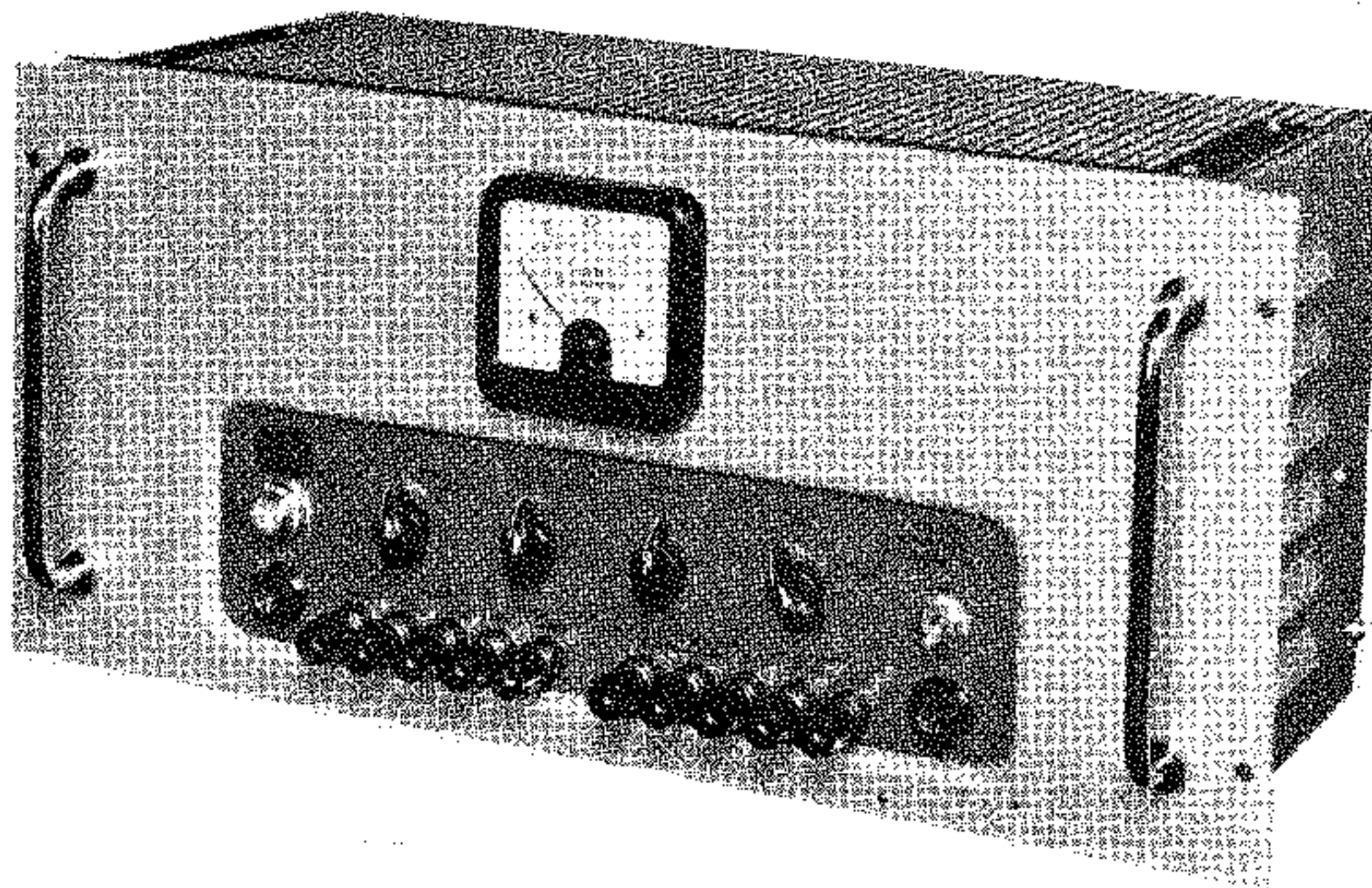


STABILIZED POWER SUPPLY

TYPE 8619

OPERATING AND MAINTENANCE MANUAL



C O N T E N T S

	Page
1. Application	1
2. Technical description	2
2.1 Circuit description	2
2.2 Octal base socket at rear of instrument	2
3. Mains voltage arrangement	3
4. Operating instructions	3
5. Use of two instruments in parallel	3
6. Specification	4
7. Directions for the location and remedy of faults	5
8. Typical values	7/8
9. Parts list and diagrams	8

L I S T O F F I G U R E S

Fig.

