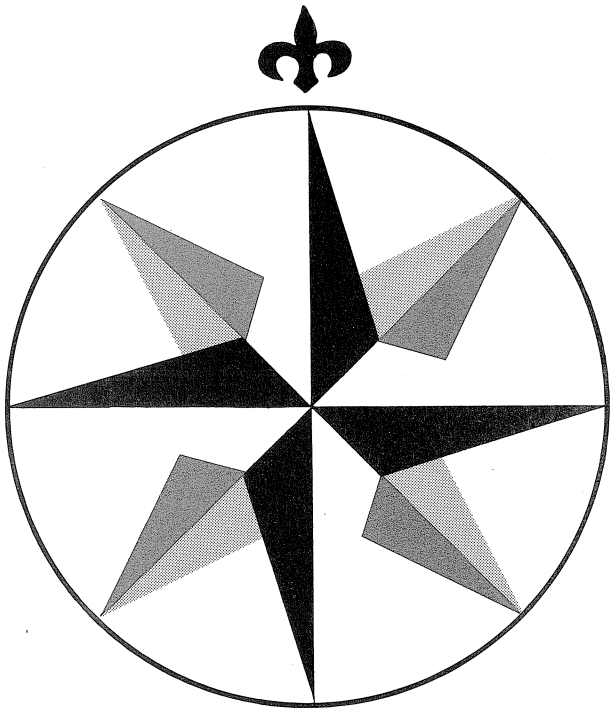


Sailor

Sailor

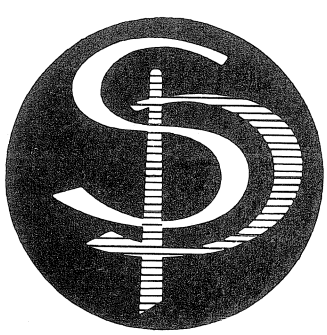
INSTRUKTIONSBOG FOR
HF SSB PROGRAMME 1200W PEP

INSTRUCTION BOOK FOR
HF SSB PROGRAMME 1200W PEP

INSTRUKTIONSBUCH FÜR
HF SSB PROGRAMME 1200W PEP

INSTRUCTIONS POUR
HF SSB PROGRAMME 1200W PEP

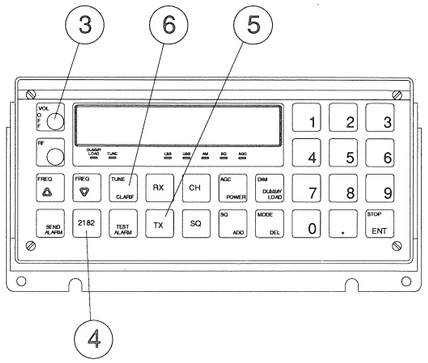
INSTRUCCIONES PARA
HF SSB PROGRAMME 1200W PEP



A/S S. P. RADIO · AALBORG · DENMARK

MANUAL TUNE–UP PROCEDURE

INITIAL SETTING: Switch the radio off (3)



1 Open the cover (1) on T2131/T2135.

2 Set TUNE switch (2) to position MAN.

3 Switch the radio on (3)

Press <2182> (4)

4 Press <TX> (5)

5 Press <TUNE/CLARIF> (6)

6 Place the TUNING INDICATOR (the fork) on the aerial insulator on the aerial coupler.

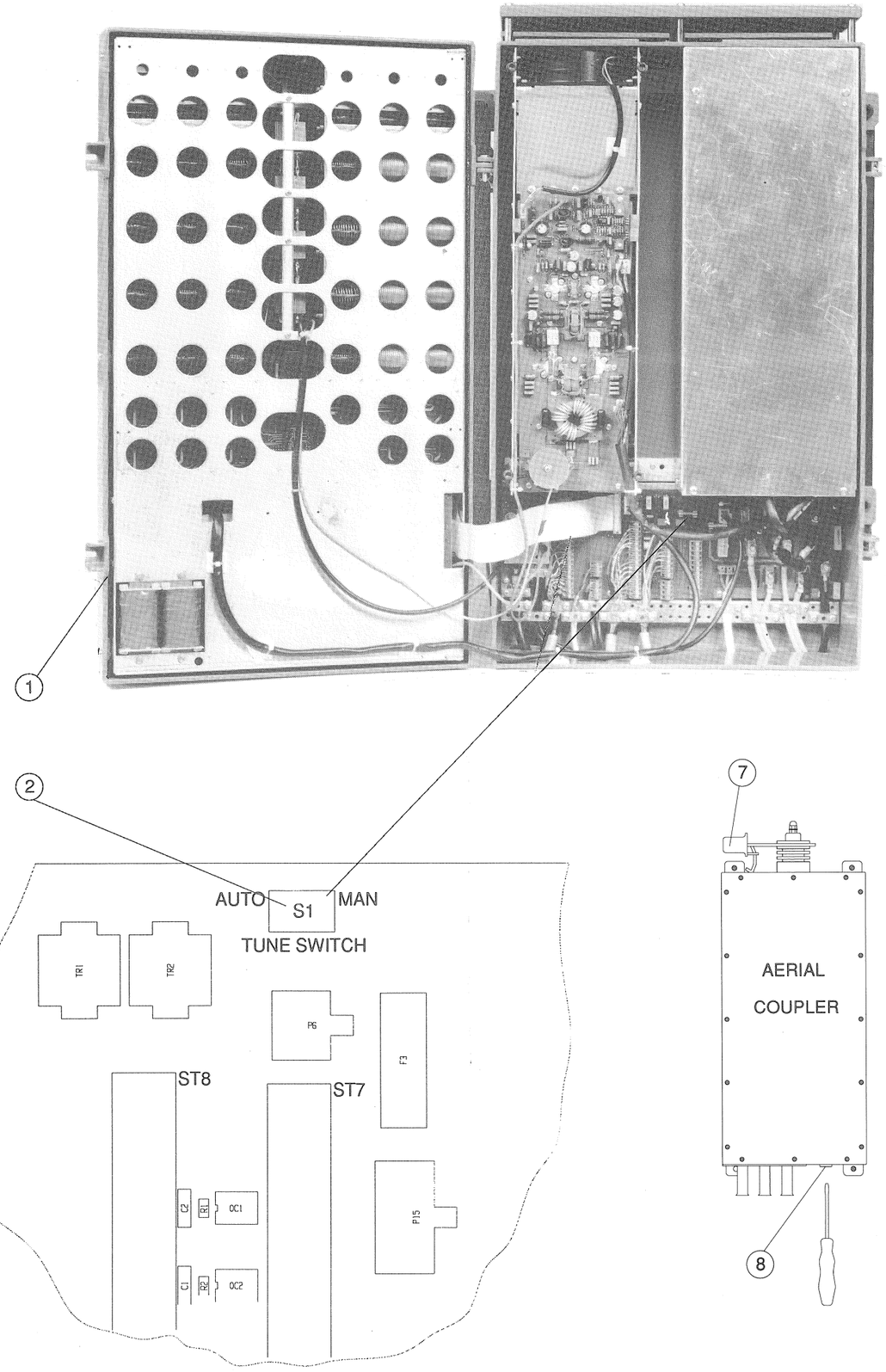
7 Remove the plug in the bottom of the aerial and tune the aerial coupler by means of the supplied tuning tool (8) to max. light in the tuning indicator (7)

8 When tuned to max. press <STOP/ENT>

9 Press <SEND ALARM> and <TEST ALARM> simultaneously to transmit the alarm signal.

10 When the alarm signal disappears from the earpiece (after 45 secs), then press the handset key and make your distress call.
(MAY–DAY – name of ship – position etc.)

11 Release the handset key and listen for an answer.



CONTENTS

PART I /1200W	INSTRUCTION BOOK FOR 1200W PEP HF SSB SYSTEM
PART II	INSTRUCTION BOOK FOR TX CONTROL UNIT
PART III	INSTRUCTION BOOK FOR POWER AMPLIFIER UNIT
PART IV	INSTRUCTION BOOK FOR COMBINER UNIT (ONLY IN 1200W)
PART V	INSTRUCTION BOOK FOR POWER SUPPLY UNIT 24V DC 600W
PART VI	INSTRUCTION BOOK FOR POWER SUPPLY UNIT 220W AC 600W
AT2112	INSTRUCTION BOOK FOR AERIAL COUPLER AT2112

FOR YOUR INFORMATION

All information and illustrations in this manual are based on the information available when this manual was printed.

This third edition, first issue, is printed in march 1992.

We make reservations concerning errors in this manual, and all specifications are subject to change without further notice.

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INSTRUCTION BOOK FOR 1200W HF SSB SYSTEM

CONTENTS

1. INTRODUCTION
1.1. GENERAL DESCRIPTION SAILOR HF SSB PROGRAMME
1.2. TECHNICAL DATA
1.3. SYSTEM OVERVIEW (BLOCK DIAGRAMS FOR UNITS)

2. INSTALLATION MECHANICAL
2.1. MOUNTING POSSIBILITIES
2.2. DIMENSIONS AND DRILLING PLAN
2.3. INSTALLATION ELECTRICAL, BETWEEN CABINETS
2.4. CABLE SPECIFICATIONS
2.5. BATTERY REQUIREMENTS
2.6. ELECTRICAL CONNECTIONS AND ASSEMBLING, BETWEEN UNITS

3. SERVICE
3.1. MAINTENANCE
3.2. ALIGNMENT INSTRUCTIONS
3.3. PROPOSAL FOR NECESSARY TEST EQUIPMENT
3.4. TROUBLE SHOOTING
3.4.1. ERROR CODES
3.4.2. INTELLIGENT FAULT SYSTEM
3.4.3. SYSTEM FUNCTION DESCRIPTION
3.5. PERFORMANCE CHECK
3.6. FUNCTION CHECK
3.7. SERVICE PROGRAMMES

4. MECHANICAL DESCRIPTION
4.1. MECHANICAL ASSEMBLING/DISASSEMBLING AND UNITS LOCATION

5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS
5.1. CONNECTION BOARD (MODULE 14) SP NO. 626414

6.

7. PARTS LISTS

CONTENTS

1	**GENERAL INFORMATION**	1-1
1.1	INTRODUCTION	1-1
1.2	DESCRIPTION OF SAILOR HF SSB PROGRAMME	1-1
1.3	TECHNICAL DATA	1-2
1.4	SYSTEM OVERVIEW	1-5
2	**INSTALLATION**	2-1
2.1	DIMENSIONS AND DRILLING PLAN	2-1
2.2	INSTALLATION ELECTRICAL, BETWEEN CABINETS	2-2
2.3	BATTERY REQUIREMENTS FOR GMDSS	2-14
3	**SERVICE**	3-1
3.1	MAINTENANCE	3-1
3.2	ALIGNMENT INSTRUCTIONS	3-1
3.3	PROPOSAL FOR NECESSARY MEASURING INSTRUMENTS	3-1
3.4	TROUBLE SHOOTING	3-2
3.5	SYSTEM FUNCTION DESCRIPTION	3-9
3.6	PERFORMANCE CHECK	3-18
3.7	FUNCTION CHECK	3-20
3.8	SERVICE PROGRAMMES	3-22
4	**MECHANICAL DESCRIPTION**	4-1
4.1	MECHANICAL ASSEMBLING / DISASSEMBLING AND UNITS LOCATION	4-1
5	**CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS**	5-1
5.1	CONNECTION BOARD (MODULE 13) SP NO. 626413	5-1
5.2	CONNECTION BOARD (MODULE 5) SP NO. 626425	5-5
5.3	CONN. SINGLE BATTERY CHARGER (MODULE 3) SP NO. 626446	5-9
5.4	CONN. DUAL BATTERY CHARGER (MODULE 4) SP NO. 626447	5-13
5.5	REMOTE CONTROL UNIT H2180 FOR N2174 BATTERY CHARGER	5-17
5.6	FUSE BOX H2182	5-18
6	**PARTS LISTS**	6-1

CONTENTS

5	CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS	5-1
5.1	CONNECTION BOARD (MODULE 13) SP NO. 626413	5-1
5.2	CONNECTION BOARD (MODULE 5) SP NO. 626425	5-5
5.3	CONN. SINGLE BATTERY CHARGER (MODULE 3) SP NO. 626446	5-9
5.4	CONN. DUAL BATTERY CHARGER (MODULE 4) SP NO. 626447	5-13
5.5	REMOTE CONTROL UNIT H2180 FOR N2174 BATTERY CHARGER	5-17
5.6	FUSE BOX H2182	5-18

GRØN SIDE

5 CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS

5.1 CONNECTION BOARD (MODULE 13) SP NO. 626413

The connection board contains following circuits:

Aerial switch relays RE3 and RE4. In transmit mode is RE3 and RE4 activated.
The output from the power amplifier (filter switch) is fed tough RE4 to the aerial coupler AT2112 / the antenna.
The output from the RE2100 (exciter) is fed trough RE3 to the power amplifier.

The power-in detector consists of the amplifier Q1 and the detector D4, C34.
This detector is used to measure whether the input from RE2100 is sufficient. It is also used together with the power out detector to check if the power amplifier is working ok.

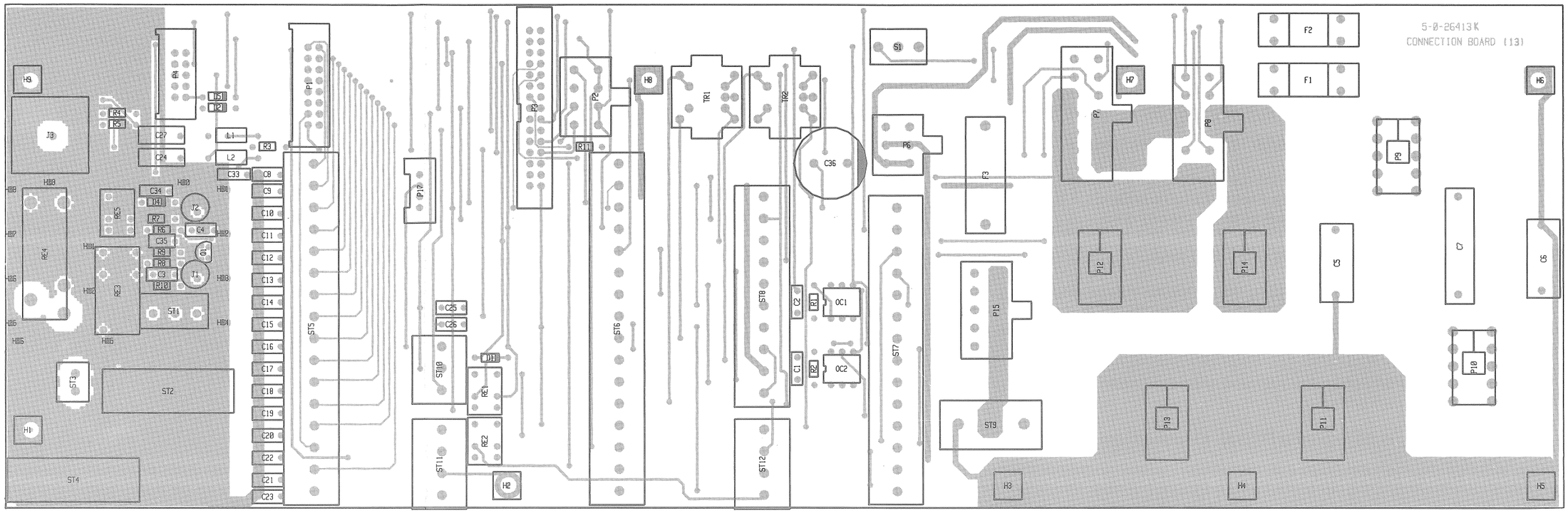
The audiotransformers for aux AF to transmitter and 0 dBm input.

The optocoupler's OC1, OC2 is used for controlling the transmitter in telex mode.
When OC1 is on, then the power supply is switch on and the transmitter is ready to transmit (this function is not used when SAILOR telex modem RM2151 is used, then this is done via the SP-BUS).
OC1 is a fast on/off switch for the RF signal, and is used for ARQ telex.

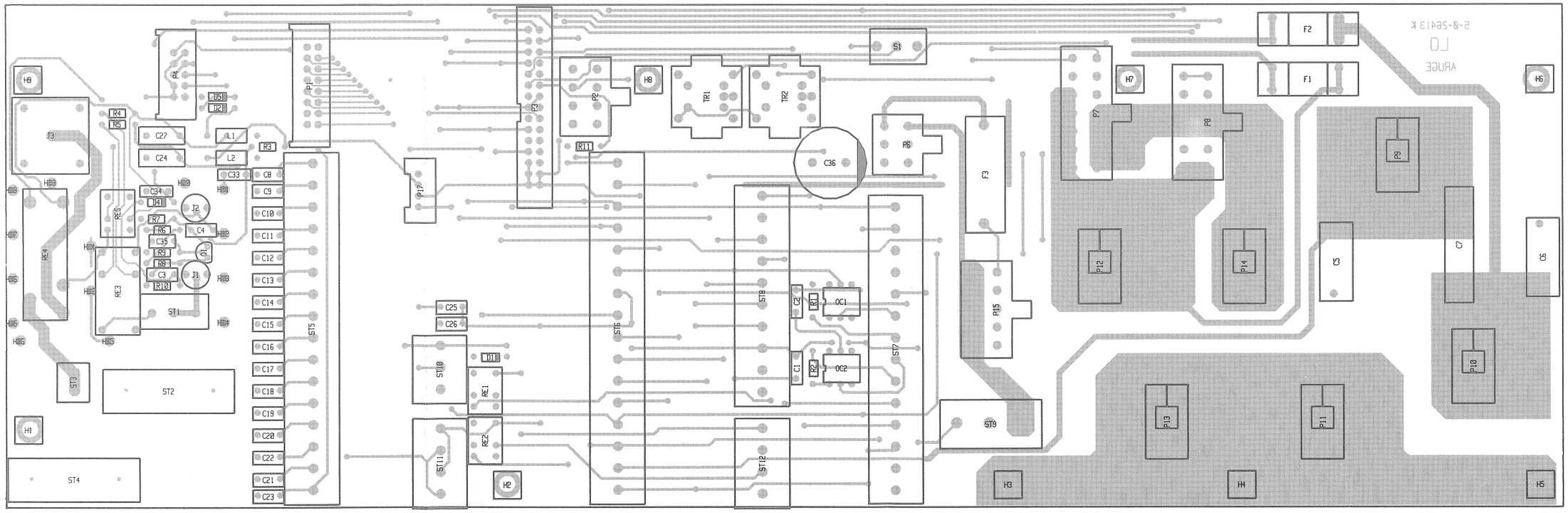
RE1 is a mute relay for external muting. It is activated when the transmitter is ready for transmit, tuning and transmitting.

RE2 is a mute relay for muting of the receiver in RE2100. It has to activated when other transmitters is used on the same installation.

COMPONENT LOCATION CONNECTION BOARD MODULE 13

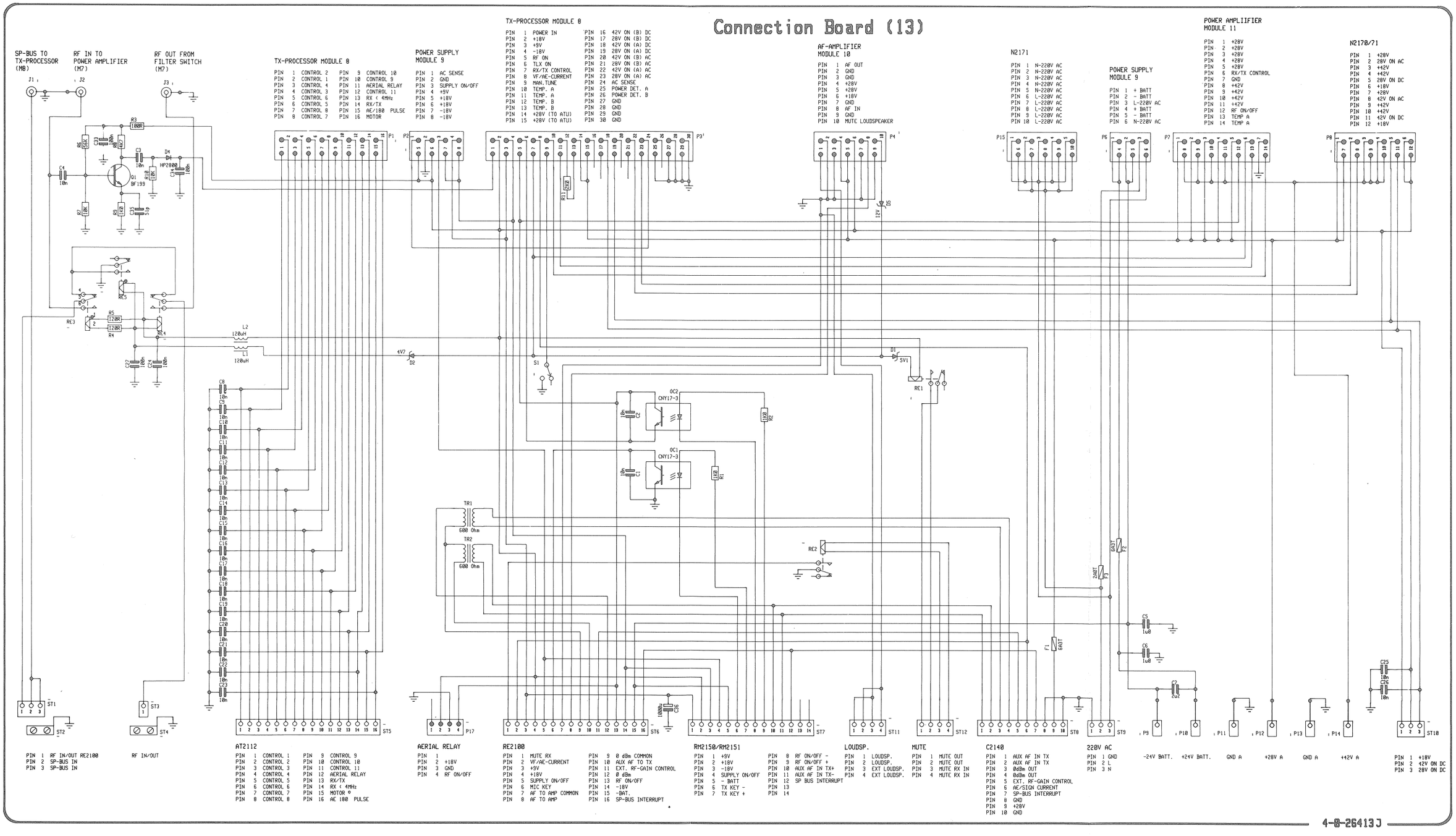


View from component side with upper side tracks.



View from component side with lower side tracks.

CONNECTION BOARD MODULE 13

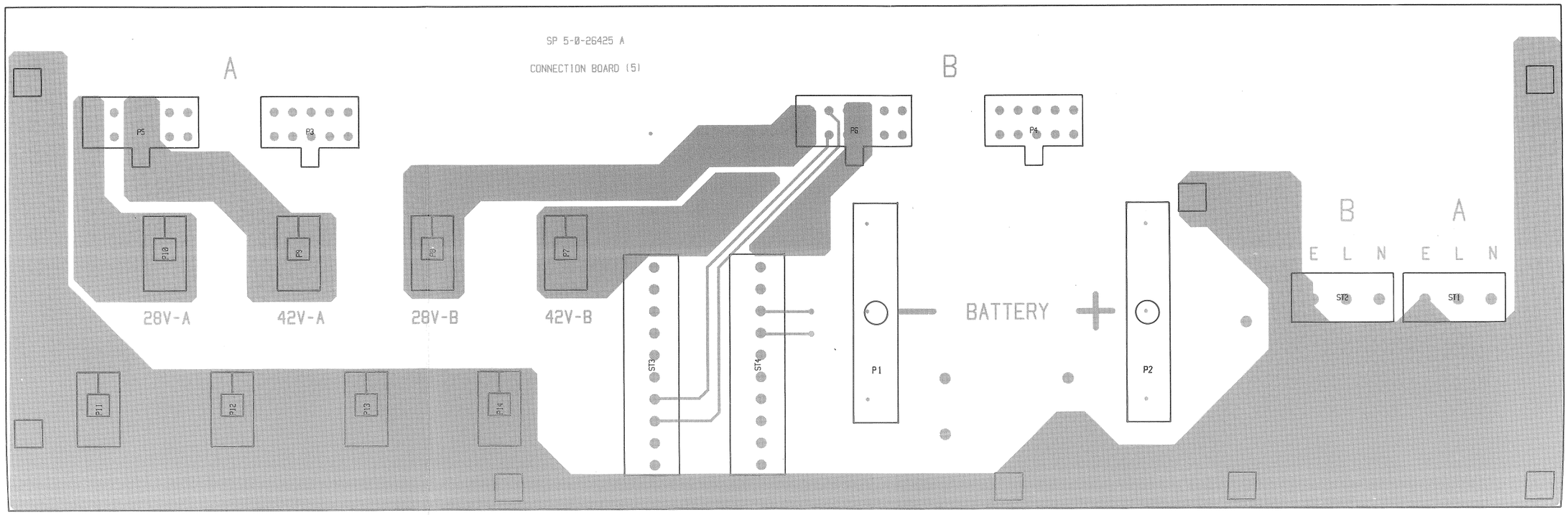


5.2 CONNECTION BOARD (MODULE 5) SP NO. 626425

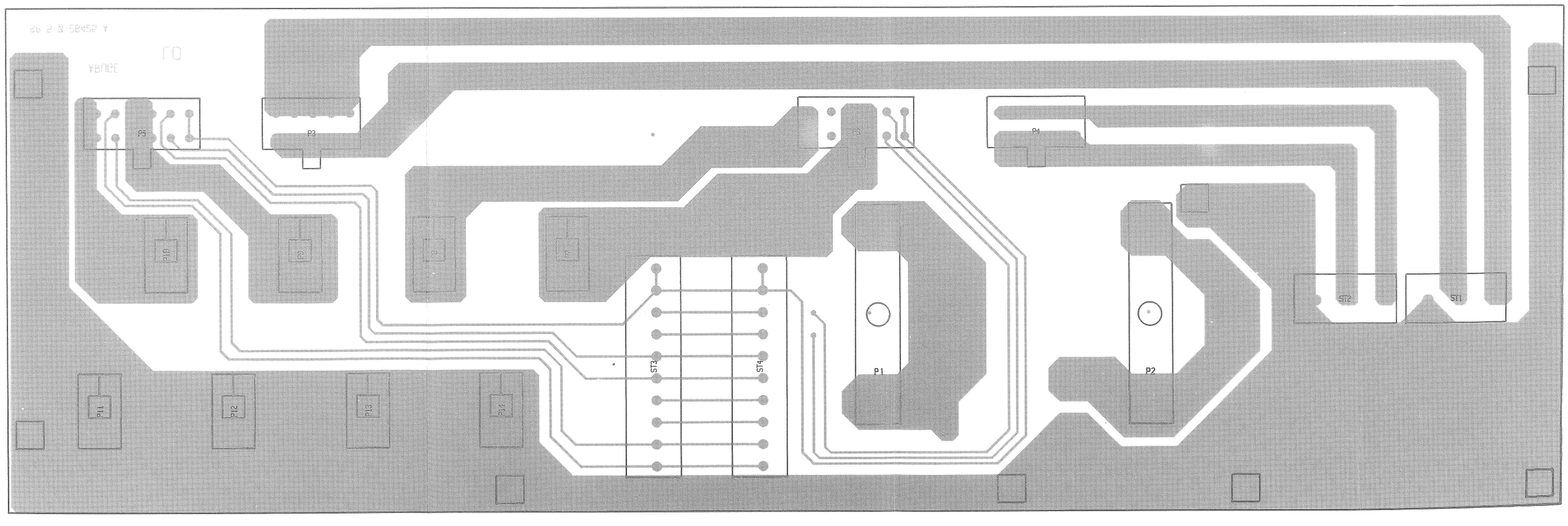
CIRCUIT DESCRIPTION

The connection board (module 5) is a multi connection board intended for connection of different kind of power supply configutations for the 600W or the 1200W transmitter. It can be used for installing a single AC power supply (N2171) or a single DC power supply (N2170) for supplying a 600W transmitter. It can also be used for installing a dual AC power supply (2 x N2171) or a dual DC power supply (2 x N2170) for supplying a 1200W transmitter.

COMPONENT LOCATION CONNECTION BOARD MODULE 5



View from component side with upper side tracks.



View from component side with lower side tracks.

5-0-26425A / 4-6-26425A

CONNECTION BOARD MODULE 5

Connection Board (5)

TO PS-A

PIN	1	AC-N
PIN	2	AC-N
PIN	3	AC-N
PIN	4	
PIN	5	
PIN	6	AC-L
PIN	7	AC-L
PIN	8	AC-L
PIN	9	
PIN	10	

TO PS-B

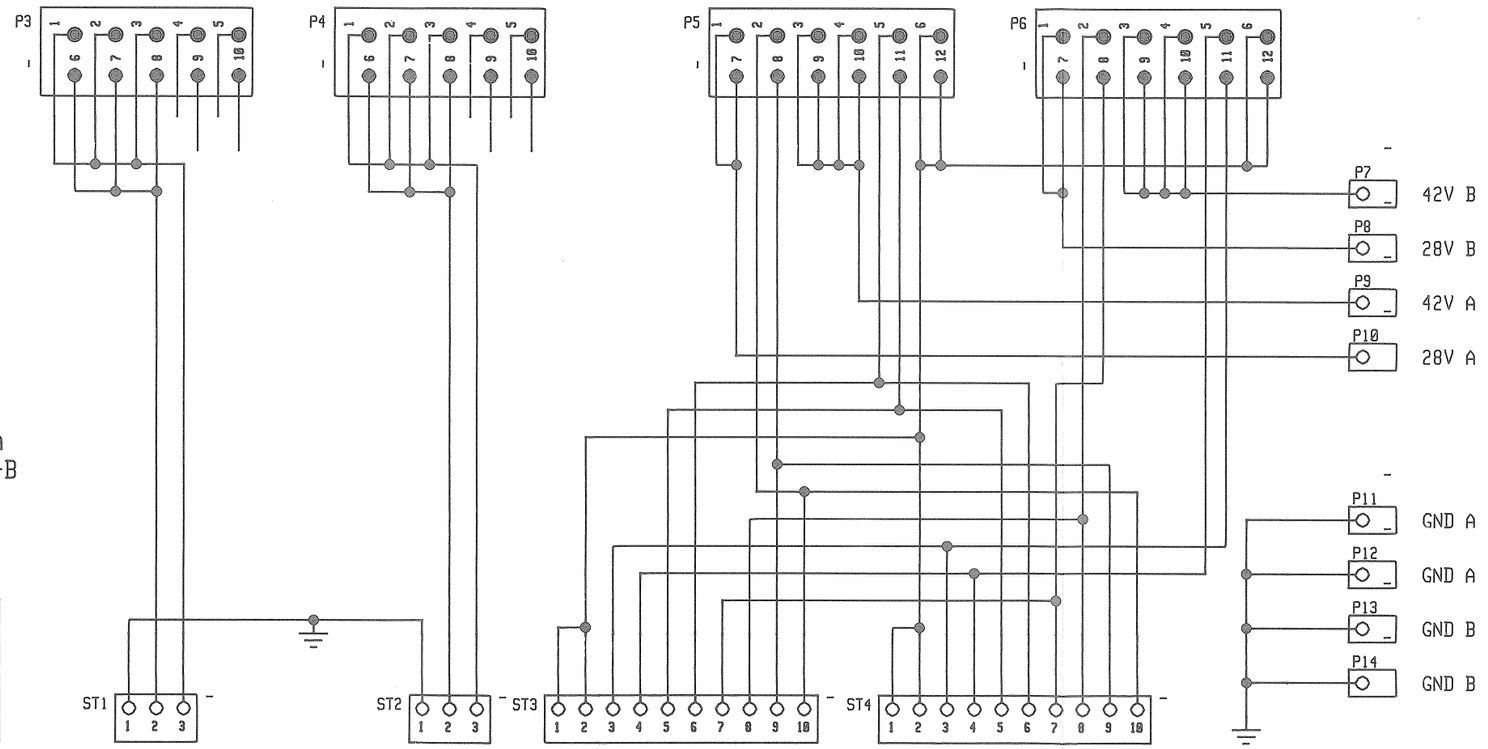
PIN	1	AC-N
PIN	2	AC-N
PIN	3	AC-N
PIN	4	
PIN	5	
PIN	6	AC-L
PIN	7	AC-L
PIN	8	AC-L
PIN	9	
PIN	10	

TO PS-A

PIN	1	+28V
PIN	2	28V ON AC
PIN	3	+42V
PIN	4	+42V
PIN	5	28V ON DC
PIN	6	+18V
PIN	7	+28V
PIN	8	42V ON AC
PIN	9	+42V
PIN	10	+42V
PIN	11	42V ON DC
PIN	12	+18V

TO PS-B

PIN	1	+28V
PIN	2	28V ON AC
PIN	3	+42V
PIN	4	+42V
PIN	5	28V ON DC
PIN	6	+18V
PIN	7	+28V
PIN	8	42V ON AC
PIN	9	+42V
PIN	10	+42V
PIN	11	42V ON DC
PIN	12	+18V



TO T2135 (MODULE 14)

PIN	1	+18V
PIN	2	+18V
PIN	3	42V ON (B) DC
PIN	4	28V ON (B) DC
PIN	5	42V ON (A) DC
PIN	6	28V ON (A) DC
PIN	7	42V ON (B) AC
PIN	8	28V ON (B) AC
PIN	9	42V ON (A) AC
PIN	10	28V ON (A) AC

TO N2170/71

PIN	1	+18V
PIN	2	+18V
PIN	3	42V ON (B) DC
PIN	4	28V ON (B) DC
PIN	5	42V ON (A) DC
PIN	6	28V ON (A) DC
PIN	7	42V ON (B) AC
PIN	8	28V ON (B) AC
PIN	9	42V ON (A) AC
PIN	10	28V ON (A) AC

4-0-26425B

4-0-26425B

5.3 CONN. SINGLE BATTERY CHARGER (MODULE 3) SP NO. 626446

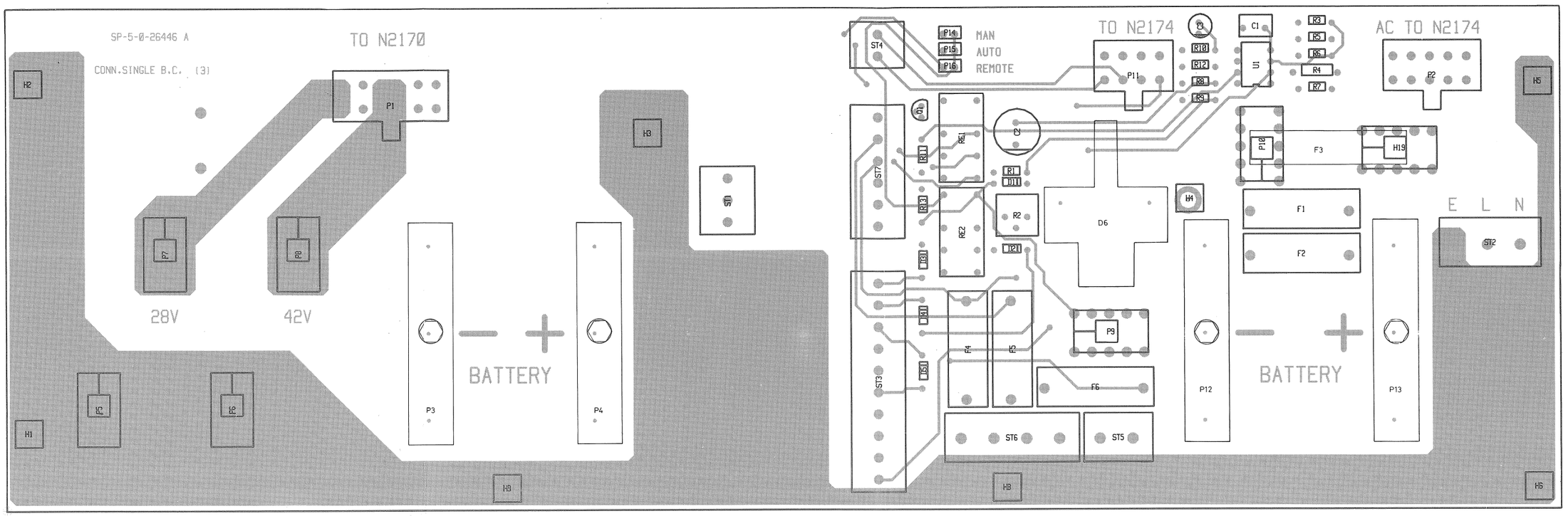
CIRCUIT DESCRIPTION

The connection board consist of two part: One part for connection to the power supply N2170 and one part for connection to the BATTERY CHARGER N2174. The part for the N2174 contains the connections for the REMOTE BOX N2180, for the FUSE BOX N2182, for the battery temperature sensor, for the voltage alarms and for an auxillary output.
The battery voltage and the charge current are monitored by the remote voltage sense wires (+VS and -VS) and by the current shunt wires (+SHUNT and -SHUNT), connected to the connection board and led to the REMOTE BOX N2180.
Connections for the voltage alarms can be connected in several ways depending on the need. The relay RE2 is activated by the "26V" from N2174. When the AC mains fails, the "26V" disappears and the relay RE2 falls. This might be used to give alarm for AC mains failure.
The comparator U1 is a **battery low detector**, which switches off the relay RE1, if the battery voltage goes under a preset value set by R2. Normally it is set for detecting battery voltage under 24VDC.
The diode D6 protects against reverse polarity of the battery.
The connection board also contains a **service strapfield**. It might be useful during adjustment of the charger N2174, if the REMOTE BOX H2180 is placed far away. The strapfield has the same function as the switches in H2180. Normally the strap is placed in REMOTE position, which means the H2180 is controlling the N2174. Moving the strap to MAN position means that the N2174 is forced to charge in MANUAL mode. Moving the strap to AUTO position means that the N2174 is forced to charge in AUTOMATIC mode. Remember to move the strap back to REMOTE position when the adjustment of the N2174 is completed.

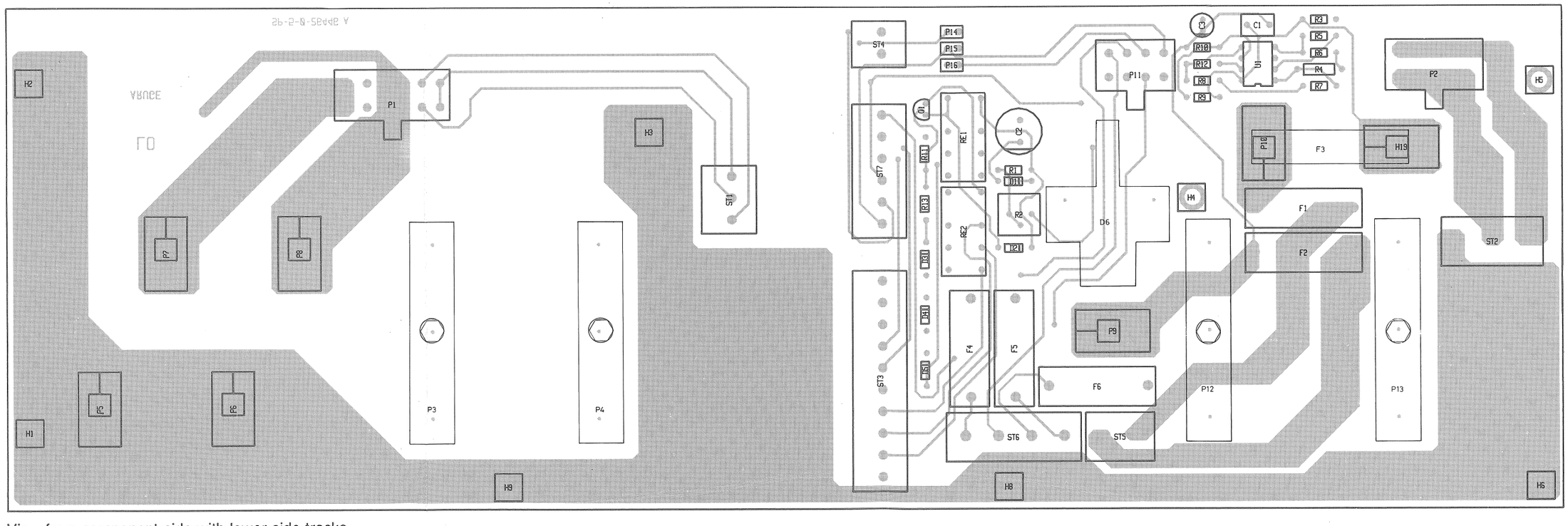
ADJUSTMENT OF BATTERY LOW DETECTOR

Disconnect the connection board from the battery and connect a power supply to the output terminals for the battery and set it for 24.0VDC. Turn R2 fully counter clockwise and the relay RE1 is activated. Then turn R2 slowly clockwise just until the relay RE1 falls. Now the RE1 will fall when battery voltage goes under 24.0V and will not be activated again before the battery voltage is over 25.5V.

COMPONENT LOCATION CONN. SINGLE BATTERY CHARGER MODULE 3

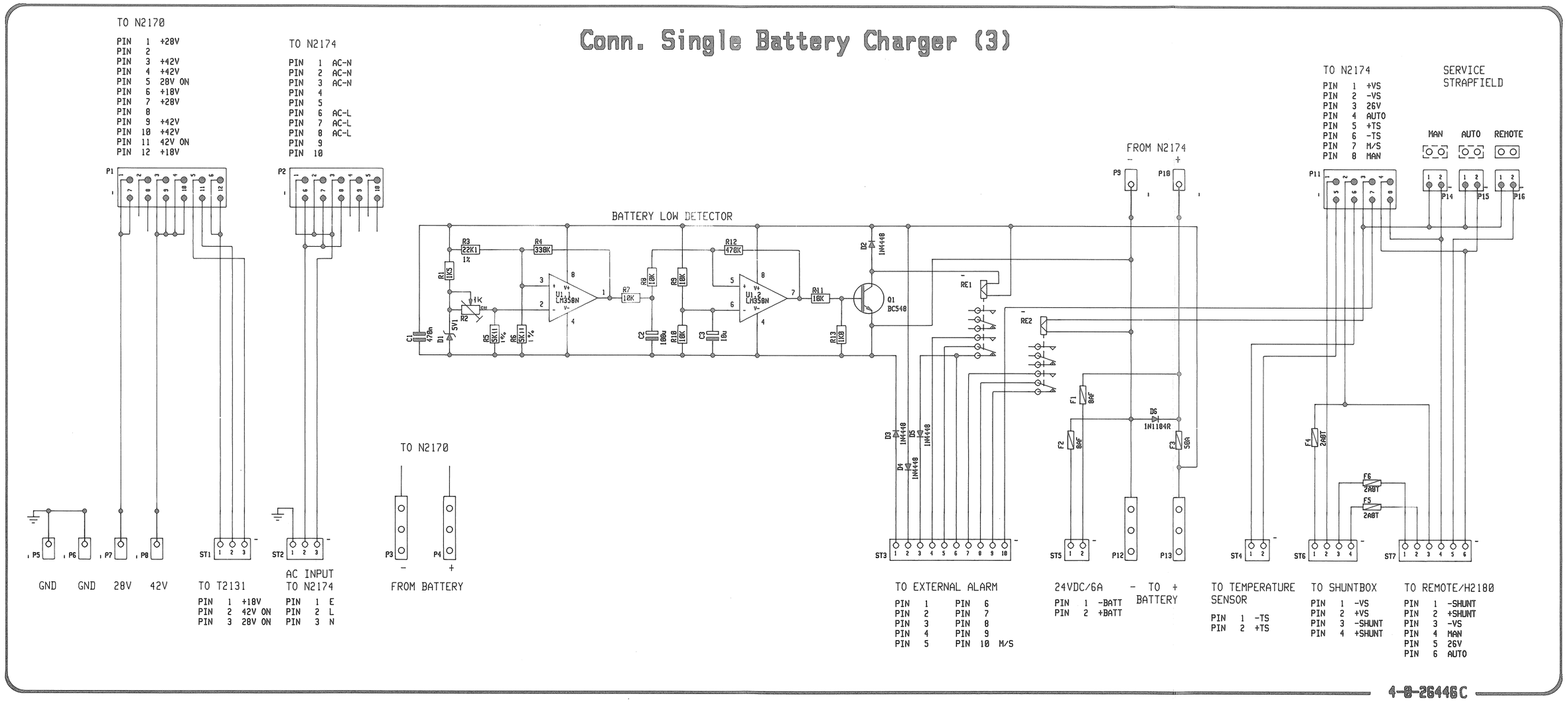


View from component side with upper side tracks.



View from component side with lower side tracks.

CONN. SINGLE BATTERY CHARGER MODULE 3



5.4 CONN. DUAL BATTERY CHARGER (MODULE 4) SP NO. 626447

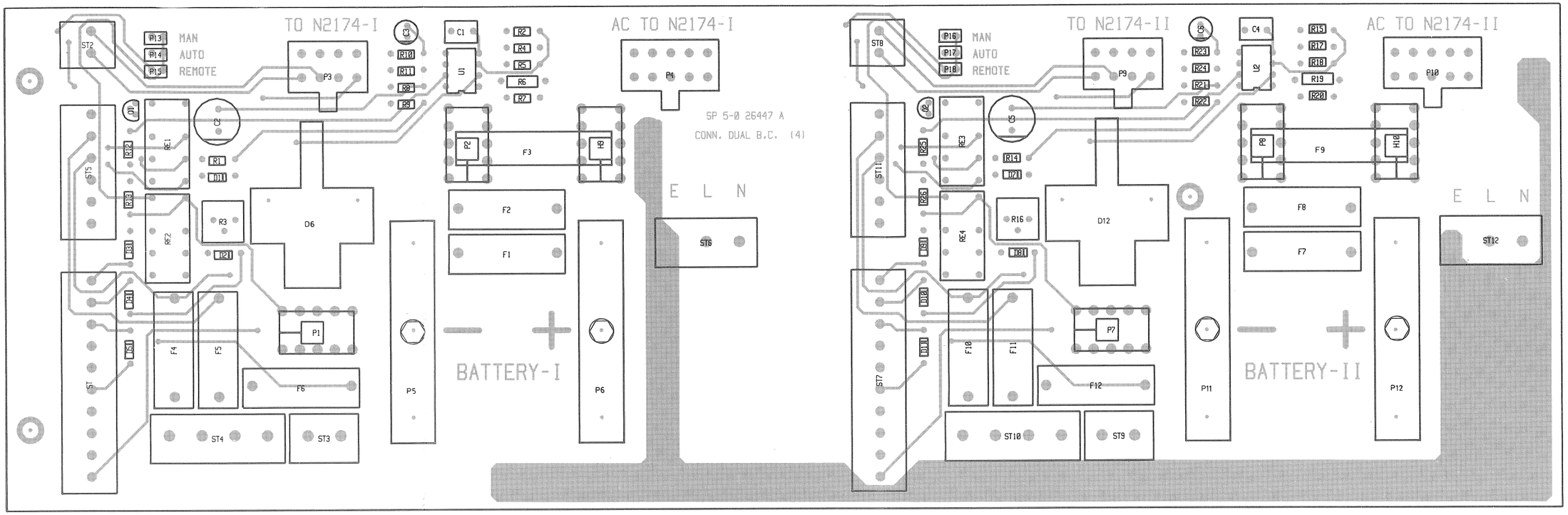
CIRCUIT DESCRIPTION

The connection board consist of two equal parts. One part for each N2174. The two N2174 can be connected as two separate and independent chargers, but the two N2174 can also be connected in parallel (DUAL) to form a high current charger of 60A. In DUAL operation the outputs from both N2174 are connected together. One N2174 is designated MASTER and the other N2174 as SLAVE. The designation is determined by a strap placed in the AUTOMATIC mdule in N2174 (see circuit description for that module). On the connection board the SLAVE unit is connected to the MASTER unit by three wires. That is the MAN wire (ST5 pin 4 to ST11 pin 4), the AUTO wire (ST5 pin 6 to ST11 pin 6) and the M/S wire (ST1 pin 10 to ST7 pin 10). In DUAL operation only the MASTER part of the connection board (normally designated N2174-II) is connected to the environment. It containes all the connections for the REMOTE BOX N2180, for the FUSE BOX N2182, for the battery temperature sensor, for the voltage alarms and for an auxillary output.
The battery voltage and the charge current are monitored by the remote voltage sense wires (+VS and -VS) and by the current shunt wires (+SHUNT and -SHUNT), connected to the connection board and led to the REMOTE BOX N2180.
Connections for the voltage alarms can be connected in several ways depending on the need. The relay RE4 is activated by the "26V" from N2174. When the AC mains fails, the "26V" disappears and the relay RE4 falls. This might be used to give alarm for AC mains failure.
The comparator U2 is a **battery low detector**, which switches off the relay RE3, if the battery voltage goes under a preset value set by R16. Normally it is set for detecting battery voltage under 24VDC.
The diodes D6 and D12 protects against reverse polarisation of the battery.
The connection board also contains a **service strapfield**. It might be useful during adjustment of the charger N2174, if the REMOTE BOX H2180 is placed far away. The strapfield has the same function as the switches in H2180. Normally the strap is placed in REMOTE position, which means the H2180 is controlling the N2174. Moving the strap to MAN position means that the N2174 is forced to charge in MANUAL mode. Moving the strap to AUTO position means that the N2174 is forced to charge in AUTOMATIC mode. Remember to move the strap back to REMOTE position when the adjustment of the N2174 is completed.

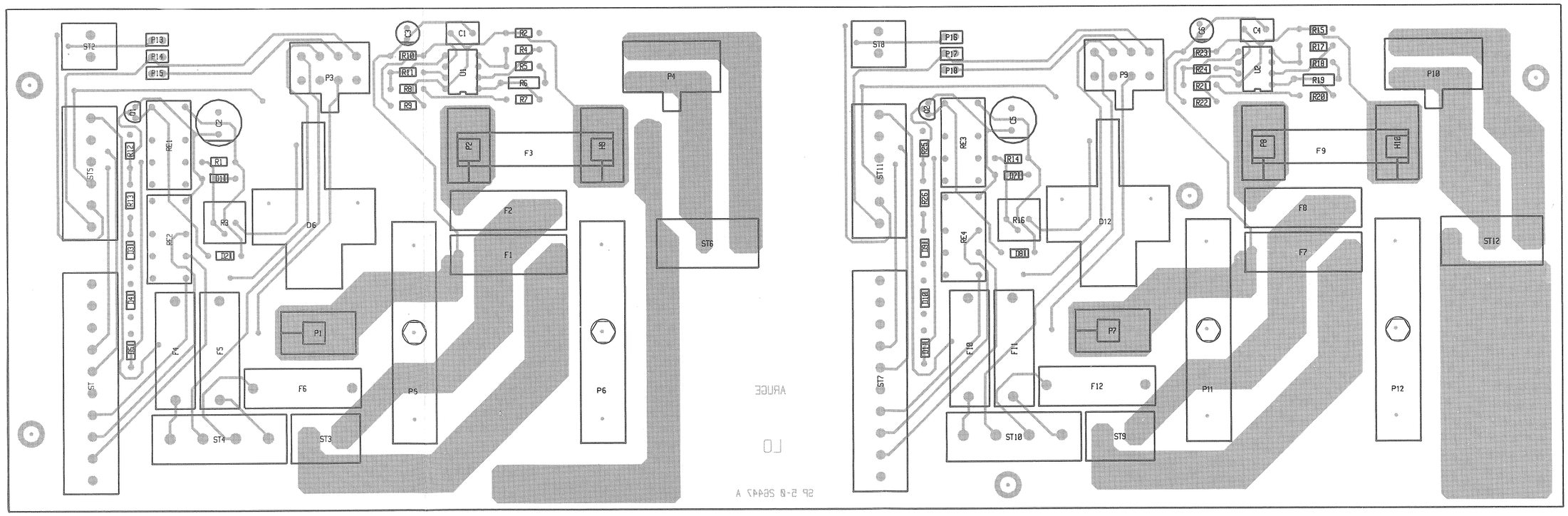
ADJUSTMENT OF BATTERY LOW DETECTOR

Disconnect the connection board from the battery and connect a power supply to the output terminals for the battery and set it for 24.0VDC. Turn R16 fully counter clockwise and the relay RE3 is activated. Then turn R16 slowly clockwise just until the relay RE3 falls. Now the RE3 will fall when battery voltage goes under 24.0V and will not be activated again before the battery voltage is over 25.5V.
The other part of the connection board can be adjusted in the samme way.

COMPONENT LOCATION CONN. DUAL BATTERY CHARGER MODULE 4

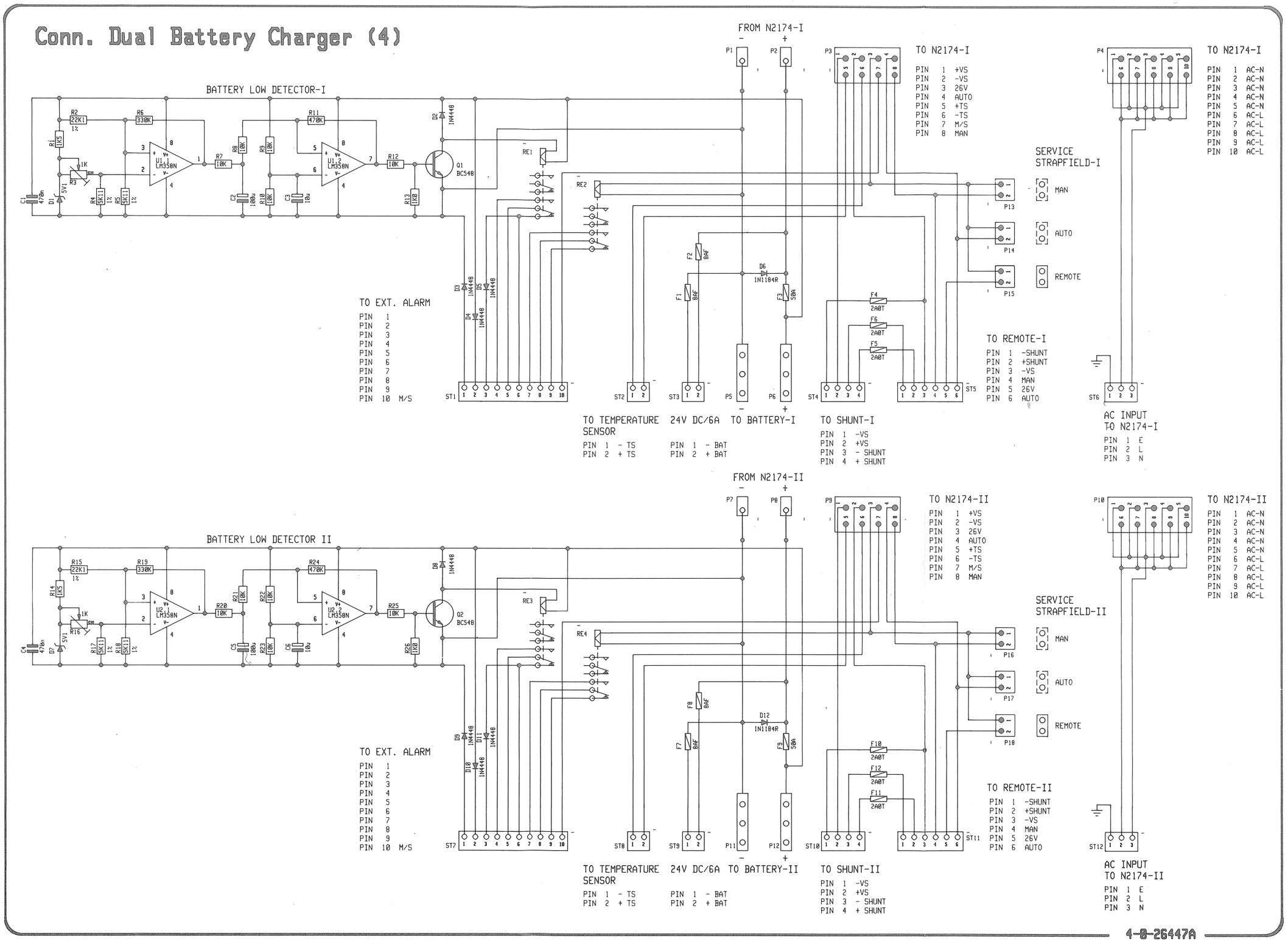


View from component side with upper side tracks.

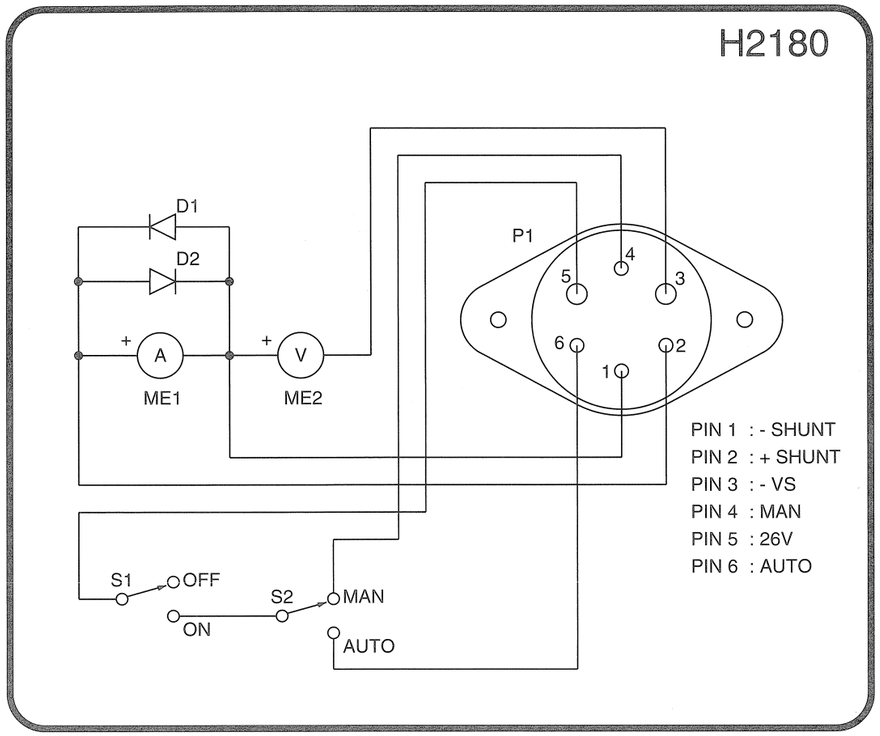


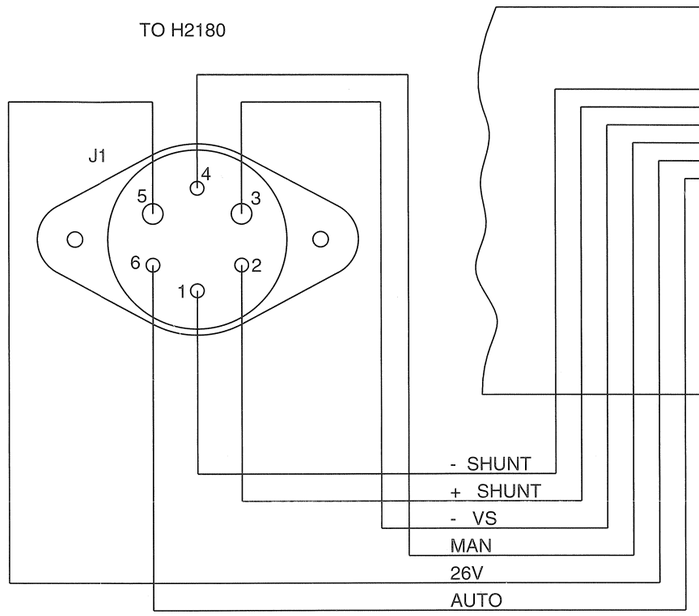
View from component side with lower side tracks.

