

MINIATURE CATHODE RAY OSCILLOSCOPE

OPERATING INSTRUCTIONS

INTRODUCTION.

The complete equipment comprises the following items.

OSCILLOSCOPE.

Test Lead. This is single-core screened cable with p.v.c. outer sheath and the screening is used as one of the conductors.

Mains Lead. This is terminated in a specially designed plug engraved on three sides, "110V," "180V" and "230V" respectively.

Black Carrying Case.

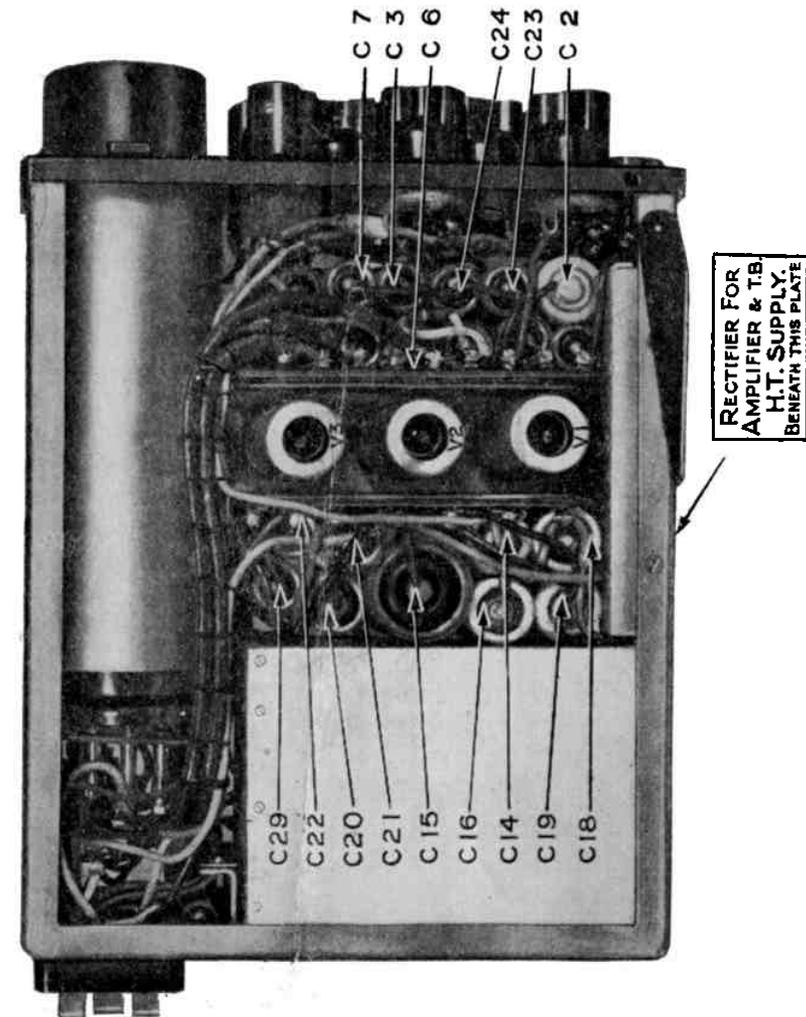
A mumetal shield around the cathode-ray tube is incorporated to guard against interference from magnetic fields.

The multiway socket on the top of the instrument case is provided for use with additional miniature equipment namely, a Double Beam Unit, and an Intermediate Frequency Alignment Unit, and other attachments such as Signal Gen, Crystal Calibrator, etc.

The short, detachable tubular hood over the screen aperture provides a means of fixing viewing lenses or camera attachments in front of the screen.

Users of the oscilloscope will appreciate that, in the design of a reliable self-contained oscilloscope of such small size and weight, certain compromises had to be reached for the sake of compactness. These, however, have no serious adverse effect on the usefulness of the instrument and the simple precautions to be taken to ensure long and satisfactory service from the instrument are dealt with fully in appropriate sections of the following notes.

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Case removed showing Valves and Condensers

SUPPLIES.

