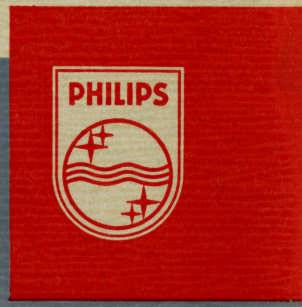
PHILIPS



POWER AMPLIFIER
PM 5175

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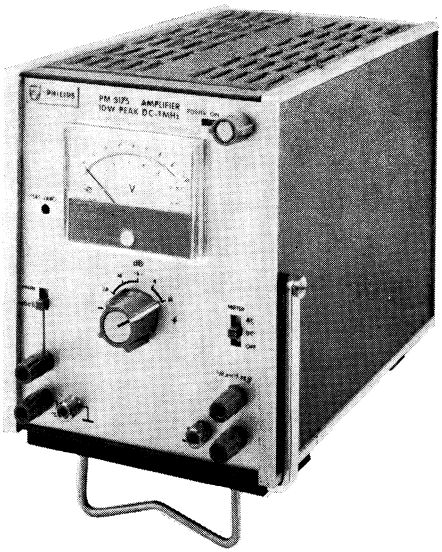
9499 450 02411

1/368/01



PHILIPS

Manual

POWER AMPLIFIER
PM 5175

9445 051 75011

9499 450 02411

1/368/01

Contents

List of figures

IMPORTANT

In correspondence concerning this apparatus, please quote the type number and serial number as given on the plate at the back of the apparatus.

GENERAL

Introduction

1

Power amplifier PM 5175 is a fully transistorised low-drift d.c. amplifier having a gain of 5 (+14 dB) at a very low distortion. The maximum output voltage is 5.5 $V_{r.m.s.}$ (7.75 V_p), which gives 5 W (10 W_p) into 6 Ω. With the aid of a built-in attenuator the gain settings +14 dB, +4 dB, —6 dB, —16 dB and —26 dB are obtained.

The frequency response is flat within 0.5 dB from D.C. to 1 MHz, when the output is loaded with 6 Ω.

The output impedance is approx. 60 mΩ at low frequencies.

The input impedance can be either 600 Ω or 100 kΩ.

Technical data

II

Properties, expressed in numerical values with tolerances stated, are guaranteed by the factory.
Values without tolerances serve for information purposes only and indicate the characteristics of an average instrument.
The undermentioned data are valid when the following conditions are fulfilled:

- Sockets BU3 and BU4 interconnected
- Output loaded with 6 Ω
- Attenuator in position +14 dB
- Input selector SK2 in position 600 Ω

A. GENERAL DATA

Frequency

D.C. ... 1 MHz
Frequency response flat within ± 0.5 dB up to 1 MHz, referred to 1 kHz.
Also see curves in Figs. 1 and 2.

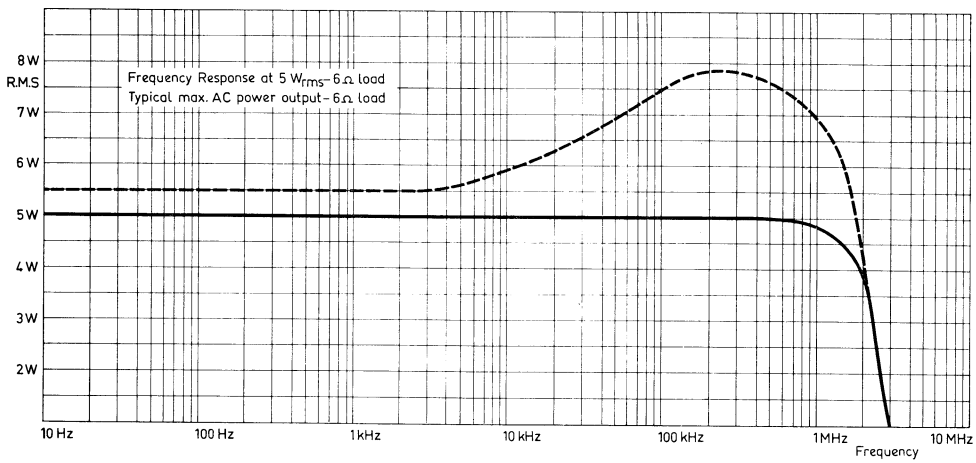


Fig. 1. Frequency response at 5 $W_{r.m.s.}$ and typical max. AC output power

Gain	Maximum +14 dB
Rise time	100 ns
Overshoot (rise time of input signal: 300 ns)	2%
Input impedance	600 Ω or 100 kΩ
Input capacitance	50 pF
Input voltage	1 $mV_{r.m.s.}$ ... 1.1 $V_{r.m.s.}$
Max. overvoltage of input	10 V_p

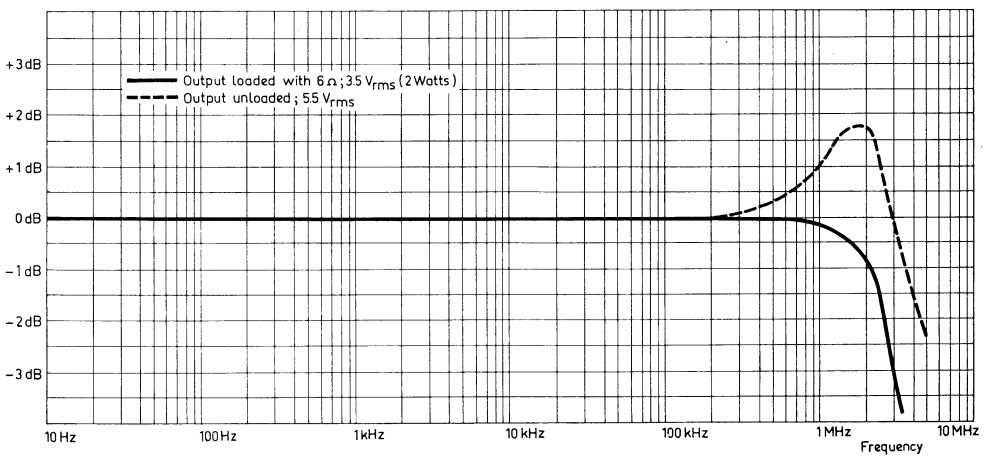


Fig. 2. Typical frequency response curve

Output power	AC: 5 $W_{r.m.s.}$ into 6 Ω (7.75 V_p) DC: 10 W into 6 Ω (7.75 V) Also see curves in Fig. 3
Output circuit	Short-circuit proof
Internal resistance	< 60 mΩ at 1 kHz Typical value at 1 MHz: 1 Ω

B. ATTENUATOR

Attenuation	Four steps of 10 dB
Error	Between two arbitrary steps: < 0.3 dB Overall: < 0.5 dB
Maximum capacitive load	10 nF

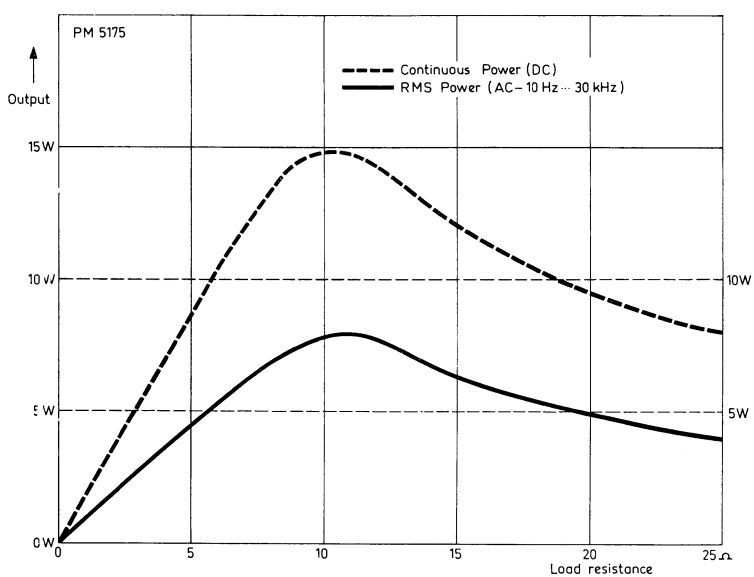


Fig. 3. Typical variation of power output as a function of the load

C. DISTORTION

$< 2\%$ at 600 kHz
$< 1\%$ at 100 kHz
$< 0.1\%$ at 10 kHz
Also see curve in Fig. 4

D. HUM AND NOISE

Less than 80 dB of full output power (input matched with 600 Ω)

E. DRIFT WITH

- input terminated with 600 Ω
- output terminated with 6 Ω
- attenuator in position +14dB

5 μV/°C and 3 μV/% change in supply voltage referred to input

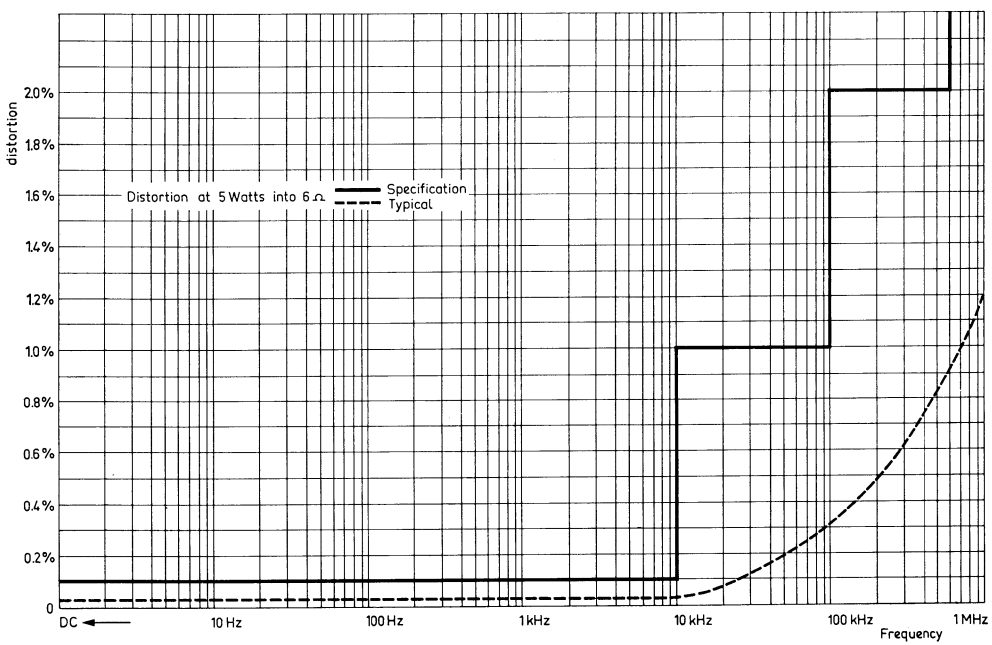


Fig. 4. Harmonic distortion

F. METER

Frequency range	10 Hz...1 MHz and DC
Frequency response in position AC	Flat within $\pm$ 2% referred to 1 kHz
Error	AC: $<$ 0.5 dB of f.s.d. DC: $<$ 0.7 dB of f.s.d. (8 V)

G. AMBIENT TEMPERATURE

10...45°C

H. POWER SUPPLY

Supply voltage	100...130 V or 200...260 V
Frequency	50...100 Hz
Power consumption	40 W at full output power

I. MECHANICAL DATA

Dimensions	2-module cabinet (see chapter XV)
Weight	5 kg (11 lbs)

Accessories

III

- Manual

Optional accessories

- coupling kit PM 9500
- 5 different cover kits, PM 9502...PM 9506
- rack-mounting kit PM 9510 for mounting a 6-module cabinet into a 19″ rack.
- extension board for carrying out measurements on the plug-in printed wiring boards while the instrument is in operation.

