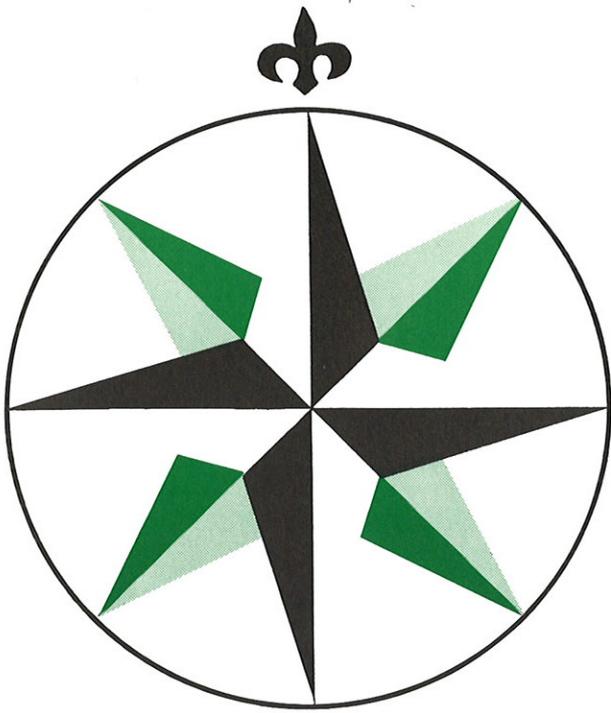


N1410



Sailor

Sailor

**INSTRUKTIONSBOG FOR
SAILOR AC POWER SUPPLY N1410**

**INSTRUCTION BOOK FOR
SAILOR AC POWER SUPPLY N1410**

**INSTRUKTIONSBUCH FÜR
SAILOR AC POWER SUPPLY N1410**

**INSTRUCTIONS POUR
SAILOR AC POWER SUPPLY N1410**

**INSTRUCCIONES PARA
SAILOR AC POWER SUPPLY N1410**

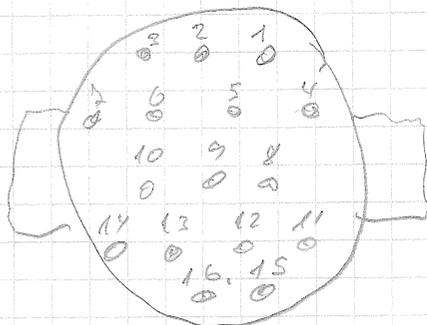
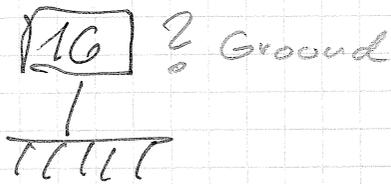


A/S S. P. RADIO · AALBORG · DENMARK

N 1410

TX. 1238,

- | | |
|--------------------|----------------------|
| 1. + Battery. | Battery 1. |
| 2 PU. 1. start | PU 1, start 2 |
| 3 Blower 1. | Blower 1. 3+4 |
| 4 " 2. | Blower 2. 5+6 |
| 5 TX start | TX start 7. |
| 6 Suppl. block | Supp block 8 |
| 7 22V. AT1500 | 22V AT1500 9 |
| 8 Suppl. reduction | Suppl. red. 10 |
| 9 + 22. | + 22. 11 |
| 10 + 22. | + 22 12. |
| 11 ÷ 45 | ÷ 45 13 |
| 12 " + 8 " | " + 8 " 14. |
| 13 " + 8 " | " + 8 " 15 |
| 14 ÷ 3 db. | ÷ 3 db. 16 |
| 15. AC/DC. | AC/DC. 17. |
| | Ground 18. grøn/gul. |



sil fra koddessiden (Hønstik)

H 1238

N. 1410.

Kabel Nr:

Kabel Nr.

1	Battery
2	PU. 1. start
3-4	Blower I
5-6	" II
7	TX start
8	Suppl. block
9	+ 22 V. AT 1500
10	Suppl. red.
11	+ 22
12	+ 22
13	÷ 45
14	" + 8 u
15	" + 8 u
16	÷ 3 db.
17	AC/DC.
18.	Ground. ?

1.
2
3
4.
5.
6.
7
8
9
10
11
12
13
14
15.
16. fvi°

gul/grøn 18.

OBS! OBS! OBS! OBS! OBS! OBS! OBS! OBS! OBS! OBS! OBS! OBS! OBS! OBS!

Vedrørende strømforsyningerne N1410 & N1411

Disse strømforsyninger er ved forsendelse fastspændt på træpallen med 4 bræddebolte isat de normale opspændingshuller, som sidder under det grønne svøb.

Se venligst afsnit 4. MECHANICAL DISASSEMBLING i instruktionsbogen for N1410/N1411.

Det grønne svøb aftages ved at afmontere de 4 skruer på fronten, som vender opad under forsendelse. Derefter løftes det grønne svøb af, løft først i bunden (der, hvor ledningsindføringen er).

Vær opmærksom på, at kabel til blæser ikke er monteret fra fabrikken. Det skal monteres, når strømforsyningen er færdiginstalleret.

Concerning Power Supplies N1410 & N1411

In transit these power supplies are clamped to the wooden pallet by means of 4 carriage bolts fixed into the normal fixing holes, situated under the green cover.

Please see the section 4. MECHANICAL DISASSEMBLING in the instruction book for N1410/N1411.

The green cover is removed by unscrewing the 4 screws on the front turning upwards in transit. Then the green cover is taken off (start lifting from the bottom, where the cable lead-in is situated).

Please note that the cable for the blower is not mounted from the factory, but must be mounted when the installation of the power supply has been completed.

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 - 3.2. RECOMMENDED TEST EQUIPMENT
 - 3.3. TROUBLE SHOOTING
 - 3.4. PERFORMANCE CHECK
 - 3.5. NECESSARY ADJUSTMENTS AFTER REPAIR
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4. MECHANICAL DISASSEMBLING

5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS
 - 5.1. REGULATOR UNIT N1410 (MODULE 1)
 - 5.2. CONTROL UNIT N1410 (MODULE 2)
 - 5.3. THYRISTOR UNIT N1410 (MODULE 3)
 - 5.4. POWER SECTION (MODULE 4) AND MAIN SCHEMATIC DIAGRAM FOR ONE POWER SECTION
 - 5.5. CONNECTION BOARD (MODULE 5) AND MAIN SCHEMATIC DIAGRAM FOR N1410

6. PARTS LIST

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- 1.3. PRINCIPLE OF OPERATION

1. INTRODUCTION

1.1. GENERAL DESCRIPTION

SAILOR N1410 is an AC power supply intended for use in conjunction with a SAILOR 1250 Watt SSB short wave station. It converts mains voltage to the necessary DC voltages used by the short wave station.

SAILOR N1410 is intended for connection to the AC mains. It can be strapped for 110V to 240V AC in single-phase or in three-phase star-connected AC mains. In case of a 127V AC mains voltage, the SAILOR N1410 can be connected in a three-phase Delta-connection.

Please see section 2.2. ELECTRICAL CONNECTIONS for correct strapping to the voltage in question.

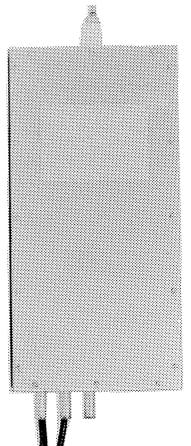
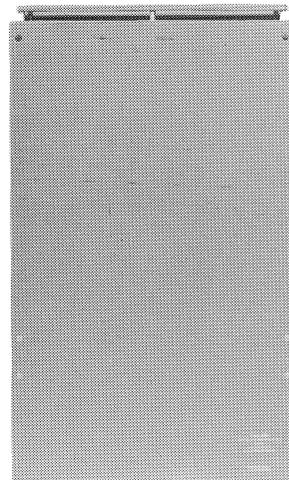
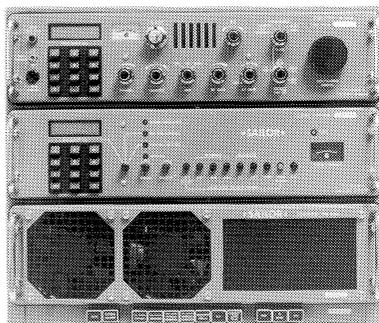
SAILOR N1410 is controlled from the short wave station.

SAILOR N1410 is an extremely high-reliable power supply because it consists of three input and output short-circuit free power sections connected in parallel. The same configuration is used by the European Space Agency (ESA) to ensure the reliability of the power supplies to the receivers in satellites.

A signal lamp for each of the three parallel sections indicates that the supply is functioning. The lamp is turned off if the supply is out of order.

SAILOR N1410 will automatically order the transmitter to reduce the output power slightly if one of the three parallel sections fails. If two sections are out of order, the transmitter is ordered to reduce output power with 3 dB. There will nearly always be enough power for sufficient transmitting.

All the power outputs from SAILOR N1410 are short-circuit proof.



1.2. TECHNICAL DATA

The power supply N1410 delivers all necessary voltages to a SAILOR 1250 Watt PEP SSB short wave station from the 1000/B programme.

INPUT VOLTAGES:

Single phase: 110/127/220/240V AC

Three phase: 3 x 110/3 x 127/3 x 220/3 x 240V AC star-connected with neutral or 2 x 127V without neutral
3 x 127V AC Delta-connected with/without neutral.

Voltage tolerance: +10%

Frequency: 50 - 60 Hz

INPUT CURRENTS:

110V AC single phase	approx.	22A RMS
127V AC single phase	approx.	19A RMS
220V AC single phase	approx.	11A RMS
240V AC single phase	approx.	10A RMS
2 x 127V AC two-phase without neutral	approx.	11A RMS
3 x 110V AC three-phase star-connected	approx.	3x7.5A RMS
3 x 127V AC three-phase star-connected	approx.	3x6.5A RMS
3 x 220V AC three-phase star-connected	approx.	3x3.7A RMS
3 x 240V AC three-phase star-connected	approx.	3x3.3A RMS
3 x 127V AC three-phase Delta-connected	approx.	3x3.7A RMS
3 x 127V AC three-phase without neutral	approx.	3x6.5A RMS

POWER CONSUMPTION: 2400 W

NOISE ON INPUT: less than CISPR

OUTPUT VOLTAGES:

PUII: +42V DC	I_0 max. 36 A	current limited
+28V DC	I_0 max. 6 A	current limited
PUI: +22V DC	I_0 max. 3.3 A	current limited
"+8V DC"	I_0 max. 2.2 A	limited with fuse F1-1
-45V DC	I_0 max. 0.15A	limited with fuse F2-1
Aux.: +24V DC	I_0 max. 0.5 A	
24V AC	I_0 max. 3 A	

The output currents are continuous ratings except from the PUII voltages. These ratings are peak currents to be delivered for less than 25 minutes.

OPERATION TEMPERATURE RANGE: -15°C to +55°C

Weight: 57 kg

1.3. PRINCIPLE OF OPERATION

The power supply N1410 consists of three power sections and an auxiliary power supply.

One power section consists of Power Unit I and Power Unit II.

Power Unit I consists of a 22V regulator, an "8V" rectifier and a -45V rectifier, which is producing low power voltage for receiver, exciter and transmitter.

Power Unit II consists of two regulators, a 42V regulator and a 28V regulator, producing high power to the transmitter.

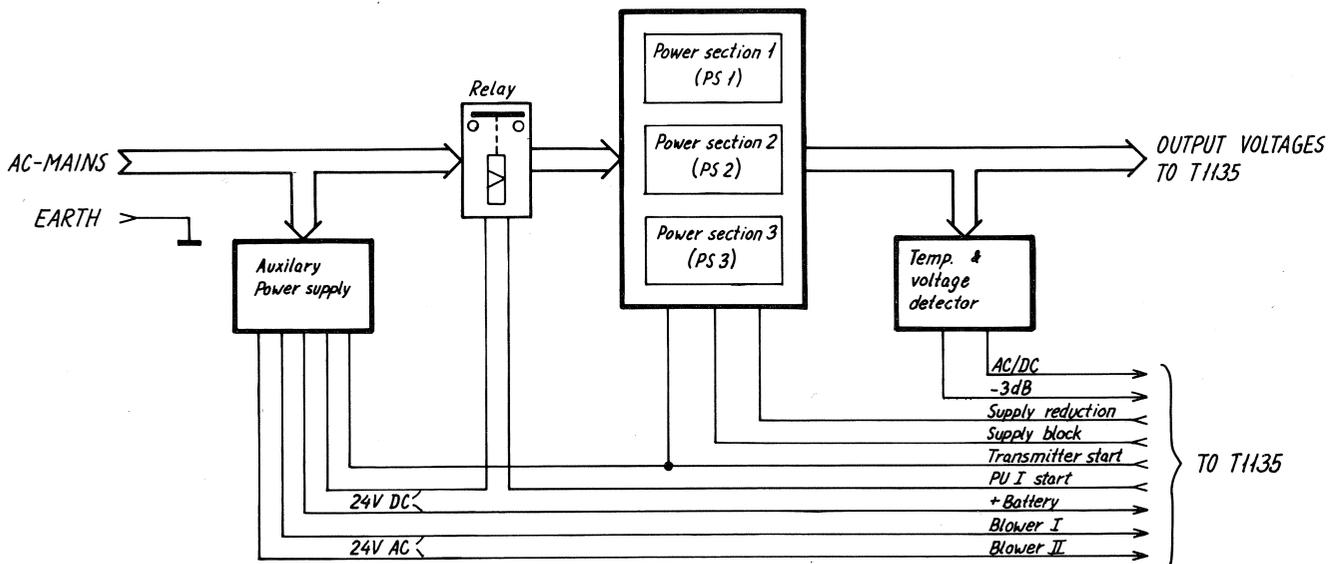
An auxiliary power supply produces internal 24V DC for the switching on/off circuit and a 24V AC for the blowers in the transmitter.

The auxiliary power supply is always switched on when N1410 is connected to AC-mains.

PU I is working when the set is switched on.

PU II is only working when PU I is switched on and the transmitter is keyed.

N1410 is switched on/off by the switches in H1238 rack system.



N1410
Tg. 4-O-25245

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2. INSTALLATION (HINTS)

The power supply has to be installed vertically because it is convection cooled.

To ensure free air flow inside the power supply it is necessary with free space of at least 10 cm at the top and at the bottom of the cover.

In order to facilitate the installation dismantle the power supply sections (see the MECHANICAL DISASSEMBLING). Then install the back plate with the printed circuit board and after that install the power sections on the back plate one by one.

When all the cables are connected, execute the Performance Check (see the section SERVICE).

2. INSTALLATION (hints) cont.

GENERAL DESCRIPTION SAILOR PROGRAMME 1000/B, 1250W

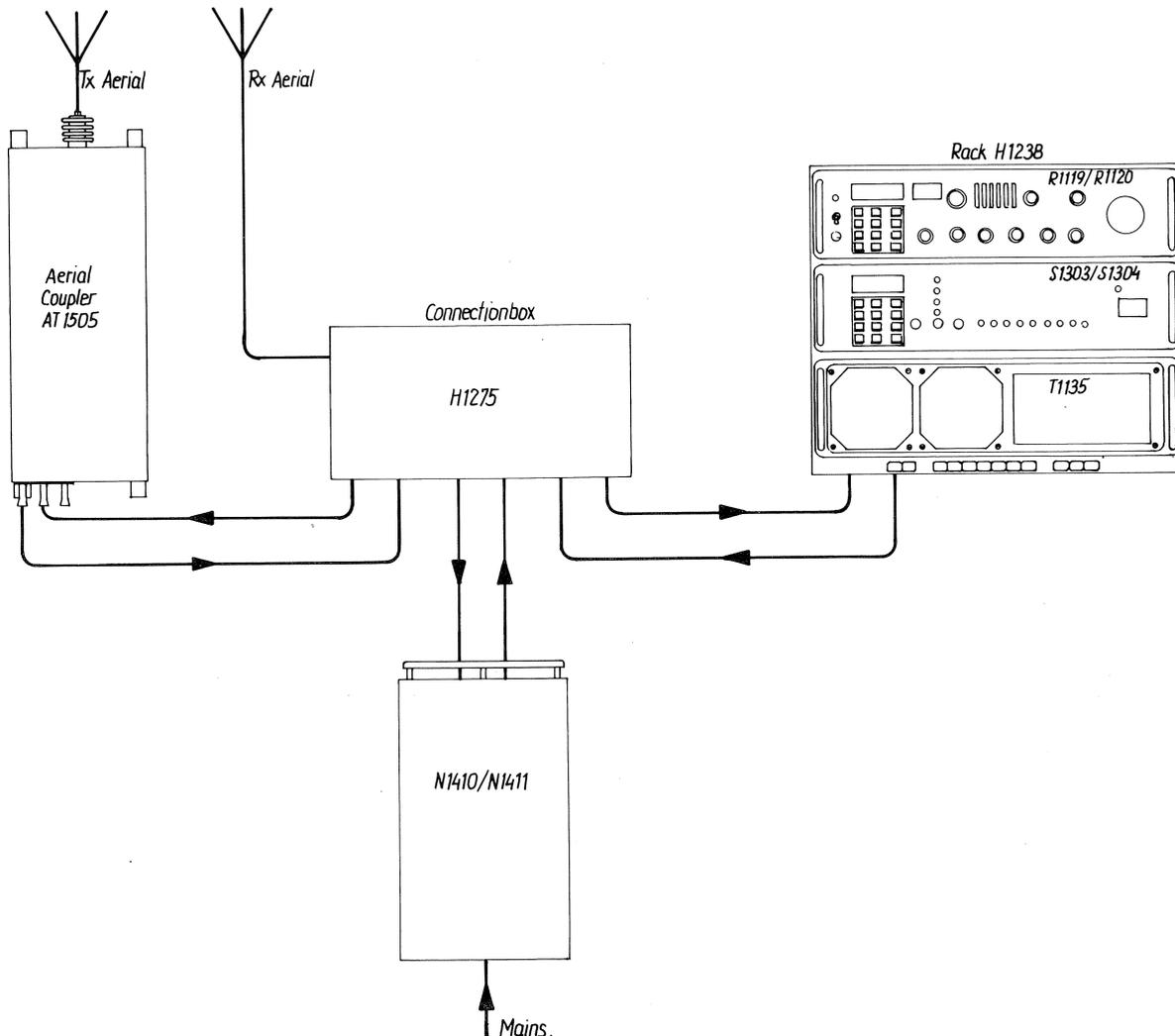
SAILOR Programme 1000/B, 1250W is a flexible short wave communication system. The system consists of the following main units:

three receivers	R1119, R1120, R1121
two exciters	S1303, S1304
one transmitter	T1135
two power supplies	N1410, N1411
one aerial coupler	AT1505
one radiotelex modem	H1240

For technical data, see the manual for the units in question.