The instrument can be operated from the following sources :—

- (a) 110 volts, 50/100 cycles A.C.
- (b) 180 volts, 500 cycles A.C.
- (c) 230/250 volts, 50/100 cycles A.C.

IMPORTANT.

To connect the instrument to the supply, attach the special mains plug to the instrument so that the voltage marking on the uppermost side of the plug corresponds to the mains supply voltage.

The instrument should not be operated on supply voltages varying more than plus or minus 5% from the indicated values or short life of certain of the components may be experienced.

The case of the instrument must be earthed when in use. To do this connect the earthing terminal on the rear of the instrument to a suitable earthing point.

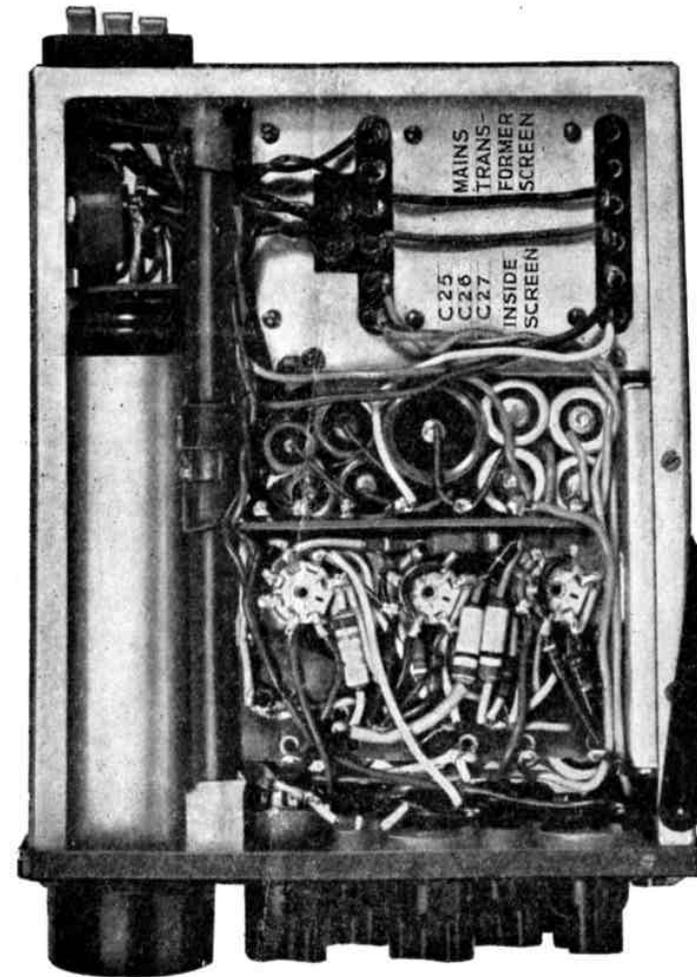
CONTROLS.

“ **BRILL** ” (Brilliance).

Clockwise rotation of this control increases the brilliance of the luminous trace on the screen.

The tube is being operated under conditions which could result in the burning of the luminescent screen if a spot or stationary trace were to be left on the screen for an average period of about 50 hours with the brilliance control set to maximum brilliance. There will, of course, be considerable variations among different cathode-ray tubes in regard to the seriousness of this screen-burning but, in general, it must be emphasised that tubes should always be run with the minimum brilliance consistent with satisfactory observation on the trace. In brightly lit surroundings observations should therefore be carried out with the aid of a hood. The provision of the green celluloid filter in front of the screen assists materially in increasing the apparent brilliance of the trace relative to its background. Finally, in accordance with best oscillograph practice, the brilliancy control should always be turned right down whenever the instrument is standing by and is not being used for immediate observations.

It must be remembered, however, that even when traces of burning of the luminescent coating do finally appear on the screen, the tube remains useful for a long time afterwards.



Showing Transformer, Resistances and Wiring

Brilliance Modulation.

External signals may be fed in at the socket marked "GRID"; according to the relative values of the peak of the signal and the setting of the brilliance control, this signal will then modulate the brightness of the trace.

