Sailor

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INSTRUKTIONSBOG FOR SAILOR N 1400

INSTRUCTION BOOK FOR SAILOR N 1400

A/S S. P. RADIO · AALBORG · DENMARK

CONTENTS:

GENERAL DESCRIPTION

SAILOR N1400 is a DC power supply intended to supply a SAILOR SSB short-wave set, when the set has to be supplied from a 24V battery.

SAILOR N1400 has a MAIN SWITCH which controls all power supply to the short-wave set. All fuses for the short-wave set are located behind the AIR FILTER.

SAILOR N1400 has a built-in delay unit which ensures the proper sequence for applying voltages to the transmitter, regardless of how the MAIN SWITCH is operated.

SAILOR N1400 with MAIN SWITCH in position RECEIVER ONLY. Only the receiver is supplied and low power consumption is achieved.

SAILOR N1400 with MAIN SWITCH in position STAND BY, filament and negative bias are supplied to the transmitter.

SAILOR N1400 has a meter which controls the input voltage. A switch behind the AIR FILTER makes it possible with the same meter to check the voltages inside the set.

SAILOR N1400 is provided with thermal breakers which switch off the set, if the temperature inside the power supply gets too high.

SAILOR N1400 has a built-in loudspeaker for the connected receiver.

SAILOR N1400 fits into SAILOR 19" rack system.

TECHNICAL DATA

The power supply N1400 delivers all necessary voltages to a SAILOR SSB short-wave set with an output power of 800 W PEP in the frequency range 4 - 27.5 MHz. In the frequency range 1.6 - 4 MHz the plate voltage is reduced in order to limit the output power to 400 W PEP.

Input voltage: Normal voltage 26.5 VDC ±10%

Input current:

Input current (24V DC)	1.6 - 4 MHz	4 - 27.5 MHz
Receiver only	1.8A	1.8A
Stand by	8.2A	8.2A
On	9.0A	9.0A
Tune (full PEP 2-tone)	41A	55A
SSB Normal Speech	34A	43A
A3H Normal Speech	40A	52A

Output voltages:

DC unstabilized

Va 1.4/2 KV
$V_{filament}$ = input
-45V -45V

DC stabilized

V_{driver}	28V ±5%
V_{g1}	-60V ±5%
22V	22V ±2%
$2xV_{g2}$	400V ±2%

The currents from V_{g2}'s are limited to protect the screen in the P.A. tubes.

AC unstabilized

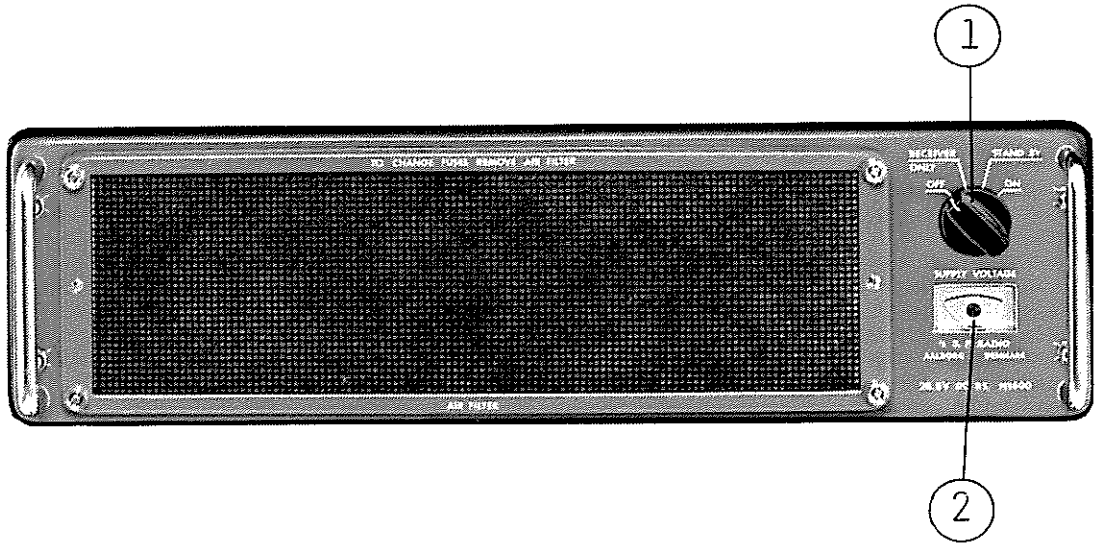
Blower supply 50-60 Hz

Operation temperature range: $-15^{o}C$ to $+55^{o}C$

Cooling: With MAIN SWITCH in position STAND BY and ON the internal blower is running. If the inside temperature gets too high thermal breakers disconnect the 22V and stop the set until is has cooled down.

When MAIN SWITCH is in position RECEIVER ONLY and the internal temperature exceeds $+55^{o}C$ the internal blower starts automatically, when the temperature falls below $+40^{o}C$ the blower stops. (Valid for power supplies N1400 with serial number higher than 173759).

CONTROLS



(1) MAIN SWITCH

Switching between the functions.

OFF

The set is switched off.

RECEIVER ONLY

The receiver is supplied with power and ready for use.

STAND BY

Internal blower starts and voltages are supplied to the transmitter in order to make it ready for use.

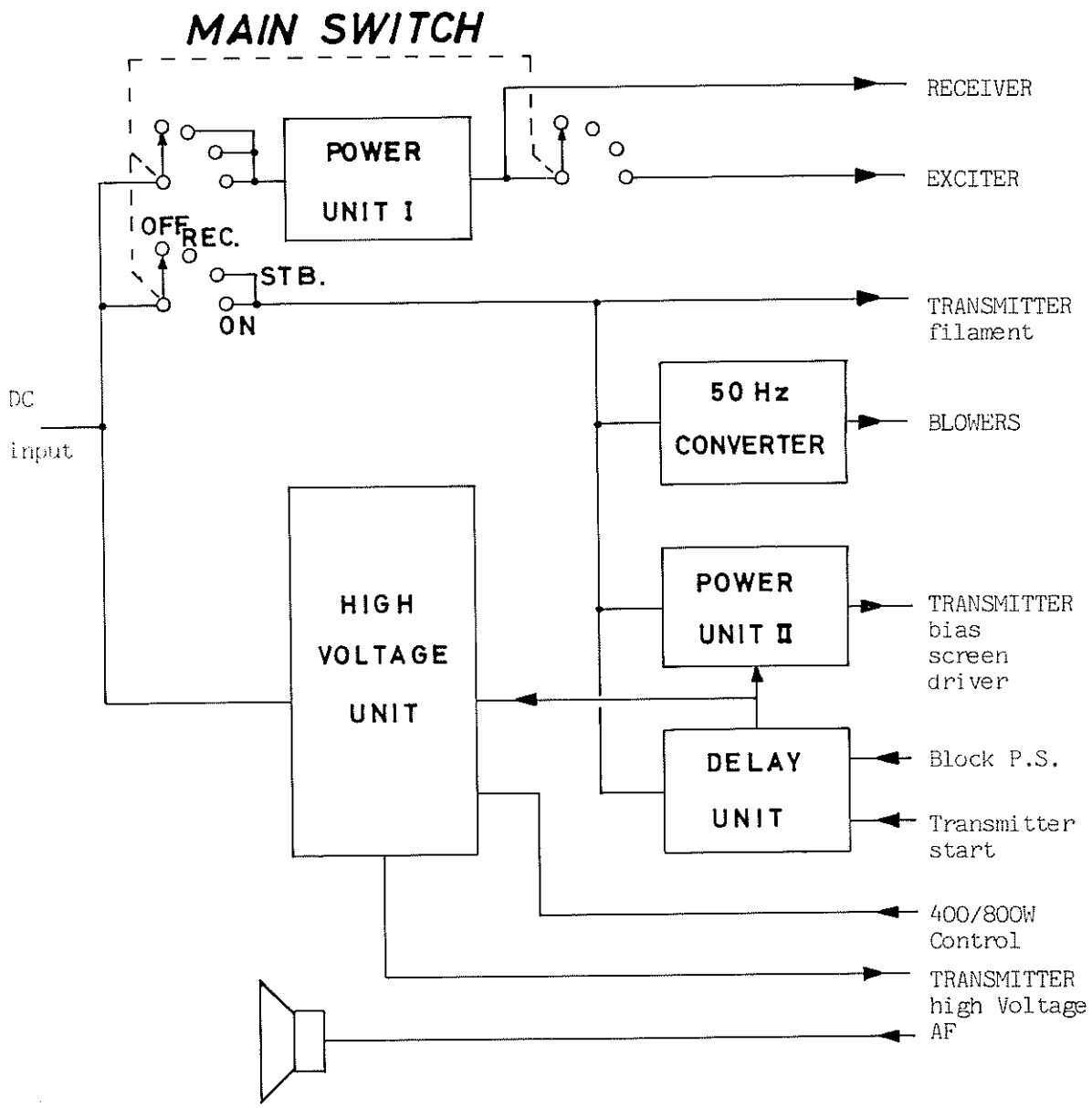
ON

The transmitter is ready for use if it has been in position STAND BY or ON for a period equal to or longer than the delay time.

