PHILIPS

INSTRUCTION MANUAL
ANLEITUNG
NOTICE D'EMPLOI ET D'ENTRETIEN

Electronic VA Ω meter

PM 2504

9447 025 04..1

PHILIPS

9499 470 11502

7904

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SERVICE

Cryogenic Equipment / Electro Chemistry / Electron Optics / Electronic Weighing / Industrial Data Systems / Numerical Control / Philips Pollution Measuring / Radiation Measuring Equipment / Test and Measuring Equipment / Welding Equipment / X-Ray Analytical Equipment

equipment for science and industry

770819 PM 2504 SME 72

Already issued: ——
RE : Erratum technical data

II-1.1. D.c. and a.c. voltage

Max. input voltage	1000 V⎓ on all ranges 600 V ~ on all ranges,	
should be changed in:		
Max. input voltage	1000 V⎓ on all ranges 600 V ~ on all ranges	
Max. V Hz product	Ranges 10, 30, 100 and 300 mV~ Ranges 1, 3, 10, 30, 100, 300 and 600 V~	$\leqslant 3.10^4$ $\leqslant 10^7$

Bereits veröffentlich: ——
Betrifft : Erratum Technische Daten

II-1.1. Gleich und Wechselspannungen

Max. Eingangsspannung	1000 V⎓ in allen Bereiche 600 V ~ in allen Bereichen	
soll geändert werden in:		
Max. Eingangsspannung	1000 V⎓ in allen Bereichen 600 V ~ in allen Bereichen	
Max. V Hz Produkt	Bereiche 10, 30, 100 und 300 mV~ Bereiche 1, 3, 10, 30, 100, 300 und 600 V~	$\leqslant 3.10^4$ $\leqslant 10^7$

Déja publié : ——
Concerne : Erratum caractéristiques techniques

II-1.1. Tensions continues et alternatives

Tension d'entrée maximale	1000 V⎓ pour toutes les gammes 600 V ~ pour toutes les gammes	
doit être changé à :		
Tension d'entrée maximale	1000 V⎓ pour toutes les gammes. 600 V ~ pour toutes les gammes	
Produit maxi V Hz	Gammes 10, 30, 100 et 300 mV ~ Gammes 1, 3, 10, 30, 100, 300 et 600 V~	$\leqslant 3.10^4$ $\leqslant 10^7$

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equipment for science and industry

780814 PM 2504/01/02/03/.. SME 77

Already issued : SME 72
Re : 1 Modifications of the instruction manual, codenumber 9499 470 11502
2 Rectifier diodes for measuring system
3 Addition to the parts list

1. MODIFICATIONS

PM 2504/01 and following versions
Capacitor C403, 560pF has been replaced by 82pF, 100 V 10%, ordering number 4822 122 31208.

PM 2504/02 and following versions
Rectifier diodes V510/V513 (FH1100) have been replaced by types BA280, ordering number 5322 130 34302.
In addition to this resistor R515 (8k2) has been modified into 2k7 □ and capacitor C506 has been removed.

Shunts R201, R203 and R204, R205 and R206 have been replaced

R201	90 Ω	1%	2W	5322 116 64032
R203	9 Ω	1%	2W	5322 116 64033 (R203 - R204)
R205	0.9 Ω	1%	2W	5322 113 24147
R206	0.1 Ω	1%	2W	5322 113 24148

Resistors R203 and R204 (4.5 Ω) have been replaced by one 9 Ω resistor R203.
The combined wire wound shunt R205/R206 has been replaced by two precision resistors (refer to Fig. 1.).

2. RECTIFIER DIODES FOR MEASURING SYSTEM (see Fig. 2.)

Static fields, caused by plastic packing materials, and voltages generated by movement of the measuring system during transport, can damage the rectifier diodes GR510/GR513 of type BA 280. To avoid this the following modifications have been carried out from serialnumber DM 05 2251 on.

- GR510 upto and including GR513 (BA 280) have been replaced by type MBD 102, ordering number 5322 130 34566.
- A capacitor of 100 pF 100 V ceramic plate, codenumber 4822 122 31081 has been mounted in parallel to capacitor C507.
- Diode GR514, BAW62, has been replaced by a stabistor of type BZX75 C1V4, codenumber 5322 130 34047.
- In Anti-parallel to stabistor GR514 a diode of type BAW62, codenumber 5322 130 30613 has been replaced.
- All instruments are packed in paper instead of plastic.

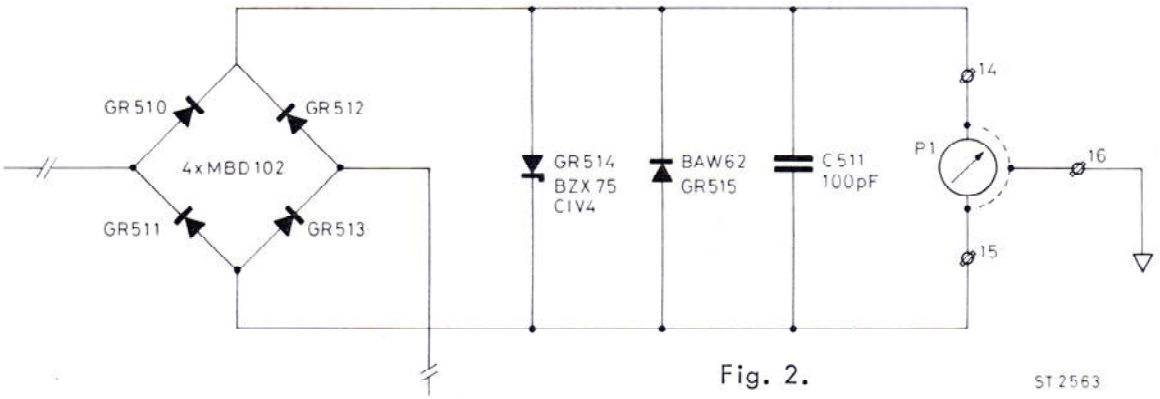


Fig. 2.

Survey:

PM 2504/01	4 x FH 1100
PM 2504/02/03	4 x BA 280
PM 2504/04 (DM 05 2251)	4 x MBD 102 including above mentioned modifications.

3. ADDITION TO THE PARTS LIST

Correction screw for measuring system	5322 500 14213
Transparant window	5322 447 74005
Fuse holder for spark gap F3	5322 256 34057
Rear foot	5322 462 44181
Battery cover spring	5322 492 64719 (3 pieces)

PHILIPS

SERVICE

Scientific & Analytical Equipment
Test & Measuring Instruments
Industrial Automation
Advanced Automation Systems
Welding

Scientific & Industrial Equipment Division

820624 | PM2504/01/.. | SME 97

Already issued : SME 72, SME 77
RE : Modification of partslist and circuit diagram.

As documentation for the PM2504 should be used: Service Manual 9499 470 11502, SME 72, SME 77 and this information sheet.

1. Parts list

Mechanical

Add: Battery cover spring 5322 492 64719
Rear cover assembly 5322 694 54014
(including battery springs)
– nuts
– sockets (2x)

Electrical

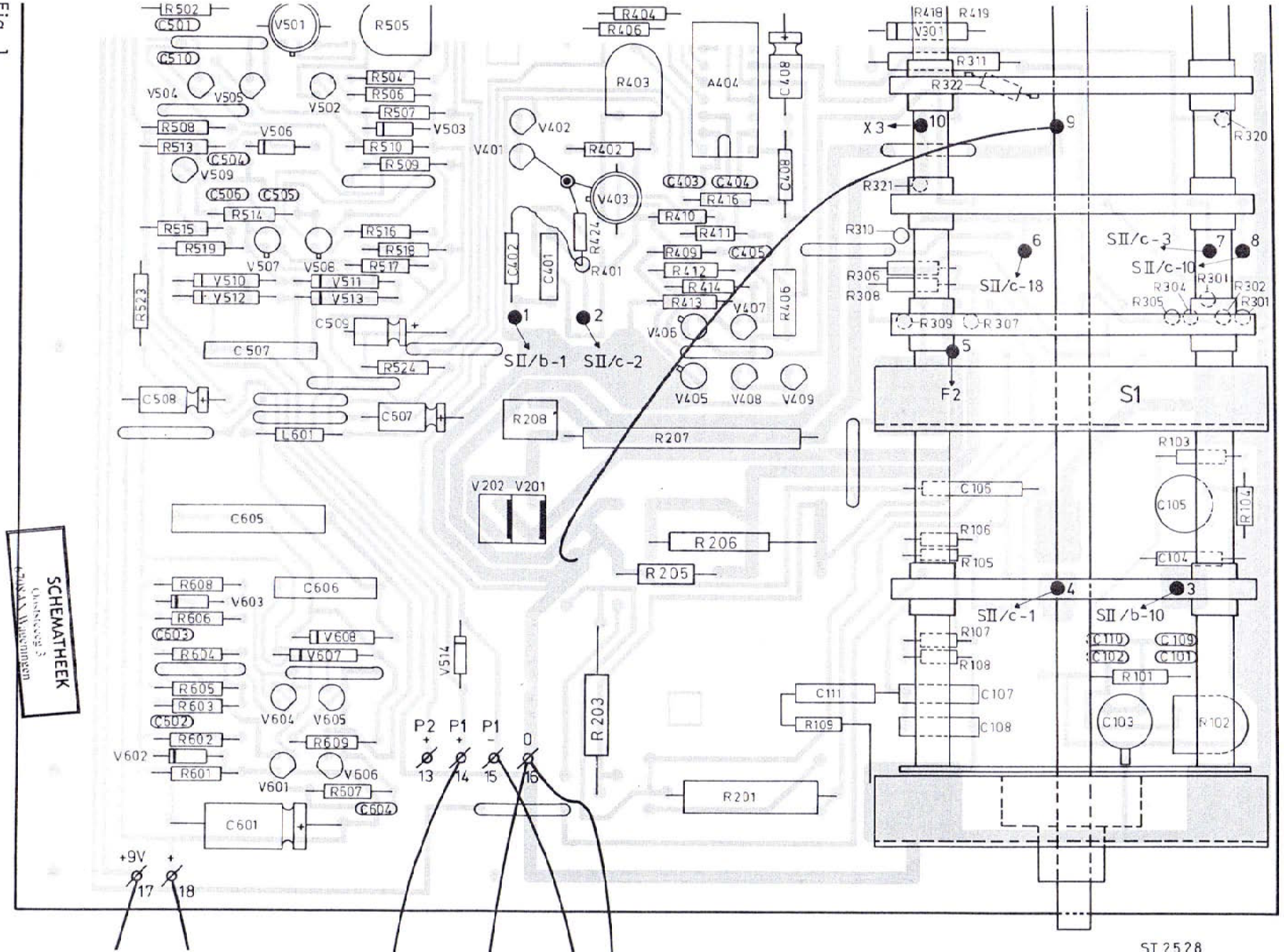
R4. The ordering number of R4 is incorrect, it should be changed into 5322 115 84034.
C2 Should be added, 1nF 10% 500V, 4822 122 31175.
C403 is modified to 820pF 10% 100V, 4822 122 30031
(also refer to SME 77)
R201 The ordering number stated in SME 77 is incorrect, it should be changed into 5322 116 64032.

2. Circuit diagram

C403 is 820pF
Short circuit over R607 should be removed.

9499 478 12811
PRINTED IN THE NETHERLANDS

Fig. 1



SCHEMATHEEK

ST 2528

CONTENTS / INHALTSANGABE / TABLES DES MATIERES

IMPORTANT

In correspondence concerning this instrument please quote the type-number and the serial-number as given on the text-plate at the rear of the instrument.

WICHTIG

Bei einem eventuellen Schriftverkehr über dieses Gerät geben Sie bitte die Typen- und Serienummer an, die auf dem Typenschild des Gerätes stehen.

IMPORTANT

Nous vous prions de compléter votre correspondance éventuelle, concernant l'appareil en question, du numéro de type et du numéro de série tels que figurant sur la plaquette signalétique.

LIST OF FIGURES / BILDVERZEICHNUNG / / LISTE DES ILLUSTRATIONS

I. INTRODUCTION

The electronic multifunction meter PM 2504 is a universal measuring instrument with 66 measuring ranges, an integrated amplifier part, a FET - input stage, a linear ohm - scale and a combined V - Ω input socket.
The number of measuring ranges can be increased to 82 using optional accessories such as: x 2 attenuator PM 9262, current transformer PM 9245, HT measuring probe PM 9246 and HF probe PM 9210. The PM 2504 is very easy to control by means of the mono-knob for range selection and three push buttons for the functions " ⎓ " " ∼ ", and "Ω".
For measuring diodes a special range is available.
The PM 2504 is supplied from six 1.5 V batteries while a special socket is available for external 9 V power supply.

The high input impedance and high accuracy enables precise measurements to be made on circuits with a high source impedance. The properties mentioned together with the easily readable mirror scale and automatic polarity indication offer a wide range of applications for the multifunction meter in laboratories, TV - and radio service stations, educational purposes and industry.

II. TECHNICAL DATA

Properties expressed in numerical values tolerance stated are quaranteed by the factory. Numerical values without tolerances serve only for information and represent the properties of an average instrument.

II-1 ELECTRICAL DATA

II-1.1 D.c. and a.c. voltages

Measuring range	100 µV ... 1000 V 11 ranges 10 mV, 30 mV, 100 mV, 300 mV, 1 V 3 V, 10 V, 30 V, 100 V, 300 V and 1000 V
Sensitivity	100 µV

Input impedance

Range	Impedance
10 mV 30 mV 100 mV 300 mV	10.18 MΩ // 115 pF
1 V 3 V 10 V	10.18 MΩ // 70 pF
30 V 100 V 300 V 1000 V 600 V~ max.	9.87 MΩ // 70 pF

Accuracy (f.s.d.)

d.c. voltages ± 1 %
a.c. voltages ± 1.5 % for sinewave voltages at 50 - 60 Hz.

Frequency influence

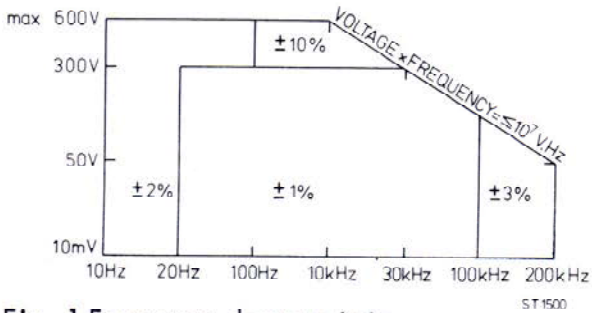


Fig. 1 Frequency characteristic

Max. input voltage

1000 V⎓ on all ranges
600 V~ on all ranges

Protection

Spark gap 1700 V

II-1.2 D.c. and a.c. currents

Measuring range

10 µA ... 30 A
9 ranges
1 mA, 3 mA, 10 mA, 30 mA, 100 mA
300 mA, 1 A, 10 A and 30 A

Sensitivity

10 µA

Accuracy f.s.d.

d.c. currents ± 1.5 %
a.c. currents ± 1.5 % 50 - 60 Hz for sinewave currents
± 2.5 % 10 Hz - 1 kHz for sinewave currents

Voltage drop

Range	Voltage drop
1 mA	100 mV
3 mA	35 mV
10 mA	105 mV
30 mA	40 mV
100 mA	125 mV
300 mA	100 mV
1 A	300 mV
10 A	180 mV
30 A	300 mV

Protection

2 A fuse for the ranges 1 mA ... 1 A
For the 10 A and 30 A range a separate input is availabl

II-1.3 Resistance values

Measuring range

0.1 Ω ... 100 MΩ
15 ranges
10 Ω, 30 Ω, 100 Ω, 300 Ω, 1 kΩ, 3 kΩ
10 kΩ, 30 kΩ, 100 kΩ, 300 kΩ, 1 MΩ, 3 MΩ, 10 MΩ,
30 MΩ and 100 MΩ
Linear Ω - scale

Sensitivity

0.1 Ω

Accuracy (f.s.d.)

Range	Measuring current	Accuracy
10 Ω	1 mA	± 5 %
30 Ω 100 Ω 300 Ω		± 2.5 %
1 kΩ 3 kΩ 10 kΩ	31.6 nA	± 1.5 %
30 kΩ 100 kΩ 300 kΩ	1 µA	
1 MΩ 3 MΩ 10 MΩ	100 nA	± 2.5 %
30 MΩ 100 MΩ	3.16 nA	± 5 %

Protection

125 mA fuse
Max. permissable voltage 220 V

II-1.4 Diodes

Measuring current
Measuring voltage

1 mA
1 V f.s.d.

