n.v. delta elektronika

nieuwe boogerdstraat 2 zierikzee holland telefoon (01110) 2734

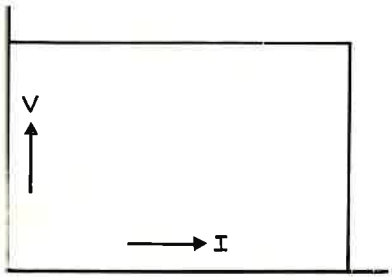
up to serial number 8172

REGULATED POWER SUPPLY D 030-3

0 — 30 V, 0 — 3 A

- Voltage and current regulated.
- Silicon transistors.
- 10-turn potentiometers for voltage- and curren· controls.
- Voltage and current programming.
- Output terminals at the front and at the back.
- Parallel and series connection permitted at al load conditions.
- Bench model can also be used for 19-inch rack mounting.

- Constant voltage regulation changes sharply into constant current regulation.



- Can be short circuited.

Remote programming	Voltage and current can be programmed with variable resistors of 0-5000 Ohm which can be connected at the back side.
Remote sensing	The output voltage can be regulated at a load point remote from the power supply by means of two extra wires.
Voltage regulation	The output voltage changes less than + or − 3 mV for a AC line voltage variation of + or − 10 % and less than + or− 10 mV for a maximum load change.
Current regulation	The output current changes less than + or − 3 mA for a AC line voltage variation of + or − 10 % and less than + or − 3 mA for a maximum load change.
Ripple voltage	At voltage regulation the ripple voltage is less than 0,1 mV r.m.s.
Ripple current	At current regulation the ripple current is less than 0,5 mA r.m.s.
Output impedance	At voltage regulation the output impedance is less than 3 milli-ohms for slow load variations and less than 200 milli-ohms for sine shape load variations up to 100 kHz. At current regulation the output impedance is larger than 10 kilo-ohms for slow load variations.
Temperature coëfficiënt	The temperature dependence of the constant voltage is less than + or − 3 mV per °C. The temperature dependence of the constant current is less than + or − 3 mA per °C.
Meters	Voltage meter 0 − 30 V accuracy 1.5 %. Current meter 0 − 3 A accuracy 1.5 %.
Cooling	Heat removal is by natural convection. One should take care that the air can flow freely vertically through the cooling fins.
Grounding	The output terminals are isolated from the case.
Models	Suffix A is a bench model. Suffix B is uncased. Two power supplies D 030-3 B can be screwed together and be used in a 19-inch rack with two mounting pieces H2.
Input voltage	220 V AC 50 Hz
Dimensions and weight	D 030-3 A 221 x 150 x 250 mm 11,4 KG. D 030-3 B 215 x 133 x 250 mm 10,0 KG. (width x height x depth).

Das stabilisierte Netzgerät D 030-3 kann als Spannungsquelle mit konstanter Spannung und begrenztem Strom, oder als Stromquelle mit konstantem Strom und begrenzter offener Spannung benutzt werden.

Fernstabilisierung

Die Ausgangsspannung kann, mit Hilfe von 2 Extra Leitungen, an einem Verbraucherpunkt vom Netzgerät entfernt, stabilisiert werden (Abb.1).

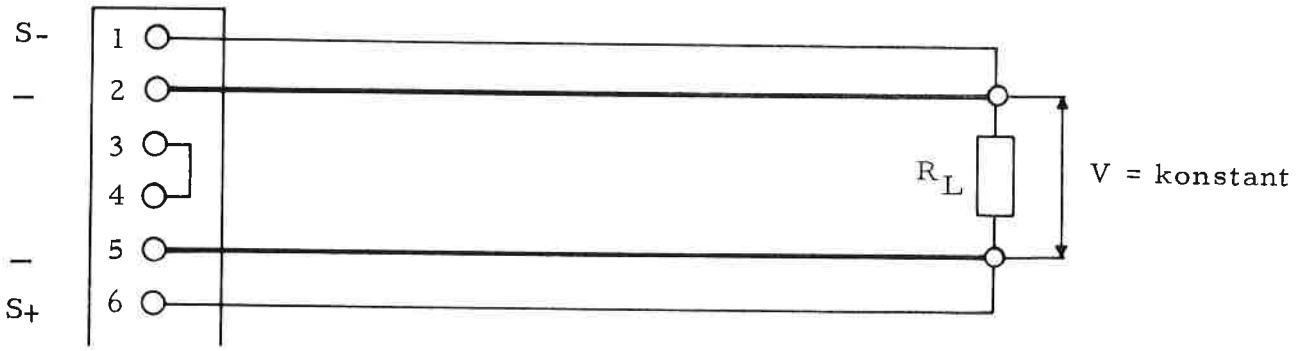


Abb. 1

Die Kurzschluss-Verbindungen zwischen den Klemmen S+ und + und den Klemmen S- und -, an der Rückseite, sind in diesem Falle zu entfernen.

Ein Spannungsabfall bis zu 1,5 Volt kann in jeder Leitung kompensiert werden. Abhängig von der Ausgangsspannung und dem Strom kann man in vielen Fällen grössere Spannungsabfälle kompensieren.
Bei Fernstabilisierung wird die Induktivität der Verbindungsleitungen zum Verbraucher nicht kompensiert.
Um einen niedrigen Scheinwiderstand der Spannungsquelle am Verbraucherpunkt zu erhalten, wäre ein Kondensator parallel zu den Belastungsklemmen nützlich.
Um die Induktivität zu verringern, sind die Drähte zu verdrehen.
Die Fühler-Drähte können ebenso verdreht werden.

Umgebungstemperatur

Eine Umgebungstemperatur bis 40°C ist gestattet wenn ununterbrochen belastet mit 3 A und bis 70°C wenn ununterbrochen belastet mit 1,5 A.

Wird das Gerät in Gestellaufbau verwendet, so ist für ausreichende Luftkühlung und Abfuhr der erzeugten Wärme zu sorgen.

Schaltungsbeschreibung

Zur Beschreibung der Schaltung ist ein einfaches Schaltbild beigefügt (Abb. 2).

Die Stabilisierung besteht aus zwei Teilen.
Eine schnelle Stabilisierung mit Silizium Transistoren und eine langsame Vor-Stabilisierung mit Thyristoren (Silicon controlled Rectifiers).

Vor-Stabilisierung:

Die Vor-Stabilisierung mit Thyristoren wird benutzt um die Verlustleistung im Transistor T niedrig zu halten.
Zu diesem Zweck wird die Spannung über T unabhängig von der Eingangs- und Ausgangsspannung konstant gehalten.
Die Spannung über T wird mit einem Teil der Spannungsreferenz verglichen (Die Spannung über R1 wird zur Vereinfachung nicht betrachtet).