The description and ordering information of these accessories are given in chapter XV of this manual.

Description of the block diagram

IV

The basic part of the instrument is a d.c.-amplifier, consisting of a voltage amplifier and a power amplifier.
Negative feedback of the voltage amplifier stage is effected via a high-pass filter, while overall negative feedback takes place via a low-pass filter. A high-pass filter and a low-pass filter have been used in order to isolate the output stage from the feedback loop at high frequencies.
The gain of the complete amplifier is 5 (+14 dB), determined by the feedback loops.
An accurate 40 dB attenuator is incorporated at the input, enabling the gain to be set between —26 dB and +14 dB in five steps of 10 dB.
The input impedance of the instrument, which is either 600 Ω or 100 kΩ, can be selected by means of switch SK2.
The output voltage may be monitored by a meter via a meter circuit. By means of switch SK4 the meter may be switched to a.c. or d.c., the d.c. scale having a centre zero position.
In position OFF of SK4 the meter is short-circuited.
The output impedance of the instrument is very low.
The instrument has a semi-floating circuit, the circuit earth (BU6) and the cabinet earth (BU5) being connected via a 100 kΩ resistor.

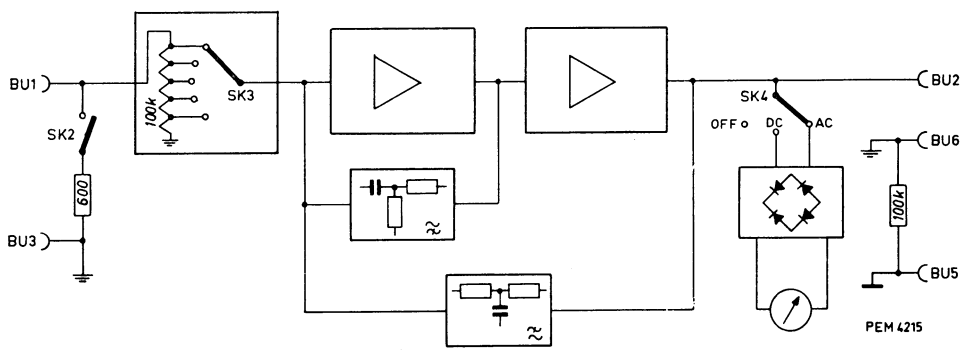


Fig. 5. Block diagram

DIRECTIONS FOR USE

Installation

V

For coupling two or more modular units, refer to chapter XV.

A. ADJUSTING TO THE LOCAL MAINS VOLTAGE (see Fig. 6)

The instrument may be adjusted to a mains voltage of 100...130 V or 200...260 V by means of switch SK10 on the rear panel.
When the instrument is used at a mains voltage of 100...130 V, fuse VL1, having a 800-mA rating, should be replaced by a 1,6-A fuse.

B. EARTHING (see Figs. 6 and 7)

The instrument should be earthed in conformity with the local safety regulations,

a. via the 3-core mains cable supplied or
b. via earthing socket BU10, marked ⏚, on the rear panel or
c. via earthing sockets BU4 or BU5, marked ⊥, on the front panel.

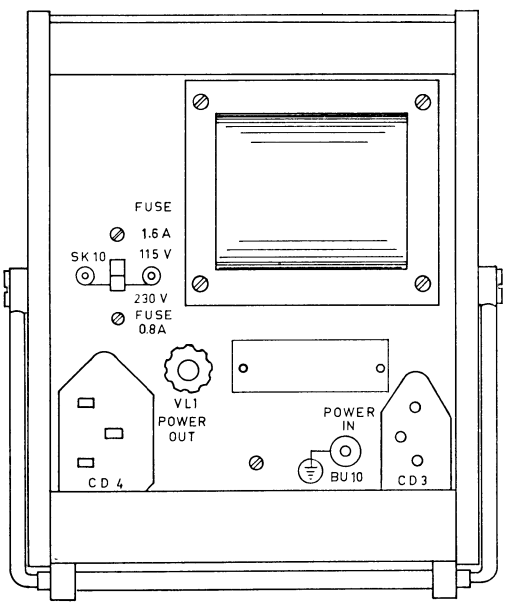


Fig. 6.
Rear view

Note:

For operation as a single unit connect BU3 to BU4

The units of the modular system have a semi-floating circuit so that, when several units are coupled, the circuit need only be earthed at one point. Earth currents which may give rise to hum are thus avoided.
Sockets BU4, BU5 and BU10 are connected to the metal frame of the cabinet. The signal earth is connected direct to sockets BU3 and BU6, marked ⏚, and to the cabinet via a 100 kΩ resistor.

This provides the following output possibilities:

- output from a circuit which is earthed by linking BU3 (⏚) to BU4 (⊥)
- output from a circuit which is earthed via other coupled modules or via auxiliary equipment.

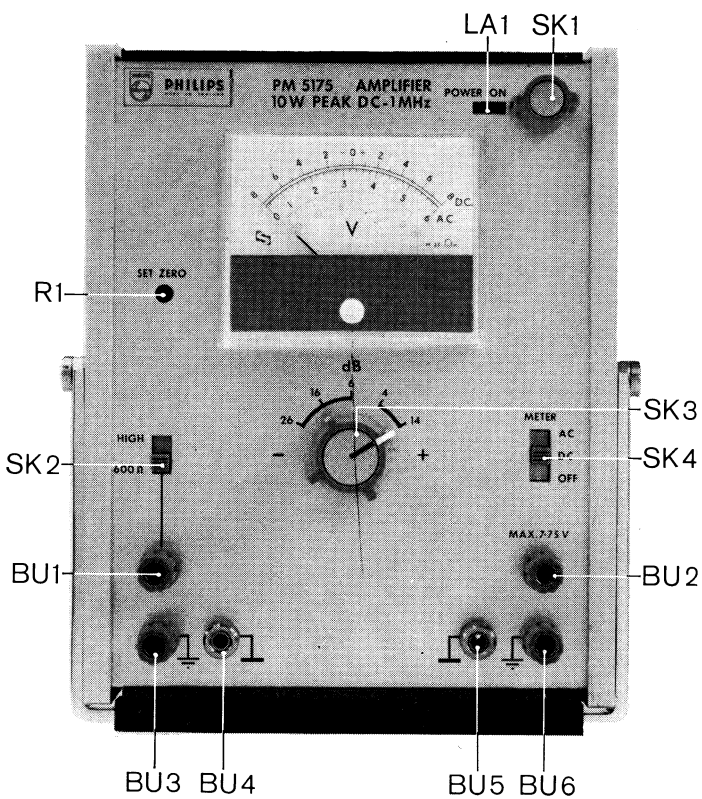


Fig. 7. Controls and sockets

Controls and sockets and their functions

VI

POWER ON (SK1, LA1)	On/off switch with pilot lamp
SET ZERO (R1)	D.C.-level control of the output voltage
HIGH-600 Ω (SK2)	Switch for changing the input resistance from 600 Ω to 100 kΩ
dB-Attenuator (SK3)	Switch for setting the voltage gain of the amplifier in five steps of 10 dB, viz: +14 dB, +4 dB, —6 dB, —16 dB and —26 dB
Meter switch (SK4)	Switch for selecting the a.c. or d.c.-scale of the meter. In the OFF-position of SK4 the meter is short-circuited
Input (BU1)	Signal input terminal
Output (BU2)	Signal output terminal
Signal earth (BU3, BU6)	Terminal to which the signal earth is connected
Chassis earth (BU4, BU5, front panel and BU10, rear panel)	Earthing terminals connected to the metal frame
	The signal earth and the chassis earth may be connected by linking BU3 to BU4. Also refer to chapter V.B.
SK10, rear panel	Mains selector
CD3, rear panel	Mains input socket
CD4, rear panel	Mains output socket

Operation

VII

A. METER

The meter has three scales, viz: two voltage scales and one dB scale. The top scale is the d.c. scale with a centre zero position. This scale, which is graduated from —8 V...+8 V, is used in conjunction with position DC of switch SK4. In this position the meter gives a true d.c. level indication. A superimposed a.c. voltage does not affect the meter reading.

The middle scale, which is graduated from 0...6 V, is the a.c. scale and is used in conjunction with position AC of switch SK4. In this position the meter reading is independent of the d.c. level of the output waveform.

The bottom scale is graduated from —20...0 dB. The 0 dB point corresponds to 5.5 $V_{r.m.s.}$ on the middle scale, which is the maximum output voltage corresponding to 5 W into 6 Ω.

The dB scale is used in conjunction with position AC of SK4. When the meter is not used for monitoring the output voltage or when frequencies below 10 Hz cause an unstable meter deflection, meter switch SK4 is set to position OFF. In this position the meter coil is short-circuited and thus protected against vibrations which may occur during transport.

B. GENERAL NOTES

As stated in the TECHNICAL DATA, chapter II, the drift of the instrument in position +14 dB of attenuator switch SK3 is typically 5μV/° C when the input is matched with 600 Ω.

It should be noted that the drift may increase when switching input selector SK2 to position HIGH or when selecting a gain setting other than +14 dB.

SERVICE DATA

Circuit description

VIII

A. ATTENUATOR (see Fig. 28)

The attenuator is formed by the five resistors R120...R124, the sum of their values being 100 kΩ.
The input signal on BU1 is loaded with 600 Ω or 100 kΩ (attenuator) dependent on the position of input switch SK2.
By tapping the resistor chain by means of switch SK3, attenuation of the applied signal is obtained in steps of 10 dB.
The frequency response of the attenuator may be adjusted for each step separately by means of trimmers C50–C52–C54–C56.

