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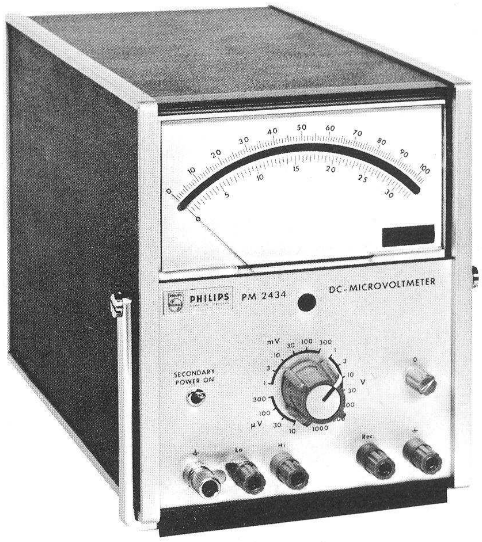

INSTRUCTION MANUAL

DC-MICROVOLTMETER
PM 2434

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CONTENTS

1. GENERAL

1-1. Introduction

The Philips d.c. microvoltmeter PM 2434 is a very sensitive instrument for the accurate measurement of a direct voltages from 10 µV to 1000 V.
Its internal resistance is:
1 MΩ in the range of 10 µV - 30 mV
10 MΩ in the range of 100 mV - 300 mV
100 MΩ in the V ranges.

For indicating the polarity at the input sockets, a separate indicator has been provided.

Electrical zero setting is effected by means of a combined coarse-fine adjustment at the front of the instrument.
The instrument has been provided with a fully isolated recorder output.
This efficiently designed instrument can be employed for all applications in modern electronics.

1-2 Technical data

Numerical values followed by a statement of tolerances indicate guaranteed properties.
Numerical values without tolerances are intended for information only and indicate the properties of an average instrument.

A. Measuring range

D.c Voltage	10 µV ... 1000 V in 17 ranges
Input	Floating
Maximum voltage between Hi-Lo and ⏚	1000 V d.c.
Input impedance	1 MΩ ± 2% in the range of 10 µV ... 30 mV 10 MΩ ± 3% in the range of 100 mV ... 300 mV 100 MΩ ± 3% in the range of 1 V ... 1000 V
Accuracy	± 1% of reading ± 1% f.s.d. in the 10-µV and 30-µV ranges (exclusive of noise and drift). ± 1% of reading ± 0.5% f.s.d. in the other ranges
Pre-deflection	5 scale divisions in the 10-µV range
Drift	± 0.2 µV/°C
Common mode rejection ratio	160 dB at 50 Hz and d.c. Impedance beteen Hi and Lo 1 kΩ Max. voltage beteen Lo and ⏚ 750 V
Serial mode rejection ratio	> 90 dB for 50 Hz signals
Overload protection	Max. 500 V d.c. or 350 V_{rms} in the 10 µV ... 300 mV range 1500 V d.c. or 1000 V_{rms} in the 1 V range ... 1000 V range.

B. General data

Supply	a. Mains 115 V - 230 V ± 15%, freq. 50-60 Hz. b. Battery box PM 9204, which can be fitted at the rear of the instrument. Operation per charge 72 hours Charging and operation possible simultaneously.
Temperature range	The specified data refer to a ambient temperature of 15°C - 40°C. Between 0-15°C and 40-50°C additional error of ± 1% may be introduced.
Calibration	There is an output for a calibration voltage of 1 mV at the rear of the instrument.
Polarity and null indication	Distinct indication from 1 μV upward
Recorder output	Output voltage at f.s.d. id 1 V, fully separated from the input. Output impedance ca. 1 kΩ.

Mechanical data

Dimensions	Height 190 mm Width 140 mm Depth 250 mm
Weight	3.5 kg.

1-3 Accessories

A. Accessories supplied as part of the equipment

1. Set of measuring leads
2. Mains lead
3. Short-circuiting strip
4. Manual

B. Optional accessories

1. Battery supply unit type PM 9204

The battery supply unit can be fitted to the rear of the instrument to provide battery operation.

Characteristics:

Nominal voltage	5 V
Capacity	3.5 Ah.
Max. charging current	350 mA
Max. trickle charging current	35 mA
Life per charge, in conjunction with the PM 2434	75 h.
Recharging time	15 h.

It is advisable to use the PM 9204 for very sensitive measurements, because the housing of the instrument can then be used as a GUARD.
The instrument should not then be connected to the mains.
The earth socket, which is connected to the housing of the instrument, should now be connected to that point of the circuit under test which has the most suitable potential with respect to the Lo socket.

2. EHT probe type PM 9246 (Fig. 1, page 20)

The HT probe type PM 9246 is suitable for measuring direct voltages up to 30 kV.
The PM 9246 may be used for the measuring instrument with an input impedance of 100 MΩ, 10 MΩ or 1.2 MΩ (selectable on the probe).

Maximum voltage	30 kV
Attenuation	1000 x
Input impedance	600 MΩ ± 5%
Accuracy	± 3% for instrument impedance of 10 MΩ and 100 MΩ
Relative humidity	20% ... 80%

3. HF probe PM type 9210 (Fig. 2, page 20) Accessory set for HF probe type PM 9212

	PM 9210	PM 9210 + PM 9212
Frequency range	100 kHz ... 1 GHz	100 kHz ... 1 GHz
Straight line within 5%	100 kHz ... 6 MHz	100 kHz ... 6 MHz
Maximum deviation	3 dB	3,5 dB
Voltages ranges	150 mV ... 15 V	15 V ... 200 V
Max. voltage a.c.	30 V	200 V
Max. voltage d.c.	200 V	500 V
Input capacitance	2 pF	2 pF
T-piece	optional	
Frequency range		100 kHz ... 1.2 GHz
Impedance		50 Ω
Standing wave ratio		1.25 at 700 MHz; With 1.15 at 1 GHz

Probe type PM 9210 in combination with the probe accessories (adjustable earthing pin and Dage adaptor) is suitable for measurements up to a frequency of 100 MHz.

For measurements beyond this frequency it is advisable to use the 50 Ω T-piece and the 50 Ω terminating resistance which are parts of the PM 9212 probe accessories set.

1-4 Circuit description (Fig. 3, page 20)

The test d.c. voltage is supplied to the input sockets "Hi" and "Lo" (BU3 and BU2). The ranges are selected by means of the stepping switch SK3. The d.c. voltage is converted by a chopper into a 190 Hz square-wave voltage. The frequency of 190 Hz has been adopted specially so as to avoid interference with the mains frequency. The chopper is controlled by a 190 Hz square-wave oscillator.
The resulting square-wave voltage is amplified by an a.c. amplifier. This amplifier stage is followed by an attenuator and a second a.c. amplifier. The dividing of the a.c. amplifier into two stages with an attenuator leads to greater stability, because the open-loop gain is reduced. The amplifier a.c. signal is rectified by a demodulator, which is controlled by the same 190 Hz oscillator which controls also the chopper. The resulting d.c. voltage is amplifier in a d.c. amplifier circuit serving as an integrator.

The output voltage is kept constant at 1 V by varying of the gain factor by means of the feedback circuit.
In the ranges of between 10 µV and 1 mV the test voltage is supplied directly to the chopper via the hum filter. In the other ranges the test signal is first attenuated to 1 mV full-scale deflection by means of the input attenuator.
In the ranges of between 10 µV and 1 mV the gain is controlled by the feedback circuit. In the other ranges the feedback circuit remains set as in the 1 mV range. In this way the output voltage of the overall amplifier remains constant at 1 V full-scale deflection.
The output voltage thus obtained is used for the following functions.

A. Indication of the Test Voltage

By means of a diode bridge the meter will always deflect to the right, irrespective of the polarity of the test voltage.

B. Polarity Indication

The polarity of the test voltage is shown by means of a separate indicator. The sensitive of this polarity indicator is ten times greater than that of the meter; it can therefore be used as a null indicator.

