GENERAL DESCRIPTION

CATHODE RAY TUBE

The 3" flat faced tube operates at 1,400 Volts, giving an extremely bright fine trace over the whole of the working area (5cms x 5cms). A P1 phosphor is normally supplied but a long persistence tube is available if specified.

A green filter improves the contrast under conditions of high ambient light.

VERTICAL DEFLECTION AMPLIFIER

The four-stage, balanced, D.C. coupled amplifier drives the deflector plates through output cathode-followers. The amplifier is compensated for optimum pulse response with no overshoot and has a bandpass of 6 Mc/s (-3dB-). The rise time is about .06 usec.

The nine-position input attenuator is frequency compensated and gives sensitivities of 100mV, 500mV, 1V, 2V, 5V, 10V, 20V & 50V per centimeter.

The pre-set gain control standardises the sensitivity against an internally generated 1 volt p.p. squarewave.

The input impedance is 1 Megohm, shunted by about 30pf.

VOLTAGE CALIBRATOR

A 1 volt p.p. squarewave, stabilised against line voltage variations is available at a connector of the front panel.

SWEEP CIRCUIT

The sweep generator is a Miller run-down circuit giving excellent linearity. Eighteen pre-set sweep speeds are provided, from 1sec per cm, down to .5 sec per cm, in 1, 2, 5, 10 etc. multiples. Slower speeds, down to about 3 seconds can be obtained by adjusting the SET SPEED control to the bottom end of its range.

HORIZONTAL AMPLIFIER

The X GAIN control expands the trace to over 10 diameters and sufficient shift is provided to enable any part of the expanded trace to be positioned centrally on the screen.

TRACE UNBLANKING

D.C. coupling of the unblanking waveform gives uniform trace brightness at all sweep speeds.

TRIGGERING

Two modes of triggering are provided:

1. AUTO. On this setting the sweep free runs at a slow speed in the absence of an input signal, but will be triggered automatically as soon as an

TRIGGERING (continued)

input signal is applied. This mode of operation can be used for 90% of all normal laboratory uses.

2. TRIGGER LEVEL SELECTION. With the AUTO switch OFF the Trigger Level Control allows the sweep to be triggered at any point on the input waveform.

T.V. SYNC SEPARATOR

The built-in TV sync separator triggers the sweep from the Line or Frame pulses of a composite Television waveform.

REAR CONNECTORS

Connectors on the rear panel provide access to the Horizontal Amplifier, intensity modulation of the beam and the sweep output waveform.

COOLING

The S31 is cooled by convection. Air enters the bottom of the case and is drawn up past the tubes and other hot components which are all located on the left hand side of the chassis, passing out through the slots at the top. Do not obstruct the air flow in any way. Do not put anything on top of the instrument and make sure that there is an air space underneath.

MAINTENANCE ADJUSTMENTS.

The simplicity of the circuitary of the S31 make it an extremely reliable instrument and for the most part servicing will be limited to the replacement of defective tubes. When replacing tubes in the vertical Amplifier you may find that you will have to select pairs of tubes of approximately the same characteristics in order to get the vertical SHIFT to operate symmetrically about the centre of the screen, apart from this replacements of tubes in the vertical Amplifier will have very little effect on its performance and no re-adjustment should be necessary. In the sweep generator and Horizontal Amplifier the tubes are not particularly critical and you will find that you can replace these without having to alter the internal adjustments. If for any reason the internal pre-set controls do require adjustment the following detailed instructions will allow you to do this quickly and accurately.

ADJUSTMENT PROCEDURE.

INPUT ATTENUATOR.

In order to adjust the input attenuator compensation you will need a squarewave generator with a frequency of approximately 2 KC's and whose output can be varied between .2 volts and 100 volts. The rise time of the squarewave need not be particularly fast but it must have a good flat top and bottom. Connect the squarewave generator to the input socket and adjust the output to approximately .2 volt. Set the input attenuator to .1 volt per cm. and adjust the sweep controls so that you are displaying 3 cycles of the squarewave. 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 you should adjust the output of the squarewave generator to give a trace of approximately 2 - 3 cm. amplitude.