This method is often used for frequency comparisons.

FOCUS.

This control is preset and is adjusted during final inspection of the instrument to give the sharpest line trace. It will not normally be necessary to readjust this control except when a replacement cathode-ray tube has to be fitted. The control is accessible for screwdriver adjustment on top of the instrument near the multiway socket.

"TIME BASE."

This switch has two positions

- "ON." In this position the output from the time base appears on the socket marked "TB out" at the rear of the instrument. This socket may be linked to the free X deflector plate socket marked "X" for providing a linear horizontal sweep of the cathode-ray beam. Control of the frequency of sweep is provided by the four-position switch marked "COARSE" and potentiometer marked "FINE."
- "OFF." In this position the time base circuit is rendered inoperative. The "X" deflector plate may then be controlled from an external source such as a special time base or a signal to be compared with another applied to the free "Y" plate. Such inputs should be connected to socket "X" and the socket "E" at the rear (or front) of the instrument. See also "REAR PANEL" below.
- "GAIN." This controls the degree of signal amplification.
- "X" Shift. Moves the complete trace horizontally.
- "Y" Shift. Moves the complete trace vertically.
- "SYNC." Controls the magnitude of the synchronising signal fed to the time base.

REAR PANEL.

For ordinary use, i.e., the examination of recurrent waveforms against the built-in time base, the four shorting-link plugs should join sockets:—

- "Y" and "AMP OUT," "TB OUT" and "X," "SYNC OUT" and "SYNC IN," "BLACKOUT" and "GRID."
(See "Blackout" below.)

Note.—Socket "E" on this panel is connected internally to socket "E" on the front panel. The former is, of course, more convenient when using an external time base or in feeding a signal direct to the "Y" (or "X" plates and the latter when using the amplifier attenuator.

SIGNAL INPUTS.

On the front panel, socket "L" is for signal voltages up to 10 volts peak, socket "M" for voltages between 10 volts and 70 volts peak and socket "H" for voltages between 70 volts and 500 volts peak. Higher voltages must be applied through an external attenuator. Signals may also be applied directly to the "X" and "Y" deflector plates by means of the sockets at the rear of the instrument. In all cases the "Earthy" side of the signal input should be connected to socket "E."

In using the test lead provided with the instrument, make sure that the black wanderplug is always inserted in the socket marked "E"; the red plug should be inserted in socket "L," "M" or "H" as explained above. Of the two clips at the other end of the test lead, the one wired to the black extension flex is the "earthy" connection.

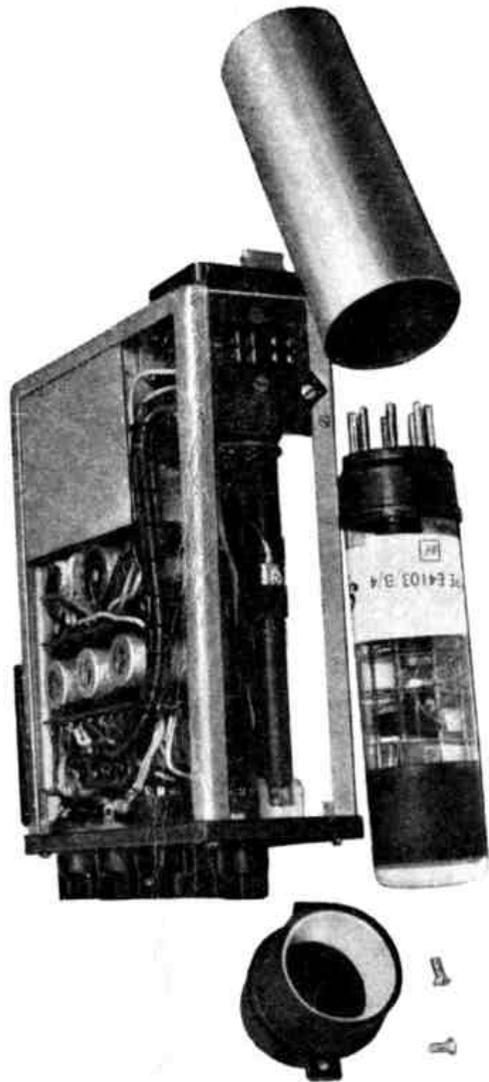
SYNCHRONISING.

