

PHILIPS

Service Manual

PM 3418

IMPORTANT

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

Contents

I. Technical description	5
II. Controls and their function	8
III. Checking and adjusting	9
IV. Parts list	11

List of figures

1. Diagram of the control circuit	4
2. Front view	12
3. Side view	13
4. Layout of trimming capacitors (attenuator)	13
5. Bottom view	19
6. Printed circuit. Unit 4	21
7. Printed circuit. Unit 5	19
8. Printed circuit. Unit 6	21
9. Printed circuit. Unit 7	24
10. Circuit diagram of the attenuator	25
11. Layout of attenuator switch SK1	27
12. Circuit diagram of the plug-in unit.	33

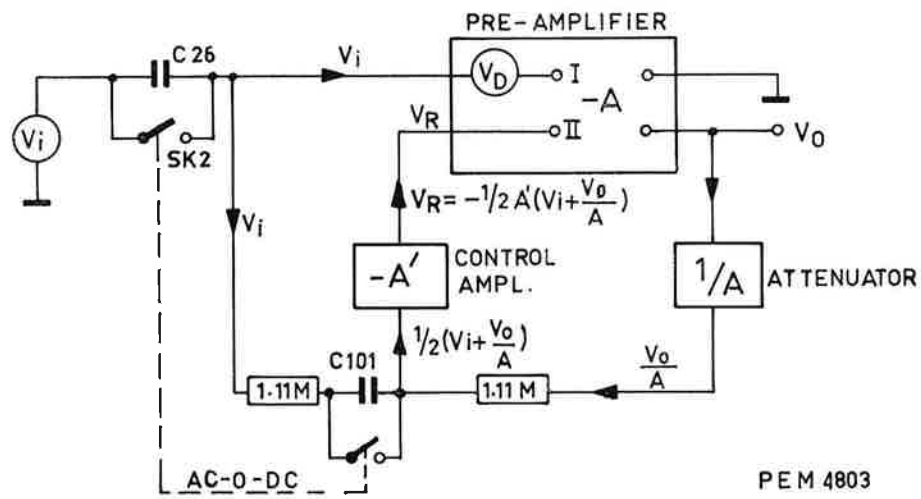


Fig. 1. Diagram of the control circuit

Technical description



A. CONTROL CIRCUIT

1. Principle

Fig. 1. shows a simplified diagram of the control circuit. The signal voltage V_i is applied to input I of the symmetrical pre-amplifier and control voltage V_R is applied to input II.

The total drift occurring in the pre-amplifier is represented by voltage source V_D , connected to input I. The control amplifier is a contact-modulated amplifier (chopper amplifier).

Assume that the gain of the pre-amplifier and the control amplifier is $-A$ and $-A'$ respectively (the minus sign indicates a 180° phase shift between the input and the output of the amplifier).

Next, assume, that the attenuator gives an attenuation A . The output voltage V_0 of the pre-amplifier, which is equal to $-A(V_i + V_D - V_R)$ is then indicated by the following formula:

$$V_0 = -A V_i - A \frac{V_D}{1 + \frac{1}{2}A^1}$$

This means that the input signal V_i is amplified by a factor A and the drift voltage V_D only by a factor

$$\frac{A}{1 + \frac{1}{2}A^1}$$

For high values of gain factor A' , drift voltages are therefore strongly reduced.

In position AC of the AC-O-DC switch SK2, capacitor C101 is included in the control circuit. As a result a direct voltage arising at the input of the pre-amplifier due to leaking of input capacitor C26 will also be compensated for by the control system.

2. The control amplifier

The control amplifier consists of an oscillator circuit, a chopper, a d.c. amplifier and a phase-sensitive detector.

a. Oscillator

Transistors TS312 and TS313 form the power amplifiers of the push-pull oscillator. The oscillating frequency is determined by L301 and C313 and is adjusted to 400 Hz. C314 is fitted across the secondary winding of L301 to prevent HF oscillations. The chopper is supplied from the secondary winding of L301.

b. Chopper

The drift signal generated in the pre-amplifier is applied to point 1 of the chopper. This direct voltage is converted into a squarewave voltage of 400 Hz by the chopper and subsequently applied to the a.c. amplifier.

Dependent on the polarity of the drift voltage the squarewave voltage is in phase with or in phase opposition to the oscillator voltage.

c. A.C. amplifier

Transistors TS301, TS302 and TS303 form a voltage fed-back amplifier stage with a high input impedance. Due to the presence of C306 the d.c. feedback is larger than the a.c. feedback, so that direct voltage variations in the amplifier will hardly affect the stability of the control circuit.

The squarewave voltage is again amplified by transistor TS304 and subsequently applied to the phase sensitive detector via emitter follower TS306.

d. Phase sensitive detector

The detector consists of symmetrical transistors TS307 - TS308 and TS309 - TS311. Via L302 these transistors are alternately turned on and off with oscillator frequency, so that the applied squarewave voltage is rectified. Dependent on whether the squarewave voltage is in phase with or in phase opposition to the oscillator voltage (positive or negative drift voltage) capacitor C311 is charged positively or negatively. The earth point of C311 has been selected so that the polarity of the output voltage of the detector is opposite to the polarity of the drift signal at the input of the chopper.

To ensure that the peak rectification by the detector is effected at the proper moment, i.e. during the flat section of the squarewave voltage, the oscillator voltage is applied to the detector via phase correction filter R308 - C317. As a result, the switching voltage is slightly shifted in time with respect to the squarewave voltage.

As it should be possible both to charge and to discharge C311, dependent on the polarity of the drift voltage, symmetrical transistors have been selected for transistors TS307, TS308, TS309 and TS311. These transistors have the property that they can pass current both in positive and negative direction, when driven by a base current.

Via filter R113...C306 the direct voltage across C311 is applied to the pre-amplifier. This filter suppresses interference signals from the oscillator (400 Hz) and effects phase correction to prevent oscillations.

Because the input resistance of the amplifier is high, capacitor C311 is only slightly discharged. Brief malfunctioning of the chopper therefore will not affect the output voltage of the detector. Moreover, in view of the slight discharge of C311 the detector transistors need only be conductive for a brief period. The d.c. balance of the pre-amplifier is adjusted with potentiometer R119. The balance is correct, if no direct voltage is present across continuous gain control R2. The adjustment need therefore only be carried out once, because the control circuit maintains the balance.

B. INPUT ATTENUATOR

The input attenuator consists of 10 networks which are switched on individually by means of switch SK1. The attenuation can thus be varied between 1x and 1000x according to a 1-2-5 series.

The squarewave response of the networks is adjusted with trimmers C29...C59.

The input capacitance of the networks is adjusted with trimmers C27...C61.

C. PRE-AMPLIFIER

Resistors "R103 - R104" and "R101 - R102" form the accurate resistances of 1.11 Mohm shown in Fig. 1. The input signal applied to BU1 and the output signal of the pre-amplifier, fed back via an attenuator, are applied to these resistors respectively.

The values of 1.11 M ohm have been selected to ensure that R103 - R104, in combination with grid current compensation network R106...R109, provide an input resistance of 1 Mohm.

In the AC position of SK2 capacitor C101 causes unbalance of the two 1.11 Mohm tappings for input signals with low frequencies. As a result the balance is disturbed, so that the AC procedure is not suitable for frequencies lower than 20 Hz.

By means of cathode follower B101 a high input impedance of the pre-amplifier is obtained.

Grid current compensation is effected with potentiometer R109. The drift compensation voltage from the control amplifier is applied to the control grid of B101'.

Transistors TS101 and TS102 are protected against excessively high voltages by diodes GR103, GR104 and GR106.