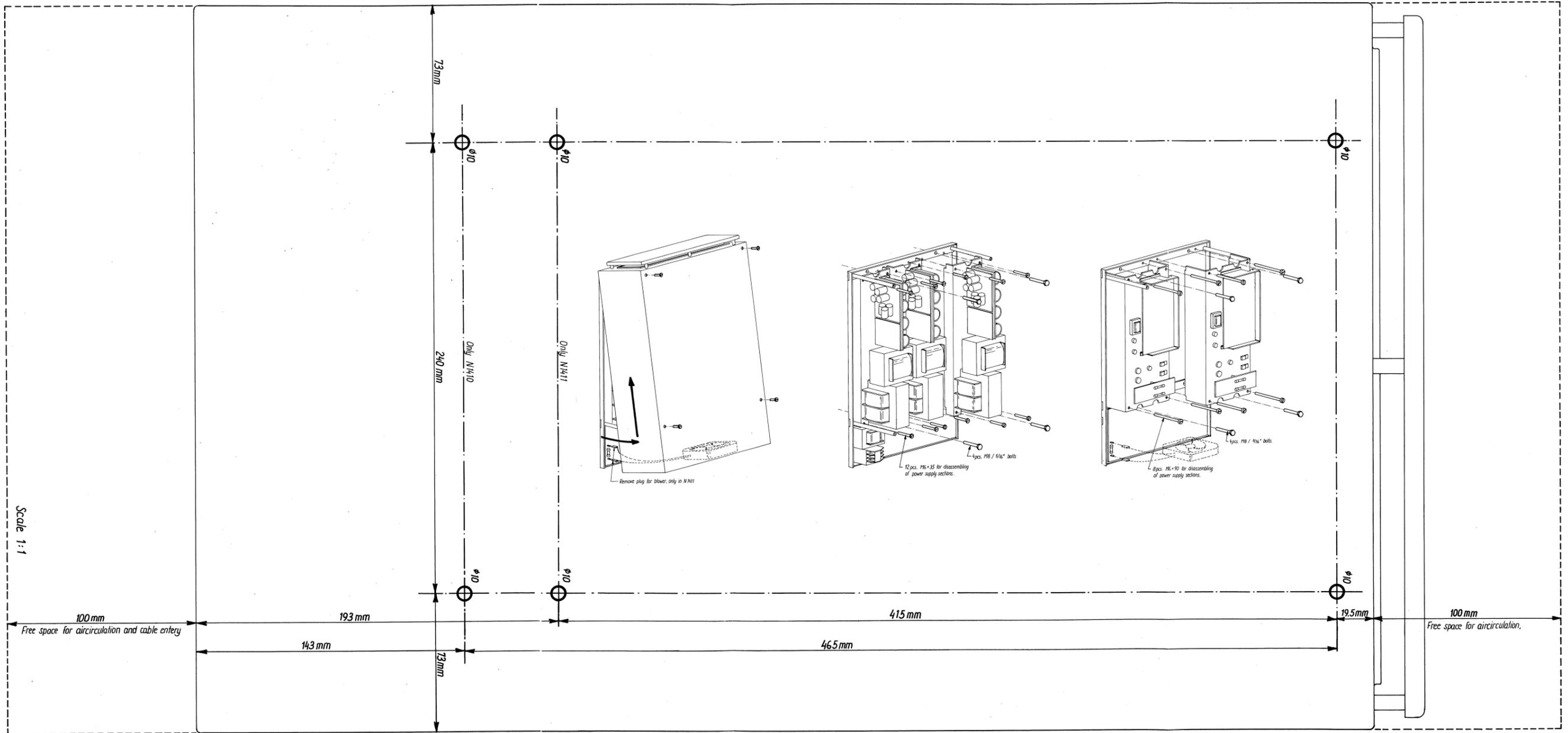
The above units can be combined to fit any demand. The units are placed in SAILOR standard rack system.

The basic system consists of the four units shown below:



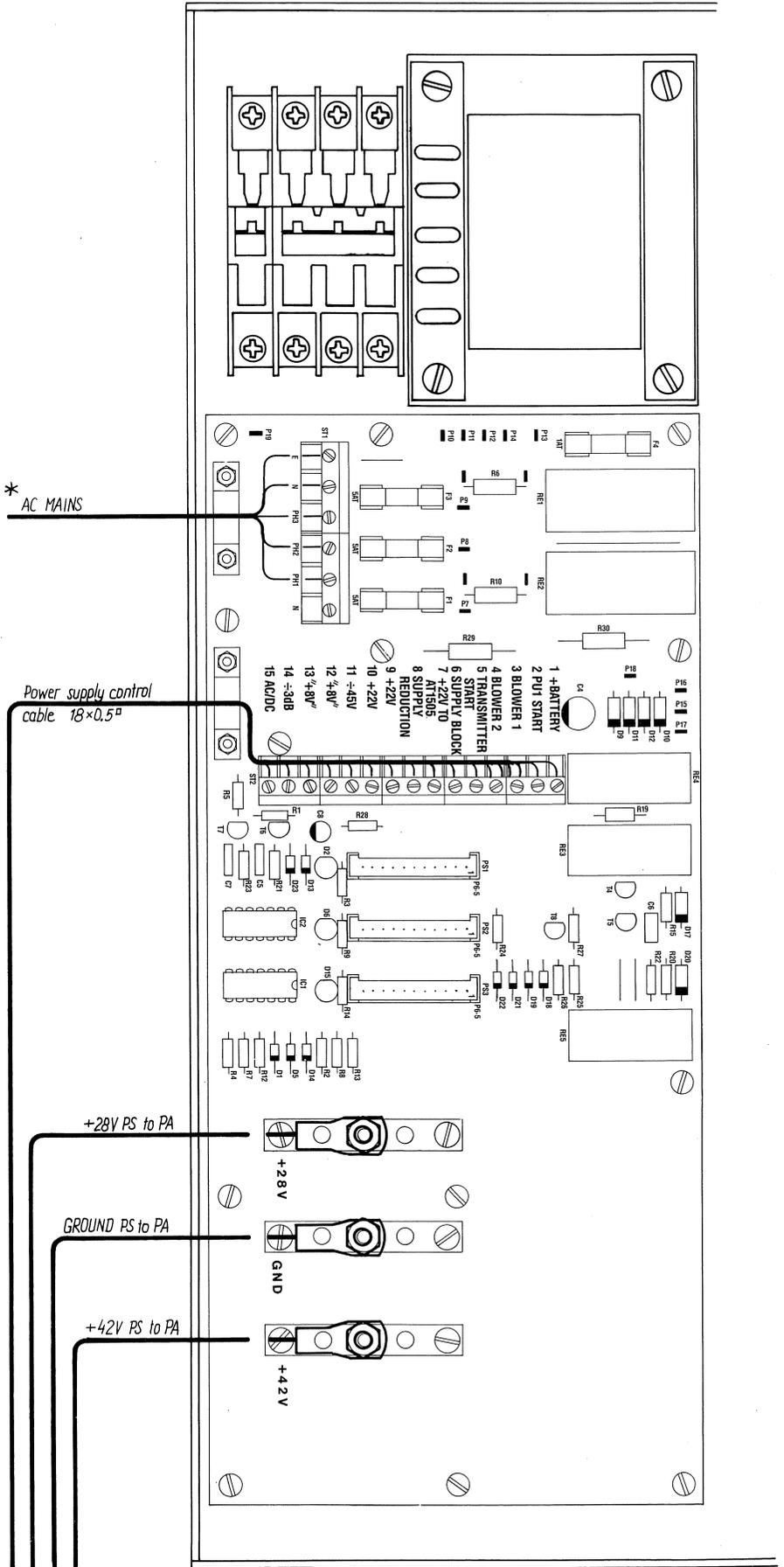
2.1. DIMENSIONS AND DRILLING PLAN

NI410
 Tg. 4-O-25227A



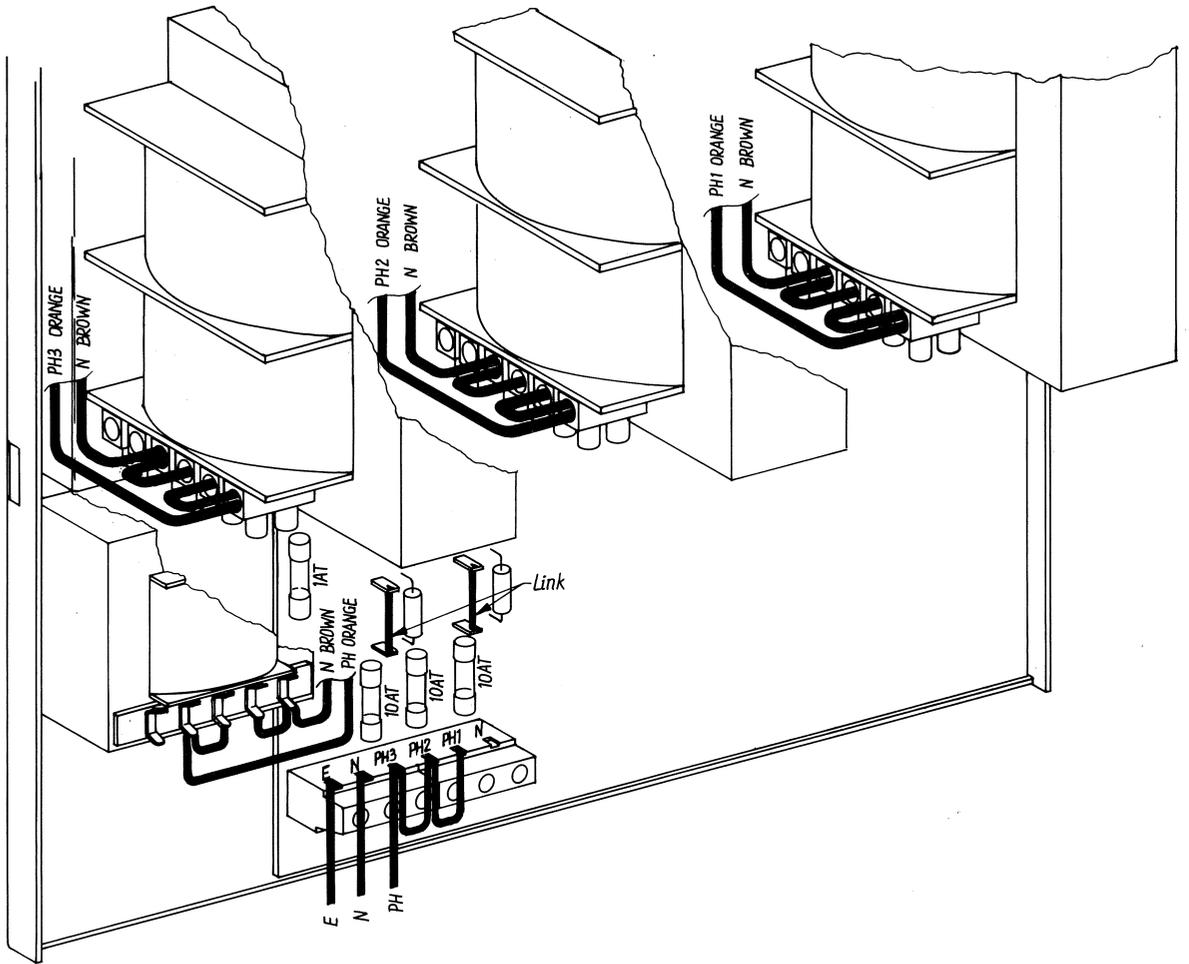
2.2. ELECTRICAL CONNECTIONS

* For information about electrical connections, see section 2, Installation in NI410 instruction book.

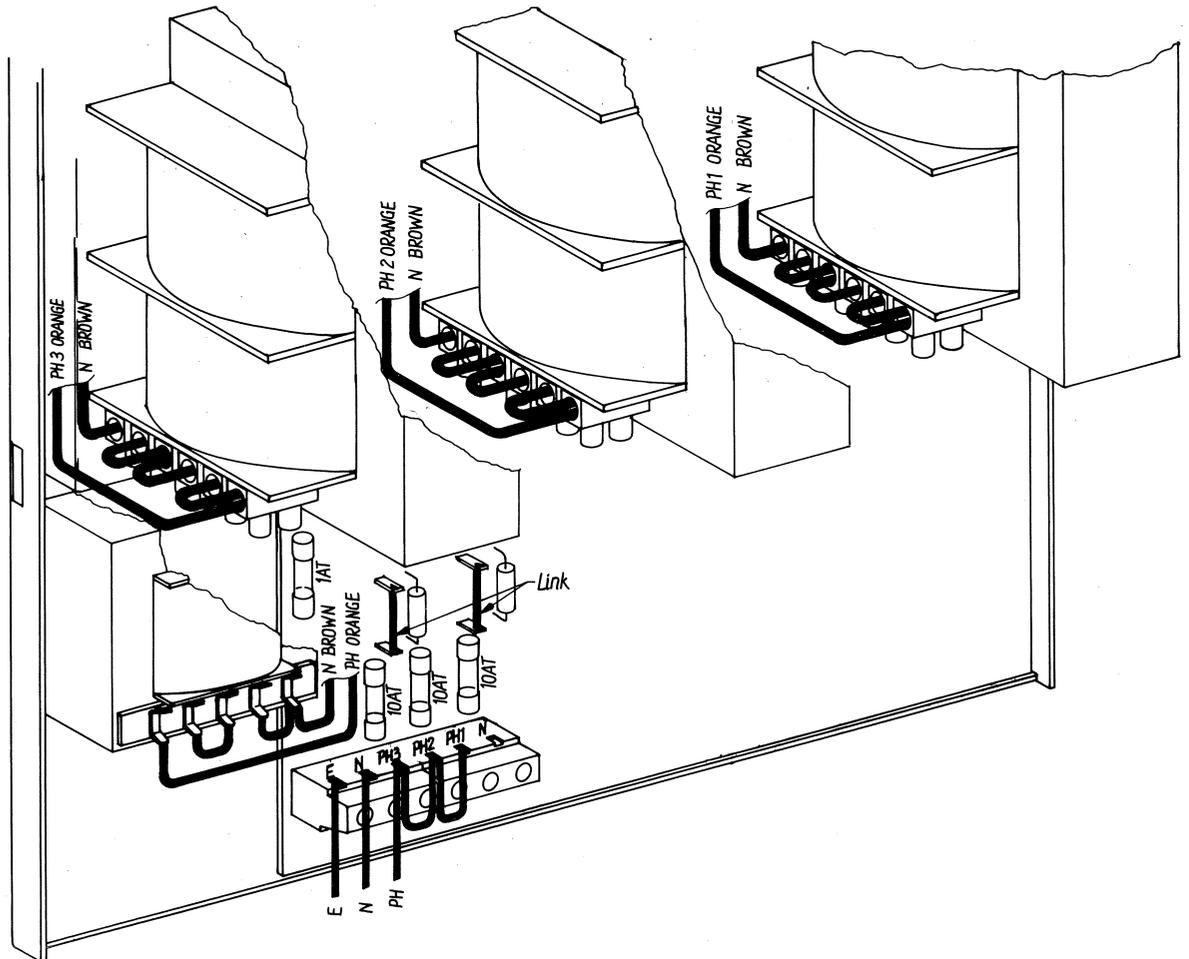


Note: In Blower 1, 2 wires in parallel.
In Blower 2, 2 wires in parallel.