B. VOLTAGE AMPLIFIER (see Fig. 26)

The voltage amplifier is a differential d.c. amplifier with symmetrical inputs, one being connected to the input attenuator, the other to the internal feedback loops.
The output signal of the attenuator is fed to the base of transistor TS1′ via R21, which limits the current in case of overload. TS1′ is part of long-tailed pair TS1′–TS1″, which has a constant current source in its emitter circuit.
The voltage on the base of TS1′ is limited to +3 and —3 V by means of diodes GR2 and GR3.
To avoid a d.c. shift on the base of TS1′ when changing the input resistance from 600 Ω to 100 kΩ, the base current of TS1′ is supplied by the network formed by GR1, R23, R26 and R27. The drift is reduced by supplying the base current of TS1″ from the same network.
With potentiometer R26 the base current can be accurately adjusted. NTC resistor R24 ensures that temperature variations will not affect the base current compensation.
By means of R1 (SET ZERO) the d.c. voltages on the collectors of long-tailed pair TS1 can be adjusted so that the d.c. level at the output of the amplifier equals zero.
To ensure that temperature variations will not affect the symmetry of TS1,

both transistors are housed in a metal block, while a plastic cover prevents temperature variations due to air circulation.
The two anti-phase signals on the collectors of TS1 are fed to the second long-tailed pair TS5–TS6. TS7 in the emitter circuit serves as a constant current source. Temperature stabilisation of this current source is effected by means of diodes GR7...GR10.
Diodes GR11 and GR12 across long-tailed pair TS5–TS6 serve to limit the voltage in such a way, that an overvoltage on the input results in a cleanly clipped output waveform.
The signal on the collector of TS6 is fed to emitter-follower TS8. Negative feedback is effected via R50 and C13. The signal on the collector of TS5 is applied to TS3.
The complementary output stage is formed by transistors TS9 and TS10. The correct d.c. voltage on the base of output transistor TS10 is obtained by connecting this base to emitter-follower TS8 via 1 kΩ-resistor R54. In order to obtain the required d.c. voltage at the base of TS9 and yet maintain the correct phase and amplitude of the signal, a common-base stage TS4 is inserted in the collector circuit of TS3.
The single ended push-pull output stage gives two output signals having the same phase and amplitude but a different d.c. level, which is necessary to drive the symmetrical power amplifier. The difference in d.c. level between the two output signals can be accurately adjusted by means of R57.
Negative feedback is effected by connecting the base input transistor TS1″ to the feedback network consisting of high-pass filter R47, R44, R48, C11 and resistor R37.
Compensation network R46–C12 has been included because of the interaction between the high-pass filter and the low-pass filter (overall feedback network) at high frequencies.

C. OUTPUT AMPLIFIER (see Fig. 27)

Fig. 8a shows the principle of the output amplifier. The circuit employed deviates from the principle in this respect, that instead of the two pnp-transistors E and F two npn-transistors and a diode are used as shown in Fig. 8b.

The current through output transistors TS25–TS26 and TS27–TS28 is limited with the aid of 1.1 Ω resistors R89 and R90 and switching transistors TS17 and TS18.
At a certain voltage across resistors R89 and R90, transistors TS17 and

TS18 will be switched on, which results in a voltage drop across resistors R70 and T73.
When the cathode voltage of GR25 is lower than the input voltage of the output amplifier (on the anode of GR25), GR25 becomes conductive and a further rise of the input voltage is prevented. In the same way a further drop of the input voltage is prevented as soon as GR26 becomes conductive.
Temperature compensation of switching transistors TS17 and TS18 is effected by NTC resistors R85 and R87.
Overall negative feedback is effected via the feedback network consisting of low-pass filter R93, R94, C30 and R37 connected to the base of the voltage amplifier input transistor TS1″.
Network R92 and C29 is incorporated to serve as a load for the amplifier at high frequencies. This is necessary to improve the stability of the amplifier at high frequencies when no external load is connected.

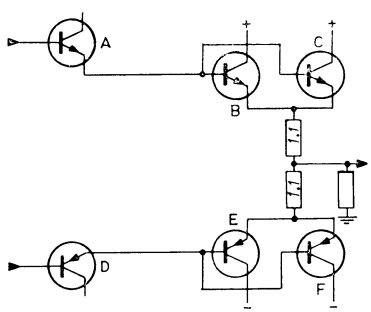


Fig. 8a

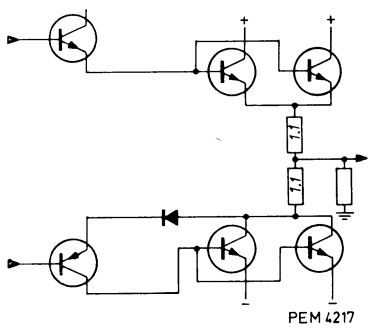


Fig. 8b

Fig. 8. Simplified diagram of the output amplifier

D. METER CIRCUIT (see Fig. 28)

a. Position AC of SK4

The output signal is applied to the rectifier bridge via blocking capacitors C40 and C41 and calibration resistor R106.
The sensitivity of the meter can be accurately adjusted by means of resistor R107 in parallel with the meter.

b. Position DC of SK4

The bias current, which is necessary to obtain the centre zero position, flows through R111, R110, R109, GR27, meter and switch SK4. (GR40 is short-circuited in position DC of SK4).
The value of this current is adjusted by means of potentiometer R110. Current variations due to temperature variations of GR37 are compensated by zener diode GR41.
The output signal is applied to the meter via calibration resistor R105.

Note: In position AC of SK4 the bias current is prevented from flowing through the meter by connecting junction R109–R110 to earth. This brings 1%-resistor R109 in parallel with the rectifier bridge.

c. Position OFF of SK4

In this position of SK4 the output voltage is not connected to the meter and the meter coil is short-circuited and thus protected against vibrations.

E. POWER SUPPLY (see Fig. 28)

The power supply unit can be made suitable for connection to a 115 or 230 V mains by connecting the primary windings in parallel or in series by means of switch SK10.
The positive and negative d.c. voltage supplies are derived from the rectified and smoothed a.c. voltages of the secondary transformer windings. Moreover, the d.c. voltages of +24 V and —24 V are stabilised by zener diodes GR50 and GR51.

Gaining access to parts

IX

A. REMOVING THE TOP PLATE

The top plate can be removed after loosening the fastener at the rear of the instrument.
To refit the top plate, place the groove of the fastener in the horizontal position and push the cover home.

B. REMOVING THE SIDE PLATES

The side plates can be taken off after removing the screw on each side of the instrument.

C. REMOVING THE BOTTOM PLATE

The bottom plate can be removed after loosening the appropriate screws at the rear of the cabinet.

D. REMOVING THE STRIP WITH TILTING SUPPORT

This strip can be removed by pushing the two nylon slides "A" in the direction indicated in Fig. 9.

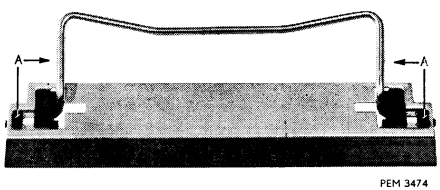


Fig. 9. Removing the strip with tilting support

E. REMOVING THE REAR PANEL

- Remove two screws "A" on each side of the instrument (Fig. 10).
- Remove two screws "B" (Fig. 10).
- The rear panel with mains transformer can be hinged down after pressing the side panels slightly apart.

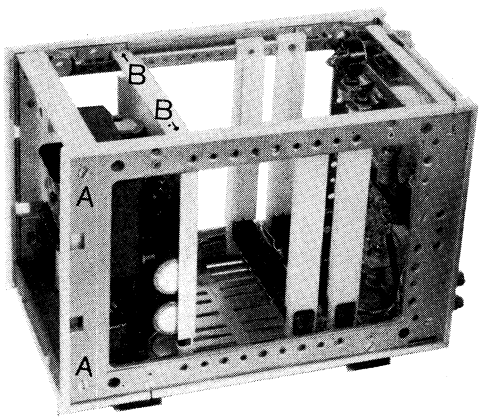


Fig. 10. Removing the rear panel

F. REMOVING THE PLUG-IN PRINTED WIRING BOARDS

In order to pull out the plug-in printed wiring boards, they should first be slightly bent.

Adjusting elements and auxiliary equipment

X

Adjustment	*Adjusting element*	*Fig.*	*Measuring equipment*	*Recommended Philips equipment*	*Section of chapter XI*
MAINS CURRENT	—	—	ammeter	PM 2411	B
DC LEVEL	R1, R26	11	d.c. voltmeter	PM 2430	C
CURRENT LIMITING	R81, R82	11	power supply ammeter	PE 4805 PM 2411	D
HUM AND NOISE	—	—	a.c. voltmeter	PM 2451	E
METER CALIBRATION	R107, R110	11	sinewave generator a.c./d.c. converter digital voltmeter	PM 5160 PM 2433	F
FREQUENCY RESPONSE	C12		sinewave generator voltmeter	PM 5160 GM 6000	G
L.F. GAIN	—	—	power supply digital voltmeter	PE 4805 PM 2433	H
DISTORTION	R57	11	distortion meter	—	J
SQUAREWAVE RESPONSE	C50, C52 C54, C56	12	squarewave generator oscilloscope	GM 2314 PM 3220	K

