SOLARTRON

Instruction Manual

for

Solarscope

Type CD523S.2

Interservice Reference No. CT386A

Joint Services Catalogue

No. 6625-99-943-7177

SOLARTRON LABORATORY INSTRUMENTS LTD.
Chessington, Surrey, England.

INSTRUCTION MANUAL

FOR

SOLARSCOPE MODEL C.D.523S.2

INTERSERVICE REFERENCE No. CT386A

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PREFACE

The CD.523S Solarscope is a high quality, general purpose oscilloscope with many industrial and laboratory applications. Typical examples include the measurement of rise time and overshoot; examination of pulses and high speed phenomena, transient recording; servo system analysis; and investigation of waveforms from D.C. to 10 Mc/s.

The Y amplifier has a maximum bandwidth at 3 db down from DC to 10 Mc/s with faithful pulse reproduction and a built-in AC pre-amplifier gives a maximum sensitivity of 1 mV/cm. Amplitude measurement to an accuracy of $\pm 10\%$ is provided by gain stabilising the amplifiers with degenerative feedback and calibrating the multiplier and sensitivity range controls directly in Volts/cm.

The wide range time base circuit has excellent synchronising and triggering properties over a range of sweep speeds from 10 cm/μsec to 1 cm/sec. The time base range and sweep speed controls are calibrated directly in time/cm providing time measurement to an accuracy of $\pm 10\%$.

The trace is displayed on a flat screen P.D.A. type cathode ray tube operating at a total accelerating potential of 4 kV to give a brilliant trace of high definition.

The power supplies incorporate hermetically-sealed C core transformers and chokes and high quality paper capacitors for the utmost reliability under all operating conditions. Additional features include a retractable stand for tilting the instrument, an illuminated graticule, a detachable viewing hood and fittings for attaching standard cameras.

This instrument has been designed to meet Ministry requirements. It has been built so that all components are readily accessible for servicing and provides a reliable instrument which is simple to operate.

Issue Five

Date July 1962

Mod. Ref. 523S.2/130

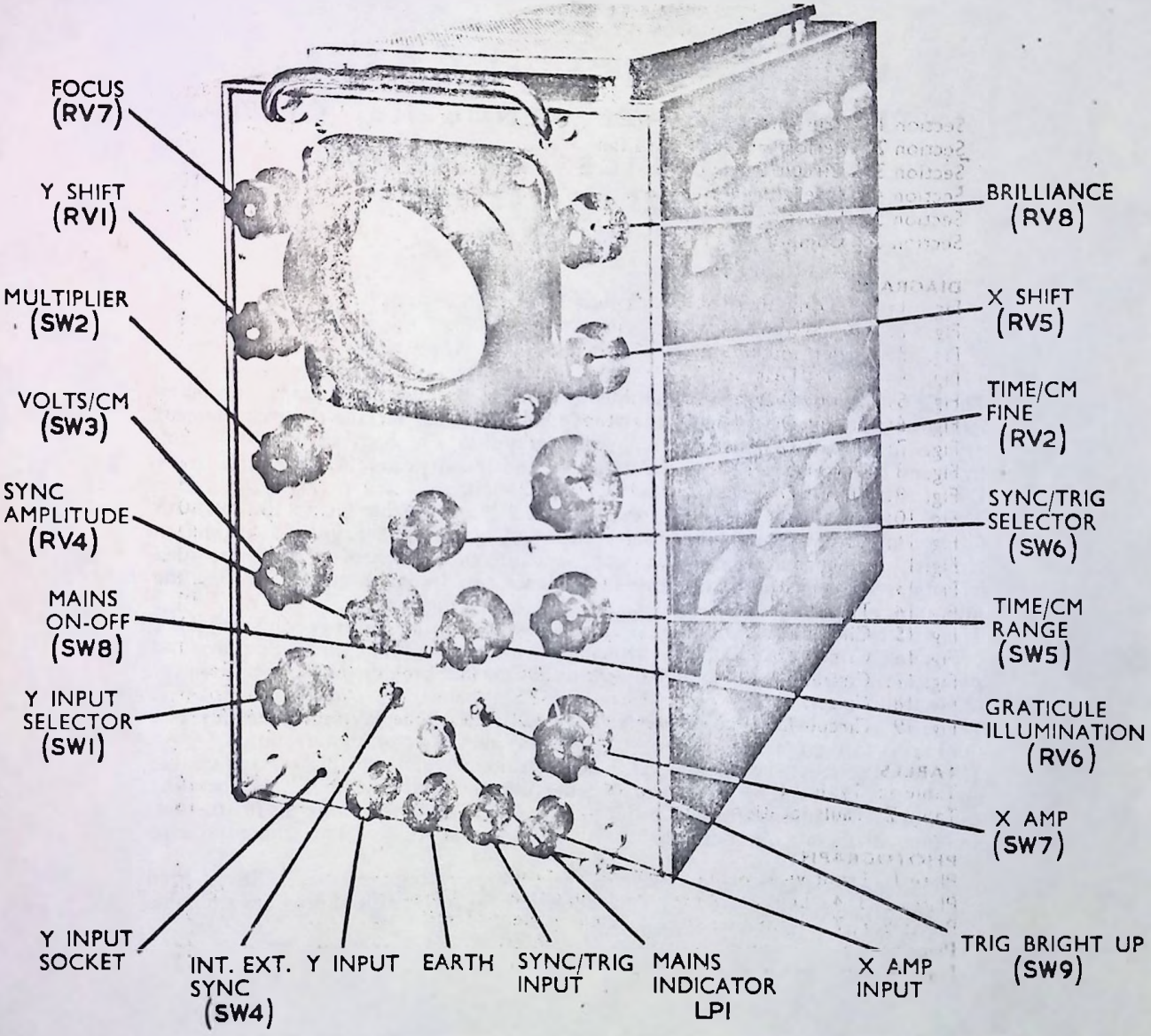

Plate 1: CD.523S with labelled controls

LIST OF CONTENTS

SECTION 1

PRINCIPLES OF OPERATION

The oscilloscope consists of three major sections which will be discussed separately:—

'Y' Amplifier
'X' System
Power Supplies

1.1. 'Y' Amplifier

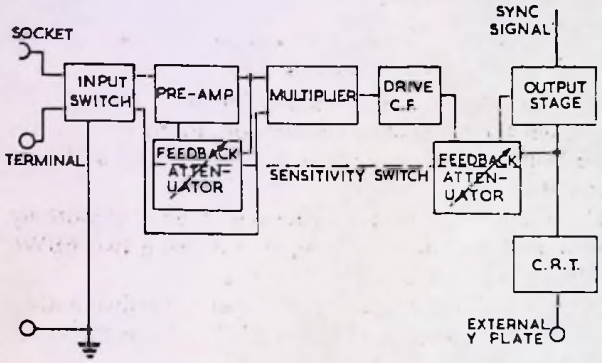

FIG.1 Y AMPLIFIER

The 'Y' Amplifier may be considered in five stages, the input switch, the preamplifier, the multiplier, the drive cathode follower and the output stage.

The input switch selects either socket or terminal input, either direct or through a 0·1 μFd blocking capacitor except on the three most sensitive ranges when the signal is always A.C. coupled into the pre-amplifier.

This consists of two amplifying stages followed by a cathode follower, overall negative feedback being taken from the cathode follower output to the cathode of the first valve. This amplifier has gains of 10, 100 and 1,000, corresponding to input sensitivities of 100, 10 and 1 mV cm.

The multiplier, which consists of a series of capacity-compensated, resistive attenuators, is fed with signal from either the pre-amplifier or the input switch. It reduces the input-sensitivity in steps of about 30%.

The output of the multiplier is directly coupled into a cathode follower which operates as an impedance transformer, driving the input capacity of the output stage feedback attenuator without loading the multiplier.

The output amplifier, which drives the 'Y' plates of the cathode-ray tube, consists of two pentodes connected as a self-balancing paraphase amplifier. The gain of this stage, which is directly coupled, is controlled by negative feedback between anode and grid.

Sync signals are taken from the drive cathode follower output.

Shift voltages are introduced into the negative feedback network, varying the bias on the output amplifier.

1.2. 'X' System

The 'X' system can be considered in five sections as follows:—

Sweep generator.
Sync. circuit.
Trigger circuit.
'X' amplifier.
Sync. amplifier.

The sawtooth sweep waveform is generated by the miller action of a pentode and double triode cathode follower. The waveform is coupled to a bi-stable circuit which operates at the extreme end of the sweep and the flyback. The rectangular output waveform from the bi-stable circuit is then used to 'gate' the miller integrator so completing a regenerative loop.

Synchronising signals are injected into the bi-stable circuit through a pentode valve, the screen of which is coupled to the sweep waveform. This arrangement prevents any synchronising signal being coupled into the bi-stable circuit until the sweep is at least two-thirds complete.

The circuit is triggered from a second bi-stable circuit. This applies a fixed potential to the grid of the Miller

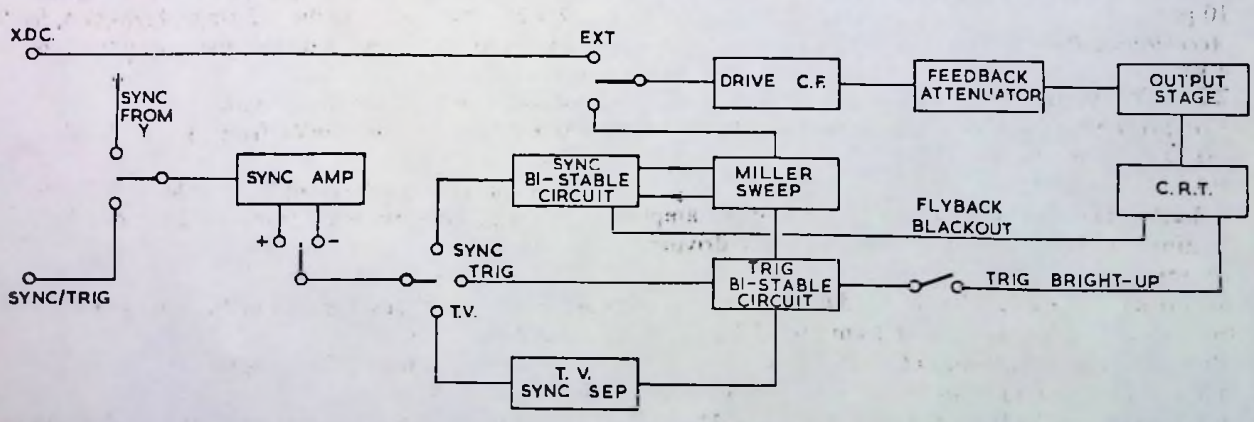

FIG. 2 X SYSTEM

valve which arrests the sweep waveform after it has commenced. The trigger signal reverses the state of the bi-stable circuit which removes the potential from the Miller and the sweep proceeds. At the end of the flyback the waveform from the 'free running' bi-stable circuit resets the trigger bi-stable circuit. During the sweep the trigger bi-stable circuit is not receptive to trigger waveforms.

The 'X' amplifier consists of a drive cathode follower, and an output amplifier. The drive cathode follower acts as an impedance transformer driving the input capacities of the output amplifier feedback network. The output amplifier consists of two pentodes connected as a self-balancing paraphase amplifier driving the 'X' plates of the cathode-ray tube.

The gain of this amplifier, which is directly coupled, is controlled by negative feedback connected between anode and grid.

Shift voltages are introduced into the negative feedback network altering the bias on the output stages.

The sync amplifier consists of a cathode follower, two stages of amplification, and a phase splitter. The sync/trigger control selects a +ve output from either +ve or −ve input.

1.3. Power Supplies

The H.T. supplies used in this unit are derived through two rectifier systems, one supplying the +ve voltages and the other the −ve. Capacitor input filtering is used in each case. +440V H.T. is taken from the power supply after one stage of smoothing

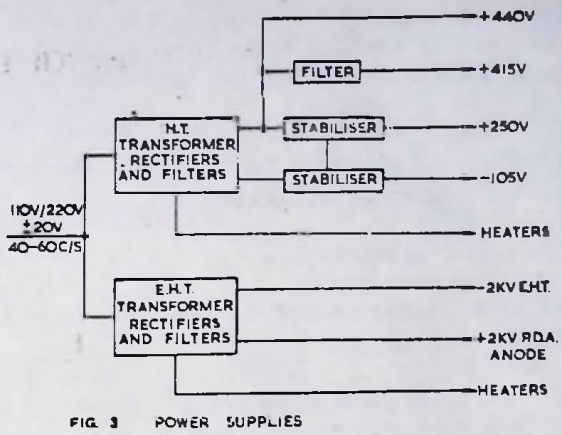

FIG. 3 POWER SUPPLIES

to supply the gating bi-stable circuit. +415V H.T. is taken after two stages of smoothing to be used on the Miller sweep generator, and on the 'X' and 'Y' amplifiers.

The +250V H.T. is taken after one stage of smoothing into an electronic stabilising circuit using two 6BW6 valves as series control valves.

The −105V line again uses electronic stabilising after one stage of smoothing. Two A2134's form the series control element.

The E.H.T. supply is derived from a separate transformer. Half-wave rectification using a vacuum diode supplies the bleeder chain at −2 kV. A P.D.A. potential of +2 kV is obtained from the same winding through a similar rectifier. R.C. smoothing is used in both cases.

SECTION 2

SPECIFICATION

2.1. Cathode-Ray Tube

Post-deflection-acceleration type 4EP7, manufactured by Electronic Tubes Ltd., with 10 cm. dia. screen and long persistence blue trace, suitable for photographs at time-base speeds up to ·5μS/cm.

'Y' Plate Sensitivity

0·4 mm/V (i.e. 25 V/cm.)

'Y' Plate Capacitance

10 pf.

Accelerating Potential

4 kV.

2.2. 'Y' Amplifier

Comprising:

(a) D.C. main amplifier.

(b) A.C. pre-amplifier.

2.2.1. D.C. amplifier has a single-stage of amplification and consists of a cathode follower driving a paraphase feedback output stage.

Sensitivity and Bandwidth for (−3db)

(measured with picture size of 1 cm., see 5.2.2.)

10 V/cm. (1 mm/V) from D.C.—10 Mc/s.

3 V/cm. (3·3 mm/V) from D.C.—7·5 Mc/s ± 1 Mc/s.

1 V/cm (10 mm/V) from D.C.—5 Mc/s ± 1 Mc/s.

'Y' Shift: 3 diams.

Picture Size

1 cm. maximum at 10 Mc/s.

Input Impedance

1 megohm shunted by approx. 60 pf.

Input Connections

Terminals or B.N.C. coaxial socket with provision for switching in 500 V blocking capacitor of 0·1 μFd.

2.2.2. A.C. pre-amplifier. 2-stage, high-gain, feedback amplifier, designed to give optimum pulse response.

Sensitivity and Bandwidth (−3db)

100 mV/cm. (0·1 mm/mV) from 3 c/s—5 Mc/s ± 1 Mc/s.

10 mV/cm. (1 mm/mV) from 3 c/s—2 Mc/s ± 0·5 Mc/s.

1 mV/cm. (10 mm/mV) from 10 c/s—100 kc/s ± 25 kc/s.

Voltage Measurement

Accuracy ± 10% excluding 1 mV/cm. range (± 20%).

Input Impedance

1 megohm shunted by 40 pf. approx.

Input Connections

Terminals or coaxial socket, with 0·1 μFd. blocking capacitor always in circuit on these ranges.

2.3. Time Base

Consists of a modified Miller circuit gated by high-speed bi-stable circuits and uses hard valves throughout.

Time Scales

0·1 μS/cm.—1 sec/cm. in 7 decades. A calibrated fine control operates on each decade.

Sweep Speeds

10 cm/μsec—1 cm/sec.

Time Measurement

Accuracy ± 10% except 0·1 μsec/cm.—1 μsec/cm. range (± 15%).

Synchronisation

Positive or negative going internal or external continuous waves.

Internal: Minimum picture size 1cm.

External: 1V p-p.

Trigger

Positive or negative going internal or external pulses or television frame signals.

Internal: Minimum picture size 1cm.

External: 1 volts p-p.

Optional bright up on triggered operation.

Trigger/Synchronisation Amplifier

Input impedance 1 MΩ shunted by 30 pf.

