

T E L E Q U I P M E N T

OSCILLOSCOPE

TYPE S51B AND S51E

All Telequipment instruments are the subject of continuous development and improvement, and, in consequence, may incorporate minor detail changes from the information contained herein.

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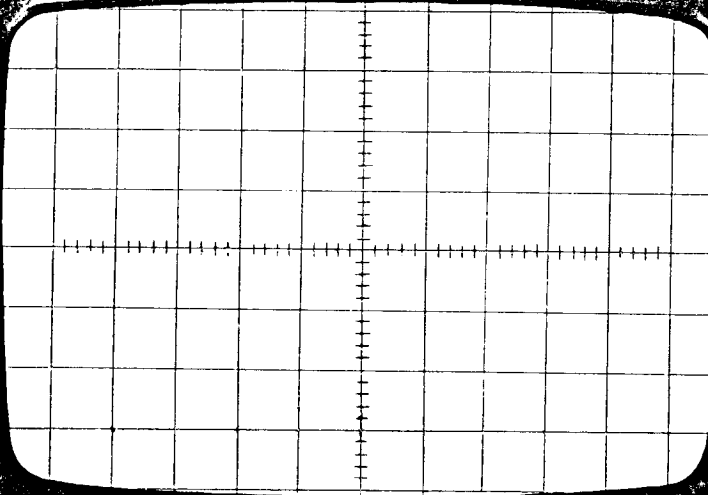
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TELEQUIPMENT



OSCILLOSCOPE 551B



BRIGHTNESS



OFF

FOCUS



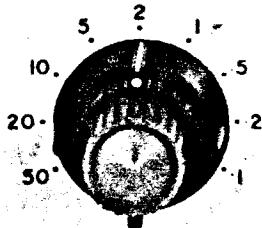
X GAIN



X SHIFT



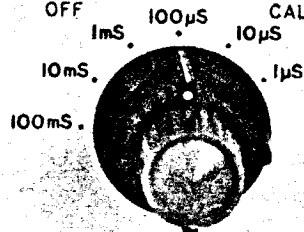
Y SHIFT
VOLTS/CM



STABILITY



VARIABLE
TIME/CM



NORMAL

TV FIELD

EXT. TRIG

INPUT



D.C. A.C.

TRIG LEVEL



INT. EXT.

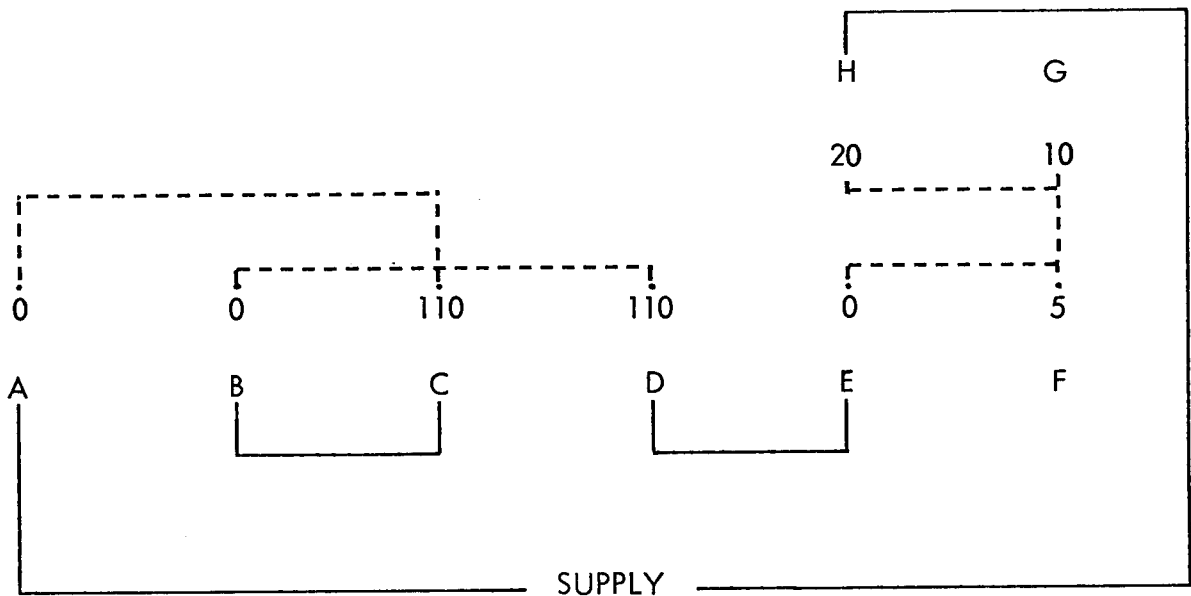


FIRST TIME OPERATION

CHECK SUPPLY VOLTAGE AND FUSE

Before connection to the mains supply check that the transformer primary windings are interconnected to suit the local supply voltage and that the fuse is of the correct rating, 1A for 90 to 130V and 500mA for 200 to 240V. For access to the transformer, remove the case after unscrewing the two screws at the rear of the instrument.