(2) SUPPLY VOLTAGE METER

Meter checking the input voltage to the set. Internal voltage check, by using the switch located behind the AIR FILTER it is possible to check different voltages in the set.

PRINCIPLE OF OPERATION N1400



POWER SUPPLY N1400

The function of the power supply is controlled from MAIN SWITCH, DELAY UNIT and the control inputs Transmitter start and Block P.S.

POWER UNIT I is connected in positions RECEIVER ONLY, STAND BY and ON. It supplies the RECEIVER and the EXCITER. The EXCITER in position ON only.

POWER UNIT II is connected in positions STAND BY and ON. The output bias is present, whereas the outputs screen and driver follows the Transmitter start control input if the power supply N1400 is not blocked via the control input Block P.S.

50 Hz CONVERTER is connected in positions STAND BY and ON, the internal blower runs and AC is supplied to the transmitter blower.

HIGH VOLTAGE UNIT is only in function in position ON when the control inputs Transmitter start and Block P.S. are present. The size of the HIGH VOLTAGE is controlled via the control input 400/800W Control.

DELAY UNIT is started in position STAND BY and runs in STAND BY and ON while filament is supplied to the transmitter tubes. After the delay time, the control inputs Transmitter start and Block P.S. are allowed to pass through the DELAY UNIT.

SERVICE

1. MAINTENANCE

1.1.
When the SAILOR SHORT WAVE SET type 1000 has been correctly installed, the maintenance can, dependent on the environment and working hours, be reduced to a performance check at the service workshop at intervals not exceeding 5 years. A complete performance check list is enclosed in the PERFORMANCE CHECK section.

Also inspect the antennes, cables and plugs for mechanical defects, salt deposits, corrosion and any foreign bodies.

Along with each set a TEST SHEET is delivered, in which some of the measurings made at the factory are listed. If the performance check does not show the same values as those on the TEST SHEET, the set must be adjusted as described under ADJUSTMENT PROCEDURE.

Any repair of the set should be followed by a FUNCTION CHECK of the unit in question.

2. NECESSARY TEST EQUIPMENT

T1127	N140X	S1300	R1117	
X	X	X	X	OSCILLOSCOPE:
				Bandwidth 0-25 MHz
				Sensitivity 2mV/cm
				Input impedance 1 Mohm//30 pF
				Triggering EXT-INT-ENVELOPE
				E.g. PHILIPS PM3212
X		X	X	PASSIVE PROBE:
				Attenuation 10x
				Input resistance DC 10 Mohm
				Input capacitance 15 pF
				Compensation range 10 pF - 30 pF
				E.g. PHILIPS PM 9396
		X	X	MULTIMETER:
				Sensitivity (f.s.d.) 1V
				Input impedance 10 Mohm
				Accuracy (f.s.d.) ±2%
				E.g. PHILIPS PM2503
X	X			MULTIMETER:
				Sensitivity 0.3V and 3A
				Input impedance 30 Kohm/V
				Accuracy (F.S.d.) ±1%
				Current range 100A
				Voltage range 500V, and 2.5 kV
				E.g. Unigor A43, with probe and shunt

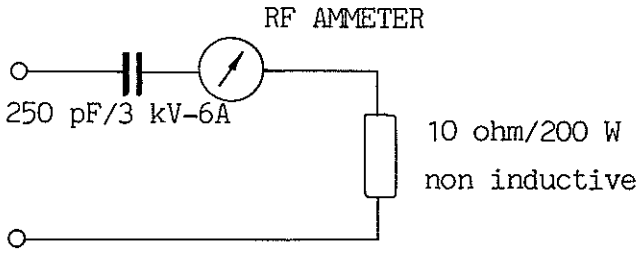
NECESSARY TEST EQUIPMENT cont.:

T1127	N140X	S1300	R1117		
		X		TONEGENERATOR:	
				Frequency range	200 - 3000 Hz
				Output	1V RMS
				Output impedance	≦ 600 ohm
				E.g. PHILIPS	PM5107
			X	AF VOLTMETER:	
				Sensitivity (f.s.d.)	300 mV
				Input impedance	≧ 4 ohm
				Accuracy (f.s.d.)	±5 %
				Frequency range	100 Hz - 5 kHz
				E.g. PHILIPS	PM2503
		X	X	FREQUENCY COUNTER:	
				Frequency range	100 Hz - 40 MHz
				Resolution	0,1 Hz at f ≧ 10 MHz
				Accuracy	$1 \cdot 10^{-7}$
				Sensitivity	100 mV RMS
				Input impedance	1 Mohm
				Single period measurement	
				range	1 sec.
				resolution	1 mS
				E.g. PHILIPS	PM6611 + PM9679
			X	SIGNAL GENERATOR	
				Frequency range	550 kHz - 30 MHz R1118: 100 kHz - 30 MHz
				Output impedance	50/75 ohm
				Output voltage	1 uV - 100 mV EMF
				Modulation	AM, 30%, 1000 Hz
				E.g. PHILIPS	PM5326

T1127	N140X	S1300	R1117	
				POWER SUPPLIES
X				T1127:
				V_{out} 26,5V DC
				I_{out} 60A DC
				E.g. 2 pcs. LAMBDA type LMG24
		X	X	R1117/S1300:
				V_{out} 1 22V
				I_{out} 1 1,5A
				V_{out} 2 -45V
				I_{out} 2 0,2A
				E.g. SAILOR POWER SUPPLY type N1402
		X		TEST BOX S1300:
				SP type S1300/01 TEST BOX
X				POWER METER:
				Power range 500W
				E.g. Bird Thruline Wattmeter Model 43
				plug-in element 500W 2-30 MHz
				impedance 50 ohm
X				RF-AMMETER (Thermocross)
				Current range 5A
				E.g. HELWEG MIKKELSEN & CO. Copenhagen, Denmark
				type TR-68x71 5A
X		X		DUMMY LOAD for HF bands, 4 MHz to 25 MHz
				Impedance 50 ohm
				Frequency range 0-25 MHz
				Power range 500W
				E.g. BIRD Termaline Coaxial resistor Model 8401

NECESSARY TEST EQUIPMENT cont.:

T1127	N140X	S1300	R1117	
X				DUMMY LOAD for C.T. band 1.6 MHz to 4 MHz
			X	DUMMY LOAD for the C.T. band 1.6 to 4 MHz
			X	DUMMY LOAD for the HF bands 4 MHz to 25 MHz

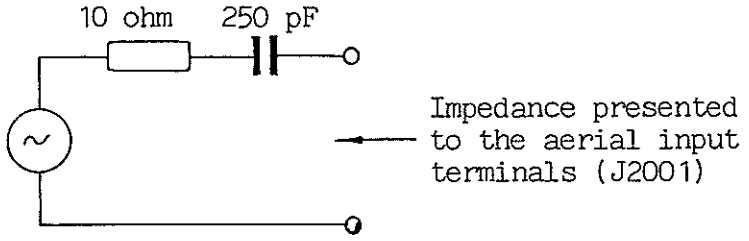


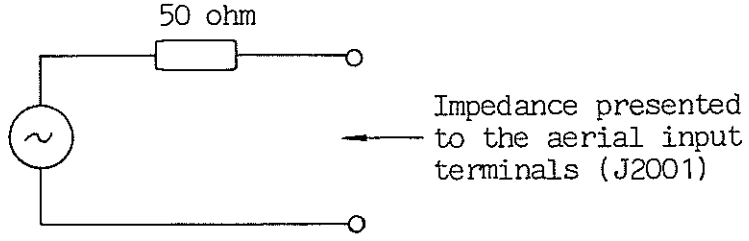
250 pF

E.g. DRALORIC 06 1291 TD 20x50 L
8 KV_S 250 pF ±20% R85

10 ohm

E.g. 10 pcs. DALE PH-25A-17, 100 ohm 5% 25W





E.g. SAILOR Rx DUMMY LOAD type H219.