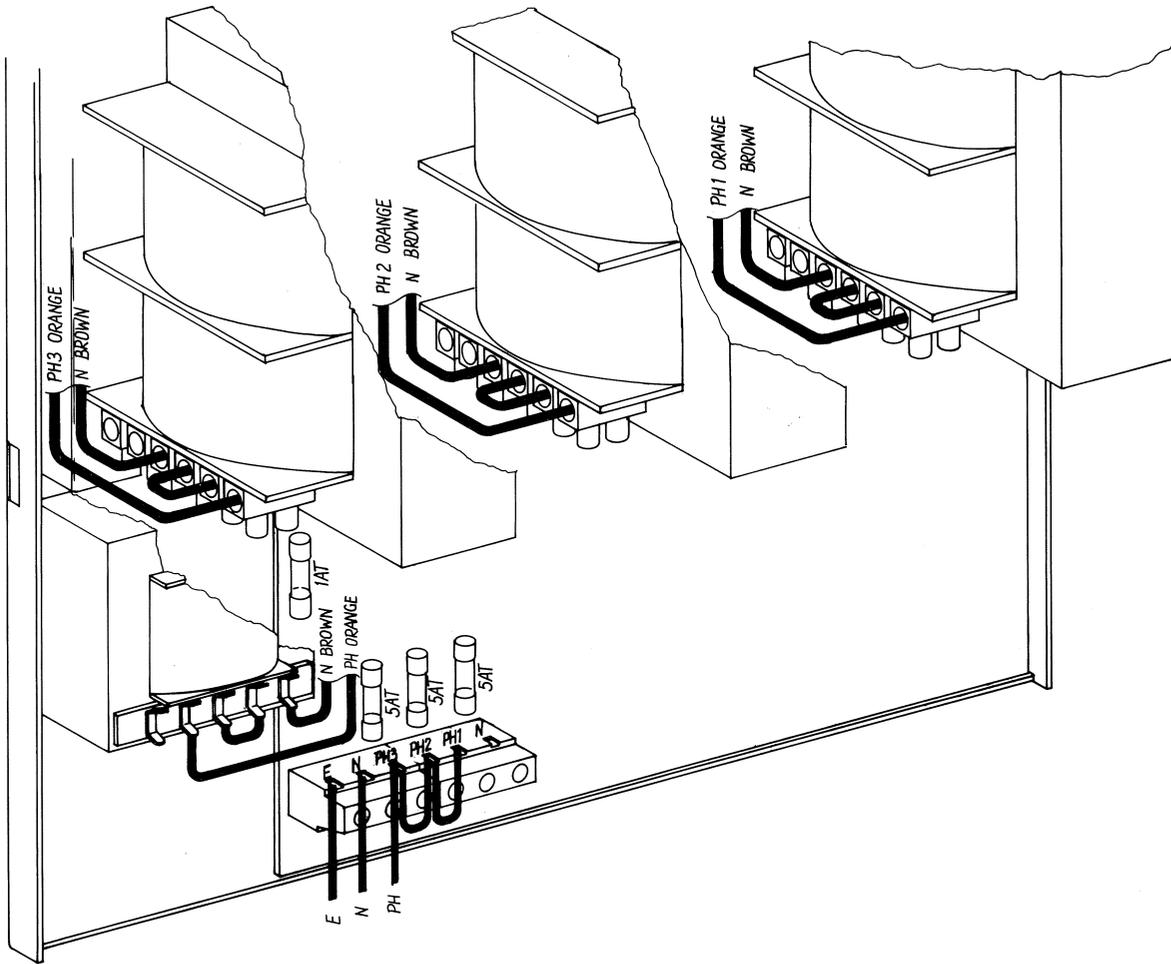
2.2.1. 110V AC SINGLE PHASE



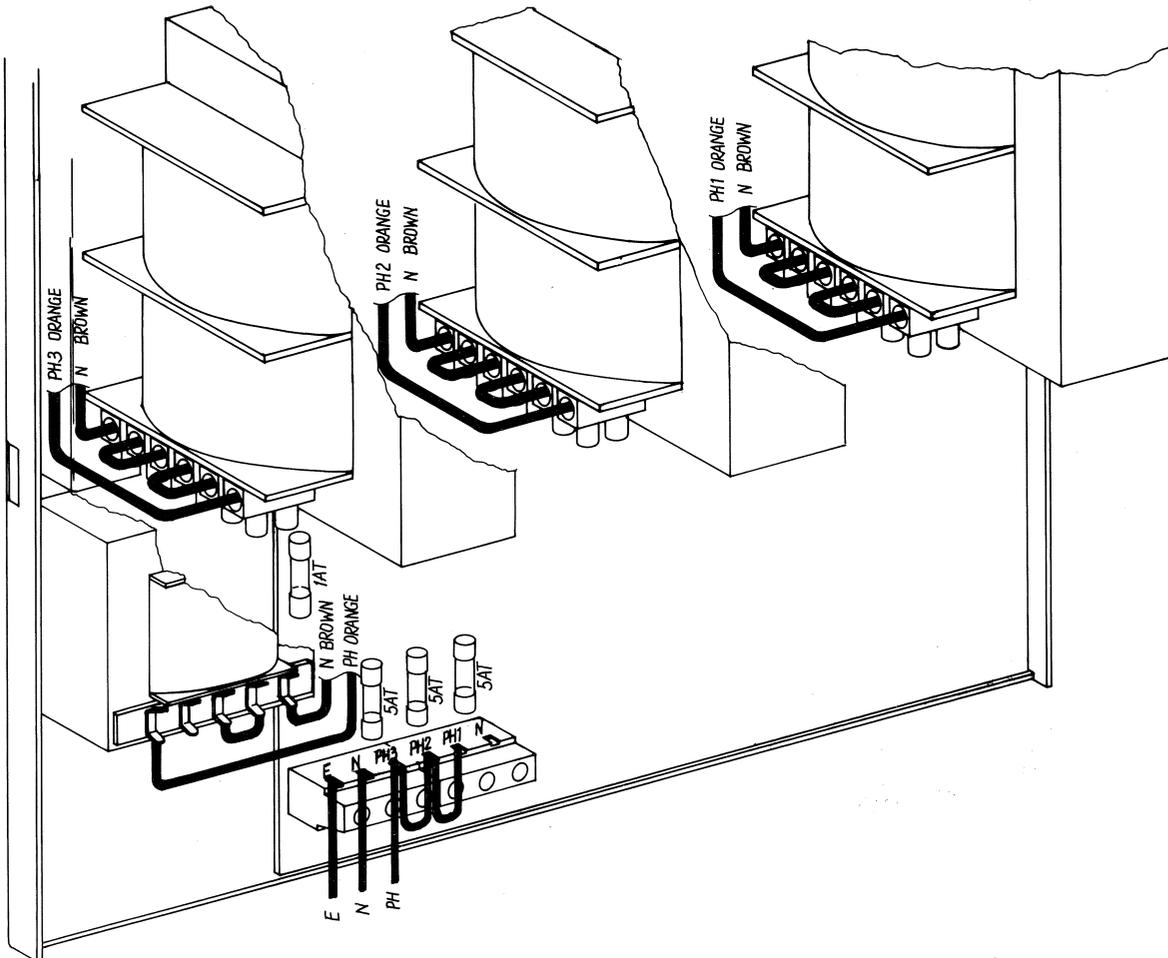
2.2.2. 127V AC SINGLE PHASE



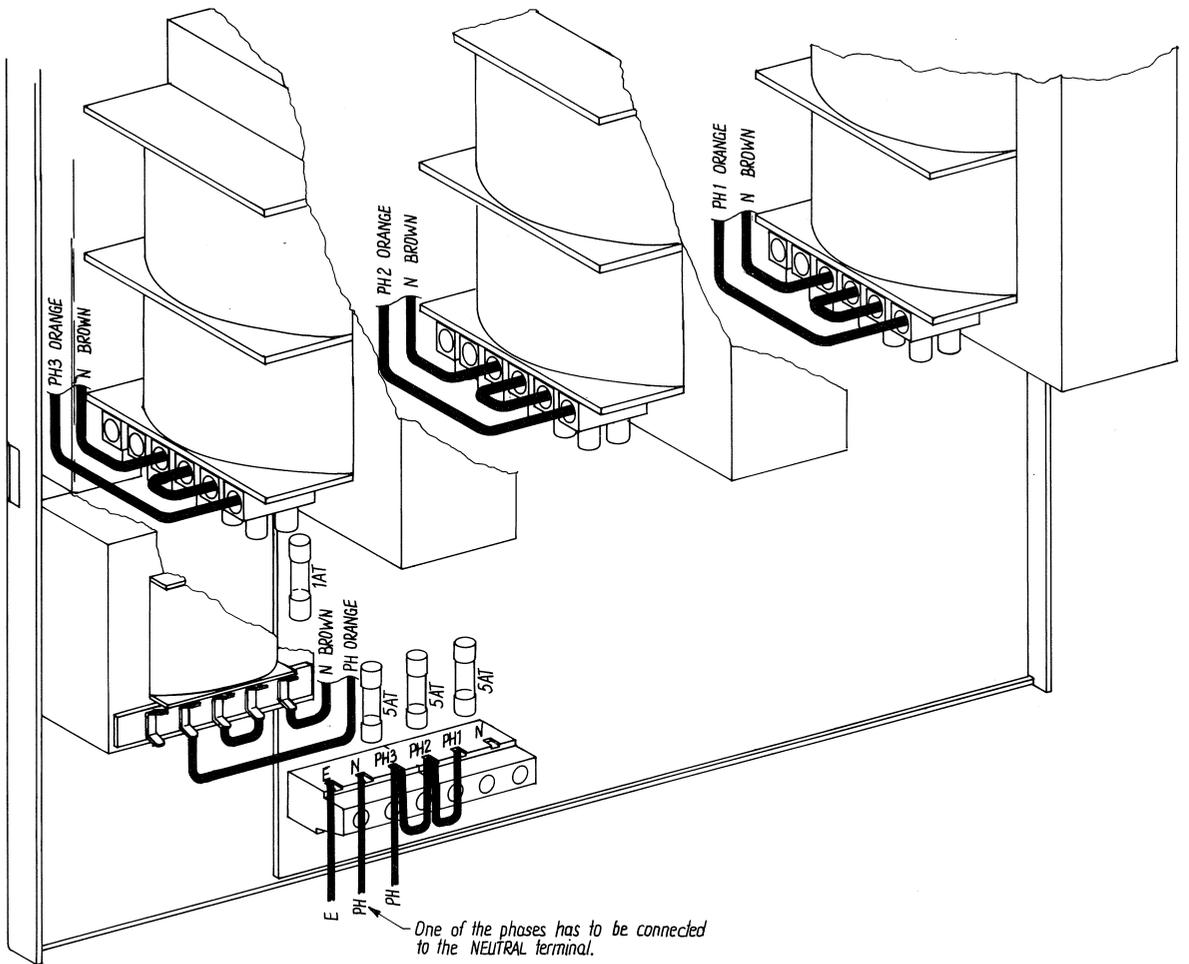
2.2.3. 220V AC SINGLE PHASE



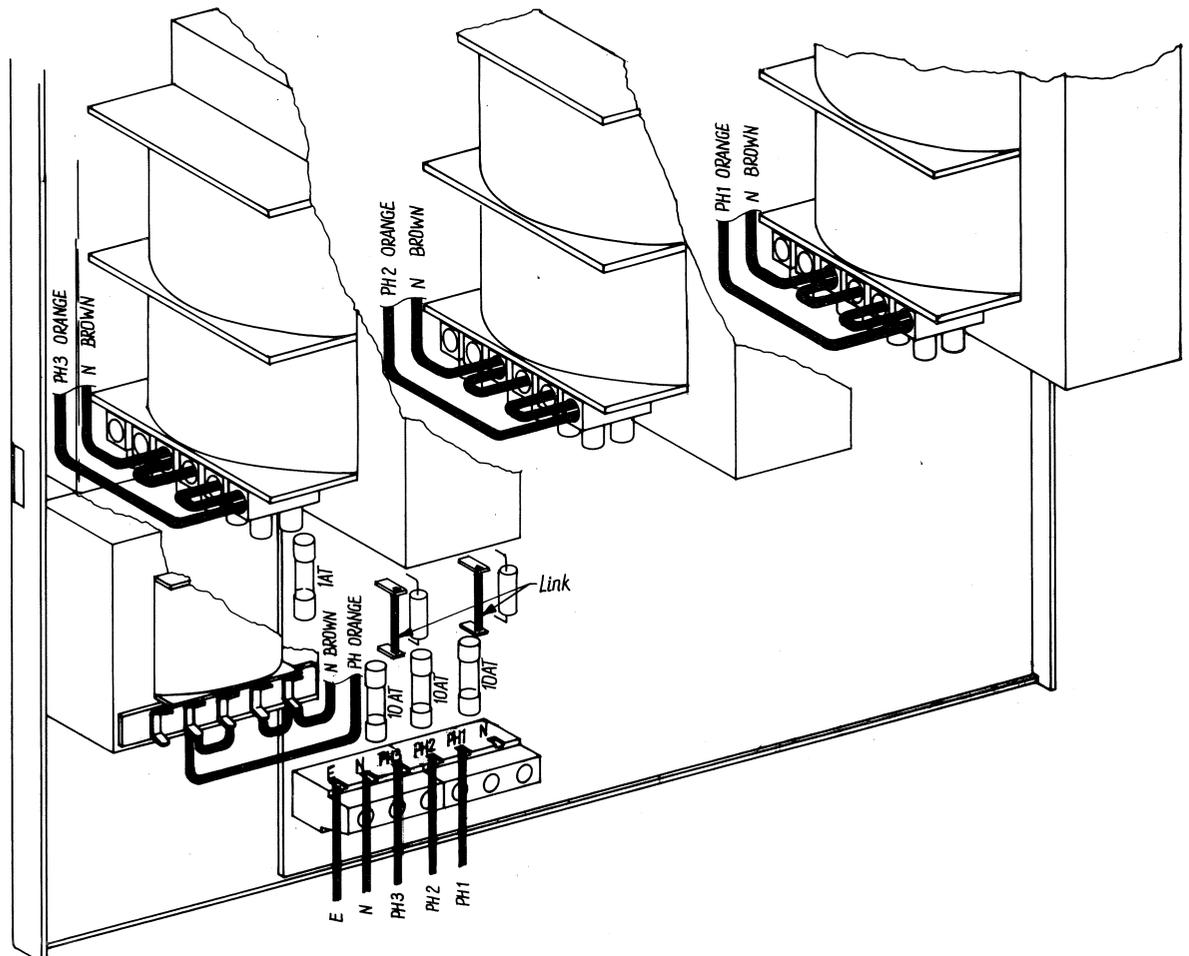
2.2.4. 240V AC SINGLE PHASE



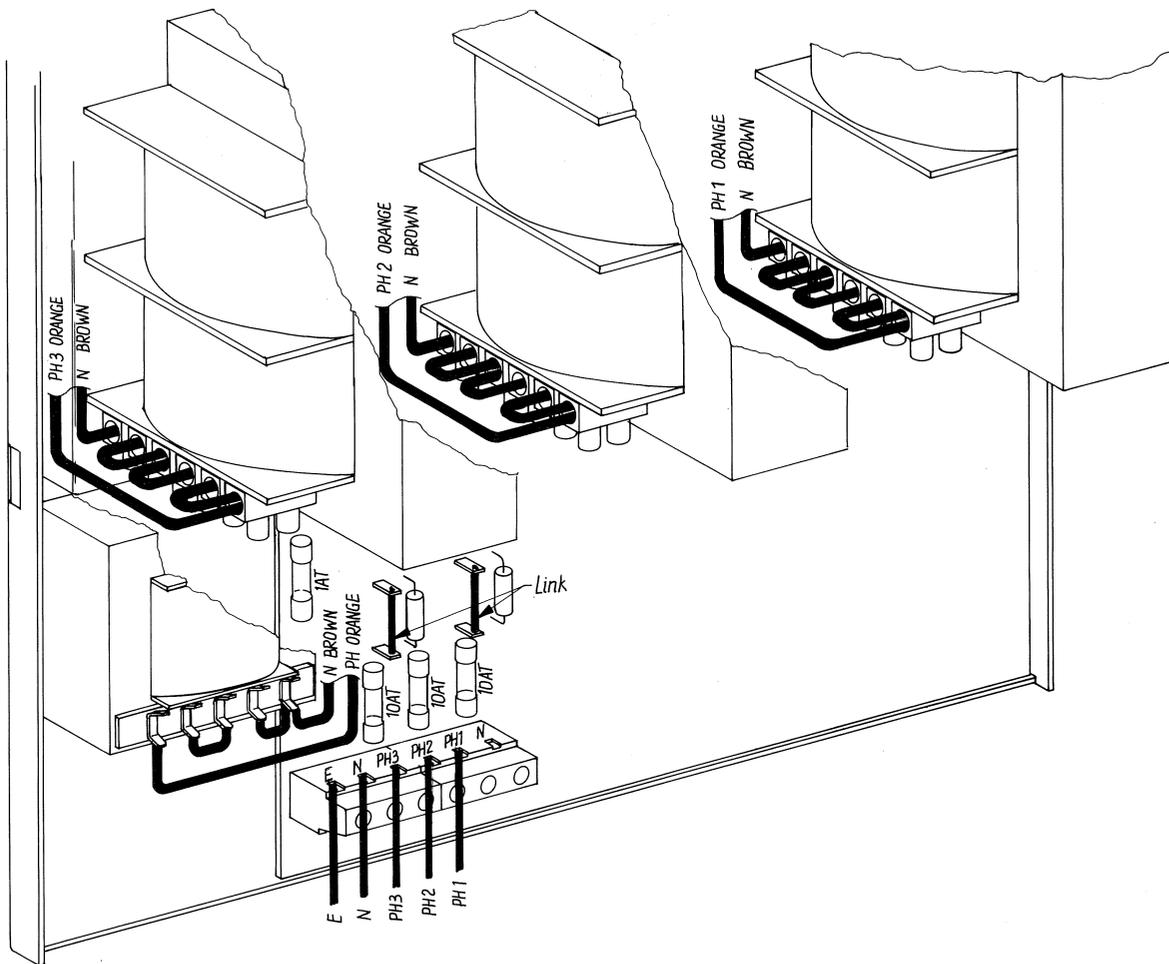
2.2.5. 2x127V AC TWO-PHASE WITHOUT NEUTRAL (220V BETWEEN PHASES)



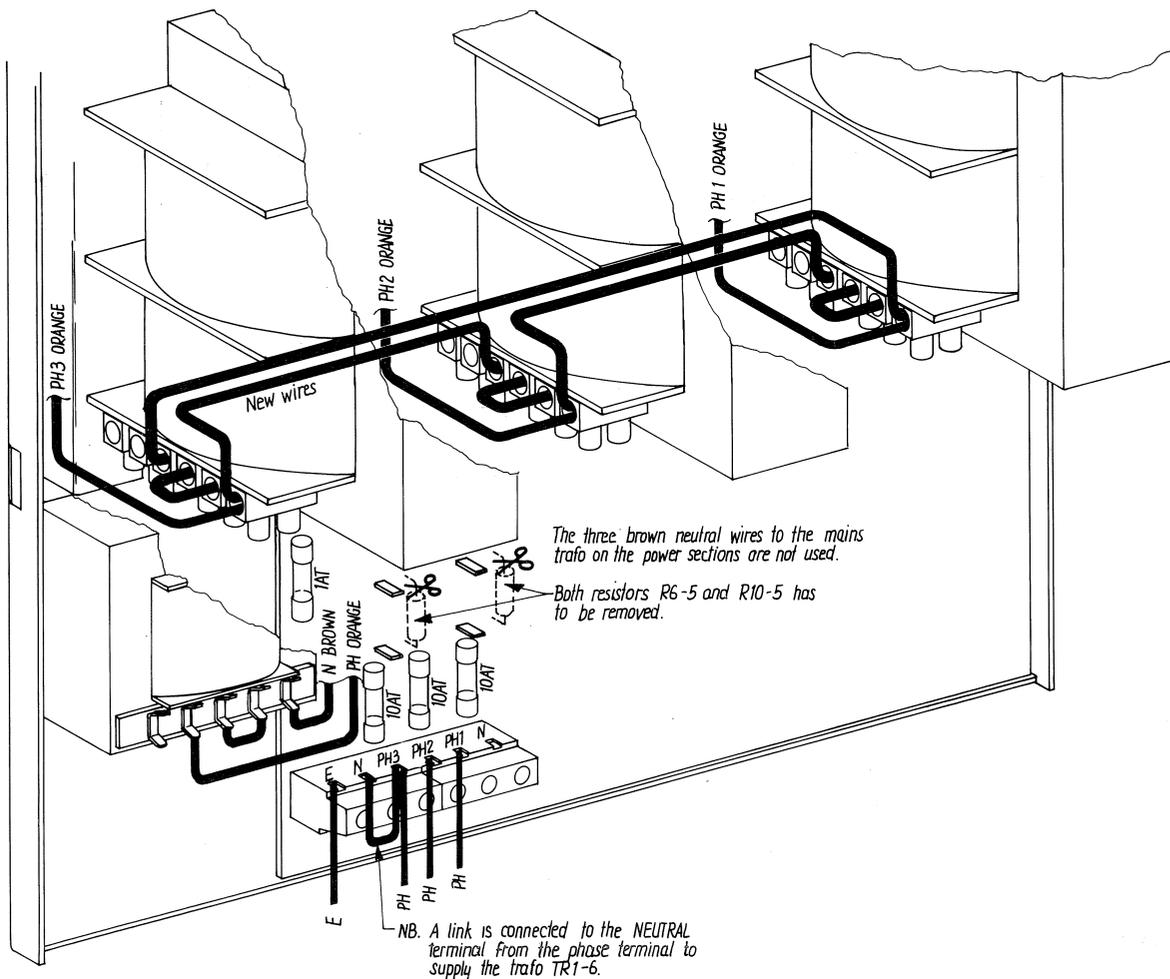
2.2.6. 3x110V AC THREE-PHASE STAR CONNECTED



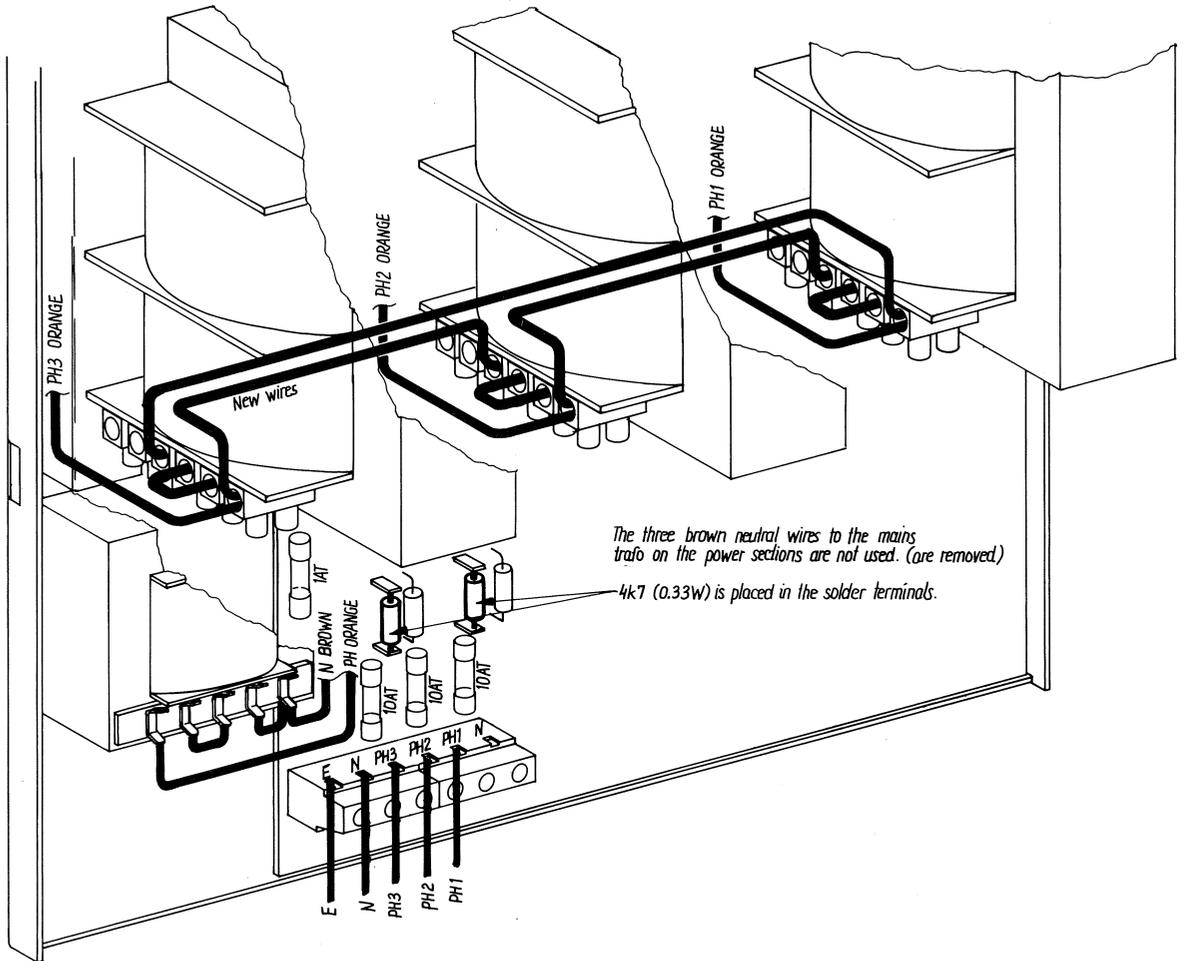
2.2.7. 3x127V AC THREE-PHASE STAR CONNECTED