RELEVANT TRANSFORMER CONNECTIONS



90-130V Link A to B and C to D. Connect link and supply leads as below.

200-240V Link B to C. Connect link and supply leads as below.

Supply voltage	90	95	100	105	110	115	120	125	130
	200	205	210	215	220	225	230	235	240
Link	DH	DH	DG	DF	-	DE	DE	DF	DE
Supply to	AE	AF	AE	AE	AD	AF	AG	AH	AH

The interconnections for 240V operation are illustrated.

CIRCUIT DESCRIPTION

VERTICAL AMPLIFIER

The vertical amplifier consists of three double triodes. V1a and b form a cathode coupled amplifier stage with RV6 acting as the gain control.

The signal is taken from V1b anode and drives the output stage V3 via cathode follower V2a.

V3 consists of a long-tailed pair with the signal taken to V3a and the vertical shift applied to V3b.

V2b acts as a low impedance HT supply for V1, also providing approximately 150V for Y shift and timebase circuits.

The signal at the anode of V3b is taken to the INT-EXT trigger switch.

The HT supply for the trigger circuit, V4 and V5b is taken from a common resistor R15 in the cathode circuit of V3.

TRIGGER CIRCUIT

The trigger selection is performed by three switches in the S51B and one in the S51E; S2 selects the INT-EXT triggering signal and connects it to the grid of phase splitter V4b. S3 selects the positive or negative output of the phase splitter and connects it to S4 which either passes the signal directly or via an integrating circuit to V4a. The latter position, TV FIELD, integrates the field pulses of a television waveform and attenuates the line pulses allowing the time base to be triggered by the field sync pulses.

From S4 the signal is fed to V4a and V5b which form a cathode coupled bistable switch, the switching level being adjusted by the grid potential of V4a. On the AUTO position the switch S5 is opened and the grid of V4a is returned to the grid of V5b. In the absence of a signal V4a and V5b oscillate at a frequency determined by the time constant R42 and C19, but as soon as any input signal between about 50Hz and 1MHz is applied to the grid of V4a, the self-oscillation ceases and the multivibrator synchronises to the signal frequency. The square wave appearing at the anode of V5b is differentiated, the positive pulse removed by MR7 and the negative pulse used to trigger the time base.

TIMEBASE & HORIZONTAL AMPLIFIER

V6a is the Miller sweep generator, the speed of run down being controlled by S8 and the VARIABLE speed control.

The Miller valve is keyed by V5a and V6b which together form a d.c. coupled multivibrator.

In the rest position of the timebase, V5a is off and its anode potential is clamped by MR8 and 9. V6b is conducting. A negative trigger pulse from V5b lowers the grid potential of V6b and hence that of the anode of V6a. This is coupled to the grid of V6a, so reducing the valve current. The resulting rise in screen potential developed across R65 is coupled via R54 and S6a to the grid of V5a. This causes V5a anode voltage to fall; which leads to regenerative action whereby V6b becomes quickly cut off and V5a hard on.

When the run down has reached the point where the cathode voltage of V6b has fallen to near that of the grid, V6b starts to conduct and a negative pulse is applied to the grid of V5a. Regeneration again takes place driving V5a to cut off and V6b to conduction.

The positive going voltage at V6b anode, developed during the sweep, is coupled via S6b to the modulator plate of the CRT, to provide trace unblanking.

The STABILITY control RV49 serves to set the grid potential of V5a to the point just short of the free running condition of V5a and V6b.

The linear sweep voltage at the anode of V6a is taken via R64, C41 and R73 to one grid of the horizontal amplifier V7, horizontal shift voltage is applied to the other grid and the output at the anodes drives the CRT X plates in push-pull.

Transistor TR1 in the common cathode circuit, acts as a constant current source and provides a balanced output at the two anodes.

An external signal may be applied through a connector at the rear of the instrument. In this condition, the timebase should be switched off with the VARIABLE speed control. V5a is then switched for use as a preamplifier, the signal being applied to its grid. Cathode bias is provided by RV56, decoupled by C25. The signal at V5a anode is coupled via V6b, acting as a cathode follower, and S6d to the horizontal output amplifier V7. In order to keep the d.c. conditions correct, V5a and V6b anodes are switched by S6b to the 150V HT supply and in addition V6b anode is decoupled by C26.

POWER SUPPLY

Silicon rectifiers **MR1** and 2 in a voltage doubling circuit supply the various HT voltages via smoothing resistor R24.

The negative EHT supply for the CRT and STABILITY control via R29 is provided by MR3, 4 and 5, C8, 9 and 11. It is applied via voltage reference neons **N1** and 2, in parallel with the BRIGHTNESS control, to the cathode of the CRT.

The positive EHT supply is derived from MR6 and C12. The negative end of C 12 is returned to the HT line.

CRT

Intensity modulation signals may be applied via C16 to the grid of the CRT.

The interplate shield potential is adjusted by RV88 to the mean potential of the deflector plates for optimum geometry or freedom from bowing of the display. RV89 provides preset astigmatism adjustment and RV92, blanking, allows the beam intensity to be adjusted to a maximum by varying the first anode potential.

