Electronic VAΩmeter
PM2505

9447 025 050.1

Service Manual

9499 475 01411

800301

S&I

Scientific & Industrial Equipment Division

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PHILIPS

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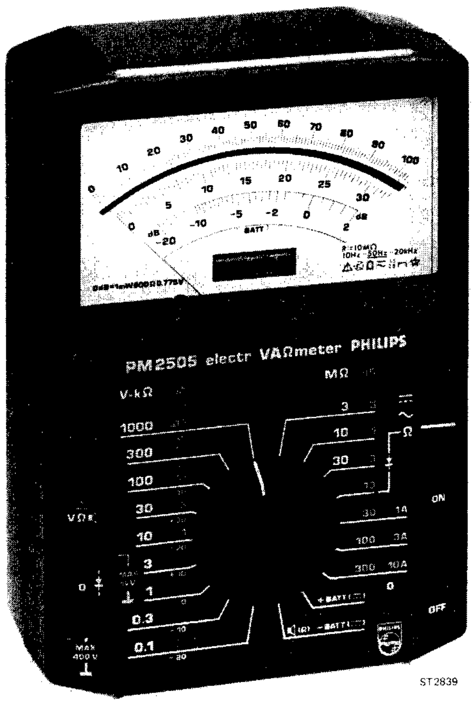

ST2839

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IMPORTANT

In correspondence concerning this instrument, please quote the type number and serial number as given on the type plate.

WICHTIG

Bei Schriftwechsel über dieses Gerät wird gebeten, die genaue Typenbezeichnung und die Gerätenummer anzugeben. Diese befinden sich auf dem Leistungsschild.

IMPORTANT

RECHANGE DES PIECES DETACHEES (Réparations)

Dans votre correspondance et dans vos réclamations se rapportant à cet appareil, veuillez TOUJOURS indiquer le numéro de type et le numéro de série qui sont marqués sur la plaquette de caractéristiques.

Note: *The design of this instrument is subject to continuous development and improvement. Consequently, this instrument may incorporate minor changes in detail from the information contained in this manual.*

Bemerkung: *Die Konstruktion und Schaltung dieses Geräts wird ständig weiterentwickelt und verbessert. Deswegen kann dieses Gerät von den in dieser Anleitung stehenden Angaben abweichen.*

Remarques: *Cet appareil est l'objet de développements et améliorations continuels. En conséquence, certains détails mineurs peuvent différer des informations données dans la présente notice d'emploi et d'entretien.*

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LIST OF FIGURES

1. INTRODUCTION

The analog electronic multimeter PM 2505 is a universal measuring instrument with 62 measuring ranges. With the optional accessories the measuring ranges can be extended up to 77.
The PM 2505 measures:

- ac and dc voltages from 100mV f.s.d. to 1000V f.s.d.
- resistances with a linear scale from 100Ω f.s.d. to 30MΩ f.s.d.
- ac and dc currents from 1 µA f.s.d. to 10A f.s.d..

The ranges in the voltage, resistance and current functions are divided in 1-3-10 steps.
Separate ranges are available for testing semiconductors , and for continuity check with the aid of an internal buzzer .
The instrument is powered by two 9V batteries which enable continuous measuring for at least 1000 hours.

2. TECHNICAL DATA

This apparatus has been designed and tested in accordance with IEC publication 348, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe cordilion . The present instruction manual contains some information and warnings which have to be followed by the user to ensure safe operation and to retain the apparatus in safe condition.

All values mentioned in this description are nominal; those given with tolerances are binding and guaranteed by the manufacturer.

Manufacturer	:	N.V. Philips MIG S&I
Typenumber	:	PM 2505
Designation	:	Electronic VAΩ-meter
Measuring quantities	:	Vdc, Vac, Adc, Aac, Ω, , , dB

2.1. MEASURING PERFORMANCE

2.1.1. Dc voltage measurements

Ranges (full scale deflection)	mV: 100 - 300 V: 1 - 3 - 10 - 30 - 100 - 300 - 1000
Sensitivity	1mV in 100mV range
Accuracy	± 1.5% f.s.d.
Temperature coëfficient	± 0.1% f.s.d. /°C.
Input impedance	10 MΩ//75pF
SMRR	> 60 dB at 50/60Hz
Maximum Series Mode signal	2 times full scale
CMRR with 1 KΩ unbalance	100dB for ac (48 - 62Hz)) 120dB for dc As common is used a grounded metal plate.
Max. voltage between:	
Hi and Lo	1000V peak,on all ranges
Hi and earth	1000V rms , 1400V peak – V test 6kV
Lo and earth	400V rms , 580V peak – V test 4kV
Recovery time	20s within specification in the 100mV range, after measuring 1000V in the 1000V range

2.1.2. Ac voltage measurements

Ranges (full scale deflection)

mV	100 - 300
V	1 - 3 - 10 - 30 - 100 - 300 - 1000

Sensitivity: 1mV in 100mV range

Accuracy

Range	Frequency	Acc.
100mV - 1000V	50 - 60Hz	± 2.5%
100mV - 300 V	10Hz - 30kHz	± 5% f.s.d.
1000V	10Hz - 1kHz	± 5% f.s.d.

Temperature coëfficient: ± 0.1% f.s.d. /°C

Input impedance: 10MΩ//75pF

CMRR with 1kΩ unbalance: 100dB for ac (48 - 62Hz)

Max. VHz product: $< 1.10^7$

Max. voltage between :

Hi and Lo: 600V rms, 1000V peak on all ranges

Hi and earth: 1400V peak - V test 6kV

Lo and earth: 400V rms, 580V peak - V test 4kV

2.1.3. Dc current measurements

Ranges (full scale deflection)

µA	1 - 3 - 10 - 30 - 100 - 300
mA	1 - 3 - 10 - 30 - 100 - 300
A	1 - 3 - 10

Sensitivity: 10nA in 1 µA range

Accuracy: ± 1.5% f.s.d.

Temperature coëfficient: ± 0.1% f.s.d. /°C.

Voltage drop over shunt f.s.d.

Range			Voltage drop
1µA	10µA	100µA	31.6mV
3µA	30µA	300µA	100 mV
1mA	30mA	1 A	10 mV
3mA	100mA	3 A	31.6mV
10mA	300mA	10 A	100 mV

Voltage drop over input sockets f.s.d.

Range	Voltage drop
1µA – 30mA	< 100mV
100mA	< 150mV
300mA	< 450mV
1 A	< 50mV
3 A	< 100mV
10 A	< 250mV

Protection:

Range 1µA – 300mA: Ceramic or glass fuse 20x5mm. 400mm. 400mA fast 250V IEC 127/1 High breaking capacity.
Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of make shift fuses and the short circuiting of fuseholders are prohibited.

Range 1A – 10A	Not protected. Maximum current 16A for 1 minute
Max. overload voltage	250V rms (40 - 400Hz)
Max. voltage between:	
Hi and earth	400V rms
Lo and earth	400V rms

2.1.4. Ac current measurements

Ranges (full scale deflection)

μA	1 - 3 - 10 - 30 - 100 - 300
mA	1 - 3 - 10 - 30 - 100 - 300
A	1 - 3 - 10

Sensitivity: 10nA in 1μA range

Accuracy

Range	Frequency	Acc.
1μA - 10 A	50 - 60 Hz	± 3%
1μA - 30μA	10 - 70 Hz	± 3%
100μA - 10 mA	10 Hz - 20 kHz	± 3%
30mA - 10 A	10 Hz - 10 kHz	± 3%

Temperature coëfficient: ± 0.1% f.s.d. /^{0}C.

Voltage over shunt at f.s.d.

Range			Voltage drop
1μA	10μA	100μA	31.6mV
3μA	30μA	300μA	100 mV
1mA	30mA	1 A	10 mV
3mA	100mA	3 A	31.6mV
10mA	300mA	10 A	100 mV

Voltage drop over input sockets at f.s.d.

Range	Voltage drop
1μA – 30mA	< 100mV
100mA	< 150mV
300mA	< 450mV
1 A	< 50mV
3 A	< 100mV
10 A	< 250mV

Protection:

Range 1μA – 300mA	Ceramic or glass fuse 20x5mm 400mA Fast, 250V. IEC 127/1 High breaking capacity Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of make shift fuses and the short circuiting of fuseholders are prohibited.
Range 1 A – 10 A	Not protected. Max. current 16A for 1 minute.
Max. overload voltage	250V rms (40 - 400Hz).
Max. voltage between:	
Hi and earth	400V rms
Lo and earth	400V rms

2.1.5. Resistance measurements

Ranges

Ω	100 - 300
kΩ	1 - 3 - 10 - 30 - 100 - 300
MΩ	1 - 3 - 10 - 30

Sensitivity — Linear-scale 1 Ω in 100 Ω range

Accuracy — ± 3% f.s.d. for 100 Ω to 10MΩ range
± 10% f.s.d. for 30MΩ range

Temperature coëfficient — ± 0.1% f.s.d. /°C

Measuring voltage and measuring current

Range	Measuring Voltage f.s.d.	Measuring current
100Ω 300Ω	31.6mV 100 mV	316μA
1kΩ 3kΩ	31.6mV 100 mV	31.6μA
10kΩ 30kΩ	31.6mV 100 mV	3.16μA
100kΩ 300kΩ	31.6mV 100 mV	316nA
1MΩ	1V	1μA
3MΩ		316nA
10MΩ		100nA
30MΩ		31.6nA

Protection — With semi-conductor protection devices

Maximum overload voltage — 250V rms (40 - 400Hz).

Maximum voltage between:

Hi and earth — 400V rms

Lo and earth — 400V rms

2.1.6. Semi-conductor testing ⯈| .

Range — Semi-conductor ⯈|

Measuring current — 316μA

Measuring voltage f.s.d. — 1V

	Meter indication	
	Conducting	Reversed
Si	50 – 80	100
Ge	10 – 30	100

Polarity for conducting — Anode on [VΩ 🔈] socket
Cathode on [0] socket

Maximum reverse voltage — 7.5V

Protection — With semi-conductor protection devices

Maximum overload voltage — 250V rms (40 - 400Hz)

Max. voltage between:

Hi and earth — 400V rms

Lo and earth — 400V rms

2.1.7. Continuity check (BUZZER – RANGE)

Range	BUZZER
Shortcircuit	Audible tone from 0Ω ... 20Ω
Isolation	Resistance > 20Ω, no tone
Protection	With semi-conductor protection devices
Maximum overload voltage	250V rms (40 - 400Hz).
Max. voltage between:	
Hi and earth	400V rms
Lo and earth	400V rms

2.1.8. dB measurements

Ranges

dB	-20, -10, 0, +10, +20, +30, +40
	+50, +60

0 dB reference	0dB = 1mW 600Ω 0,775V

2.2. GENERAL DATA

2.2.1. Conversion characteristics

Kind of conversion	Linear by means of FET and IC. The IC consists of an amplifier and current source for resistance measurement.
Operating principle	Current moving coil with taut band,driven by integrated circuit.
Basic mode of operation	Continuous indication on moving coil
Range setting	Manual with mono-knob
Function setting	Manual with slideswitch ⎓, ~, Ω.
Polarity setting	Automatic on separate moving coil system
Polarity indication	+ – ~ on separate moving coil system
Zeroing	Mechanical zero of moving coil Electrical zero of amplifier

2.2.2. Display

Visual representation:	3 scales: (0 - 100) (0 - 31.6) (-20 - +2 dB) Battery OK scale, mirror for parrellax free reading.
Means of representation of measured value	Position of needle on the scale of the measuring system.
Means of polarity representation	Position of needle of polarityindicator – ~ +
Means of function representation	Position of function switch: ⎓, ~, Ω.

2.2.3. Warm-up time

Warm-up time	None.

2.2.4. Operating conditions in accordance with IEC 68 - 2.

Climatic conditions	Acc IEC 359 Class 1
Ambient temperature	$23^{o}C \pm 2^{o}C$.
Rated range of use	$0^{o}C$ ... $+55^{o}C$
	The apparatus has been designed for indoor use it may occasionally be subjected to temperatures between $0^{o}C$ and $-10^{o}C$ without degradation of its safety.
Limit range of storage and transport	$-40^{o}C$ ... $+70^{o}C$
Relative humidity	10% ... 90% at $\leqslant 35^{o}C$ 10% ... 70% at 35^{o} to $55^{o}C$
Mechanical conditions	Acc IEC 68–2–6 FC
Vibration test	Acc IEC 359 M2
Fields and radiation	
From external origin	Electric / Magnetic } fields acc. MIL std 461A –R303
From internal origin	Electric / Magnetic } fields acc. MIL std 461A

2.2.5. Mechanical data

Material	ABS
Use of instrument	In three positions, horizontal, vertical and with stand-up bracket.
Dimensions	172 x 118 x 60mm.
Weight	Approx. 750 gr.

2.2.6. Power requirements

Batteries	Two 9V batteries 49 x 26 x 17.2mm dimensions acc. to IEC publ. 86 e.g. Philips 6F 22 TR
Battery life	Approx. 1000 hours Life-time in Ω, diode and BUZZER mode is lower.
Battery check	Two separate positions on the range switch for + and –battery check. Battery is OK when pointer is within battery scale.

2.2.7. Input terminals arrangement

Inputs	Floating
Number of input sockets	4 [0] Common socket for voltage, current, resistance, diode and BUZZER measurements. [VΩ buzzer] High socket for voltage and resistance, diode and BUZZER measurements. [μA-mA] High socket for low current-measurement from 1μA ... 300mA f.s.d. [A] High socket for high current-measurement from 1A ... 10A f.s.d.

Impedance between input-sockets	Between [VΩ 🔈] and [0]: 10MΩ // 75pF Between [μA-mA] and [0]: 1.8Ω in 300mA range. to 31.6KΩ in 1μA range. Between [A] and [0]: 20mΩ

2.2.8. Calibration

Calibration interval	Every 6 months.