The input stage is followed by current-and-voltage-feedback amplifier TS101 - TS103, TS102 - TS104 in push-pull arrangement. However the signal voltage is applied asymmetrically to the base of TS102. The gain of this stage is almost exclusively determined by

the feedback resistors in the emitter circuit of TS101 and TS102 and by feedback resistors R131, R132. The gain of this stage can be varied in steps by varying the emitter resistance of TS101 and TS102 with the aid of SK1.

Diodes GR107 and GR108 prevent that transistors TS103 and TS104 are cut off in case of overdrive. To reduce the capacitive load on the first amplifier stage, coupling with the second stage has been effected via emitter followers TS106, TS107.

The second stage consists of symmetrical amplifier TS108 - TS109, of which TS108 has been included in series - and shunt - feedback circuit TS108 - TS111. The gain of this stage can also be varied in steps by varying the emitter resistance of TS108 - TS109.

In combination with the gain control in the emitter circuit of TS101 and TS102 it is thus possible to vary the gain of the pre-amplifier from 200x to 10x, so that deflection coefficients are obtained in the range from 0.5 mV/cm to 10 mV/cm.

The coefficients exceeding 10 mV/cm are adjusted with the input attenuator. The gain of the pre-amplifier is then maintained at 10x.

The control system is adjusted to optimum with potentiometer R147. Diode GR111 prevents that TS111 is cut off in case of overdrive. C111 serves to counteract decay phenomena in the squarewave response.

Via emitter follower TS112 the signal is applied to lowohmic potentiometer circuit R1 - R2 - R156. With the aid of R1 the deflection coefficient 10 mV/cm is adjusted, while with the aid of R2 the signal can be continuously attenuated.

The d.c. level at the emitter of TS112 is kept at 0 V by the control system, because the voltage at this emitter is connected to one side of the 1.11 M ohm resistors via attenuator R157...R162 (see Fig. 12). The attenuation is varied simultaneously with the gain of the pre-amplifier, in the range from 200x...10x. With the aid of R147 the 10x amplification of the amplifier is made identical to the 10x attenuation of the attenuator in the control circuit.

In order to keep the hum of the pre-amplifier at a low level, GR101, GR102, C102, point 3 of RE301, C301, R301, C303, C304, C306, R157 and the cable screenings are earthed at one point.

D. DRIVER STAGE

The signal is applied to emitter follower TS113 from continuous attenuator R2. To minimise drift, the circuit has been arranged symmetrically (TS114).

Shift potentiometer R3 and shift symmetry potentiometer R168 have been included in the base circuit of TS114.

GR113 is fitted to prevent that the base voltage of

TS116 would become excessively high in case of overdrive. For reasons of drift the protection has been made symmetrical (GR114).

Via TS116 and TS117 the signal is subsequently applied symmetrically to the delay line.

E. DELAY LINE

The delay line is included in the symmetrical series and shunt feedback arrangement TS116 - TS118, TS117 - TS119. The delay line input is terminated with resistors R187 and R189 and the delay line output with resistors R191 and R192 and the input impedances of TS118 and TS119.

F. OUTPUT STAGE

The output stage consists of the shunt feedback arrangement (TS118, TS119) and emitter followers TS121 and TS122. Via these emitter followers the signal is applied to the vertical output amplifier in the basic oscilloscope.

The squarewave response is adjusted to optimum with the aid of trimmers C115, C117, C118 and potentiometer R216.

C116 and C121 serve to counteract decay phenomena in the squarewave response.

G. LIMITATION

To prevent overdriving of the Y-amplifier in the basic oscilloscope, the output level and maximum output voltage of the amplifier should meet certain requirements. The output level is fixed at approx. 12.8 V by proper proportioning of the driver stage in the output stage. The minimum and the maximum output voltage are limited by the output stage and the driver stage respectively.

H. TRIGGER AMPLIFIER

The trigger signal is taken from junction R153 - R1. After amplification the trigger signal is applied to time base unit PM 3417 via cathode follower TS129. Diode GR119 limits the base voltage of TS128 in the case of positive drive voltages. Circuit L201 - R233 serves to counteract the influence of parasitic capacitances of the connection plug.

J. CONNECTION PLUG

Networks L106 - C124...L112 - C137 prevent interaction of the circuits via the supply voltages.

Controls and their functions



<i>Adjustment</i>	<i>Control</i>	<i>Auxiliary equipment</i>	<i>Recommended PHILIPS equipment</i>	<i>Section of chapter</i>
Balance	R119	—	—	A
Shift	R168	—	—	A
Grid current compensation	R109	—	—	B
Squarewave response LF	R147	Squarewave generator (10 Hz) Squarewave generator (0.3 Hz)	PM5720-40	C D
Squarewave response HF	C117, C118 R216, C115	Squarewave generator (100 kHz and 1 MHz) rise time ≤ 8 ns)	PM5720-40	E
Attenuator	See table I chapter III	Squarewave generator (20 kHz)	GM2324	F, G
Amplitude characteristic	—	Sinewave generator (15 MHz)	PM5300	H
Deflection	—	Sinewave generator (1 kHz) Oscilloscope Sinewave generator (15 MHz)	PM5100 PM3221 PM5300	J
Trigger voltage	—	Sinewave generator (1 MHz)	PM5300	K

Checking and adjusting

III

A. BALANCE CONTINUOUS ATTENUATOR AND SHIFT ADJUSTMENT

- Set SK1 "Y.AMPL." to position 0.5 mV/cm and SK2 "AC-O-DC" to position 0.
- With the aid of R3 "SHIFT" display a time-base line.
- Adjust R119 so that the time-base line does not move if R2 "Y.AMPL." is turned.
- Set R3 "SHIFT" to the centre position and move the line to the screen centre with the aid of R168.

B. GRID CURRENT COMPENSATION

- Set SK2 "AC-O-DC" to position DC.
- Adjust R109 so that the time-base line is in the screen centre. Tolerance 2 mm.
- Check that the time-base line does neither jump nor oscillate, if SK2 "AC-O-DC" is switched from position 0 to position AC.

C. DEFLECTION COEFFICIENT AMPLIFIER

- Set SK1 "Y.AMPL." to position 10 mV/cm and R1 "Y.-AMPL." to position "CAL."
- Set SK2 "AC-O-DC" to position DC.
- Apply a squarewave voltage of 40 mV_{p-p}, 10 Hz to BU1.
- Adjust R147 so that the top of the displayed squarewave voltage is as flat as possible (ringing $\leq 1\%$).
- Next adjust R1 "GAIN ADJ." so that the trace height is 4 cm.
- Check that the control range of R2 "Y.-AMPL." is 1:2.5 to 1:4.
- Set R2 to position "CAL."
- Successively check, in the positions 5-2-1 and 0.5 mV/cm of SK1, that the top of the displayed squarewave voltage remains flat. Max. tilt 1%.
- Simultaneously check that the accuracy of the attenuator remains within 1% in these positions.

D. SQUAREWAVE RESPONSE L.F.

- Set SK1 "Y.-AMPL." to position 10 mV/cm.
- Connect a squarewave voltage 40 mV_{p-p}, 0.3 Hz to BU1.
- Check that the displayed voltage does not show more than 1% sag (measure in the position X INPUT of SK8 - PM3417).
- Check the squarewave response at 100 Hz and 5 kHz. The trace should not be rounded off. Max. droop 1%.