Synchronisation range 2 c/s—10 Mc/s.

2.4. 'X' Amplifier

Single-stage D.C. feedback amplifier similar to 'Y' amplifier, designed for pulse signals with no overshoot.

Sensitivity and Bandwidth (−3*db*)

10 V/cm. (1 mm/V) from D.C.—5·5 Mc/s ± 1 Mc/s.

5 V/cm. (2 mm/V) from D.C.—4·5 Mc/s ± 0·75 Mc/s.

2·5 V/cm. (4 mm²/V) from D.C.—3 Mc/s ± 0·5 Mc/s.

1 V/cm. (10 mm/V) from D.C.—2 Mc/s ± 0·5 Mc/s.

Expansion Control

In 4 steps x0·5, x1, x2 and x5.

Voltage Measurement

Accuracy ± 10%.

Input Impedance

1 megohm shunted by 30 pf (approx.).

2.5. A.C. Supply

110 V 220 V ± 20 V, 40-60 c.p.s., 230 vA.

2.6. Dimensions

16¾ in. high × 10 in. × 23 in. long, less viewing hood (42 × 26 × 59 cm.).

Weight

70 lb. (33 kg.) approx.

2.7. Additional Facilities

(a) Illuminated graticule—variable intensity—amber.

(b) Power socket for probe, supplying 6·3 V, 0·6 amp. A.C.: 250 V 10 ma. D.C.

(c) Fittings for camera attachments:—
Cossor Model 1428.
J. L. Thomson, Series 100.

(d) Direct access to the cathode of the cathode ray tube is provided, permitting brilliance modulation of the trace.
Input Impedance: Approx. 0·5 MΩ.
Sensitivity: White to Black—approx. 10 V peak.

SECTION 3

CIRCUIT DESCRIPTION

The circuit will be described under three main headings:—

'Y' Amplifier (*See drawing DC 523S, Sheet 1*)
'X' System (*See drawing DC 523S, Sheet 2*)
Power Supplies (*See drawing DC 523S, Sheet 3*)

3.1. The 'Y' Amplifier

To simplify description, the 'Y' amplifier will be described in sections as follows:—

1. *Y Input switch.*
2. *Volts/cm. switch.*
3. *Multiplier switch.*
4. *Pre-amplifier.*
5. *Drive cathode follower.*
6. *Output amplifier.*

3.1.1. The signal to be examined may be connected to the Solarscope either through the terminal TL1 or the coaxial socket SK1. The input switch SW1 selects either the socket or the terminal and shorts the connector not in use to earth. It also connects C28 in series with the signal to the output amplifier when A.C. coupling is selected.

3.1.2. The Volts/cm. switch SW3 has six positions and several functions. It is best considered wafer by wafer and range by range. The first wafer SW3/1R connects the input signal to the pre-amplifier through C29 on the most sensitive ranges and to the multiplier through SW1/1R and SW3/2R on the other ranges.

SW3/2R connects the output of the pre-amplifier or the input signal directly to the multiplier. SW3/3R is an earthing wafer which, on the two most sensitive ranges, earths the link from SW3/1R to SW3/2R.

SW3/4R and SW3/5F combine to control the gain of the pre-amplifier to X1000 on the 1 mV/cm. range, X100 on the 10 mV/cm. range and X10 on all other ranges. This is done by selecting one of three feedback attenuators composed of R15 with R46, R47 on the X10 range. R45 on the X100 range. There is no feedback on the X1000 range. R43 and R44 give correct bias for V1.

SW3/6R, SW3/7F combine to control the gain of the output amplifier to give input sensitivities of 10 V/cm., 3 V/cm. and 1 V/cm. by selecting R46, C32; R49, C34; or R50, C31, C35; in conjunction with R3, C22 a.. the feedback attenuator.

SW3/8R and SW3/8F connect the feedback components not in use to earth through C36.

3.1.3. The purpose of the multiplier is to reduce the size of the picture in steps of about 30%. It consists of resistors R16–R25, an attenuator with a nominal impedance of 1 megohm. The switch positions are marked 1, 1·5, 2·5, 4 and 6, corresponding to transmission factors of 1, 2/3, 2/5, 1/4 and 1/6 respec-

tively. Frequency compensation is provided (capacitors C11–C19) to prevent loss of bandwidth on any of the six ranges. The required transmission is selected by the multiplier switch SW2.

3.1.4. The pre-amplifier is a feedback amplifier with three forward gain conditions, i.e., X10, X100, X1000, corresponding to sensitivities of 100 mV/cm., 10 mV/cm. and 1 mV/cm.

It consists of two amplifier stages V1 (6BS7) and V2 (CV4014) in cascade, followed by a cathode follower V3 (CV4042). In the high gain condition, V1, a 6BS7 low-noise pentode, has R43 in the cathode to give some degeneration. No overall feedback is applied, but D.C. feedback is closed around V2 and V3 by R11 and R7 to set the cathode potential of V3.

In the medium gain condition, overall feedback is applied to the cathode of V1 through R15 and R45. R44 sets the bias of V1. C10 and C30 provide frequency compensation.

In the low gain condition, feedback is through R15 and R46 with R47 to correct the bias. The H.F. feedback is closed by C7 which eliminates the time delay into the cathode follower and improves the square-wave response.

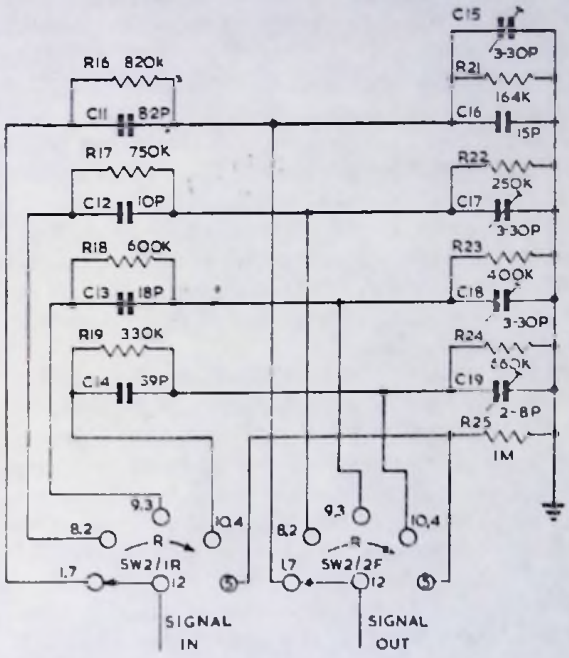

FIG. 4

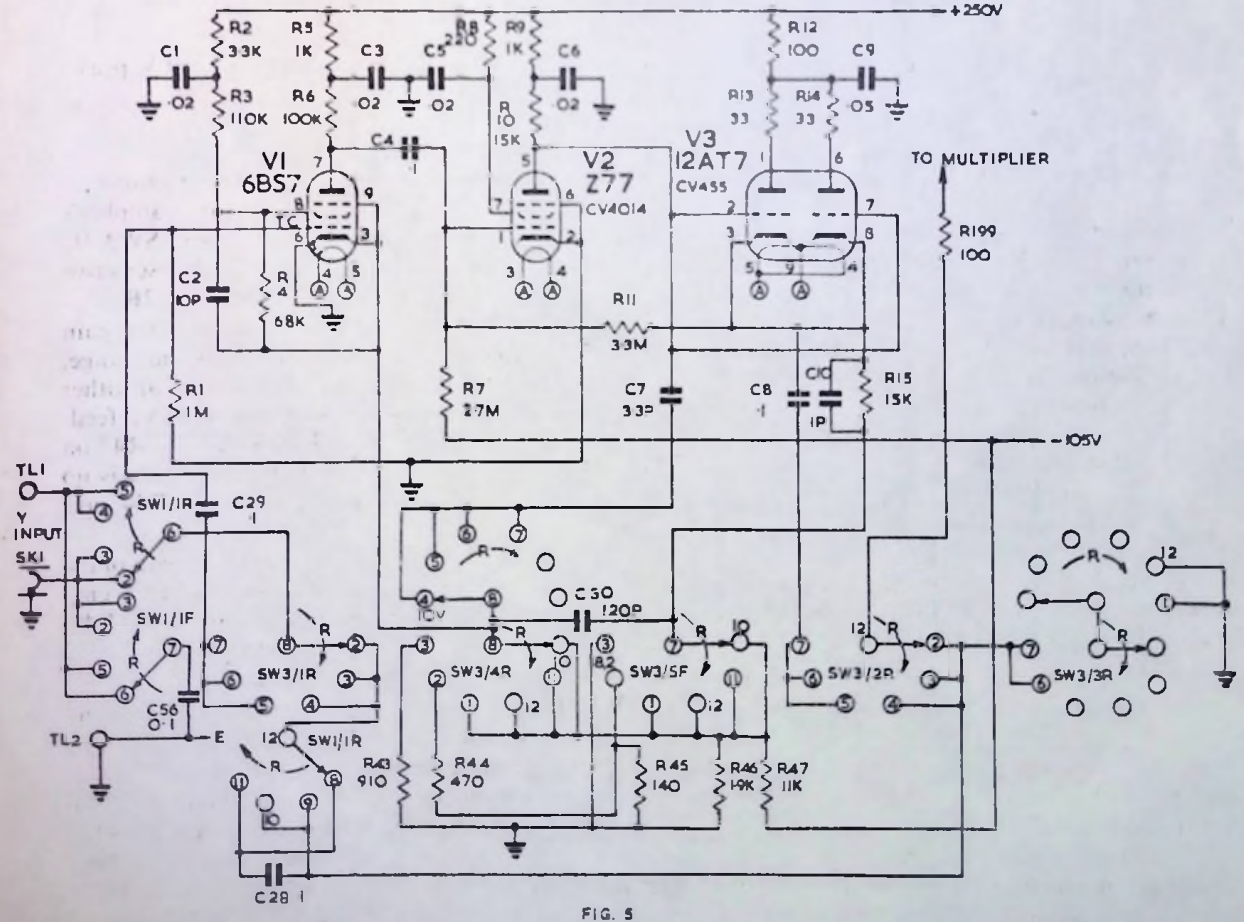

FIG. 5

In view of the low signal levels, adequate decoupling from both rails is provided. When using the pre-amplifier, the D.C. voltage at the output cathode is blocked by C8.

3.1.5. The drive cathode follower employs a Z759 pentode connected as a cathode follower with R20, R26 and R29 as stoppers in grid, screen and anode circuits to prevent parasitic oscillation. This stage acts as a wide band impedance transformer driving the input capacities of the output amplifier feedback attenuator at low impedance while not appreciably loading the multiplier. R27 is the cathode load and R28, C21 and R30, C20 provide H.F. decoupling of the H.T. supply lines.

Internal sync. signals are taken from V4 cathode.

3.1.6. The output amplifier consists of V5 and V6, two Z759's, in a self-balancing paraphase circuit. Each valve has an open gain of 150 approximately, which is reduced by negative feedback. V6 operates at unity gain and V5 has a gain determined by the frequency compensated feedback attenuator consisting of R31 and switched resistors R48, R49, R50. These resistors are adjusted to give sensitivities of 10 V/cm., 3 V/cm. and 1 V/cm. at the input terminal. R51–55

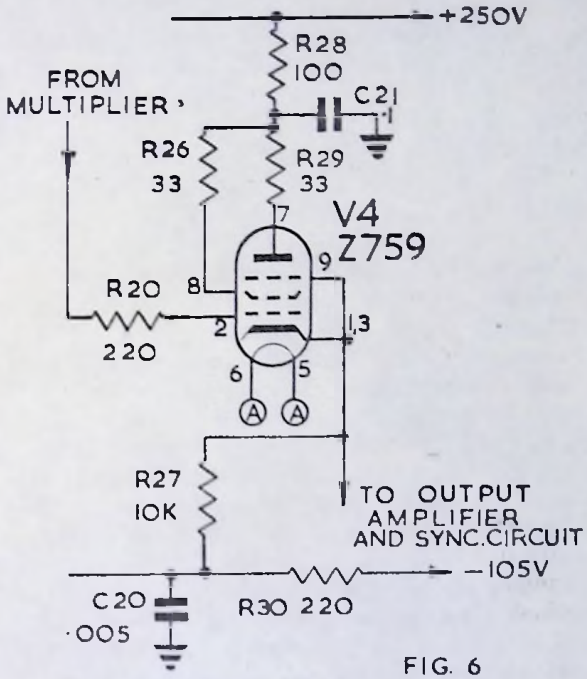

FIG. 6

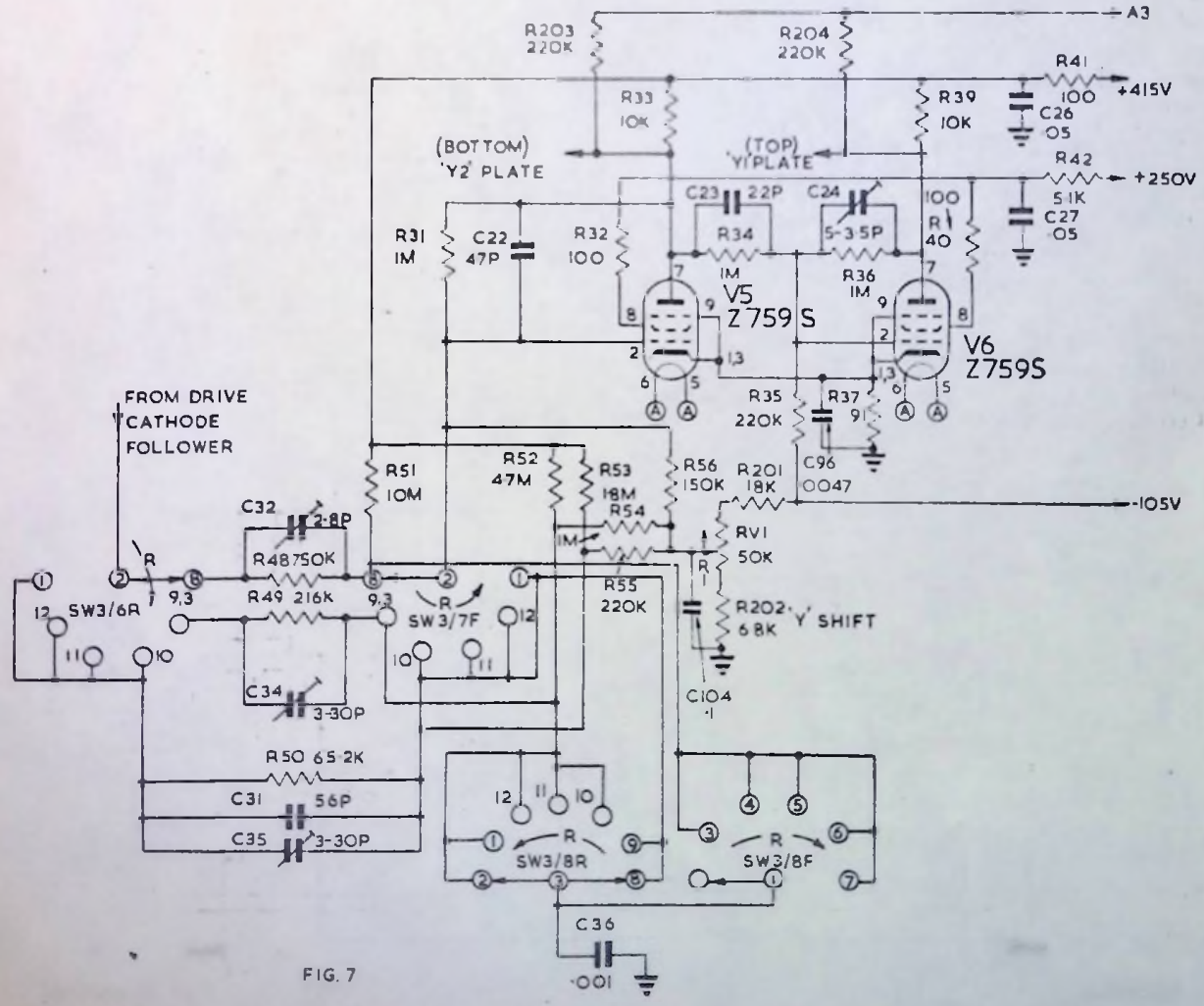

FIG. 7

inject hum from the H.T. line to V5 and V6 grids, to cancel hum fed to the plates through the anode loads R33 and R39. 'Y' shift voltages are fed from RV1 through R56 to the grid of V5.

