

**Philips measuring instruments
for
laboratories, workshops and test stations**

Philips Valve Tester "Cartomatic I" GM 7629



Fig. 1
Philips Valve Tester "Cartomatic I" type GM 7629.

Philips Valve Tester GM 7629 is a service instrument capable of performing all the usual tests on radio valves, as well as current, voltage, capacitance and resistance measurements.

All the settings of the instrument are effected automatically by means of a contact box having 140 contacts (see Fig. 2) and suitably perforated cards (Fig.3).

Only those contacts which are

opposite to the perforations can be closed, and the correct strappings for the currents and voltages required for the measurement are therefore automatically established. Measurement is extremely simple, quick and reliable, and the required cards are supplied with each unit.

The 140 conical, silver-plated contact pins are disposed opposite solid silver contact plates which are automatically maintained in a bright condition by the friction set up by the closing of the contact box. The latter also contains a safety contact, by means of which the mains circuit is closed only when the card has been correctly inserted.

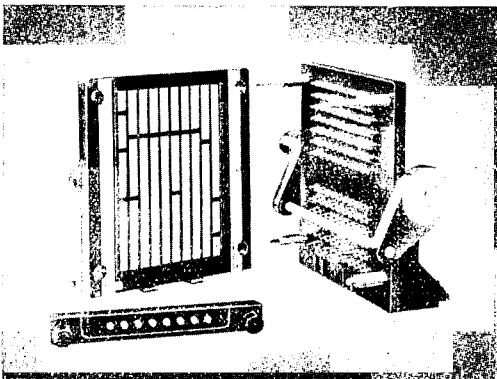


Fig. 2
Contact box with 140 contacts.

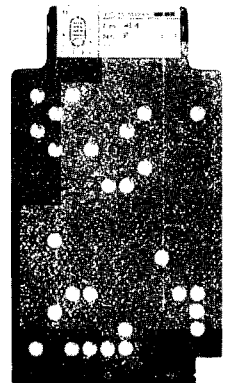


Fig. 3
Perforated card

The unit is equipped with 12 different types of valve-holders to accommodate almost every current type of valve base, British, Continental and American.

A particularly sensitive milliammeter is fitted, capable of giving full deflection on 0.5 mA, all the moving parts being of extremely light construction. The scale, which can be quickly read, is 80 mm in length, with an overall diameter of 105 mm, and the instrument is protected by a rectifier connected in parallel with it; a choke is included in series with this rectifier in order that the measurement of pulsating direct voltages may not be affected. For the measurement of the emission of all types of valves a special circuit is provided, whereby the limit at which a valve may be regarded as being no longer serviceable is in every case at the same point on the scale; if the pointer does not deflect beyond this point, in the red area on the scale; the valve emission is inadequate. It is therefore not necessary to work with tables of the limits at which different valves are considered to have lost their emission, thus effecting a considerable saving of time and trouble.

VALVE MEASURING

By operating in succession the eight switch buttons on the right-hand side of the panel, the requisite card having been duly inserted in the contact box and the latter closed, or not, a valve may be tested very quickly under the following headings:

1. Broken filament
2. Shorting electrodes
3. Contact between metallizing and relative pin.
4. Insulation between electrodes of "hot" valve.
5. Adequate emission
6. Mutual conductance
7. Open-circuited leads to the electrodes.

RANGES FOR D.C. MEASUREMENTS

Range	Internal resistance	Current consumption
10 —500 V	500,000 ohms	1 mA
2 —100 V	100,000 ohms	1 mA
1 — 50 V	100,000 ohms	0.5 mA
0.2— 10 V	20,000 ohms	0.5 mA

RANGES FOR A.C. MEASUREMENTS

Range	Internal resistance	Current consumption
50—500 V	500,000 ohms	1 mA
10—100 V	100,000 ohms	1 mA
5— 25 V	25,000 ohms	1 mA
1— 5 V	5,000 ohms	1 mA

RANGES FOR D.C. MEASUREMENTS

Range	Voltage drop
20 —1,000 mA	0.1—0.25 V
10 — 500 mA	0.1—0.25 V
2 — 100 mA	0.1—0.25 V
0.5— 25 mA	0.1—0.25 V
0.1— 5 mA	0.1—0.25 V

RANGES FOR A.C. MEASUREMENTS

Range	Voltage drop
100—1,000 mA	5 V
100— 500 mA	5 V
10— 100 mA	5 V
5— 25 mA	5 V

RANGES FOR RESISTANCE MEASUREMENTS

50,000 ohms — 5 megohms
10,000 ohms — 500,000 ohms
1,000 ohms — 50,000 ohms
20 ohms — 4,000 ohms
1 ohm — 200 ohms

RANGES FOR CAPACITANCE MEASUREMENTS

10 — 200 μF
1 — 20 μF
0.1 — 2 μF
0.03 — 0.5 μF
1,000 — 30,000 $\mu\mu\text{F}$

MEASUREMENT OF ALTERNATING OUTPUT VOLTAGES

For the measurement of the alternating output voltage of a receiver, three cards are provided, for ranges of 25, 100 and 500 V.

SHORT-CIRCUIT TEST

For detecting the presence of a short circuit, a neon tube is provided, which lights up when the test leads are shorted.

POTENTIOMETER FOR MAINS VOLTAGE

The unit is fitted with a potentiometer for the accurate adjustment of the mains supply, to ensure that all the tests are carried out at the correct potentials.

VALVES

AX 1 Full-wave rectifying valve for the anode feed.
1823 or 506 K Full-wave rectifying valve for the grid bias.
2 \times 4357 Neon stabilizers for control- and screen-grid voltages.
8041 Signal lamp to indicate broken filament.
9512 Neon tube for short-circuit test.

MAINS CONNECTION

The unit incorporates a tapping switch for use on all the mains supplies from 100 to 250 V, 50—100 c/s.

DIMENSIONS

Width 49 cm
Depth 40 cm
Height 28 cm

WEIGHT

Complete: 20 kg nett.

Philips Universal Measuring Bridge "Philoscop" GM 4140

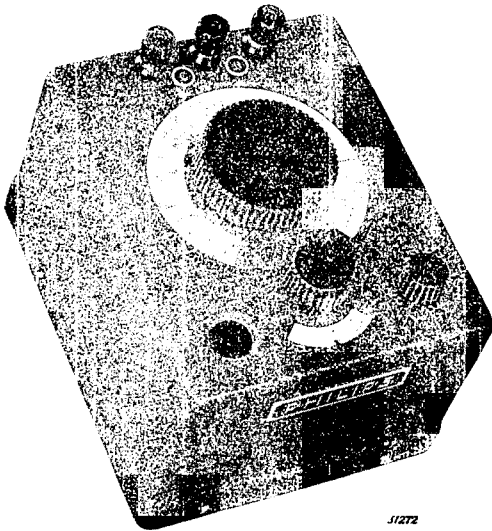


Fig. 1
Philips universal measuring bridge "Philoscop" GM 4140.