Set Input Attenuator to:	Adjust
.2 volts per cm.	C12
.5 " " "	C13
1 " " "	C4
2 " " "	C8
5 " " "	C9
10 " " "	C5

If you have carried out these adjustments correctly the 20 volts per cm. and the 50 volts per cm. ranges are automatically correct. In order to adjust the capacitors C2 and C3 it is necessary to use the high impedance probe as these two capacitors only affect compensation when this 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 volt per cm. set the output of the squarewave generator to give approximately 2 cm. amplitude and adjust the probe trimmer (this is accessible through the hole in the probe body) to give a flat top to the squarewave, now switch the input attenuator to the 1 volt per cm. range, re-adjust the output of the squarewave generator and adjust C2, set the input attenuator to the 10 volts per cm. range and adjust C3. All other ranges will automatically be correct.

DJUSTMENT PROCEDURE. (continued)

ERTICAL AMPLIFIER

Adjustment of the high frequency compensation of the vertical mplifier should only be carried out if you have at your disposal a squarewave enerator which is capable of producing an accurate squarewave at a frequency of bout 250 KC's with a rise time less than 40 milli microseconds and which is known o be absolutely free from ring or overshoot. The compensation circuits in the ertical Amplifier are extremely stable and unless such a generator is available ou would be wise not to attempt any readjustment. Suitable squarewave generators re the Tektronix and the Hewlett Packard type 211A, and if one of these or an quivalent is available then the adjustments can be carried out in the following anner:-

Set the input attenuator switch to .1 volt per cm. and adjust the utput of the squarewave generator to give a trace of approximately 2 - 3 cm. mplitude (the output frequency on the generator should be between 200 and 300 C's). The variables L3 L4 C17 and C18 are to some extent independent and it may e necessary to adjust any or all of these to obtain the desired result which is a lat topped squarewave with a fast rise time, square corners and no overshoot. 3 and L4 affect the extreme corners of the squarewave and should be adjusted so hat they are approximately equal inductances. C17 has a longer time constant and hould be set to give a flat top to the squarewave, C18 has an even longer time onstant and sets the overall slope of the top. You may find that you can adjust C18 more easily on a lower frequency squarewave, say about 50 KC's.

The only other adjustment on the vertical amplifier is the set GAIN control, which is accessible through the bottom of the instrument.

TRIGGER CIRCUIT

The only adjustments necessary in the TRIGGER circuit is an occasional setting of the TRIGGER sensitivity control R63, 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 eratic operation will almost inevitably result. This adjustment can conveniently be made using the internal calibration signal. Join a connector between the CAL. output and the input and adjust the sweep controls so that you are displaying about 5 cycles of the calibration waveform. Now set the input attenuator to the 5 volts per cm. range (giving a trace 2 mm. high) and adjust the TRIGGER sensitivity control so that at a critical setting of the TRIG. LEVEL control the sweep will just trigger, now reduce the trace amplitude to 1 mm. and make sure that the sweep will not trigger on this signal.

SWEEP GENERATOR AND HORIZONTAL AMPLIFIER

To make a complete readjustment of the Sweep Generator and Horizontal Amplifier carry out the following procedure.

Set the TIME/CM switch to 100 usecs. and the MULTIPLIER switch to 10, advance the STABILITY control until the Sweep just free runs. With the X-SHIFT control in its mid position and the X-GAIN control in the minimum position adjust R93 until the trace length is approximately 6 cm. and adjust R105 to centre this trace about the

SWEEP GENERATOR AND HORIZONTAL AMPLIFIER. (continued)

