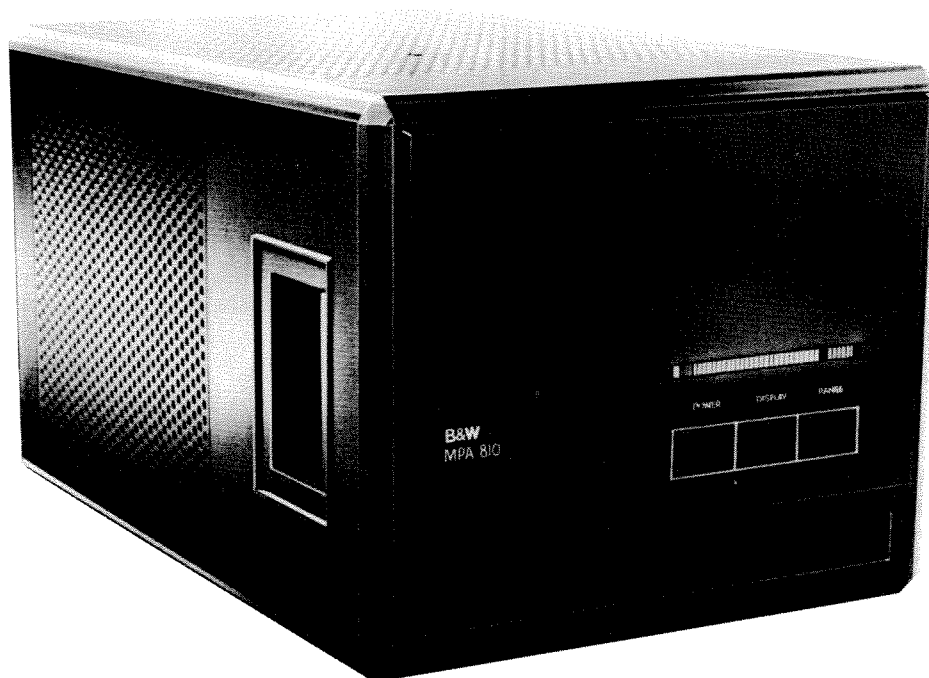


B&W – MPA 810



Service Manual

1. MAIN AMPLIFIER

1. INPUT STAGE

IC1 a/d are configured as a differential buffer with a common mode gain of unity and differential gain which can be adjusted using the switchable resistor option. The two outputs feed differential amplifiers IC1b and IC1c which are connected in a complementary manner to give the two mutually inverse drive signals to the main amplifier stages. The use of an input buffer provides the following differential stages with a predictable (low) source impedance which improves the overall symmetry and hence common mode performance of the stage.

2. AMPLIFIER CIRCUIT

The basic amplifier consists of two complementary long-tailed pair circuits each with its own 2mA emitter current source. The outputs of the long-tailed pairs are fed to a complementary cascode circuit running at a quiescent current of 50mA, this current being set by two diode chains. The voltage difference between the two outputs of the cascode circuit is set by a V_{BE} Multiplier, this is used to set the quiescent current flowing through the output devices.

The two outputs from the cascode circuit are connected via gate resistors, to parallel groups of closely matched N-Channel and P-Channel MOSFETS in a complementary arrangement. Eight N-Channel and eight P-Channel devices are used, each with its own source resistor. VR401 of the V_{BE} Multiplier should be adjusted so that the voltage across the 0.22R source resistor is 15mV, this corresponds to a quiescent current of 65mA.

2. PROTECTION CIRCUIT

1. CIRCUIT DESCRIPTION

Two signals are taken from each output circuit board (+Ve and -Ve) and fed into the protection circuit. One signal being proportional to the voltage across an output device, and the other to the current flowing through it.

These signals are processed through separate differential amplifiers, which feature a high common mode capability. The outputs from these amplifiers are fed into an SG1495 (IC8/9) Multiplier I.C. which performs a multiplication function on the signals. The result of this multiplication is buffered by I.C.4/5 so that the signal at Test Point 1 is proportional to the instantaneous power dissipated in the junction of the output M.O.S.F.E.T.

This 'power' signal is then fed into a current amplifier which drives a thermal analogue circuit. The purpose of the thermal analogue being to simulate the thermal properties of the M.O.S.F.E.T.'s junction. This results in the signal at Test Point 2, which will be proportional to the temperature in the junction of the M.O.S.F.E.T.

Test Point 2 together with the 'current signal' are fed to separate 'Trigger Circuits'. These circuits monitor the 2 signals and will switch-on if the input exceeds a set value (-4.4V). Activation of the 'trigger' circuits will indicate either an impending current overload of the M.O.S.F.E.T.S, or a temperature excess, neither condition being desirable. The trigger circuits are connected to a 4538 Monostable I.C. (I.C.10) in such a way that any trigger circuit can set the Monostable independently. The Monostable is used to switch on an opto-isolator (I.C.11), and stays activated for 4 seconds. The opto-isolator is then used to switch on 'clamping transistors' on the amplifier section of the board, which severely limit the gate drive of the output devices and hence the devices are protected.

In addition to the aforementioned protection circuit, a relay circuit is employed which clamps the gate drive of the output devices during switch-on and switch-off modes. This is primarily to guard against the accidental application of short-circuits during switch-on.

PROTECTION CIRCUIT (Contd)

2. EQUIPMENT CONNECTION FOR CALIBRATION

A signal generator will be needed to simulate the 'current sense' and voltage -sense' signals, these are applied to the protection circuit via the six-way edge connector. (See Sheet DS12/1).

The signals to be applied are as follows:-

<u>Pin No.:</u>	<u>RMS Voltage</u>	<u>(Peak to Peak)</u>	<u>Purpose</u>
1	30V	(84V)	Voltage-sense
2	0V	(0V)	Common
3	2.5V	(7V)	Current-sense
4	30V	(84V)	Voltage-sense
5	0V	(0V)	Common
6	2.5V	(7V)	Current-sense

Both voltage and current signals should be at a frequency of 1k.Hz.

A power amplifier can be used to produce the 30V RMS signal.

3. CALIBRATION METHOD

Starting with the righthand protection circuit:

- A, Connect an oscilloscope probe to Test Point 1 (This is Pin 6 of IC5) and the oscilloscope to 0.2V/cm.
- B, Apply the 2.5V RMS, 1 kHz signal to Pins 3 and 6 of the edge connector.
- C, Adjust VR8 to reduce the signal at TP1 to zero. In the case of a large D.C. offset, use VR7 to reduce the offset, so that the signal appears on the screen.
- D, Apply the 30V RMS, 1kHz signal to Pins 1 and 4 of the edge connector.
- E, Adjust VR9 to reduce the signal at TP1 to zero.
- F, Apply both the 30V and the 2.5V signals to their respective Pins simultaneously.
- G, Adjust VR10 to give a 1 kHz sine wave of 3.1V peak to peak at TP1.
- H, Remove the input signals from the edge connector.
- I, Adjust VR7 to reduce the D.C. offset to zero.
- J, Repeat steps A to I, but on the lefthand protection circuit, using potentiometers VR3,4,5 & 6 instead of VR7,8,9 & 10. In this case Test Point 1 is Pin 6 of IC4.

PROTECTION CIRCUIT (Contd)

4. CHECKING PROTECTION CIRCUIT OPERATION

- A, Apply both the 30V and the 2.5V 1kHz signals to their respective pins simultaneously.
- B, With an oscilloscope probe, check Pin 7 of both IC6 and IC7 for a 1kHz sine wave of 3V peak to peak.
- C, Check Pin 8 of both IC6 and IC7 for a 1kHz sine wave of 10.2V peak to peak.
- D, Check Pin 7 (TP2) of both IC2 and IC3 for a 1kHz sine wave of 2.5V peak to peak, with its bottom edge floating 11.1V about ground.
(Allow 5% error for measurements B & C and 10% error for measurement D)
- E, Remove the input signals from the edge connector.
- F, Using a voltmeter check that pins 10 and 12 on IC's 2 and 3 are at -4.4V.
- G, Apply the 2.5V signal to pins 3 & 6 of the edge connector.
- H, Using an oscilloscope probe, check that pin 14 on both IC2 and IC3 has a square wave on it.
- I, Apply a 1kHz signal to the input of the amplifier such that a signal of = 30V p to p appears on the output terminals.
- J, Now briefly apply the 2.5V signal to pins 3 & 6 of the edge connector.
- K, The signal on the output terminals should be a severely clipped sine wave, and will remain clipped for 4 seconds, this demonstrates that the protection circuit has been triggered.

3. POWER SUPPLY

The MPA810 uses two sets of power rails for the amplifier stage: the main $\pm 60V$ supply for the output stage and the lower current $\pm 70V$ supply for the drivers.

Transformer primary voltage tap selection is made using the screw terminals according to the table (refer to circuit diagram). Low voltage supplies for the protection and display circuitry are provided by a separate winding and filter feeding $\pm 15V$ and $\pm 5V$ regulators. In addition to these a back-up battery is used to provide the power necessary to trigger the opto-isolated triacs.

Main power switching is accomplished in two stages by triacs with associated opto-isolated triac IC drivers. The first stage, SCR302, supplies power via a 22R power resistor. This magnetises the transformer core safely even when heavily saturated. After a settling period of about four seconds, the resistor is bypassed by SCR301. IC303 produces the direct and delayed drive signals for the opto-isolators.

IC304 is a D.C. offset detection circuit. The mode of operation is identical to a precision full-wave rectifier which, with the addition of C320 and C321 has falling response above 1Hz, hence if either input receives either positive or negative D.C. levels, T303 is turned on resetting the triac drive.

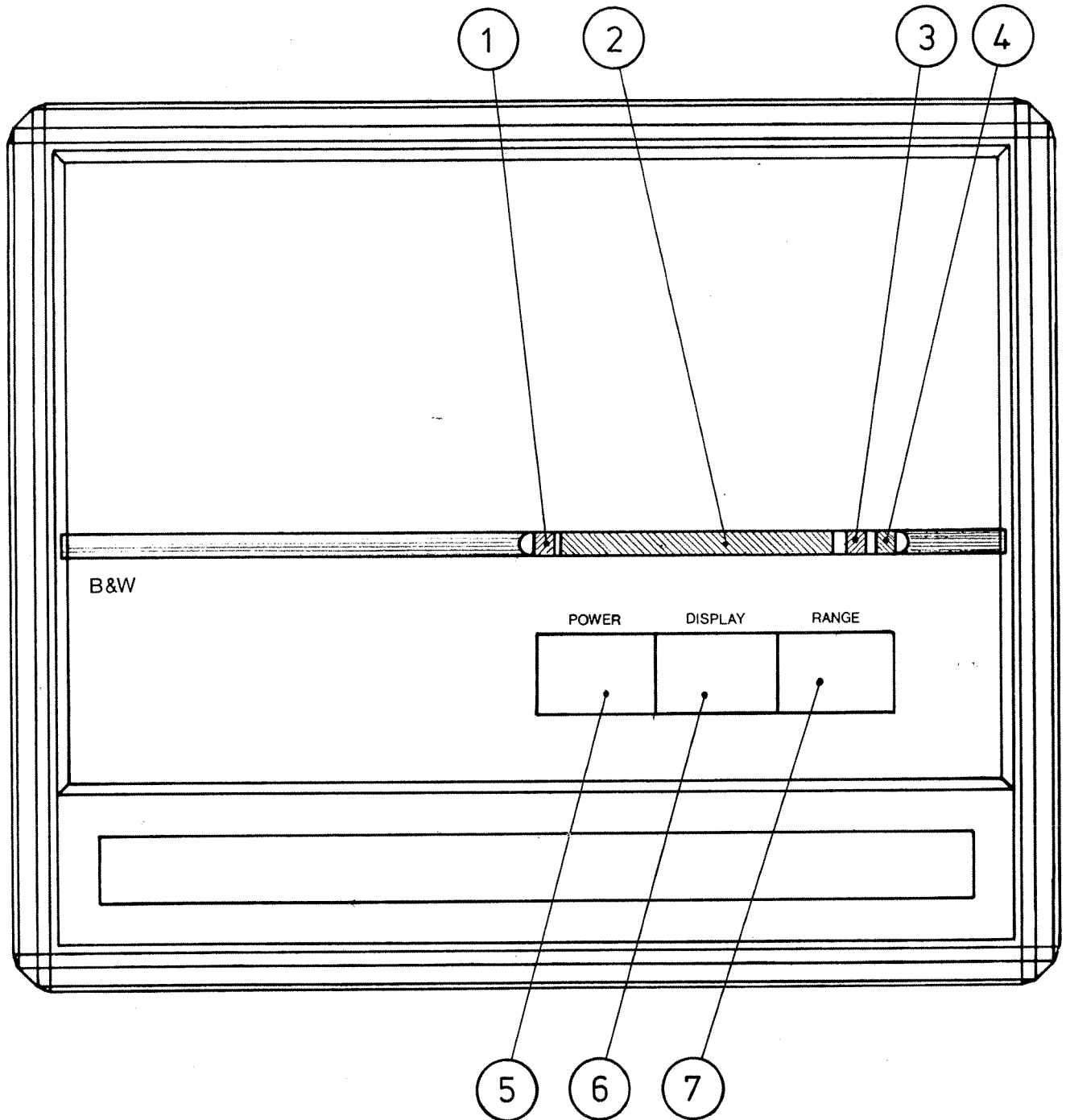
4. DISPLAY BOARD

The display board contains not only the bargraph output level meter, but also the fan drive and switching logic.