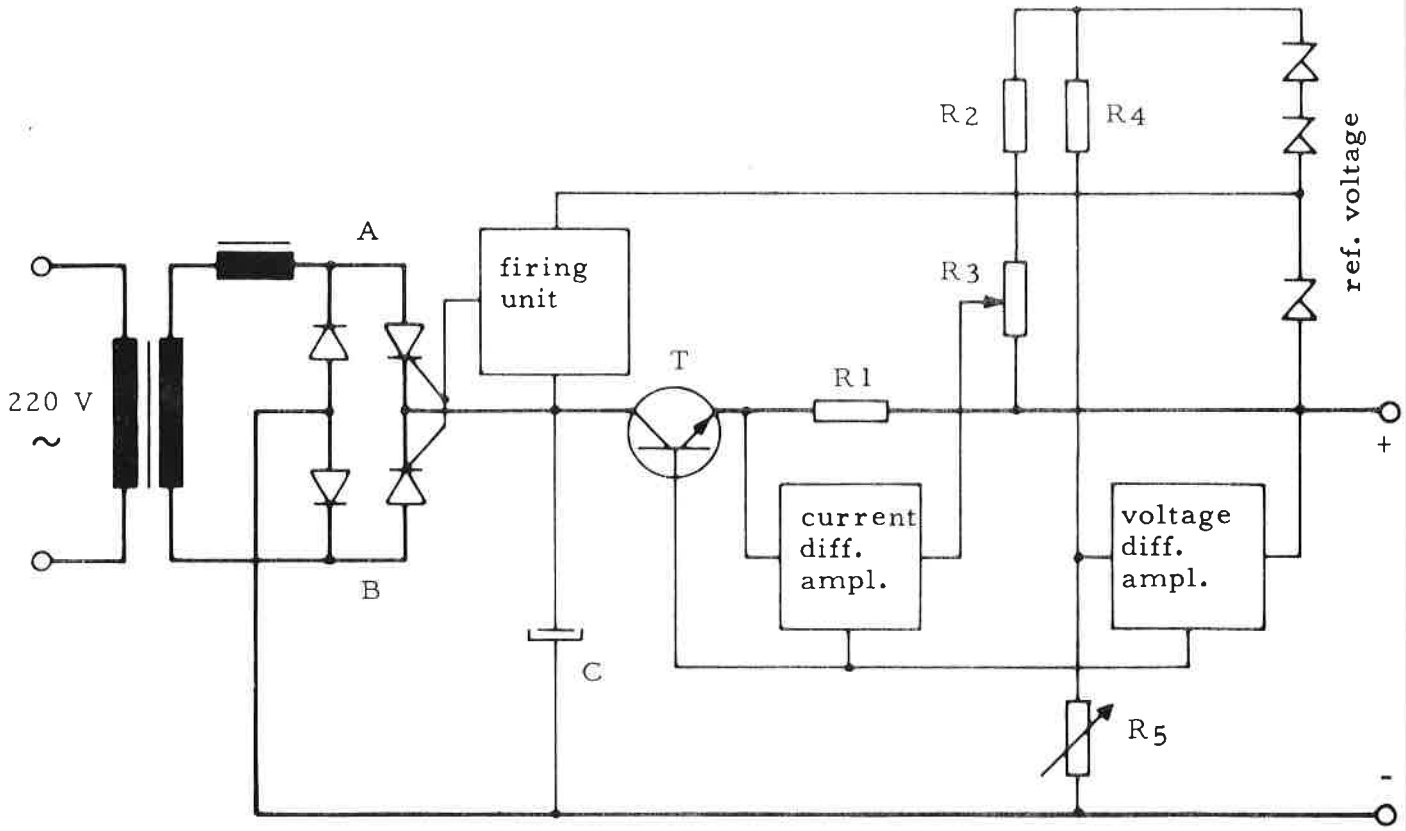


Fig. 2 Simplified Circuitdiagram D 050-10
D 030- 3

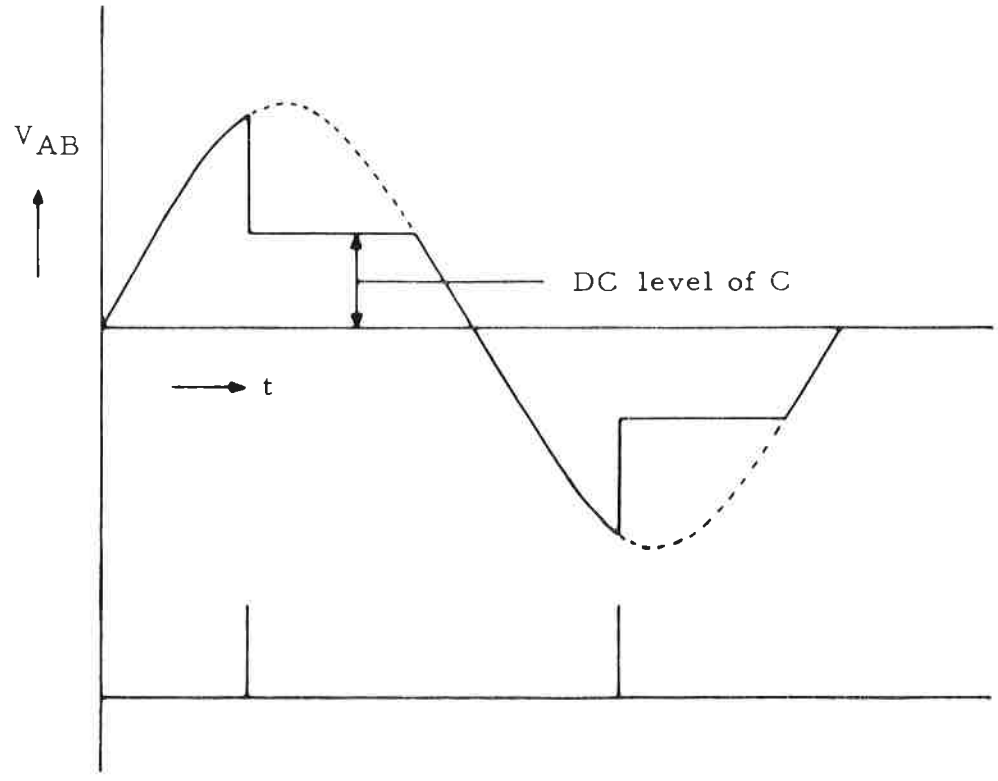


Fig. 3

The error voltage is converted into a time shift of the firing pulses of the controlled rectifiers, with regard to the zero crossings of the sine wave input voltage.
This causes a voltage change across the capacitor C in order to keep the voltage across T constant.

At a load current of 3 Amp. the voltage across T is about 3 Volts.
So the dissipation of T is than 9 Watts.
Without pre-regulation the dissipation would be about 90 Watts at low output voltages.

Constant voltage regulation:

A comparison bridge is formed with the resistors R4, R5, the reference voltage and the output voltage.

After amplification the error voltage of the bridge drives transistor T. At the condition of balance the output voltage is practically proportional to R5.

As long as the constant voltage regulation is active, the constant current regulation is inoperative, because one of the transistors of the current error amplifier is blocked.

Constant current regulation:

At constant current regulation the voltage drop across R1, which is proportional to the output current, is compared with the part of the reference voltage across R3.
The error voltage is amplified and drives transistor T in such a way that the voltage across R1 is kept constant and this means that the output current is constant.
The constant current is adjustable with potentiometer R3.

As long as the constant current regulation is active, the constant voltage regulation is inoperative, because one of the transistors of the voltage error amplifier is blocked.

The position of the crossover point of constant voltage regulation and constant current regulation depends on the settings of the voltage and current controls.

In fig. 4 the crossover point is drawn.

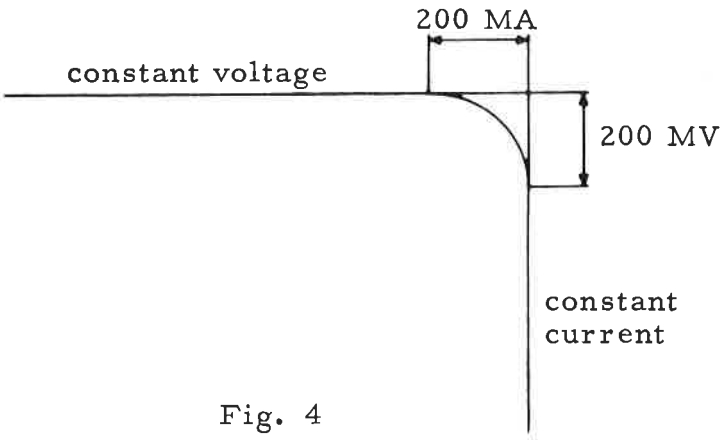


Fig. 4

R (Ohm)

1 =	1,2	k	5W 5%
2 =	10	k	var.
3 =	1	k	var.
4 =	560		½W 2% MF
5 =	15	k	½W 2% MF
6 =	4,7	k	½W 2% MF
7 =	ARW		
8 =	10	k	½W 2% MF
9 =	1,2	k	½W 2% MF
10 =	1,5	k	½W 5%
11 =	1	k	½W 5%
12 =	33	k	½W 5%
13 =	68	k	1W 2% MF
14 =	10	k	½W 2% MF
15 =	15	k	½W 2% MF
16 =	1	k	½W 5%
17 =	18	k	½W 5%
18 =	4,7	k	½W 2% MF
19 =	ARW		
20 =	100	k	½W 5%
21 =	8,2	k	½W 5%
22 =	1	k	½W 5%
23 =	1	k	½W 5%
24 =	100		½W 5%
25 =	4,7	k	½W 5%
26 =	470		½W 5%
27 =	100		½W 5%
28 =	330		½W 5%
29 =	1,8	k	½W 5%
30 =	1	k	var.
31 =	330		½W 5%
32 =	330		½W 5%
33 =	3,3	k	½W 5%
34 =	8,2	k	½W 5%
35 =	10	k	var.
36 =	47	k	½W 5%
37 =	15	k	½W 5%
38 =	470	k	½W 5%
39 =	1	m	var.
40 =	3,9	k	½W 5%
41 =	ARW		
42 =	30	k	½W 2% MF
43 =	1	k	var.
44 =	1,2	k	9W 5%
45 =	10		½W 5%
46 =	0,6		dr. gew.
47 =	5	k	var. 10 sl. potm.
48 =	5	k	var. 10 sl. potm.
49 =	1,2	k	9W 5%
50 =	330		5W 5%
51 =	150		5W 5%

C (microfarad)

1 =	100	100 V
2 =	25	15 V
3 =	10	100 V
4 =	25	70 V
5 =	0,00047	400 V
6 =	10	100 V
7 =	0,00047	400 V
8 =	1	250 V
9 =	10.000	70 V
10 =	250	15 V
11 =	250	15 V
12 =	10	100 V
13 =	0,1	630 V
14 =	0,47	250 V
15 =	500	70 V
16 =	0,2 + 2 x 0,005	250 V

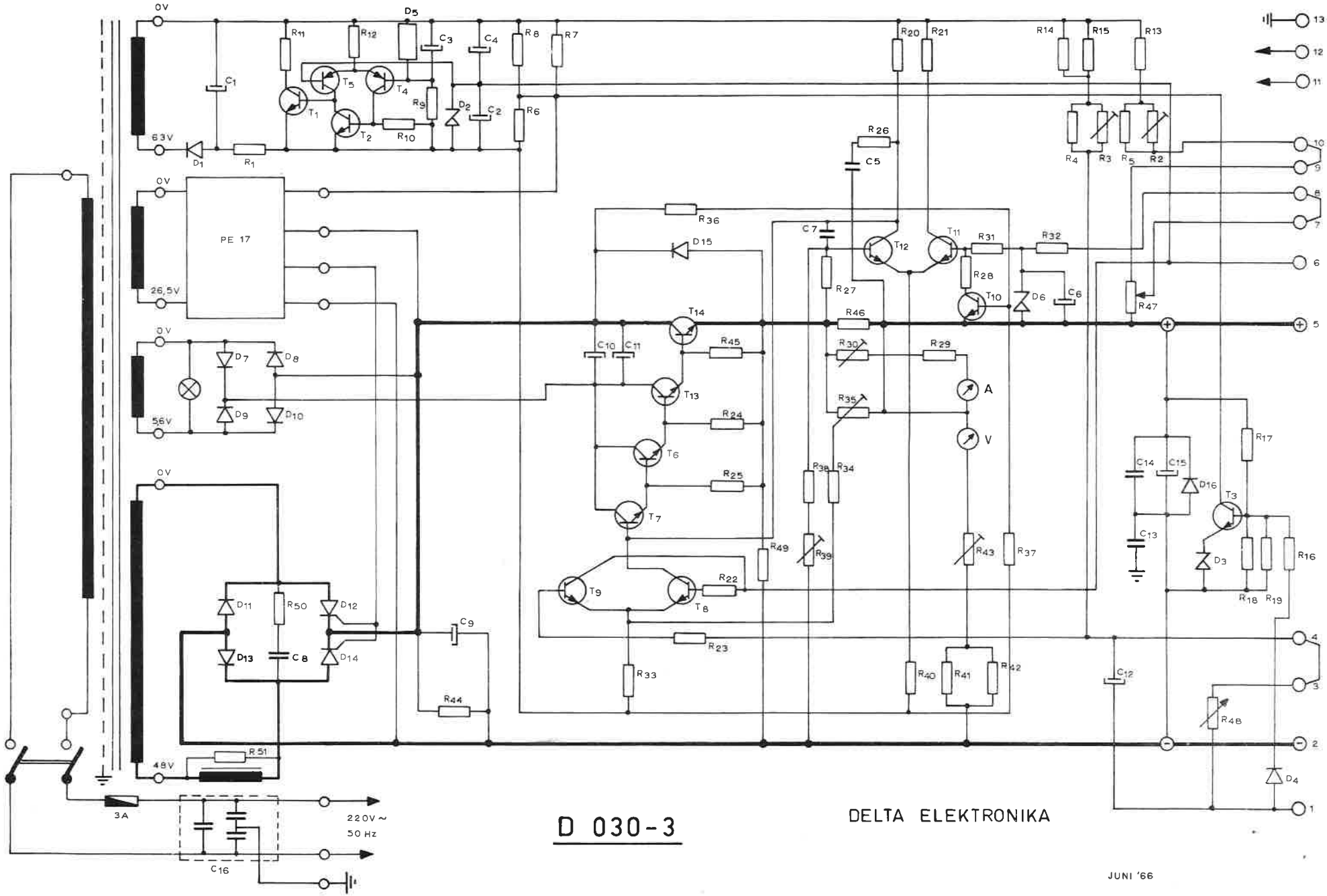
T 1 = 40348 RCA
2 = 2N3704 TI
3 = 40348 RCA
4 = 2N3703 TI
5 = 2N3703 TI
6 = 40348 RCA
7 = 40348 RCA
8 = 2N3704 TI
9 = 2N3704 TI
10 = 2N3704 TI
11 = 2N3704 TI
12 = 2N3704 TI
13 = 2N3055 RCA
14 = 2N3055 RCA