A 4/5

3. TROUBLE-SHOOTING

Trouble-shooting should only be performed by persons with sufficient technical knowledge, who have the necessary test equipment at their disposal, and who have carefully studied the operation principles and structure of the unit in question.

Start to find out whether the fault is somewhere in the antenna circuit, the power source, or in the short-wave set.

For help with trouble-shooting in the short-wave set there is a built-in test meter and test meter switch, located behind the air filter on the power supply.

When the fault has been located to a certain unit look up the PERFORMANCE CHECK list in the instruction book and make relevant performance check to incircle the fault. Then look up the CIRCUIT DESCRIPTION. This section contains schematic diagrams, description of the modules and pictures showing the location of the components. (ADJUSTMENT LOCATIONS).
Typical AC and DC voltages are indicated on the schematic diagrams.

No adjustment must take place unless the service workshop has the necessary test equipment to perform the ADJUSTMENT PROCEDURE in question.

After repair or replacement of the module look up the section NECESSARY ADJUSTMENTS AFTER REPAIR to see, whether the unit has to be adjusted or not.

Anyway the unit has to have a complete FUNCTION CHECK after repair.

4. PERFORMANCE CHECK FOR N1400

In order to make the performance check easier, the function of the power supply for the different modes, in which the power supply can operate, are listed in the tables below.

4.1.
TABLE I, POWER SUPPLY FUNCTION.

This table indicates the outputs from the power supply and in which conditions the different outputs are present.
To achieve all these outputs, the power supply shall be connected to a short-wave set or controlled externally as indicated in 4.3. (table III) and 4.4. (table IV).

Used in	Use	Voltage (V)	Pin in J701		OFF	RECEIVER ONLY	STAND BY	ON	
			Common						keyed
Receiver		22	Chassis 10, 16 22, 23	11		X	X	X	X
		-45		12		X	X	X	X
Exciter		22		25				X	X
		-45		24		X	X	X	X
Transmitter	Va	1.4/2K							XD
	Vg2	400		1					XD
	Vg2	400		4					XD
	Vg1	-60		18			X	X	X
	V_{driver}	28		7					XD
	Blower	220 AC	Between	33 36			X	X	X
	Filament	26.5	26, 27	6			X	X	X
		26.5		9			X	X	X
		26.5		15			X	X	X

X voltage present

XD voltage present after delay

PERFORMANCE CHECK FOR N1400 cont.:

4.1.1.
The accuracy of voltages.

Following voltages are stabilized:

22V, Vg2, Vg1 and V_{driver}

22V and Vg2 = 400V within $\pm$2%

Vg1 = -60V and V_{driver} = 28V within $\pm$5%

Other voltages are not stabilized and will vary with input voltage and load.

4.2.
TABLE II, VOLTAGE CHECK WITH SUPPLY VOLTAGE METER.

This table indicates in which way the meter marked SUPPLY VOLTAGE can be used for checking different voltages inside the power supply.
Correct reading is when the pointer is in the middle of the green area.

NOTE: Va only reaches the green area when Va = 2kV (frequency above 4 MHz, pin 17 in J701 grounded).

This meter is only for checking, not for measuring voltages.

MAIN SWITCH / meter switch	OFF	RECEIVER ONLY	STAND BY	ON	
					keyed
input		X	X	X	X
Va					XD
Vg2					XD
22V		X	X	X	X
V_{driver}					XD
Vg1				X	X

After use leave the meter switch in pos. input.

4.3.
TABLE III, CONTROL OF POWER SUPPLY.

This table indicates the state for the power supply, versus the control conditions. The MAIN SWITCH in position ON.

Control Conditions			State for P.S.	
Block P.S.	Transmitter start	Delay time past	Keyed	High Voltage present
pin 14 J701	pin 31 J701	30 secs		
grounded	22V	No		
grounded	0V	Yes		
grounded	22V	Yes	X	X
open	22V	Yes		
open	0V	Yes		

4.4.
TABLE IV, CONTROL OF Va VERSUS FREQUENCY.

This table indicates how the high voltage Va is changed when the frequency is above or below 4 MHz.

Frequency	400/800W Control	High Voltage Va
MHz	pin 17 J701	kV
below 4	open	1.4
above 4	grounded	2

5. ADJUSTMENT PROCEDURE FOR N1400

5.1.
ADJUSTMENT OF 22V.

5.1.1.
With the voltmeter in 30V range connect the + terminal to TP1 and the - terminal to chassis. The MAIN SWITCH in pos. ON (if the power supply is separate, load the 22V with 3 - 3.5A).

5.1.2.
Adjust with potentiometer R111 to the voltmeter reads 22.0V.

5.1.3.
Connect an oscilloscope to TP1 and check that the ripple is less than 200 mVpp.

5.1.4.
If possible variate the supply voltage and check that the 22V remains stable.

5.2.
ADJUSTMENT OF Vg2.

5.2.1.
With the voltmeter in 500 or 1000V range, connect the + terminal to TP2 and the - terminal to chassis. Key the short-wave set, but no drive to the PA stage (ex. A3J, no modulation). If the power supply is separate, key the power supply using the informations in TABLE III 4.3.

5.2.2.
Adjust with potentiometer R226 to the voltmeter reads 400V.

5.2.3.
Move the voltmeter to TP3, the reading shall remain 400V, even though TP4 is short-circuited to chassis. With the voltmeter on TP4 check that the voltage remain 400V when TP3 is short-circuited to chassis.

5.2.4.
Check that the voltage of TP5 is -60V.

5.2.5.
Check that the voltage of TP6 is 28V.

6. NECESSARY ADJUSTMENTS AFTER REPAIR

6.1.
AFTER REPAIR IN POWER UNIT I, PERFORM ADJUSTMENT IN ACCORDANCE WITH SECTION 5.1. ADJUSTMENT OF 22V.

6.2.
AFTER REPAIR IN POWER UNIT II PERFORM ADJUSTMENT IN ACCORDANCE WITH SECTION 5.2. ADJUSTMENT OF Vg2.

7. FUNCTION CHECK FOR N1400

7.1.
FUNCTION CHECK WHEN THE POWER SUPPLY IS INSTALLED IN A SHORT-WAVE SET.

7.1.1.
Using TABLE II section 4.2. check that the reading on the meter marked SUPPLY VOLTAGE is correct.

7.2.
FUNCTION CHECK WHEN THE POWER SUPPLY IS SEPARATE.

7.2.1.
The power supply supplied with the correct input and controlled in accordance with TABLE III section 4.3. and TABLE IV section 4.4. Use TABLE II section 4.2. to check the function via the SUPPLY VOLTAGE meter.

7.2.2.
When the power supply is separate and unloaded the power consumption can give information about the condition of the circuit.

Input Voltage	OFF	RECEIVER ONLY	STAND BY	ON		
					Keyed 1.4KV	Keyed 2KV
	Iin	Iin	Iin	Iin	Iin	Iin
24V DC	0	0.75	3	3	7.5	9.3

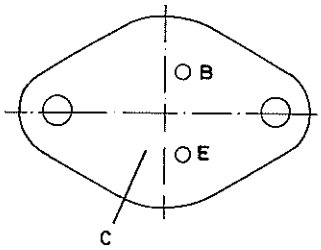
7.3.
NOTES FOR SUPPLY VOLTAGE METER.

7.3.1.
In position Vg2 only Vg2 on pin 4 in J701 is checked.

7.3.2.
In N1400 it is not possible to check the voltage -45V with the meter.

7.3.3.
Working frequency of converters. The frequency is between 300 - 500 Hz.

BOTTOM VIEW



MJ 802
MJ 3000
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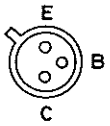
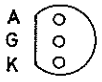


BC 141-10

BRY 39



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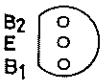

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CIRCUIT DESCRIPTION N1400

HIGH VOLTAGE UNIT

The HIGH VOLTAGE UNIT is made by three DC - DC converter units, which are identical except for the first one, which is self-oscillating. The two next ones are driven from the preceding converter.