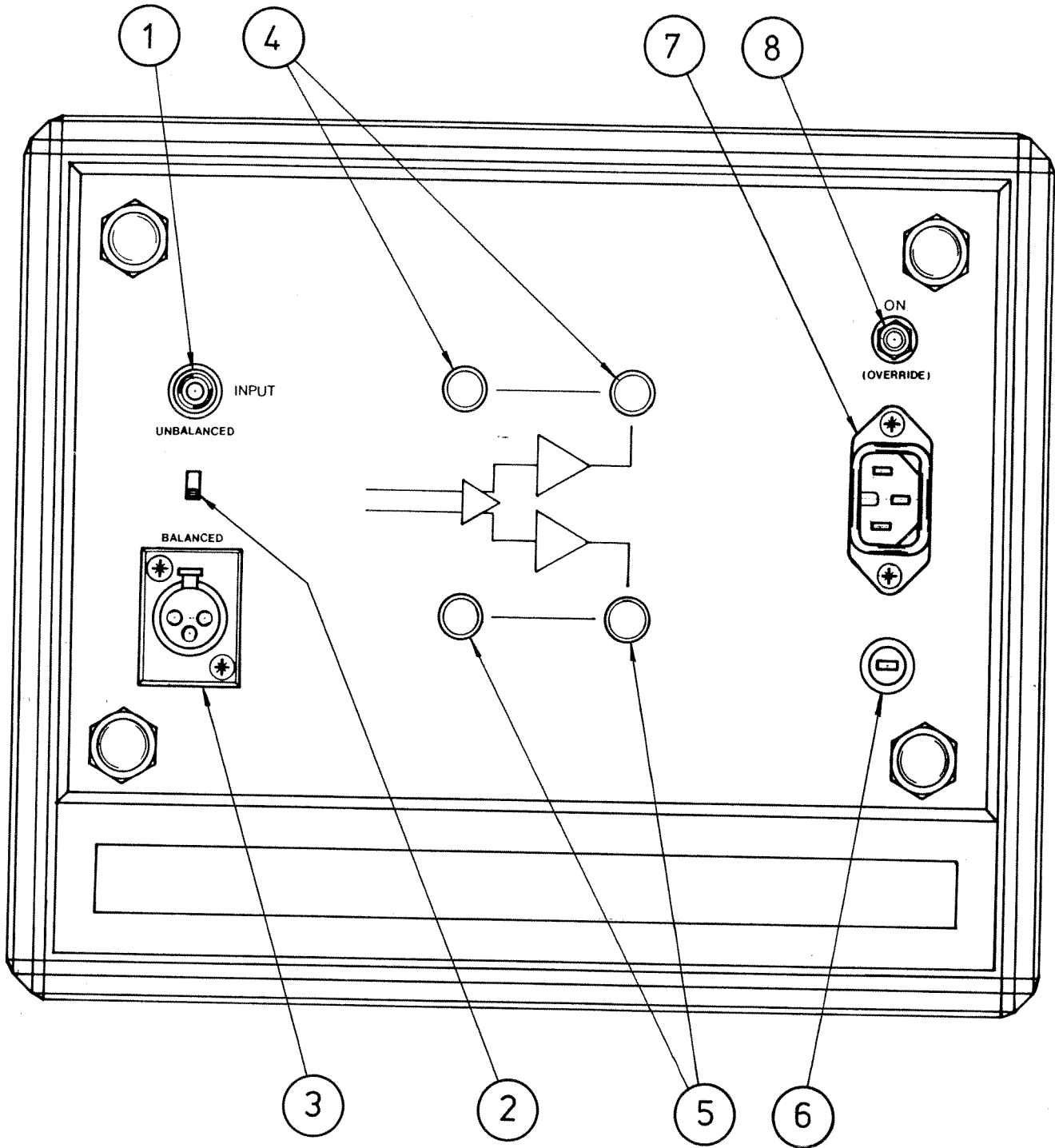
The signal input is fed to the potential divider (R534, R538 and R548). In the 'Normal' range setting, T512 is conducting and the bargraph F.S.D. corresponds to 51V peak. This is reduced to 16V on the 'low' range (selected by the 'RANGE' switch) when T512 is switched off. The attenuated signal is fed to IC1c/d which operate as a precision peak level detector, the time constant of which is determined by C505/506 (selected by the 'DISPLAY' function). IC2c/d together with IC9 operate as a logarithmic amplifier. The buffered level is now fed to the three cascaded CM3914 linear bargraph IC's. The LED drive can be blanked by mode three of the 'DISPLAY' function which switches off T511 and hence T510.

The three switch functions are implemented by CMOS latches (on the back-up power supply). IC3 & IC4 are configured as Ring-of-3 counters to select 'RANGE' and 'DISPLAY' functions. IC5 is a simple two state toggling arrangement which operates the 'POWER' function. The latch can, however, be reset if the supply fails to come up. This conserves the back-up battery if the switch is operated when the unit is not connected to the mains supply.

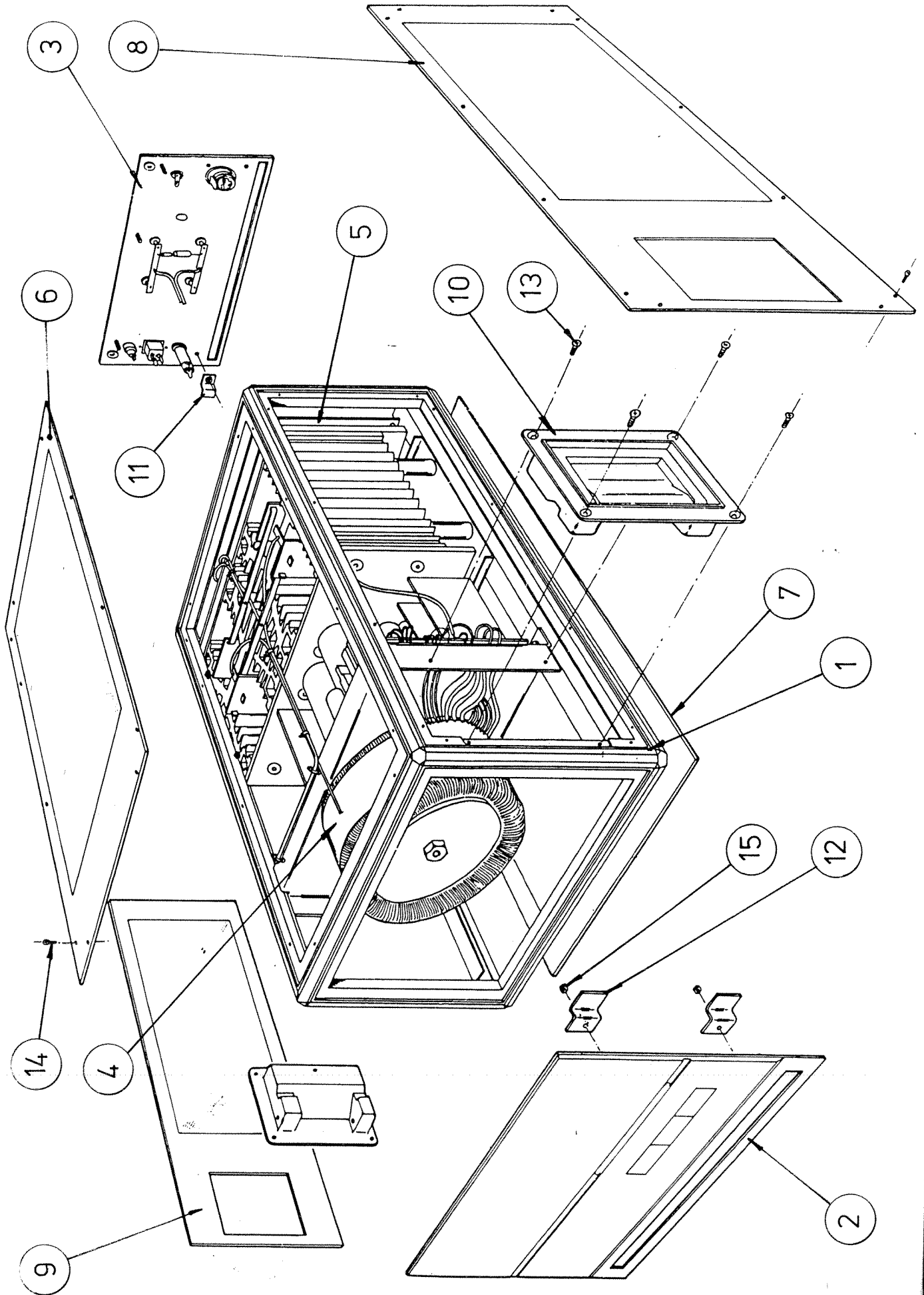
The fan drive voltage is generated by IC1a/b. IC1a produces a voltage of $R502/R \times 4.7V$ which is clamped to a minimum of 8.5V by D503, D502 and R509. IC1 buffers this level and also enables the level to be clamped to -15V or +13V depending on the 'RANGE' mode selected. T501 provides the final current drive to the fan. Whenever the 'RANGE' switch is operated or at initial switch-on, a brief pulse of +15V is applied to the fan to start its rotation.



ITEM	DESCRIPTION
1	POWER INDICATOR (RED)
2	BARGRAPH OUTPUT LEVEL INDICATOR
3	LOW RANGE INDICATOR (ORANGE)
4	CLIPPING (RED) PROTECT (GREEN) INDICATOR
5	POWER SWITCH
6	DISPLAY (OFF / FAST / SLOW)
7	RANGE (LOW / NORMAL / HIGH)



ITEM	DESCRIPTION
1	UNBALANCED (PHONO) INPUT
2	UNBALANCED / BALANCED SELECTOR SWITCH
3	BALANCED (XLR) INPUT
4	OUTPUT (NON-INVERTING)
5	OUTPUT (INVERTING)
6	MAIN POWER FUSE
7	POWER CONNECTOR
8	POWER SWITCH OVERRIDE



B&W Loudspeakers Ltd.

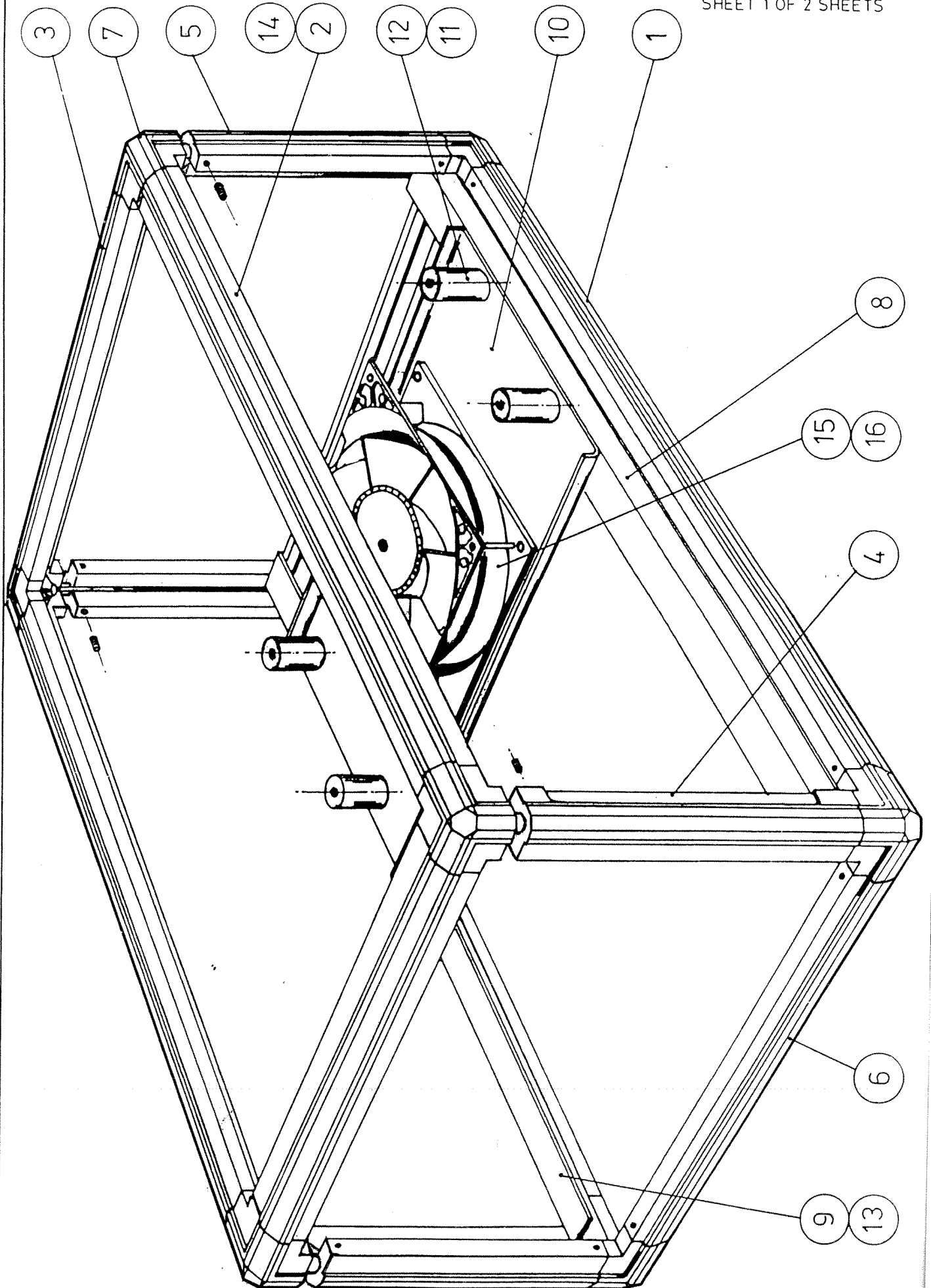
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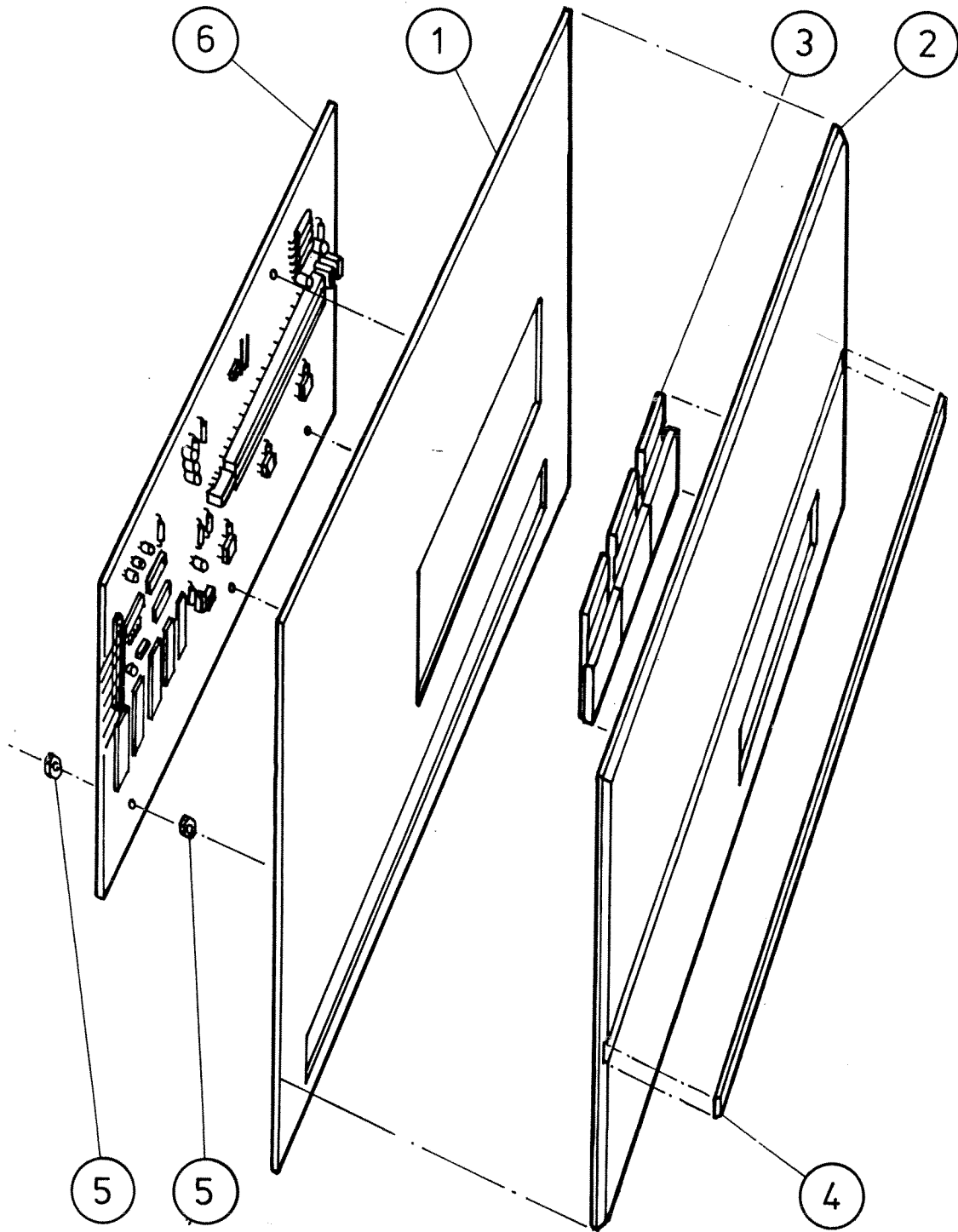
UNIT No.