This is a new and very practical instrument for measurements of resistance and capacitance, which excels by reason of its small dimensions, light weight, low test voltage, extra high sensitivity, reliability and simplicity in operation. The entirely new principle of the bridge circuit enables the unit to be employed for the most divergent purposes.

The "Philoscop" is adapted for feeding from all available A.C. mains voltages from 100 to 250 V and operated on frequencies between 40 and 10,000 c/s; no batteries are required.

It is especially important when carrying out measurements on chemical solutions (electrolytes, etc.) that the instrument used can be fed with high-frequency current. The test voltage, obtained by transforming the feed voltage, is

only 1 V, which means that low resistance values and high capacitances can be measured without difficulty; low value resistances otherwise quickly run a risk of being overloaded. The finely calibrated range of measurement is particularly wide, including as it does capacitances of $1 \mu\mu\text{F}$ to $10 \mu\text{F}$ and resistances of 0.1 megohm to 10 megohms, whilst by means of separate standard inductances it is also possible to measure self-inductances. The range, furthermore, can be extended to some hundreds of microfarads or megohms.

The zero-indicator is not the usual type of pointer instrument but is a Philips electronic indicator EM 1, the action of which is not subject to any lag and which is, moreover, parallax-free; this indicator contains a triode as amplifying valve, and the high sensitivity thus obtained is further augmented by a pre-amplifier stage with a pentode valve. A direct reading of all results is obtained from a single scale, accurate to within 2%, which eliminates the old and cumbersome method of working with calibration curves. Zero-calibration is effected by means of the instrument itself. The "Philoscop" will be found an indispensable instrument in many kinds of laboratories and factory production departments.

TECHNICAL DATA

Ranges, using the built-in standard resistances and capacitances:

<i>Resistances:</i>	0.1 ohm	—	10 ohms
	10 ohms	—	1,000 ohms
	1,000 ohms	—	0.1 megohm
	0.1 M ohm	—	10 megohms
<i>Capacitances:</i>	10 $\mu\mu\text{F}$	—	1,000 $\mu\mu\text{F}$
	1,000 $\mu\mu\text{F}$	—	0.1 μF
	0.1 $\mu\mu\text{F}$	—	10 μF

Capacitances between $1 \mu\mu\text{F}$ and $10 \mu\mu\text{F}$ can also be measured accurately, and the ranges may be further extended to some hundreds of μF and megohms by using separate standard resistances and capacitances.

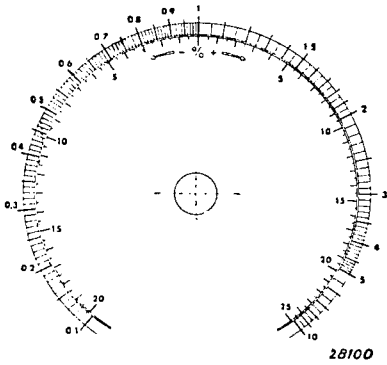


Fig. 1
Calibration of the scale.

Continuously variable sensitivity. Owing to the fact that the sensitivity is continuously variable, approximate measurements may be made in quick succession at low sensitivity, whilst more accurate readings may be taken with the sensitivity at its maximum.

Zero indication without inertia or parallax. The electronic indicator functions without the slightest lag and is quite free from the effects of parallax, allowing quick and accurate readings.

A. C. Supply. The unit is suitable for use on all lighting mains between 100 and 250 V, and for all sources of alternating current at frequencies of 40—10,000 c/s.

D. C. Supply. If the bridge is to be used on direct-current mains, one of the following auxiliary instruments will also be required:

“Vibraphil” vibratory converter Type 7710 for 110 V D.C., or

“Vibraphil” vibratory converter Type 7711 for 220 V D.C.

For use on a 6 V car battery, the “Vibraphil” vibratory converter Type GM 4226 is employed.

1000 c/s supply. For the measurement of electrolytes, the bridge is fed with a voltage of frequency 1,000 c/s, e.g. as supplied by the A.F. oscillator GM 4260, instead of the normal 50 c/s test voltage.

Mains voltage fluctuations. The bridge is not affected by variations in the mains voltage.

Insensitivity to mechanical vibration. Although the electronic indicator is extremely sensitive electrically, it is unaffected by the usually unavoidable jarring and vibration occurring in everyday use.

Consumption. On 220 V mains supplies the consumption of power is only 11 W.

Dimensions. The dimensions are quite small, viz: length 17.5 cm, width 13.5 cm, height 13 cm.

Weight. The weight, including valves, is 2.9 kg.

Valves. EM 1 — Electronic indicator

EF 6 — Amplifier pentode

AB 2 — Full-wave rectifying valve



Fig. 3
Electronic indicator.

Philips Cathode Ray Oscilloscope GM 3152

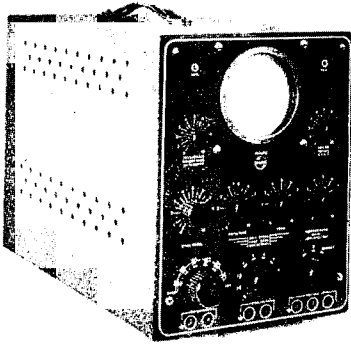


Fig. 1
Philips Cathode Ray Oscilloscope GM 3152.

Philips portable cathode ray oscilloscope GM 3152 is housed in a robust metal case (see Fig. 1), containing all the essential elements, viz. Philips high-vacuum C.R. tube with 95 mm screen, time base, variable frequency between 2 and 150,000 c/s, a 2-stage amplifier having a range of 10 to 1,000,000 c/s, and a supply unit.

Owing to its relatively light weight and small dimensions this precision instrument is an extremely handy and easily portable piece of equipment. Its applications are so extensive that, in conjunction with simple transducers, it is also suitable for the measurement of

mechanical, thermal and optical phenomena.

PHILIPS CATHODE RAY TUBE

The cathode ray tube contained in this unit has a screen diameter of 95 mm and, apart from the electron-optical system, comprises two pairs of perpendicularly opposed deflector plates. The following tubes may be employed in this unit:

- DN 9-3 (long persistent)
- DG 9-3 (green fluorescence)
- DB 9-3 (blue fluorescence)

TIME BASE

The time base includes three high-vacuum pentodes, and the frequency of the linear base is continuously variable between 2 and 150,000 c/s. For the adjustment of the frequency a 10-way switch with potential divider for vernier reading is provided. A single-impulse time base is also included.

