GRAPHOSCOPE 126

ENGINEERS AND
MANUFACTURERS OF
ELECTRICAL EQUIPMENT

The CLOUGH-BRENGLE CO.

CHICAGO, U. S. A.

W A R R A N T Y

We warrant each new instrument manufactured and/or sold by us to be free from defects in material and workmanship under normal use and service. Our obligation under this warranty is limited to repairing (or replacing, at our option) any instrument (except tubes) which shall within ninety days after delivery to the customer prove by our examination to be thus defective.

In the interest of the purchaser as well as ourselves, the operation of this guarantee is conditioned upon the following procedure, established for the purpose of servicing as speedily and economically as possible, apparatus that may be defective or appear to be so.

1. Write stating trouble and request permission to return apparatus for examination. The reason for this is that frequently we find no real trouble, but only a misunderstanding of the functions and uses of the instrument, which we are able promptly to correct by letter. Where we find that replacement of a reportedly defective part would upset calibration, we request return of the entire instrument, for recalibration as well as repair.

2. Return the apparatus transportation prepaid, provided our analysis of reported trouble proves this necessary. Our reason for this, quite frankly, is to save payment of transportation on instruments that have been damaged through tampering, misuse, negligence, accident or other fault not our own. Where our examination discloses a genuine manufacturing defect within our guarantee period, prepaid transportation charges are cheerfully refunded.

3. Each instrument must be returned to us complete. This requirement hardly needs explanation, since obviously we do not guarantee instruments from which parts have been removed.

Vacuum tubes are specifically excluded from the terms of the guarantee, due to their nature as well as the fact that they are separately and specifically guaranteed by the manufacturer. All claims for tube adjustment must be made against the tube manufacturer.

This guarantee is expressly in lieu of all other guarantees, expressed or implied, and of all other obligations on our part, and no other representative or person is authorized or permitted to make any guarantee or to assume for this Company any liability not strictly in accordance with the foregoing.

This guarantee will not apply to any product which has been subjected to tampering, misuse, negligence, or accident, or which has the serial number altered, removed, or effaced.

THE CLOUGH-BRENGLE COMPANY

2815 W. NINETEENTH STREET

CHICAGO, ILLINOIS - U.S.A.

INSTRUCTIONS
G R A P H O S C O P E
Model 126
CLOUGH-BRENGLE CO.

(1) SETTING UP THE INSTRUMENT.
The 906 tube is rotatable in its mount to bring the axes of deflection into line with the calibrated screen. If this adjustment proves necessary, see Par. (2).

To get at the tube mount, remove the two screws at the upper corners of the front panel and the three screws in the forward edge of the bottom. Removal of the two screws at the rear of the base will now permit withdrawal of the front panel and case assembly from the case.

(2) INTENSITY AND FOCUS CONTROLS.
These are at the lower left of the panel. The INTENSITY control also carries the on-off switch for the line, in the extreme counter-clockwise position.

To set the axes of the tube, turn the VERTICAL amplitude control to 0, and the SWEEP control to 60 cycles. The HORIZONTAL amplitude control should be set to about 5. Next set the controls INTENSITY and FOCUS so that the arrows are approximately vertical, and plug in the line cord. After the tube has had about three minutes to warm up, a line or green haze should be seen on the screen of the tube. Adjust INTENSITY AND FOCUS simultaneously until the line has been focused to about 1/64" width. The BEAM CENTERING controls should now be adjusted until the line is centered on the screen of the tube.

(3) THE SCALE.
A transparent scale is provided for insertion into the grooves of the rubber bumpers spaced around the face of the 906 tube. This scale is divided into ten equal divisions in both vertical and horizontal direction, and is a great aid in observing the various patterns formed on the tube screen.

Scale and tube should be adjusted until the horizontal line pattern on the screen lines up with the horizontal rulings on the scale, after which the tube should be tightened down permanently with the thumb nuts and the case replaced.

Scales for special problems may be made on blank pyralin, which we will be glad to supply, cut to size, on order.

(4) BEAM CENTERING.
The initial setting of the spot or trace will vary with the type of measurement to be made. It is controlled by the two knobs designated LEFT-RIGHT and UP-DOWN, the first mentioned moving the spot from side to side, and the second up and down. For the general run of applications, these adjustments should center the spot on the scale. For others, such as frequency alignment of radio receivers, it will be desirable to move the spot pretty well up or down on the screen initially,

depending on the type of detector used in the output of the receiver. This matter is treated more fully in the instructions for the MODEL OMA Frequency Modulated Oscillator, the MODEL 111 Modulator and the MODEL 127 Combined Graphoscope and Frequency Modulator.

(5) APPLICATION OF VERTICAL VOLTAGES.