The high voltage can be either 1.4 kV or 2 kV dependent on whether the third converter is driven or not. The drive is controlled via relay RE301 (400/800 W Control).

The high voltage unit starts when +22V is supplied to the relays RE302 and RE303. RE302 has no time delay and supplies DC bias to the transistors T301 and T302 and opens up for the feed-back of AC via transformer TR301 and oscillation starts. After the delay time for RE303 (50 - 90 mS), the DC bias to T301 and T302 is disconnected and only AC is fed back. If an overload comes up, the collector-collector impedance is reduced, the feed-back disappears and the converter stops.

NOTE! In order to ensure the correct function of the converters during overload: the transistors T301 and T302 must have lower h_{FE} or the same as T303 - T306 (matched pairs).

When the high voltage is 1.4 kV the diodes D318 and D319 protect the rectifier circuits with D316 and D317 if an overload or a flash-over take place. C320. R324, D320 and D321 suppress high voltages during start and switching.

POWER UNIT I

This unit supplies the receiver and the exciter with the voltages +22V and -45V and insulates the battery from the chassis.

The transistors T101 and T102 together with the matching transformers TR101 and TR102 are a DC-DC converter which gives two output voltages, the negative one is -45V and unstabilized. The other output is positive and via the regulator, consisting of the transistors T103 and T104 and the 7.5V zener diode D105 stabilized to +22V, adjustment of +22V is made by R111. The output +22V is secured against overload by the fuse F702 6.3A.

The diode D106 limits the peak current through the switch S701, because the capacitor C103 is charged-up.

POWER UNIT II

This unit supplies the transmitter and the driver unit with stabilized voltages. The input to the DC-DC converter is stabilized in the regulator, consisting of the transistors T201 and T202 and the 7.5V zener diode D201.

The output from the regulator is fed to the DC-DC converter with the transistors T203 and T204 and the matching transformers TR201 and TR202. The four outputs of the transformer TR202 are thereby stabilized and adjustment of the voltages is made by R226. The ratio of the voltages is determined by the transformer TR202.

The output Vg1 -60V is present as soon as the unit is in function, whereas the outputs V_{driver} +28V and the two Vg2 +400V are controlled by the +22V to the relays RE201, RE202 and RE203 (Transmitter start).

The circuit for the Vg2 supply is made so that the currents to the screens in the PA tubes are limited due to R219 and R220. If a screen tends to emit the increase of screen voltage is prevented due to a low impedance in the circuit consisting of R218 and the diodes D208 and D209.

The POWER UNIT II has built-in resistors for the TEST METER.

DELAY UNIT

The DELAY UNIT starts when it is connected. Across the zener diode D401 there is a voltage of 7.5V and the capacitor C404 starts charging up via resistor R407, when the anode gate is 0.7V below the anode, the D404 is triggered and the capacitor C404 is discharged.

In order to ensure enough current in the gate, a negative going pulse 200 - 500 mS of 0.7V is fed to the gate via C403.

The discharge of C404 causes a positive pulse across R406. The SCR D405 is triggered and relay RE402 is closed.

Relay RE401 is controlled via the control input Block P.S., when both relays are closed control inputs are allowed to pass through the DELAY UNIT.

50 Hz CONVERTER

This unit supplies the blowers with AC voltages with a frequency of 50 - 60 Hz dependent on the input voltage. The converter consists of the transistors T501 and T502 and the matching transformers TR501 and TR502. The diodes D503 and D504 limit the voltage with reversal polarity across T501 and T502.

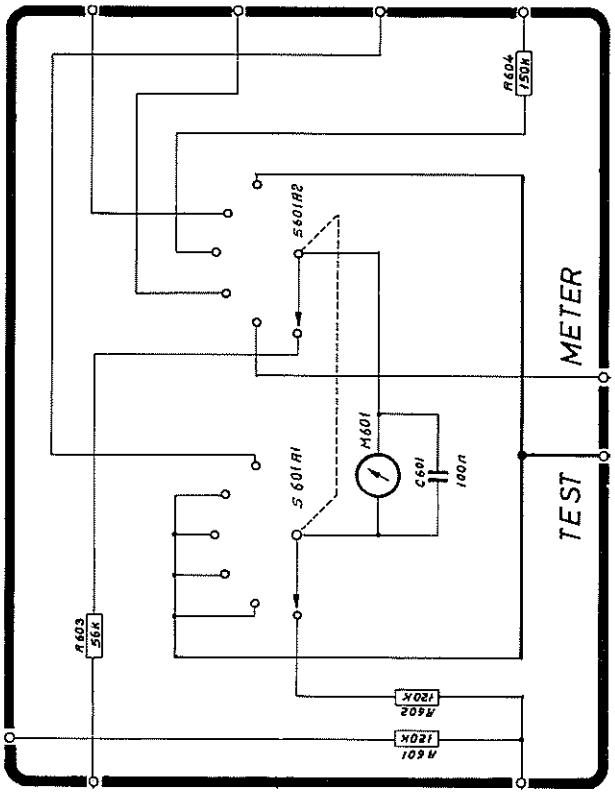
The diode D505 limits the peak current through the switch S701, because the capacitor C501 is charged up. L501 is a choke which limits the current peaks to the blowers. R504, C502 and C503 suppress high voltages during switching T501 and T502.

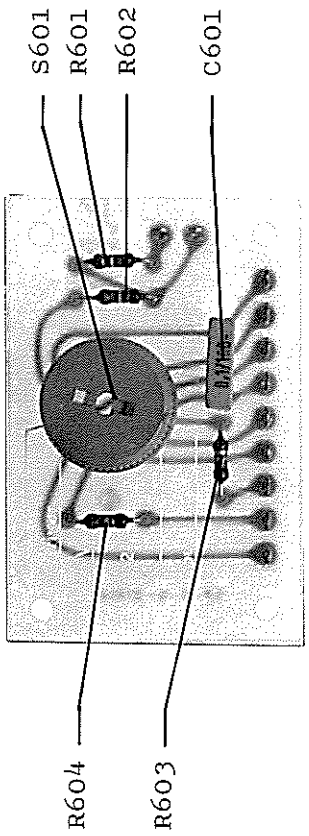
TEST METER

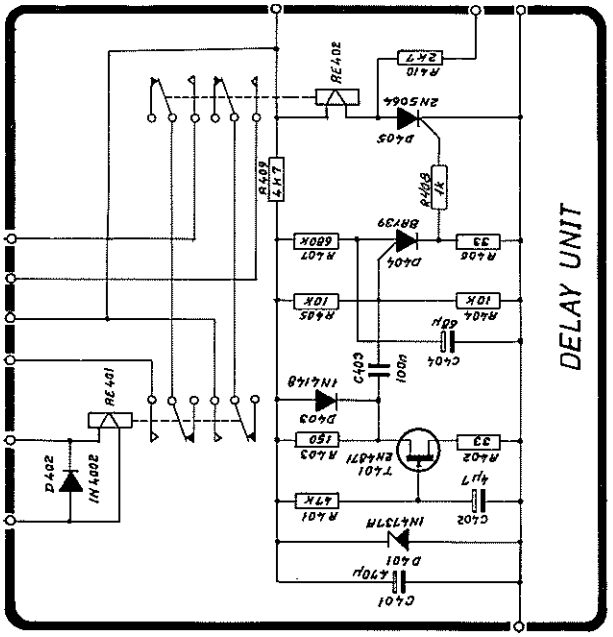
When using the SUPPLY VOLTAGE meter M601 and the switch S601, voltages are monitored. The resistors are placed either on the test meter print or in the different units.