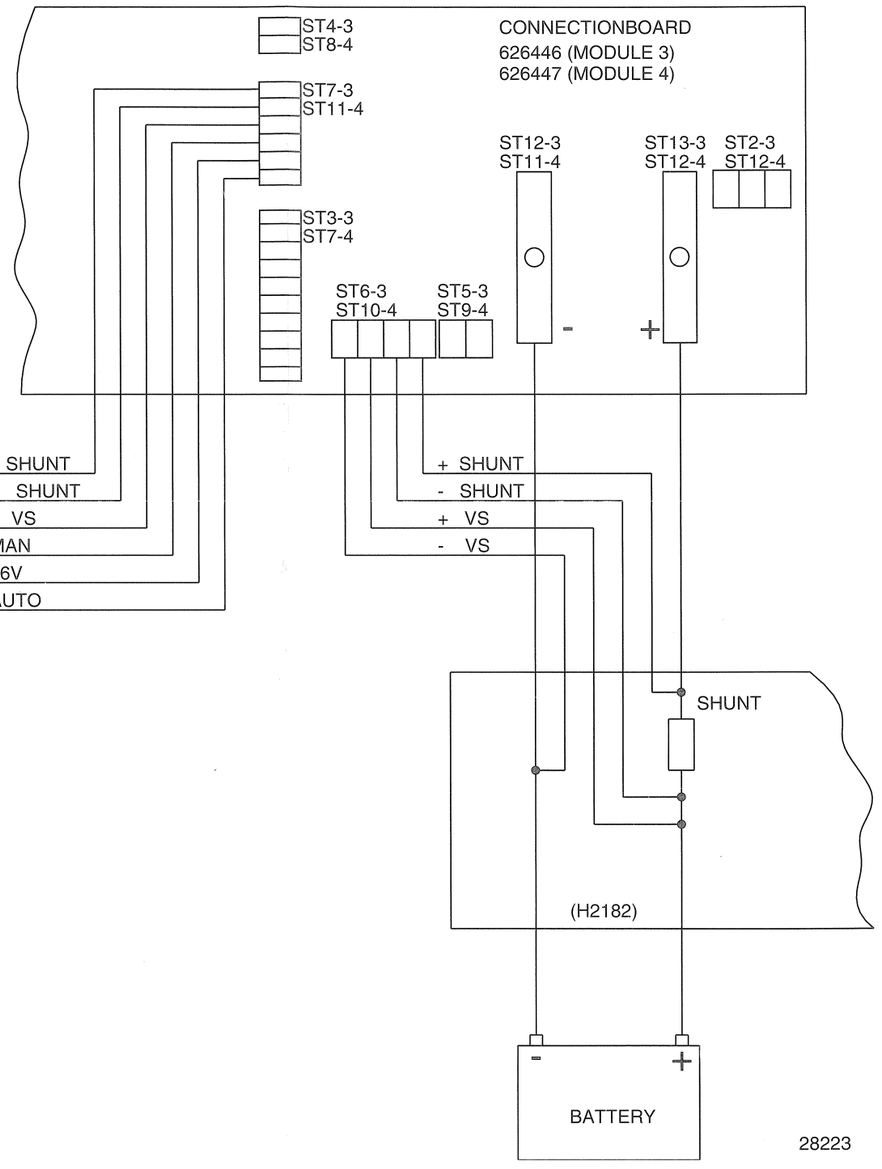
CONN. DUAL BATTERY CHARGER MODULE 4



5.5 REMOTE CONTROL UNIT H2180 FOR N2174 BATTERY CHARGER







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5.6 FUSE BOX H2182

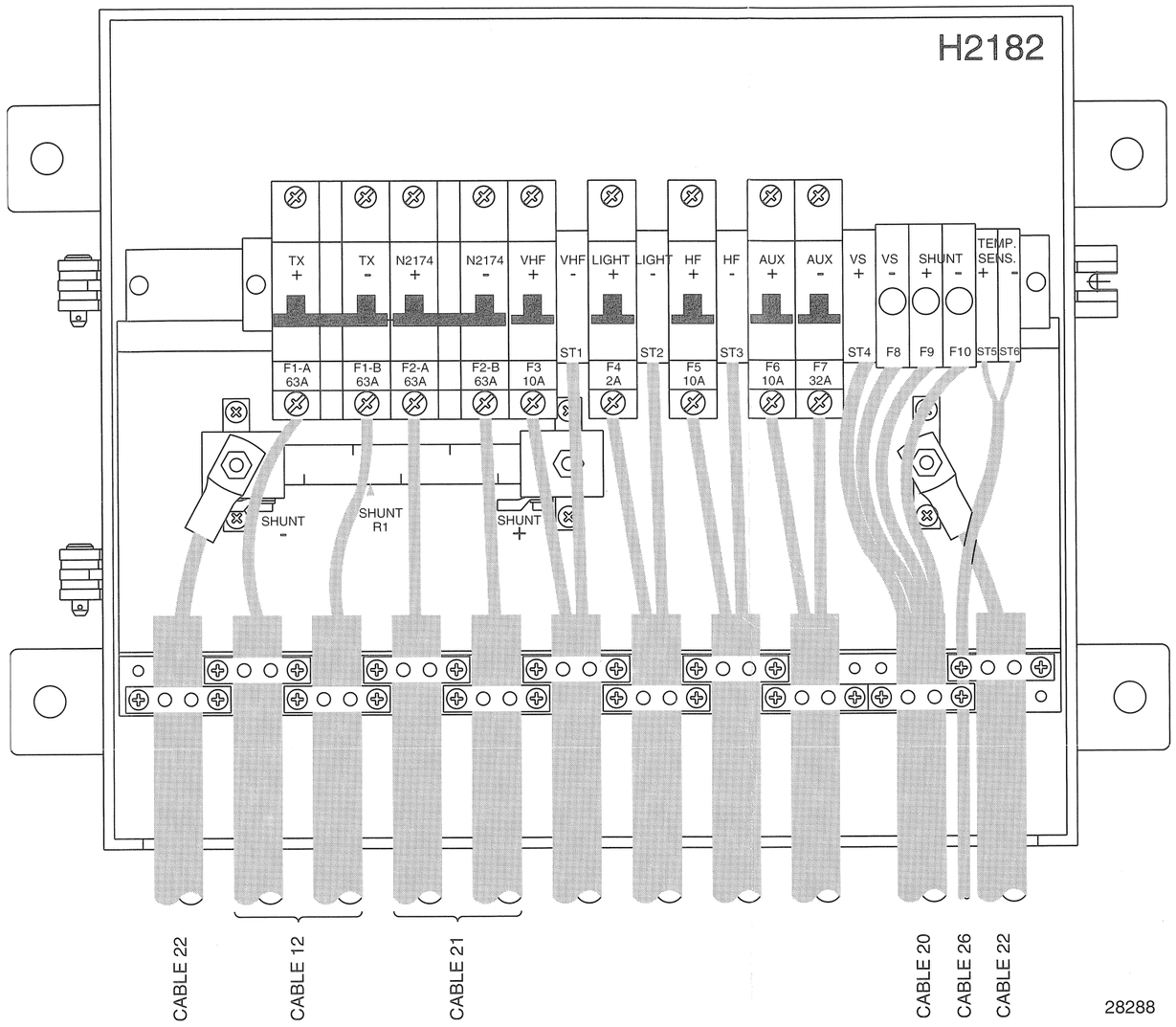
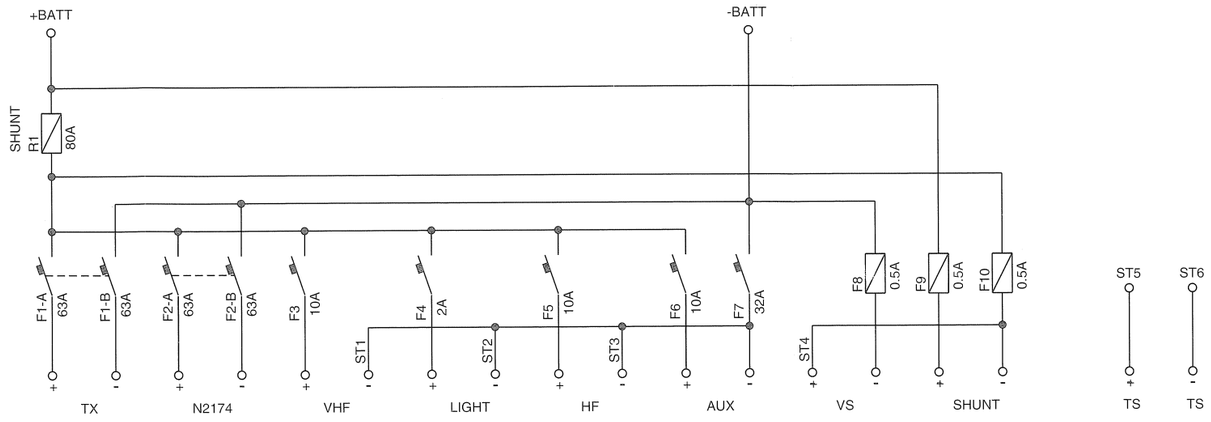


DIAGRAM FOR FUSE BOX H2182



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CONTENTS

6 PARTS LISTS 6-1

GRØN SIDE

6 PARTS LISTS

CONNECTION BOARD 600W	T2131-N2170/N2171	ESPERA	0-0-26395	726395

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
VARIOUS	RF COVER - CON. BOARD	CONNECTIONBOARD 26413/14	ESPERA	1-0-26869	226869
VARIOUS	COAX CABLE Ø3x50cm		ESPERA	0-0-26918	526918
VARIOUS	DISTANCE PIECE	Ø4.8x0.8x8mm	OJD	4,8X0,8X8 MESS.	63.106
VARIOUS	SPARE FUSES F.N2165/HFSSB	N2165	S.P.RADIO	0-0-27245	727245
VARIOUS	KIT, WASHERS AND NUTS,FOR	CONNECTION BOARD 6/1200W	ESPERA	0-0-27676	727676
VARIOUS	SCREW M3x12mm PHJX-Z	DIN 7985	HFC	HFC9041 M3x12 PHJX-Z DIN 7985	86.956
-13	CONNECTION BOARD MODUL.13	T2131/N2170/N2171 - 600W	ESPERA	5-0-26413K / 4-0-26413J	626413

CONNECTION BOARD MODULE 13	T2131/N2170/N2171 - 600W	ESPERA	5-0-26413K / 4-0-26413J	626413

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
VARIOUS	FUSE COVER	5x20mm FUSE SIZE	ELU	199016	48.716
VARIOUS	FUSE HOLDER	FOR PCB	SHURTER	OG 751 0042	78.421
VARIOUS	SCREW M3x12mm PHJX-Z	DIN 7985	HFC	HFC9041 M3x12 PHJX-Z DIN 7985	86.956
VARIOUS	SCREW M3x16 PHJX-Z	DIN 7985	WULCAN	HFC 9041 M3x16 PHJX-Z DIN 7985	86.957
VARIOUS	SCREW	M5x12 STEEL	HFC	HFC 473 FORZ.	87.413
C1-13	CAPACITOR MKT	10nF 5% 63VDC	PHILIPS	2222 370 89103	11.134
C2-13	CAPACITOR MKT	10nF 5% 63VDC	PHILIPS	2222 370 89103	11.134
C3-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C4-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C5-13	CAPACITOR MKT	1u0F 10% 100VDC	PHILIPS	2222 373 21105	11.079
C6-13	CAPACITOR MKT	1u0F 10% 100VDC	PHILIPS	2222 373 21105	11.079
C7-13	CAPACITOR MKT	2u2F 10% 100VDC	PHILIPS	2222 373 90002	11.142
C8-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C9-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C10-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C11-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C12-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C13-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C14-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C15-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C16-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C17-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C18-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C19-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C20-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C21-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C22-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C23-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C24-13	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C25-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
C26-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C27-13	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C33-13	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C34-13	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C35-13	CAPACITOR CERAMIC	51pF 5% NPO 50VDC	NKE	DT 360 758S CH 510 J 50V FLAT PACK	15.110
C36-13	CAPACITOR ELECTROLYTIC	1000uF -10/+50% 25VDC	ERO	EKM 05 JG 410 E 05	14.600
D1-13	DIODE ZENER	5.1V 5% 0.4W BZX79C5V1	PHILIPS	BZX79C5V1	26.527
D2-13	DIODE ZENER	4.7V 5% 0.4W BZX79C4V7	PHILIPS	BZX79C4V7	26.524
D4-13	DIODE SCHOTTKY BARRIER	70V/15mA 1N5711/5082-2800	SGS-THOMSON	1N5711	27.500
D5-13	DIODE ZENER	12V 5% 0.4W BZX79C12	PHILIPS*	BZX79C12	26.554
F1-13	FUSE	5x20mm 6A3 T 250V	* ELU	17912006300	45.510
F2-13	FUSE	5x20mm 6A3 T 250V	* ELU	17912006300	45.510
F3-13	FUSE	2AT 250V 5x20mm	ELU	179 120 2AT	45.508
VARIOUS	FUSE HOLDER	1 POLE 5x20mm PCB VERSION	ELU	199015	78.398
J1-13	SOCKET COAX	VERTICAL FOR PCB MOUNT.	TAIKO	TMP-J01X-V6	78.518
J2-13	SOCKET COAX	VERTICAL FOR PCB MOUNT.	TAIKO	TMP-J01X-V6	78.518
J3-13	SOCKET BNC	PCB VERSION	ROSENBERGER	51K102-400 A4	78.444
L1-13	CHOKE FIXED	120uH 10%	FASTRON	MICC-121K-02	20.372
L2-13	CHOKE FIXED	120uH 10%	FASTRON	MICC-121K-02	20.372
OC1-13	OPTO COUPLER	CNY17-3	TOSHIBA	CNY17-3	32.533
OC2-13	OPTO COUPLER	CNY17-3	TOSHIBA	CNY17-3	32.533
P1-13	MULTI PLUG	2x8 POLES PCB VERSION	3M	3599-6002 / 7616-6002 JL	78.249
P2-13	MULTIPLUG	2x4 POLES PCB VERSION	MOLEX	39-28-1083	78.218
P3-13	MULTIPLUG	2x15 POLES PCB VERSION	3M	3531-6002 / 7630-6002 JL	78.253
P4-13	PLUG	2x5 POLES	3M	3654-6002 / 7610-6002 JL	78.251
P6-13	MULTIPLUG	2x3 POLES PCB VERSION	MOLEX	39-28-1063	78.217
P7-13	MULTIPLUG	2x7 POLES PCB VERSION	MOLEX	39-28-1143	78.222
P8-13	MULTIPLUG	2x6 POLES PCB VERSION	MOLEX	39-28-1123	78.221
P9-13	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P10-13	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P11-13	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P12-13	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P13-13	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P14-13	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P15-13	MULTIPLUG	2x5 POLES PCB VERSION	MOLEX	39-28-1103	78.220
P17-13	PLUG (MALE)	4 POLE	AMP	0-826375-4	78.104
Q1-13	TRANSISTOR RF	BF199	PHILIPS	BF199	28.178
R1-13	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R2-13	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R3-13	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R4-13	RESISTOR MF	120 OHM 5% 0.33W	PHILIPS	2322 180 73121	02.450
R5-13	RESISTOR MF	120 OHM 5% 0.33W	PHILIPS	2322 180 73121	02.450
R6-13	RESISTOR MF	56k OHM 5% 0.33W	PHILIPS	2322 180 73563	02.514
R7-13	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R8-13	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R9-13	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R10-13	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R11-13	RESISTOR MF	2k0 OHM 5% 0.33W	PHILIPS	2322 180 73202	02.479
RE1-13	RELAY	12VDC 1SH. 2A.	MILTRONIC AB	OUC-S-112D	21.300
RE2-13	RELAY	12VDC 1SH. 2A.	MILTRONIC AB	OUC-S-112D	21.300
RE3-13	RELAY	15V DC 2A 1SH.	SIEMENS	V23040-A0003-B201	21.062
RE4-13	RELAY	12VDC 1SH. 8A.	SCHRACK	RY S 12 012	21.031
RE5-13	RELAY	12VDC 1SH. 2A.	MILTRONIC AB	OUC-S-112D	21.300
S1-13	SWITCH TOGGLE	SPDT ON-ON	C&K	7101-S-Y-C-Q-E	43.019
ST11-13	TERMINAL BLOCK	4 POLES 1.5mm2	PTR	AK300/4b M:MESS.SKRUER BLÅ	81.025
ST12-13	TERMINAL BLOCK	4 POLES 1.5mm2	PTR	AK300/4b M:MESS.SKRUER BLÅ	81.025
ST1-13	TERMINAL BLOCK	3 POLES 1.5mm2	PTR	AK500/3DS m.MESS.SKRUER	81.008
ST2-13			ESPERA	1-0-23762 *	207607
ST3-13	TERMINAL BLOCK	SINGLE POLE	RIACON	360291	81.028
ST4-13			ESPERA	1-0-23762 *	207607
ST5-13	TERMINAL BLOCK	16 POLES 1.5mm2	PTR	AK300/16b m.MESS SKRUER BLÅ	81.014
ST6-13	TERMINAL BLOCK	16 POLES 1.5mm2	PTR	AK300/16b m.MESS SKRUER BLÅ	81.014
ST7-13	TERMINAL BLOCK	14 POLES 1.5mm2	PTR	AK300/14b m.MESS.SKRUER	81.029
ST8-13	TERMINAL BLOCK	10 POLES 1.5mm2	PTR	AK300/10b m.MESS.SKRUER BLÅ	81.017

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
ST9-13	TERMINAL BLOCK	3 POLES 2.5mm2	PTR	AK110/3DS m.MESS.SKRUER	81.037
ST10-13	TERMINAL BLOCK	3 POLES 1.5mm2	PTR	AK300/3b m.MESS.SKRUER	81.026
TR1-13	TRAFO AF	1:1 600 OHMS	TDK	L04EE13-C10153	22.500
TR2-13	TRAFO AF	1:1 600 OHMS	TDK	L04EE13-C10153	22.500

CONNEC.BOARD POWER SUPPLY N2170/71 SINGLE & DUAL ESPERA 0-0-26397 726397

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
VARIOUS	DISTANCE PIECE	Ø4.8x0.8x8mm	OJD	4,8X0,8X8 MESS.	63.106
VARIOUS	KIT, WASHERS AND NUTS,FOR	CONNECTION BOARD 6/1200W	ESPERA	0-0-27676	727676
VARIOUS	SCREW M3x12mm PHJX-Z	DIN 7985	HFC	HFC9041 M3x12 PHJX-Z DIN 7985	86.956
-5	CONNECTION BOARD MODULE 5	N2170/N2171	ESPERA	5-0-26425A / 4-0-26425B	626425

CONNECTION BOARD MODULE 5 N2170/N2171 ESPERA 5-0-26425A / 4-0-26425B 626425

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
P1-5			ESPERA	2-0-25057 *	200878
P2-5			ESPERA	2-0-25057 *	200878
P3-5	MULTIPLUG	2x5 POLES PCB VERSION	MOLEX	39-28-1103	78.220
P4-5	MULTIPLUG	2x5 POLES PCB VERSION	MOLEX	39-28-1103	78.220
P5-5	MULTIPLUG	2x6 POLES PCB VERSION	MOLEX	39-28-1123	78.221
P6-5	MULTIPLUG	2x6 POLES PCB VERSION	MOLEX	39-28-1123	78.221
P7-5	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P8-5	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P9-5	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P10-5	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P11-5	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P12-5	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P13-5	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P14-5	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
ST1-5	TERMINAL BLOCK	3 POLES 2.5mm2	PTR	AK110/3DS m.MESS.SKRUER	81.037
ST2-5	TERMINAL BLOCK	3 POLES 2.5mm2	PTR	AK110/3DS m.MESS.SKRUER	81.037
ST3-5	TERMINAL BLOCK	10 POLES 1.5mm2	PTR	AK300/10b m.MESS.SKRUER BLÅ	81.017
ST4-5	TERMINAL BLOCK	10 POLES 1.5mm2	PTR	AK300/10b m.MESS.SKRUER BLÅ	81.017

CONNECTION BOARD N2174 SINGLE & N2174/N2170 S.P.RADIO A/S 0-0-26398 726398

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
VARIOUS	DISTANCE PIECE	Ø4.8x0.8x8mm	OJD	4,8X0,8X8 MESS.	63.106
VARIOUS	SPARE FUSES FOR N2174	CONNECTION BOARDS	S.P.RADIO	0-0-27794	727794
VARIOUS	SCREW M3x12mm PHJX-Z	DIN 7985	HFC	HFC9041 M3x12 PHJX-Z DIN 7985	86.956
-3	CONNECTION SINGLE BATTERY	CHARGER(MODULE 3)N2170/74	ESPERA	5-0-26446A	626446
D6-3	DIODE POW.RECT.35A/100VDC	1N1184R/BYX52-300R	INT.RECTIFIER	1N1184R INCL.HARDWARE (1N1185R,-86R,-----,-90R)	25.165
F3-3	FUSE	50A 11x41mm	BOSCH	1 191 017 005 DIN 72 581 - B 50	45.702
R1	SHUNT 80A-75mV		SIFAM	SHUNT MEDIUM CURRENT 80A-75mV	23.160

CONNECTION SINGLE BATTERY CHARGER (MODULE 3) N2170/74 ESPERA 5-0-26446A 626446

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
C1-3	CAPACITOR MKT	470nF 20% 63VDC	ERO	MKT 1826-447/06 6-G	11.188
C2-3	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C3-3	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ERO	EKI 00 AA 210 F M0E	14.512

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
D1-3	DIODE ZENER	5.1V 5% 0.4W BZX79C5V1	PHILIPS	BZX79C5V1	26.527
D2-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D3-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D4-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D5-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D6-3	DIODE POW.RECT.35A/100VDC	1N1184R/BYX52-300R	INT.RECTIFIER	1N1184R INCL.HARDWARE (1N1185R,-86R,-----,-90R)	25.165
F1-3	FUSE	8AF 250V Ø5x20mm	ELU	171 100 8AF (DIN 41571/1)	45.561
F2-3	FUSE	8AF 250V Ø5x20mm	ELU	171 100 8AF (DIN 41571/1)	45.561
F3-3	FUSE	50A 11x41mm	BOSCH	1 191 017 005 DIN 72 581 - B 50	45.702
F4-3	FUSE	2AT 250V 5x20mm	ELU	179 120 2AT	45.508
F5-3	FUSE	2AT 250V 5x20mm	ELU	179 120 2AT	45.508
F6-3	FUSE	2AT 250V 5x20mm	ELU	179 120 2AT	45.508
P1-3	MULTIPLUG	2x6 POLES PCB VERSION	MOLEX	39-28-1123	78.221
P2-3	MULTIPLUG	2x5 POLES PCB VERSION	MOLEX	39-28-1103	78.220
P3-3			ESPERA	2-0-25057 *	200878
P4-3			ESPERA	2-0-25057 *	200878
P5-3	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P6-3	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P7-3	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P8-3	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P9-3	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P10-3	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P11-3	MULTIPLUG	2x4 POLES PCB VERSION	MOLEX	39-28-1083	78.218
P12-3			ESPERA	2-0-25057 *	200878
P13-3			ESPERA	2-0-25057 *	200878
P14-3	PLUG	1/10" SIL SQ.PINS 2 POLES	AMP	0-826629-2 (0-826647-2)	78.322
P15-3	PLUG	1/10" SIL SQ.PINS 2 POLES	AMP	0-826629-2 (0-826647-2)	78.322
P16-3	PLUG	1/10" SIL SQ.PINS 2 POLES	AMP	0-826629-2 (0-826647-2)	78.322
Q1-3	TRANSISTOR AF	BC548 NPN TO-92	PHILIPS	BC548 (-A/-B/-C)	28.070
R1-3	RESISTOR MF	1k5 OHM 5% 0.33W	PHILIPS	2322 180 73152	02.476
R2-3	PRESET CERMET	1k0 OHM 10% 0.5W	BOURNS	3386P-1-102	07.886
R3-3	RESISTOR MF	22k1 OHM 1% 0.25W	PHILIPS	2322 157 12213	02.234
R4-3	RESISTOR MF	330k OHM 5% 0.4W	PHILIPS	2322 181 53334	01.262
R5-3	RESISTOR MF	5k11 OHM 1% 0.25W	PHILIPS	2322 157 15112	02.228
R6-3	RESISTOR MF	5k11 OHM 1% 0.25W	PHILIPS	2322 157 15112	02.228
R7-3	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R8-3	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R9-3	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R10-3	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R11-3	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R12-3	RESISTOR MF	470k OHM 5% 0.33W	PHILIPS	2322 180 73474	02.536
R13-3	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
RE1-3	RELAY	24VDC 2SH. 2A	OMRON	G5V-2-24 VDC	21.327
RE2-3	RELAY	24VDC 2SH. 2A	OMRON	G5V-2-24 VDC	21.327
ST1-3	TERMINAL BLOCK	3 POLES 1.5mm2	PTR	AK300/3b m.MESS.SKRUER	81.026
ST2-3	TERMINAL BLOCK	3 POLES 2.5mm2	PTR	AK110/3DS m.MESS.SKRUER	81.037
ST3-3	TERMINAL BLOCK	10 POLES 1.5mm2	PTR	AK300/10b m.MESS.SKRUER BLÅ	81.017
ST4-3	TERMINAL BLOCK	2 POLES 1.5mm2	PTR	AK300/2b m.MESS.SKRUER BLÅ	81.023
ST5-3	TERMINAL BLOCK	2 POLES 2.5mm2	PTR	AK110/2DS m.MESS.SKRUER	81.035
ST6-3	TERMINAL BLOCK	4 POLES 2.5mm2	PTR	AK110/4DS m.MESS.SKRUER	81.038
ST7-3	TERMINAL BLOCK	6 POLES 1.5mm2	PTR	AK300/6b m.MESS.SKRUER BLÅ	81.016
U1-3	DUAL OP AMP	LM358N	TEXAS	LM358P	31.100

CONNECTION BOARD	N2174 DUAL	S.P.RADIO A/S 0-0-26398	726399

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
VARIOUS	DISTANCE PIECE	Ø4.8x0.8x8mm	OJD	4,8X0,8X8 MESS.	63.106
VARIOUS	SPARE FUSES FOR N2174	CONNECTION BOARDS	S.P.RADIO	0-0-27794	727794

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
VARIOUS	SCREW M3x12mm PHJX-Z	DIN 7985	HFC	HFC9041 M3x12 PHJX-Z DIN 7985	86.956
-4	CONNECTION DUAL BATTERY	CHARGER (MODULE 4) N2174	ESPERA	5-0-26447A	626447
D6-4	DIODE POW.RECT.35A/100VDC	1N1184R/BYX52-300R	INT.RECTIFIER	1N1184R INCL.HARDWARE (1N1185R,-86R,-----,-90R)	25.165
D12-4	DIODE POW.RECT.35A/100VDC	1N1184R/BYX52-300R	INT.RECTIFIER	1N1184R INCL.HARDWARE (1N1185R,-86R,-----,-90R)	25.165
F3-4	FUSE	50A 11x41mm	BOSCH	1 191 017 005 DIN 72 581 - B 50	45.702
F9-4	FUSE	50A 11x41mm	BOSCH	1 191 017 005 DIN 72 581 - B 50	45.702
R1	SHUNT 80A-75mV		SIFAM	SHUNT MEDIUM CURRENT 80A-75mV	23.160

CONNECTION DUAL BATTERY CHARGER (MODULE 4) N2174 ESPERA 5-0-26447A 626447

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	CONNECTION DUAL BATTERY	CHARG.(4) FOR N2174 DUAL		5-0-26447A/ 1-0-26447	52.017
C1-4	CAPACITOR MKT	470nF 20% 63VDC	ERO	MKT 1826-447/06 6-G	11.188
C2-4	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C3-4	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ERO	EKI 00 AA 210 F M0E	14.512
C4-4	CAPACITOR MKT	470nF 20% 63VDC	ERO	MKT 1826-447/06 6-G	11.188
C5-4	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C6-4	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ERO	EKI 00 AA 210 F M0E	14.512
D1-4	DIODE ZENER	5.1V 5% 0.4W BZX79C5V1	PHILIPS	BZX79C5V1	26.527
D2-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D3-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D4-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D5-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D6-4	DIODE POW.RECT.35A/100VDC	1N1184R/BYX52-300R	INT.RECTIFIER	1N1184R INCL.HARDWARE (1N1185R,-86R,-----,-90R)	25.165
D7-4	DIODE ZENER	5.1V 5% 0.4W BZX79C5V1	PHILIPS	BZX79C5V1	26.527
D8-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D9-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D10-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D11-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D12-4	DIODE POW.RECT.35A/100VDC	1N1184R/BYX52-300R	INT.RECTIFIER	1N1184R INCL.HARDWARE (1N1185R,-86R,-----,-90R)	25.165
F1-4	FUSE	8AF 250V Ø5x20mm	ELU	171 100 8AF (DIN 41571/1)	45.561
F2-4	FUSE	8AF 250V Ø5x20mm	ELU	171 100 8AF (DIN 41571/1)	45.561
F3-4	FUSE	50A 11x41mm	BOSCH	1 191 017 005 DIN 72 581 - B 50	45.702
F4-4	FUSE	2AT 250V 5x20mm	ELU	179 120 2AT	45.508
F5-4	FUSE	2AT 250V 5x20mm	ELU	179 120 2AT	45.508
F6-4	FUSE	2AT 250V 5x20mm	ELU	179 120 2AT	45.508
F7-4	FUSE	8AF 250V Ø5x20mm	ELU	171 100 8AF (DIN 41571/1)	45.561
F8-4	FUSE	8AF 250V Ø5x20mm	ELU	171 100 8AF (DIN 41571/1)	45.561
F9-4	FUSE	50A 11x41mm	BOSCH	1 191 017 005 DIN 72 581 - B 50	45.702
F10-4	FUSE	2AT 250V 5x20mm	ELU	179 120 2AT	45.508
F11-4	FUSE	2AT 250V 5x20mm	ELU	179 120 2AT	45.508
F12-4	FUSE	2AT 250V 5x20mm	ELU	179 120 2AT	45.508
P1-4	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P2-4	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P3-4	MULTIPLUG	2x4 POLES PCB VERSION	MOLEX	39-28-1083	78.218
P4-4	MULTIPLUG	2x5 POLES PCB VERSION	MOLEX	39-28-1103	78.220
P5-4			ESPERA	2-0-25057 *	200878
P6-4			ESPERA	2-0-25057 *	200878
P7-4	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P8-4	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P9-4	MULTIPLUG	2x4 POLES PCB VERSION	MOLEX	39-28-1083	78.218
P10-4	MULTIPLUG	2x5 POLES PCB VERSION	MOLEX	39-28-1103	78.220
P11-4			ESPERA	2-0-25057 *	200878
P12-4			ESPERA	2-0-25057 *	200878

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
P13-4	PLUG	1/10" SIL SQ.PINS 2 POLES	AMP	0-826629-2 (0-826647-2)	78.322
P14-4	PLUG	1/10" SIL SQ.PINS 2 POLES	AMP	0-826629-2 (0-826647-2)	78.322
P15-4	PLUG	1/10" SIL SQ.PINS 2 POLES	AMP	0-826629-2 (0-826647-2)	78.322
P16-4	PLUG	1/10" SIL SQ.PINS 2 POLES	AMP	0-826629-2 (0-826647-2)	78.322
P17-4	PLUG	1/10" SIL SQ.PINS 2 POLES	AMP	0-826629-2 (0-826647-2)	78.322
P18-4	PLUG	1/10" SIL SQ.PINS 2 POLES	AMP	0-826629-2 (0-826647-2)	78.322
Q1-4	TRANSISTOR AF	BC548 NPN TO-92	PHILIPS	BC548 (-A/-B/-C)	28.070
Q2-4	TRANSISTOR AF	BC548 NPN TO-92	PHILIPS	BC548 (-A/-B/-C)	28.070
R1-4	RESISTOR MF	1k5 OHM 5% 0.33W	PHILIPS	2322 180 73152	02.476
R2-4	RESISTOR MF	22k1 OHM 1% 0.25W	PHILIPS	2322 157 12213	02.234
R3-4	PRESET CERMET	1k0 OHM 10% 0.5W	BOURNS	3386P-1-102	07.886
R4-4	RESISTOR MF	5k11 OHM 1% 0.25W	PHILIPS	2322 157 15112	02.228
R5-4	RESISTOR MF	5k11 OHM 1% 0.25W	PHILIPS	2322 157 15112	02.228
R6-4	RESISTOR MF	330k OHM 5% 0.4W	PHILIPS	2322 181 53334	01.262
R7-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R8-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R9-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R10-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R11-4	RESISTOR MF	470k OHM 5% 0.33W	PHILIPS	2322 180 73474	02.536
R12-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R13-4	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R14-4	RESISTOR MF	1k5 OHM 5% 0.33W	PHILIPS	2322 180 73152	02.476
R15-4	RESISTOR MF	22k1 OHM 1% 0.25W	PHILIPS	2322 157 12213	02.234
R16-4	PRESET CERMET	1k0 OHM 10% 0.5W	BOURNS	3386P-1-102	07.886
R17-4	RESISTOR MF	5k11 OHM 1% 0.25W	PHILIPS	2322 157 15112	02.228
R18-4	RESISTOR MF	5k11 OHM 1% 0.25W	PHILIPS	2322 157 15112	02.228
R19-4	RESISTOR MF	330k OHM 5% 0.4W	PHILIPS	2322 181 53334	01.262
R20-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R21-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R22-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R23-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R24-4	RESISTOR MF	470k OHM 5% 0.33W	PHILIPS	2322 180 73474	02.536
R25-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R26-4	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
RE1-4	RELAY	24VDC 2SH. 2A	OMRON	G5V-2-24 VDC	21.327
RE2-4	RELAY	24VDC 2SH. 2A	OMRON	G5V-2-24 VDC	21.327
RE3-4	RELAY	24VDC 2SH. 2A	OMRON	G5V-2-24 VDC	21.327
RE4-4	RELAY	24VDC 2SH. 2A	OMRON	G5V-2-24 VDC	21.327
ST1-4	TERMINAL BLOCK	10 POLES 1.5mm2	PTR	AK300/10b m.MESS.SKRUER BLÅ	81.017
ST2-4	TERMINAL BLOCK	2 POLES 1.5mm2	PTR	AK300/2b m.MESS.SKRUER BLÅ	81.023
ST3-4	TERMINAL BLOCK	2 POLES 2.5mm2	PTR	AK110/2DS m.MESS.SKRUER	81.035
ST4-4	TERMINAL BLOCK	4 POLES 2.5mm2	PTR	AK110/4DS m.MESS.SKRUER	81.038
ST5-4	TERMINAL BLOCK	6 POLES 1.5mm2	PTR	AK300/6b m.MESS.SKRUER BLÅ	81.016
ST6-4	TERMINAL BLOCK	3 POLES 2.5mm2	PTR	AK110/3DS m.MESS.SKRUER	81.037
ST7-4	TERMINAL BLOCK	10 POLES 1.5mm2	PTR	AK300/10b m.MESS.SKRUER BLÅ	81.017
ST8-4	TERMINAL BLOCK	2 POLES 1.5mm2	PTR	AK300/2b m.MESS.SKRUER BLÅ	81.023
ST9-4	TERMINAL BLOCK	2 POLES 2.5mm2	PTR	AK110/2DS m.MESS.SKRUER	81.035
ST10-4	TERMINAL BLOCK	4 POLES 2.5mm2	PTR	AK110/4DS m.MESS.SKRUER	81.038
ST11-4	TERMINAL BLOCK	6 POLES 1.5mm2	PTR	AK300/6b m.MESS.SKRUER BLÅ	81.016
ST12-4	TERMINAL BLOCK	3 POLES 2.5mm2	PTR	AK110/3DS m.MESS.SKRUER	81.037
U1-4	DUAL OP AMP	LM358N	TEXAS	LM358P	31.100
U2-4	DUAL OP AMP	LM358N	TEXAS	LM358P	31.100

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
REMOTE CONTROL UNIT FOR N2174 BATTERY CHARGER			**S.P.RADIO A/S**	**H2180**	**802180**
POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
D1	DIODE RECTIFIER	1N4002 100V/1A	THOMSON	1N4002 (03/04/05/06/07)	25.100
D2	DIODE RECTIFIER	1N4002 100V/1A	THOMSON	1N4002 (03/04/05/06/07)	25.100
ME1	PANEL METER	SCALED 80-0-80 AMP.	SIFAM	29WF/75-0-75mV SCALED 80/0/80A	23.136
ME2	PANEL METER	SCALED 0-30V	SIFAM	29WF/0-30V, SCALED 0-30V	23.135
P1	PLUG	6 POLES	HIRSCHMANN	973 021-100 6 pole Male for Chassis	78.311
S1	ROCKER SWITCH	DPDT ON-NONE-ON 4A/250VAC	CARLINGSWITCH	6 10 1 2 4 2 1-0-0	43.011
S2	ROCKER SWITCH	DPDT ON-NONE-ON 4A/250VAC	CARLINGSWITCH	6 10 1 2 4 2 1-0-0	43.011
FUSE BOX, 30 Amps.			**S.P.RADIO A/S**	**H2182**	**802182**
POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
VARIOUS	CABINET,FUSE BOX H2182/3		S.P.RADIO A/S	0-0-28250	728250
VARIOUS	FUSE ARRANGEMENT H2182		S.P.RADIO A/S	0-0-28252	728252
FUSE ARRANGEMENT H2182			**S.P.RADIO A/S**	**0-0-28252**	**728252**
POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
F1	CIRCUIT BREAKER FUSED	2 POLES 440VAC-110VDC/63A	AEG	E82 U63A / 11.022.200.871	43.215
F2	CIRCUIT BREAKER FUSED	2 POLES 440VAC-110VDC/63A	AEG	E82 U63A / 11.022.200.871	43.215
F3	CIRCUIT BREAKER FUSED	1 POLE 440VAC-48VDC/10A	AEG	E81 U10A / 11.022.120.809	43.203
F4	CIRCUIT BREAKER FUSED	1 POLE 440VAC-48VDC/2A	AEG	E81 U 2A / 11.022.100.735	43.201
F5	CIRCUIT BREAKER FUSED	1 POLE 440VAC-48VDC/10A	AEG	E81 U10A / 11.022.120.809	43.203
F6	CIRCUIT BREAKER FUSED	1 POLE 440VAC-48VDC/10A	AEG	E81 U10A / 11.022.120.809	43.203
F7	CIRCUIT BREAKER FUSED	1 POLE 440VAC-48VDC/32A	AEG	E81 U32A / 11.022.120.854	43.205
F8	FUSE	5x20mm 500mA M 250V	ELU	172000	45.513
F9	FUSE	5x20mm 500mA M 250V	ELU	172000	45.513
F10	FUSE	5x20mm 500mA M 250V	ELU	172000	45.513
R1	SHUNT 80A-75mV		SIFAM	SHUNT MEDIUM CURRENT 80A-75mV	23.160
ST1	THROUGH TERMINAL BLOCK	16mm2	WEIDMULLER	SAK16/35 - 3806.6	81.061
ST2	THROUGH TERMINAL BLOCK	16mm2	WEIDMULLER	SAK16/35 - 3806.6	81.061
ST3	THROUGH TERMINAL BLOCK	16mm2	WEIDMULLER	SAK16/35 - 3806.6	81.061
ST4	THROUGH TERMINAL BLOCK	16mm2	WEIDMULLER	SAK16/35 - 3806.6	81.061
ST5			WEIDMULLER	SAK2,5/35 3804.6	81.049
ST6			WEIDMULLER	SAK2,5/35 3804.6	81.049

CONTENTS

7. PARTS LISTS

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	CONNECTION BOARD 600W	T2131-N2170/N2171	ESPERA	0-0-26395	726395
VARIOUS	RF COVER - CON. BOARD	CONNECTIONBOARD 26413/14	ESPERA	1-0-26869	226869
VARIOUS	COAX CABLE Ø3x50cm		ESPERA	0-0-26918	526918
VARIOUS	DISTANCE PIECE	Ø4.8xO.8x8mm	OJD	4,8XO,8X8 MESS.	63.106
VARIOUS	SPARE FUSES F.N2165/HFSSB	N2165	S.P.RADIO	0-0-27245	727245
VARIOUS	KIT, WASHERS AND NUTS,FOR	CONNECTION BOARD 6/1200W	ESPERA	0-0-27676	727676
VARIOUS	SCREW M3x12mm PHJX-Z	DIN 7985	HFC	HFC9041 M3x12 PHJX-Z DIN 7985	86.956
-13	CONNECTION BOARD MODUL.13	T2131/N2170/N2171 - 600W	ESPERA	5-0-26413H	626413

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	CONNECTION BOARD MODUL.13	T2131/N2170/N2171 - 600W	ESPERA	5-0-26413H	626413
VARIOUS	FUSE COVER	5x20mm FUSE SIZE	ELU	199016	48.716
VARIOUS	FUSE HOLDER	FOR PCB	SHURTER	OG 751 0042	78.421
VARIOUS	SCREW M3x12mm PHJX-Z	DIN 7985	HFC	HFC9041 M3x12 PHJX-Z DIN 7985	86.956
VARIOUS	SCREW M3x16 PHJX-Z	DIN 7985	WULCAN	HFC 9041 M3x16 PHJX-Z DIN 7985	86.957
VARIOUS	SCREW	M5x12 STEEL	HFC	HFC 473 FORZ.	87.413
C1-13	CAPACITOR MKT	10nF 5% 63VDC	PHILIPS	2222 370 89103	11.134
C2-13	CAPACITOR MKT	10nF 5% 63.VDC	PHILIPS	2222 370 89103	11.134
C3-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C4-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C5-13	CAPACITOR MKT	1u0F 10% 100VDC	PHILIPS	2222 373 21105	11.079
C6-13	CAPACITOR MKT	1u0F 10% 100VDC	PHILIPS	2222 373 21105	11.079
C7-13	CAPACITOR MKT	2u2F 10% 100VDC	PHILIPS	2222 373 90002	11.142
C8-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C9-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C10-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C11-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C12-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C13-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C14-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C15-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C16-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C17-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C18-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C19-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C20-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V	15.170

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
				FLAT PACK	
C21-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C22-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C23-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C24-13	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C25-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C26-13	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C27-13	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C33-13	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C34-13	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C35-13	CAPACITOR CERAMIC	51pF 5% NPO 50VDC	NKE	DT 360 758S CH 510 J 50V FLAT PACK	15.110
D1-13	DIODE ZENER	5.1V 5% 0.4W	PHILIPS	BZX79C5V1	26.527
D2-13	DIODE ZENER	4.7V 5% 0.4W	PHILIPS	BZX79C4V7	26.524
D4-13	DIODE SCHOTTKY BARRIER	70V/15mA DO-35	SGS-THOMSON	1N5711	27.500
D5-13	DIODE ZENER	12V 5% 0.4W BZX79C12	PHILIPS*	BZX79C12	26.554
F1-13	FUSE	5x20mm 6A3 T 250V	* ELU	17912006300	45.510
F2-13	FUSE	5x20mm 6A3 T 250V	* ELU	17912006300	45.510
F3-13	FUSE	2AT 250V 5x20mm	ELU	179 120 2AT	45.508
VARIOUS	FUSE HOLDER	1 POLE 5x20mm PCB VERSION	ELU	199015	78.398
J1-13	SOCKET COAX	VERTICAL FOR PCB MOUNT.	TAIKO	TMP-J01X-V6	78.518
J2-13	SOCKET COAX	VERTICAL FOR PCB MOUNT.	TAIKO	TMP-J01X-V6	78.518
J3-13	SOCKET BNC	PCB VERSION	ROSENBERGER	51K102-400 A4	78.444
L1-13	CHOKE FIXED	120uH 10%	FASTRON	MICC-121K-02	20.372
L2-13	CHOKE FIXED	120uH 10%	FASTRON	MICC-121K-02	20.372
OC1-13	OPTO COUPLER	CNY17-3	TOSHIBA	CNY17-3	32.533
OC2-13	OPTO COUPLER	CNY17-3	TOSHIBA	CNY17-3	32.533
P1-13	MULTI PLUG	2x8 POLES PCB VERSION	3M	3599-6002 / 7616-6002 JL	78.249
P2-13	MULTIPLUG	2x4 POLES PCB VERSION	MOLEX	39-28-1083	78.218
P3-13	MULTIPLUG	2x15 POLES PCB VERSION	3M	3531-6002 / 7630-6002 JL	78.253
P4-13	PLUG	2x5 POLES	3M	3654-6002 / 7610-6002 JL	78.251
P6-13	MULTIPLUG	2x3 POLES PCB VERSION	MOLEX	39-28-1063	78.217
P7-13	MULTIPLUG	2x7 POLES PCB VERSION	MOLEX	39-28-1143	78.222
P8-13	MULTIPLUG	2x6 POLES PCB VERSION	MOLEX	39-28-1123	78.221
P9-13	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P10-13	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P11-13	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P12-13	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P13-13	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
P14-13	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P15-13	MULTIPLUG	2x5 POLES PCB VERSION	MOLEX	39-28-1103	78.220
P17-13	PLUG (MALE)	4 POLE	AMP	0-826375-4	78.104
Q1-13	TRANSISTOR RF	BF199	PHILIPS	BF199	28.178
R1-13	RESISTOR MF	1kO OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R2-13	RESISTOR MF	1kO OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R3-13	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R4-13	RESISTOR MF	120 OHM 5% 0.33W	PHILIPS	2322 180 73121	02.450
R5-13	RESISTOR MF	120 OHM 5% 0.33W	PHILIPS	2322 180 73121	02.450
R6-13	RESISTOR MF	56k OHM 5% 0.33W	PHILIPS	2322 180 73563	02.514
R7-13	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R8-13	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R9-13	RESISTOR MF	1kO OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R10-13	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R11-13	RESISTOR MF	2kO OHM 5% 0.33W	PHILIPS	2322 180 73202	02.479
RE1-13	RELAY	12VDC 1SH. 2A.	MILTRONIC AB	OUC-S-112D	21.300
RE2-13	RELAY	12VDC 1SH. 2A.	MILTRONIC AB	OUC-S-112D	21.300
RE3-13	RELAY	15V DC 2A 1SH.	SIEMENS	V23040-AC003-B201	21.062
RE4-13	RELAY	12VDC 1SH. 8A.	SCHRACK	RY S 12 012	21.031
RE5-13	RELAY	12VDC 1A 1 SHIFT	SIEMENS	V23026-A1002-B201	21.029
S1-13	SWITCH TOGGLE	SPDT ON-ON	C&K	7101-S-Y-C-Q-E	43.019
ST11-13	TERMINAL BLOCK	4 POLES 1.5mm2	PTR	AK300/4b M:MESS.SKRUER BLA	81.025
ST12-13	TERMINAL BLOCK	4 POLES 1.5mm2	PTR	AK300/4b M:MESS.SKRUER BLA	81.025
ST1-13	TERMINAL BLOCK	3 POLES 1.5mm2	PTR	AK500/3DS m.MESS.SKRUER	81.008
ST2-13			ESPERA	1-0-23762 *	207607
ST3-13	SUPPLY TERMINAL BLOCK	1 POLE	RIACON	00247	81.028
ST4-13			ESPERA	1-0-23762 *	207607
ST5-13	TERMINAL BLOCK	16 POLES 1.5mm2	PTR	AK300/16b m.MESS SKRUER BLA	81.014
ST6-13	TERMINAL BLOCK	16 POLES 1.5mm2	PTR	AK300/16b m.MESS SKRUER BLA	81.014
ST7-13	TERMINAL BLOCK	14 POLES 1.5mm2	PTR	AK300/14b m.MESS.SKRUER	81.029
ST8-13	TERMINAL BLOCK	10 POLES 1.5mm2	PTR	AK300/10b m.MESS.SKRUER BLA	81.017
ST9-13	TERMINAL BLOCK	3 POLES 2.5mm2	PTR	AK110/3DS m.MESS.SKRUER	81.037
ST10-13	TERMINAL BLOCK	3 POLES 1.5mm2	PTR	AK300/3b m.MESS.SKRUER	81.026
TR1-13	TRAFO AF	1:1 600 OHMS	TDK	L04EE13-C10153	22.500
TR2-13	TRAFO AF	1:1 600 OHMS	TDK	L04EE13-C10153	22.500

CONTENTS

3. SERVICE

3.1. MAINTENANCE

3.2. ALIGNMENT INSTRUCTIONS

3.3. PROPOSAL FOR NECESSARY TEST EQUIPMENT

3.4. TROUBLE SHOOTING

3.4.1. ERROR CODES

3.4.2. INTELLIGENT FAULT SYSTEM

3.4.3. SYSTEM FUNCTION DESCRIPTION

3.5. PERFORMANCE CHECK

3.6. FUNCTION CHECK

3.7. SERVICE PROGRAMMES

3. SERVICE

3.1. MAINTENANCE

PREVENTIVE MAINTENANCE
If the HF SSB system has been installed properly the maintenance can, dependent on the environments and working hours, be reduced to a performance check at intervals, not exceeding 12 months. A complete performance check is enclosed in this manual, chapter 3.5. PERFORMANCE CHECK.
Inspection of the antenna, cables, and plugs of mechanical defects, salt deposits, corrosion, and any foreign bodies shall be done at regular intervals not exceeding 12 months.
Along with each HF SSB system test sheets are delivered in which all the measurements made in the test department of the factory, are listed. If the control mesurings made in the service workshop should not show the same values as those listed in the test sheet, the set must be adjusted as specified in the parts concerning the units in question.

3.2. ALIGNMENT INSTRUCTIONS

PART I/1200W

INTRODUCTION
The measuring values indicated in chapter 5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS are typical values and as indicated it will be necessary to use instruments in absolute conformity with the below list:

3.3. PROPOSAL FOR NECESSARY MEASURING INSTRUMENTS

Tone Generator type PM5107	PHILIPS	
Electronic Multimeter type PM2505	PHILIPS	
RF Directional Wattmeter model 43	BIRD	
Oscilloscope type PM321	PHILIPS	
Dummy load 50 ohm/600W		
Power supply 21-32V,	50A	(600W transmitter)
	100A	(1200W transmitter)

3.4. TROUBLE SHOOTING

In this section you will find guidelines which will enable you to find the faulty unit. The units are the following:

Control Unit RE2100
Power supply unit N2170 DUAL / N2171 DUAL
Power amplifier unit
TX-control unit
Connection board

In order to help you finding the faulty unit we have built detectors into the transmitter. The RE2100 will show an error code in the display when a fault is detected. Furthermore we have built in some service programmes. How to select these service programmes please refer to chapter 3.5. ERROR MESSAGES
The error messages are displayed in the upper part of the display in the RE2100. Table 1. indicates the possible faulty units. An asterisk in parenthesis (*) indicates the alternative unit where the error may also be found.

ERROR	RE2100	T2135	AT2112
70		*	*
73		(*)	*
75		(*)	*
78		*	
80		*	
81	*	(*)	
82	*	(*)	
83		*	
84		*	
85		(*)	
86		*	
87		*	
88		*	
91		*	
92		*	
95			

Table 1.

The error messages with numbers from 70 to 95 are generated by the TX-processor and mainly related to the T2135 and the AT2112. For the detailed error description please refer to the following table and the block diagram.

2.3. INSTALLATION ELECTRICAL, BETWEEN CABINETS cont.:

BATTERY TO N2170 DUAL:

24V DC

Max. Current: approx. 100 Amp.

LENGTH IN METRES	2.5	4	5	6.5	8	12	17
CABLE DIMENSION	16	25	35	50	70	95	120

CABLE 14

MAINS TO N2171:

220V MAINS:

Current: approx 6 Amp.
Mains fuse min. 10 Amp.
3 x 1.5 mm^2 max. length 12 metres

110V MAINS:

Current: approx 12 Amp.
Mains fuse min. 16 Amp.
3 x 2.5 mm^2 max. length 10 metres

CONNECTION BOARD (5)	SIGNAL
ST1 and ST2	
1	GND
2	LIVE
3	NEUTRAL

2.3. INSTALLATION ELECTRICAL, BETWEEN CABINETS cont.:

CABLE 2

N2170 – T2131:

3 x 0.18 mm² multicable 10 metres

T2131	N2170	SIGNAL
ST10	ST3	
1	1	+18V
2	5	42V ON DC
3	6	28V ON DC

CABLE 3

N2170/N2171 – T2135:

3 x 0.18 mm² multicable 10 metres

T2135	N2170 DUAL	N2171 DUAL	SIGNAL
ST10	ST3	ST3	
1	1	1	+18V
2	2	2	+18V
3	3	3	42V ON (B) DC
4	4	4	28V ON (B) DC
5	5	5	42V ON (A) DC
6	6	6	28V ON (A) DC
7	7	7	42V ON (B) AC
8	8	8	28V ON (B) AC
9	9	9	42V ON (A) AC
10	10	10	28V ON (A) AC

2.3. INSTALLATION ELECTRICAL, BETWEEN CABINETS cont.:

CABLE 10

N2170/N2171 TO T2135:

+28V and GND: 4 mm² length max. 10 metres

+42V cable dimension in mm²

LENGTH IN METRES	2.5	6	10
CABLE DIMENSION	4	10	16

CABLE 12

BATTERY TO T2131:

Only when N2170 is in a separate cabinet
24V BATT. 2.5 mm² max. length 10 metres

Only when N2170 is in the same cabinet as T2131.
Current: 50 Amp.
24V BATT.

LENGTH IN METRES	2	3.2	5	8	10	13	16	24	34
CABLE DIMENSION	6	10	16	25	35	50	70	95	120

CABLE 13

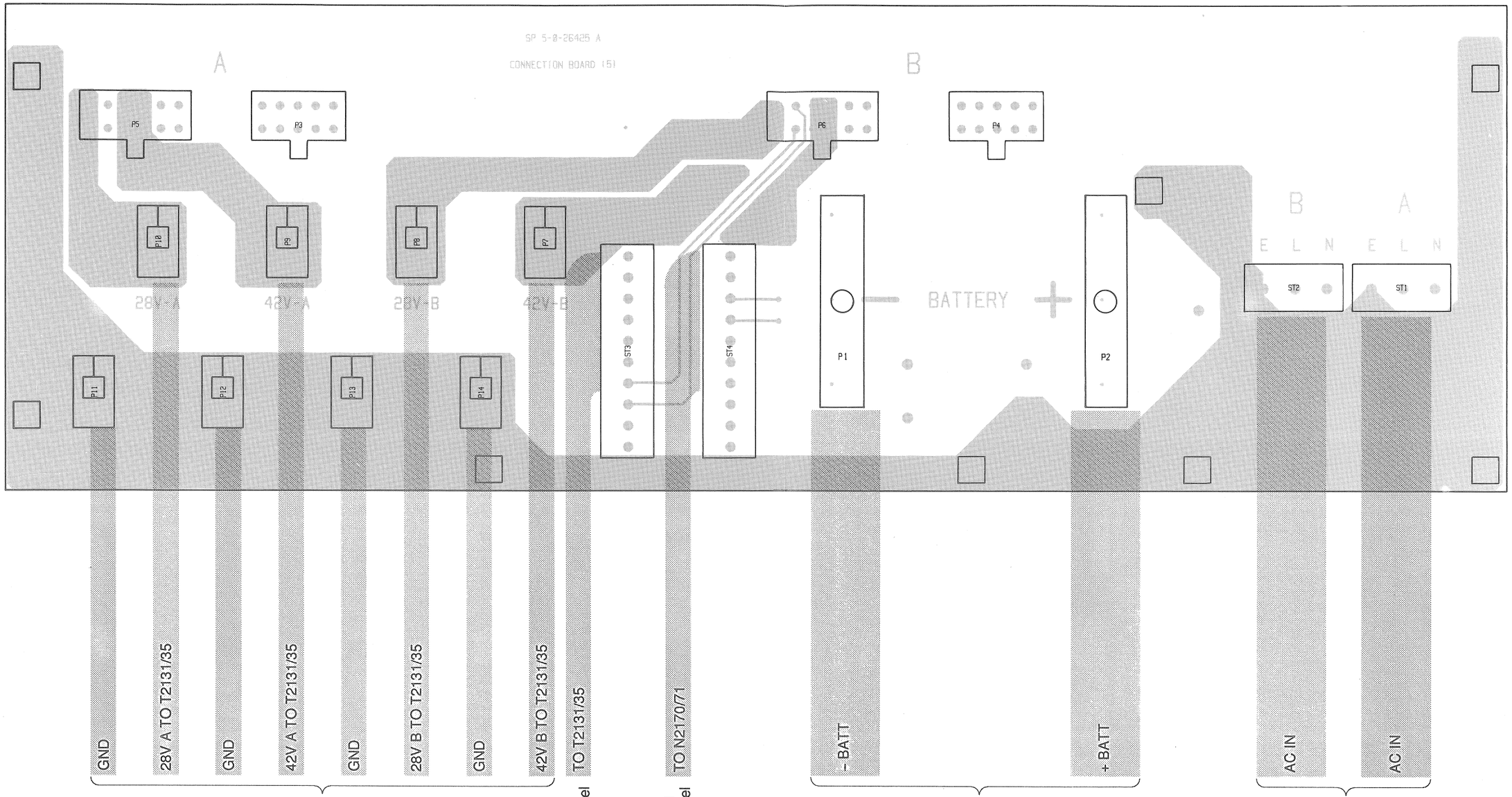
BATTERY TO N2170

24V BATT.
Current: approx. 50 Amp.

LENGTH IN METRES	2	3.2	5	8	10	13	16	24	34
CABLE DIMENSION	6	10	16	25	35	50	70	95	120

CONNECTION BOARD (MODULE 5) cont.:

COMPONENT LOCATION CONNECTION BOARD MODULE 5.



2.3. INSTALLATION ELECTRICAL, BETWEEN CABINETS (POWER SUPPLY)

2.3. INSTALLATION ELECTRICAL, BETWEEN CABINETS cont.:

CABLE 8

RM2150/RM2151 – T2135:

HT–ON:
Optocoupler:

12V	< V_{in} high	< 22V
10 mA	< I_{in} high	< 20mA
–1V	< V_{in} low	< 2V

AUX AF TO TX:
Transformer:
Impedance 600 ohm
Level 0 dBm to 10dBm

TX KEY:
Optocoupler:

12V	< V_{in} high	< 22V
10 mA	< I_{in} high	< 20mA
–1V	< V_{in} low	< 2V

0 dBm OUT:
Transformer:
Impedance 600 ohm
Level 0 dBm

T2135	RM2150/51	COLOUR	SIGNAL
ST7	P2–5		
1	11	GREY	+9V
2	12	WHITE	+18V
3	10	VIOLET	–18V
4	13	BROWN/PINK	SUPPLY ON/OFF
5	25	RED/BLUE	–BATT
6	–	–	HT ON–
7	–	–	HT ON +
8	15	BROWN/GREEN	TX–KEY–
9/2	–	–	TX–KEY+
10	18	WHITE/YELLOW	AUX AF TO TX
11	9	BLUE	AUX AF TO TX
12	6	YELLOW	SP–BUS INTERRUPT
13	–	–	SPARE
14	–	–	SPARE

2.3. INSTALLATION ELECTRICAL, BETWEEN CABINETS cont.:

CABLE 9

MAINS TO T2135:

220V/110V: 3 x 1.5 mm²

MAINS TO N2171:

220V MAINS:

Current: approx 6 Amp.
Mains fuse min. 10 Amp.
3 x 1.5 mm² max. length 12 metres

110V MAINS:

Current: approx 12 Amp.
Mains fuse min. 16 Amp.
3 x 2.5 mm² max. length 10 metres

CONNECTION BOARD (5)	SIGNAL
ST1 and ST2	
1	GND
2	LIVE
3	NEUTRAL

CABLE 10

N2170/N2171 TO T2135:

+28V and GND: 4 mm² length max. 10 metres

+42V cable dimension in mm²

LENGTH IN METRES	2.5	6	10
CABLE DIMENSION	4	10	16

CABLE 11

BATTERY TO T2135:

24V BATT. 2.5 mm² max. length 10 metres

2.3. INSTALLATION ELECTRICAL, BETWEEN CABINETS cont.:

CABLE 13

BATTERY TO N2170

24V BATT.
Current: approx. 50 Amp.

LENGTH IN METRES	2	3.2	5	8	10	13	16	24	34
CABLE DIMENSION	6	10	16	25	35	50	70	95	120

BATTERY TO N2170 DUAL:

24V DC
Max. Current: approx. 100 Amp.

LENGTH IN METRES	2.5	4	5	6.5	8	12	17
CABLE DIMENSION	16	25	35	50	70	95	120

2.3. INSTALLATION ELECTRICAL, BETWEEN CABINETS cont.:

CABLE 5

RE2100 – T2135:

Factory supplied: 2 pcs. 10 metres RG58C/U coax cable and
10 metres 21 x 0.5 mm² multicable

BLUE COAX CABLE to ST1 pin 2
RED COAX CABLE to ST1 pin 1

T2135	RE2100	COLOUR	SIGNAL
ST6	P3–5		
1	1	BLACK	RX MUTE
2	15	YELLOW/BROWN	VF/AE–CURRENT
3	11	VIOLET	+9V
4	12	GREY	+18V
5	13	WHITE	SUPPLY ON/OFF
6	14	PINK/BROWN	MIC KEY
7	2	BROWN	AF TO AMP COMMON
8	16	BROWN/GREEN	AF TO AMP
9	17	BROWN/GREY	0 dBm OUT COMMON
10	20	WHITE/GREEN	AUX AF TO TX
11	19	WHITE/YELLOW	EXT. RF CONTROL
12	18	WHITE/PINK	0 dBm OUT
13	21	WHITE/BLUE	TX–KEY
14	10	BLUE	–18V
15	25	RED/BLUE	–BATTERY
16	6	RED	SP–BUS INTERRUPT

2.3. INSTALLATION ELECTRICAL, BETWEEN CABINETS cont.:

CABLE 6

C2140 – T2135:

10 x 0.5 mm² max. length 100 metres, see also instruction book for C2140.

T2135	C2140	SIGNAL
ST8	ST1	
1	1	AUX AF IN TX
2	2	AUX AF IN TX
3	3	0 dBm OUT
4	4	0 dBm OUT
5	5	EXT. RF–GAIN CONTROL
6	6	AE/SIGN CURRENT
7	7	SP–BUS INTERRUPT
8	8	GND
9	9	+28V
10	10	GND

CABLE 7

MUTE:

MUTE OUT:

Relay contact closed when transmitting.
Max. ratings: 30V/2A

MUTE RX IN:

Relay coil: Max. voltage: 35V, 20°C
Min. voltage: 9V, 20°C
Coil resistance: 2250 ohm ±300 ohm

T2135	SIGNAL
ST12	
1	MUTE OUT
2	MUTE OUT
3	MUTE RX IN
4	MUTE RX IN

2.3. INSTALLATION ELECTRICAL, BETWEEN CABINETS cont.:

CABLE 1

AT2112 – T2135:

Multicable 16 x 0.5 mm², up to 100 metres

T2135	AT2112	SIGNAL
ST5	J1	
1	1	CONTROL 1
2	2	CONTROL 2
3	3	CONTROL 3
4	4	CONTROL 4
5	5	CONTROL 5
6	6	CONTROL 6
7	7	CONTROL 7
8	8	CONTROL 8
9	9	CONTROL 9
10	10	CONTROL 10
11	11	CONTROL 11
12	12	CONTROL 12
13	13	RX/TX
14	14	RX <4MHz
15	15	MOTOR
16	16	AE/180° PULSE

2.3. INSTALLATION ELECTRICAL, BETWEEN CABINETS cont.:

CABLE 3

N2170/N2171 – T2135:

3 x 0.18 mm² multicable 10 metres.

T2135	N2170 DUAL	N2171 DUAL	SIGNAL
ST10	ST3	ST3	
1	1	1	+18V
2	2	2	+18V
3	3	3	42V ON (B) DC
4	4	4	28V ON (B) DC
5	5	5	42V ON (A) DC
6	6	6	28V ON (A) DC
7	7	7	42V ON (B) AC
8	8	8	28V ON (B) AC
9	9	9	42V ON (A) AC
10	10	10	28V ON (A) AC

CABLE 4

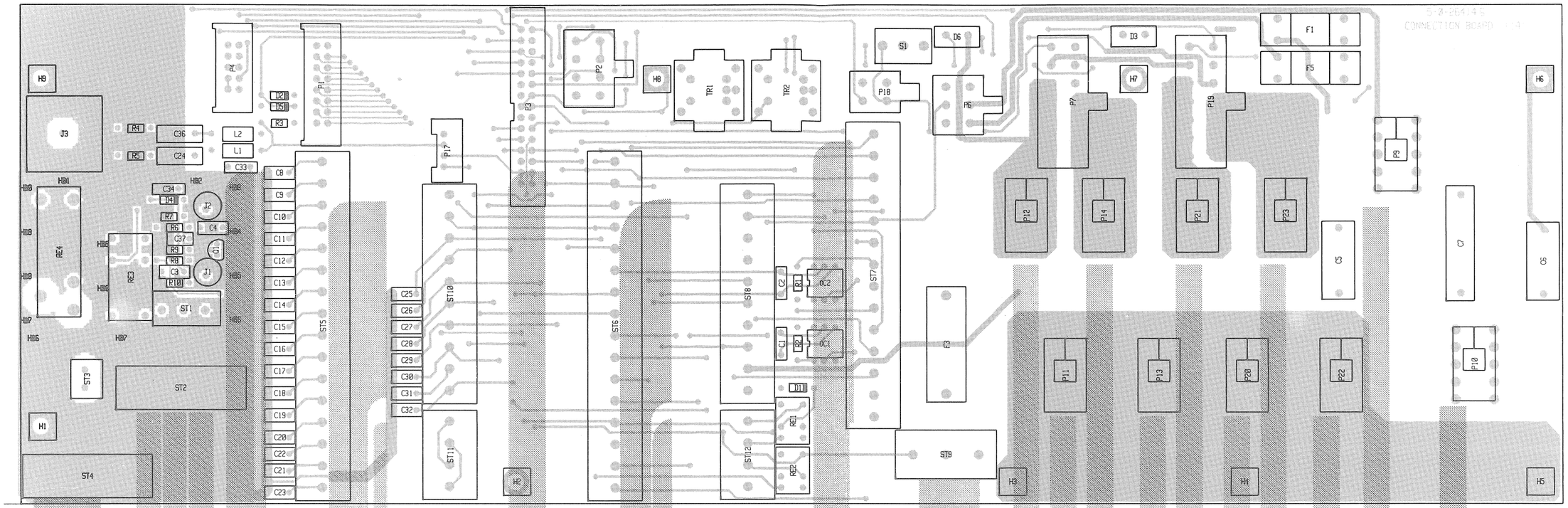
LOUDSPEAKER:

8 ohm, max. power 10W

T2135	LOUDSPEAKER
ST11	
1	GND
2	AF OUT
3	GND
4	AF OUT

2.3. CONNECTION BOARD (MODULE 14) cont.:

COMPONENT LOCATION CONNECTION BOARD MODULE 14.



RX IN/OUT TO AT2112 TRIAXIAC CABLE H1213	RG 58c/u	
CABLE 1		TO AT2112
		TO SP-BUS C2140
		TO SP-BUS RE2100
		TO RF IN/OUT RE2100
CABLE 2		TO POWER SUPPLY N2170/ N2171
CABLE 4		TO LOUDSPEAKER
CABLE 5		TO RE2100
CABLE 6		TO C2140
CABLE 7		MUTE IN/OUT
CABLE 8		TO RM2150/2151
CABLE 9		AC IN
CABLE 10		+28V A FROM N2170/71 DUAL
		GND
		+42V A FROM N2170/71 DUAL
		GND
		+28V B FROM N2170/71 DUAL
		GND
		+42V B FROM N2170/71 DUAL
		GND
CABLE 11		- BATT
		+ BATT

2.3. INSTALLATION ELECTRICAL, BETWEEN CABINETS (TRANSMITTER)

CONTENTS

1. INTRODUCTION
1.1. GENERAL DESCRIPTION SAILOR HF SSB PROGRAMME
1.2. TECHNICAL DATA
1.3. SYSTEM OVERVIEW (BLOCK DIAGRAMS FOR UNITS)

1. INTRODUCTION

This instruction book consists of one general section with description down to unit level, and one section for each unit in the system with description of the units down to component level.

This section gives you all necessary information to install the system and make service down to unit level.

1.1. GENERAL DESCRIPTION SAILOR HF SSB PROGRAMME

The SAILOR HF SSB programme is designed to meet all requirements within HF radio communication.

The SAILOR HF SSB programme consists of one main control unit and three transmitters with different power levels (250W, 600W, 1200W PEP).

To obtain maximum performance, the systems are designed with aerial couplers, which can be mounted outdoors. All the aerial couplers have automatic tuning.

Each of these three systems can be extended with:

- remote control units C2140
- telex/DSC sscanning receiver with built–in modem RM2151
- DSC MF/HF watchkeeping receiver with built–in modem RM2150
- duplex receiver R2120

The system may be supplied for 24V DC or 110/220V AC power source.

The 600W PEP and 1200W PEP transmitters and power supplies are built up of the following units:

1) TX control unit, consisting of output filter, power supply, and audio amplifier for RE2100 and the TX–processor.

2) Power amplifier unit, consisting of a 600W power amplifier.

3) Combiner unit, consisting of power splitter and power combiner.

4) 24V DC power unit, consisting of a 24V DC to 28V and 42V DC switch mode power supply, which supplies the power amplifier unit.

5) 110/220V AC power supply unit, consisting of a 110/220V AC to 28V DC and 42V DC thyristor controlled power supply, which supplies the power amplifier unit.