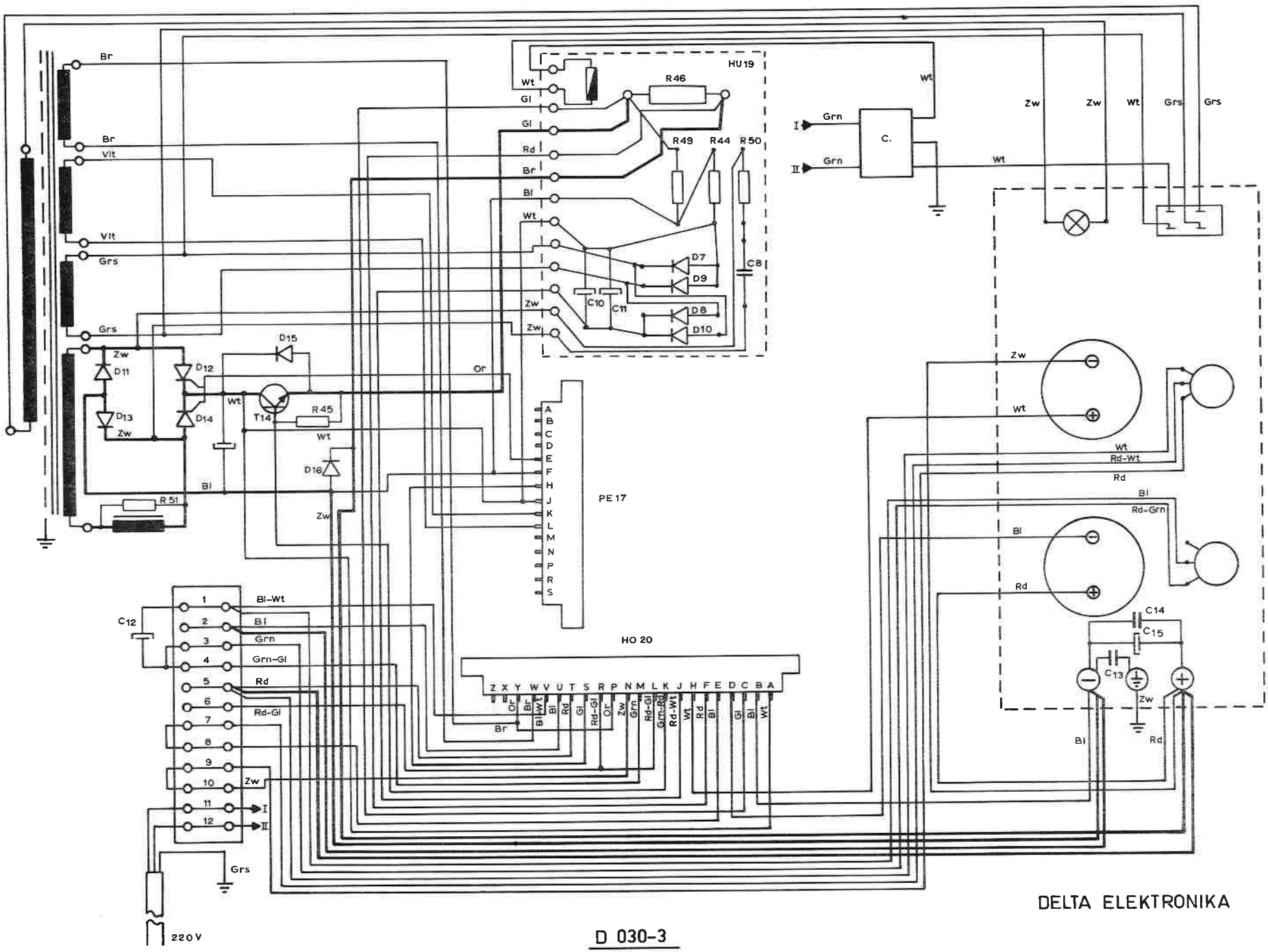
D 1 =	TS-2	DI
2 =	ZG 6,8	Intermetall
3 =	ZG 6,8	Intermetall
4 =	OA 202	Philips
5 =	RE 38	Delta
6 =	ZG 6,8	Intermetall
7 =	TS 05	DI
8 =	TS 05	DI
9 =	TS 05	DI
10 =	TS 05	DI
11 =	40209	RCA
12 =	2N3668	RCA
13 =	40209	RCA
14 =	2N3668	RCA
15 =	MR 1031 B	Motorola
16 =	40209	RCA

MF = Metaalfilmweerstand
Metalfilmresistor
Metallfilmwiderstand

ARW = Afregelweerstand
Calibration resistor
Abregelwiderstand

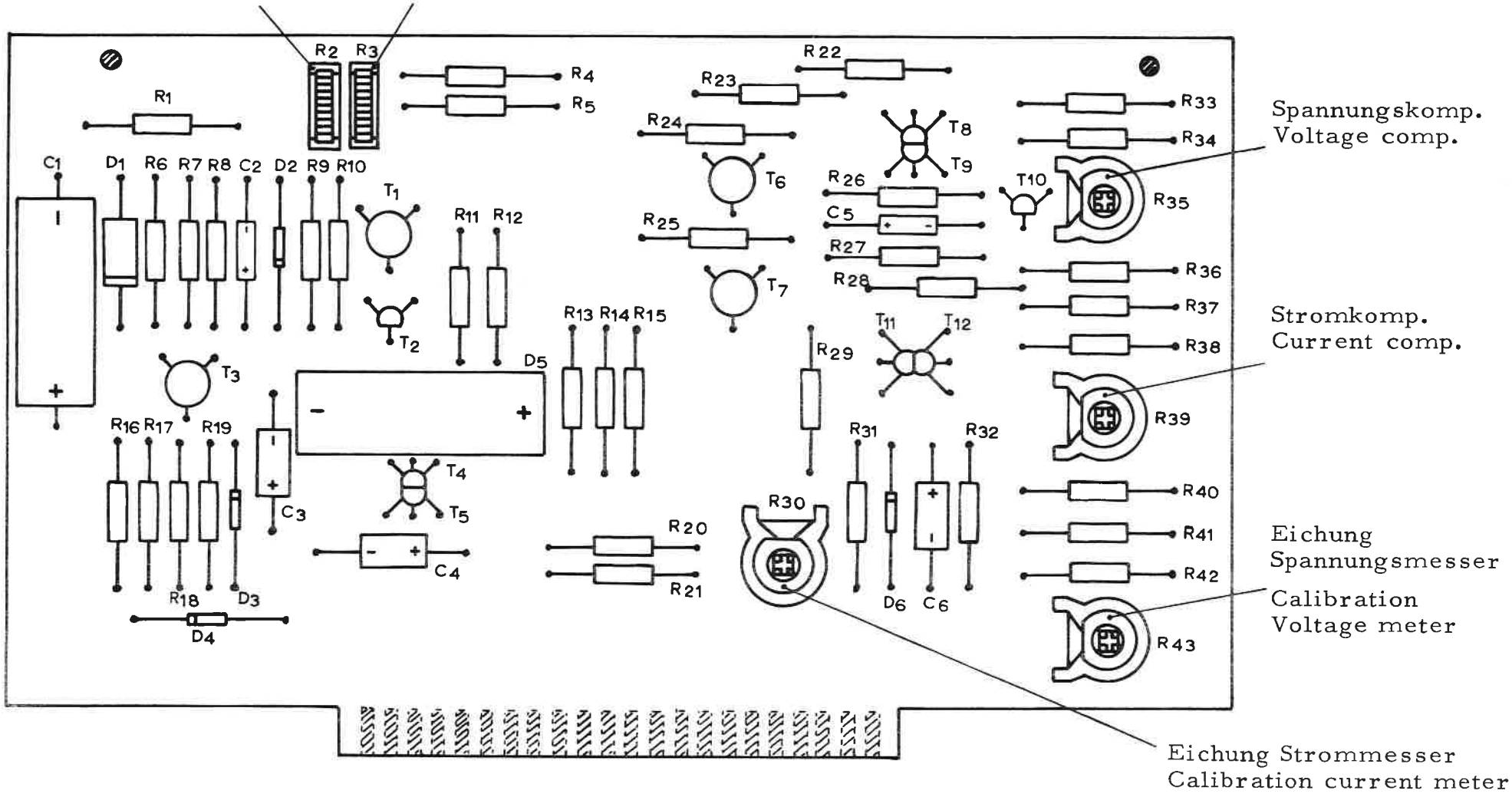
L = Liliput telefonlampe
6 V 0,04 A
Fabr. Taunuslicht


0V
63V
26,5V
56V
48V
PE 17
3A
220V ~
50 Hz
A
V
D 030-3
DELTA ELEKTRONIKA
JUNI '66

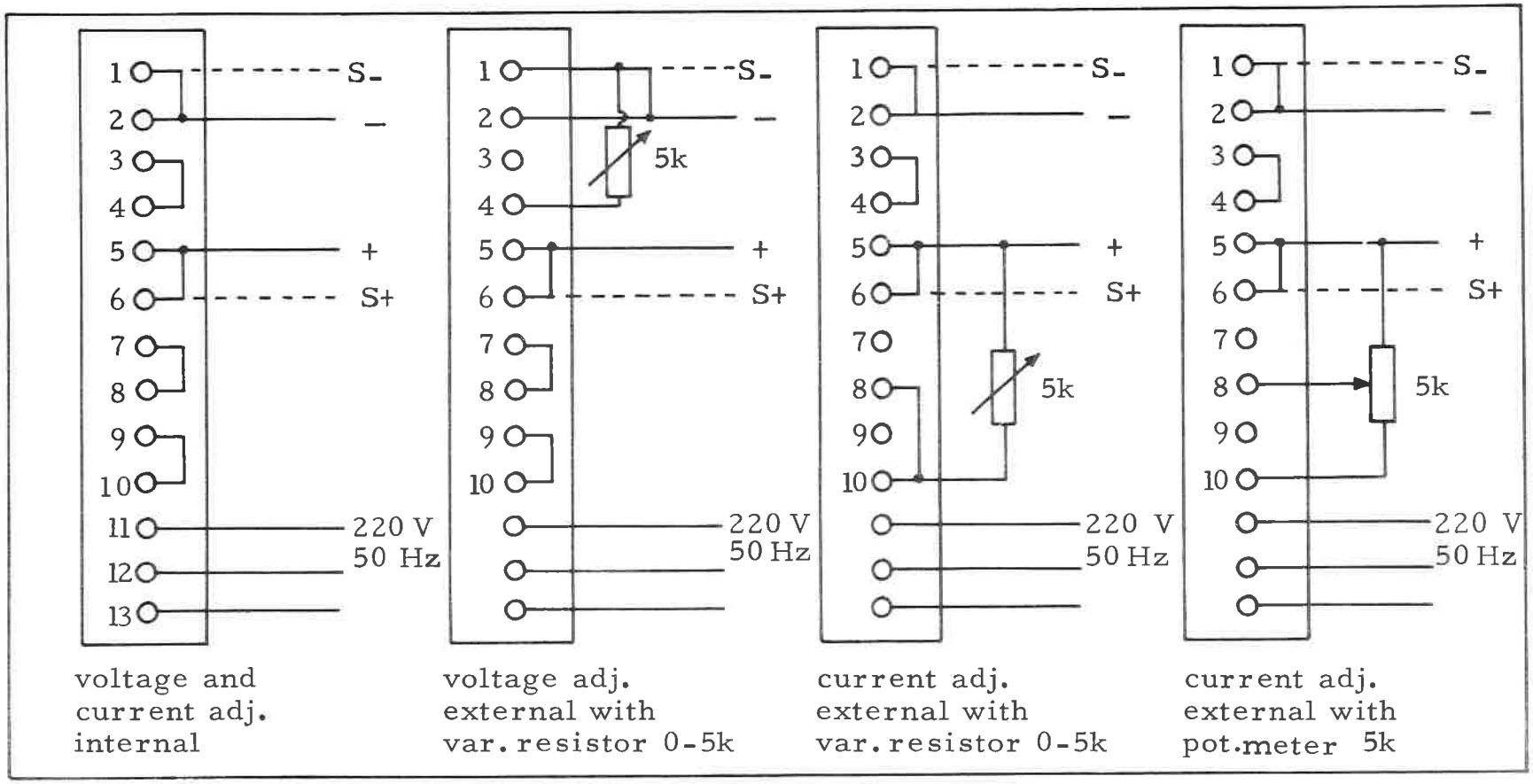

HU19
R46
R49
R44
R50
C8
C10
C11
D7
D9
D8
D10
D11
D12
D13
D14
D15
D16
T14
R45
R51
C12
PE 17
HO 20
C.
I
II
Grn
Wt
Zw
Grs
Br
Vlt
Gl
Rd
Bl
Or
Rd-Wt
Rd-Grn
C14
C15
C13
Bl-Wt
Grn-Gl
Rd-Gl
220V
DELTA ELEKTRONIKA
D 030-3
8