With the above adjustments made, the instrument is ready for the study of voltages applied to the vertical plates. Binding posts for these connections are marked VERT. The lower post of the pair, marked GND (ground), should always be connected to the earth or low potential side of the circuit under test. If the instrument is used in a room containing equipment or wiring that causes stray fields, it will be necessary actually to ground this post to prevent spurious deflections of the instrument.

The application of voltages to the vertical plates through the amplifier is controlled by the knob at the right of the panel marked VERTICAL.

With the vertical amplifier in use and adjusted to high gain, the vertical posts will be found very sensitive to stray AC fields. For this reason it is suggested that the high lead to the vertical posts be shielded, whenever the capacity of such shielding will not disturb the circuit under test.

(6) USE OF VERTICAL PLATES WITHOUT AMPLIFICATION.

Certain applications of the Graphoscope may require the use of the vertical deflection plates without amplification. This may occur when the voltage to be viewed is high (50-400 volts), or when the frequency is so high as to be outside the range of the amplifier (100,000 cycles).

If this is the case, the test voltage may be applied to the binding head screw marked V on the rear of the case, after removing the strap connecting the two posts.

(7) APPLICATION OF LINEAR SWEEP TO THE HORIZONTAL PLATES.

The Linear Sweep is used in the determination of wave form of the output of audio amplifiers and modulation measurements, as described in the CLOUGH-BRENGLE Application Bulletin entitled "Cathode-Ray Testing and Analysis".

The Sweep consists of an 884 tube functioning as a saw-tooth wave generator, together with a 42 amplifier tube connected as a triode and so biased as to straighten out the inherent non-linearity of the condenser charging cycle and to bring the output perfectly into line. The sweep is applied to the horizontal plates by turning the SWEEP switch to LINEAR.

(8) LINEAR SWEEP RATE.

The knob marked FREQUENCY in the center of the panel adjusts the rate in coarse steps from 15 to 30,000 sweeps or cycles per second,

substantially as marked on the panel.

Precise setting of the sweep frequency is made by the VERNIER knob at the left of the step control.

(9) SELECTING THE PROPER FREQUENCY.
The sweep rate should always be equal to or less than the frequency of the voltage under observation. If the sweep rate is equal to the frequency of the observed voltage, a single complete cycle will be traced on the screen. With a sweep rate one-half the frequency of the observed voltage, two waves will be seen, etc. (See Patterns 5 & 6 of the C-B Application Bulletin).

(10) DOUBLE TRACES - MULTIPLE TRACES.
Misadjustments of sweep frequency to observed frequency give stationary patterns consisting of multiple traces directly on top of each other. Such traces do not reveal the true wave being studied and so are to be avoided. The most common cause of such traces is setting the sweep rate to a higher frequency than that of the wave, although setting to some of the harmonic ratios, such as 2/3, 3/4, 4/5, etc., will also cause multiple traces. To correct, readjust the sweep to a lower frequency until a single trace of the desired number of cycles is seen. (See Pattern No. 7).

(11) CONTROL OF THE PATTERN (SYNCHRONIZATION).
When the correct sweep rate has been found, the pattern will drift across the face of the tube, unless a small amount of voltage of related frequency is introduced into the grid circuit of the 884 tube to synchronize the sweep rate precisely.

Choice of voltage for this purpose is given by the switch marked CONTROL. The amount of voltage is controlled by the 0-10 dial, SYNC. (synchronization).

With the CONTROL switch set on INTERNAL, control voltage for the grid circuit of the 884 is obtained from the voltage applied to the vertical plates of the cathode-ray tube.

With the CONTROL switch set to EXT. (external), control voltage may be applied to the grid of the 884 from any external source, through the binding post marked EXT. SYNC. (external synchronization).

With the CONTROL switch set to 60 cycles, control is from a tap on the power transformer within the Graphoscope, for holding the linear sweep to a 60-cycle rate.

(12) LIMITATION OF VOLTAGES APPLIED.
In order to avoid damage to any of the internal parts of the instrument, it is important that the peak voltage applied to the horizontal or vertical binding posts be limited to 400 volts.

This requires an external transformer or dropping resistor for excessive AC potentials, and a guard circuit consisting of a condenser and resistor, for circuits having excessive DC potentials.

In applying external protective circuits, care should be exercised to see that the circuit reactances are such as not to distort the wave to be observed.

(13) AMPLIFICATION ON THE HORIZONTAL PLATES.

A few applications call for amplification of an external voltage to the horizontal plates, where available voltage is too small to give a suitable deflection.

This is provided by turning the SWEEP switch to LINEAR, and the FREQUENCY switch to the position marked TO HORIZONTAL THRU AMPLIFIER. The external voltage may then be connected to the horizontal input binding posts for amplification by the 42 tube of the linear sweep circuit, before being applied to the deflecting plates.

(14) PERFORMANCE DATA.

