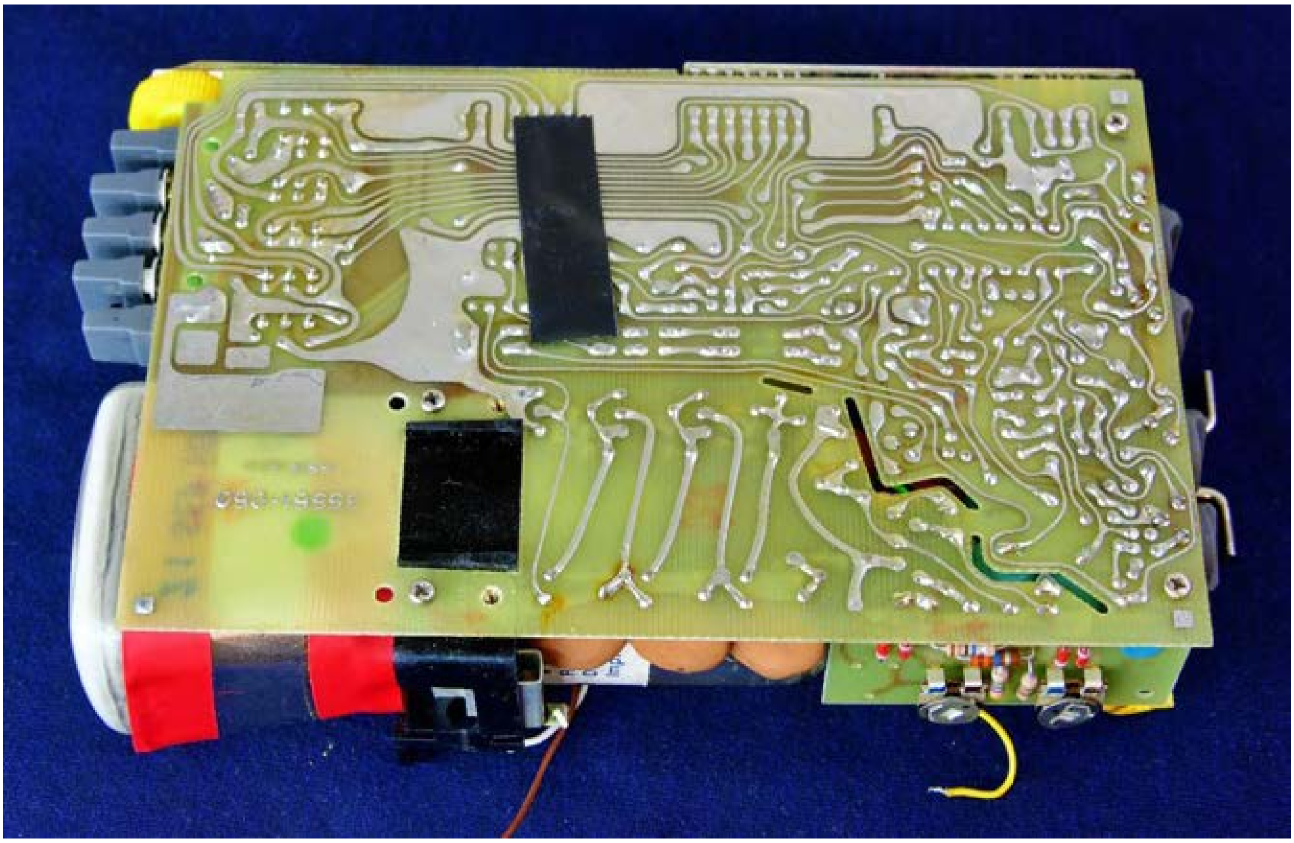
The screws can now be removed from the rear of the tuner panel.

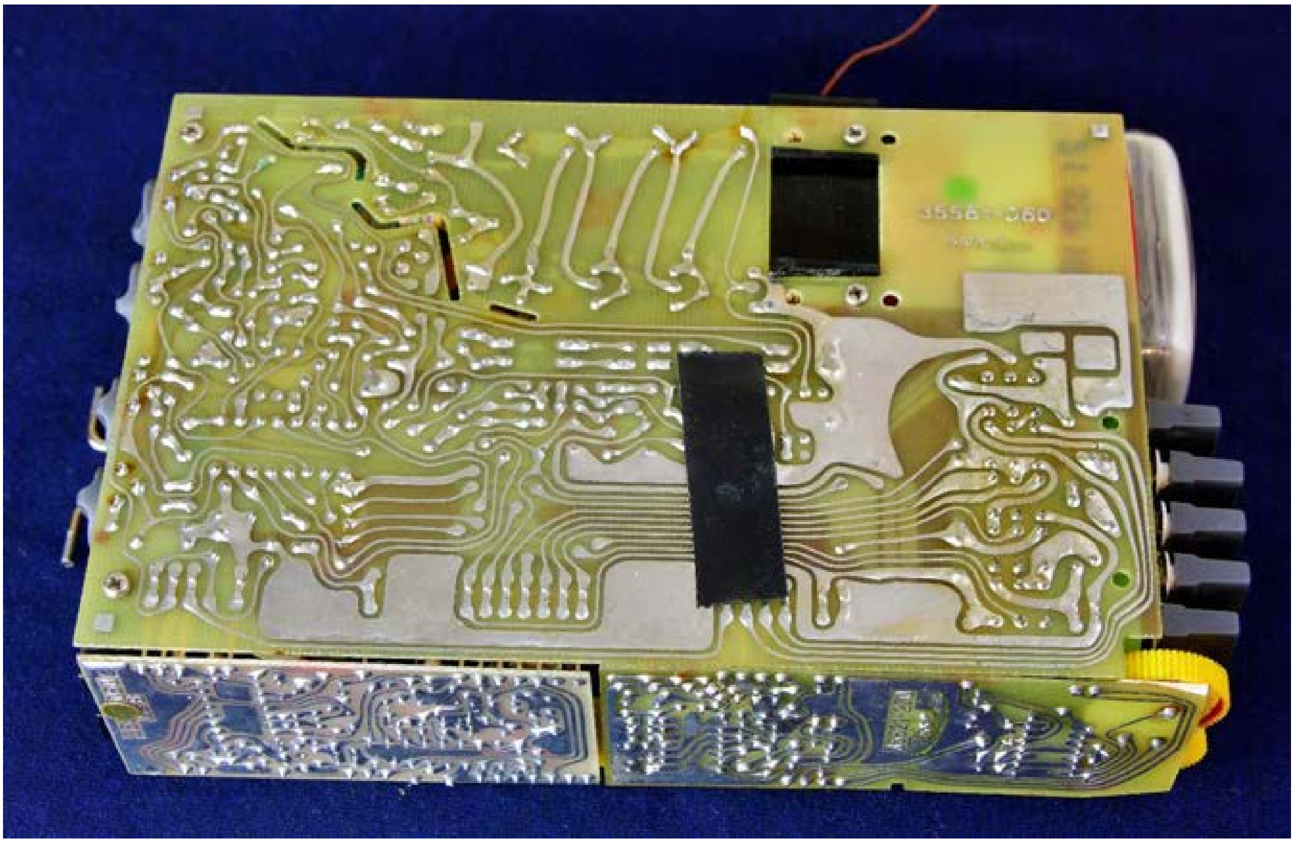
The Audio panel can now be removed by carefully pulling out sideways, removing the pins in the sockets. The Vision panel is removed in the same way.

The Tuner panel can now be lifted up, and after removing the Earphone Jack Socket and prising the VHF aerial holder and contact from the Tube moulding, can be removed completely.









Assembly

To assemble the receiver the reverse actions to the Dismantling procedure is required. Care must be taken in replacing the Audio and Video panels. The pins must locate exactly with the sockets or a short will take place, open-circuiting the battery safety fuse line on the print side of the Tuner board and possibly causing other damage.

It can be quite tricky to get all the pins ‘just right’ and visibility is extremely limited. The lower pins (on the Power/Deflection board, with the tube) are usually the hardest to get right. Generally, if a panel feels at all spongy or springy and/or doesn’t sit flat against the two larger boards, then it probably isn’t correctly mated and should be removed for another go. It is worth checking continuity between boards on a few pins and also checking that adjacent pins aren’t shorted.

The two insulators must be replaced over the audio panel and under the power board in the appropriate places.

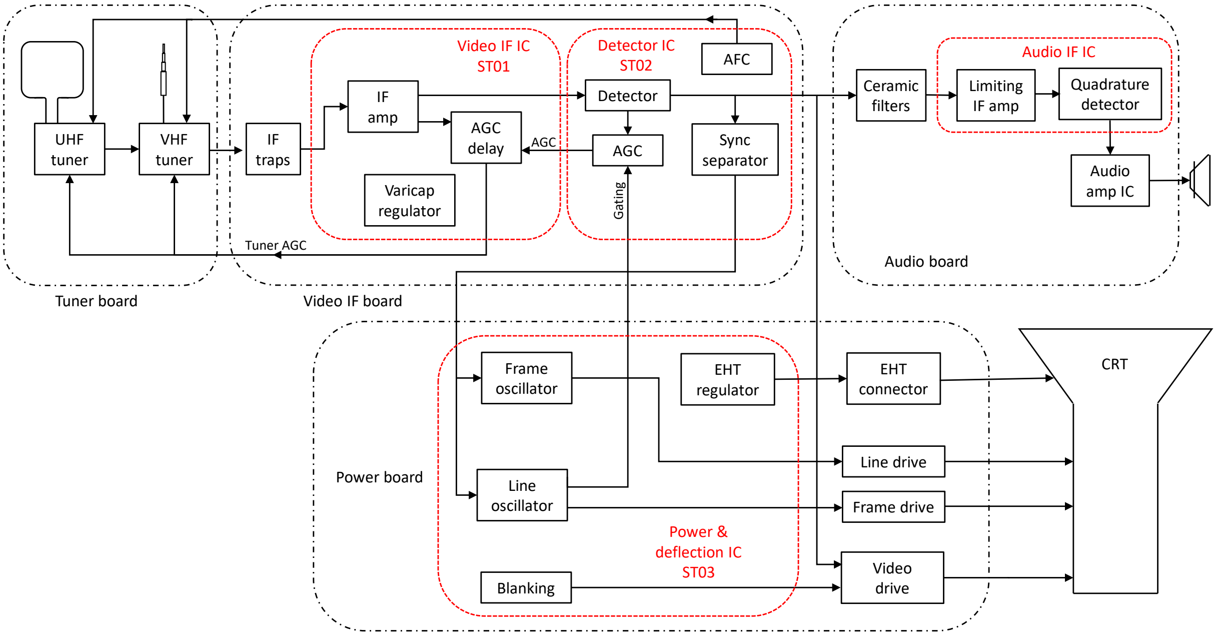
When refitting the front panel assembly, care must be taken to locate the front of the tuner panel into the two slots in the front panel.

When fitting the case assembly, the speaker grille is placed to cover the loudspeaker.

Mechanical Construction

The electronic circuits are built on four major glass fibre printed circuit boards. These are interconnected by gold plated plug/socket units and form a modular chassis type construction. The whole is incorporated in a tough steel case with plastic front and rear trim panels.

