

GENERAL DESCRIPTION

The S51 Serviscope is produced in three versions:

S51A - general purpose Oscilloscope.

S51E - simplified educational version with the NORMAL/TV FIELD switch and INT/EXT switch both deleted, and the time base always triggered by an internal signal. Also in the S51E the sawtooth voltage is brought out to a terminal on the front panel marked SWEEP OUTPUT, at an amplitude of approximately 20 v P to P. (The SWEEP OUTPUT terminal replaces the EXT TRIG terminal on the S51A.)

S51T - similar to the S51A but incorporates an additional Horizontal Pre-Amplifier, with a gain of X10. A switch at the rear of the instrument enables the Pre-Amplifier to be switched out, when the S51T has a performance and specification identical to the S51A. With the Pre-Amplifier switched in, the X Amplifier gain is increased to 100 mV/cm and the bandwidth is DC to approximately 10 Kc/s at -3 dB.

CATHODE RAY TUBE

The 5" flat faced tube operates at 3 Kv overall, giving an extremely bright fine trace over the whole of the working area (8 cms. x 8 cms.). 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 amplifier consists of two stages. A cathode coupled input stage, the output of which drives a cathode follower, and an output stage consisting of a long tailed pair, the signal being fed to one grid and a DC shift voltage to the other grid.

The amplifier has a sensitivity of 100mV/cm and a bandwidth of DC to 3 Mc/s (-3dB. approx.).

The nine-position input attenuator is frequency compensated and gives sensitivities of 100mV, 200mV, 500mV, 1V, 2V, 5V, 10V, 20V, 50V, per cm.

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

SWEEP CIRCUIT

The sweep generator consists of a Miller run-down circuit. Six preset sweep speeds are provided from 1 usec/cm. to 100Msec/cm. A variable control with a 10:1 range provides overlap between fixed ranges and reduces the slowest sweep to 1 sec/cm.

HORIZONTAL AMPLIFIER

The X GAIN control expands the trace to approximately 2 times 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 and operates in such a way that the time base flyback is completely eliminated.

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 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. The circuit will trigger internally on 2 mm. of displayed signal, and externally (except S51E) from 3v. peak to peak.

T. V. SYNC

The built-in TV sync integrator circuit (S51A and S51T only) makes it possible to trigger the sweep from the Frame pulses of a composite Television waveform.

REAR CONNECTORS

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

COOLING

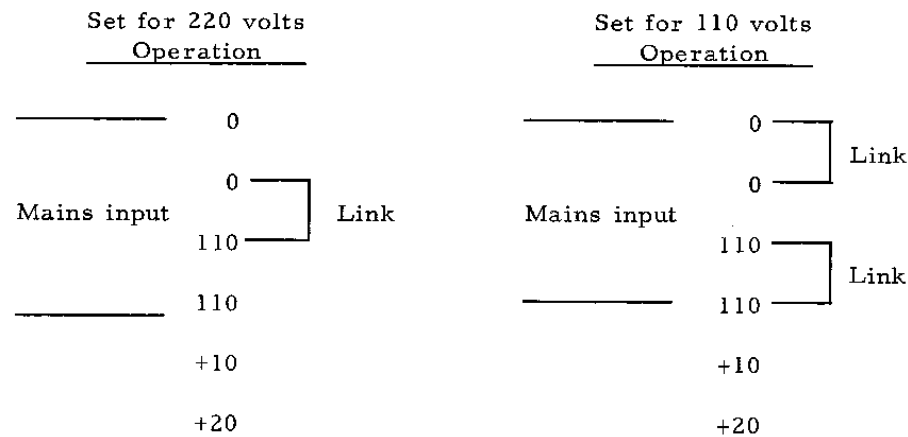
The S51 is cooled by convection. Air enters the bottom of the case and is drawn up past the tubes and other hot components, passing out through the slots at the top. Do not obstruct the air flow in any way. Do not put anything on top of the instrument and make sure that there is an air space underneath.



FIRST TIME OPERATION

CHECK SUPPLY VOLTAGE

To check that the oscilloscope is adjusted to the correct supply voltage remove the cover by undoing the two screws at the rear of the instrument. The correct setting will be obtained by soldering the required links for 110 volt or 220 volt operation and taking the supply leads to the appropriate tags as shown below.



USE OF CONTROLS

Unless you are familiar with this type of oscilloscope, follow these simple instructions carefully and then run through the procedure a few times to feel thoroughly at home with the instrument before putting it into use.

Set the front panel controls as follows:

| | |
|--------------|--------------|
| INPUT SWITCH | D.C. |
| VOLTS/CM | .5 |
| FOCUS | Mid position |

| | |
|----------------|--|
| Y SHIFT | Mid position |
| BRILLIANCE | Fully anti-clockwise |
| X GAIN | Fully anti-clockwise |
| X SHIFT | Mid position |
| STABILITY | Fully clockwise |
| TRIGGER LEVEL | Anti-clockwise to position just before switch operates |
| TIME/CM | 1 ms |
| TRIG. SELECTOR | Normal. +ve Int. |

Switch on and allow a few minutes for the instrument to warm up. Now advance the brilliance control until a trace appears and position the trace in the centre of the screen by means of the X and Y SHIFT control. Adjust the FOCUS control for a clean sharp trace.

