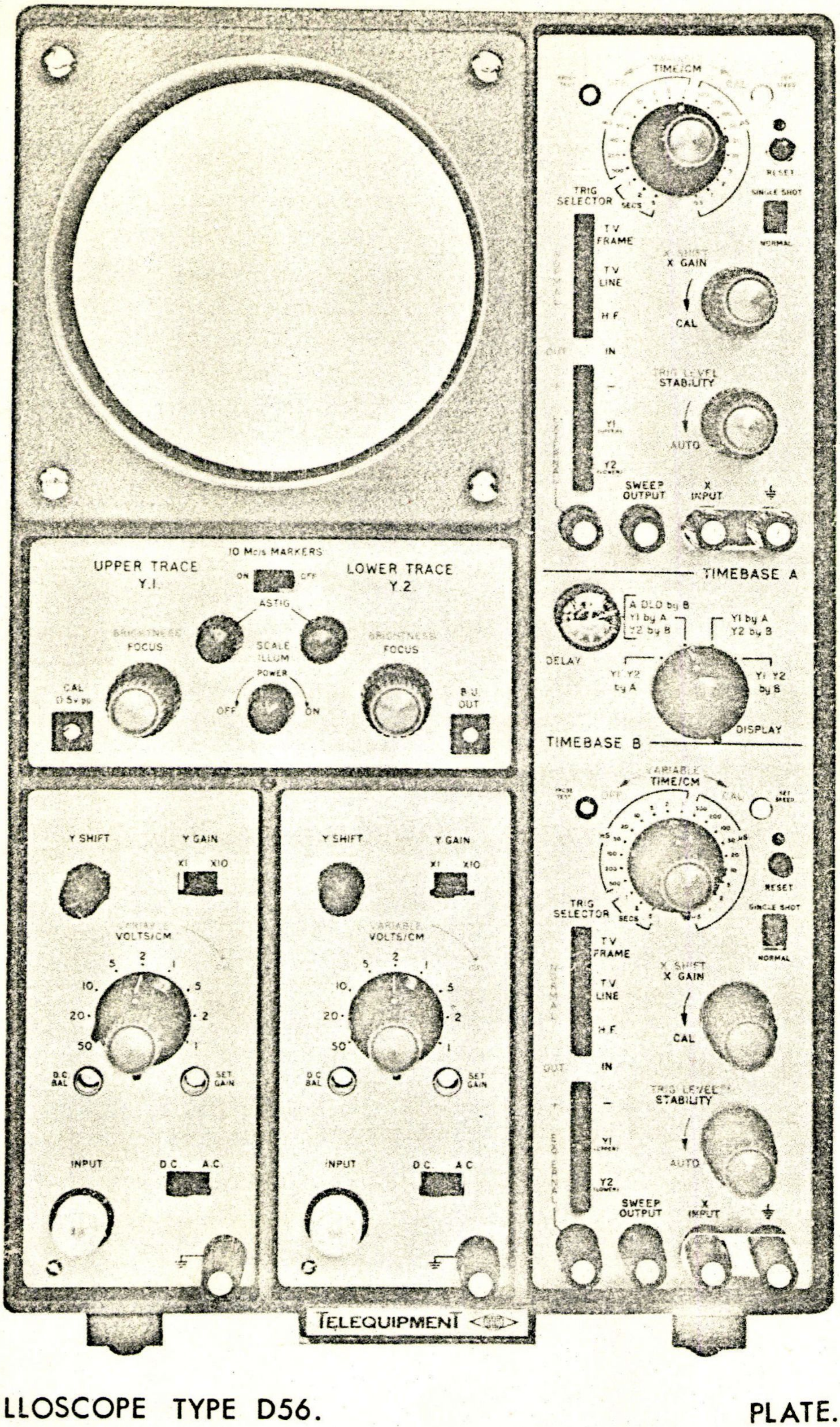


OSCILLOSCOPE TYPE D56. PLATE. 1.

CHAPTER 1

GENERAL DESCRIPTION, SPECIFICATION,

FIRST TIME OPERATION

1. GENERAL DESCRIPTION

The D56 is a double-beam instrument, with two identical timebases, "A" and "B". A versatile switching arrangement enables either timebase to be coupled to either beam, or alternatively enables both beams to be coupled to one timebase. Alternatively, timebase "B" can be switched to trigger timebase "A". The point at which timebase "A" is triggered can be varied by a delay pick-off control, calibrated from 0-100.

Thus the instrument has a unique facility whereby a signal displayed on the lower beam has a bright-up marker superimposed on it. This marker may be moved over the entire length of the trace by the delaying sweep control; the portion of the signal covered by the marker is determined by the setting of the main sweep and is simultaneously displayed across the entire length of the upper trace.

A special 5" Spiral PDA C.R. tube, with a double-gun assembly, ensures that both traces are completely independent. This enables both a completed waveform and a selected and magnified part of it to be displayed simultaneously. The double-gun assembly also eliminates the need for "chopper circuits", which are normally used when the phase relationship between waveforms is being examined.

In addition, the instrument is ideally suitable for use as a general purpose oscilloscope where a large display is required.

Twin High Gain D.C. Coupled Amplifiers

Each has a total of four stages, including interstage and output cathode-followers. The amplifiers are compensated for optimum pulse response.

Accurate Calibrated Input Attenuators

Give direct reading of input voltages A.C. and D.C. from
100mV/cm to 50V/cm. D.C. to 15Mc/s.
10mV/cm to 5V/cm. D.C. to 500Kc/s.

A 10Mc/s triggered marker is provided for accurate measurement of rise times to 1/10th of a microsecond. This is available when using the upper beam, and the trace is displayed by Timebase "A".

High Quality Components

"C" core mains transformer and latest high efficiency valves ensure complete reliability and long periods of service between maintenance.

Unique System of Construction

Ensures adequate cooling under continuous operating conditions in addition to ensuring maximum accessibility for easy maintenance.

2. SPECIFICATION

2.1 Timebases

Two identical Timebases, "A" and "B" are provided, each with:

22 Pre-set calibrated Sweep Speeds.

5, 2 and 1 seconds per cm. 500, 200, 100, 50, 20, 10, 5, 2 and 1 milliseconds per cm. 500, 200, 100, 50, 20, 10, 5, 2, 1 and 0.5 microseconds per cm.	at minimum "X" expansion.

Variable control covering intermediate speeds.

Time measurement accuracy $\pm$ 5%.

Timebase "A" may be switched to both traces or to the upper one only. In the latter case, the lower trace is coupled to Timebase "B".

Similarly, Timebase "B" may be switched to both traces, or to the lower one only.

2.2 "X" Expansion

Continuously variable up to 10 screen diameters (100 cms.) approx. Trace expands symmetrically about centre of screen. "X" - Shift - Control positions any portion of expanded trace on screen. Both these facilities are available for Timebases "A" and "B".

2.3 D.C. Coupled Trace Bright Up

Ensures uniform trace brightness at slow sweep speeds.

2.4 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 is triggered automatically as soon as an input signal is applied.

(2) Trigger Level Selection. With the AUTO switch off, the TRIG LEVEL control allows the sweep to be triggered from any part of the slope of the input waveform.

2.5 Trigger Selection

Selector switches enable the timebases to be triggered from the output of either Vertical Deflection Amplifier, positive or negative; or from an EXTERNAL input, positive or negative.

2.5.1 H.F. Triggering

A special H.F. switch position gives good synchronization from high frequency input signals between 1 Mc/s and 15 Mc/s.

2.5.2 TV Sync.

D.C. restoration enables the sweep to be triggered from the LINE or FRAME pulses of a composite TV waveform without a change of picture content affecting the triggering point.

2.5.3 Delay

The DISPLAY switch, when set to

"A" DLD by "B"
Y1 by "A"
Y2 by "B"

allows timebase "A" to be triggered by timebase "B". Under these conditions, the "A" timebase produces a brightening pulse which is added to the "B" timebase trace, so that the position of the delayed sweep can be seen.

2.6 Trigger Level Control

Allows any point on the synchronizing waveform, (repetitive, random or single shot) to be selected for triggering the timebase. A similar control is available for either timebase "A" or "B".

2.7 Cathode Ray Tube

5" flat-faced, double-gun, tube, operated at 6KV overall. Screen phosphor P31 fitted as standard, removable filters are fitted to improve contrast at high ambient illumination.

10 x 6 cms "X" and "Y" deflection with 4 cms of overlap.

2.8 Illuminated Graticule

Edge-lit Illuminated Graticule facilitates accurate measurements. A front panel control varies illumination intensity.

2.9 Y Amplifiers

	X1 Position	X10 Position
Frequency Response	D.C. to 15Mc/s (approx. -3dB) adjusted for optimum pulse response.	D.C. to 500Kc/s (approx. -3dBs).
Maximum Sensitivity	100mV/cm at all frequencies.	10mV/cm at all frequencies.
Rise Time	0.023uSec (less than 2% overshoot).	0.7uS
Maximum "Y" Deflection	6 cms at all frequencies.	

2.10 Input Attenuators

Nine position, frequency compensated.

Direct reading in Volts/cm:-

100mV, 200mV, 500mV, 1V, 2V, 5V, 10V, 20V, 50V/cm on X1 position.

10mV, 20mV, 50mV, 100mV, 200mV, 500mV, 1V, 2V, 5V on X10 position.

Input Impedance 1 Megohm + 40pf (approx.).

Voltage Measuring Accuracy ± 5%.

A variable control provides continuous gain variation between the fixed steps.

2.11 Marker

A 10Mc/s marker may be switched in to give Z-modulation at 0.1 us intervals, for the purpose of accurate measurements of rise times, etc. This is available on the upper beam, and using timebase "A".

2.12 Supply Voltage & Current

90 - 130v)
200 - 240v) 50c/s VA = 375

2.13 Valve Content

Qty		Type	Qty		Type
13	-	ECF80 Mullard	1	-	EL86 Mullard
11	-	ECC88 "	1	-	XC12 Hivae
4	-	E810F "	1	-	C.R.T. 1374K, G.E.C.
5	-	EF184 "			

Transistor Content

Qty		Type	
6	-	A1668	SGS Fairchild
2	-	ACY22	Mullard
1	-	NKT452	Newmarket

2.14 Cooling

Convected air thermo-syphon cooling.

2.15 Dimensions

9.7/8" wide x 17" high x 19" long.
(24 cms x 43 cms x 48 cms)

Weight: 58 lbs.

3. FIRST TIME OPERATION

3.1 Introduction

The following detailed instructions are intended for those unfamiliar with this type of oscilloscope. It is suggested that the user should carefully carry out this procedure several times, in order to become thoroughly familiar with the instrument before putting it into use.

Throughout this handbook all front panel controls and sockets are shown in CAPITALS UNDERLINED; preset (internal) controls are shown in CAPITALS only.

3.2 Operation

Set the front panel controls for both Amplifiers and both Timebases as follows:

INPUT SWITCH	"DC"
VOLTS/CM	"0.2"
Y GAIN	X1
VARIABLE	Fully clockwise
FOCUS	Mid-position
ASTIG	Mid-position
Y SHIFT	Mid-position
BRILLIANCE	Fully anticlockwise
X GAIN	Fully anticlockwise
X SHIFT	Mid-position
STABILITY	Fully clockwise
TRIG LEVEL	Anticlockwise to position just before switch operation
TIME/CM	"10MS"
VARIABLE	Fully clockwise
TRIG SELECTOR	"NORMAL" (all out), "+" in, "Y1" in.
DISPLAY	Y1 by "A" Y2 by "B"
SINGLE SHOT/NORMAL SWITCH	Normal

3.2.1 Set the links on the Voltage Selector Panel, at the rear of the instrument, according to the mains supply voltage to be used. Plug in, rotate the POWER switch clockwise, to the "ON" position, and allow a few minutes for the instrument to warm up. (Further clockwise rotation of the POWER switch will simply increase the graticule illumination).

3.2.2 Advance each BRILLIANCE control until a trace appears; position the trace in the centre of the screen by means of the X SHIFT (Horizontal) and Y SHIFT (Vertical) controls. Adjust the ASTIG and FOCUS controls, in conjunction with one another, for a well-defined trace.

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

3.3 Triggering

If the TRIG LEVEL controls are turned fully anticlockwise to operate the AUTO switch, the traces will reappear. In this condition the instrument is ready to accept almost any input waveform and will automatically be triggered by it. The only adjustments required are the selection of the appropriate sweep speeds and "Y" sensitivity (VOLTS/CM). However, in order to use the instrument to best advantage, the functions of the controls should be fully understood. The following procedure will demonstrate their use:

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

Joint a short connector between the CAL terminal and each INPUT socket and rotate the TRIG LEVEL controls clockwise, until the traces just appear. (If the sweep is not triggered, the STABILITY control has been backed off too far).

The oscilloscope is now displaying the CALIBRATION VOLTAGE waveform (see Chapter 4, Section 2.4), which should be a square wave of $2\frac{1}{2}$ cms amplitude, with one cycle occurring every 2 cms. This is a very convenient waveform for demonstrating the functions of the controls.

3.4 Focus and Astigmatism

By adjusting the FOCUS control, either the horizontal or vertical edges of the squarewave can be brought into focus, but only if the ASTIG control is correctly adjusted will it be possible to focus the whole of the waveform simultaneously. Once the ASTIG control is set, it should require no further adjustment and a well-defined trace will be obtained over the whole of the screen.

3.5 Speed Calibration

The calibration waveform is at supply-line frequency, so that when the instrument is operated on 50c/s mains, 1 cycle occupies 20 milliseconds. With the TIME/CM switch set to "10 milliseconds" and the VARIABLE control fully clockwise, the timebase speed is 10 milliseconds per centimetre, so that one cycle should occupy two centimetres. The SET SPEED control, adjacent to the TIME/CM switch, is used to adjust the sweep speed on this calibration waveform to give precisely 1 cycle per 2 cms. This standardizes the whole of the time calibration of the instrument, all other ranges being direct multiples of this. Speed calibrations only apply when the VARIABLE control is in the fully clockwise position. On 60c/s mains the SET SPEED should be adjusted on 10mS/cm so that 3 cycles occupy 5 cms.

For most purposes, when accurate time calibration is not required, the above controls are used to produce a picture of convenient size, with the TIME/CM switch as the "coarse" control and the VARIABLE control for "fine" adjustments.

4. SWEEP CONTROLS

4.1 Trig Level

The Trigger Level control is used to set the precise part of the slope of the input waveform at which the sweep is triggered. The use of this control may be demonstrated as follows:

Set the TIME/CM switch to 5m/s, as described in Chapter 2, to give one cycle of the squarewave, 4 cm long. Now rotate the TRIG LEVEL control. It will be found that the starting point of the trace can be moved up and down the sloping edge of the squarewave. If the control is turned too far clockwise, this point rises above the top of the squarewave and the sweep stops. Similarly, rotation too far anticlockwise produces the same effect.

This facility is useful for displaying complex waveforms, when a normal type of sweep generator will either fail to trigger the sweep or cause double trigger action, producing a multiple pattern. It may also be used as an amplitude discriminator, so that signals of small amplitude are ignored and the sweep is triggered only when the input voltage reaches a predetermined value. Positive or negative going edges may be selected by using the TRIG SELECTOR switch.

Adjustment of the sweep speed controls does not shift the starting point of the sweep but expands the trace from this point. Thus it is possible to examine a section of the waveform in detail by setting the TRIG LEVEL control so that the sweep is triggered just in advance of the portion to be examined and then expanding this portion as required by means of the sweep speed control(s).