DATA SHEET D.S. 4.

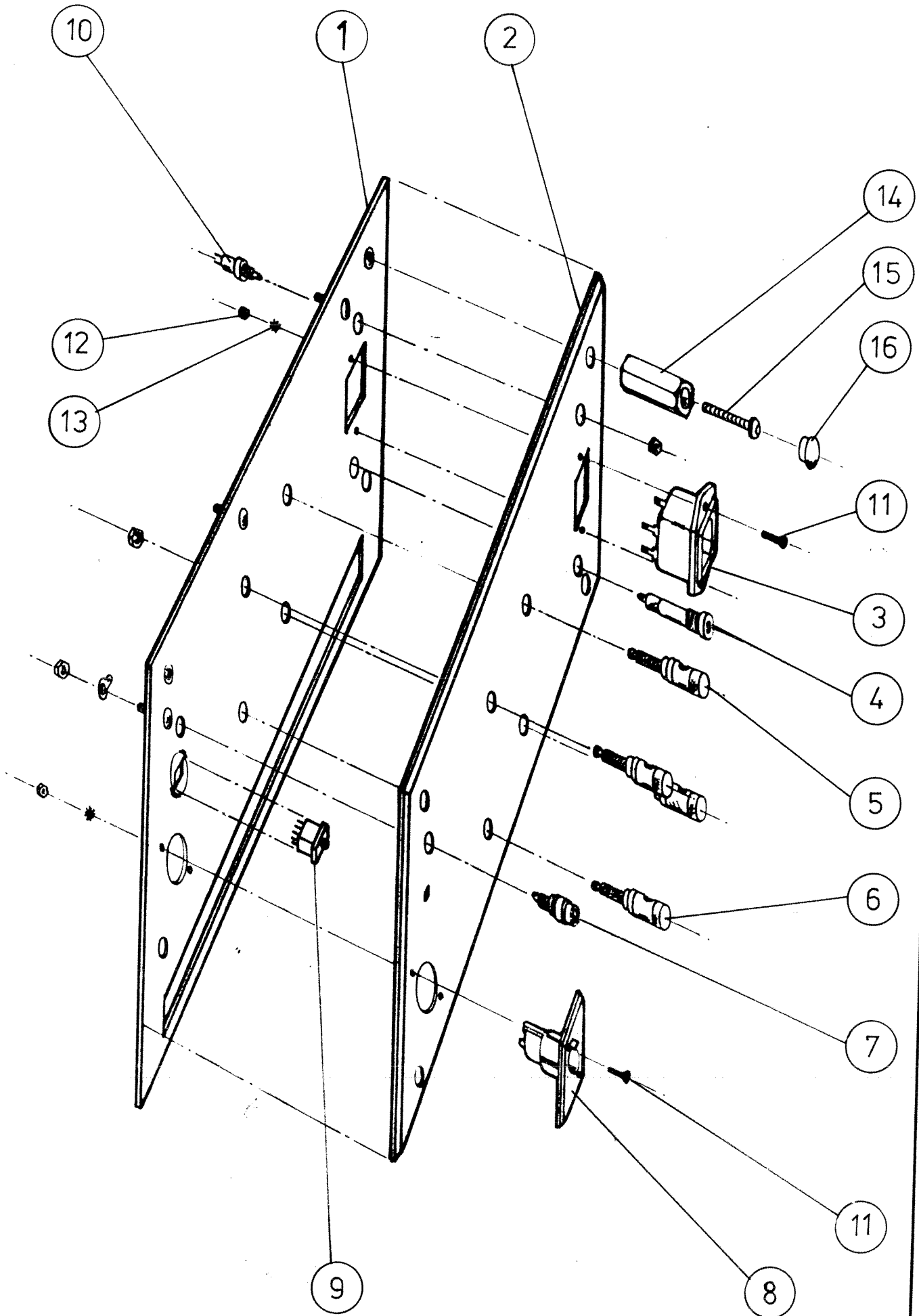
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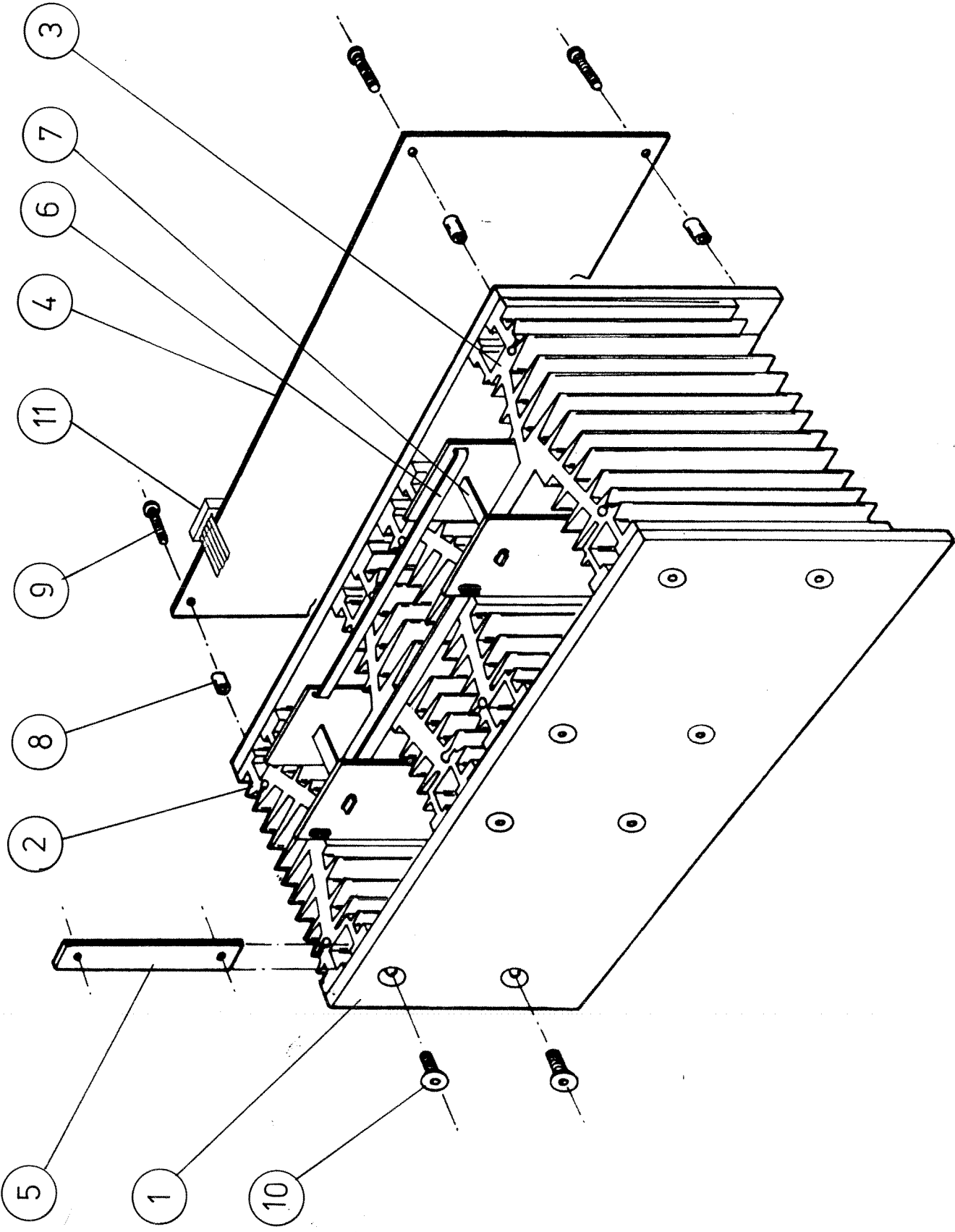
SHEET 1 OF 2 SHEETS

