PHILIPS *Service*

transistor tester

PP3000

PHILIPS 1964

A. GENERAL

A1. Purpose

The PP 3000 is a simple apparatus for rapid check of transistors, which is specially suitable for use in laboratories ans service shops. For data about the use and control, please consult the directions for use.

A2. List of figures

A3. Technical data

Note

The data below are supplied by the commercial department and indicate the properties of the average apparatus.

SERVICE INFORMATION										

Printed in Holland
93 711 11.1.10

A3a. Measuring ranges

(Both for PNP and NPN transistors)

Measurement		Currents	LP	P
			Pc ≤ 200 mW	Pc>200 mW
SC	Check for short-circuit between emitter and collector.	normal current (up to red line)	0-500 µA	0-2.5 mA
		Short-circuit current	ca. 2.5 mA	ca. 10 mA
I_{CEO}	Collector current with open base	Collector current	0-500 µA	0-2.5 mA
∝FE	Static (short-circuit) current gain factor ($\propto FE = \frac{Ic}{Ib}$)	∝ FE	0-200	0-200
		Collector current	0-5 mA	0-200 mA
		Base current	25 µA	1 mA

A3b. Supply

The apparatus is suitable for the supply from AC mains of 110, 125, 145, 200, 220 and 245 V.
Mains frequency 50-60 c/s.
The power consumed from the mains is approx. 3 W.

A3c. Dimensions

Length : 195 mm
Width : 135 mm
Height : 100 mm
} Knobs and bracket included

A3d. Weight

approx. 2.4 kg.

B. DESCRIPTION OF THE CIRCUIT DIAGRAM

B1. Principle

Testing of the transistors takes place in an "earthed" emitter-circuit whilst the measuring instrument has been incorporated in the collector lead.
The supply voltages necessary for testing are drawn from two rectifier circuits.

B2. Switch SK3 (PNP-NPN)

This switch serves for the reversal of polarity of the supply voltages.
In the position PNP the collector (and at the ∝FE measurement also the base) is negative with respect to the emitter.
In the position NPN the collector (and at the ∝FE measurement also the base) is positive with respect to the emitter.

B3. Switch SK4 (LP-P)

a. In the position LP transistors can be tested with a maximum collector dissipation of 200 mW.
With the short-circuit test (SK5 in position SC) R8 (1.2 kΩ) is connected in the collector circuit, so that the short-circuit current is limited up to approximately 2.5 mA.
During the ∝ FE measurement (SK5 in position ∝ FE) R6 (1 MΩ) has been incorporated in the base circuit; the constant base current is then 25 µA at a voltage (with respect to the emitter) of + or - 25 V.

b. In the position P transistors can be tested with a collector dissipation greater than 200 mW.
With the short-circuit test (SK5 in position SC) R7 (220 Ω) has been connected in the collector circuit so that the short-circuit current is limited up to about 10 mA.
During ∝FE measurements (SK5 in position ∝ FE) R5 (24 kΩ) is incorporated in the base circuit; the constant base current is then 1 mA at a voltage (with respect to the emitter) of + or - 24 V.

B4. Switch SK5 (SC - I_{CEO} - ∝FE)

a. In the position SC the transistor is tested for short-circuit between emitter and collector (see fig. 2).
The normal current is maximum 500 µA (LP) or 2.5 mA (P).
The values are reached when the point of the meter comes on to the red mark. In the case of short-circuit a current is limited (see former point).

b. In the position I_{CEO}, just as in the former position, the collector current is measured at open base (see fig. 3).
Range : 0-500 µA (LP) or
0-2.5 mA (P)

c. In the position ∝ FE the static current gain factor is measured with (via the measuring instrument) short-circuited collector, (see fig. 4).

$\alpha FE = \frac{Ic}{Ib}$; range 0 - 200

Constant base current : 25 µA (LP) or mA (P).
Collector current : max. 5 mA (LP) or max. 200 mA (P).

B5. Measuring instrument

Moving coil meter 300 µA full scale deflection with non-linear scale.
The internal resistance (correction resistance included) is 400 Ω ± 2%.
The moving coil is protected against overcharge by a silicium-diode connected in parallel (GR3 : OA200).

B6. Supply

The rectifying circuit GR2 supplies a voltage of 2 volt. R4 serves to keep this voltage constant at the charge variations. The supply part GR1 supplies a voltage of 25 V, which is adjusted to the correct value with R2.

C. REPLACEMENT OF PARTS

C1. Uncasing

a. Undo the four screws at the lower side of the casing.

b. The rear cover can now be removed after the mains cord has been pushed somewhat inwards through the opening in the rear cover.

C2. Mounting plate with printed wiring

a. Undo the four screws with which the hard paper plate has been fixed to the front panel. (The screws A in fig. 6).

b. Remove the three knobs on the spindles of the switches SK3-SK4-SK5.

c. The mounting plate can now be pulled upwards about 2 cm. and then turned over. The plate is now still connected electrically to the front panel via 6 wires.
All parts are now accessible.

C3. Replacement of the supply transformer

The supply transformer is fixed with four screws on the hard paper plate. As a service part the transformer is supplied complete with voltage adaptor and fuse holder.

C4. Replacement of the switches SK3-SK4-SK5

In order to be able to replace the switches SK3-SK4-SK5 the supply transformer must be removed. Then the two screws are accessible with which each switch is fixed to the hard paper plate. The contact springs of the switches are all the same type. For the correct position of these springs into the wafers, see fig. 8.

C5. Replacement of the moving coil instrument

As a service part the moving coil instrument is supplied complete with adjusted correction resistor.
When 300 µA is sent through the meter with correction resistance (in series with calibration meter) full deflection must be obtained. If necessary readjust the magnetic shunt.

Note

Some hints for measuring and treating printed wiring have been published in service information Cd 201.

D. CHECK AND ADJUSTMENT

D1. Supply

Put the voltage adaptor to 220 V and connect it to 220 V ± 1% (if necessary via a regulating transformer).
Connect the apparatus (SK1); the pilot lamp La1 should burn.