4.2 Auto

On this setting no control over the trigger level is available; the sweep automatically adjusts itself to trigger at the mean level of the input waveform. This setting may be used for almost all applications involving repetitive waveforms of a simple nature. The sweep generator will be automatically triggered by signals between about 50c/s and 1Mc/s. In the H.F. position the sweep generator will synchronize to incoming signals up to at least 15Mc/s provided their amplitude gives about 2 centimetres vertical deflection. Correct synchronization can be achieved by adjusting the level control.

In the "AUTO" position with no input signals the trace will become progressively fainter as the sweep speed is increased. This is due to the sweep running free at about 40c/s in the absence of a trigger signal, regardless of the setting of the speed controls. As soon as an input signal is applied, the sweep is immediately synchronized by it and the trace reverts to its full brightness.

4.3 Trig Selector

The Trigger Selector switch is divided into two sets of three push buttons. One position, used for most purposes, selects "NORMAL" triggering. The top two buttons bring the D.C. restoration into circuit. This enables the sweep to be triggered from the Line or Frame pulses of a TV waveform (normally negative going) independent of the picture content (positive going). The third button selects H.F. operation. In this latter position the sweep is synchronized by the incoming signals. The lower three buttons select positive or negative, Y1, Y2, or external triggering waveforms as required.

A differentiating circuit of 22uS is used in the Sync. Separator to permit triggering from the Frame pulse, effectively removing the line pulse.

For triggering from an external signal, set the switch to EXT, both buttons out, and connect the signal to the EXT TRIG terminal socket.

4.4 X Gain and Shift

The X GAIN control expands the length of the trace from approximately one screen diameter in the anticlockwise position to approx. 10 screen diameters when rotated fully clockwise.

The X SHIFT control is used to centre the trace symmetrically about the ruled graticule or to display any portion of the expanded trace on the screen for examination.

The time calibration holds good only at the minimum setting of the X GAIN control. It is possible to measure time intervals at other settings, however, by using the internal calibration waveform as a standard. For instance, if the X GAIN control is adjusted so that one cycle of the calibration waveform occupies 5 centimetres on the 20Ms/cm range, then the gain is exactly five times on all ranges and, provided the X GAIN control is not touched, all sweep speeds will be multiplied by a factor of 5. Any multiplication factor between 1 and 10 is possible.

4.5 Display Switch

4.5.1 The DISPLAY switch, switches the output sawtooth waveforms from timebases "A" and "B" to the appropriate pair of C.R.T. "X" plates.

In the "Y1, Y2 by A" position, both Y1 and Y2 amplifier signals are displayed by the "A" timebase only.

Similarly, in the "Y1, Y2 by B" position, both Y1 and Y2 amplifier signals are displayed by the "B" timebase only.

In the (Y1 by A) (Y2 by B) position,

the Y1 amplifier signal is displayed on the "A" timebase and the Y2 amplifier signal is displayed on the "B" timebase. Under these conditions, the timebase trigger selector buttons should be switched to the appropriate amplifier and trigger conditions.

(A DLD by B)
In the (Y1 by A) position,
(Y2 by B)

the "B" timebase is triggered from any selected source, "Y1 or Y2 or EXT" and a pulse is produced, part of the way along the sweep, which is automatically used to arm timebase "A".

If the "Stability" control on timebase "A" is fully clockwise, it will trigger on receipt of the arming pulse.

The displayed waveform will show the "B" sweep with a brightened portion. The length of the brightened portion is the time duration of sweep "A", and its position can be varied along the trace using the DELAY control.

If now, the same signal is connected to both Y1 and Y2 inputs, then the "B" trace will show the waveform with a brightened portion, and the "A" trace will show the brightened portion only. Hence, an expanded portion of the "B" trace may be viewed simultaneously with the unexpanded wave train.

If the "Stability" control on timebase "A" is set to its normal triggering position, it will trigger from the first trigger pulse which occurs after the arming pulse. This is the gated condition and jitter in the delay circuit will not affect the displayed trace.

To set up the correct conditions, switch to

(Y1 by A)
(Y2 by B) position

and trigger both timebases from the appropriate trigger sources. These can, of course, be two independent but time related sources.

Then switch to

(A DLD by B)
(Y1 by A)
(Y2 by B)

and adjusting the delay control will vary the position of the bright up portion of the "B" timebase waveform in a series of discrete jumps instead of a smooth variation as when the "Stability" control of the "A" timebase is in the fully clockwise position. If gated operation is not required no trigger waveform should be fed to timebase A.

4.6 Single Shot Operation

With the switch in the Single Shot position the timebase will trigger from the first trigger pulse received after release of the "Reset" button. A neon indicator lights when the timebase is ready for triggering. After the timebase has fired it is insensitive to further triggering pulses until reset.

5. VERTICAL DEFLECTION AMPLIFIER CONTROLS

5.1 VOLTS/CM Switch

This nine-position switch inserts a series of frequency compensated attenuators between the coaxial INPUT socket and the Vertical Deflection Amplifier. If the gain of the amplifier is calibrated, direct readings of input voltages may be obtained. The $\frac{1}{2}$ volt calibration squarewave should measure 5 centimetres vertically with the VOLT/CM switch set to 0.1V/cm. It is most important that the amplitude of the calibration squarewave should be measured between the horizontal flat portions.

5.2 Variable Gain Control

The Variable Gain Control is mounted concentric with the VOLTS/CM switch and varies the gain of the amplifier to cover the range between the VOLTS/CM switch positions. The amplifier gain is only calibrated when the Variable Gain Control is in the fully clockwise position.

5.3 DC/AC Switch

This switch will normally be used in the "AC" position, in which a blocking capacitor removes the DC component of the input signal to the Vertical Deflection Amplifier. The time constant of the input circuit in this position is such that the response is 3dB down at 2c/s, which, whilst adequate for most normal purposes, may prove critical in some applications. (For example, in the "AC" position, the 50c/s calibration waveform acquires a pronounced tilt). If a longer time constant is required, an external blocking capacitor must be used, with a value suitably greater than 0.1 microfarad and the input switch set to "DC".

The "DC" position is also used if it is specifically desired to include the DC component of the input waveform to be measured.

5.4 X1/X10 Y Gain Switch

This switch changes the gain of the Y amplifier, the normal X1 sensitivity being multiplied by 10 when the X10 position is selected. The calibration of the attenuator (VOLTS/CM) switch applies only in the X1 position and should be divided by ten in the X10 position.

6. ADDITIONAL FACILITIES

6.1 Sweep Output

The terminal marked Sweep Output on the timebase front panel provides an A.C. coupled positive going sawtooth waveform of approximately 50v amplitude.

6.2 X Input

The terminal marked X Input on the timebase front panel is normally linked to earth. Removing the link and turning the Variable control to the Off position enables external signals to be fed to the X amplifier. The sensitivity is approx. 0.1 to 1V/cm and the bandwidth D.C. to 500Kc/s (approx. -3dBs). Input impedance is 1M + 30pF (approx.).

6.3 Z Mod

This connector, at the rear of the instrument, is taken, via a blocking capacitor, to the upper gun grid. A positive pulse applied here will brighten the trace. The bandwidth is 20c/s to 30Kc/s (-3dBs) and a 10v P/P signal will give a clearly visible modulation of the trace.

CHAPTER 2

TIMEBASES & ASSOCIATED CIRCUITS

In the D56 two similar Timebases "A" and "B" are incorporated. The circuit description refers to either timebase unless specifically stated otherwise.

1. THE TRIGGER CIRCUIT

1.1 General

Figure 2.1 shows the trigger and TV sync. selection. The operation of the push button switches is described and a detailed summary of the switch positions is also given in this chapter.

1.2 Circuit Description

The trigger amplifier consists of a longtailed pair followed by a cathode follower. The trigger signal from Y1, Y2 or External is fed to either grid of the longtailed pair depending on the setting of S101A (+,-), the other grid being earthed. The output from the pentode anode (V101B) is taken via cathode follower (V101A) to the input of the Schmitt trigger circuit (V103 ECC88). The output D.C. level of the trigger amplifier is varied by RV115, the Trig Level control which varies the D.C. level of both input grids symmetrically, allowing the triggering point to be set to any desired point on the waveform. On the Auto position the Level control is switched out of circuit and the output of the trigger amplifier is A.C. coupled to the Schmitt trigger circuit. The input grid resister R125 is returned to the opposite grid causing the circuit to free run at approx. 40c/s in the absence of triggering signal. As soon as a trigger signal is applied the circuit is synchronised and the time base will trigger from a point near the mean level of the trigger waveform. This setting may be used for almost all applications involving repetitive waveforms with approximately equal excursions about the mean level and repetition frequencies between 50c/s and 1Mc/s.

1.3 H.F. Operation

On H.F. operation S102C removes the D.C. coupling between the cathodes of the Schmitt trigger converting it into a multivibrator running at approx. 0.5Mc/s. The circuit will then synchronise to high frequencies from approx. 1 to 15Mc/s.

1.4 TV Sync. Pulse Selection

On these positions + and - refer to the picture content not the sync. pulse.

On TV Frame and TV Line positions the gain of the trigger amplifier is increased 3 times and a D.C. restoring circuit C106, R123 and MR101 introduced into the Schmitt trigger circuit input. The Trig Level control is set to trigger off the synchronising pulses. The D.C. restoration prevents change of triggering point with picture content variations. On TV Line the output of the Schmitt trigger circuit is differentiated by a short time constant C111 and R136 and fed to the time base. On TV Frame the time constant is increased by the addition of R137. This gives a greater output from the wider frame pulses than from the line pulses and the time base can be adjusted to trigger off the frame pulses by means of the Stability control.

1.5 Trigger Sensitivity

The trigger sensitivity control RV127 is a preset resistor between the cathodes of V103 and is set to give the maximum trigger sensitivity on the 'Cal' waveform without multi-triggering.

1.6 Facilities

The trigger selector switch is divided into two sections, each of which is operated by three push buttons. The functions of the sections are as follows:

Upper Section:	selects NORMAL operation, H.F. operation, or TV sync., line or frame.
Lower Section	selects the polarity of the triggering signal (positive or negative) and selects the source of the triggering signal (internal Y1 or Y2: external).

In order to clarify the operation of the selector switches, their positions are summarized below:

Switch	Positions of Buttons	Function
Upper Section	All Out	Normal
	Top In	TV Frame
	Middle In	TV Line
	Lower In	H.F.
Lower Section	Top In	- ve
	Top Out	+ ve
	Middle In	Y1
	Lower In	Y2
	Both Out	EXT

2. THE TIMEBASE AND HORIZONTAL DEFLECTION AMPLIFIER

Fig. 2.4 shows the Timebase and Horizontal Amplifier and Fig. 2.5 the Time/Cm switch.

2.1 Timebase - Technical Description

V102B and V107A form a grid triggered Miller circuit, the timing components comprising C276, 277, 278, 279, 280 and R285, 287, 288, 289, 290. The Miller is driven by a bistable circuit V104 via diodes MR104 and V105A. MR105 clamps the starting point of the sweep at approx. 97.5v.

The bistable circuit is triggered by a positive pulse from the trigger circuit via V106A. This cuts off diode V105A and the Miller action produces a positive going linear waveform at V107A cathode. A fraction of this voltage is fed via diodes MR107 and V105B to the timebase bistable resetting it at an amplitude determined by RV148 the T.B. Length control. When the bistable resets MR104 is cut off and V105A conducts starting the flyback. The flyback continues until MR105 conducts and clamps the cathode potential of V107A to that of V102B grid. During the flyback V105B is cut off and its cathode falls on a time constant R275, R277 and C275, 277, 278, 279, 280 until MR106 conducts. During this hold off period the timebase can not be retriggered. If the Stability control RV152 is turned clockwise the potential at which MR106 conducts is reduced and eventually the potential of V105B cathode will fall low enough to retrigger the timebase bistable. The timebase will then free-run.

V106B amplifies the timebase bistable waveform to drive the bright-up circuits.

The timing and hold-off capacitors are switched in 10:1 steps the intermediate 1, 2 and 5 steps being obtained by switching the timing resistor. RV291 is the Variable control giving a continuous variation of 2.5:1 and the calibration is correct in the fully clockwise position only. C276 is set up on the highest time base speed to give 0.5uS/cm sweep speed. The output from V107A cathode, approx. 50v of sawtooth, is taken via C118 to the Sweep Output terminal and to the X amplifier.

When switched to Single Shot transistor bistable TR101 and TR102 is triggered at the end of the sweep and holds the anode of V105B sufficiently positive to prevent the timebase being retriggered. The transistor bistable is reset by S105 the Reset button and a neon N101 lights to indicate that the timebase is ready for triggering.

2.2 X Amplifier Technical Description

The sawtooth from the timebase and the X shift voltage from RV182 are mixed in a capacity compensated mixing circuit C116, R163, R164, R165 and applied to the grid of V107B which together with V108B form a longtailed pair. The X Gain control RV171 is connected between the cathodes and gives approx. 10:1 variation. RV172 Set Speed is set up with the X Gain in the fully anticlockwise (minimum gain) position. The push-pull output from the anodes is directly coupled via cathode followers V303 (Timebase A), V302 (Timebase B), to the X plates of the C.R.T. Trace equalising potentiometers RV311, 315, 319 and 324 are provided to set the traces to exactly the same length and position on both timebases. The grid of V108B is D.C. coupled to the anode of V109A the 'X' Input amplifier. The grid of V109A is D.C. coupled to the 'X' Input terminal which is normally linked to earth. V109B is a cathode follower supplying the H.T. for V109A and RV195 is adjusted to give the correct D.C. level at V109A anode.

V108A is a cathode follower giving a low impedance 100v supply for the timebase.

3. TIME BASE CONTROLS

3.1 The Stepped Sweep Control

Fig. 2.5 shows the stepped sweep control which consists of a 3 wafer 24 way rotary switch (Time/cm) to which are connected the resistor-capacitor networks for obtaining the required time base speeds. These speeds range from 5 seconds to 0.5 microsecond per cm ascending in 5, 2, 1 steps.

3.2 Variable Sweep Control

This control (RV291) is concentric with the Time/cm switch and the calibration is correct in the fully clockwise position. Turning the Variable anticlockwise decreases the speed by greater than 2.5:1 ensuring continuous coverage over a range of 0.5 microsecond per cms to 12.5 seconds per cm. In the fully anticlockwise position a switch turns the timebase off.

3.3 Preset Speed Adjustment

This is formed by the combination of a preset panel control (RV172) Set Speed (Fig. 2.4) and a small preset capacitor (C276 Fig. 2.5) which is mounted on the Time/cm switch assembly. The Set Speed control is adjusted at relatively low timebase speeds and the preset capacitor on the highest speed (0.5 microsecond/cm).

Details of these adjustments are given in the setting-up instructions (Chapter 5). The calibration is correct when the Variable is set fully clockwise and the X Gain fully anticlockwise (i.e. minimum X expansion).

3.4 X Gain and X Shift

The X Gain control (RV171) connected between the cathodes of V107B and V108B varies the gain of the X amplifier and allows the trace to be expanded approx. 10 times.

The X Shift control RV182 is concentric with the X Gain and provides a variable voltage which is mixed with the sweep voltage and fed to the grid of V107B. By this means the trace, with or without expansion, may be moved laterally across the screen to centralise any portion of it.