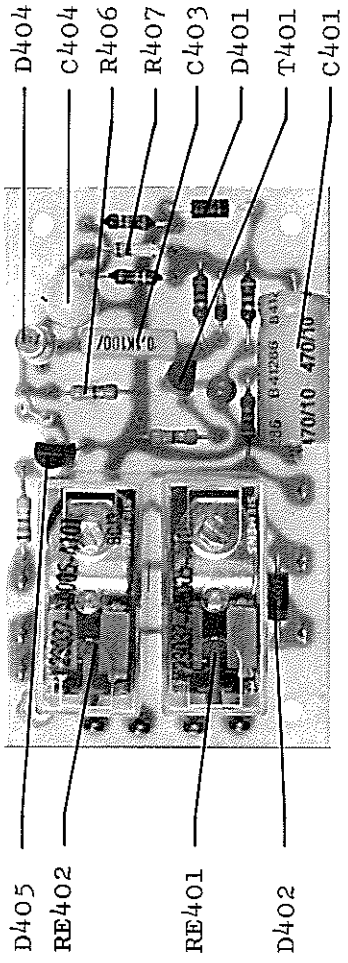
MAIN SWITCH

The switch S701 controls the function of the power supply and it is operated from the front.

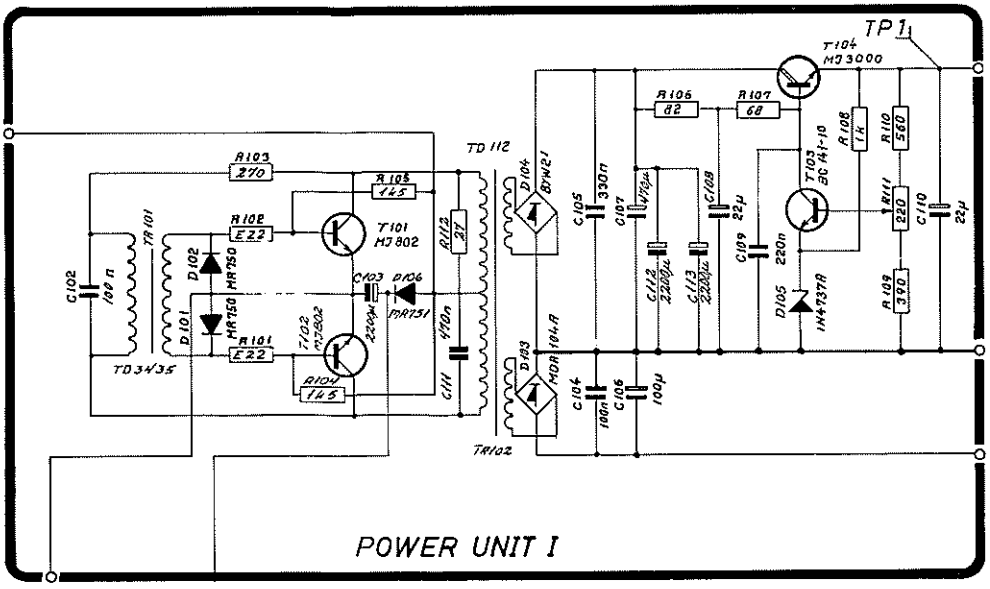


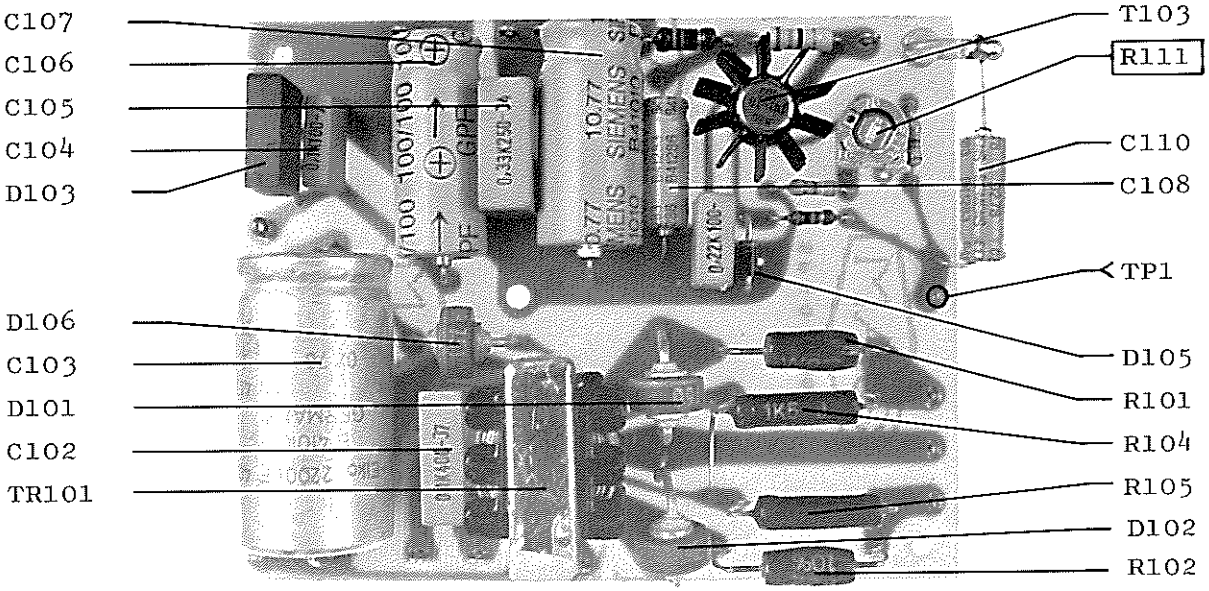