5 cm. marks on the graticule. Now advance the BRILLIANCE control until you can see the spot at the beginning of the trace and you will find that by adjusting C38 you will be able to make a small "tail" appear to one side of the spot or the other. The correct setting for C38 is the point at which this "tail" just disappears into the spot, alternatively, C38 can be adjusted by displaying a signal of approximately 100 KC's and setting C38 for optimum linearity at the beginning of the trace, but the first method is more simple and is quite satisfactory. Now set the TIME/CM switch to 1 millisecond and the MULTIPLIER switch to 20 (to the CAL. 60 cycle position when the instrument is being operated from a 60 cycle supply). Now display the calibration voltage waveform and set the "set speed" control so that 1 cycle of the calibration waveform occupies exactly 1 cm. (still with the X)GAIN control to its minimum position). Now set the TIME/CM switch to one usec and the MULTIPLIER switch to 1. Inject an accurate 1 megacycle signal into the input and adjust the volts per cm. switch to give a trace approximately 2 cm. amplitude. Now adjust C27 so that each cycle of this 1 megacycle signal occupies 1 cm.

VOLTAGE CALIBRATOR.

R129 in the voltage calibrator circuit is provided so that the output can be set to precisely 1 volt. This adjustment can only be made by comparing the output with a known accurate 1 volt peak to peak signal. R129 will normally require no adjustment provided if the gas diode NT3 is replaced one of a similar type is used (NT1 and NT2 have no effect on the amplitude of the output waveform).

CRT. CIRCUIT.

There are two pre-set controls in the CRT Circuit. R120 is a pre-set BRILLIANCE control and is adjusted so that with the front BRILLIANCE control at its minimum position the trace just disappears. Due to ageing of the CR tube you will find that after the initial period of use it will be necessary to make a slight adjustment to this internal pre-set control. The other adjustment is the frequency compensation of the re-trace blanking circuit C47. Set the sweep speed to 20 usecs per cm. and remove the input signal so that you are simply displaying a trace. You will find that adjustment of C47 varies the BRILLIANCE of the first part of the trace and you should set this capacitor so that the trace is of uniform brightness along its length.

HIGH IMPEDANCE PROBE

The adjustment of the probe compensation is best carried out with a squarewave generator with an output frequency of approximately 1 KC. The compensation trimmer is accessible through the hole in the body of the probe and you should adjust this to give a square corner to the squarewave. If a squarewave generator is not readily available the probe can be compensated using an internal signal from the sweep generator in the following manner:-

Set the sweep speed to 1 millisecond per cm. and set the input attenuator to the 20 volts per cm. position. Set the AC/DC switch to AC. Now apply the tip of the probe to the test point and adjust the probe compensating trimmer to give a

HIGH IMPEDANCE PROBE. (continued)

level start to the trace, under compensation and over compensation conditions are shown in the following diagram.

NOTE. In the case of instruments having a serial number smaller than 1530, it is necessary to remove the right-hand side cover of the instrument in order to use this probe test signal. On later instruments this point is accessible through the slot in the top cover as shown in the photograph. Take care not to short this point to ground. Provided that the input attenuator adjustments have been carried out correctly the probe adjustment will hold good on all ranges of the input attenuator.

Abbreviations used in components lists.