3.5 Stability Control

This control (RV152) varies the grid potential of V104A and is normally set to a point just above the free-running condition. The control adjusts the sensitivity of the sweep circuit to trigger pulses.

3.6 Internal Preset Controls

RV148 (T/B Length) controls the amplitude of the sawtooth from the Miller circuit and is set with the X Gain fully anticlockwise.

RV195 is a preset X Shift and is set so that the X Shift control moves the trace symmetrically about the screen centre.

RV201 is a preset control on the transistor bistable which is set for correct operation on Single Shot.

C116 is the capacity compensation on the shift mixing circuit and is set to give no overshoot after the flyback on the 10 microseconds per cm range.

RV319 and RV324 (Trace Equalising) are set up so that both traces are identical in length and position on the screen when displaying Timebase A.

RV311 and RV315 (Trace Equalising) are set up so that both traces are identical in length and position on the screen when displaying Timebase B.

4. DELAY CIRCUIT

Fig. 2.6 shows the Delay Circuit which enables Timebase A to be triggered from any portion of the sawtooth voltage produced by Timebase B.

Any waveform occurring during the period of one sweep of the lower trace (Y2) may be examined on the upper trace (Y1) at a faster timebase speed selected on Timebase A. The duration of the upper trace (Y1) appears on the lower trace (Y2) as a brightened portion allowing the delaying time to be determined.

4.1 Operation

The Timebase B sweep voltage is mixed with a variable D.C. voltage from the Delay potentiometer RV251 and applied to the base of TR251. TR251 and TR252 of a transistor bistable circuit which produces a fast positive edge at the collector of TR252 when the base of TR251 reaches a high enough potential for TR251 to conduct. The point on the incoming sawtooth at which the bistable circuit produces an output edge can be varied by means of the 10 turn Delay potentiometer.

In the "A" delayed by "B" position of the Display switch Timebase A is automatically switched to Single Shot as the single shot and display switches are in series. The positive edge from the Delay circuit resets the Single Shot bistable and if the Stability control of Timebase A is in the free-running position Timebase A will fire. If Delayed gating operation is required Timebase A Stability control is set for normal triggered operation and the timebase will fire from the first triggered pulse occurring after the Single Shot bistable has been reset by the Delay circuit.

A portion of the bright-up pulse from Timebase A is fed to the grid of the lower trace gun of the C.R.T. on the 'A delayed by B' position of the Display switch S302. A 0.5v positive going bright-up pulse is also available at a front panel socket marked B.U. Out.

5. BRIGHT-UP CIRCUITS

These are shown in Fig. 4.1.

Each gun of the C.R.T. has its own bright-up bistable V305 for the upper gun and V304 for the lower gun. Triggering waveforms from the appropriate time-bases are switched by S302b (F) the Display switch.

5.1 Operation

The bright-up bistables V304 and V305 have their own 150v D.C. supply at the C.R.T. cathode potential -1200v. The cathodes of the C.R.T. guns are D.C. coupled to the anodes of their appropriate bistable circuit. A positive triggering edge at the start of the sweep is fed to the input grid of the bistable circuit from the timebase. This triggers the bistable and drives the C.R.T. cathode negative thus brightening the trace. At the end of the sweep a negative edge from the timebase resets the bistable blanking the trace. Presets RV347 and RV356 set the D.C. level of the unused grid to a suitable potential for correct operation of the bistable circuit.

5.2 10Mc/s Markers

V301A is a cathode coupled L.C. oscillator whose output is fed to the grid of the upper gun of the C.R.T. The tuned circuit is normally heavily damped by V301B which is conducting. When Timebase A is triggered a portion of the bright-up pulse is fed to the grid of V301B cutting it off. The circuit then oscillates at 10Mc/s until V301B again conducts and damps out the oscillation. RV305 adjusts the amplitude of oscillation and L301 the frequency.

6. TRACE SWITCHING

The Display switch S302 has four positions:-

Y1 Y2 by B	A DLD by B Y1 by A Y2 by B	Y1 by A Y2 by B	Y1 Y2 by B

S302A switches the sweep outputs leads to the appropriate pairs of X plates. S302B switches the timebase bright-up pulses to the appropriate bright-up bistable circuit and also switches Timebase A to Single Shot operation on position 2.

CHAPTER 3

VERTICAL DEFLECTION CIRCUITS

1. INTRODUCTION

The oscilloscope contains two identical "Y" amplifiers, each with its own switched attenuator network; this network may be varied in 1, 2, 5 steps up to a division ratio of 1:500.

A switch provides facilities for alternating or direct voltage inputs and is connected directly in the input circuit.

The amplifiers employ D.C. -coupling and are frequency- compensated throughout, thus giving substantially uniform application from D.C. to 15Mc/s with a sensitivity of 100mV/cm and from D.C. to 500Kc/s with a sensitivity of 10mV/cm.

Maximum visible "Y" deflection is 6 cms at all frequencies. Rise time of 0.023 microsecond, with less than 2% overshoot on X1 position. Rise time of 0.7 microsecond, with less than 2% overshoot on X10 position.

2. INPUT ATTENUATORS (Fig. 3.2)

These are identical for the upper and lower trace amplifiers.

An A.C.D.C. switch S1, brings a capacitor (C1) in series with the INPUT coaxial socket (Amphenol Type 83-1R) and the attenuator, in the "A.C." position.

The VOLTS/CM stepped switch S2, may be set to one of nine positions marked .1, .2, .5, 1, 2, 5, 10, 20 and 50 read in a counter-clockwise direction; these figures indicate volts per centimeter. Four frequency-compensated resistance-divider networks are used; these will be obvious from the appropriate figure.

They may, however, be used singly or in cascade, as will be seen by the various positions of the ganged switch (S2).

The first attenuator section has ratios of 1, 10, and 100 and the second section 1, 2 and 5.

The attenuated output from R11 is taken to the grid of V26 (Fig. 3.2).

Input impedance to the attenuator is one megohm + 40 picofarads (approx.) with a voltage measuring accuracy of ± 5%.

3. VERTICAL DEFLECTION AMPLIFIERS (Fig. 3.1)

Apart from HT supplies, these amplifiers are identical for upper and lower trace in each case; both HT supplies, however, are taken from the same winding on T402 through a voltage-doubling network (Fig. 5.1).

3.1 Input Circuit

A signal (A.C. or D.C.) is fed into the control grid of V21 from the associated attenuator.

V21 and V22 form a cathode-coupled pair. The cathodes are coupled through RV22, a variable gain control, and RV23, a preset gain control, and the cathode currents are supplied through cathode resistors R26, R28 and RV27. RV27 is a DC BALANCE control and is adjusted so that there is no trace shift as the VARIABLE gain control is rotated.

A negative supply of -10 volts is available to provide the valve current, and also the shift voltage. This is applied to the grid of V22 via RV42.

The peaking inductors L21 and L22 in the anode circuits of V21 and V22 respectively are compensation for high-frequency inputs.

3.2 Anode Supply to Input Valves

The supply to the anodes and screens of V21 and V22 is somewhat unusual and is obtained from the common-cathode resistor V26 (a) and (b) cathode-followers;

hence the cathode current of the input stages flows through these two output cathode-followers.

This is done to reduce the total current consumption of the amplifier.

3.3 Y Shift

This is obtained from a potentiometer network connected between the minus 10 volt supply and the output stage H.T. supply. The negative line is obtained by rectifying the 12.6 volt heater and smoothing with R416, C413 in Y1 and R417, C414 in Y2.

3.4 Pre-stage Cathode-followers and Final Amplifiers

V21 and V22 are D.C. -coupled to the grids of their respective cathode followers, the outputs of which are fed to the grids of the output amplifying valves V24 and V25 respectively. The output amplifier is a cathode compensated stage, C23 being set for optimum pulse response. The diode between grid and cathode prevent high grid cathode voltages being applied when switching on and the valves are non-conducting. The diodes are automatically cut off when the valves have warmed up.

3.5 Output Cathode-followers

V24 and V25 are D.C. -coupled to the grids of the cathode- followers V26 (a) and (b).

The outputs from both cathode-followers are then fed to the "Y" plates and also fed via attenuator R56, R57 to the TRIGGER SELECTOR switches. See Chapter 2, Section 1.7.

3.6 Y Gain X1/10

With the Y Gain switch in the 'X1' position, the maximum sensitivity of the amplifier is 100mV/cm. The gain is set up by the Set Gain control RV23 with the Variable control RV22 in the fully clockwise position.

When the Y Gain switch S21 is in the 'X10' position, higher value load resistors are switched into the anode circuits of the input stage V21, V22. The amount of Y Shift is also reduced by a factor of 10. The D.C. Bal control RV44 is adjusted to give no trace movement when switching from 'X1' to 'X10'.

3.7 Gain Stability

Due to the large amount of feedback on both amplifier stages the gain is unaffected by mains variations and the measurement accuracy of ∓ 5% is maintained with mains variations of ∓ 10%.

CHAPTER 4

POWER SUPPLIES

1. INTRODUCTION

The Power Supply schematic is shown in Figure 5.1. All the rectifiers used are semiconductor diodes, thus ensuring maximum reliability.

2. CIRCUITRY

Two mains transformers provide all the required secondary voltages. The primary may be adjusted, by means of a double-link input voltage selector panel, for operation on alternating voltages from 90-130V and 200-240V, 50-60 cycles.

2.1 H.T. Supplies

2.1.1 Time Base H.T.'s

A voltage doubler circuit MR403, MR404, C404, C405 supplies all the timebase H.T. voltages. Both X amplifiers and their associated cathode followers are fed from separately smoothed unstabilised supplies whilst both sweep and trigger circuits are stabilised. The stabiliser consists of series valve V401 which is controlled by a long-tailed pair amplifier V402 with a constant current transistor TR403 as the anode load. This arrangement gives a very high gain and therefore good stabilisation against both mains variations and load variations. The reference is a neon N401. The output voltage of the stabiliser is approx. 250v for the timebases and dropping resistors R432, 433, 434, 435 provide separate 120v supplies for the trigger circuits.

2.1.2 Y Amplifier H.T.'s

A voltage doubler circuit MR407, MR408, C406, C407 supplies both Y amplifiers via separate smoothing and decoupling circuits. The values of the H.T. voltages are shown against the appropriate outputs in Fig. 5.1.

2.1.3 Bright-Up H.T.

A half wave rectifier circuit MR419, C431, R436 provides the H.T. supply for both Bright-Up circuits and also the supply for the Brightness potentiometers RV331 and RV337. The positive side of this floating supply is connected to the -1200v E.H.T. supply.

2.2 E.H.T. Supplies

The positive P.D.A. supply of + 4.7Kv is obtained by voltage doubling a 750v winding with MR411, MR412, C415 and C419 and then adding a further doubler from a 1000v winding MR413, MR414, C417 and C418.

The negative supply of -1200v is obtained from a voltage doubler circuit MR415, MR416, MR417, MR418, C421, C422, C423 and C424. The output from the doubler is stabilised by series valve V403 the reference being the +250v stabilised line. In order to compensate for changes in C.R.T. sensitivity due to the unstabilised A3 and P.D.A. supplies the -1200v supply is arranged to change in the opposite direction to the mains variations by taking resistor R441 from the reference network to -16v unstabilised across C409. MR410 protects V403 against high anode voltages on switch on.

2.3 L.T. Supplies

The transformer secondary windings supply 6.3v and 12.6v A.C. for valve heaters, pilot light and graticule illumination. A separate 6.3v winding is provided for the C.R.T. and bright-up circuit heaters.

A stabilised 6.3v D.C. supply for Timebase B heaters is provided by a full wave rectifier circuit MR401, MR402, C403 feeding a transistor stabiliser TR401 and TR402. Zener diode MR409 is the reference.

Half wave rectifier MR405 and C409 rectify the 12.6v heater voltage to give -16v which is smoothed by R416, C413 and R417, C414 to give -10v supplies for each Y amplifier.

2.4 Calibration Voltage

A square wave of 0.5v peak to peak is provided for calibrating purposes. This is obtained from a Zener diode clipping circuit fed from the 150v tap on T402.

The square wave of approx. 11.5v across the Zener diode MR406 is attenuated by a network of resistors having an opposite temperature coefficient to that of the Zener to 0.5v p/p and fed to a socket on the front panel. RV406 allows the amplitude to be set to exactly 0.5v.

2.5 General

A fuse (F401) in the primary circuit, in series with the POWER switch (S401), protects the transformers against overload. The SCALE ILLUM control is coupled mechanically to the mains switch; it varies the brightness of the lamps illuminating the graticule and consists of a potentiometer (RV403) across the 6.5V winding (see Chapter 1).

CHAPTER 5

MAINTENANCE, SERVICING AND SETTING-UP PROCEDURE

1. GENERAL

The simplicity of the circuitry of the D56 makes it an extremely reliable instrument. For the most part, servicing will be limited to the replacement of defective valves, but should a less common fault occur no difficulty should be experienced in detecting the source, if the circuit diagrams are used, in conjunction with normal test procedure. Test voltages at critical points are shown on the circuit diagrams, and the location of major components is given on Plates 2 - 4.

2. DISMANTLING FOR SERVICING

The "unit" method of construction used for the D56 ensures that all components are easily accessible for testing and servicing. The Timebases and Delay Circuit are built as a detachable unit and may be withdrawn as follows:

2.1 Removing the Timebases and Delay Circuit

To remove this unit the cover plates of the oscilloscope must be removed, by loosening the Philips type screws securing the carrying handle (the handle need not be removed). Then proceed as follows:

(1) Remove the four fixing screws at the centre top and bottom of the timebase chassis.

(2) Disconnect the four noval plugs on the leads from the timebase unit to the main chassis.

(3) Withdraw the unit by sliding it forward out of the front of the instrument.

2.2 Access to the Power Supply and CRT Circuitry

Access to the Power Supply and C.R.T. circuitry is by removal of the rear cover plate of the oscilloscope. This is secured by the two screws at either side of the voltage selector panel. The components in these circuits are easily identified from the circuit diagrams. The voltage tappings on the transformer are marked.

3. REPLACEMENT OF DEFECTIVE VALVES

When replacing valves in the Vertical Deflection Amplifier it is necessary to reset the DC Bal, RV27 and the Set Gain controls. Apart from this, little effect on the performance of the Vertical Deflection Amplifier should be experienced when valves are replaced, and no further readjustments should be necessary.

In the Sweep Generator and associated Amplifier the valve characteristics are not critical, and valves may be replaced without readjusting the preset controls.

If the internal preset controls should require readjustment, the following detailed instructions should be followed.

4. SETTING-UP PROCEDURE

4.1 Input Attenuator

The eight trimmer capacitors of the Input Attenuator Switch (C12, C13, C4, C8, C9, C5, C2 and C3) are accessible for adjustment from underneath the instrument.

4.2 Apparatus and Procedure

In order to carry out this adjustment a square wave generator is required, giving a frequency of approximately 1Kc/s; its output must be variable between 0.5V and 100V. The rise time of the square wave need not be particularly fast, but it must have good, flat tops and bottoms. The adjustment procedure is as follows:

(1) Connect the square wave generator to the INPUT socket and adjust its output to approximately 0.5V.

(2) Set the input attenuator to 0.1 volt/cm. Adjust the sweep controls to display three cycles of the square wave on the screen.

(3) Adjust each capacitor in turn, to give square corners to the waveform. The input attenuator switch should be turned to the appropriate setting as shown in the table below. At the same time, adjust the output of the square wave generator to give a trace of 5 cm amplitude in each case.