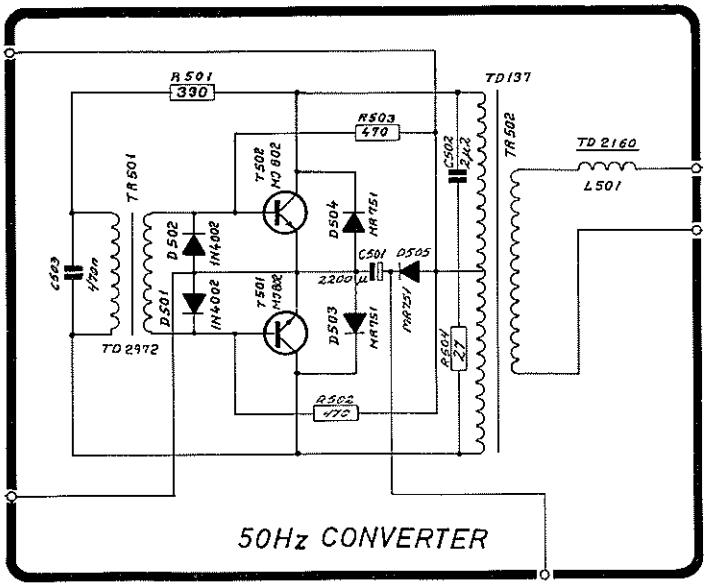


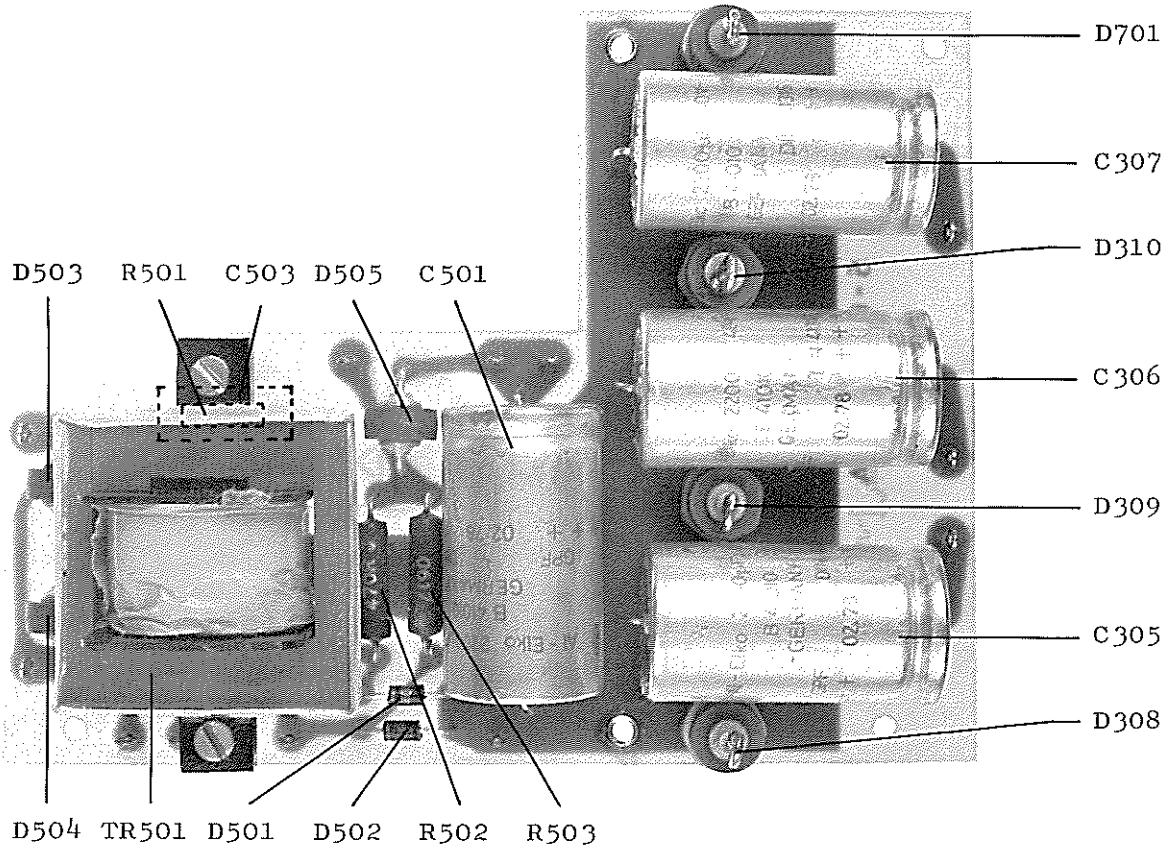
DELAY UNIT & TEST METER N1400/N1401



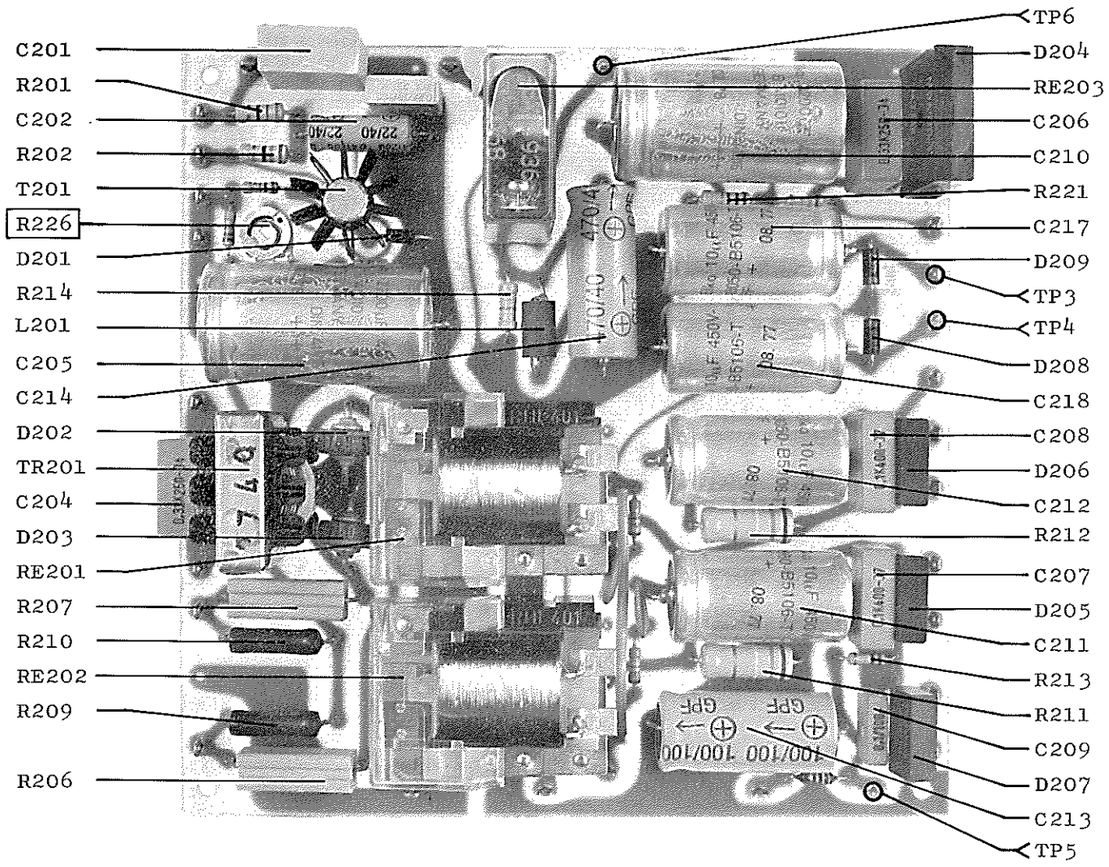


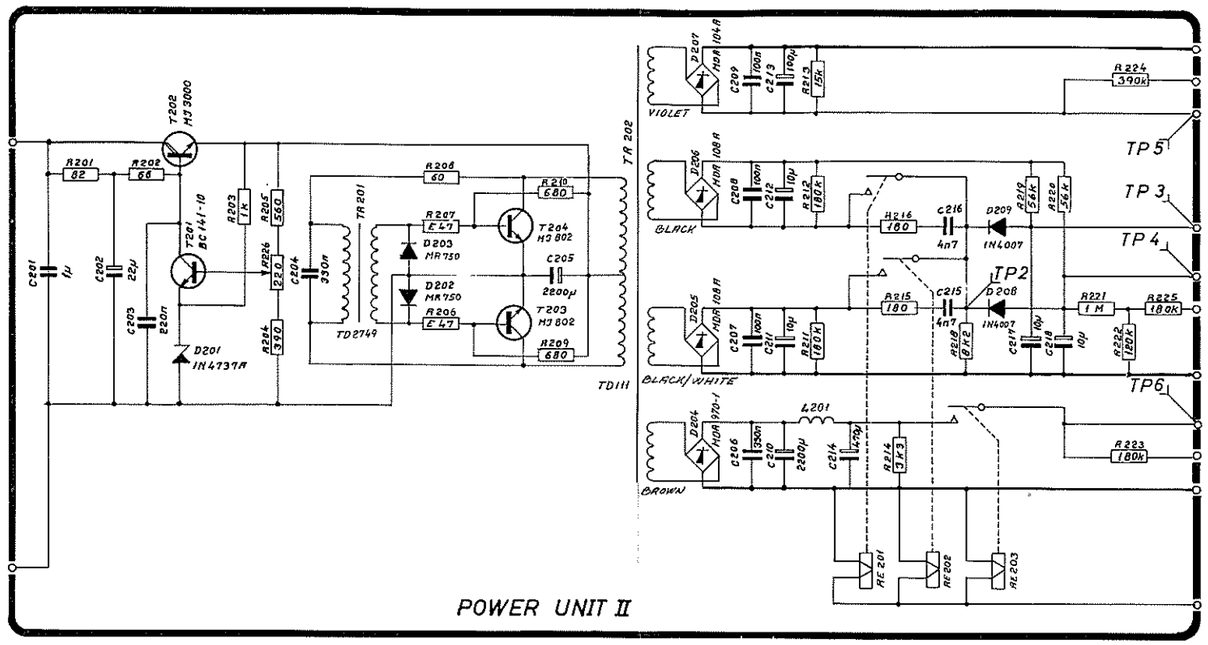
POWER UNIT I N1400



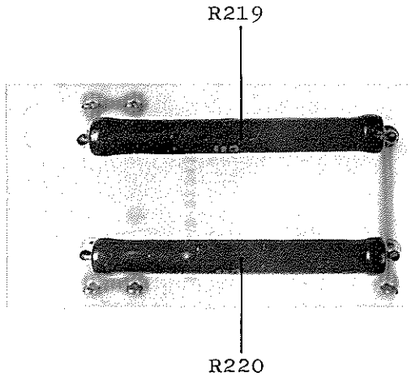