MAINTENANCE ADJUSTMENTS

The simplicity of the circuitry of the S51 makes it an extremely reliable instrument, and for the most part servicing will be limited to the replacement of defective valves. Valve replacement will have little effect on performance and should not necessarily entail readjustment of preset controls. If for any reason the internal presets do require adjustment, the following detailed instructions will allow this to be done quickly and accurately.

The case may be removed after unscrewing the two screws at the rear of the instrument.

INPUT ATTENUATOR & PROBE

In order to adjust the input attenuator compensation a squarewave generator is required with a frequency of approximately 2kHz and whose output can be varied between 0.2 and 100V. The rise time of the squarewave need not be particularly fast, but it must have a flat top and bottom. Connect the squarewave generator to the input socket and adjust the output to approximately 0.2V. Set the input attenuator to .1 and adjust the sweep controls so that 3 cycles of the squarewave are displayed. Now carry out the following procedure step by step, adjusting each trimmer to give a square corner to the squarewave. On each setting of the input attenuator the output of the squarewave generator should be adjusted to give a display of approximately 2-3 cm amplitude.

<u>Set VOLTS/CM to:</u>	<u>Adjust</u>
.2	C112
.5	C111
1	C104
2	C108
5	C109
10	C105

If these adjustments have been carried out correctly the 20 and 50V/cm ranges are automatically compensated.

In order to adjust C102 and 103 it is necessary to use a high impedance probe, as these two capacitors only affect compensation when a probe is in use. Remove

the squarewave generator from the input socket and plug in the high impedance probe, connect the output of the squarewave generator to the probe tip and set the input attenuator to .1, set the output of the squarewave generator to give approximately 2cm amplitude and adjust the probe trimmer to give a flat top to the squarewave. Now switch the input attenuator to 1, readjust the output of the squarewave generator and adjust C102. Set the input attenuator to 10, readjust the generator and adjust C 103. All other ranges will automatically be correct.

VERTICAL AMPLIFIER

Adjustment of the high frequency compensation of the vertical amplifiers should only be carried out if a squarewave generator is available which is capable of producing an accurate squarewave at a frequency of about 250kHz with a rise time of less than 100ns and which is known to be absolutely free from ring or overshoot. The compensation circuits in the vertical amplifier are extremely stable and, unless such a generator is employed readjustment is undesirable.

Set the input attenuator switch to 0.1 and adjust the output of the squarewave generator to give a trace of approximately 2-3cm amplitude (the output frequency of the generator should be between 200 and 300kHz). L1 is adjusted to give a flat topped squarewave with a fast -rise time, square corners and no overshoot.

The only other variable on the vertical amplifier is the SET Y GAIN control, which should be adjusted with a signal of known amplitude with appropriate setting of the VOLTS/CM switch.

— RV8 *

TRIGGER CIRCUIT

The only adjustment necessary in the trigger circuit is an occasional resetting of the trigger sensitivity control RV48; this should be set so that the trigger circuit will operate when the trace amplitude on the screen exceeds 2mm. If any attempt is made to increase the sensitivity beyond this point erratic operation will almost inevitably result. Connect a signal, say a 2kHz squarewave, to INPUT. Now set the input attenuator and squarewave generator to give a trace 2mm high and adjust the TRIG SENS control so that, at a critical setting of the TRIG LEVEL control, the sweep will just trigger. Reduce the trace amplitude to 1mm and make sure that the sweep will not trigger on this signal.

SWEEP GENERATOR & HORIZONTAL AMPLIFIER

To make a complete readjustment of the sweep generator and horizontal amplifier, carry out the following procedure:-

Remove the lead to the modulator anode, pin 7 on the CRT. Set the TIME/CM switch to $100\mu\text{s}$. Now advance the BRIGHTNESS control until the spot at the beginning of the trace may be seen. By adjusting C41 a small tail may be made to appear on one side of the spot or the other. The correct setting for C41 is the point at which this tail just disappears into the spot.

Reconnect the lead to the modulator anode on the CRT.

Now set the TIME/CM switch to $100\mu\text{s}$ and the VARIABLE speed to the CAL position. X GAIN should be at minimum and the trace centred by the X SHIFT control.

Connect accurately known $100\mu\text{s}$ marker pulses or an accurate 10kHz square-wave to the input terminals and adjust RV72 for 1 pulse or cycle per cm. As adjustment of RV72 will cause the trace to move horizontally, it should be recentred using the X SHIFT control. For greatest accuracy, calibration should be carried out over the centre 4 cm of horizontal trace.

To set up the X amplifier, adjust X SHIFT until the start of the sweep is at the centre of the screen. Turn the VARIABLE speed control to the timebase off position and adjust trace position (RV56) so that the spot is in the centre of the screen. Feed into X IN a sine wave of 0.5V P.-P. Now adjust X GAIN until 5cm of trace is displayed. The X amplifier is now set to 100mV/cm.