II-2 GENERAL DATA

Meter system

Taut band suspension 50 µA

Polarity indicator - ∿ +

Supply

6 x 1.5 V batteries
(e.g. Type R 14 DD)
Life 1000 hours
Possible battery check
External supply via 9 V input socket

dB scale

Range	
10 mV	- 40 dB
30 mV	- 30 dB
100 mV	- 20 dB
300 mV	- 10 dB
1 V	0 dB
3 V	+ 10 dB
10 V	+ 20 dB
30 V	+ 30 dB
100 V	+ 40 dB
300 V	+ 50 dB
1000 V	+ 60 dB

0 dB = 1 mW, 600 Ω, 0.775 V

Technical data

According to IEC 217

Environmental conditions

According to IEC 359

Climatic conditions

Group 1

Ambient temperature	23 °C ± 2 °C (reference value)
Temperature coefficient	< 1 % / 10 °C
Rated range of use	-10 °C ... + 55 °C
Limit range of storage and transport	-40 °C ... + 70 °C
Relative humidity	20 % ... 80 % (excluding condensation)

A recovery time of a few hours is advised at large fluctuations of temperature and humidity.

Mechanical conditions	Group 2
Supply conditions	Group 2
Max. voltage between "O" and mains earth	400 V⎓
Dimensions	Height 145 mm Width 236 mm Depth 298 mm Weight 2.7 kg

III. ACCESSORIES

III-1 SUPPLIED WITH THE INSTRUMENT

- Measuring cable PM 9260 (Fig. 2 page 34)
- Fuse 2A
- Fuse 125 mA
- Instruction manual

III-2 OPTIONAL

III-2.1 x 2 attenuator PM 9262 (Fig. 3 page 34)

Input resistance 10 MΩ

Max. power 1 W

Max. operating voltage 1700 V

III-2.2 Current transformer PM 9245 (Fig. 4 page 34)

Measuring range	10 A ... 100 A~
Transformer ratio	1000 x (100 A = 100 mA)
Accuracy	± 3 %
Frequency range	45 Hz ... 1 kHz
Secundary voltage drop	< 200 mV
Max. voltage to earth	400 V~
Maximum air gap	0.05 mm

III-2.3 H.T. measuring probe PM 9246 (Fig. 5 page 34)

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

III-2.4 HF probe PM 9210 (Fig. 6 page 34)

Voltage range	150 mV a.c. ... 15 V a.c. peak to peak rectification calibrated on the RMS value of a sinewave a.c. voltage
Accuracy	with a 10 MΩ ± 10 % load at 100 kHz ± 5 % 20°C - 25°C ± 10 % 15°C - 30°C
Influence of the frequency	≤ 3 dB at 10 kHz and 1 GHz.
Input capacitance	≤ 2 pF
Maximum input voltage	30 V superimposed on 200 V d.c.

Probe 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 probe accessories set PM 9212 (Fig. 7 page 34).

III-2.5 9 V - Power supply PM 9218/01 (Fig. 8 page 34)

IV. PRINCIPLE OF OPERATION

IV-1 GENERAL

The circuitry of the PM 2504 is built up of an integrated pre-amplifier preceded by attenuators for the various voltage, current and resistance ranges. The pre-amplifier is followed by a second attenuator which is used in all ranges and an amplifier together with the rectifier diodes for the measuring system. At end of range the attenuated input voltage supplied to the amplifier is 31.6 mV. The gain of the amplifier 1.

IV-2 D.C. AND A.C. VOLTAGE MEASUREMENTS (Fig. 9 page 38)

In the case of d.c. and a.c. voltage measurements the input voltage supplied to the „V" socket and "O" socket is attenuated by the voltage attenuator.
Depending on the range selected, the attenuation is 31.6, 1000, or 10.000.
The attenuated input voltage is then supplied to the pre-amplifier.

The gain of the pre-amplifier is x 3.16 or x 1 depending on the selected range. The output of the pre-amplifier is supplied to the second attenuator which has an attenuation of 3.16, 10 or 31.6.
At end of range the voltage supplied to the amplifier (gain x 1) is 31.6 mV in all ranges.
The output current of the amplifier is supplied to the measuring instrument via the rectifier circuit and is measured (31.6 mV equals 100 scale divisions).
The voltage attenuator, the gain of the pre-amplifier and the second attenuator are controlled by range selector S1.
At d.c. voltages the polarity indicator automatically indicates the polarity of the input voltage supplied to the "V-Ω" input socket with respect to the "O" socket.

IV-3 D.C. AND A.C. CURRENTS (Fig. 10 page 38)

By means of shunts the input currents supplied to the „A" and „O" socket are transfered to measuring voltages which are supplied to the pre-amplifier.
The gain of the pre-amplifier for all current ranges is x1. The output of the pre-amplifier is supplied to the second attenuator which has an attenuation of 3.16 or 1 dependent on the selected range. At end of range the voltage supplied to the amplifier is 31.6 mV in all ranges (31.6 mV equals 100 scale divisions). The output voltage of the amplifier is supplied to the measuring instrument via the rectifier diodes and is measured.
The shunts, the gain of the pre-amplifier and the second attenuator are controlled by range selector S1.
At d.c. currents the polarity indicator indicates the polarity of the input supplied to the "A" socket with respect to the "O" socket.

IV-4 RESISTANCE MEASUREMENTS

IV-4.1 Ranges 10 Ω - 10 MΩ (Fig. 11 page 38)

Resistance measurements in the 10 Ω to 10 MΩ range are effected by measuring the voltage drop across the unknown resistance Rx.
The voltage drop is caused by a constant current flowing through the unknown resistor.
The voltage drop Vx is supplied to the pre-amplifier (gain x1). The output voltage Vx of the pre-amplifier is supplied to the reference amplifier which has an internal voltage source of 1.2 V
The ouput of the reference amplifier is therefore 1.2V + Vx.
As the input voltage is Vx, the voltage across attenuator Rs is 1.2V. Independently by of the value of Rx, the voltage across Rs is 1.2V and a constant current will flow through the unknown resistor R
The output voltage Vx of the pre-amplifier is supplied to the amplifier via the second attenuator which has an attenuation of 1, 3.16, 10 and 31.6 dependent to the select range.
At end of range the voltage supplied to the amplifier (gain x 1) is 31.6 mV.
The output voltage of the amplifier is supplied to the measuring instrument and measured (31.6 mV equals 100 scale divisions)
The attenuator Rs , the gain of the pre-amplifier and the second attenuator are controlled by range selector S1.

IV-4.2 Ranges 30 MΩ and 100 MΩ (Fig. 12 page 38)

In the ranges 30 MΩ and 100 MΩ a constant current from the reference amplifier, which is switched as a constant current source, flows through fixed resistor R.
As a result of this a constant voltage source is obtained.

As the unknown resistor Rx is included in the feedback of the pre-amplifier, the gain of the pre-amplifier is dependent on the value of Rx. The output of the pre-amplifier is supplied to the amplifier via the second attenuator (attenuation 10 or 31.6). The output voltage (31.6 mV) of the amplifier (gain x 1) is supplied to the measuring instrument and measured (31.6 mV equals 100 scale divisions).
The second attenuator is controlled by range selector S1.

IV-5 DIODE MEASUREMENTS

For diode measurements a special diode range is available.
Diode measurements are performed in the same way as the resistor measurements described in section IV-4.1.
At end of range the measuring voltage is 1 V and the measuring current is 1 mA. (at full scale deflection).

V. INSTALLATION

DIRECTIONS FOR USE

V-1 POWER SUPPLY

The PM 2504 is powered by six 1.5V batteries, which are accomodated in the battery compartment
Recommended type: R 14 DD.
The battery compartment is accessible by removing the battery cover, (Fig. 15 and 16 page 42).

Note: External power supply is possible by means of the optional 9V power supply PM 9218/01. When used, the PM 9218/01 should be connected to the „EXT 9V DC" input at the rear of the voltmeter (Fig. 15 page 42).

V-2 BATTERY CHECK (Fig. 14, 15 and 16 page 42)

- Depress push-button switch "POWER ON".
- Depress function switch " ⎓ ".
- Select the 10V range by means of rangeselector switch S1
- Interconnect the "V-Ω" input socket (X1) with the "BATT" socket (X6). The battery supply voltage is available at the "BATT" socket.
- The meter indication should be in the "BATT" region (lower scale). The upper scale indicates the battery voltage in volts.
- If necessary, replace the batteries.

V-3 ZERO SETTING (Fig. 14 and 15 page 42)

Mechanical

- Adjust the pointer to "O" by means of correction screw "A" at the front of the PM 2504 (instrument switched-off).

Electrical

- Depress push-button switch "POWER ON".
- Depress function switch " ⎓ ".
- Select the 10mV range by means of range selector switch (S1).
- Interconnect the "O" socket and the "V-Ω" socket (Fig. 14 page 42).
- Adjust the polarity indicator to the middle of the a.c. sign. [- ∿ +] with potentiometer "O", which is situated at the rear of the PM 2504.

V-4 CALIBRATION (Fig. 14 and 15 page 42)

- Depress push-button switch "POWER ON".
- Depress function switch " ⎓ ".

- Select the 1V range by means of range selector switch S1.
- Interconnect the "V-Ω" input socket with the "REF 1V" socket X4 which is situated at the rear of the PM 2504.
- Adjust the meter indication to 100 scale divisions with potentiometer "CAL".

V-5 RACK MOUNTING

The PM 2504 can be mounted in a 19 "rack by using a mounting set as shown in Fig. 17 page 46 . This set is not suppled by Philips.

VI. MEASURING

VI-1 D.C. AND A.C. VOLTAGES

- Depress push-button switch "POWER ON".
- Depress button " ⎓ " or " ∼ ".
- Set range selector S1 to the highest voltage range.
- Connect the unknown measuring voltage to the sockets "V-Ω" and "O".
- Select the correct measuring range by means of range selector S1.
- For d.c. voltages the polarity indicator P2 indicates the polarity of the "V-Ω" input socket with respect to the "O" socket.

Note: 1. D.C. voltages between 1 kV and 30 kV can be measured with the H.T. measuring probe PM 9246.
Select an impedance of 10 MΩ on the probe.
2. D.C. voltages with H.F. interference can be measured with the aid of x 2 attenuator PM 9262.
3. H.F. voltages from 100 kHz to 1 GHz and 150 mV to 200 V can be measured with the H.F. measuring probe PM 9210 and probe accessories set PM 9212.

VI-2 D.C. AND A.C. CURRENTS

VI-2.1 Currents up to 1 A

- Depress push-button switch "POWER ON".
- Depress button " ⎓ " or " ∼ ".
- Set range selector S1 to the highest current range (1A).
- Connect the unknown current to the sockets "A" and "O".
- Select the correct measuring range by means of range selector S1.
- For d.c. currents the polarity indicator P2 indicates the polarity of the "A" socket with respect to the "O" socket.

VI-2.2 Current up to 10 A and 31.6 A

- Depress push-button switch "POWER ON".
- Depress button " ⎓ " or " ∼ ".
- Set range selector S1 to the "rear - 10-30 A" range.
- Connect currents up to 10 A to the sockets "O" (X7) and "10 A" (X8) and currents up to 31.6 A to the sockets "O" (X8) and 31.6 A (X9).

Note: A.C. currents up to 100 A can be measured with current transformer PM 9245.

VI-3 RESISTANCE VALUES

- Depress push-button switch "POWER ON".
- Depress button "Ω ⊣◀⊢ ".
- Connect the unknown resistor to the "V-Ω" and "O" socket.
- Select the correct measuring range by means of range selector knob S1.

Note: 1. Measuring of resistance should be performed without voltage.

2. Due to the use of a linear scale the pointer moves rapidly to the right-hand end of the scale when button "Ω ⊣◀⊢ " is depressed and no resistor is connected to the "V-Ω" and "O" socket. This is normal and will not damage the instrument.

VI-4 DIODE MEASUREMENTS

- Depress push-button switch "POWER ON".
- Depress button "Ω ⊣◀⊢ ".
- Select the diode measuring range " ⊣◀⊢ " by means of range selector S1.
- Connect the diode to the "V-Ω" and "O" socket according the table below:

	V-Ω ⌀ ▼ 0 ⌀	V-Ω ⌀ ▲ 0 ⌀
Ge	10 - 30	> 100
Si	60 - 70	> 100

VI-5 PROTECTION

Voltage ranges

The voltage ranges are protected with a spark-gap (F3) against a voltage overload up to 1700 V. The spark-gap is accessible after removal of the bottom by means of removing the two screws "B" (Fig. 15 page 42 and Fig. 24 page 53).

Current ranges

The current ranges are protected with a 2A fuse (F2).

Resistance ranges

The resistance ranges are protected with a 125 mA fuse (F1)

Note: The fuses F1 and F2 placed in the "V-Ω" and "A" socket (see Fig. 13 page 46).