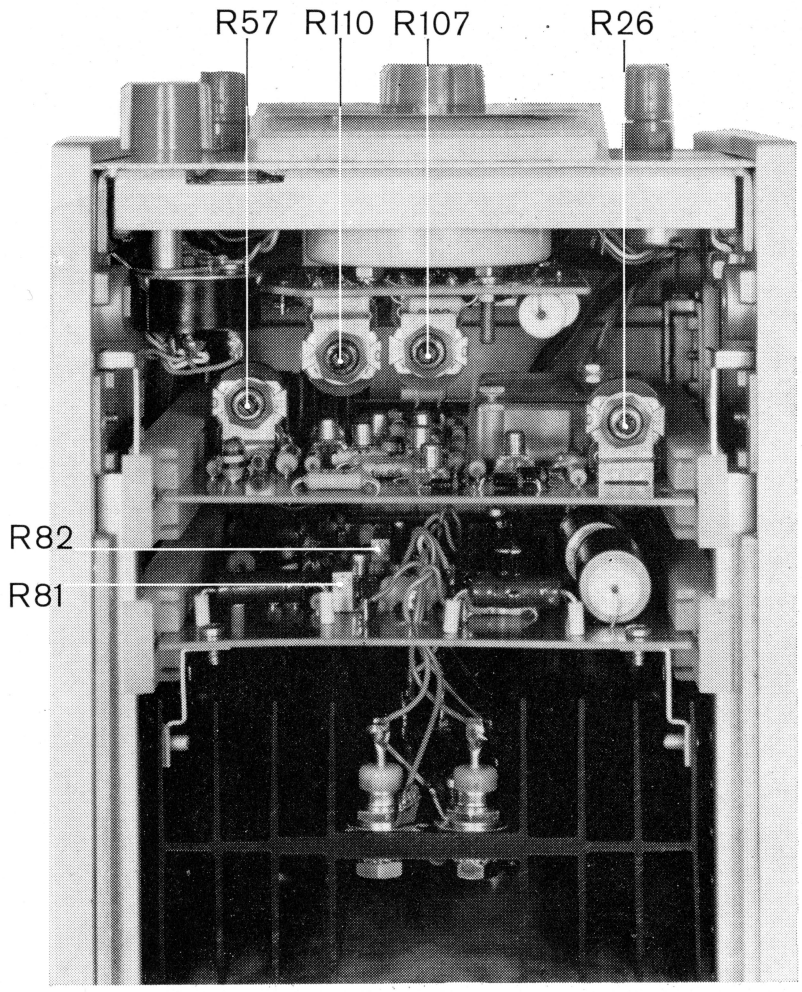


Fig. 11. Top view, indicating the adjusting elements

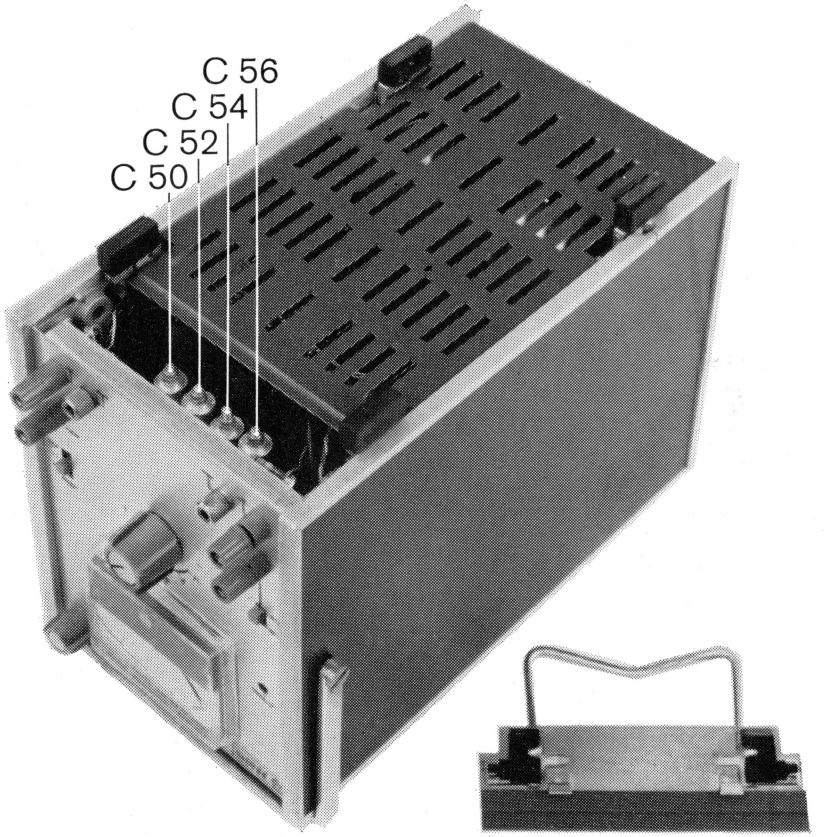


Fig. 12. Bottom view, indicating the adjusting elements

Checking and adjusting

XI

The tolerances mentioned in the following text apply only to completely readjusted instruments. The values may differ from those given in chapter II, TECHNICAL DATA.
For optimum performance the instrument should be adjusted at the temperature at which it will be used.
The adjusting elements and the auxiliary equipment required for the adjusting procedure have been indicated in chapter X.

A. GENERAL

Before commencing the test procedure below, the instrument should be switched on for at least 30 minutes.
The circuit should be earthed by connecting BU3 to BU4. All test equipment should be earthed via the instrument under test. The output should be loaded with 6 Ω ± 1%, unless otherwise stated.
The 6 Ω load can be made up by paralleling three 1% carbon resistors of 18 Ω; total power to be 5 W.

B. MAINS CURRENT

Connect the instrument to the mains and check that the current consumption does not exceed 150 mA at 230 V mains or 300 mA at 115 V mains.

C. DC LEVEL

- Set SK2 (600-HIGH) to position HIGH.
- Set SK3 to position +14 dB.
- Short-circuit sockets BU1 and BU3.
- Check that the output voltage on socket BU2 is less than + or —10mV.
- If necessary, adjust to zero by means of R1 (SET ZERO).
- Remove the short-circuit between BU1 and BU3.
- Check that the output voltage is still less than + or —10 mV.
- If necessary, adjust to zero by means of R26.

D. CURRENT LIMITING

- Set SK3 to position +14 dB.
- Apply a variable d.c. voltage (0...1.5 V) to socket BU1.

- Measure the short-circuit output current.
- Starting from zero, increase the input voltage and check that current limiting takes place initially at 1.6 A to 1.65 A. Adjusting element R81.
- Check the same with a negative input voltage. Adjusting element R82.

E. HUM AND NOISE

- Set SK2 (600-HIGH) to position 600.
- Set SK3 to position +14 dB.
- Check that the hum and noise at the output terminals loaded with 6 Ω is less than 0.4 $mV_{r.m.s.}$

F. METER CALIBRATION

- Set SK2 (600-HIGH) to position 600.
- Set SK3 to position +14 dB.
- Remove the 6 Ω load.
- Set meter switch SK4 to position AC.
- Apply an input signal with a frequency of 1 kHz so that an output signal of 6 V ± 0.5% is obtained.
- Check that the meter reads 6 V on the middle scale. Adjusting element R107.
- Set SK4 to position DC.
- Remove the input signal.
- Short-circuit the output terminals.
- Check that the meter reads 0 V on the d.c. scale. Adjusting element R110.
- Remove the short-circuit and apply a d.c. input voltage (approx. 1.6 V) to obtain a meter reading of exactly 8 V.
- Check that the output voltage is 8 V ± 0.3 V.

G. FREQUENCY RESPONSE

If the built-in meter is used for monitoring the output voltage, first the meter calibration should be checked as described in section F.

- Set SK2 (600-HIGH) to position 600.
- Set SK3 to position +14 dB.

- Apply an input signal with a frequency of 1 kHz (approx. 1 $V_{r.m.s.}$) so that an output signal of 5 $V_{r.m.s.}$ across 6 Ω is obtained.
- Change the frequency of the input signal to 1 MHz, keeping its amplitude constant.
- Check that the output voltage has changed less than ± 0.2 V.

Note: Capacitor C12 is a select-on-test capacitor, with which the frequency response at 1 MHz can be adjusted. Minimum overshoot (see section K) is obtained if the frequency response is adjusted to be —0.4 dB (—0.2 V) with respect to 1 kHz.

Table I

Input voltage	*Position of SK3*	*Meter reading*
20 V ± 1%	—26	1 V ± 7%
6.3 V ± 1%	—16	1 V ± 7%
2 V ± 1%	— 6	1 V ± 7%
0.63 V ± 1%	+ 4	1 V ± 7%
0.2 V ± 1%	+14	1 V ± 7%

H. L.F. GAIN

- Set SK2 (600-HIGH) to position 600.
- Set SK3 to position +14 dB.
- Apply a variable d.c. voltage to the input and check the gain of the instrument according to table I with the aid of a voltmeter connected to BU2 loaded with 6 Ω.

I. DISTORTION

- Set SK2 (600-HIGH) to position 600.
- Set SK3 to position +14 dB.
- At a nominal mains voltage, check with frequencies of 10 kHz, 100 kHz and 600 kHz that the distortion caused by the instrument under test is less than 0.08%, 0.8% and 1.6% respectively.
- If not, adjust with R57 for minimum distortion at 600 kHz.

Note: If no H.F. distortion meter is available, an approximate adjustment may be carried out by adjusting to minimum cross-over distortion of a sinusoidal waveform at full output (5.5 $V_{r.m.s.}$, approx. 600 kHz). Please refer to Fig. 13.

J. SQUAREWAVE RESPONSE

- Set SK2 (600-HIGH) to position 600.
- Set SK3 to position +14 dB.
- Apply to the input a squarewave voltage with a rise and fall time between 100 and 200 nsecs and an amplitude less than 3.2 V_{p-p}.
- Check the squarewave reproduction of the output voltage.
  For minimum overshoot see note in section G.
- Repeat the above check for the other positions of gain control SK3.
- Adjust, if necessary, with the aid of the trimmers mentioned in table II to obtain as nearly as possible the same rise time and overshoot on all gain settings.

Table II

Setting of SK3	*Adjusting element*
+ 4 dB	C56
— 6 dB	C54
—16 dB	C52
—26 dB	C50

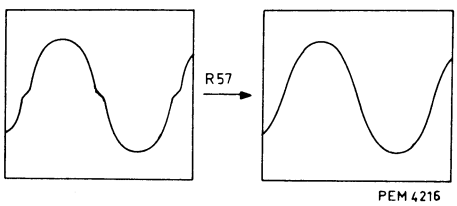


Fig. 13. Adjustment of cross-over distortion

Fault finding

XII

To facilitate fault finding the d.c. voltages at various places in the circuit have been indicated in the circuit diagram. The voltage levels given serve merely as a guide and apply at a nominal mains voltage with out input signal.
When replacing parts, switch off the instrument. After replacing parts it may be necessary to readjust the instrument according to chapter XI. Also refer to chapter XIII.

Note: In case of breakdowns, the assistance of the PHILIPS Service organisation can always be called upon.
Whenever the instrument is to be forwarded to a PHILIPS Service Centre for repair, the following should be observed:
- Provide the instrument with a label bearing full name and address of the sender.
- Indicate as completely as possible the symptoms of the fault
- Carefully pack the instrument in the original packing, or, if this is no longer available, in a wooden crate.
- Forward the instrument to the address provided by your local PHILIPS representative.

Replacing parts

XIII

To ensure proper heat transmission from the power transistors to the heat sink, silicon grease should be applied to the transistor bottom, both sides of the insulating washer and to the heat sink, when mounting a new power transistor.