2.2.9. Safety

Safety class II acc IEC 348 and VDE 0411

3. ACCESSORIES

3.1. ACCESSORIES SUPPLIED WITH THE PM 2505

- 2 Fuses 400mA fast
- Measuring-leads with testpins PM 9260

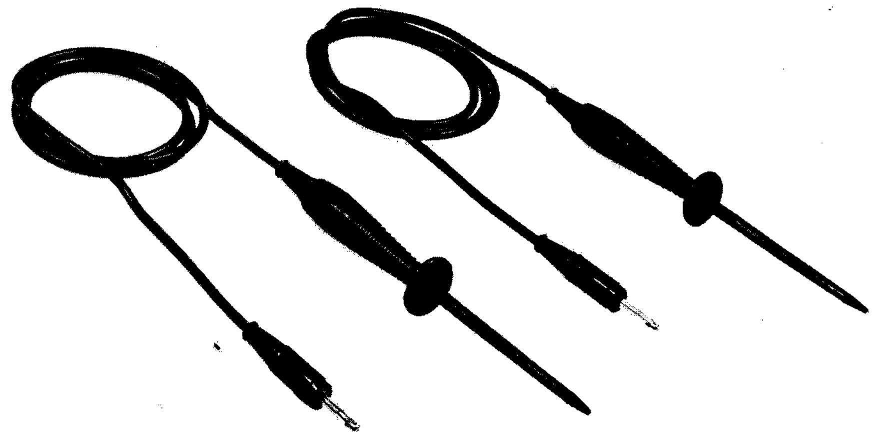


Fig. 1. Measuring leads with testpins PM 9262

3.2. OPTIONAL ACCESSORIES

3.2.1. HF probe type PM 9210 (Fig. 2) Accessory set for the probe type PM 9212 (Fig. 3).

	PM 9210	PM 9210 + PM 9212
Frequency range	100kHz to 1GHz	100kHz to 1GHz
Straight line within 5%	100kHz to 6MHz	100kHz to 6MHz
Maximum deviation	3dB	3.5dB
Voltages ranges	150mV to 15V	15V to 200V
Max. voltage a.c.	30V	200V
Max. voltage d.c.	200V	500V
Input capacitance	2pF	2pF
T-piece (included in PM 9212)		
Impedance		50Ω
Standing wave ratio		1.25 at 700MHz and 1.15 at 1GHz

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 100MHz.
For measurements beyond this frequency it is advisable to use the 50Ω T-piece and the 50 terminating resistance which are included in the PM 9212 probe accessories set.

3.2.2. EHT probe type PM 9246 (Fig. 4.)

The EHT probe PM 9246 is suitable for measuring dc voltages up to 30kV. The PM 9246 can be used for measuring instruments having an input impedance of 100MΩ, 10MΩ or 1.2MΩ (selectable on the probe).

Maximum voltage	30kV
Attenuation	1000x
Input impedance	600MΩ ± 5%
Accuracy	± 3%
Relative humidity	20% to 80%

Note: Check that earth connections are made correctly.

3.2.3. Current transformer type PM 9245 (Fig. 5)

With this transformer it is possible to measure alternating currents over 10A up to 100A.

Transfer factor	1000x (100A = 100mA)
Transfer error	± 3%
Frequency range	45Hz to 1kHz
Max. permissible secundary voltage loss.	200mV
Max. voltage with respect to earth	400V a.c.

Before measuring, connect the current transformer to the instrument.

Avoid contamination of the core parts.

3.2.4. Shunt type PM9244 (fig. 6)

With this shunt it is possible to measure direct- and alternating currents (max. 1kHz) up to 31.6A.

Current range	10A and 31.6A
Output voltage	100mV and 31.6mV
Accuracy	100mV : ± 1% 31.6mV : ± 2%
Dissipation	Max. 3.16W
Dimensions	Height 55mm Width 140mm Depth 65mm

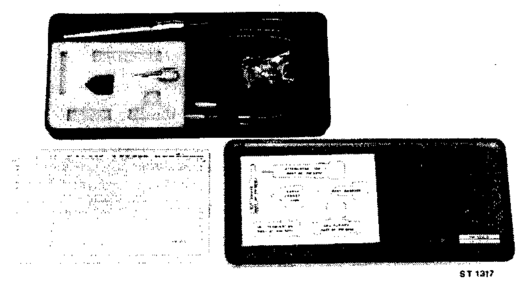


Fig. 2. HF-probe PM 9210

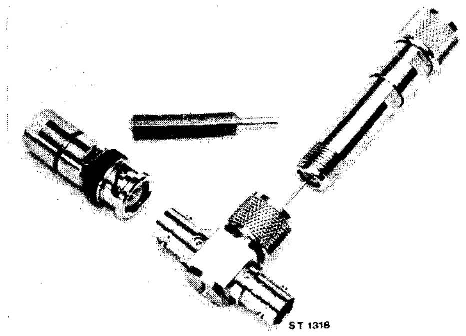


Fig. 3. Accessory set PM 9212

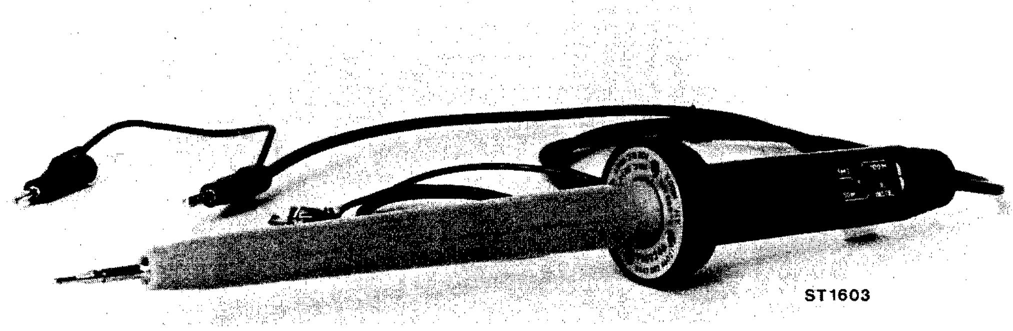


Fig. 4. HT-probe PM 9246

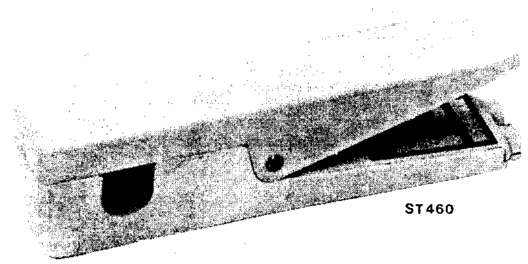


Fig. 5. Current transformer PM 9245

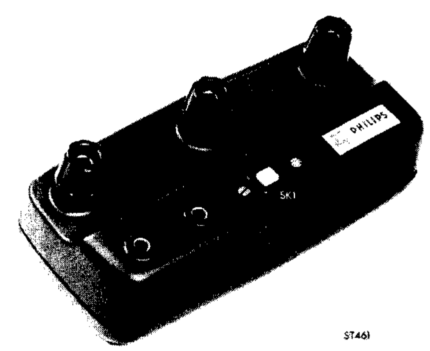


Fig. 6. Shunt PM 9244

3.2.5. RF probe PM 9213 (Fig. 7)

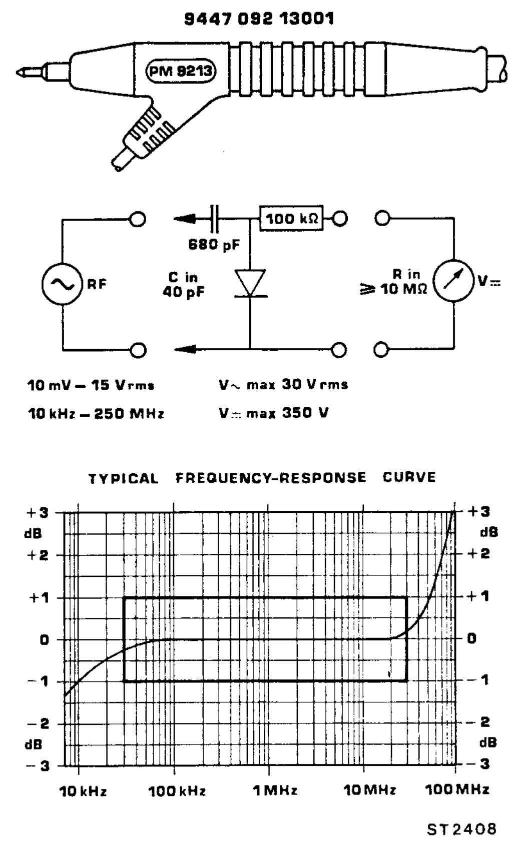


Fig. 7. RF-probe PM 9213

3.2.6. Carrying case PM 9278

The PM 9278 is a hard-plastic case carrying the PM 2505 and the accessories.

4. CIRCUIT DESCRIPTION

4.1. INTRODUCTION

The circuitry of the PM 2505 is built-up of a complete integrated amplifier part, preceded by attenuators for the various voltage, current and resistance ranges. The integrated amplifier part consists of an operational amplifier (V201/A) together with the rectifier diodes for the measuring system and a reference amplifier (V201/B) for the resistance ranges.
The high input impedance of the PM 2505 is obtained by a FET-input stage.
The high sensitivity of the moving-coil system has been achieved by tautbandsuspension.
If sinusoidal voltages or currents are applied, the moving coil instrument measures the average value of the signal. With the aid of a formfactornetwork (x 1.11) the instrument indicates the rms value.

4.2. PRINCIPLE OF OPERATION (Fig. 8)

4.2.1. V ⎓, V ~, + BATT and – BATT measurements

The unknown direct or alternating voltage is connected to the voltage attenuator. Dependent on the selected range the unknown voltage is attenuated 3.16, 31.6, 316, 3160 or 31.600 times. From the attenuator the voltage is supplied to the amplifier, converted in to a current and measured.
At +BATT and -BATT measurements the +9V and -9V battery voltages are connected to a special voltage attenuator. From this attenuator the voltages are supplied to the amplifier and measured.

4.2.2. A ⎓ and A ~ measurements

The unknown direct or alternating currents are supplied to the shunts. For the 1A, 3A and 10A ranges a special shunt is built-in. Dependent on the range corresponding shunts are connected to the input. The resulting voltages are supplied to the amplifier, converted into a current and measured.

4.2.3. Ω, diode and measurements with BUZZER (continuity-check)

At resistance measurements a constant current flows through the unknown resistance. The constant current is generated by the current source. Dependent on the range selected different constant currents are generated. The voltage-drop over the unknown resistance is supplied to the amplifier, converted into a current and measured.
At diode measurements a constant current of 316µA (V measuring is 1V f.s.d.) is generated by the current source. The current flowing through the diode causes a voltage drop which is supplied to the amplifier, converted into a current and measured.
In the BUZZER mode a constant current of 316µA is generated by the current source. This current will flow for example through a wire which has a certain resistance value (Rx). The voltage drop over Rx is supplied to the amplifier and measured. At the same time the BUZZER will produce a tone. If Rx is greater than 20Ω the BUZZER is blocked. The BUZZER is coupled to the output of the amplifier.

4.2.4. Amplifier

The direct and alternating voltages from the attenuators, shunts, or unknown resistances are converted in to a current of 50µA f.s.d. by the amplifier.
The output of the amplifier, with internal full-wave rectifier, is connected to the measuring system.
For + and – direct output voltages the internal full-wave rectifier ensures that the current through the measuring system flows in one direction and that the polarity indicator shows + or –.

Alternating output voltages are rectified by the full-wave rectifier. As a measuring system indicates the average value, a form-factor network is included in the feedback circuit of the amplifier. The network attenuates the feedback signal by 1,11 $V_{rms} = \frac{V_{average}}{1{,}11}$ so that the measuring system will indicate the rms-value of the input signal. This only applies for sinusoidal input signals.

To avoid leakage currents to influence the measuring result an internal buffer circuit is built-in.

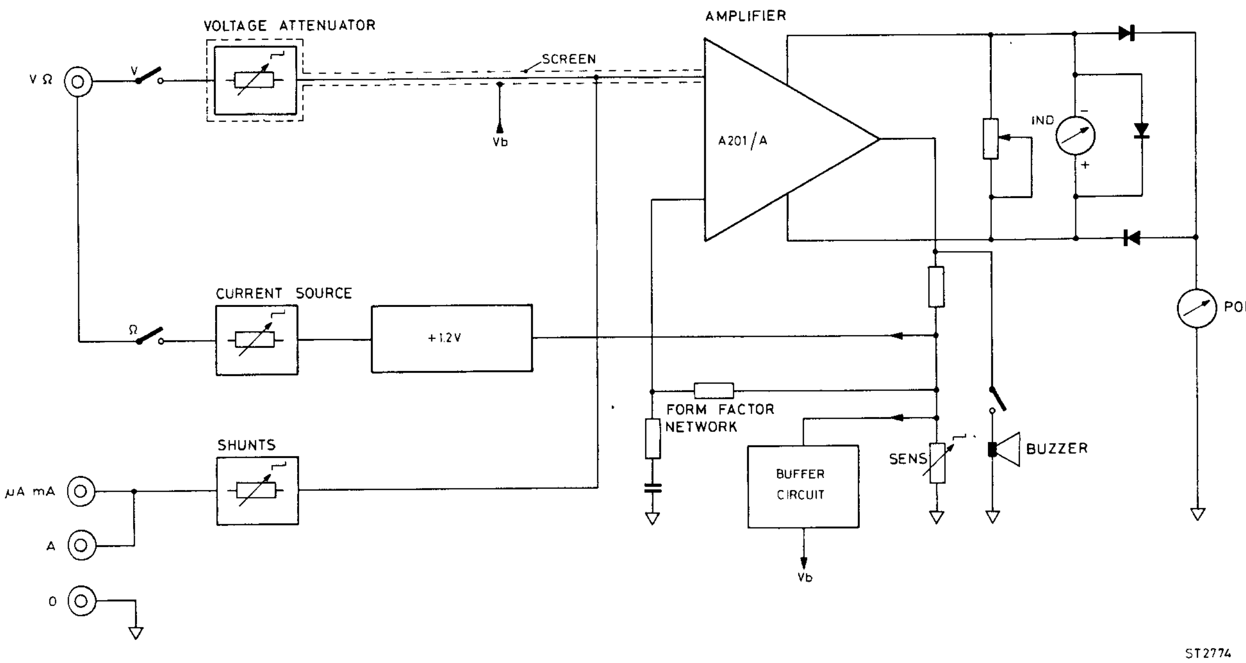


Fig. 8. *Blockdiagram*

4.3. DETAILED CIRCUIT–DESCRIPTION (Fig. 25)

4.3.1. V ⎓ , V~, + BATT and – BATT attenuators (Fig. 9)

V ⎓, V~.