Now back off the STABILITY control until the sweep just fails to free run. This is the normal position of the STABILITY control and once it is set it should not require any re-adjustment except at the very highest sweep speeds. The instrument is now ready for use.

You will find that if the TRIGGER LEVEL control is turned fully anti-clockwise to operate the AUTO switch, the trace will reappear. In this condition the instrument is ready to accept almost any input waveform and trigger automatically from it, the only adjustments required are the selection of the appropriate sweep speed and Y Sensitivity (VOLTS/CM). However, in order to use the S51 to best advantage the functions of the controls should be understood fully and the following procedure will demonstrate their use.

Return the TRIG. LEVEL control to the position just before the Switch operates. There should now be no trace visible on the screen.

Connect a 50 C/S signal to the INPUT sockets and rotate the TRIG. LEVEL control clockwise until the trace appears. (If the sweep does not trigger it is because the STABILITY control has been backed off too far.) The Scope is now displaying the voltage waveform. You will find that this is a very convenient waveform for demonstrating the functions of the controls.

AUTO

On this setting no control over the trigger level is available. The sweep automatically adjusts itself to trigger at approximately the mean level of the input waveform. You can use this setting for practically all applications involving repetitive waveforms of a fairly simple nature and the sweep generator will trigger automatically on signals between about 50 c/s and 1 Mc/s. provided the amplitude exceeds about 2 mm.

In the AUTO position with no input signal the trace will become progressively less bright as the sweep speed is increased. This is normal since in the absence of a trigger signal the sweep free runs at about 50 c/s whatever the setting of the speed control. As soon as an input signal is applied the sweep will immediately synchronise to it and the trace will revert to its full brightness.

TRIG SELECTOR

There are four positions on the selector switches. For most purposes use the positive or negative normal positions depending on the polarity of the input waveform.

The other position brings the internal integrating circuit into use on TV waveforms enabling the sweep to be triggered from the Frame pulses (the +ve TV positions refer to positive-going video signals, i.e., picture + ve, sync. - ve). When triggering from a TV frame pulse, adjustment of the TRIG. LEVEL control will determine which of the broad pulses actually triggers the sweep.

The integrating circuit for the frame pulse can be useful on occasions for frequency discrimination. For instance, an audio signal containing a large proportion of HF noise will trigger better on the TV frame position, the integrator acting as a low pass filter.

For triggering from an external signal select the EXT setting and connect the signal into the external trigger socket.

X-GAIN and X-SHIFT

With the X-GAIN control in the minimum (anti-clockwise) position, the trace will be approximately 8 cm. long and the X-SHIFT control should be used to centre this trace about the 10 x 8 cm. ruled graticule. Increasing the X-GAIN control expands the trace about the centre of the screen up to a maximum of X2 and the X-SHIFT control is then used to position the required portion of this trace on the screen.

It should be noted that the time calibration only holds good at the minimum setting of the X-GAIN control. If you want to measure time intervals at any other setting the speed must be standardised at this setting.

VOLTS PER CM.

This is a nine-position switch which inserts a series of frequency compensated resistance dividers between the input socket and the Vertical Amplifier. Normally this is used merely to obtain a picture of convenient height, but if the gain of the Amplifier is standardised, direct readings of the input voltage can be made.

D.C./A.C. SWITCH

On the A.C. position this switch inserts a blocking capacitor in series with the input of the Vertical Amplifier removing the D.C. component of the signal. This is the condition in which the S51 will normally be used unless it is specifically required to include the D.C. component or to use the instrument on very low frequency signals. The time constant of the input circuit on the A.C. position is such that the response is 3 dB down at 2 cycles, which, while adequate for all normal purposes, may limit the application in some instances. For example, you will notice that on a 50 cycle square-wave a pronounced tilt occurs on the A.C. position. If a longer time constant is required, a higher capacity external blocking capacitor must be used with the input switch set to D.C.

REAR CONNECTORS

1. X-Amp Input. This socket provides an access to the input of the Horizontal Deflection Amplifier and is suitable for signals between about 4 and 10 volts p.p. The X-GAIN control gives about a 2 to 1 variation of gain. When using the X-Amplifier the sweep can be stopped by turning the VARIABLE SPEED control fully anti-clockwise. The input impedance is about 500 K and the input capacity about 100 pf. The frequency response is 3 dB down at 5 cycles and at about 200 Kc/s.

2. Z. Mod. This socket is connected via a blocking capacitor to the cathode of the CRT. Thus, a negative pulse will brighten the trace. The time constant of this circuit is .01 mf and 10,000 ohms.

SIMPLIFIED METHOD

In the above instructions the functions of controls have been explained in some detail so that the engineer using the S 51 may fully appreciate its capacities and the method of function. There will, however, be a large number of users who will not require all the facilities provided and to whom simplicity of operation is of major importance. The following simplified instructions will suffice for most applications, in fact for any application where the older type of Oscilloscope could be used the following method will provide better results much more quickly and simply.

Set input switch to A.C.