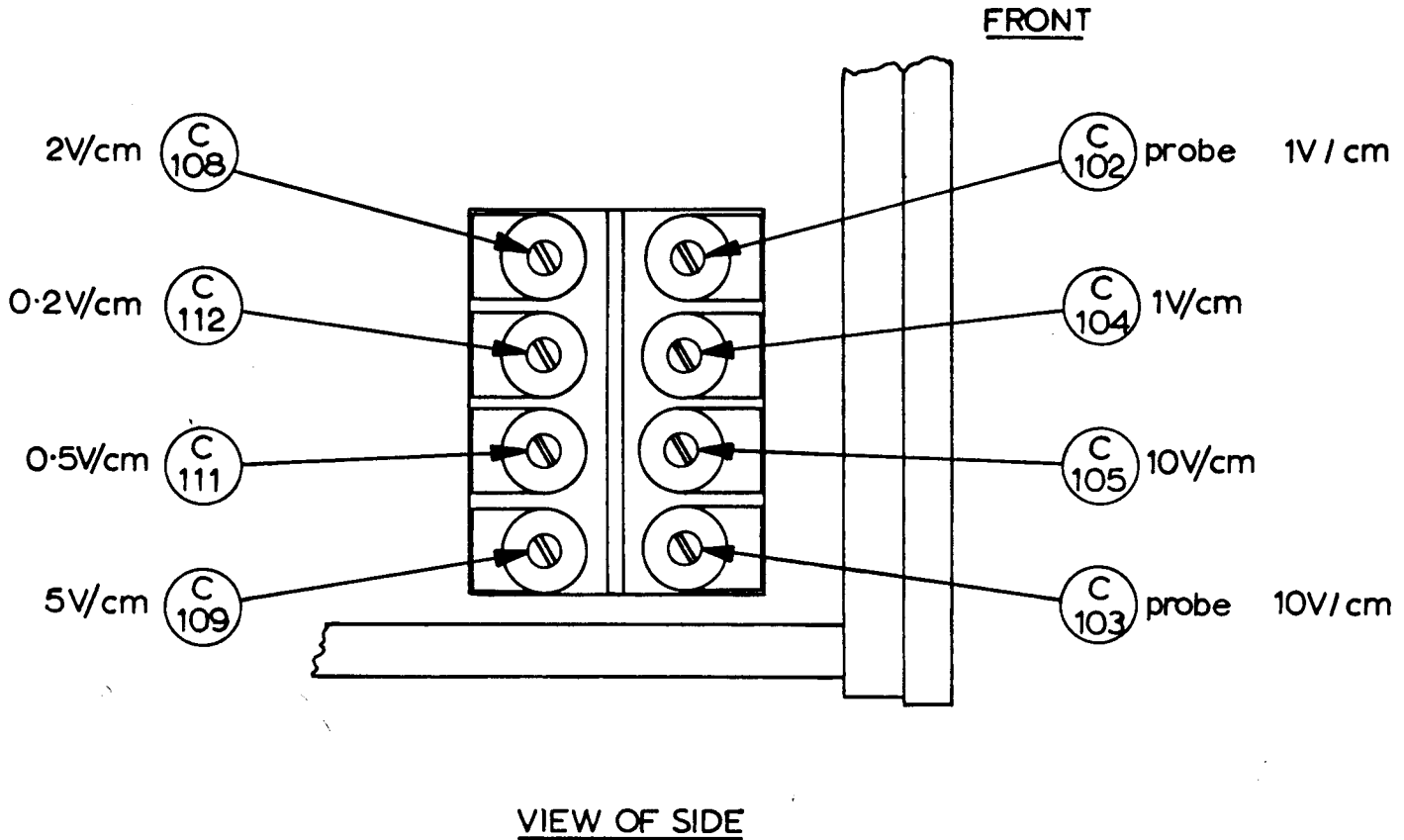
CRT CIRCUIT

Feed 0.5V P.-P. into both X and Y inputs, with VOLTS/CM at .1, and a diagonal line will be produced. By varying the X and Y shifts, see that the trace remains undistorted over the tube face. If any bowing occurs, adjust interplate shield potential, (RV88), to straighten.

Remove the X input and set TIME/CM to a convenient speed, adjust RV89, ASTIG, in conjunction with FOCUS for optimum trace definition.

Remove the Y input and reduce BRIGHTNESS, adjust RV92, BLKG, for maximum trace intensity.