50 Hz CONVERTER N1400

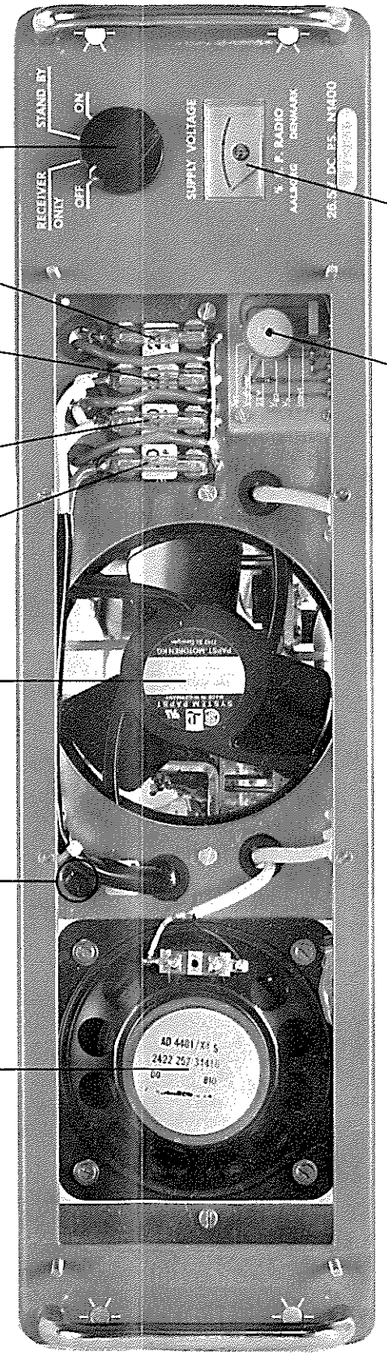




POWER UNIT II

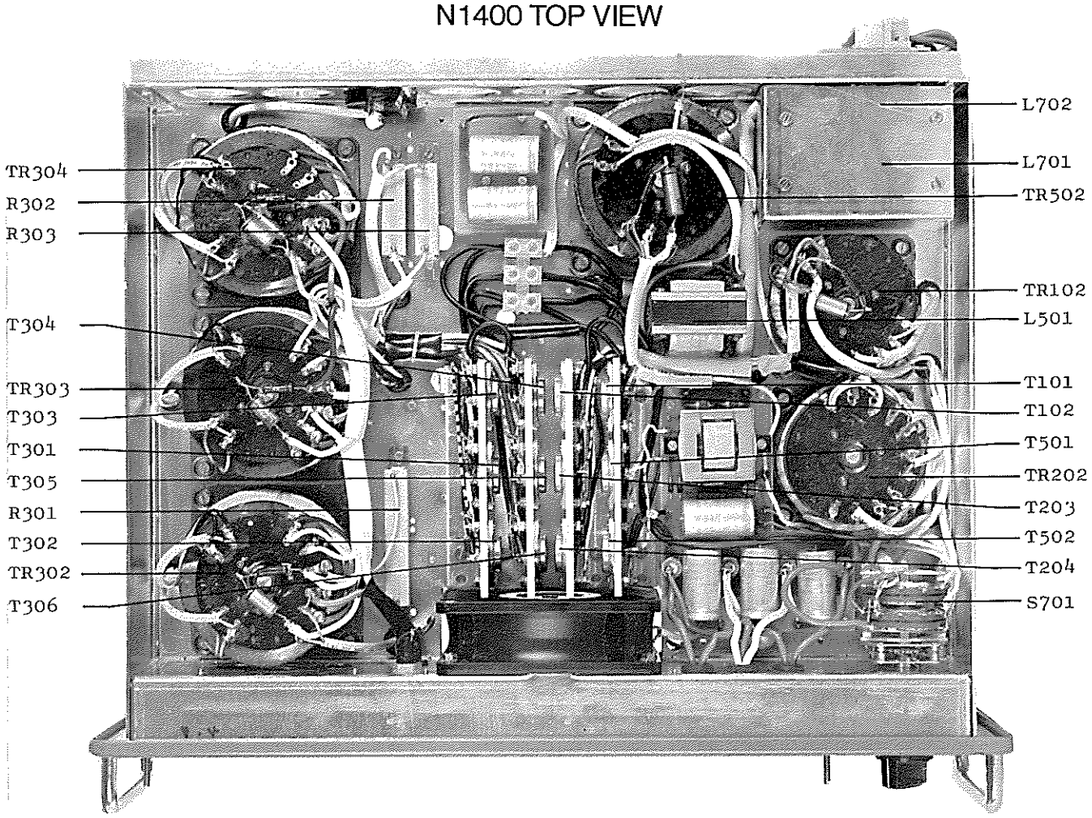


N1400 FRONT VIEW



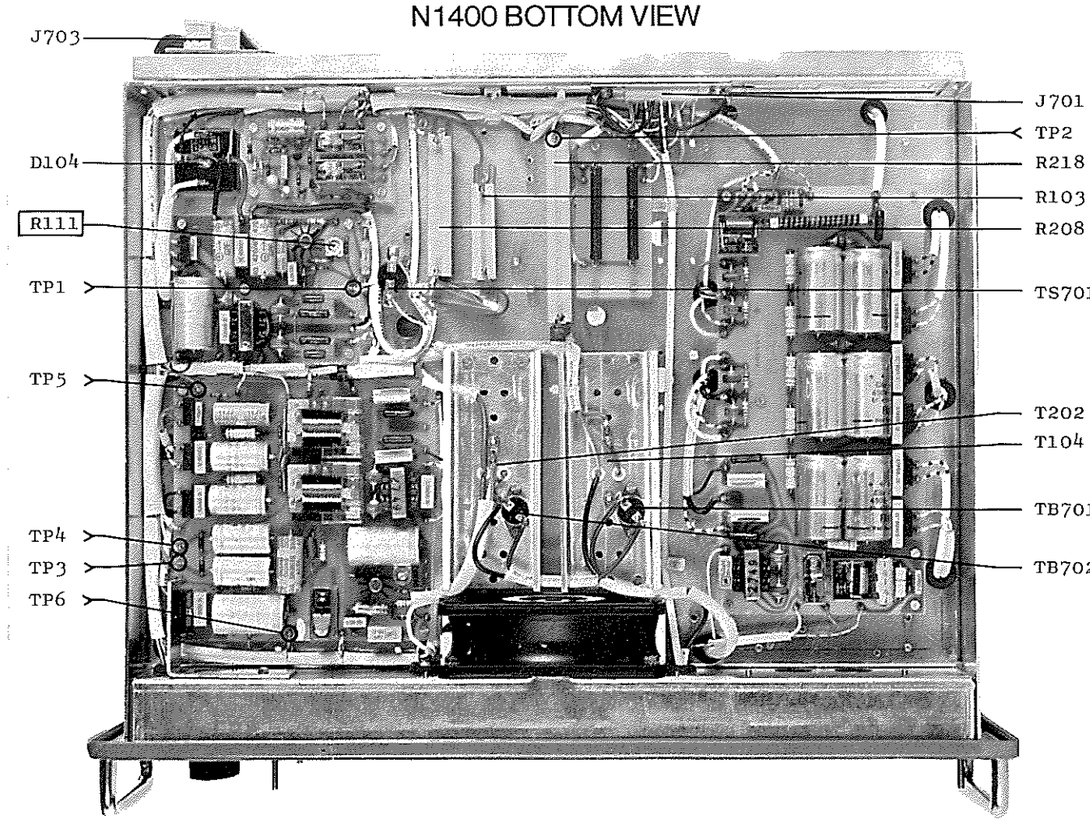
BL701
F702
LS701
F301
F302
F303
F701
MAIN SWITCH
M601
S601