C. Supply of the Recorder Output

The 1 V output of the d.c. amplifier is passed, fully separated galvanically, to the recorder output sockets BU4 and BU5 via a chopper, a transformer, and a demodulator.
For calibration of the instrument there is an internal calibration voltage of 1 mV.
The instrument can obtain its supply from the mains or from the battery supply unit PM 9204.

2. OPERATING INSTRUCTIONS

2-1 Installation

A. Adjustment to the local mains voltage

Check that the voltage adaptor SK1, at the rear of the instrument, is in the position correcsponding to the local mains voltage, before the instrument is put into operation.
Mains voltage between 100 V and 132 V: 115 V setting.
Mains voltage between 200 V and 264 V: 230 V setting.
The rating of the mains fuses at the rear of the instrument is 125 mA for 230 V and 250 mA for 115 V, both delayed action.

B. Earthing

The instrument can be connected to a mains socket with rim earthing contacts by means of the 3 core mains lead supplied.
The housing of the instrument is then earthed via this lead.
Moreover it is possible to earth the instrument by connecting a separate earthing lead to the earth socket BU1, marked ⏚, at the front.

C. Battery supply

To fit the battery supply unit PM 9204 to the rear of the instrument, allow its projections to engage the recesses A, Fig. 5, and secure the unit with screws B.
Connect the 6 pole supply plug of the battery unit to the BATT. socket, BU7, at the rear of the instrument.
The life of the battery unit per charge is approximately 72 hours.
The batteries are automatically charged when the PM 2434 is connected to the mains, and the instrument can be used normally during the charging process.

2-2 Operation (Fig.'s 4 and 5, page 26)

A. Switching on

The PM 2434 does not have a mains switch. The SECONDARY POWER ON switch SK2 controls only the secondary circuit.
By means of this switch the instrument can be switched on, for mains as well as for battery operation.

B. Zero setting

1. Mechanical

Switch off the instrument and check the zero setting of the meter.
If necessary, correct the zero by means of the screw below the meter.

2. Electrical

Switch on the instrument by means of the SECONDARY POWER ON switch SK2. Interconnect terminals Lo (BU2) and Hi (BU3).
Set the range selector SK3 to 10 µV.
Adjust for minimum deflection by means of the zero control potentiometers "0". (Pointer of polarity indicator must be in the centre position).

C. Calibration

Connect the 1 mV from BU6 to the Hi input.
Set the range selector SK3 to 1 mV.
The meter should indicate exactly 100.
If necessary, the deviation can be corrected by means of potentiometer "CAL" (Fig.5).

D. Measurements

1. Connections

The test voltage should be applied to sockets Lo (BU2) and Hi (BU3).
By means of the interconnection link the Lo socket can be connected to the earth socket (BU1) so that one side of the measuring signal will be connected to earth.
For floating measurements, remove the link between the Lo and the earth socket.

2. Direct voltage measurements

The voltage ranges can be selected by means of the range selector switch SK3.
For measurements in the most sensitive ranges it is advisable to check the preliminary deflection before each new measurement.
Pre-deflection can be reduced by means of the combined coarse-fine control "0".
Parasitic voltages in the measuring circuit, e.g. thermovoltages etc., can thus be eliminated.
The input resistance of the instrument has a constant value, viz.
1 MΩ in the ranges of 10 μV to 30 mV.
10 MΩ in the ranges of 100 mV and 300 mV.
100 MΩ in the ranges of 1 V to 1000 V.
As a result of this constant input resistance, very small direct currents (10 pA to 30 nA) can be measured in the corresponding 10 μV to 30 mV ranges.

E. Polarity indication

The polarity indicator gives an indication of the polarity of the voltage applied to the instrument.
When the pointer deflects to the "+", the Hi socket is positive with respect to the Lo, and when the pointer deflects to the "-" the Lo socket is positive with respect to the Hi.
As the polarity indicator has a high sensitivety, (full scale deflection at approx. 10% of f.s.d. of the instrument) it is extremely suitable for balancing measuring bridges, compensation circuits etc.

F. Recorder output

To the sockets "Rec" and "⏚" (BU4 and BU5) a recorder can be connected.
When the instrument is used as d.c. amplifier, they may also be employed as d.c. output.
The output voltage is proportional to the input and is 1 V at full-scale deflection, irrespective of the selected measuring range.
The polarity of the output voltage is the same as the polarity of the input voltage.
The output is fully isolated from the input and one side of it is connected to the housing.
The impedance of the recorder output is approx. 1 kΩ.

EFFECTS ON THE TEST CIRCUIT

A set-up can be influenced by external interference.
The most important sources of interference, which have the greatest influence in the case of sensitive measurements of electric magnitudes, are the following:

A. Dynamic electric fields

Such field are caused by conductors which conduct alternating currents, and they create around themselves a low-frequency or high-frequency electric field.

B. Static electric fields

These fields are due to frictional electricity or heat, and they occur mainly at the insulating materials acting as charge support then.
The voltage produced in such charge supports is often very high and may reach many thousends of volts.

C. Dynamic magnetic fields

Electromagnetic fields are mainly produced by transformers, chokes, coils, motors etc. The magnetic fields, which often have local definitions, can give rise to great difficulties.

D. Static mafnetic fields

They are produced by permanent magnets and have only a slight influence on the electric circuits as long as the conductor in the field or lines of force remains stationary. As soon as the conductor is set into motion, there is an induction voltage.
In the case of very sensitive measurements the terrestrial magnetism is sufficient to produce an interference voltage in a moving conductor.

E. Thermic influence

There are almost always different interconnected metals (soldering points) in the electric circuits, which can act as thermoelectric couples and give rise to more or less high voltages, depending on the material at the various connections.
These voltages remain constant as long as the contact temperature is constant.
In this way, these voltages can be compensated.

F. Climatic influence

The humidity of the air is an important factor in sensitive test, especially in the case of high ohmic circuits.

To reduce the influence of these types of interference it is imperative that:
- a shielded cable is used,
- the connections are kept short,
- the circuit is not submitted to temperature fluctuations,
- measures are adopted to prevent changes in the humidity of the air during the tests.

Note: If possible, a test should be repeated with the polarity reversed.

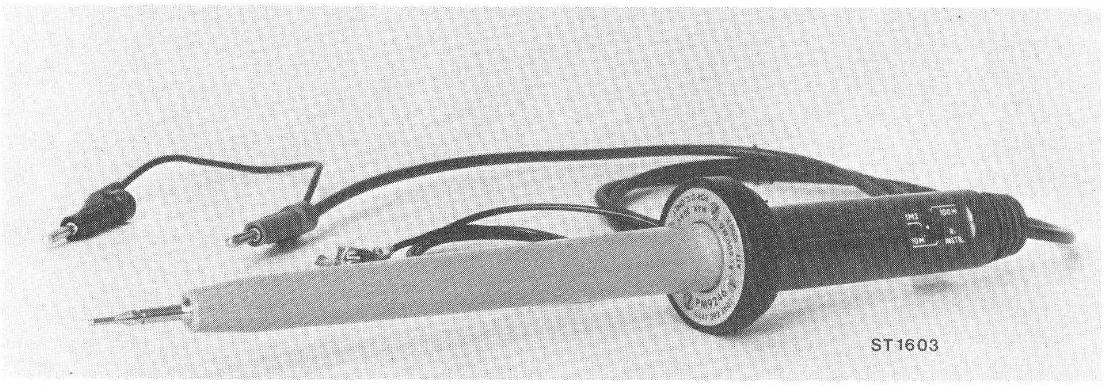


Fig. 1.