1. Octal socket at rear of instrument
2. Simplified schematic diagram
3. Mains voltage arrangement
4. Schematic circuit diagram
5. Wiring diagram

TYPE 8619 - POWER SUPPLY
STABILIZED D.C.
TECHNICAL MANUAL

1. APPLICATION

The Type 8619 Power Supply can be used to supply a stabilized d.c. voltage of low source impedance e.g. for powering experimental set-ups and calibration of instruments and for numerous other applications in laboratory and industry. It provides a stabilized d.c. voltage which is continuously adjustable in three ranges: 0 - 35 V, 20 - 190 V and 180 - 350 V, at a current of 150 mA max. on all ranges. An unstabilized voltage of 245, 375 or 540 V is available. Furthermore the instrument supplies two filament voltages (a.c.) 6,3 V, one of which with a tapping at 4 V, and a continuously adjustable negative voltage 0- -40V.

2. TECHNICAL DESCRIPTION

2.1 Circuit description

Reference is made to circuit diagram fig. 4. The instrument consists of a power supply section and a regulator section. The power supply section is provided with a heavy duty mains transformer which supplies all a.c. voltages required. Selenium rectifiers are used and a pi-type smoothing filter consisting of a choke and four electrolytic capacitors. The regulator section is provided with two parallel connected EL 34 valves in series with the load, the internal resistance of which is controlled by means of an EF 94 amplifier valve, a 85 A2 voltage reference tube supplying the reference voltage. The current through this tube is stabilized by means of a stabilizing tube OA 2 (150 C2). The transformer has, in addition to the filament, windings for the valves in the instrument, two other 6,3 volt windings (one of which having a tapping at 4 volts); the latter are connected to terminals on the front panel. They can supply 3 amps each and may be connected in series or in parallel or be used separately. Furthermore the transformer supplies an AC voltage of 250 V, which after rectification by means of a selenium rectifier and smoothing by an electrolytic capacitor of 100 uF supplies the negative voltage required to operate the OA 2 and 85 A2 tubes. The 85 V negative voltage, stabilized by means of the 85 A2 tube, serves two purposes: as a reference voltage for the electronic regulator section and to provide an external negative voltage (e.g. grid bias), which is continuously adjustable between 0 and -40 Volts. Incorporated between the reference voltage (-85 V) and the stabilized output voltage is a voltage divider chain comprising 7 resistors (one of which is adjustable and one a potentiometer used as a variable resistor) fig. 1. By means of this potentiometer the output voltage can be set to the desired value. The grid of the EF 94 amplifier valve is connected to a variable tapping on this voltage divider chain.

As a result of the high loop gain and the high negative feedback ratio the grid of the EF 94 amplifier tube may be considered to be a constant potential difference with respect to the common lead. Consequently it may be assumed that the output voltage is determined by the dividing ratio at any setting of the divider chain.

Equally it may be assumed that the current through this voltage divider chain at the two higher ranges (R 11 short circuited) is nearly constant and independent from the output voltage (See fig. 2).

On the lower voltage range (0 - 35 V) R 11 is switched into the circuit. Consequently the current through the voltage divider chain is reduced to 1/5 the value of the other ranges.

The lower limits of the voltage ranges, being 20 and 180 V, are determined by the resistances R 29 and R 29 + R 28 respectively. In the same way the voltage difference between the highest and lowest voltage adjustable in one particular range (being 170 V on the middle and higher range and 35 V on the lower range) is determined by the value of the potentiometer. The lower limit of the voltage in the lower range (0 Volt) can be adjusted by means of resistance R 45. All aforementioned voltages are eventually determined by the current through the voltage divider, which can be adjusted with R 13.

As a result of the high loop gain and the high negative feedback ratio the source impedance of the instrument is very low. At high frequencies, however, the gain decreases and consequently the source impedance increases. In order to maintain a low internal impedance at these frequencies an electrolytic capacitor of 50 uF is connected in parallel with the output terminals.

The voltage range switch is a 5-position switch with a stand-by position between any two voltage ranges. In the latter positions the rectifier circuits are disconnected, the filaments of the valves remain glowing, however. Consequently the instrument can supply current instantly when switched to one of the voltage ranges. The series resistances of the voltmeter, in the position "+V" of the meter function switch, are switched simultaneously with the range switch for positions of 40, 200 or 400 V full scale deflection.

In the position of the meter switch marked 200 and 40 mA the measuring instrument is connected in the common lead of the current circuit as a milliammeter having 200 and 40 mA full scale deflection respectively. The internal resistance of the power supply in the position 200 and 40 mA is increased by 0,67 and 3,33 ohms respectively.

In the positions "+V" and "-V" of the meter switch the shunt resistances are short-circuited.

Caution.

It is recommended in view of the aforementioned to put the meter switch in the "+V" or "-V" position in all cases where a low internal resistance is required and a current reading is of no use. At the same time the ammeter is prevented from being overloaded.