Provision for external connection to the 'Y' plates is restricted to Y1 to prevent loss of bandwidth

3.2. The 'X' System

The 'X' system will be discussed in the following sections:—

1. *The sweep generator.*
2. *The gating circuit.*
3. *The synchronising system.*
4. *The trigger system.*
5. *The sync trigger amplifier.*
6. *The 'X' amplifier.*

3.2.1. The sweep waveform is initiated by applying a negative step function to the grid V7A cutting it off. AsV9a anode is negative with respect to its cathode and V9b cathode is earthed,both these valves look like open circuits. The grid of V10 is therefore returned to a negative potential determined by R58, R59, R57, RV2 and RV3.

The grid of V10 commences to move negative as one of the timing capacitors, selected by SW5, is charged through R58 and the corresponding rise in the anode potential of V10 is coupled back through V11 on to the timing capacitor giving rise to the familiar Miller action.

At the end of the sweep a positive step function is applied to the grid of V7A, which raises the grid of V10 to earth potential where it is clamped by the diode V9B. The anode potential of V10 now falls rapidly as the timing capacitor is discharged through V7A giving a fast flyback.

SW5 is the time base range switch selecting timing capacitors to give 10: 1 steps of sweep speed. RV2 is the calibrated time scale control which gives a smooth 10: 1 coverage between steps on the range control.

When first switching on, it is possible for V17A grid to settle at its upper voltage limit, when the scan has not taken place. This is an abnormal condition, normal conditions can be restored by rotating the time base switch to the 'PRIME' position. This position shorts V17A grid to ground via R112, and switches over the bi-stable circuit. When an external time base is used, the time base switch selects R72 in place of a capacitor, and the circuit becomes quiescent.

The negative pulse occurring at V17B cathode is fed to the C.R. tube grid to black-out the flyback trace.

3.2.2. V17 and V18 form a bi-stable circuit. In the interests of high-speed operation, one half of each valve is used as a cathode follower buffering the strays of the divide down circuit from the anode of the amplifier.

The sweep waveform is coupled into the grid of V17A through R118 and when it reaches its highest potential it causes the bi-stable circuit to change state. This produces a positive step function at the cathode of V18B which is coupled to the grid of V7A through C65 and initiates the flyback.

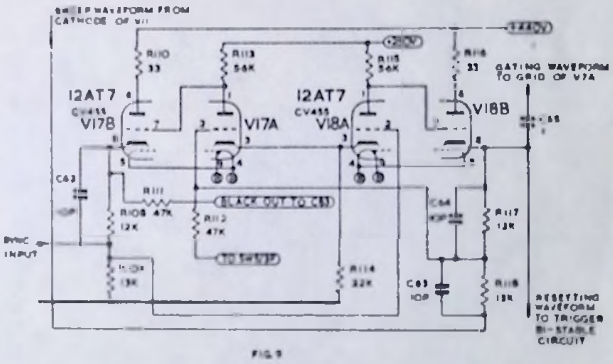

FIG. 9

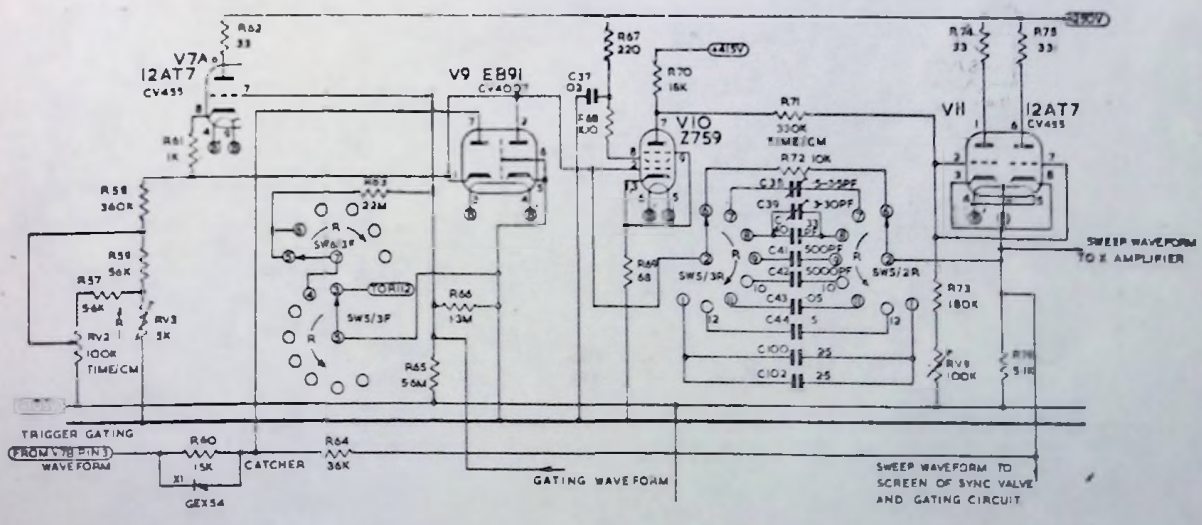

FIG. 8

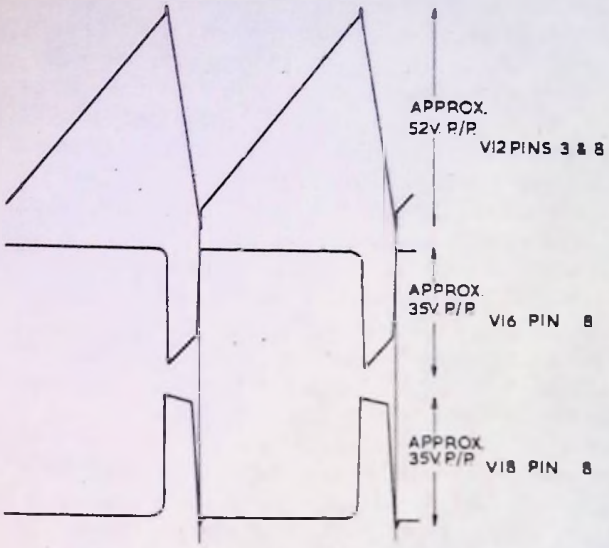

FIG. 10

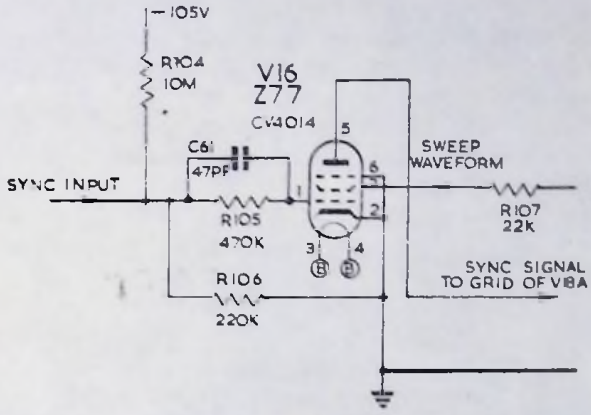

FIG. 11

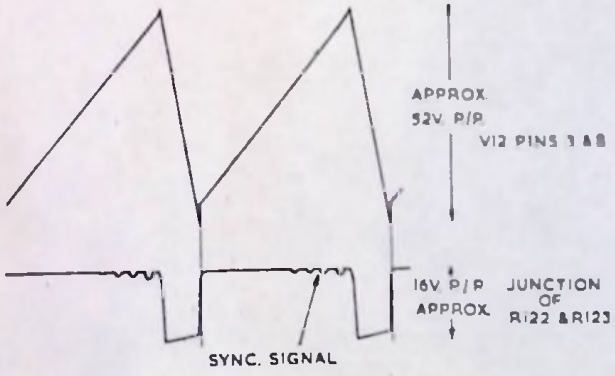

FIG. 12

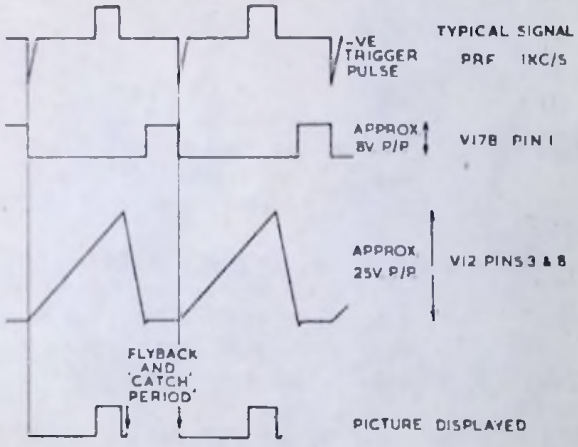

FIG. 14

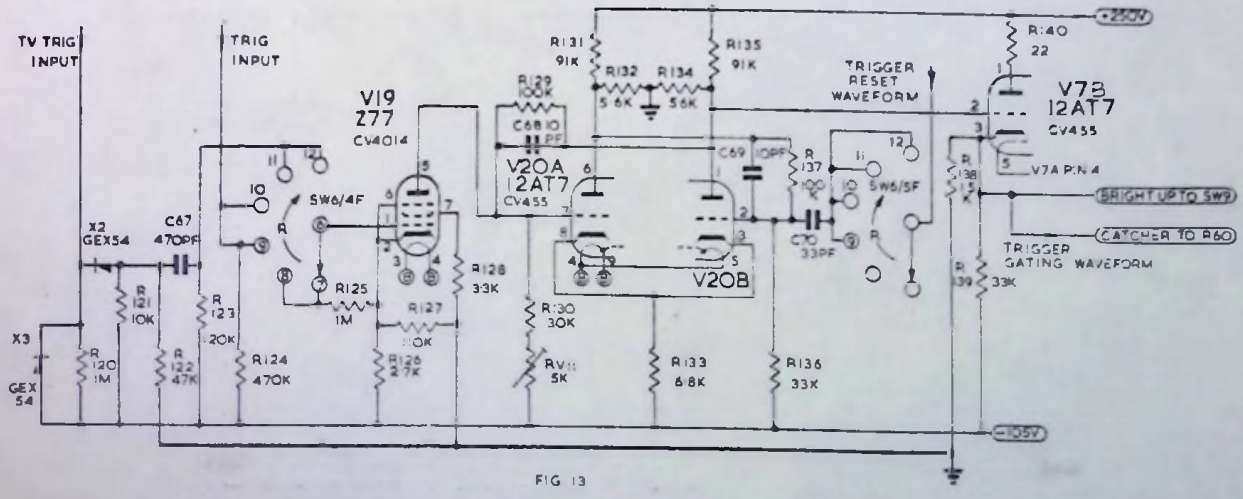

FIG 13

At the end of the flyback, the bi-stable circuit again changes state producing a negative step function at the cathode of V18B which initiates the sweep.

3.2.3. V16 is a pentode which injects sync signals into the gating circuit. It operates with its grid just cut off at a potential determined by the resistors R106, R104, and its screen coupled to the sweep waveform and therefore negative w.r.t. cathode for at least half the sweep. Thus, synchronising signals do not pass through this valve until it comes to 'life' when the screen comes positive, towards the end of the sweep. Then a positive signal of suitable amplitude will cause a negative signal to appear at the grid of V18A, the bi-stable will change state, and flyback will commence.

3.2.4. When the unit is switched to triggered operation, the negative step function which commences the sweep will also change the state of the bi-stable circuit formed by the two halves of V20. This applies a positive step function to the grid of the cathode follower V7B and hence to the anode of V9A through R60 and X1. This causes the diode V9A to conduct carrying the charging current and arresting the sweep just after it has commenced.

A positive trigger pulse applied to the control grid of V19, which is normally cut off, drives the grid of V20B negative and the bi-stable circuit changes state. This cuts off the diode V9A and the sweep continues in the normal way.

The trigger bi-stable circuit is reset by the negative step function at the end of the flyback.

After the initiation of the triggered sweep, further trigger pulses can have no effect until the trigger bi-stable circuit is reset, as V19 will not accept negative pulses, being cut off, and the state of the bi-stable circuit cannot be altered by a positive pulse.

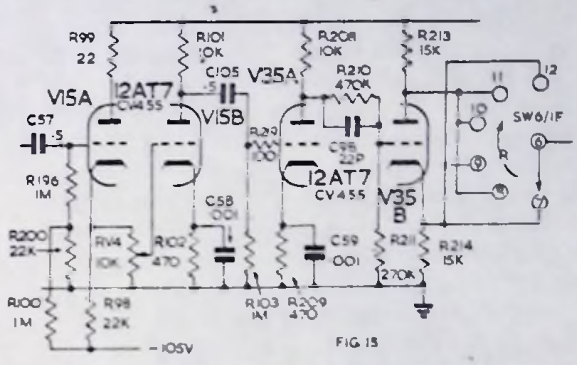

FIG 15

For the study of TV Frame sync. waveforms, a sync. separator is included. The live TV voltage waveform passes through the sync. amplifier and arrives at the junction of X2 and X3 with the picture content positive going. X3 clamps the negative edge of the signal to the −105 rail and X2, whose anode is at a level of approximately −90 V, clips the picture content. The resultant pulse train is fed through a differentiating network C67, R123, which has little effect on line pulses. Frame pulses are, however, differentiated and the inversion pulses appear as positive going pulses. These positive pulses are inverted in V19, and an early one of them triggers the bi-stable circuit on V20A grid, thus triggering the time base.

3.2.5. The sync./trig. amplifier consists of V15 and V35, two double triodes. V15A is the input cathode

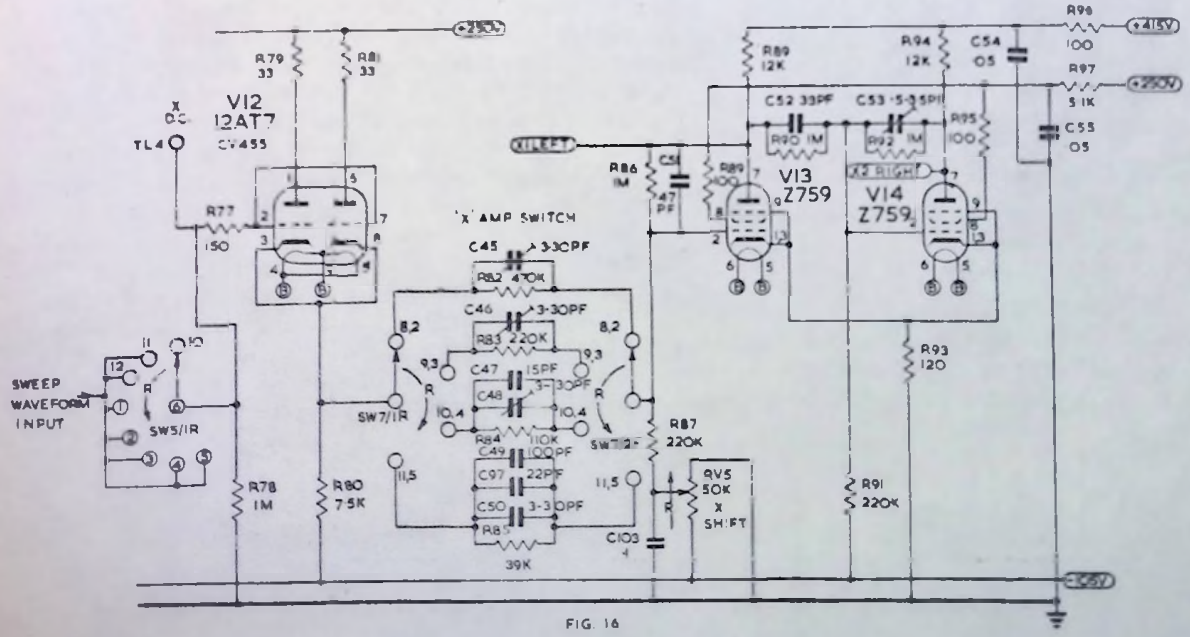

FIG. 16

follower which receives signals from either the EXT SYNC/TRIG terminal or from the 'Y' amplifier drive cathode follower. The quiescent cathode potential is held at earth by the bias resistors R100 and R200. The output is directly coupled to the grid of V15B through RV4 the sync. amplitude control. V15B and V35A form two stages of gain in cascade, coupled by C105. The output from V35A is directly coupled into V35B, a phase-splitting stage. There will always be a positive sync. signal at the anode or the cathode of V35B, according to whether the input is +ve or −ve, and the correct polarity for the sync. and trigger circuits is selected by SW6 which also directs the signal to either the sync. or trigger system.