Input Attenuator Setting	Capacitor to be adjusted
0.2 volt/cm	C12
0.5 " "	C13
1.0 " "	C4
2.0 " "	C8
5.0 " "	C9
10.0 " "	C5

When this procedure is correctly carried out, the 20 volts/cm and 50 volts/cm ranges are automatically correct.

4.3 Adjustments for Using Probe

The capacitors C2 and C3 affect compensation only when the High Impedance probe is in use. To adjust them proceed as follows:

(1) Remove the square wave generator from the input socket and plug in the High Impedance probe. Connect the output of the generator to the probe tip.

(2) Set the input attenuator to 0.1 volt/cm and the square wave generator output to give approximately 5 cm vertical deflection.

(3) Adjust the probe trimmer, which is accessible through a hole in the probe body, to give a flat top to the square wave.

(4) Switch the input attenuator to the 1 volt/cm range. Readjust the square wave generator output as before, and adjust C2. Set the input attenuator to the 10 volts/cm range and adjust C3. All other ranges will automatically be correct.

4.4 Adjustment of High Impedance Probe Compensation Trimmer

This adjustment is best carried out with a square wave generator at an output frequency of 1Kc/s. Connect the probe to the INPUT socket and apply it to the signal generator output. The compensation trimmer is accessible through the hole in the body of the probe and should be adjusted to give square wave corners to a few cycles of the 1Kc/s square wave displayed on the screen.

5. VERTICAL AMPLIFIER ADJUSTMENT

5.1 General

The preset controls on the Vertical Amplifier are the high frequency compensation and the Set Gain and Balance controls. The Set Gain controls should be set before adjusting the high frequency compensation.

5.2 Set Gain and Balance controls

(1) Set Variable control fully clockwise, Volts/cm switch to 0.1 and Y Gain control to X1. Set Y1 trace to +1.2 cms and Y2 trace to -1.2 cms with Y Shift. Switch Y Gain to X10 and reset trace with DC Bal. Repeat until switching from X1 to X10 gives no shift of the trace.

(2) On X10 rotate Variable control anticlockwise and reset trace with RV27. Repeat until rotation of the Variable control gives no shift of trace.

Repeat (1) and (2) until there is no shift of the trace with either Variable or Y Gain switch.

5.3 High Frequency Compensation

This should not be attempted unless a square wave generator capable of producing an accurate square wave at 100Kc/s to 1Mc/s, with a rise time of less than 5 millimicroseconds, is available. It must also be absolutely free from ring or overshoot.

The H.F. compensation circuits are extremely stable, and unless such a generator is available, it is best not to attempt any readjustment. Suitable square wave generators are the Tektronix Type 107 and Cossor Type 1090 or Telequipment Calibrator Type C1.

If such a generator is available, the following procedure should be adopted.

(1) Connect the square wave generator to the input socket. Set the attenuator switch to 0.1 volt/cm.

(2) Adjust the output of the generator to give a vertical deflection of 2-3 cm.

(3) Set L21 and L22 to minimum (fully in). Adjust C23 for best square wave. Adjust L21 and L22 by equal amounts to obtain a flat topped square wave with a fast rise time, square corners and no overshoot rechecking C23 if necessary. The inductor affects the extreme corners of the square wave while the trimmer adjusts the flatness at the start of the flat top.

6. THE TRIGGER CIRCUIT

RV127 is adjusted to give maximum trig sensitivity and RV138 is adjusted so that the Level control operates symmetrically about its mid-position.

Procedure

The internal calibration signal may be used to make this adjustment.

(1) Connect the CAL 0.5 V P-P and INPUT sockets and set the TIME/CM switch to 500us/cm.

(2) Set the input attenuator to the 2V/cm range. This gives a trace 2.5mm high.

(3) Adjust RV127 to give maximum trigger sensitivity without multi-triggering on AUTO, +ve or -ve.

(4) Set the V/cm switch to 0.1V/cm range and set RV135 so that the LEVEL control operates symmetrically about its mid-position.

(5) Re-check RV127 setting.

7. THE SWEEP GENERATOR AND AMPLIFIER

7.1 Trace Length Control (RV148)

Set TIME/CM to 1Ms/cm and STABILITY control fully clockwise, adjust Trace Length (RV148) control to give approx. 50v at the sweep output terminal. Turn STABILITY fully anti-clockwise and if the time base does not stop, turn Trace Length (RV148) anti-clockwise until it does.

7.2 Frequency Compensation Trimmer C116

Short together pins 7 and 8 on TB power socket. On 10uS/cm range with X GAIN at minimum increasing C116 will produce a small 'tail' to the left of the spot at the start of the time base. The correct setting of C116 is that at which the 'tail' just disappears into the spot. With X GAIN at maximum adjust neutralizing by bending wire connected to anode of V108B until the 'tail' just disappears. Check setting of C116 at minimum gain and repeat until rotating the X GAIN from maximum to minimum produces no 'tail' on the spot in either direction.

7.3 Preset Speed Adjustments (RV172, C276)

Set X GAIN to minimum and TIME/CM to 1Ms/cm. Remove the short between pins 7 and 8 and display a 1Kc/s crystal controlled waveform. Set RV172 SET SPEED control to give one cycle per cm. Turn STABILITY control fully clockwise. Set trace length (RV148) to give slightly more than 10 cms of trace. Set TIME/CM to 0.5uS/cm and display 1Mc/s crystal controlled waveform. Adjust C276 to give one cycle per two cms.

Set RV195 so that X Shift control moves the trace by equal amounts to the left and right.

7.4 Single Shot Adjustment (RV201)

Display CAL waveform, switch to Single Shot and set RV201 to centre of range over which timebase triggers correctly when Reset button is pressed.

7.5 Bright-Up Circuits

Display 0.5v Cal on both traces with Display switch on Y1 by A, Y2 by B. Adjust RV347 and RV356 to centre of region where the flyback is blanked. Check on all Display switch positions.

7.6 Trace Equalization

(1) Timebase "A"

Set DISPLAY Switch to Y1 Y2
by A

Display 1mS markers on 1mS/cm range of Timebase A on both traces.

Using both Y SHIFT controls, bring the two traces so that they are almost touching each other.

Adjust both upper TRACE EQUALIZATION potentiometers, RV319, 324, together to make the start and finish of both traces coincident. RV319 affects mostly the start of the traces and RV324 the finish.

(2) Timebase "B"

Set DISPLAY Switch to (Y1 by B)
(Y2 by B)

Display 1mS markers on 1mS/cm range of Timebase B on both traces.

Adjust both lower TRACE EQUALISATION potentiometers together to make the start and finish of both traces coincident. RV311 affects mostly the start of the traces and RV315 the finish.

8. ADJUSTMENTS IN THE POWER SUPPLY CIRCUIT

8.1 The Calibration Voltage

The preset variable resistor (RV406) in the calibration voltage supply circuit (Power Supply Circuit, Fig. 5.1) is provided so that the output voltage can be set to precisely 0.5 volt peak to peak. This adjustment can only be made by comparing the calibration voltage with a known, accurate 0.5 volt peak to peak signal.

In practice RV416 should not require adjustment, unless the Zener diode MR406 has been replaced. If MR406 is replaced an equivalent type must be used.

8.2 The E.H.T. Stabiliser

Set mains voltage to exactly 240v on 240v tap. Adjust RV439 to give 250v at anode of V403.

9. CRT CIRCUIT ADJUSTMENTS (Fig. 4.1)

9.1 10Mc/s Markers

Switch the MARKERS on, and switch the DISPLAY switch to

Y1 Y2
by A

Set Timebase "A" T/cm switch to 0.5uSec/cm, and display 1Mc/s square wave with X expansion. Adjust L301, available through the printed circuit board PC23, mounted on the side of the H.T. chassis so that 10 markers occupy 1uS. The amplitude of markers is adjusted by RV329. There should be approximately 15V at the CRT grid.

CHAPTER 6

COMPONENTS LIST

ABBREVIATIONS

Capacitors

SM	Silver Mica
CER	Ceramic
ELEC	Electrolytic
P	Paper
PC	Polycarbonate
PE	Polyester
PS	Polystyrene

Resistors

C	Carbon Composition
HS	High Stability Carbon
WW	Wire Wound
MO	Metal Oxide
MF	Metal Film

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
313 Chase Road
Southgate,
LONDON, N.14.

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

or from our Agents.

INPUT ATTENUATOR TYPE D56

Part No.	C.C.T. Ref.	Value	Description	Tolerance	Rating @ 70°C
2H90401	R 1	900K	HS	1%	$\frac{1}{4}$w
2H99401	R 2	990K	HS	1%	$\frac{1}{4}$w
18M	R 3	111K	HS	1%	$\frac{1}{4}$w
20M	R 4	10.1K	HS	1%	$\frac{1}{4}$w
2H50401	R 5	500K	HS	1%	$\frac{1}{4}$w
2H80401	R 6	800K	HS	1%	$\frac{1}{4}$w
2H10501	R 7	1M	HS	1%	$\frac{1}{4}$w
2H25401	R 8	250K	HS	1%	$\frac{1}{4}$w
2H10501	R 9	1M	HS	1%	$\frac{1}{4}$w
S10410	R10	100K	C	10%	$\frac{1}{4}$w
S82010	R11	82 OHM	C	10%	$\frac{1}{4}$w
16K	C 1	0.1uf	POL	10%	400v
16J	C 2	6-30pf	CER TRIMMER		250v
16J	C 3	6-30pf	CER TRIMMER		250v
16J	C 4	6-30pf	CER TRIMMER		250v
16J	C 5	6-30pf	CER TRIMMER		250v
59K	C 6	100pf	SM	10%	350v
61K	C 7	1000pf	SM	10%	350v
16J	C 8	6-30pf	CER TRIMMER		250v
16J	C 9	6-30pf	CER TRIMMER		250v
63X	C10	15pf	SM	5%	350v
64X	C11	20pf	SM	5%	350v
16J	C12	6-30pf	CER TRIMMER		250v
16J	C13	6-30pf	CER TRIMMER		250v
65X	C14	30pf	SM	5%	350v
63X	C15	15pf	SM	5%	350v
67J	C16	0.01uf	MP	10%	500v
36P	S 2		SWITCH (Drg. SW1015)		

NOTE: 2 Per Instrument

VERTICAL AMPLIFIER TYPE D56

Part No.	C.C.T. Ref.	Value	Description	Tolerance	Rating @ 70°C
S10110	R21	100	C	10%	$\frac{1}{4}$w
82C	RV22	500	Potentiometer 'Variable Gain'		
119C	RV23	500	Potentiometer 'Preset Gain' Drg.No. P105		
2H82201	R24	8.2K	HS	1%	$\frac{1}{4}$w
2H75101	R25	750	HS	1%	$\frac{1}{4}$w
S15210	R26	1.5K	C	10%	$\frac{1}{4}$w
16C	RV27	470	Potentiometer (MP Plessey)		
S15210	R28	1.5K	C	10%	$\frac{1}{4}$w
2H75101	R29	750	HS	1%	$\frac{1}{4}$w
S39210	R30	3.9K	C	10%	$\frac{1}{4}$w
2H82201	R31	8.2K	HS	1%	$\frac{1}{4}$w
S10110	R32	100	C	10%	$\frac{1}{4}$w
S10110	R33	100	C	10%	$\frac{1}{4}$w
S10110	R34	100	C	10%	$\frac{1}{4}$w
Y27310	R35	27K	C	10%	$\frac{1}{2}$w
S12410	R37	1.2M	C	10%	$\frac{1}{4}$w
S10110	R38	100	C	10%	$\frac{1}{4}$w
S12510	R39	1.2M	C	10%	$\frac{1}{4}$w
S18210	R40	1.8K	C	10%	$\frac{1}{4}$w
910610	R41	10M	C	10%	$\frac{1}{4}$w
62C	RV42	100K	Potentiometer 'Shift'		
S68410	R43	680K	C	10%	$\frac{1}{4}$w
125C	RV44	100K	Potentiometer 'D.C. BAL' (Drg.No. P110)		
S18010	R45	18	C	10%	$\frac{1}{4}$w
Y27310	R46	27K	C	10%	$\frac{1}{2}$w
S10110	R47	100	C	10%	$\frac{1}{4}$w
S18010	R48	18	C	10%	$\frac{1}{4}$w
S10110	R49	100	C	10%	$\frac{1}{4}$w
S47410	R50	470K	C	10%	$\frac{1}{4}$w
82M	R51	2.2K	MO	5%	3.25w
131L	R52	5.1K	MO	5%	3.25w
131L	R53	5.1K	MO	5%	3.25w
82M	R54	2.2K	MO	5%	3.25w
S10310	R55	10K	C	10%	$\frac{1}{4}$w

VERTICAL AMPLIFIER TYPE D56 (continued)

Part No.	C.C.T. Ref.	Value	Description	Tolerance	Rating @ 70°C
S56110	R56	560	C	10%	¼w
111L	R57	6.2K	MO	5%	3.25w
S10110	R58	100	C	10%	¼w
S10310	R59	10K	C	10%	¼w
S47410	R60	470K	C	10%	¼w
S10110	R61	100	C	10%	¼w
112L	R62	6.8K	MO	5%	3.25w
Y10210	R63	1K	C	10%	½w
113L	R64	7.5K	MO	5%	1.5w
S18210	R65	1.8K	C	10%	¼w
S18210	R66	1.8K	C	10%	¼w
65M	R67	1K	WW	5%	4.5w
43K	C21	2.2 PF	CER		
29K	C22	0.47	PE	10%	125v
15J	C23	450 PF	CER TRIMMER		
96J	C24	32+32	ELEC		275v
16K	C25	0.1	PE	10%	400v
29K	C26	0.47	PE	10%	125v
59J	C27	32+32			450v
39D	S21		Switch X1 - X10 3 Pole 2 Way		
34E	MR21		Diode OA81		
34E	MR22		Diode OA81		
	L21		Variable Coil		
	L22		Variable Coil		

VERTICAL AMPLIFIER TYPE D56 (continued)

Part No.	C.C.T. Ref.	Value	Description	Tolerance	Rating @ 70°C
26T	V21		Valve Mullard EF184		
26T	V22		Valve Mullard EF184		
18T	V23		Valve Mullard ECC88		
27T	V24		Valve Mullard E801F		
27T	V25		Valve Mullard E801F		
18T	V26		Valve Mullard ECC88		

TRIGGER CIRCUIT & TIME BASE

Part No.	C.C.T. Ref.	Value	Description	Tolerance	Rating @ 70°C
968510	R101	6.8M	C	10%	¼W
968510	R102	6.8M	C	10%	¼W
S10110	R103	100	C	10%	¼W
S10510	R104	1M	C	10%	¼W
S18010	R105	18	C	10%	¼W
S15210	R106	1.5K	C	10%	¼W
S68210	R107	6.8K	C	10%	¼W
S33210	R108	3.3K	C	10%	¼W
S10110	R109	100	C	10%	¼W
S10110	R110	100	C	10%	¼W
S10510	R111	1M	C	10%	¼W
S22410	R112	220K	C	10%	¼W
S15310	R113	15K	C	10%	¼W
933510	R114	3.3M	C	10%	¼W
	RV115		See RV152		
933510	R116	3.3M	C	10%	¼W
S10110	R117	100	C	10%	¼W
S18010	R118	18	C	10%	¼W
S10310	R119	10K	C	10%	¼W
Y22310	R120	22K	C	10%	½W
S33410	R121	330K	C	10%	¼W
S68410	R122	680K	C	10%	¼W
S10410	R123	100K	C	10%	¼W
S10110	R124	100	C	10%	¼W
S47410	R125	470K	C	10%	¼W
S68310	R126	68K	C	10%	¼W
16C	RV127	470	C Potentiometer Preset	20%	¼W
S22210	R128	2.2K	C	10%	¼W
S10210	R129	1K	C	10%	¼W
S33310	R130	33K	C	10%	¼W
S10410	R131	100K	C	10%	¼W
S10110	R132	100	C	10%	¼W
Y22310	R133	22K	C	10%	½W
S68310	R134	68K	C	10%	¼W
112C	RV135	47K	Potentiometer Preset	20%	¼W