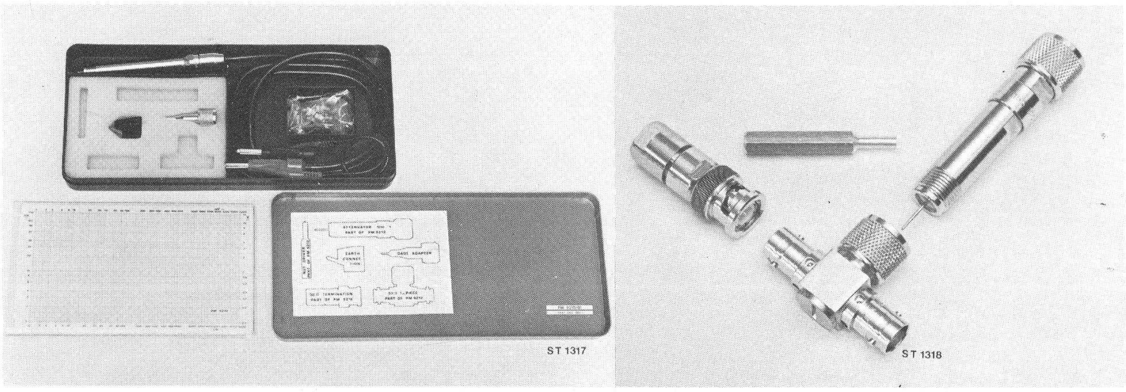


Fig. 2.

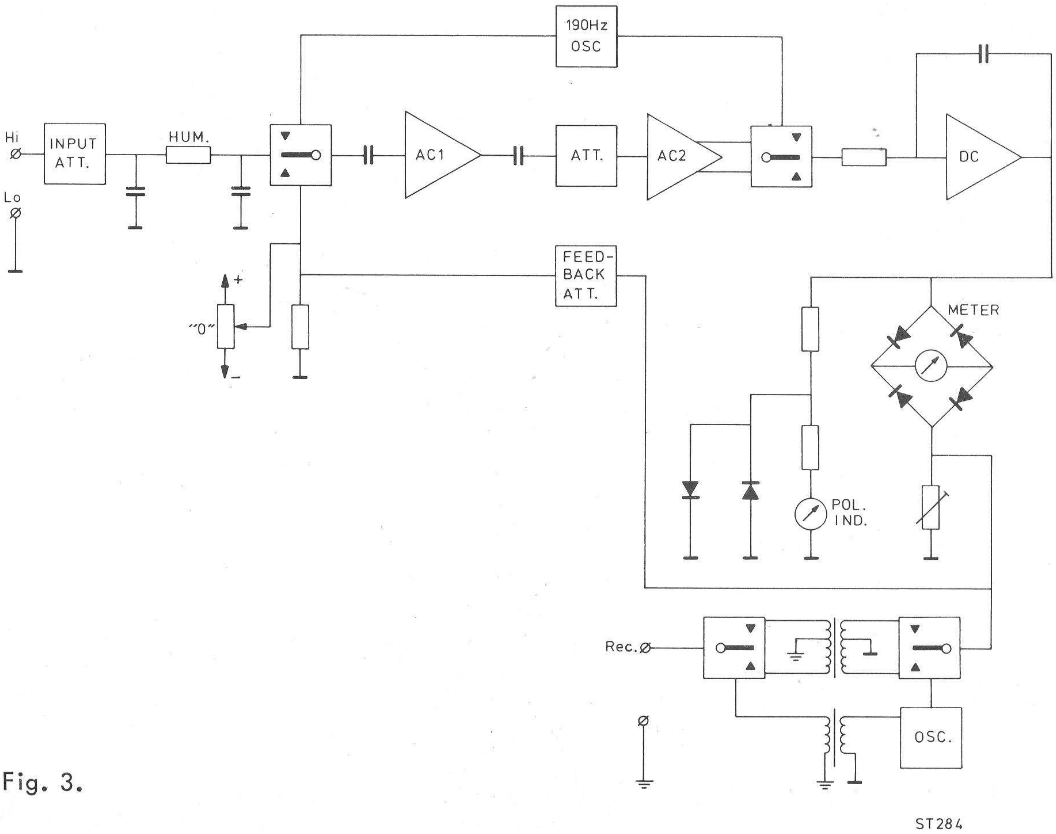


Fig. 3.

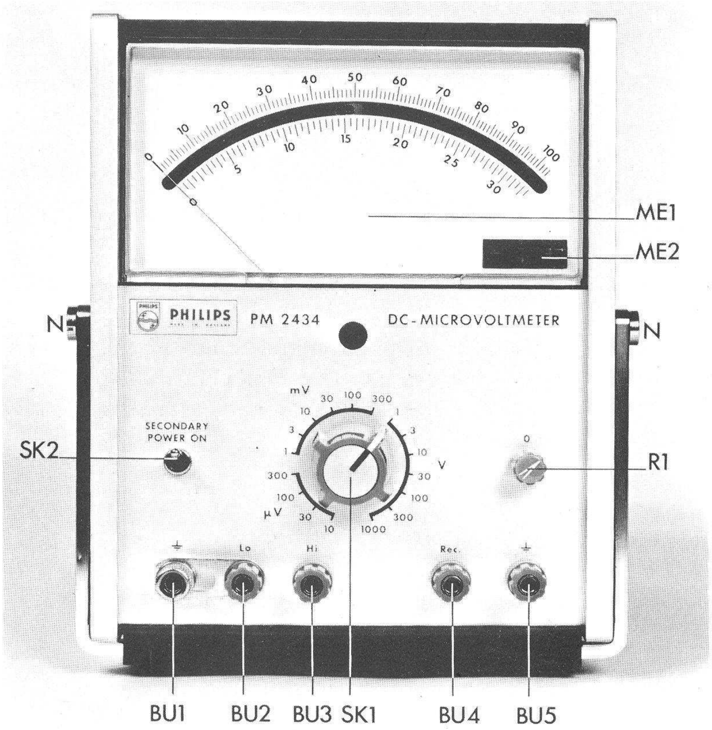

ME1
ME2
PHILIPS
PM 2434
DC-MICROVOLTMETER
N
N
SECONDARY POWER ON
SK2
mV
V
µV
R1
Lo
Hi
Rec.
BU1
BU2
BU3
SK1
BU4
BU5

Fig. 4.

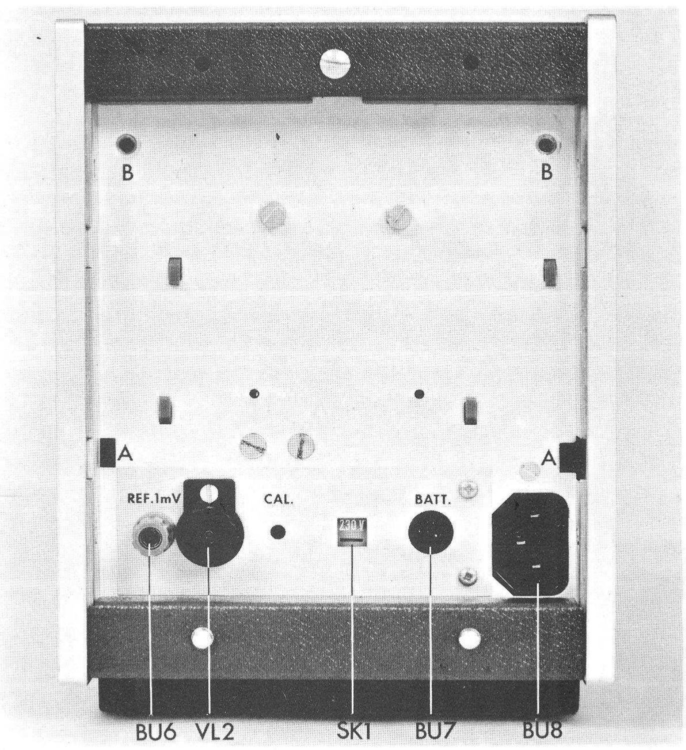

B
B
A
A
REF.1mV
CAL.
BATT.
230V
BU6
VL2
SK1
BU7
BU8

Fig. 5.

3. SERVICE DATA

3-1 Access (Fig.'s 7 and 8)

A. Dismantling of Housing

To remove the panels of the housing, proceed as follows:

- Loosen the screws N, Fig. 4 of the carrying handle.
- Remove the side panels and the carrying handle.
- Give the bayonet screw C a quarter turn.
- Remove top panel.
- Remove screw D and pull out the bottom panel to the rear.

B. Rear panel

The rear panel can be hinged down after the screws E have been taken out and the side panels have been pressed out a little.

Note: Make certain that, when the cover plate is fitted again to the rear panel, the spacers are mounted again on the supply transformer and that the insulating tape on this plate has not been damaged (Fig. 6).