The input attenuator for dc voltages consists of R101 upto R110. For ac voltages also the frequency compensation capacitors C101 up to C116 are in use.
Capacitor C107 is used to block a dc component in V~ mode.
Trimmer C105 and cut-away adjusting capacitors C106 and C116 are used to calibrate the 300mV~ range.
Trimmer C108 is used to calibrate the 3V~ range.
Capacitor C115 is only used in the 100mV~ range.

+ Batt and – Batt.

To attenuate the +9V and –9V from the batteries resistors R401 and R402 are used.
At +BATT, +9V is connected to R401 via the Ω/17 deck contact. From the attenuator R401/R402 the voltage is supplied to the amplifier via the A/17 and the V/17 deck-contacts.
At –BATT, –9V is connected to R401 via the A/18 deck-contact. From the attenuator R401/R402 the voltage is supplied to the amplifier via the V/18 deck-contact.

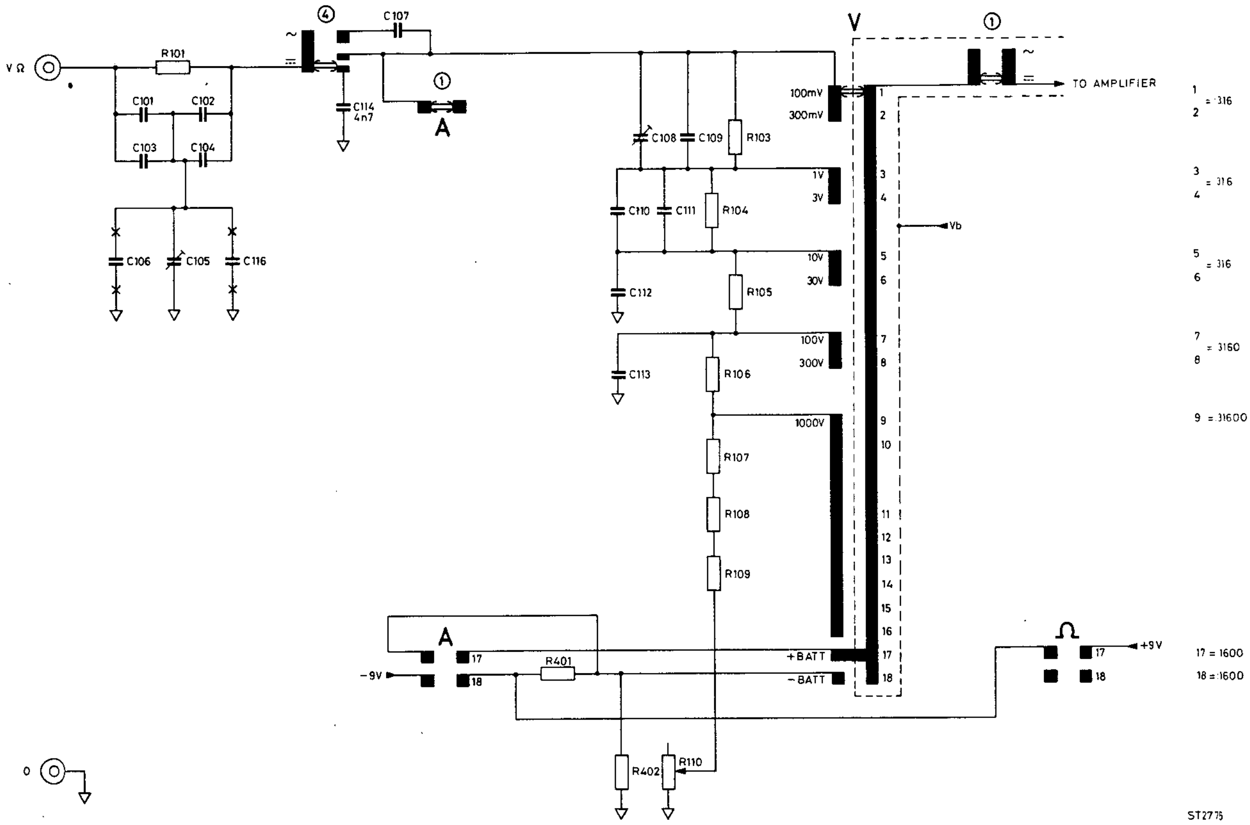


Fig. 9. V ⎓, V ∿ , +BATT and – BATT attenuators

4.3.2. A ⎓ and A~ shunts (Fig. 10)

The shunts for the ranges 1μA up to 300mA consists of the resistors R105 up to R110. The shunts are selected by the A and the V deck.
In the ranges 1,3 and 10A the current is supplied to shunt R110 (metal strip) via the A input socket.
From the shunts the voltage is supplied to the amplifier and measured.
Fuse F101, resistor R211 and bridge rectifier V101 serve for protection of the current ranges. For detailed information refer to chapter 4.3.5., page 24 PROTECTION

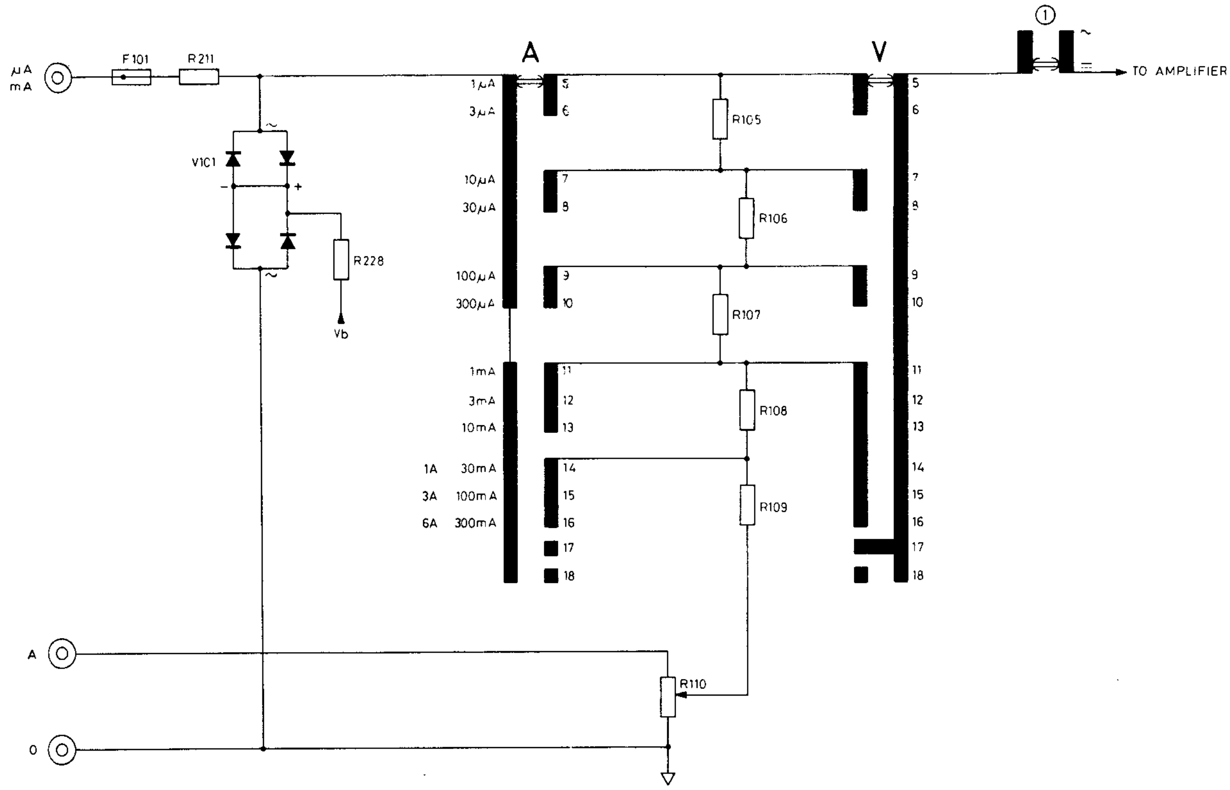


Fig. 10. A ⎓ , and A ∿ shunts

4.3.3. Ω, ⯓ and BUZZER measurements

4.3.3.1. Principle (Fig. 11)

When a unknown resistance Rx (resistor, diode or wire) is connected to the PM 2505, a constant current generated by the constant current source will flow through it. The constant current causes a voltage drop Vx which is supplied to the amplifier (+) and measured. When the voltage is in balance on the – input of the amplifier and the + input of the current source Vx will be available. The amplifier A201/B of the current-source has an internal voltage source of 1.2V.
At the output of the amplifier A201/B Vx +1.2V will be available. On one side of series resistor R5,Vx is available and on the other side Vx + 1.2V. This means that over series resistor R5, 1.2V is available.
Independent of the value of Vx (value of Rx) there always will be 1.2V across R5. This means that a constant current flows through Rx and R5.
The constant current can be influenced by changing series resistor R5.
In case of Ω measurements R5 is changed with the aid of the range selector.

At ⯓ measurements a fixed range is selected with a constant current of 316μA.
At BUZZER measurements a fixed range is selected with a constant current of 316μA.
At the same time the BUZZER circuit is switched to the output of amplifier A201/A. If the measured Rx is > 20Ω the BUZZER is cut-off.

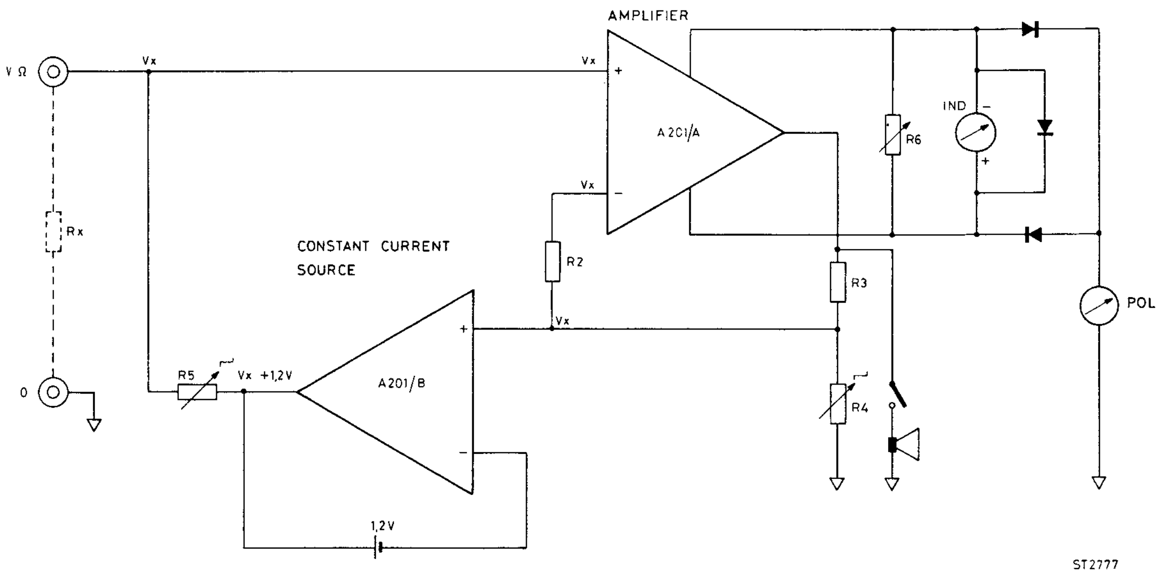


Fig. 11. Ω , ⯓ , BUZZER measurements principle

4.3.3.2. Ω, ⯁ and BUZZER current source (Fig. 12)

The series resistors R301 up to R309 for the constant current source are switched with the Ω range switch. The internal voltage source (1.2V) of OQ0051 can be adjusted with potentiometer R314 and cut-away resistor R316. At the input of the constant current source (A201/B) the feedback voltage of the amplifier (Vx) is available. At full scale deflection Vx is 10mV, 31.6mV, 100mV or 1V dependent to the range selected (refer to the gain table fig. 16). From the Ω range switch the constant current is supplied to the input sockets via the protection PTC R301 and the Ω ④ function-switch.
The unknown voltage Vx over Rx is supplied to the amplifier via filter R318/C301 and the Ω ① function-switch.
In BUZZER mode (function Ω and position 18 of the range-selector) the −9V supply voltage is connected to the BUZZER-circuit via the A/18 range switch contact, by which the buzzer is switched-on. The baise of transistor V302 is connected to the output of amplifier A301/A.
If the output of the amplifier exceeds ≈ 600mV then the buzzer is cut-off. In position 18 of the range selector the constant current source delivers 316μA to the input sockets (Rx).
The buzzer is switched off in case of ⎓ measurements with the ② function switch. In case of ~ measurements with the function selector in position 18 the buzzer will also be switched on.

PTC R301 and zener diode V301 serve for protection.
Refer to chapter 4.3.5. PROTECTION.