Block diagram

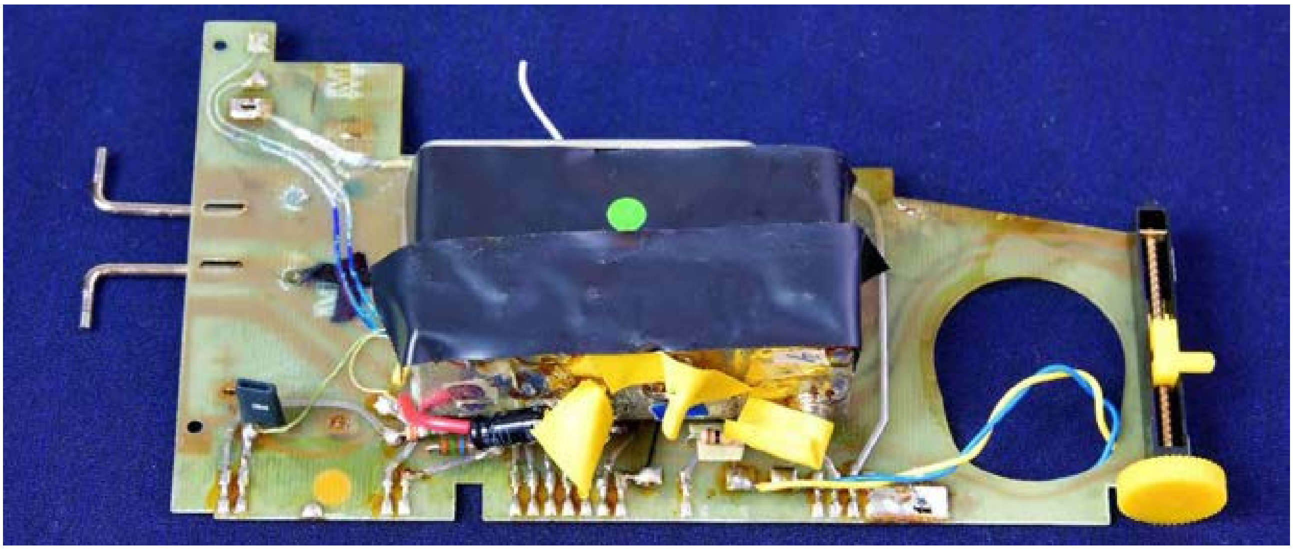


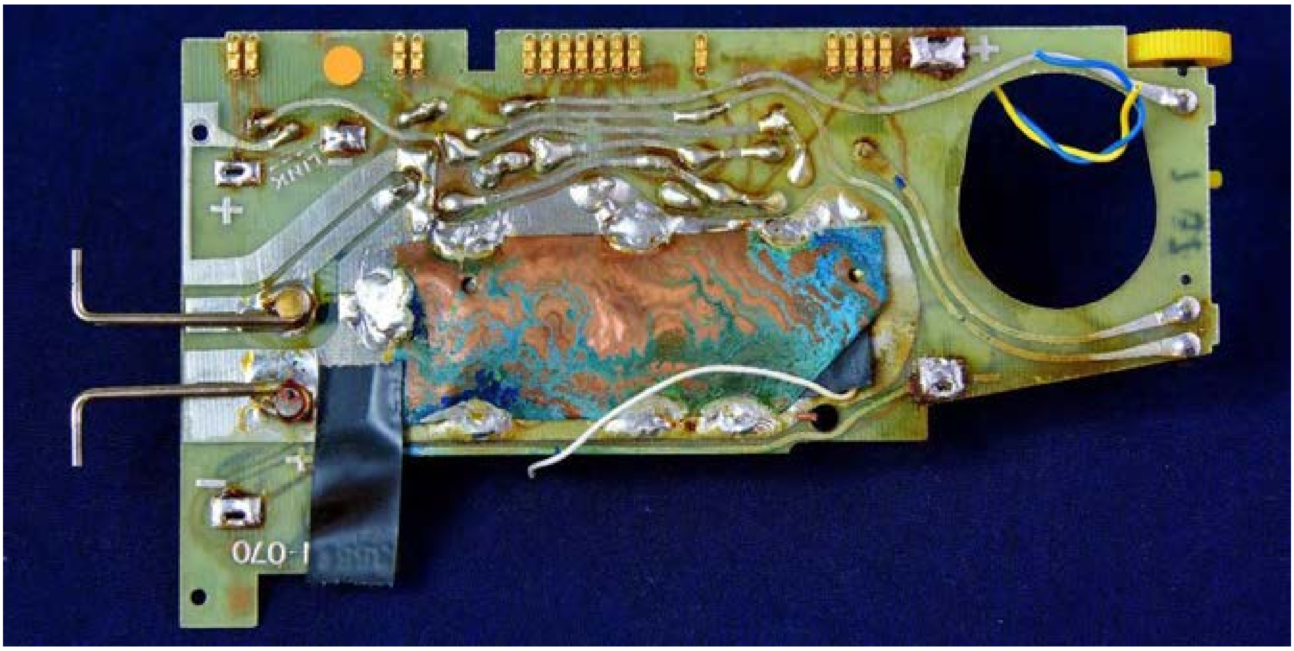
Tuner board

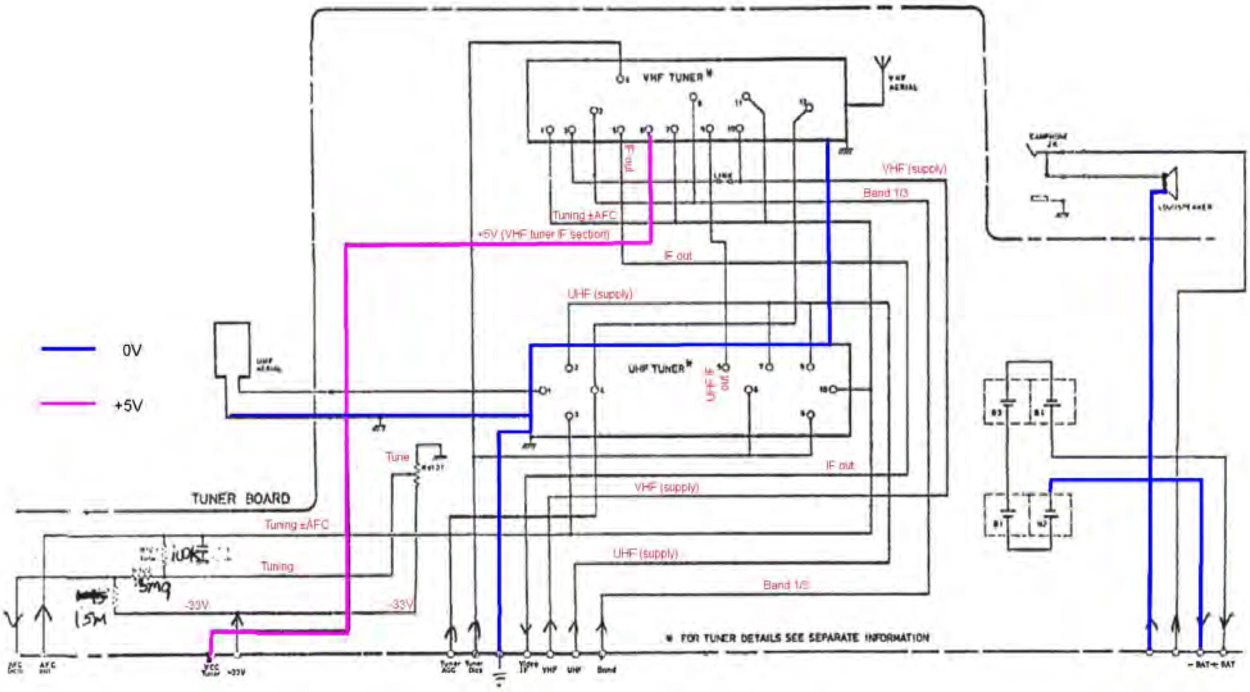
The tuner board carries the tuning pot, batteries, VHF and UHF tuners and associated circuitry.

Tuner board shown below after removing batteries. The tuner modules are under the black insulating tape. Note the chemical attacks on the tracks to the centre left. Discolouration of the copper shield may not be battery-related.

The gold connection points across the long edge were referred to as ‘Berg’ connectors (Berg pin / Berg socket) after their manufacturer.



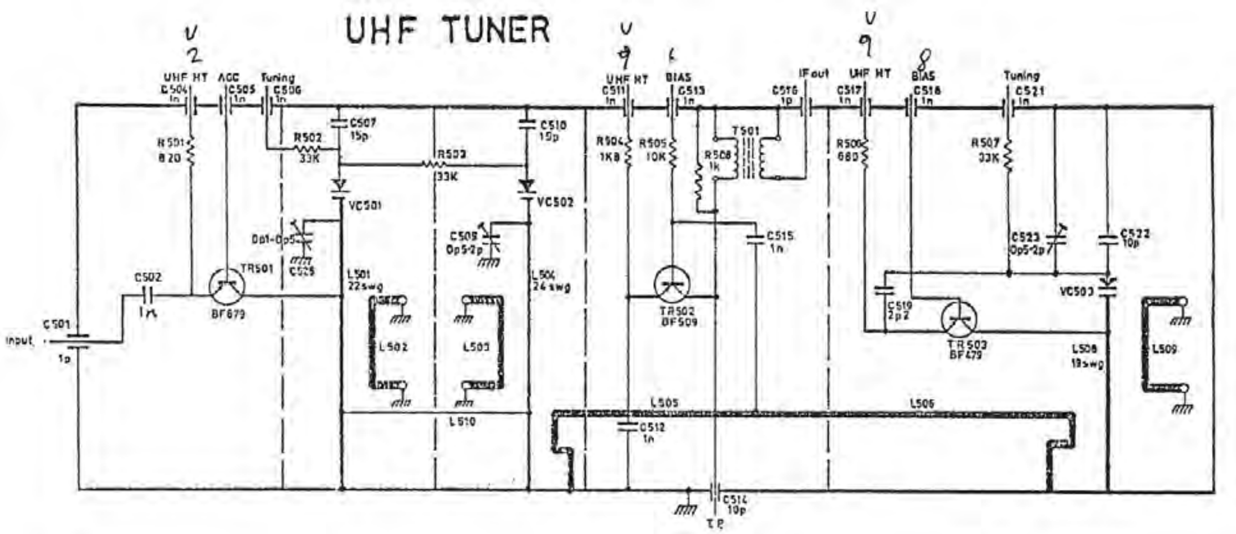




Circuit diagram for reference only; it is suggested you refer to the original later in this document.

UHF Tuner

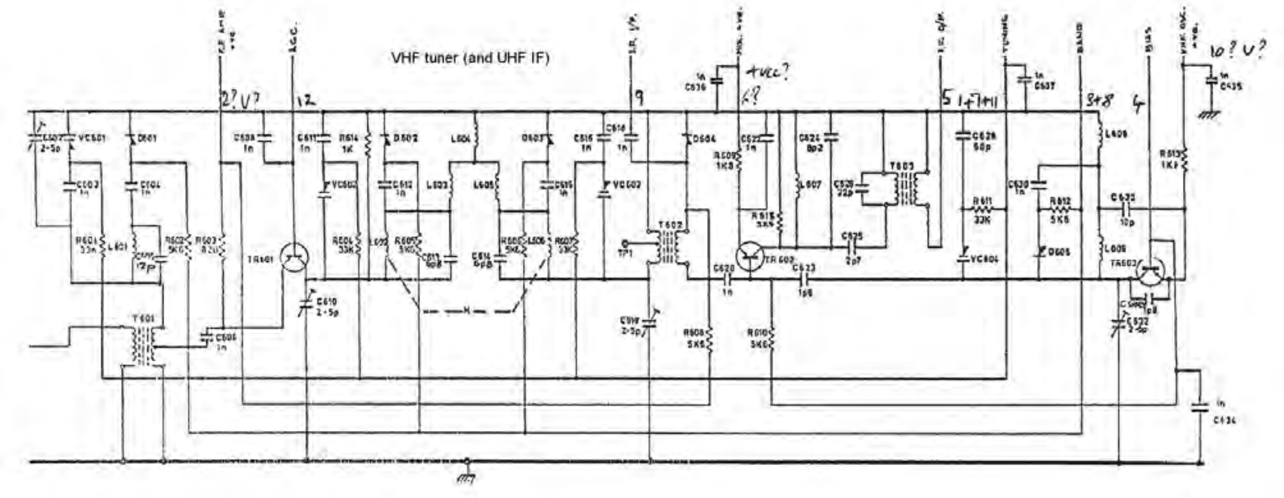
This comprises of input amplifier, tuned bandpass circuit, mixer and local oscillator. All transistors are silicon bipolar. Tuning is by variable capacitance diodes. Delayed Automatic Gain Control (AGC) is applied. to the input stage. Automatic Frequency Control (AFC) is applied to the tuning voltage. Frequency range: Bands IV and V.



Circuit diagram for reference only; it is suggested you refer to the original later in this document.

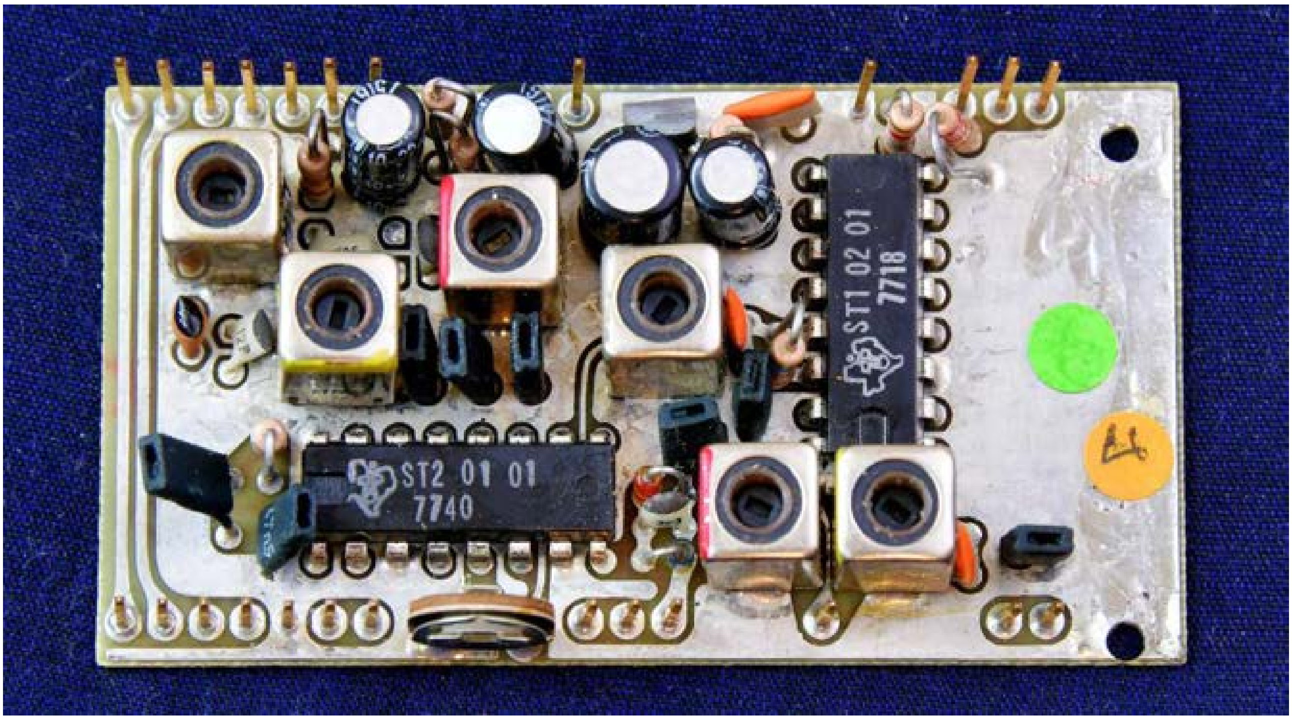
VHF Tuner

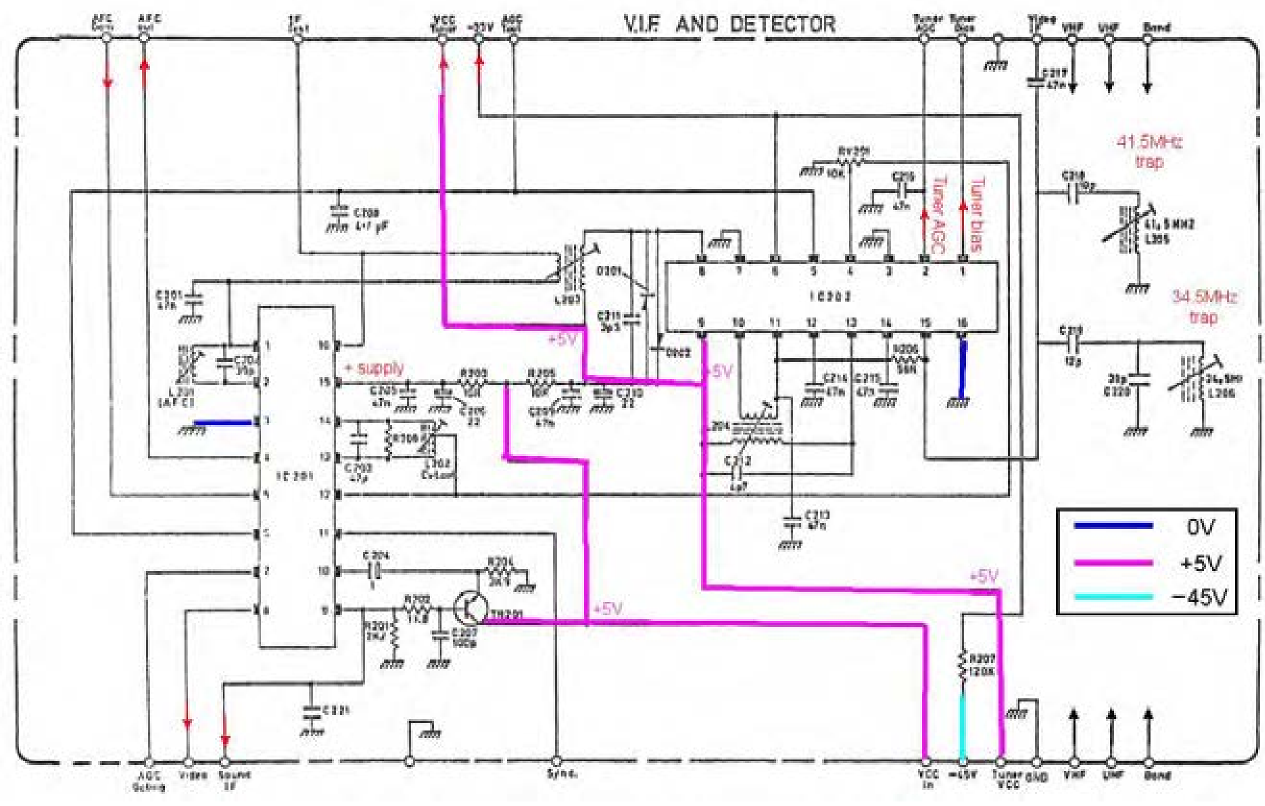
This comprises of input tuned circuit, RF amplifier, tuned bandpass circuit, mixer and local oscillator. All transistors are silicon bipolar. Tuning is by varicap diodes. Band switching is by PIN diode. The mixer stage acts as an Intermediate Frequency (IF) amplifier when the set is receiving Bands IV and V (UHF). AGO and AFC are applied as in the UHF tuner.



Circuit diagram for reference only; it is suggested you refer to the original later in this document.

Video IF panel





Circuit diagram for reference only; it is suggested you refer to the original later in this document.

Video IF Amplifier

IF amplification, after the tuners, is carried out in two stages, on a Sinclair designed bipolar linear Integrated Circuit (IC). IF frequency response is determined by tuned circuits. Unwanted responses are rejected by traps. AGC is applied to both IF stages.