TRIGGER CIRCUIT & TIME BASE (continued)

Part No.	C.C.T. Ref.	Value	Description	Tolerance	Rating @ 70°C
S10310	R136	10K	C	10%	$\frac{1}{4}$w
S22410	R137	220K	C	10%	$\frac{1}{4}$w
Y68310	R138	68K	C	10%	$\frac{1}{2}$w
S10110	R139	100	C	10%	$\frac{1}{4}$w
S10110	R140	100	C	10%	$\frac{1}{4}$w
S56310	R141	56K	C	10%	$\frac{1}{4}$w
S33205	R142	3.3K	C	5%	$\frac{1}{4}$w
S15305	R143	15K	C	5%	$\frac{1}{4}$w
S82310	R144	82K	C	10%	$\frac{1}{4}$w
S10110	R145	100	C	10%	$\frac{1}{4}$w
S18410	R146	180K	C	10%	$\frac{1}{4}$w
S68310	R147	68K	C	10%	$\frac{1}{4}$w
104C	RV148	100K	Potentiometer Preset 'T/B Length'	20%	$\frac{1}{4}$w
S15410	R149	150K	C	10%	$\frac{1}{4}$w
S10110	R150	100	C	10%	$\frac{1}{4}$w
S22310	R151	22K	C	10%	$\frac{1}{4}$w
	RV115)	100K	Potentiometer 'Level'		
115C	RV152)	10K	Potentiometer 'Stab'	20%	2w
	S104)		Switch Auto On/Off		
S12310	R153	12K	C	10%	$\frac{1}{4}$w
S10110	R154	100	C (Positioned on copper side)	10%	$\frac{1}{4}$w
S56310	R155	56K	C	10%	$\frac{1}{4}$w
S33410	R156	330K	C	10%	$\frac{1}{4}$w
S10110	R157	100	C	10%	$\frac{1}{4}$w
S10510	R158	1M	C	10%	$\frac{1}{4}$w
S18010	R159	18	C	10%	$\frac{1}{4}$w
Y10305	R161	10K	C	5%	$\frac{1}{2}$w
Y56205	R162	5.6K	C	5%	$\frac{1}{2}$w
S33405	R163	330K	C	5%	$\frac{1}{4}$w
S56405	R164	560K	C	5%	$\frac{1}{4}$w
S51405	R165	510K	C	5%	$\frac{1}{4}$w
S10110	R166	100	C	10%	$\frac{1}{4}$w
102M	R167	22K	MO	5%	3w
S10110	R168	100	C	10%	$\frac{1}{4}$w

TRIGGER CIRCUIT & TIME BASE (continued)

Part No.	C.C.T. Ref.	Value	Description	Tolerance	Rating @ 70°C
010310	R169	10K	C	10%	1w
	RV171		See RV182		
106C	RV172	25K	Potentiometer Preset 'Set Speed'	20%	$\frac{1}{4}$w
S10110	R173	100	C	10%	$\frac{1}{4}$w
S10110	R174	100	C	10%	$\frac{1}{4}$w
010310	R175	10K	C	10%	1w
102M	R176	22K	MO	5%	3w
2H15401	R179	150K	HS	1%	$\frac{1}{4}$w
S10810	R180	18	C	10%	$\frac{1}{4}$w
2H82301	R181	82K	HS	1%	$\frac{1}{4}$w
107C	RV182 RV171	50K) 10K)	Potentiometer 'X Shift' " 'X Gain'	20%	2w
S10310	R183	10K	C	10%	$\frac{1}{4}$w
015310	R184	15K	C	10%	1w
S82410	R185	820K	C	10%	$\frac{1}{4}$w
S10510	R190	1M	C	10%	$\frac{1}{4}$w
S10110	R191	100	C	10%	$\frac{1}{4}$w
S33210	R192	3.3K	C	10%	$\frac{1}{4}$w
S15310	R193	15K	C	10%	$\frac{1}{4}$w
S10110	R194	100	C	10%	$\frac{1}{4}$w
18C	RV195	1M	Potentiometer Preset	20%	$\frac{1}{4}$w
S15510	R196	1.5M	C	10%	$\frac{1}{4}$w
S47310	R197	47K	C	10%	$\frac{1}{4}$w
S10610	R198	10M	C	10%	$\frac{1}{4}$w
S39310	R199	39K	C	10%	$\frac{1}{4}$w
17C	RV201	10K	Potentiometer Preset	20%	$\frac{1}{4}$w
S12310	R202	12K	C	10%	$\frac{1}{4}$w
S22410	R203	220K	C	10%	$\frac{1}{4}$w
922510	R204	2.2M	C	10%	$\frac{1}{4}$w
S18310	R205	18K	C	10%	$\frac{1}{4}$w
S56310	R206	56K	C	10%	$\frac{1}{4}$w
S10310	R207	10K	C	10%	$\frac{1}{4}$w
S68210	R208	6.8K	C	10%	$\frac{1}{4}$w
S10410	R209	100K	C	10%	$\frac{1}{4}$w

TRIGGER CIRCUIT & TIME BASE (continued)

Part No.	C.C.T. Ref.	Value	Description	Tolerance	Rating @ 70°C
S56310	R211	56K	C	10%	$\frac{1}{4}$w
S10410	R212	100K	C	10%	$\frac{1}{4}$w
74J	C101	3.9pf	CER	$\pm\frac{1}{4}$pf	750v
74J	C102	3.9pf	CER	$\pm\frac{1}{4}$pf	750v
67J	C103	0.01	POL	20%	400v
67J	C104	0.01	POL	20%	400v
66J	C105	0.1	POL	20%	250v
66J	C106	0.1	POL	20%	250v
33K	C107	0.1	POL	20%	125v
66J	C108	0.1	POL	20%	250v
76J	C109	470pf	CER	10%	500v
66J	C110	0.1	POL	20%	250v
69J	C111	100pf	POLY	10%	350v
39K	C112	15pf	CER	5%	750v
39K	C113	15pf	CER	5%	750v
45K	C114	10pf	CER	10%	750v
41K	C115	30pf	CER	10%	750v
17J	C116	4-20pf	TRIMMER		
16K	C118	0.1	POL	20%	400v
71J	C119	50	ELEC		150v
45K	C122	10pf	CER	20%	750v
72J	C123	2200pf	P.E.	20%	400v
100J	C124	100pf	CER	10%	500v
67J	C125	0.01	POL	20%	400v
100J	C126	100pf	CER	10%	500v
101J	C127	150pf	CER	10%	500v
90J	C128	0.033	POL	20%	250v
66J	C129	0.1	POL	20%	250v
34E	MR141		Diode OA 81		
34E	MR102		Diode OA 81		
34E	MR103		Diode OA 81		
34E	MR104		Diode OA 81		

TRIGGER CIRCUIT & TIME BASE (continued)

Part No.	C.C.T. Ref.	Value	Description	Tolerance	Rating @ 70°C
34E	MR105		Diode OA 81		
34E	MR106		Diode OA 81		
34E	MR107		Diode OA 81		
34E	MR108		Diode OA 81		
34D	S101)		Trig Selector Switches		
25D	S102)				
	S103		Switch See RV284		
	S104		Switch See RV115 & RV152		
94C	S105		Reset		
56O	S106		Single Shot/Normal		
36Y	N101		Neon Type 3L		
119T	TR101		Transistor LB293 motorola		
119T	TR102		Transistor LB293 motorola		
10T	V101		Valve ECF80		
10T	V102		Valve ECF80		
18T	V103		Valve ECC88		
18T	V104		Valve ECC88		
11T	V105		Valve EB91		
10T	V106		Valve ECF80		
10T	V107		Valve ECF80		
10T	V108		Valve ECF80		
10T	V109		Valve ECF80		

TIME/CM SWITCH CIRCUIT D56

Part No.	C.C.T. Ref.	Value	Description	Tolerance	Rating @ 70°C
S47510	R276	4.7M	C	10%	¼w
S47410	R277	470K	C	10%	¼w
S33410	R278	330K	C	10%	¼w
S39410	R279	390K	C	10%	¼w
S68310	R280	68K	C	10%	¼w
S30305	R281	30K	C	5%	¼w
S15310	R282	15K	C	10%	¼w
S51405	R283	510K	C	5%	¼w
S10410	R284	100K	C	10%	¼w
3H15506	R285	15M	HS 2HS3	2%	½w
2H50501	R286	5M	HS 2HS2	1%	¼w
2H25501	R287	2.5M	HS 2HS2	1%	¼w
159L	R288	1.5M	M.F.	1%	¼w
160L	R289	500K	M.F.	1%	¼w
14M	R290	500K	HS 2HS2	1%	¼w
103C	RV291	1M	C Potentiometer 'Variable' Drg. P101	20%	¼w
912510	R292	1.2M	C	10%	¼w
42K	C275	39pf	CER	5%	750v
16J	C276	6/30pf	CER TRIMMER Stentite		250v
102J	C277	20pf	CER Lemco 310 NPO Erie BD NPO	∓0.25p	750v
103J	C278	380pf	P.S. Lemco G.E.C. Suflex or Lemco	1%	125v
104J	C279	4000pf	P.S. Lemco G.E.C. Suflex or Lemco	1%	125v
105J	C280	0.04	P.S. Lemco G.E.C. Suflex or Lemco	1%	125v
106J	C281	0.4	P.E. (0.33 1% + .068 3%) Wima M	2%	125v
107J	C282	4	P.E. Wima MKB2	2%	250v
	S103		Switch 'T/B ON OFF' see Drg. P101		
55D	S275		Switch 24 POS 'TM/CM' Drg. SW1350		

DELAY CIRCUIT

Part No.	C.C.T. Ref.	Value	Description	Tolerance	Rating @ 70°C
86C	RV251	100K	Potentiometer 'Knobpot'	5%	
168L	R252	47K	M.F.	5%	$\frac{1}{4}$w
118L	R253	27K	M.F.	5%	$\frac{1}{4}$w
S68110	R254	680	C	10%	$\frac{1}{4}$w
S22210	R255	2.2K	C	10%	$\frac{1}{4}$w
S18210	R256	1.8K	C	10%	$\frac{1}{4}$w
Y47310	R257	47K	C	10%	$\frac{1}{2}$w
Y33310	R258	33K	C	10%	$\frac{1}{2}$w
S33410	R259	330K	C	10%	$\frac{1}{4}$w
54K	C251	200P	CER	10%	750v
53K	C252	100P	CER	10%	750v
34E	MR251		Diode OA 81		
119T	TR251		Transistor LB293 Motorola		
119T	TR252		Transistor LB293 Motorola		

C.R.T. CIRCUIT

Part No.	C.C.T. Ref.	Value	Description	Tolerance	Rating @ 70°C
S10410	R301	100K	C	10%	$\frac{1}{4}$w
Y15310	R302	15K	C	10%	$\frac{1}{2}$w
S56110	R303	560	C	10%	$\frac{1}{4}$w
117L	R304	6.8K	MO	5%	3.25w
55C	RV305	4.7K	Potentiometer		
S10310	R306	10K	C	10%	$\frac{1}{4}$w
114L	R307	56K	MO	5%	1.5w
S10110	R308	100	C	10%	$\frac{1}{4}$w
114L	R309	56K	MO	5%	1.5w
55C	RV311	4.7K	Potentiometer		
114L	R312	56K	MO	5%	1.5w
S10110	R313	100	C	10%	$\frac{1}{4}$w
114L	R314	56K	MO	5%	1.5w
55C	RV315	4.7K	Potentiometer		
114L	R316	56K	MO	5%	1.5w
S10110	R317	100	C	10%	$\frac{1}{4}$w
114L	R318	56K	MO	5%	1.5w
55C	RV319	4.7K	Potentiometer		
114L	R321	56K	MO	5%	1.5w
S10110	R322	100	C	10%	$\frac{1}{4}$w
114L	R323	56K	MO	5%	1.5w
55C	RV324	4.7K	Potentiometer		
98C	RV325	250K	Potentiometer 'Astig'		
S56310	R326	56K	C	10%	$\frac{1}{4}$w
922510	R327	2.2M	C	10%	$\frac{1}{4}$w
46C	RV328	1M	Potentiometer 'Focus'		
S56410	R329	560K	C	10%	$\frac{1}{4}$w
46C	RV331	500K	Potentiometer 'Brilliance'		
98C	RV332	250K	Potentiometer 'Astig'		
S56310	R333	56K	C	10%	$\frac{1}{4}$w
922510	R334	2.2M	C	10%	$\frac{1}{4}$w
46C	RV335	1M	C Potentiometer 'Focus';		
S56410	R336	560K	C	10%	$\frac{1}{4}$w
46C	RV337	500K	Potentiometer 'Brilliance'		
S10510	R338	1M	C	10%	$\frac{1}{4}$w

C.R.T. CIRCUIT (continued)

Part No.	C.C.T. Ref.	Value	Description	Tolerance	Rating @ 70°C
S10510	R339	1M	C	10%	$\frac{1}{4}$w
S18310	R341	18K	C	10%	$\frac{1}{4}$w
S18310	R342	18K	C	10%	$\frac{1}{4}$w
S18310	R343	18K	C	10%	$\frac{1}{4}$w
S18310	R344	18K	C	10%	$\frac{1}{4}$w
Y39210	R345	3.9K	C	10%	$\frac{1}{2}$w
2H40401	R346	400K	H.S.	1%	$\frac{1}{4}$w
57C	RV347	22K	Potentiometer		
2H82301	R348	82K	H.S.	1%	$\frac{1}{4}$w
2H33401	R349	330K	H.S.	1%	$\frac{1}{4}$w
S10210	R350	1K	C	10%	$\frac{1}{4}$w
2H10401	R351	100K	H.S.	1%	$\frac{1}{4}$w
Y47210	R352	4.7K	C	10%	$\frac{1}{2}$w
Y75205	R353	7.5K	C	5%	$\frac{1}{2}$w
Y39210	R354	3.9K	C	10%	$\frac{1}{2}$w
2H40401	R355	400K	H.S.	1%	$\frac{1}{4}$w
57C	RV356	22K	Potentiometer		
2H82301	R357	82K	H.S.	1%	$\frac{1}{4}$w
2H33401	R358	330K	H.S.	1%	$\frac{1}{4}$w
2H10401	R359	100K	H.S.	1%	$\frac{1}{4}$w
Y56210	R361	5.6K	C	10%	$\frac{1}{2}$w
Y75205	R362	7.5K	C	5%	$\frac{1}{2}$w
S39210	R363	3.9K	C	10%	$\frac{1}{4}$w
S15210	R364	1.5K	C	10%	$\frac{1}{4}$w
S22110	R365	220	C	10%	$\frac{1}{4}$w
S56210	R366	5.6K	C	10%	$\frac{1}{4}$w
S10110	R367	100	C	10%	$\frac{1}{4}$w
S10110	R368	100	C	10%	$\frac{1}{4}$w
S10110	R369	100	C	10%	$\frac{1}{4}$w
S10110	R371	100	C	10%	$\frac{1}{4}$w
20X	C301	0.01	CER	20%	1.5KV
18K	C302	1000P	PE	10%	400v
46K	C303	5P	SM	10%	250v