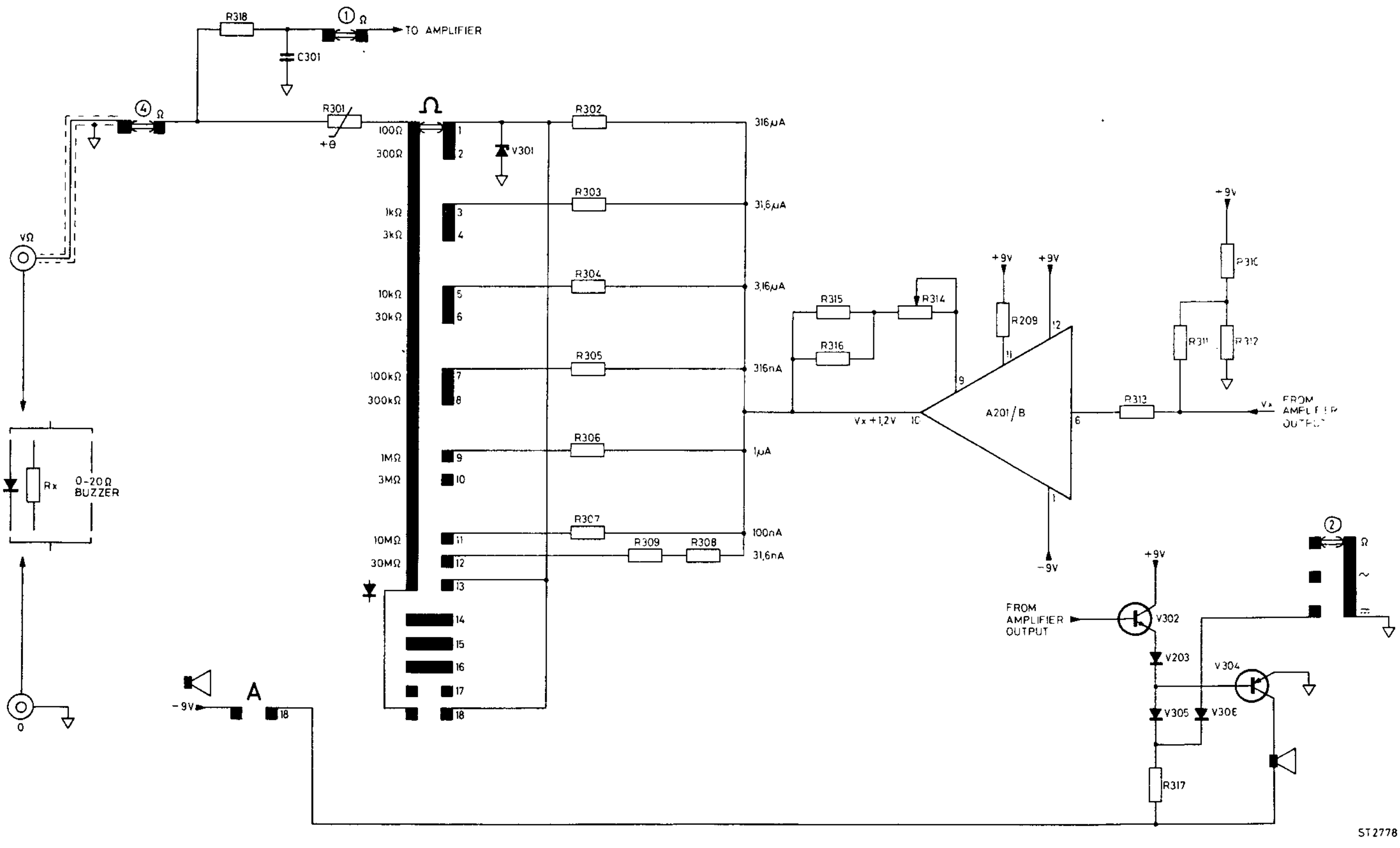


Fig. 12. Ω ⯁ , BUZZER current source

4.3.4. Amplifier and buffer - ciruit (fig. 14)

4.3.4.1. Amplifier

The total amplifier consists of a FET input stage (V204), an operational amplifier (A201/A, ½ OQ0051) and the feedback circuitry. The amplifier ensures that the unknown input voltage, 1V, 100mV, 31.6mV or 10mV at full scale is converted into a current flowing through the measuring system of 50μA.
The attenuatedl voltage from the attenuators, shunts or Rx is first supplied to a filter (R201//C203, C204).
At dc measurements the filter connects the ac component to zero.
The filter is switched by FET V203. At dc measurements the FET is conductive (—•—o—), its gate is connected to zero via the ② function switch. At ac measurements the FET is non-conductive (—•—o—).
Also the polarity indicator is switched on at dc measurements via the ② function switch and FET V208.

From the filter the unknown input voltage is supplied to the dual FET-stage of the amplifier. On one side of the dual FET the input voltage is available. On the other side the feedback voltage is available.

In fig. 13 the feedback circuitry is given with the different sensitivities. Also refer to fig. 16.

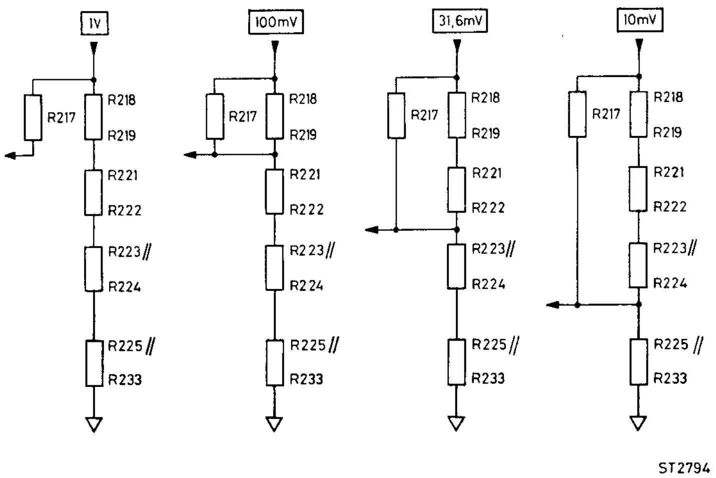


Fig. 13. Feedback circuitry

In the feedback circuit of the amplifier formfactor network is incorperated for ac voltages. If sinusoidal voltages or currents are measured the measuring system measures the average value. With the formfactor network the feedback of the total amplifier is raised by 1,11, so the measuring system measures the rms value of the ac signal.
The output current of the amplifier is supplied to the measuring system via the internal rectifier diodes of the OQ0051
Transistors V201, V202 and diode V206 serve for protection.
Refer to chapter 4.3.5. PROTECTION.

4.3.4.1. Buffer circuit (Fig. 14)

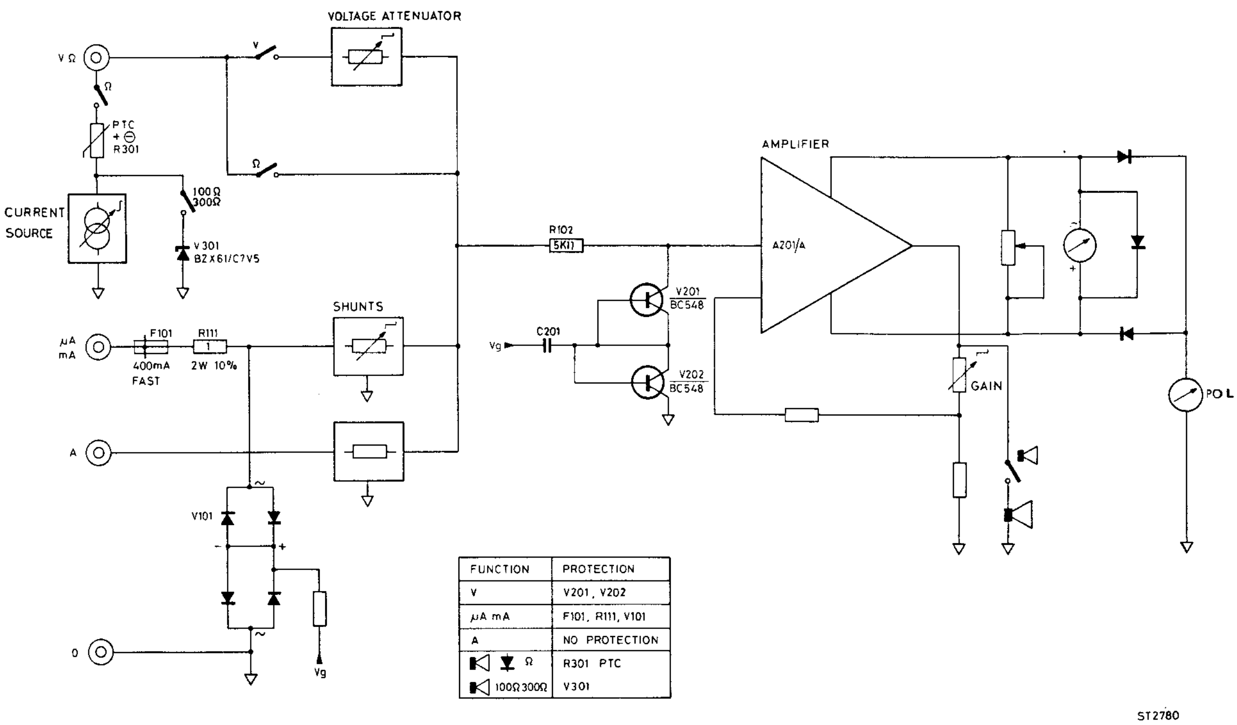
To prevent leakage currents through the protection devices (V101, V201, V202) and the switch in FET V203 to influence the measuring result, the leakage currents are compensated.
The compensation is made with the aid of the BUFFER-circuit.
The Buffer circuit is an impedance converter with a high input impedance (baise V211) and a low output impedance (collector V210).

4.3.5. Protection (Fig. 15)

Function V is protected by means of the protection transistors V201 and V202. If the input voltage of the amplifier exceeds 1.2V the transistors start conducting

Function Ω ⯆ and 🔈 are protected by a PTC R301. Range 100Ω and 300Ω and 🔈 are additional protected with zener diode V301.

Function μA and mA are protected by Fuse F101, R111 and the diodes of bridge rectifier V101.
The measuring system is protected by diode V206



FUNCTION	PROTECTION
V	V201, V202
μA mA	F101, R111, V101
A	NO PROTECTION
🔈 ⯆ Ω	R301 PTC
🔈 100Ω 300Ω	V301

Fig. 15. Protection

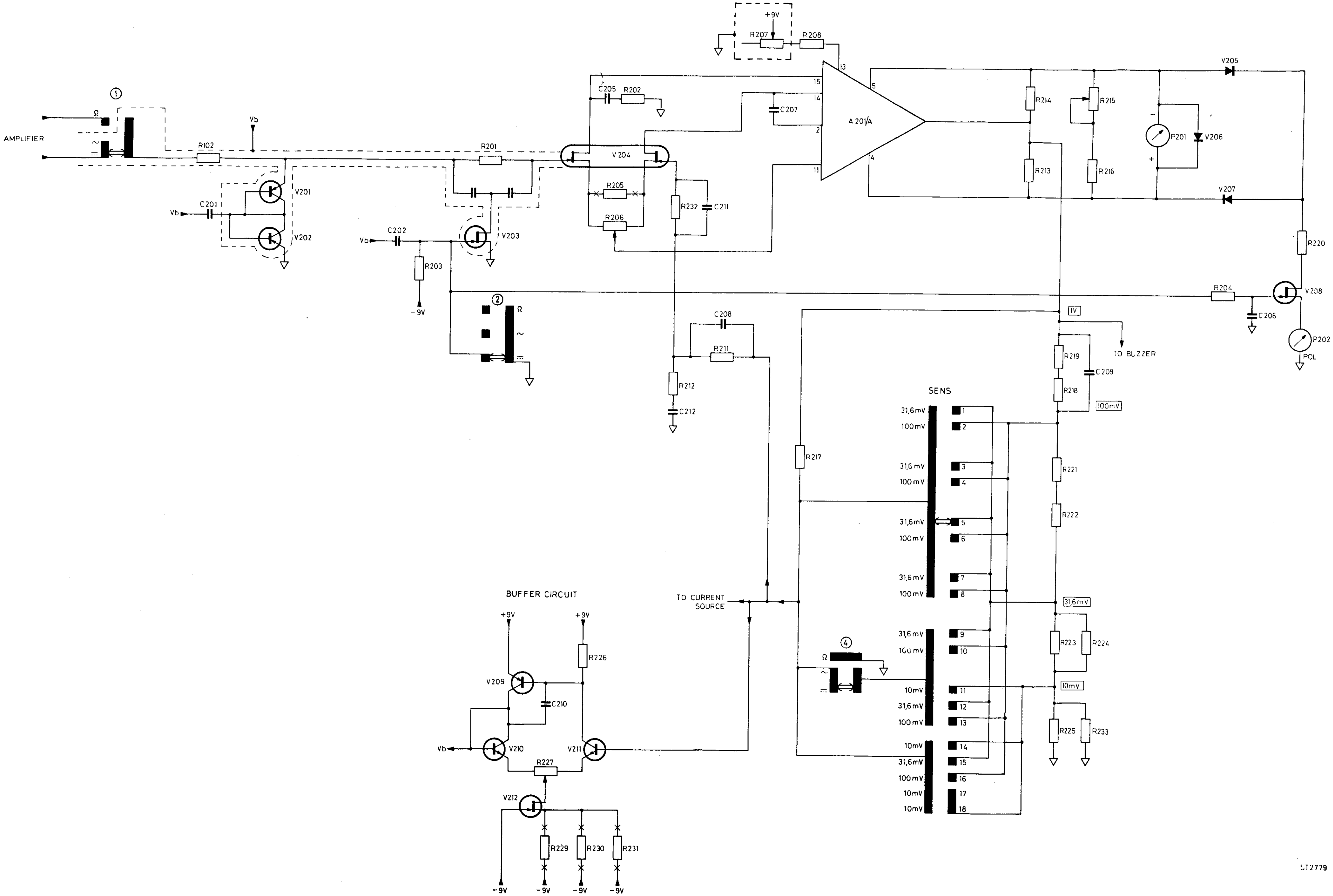
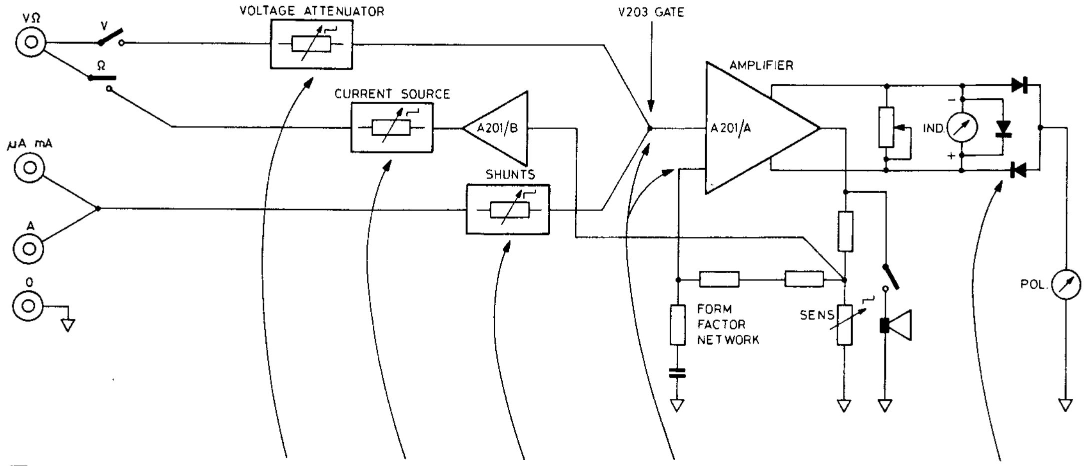