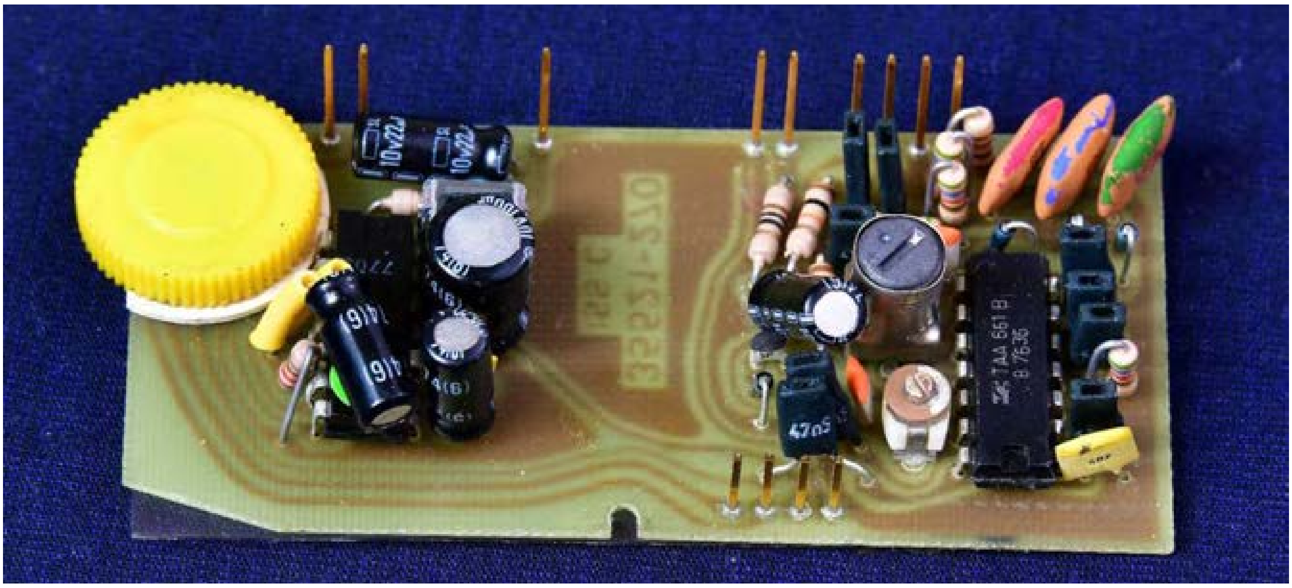
The varicap diode voltage regulator and tuner AGC delay circuit are included on the video IF amplifier IC.

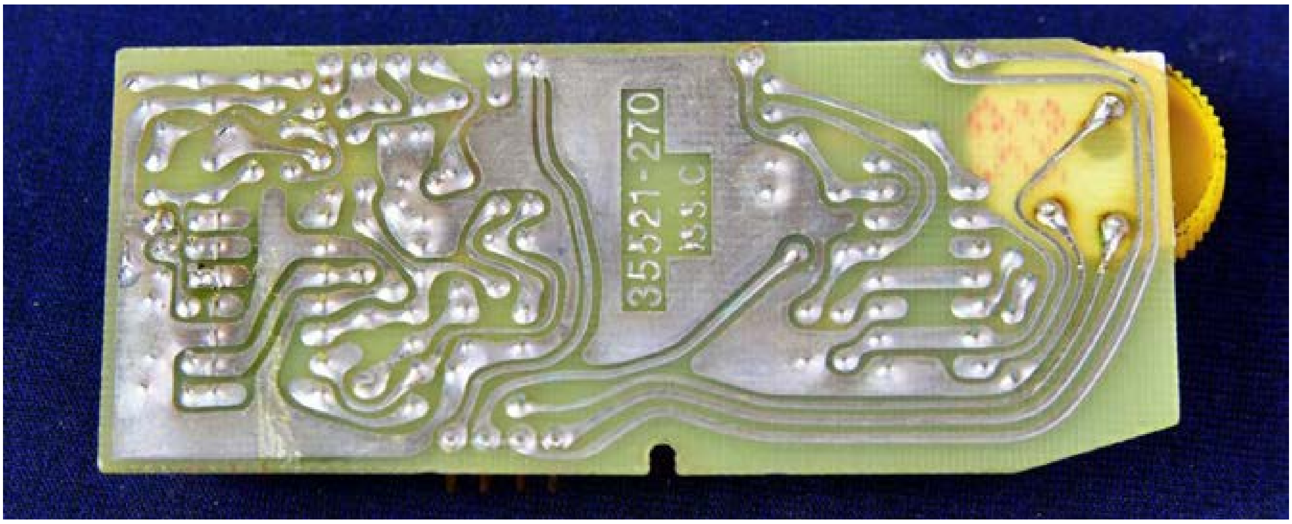
The two ICs mentioned were made by Texas Instruments and are now completely Unobtanium. No data sheets appear available and there is no obvious substitute. A dead IF panel IC essentially means the rest of the set becomes a parts donor. Thankfully though, these seem to be reasonably reliable and not subject to too much stress in their application.

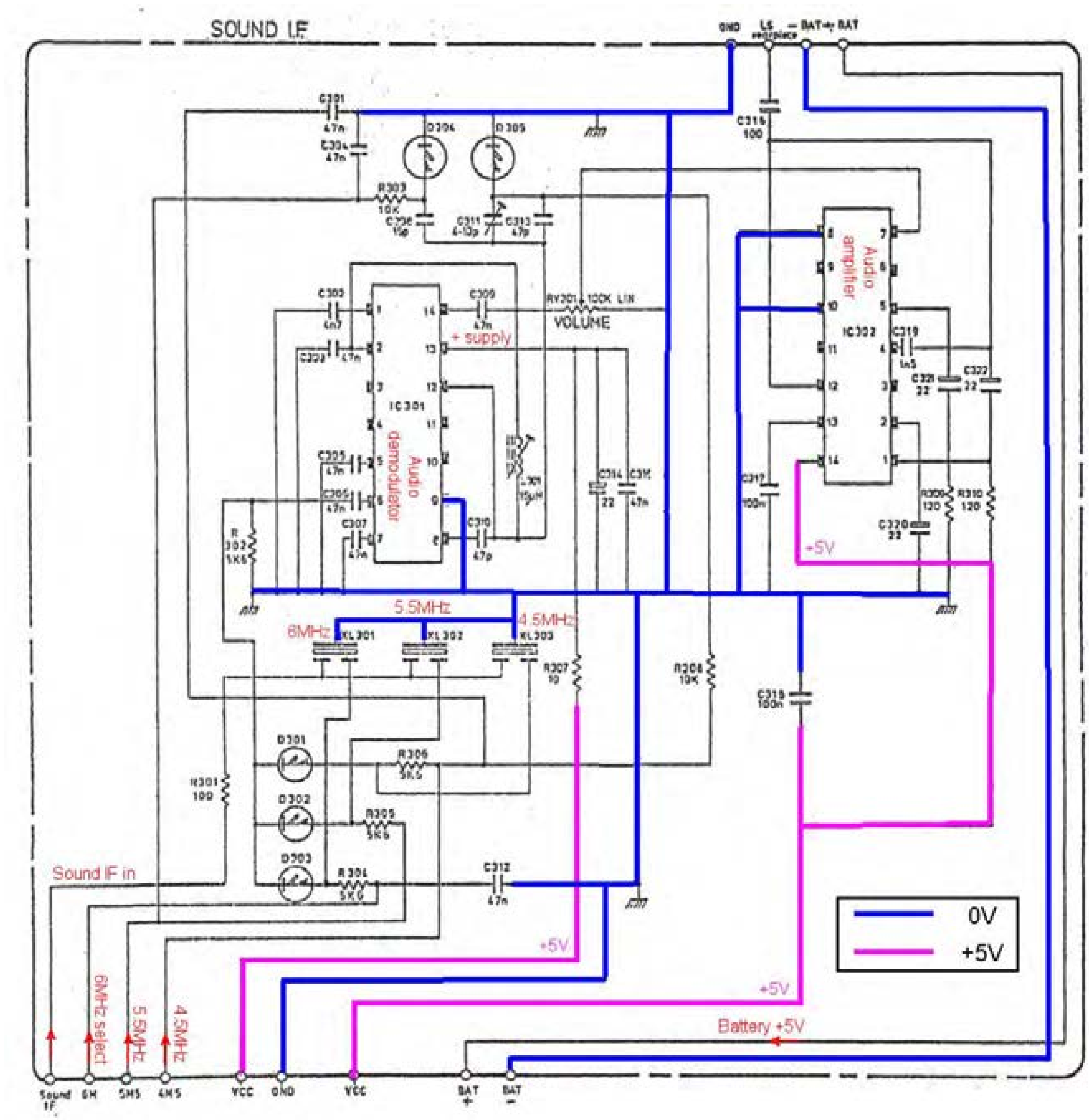
Video Detector

This is a low level synchronous (switching) detector, providing both positive and negative video outputs at low impedance. The circuitry is contained in a Sinclair designed bipolar linear integrated circuit which also provides APC, gated AGC (for high noise immunity) and composite synchronization pulse outputs.

Sound IF and Audio Amplifier







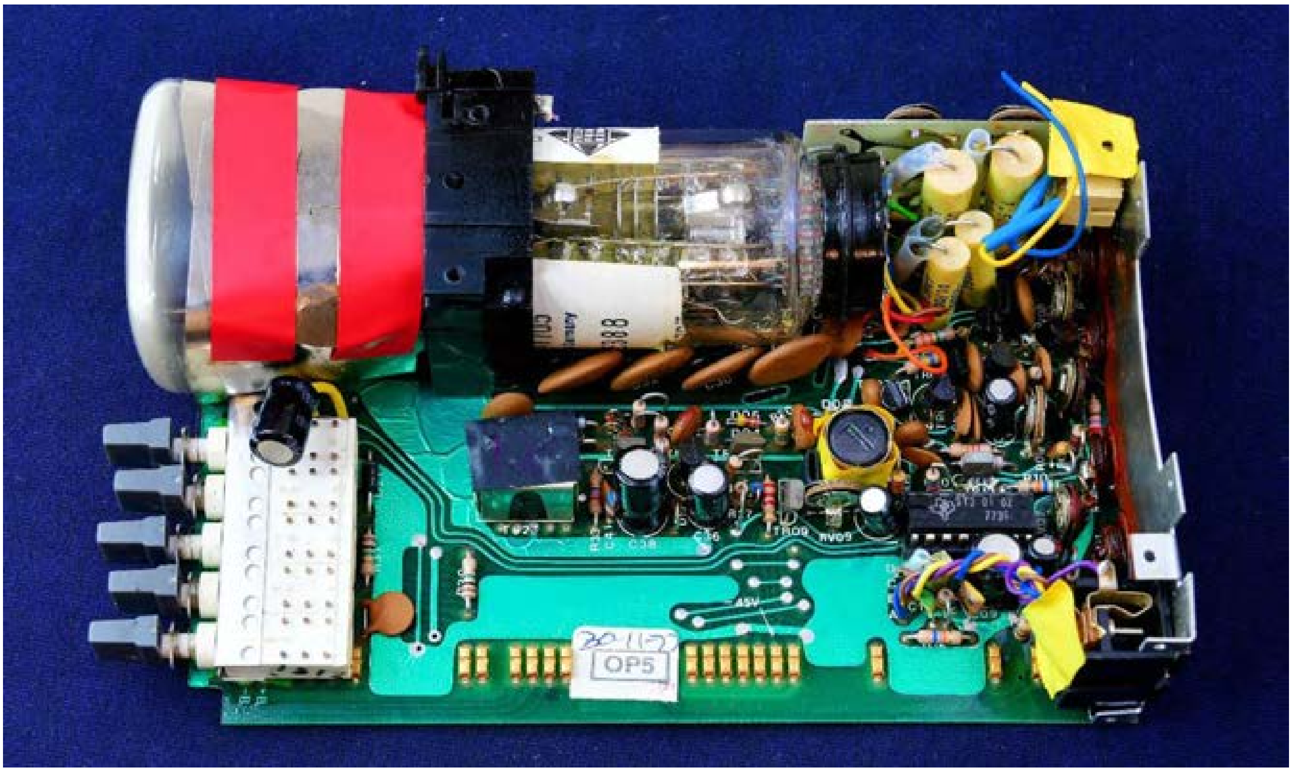
Circuit diagram for reference only; it is suggested you refer to the original later in this document.

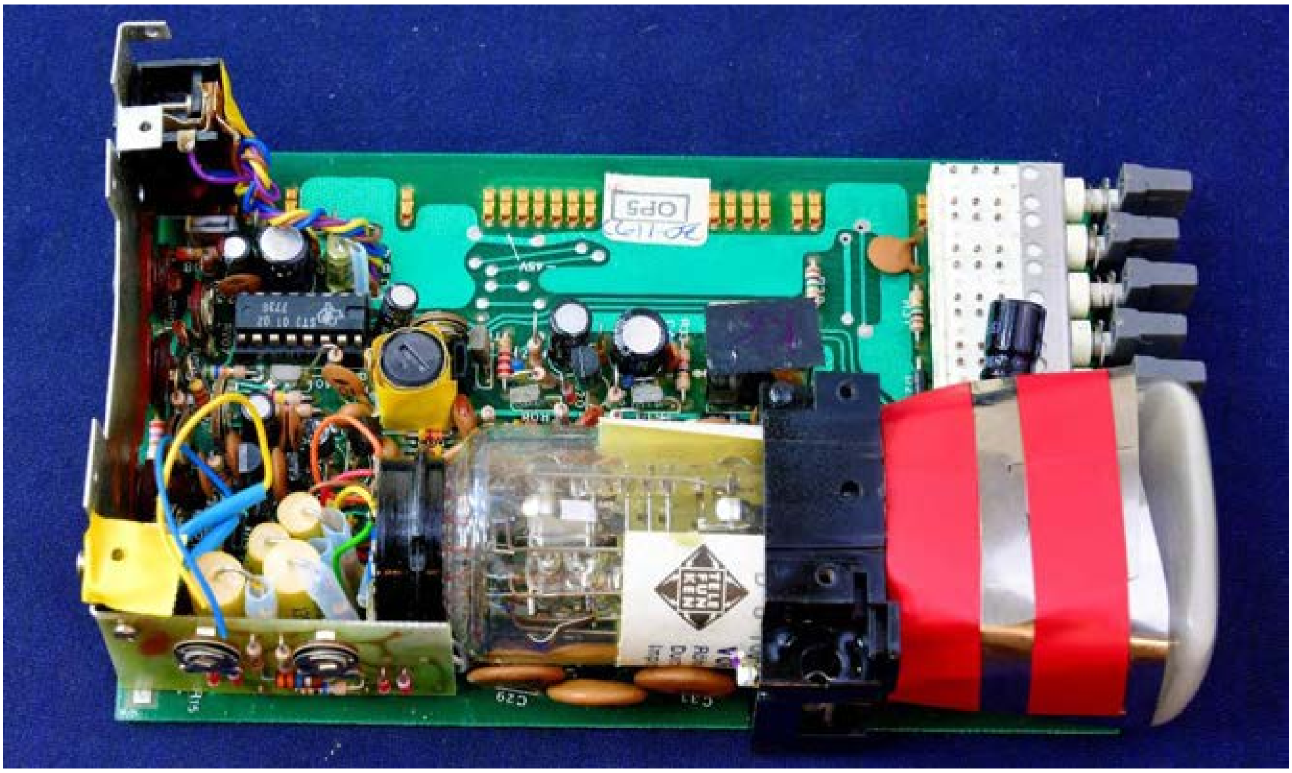
The sound IF limiting amplifier is preceded by three PIN diode switched ceramic filters (to select the correct intercarrier sound IF frequency of 4.5, 5.5 or 6.0MHz). The limited IF signal is fed to a quadrature detector producing an AF output for amplification to drive the loudspeaker.