Capacitors

MP	Moulded Paper
SM	Silver Mica
Cer.	Ceramic Tubular
Elec.	Electrolytic

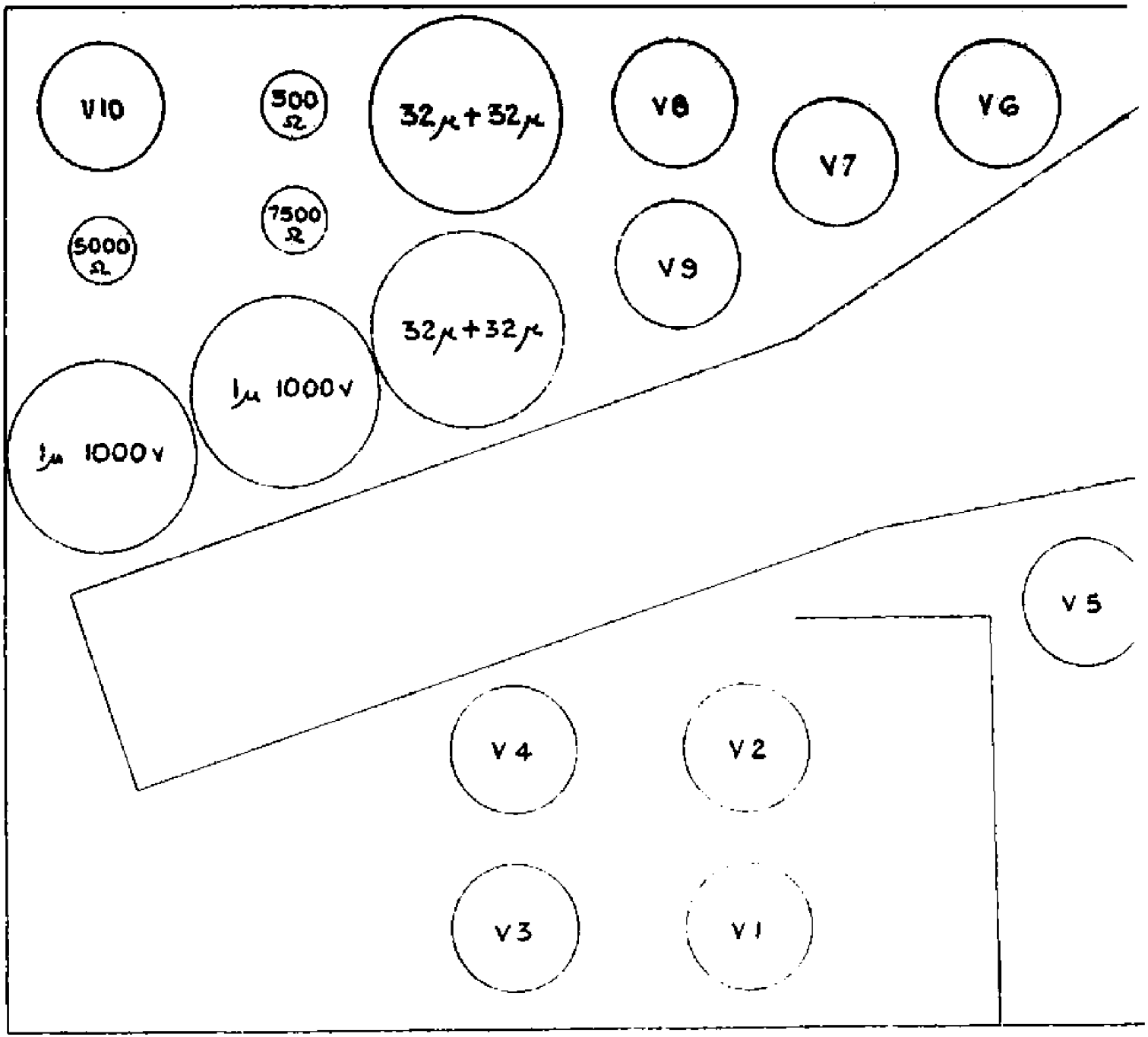
Resistors

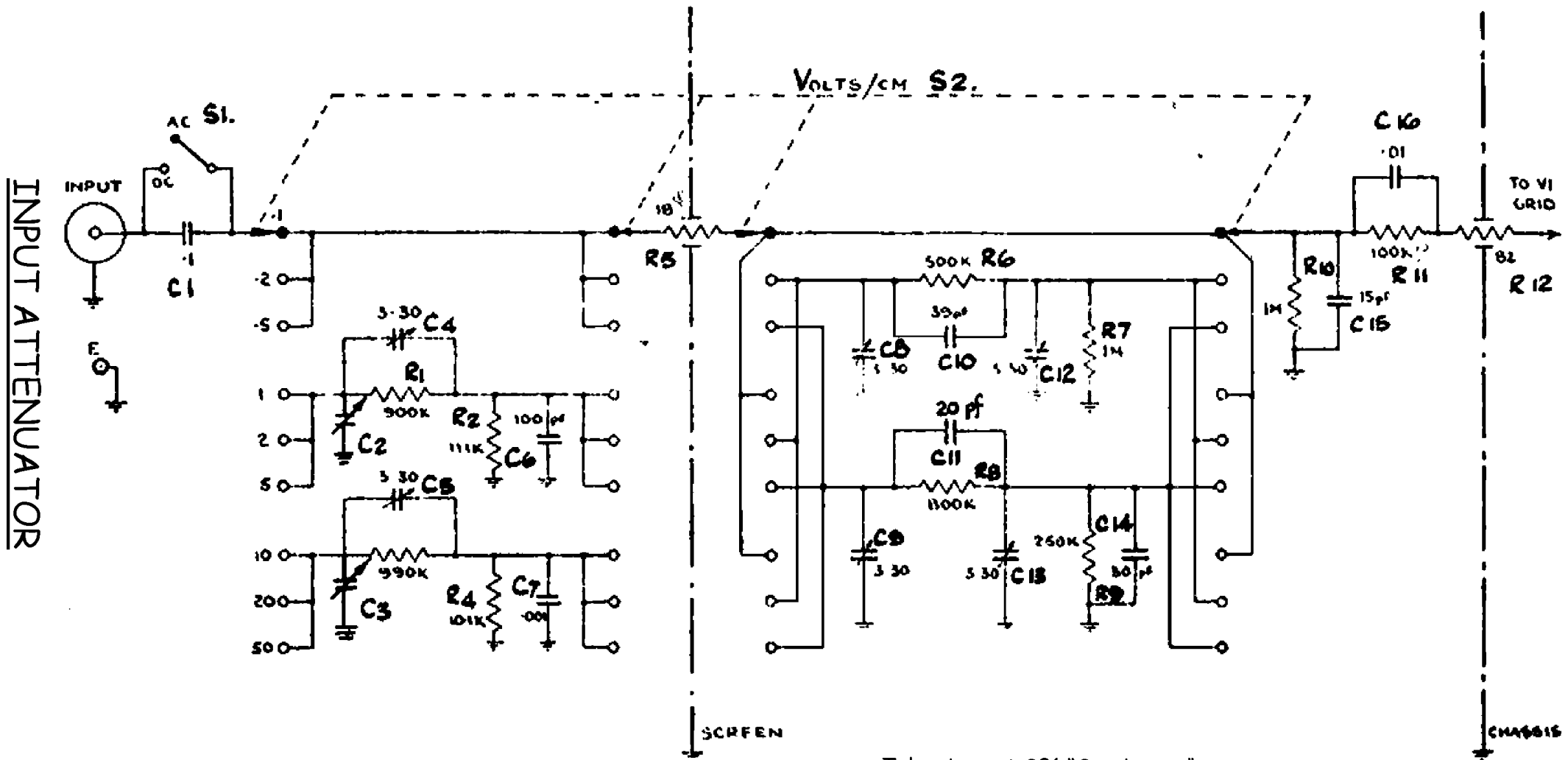
C	Carbon Composition
HSC	High Stability Carbon
WW	Wire Wound
PS	Preset Carbon (Internal Adjustment)

In the following component lists, no manufacturers names have been included. When replacing components, locally available alternatives may be used if exact replacements are not to hand, provided the physical size is the same.

It is, however, preferable to use exact replacements whenever possible, and these should be ordered direct from TELEQUIPMENT LIMITED or from our agents.