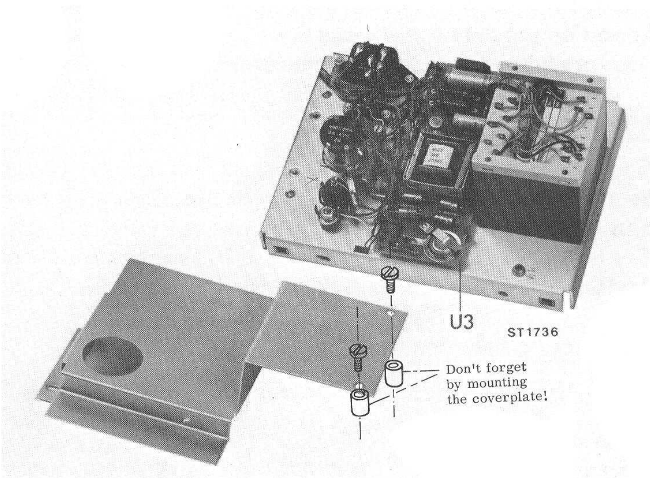


Fig. 6. Rear panel with cover plate

C. Test System

The test system is removed as follows:

- Loosen the screws F, K, and M a few turns.
- Take out the screw H.
- Unsolder the wiring.
- Press the side panels outward a little and take out the test system.

D. Replacement of Null Potentiometer Assembly

- Unsolder the wiring, resistors, and VL1 from the base plate L.
  Unsolder also the wires of the test system.
- Loosen screws H a few turns.
  Remove screws M and the knobs of SK3 and R1.
- Hinge down the front panel.
  Loosen the nut of SK3.
- Remove the screws K and take out the base plate with potentiometer.
- Replace these with a new assembly.

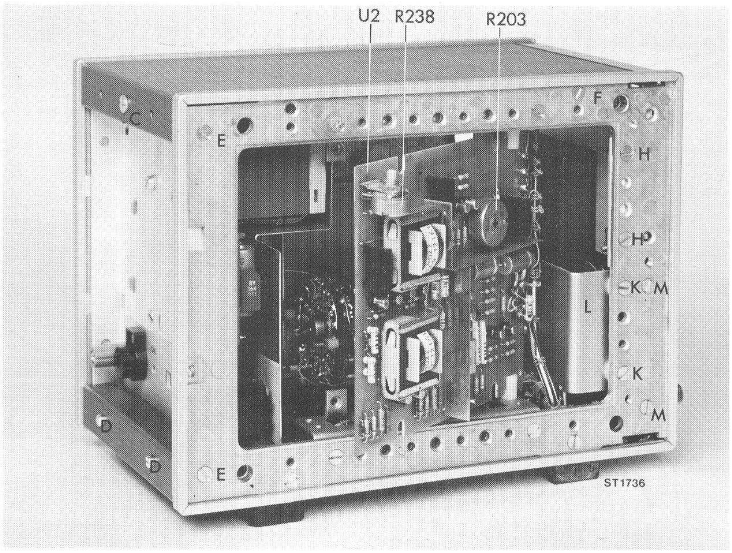


Fig. 7.

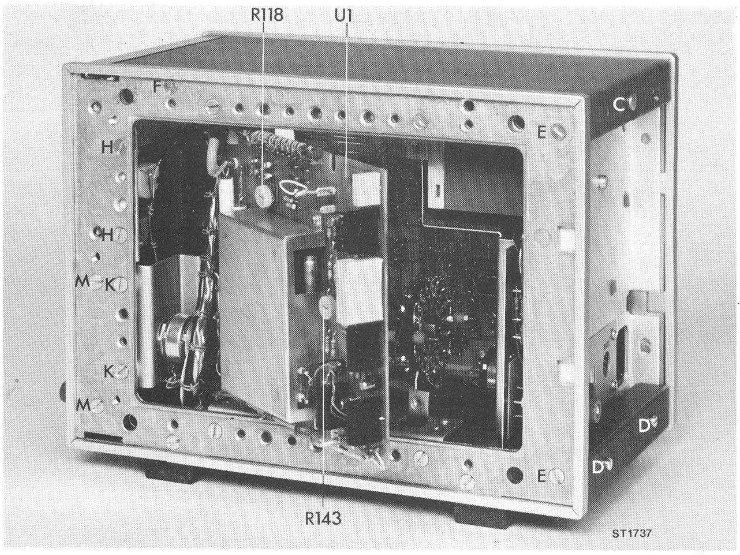


Fig. 8.

3-2 Checking and adjusting

The values and tolerances given in this section are factory data. They may depart from the specifications given in Section 1-2. Values given without tolerances are intended for information only; they are representative of any instrument.

Mechanical Zero Setting

With the instrument switched off, check whether the pointer of the meter indicates zero. Departures can be corrected by means of the screw below the meter.

Mains Supply

- Check whether SK1, Fig. 5, is set to the position corresponding with the local mains voltage.
- Connect the instrument to the mains voltage and set SK2, Fig. 4, to the position SECONDARY POWER ON
- The supply voltages must be +12.3 V and -12.3 V, with a tolerance of ± 1 V with respect to Lo
  Test points:

+ 12.3 V	U3/12
LO	U3/11
- 12.3 V	U3/10

These voltages must be tested under load.

Battery operation

- Apply a voltage of 5 V to BU7, the positi e to pin b and the negative to pin d, Fig. 9.
- Check the current consumption. This should be less than 31 mA.
- Check the supply voltages of +12.3 and -12.3 V.
- Reduce the voltage from 5 V to 4.4 V. The drop in the output voltage should be less than 0.4 V.

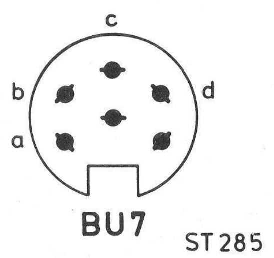


Fig. 9.

Power Consumption

About 100 mA at a mains voltage of 220 V.
About 220 mA at a mains voltage of 110 V.

Direct Current Settings

The d.c. settings must be tested with points BU2 and BU3 short-circuited.

A. A.c. amplifier

TS103 collector	2.8 V
TS105 collector	5.7 V
TS105 emitter	5.1 V
TS106 emitter	5.1 V
TS107 base	3 V
TS107 collector	7.4 V
TS108 base	-3 V
TS108 collector	-7.4 V

B. D.c. amplifier

TS111 base	0 V
TS111 collector	5.2 V
TS112 base	0 V
TS112 collector	5.2 V
TS115 collector	12 V
TS116 collector	-12 V

C. MΩ-Ω converter

TS201 drain	1.4 V
TS201 source	4.2 V
TS202 drain	1.4 V
TS202 source	4.2 V
TS205 collector	12 V
TS205 emitter	0 V
TS206 collector	-12 V

D. 5.6 kHz oscillator

TS215 collector	- 0.7 V
TS216 collector	- 0.7 V
GR210 cathode	11.8 V
GR216 cathode	-11.8 V

E. 190 Hz oscillator

R211/R212	5.2 V
TS211 emitter	6.1 V
TS213 emitter	- 5.2 V

Output: 190 Hz square-wave voltage +0.5 ... -4.5 V.
Outputs A and B are mutually displaced by 180°.

ADJUSTMENTS

A. 190 Hz oscillator

SK3 set to 10 mV range.
Adjust the frequency, with the help of R210, to 190 Hz ± 2 Hz, using a Lissajoux figure on the oscilloscope.
Measure at points 8 and 10 of U2 (Fig. 13);

B. Null point and recorder output

Short-circuit the input of the instrument to BU2 and BU3, Fig. 4.
Set SK3 to 10 µV.
Check the control range of R1 (ZERO).

Turned fully to the right, the indicator should indicate "+" and the meter more than 100 scale divisions.
Turned fully to the left, the indicator should indicate "-" and the meter more than 100 scale divisions.
By means of R1, set the indicator to zero (centre of scale).
Connect U2/4 to U2/6, Fig. 13.
By means of R203, adjust the voltage across BU4 and BU5 to ± 0.5 mV.
Disconnect U2/4 from U2/6.
By means of R1, set the meter to 100 scale divisions.
By means of R238, adjust the voltage across BU4 and BU5 to 1 V ± 10 mV.