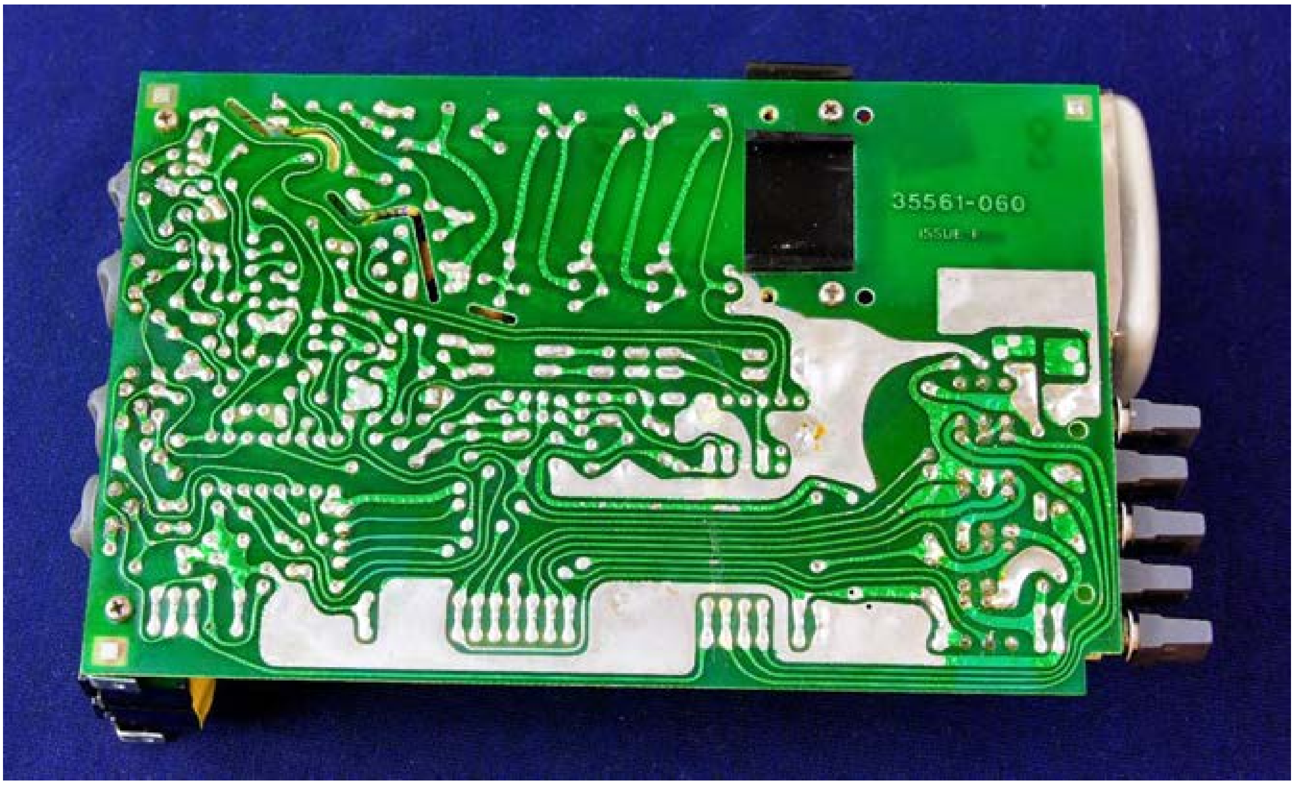
The IF amplifier and detector and audio amplifier are contained on two bipolar linear ICs.

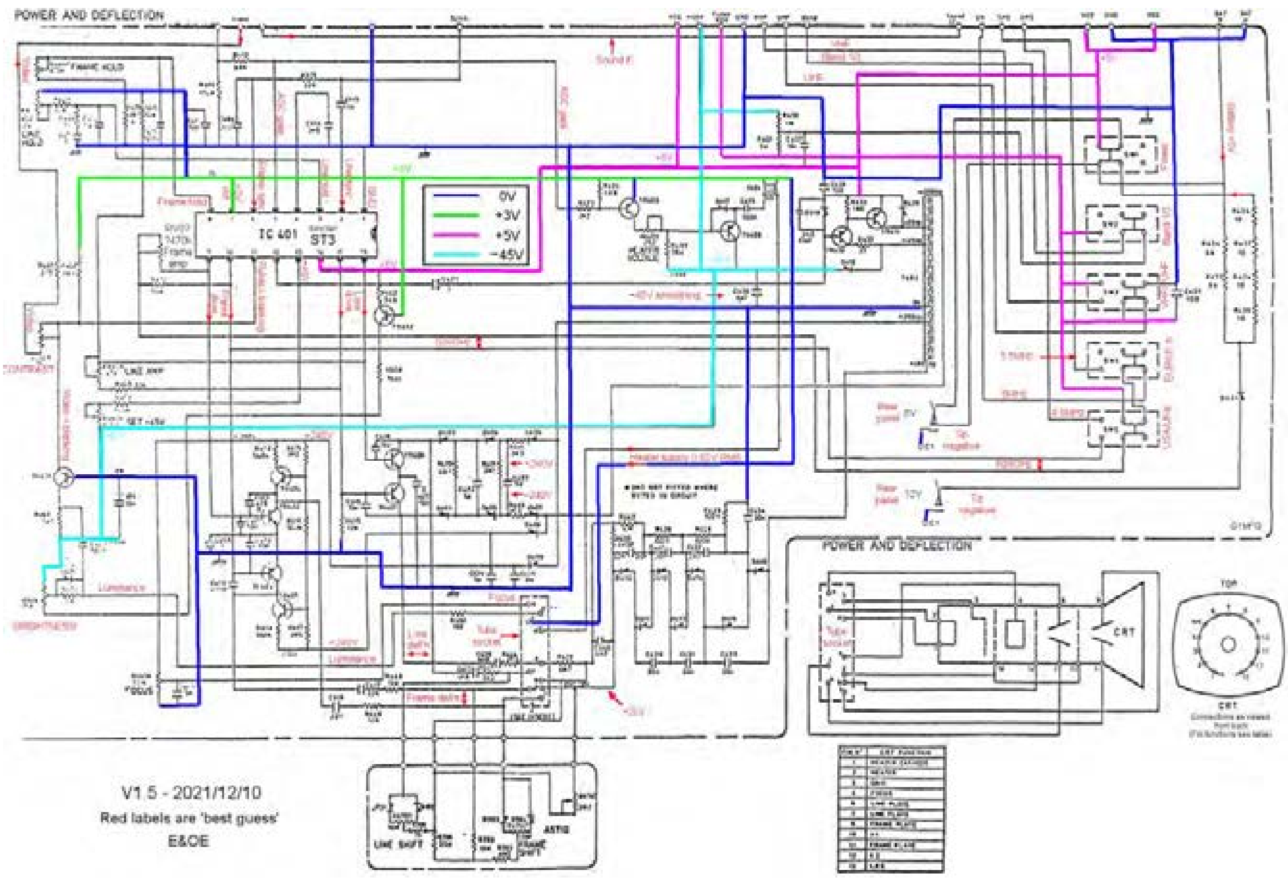
Main board

The main board contains the line and frame drive, EHT converter, front panel buttons and tube.









Circuit diagram for reference only; it is suggested you refer to the original later in this document.

Line and Frame Oscillator and Drive

Composite sync from the video detector· is separated into line and frame sync. The line oscillator is a phase locked loop with excellent hold in and pull-in. The frame oscillator is injection locked. Both oscillators have excellent stability and are part of the third Sinclair designed bipolar linear integrated circuits.

This device also includes the control circuit for the regulated EHT.

Oscillator-waveforms are fed to discrete transistor CRT deflection plate drive circuits.

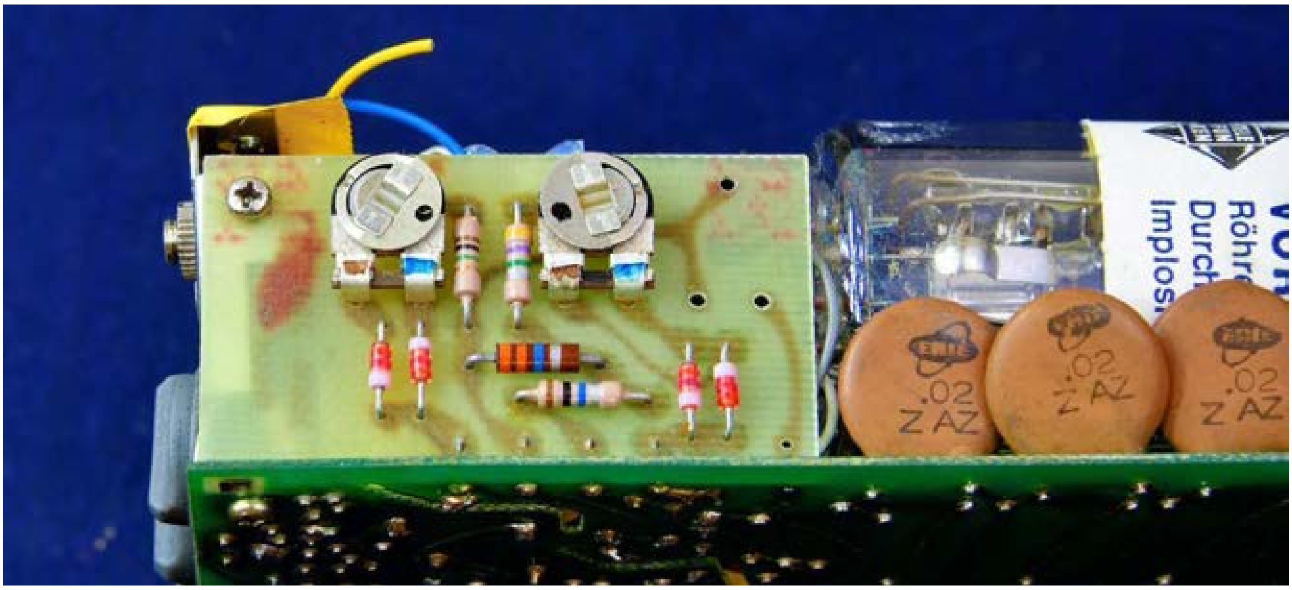
The frame output is adjusted for the US 60Hz standard.

EHT Converter – 2kV

This is produced by a high efficiency switching convertor and is regulated.

Line and frame shift board

The line shift and frame shift pots are contained on a small daughterboard permanently mounted to the power board. Be aware that the pots are at high voltage and should only be adjusted with a well-insulated tool.



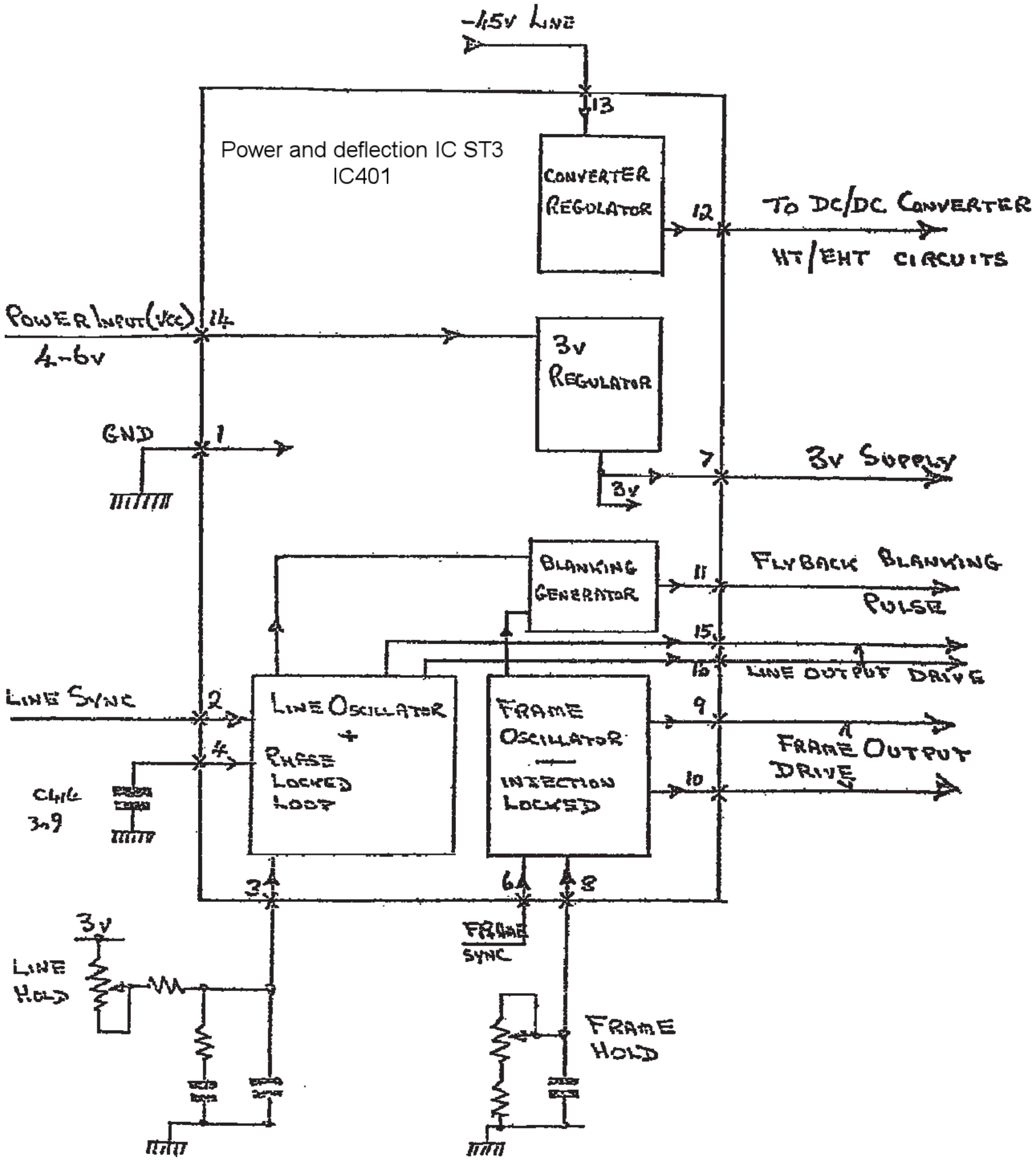
As an aside, note the extremely high value resistors, of up to 33MΩ. Even higher values are employed on the main board.

CIRCUIT DESCRIPTION

The 16 pin Sinclair-designed IC (ST3) on the Power board can be divided into four sections

1. Stabilised rail
2. Line oscillator and phase comparator with dual output drivers
3. Frame oscillator and dual output drivers
4. EHT regulator

Block diagram



Stabilised rail

An 0.5mA current source is generated and fed into a 5-diode chain to produce a stabilised 3.6V point. Two emitter followers are connected from this point to produce two 2.9V rails, which are used throughout the circuitry as a stabilised rail and reference voltage. The 2.9V rail has a -Vbe temperature coefficient.