3.2.6. V12, a CV4024, wired as a cathode follower, acts as an impedance transformer buffering the input capacitance of the feedback attenuator from the sweep generator and the external time base terminal.

The output amplifier consists of V13 and V14, two Z759's connected as a self-balancing paraphase amplifier. Each valve has an open gain of 180 which is reduced by negative feedback. V14 operates at Unity gain determined by R90, R92; and V13 has a gain determined by the frequency compensated attenuator consisting of R86 and the switched resistors R82, R83, R84 and R85. These resistors are adjusted to give sensitivities of X0·5=10 V/cm.; X1=5 V/cm.; X2=2·5 V/cm. and X5=1 V/cm.

The X1 range is the range on which the time base is calibrated, and the expansions are, in the interests of time measurement, based on this range. On the X5 range, the forward gain taken from the loop is of the order of 20. Direct access to the 'X' plates is not provided. When supplying the time base from an external source, the T.B. range switch must be set at the 'EXT & T.B. PRIME' position. The internal time base is then inoperative and the buffer stage is connected to the 'X' D.C. terminal. No blocking capacitor is provided.

3.3. Power Supplies

The supplies can be divided into two sections:—

1. *H.T. supplies.*
2. *E.H.T. supplies.*

3.3.1. H.T. Supplies

The mains supply to the instrument feeds, via switch and fuse, two separate C-core transformers, using a mains adjustment link. The larger transformer supplies the majority of the H.T. and heater current in the instrument. A secondary on this transformer feeds V21, which produces after filtering a supply of 200mA at a nominal 440 V. At this voltage, the 'X' sync. bi-stable circuit draws approximately 20 mA and, after further filtering, approximately 60 mA is consumed by the 'X' and 'Y' output amplifiers. The remainder of the current passes through a stabilising system which produces a 250 V rail. Stabilisation is achieved with a series type stabiliser using a bleed resistor R142. There are two stages of gain within the loop; the first is a pentode whose cathode is held at the reference voltage of V28. The output of the pentode is directly coupled to a cathode follower, which injects signal into the cathode of a triode amplifier controlling the series valves. The ripple on this rail is of the order of 10 mV and its frequency is a function of the time base repetition rate.

A second centre tapped secondary, followed by conventional full wave rectification and filtering, supplies the power for a negative stabilised rail. Again, a series stabiliser with bleed resistor is used with two gain stages in the loop. The reference level is taken from the 250 V reference source via R190.

There are three main heater windings on the H.T. transformers:—

1. Winding AA—Supplies 'Y' Amplifier, Panel Light, Probe Heaters and Illuminated Graticule.
2. Winding BB—Supplies 'X' System.
3. Winding CC—Supplies Power Supply Valves.

3.3.2. E.H.T. Supplies

The E.H.T. is derived from a second transformer which feeds a half-wave valve rectifier with an R.C. filter circuit. This supplies approximately 1·2 mA at −2 kV to the tube bleeder chain. Both the black-out and bright-up pulses, which are R.C. coupled to the grid and cathode of the tube respectively, are D.C. restored by the double Diode V32.

A positive voltage of approximately 2 kV for the P.D.A. anode is obtained from the same transformer winding via a resistance dropper chain and a half-wave valve rectifier. Filtering is by the reservoir capacitor only, and THERE IS NO BLEEDER CHAIN.

The E.H.T. transformer supplies heater current for its own rectifiers, the C.R.T. and the double diode. The oscilloscope frame or ground is connected to mains earth via a 47Ω resistor. This resistor prevents earth loop currents when using the high sensitivity.

SECTION 4

OPERATING INSTRUCTIONS

4.1. Before connecting the instrument to the supply, adjust the mains voltage selector at the rear of the instrument to the setting nearest to the supply voltage.

4.2. Set the controls of the instrument in the following positions:—

MAINS	OFF
TRIG. BRIGHT-UP	EXT. Z. MOD.
INT./EXT. Sync.	INT.
SYNC. amplitude	Maximum anti-clockwise
SYNC./TRIG. selector	SYNC.+
'Y' INPUT selector	TERM D.C.
VOLTS/CM.	10 V
MULTIPLIER	X1
BRILLIANCE	Maximum anti-clockwise
FOCUS	Mid-traverse
'X' SHIFT	Mid-traverse
'Y' SHIFT	Mid-traverse
GRATICULE	Mid-traverse
'X' AMP.	X1
TIME/CM. range	·1—1 millisec
TIME/CM. fine	3

4.3. Connect the instrument to the mains supply and switch on, both pilot lamp and graticule should be illuminated. Increase BRILLIANCE, adjust FOCUS, 'X' SHIFT and 'Y' SHIFT and examine the trace.

If the time base does not start, rotate the TIME/CM. switch to the PRIME position and back to 0·1 to 1 millisec. The trace should be a clearly defined horizontal straight line.

4.4. The Solarscope is now ready for use and further adjustment depends on the waveform to be examined.

4.5. Use of input terminal or socket:

The input terminal provides a simple method of connection to the unit, but where input levels are low and continuous screening is required the coaxial socket should be used. A.C. coupling is suitable for most requirements, especially when small A.C. signals are superimposed on large quiescent potentials, but D.C. coupling must be used when examining very low frequency phenomena or balancing D.C. bridges.

4.6. Measurement of signal amplitude:

This is achieved by measuring the vertical picture size on the cathode-ray tube and multiplying this by the multiplier and Volts/cm. control readings.

4.7. To obtain a steady picture:

4.7.1. If the phenomena to be examined is a continuous wave, the time base should be operated repetitively and by adjusting the TIME/CM. range and fine controls, a stationary picture can be obtained. This can be held by turning the SYNC amplitude in a clockwise direction.

4.7.2. If the phenomena to be examined is a pulse or a transient, the SYNC/TRIG selector should be adjusted to TRIG+ or TRIG— according to the polarity of the triggering pulse. A pre-pulse should be used for triggering wherever possible. This is connected to the SYNC/TRIG terminal and the INT./EXT. sync switch is set to EXT.

4.8. Use of TRIG BRIGHT UP:

When examining fast phenomena with slow repetition rates, it is desirable to switch the TRIG BRIGHT UP to TRIG BRIGHT UP. This holds the cathode-ray tube intensity to just below visible until the spot commences to move, when a pulse is applied to the C.R.T. which increases brilliance throughout the duration of the trace. This has the effect of suppressing a bright spot at the commencement of the trace.

When the TRIG BRIGHT UP is not in use, a bright spot may appear at the left-hand end of the trace. The 'X' shift should be adjusted so that this spot just disappears from the left-hand side of the tube.

4.9. Time measurement on this instrument is achieved by obtaining a stationary picture and measuring the horizontal length in cms. of the period to be measured. Reference to the TIME/CM controls and the 'X' EXPANSION control then provide direct reading of the time period measured.

4.10. To obtain access to Y1 plate release the fastener in the trap door in the top of the oscilloscope. Set the selector at EXT and apply signal to the terminals. It is advisable to set the VOLTS/CM switch at 10 V/cm. to prevent spurious signal being picked up and applied to Y2.

4.11. Sweep Waveform

The Time Base Waveform is available at low impedance on TL.4. ('X' DC). No resistive or capacitive loading can be put on this point without modifying the time base linearity and reducing the fastest sweep speeds.

4.12. To fit J. Langham Thompson Ltd. Series 100 Camera, remove graticule cover plate, as in paragraph 5.3.3, and fit special cover plate by means of the two 6BA countersunk screws. Fit the camera to the oscilloscope, using the four 2BA knurled-head screws. Graticule edges must be obscured with black tape.

To fit Cossor 1428 camera remove graticule assembly, as in paragraph 5.3.3. The camera may now be fitted to the flange on the face of the oscilloscope. Due to variations in tube face thickness, it may be necessary to re-focus the camera.

4.13. To obtain external brilliance modulation, connect the brightening signal to the Z MOD. terminal and switch the TRIG. BRIGHT-UP to EXT. Z. MOD.

SECTION 5

SETTING UP, TESTING AND SERVICING INSTRUCTIONS

5.1. Setting-up Procedure

The oscilloscope is set up and sealed before leaving the factory and should not be touched except to correct a fault. This information is not a complete setting up and test procedure. It is given for guidance during fault finding only.

5.1.1. Set controls as in paragraph 4.2. Switch on and make sure that the oscilloscope is functioning. Switch Y INPUT selector to TERM A.C. and VOLTS/CM to 3 V. Apply a signal of 4·25 Volts at 200 c/s. Adjust RV10 until the picture size is 4 cms.

5.1.2. To set up the 'Y' amplifier apply a squarewave of 10 V P-P amplitude, at 10 kc/s to the 'Y' input. Set the 'Y' range control to 3 V/cm. and adjust the oscilloscope controls to obtain a synchronised picture. Adjust C34 and C24 to obtain the best squarewave. Check with a 100 kc/s squarewave and seal the trimmers. Switch to the 10 V/cm. range and adjust and seal C32.

Switch to the 1 V/cm. range, adjust and seal C35. Switch the multiplier to X1·5, X2·5, X4 and X6 and adjust and seal C19, C18, C17 and C15 respectively.

Check that the pre-amplifier is working correctly.

5.1.3. To set up the 'X' amplifier apply a time base, synchronised to a 10 kc/s squarewave, to the 'Y' input from an external oscilloscope. Switch the internal TIME/CM. range control to EXT and PRIME, and apply the squarewave to the 'X' D.C. terminal. Adjust C46 and C53 to obtain the best squarewave response. Check with a 100 kc/s squarewave, and seal C46 and C53. Switch the 'X' AMP to X0·5, X2 and X5 and adjust and seal C45, C48 and C50.

5.1.4. To set up the Time Base apply a 10 kc/s sinusoidal signal to the 'Y' input, synchronise the picture and adjust the TIME/CM. fine control until one wavelength occupies 1 cm. of the screen. Check this setting and the time base linearity over several cms. of the screen. Without altering the setting of the potentiometer, remove the control knob and replace it so that the pointer coincides with 1 on the calibrated scale. Change the frequency to 1 kc/s and rotate the TIME/CM. fine control to 10 on the calibrated scale. Adjust RV3 until 1 wavelength occupies 1 cm. of the screen.

Apply a 333 kc/s sinusoidal signal to the 'Y' input. Set the TIME/CM. range to the 1–10 μsec position and the TIME/CM. fine control to 3. Adjust C39 until 1 wavelength occupies 1 cm. of the screen. Seal C39.

Increase the signal frequency to 3·33 Mc/s and set the TIME/CM. range to 0·1 to 1 μsec position. Adjust C38 until 1 wavelength occupies 1 cm. of the screen. Seal C38.

5.2. Performance Checks

5.2.1. Time base accuracy:

Apply a sinusoidal signal to the 'Y' INPUT at various settings of the TIME/CM. switch and the TIME/CM. potentiometer, adjust the signal frequency until 1 cycle occupies 1 cm. of the trace.

Then the frequency should be within ± 10% of the reciprocal of the TIME/CM. control settings.

5.2.2. Amplifier Bandwidths:

Apply a 100 kc/s signal from a signal generator to the 'Y' input. Remove the hood and graticule assembly as in paragraph 5.3.3. Adjust the input signal to give a 1 cm. p-p picture, monitoring the input level with a valve voltmeter. Keeping the input level constant, increase the signal frequency to 1 Mc/s and note that there is no significant change in picture size. At constant input, increase the frequency until the picture size is reduced to 0·71 cms. The frequency at which this occurs should be > 10 Mc/s. Check that the scope will display 1 cm. picture at 10 Mc/s. Repeat this procedure for the ranges listed below.

Range	Initial picture size and frequency		2nd Check	—3 db Point
3 V/cm.	1 cm.	100 Kc/s	1 Mc/s	< 6·5 Mc/s
1 V/cm	1 cm.	50 Kc/s	500 Kc/s	< 4 Mc/s
100 mV/cm.	1 cm.	50 Kc/s	500 Kc/s	< 4 Mc/s
10 mV/cm.	2 cm.*	20 Kc/s	200 Kc/s	< 1·5 Mc/s
1 mV/cm.	2 cm.*	1 Kc/s	10 Kc/s	< 75 Kc/s

*—3 db point occurs at 1·41 cms.

Switch T.B. to EXT. and PRIME and connect the oscillator to the 'X' D.C. terminal.

Repeat the above procedure on the 'X' amplifier for the ranges listed below.

Range	Initial picture size and frequency		2nd Check	—3 db Point
X0·5	1 cm.	50 Kc/s	500 Kc/s	< 4·5 Mc/s
X1	1 cm.	50 Kc/s	500 Kc/s	< 3·75 Mc/s
X2	1 cm.	20 Kc/s	200 Kc/s	< 2·5 Mc/s
X5	1 cm.	20 Kc/s	200 Kc/s	< 1·5 Mc/s

5.2.3. Amplitude Measuring Accuracy:

Apply signals of accurately known amplitude and check that the peak to peak voltage of the signal corresponds to the picture size and the settings of the VOLTS/CM. and Multiplier controls.

Check the ' X ' amplifier in a similar way (X·5 corresponds to a sensitivity of 10 V/cm.).

Obtain access to the ' Y ' plates (paragraph 4.10) and set plate connector to EXT. Apply a 1 kc/s signal to the plate terminal. A picture size of 1 cm. p–p should be obtained from an applied voltage between 8 and 9·7 volts.

Reset plate connections to INT.

5.2.4. Input Capacity:

Apply a 250 kc/s signal to the ' Y ' input monitoring the input with an A.C. millivoltmeter and note the picture size. Insert a 68 Pfd capacitor close to the input terminal in series with the signal and note the new picture size, let the first picture size be X and the second be Y. Then the input capacitance is obtained from the following formula:

$$\frac{X-Y}{Y} \times 68 \text{ Pfd}$$

The input capacitance should be less than 60 Pfd on the D.C. amplifier ranges, at all settings of the multiplier and on either socket or terminal, A.C. or D.C. The input capacitance should be less than 40 Pfd on the A.C. pre-amplifier ranges on either socket or terminal A.C.

The input capacitance of the ' X ' amplifier from the ' X ' D.C. terminal should be less than 30 Pfd at all expansion settings.

The input capacitance of the direct connection to the plates should be less than 10 Pfd.

5.2.5. Synchronisation Sensitivity:

Set the SYNC amplitude to maximum clockwise rotation.

Apply sinewave voltages at various frequencies to the ' Y ' INPUT and note that it is possible to obtain a synchronised picture less than 1 cm. p–p amplitude at all frequencies from 5 c/s to 10 Mc/s using suitable time base ranges.

Switch to EXT, apply a common signal to ' Y ' INPUT and SYNC/TRIG terminal and note that it is possible to obtain a synchronised picture at all frequencies from 5 c/s to 10 Mc/s when input signal is less than 0·5 R.M.S.

5.2.6. Trigger Sensitivity:

Set SYNC/TRIG controls to TRIG +, INT. Apply a sequence of positive pulses to the ' Y ' input and check that the time base will trigger with a picture size less than 1 cm. peak on all settings of the TIME/CM. switch on pulse durations of 1 μsec, 10 μsec and 100 μsec. Note that on positive pulses, the time base will not trigger from 1 and 10 μsec pulses when set to TRIG–

When adjusted for EXT triggering, note that the time base will trigger from a pulse of 1 volt peak amplitude.

5.2.7. Television Trigger:

Apply a live TV signal to the ' Y ' input and set the SYNC/TRIG controls to TV TRIG, INT. Note that the time base will trigger from an early frame sync pulse.

5.2.8. Power Supply Checks:

Check that the ripple on the stabilised rails is less than 10 mV R.M.S.

Check that the operation of the instrument is not impaired by variations of A.C. supply voltage ± 7% from nominal.

5.3. Servicing Information

When servicing the instrument, do not connect to the supply main with the dust cover off except for setting up and fault finding. Great care must be taken to avoid electric shock when operating in this condition.