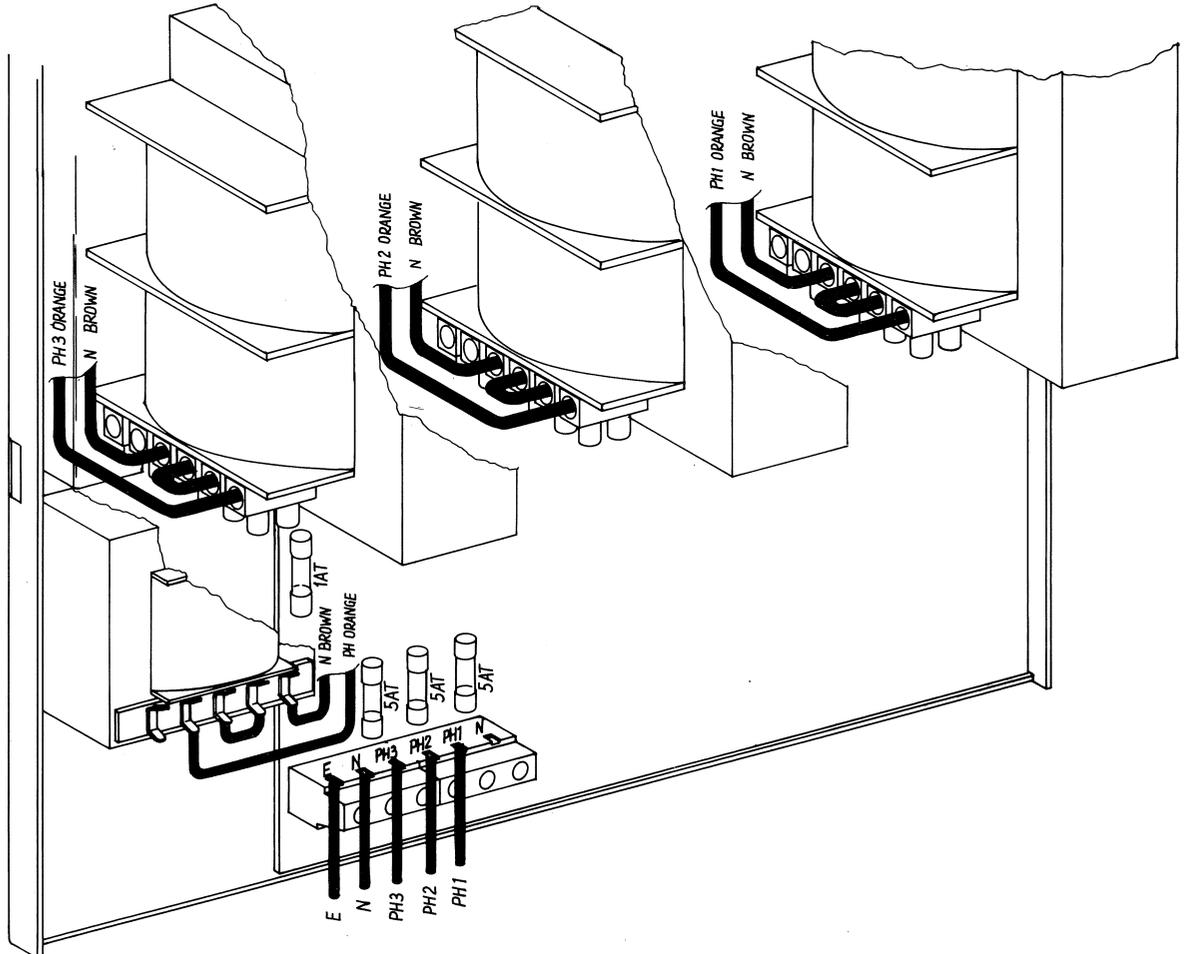
2.2.8. 3x127V AC THREE-PHASE WITHOUT NEUTRAL (220V BETWEEN PHASES)



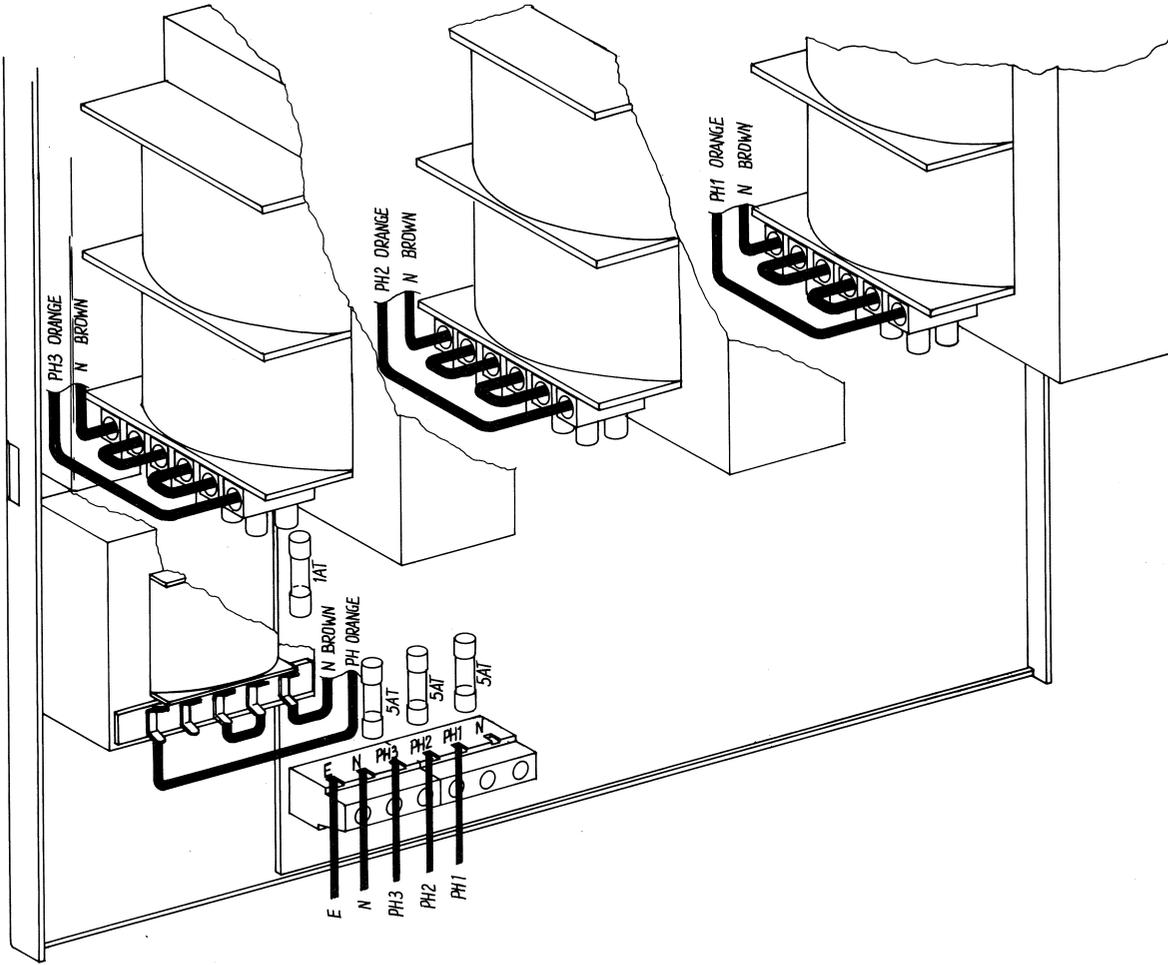
2.2.9. 3x127V AC THREE-PHASE WITH NEUTRAL DELTA CONNECTED



2.2.10. 3x220V AC THREE PHASE STAR-CONNECTED



2.2.11. 3x240V AC THREE-PHASE STAR CONNECTED



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- 3.6. PIN CONFIGURATIONS
- 3.7. ADJUSTMENT LOCATIONS

3. SERVICE

3.1. MAINTENANCE

When the SAILOR short wave set programme 1000/B has been correctly installed, the maintenance of the power supply can, dependent on the environments and working hours, be reduced to a performance check at the service workshop at intervals not exceeding 5 years.

A performance check list is enclosed in the PERFORMANCE CHECK section.

Also inspect cables and plugs for mechanical defects and corrosion.

Any repair of the set should be followed by a check described in the section NECESSARY ADJUSTMENTS AFTER REPAIR.

3.2. RECOMMENDED TEST EQUIPMENT

Multimeter Philips PM2505
Oscilloscope Philips PM3214

Because of main voltage in the power supply we recommend that you use an oscilloscope probe which can withstand at least 1000V DC, e.g. PHILIPS PM8932.

3.3. TROUBLE SHOOTING

1. Transmitter is out of function and no light in display on the exciter S13XX.
 - a. Fuse F4-5 for auxiliary power supply is blown.
 - b. Relay RE4-5 and/or RE1-6 are not activating.
 - c. Bad connection in cables to T1135.
2. Blowers are not running while pressing the handset key.
 - a. No +22V to RE3-5 or no AC voltage from auxiliary supply.
 - b. The TRANSMITTER START wire to TR5-5 does not go low, while pressing the handset key.
 - c. The RE3-5, D17-5, T4-5 or T5-5 is defective.
3. Output power is reduced.
 - a. Check if pin 11, 12 and 13 on IC2-5 are high and collector on T7-5 is low. If one of the inputs of IC2-5 is low, and all the LED's are alight, then one of the thermal breakers "TB1" on one of the sections has been activated. This activates the AC/DC wire to T1135. If this wire is at a high level, the transmitter reduces its output power with approx. 1 dB.
 - b. Check if the inputs of IC1-5 and the collector of T6-5 are high. If two of the inputs on IC1-5 are low, T6-5 pulls down the -3 dB wire to T1135 and the transmitter reduces its output power with 3 dB. If all the three LED's are alight, two of the sections are too hot, and the thermal breakers "TB1" have been activated.
4. Transmitter is out of function.
 - a. Check if the wire TRANSMITTER START can be drawn to a low level from the transmitter when the key is pressed.
 - b. The three 42V are defective or the three transformers are too hot, controlled by thermal breakers "TB2" on each transformer, then there is no 22V either, and the three LED's are not alight.
 - c. If there is light in the exciter S13XX display and the three LED's are alight, check the four fuses placed on the supply distribution unit in the transmitter, or check the 28V in the power supply.
 - d. If both the 28V and the 42V are missing, check if relay RE5-5 is activated when the handset key is pressed. If not, check if there is 22V on the SUPPLY BLOCK wire on the terminal ST2-5.
5. The 42V DC is missing.
 - a. The 22V AC from transformer T1-4 to regulator unit (module 1) is missing.
 - b. The 54V AC from transformer T1-4 is missing.
 - c. The 15V regulator IC3-2 is out of function.
 - d. The control unit (module 2) is out of function (see scope picture on diagram).
 - e. Check that T5-2 is off. The voltage on the emitter has to be about 1.8V.
 - f. The oscillator on module 2 is not working.
 - g. The zero crossing detector IC2a-2 is not working (see picture on diagram).
 - h. The voltage comperator IC1-2 is out of function.
 - i. The current comperator IC2b-2 is out of function.
 - j. Check the thyristors and the diodes on module 3.

3.3. TROUBLE SHOOTING cont.

6. The 28V DC is missing.
 - a. The fuse F4-1 is blown.
 - b. The transistor T4-1 is defective.
 - c. The diode D23-1 is open-circuited.
 - d. Check the connector P5-1 and P4-1 and the wires.
 - e. The voltage on diode D19-1 is 30V DC.
 - f. Transistor T3-1 or T1-1 is short-circuited.
7. The 28V DC is too high.
 - a. Transistor T4-1 is short-circuited.
 - b. Diode D19-1 is open-circuited.
8. The "8V DC" is missing.
 - a. The fuse F1-1 is blown.
 - b. Check the AC voltage from TR1-4.
 - c. Diode D20-1 is open-circuited.
 - d. Check the connector P5-1 and P3-1 and the wires.
9. The -45V DC is missing.
 - a. The fuse F2-1 is blown.
 - b. Check the AC voltage from transformer TR1-4.
 - c. Diode D21-1 is open-circuited.
 - d. Check the connectors P5-1 and P3-1 and the wires.
10. The 22V DC is missing.
 - a. The fuse F3-1 is blown.
 - b. Transistor T3-1 is open-circuited.
 - c. Diode D22-1 is open-circuited.
 - d. Diode D18-1 is short-circuited, there has to be +24V DC.
 - e. Transistor T2-1 is short-circuited.
 - f. Check the connectors P5-1 and P3-1 and the wires.
11. The 22V is too high.
 - a. Transistor T3-1 is short-circuited.
 - b. Diode D18-1 is open-circuited.

3.4. PERFORMANCE CHECK

Be sure that the N1410 is correct strapped for the mains which it is connected to.

Turn on the equipment from T1135, select frequency and tune transmitter.

POWER SECTION 1

PU 1

Remove both 11 pole connectors "J6-5" for PS2 and PS3 from connection board and check "+8V", +22V and -45V on terminal ST2, which is placed on the connection board.

The "+8V" is approx.	+14 V
The +22V is approx.	+22.3V
The -45V is approx.	-41.5V

PU2:

Reduce transmitter output power with button on front panel of the exciter S13XX, then press the key.

Remove the -3 dB wire from ST2 to prevent reduction of the 42V during the measuring.

Then the last four voltages can be measured.

The +28V is approx.	+29.7V.
The +42V is approx.	+45 V.
The AC/DC is approx.	+1.4V.
The -3 dB is approx.	0 V

Check that only LED D2 is alight.

POWER SECTION 2

Reconnect "J6-5" for PS2 and remove "J6-5" for PS1, then check the seven voltages in the same way as for PS1.

Check that only LED D6 is alight.

POWER SECTION 3

Replace "J6-5" for PS3 and remove "J6-5" for PS2. Then check the seven voltages in the same way as for PS1 and PS2.

Check that LED D15 is alight.

CONTROL OF ERROR DETECTOR

AC/DC:

Measure the voltage on ST2 terminal 15 "AC/DC". Then connect "J6-5" for PS2. Check that the voltage decreases from about 1.4V to about 0V.

Replace -3 dB wire to ST2 terminal 14.

-3 dB:

Measure the voltage on ST2 terminal 14 "-3 dB". Then remove connectors "J6-5" for PS1 and PS2, and check that the voltage decreases from about 4.7V to about 0V.

Replace "J6-5" for PS1 and remove "J6-5" for PS3. Check that the voltage decreases the same way as before.

Connect "J6-5" for PS2 and PS3.

Check that D2, D6 and D15 are turned on. This indicates that the +42V is represented on the three PS sections.

Check that the three blowers in T1135 are running.

Release the key and check that the +28V decreases to about 0V.

3.5. NECESSARY ADJUSTMENTS AFTER REPAIR

There are two adjustments in each of the power sections PS1, PS2 and PS3. One current limiter adjustment and one voltage adjustment both concerning the +42V supply.

THE VOLTAGE ADJUSTMENT is adjusted under the following conditions (one power section).

Mains Voltage: 220V AC $\pm 4\%$

Load: 6A DC $\pm 10\%$

The voltage is then adjusted to 42.5V DC $\pm 1V - 0.5V$ by means of R13-2 (module 2).

THE CURRENT LIMITER is adjusted under the following conditions (one power section).

Mains Voltage: 220V AC $\pm 10\%$

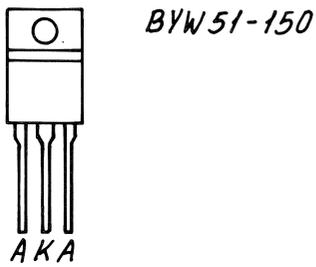
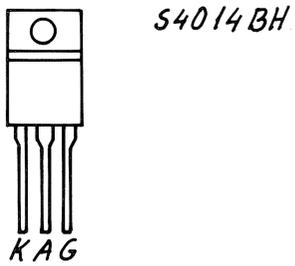
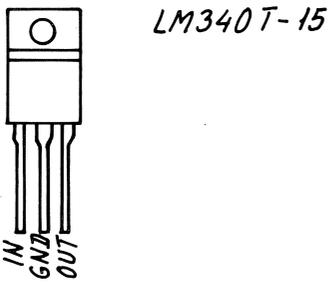
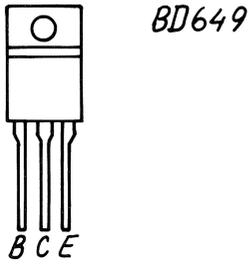
Load: 12A DC $\pm 0.1A$

The output voltage is then adjusted to 35.0V DC $\pm 1V$ by means of R44-2 (module 2).

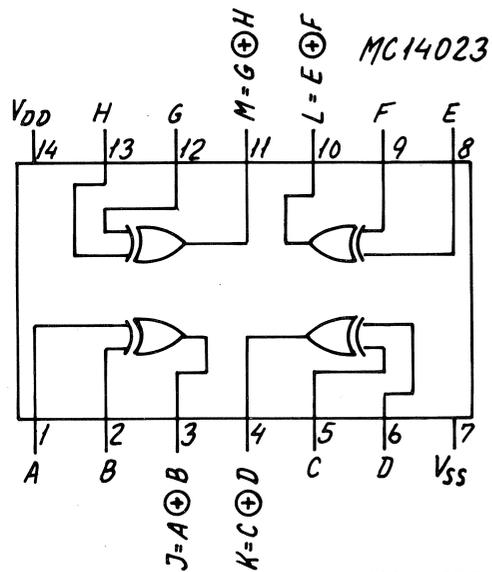
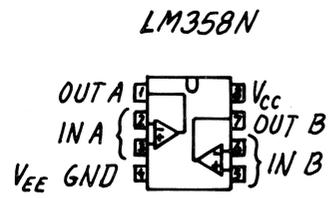
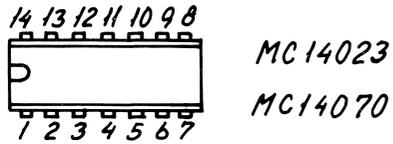
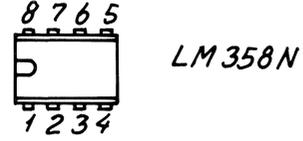
To ensure that all three power sections are working in parallel and sharing the output current, it is necessary that all power sections are adjusted to the same output voltage.