2.2 Octal base socket at rear of instrument. (Fig. 1)

- | | |
|------------------------------|-----------------------|
| 1) Chassis | 5) Negative voltage |
| 2) Grid EF 94 | 6) Common |
| 3) Grids EL 34 | 7) 6,3 V AC filaments |
| 4) Stabilized output voltage | |

The stabilized voltages and the 6,3 V filament voltage supplied by the instrument are connected not only to the corresponding terminals but also to an octal base socket at the rear of the instrument for a convenient connection of instruments which are frequently used in conjunction with the power supply. At the same time the circuit points necessary for interconnection of two instruments in parallel are brought to the octal base socket (see fig. 1)

3. MAINS VOLTAGE ARRANGEMENT.

The instrument has been fitted with a mains transformer, which has a double-wound primary of 110 and 110 + 15 volts respectively. The two sections can be connected in series for 220 V operation, in parallel for 110 V operation or in series-parallel for 125 V operation.

The instrument as delivered by the works has its primary arranged for 220 V operation.

For 110 V or 125 V operation, the links, which are mounted on an insulated strip at the rear of the transformer, have to be rearranged as shown in fig. 3.

4. OPERATING INSTRUCTIONS.

Check the mechanical zero setting of the meter. Adjust to zero, if necessary. Connect the power plug at the rear of the instrument with the mains, after first having made the necessary adjustments as stated in point 3.

Set the range control, which simultaneously switches the meter range, for the desired output voltage.

Switch on the instrument with the switch marked "on" and "off". Use the fine adjustment and the meter to set the output voltage exactly to the desired value.

Connect the load to the output terminals and check the load current by switching the meter to one of the mA ranges.

N.B. In this position of the meter switch, the internal resistance of the instrument is increased; for proper stabilization the meter switch should be returned to the voltage range.

5. USE OF TWO INSTRUMENTS IN PARALLEL.

For operation of two instruments in parallel it is required to connect a special connecting cable between the octal base sockets at the rear of the instruments. No additional cables are required. The stabilized positive voltage may be taken from either instrument.

The stabilized voltage can be adjusted between 0 - 35, 20 - 190 or 180 - 350 V by adjusting the knobs of both the instruments.

It is an absolute necessity that the range switches of both instruments are in the same position.

When switching ranges it is recommended first to switch both range switches to the stand-by position.

When the meter switch is in a "current" position the built-in instrument indicates the current supplied by the corresponding power supply only.

Since the currents supplied by both instruments will be nearly equal, it is possible in case of less accurate measurements to use one instrument as a voltmeter and the other one as an ammeter.

In case of accurate measurements the currents indicated by the two instruments should be aided.

When a parallel operation is no longer required it is recommended to disconnect the connecting cable from both sockets in order to prevent accidental shock from exposed metal parts. All data given in this manual in the section "specifications" as to voltages etc. remain valid, the maximum permissible output current is, however, doubled and the internal resistance approximately halved.

6. SPECIFICATIONS.

Output voltages d.c.
Stabilized:

Continuously adjustable in 3 ranges 0 - 35, 20 - 190 and 180 - 350 V.

Unstabilized:

Range 0 - 35 V, unloaded 330V, loaded 245V
20 -190V, unloaded 490V, to 375V
180 -350V, unloaded 680V, 150 mA 540V

Output current d.c.

0 - 150 mA
The total of stabilized and unstabilized output currents should not exceed 150 mAmps.

Meter

A meter function switch has the following positions:

- 1) Negative voltage 0 - 40V
- 2) Positive voltage (0 - 40V, 0 - 200V or 0 - 400V according to the selected voltage range).
- 3) Output current 0 - 200 mA
- 4) Output current 0 - 40 mA

Stabilization

Against variations in load

Between no load and full load the output varies less than 0,25 of a percent of the set value plus or minus 0,1V.

Against mains voltage

With a 10 percent variation in mains voltage the output voltage remains constant within 0,25 of a percent plus or minus 0,1V. The values given for the variations are valid within the following voltage limits:
Range 0 - 35V; 0 - 35V
20 -190V; 30 -190V
180 -350V; 180 -350V

Internal impedance

For mains audio frequency alternating currents less than 3 ohms.

Ripple content
hum and noise

In the 0 - 35V range less than 0,5 mV r.m.s.
In the 20-190V range less than 2 mV r.m.s.
In the 180-350V range less than 3 mV r.m.s.

Short circuiting

Occasional overloads up to and including short-circuits are not harmful. The maximum short-circuiting current varies between 0,3 and 0,5A dependent on the voltage setting.

Filament voltage a.c.

Two separate windings of 6,3V 3 Amps each (unstabilized), one with a 4 volts tapping. Each winding is insulated for 700 V a.c. (1000V d.c.) to chassis or to common terminal.