Fig. 14. Amplifier and buffer circuit



No	A⎓ A∼		V⎓ V∼	Ω	VOLTAGE ATTENUATOR	CURRENT SOURCE	SHUNTS		INPUT AMPLIFIER		MEASURING SYSTEM	SCALE DIVISIONS
1	–		100mV	100Ω	3.16	316μA	–			31.6mV	50μA	100
2	–		300mV	300Ω	3.16	316μA	–			100mV	↑	↑
3	–		1V	1kΩ	31.6	31.6μA	–			31.6mV		
4	–		3V	3kΩ	31.6	31.6μA	–			100mV		
5	1μA		10V	10kΩ	316	3.16μA	31.6kΩ			31.6mV		
6	3μA		30V	30kΩ	316	3.16μA	31.6kΩ			100mV		
7	10μA		100V	100kΩ	3160	316nA	3.16kΩ			31.6mV		
8	30μA		300V	300kΩ	3160	316nA	3.16kΩ			100mV		
9	100μA		1000V	1MΩ	31600	1μA	316Ω		1V(1MΩ)	31.6mV		
10	300μA		–	3MΩ	–	316nA	316Ω		1V(3MΩ)	100mV		
11	1mA		–	10MΩ	–	100nA	10Ω		1V(10MΩ)	10mV		
12	3mA		–	30MΩ	–	31.6nA	10Ω		1V(30MΩ)	316mV		
13	10mA		–	▼	–	316μA	10Ω		1V(▼)	100mV		
14	30mA	1A	–	–	–	–	0.316Ω	10mΩ		10mV		
15	100mA	3A	–	–	–	–	0.316Ω	10mΩ		31.6mV		
16	300mA	10A	–	–	–	–	0.316Ω	10mΩ		100mV		
17	–		+BATT	–	1600	–	–			10mV	↓	↓
18	◁		−BATT	–	1600	316μA	–			10mV	50μA	100

NOTE: ALL VALUES ARE GIVEN AT FULL SCALE DEFLECTION.

ST2793

Fig. 16. Full scale deflection values

5. ACCESS

5.1. GENERAL

The opening of covers or removal of parts, except those which access can be gained by hand, is likely to expose live parts and also accessible terminals may be live.
The instrument shall be disconnected from all voltage sources before any adjustment, replacement or repair during which the instrument will be opened.
If afterwards any adjustment or repair of the opened instrument under voltage is inevitable, it shall be carried out only by a skilled person who is aware of the danger involved.
Bear in mind that capacitors inside the instrument may still be charged, even if the instrument has been separated from all voltage sources.

5.2. DISMANTLING THE PM 2505

- Remove the battery cover.
- Remove the batteries.
- Loosen the two screws situated under the battery cover. The rear cover can be pulled off now.
- Remove the two screws which are situated in the rear of the measuring system.
- The printed circuit board together with clip-on measuring system can be pulled out of the top cover now. The measuring system is clipped on the p.c. board and can be pulled off.

5.3. REPLACING PARTS

5.3.1. Slide switch ON/OFF or $\eqsim$, $\sim$, Ω.

5.3.1.1. Printed circuit board part

Remove the two retaining rings from the slide bodies. The slide switch consists of two bodies.
In the bodies the switch contacts are situated. A switch contact consists of a spring and a slider.

Note: *All parts of slide switch are in stock separately.*
When a complete switch has to be replaced all parts should be ordered. When mounting the slide switch again, push both bodies slightly on the p.c. board and slide the retaining rings on the pins again.

5.3.1.2. Topcover part

The topcover part consists of a locking spring, two ball-bearings and a knob.
Remove the locking spring by bending out the two lips.
The ball-bearings, the knob and the locking spring can be replaced now.

5.3.2. Range switch

5.3.2.1. Topcover part

Remove the screening plate situated inside the topcover. The function switch and the two leaf springs are accessible now.

5.3.2.2. Printed circuit board part

The p.c. board part of the range switch consists of:
- 2 slide bodies
- 4 springs
- 4 switch contacts

Remove the screws and nuts from the slide bodies. The bodies can be lifted from the p.c. board now.

Note: *From function switch only the separate parts are in stock. When the complete switch has to be replaced all parts should be ordered.*

5.3.3. Polarity indicator (fig.'s 17 and 18)

- Take the measuring system from the p.c. board (Refer to 5.2.).
- Unsolder the wires from the polarity indicator.
  Before removing the window ensure that you do not touch the inside of the window as it is treated with anty static liquid.
- Lever the window from the container by putting e.g. a screwdriver in the lever point (item 4).
- Unsolder the screen-wire (item 2).
- Remove the two screws (item 1) which fix the measuring system to the container.
- Take the measuring system out of the container, place it on the container (Fig. 18).
- Remove the mirror.
- Take the polarity indicator out of the container and replace it. Use the piece of self glueing foam again.
- Place the mirror in the container again.
- Place the measuring system in the container.
  Take care that the counter-balance assembly (item 5) is not touched.
- Fix the measuring system to the container with the two fixing screws. Ensure that the top of the scale is fitted under the two fixing clips (item 3).
- Solder the screen-wire to the measuring system again (item 2)
- Fit the window on the container again.

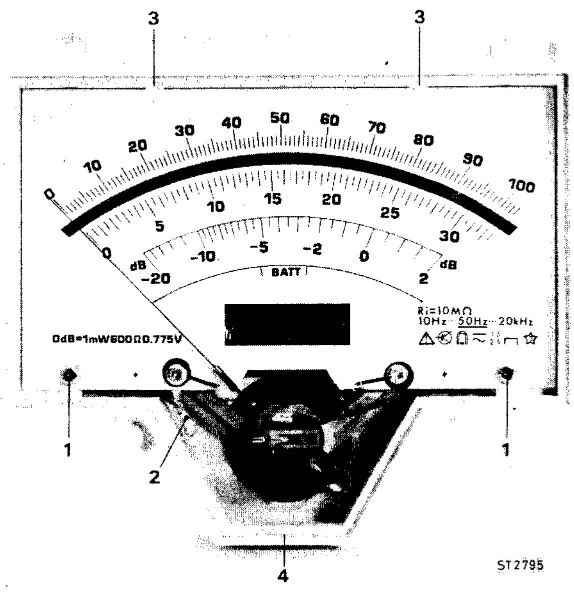


Fig. 17. Measuring system

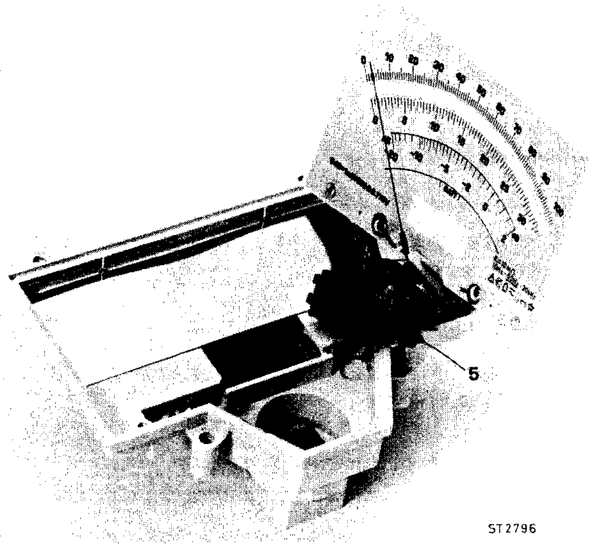


Fig. 18. Replacing the polarity indicator

6. CHECKING AND ADJUSTING

6.1. GENERAL

The tolerances in this chapter correspond to the factory data, which only apply to a completely re-adjusted instrument. These tolerances may deviate from those mentioned in the Technical Data (Chapter 2).

For a complete re-adjustment of the instrument the sequence in this chapter should be adhered too. When individual components, especially semi-conductors are replaced, the relevant section should be completely re-adjusted.

To calibrate this measuring instrument only reference voltages and measuring equipment with the required accuracy should be applied. If such equipment is not available, comparative measurements can be made with another calibrated PM 2505. However, theoretically the tolerances may be doubled in the extreme case.

The measuring arrangement should be such that the measurement cannot be affected by external influences. Protect the circuit against temperature variations (fans, sun).

With all the measurements the cables should be kept as short as possible; at higher frequencies co-axial leads should be used.
Non-screened measuring cables act as serials so that the measuring instrument will measure HF voltage values or hum voltages.

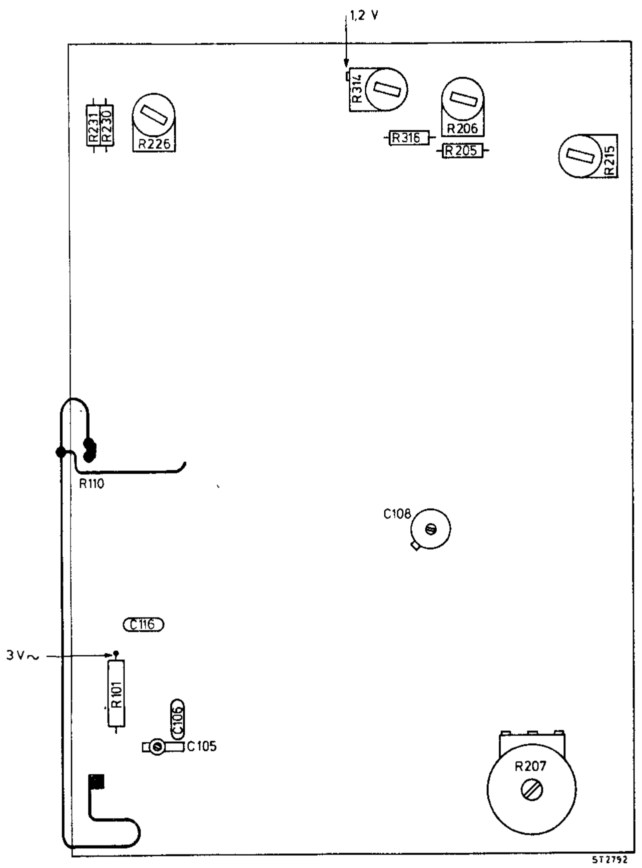


Fig. 19. Adjusting elements

6.2. ADJUSTING TABLE

No.	Adjustment	Adjusting element	Preparations	Measuring points	Adjustment data
1.	Mechanical zero-setting	Adjusting screw above the range selector knob.	Instrument switched OFF	Visible on measuring system	Adjust the pointer to zero
2.	Battery check.		Select: + BATT (⎓) and (Ω) –BATT (⎓).	Visible on measuring system	The meter indication should be in the BATT region (lowest scale).
3.	Electrical zero-setting. If this adjustment cannot be made, carry out first adjustment 4 and then 3 again.	Potentiometer "0" (R207)	Select: Range 1mA ⎓	Visible on the polarity indicator	Adjust the pointer to the middle of the ~ sign. [– ~ +]
4.	Offset When adjustment 3 cannot be made first carry out this adjustment and then adjustment 3 again	Potentiometer R206 R207 Cut away resistor R205	Select: Range 1mA ⎓ Set potentiometer R207 in its mid-position.	Visible on the polarity indicator	Adjust the pointer to the middle of the ~ sign with R206 [– ~ +] If the adjustment cannot be made, remove cutaway resistor R205
5.	Offset buffer circuit	Potentiometer R227 Cut away resistors R229 R230 R231	Select: Range 1mA ⎓ Set potentiometer R227 in its mid-position.	Accross R230 (Factory adj.) Hi = coll V211 Lo = 0 socket (Service adj.)	–Factory adjustment (R229, R230, R231) refer to table below. –Service adjustment (227) 0V ± 1mV
6.	1.2V internal voltage source of OQ0051	Potentiometer R314 Cut-away resistor R316	Select: Range 1kΩ Short circuit the VΩ and 0 socket	Hi = OQ0051/10 or R314 R218 R211 R314	1190mV ± 2mV If the adjustment cannot be made, remove cutaway resistor R316.
7.	Calibration of range 100mV ⎓	Potentiometer R215	Select: Range 100mV ⎓ Supply: 100mV ± 0,1% to the VΩ and 0 socket	Visible on measuring system	100 scale divisions ± 0.2 ± 0.2 scale divisions
8.	Calibration of range 1A ⎓	Wire on shunt R110	Select: Range 1A ⎓ Supply: 1A ⎓ ± 0.2% to the A and 0 socket	Visible on measuring system	100 scale divisions ± 0.2 ± 0.2 scale divisions.
9.	Calibration of range 3V~	Trimmer C108	Select: Range 3V~ Supply: 3V~ ± 0.2% 10kHz to R101 and the 0-socket.	Visible on measuring system	100 scale divisions ± 0.2 ± 0.2 scale divisions
10.	Calibration of range 300mV~	Trimmer C105 Cut-away capacitors C106 C116	Select: Range 300mV~ Supply: 300mV~ ± 0.2% 10kHz to the VΩ and 0 socket	Visible on measuring system	100 scale divisions ± 0.2 scale divisions. If the adjustment cannot be made remove cutaway capacitors C106 and C116

ADJUSTING TABLE R229, R230, R231.