1.2. TECHNICAL DATA

(Complies with SOLAS, ITU, CEPT, MPT, DOC, FTZ, KSR, FCC)

GENERAL

Frequency Range:	Receiver: 100 kHz to 30 MHz Transmitter: 1.6 MHz to 28 MHz
Modes:	J3E (USB/LSB), R3E, H3E and J3B.
Channel Capacity:	100 user defined quick-select channels and ITU defined channels in the maritime bands. Each channel contains both RX and TX frequency and mode settings.
Scanning Facilities:	10 scanning programmes, each able to contain 128 pairs of frequencies.
Distress Call:	Quick selection of 2182 kHz. Built-in two tone alarm: 1300 Hz and 2200 Hz with a duration of 45 secs.
Operating Temperature Range:	-15°C to +55°C
Frequency Stability:	Better than 1.3 ppm (optional 0.3 ppm)
Primary Voltage:	Depending on selected power supply.
Current Drain:	Depending on selected power supply.
Aerials:	Wire or whip aerials length 9 – 16 metres.

TRANSMITTER T2135

Power Output:	1200 Watt PEP ±1.4 dB
Intermodulation:	Better than 32 dB below PEP
Spurious Emission:	Better than 67 dB below PEP
Harmonics:	Better than 43 dB below PEP or better than 67 dB below PEP with aerial coupler AT2112
Carrier Suppression:	Better than 46 dB below PEP
Audio Response:	350 Hz to 2700 Hz at -6 dB

RECEIVER RE2100

Receive System:	Double conversion super heterodyne 1st IF 70 MHz. 2nd 10.73 MHz
Selectivity:	J3E (SSB) 350 Hz to 2700 Hz at -6 dB H3E (AM) ±3.3 kHz at -6 dB
Sensitivity:	J3E (SSB) <10 dB/uV for 20 dB SINAD H3E (AM) <24 dB/uV for 20 dB SINAD
Spurious and IF Rejection:	Better than -70 dB

1.2. **TECHNICAL DATA** cont.:

Cross Modulation:	Better than 90 dB/uV (CEPT method of test)
Desensitization:	Better than 100 dB/uV (CEPT method of test)
AGC:	Less than 2 dB audio level change from 10 dB/uV to 80 dB/uV. Fast attack, slow release time.
Intermodulation:	Better than 90 dB/uV (CEPT method of test)
Spurious Emission:	Better than 1 nW into dummy aerial.
Clarifier:	±150 Hz in steps of 10 Hz.
Squelch:	Voice activated, opens for SINAD >6 dB.
Audio Power:	5 Watt in 8 ohm, or 10 Watt in 4 ohm, less than 10% distortion.

AERIAL COUPLER AT2112

Power:	1200W PEP
Aerial:	Wire or whip aerial, 9 – 16 metres length
Temperature Range:	–25°C to +70°C
Tuning Time:	Typical less than 2 secs.

POWER SUPPLIES 24V DC

Input Voltage:	21.6 Volt to 32 Volt
Current Drain:	Receive (standby) 2.5A Transmit voice 28A Telex (ARQ) 70A

POWER SUPPLIES 220V AC

Input Voltage:	220 Volt ±10% 50 Hz to 60 Hz 240 Volt ±10% 50 Hz to 60 Hz 110 Volt ±10% 50 Hz to 60 Hz
Current Drain:	Receive (standby) 0.5A, 220 Volt Transmit voice 3.4A, 220 Volt Telex (ARQ) 9.0A, 220 Volt

1.3. SYSTEM OVERVIEW

The 1200W PEP transmitter T2135 is built-up of the following units:

TX CONTROL UNIT
containing the output filters 1 to 6, filter switch, TX processor, power supply and AF amplifier.

TWO PA UNITS
each with a 600W power amplifier.

COMBINER UNIT
containing the necessary circuit for power splitting and power combining.

CONNECTION BOARD
with all screw terminals for external connections.

All the above mentioned units are placed in one standard cabinet.

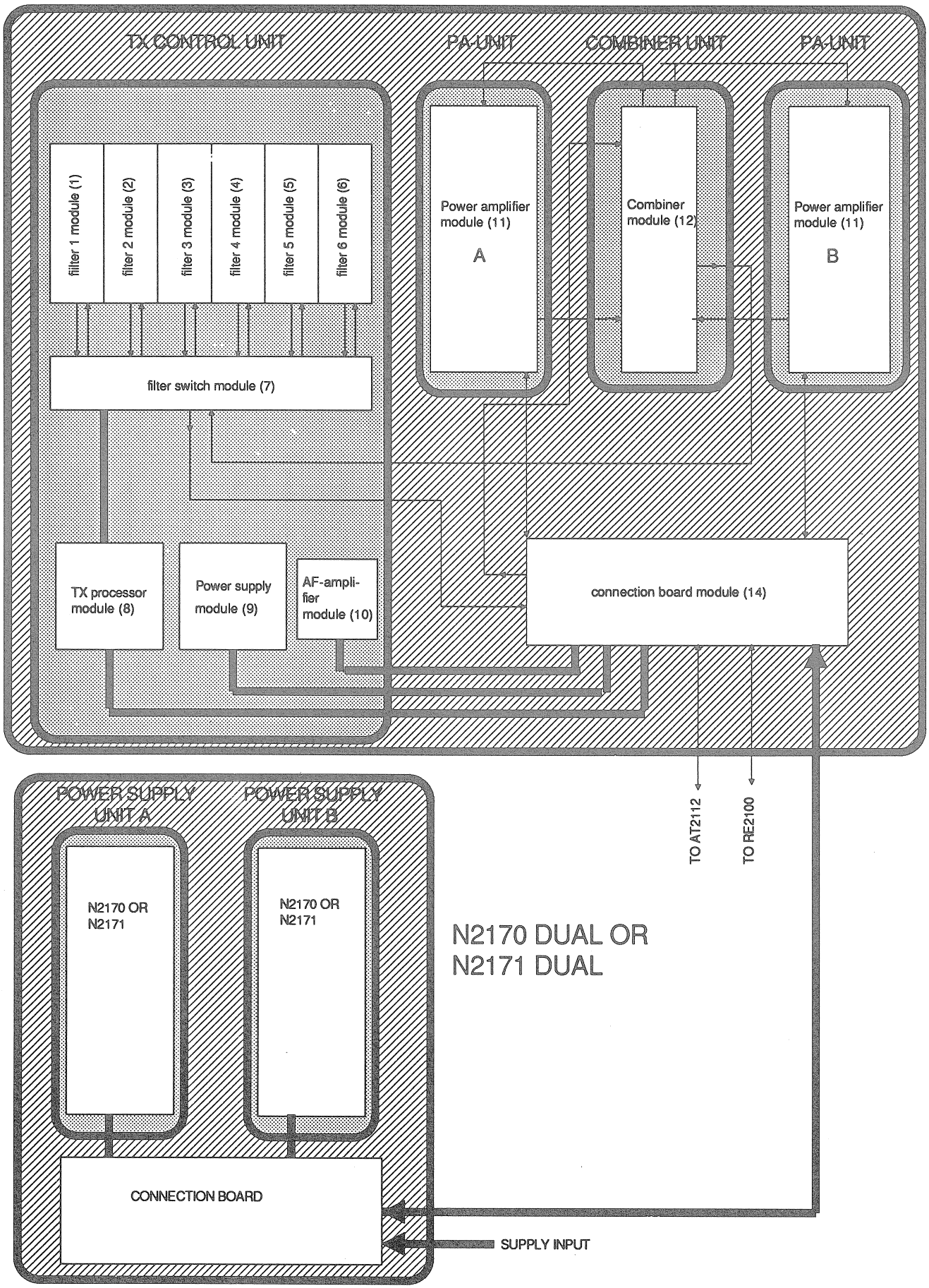
The power supply for a 1200W transmitter can be an N2170 DUAL and/or an N2171 DUAL.

N2170 DUAL for 24V DC contains two N2170 units, each supplying one 600W PA unit.

N2171 DUAL for 110/220V AC contains two N2170 units, each supplying one 600W PA unit.

The N2170 DUAL or N2171 DUAL is placed in one standard cabinet.

T2135



N2170 DUAL OR
N2171 DUAL

CONTENTS

2. INSTALLATION MECHANICAL

2.1. MOUNTING POSSIBILITIES

2.2. DIMENSIONS AND DRILLING PLAN

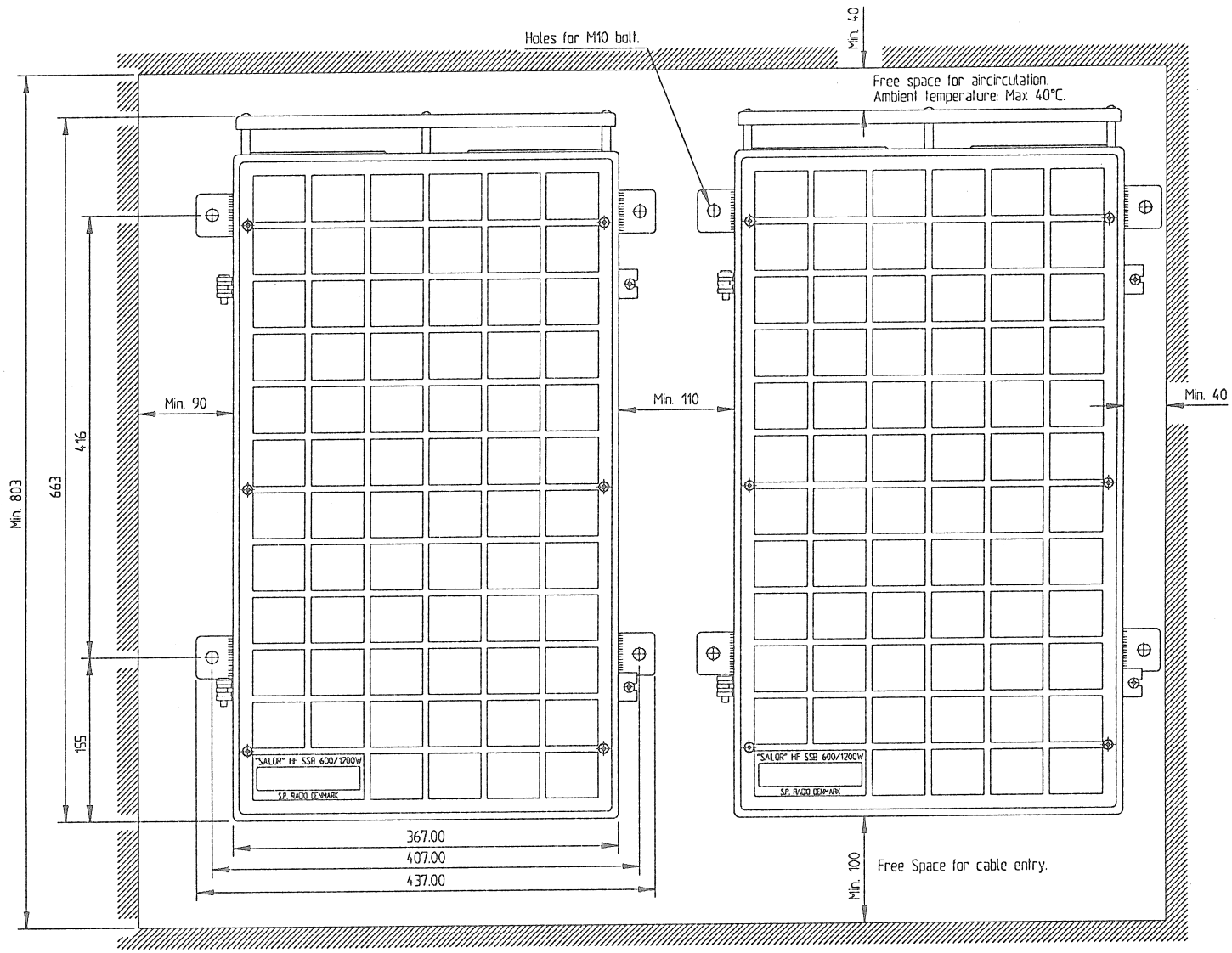
2.3. INSTALLATION ELECTRICAL, BETWEEN CABINETS

2.4. CABLE SPECIFICATIONS

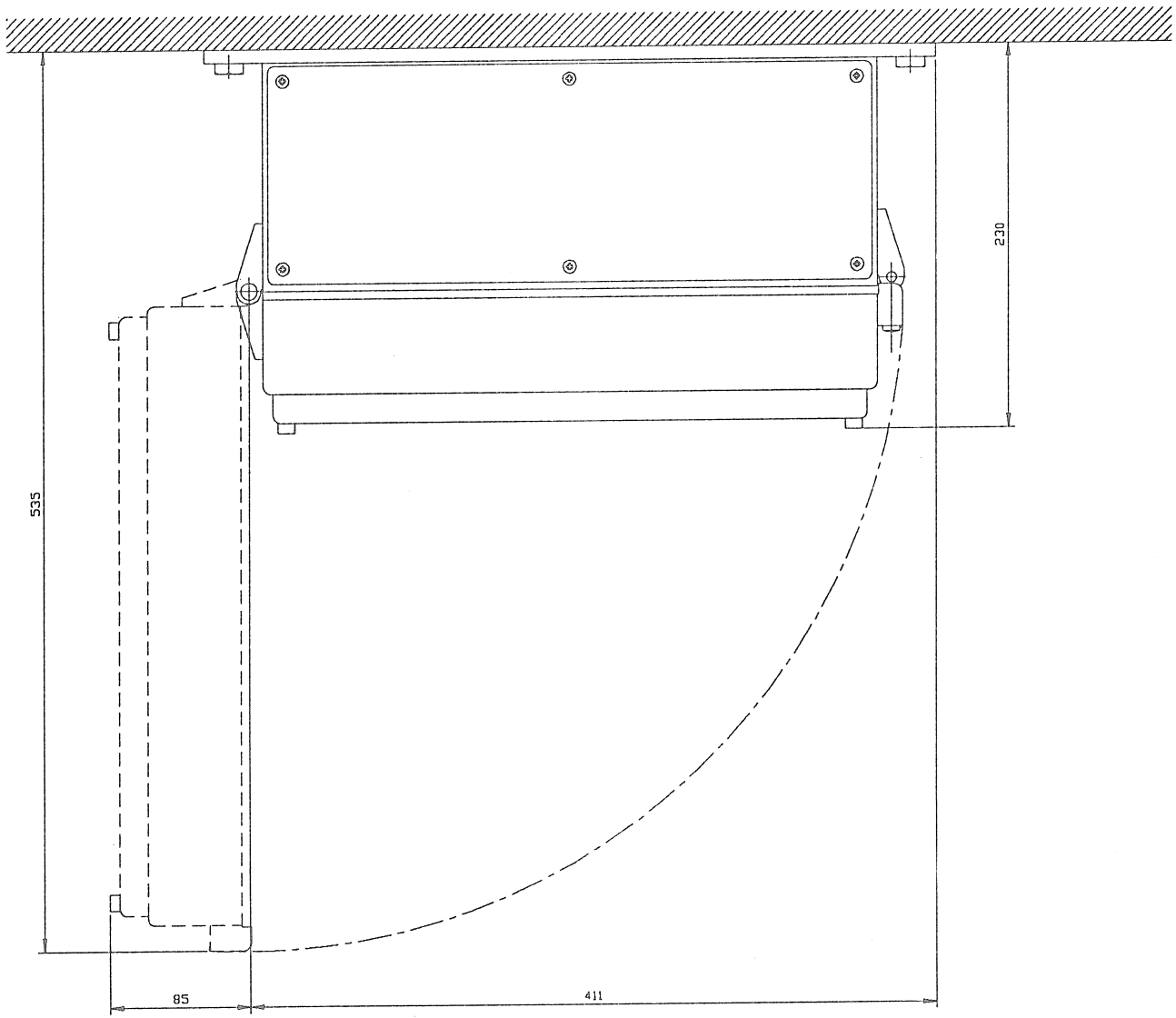
2.5. BATTERY REQUIREMENTS

2.6. ELECTRICAL CONNECTIONS AND ASSEMBLING, BETWEEN UNITS

MOUNTING POSSIBILITIES/DIMENSIONS AND DRILLING PLAN



FRONT VIEW



TOP VIEW

3.4.2. INTELLIGENT FAULT SYSTEM

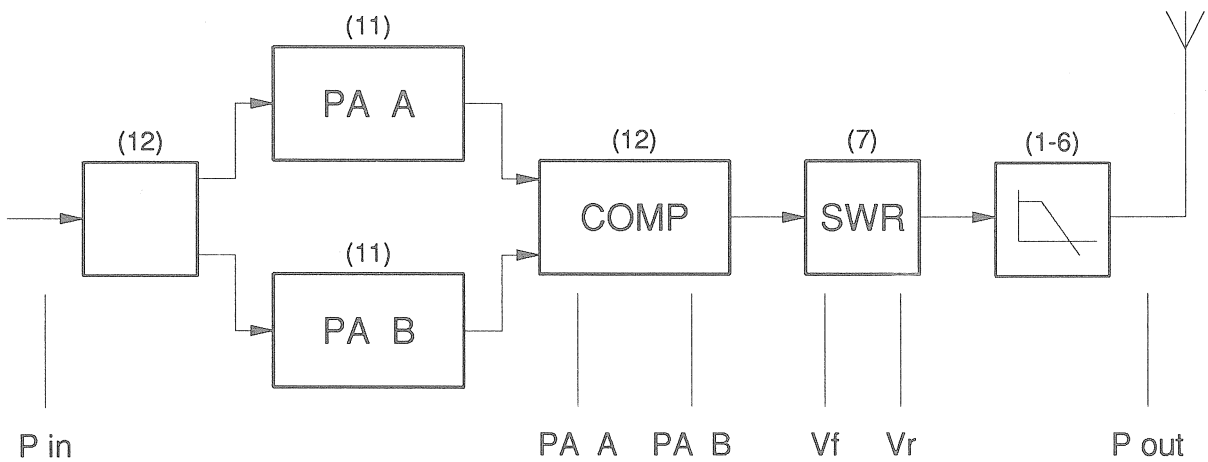
The T2135 transmitter is designed with an intelligent fault system. This fault system secures a safe transmission if one or more errors occur in the T2135 under stand by or transmission. If an error arises in one of the power supplies, the transmission is only stopped in max. 400 msecs., the time it takes to start another power supply. Therefore, it is possible to transmit voice or telex without being interrupted. The T2135 will after some time try to use the AC power supply again, in order to protect the ships radio batteries.

Variation in AC Supply
If the AC sense detects a low AC supply (< 180 volt), the power supplies are switched over from AC to DC. If the AC supply returns later, the TX-processor makes a new "drive set" and the AC power supply is switched on again.
If reduced DC power out is chosen, the fault system reduces the power out automatically, 'error 85' is displayed in the RE2100.

Fault in Power Amplifiers B
If an error arises in power amplifier B, the power supply is switched off and the power out is reduced app. 6 dB in order to protect the combiner (12). 'error 84' message is displayed in the RE2100.

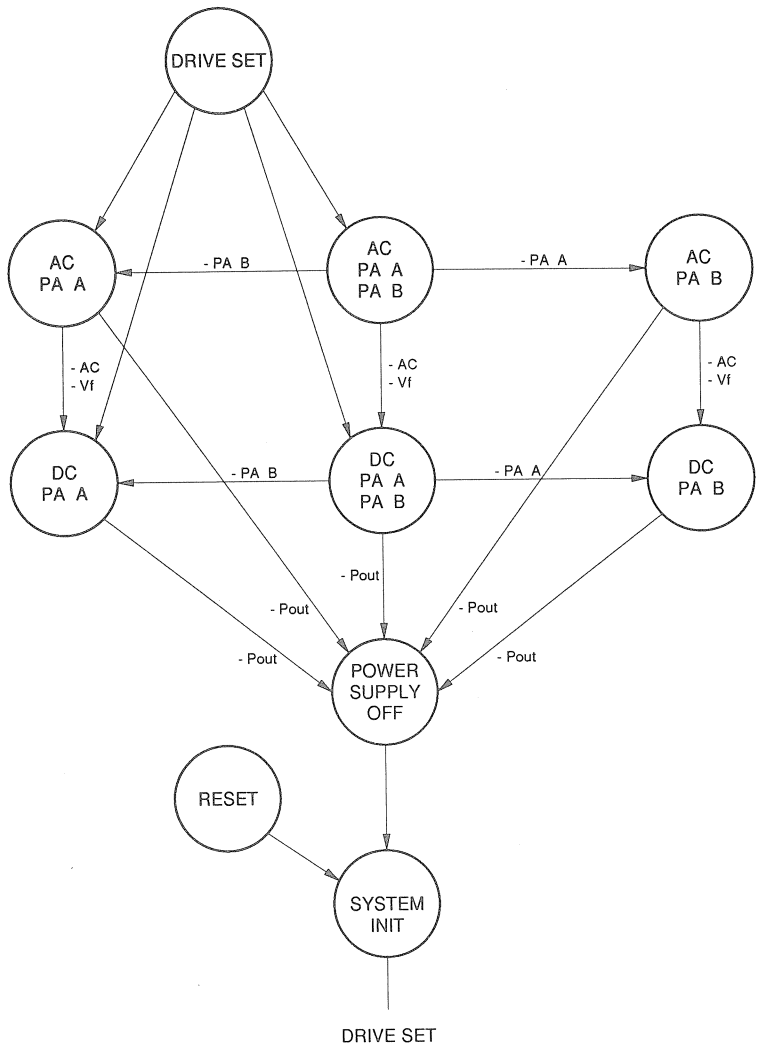
Fault in the Output Filter
If an error arises in the output filter it is not possible to transmit, the power supplies are switched off, and 'error 80' is displayed in the RE2100.

Fault in Power Supplies
The intelligent fault system handles an error in one power supply, as if it was an error in a power amplifier.



The measurements are executed in the following order Pin, Vf, PA_A, PA_B, Pout.

3.4.2. INTELLIGENT FAULT SYSTEM cont.:



This figure illustrates what happens if one or more fault occur.

3.4.2. INTELLIGENT FAULT SYSTEM cont.:

EXAMPLE
A T2135 is installed with AC and DC power supply (1200W).

Under Transmission
An error occurs in the Power Amplifier B. There is no signal on PA_B.

1. The +28V-B, +42V-B AC power supply is switched off.
2. The RF power is reduced by 6 dB.
3. "error 84" is displayed in the RE2100 when the key is released.

Later under Transmission
The fuse blows in +42V-A AC power supply. There is no signal on $V_{forward}$ (Vf).

1. The +28V-A, +42V-A AC power supply is switched off.
2. The +28V-A, +42V-A DC power supply is switched on (600W).
3. "error 86" is displayed in the RE2100 when the key is released.

Under these circumstances with Power Amplifier B and +42V-A AC power supply defective, the intelligent fault system always tries the AC power supplies and then switches over to DC power supplies. This is done in order to protect the ships radio batteries.

PART I/1200W

3.4.3. SYSTEM FUNCTION DESCRIPTION

This section mainly describes the overall functions of the software in the T2135.
The main functions are described in sections, where section 3.4.3. SP-BUS COMMUNICATION TO T2135 is a common section to be read in conjunction with the other.
In order to have the full understanding of the mode of operation of the T2135, section 3.4.3. SYSTEM FUNCTION DESCRIPTION has to be read together with the chapter 5. CIRCUIT DESCRIPTION in PART II.

This section describes the following function.

SP-BUS COMMUNICATION TO T2135
The SP-bus is a time multiplexed serial data bus. The RE2100 is the master and the T2135 is one of several slaves. The T2135 is assigned a given slave address. RE2100 initiates and controls all communication to the T2135. This means that all activities performed in T2135 is controlled by the RE2100.
The T2135 may receive a number of commands according to the expected action in the T2135. When the T2135 has received a message it must replay immediately. The T2135 has four different options to answer the RE2100:

A: The received command is understood and is executed.
B: The received command is understood and T2135 is busy executing the command.
C: The received command is understood and is executed. The T2135 has information for the RE2100.
D: A communication error is detected. The command is not executed. The error can be a parity error or a message length error.

The answer options A, B and C may be followed by information related to the specific command. If the T2135 does not answer, the RE2100 is repeating the command a number of times. If the T2135 does still not answer, an error (Error 20) will occur in the display of the RE2100.

Commands and Answers
In the following the commands to the T2135 and the answers from T2135 are described.

Synchronize/Status and Error Code
This command/answer is used in two situations:
- When the power has been switched on at the RE2100, the RE2100 detects the existence of possible slaves.
- When the T2135 has detected an error, the T2135 has answered the previous message with the answer option (C). This results in a synchronized message from the RE2100.

Receiver Frequency
Whenever the receiver frequency has been changed at the RE2100 the frequency is sent to the T2135. The T2135 ensures that a transformer is switched in at receiver frequencies below 4000 kHz and switched out at frequencies above 4000 kHz. If the aerial coupler is tuned properly on the same frequent as the receiving frequent, the aerial coupler relays are activated in order to have the correct impedance.

PART I/1200W

3.4.3. SYSTEM FUNCTION DESCRIPTION cont.:

Key
This command is sent continuously to the T2135 when the handset key is activated at the RE2100. The first time it is sent, the command is followed by the actual transmitter frequency and the selected mode (telex etc.) at the RE2100. The answer is option (A). The following commands are sent without associated data. There are two different answers depending on the state of the T2135. In both states the T2135 has the full control of the step attenuator placed in the Exciter Unit (4) in the RE2100.

- State one. Indicates that the T2135 and the AT2112 are N O T ready to transmit.
  The answers consist of the answer option (B) associated with an absolute step.
  The duration of this state is given by the duration of the automatic power setting and the tuning of the AT2112.
- State two. The T2135 and the AT2112 is ready to transmit.
  The answers consist of the answer option (A) associated with an absolute step.
  This state continues until the key is released and the "Stop" command is sent from the RE2100.

Tune
This command is a subset of the "Key" command. Only state one is performed followed by the "Stop" command. The command is only sent from the RE2100 when the "TX" and "Tune" keys are activated.

Dummy Load Key
This command is equal to the "Key" command except for the RF output power. The RF output power is delivered to the AT2112 built in dummy load instead of the connected aerial.

Dummy Load Tune
This command is equal to the "Tune" command except for the RF output power. The RF output power is delivered to the AT2112 built in dummy load instead of the connected aerial.

Stop Tune/Key
This command always terminates the above mentioned 4 variants of "Tune" and "Key" commands. The answer is option (A). The command is sent from the RE2100 at one of the following events:
- When the handset key is released after a transmit period.
- When the T2135 is ready to transmit after the "TX" - "Tune" keys have been activated.
- When the "Enter/Stop" key is pressed while the Automatic Power setting or the tuning of the AT2112 takes place.

Open Aerial
This command sets the relays in the AT2112 so that the aerial is disconnected from the HF SSB RE2100.

Service
This command is always associated by a service subcommand. There are several service subcommands, each corresponding to a given Service Programme. The answer consists of option (A) or (B) followed by 5 ASCII characters which are displayed in the lower part of the display in the RE2100.

AUTOMATIC POWER SETTING

Motive for the Automatic Power Setting
The automatic setting of the power level is done in order always to have the maximum RF-level out of the Transmitter T2135 regardless of:

- Variations in the RF-level out of the RE2100 Exciter
- RF-loss due to long cables between the RE2100 and the T2135.
- Variations in the loss in the Power Splitter from one to another.
- Variations in the loss in the Power Splitter due to the frequency.
- Variations in the gain in the Power Amplifier from one to another.
- Variations in the gain in the Power Amplifier due to the frequency.
- Variations in the loss in the Combiner from one to another.
- Variations in the loss in the Combiner due to the frequency.
- Variations in the loss in the Output Filter module from one to another.
- Variations in the loss in the Output Filter module due to the frequency.

3.4.3. SYSTEM FUNCTION DESCRIPTION cont.:

Principles for the Automatic Power Setting
The RF-level out of the RE2100 Exciter is increased step-wise until a predetermined maximum allowable Power out level of the Output Filter (1) is reached.

Events for Starting the Automatic Power Setting
The automatic power setting is done because of one of the following events:
- The TX-frequency is changed and the key on the handset has been activated.
- The TX-tune key on the Keyboard is pushed.
- The time elapsed since latest transmission is more than approx. 30 secs.
- The AC supply is returned after a short or long period
- One PA- or power supply module is defective.

Necessary Signals and Parameters
- Power out.
  The RF-level is measured by a detector circuit on the Output Filter (7) and is mentioned as "P_out".

  P_out is measured by the TX-processor (8) by use of an analog to digital converter.

- P_out maximum.
  The predetermined maximum allowable P_out level is composed of a number of parameters. This composition of the maximum allowable P_out is described in a section below.
  In the following it is assumed that the maximum allowable P_out has already been calculated.
  The predetermined maximum allowable P_out level will in the following sections be mentioned as Po_max (Power out maximum).

- RF-level control.
  A digitally controlled step attenuator with 64 steps, each step is approx. 0.3 dB, is placed in the Exciter Unit (4) in the RE2100.
  During the automatic power setting the TX-processor (8) in the T2135 has the full control of the step attenuator via the SP-Bus and the Processor Module (5) in the RE2100.

PART I/1200W

Functional Description of the Automatic Power Setting
When the automatic power setting is about to start the step attenuator in the Exciter Unit (4) is preset to step 43 by the answer to the first "Tune" command. The automatic power setting may now take place in 2 or 3 states, depending on the initial measured P_out (step 43) related to the Po_max.

- State 1 is always executed as the first state.
- State 2 is executed when the RF-level has to be increased one or more steps.
- State 3 is always executed as the last state in the automatic power setting.

State 1
The P_out level measured by the TX-processor at step 43 is compared to 4 different levels:

- A minimum level.
  If p_out is lower, then an error is generated. The p_out level is too low.
- Po_max - 0.6 dB.
  If P_out is lower, then a number of steps is calculated to increase the RF-level out of the Exciter. The calculation is described below. The automatic power setting continues at state 2.
- Po_max.
  If P_out is lower or equal to, then the step is increased with one. The automatic power setting continues at state 2.
- Po_max +0.3 dB.
  If P_out is lower, then the automatic power setting continues at state 3.
- Else an error is generated. The P_out level is too high.

Step Calculation
In order to reduce the time used for the automatic power setting the RF-level is increased a number of steps initially. The number of steps "n" is calculated in the following way:

$$\frac{Po_max}{P_out} = 10^{((A / 20)) * n}$$

3.4.3. SYSTEM FUNCTION DESCRIPTION cont.:

Where A is the resolution in dB in the step attenuator. Theoretically should A = 0.3 dB/step. However, there is a certain compression in the amplifiers, etc. involved. Iterations have shown that A = 0.43 dB/step is suitable in order to reach the correct power level in an acceptable time without overshot.

State 2
In this state the RF-level is increased one step at a time and compared to 2 different levels:

- If P_out is higher then the automatic power setting continues at state 3.
- The previously measured P_out +0.2 dB. If P_out is lower, then the automatic power setting continues at state 3.
  Else state 2 is repeated.
  This specific comparing to the previous P_out +0.2 dB is performed to ensure that the increasing of the P_out is stopped if there has been an increase less than 0.2 dB.
  This may occur when the Power Amplifier (1) has begun compressing the signal. The compressing of the signal gives amplitude distortion and increase the intermodulation.

State 3
This state is run when the P_out was measured to be one step too high. RF-level is reduced one step because the previous level was too high. Depending of the event which started the automatic power setting, the RF-level is reduced further. If an AT2112 is in the system, (jumper 5 is not inserted) P_out is reduced 20 steps further (approx. 6 dB) in order to protect the Power Amplifier (1) while tuning the AT2112.

Calculating Power out Maximum
Po_max is compound of 3 parameters:
- An addition (Po_cal) as a result of the Calibration.
  The calibration procedure is described in section 2.3.3.5. "Calibration of the T2135"
- A gain/loss (po_frq) related to the frequency.
- A reduction (po_rdc) of reduced power in DC mode.
- A reduction (po_mrp) of reduced power for frequency <4 MHz.

Po_max is found in the following way:

- po_max1 = po_cal * po_frq

IF DC mode with two Power Amplifier modules (1200W)
THEN po_max = the lowest selected of po_max1 and po_rdc.

IF the FREQUENT <4 MHz
THEN po_max = the lowest selected of po_max1 and po_mrp.

In the following the parameters are described separately.

po_cal
This factor is the result of the calibration of the T2135 in maximum power out at 1.6 MHz. The principles for the calibration of the T2135 is described below.

po_frq
This factor is to reduce the variations in the gain of the Power Amplifier (11) and the variations in the loss in the Output Filter (1).
The size may either be higher or lower than one approx. (0.8 - 1.2).
There are 6 different sizes which may be multiplied. One for each frequency range covered by the lowpass filters in the Output Filter Module (1). The size for the frequency range 1.6 - 2.599 MHz is always 1.00, because 1.6 MHz is used as a reference.

po_rdc (only used in DC mode with two Power Amplifier modules)
This is in fact not an addition. It is possible to reduce the RF PEP power out of the transmitter in some steps by use of Service Programmes.
When the power is not reduced the po_mdc has a value which are always higher than po_max1.
When the power is reduced the po_rdc has a fixed value corresponding to the selected PEP power level (1000W, 800W, 600W). This is done in order to protect the ships radio batteries.

3.4.3. SYSTEM FUNCTION DESCRIPTION cont.:

po_mrf (only used for frequency <4 MHz)
This is in fact not an addition. It is possible to reduce the RF PEP power out of the transmitter in some steps by use of Service Programmes.
When the power is not reduced the po_mdc has a value which is 600 Watt.
When the power is reduced, the po_mdc has a fixed value corresponding to the selected PEP power level (400W, 200W, 100W).

TUNING THE AT2112
The tuning may take place in 3 different procedures:

- Tune-up, where a tuning is done from basic data.
- Retune, where the tuning is done from data saved at the latest tune-up.
- No tune, which is done when there is no AT2112 in the system (jumper 5 is inserted).

Tune-up Procedure
This is the basic tuning procedure for tuning the AT2112.
The conditions for an tune-up procedure are the following:

- "TX-TUNE" is entered on the keyboard on the RE2100.
- The frequency has not been tuned before. This means that there is no valid data in the EEPROM's for the specific 200 kHz band in which the frequency is situated.
- The Retune procedure did not work out. The Retune could not be done with the data saved in the EEPROM's. The measured Standing Wave Ratio (SWR) was too high.
  The aerial conditions may have been changed since the latest tune-up of a frequency in the 200 kHz band concerned or the data saved in the EEPROM's are deleted by use of Service Programmes.

The uptuning may take place in up to 6 states. The states are sequentially executed until the uptuning has been accepted.

1. The relays in the AT2112 are set so that the RF signal is fed straight through the coupler. This means that no resonance (inductance, (L)) or load (capacitance, (C)) are active.
   If the SWR (Standing Wave Ratio) is better than or equal to 1.7, the tuning of the aerial is accepted.
   A possible previously saved combination is deleted from the EEPROM's.
   If Jumper 4 on the TX-processor (8) is inserted this "signal straight through" combination will NOT be tested.

2. A sequence of shifting the resonance and the load in a certain pattern is run through. For each frequency band (200 kHz) a number of combinations of fixed resonance values (L) and fixed load values (C) are switched in.
   For every combination of a fixed resonance and a fixed load, the variable inductor is run through the working range.
   Within the working range of the variable inductor the SWR is measured and compared continuously to certain limits.

   The first combination always contains the highest value of the resonance (most L is in) and the lowest value of the load (least C is in).
   The next combinations each contains an increasing value of the load (C) and the highest value of resonance (L).
   When the highest value of load has been tested the next lower value of resonance is switched in and all the load values are tested again.
   The variable inductor is activated by the tune motor M01. The motor may run at high speed or at low speed. In the following mentioned as "high tune speed" and "low tune speed".
   With the tune speed high, the SWR is measured and continuously compared to the following limits, and different actions may take place:

   1.0 <= SWR <= 1.5.
   The actual combination of resonance and load is kept and the tune speed is changed to low. The variable inductor is run through its variation range again.
   When the SWR limit again is passed, the tune motor is stopped immediately and the tuning is accepted. The found combination of resonance and load and the SWR limit is saved in the EEPROM's for a later Retune procedure.

PART I/1200W

3.4.3. SYSTEM FUNCTION DESCRIPTION cont.:

1.5 < SWR <= 2.0.
The actual combination of resonance and load is remembered by the processor in order to tune with the low speed later.

2.0 < SWR <= 2.5.
The actual combination of resonance and load is remembered together with a flag, indicating that the SWR is in the range 2.0 < SWR <= 2.5 by the processor in order to tune with the low speed later.

3. If no combination could give an SWR <= 1.5 the remembered combinations giving an SWR <= 2.0 are tested at low tune speed. The SWR is measured and is compared to the following limits, and different actions take place:

   1.5 < SWR <= 1.7.
   The tune motor is stopped immediately and the tuning is accepted.
   The found combination of resonance and load and the SWR limit is saved in the EEPROM's for a later Retune procedure.

4. If no combination could give an SWR <= 1.7 the remembered combinations giving an SWR <= 2.0 are tested again at low tune speed. The SWR is measured and is now compared to the following limit:

   1.7 < SWR <= 2.0.
   The tune motor is stopped immediately and the tuning is accepted.
   The found combination of resonance and load and the SWR limit is saved in the EEPROM's for a later Retune procedure.

PART I/1200W

5. If no combination could give an SWR <= 2.0 the remembered combinations giving an SWR in the range 2.0 < SWR <= 2.5 are tested at low tune speed.
   The SWR is measured and is compared to the following limit:

   SWR <= 2.5.
   The tune motor is stopped immediately and the tuning is accepted.

6. If no combination could give an SWR <= 2.5, the AT2112 relays are set to feed the RF-signal straight through the coupler and this is then accepted as an Uptune. When the transmitter is keyed the RF-power is reduced accordingly to the actual SWR.

Retune Procedure
This is the tune procedure normally used. The conditions for a Retune procedure are the following:

- A frequency within the same 200 kHz band has been tuned before to an SWR <= 2.0. This means that valid data are read out of the EEPROM's and the aerial conditions have not changed essentially.

The data saved in the EEPROM's for a Retune is divided into 132 elements. Each element equals a frequency band covering 200 kHz. For each 200 kHz band a relay combination and a code for the tuned SWR are saved.

The principles for a Retune procedure are described in the following. Data concerning the actual 200 kHz band is read out of the EEPROM's and validated. If the code for the SWR is not acceptable, an Uptune procedure is started immediately. If the code for the SWR is valid then the codes for the SWR and the relays are converted. The specific relays are activated.

3.4.3. SYSTEM FUNCTION DESCRIPTION cont.:

With the tune speed low the SWR is measured and compared continuously to the limit which is read out from the EEPROM's. The SWR limit is 1.5 or 1.7 or 2.0. The Retune procedure will then always try to tune to the same SWR limit as the Uptune procedure. However, if this is not possible the Retune will try to tune to the next higher limit. If not it is possible to tune to an SWR <= 2.0 the Uptune procedure is started immediately.

Notune Procedure
This procedure is run only when there is no AT2112 connected to the T2135. In fact the jumper 5 on the TX-processor (8) must be inserted.
The only purpose for this routine is to measure the SWR and if SWR > 2.0 inform the RE2100 and the user.

TRANSMIT SUPERVISING
The motives for the supervising are as follows:
- Protection of the Transmitter T2135 against high SWR (bad antenna conditions).
- Protection of the power transistors in Power Amplifier (11) against damage caused by high temperature.
- Ensure that the transmitter T2135 always delivers maximum RF-power with a minimum of intermodulation.
- Ensure that the T2135 is transmitting even if one PA- or power supply module is destroyed.

When the Transmitter T2135 is keyed certain parameters are watched by the TX-processor (8) and action is taken if the change of the parameters is essential. The following parameters are watched:

- SWR, Standing Wave Ratio
- Temperature in the Power Amplifier A and B (11)
- Power out from PA module A and PA module B
- AC supply to the RE2100/T2135 system

In general causes a change of any of the watched parameters is a control of the RF-level input to the Power Amplifier. While the transmitter is keyed the TX-processor has the full control of the digitally controlled step attenuator in the Exciter Unit (4) in the RE2100 via the SP-Bus and processor Unit (5) in the RE2100. Each of the watched parameters results in a number of steps. The steps are simply added to the step found when the Automatic Power Setting was performed.

act_step = APS_step + n1 + n2 + n3 + n4

Where:
act_step = Actual step for the attenuator
APS_step = The step found at the Automatic Power Setting.

n1 = Deviation step related to SWR
n2 = Deviation step related to Temperature
n3 = Deviation step related to Power A,B
n4 = Deviation step related to DC supply

The subsections below describe each of the parameters watched.

SWR Watching
When the T2135 is transmitting, the SWR is continuously watched. This means in terms that the TX-processor (8) measures the Rho approx. 3100 times per second.

Note: Rho and SWR are two expressions describing the same physics.

$$Rho = \frac{SWR - 1}{SWR + 1} \qquad SWR = \frac{+ Rho}{- Rho}$$

3.4.3. SYSTEM FUNCTION DESCRIPTION cont.:

The measured Rho is compared to two limits.
If SWR > 2.0 (Rho > 0.333) then a calculation takes place. The result of the calculation gives a number of 0.3 dB steps that the RF-signal has to be reduced with. The number of steps n1, is given by:

$$n1 = \frac{(Rho - 0.333) * 18}{0.3}$$

(n1 can not be negative or higher than 30 (10dB)).

If SWR > 5.0 then the error message "Bad SWR" is enervated.
The operator is informed when the key is released.

Temperature Watching
The temperature at the power transistors in the Power Amplifier (11) is measured 5 times per second. The temperature is measured on both PA module A and PA module B, and the highest temperature of these is used in the calculation.
The measured temperature is compared to two limits. If the temperature is above 98° Celsius a calculation takes place. The result of the calculation gives a number of 0.3 Db steps that the rf-signal has to be reduced with. The number of steps n2, is given by:

$$n2 = \frac{\text{Measured temperature} - 98°}{2}$$

(n2 can not be negative.)

This means that a temperature increase of 20° reduces the RF power approx. 3 dB.

If the temperature is above 118° Celsius the Power Amplifier (11) is blocked and the RF-power is further reduced approx. 60 dB, an error message is generated, and when the key is released the operator is informed. When the temperature has fallen to 108° Celsius the Power Amplifier (11) is opened again.

Power Fail Watching
The power from PA module A and PA module B is measured 5 times per second. IF one PA module has no power out over a period of approx. 2 second the RF-power is reduced by 10 steps (3 dB), and the power supply to the defect module is switched off. An error message is generated, and when the key is released the operator is informed.

AC Supply Missing
If the voltage of the AC supply is falling under a low level the DC power supply is switched on, an error message is generated and when the key is released the operator is informed. If reduced power (P_out max with DC supply) is selected, the RF-power is reduced by 6 steps (2dB). From 1200 Watt down to 750 Watt.

CALIBRATION OF THE T2135
In practice the calibration is done by use of a Service Programme. Please refer to the Service Programmes. In the following the calibration is described functionally.

Motive for the Calibration
The calibration is done in order to eliminate tolerances in specific components related to the measuring of the Power_out voltage.

Principles for the Calibration
The principle for the calibration is as follows.
The RF-power (1.6 MHz) is increased until a specific distortion is reached. The Power_out voltage is measured and stored as the Power_out_calibration voltage.

3.7 SERVICE PROGRAMMES.

General information:
It is in the following assumed, that the Service Programme Jumper is inserted in the RE2100.
If the RE2100 displays 'Err.0' in a Service Programme the selected SP does not exist.

Example:

Operator:	Key:	20-7 <ENT>
RE2100:	Displays:	'SP-20-7 '
		' Err.0'

Legend: Err.0 = The entered service programme does not exist.

3.7.1 SERVICE PROGRAMMES IN T2135.

TEMPERATURE

SP-21-0
Display the state of the temperature protection.

Example:

Operator:	Key:	21-0 <ENT>
RE2100:	Displays:	'SP-21-0 '
		' 00.1'

Legend:

00.0 There has been no reduction of Power_out due to high temperature

00.1 There has been a reduction of rf-power due to high temperature in POWER AMPLIFIER A

00.2 The POWER AMPLIFIER A has been blocked due to very high temperature.

00.3 The is a error in the temperature censor A

00.4 There has been a reduction of rf-power due to high temperature in POWER AMPLIFIER B

00.5 The POWER AMPLIFIER B has been blocked due to very high temperature.

00.6 The is a error in the temperature censor B

SP-21-1
Display the actual temperature in Amplifier A in ADC temp.

Example:

Operator:	Key:	21-1 <ENT>
RE2100:	Display	'SP-21-1'
		' 15.8'

Legend: The 15.8 must be changed to an actual temperature. Temperature = app. 65°C

SP-21-2
Display the actual temperature in Amplifier B in ACD temp.

Example:

Operator:	Key:	21-2 <ENT>
RE2100:	Display	'SP-21-2'
		' 21.7 '

Legend: The 21.7 must be changed to an actual temperature.

3.7.1 SERVICE PROGRAMMES IN T2135 cont.:

SP-21-3
Display the latest measured temperature in Amplifier A.
The temperature is only valid after the transmitter has been keyed.

Example:

Operator:	Key:	21-3 <ENT>
RE2100:	Display	'SP-21-3'
		' 19.6'

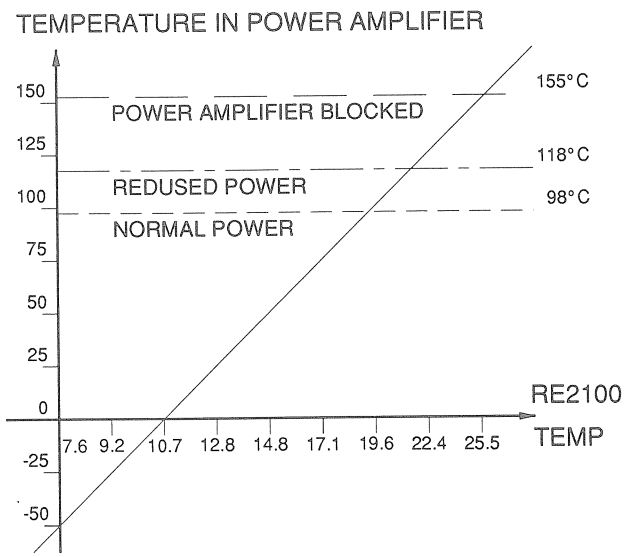
Legend: The 19.6 must be changed to an actual temperature. Temperature = app. 98°C

SP-21-4
Display the latest measured temperature in Amplifier B.
The temperature is only valid after the transmitter has been keyed.

Example:

Operator:	Key:	21-4 <ENT>
RE2100:	Display:	'SP-21-4'
		' 22.0'

Legend: The 22.0 must be changed to an actual temperature.
Temperature = app. 123°C



Function between the ADC temp and the real temperature.

3.7.1 SERVICE PROGRAMMES IN T2135 cont.:

POWER IN, PA 1 , PA 2, Vforward and POWER OUT

SP-22-0
Display the latest Power_out MAX voltage.
The Voltage is only valid after the transmitter has been keyed, and the "Drive set" is accpeted.

Example:

Operator:	Key:	22-0 <ENT>
RE2100:	Displays:	'SP-22-0'
		' 10.7'

Legend: Measured in Volt.

SP-22-1
Display the latest measured Power_in voltage.
Measured at P5 pin 1 on the Microprocessor module (8).
The Voltage is only valid after the transmitter has been keyed.

Example:

Operator:	Key:	22-1 <ENT>
RE2100:	Displays:	'SP-22-1'
		' 0.7'

Legend: Measured in Volt.

SP-22-2
Display the latest measured POWER DET A voltage.
Measured at P5 pin 25 on the Microprocessor module (8).
The Voltage is only valid after the transmitter has been keyed.

Example:

Operator:	Key:	22-2 <ENT>
RE2100:	Displays:	'SP-22-2'
		' 2.6'

Legend: Measured in Volt.

SP-22-3
Display the latest measured POWER DET B voltage.
Measured at P5 pin 26 on the Microprocessor module (8).
The Voltage is only valid after the transmitter has been keyed.

Example:

Operator:	Key:	22-3 <ENT>
RE2100:	Displays:	'SP-22-3'
		' 2.7'

Legend: Measured in Volt.

3.7.1 SERVICE PROGRAMMES IN T2135 cont.:

SP-22-4
Display the latest measured Vforvard voltage.
Measured at P4 pin 7 on the Microprocessor module (8).
The Voltage is only valid after the transmitter has been keyed.

Example:

Operator:	Key:	22-4 <ENT>
RE2100:	Displays:	'SP-22-5'
		' 10.8'

Legend: Measured in Volt.

SP-22-5
Display the latest measured POWER_OUT voltage.
Measured at P4 pin 9 on the Microprocessor module (8).
The Voltage is only valid after the transmitter has been keyed.

Example:

Operator:	Key:	22-5 <ENT>
RE2100:	Displays:	'SP-22-5'
		' 10.7'

Legend: Measured in Volt.

SWR

SP-23-0
Display the latest measured SWR.

Example:

Operator:	Key:	23-0 <ENT>
RE2100:	Displays:	'SP-23-0 '
		' 1.6'

SP-23-1
Display the measured SWR when the tuning was finished.

Example:

Operator:	Key:	23-1 <ENT>
RE2100:	Displays:	'SP-23-1 '
		' 1.7'

EEPROM

SP-24-0
Test the EEPROM's for write and read.

Example:

Operator:	Key:	24-0 <ENT>
RE2100:	Displays:	'SP-24-0 '

RE2100:	Displays:	'SP-24-0 '
		' A. '

Legend: A. = No Errors found
Err.1 = Error found in U8.
Err.2 = Error found in U9.

N O T E !
The duration of the test is approximately 8 seconds.

3.7.1 SERVICE PROGRAMMES IN T2135 cont.:

SP-24-1
Delete all stored Retune Data from the EEPROM's.

Example:

Operator:	Key:	24-1 <ENT>
RE2100:	Displays:	'SP-24-1 '

RE2100:	Displays:	'SP-24-1'
		' A. '

Legend: A. = Deleting finished.

Initialize EEPROM's from scratch.
Stores standard data in the eeprom

SP-24-2

Example:

Operator:	Key:	24-2<ENT>
RE2100:	Displays:	'SP-24-2 '

RE2100:	Displays:	'SP-24-2'
		' A. '

Legend: A. = Initialize finished.

Note: The T2135 must be turned off and on after the execution of this Service Programme.

The T2135 M U S T be Calibrated after this Service Programme.

3.7.1 SERVICE PROGRAMMES IN T2135 cont.:

CALIBRATION

SP-25
Calibrate the T2135.

Example:
Operator: Connect an oscilloscope to the internal
Dummy Load in the T2135.

Operator:	Key:	25
RE2100:	Displays:	'SP-25-0'
		' CAL. '

RE2100: Delivers a two-tone rf-signal continuously (Same as tune tones).

Tx-frequency: 1600.0 KHz

T2135: Opens and closes for the two-tone rf-signal.
Open in 2 seconds and closed in 2 seconds.

Operator: Adjust the rf-level of the two-tones by using the keys <FREQ UP> and <FREQ DOWN> until the rf-signal on the oscilloscope just is not distorted.

Operator:	Key:	1
RE2100:	Displays:	'SP-25-1'
		' A. '

Legend: A. = Accepted. The T2135 is calibrated.
Err.1 = POWER OUT Voltage high. See the description of Error Message 82
Err.2 = POWER OUT Voltage low. See the description of Error Message 81
Err.3 = Bad SWR in the internal dummy load.

Note: If any 'Err.' comes up the T2135 is N O T calibrated.

Note: After calibration it is necessary to switch off the power on the RE2100.

Unintentional call of SP-25

If the operator unintentionally has keyed '25' it is possible to leave Service Programme 25 without calibrating the T2135 in the following way:

Operator: Key: <ENT> or <TUNE>

SP-25 may also be left by switching off the power on the RE2100.

Note: If any 'Err.' comes up the T2135 is N O T calibrated.

Note: After calibration it is necessary to switch off the power on the RE2100.

Unintentional call of SP-25

If the operator unintentionally has keyed '25' it is possible to leave Service Programme 25 without calibrating the T2135 in the following way:

Operator: Key: <ENT> or <TUNE>

SP-25 may also be left by switching off the power on the RE2100.

3.7.1 SERVICE PROGRAMMES IN T2135 cont.:

STEP ATTENUATOR

SP-26-0
Display the Maximal step of the Step attenuator in the RE2100 Exciter.

Example:

Operator:	Key:	26-0 <ENT>
RE2100:	Displays:	'SP-26-0'
		' 14. '

SP-26-1
Display the Actual step of the Step attenuator in the RE2100 Exciter.

Example:

Operator:	Key:	26-1 <ENT>
RE2100:	Displays:	'SP-26-1'
		' 18. '

SOFTWARE VERSION

SP-27-0
Display the Version and the Release of the software in the Tx-processor(3) in T2135.

Example:

Operator:	Key:	27-0 <ENT>
RE2100:	Displays:	'SP-27-0 '
		' 1096.A'

Legend: '1096A' is S. P. Radio's identification of the version of the software. On the label on the EPROM is written: C1096A

' ' = 1. release
'A' = 2. release
'B' = 3. release
etc.

3.7.1 SERVICE PROGRAMMES IN T2135 cont.:

TROUBLE SHOOTING

SP-29
Trouble shooting service programme.

Example:
Operator: Key: 29
RE2100: Displays: 'SP-29-0 '
' SE. '

RE2100: Delivers a two-tone rf-signal continuously
(Same as tune tones).

Tx-frequency: 1600.0 KHz

T2135: The accordingly Low Pass filter is switched in and the transmitter is keyed.
It is advisable to connect a 50 Ohm dummy load instead of the aerial coupler.

Operator: May now trouble shoot the transmitter without being disturbed by error messages etc.
Adjustment of the rf-level of the two-tones is done by using the keys
<FREQ UP> and <FREQ DOWN> on the front of RE2100.

When the trouble shooting is finished:

Operator: Key: <ENT>
RE2100: Displays: 'SP- '

ADJUSTMENT

SP-33

Adjustment of the bias current in the power transistors in the Power Amplifier A
and Power Amplifier B.

Example:
Operator: Key: 33
RE2100: Displays: 'SP-33-0 '
' SE. '

T2135: The transmitter is keyed. There are no rf-signals
applied to the Power Amplifier A and Power Amplifier B.

Operator: May now adjust the bias current in accordance to the adjustment procedure.

When the adjustment is finished:

Operator: Key: <ENT>
RE2100: Displays: 'SP- '

3.7.1 SERVICE PROGRAMMES IN T2135 cont.:

POWER SUPPLIES

SP-34-X
Activates the power supplies 28V and 42V in one supply, and releases any other.

Operator:	Key:	34-1 <ENT>
RE2100:	Displays:	'SP-34-1 '
		' A. '

Power supply	SP-34-[1-8] <ENT>	Check
(A) AC	34-1	28V-A and 42V-A
(B) AC	34-2	28V-B and 42V-B
(A) DC	34-3	28V-A and 42V-A
(B) DC	34-4	28V-B and 42V-B

Deactivate all Power Supplies:

Operator:	Key	34-0 <ENT>
RE2100:	Displays:	'SP-34-0 '
		' A. '

ACTUAL STATUS

SP-35-0
Display the actual status of the T2135.

Operator:	Key:	35-0 <ENT>
RE2100:	Display	'SP-35-0 '
		' 0.2 '

Legend:

0.0 It is NOT possible to transmit, all power supplies are released.

0.1 Power Amplifier A is install and is working. AC supply.

0.2 Power Amplifier A is install and is working. Power Amplifier B is install and is working. AC supply.

0.3 Power Amplifier A is install and is working. Power Amplifier B is install and is NOT working. AC supply.

0.4 Power Amplifier A is install and is NOT working. Power Amplifier B is installed and is working. AC supply.

0.5 Power Amplifier A is install and is working. DC supply.

0.6 Power Amplifier A is install and is working. Power Amplifier B is install and is working. DC supply.

0.7 Power Amplifier A is install and is working. Power Amplifier B is install and is NOT working. DC supply.

0.8 Power Amplifier A is install and is NOT working. Power Amplifier B is installed and is working. DC supply.

MAX_RF POWER AT DC SUPPLY

SP-36-X
Set MAX Rf-Power when DC supplies are used.

Power Levels:
0 = Normal, 1200 W
1 = 1000 W
2 = 800 W
3 = 600 W

Example:

Operator:	Key:	36-[0-3]<ENT>
RE2100:	Displays:	'SP-36-[0-3] '

RE2100:	Displays:	'SP-36-2 '
		' 800. '

Legend: 800. = Set to 800 W.

MAX RF POWER AT FREQUENT < 4 M Hz

SP-37-X
Set MAX Rf-Power for frequents < 4 Mhz

Power Levels:
0 = Normal, 600 W
1 = 1200 W
2 = 400 W
3 = 200 W

Example:

Operator:	Key:	37-[0-3]<ENT>
RE2100:	Displays:	'SP-37-[0-3] '

RE2100:	Displays:	'SP-37-2 '
		' 400. '

Legend: 400. = Set to 400 W.

FILTER RELAYS

SP-38-X
OUTPUT FILTER relay drivers.

Activate each of the six Filter Drivers one bye one, and release any other.

A. Enter SP-38-[1-6]

Driver	Frequency range	SP-38-X <ENT>	U	pin
Filter 1	1.6 - 2.399 Mhz	38-1	21	14
Filter 2	2.4 - 3.899 Mhz	38-2	21	15
Filter 3	3.9 - 6.399 Mhz	38-3	21	13
Filter 4	6.4 - 10.399 Mhz	38-4	21	11
Filter 5	10.4 - 16.899 Mhz	38-5	14	12
Filter 6	16.9 - 28.000 Mhz	38-6	21	10
DRIVE Control		38-7	21	16
RX/TX Control		38-8	21	12

B. Connect the voltmeter to the specific pin
Voltage is < 1.1 Volt
C. Enter SP-38-0 <ENT>

3.7.1 SERVICE PROGRAMMES IN T2135 cont.:

POWER LIMITS

SP-39-3
Display the POWER DET. A limit that shall be exceed,
unless the Power amplifier is NOT OK.
The Voltage is only valid after the transmitter has been keyed or tuned.

Example:

Operator:	Key:	39-3 <ENT>
RE2100:	Displays:	'SP-39-3'
		' 2.6'

Legend: Measured in Volt.

SP-39-3
Display the POWER DET. B that shall be exceed,
unless the Power amplifier is NOT OK.
The Voltage is only valid after the transmitter has been keyed or tuned.

Example:

Operator:	Key:	39-3 <ENT>
RE2100:	Displays:	'SP-39-3
		' 2.6'

Legend: Measured in Volt.

SP-39-4
Display the Vforward voltage that shall be exceed, unless the combiner is NOT OK.
The Voltage is only valid after the transmitter has been keyed or tuned.

Example:

Operator:	Key:	39-4 <ENT>
RE2100:	Displays:	'SP-39-4'
		' 3.4'

Legend: Measured in Volt.

SP-39-5
Display the Power out voltage that shall be exceed, unless the Filter module is NOT OK.
The Voltage is only valid after the transmitter has been keyed or tuned.

Example:

Operator:	Key:	39-5 <ENT>
RE2100:	Displays:	'SP-39-5'
		' 3.2'

Legend: Measured in Volt.

SP-39-0, SP-39-1 and SP-39-2 are used for internal test.

3.7.2 SERVICE PROGRAMMES RELATED TO AT2112

AT2112 RELAYS

SP-30-X
Activate AT2112 Relays, Control 1-9 one by one, and release any relay.
Example:

Operator:	Key:	30 - [0-9] <ENT>
RE2100:	Displays:	'SP-30-[0-9] '
		' A. '

Legend: 0 = No relays activated
1 - 9 = Relays 1 - 9 activated
A. = Accepted.

The T2135 Activates the entered AT2112 Relay no., other relays are released.

SP-31-X

Activate AT2112 Relays, Control (10-11), AERIAL RELAY (12), RX/TX (13) and RX < 4 Mhz (14) one by one.

Example:

Operator:	Key:	31 - [0-4] <ENT>
RE2100:	Displays:	'SP-31-[0-4] '
		' A. '

Legend: 0 -1 = Relays 10 - 11 activated
2 = Antenne Relay TX
3 = RX / TX Relay
4 = RX < 4 MHz
A. = Accepted.

If The AT2112 not is in the system (Jumper 5 is inserted in the Tx-processor) the following is displayed:

RE2100:	Displays:	'SP-31-1 '
		' Err.1'

Release all areal relays.

Enter:	SP-30-0<ENT>

MOTOR

SP-32-1
Sets supply on the AT2112 'MOTOR' line, (low speed).

Example:

Operator:	Key:	32 - 1 <ENT>
RE2100:	Displays:	'SP-32-1 '
		' A. '

SP-32-2
Sets supply on the AT2112 'MOTOR' line, (high speed).

Example:

Operator:	Key:	32 - 2 <ENT>
RE2100:	Displays:	'SP-32-2 '
		' A. '

Stop motor

Operator:	Key:	32 - 0 <ENT>
RE2100:	Displays:	'SP-32-0 '
		' A. '

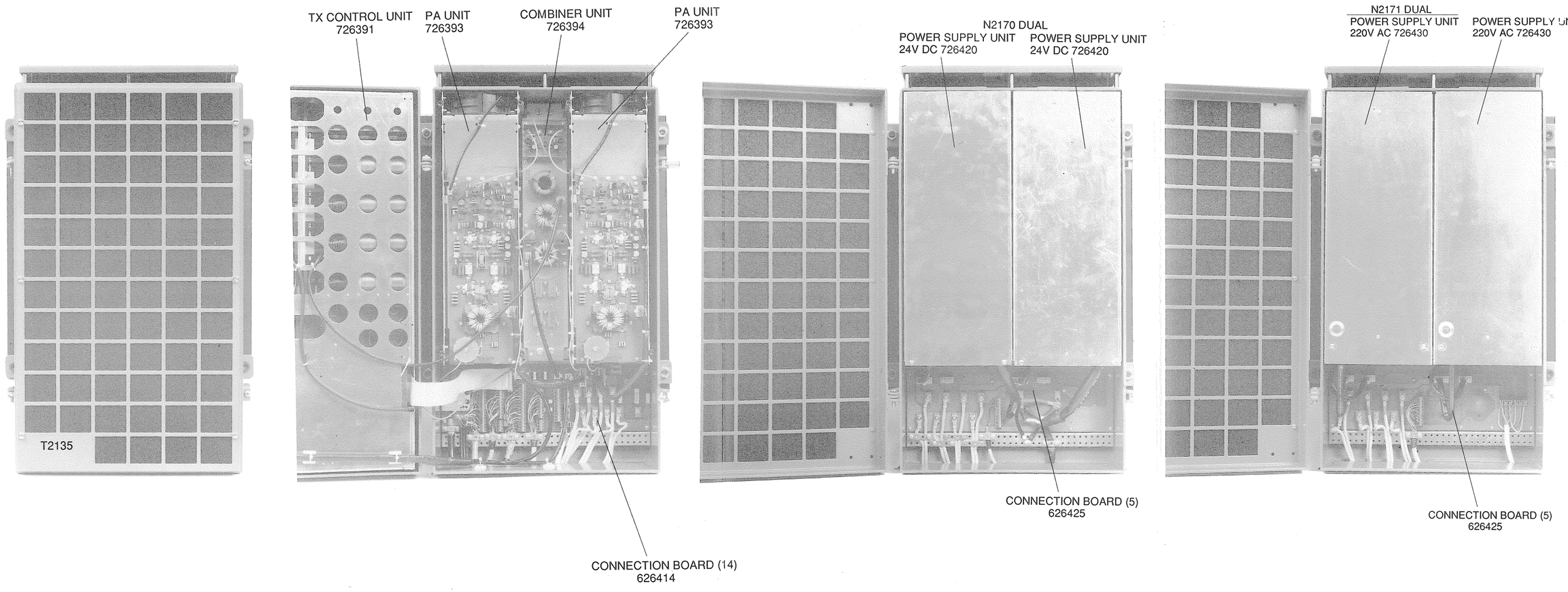
CONTENTS

4. MECHANICAL DESCRIPTION

4.1. MECHANICAL ASSEMBLING/DISASSEMBLING AND UNITS LOCATION

4. MECHANICAL DESCRIPTION

4.1. MECAHNICAL ASSEMBLING/DISASSEMBLING AND UNITS LOCATION



CONTENTS

5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS

5.2. CONNECTION BOARD (MODULE 14) SP NO. 626414, USED IN CABINET FOR 1200W TRANSMITTER

5.3. CONNECTION BOARD (MODULE 5) SP NO. 626425, USED IN CABINET FOR 1200W POWER SUPPLIES

5.1 CONNECTION BOARD (MODULE 14) SP NO 626414

The connection board contains following circuits:

Aerial switch relays RE3 and RE4. In transmit mode is RE3 and RE4 activated.
The output from the power amplifier (filter switch) is fed tough RE4 to the aerial coupler AT2112/the antenna.
The output from the RE2100 (exciter) is fed trough RE3 to the power amplifier.