<u>Negative voltage</u>	Stabilized against variations in mains voltage. Continuously adjustable between 0 and 40 Volts. Internal resistance approx. 25.000 ohms. Max.output current 2 milliamps.
<u>Mains voltage</u>	Primary windings arrangements for 110, 125 and 220 Volts, 40 - 100 c/s (see fig.3)
<u>Fuses</u>	Two cartridge-type fuses on the front panel.
<u>Valves and lamp</u>	0A 2 (150 C2) voltage stabilizer tube 85 A2 voltage reference tube EF 94 pentode amplifier valve 2 x EL 34 power pentode valves 8034 D pilot lamp 10V 0,2A
<u>Series operation of two units</u>	To obtain voltages ranging from 350 to 700 V two units may be connected in series. The d.c. common terminal is insulated from the chassis.
<u>Parallel operation</u>	Two units may be connected in parallel by means of a connecting cable.
<u>Dimensions</u>	482 x 223 x 250 mms. 19 x 8 3/4 x 9 7/8 in.
<u>Weight</u>	12 kg net 26,4 lbs.

7. DIRECTIONS FOR THE LOCATION AND REMEDY OF FAULTS.

1.0 General

The directions given in this section are a guidance for the location and remedy of faults as might occur in the instrument under normal operating conditions.

When difficulties are encountered or when service equipment is insufficient, please contact our Service Department, which will co-operate as much as possible by furnishing information as well as any replacement part needed.

When notifying our Service Department of any troubles in operation or service of the instrument please mention the serial and type numbers of the instrument and code numbers of the replacement parts.

- 2.0 If the instrument does not work at all (no filament voltage, pilot lamp does not glow), proceed as follows:
 - 2.1 Check mains voltage outlet.
 - 2.2 Check cable, plug and female plug for continuity and proper contact.
 - 2.3 Check mains switch, and check fuse 2A also for proper contact.
 - 2.4 Check mains voltage links on the mains transformer for proper contact and proper position (see fig. 3).
 - 2.5 Check connections to and continuity of mains transformer primary windings with the aid of an ohmmeter.
- 3.0 If the meter (in the position "+V" of the meter switch) shows a negative deflection, proceed as follows:
 - 3.1 Check 0,15 A fuse for continuity and proper contact.
 - 3.2 Check electrolytic capacitors C2 (grey wire) and C1 (red-black wire). The voltages on either of these capacitors should correspond with the voltages mentioned in section "Typical Values", page 7/8. In case they do not correspond, check secondary winding of mains transformer, switch contacts and rectifiers G 1 up to and incl. G 4 and the wiring concerned.

- 3.3 Check capacitors C 3 and C 4 (white and red wires).
The voltages should correspond to the values mentioned on page 7/8 section "Typical Values".
When they do not correspond, check choke for continuity,
 R_{DC} = approx. 100 ohms.
- 3.4 Check valves EL 34 with the aid of a valve tester; or replace by another pair.
- 3.5 Check resistors R 20 and R 21, connected to contacts 8 of the EL 34 sockets for continuity.
- 4.0 If the instrument does not supply a negative voltage and it supplies about + 10V on the lower range, about 50V on the middle range and about 100V on the higher voltage range, irrespectively the position of the voltage adjusting potentiometer, proceed as follows:
 - 4.1 Check electrolytic capacitors C10. The voltage across this capacitor (between white and yellow wire) should be about 310V. If not, check winding S 4 of the power transformer, the corresponding switch contacts and rectifier unit G 5 for operation.
 - 4.2 If the voltage on C 10 is right check resistors R 9 and R 10 and the wiring concerned.
 - 4.3 Check tubes OA2 and 85A2 and valve holders for short circuits.
- 5.0 If the instrument does not supply a negative voltage, but all other functions are normal, (if not, see 4.0) proceed as follows:
 - 5.1 Check potentiometer R 42 (50 k Ω) for continuity.
 - 5.2 Check resistor R 43 (43 k Ω) for continuity and capacitor C 61 (0.1 μ F) for a short circuit.
- 6.0 If the instrument supplies a small d.c. voltage to the terminal for the stabilized output voltage, which cannot be set by means of the potentiometer R 32, proceed as follows:
 - 6.1 Check resistor R 22 (470 k Ω) for continuity.
 - 6.2 Check valve EF 94 with the aid of a valve tester or try another one.
 - 6.3 Check valves EL34 with the aid of a valve tester or try another pair.
 - 6.4 Check resistors R11, R12 and R13 (47k, 9, 1k and 3,3 k Ω adjustable) for continuity.
 - 6.5 Check capacitor C7 (0,1 μ F) for a short circuit.
 - 6.6 Check potentiometer R32 (25 k Ω) for continuity.
- 7.0 If the instrument supplies too high a voltage to the terminal for the stabilized output voltage, which cannot be adjusted; proceed as follows:
 - 7.1 Check valves EL 34 with the aid of a valve tester or replace.
 - 7.2 Check valve EF 94 with the aid of a valve tester or replace.
 - 7.3 Check resistor R 29 (2200 Ω) for continuity.
 - 7.4 Check potentiometer R 32 (25 k Ω) for continuity.
 - 7.5 If the output voltage is too high on the higher range only check resistor R 28 (22 k Ω , 6W).
- 8.0 If the output voltage cannot be adjusted to low values on the lower and middle ranges with the instrument unloaded, proceed as follows:
 - 8.1 Check resistor R 26 (15 m Ω) for continuity and value. It should not deviate more than 5% of the nominal value.
 - 8.2 Check switch contacts concerned.
 - 8.3 Check resistor R 23 (2,2 m Ω). It should not deviate by more than 10%.
 - 8.4 Check capacitor C 8 (25 nF) for a short circuit.
 - 8.5 If the output voltage on the lower voltage range cannot be adjusted to a lower value than about 2V check resistor R 27 (27 M Ω), the wiring and switch contacts concerned for continuity.