C. Current offset TS101 - 102

Set the meter to zero with R1.
Disconnect the short-circuit between BU2 and BU3.
By means of R118, set the meter to zero.
If the control range is too small, R116 and R117 must be adjusted as follows:
Set R118 to its centre position.
Read the meter.
Mount R116 and R117 in accordance with the table below.

indication → µV

Pos	Neg	0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360							
R116	R117	10k	12k	15k	18k				
R117	R116	10k	8k2	6k8	5k6	4k7	3k9	3k3	2k7
		0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360							

→ µV indication

After R116 and R117 have been mounted, set the meter by means of R118 to zero again (SK3 set to 10 µV).
Check the zero point after fitting of the right-hand side panel.
Any deviation must be less than 7.5 µV.

D. Calibration of the meter

Set SK3 to the 1 mV range.
Connect a voltage of 1 mV across BU2 and BU3.
By means of R25 (CAL, Fig. 5) set the meter to 100.
Invert the voltage.
The meter must now indicate 100 ± 0.5 scale divisions.

E. Linearity

Set SK3 to 1 mV

Input voltage across BU2 and BU3	Deflection of meter	Recorder output
0.8 mV	80 ± 1 scale divisions	0.8 V ± 10 mV
0.6 mV	60 ± 1 scale divisions	0.6 V ± 10 mV
0.4 mV	40 ± 1 scale divisions	0.4 V ± 10 mV
0.2 mV	20 ± 1 scale divisions	0.2 V ± 10 mV

F. Reference voltage

Connect BU3 to BU6.
Set SK3 to 1 mV.
By means of R308, set the meter to 100 ± 1 scale divisions.

G. Input attenuator

The input attenuator, after components have been exchanged, requires adjustment again in the following manner:
Set SK3 to 100 mV.
Connect a voltage of 100 mV across BU2 and BU3.
By means of R101, adjust the meter delfection to 100 ± 0.5 scale divisions.
Set SK3 to 1 V.
Connect a voltage of 1 V across BU2 and BU3.
By means of R104, adjust the deflection of the meter to 100 ± 0.5 scale divisions.
Set SK3 to 100 V.
Connect a voltage of 100 V across BU2 and BU3.
By means of R28, adjust the deflection of the meter to 100 ± 0.5 scale divisions.

H. Final check

After the above adjustments, the instrument must comply with the specifications given in the table below:

Position of SK3	Voltage across BU2 and BU3 (+)	Indication	
		0-100 scale	0-30 scale
10 µV	10 µV ± 0.5 %	100 ± 1.5	
30	30 µV ± 0.5 %		30 ± 1.5
100	100 µV ± 0.1 %	100 ± 1	
300	300 µV ± 0.1 %		30 ± 1
1 mV	1 mV ± 0.1 %	100 ± 1	
3	3 mV ± 0.1 %		30 ± 1
10	10 mV ± 0.1 %	100 ± 1	
30	30 mV ± 0.1 %		30 ± 1
100	100 mV ± 0.1 %	100 ± 1	
300	300 mV ± 0.1 %		30 ± 1
1 V	1 V ± 0.1 %	100 ± 1	
3	3 V ± 0.1 %		30 ± 1
10	10 V ± 0.1 %	100 ± 1	
30	30 V ± 0.1 %		30 ± 1
100	100 V ± 0.1 %	100 ± 1	
300	300 V ± 0.1 %		30 ± 1
1000	1000 V ± 0.1 %	100 ± 1	

3-3 List of parts

A. Mechanical

Item	Fig.	Qty.	Ordering number	Description
1	10	1	5322 344 64025	Meter M1 250 μA 334 Ω
2	10	1	5322 344 64026	Polarity indicator M2
3	10	1	5322 456 14004	Text plate front
4	-	1	5322 456 14005	Text plate rear
5	10	1	5322 310 10044	Handle bracket ASSY
6	10	1	5322 413 40112	Knob for SK3
7	10	1	5322 413 70037	Knob cap
8	10	1	5322 414 34052	Knob for R1
9	10	1	5322 413 70067	Knob cap
10	10	2	5322 460 60014	Ornamental frame
11	10	2	5322 460 60017	Ornamental strip
12	-	2	5322 520 10182	Bracket pivot
13	-	1	5322 404 50451	Stand up
14	11	4	5322 462 50101	Foot
15	11	4	5322 462 40157	Foot cap
16	-	1	5322 256 90086	Strip holder
17	-	2	5322 462 70366	Slide piece
18	11	4	5322 693 40001	Print support
19	11	14	5322 325 64034	Insulating plug
20	10	1	5322 505 14143	Nut
21	11	4	5322 532 64098	Pin
22	10	1	5322 532 54156	Bush for R1
23	10	1	5322 532 64099	Bush for SK3
24	10	1	5322 290 30001	Interconnection strip
25	-	1	5322 321 10071	Mains cable

B. Miscellaneous

BU1	4	1	5322 290 40012	Earth terminal
BU2 t/m 6	4-5	5	5322 290 40011	Terminals
BU7	5	1	5322 267 40127	Six-pole socket
BU8	5	1	5322 265 30066	Mains input socket
LA101	12	1	5322 134 20102	Neon lamp
SK1	5	1	5322 277 20014	Sliding switch
SK2	4	1	5322 277 10323	Power on switch
SK3	4	1	5322 293 84007	Range selector switch
U1	11	1	5322 216 74011	Printed wiring board
U2	11	1	5322 216 74012	Printed wiring board
U3	11	1	5322 216 74013	Printed wiring board
VL1	-	1	5322 252 60019	Spark gap
VL2	11	1	5322 256 40026	Fuse holder
VL2	11	1	5322 253 30007	Fuse 125 mA d.a.
T1	11	1	5322 146 30277	Mains transformer

Item	Fig.	Qty.	Ordering number	Description
TS201-202	13	2	5322 142 64003	Transformer
T301	14	1	5322 142 60131	Transformer
R1 a-b	11	1	5322 218 64029	Zero potentiometer with mounting plate