Switch on and allow a few minutes to warm up.

Turn STABILITY control fully clockwise and adjust BRILLIANCE and FOCUS controls for a sharp trace.

Back off STABILITY control until the TIME BASE stops. The STABILITY control once set should not require any further adjustment.

The instrument is now set for use.

For most applications switch to AUTO, connect input signal, and adjust VOLTS/CM switch to give a convenient size trace. Use TIME/CM and VARIABLE as coarse and fine frequency controls to suit the input signal.

For T.V. waveforms use T.V. FIELD position (S51A and S51T only). If the sweep fails to lock, the STABILITY control has been turned up too far.

For some input waveforms and sometimes for T.V. waveforms it may be necessary to adjust the TRIG. LEVEL control rather than to use the AUTO position.

CIRCUIT DESCRIPTION

VERTICAL AMPLIFIER

The vertical amplifier consists of three double triodes. V1A and V1B form a cathode coupled amplifier stage with RV1 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.

The signal at the anode of V3B is taken to the INT/EXT. trigger switch.

The HT supply for the trigger circuit, V4 and V5 is taken from a common resistor R19 in the cathode circuit of V3.

TRIGGER CIRCUIT

The trigger selection is performed by three switches; SW2 selects the INT/EXT. triggering signal and connects it to the grid of phase splitter V4B. SW3 selects the positive or negative output of the phase splitter and connects it to SW4 which either passes the signal direct to V4A or via an integrating circuit. This position, marked 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 SW4 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 SW5 is opened and the grid of V4A is returned to the grid of V5B. In the absence of a signal V4A, V5B oscillates at a frequency determined

by the time constant R38, C18 but as soon as any input signal between about 50 c/s and 1 Mc/s 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 MR5 and the negative pulse used to trigger the time base.

TIME BASE & HORIZONTAL AMPLIFIER

V6A is the Miller sweep generator, the speed of run down being controlled by SW7A 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 time base, V5A is off and its anode potential is clamped by MR6. V6B is conducting. A negative trigger pulse from V5B lowers the grid of V6B. The resulting rise in anode potential is coupled to the grid of V5A via R71 and SW7B, this causes the anode voltage to fall which leads to regenerative action whereby V6B becomes quickly cut off and V5A is hard on.

When the run down has reached the point where the cathode of V6B has fallen to near the grid voltage of V6B then 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 STABILITY control RV11 sets the grid potential of V5A to the point just short of the free running condition.

The linear sweep voltage at the anode of V6A is taken via R57, C23, RV15, to the grid of the horizontal amplifier V7. Horizontal shift voltage is applied to the grid of V7A and the outputs at the anodes of V7A and B drive the C.R.T. X plates.

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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 tubes. Replacement 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.

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.

| <u>Set Input Attenuator to:</u> | <u>Adjust</u> |
|---------------------------------|---------------|
| .2 volts per cm. | C112 |
| .5 " " " | C113 |
| 1 " " " | C104 |
| 2 " " " | C108 |
| 5 " " " | C109 |
| 10 " " " | C105 |

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 C102 and C103 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.

VERTICAL AMPLIFIER

Adjustment of the high frequency compensation of the vertical amplifier should only be carried out if you have at your disposal a squarewave generator which is capable of producing an accurate squarewave at a frequency of about 250 Kc/s with a rise time less than 100 millimicroseconds 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 available you would be wise not to attempt any readjustment.

Set the input attenuator switch to .1 volt per cm. and adjust the output of the squarewave generator to give a trace of approximately 2-3 cm. amplitude (the output frequency on the generator should be between 200 and 300 Kc/s). The variable 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 GAIN control.

TRIGGER CIRCUIT

The only adjustment necessary in the TRIGGER circuit is an occasional setting of the TRIGGER sensitivity control RV9; this

should be set so that the TRIGGER circuit will operate when the trace amplitude on the screen exceeds 2 mm. If any attempt is made to increase the sensitivity beyond this point erratic operation will almost inevitably result. Connect a signal, say a 2 Kc/s square wave to the input. Now set the input attenuator to give 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 & 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 usecs. Now advance the BRILLIANCE control until you can see the spot at the beginning of the trace and you will find that by adjusting C23 you will be able to make a small "tail" appear to one side of the spot or the other. The correct setting for C23 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 usecs and the VARIABLE speed to the cal. position. The X-GAIN should be at minimum and the trace centred using the X-SHIFT control.

Connect an accurately known 100 usec. pulse repetition frequency (10 Kc/s) to the input terminals and adjust RV15 so that the TIME/CM is correct. Adjustment of RV15 will cause the trace to move horizontally so it should always be recentred using the X-SHIFT control. For greatest accuracy, the calibration of the TIME/CM should be carried out, using the centre 4 cms. of horizontal trace.

CRT CIRCUIT

The Cathode Ray Tube used in the S51 is equipped with an inter-deflector plate shield. This is returned to HT1 via a 1 meg-ohm preset RV8. This is adjusted in order to ensure that the inter plate shield is at the average potential of the deflector plates. Variation of the inter plate shield voltage serves to correct pin cushion and barrel pattern distortion. This control is set during test. No further adjustment should be necessary unless the tube is changed.