The usual arrangements for synchronising the input signal with the time base, to give stationary patterns, are provided. The synchronising voltage is normally obtained from the signal itself by using part of the signal to the "Y" deflector plate appearing at the socket "SYNC OUT." This is applied by means of the link provided to the socket "SYNC IN."

In all oscilloscopes, use of excessive synchronising voltage may result in some distortion of the trace and the least possible amount therefore should be used. To ensure this, the time base "FINE" control should be carefully adjusted, with the "SYNC" control fully anti-clockwise, until the trace is as nearly as possible stationary. The "SYNC" control may then be advanced until the trace "locks" in position on the screen. During adjustment of the "SYNC" control, some very slight readjustment of the time base "FINE" control may sometimes be helpful in obtaining a stationary trace with the minimum of synchronising voltage.

BLACKOUT.

Whenever possible the instrument should be operated without the link joining "Blackout" to "Grid" at the rear panel. Whilst this link provides blackout of the time base fly-back, it also, to some extent, modulates the forward stroke of the time base. This results in uneven brilliance along the trace at lower brilliancy levels and may prompt



View showing Cathode Ray Tube removed

the user to increase this level in order to mask the effect and thus cause screenburn. Without fly-back blackout the trace remains uniformly bright and may be controlled uniformly in brilliance along its whole length. If an external time base is in use and blackout is desired, the blackout signal should be fed to the " GRID " socket.

IMPORTANT.

To obtain maximum life from the rectifiers the instrument should always be switched off when not in use, and in any case, should not be operated continuously for a longer period than six hours.

To ensure efficient ventilation, the hinged support at the front of the instrument must always be used. This also gives a very convenient viewing angle for general bench work, i.e., about 70 degs., to the horizontal.