List of parts

XIV

A. MECHANICAL

Item	*Number*	*Fig.*	*Code number*	*Description*
1	1	14	4822 454 40047	Text plate
2	1	14	4822 413 30084	Knob
3	1	14	4822 413 70038	Cap
4	2	14	4822 460 60014	Ornamental surround
5	1	14	4822 346 20076	Meter
6	2	14	4822 502 10801	Handle screw
7	2	14	4822 532 50653	Washer for handle screw
8	2	14	4822 404 50199	Handle bracket
9	1	14	4822 413 40112	Knob
10	1	14	4822 413 70037	Cap
11	2	14	4822 535 20023	Terminal BU4–BU5
12	2	14	4822 506 40016	Nut on BU4–BU5
13	4	14	4822 290 40011	Socket BU1–BU2–BU3–BU6
14	2	15	4822 520 10182	Bracket holder
15	2	15	4822 462 70366	Slide
16	2	15	4822 460 60017	Ornamental strip (6-module length)
18	1	16	56 201 (CA)	Mica washer and bushes
—	1	16	4822 256 40017	Fuse holder
20	4	16	4822 462 40157	Foot cap
21	2	17	4822 267 70043	Connector CD1–CD2
22	1	17	4822 462 70506	Plastic cover
23	12	17	4822 255 40006	Transistor spacer
24	14	17	4822 255 40049	Transistor holder
—	1	6	4822 273 40115	Switch SK1
—	2	6	4822 277 20014	Slide switch SK2–SK10
—	1	6	4822 273 30166	Switch SK3
—	1	6	4822 277 20009	Slide switch SK4
—	1	7	4822 265 30066	Mains input socket CD3
—	1	7	4822 267 40106	Mains output socket CD4
—	1	—	4822 321 10071	Mains flex with plug
—	—	—	4822 263 70024	Mains interconnection link

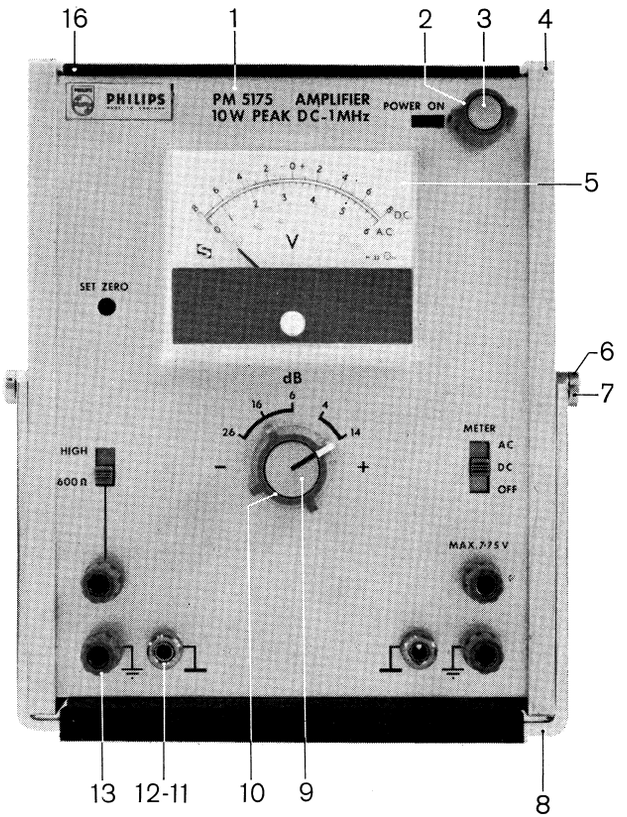


Fig. 14. Front view, mechanical components

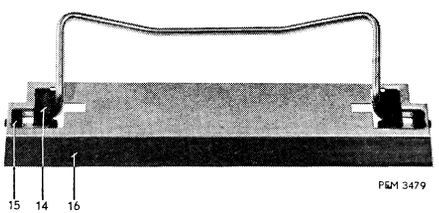


Fig. 15. Tilting assembly, mechanical components

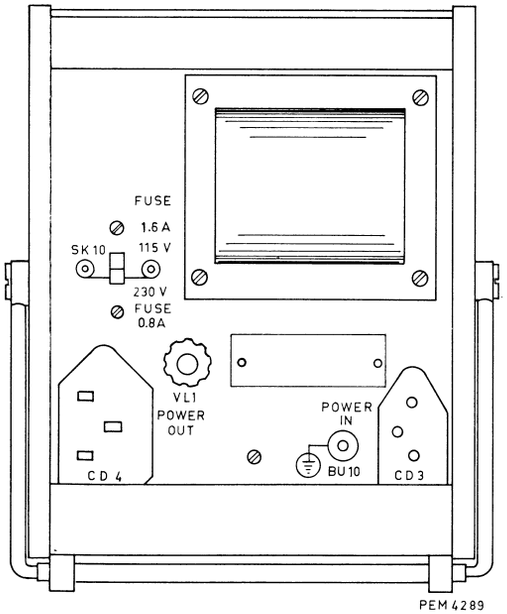


Fig. 16. Rear view, mechanical components

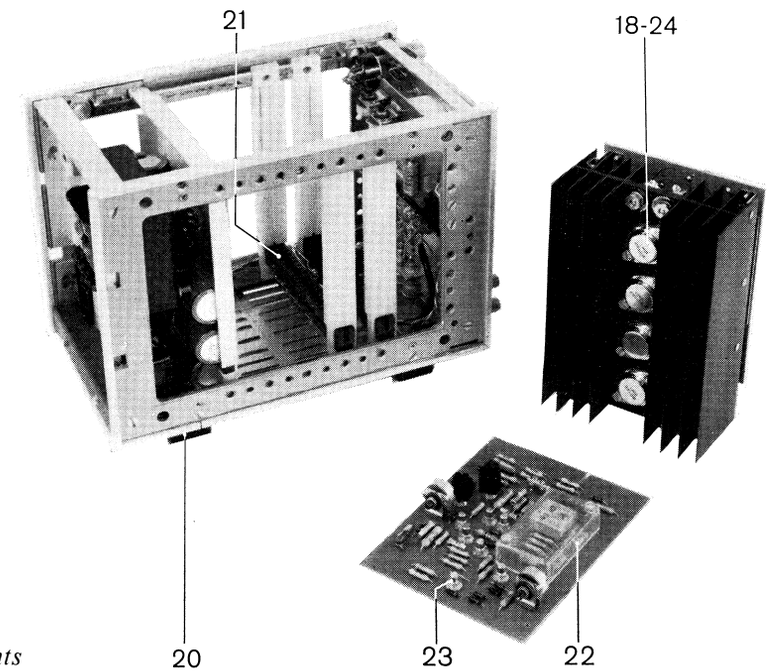


Fig. 17. Left-hand view, mechanical components

B. ELECTRICAL — ELEKTRISCH — ELEKTRISCH — ELECTRIQUE — ELECTRICOS

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 (flach)
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.

RESISTORS

No.	*Code number*	*Value*		*%*	*Watt*	*Description*
R1	4822 101 20074	2.2	Ω			Potentiometer
R24	4822 116 30021	4.7	Ω			Thermistor
R26	4822 101 20258	1	MΩ			Potentiometer
R31	4822 111 20005	390	Ω	1	0.125	Carbon resistor
R34	4822 111 20005	390	Ω	1	0.125	
R36	4822 111 20034	100	kΩ	1	0.125	
R38	4822 111 20018	1	kΩ	1	0.125	
R45	4822 111 20018	1	kΩ	1	0.125	
R51	4822 111 20018	1	kΩ	1	0.125	
R52	4822 111 20018	1	kΩ	1	0.125	
R54	4822 111 20018	1	kΩ	1	0.125	
R57	4822 101 20241	1	kΩ			Potentiometer
R75	4822 116 60003	4.7	Ω	5	0.25	Carbon resistor
R79	4822 116 60003	4.7	Ω	5	0.25	
R81	4822 103 10065	10	Ω			Potentiometer
R82	4822 103 10065	10	Ω			
R85	4822 116 30086	10	Ω			Thermistor
R87	4822 116 30086	10	Ω			
R89	4822 116 50422	1.1	Ω	5	3	Metal film resistor
R90	4822 116 50422	1.1	Ω	5	3	
R93	4822 111 20014	560	Ω	1	0.125	Carbon resistor
R96	4822 116 60003	4.7	Ω	5	0.25	
R105	4822 116 50213	27.3	kΩ	1	0.125	
R106	4822 111 20295	7.89	kΩ	1	0.125	
R107	4822 101 20241	1	kΩ			Potentiometer
R110	4822 101 20002	4.7	kΩ			
R120	4822 116 50111	67.7	kΩ	1		Carbon resistor
R122	4822 116 50104	6.84	kΩ	1		
R123	4822 116 50261	2.16	kΩ	1		
R124	4822 111 20018	1	kΩ	1	0.125	
R131	4822 116 50266	604	Ω	1		

CAPACITORS

No.	*Code number*	*Value*	*%*	*Volt*	*Description*
C11	4822 120 60102	62 pF	5	500	Ceramic
C31	4822 124 20353	8 µF	—10+50	40	Electrolytic
C32	4822 124 20353	8 µF	—10+50	40	
C33	4822 124 20247	160 µF	—10+50	64	
C34	4822 124 20247	160 µF	—10+50	64	
C40	4822 124 20366	32 µF		16	
C41	4822 124 20366	32 µF		16	
C43	4822 124 20408	500 µF		2.5	
C55	4822 120 60071	43 pF	5	500	Ceramic
C57	4822 122 10035	4.3 pF	5	500	
C66	4822 124 70018	1250 µF		40	Electrolytic
C67	4822 124 70018	1250 µF		40	
C68	4822 124 70018	1250 µF		40	
C69	4822 124 70018	1250 µF		40	

DIODES

No.	*Code number*	*Description*
GR1	BZY 88/C9V1	Zener
GR2	BAY 38	Silicon
GR3	BAY 38	Silicon
GR4	BZY 88/C3V3	Zener
GR5	BZY 88/C3V3	
GR6	BZY 88/C4V7	
GR7	AAZ 15	Germanium
GR8	AAZ 15	
GR9	AAZ 15	
GR10	AAZ 15	
GR11	BAY 38	Silicon
GR12	BAY 38	Silicon
GR13	AAZ 15	Germanium
GR14	AAZ 15	
GR15	AAZ 15	

No.	*Code number*	*Description*
GR16	AAZ 15	Germanium
GR25	BAY 38	Silicon
GR26	BAY 38	
GR27	BAY 38	
GR28	BY 123	Silicon, bridge rectifier
GR35	BAY 38	Silicon
GR36	BAY 38	Silicon
GR37	AAZ 13	Germanium
GR38	AAZ 13	
GR39	AAZ 13	
GR40	AAZ 13	
GR41	BZY 88/C4V7	Zener
GR50	BZY 93/C24V	
GR51	BZY 93/C24V	
GR52	OSH02/200	Bridge rectifier