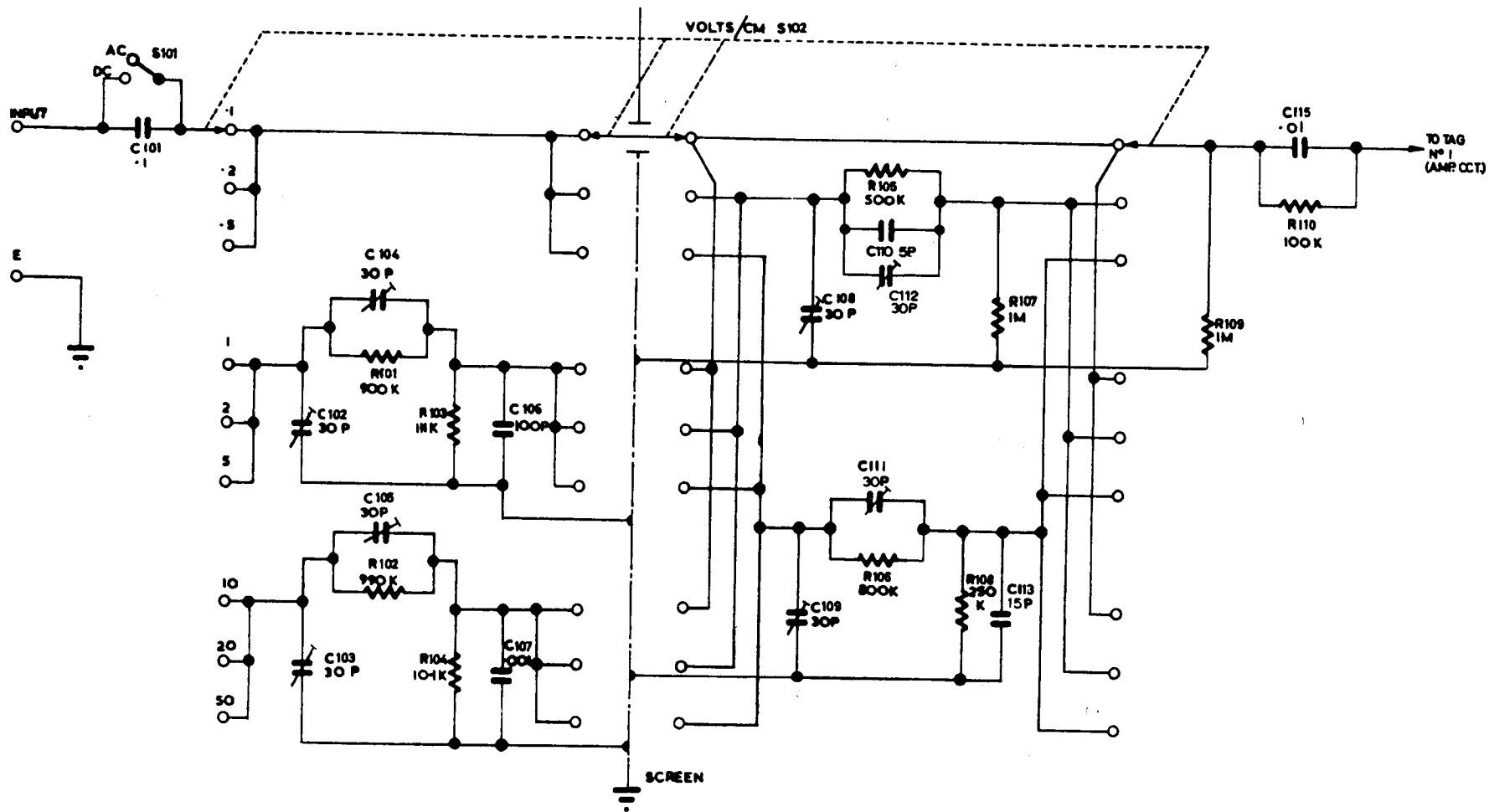
On tube replacement, the link across N2 is removed if the range of the BRIGHTNESS control is not adequate to cut off the beam.