N1400 TOP VIEW

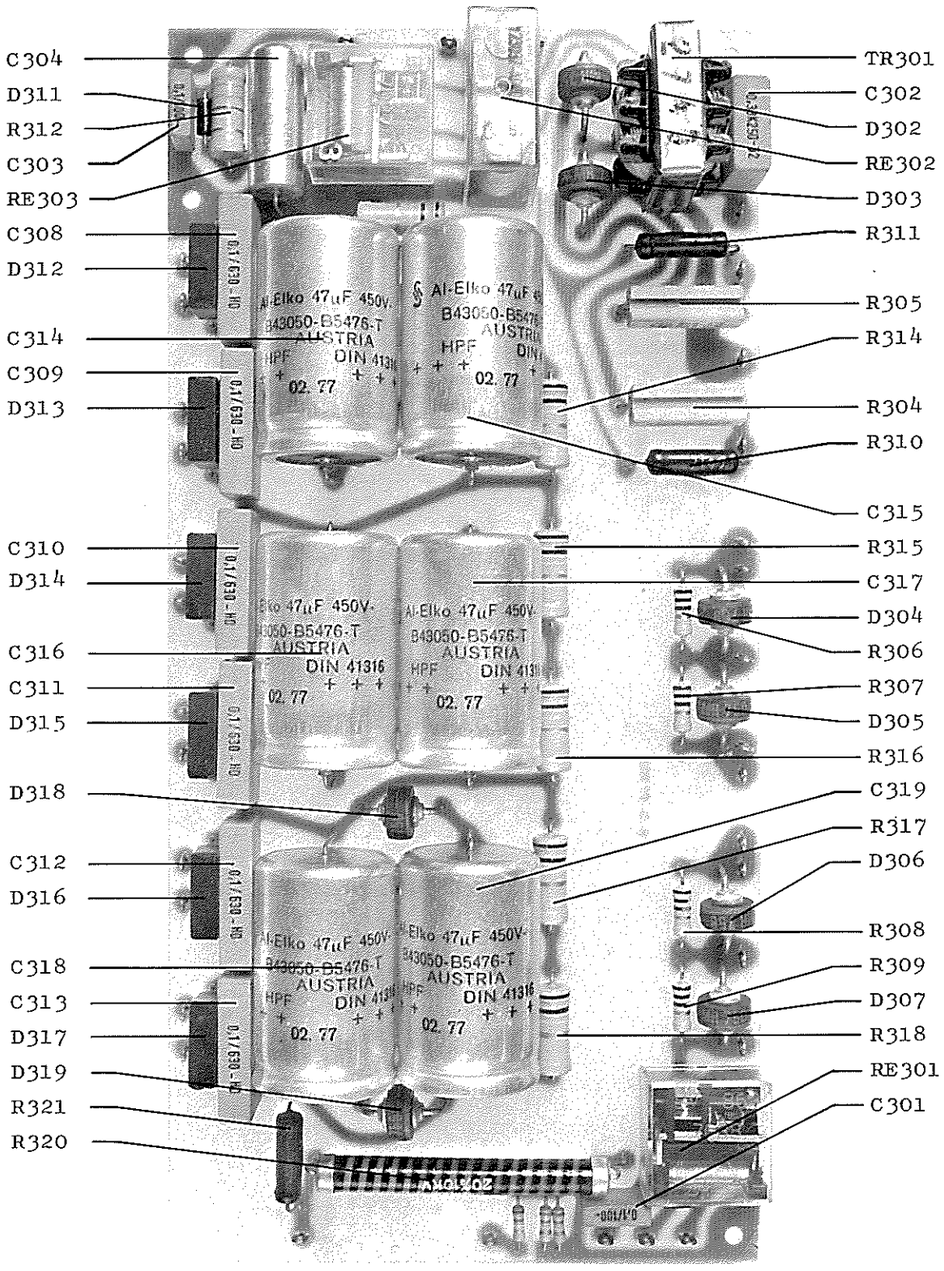


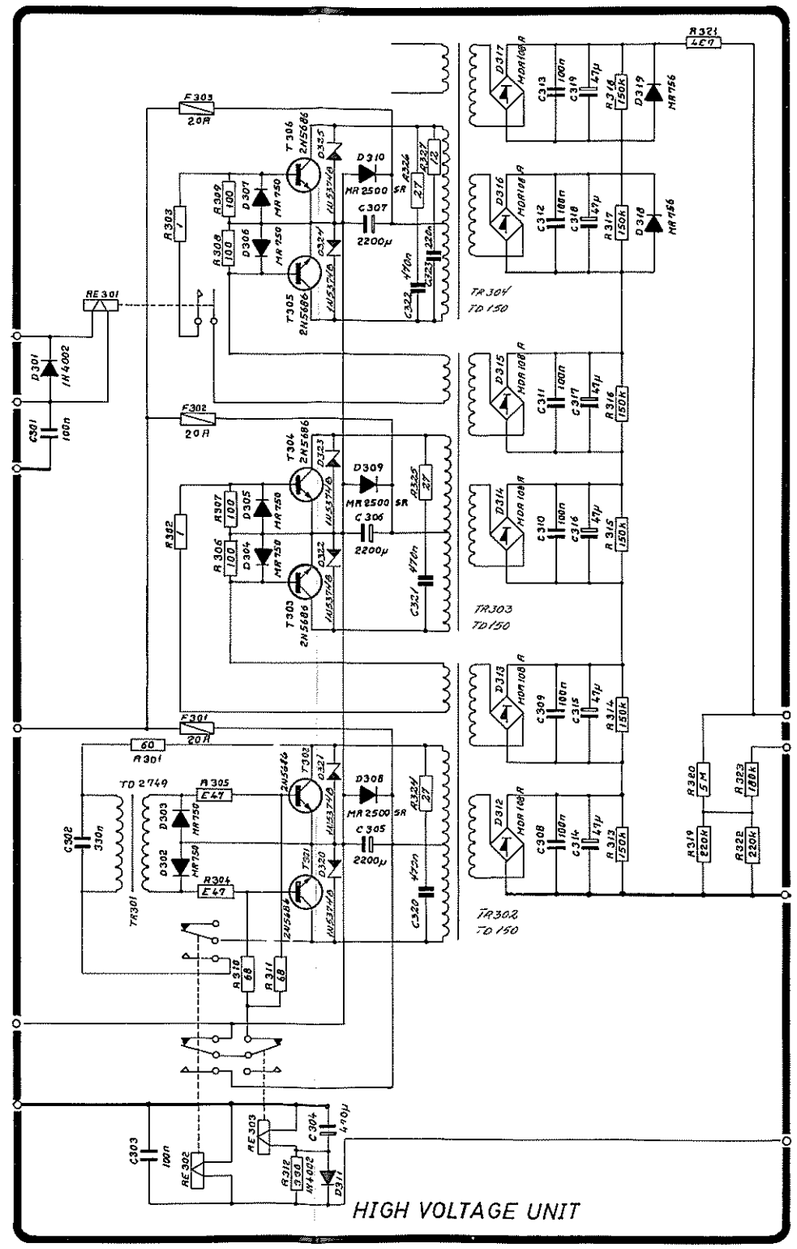
TR304
R302
R303
T304
TR303
T303
T301
T305
R301
T302
TR302
T306
L702
L701
TR502
TR102
L501
T101
T102
T501
TR202
T203
T502
T204
S701

N1400 BOTTOM VIEW



J703
D104
R111
TP1
TP5
TP4
TP3
TP6
J701
TP2
R218
R103
R208
TS701
T202
T104
TB701
TB702





HIGH VOLTAGE UNIT N1400

POWER UNIT I

POWER UNIT II

DELAY UNIT

TEST METER

HIGH VOLTAGE UNIT

50Hz CONVERTER

INTERNAL BLOWER

WHITE/GREEN 12 -45 V Receiver
WHITE 24 -45V Exciter
BROWN 0,4" 11 +22V Receiver
GREEN/WHITE 0,4" 15 +26,5V on
RED 1" 6 +26,5V for Filament (Battery)
RED 0,4" 9 +26,5V on (Battery)
BLUE/WHITE
BLUE 0,4" 18 -60V Vg1
WHITE 0,4" 1 +400V Vg2
GREEN 0,4" 4 +400V Vg2
BLUE/BLACK
VIOLET 0,4" 7 +28V to driver T1127
BLUE/GREY
BROWN/WHITE 0,4" 25 +22V Exciter
RED/YELLOW
GREY/YELLOW 14 Block P.S.
YELLOW 31 Transmitter start (22V)
BLACK/RED 30 Transmitter start (22V out)

J701
J702
J702 1,2,3
J702 1400/2000V High Voltage 12, 13
10
16
23
22
ORANGE 0,4" 33 AC Blower (220V/50Hz)
GREY 0,4" 36 AC Blower (220V/50Hz)
BL 701
BLACK 0,4" 19 Speaker
BLUE/WHITE 0,4" 20 Speaker
LS701
YELLOW 0,4" 26 Ground Renal Relay (-26,5V Battery)
BLUE 1" 27 -26,5V for Filament (Battery)
RED/GREEN 17 400/800 W Control
J703