Mains current consumed : max. 36 mA.
Check the following direct voltages:

across C1 : approx. 25 V
across C2 : 2 V ± 10%

N.B. Measure the above voltages when nothing has been connected to the sockets E.B.C.

D2. Adjustment of the base current

SK3 on PNP.
SK4 on LP.
SK5 on αFE.

Connect a universal meter between B and E (e.g. P 817 00). (B= - and E = +).
Adjust the base current to 25 µA with the aid of R2.
Universal meter on higher range.
SK4 on P.
The base current should now be 1 mA.
When the deviation is greater than 2% a compromise adjustment of R2 must be found, in which case the deviations of the base current both with SK4 on LP and on P are as favourable as possible.

SK3 on NPN
Change the polarity of the universal meter (B = + and E = -)
Now the pointer of the meter should deflect in the same direction.

D3. Check of the measuring ranges

D3a. Low power (LP)

SK3 on PNP
SK4 on LP

SK5 on SC

Short-circuit the sockets E and C. The meter should show nearly full defleqtion.
Remove the short-circuit and connect a series connection of the universal meter and a variable resistance (of about 20 kΩ) between E and C (E = + and C = -).
Adjust the variable resistance so that the current through the universal meter is 0.5 mA.
The pointer of the meter of the PP 3000 should then be on the red scale mark (tolerance: ± 1 scale division of the I_{CEO} - scale).

SK5 on I_{CEO}

Make the qurrent through the universal meter 150 µA (with the aid of the variable resistor). The pointer of the PP 3000 must indicate 60 on the ∝ FE scale (tolerance ± 1 scale division of this scale).

SK5 on ∝ FE

Make the current through the universal meter 1.5 mA.
The pointer of the PP 3000 must indicate 60 on the ∝ FE scale (tolerance ± 1 scale division of this scale).

D3b. High power (P)

SK3 on PNP
SK4 on P

SK5 on SC

Short-circuit the sockets E and C. The meter must show approxiamately full deflection.
Remove the short-circuit and connect a series connection of a universal meter and a variable resistor (of about 20 kΩ) between E and C.
(E = + and C = -).
Make the current through the universal meter 2.5 mA with the aid of the variable resistor. The pointer of the PP 3000 must then be on the red mark. (tolerance ± 1 scale division of the I_{CEO} scale).

SK5 on I_{CEO}

Make the current through the universal meter 750 µA.
The pointer of the PP 3000 must indicate 60 on the ∝ FE scale.
(tolerance ± 1 scale division of this scale).

SK5 on ∝ FE

Make the current through the universal meter 60 mA.
The pointer of the PP 3000 must indicate 60 on the ∝ FE scale (tolerance ± 1 scale division of this scale).

D4. Scale check

A check on the scale trend can follow the above measurement without modification of the measuring arrangement.
Make the current through the universal meter 200 mA (SK5 on ∝ FE).

Note

When this value cannot be reached by the rest resistance of the variable resistor used it will be necessary to make use of a wire wound potentiometer of about 20 Ω which has a very small rest resistance.

On the ∝ FE scale of the PP 3000 200 must be indicated (tolerance ± 1 scale division of this scale).
Check points 120-100-80-60-40 and 20 in the same manner (tolerance ± 1 scale division).

BH/PB

Fig.	Item	Qty.	Description	Code number	S
5	1	1	Transistor clamping device	ZD 303 22	*
5	2	1	Indication plate with 3 fixing screws	A9 024 74	**
5	3	1	Lens	A9 867 15	**
5	4	3	Knob	ZD 406 91	*
5	5	2	Bolt (special; with fixing material)	A9 024 73	**
5	6	2	Bolt (special)	ZD 505 18	**
5	7	1	Casing	ZD 303 23	*
5	8	1	Front panel (with window, lens and correction screw)	A9 024 71	*
6	9	1	Bush holder with 3 bushes	A9 024 72	*
6	10	1	Plate with printed wiring	ZD 303 19	*
6	11	1	Cap	ZD 505 20	**
7	12	1	Mains switch SK1	970/3x250	*
-	-	4	Rubber foot (for item 7)	P5 675 05	**
-	-	1	Screw for mechanical zero adjustment of the instrument	23 653 37	*
-	-	-	Clamping ring on the above screw	E6 145 44	*
-	-	1	Switch SK3 (complete)	ZD 407 17	*
-	-	1	Switch SK4 (complete)	ZD 407 18	*
-	-	1	Switch SK5 (complete)	ZD 407 19	*
-	-	9	Contact spring in the switch wafers	ZD 303 01	*
-	-	1	Voltage adaptor	A3 228 85	*
-	-	-	Service moving coil system with correction resistor	E6 220 47	*

BH/PB

Explanation of column S of the list of parts.

Parts not marked with an asterisk, viz.:

a. Almost all the electrical parts;

b. Damageable mechanical parts, or parts that are subject to wear.

These parts have to be stored by the Service Department in the country concerned, or by the user of the apparatus.

2. (*) Parts, marked with one asterisk.

In general, these parts have a long or unlimited life time, but they are essential for the good working of the apparatus.
Whether a small stock of these parts is taken in store depends on the following factors:

a. The number of the apparatus present in the country concerned;

b. The necessity for the apparatus to be continously in operation, or to be ready for operation.

c. The delivery times of the parts in connection with the import possibilities into the country concerned, and the time for transport.

3. (**) Parts, marked with two asterisks.