5.3.1. To remove the dust cover undo the two knurled captive nuts at the rear of the dust cover and draw it off the back of the instrument.

5.3.2. To obtain access to the valves remove the dust cover. All valves are now immediately accessible with the following exceptions:

V1 is enclosed in a small screening box behind the ' Y ' INPUT selector switch. The side cover of the box is fixed by four screws.

V2, V3, V4, V15, V19 and V20 can be extracted through the hole in the base of the instrument after removing the small cover plate provided.

5.3.3. To remove the cathode-ray tube remove the dust cover, release the four knurled captive screws retaining the escutcheon and remove it. SHORT CIRCUIT THE P.D.A. CONNECTOR TO FRAME. Release the cathode-ray tube base retainers and remove the base assembly. Loosen the clamps at front and rear of the mu-metal screen.

Remove the cathode-ray tube connections as follows: (i) ' Y ' plate connectors, (ii) ' X ' plate connectors, (iii) A3 connection (iv) P.D.A. cap. Remove four countersunk screws in the escutcheon block and withdraw the cathode-ray tube assembly from the front of the instrument.

The cathode-ray tube may then be gently eased out of the screen.

5.3.4. To remove the base plate remove the dust cover, push the support foot into the base of the oscilloscope, after removing the small cover plate. Extract the eight 2BA screws and remove the base plate carefully.

5.3.5. Quiescent Potentials:

These D.C. levels are provided for guidance only during fault finding, and should not be taken as mandatory requirements. All measurements were made using an AVO model 8, with the solarscope switched on and other controls set as in paragraph 4.2.

Table 1. Typical D.C. Voltages at Valve Electrodes

Test Point	+ Lead	— Lead	Indication	Range	Test Point	+ Lead	— Lead	Indication	Range
V1 Anode	V1/7	Frame	108V	250V	V16 Grid	Frame	V16/1	0.7V	10V
V1 Screen	V1/8	Frame	76V	250V	V17 (a) Cathode	V17/8	Frame	250V	250V
V2 Anode	V2/5	Frame	118V	250V	V17 (b) Anode	V17/1	Frame	248V	250V
V2 Grid	Frame	V2/1	1.9V	10V	V17 (b) Cathode	V17/3	Frame	128V	250V
V3 Cathode	V3/3	Frame	118V	250V	V17 (b) Grid	V17/2	Frame	113V	250V
V4 Cathode	V4/3	Frame	3.2V	10V	V18 (a) Anode	V18/1	Frame	215V	250V
V5 Anode	V5/3	Frame	250V	1000V	V18 (b) Cathode	V18/8	Frame	218V	250V
V5 Cathode	V5/7	Frame	3.4V	10V	V19 Anode	Frame	V19/5	90V	250V
V5 Grid	V5/2	Frame	1.6V	10V	V19 Cathode	Frame	V19/2	93V	250V
V6 Anode	V6/7	Frame	250V	1000V	V19 Grid	Frame	V19/1	93V	250V
V6 Grid	V6/2	Frame	1.5V	10V	V19 Screen	Frame	V19/7	38V	100V
V7 (a) Cathode	Frame	V7/8	1.3V	10V	V20 (a) Anode	V20/6	Frame	10V	100V
V7 (a) Grid	Frame	V7/7	12V	100V	V20 (a) Cathode	Frame	V20/8	76V	100V
V7 (b) Cathode	Frame	V7/3	3.8V	10V	V20 (b) Anode	Frame	V20/1	9.2V	10V
V8 Anode	Frame	R60/R64	4.7V	10V	V20 (b) Grid	Frame	V20/2	75V	100V
V9 Anode	Frame	V9/7	1.5V	10V	V21 Cathode	V21/8	Frame	465V	1000V
V10 Anode	V10/7	Frame	128V	250V	Choke drop	L1	L1	22.5V	25V
V10 Anode	V10/3	Frame	1.1V	10V	V22 Cathode	V22/3	Frame	100V	250V
V11 Cathode	V11/3	Frame	0.7V	10V	Choke drop	L2	L2	21V	25V
V11 Grid	V11/2	—105 rail	102V	250V	Choke drop	L3	L3	24.8V	25V
V12 Cathode	V12/3	Frame	3.3V	10V	V23 Grid	V23/2	Frame	236V	250V
V12 Grid	V12/2	Frame	0.7V	10V	V27 Cathode	V27/3	Frame	86V	250V
V13 Anode	V13/7	Frame	246V	250V	V27 Grid	V27/7	Frame	83V	250V
V13 Cathode	V13/1	Frame	4V	10V	V29 Anode	V29/1	Frame	154V	250V
V13 Grid	V13/2	Frame	2.2V	10V	V29 Anode	V29/6	Frame	103V	250V
V14 Anode	V14/7	Frame	250V	250V	V29 Grid	V29/2	—105 rail	103V	250V
V14 Grid	V14/2	Frame	1.7V	10V	V29 Grid	V29/7	—105 rail	97V	250V
V15 (a) Anode	V15/1	Frame	166V	250V	V30 Grid	V30/1	Frame	84V	250V
V15 (a) Cathode	V15/3	Frame	1.7V	10V	V30 Screen	V30/7	Frame	111V	250V
V15 (b) Anode	V15/6	Frame	185V	250V	V30 Anode	V30/5	Frame	140V	250V
V15 (b) Cathode	V15/8	Frame	59V	100V	C72	C72/L1	Frame	440V	1000V
V15 (b) Grid	V15/7	Frame	53V	100V	C74	C/74/L3	Frame	415V	1000V
V16 Anode	V16/5	Frame	128V	250V	C78	250V rail	Frame	250V	1000V
V16 Screen	V16/7	Frame	0.6V	10V	C95	Frame	—105V rail	105V	250V

Using an electrostatic voltmeter:

Test Point	Indication
C80	2.3 kV
C81	2 kV
C79	2 kV

Table 2. Fault Location Chart

SYMPTOMS	POSSIBLE CAUSE	REMEDY
Nothing happens on switching on.	Open circuit fuse.	Replace fuse. Persistent blowing of fuses indicates a fault in the oscilloscope.
	No mains supply.	Check mains voltage at power socket.
105V rail incorrect voltage.	V29 faulty.	Replace faulty component.
	R190, R185 O/C or changed value.	
No spot on cathode-ray tube.	No E.H.T. voltage.	Replace rectifier valves.
	Check E.H.T. potentials.	
No focus control.	Incorrect voltage on A2.	Check focus potentiometer and replace if necessary.
	P.D.A. cap either s/c to earth or not connected.	Locate and relieve the s/c or O/C.
No time base.	Abnormal condition.	Rotate TIME/CM switch to PRIME and back to the range required.
	Faulty valve V7, V8, V9, V10, V11.	Replace the faulty valve.
	Check DC voltages to isolate the fault.	
	R108, 109, 117, 118 all 1%. Changed value or O/C.	Replace the faulty resistor.
Time base ceases to operate on rotating. Time/cm pot and spot holds at end of trace.	Faulty V11, V17, V18 or V10.	Replace V11, V17, V18, V10.
	V11, V17, V18 or V10 aged.	Adjust RV9.
T.B. fails to synchronise.	V15 or V16 faulty.	Replace V15 or V16.
T.B. fails to trigger.	V15, V19, V20 or V7 faulty.	Replace faulty valve.
X amplifier not operating.	V12, V13, V14 faulty.	Replace faulty valve.
	R80 O/C. R86, 90 92 O/C.	Replace faulty resistor.
Y amplifier not operating.	V4, V5 or V6 faulty.	Replace faulty valve.
Excessive shift when switching DC range of Y amplifier with no signal input.	Grid current in V5.	Replace V5.
Y pre-amp not operating.	V1, V2 or V3 faulty.	Replace faulty valve.
	R43, 44, 45, 46, 47, 15 and R10 O/C or changed value.	Replace faulty resistor.
Excessive hum on trace when using pre-amp at 1mV/cm with s/c input.	Ageing of V1.	Replace V1.
Brilliance mod.	V32 faulty.	Replace V32.

COMPONENT SCHEDULE

RESISTORS FIXED Class Group No. 5905. Country of Origin Code 99.

Circuit Ref.	Value Ohms	Tol. %	Rating Watts	Solartron Part No.	Inter-Service Ref. No.	Manufacturer & Type	
R1	1M	1	½	223714	021-6654	Painton	73 H.S.
R2	3.3k	10	¼	226331	022-2067	Erie	9 Carbon
R3	110k	2	1/8	221174	021-9848	Erie	109 H.S.
R4	68k	2	1/8	221169	021-9820	Erie	109 H.S.
R5	1k	10	¼	226325	022-2004	Erie	9 Carbon
R6	100k	2	1/8	221173	021-9843	Erie	109 H.S.
R7	2.7M	2	¾	224524	021-6852	Painton	74 H.S.
R8	220	10	¼	226317	022-1151	Erie	9 Carbon
R9	1K	10	¼	226325	022-2004	Erie	9 Carbon
R10	15k	5	3	238451	011-3348	Painton	P306 WW.
R11	3.3M	2	¾	224526	021-6858	Painton	74 H.S.
R12	100	10	¼	226313	022-1109	Erie	9 Carbon
R13	33	10	¼	226307	022-1046	Erie	9 Carbon
R14	33	10	¼	226307	022-1046	Erie	9 Carbon
R15	15k	1	3	239277		Painton	P406 WW.
R16	820k	1	½	223712	021-6638	Painton	73 H.S.
R17	750k	1	½	223711	021-6630	Painton	73 H.S.
R18	600k	1	½	N22019		Painton	73 H.S.
R19	330k	1	½	223702	021-6558	Painton	73 H.S.
R20	220	10	¼	226317	022-1151	Erie	9 Carbon
R21	164k	1	1/8	N22020		Erie	109 H.S.
R22	250k	1	1/8	N22021		Erie	109 H.S.
R23	400k	1	½	N22022		Painton	73 H.S.
R24	660k	1	½	N22023		Painton	73 H.S.
R25	1M	1	½	223714	021-6654	Painton	73 H.S.
R26	33	10	¼	226307	022-1046	Erie	9 Carbon
R27	10k	5	3	238449	011-3344	Painton	306 WW.
R28	100	10	¼	226313	022-1109	Erie	9 Carbon
R29	33	10	¼	226307	022-1046	Erie	9 Carbon
R30	220	10	¼	226317	022-1151	Erie	9 Carbon
R31	1M	1	½	223714	021-6654	Painton	73 H.S.
R32	100	10	¼	226313	022-1109	Erie	9 Carbon
R33	10k	1	6	N22024		Painton	P402 Vi WW.
R34	1M	1	½	223714	021-6654	Painton	73 H.S.
R35	220k	2	¾	224498	021-6531	Painton	74 H.S.
R36	1M	1	½	223714	021-6654	Painton	73 H.S.
R37	91	2	½	223817	021-5392	Painton	73 H.S.
R38	Not fitted						
R39	10k	1	6	N22024		Painton	P402 Vi WW.
R40	100	10	¼	226313	022-1109	Erie	9 Carbon
R41	100	10	¼	226313	022-1109	Erie	9 Carbon
R42	5.1k	5	3	N22259	011-7889	Painton	P306 WW.
R43	910	1	1/8	221024	021-9548	Erie	109 H.S.
R44	470	10	¼	226321	022-1193	Erie	9 Carbon
R45	140	1	1/8	N22025		Erie	109 H.S.
R46	1.9k	1	1/8	N22026		Erie	109 H.S.
R47	11k	1	3	238274		Painton	P406 WW.
R48	750k	1	½	223711	021-6630	Painton	73 H.S.
R49	216k	1	1/8	N22027		Erie	109 H.S.
R50	65.2k	1	1/8	N22028		Erie	109 H.S.