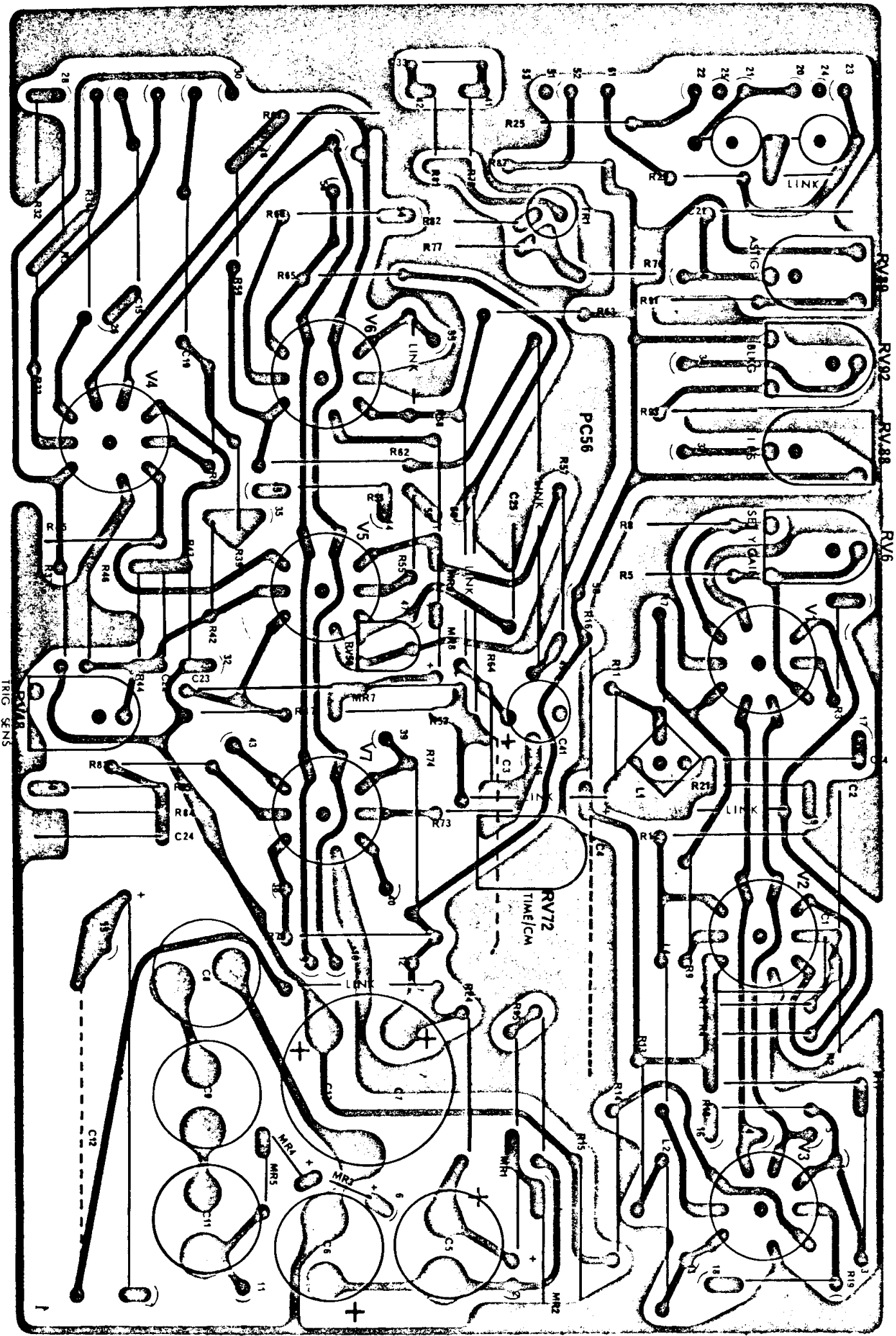


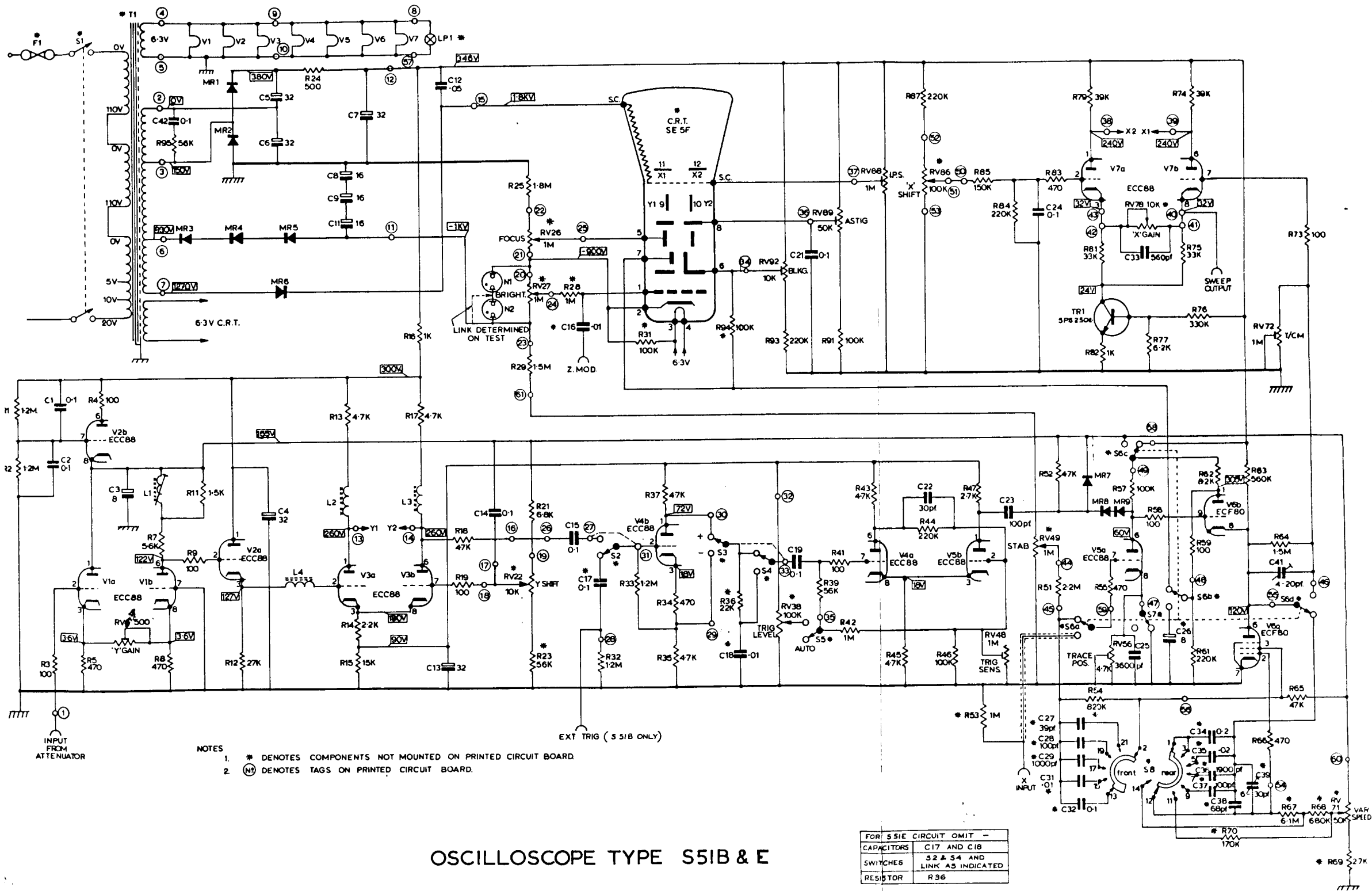
INPUT ATTENUATOR PRE-SET
CAPACITOR LOCATIONS