C.R.T. CIRCUIT (continued)

Part No.	C.C.T. Ref.	Value	Description	Tolerance	Rating @ 70°C
65J	C304	0.1	PE	10%	400v
6J	C305	470P	CER	20%	1.5KV
20X	C306	0.01	CER	20%	1.5KV
98J	C307	0.02	CER	-20% +40%	2KV
49K	C309	30P	CER		500v
67J	C311	0.01	PE	20%	400v
49K	C312	30P	CER		500v
67J	C313	0.01	PE	20%	400v
16K	C314	0.1	PE	10%	400v
78C	S301		Switch 'Markers On/Off'		
42D	S302		Switch 'Display' (Drg. S1301)		
	L301		Coil Variable set 10 mc/s Markers Drg. 41114		
18T	V301		Valve ECC88		
18T	V302		Valve ECC88		
18T	V303		Valve ECC88		
18T	V304		Valve ECC88		
18T	V305		Valve ECC88		
50Y	CRT		M.O. Valve Co type 1374K		

POWER SUPPLY

Part No.	C.C.T. Ref.	Value	Description	Tolerance	Rating @ 70°C
S22410	R401	220K	C	10%	$\frac{1}{4}$w
69L	R402	100K	M.F.	5%	$\frac{1}{4}$w
99C	RV403	25	Potentiometer Scale Illum ganged to S401		
S22110	R404	220	C	10%	$\frac{1}{4}$w
Y33210	R405	3.3K	C	10%	$\frac{1}{2}$w
56C	RV406	2.2K	C Potentiometer		
2H36201	R407	3.6K	H.S.	1%	$\frac{1}{4}$w
65M	R408	1K	W/W	5%	4.5w
Y82110	R409	820	C		$\frac{1}{2}$w
65M	R411	1K	W/W	5%	4.5w
Y82110	R412	820	C	10%	$\frac{1}{2}$w
S27210	R413	2.7K	C	10%	$\frac{1}{4}$w
S22110	R414	220	C	10%	$\frac{1}{4}$w
Y33210	R415	3.3K	C	10%	$\frac{1}{2}$w
S68110	R416	680	C	10%	$\frac{1}{4}$w
S68110	R417	680	C	10%	$\frac{1}{4}$w
116L	R418	2.2K	W/W	10%	10w
2H18401	R419	180K	H.S.	1%	$\frac{1}{4}$w
2H35401	R421	350K	H.S.	1%	$\frac{1}{4}$w
S10110	R422	100	C	10%	$\frac{1}{4}$w
S10110	R423	100	C	10%	$\frac{1}{4}$w
S56210	R424	5.6K	C	10%	$\frac{1}{4}$w
S10510	R425	1M	C	10%	$\frac{1}{4}$w
S47210	R426	4.7K	C	10%	$\frac{1}{4}$w
S33310	R427	33K	C	10%	$\frac{1}{4}$w
S10110	R428	100	C	10%	$\frac{1}{4}$w
S10510	R429	1M	C	10%	$\frac{1}{4}$w
S18410	R431	180K	C	10%	$\frac{1}{4}$w
Y27310	R432	27K	C	10%	$\frac{1}{2}$w
Y27310	R433	27K	C	10%	$\frac{1}{2}$w
Y27310	R434	27K	C	10%	$\frac{1}{2}$w
Y27310	R435	27K	C	10%	$\frac{1}{2}$w
Y15210	R436	1.5K	C	10%	$\frac{1}{2}$w
S10510	R437	1M	C	10%	$\frac{1}{4}$w

POWER SUPPLY (continued)

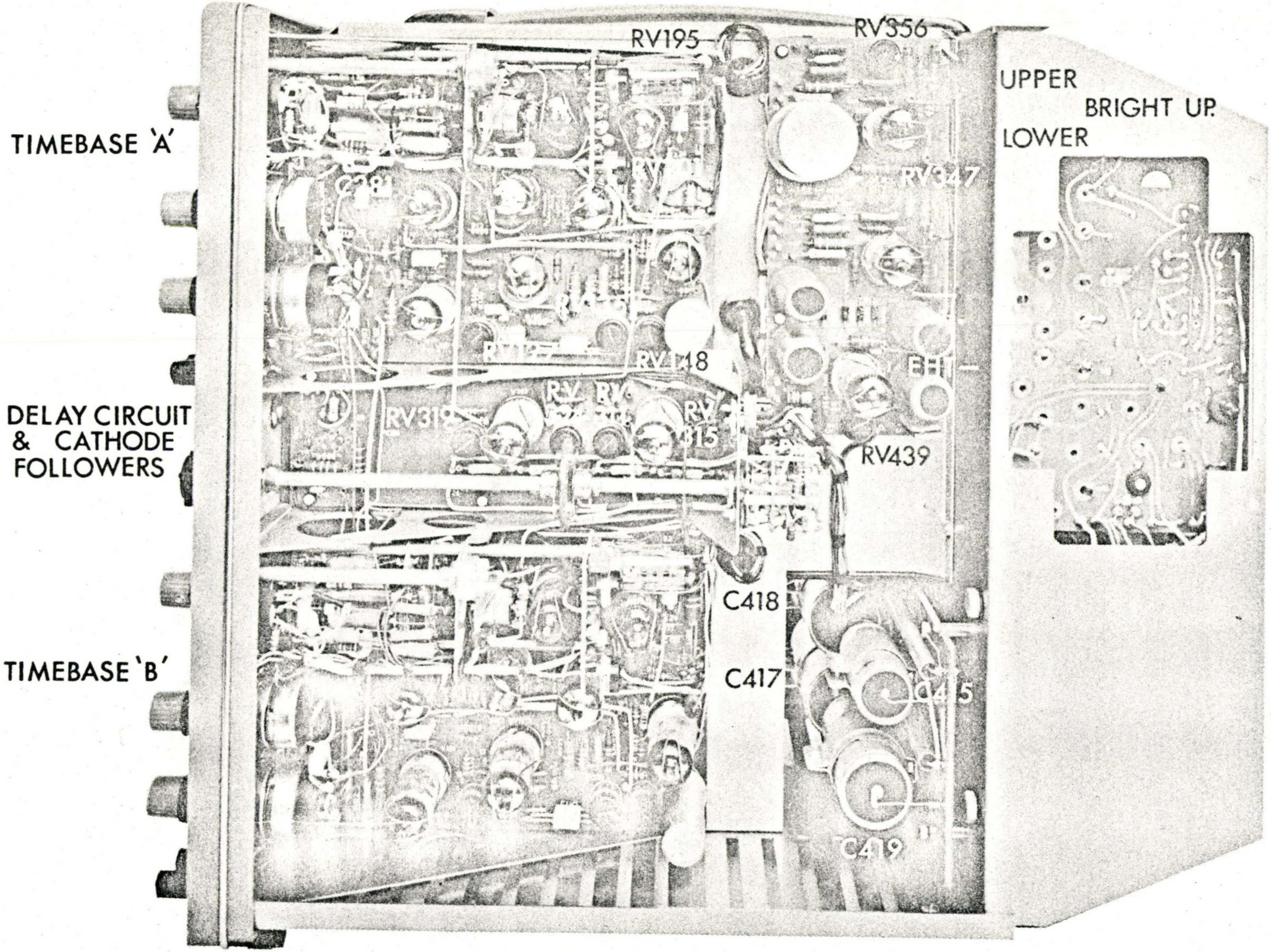
Part No.	C.C.T. Ref.	Value	Description	Tolerance	Rating @ 70°C
S27410	R438	270K	C	10%	$\frac{1}{4}$w
58C	RV439	220K	Potentiometer		
S68310	R441	68K	C	10%	$\frac{1}{4}$w
S10110	R442	100	C	10%	$\frac{1}{4}$w
65J	C401	0.1	PE	10%	400v
65J	C402	0.1	PE	10%	400v
99J	C403	16000	ELEC		10v
91J	C404	120	ELEC		200v
91J	C405	120	ELEC		200v
91J	C406	120	ELEC		200v
91J	C407	120	ELEC		200v
42X	C408	32+32	ELEC		450v
93J	C409	1000 + 1000	ELEC		18v
20K	C411	4700P	PE	10%	125v
42X	C412	32 + 32	ELEC		450v
33X	C413	250	ELEC		18v
33X	C414	250	ELEC		18v
39J	C415	0.05	P		2Kv
66J	C416	0.1	PE	10%	250v
37X	C417	0.05	P		3.5Kv
37X	C418	0.05	P		3.5Kv
13K	C419	0.05	P		2.5Kv
92J	C421	16	ELEC		450v
92J	C422	16	ELEC		450v
92J	C423	16	ELEC		450v
92J	C424	16	ELEC		450v
66J	C425	0.1	PE	10%	250v
94J	C426	32+32+32	ELEC		350v
65J	C427	0.1	PE	10%	400v
42X	C428	32+32	ELEC		450v
42X	C429	32+32	ELEC		450v

POWER SUPPLY (continued)

Part No.	C.C.T. Ref.	Value	Description	Tolerance	Rating @ 70°C
97J	C431	50+50	ELEC	-20% +50%	200v
98J	C432	0.02	CER		2Kv
98J	C433	0.02	CER		2Kv
55F	MR401		Rectifier Type 1S020 Texas		
55F	MR402		" " 1S020 Texas		
18O	MR403		" " ZS75		
18O	MR404		" " ZS75		
10E	MR405		" " ZS70		
68T	MR406		Zener Diode 11V	15%	
18O	MR407		Rectifier Type ZS75		
18O	MR408		" " ZS75		
72T	MR409		Zener Diode ZB7.5 Brush		
18O	MR410		Rectifier ZS75 or DDO58		
6O	MR411		" K8/50		
6O	MR412		" K8/50		
6O	MR413		" K8/50		
6O	MR414		" K8/50		
7O	MR415		" ZS78 or DDO58		
7O	MR416		" ZS78 or DDO58		
7O	MR417		" ZS78 or DDO58		
7O	MR418		" ZS78 or DDO58		
18O	MR419		" ZS75		
120T	TR401		Transistor Mullard Type ACY22		
118T	TR402		" Newmarket Type NKT452		
120T	TR403		" Mullard Type ACY22		
38T	V401		Valve Mullard EL86		
10T	V402		" " ECF80		
26T	V403		" " EF184		

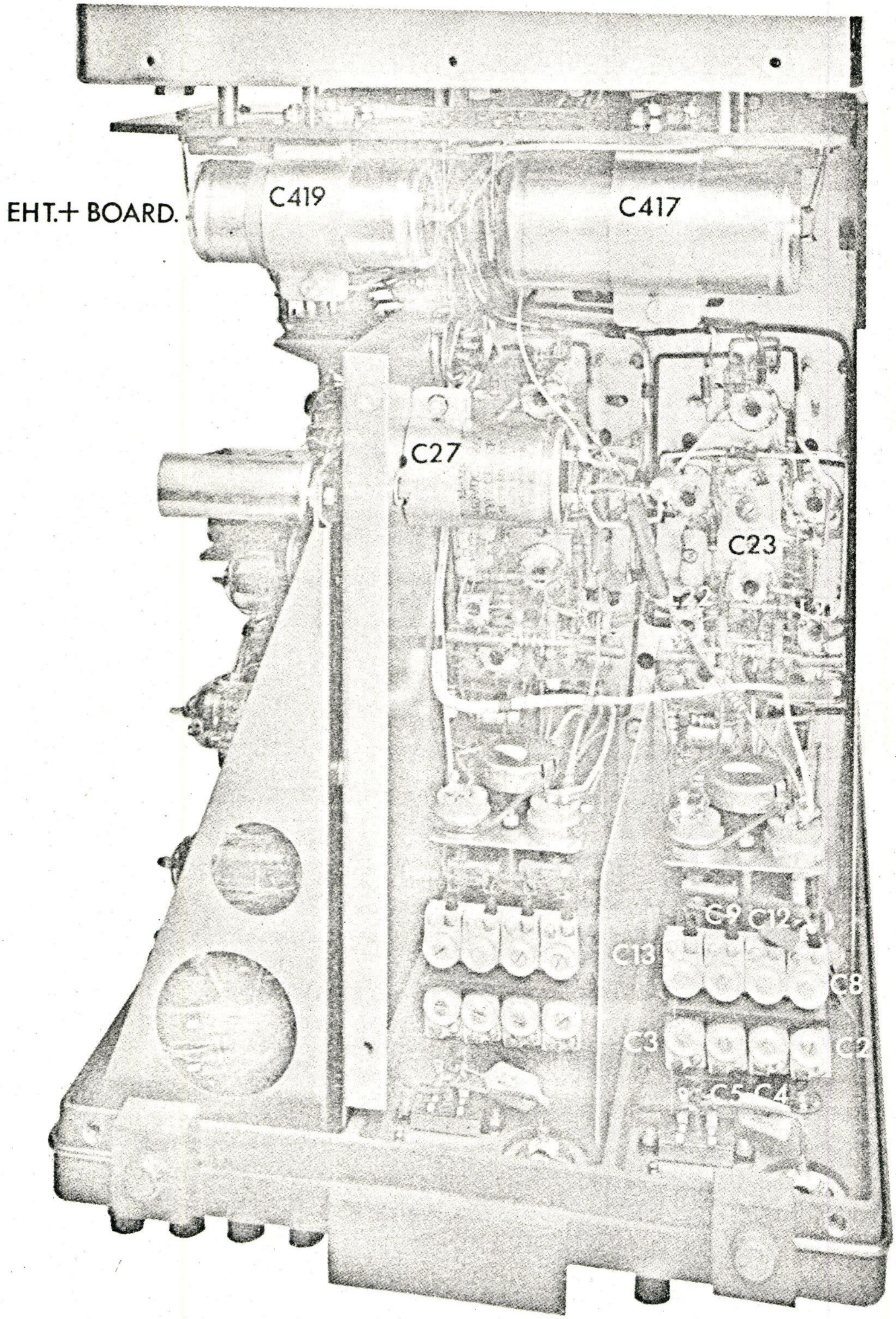
POWER SUPPLY (continued)

Part No.	C.C.T. Ref.	Value	Description		Tolerance	Rating @ 70°C
48Y	N401		Neon XC 12			
4Y	LP401		Power Supply Lamp 6.5v			
4Y	LP402		Scale Illum 6.5v			
4Y	LP403		" 6.5v			
61S	T401		Primary	Secondary		
			0-110v AC	0-6.5v		
			0-110v AC	8.1v-0-8.1v		
			0-5-10-20v AC	0-153v		
				0-510v		
62S	T402		Primary	Secondary		
			0-110v AC	0-6.3v 0-6.3v		
			0-110v AC	0-6.3v		
			0-5-10-20v AC	150v		
				0-150-350-750-1000		
	P401		Fuse 1.5A at 250v 3A at 110v			
99C	S401		Mains On/Off on Scale Illum Pot			