- 9.0 If the output voltage cannot be adjusted to high values on the lower and middle range proceed as follows:
- 9.1 Check unstabilized voltage of the rectifier section (red wire). At the nominal mains voltage the deviation from the nominal values of 245 and 375 V respectively should not be more than 6%, with the instrument loaded to 150 mA.
- 9.2 Check valves EL 34 and EF 94 with the aid of a valve tester or replace.
- 9.3 Check resistor R 18 (100 kΩ) for continuity.
- 9.4 Check resistor R 22 (470 kΩ) for continuity.
- 10.0 If the output voltage cannot be adjusted to a low value (e.g. 200 V) on the higher voltage range with the instrument unloaded, proceed as follows:
- 10.1 Check valves EF 94 with the aid of a valve tester or replace.
- 10.2 Check valves EL 34 with the aid of a valve tester or replace.
- 10.3 Check if voltages of EF 94 correspond with the values mentioned in section "Typical Values" page 7/8.
- 11.0 If the output voltage cannot be adjusted to a high value (e.g. 350 V) on the higher range proceed as follows:
- 11.1 Check valves EL 34 with the aid of a valve tester or replace.
- 11.2 Check unstabilized voltage of rectifier section (red wire). At the nominal mains voltage the deviation from the nominal value of 540 V should not be more than 6% with the instrument loaded to 150 mA.
- 12.0 If meter shows incorrect readings as a voltmeter:
- 12.1 Check series resistors R 33, 34 and 35 (200 kΩ, 160 kΩ and 39,88 kΩ respectively) or wire-wound resistor R 8 (30 Ω).
- 12.2 Check switch contacts of voltage range switch S 1.
- 12.3 Check switch contacts of meter switch S 2.
- 13.0 If meter shows incorrect reading as an ammeter:
- 13.1 Check resistor R 6 (0,67 Ω) if only the range of 200 mA f.s.d. and in addition R 7 (2,75 Ω) if range of 40 mA f.s.d. is concerned.
- 13.2 Check resistor R 8 (30 Ω adjustable) for continuity.
- 13.3 Check switch contacts of meter switch.

8. TYPICAL VALUES.

The voltages given in this section for guidance when servicing the instrument are representative of the readings to be expected if measurements are made with a meter having a resistance of 10.000 ohm per volt. Voltages are measured with respect to the common lead.

Before measurements are made the instrument is adjusted to an output voltage of 20 V on the lower voltage range, 100 V on the middle range (values between brackets), and 200 V on the higher voltage range. Instrument unloaded.

Electrolytic capacitor C 1 (red,black)	330 (490)	680 V
C 2 (grey)	155 (230)	320 V
C 3 (white)	155 (230)	320 V
C 4 (red)	330 (490)	680 V

Valve holder EF 94	Contact no.1 control grid	- 0(0,4)	0,9 V
	no.2 suppr. grid	1,5(1,5)	1,6 V
	no.3 filament		6,4 V
	no.4 filament		0
	no.5 anode	53 (112)	140 V
	no.6 screen grid	65 (63)	63 V
	no.7 cathode	1,5 (1,5)	1,6 V

Valve holder EL 34	Contact no. 1	suppr.grid	20(100)	200
	no. 2	filament	20(100)	200
	no. 3	anode	330(490)	680
	no. 4	screen grid	330(490)	680
	no. 5	control grid	-13(60)	50
	no. 6	n.c.		
	no. 7	filament	20(100)	200
	no. 8	cathode	20(100)	200
Valve holder 85 A2	Contact no. 4		85 V \pm 2 V	
Valve holder OA 2 (150C2)	Contact no. 4		150 V \pm 6 V	
Negative terminal rectifier-unit B 275 C 75			-310 V	
Power transformer primary current (a.c.)				
no load			110 V	0,32 A
Voltage range switch in stand by position			125 V	0,28 A
			220 V	0,16 A
no load			110 V	0,42 A
Voltage range switch in			125 V	0,37 A
0 - 35 V range			220 V	0,24 A
Loaded to 150 mA			110 V	1,61 A
Voltage range switch in			125 V	1,41 A
180 - 350 V range			220 V	0,82 A