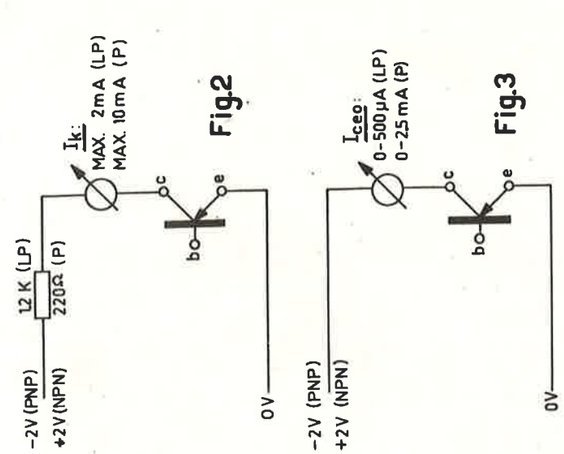
These parts have a long or unlimited life time, and are not essential for the good working of the apparatus. Generally, these parts are not stored on the spot.

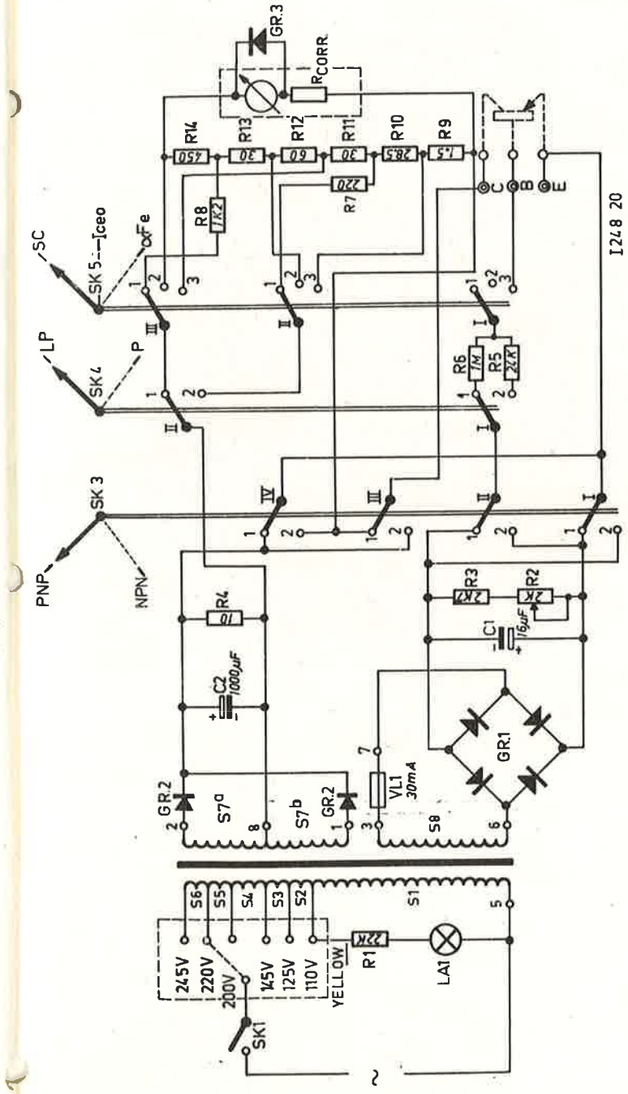
GrB/PvE/29-5-'58.

No.	Type	Value	%	Volt	Service part
C1	Electrolytic	16 µF	-	40	AC 5716/16
C2	" ;(Hunts L37/1-JFN34T)	1000 µF	-	12	A9 024 75

No.	Type	Value	%	Watt	Service part
R1	Carbon	22 kΩ	10	0.5	901/22K
R2	Pot.meter, wire wound	2 kΩ	-	1	B8 310 04A/2K
R3	Carbon	2.7 kΩ	10	0.5	901/2K7
R4	"	10 Ω	10	1.5	B8 305 08B/10E
R5	"	24 kΩ	1	0.25	901/24K
R6	"	1 MΩ	1	0.25	901/1M
R7	"	220 Ω	10	0.5	901/220E
R8	"	1.2 kΩ	10	0.5	901/1K2
R9	Wire wound	1.5 Ω	1	0.4	901/W1E5
R10	" " 28.5Ω	30 Ω	1	0.4	901/W30E
	" "	560 Ω	1	0.4	901/W560E
R11	" "	30 Ω	1	0.4	901/W30E
R12	" " 60 Ω	120 Ω	1	0.4	901/W120E
	" "	120 Ω	1	0.4	901/W120E
R13	" "	30 Ω	1	0.4	901/W30E
R14	" "	450 Ω	1	0.4	48 063 01/450E
GR1	Rectifier (Siemens E25C5)				A9 024 76
GR2	Rectifier (Siemens PH11a12/1 M25/10-1.5)				A9 024 77
GR3	Silizium-diode				OA 200
T1	Mainstransformer and voltage adaptor	See fig.	-	-	ZD 600 50
V11	Fuse	30 mA			974/50
La1	Pilot lamp				Z10

BH/SR.