INPUT ATTENUATOR

TYPE S51B







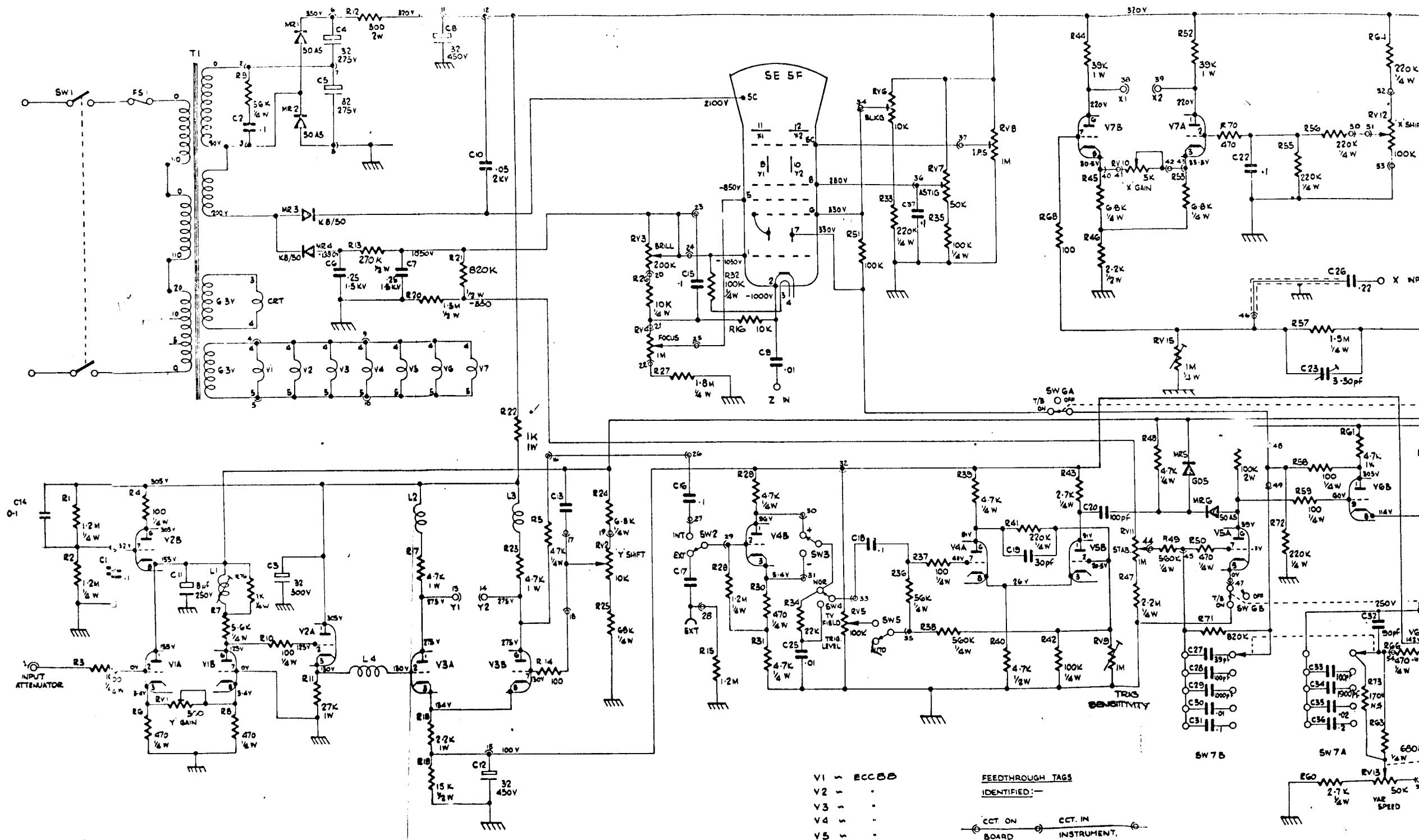
- NOTES
- * DENOTES COMPONENTS NOT MOUNTED ON PRINTED CIRCUIT BOARD.
 - (N) DENOTES TAGS ON PRINTED CIRCUIT BOARD.