STATIONARY IMAGES

For stationary images, the time base can be synchronized as required with the frequency on test, the mains, or any other externally applied frequency.

AMPLIFIER

The built-in linear amplifier consists of a pre-amplifier with a balanced output stage; the anode voltage for the former stage is stabilized by means of a Philips 7475 neon tube. Fig. 2 depicts the frequency characteristic of the amplifier, from which it will

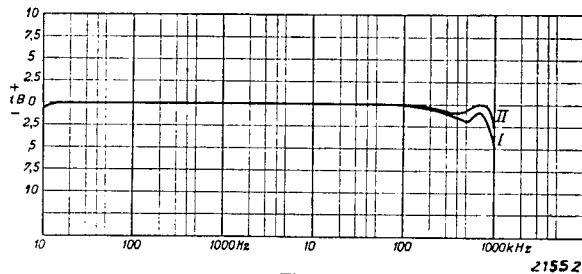


Fig. 2
Frequency characteristic of the amplifier.

be seen that the amplification between 10 and 1,000,000 c/s is linear to within ± 2 dB. The overall gain, which exceeds a factor of 1,600, is adjustable in three stages by means of the sensitivity switch and is further continuously variable.

Sensitivity of the oscillograph. The total sensitivity is 6 mV_{eff} per cm image height; without amplification the sensitivity is 10 V_{eff} per cm.

Input impedance. The normal input impedance, using the sensitivity switch, is 10,000 ohms, and the maximum permissible voltage is 45 V.

High input impedance. When the sensitivity switch is not operating the input impedance is 1 megohm and the input capacitance 20 μ F.

ULTRA SHORT WAVES.

For the measurement of ultra short waves, for example 60 Mc/s (5 metres), there is at the rear of the unit a terminal plate which is in direct contact with the deflector plates. In this way all long leads and stray capacitances are eliminated.

SUPPRESSION OF THE CATHODE RAY

Fitted on the terminal plate on the back panel is a switch for suppressing the cathode ray; by applying 45 V D.C. to the unit and reversing the switch it is possible to suppress the ray for a certain period, thus facilitating certain kinds of observation or photographic recording.

MAINS CONNECTION

The unit has a voltage tapping switch covering all normal mains voltages, viz. 110 V, 125 V, 145 V, 200 V, 220 V and 245 V, 40—100 c/s. Adjacent to this switch, two fuse-holders are fitted to accommodate I-A fuses. The unit can be used on D.C. mains in conjunction with Philips "Vibraphil" vibratory converter Type 7710 for 110—145 V, or Type 7711 for 220—245 V, D.C.

Consumption. The total consumption of power is approximately 100 W.

SUPPLY SECTION

This oscillograph contains two rectifiers, namely one for the anode feeds of the six amplifier pentodes and time base, and one for the C.R. tube. For the smoothing of this potential, of about 1,000 V, Philips "Microlyte" capacitors, connected in series, are employed, these ensuring high capacitance and effective smoothing.

The whole of the feed section is screened from the rest of the unit by a steel screening plate.

VALVES:

There are in all 10 valves, viz:

- 1 C.R. tube DN 9-3 (long persistent), or
- DG 9-3 (green screen), or
- DB 9-3 (blue screen)

Amplifier 1 amplifier pentode 4673 for the input stage
 2 amplifier pentodes 4673 in balanced circuit.

Time base 1 charging pentode 4673
 1 discharging pentode (9 W) AL 4
 1 modulator and synchronizing pentode 4673

Supply section 1 high-voltage rectifying valve 1876
 1 full-wave rectifying valve AZ 1
 1 neon tube for stabilization, type 7475.

WEIGHT: The weight, complete, is about 19 kg.

DIMENSIONS: Length 42 cm
 Width 22.5 cm
 Height 29 cm

Philips Cathode Ray Oscillograph GM 3155

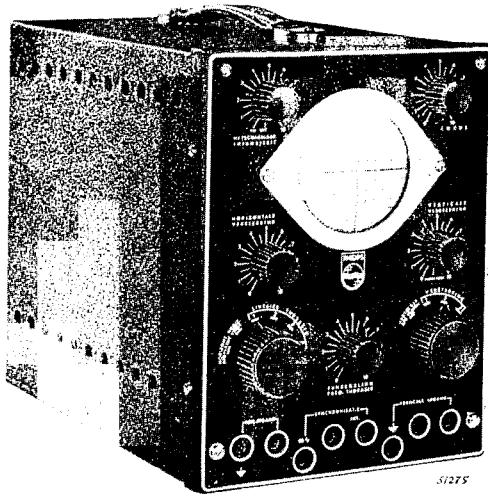


Fig. 1
Philips Cathode Ray Oscillograph GM 3155.

This portable cathode ray oscillograph was designed for the rapid qualitative measurement of periodic electrical phenomena. The auxiliary apparatus contained in the unit makes it possible to carry out numerous types of measurement without the aid of additional equipment, and the circuits are sufficiently universal to permit of investigations into mechanical, magnetic and other phenomena when used in conjunction with simple transducers.

Measurements of heavy currents can likewise be effected, e.g. the two built-in amplifiers can be employed for phase measurement. Screws are provided at each side of the fluorescent screen for attachment of a transparent scale or camera stand.

In conjunction with Philips Service Oscillator GM 2880 or GM 2882 and Philips Frequency Modulator GM 2881, this cathode ray oscilloscope is eminently suitable for the rapid servicing of radio receivers, R.F. amplifiers and so on; the tuning curve of a receiver can be traced directly from the fluorescent screen of the C.R. tube and, further, the selectivity can be measured with sufficient accuracy for all practical purposes.

CONSTRUCTION AND CIRCUITS

The oscillograph is housed in a sprong metal case and comprises the following main units: Philips high-vacuum C.R. tube (70 mm screen), time-base with frequency variable between 20 and 20,000 c/s, two single-stage amplifiers, one for the horizontal and one for the vertical deflection and having a range of 25—100,000 c/s. Special facilities are provided for modulation of the ray. The feed section consists of 2 separate rectifiers. All the controls are clearly marked and calibrated.

PHILIPS C.R. TUBE DN 7-2

The Philips high-vacuum C. R. tube DN 7—2 fitted in this unit has a 70 mm screen; the deflector plates are in two pairs, perpendicular to each other.