3.6. PIN CONFIGURATION

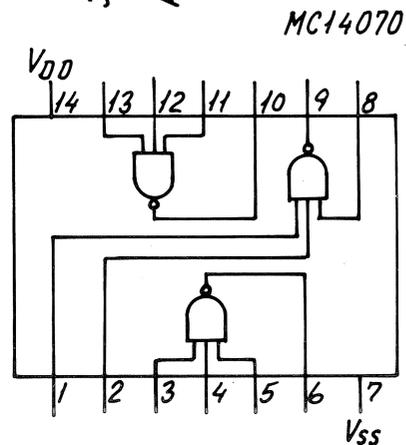
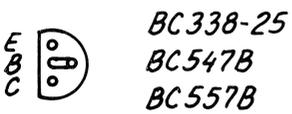
FRONT VIEW



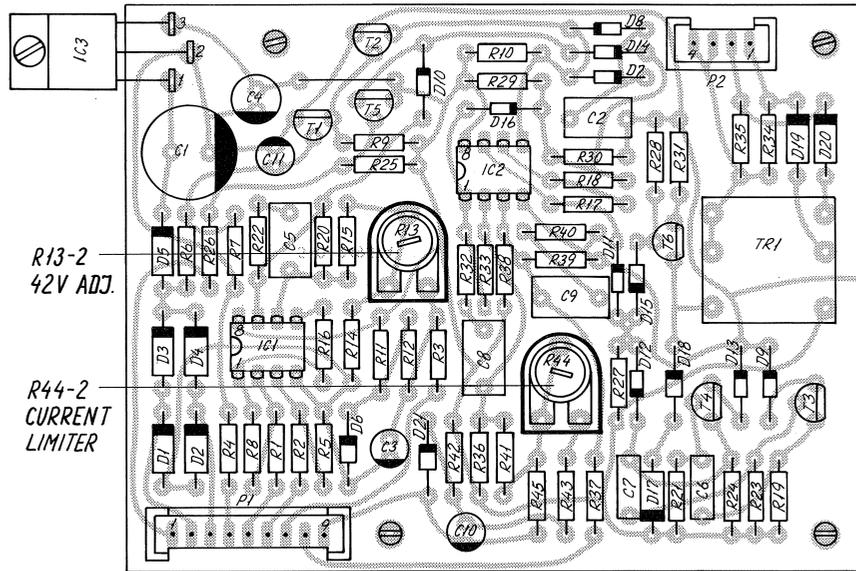
TOP VIEW



BOTTOM VIEW



3.7. ADJUSTMENT LOCATIONS



CONTROL UNIT (MODULE 2)

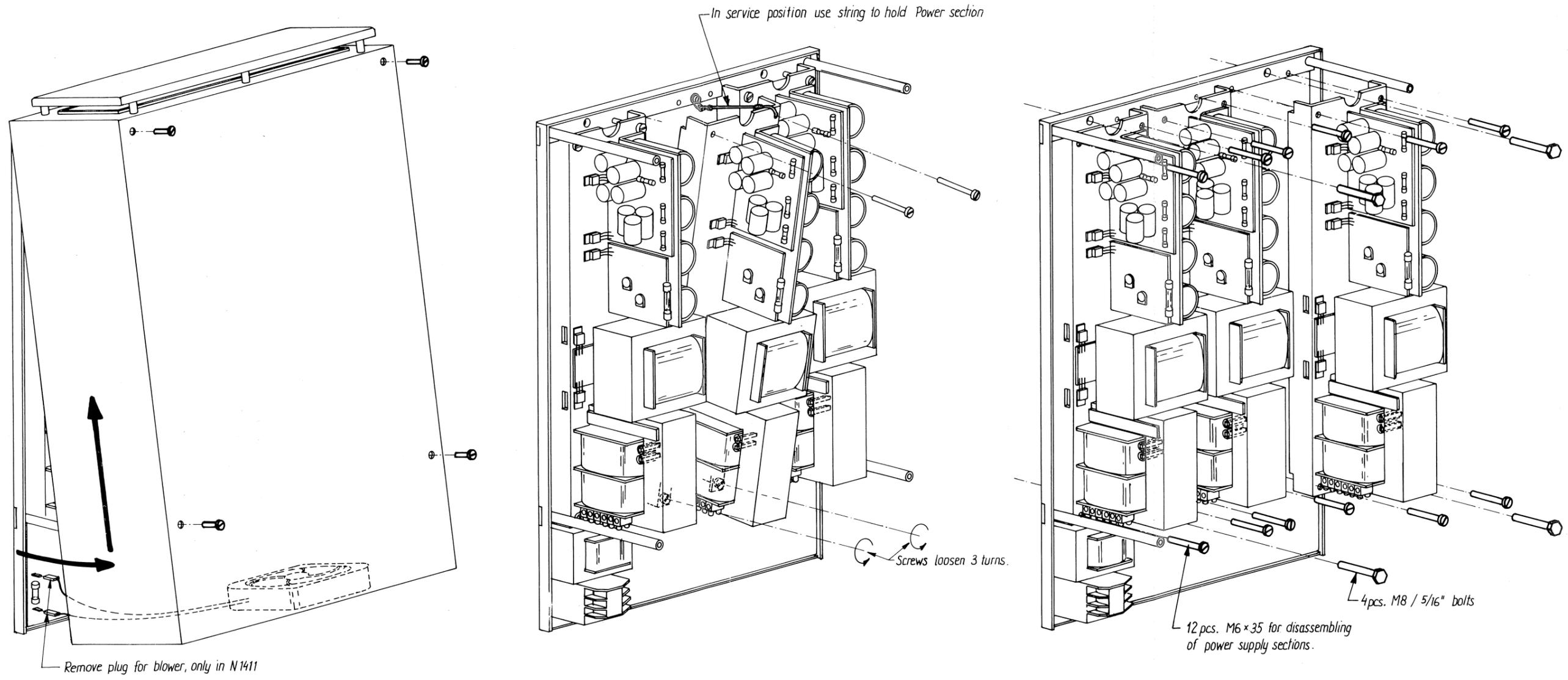
NI410
 Tg. 4-6-24957, Tg. 4-8-24957

CONTENTS

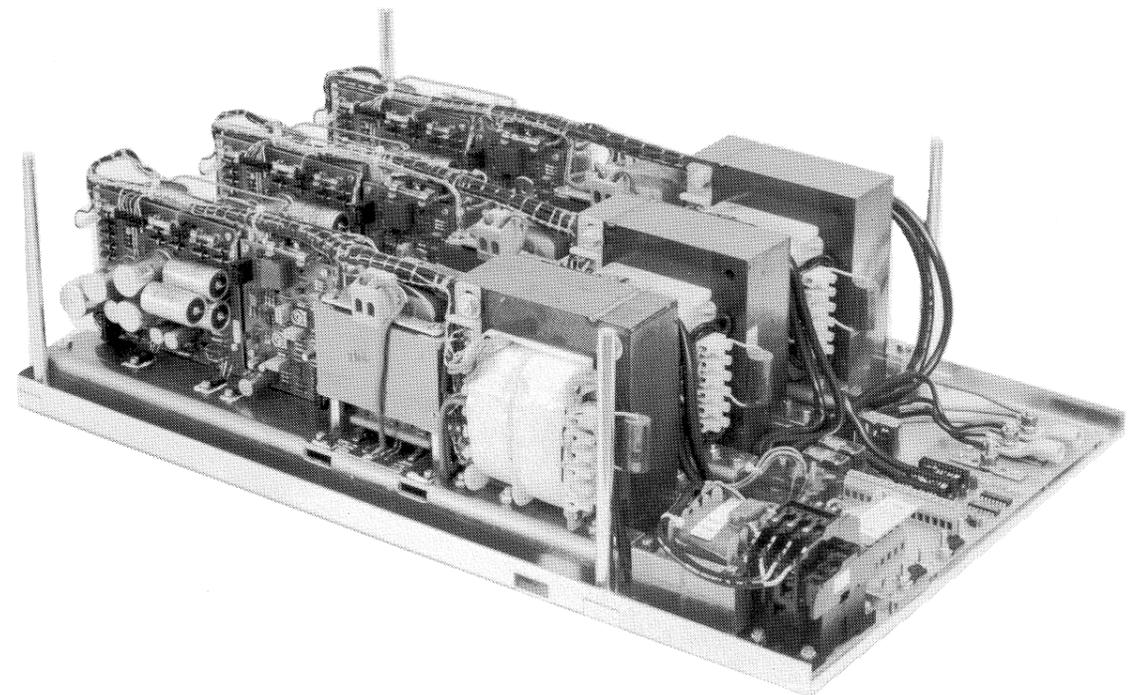
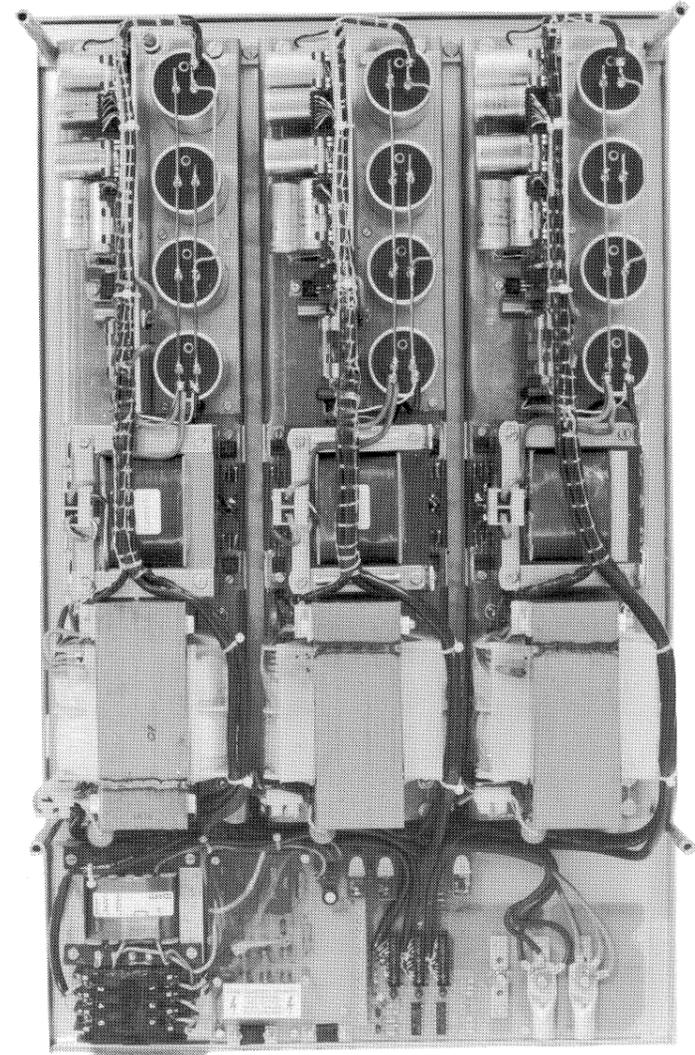
4. MECHANICAL DISASSEMBLING

4. MECHANICAL DISASSEMBLING

N1410
Pg. 4-O-25230, Pg. 4-O-25231
Pg. 4-O-25232



4. MECHANICAL DISASSEMBLING cont.



CONTENTS

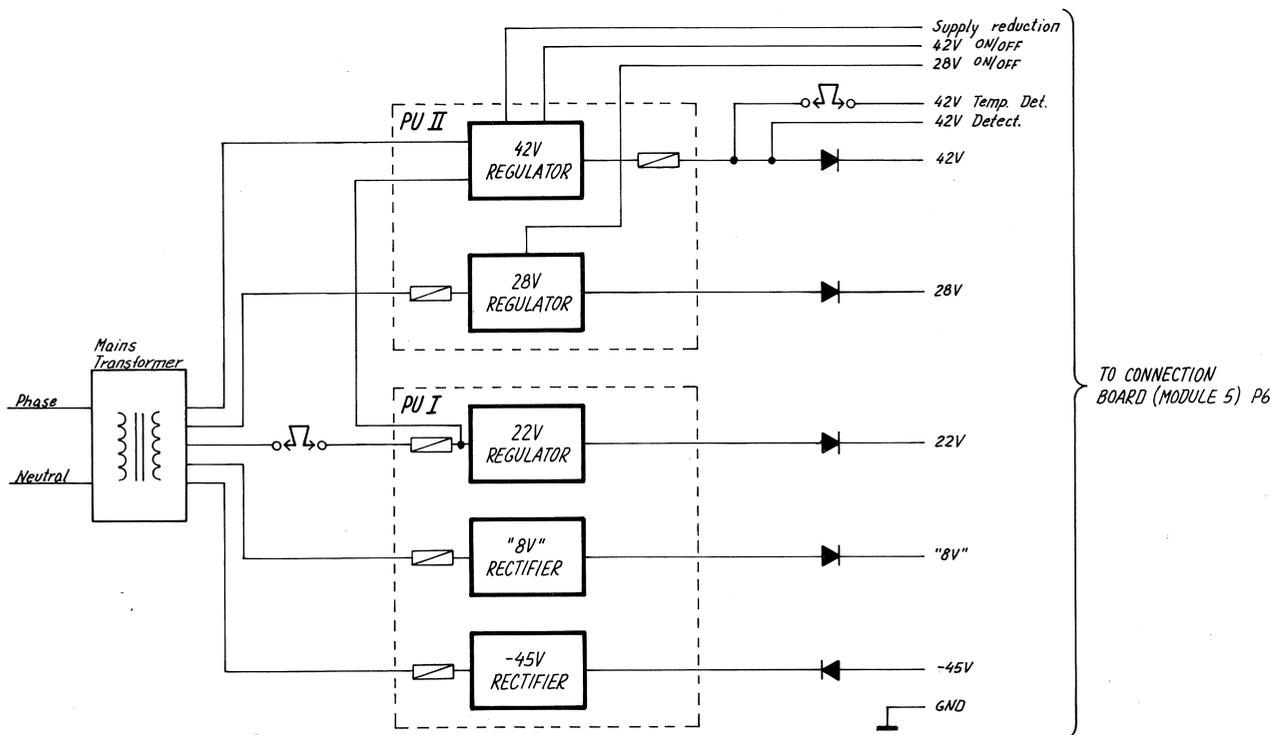
- 5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS
 - 5.1. REGULATOR UNIT N1410 (MODULE 1)
 - 5.2. CONTROL UNIT N1410 (MODULE 2)
 - 5.3. THYRISTOR UNIT N1410 (MODULE 3)
 - 5.4. POWER SECTION (MODULE 4) AND MAIN SCHEMATIC
DIAGRAM FOR ONE POWER SECTION
 - 5.5. CONNECTION BOARD (MODULE 5) AND MAIN SCHEMATIC
DIAGRAM FOR N1410

5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS.

POWER SECTION PS1, PS2, AND PS3 ARE THREE IDENTICAL POWER SUPPLY SECTIONS CONNECTED IN PARALLEL, THEREFORE ONLY ONE OF THEM IS DESCRIBED (MODULE 1, 2, 3, AND 4 IN N1410).

POWER SECTION 1 (PS1)

In one power section there are 3 printed circuit boards. The regulator unit (module 1), the control unit (module 2), and the thyristor unit (module 3).



5.1. REGULATOR UNIT N1410 (MODULE 1)

On the regulator circuit board there are 4 independent power supplies. The power to the regulator unit comes from the mains transformer TR1-4.

"8V" Output

The 12V AC is rectified by D1-1 to D4-1 and filtered by C1-1 and C5-1. D20-1 is an OR-ing diode. When the three power sections (PS1, PS2, and PS3) are connected in parallel, the OR-ing diodes protect against a short-circuit in one of the sections. If OR-ing was not used, a fail in one supply might result in a total failure.

-45V Output

The 32V AC is rectified in D5-1 to D8-1 and filtered by C2-1 and results in the -45V voltage. D21-1 is an OR-ing diode (see explanation of D20-1).

22V Reg.

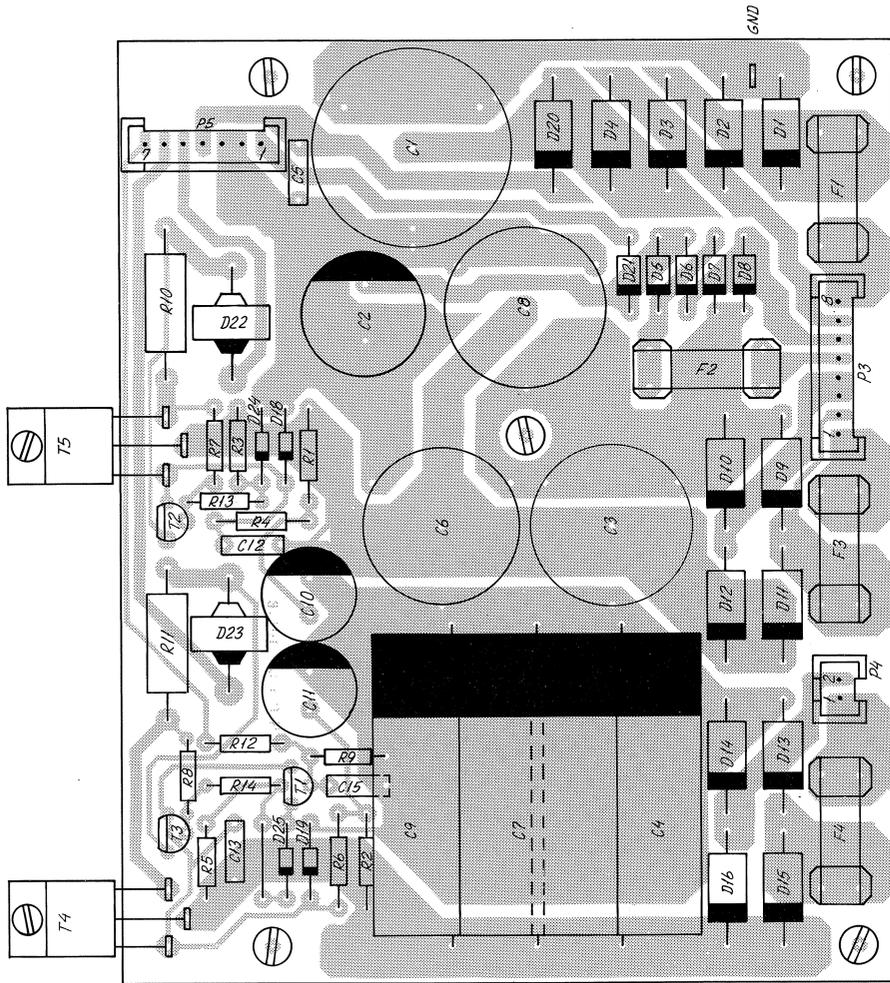
The 23V AC is connected to a thermal breaker TB2, which is placed on the mains transformer T1-4. If the temperature of the mains transformer exceeds about 120°C, the thermal breaker TB2 will switch off. This is done to prevent that the mains transformer gets too hot. It will cause that the 22V disappears.

The 23V AC is rectified by D9-1 to D12-1 and filtered by C3-1, C6-1, and C8-1. The voltage is filtered one more time by R1-1 and C10-1. The voltage on C10-1 is virtually ripple-free and the base voltage on the Darlington series transistor T5-1 too. The emitter potential is therefore nearly without ripple. The output voltage is thus stabilized to the mean input voltage. If this value is higher than the zener voltage of D18-1 minus the base-emitter voltage of the series transistor, the zener diode will limit the output voltage. D24, R3-1, R7-1, R10-1, R13 and T2-1 work as current limiters. The limiting level depends on the input-output differential and the voltage across R10-1. If the input-output differential is high, the limiter starts on a low current level, and if it is low the current limit level will be high. This is done to protect the series transistor against stressing in case of overloading and/or short-circuiting. C12-1 is an AC feed-back. R4-1 protects T2-1 against excessive current from C10-1 in case of a short-circuit of the output. D22-1 is an OR-ing diode (see explanation of D20-1).

28V Reg.

The 28V AC is rectified, filtered and stabilized the same way as the 23V AC but it has a shut-down facility. When pin 7 on P5-2 is connected to a voltage above 8V, T1-1 conducts and all the base current to the series transistor T4-1 is removed, and the output voltages go to zero. When pin 7 is floating T1-1 is off.

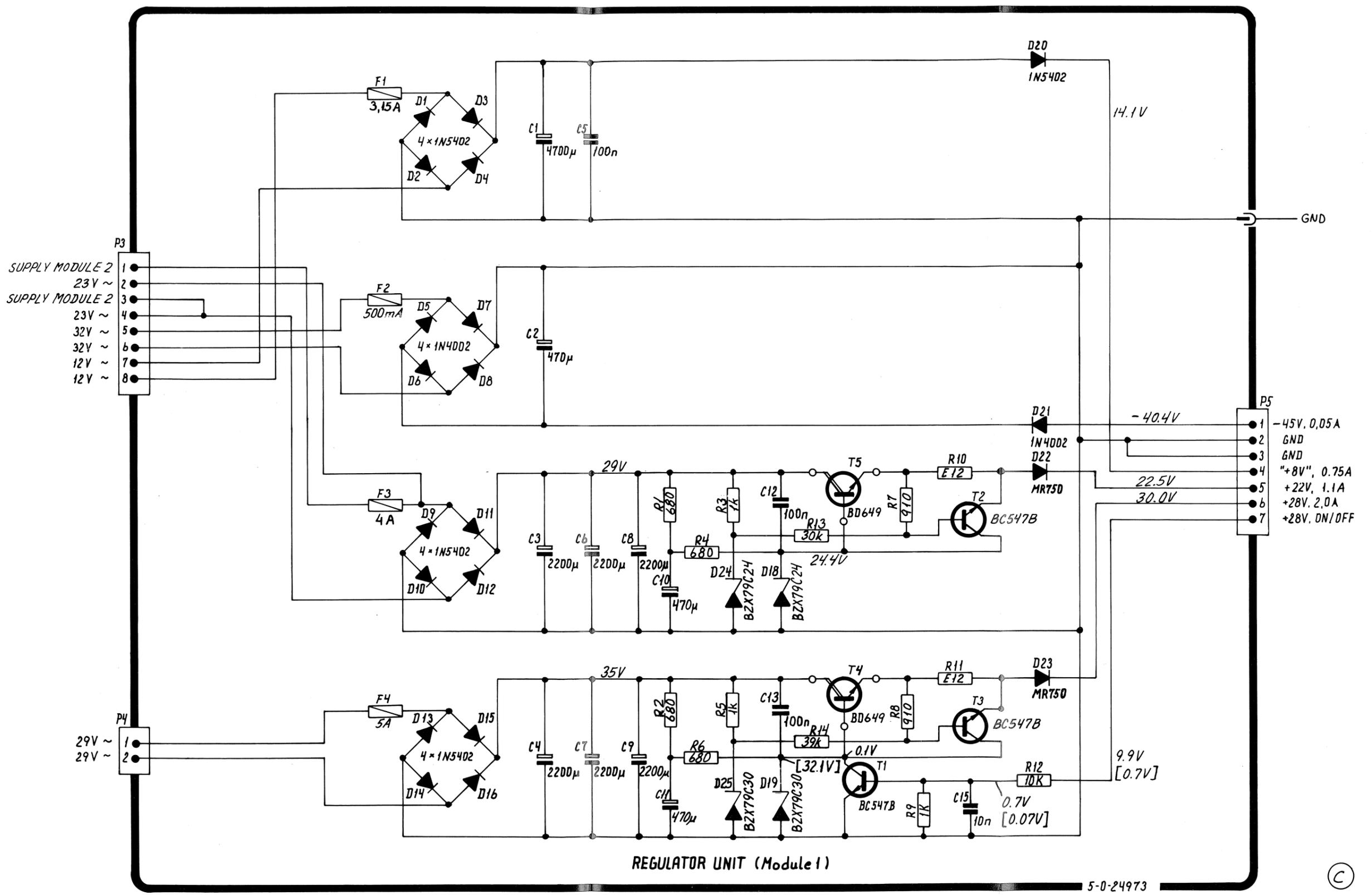
5.1. REGULATOR UNIT N1410 (MODULE 1) cont.