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/s. 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.

COMPONENTS LIST

ABBREVIATIONS USED IN COMPONENTS LISTCapacitors

| | |
|------|-----------------|
| MP | Moulded Paper |
| SM | Silver Mica |
| CER | Ceramic Tubular |
| ELEC | Electrolytic |
| P | Paper |
| POL | Polyester Film |

Resistors

| | |
|-----|--------------------------------------|
| C | Carbon Composition |
| HSC | High Stability Carbon |
| WW | Wire Wound |
| CP | Pre-set Carbon (Internal Adjustment) |

In the following components list, 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
313 Chase Road,
Southgate,
LONDON, N.14.

Telephone: FOX Lane 1166
Telegraph: Telequipt. London. N.14.

or from our agents.

COMPONENTS LIST

| Part No. | C.C.T. Ref. | Value | DESCRIPTION | Type | Tol. | Rating |
|----------|-------------|--------|-------------|------|------|--------|
| S-12510 | R 1 | 1.2M | RESISTOR | C | 10% | 1/4w |
| S-12510 | 2 | " | " | " | " | " |
| S-10110 | 3 | 100 | " | " | " | " |
| S-10110 | 4 | " | " | " | " | " |
| S-47210 | 5 | 4.7K | " | " | " | " |
| S-47110 | 6 | 470 | " | " | " | " |
| S-56210 | 7 | 5.6K | " | " | " | " |
| S-47110 | 8 | 470 | " | " | " | " |
| S-56310 | 9 | 56K | " | " | " | " |
| S-10110 | 10 | 100 | " | " | " | " |
| Y-27310 | 11 | 27K | " | " | " | 1w |
| 30M | 12 | 500 | " | W/W | " | 2w |
| S-33410 | 13 | 330K | " | C | 10% | 1/4w |
| S-10110 | 14 | 100 | " | " | " | " |
| S-12510 | 15 | 1.2Meg | " | " | " | " |
| Y-47210 | 17 | 4.7K | " | " | " | 1w |
| Y-22210 | 18 | 2.2K | " | " | " | " |
| 9-15510 | 20 | 1.5Meg | " | " | " | 1/2w |
| Y-82410 | 21 | 820K | " | " | " | " |
| Y-10210 | 22 | 1K | " | C | 10% | 1w |
| Y-47210 | 23 | 4.7K | " | " | " | " |
| S-68210 | 24 | 6.8K | " | " | " | 1/4w |
| S-68310 | 25 | 68K | " | " | " | " |
| S-10310 | 26 | 10K | " | " | " | " |
| 9-18510 | 27 | 1.8Meg | " | " | " | " |
| S-12510 | 28 | 1.2Meg | " | " | " | " |
| S-47210 | 29 | 4.7K | " | " | " | " |
| S-47110 | 30 | 470 | " | " | " | " |
| S-47210 | 31 | 4.7K | " | " | " | " |
| S-10410 | 32 | 100K | " | " | " | " |
| S-22410 | 33 | 220K | " | " | " | " |
| S-22310 | 34 | 22K | " | " | " | " |
| S-10410 | 35 | 100K | " | " | " | " |
| S-56310 | 36 | 56K | " | " | " | " |

| Part No. | C.C.T. Ref. | Value | DESCRIPTION | Type | Tol. | Rating |
|----------|-------------|---------|-------------|--------|------|--------|
| S-10110 | R37 | 100 | RESISTOR | C | 10% | 1/4w |
| S-56410 | 38 | 560K | " | " | " | " |
| S-47210 | 39 | 4.7K | " | " | " | " |
| Y-47210 | 40 | 4.7K | " | " | " | 1/2w |
| S-22410 | 41 | 220K | " | " | " | 1/4w |
| S-10410 | 42 | 100K | " | " | " | " |
| S-27210 | 43 | 2.7K | " | " | " | " |
| O-39310 | 44 | 39K | " | " | " | 2w |
| S-68210 | 45 | 6.8K | " | " | " | " |
| Y-22210 | 46 | 2.2K | " | " | " | 1w |
| 9-22510 | 47 | 2.2Meg | " | " | " | " |
| S-47210 | 48 | 4.7K | " | C | 10% | 1/4w |
| S-56410 | 49 | 560K | " | " | " | " |
| S-47110 | 50 | 470 | " | " | " | " |
| S-10410 | 51 | 100K | " | " | " | 1/4w |
| O-39310 | 52 | 39K | " | " | " | 2w |
| S-68210 | 53 | 6.8K | " | " | " | " |
| O-10410 | 54 | 100K | " | " | " | " |
| S-22410 | 55 | 220K | " | " | " | 1/4w |
| S-22410 | 56 | 220K | " | " | " | " |
| S-15510 | 57 | 1.5 Meg | " | " | " | " |
| S-10110 | 58 | 100 | " | " | " | " |
| S-10110 | 59 | 100 | " | " | " | " |
| S-27210 | 60 | 2.7K | " | " | " | " |
| Y-47210 | 61 | 4.7K | " | " | " | 1w |
| 97M | 63 | 680K | " | H.S.C. | 1% | 1/4w |
| S-22410 | 64 | 220K | " | C | 10% | " |
| S-47110 | 66 | 470 | " | C | 10% | 1/4w |
| S-56410 | 67 | 560K | " | " | " | " |
| S-10110 | 68 | 100 | " | " | " | " |
| S-47110 | 70 | 470 | " | " | " | " |
| S-82410 | 71 | 820K | " | " | " | " |
| S-22110 | 72 | 220 | " | " | " | " |
| 96M | 73 | 170K | " | H.S.C. | 1% | " |
| S-10210 | 76 | 1K | " | C | 10% | 1/4w |