TIME BASE

The built-in time base includes a charging pentode 4673 and a gas-filled discharging triode 4690; the linear time-base frequency is variable between 20 and 20,000 c/s, the different ranges being controlled by switches. Throughout the whole frequency range the amplitude of the time-base is variable from about 2 to 5 cm.

SYNCHRONIZED TRACE

For stationary images the time-base may be synchronized with either the frequency under investigation or an externally applied voltage or, again, with the mains frequency.

AMPLIFIERS

The two amplifiers contained in the unit, for the horizontal and vertical deflection, are each equipped with a pentode 4673.

FREQUENCY RANGE

The linear frequency range of the two amplifiers is 25—100,000 c/s, and with the feed-back in circuit the linearity is within ± 1 dB.

TEST SENSITIVITY

The maximum sensitivity of the amplifier for perpendicular deflection is 125 mV_{eff} per cm overall height of the trace, with the feed-back switched off; with the latter fully applied the sensitivity is 830 mV_{eff} per cm and when partially applied 350 mV_{eff} per cm.

Without amplification the sensitivity is 17 V_{eff} per cm and that of the amplifier for the horizontal deflection, which works with feed-back in every case, is about 30 % less than that of the vertical amplifier with feed-back switched on.

INPUT RESISTANCE

When the potential divider for controlling the sensitivity is in use the input resistance of the vertical amplifier is 10,000 ohms; the maximum permissible voltage is 45 V. With the potential divider turned fully anticlockwise ("off" position) the input resistance is 1 megohm and the maximum voltage 150 V.

MODULATION OF THE RAY

Terminals are provided at the rear of the unit for the purpose of modulating the ray with an external alternating voltage.

MAINS CONNECTION

A tapping switch is provided so that the unit may be used on 110 V, 125 V, 145 V, 200 V, 220 V or 245 V, 40—100 c/s mains, and the necessary fuses are fitted. The oscillograph can be used on D.C. mains in conjunction with a "Vibraphil" vibratory converter Type 7710 (110—145 V), or Type 7711 (220—245 V mains).

CONSUMPTION

The total consumption is about 40 W.

VALVES

There are in all 6 valves:

1 high-vacuum cathode ray tube	DN 7-2
1 R.F. amplifier pentode (vertical deflection)	4673
1 R.F. amplifier pentode (horiz. defl.)	4673
1 gas-filled discharging triode	4690
2 half-wave rectifying valves	1876

WEIGHT

The total weight is approx. 7.7 kg.

DIMENSIONS

Height	22 cm
Width	17 cm
Depth	24 cm (without knobs)

Philips Electronic Switch GM 4196

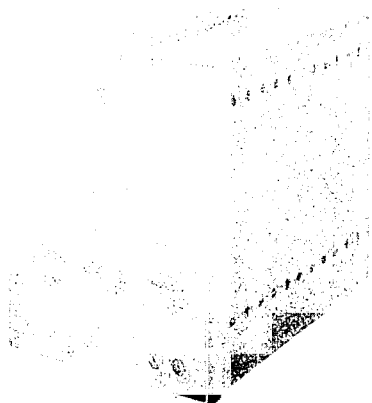


Fig. 1
Philips Electronic Switch GM 4196.

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The electronic switch is used as auxiliary equipment with a cathode ray oscillograph. By means of this unit two different electrical phenomena can be observed simultaneously and independently on the fluorescent screen of the C.R. tube, thus greatly extending the field of application of the latter. The electronic switch depends for its action on the fact that it enables the two electrical phenomena to be reproduced alternately, at a very high frequency. Since the fluorescent coating on the screen gives a certain amount of persistence, whilst the human eye, on the other hand, exhibits a certain lag, the two oscillograms are "seen" simultaneously. The switching, which takes place at about 10,000 per second, is produced by high-vacuum valves; hence the term

"electronic switch". Using this instrument, it is possible to adjust two images to a common zero line on the screen or, if required, to separate lines, one above the other, without modification of the phasing; it is thus possible to observe in detail the amplitude, wave form, frequency ratio and phase displacement of any two given voltages. The electronic switch GM 4196 was designed especially for use with the cathode ray oscilloscope GM 3152 and its practical performance has already earned for it a very great deal of interest. By means of this unit it is possible with only one oscillograph to carry out investigations which would normally require two such instruments; the features which this unit offers will make it a welcome addition to the equipment of any laboratory.

OUTSTANDING FEATURES

The more important features of Philips Electronic Switch GM 4196, when used with Philips Cathode Ray Oscillograph, are as follows:

1. Two voltages or currents may be oscillographed at the same time but quite independently.
2. The two oscillograms may be adjusted as desired to a single zero line, or two separate lines.
3. The phasing of the two phenomena remains unaffected.
4. The two signals may be amplified separately.
5. The frequency of switching is about 10,000 c/s, giving an image of excellent quality.
6. Due to the use of a carefully adjusted compensating circuit, the switching voltage is very nearly rectangular, resulting in a very clear image.
7. Only high-vacuum valves are used in this unit; it does include any mechanical devices.

WORKING PRINCIPLE

The working of the instrument is as follows: two separate high-vacuum valves are alternately switched on and off with the aid of a multivibrator delivering a voltage the frequency of which is about 10,000 c/s. In this way the oscillogram is built up from very small elements, traced at the frequency of 10,000 per second, giving the impression that the trace consists of a full line. This applies to all phenomena of a frequency above 400 or 500 c/s.

The electronic switch is fully equipped for use on lighting mains of all A.C. voltages, being quickly strapped to suit any local voltage.

TECHNICAL DATA

Amplifiers I and II

Each of the applied signals can be amplified separately, within a frequency range having its lower limit at about 25 c/s, the upper limit being determined by the frequency of the multivibrator, which is approximately 10,000 c/s; a fundamental frequency of 500 c/s can therefore be oscillographed with perfectly clear definition.

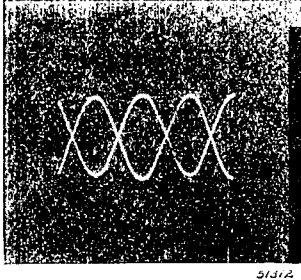


Fig. 2
The electronic switch enables two characteristics to be observed as flowing lines.

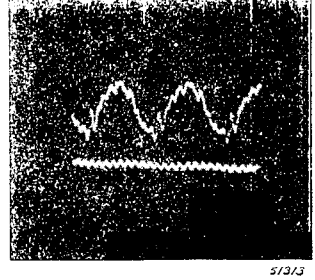


Fig. 3
The large amplitude makes it possible to reproduce the mechanical vibration of an electric motor; the vibration of small amplitude is that of a normal frequency of 500 c/s.