Line oscillator

The line oscillator produces a sawtooth voltage across an externally connected capacitor. This is done by switching a reference voltage in conjunction with a current source. Both scan and flyback times are caried when changing this line oscillator frequency. The oscillator flyback time is 9µs.

The phase comparator uses a long-tailed pair and compares the phase of the sawtooth voltage from the oscillator with that of the line sync pulse, during the flyback time.

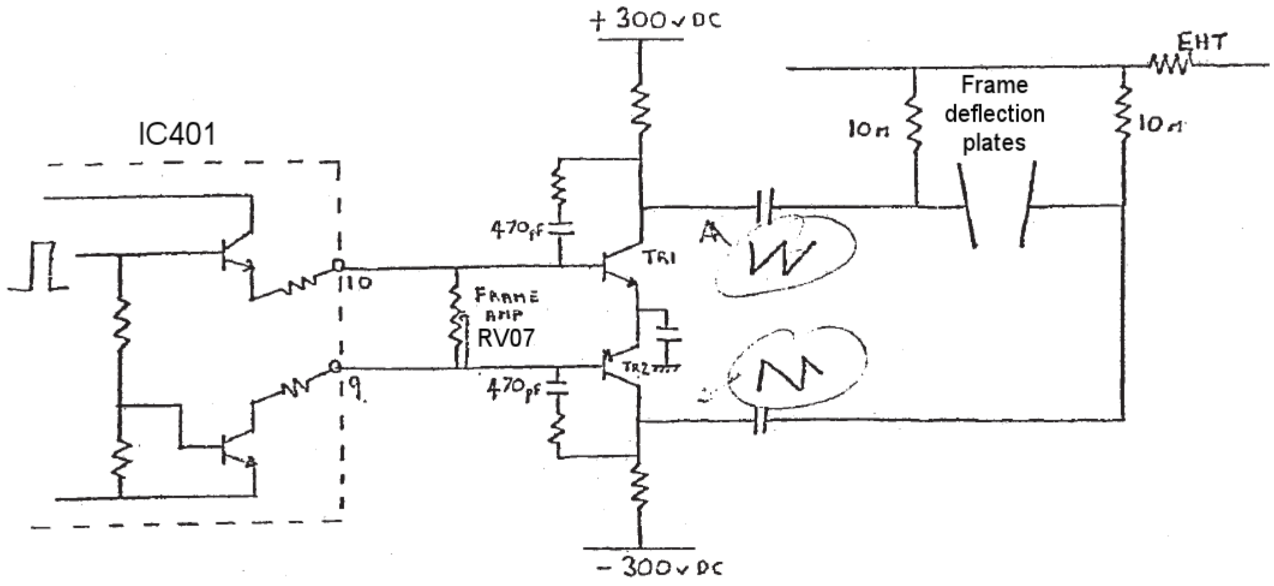
Outputs from the line oscillator are used to produce an AGC gating pulse (which is also used by the filament driver circuit), a pulse to reset the EHT converter, a line blanking output, and two pulses that are used by the line deflection circuitry.

Frame oscillator

The frame oscillator charges an externally connected capacitor for a short period (600µs), via a resistor to a stabilised rail. This charging current is then switched off and the capacitor is allowed to discharge via a variable resistance (the frame hold pot), connected across the capacitor. The switching occurs when the voltage across the capacitor is the same as the reference voltage inside the IC. This reference voltage is switched between two levels. The oscillator is triggered by a frame sync pulse.

Outputs from the oscillator are used to produce a frame blanking pulse, and two pulses that are used by the frame deflection circuitry.

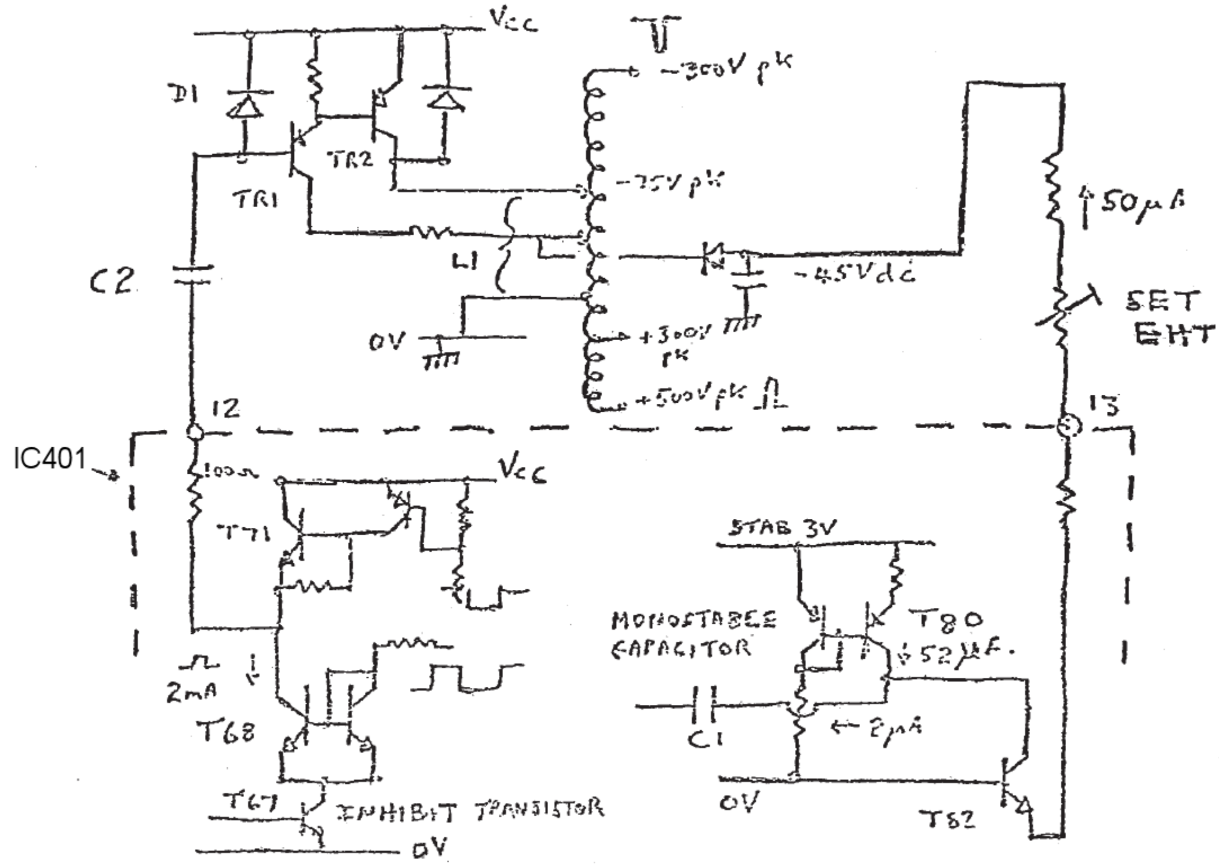
Frame scan



During frame flyback transistors T52 and T50 are turned on. This causes the transistors TR1 and TR2 to turn on and eventually saturate.

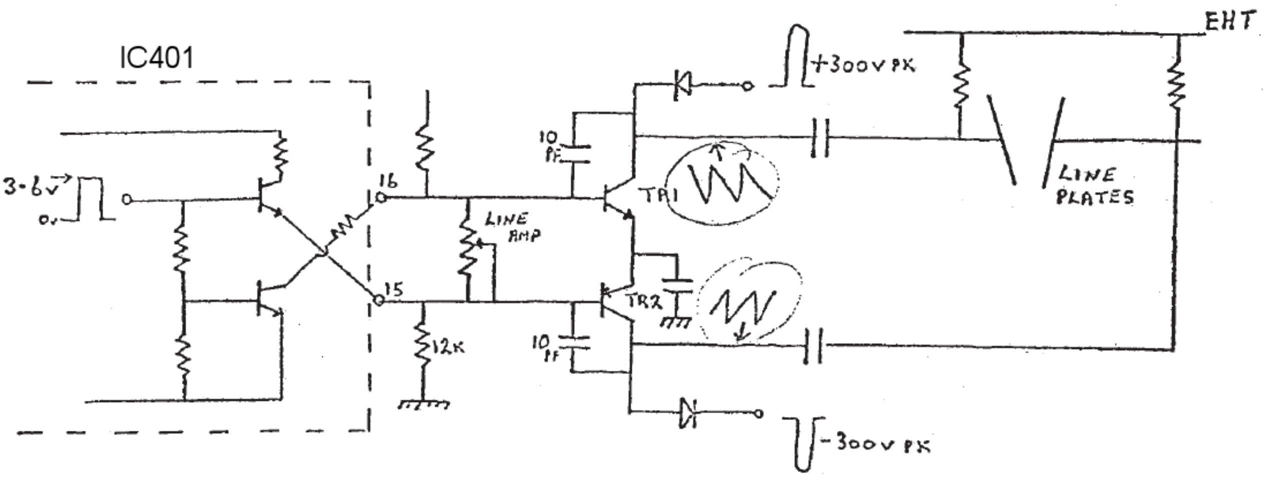
During frame scan, the transistors T52 and T50 turn off and the collectors of TR1 and TR2 rise linearly towards their respective 300V HTs. Their scan amplitudes are dictated by the rate at which the 470pF capacitors are charged. This current is due to the 1.2V across TR1 and TR2 V_{BE}s and the value of the amplitude pot.

EHT regulator



Energy is stored in L1 during part of the line scan period and is then released into the various parts of the circuitry suring line flyback time.

To put energy into the coil L1 during part of the scan period the current source T68 (2mA) is turned on (T71 is off) and this current turns TR1 and TR2 on into saturation via the capacitor C2. After the required amount of energy has been stored by L1 the transistor T71 turns on (due to a trigger pulse from the line oscillator at the beginning of flyback). This removes the charge on C2 via D1 and turn TR1 and TR2 off. The time period for which T68 is in its off state is determine by the charging state of C1 which is in turn determined by the –45V rail setting of the EHT pot and current source T80.



The EHT regulator comprises a constant current reference, a monostable triggered by the line oscillator, and a push-pull type output driver for the converter transistor. The converter driver's output is inhibited during the switch-on transient until the supply voltage Vcc has built up to greater than 3.1V. This allows the line oscillator to start before the converter transistor switches on.

During flyback, T35 and T36 turn on, which makes TR1 and TR2 turn off. At this time a flyback voltage on the EHT transformer produces a ±300V pulse. These pulses charge the 10pF capacitors to their peak voltages. At the end of the flyback time the transistors TR35 and TR36 turn off and the transistors TR1 and TR2 produce a voltage ramp at their collectors (and hence on the deflection plates) due to their Miller capacitance of 10pF and the resultant constant current through the 12k resistor and line amplitude pot. The maximum amplitude of scan voltage si when the transistors TR1 and TR2 saturate.

This type of circuit has low output impedance due to the Miller capacitance, low power consumption, and a single line amplitude control.

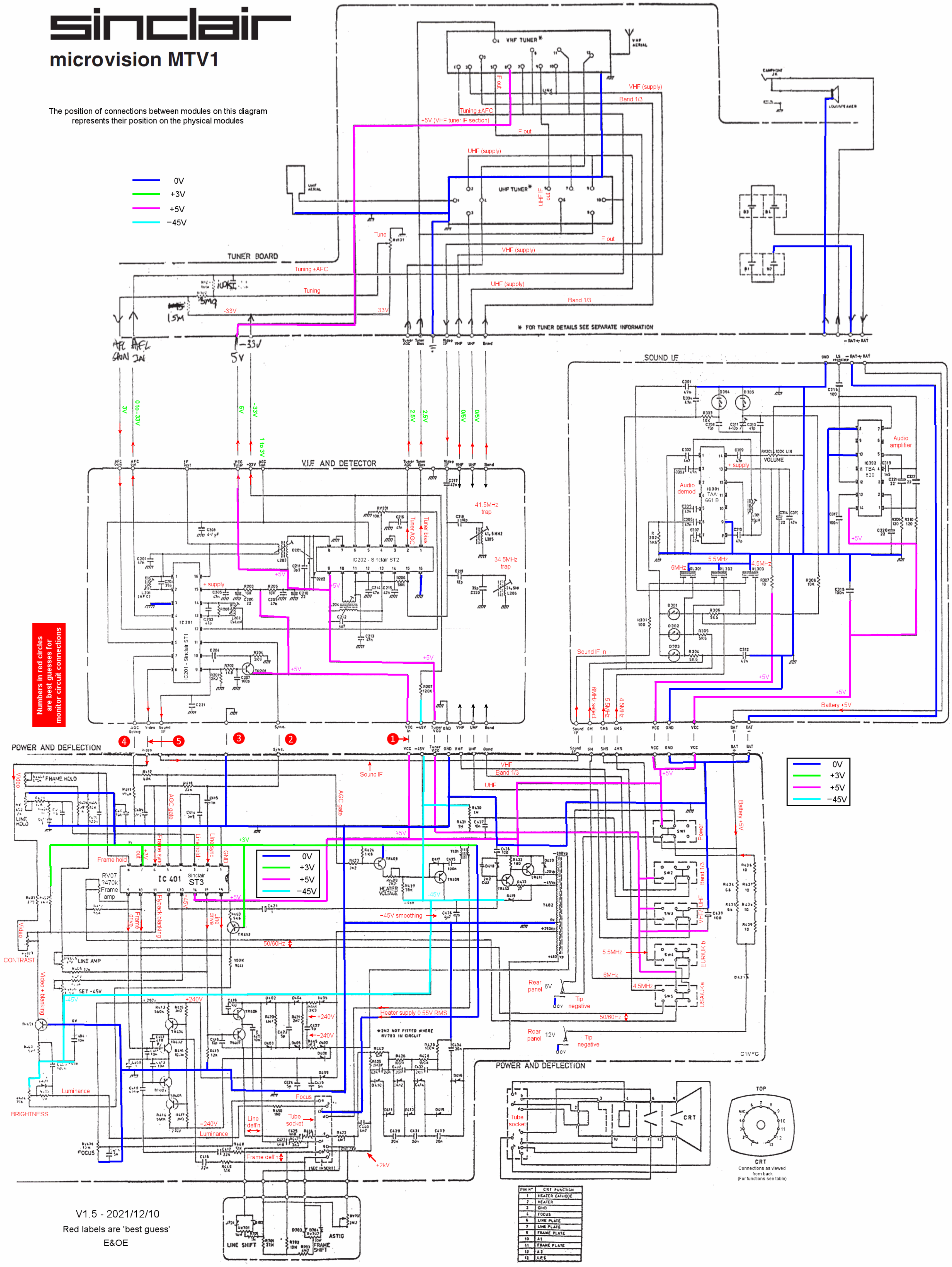
A careful choice of temperature coefficient of the 10pF capacitor makes the line scan amplitude almost independent of temperature.

CIRCUIT DIAGRAMS

The following pages contain detailed circuit diagrams. All but the coloured version are reproduced directly from the earlier edition of this manual. The coloured version was created to assist understanding. Apart from identifying the various voltage rails in colour, it has also had some sections clarified from the original (eg adding the DC input sockets to the main board part of the diagram). The all-in-one diagram was found to be particularly useful when developing an understanding of the set, as it shows the interrelation of all the parts on a single view. Unfortunately this means that it is necessarily quite cramped. It has been found possible to print successfully at A4/Letter size using an inkjet set to high resolution mode via the options in the print dialog (system-dependent). It is unlikely to print well at A4/Letter size on a 300dpi mono laser.