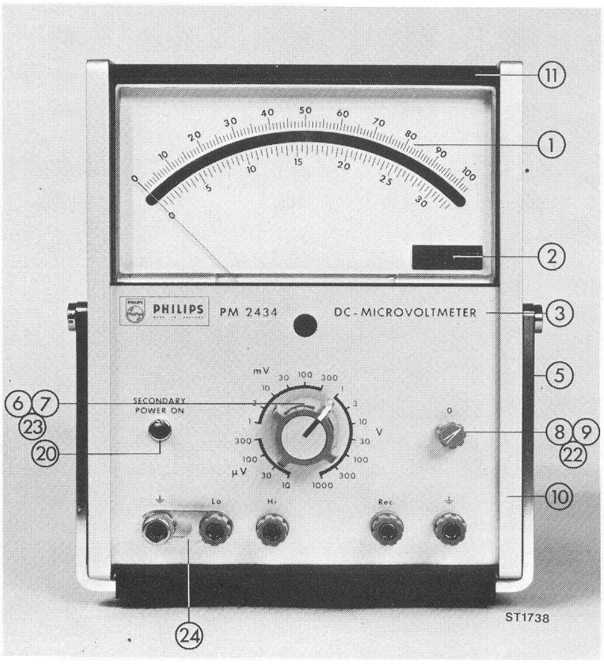


Fig. 10. Front view with item numbers

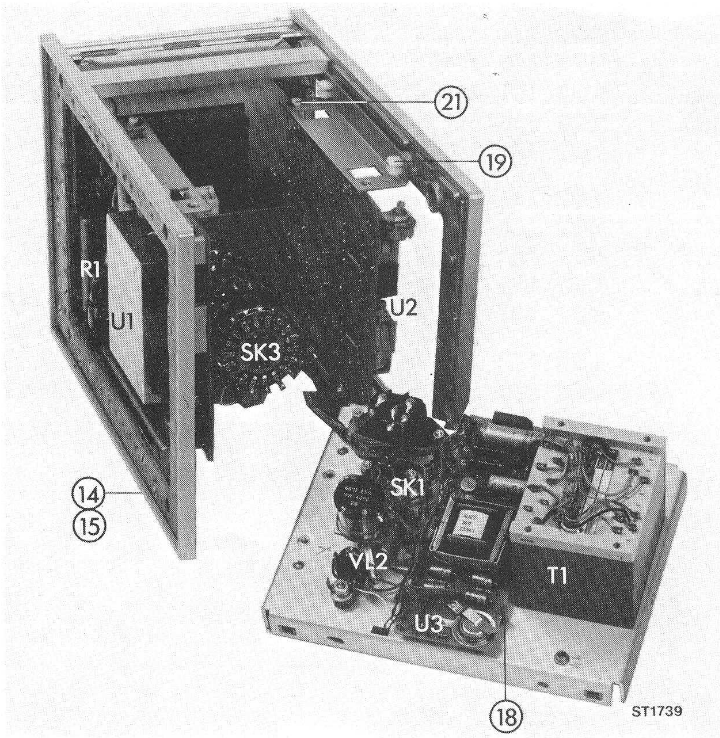


Fig. 11. Rear view

Resistors

No.	Ordering number	Value (Ω)	%	Series	Description
R2	5322 116 50703	681k	0.25	MR54E	Metal film
R3	5322 116 50636	2k74	1	MR25	Metal film
R4	5322 116 54149	215k	0.25	MR34E	Metal film
R5	5322 116 50965	1k21	1	MR25	Metal film
R6	5322 116 54151	68k1	0.25	MR24E	Metal film
R7	5322 116 50928	274E	1	MR25	Metal film
R8	5322 116 54152	21k5	0.25	M24E	Metal film
R9	5322 116 54054	121E	1	MR25	Metal film
R10	5322 116 51041	6k81	0.25	MR24E	Metal film
R11	5322 116 54191	30k1	1	MR25	Metal film
R12	5322 116 54153	1M	0.25	MR54E	Metal film
R14-R16	5322 116 50748	10k	1	MR25	Metal film
R15	5322 116 54154	316k	0.25	M34E	Metal film
R17	5322 116 54155	100k	0.25	MR24E	Metal film
R18	5322 116 51056	11k	1	MR25	Metal film
R19	5322 116 50421	31k6	0.25	MR24E	Metal film
R20	5322 116 50525	14k7	1	MR25	Metal film
R21	5322 116 50748	10k	0.25	MR24E	Metal film
R29	5322 116 50493	27E4	1	MR25	Metal film
R30	5322 116 50947	3k16	0.25	MR24E	Metal film
R103	5322 111 24011	8M66	1		Carbon
R106	5322 111 24012	86M6	1		Carbon
R107	5322 116 54191	30k1	1	MR25	Metal film
R108	5322 116 50875	59k	1	MR25	Metal film
R109	5322 116 50875	59k	1	MR25	Metal film
R111	5322 111 30336	1G	10		Carbon Allen Bradley
R112	5322 116 50452	10E	1	MR25	Metal film
R118	5322 101 14024	2k2	20		Potentiometer
R120-R156	5322 116 54153	1M	1	MR30	Metal film
R143	5322 101 14025	220E	20		Potentiometer
R154	5322 116 50913	6k34	1	MR25	Metal film
R159	5322 116 50577	215k	1	MR30	
R203	4822 103 10083	220E	10		Wire-wound potentiometer
R232-R233	5322 116 54156	154k	1	MR30	Metal film
R238	5322 101 20076	4k7	20		Potentiometer
R301	5322 112 20069	39E	10		Wire-wound 5.5 W
R302	5322 112 20083	120E	10		Wire-wound 5.5 W
R309	5322 116 54157	169k	1	MR30	Metal film
R310	5322 116 50354	133E	1	MR30	Metal film

Capacitors

No.	Ordering code	Value	%	V	Description
C101	5322 121 40176	1 µF	10	100	Polyester
C102, C103	5322 121 40015	0.47 µF	10	250	Polyester
C104	5322 121 40057	68 nF	10	100	Polyester
C105	4822 124 20372	47 µF		4	Electrolytic
C106- C107	5322 124 20377	68 µF		16	Electrolytic
C108	5322 124 20373	47 µF		10	Electrolytic
C109	5322 121 40232	0.22 µF	10	100	Polyester
C110	4822 124 20565	100 µF		4	Electrolytic
C111, C115, C117	5322 121 40197	1 µF	10	100	Polyester
C112	5322 124 20375	68 µF		6.3	Electrolytic
C113	5322 121 40233	0.68 µF	10	100	Polyester
C114	5322 120 10107	1 nF	10	500	Ceramic
C116	5322 121 40256	2.2 µF	10	100	Polyester
C118	4822 124 20372	47 µF		4	Electrolytic
C201	5322 121 40197	1 µF	10	100	Polyester
C202- C203	4822 124 20574	150 µF		16	Electrolytic
C208- C209	5322 121 40175	0.47 µF	10	100	Polyester
C210- C211	5322 121 50424	1 nF	1	63	Polyester
C212- C213	4822 124 20368	33 µF		16	Electrolytic
C214	5322 121 50097	10 nF	1	63	Polyester
C301	5322 124 20411	680 µF		16	Electrolytic
C302	5322 124 20382	100 µF		10	Electrolytic
C303	4822 122 10014	2.2 nF	10	500	Ceramic
C304	5322 124 20373	47 µF		10	Electrolytic
C305	4822 120 10107	1 nF	10	500	Ceramic
C306- C307	4822 124 20368	33 µF		16	Electrolytic
C308- C309	4822 124 20368	33 µF		16	Electrolytic

Transistors

Type	Ordering number	Pos.
BSY81	5322 130 44041	TS101...TS102...TS109...TS110
BC109C	5322 130 40144	TS103...TS105
BC179	5322 130 40353	TS104
BCY57	5322 130 40491	TS106...TS107...TS115
BCY71	5322 130 40373	TS108...TS113...TS114...TS116
BCY87	5322 130 40423	TS111...TS112
BFS21A	5322 130 40709	TS201...TS202
BCY71	5322 130 40373	TS203...TS204...TS206...TS211
BCY57	5322 130 40491	TS205...TS212...TS213...TS214
BSV80	5322 130 34044	TS207...TS208...TS209...TS210
BSX20	5322 130 40417	TS215...TS216
BFY55	5322 130 40323	TS301

Diodes

Type	Ordering number	Pos.
BAX16	5322 130 30273	GR101...GR102...GR103...GR104...GR105 GR107...GR108...GR109...GR110...GR111 GR112
AAZ15	5322 130 30229	GR106
BAX16	5322 130 30273	GR201
AAZ15	5322 130 30229	GR202
BAX13	5322 130 40182	GR203...GR204...GR205...GR206...GR207 GR208...GR209...GR210...GR211...GR212 GR213...GR214
BAV10	5322 130 30594	GR215...GR216
BY164	5322 130 30414	GR301
BZX29-C6V8	5322 130 30609	GR302
BAX13	5322 130 40182	GR303...GR305...GR306...GR307
BZX79-C6V2	5322 130 34167	GR304
BZX79-C15	5322 130 30781	GR113...GR114

CODING SYSTEM OF FAILURE REPORTING FOR QUALITY ASSESSMENT OF T & M INSTRUMENTS

(excl. potentiometric recorders)

The information contents of the coded failure description is necessary for our computerized processing of quality data.

Since the reporting of repair and maintenance routines must be complete and exact, we give you an example of a correctly filled-out PHILIPS SERVICE Job sheet.