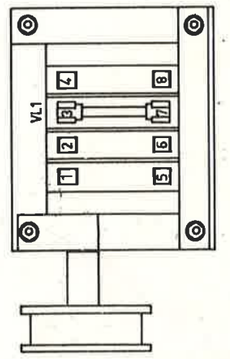


Fig.1

CODE	S1	S2	S3	S4	S5	S6	S7a	S7b	S8
VOLTS	110	15	20	55	20	25	27	27	27
TURNS	854	116	155	428	155	192	21	21	210

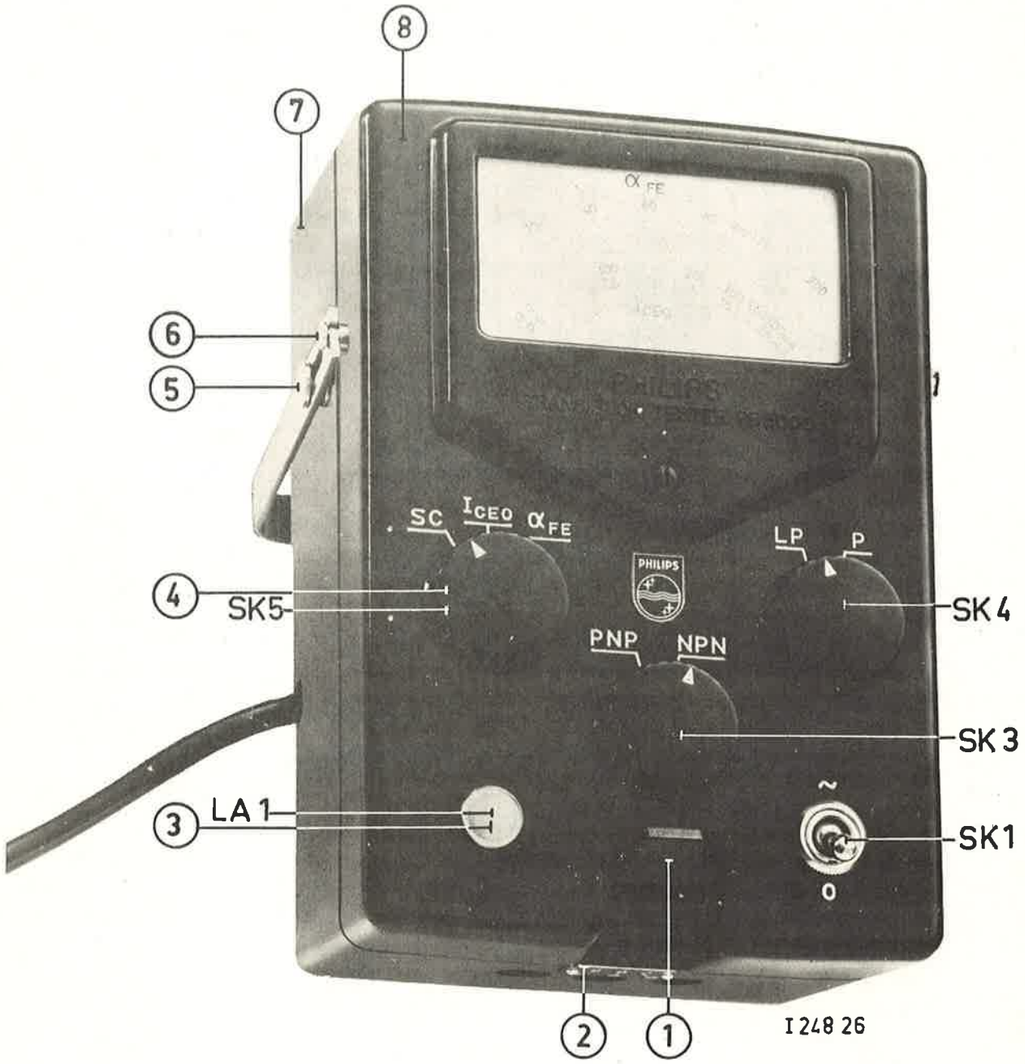


Fig.5

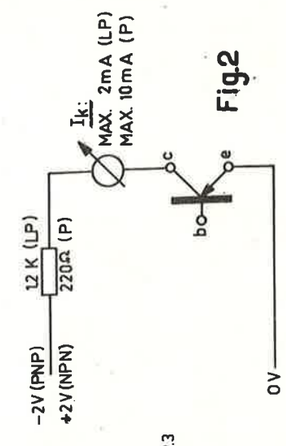


Fig.2

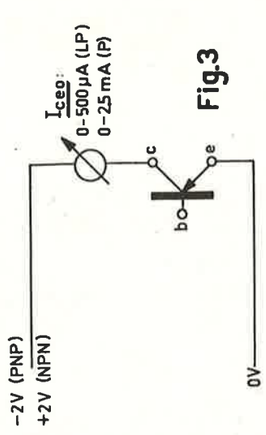


Fig.3

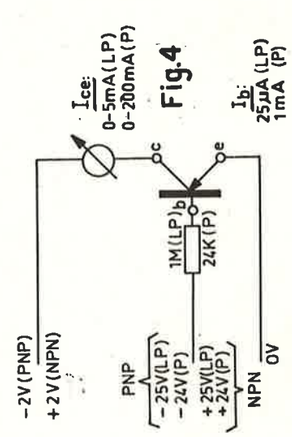


Fig.4

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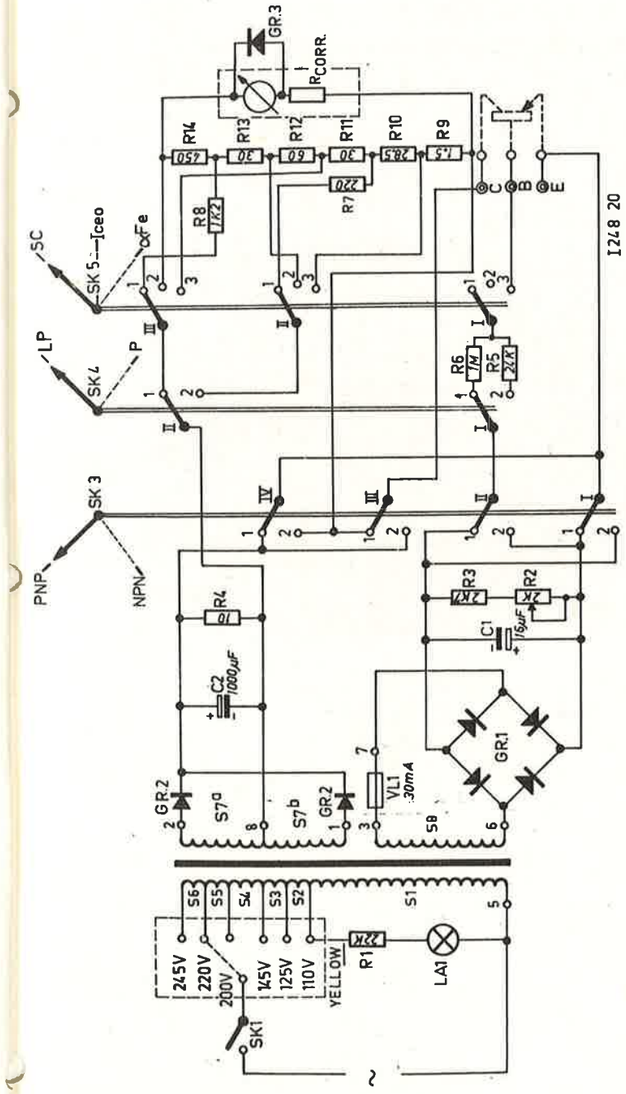