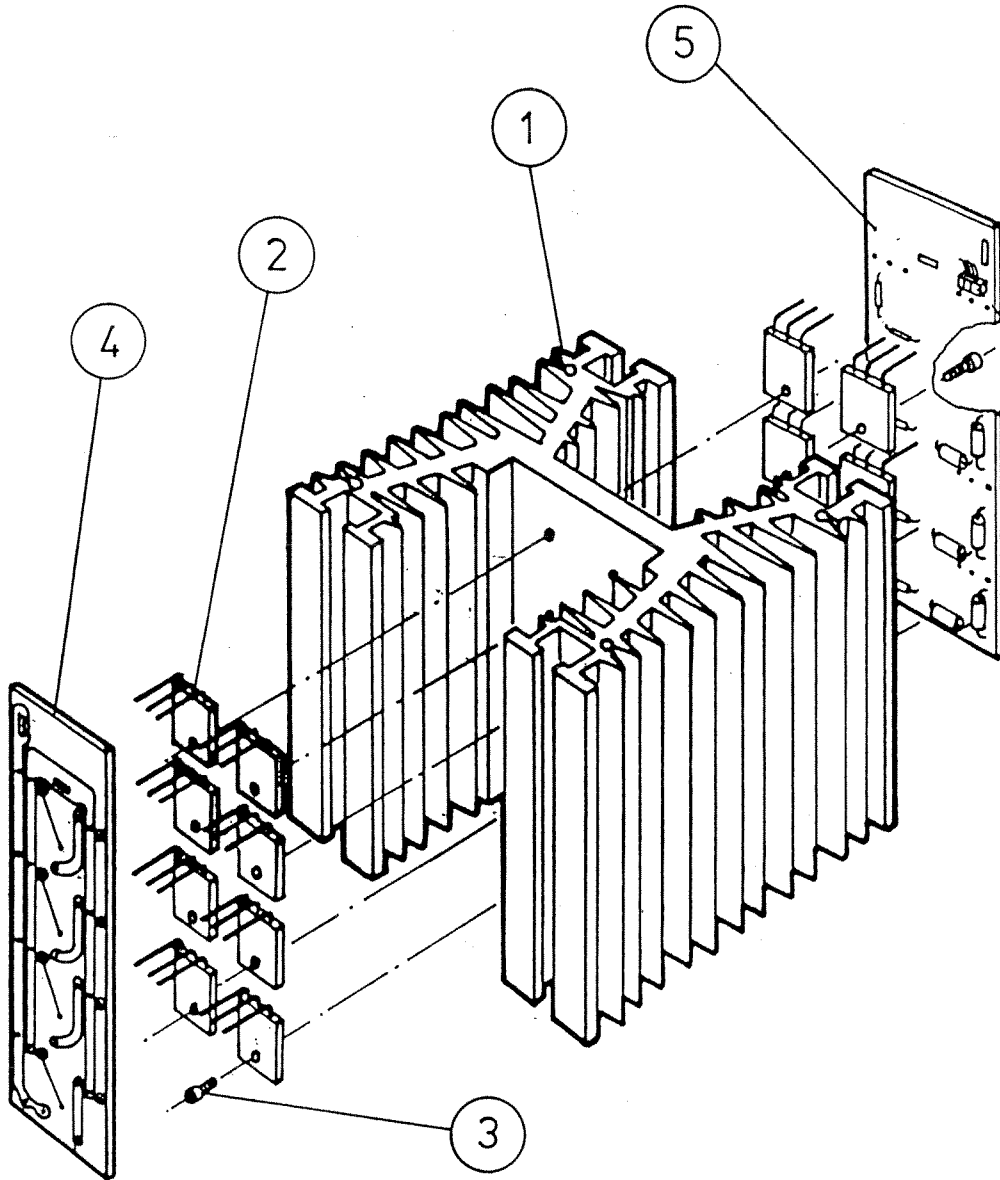




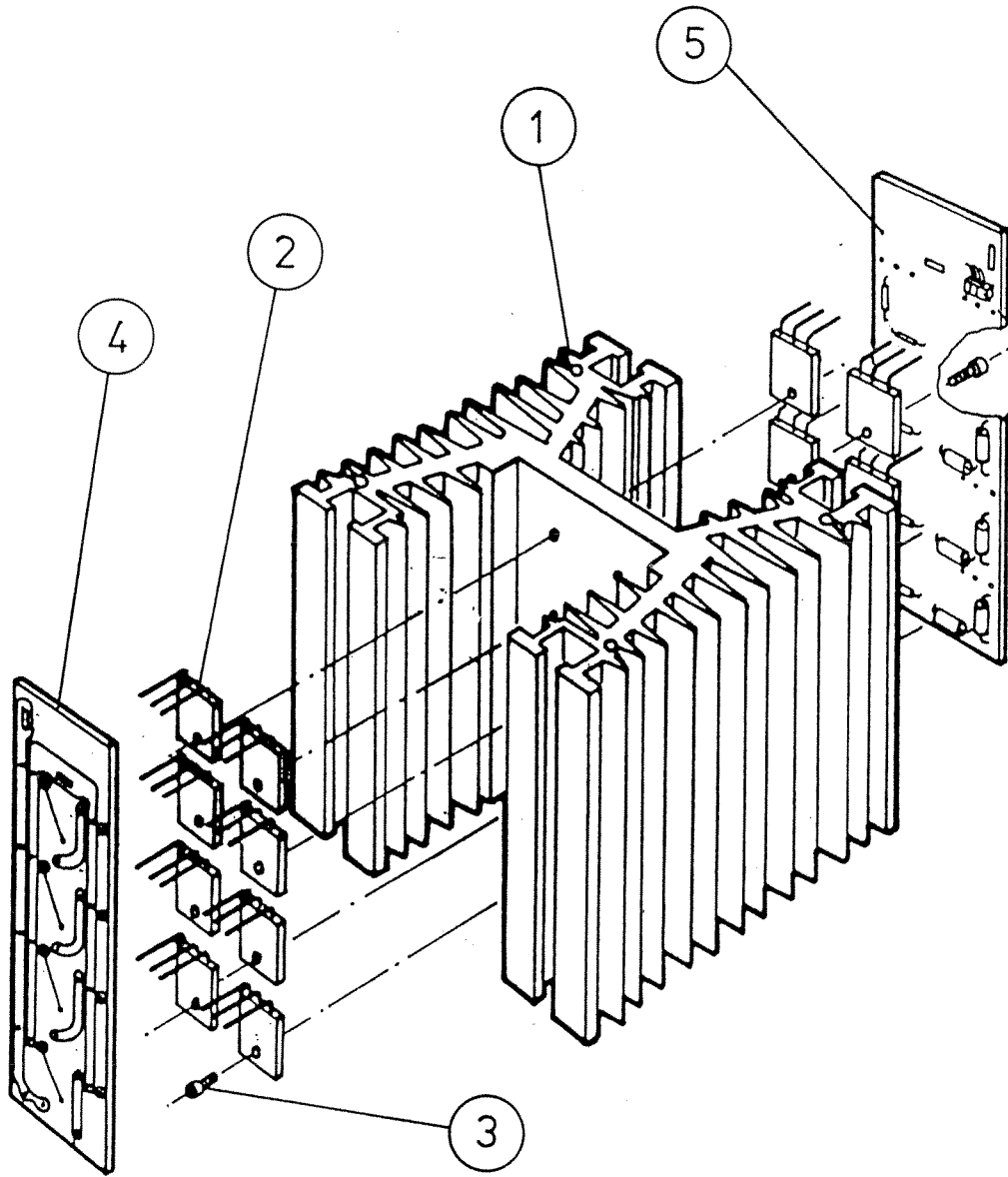
ITEM	QTY.	CODE No.	DESCRIPTION	DRG. No.
1	1		FRONT MOUNTING PANEL	A 0046
2	1		FRONT PANEL	B 0070
3	3		SWITCH PAD ASSEMBLY	A 0073
4	1		SCREEN	A 0077
5	2		NUT M3	
6	1		DISPLAY PRINTED CURCUIT BOARD	



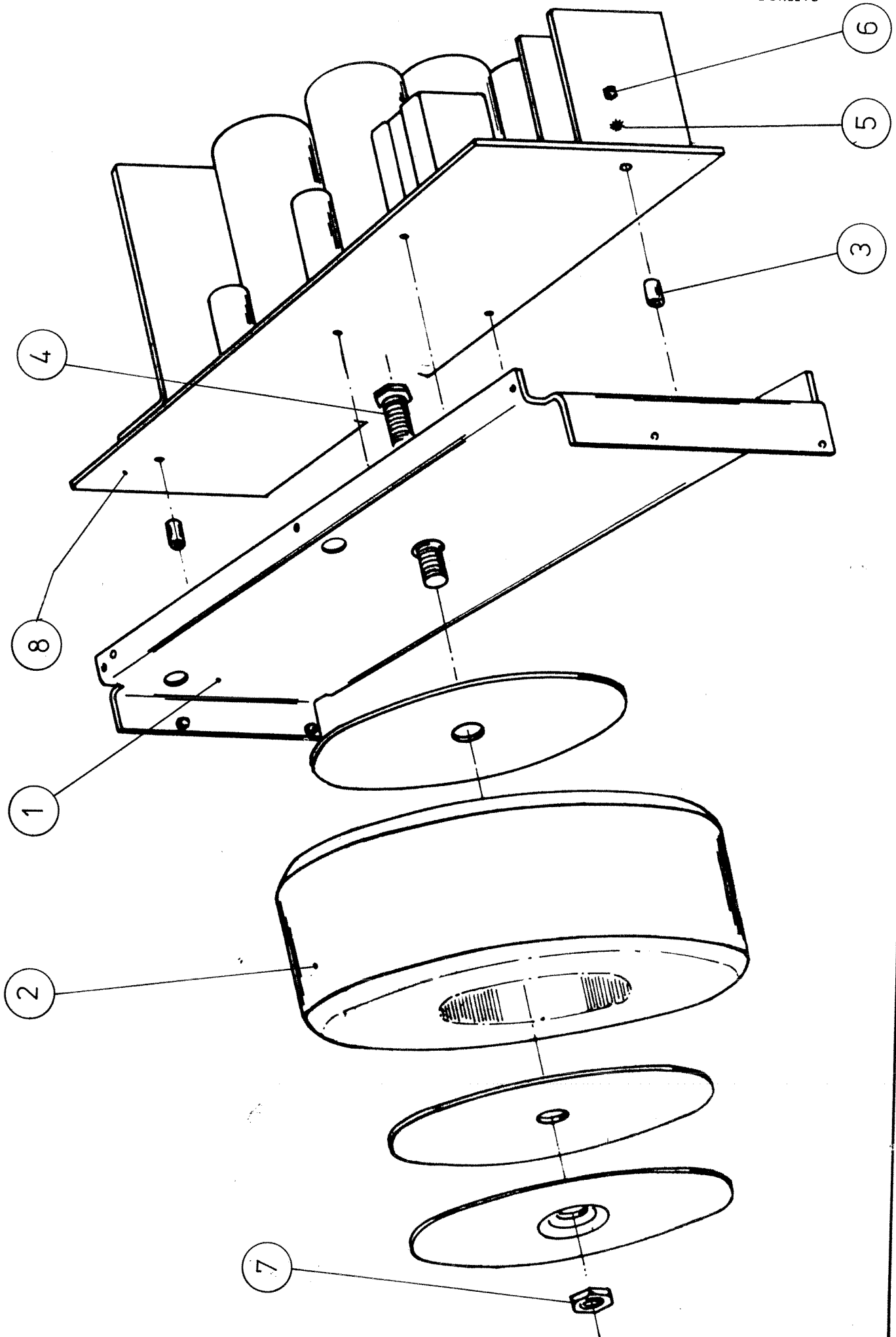


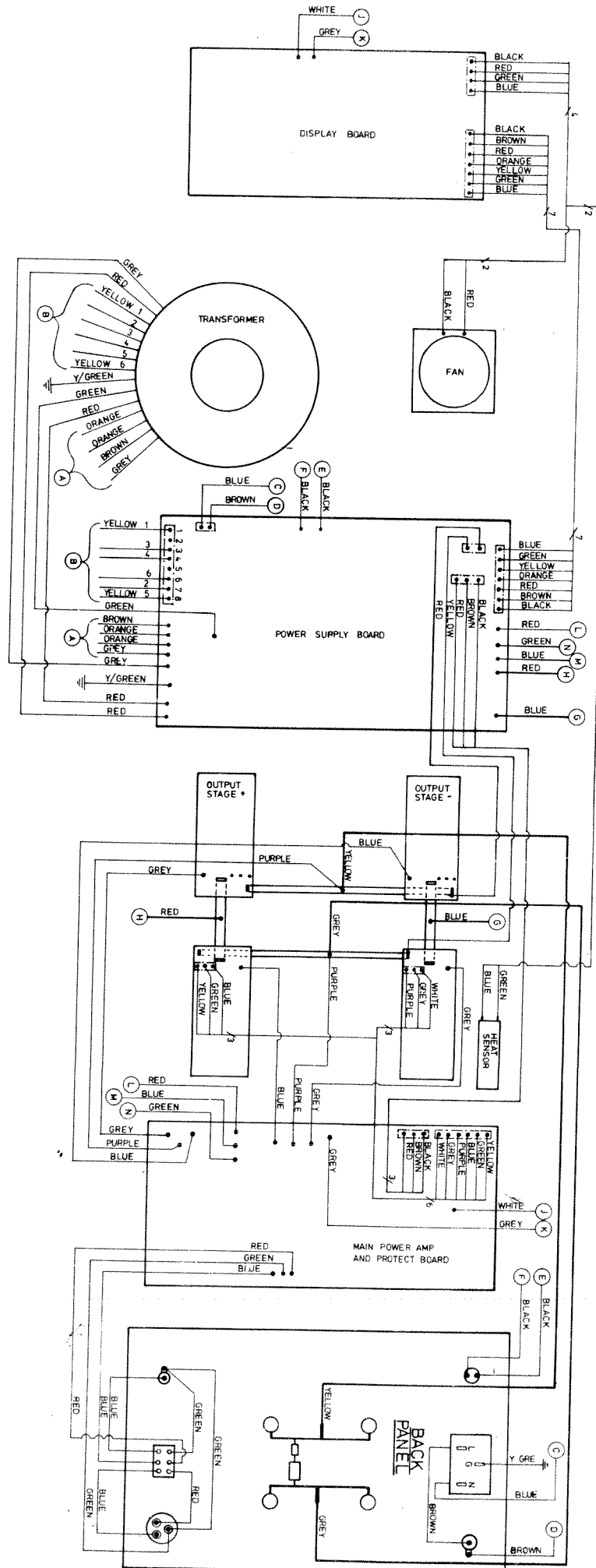


ITEM	QTY.	CODE N°	DESCRIPTION	DRG N°
1	1		HEAT SINK	
2	16		MOSFET's 2SK405	
3	16		SOC HD CAP SCR	
4	1		P.C.B. (DATA SHT DS 15)	
5	1		P.C.B. (DATA SHT DS 15)	