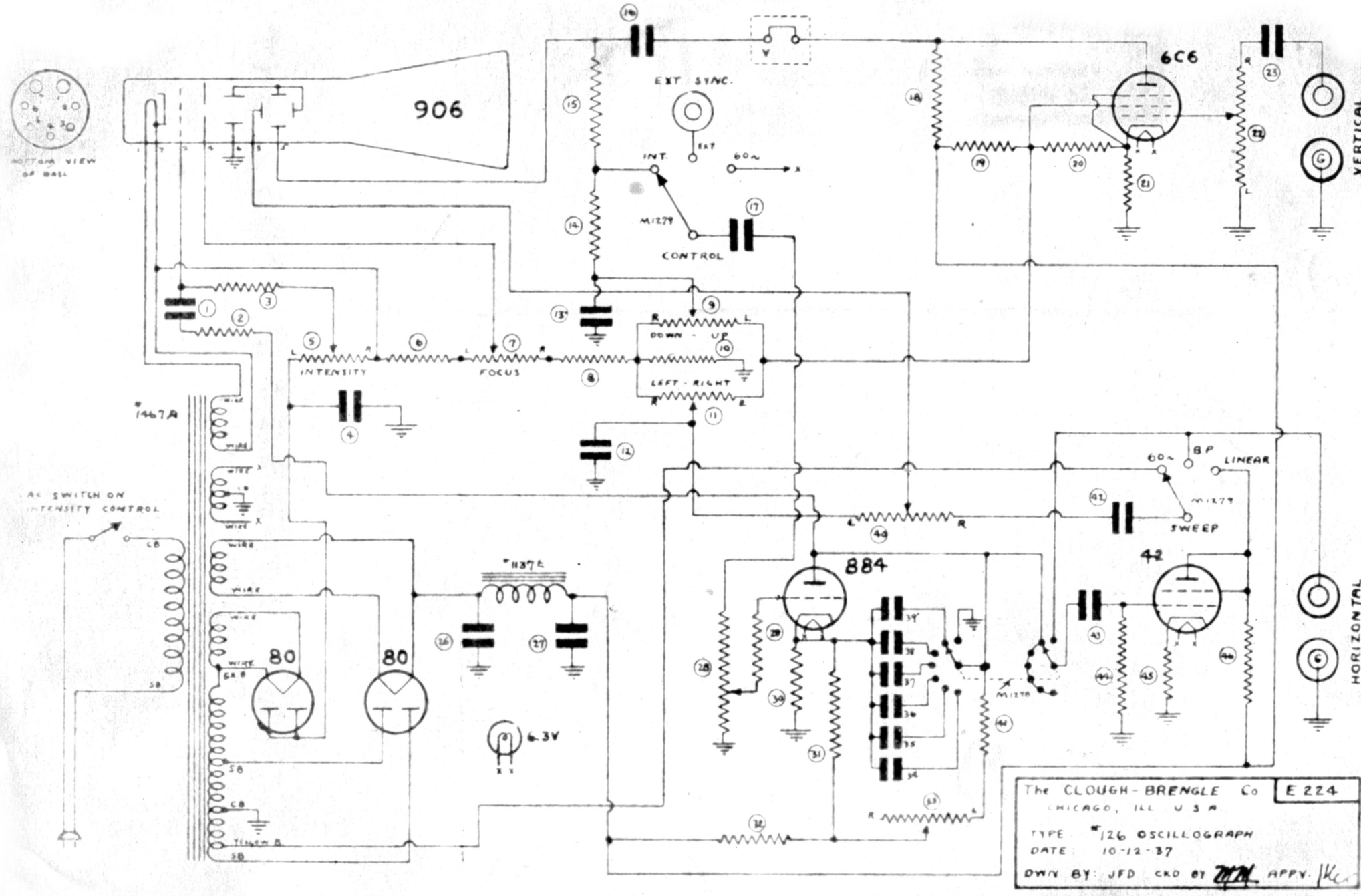
The average characteristics of the 126 Graphoscope are as follows:

Sensitivities.

Vertical amplifier	.26 Volts RMS/Inch.
Horizontal amplifier	6.8 Volts RMS/Inch.
Vertical plates (no amplifier)	25 Volts RMS/Inch.
Horizontal plates (no amplifier)	20 Volts RMS/Inch.

Input Impedances.

To Vertical amplifier	1 megohm.
To Horizontal amplifier	2.5 megohms.
To Vertical plates (no amplifier)	5 megohms.
To Horizontal plates (no amplifier)	2.5 megohms.