V1 ECF 80
V2 ECF 80
V3 ECF 80
V4 ECF 80
V5 ECF 80
V6 ECF 80
V7 ECF 80
V8 ECF 80
V9 ECF 80
V10 EZ 81
C.R.T. DG7/36





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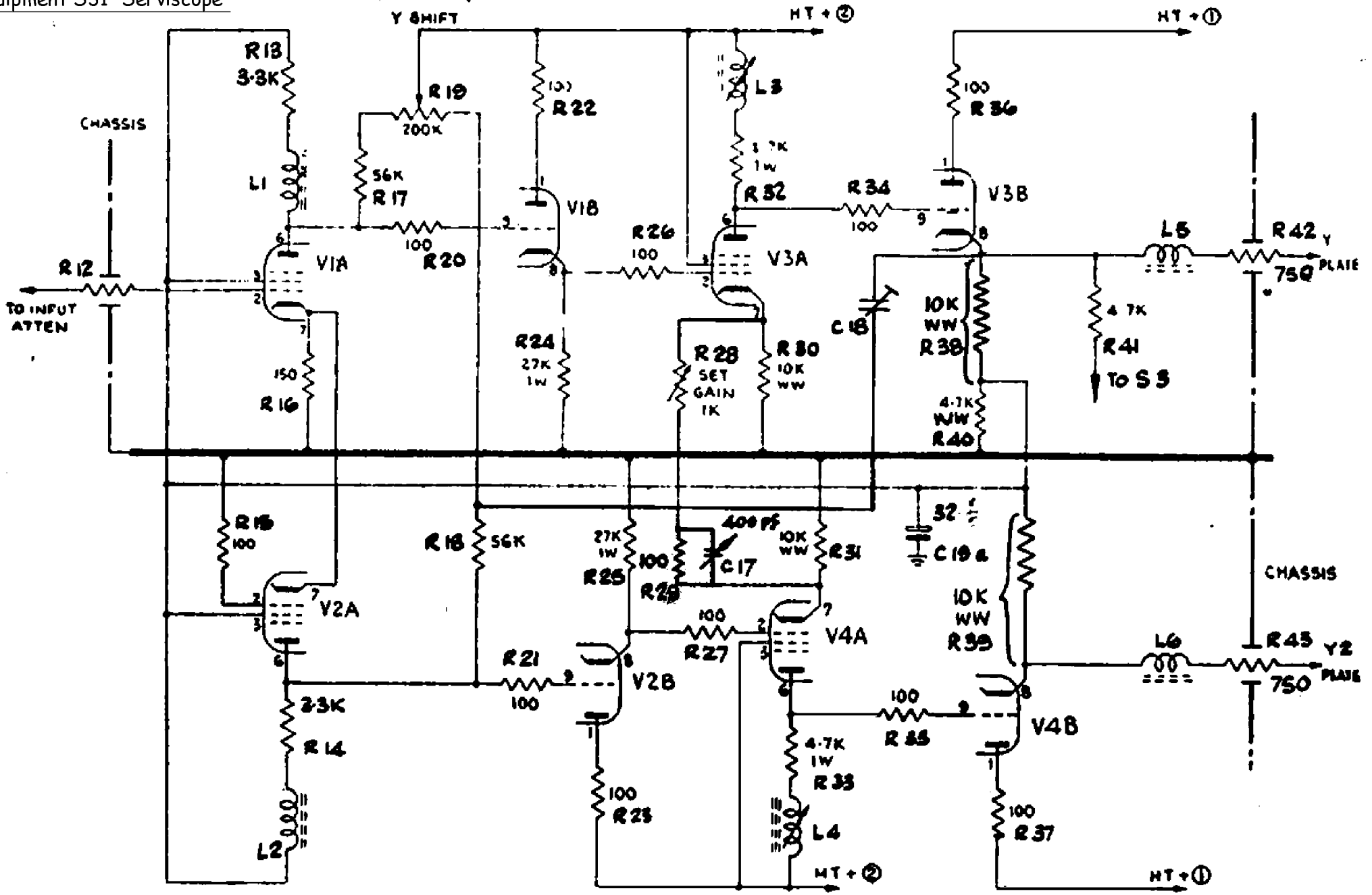
VERTICAL AMPLIFIER



TRIGGER CIRCUIT & SYNC SEPARATOR.