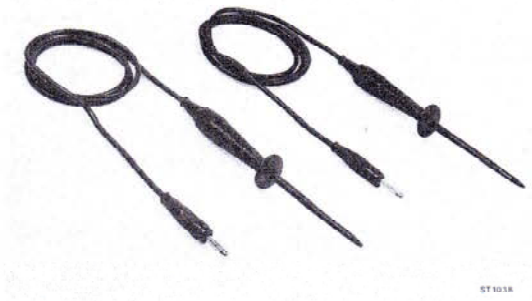


Fig. 2

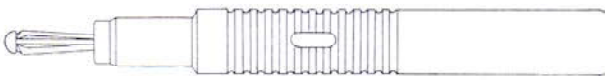


Fig. 3

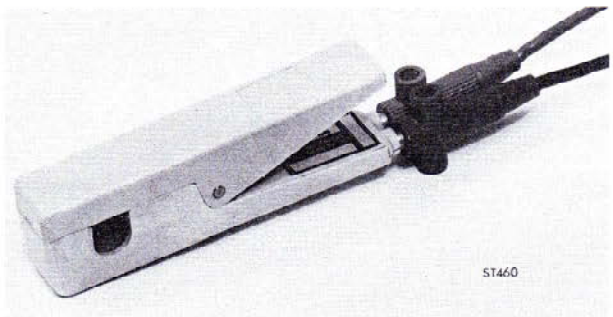


Fig. 4

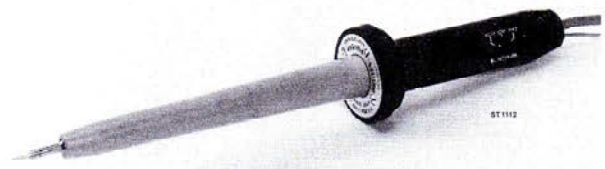


Fig. 5

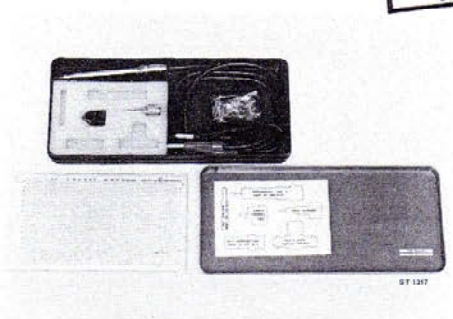


Fig. 6

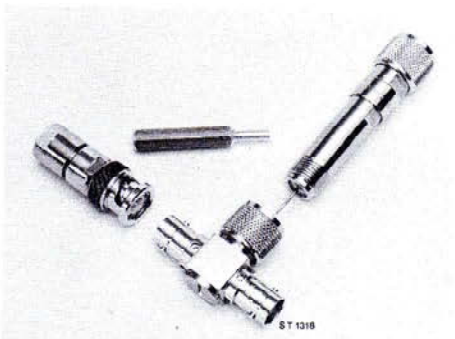


Fig. 7

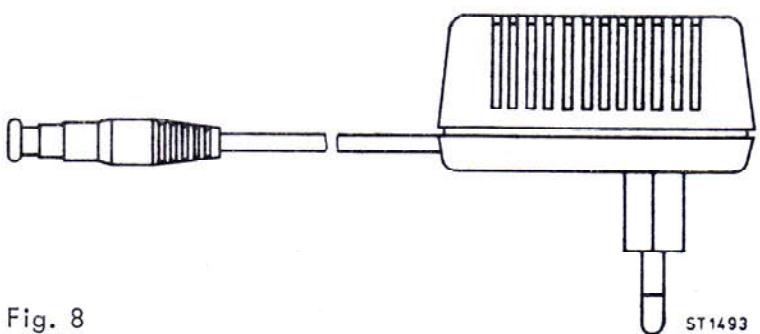


Fig. 8

VOLTAGE

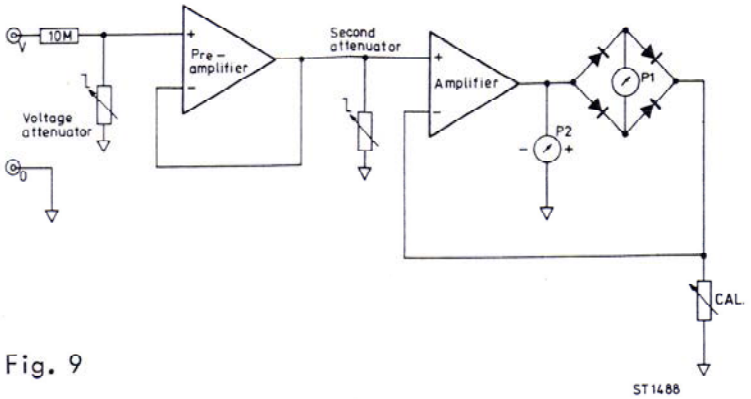


Fig. 9

CURRENT

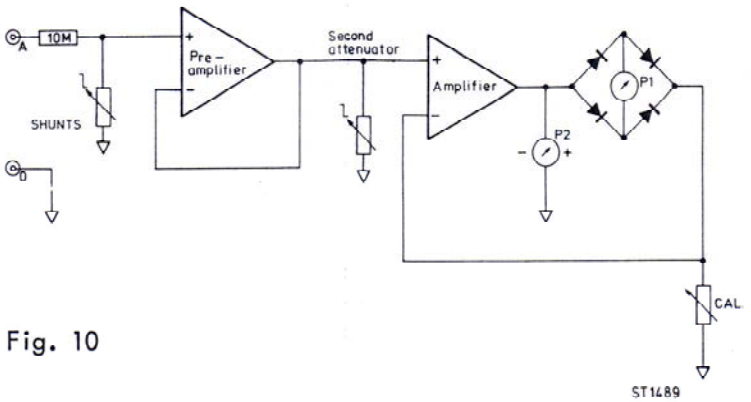


Fig. 10

RANGE 10Ω – 10MΩ

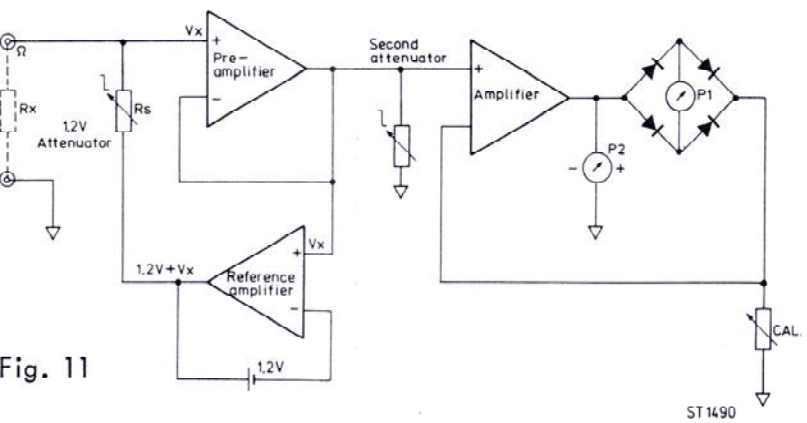


Fig. 11

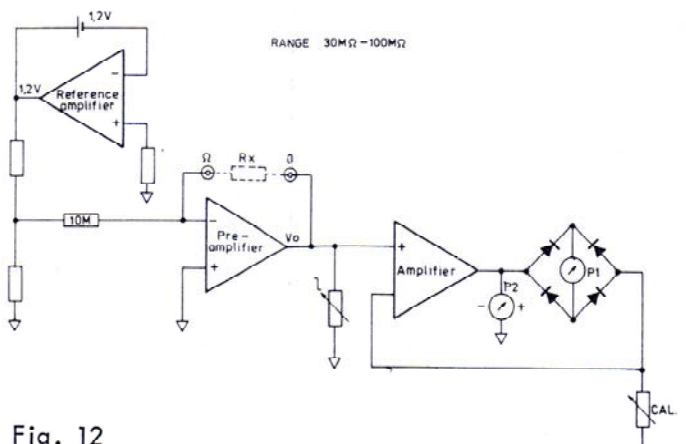


Fig. 12

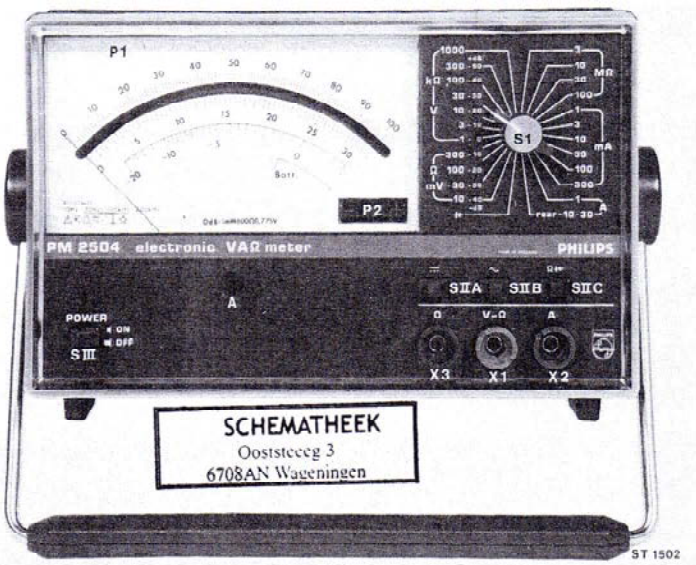


Fig. 14

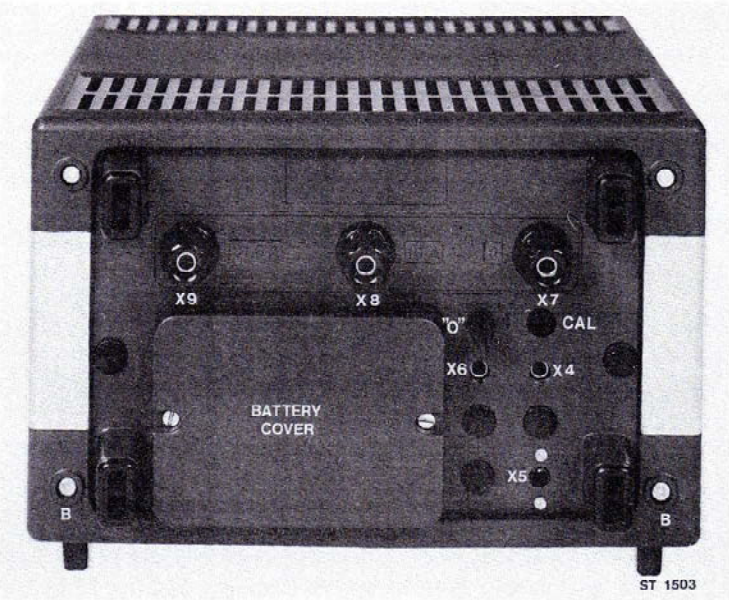


Fig. 15

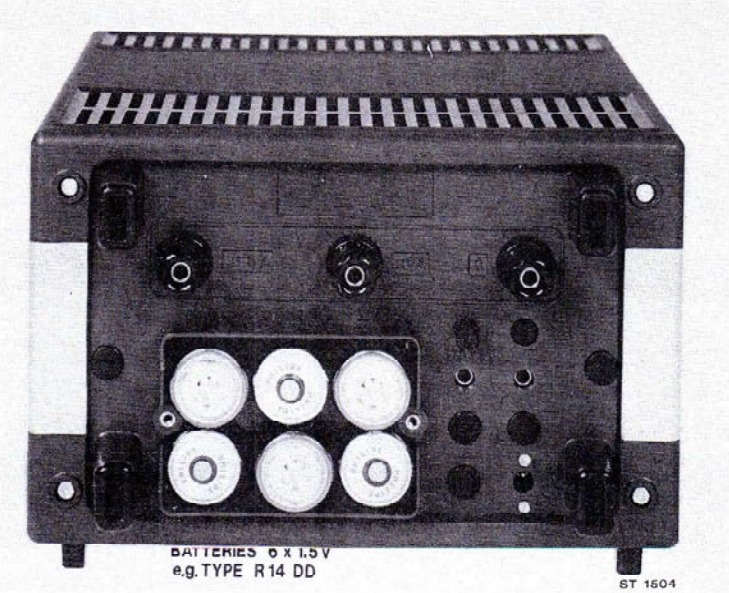


Fig. 16

VII. CIRCUIT DESCRIPTION SERVICE DATA

VII-1 GENERAL

The multifunction meter PM 2504 is built up of the input attenuators for the voltage - current and resistance ranges followed by the pre-amplifier (A 404/A) which has a FET-input stage.
The pre-amplifier is followed by the second attenuator (R418 upto R423) and the amplifier (gain x1) which is built up to the transistors V501 upto V509. The output of the amplifier is supplied to the measuring system P1 via the rectifier diodes V510 upto V513. For resistance measurements the voltage reference amplifier (A 404/B) is incorperated in the circuitry of the PM 2504.
The attenuation factors of the voltage-, current- and resistance attenuator, the gain of the pre-amplifier and the attenuation factor of the second attenuator is controlled by range selector S1. The gain and attenuation factors for all ranges are given in the figure 18.

Together with the circuit diagram a positive film (Fig. 33) is given of range selector S1. When the figures 1 and 13 of the film are placed on the corresponding figures of the range selector S1 in the the circuit diagram (Fig. 32), then range selector S1 is switched in position 10 mV. When sliding the positive film stepwise downwards all the ranges in the sequence of range 10 mV (10 Ω) up to 1000 V (1000 kΩ), 3 MΩ up to 100 MΩ. 1 mA up to rear 10 - 30 A and ⊣◀ can be checked (clockwise turning of the range selector).

VII-2 INPUT CIRCUITS

VII-2.1 D.c. and a.c. voltage input circuit

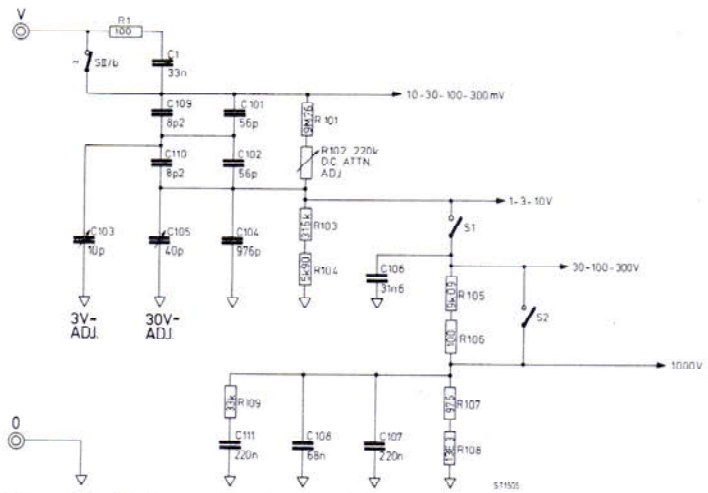


Fig. 19 Voltage input circuit

The input attenuator for d.c. voltages consists of resistors R101 up to R109 and for the a.c. voltage of R101 up to R109 and the frequency compensation capacitors C101 up to C111 (range selector segment S1/a). In case of the ranges 10 - 30 - 100 - 300 mV the input voltage is directly supplied to the pre-amplifier.
The ranges 1 - 3 - 10 V are attenuated by the resistors R101, R102, R103 and R104 (attenuation 31.6 see Fig. 18). Potentiometer R102 is for the D.C. attenuator adjustment and capacitor C103 is for the 3 V~ adjustment (see section IX).
The ranges 30 - 100 - 300 V are attenuated by the resistors R101 up to R109 (attenuation 1000 see Fig. 18). Switch S1 closed.
Capacitor C105 is for the 30 V~ adjustment. (see section IX)

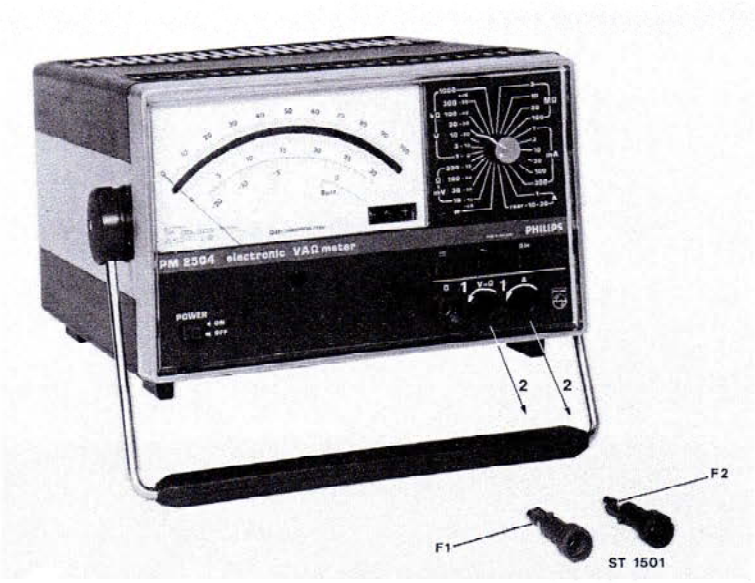


Fig. 13

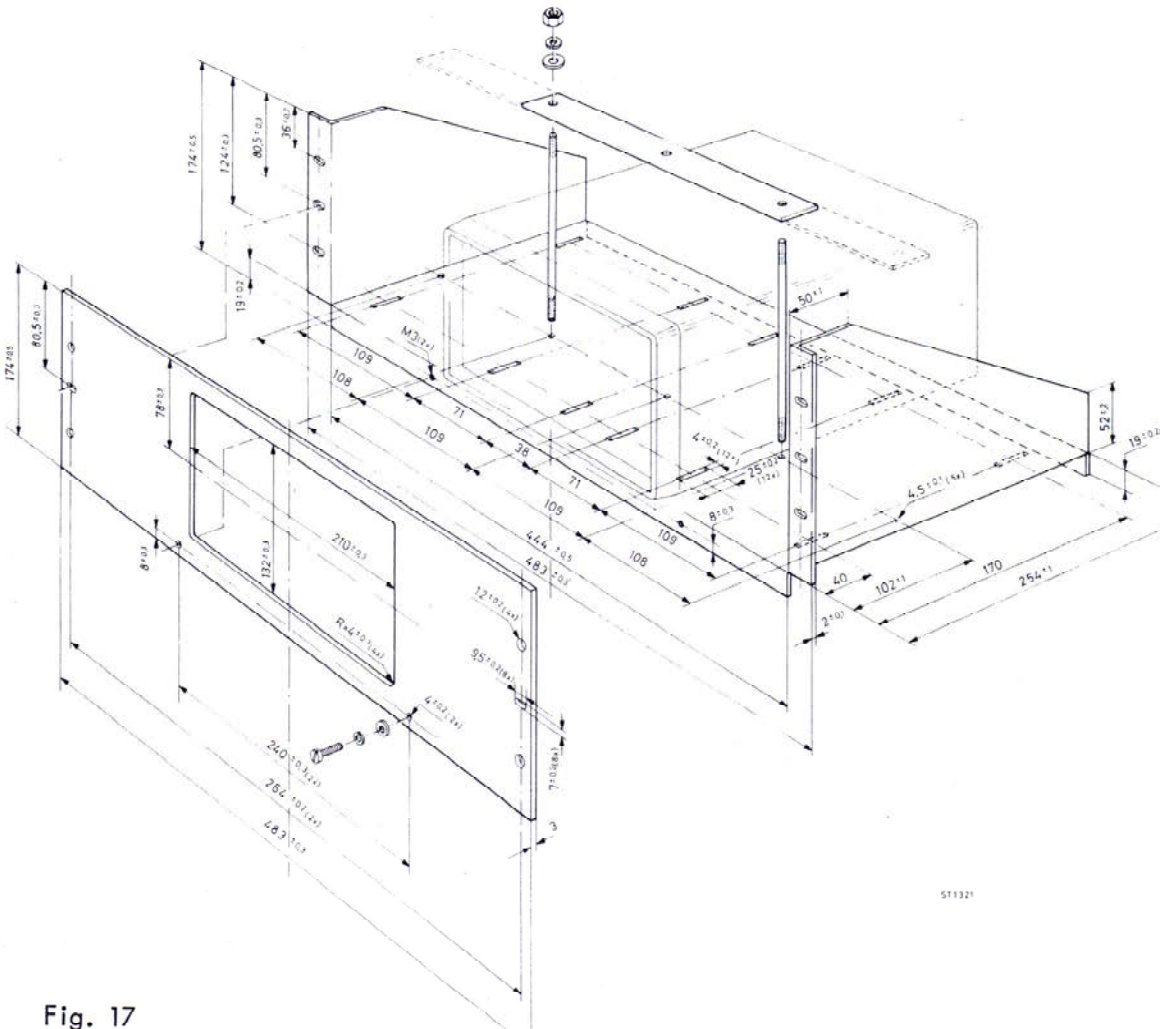


Fig. 17

The 1000 V range is attenuated by resistors R101 up to R105, R107 and R108, (attenuation 10.000 see Fig. 18). R105 and R106 are short circuited as switch S2 is closed.