TRANSISTORS

No.	*Code number*	*Description*
TS1	BCY 55	Pair, silicon
TS2	BC 107	Silicon
TS3	BCY 70	
TS4	BCY 70	
TS5	BC 107	
TS6	BC 107	
TS7	BC 107	
TS8	BCY 70	
TS9	BC 107	
TS10	BCY 70	
TS15	BFY 50	
TS16	2N2904A	
TS17	BC 107	
TS18	BCY 70	
TS25	BD 123	
TS26	BD 123	
TS27	BD 123	
TS28	BD 123	

MISCELLANEOUS

No.	*Code number*	*Description*
LA1	GL9 (CA)	Pilot lamp
T1	4822 146 20344	Mains transformer
VL1	4822 253 20017	Fuse 800 mA
	4822 253 20022	Fuse 1.6 A
—	4822 214 10055	Printed wiring board of meter assembly with components
—	4822 214 10056	Printed wiring board of preamplifier with components
—	4822 214 10057	Printed wiring board of power amplifier with components

Information on the modular system and optional accessories XV

A. GENERAL

Power amplifier PM 5175 is part of the modular L.F. system, which consists of various units, which can be easily linked, thus forming several alternative L.F. systems for a wide field of applications. (Refer to PHILIPS publication: "Instrument and Application").
The width of the various units is expressed in modules, one module having the following dimensions:

width: 70 mm
height: 178 mm
depth: 250 mm

The units have a width of one, two or three modules. They can be linked to a maximum width of six modules.
The instruments are suitable for rack-mounting.
The following units are, amongst others, suitable for use with the PM5175.

PM 5160-Oscillator

Frequency range	1 Hz...1 MHz
Output voltage	1 $V_{r.m.s.}$ into 600 Ω
Attenuator	continuous (ogarithmic)
Width	2 modules
Suitable for use with:	
Wide-band amplifier	PM 5170 (width: 1 module)
Power amplifier	PM 5175 (width: 2 modules)
Monitored attenuator	PM 5180 (width: 2 modules)

PM 5162-L.F. Sweep oscillator

Frequency range	0.1 Hz...100 kHz
Waveforms	– triangle wave
	– squarewave
	– sinewave
Output voltage	3 V_{p-p} into 600 Ω
Attenuator	continuous (logarithmic)

Frequency sweep

a. $\frac{f_{max}}{f_{min}}$	$1...10^4$
b. speed	10...100 sec.
Width	3 modules
Suitable for use in combination with:	
Wide-band amplifier	PM 5170 (width: 1 module)
Power amplifier	PM 5175 (width: 2 modules)
Monitored attenuator	PM 5180 (width: 2 modules)

PM 5168-Function generator

Frequency range	0.5 mHz...5 kHz
Output voltage	3 V_{p-p} into 600 Ω
Attenuator	continuous (logarithmic)
Waveforms	– triangle wave
	– squarewave
	– sinewave
Facilities	– single shot
	– external triggering
Width	3 modules

Suitable for use in combination with:

Wide-band amplifier	PM 5170 (width: 1 module)
Power amplifier	PM 5175 (width: 2 modules)
Monitored attenuator	PM 5180 (width: 2 modules)

PM 5170-Wide-band amplifier

Frequency range	DC...1 MHz
Maximum output	10 $V_{r.m.s.}$ into 600 Ω
Input impedance	– 600 Ω and
	– high impedance (100 kΩ)
Width	1 module

Suitable for use in combination with:

Oscillator	PM 5160 (width: 2 modules)
Sweep oscillator	PM 5162 (width: 3 modules)
Function generator	PM 5168 (width: 3 modules)
Monitored attenuator	PM 5180 (width: 2 modules)

PM 5180-Monitored attenuator

Attenuation	0...99.9 dB in 10 – 1 and 0.1 dB steps
Outputs	– 600 Ω unbalanced
	– 600 or 150 Ω balanced (floating)
Maximum input voltage	10 $V_{r.m.s.}$
Frequency ranges	
a. attenuator	DC ... 1 MHz
b. meter	10 Hz ... 1 MHz
c. transformer output	20 Hz ... 20 kHz
Width	2 modules

Suitable for use in combination with:

Oscillator	PM 5160 (width: 2 modules)
Sweep oscillator	PM 5162 (width: 3 modules)
Function generator	PM 5168 (width: 3 modules)
Wide-band amplifier	PM 5170 (width: 1 module)

B. COUPLING ACCESSORIES

For coupling the various units to form one complete instrument, coupling accessories are available for every combination up to a width of six modules.

These accessories comprise one coupling kit and five different cover kits. With the aid of the parts provided in the *coupling kit* any two modular units can be linked to each other.

A *cover kit* contains a top cover, a tilting assembly and an extension piece for the carrying handle; with these parts the coupled units can be equipped to form one complete instrument.

Ordering information

One coupling kit PM 9500 should be ordered for each coupling connection to be made. Depending on the total width of the coupled units, one of the following cover kits should also be ordered.

Type number	*Cover kit for a total width of*
PM 9502	2 modules
PM 9503	3 modules
PM 9504	4 modules
PM 9505	5 modules
PM 9506	6 modules

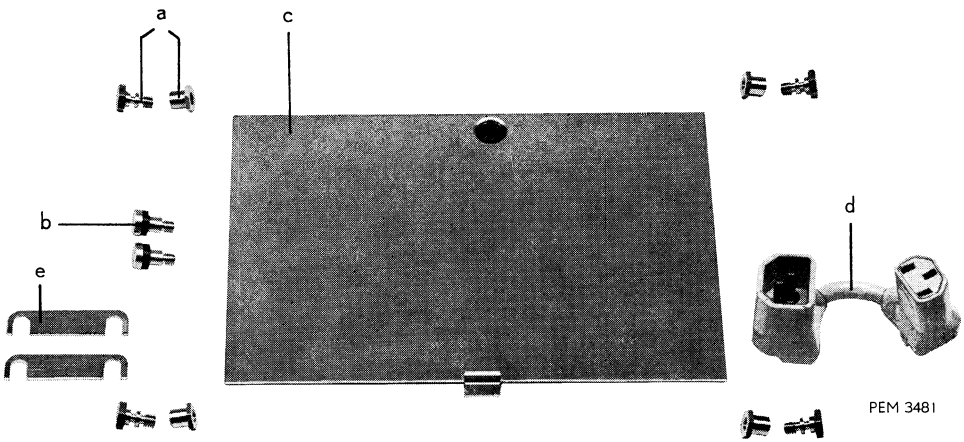


Fig. 18. Coupling kit

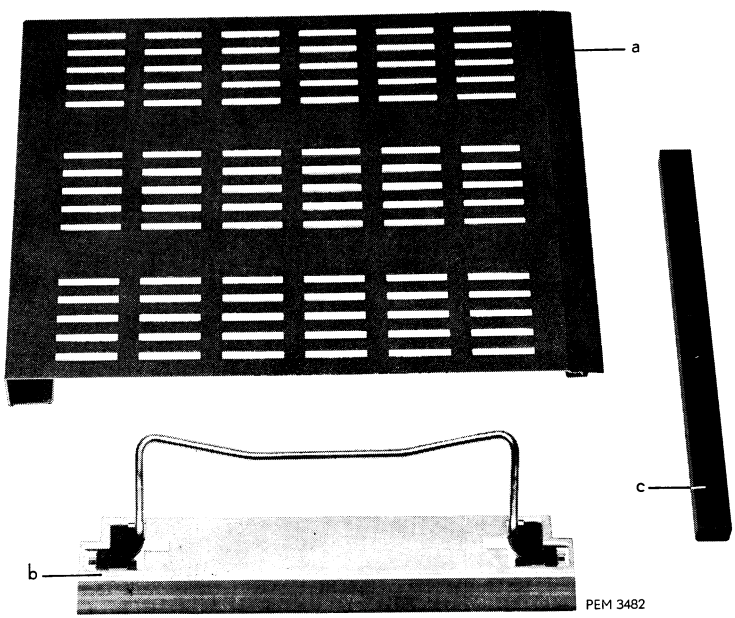


Fig. 19. Cover kit

For example:

To be coupled	one 2-module unit two 1-module units
Required coupling accessories	two coupling kits PM 9500 one cover kit PM 9504

The coupling kit PM 9500 includes: (Fig. 18)

a. 4 coupling screws with nuts
b. 2 fixing screws for handle
c. 1 inter-units screen
d. 1 mains interconnection link
e. 2 signal interconnection links

A COVER KIT PM 9502 ... PM 9506 INCLUDES: (Fig. 19)

a. 1 n-module top cover
b. 1 n-module tilting assembly
c. 1 n-module handle bar

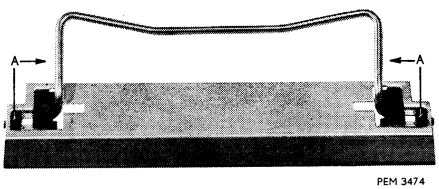


Fig. 20 Tilting assembly

Further optional accessories available

a. Coupling parts for one-module units

When an equipment is to be made up from 1-module units only, coupling parts additional to the coupling kit and cover kit are required.
This is because 1-module units are not equipped with a carrying handle.
These additional parts are:

Number	*Description*	*Ordering number*
2	Handle bracket	4822 404 50199
2	Handle screw	4822 502 10801
2	Washer for handle screw	4822 532 50653
2	Screw for handle bar	4822 502 10555

b. PM 9510, rack-mounting kit (See exploded view, Fig. 21)

Adaptation set for mounting a 6-module cabinet into a 19″ rack, including:
- 2 brackets
- 2 handles
- 4 fixing screws
- 2 inter-unit screens

C. COUPLING INSTRUCTIONS (also see Fig. 22)

1. Detach the carrying handles by removing the screws on both sides of each unit. Next remove the handle bar and replace it by the bar, provided in the cover kit.

   Note: When two or more 1-module units have to be coupled a handle should be composed and fixed to the instrument by means of the additional coupling parts mentioned in the preceding section under point ″a″.

2. The side covers should be removed from the sides which are to be connected together and the inter-unit screen from the coupling kit should be fitted to one of the exposed side frames.
3. Remove the top covers by loosening the fastener at the rear of each unit.

4. Detach the bottom covers by removing the appropriate screw(s) at the rear of the units.

   N.B.: Ensure that the bottom covers are refitted to the units from which they have been taken. (See point 9.)