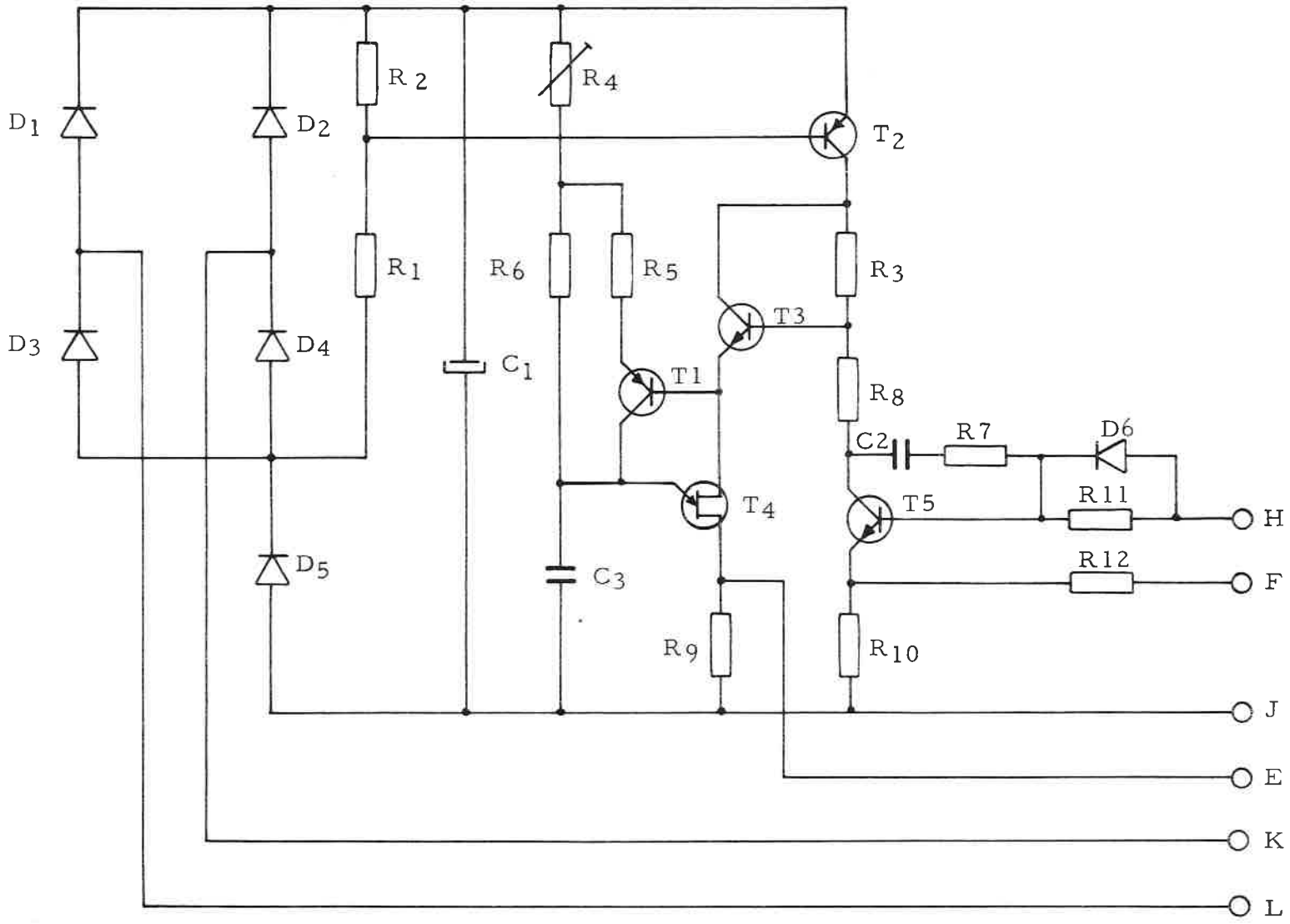
Strombereich
Current range

Spannungsbereich
Voltage range



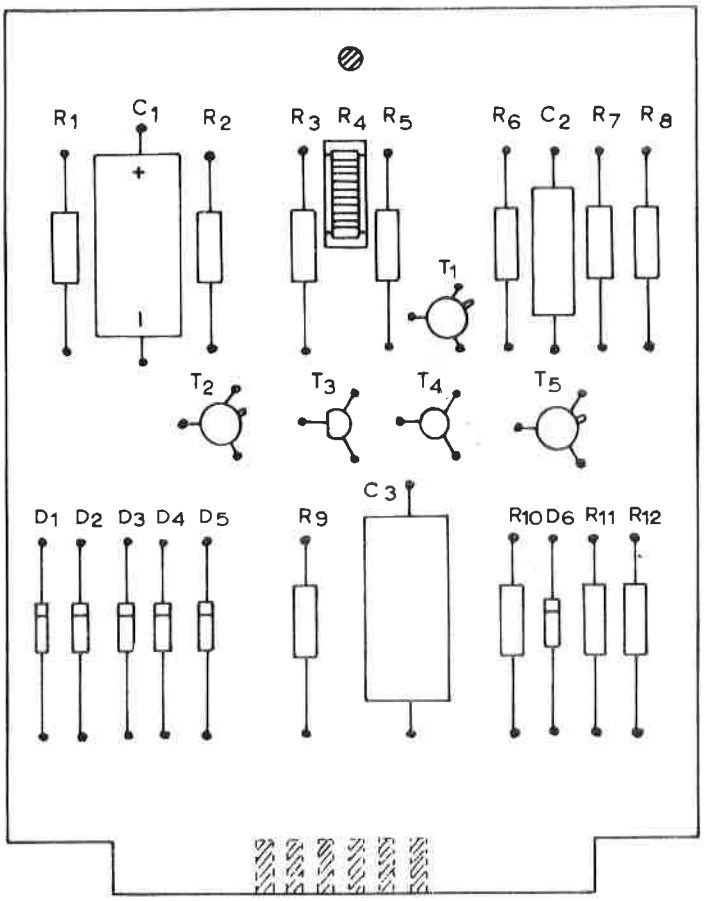
HO 20


1
2
3
4
5
6
7
8
9
10
11
12
13
S-
–
+
S+
220 V
50 Hz
5k
voltage and current adj. internal
voltage adj. external with var. resistor 0-5k
current adj. external with var. resistor 0-5k
current adj. external with pot.meter 5k


D1
D2
D3
D4
D5
R2
R4
R1
R6
R5
R3
C1
T1
T2
T3
T4
T5
R8
C2
R7
D6
R11
R12
C3
R9
R10
H
F
J
E
K
L

D 030-3

PE 17



PE 17

R (Ohm)

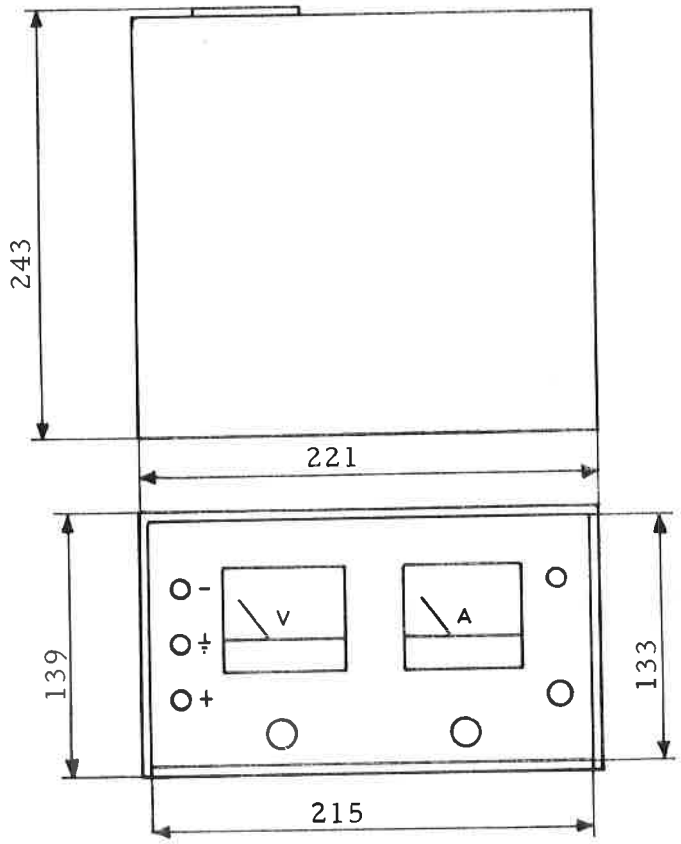
1 =	4,7 k	½W	5%
2 =	4,7 k	½W	5%
3 =	4,7 k	½W	2% MF
4 =	10 k	var.	
5 =	33 k	½W	2%
6 =	56 k	½W	2%
7 =	22 k	½W	5%
8 =	2,7 k	½W	2% MF
9 =	27	½W	5%
10 =	2,7 k	½W	2% MF
11 =	10 k	½W	5%
12 =	22 k	½W	5%

C (microfarad)