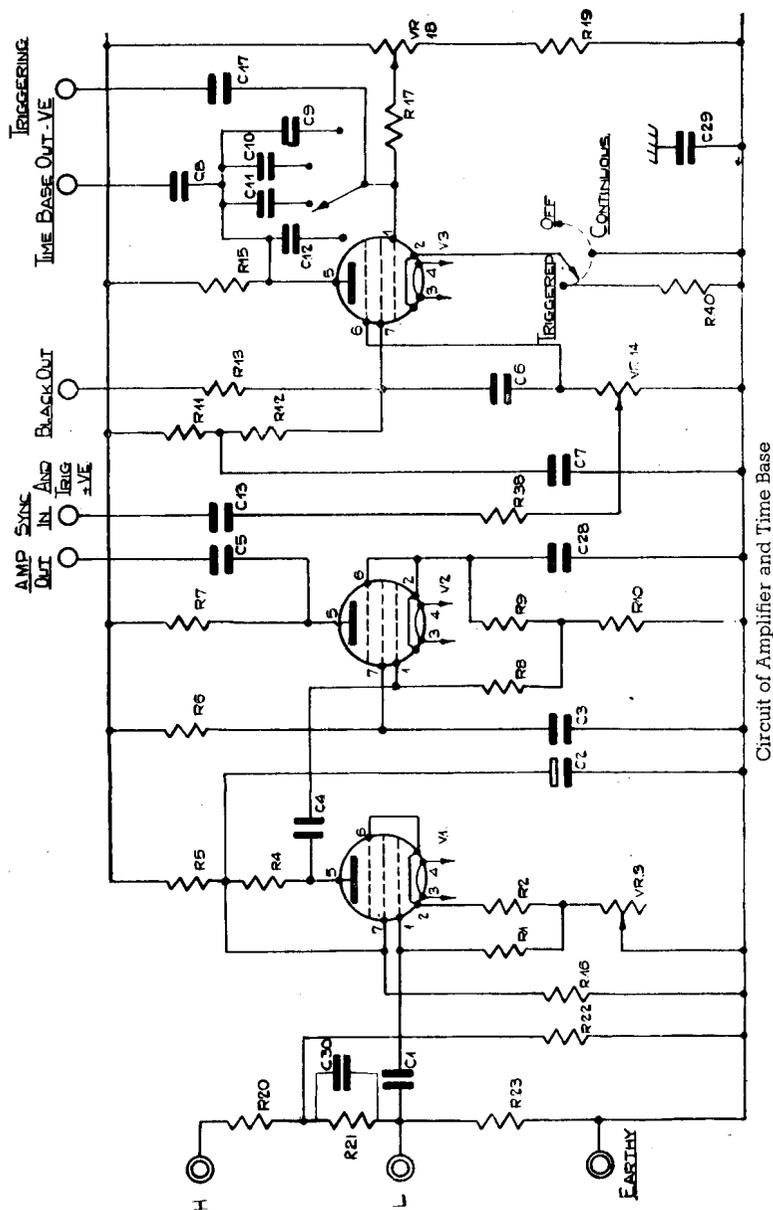
SERVICING INSTRUCTIONS

CATHODE RAY TUBE—REPLACEMENT.

1. Remove the instrument from case ; by removing the earth screws and locking nut.
2. Remove two hood-fixing screws on front panel.
3. Withdraw hood, tube and screen together from the cathode-ray tube connection socket—avoid disturbing the position of this connector. (See 6 below.)
4. Remove mumetal screen (no screws).
5. Withdraw tube from hood.
6. Fit replacement tube into hood. In doing this make sure that the tube is fitted in the hood in such a way that the original position of the connector is not disturbed.
7. Refit mumetal screen and refit the complete assembly.
8. Before replacing the cover, check that the " X " sweep is horizontal by connecting up the instrument, if not, disconnect the instrument from the supply and make the necessary adjustment to the tube position.
9. Finally, adjust the focus control to give the sharpest possible line trace.

VALVES —REPLACEMENT.

Remove, by slight anti-clockwise twist, the internally-sprung valve screen covers : valves can then be withdrawn. Counting from the valve nearest the base of the instrument the order is as follows : 1st and 2nd amplifier valves, time base valve.



SUMMARISED SPECIFICATION

POWER RATING.

A.C. Mains Voltage ...	...	230/250 v. 50/60 c.p.s.
		110 v. 50/100 c.p.s.
		180 v. 500 c.p.s.
Power Consumption...	...	Approx 25 watts.
E.H.T. volts across C20 & C21	...	650 v.
H.T. volts. across C18 & C19	...	350 v.

CATHODE RAY TUBE.

Types ...	...	E-4103-B-4 (G.E.C.)
Heater ...	...	4.0 v.
Screen diameter ...	...	1½"
Sensitivity of " X " plates ...	...	50 v./cm.
Sensitivity of " Y " plates ...	...	60 v./cm.

TIME BASE.