OSCILLOSCOPE TYPE S5IB & E

FOR S5IE CIRCUIT OMIT -	
CAPACITORS	C17 AND C18
SWITCHES	S2 & S4 AND LINK A5 INDICATED
RESISTOR	R36

* R69 27K

OSCILLOSCOPE TYPE S51



- V1 - ECC88
- V2 - .
- V3 - .
- V4 - .
- V5 - .
- V6 - ECF 80
- V7 - ECC88

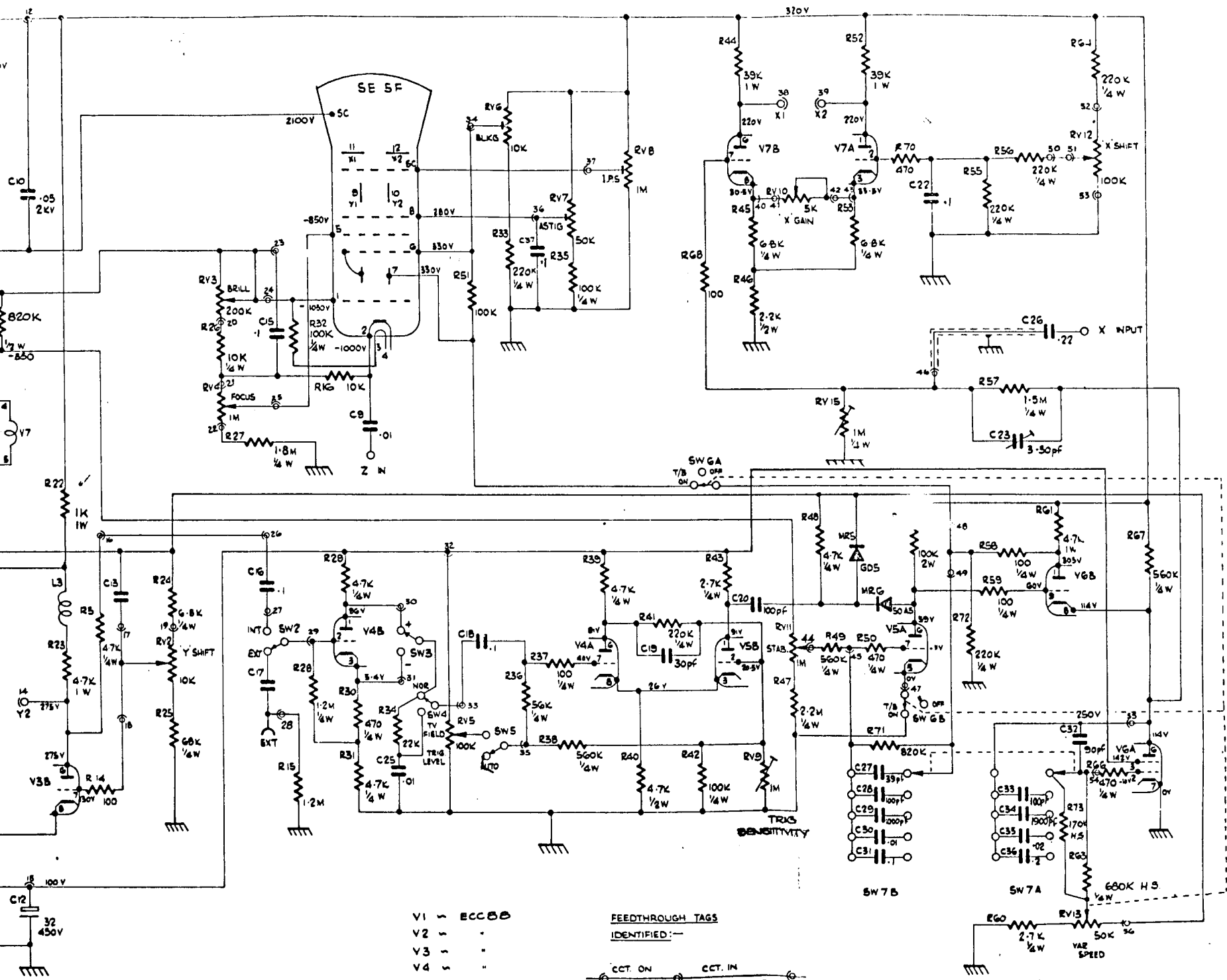
FEEDTHROUGH TAGS IDENTIFIED: -

CCT ON BOARD CCT. IN INSTRUMENT, NOT ON BOARD

SW 7 B SW 7 A

VAR SPEED

OSCILLOSCOPE TYPE 951



- V1 - ECC88
- V2 - "
- V3 - "
- V4 - "
- V5 - "
- V6 - ECF 80
- V7 - ECC88

FEEDTHROUGH TAGS IDENTIFIED:-