View from component side with lower side tracks.

N1410
 Fig. 4-6-24973B

N1410
4-0-24973C



Test conditions:

Voltage without brackets meter input impedance 10 Mohm.

Voltage in brackets [] circuit is activated.

REGULATOR UNIT (MODULE 1)

(C)

5.2. CONTROL UNIT N1410 (MODULE 2)

The control unit produces the necessary pulses to the thyristors. These thyristors are the stabilizing element for the 42V supply. The 23V AC from the mains transformer TR1-4 is led via the thermal breaker TB2 through F3-1 to the control unit. If the thermal breaker TB2 is switched off or the fuse F3-1 is blown, the 42V supply will disappear.

23V AC from the mains transformer TR1-4 is rectified by D1-2 to D4-2. This full wave rectified sine wave is then peak rectified by D5-2 and C1-2 and led to IC3-2. This is a fixed 15V voltage regulator, which delivers all the supply current to the other components on the board.

ZERO CROSSING DETECTOR

The full wave rectified sine wave is in addition led to the base of T1-2 through R6-4. T1-2 is conducting most of the time, but is off for a short period around the zero crossing of the sine wave. In this short period T2-2 is conducting and discharges C2-2 through D8-2. C2-2 is discharged down to approx. 0.7V, which is the forward voltage of D8-2. The voltage on pin 5 on IC2a-2 is then nearly zero. When T2-2 stops conducting, this voltage rises instantly to two forward voltages, D7-2 and D8-2. C2-2 starts to be charged by R10-2 and D7-2. The voltage at pin 5 now rises with a nearly constant slope. T2-2 starts discharging C2-2 again, etc. This takes place two times every period of the mains frequency. This ramp voltage is compared with the control voltage at the common point of R18-2, R29-2, R30-2, D14-2, and D16-2 by IC2a-2. If the ramp voltage is smaller than the control voltage the output pin 7 of IC2a-2 is low.

THE OSCILLATOR

The combination of R19-2, R21-2, R23-2, R24-2, C6-2, C7-2, D9-2, D13-2, T3-2, T4-2 makes a 7 kHz astable multivibrator. The diodes D9-2 and D13-2 eliminate the influence of spreads in base-emitter break-down voltages of the transistors on the frequency. This 7 kHz signal is gated together with the signal from the comparator and led to T6-2. If the voltage on pin 7 at IC2a-2 is low, the 7 kHz signal is not allowed to pass to T6-2. D15-2 secures a proper turn on and off of T6-2. T6-2 acts as a constant AC current source to the trigger transformer TR1-2. The current is determined by the supply voltage, R27-2, R28-2, R31-2 and D15-2 to approx. 100 mA. The combination D17-2 and D18-2 demagnetizes TR1-2.

The current signal is amplified by a factor 3:1:1 by TR1-2 and rectified by D19-2 and D20-2 and led to the thyristors. R34-2 and R35-2 prevent false triggering of the thyristors.

The control voltage can never be less than approx. 0.7V due to R29-2 and R30-2, but the ramp voltage is always less than 0.7V every time the mains frequency is zero crossing. Therefore pin 7 at IC2a-2 goes low and prevents the 7 kHz trigger signal from reaching the thyristors. The thyristors are thus ensured a proper turn off of one thyristor before the other is turned on.

42V ON/OFF

If terminal 1 on P1, 42V ON/OFF, is floating, the transistor T5-2 will pull up the control voltage point to approx. 14V. The maximum voltage of the ramp voltage is approx. 8V, so the output voltage of IC2a-2 is then permanently low and no trigger signal is led to the thyristors. If 42V ON/OFF is connected to ground, T5-2 is reverse biased and has no influence on the control voltage.

5.2. CONTROL UNIT N1410 (MODULE 2) cont.

THE VOLTAGE CONTROL

By varying the control voltage, the moment of triggering the thyristors on sine wave is varied and thus the output voltage.

The +42V voltage is sensed by the common mode amplifier IC1a-2 and divided down to 3.8V. A common mode amplifier is used to remove the sensitivity to noise. This voltage is compared to the reference voltage 5.1V, D6-2, divided by R12-2, R13-2 and R14-2. The difference is amplified by IC1b-2 (voltage error amplifier) and led by D10-2 and D14-2 to the control voltage point.

THE SUPPLY REDUCTION

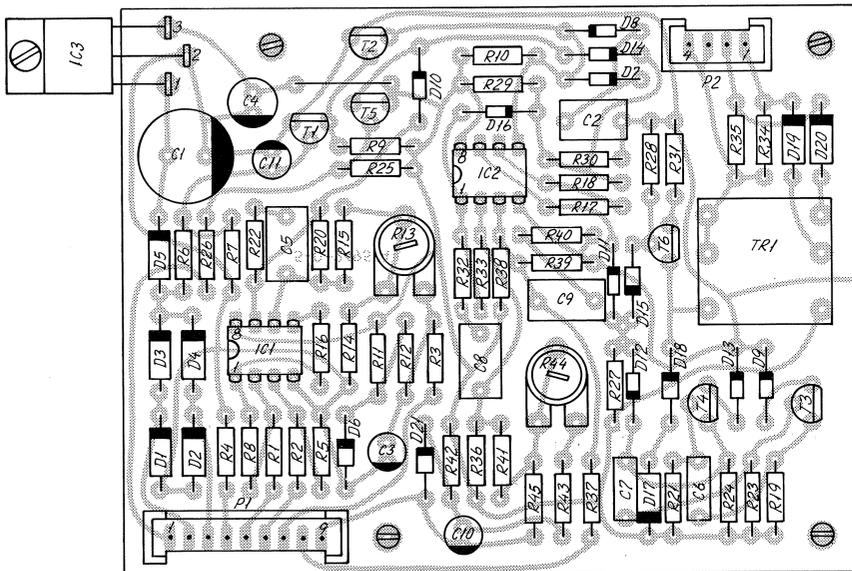
In case of supply reduction, P1-7 is grounded and R3-2 bypasses some of the currents around R13-2 and reduces the reference potential for IC1b-2. The +42V is then reduced by a factor -3 dB.

The +42V is adjusted by R13-2 with a load current of 6A DC to 42.5V DC (+1V - 0.5V) and an input voltage of 220V AC +2%.

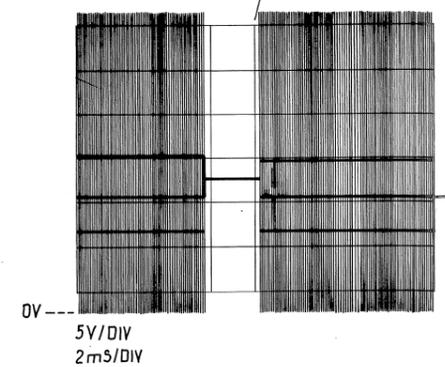
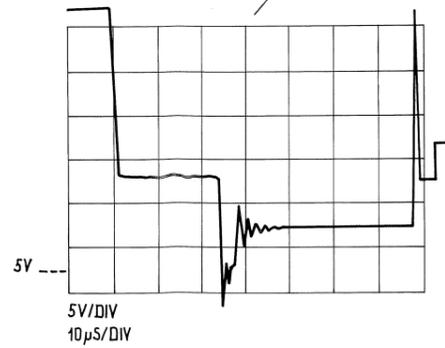
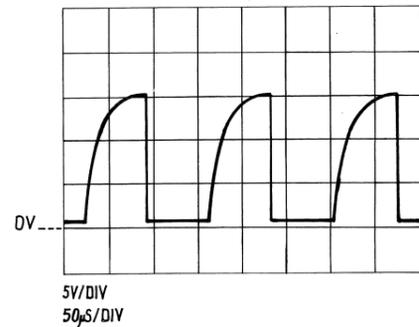
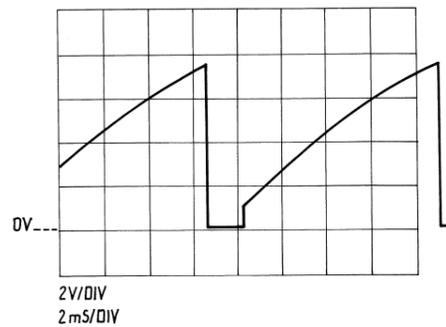
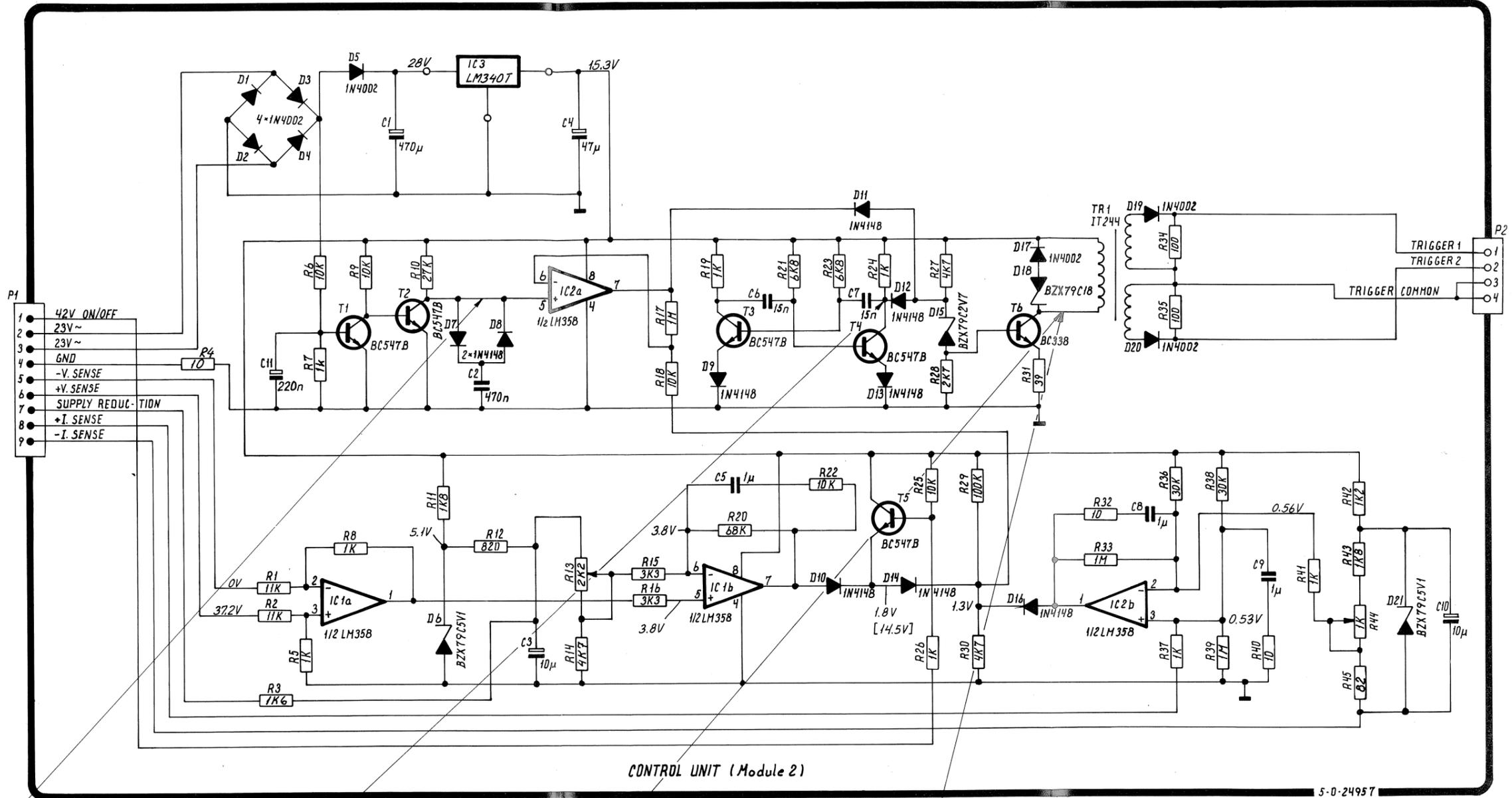
THE CURRENT CONTROL

The output current is sensed by R1-4. The voltage across R1-4 is led to P1,8-2 and P1,9-2. This voltage is compared with a reference voltage produced by D21-2, R43-2, R44-2 and R45-2 in the common mode current error amplifier IC2b-2. The two resistors R36-2 and R38-2 offset the amplifier to ensure that the input common mode voltage range of IC2b-2 is not exceeded. The error voltage is fed to the control voltage point by D16-2.

The diodes D10-2, D14-2 and D16-2 ensure that the highest voltage of the error voltages has the highest priority.



View from component side with lower side tracks.



Test conditions:

Voltage without brackets meter input impedance 10 Mohm.

Voltage in brackets [] circuit is activated.

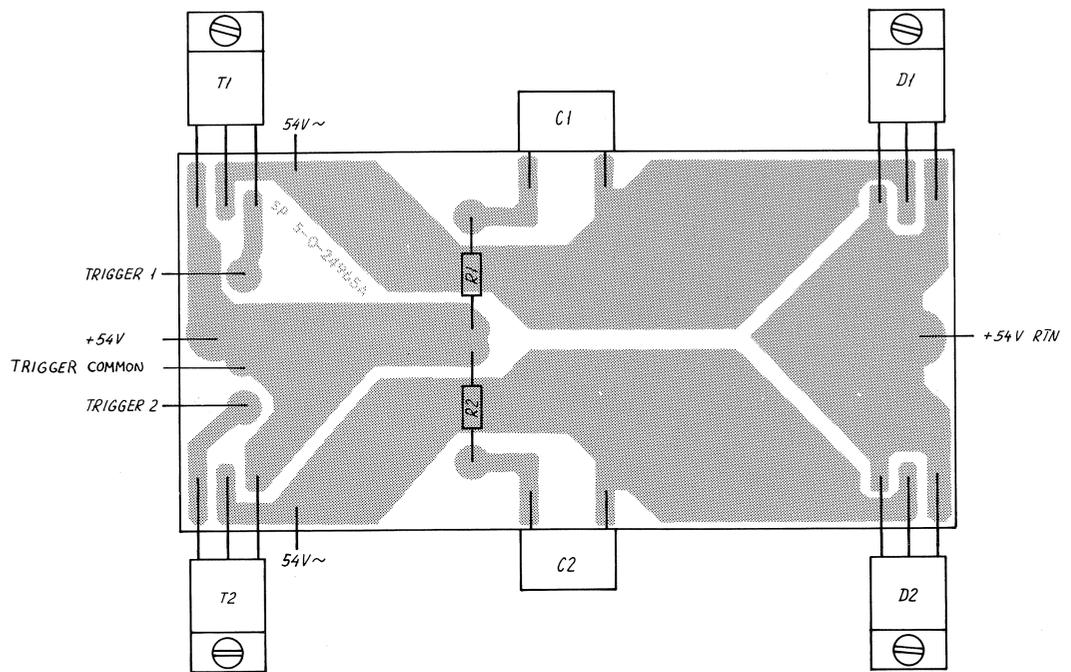
5.3. THYRISTOR UNIT N1410 (MODULE 3)

The thyristor unit serves as an interconnection board for the thyristors T1-3 and T2-3 and the diodes D1-3 and D2-3. The two RC-combinations limit the DV/DT across the thyristors to prevent false triggering.

The function of the regulator unit is already described, see above. The 54V AC from TR1-4 is fed to the thyristor unit. The firing time is controlled by the control unit.

Firing pulses from the control unit is led to both thyristors at the same time, but the thyristor, which is reverse biased, cannot turn on.

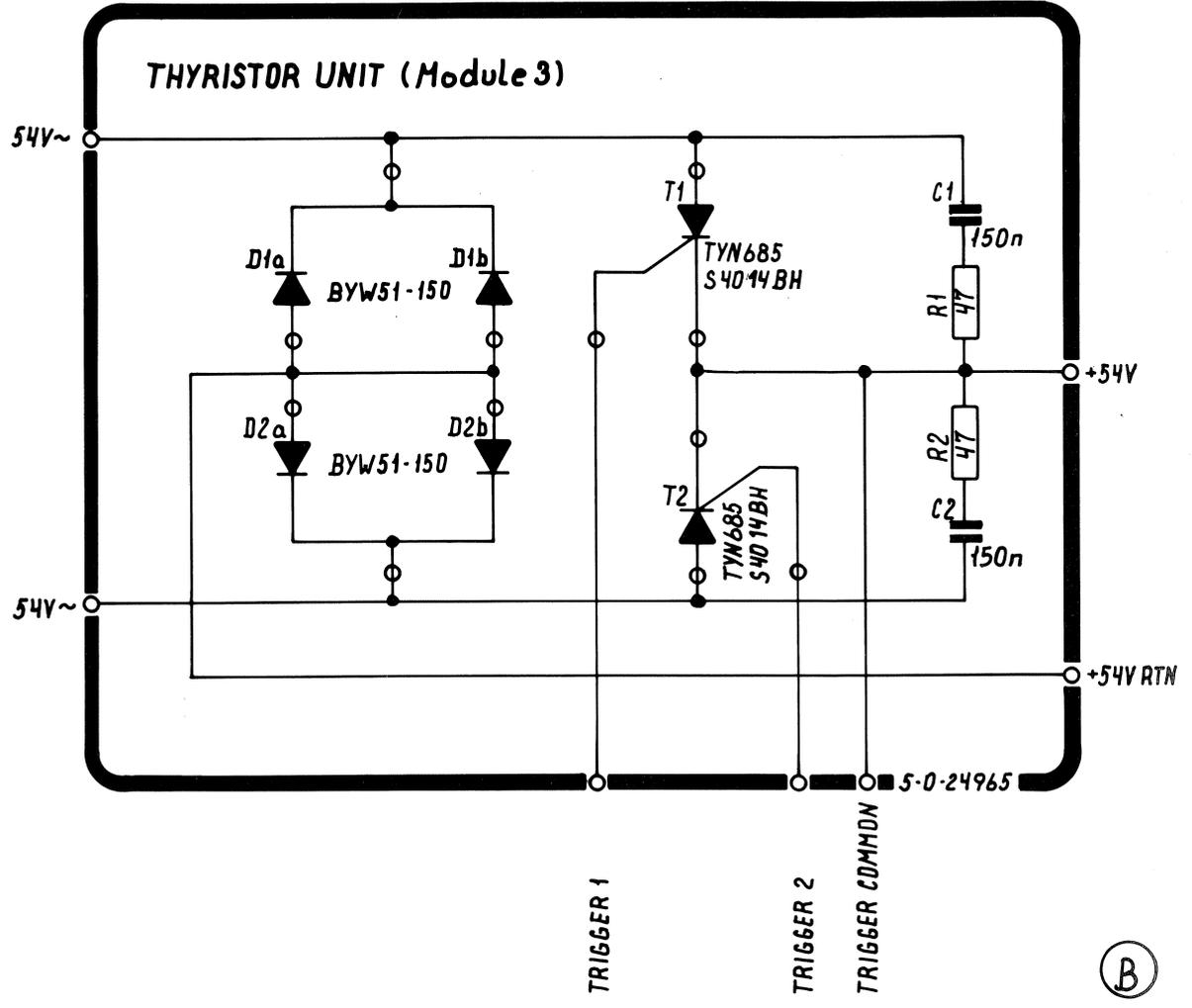
When the thyristor is fired, a rectified AC voltage is fed to the output smoothing capacitors C1-4 to C4-4 through the inductor L1-4. When the rectified AC voltage is higher than the output voltage, the current starts to run in the inductor L1-4. When the rectified AC voltage becomes smaller than the output voltage, the inductor forces the current in the thyristor to continue until the zero crossing of the AC voltage. At this moment the thyristor turns off instantly. In the next period it is the other thyristor which is fired by the control unit. The shunt R1-4 is used by the control unit to measure the output current.