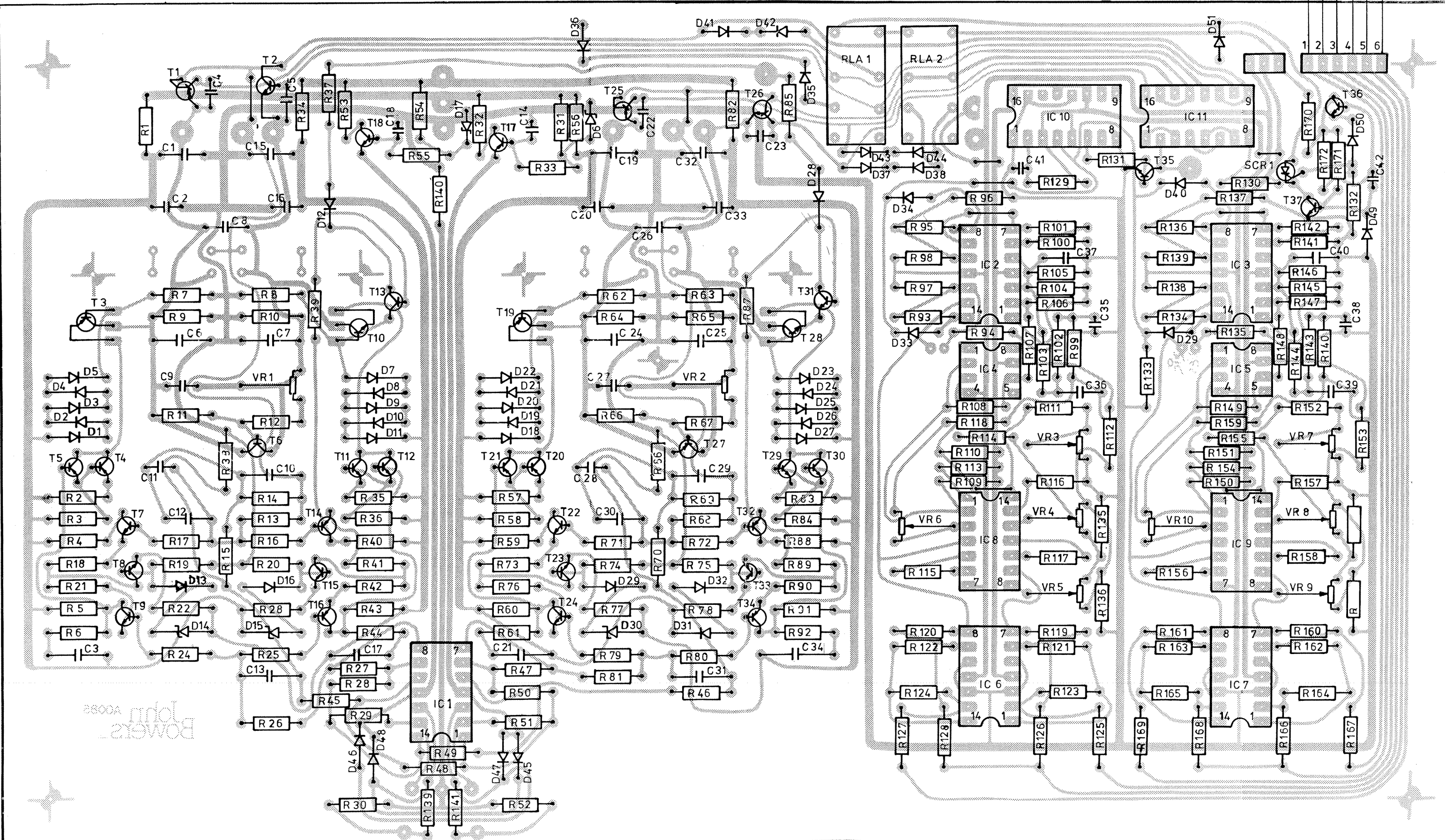


ITEM	QTY.	CODE N°	DESCRIPTION	DRG N°
1	1		HEAT SINK	
2	16		MOSFET'S 2SJ115	
3	16		SOC HD CAP SCE	
4	1		P.C.B. (DATA SHT DS 16)	
5	1		P.C.B. (DATA SHT DS 16)	

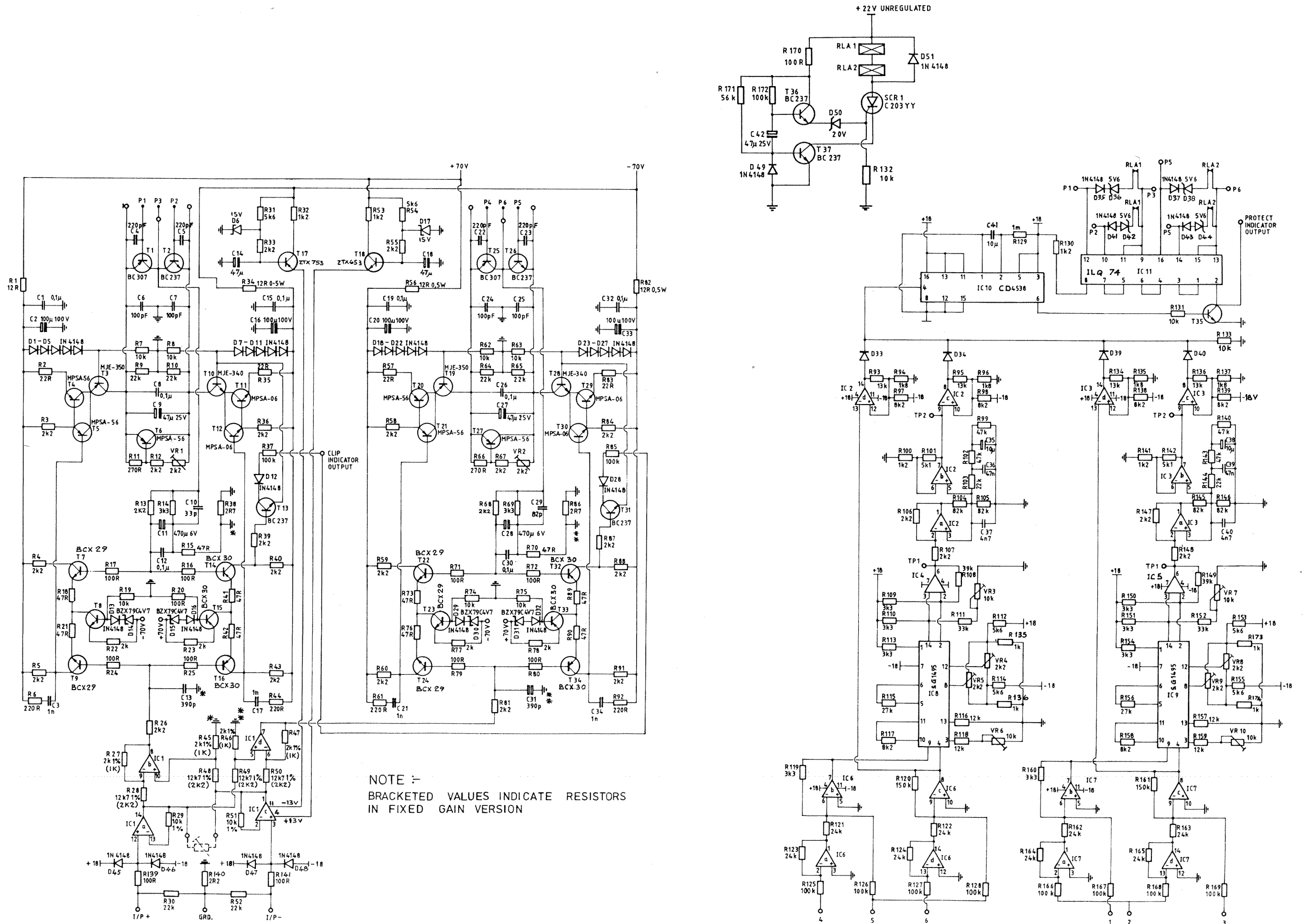




SHT N°
DS 15/1 DS 16/1



Bowers
John
85004



NOTE :-
BRACKETED VALUES INDICATE RESISTORS
IN FIXED GAIN VERSION

ITEM	QTY.	CODE No.	DESCRIPTION
R 1	1		RESISTOR 12R 0.5W carbon film
R 2	1		" 22R
R 3	1		" 2K2
R 4	1		" 2K2
R 5	1		" 2K2
R 6	1		" 220R
R 7	1		" 10K
R 8	1		" 10K
R 9	1		" 22K
R 10	1		" 22K
R 11	1		" 270R
R 12	1		" 2K2
R 13	1		" 2K2
R 14	1		" 3K3
R 15	1		" 47R
R 16	1		" 100R
R 17	1		" 100R
R 18	1		" 47R
R 19	1		" 10K
R 20	1		" 100R
R 21	1		" 47R
R 22	1		" 2K
R 23	1		" 2K
R 24	1		" 100R
R 25	1		" 100R
R 26	1		" 2K2
R 27	1		" 2K 1%
R 28	1		" 12K7 1%
R 29	1		" 10K 1%
R 30	1		" 22K
R 31	1		" 5K6
R 32	1		" 1K2
R 33	1		" 2K2
R 34	1		" 12R
R 35	1		" 22R
R 36	1		" 2K2
R 37	1		" 100K
R 38	1		" 2R7
R 39	1		" 2K2
R 40	1		" 2K2
R 41	1		" 47R
R 42	1		" 47R
R 43	1		" 2K2
R 44	1		" 220R
R 45	1		" 2K 1%
R 46	1		" 2K 1%
R 47	1		" 2K 1%
R 48	1		" 12K7 1%
R 49	1		" 12K7 1%
R 50	1		" 12K7 1%
R 51	1		" 10K 1%
R 52	1		" 22K
R 53	1		" 1K2
R 54	1		" 5K6
R 55	1		" 2K2
R 56	1		" 12R 0.5W carbon film
R 57	1		" 22R
R 58	1		" 2K2
R 59	1		" 2K2
R 60	1		" 2K2
R 61	1		" 220R
R 62	1		" 10K
R 63	1		" 10K
R 64	1		" 22K
R 65	1		" 22K
R 66	1		" 270R
R 67	1		" 2K2
R 68	1		" 2K2

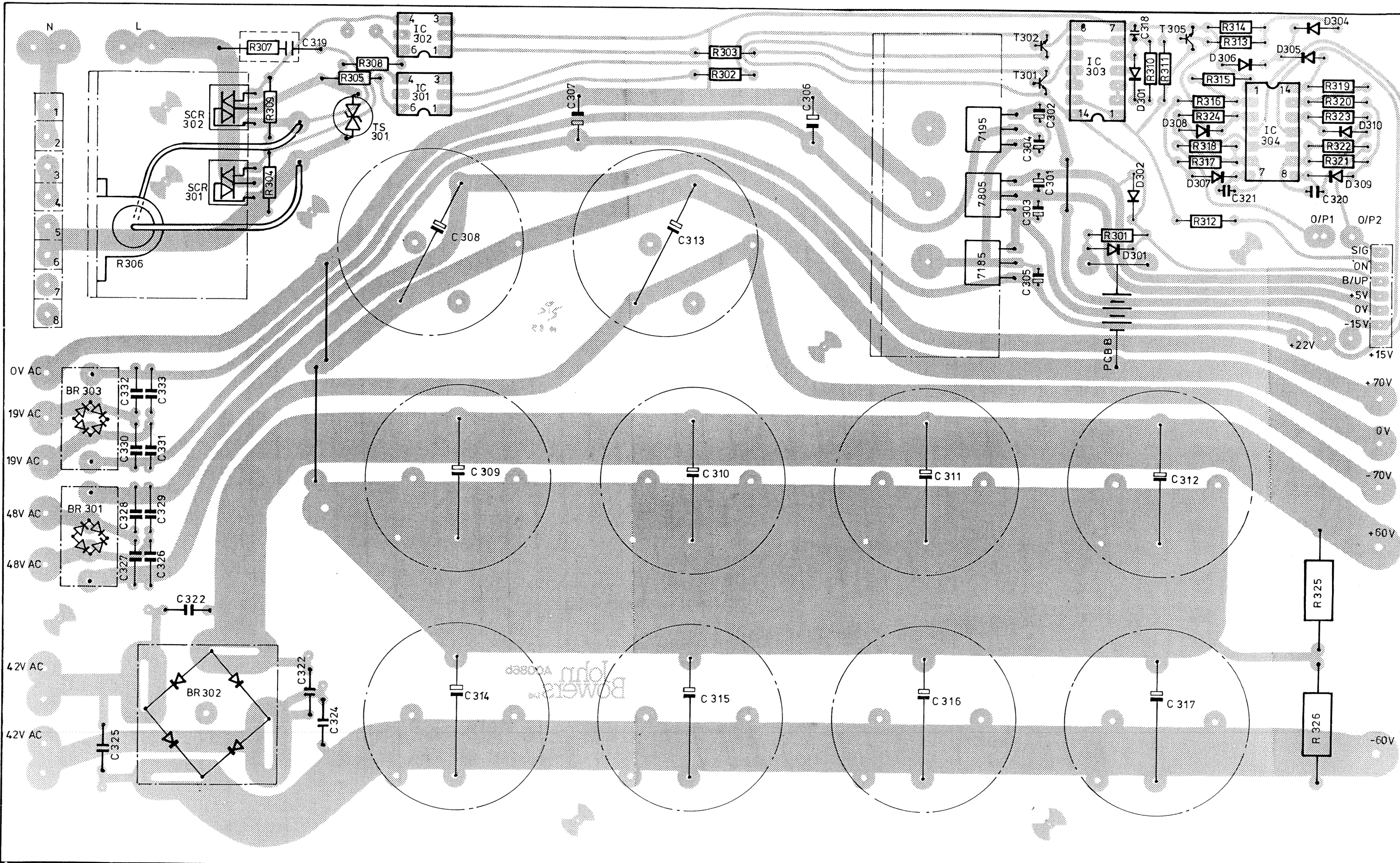
ITEM	QTY.	CODE No.	DESCRIPTION
C 1	1		CAPACITOR 0.1 μ 100V polyester
C 2	1		" 100 μ 100V electrolytic
C 3	1		" 1 n polystyrene
C 4	1		" 220 pF ceramic
C 5	1		" 220 pF ceramic
C 6	1		" 100 pF polystyrene
C 7	1		" 100 pF polystyrene
C 8	1		" 0.1 μ polyester
C 9	1		" 47 μ 25V electrolytic
C 10	1		" 33 p polystyrene
C 11	1		" 470 μ 6V bi-polar electrolytic
C 12	1		" 0.1 μ polyester
C 13	1		" 390 pF electrolytic
C 14	1		" 47 μ polyester
C 15	1		" 0.1 μ electrolytic
C 16	1		" 100 μ 100V electrolytic
C 17	1		" 1 n polystyrene
C 18	1		" 47 μ electrolytic
C 19	1		" 0.1 μ polyester
C 20	1		" 100 μ 100V electrolytic
C 21	1		" 1 n polystyrene
C 22	1		" 220 pF ceramic
C 23	1		" 220 pF ceramic
C 24	1		" 100 pF polystyrene
C 25	1		" 100 pF polystyrene
C 26	1		" 0.1 μ polyester
C 27	1		" 47 μ 25V electrolytic
C 28	1		" 470 μ 6V bi-polar electrolytic
C 29	1		" 82 p polystyrene
C 30	1		" 0.1 μ polyester
C 31	1		" 390 pF electrolytic
C 32	1		" 0.1 μ polyester
C 33	1		" 100 μ 100V electrolytic
C 34	1		" 1 n electrolytic
C 35	1		" 10 μ electrolytic
C 36	1		" 47 pF electrolytic
C 37	1		" 4 pF electrolytic
C 38	1		" 10 μ electrolytic
C 39	1		" 47 n electrolytic
C 40	1		" 4.7 n electrolytic
C 41	1		" 10 μ electrolytic
C 42	1		" 47 μ 25V electrolytic
IC 1	1		SEMICONDUCTOR TL 074
IC 2	1		" TL 074
IC 3	1		" TL 074
IC 4	1		" TL 071
IC 5	1		" TL 071
IC 6	1		" TL 074
IC 7	1		" TL 074
IC 8	1		" SG 1495
IC 9	1		" SG 1495
IC10	1		" CD 4538
IC11	1		" ILQ 74
RLA1	1		RELAY B&R V23102A 0006A201 or RS 346845
RLA2	1		" B&R V23102A 0006A201 or RS 346845