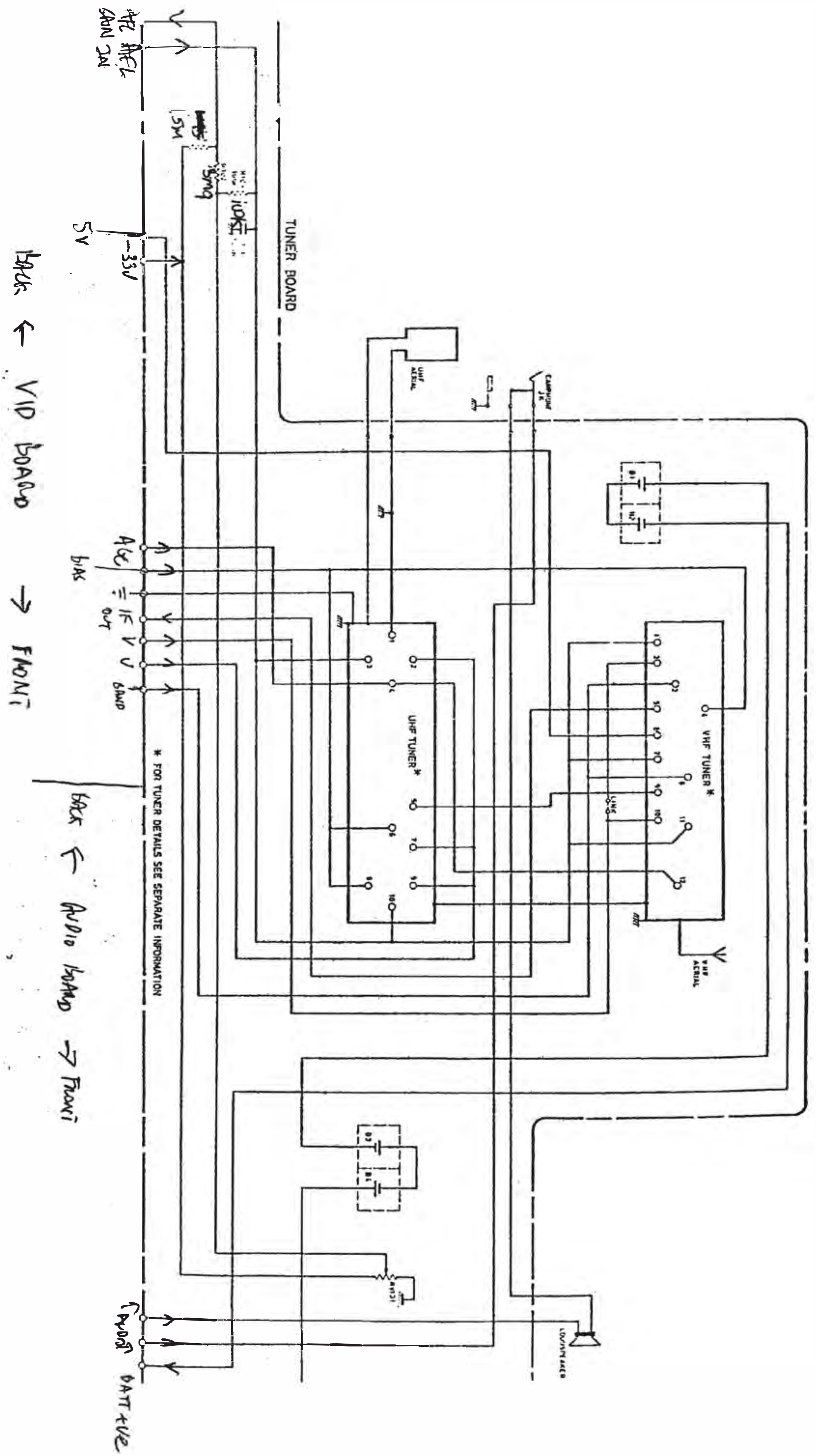
microvision MTV1

The position of connections between modules on this diagram represents their position on the physical modules

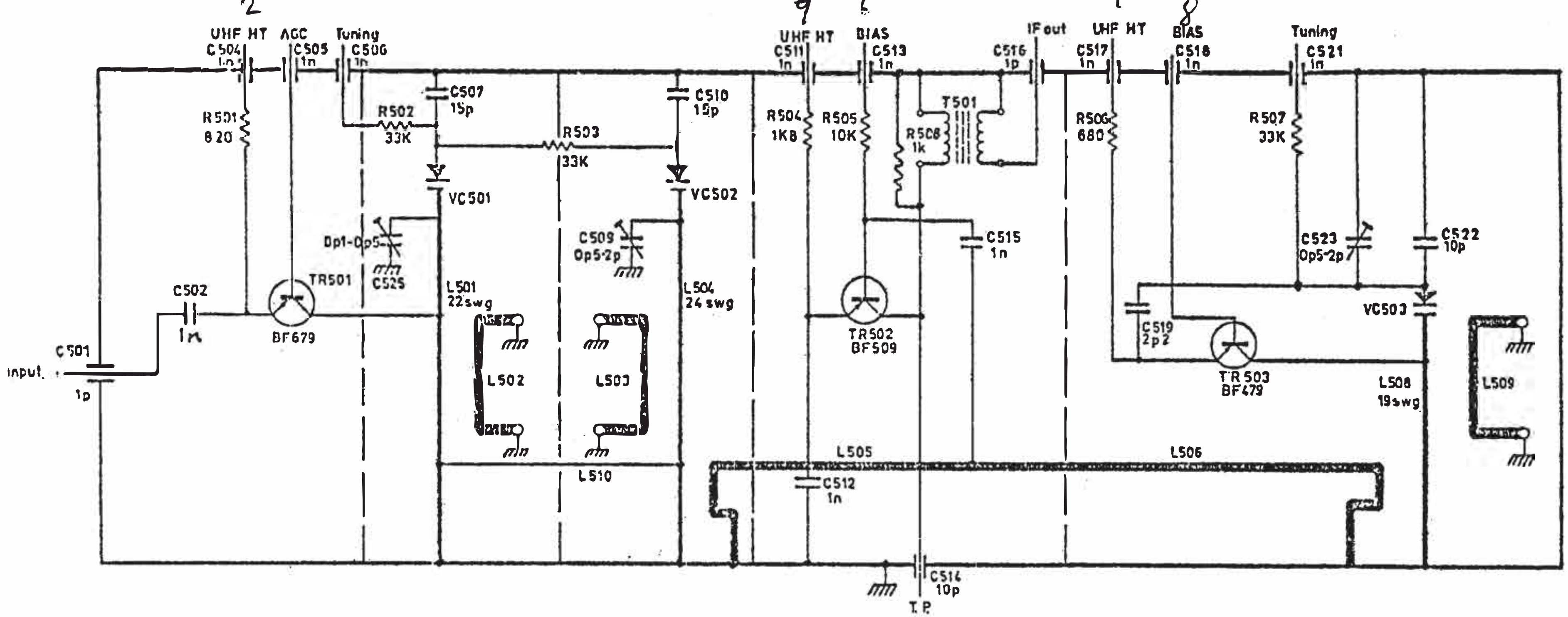


PIN Nº	CRT FUNCTION
1	HEATER CATHODE
2	HEATER
3	GRID
4	FOCUS
6	LINE PLATE
7	LINE PLATE
9	FRAME PLATE
10	A1
11	FRAME PLATE
12	A3
13	LRS

V1.5 - 2021/12/10
Red labels are 'best guess'
E&OE


TUNER BOARD
UHF TUNER*
VHF TUNER*
* FOR TUNER DETAILS SEE SEPARATE INFORMATION
UHF AERIAL
VHF AERIAL
LOUDSPEAKER
BACK ← VID BOARD → FRONT
BACK ← AUDIO BOARD → FRONT
5V
-33V
AGC
BIAS
IF OUT
BATT +VE

UHF TUNER



UHF HT
AGC
Tuning
C504
1n
C505
1n
C506
1n
C507
15p
C510
15p
R501
820
R502
33K
R503
33K
VC501
VC502
Op1-Op5
C525
C509
Op5-2p
C502
1n
C501
1p
input
TR501
BF679
L501
22swg
L502
L503
L504
24 swg
L510
UHF HT
BIAS
C511
1n
C513
1n
R504
1K8
R505
10K
R508
1k
T501
C516
1p
IF out
C515
1n
TR502
BF509
L505
C512
1n
C514
10p
T.P.
UHF HT
BIAS
Tuning
C517
1n
C518
1n
C521
1n
R506
680
R507
33K
C523
Op5-2p
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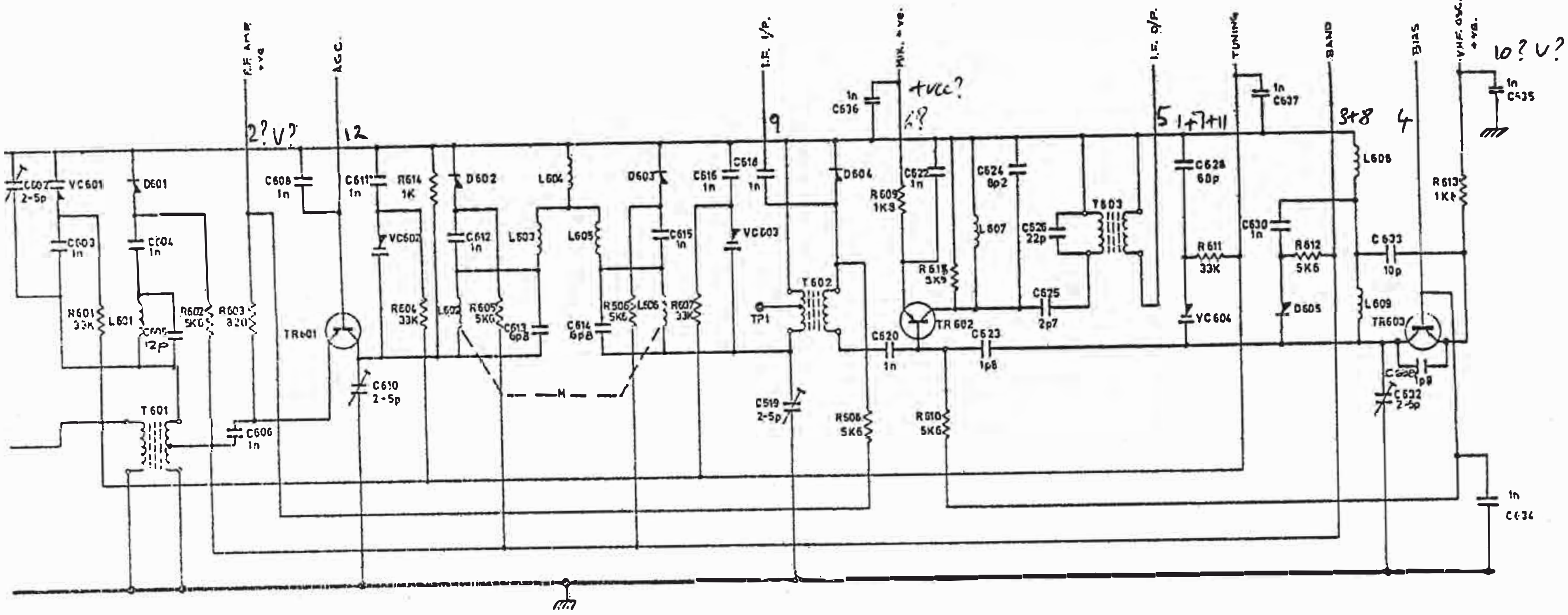
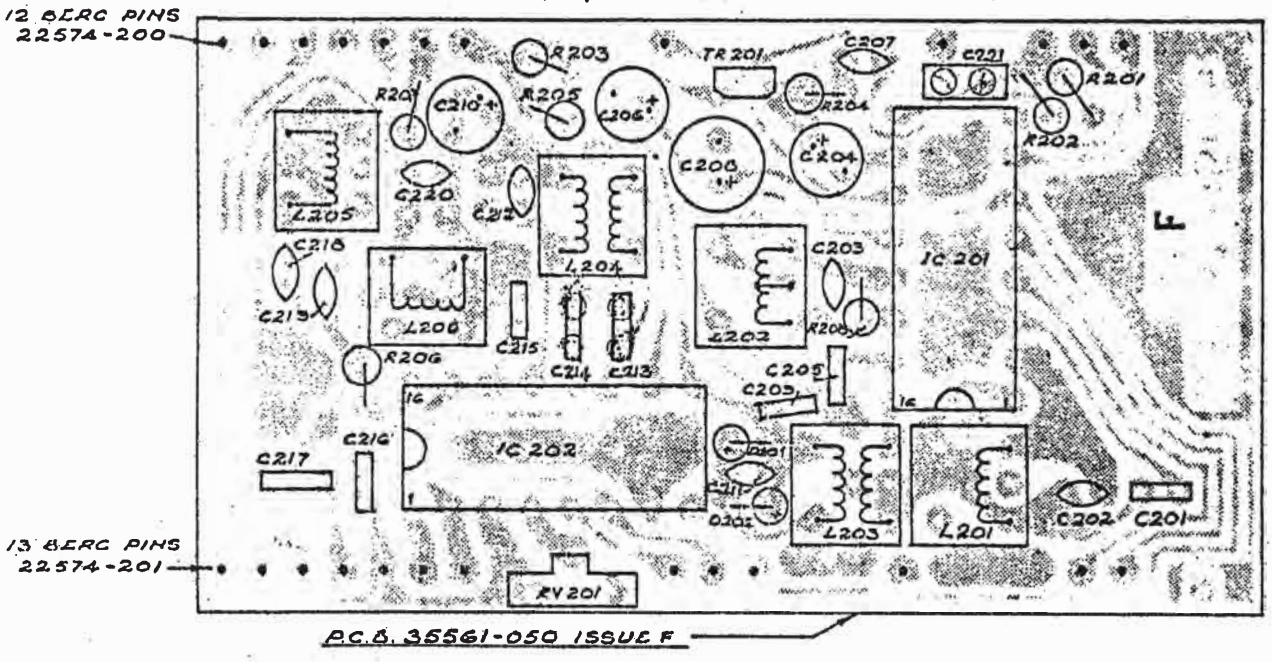
L508
19swg
L509
L506

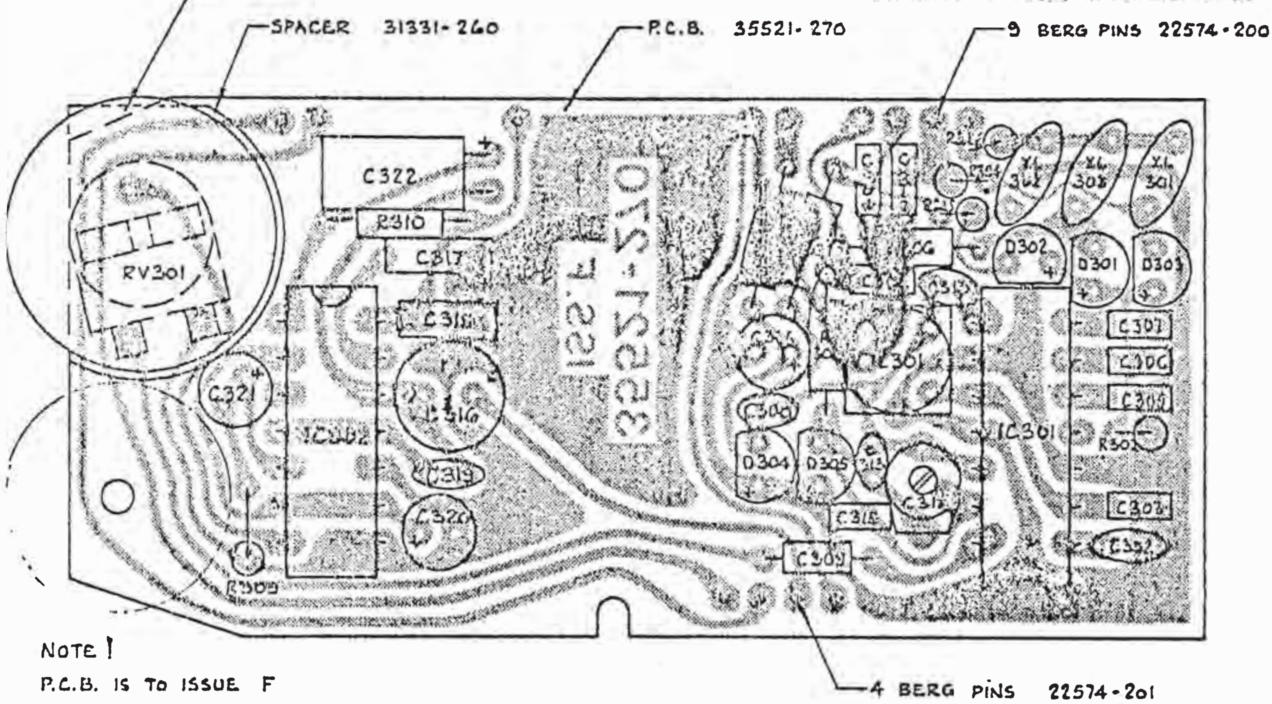


R.F. AMP. +VE
A.G.C.
I.F. I/P.
MIX. +VE.
I.F. O/P.
TUNING
BAND
BIAS
V.H.F. OSC. +VE.
2? V?
12
9
+VCC?
5 1+7+11
3+8
4
10? V?
TR601
TR602
TR603
T601
T602
T603
TP1

VIDEO I.F & D.E.T. BOARD ASSY.