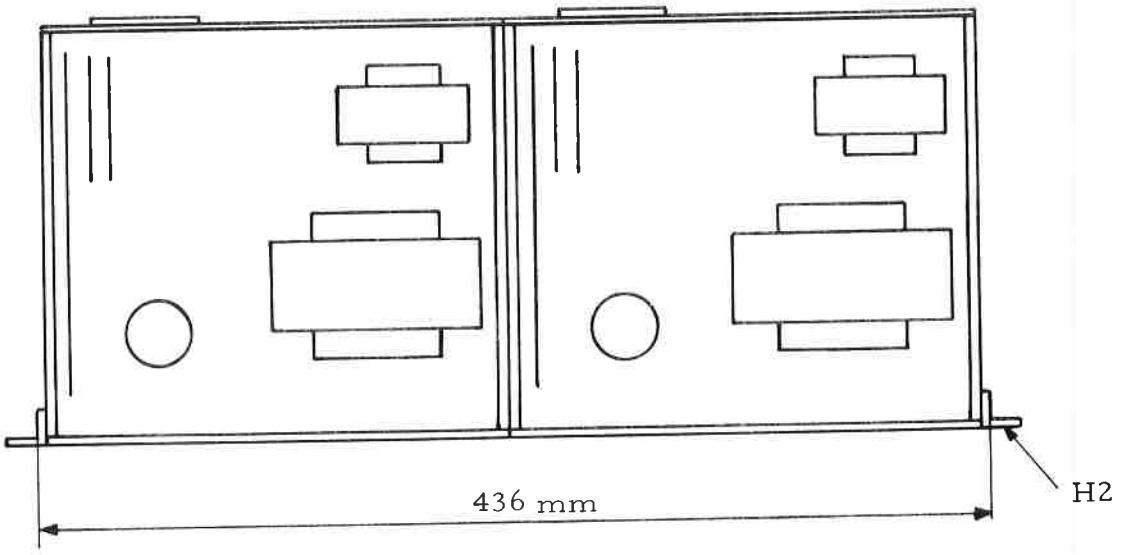
1 =	50	70 V
2 =	0,1	250 V
3 =	0,22	63 V

D 1 = TS 05 DI
2 = TS 05 DI
3 = TS 05 DI
4 = TS 05 DI
5 = TS 05 DI
6 = OA 202 Philips

T 1 = 2N4037 RCA
2 = 2N4037 RCA
3 = 2N3704 TI
4 = 2N2646 GE
5 = 40348 RCA



D 030-3 A



2 x D 030-3 B

NV DELTA ELEKTRONIKA

P.O. BOX 27
ZIERIKZEE
NETHERLANDS
TELEPHONE (01110) 2734

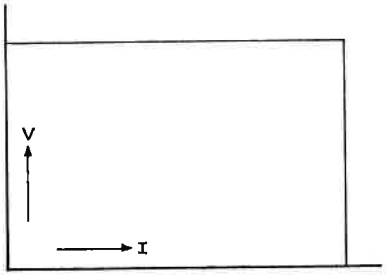
REGULATED POWER SUPPLY D 030-3

0 – 30 V, 0 – 3 A

from serial number 8173

DESCRIPTION

The power supply D 030-3 can be used as a constant voltage source with a limited current or as a constant current source with a limited open voltage. The change of mode occurs sharply at the crossing of the voltage and current settings.
A preregulator with silicon controlled rectifiers keeps the rectified voltage in accordance with the output voltage.
This means low dissipation in the transistors of the series regulator, so that no blower is needed for cooling.
The preregulator causes no interference on the mains.
The power supply is protected against any overload condition.



CONSTANT VOLTAGE OPERATION

Voltage control	10-turn potentiometer, range 0-30 V.
Remote programming	The voltage can be programmed by an external variable resistor of 0-5000 Ohm. Input on the rear panel.
Remote sensing	Separate amplifier terminals enable the output voltage to be regulated at a remote load point, using two sensing leads.
Voltage regulation	3 mV for a + or – 10 % AC input voltage variation. 10 mV for a 100 % load change.
Temp. coeff.	Less than 3 mV per °C.
Ripple voltage	0.1 mV r.m.s.

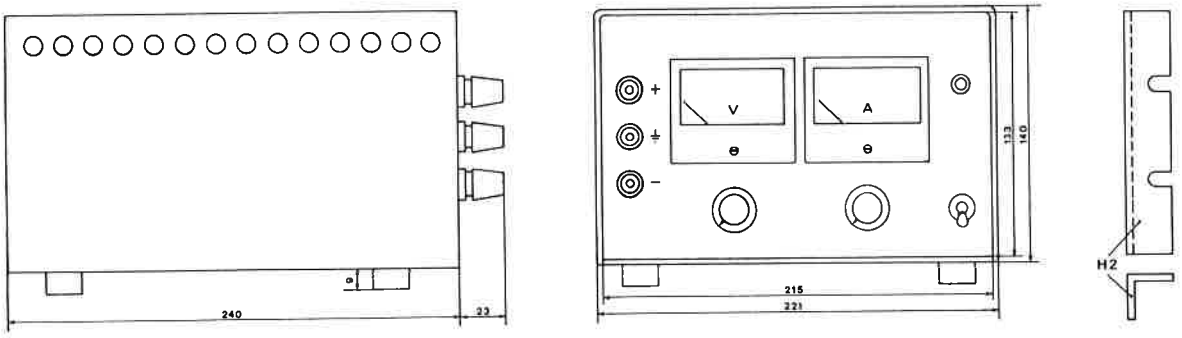
Output impedance	Maximum 0.1 Ohm up to 100 kHz load frequency.
Recovery time	20 micro seconds for recovery to within 30 mV of steady state voltage after a step load change from 10 % to 100 %.

CONSTANT CURRENT OPERATION

Current control	10-turn potentiometer, range 0-3 A.
Remote programming	The current can be programmed by an external variable resistor of 0-5000 Ohm. Input on the rear panel.
Current regulation	3 mA for a + or − 10 % AC input voltage variation. 3 mA for a maximum output voltage swing.
Temp. coeff.	Less than 3 mA per °C.
Ripple current	0.5 mA r.m.s.

REMAINING SPECIFICATIONS

Input voltage	110-120-220-240 V, 50 Hz.
Parallel and series connection	Special design enables parallel and series operation without any precaution.
Ambient temp.	− 20 to + 45 °C.
Output terminals	On front and rear panel, isolated from the case. Maximum voltage between output terminals and case 500 V.
Rack mounting	Two uncased units can be mounted side by side and with the addition of two H2 brackets can be inserted in a 19" rack. For ordering uncased units add B to type number (D 030-3 B).
Cooling	By natural convection cooling. The air must flow freely through the vertical heat sink for effective cooling.
Meters	Voltage meter 0-30 V, accuracy 1.5 %. Current meter 0- 3 A, accuracy 1.5 %.
Finish	Light gray front panel with dark blue case.
Weight and size	11.4 kg, 221 x 140 x 240 mm.



The power supply D 030-3 can be used as a source of constant voltage with a limited current, or as a source of constant current with a limited open voltage.

Remote sensing

The output voltage may be regulated at a load point remote from the power supply by means of two extra wires (fig. 1).

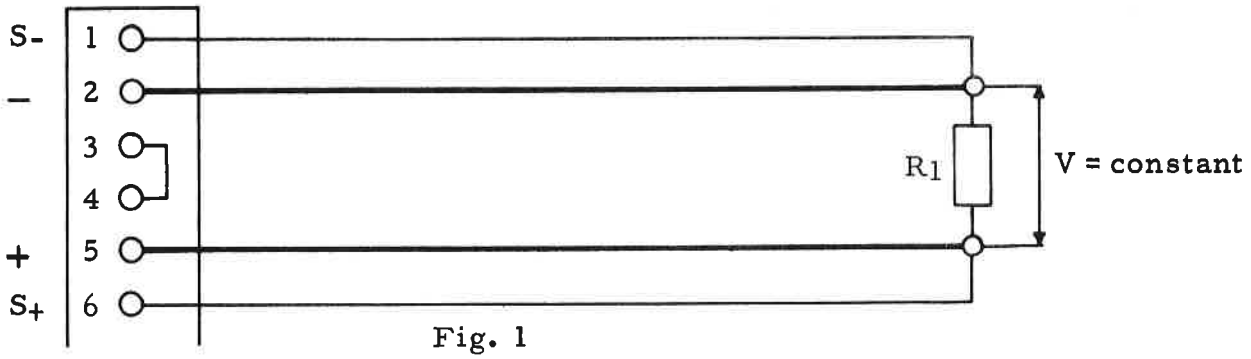


Fig. 1

The shorting links between the terminals S+ and + and between the terminals S- and - at the back side of the power supply have to be disconnected in this case.

A voltage drop up to 1.5 Volts in each connecting wire can be compensated.

Depending on the output voltage and current it is often possible to compensate for still larger voltage drops.

Remote sensing does not compensate for the inductance of the load connecting wires.
To establish a low source impedance at the load a capacitor bypass directly at the load terminals is useful.
To minimize the inductance the load wires should be twisted together.
The sensing wires can also be twisted together.

Ambient temperature

The maximum allowed ambient temperature is 40°C when the load current is 3 A continuously and 70°C at 1,5 A.

When mounted in a rack or cabinet one should care for sufficient ventilation to remove the dissipated heat.

Circuit description

To explain the circuit a simplified circuit diagram is drawn (fig. 2).

The regulation consist of two parts: A fast regulation with silicon transistors and a slower pre-regulation with silicon controlled rectifiers.

Pre-regulation:

The switching pre-regulation with controlled rectifiers is used to keep the dissipation in the pass transistor T low.
For this purpose the voltage across T is kept constant, independent of the input and output voltage.
The voltage across T is compared with a part of the reference voltage (the voltage across R_1 is neglected for simplification).