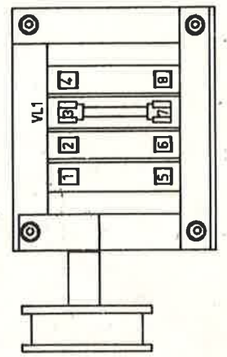

Fig.1

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TURNS	854	116	155	428	155	192	21	21	210

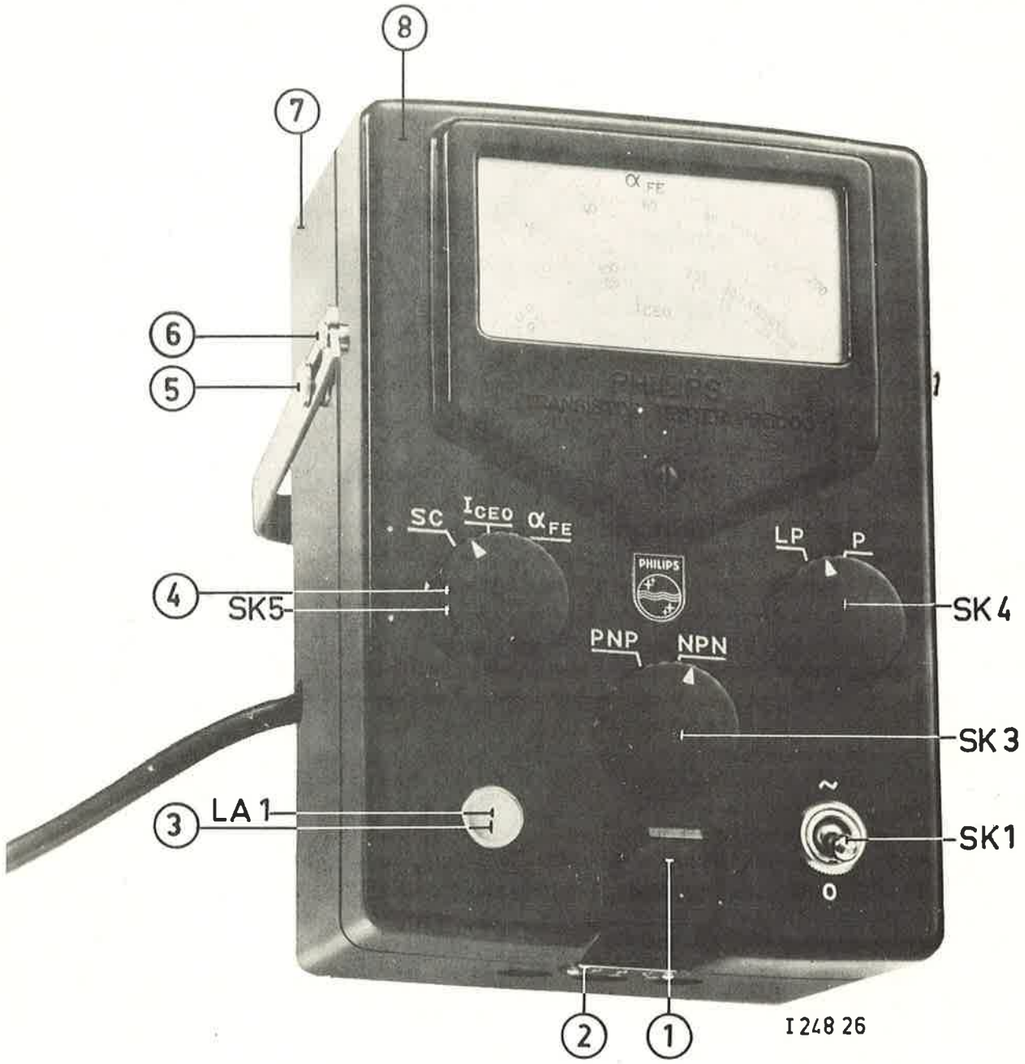
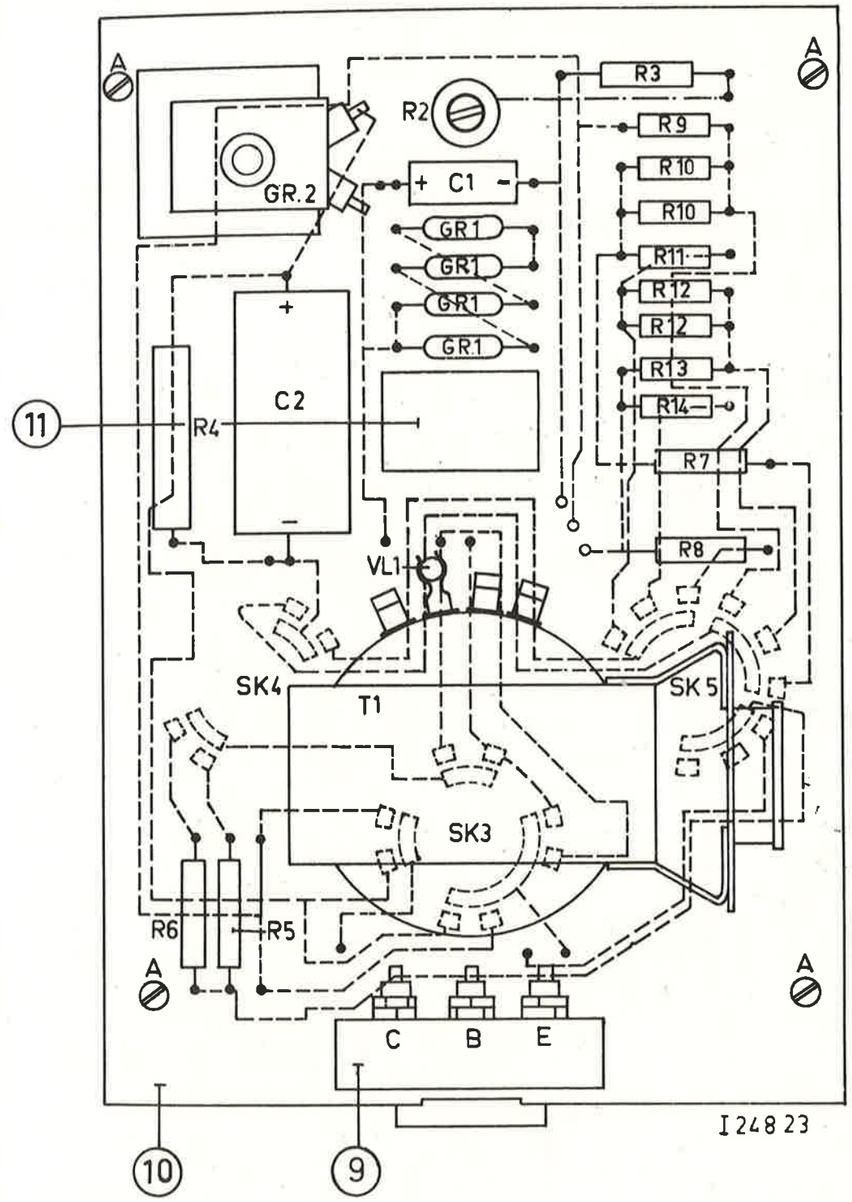