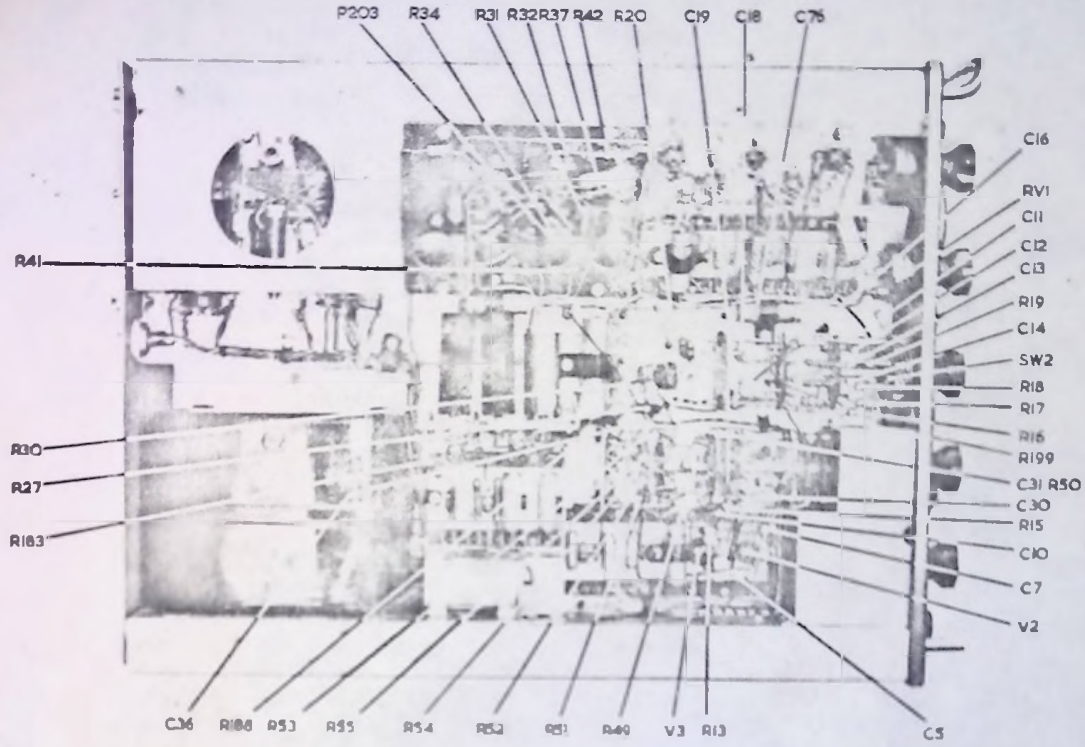

Plate 2: Left side view

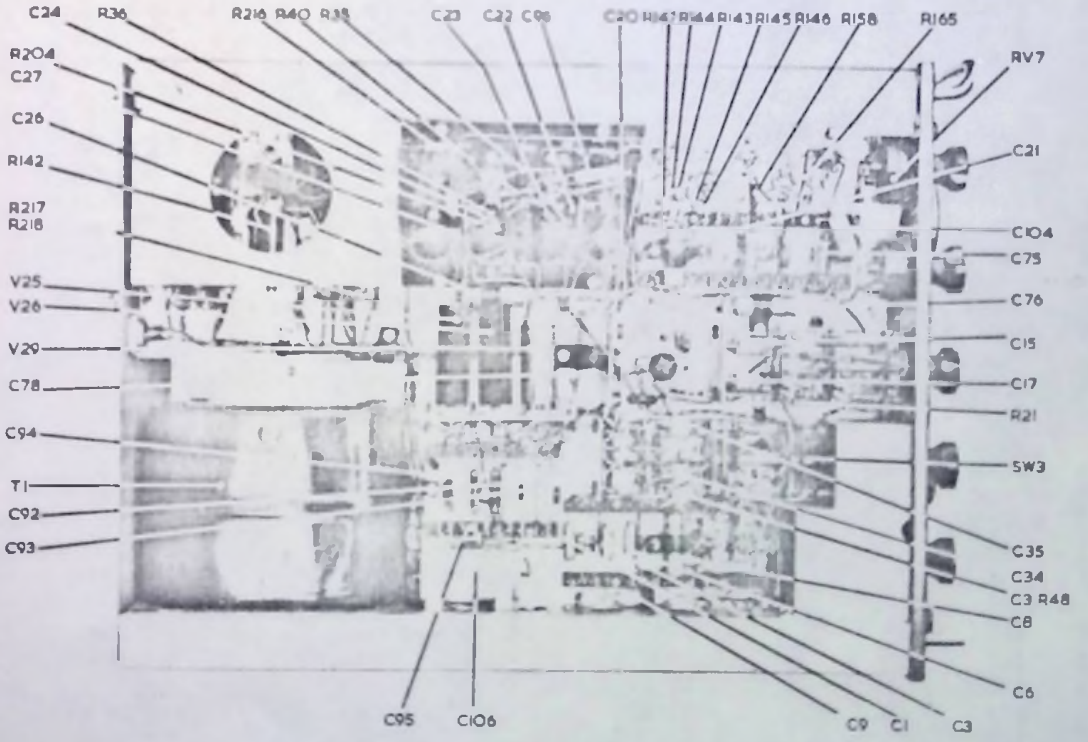

Plate 3: Left side view

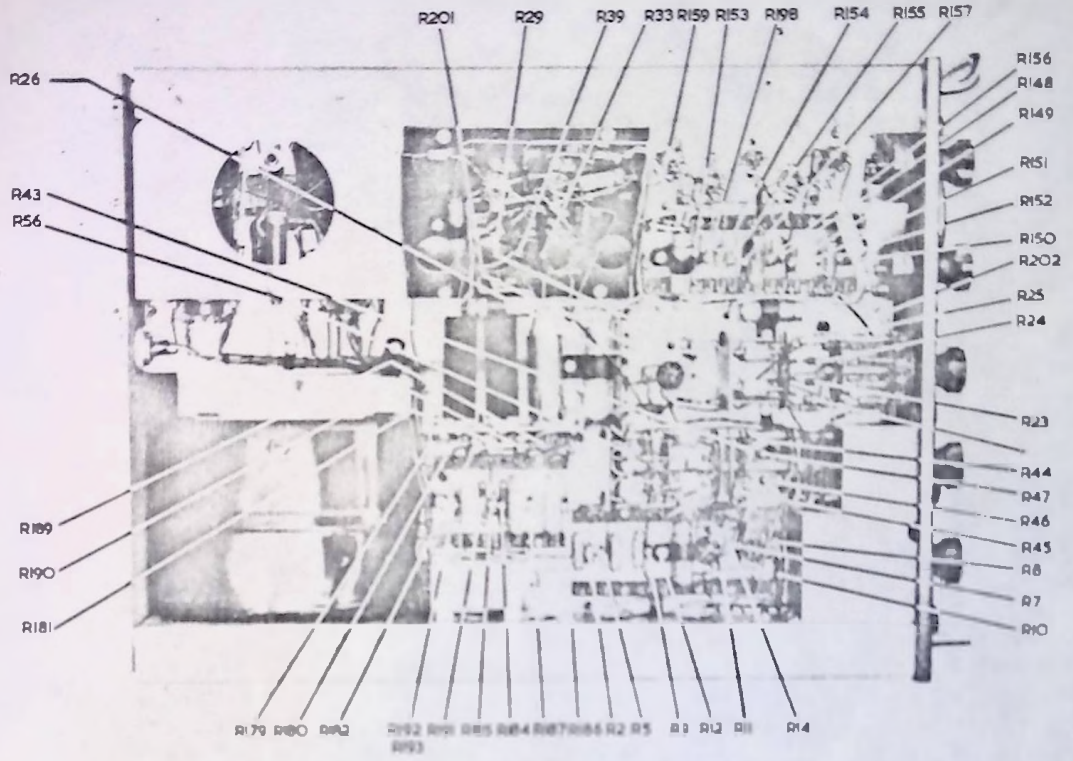

Plate 4: Left side view

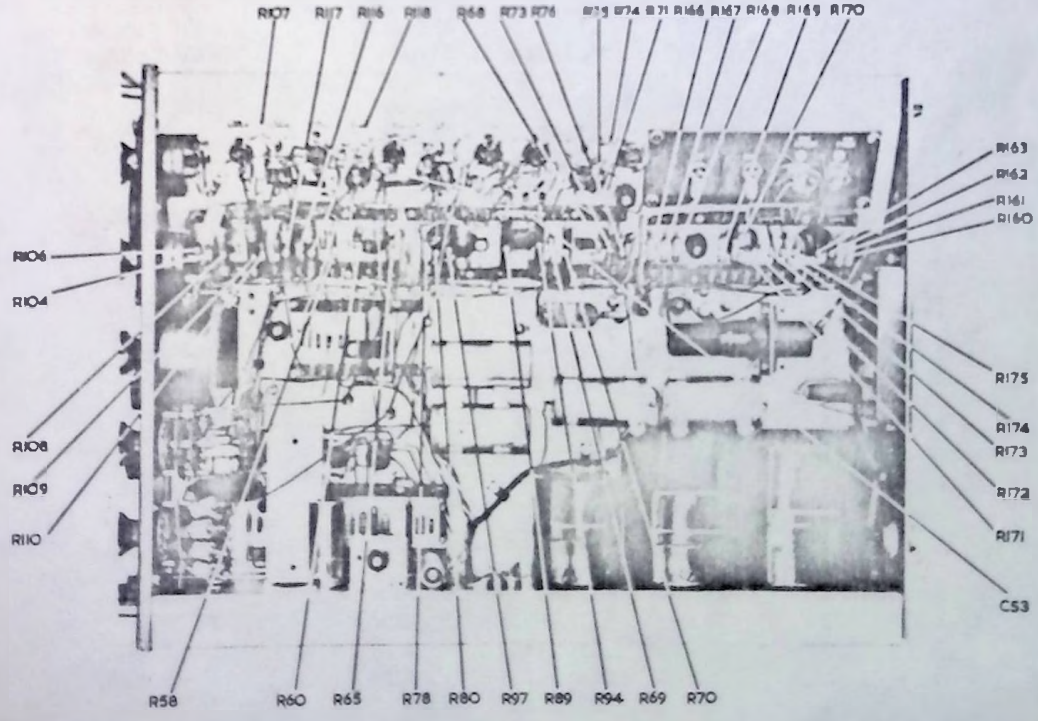

Plate 5: Right side view

RESISTORS FIXED Class Group No. 5905. Country of Origin Code 99.

Circuit Ref.	Value Ohms	Tol. %	Rating Watts	Solartron Part No.	Inter-Service Ref. No.	Manufacturer & Type	
R51	10M	10	1/4	226373	022-3290	Erie	9 Carbon
R52	4.7M	10	1/4	226369	022-3248	Erie	9 Carbon
R53	1.8M	10	1/4	226364	022-3197	Erie	9 Carbon
R54	1M	10	1/4	226361	022-3164	Erie	9 Carbon
R55	220k	10	1/4	226353	022-3079	Erie	9 Carbon
R56	150k	2	1/8	221177	021-9865	Erie	109 H.S.
R57	5600	1	1/8	221043	021-9662	Erie	109 H.S.
R58	360k	1	1/4	224303	021-6567	Painton	74 H.S.
R59	56k	1	1/8	221067	021-9805	Erie	109 H.S.
R60	15k	1	1/8	221053	021-9722	Erie	109 H.S.
R61	1000	10	1/4	226325	022-2004	Erie	9 Carbon
R62	33	10	1/4	226307	022-1046	Erie	9 Carbon
R63	2.2M	10	1/4	226365	022-3206	Erie	9 Carbon
R64	36k	1	1/8	221062	021-9779	Erie	109 H.S.
R65	5.6M	2	1/4	N22260	021-6876	Painton	74 H.S.
R66	1.3M	2	1/4	224517	021-6772	Painton	74 H.S.
R67	220	10	1/4	226317	022-1152	Erie	9 Carbon
R68	100	10	1/4	226313	022-1109	Erie	9 Carbon
R69	68	10	1/4	226311	022-1089	Erie	9 Carbon
R70	18k	5	6	239040	011-3427	Painton	P305 WW.
R71	330k	5	1/2	N22038		Erie	8 Carbon
R72	10k	10	1/4	226337	022-2130	Erie	9 Carbon
R73	180k	2	1/4	224496	021-6511	Painton	74 H.S.
R74	33	10	1/4	226307	022-1046	Erie	9 Carbon
R75	33	10	1/4	226307	022-1046	Erie	9 Carbon
R76	5100	1	3	238266		Painton	P406 WW.
R77	150	10	1/4	226315	022-1130	Erie	9 Carbon
R78	1M	10	1/4	226361	022-3164	Erie	9 Carbon
R79	33	10	1/4	226307	022-1046	Erie	9 Carbon
R80	7500	1	3	238270		Painton	P406 WW.
R81	33	10	1/4	226307	022-1046	Erie	9 Carbon
R82	470k	1	1/2	223706	021-6590	Painton	73 H.S.
R83	220k	1	1/2	223698	021-6525	Painton	73 H.S.
R84	110k	1	1/2	223691	021-6456	Painton	73 H.S.
R85	39k	1	1/2	223680	021-6346	Painton	73 H.S.
R86	1M	1	1/4	224314	021-6655	Painton	74 H.S.
R87	220k	10	1/4	226353	022-3079	Erie	9 Carbon
R88	100	10	1/4	226313	022-1109	Erie	9 Carbon
R89	12k	5	6	N22035	011-3423	Painton	P305 WW.
R90	1M	1	1/4	224314	021-6655	Painton	74 H.S.
R91	220k	2	1/4	224498	021-6531	Painton	74 H.S.
R92	1M	1	1/4	224314	021-6655	Painton	74 H.S.
R93	120	5	1/4	N22041	021-9047	Erie	108 H.S.
R94	12k	5	6	N22035	011-3423	Painton	P305 WW.
R95	100	10	1/4	226313	022-1109	Erie	9 Carbon
R96	100	10	1/4	226313	022-1109	Erie	9 Carbon
R97	5100	5	3	N22259	011-7889	Painton	P306 WW.
R98	22k	10	1/4	226341	022-2172	Erie	9 Carbon
R99	22	10	1/4	226305	022-1026	Erie	9 Carbon
R100	1M	10	1/4	226361	022-3164	Erie	9 Carbon

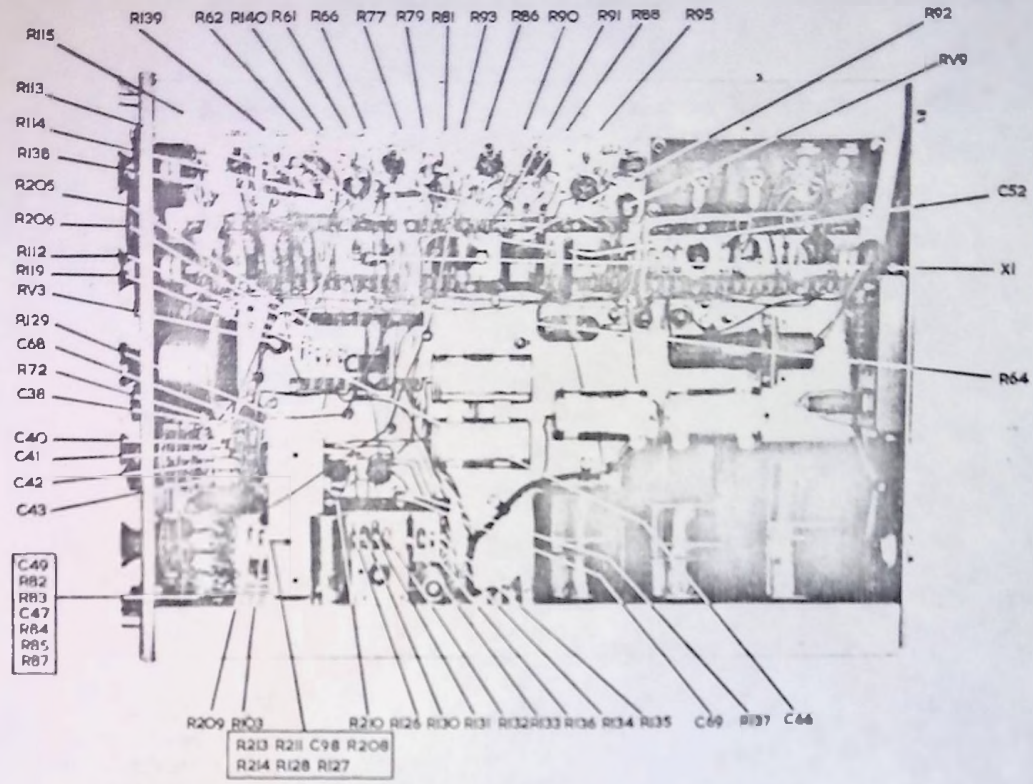

Plate 6: Right side view

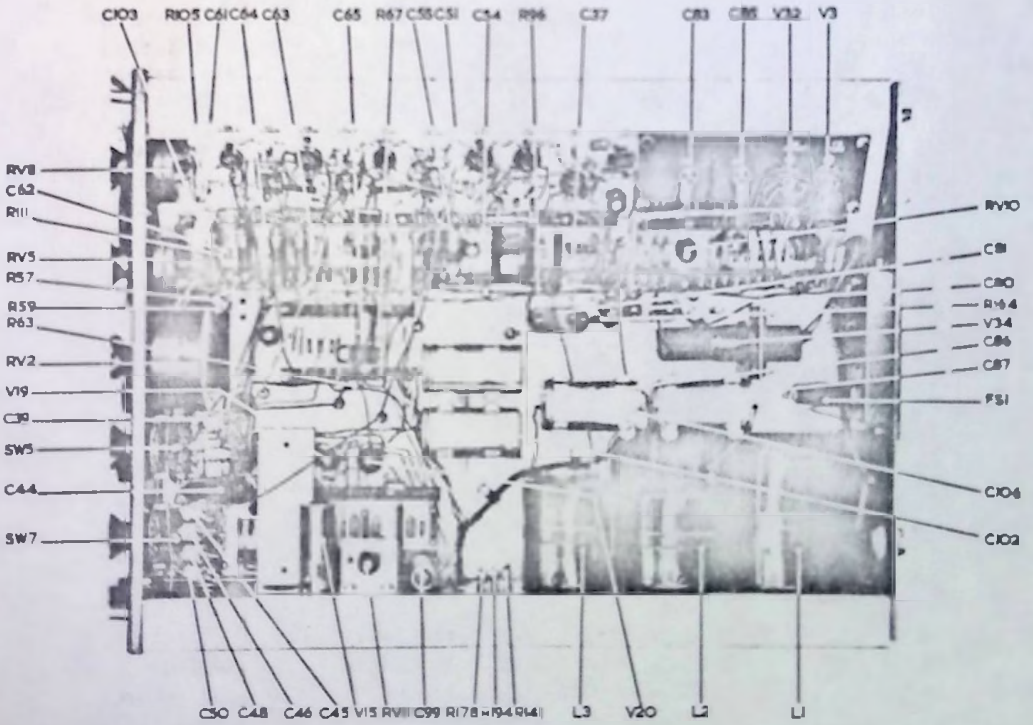

Plate 7: Right side view

RESISTORS FIXED Class Group No. 5905. Country of Origin Code 99.