ITEM	QTY.	CODE No.	DESCRIPTION
R137	1		RESISTOR 1K8
R138	1		" " 8K2
R139	1		" " 8K2
R140	1		" " 47K
R141	1		" " 1K2
R142	1		" " 5K1
R143	1		" " 47K
R144	1		" " 22K
R145	1		" " 82K
R146	1		" " 82K
R147	1		" " 2K2
R148	1		" " 2K2
R149	1		" " 39K
R150	1		" " 3K3
R151	1		" " 3K3
R152	1		" " 33K
R153	1		" " 5K6
R154	1		" " 3K3
R155	1		" " 5K6
R156	1		" " 27K
R157	1		" " 12K
R158	1		" " 8K2
R159	1		" " 12K
R160	1		" " 3K3
R161	1		" " 150K
R162	1		" " 24K
R163	1		" " 24K
R164	1		" " 24K
R165	1		" " 24K
R166	1		" " 100K
R167	1		" " 100K
R168	1		" " 100K
R169	1		" " 100K
R170	1		" " 100K
R171	1		" " 56K
R172	1		" " 100K
R173	1		" " 1K
R174	1		" " 1K
VR 1	1		VARIABLE RESISTOR 2K2
VR 2	1		" " 2K2
VR 3	1		" " 10K
VR 4	1		" " 2K2
VR 5	1		" " 2K2
VR 6	1		" " 10K
VR 7	1		" " 10K
VR 8	1		" " 2K2
VR 9	1		" " 2K2
VR 10	1		" " 10K
SCR 1	1		
T 1	1		TRANSISTOR BC 307
T 2	1		" BC 237
T 3	1		" MJE - 350
T 4	1		" MPSA - 56
T 5	1		" MPSA - 56
T 6	1		" MPSA - 56
T 7	1		" BCX 29
T 8	1		" BCX 29
T 9	1		" BCX 29

ITEM	QTY.	CODE No.	DESCRIPTION
R 69	1		RESISTOR 3K3
R 70	1		" " 100R
R 71	1		" " 100R
R 72	1		" " 47R
R 73	1		" " 10K
R 74	1		" " 10K
R 75	1		" " 47R
R 76	1		" " 2K
R 77	1		" " 2K
R 78	1		" " 100R
R 79	1		" " 100R
R 80	1		" " 2K2
R 81	1		" " 12R
R 82	1		" " 22R
R 83	1		" " 2K2
R 84	1		" " 100K
R 85	1		" " 2K2
R 86	1		" " 2K2
R 87	1		" " 2K2
R 88	1		" " 47R
R 89	1		" " 47R
R 90	1		" " 2K2
R 91	1		" " 220R
R 92	1		" " 13K
R 93	1		" " 13K
R 94	1		" " 13K
R 95	1		" " 13K
R 96	1		" " 8K2
R 97	1		" " 8K2
R 98	1		" " 47K
R 99	1		" " 47K
R100	1		" " 5K1
R101	1		" " 47K
R102	1		" " 22K
R103	1		" " 82K
R104	1		" " 2K2
R105	1		" " 2K2
R106	1		" " 39K
R107	1		" " 3K3
R108	1		" " 3K3
R109	1		" " 5K6
R110	1		" " 3K3
R111	1		" " 3K3
R112	1		" " 5K6
R113	1		" " 3K3
R114	1		" " 5K6
R115	1		" " 27K
R116	1		" " 12K
R117	1		" " 8K2
R118	1		" " 12K
R119	1		" " 3K3
R120	1		" " 150K
R121	1		" " 24K
R122	1		" " 24K
R123	1		" " 24K
R124	1		" " 24K
R125	1		" " 100K
R126	1		" " 100K
R127	1		" " 100K
R128	1		" " 1m
R129	1		" " 1K2
R130	1		" " 10K
R131	1		" " 10K
R132	1		" " 10K
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R136	1		" " 13K

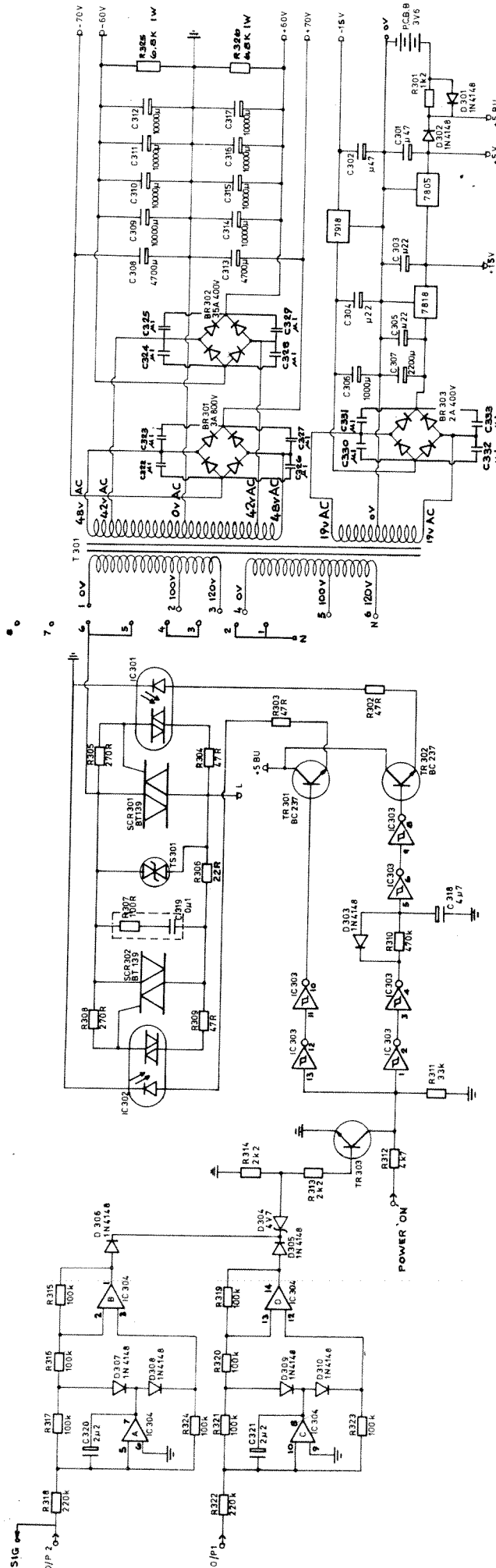
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D 37	1		DIODE 1N 4148
D 38	1		" 5.6V ZENER
D 39	1		" 1N 4148
D 40	1		" 1N 4148
D 41	1		" 1N 4148
D 42	1		" 5.6V ZENER
D 43	1		" 1N 4148
D 44	1		" 5.6V ZENER
D 45	1		" 1N 4148
D 46	1		" 1N 4148
D 47	1		" 1N 4148
D 48	1		" 1N 4148
D 49	1		" 20V ZENER
D 50	1		" 1N 4148
D 51	1		" 1N 4148

ITEM	QTY.	CODE No.	DESCRIPTION
T 10	1		TRANSISTOR MJE - 340
T 11	1		" MPSA - 06
T 12	1		" MPSA - 06
T 13	1		" BC 237
T 14	1		" BCX 30
T 15	1		" BCX 30
T 16	1		" BCX 30
T 17	1		" ZTX 753
T 18	1		" ZTX 653
T 19	1		" MJE - 350
T 20	1		" MPSA - 56
T 21	1		" MPSA - 56
T 22	1		" BCX 29
T 23	1		" BCX 29
T 24	1		" BCX 29
T 25	1		" BC - 307
T 26	1		" BC 237
T 27	1		" MPSA - 56
T 28	1		" MJE - 340
T 29	1		" MPSA - 06
T 30	1		" MPSA - 06
T 31	1		" BC 237
T 32	1		" BCX 30
T 33	1		" BCX 30
T 34	1		" BCX 30
T 35	1		" BC - 237
T 36	1		" BC 237
T 37	1		" BC 237
D 1	1		DIODE 1N 4148
D 2	1		" 1N 4148
D 3	1		" 1N 4148
D 4	1		" 1N 4148
D 5	1		" 1N 4148
D 6	1		" BZX 79 15 V ZENER
D 7	1		" 1N 4148
D 8	1		" 1N 4148
D 9	1		" 1N 4148
D 10	1		" 1N 4148
D 11	1		" 1N 4148
D 12	1		" 1N 4148
D 13	1		" 1N 4148
D 14	1		" BZX 79 C4 V7 400mW ZENER
D 15	1		" BZX 79 C4 V7 400mW ZENER
D 16	1		" 1N 4148
D 17	1		" BZX 79 15 V ZENER
D 18	1		" 1N 4148
D 19	1		" 1N 4148
D 20	1		" 1N 4148
D 21	1		" 1N 4148
D 22	1		" 1N 4148
D 23	1		" 1N 4148
D 24	1		" 1N 4148
D 25	1		" 1N 4148
D 26	1		" 1N 4148
D 27	1		" 1N 4148
D 28	1		" 1N 4148
D 29	1		" 1N 4148
D 30	1		" BZX 79 C4 V7 400mW ZENER
D 31	1		" BZX 79 C4 V7 400mW ZENER
D 32	1		" 1N 4148
D 33	1		" 1N 4148
D 34	1		" 1N 4148
D 35	1		" 1N 4148
D 36	1		" 5.6V ZENER



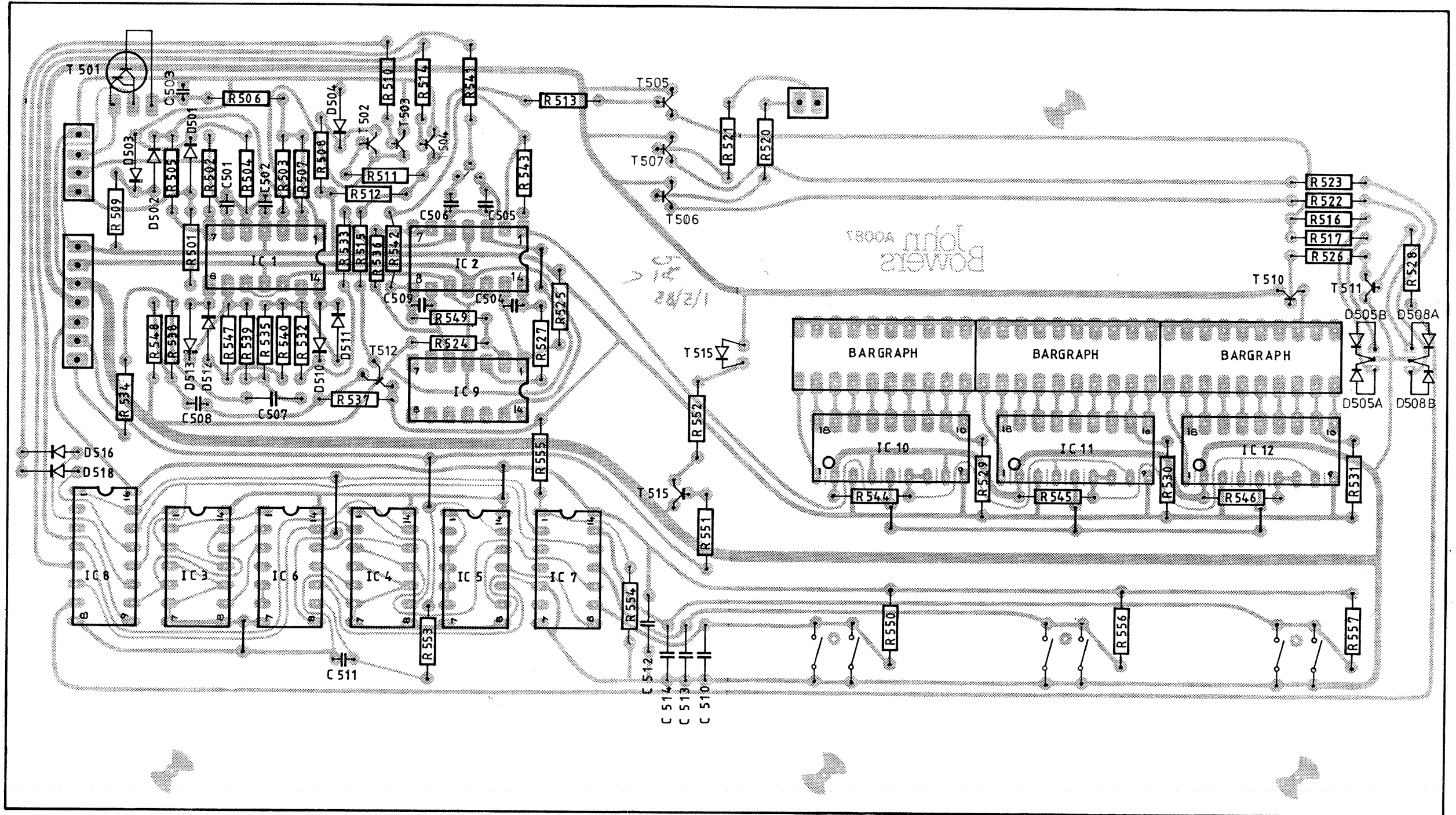
VOLTAGE	TERMINAL N°							
	1	2	3	4	5	6	7	8
100	1	4			2	5	3	6
120	1	4			3	6	2	5
220	1	3	4		5	2	6	5
240	1	3	4		6	2	5	5