9. PARTS LIST.

R 1	Carbon resistor	220 k Ω	10%	1 W
R 2	Carbon resistor	220 k Ω	10%	1 W
R 3	Carbon resistor	220 k Ω	10%	1 W
R 4	Carbon resistor	220 k Ω	10%	1 W
R 5	High stability carbon resistor	22 Ω	10%	1 W
R 6	Wire-wound resistor	0,67 Ω	1%	0,5 W
R 7	Wire-wound resistor	2,75 Ω	1%	0,5 W
R 8	Adjustable wire-wound resistor	30 Ω	10%	3 W
R 9	Wire-wound resistor	6 k Ω	5%	5 W
R 9a	In parallel R 9 high stab. carbon resistor	33 k Ω	10%	1 W
R10	Wire-wound resistor	3,9 k Ω	5%	2 W
R11	High stability carbon resistor	47 k Ω	2%	1/2 W
R12	High stability carbon resistor	10 k Ω	2%	1 W
R13	Adjustable wire-wound resistor	3,3 k Ω	10%	3 W
R14	High stability carbon resistor	220 k Ω	10%	1/2 W
R15	Carbon resistor	100 k Ω	10%	1/2 W
R16	High stability carbon resistor	1 M Ω	10%	1/2 W
R17	Midget preset resistor	0,5 M Ω	10%	1/2 W
R18	Carbon resistor	100 k Ω	10%	1/2 W
R19	Omitted			
R20	High stability carbon resistor	100 Ω	2%	1 W

R 21	High stability carbon resistor	100 Ω	2%	1 W
R 22	Carbon resistor	470 k Ω	10%	1 W
R 23	High stability carbon resistor	2,4 M Ω	5%	1/2W
R 24	Carbon resistor	15 k Ω	10%	1/2W
R 25	Carbon resistor	15 k Ω	10%	1/2W
R 26	High stability carbon resistor	15 M Ω	5%	1/2W
R 27	High stability carbon resistor	27 M Ω	10%	1/2W
R 28	High stab. wire-wound resistor	22 k Ω	2%	6 W
R 29	High stability carbon resistor	2,2 k Ω	10%	1/2W
R 31	High stability carbon resistor about actual value determined during calibration	470 k Ω	10%	1/2W
R 32	Wire-wound potentiometer	25 k Ω	5%	3 W
R 33	High stability carbon resistor	200 k Ω	1%	1/2W
R 34	High stability carbon resistor	160 k Ω	1%	1/2W
R 35	High stability carbon resistor	39,88 k Ω	1%	1/2W
R 36	Carbon resistor	100 k Ω	10%	1/2W
R 37	High stability carbon resistor	560 Ω	5%	1/2W
R 38	High stability carbon resistor	18 k Ω	5%	1/2W
R 39	High stability carbon resistor	68 k Ω	10%	1 W
R 40	High stability carbon resistor	43 k Ω	5%	1 W
R 41	Carbon resistor	47 k Ω	10%	1 W
R 42	Wire-wound potentiometer	50 k Ω	10%	3 W
R 43	High stability carbon resistor	43 k Ω	5%	1 W
R 44	High stability carbon resistor	39,88 k Ω	1%	1/2W
R 45	High stability carbon resistor	50 k Ω	-	

actual value determined during calibration

C 1	Electrolytic capacitor	50 + 50	μ F	350 V d.c.
C 2	Electrolytic capacitor	50 + 50	μ F	350 V d.c.
C 3	Electrolytic capacitor	50 + 50	μ F	350 V d.c.
C 4	Electrolytic capacitor	50 + 50	μ F	350 V d.c.
C 5	Electrolytic capacitor	50	μ F	450 V d.c.
C 6	Paper capacitor	0,1	μ F	125 V d.c.
C 7	Paper capacitor	0,1	μ F	500 V d.c.
C 8	Paper capacitor	25	nF	125 V d.c.
C 9	Ceramic capacitor	15	pF	500 V d.c.
C 10	Electrolytic capacitor	50 + 50	μ F	350 V d.c.