II-2.2 D.c. and a.c. current input circuit

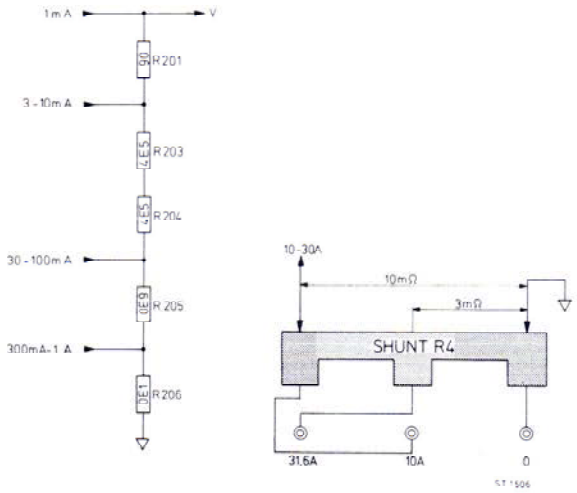


Fig. 20 Current input circuit

The shunts for the current ranges 1 mA up to 1 A consists of the resistors R201 up to R206 and are switched by range selector segment S1/b.
The 10 A and 30 A ranges are attenuated by shunt R4 which is situated at the rear of the PM 2504.
For the attenuation factors refer to Fig. 18.

II-2.3 Resistance input circuits

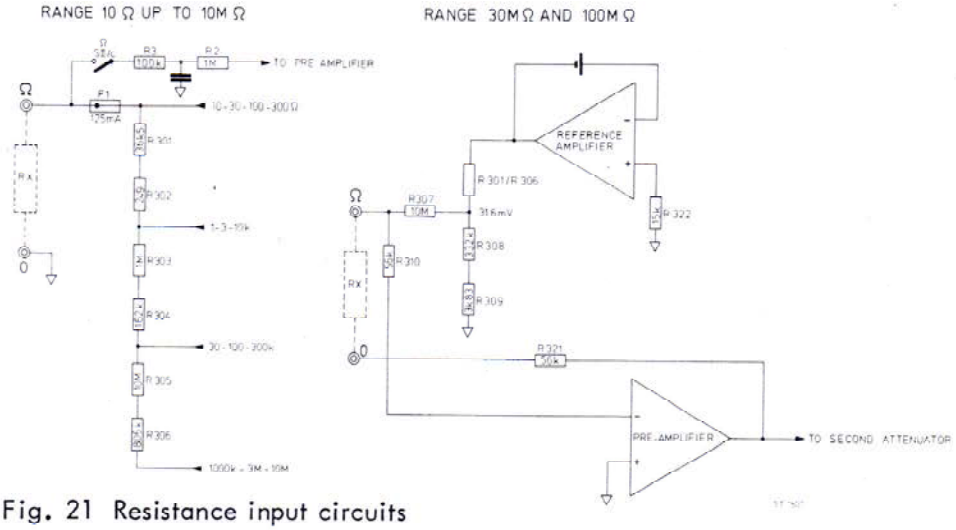


Fig. 21 Resistance input circuits

The series resistor Rs for the resistance ranges 10 Ω up to 10 MΩ consists of the resistor R301 up to R306 and are switched by range selector segment S1/b.
In the ranges 30 MΩ and 100 MΩ the unknown resistor is switched in the feedback circuit of the pre-amplifier. The pre-amplifier is switched as a non-inverting amplifier and the reference amplifier is switched as a constant current source. The + input of the reference amplifier is switched to zero via resistor R32 (15k). Only in the 30 MΩ and 100 MΩ range and the diode range the + input of the reference amplifier is connected to zero via resistor R322. In all other ranges the + input of the reference amplifier is connected to the output of the pre-amplifier via resistor R320 (15k). The switching in effected by range selector segment S1/b, S1/c and S1/d.
The principle of resistance measurements is described in Section IV-4.
For the different measuring currents and attenuation factors refer to Fig. 18.

VII-2.4 Diode input circuit

Diode measurements are performed in the same way as the 10 Ω up to 10 MΩ resistance measurements. Only the input of the reference amplifier A 404/B is connected to zero via R322 (15k) instead of being connected to the output of the pre-amplifier. The measuring current is 1 mA f.s.d. and the measuring voltage is 1 V f.s.d. (see Fig. 18).

VII-3 PRE-AMPLIFIER

The attenuated input signal is supplied to the input of the pre-amplifier (gate V403). At d.c. measurements the filter C401/C402 and R401 connects the a.c. component to zero.
The transistors V401, V402 and V408. V409 are safety conductors and start conducting when the in or output voltages of the pre-amplifier exceed 1.4 V. The gain of the pre-amplifier (OQ051) is controlled by range selector segment S1/c point 21. Only in case of the 10 mV range the gain of the pre-amplifier is x 3.16 (refer to Fig. 18). FET V405 is conductive then and FET V406 is blocked, as S1/c point 21 is connected to zero. The output of the pre-amplifier is connected to the input via R410 and R411 and the input is connected to zero via R409.
In all other ranges the gain of the pre-amplifier is x1, FET V405 is blocked and FET V406 is conductive, thus short circuiting resistors R410 and R411.

VII-4 SECOND ATTENUATOR

The second attenuator (R418 up to R423) is controlled by range selector segment S1/e. The attenuatio factors are 1, 3, 16, 10 and 31.6 dependent to the range selected (refer to Fig. 18).

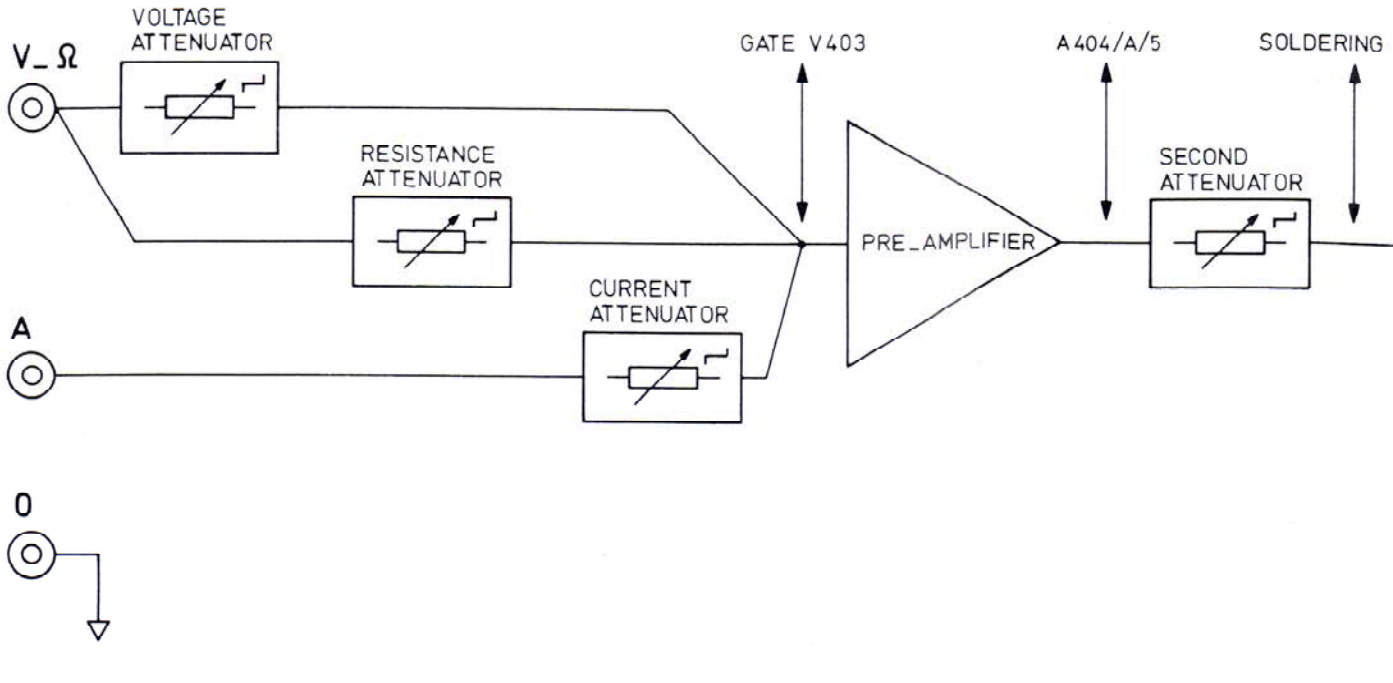
VII-5 AMPLIFIER

The gain of the amplifier is x1 and the input voltage in all ranges at full scale deflection is 31.6 mV (refer to Fig. 18).
In the feedback of the amplifier the calibration potentiometer R522 and the formfactor network for the a.c. ranges is incorperated (R511, R512 and C503). If sinusoidal voltages or currents are supplied the measuring instrument measures $\frac{1}{2}\sqrt{2} \times V = V_{rms}$ of the input signal with the aid of the formfactor network.

The output current out of the amplifier is supplied to the measuring instrument P1 via the rectifier diodes V510 up to V513. Diode V514 is used as safety-diode.
Only in case of d.c. measurement the polarity of the input signal is measured by polarity indicator P2.

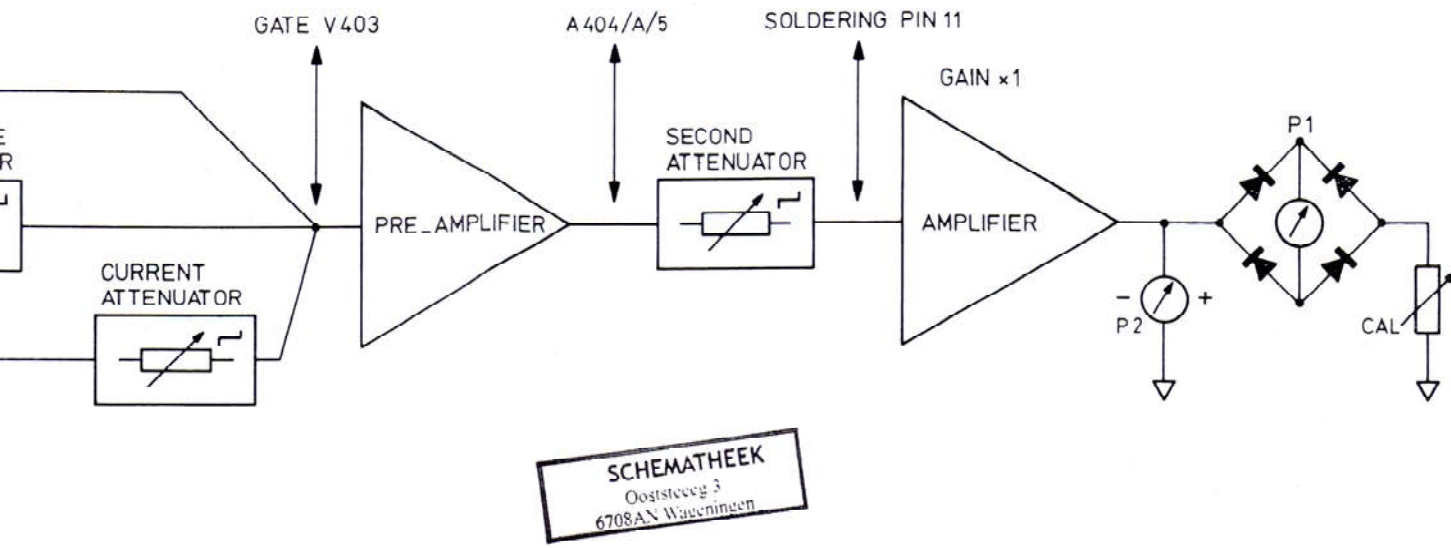
VII-6 REFERENCE AMPLIFIER

The reference amplifier A 404/B has an internal voltage source of 1.2 V and is used at resistance measurements. The output voltage of the reference amplifier is always Vin + 1.2 V.
The input of the reference amplifier is connected to the output of the pre-amplifier via resistor R320 (15k) in all ranges except for the ranges 30 MΩ and 10 MΩ.
In the ranges 30 MΩ and 100 MΩ the reference amplifier is switched as a constant current source (refer to Section IV-4.1 and 2). The input then is connected to zero via R322 (15k). At the same time the pre-amplifier is switched as a non-inverting amplifier and the unknown resistor is switched in the feedback circuit of the pre-amplifier.
From the reference amplifier the IV ref. (X4) is obtained for calibrating the PM 2504.



10	10	1	1 mA		x 3.16	31.6 mV	1	31.6 m
30 mV	30 Ω	1	1 mA		x 1	31.6 mV	1	
100	100	1	1 mA		x 1	100 mV	3.16	
300	300	1	1 mA		x 1	316 mV	10	
1	1	31.6	31.6 µA		x 1	31.6 mV	1	
3	3	31.6	31.6 µA		x 1	100 mV	3.16	
10	10 kΩ	31.6	31.6 µA		x 1	316 mV	10	
30 V	30	1000	1 µA		x 1	31.6 mV	1	
100	100	1000	1 µA		x 1	100 mV	3.16	
300	300	1000	1 µA		x 1	316 mV	10	
1000	1	10000	100 nA		x 1	100 mV	3.16	
	3		100 nA		x 1	316 mV	10	
	10 MΩ		100 nA		x 1	1 V	31.6	
	30		–		–	100 mV	3.16	
	100		–		–	316 mV	10	
	1		–	100 Ω	x 1	100 mV	3.16	
	3		–	10 Ω	x 1	31.6 mV	1	
	10 mA		–	10 Ω	x 1	100 mV	3.16	
	30		–	1 Ω	x 1	31.6 mV	1	
	100		–	1 Ω	x 1	100 mV	3.16	
	300		–	100 mΩ	x 1	31.6 mV	1	
	1		–	100 mΩ	x 1	100 mV	3.16	
rear 10 - 30	A		–	10 - 3 mΩ	x 1	100 mV	3.16	
			1 mA		x 1	1 V	31.6	31.6 m

Fig. 18 Bloc



ST 1494

	x 3.16	31.6 mV	1	31.6 mV	100
	x 1	31.6 mV	1		
	x 1	100 mV	3.16		
	x 1	316 mV	10		
	x 1	31.6 mV	1		
	x 1	100 mV	3.16		
	x 1	316 mV	10		
	x 1	31.6 mV	1		
	x 1	100 mV	3.16		
	x 1	316 mV	10		
	x 1	100 mV	3.16		
	x 1	316 mV	10		
	x 1	1 V	31.6		
	—	100 mV	3.16		
	—	316 mV	10		
100 Ω	x 1	100 mV	3.16		
10 Ω	x 1	31.6 mV	1		
10 Ω	x 1	100 mV	3.16		
1 Ω	x 1	31.6 mV	1		
1 Ω	x 1	100 mV	3.16		
100 mΩ	x 1	31.6 mV	1		
100 mΩ	x 1	100 mV	3.16		
10 - 3 mΩ	x 1	100 mV	3.16		
	x 1	1 V	31.6	31.6 mV	100

scale divisions

Fig. 18 Blockdiagram with attenuation/gain factors

VII-7 POWER SUPPLY

For power supply of the PM 2504 six 1.5V batteries or external 9V d.c. power supply can be used.
The power supply consists of an a- stablemultivibrator (≈ 20 kHz) and the transistor V605 and V606 and coil L601.
From the 9V d.c. the supply voltages + 9V and - 7.5V are derived.

VIII. ACCESS

VIII-1 REMOVING THE TOP AND BOTTOM COVER (Fig. 22)

- By means of removing the two crosshead screws A the topcover can be pulled of the PM 2504
- By means of removing the two crosshead screws B bottom cover can be pulled of the PM 2504

VIII-2 REMOVING THE SCREENING PLATES

VIII-2.1 Removing the top - screening plate (Fig. 23)

- Remove the top and bottom cover
- Remove the three screws C and the three screws D
- The top - screening plate can now be lifted of the PM 2504

VIII-2.2 Removing the bottom - screening plate (Fig. 24)

- Remove the top and bottom cover
- Remove the small - screening plate to which the spark gap F3 is fastened in the following way: - Remove the spark gap and the spark gap holder
  - Remove the screw which is situated under the sparkgap holder
  - Remove the two screws E
  - The small - screening plate can now be lifted of the PM 2504
- Remove the four screws D
- Remove the three screws G
- The bottom - screening plate can now be lifted of the PM 2504

VIII-3 REPLACING TEXTPLATE, THE MEASURING SYSTEM P1 AND POLARITY INDICATOR P2

- Remove the knob of range selector S1
- Remove the ornamental frame by means of bending out the retaining lugs of the ornamental frame and pulling it from the PM 2504

- Together with the ornamental frame the texplate is removed.
- By removing the two crosshead screws of the transparant window, the transparant window and measuring system P1 can be removed (take care that the wires to the measuring system do not brake or damage the measuring system).
- After removal of the measuring systems, polarity indicator P2 is accessible.