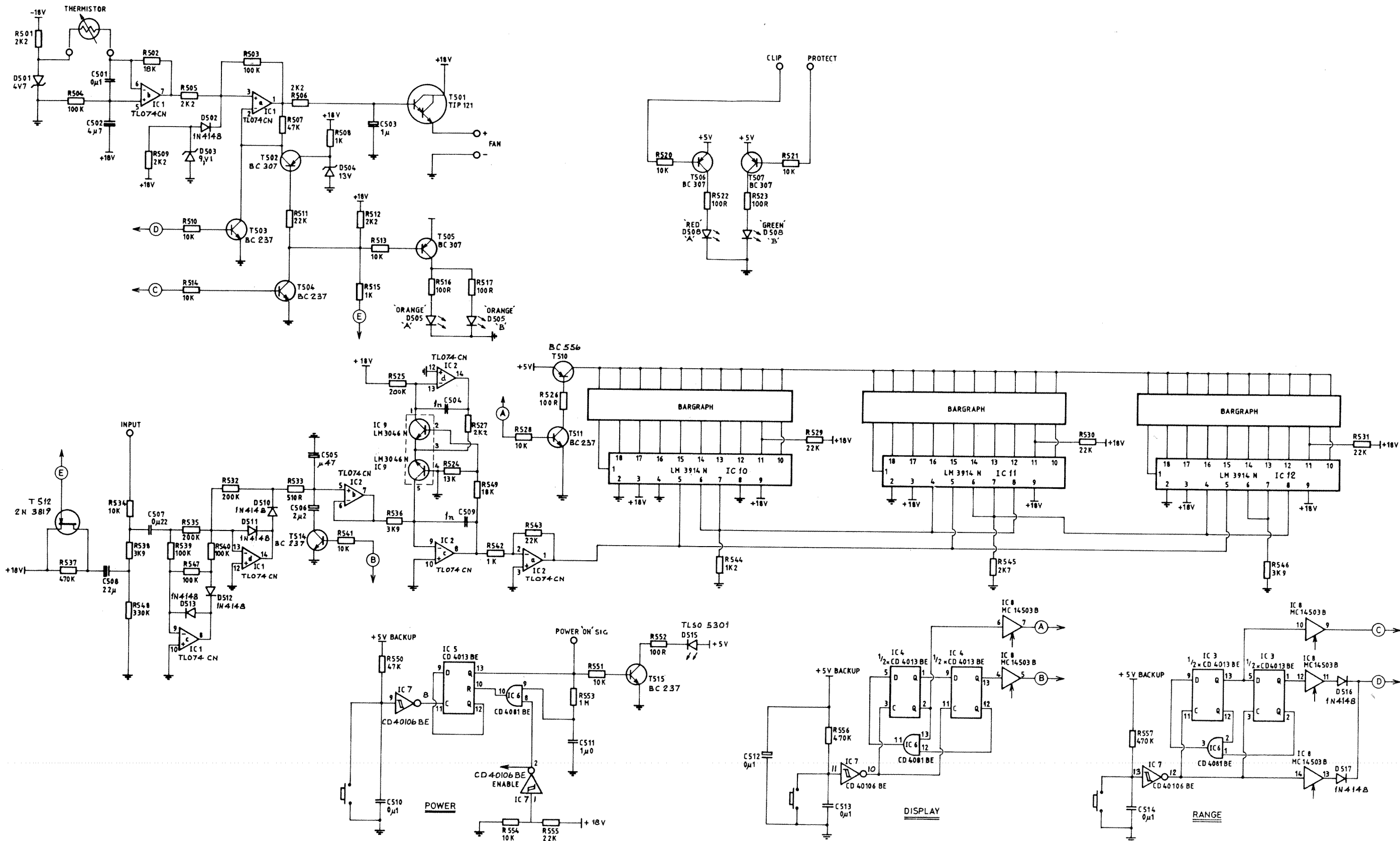
WIRE N°



ITEM	QTY.	CODE No.	DESCRIPTION
R 323	1		RESISTOR 100K
R 324	1		" 100K
R 325	1		" 6.8 K 1W
R 326	1		" "
TR 301	1		TRANSISTOR BC 237
TR 302	1		" BC 237
TR 303	1		" BC 237
T 301	1		TRANSFORMER 1.3KVA
IC 301	1		OPTICALLY ISOLATED TRIAC
IC 302	1		OPTICALLY ISOLATED TRIAC
IC 303	1		"
IC 304	1		"
7805	1		REGULATOR
7818	1		"
7918	1		"
TS 301	1		Z15 X401 ZENAMIC VARIATOR
POBB	1		3.6V PCB BATTERY
SCR 301	1		BT 139
SCR 302	1		BT 139

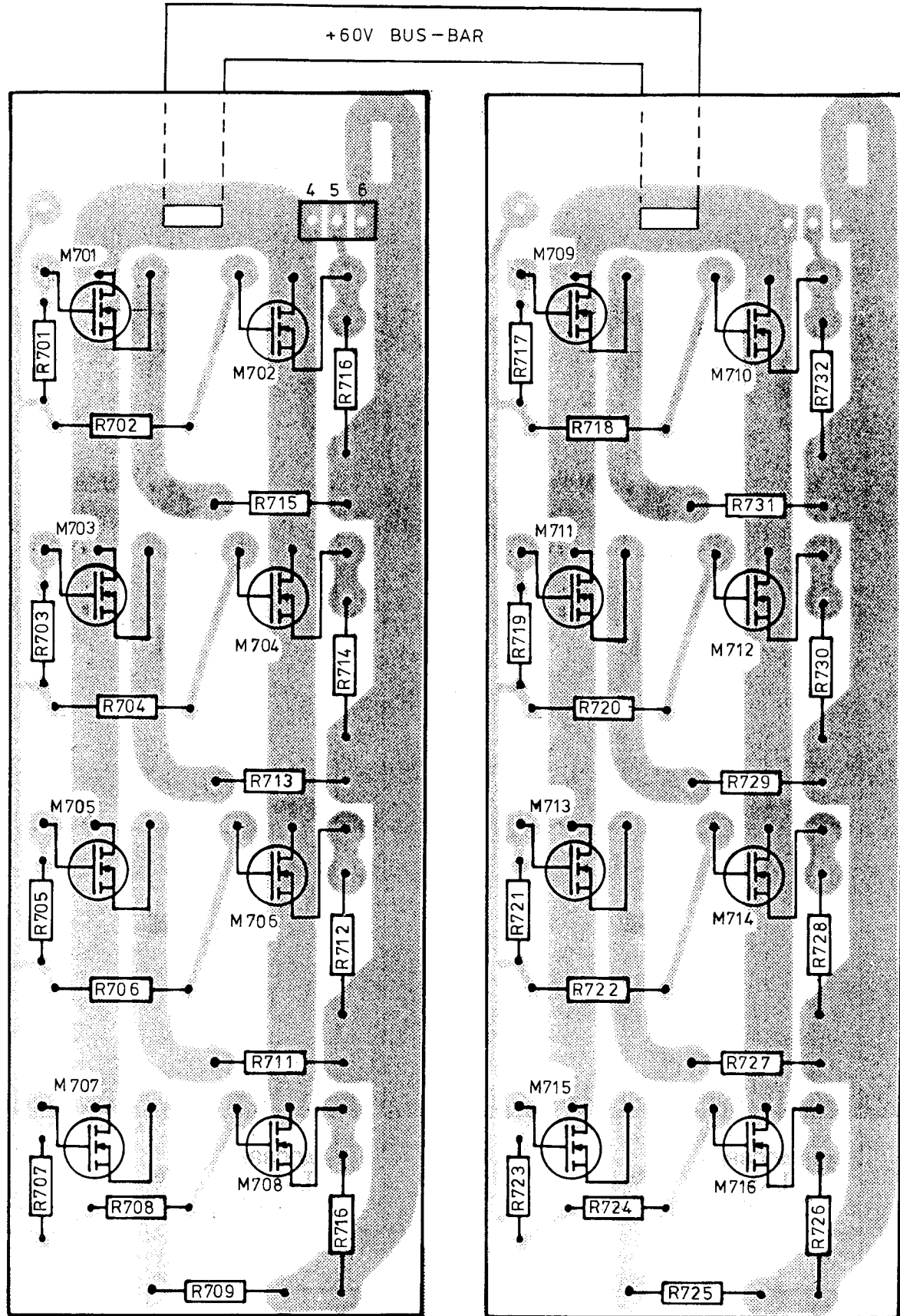
ITEM	QTY.	CODE No.	DESCRIPTION
C 301	1		CAPACITOR 47 μ
C 302	1		" 47 μ
C 303	1		" 22 μ
C 304	1		" 22 μ
C 305	1		" 22 μ
C 306	1		" 1000 μ
C 307	1		" 2200 μ
C 308	1		" 4700 μ
C 309	1		" 10000 μ
C 310	1		" 10000 μ
C 311	1		" 10000 μ
C 312	1		" 10000 μ
C 313	1		" 4700 μ
C 314	1		" 10000 μ
C 315	1		" 10000 μ
C 316	1		" 10000 μ
C 317	1		" 10000 μ
C 318	1		" 4 μ 7
C 319	1		" 0 μ 1
C 320	1		" 2 μ 2
C 321	1		" 2 μ 2
C 322	1		" 1 μ from 322
C 333	1		" 1 μ to 333 = 1 μ
D 301	1		DIODE 1N 4148
D 302	1		" 1N 4148
D 303	1		" 1N 4148
D 304	1		" 4V7 ZENER
D 305	1		" 1N 4148
D 306	1		" 1N 4148
D 307	1		" 1N 4148
D 308	1		" 1N 4148
D 309	1		" 1N 4148
D 310	1		" 1N 4148
BR 301	1		RECTIFIER
BR 302	1		"
BR 303	1		"
R 301	1		RESISTOR 1K2
R 302	1		" 47R
R 303	1		" 47R
R 304	1		" 47R
R 305	1		" 270R
R 306	1		" 4R7
R 307	1		" 100R
R 308	1		" 270R
R 309	1		" 47R
R 310	1		" 470K
R 311	1		" 33K
R 312	1		" 4K7
R 313	1		" 2K2
R 314	1		" 2K2
R 315	1		" 100K
R 316	1		" 100K
R 317	1		" 100K
R 318	1		" 220K
R 319	1		" 100K
R 320	1		" 100K
R 321	1		" 100K
R 322	1		" 220K