P.C.B. ASSEMBLY - AUDIO & I.F. DETECTOR.



NOTE !
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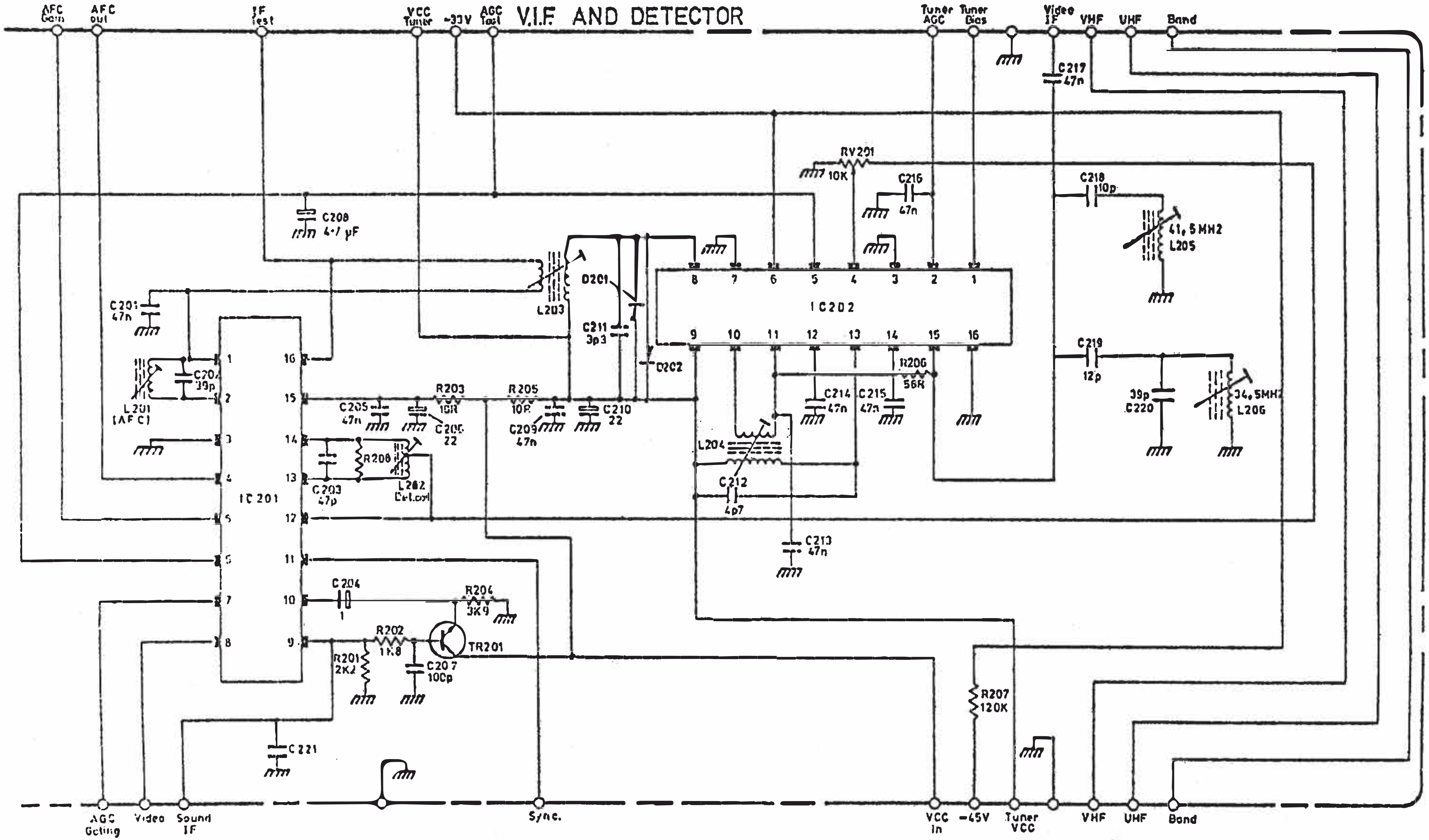
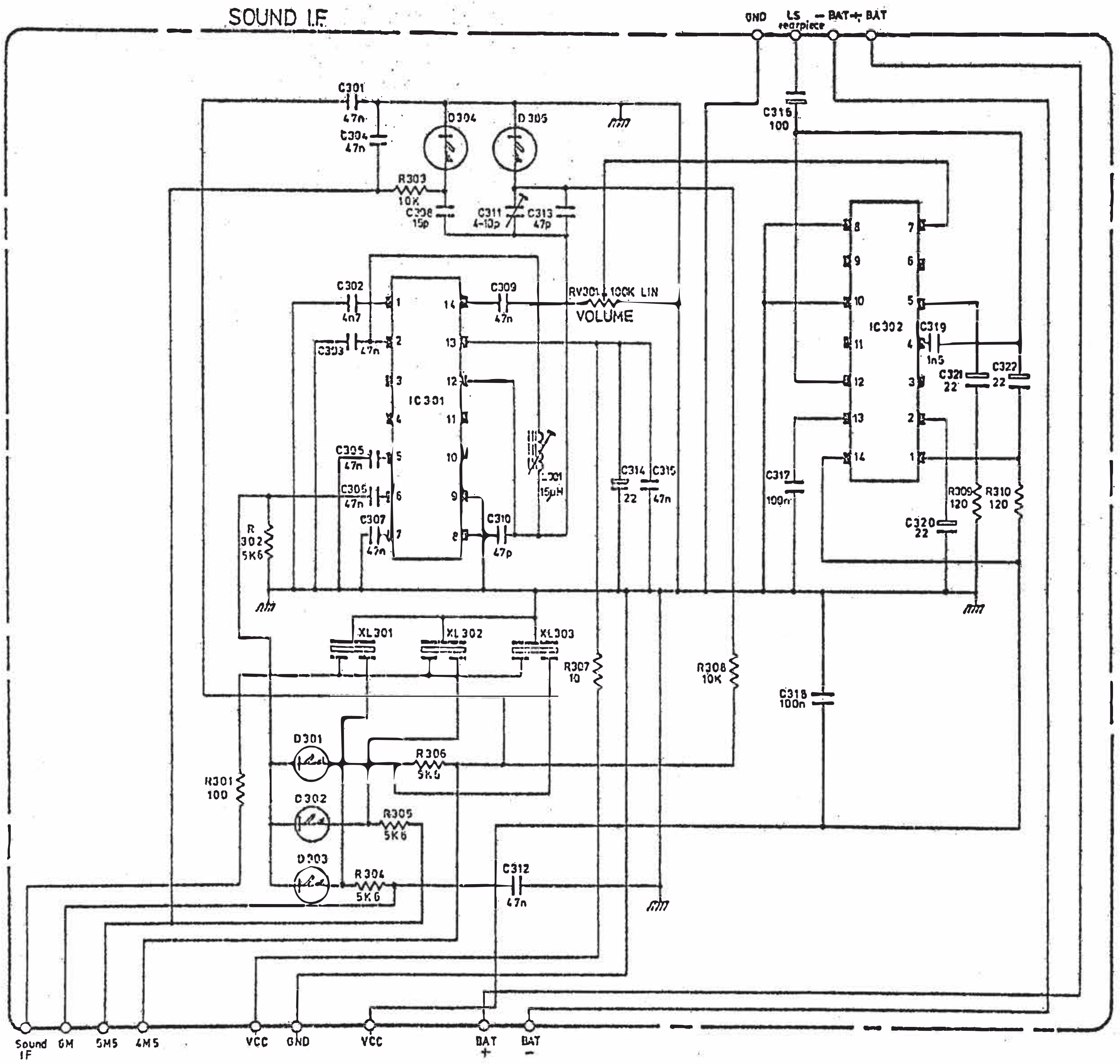
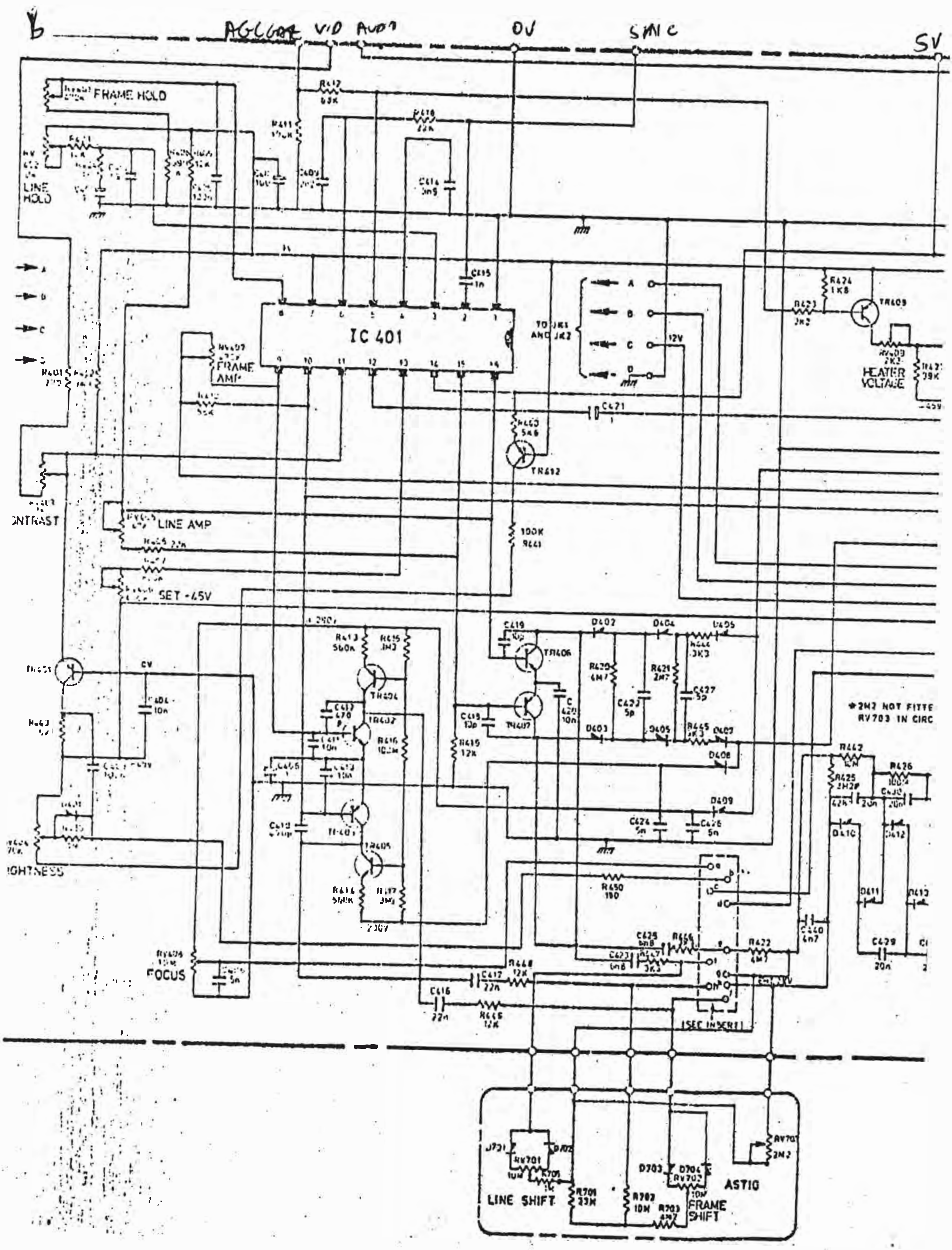
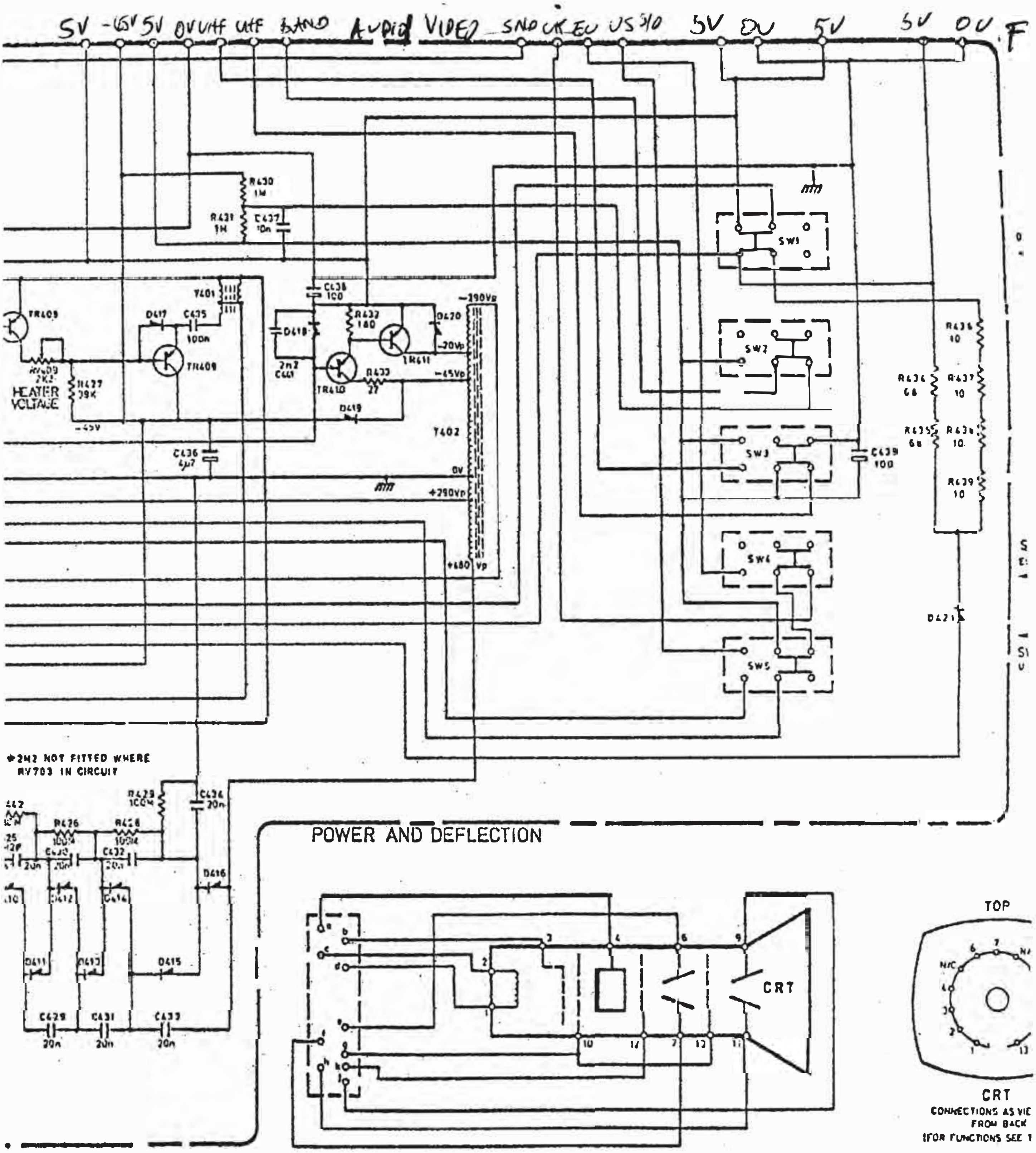
ARTWORK IS TO ISSUE F