View from component side with upper side tracks.

N1410
Pg. 4-6-24965A

N1410
4-0-24965B



(B)

Test conditions:

Voltage without brackets meter input impedance 10 Mohm.
Voltage in brackets [] circuit is activated.

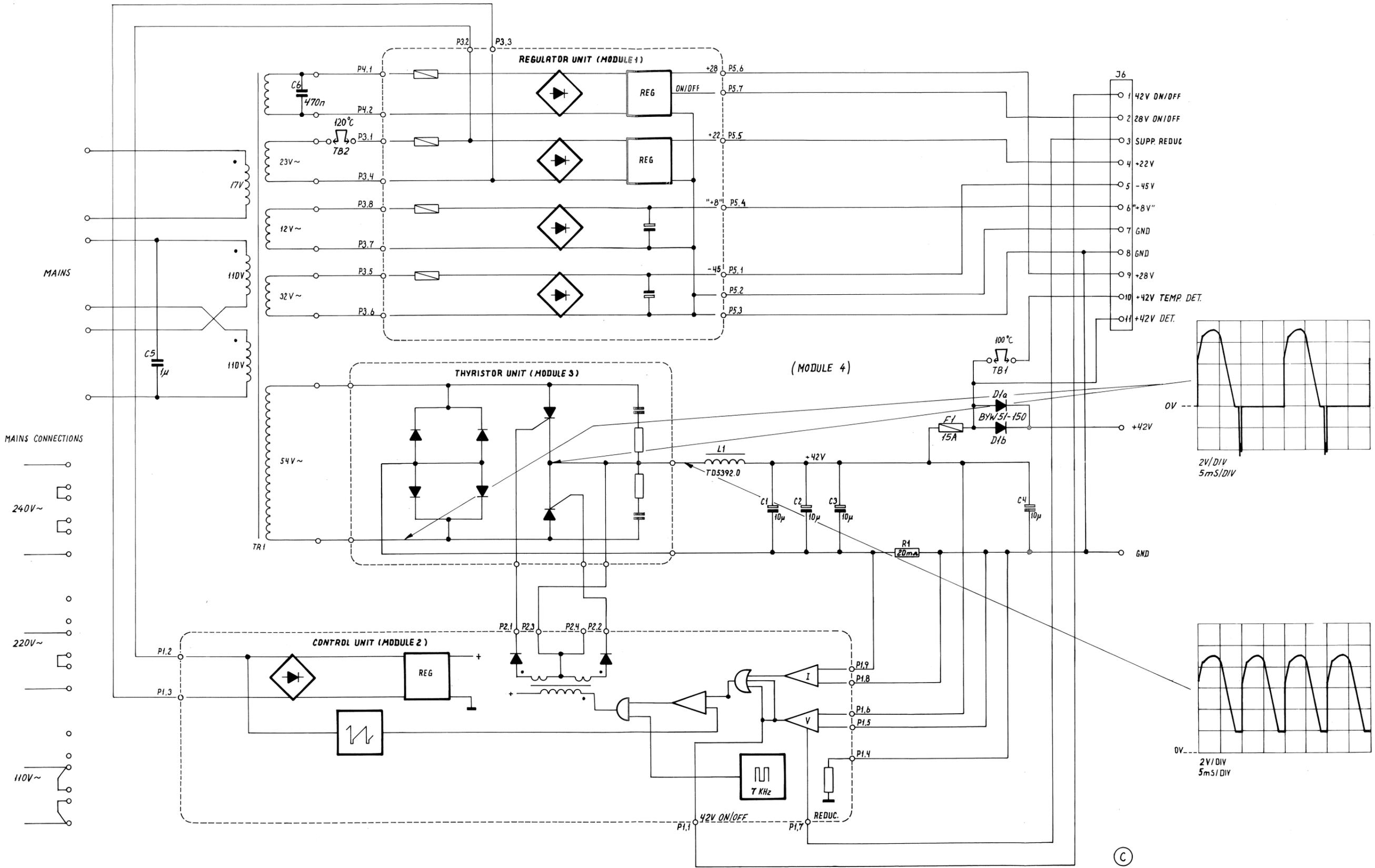
THYRISTOR UNIT (MODULE 3)

5.4. POWER SECTION (MODULE 4) AND MAIN SCHEMATIC DIAGRAM FOR ONE POWER SECTION

This module consists of:

- one regulator unit (module 1)
- one control unit (module 2)
- one thyristor unit (module 3)
- one mains transformer TR1-4
- four capacitors C1-4 to C4-4
- one inductor L1-4
- one shunt R1-4

N1410
4-0-25016C



Test conditions:

Voltage without brackets meter input impedance 10 Mohm.

Voltage in brackets [] circuit is activated.

POWER SECTION (MODULE 4) AND
MAIN SCHEMATIC DIAGRAM FOR ONE POWER SECTION

5.5. CONNECTION BOARD (MODULE 5) AND MAIN SCHEMATIC DIAGRAM FOR N1410

The connection board has four basic functions:

1. It makes the parallelling of the three power sections PS1 - PS3.
2. It distributes the control signals from the transmitter.
3. It monitors the +42V supply voltage from each of the three power sections PS1 - PS3 to make the reduction signals.
4. It contains the auxiliary supply which is necessary for the remote turn on and off for the power sections PS1 - PS3.

THE AUXILIARY POWER SUPPLY

The auxiliary supply is always turned on when N1410 is connected to the mains.

The transformer TR1-6, the diodes D9-5 to D11-5 and the capacitor C4-5 form the auxiliary supply.

The primary winding on TR1-6 is normally connected to the mains phase PH3 by relay RE1-6. If phase PH3 is missing it is connected to phase PH2 by relay RE2-5. If also phase PH2 is missing, it is connected to phase PH1.

The transformer TR1-6 must be strapped for 110V, 127V, 220V or 240V depending on the mains which it has to be connected to.

The resistors R6-5 and R10-5 are series resistors for the relays RE1-5 and RE2-5. When the relays are connected in series with the resistors, the N1410 can be supplied from a mains of 220V AC to 240V AC. The transformer TR1-4 has to be strapped for the same voltage as TR1-6.

If N1410 has to be supplied from a mains of 110V AC to 127V AC, the resistors R6-5 and R10-5 have to be short-circuited.

The auxiliary power supply produces an internal 24V DC and a 24V AC.

THE 24V DC SUPPLY AND PU I START

The transformer TR1-6, the diodes D9-5 to D15 and the capacitor C4-5 make the necessary DC which is used to draw relay RE4-5. When the wires PU I START and +BATTERY are short-circuited, by pressing the "ON" button on the rack H1238, the relay RE4-5 connects 24V AC to the mains relay RE1-6.

Now the PU I on each of the three power sections PS1 to PS3 is started, and the "+8V", +22V DC and -45V DC are now represented.

THE 24V AC SUPPLY

The transformer TR1-6 delivers the necessary voltage to the three blowers in T1135, and it also delivers the supply voltage to the mains relay RE1-6.

PU II START

The PU II starts when relay RE5-5 is drawn. This is done when the wire SUPPLY BLOCK is connected to +22V DC, which is controlled by the temperature protection circuit in the transmitter T1135, and TRANSMITTER START is connected to ground by the handset key.

When relay RE5-5 is activated, the +42V DC on/off and the +28V DC on/off terminals of the three power sections PS1 to PS3 are connected to ground. There are now +42V DC and +28V DC to the PA-stage in the transmitter. At the same time the +22V DC is connected to the aerial coupler.

When the transmitter is keyed, the transistor T5-5 is turned off. Transistor T4-5 starts conducting, relay RE3-5 is activated and 24V AC is supplied to the blower terminals. Diodes D17-5 and D20-5 are demagnetizer diodes. Capacitor C6-5 is an HF decoupler. Resistor R24 is a pull-up resistor for the +28V ON/OFF circuit.

5.5. CONNECTION BOARD N1410 (MODULE 5) cont.

SUPPLY BLOCK

If the PA-stage in the transmitter gets too hot, the transmitter connects the wire SUPPLY BLOCK to ground, and the relay RE5-5 does not get any supply voltage. This prevents the switching on of the +42V DC and the +28V DC to the PA-stage.

However, the blowers in the transmitter start because T5-5 stops conducting.

THE +42V DETECTORS AND THE TEMPERATURE DETECTORS

The +42V DC detector senses the voltage after the fuse in each of the power sections PS1 to PS3. If a +42V DC supply is not functioning and/or a fuse is blown, the voltage across the LED-diode D6-5, D14-5 or D15-5 will be zero and they are turned off. This 42V temp. detect signal is led through J6-4 to the connection board.

The voltage after the fuse on the +42V supply and the temperature on the mains transformer are sensed by the CMOS digital integrated circuits IC1-5 and IC2-5. The temperature is tested by a thermal breaker TB1, which is placed on the mains transformer.

If the temperature goes too high, the thermal breaker TB1 will turn off, or the +42V DC after the fuse disappears. Then the sense circuit will give information to the transmitter to reduce its output power.

THE SENSE AND REDUCTION CIRCUIT

The 42V temp. detect voltages are clamped to the "+8V DC" output by D1-5, D5-5 and D14-5 to protect the inputs of the IC's.

IC2-5 senses if one of the +42V DC supplies is missing.

If one of the +42V DC supplies is missing, the output from pin 9 on IC2-5 will go high and turn on the transistor T7-5, which turns the AC/DC control wire high.

The transmitter will reduce its output power with approx. 1 dB.

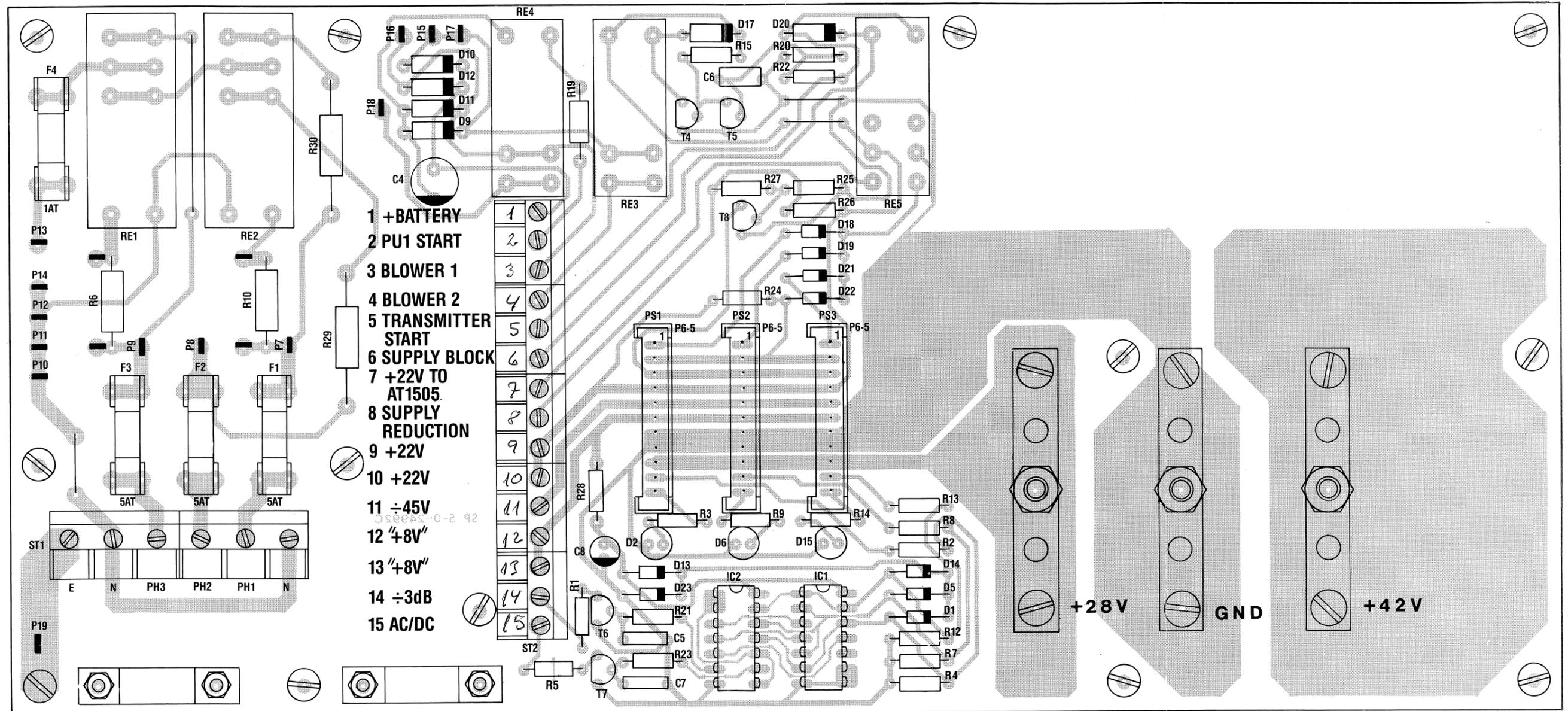
If two +42V DC supplies are missing, the output of IC2-5 pin 6 goes high and transistor T6-5 is turned on. This pulls down the -3 dB control wire.

The transmitter releases the SUPPLY REDUCTION wire from ground and transistor T8-5 turns on. The SUPPLY REDUCTION inputs on the three power sections PS1 to PS3 are pulled down to ground and the +42V DC is reduced to about 29V DC.

Then the transmitter reduces its output power further 3 dB.

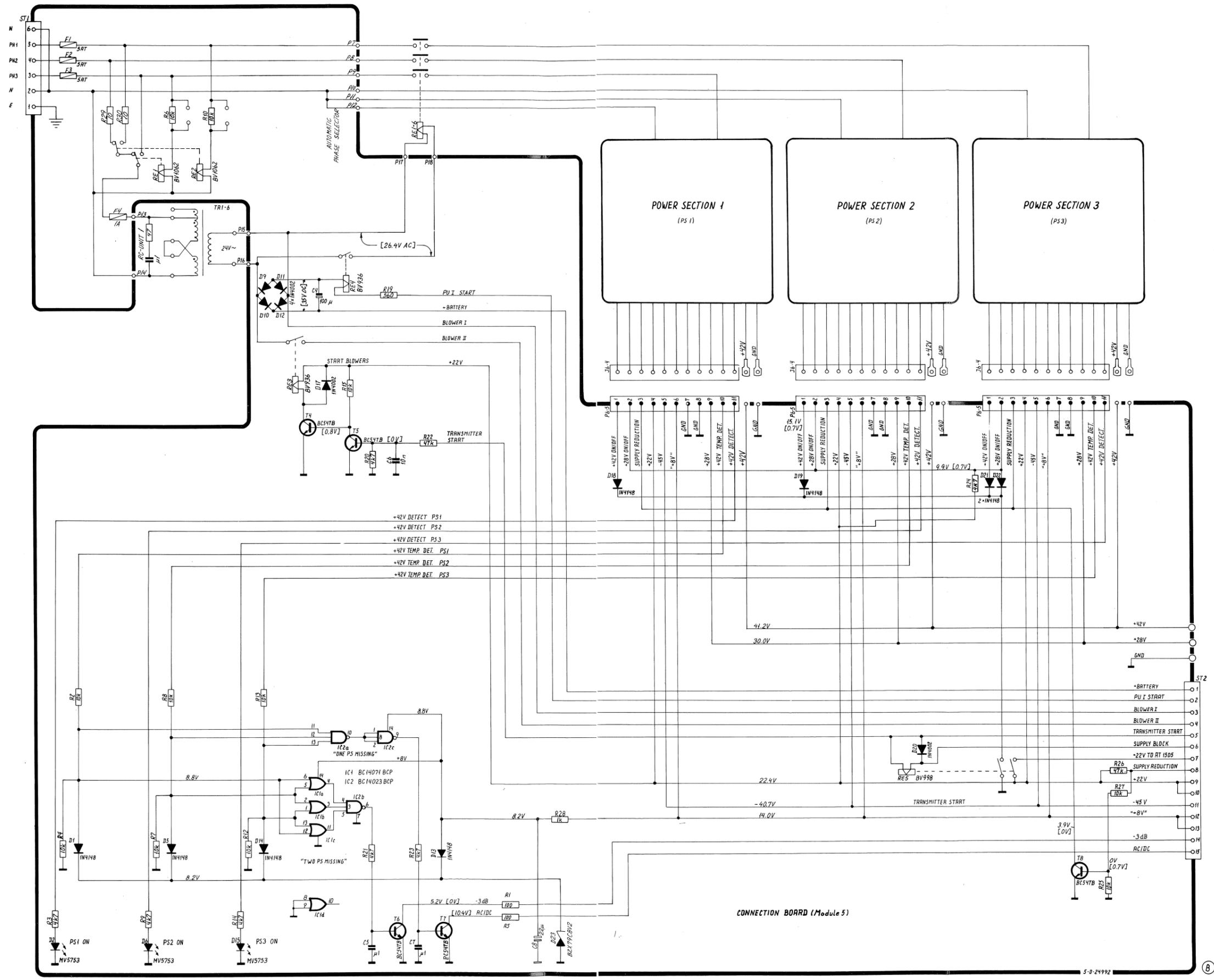
The capacitors C5-5 and C7-5 are HF decouplers.

5.5. CONNECTION BOARD (MODULE 5) cont.



View from component side with lower side tracks.

Tg. 4-6-24992A



Test conditions:

Voltage without brackets meter input impedance 10 Mohm.

Voltage in brackets [] circuit is activated.