① *Country*	② *Day Month Year*	③ *Typenumber /Version*	④ *Factory/Serial no.*
3 2	1 5 0 4 7 5	O P M 3 2 6 0 0 2	D O 0 0 7 8 3

CODED FAILURE DESCRIPTION ⑥

⑤ *Nature of call*	*Location*	*Component/sequence no.*	*Category*
☐ Installation		T S 0 6 0 7	5
☐ Pre sale repair		R 0 0 6 3 1	2
☐ Preventive maintenance	0 0 2 1	9 9 0 0 0 1	4
☒ Corrective maintenance			
☐ Other			

⑦ *Job completed* ☒

Working time ⑧ [ ][ ][1][2] Hrs

Detailed description of the information to be entered in the various boxes:

①Country: [3 2] = Switzerland

②Day Month Year [1 5 0 4 7 5] = 15 April 1975

③Type number/Version [O P M 3 2 6 0 0 2] = Oscilloscope PM 3260, version 02 (in later oscilloscopes this number is placed in front of the serial no)

④Factory/Serial number [D O 0 0 7 8 3] = DO 783 These data are mentioned on the type plate of the instrument

⑤Nature of call: Enter a cross in the relevant box

⑥Coded failure description

Location

[ ][ ][ ][ ]

These four boxes are used to isolate the problem area. Write the code of the part in which the fault occurs, e.g. unit no or mechanical item no of this part (refer to 'PARTS LISTS' in the manual).

Example: 0001 for Unit 1
000A for Unit A
0075 for item 75

If units are not numbered, do not fill in the four boxes; see Example Job sheet.

Component/sequence no.

[ ][ ][ ][ ][ ][ ]

These six boxes are intended to pinpoint the faulty component.

A. Enter the component designation as used in the circuit diagram. If the designation is alfa-numeric,the letters must be written (starting from the left) in the two left-hand boxes and the figures must be written (in such a way that the last digit occupies the right-most box) in the four right-hand boxes.

B. Parts not identified in the circuit diagram:

- 990000 Unknown/Not applicable
- 990001 Cabinet or rack (text plate, emblem, grip, rail, graticule, etc.)
- 990002 Knob (incl. dial knob, cap, etc.)
- 990003 Probe (only if attached to instrument)
- 990004 Leads and associated plugs
- 990005 Holder (valve,transistor, fuse, board, etc.)
- 990006 Complete unit (p.w. board, h.t. unit, etc.)
- 990007 Accessory (only those without type number)
- 990008 Documentation (manual, supplement, etc.)
- 990009 Foreign object
- 990099 Miscellaneous

Category

[ ]

- 0 Unknown, not applicable (fault not present, intermittent or disappeared)
- 1 Software error
- 2 Readjustment
- 3 Electrical repair (wiring, solder joint, etc.)
- 4 Mechanical repair (polishing, filing, remachining, etc.)
- 5 Replacement (of transistor, resistor, etc.)
- 6 Cleaning and/or lubrication
- 7 Operator error
- 8 Missing items (on pre-sale test)
- 9 Environmental requirements are not met

⑦Job completed: Enter a cross when the job has been completed.

⑧Working time: Enter the total number of working hours spent in connection with the job (excluding travelling, waiting time, etc.), using the last box for tenths of hours.

[ ][ ][1][2] = 1,2 working hours (1 h 12 min.)