8
7
6
5
4
SK5
3
LA 1
2
1
SC
ICEO
αFE
LP
P
PHILIPS
PNP
NPN
SK 4
SK 3
~
SK1
0
I 248 26

Fig.5


A
A
R3
R2
R9
R10
GR.2
+ C1 -
R10
GR1
GR1
R11
R12
GR1
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GR1
R13
R14
11
R4
C2
R7
R8
VL1
SK4
T1
SK 5
SK3
R6
R5
A
A
C
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E
I 248 23
10
9

Fig.6

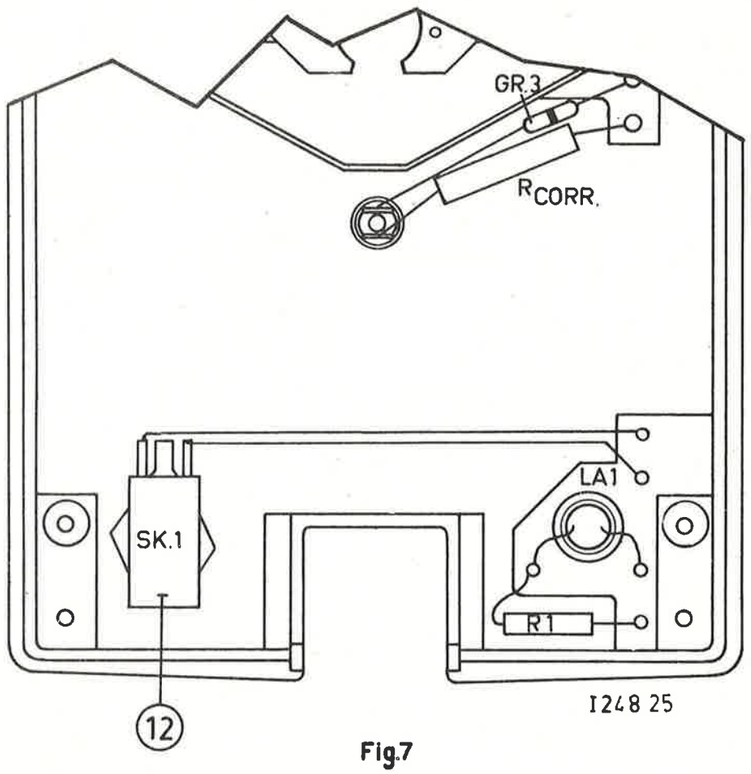

Fig.7

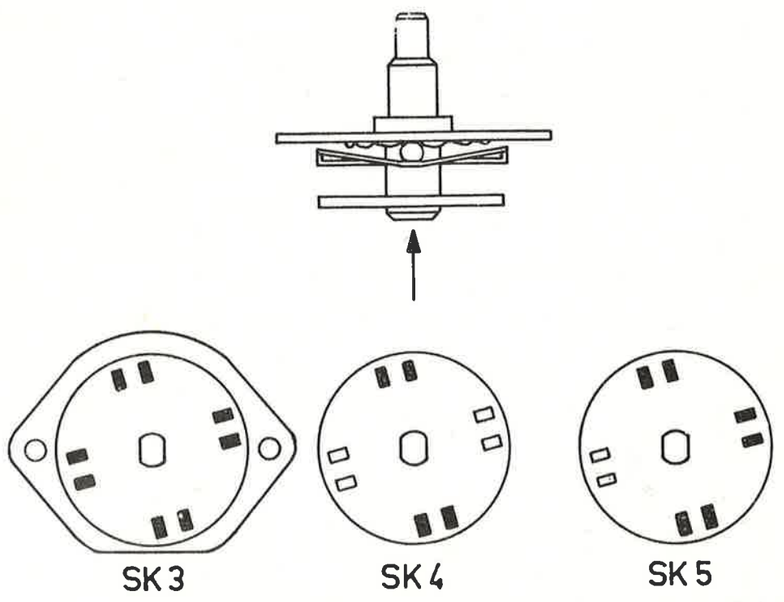

Fig.8

N.V. PHILIPS' GLOEILAMPEN-FABRIEKEN EINDHOVEN	Delivery Test	I
		DATE 4-9-1959
CENTRAL SERVICE DIVISION	GROUP: P.I.T. - E.M.A. ARTICLE: Transistor tester TYPE: PP 3000	BH/PB

A. MECHANICAL

Check the apparatus for:

1. Damages
2. Closing of the casing
3. Fixing and position of the knobs
4. Stop of the switches
5. Mechanical zero adjustment of the instrument
6. Smooth turning of the supporting bracket
7. Proper functioning of the transistor holder
8. Presence of the directions for use.