| Part No. | C.C.T. Ref. | Value | DESCRIPTION | Type | Tol. | Rating |
|-----------|-------------|----------|-------------|--------|------|-----------------|
| 12M | R 101 | 900K | RESISTOR | H.S.C. | 1% | $\frac{1}{4}$ w |
| 11M | 102 | 990K | " | " | " | " |
| 18M | 103 | 111K | " | " | " | " |
| 20M | 104 | 10.1K | " | " | " | " |
| 14M | 105 | 500K | " | " | " | " |
| 13M | 106 | 800K | " | " | " | " |
| 10M | 107 | 1 Meg | " | " | " | " |
| 17M | 108 | 250K | " | " | " | " |
| 10M | 109 | 1 Meg | " | " | " | " |
| S-10410 | 110 | 100K | " | C | 10% | " |
| * S-10510 | 121 | 1 M | " | C | 10% | " |
| * S-75110 | 122 | 750 Ohms | " | " | " | " |
| * S-12410 | 123 | 120K | " | " | " | " |
| * S-22310 | 124 | 22K | " | " | " | " |
| 16K | C 101 | 0.1 uf | CAPACITOR | POL | 10% | 400v |
| 16J | 102 | 6-30 Pf | TRIMMER | CER | | |
| 16J | 103 | " | " | " | | |
| 16J | 104 | " | " | " | | |
| 16J | 105 | " | " | " | | |
| 59K | 106 | 100 Pf | CAPACITOR | SM | 10% | |
| 61K | 107 | 1000 Pf | " | " | " | |
| 16J | 108 | 6-30 Pf | TRIMMER | CER | | |
| 16J | 109 | " | " | " | | |
| 52K | 110 | 50 Pf | CAPACITOR | " | | |
| 48K | 111 | 24 Pf | " | " | | |
| 16J | 112 | 6-30 Pf | TRIMMER | CER | | |
| 16J | 113 | " | " | " | | |
| 41K | 114 | 30 Pf | CAPACITOR | " | 5% | |
| 28K | 115 | 0.01 uf | " | MP | 10% | 500v |
| 16K | C 1 | 0.1 uf | CAPACITOR | | | 400v |
| 16K | 2 | " | " | | | " |
| 40X | 3 | 32 uf | " | ELEC | | 300v |
| 43X | 4 | " | " | " | | 275v |
| 43X | 5 | " | " | " | | " |
|) | 6 | .25 uf | " | | | |
| 41X) | 7 | " | " | | | 1.5KV |

* S51T only - Note.

| Part No. | C.C.T. Ref. | Value | DESCRIPTION | Type | Tol. | Rating |
|----------|-------------|----------------------|-------------------|------|-------------------|--------|
| | C 8 | | CAPACITOR See C12 | | | |
| 20X | 9 | 0.01 uf | " | CER | | 1500v |
| 39J | 10 | 0.05 uf | " | | | 2 KV |
| 39X | 11 | 8 uf | " | ELEC | | 300v |
| 42X | 12 | 32 uf | " | | | 450v |
| 16K | 14 | 0.1 uf | " | | | 400v |
| 16K | 16 | 0.1 uf | " | POL | | 400v |
| 16K | 17 | 0.1 uf | " | " | | 400v |
| 33K | 18 | 0.1 uf | " | " | | 125v |
| 41K | 19 | 30 Pf | " | CER | | 500v |
| 53K | 20 | 100 Pf | " | " | | " |
| 33K | 22 | 0.1 uf | " | POL | | 125v |
| 16J | 23 | 3-30 Pf | " | CER | | |
| 28K | 25 | 0.01 uf | " | POL | | 400v |
| 10J | 26 | 0.22 uf | " | " | | |
| 42K | 27 | 39 Pf | " | CER | | |
| 53K | 28 | 100 Pf | " | " | 20% | |
| 18K | 29 | 0.001 uf | " | POL | | 500v |
| 28K | 30 | 0.01 uf | " | " | | 500v |
| 16K | 31 | 0.1 uf | " | " | | 400v |
| 46X | 32 | 90 Pf | " | SM | | |
| 45X | 33 | 100 Pf | " | " | | |
| 36X | 34 | 1900 Pf | " | " | 2 $\frac{1}{2}$ % | |
| 37K | 35 | 0.02 uf | " | CER | | |
| 17K | 36 | 0.1 x 0.1 = .2 uf | " | POL | | 400v |
| 16K | 37 | 0.1 uf | " | POL | | " |
| * 29K | 38 | .47 | " | POL | | 125v |