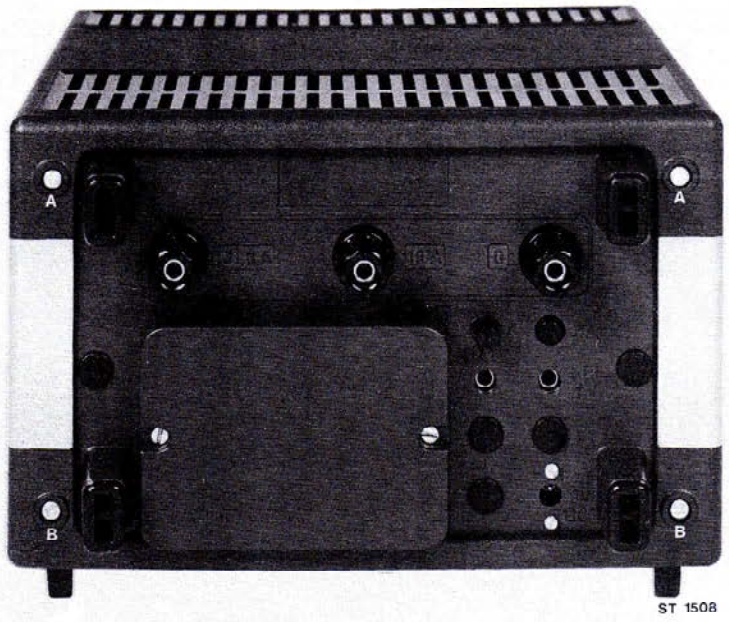


Fig. 22 Removing the top- and bottom cover

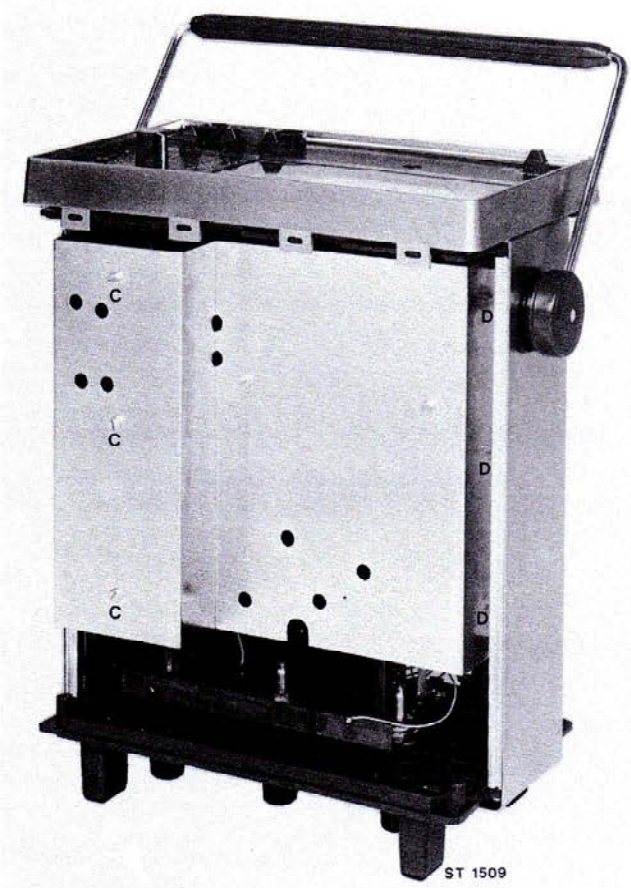


Fig. 23 Removing the top screening plate

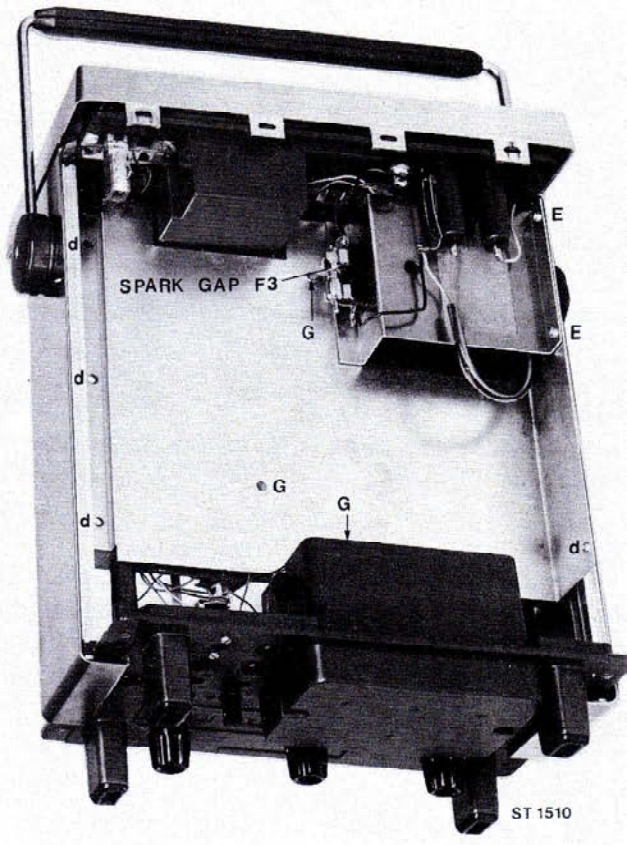
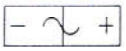
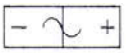


Fig. 24 Removing the bottom screening plate

IX-2. ADJUSTING TABLE

ADJ. NO.	ADJUSTMENT	ADJUSTING ELEMENT	PREPARATIONS	MEASURING POINTS	ADJUSTMENT DATA
1.1.	Battery check	—	Depress pushbutton "POWER ON" Select the 10 V⎓ range Interconnect the "V Ω" and "BATT" socket	Visible on measuring system P1	The meter indication should be in the "BATT" region (lower scale)
1.2.	Battery check With this battery check also the power supply part of the PM 2504 can be checked.	—	Remove the top- and bottom cover of the PM 2504 Also remove the top- and bottom screening plate Depress pushbutton "POWER ON"	Soldering pin 19 Soldering pin 20 Capacitor C607	+9 V 0 V −7.5 V In this way the d.c. to d.c. converter in the power supply part is checked.
2.	Zerosetting (mechanical)	Correction screw "A"	PM 2504 switched off	Visible on measuring system P1	Adjust the pointer to zero.
3.1.	Zerosetting (electrical) If the electrical zerosetting by means of potentiometer "0" can not be made first carry out the offset adjustment of the pre-amplifier and the amplifier (3.2. and 3.3.)	Potentiometer "0" (R405)	Depress pushbutton "POWER ON" Select the 10 mV⎓ range Interconnect socket "0" and "V Ω"	Visible on polarity indicator P2	Adjust the polarity indicator to the middle of the a.c. sign. 
3.2.	Offset coarse amplifier	Potentiometer R505	Remove the top- and bottom cover and the top- and bottom screening plate Depress pushbutton "POWER ON" Select the 30 mV⎓ range Interconnect soldering pins 11 and 12	Visible on polarity indicator P2	Adjust the polarity indicator to the middle of the a.c. sign. 
3.3.	Offset coarse pre-amplifier	Potentiometer R403	Depress pushbutton "POWER ON" Select the 10 mV⎓ range Interconnect the "V Ω" and "0" socket Place potentiometer R405 ("0") in its mid position	Visible on polarity indicator P2	Adjust the polarity indicator to the middle of the a.c. sign. 
4.	Gain of the amplifier	Potentiometer "CAL." R522	Remove the top- and bottom cover and the top- and bottom screening plate Depress pushbutton "POWER ON" Select the 30 mV⎓ range a. Supply +31.62 mV + 1 μV to soldering pin 11 (+) and soldering pin 12 (zero) b. Supply −31.62 mV + 1 μV to soldering pin 11 (−) and soldering pin 12 (zero)	Visible on measuring system P1	100 scale divisions
5.	Check zerosetting electrical (adj. 3) and if necessary repeat these adjustments.	—	—	—	—
6.	1.2 V	Potentiometer R315	Remove the top- and bottom cover and the top- and bottom screening plate Depress pushbutton "POWER ON" Select the diode measuring range	Lefthand pin of potentiometer R315 (see figure 26) Soldering pin 20 zero	1200 mV ± 1 mV
7.	D.C. attenuator	Potentiometer R102	Depress pushbutton "POWER ON" Select the 1 V⎓ range Supply +1.000 V + 1 mV and −1.000 V + 1 mV to the "V Ω" and the "0" socket	Visible on measuring system P1	100 scale divisions
8.	1 V reference	Potentiometer R317	Depress pushbutton "POWER ON" Select the 1 V⎓ range Interconnect the "V Ω" socket with the "1 V_{REF}" socket at the rear of the PM 2504	Visible on measuring system P1	100 scale divisions
9.	Calibration	Potentiometer "CAL." R522	Depress pushbutton "POWER ON" Select the 1 V⎓ range Interconnect the "V Ω" socket with the "1 V_{REF}" socket at the rear of the PM 2504	Visible on measuring system P1	100 scale divisions
10.	Shunt R4 This adjustment must only be carried out in case of replacement of the shunt R4.	Shunt R4 a. Soldering point "A" b. Soldering point "B"	Depress pushbutton "POWER ON" Select the "REAR-10A-30A⎓" range Interconnect soldering pin 10/30A and the "10 A" (X8) socket a. Supply 31.6 A — to the "31.6 A" input (X9) and the "0" A input (X7) *Note: The wire must be soldered to that point on the small adjusting surface "A" until the measuring instrument P1 indicates 100 scale divisions.* b. Disconnect the wire between input (X8) and soldering pin 10/30A. Supply 10 A⎓ to the "10 A" input (X8) and the "0" A input (X7). *Note: The wire must be soldered to that point on the large adjusting surface "B" until the measuring instrument P1 indicates 100 scale divisions.*	Visible on measuring system P1	100 scale divisions
Adjustment numbers 11 and 12 must be carried out with mounted screening plates.					
11.	30 V range	Trimming capacitor C103	Depress pushbutton "POWER ON" Select the 30 V range Supply 31.6 V + 10 mV frequency 10 kHz + 1% to the "V Ω" and "0" socket	Visible on measuring system P1	100 scale divisions
12.	3 V range	Trimming capacitor C105	Depress pushbutton "POWER ON" Select the 3 V range Supply 3.16 V + 1 mV frequency	Visible on measuring system P1	100 scale divisions

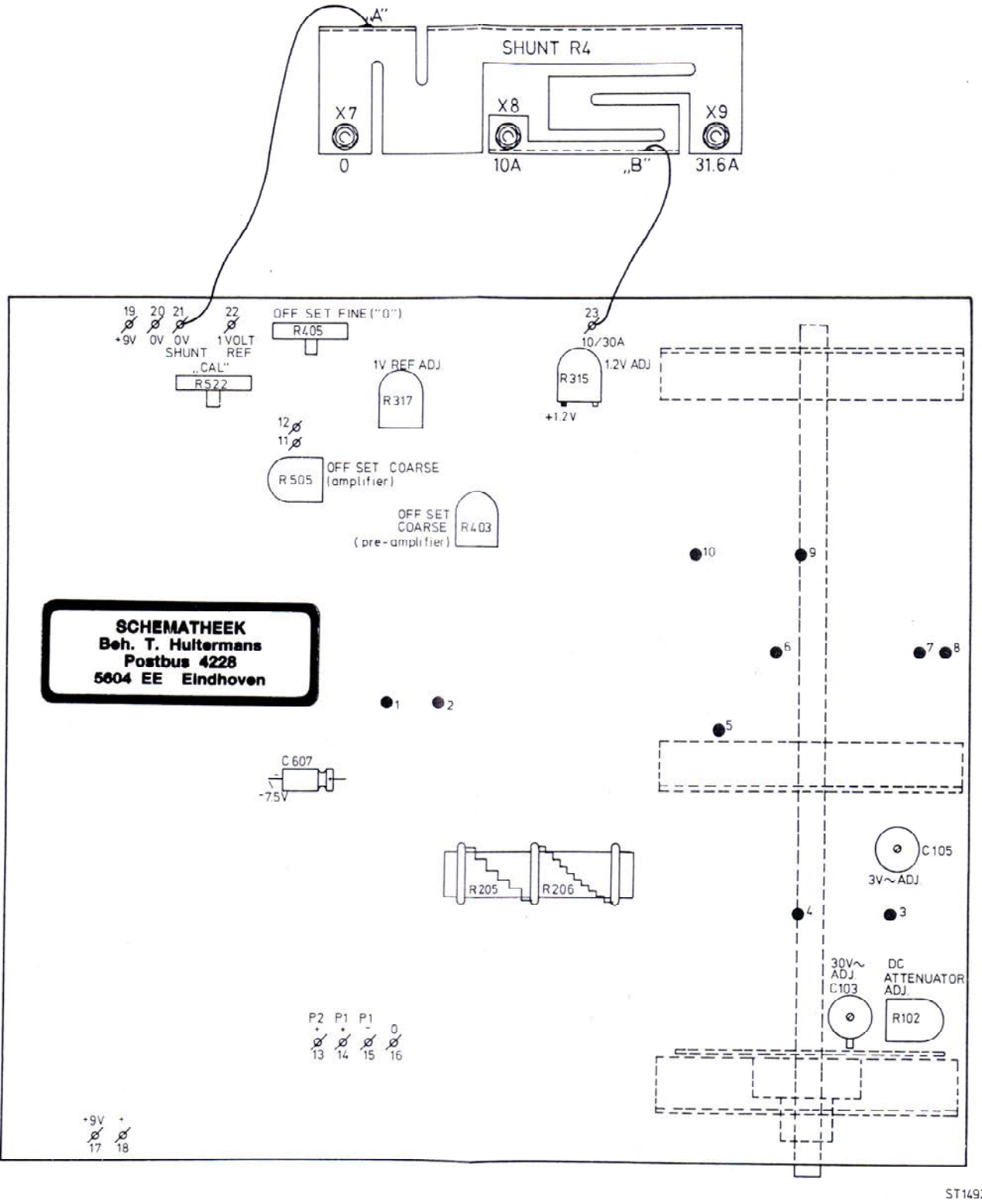


Fig. 26 Adjusting elements

IX. CHECKING AND ADJUSTING

IX-1 ADJUSTING PROCEDURE

The tolerances stated in this chapter correspond to the factory data, which only apply for a complete readjusted instrument.
The tolerances may deviate from those mentioned in the technical data.
When adjusting the PM 2504 the following rules should be taken into account:

- Adjusting the PM 2504, only reference voltage and measuring equipment with the required accuracy should be applied.
- When individual components such as semiconductors or integrated circuits are replaced, the relevant parts of the circuitry should be completely readjusted.
- When adjustments are made always carry out the zerosetting and calibration again.
- For the adjustments 1 upto 10 it is not necessary that the screening plates are mounted. For adjustments 11 and 12 the screening plates must be mounted.