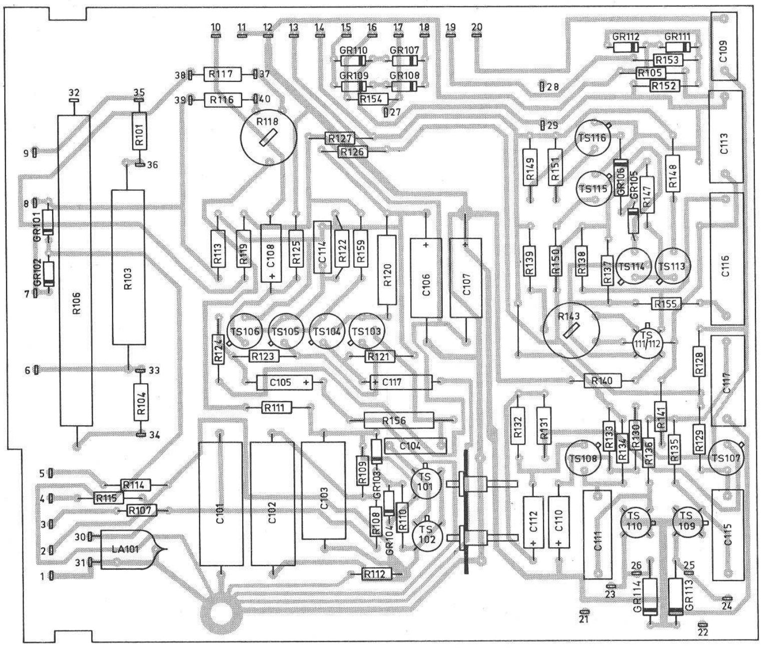


Fig. 12. Unit 1

ST279

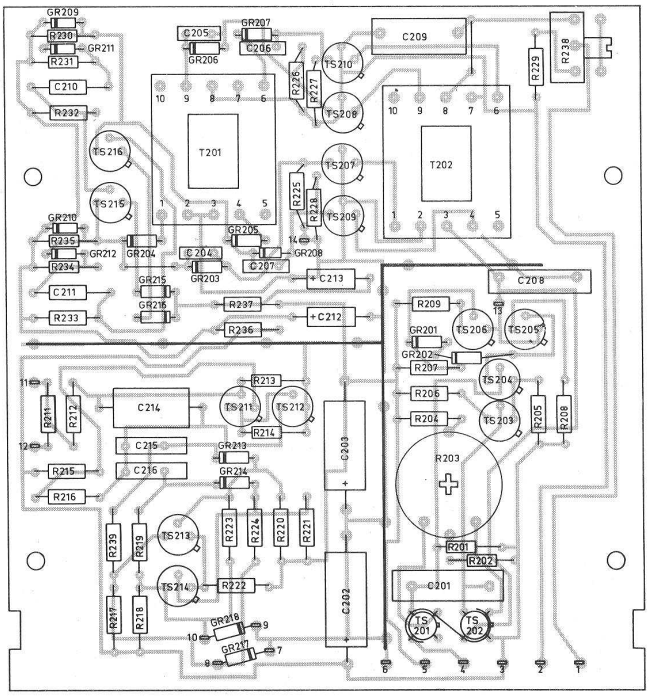


Fig. 13. Unit 2

ST280

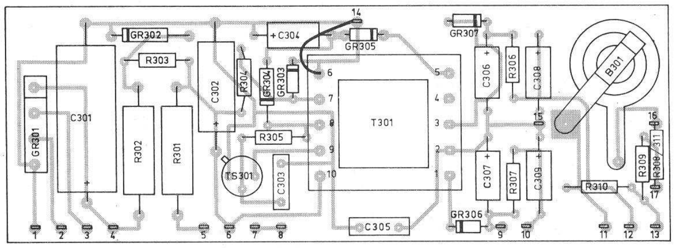
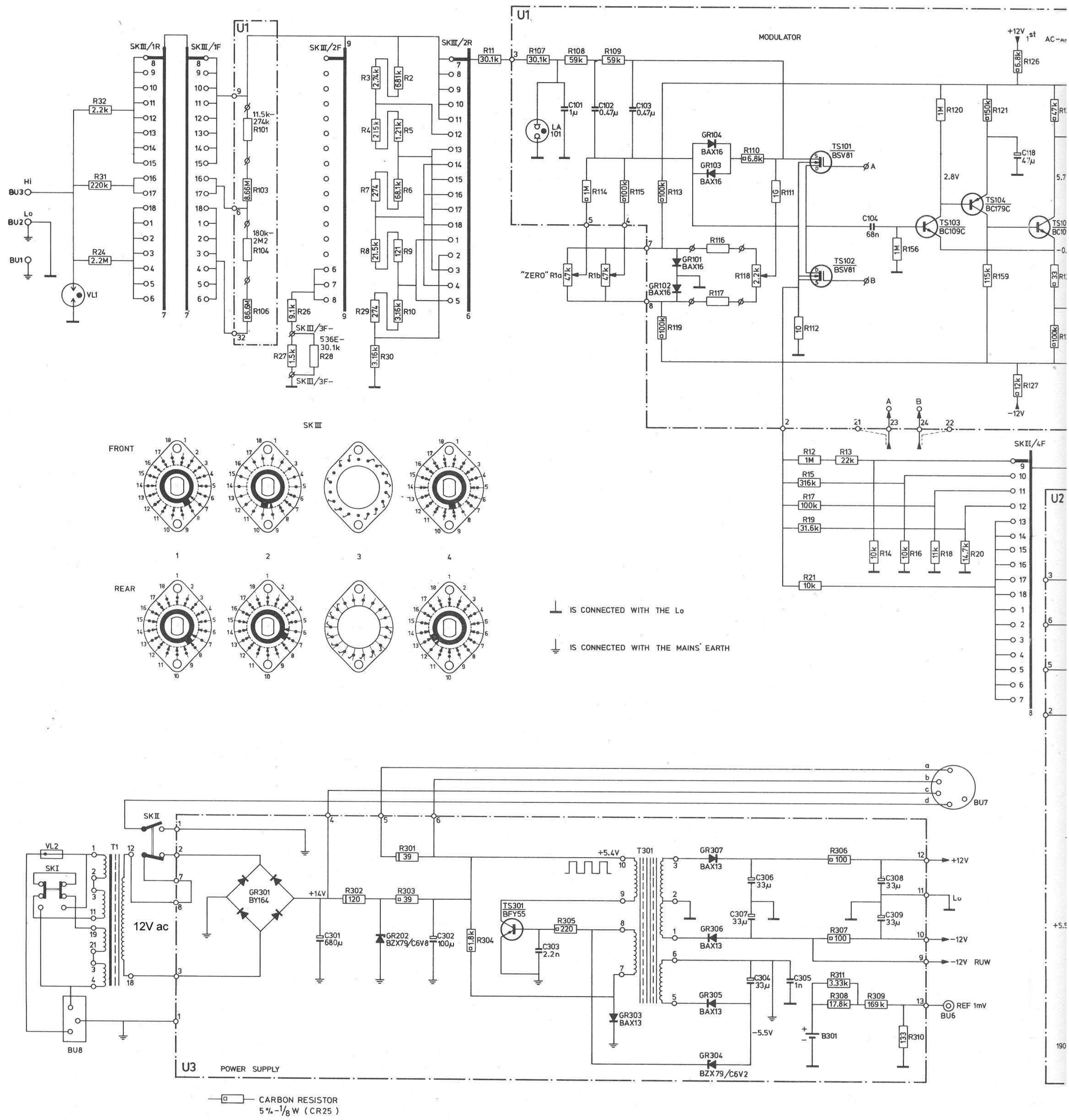


Fig. 14. Unit 3

ST278


MODULATOR
U1
U2
U3
POWER SUPPLY
SKIII
FRONT
REAR
1
2
3
4
IS CONNECTED WITH THE Lo
IS CONNECTED WITH THE MAINS' EARTH
Hi
BU3
Lo
BU2
BU1
VL1
R32 2.2k
R31 220k
R24 2.2M
R101
R103
R104
R106
R11 30.1k
R107 30.1k
R108 59k
R109 59k
C101 1μ
C102 0.47μ
C103 0.47μ
LA 101
GR104 BAX16
GR103 BAX16
R110 6.8k
TS101 BSV81
TS102 BSV81
"ZERO" R1a
R1b
GR101 BAX16
GR102 BAX16
R116
R117
R118
R119
R112
C104 68n
R156
TS103 BC109C
TS104 BC179C
R126
R120
R121
C118 47μ
R159
R127
-12V
+12V
SKII/4F
R12 1M
R13 22k
R15 316k
R17 100k
R19 31.6k
R21 10k
R14
R16
R18
R20
BU7
BU8
VL2
SKI
SKII
T1
12V ac
GR301 BY164
+14V
R302 120
R303 39
R301 39
C301 680μ
GR202 BZX79/C6V8
C302 100μ
R304
TS301 BFY55
R305 220
C303 2.2n
+5.4V
T301
GR303 BAX13
GR307 BAX13
GR306 BAX13
GR305 BAX13
GR304 BZX79/C6V2
C306 33μ
C307 33μ
C304 33μ
C305 1n
-5.5V
B301
R306 100
R307 100
C308 33μ
C309 33μ
R311 3.33k
R308 17.8k
R309 169k
R310
+12V
-12V
-12V RUW
REF 1mV
BU6
CARBON RESISTOR 5%-1/8W (CR25)

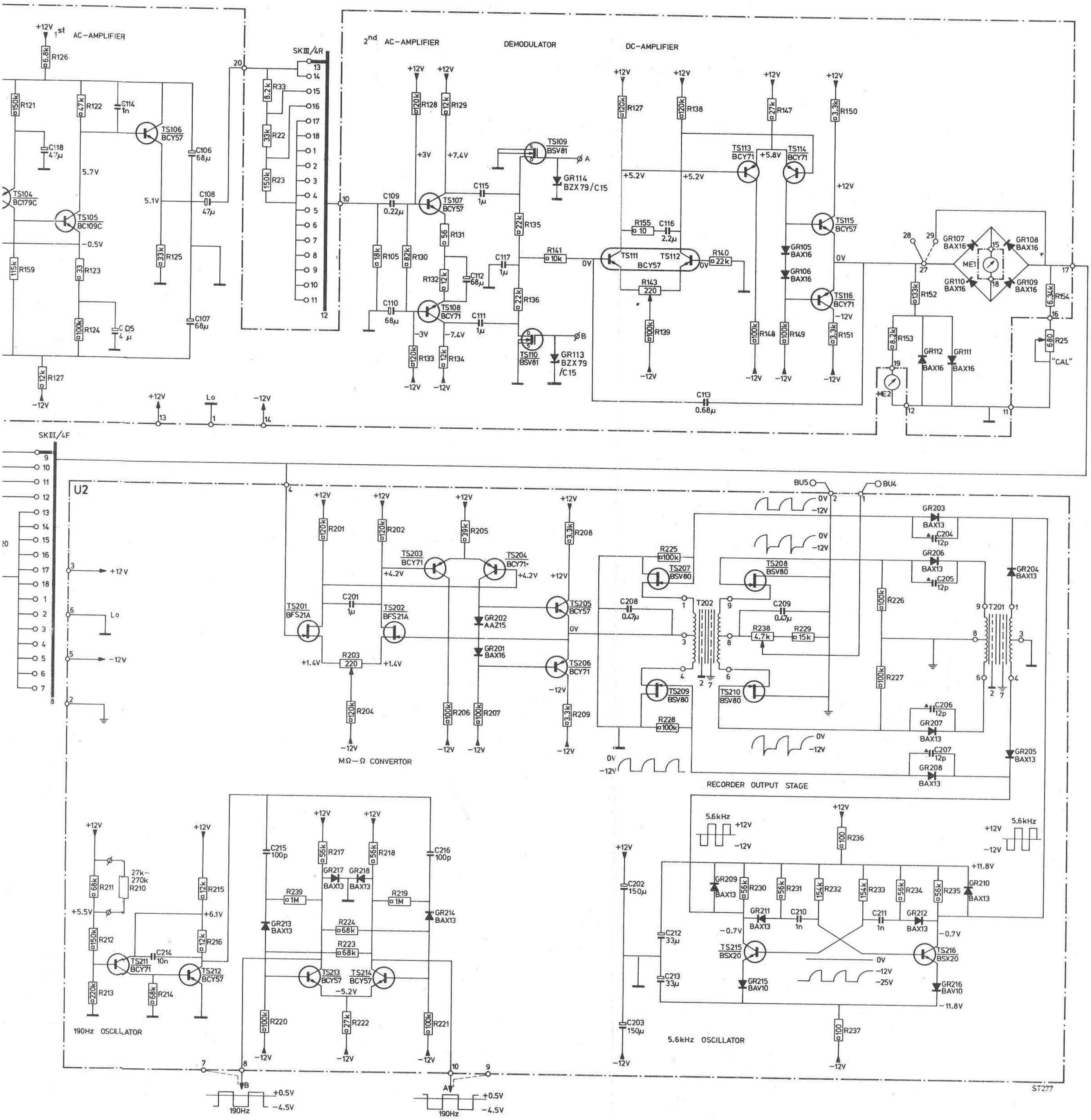


Fig. 15. Schematic diagram