B. ELECTRICAL

B1. Necessary measuring instruments

Universal meter, for instance P 817 00.
Variable resistor of approx. 20 kΩ.

B2. Supply

Put the voltage adaptor to 220 V and connect the apparatus to that voltage (220 V ± 1%; via a regulating transformer, if necessary).
Connect the apparatus (SK1); the pilot lamp La1 should burn.
The current drawn from the mains may be 36 mA at maximum.
(This only applies to 220 V - 50 c/s).

B3. Check of the base current

SK3 on PNP
SK4 on LP
SK5 on α_{FE}
Connect a universal meter between B and E (B = - and E = +).
The base current should be 25 µA.
Universal meter on higher range.
SK4 on P
The base current must be 1 mA ± 2%.

SK3 on NPN
Reverse the polarity of the universal meter.
The pointer of the meter should deflect again in the same direction.

B4. Check of the measuring ranges

B4a. Small power (LP)

SK3 on PNP
SK4 on LP

SK5 on SC

Short-circuit the bushes E and C. Now the meter should show nearly full deflection.
Remove the short-circuit and connect a series connection of the universal meter and a variable resistor (of about 20 kΩ) between E and C (E = + and C = -).
Adjust the variable resistor so that the current through the universal meter is 0.5 mA.
Then the pointer of the meter of the PP 3000 should be on the red scale line (tolerance ± 1 scale division of the I_{CEO} - scale).

SK5 on I_{CEO}

Make the current through the universal meter 150 µA (with the aid of the variable resistor). The pointer of the PP 3000 should indicate 60 on the ∝ FE scale (tolerance ± 1 scale division of this scale).

SK5 on ∝ FE

Make the current through the universal meter 1.5 mA.
The pointer of the PP 3000 must indicate 60 on the ∝FE scale. (tolerance ± 1 scale division of this scale).

B4b. Great power (P)

SK3 on PNP
SK4 on P

SK5 on SC

Short-circuit the bushes E and C. Now the meter should show approxiamately full deflection.
Remove the short-circuit and connect a series connection of a universal meter and a variable resistor (of approx. 20 kΩ) between E and C (E = + and C = -). Make the current through the universal meter 2.5 mA (with the aid of the variable resistor). The pointer of the PP 3000 must then be on the red line (tolerance : ± 1 scale division of the I_{CEO} scale).

SK5 on I_{CEO}

Make the current through the universal meter 750 µA.
The pointer of the PP 3000 should show 60 on the ∝FE scale. (tolerance : ± 1 scale division of this scale).

SK5 on ∝ FE

Make the current through the universal meter 60 mA.
The pointer of the PP 3000 should indicate 60 on the ∝ FE scale. (tolerance : ± 1 scale division of this scale).

B5. Final check

When various apparatuses must be checked quickly, use can be made with advantage of a special checking box which can be easily made in every workshop.
The circuit diagram of this box has been given in fig. 2.
For an idea about the construction, see fig. 3.
An electrical parts' list has been given at the end of the presale test.

Measurement

The principle of the measurement follows from fig. 4; the measurement is based on a I_b - I_c ratio of 1 : 100, which gives a ∝ FE of 100 ($\propto FE = \frac{Ic}{Ib}$)

SK3 on PNP
SK4 on LP
SK5 on ∝ FE

Connect the bushes E-B-C of the checking box with the corresponding bushes of the PP 3000 and the bushes + and - of the checking box with the corresponding bushes of the universal meter (P 817 00).

a. The switch of the checking box on LP; adjust the potentiometer LP (300Ω) so that no current flows through the universal meter.
   On the ∝ FE scale 100 ± 1 scale division must be indicated.

b. SK4 on P.
   The switch of the checking box to P; adjust the potentiometer P (10Ω) so that no current flows through the universal meter.
   On the ∝ FE scale 100 ± 1 scale division must be indicated.

c. Repeat the same measurements with SK3 in the position NPN.

Note:

If at the above measurement the deviation is greater than 1 scale division (∝ FE-scale), R2 must be readjusted according to point D2 of the documentation.

Electrical parts'list of fig. 2
of this pre-sale test

Description	Value	%	Watt	Code No.
Pot.meter; wire wound	10 Ω	-	-	914/10E
Pot.meter; carbon	300 Ω	-	-	915/E300E
Resistor; wire wound	1 Ω	0.5	0.4	901/W1E
Resistor; carbon	10 Ω	1	0.5	901/10E
Resistor; carbon	18 Ω	1	0.5	901/18E
Resistor; carbon	39 Ω	1	0.5	901/39E
Resistor; carbon	100 Ω	1	0.5	901/100E
Resistor; carbon	750 Ω	1	0.5	901/750E
Resistor; carbon	3900 Ω	1	0.5	901/3K9

BH/SR.