The power-in detector consists of the amplifier Q1 and the detector D4, C34.
This detector is used to measure whether the input from RE2100 is sufficient. It is also used together with the power out detector to check if the power amplifier is working ok.

The audiotransformers for aux AF to transmitter and 0 Dbm input.

The optocoupler's OC1, OC2 is used for controlling the transmitter in telex mode.
When OC1 is on, then the power supply is switch on and the transmitter is ready to transmit (this function is not used when SAILOR telex modem RM2151 is used, then this is done via the SP-BUS).
OC1 is a fast on/off switch for the RF signal, and is used for ARQ telex.

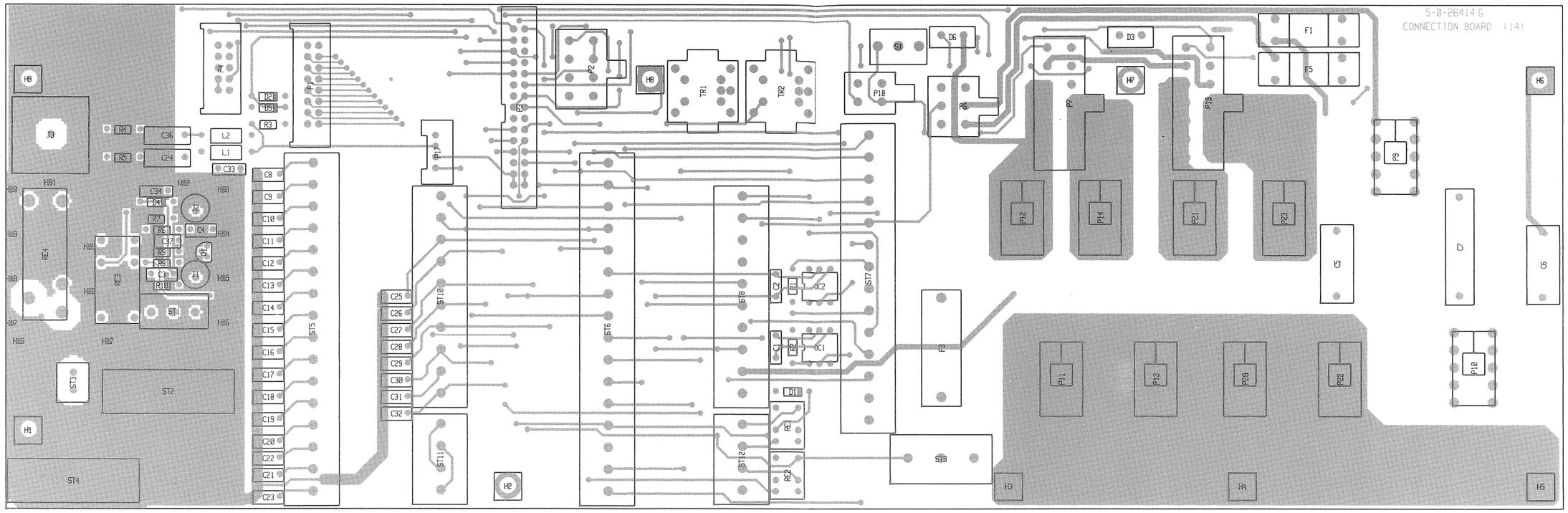
RE1 is a mute relay for external muting. It is activated when the transmitter is ready for transmit, tuning and transmitting.

RE2 is a mute relay for muting of the receiver in RE2100. It has to activated when other transmitters is used on the same installation.

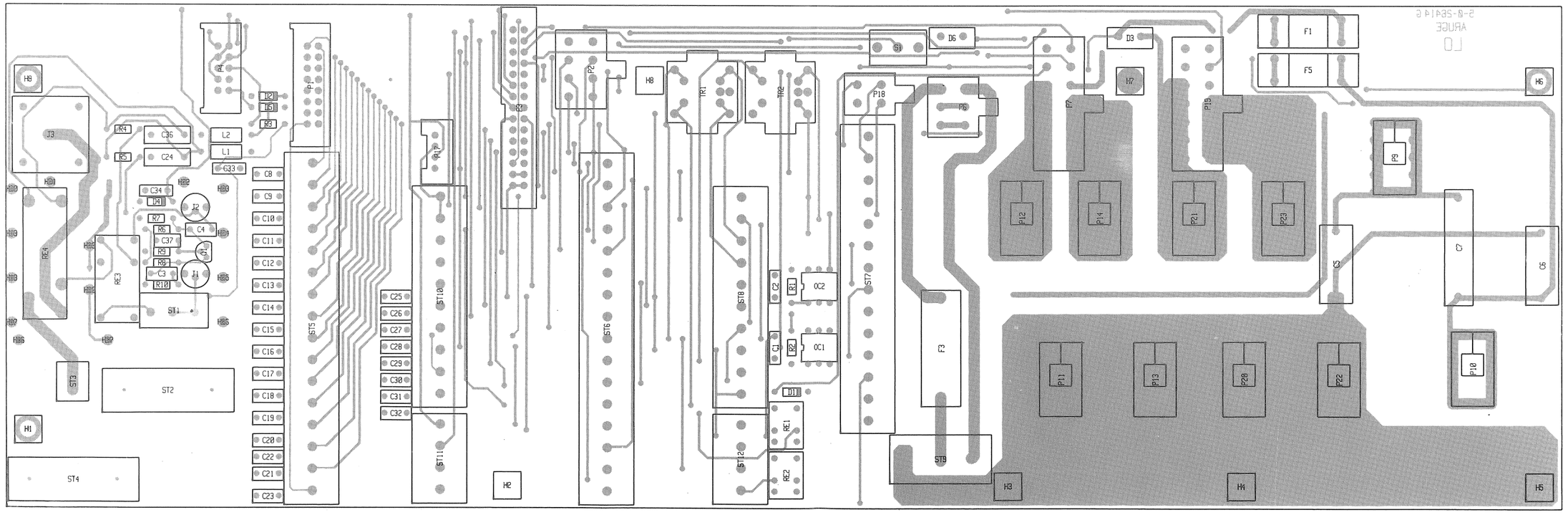
CONNECTION BOARD MODULE 14

5.2. CONNECTION BOARD (MODULE 14) cont.:

COMPONENT LOCATION CONNECTION BOARD MODULE 14.



View from component side with upper side tracks.



View from component side with lower side tracks.

5-0-26414G
PART I
/ 4-6-26414G
2135/1200W

Connection Board (14)

SP-BUS TO TX-PROCESSOR J1
RF IN TO COMBINER J2
RF OUT FROM FILTER SWITCH J3

TX-PROCESSOR MODULE 8

PIN 1	CONTROL 2	PIN 9	CONTROL 10
PIN 2	CONTROL 1	PIN 10	CONTROL 9
PIN 3	CONTROL 4	PIN 11	AERIAL RELAY
PIN 4	CONTROL 3	PIN 12	CONTROL 11
PIN 5	CONTROL 6	PIN 13	RX < 4MHz
PIN 6	CONTROL 5	PIN 14	RX/TX
PIN 7	CONTROL 8	PIN 15	AE/180° PULSE
PIN 8	CONTROL 7	PIN 16	MOTOR

POWER SUPPLY MODULE 9

PIN 1	AC SENSE
PIN 2	GND
PIN 3	SUPPLY ON/OFF
PIN 4	+9V
PIN 5	+10V
PIN 6	+10V
PIN 7	-10V
PIN 8	-10V

TX-PROCESSOR MODULE 8

PIN 1	POWER IN	PIN 16	42V ON (B) DC
PIN 2	+10V	PIN 17	28V ON (B) DC
PIN 3	+9V	PIN 18	42V ON (A) DC
PIN 4	-10V	PIN 19	28V ON (A) DC
PIN 5	RF ON/OFF	PIN 20	42V ON (B) AC
PIN 6	TLX ON/OFF	PIN 21	28V ON (B) AC
PIN 7	RX/TX CONTROL	PIN 22	42V ON (A) AC
PIN 8	VF/AE-CURRENT	PIN 23	28V ON (A) AC
PIN 9	MAN. TUNE	PIN 24	AC SENSE
PIN 10	TEMP. A	PIN 25	POWER DET. A
PIN 11	TEMP. A	PIN 26	POWER DET. B
PIN 12	TEMP. B	PIN 27	GND
PIN 13	TEMP. B	PIN 28	GND
PIN 14	+28V (TO ATU)	PIN 29	GND
PIN 15	+28V (TO ATU)	PIN 30	GND

AF-AMPLIFIER MODULE 10

PIN 1	AF OUT
PIN 2	GND
PIN 3	GND
PIN 4	+28V
PIN 5	+28V
PIN 6	+10V
PIN 7	GND
PIN 8	AF IN
PIN 9	GND
PIN 10	MUTE LOUDSPEAKER

COMBINER MODULE 12

PIN 1	POWER DET A
PIN 2	POWER DET B
PIN 3	GND
PIN 4	+10V

POWER SUPPLY MODULE 9

PIN 1	+ BATT.
PIN 2	- BATT.
PIN 3	P-220V AC
PIN 4	+ BATT.
PIN 5	- BATT.
PIN 6	N-220V AC

POWER AMPLIFIER A MODULE 11

PIN 1	+28V	PIN 8	+42V
PIN 2	+28V	PIN 9	+42V
PIN 3	+28V	PIN 10	+42V
PIN 4	+28V	PIN 11	+42V
PIN 5	+28V	PIN 12	RE ON/OFF A
PIN 6	RX/TXCONTROL	PIN 13	TEMP A
PIN 7	GND	PIN 14	TEMP A

POWER AMPLIFIE MODULE 11

PIN 1	+28V
PIN 2	+28V
PIN 3	+28V
PIN 4	+28V
PIN 5	+28V
PIN 6	RX/TXCONTROL
PIN 7	GND

TR1 600 Ohm
TR2 600 Ohm
D1 5V1
D2 4V7
D3 PBYR1045
D4 HP2800
D5 PBYR1045
Q1 BF199
OC1 CNY17-3
OC2 CNY17-3
RE1
RE2
RE3 V23040
RE4
RE5
F1 6A3T
F2 2A8T
F3 6A3T
S1

ST1

PIN 1	RF IN/OUT RE2100
PIN 2	SP-BUS IN
PIN 3	SP-BUS IN

ST3 RF IN/OUT

AT2112

PIN 1	CONTROL 1	PIN 9	CONTROL 9
PIN 2	CONTROL 2	PIN 10	CONTROL 10
PIN 3	CONTROL 3	PIN 11	CONTROL 11
PIN 4	CONTROL 4	PIN 12	AERIAL RELAY
PIN 5	CONTROL 5	PIN 13	RX/TX
PIN 6	CONTROL 6	PIN 14	RX < 4MHz
PIN 7	CONTROL 7	PIN 15	MOTOR
PIN 8	CONTROL 8	PIN 16	AE 180 PULSE

AERIAL RELAY

PIN 1	
PIN 2	+10V
PIN 3	GND
PIN 4	RF ON/OFF

RE2100

PIN 1	MUTE RX	PIN 9	0 dBm COMMON
PIN 2	VF/AE-CURRENT	PIN 10	AUX AF TO TX
PIN 3	+9V	PIN 11	EXT. RF-GAIN CONTROL
PIN 4	+10V	PIN 12	0 dBm
PIN 5	SUPPLY ON/OFF	PIN 13	RF ON/OFF
PIN 6	MIC KEY	PIN 14	-10V
PIN 7	AF TO AMP COMMON	PIN 15	-BAT.
PIN 8	AF TO AMP	PIN 16	SP-BUS INTERRUPT

RM2150/RM2151

PIN 1	+ 9V	PIN 8	RF ON/OFF-
PIN 2	+ 10V	PIN 9	RX ON/OFF+
PIN 3	-10V	PIN 10	AUX AF IN TX-
PIN 4	SUPPLY ON/OFF	PIN 11	AUX AF IN TX+
PIN 5	-BATT	PIN 12	SP BUS INTERRUPT
PIN 6	TX KEY-	PIN 13	
PIN 7	TX KEY+	PIN 14	

LOUDSP.

PIN 1	LOUDSP.	PIN 3	EXT LOUDSP.
PIN 2	LOUDSP.	PIN 4	EXT LOUDSP.

MUTE

PIN 1	MUTE OUT	PIN 3	MUTE RX IN
PIN 2	MUTE OUT	PIN 4	MUTE RX IN

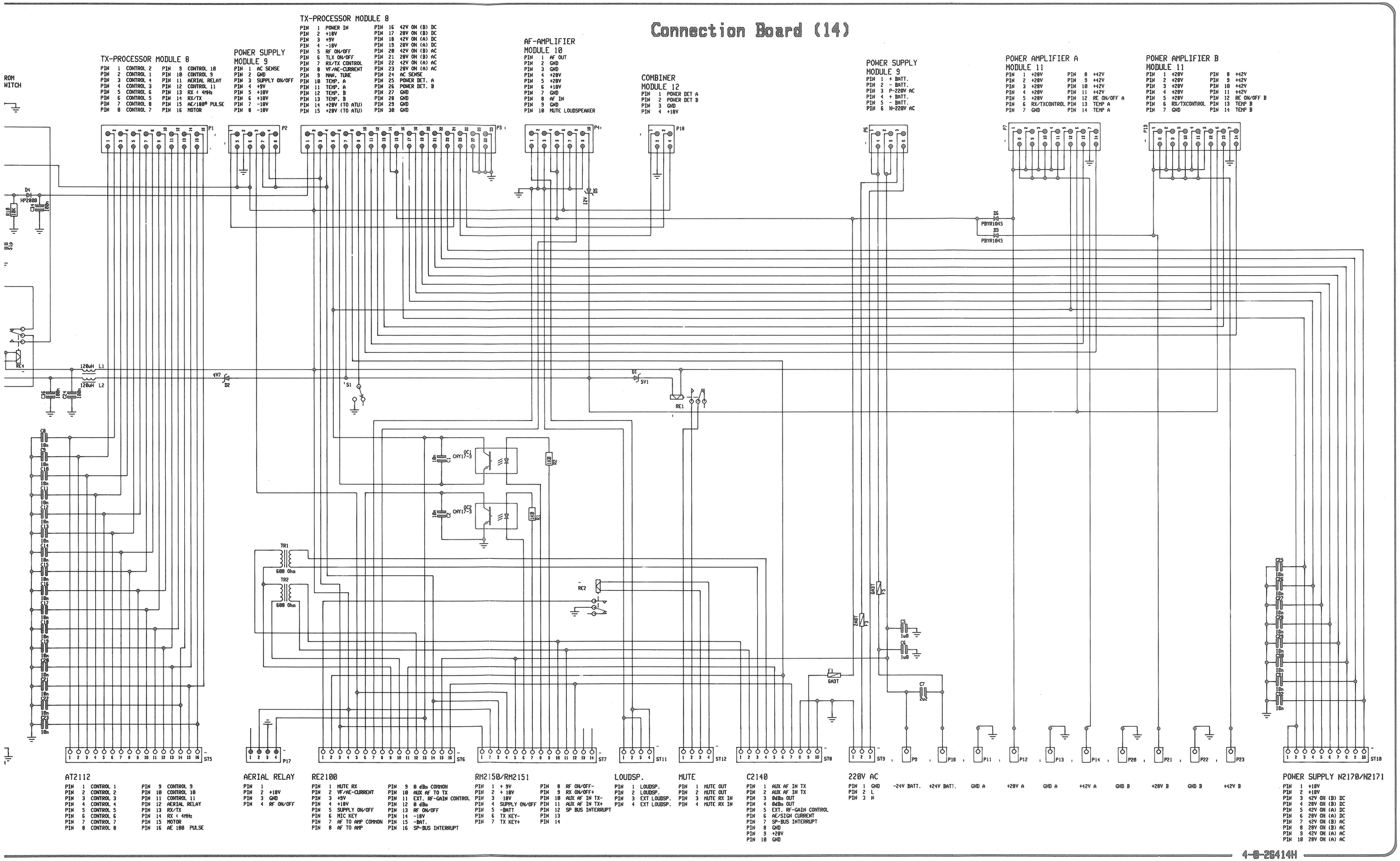
C2140

PIN 1	AUX AF IN TX
PIN 2	AUX AF IN TX
PIN 3	0dBm OUT
PIN 4	0dBm OUT
PIN 5	EXT. RF-GAIN CONTROL
PIN 6	AE/SIGN CURRENT
PIN 7	SP-BUS INTERRUPT
PIN 8	GND
PIN 9	+28V
PIN 10	GND

220V AC

PIN 1	GND	-24V BATT.	+24V BATT.	GND A	+28V A	GND A	+42V A	GND B	+28V B	GND B
PIN 2	L									
PIN 3	N									

Connection Board (14)



AT2112

PIN 1	CONTROL 1	PIN 9	CONTROL 9
PIN 2	CONTROL 2	PIN 10	CONTROL 10
PIN 3	CONTROL 4	PIN 11	CONTROL 11
PIN 4	CONTROL 3	PIN 12	AERIAL RELAY
PIN 5	CONTROL 5	PIN 13	RX/TX
PIN 6	CONTROL 6	PIN 14	RX < 4MHz
PIN 7	CONTROL 7	PIN 15	MOTOR
PIN 8	CONTROL 8	PIN 16	AE 180 PULSE

AERIAL RELAY

PIN 1	
PIN 2	+18V
PIN 3	GND
PIN 4	RF ON/OFF

RE2100

PIN 1	MUTE RX	PIN 9	0 dBm COMMON
PIN 2	VF/AE-CURRENT	PIN 10	AUX AF TO TX
PIN 3	+9V	PIN 11	EXT. RF-GAIN CONTROL
PIN 4	+18V	PIN 12	0 dBm
PIN 5	SUPPLY ON/OFF	PIN 13	RF ON/OFF
PIN 6	MIC KEY	PIN 14	-18V
PIN 7	AF TO AMP COMMON	PIN 15	-BAT.
PIN 8	AF TO AMP	PIN 16	SP-BUS INTERRUPT

RM2150/RM2151

PIN 1	+ 9V	PIN 8	RF ON/OFF-
PIN 2	+ 18V	PIN 9	RX ON/OFF+
PIN 3	-18V	PIN 10	AUX AF IN TX-
PIN 4	SUPPLY ON/OFF	PIN 11	AUX AF IN TX+
PIN 5	-BATT	PIN 12	SP BUS INTERRUPT
PIN 6	TX KEY-	PIN 13	
PIN 7	TX KEY+	PIN 14	

LOUDSP.

PIN 1	LOUDSP.	PIN 3	EXT LOUDSP.
PIN 2	LOUDSP.	PIN 4	EXT LOUDSP.

MUTE

PIN 1	MUTE OUT	PIN 3	MUTE RX IN
PIN 2	MUTE OUT	PIN 4	MUTE RX IN

C2140

PIN 1	AUX AF IN TX
PIN 2	AUX AF IN TX
PIN 3	0dBm OUT
PIN 4	0dBm OUT
PIN 5	EXT. RF-GAIN CONTROL
PIN 6	AE/SIGN CURRENT
PIN 7	SP-BUS INTERRUPT
PIN 8	GND
PIN 9	+28V
PIN 10	GND

220V AC

PIN 1	GND	-24V BATT.	+24V BATT.	GND A	+28V A	GND A	+42V A	GND B	+28V B	GND B	+42V B
PIN 2	L											
PIN 3	N											

POWER SUPPLY N2170/N2171

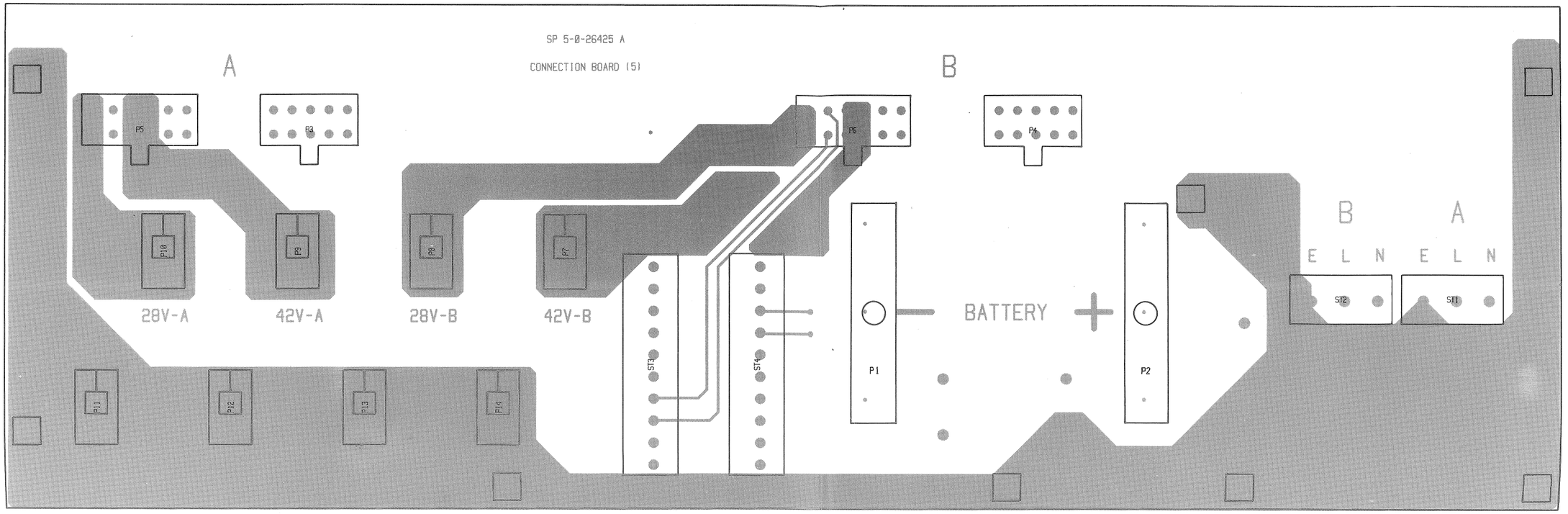
PIN 1	+18V
PIN 2	+18V
PIN 3	42V ON (B) DC
PIN 4	28V ON (B) DC
PIN 5	42V ON (A) DC
PIN 6	28V ON (A) DC
PIN 7	42V ON (B) AC
PIN 8	28V ON (B) AC
PIN 9	42V ON (A) AC
PIN 10	28V ON (A) AC

4-8-26414H

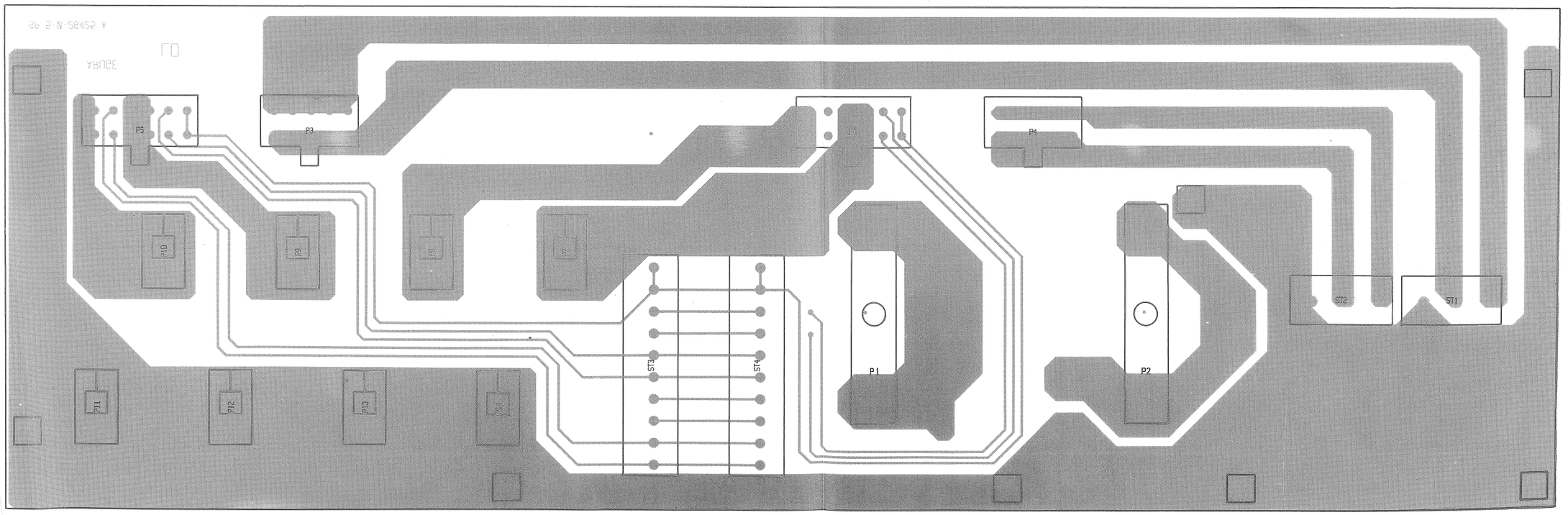
CONNECTION BOARD MODULE 5

5.3. CONNECTION BOARD (MODULE 5) cont.:

COMPONENT LOCATION CONNECTION BOARD MODULE 5.



View from component side with upper side tracks.



View from component side with lower side tracks.

Connection Board (5)

TO PS-A

PIN	1	AC-N
PIN	2	AC-N
PIN	3	AC-N
PIN	4	
PIN	5	
PIN	6	AC-L
PIN	7	AC-L
PIN	8	AC-L
PIN	9	
PIN	10	

TO PS-B

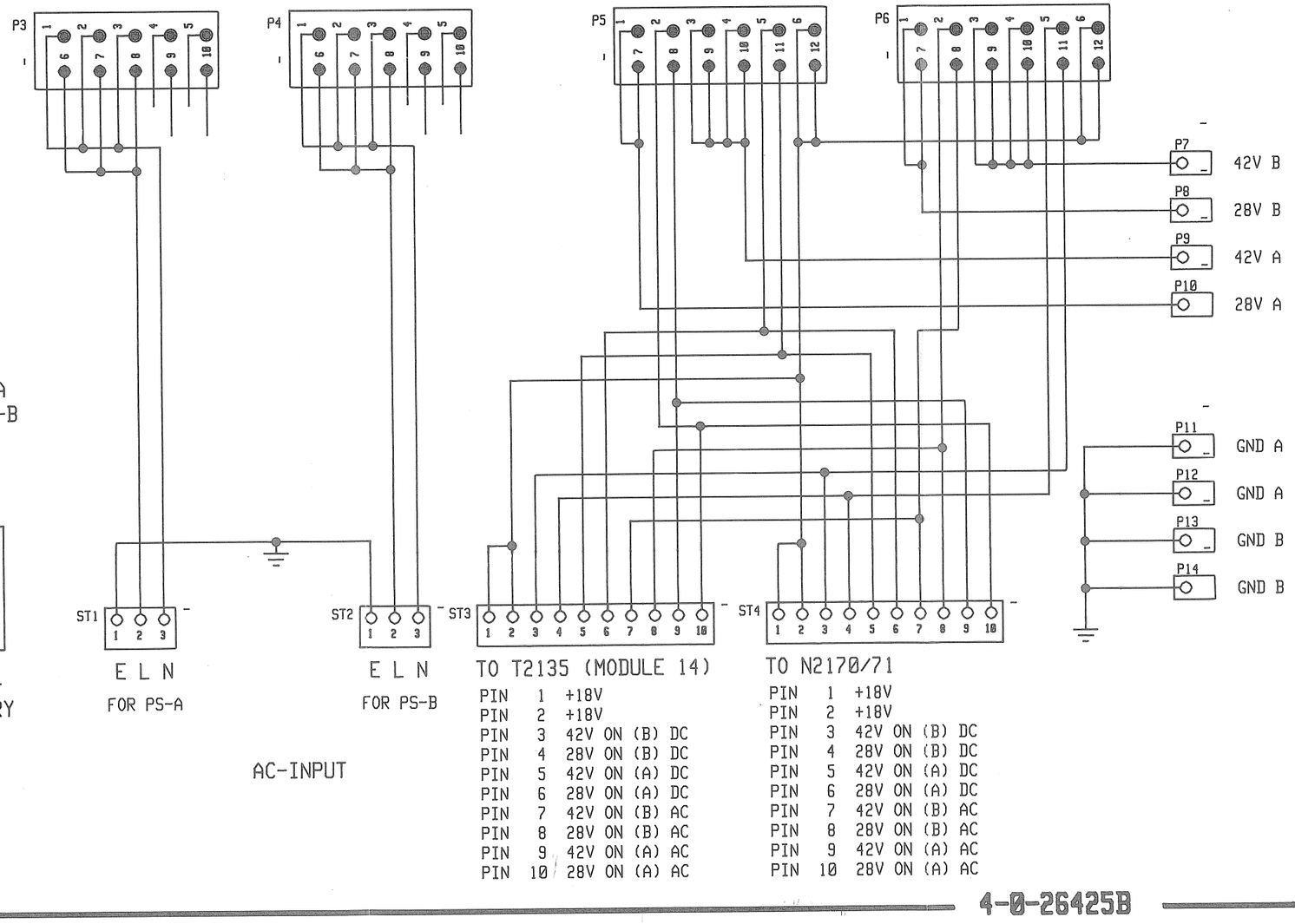
PIN	1	AC-N
PIN	2	AC-N
PIN	3	AC-N
PIN	4	
PIN	5	
PIN	6	AC-L
PIN	7	AC-L
PIN	8	AC-L
PIN	9	
PIN	10	

TO PS-A

PIN	1	+28V
PIN	2	28V ON AC
PIN	3	+42V
PIN	4	+42V
PIN	5	28V ON DC
PIN	6	+18V
PIN	7	+28V
PIN	8	42V ON AC
PIN	9	+42V
PIN	10	+42V
PIN	11	42V ON DC
PIN	12	+18V

TO PS-B

PIN	1	+28V
PIN	2	28V ON AC
PIN	3	+42V
PIN	4	+42V
PIN	5	28V ON DC
PIN	6	+18V
PIN	7	+28V
PIN	8	42V ON AC
PIN	9	+42V
PIN	10	+42V
PIN	11	42V ON DC
PIN	12	+18V



TO T2135 (MODULE 14)

PIN	1	+18V
PIN	2	+18V
PIN	3	42V ON (B) DC
PIN	4	28V ON (B) DC
PIN	5	42V ON (A) DC
PIN	6	28V ON (A) DC
PIN	7	42V ON (B) AC
PIN	8	28V ON (B) AC
PIN	9	42V ON (A) AC
PIN	10	28V ON (A) AC

TO N2170/71

PIN	1	+18V
PIN	2	+18V
PIN	3	42V ON (B) DC
PIN	4	28V ON (B) DC
PIN	5	42V ON (A) DC
PIN	6	28V ON (A) DC
PIN	7	42V ON (B) AC
PIN	8	28V ON (B) AC
PIN	9	42V ON (A) AC
PIN	10	28V ON (A) AC

4-0-26425B

CONTENTS

7. PARTS LISTS

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	CONNECTION BOARD 1200W	T2135	ESPERA	0-0-26396	726396
VARIOUS	RF COVER - CON. BOARD	CONNECTIONBOARD 26413/14	ESPERA	1-0-26869	226869
VARIOUS	DISTANCE PIECE	Ø4.8xO.8x8mm	OJD	4,8XO,8X8 MESS.	63.106
VARIOUS	SPARE FUSES F.N2165/HFSSB	N2165	S.P.RADIO	0-0-27245	727245
VARIOUS	KIT, WASHERS AND NUTS,FOR	CONNECTION BOARD 6/1200W	ESPERA	0-0-27676	727676
VARIOUS	SCREW M3x12mm PHJX-Z	DIN 7985	HFC	HFC9041 M3x12 PHJX-Z DIN 7985	86.956
-14	CONNECTION BOARD MODUL.14	T2135	ESPERA	5-0-26414H	626414

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	CONNEC.BOARD POWER SUPPLY	N2170/71 SINGLE & DUAL	ESPERA	0-0-26397	726397
VARIOUS	DISTANCE PIECE	Ø4.8x0.8x8mm	OJD	4,8X0,8X8 MESS.	63.106
VARIOUS	KIT, WASHERS AND NUTS,FOR	CONNECTION BOARD 6/1200W	ESPERA	0-0-27676	727676
VARIOUS	SCREW M3x12mm PHJX-Z	DIN 7985	HFC	HFC9041 M3x12 PHJX-Z DIN 7985	86.956
-5	CONNECTION BOARD MODULE 5	N2170/N2171	ESPERA	5-0-26425A	626425

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	CONNECTION BOARD MODUL.14	T2135	ESPERA	5-0-26414H	626414
VARIOUS	SPACER	TO220 H = 1/8"	BIVAR	424-125	30.705
VARIOUS	FUSE COVER	5x20mm FUSE SIZE	ELU	199016	48.716
VARIOUS	FUSE HOLDER	FOR PCB	SHURTER	OG 751 0042	78.421
VARIOUS	SCREW M3x12mm PHJX-Z	DIN 7985	HFC	HFC9041 M3x12 PHJX-Z DIN 7985	86.956
VARIOUS	SCREW M3x16 PHJX-Z	DIN 7985	WULCAN	HFC 9041 M3x16 PHJX-Z DIN 7985	86.957
VARIOUS	SCREW	M5x12 STEEL	HFC	HFC 473 FORZ.	87.413
C1-14	CAPACITOR MKT	10nF 5% 63VDC	PHILIPS	2222 370 89103	11.134
C2-14	CAPACITOR MKT	10nF 5% 63VDC	PHILIPS	2222 370 89103	11.134
C3-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C4-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C5-14	CAPACITOR MKT	1u0F 10% 100VDC	PHILIPS	2222 373 21105	11.079
C6-14	CAPACITOR MKT	1u0F 10% 100VDC	PHILIPS	2222 373 21105	11.079
C7-14	CAPACITOR MKT	2u2F 10% 100VDC	PHILIPS	2222 373 90002	11.142
C8-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C9-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C10-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C11-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C12-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C13-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C14-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C15-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C16-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C17-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C18-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C19.14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170

PART I/1200W 12/92

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
C20-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C21-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C22-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C23-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C24-14	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C25-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C26-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C27-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C28-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C29-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C30-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C31-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C32-14	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	NKE	DT 350 758L F 103 Z 50V FLAT PACK	15.170
C33-14	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C34-14	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C36-14	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C37-14	CAPACITOR CERAMIC	51pF 5% NPO 50VDC	NKE	DT 360 758S CH 510 J 50V FLAT PACK	15.110
D1-14	DIODE ZENER	5.1V 5% 0.4W	PHILIPS	BZX79C5V1	26.527
D2-14	DIODE ZENER	4.7V 5% 0.4W	PHILIPS	BZX79C4V7	26.524
D2-14	DIODE POWER	SCHOTTKY 45VDC/10A	PHILIPS	PBYR 1045	27.617
D3-14	DIODE POWER	SCHOTTKY 45VDC/10A	PHILIPS	PBYR 1045	27.617
D4-14	DIODE SCHOTTKY BARRIER	70V/15mA DO-35	SGS-THOMSON	1N5711	27.500
D5-14	DIODE ZENER	12V 5% 0.4W BZX79C12	PHILIPS*	BZX79C12	26.554
F1-14	FUSE	5x20mm 6A3 T 250V	* ELU	17912006300	45.510
F3-14	FUSE	2AT 250V 5x20mm	ELU	179 120 2AT	45.508
VARIOUS	FUSE HOLDER	1 POLE 5x20mm PCB VERSION	ELU	199015	78.398
F5-14	FUSE	5x20mm 6A3 T 250V	* ELU	17912006300	45.510
J1-14	SOCKET COAX	VERTICAL FOR PCB MOUNT.	TAIKO	TMP-J01X-V6	78.518
J2-14	SOCKET COAX	VERTICAL FOR PCB MOUNT.	TAIKO	TMP-J01X-V6	78.518
J3-14	SOCKET BNC	PCB VERSION	ROSENBERGER	51K102-400 A4	78.444
L1-14	CHOKE FIXED	120uH 10%	FASTRON	MICC-121K-02	20.372

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
L2-14	CHOKE FIXED	120uH 10%	FASTRON	MICC-121K-02	20.372
OC1-14	OPTO COUPLER	CNY17-3	TOSHIBA	CNY17-3	32.533
OC2-14	OPTO COUPLER	CNY17-3	TOSHIBA	CNY17-3	32.533
P1-14	MULTI PLUG	2x8 POLES PCB VERSION	3M	3599-6002 / 7616-6002 JL	78.249
P2-14	MULTIPLUG	2x4 POLES PCB VERSION	MOLEX	39-28-1083	78.218
P3-14	MULTIPLUG	2x15 POLES PCB VERSION	3M	3531-6002 / 7630-6002 JL	78.253
P4-14	PLUG	2x5 POLES	3M	3654-6002 / 7610-6002 JL	78.251
P6-14	MULTIPLUG	2x3 POLES PCB VERSION	MOLEX	39-28-1063	78.217
P7-14	MULTIPLUG	2x7 POLES PCB VERSION	MOLEX	39-28-1143	78.222
P9-14	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P10-14	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P11-14	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P12-14	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P13-14	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P14-14	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P17-14	PLUG (MALE)	4 POLE	AMP	0-826375-4	78.104
P18-14	PLUG 4 POLES		MOLEX	39-28-1043	78.216
P19-14	MULTIPLUG	2x7 POLES PCB VERSION	MOLEX	39-28-1143	78.222
P20-14	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P21-14	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P22-14	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P23-14	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
Q1-14	TRANSISTOR RF	BF199	PHILIPS	BF199	28.178
R1-14	RESISTOR MF	1kO OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R2-14	RESISTOR MF	1kO OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R3-14	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R4-14	RESISTOR MF	120 OHM 5% 0.33W	PHILIPS	2322 180 73121	02.450
R5-14	RESISTOR MF	120 OHM 5% 0.33W	PHILIPS	2322 180 73121	02.450
R6-14	RESISTOR MF	56k OHM 5% 0.33W	PHILIPS	2322 180 73563	02.514
R7-14	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R8-14	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R9-14	RESISTOR MF	1kO OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R10-14	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
RE1-14	RELAY	12VDC 1SH. 2A.	MILTRONIC AB	OUC-S-112D	21.300
RE2-14	RELAY	12VDC 1SH. 2A.	MILTRONIC AB	OUC-S-112D	21.300
RE3-14	RELAY	15V DC 2A 1SH.	SIEMENS	V23040-A0003-B201	21.062
RE4-14	RELAY	12VDC 1SH. 8A.	SCHRACK	RY S 12 012	21.031
RE5-14	RELAY	12VDC 1A 1 SHIFT	SIEMENS	V23026-A1002-B201	21.029
S1-14	SWITCH TOGGLE	SPDT ON-ON	C&K	7101-S-Y-C-Q-E	43.019
ST1-14	TERMINAL BLOCK	3 POLES 1.5mm2	PTR	AK500/3DS m.MESS.SKRUER	81.008
ST2-14			ESPERA	1-0-23762 *	207607
ST3-14	SUPPLY TERMINAL BLOCK	1 POLE	RIACON	00247	81.028
ST4-14			ESPERA	1-0-23762 *	207607
ST5-14	TERMINAL BLOCK	16 POLES 1.5mm2	PTR	AK300/16b m.MESS SKRUER	81.014

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
ST6-14	TERMINAL BLOCK	16 POLES 1.5mm2	PTR	AK300/16b m.MESS SKRUER BLÅ	81.014
ST7-14	TERMINAL BLOCK	14 POLES 1.5mm2	PTR	AK300/14b m.MESS.SKRUER	81.029
ST8-14	TERMINAL BLOCK	10 POLES 1.5mm2	PTR	AK300/10b m.MESS.SKRUER BLÅ	81.017
ST9-14	TERMINAL BLOCK	3 POLES 2.5mm2	PTR	AK110/3DS m.MESS.SKRUER	81.037
ST10-14	TERMINAL BLOCK	10 POLES 1.5mm2	PTR	AK300/10b m.MESS.SKRUER BLÅ	81.017
ST11-14	TERMINAL BLOCK	4 POLES 1.5mm2	PTR	AK300/4b M:MESS.SKRUER BLÅ	81.025
ST12-14	TERMINAL BLOCK	4 POLES 1.5mm2	PTR	AK300/4b M:MESS.SKRUER BLÅ	81.025
TR1-14	TRAFO AF	1:1 600 OHMS	TDK	L04EE13-C10153	22.500
TR2-14	TRAFO AF	1:1 600 OHMS	TDK	L04EE13-C10153	22.500

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	CONNECTION BOARD MODULE 5	N2170/N2171 .	ESPERA	5-0-26425A	626425
P1-5			ESPERA	2-0-25057 *	200878
P2-5			ESPERA	2-0-25057 *	200878
P3-5	MULTIPLUG	2x5 POLES PCB VERSION	MOLEX	39-28-1103	78.220
P4-5	MULTIPLUG	2x5 POLES PCB VERSION	MOLEX	39-28-1103	78.220
P5-5	MULTIPLUG	2x6 POLES PCB VERSION	MOLEX	39-28-1123	78.221
P6-5	MULTIPLUG	2x6 POLES PCB VERSION	MOLEX	39-28-1123	78.221
P7-5	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P8-5	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P9-5	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P10-5	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P11-5	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P12-5	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P13-5	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P14-5	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
ST1-5	TERMINAL BLOCK	3 POLES 2.5mm2	PTR	AK110/3DS m.MESS.SKRUER	81.037
ST2-5	TERMINAL BLOCK	3 POLES 2.5mm2	PTR	AK110/3DS m.MESS.SKRUER	81.037
ST3-5	TERMINAL BLOCK	10 POLES 1.5mm2	PTR	AK300/10b m.MESS.SKRUER BLÅ	81.017
ST4-5	TERMINAL BLOCK	10 POLES 1.5mm2	PTR	AK300/10b m.MESS.SKRUER BLÅ	81.017

INSTRUCTION BOOK FOR TX CONTROL UNIT
(SP NO. 726391)

CONTENTS

1. INTRODUCTION
1.1. PRINCIPLE OF OPERATION AND BLOCK DIAGRAM

2. INSTALLATION
2.1. ELECTRICAL CONNECTION AND ASSEMBLING

3. SERVICE

4. MECHANICAL DESCRIPTION
4.1. MECHANICAL DISASSEMBLING AND MODULE LOCATION

5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS
5.1. FILTER 1 (MODULE 1) SP NO. 726401
5.2. FILTER 2 (MODULE 2) SP NO. 726402
5.3. FILTER 3 (MODULE 3) SP NO. 726403
5.4. FILTER 4 (MODULE 4) SP NO. 726404
5.5. FILTER 5 (MODULE 5) SP NO. 726405
5.6. FILTER 6 (MODULE 6) SP NO. 726406
5.7. FILTER SWITCH (MODULE 7) SP NO. 626407
5.8. TX PROCESSOR (MODULE 8) SP NO. 626408
5.9. POWER SUPPLY (MODULE 9) SP NO. 626409
5.10. AF AMPLIFIER (MODULE 10) SP NO. 626410

6.

7. PARTS LISTS

CONTENTS

1. INTRODUCTION

1.1. PRINCIPLE OF OPERATION AND BLOCK DIAGRAM

1. INTRODUCTION

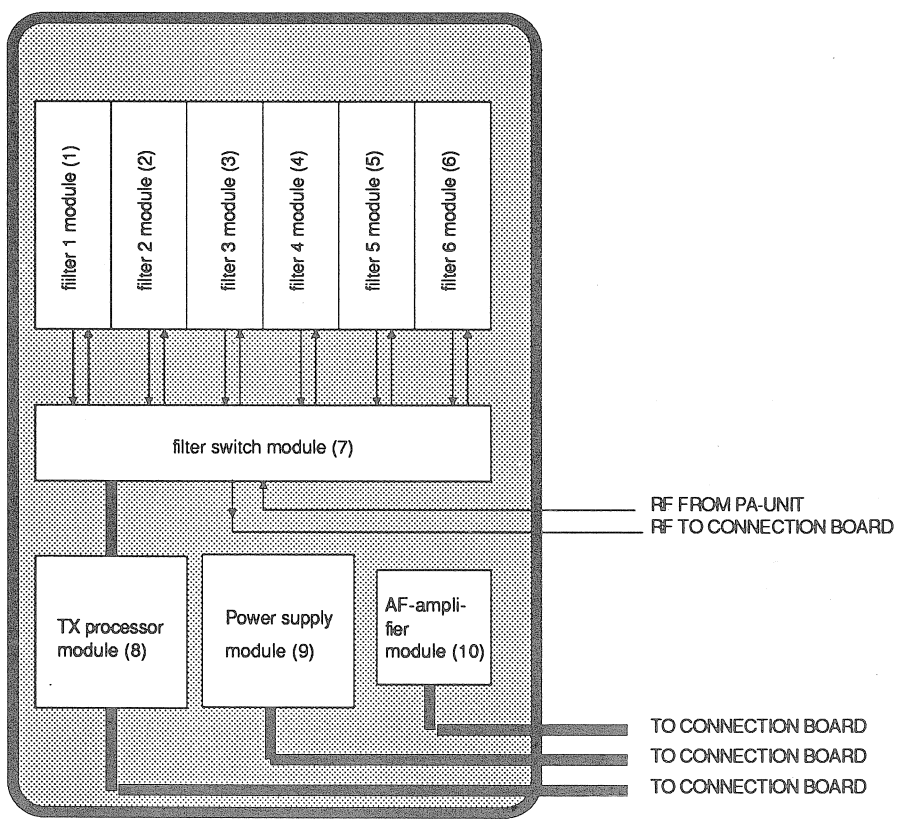
This section gives you all necessary information to make service of this unit down to component level.

1.1. PRINCIPLE OF OPERATION AND BLOCK DIAGRAM

The TX control unit consists of the following modules:

FILTER 1	(MODULE 1)
FILTER 2	(MODULE 2)
FILTER 3	(MODULE 3)
FILTER 4	(MODULE 4)
FILTER 5	(MODULE 5)
FILTER 6	(MODULE 6)
FILTER SWITCH	(MODULE 7)
TX PROCESSOR	(MODULE 8)
POWER SUPPLY	(MODULE 9)
AF AMPLIFIER	(MODULE 10)

The block diagram of the modules are shown on the next pages with a short function description.

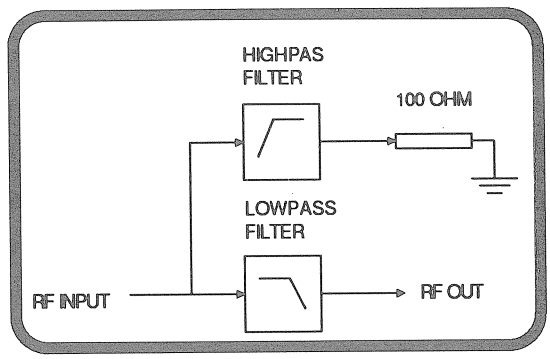


1.1. PRINCIPLE OF OPERATION AND BLOCK DIAGRAM cont.:

FILTER 1 – 6 (MODULE 1 – 6)

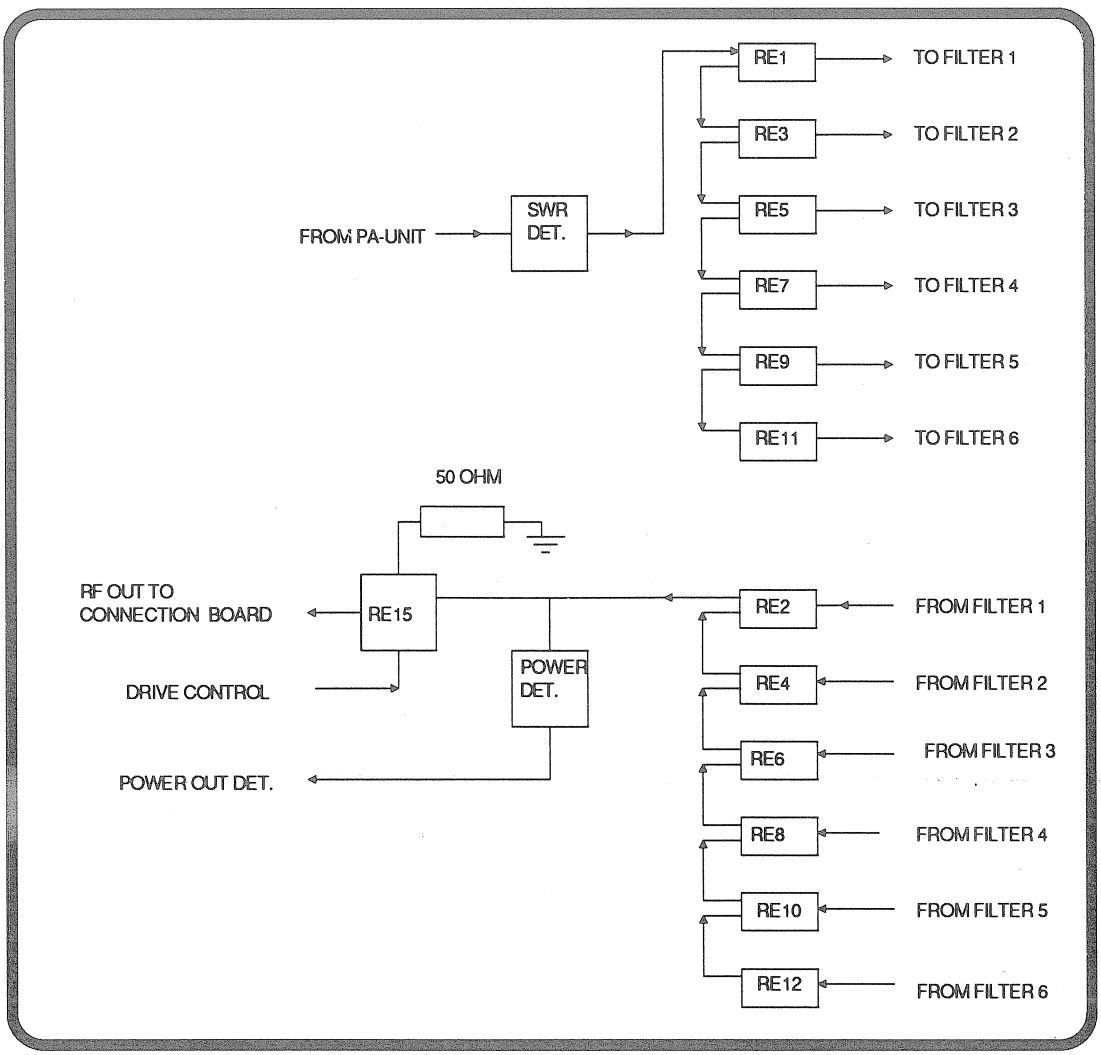
The filters are all constructed in the same way.
The RF from the power unit/combiner unit is fed into the lowpass and highpass filter.
The fundamental frequency passes the lowpass filter to the output. The harmonic frequencies are reflected by the lowpass filter, but passes through the highpass filter, which are terminated with a 100 ohm resistor. This gives a correct load impedance for the power amplifier for the whole frequency range of the filter.

FILTER 1 TO 6



FILTER SWITCH (MODULE 7)

The filter switch takes care of switching in the correct filters and selecting the dummy load. It also contains the standing wave detector which is used for protection of the power amplifier and tuning of the aerial coupler.



1.1. PRINCIPLE OF OPERATION AND BLOCK DIAGRAM cont.:

TX PROCESSOR (MODULE 8)

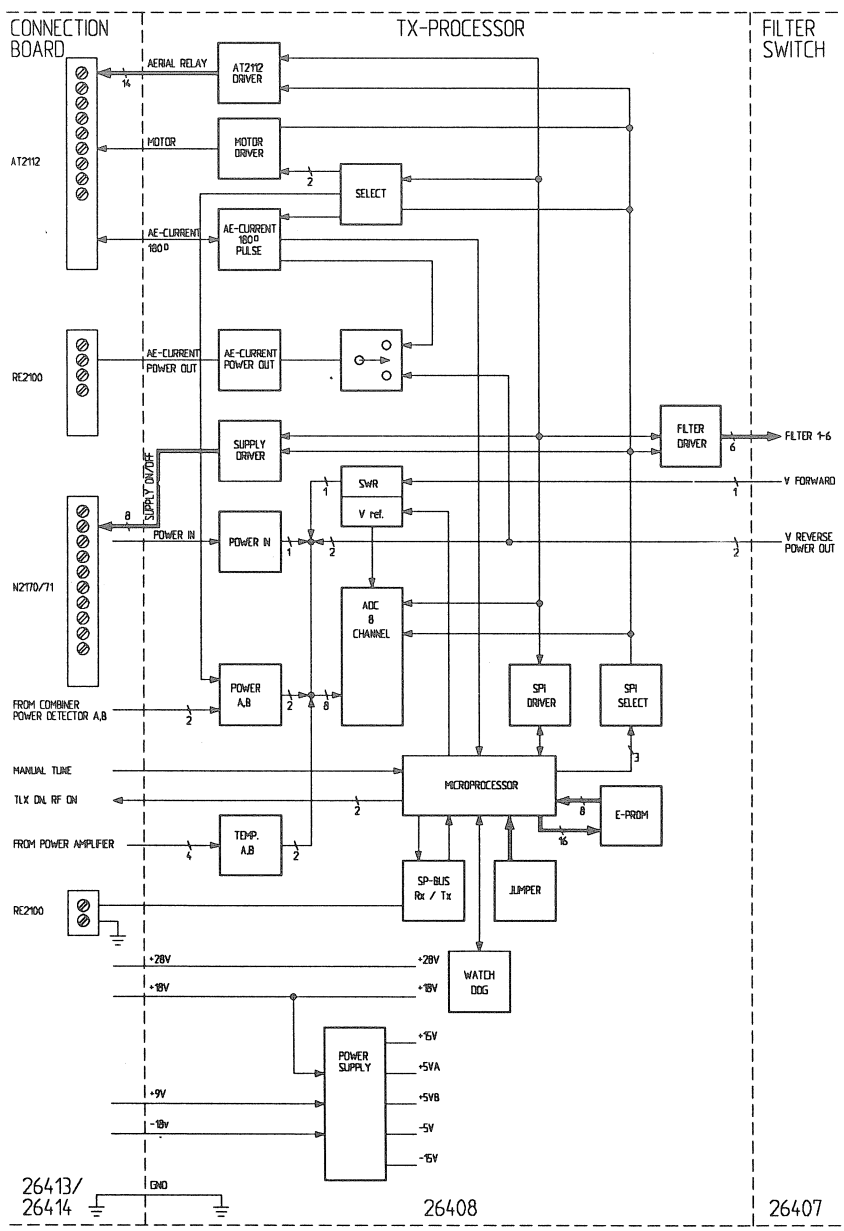
The processor controls the power supplies, the power amplifiers, output filters, aerial coupler AT2112, and the communication with RE2100.

During rise, the TX processor tests the system and turns on the power supplies, respectively.

From RE2100, the TX processor receives information about frequency and receive/transmit mode. The TX processor gives information to RE2100 about tuning/tune ready and attenuated setting.

During tune–up, the TX processor controls the aerial coupler. The aerial coupler tunes for best standing wave ratio measured with the directional coupler on the output filter module.

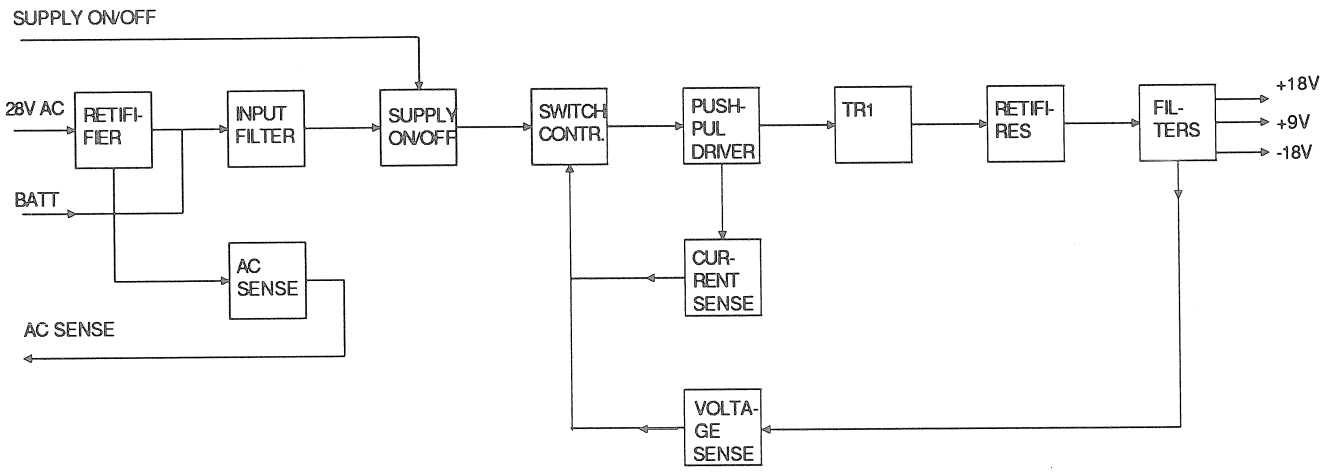
During transmit, the TX processor checks the temperature of the PA transistors, power from each PA module, AC supply and standing wave ratio. From these data, the TX processor calculates the max. permissible power and then sends this information to the RE2100, where the processor unit sets the attenuation in the exciter unit to the values.



1.1. PRINCIPLE OF OPERATION AND BLOCK DIAGRAM cont.:

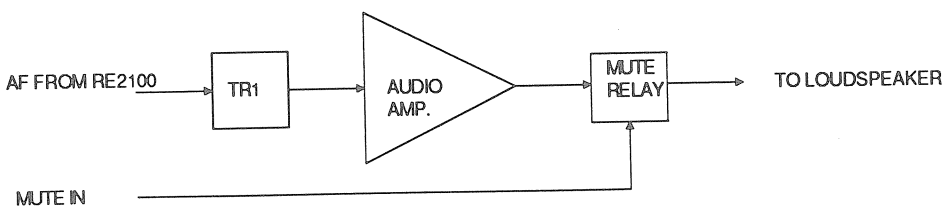
POWER SUPPLY (MODULE 9)

The power supply is supplying the RE2100 and the TX processor (module 8), the filter switch (module 7), the combiner unit (only in 1200W version) and the power supply N2170 or N2171.
The power supply can be supplied from 24V battery and/or from 220V AC via the transformer and the rectifier.
The rectifier is followed by the input filter. After the input filter, the on/off relay is situated.
Then follows the switch control and the push–pull switch transistors. The switch control has two external regulations loops, one for current and one for voltage regulation.
The power supply has three output voltages ±19V and 9.5V.



AF AMPLIFIER (MODULE 10)

The audio amplifier amplifies the audio, which comes from the RE2100. At the input is a transformer which gives a balanced input. This is done to avoid noise to get into the amplifier.
The mute relay in the output is activated when transmitting.



CONTENTS

2. INSTALLATION

2.1. ELECTRICAL CONNECTION AND ASSEMBLING

CONTENTS

3. SERVICE

3.3.8 Trouble shooting Tx-processor (8).

Motor 'error 70'
The error may be one of following possibilities:
A: If the tune motor MO1 starts running immediately after the RE2100 has been switched on then check:

- Check the AE/180° pulse at ST5 pin 16, on the connection board (14) in T2131/35.
- If the level is high, approx. 15V, the error is probably in the aerial coupler AT2112.
  Then:
- Check the AE/180° pulse connection to AT2112.
- Check the light in the optocoupler OC1 on the aerial current detector (1) in AT2112. This may be done by measuring the voltage across the resistor R3 in the aerial current detector (1).
  If the level is low:
- The error is probably in the T2131/35:
- Check the AE/180° pulse connection from the connection board (14) P1 pin 15 to TX-processor (8) P3 pin 15 in T2131/35.

b) If the tune motor MO1 in AT2112 does not start immediately after the RE2100 has been switched on:
- Check the voltage at ST5 pin 15 on the connection board (14) (chassis as -), when RE2100 is switched on this voltage should be approx. 18V.
- If the 18V is ok then the error is probably in AT2112 then:
- Check the connection to the tune motor MO1 in AT2112, and the connection from the connection board (14) to AT2112.
- If the 18V is not present then the error is probably in T2131/35:
- Check the connection from the connection board (14) P1 pin 16 to TX-processor (8) P3 pin 16.

3.4 Performance check

All tests are with an RE2100 connected, and all incoming power supplies must be accurate.

In the subsections in this section is referred to the following test setup mode.

Mode 1: Standby. Receive mode, with aerial connected. The service strap in the RE2100 must be in.

Mode 2: 50 Ohm dummy load connected to the output of T2131/35. Jumper 5 is inserted into plug P02/5 in the Tx-processor (8) in the T2131/35. The service strap in the RE2100 must be in.

Mode 3: 50 Ohm dummy load connected to the output of the AT2112.

3.4.1 Performance check Filter (1)
3.4.2 Performance check Filter (2)
3.4.3 Performance check Filter (3)
3.4.4 Performance check Filter (4)
3.4.5 Performance check Filter (5)
3.4.6 Performance check Filter (6)
3.4.7 Performance check Filter switch (7)

3.4.8 Performance check Tx-Processor (8)

3.4.8.1 Incoming voltages.

Measured with voltmeter Test setup Mode 1.

Incoming:	Pin	Plug	Meas. ref
GND	27,28,29,30	5	
+9 Volt	3	5	GND
+18 Volt	2	5	GND
-18 Volt	4	5	GND
+28 Volt	14,15	5	GND

3.4.8.2 Internal power supply.

Reference voltage. Test setup: Mode 1.
A. Connect a Voltmeter to pin 3 on U25, (MC7805). Voltage is +5.0 Volt +/- 0.2 Volt
B. Connect a Voltmeter to pin 3 on U26, (MC7805). Voltage is +5.0 Volt +/- 0.2 Volt
C. Connect a Voltmeter to pin 3 on U27, (MC7815). Voltage is +15.0 Volt +/- 0.6 Volt
D. Connect a Voltmeter to pin 3 on U28, (MC79L15). Voltage is -15.0 Volt +/- 1.2 Volt
E. Connect a Voltmeter to pin 3 on U29, (MC7905). Voltage is -5.0 Volt +/- 0.2 Volt
F. Connect a Voltmeter to pin 8 on U15 (MC1458). Voltage is +28.0 Volt +/- 2.0 Volt

3.4.8.3 A/D Converter.

Reference voltage. Test setup: Mode 1.
A. Connect a Voltmeter to pin 13 on U23, (4053). Voltage is +2.5 Volt +/- 1.5%
B. Connect a Voltmeter to pin 7 on U16, (TL072). Voltage is +5.0 Volt +/- 1.7%

POWER IN measuring. Test setup: Mode 2.
A. Enter SP-29.
   Connect a Voltmeter to pin 3 on U16, (TL072). POWER IN voltage should be approx. 1.4 Volt DC
   Leave SP-29 by entering the 'ENT' key
B. Enter SP-22-1.
   Compare the displayed POWER IN to the measured. Maximum deviation from the measured is +/-5%

POWER DET. A measuring. Test setup: Mode 2.
A. Enter SP-29.
   Connect a Voltmeter to pin 6 on U13, (ADC0838). POWER DET A voltage should be approx. 1. Volt DC
   Leave SP-29 by entering the 'ENT' key
B. Enter SP-22-2.
   Multiply the measured voltage with 3 and compare with the displayed POWER DET A.
   Maximum deviation from the measured is +/-5%

POWER DET. B measuring. Test setup: Mode 2.
A. Enter SP-29.
   Connect a Voltmeter to pin 7 on U13, (ADC0838). POWER DET A voltage should be approx. 1. Volt DC
   Leave SP-29 by entering the 'ENT' key
B. Enter SP-22-3.
   Multiply the measured voltage with 3 and compare with the displayed POWER DET B.
   Maximum deviation from the measured is +/-5%

VF (Vforvard) measuring. Test setup: Mode 2.

A. Enter SP-29.
   Connect a Voltmeter to the upper end of R56, (3K92). VF voltage should be approx. 5 Volt DC
   Leave SP-29 by entering the 'ENT' key
B. Enter SP-22-4.
   Compare the displayed VF to the measured. Maximum deviation from the measured is +/-5%

POWER OUT measuring. Test setup: Mode 2.

A. Enter SP-29.
   Connect a Voltmeter to the upper end of R58, (3K92). VF voltage should be approx. 7 Volt DC.
   Leave SP-29 by entering the 'ENT' key
B. Enter SP-22-1.
   Compare the displayed POWER IN to the measured. Maximum deviation from the measured is +/-5%

SWR measuring. Test setup: Mode 2.