T 1	Mains transformer	codenumber	EM 8619	B 1
T 2	Choke	codenumber	139160	
S1 _aS1 _f	Rotary switch			
S2 _aS2 _b	Rotary switch			
S 3	Toggle switch d.p.d.t.			
Z 1	Fuse 20 x 5 mm	2 Amps		
Z 2	Fuse 20 x 5 mm	150 milliamps		
M	Milliammeter moving coil 1 mA f.s.d.		120 Ω ± 5 Ω	
G 1 to G 4	Rectifier		E 250 C 30	
G 5	Rectifier		B 275 C 90	
B 1	EL 34			
B 2	EL 34			
B 3	EF 94			
B 4	OA 2	(150 C 2)		
B 5	85	A 2		
B 6	8034 D	10 V 0,2 A		

Resistance of windings of power transformer

W 1	28 Ω
W 2	13 Ω
W 3	18 Ω
W 4	170 Ω
W 10	4,2 Ω
W 11 + S 12	5,2 Ω

Resistance of choke: about 100 Ω

OPERATING MANUAL
POWER SUPPLY
TYPE 8519

Set: 14-7-61

Heesen

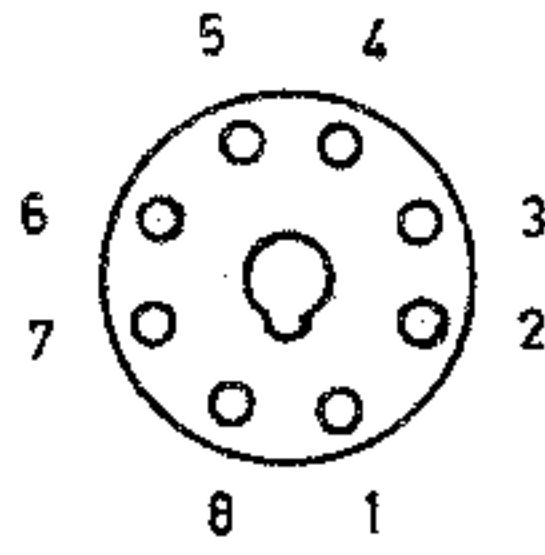


Fig.1

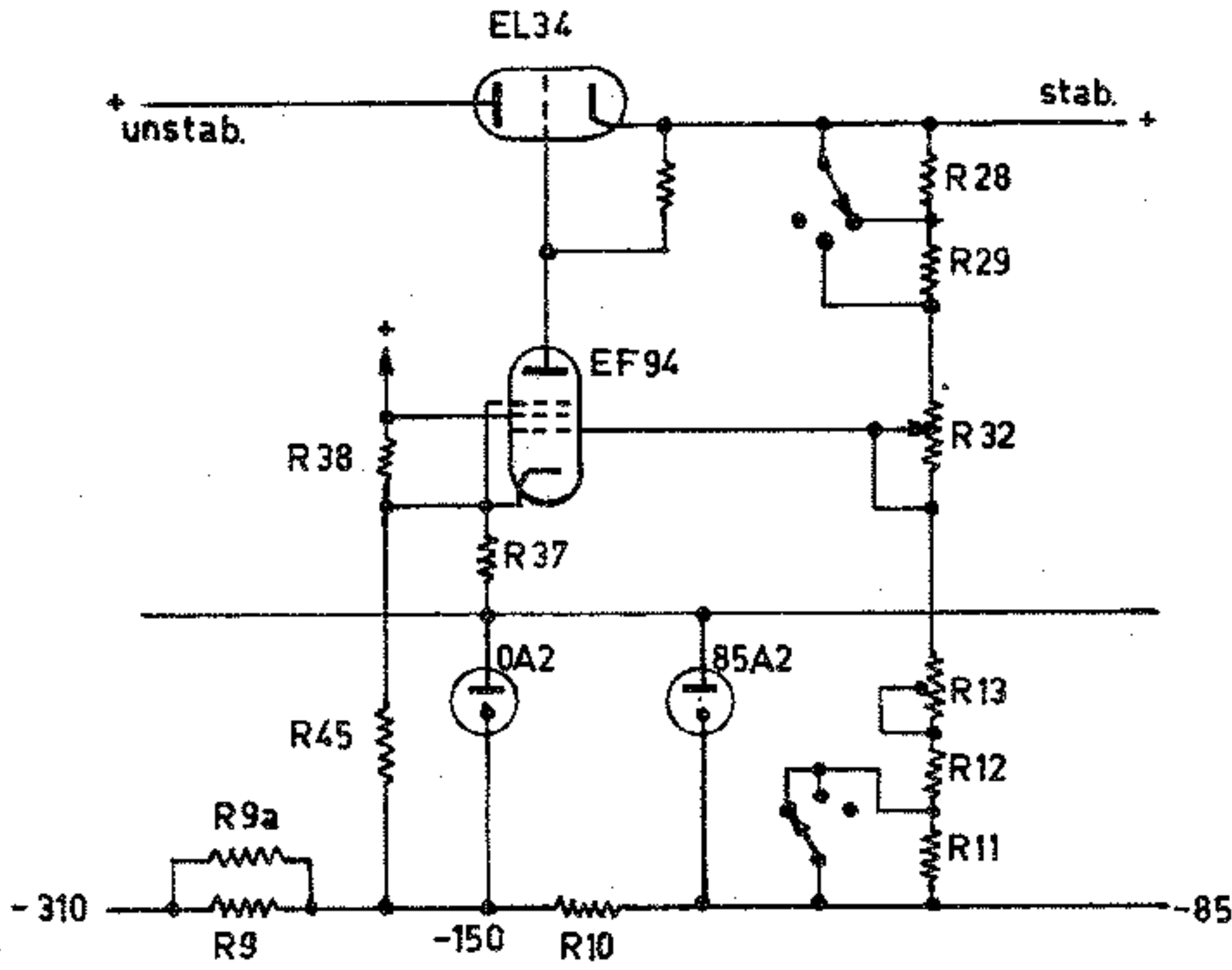


Fig.2

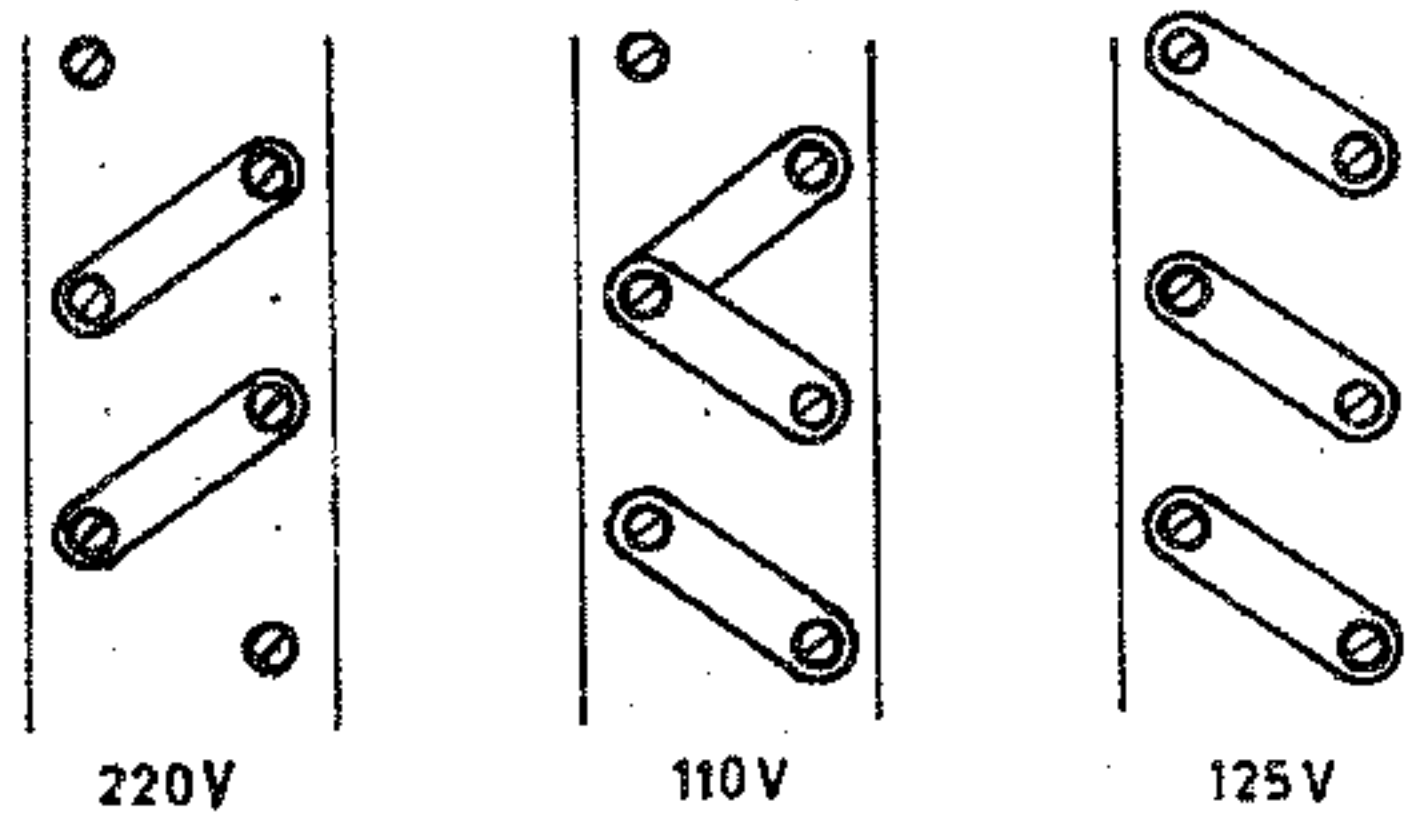


Fig.3

Auteursrecht volgens de wet vooruitlicoude

WIRING DIAGRAM
POWER SUPPLY
type 8619