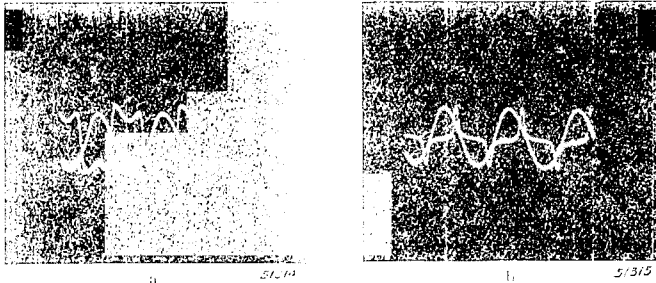


Fig. 4
The sinusoidal curve illustrates the primary voltage of the transformer; the flattened curve in a is that of the secondary voltage and the sharply peaked curves in b the primary current. In both cases the 3rd harmonic is very marked

Each amplifier has two sets of input sockets, one for the low voltage, of minimum $0.1 V_{\text{eff}}$ to maximum $75 V_{\text{eff}}$, having an input impedance of 50,000 ohms, and one for minimum $2 V_{\text{eff}}$ to maximum $300 V_{\text{eff}}$ with an input impedance of 1 megohm. One of the input sockets is in each case earthed.

Multivibrator

The built-in multivibrator delivers a voltage of rectangular wave form, of about 10,000 c/s. The switching impulses, which in many well-known circuits produce interference, have been here reduced to a negligible minimum, as will be seen from the oscillogram, Figs. 2 and 4.

Variable zero-line

A common zero-line or two separate lines can be obtained as desired by means of a potential divider.

Connection to oscillograph

The electronic switch has two sockets for connection to the oscillograph, one being earthed.

Mains connection

The instrument is intended for use on A.C. mains; a red signal lamp lights up as soon as the mains switch is closed. This unit can be adapted for all mains supply voltage between 100 and 250 V, 40—60 c/s, by means of a tapping switch. The consumption of power is approximately 30 W at 220 V.

Valves

- 2 R.F. pentodes EF 6
- 2 9-W pentodes EL 3
- 1 rectifying valve EZ 3
- 1 signal lamp 8045 D-07.

Weight and dimensions

Weight: approx. 5.5 kg

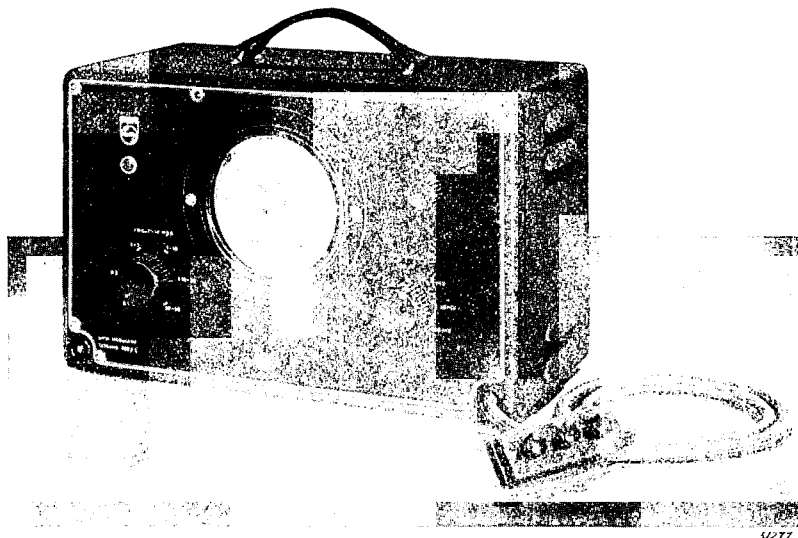
Dimensions:

Length 25 cm (over the knobs 27 cm)

Width 23 cm

Height 27 cm

Philips Service Oscillator GM 2882



The practical build, the new type of circuit employed, and specially designed components of the Philips Service Oscillator GM 2882 give this instrument many advantages over earlier types. It is extremely simple in operation.

1. The number of controls has been reduced to a minimum.
2. The frequency is read from the scale direct in kc/s or Mc/s.
3. A direct indication of the input voltage is shown on the attenuator.

The power consumption, physical dimensions and weight have all been reduced as far as possible for this type of unit, making it an extremely practical service oscillator for the calibration of station dials, trimming of circuits and checking sensitivity, A.G.C. and automatic tuning.

The entire frequency range is divided into 6 bands and the output voltage is continuously variable between 1 μ V and 100 mV. For selectivity measurements, moreover, an attenuator, calibrated in steps of 1 : 10, is combined with a dummy aerial at the end of the cable. The signal can be modulated to a depth of 30 % by the built-in 400 c/s oscillator, or an external frequency can be employed for modulation to a depth of 80 %.

Every possible measure has been taken to ensure the highest possible stability of the frequency; the design of the oscillator coils and their switching aims at the shortest possible connections in each waveband. The coils are mounted on a disc which is rotated by the control knob to six different positions, introducing a fresh coil at each setting; in this way the same short leads to the variable capacitor and oscillator valve are employed in each case, so that neither mechanical nor electrical effects can disturb the stability of the frequency.

The oscillator coils themselves are so constructed that they have a negative temperature coefficient, to compensate the positive coefficient of the variable capacitor; temperature stability of the oscillator circuit is therefore very good. The oscillator valve is the steep-slope pentode EF 50 which was specially developed for operating on very high

frequencies, and accordingly the oscillator frequency is to a very high degree independent of any fluctuations in the mains voltage.

Moreover, the frequency is not affected by the setting of the attenuator, whilst frequency modulation is obviated by the use of a special circuit consisting of a separating stage between the oscillator valve and the attenuator; the modulation, therefore, is practically undistorted, even at very high frequencies.

The frequency scale gives readings which are accurate to within 1 %, this being usually ample for the trimming of radio-receiver circuits; an ingenious type of potentiometer, operated by a single knob, controls the attenuator, thus reducing the total number of controls on the unit to four, these being as follows:

1. wave-range control
2. tuning
3. attenuator
4. on-off and modulator switch.

TECHNICAL DATA

Frequency ranges. 1) 100— 300 kc/s, 3) 1— 3 Mc/s, 5) 10—30 Mc/s,
2) 300—1,000 kc/s, 4) 3—10 Mc/s, 6) 30—60 Mc/s.

R. F. Voltage. The maximum obtainable R.F. voltage is 100 mV.

Attenuator. The attenuator controls the signal continuously, down to $< 1 \mu\text{V}$. An attenuator 1 : 10 is also included with the dummy aerial.