Voltage accross R230		Actions (start adjustment with R299, R230 and R231 mounted)
< 520mV		Replace V212
⩾ 520mV	⩽ 675mV	–
⩾ 675mV	⩽ 900mV	Cutaway R229
⩾ 900mV	⩽ 1200mV	Cutaway R229 and R230
⩾ 1200mV	⩽ 1500mV	Cutaway R231
⩾ 1500mV	⩽ 2300mV	Cutaway R229, R229 ,R230 and replace them by a resistor of 61 kg, metalfilm MR25 series
⩾ 2300mV	⩽ 2800mV	Cutaway R229 and R231
⩾ 2800mV	⩽ 3500mV	Cutaway R230 and R231
⩾ 3500mV		Replace V212

7. PARTS LIST

7.1. MECHANICAL

Description	*Ordering number*	*Qty*
TOPCOVER		
Topcover	5322 456 94088	1
RANGE SWITCH		
Knob for range switch	5322 414 64099	1
Leaf spring	5322 492 64676	2
⎓, ~, Ω SWITCH		
Knob	5322 414 64098	1
Lock spring	5322 492 64742	1
Ball-bearing	4822 520 40012	2
ON/OFF SWITCH		
Knob	5322 414 64119	1
Lock spring	5322 492 64742	1
Ball-bearing	4822 520 40012	2
BOTTOM COVER		
Bottom cover assy (incl. screening, feet and stand-up bracket).	5322 447 94572	1
Stand-up bracket	5322 405 94164	1
Rubber foot	5322 462 44148	2
BATTERY COVER		
Battery cover assy (incl. feet).	5322 447 94573	1
Rubber foot	5322 462 44148	2
MEASURING SYSTEM		
Measuring system assy (incl. polarity indicator window and correction screw)	5322 694 54011	1
Window	5322 459 24098	1
Correction screw	5322 500 14213	1
Polarity indicator	5322 347 10061	1
PRINTED CIRCUIT BOARD		
Printed circuit board assy (incl. range and function switch)	5322 216 74054	1
RANGE SWITCH		
Body	5322 405 94155	2
Switch segment	5322 492 64628	4
Spring	5322 492 54291	4

Description	*Ordering number*	*Qty*
⎓, ~, Ω SWITCH		
Body	5322 278 54001	2
Switch segment	5322 492 64628	4
Spring	5322 492 54291	4
Retaining ring	4822 530 70122	2
ON/OFF SWITCH		
Body	5322 278 54001	2
Switch segment	5322 492 64628	2
Spring	5322 492 54291	2
Retaining ring	4822 530 70122	2
Buzzer	5322 280 14026	1
Fuse holder	5322 256 34097	1
Fuse 400mA FAST	5322 253 30016	1
IC foot 16p	5322 255 44218	1
Input socket	5322 268 24109	4
Battery cable	4822 290 80013	2
Testpin RED	5322 264 24013	1
Testpin BLACK	5322 264 24014	1

7.2. ELECTRICAL

7.2.1. Capacitors

Item	*Ordering number*	*Farad*	*Tol (%)*	*Volts*	*Remarks*
C101	4822 122 31081	100p	2	500	Ceramic plate
C102	4822 122 31081	100p	2	500	Ceramic plate
C103	4822 122 31205	47p	2	500	Ceramic plate
C104	4822 122 31205	47p	2	500	Ceramic plate
C105	5322 125 54027	5p5		400	Trimmer
C106	4822 122 31195	10p	2	500	Ceramic plate
C107	5322 121 44025	33n	10	400	Polyester
C108	4822 125 50045	22p		250	Trimmer
C109	4822 122 31081	100p	2	500	Ceramic plate
C110	4822 121 50566	1n	1	160	Polystyrene
C111	4822 122 31081	100p	2	500	Ceramic plate
C112	4822 121 50602	10n	1	160	Polystyrene
C113	4822 122 30034	470p	2	100	Ceramic plate
C114	4822 122 31174	2, 7n	10	500	Ceramic plate
C115	4822 122 31192	6, 8p	±0,25pF	500	Ceramic plate
C201	4822 122 31166	560p	10	100	Ceramic plate
C202	4822 122 31166	560p	10	100	Ceramic plate
C203	4822 122 30103	22n	−20+80	40	Ceramic plate
C204	4822 122 30103	22n	−20+80	40	Ceramic plate
C205	4822 122 31166	560p	10	100	Ceramic plate
C206	4822 122 31174	2, 7n	10	100	Ceramic plate
C207	4822 122 31177	470p	10	100	Ceramic plate
C208	4822 12231054	10p	2	100	Ceramic plate
C209	4822 122 30103	22n	−20+80	40	Ceramic plate
C210	4822 122 31072	47p	2	100	Ceramic plate
C211	4822 122 30103	22n	−20+80	40	Ceramic plate
C212	4822 121 40232	220n	10	100	Polyester
C301	4822 122 31175	1n	10	500	Ceramic plate
C401	4822 124 20459	22µ	−10+50	10	Electrolytic
C402	4822 124 20459	22µ	−10+50	10	Electrolytic

7.2.2. Resistors

Item	*Ordering number*	*Ohm*	*Tol(%)*	*Type*	*Remarks*
R101	5322 116 64106	6,81M	1	VR37	High voltage
R102	5322 116 54595	5,11k	1	MR25	Metal film
R103	5322 116 64107	2,87M	0,5	SPEC	High voltage
R104	5322 116 55463	287k	0,5	MR25	Metal film
R105	5322 116 55462	28,7k	0,5	MR25	Metal film
R106	5322 116 55279	2,87k	0,5	MR25	Metal film
R107	5322 116 55464	309	0,5	MR25	Metal film
R108	5322 116 54423	9,76	1	MR25	Metal film
R109	5322 113 44229	0,301	1	2W	Pot. meter
R111	4822 113 60056	1	10	2W	Pot. meter
R201	4822 110 63192	1,5M	10	CR25	Carbon
R202	5322 116 54513	332	1	MR25	Metal film
R203	4822 110 63187	1M	5	CR25	Carbon
R204	5322 116 54696	100k	1	MR25	Metal film
R205	5322 116 54519	402	1	MR25	Metal film
R206	4822 100 10038	470	20	0.05W	Pot.meter
R207	5322 101 24173	100k	20	0.1W	Pot.meter
R208	5322 116 50481	22.6k	1	MR25	Metal film
R209	4822 110 63214	10M	10	CR25	Carbon
R211	5322 116 54655	30,1k	1	MR25	Metal film
R212	5322 116 54738	274k	1	MR25	Metal film
R213	4822 110 63212	8,2M	10	CR25	Carbon
R214	4822 110 63212	8,2M	10	CR25	Carbon
R215	4822 100 10035	10k	20	0.05W	Pot.meter
R216	5322 116 50479	15,4k	1	MR25	Metal film
R217	5322 116 54637	17,8k	1	MR25	Metal film
R218	5322 116 55459	15,4k	0,5	MR25	Metal film
R219	5322 116 54502	261	1	MR25	Metal film
R220	5322 116 50572	12,1k	1	MR25	Metal film
R221	5322 116 50926	40,2	1	MR25	Metal film
R222	5322 116 55465	1,15k	0,1	MR24C	Metal film
R223	5322 116 50451	21,5k	1	MR25	Metal film
R224	5322 116 54163	383	0,1	MR24C	Metal film
R225	5322 116 55461	174	0,5	MR25	Metal film
R226	5322 116 50483	38,3k	1	MR25	Metal film
R227	4822 100 10036	4,7k	20	0.05W	Pot.meter
R228	5322 116 54683	68,1k	1	MR25	Metal film
R229	5322 116 54696	100k	1	MR25	Metal film
R230	5322 116 54689	82k5	1	MR25	Metal film
R231	5322 116 50872	61k9	1	MR25	Metal film
R232	4822 110 63192	1,5M	10	CR25	Carbon
R233	4822 111 30265	22k	5	CR25	Carbon
R301	4822 116 40006	100	20	265V	PTC
R302	5322 116 54587	3,65k	1	MR25	Metal film
R303	5322 116 54663	37,4k	1	MR25	Metal film
R304	5322 116 55457	374k	1	MR25	Metal film

Item	*Ordering number*	*Ohm*	*Tol(%)*	*Type*	*Remarks*
R305	5322 116 64104	3,74M	1	VR37	High voltage
R306	5322 116 64101	1,18M	1	VR37	High voltage
R307	5322 116 64102	11,8M	1	VR37	High voltage
R308	5322 116 64103	31,6M	1	VR37	High voltage
R309	5322 116 64105	5,9M	1	VR37	High voltage
R310	5322 116 54704	121k	1	MR25	Metal film
R311	4822 110 63214	10M	10	CR25	Carbon
R312	5322 116 50481	22,6k	1	MR25	Metal film
R313	5322 116 54632	14,7k	1	MR25	Metal film
R314	4822 100 10107	470k	20	0.05W	Pot.meter
R315	5322 116 55458	442k	1	MR25	Metal film
R316	5322 116 54696	100k	1	MR25	Metal film
R317	5322 116 54696	100k	1	MR25	Metal film
R318	5322 116 54696	100k	1	MR25	Metal film
R401	5322 116 54743	301k	1	MR25	Metal film
R402	5322 116 50506	154	1	MR25	Metal film

7.2.3. Semi conductors

Item	*Ordering number*	*Type/Description*	
V101	5322 130 34761	BY224-600	Bridge rectifier
V201	4822 130 40938	BC548	Transistor
V202	4822 130 40938	BC548	Transistor
V203	5322 130 44418	BF256A	Transistor
V204	5322 130 44405	ON528	Dual FET
V205	4822 130 30613	BAW62	Diode
V206	4822 130 30613	BAW62	Diode
V207	4822 130 30613	BAW62	Diode
V208	5322 130 44418	BF256A	FET
V209	4822 130 40941	BC558	Transistor
V210	4822 130 44246	BX545C	Transistor
V211	4822 130 44246	BC549C	Transistor
V212	5322 130 44418	BF256A	FET
V301	5322 130 34123	BZX61 - C7V5	Zener diode
V302	4822 130 40964	BC549	Transistor
V303	4822 130 30613	BAW62	Diode
V304	4822 130 40963	BC559	Transistor
V305	4822 130 30613	BAW62	Diode
V306	4822 130 30613	BAW62	Diode