E. SQUAREWAVE RESPONSE H.F.

- Adjust trimmer C115 to max. capacitance.
- Connect to BU1 a squarewave voltage of 40 mV_{p-p}, 100 kHz, having a rise time of 7 to 8 ns.
- Adjust trimmers C117 and C118 so that the displayed squarewave voltage has a minimum rise time, that just no overshoot occurs and that the drop is minimum. If necessary, select an other value for resistors R199 and R197.
- Increase the frequency to 1 MHz.
- With the aid of R216 and C115 adjust for proper squarewave response (just no overshoot; minimum droop). If necessary readjust trimmers C117 and C118 and repeat the check under point E until optimum response is obtained.
- Then check the squarewave response in positions 5-2-1 and 0.5 mV/cm of SK1 "Y.-AMPL.". Max. permissible overshoot 1%.
- At normal brightness check that the effective delay of the delay cable is ≥ 40 ns.

F. SQUAREWAVE RESPONSE ATTENUATOR

- Set R2 "Y.-AMPL." to position "CAL."
- Connect to BU1 a squarewave voltage of 20 kHz, having a rise time of 20 to 30 ns.
- In positions 20 mV/cm...10 V/cm (SK1 "Y.-AMPL.") and at a trace height of 4 cm, adjust the attenuator trimmers - see table I - so that just no overshoot occurs.
- Also check that the accuracy of the attenuator lies within approx 2.5%.

TABLE I

Position SK1 "Y.-AMPL." Controls, see also Fig. 4
Squarewave response Input capacitance

20 mV/cm	C29	C31
50 mV/cm	C33	C34
100 mV/cm	C37	C38
200 mV/cm	C41	C42
500 mV/cm	C44	C46
1 V/cm	C48	C49
2 V/cm	C52	C53
5 V/cm	C56	C57
10 V/cm	C59	C61

G. INPUT CAPACITANCE

- Set SK1 "Y.-AMPL." to position 0.5 mV/cm.
- Connect to BU1 a squarewave voltage of 20 mV_{p-p}, 20 kHz, via an attenuator measuring probe PM 9326.
- Adjust the measuring probe trimmer so that the displayed squarewave voltage just does not show any overshoot and then check the squarewave response in positions 20 mV/cm...10 V/cm. Controls table I.
- Check the attenuation of the measuring probe. This should be 10x, $\pm 2,5\%$.
- Also check the squarewave response in positions 1-2-5 and 10 mV/cm via the measuring probe.

H. AMPLITUDE CHARACTERISTIC

- Set SK1 "Y.-AMPL." to position 10 mV/cm.
- Set SK2 "AC-O-DC" to position DC.
- Apply to BU1 a sinewave voltage of 40 mV_{p-p}; 15 MHz.
- Check that the trace height is > 2.8 cm.
- Check that the blocking capacitor is switched in in position AC of SK2.

J. DRIVE AND SHIFT

- Set SK1 "Y.-AMPL." to position 5 mV/cm.
- Set SK2 "AC-O-DC" to position DC.
- Apply to BU1 a sinewave voltage of 120 mV_{p-p}, symmetrical with respect to earth. Select such a time coefficient that 2 or 3 periods are displayed.
- Check that with shift control R3 the peaks of the signal can be displayed within the measuring graticule without distortion.
- Connect an oscilloscope to point 32 of socket B and check that the output level is max. +14.75 V

and min. +10.85 V with R3 "SHIFT" in the mid position.

- Next apply a voltage of 15 MHz to BU1 so that a trace height of 4 cm is obtained.
- Double the input voltage and check that the deflection is 8 cm (-5%).

K. TRIGGER VOLTAGE

- Set the time-base line to the screen centre with the aid of R3 "SHIFT".
- Set R2 "Y.-AMPL." to position "CAL."
- Apply a sinewave voltage of 1 MHz to BU1 so that a trace height of 2 mm is obtained.
- Set SK2 "TRIGGER MODE" of the PM 3417 to position HF.
- Check that a properly triggered trace can be obtained with R3 "LEVEL"-PM 3417.
- Set SK2 (of the PM 3417) to position DC.
- Adjust again for a triggered trace with the aid of R3 "LEVEL"-PM 3417.
- Check that the d.c. level has not shifted more than 1 mm.

L. HUM AND NOISE

- Set SK1 "Y.-AMPL." to position 0.5 mV/cm and SK2 "AC-O-DC" to position 0.
- Set R2 "Y.-AMPL." to position "CAL."
- Adjust the time coefficient at 1 ms/cm.
- Check that the noise amplitude is ≤ 2 mm.
- Set SK2 to position DC and check that the noise amplitude is ≤ 3 mm.
- Adjust for a time coefficient of 200 ms/cm.
- Measure the hum at a mains voltage that has been increased by 10%.
- Requirement ≥ 2 mm.

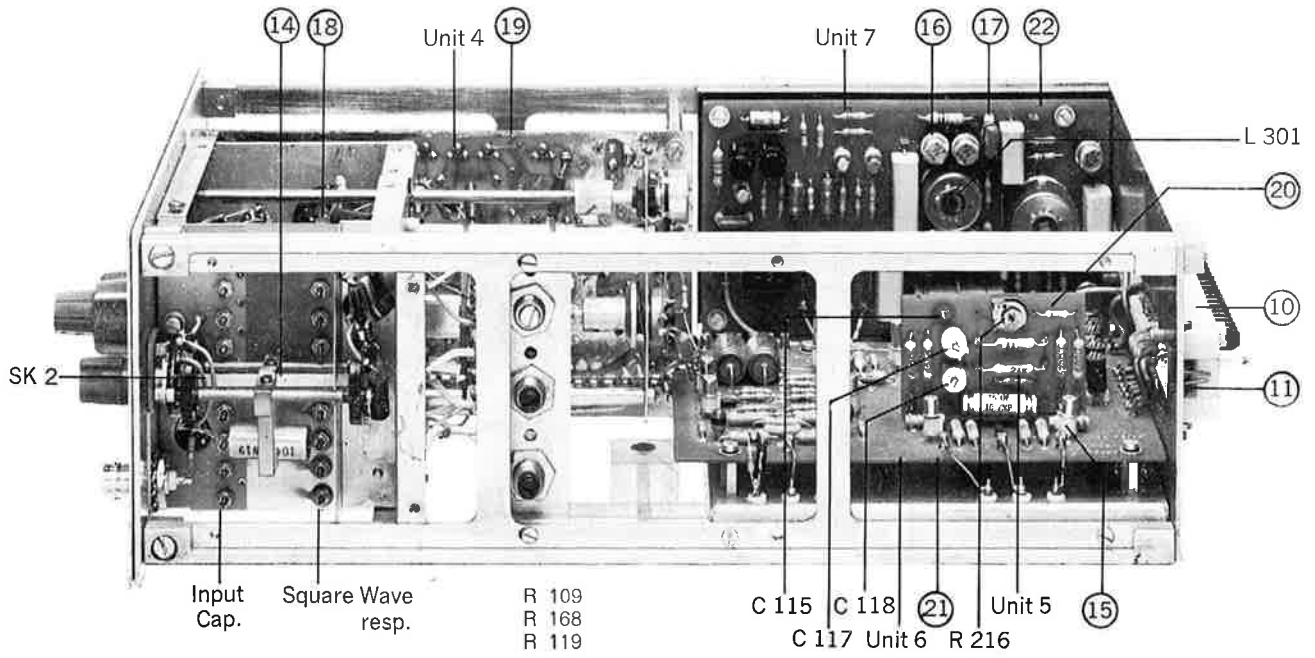


Fig. 3. Side view

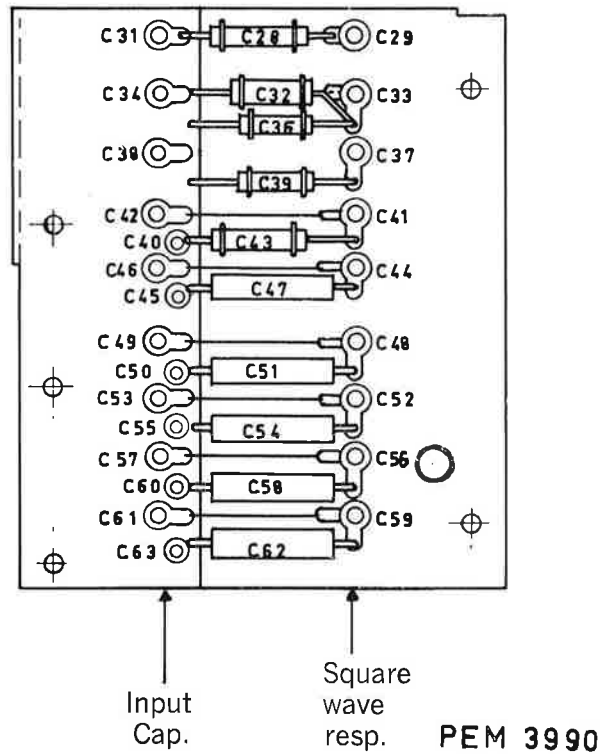


Fig. 4. Layout of trimming capacitors (attenuator)