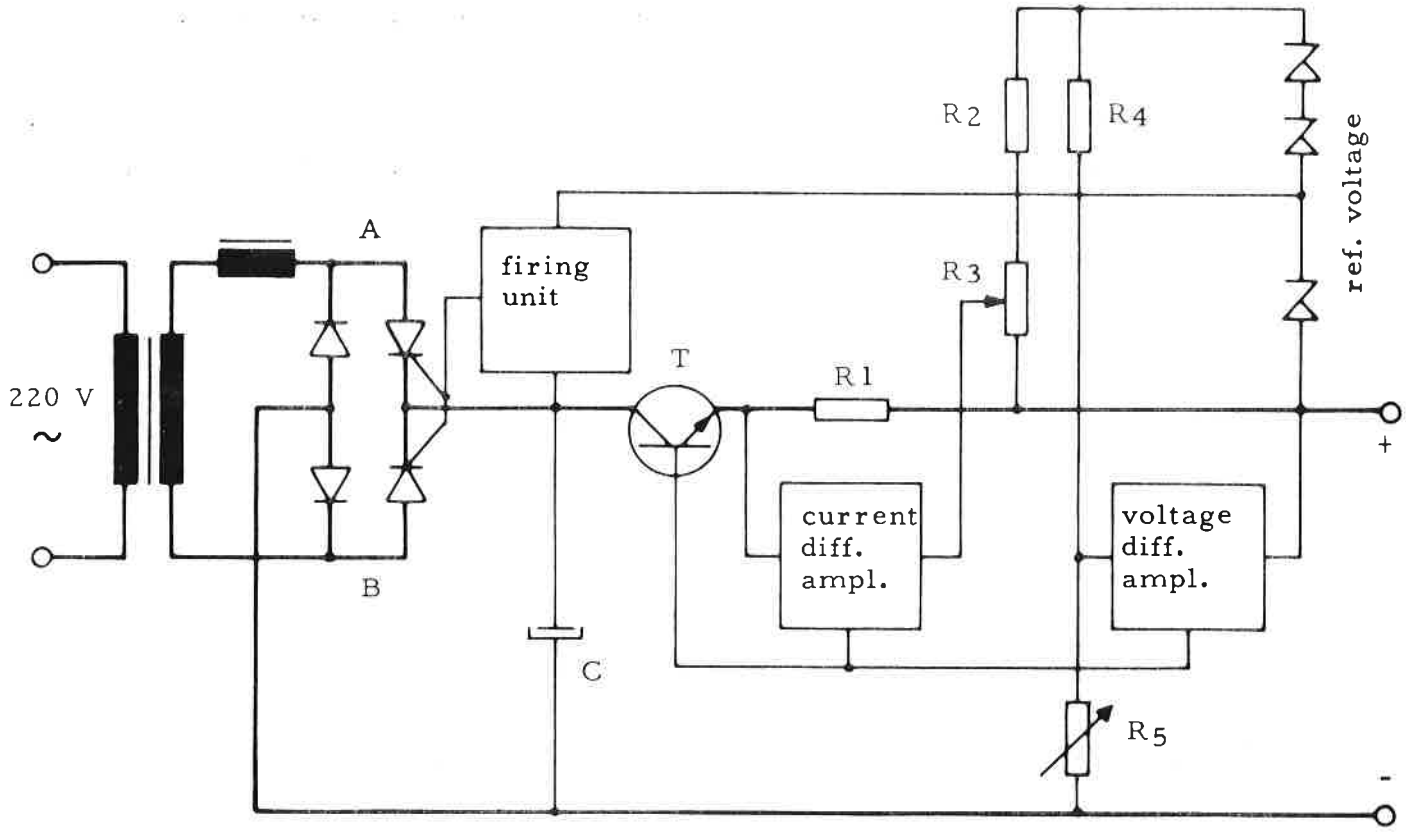


Fig. 2 Simplified Circuitdiagram D 050-10
D 030- 3

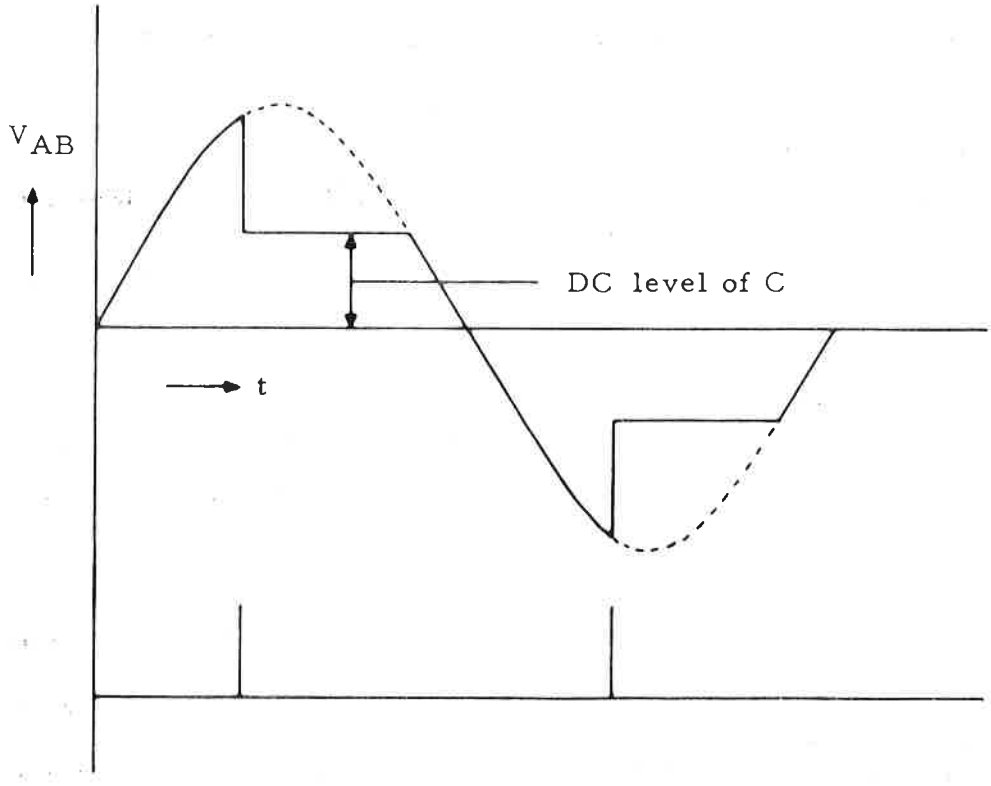


Fig. 3

DELTA ELEKTRONIKA

The error voltage is converted into a time shift of the firing pulses of the controlled rectifiers, with regard to the zero crossings of the sine wave input voltage.
This causes a voltage change across the capacitor C in order to keep the voltage across T constant.

At a load current of 3 Amp. the voltage across T is about 3 Volts.
So the dissipation of T is than 9 Watts.
Without pre-regulation the dissipation would be about 90 Watts at low output voltages.

Constant voltage regulation:

A comparison bridge is formed with the resistors R4, R5, the reference voltage and the output voltage.

After amplification the error voltage of the bridge drives transistor T. At the condition of balance the output voltage is practically proportional to R5.

As long as the constant voltage regulation is active, the constant current regulation is inoperative, because one of the transistors of the current error amplifier is blocked.

Constant current regulation:

At constant current regulation the voltage drop across R1, which is proportional to the output current, is compared with the part of the reference voltage across R3.
The error voltage is amplified and drives transistor T in such a way that the voltage across R1 is kept constant and this means that the output current is constant.
The constant current is adjustable with potentiometer R3.

As long as the constant current regulation is active, the constant voltage regulation is inoperative, because one of the transistors of the voltage error amplifier is blocked.

The position of the crossover point of constant voltage regulation and constant current regulation depends on the settings of the voltage and current controls.

In fig. 4 the crossover point is drawn.

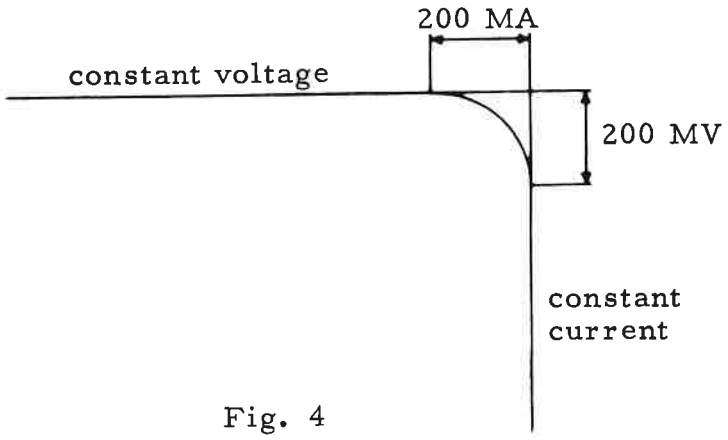


Fig. 4

R (Ohm)

1 =	1,2	k	5W 5% WW
2 =	330		
3 =	1	k	
4 =	33	k	
5 =	1,5	k	
6 =	1,2	k	MF
7 =	10		5W 5% WW
8 =	1,2	k	9W 5% WW
9 =	12	k	MF
10 =	4,7	k	MF
11 =	CR		
12 =	3,3	k	
13 =	47	k	
14 =	10		
15 =	100		
16 =	4,7	k	
17 =	1	k	
18 =	1	k	
19 =	1,2	k	9W 5% WW
20 =	330	k	
21 =	1	m	variable
22 =	1	k	
23 =	100		
24 =	0,68	k	25W 3% WW
25 =	1	k	variable
26 =	10	k	
27 =	8,2	k	
28 =	10	k	
29 =	100	k	
30 =	8,2	k	
31 =	3,9	k	
32 =	1,8	k	
33 =	330		
34 =	330		
35 =	1	k	variable
36 =	1	m	
37 =	15	k	
38 =	30	k	
39 =	6,8	k	$\frac{1}{2}$W 2% WW
40 =	CR		
41 =	CR		
42 =	330		
43 =	CR		
44 =	82	k	MF
45 =	5	k	var. 10 t. potm.
46 =	5	k	var. 10 t. potm.
47 =	18	k	
48 =	6,8	k	MF
49 =	CR		
50 =	1	k	

C(microfarad)

1 =	100	100 V
2 =	0,07 + 2 x 0,0025	250 V - 50 Hz F 1185/14 Roe
3 =	1	250 V
4 =	10	100 V
5 =	5900	70 V
6 =	25	70 V
7 =	25	15 V
8 =	250	15 V
9 =	250	15 V
10 =	0,01	250 V
11 =	0,01	250 V
12 =	10	100 V
13 =	10	100 V
14 =	0,47	250 V
15 =	0,1	630 V
16 =	500	70 V
17 =	100	70 V