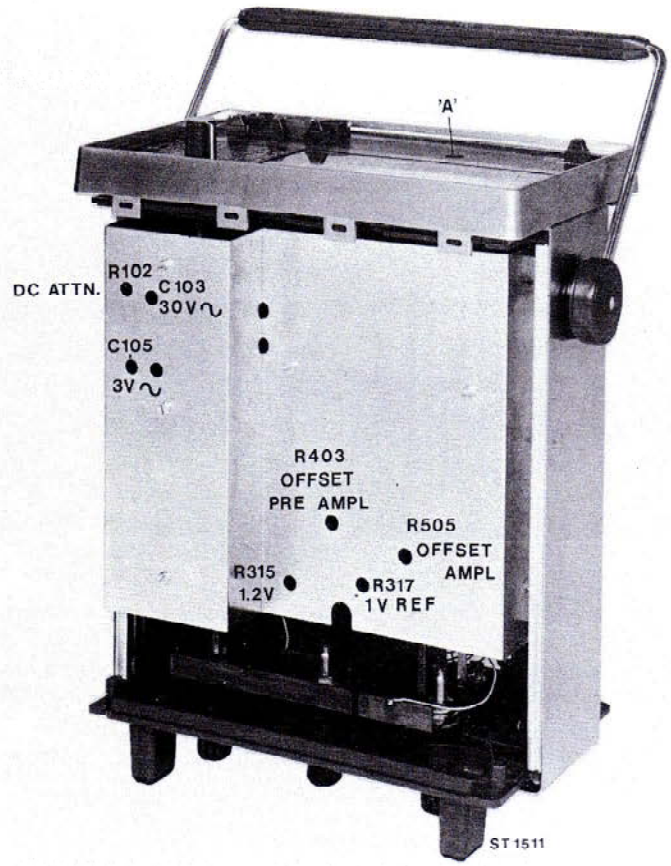


Fig. 25 Position of adjusting elements

X. LIST OF PARTS

X-1 MECHANICAL

Item	Fig.	Qty.	Ordering number	Description
1	27	2	5322 447 94068	Top- or bottom cover
2	27	4	5322 462 44121	Foot
3	27	1	5322 460 64003	Ornamental strip
4	27	2	5322 535 74367	Spindle for handle
5	27	1	5322 520 34138	Bearing bush, left
6	27	1	5322 520 34139	Bearing bush, right
7	27	2	5322 498 74003	Cup for handle
8	27	1	5322 498 54032	Handle assembly
9	27	1	5322 460 64002	Ornamental frame
10	27	1	5322 414 64039	Knob for range selector S1
11	27	1	5322 414 74019	Cap for knob S1
12	27	1	5322 276 34029	Function switch S2 assy.
13	27	1	5322 276 14227	Power on switch S3
14	27	4	5322 414 24883	Knob for push button switch S2, S3
15	27	1	5322 456 14048	Textplate
18	27	1	5322 344 54003	Measuring system P1
19	27	1	5322 347 10061	Polarity indicator P2
20	27	1	5322 532 24423	Socket "O"
21	27	1	5322 256 34048	Fuse holder "V-Ω" (red)
22	27	1	5322 256 34036	Fuse holder "A"
23	28	1	5322 447 94318	Battery cover
24	28	2	5322 414 34171	Potentiometer knob
25	28	2	5322 532 24423	Socket "1 VREF / BATT"
26	28	1	5322 265 20051	Socket with switch "EXT 9V DC"
27	28	3	5322 290 64103	Socket 0, 10A, 31.6A
28	29	1	5322 532 54209	Coupling piece for range selector S1
29	29	1	5322 273 84021	Segment switch assy S1
	30	1	5322 255 44044	IC socket A404

X-2 MISCELLANEOUS

30	29	1	5322 216 74044	P.c. board U1 without IC A404
31	29	1	5322 115 84009	Shunt 31.6/10A R4
22	28	1	5322 253 20023	Fuse 2 A F1
21	28	1	5322 253 20007	Fuse 125 mA F2
-	-	1	5322 252 60019	Spark-gap 1700V F3
L601	32	1	5322 158 10329	Coil 2200 µH

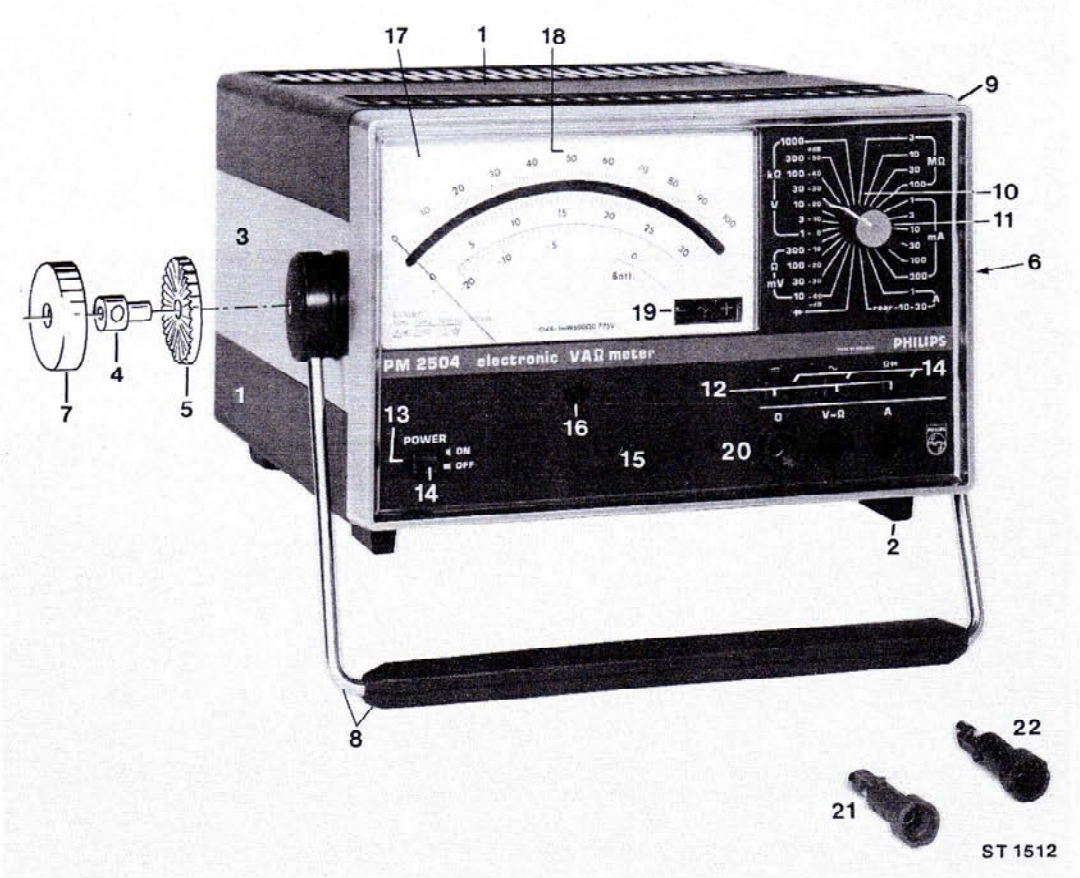


Fig. 27 Front view with item numbers

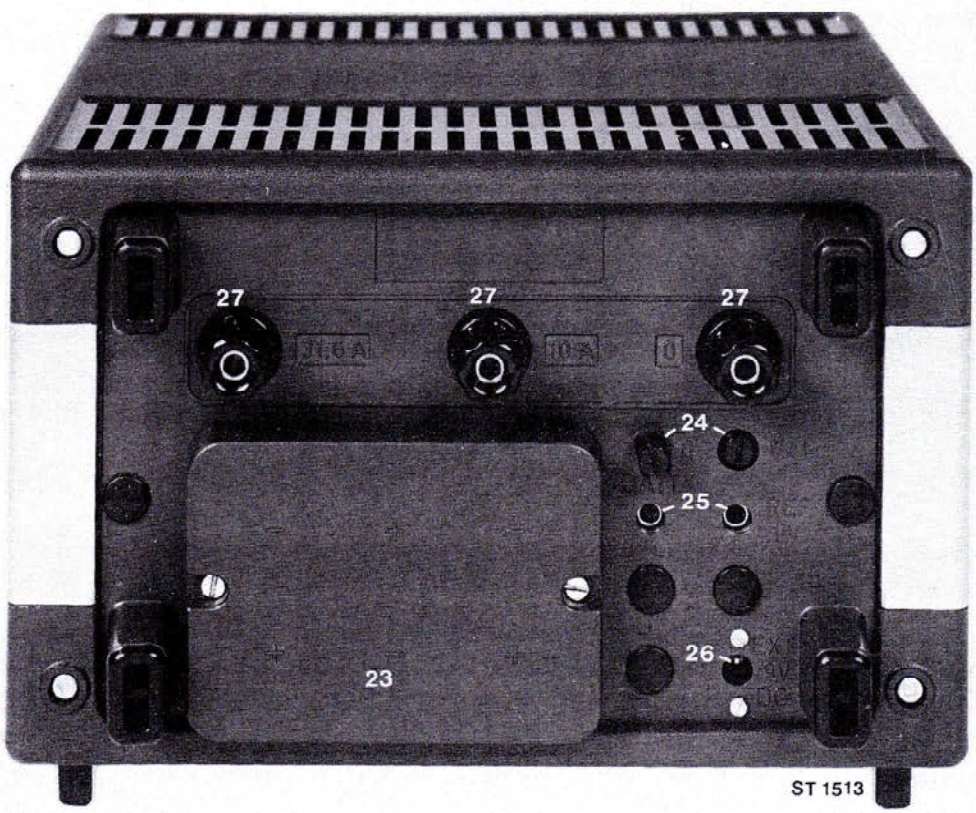


Fig. 28 Rear view with item numbers

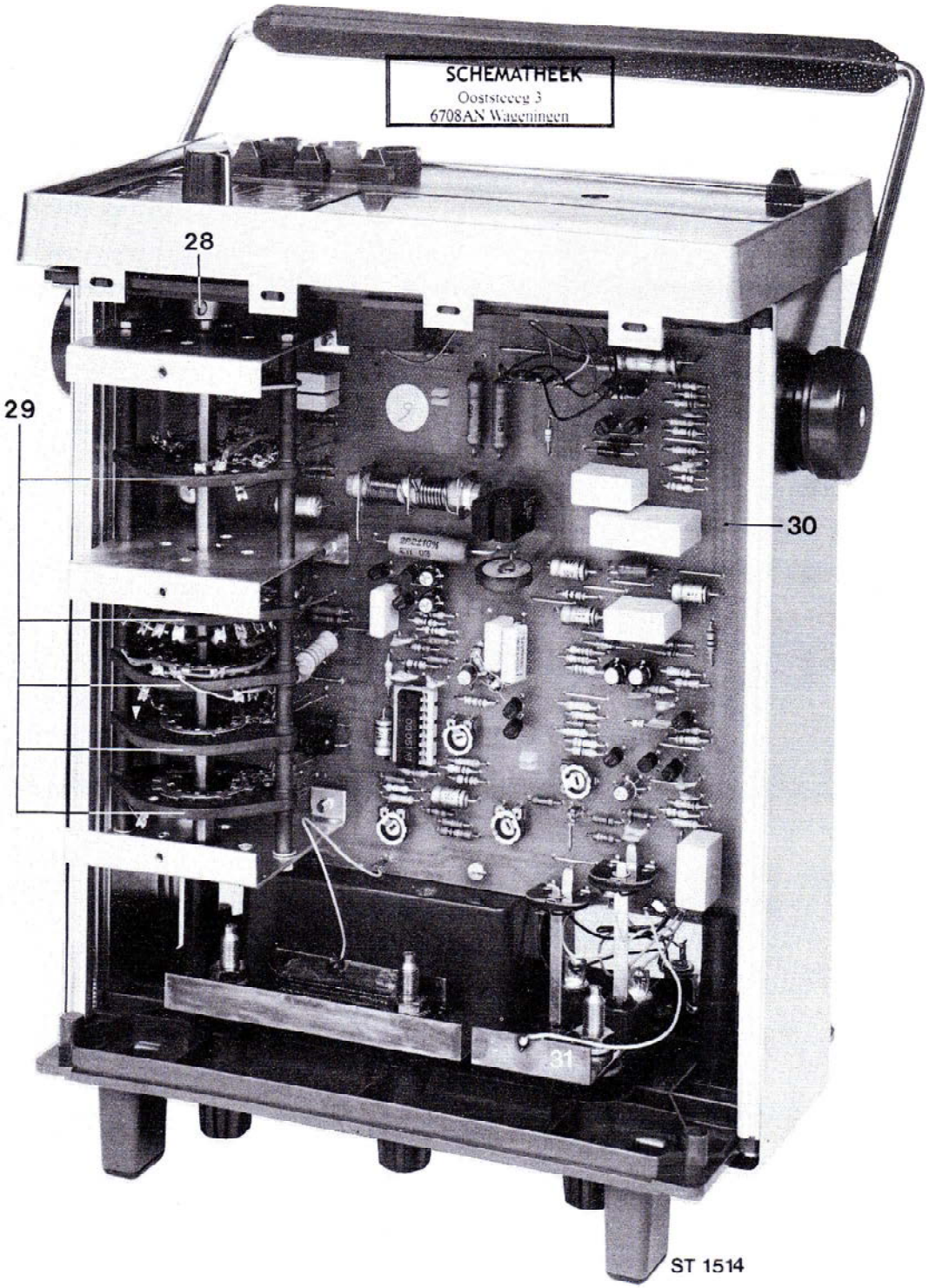


Fig. 29 Inside view with item numbers

X-3 ELECTRICAL

X-3.1 Resistors

Item	Ordering number	Value (Ω)	Tol (%)	Series
R4	5322 115 84009	3/10m		Shunt
R101	5322 116 64036	9.76 M	1	VR 37 Metal glass
R102	4822 100 10088	220 k	20	Potentiometer 0.1 W
R103	5322 116 55083	316 k	0.1	MR34C
R104	5322 116 50583	5.9 k	1	MR25
R105	5322 116 55081	9.09 k	0.1	MR24C
R106	5322 116 54469	100	1	MR25
R107	5322 116 55082	976	0.1	MR24C
R108	5322 116 51047	13.3	1	MR25
R201	5322 113 24096	90	0.25	0.6 W metal film
R203	5322 113 24095	4.5	0.25	0.6 W metal film
R204	5322 113 24095	4.5	0.25	0.6 W metal film
R205/206	5322 115 80099	0.1/0.9	-	Shunt wire-wound
R207	5322 113 60028	2.2	10	2 W
R208	5322 116 34035	15		NTC
R301	5322 116 54333	36.5 k	0.25	MR24C
R302	5322 116 54499	249	1	MR25
R303	5322 116 54237	1 M	0.25	MR54C
R304	5322 116 54716	162 k	1	MR25
R305	5322 116 64002	10 M	1	VR 37 Metal glass
R306	5322 116 55078	806 k	1	MR30
R307	5322 116 64002	10 M	1	VR 37 Metal glass
R308	5322 116 54185	332 k	0.25	MR34C
R309	5322 116 54589	3.83 k	1	MR25
R311	4822 112 21081	100		4.2 W WR0617E
R312	5322 116 50844	1.1 k	0.1	MR24C
R315	4822 100 10107	470 k	20	Potentiometer 0.1 W
R316	5322 116 50664	205 k	1	MR25
R317	4822 100 10052	200 k	20	Potentiometer 0.1 W
R318	5322 116 54708	133 k	1	MR25
R319	5322 116 54327	1 M	1	MR30
R403	4822 100 10038	470	20	Potentiometer 0.1 W
R405	5322 101 14124	100 k	20	Potentiometer 0.25 W
R409	5322 116 50748	10 k	0.1	MR24C
R410	5322 116 54152	21.5 k	0.1	MR24C
R411	5322 116 54489	169	1	MR25
R417	5322 116 50748	10 k	0.1	MR24C
R418	5322 116 55079	4.75 k	0.1	MR24C
R419	5322 116 54721	178 k	1	MR25
R420	5322 116 50752	1.15 k	0.1	MR24C
R421	5322 116 50482	33.2 k	1	MR25
R422	5322 116 54996	332	0.1	MR24C
R423	5322 116 54641	19.6 k	1	MR25
R505	4822 100 10038	470	20	Potentiometer 0.1 W
R511	5322 116 54655	30.1 k	1	MR25

Item	Ordering number	Value (Ω)	Tol (%)	Series
R512	5322 116 54738	27.4 k	1	MR25
R520	5322 116 54552	1.05 k	1	MR25
R521	5322 116 50635	1.47 k	1	MR25
R522	5322 101 14123	330	20	Potentiometer 0.25 W

X-3.2 Capacitors

Item	Ordering number	Value (F)	Tol (%)	Voltage (V)	Description
C1	4822 121 40322	33 n	10	630	Polyester
C101	4822 122 31206	56 p	2	500	Ceramic
C102	4822 122 31206	56 p	2	500	Ceramic
C103	5322 125 54037	10 p	-	500	Trimming cap
C104	5322 121 54088	910 p	1	250	Polystyrene
C105	5322 125 54038	40 p	-	250	Trimming cap
C106	5322 121 54169	31.6 n	1	63	Polystyrene
C107	4822 121 40232	220 n	10	100	Polyester
C108	4822 121 41156	68 n	10	100	Polyester
C109	4822 122 31194	8.2 p	±0.25 pF	500	Ceramic
C110	4822 122 31194	8.2 p	±0.25 pF	500	Ceramic
C111	4822 121 40232	220 n	10	100	Polyester
C401	4822 121 41134	10 n	10	630	Polyester
C402	4822 121 40042	47 n	10	250	Polyester
C403	4822 122 31166	560 p	10	100	Ceramic
C404	4822 122 30098	3.9 n	10	100	Ceramic
C405	4822 122 31054	10 p	2	100	Ceramic
C406	5322 121 40301	15 n	10	250	Polyester
C407	4822 124 20461	47 µ	-10/+50	10	Electrolytic
C408	4822 124 20461	47 µ	-10/+50	10	Electrolytic
C501	4822 122 31177	470 p	10	100	Ceramic
C502	4822 122 31074	56 p	2	100	Ceramic
C503	5322 121 40197	1 µ	10	100	Polyester
C504	4822 122 30103	22 n	-20/+80	40	Ceramic
C505	4822 122 30103	22 n	-20/+80	40	Ceramic
C506	4822 122 31043	3.9 p	±0.25 pF	100	Ceramic
C507	5322 121 40197	1 µ	10	100	Polyester
C508	4822 124 20461	47 µ	-	10	Electrolytic
C509	4822 124 20461	47 µ	-	10	Electrolytic
C510	4822 122 31056	12 p	2	100	Ceramic
C601	4822 124 20589	220 µ	-	10	Electrolytic
C602	4822 122 31164	1.8 n	10	100	Ceramic
C603	4822 122 31164	1.8 n	10	100	Ceramic
C604	4822 122 30114	22 n	-20/+100	40	Ceramic
C605	5322 121 40256	2.2 µ	10	100	Polyester
C606	5322 121 40197	1 µ	10	100	Polyester
C607	4822 124 20461	47 µ	-	10	Electrolytic