* S51T only - Note.

| Part No. | C.C.T. Ref. | Value | DESCRIPTION | Type |
|----------|-------------|-------|-------------------|--------------|
| 18T | V 1 | | VALVE | ECC88 |
| 18T | V 2 | | " | " |
| 18T | V 3 | | " | " |
| 18T | V 4 | | " | " |
| 18T | V 5 | | " | " |
| 10T | V 6 | | " | ECF80 |
| 18T | V 7 | | " | ECC88 |
| * 18T | V 8 | | " | ECC88 |
| 18 O | MR1 | | DIODE | 50AS Mullard |
| 18 O | MR2 | | " | " " |
| 6 O | MR3 | | RECTIFIER | K8-50 STC |
| 6 O | MR4 | | " | " " |
| 34E | MR5 | | DIODE | OA81 Mullard |
| 18 O | MR6 | | " | 50AS Mullard |
| 4C | RV 1 | 500 | 'Y' GAIN | PRESET |
| 76C | RV 2 | 10K | 'Y' SHIFT | |
| 70C | RV 3 | 200K | ('BRILLIANCE' | |
| | SW 1 | | (ON/OFF | |
| 71C | RV 4 | 1 Meg | 'FOCUS' | |
| 74C | RV 5 | 100K | (TRIG. LEVEL | |
| | SW 5 | | (AUTO | |
| 1C | RV 6 | 10K | BLANKING | PRESET |
| 2C | RV 7 | 50K | ASTIG | PRESET |
| 3C | RV 8 | 1 Meg | I. P. S. | PRESET |
| 3C | RV 9 | 1 Meg | TRIG. SENSITIVITY | PRESET |
| 72C | RV 10 | 5K | 'X' GAIN | |
| 75C | RV 11 | 1 Meg | 'STABILITY' | |
| 73C | RV 12 | 100K | 'X' SHIFT | |
| 77C | RV 13 | 50K | (VARIABLE SPEED | |
| | SW 6 | | (T/B ON/OFF. | |
| 3C | RV 15 | 1 Meg | T/CM | PRESET |

* S51T only - Note

| Part No. | C.C.T. Ref. | Value | DESCRIPTION | Type |
|----------|--------------|--------------------|------------------|--------|
| 42S | L1 | Var from 160 uH | COIL | |
| 41S | (L2 (L3 | 160 uH 160 uH | COIL | |
| 32Y | CRT | | CATHODE RAY TUBE | SE5F31 |

ADDENDUM

The following have been amended:

Add R19, 15K, 1 watt, Part No. Y15310 (across C12).

R25 was 68K, is now 56K, 1/2 watt, Part No. S56310.

C111 was 24 Pf, is now 20 Pf.

Add C39, 50 Pf, on S51T only (across RV15).