D

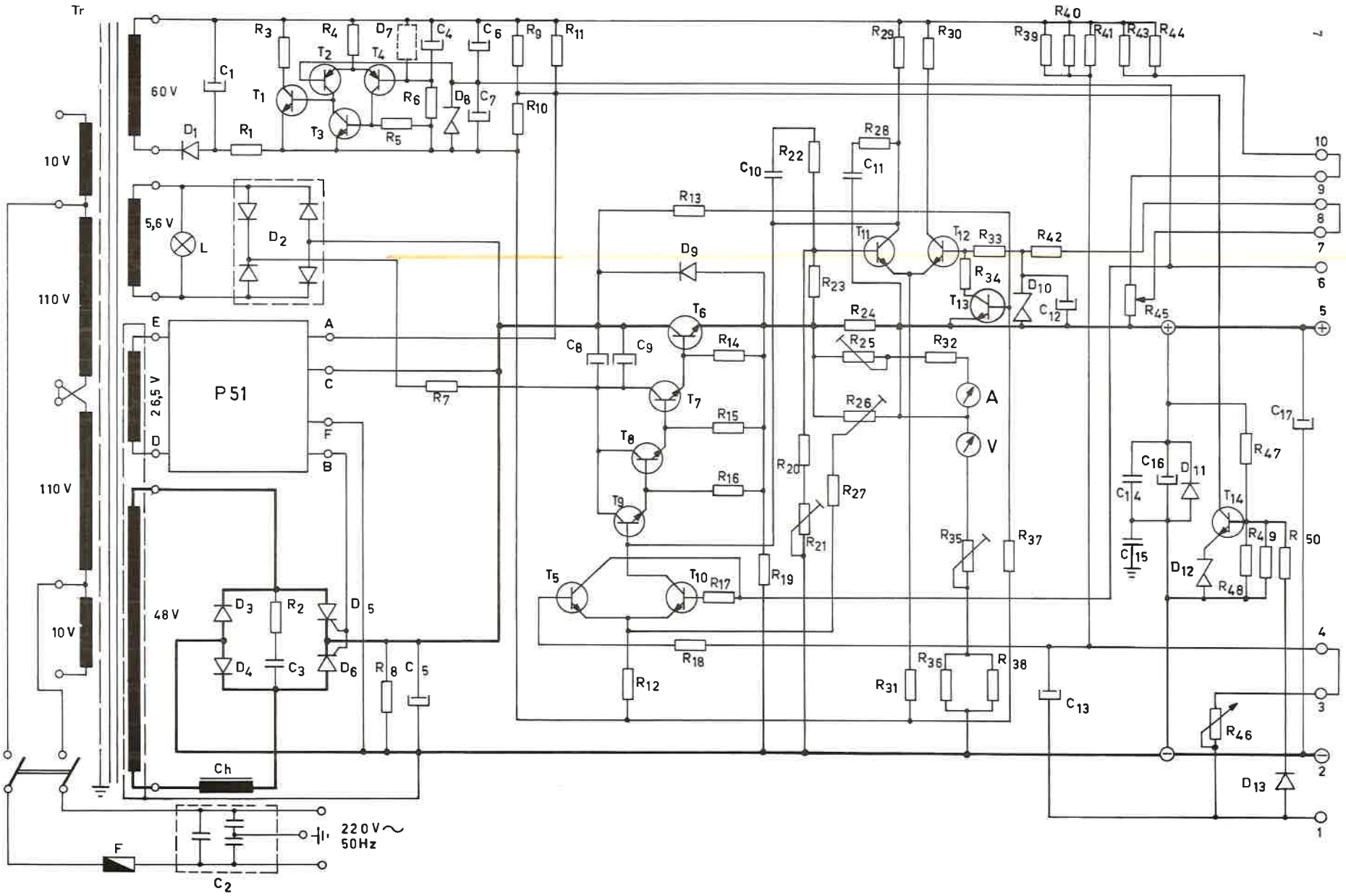
1 =	TS 2	DI
2 =	VE 18	Varo
3, 4, 11 =	VTD 200/S	Varo
5 =	2N3668	RCA
6 =	2N3668	RCA
7 =	RE 38	Delta
8 =	ZP 6,8	Intermetall
9 =	TS 2	DI
10 =	ZP 6,2	Intermetall
12 =	ZP 6,8	Intermetall
13 =	OA 202	Philips

T

1 =	2N3053	RCA
2 =	BC 212	TI
3 =	BC 182	TI
4 =	BC 212	TI
5 =	BC 182	TI
6 =	2N3055	RCA
7 =	2N3055	RCA
8 =	2N3053	RCA
9 =	2N3053	RCA
10 =	BC 182	TI
11 =	BC 182	TI
12 =	BC 182	TI
13 =	BC 182	TI
14 =	2N3053	RCA

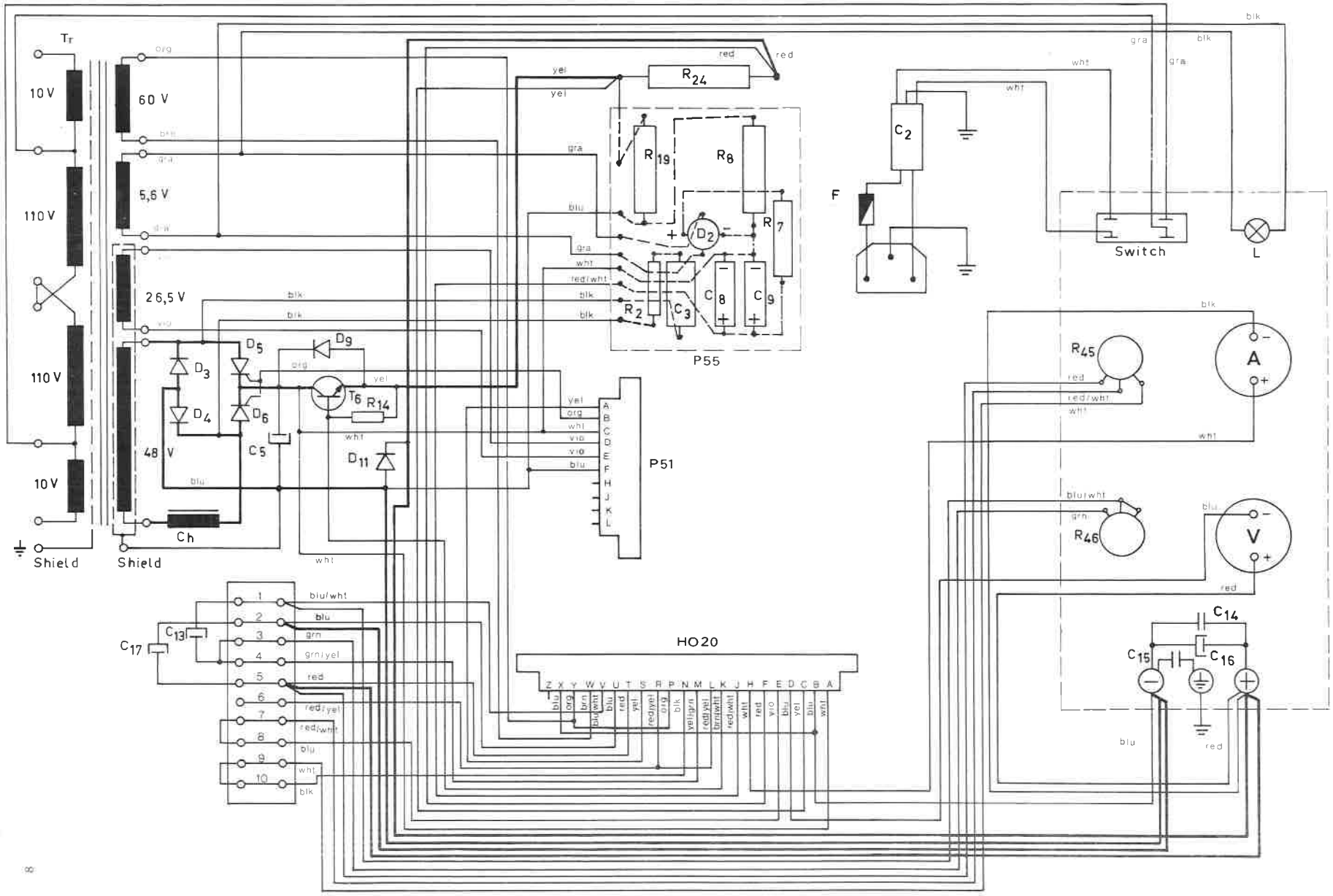
Ch = Choke S 030-3 Delta
Tr = Transformer T 030-3 D Delta
L = Liliput telefonlamp 6 V 0,04 A - Taunuslicht
F = Fuse 3,15 A -delay- $5\frac{1}{4}$" x $\frac{1}{4}$" - 250 V

CR = Calibration resistor
WW = Wire wound resistor
MF = Metalfilm resistor $\frac{1}{2}$W 2%
all other resistors carbon $\frac{1}{2}$W 5%



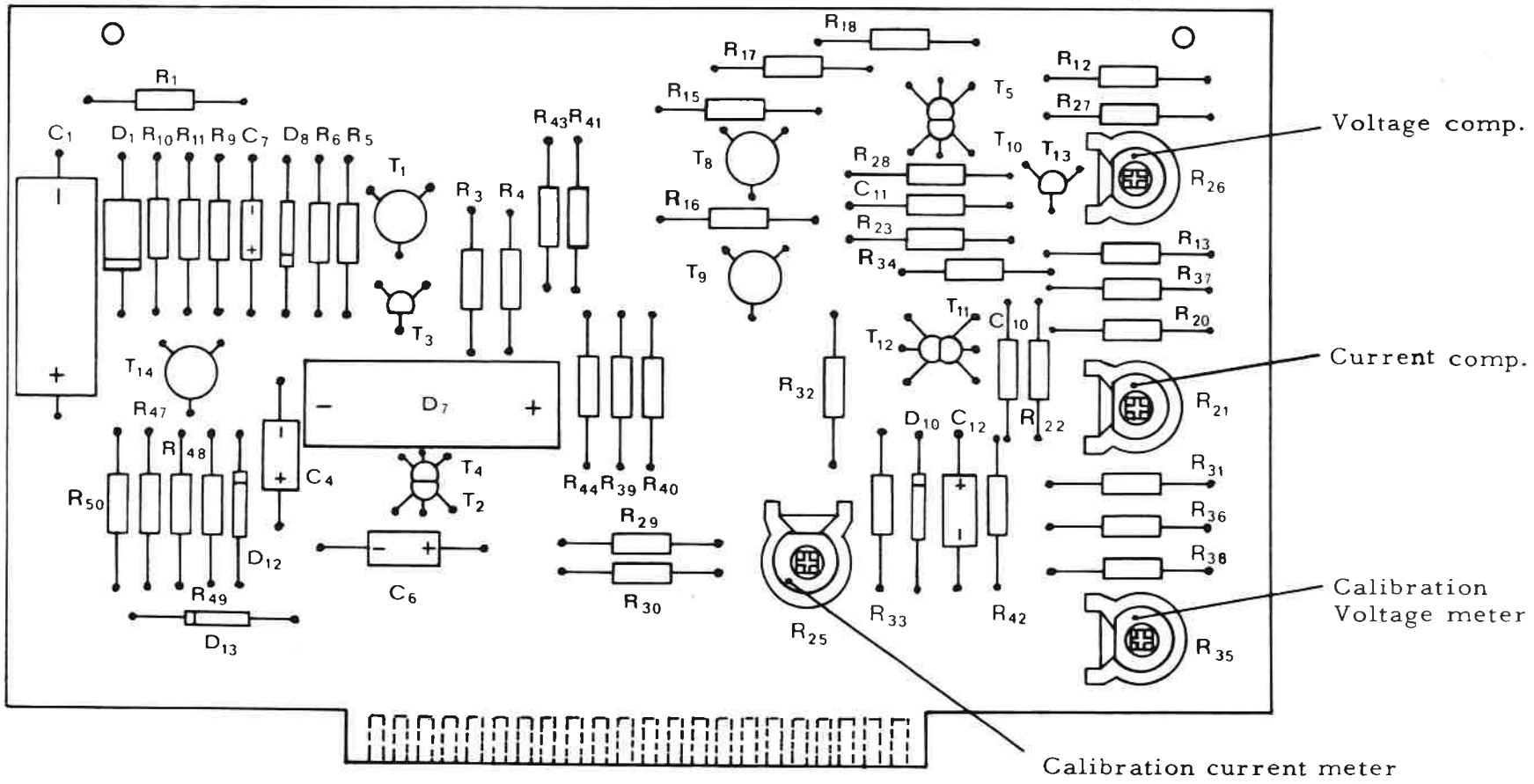
D 030 _ 3 , to start with serial nr 8173