Parts list

IV

A. MECHANICAL

Item	Fig	Qty	Code number	Description	Version	
					/00	/01
1	2	1	4822 413 40279	Selector knob (SK1)	*	-
		1	4822 413 40112	Selector knob (SK1)	-	*
2	2	1	4822 413 30085	Knob (R2)	*	*
3	2	1	4822 413 70039	Cap (red line) (R2)	*	*
4	2	1	4822 413 30082	Knob (R3)	*	*
5	2	1	4822 413 30084	Selector knob (SK2)	*	*
6	2	2	4822 413 70038	Cap (black line) (R3, SK2)	*	*
7	2	1	4822 265 10004	BN Connector (BU1)	*	*
8	2	1	4822 454 40038	Text plate	-	*
9	2	1	4822 265 60002	Connector (32 pole)	*	*
10	3	1	4822 266 90317	Block (for item 9)	*	*
11	3	2	4822 492 40231	Spring (for item 9)	*	*
12	5	153 cm	4822 320 40022 (per meter)	Delay cable	*	*
13	5	1	4822 273 80089	Selector SK1 (OAK)	*	-
		1	4822 273 80109	Selector SK1 (J.R.)	-	*
14	3	1	4822 273 40169	Selector SK2	*	*
15	3	25	4822 255 40012	Transistor holder (small)	*	*
16	3	8	4822 255 40015	Transistor holder (large)	*	*
17	3	45	4822 535 90178	Ceramic bead (insul.)	*	*
18	3	1	4822 255 70076	Valve holder (B101)	*	*
19	3	1	4822 214 10036	Printed circuit, Unit 4	*	*
20	3	1	4822 214 10037	Printed circuit, Unit 5	*	-
		1	4822 214 10041	Printed circuit, Unit 5	-	*
21	3	1	4822 214 10038	Printed circuit, Unit 6	*	*
22	3	1	4822 214 10039	Printed circuit, Unit 7	*	*

Note: Printed circuits are delivered without transistors, valve, chopper and choice resistors.

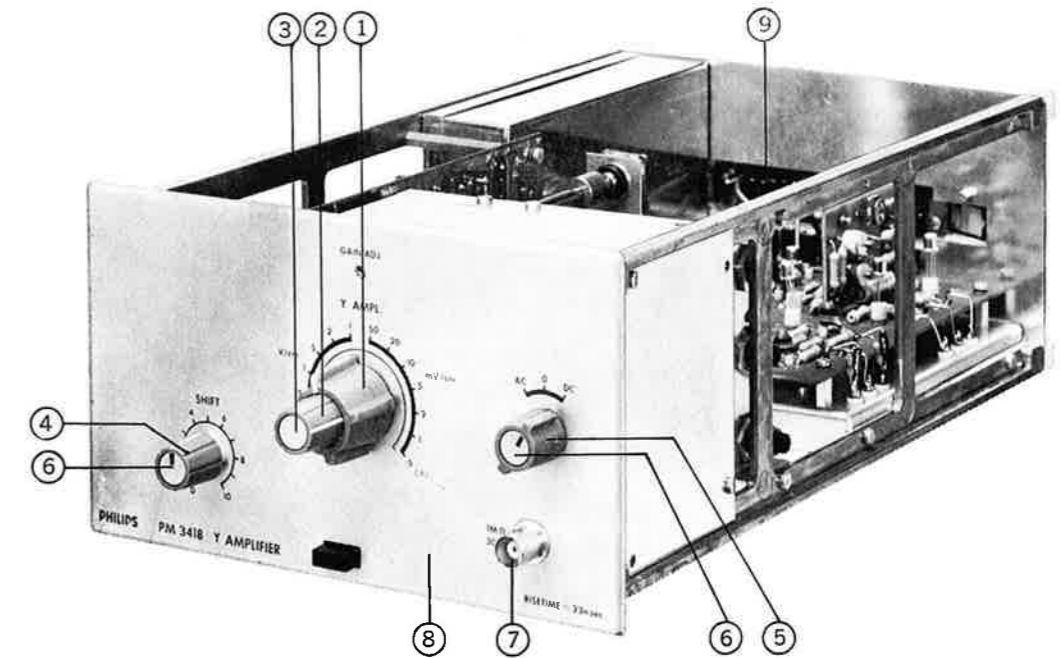


Fig. 2. Front view

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 principschema 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 spécifications 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	} 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			} 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 MΩ, 2% ≤ 10 MΩ, 5%			Wire-wound resistor Drahtwiderstand Draadgewonden weerstand Résistance bobinée Resistencia bobinada	} 0,4 – 1,8 W	0,5%
	Carbon resistor E12 series Kohleschichtwiderstand, Reihe E12 Koolweerstand E12 reeks Résistance au carbone, série E12 Resistencia de carbón, serie E12		} 0,5 W ≤ 1,5 MΩ, 5% > 1,5 MΩ, 10%		Wire-wound resistor Drahtwiderstand Draadgewonden weerstand Résistance bobinée Resistencia bobinada		
	Wire-wound resistor Drahtwiderstand Draadgewonden weerstand Résistance bobinée Resistencia bobinada	} 10 W		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			Polyester capacitor Polyesterkondensator Polyesterkondensator Condensateur au polyester Condensador polyester	
	Ceramic capacitor, "pin-up" Keramikkondensator "Pin-up" (Perltyp) Keramische kondensator "Pin-up" type Condensateur céramique, type perle Condensador cerámico, versión "colgable"	} 500 V			Flat-foil polyester capacitor Miniatur-Polyesterkondensator (flach) Platte miniatuur polyesterkondensator Condensateur au polyester, type plat Condensador polyester, tipo de placas planas	} 250 V	
	"Microplate" ceramic capacitor Miniatur-Scheibenkondensator "Microplate" keramische kondensator Condensateur céramique "microplaca" Condensador cerámico "microplaca"		} 30 V		Paper capacitor Papierkondensator Papierkondensator Condensateur au papier Condensador de papel		} 1000 V
	Mica capacitor Glimmerkondensator Micakondensator Condensateur au mica Condensador de mica	} 500 V			Wire-wound trimmer Drahttrimmer Draadgewonden trimmer Trimmer à fil Trimmer bobinado	} 500 V	
	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