Modulation. Internal modulation of 400 c/s (mod. depth 30 %); external modulation up to 10,000 c/s (mod. depth up to 80 %).

A. F. Voltage. The A. F. voltage for internal modulation may be tapped from the connecting socket for the external modulation; this voltage is 1.5 V at 400 c/s.

Calibrated scale. Calibration of the scale is in kc/s and Mc/s, to within a tolerance of 1 %, giving a high degree of accuracy in reading.

Constant frequency. It is of the greatest importance that the frequency should be as constant as possible; the frequency is constant to within 0.02 % for voltage variations of 10 % and to within 0.1 % with an increase in temperature of 10 %, so that the accuracy of the scale is superior to all these factors.

Frequency modulation is negligible.

Valves. Oscillator valve EF 50
Modulator valve EF 50

A.F. oscillator valve EF 6
Rectifying valve EZ 2
Signal lamp 8060-00.

Mains voltage.

The service oscillator is suitable for use on all A.C. mains, viz. 110 V, 125 V, 145 V, 200 V and 245 V $\pm 10\%$, 50-100 c/s. The unit is fully mains-operated.

Consumption.

18 W

Dimensions.

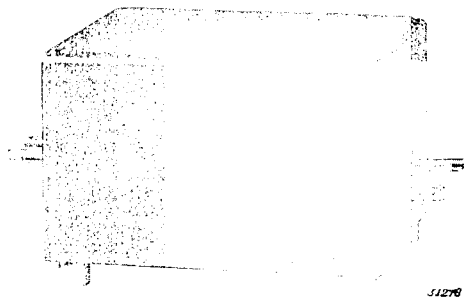
Width 33.3 cm

Height 22 cm

Depth 16.5 cm

Weight.

8.5 kg



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Philips Frequency Modulator GM 2881

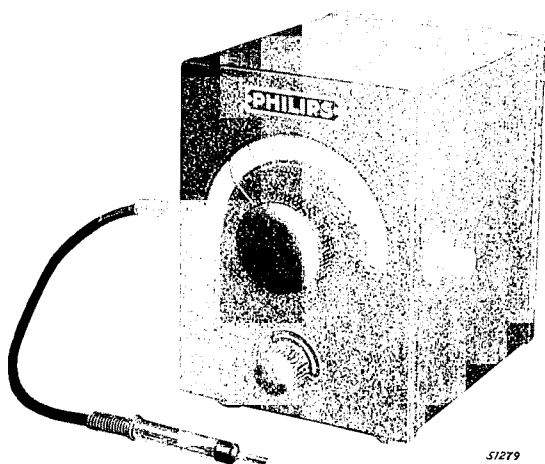


Fig. 1
Philips Frequency Modulator GM 2881.

Philips Frequency Modulator GM 2881 is used for the purpose of visually testing the tuning curves of radio receivers and R.F. amplifiers; it should be employed preferably in conjunction with Philips Service Oscillator GM 2882 and the small Cathode Ray Oscillograph GM 3155, although, naturally, the larger oscillograph GM 3152 will also serve this purpose.

OUTSTANDING FEATURES

This frequency modulator has the following features to offer:

1. The tuning curve and the output amplitude are rendered directly visible in combination with each other; any deviations in the form of the tuning curves are immediately observed.
2. Simple readings and operation, rapid control of the tuning curve on wide or narrow bandwidth (variable bandwidth).
3. Direct reading of bandwidth in kc/s; range of measurement up to about 25 kc/s.
4. Adjustment of tuning curve in accordance with a standard characteristic.
5. Effects of trimming upon the tuning curve are immediately visible.
6. When the R.F. voltage and A.F. voltage immediately after detection are oscillographed, the effect of the detection on the tuning curve can be determined.
7. The frequency scale of the oscillogram can be matched with the form of the tuning curve (bandwidth).

CIRCUIT

The modulator contains two octodes CK 1 which serve respectively as mixer valve and frequency modulator and, further, a full-wave rectifying valve AZ 1. In principle the working of the instrument in conjunction with Service Oscillator GM 2882 and the oscillograph is as follows. The service oscillator delivers a certain R.F. signal f_2 and the frequency modulator another signal f_1 of 4,000 kc/s (maximum tolerance $\pm 1.5\%$): suppose that the frequency of the required R.F. signal, to which the receiver is tuned, is f_0 , then the frequency of the service oscillator will be adjusted to $f_1 - f_2 = f_0 =$ R.F. tuning of the receiver.

FREQUENCY MODULATION

The time-base voltage of the cathode ray oscillograph is employed for frequency modulation, this saw-tooth voltage being used to modulate the R.F. test signal between 25 kc/s above and below the mean frequency (varying impedance of the octode).

SELECTIVITY CURVES

The amplifier in the cathode ray oscillograph GM 3152 has a linear frequency characteristic of 10—1,000,000 c/s, enabling both the tuning curve of the R.F. signal and

that of the A.F. signal to be reproduced (to ascertain the effect of the detector): the oscillograph GM 3155, the two amplifiers of which have a linear characteristic of 25—100,000 c/s, permit of inspecting the tuning curve only with the A.F. signal, although this is quite sufficient for most service purposes.

WIDTH OF TUNING CURVE

The frequency f_1 (4,000 kc/s) of the oscillator in the modulator unit is variable through a range of about ± 25 kc/s, the scale being generously proportioned and clearly calibrated in kc/s. When the control is rotated from the "off" position in the direction "+", or — 25 kc/s, the tuning curve moves from left to right on the screen, so that the bandwidth can be read directly in kc/s at any desired point on the curve, with an accuracy that is quite ample for all practical purposes. The height of the oscillogram is directly proportional to the R.F. or A.F. signal of the receiver under test.

CONNECTIONS

Sockets for connection of the frequency modulator to the service oscillator GM 2882 are provided on the left-hand side of the metal case. On the right is an R.F. cable with dummy aerial.

VALVES

Oscillator and mixer valve: octode CK 1

Frequency-modulator valve: octode CK 1

Full-wave rectifying valve AZ 1.

MAINS CONNECTIONS

The unit is fitted with a tapping switch for voltages of 110 V, 125 V, 145 V, 200 V, 220 V and 245 V.

CONSUMPTION

Approx. 20 W.

WEIGHT

The total weight, including valves, is about 4.4 kg.