Circuit Ref.	Value Ohms	Tol. %	Rating Watts	Solartron Part No.	Inter-Service Ref. No.	Manufacturer & Type	
R101	10k	10	1/4	226337	022-2130	Erie	9 Carbon
R102	470	10	1/4	226321	022-1193	Erie	9 Carbon
R103	1M	10	1/4	226361	022-3164	Erie	9 Carbon
R104	10M	10	1/4	226373	022-3290	Erie	9 Carbon
R105	470k	10	1/4	226357	022-3121	Erie	9 Carbon
R106	220k	10	1/4	226353	022-3079	Erie	9 Carbon
R107	22k	10	1/4	226341	022-2172	Erie	9 Carbon
R108	12k	1	3	238275		Painton	P406 WW.
R109	13k	1	3	238276		Painton	P406 WW.
R110	33	10	1/4	226307	022-1046	Erie	9 Carbon
R111	4700	10	1/4	226333	022-2088	Erie	9 Carbon
R112	47k	10	1/4	226345	022-2214	Erie	9 Carbon
R113	5600	10	1/4	226334	022-2100	Erie	9 Carbon
R114	22k	2	1/4	224474	021-6293	Painton	74 H.S.
R115	5600	10	1/4	226334	022-2100	Erie	9 Carbon
R116	33	10	1/4	226307	022-1046	Erie	9 Carbon
R117	12k	1	3	238275		Painton	P406 WW.
R118	13k	1	3	238276		Painton	P406 WW.
R119	220	10	1/4	226317	022-1151	Erie	9 Carbon
R120	1M	10	1/4	226361	022-3164	Erie	9 Carbon
R121	10k	10	1/4	226337	022-2130	Erie	9 Carbon
R122	47k	10	1/4	226345	022-2214	Erie	9 Carbon
R123	120k	10	1/4	226350	022-3049	Erie	9 Carbon
R124	470k	10	1/4	226357	022-3121	Erie	9 Carbon
R125	1M	10	1/4	226361	022-3164	Erie	9 Carbon
R126	2700	10	1/4	226330	022-2058	Erie	9 Carbon
R127	68k	1	1/8	221069	021-9817	Erie	109 H.S.
R128	33k	10	1/4	226343	022-2193	Erie	9 Carbon
R129	100k	2	1/8	221173	021-9843	Erie	109 H.S.
R130	30k	2	1/8	221160	021-9767	Erie	109 H.S.
R131	91k	2	1/4	224489	021-6442	Painton	74 H.S.
R132	5600	10	1/4	226334	022-2100	Erie	9 Carbon
R133	6800	2	1/4	224462	021-5842	Painton	74 H.S.
R134	5600	10	1/4	226334	022-2100	Erie	9 Carbon
R135	91k	2	1/4	224489	021-6442	Painton	74 H.S.
R136	33k	2	1/8	221161	021-9773	Erie	109 H.S.
R137	100k	2	1/8	221173	021-9843	Erie	109 H.S.
R138	1500	10	1/4	226327	022-2025	Erie	9 Carbon
R139	33k	10	1/2	226543	022-2195	Erie	8 Carbon
R140	22	10	1/4	226305	022-1026	Erie	9 Carbon
R141	180	5	10	N22909	011-3046	Welwyn	AW3192
R142	330	5	15	N22042	011-3076	Painton	P2001/B1 WW
R143	22	10	1/4	226305	022-1026	Erie	9 Carbon
R144	220	10	1/4	226317	022-1151	Erie	9 Carbon
R145	220	10	1/4	226317	022-1151	Erie	9 Carbon
R146	22	10	1/4	226305	022-1026	Erie	9 Carbon
R147	150k	10	1/2	N22040	022-3060	Erie	8 Carbon
R148	15k	10	1/4	226339	022-2151	Erie	9 Carbon
R149	22k	10	1/2	226541	022-2174	Erie	8 Carbon
R150	22	10	1/4	226305	022-1026	Erie	9 Carbon

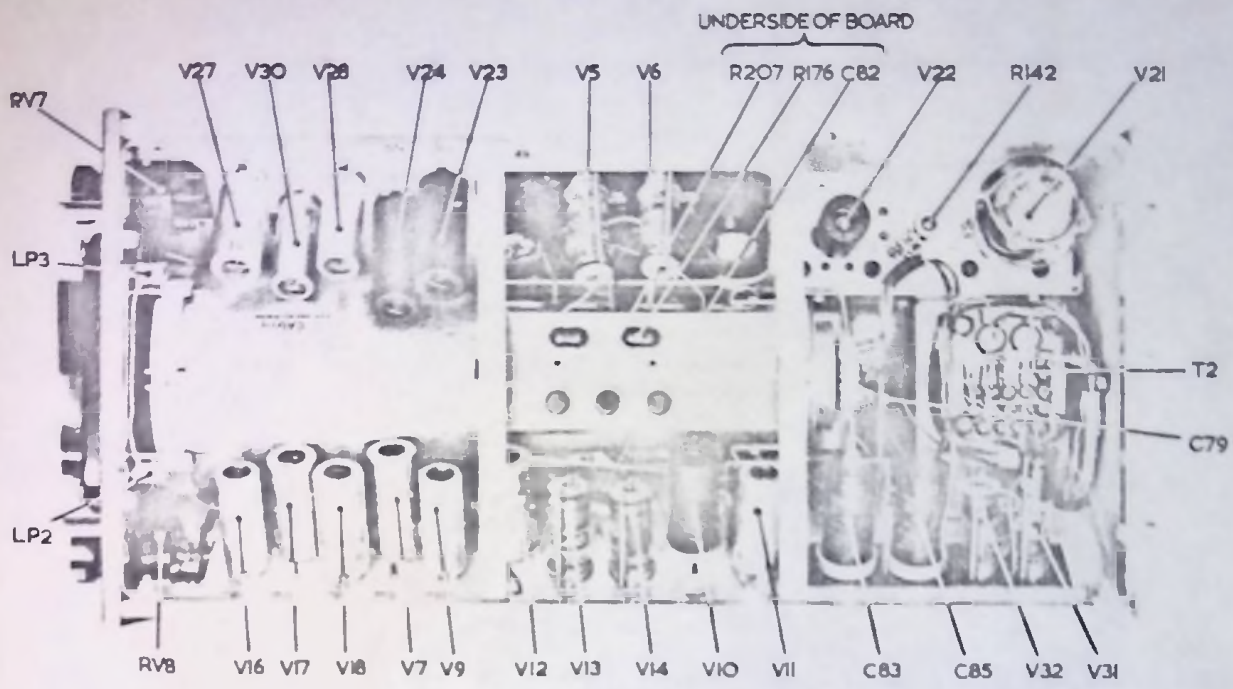

Plate 8: Top view

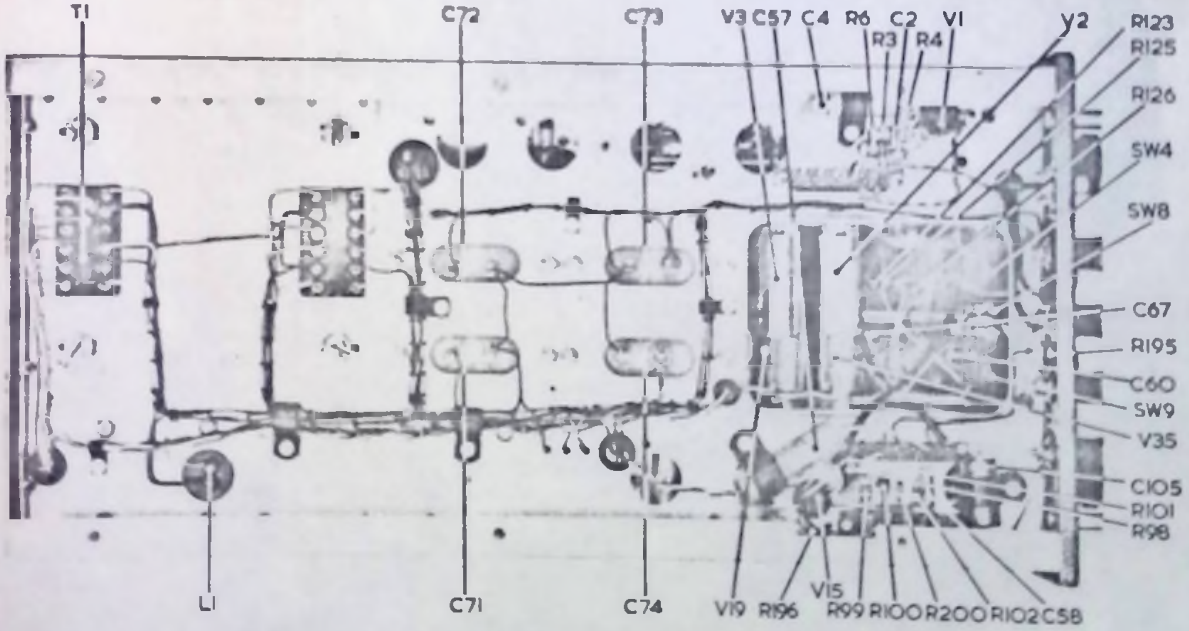

Plate 9: Bottom view

RESISTORS FIXED Class Group No. 5905. Country of Origin Code 99.

Circuit Ref.	Value Ohms	Tol. %	Rating Watts	Solartron Part No.	Inter-Service Ref. No.	Manufacturer & Type	
R151	2.2M	10	1/4	226365	022-3206	Erie	9 Carbon
R152	3.3M	10	1/4	226367	022-3227	Erie	9 Carbon
R153	33k	2	3/4	224478	021-6333	Painton	74 H.S.
R154	6200	2	1/8	221144	021-9671	Erie	109 H.S.
R155	100	10	1/4	226313	022-1109	Erie	9 Carbon
R156	680k	10	1/4	226359	022-3143	Erie	9 Carbon
R157	470k	2	3/4	224506	021-6595	Painton	74 H.S.
R158	240k	2	3/4	224499	021-6539	Painton	74 H.S.
R159	1	10	1 1/2	238102	011-3195	Painton	MV1 WW.
R160	6.8M	10	1/2	N22070	022-3269	Erie	9 Carbon
R161	6.8M	10	1/2	N22070	022-3269	Erie	9 Carbon
R162	6.8M	10	1/2	N22070	022-3269	Erie	9 Carbon
R163	56k	10	1/4	226346	022-3007	Erie	9 Carbon
R164	220k	10	1/4	226353	022-3081	Erie	8 Carbon
R165	10k	10	1/4	226337	022-2131	Erie	9 Carbon
R166	220k	10	1/4	226353	022-3081	Erie	8 Carbon
R167	220k	10	1/4	226353	022-3081	Erie	8 Carbon
R168	220k	10	1/4	226353	022-3081	Erie	8 Carbon
R169	220k	10	1/4	226353	022-3081	Erie	8 Carbon;
R170	180k	10	1/4	226352	022-3072	Erie	8 Carbon
R171	150k	10	1/4	226351	022-3058	Erie	9 Carbon
R172	150k	10	1/4	226351	022-3058	Erie	9 Carbon
R173	10k	10	1/4	226337	022-2130	Erie	9 Carbon
R174	1M	10	1/4	226361	022-3164	Erie	9 Carbon
R175	1M	10	1/4	226361	022-3164	Erie	9 Carbon
R176	10M	10	1/4	226373	022-3290	Erie	9 Carbon
R177	180	5	10	N22909	011-3046	Welwyn	AW3192
R178	22	10	1/2	226505	022-1027	Erie	8 Carbon
R179	22	10	1/4	226305	022-1026	Erie	9 Carbon
R180	220	10	1/4	226317	022-1151	Erie	9 Carbon
R181	220	10	1/4	226317	022-1151	Erie	9 Carbon
R182	22	10	1/4	226305	022-1026	Erie	9 Carbon
R183	2200	5	6	N22017	011-3405	Painton	P305 W.W.
R184	330k	1	3/4	224302	021-6559	Painton	74 H.S.
R185	220k	2	1/8	221181	021-9888	Erie	109 H.S.
R186	1M	10	1/4	226361	022-3164	Erie	9 Carbon
R187	1M	10	1/4	226361	022-3164	Erie	9 Carbon
R188	220k	2	3/4	224498	021-6531	Painton	74 H.S.
R189	270k	10	1/4	226354	022-3091	Erie	9 Carbon
R190	270k	1	3/4	224300	021-6543	Painton	74 H.S.
R191	330k	1	3/4	224302	021-6559	Painton	74 H.S.
R192	1	10	1 1/2	238102	011-3195	Painton	MV1 WW
R193	1	10	1 1/2	238102	011-3195	Painton	MV1 WW
R194	Not fitted						
R195	10M	10	1/4	226373	022-3290	Erie	9 Carbon
R196	1M	10	1/4	226361	022-3164	Erie	9 Carbon
R197	100	10	1/4	226313	022-1109	Erie	9 Carbon
R198	220k	10	1/4	226353	022-3079	Erie	9 Carbon
R199	100	10	1/4	226313	022-1109	Erie	9 Carbon
R200	22k	10	1/4	226341	022-2172	Erie	9 Carbon

RESISTORS FIXED Class Group No. 5905. Country of Origin Code 99.

Circuit Ref.	Value Ohms	Tol. %	Rating Watts	Solartron Part No.	Inter-Service Ref. No.	Manufacturer & Type	
R201	18k	10	1/4	226340	022-2163	Erie	9 Carbon
R202	6800	10	1/4	226335	022-2109	Erie	9 Carbon
R203	220k	10	1/4	226353	022-3079	Erie	9 Carbon
R204	220k	10	1/4	226353	022-3079	Erie	9 Carbon
R205	47k	10	1/4	226345	022-2214	Erie	9 Carbon
R206	680k	10	1/4	226359	022-3144	Erie	9 Carbon
R207	1M	10	1/4	226361	022-3164	Erie	9 Carbon
R208	10k	10	1/4	226337	022-2130	Erie	9 Carbon
R209	470	10	1/4	226321	022-1193	Erie	9 Carbon
R210	470k	2	1/8	221189	021-9935	Erie	109 H.S.
R211	270k	2	1/8	223900	021-6546	Painton	74 H.S.
R212	100	10	1/4	226313	022-1109	Erie	9 Carbon
R213	15k	10	1/4	226339	022-2151	Erie	9 Carbon
R214	15k	10	1/4	226339	022-2151	Erie	9 Carbon
R215	100	10	1/4	226313	022-1109	Erie	9 Carbon
R216	8.2k	10	1/4	226336	022-2121	Erie	9 Carbon
R217	22	10	1/4	226305	022-1026	Erie	9 Carbon
R218	22	10	1/4	226305	022-1026	Erie	9 Carbon
R219	100	10	1/4	226313	022-1109	Erie	9 Carbon

RESISTORS VARIABLE Class Group No. 5005. Country of Origin Code 99.

Circuit Ref.	Value Ohms	Tol. %	Rating Watts	Solartron Part No.	Inter-Service Ref. No.	Manufacturer & Type	
*RV1	50k	10	1	N25021		Colvern	CLR4201
RV2	100k	2	5	N25004		Colvern	Drg. B 6034
RV3	5000	20	1/4	251204	026-1502	Morgan	LHNAR
RV4	10k	20	1/4	N25006	026-1719	Morgan	LHNAR
*RV5	50k	10	1	N25021		Colvern	CLR4201
RV6	50	10	1/2	N25014		Colvern	CLR1232
RV7	250k	20	3/4	N25007	026-2415	Morgan	HNAR25450
RV8	50k	20	3/4	N25008	026-2013	Morgan	HNAR50350
RV9	100k	20	1/4	251208	026-2170	Morgan	LHNAR
RV10	100k	20	1	256616	027-2549	Colvern	CLR4201/9S WW.
RV11	5000	10	1/2	256412		Colvern	CLR1206/9S

* Interchangeable with Inter-Services Ref. No. 5905-99-027-2409

CAPACITORS Class Group No. 5910. Country of Origin Code 99.