906
BOTTOM VIEW OF BASE
EXT. SYNC.
INT.
EXT
60~
X
M1279
CONTROL
6C6
INTENSITY
FOCUS
DOWN - UP
LEFT - RIGHT
*1467A
AC SWITCH ON INTENSITY CONTROL
CB
SB
WIRE
80
80
*1137E
6.3V
884
42
60~
BP
LINEAR
SWEEP
M1279
VERTICAL
HORIZONTAL
The CLOUGH-BRENGLE Co
CHICAGO, ILL U.S.A.
E 224
TYPE *126 OSCILLOGRAPH
DATE 10-12-37
DWN BY: JFD CKD BY APPV.

LEGEND # 127 Graphoscope & Freq. Mea. E 227
also for # 128 Graphoscope E224

1. 60 mmf mica condenser
2. 200,000 ohm ± 20% ½ watt resistor
3. 50,000 ohm ± 10% ½ " "
4. .5 mfd. 600 V. condenser
5. 200,000 ohm pot. Curve 1 with AC switch
6. 250,000 ohm ± 10% ½ watt resistor
7. 500,000 ohm Curve 1 pot.
8. 1 megohm ± 10% ½ watt resistor (on #126 may be 500,000 ohm)
9. 1 megohm Curve 1 pot.
10. 2 megohm ± 20% ½ watt resistor
11. 1 megohm Curve 1 pot.
12. .5 mfd. 200 V. condenser
13. .05 mfd. 400 V. "
14. 1 megohm ± 20% watt resistor
15. 5 megohm ± 20% ½ " "
16. .25 mfd. 400 V. Condenser
17. .05 mfd. 400 V. "
18. 100,000 ohm ± 10% ½ watt resistor
19. 25,000 ohm ± 10% 5 watt resistor
20. 7,500 ohm ± 5% 1 watt resistor
21. 140 ohm ± 5% ½ " "
22. 1 megohm Curve 1 pot.
23. .25 mfd. 400 V. condenser
24. .02 mfd. 400 V. "
25. .02 mfd. 400 V. "
26. 4 mfd. 450 V. condenser
27. 8 mfd. 450 V. "
28. 75,000 ohm Curve 1 pot.
29. 100,000 ohm ± 20% ½ watt resistor
30. 1638 ohm ± 5% ½ " "
31. 100,000 ohm ± 10% 1 watt resistor
32. 30,000 ohm ± 10% ½ " "
33. 5 megohm Curve 1 pot.
34. .08 mfd. ± 10% 400 V. condenser
35. .02 mfd. " " "
36. .0056 mfd. " " "
37. 1500 mmf. " Mica condenser
38. 390 mmf. " " "
39. 95 mmf. " " "
40. 2.5 megohm Curve 1 pot.
41. 1 megohm ± 5% ½ watt resistor
42. .1 mfd. 400 V. condenser
43. .1 mfd. 400 V. "
44. 10 megohm ± 20 % ½ watt resistor
45. 18,750 ohm ± 5% ½ " "
46. 125,000 ohm ± 10% ½ " "
47. 5000 ohm ± 10% 10 watt resistor
48. 300,000 ohm ± 10% ½ " "
49. .005 mfd. 200 V. condenser
50. .005 mfd. 200 V. "
51. 2000 ohm Curve 1 pot.
52. 3500 ohm ± 5% ½ watt resistor
53. 3500 ohm ± 5% ½ " "
54. 100,000 ohm ± 10% 1 watt resistor
55. 100,000 ohm ± 10% 1 watt resistor
56. 25,000 ohm Curve 1 pot.
57. 10,000 ohm ± 5% ½ watt resistor
58. 10,000 ohm ± 5% ½ " "
59. .005 mfd. 400 V. condenser
60. 100 mmf. mica condenser
61. 19,800 ohm ± 10% ½ watt resistor
62. 19,800 ohm ± 10% ½ " "
63. 2200 ohm ± 10% ½ " "
64. 2445 ohm ± 10% ½ " "
65. 35 mmf mica condenser
66. .005 mfd. 400 V. condenser
67. .005 mfd. 400 V. condenser
68. 1000 ohm ± 10% ½ watt resistor
69. 15,000 ohm ± 10% 1 watt resistor
70. 15,000 ohm ± 10% 1 watt resistor
71. .005 mfd. 200 V. condenser
72. 250 ohm ± 10% ½ watt resistor
73. 300 ohm WW copper resistor
74. .02 mfd. 200 V. condenser
75. .02 mfd. 200 V. "
76. 100,000 ohm ± 10% ½ watt resistor
77. 100 mmf mica condenser
78. .005 mfd. 400 V. condenser
79. 90 mmf. variable condenser
80. 110 ohm WW resistor (#1423A)
81. .01 mfd. 400 V. condenser.
82. .01 mfd. 200 V. "
83. 500 ohm ± 10% ½ watt resistor
84. 400 ohm linear pot. WW.

The Clough-Brengle Co.
Chicago, Ill. U.S.A.