A. Enter SP-29.
   Connect a Voltmeter to the upper end of R56,(3K92) VF (Vforward) voltage should be approx. 5 Volt DC
B. Connect a Voltmeter to the upper end of R65,(3K92) VR (Vreverse) voltage should be approx. 0.1-1.0 Volt DC
   Leave SP-29 by entering the 'ENT' key
C. Calculate the SWR.

$$SWR = \frac{Vforward + Vreverse}{Vforward - Vreverse}$$

D. Enter SP-23-0
   Compare the displayed SWR to the calculated.
   Maximum deviation from the calculated is +12%/-5%

Temperature measuring. Test setup: Mode 1.
Temperature in POWER AMPLIFIER A

A. Disconnect the P5 on the Connection board (14). This is the cable to the temperature sensor R64 on the Power Amplifier (11).
   Connect a resistor on 2 Kohm on the P5 between pin 10 and 11 Power Supply(4).
B. Connect a Voltmeter to the lower end of R60,(8K2). Voltage is 2.5 Volt +/-1.7% +/- tolerances on the 2 Kohm resistor.
C. Calculate an adctemp:

$$adctemp = \frac{Measured\ voltage\ *\ 255}{5.0\ Volt}$$

D. Enter SP-21-1. Multiply the displayed result by 10.
   Compare to the calculated adctemp. Maximum deviation is +/- 2.

Temperature in POWER AMPLIFIER B

A. Disconnect the P5 on the Connection board (14). This is the cable to the temperature sensor R64 on the Power Amplifier (11).
   Connect a resistor on 2 Kohm on the P5 between Power Supply(4).
B. Connect a Voltmeter to the lower end of R60,(8K2). Voltage is 2.5 Volt +/-1.7% +/- tolerances on the 2 Kohm resistor.
C. Calculate an adctemp:

$$\text{adctemp} = \frac{\text{Measured voltage} * 255}{5.0 \text{ Volt}}$$

D. Enter SP-21-1. Multiply the displayed result by 10.
   Compare to the calculated adctemp. Maximum deviation is +/- 2.

3.4.8.4 AC SENSE.

Test setup: Mode 2.

A. Connect a voltmeter to P5 pin 24
   IF 220 volt ac is present: The voltage is < 0.1 volt.
   IF 220 volt ac is NOT present: The voltage is > 4.5 volt.

3.4.8.5 Output filter module drivers

RX/TX CONTROL relay driver
Test setup: Mode 1, or Test setup: Mode 2.
A. Enter SP-38-8 Connect the voltmeter to U21 pin 12. Voltage is < 1.1 Volt
   Leave SP-38-0 by entering 'ENT'

DRIVE CONTROL relay driver
A. Enter SP-38-7 Connect the voltmeter to U21 pin 16 Voltage is < 1.1 Volt
   Leave SP-30-0 by entering 'ENT'

OUTPUT FILTER relay drivers.
Each of the six drivers control two relays for switching in the lowpass filters.

A. Enter SP-38-[1-6]

Driver	Frequency range	SP-38-X<ENT>	U	pin
Filter 1	1.6 - 2.399 Mhz	38-1	21	14
Filter 2	2.4 - 3.899 Mhz	38-2	21	15
Filter 3	3.9 - 6.399 Mhz	38-3	21	13
Filter 4	6.4 - 10.399 Mhz	38-4	21	11
Filter 5	10.4 - 16.899 Mhz	38-5	14	12
Filter 6	16.9 - 28.000 Mhz	38-6	21	10

B. Connect the voltmeter to the specific pin
   Voltage is < 1.1 Volt

C. Enter SP-38-0 <ENT>

3.4.8.6 RF ON

Test setup: Mode 1.

A. Connect a voltmeter to the collector of Q5 or at P5 pin 5.
B. Key the transmitter: Voltage is < 0.8 Volt

3.4.8.7 TELEX ON.

Test setup: Mode 1.
A. Connect a voltmeter to the collector of Q4 or at P5 pin 6.
B. Select 'Telex mode' on the RE2100
C. Set 'RF ON' to on by applying a voltage to the external 'RF ON',pin 5 and pin 6 is ST07 on the Connection Board (14).
For example +18 volt from ST06 pin 4 to ST03 pin 7 and GND from ST08 pin 8 to ST07 pin 5.
D. Voltage is < 0.8 Volt

3.4.8.8 ANTENNA COUPLER AT2112 drivers.

Test setup: Mode 1.

Each of the 14 drivers control one relays in the AT2112 and there is a service program for each of the drivers.

Driver	SP-XX-X	U	Pin
Control 1	30-1	18	12
Control 2	30-2	18	11
Control 3	30-3	20	17
Control 4	30-4	18	13
Control 5	30-5	18	14
Control 6	30-6	20	16
Control 7	30-7	18	15
Control 8	30-8	20	15
Control 9	30-9	18	16
Control 10	31-0	20	14
Control 11	31-1	18	17
AREAL relay	31-2	20	12,13
RX/TX	31-3	18	18
RX < 4MHz	31-4	20	11

B. Connect the voltmeter to the specific pin. The voltage > 26.0 Volt.
C. Enter SP 30-0 <ENT>

3.4.8.9 POWER SUPPLY control drivers.

Test setup: Mode 1

Each of the 8 drivers control one power supply, and there is a service program for each power supply one +28 Volt and one +42 Volt.

Driver	SP-XX-X	U	Pin
28V,42V (A) AC	34-1	22	10,11
28V,42V (B) AC	34-2	22	12,13
28V,42V (A) DC	34-3	22	14,15
28V,42V (B) DC	34-4	22	16
		14	11

B. Connect the voltmeter to the specific pin . The voltage > 3.0 Volt.
C. Enter SP 34-0 <ENT>

3.4.8.10 AE/POWER conditioning AE-Current.

Test setup: Mode 1.
A. Connect a voltmeter to U06 pin 7 or at ST6 pin 2 on the Connection Board (14).
B. Disconnect the wire at pin 3 at ST1 on the Connection Board (6) and connect a variable power supply instead with a 1Kohm in series.
C. Vary the power supply and check the voltmeter according the table below:

Vin:	Vout:
0.0 V	0.87 V
5.0 V	4.27 V
10.0 V	7.77 V
15.0 V	8.00 V
18.5 V	9.80 V

POWER OUT
Test setup: Mode 1.
A. Insert jumper 5 in the Tx-processor (8).
B. Switch off/on the RE2100
C. Connect a voltmeter to U06 pin 7 or at ST6 pin 2 on the Connection Board (14).
D. Key the transmitter and modulate. Read the voltmeter.Voltage follows the modulation.
G. Remove the jumper.

3.4.8.11 EEPROM's.

A. See Service Programme SP-24-0.

3.4.8.12 SP-Bus

Test setup: Mode 1.
A. Ensure that exactly two termination jumpers are inserted in two of the Units connected to the SP Bus.
B. Switch on the power on the RE2100.
   If 'Error 20' is N O T displayed the SP Bus working.
   If 'Error 20' appears on the RE2100 then the RE2100 cannot establish the communication link to the T2131/35.
C. Check the cable connection between the RE2100 and the Tx-processor (8) in the T2131/35.
D. Ensure that jumper 1 (the upper) is removed on Tx-Processor (8) .

Receiver.
Test setup: Mode 1.
A. Remove the SP Bus cable from J01 on the Tx-Processor (8).
B. Connect an oscilloscope.
   Ch 1 to the left end of L01. (2 Volt/div)
   Ch 2 at pin 11 on U05 (74HC08). (2 Volt/div
C. Connect a variable power supply to J01 instead of the SP Bus.
D. Vary the voltage from +5 Volt to -5 Volt and reverse.
   Check the trigger voltages = +/- 3 Volt +/-10%.

Driver.
Test setup: Mode 1.
A. It is assumed that the received is checked and found OK.
   Connect an Oscilloscope. 0.5 msec/div.
   Ch 1 to U02 pin 2 as trigger+ (Driver Enable).(2 Volt/div)
   Ch 2 to or with a 'T' on the SP Bus. (2 Volt/div)
B. Let the RE2100 scan two frequencies, one below 3900 Khz, the other above 4100 Khz. Remove the antenna from RE2100.
C. Check the output levels for the driver when the Tx-Processor 'answers' the RE2100.
   Levels:
      Positive: +4.0 up to 4.8 Volt.
      Negative: -4.0 down to -4.8 Volt

3.4.8.13 Tune Motor Control

High Speed. Test setup: Mode 1.
A. Connect a voltmeter to the cathode on D22 on the Tx-Processor (8) or at pin 15 in ST5 on the Connection Board(14) . 'MOTOR'
B. Switch off and on the RE2100. The tune motor is then being reset at high speed. The motor runs approx. 1.5 sec. Voltage is approx 18 Volt.

Low Speed. Test setup: Mode 1.
A. Connect a voltmeter to the cathode on D22 on the Tx-Processor (8) or at pin 15 in ST5 on the Connection Board (14). 'MOTOR'
B. Ensure that the AT2112 is tuned on a given frequency by entering 'Tx-tune' on the RE2100.
C. Switch off the RE2100.
D. Remove the rf power cable between the T2131/35 and the AT2112.
   (Remove the cable from J04 on the Output Filter (2) in T2131/35).
E. Switch on the RE2100.

F. Key the transmitter on the handset. The tune motor runs now at least one time at low speed. The motor runs approx. 3 secs. every time. Voltage is approx 9 Volt.

3.4.8.14 Manual Tune.

Test setup: Mode 1.
A. Connect a voltmeter at pin 23 on U03 (HD63B03Y)
B. Toggle the 'Manual Tune' switch on the Connection Board (14).
   High level voltage = approx. 5 Volt
   Low level voltage < 0.5 Volt

3.4.8.15 Micro Processor

Reset. Test setup: Mode 1.
A. Check the +5 Volt B supply at pin 1 and 2 on U03 (Max 690). Voltage = 5 Volt +/-0.25 Volt.
B. Check the reset at pin 6 on U02 (HD63B03Y). Voltage is above the +5 Volt B minus 0.5 Volt Battery low detector.
A. Check the +18 Volt supply at the upper end of R01 (22K1). Voltage > 17.3 Volt
B. Check the 'Power fail output' at pin 20 on U03 (HD63B03Y). Voltage > 4.5 Volt.

Watch dog.
Test setup: Mode 1.
A. Connect an oscilloscope to the 'Watch dog input' at pin 6 on U04 (Max 690). (0.2 sec/div and 2volt/div). Check that the level is shifted for every 0.8sec..
   If it does not then the Micro processor does not execute the programme properly.

3.5 Adjustment procedure.

3.5.1
3.5.2
3.5.3
3.5.4
3.5.5
3.5.6
3.5.7

3.5.8 Adjustment procedure Tx-processor (8).

New module is delivered directly from S. P. Radio A/S :
1. Calibrate the T2131/35. Please refer to PART1 chapter 3.5 'Service Programmes', SP-25.

An exchanged module:
1. Check the EEPROM's by entering SP 24-0. Please refer to PART1 chapter 3.5.
2. Initialize the EEPROM's by entering SP 24-2. Please refer to PART1 chapter 3.5.
3. Calibrate the T2131/35. Please refer to PART1 chapter 3.5.

3.6 Necessary Adjustment after repair

3.6.1
3.6.2
3.6.3
3.6.4
3.6.5
3.6.6
3.6.7

3.6.8 Tx-Processor (8).

If U8 or U9 has been replaced: Please refer to chapter 3.5.8 'Adjustment procedure'.

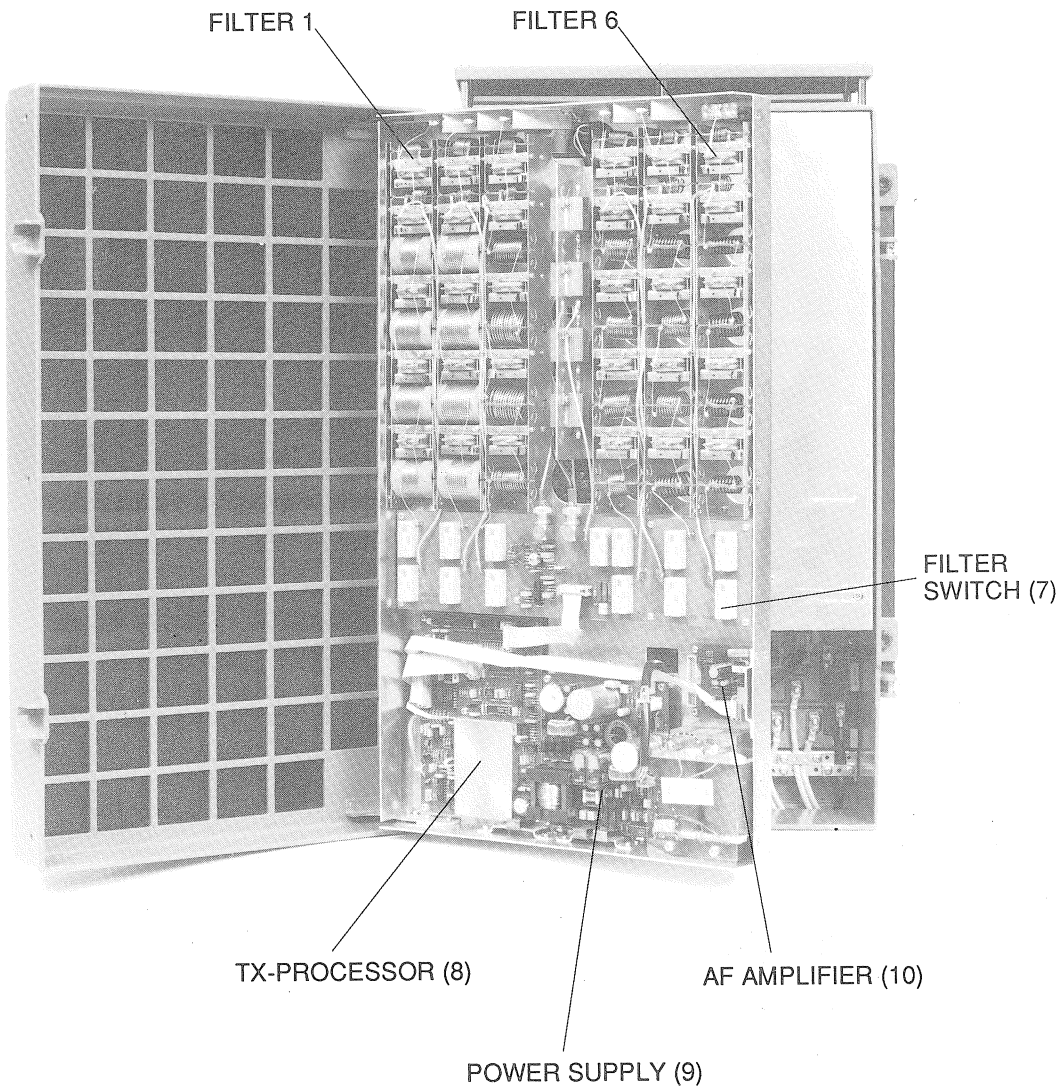
CONTENTS

4. MECHANICAL DESCRIPTION

4.1. MECHANICAL DISASSEMBLING AND MODULE LOCATION

4. MECHANICAL DESCRIPTION

4.1. MECHANICAL DISASSEMBLING AND MODULE LOCATION



CONTENTS

5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS

5.1. FILTER 1 (MODULE 1) SP NO. 726401

5.2. FILTER 2 (MODULE 2) SP NO. 726402

5.3. FILTER 3 (MODULE 3) SP NO. 726403

5.4. FILTER 4 (MODULE 4) SP NO. 726404

5.5. FILTER 5 (MODULE 5) SP NO. 726405

5.6. FILTER 6 (MODULE 6) SP NO. 726406

5.7. FILTER SWITCH (MODULE 7) SP NO. 626407

5.8. TX PROCESSOR (MODULE 8) SP NO. 626408

5.9. POWER SUPPLY (MODULE 9) SP NO. 626409

5.10. AF AMPLIFIER (MODULE 10) SP NO. 626410

5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS

5.1. FILTER 1 (MODULE 1) SP NO. 726401

The filter is constructed as a combination of a 7th order lowpass filter and a 4th order highpass filter.

The lowpass filter filters all the harmonics from the power amplifier and therefore gives an output signal with a very low content of harmonics.

The highpass filter is constructed so that the standing wave ratio of the combined filter is less than 2 above the entire frequency range for the filter plus the harmonics of the amplifier.

5.2. FILTER 2 (MODULE 2) SP NO. 726402

The filter is constructed as a combination of a 7th order lowpass filter and a 4th order highpass filter.

The lowpass filter filters all the harmonics from the power amplifier and therefore gives an output signal with a very low content of harmonics.

The highpass filter is constructed so that the standing wave ratio of the combined filter is less than 2 above the entire frequency range for the filter plus the harmonics of the amplifier.

5.3. FILTER 3 (MODULE 3) SP NO. 726403

The filter is constructed as a combination of a 7th order lowpass filter and a 4th order highpass filter.

The lowpass filter filters all the harmonics from the power amplifier and therefore gives an output signal with a very low content of harmonics.

The highpass filter is constructed so that the standing wave ratio of the combined filter is less than 2 above the entire frequency range for the filter plus the harmonics of the amplifier.

5.4. FILTER 4 (MODULE 4) SP NO. 726404

The filter is constructed as a combination of a 7th order lowpass filter and a 4th order highpass filter.

The lowpass filter filters all the harmonics from the power amplifier and therefore gives an output signal with a very low content of harmonics.

The highpass filter is constructed so that the standing wave ratio of the combined filter is less than 2 above the entire frequency range for the filter plus the harmonics of the amplifier.

5.5. FILTER 5 (MODULE 5) SP NO. 726405

The filter is constructed as a combination of a 7th order lowpass filter and a 4th order highpass filter.

The lowpass filter filters all the harmonics from the power amplifier and therefore gives an output signal with a very low content of harmonics.

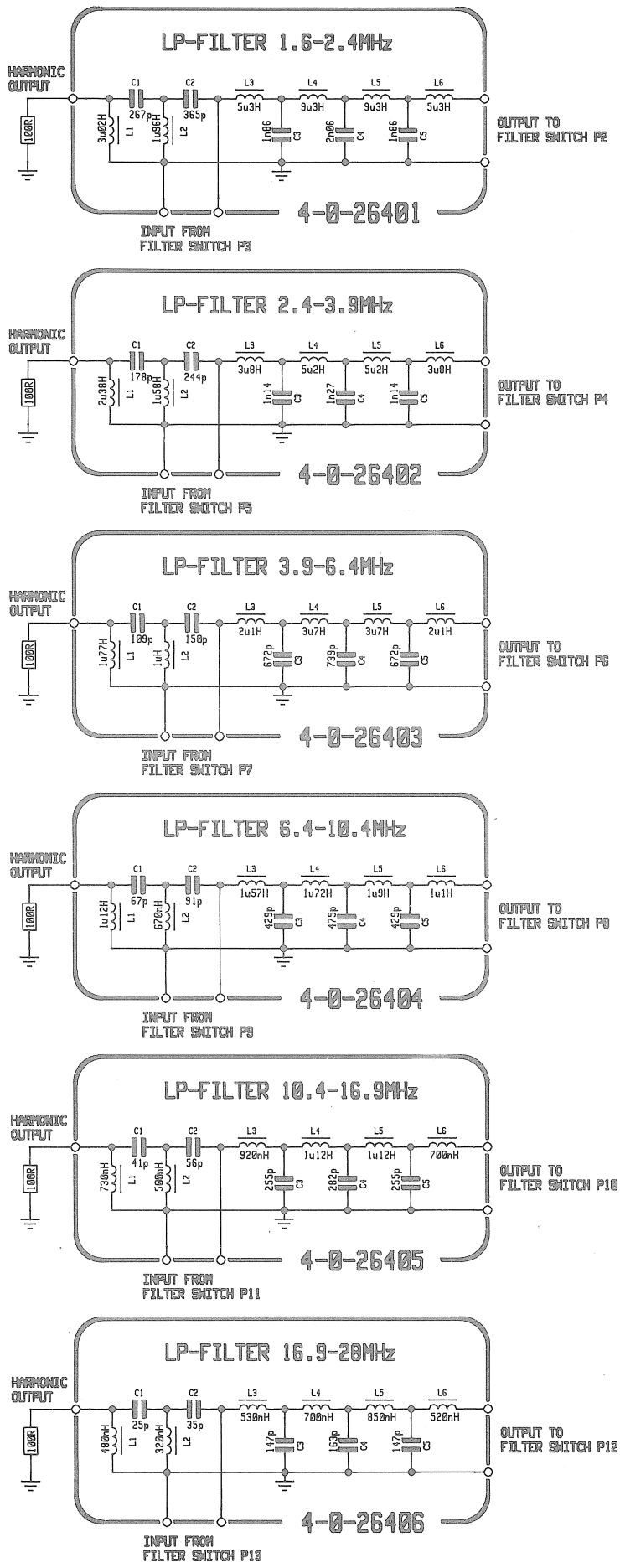
The highpass filter is constructed so that the standing wave ratio of the combined filter is less than 2 above the entire frequency range for the filter plus the harmonics of the amplifier.

5.6. FILTER 6 (MODULE 6) SP NO. 726406

The filter is constructed as a combination of a 7th order lowpass filter and a 4th order highpass filter.

The lowpass filter filters all the harmonics from the power amplifier and therefore gives an output signal with a very low content of harmonics.

The highpass filter is constructed so that the standing wave ratio of the combined filter is less than 2 above the entire frequency range for the filter plus the harmonics of the amplifier.


LP-FILTER 1.6-2.4MHz
HARMONIC OUTPUT
100R
C1
C2
L3
L4
L5
L6
267p
365p
5u3H
9u3H
9u3H
5u3H
3u02H
1u96H
1n86
2n06
1n86
L1
L2
C3
C4
C5
OUTPUT TO FILTER SWITCH P2
4-0-26401
INPUT FROM FILTER SWITCH P3
LP-FILTER 2.4-3.9MHz
HARMONIC OUTPUT
100R
C1
C2
L3
L4
L5
L6
178p
244p
3u8H
5u2H
5u2H
3u8H
2u38H
1u58H
1n14
1n27
1n14
L1
L2
C3
C4
C5
OUTPUT TO FILTER SWITCH P4
4-0-26402
INPUT FROM FILTER SWITCH P5
LP-FILTER 3.9-6.4MHz
HARMONIC OUTPUT
100R
C1
C2
L3
L4
L5
L6
109p
150p
2u1H
3u7H
3u7H
2u1H
1u77H
1uH
672p
739p
672p
L1
L2
C3
C4
C5
OUTPUT TO FILTER SWITCH P6
4-0-26403
INPUT FROM FILTER SWITCH P7
LP-FILTER 6.4-10.4MHz
HARMONIC OUTPUT
100R
C1
C2
L3
L4
L5
L6
67p
91p
1u57H
1u72H
1u9H
1u1H
1u12H
670nH
423p
475p
423p
L1
L2
C3
C4
C5
OUTPUT TO FILTER SWITCH P8
4-0-26404
INPUT FROM FILTER SWITCH P9
LP-FILTER 10.4-16.9MHz
HARMONIC OUTPUT
100R
C1
C2
L3
L4
L5
L6
41p
56p
920nH
1u12H
1u12H
700nH
730nH
590nH
255p
282p
255p
L1
L2
C3
C4
C5
OUTPUT TO FILTER SWITCH P10
4-0-26405
INPUT FROM FILTER SWITCH P11
LP-FILTER 16.9-28MHz
HARMONIC OUTPUT
100R
C1
C2
L3
L4
L5
L6
25p
35p
530nH
700nH
850nH
520nH
480nH
326nH
147p
163p
147p
L1
L2
C3
C4
C5
OUTPUT TO FILTER SWITCH P12
4-0-26406
INPUT FROM FILTER SWITCH P13

5.7. FILTER SWITCH UNIT (MODULE 7) SP NO. 626407

This module contains the relays for switching between the 6 lowpass filters and the SWR detector circuit.

The relays RE1 to RE10 are controlled from the microprocessor.

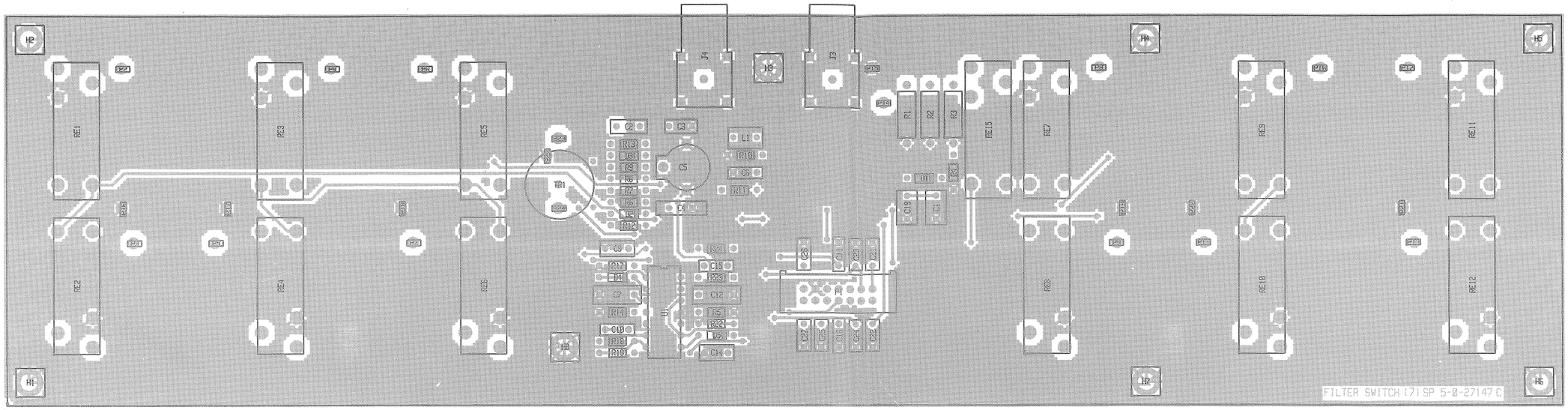
The relays RE1 and RE2 are activated from 1.6 – 2.399 MHz
The relays RE3 and RE4 are activated from 2.4 – 3.899 MHz
The relays RE5 and RE6 are activated from 3.9 – 6.399 MHz
The relays RE7 and RE8 are activated from 6.4 – 10.399 MHz
The relays RE9 and RE10 are activated from 10.4 – 16.899 MHz
The relays RE11 and RE12 are activated from 16.9 – 28.000 MHz

The relay RE15 is activated when the power level is set during the first key on a new frequency. R1, R2, R3, and R4, L2 is a voltage divider for the power out detector consisting of D1 and C1, C19. The power out voltage is fed to the microprocessor, which controls the power level. The SWR detector circuit consists of an SWR bridge (TR1, R6, R7, R8, R9 and C2, C3, C4 and C5), quasi effective value detector (D2, R12, R5, C12 and D3, R13, R14, C7) and a peak detector/buffer amplifier built around U1.

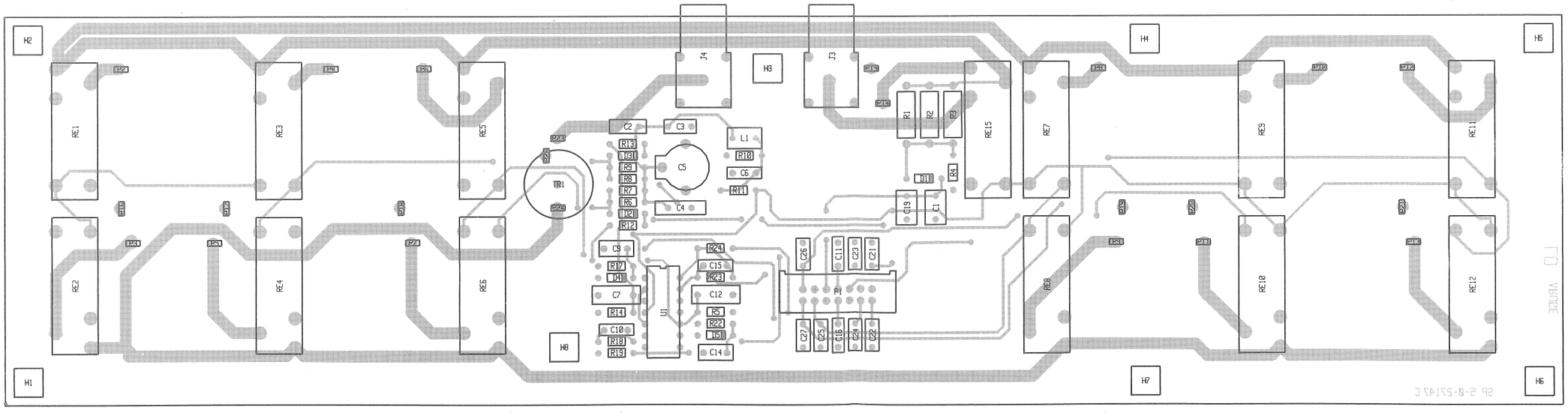
FILTER SWITCH MODULE 7

5.7. FILTER SWITCH UNIT (MODULE 7) cont.:

COMPONENT LOCATION AF FILTER SWITCH UNIT MODULE 7.



View from component side with upper side tracks.



View from component side with lower side tracks.

Tx-Processor (8)

TO CONNECTION BOARD MODULE 13/14

PIN 1	CONTROL 2	PIN 9	CONTROL 10		
PIN 2	CONTROL 1	PIN 10	CONTROL 9		
PIN 3	CONTROL 4	PIN 11	AERIAL RELAY		
PIN 4	CONTROL 3	PIN 12	CONTROL 11		
PIN 5	CONTROL 6	PIN 13	RX < 4MHz		
PIN 6	CONTROL 5	PIN 14	RX/TX		
PIN 7	CONTROL 8	PIN 15	RE/180° PULSE		
PIN 8	CONTROL 7	PIN 16	MOTOR		

TO INPUT FILTER MODULE 1

PIN 1	+15V	PIN 8	
PIN 2	FILTER 1	PIN 9	
PIN 3	FILTER 2	PIN 10	
PIN 4	FILTER 3	PIN 11	
PIN 5	DRIVE CONTROL	PIN 12	
PIN 6		PIN 13	
PIN 7	VF	PIN 14	

SERIEL DEVICE SELECT

SP-BUS DRIVER/RECEIVER

BATTERY WATCH DOG AND LOW DETECTOR

ADDRESS SELECT

SERIEL DEVICE BUS DRIVER

TELEX ON

RF ON

DATA BUS(7:0)

ADDRESS BUS(14:0)

U3 ADC0838
1 VF
2 VR
3 Pout
4 TEMP A
5 TEMP B
6 POWER A
7 POWER B
8 Pin

x-Processor (8)

TO CONNECTION BOARD MODULE 13/14

PIN 1	CONTROL 2	PIN 9	CONTROL 10
PIN 2	CONTROL 1	PIN 10	CONTROL 9
PIN 3	CONTROL 4	PIN 11	AERIAL RELAY
PIN 4	CONTROL 3	PIN 12	CONTROL 11
PIN 5	CONTROL 6	PIN 13	RX < 4MHz
PIN 6	CONTROL 5	PIN 14	RX/TX
PIN 7	CONTROL 8	PIN 15	AE/180° PULSE
PIN 8	CONTROL 7	PIN 16	MOTOR

TO INPUT FILTER MODULE 1

PIN 1	+15V	PIN 8	VR
PIN 2	FILTER 1	PIN 9	POWER OUT
PIN 3	FILTER 2	PIN 10	
PIN 4	FILTER 3	PIN 11	GND
PIN 5	DRIVE CONTROL	PIN 12	FILTER 4
PIN 6		PIN 13	FILTER 5
PIN 7	VF	PIN 14	FILTER 6

TO CONNECTION BOARD MODULE 13/14

PIN 1	POWER IN
PIN 2	+18V
PIN 3	+9V
PIN 4	-18V
PIN 5	RF ON
PIN 6	TLX ON
PIN 7	RX/TX CONTROL
PIN 8	AE/POWER
PIN 9	MAN.TUNE
PIN 10	TEMP. A
PIN 11	TEMP. A
PIN 12	TEMP. B
PIN 13	TEMP. B
PIN 14	+28V (TO ATU)
PIN 15	+28V (TO ATU)
PIN 16	42V ON (B) DC
PIN 17	28V ON (B) DC
PIN 18	42V ON (A) DC
PIN 19	28V ON (A) DC
PIN 20	42V ON (B) AC
PIN 21	28V ON (B) AC
PIN 22	42V ON (A) AC
PIN 23	28V ON (A) AC
PIN 24	AC SENSE
PIN 25	POWER DET. A
PIN 26	POWER DET. B
PIN 27	GND
PIN 28	GND
PIN 29	GND
PIN 30	GND

SP-BUS DRIVER/RECEIVER

SERIEL DEVICE SELECT

RY WATCH DOG AND LOW DETECTOR

SERIEL DEVICE BUS DRIVER

TELEX ON

RF ON

1	VF
2	VR
3	Pout
4	TEMP A
5	TEMP B
6	POWER A
7	POWER B
8	Pin

5.8. TX PROCESSOR (MODULE 8) SP NO. 626408

This section applies to a T2131 (600 Watt) as well as a T2131/T2135 (1200 Watt) HF SSB transmitter. If you have a T2131 (600 Watt) transmitter, the text written about power amplifier B, power det. B and temp. B must be skipped.

FUNCTIONAL DESCRIPTION

The TX processor has the following main functions:

- communicates with the RE2100
- switches in the power supply
- switches over to DC supply if the AC supply is failing
- switches in the correct lowpass filter
- sets the drive level
- tunes the AT2112 to an acceptable SWR
- remembers the AT2112 relay combination for an acceptable SWR
- protects the PA stage against high temperatures
- protects the PA stage against bad SWR
- protects the combiner against destruction if one power amplifier breaks down
- activates the AT2112 RX relay according to selected RX frequency
- activates the AT2112 relays, if RX and TX frequencies are the same

These functions are implemented partially in the hardware and partially in the software.

The TX processor hardware is separated in a number of circuits, referring to the diagram:

- power supply
- microcomputer
- watch dog & battery low detector
- communication bus driver & receiver (SP–Bus)
- serial device bus driver & selector
- EEPROM's
- filter module driver
- power supply driver
- A/D Converter
- power det. A and B
- RF and telex controls
- AT2112 module driver
- tune motor control
- AE current and power–out conditioning
- option selections (jumpers)

POWER SUPPLY

The board is supplied with the following voltages via P5:

GND
+9V
+18V
–18V
+28V

5.8. **TX PROCESSOR (MODULE 8) SP NO. 626408** cont.:

These voltage are changed into the voltage regulator U25–U29 to the following internal supplies.

+5VA	general purpose 5 Volt
+5VB	back–up voltage. This supply is kept stable in a period after there has been a switch–off on the RE2100, or the AC or DC voltage has fallen accidentally.
–5V	used for the SP–Bus driver
+15V	supply for op–amps and for the output filter (module 2).
–15V	supply for op–amps
+18V	this is only used for sensing as the +5VB is generated from this supply.
+28V	supply for tune motor and AT2112 relays
GND	common to the above supplies.

MICROCOMPUTER
The purpose of the microcomputer block is to run the programme properly. It consists of the following units:

- an 8 bit Hitachi microprocessor, U03
- an EPROM, carrying the programme, U01
- chip select circuit for the EPROM U2/3
- a watch dog & battery low detector, U04.

WATCH DOG & BATTERY LOW DETECTOR
The MAX 690 (U04) has the following purposes:

- ensures a proper reset for the microprocessor when the +5VB is stable.
- senses the +18V (PFI, pin 4), and gives an early warning when the supply is failing.

The limits for the battery low detector are the as follows:

- The PFO (pin 5) must be high (+5V) at 17.231 Volt or higher on the +18V
- The PFO must be low (0V) at 14.148 Volt or less on the +18V supply.
- watch dog

During normal operation the microprocessor resets the watch dog at known locations in the programme. If the microprocessor stays too long time in an unintentional loop, without resetting the watch dog, the watch dog will activate the reset pin on the microprocessor.
This may happen if the microprocessor is waiting for an event, which never happens (e.g. failure in hardware), or noise has disturbed the programme execution.

The watch dog function may be disabled by inserting jumper 2 in the P02. This may make fault finding in the T2131/T2135 easier.

SP–BUS DRIVER & RECEIVER
The communication to the RE2100 is time multiplexed data bus.
It is implemented with one 50 Ohm coax cable terminated in each end, and a driver and a receiver is connected in each end. The RE2100 is the master and a number of slaves may be connected to the SP–Bus.
The driver and the receiver are identical in each unit connected to the SP–Bus.
The driver output is normally in high impedance state except when transmitting on the SP–Bus.
The driver consists of two gates, U02/1 & U02/2 (74HC132), a transistor Q01 (BC558) for level shifting and two complementary output transistors Q02 (BC328), Q03 (BC338).
The driver is connected to the microprocessor U03, pin 13 (port 2, bit 4, transmit data), and pin 9 (port 2, bit 1, driver enable).

The receiver consists of an op–amp, U06/1 (1458), which is configurated as a Schmitt Trigger and a gate U05/4 (74HC08) for level conditioning.
The receiver is connected to the microprocessor U03, pin 12 (port 2, bit 3, receive data).
As the levels on the SP–Bus approximately matches the RS232C standard, it is possible to connect an RS232C to the SP–Bus. The cable terminations (jumper P2) must be removed when the RS232C is to transmit on the SP–Bus.

5.8. TX PROCESSOR (MODULE 8) SP NO. 626408

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- power supply driver
- A/D Converter
- power det. A and B
- RF and telex controls
- AT2112 module driver
- tune motor control
- AE current and power–out conditioning
- option selections (jumpers)

POWER SUPPLY

The board is supplied with the following voltages via P5:

GND
+9V
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+28V

5.8. TX PROCESSOR (MODULE 8) SP NO. 626408 cont.:

These voltage are changed into the voltage regulator U25–U29 to the following internal supplies.

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The purpose of the microcomputer block is to run the programme properly. It consists of the following units:

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During normal operation the microprocessor resets the watch dog at known locations in the programme. If the microprocessor stays too long time in an unintentional loop, without resetting the watch dog, the watch dog will activate the reset pin on the microprocessor.
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The driver and the receiver are identical in each unit connected to the SP–Bus.
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The driver consists of two gates, U02/1 & U02/2 (74HC132), a transistor Q01 (BC558) for level shifting and two complementary output transistors Q02 (BC328), Q03 (BC338).
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The receiver is connected to the microprocessor U03, pin 12 (port 2, bit 3, receive data).
As the levels on the SP–Bus approximately matches the RS232C standard, it is possible to connect an RS232C to the SP–Bus. The cable terminations (jumper P2) must be removed when the RS232C is to transmit on the SP–Bus.

5.8. **TX PROCESSOR (MODULE 8) SP NO. 626408** cont.:

SERIAL DEVICE BUS DRIVER
The serial device bus consists of:

- clock
- data out
- data in
- several select lines
- special select for the A/D converter

The serial bus occupies 6 bits of port 6 on the microprocessor. Bit 0, bit 1 and bit 2 are connected to the serial device selector. Bit 3 is the special select for the A/D converter. Bit 6 is clock, bit 7 is data.

The serial device selector is a 3 to 8 line decoder 74HC237 (U07). The 3 input lines give 8 selects on the output, one selected at a time. The following codes are used:

0 – none is selected
1 – EEPROM U8
2 – EEPROM U9
3 – shift register U10, filter module driver
4 – shift register U12, tune motor control
5 – shift register U17,U18, areal coupler driver
6 – shift register U11, power supply module driver
7 – A/D converter, reference voltage switch.

The serial device selector is supplied by +5VB.

The serial device bus driver consists of 3 lines:

- clock, port 6, bit 6
- data out, port 6, bit 7
- data in, port 6, bit 7

In order to have a safe communication the clock and data out are buffered. The buffers are 74HC08 (U05/1 and U05/2) supplied by +5VB.
The data in line is connected direct to port 6, bit 7. R04 ensures a definite impedance on the data in line.

To inhibit an unknown current sink in the serial device bus when the supply is failing, the buffers are gated with PFO signal from the battery low detector (U4, pin 5).

EEPROM's
U8 and U9 EEPROM's are supplied by the back–up voltage +5VB. They are connected to the serial device bus direct to the microprocessor, as the serial device bus closes down when the +18V is failing.
U8 and U9 EEPROM's remember the data for the fast retune of the AT2112.
By use of service programmes it is possible to delete these retune data.

U8 and U9 EEPROM's are from S. P. Radio initialized and programmed with certain constants related to the specific T2131/T2135, where the TX processor is located. The constants are saved in the EE–PROM's by use of service programmes.

When any of the EEPROM's are replaced, both must be initialized again and the T2131/T2135 must be calibrated. Refer to the service programmes.
When the TX processor board is replaced or is moved to another T2131/T2135, the T2131/T2135 must be calibrated again. Refer to the service programmes.

FILTER MODULE DRIVER
This unit activates all relays on the output filter module (1). It consists of a serial to parallel shift register U10, 74HC595 and 8 open collector Darlington drivers, located in U14 and U21 (MC1413/ ULN2003).

5.8. TX PROCESSOR (MODULE 8) SP NO. 626408 cont.:

The filter module driver is connected to the serial device bus and supplied from the +5VA. The +15V is connected to U14 and U21 for protection purposes.

POWER SUPPLY DRIVER

This unit activates all the power supplies in the N2170 and N2171.
It consists of a serial to parallel shift register U11, 74HC595 and open collector Darlington drivers, located in U14 and U22 (MC1413/ ULN2003) pulled up by 8x10 kohm resistors.

The power supply driver is connected to the serial device bus and supplied from the +5VA. The +15V is connected to U14 and U22 for protection purposes.

A/D CONVERTER AND SURROUNDING CIRCUITS

The A/D converter converts the following analog signals to digital values:

- forward voltage, (VF)
- reverse voltage, (VR)
- power out voltage, (Pout)
- temperature in power amplifier A, (converted to a voltage)
- temperature in power amplifier B, (converted to a voltage)
- power out from power amplifier A, (power det. A)
- power out from power amplifier B, (power det. B)
- power in voltage, (Pin)

The ADC (U13, ADC0838) is an 8 bit converter and an 8 channel multiplexer (MUX). Data in and out are serial.
The ADC is connected to the serial device bus and to a reference voltage, +5.00V to the Vref input (pin 12). It is possible to switch the Vforward to the Vref input (pin 12) on the ADC and do a ratiometric measuring with Vforward and Vref giving the parameter RHO direct.

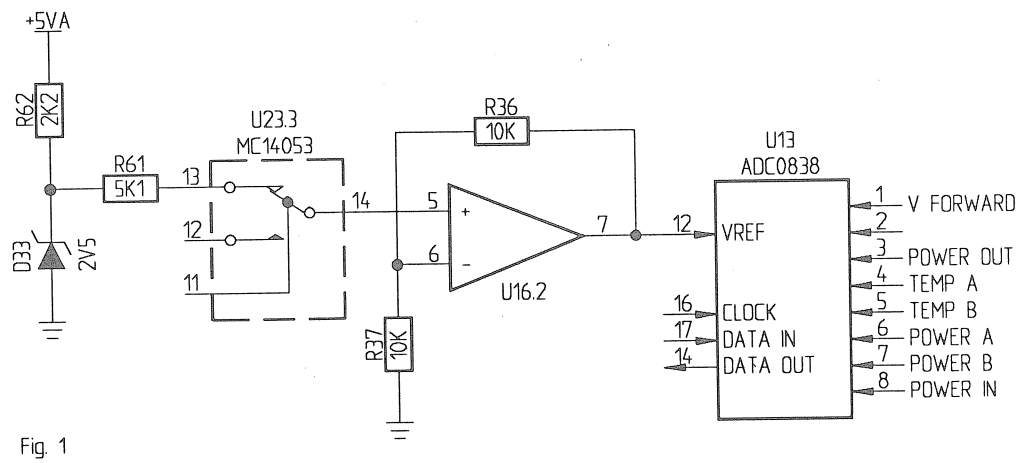


Fig. 1

Measuring Vforward (VF), power out, temperature A and B, power det. A and B, and power in.

5.8. **TX PROCESSOR (MODULE 8) SP NO. 626408** cont.:

When measuring a voltage, the Vref (pin 12) is at +5.0 Volt. The reference diode D33 (LM385) gives +2.5 Volt. The analog switch U23/3 (MC14053) is controlled by the serial device selector and connects the 2.5 Volt reference to the non inverting input of the op–amp U16/2. The op–amp has a gain of 2, giving the 5.0 Volt reference to the ADC, pin 12.

– VF (P4 pin 7) is connected to channel 0 pin 1 of the MUX in the ADC via a divider, R56, R55, R54.

– VR (P4 pin 8) is connected to channel 1 pin 2 of the MUX in the ADC via a divider, R60, R59.

– Power out (P4 pin 9) is connected to channel 2 pin 3 of the MUX in the ADC via a divider, R58, R57

– Temperature from power amplifier A. The temperature sensor R64 (KTY11–2B) is placed near the output transistors in the power amplifier A (11) and is connected to the TX processor in P05, pin 10 and pin 11.

– Temperature from power amplifier B. The temperature sensor R64 (KTY11–2B) is placed near the output transistors in the power amplifier B (11) and is connected to the TX processor in P05, pin 12 and pin 13.

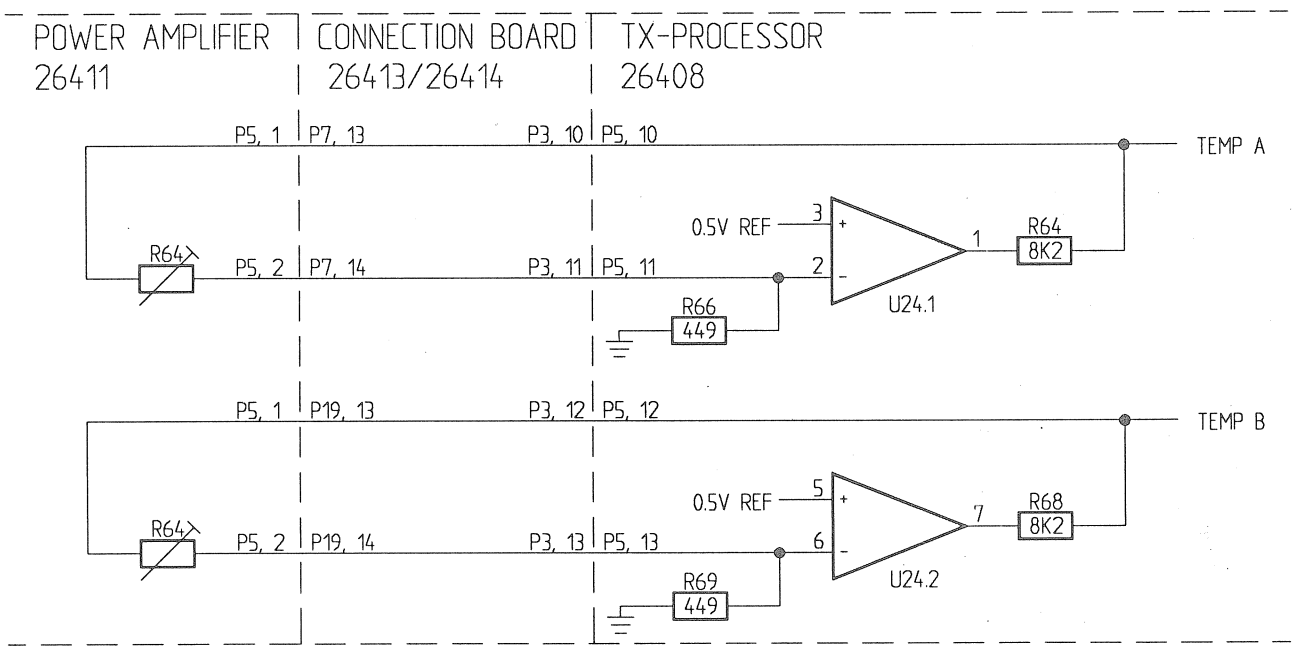


Fig. 2

Fig. Temperature sensor connections

Temperature from Power Amplifier

The sensor is a nonlinear resistive element, which has 2.000 Kohm at 1 mA and 25°C. The op–amp U24/1 is a voltage–to–current converter. The input voltage is the 2.5 Volt reference divided by the resistors R65 and R70, which gives 0.500 Volt at the non inverting input of the op–amp. The resistor from the inverting input to ground is 449 Ohm and gives a constant current flow (1 mA) in the sensor connected from the output to the inverting input of the op–amp. R64 and C37,C62 inhibits the op–amp from oscillating.

5.8. TX PROCESSOR (MODULE 8) SP NO. 626408 cont.:

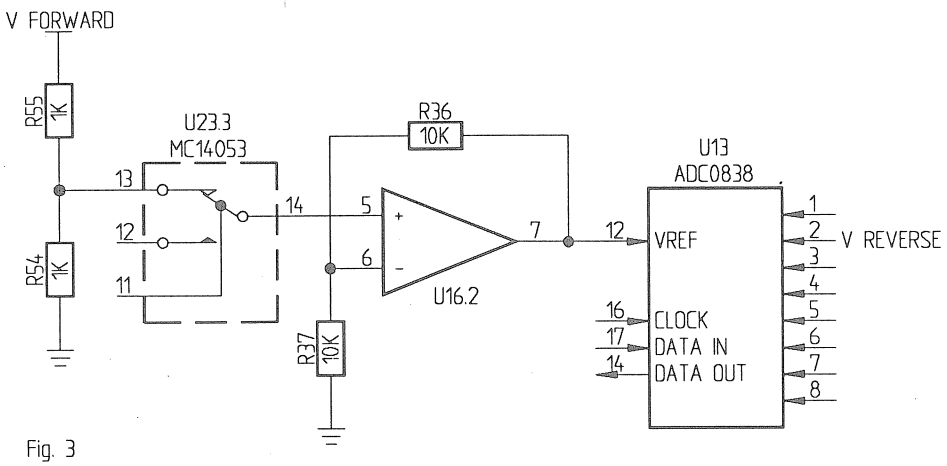


Fig. 3

Fig. Measuring RHO

When Measuring RHO, the Vforward is connected to reference input of the ADC (U13, pin 12). Vreverse is connected to pin 2. The result of the ratiometric measuring is the parameter RHO, defined by Vreverse divided by Vforward.

POWER DET. A AND B

During rise or after a fatal error, the intelligent fault system investigates which power amplifier has been installed. This is done in the following way.

Two 10 kohm (R31,R32) pull-up resistors are connected to the power det. A and power det. B during Q8 and Q9.

If only one power amplifier (A) is installed.
The power det. A line on U13 pin 6 is low app. 0.9 volt, and
the power det. B line on U13 pin 7 is high app. 4.0 volt.

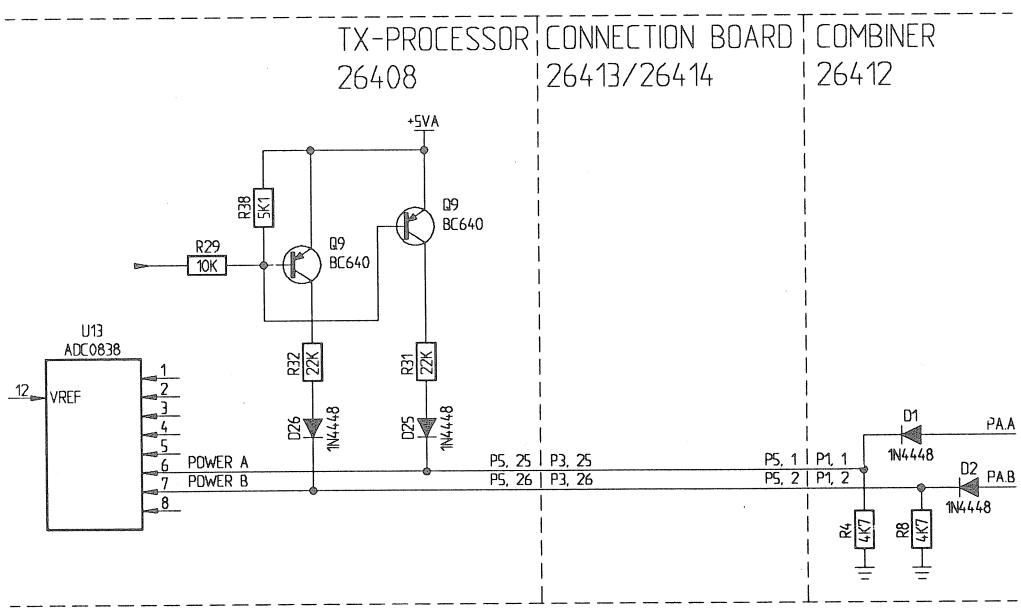


Fig. 4

Fig. Power detector A and B

5.8. **TX PROCESSOR (MODULE 8) SP NO. 626408** cont.:

RF AND TELEX

The transistor Q4 is the telex open function and Q5 is the RF on/off function. Both are controlled direct from the microprocessor, (port 6, bit 4 and bit 5).
The RF on/off controls the bias for the power transistors by means of the transistors Q02, Q05 and Q11 in the power amplifier.

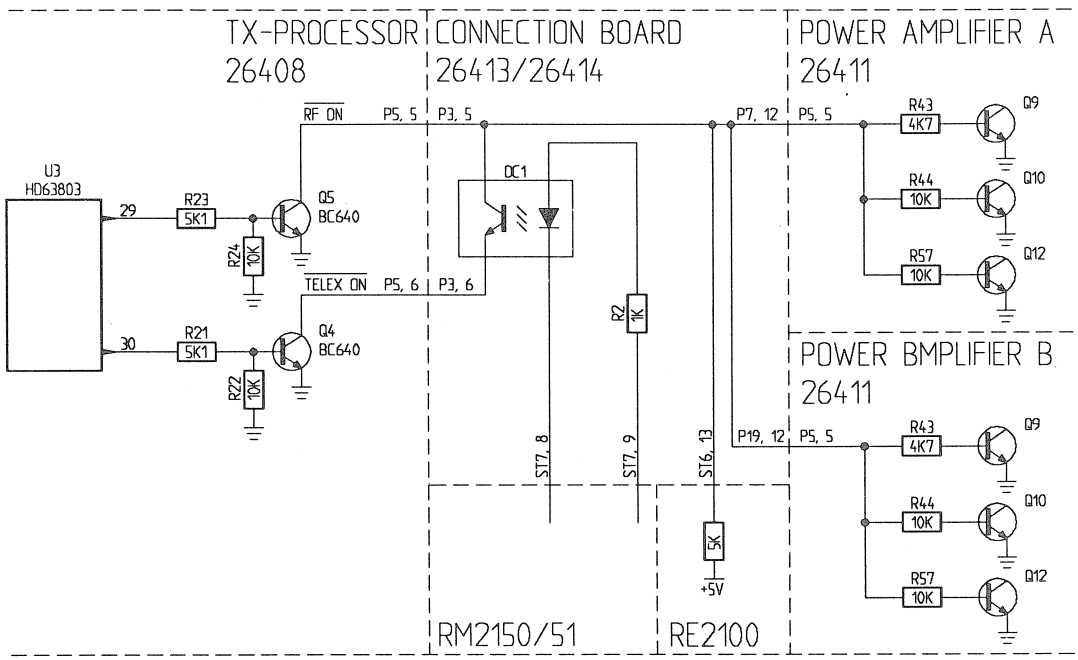


Fig. 5

Fig. RF and telex control

RF off and Telex Closed
Q4 is off and Q5 is off. This means that the transistors Q9, Q10, Q12 in power amplifier is at saturation state by a current flow from +5V through 5 kohm in the RE2100.

RF on: (During tune and "key" from the handset)
Q4 is off and Q5 is on. The transistors Q9,Q10, Q12 in the power amplifier is at off state.

Telex open ("key" from the Telex equipment)
Q4 is on and Q5 is off. This allows the optocoupler L2,L3,L4 in the connection board (14) from the RM2151 to control the RF on/off function to the power amplifier.

AT2112 DRIVER

This unit activates all relays in the AT2112. It consists of two serial to parallel shift registers U17, U19, 74HC595 and 16 source Darlington drivers, located in U18 and U19 (UDN2981A).
The areal module driver is connected to the serial device bus and supplied from the +5VA. The source driver (U18,U20) is supplied from +28V. D4–D17 and GND are connected to U18 and U20 for protection purposes.

5.8. TX PROCESSOR (MODULE 8) SP NO. 626408 cont.:

TUNE MOTOR CONTROL

The main function of this circuit is to control the M01 in the AT2112 at two speeds, high and low, and when the variable inductor has rotated one half to stop the tune motor. The speed of the motor is selected from the microprocessor via the serial device bus and the shift register U12 (74HC595), (high speed pin 7),(low speed pin 6). The signal from U12 pin 6 (low speed) is divided by R25 and R26, where the signal from U12 pin 7 (high speed) is applied direct to the non–inverting input of the op–amp. The op–amp. U15/1 has a gain of app. 4.6 . The output voltage is buffered by the output transistors Q6 and Q7.

When the motor is running, as it does in the moment when the power is turned on (high speed) or when tuning the AT2112 (high or low speed), a current flows into the light emitting diode in the optocoupler L2,L3,L4 on the aerial current detector module (1) in the AT2112.

The transistor Q02 is saturated via R05 and the collector current flows in the LED in the L2,L3,L4 and the resistor R26. The detectors in the optocoupler L2,L3,L4 and Q01 on the aerial current detector module (1) are both in saturation state caused by the light from the emitter in the L2,L3,L4.

The transistor Q10 on the TX processor (8) is on (controlled by the microprocessor). This ensures a current flow in R48 on the TX processor (8) and in Q01 (and the detector in L2,L3,L4) on the aerial current detector module in the AT2112. The collector of the Q01 on the aerial current detector module in the AT2112 is sensed by the divider R47 and R46 and the driver U14/4 (MC1413) which is connected to the microprocessor, port 5 bit 7, (U02, pin 24). The light is broken in the open type optocoupler L2,L3,L4 on the aerial current detector module (1) when the variable inductor C01 in AT2112 has maximum induction and when it has minimum induction (every 180°). When the light is broken in the optocoupler L2,L3,L4, the current flow stops in the detector in L2,L3,L4 and Q01 on the aerial current detector module (1) in AT2112. This gives a level shift, which is detected by driver U14/4 and the microprocessor is informed. The microprocessor turns off the supply voltage to the motor M01 and the rotation stops. When the motor M01 must run at low (the AT2112 is tuning) it is always started at high speed and reduced to low speed when the rotation has begun. The high speed time period is the time it takes to rotate the variable inductor C01 so far that the light from the light emitter diode in L2,L3,L4 turns on the detector in L2,L3,L4, and the transistor Q01 on the aerial current detector module (1). This is detected and the microprocessor will immediate change to low speed.

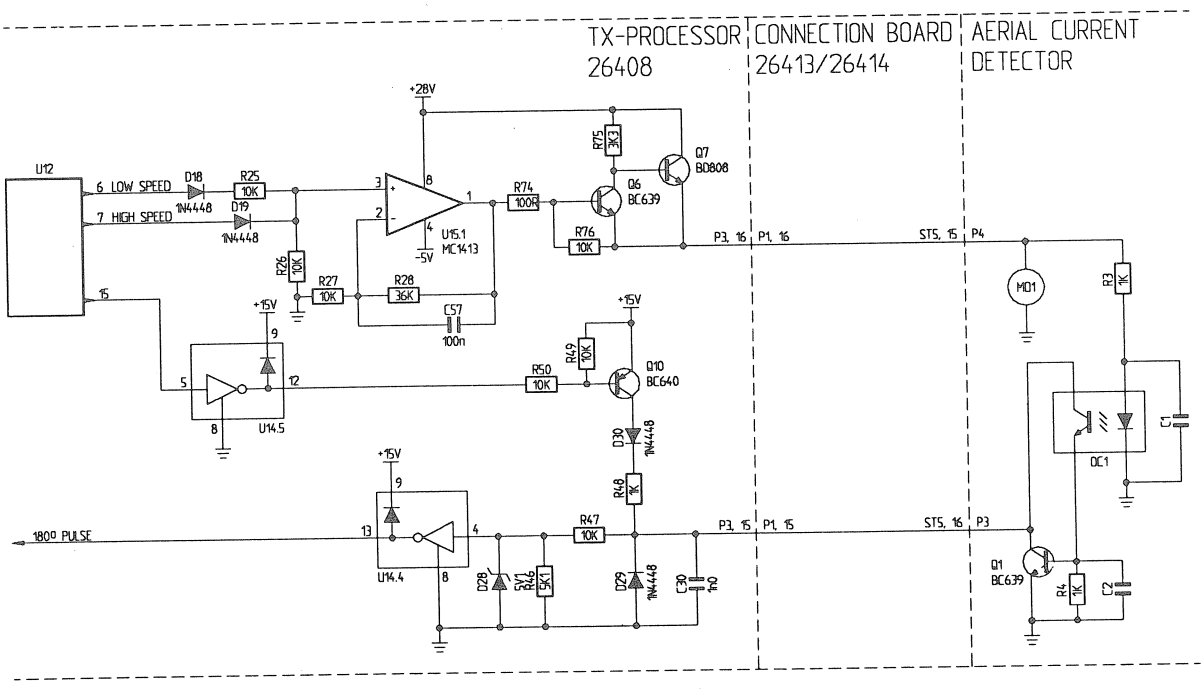


Fig. 6

Fig. Motor control circuit

5.8. **TX PROCESSOR (MODULE 8) SP NO. 626408** cont.:

AE-CURRENT AND POWER OUT CONDITIONING

The signal 'AE-current' and the signal '180° pulse' share one wire between the AT2112 and T2131/T2135. This means that the 'AE-current' cannot be transferred to the Bar-graph in the RE2100 when the AT2112 is tuning. The 'POWER OUT'is transferred to the Bar-graph when the AT2112 is tuning.

When the T2131/T2135 is keyed (the tuning has finished), the 'AE-current' is displayed on the Bar-graph.

If the jumper 5 is inserted in the P02 and the T2131/T2135 is keyed, the 'POWER OUT' is displayed on the Bar-graph.

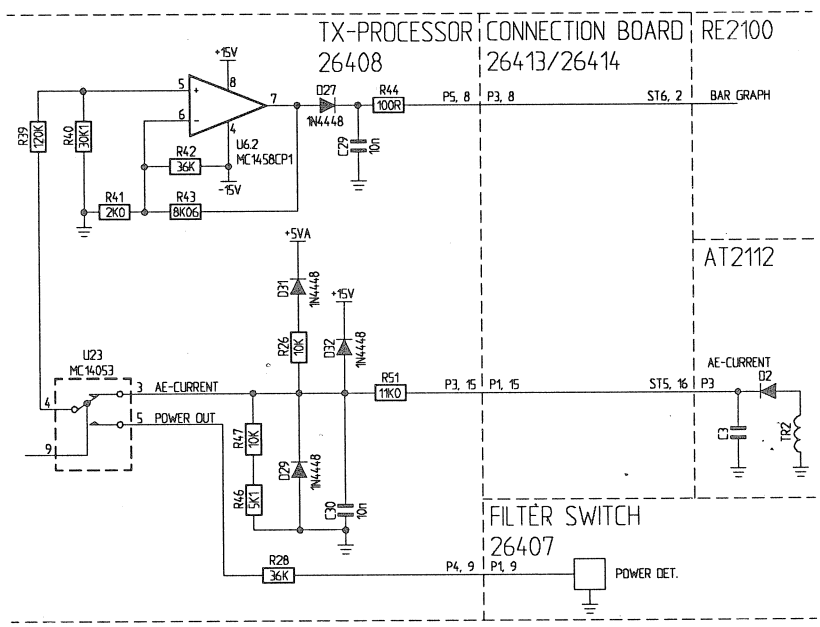


Fig. 7

Fig. AE-current/POWER OUT - Bar graph

The analog switch U23/2, which is controlled by the microprocessor via the serial device bus and the shift register U12 and the driver U14/5, switches between the 'AE-current' and the 'POWER OUT'.

'AE-current' comes in from the AT2112 to the TX processor in P3, pin 15 and is divided by the resistors R51, R39 and R40. When the level exceeds app. 5.7 Volt, the diode D31 opens and the dividing ratio is changed. This ensures that the level corresponds to the logarithmic scale on the RE2100.

The 'POWER OUT' comes in, from the output-filter (1) at P4, pin 9 and is divided by the resistors R53, R39 and R40. The selected signal is gained by U06/2 and surrounding resistors R41, R42, R43 and R44. The output is fed to P5, pin 8 and runs to the processor unit (8) in the RE2100, where it is conditioned and lead to the display unit (7) (in the RE2100), where it is mixed with the AGC-signal from the receiver module (1). Please refer to the circuit description for the RE2100 modules.

5.8. TX PROCESSOR (MODULE 8) SP NO. 626408 cont.:

OPTION SELECTIONS (JUMPERS)

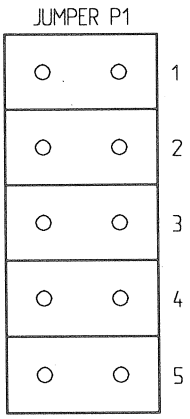


Fig. Jumper Options

Jumper 1 is the upper one.