DIMENSIONS

Depth (with knobs)	23 cm
Depth (without knobs)	20 cm
Height	20 cm
Width	15 cm

Philips A. F. Signal Generator GM 2307

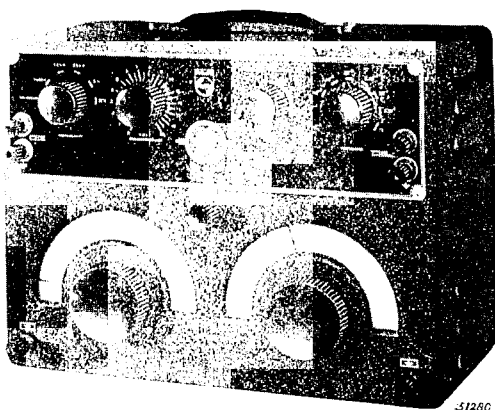


Fig. 1
Philips A.F. signal generator GM 2307.

Philips A.F. signal generator GM 2307 furnishes a very constant alternating voltage of a variable amplitude, so that it is suitable for all measurements falling within the range of 30—16,000 c/s.

The test frequency is produced by filtering out and amplifying the beat frequency obtained from two R.F. oscillators, preset to different frequencies. The frequency of the A.F. signal is of course the difference between the two R.F. frequencies.

OUTSTANDING FEATURES

1. High accuracy of scales.
2. Wide frequency range.
3. Constant output voltage throughout the range.
4. During warming up, very little change in frequency and amplitude of the signal.
5. Practically no effects of mains voltage fluctuations.
6. High output voltage, with balanced output stage if required, also when the attenuator is in use.
7. Output can be matched to four different load impedances.
8. Good sinusoidal wave form; very weak harmonics.
9. Very low ripple voltage.
10. The zero point of the A.F. beat frequency can be accurately adjusted by means of the electronic indicator.

TECHNICAL DATA

Frequency range. The right-hand frequency control covers a range of 0—1,000 c/s and the left-hand control 0—15,000 c/s; the readings of the two controls are additive and the maximum frequency (with both controls at maximum) is therefore 16,000 c/s.

Frequency variation during warming-up period. After 10 minutes from the time the unit is switched on, the difference in frequency for the next three hours is less than 20 c/s, after which there is no further variation at all.

Setting and accuracy of frequency scales. With both scales set to zero the frequency is adjusted to the zero point with the aid of an electronic indicator, after which adjustment the scale tolerance is $\pm 1\%$ from 200 to 16,000 c/s; between 30 and 200 c/s the maximum deviation is 2 c/s.

Frequency curve. The deviation in the linearity of the curve is less than $\pm 2.5\%$ between 30 and 16,000 c/s, this applying to all settings of the matching switch.

Matching. The output of the instrument can be matched to the following loads by means of a switch:

- | | |
|---|--|
| 1. Attenuator in circuit ¹⁾ | 4. Output resistance 250 ohms ²⁾ |
| 2. Output resistance 1,000 ohms ²⁾ | 5. Output resistance 5 ohms ²⁾ |
| 3. Output resistance 500 ohms ²⁾ | 6. Maximum voltage approx. 50 V; output resistance approx. 25,000 ohms ³⁾ . |

Attenuator. The built-in attenuator has 8 settings, giving a total attenuation of 1 : 10,000: these correspond to 1.3×10^{-1} , 10^{-1} , 3×10^{-2} , 10^{-2} , 3×10^{-3} , 10^{-3} , 3×10^{-4} , 10^{-4} times the input voltage and represent approximately 10 dB per stage. Normally the input voltage of the attenuator is 0–15 V, and this can be measured with a valve voltmeter, e.g. Philips R.F. Triode Voltmeter GM 4151, or Philips Thermionic Voltmeter GM 4132, connected to the left-hand terminals. The loading resistance between the output (R. H.) terminals should be 25,000 ohms or more; a separate switch is provided whereby the output may be rendered symmetrical, or not, with respect to earth. The voltage across the output terminals then remains unaltered, any difference being less than 2 %. At the “asymmetrical” setting the lower terminal is automatically earthed.

Once the output voltage of the attenuator has been carefully adjusted, the attenuated voltage, at the various settings, does not deviate by more than 1 % from the nominal value.

Maximum output power and distortion. With the load correctly matched the maximum output power at settings 2 to 5 of the matching control is normally 200 mW, but, should such be required for special purposes, the maximum available output can be increased to 1 W or reduced to 100 mW by means of a screw at the rear of the unit. The distortion then varies in accordance with the following:

Frequency	Distortion at		
	100 mW	225 mW	1 W
30–200 c/s	0.5 %	1 %	2.5 %
200–16,000 c/s	0.25 %	0.5 %	1.5 %

When the voltage control is set to its maximum the ripple voltage, for an output of 15 V, is less than 0.5–1 %.

Calibration of the voltage control. The voltage occurring across the left-hand terminals with respect to settings 1 and 2 of the matching switch may be read from the graduations on R_1 . The maximum voltage is adjusted to 15 V_{eff} but is variable between 10 V and 32 V by means of the screw at the back of the case. This voltage is unaffected by variations in the mains voltage or the temperature, but for very accurate measurements it is essential to measure the voltage.

Supply. A voltage tapping plate is provided at the rear of the generator, by means of which the unit may be made suitable for use on mains of 110, 125, 145, 200 or 245 V, 40–100 c/s as required. The consumption is approximately 40 W. Variations in output voltage due to fluctuations in the mains supplies amount to less than 2 %.

Use with vibrator-converter. The signal generator may be employed on D.C. mains when used in conjunction with Philips “Vibraphil” vibratory converter Type 7710 (110–145 V) or Type 7711 (200–245 V).

<i>Valves.</i>	Triode-hexode	ECH 3	Pentode	EL 3
	Pentode	EF 6	Rectifying valve	EZ 2
	A.F. pentode-electronic indic.	EFM 1	Neon stabilizer	150 A 1.

Weight and dimensions. Weight: approx. 12 kg
 Width: 34 cm
 Height: 25.5 cm
 Depth: 20 cm (incl. knobs).

¹⁾ The unit is provided with a switch by means of which the output can be made symmetrical with respect to earth, or not, as desired. ²⁾ The lower terminal may be earthed, as required, by means of a switch. ³⁾ The lower terminal must then be earthed through the earthing switch.