7.2.4. Integrated circuits

Item	*Ordering number*	*Type/Description*
A201	5322 209 84444	OQ0051

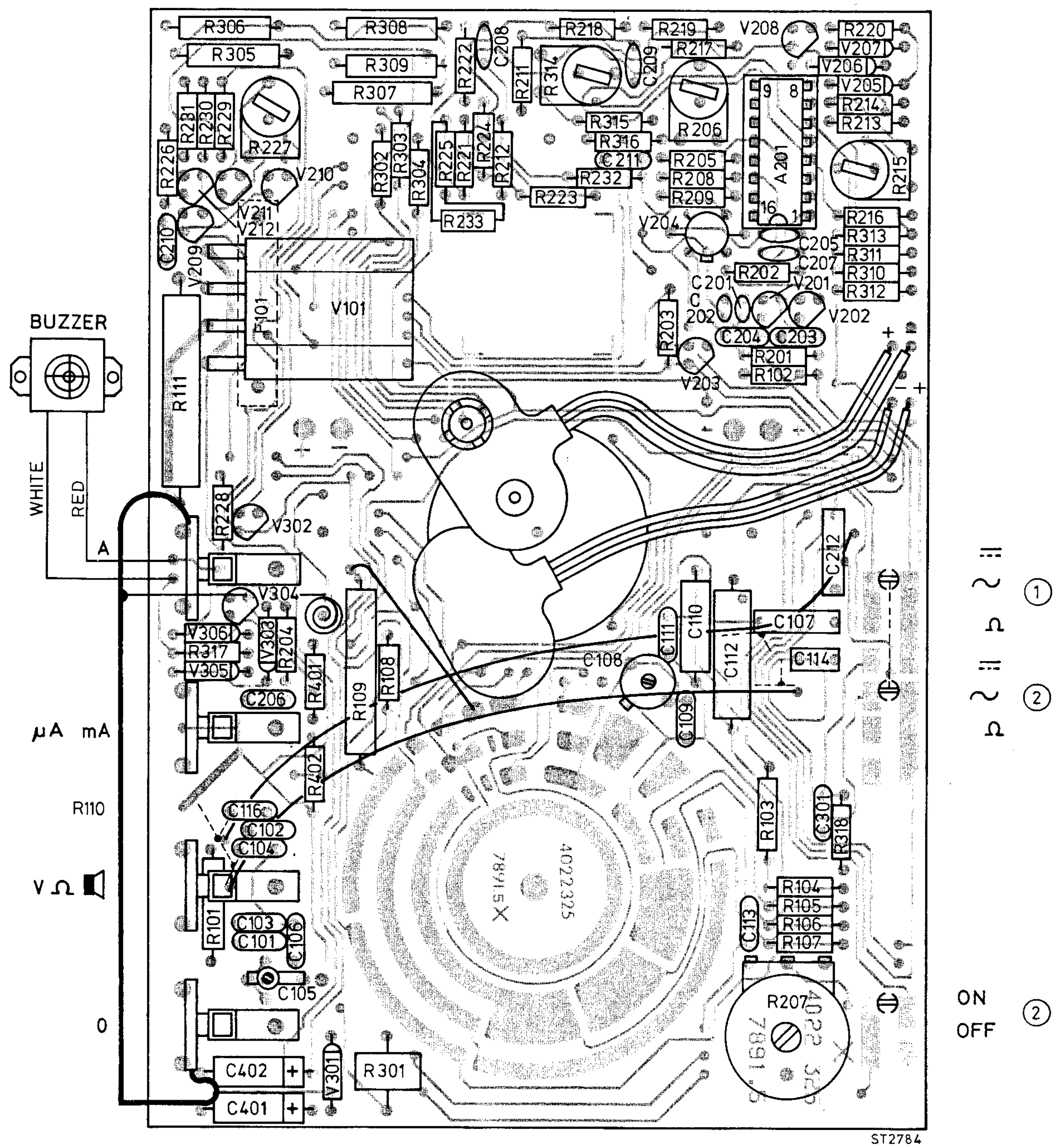


Fig. ***20.*** *P.c. board component side*

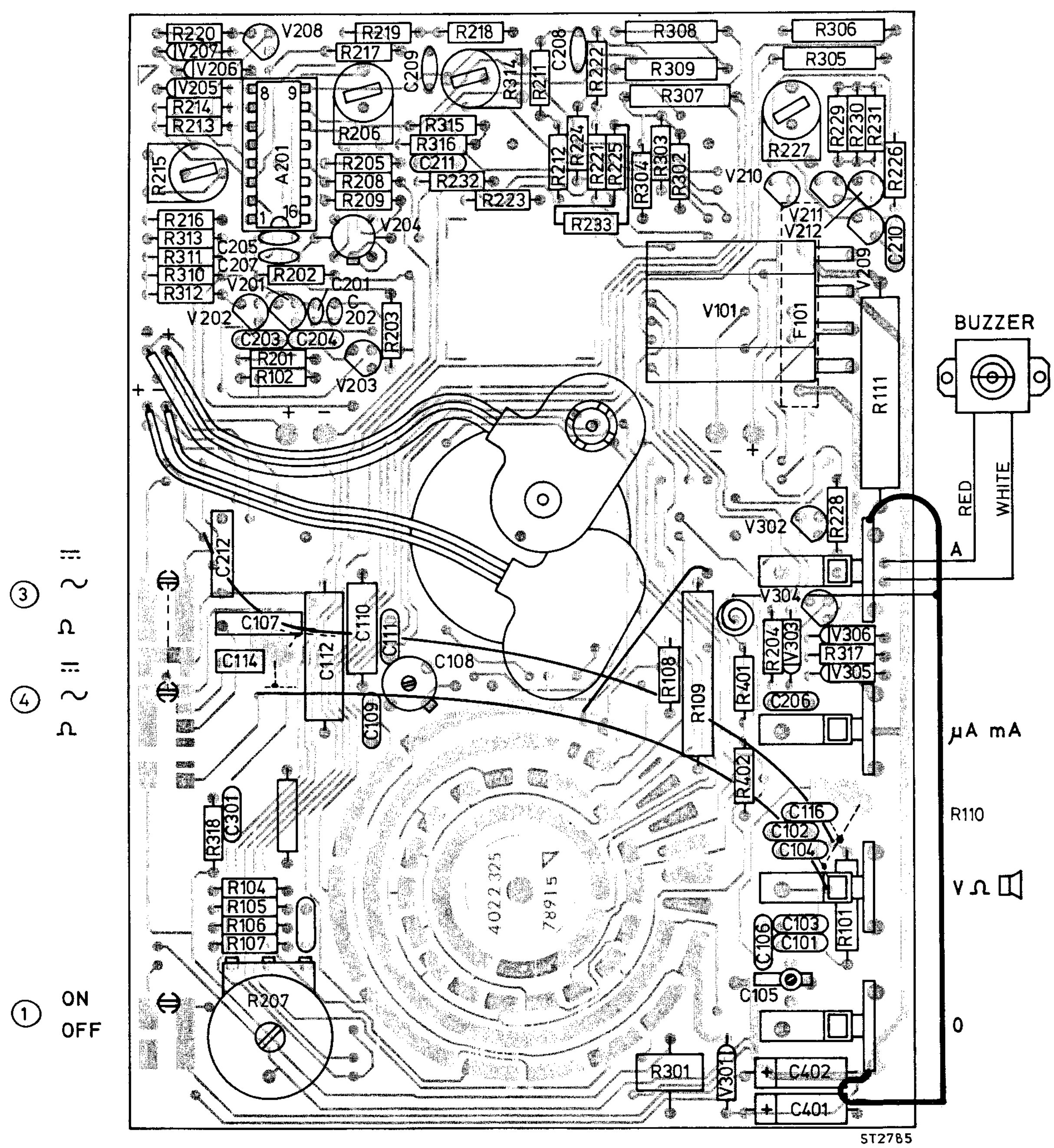


Fig. 21. P.c. board conductor side

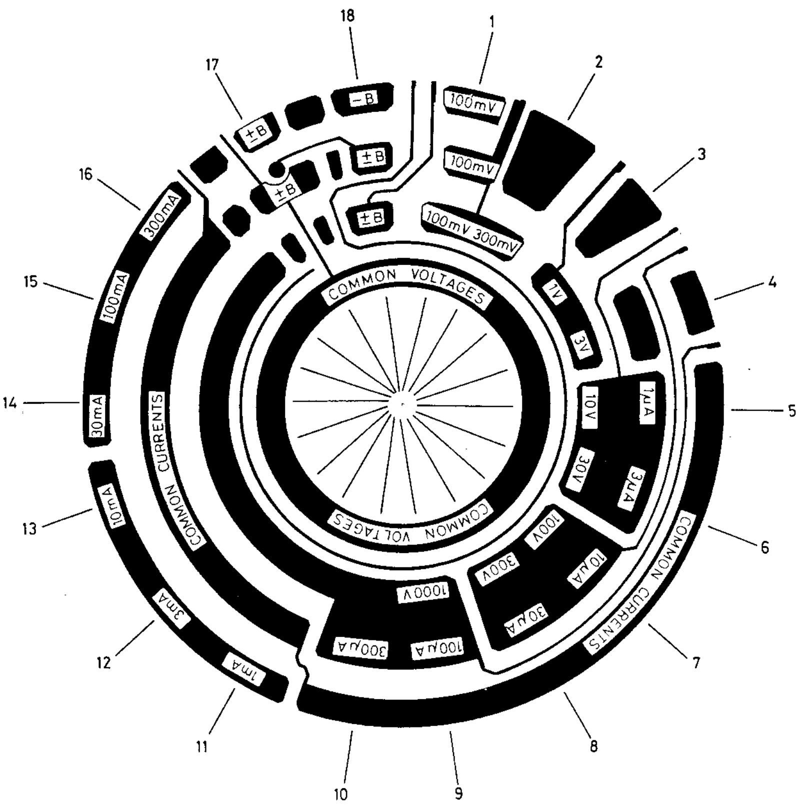


Fig. 22. Function switch lay-out component side

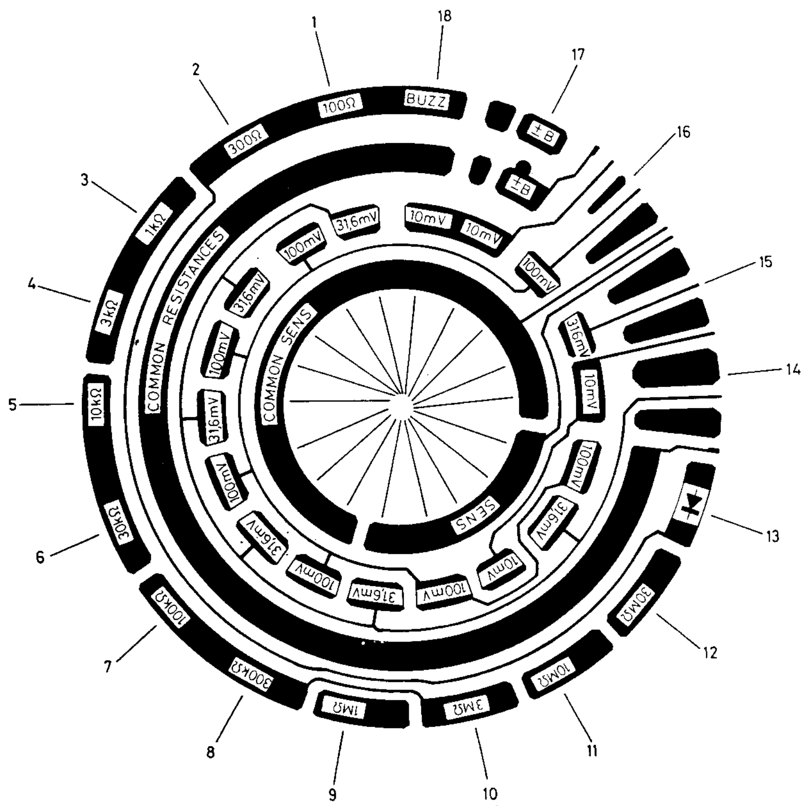


Fig. 23. Function switch lay-out conductor side

ST2782

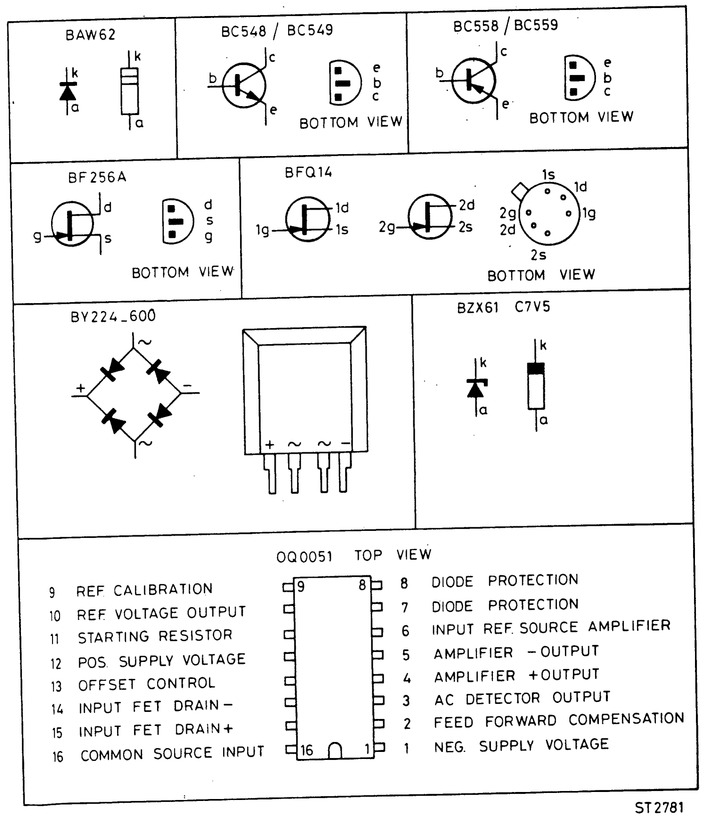
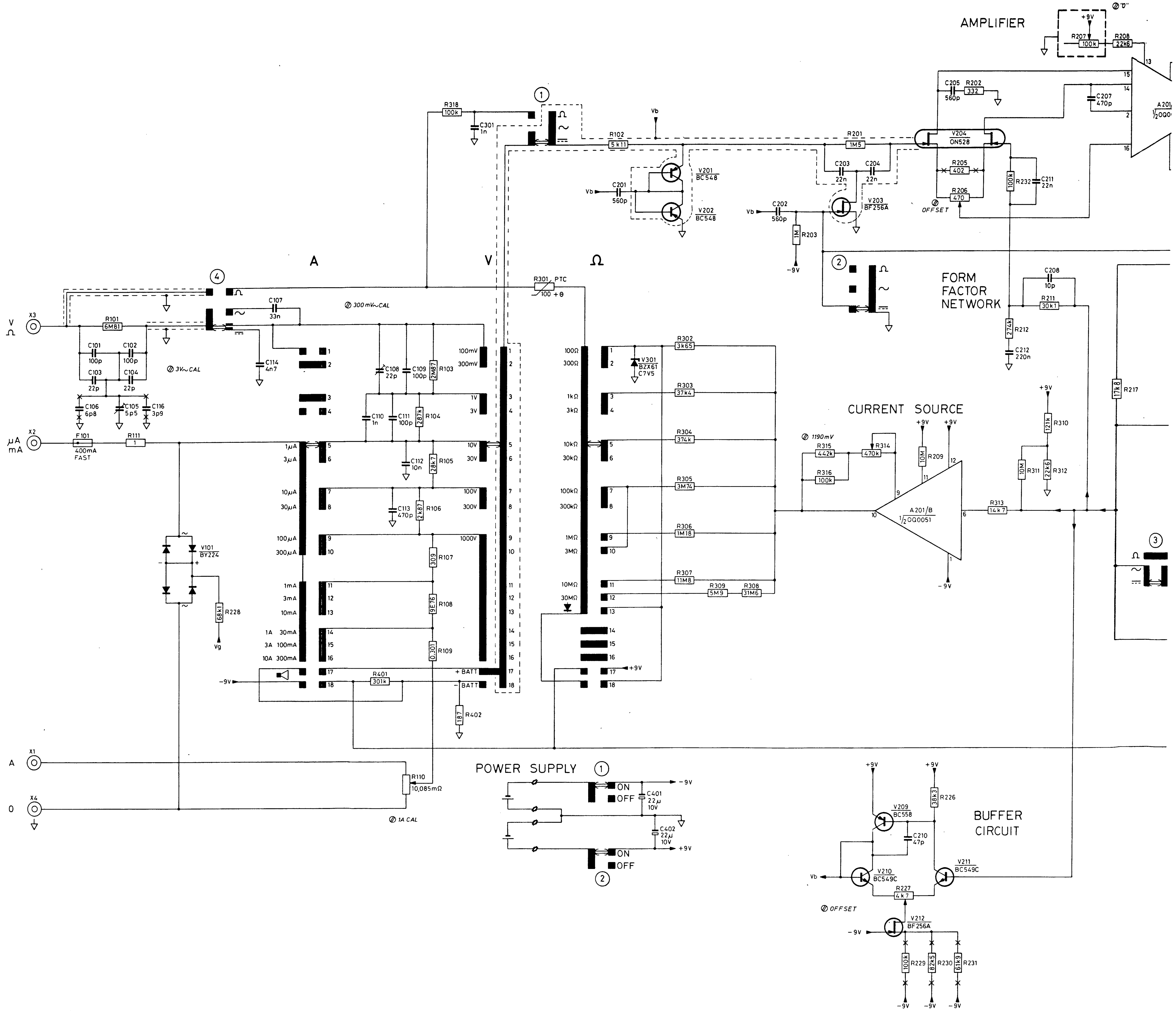
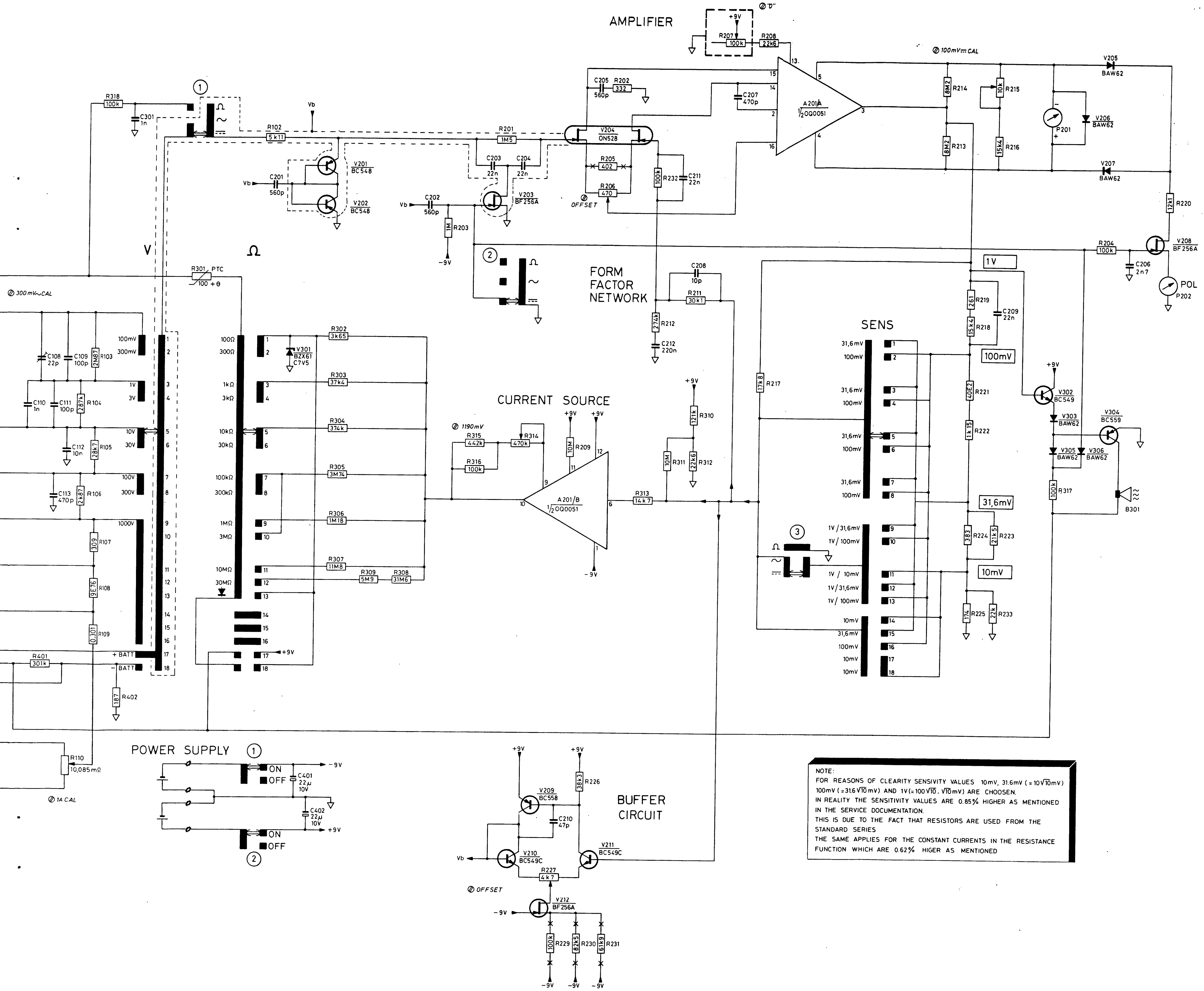