Jumper	Inserted	Out
1	The communication on the with SP–Bus is without parity bit.	Normal communication RE2100.
2	Watch dog reset disabled.	Normal operation of the watch dog.
3	The drive set is made without being disturbed of compression.	Normal operation.
4	Do not insert. For future use.	Normal operation.
5	This tells the micropro–cessor that a AT2112 does not exist in the system. All communication to the AT2112 is disabled.	Normal operation. The AT2112 is in the system.

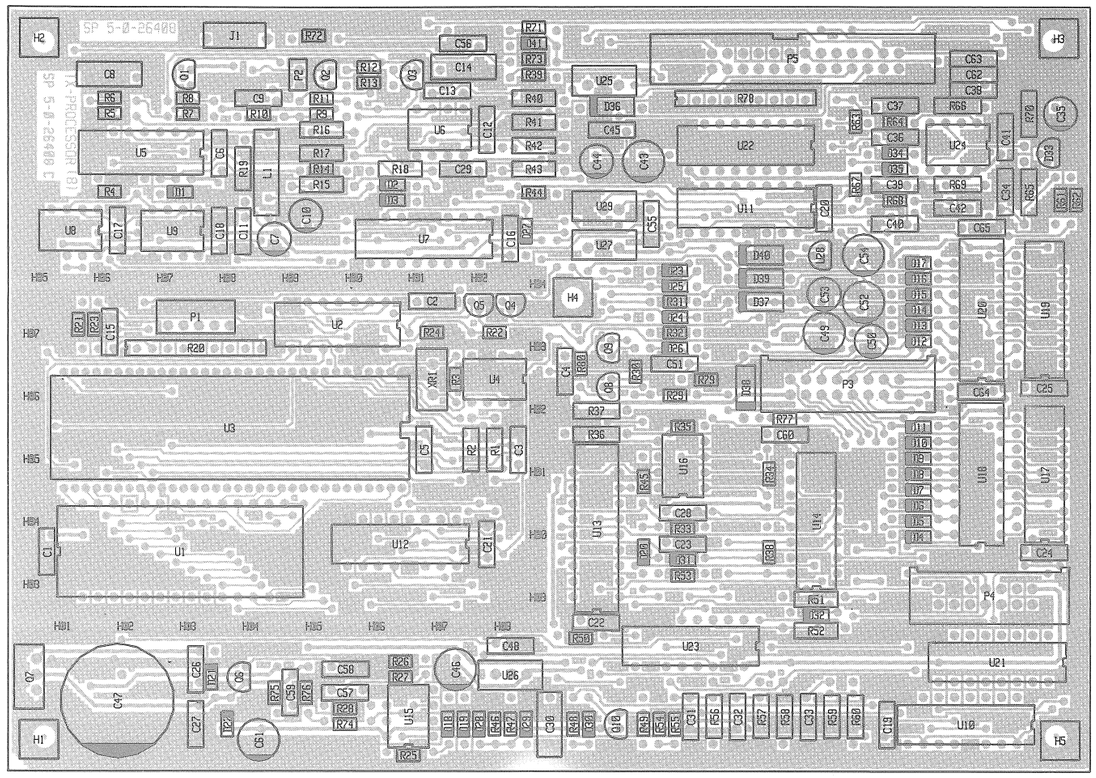
Jumper 1 is:

The upper one on the TX processor 26408 (Ver,B,C, , ,).

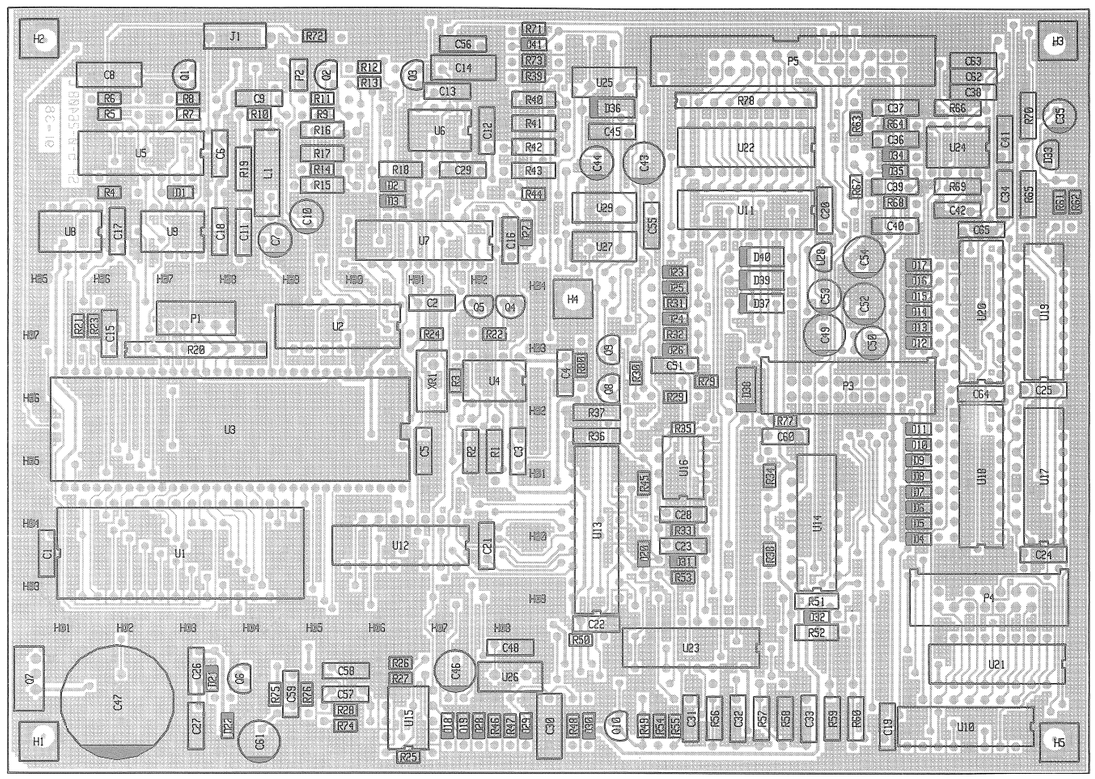
TX PROCESSOR MODULE 8

5.8. TX PROCESSOR (MODULE 8) cont.:

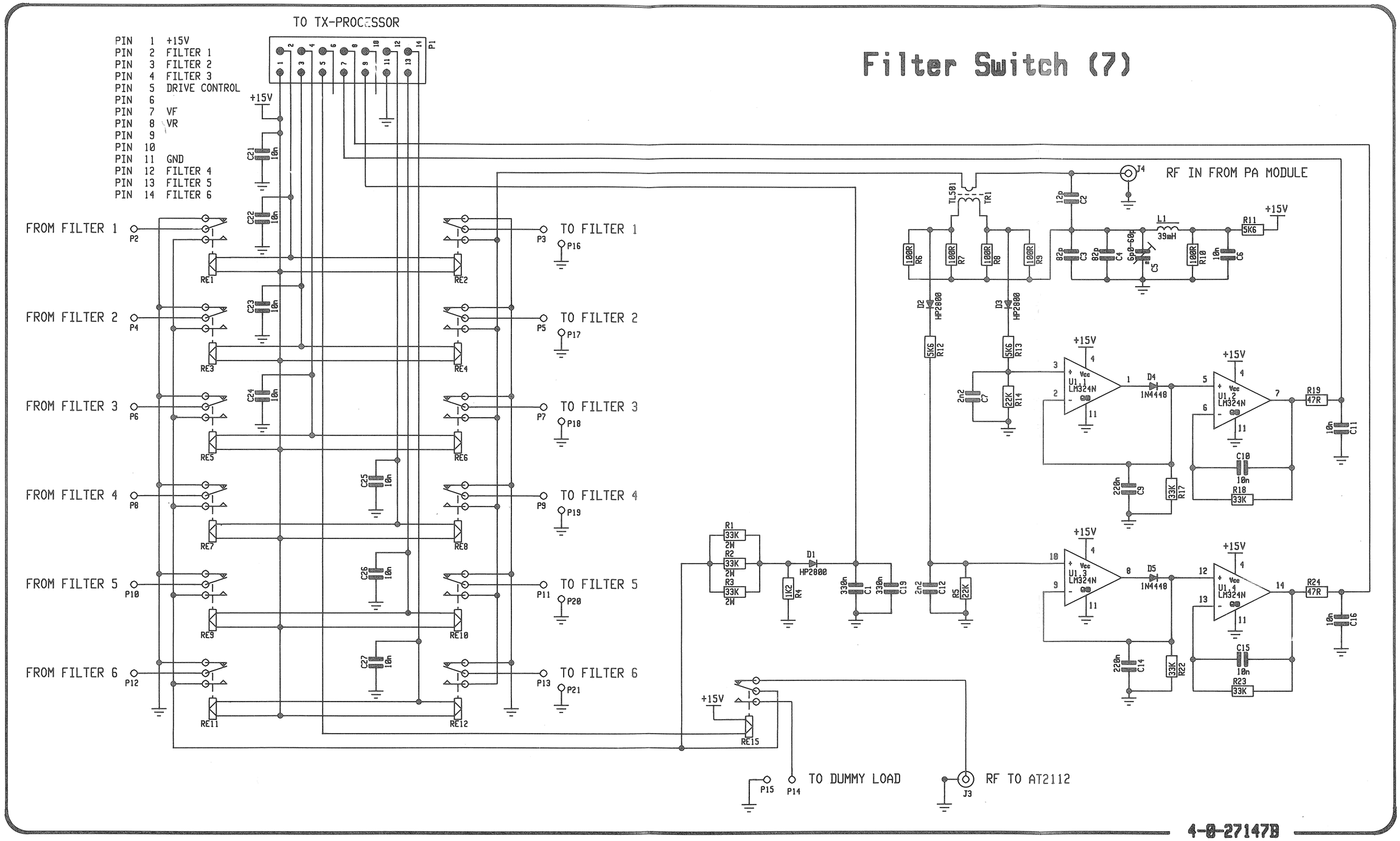
COMPONENT LOCATION TX PROCESSOR MODULE 8.



View from component side with upper side tracks.



View from component side with lower side tracks.

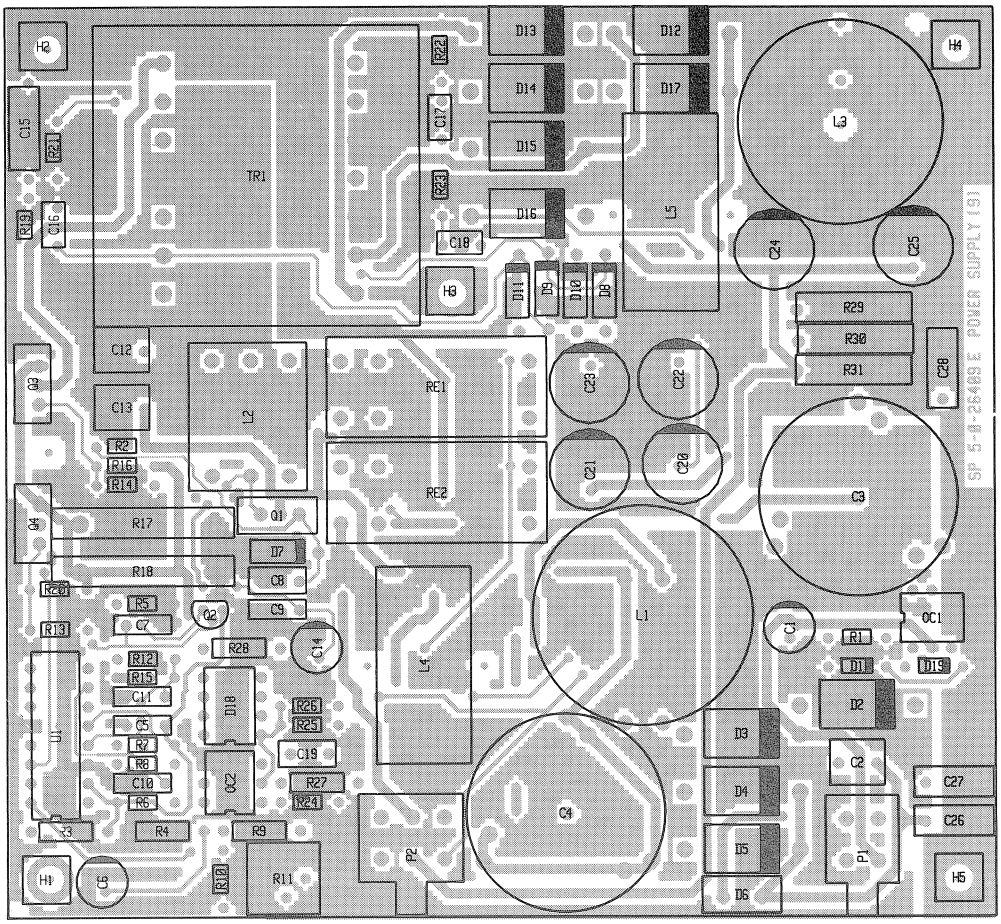

Filter Switch (7)
TO TX-PROCESSOR
PIN 1 +15V
PIN 2 FILTER 1
PIN 3 FILTER 2
PIN 4 FILTER 3
PIN 5 DRIVE CONTROL
PIN 6
PIN 7 VF
PIN 8 VR
PIN 9
PIN 10
PIN 11 GND
PIN 12 FILTER 4
PIN 13 FILTER 5
PIN 14 FILTER 6
P1
FROM FILTER 1
FROM FILTER 2
FROM FILTER 3
FROM FILTER 4
FROM FILTER 5
FROM FILTER 6
TO FILTER 1
TO FILTER 2
TO FILTER 3
TO FILTER 4
TO FILTER 5
TO FILTER 6
RE1
RE2
RE3
RE4
RE5
RE6
RE7
RE8
RE9
RE10
RE11
RE12
RE15
RF IN FROM PA MODULE
TO DUMMY LOAD
RF TO AT2112
LM324N
HP2800
IN4448
4-0-27147B

5.9. POWER SUPPLY (MODULE 9) SP NO. 626409

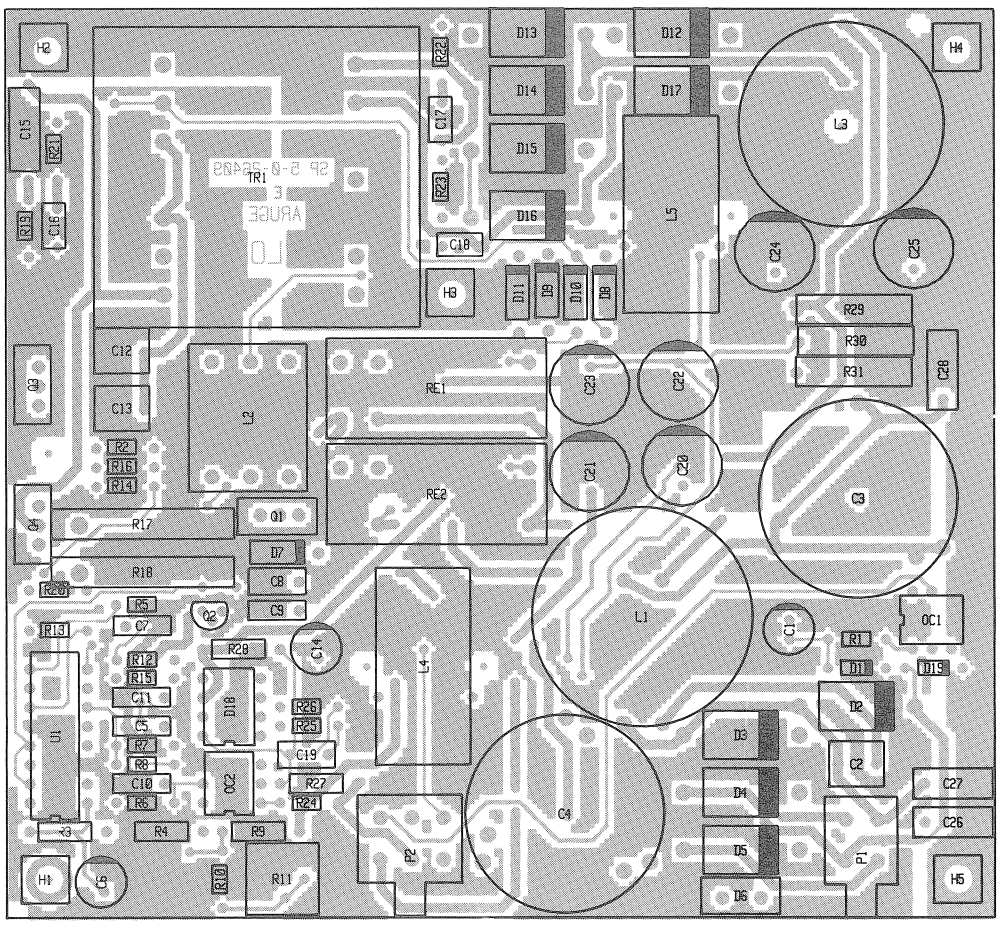
The power supply is an isolated forward switch mode converter. It converts a 24V –10% +30% DC voltage to all the necessary voltages for the RE2100 and the control circuits in the transmitter. These voltages are ±19V and +9.5V.
Most of the necessary amplifiers, flip–flops etc. are contained in the ICU1. The only exception from this, is the secondary voltage sense D18.
C2, C26, C27, L1, C3, C4 and C12, C13 are the input filter. The 12V DC supply voltage for U1 is supplied to R2, D7, C8, Q4 and C9 during starting–up. When the converter is in function it is supplied by L2 and D8, D9. This voltage is approx. 15 Volt and forces Q1 to turn off. This configuration reduces the power loss in Q1. R5 and C7 determine the oscillator frequency to approx. 50 kHz.
The +18V DC output voltage is sensed by D18 via the voltage divider R27 and R28. D18 is an integrated shunt regulator. If the voltage on the sense input (R27/R28 common point) is higher than 2.5V, then the D18 starts conducting. In this case, current starts running in the optocoupler diode OC2. R26 is a DC feed–back and R25/C19 is an AC feed–back.
R24 limits the current in the optocoupler diode.
When current runs in the optocoupler diode, the optocoupler transistor (OC2) starts conducting nearly the same current. This current results in a voltage across R6. This voltage is connected to the non inverting input of the internal error amplifier of U1. The internal error amplifier is fixed to a gain of 2 by R7 and R8.
The output MOS transistor current is sensed by R17 and R18. The current signal is then led to the current sense amplifier input, pin 4. The R15 and C11 is a lowpass filter to remove noise. The emitter of Q2 follows the ramp voltage on the oscillator capacitor C7. R12 adds some of this ramp signal to the current signal. This is necessary to avoid sub–harmonic oscillations when the duty cycle is higher than 50%.
The voltage on pin 1 determines the clamp voltage for the error voltage and thus also the max. current in the output MOS transistors. This voltage is determined by R3 and R4. The capacitor C6 is the soft start capacitor, making the duty cycle and the output voltage rise slowly.
The two pulse width modulated outputs are led to the two output MOS transistors by R13 and R14. These two resistors slow down the rising time of the MOS transistors to prevent spurious oscillations. R16 and R20 ensure that the transistors always stay off when the IC U1 is off.
R19, C15 and R21, C16 and R22, C17 and R23, C18 are snuppers reducing oscillation due to stray capacitors and stray inductions in the transformer TR1.
D12 to D17 and L3 to L5 and C20 to C25 are the three output rectifiers and filters.
The input voltage is sensed by a 0.35 Volt shut down terminal pin 16 of U1 via R9, R10 and R11. If the supply voltage is higher than approx. 45V DC, the converter stops.

5.9. POWER SUPPLY (MODULE 9) cont.:

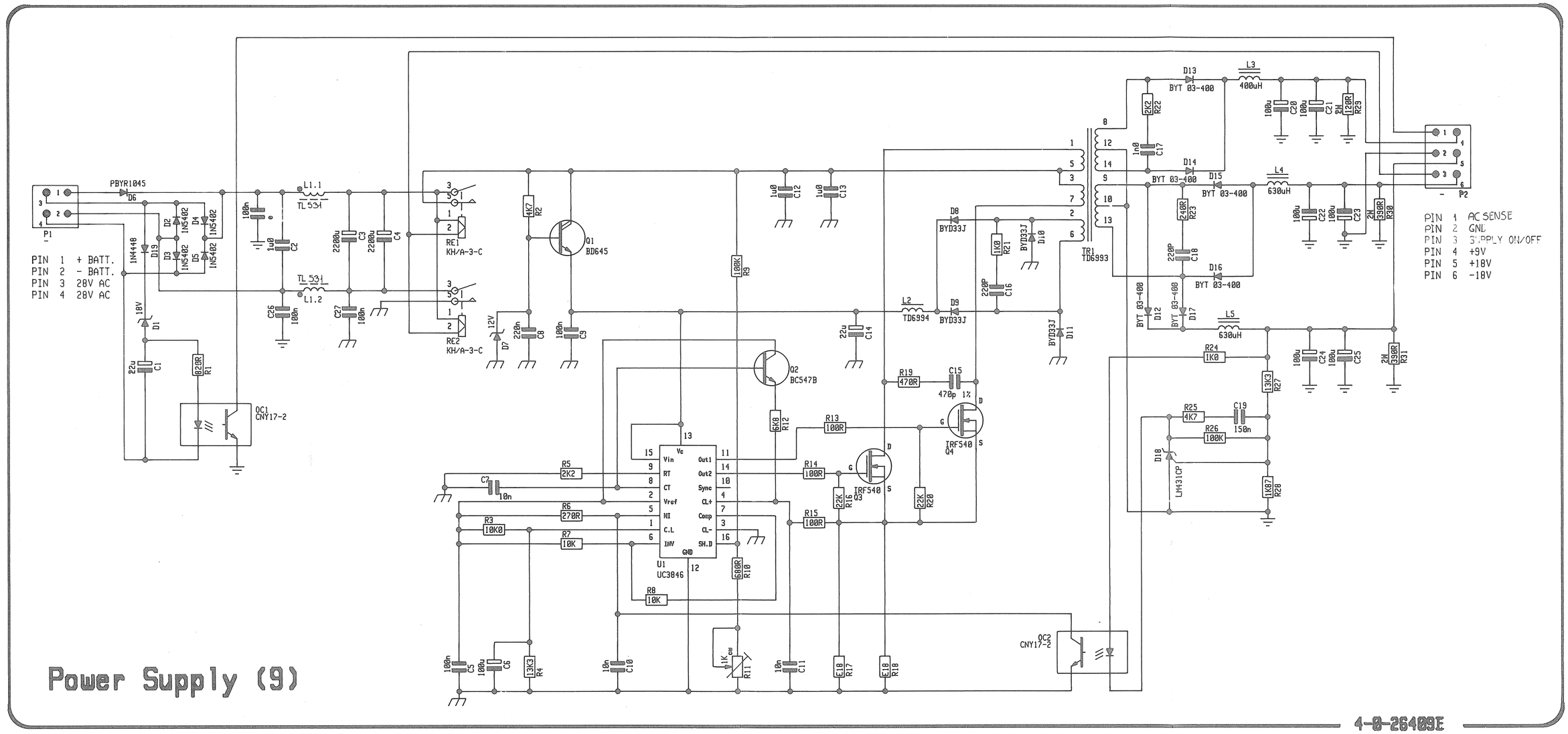
COMPONENT LOCATION POWER SUPPLY MODULE 9.



View from component side with upper side tracks.



View from component side with lower side tracks.



Power Supply (9)

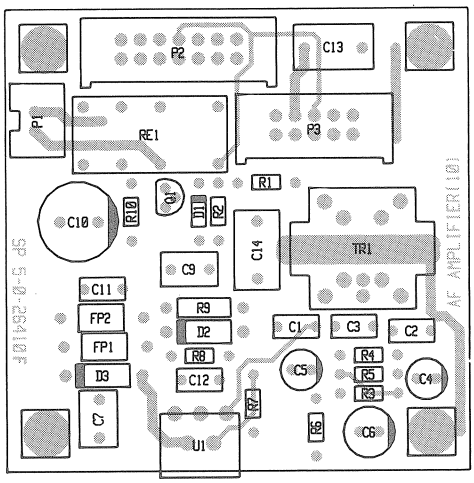
4-0-26409E

5.10. AF AMPLIFIER (MODULE 10) SP NO. 626410

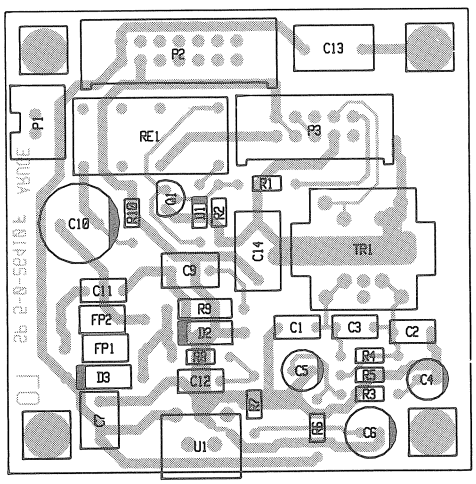
The audio amplifier is an integrated circuit TDA2030 U1, and it is supplied from the 28 Volt supply for the PA module. To insulate the battery from ground, there is a transformer TR1 at the input of the amplifier. RE1 and Q1 form a muting circuit for the loudspeaker. This circuit is controlled from the processor.

5.10. AF AMPLIFIER (MODULE 10) cont.:

COMPONENT LOCATION AMPLIFIER MODULE 10.



View from component side with upper side tracks.



View from component side with lower side tracks.

AF-amplifier (10)

TO LOUDSPEAKER

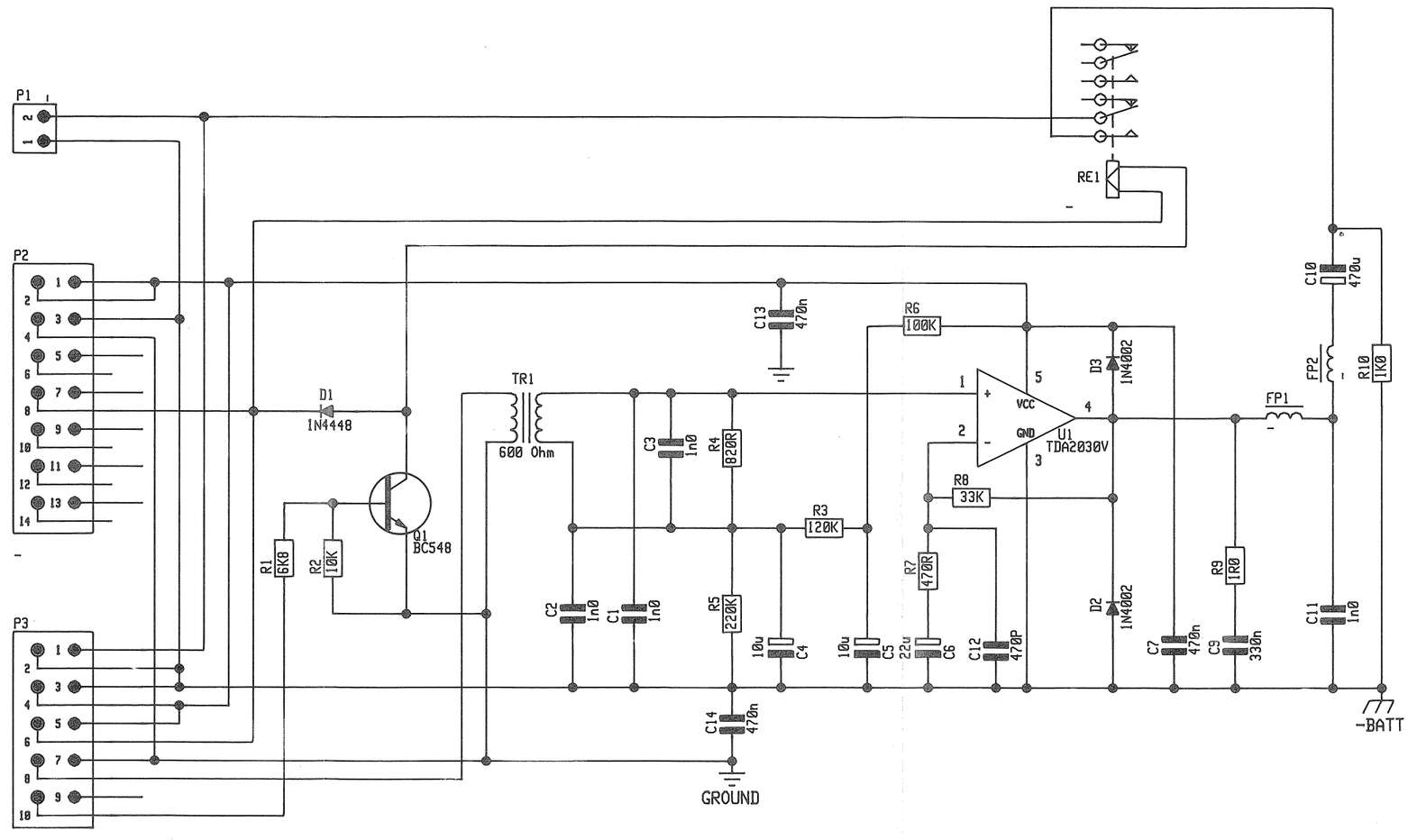
PIN 1 -BATT.
PIN 2 AF-OUT

TO SYNTHESIZER RE2100

PIN 1 +28V
PIN 2 +28V
PIN 3 -BATT.
PIN 4 NC
PIN 5
PIN 6
PIN 7
PIN 8 +18V
PIN 9
PIN 10
PIN 11
PIN 12
PIN 13
PIN 14

TO RECEIVER RE2100
TO CONNECTION BOARD

PIN 1 AF-OUT
PIN 2 -BATT.
PIN 3 -BATT.
PIN 4 +28V
PIN 5 +28V
PIN 6 +18V
PIN 7 GND
PIN 8 AF-IN
PIN 9
PIN 10 MUTE LOUDSPEAKER



4-0-26410F

CONTENTS

7. PARTS LISTS

1

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	FILTER UNIT MODULE 1	**600/1200W HF SSB**	**ESPERA**	**0-0-26401**	**726401**
C1-1	**CAPACITOR**	**267pF**	**ESPERA**	**3-0-26341**	**726341**
C2-1	CAPACITOR	365pF	ESPERA	3-0-26340	726340
C3-1	CAPACITOR	1.86nF	ESPERA	3-0-26342	726342
C4-1	CAPACITOR	2.06nF	ESPERA	3-0-26343	726343
C5-1	CAPACITOR	1.86nF	ESPERA	3-0-26342	726342
L1-1	**INDUCTOR**	**2,14uH**	**ESPERA**	**6-0-23163D**	**400311**
L2-1	INDUCTOR	1,46uH	ESPERA	6-0-23164C	400312
L3-1	INDUCTOR	4,07uH	S.P.RADIO	6-0-23186	400334
L4-1	INDUCTOR	9,3uH	ESPERA	6-0-26370	400533
L5-1	INDUCTOR	9,3uH	ESPERA	6-0-26370	400533
L6-1	**INDUCTOR**	**4,07uH**	**S.P.RADIO**	**6-0-23186**	**400334**

91.12.05

1

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	FILTER UNIT MODULE 2	**600/1200W HF SSB**	**ESPERA**	**0-0-26402**	**726402**
C1-2	**CAPACITOR**	**178pF**	**ESPERA**	**3-0-26344**	**726344**
C2-2	CAPACITOR	244pF	ESPERA	3-0-26345	726345
C3-2	CAPACITOR	1.14nF	ESPERA	3-0-26346	726346
C4-2	CAPACITOR	1.27nF	ESPERA	3-0-26347	726347
C5-2	CAPACITOR	1.14nF	ESPERA	3-0-26346	726346
L1-2	**INDUCTOR**	**1,56uH**	**S.P.RADIO**	**6-0-23165C**	**400313**
L2-2	INDUCTOR	1,11uH	ESPERA	6-0-23166C	400314
L3-2	INDUCTOR	3,8uH	ESPERA	6-0-26371	400534
L4-2	INDUCTOR	6,6uH	ESPERA	6-0-26372A	400535
L5-2	INDUCTOR	6,6uH	ESPERA	6-0-26372A	400535
L6-2	**INDUCTOR**	**3,8uH**	**ESPERA**	**6-0-26371**	**400534**

1

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	FILTER UNIT MODULE 3	**600/1200W HF SSB**	**ESPERA**	**0-0-26403**	**726403**
C1-3	**CAPACITOR**	**109pF**	**ESPERA**	**3-0-26348**	**726348**
C2-3	CAPACITOR	150pF	ESPERA	3-0-26349	726349
C3-3	CAPACITOR	720pF	ESPERA	3-0-26350A	726350
C4-3	CAPACITOR	780pF	ESPERA	3-0-26351A	726351
C5-3	CAPACITOR	720pF	ESPERA	3-0-26350A	726350
L1-3	**INDUCTOR**	**1,11uH**	**S.P.RADIO**	**6-0-23167C**	**400315**
L2-3	INDUCTOR	755nH	ESPERA	6-0-23168B	400316
L3-3	INDUCTOR	1,9uH	ESPERA	6-0-26377B	400540
L4-3	INDUCTOR	3,7uH	ESPERA	6-0-26384B	400547
L5-3	INDUCTOR	3,7uH	ESPERA	6-0-26384B	400547
L6-3	**INDUCTOR**	**1,9uH**	**ESPERA**	**6-0-26377B**	**400540**

1

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	FILTER UNIT MODULE 4	**600/1200W HF SSB**	**ESPERA**	**0-0-26404**	**726404**
C1-4	**CAPACITOR**	**67pF**	**ESPERA**	**3-0-26353**	**726353**
C2-4	CAPACITOR	91pF	ESPERA	3-0-26352	726352
C3-4	CAPACITOR	429pF	ESPERA	3-0-26354	726354
C4-4	CAPACITOR	475pF	ESPERA	3-0-26355	726355
C5-4	CAPACITOR	429pF	ESPERA	3-0-26354	726354
L1-4	**INDUCTOR**	**0,93uH**	**ESPERA**	**6-0-26373A**	**400536**
L2-4	INDUCTOR	0,67uH	ESPERA	6-0-26374	400537
L3-4	INDUCTOR	1,57uH	ESPERA	6-0-26375B	400538
L4-4	INDUCTOR	1,72uH	ESPERA	6-0-26376B	400539
L5-4	INDUCTOR	1,9uH	ESPERA	6-0-26377B	400540
L6-4	**INDUCTOR**	**1,1uH**	**ESPERA**	**6-0-26378B**	**400541**

1

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	FILTER UNIT MODULE 5	**600/1200W HF SSB**	**ESPERA**	**0-0-26405**	**726405**
C1-5	**CAPACITOR**	**41pF**	**ESPERA**	**3-0-26356**	**726356**
C2-5	CAPACITOR	56pF	ESPERA	3-0-26357	726357
C3-5	CAPACITOR	255pF	ESPERA	3-0-26358	726358
C4-5	CAPACITOR	282pF	ESPERA	3-0-26359	726359
C5-5	CAPACITOR	255pF	ESPERA	3-0-26358	726358
L1-5	**INDUCTOR**	**0,73uH**	**ESPERA**	**6-0-26379**	**400542**
L2-5	INDUCTOR	0,5uH	ESPERA	6-0-26537	400551
L3-5	INDUCTOR	0,92uH	ESPERA	6-0-26380B	400543
L4-5	INDUCTOR	1,2uH	ESPERA	6-0-23178B	400326
L5-5	INDUCTOR	1,2uH	ESPERA	6-0-23178B	400326
L6-5	**INDUCTOR**	**0,65uH**	**ESPERA**	**9-0-23177B**	**400325**

1 POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	FILTER UNIT MODULE 6	**600/1200W HF SSB**	**ESPERA**	**0-0-26406**	**726406**
C1-6	**CAPACITOR**	**25pF**	**ESPERA**	**3-0-26360A**	**726360**
C2-6	CAPACITOR	35pF	ESPERA	3-0-26361A	726361
C3-6	CAPACITOR	147pF	ESPERA	3-0-26362	726362
C4-6	CAPACITOR	163pF	ESPERA	3-0-26363	726363
C5-6	CAPACITOR	147pF	ESPERA	3-0-26362	726362
L1-6	**INDUCTOR**	**214nH**	**ESPERA**	**6-0-23173E**	**400321**
L2-6	INDUCTOR	146nH	S.P.RADIO	6-0-23174C	400322
L3-6	INDUCTOR	0,53uH	ESPERA	6-0-26381B	400544
L4-6	INDUCTOR	0,65uH	ESPERA	9-0-23177B	400325
L5-6	INDUCTOR	0,85uH	ESPERA	6-0-26382B	400545
L6-6	**INDUCTOR**	**0,52uH**	**ESPERA**	**6-0-23179C**	**400327**

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	FILTER SWITCH MODULE 7	**T2131/35**	**ESPERA**	**5-0-26407E**	**626407**
C1-7	**CAPACITOR MKT**	**330nF 10% 63VDC**	**PHILIPS**	**2222 370 78334**	**11.189**
C2-7	CAPACITOR CERAMIC	12pF 5% NPO 500VDC	KCK	RT-HM60-SK CH 120 J AMMO PACK	15.575
C3-7	CAPACITOR CERAMIC	82pF 5% N150 50VDC	KCK	RT-HE70-SK PH 820 J AMMO PACK	15.126
C4-7	CAPACITOR CERAMIC	110pF 10% NPO 500VDC	KCK	RT-HM11-SK CH 111 K AMMO PACK	15.140
C5-7	CAPACITOR TRIMMING	5-60pF PTFE Ø9	DAU	109.4901.060	17.210
C6-7	**CAPACITOR MKT**	**10nF 20% 100VDC**	**PHILIPS**	**2222 370 38103**	**11.168**
C7-7	CAPACITOR MKT	2n2F 10% 400VDC	ERO	MKT 1818-222/63 5-G	11.143
C9-7	CAPACITOR MKT	220nF 10% 63VDC	PHILIPS	2222 370 78224	11.095
C10-7	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 38103	11.168
C11-7	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 38103	11.168
C12-7	**CAPACITOR MKT**	**2n2F 10% 400VDC**	**ERO**	**MKT 1818-222/63 5-G**	**11.143**
C14-7	CAPACITOR MKT	220nF 10% 63VDC	PHILIPS	2222 370 78224	11.095
C15-7	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 38103	11.168
C16-7	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 38103	11.168
C19-7	CAPACITOR MKT	330nF 10% 63VDC	PHILIPS	2222 370 78334	11.189
C21-7	**CAPACITOR CERAMIC**	**10nF -20/+80% CL2 50VDC**	**KCK**	**RT-HE70 SK YF 103 Z AMMO PACK**	**15.170**
C22-7	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	KCK	RT-HE70 SK YF 103 Z AMMO PACK	15.170
C23-7	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	KCK	RT-HE70 SK YF 103 Z AMMO PACK	15.170
C24-7	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	KCK	RT-HE70 SK YF 103 Z AMMO PACK	15.170
C25-7	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	KCK	RT-HE70 SK YF 103 Z AMMO PACK	15.170
C26-7	**CAPACITOR CERAMIC**	**10nF -20/+80% CL2 50VDC**	**KCK**	**RT-HE70 SK YF 103 Z AMMO PACK**	**15.170**
C27-7	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	KCK	RT-HE70 SK YF 103 Z AMMO PACK	15.170
D1-7	DIODE SCHOTTKY BARRIER	70V/15mA DO-35	SGS-THOMSON	1N5711	27.500
D2-7	DIODE SCHOTTKY BARRIER	70V/15mA DO-35	SGS-THOMSON	1N5711	27.500
D3-7	DIODE SCHOTTKY BARRIER	70V/15mA DO-35	SGS-THOMSON	1N5711	27.500
D4-7	**DIODE HIGH SPEED**	**1N4448**	**PHILIPS**	**1N4448**	**25.147**
D5-7	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
J3-7	RECEPTACLE	BNC RIGHT ANGLE	ROSENBERGER	51K-201-400 A4	78.443
J4-7	RECEPTACLE	BNC RIGHT ANGLE	ROSENBERGER	51K-201-400 A4	78.443
L1-7	CHOKE FIXED	39mH 5%	NEOSID	00 6122 43 AMMO PACK	20.218

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
L2-7	**CHOKE FIXED**	**3u9H 10%**	**FASTRON**	**MICC-3R9K-02**	**20.354**
P1-7	PLUG	2x7 POLES	3M	3598-6002	78.254
P2-7			OJD	01016C	82.006
P4-7			OJD	01016C	82.006
P4-7			OJD	01016C	82.006
P5-7			**OJD**	**01016C**	**82.006**
P5-7			OJD	01016C	82.006
P7-7			OJD	01016C	82.006
P8-7			OJD	01016C	82.006
P9-7			OJD	01016C	82.006
P10-7			**OJD**	**01016C**	**82.006**
P11-7			OJD	01016C	82.006
P12-7			OJD	01016C	82.006
P13-7			OJD	01016C	82.006
P14-7			OJD	01016C	82.006
P15-7			**OJD**	**01016C**	**82.006**
P16-7			OJD	01016C	82.006
P17-7			OJD	01016C	82.006
P18-7			OJD	01016C	82.006
P19-7			OJD	01016C	82.006
P20-7			**OJD**	**01016C**	**82.006**
P21-7			OJD	01016C	82.006
R1-7	RESISTOR PMF	33k OHM 5% 2W	PHILIPS	2322 194 13333	04.229
R2-7	RESISTOR PMF	33k OHM 5% 2W	PHILIPS	2322 194 13333	04.229
R3-7	RESISTOR PMF	33k OHM 5% 2W	PHILIPS	2322 194 13333	04.229
R4-7	**RESISTOR MF**	**1k2 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73122**	**02.474**
R5-7	RESISTOR MF	22k OHM 5% 0.33W	PHILIPS	2322 180 73223	02.504
R6-7	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R7-7	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R8-7	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R9-7	**RESISTOR MF**	**100 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73101**	**02.448**
R10-7	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R11-7	RESISTOR MF	5k6 OHM 5% 0.33W	PHILIPS	2322 180 73562	02.490
R12-7	RESISTOR MF	5k6 OHM 5% 0.33W	PHILIPS	2322 180 73562	02.490
R13-7	RESISTOR MF	5k6 OHM 5% 0.33W	PHILIPS	2322 180 73562	02.490
R14-7	**RESISTOR MF**	**22k OHM 5% 0.33W**	**PHILIPS**	**2322 180 73223**	**02.504**
R17-7	RESISTOR MF	33k OHM 5% 0.33W	PHILIPS	2322 180 73333	02.508
R18-7	RESISTOR MF	33k OHM 5% 0.33W	PHILIPS	2322 180 73333	02.508
R19-7	RESISTOR MF	47 OHM 5% 0.33W	PHILIPS	2322 180 73479	02.440
R22-7	RESISTOR MF	33k OHM 5% 0.33W	PHILIPS	2322 180 73333	02.508
R23-7	**RESISTOR MF**	**33k OHM 5% 0.33W**	**PHILIPS**	**2322 180 73333**	**02.508**
R24-7	RESISTOR MF	47 OHM 5% 0.33W	PHILIPS	2322 180 73479	02.440
RE1-7	RELAY	16VDC 1SH.8A	SDS	ST1-16V	21.188
RE2-7	RELAY	16VDC 1SH.8A	SDS	ST1-16V	21.188

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
RE3-7	**RELAY**	**16VDC 1SH.8A**	**SDS**	**ST1-16V**	**21.188**
RE4-7	RELAY	16VDC 1SH.8A	SDS	ST1-16V	21.188
RE5-7	RELAY	16VDC 1SH.8A	SDS	ST1-16V	21.188
RE6-7	RELAY	16VDC 1SH.8A	SDS	ST1-16V	21.188
RE7-7	RELAY	16VDC 1SH.8A	SDS	ST1-16V	21.188
RE8-7	**RELAY**	**16VDC 1SH.8A**	**SDS**	**ST1-16V**	**21.188**
RE9-7	RELAY	16VDC 1SH.8A	SDS	ST1-16V	21.188
RE10-7	RELAY	16VDC 1SH.8A	SDS	ST1-16V	21.188
RE11-7	RELAY	16VDC 1SH.8A	SDS	ST1-16V	21.188
RE12-7	RELAY	16VDC 1SH.8A	SDS	ST1-16V	21.188
RE15-7	**RELAY**	**16VDC 1SH.8A**	**SDS**	**ST1-16V**	**21.188**
TR1-7	TRANSFORMER	TL501	ESPERA	6-0-25786	400501
U1-7	QUAD OP.AMP.	324	TEXAS	LM324N	31.065

1

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	TX PROCESSOR MODULE (8)	**T2131/35**	**ESPERA**	**5-0-26408C**	**626408**
C1-8	**CAPACITOR MKT**	**0.1uF 10% 63VDC**	**PHILIPS**	**2222 370 78104**	**11.136**
C2-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C3-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C4-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C5-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C6-8	**CAPACITOR MKT**	**0.1uF 10% 63VDC**	**PHILIPS**	**2222 370 78104**	**11.136**
C7-8	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ERO	EKI 00 AA 147 H M9	14.510
C8-8	CAPACITOR MKT	1000pF 10% 400VDC	SIEMENS	B32520-A6102-K-289	11.139
C9-8	CAPACITOR MKT	10nF 5% 63VDC	PHILIPS	2222 370 89103	11.134
C10-8	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ERO	EKI 00 AA 147 H M9	14.510
C11-8	**CAPACITOR MKT**	**0.1uF 10% 63VDC**	**PHILIPS**	**2222 370 78104**	**11.136**
C12-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C13-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C14-8	CAPACITOR MKT	1000pF 10% 400VDC	SIEMENS	B32520-A6102-K-289	11.139
C15-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C16-8	**CAPACITOR MKT**	**0.1uF 10% 63VDC**	**PHILIPS**	**2222 370 78104**	**11.136**
C17-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C18-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C19-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C20-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C21-8	**CAPACITOR MKT**	**0.1uF 10% 63VDC**	**PHILIPS**	**2222 370 78104**	**11.136**
C22-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C23-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C24-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C25-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C26-8	**CAPACITOR MKT**	**0.1uF 10% 63VDC**	**PHILIPS**	**2222 370 78104**	**11.136**
C27-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C28-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C29-8	CAPACITOR MKT	10nF 5% 63VDC	PHILIPS	2222 370 89103	11.134
C30-8	CAPACITOR MKT	1000pF 10% 400VDC	SIEMENS	B32520-A6102-K-289	11.139
C31-8	**CAPACITOR MKT**	**0.1uF 10% 63VDC**	**PHILIPS**	**2222 370 78104**	**11.136**
C32-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C33-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C34-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C35-8	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ERO	EKI 00 AA 147 H M9	14.510
C36-8	**CAPACITOR MKT**	**0.1uF 10% 63VDC**	**PHILIPS**	**2222 370 78104**	**11.136**
C37-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C38-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C39-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C40-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136

2

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
C41-8	**CAPACITOR MKT**	**0.1uF 10% 63VDC**	**PHILIPS**	**2222 370 78104**	**11.136**
C42-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C43-8	CAPACITOR ELECTROLYTIC	22uF 20% 35VDC	ERO	EKI 00 BB 222 F M9	14.516
C44-8	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ERO	EKI 00 AA 210 F M9	14.512
C45-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C46-8	**CAPACITOR ELECTROLYTIC**	**22uF 20% 35VDC**	**ERO**	**EKI 00 BB 222 F M9**	**14.516**
C47-8	CAPACITOR ELECTROLYTIC	1000uF 20% 35VDC	SAMHWA ELEC.	SV-1000uF-35WV	14.655
C48-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C49-8	CAPACITOR ELECTROLYTIC	22uF 20% 35VDC	ERO	EKI 00 BB 222 F M9	14.516
C50-8	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ERO	EKI 00 AA 210 F M9	14.512
C51-8	**CAPACITOR MKT**	**0.1uF 10% 63VDC**	**PHILIPS**	**2222 370 78104**	**11.136**
C52-8	CAPACITOR ELECTROLYTIC	22uF 20% 35VDC	ERO	EKI 00 BB 222 F M9	14.516
C53-8	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ERO	EKI 00 AA 210 F M9	14.512
C54-8	CAPACITOR ELECTROLYTIC	22uF 20% 35VDC	ERO	EKI 00 BB 222 F M9	14.516
C55-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C56-8	**CAPACITOR MKT**	**0.1uF 10% 63VDC**	**PHILIPS**	**2222 370 78104**	**11.136**
C57-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C58-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C59-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C60-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C61-8	**CAPACITOR ELECTROLYTIC**	**22uF 20% 35VDC**	**ERO**	**EKI 00 BB 222 F M9**	**14.516**
C64-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C65-8	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
D1-8	DIODE ZENER	5.1V 5% 0.4W	PHILIPS	BZX79C5V1	26.527
D2-8	DIODE ZENER	5.1V 5% 0.4W	PHILIPS	BZX79C5V1	26.527
D3-8	**DIODE ZENER**	**5.1V 5% 0.4W**	**PHILIPS**	**BZX79C5V1**	**26.527**
D4-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D5-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D6-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D7-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D8-8	**DIODE HIGH SPEED**	**1N4448**	**PHILIPS**	**1N4448**	**25.146**
D9-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D10-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D11-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D12-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D13-8	**DIODE HIGH SPEED**	**1N4448**	**PHILIPS**	**1N4448**	**25.146**
D14-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D15-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D16-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D17-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D18-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D19-8	**DIODE HIGH SPEED**	**1N4448**	**PHILIPS**	**1N4448**	**25.146**
D20-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D21-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
D22-8	**DIODE HIGH SPEED**	**1N4448**	**PHILIPS**	**1N4448**	**25.146**
D23-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D24-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D25-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D26-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D27-8	**DIODE HIGH SPEED**	**1N4448**	**PHILIPS**	**1N4448**	**25.146**
D28-8	DIODE ZENER	5.1V 5% 0.4W	PHILIPS	BZX79C5V1	26.527
D29-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D30-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D31-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D32-8	**DIODE HIGH SPEED**	**1N4448**	**PHILIPS**	**1N4448**	**25.146**
D33-8	DIODE VOLTAGE REFERENCE	2.5V 1.5%	MOTOROLA	LM385BZ-2.5	26.880
D34-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D35-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D36-8	DIODE RECTIFIER	1N4002 100V/1A	THOMSON	1N4002 (03/04/05/06/07)	25.100
D37-8	**DIODE RECTIFIER**	**1N4002 100V/1A**	**THOMSON**	**1N4002 (03/04/05/06/07)**	**25.100**
D38-8	DIODE RECTIFIER	1N4002 100V/1A	THOMSON	1N4002 (03/04/05/06/07)	25.100
D39-8	DIODE RECTIFIER	1N4002 100V/1A	THOMSON	1N4002 (03/04/05/06/07)	25.100
D40-8	DIODE RECTIFIER	1N4002 100V/1A	THOMSON	1N4002 (03/04/05/06/07)	25.100
D41-8	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
J1-8	**SOCKET COAX**	**HORISONTAL FOR PCB MOUNT.**	**TAIKO**	**TMP-J01X-A2**	**78.517**
L1-8	CHOKE FIXED	180uH 5%	FASTRON	SMCC-181J-02	20.313
P1-8	MULTIPLUG	1/10" DIL SQ PINS 5x2 POL	AMP	826656-5	78.321
P2-8	PLUG	1/10" SIL SQ.PINS 2 POLES	EURODIP	PH1-029/058-2-ZG075	78.322
P3-8	MULTI PLUG	2x8 POLES PCB VERSION	3M	3599-6002	78.249
P4-8	**PLUG**	**2x7 POLES**	**3M**	**3598-6002**	**78.254**
P5-8	MULTIPLUG	2x15 POLES PCB VERSION	3M	3531-6002	78.253
Q1-8	TRANSISTOR AF	BC558 PNP TO-92	PHILIPS	BC558 (-A/-B/-C)	28.095
Q2-8	TRANSISTOR	BC640	PHILIPS	BC640	28.124
Q3-8	TRANSISTOR AF	NPN BC639 TO-92	PHILIPS	BC639	28.120
Q4-8	**TRANSISTOR AF**	**NPN BC639 TO-92**	**PHILIPS**	**BC639**	**28.120**
Q5-8	TRANSISTOR AF	NPN BC639 TO-92	PHILIPS	BC639	28.120
Q6-8	TRANSISTOR AF	NPN BC639 TO-92	PHILIPS	BC639	28.120
Q7-8	TRANSISTOR AF POWER	PNP TO-220	MOTOROLA	BD808 (BD810)	29.095
Q8-8	TRANSISTOR	BC640	PHILIPS	BC640	28.124
Q9-8	**TRANSISTOR**	**BC640**	**PHILIPS**	**BC640**	**28.124**
Q10-8	TRANSISTOR	BC640	PHILIPS	BC640	28.124
R1-8	RESISTOR MF	20k5 OHM 1% 0.6W	PHILIPS	2322 156 12053	03.478
R2-8	RESISTOR MF	1k96 OHM 1% 0.6W	PHILIPS	2322 156 11962	03.401
R3-8	RESISTOR MF	1M OHM 5% 0.33W	PHILIPS	2322 180 73105	02.544
R4-8	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R5-8	**RESISTOR MF**	**10k OHM 5% 0.33W**	**PHILIPS**	**2322 180 73103**	**02.496**
R6-8	RESISTOR MF	12k OHM 5% 0.33W	PHILIPS	2322 180 73123	02.498
R7-8	RESISTOR MF	120k OHM 5% 0.33W	PHILIPS	2322 180 73124	02.522

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R8-8	**RESISTOR MF**	**2k7 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73272**	**02.482**
R9-8	RESISTOR MF	12k OHM 5% 0.33W	PHILIPS	2322 180 73123	02.498
R10-8	RESISTOR MF	1k2 OHM 5% 0.33W	PHILIPS	2322 180 73122	02.474
R11-8	RESISTOR MF	5.6 OHM 5% 0.33W	PHILIPS	2322 180 73568	02.418
R12-8	RESISTOR MF	5.6 OHM 5% 0.33W	PHILIPS	2322 180 73568	02.418
R13-8	**RESISTOR MF**	**12k OHM 5% 0.33W**	**PHILIPS**	**2322 180 73123**	**02.498**
R14-8	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R15-8	RESISTOR MF	39k2 OHM 1% 0.6W	PHILIPS	2322 156 13923	03.439
R16-8	RESISTOR MF	10k0 OHM 1% 0.6W	* PHILIPS	2322 156 11003	03.427
R17-8	RESISTOR MF	10k0 OHM 1% 0.6W	* PHILIPS	2322 156 11003	03.427
R18-8	**RESISTOR MF**	**1k00 OHM 1% 0.4W**	**PHILIPS**	**2322 156 11002**	**03.395**
R19-8	RESISTOR MF	51R1 OHM 1% 0.6W	PHILIPS	2322 156 15119	03.370
R20-8	RESISTOR ARRAY	8x10k OHM 5% 1/8W	PANASONIC	EXB-F9E-103 J	08.630
R21-8	RESISTOR MF	5k1 OHM 5% 0.33W	PHILIPS	2322 180 73512	02.489
R22-8	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R23-8	**RESISTOR MF**	**5k1 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73512**	**02.489**
R24-8	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R25-8	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R26-8	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R27-8	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R28-8	**RESISTOR MF**	**36k OHM 5% 0.33W**	**PHILIPS**	**2322 180 73363**	**02.509**
R29-8	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R30-8	RESISTOR MF	5k1 OHM 5% 0.33W	PHILIPS	2322 180 73512	02.489
R31-8	RESISTOR MF	22k OHM 5% 0.33W	PHILIPS	2322 180 73223	02.504
R32-8	RESISTOR MF	22k OHM 5% 0.33W	PHILIPS	2322 180 73223	02.504
R33-8	**RESISTOR MF**	**10k OHM 5% 0.33W**	**PHILIPS**	**2322 180 73103**	**02.496**
R34-8	RESISTOR MF	15k OHM 5% 0.33W	PHILIPS	2322 180 73153	02.500
R35-8	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R36-8	RESISTOR MF PRECISION	10k0 OHM 0.1% 75mW	BEYSCHLAG	MBB-0207-25-0.1%-10k0	06.130
R37-8	RESISTOR MF PRECISION	10k0 OHM 0.1% 75mW	BEYSCHLAG	MBB-0207-25-0.1%-10k0	06.130
R38-8	**RESISTOR MF**	**10k OHM 5% 0.33W**	**PHILIPS**	**2322 180 73103**	**02.496**
R39-8	RESISTOR MF	120k OHM 5% 0.33W	PHILIPS	2322 180 73124	02.522
R40-8	RESISTOR	30 KOHM 1% 0.4W	*PHILIPS	2322 156 13003	03.460
R41-8	RESISTOR MF	2k0 OHM 1% 0.6W	* PHILIPS	2322 156 12002	03.403
R42-8	RESISTOR MF	90k9 OHM 1% 0.6W	PHILIPS	2322 156 19093	03.476
R43-8	**RESISTOR**	**8.06 KOHM 1% 0.4W**	***PHILIPS**	**2322 156 18062**	**03.422**
R44-8	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R45-8	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R46-8	RESISTOR MF	5k1 OHM 5% 0.33W	PHILIPS	2322 180 73512	02.489
R47-8	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R48-8	**RESISTOR MF**	**1k0 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73102**	**02.472**
R49-8	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R50-8	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R51-8	RESISTOR MF	10k0 OHM 1% 0.6W	* PHILIPS	2322 156 11003	03.427

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R52-8	**RESISTOR MF**	**5k11 OHM 1% 0.6W**	*** PHILIPS**	**2322 156 15112**	**03.414**
R53-8	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R54-8	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R55-8	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R56-8	RESISTOR MF	3k92 OHM 1% 0.6W	PHILIPS	2322 156 13922	03.409
R57-8	**RESISTOR MF**	**2k0 OHM 1% 0.6W**	*** PHILIPS**	**2322 156 12002**	**03.403**
R58-8	RESISTOR MF	3k92 OHM 1% 0.6W	PHILIPS	2322 156 13922	03.409
R59-8	RESISTOR MF	2k0 OHM 1% 0.6W	* PHILIPS	2322 156 12002	03.403
R60-8	RESISTOR MF	3k92 OHM 1% 0.6W	PHILIPS	2322 156 13922	03.409
R61-8	RESISTOR MF	5k1 OHM 5% 0.33W	PHILIPS	2322 180 73512	02.489
R62-8	**RESISTOR MF**	**2k2 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73222**	**02.480**
R63-8	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R64-8	RESISTOR MF	8k2 OHM 5% 0.33W	PHILIPS	2322 180 73822	02.494
R65-8	RESISTOR MF PRECISION	2k58 OHM 0.1% 75mW	BEYSCHLAG	MBB 0207-25-0.1%-2k58	06.120
R66-8	RESISTOR MF PRECISION	499 OHM 0.1% 75mW	BEYSCHLAG	MBB 0207-25-0.1%-499R	06.105
R67-8	**RESISTOR MF**	**10k OHM 5% 0.33W**	**PHILIPS**	**2322 180 73103**	**02.496**
R68-8	RESISTOR MF	8k2 OHM 5% 0.33W	PHILIPS	2322 180 73822	02.494
R69-8	RESISTOR MF PRECISION	499 OHM 0.1% 75mW	BEYSCHLAG	MBB 0207-25-0.1%-499R	06.105
R70-8	RESISTOR MF PRECISION	642 OHM 0.1% 75mW	BEYSCHLAG	MBB 0207-25-0.1%-642R	06.110
R71-8	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R72-8	**RESISTOR MF**	**100 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73101**	**02.448**
R73-8	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R74-8	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R75-8	RESISTOR MF	3k3 OHM 5% 0.33W	PHILIPS	2322 180 73332	02.484
R76-8	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R77-8	**RESISTOR MF**	**100 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73101**	**02.448**
R78-8	RESISTOR ARRAY	8x10k OHM 5% 1/8W	PANASONIC	EXB-F9E-103 J	08.630
R79-8	RESISTOR MF	20k OHM 5% 0.33W	PHILIPS	2322 180 73203	02.503
R80-8	RESISTOR MF	470 OHM 5% 0.33W	PHILIPS	2322 180 73471	02.464
U1-8	PROGRAMMED PROM U1-8	T2131/35	ESPERA	0-0-27203 / C1096 - F9FB	727203
U2-8	**NAND SCHMIDT TRIGGER**	**74HC132**	**TEXAS**	**74HC132**	**34.521**
U3-8	MASTER PROCESSOR UNIT	8 BIT SERIAL INTERFACE	HITACHI	HD63B03YP	32.575
U4-8	uC SUPERVISORY CIRCUIT	MAX 690	MAXIM	MAX 690 CPA (EJA-MJA)	32.585
U5-8	QUAD 2-INP.POS.AND GATE		TEXAS	SN74HC08N	34.517
U6-8	INTEGRATED CIRCUIT	DUAL OPERATIONAL AMP.	TEXAS	MC1458P	31.215
U7-8	**3 to 8 LINE DECODER**		**MOTOROLA**	**MC74HC237N**	**34.550**
U8-8	EEPROM	1k BIT SERIAL	OKI	MSM16811RS	32.708
U9-8	EEPROM	1k BIT SERIAL	OKI	MSM16811RS	32.708
U10-8	INTEGRATED CIRCUIT	8 BIT SHIFT REG.SERIAL IO	NATIONAL	MM74HC595N	34.502
U11-8	INTEGRATED CIRCUIT	8 BIT SHIFT REG.SERIAL IO	NATIONAL	MM74HC595N	34.502
U12-8	**INTEGRATED CIRCUIT**	**8 BIT SHIFT REG.SERIAL IO**	**NATIONAL**	**MM74HC595N**	**34.502**
U13-8	INTEGRATED CIRCUIT	ADC 0838 CCN	NATIONAL	ADC 0838 CCN	32.800
U14-8	DARLINGTON DRIVERS	HIGH CURRENT/VOLTAGE	TEXAS	ULN2003A	31.077
U15-8	INTEGRATED CIRCUIT	DUAL OPERATIONAL AMP.	TEXAS	MC1458P	31.215

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
U16-8	**INTEGRATED CIRCUIT**	**TL072CP**	**TEXAS**	**TL072CP**	**31.710**
U17-8	INTEGRATED CIRCUIT	8 BIT SHIFT REG.SERIAL IO	NATIONAL	MM74HC595N	34.502
U18-8	SOURCE DRIVER 8-UNIT	50V/500mA	SPRAGUE	UDN 2981 A	32.791
U19-8	INTEGRATED CIRCUIT	8 BIT SHIFT REG.SERIAL IO	NATIONAL	MM74HC595N	34.502
U20-8	SOURCE DRIVER 8-UNIT	50V/500mA	SPRAGUE	UDN 2981 A	32.791
U21-8	**DARLINGTON DRIVERS**	**HIGH CURRENT/VOLTAGE**	**TEXAS**	**ULN2003A**	**31.077**
U22-8	DARLINGTON DRIVERS	HIGH CURRENT/VOLTAGE	TEXAS	ULN2003A	31.077
U23-8	ANALOG MULTIPLEXER	MC14053BCP	SIGNETICS*	HEF 4053 BP	33.201
U24-8	INTEGRATED CIRCUIT	DUAL OPERATIONAL AMP.	TEXAS	MC1458P	31.215
U25-8	VOLTAGE REGULATOR	FIXED 5V/1A	MOTOROLA	MC7805CT	31.250
U26-8	**VOLTAGE REGULATOR**	**FIXED 5V/1A**	**MOTOROLA**	**MC7805CT**	**31.250**
U27-8	VOLTAGE REGULATOR	FIXED 15V/1A	MOTOROLA	MC7815CT	31.090
U28-8	VOLTAGE REGULATOR	-15V 5% 0.1A	MOTOROLA	MC79L15ACP	31.143
U29-8	VOLTAGE REGULATOR	FIXED -5V/1A	MOTOROLA	MC7905CT	31.071
XR1-8	CERAMIC RESONATOR		MURATA	CST 800MT-TR	41.505