X-3.3 Semiconductors

Item	Ordering number	Description	
V201	5322 130 34262	BYX72-300	Diode
V202	5322 130 34262	BYX72-300	Diode
V301	5322 130 34299	BZX70/C10	Zenerdiod
V401	5322 130 44257	BC 547	Transistor
V402	5322 130 44257	BC 547	Transistor
V403	5322 130 44528	ON527	Transistor
V405	5322 130 34044	BSV 80	Transistor
V406	5322 130 34044	BSV 80	Transistor
V407	5322 130 44257	BC 547	Transistor
V408	5322 130 44257	BC 547	Transistor
V409	5322 130 44257	BC 547	Transistor
V501	5322 130 44355	BFQ 10	Transistor
V502	5322 130 44257	BC 547	Transistor
V503	5322 130 30773	BZX79-C4V7	Zenerdiod
V504	4822 130 40963	BC 559	Transistor
V505	4822 130 40963	BC 559	Transistor
V506	5322 130 30613	BAW62	Diode
V507	5322 130 40493	BFY 90	Transistor
V508	5322 130 40493	BFY 90	Transistor
V509	4822 130 40963	BC 559	Transistor
V510	5322 130 34062	FH1100	Diode
V511	5322 130 34062	FH1100	Diode
V512	5322 130 34062	FH1100	Diode
V514	5322 130 30613	BAW62	Diode
V601	4822 130 40963	BC 559	Transistor
V602	5322 130 30613	BAW 62	Diode
V603	5322 130 30613	BAW 62	Diode
V604	4822 130 40963	BC 559	Transistor
V605	4822 130 40963	BC 559	Transistor
V606	4822 130 40963	BC 559	Transistor
V607	5322 130 30191	OA 95	Diode
V608	5322 130 30191	OA 95	Diode

X-3.4 Integrated circuits

Item	Ordering number	Description
A404	5322 209 84444	OQ 051

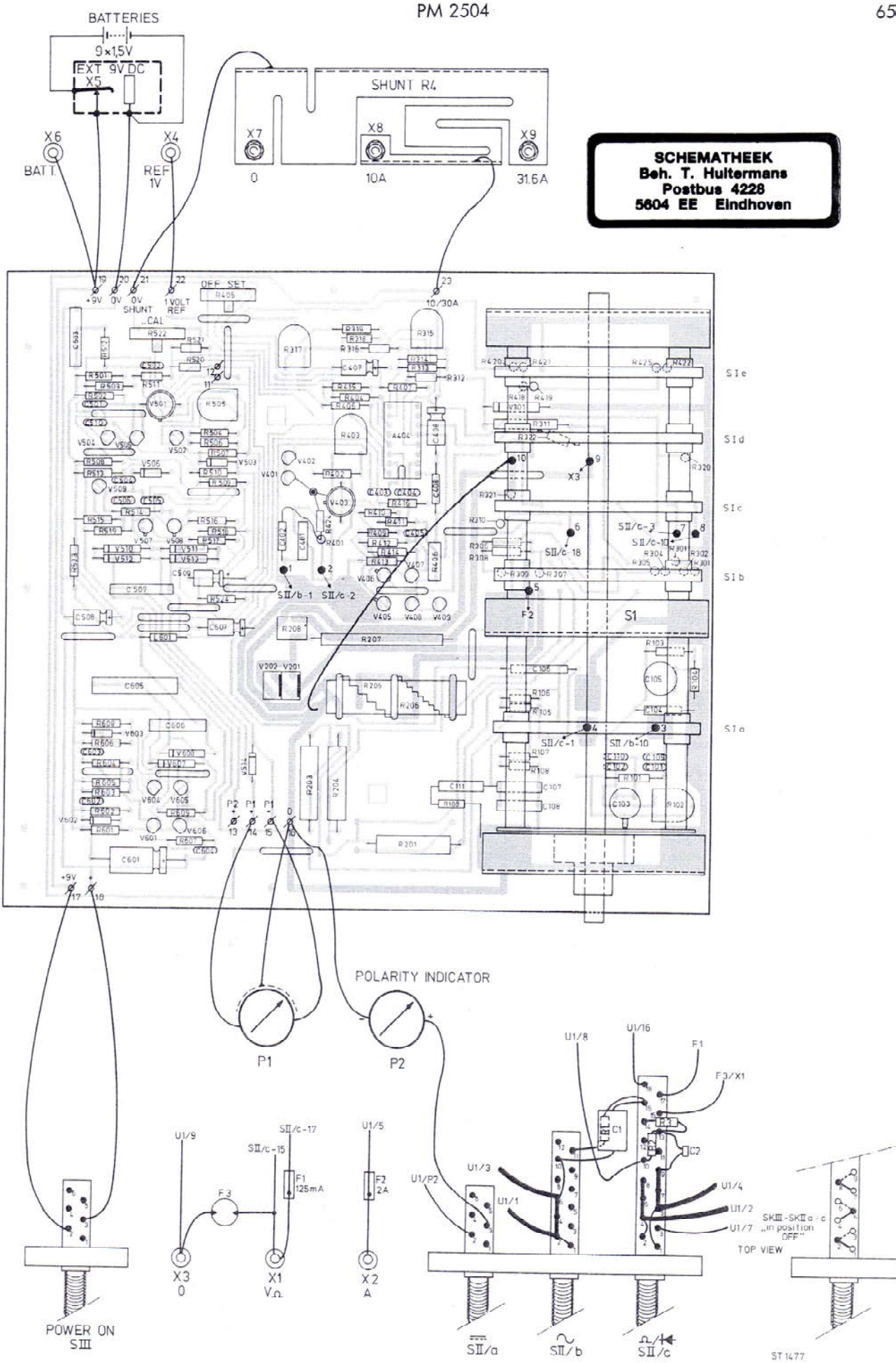
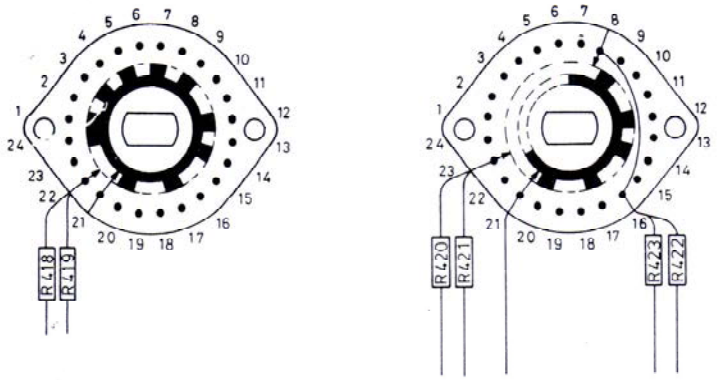
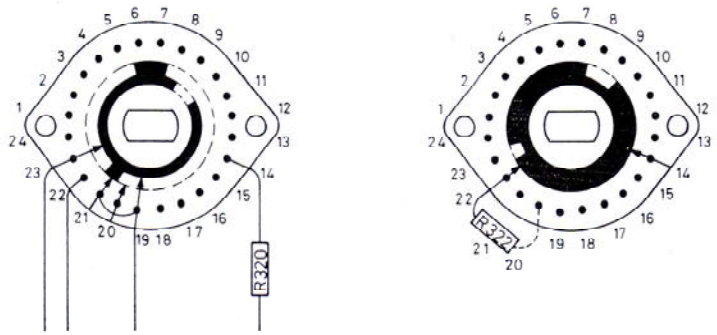


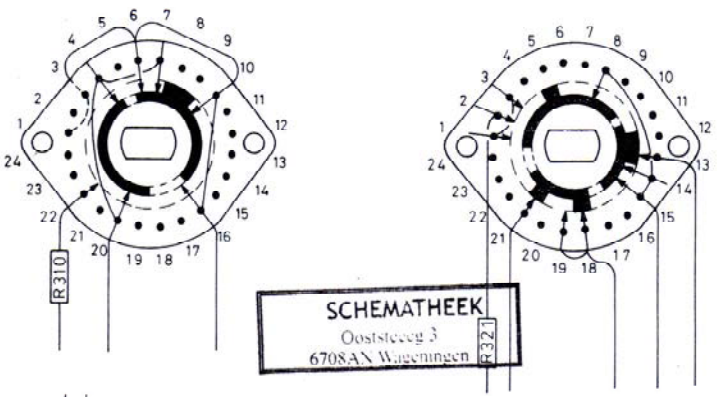
Fig. 30 P.c. board U1



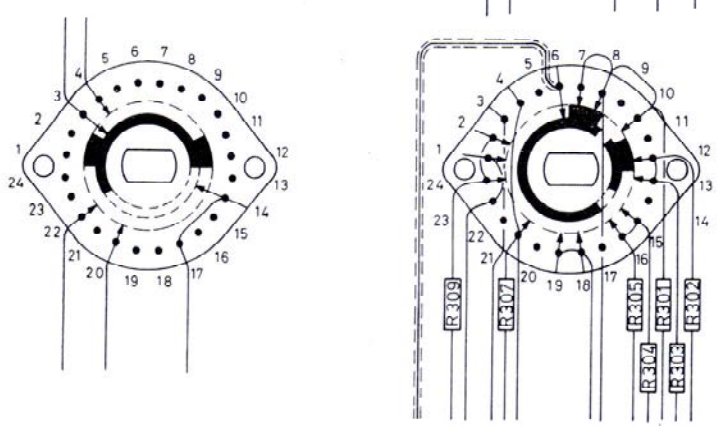
S1/e



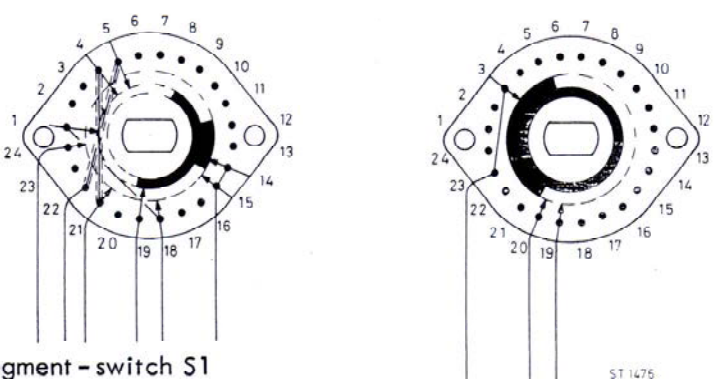
S1/d



S1/c



S1/b



S1/a

FRONT VIEW

REAR VIEW
(SEEN FROM TH
FRONT OF THE
PM 2504)

ST 1475

Fig. 31 Segment-switch S1

How to use the positive film

- Place the figures 1 and 13 on the corresponding figures of rangeselector S1 in the circuit diagram (Fig. 32). Range selector S1 is switched in position 10 mV.
- When sliding the film stepwise downwards all the ranges in the sequence of range 10 mV (10 Ω) upto 1000 V (1000 kΩ), 3 MΩ upto 100 MΩ, 1 mA upto rear 10 -30 A and ⊣◀ can be checked.
  (clockwise turning of the range selector knob)

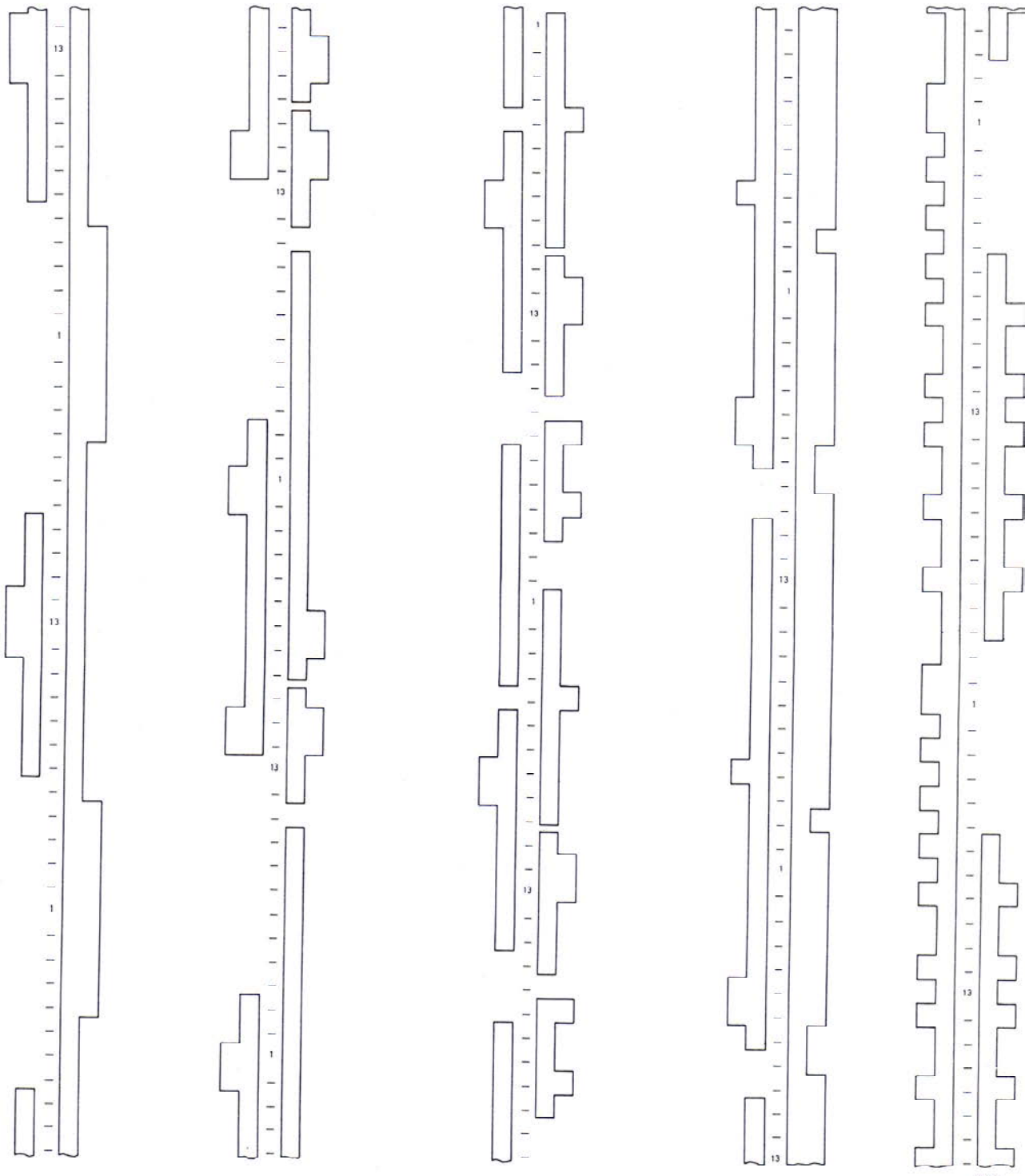
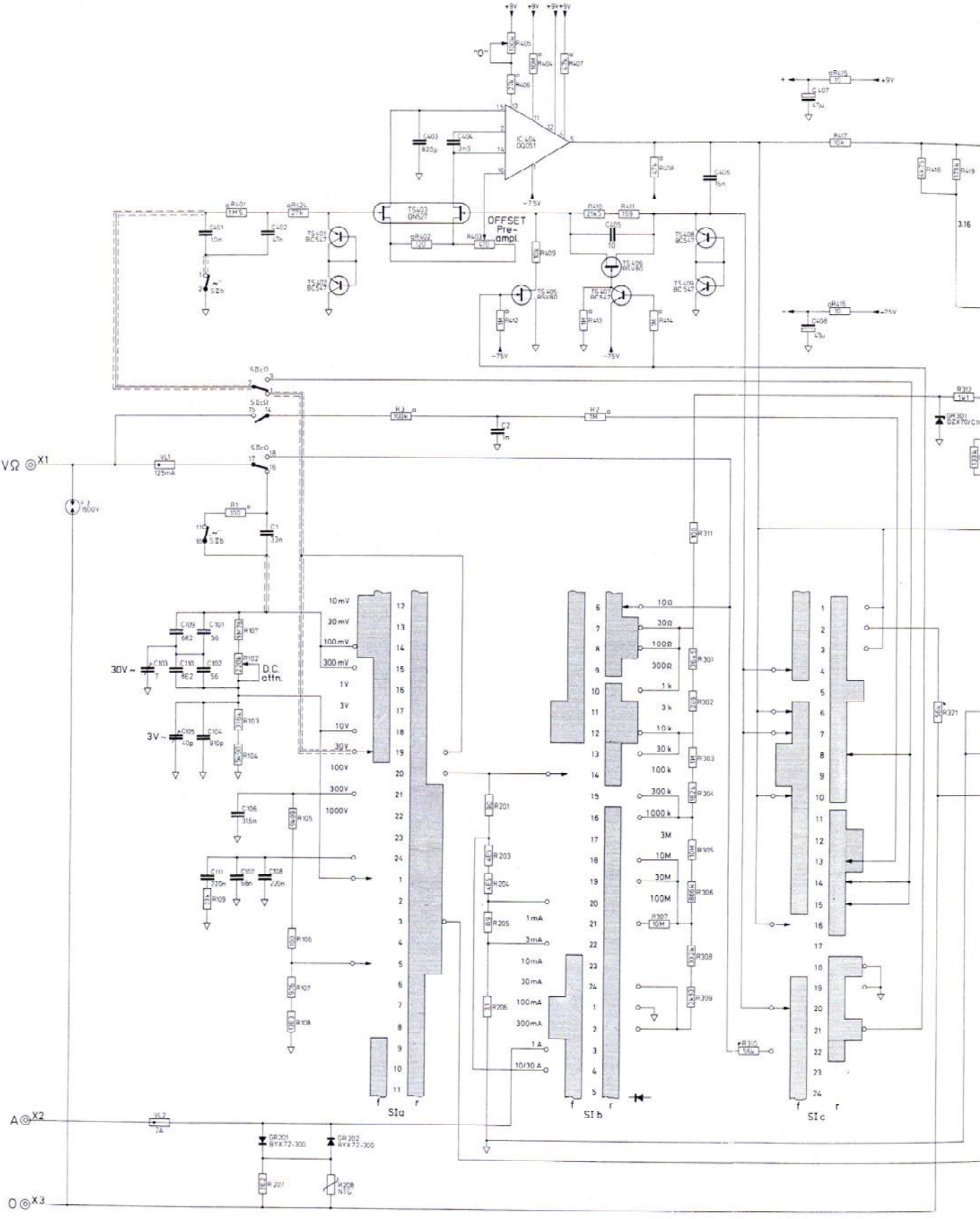
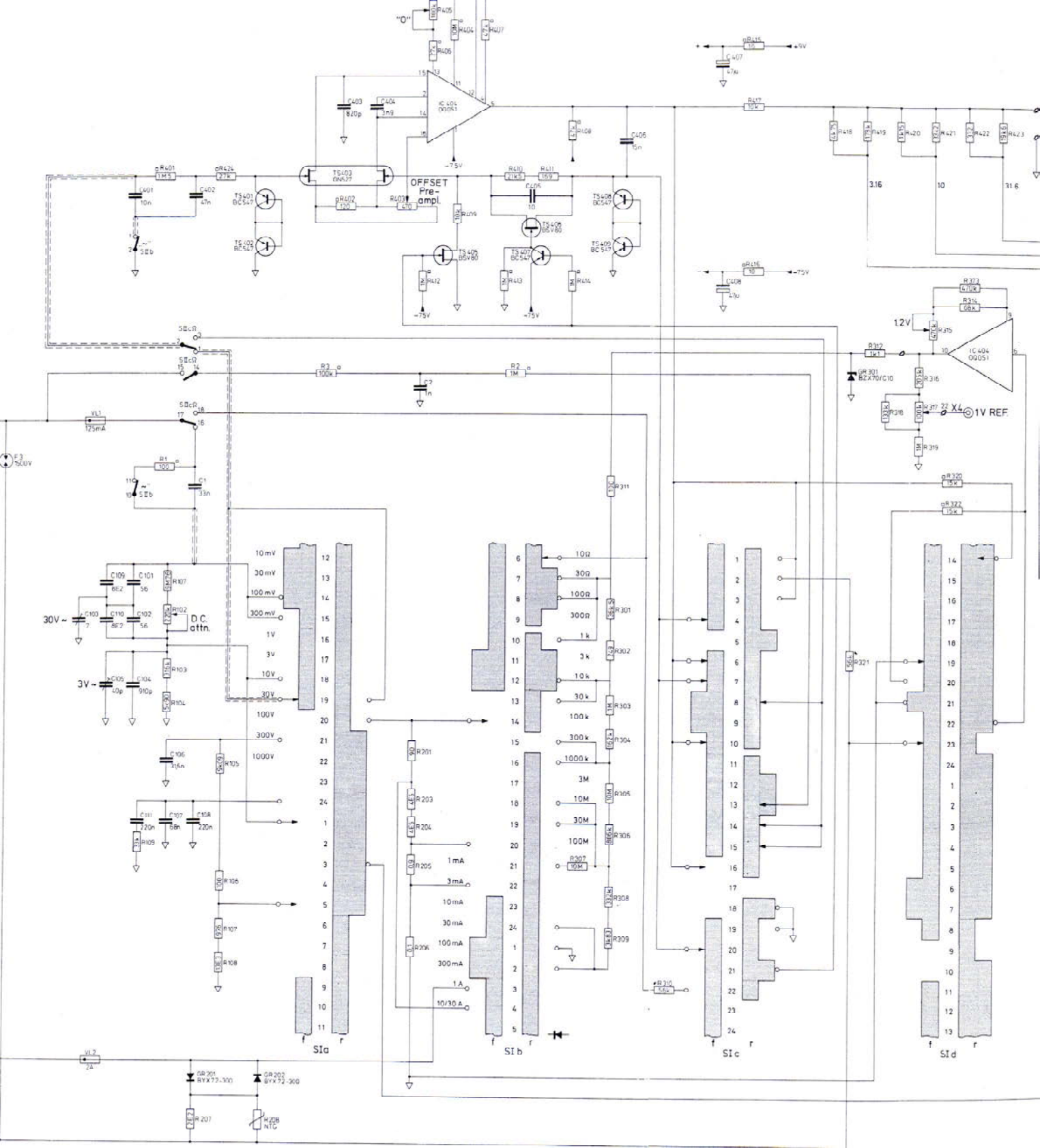