<i>Item</i>	<i>Code number</i>	<i>Value</i>	<i>%</i>	<i>Watt</i>	<i>Description</i>
R1	4822 101 20184	100 Ω			Potentiometer lin.
R2	4822 101 20185	500 Ω			Potentiometer lin.
R3	4822 101 20109	10 $k\Omega$			Potentiometer lin.
R27	4822 111 20087	0.5 $M\Omega$	1	$\frac{1}{8}$	Carbon
R28	4822 111 20121	1 $M\Omega$	1	$\frac{1}{10}$	Carbon
R29	4822 111 20098	0.8 $M\Omega$	1	$\frac{1}{4}$	Carbon
R31	4822 111 20083	0,25 $M\Omega$	1	$\frac{1}{8}$	Carbon
R32	4822 111 20148	0,9 $M\Omega$	1	$\frac{1}{4}$	Carbon
R33	4822 111 20115	111 $k\Omega$	1	$\frac{1}{8}$	Carbon
R34	4822 111 20099	0,95 $M\Omega$	1	$\frac{1}{4}$	Carbon
R36	4822 111 20136	52.6 $k\Omega$	1	$\frac{1}{8}$	Carbon
R37	4822 111 20151	980 $k\Omega$	1	$\frac{1}{4}$	Carbon
R38	4822 111 20109	20.4 $k\Omega$	1	$\frac{1}{8}$	Carbon
R39	4822 111 20152	990 $k\Omega$	1	$\frac{1}{4}$	Carbon
R41	4822 111 20107	10.1 $k\Omega$	1	$\frac{1}{8}$	Carbon
R42	4822 111 20237	995 $k\Omega$	1	$\frac{1}{4}$	Carbon
R43	4822 111 20238	5030 Ω	1	$\frac{1}{8}$	Carbon
R44	4822 111 20239	998 $k\Omega$	1	$\frac{1}{4}$	Carbon
R47	4822 111 20244	999 $k\Omega$	1	$\frac{1}{4}$	Carbon
R101, R104	4822 116 50022	1 $M\Omega$	2	$\frac{1}{4}$	Metal film
R109	4822 101 20112	50 $k\Omega$			Potentiometer lin.
R119	4822 103 20094	10 $k\Omega$		3	Potentiometer wire wound
R126	4822 116 50236	861 Ω	1	$\frac{1}{8}$	Metal film
R127	4822 116 50237	284 Ω	1	$\frac{1}{8}$	Metal film
R128	4822 116 50174	249 Ω	1	$\frac{1}{8}$	Metal film
R145	4822 116 50174	249 Ω	1	$\frac{1}{8}$	Metal film
R147	4822 100 10058	500 Ω			Potentiometer lin.
R157	4822 116 50239	5970 Ω	1	$\frac{1}{8}$	Metal film
R158	4822 116 50241	3240 Ω	1	$\frac{1}{8}$	Metal film
R159	4822 116 50242	1040 Ω	1	$\frac{1}{8}$	Metal film
R160	4822 116 50095	511 Ω	1	$\frac{1}{8}$	Metal film
R161	4822 116 50243	505 Ω	1	$\frac{1}{8}$	Metal film
R162	4822 116 50244	0.1 $M\Omega$	1	$\frac{1}{8}$	Metal film
R168	4822 101 20112	50 $k\Omega$			Potentiometer lin.
R216	4822 100 10029	2 $k\Omega$			Potentiometer lin.

CAPACITORS

<i>Item</i>	<i>Code number</i>	<i>Value</i>	<i>%</i>	<i>Voltage</i>	<i>Description</i>
C26	4822 121 20083	0.1 μ F		600	Paper
C27, 29, 31 C33, 34, 37 C38, 41, 42 C44, 46, 48 C49, 52, 53 C56, 57, 59 C61	4822 125 60045	68 pF			Trimmer
C101	4822 121 40059	0.1 μ F		250	Plate
C102	4822 121 40047	0.01 μ F		250	Plate
C104	4822 121 40044	0.56 μ F		250	Polyester
C106	4822 121 40093	0.056 μ F		250	Polyester
C107	4822 124 20072	200 μ F		10	Electrolyt
C108, 122	4822 121 40057	0.068 μ F		250	Plate
C109	4822 124 20095	2.5 μ F		64	Electrolyt
C115	4822 125 60039	3 pF			Trimmer
C117	4822 125 50026	10 pF			Trimmer
C118	4822 125 50005	20 pF			Trimmer
C119	4822 124 10049	25 μ F		6	Electrolyt. (bipolar) only /00 version
C124, 127	4822 124 20016	80 μ F		25	Electrolyt.
C125, 126	4822 124 10091	33 μ F		10	Tantalum only /01 version
C129	4822 124 20198	20 μ F		150	Electrolyt.
C132, 134	4822 124 20097	32 μ F		64	Electrolyt.
C136, 137	4822 124 20072	200 μ F		10	Electrolyt.
C302	4822 121 40047	0.01 μ F		250	Plate
C303, 304 C306, 316	4822 124 20052	12.5 μ F		25	Electrolyt.
C307, 311	4822 121 40015	0.47 μ F		250	Polyester
C308, 309	4822 121 40059	0.1 μ F		250	Polyester
C312	4822 124 20182	250 μ F		40	Electrolyt.
C313	4822 121 40098	0.39 μ F		250	Polyester
C314	4822 121 40052	0.039 μ F		250	Plate
C317	4822 121 40061	0.22 μ F		250	Polyester

TUBES; SEMICONDUCTORS

<i>Item</i>	<i>Type</i>	<i>Description</i>	<i>Remarks</i>
B101	E188CC	Duo triode	
GR101, 102	OA202	Silicon diode	
GR103	BA100	Silicon diode	
GR104, 106	BAY38	Silicon diode	
GR107, 108, 111	OA92	Germanium diode	
GR109	BZY63	Zener diode	
GR112	BZY60	Zener diode	
GR113, 114	AAZ13	Germanium diode	
GR116	BZY63	Zener diode	to be selected for $9.1V < V_Z < 9.3V$ at $I_Z = 5mA$
GR119	OA92	Germanium diode	
TS101, 102 TS103, 104	BF115	Silicon transistor	To be selected for $h_{fe} = 100$ at $V_{ce} = V$ and $I_c = 1 mA$
TS106, 107	BF115	Silicon transistor	
TS108, 109	AF121	Germanium transistor	
TS111	AF121	Germanium transistor	To be selected for $h_{fe} = 60$ at $-V_{ce} = 5V$ and $-I_c = 1 mA$.
TS112	BSX20	Silicon transistor	
TS113, 114 TS116, 117 TS118, 119	BF115	Silicon transistor	
TS121, 122	BF173	Silicon transistor	
TS126, 127	AF121	Germanium transistor	
TS128	BF115	Silicon transistor	
TS129	BF115	Silicon transistor	To be selected for $h_{fe} = 100$ at $V_{ce} = 5V$ and $I_c = 1 mA$.
TS301	2N930	Silicon transistor	
TS302, 303	BCY32	Silicon transistor	
TS304, 306	BC107	Silicon transistor	
TS307, 308 TS309, 311	ASY75	Symmetrical Ge-transistor	
TS312, 313	ASY77	Germanium transistor	

COILS

<i>Item</i>	<i>Code number</i>	<i>Value</i>	<i>Description</i>
L101	4822 526 10024		Bead
L102, 103	4822 157 50049	1.5 μ H	Coil
L106, 107 L108, 109 L111, 112 L201	4822 526 10036		Bead
L301	4822 158 30102		Oscillator coil
L302	4822 158 40033		Demodulator coil
Relay R301	4822 280 10025		Chopper