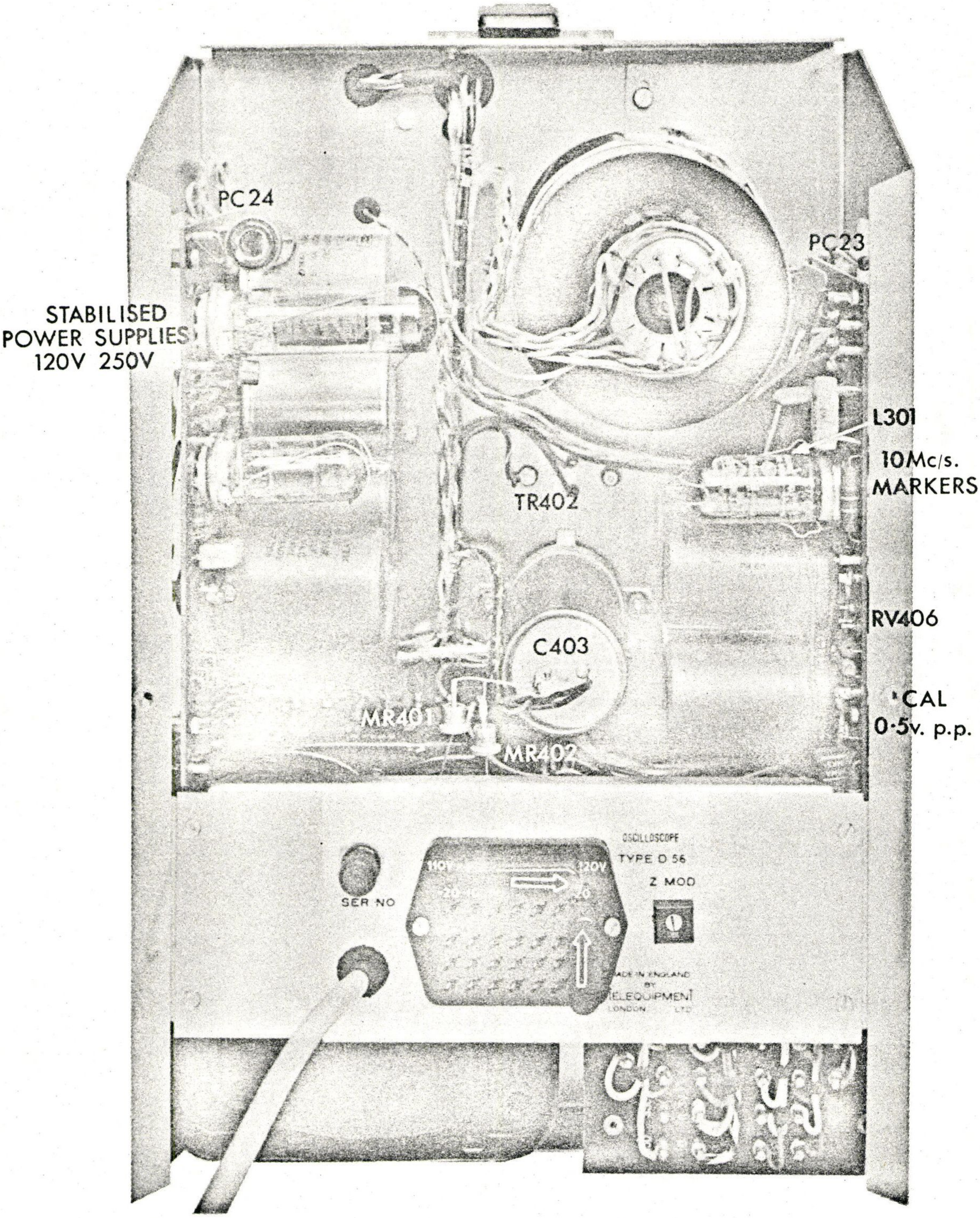


VIEWED AT SIDE.

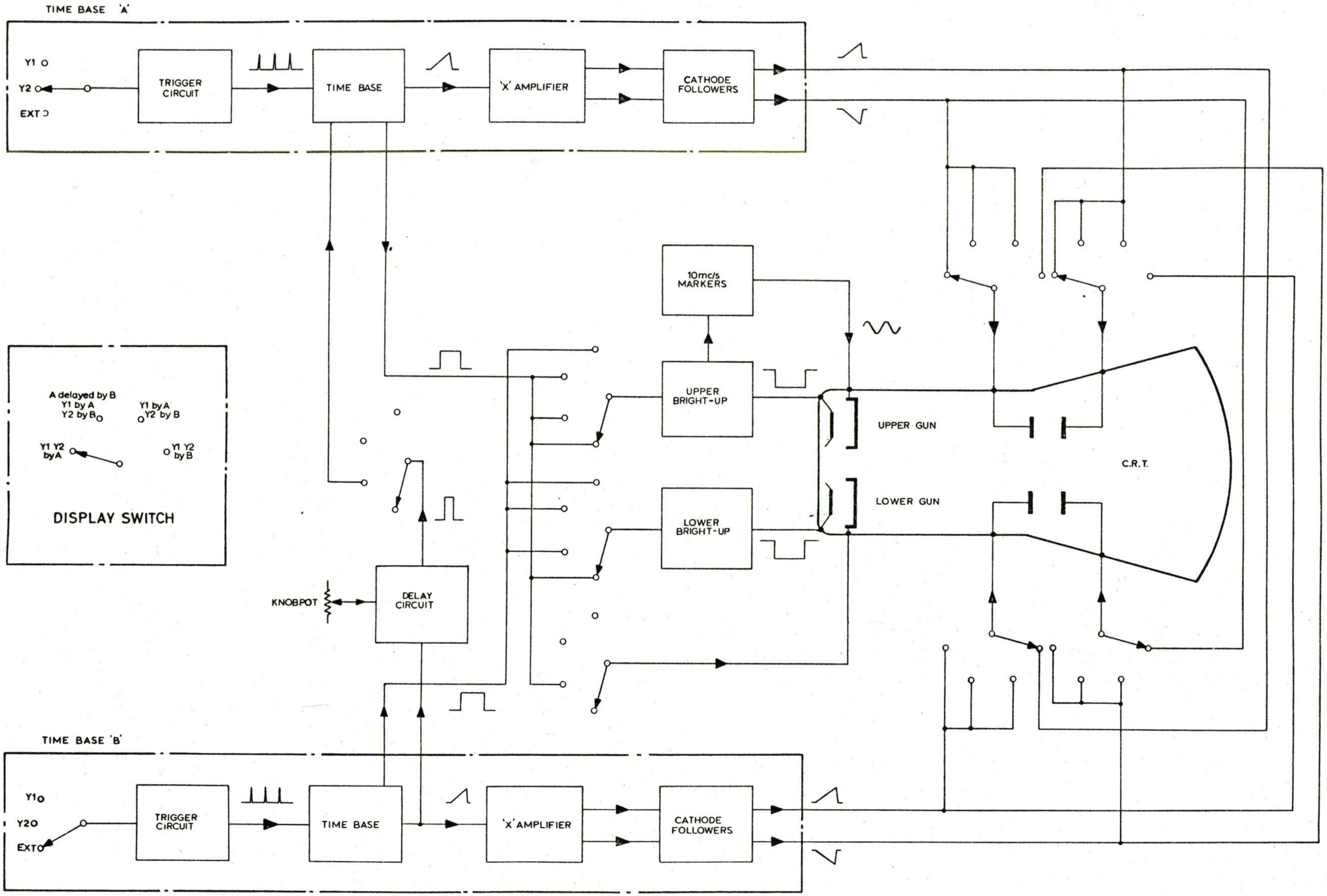
PLATE. 2.



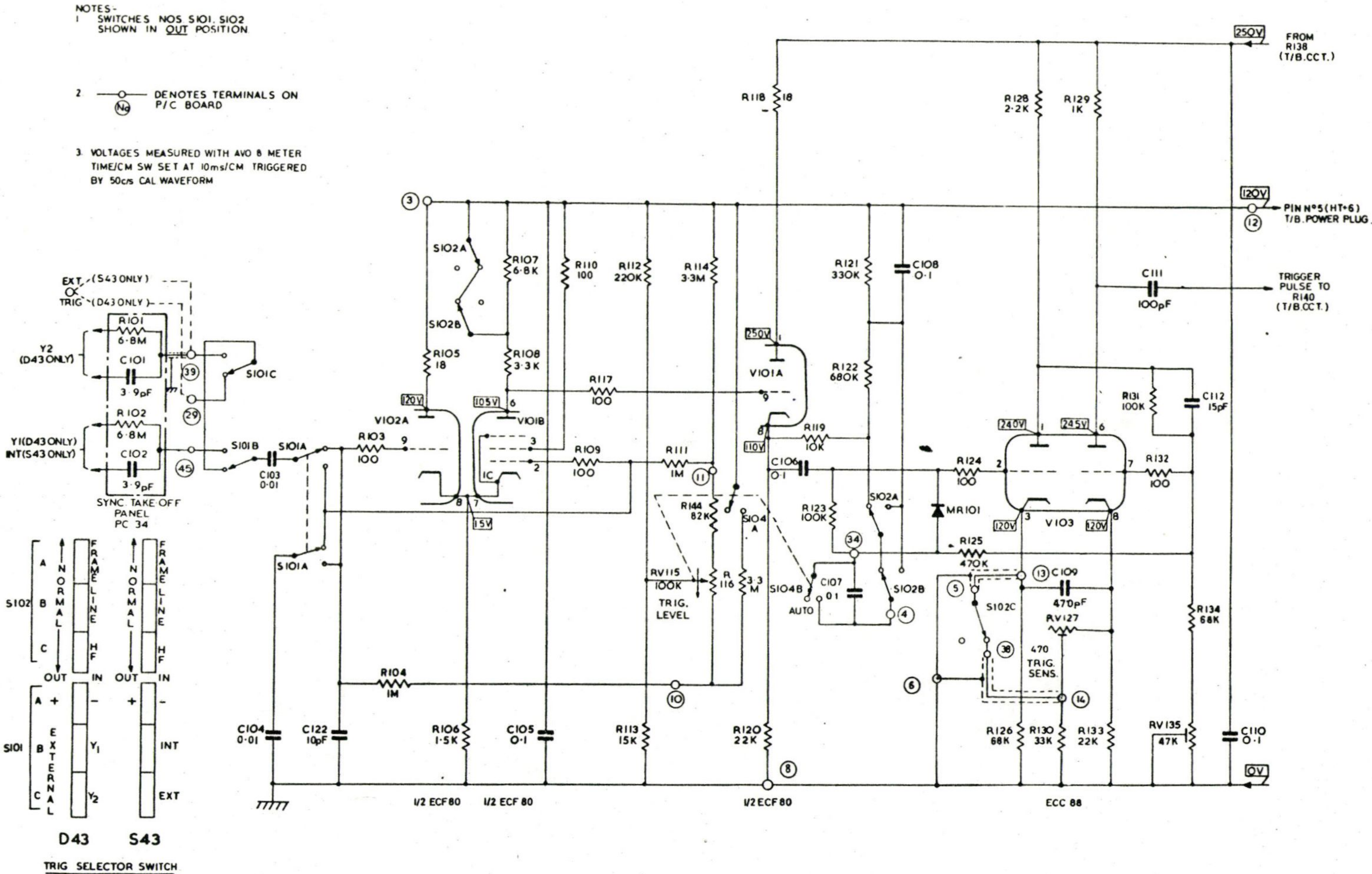
VIEWED AT BOTTOM. PLATE. 3.



VIEWED AT REAR. PLATE. 4.



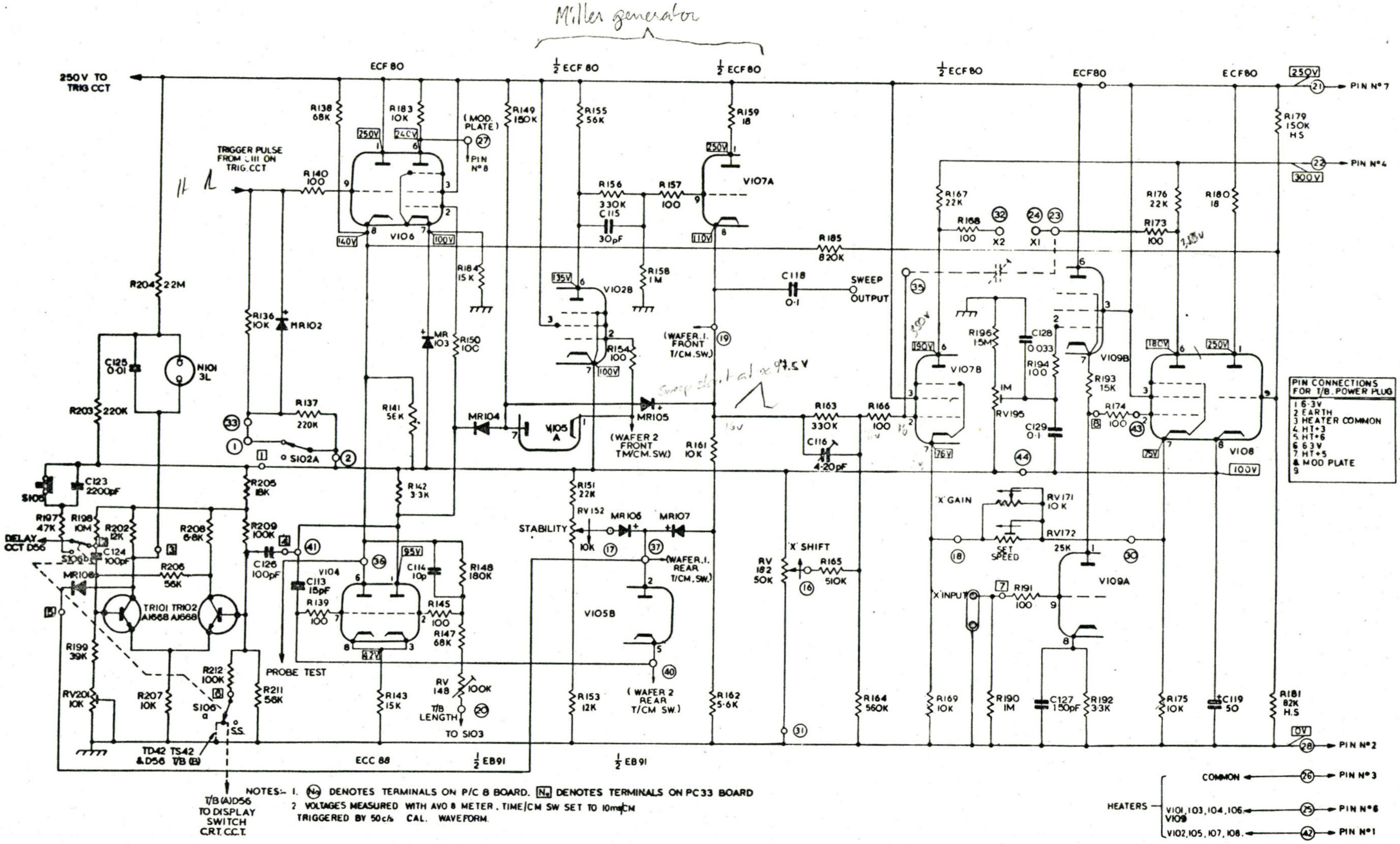
HORIZONTAL SYSTEM BLOCK DIAGRAM TYPE D56 FIG. I.



TRIGGER CIRCUIT

FIG. 2·1.