Circuit Ref.	Value µFd	Tol. %	Rating Volts	Solartron Part No.	Inter-Service Ref. No.	Manufacturer & Type	
C1	.02	20	350	214103	011-5629	T.C.C.	CP33N Pa.
C2	10pf	10	500	217607		Suflex	HS2206/500 Po.
C3	.02	20	350	214103	011-5629	T.C.C.	CP33N Pa.
C4	.1	20	350	214105	011-7818	T.C.C.	CP37N Pa.
C5	.02	20	350	214103	011-5629	T.C.C.	CP33N Pa.
C6	.02	20	350	214103	011-5629	T.C.C.	CP33N Pa.
C7	3.3pf	.25pf	500	201007		Erie	P100k Ce.
C8	.1	20	350	214105	011-7818	T.C.C.	CP37N Pa.
C9	.05	20	350	214104	011-5554	T.C.C.	CP35N Pa.
C10	1.0pf	.25pf	500	201001		Erie	P100k Ce.
C11	8.2pf	.25pf	500	201012		Suflex	HS2206/500 Po.
C12	10pf	10	500	217607		Suflex	HS2206/500 Po.
C13	18pf	.5pf	500	217416		Suflex	HS2206/500 Po.
C14	39pf	2	500	217420		Suflex	HS2206/500 Po.
C15	3/30pf	- 0 + 15	150	240002	016-7006	Mullard	7864/01
C16	15pf	10	500	217608		Suflex	HS2206/500 Po.
C17	3/30pf	- 0 + 15	150	240002	016-7006	Mullard	7864/01
C18	3/30pf	- 0 + 15	150	240002	016-7006	Mullard	6864/01
C19	2/8pf	- 0 + 15	150	240001	016-7002	Mullard	E7850
C20	.0047	10	500	217623		Suflex	HS2420/500 Po.
C21	.1	20	350	214105	011-7818	T.C.C.	CP37N Pa.
C22	4.7pf	.25pf	500	201009		Erie	P100k Ce.
C23	2.2pf	.25pf	500	201005		Erie	P100k Ce.
C24	.7/4pf		1000	243001		Wingrove Rogers	S50.01
C25	Not fitted						
C26	.05	20	500	214206	011-7822	T.C.C.	CP37S Pa.
C27	.05	20	350	214104	011-5554	T.C.C.	CP35N Pa.
C28	.1	20	500	214207	011-7823	T.C.C.	CP46S Pa.
C29	.1	20	500	214207	011-7823	T.C.C.	CP46S Pa.
C30	120pf	2	500	217426		Suflex	HS2206/500 Po.
C31	56pf	2	500	217422		Suflex	HS2206/500 Po.
C32	2/8pf	- 0 + 15	150	240001	016-7002	Mullard	E7850
C33	Not fitted						
C34	3/30pf	- 0 + 15	150	240002	016-7006	Mullard	7864/01
C35	3/30pf	- 0 + 15	150	240002	016-7006	Mullard	7864/01
C36	.001	10	500	217619		Suflex	HS2307/500 Po.
C37	.02	20	350	214103	011-5629	T.C.C.	CP33N Pa.
C38	.7/4pf		1000	243001		Wingrove Rogers	S50.01
C39	3/30pf	- 0 + 15	150	240002	016-7006	Mullard	7864/01
C40	33pf	10	500	217610		Suflex	HS2206/500 Po.
C41	500pf	2	250	N20012		Suflex	HS2206/250 Po.
C42	.005	2	250	N20013		Suflex	HS2412/250 Po.
C43	.05	2	250	N20014		T.M.C.	S125033 Po.
C44	.5	2	150	N20326		G.E.C.	Met. Polyester
C45	3/30pf	- 0 + 15	150	240002	016-7006	Mullard	7864/01
C46	3/30pf	- 0 + 15	150	240002	016-7006	Mullard	7864/01
C47	27pf	2	500	217418		Suflex	HS2206/500 Po.
C48	3/30pf	- 0 + 15	150	240002	016-7006	Mullard	7864/01
C49	100pf	2	500	217425		Suflex	HS2206/500 Po.
C50	3/30pf	- 0 + 15	150	240002	016-7006	Mullard	7864/01

CAPACITORS Class Group No. 5910. Country of Origin Code 99.

Circuit Ref.	Value µFd	Tol. %	Rating Volts	Solartron Part No.	Inter-Service Ref. No.	Manufacturer & Type	
C51	4.7pf	.25pf	500	201009		Erie	P100k Ce.
C52	3.3pf	.25pf	500	201007		Erie	P100k Ce.
C53	.7/4pf		1000	243001		Wingrove Rogers	S50.01
C54	.05	20	500	214206	011-7822	T.C.C.	CP37S Pa.
C55	.05	20	350	214104	011-5554	T.C.C.	CP35N Pa.
C56	0.1	20	500	214207	011-7823	T.C.C.	CP46S Pa.
C57	.5	25	350	206705	011-9835	Hunt	W49/B514P
C58	.001	10	500	217619		Suflex	HS2307/500 Po.
C59	Not fitted						
C60	.25	25	250	206603	011-9831	Hunt	W49/B507k
C61	4.7pf	.25pf	500	201009		Erie	P100k Ce.
C62	10pf	10	500	217607		Suflex	HS2206/500 Po.
C63	10pf	10	500	217607		Suflex	HS2206/500 Po.
C64	10pf	10	500	217607		Suflex	HS2206/500 Po.
C65	.1	20	350	214105	011-7818	T.C.C.	CP37N Pa.
C66	.001	10	500	217619		Suflex	HS2307/500 Po.
C67	470pf	10	500	217617		Suflex	HS2206/500 Po.
C68	10pf	10	500	217607		Suflex	HS2206/500 Po.
C69	10pf	10	500	217607		Suflex	HS2206/500 Po.
C70	33pf	10	500	217610		Suflex	HS2206/500 Po.
C71	8	20	600	211204	011-2825	T.C.C.	CP150T Pa.
C72	8	20	600	211204	011-2825	T.C.C.	CP150T Pa.
C73	8	20	600	211204	011-2825	T.C.C.	CP150T Pa.
C74	8	20	600	211204	011-2825	T.C.C.	CP150T Pa.
C75	.02	20	350	214103	011-5629	T.C.C.	CP33N Pa.
C76	.1	20	350	214105	011-7818	T.C.C.	CP37N Pa.
C77	.05	20	350	214104	011-5554	T.C.C.	CP35N Pa.
C78	2	25	250	206606	011-9840	Hunt	W49/B510P
C79	.005	20	2500	N20015	011-6406	T.C.C.	CP55HO
C80	.25	20	2500	N20016	011-1464	T.C.C.	CP146KO
C81	0.5	20	2500	N20017	011-1465	T.C.C.	CP147KO
C82	0.01	20	500	214204	011-5525	T.C.C.	CP33S
C83	0.05	20	3000	N20045	011-6413	T.C.C.	CP56HO
C84	Not fitted						
C85	0.05	20	3000	N20045	011-6413	T.C.C.	CP56HO Pa
C86	6	25	250	N20044		Hunt	W49/1 B554
C87	6	25	250	N20044		Hunt	W49/1 B554
C88	Not fitted						
C89	Not fitted						
C90	Not fitted						
C91	Not fitted						
C92	.25	25	250	206603	011-9831	Hunt	W49/B507 Pa.
C93	.25	25	250	206603	011-9831	Hunt	W49/B507 Pa.
C94	.25	25	150	206502	011-9830	Hunt	W49/B501 Pa.
C95	1	25	150	206504	011-9836	Hunt	W49/B503P
C96	.0047	10	500	217623		Suflex	HS2402/500 Po.
C97	Not fitted						
C98	.25	20	150	206502	011-9830	Hunt	W49/B501 Pa.
C99	.25	25	350	206704	011-9832	Hunt	B513 Pa.
C100	2.5	2	150	N20067		T.M.C.	CE6032NF

CAPACITORS Class Group No. 5910. Country of Origin Code 99.

Circuit Ref.	Value µFd	Tol. %	Rating Volts	Solartron Part No.	Inter-Service Ref. No.	Manufacturer & Type	
C101	Not fitted						
C102	2.5	2	150	N20067		T.M.C.	CE6032NF
C103	.1	25	150	N20138	011-9827	Hunt	B500 Pa.
C104	.1	25	150	N20138	011-9827	Hunt	B500 Pa.
C105	.5	25	250	206604	011-9834	Hunt	B508 Pa.
C106	6	25	250	N20044		Hunt	W49/1B554 Pa.

VALVES AND RECTIFIERS Class Group No. 5960 Country of Origin Code 99.

Circuit Ref.	Description	Solartron Part No.	Inter-Service Ref. No.	Manufacturer & Type	
V1	Pentode		000-5086	S.T.C.	6BS7
V2	Pentode		000-4014	G.E.	QA2403
V3	Double triode		000-4024	S.T.C.	12AT7
V4	Pentode -		000-5060	G.E.	Z759
V5	Pentode -			G.E.	Z759S
V6	Pentode			G.E.	Z759S
V7	Double triode		000-4024	S.T.C.	12AT7
V8	Not fitted				
V9	Double diode		000-4007	Mullard	M8079
V10	Pentode —		000-5060	G.E.	Z759
V11	Double triode		000-4024	S.T.C.	12AT7
V12	Double triode		000-4024	S.T.C.	12AT7
V13	Pentode -		000-5060	G.E.	Z759
V14	Pentode -		000-5060	G.E.	Z759
V15	Double triode		000-4024	S.T.C.	12AT7
V16	Pentode		000-4014	G.E.	QA2403
V17	Double triode		000-4024	S.T.C.	12AT7
V18	Double triode		000-4024	S.T.C.	12AT7
V19	Pentode		000-4014	G.E.	QA2403
V20	Double triode		000-4024	S.T.C.	12AT7
V21	Fullwave rectifier		000-5745	Mullard	GZ33
V22	Fullwave rectifier		000-5072	Mullard	EZ81
V23	Beam tetrode		000-4043	Mullard	6061
V24	Beam tetrode		000-4043	Mullard	6061
V25	Pentode		000-4062	G.E.	A2134
V26	Pentode		000-4062	G.E.	A2134
V27	Double triode		000-4024	S.T.C.	12AT7
V28	Voltage regulator		000-4048	Mullard	85A2
V29	Double triode		000-4004	S.T.C.	6057
V30	Pentode		000-4014	G.E.	C A2403
V31	Half wave rectifier		000-0261	S.T.C.	R10
V32	Double diode		000-4007	Mullard	M8079
V33	Cathode ray tube			E.T.	4E P7
V34	Half wave rectifier		000-0261	S.T.C.	R10
V35	Double triode		000-4024	S.T.C.	12AT7
X1	Crystal diode		000-0448	G.E.	GEX54
X2	Crystal diode		000-0448	G.E.	GEX54
X3	Crystal diode		000-0448	G.E.	GEX54

MISCELLANEOUS

Circuit Ref.	Description	Solartron Part No.	Inter-Service Ref. No.	Manufacturer & Type	
FS1	Fuse, 3 amp	372275	5920-99-059-0111	Belling & Lee	L1055/3.0A
L1	Choke 5H. 250 mA			Parmeko	P486
L2	Choke 10H. 120 mA			Parmeko	P478
L3	Choke 10H. 75 mA			Parmeko	P474
LP1	Lamp. Festoon 6V, 1A		6240-99-995-9119	Thorn	7.5mm
LP2	Lamp, 3.5V, .15A		6240-99-995-1123	Thorn	11mm MES
LP3	Lamp 3.5V, .15A		6240-99-995-1123	Thorn	11mm MES
MSP	Main Selector Panel	279001		McMurdo	
PL1	Plug Mk. 1V 4 pin		AP208607	Plessey	CZ48993/5
SK1	Socket coaxial		5935-99-911-6872	Transradio	UG-447/U
SK2	Socket Mk. 1V 4 pin		AP208708	Plessey	CZ49221
SW1	Switch, Wafer	261023			
SW2	Switch, Wafer	261024			
SW3	Switch, Wafer	261025			
SW4	Switch, Toggle		5930-99-943-6775	Painton	501085
SW5	Switch, Wafer	261028			
SW6	Switch, Wafer	261026			
SW7	Switch, Wafer	261027			
SW8	Switch, Toggle		5930-99-943-6775	Painton	501085
SW9	Switch, Toggle		5930-99-943-6775	Painton	501085
T1	Transformer, mains	295015		Parmeko	
T2	Transformer, EHT	295016		Parmeko	
TL1	Terminal, Spring loaded	B5059	5940-99-999-6450	Solartron	
TL2	Terminal, Spring loaded	B5059	5940-99-999-6450	Solartron	
TL3	Terminal, Spring loaded	B5059	5940-99-999-6450	Solartron	
TL4	Terminal, Spring loaded	B5059	5940-99-999-6450	Solartron	
TL5	Terminal, Spring loaded	311147	5940-99-911-4721	Painton	
TL6	Terminal, Spring loaded	311147	5940-99-911-4721	Painton	

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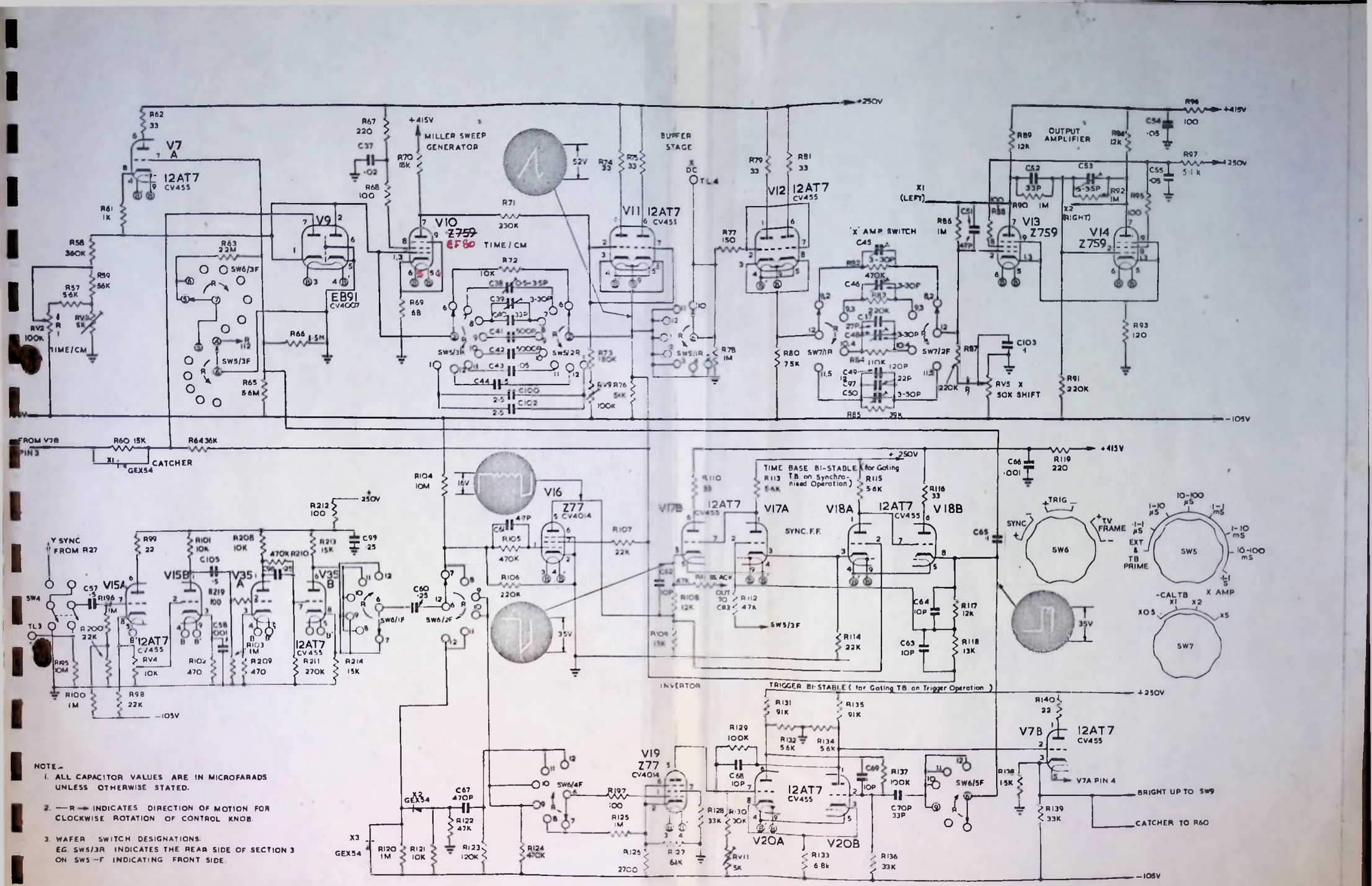

NOTE:-

1. ALL CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE STATED.
2. —R→ INDICATES DIRECTION OF MOTION FOR CLOCKWISE ROTATION OF CONTROL KNOB.
3. WAFER SWITCH DESIGNATIONS. EG. SW5/3R INDICATES THE REAR SIDE OF SECTION 3 ON SW5 —F INDICATING FRONT SIDE.

SOLARSCOPE CD.523S.2
CIRCUIT DIAGRAM 'X' SYSTEM
SHEET 2 OF 3. DRAWING No. DC 523S.2

CIRCUIT DIAGRAM Y AMPLIFIER SHEET 1 DC5235.2
CIRCUIT DIAGRAM POWER SUPPLY SHEET 3. DC 523S.2

NOTE:—

1. ALL CAPACITOR VALUES ARE GIVEN IN MICROFARADS UNLESS OTHERWISE STATED
2. —R→ INDICATES DIRECTION OF MOTION FOR CLOCKWISE ROTATION OF CONTROL KNOB

SOLARSCOPE CD.523S.2

CIRCUIT DIAGRAM POWER SUPPLY
SHEET 3 OF 3
DRAWING No DC. 523S.2