Fig. 24. List of used components





NOTE:
FOR REASONS OF CLEARITY SENSIVITY VALUES 10mV, 31.6mV ($=10\sqrt{10}$mV) 100mV ($=31.6\sqrt{10}$mV) AND 1V($=100\sqrt{10}.\sqrt{10}$mV) ARE CHOOSEN.
IN REALITY THE SENSITIVITY VALUES ARE 0.85% HIGHER AS MENTIONED IN THE SERVICE DOCUMENTATION.
THIS IS DUE TO THE FACT THAT RESISTORS ARE USED FROM THE STANDARD SERIES
THE SAME APPLIES FOR THE CONSTANT CURRENTS IN THE RESISTANCE FUNCTION WHICH ARE 0.62% HIGER AS MENTIONED

RANGE SWITCH

SWITCH CONTACTS	A ⎓ OR ~	V ⎓ OR ~	Ω	SENS
1		100mV	100Ω	31,6mV
2		300mV	300Ω	100mV
3		1V	1k	31,6mV
4		3V	3k	100mV
5	1μA	10V	10k	31,6mV
6	3μA	30V	30k	100mV
7	10μA	100V	100k	31,6mV
8	30μA	300V	300k	100mV
9	100μA	1000V	1M	1V/31,6mV
10	300μA		3M	1V/100mV
11	1mA		10M	1V/ 10mV
12	3mA		30M	1V/31,6mV
13	10mA			1V/100mV
14	30mA 1A			10mV
15	100mA 3A			31,6mV
16	300mA 10A			100mV
17		+BATT		10mV
18		-BATT		10mV

Fig. 25. Circuit diagram

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	0 P M 3 2 6 0 0 2	D 0 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
[X] Corrective maintenance			
[ ] Other			

⑦ *Job completed* [X]

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 [0 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.)

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equipment for science and industry

800904 PM 2505 SME 86

Already issued: - - -
Re : 1. Modification of the technical data
2. Corrections of the service manual

This service note is intended to be used in combination with the service manual of the PM 2505, ordering number 9499 475 01411.

1. MODIFICATION OF THE TECHNICAL DATA

The frequency range of the a.c. current accuracy has been modified.
Page 7 2.1.4. A.c. current measurements, Accuracy

Former design		
Range	**Frequency**	**Acc.**
1 µA - 10A	50-60Hz	±3%
1µA - 30µA 100 µA - 10mA 30mA - 10A	10Hz - 70Hz 10Hz - 20kHz 10Hz - 10kHz	

Present design		
Range	**Frequency**	**Acc.**
1 µA-10A	50-60Hz	±3%
1µA - 30µA 100 µA - 10A	10Hz - 70Hz 10Hz - 2kHz	

2. CORRECTIONS OF THE SERVICE MANUAL

Page 12 3.1. ACCESSORIES SUPPLIED WITH THE PM 2505
Add: Directions for use

Fig. 1. Measuring leads with testpins PM 9262
Change: PM 9262 into PM 9260

Page 23 4.3.4.1. Amplifier
At ac measurements the FET is non conductive (-●—o-).

Change (-●—o-) into (-●/ o-)

Page 24 Fig. 15 Protection
Change: Vg into Vb

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Page 32

6.2. ADJUSTING TABLE

In the adjustment data of the adjustments 7, 8 and 9, ± 0.2 is mentioned twice.
Omit one time ± 0.2

ADJUSTIGE TABLE R229, R230, R231

Change: Cut away R229, R229, R230 and replace them by a resistor of 61 kg. metal film MR25 series

Into: Cut away R229, R231, R230 and replace them by a resistor of 61 k9 metal film MR 25 series

Page 35

7.1. MECHANICAL parts list

Change: Fuse 400 mA FAST 5322 253 30016

Into: Fuse 400 mA FAST SAND FILLED 4822 255 20013

Page 36

7.2.1. Capacitors parts list

Omit: C115

Add: C116 4822 122 31217 3 p9 2 500 Ceramic plate

Page 39

7.2.3. Semiconductors parts list

Change: V210 4822 130 44246 BX 545C Transistor

Into: V210 4822 130 44246 BC 549C Transistor

Page 43

Fig. 25 Circuit diagram

Change: C114 4n7 Into: C114 2n7

Change: 3V~CAL Into: 3V~CAL

Interchange: ① and ② of the POWER SUPPLY

Interchange: the + and – of the measuring system P201

Change: Vg on R228 into Vb

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Test & Measuring Instruments
Industrial Automation
Advanced Automation Systems
Welding

Scientific & Industrial Equipment Division

820702	PM2505	SME96

Already issued:	SME86
Reason:	1. Modification of the Technical Data
	2. Modification of the parts list and the circuit diagram

This service note is intended to be used in combination with the service manual of the PM2505, ordering number 9499 475 01411.

1. MODIFICATION OF THE TECHNICAL DATA

The Technical Data, chapter 2 is modified as follows:

2.1.3. DC current measurements
2.1.4. AC current measurements

Voltage drop over the input sockets f.s.d., should be changed into:

Range	**Voltage drop**
1μA ... 30mA	< 135mV
100mA	< 350mV
300mA	< 1050mV
1A ... 10A	< 250mV

2.2.6. Power requirements

Add: Current consumption at 2 x 9V batteries
< 600μA in all ranges except Ω (< 1,5mA)
and ◁ (< 6mA).

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2. MODIFICATIONS TO THE PARTS LIST AND CIRCUIT DIAGRAM

C213 is added: 3,3μF 20% 16V, Electrolytic, 4822 124 20947

C213 is placed in parallel to the polarity indicator P201 and diode V206.
+ to anode and – to cathode of V206.

Reason: To prevent resonance of the pointer at 50Hz input signals.

R318 is modified to: 1MΩ 1% MR25, 5322 151 54188

Reason: To prevent oscillation in the lowest ohm ranges when measuring the ohmic value of large self inductions.

R215 is modified to: 22k 20% 0,05W potentiometer, 4822 100 10051
R216 is modified to: 14k7 1% MR25 , 5322 151 54632

Reason: Adaption of the circuitry to the measuring system.

R310 is modified to: 1M2 VR25 high voltage 5322 110 72189
R312 is modified to: 226k MR25 5322 151 54729

Reason: Reduce of current consumption from the + battery with 90μA.

Already issued	:	SME 86, SME 96
Re	:	1. Cracking of the stand-off lugs in the top-cover PM2505/03 2. Too small creeping distance between battery cover and batteries in PM2505/03 3. Brown version PM2505/04 4. Oscillation when measuring the ohmic value of high inductions
1. Problem	:	Cracking of stand-off lugs in the top-cover
Cause	:	Chemical reaction of oil on the metal screening (should have been cleaned) with the topcover can affect the stand-off lugs, causing cracking of the plastic.
Serial numbers involved	:	PM2505/03 DM13067 - DM14317 (grey version)
Remedy	:	New topcover assembly (with screening, knobs und function selector) if the above instruments are returned for repair with this problem.

The topcovers can be obtained **free of charge** from:

Mr. J. Stegeman
Service Voltmeters
Test & Measuring Instruments

Nederlandse Philips Bedrijven B.V.
Scientific & Industrial Equipment Division
Lelyweg 1
7602 EA Almelo, The Netherlands
Tel. 0(internat.-31)5490-18291
Telex 36591 nlxalsu

If possible please indicate how many topcovers are needed in total, so that they can be sent at once.

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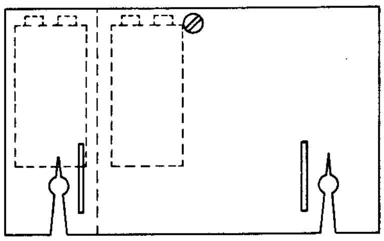
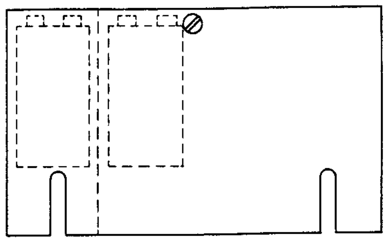
2 Problem : Too small creeping distance between batteries and the stand-up bracket holes in the PM2503/03.

Cause : PM2503/03 is equipped with old version battery covers without the piece of distance foam.



OLD BATTERY COVER
(TOP VIEW)

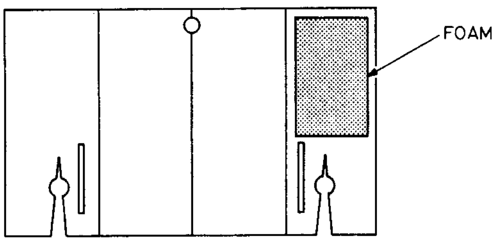


NEW BATTERY COVER
(TOP VIEW)

ST4111
830816

Serial numbers involved : PM2503/03 DM13474 – DM14554 (Grey version)

Remedy : Stick a piece of selfadhesive foam (ordering number 5322 446 60953) on the inside of the battery cover.



(BOTTOM VIEW)

ST4112
830816

It is advised to modify all instruments which are returned for repair.

3 Brown version PM2505/04

The following parts have been modified from grey to brown

Topcover	brown	5322 447 70074
Bottom cover assy	brown	5322 447 70073
Battery cover assy	brown	5322 447 70072
Measuring system	brown	5322 694 54021

4 Problem : Oscillation of the OQ0051 when measuring the ohmic value of high inductions.

Remedy : Modify R318 from 100 kΩ to 1 MΩ (5322 116 54188)

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Scientific & Industrial Equipment Division

840116 PM2505/.. SME110

Already issued: SME86,SME96,SME105
Re : 1. Erratum SME86
2. Modifications in the service manual of the PM2505 (9499 475 01411)

This service-note should be used in combination with the service manual of the PM2505 (9499 475 01411) and the service-notes SME86,SME96 and SME105.

1. Erratum SME86

-The correct ordering number for FUSE 400mA FAST SANDFILLED is 4822 253 20013.
-Page 43, Change: $3V_{\sim}$CAL Into: $3V_{\sim}$CAL

should be modified into:

Interchange: $300mV_{\sim}$CAL and $3V_{\sim}$CAL

2. Modifications in the Service Manual (9499 475 01411)

-Chapter 6. CHECKING AND ADJUSTING page 32, Adjustment No 9.

Under heading PREPARATIONS, Supply: $3V_{\sim}\pm0.2\%$

should be changed into: Supply: $1V_{\sim}\pm0.2\%$

-Chapter 7. PARTS LIST page 34.

The following items have been modified:

C101/C102 to	4822 122 31626	100p 2% 500V	Ceramic plate.
C103/C104 to	4822 122 31199	22p 2% 500V	" "
C106	4822 122 31192	6p8 2% 500V	" "
V210	4822 130 40938	BC548	

-CIRCUIT-DIAGRAMS AND BLOCK-DIAGRAMS
The arrows of transistors V201/V202 should be reversed (NPN BC548)

9499 478 1411

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