TYPE TS41, TD41, TS42 & TD42



NOTES:- 1. (Nº) DENOTES TERMINALS ON P/C 8 BOARD. [Nº] DENOTES TERMINALS ON PC33 BOARD

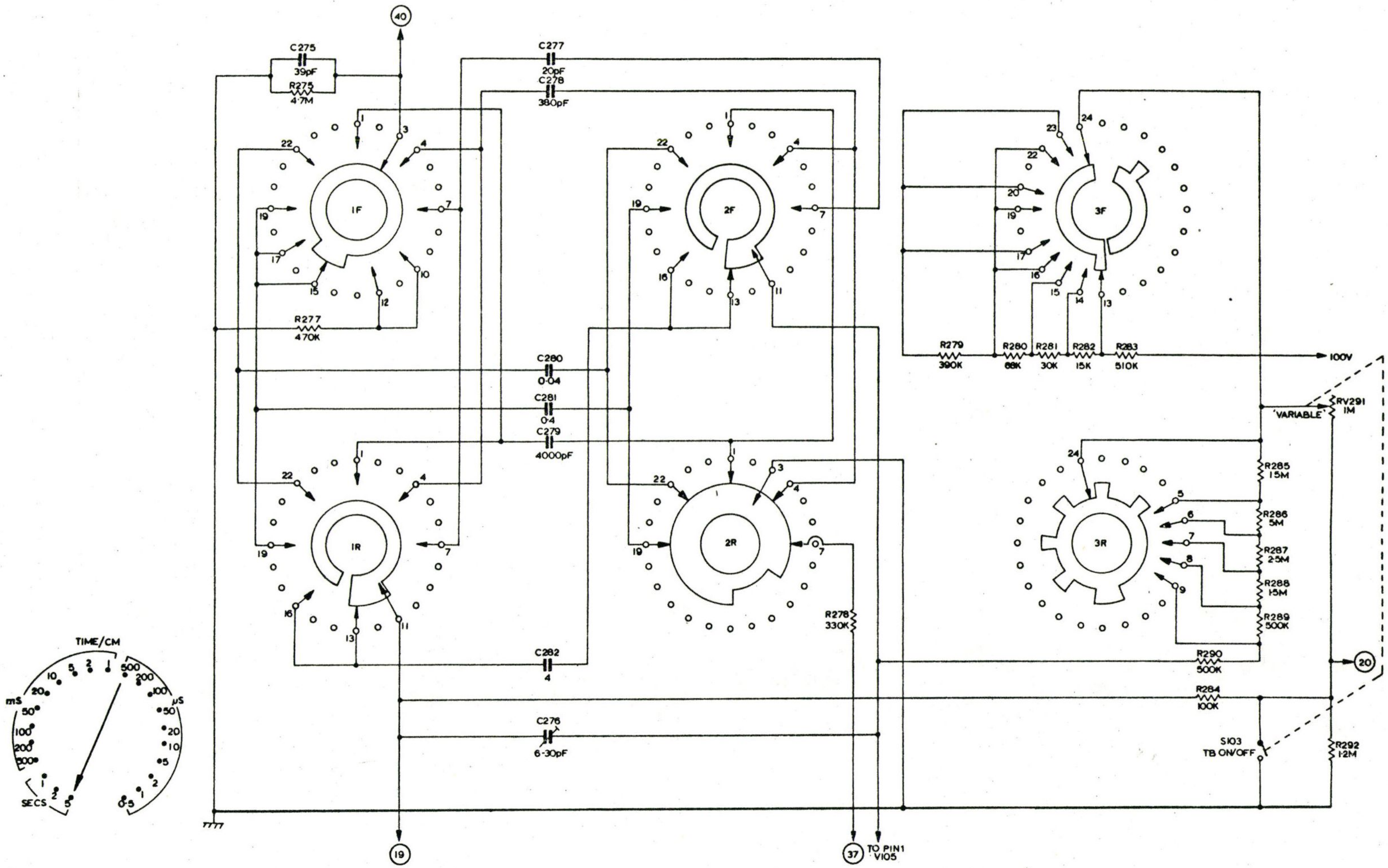
2. VOLTAGES MEASURED WITH AVO 8 METER. TIME/CM SW SET TO 10ms/CM TRIGGERED BY 50c/s CAL. WAVEFORM.

TIMEBASE & HORIZONTAL AMPLIFIER

TYPE TD42 & TS42

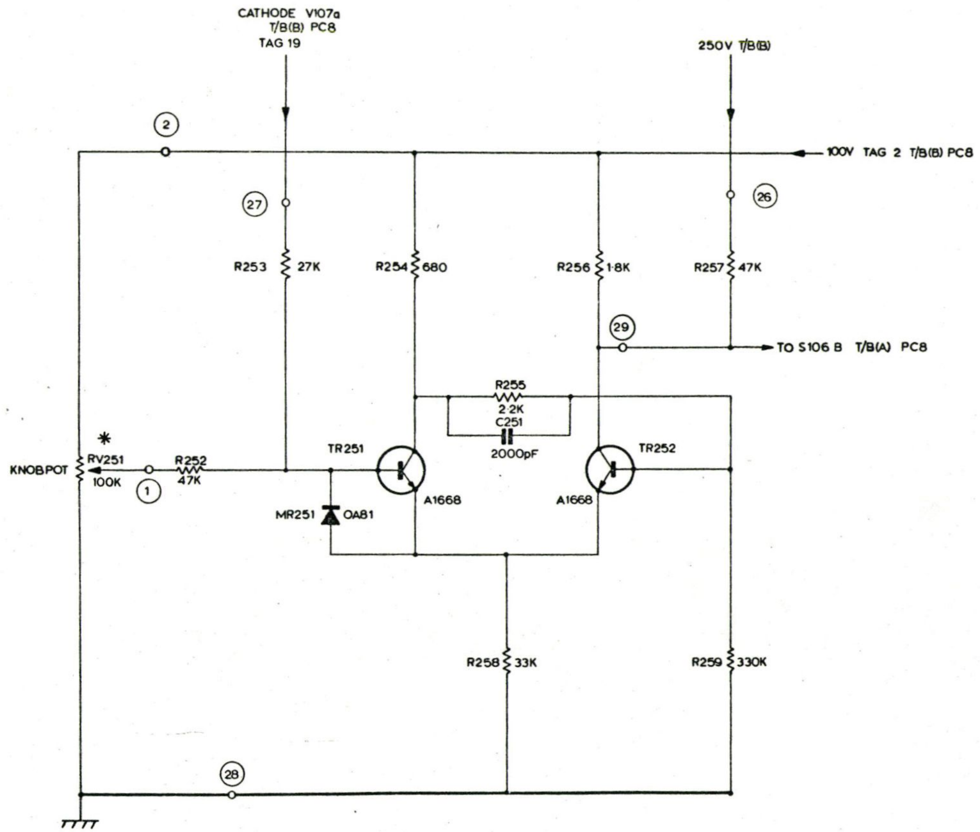
FIG. 2·4

TB (B) Pin 6 — 6.3 volt DC



NOTES
1 (Nº) DENOTES PRINTED CIRCUIT PCB TERMINAL NUMBERS
(see timebase and horizontal amp. cct.)

TIME/CM SWITCH FIG 2·5
TYPE TD42 & TS42

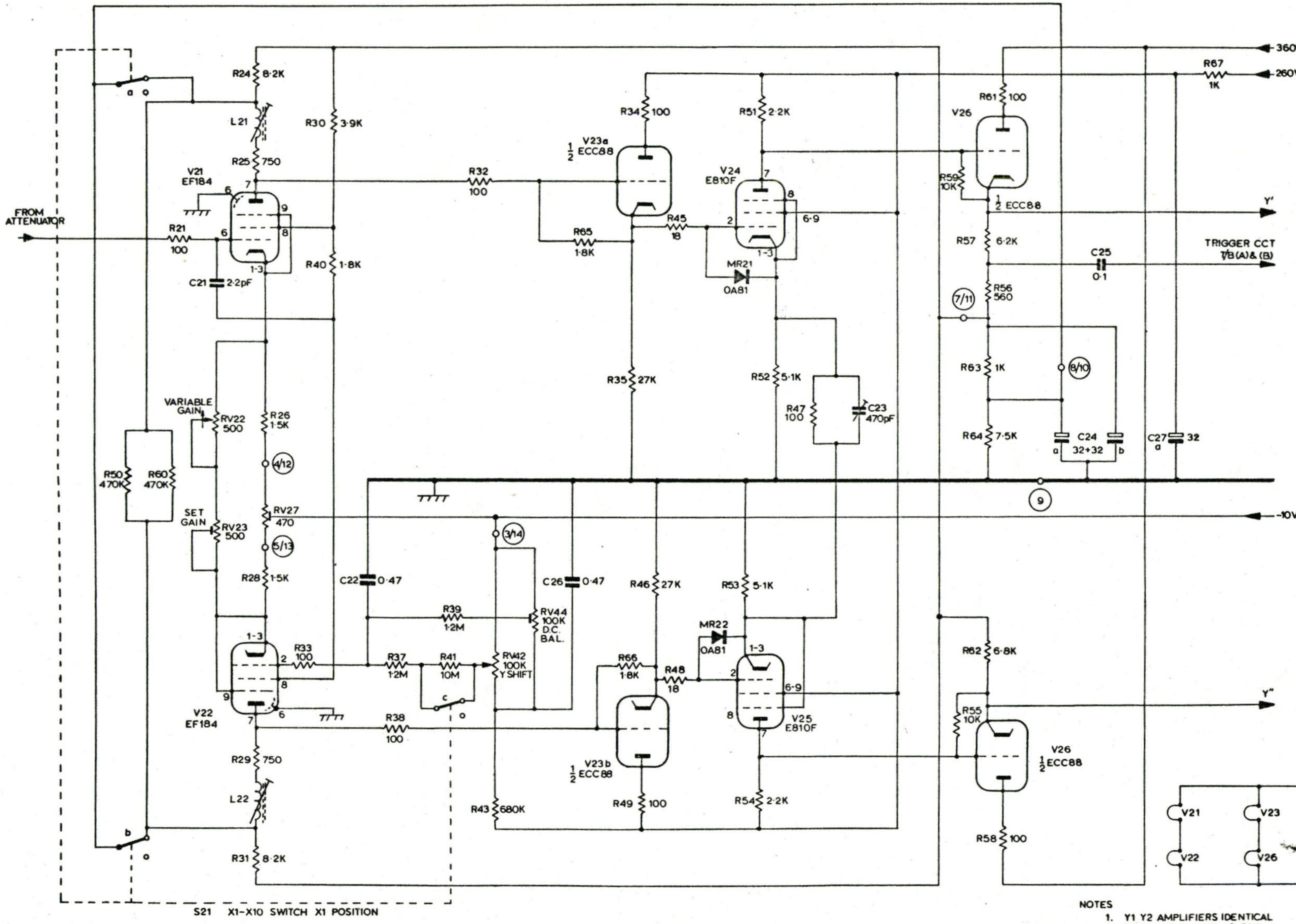


NOTES

1 * DENOTES COMPONENTS NOT MOUNTED ON PC26

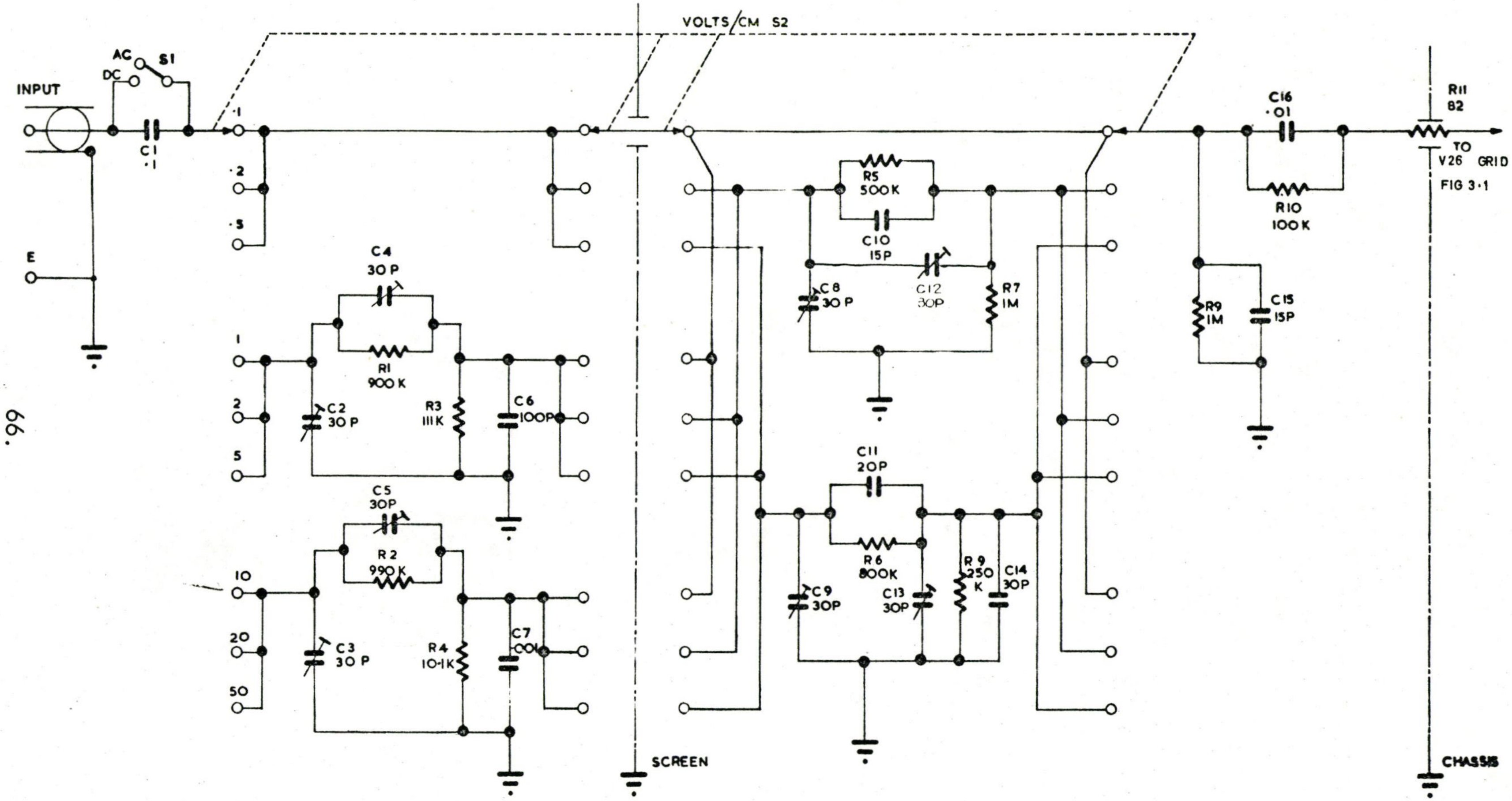
2 (No) DENOTES TERMINALS ON PC 26

DELAY CIRCUIT TYPE D56 FIG 2·6



NOTES
1. Y1 Y2 AMPLIFIERS IDENTICAL (C27a on Y1 amplifier & C27b on Y2 amplifier)
2. (No) DENOTES TAG Nos ON PC25

VERTICAL AMPLIFIERS TYPE D56 FIG 3·1



INPUT ATTENUATOR

TYPE. D 56 FIG. 3·2.

TELEQUIPEMENT D56 TD - BAS PC 8