1

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	POWER SUPPLY MODULE 9	**N2165**	**ESPERA**	**5-0-26409E**	**626409**
C1-9	**CAPACITOR ELECTROLYTIC**	**22uF 20% 35VDC**	**ERO**	**EKI 00 BB 222 F M9**	**14.516**
C2-9	CAPACITOR MKT	1uF 10% 63VDC	PHILIPS	2222 370 78105	11.137
C3-9	CAPACITOR ELECTROLYTIC	2200uF -20/+50% 63VDC	PHILIPS	2222 021 48222	14.733
C4-9	CAPACITOR ELECTROLYTIC	2200uF -20/+50% 63VDC	PHILIPS	2222 021 48222	14.733
C5-9	CAPACITOR MKT	100nF 5% 63VDC	PHILIPS	2222 370 79104	11.135
C6-9	**CAPACITOR ELECTROLYTIC**	**100uF 20% 10VDC**	**ERO**	**EKI 00 BB 310 C M9**	**14.607**
C7-9	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 38103	11.168
C8-9	CAPACITOR MKT	220nF 10% 63VDC	PHILIPS	2222 370 78224	11.095
C9-9	CAPACITOR MKT	100nF 5% 63VDC	PHILIPS	2222 370 79104	11.135
C10-9	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 38103	11.168
C11-9	**CAPACITOR MKT**	**10nF 20% 100VDC**	**PHILIPS**	**2222 370 38103**	**11.168**
C12-9	CAPACITOR MKT	1uF 10% 63VDC	PHILIPS	2222 370 78105	11.137
C13-9	CAPACITOR MKT	1uF 10% 63VDC	PHILIPS	2222 370 78105	11.137
C14-9	CAPACITOR ELECTROLYTIC	22uF 20% 35VDC	ERO	EKI 00 BB 222 F M9	14.516
C15-9	CAPACITOR POLYSTYRENE	470pF 1% 630VDC	PHILIPS	2222 431 84701	10.429
C16-9	**CAPACITOR CERAMIC**	**220pF 10% 500VDC CL2**	**KCK**	**RT-HM60-SK YB 221 K AMMO PACK**	**16.090**
C17-9	CAPACITOR CERAMIC	1nOF 10% CL2 500VDC	KCK	RT-HM60 SK YB 102 K AMMO PACK	15.160
C18-9	CAPACITOR CERAMIC	220pF 10% 500VDC CL2	KCK	RT-HM60-SK YB 221 K AMMO PACK	16.090
C19-9	CAPACITOR MKT	150nF 5% 50VDC	ERO	MKT 1826-415/06 4-G	11.181
C20-9	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C21-9	**CAPACITOR ELECTROLYTIC**	**100uF -10/+50% 25VDC**	**ERO**	**EKM 00 CC 310 E G5**	**14.610**
C22-9	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C23-9	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C24-9	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C25-9	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C26-9	**CAPACITOR MKT**	**100nF 10% 100VDC**	**PHILIPS**	**2222 371 28104**	**11.180**
C26-9	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C28-9	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
D1-9	DIODE ZENER	18V 5% 0.4W BZX79C18	PHILIPS	BZX79C18	26.564
D2-9	DIODE RECTIFIER	1N5402 200V/3A	PROMAX	1N5402	25.116
D3-9	**DIODE RECTIFIER**	**1N5402 200V/3A**	**PROMAX**	**1N5402**	**25.116**
D4-9	DIODE RECTIFIER	1N5402 200V/3A	PROMAX	1N5402	25.116
D5-9	DIODE RECTIFIER	1N5402 200V/3A	PROMAX	1N5402	25.116
D6-9	DIODE POWER	SCHOTTKY 45VDC/10A	PHILIPS	PBYR 1045	27.617
D7-9	ZENER DIODE	12V 5% 1.3W	PHILIPS	BZV85C12	26.638
D8-9	**DIODE FAST RECOVERY**	**600VDC/1A**	**PHILIPS**	**BYD 33 J**	**27.150**
D9-9	DIODE FAST RECOVERY	600VDC/1A	PHILIPS	BYD 33 J	27.150
D10-9	DIODE FAST RECOVERY	600VDC/1A	PHILIPS	BYD 33 J	27.150

2

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
D11-9	**DIODE FAST RECOVERY**	**600VDC/1A**	**PHILIPS**	**BYD 33 J**	**27.150**
D12-9	DIODE FAST RECOVERY	400V/3A	THOMSON	BYT 03-400 TAPED	25.212
D13-9	DIODE FAST RECOVERY	400V/3A	THOMSON	BYT 03-400 TAPED	25.212
D14-9	DIODE FAST RECOVERY	400V/3A	THOMSON	BYT 03-400 TAPED	25.212
D15-9	DIODE FAST RECOVERY	400V/3A	THOMSON	BYT 03-400 TAPED	25.212
D16-9	**DIODE FAST RECOVERY**	**400V/3A**	**THOMSON**	**BYT 03-400 TAPED**	**25.212**
D17-9	DIODE FAST RECOVERY	400V/3A	THOMSON	BYT 03-400 TAPED	25.212
D18-9	DIODE SHUNT REGULATOR	PROGRAMMABLE	MOTOROLA	TL431CP	26.997
D19-9	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
L1-9	CHOKE	TL531	TRANS-ELECTRO	6-0-26309A	400531
L2-9	**CHOKE FIXED**	**10mH/100mADC**	**TRADANIA**	**6-0-26623**	**20.254**
L3-9	CHOKE FIXED TOROIDAL	400uH/2A +20/-12%	ULVECO	Art.Nr: TD 6994.0 2-2.0-400-2-R (DK11752) UDT.IFLG.SP Tg:0-0-26192	20.245
L4-9	CHOKE FIXED TOROIDAL	630uH/1A6 +20/-12.5%	ULVECO	Art.Nr: DK11-542 (2-1.6-630-1/SP Tg:26271)	20.244
L5-9	CHOKE FIXED TOROIDAL	630uH/1A6 +20/-12.5%	ULVECO	Art.Nr: DK11-542 (2-1.6-630-1/SP Tg:26271)	20.244
OC1-9	OPTO COUPLER	CNY17-2	TOSHIBA	CNY 17-2	32.530
OC2-9	**OPTO COUPLER**	**CNY17-2**	**TOSHIBA**	**CNY 17-2**	**32.530**
P1-9	PLUG 4 POLES		MOLEX	39-28-1043	78.216
P2-9	MULTIPLUG	2x3 POLES PCB VERSION	MOLEX	39-28-1063	78.217
Q1-9	TRANSISTOR AF POWER	NPN DARLINGTON TO220	PHILIPS	BD645	29.122
Q2-9	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
Q3-9	**TRANSISTOR POWER MOSFET**	**N-CHANNEL 100V/27A/85mOHM**	**MOTOROLA**	**IRF540**	**29.402**
Q4-9	TRANSISTOR POWER MOSFET	N-CHANNEL 100V/27A/85mOHM	MOTOROLA	IRF540	29.402
R1-9	RESISTOR MF	820 OHM 5% 0.33W	PHILIPS	2322 180 73821	02.470
R2-9	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R3-9	RESISTOR MF	10k0 OHM 1% 0.6W	* PHILIPS	2322 156 11003	03.427
R4-9	**RESISTOR MF**	**13k3 OHM 1% 0.6W**	**PHILIPS**	**2322 156 11333**	**03.473**
R5-9	RESISTOR MF	2k2 OHM 5% 0.33W	PHILIPS	2322 180 73222	02.480
R6-9	RESISTOR MF	270 OHM 5% 0.33W	PHILIPS	2322 180 73271	02.458
R7-9	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R8-9	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R9-9	**RESISTOR MF**	**100k OHM 1% 0.6W**	*** PHILIPS**	**2322 156 11004**	**03.477**
R10-9	RESISTOR MF	680 OHM 5% 0.33W	PHILIPS	2322 180 73681	02.468
R11-9	PRESET CERMET	1k0 OHM 10% 0.5W	BOURNS	3386P-1-102	07.886
R12-9	RESISTOR MF	6k8 OHM 5% 0.33W	PHILIPS	2322 180 73682	02.492
R13-9	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R14-9	**RESISTOR MF**	**100 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73101**	**02.448**
R15-9	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R16-9	RESISTOR MF	22k OHM 5% 0.33W	PHILIPS	2322 180 73223	02.504
R17-9	RESISTOR WW	R180 OHM 5% 2W	MODULOHM	R18-J-2W-E-1	06.220
R18-9	RESISTOR WW	R180 OHM 5% 2W	MODULOHM	R18-J-2W-E-1	06.220

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R19-9	**RESISTOR MF**	**470 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73471**	**02.464**
R20-9	RESISTOR MF	22k OHM 5% 0.33W	PHILIPS	2322 180 73223	02.504
R21-9	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R22-9	RESISTOR MF	2k2 OHM 5% 0.33W	PHILIPS	2322 180 73222	02.480
R23-9	RESISTOR MF	240 OHM 5% 0.33W	PHILIPS	2322 180 73241	02.457
R24-9	**RESISTOR MF**	**1k0 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73102**	**02.472**
R25-9	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R26-9	RESISTOR MF	100k OHM 5% 0.33W	PHILIPS	2322 180 73104	02.520
R27-9	RESISTOR MF	13k3 OHM 1% 0.6W	PHILIPS	2322 156 11333	03.473
R28-9	RESISTOR MF	1k87 OHM 1% 0.6W	PHILIPS	2322 156 11872	03.474
R29-9	**RESISTOR PMF**	**120 OHM 5% 2W**	**PHILIPS**	**2322 191 31201**	**04.178**
R30-9	RESISTOR PMF	390 OHM 5% 2W	PHILIPS	2322 194 13391	04.189
R31-9	RESISTOR PMF	390 OHM 5% 2W	PHILIPS	2322 194 13391	04.189
RE1-9	RELAY	24VDC 1MAKE 16A.	PASI	KH/A-3-C	21.027
RE2-9	RELAY	24VDC 1MAKE 16A.	PASI	KH/A-3-C	21.027
TR1-9	**TRANSFORMER SMPS**	**35x40x43mm**	**TRADANIA**	**6-0-26620A** Art.Nr: TD 6993.0	**22.173**
U1-9	CURRENT MODE PWM CONTROL.	UC3846	UNITRODE	UC3846	31.486

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	AF AMPLIFIER MODULE (10)		**ESPERA**	**5-0-25410F**	**626410**
C1-10	**CAPACITOR CERAMIC**	**1nOF 10% CL2 500VDC**	**KCK**	**RT-HM60 SK YB 102 K** AMMO PACK	**15.160**
C2-10	CAPACITOR CERAMIC	1nOF 10% CL2 500VDC	KCK	RT-HM60 SK YB 102 K AMMO PACK	15.160
C3-10	CAPACITOR CERAMIC	1nOF 10% CL2 500VDC	KCK	RT-HM60 SK YB 102 K AMMO PACK	15.160
C4-10	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ERO	EKI 00 AA 210 F M9	14.512
C5-10	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ERO	EKI 00 AA 210 F M9	14.512
C6-10	**CAPACITOR ELECTROLYTIC**	**22uF 20% 35VDC**	**ERO**	**EKI 00 BB 222 F M9**	**14.516**
C7-10	CAPACITOR MKT	470nF 5% 63VDC	PHILIPS	2222 370 79474	11.187
C9-10	CAPACITOR MKT	330nF 10% 63VDC	PHILIPS	2222 370 78334	11.189
C10-10	CAPACITOR ELECTROLYTIC	470uF -20/+50% 40VDC	ERO	EKM 05 FG 347 G 05	14.650
C11-10	CAPACITOR CERAMIC	1nOF 10% CL2 500VDC	KCK	RT-HM60 SK YB 102 K AMMO PACK	15.160
C12-10	**CAPACITOR CERAMIC**	**1nOF 10% CL2 500VDC**	**KCK**	**RT-HM60 SK YB 102 K** AMMO PACK	**15.160**
C13-10	CAPACITOR MKT	470nF 10% 100VDC	PHILIPS	2222 371 28474	11.049
C14-10	CAPACITOR MKT	470nF 10% 100VDC	PHILIPS	2222 371 28474	11.049
D1-10	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D2-10	DIODE RECTIFIER	1N4002 100V/1A	THOMSON	1N4002 (03/04/05/06/07)	25.100
D3-10	**DIODE RECTIFIER**	**1N4002 100V/1A**	**THOMSON**	**1N4002 (03/04/05/06/07)**	**25.100**
FP1-10	FERRITE BEAD INDUCTOR		MURATA	BLO1RN1-A62T5	35.188
FP2-10	FERRITE BEAD INDUCTOR		MURATA	BLO1RN1-A62T5	35.188
P1-10	PLUG	2 POLES	AMP	0-826375-2	78.102
P2-10	PLUG	2x7 POLES	3M	3598-6002	78.254
P3-10	**PLUG**	**2x5 POLES**	**3M**	**3654-6002**	**78.251**
Q1-10	TRANSISTOR AF	BC548 NPN TO-92	PHILIPS	BC548 (-A/-B/-C)	28.070
R1-10	RESISTOR MF	6k8 OHM 5% 0.33W	PHILIPS	2322 180 73682	02.492
R2-10	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R3-10	RESISTOR MF	120k OHM 5% 0.33W	PHILIPS	2322 180 73124	02.522
R4-10	**RESISTOR MF**	**820 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73821**	**02.470**
R5-10	RESISTOR MF	220k OHM 5% 0.33W	PHILIPS	2322 180 73224	02.528
R6-10	RESISTOR MF	100k OHM 5% 0.33W	PHILIPS	2322 180 73104	02.520
R7-10	RESISTOR MF	470 OHM 5% 0.33W	PHILIPS	2322 180 73471	02.464
R8-10	RESISTOR MF	33k OHM 5% 0.33W	PHILIPS	2322 180 73333	02.508
R9-10	**RESISTOR MF**	**1 OHM 5% 0.4W**	**PHILIPS**	**2322 181 53108**	**01.125**
R10-10	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
RE1-10	RELAY	24VDC 2SH. 2A	ZETTLER	AZ 820-2C-24DE	21.327
TR1-10	TRAFO AF	1:1 600 OHMS	TDK	L04EE13-C10153	22.500
U1-10	AF POWER AMPLIFIER	TDA 2030 VERT.	THOMSON	TDA 2030 V	31.483

INSTRUCTION BOOK FOR POWER AMPLIFIER UNIT 600W (T2131) SP NO. 726393

CONTENTS

1. INTRODUCTION

1.1. PRINCIPLE OF OPERATION AND BLOCK DIAGRAM

2. INSTALLATION

2.1. ELECTRICAL CONNECTION AND ASSEMBLING

3. SERVICE

4. MECHANICAL DESCRIPTION

4.1. MECHANICAL DISASSEMBLING AND MODULE LOCATION

5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS

5.1. POWER AMPLIFIER (MODULE 11) SP NO. 626411

6.

7. PARTS LISTS

CONTENTS

1. INTRODUCTION

1.1. PRINCIPLE OF OPERATION AND BLOCK DIAGRAM

1. INTRODUCTION

This section gives you all necessary information to make service of this unit down to component level.

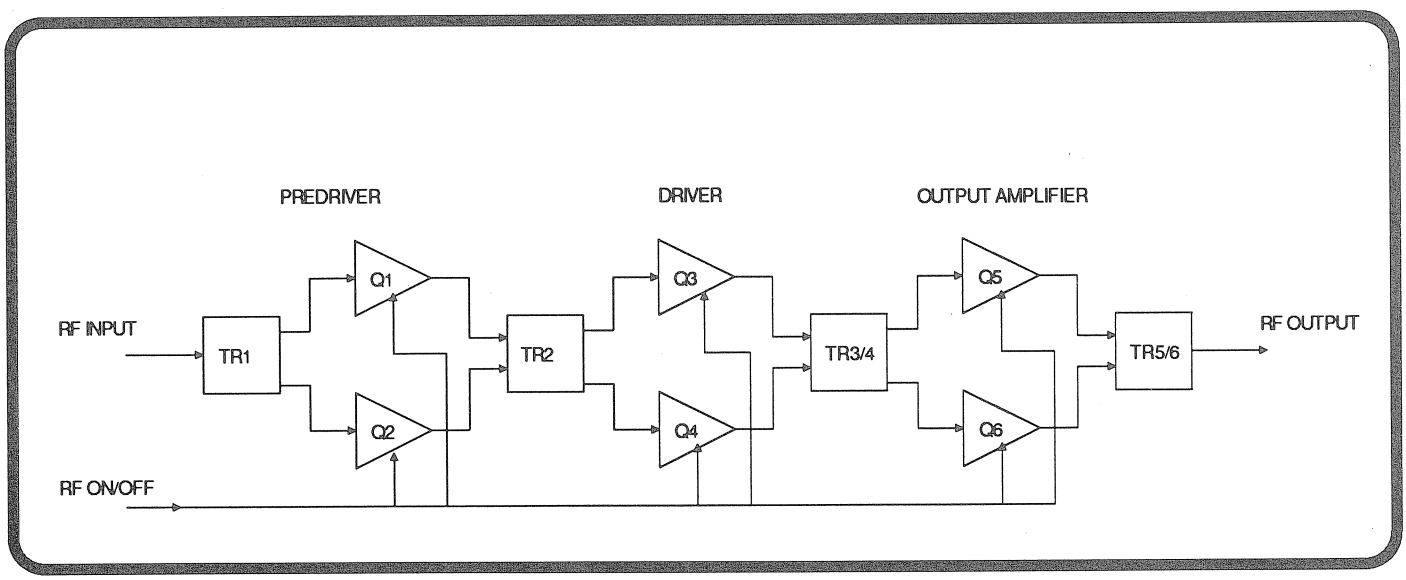
1.1. PRINCIPLE OF OPERATION

The power amplifier has three stages of amplifiers giving a total gain of approx. 43 dB and a power output of 650W PEP.

The coupling between the stages is done by impedance matching transformers. The input and output impedance is 50 ohm.

The power amplifier requires two supply voltages, 28V for the predriver and driver, 42V for the output amplifier. Both supplied from N2170 or N2171.

The amplifier has forced air cooling.



CONTENTS

2. INSTALLATION

2.1. ELECTRICAL CONNECTION AND ASSEMBLING

CONTENTS

3. SERVICE

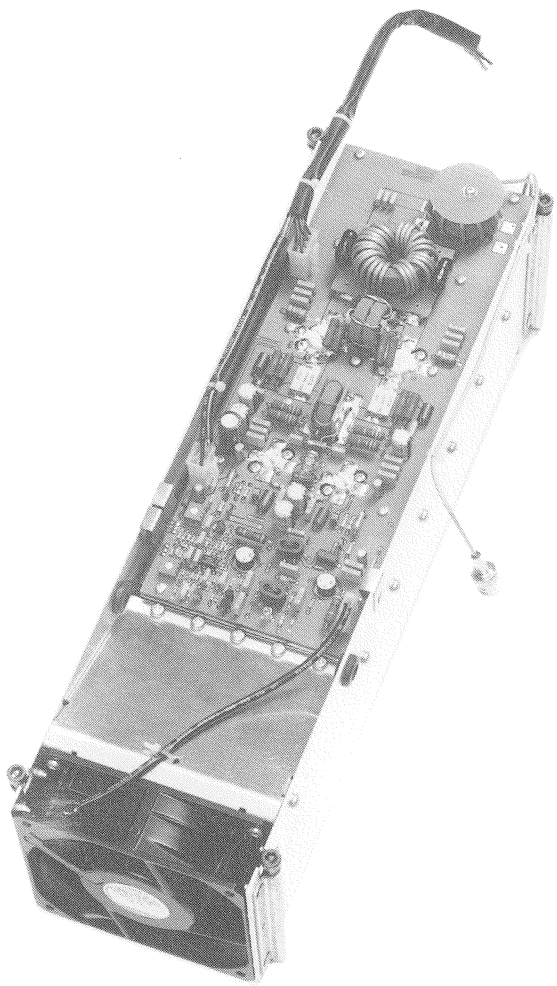
CONTENTS

4. MECHANICAL DESCRIPTION

4.1. MECHANICAL DISASSEMBLING AND MODULE LOCATION

4. MECHANICAL DESCRIPTION

4.1. MECHANICAL DISASSEMBLING AND MODULE LOCATION



CONTENTS

5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS

5.1. POWER AMPLIFIER (MODULE 11) SP NO. 626411

5.1. POWER AMPLIFIER (MODULE 11) SP NO. 626411

The power amplifier has a total gain of approx. 43 dB and the output power is 650W PEP.

The power amplifier has three stages: predriver, driver, output amplifier.

The predriver is a push-pull class A amplifier, consisting of Q1, Q2 and with a gain of 15 dB. Q8 and the voltage divider R33, R34 are bias supply for the predriver. Q9 can switch off the bias to the predriver.

The driver is a push-pull class B amplifier, consisting of Q3, Q4 (matched pairs) and the total gain is 17 dB.
The bias supply regulator consists of Q11 and U1,2. The diodes D2, D3 are mounted on the top of Q3, Q4 and are used for temperature stabilization of the bias current in Q3 and Q4.
R37 is used for adjusting the bias current in Q3 and Q4.

The output amplifier is a push-pull class B amplifier, consisting of Q5, Q6 (matched pairs) and the power gain is 11 dB.
The bias supply regulator consists of Q13 and U1,1.
The diode D4 is mounted on the top of Q5 and is used for temperature stabilization of the bias current in Q5, Q6. R51 is used for adjustment of the bias current in Q5, Q6.
Q8, Q10 and Q12 are used to switch off the bias. This is done in standby mode and under receive condition in telex mode.

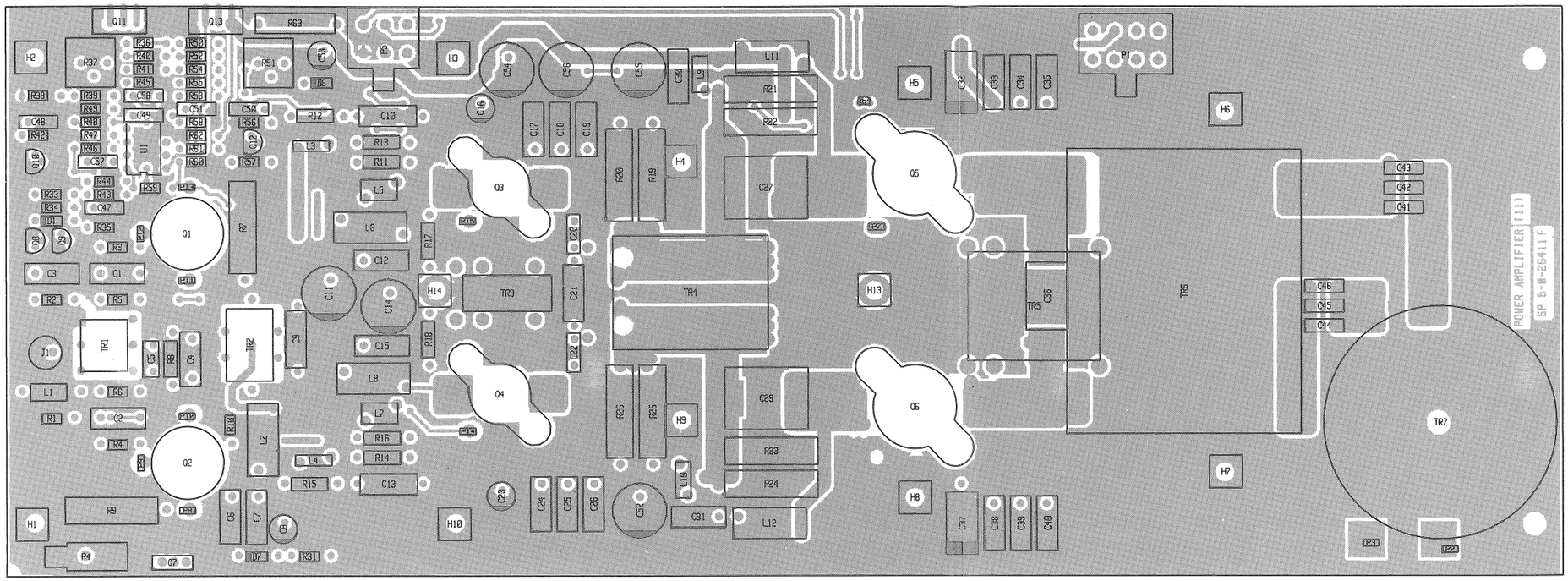
Power Amplifier (11)

RF IN
J1
2u2H L1
180R R1
TR1 TL300
100n C1
620R R3
470R R4
100n C4
100n C2
620R R1
470R R6
150R R8
150p C5
100n C3
3W 62R R7
3W 62R R9
100n C5
TR2 TL307
22R R10
100n C7
10u C8
TL067 L2
Q1 2N3553
Q2 2N3553
470u C11
100n C12
L5 TL304
6R2 R11
R12 2R2
C10 1n1 1%
R13 18R
TL067 L6
TL305 L3
560p 1% C9
TL305 L4
R14 18R
R15 2R2
C13 1n1 1%
6R2 R16
L7 TL304
TL067 L8
470u C14
100n C15
33R R17
33R R18
Q3 MRF426
Q4 MRF426
C20 33n
TR3 TL303
100p 1% C21
C22 33n
TR4 TL302
10u C16
100n C17
100n C18
100n C19
10u C23
100n C24
100n C25
100n C26
L9 TL301
470u C55
100n C30
3W 6R8 R19
3W 6R8 R20
C27 4n8
TL067 L11
Q5 SD1728-15
3W 10R R27
3W 10R R28
R21 2R7 3W
R22 2R7 3W
R23 2R7 3W
R24 2R7 3W
C29 4n8
3W 6R8 R25
3W 6R8 R26
3W 10R R29
3W 10R R30
TL067 L12
Q6 SD1728-15
L10 TL301
470u C56
100n C31
10u C32
100n C33
100n C34
100n C35
TR5 TL300
270p C36
TR6 TL298
TR1
C2 15n
C3 15n
33n C41
33n C42
33n C43
33n C44
33n C45
33n C46
TR7 TL298
10u C37
100n C38
100n C39
100n C40
P1
PIN 1 +28V
PIN 2 +28V
PIN 3 +42V
PIN 4 +42V
PIN 5 +28V
PIN 6 +28V
PIN 7 +42V
PIN 8 +42V
P2 RF OUT
P3 GND
P4
PIN 2 +28V TO BLOWER
PIN 1 GND
Q7 BD680
18V D7
10K R31
R64 KTY-2B
P5
PIN 1 TEMP.
PIN 2 TEMP
PIN 3 +28V
PIN 4 GND
PIN 5 RF ON
PIN 6 RX/TX CONTROL
R63 390R 2W
680R R33
D1 IN4448
Q8 BC328
Q9 BC547B
1K0 R34
10n C47
10K R35
3K1 R36
R37 200R
100R R38
R39 10K
3K3 R40
R41 10K
D2 IN4448
D3 IN4448
10n C46
10K R42
10K R44
4K7 R45
10n C49
470K R46
U1.2 LM358N
C57 4n7
R48 12K
Q10 BC548
Q11 BD645
22R R49
3K3 R47
R43 4K7
3K1 R50
R51 200R
100R R52
R53 10K
3K3 R54
R55 10K
D5 IN4448
10n C50
10K R56
Q12 BC548
4K7 R58
10n C51
470K R59
U1.1 LM358N
C58 4n7
R61 12K
Q13 BD645
22R R62
4700u C52
10u C53
18V D6
C54 4700u
10K R57

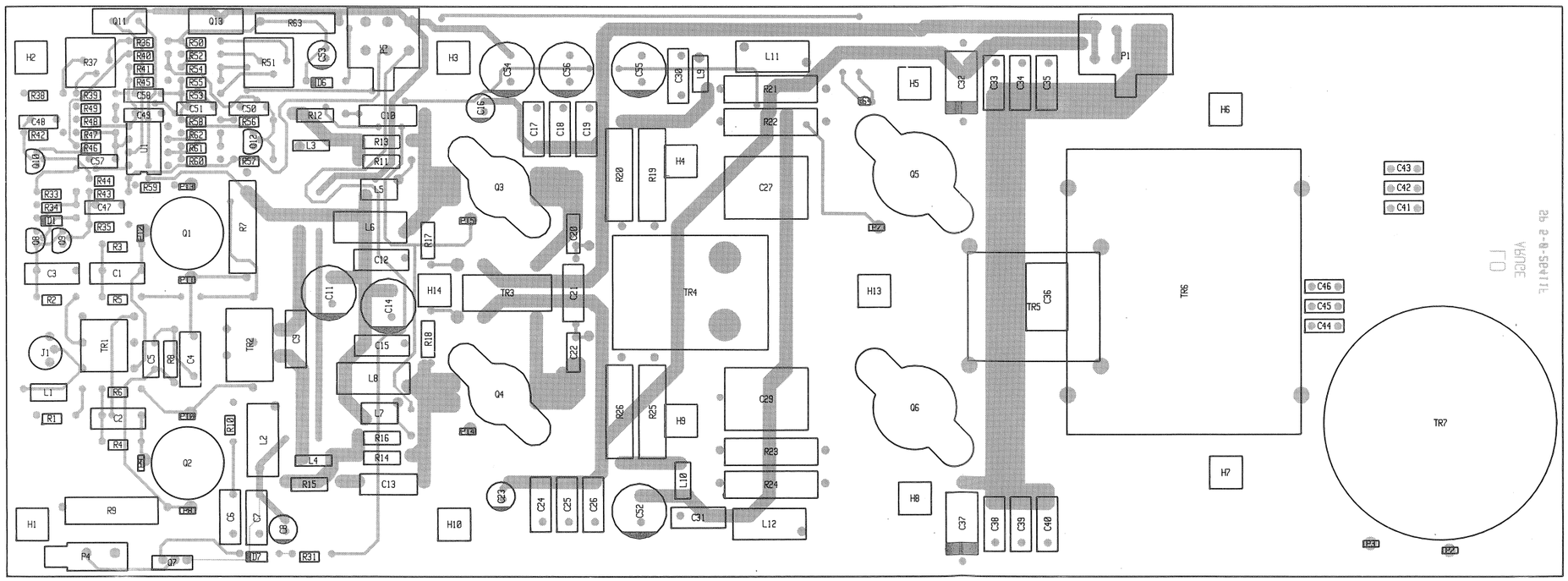
4-0-26411B

5.1. POWER AMPLIFIER (MODULE 11) cont.:

COMPONENT LOCATION POWER AMPLIFIER MODULE 11.



View from component side with upper side tracks.



View from component side with lower side tracks.

POWER AMPLIFIER MODULE 11

CONTENTS

7. PARTS LISTS

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	POWER AMPLIFIER MODULE 11	**T2131**	**ESPERA**	**5-0-26411F**	**626411**
C1-11	**CAPACITOR MKT**	**100nF 10% 100VDC**	**PHILIPS**	**2222 371 28104**	**11.180**
C2-11	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C3-11	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C4-11	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C5-11	CAPACITOR CERAMIC	150pF 2% N150 100VDC	PHILIPS	2222 683 34151	15.148
C6-11	**CAPACITOR MKT**	**100nF 10% 100VDC**	**PHILIPS**	**2222 371 28104**	**11.180**
C7-11	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C8-11	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ERO	EKI 00 AA 210 F M9	14.512
C9-11	CAPACITOR POLYSTYRENE	560pF 1% 630VDC	PHILIPS	2222 431 85601	10.433
C10-11	CAPACITOR POLYSTYRENE	1n1F 1% 160VDC	PHILIPS	2222 429 81102	10.351
C11-11	**CAPACITOR ELECTROLYTIC**	**470uF -20/+50% 10VDC**	**ERO**	**EKM 05 DD 347 C 05**	**14.633**
C12-11	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C13-11	CAPACITOR POLYSTYRENE	1n1F 1% 160VDC	PHILIPS	2222 429 81102	10.351
C14-11	CAPACITOR ELECTROLYTIC	470uF -20/+50% 10VDC	ERO	EKM 05 DD 347 C 05	14.633
C15-11	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C16-11	**CAPACITOR ELECTROLYTIC**	**10uF 20% 35VDC**	**ERO**	**EKI 00 AA 210 F M9**	**14.512**
C17-11	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C18-11	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C19-11	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C20-11	CAPACITOR MKT	33nF 5% 100VDC	PHILIPS	2222 370 89333	11.176
C21-11	**CAPACITOR POLYSTYRENE**	**100pF 1% 630VDC**	**PHILIPS**	**2222 431 81001**	**10.400**
C22-11	CAPACITOR MKT	33nF 5% 100VDC	PHILIPS	2222 370 89333	11.176
C23-11	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ERO	EKI 00 AA 210 F M9	14.512
C24-11	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C25-11	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C26-11	**CAPACITOR MKT**	**100nF 10% 100VDC**	**PHILIPS**	**2222 371 28104**	**11.180**
C27-11	CAPACITOR CERAMIC	4800 pF 10% 100V RF	#UNILATOR	102/4801K/MG0	18.155
C29-11	CAPACITOR CERAMIC	4800 pF 10% 100V RF	#UNILATOR	102/4801K/MG0	18.155
C30-11	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C31-11	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C32-11	**CAPACITOR ELECTROLYTIC**	**10uF -10/+50% 63VDC**	**PHILIPS**	**2222 030 38109**	**14.546**
C33-11	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C34-11	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C35-11	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C36-11	CAPACITOR CERAMIC	270 pF 10% 25KV	#UNILATOR	TYPE 101-STRIP LEAD	18.150
C37-11	**CAPACITOR ELECTROLYTIC**	**10uF -10/+50% 63VDC**	**PHILIPS**	**2222 030 38109**	**14.546**
C38-11	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C39-11	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C40-11	CAPACITOR MKT	100nF 10% 100VDC	PHILIPS	2222 371 28104	11.180
C41-11	CAPACITOR MKT	33nF 5% 100VDC	PHILIPS	2222 370 89333	11.176
C42-11	**CAPACITOR MKT**	**33nF 5% 100VDC**	**PHILIPS**	**2222 370 89333**	**11.176**

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
C43-11	**CAPACITOR MKT**	**33nF 5% 100VDC**	**PHILIPS**	**2222 370 89333**	**11.176**
C44-11	CAPACITOR MKT	33nF 5% 100VDC	PHILIPS	2222 370 89333	11.176
C45-11	CAPACITOR MKT	33nF 5% 100VDC	PHILIPS	2222 370 89333	11.176
C46-11	CAPACITOR MKT	33nF 5% 100VDC	PHILIPS	2222 370 89333	11.176
C47-11	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 38103	11.168
C48-11	**CAPACITOR MKT**	**10nF 20% 100VDC**	**PHILIPS**	**2222 370 38103**	**11.168**
C49-11	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 38103	11.168
C50-11	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 38103	11.168
C51-11	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 38103	11.168
C52-11	CAPACITOR ELECTROLYTIC	470uF -20/+50% 10VDC	ERO	EKM 05 DD 347 C 05	14.633
C53-11	**CAPACITOR ELECTROLYTIC**	**10uF 20% 35VDC**	**ERO**	**EKI 00 AA 210 F M9**	**14.512**
C54-11	CAPACITOR ELECTROLYTIC	470uF -20/+50% 40VDC	ERO	EKM 05 FG 347 G 05	14.650
C55-11	CAPACITOR ELECTROLYTIC	470uF -20/+50% 10VDC	ERO	EKM 05 DD 347 C 05	14.633
C56-11	CAPACITOR ELECTROLYTIC	470uF -20/+50% 10VDC	ERO	EKM 05 DD 347 C 05	14.633
C57-11	CAPACITOR MKT	4n7F 10% 63VDC	PHILIPS	2222 370 88472	11.374
C58-11	**CAPACITOR MKT**	**4n7F 10% 63VDC**	**PHILIPS**	**2222 370 88472**	**11.374**
D1-11	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D2-11	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D3-11	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D5-11	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D6-11	**DIODE ZENER**	**18V 5% 0.4W BZX79C18**	**PHILIPS**	**BZX79C18**	**26.564**
D7-11	DIODE ZENER	18V 5% 0.4W BZX79C18	PHILIPS	BZX79C18	26.564
J1-11	SOCKET COAX	VERTICAL FOR PCB MOUNT.	TAIKO	TMP-J01X-V6	78.518
L1-11	CHOKE FIXED	2u2H 10%	FASTRON	MICC-2R2K-02	20.351
L2-11	COIL	TL067	S.P.RADIO	6-0-20854A 400067=20.053	400067
L3-11	**COIL**	**TL305**	**S.P.RADIO**	**6-0-23127**	**400305**
L4-11	COIL	TL305	S.P.RADIO	6-0-23127	400305
L5-11	COIL	TL304	S.P.RADIO	6-0-23126	400304
L6-11	COIL	TL067	S.P.RADIO	6-0-20854A 400067=20.053	400067
L7-11	COIL	TL304	S.P.RADIO	6-0-23126	400304
L8-11	**COIL**	**TL067**	**S.P.RADIO**	**6-0-20854A** 400067=20.053	**400067**
L9-11	COIL	TL301	S.P.RADIO	6-0-23123	400301
L10-11	COIL	TL301	S.P.RADIO	6-0-23123	400301
L11-11	COIL	TL067	S.P.RADIO	6-0-20854A 400067=20.053	400067
L12-11	COIL	TL067	S.P.RADIO	6-0-20854A 400067=20.053	400067
P1-11	**MULTIPLUG**	**2x4 POLES PCB VERSION**	**MOLEX**	**39-28-1083**	**78.218**
P2-11	SOLDER TERMINAL		OJD	1015	82.005
P3-11	SOLDER TERMINAL		OJD	1015	82.005
P4-11	PLUG 2POLES		MOLEX	39-28-1023	78.215

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
P5-11	**MULTIPLUG**	**2x3 POLES PCB VERSION**	**MOLEX**	**39-28-1063**	**78.217**
P6-11	SOLDER TERMINAL		OJD	1015	82.005
P7-11	SOLDER TERMINAL		OJD	1015	82.005
P8-11	SOLDER TERMINAL		OJD	1015	82.005
P9-11	SOLDER TERMINAL		OJD	1015	82.005
P10-11	**SOLDER TERMINAL**		**OJD**	**1015**	**82.005**
P11-11	SOLDER TERMINAL		OJD	1015	82.005
P12-11	SOLDER TERMINAL		OJD	1015	82.005
Q1-11	TRANSISTOR RF MED.POWER	NPN TO-39 2N3553	PHILIPS	2N3553	29.315
Q2-11	TRANSISTOR RF MED.POWER	NPN TO-39 2N3553	PHILIPS	2N3553	29.315
Q3-11	**TRANSISTOR RF POWER**	**MRF426 MATCHED PAIR (hFE)**	**MOTOROLA**	**MRF 426 hFE SORTED 1SET=2PCS**	**29.266**
Q4-11	TRANSISTOR RF POWER	MRF426 MATCHED PAIR (hFE)	MOTOROLA	MRF 426 hFE SORTED 1SET=2PCS	29.266
Q5-11	TRANSISTOR RF POWER	TH430 MATCHED PAIR (HFE)	THOMSON	SD 1728-15 PAR 1SET=2PCS GRP:C,D,E,F,G	29.268
Q6-11	TRANSISTOR RF POWER	TH430 MATCHED PAIR (HFE)	THOMSON	SD 1728-15 PAR 1SET=2PCS GRP:C,D,E,F,G	29.268
Q7-11	TRANSISTOR	BD680	MOTOROLA*	BD680	29.338
Q8-11	**TRANSISTOR AF**	**PNP TO-92 BC328**	**MOTOROLA**	**BC328**	**28.050**
Q9-11	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
Q10-11	TRANSISTOR AF	BC548 NPN TO-92	PHILIPS	BC548 (-A/-B/-C)	28.070
Q11-11	TRANSISTOR AF POWER	NPN DARLINGTON TO220	PHILIPS	BD645	29.122
Q12-11	TRANSISTOR AF	BC548 NPN TO-92	PHILIPS	BC548 (-A/-B/-C)	28.070
Q13-11	**TRANSISTOR AF POWER**	**NPN DARLINGTON TO220**	**PHILIPS**	**BD645**	**29.122**
R1-11	RESISTOR MF	180 OHM 5% 0.33W	PHILIPS	2322 180 73181	02.454
R2-11	RESISTOR MF	10 OHM 5% 0.33W	PHILIPS	2322 180 73109	02.424
R3-11	RESISTOR MF	820 OHM 5% 0.33W	PHILIPS	2322 180 73821	02.470
R4-11	RESISTOR MF	820 OHM 5% 0.33W	PHILIPS	2322 180 73821	02.470
R5-11	**RESISTOR MF**	**470 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73471**	**02.464**
R6-11	RESISTOR MF	470 OHM 5% 0.33W	PHILIPS	2322 180 73471	02.464
R7-11	RESISTOR PMF	82 OHM 5% 3W	PHILIPS	2322 195 13829	04.672
R8-11	RESISTOR MF	15 OHM 5% 0.4W	PHILIPS	2322 181 53159	01.154
R9-11	RESISTOR PMF	82 OHM 5% 3W	PHILIPS	2322 195 13829	04.672
R10-11	**RESISTOR MF**	**22 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73229**	**02.432**
R11-11	RESISTOR MF	8R2 OHM 5% 0.4W	PHILIPS	2322 181 53828	01.147
R12-11	RESISTOR MF	2R2 OHM 5% 0.4W	PHILIPS	2322 181 53228	01.133
R13-11	RESISTOR MF	18 OHM 5% 0.4W	PHILIPS	2322 181 53189	01.156
R14-11	RESISTOR MF	18 OHM 5% 0.4W	PHILIPS	2322 181 53189	01.156
R15-11	**RESISTOR MF**	**2R2 OHM 5% 0.4W**	**PHILIPS**	**2322 181 53228**	**01.133**
R16-11	RESISTOR MF	8R2 OHM 5% 0.4W	PHILIPS	2322 181 53828	01.147
R17-11	RESISTOR MF	33 OHM 5% 0.4W	PHILIPS	2322 181 53339	01.162
R18-11	RESISTOR MF	33 OHM 5% 0.4W	PHILIPS	2322 181 53339	01.162
R19-11	RESISTOR PMF	6R8 OHM 5% 3W	PHILIPS	2322 195 13688	04.648

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R20-11	**RESISTOR PMF**	**6R8 OHM 5% 3W**	**PHILIPS**	**2322 195 13688**	**04.648**
R21-11	RESISTOR PMF	2R7 OHM 5% 3W	PHILIPS	2322 195 13278	04.634
R22-11	RESISTOR PMF	2R7 OHM 5% 3W	PHILIPS	2322 195 13278	04.634
R23-11	RESISTOR PMF	2R7 OHM 5% 3W	PHILIPS	2322 195 13278	04.634
R24-11	RESISTOR PMF	2R7 OHM 5% 3W	PHILIPS	2322 195 13278	04.634
R25-11	**RESISTOR PMF**	**6R8 OHM 5% 3W**	**PHILIPS**	**2322 195 13688**	**04.648**
R26-11	RESISTOR PMF	6R8 OHM 5% 3W	PHILIPS	2322 195 13688	04.648
R27-11	RESISTOR PMF	10 OHM 5% 3W	PHILIPS	2322 192 31009	04.650
R28-11	RESISTOR PMF	10 OHM 5% 3W	PHILIPS	2322 192 31009	04.650
R29-11	RESISTOR PMF	10 OHM 5% 3W	PHILIPS	2322 192 31009	04.650
R30-11	**RESISTOR PMF**	**10 OHM 5% 3W**	**PHILIPS**	**2322 192 31009**	**04.650**
R31-11	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R33-11	RESISTOR MF	680 OHM 5% 0.33W	PHILIPS	2322 180 73681	02.468
R34-11	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R35-11	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R36-11	**RESISTOR MF**	**9k1 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73912**	**02.495**
R37-11	PRESET CERMET	200 OHM 10% 0.5W	BOURNS	3386P-1-201	07.884
R38-11	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R39-11	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R40-11	RESISTOR MF	3k3 OHM 5% 0.33W	PHILIPS	2322 180 73332	02.484
R41-11	**RESISTOR MF**	**10k OHM 5% 0.33W**	**PHILIPS**	**2322 180 73103**	**02.496**
R42-11	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R43-11	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R44-11	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R45-11	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R46-11	**RESISTOR MF**	**470k OHM 5% 0.33W**	**PHILIPS**	**2322 180 73474**	**02.536**
R47-11	RESISTOR MF	3k3 OHM 5% 0.33W	PHILIPS	2322 180 73332	02.484
R48-11	RESISTOR MF	12k OHM 5% 0.33W	PHILIPS	2322 180 73123	02.498
R49-11	RESISTOR MF	22 OHM 5% 0.33W	PHILIPS	2322 180 73229	02.432
R50-11	RESISTOR MF	9k1 OHM 5% 0.33W	PHILIPS	2322 180 73912	02.495
R51-11	**PRESET CERMET**	**200 OHM 10% 0.5W**	**BOURNS**	**3386P-1-201**	**07.884**
R52-11	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R53-11	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R54-11	RESISTOR MF	3k3 OHM 5% 0.33W	PHILIPS	2322 180 73332	02.484
R55-11	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R56-11	**RESISTOR MF**	**10k OHM 5% 0.33W**	**PHILIPS**	**2322 180 73103**	**02.496**
R57-11	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R58-11	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R59-11	RESISTOR MF	470k OHM 5% 0.33W	PHILIPS	2322 180 73474	02.536
R60-11	RESISTOR MF	3k3 OHM 5% 0.33W	PHILIPS	2322 180 73332	02.484
R61-11	**RESISTOR MF**	**12k OHM 5% 0.33W**	**PHILIPS**	**2322 180 73123**	**02.498**
R62-11	RESISTOR MF	22 OHM 5% 0.33W	PHILIPS	2322 180 73229	02.432
R63-11	RESISTOR PMF	390 OHM 5% 2W	PHILIPS	2322 194 13391	04.189
R64-11	RESISTOR TEMP.SENSOR	2k0 2.5% AT 25 CENTIGRADE	SIEMENS	Q62705-K246 (KTY11-6)	07.151

5

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
TR1-11	**COIL**	**TL308**	**S.P.RADIO**	**6-0-23130**	**400308**
TR2-11	COIL	TL307	S.P.RADIO	6-0-23129	400307
TR3-11	COIL	TL303	S.P.RADIO	6-0-23125	400303
TR4-11	COIL	TL302	S.P.RADIO	6-0-23124	400302
TR5-11	TRANSFORMER	TL300	S.P.RADIO	6-0-23122B	400300
TR6-11	**OUTPUT TRANSFORMER**	**TL572**	**S.P.RADIO**	**6-0-27047**	**400572**
TR7-11	BALUN FOR T2131	TL573	S.P.RADIO	6-0-27049A	400573
U1-11	DUAL OP AMP	LM358N	TEXAS	LM358P	31.100

1

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	OUTPUT TRANSFORMER	**TL572**	**S.P.RADIO**	**6-0-27047**	**400572**
C2	**CAPACITOR MICA**	**15nF 10% 100VDC**	**SAHA**	**DM20 C 153 K 100V OBS! Tmax=8.3mm**	**18.145**
C3	CAPACITOR MICA	15nF 10% 100VDC	SAHA	DM20 C 153 K 100V OBS! Tmax=8.3mm	18.145
TR1	COAX CABLES FOR TL299		ESPERA	500299 CABLES FOR TL299	500299
TR1	**TOROIDE**		***PHILIPS**	**4322 020 97200**	**35.027**

INSTRUCTION BOOK FOR COMBINER UNIT
(only in 1200W, T2135) SP NO. 726394

CONTENTS

1. INTRODUCTION
1.1. PRINCIPLE OF OPERATION AND BLOCK DIAGRAM

2. INSTALLATION
2.1. ELECTRICAL CONNECTION AND ASSEMBLING

3. SERVICE

4. MECHANICAL DESCRIPTION
4.1. MECHANICAL DISASSEMBLING AND MODULE LOCATION

5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS
5.1. COMBINER UNIT (MODULE 12) SP NO. 626412

6.

7. PARTS LISTS

CONTENTS

1. INTRODUCTION

1.1. PRINCIPLE OF OPERATION AND BLOCK DIAGRAM

1. INTRODUCTION

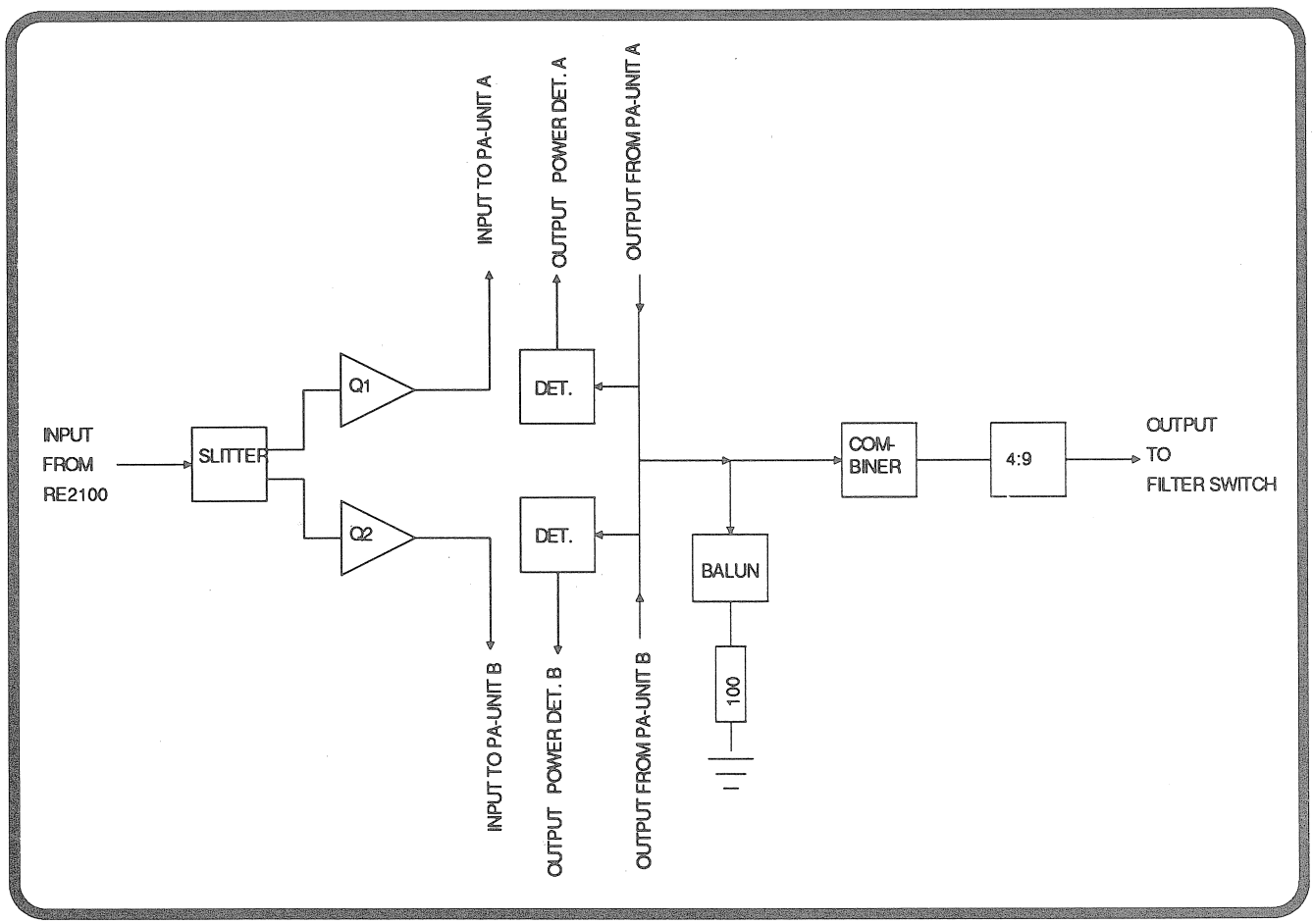
This section gives you all necessary information to make service of this unit down to component level.

1.1. PRINCIPLE OF OPERATION

The combiner unit contains the power splitter and the power combiner.
The RF signal from RE2100 is fed through the splitter to two buffer amplifiers, one for each PA unit (A and B). The gain from input to ouput is 0 dB.

The signal from the two power amplifiers (A and B) is combined in the combiner and then through the 4:9 impedance transformer to a 50 ohm output impedance.

For each PA unit there is a power detector. The detector output is fed to the TX processor.



CONTENTS

2. INSTALLATION

2.1. ELECTRICAL CONNECTION AND ASSEMBLING

CONTENTS

3. SERVICE

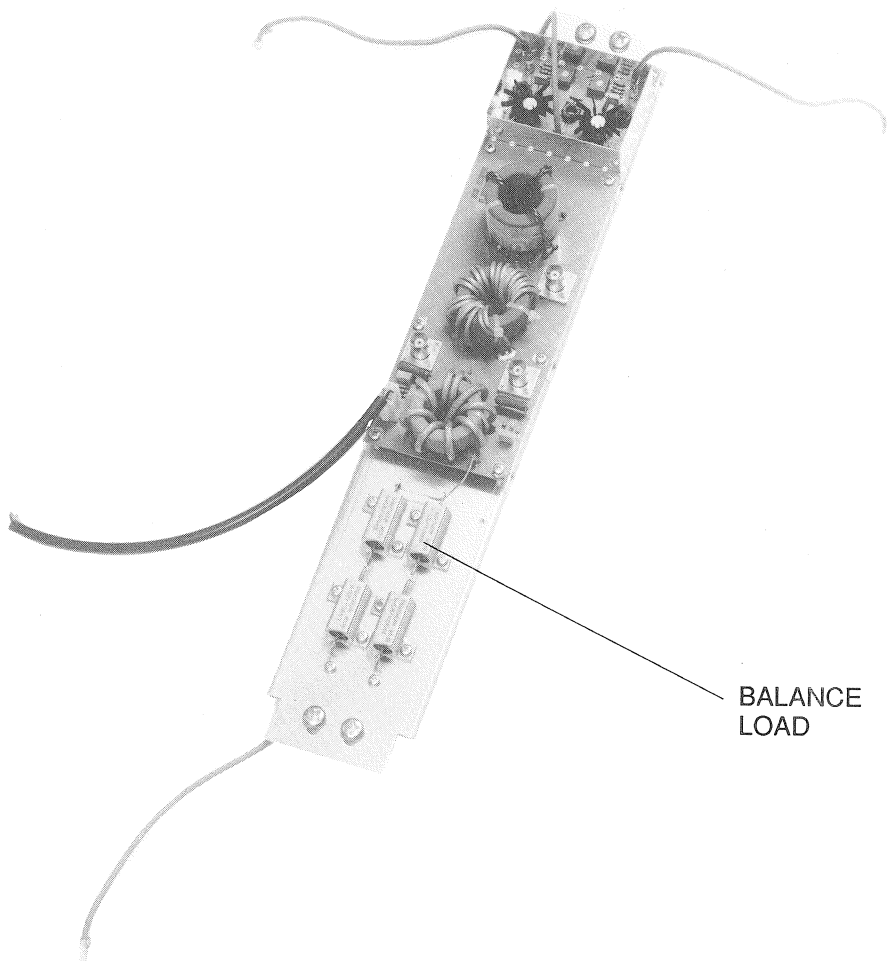
CONTENTS

4. MECHANICAL DESCRIPTION

4.1. MECHANICAL DISASSEMBLING AND MODULE LOCATION

4. MECHANICAL DESCRIPTION

4.1. MECHANICAL DISASSEMBLING AND MODULE LOCATION



CONTENTS

5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS

5.1. COMBINER UNIT (MODULE 12) SP NO. 626412

5.1. COMBINER UNIT (MODULE 12) SP NO. 626412

This module consists of the input splitter amplifier and output combiner.

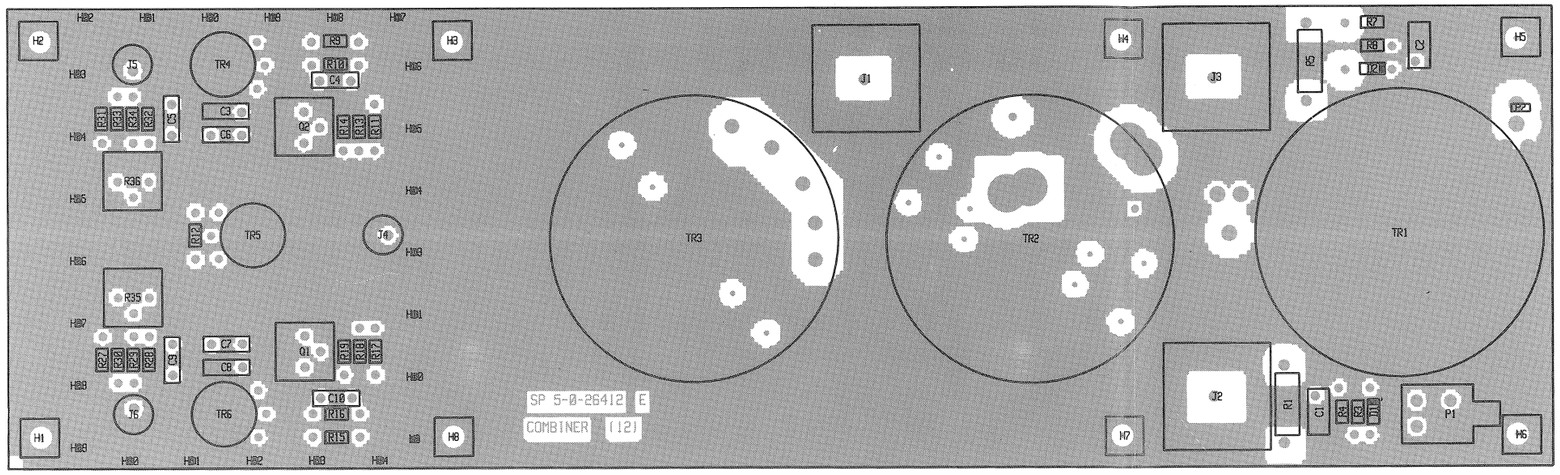
The input splitter TR5 and the following amplifier (Q2 or Q1) have a gain of approx. 0 dB measured from J4 to J5 or J6. The gain can be adjusted by R35 (module A) or by R36 (module B).

The output combiner TR2 is followed by a 4:9 impedance transformer, which gives a load impedance of 50 ohm.

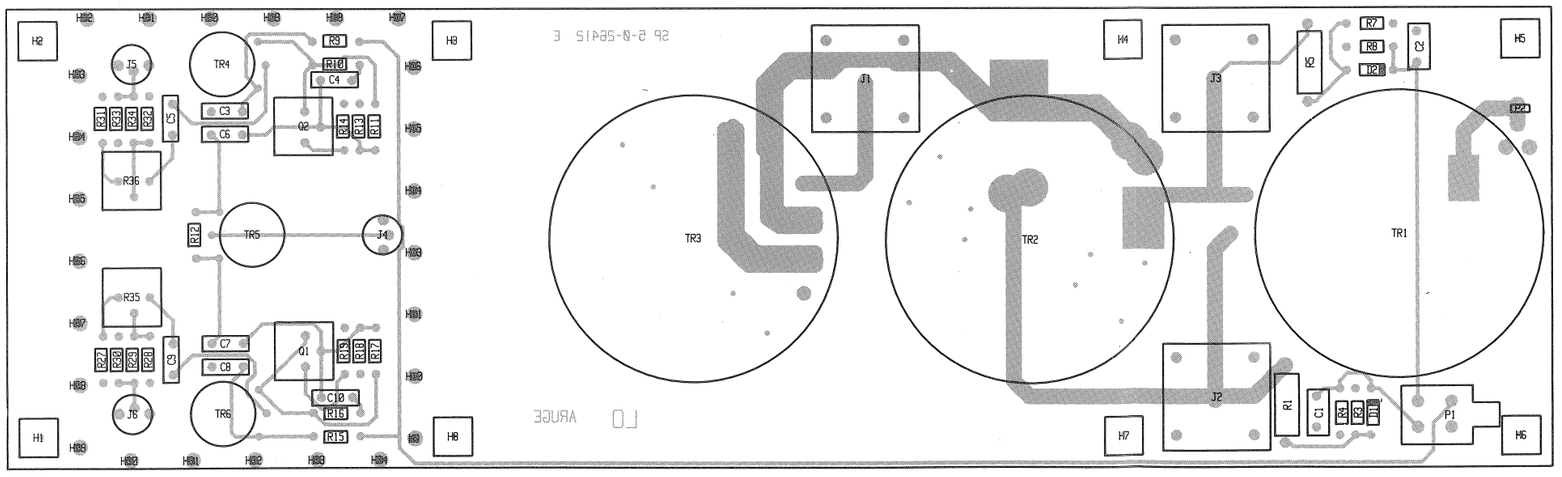
TR1 is a balum transformer which converts an unbalanced 100 ohm load to a balanced 100 ohm load, to absorb the unbalance in the two PA modules (A,B).
R1, R3, D1, R4 and C1 are the power detector for PA module A.
R5, R7, D2, R8 and C2 are the power detector for PA module B.

COMBINER MODULE 12

COMPONENT LOCATION COMBINER MODULE 12.

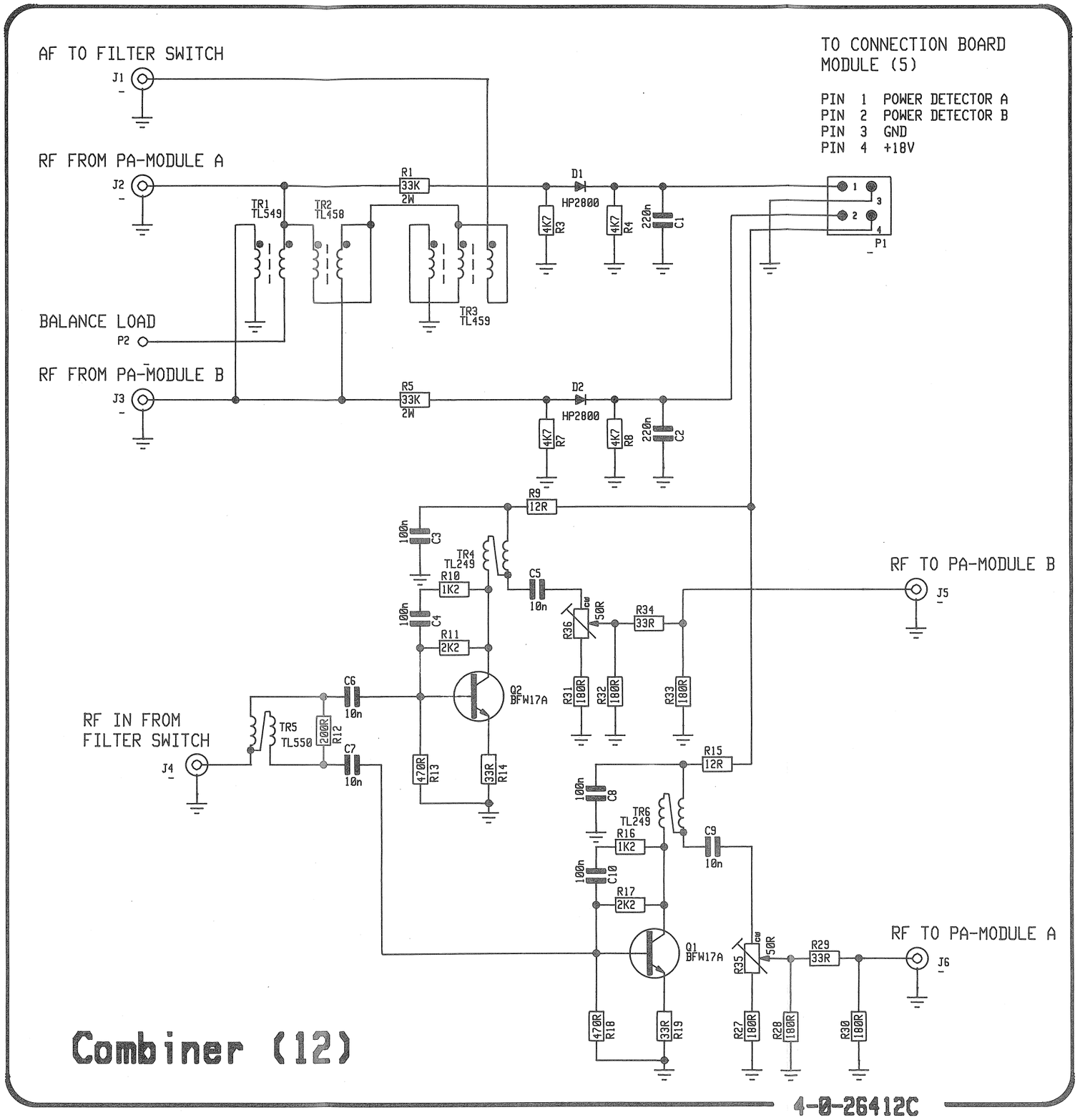


View from component side with upper side tracks.



View from component side with lower side tracks.