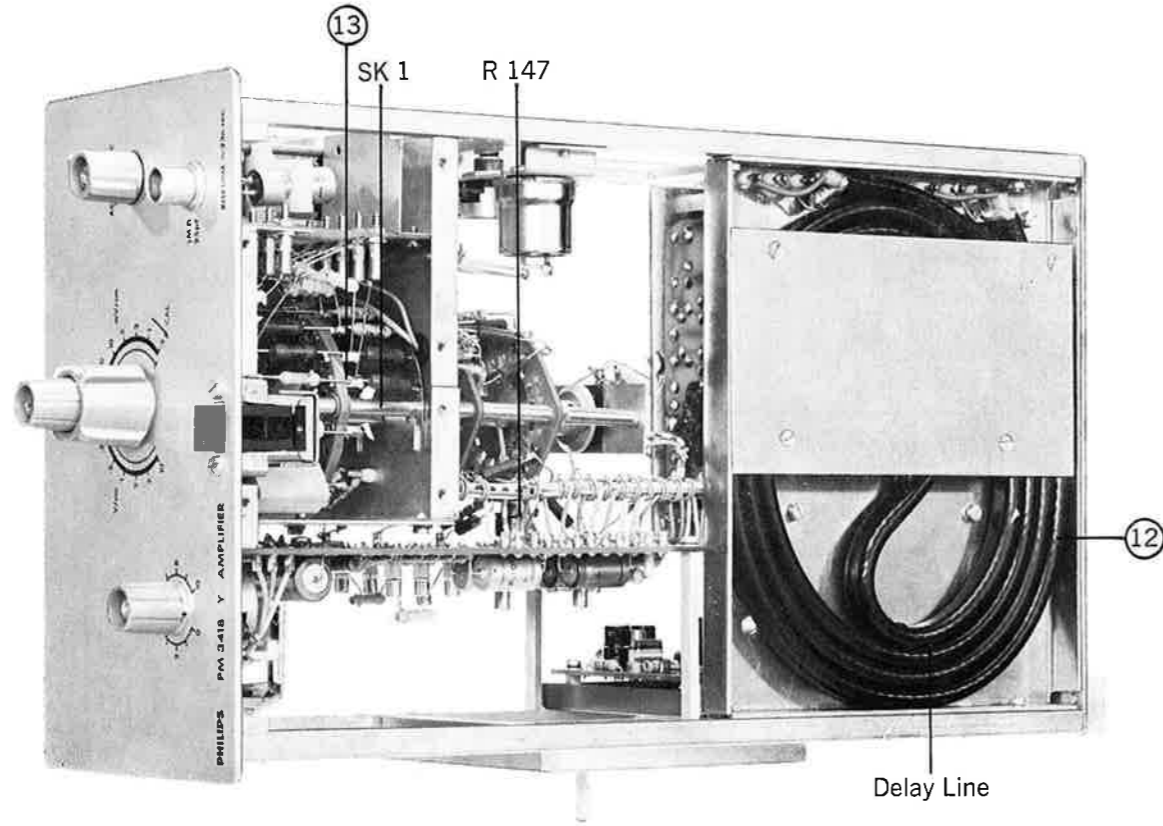


Fig. 5. Bottom view

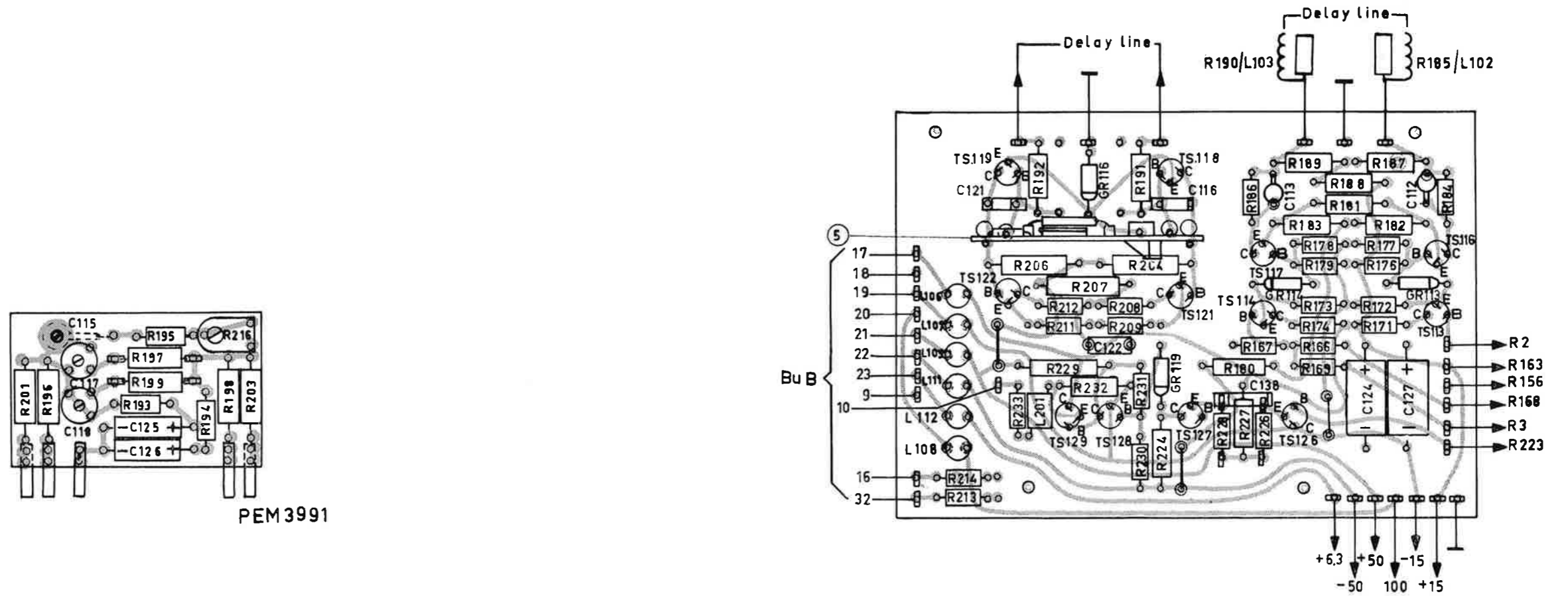
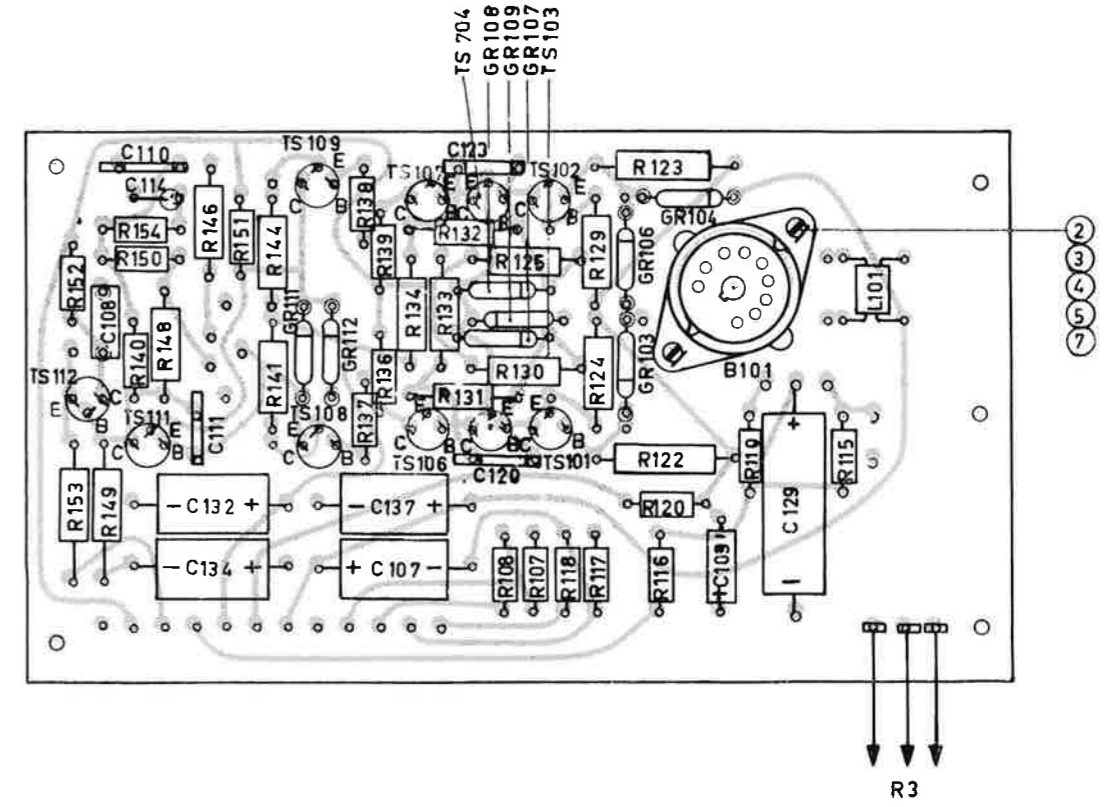