CONNECTION BOARD (MODULE 5) AND
 MAIN SCHEMATIC DIAGRAM FOR N1410

CONTENTS

6. PARTS LIST

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
	AC POWER SUPPLY	N1410 (MODULE 6)	ESPERA	AC POWER SUPPLY	801410
-5	CONNECTION BOARD N1410	MODULE 5	ESPERA	5-0-24992C	600796
PS1	AC POWER SUPPLY SECTION	FOR N1410 (MODULE 4)	ESPERA	AC P.S.SECTION N1410	700788
PS2	AC POWER SUPPLY SECTION	FOR N1410 (MODULE 4)	ESPERA	AC P.S.SECTION N1410	700788
PS3	AC POWER SUPPLY SECTION	FOR N1410 (MODULE 4)	ESPERA	AC P.S.SECTION N1410	700788
RC1-5	RC-UNIT	0.1uF+47ohm	*RIFA	PMR 209 MC 6100 M 047	18.500
RE1-6	RELAY	3*9A/4kW	DANFOSS	37H0021-24V.50Hz	21.160
TR1-6	TRAFO	TD4411	TRADANIA	TD4411	22.154

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
	AC POWER SUPPLY SECTION	FOR N1410 (MODULE 4)	ESPERA	AC P.S.SECTION N1410	700788
-1	REGULATOR UNIT N1410	MODULE 1	ESPERA	PRINT NR.5-0-24973B	600790
-2	CONTROL UNIT N1410	MODULE 2	ESPERA	PRINT NR.5-0-24957B	600792
-3	THYRISTOR UNIT N1410	MODULE 3	ESPERA	PRINT NR.5-0-24965A	600794
C1-4	CAPACITOR ELECTROLYTIC	10000uF -10/+50% 63V	FRAKO*	EBB 10000-63	14.870
C2-4	CAPACITOR ELECTROLYTIC	10000uF -10/+50% 63V	FRAKO*	EBB 10000-63	14.870
C3-4	CAPACITOR ELECTROLYTIC	10000uF -10/+50% 63V	FRAKO*	EBB 10000-63	14.870
C4-4	CAPACITOR ELECTROLYTIC	10000uF -10/+50% 63V	FRAKO*	EBB 10000-63	14.870
C5-4	CAPACITOR POLYESTER	1uF 10% 250V AC	ERO	F1773	11.080
C6-4	CAPACITOR MKT	470nF 10% 100V	SIEMENS	B32510-D1474-K000	11.231
L1-4	CHOKE	TD5392.0 2mH	TRADANIA	TD5392.1	22.183
D1a-3	DIODE FAST RECOV.	2x10A/150VDC	THOMSON*	BYW51-150	27.159
D1b-3	DIODE FAST RECOV.	2x10A/150VDC	THOMSON*	BYW51-150	27.159
D2a-3	DIODE FAST RECOV.	2x10A/150VDC	THOMSON*	BYW51-150	27.159
D2b-3	DIODE FAST RECOV.	2x10A/150VDC	THOMSON*	BYW51-150	27.159
D1a-4	DIODE FAST RECOV.	2x10A/150VDC	THOMSON*	BYW51-150	27.159
D1b-4	DIODE FAST RECOV.	2x10A/150VDC	THOMSON*	BYW51-150	27.159
F1-4	FUSE	15A M Ø6.3x32mm	WICKMANN	314015	45.630
IC3-2	VOLTAGE REGULATOR	LM340T-15	NATIONAL	LM340T-15	31.090
R1-4	RESISTOR SHUNT	TL455	ESPERA	6-0-25022A	400455
T1-3	TRANSISTOR THYR.	S4014BH 200V/40A	*TAG	S4014BH	29.930
T2-3	TRANSISTOR THYR.	S4014BH 200V/40A	*TAG	S4014BH	29.930
T4-1	TRANSISTOR POWER	BD649	PHILIPS	BD649	29.085
T5-1	TRANSISTOR POWER	BD649	PHILIPS	BD649	29.085
TB1-4	THERMAL BREAKER	9700 H 26-644 OFF AT 100	TEXAS	9700 H026-644	44.014
TB2-4	THERMAL BREAKER	9700 H 01-644 OFF AT 120	TEXAS	9700 H 01-644	44.018
TR1-4	TRANSFORMER POWER	7218 EI150N/50	SCANELECTRIC	7218 EI150N/50	22.506

N1410/12-87

POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P.NUMBER	
	REGULATOR UNIT N1410	MODULE 1	ESPERA	5-0-24973C	600790
C1-1	CAPACITOR ELECTROLYTIC	4700uF -10/+50% 25V	*FRAKO	EFR 4700-25	14.857
C2-1	CAPACITOR ELECTROLYTIC	470uF -20/+30% 63VDC	PHILIPS	2222 035 68471	14.604
C3-1	CAPACITOR ELECTROLYTIC	2200uF -10/+50% 50	FRAKO	EF 1	14.727
C4-1	CAPACITOR ELECTROLYTIC	2200uF -10/+50% 40V	ERO*	EGD	14.730
C5-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	EG 03 MG 422 G	11.219
C6-1	CAPACITOR ELECTROLYTIC	2200uF -10/+50% 40V	ERO*	B32510-D1104-K000	14.730
C7-1	CAPACITOR ELECTROLYTIC	2200uF -10/+50% 50	FRAKO	EG 03 MG 422 G	14.727
C8-1	CAPACITOR ELECTROLYTIC	2200uF -10/+50% 40V	ERO*	EGD	14.730
C9-1	CAPACITOR ELECTROLYTIC	2200uF -10/+50% 50	FRAKO	EF 1	14.727
C10-1	CAPACITOR ELECTROLYTIC	470uF -10/+50% 40VDC	ERO*	EKM 05 F6 347 G 05	14.650
C11-1	CAPACITOR ELECTROLYTIC	470uF -10/+50% 40VDC	ERO*	EKM 05 F6 347 G 05	14.650
C12-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C13-1	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C15-1	CAPACITOR MKT	10nF 5% 250V	ERO*	MKT1818-310/01	11.380
D1-1	DIODE RECTIFIER	1N5402 200V/3A	PROMAX	1N5402	25.116
D2-1	DIODE RECTIFIER	1N5402 200V/3A	PROMAX	1N5402	25.116
D3-1	DIODE RECTIFIER	1N5402 200V/3A	PROMAX	1N5402	25.116
D4-1	DIODE RECTIFIER	1N5402 200V/3A	PROMAX	1N5402	25.116
D5-1	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D6-1	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D7-1	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D8-1	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D9-1	DIODE RECTIFIER	1N5402 200V/3A	PROMAX	1N5402	25.116
D10-1	DIODE RECTIFIER	1N5402 200V/3A	PROMAX	1N5402	25.116
D11-1	DIODE RECTIFIER	1N5402 200V/3A	PROMAX	1N5402	25.116
D12-1	DIODE RECTIFIER	1N5402 200V/3A	PROMAX	1N5402	25.116
D13-1	DIODE RECTIFIER	1N5402 200V/3A	PROMAX	1N5402	25.116
D14-1	DIODE RECTIFIER	1N5402 200V/3A	PROMAX	1N5402	25.116
D15-1	DIODE RECTIFIER	1N5402 200V/3A	PROMAX	1N5402	25.116
D16-1	DIODE RECTIFIER	1N5402 200V/3A	PROMAX	1N5402	25.116
D18-1	DIODE ZENER	24V 5% 0.4W BZX79C24	PHILIPS	BZX79C24	26.572
D19-1	DIODE ZENER	30V 5% 0.4W	PHILIPS	BZX79C30	26.578
D20-1	DIODE RECTIFIER	1N5402 200V/3A	PROMAX	1N5402	25.116
D21-1	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D22-1	DIODE	MR750	MOTOROLA	MR750	25.219
D23-1	DIODE	MR750	MOTOROLA	MR750	25.219
D24-1	DIODE ZENER	24V 5% 0.4W BZX79C24	PHILIPS	BZX79C24	26.572
D25-1	DIODE ZENER	30V 5% 0.4W	PHILIPS	BZX79C30	26.578

POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P.NUMBER	
F1-1	FUSE	3.15A M Ø5x20mm	WICKMANN	919201	45.552
F2-1	FUSE	500mA 250V 5x20mm	LITTELFUSE	218.500	45.504
F3-1	FUSE	4AT 250V 5x20mm	LITTELFUSE	R.S.Nr:143-330	45.573
F4-1	FUSE	5AT 250V 5x20mm	LITTELFUSE	218004.	45.575
P3-1	PLUG (MALE)	8 POLE	AMP	0-826375-8	78.108
P4-1	PLUG	2 POLES	AMP	0-826375-2	78.102
P5-1	PLUG (MALE)	7 POLE	AMP	0-826375-7	78.107
R1-1	RESISTOR MF	680 OHM 5% 0.5W	PHILIPS	2322 156 16801	01.395
R2-1	RESISTOR MF	680 OHM 5% 0.5W	PHILIPS	2322 156 16801	01.395
R3-1	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R4-1	RESISTOR MF	680 OHM 5% 0.5W	PHILIPS	2322 156 16801	01.395
R5-1	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R6-1	RESISTOR MF	680 OHM 5% 0.5W	PHILIPS	2322 156 16801	01.395
R7-1	RESISTOR MF	910 OHM 5% 0.4W	* PHILIPS	2322 181 53911	01.199
R8-1	RESISTOR MF	910 OHM 5% 0.4W	* PHILIPS	2322 181 53911	01.199
R9-1	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R10-1	RESISTOR	0.12 ohm 10% 3W	PHILIPS	2322 329 33127	05.120
R11-1	RESISTOR	0.12 ohm 10% 3W	PHILIPS	2322 329 33127	05.120
R12-1	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R13-1	RESISTOR	30 KOHM 1% 0.4W	*PHILIPS	2322 156 13003	03.460
R14-1	RESISTOR MF	39k OHM 5% 0.4W	* PHILIPS	2322 181 53393	01.239
T1-1	TRANSISTOR AF	BC547B NPN T0-92	PHILIPS	BC547B	28.067
T2-1	TRANSISTOR AF	BC547B NPN T0-92	PHILIPS	BC547B	28.067
T3-1	TRANSISTOR AF	BC547B NPN T0-92	PHILIPS	BC547B	28.067

POSITION	DESCRIPTION	MANUFACTURER	TYPE	S.P. NUMBER	
CONTROL UNIT N1410		MODULE 2	ESPERA	5-0-24957C	600792
C1-2	CAPACITOR ELECTROLYTIC	470uF -20/+50% 40VDC	ERO	EKM 05 F6 347 G 05	14.650
C2-2	CAPACITOR MKT	470nF 10% 100V	SIEMENS	B32510-D1474-K000	11.231
C3-2	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-F12	14.512
C4-2	CAPACITOR ELECTROLYTIC	47uF 20% 25VDC	ELNA	RJ2-25-V-470-M-F1	14.524
C5-2	CAPACITOR MKT	1uF 10% 63V	ERO*	MKT1818	11.138
C6-2	CAPACITOR MKT	15nF 10% 400V	SIEMENS	B32510-D6153-K000	11.364
C7-2	CAPACITOR MKT	15nF 10% 400V	SIEMENS	B32510-D6153-K000	11.364
C8-2	CAPACITOR MKT	1uF 10% 63V	ERO*	MKT1818	11.138
C9-2	CAPACITOR MKT	1uF 10% 63V	ERO*	MKT1818	11.138
C10-2	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-F12	14.512
D1-2	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D2-2	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D3-2	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D4-2	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D5-2	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D6-2	DIODE ZENER	5.1V 5% 0.4W	PHILIPS	BZX79C5V1	26.527
D7-2	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D8-2	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D9-2	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D10-2	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D11-2	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D12-2	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D13-2	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D14-2	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D15-2	DIODE ZENER	2V7 5% 0.4W	PHILIPS	BZX79C2V7	26.506
D16-2	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D17-2	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D18-2	DIODE ZENER	18V 5% 0.4W BZX79C18	PHILIPS	BZX79C18	26.564
D19-2	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D20-2	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D21-2	DIODE ZENER	5.1V 5% 0.4W	PHILIPS	BZX79C5V1	26.527
IC1-2	DUAL OP AMP	LM358N	TEXAS	LM358P	31.100
IC2-2	DUAL OP AMP	LM358N	TEXAS	LM358P	31.100
P1-2	PLUG (MALE)	9 POLE	AMP	0-826375-9	78.109
P2-2	PLUG (MALE)	4 POLE	AMP	0-826375-4	78.104
R1-2	RESISTOR	11 KOHM 1% 0.4W	*PHILIPS	2322 156 11103	03.458
R2-2	RESISTOR	11 KOHM 1% 0.4W	*PHILIPS	2322 156 11103	03.458
R3-2	RESISTOR MF	1k6 OHM 5% 0.4W	PHILIPS	2322 181 53162	01.205
R4-2	RESISTOR MF	10 OHM 5% 0.4W	PHILIPS	2322 181 53109	01.150
R5-2	RESISTOR	1 KOHM 1% 0.4W	*PHILIPS	2322 156 11002	03.395
R6-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225

POSITION	DESCRIPTION	MANUFACTURER	TYPE	S.P. NUMBER	
R7-2	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R8-2	RESISTOR	1 KOHM 1% 0.4W	*PHILIPS	2322 156 11002	03.395
R9-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R10-2	RESISTOR MF	27k OHM 5% 0.4W	PHILIPS	2322 181 53273	01.235
R11-2	RESISTOR MF	1k8 OHM 5% 0.4W	PHILIPS	2322 181 53182	01.206
R12-2	RESISTOR MF	820 OHM 5% 0.4W	PHILIPS	2322 181 53821	01.197
R13-2	POTENTIOMETER TRIMMING	2.2 KOHM 10% 0.5W	PHILIPS	2322 482 22222	07.665
R14-2	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R15-2	RESISTOR MF	3k3 OHM 5% 0.4W	PHILIPS	2322 181 53332	01.212
R16-2	RESISTOR MF	3k3 OHM 5% 0.4W	PHILIPS	2322 181 53332	01.212
R17-2	RESISTOR MF	1M0 OHM 5% 0.4W	PHILIPS	2322 181 53105	01.275
R18-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R19-2	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R20-2	RESISTOR MF	68k OHM 5% 0.4W	PHILIPS	2322 181 53683	01.245
R21-2	RESISTOR MF	6k8 OHM 5% 0.4W	PHILIPS	2322 181 53682	01.220
R22-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R23-2	RESISTOR MF	6k8 OHM 5% 0.4W	PHILIPS	2322 181 53682	01.220
R24-2	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R25-2	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R26-2	RESISTOR MF	1k0 OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R27-2	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R28-2	RESISTOR MF	2k7 OHM 5% 0.4W	PHILIPS	2322 181 53272	01.210
R29-2	RESISTOR MF	100k OHM 5% 0.4W	PHILIPS	2322 181 53104	01.250
R30-2	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R31-2	RESISTOR MF	39 OHM 5% 0.4W	PHILIPS	2322 181 53399	01.164
R32-2	RESISTOR MF	10 OHM 5% 0.4W	PHILIPS	2322 181 53109	01.150
R33-2	RESISTOR	1 MOHM 1% 0.4W	*PHILIPS	2322 156 11005	03.604
R34-2	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R35-2	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R36-2	RESISTOR	30 KOHM 1% 0.4W	*PHILIPS	2322 156 13003	03.460
R37-2	RESISTOR	1 KOHM 1% 0.4W	*PHILIPS	2322 156 11002	03.395
R38-2	RESISTOR	30 KOHM 1% 0.4W	*PHILIPS	2322 156 13003	03.460
R39-2	RESISTOR	1 MOHM 1% 0.4W	*PHILIPS	2322 156 11005	03.604
R40-2	RESISTOR MF	10 OHM 5% 0.4W	PHILIPS	2322 181 53109	01.150
R41-2	RESISTOR	1 KOHM 1% 0.4W	*PHILIPS	2322 156 11002	03.395
R42-2	RESISTOR MF	1k2 OHM 5% 0.4W	PHILIPS	2322 181 53122	01.202
R43-2	RESISTOR MF	1k8 OHM 5% 0.4W	PHILIPS	2322 181 53182	01.206
R44-2	POTENTIOMETER TRIMMING	1 KOHM 10% 0.5W	* PHILIPS	2322 482 42102	07.660
R45-2	RESISTOR MF	82 OHM 5% 0.4W	PHILIPS	2322 181 53829	01.172
T1-2	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
T2-2	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
T3-2	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
T4-2	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
T5-2	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067

POSITION	DESCRIPTION	MANUFACTURER	TYPE	S.P. NUMBER	
T6-2	TRANSISTOR AF	BC338-25 NPN TO-92	PHILIPS	BC338-25	28.058
TR1-2	TRANSFORMER	3:1:1	SCHAFFNER	IT 244	22.000

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POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	THYRISTOR UNIT N1410	MODULE 3	ESPERA	5-0-24965A	600794
C1-3	CAPACITOR POLYESTER	0.15uF 10% 100V	PHILIPS*	2222 344 25154	11.074
C2-3	CAPACITOR POLYESTER	0.15uF 10% 100V	PHILIPS*	2222 344 25154	11.074
R1-3	RESISTOR MF	47 OHM 5% 0.5W	PHILIPS	2322 156 14709	01.366
R2-3	RESISTOR MF	47 OHM 5% 0.5W	PHILIPS	2322 156 14709	01.366

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	CONNECTION BOARD N1410	MODULE 5	ESPERA	5-0-24992C	600796
C4-5	CAPACITOR ELECTROLYTIC	100uF -20/+50% 63VDC	ELNA	RJ2-63-V-101-M-F	14.620
C5-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C6-5	CAPACITOR MKT	10nF 5% 250V	ERO*	MKT1818-310/01	11.380
C7-5	CAPACITOR MKT	100nF 10% 100V	SIEMENS*	B32510-D1104-K000	11.219
C8-5	CAPACITOR ELECTROLYTIC	22uF 20% 25VDC	ELNA	RJ2-25-V-220-M-F12	14.514
D1-5	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D2-5	DIODE LIGHT EMITTING	RED Ø5mm	GI	MV5753 RØD	25.545
D5-5	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D6-5	DIODE LIGHT EMITTING	RED Ø5mm	GI	MV5753 RØD	25.545
D9-5	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D10-5	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D11-5	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D12-5	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D13-5	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D14-5	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D15-5	DIODE LIGHT EMITTING	RED Ø5mm	GI	MV5753 RØD	25.545
D17-5	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D18-5	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D19-5	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D20-5	DIODE RECTIFIER	1N4002 100V/1A	ITT	1N4002 (03/04/05/06/07)	25.100
D21-5	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D22-5	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D23-5	DIODE ZENER	8V2 5% 0.4W	PHILIPS	BZX79C8V2	26.542
F1-5	FUSE	5AT 250V 5x20mm	LITTELFUSE	218005. R. S.Nr:143-350	45.575
F2-5	FUSE	5AT 250V 5x20mm	LITTELFUSE	218005. R. S.Nr:143-350	45.575
F3-5	FUSE	5AT 250V 5x20mm	LITTELFUSE	218005. R. S.Nr:143-350	45.575
F4-5	FUSE	1AT 250V 5x20mm	ELU	179 120 1AT	45.506
IC1-5	QUAD 2-INPUT "OR" GATE	MC14071BCP	SIGNETICS*	HEF 4071 BP	33.245
IC2-5	INTEGRATED CIRCUIT	MC14023BCP	MOTOROLA	MC14023BCP	33.105
P6-5	PLUG (MALE)	11 POLE	AMP	1-826375-1	78.111
P6-5	PLUG (MALE)	11 POLE	AMP	1-826375-1	78.111
P6-5	PLUG (MALE)	11 POLE	AMP	1-826375-1	78.111
R1-5	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R2-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R3-5	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R4-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R5-5	RESISTOR MF	100 OHM 5% 0.4W	PHILIPS	2322 181 53101	01.175
R6-5	RESISTOR PMF	10k OHM 5% 2W	PHILIPS	2322 194 13103	04.217

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R7-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R8-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R9-5	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R10-5	RESISTOR PMF	10k OHM 5% 2W	PHILIPS	2322 194 13103	04.217
R12-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R13-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R14-5	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R15-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R19-5	RESISTOR MF	560 OHM 5% 0.5W	PHILIPS	2322 156 15601	01.394
R20-5	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R21-5	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R22-5	RESISTOR MF	47k OHM 5% 0.4W	PHILIPS	2322 181 53473	01.241
R23-5	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R24-5	RESISTOR MF	4k7 OHM 5% 0.4W	PHILIPS	2322 181 53472	01.216
R25-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R26-5	RESISTOR MF	47k OHM 5% 0.4W	PHILIPS	2322 181 53473	01.241
R27-5	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R28-5	RESISTOR MF	1kØ OHM 5% 0.4W	PHILIPS	2322 181 53102	01.200
R29-5	RESISTOR	10 OHM 5% 5W	PHILIPS	2322 329 05109	05.749
R30-5	RESISTOR	10 OHM 5% 5W	PHILIPS	2322 329 05109	05.749
RE1-5	RELAY	120V AC	PASI	BV-1062	21.025
RE2-5	RELAY	120V AC	PASI	BV-1062	21.025
RE3-5	RELAY	24V DC 18A 1 SL.	PASI	KH/A-3 BV936	21.009
RE4-5	RELAY	24V DC 18A 1 SL.	PASI	KH/A-3 BV936	21.009
RE5-5	RELAY	24V DC 10A 2 SK	PASI	KS/U-3-C BV998	21.015
ST1-5	TERMINAL BLOCK	6 POLES 2.5mm2	PTR	AK110/6DS m.MESS.SKRUER BLA	81.039
T4-5	TRANSISTOR AF	BC547B NPN T0-92	PHILIPS	BC547B	28.067
T5-5	TRANSISTOR AF	BC547B NPN T0-92	PHILIPS	BC547B	28.067
T6-5	TRANSISTOR AF	BC547B NPN T0-92	PHILIPS	BC547B	28.067
T7-5	TRANSISTOR AF	BC547B NPN T0-92	PHILIPS	BC547B	28.067
T8-5	TRANSISTOR AF	BC547B NPN T0-92	PHILIPS	BC547B	28.067