VOLTAGES

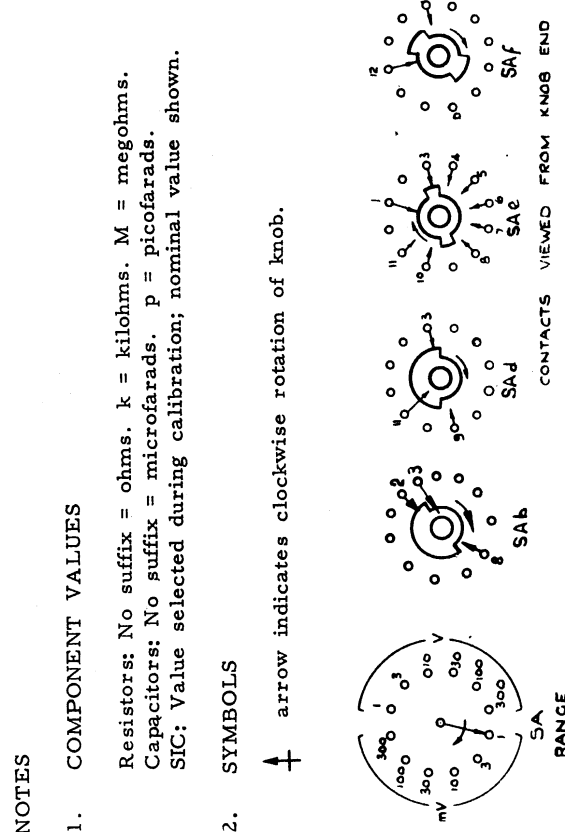
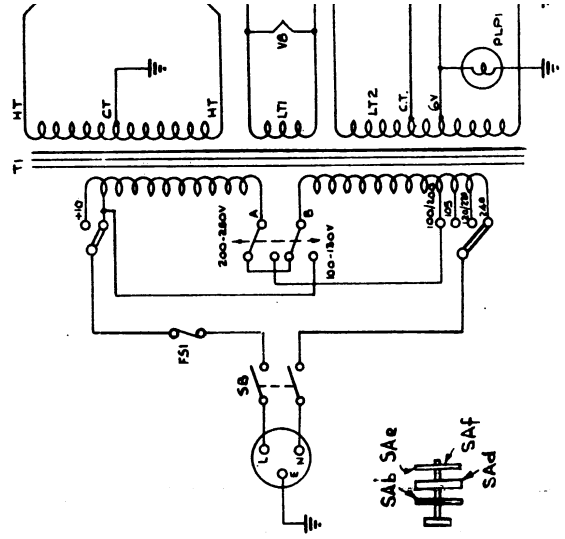
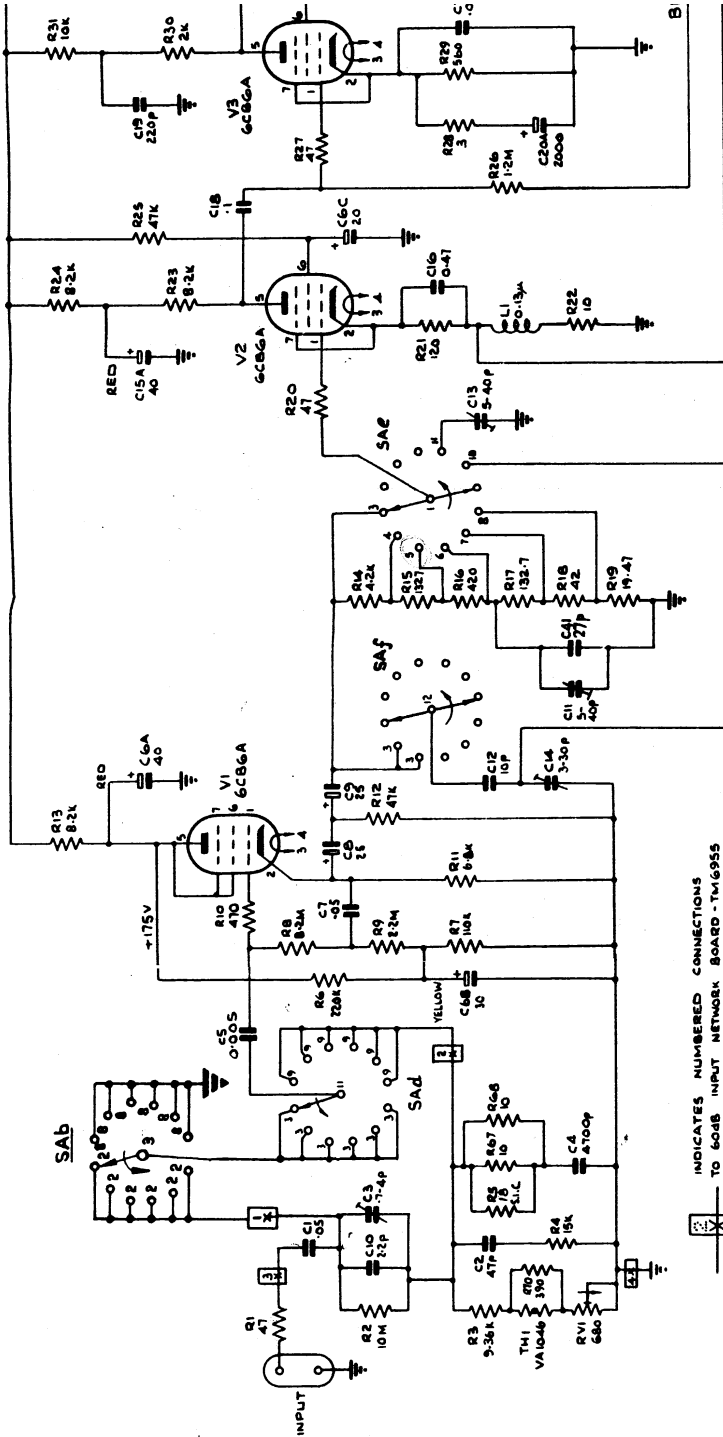
Circuit voltages are shown in the circuit diagram.

Measurements should be made in the absence of any 'Y' signal and with the time base set to 1 mS/cm with the stability advanced until timebase just free runs. All voltages are measured with respect to chassis.

All measurements made on 1,000V Range unless otherwise stated.