Fig. 33 Positive film of range selector S1


OFFSET
Pre-
ampl.
IC 404
OQ051
TS403
ON527
TS401
BC547
TS402
BC547
TS406
BC547
TS405
BC547
TS406
BF021
TS407
BF423
D.C.
attn.
10 mV
30 mV
100 mV
300 mV
1 V
3 V
10 V
30 V
100 V
300 V
1000 V
1 mA
3 mA
10 mA
30 mA
100 mA
300 mA
1 A
10/30 A
10 Ω
30 Ω
100 Ω
300 Ω
1 k
3 k
10 k
30 k
100 k
300 k
1000 k
3 M
10 M
30 M
100 M
SIa
SIb
SIc
VΩ X1
A X2
0 X3
30V ~
3V ~
+9V
-75V


"0"
IC 404 00051
OFFSET Pre-ampl.
1.2V
1V REF.
30V ~
3V ~
D.C. attn.
10 mV
30 mV
100 mV
300 mV
1 V
3 V
10 V
30 V
100 V
300 V
1000 V
10Ω
30Ω
100Ω
300Ω
1 k
3 k
10 k
30 k
100 k
300 k
1000 k
3M
10M
30M
100M
1 mA
3 mA
10 mA
30 mA
100 mA
300 mA
1 A
10/30 A
SIa
SIb
SIc
SId

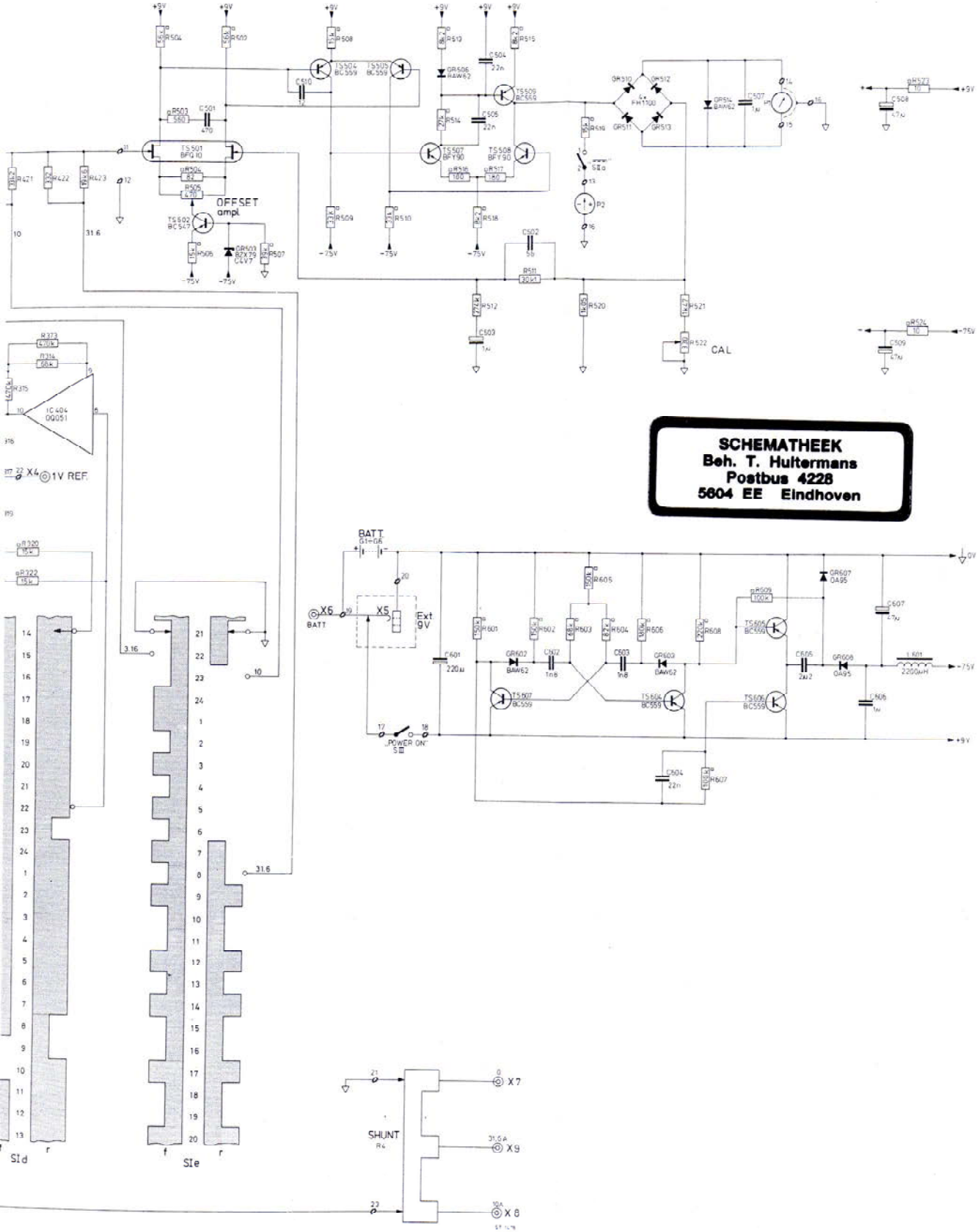


Fig. 32 Circuit diagram PM 2504

QUALITY REPORTING

CODING SYSTEM FOR FAILURE DESCRIPTION

The following information is meant for Philips service workshops only and serves as a guide for exact reporting of service repairs and maintenance routines on the workshop charts.
For full details reference is made to Information G1 (Introduction) and Information Cd 689 (Specific information for Test and Measuring Instruments).

LOCATION

☐☐☐☐

Unit number
e.g. 000A or 0001 (for unit A or 1; **not 00UA or 00U1)**

or: Type number of an accessory (only if delivered with the equipment)
e.g. 9051 or 9532 (for PM 9051 or PM 9532)

or: Unknown/Not applicable
0000

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
6 Cleaning and/or lubrication
7 Operator error
8 Missing items (on pre-sale test)
9 Environmental requirements are not met

COMPONENT/SEQUENCE NUMBER

☐☐☐☐☐

Enter the identification **as used in the circuit diagram,** e.g.:

GR1003	Diode GR1003
TS0023	Transistor TS23
IC0101	Integrated circuit IC101
R0....	Resistor, potentiometer
C0....	Capacitor, variable capacitor
B0....	Tube, valve
LA....	Lamp
VL....	Fuse
SK....	Switch
BU....	Connector, socket, terminal
T0....	Transformer
L0....	Coil
X0....	Crystal
CB....	Circuit block
RE....	Relay
BA....	Battery
TR....	Chopper

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

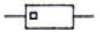
This parts list does not contain multi-purpose and standard parts. These components are indicated in the circuit diagram by means of identification marks. The specification can be derived from the survey below.

Diese Ersatzteilliste enthält keine Universal- und Standard-Teile. Diese sind im jeweiligen Prinzipschaltbild mit Kennzeichnungen versehen. Die Spezifikation kann aus nachstehender Übersicht abgeleitet werden.

In deze stuklijst zijn geen universele en standaardonderdelen opgenomen. Deze componenten zijn in het principeschema met een merkteken aangegeven. De specificatie van deze merktekens is hieronder vermeld.

La présente liste ne contient pas des pièces universelles et standard. Celles-ci ont été repérées dans le schéma de principe. Leurs specifications sont indiquées ci-dessous.

Esta lista de componentes no comprende componentes universales ni standard. Estos componentes están provistos en el esquema de principio de una marca. El significado de estas marcas se indica a continuación.



Carbon resistor E24 series
Kohleschichtwiderstand, Reihe E24
Koolweerstand E24 reeks
Résistance au carbone, série E24
Resistencia de carbón, serie E24

0,125 W 5%

Carbon resistor E12 series
Kohleschichtwiderstand, Reihe E12
Koolweerstand E12 reeks
Résistance au carbone, série E12
Resistencia de carbón, serie E12

0,25 W ≦ 1 MΩ, 5%
> 1 MΩ, 10%

Carbon resistor E24 series
Kohleschichtwiderstand, Reihe E24
Koolweerstand E24 reeks
Résistance au carbone, série E24
Resistencia de carbón, serie E24

0,5 W ≦ 5 MΩ, 1%
> 5 ≦ 10 MΩ, 2%
> 10 MΩ, 5%

Carbon resistor E12 series
Kohleschichtwiderstand, Reihe E12
Koolweerstand E12 reeks
Résistance au carbone, série E12
Resistencia de carbón, serie E12

0,5 W ≦ 1,5MΩ, 5%
> 1,5MΩ, 10%

Wire-wound resistor
Drahtwiderstand
Draadgewonden weerstand
Résistance bobinée
Resistencia bobinada

10 W 5%

Carbon resistor E12 series
Kohleschichtwiderstand, Reihe E12
Koolweerstand E12 reeks
Résistance au carbone, série E12
Resistencia de carbón, serie E12

1 W ≦ 2,2 MΩ, 5%
> 2,2 MΩ, 10%

Carbon resistor E12 series
Kohleschichtwiderstand, Reihe E12
Koolweerstand E12 reeks
Résistance au carbone, série E12
Resistencia de carbón, serie E12

2 W 5%

Wire-wound resistor
Drahtwiderstand
Draadgewonden weerstand
Résistance bobinée
Resistencia bobinada

0,4 – 1,8 W 0.5%

Wire-wound resistor
Drahtwiderstand
Draadgewonden weerstand
Résistance bobinée
Resistencia bobinada

5,5 W ≦ 200 Ω, 10%
> 200 Ω, 5%

Tubular ceramic capacitor
Rohrkondensator
Keramische kondensator, buistype
Condensateur céramique tubulaire
Condensador cerámico tubular

500 V

Tubular ceramic capacitor
Rohrkondensator
Keramische kondensator, buistype
Condensateur céramique tubulaire
Condensador cerámico tubular

700 V

Ceramic capacitor, "pin-up"
Keramikkondensator "Pin-up" (Perltyp)
Keramische kondensator "Pin-up" type
Condensateur céramique, type perle
Condensador cerámico, versión "colgable"

500 V

"Microplate" ceramic capacitor
Miniatur-Scheibenkondensator
"Microplate" keramische kondensator
Condensateur céramique "microplate"
Condensador cerámico "microplaca"

30 V

Mica capacitor
Glimmerkondensator
Micakondensator
Condensateur au mica
Condensador de mica

500 V

Polyester capacitor
Polyesterkondensator
Polyesterkondensator
Condensateur au polyester
Condensador polyester

400 V

Flat-foil polyester capacitor
Miniatur-Polyesterkondensator (flacn)
Platte miniatuur polyesterkondensator
Condensateur au polyester, type plat
Condensador polyester, tipo de placas planas

250 V

Paper capacitor
Papierkondensator
Papierkondensator
Condensateur au papier
Condensador de papel

1000 V

Wire-wound trimmer
Drahttrimmer
Draadgewonden trimmer
Trimmer à fil
Trimmer bobinado

Tubular ceramic trimmer
Rohrtrimmer
Buisvormige keramische trimmer
Trimmer céramique tubulaire
Trimmer cerámico tubular

For multi-purpose and standard parts, please see PHILIPS' Service Catalogue.
Für die Universal- und Standard-Teile siehe den PHILIPS Service-Katalog.
Voor universele en standaardonderdelen raadplege men de PHILIPS Service Catalogus.
Pour les pièces universelles et standard veuillez consulter le Catalogue Service PHILIPS.
Para piezas universales y standard consulte el Catálogo de Servicio PHILIPS.