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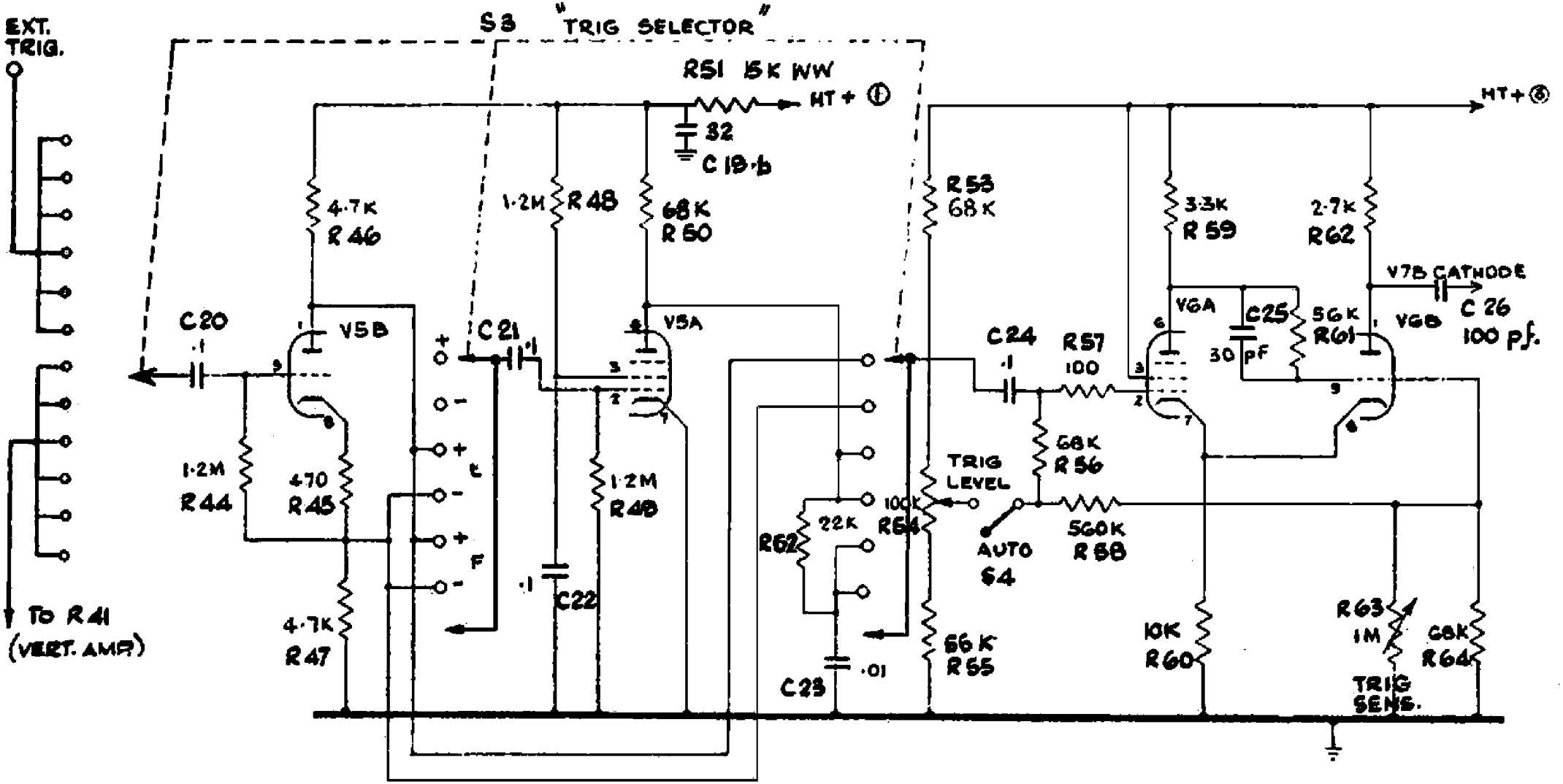
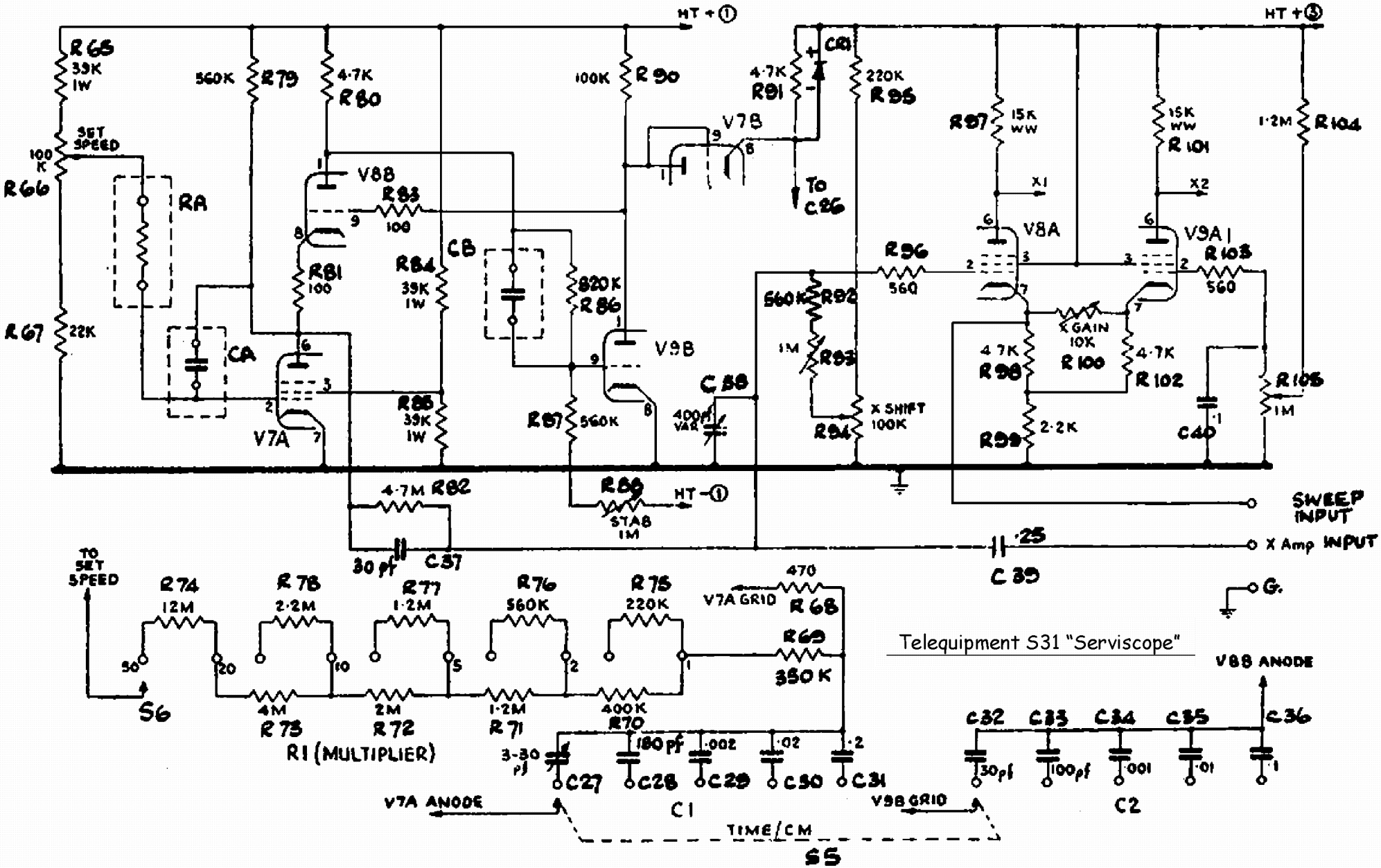


TIME BASE & HORIZONTAL AMPLIFIER



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POWER SUPPLY & C.R.T.

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