Fig. 7. Printed circuit. Unit 5

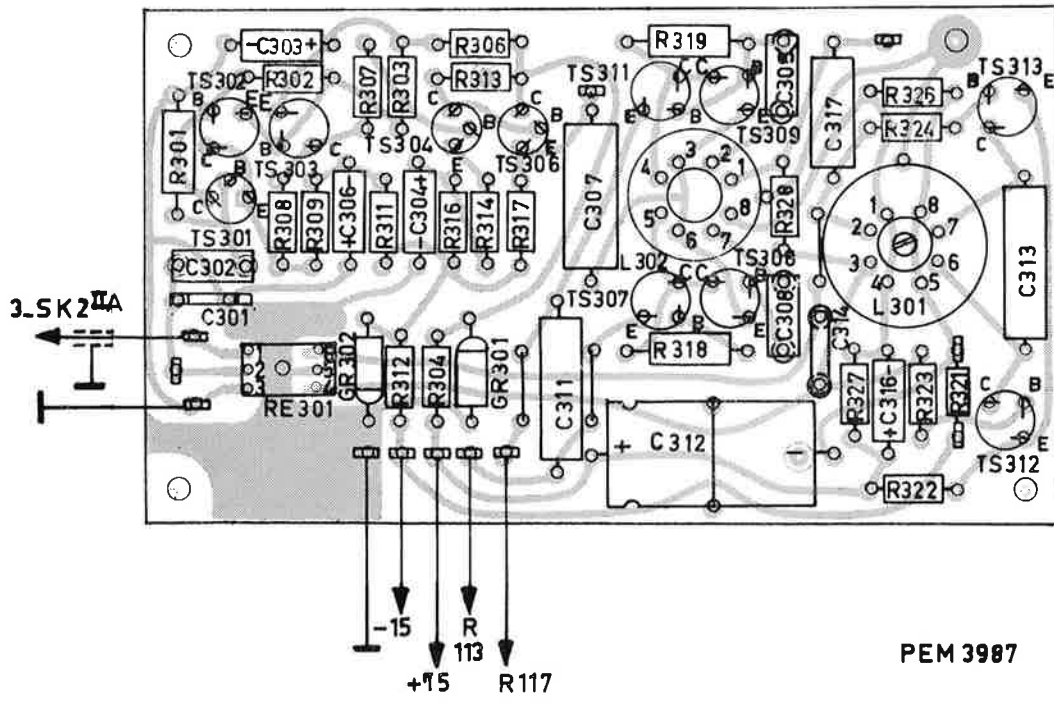


Fig. 9. Printed circuit. Unit 7

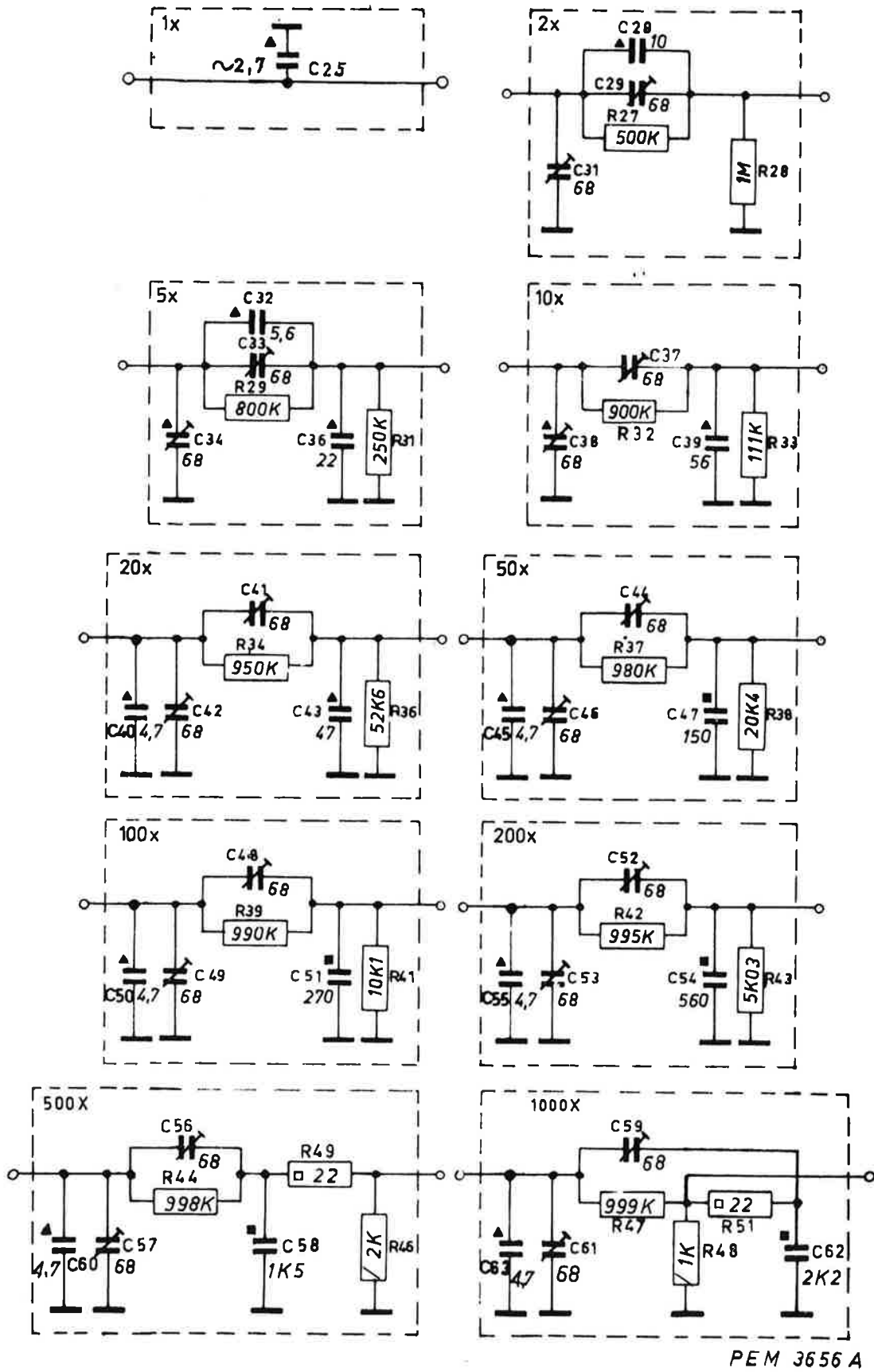


Fig. 10. Circuit diagram of the attenuator