jan.1969

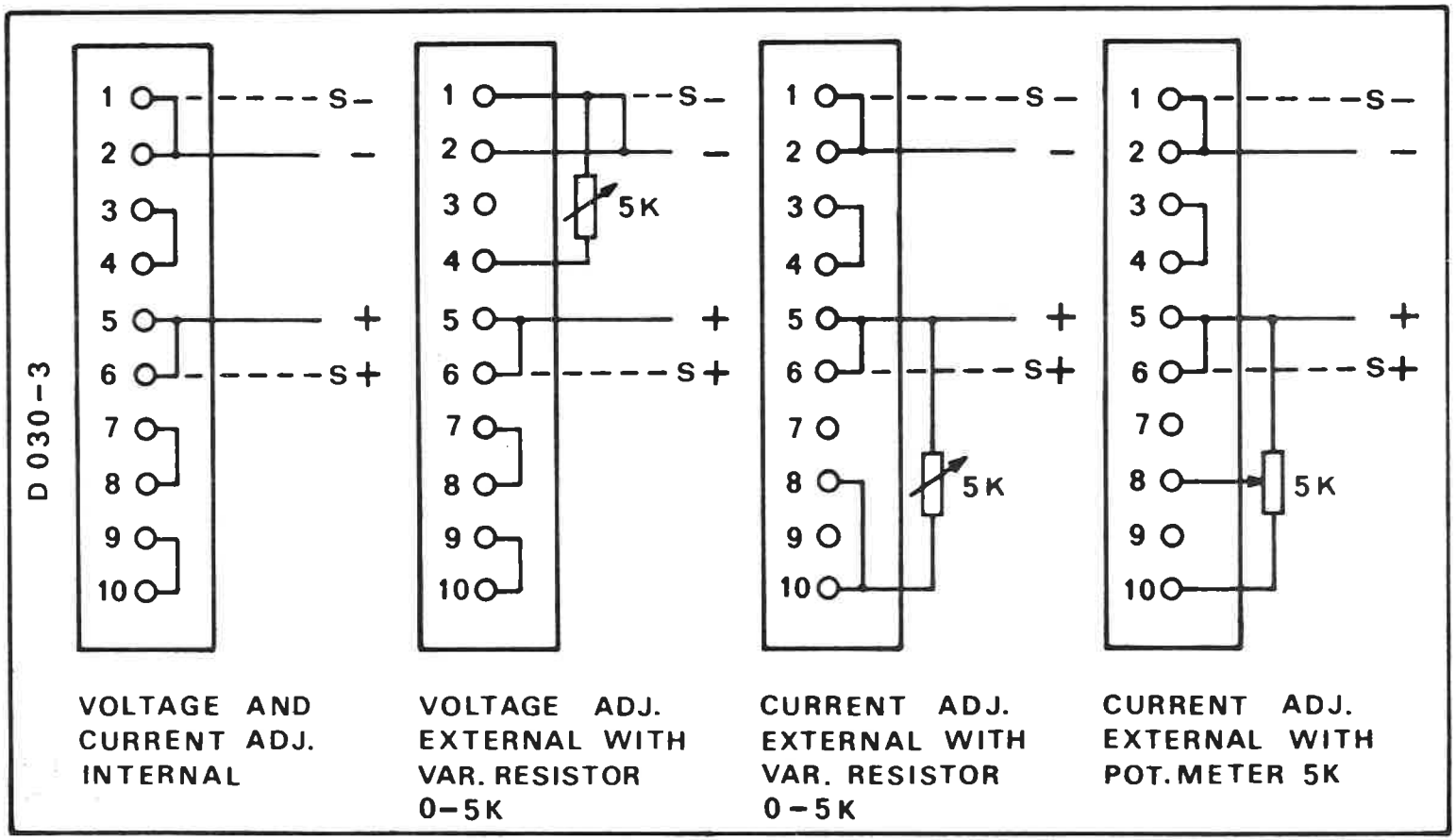


D030_3, to start with serial nr. 8173

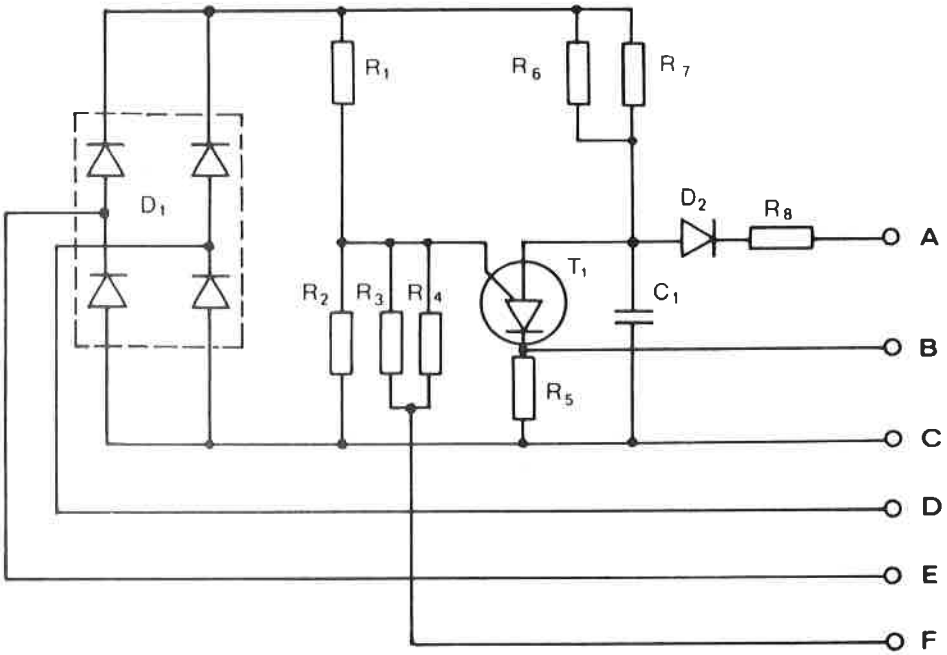
jan 1969

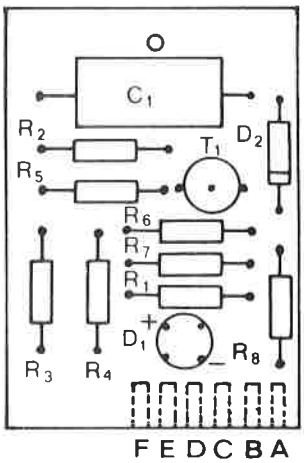

R1
C1
D1 R10 R11 R9 C7 D8 R6 R5
T1
R3 R4
R43 R41
T3
T14
R47
D7
R48
R50
C4
T4
T2
D12
R49
D13
C6
R44 R39 R40
R29
R30
R18
R17
R15
T8
R16
T9
T5
R28
C11
R23
R34
T10
T13
R12
R27
R26
Voltage comp.
R13
R37
R20
T11
T12
C10
R32
R22
R21
Current comp.
D10 C12
R31
R36
R38
R25
R33
R42
R35
Calibration Voltage meter
Calibration current meter

HO 20



Barier strip connections on rear of D 030-3





Pulse unit P 51

R (Ohm)

1 =	2,7	k	½W 2% MF
2 =	2,7	k	½W 2% MF
3 =	CR		
4 =	15	k	½W 2% MF
5 =	27		½W 5%
6 =	15	k	½W
7 =	CR		
8 =	4,7	k	½W 2% MF

C (microfarad)

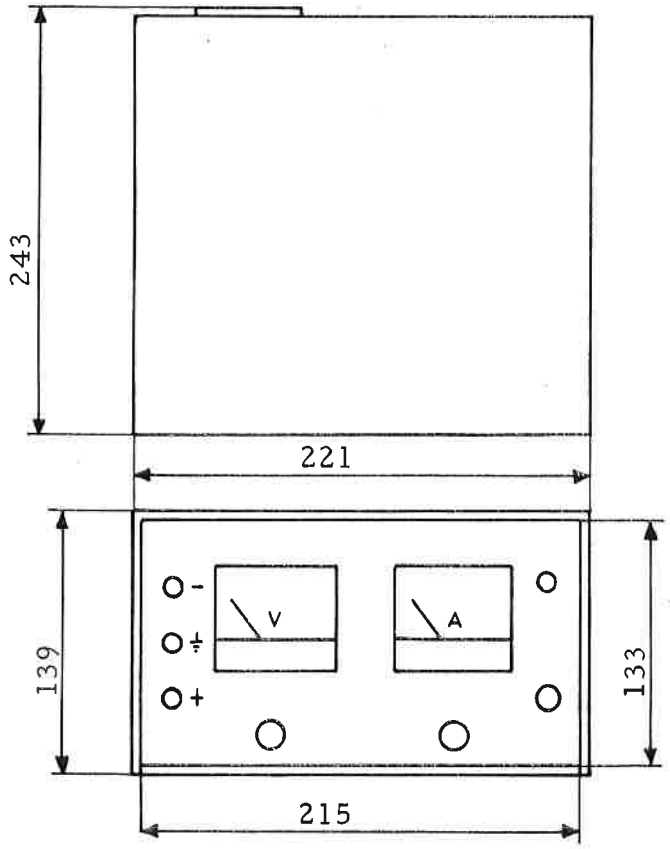
1 =	0,22	63 V 2%

D

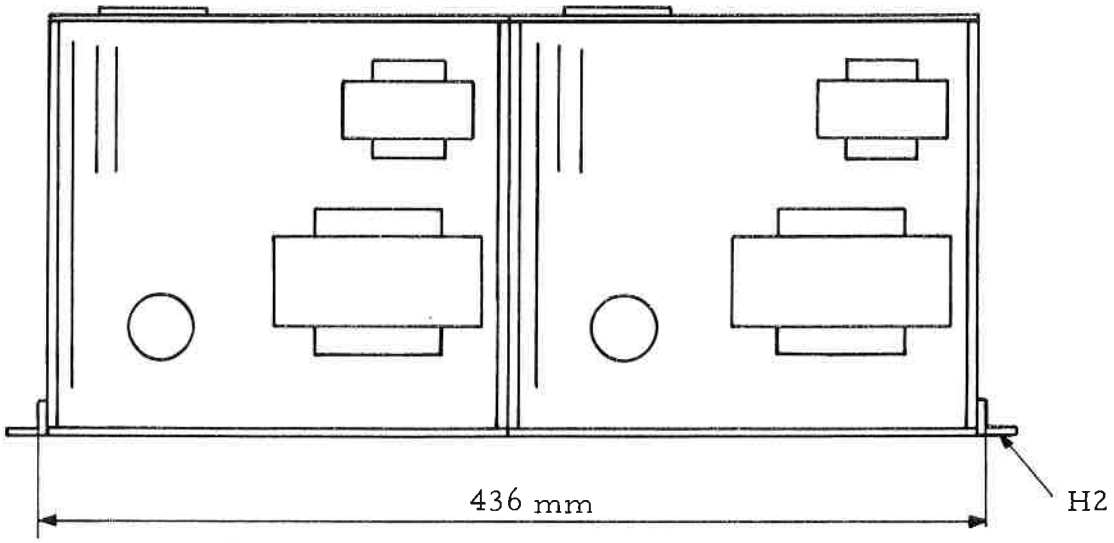
1 =	W113	Varo
2 =	OA202	Philips

T

1 =	D13T1	G.E.



D 030-3 A



2 x D 030-3 B