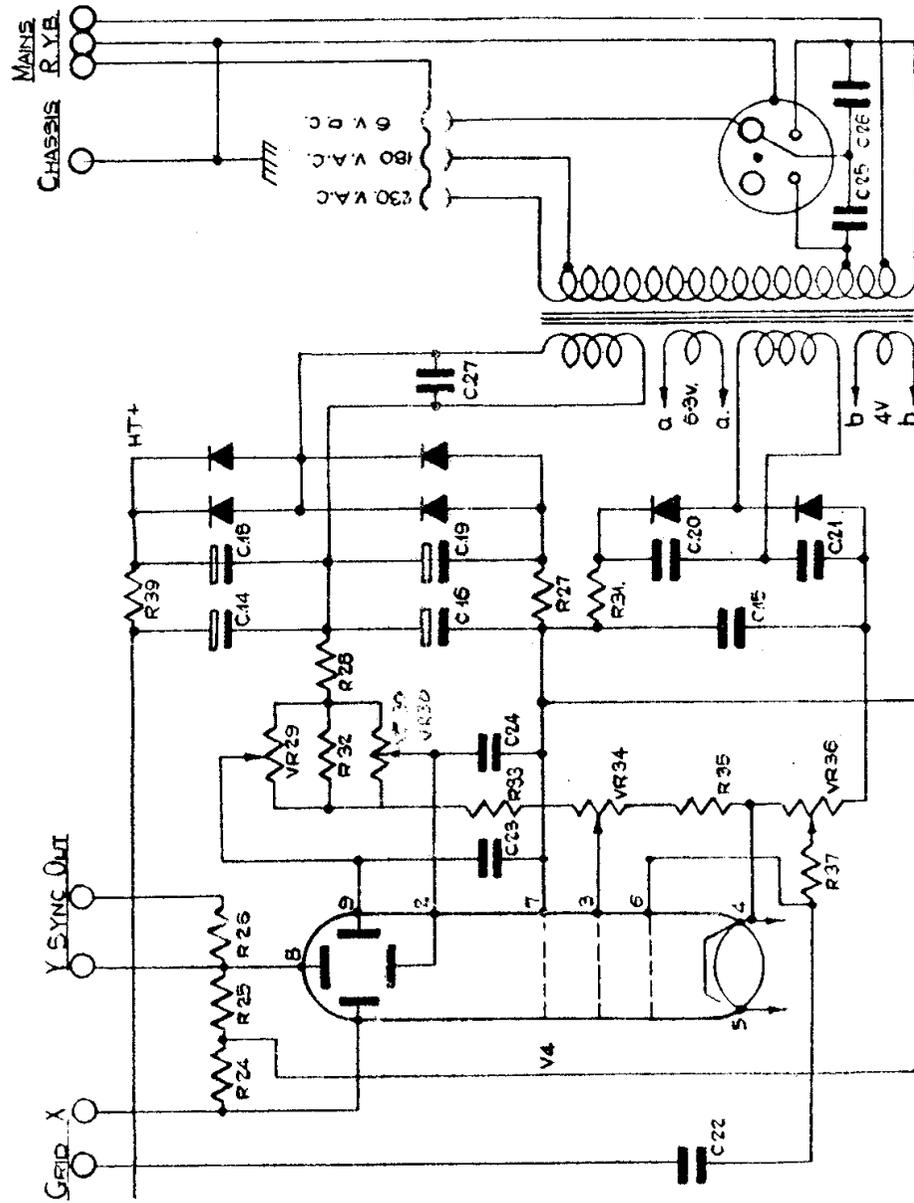
Type ...	...	" Hard " single-valve (pentode type Z77 Osram).
Frequency range ...	...	10-50,000 c.p.s.
		<i>Coarse.</i> <i>Fine.</i>
Sweep frequency ranges ...		
	1 ...	<i>Min.</i> <i>Max.</i>
	2 ...	10 120
	3 ...	100 1,200
	4 ...	1,000 12,000
		5,000 50,000

SIGNAL AMPLIFIER.

Type ...	...	2-stage r.c.-coupled with negative feed-back on both stages. (Two pentodes type Z77 Osram.)
Gain (max.) ...	...	150 (approx.)
Frequency range (plus or minus 1.5 db.	...	50 to 300,000 c.p.s. on input L and M.
Plus or minus 3 db. ...	...	50 to 100,000 c.p.s. on input H.

INPUT IMPEDANCES. (Approx. Minimum Values.)

To amplifier/attenuator input socket :—" L " ...	...	Min. 0.5 megohm, max. 1 megohm.
" M " and " H " ...	...	1 megohm.
To " X " plate socket ...	...	4.7 megohms.
To " Y " plate socket ...	...	2.2 megohms.
To " GRID " socket ...	...	0.1. megohm.



Circuit Cathode Ray Tube Supplies

KEY	TO CONTROLS
REF.	ADJUSTMENT
VR3	GAIN
VR14	SYNC
VR18	TIME BASE FINE
S2	TIME BASE COARSE
S1	TIME BASE
VR29	X SHIFT
VR30	Y SHIFT
VR36	BRILL
VR34	FOCUS PRESET