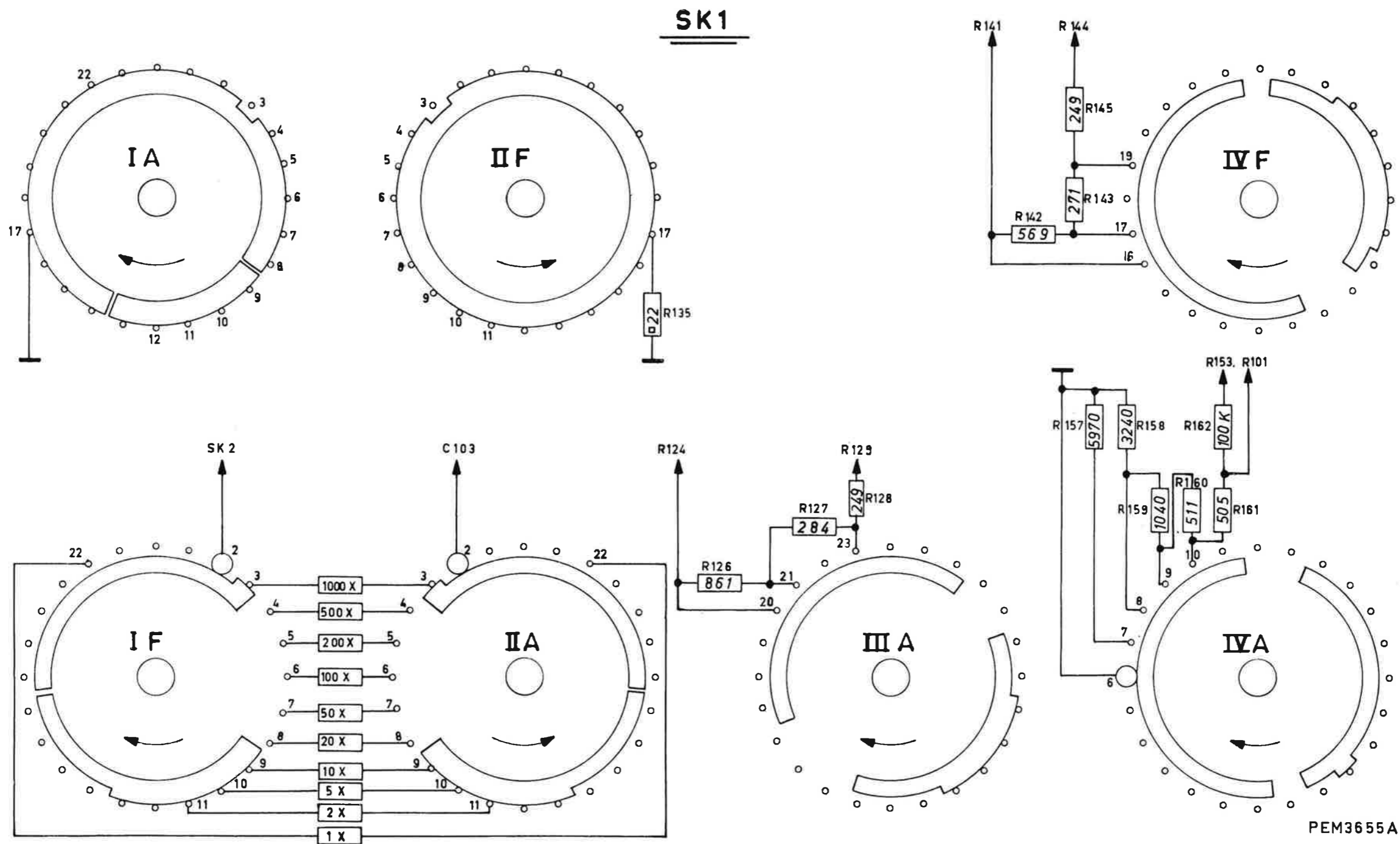


Fig. 11. Lay-out of attenuator switch SK1

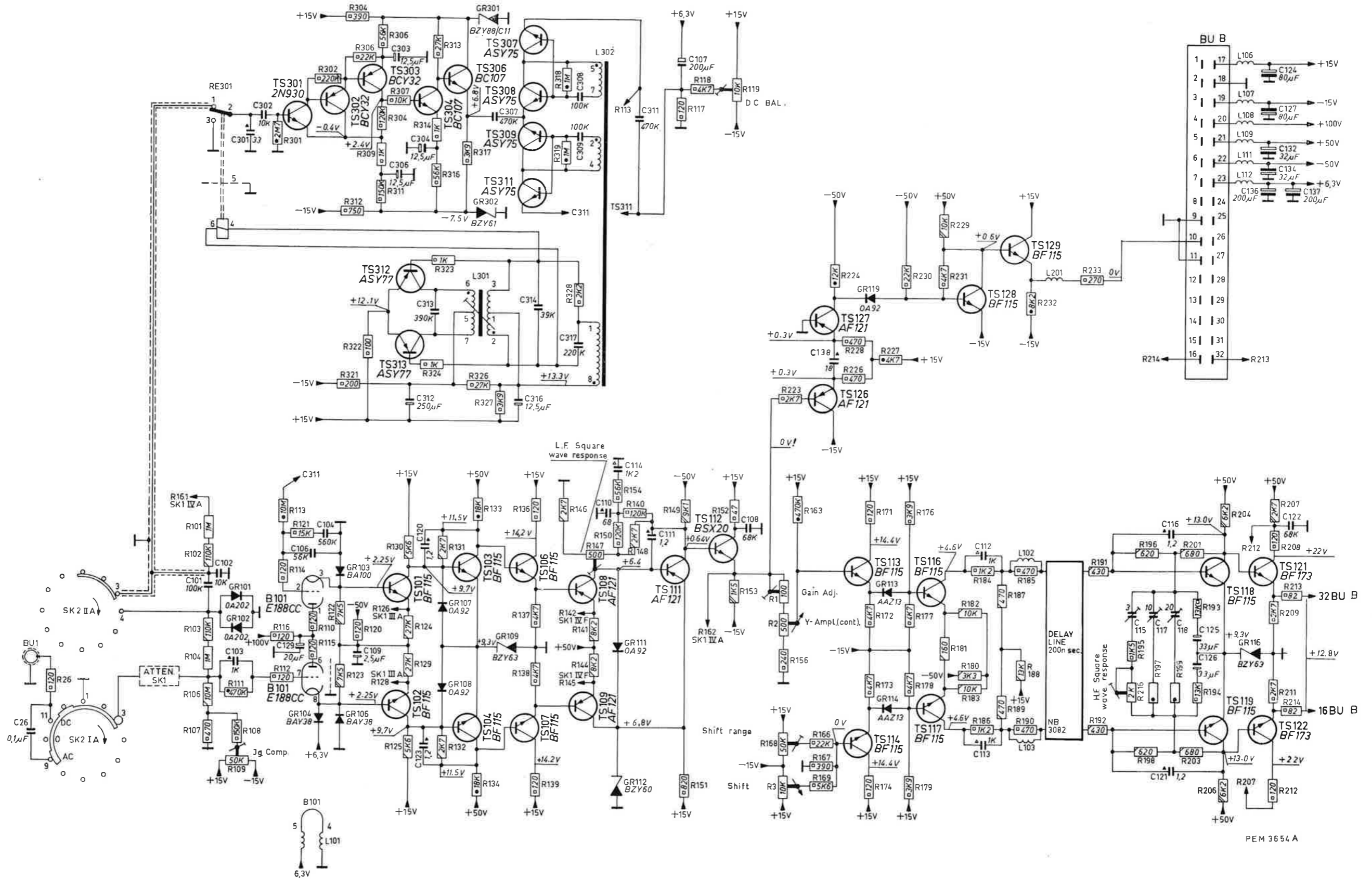


Fig. 12. Circuit diagram of the plug-in unit.