Philips Heterodyne Wavemeter GM 3110

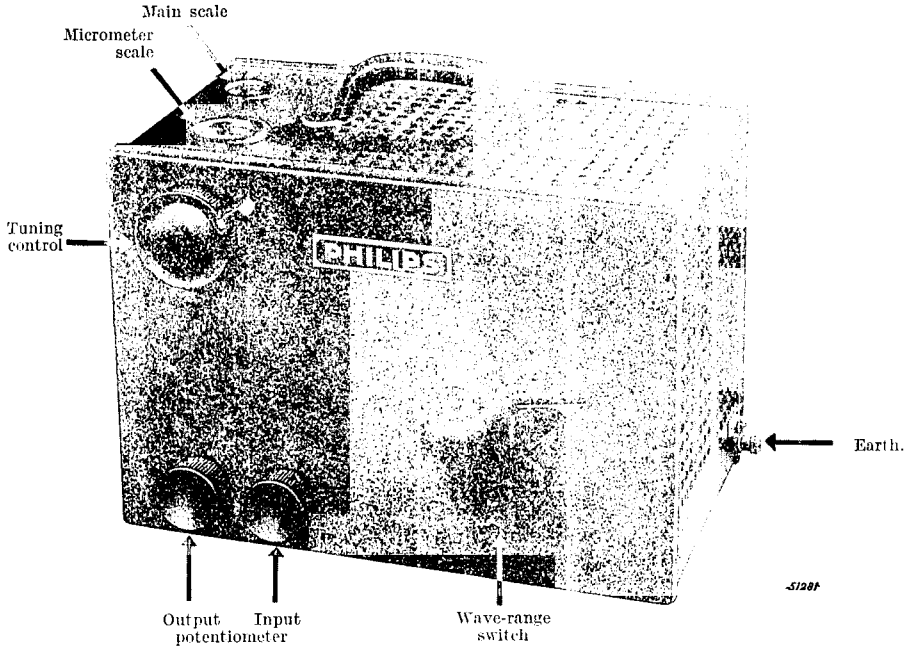


Fig. 1
Philips heterodyne wavemeter GM 3110.

By means of the Philips Heterodyne Wavemeter frequency measurements over a very wide wave-range may be carried out with a high degree of accuracy; for this purpose the heterodyne principle is preferable to any other. The built-in precision capacitor is equipped with a micrometer drive which enables tuning to be effected with the greatest possible accuracy.

The six wavelength ranges extend over the following frequencies:

Position 1:	5—	16 Mc/s
„ 2:	2—	5 „
„ 3:	600—	2,000 ke/s
„ 4:	200—	600 „
„ 5:	90—	200 „
„ 6:	40—	90 „

A special circuit ensures that the 2nd, 3rd and even the 4th harmonics are strong enough to permit of all frequency measurements occurring in normal practice, up to 60 Mc/s (5 m).

The wavebands are so arranged that they overlap each other, but a separate oscillator coil covers each range, these coils being mounted on a rotary disc and fitted with screening cans. Each coil, moreover, is operated by a reliable system of switching and the advantage of this arrangement is that it is not necessary to carry loose coils; the time entailed in changing the coils each time is therefore saved.

Broadly speaking, the wavemeter consists of an R.F. oscillator of very high accuracy and stability, the latter factor being due to the use of a special oscillator circuit in which the anode voltage is stabilized by means of a neon tube. A further advantage of this arrangement is that the frequency is unaffected by variations in the mains voltage.

Each component of the wavemeter, down to the very smallest, has been selected for its particular purpose only after the most searching technical investigation, thus ensuring a reliable and easily operated measuring instrument of practical and rugged construction.

Measurement is almost completely independent of external influences such as fluctuations in temperature, etc. during normal use.

A dull silver-plated scale having 7 graduations is mounted on the capacitor spindle, and the drum of the micrometer drive is accurately calibrated in 100ths and half 100ths, giving a scale of 1,400 divisions for each wave range. The length of the scale, apart from the unusually small amount of mechanical backlash, which is less than 0.2 of a division, is another important factor; the diameter of the micrometer drum is 50 mm, and, the total length of the scale being about 110 cm, the readings can be taken with ease and precision. The accuracy of calibration of the wavemeter itself is in excess of 0.2 %.

An attenuator is included in the unit, by means of which the R.F. signal can be controlled as required from minimum to maximum; this attenuator consists of an input and an output potentiometer, so arranged that the R.F. signal is attenuated first by the former and then by the latter.

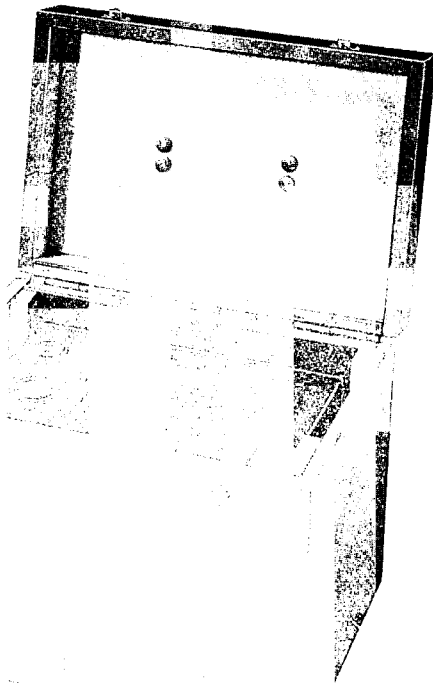


Fig. 2
Carrying case for the wavemeter

DIMENSIONS

Wavemeter including control knobs:

26 × 19 × 24 cm.

Dimensions of carrying case:

33 × 22.5 × 27 cm

WEIGHT

Wavemeter GM 3110: 6.75 kg
complete with

carrying case: 10.5 kg

VALVES

6F 7 pentode oscillator valve
1801 full-wave rectifying valve
7475 neon tube for voltage
stabilization.

It is important that the frequency should remain as constant as possible, even when the signal strength is increased from minimum to maximum, and tests have proved that variations in the frequency amount to less than 0.1 %, which may be regarded as more than satisfactory for all normal purposes. As stated, fluctuations in mains voltage have little or no effect on the frequency, these being counteracted by a frequency stabilizer with neon tube; the frequency is constant to within 0.25 % on mains variations of 10 %.

Wavemeter type GM 3111 can be supplied to order, this unit being provided with extra terminals for external modulation; it can therefore be used with or without modulation and in the latter instance normal calibration curves of the usual degree of accuracy are employed.

The wavemeter GM 3110 as supplied is suitable for use on mains supplies of nominal voltage 127 and 220 V, 50 c/s, but other models may be obtained to order. The amount of power consumed by these units is not more than 11 W approx.

Each wavemeter is supplied in a felt-lined carrying case with handle and nickel-plated fittings; the unit is small and light and thus can be easily carried about.

Supply. As mentioned above, wavemeter GM 3110 is used on A.C. mains of 127 and 250 V, 50 c/s, but it can also be employed on D.C. supplies in conjunction with Philips "Vibraphil" vibratory converter Type 7710 (110—145 V), or Type 7711 (220—245 V). With the Vibraphil converter GM 4226 the wavemeter can also be used on a 6 V accumulator.