V.I.F. AND DETECTOR
AFC Gain
AFC out
IF Test
VCC Tuner
-33V
AGC Test
Tuner AGC
Tuner Bias
Video IF
VHF
UHF
Band
C217 47n
RV201 10K
C216 47n
C218 10p
41,5MHZ L205
C208 4·7 pF
L203
D201
C211 3p3
D202
IC202
C219 12p
39p C220
34,5MHZ L206
C201 47n
C202 39p
L201 (AFC)
IC201
R203 10R
R205 10R
C205 47n
C206 22
C209 47n
C210 22
R206 56R
C214 47n
C215 47n
L204
C212 4p7
C213 47n
R208
C203 47p
L202 Det.coil
C204 1
R204 3K9
R202 1K8
TR201
R201 2K2
C207 100p
C221
R207 120K
AGC Gating
Video
Sound IF
Sync.
VCC In
-45V
Tuner VCC
VHF
UHF
Band



CIRCUIT DIAGRAM FOR SOUND I F BOARD


AGC
VID
AUD
0V
SYNC
5V
FRAME HOLD
LINE HOLD
IC 401
FRAME AMP
TO JK1 AND JK2
12V
TR409
TR412
HEATER VOLTAGE
CONTRAST
LINE AMP
SET -45V
TR406
TR407
TR404
TR405
BRIGHTNESS
FOCUS
(SEE INSERT)
LINE SHIFT
FRAME SHIFT
ASTIG
*2M2 NOT FITTED RV703 IN CIRC



PIN Nº	CRT FUNCTION
1	HEATER CATHODE
2	HEATER
3	GRID
4	FOCUS
6	LINE PLATE
7	LINE PLATE
9	FRAME PLATE
10	A1
11	FRAME PLATE
12	A3
13	LPS

SETTING UP PROCEDURES

Set up -45 volts

Connect a meter between Pin 7 of Berg socket and Earth (chassis ground).

Adjust preset pot for -45V. If you have to make more than a very slight adjustment, investigate the reason why. This rail usually doesn't drift much with time. It should also be a smooth rail; if there is line or frame frequency ripple then replace the 4µ7 capacitor C436 (marked on the coloured circuit diagram as '-45V smoothing').

Set heater volts

Connect an RMS meter between link marked X and earth. Adjust pot for 0.55 volts RMS.

It is important to use a true RMS meter here because the heater supply bears little resemblance to a sine wave; using a 'normal' meter will give an incorrect reading. Rule of thumb: if the tube lights up, and you haven't performed any major surgery, then you don't need to adjust the tube heater volts. If the tube doesn't light up, and you don't have a true RMS meter, check for the presence of some AC voltage across the heater pins on the tube (tube pins 1 & 2, or tube board pins c & d).

Other adjustments, width, height etc

Fairly obvious but advisable to check -45V after carrying out any such adjustments.

FAULT FINDING

General notes

With increasing age the electrolytic capacitors all become suspect due to possible drying out. The 1µF caps are reportedly particularly prone to this. Failure of the -45V rail smoothing cap (4µ7) can also cause strange-looking faults.

The original design used the four 1.24V Ni-Cd cells in series as a crude voltage stabiliser. Wherever you see +5V mentioned in the circuit diagrams or descriptions, it really means ‘or whatever the battery terminal voltage is’. With the Ni-Cd cells long dead, usually open circuit, the ‘+5V’ rail is likely to be more or less whatever voltage is coming out of the mains adapter. Using an original Sinclair ‘6V’ adapter, it’s not unusual to see the ‘+5V’ rail sitting at well over +7V. Thankfully the set seems to survive this, but it’s worth bearing in mind and perhaps running the set from a +5V supply when fault-finding.

Total receiver failure

No go all	Try on an adaptor to prove condition of batteries. If the batteries are completely flat, it will take a few minutes charging to produce results.	If results OK, check input socket for good connection, charge batteries. Battery fuse link O/C Batteries faulty or O/C connection at ends or connection via audio board
	If still no results after dismantling from the other boards (Tuner, Vision IF, Sound IF) it is possible to run the main board and CRT up separately via the power adapter socket on the rear panel.	If power board does not run up, go to power board faults table.
No sound	Sound Board fault	Check connection to Berg sockets. Go to sound faults table.
No picture or sound	Check for raster. If no raster then suspect power board. If raster present check Vision IF board and Tuner board.	Check Berg connections. Go to Vision IF fault table. Check Tuner board.
No frame, no line	Check Power board	
No vision	Check Power board and Vision IF board	

Tuner board

The VHF and UHF tuner units are not easily repairable, although this manual includes their circuit diagrams. In order to cure any faults in this part of the receiver it is suggested that the complete board be replaced.

Other faults that can occur on this board include:

1. Fuse from batteries – open circuit
2. Batteries faulty – open circuit
3. Loudspeaker – open circuit

The tuner board is now very often impacted by chemical damage from battery leakage, even if the batteries are now basically dry. Best advice here to perform a visual inspection, then check continuity across any suspect-looking tracks, making repairs as required.

Odd tuning results can be expected if the -33V rail isn't correct. This is derived from the -45V rail by a single 120k resistor on the video IF board. If the voltage is low (ie numerically less than 33) and you've checked for and corrected any and all chemical nasties, it's quite possible that one of the varicaps in the tuner section has gone leaky. The types originally used aren't known for certain but most VHF/UHF varicap diodes of the period go between 2pf and about 15pf or 2pf and about 35pf.

If the set appears OK but won't tune (ie you get different-looking noise when switching between VHF I and III, and UHF, but nothing happens when attempting to tune in a known-good analogue signal), check that there is 33V across the tuning pot (note that the pin furthest from the yellow knob is the wiper), then check that adjusting the tuning position alters the voltage on the wiper. If that's happy, check the second Berg pin in from the tuning knob ('AFC Out' on circuit diagram). This should have a tuning voltage of 0 to -33V that varies with the position of the tuning pot. If it doesn't have a variable voltage it's possible that IC201 on the video IF panel is suspect. Temporarily isolate the Berg pin, eg by cutting the track on the Tuner board, and check to see if tuning now works. If so then no further action is required – IC201 is Unobtanium and all that you've done by cutting the track is disable the AFC and possibly upset the tuning dial calibration.

If the tuner board is beyond repair then it may pay to convert the set into a monitor. Details on doing this are in a separate section.

Vision IF board

Vision smearing	ST1, many of coils O/C will cause smearing
No or poor vision	L203, ST1, C201, C219, C218, C215, L205, C214, ST2
High gain	ST1
AGC faulty	C216, R203, R205, RV20*[illegible]*
No sync	C216, ST1
Tuner bias incorrect	ST2
No –33V rail	ST2
High current	ST2, C213, ST1, C201, C209, C214

If the vision IF board is dead beyond resurrection (due to failure of the Sinclair chip(s)) it may still be possible to make use of the chassis: see the later section *Converting the MTV1 into a monitor*.

Audio board

No detector	C305, TAA661, C307, C303, C314, C306
No audio	TBA820, R310
Distortion	Ceramic filter faulty
	Misalignment

Power board faults

No raster	ST3, TR410 S/C, D413 S/C, D421, TR401, C29, TR409,TR406, TR407, D19
Low or no EHT	C430, C432, D411
No video	TR491, ST3
No sync	R403, C415
No frame	D408, TR403, D409, TR402, C405, TR403, C417
Frame faulty (inc shift)	D704, RV401, R702
Focus faults	D410, C431

A brief word on analogue TV

Fast-scan analogue TV broadcasts were made on the VHF and UHF bands. The signals were basically amplitude modulated, though filtering was used to attenuate substantially one sideband (making the signals into 'vestigial sideband' or VSB), a move intended to reduce the necessary RF channel bandwidth by almost half and, incidentally, reduce the transmitter power consumption by a similar amount. In most countries negative modulation was used, with the peak white corresponding to minimum instantaneous transmitter output. This meant that the sync pulses were the strongest thing in the signal, which is why receivers could lock to even fairly noisy signals. Sound was sent as an FM signal offset a few megahertz from the vision carrier.

- System I sound offset 6MHz (mono or PAL) - UK/Eire
- System B/G offset 5.5MHz (mono or PAL) - CCIR (Western Europe)
- System D offset 6.5MHz (mono or SECAM) - OIRT (Eastern Europe Block)
- System A offset 4.5MHz (mono or NTSC) - NTSC countries (and Argentina PAL)

A multi-standard set like the MTV1 had to be able to receive on VHF (Bands I & III) plus UHF (Bands IV & V), work with a 50 or 60Hz frame rate (with the concomitant different number of lines and line frequency) and be able to demodulate sound on any of the subcarrier frequencies. (For simplicity and perhaps due to lower perceived demand, the MTV-1 does not demodulate 6.5MHz).

In many parts of the world terrestrial television channels are now transmitted only via digital methods, commonly DVB-T or ASTC or variants thereon. The MTV1 is not able to receive these transmissions, however it is possible to create your own local signal source that acts as a very short-range analogue TV transmitter. The simplest approach is to use an ordinary VHF or UHF modulator (also called a 'game adapter') to produce a low level RF TV signal, then attach a small microwave amplifier IC (eg the ERA series from MiniCircuits, which are simple 3-terminal devices and straightforward to use – see www.minicircuits.com/pdfs/ERA-1+.pdf) feeding a suitable length of antenna. A modulator on its own doesn't produce enough RF to be received at more than a hand-span but with an amplifier as suggested the range will increase to a metre or three.

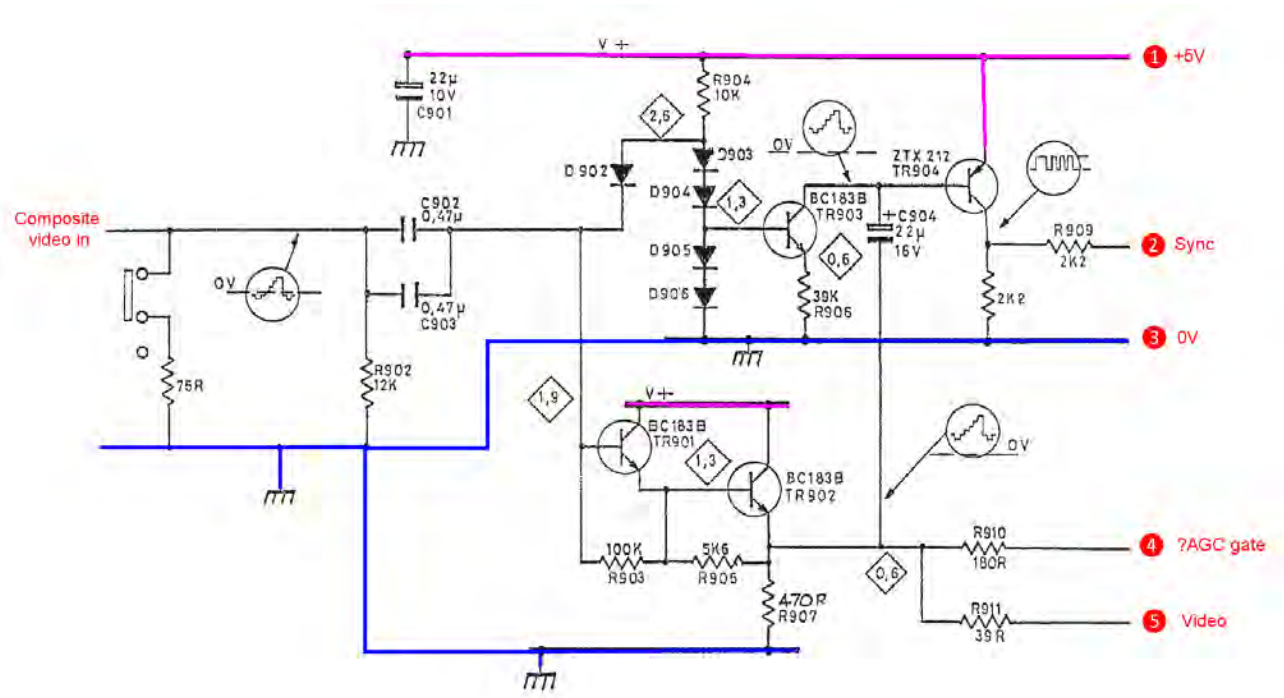
Suitable video sources include digital set-top boxes, streaming-service receivers (eg Roku, Fire, Chromecast…) and laptop/desktop computers. Most of these have no analogue outputs, instead using HDMI to output high-definition signals. Inexpensive HDMI-to-composite converters are readily available and do an excellent job, although you may have to fiddle with the settings in the source device to make it output a 4:3 format video signal as opposed to the now almost-universal 16:8 widescreen. If a 4:3 screen is fed with a 16:9 signal, everything onscreen looks stretched vertically.

Raspberry Pi computers have analogue video (and, in most cases, audio) outputs and can be set to produce PAL or NTSC-format video. This may provide a useful source of video that can be fed straight into a modulator.

Converting the MTV1 into a MON1 monitor

Given that key parts of the sets are Unobtanium (particularly the Sinclair-designed ICs on the tuner panel and, perhaps less so, the Sinclair deflection IC), there is naturally a dwindling number of scrap sets available for cannibalisation. However, if the basic chassis works then it is possible to repurpose the receiver as a composite monitor (after the style of the MON1, the composite video monitor version of the set) by omitting the tuner, video IF and sound panels.

The earlier version of this manual included an incomplete diagram of the MON1 video interface circuit, which is included at the end of this document. Below is a best-guess re-interpretation of the circuit; the numbers in circles refer to the same numbers on the coloured main circuit diagram.



It must be stressed that this is a best-guess and some experimentation may be required to obtain a stable image.

The original MON1 had a BNC socket on the rear panel for video input and a switch to select 75Ω termination. It would be possible to re-purpose the earphone jack as a video input connection and, optionally, one of the front panel switches as a termination switch.