5. Remove the tilting assembly at the bottom of each unit by pushing the two nylon slides "A" in the direction indicated in Fig. 20.
6. Remove the two feet at the coupling sides of each unit. First loosen the grub screws which hold the surround.
7. Couple the units to each other by means of the nuts and bolts provided in the coupling kit.
8. Fit the tilting assembly, which is provided in the cover kit, to the bottom of the instrument by means of the two nylon slides.
9. Refit the appropriate bottom cover of each unit. (See point 4.)
10. Fit the new top cover on the instrument, by placing the groove of the quick fastener in a horizontal position and pushing the cover towards the front of the instrument.
11. Screw the extended carrying handle to the instrument.
12. Finally fit the mains link on the rear of the instrument and the signal links on the front of the instrument.

Note:

- Always earth the coupled circuits at one point only by interconnecting the circuit earth (⏚) and the cabinet earth (⊥) of only one of the coupled units.
- Coupling two or more units may involve a temperature rise in the units. Make sure that the ambient temperature as mentioned in the TECHNICAL DATA of the manual is not be exceeded.

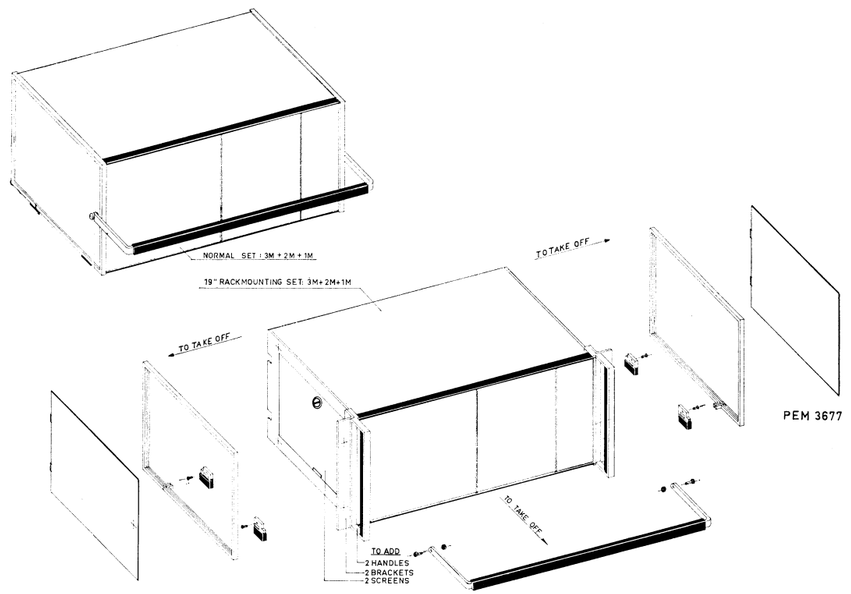


Fig. 21. Rack-mounting, exploded view

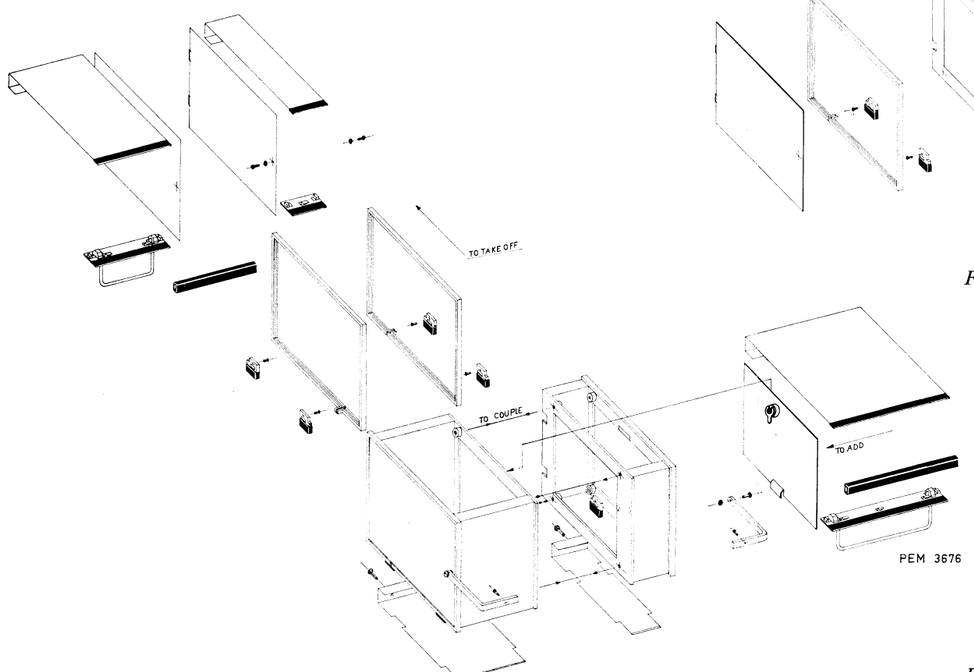


Fig. 22. Coupling two modular units, exploded view

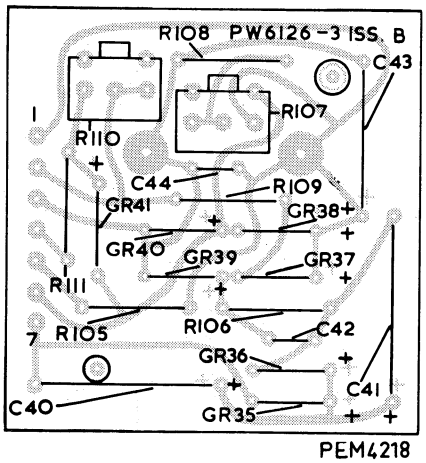


Fig. 23. Printed wiring board of meter assembly

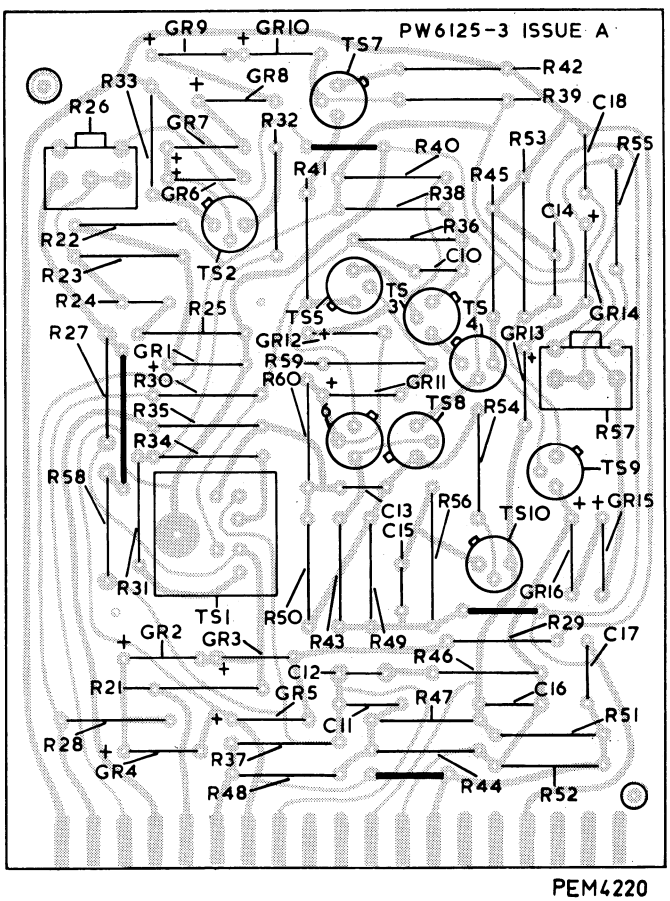


Fig. 24. Printed wiring board of pre-amplifier

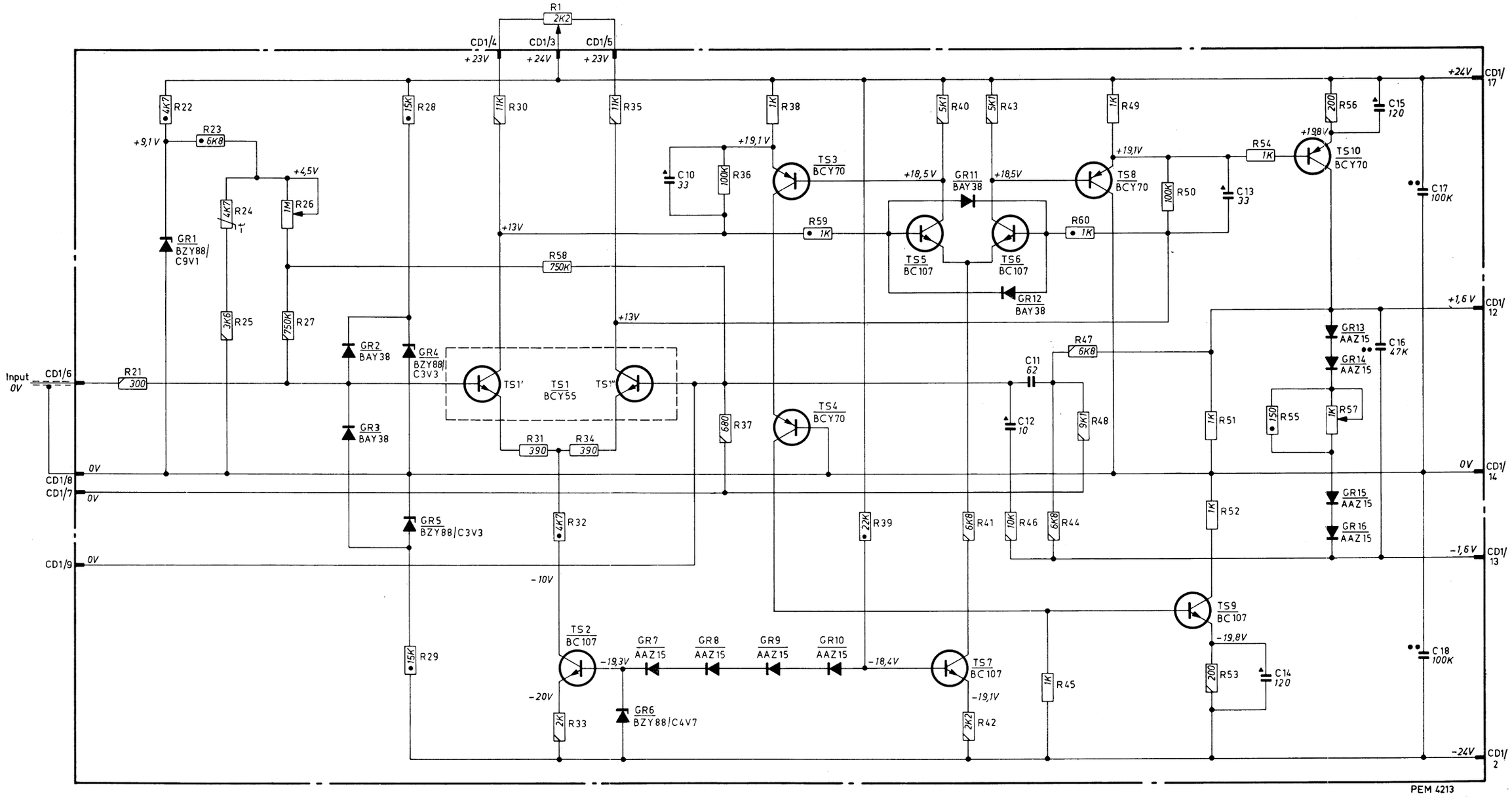


Fig. 26. Circuit diagram of pre-amplifier

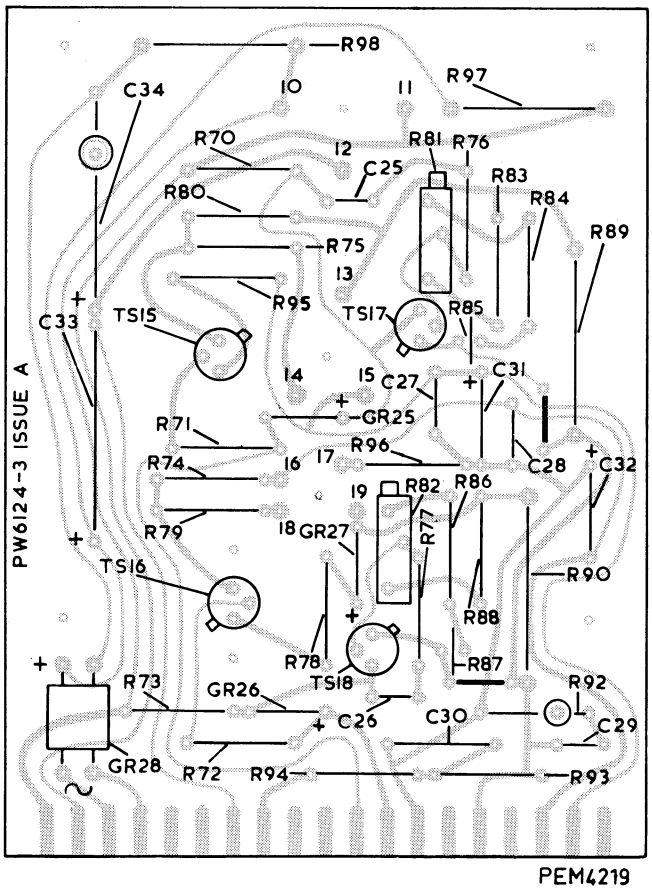


Fig. 25. Printed wiring board of power amplifier

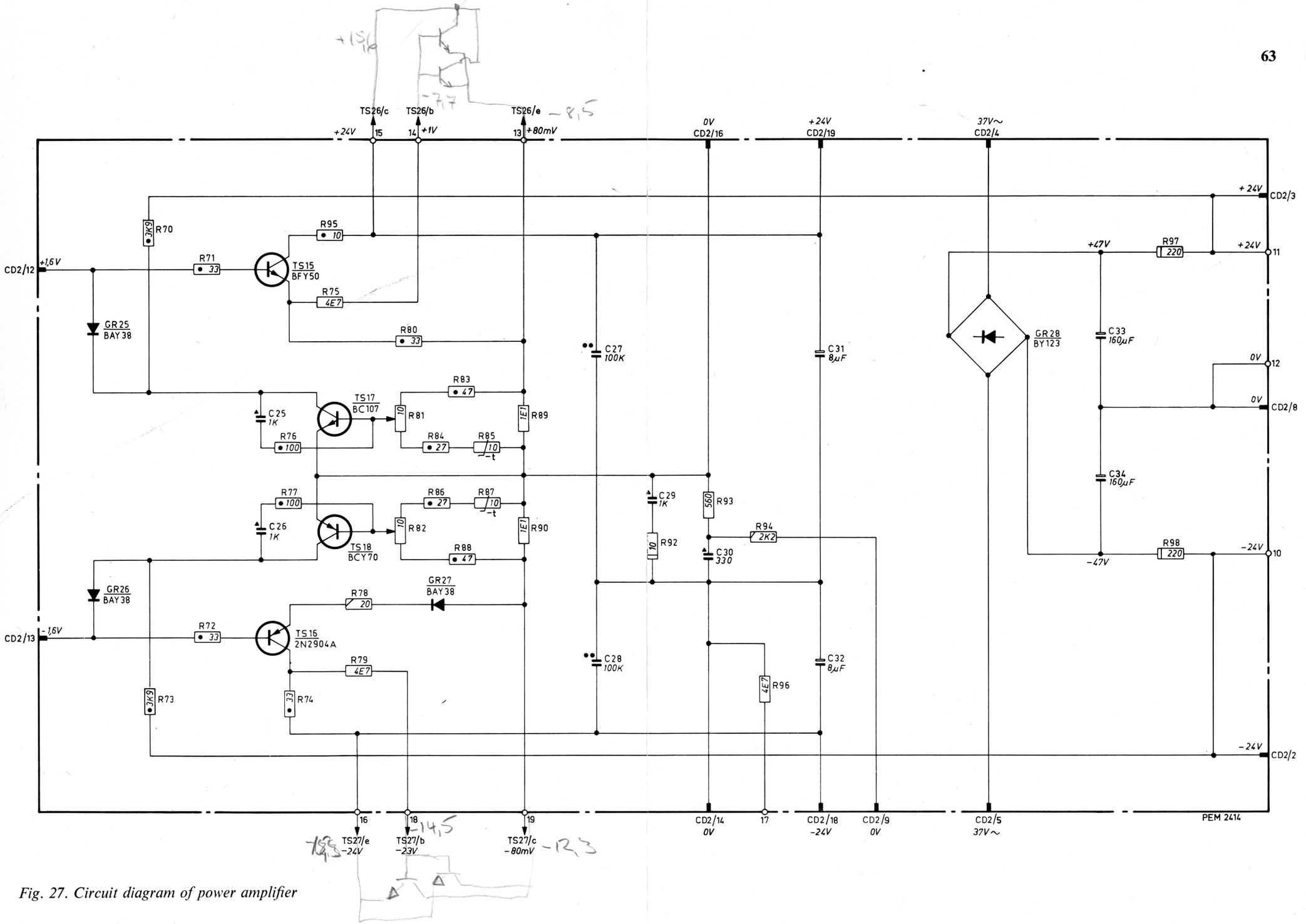


Fig. 27. Circuit diagram of power amplifier

udgangstransistor BD 123 erstattes med BDY60 iflg. Philips
13/5-75 VJ

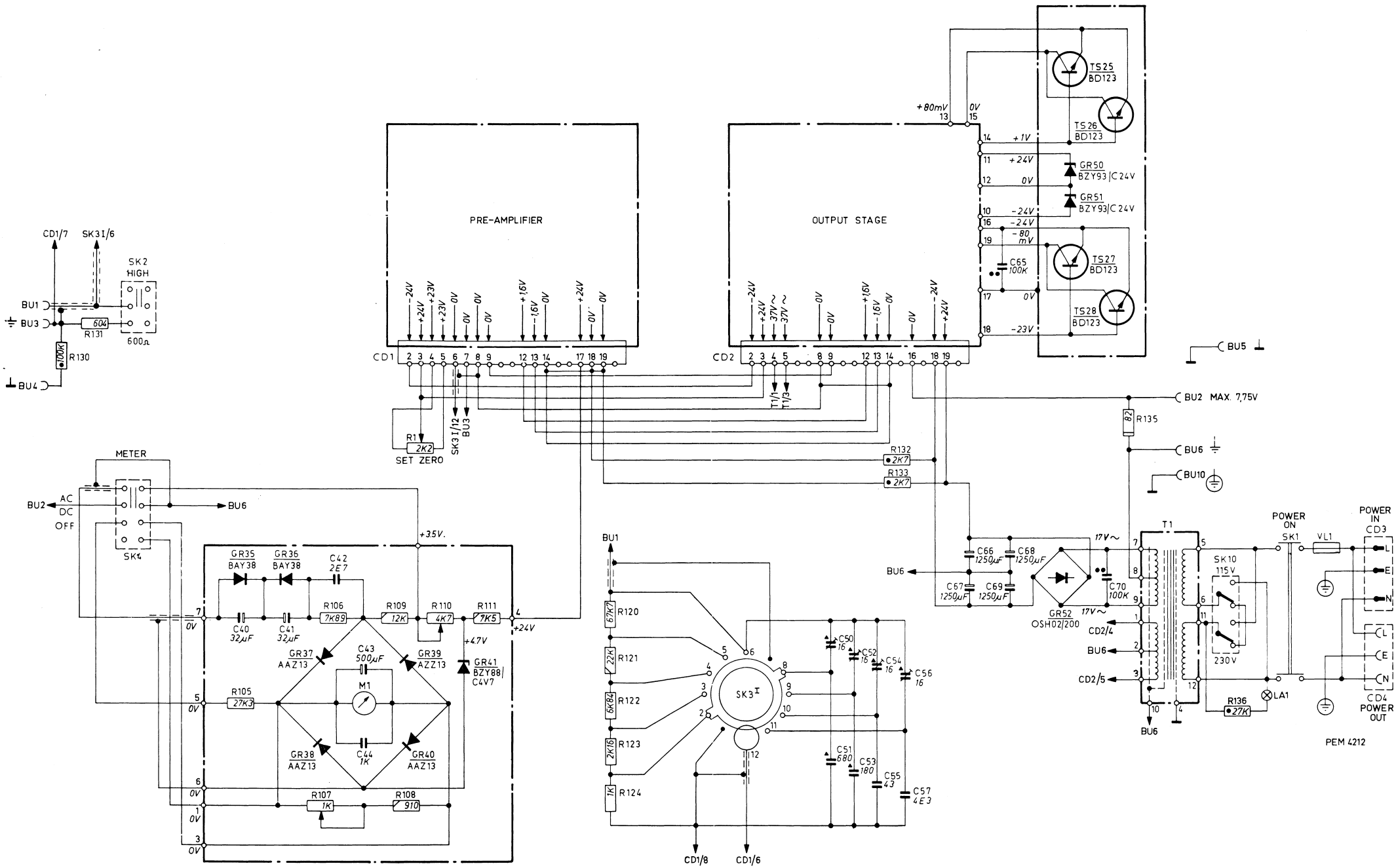


Fig. 28. Overall circuit diagram