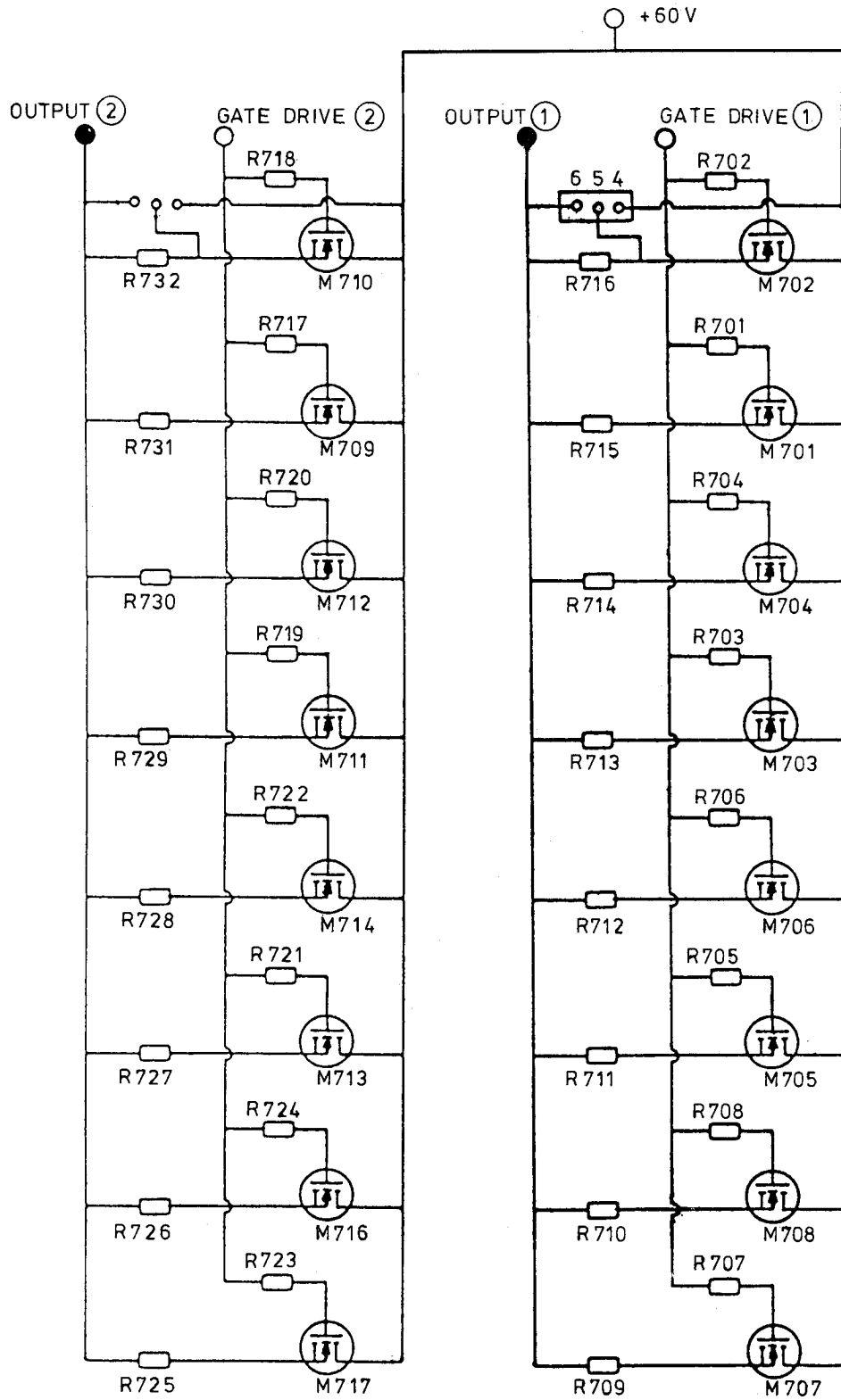




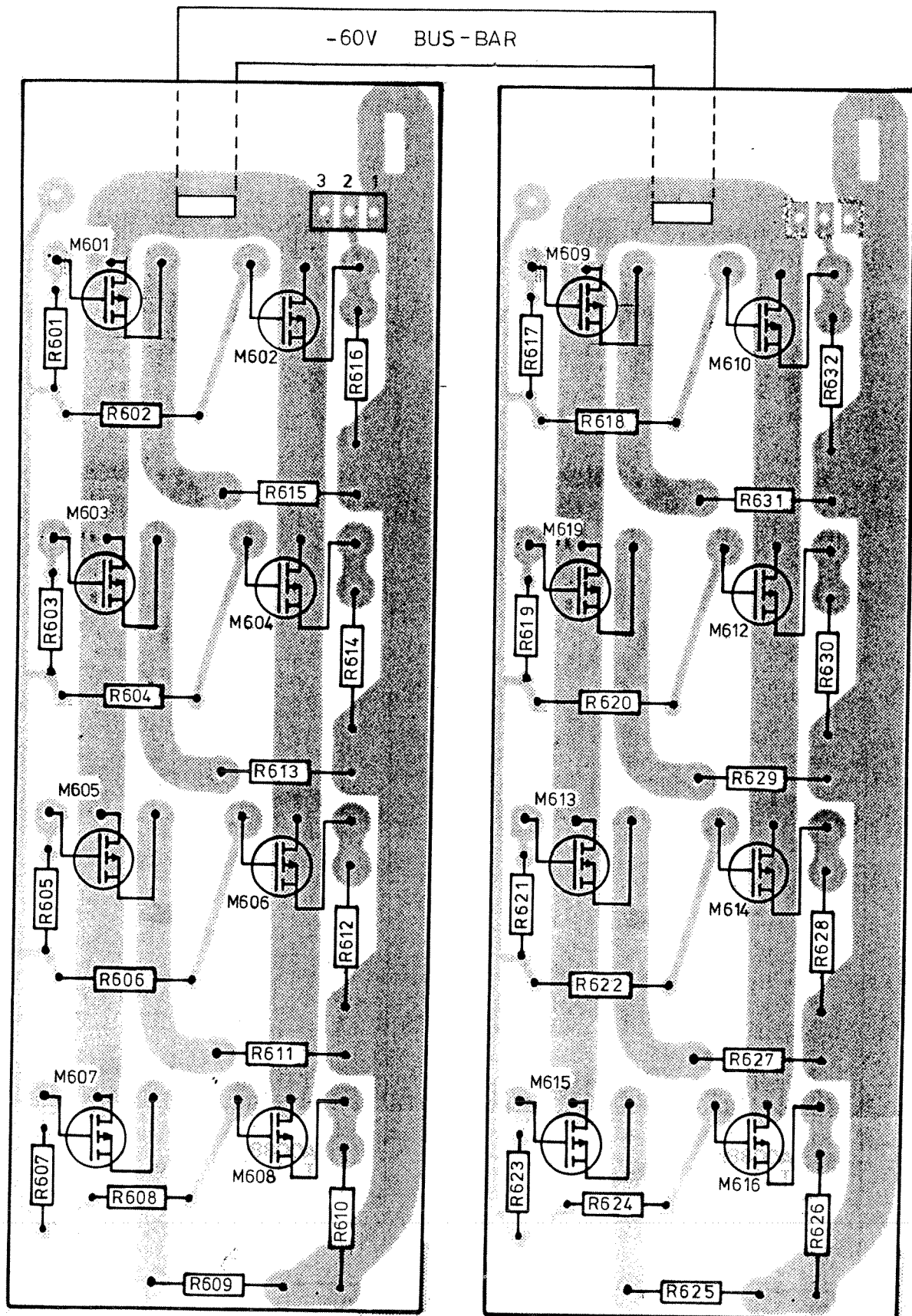
ITEM	QTY.	CODE No.	DESCRIPTION
R 531	1		RESISTOR 22 K
R 532	1		" 200 K
R 533	1		" 510 R
R 534	1		" 10 K
R 535	1		" 200 K
R 536	1		" 3 K 9
R 537	1		" 470 K
R 538	1		" 3 K 9
R 539	1		" 100 K
R 540	1		" 100 K
R 541	1		" 10 K
R 542	1		" 1 K
R 543	1		" 22 K
R 544	1		" 1 K 2
R 545	1		" 2 K 7
R 546	1		" 3 K 9
R 547	1		" 100 K
R 548	1		" 330 K
R 549	1		" 18 K
R 550	1		" 47 K
R 551	1		" 10 K
R 552	1		" 100 R
R 553	1		" 1 M
R 554	1		" 10 K
R 555	1		" 22 K
R 556	1		" 470 K
R 557	1		" 470 K
R 558			
R 559			
T 501	1		TRANSISTOR TIP 121
T 502	1		" BC 307
T 503	1		" BC 237
T 504	1		" BC 237
T 505	1		" BC 307
T 506	1		" BC 307
T 507	1		" BC 307
T 508			
T 509			
T 510	1		" BC 566
T 511	1		" BC 237
T 512	1		" 2N3819
T 513			
T 514	1		" BC 237
T 515	1		" BC 237

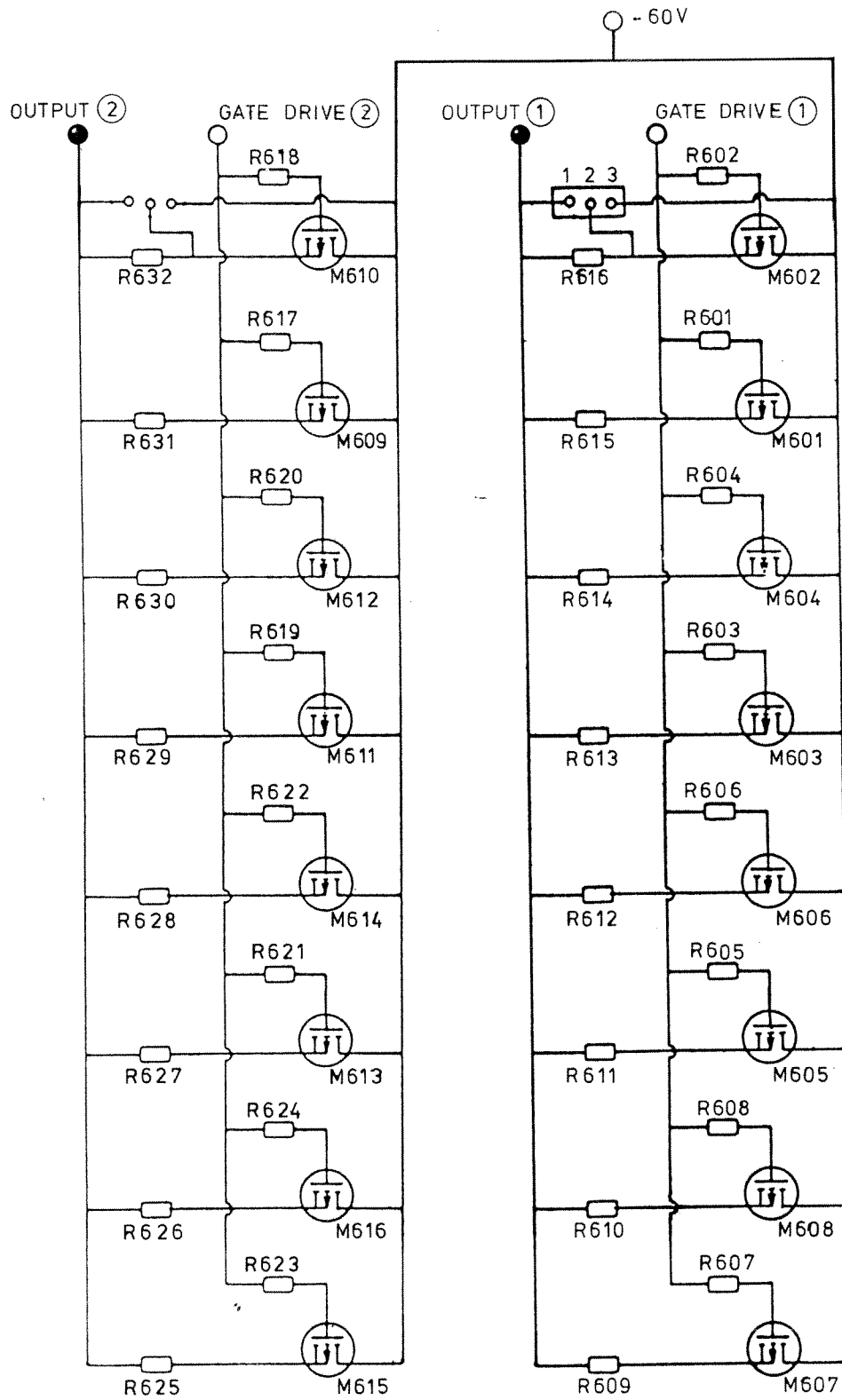
ITEM	QTY.	CODE No.	DESCRIPTION
C 501	1		CAPACITOR 0.01
C 502	1		" 4.7
C 503	1		" 1.0
C 504	1		" 10
C 505	1		" 2.2
C 506	1		" 0.01
C 507	1		" 22
C 508	1		" 10
C 509	1		" 0.01
C 510	1		" 1.0
C 511	1		" 10
C 512	1		" 0.01
C 513	1		" 0.01
C 514	1		" 0.01
D 501	1		DIODE 4V7
D 502	1		" 1N4148
D 503	1		" 9V1
D 504	1		" 13V
D 505	1		" V 518 P
D 506			
D 507			
D 508	1		" V 518 P
D 509			
D 510	1		" 1N4148
D 511	1		" 1N4148
D 512	1		" 1N4148
D 513	1		" 1N4148
D 514			
D 515	1		" TL50 5301
D 516	1		" 1N4148
D 517	1		" 1N4148
R 501	1		RESISTOR 2 K 2
R 502	1		" 18 K
R 503	1		" 100 K
R 504	1		" 100 K
R 505	1		" 2 K 2
R 506	1		" 2 K 2
R 507	1		" 47 K
R 508	1		" 1 K
R 509	1		" 2 K 2
R 510	1		" 10 K
R 511	1		" 22 K
R 512	1		" 2 K 2
R 513	1		" 10 K
R 514	1		" 10 K
R 515	1		" 1 K
R 516	1		" 100 R
R 517	1		" 100 R
R 518			
R 519			
R 520	1		" 10 K
R 521	1		" 10 K
R 522	1		" 100 R
R 523	1		" 100 R
R 524	1		" 13 K
R 525	1		" 200 K
R 526	1		" 100 R
R 527	1		" 2 K 2
R 528	1		" 10 K
R 529	1		" 22 K
R 530	1		" 22 K





ITEM	QTY.	CODE N°	DESCRIPTION	DRG N°
R701	1		RESISTOR 1 K 2	
R702	1		" "	
R703	1		" "	
R704	1		" "	
R705	1		" "	
R706	1		" "	
R707	1		" "	
R708	1		" "	
R709	1		RESISTOR R22 3W	
R710	1		" "	
R711	1		" "	
R712	1		" "	
R713	1		" "	
R714	1		" "	
R715	1		" "	
R716	1		" "	
R717	1		RESISTOR 1 K 2	
R718	1		" "	
R719	1		" "	
R720	1		" "	
R721	1		" "	
R722	1		" "	
R723	1		" "	
R724	1		" "	
R725	1		RESISTOR R22 3W	
R726	1		" "	
R727	1		" "	
R728	1		" "	
R729	1		" "	
R730	1		" "	
R731	1		" "	
R732	1		" "	
M701	1		MOSFET's 2SK405	
M702	1		" "	
M703	1		" "	
M704	1		" "	
M705	1		" "	
M706	1		" "	
M707	1		" "	
M708	1		" "	
M709	1		" "	
M710	1		" "	
M711	1		" "	
M712	1		" "	
M713	1		" "	
M714	1		" "	
M715	1		" "	
M716	1		" "	





ITEM	QTY.	CODE N°	DESCRIPTION	DRG N°
R601	1		RESISTOR 510R	
R602	1		" "	
R603	1		" "	
R604	1		" "	
R605	1		" "	
R606	1		" "	
R607	1		" "	
R608	1		" "	
R609	1		RESISTOR R22 3w	
R610	1		" "	
R611	1		" "	
R612	1		" "	
R613	1		" "	
R614	1		" "	
R615	1		" "	
R616	1		" "	
R617	1		RESISTOR 510R	
R618	1		" "	
R619	1		" "	
R620	1		" "	
R621	1		" "	
R622	1		" "	
R623	1		" "	
R624	1		" "	
R625	1		RESISTOR R22 3W	
R626	1		" "	
R627	1		" "	
R628	1		" "	
R629	1		" "	
R630	1		" "	
R631	1		" "	
R632	1		" "	
M601	1		MOSFET's 2 SJ119	
M602	1		" "	
M603	1		" "	
M604	1		" "	
M605	1		" "	
M606	1		" "	
M607	1		" "	
M608	1		" "	
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M610	1		" "	
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M616	1		" "	