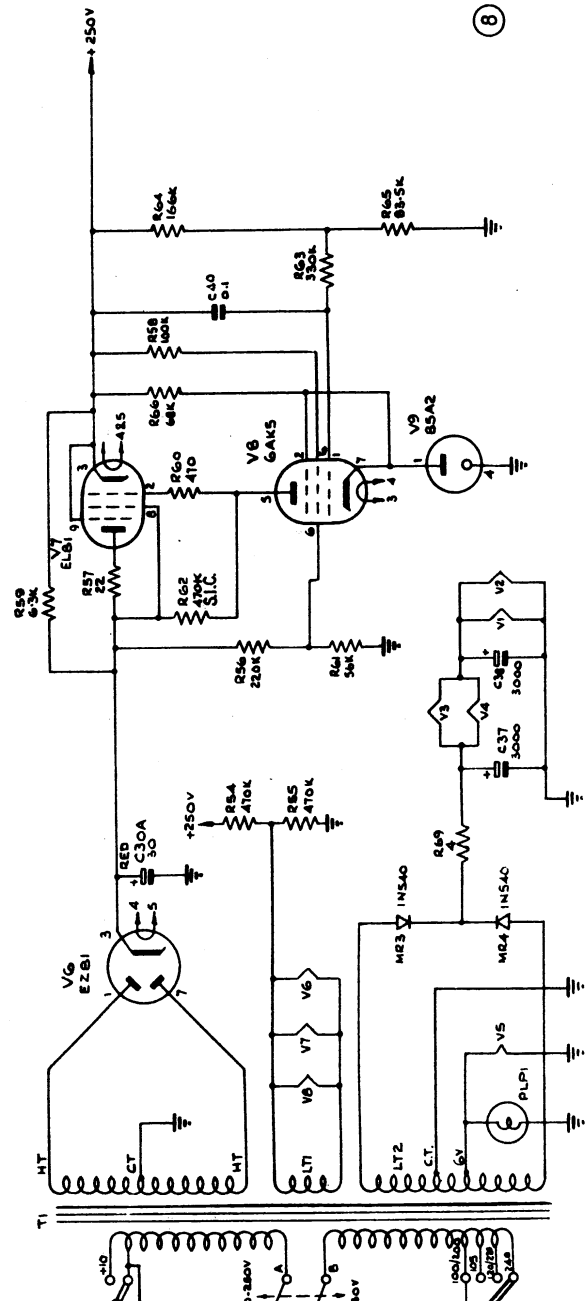
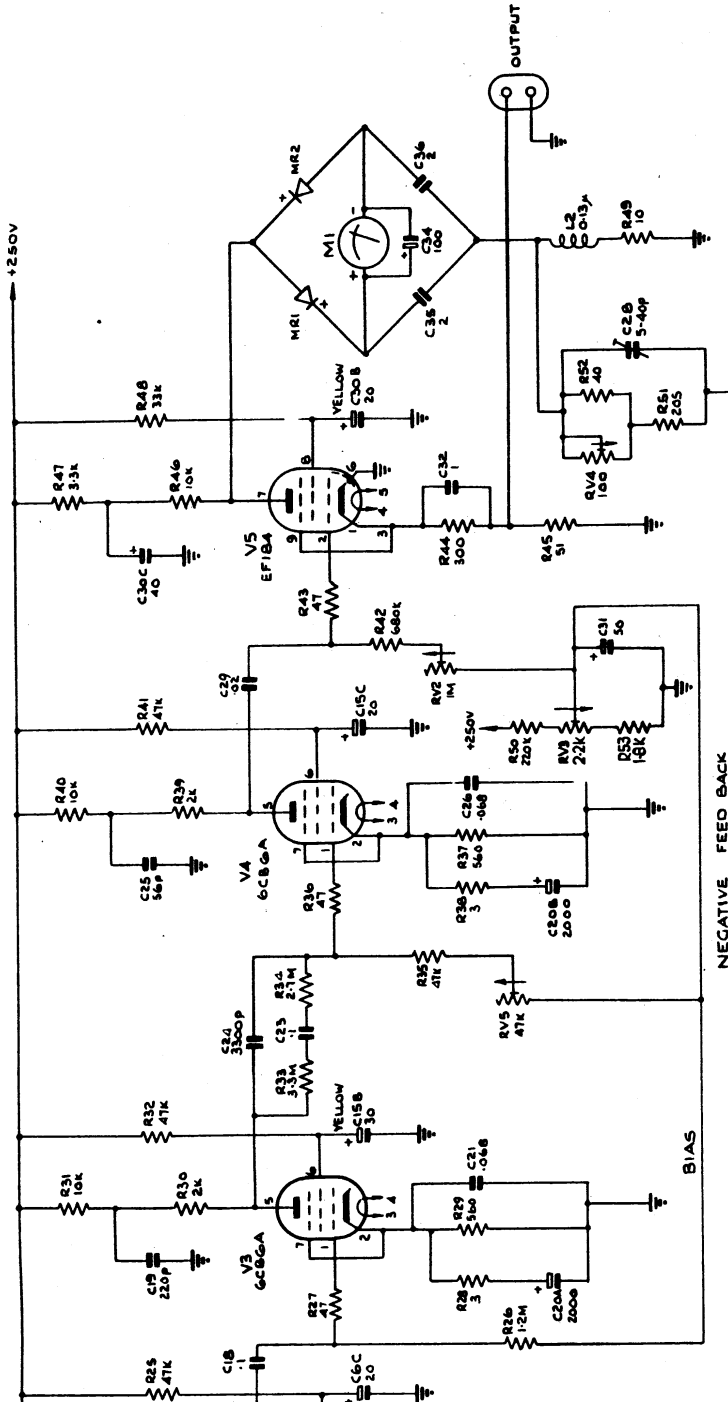
Measurements over 1,000V made on 2,500 volts Range.

Instrument used "Avo" model '8' 20,000 ohms per volt.



NOTES

1. COMPONENT VALUES
Resistors: No suffix = ohms, k = kilohms, M = megohms.
Capacitors: No suffix = microfarads, p = picofarads.
SIC: Value selected during calibration; nominal value shown.
2. SYMBOLS
↑ arrow indicates clockwise rotation of knob.



SENSITIVE VALVE VOLTMETER