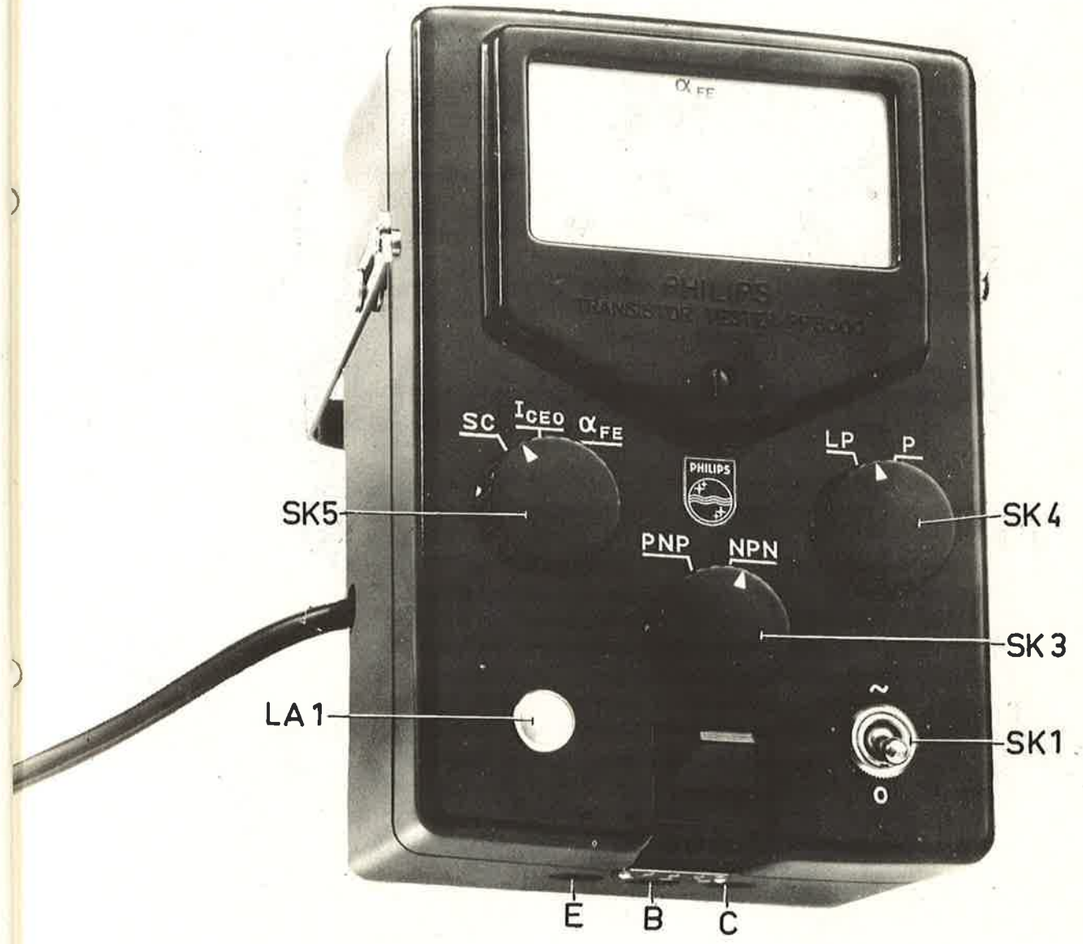

Fig.1

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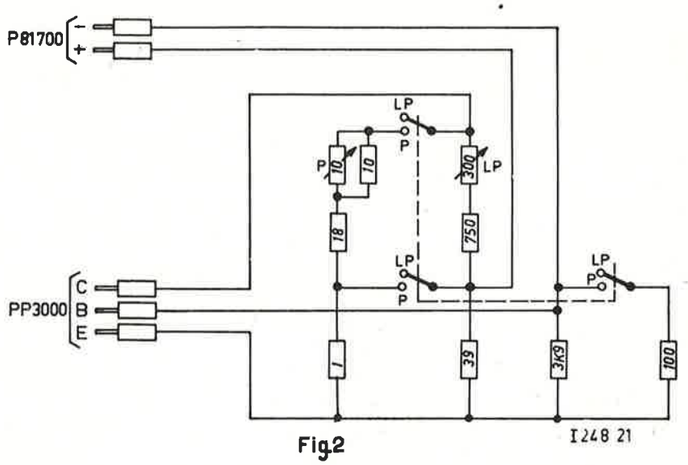

Fig.2

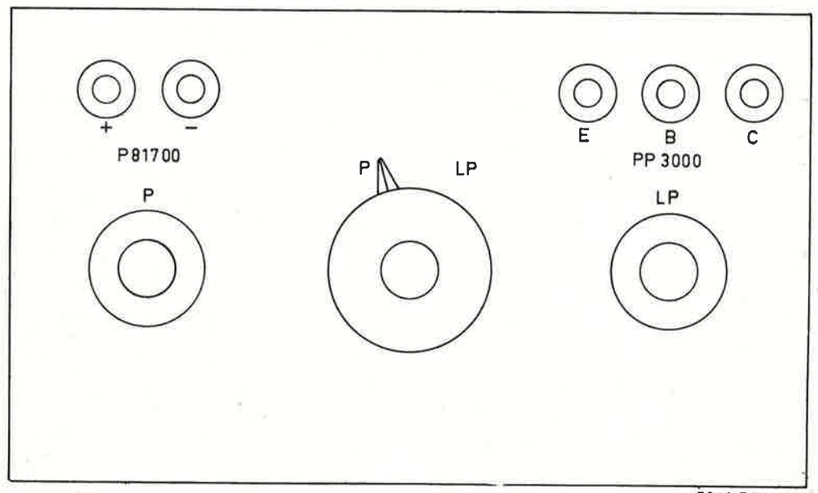

Fig.3

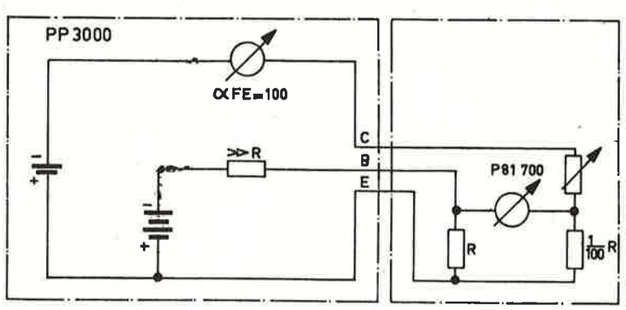

Fig.4