5.1. COMBINER (MODULE 12) cont.:



CONTENTS

7. PARTS LISTS

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	COMBINER MODULE 12	**T2135**	**ESPERA**	**5-0-26412E**	**626412**
C1-12	**CAPACITOR MKT**	**220nF 10% 63VDC**	**PHILIPS**	**2222 370 78224**	**11.095**
C2-12	CAPACITOR MKT	220nF 10% 63VDC	PHILIPS	2222 370 78224	11.095
C3-12	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C4-12	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C5-12	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 38103	11.168
C6-12	**CAPACITOR MKT**	**10nF 20% 100VDC**	**PHILIPS**	**2222 370 38103**	**11.168**
C7-12	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 38103	11.168
C8-12	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C9-12	CAPACITOR MKT	10nF 20% 100VDC	PHILIPS	2222 370 38103	11.168
C10-12	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
D1-12	**DIODE SCHOTTKY BARRIER**	**70V/15mA DO-35**	**SGS-THOMSON**	**1N5711**	**27.500**
D2-12	DIODE SCHOTTKY BARRIER	70V/15mA DO-35	SGS-THOMSON	1N5711	27.500
J1-12	SOCKET BNC	PCB VERSION	ROSENBERGER	51K102-400 A4	78.444
J2-12	SOCKET BNC	PCB VERSION	ROSENBERGER	51K102-400 A4	78.444
J3-12	SOCKET BNC	PCB VERSION	ROSENBERGER	51K102-400 A4	78.444
J4-12	**SOCKET COAX**	**VERTICAL FOR PCB MOUNT.**	**TAIKO**	**TMP-J01X-V6**	**78.518**
J5-12	SOCKET COAX	VERTICAL FOR PCB MOUNT.	TAIKO	TMP-J01X-V6	78.518
J6-12	SOCKET COAX	VERTICAL FOR PCB MOUNT.	TAIKO	TMP-J01X-V6	78.518
P1-12	PLUG 4 POLES		MOLEX	39-28-1043	78.216
P2-12	SOLDER TERMINAL		OJD	1015	82.005
Q1-12	**TRANSISTOR RF**	**BFW17A PNP TO-39**	**PHILIPS**	**BFW17A**	**29.151**
Q2-12	TRANSISTOR RF	BFW17A PNP TO-39	PHILIPS	BFW17A	29.151
R1-12	RESISTOR PMF	33k OHM 5% 2W	PHILIPS	2322 194 13333	04.229
R3-12	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R4-12	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R5-12	**RESISTOR PMF**	**33k OHM 5% 2W**	**PHILIPS**	**2322 194 13333**	**04.229**
R7-12	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R8-12	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R9-12	RESISTOR MF	12 OHM 5% 0.33W	PHILIPS	2322 180 73129	02.426
R10-12	RESISTOR MF	1k2 OHM 5% 0.33W	PHILIPS	2322 180 73122	02.474
R11-12	**RESISTOR MF**	**2k2 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73222**	**02.480**
R12-12	RESISTOR MF	200 OHM 5% 0.33W	PHILIPS	2322 180 73201	02.455
R13-12	RESISTOR MF	470 OHM 5% 0.33W	PHILIPS	2322 180 73471	02.464
R14-12	RESISTOR MF	33 OHM 5% 0.33W	PHILIPS	2322 180 73339	02.436
R15-12	RESISTOR MF	12 OHM 5% 0.33W	PHILIPS	2322 180 73129	02.426
R16-12	**RESISTOR MF**	**1k2 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73122**	**02.474**
R17-12	RESISTOR MF	2k2 OHM 5% 0.33W	PHILIPS	2322 180 73222	02.480
R18-12	RESISTOR MF	470 OHM 5% 0.33W	PHILIPS	2322 180 73471	02.464
R19-12	RESISTOR MF	33 OHM 5% 0.33W	PHILIPS	2322 180 73339	02.436
R27-12	RESISTOR MF	180 OHM 5% 0.33W	PHILIPS	2322 180 73181	02.454
R28-12	**RESISTOR MF**	**180 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73181**	**02.454**

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R29-12	**RESISTOR MF**	**33 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73339**	**02.436**
R30-12	RESISTOR MF	180 OHM 5% 0.33W	PHILIPS	2322 180 73181	02.454
R31-12	RESISTOR MF	180 OHM 5% 0.33W	PHILIPS	2322 180 73181	02.454
R32-12	RESISTOR MF	180 OHM 5% 0.33W	PHILIPS	2322 180 73181	02.454
R33-12	RESISTOR MF	180 OHM 5% 0.33W	PHILIPS	2322 180 73181	02.454
R34-12	**RESISTOR MF**	**33 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73339**	**02.436**
R35-12	PRESET CERMET	50 OHM 10% 0.5W	* BOURNS	3386P-1-500	07.882
R36-12	PRESET CERMET	50 OHM 10% 0.5W	* BOURNS	3386P-1-500	07.882
TR1-12			ESPERA	6-0-26461A	400549
TR2-12	OUTPUT POWER COMBINER	TL458	ESPERA	6-0-25043A	400458
TR3-12	**OUTPUT IMPEDANCE TRANSF.**	**TL459**	**ESPERA**	**6-0-25044D**	**400459**
TR4-12	TRANSFORMER	TL249	S.P.RADIO	6-0-21572	400249
TR5-12	INPUT POWER SPLITTER	TL550	ESPERA	6-0-26462	400550
TR6-12	TRANSFORMER	TL249	S.P.RADIO	6-0-21572	400249

INSTRUCTION BOOK FOR POWER SUPPLY UNIT 24V DC 600W
(N2170) SP NO. 726420

CONTENTS

1. INTRODUCTION
1.1. PRINCIPLE OF OPERATION AND BLOCK DIAGRAM

2. INSTALLATION
2.1. ELECTRICAL CONNECTION AND ASSEMBLING
2.1.1. CONNECTION TO N2170 600W
2.1.2. CONNECTION TO N2170 SINGLE
2.1.3. CONNECTION TO N2170 DUAL

3. SERVICE
3.1. MAINTENANCE
3.2. RECOMMENDED TEST EQUIPMENT
3.3. TROUBLE SHOOTING
3.4. PERFORMANCE CHECK
3.4.1. PERFORMANCE CHECK OF OUTPUT VOLTAGES
3.4.2. PERFORMANCE CHECK OF PROTECTION CIRCUITS
3.4.3. PERFORMANCE CHECK OF CURRENT LIMITERS
3.5. NECESSARY CHECK AND ADJUSTMENT AFTER REPAIR

4. MECHANICAL DESCRIPTION
4.1. MECHANICAL DISASSEMBLING AND MODULE LOCATION

5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS
5.1. INPUT FILTER (MODULE 1) SP NO. 626421
5.2. 28V & 42V REGULATOR (MODULE 2) SP NO. 626422
5.3. CONVERTER CONTROLLER (MODULE 3) SP NP. 626423
5.4. CONVERTER (MODULE 4) SP NO. 626424
5.5. MAIN SCHEMATIC DIAGRAM

6.

7. PARTS LISTS

CONTENTS

1. INTRODUCTION

1.1. PRINCIPLE OF OPERATION AND BLOCK DIAGRAM

1. INTRODUCTION

This section gives you all necessary information to make service of this unit down to component level.

1.1. PRINCIPLE OF OPERATION

The power supply is divided into four separate converters with individual converter controllers, a common regulator module and a common filter module. Three of the converters produce the 42V output voltage and the last converter produces the 28V output voltage.
The output voltages can be turned on/off by external signals from the TX processor in the transmitter.

The 42V converters are working at the same frequency but with a 120° phase shift in order to reduce the ripple current in the input capacitors and to reduce the output ripple. The ripple frequency is therefore 150 kHz instead of 50 kHz.
Each of the three converters is working as a current mode push–pull forward converter. The converter compares the output current (reflected by the transformer) with a control voltage from the regulator module, so that all the converters deliver the same output current, current sharing. When the control voltage is changed, the output currents are changed and thus also the output voltage.

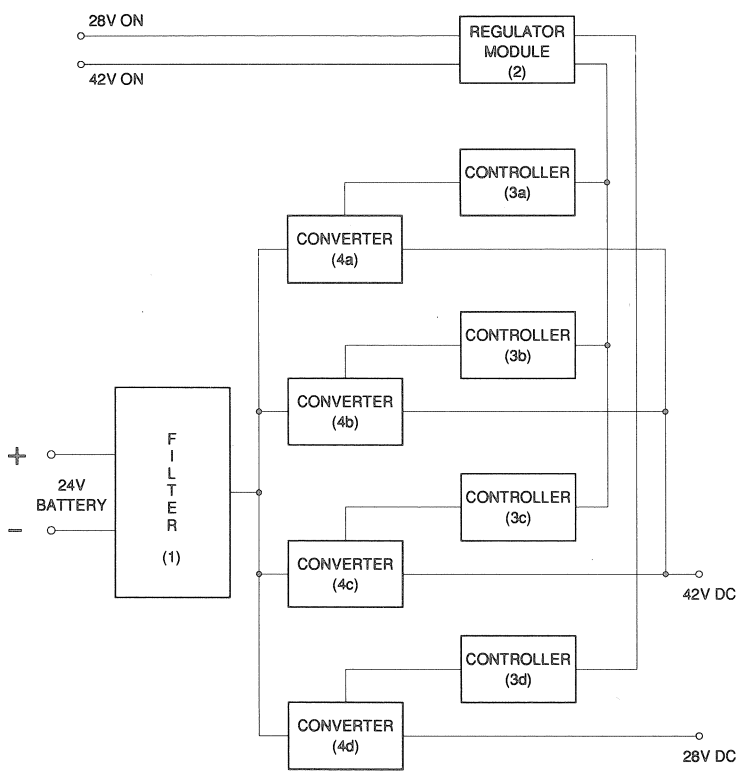
The 28V converter is also working as a current mode push–pull forward converter and the frequency is the same as for the 42V converters to prevent sub harmonics.

All fuses on the converters are monitored by the regulator module and if one is blown, the power supply is shut down.
If the input supply voltage is too low or high, the converters automatically stop.

When the converters start or restart, the output voltages slowly rises, soft starts.

A blower is switches on simultaneously with the 42V output to cool the power supply.

In case of blower failure, a thermal breaker shuts down the 42V output if heatsink temperature exceeds 90°C.



CONTENTS

2. INSTALLATION

2.1. ELECTRICAL CONNECTION AND ASSEMBLING

For 600W HF SSB: Cable dimensions and connections, see book for 600W Part I.

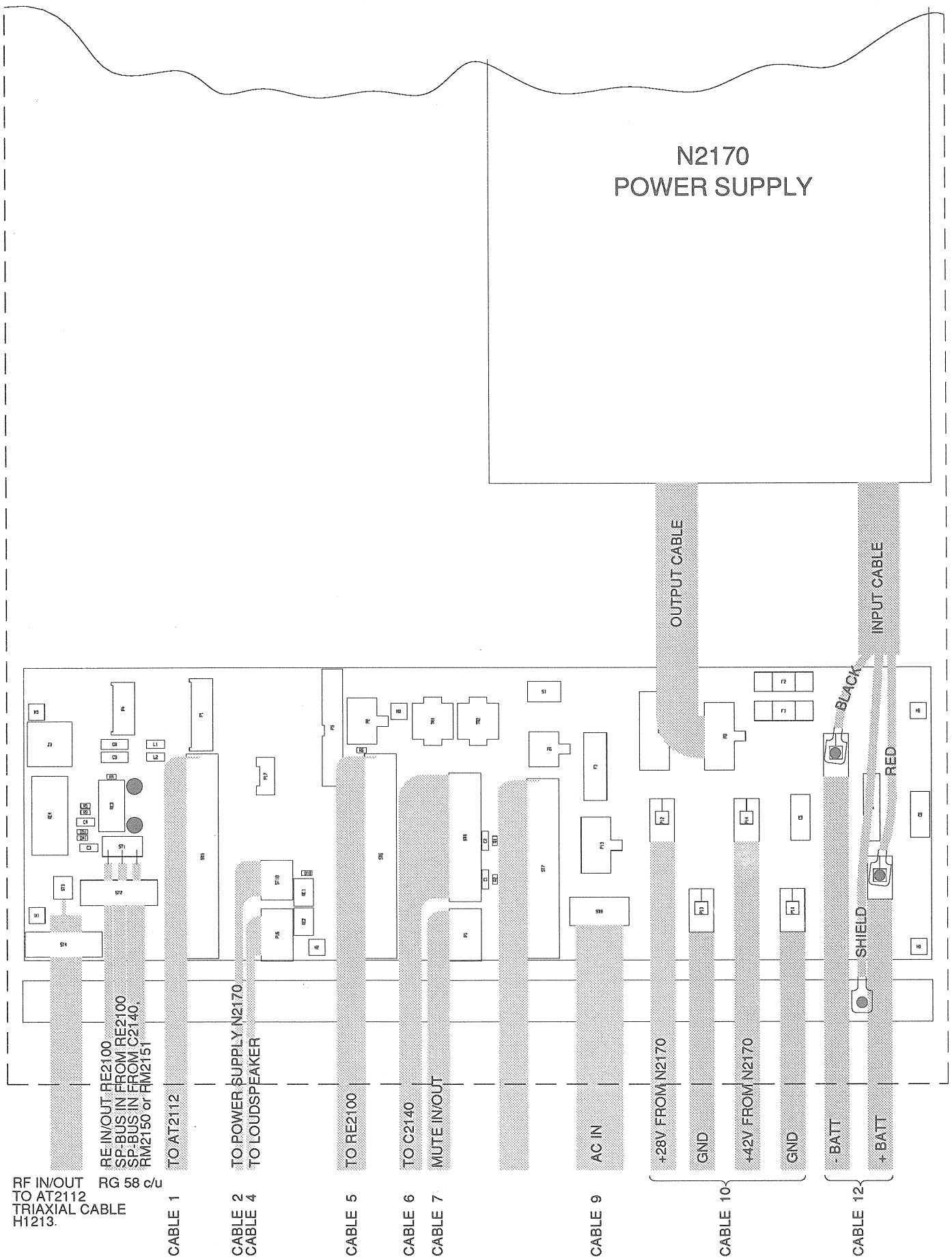
For 1200W HF SSB: Cable Dimensions and connections, see book for 1200W Part I.

2.1.1. CONNECTION TO N2170 600W

2.1.2. CONNECTION TO N2170 SINGLE

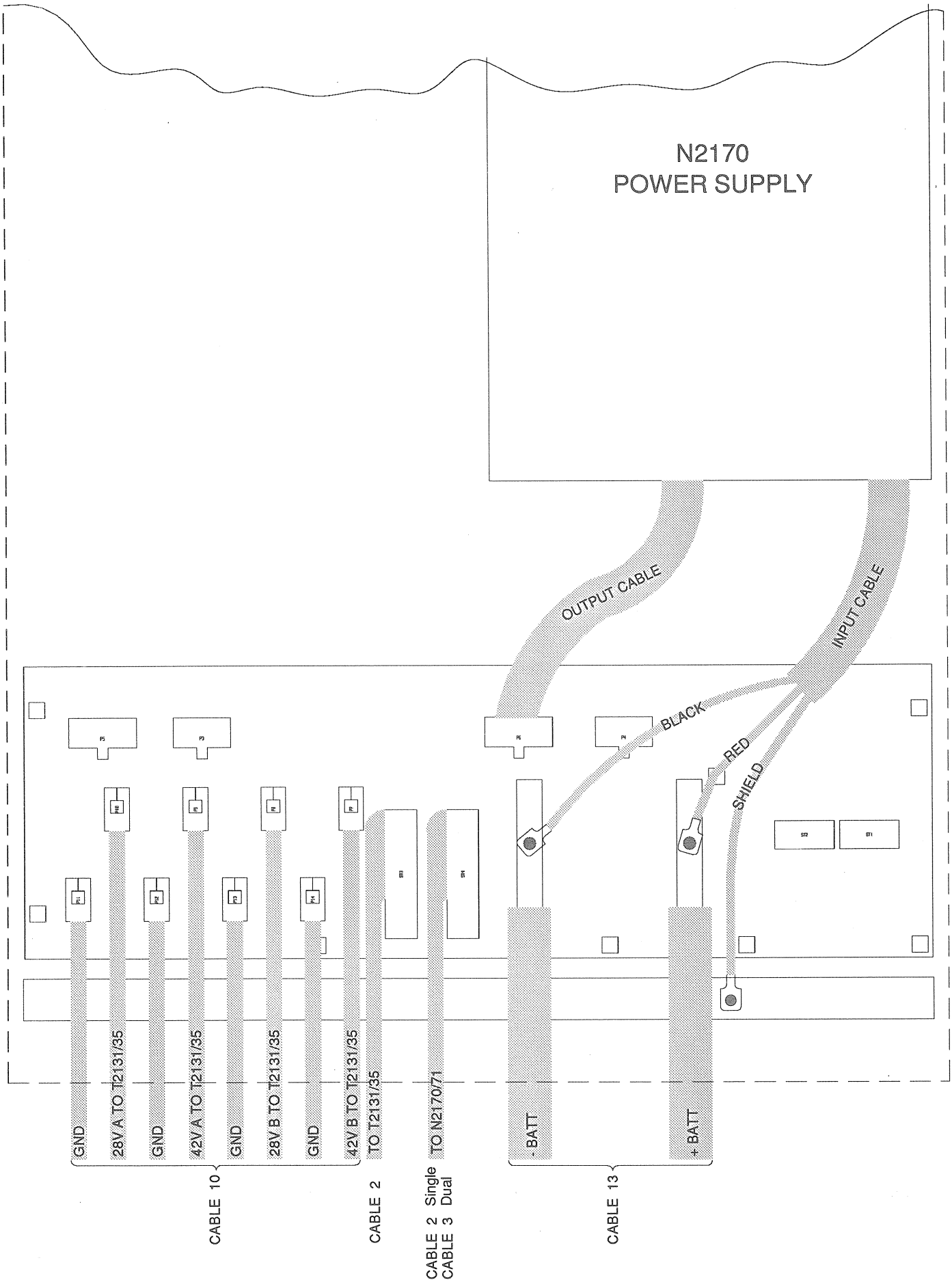
2.1.3. CONNECTION TO N2170 DUAL

2.1.1. CONNECTION TO N2170 600W



FOR CABLE DIMENSIONS: SEE PART I

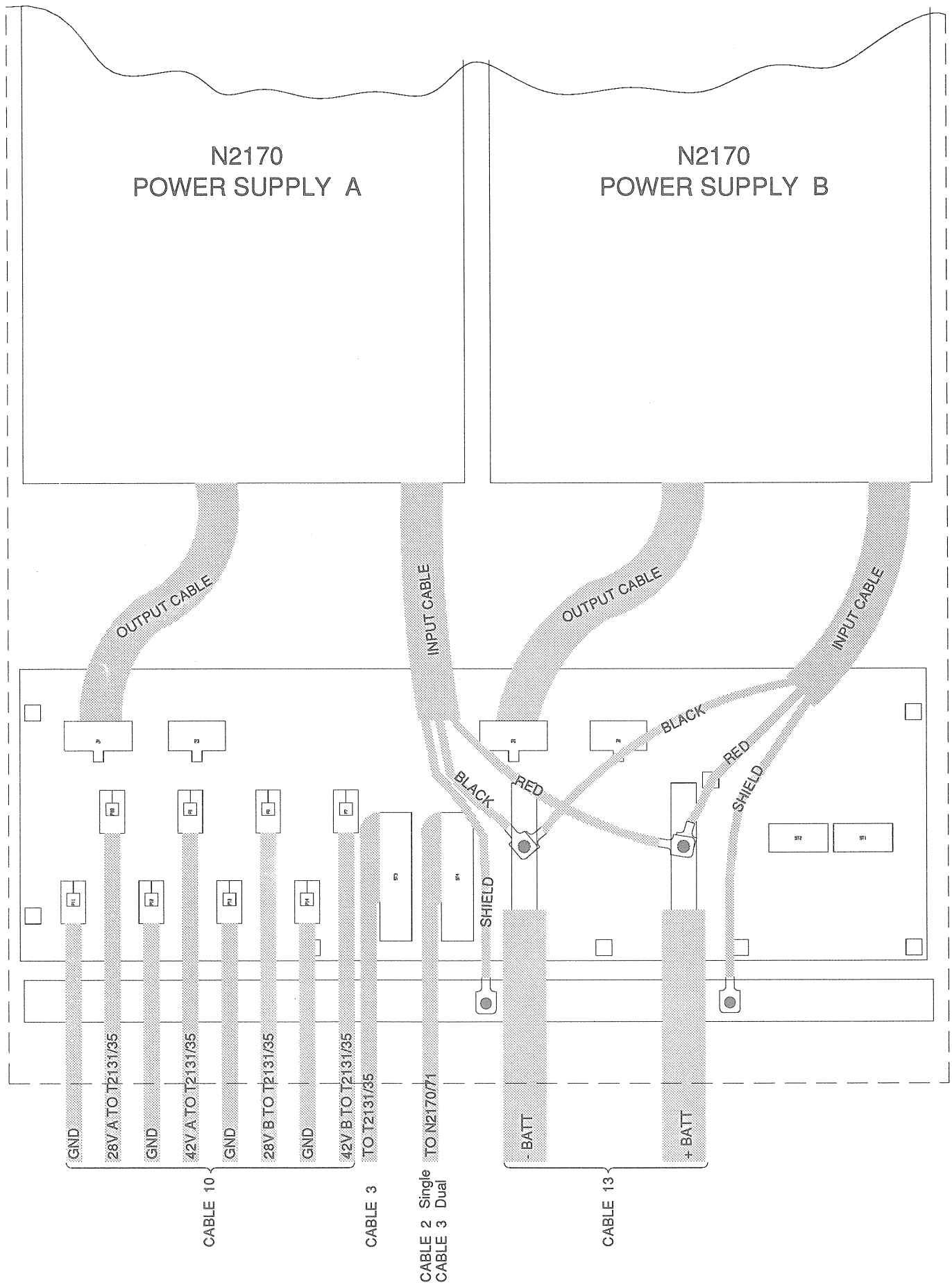
2.1.2. CONNECTION TO N2170 SINGLE



HF SSB 600/1200W
PART V 4-6-27545

FOR CABLE DIMENSIONS: SEE PART I

2.1.3. CONNECTION TO N2170 DUAL



FOR CABLE DIMENSIONS: SEE PART I

CONTENTS

3. SERVICE
3.1. MAINTENANCE
3.2. RECOMMENDED TEST EQUIPMENT
3.3. TROUBLE SHOOTING
3.4. PERFORMANCE CHECK
3.4.1. PERFORMANCE CHECK OF OUTPUT VOLTAGES
3.4.2. PERFORMANCE CHECK OF PROTECTION CIRCUITS
3.4.3. PERFORMANCE CHECK OF CURRENT LIMITERS
3.5. NECESSARY CHECK AND ADJUSTMENT AFTER REPAIR

3. SERVICE

3.1. MAINTENANCE

When the SAILOR N2170 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 section 3.4. PERFORMANCE CHECK.
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 3.5. NECESSARY ADJUSTMENT AND CHECK AFTER REPAIR.

3.2. RECOMMENDED TEST EQUIPMENT

Multimeter	Philips PM2518X
Oscilloscope	Philips PM3214

3.3. TROUBLE SHOOTING

Trouble shooting, repair and check of the N2170 should only be performed by persons, who have the sufficient technical knowledge and the necessary test equipment at their disposal.
Some faults require that each module can be checked separately. To check the 28V & 42V regulator (module 2), all cables are removed from all converter controller modules. Some measurements can now be done, but notice, that the voltages on the diagram do not correspond to this case.

In order to check only one converter module, the cables to the converter controller modules must be removed, except for the module in question. In order to switch on the module, it is necessary to cancel the fuse supervising circuit on the 28V & 42V regulator (module 2). This can be done by short-circuiting the resistor R97-2. One converter module can handle a load up to 9A.

1. No output at all:
   - a) Input voltage (battery) is too low or too high.
   - b) A voltage transient on the input voltage has occurred. Try to switch off and on the 28V output to reset the shut-down function.
   - c) A voltage transient on the output has occurred. Switch-off and on the 28V output to reset.
   - d) A failure in the control loop has occurred and triggered the shut-down circuit. Execute chapter 3.4.2. PERFORMANCE CHECK OF THE OUTPUT VOLTAGES.

2. The 42V output drops if loaded:
   - a) One of the converter modules is out of order.
   - b) One of the converter modules has shut down.
   - c) Wrong adjustment of current limiter.

3.3. **TROUBLE SHOOTING** cont.:

3. No 42V output voltage:
   a) The 28V output is not switched on.
   b) A failure in the control loop has caused an overvoltage which triggers the shut–down circuit.
   c) The thermal breaker TB1–3 is activated because the heat sink has too high temperature. The blower may be out of order.

3.4. PERFORMANCE CHECK

Any value, which differs too much from the values given in this chapter, should lead to a repair or an adjustment of the circuit or module in question.

Hints to locate some faults are given in the chapter 3.3. TROUBLE SHOOTING.

To handle the performance check in an easy way, it is recommended to connect the N2170 to a disconnected connection board (module 5 or module 13).

To make the internal voltages for the regulator module, it is necessary to connect the 18V wire from N2170 to a separate power supply, capable of delivering 18V at 0.2A, with the minus connected to N2170 chassis. The 18V supply can also be used to switch the outputs on and off by connecting the 18V to 28V ON and 42V ON wires to N2170. The 28V has to be switched on first before the 42V is switched on.

3.4.1. PERFORMANCE CHECK OF OUTPUT VOLTAGES

1. To get a proper regulation, connect small dummy loads to the outputs. For 42V output a resistor of 330 ohm/6W and for 28V output a resistor of 220 ohm/6W is sufficient.

2. Connect 24V to the battery input connection of N2170.

3. Connect 18V to the 28V ON and 42V ON terminals to switch on the outputs.

4. By means of a voltmeter, read the 42V output to 42.2V ±0.5V DC and the 28V output to 27.5V ±0.5V DC.

5. Check also that the blower is running while both outputs are switched on.

6. A scope picture of the switching voltage across the switching transistors for the 42V converters shows not a fine square wave, but a micture of square waves and spikes. This is normal because of the working principle and because of small loads.

3.4.2. PERFORMANCE CHECK OF PROTECTION CIRCUITS

1. A variable power supply delivering voltages between 14V and 37V DC is connected to the battery input of N2170.

2. Small dummy loads are connected to the outputs.

3. Set the input voltage to 14V and switch on the outputs. The outputs should not be able to switch on.

4. Set the input voltage to 17V. Check that the outputs are now switched on and within the limits.

5. Set the input voltage to 37V. Check that the outputs are shut down.

6. Set the input voltage to 19V. Switch off and on the 28V output to reset the shut-down circuit.

7. Short-circuit for a second the opto-coupler OC1-2 pin 4 and 5, and OC3-2 pin 4 and 5. Watch that the outputs are going down. Switch off and on the 28V output to reset.

8. Check with an oscilloscope to U9-2 pin 3 the frequency to approx. 120 kHz square wave.

9. Remove the cable from one of the converter controllers (module 3) and watch that the 42V is going down. (Test of fuse supervising circuit).

3.4.3. PERFORMANCE CHECK OF CURRENT LIMITERS

1. Connect a dummy load of 1.46 ohm/1000W to the 42V output. It can be made by parallelling several power resistors.

2. Connect a dummy load of 3.68 ohm/200W to the 28V output.

3. Connect a power supply or a battery, capable of delivering 26V DC at 65 A, to the battery input of N2170.

4. Switch on both outputs and read with a voltmeter the 42V output to 36.5V ±1V DC. Read also the 28V output to 26.5V ±0,5V DC.

5. Check with an oscilloscope that the output ripple of the 42V output is less than $1.5V_{pp}$ apart from the voltage spikes at full load of 25A.

6. Check with an oscilloscope that the output ripple of the 28V output is less than $1.5V_{pp}$ apart from the voltage spikes at full load of 7.2A.

7. A scope across the switching transistors of the 42V converters shows square waves with a little jitter. All three 42V converters must be working when fully loaded.

3.5. NECESSARY CHECK AND ADJUSTMENT AFTER REPAIR

Change or Repair of the Input Filter (Module 1) or of the 28V & 42V Regulator (Module 2):

Execute chapter 3.4.1. PERFORMANCE CHECK OF OUTPUT VOLTAGES and adjust if necessary the 28V output voltage to 27.5V ±0,2V DC with R29–2 and the 42V output voltage to 42.2V ±0.2V DC with R25–2.

Execute chapter 3.4.3. PERFORMANCE CHECK OF CURRENT LIMITERS and adjust if necessary the 42V current limiter to 36.5V ±0.2V DC with R23–2, and the 28V current limiter to 26.5V ±0.2V DC with R27–2.

Notice! During adjustments of the current limiters the cover of N2170 is open which means that the adjustment is drifting because of less cooling of the current sense resistors on the input filter module. Therefore the adjustment must be done quickly to close the cover. Let it run for a while and then readjust.

Execute chapter 3.4.2. PERFORMANCE CHECK OF PROTECTION CIRCUITS.

Change or Repair of Converter Controller (Module 3) or of Converter (Module 4).

Execute chapter 3.4.2. PERFORMANCE CHECK OF PROTECTION CIRCUITS.

Execute chapter 3.4.3. PERFORMANCE CHECK OF CURRENT LIMITERS and adjust if necessary as described above for the change or repair of the input filter.

Notice! If a converter module is used as 28V converter, check that the zener diode D9–4 (8.2V) is placed for overvoltage protection. Check at the same time that any of the three 42V converters does not contain D9–4. If so, it must be removed.

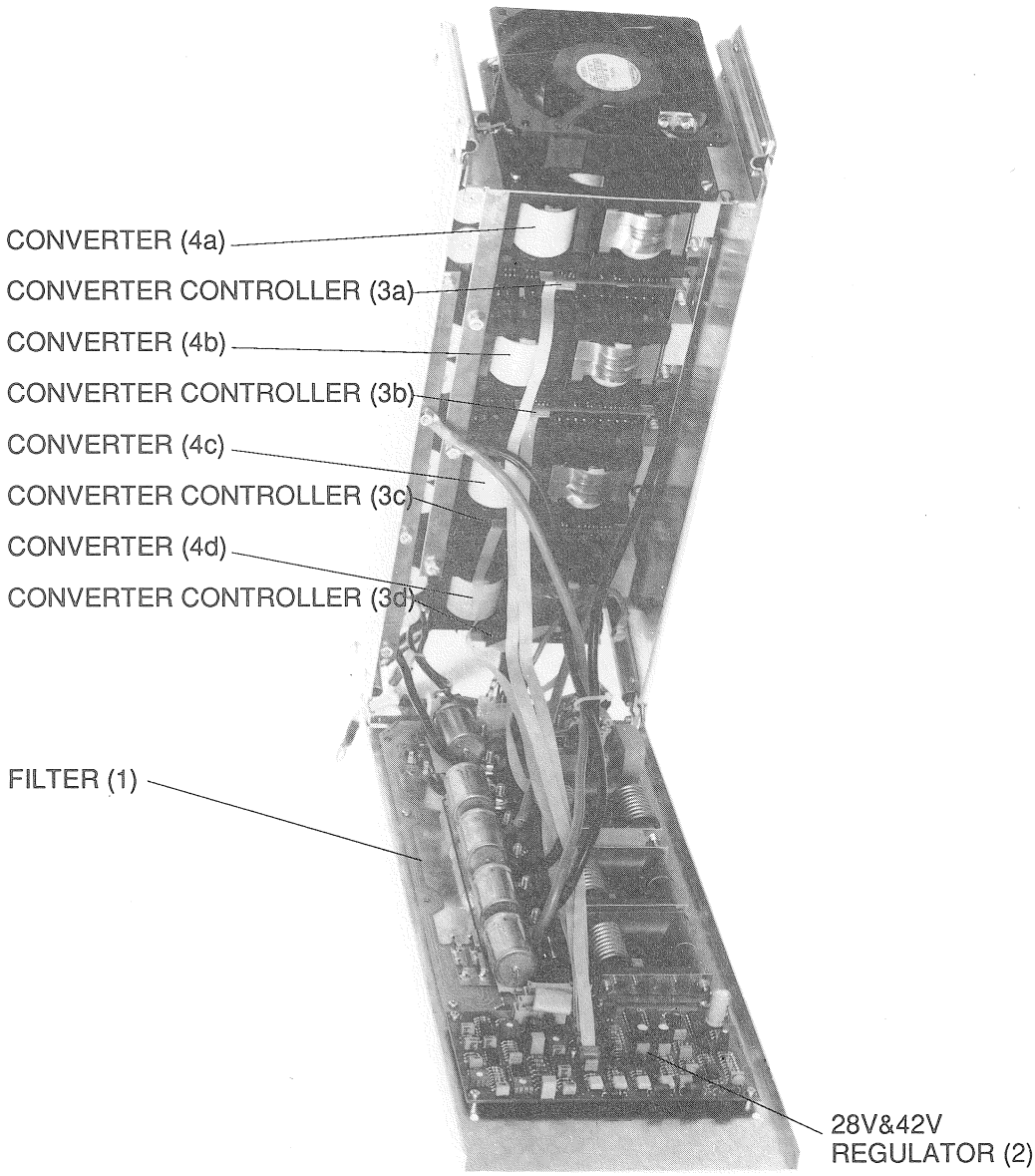
CONTENTS

4. MECHANICAL DESCRIPTION

4.1. MECHANICAL DISASSEMBLING AND MODULE LOCATION

4. MECHANICAL DESCRIPTION

4.1. MECHANICAL DISASSEMBLING AND MODULE LOCATION



CONTENTS

5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS
5.1. INPUT FILTER (MODULE 1) SP NO. 626421
5.2. 28V & 42V REGULATOR (MODULE 2) SP NO. 626422
5.3. CONVERTER CONTROLLER (MODULE 3) SP NP. 626423
5.4. CONVERTER (MODULE 4) SP NO. 626424
5.5. MAIN SCHEMATIC DIAGRAM

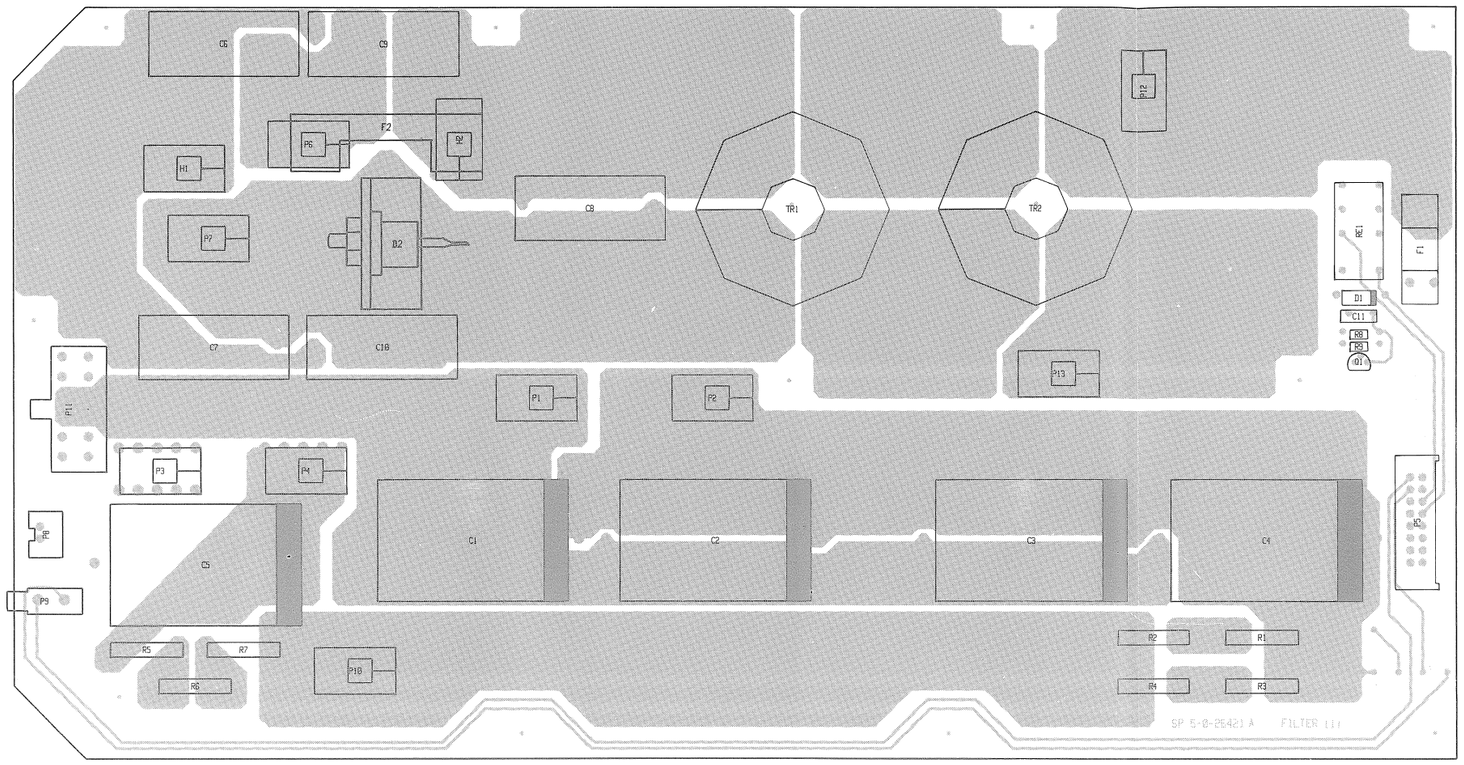
5.1. INPUT FILTER (MODULE 1) SP NO. 626421

The 3–phased output voltage from the three 42V converters are connected at the input filter module. The voltage is filtered by the capacitors C1 to C4. A 42V voltage sense signal is passed on to the regulator module.
The 42V output current is sensed by R1 to R4 and passed on to the regulator module.
The 28V output voltage from the 28V converter is connected to the input filter module. The output is filtered by the capacitors C5. A 28V voltage sense signal is passed on to the regulator module.
The 28V output current is sensed by R5 to R7 and passed on to the regulator module.
The 24V DC supply from the battery is filtered by the EMI filter formed by C6, C7, C8, C9, C10, TR1, and TR2 and passed on to the four converters.
In case of reverse polarity of the battery, the diode D2 blows the fuse F2.
The relay RE1 connects the 24V DC supply voltage to the regulator module. The 18V supply voltage to the relay comes from the transmitter. The TX processor turns on/off the regulator module via the 28V ON signal.
The wires 42V ON and 28V ON are used by the TX processor in the transmitter to turn the 42V output voltage and the 28V output voltage on/off.
A thermostat TB1 is connected in series with the 42V ON signal. In case of too high temperature on the heatsink, this thermostat disconnects the 42V ON signal.

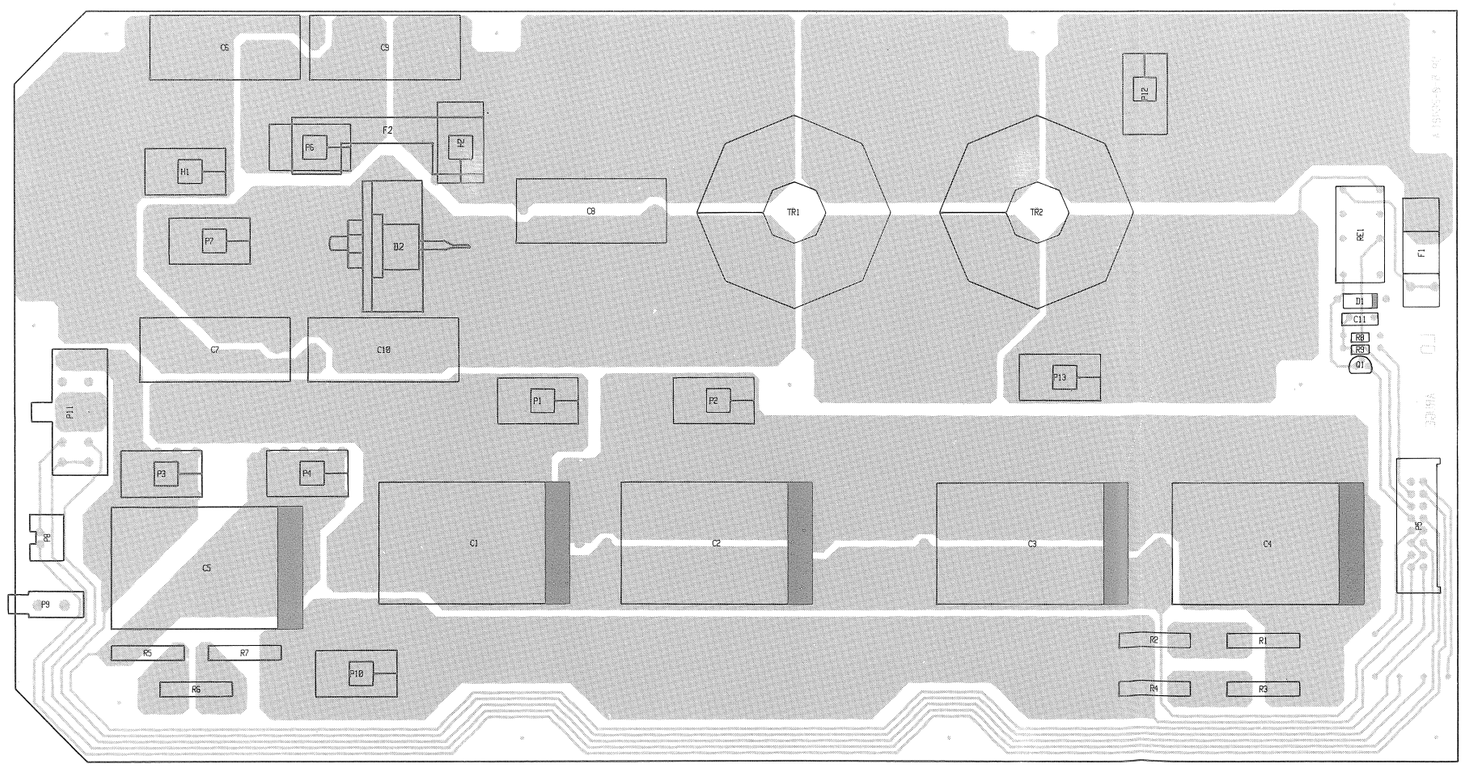
INPUT FILTER MODULE 1

5.1. INPUT FILTER (MODULE 1) cont.:

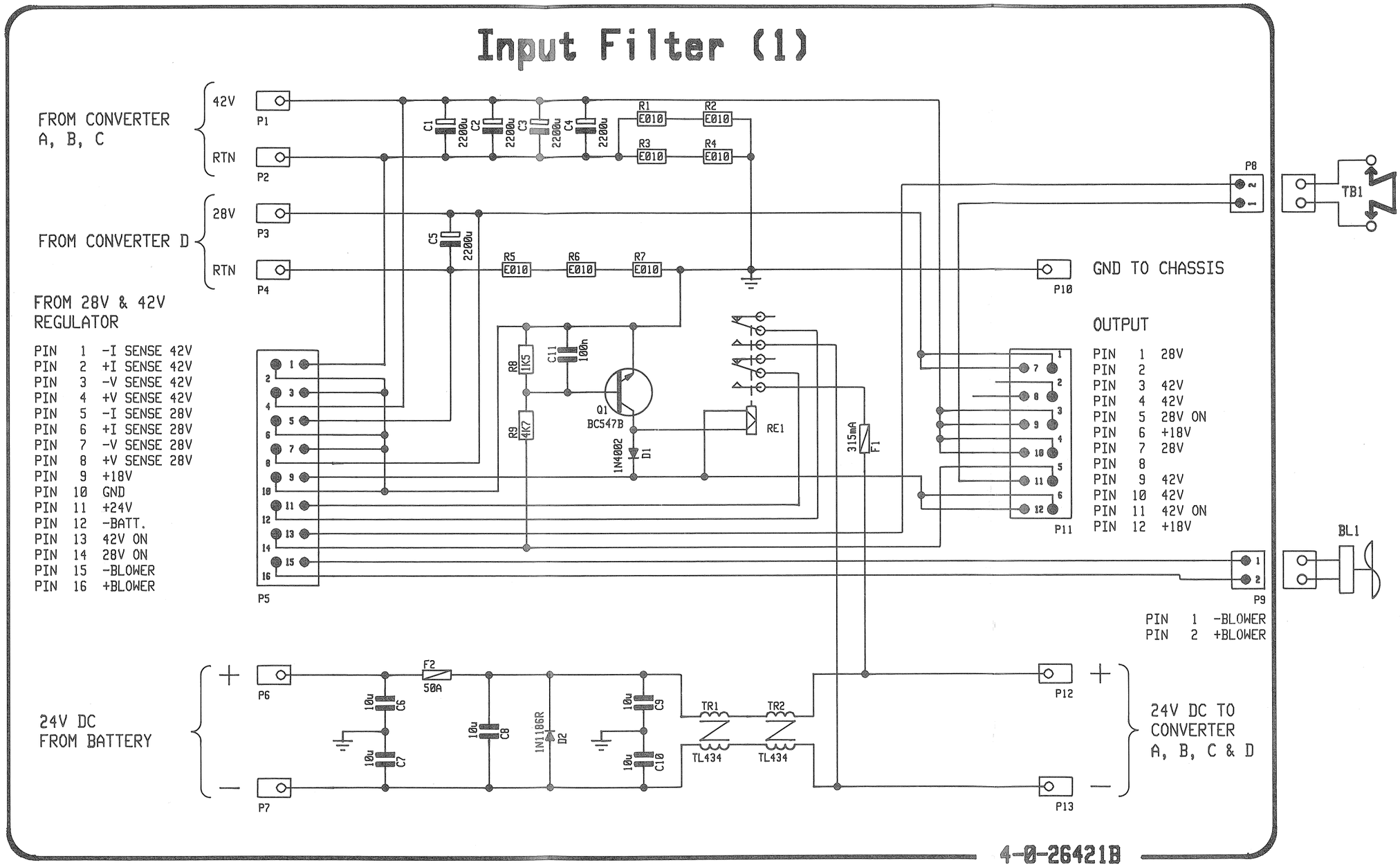
COMPONENT LOCATION INPUT FILTER MODULE 1.



View from component side with upper side tracks.



View from component side with lower side tracks.


Input Filter (1)
FROM CONVERTER A, B, C
42V
RTN
P1
P2
C1 2200u
C2 2200u
C3 2200u
C4 2200u
R1 E010
R2 E010
R3 E010
R4 E010
FROM CONVERTER D
28V
RTN
P3
P4
C5 2200u
R5 E010
R6 E010
R7 E010
P8
TB1
P10
GND TO CHASSIS
FROM 28V & 42V REGULATOR
PIN 1 -I SENSE 42V
PIN 2 +I SENSE 42V
PIN 3 -V SENSE 42V
PIN 4 +V SENSE 42V
PIN 5 -I SENSE 28V
PIN 6 +I SENSE 28V
PIN 7 -V SENSE 28V
PIN 8 +V SENSE 28V
PIN 9 +18V
PIN 10 GND
PIN 11 +24V
PIN 12 -BATT.
PIN 13 42V ON
PIN 14 28V ON
PIN 15 -BLOWER
PIN 16 +BLOWER
P5
R8 1K5
C11 100n
R9 4K7
Q1 BC547B
D1 1N4002
RE1
315mA F1
OUTPUT
PIN 1 28V
PIN 2
PIN 3 42V
PIN 4 42V
PIN 5 28V ON
PIN 6 +18V
PIN 7 28V
PIN 8
PIN 9 42V
PIN 10 42V
PIN 11 42V ON
PIN 12 +18V
P11
BL1
P9
PIN 1 -BLOWER
PIN 2 +BLOWER
24V DC FROM BATTERY
P6
P7
F2 50A
C6 10u
C7 10u
C8 10u
D2 1N1186R
C9 10u
C10 10u
TR1
TR2
TL434
TL434
P12
P13
24V DC TO CONVERTER A, B, C & D
4-0-26421B

5.2. 28V & 42V REGULATOR (MODULE 2) SP NO. 626422

INTERNAL SUPPLY

The 24V supply voltage from the battery via the input filter module is used as internal supply voltages on the primary side of the regulator module. The 13V supply is produced by R54 and D9. The 9.1V supply is produced by R48 and D7. The 6.2V reference voltage comes from R53 and D6. The capacitors C22, C17 and C18 are decoupling capacitors.

The 18V supply voltage from the transmitter via the input filter module is used as the internal supply on the secondary side of the regulator module. The 18V is used to make the internal 6.2V reference voltage by means of R17 and D1. The capacitors C9, C10 and C11 are decoupling capacitors.

CLOCK FREQUENCY CIRCUIT

The IC U7 is an astable multivibrator where the oscillation frequency (approx. 300 kHz) is fixed by R58 and C20. The output signal is then divided by 3 by the Johnson counter U8. This counter produces the three 100 kHz pulses with 120° phase shift. The three clock signals are buffered by U9 and sent to the converter controller modules. The clock for the 28V converter follows one of the 42V converter clocks.

42V SUPPLY VOLTAGE LOOP

The 42V supply voltage is sensed on the input filter module and led to the common–mode amplifier R3, R4, R11, R12, C3, C4 and U2,1. The output voltage from this amplifier is divided by R19, R24 and R25 and compared with the reference voltage. The error voltage is then amplified by R31, R35 and U2,2. This signal is then OR–ed together with the current limit signal and led to Q1. The transistor Q1 converts the voltage signal into a current signal. This current signal drives the optodiode of OC1.
The collector of the optocoupler of OC1 is connected to R60. This resistor converts the current signal into a voltage signal again. The signal is then amplified by R64, R65, R66, C23 and U5,2. The signal is then buffered by U5,1 and used as the control voltage for all three 42V converters.

The potentiometer R25 is used for adjusting the 42V output voltage.

42V ON AND SOFT START

The function of the transistor Q1 is turned on/off by the optocoupler OC2. When the signal 42V ON from the transmitter goes high, the transistor Q10 goes on and turns OC2 on. OC2 then activates Q1. If Q1 is off, then the voltage on the collector of OC1 goes high. This voltage is sensed by Q9 via R89 and R91. If this voltage is high, then Q9 short–circuits the control voltage via D12 and R75. The 42V supply then stops. When Q9 turns off, the control voltage will slowly increase, controlled by the soft start capacitor C25. The converters always start in a soft start mode.
When 42V ON goes high, the transistor Q10 turns the transistor Q3 on. This transistor turns on the blower BL1 on so that the blower always runs when the 42V output voltage is on.

UNDERVOLTAGE

The Q9 transistor can be turned on by the battery supply undervoltage control circuit, R55, R56, R63, R68, R69 and U6,2. D8 protects the U6,2 in case of voltage transients on the supply voltage. This circuit ensures that the input supply is correct before the converters start, or stops the converters if the battery voltage falls below approx. 16V.

FUSE CONTROL

The fuses on the converter modules are checked by the transistors Q5 to Q8 together with their OR–ing diodes. If a fuse is blown, then the fuse signal goes low and the OR–ing resistor pulls the control voltage down via the transistor. The 42V output then stops. This is done to protect the input and output capacitors against the high ripple currents due to the missing phase.

5.2. 28V & 42V REGULATOR (MODULE 2) SP NO. 626422 cont.:

42V OUTPUT CURRENT LIMITER

The output current is sensed on the input filter module and led to the common–mode amplifier R1, R2, R9, R10, C1, C2 and U1,1. The signal is compared with the reference voltage. If the current signal is higher than the reference voltage, the high gain amplifier takes over the control of Q1 and limits the output current.
The current limit is set by R23.

28V VOLTAGE LOOP

The 28V supply voltage is sensed on the input filter module and led to the common–mode amplifier R7, R8, R15, R16, C7, C8 and U4,2. The output voltage from this amplifier is divided by R21, R28 and R29 and compared with the reference voltage. The error voltage is then amplified by R33, R37 and U4,1. This signal is then OR–ed together with the current limit signal and led to Q2. The transistor Q2 converts the voltage signal into a current signal. This current signal drives the optodiode of OC3.
The collector of the optotransistor of OC3 is connected to R49. This resistor converts the current signal into a voltage signal again. The signal is then amplified by R52, R57, R59, C19 and U6,1 and used as the control voltage for the 28V converter controller.

The potentiometer R29 is used for adjusting the 28V output voltage.

28V ON AND SOFT START

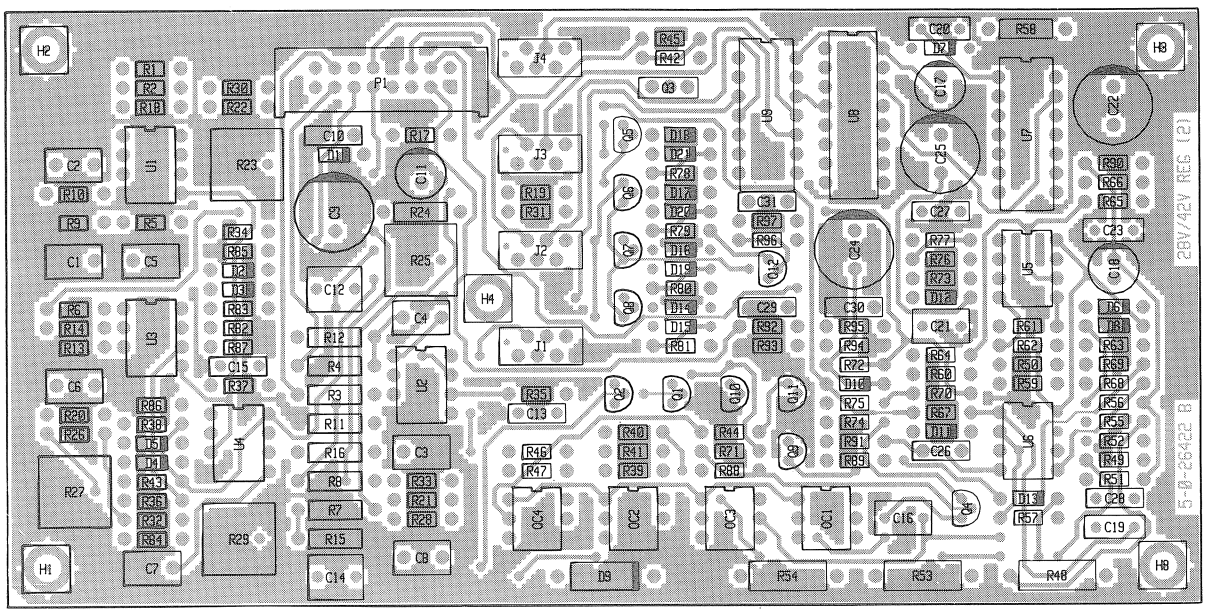
The function of the transistor Q2 is turned on/off by the optocoupler OC4. When signal 28V ON from the transmitter goes high, the transistor Q11 goes on and turns OC4 on. OC4 then activates Q2. If Q2 is off, then the voltage on the collector of OC3 goes high. This voltage is sensed by Q4 via R88 and R71. If this voltage is high then Q2 short–circuits the control voltage via R74. The 28V then stops. When Q4 turns off, the control voltage will slowly increase controlled by the soft start capacitor C24. The converters always start in a soft start mode.

28V OUTPUT CURRENT LIMITER

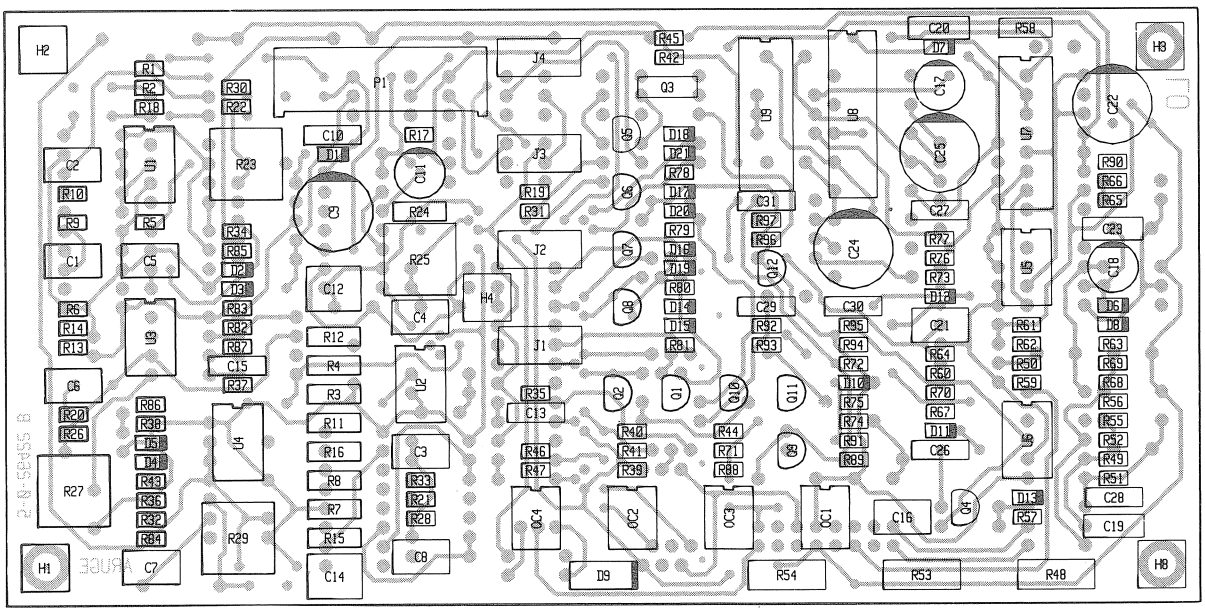
The output current is sensed in the input filter module and led to the common–mode amplifier R5, R6, R13, R14, C5, C6 and U3,1. The signal is compared with the reference voltage. If the current signal is higher than the reference voltage, the high gain amplifier takes over the control of Q2 and limits the output current.
The current limit is set by R27.

28V & 42V REGULATOR MODULE 2

COMPONENT LOCATION 28V & 42V REGULATOR MODULE 2.

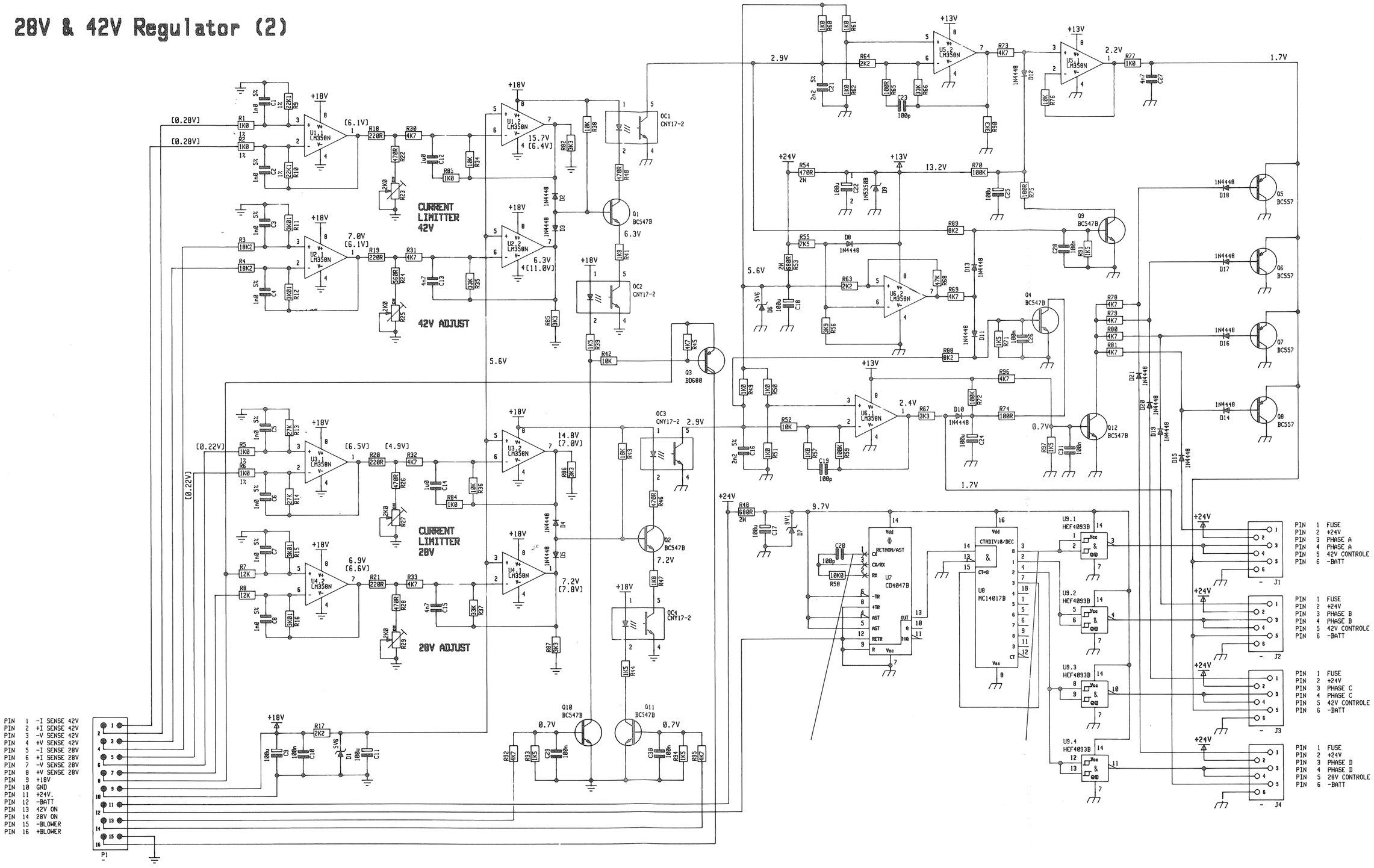


View from component side with upper side tracks.



View from component side with lower side tracks.

28V & 42V Regulator (2)



03.03.92
4-0-26422H

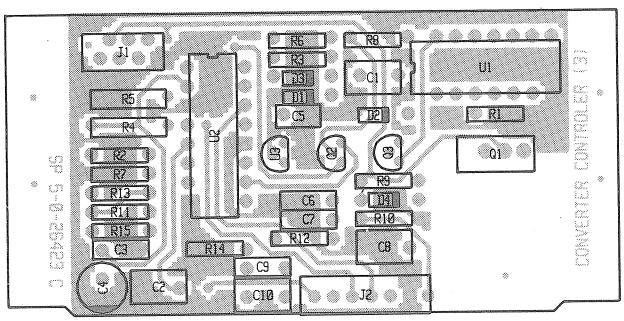
5.3. CONVERTER CONTROLLER (MODULE 3) SP NO. 626423

The internal 12V supply voltage is produced by the fixed 12 Volt regulator U3 and Q1. Q1 protects the voltage regulator against voltage spikes. The input voltage to U3 is limited to approx. 15V DC.
C6, C3 and C7 are decoupling capacitors.
The 5V reference voltage of U2 is used as an internal 5V supply voltage.
The 5 Volt clock signal from the regulator module is shaped by the first NAND Schmitt trigger U1,2 and a well-defined pulse is produced by the one-shut formed by NAND-gates U1,1 and U1,3 and C1, D2 and R1. This pulse is used for two purposes. The first purpose is to make a saw tooth signal by D3, R3 and C5. This voltage signal is converted to a current signal by Q3 and R12 and used for slope compensation to ensure loop stability. The other purpose for the pulse is to override the internal clock of PWM regulator U2 via U1,4 and R8 and Q2.
The control voltage from the regulator module is sensed by the internal control voltage amplifier in U2. This amplifier is connected as a common mode amplifier (R2, C2, R7, R13, C10 and R11) to reduce noise sensitivity.
The current signal from the output transistors on the converter module is connected to the current sense amplifier inside U2. C8 is a noise decoupling capacitor.
The first output transistor pair is turned on by the clock pulse and the current running through it starts to increase. The current is sensed and the amplified current signal is then compared with the control voltage by U2. When the current signal is higher than the control voltage, the transistors are turned off. During the next clock period the other output transistor pair is turned on/off in the same way. The output current is controlled by the control voltage. The peak output current is limited by limiting the output voltage of the control voltage amplifier. The limit is determined by voltage of pin 1 of U2. This voltage is controlled by R4 and R5. C5 is a soft start capacitor.
If the voltage on the shut down terminal pin 16 on U2 is higher than 350 mV the output transistors are instantaneously turned off. This feature is used as a shut down in case of an overvoltage on the 24V supply voltage. The voltage is divided by R9, D4 and R10.
The shut down terminal is also connected to an overvoltage protection circuit for the output voltage on the converter module.
To reset the shut down function, it is necessary to switch off the relay R1 on the filter module by switching off the 28V ON signal.
The two output signals from U2 are passed on to the converter module as gate signals.

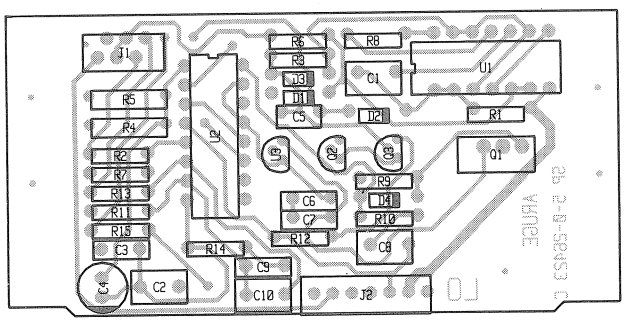
CONVERTER CONTROLLER MODULE 3

5.3. CONVERTER CONTROLLER (MODULE 3) cont.:

COMPONENT LOCATION CONVERTER CONTROLLER MODULE 3.

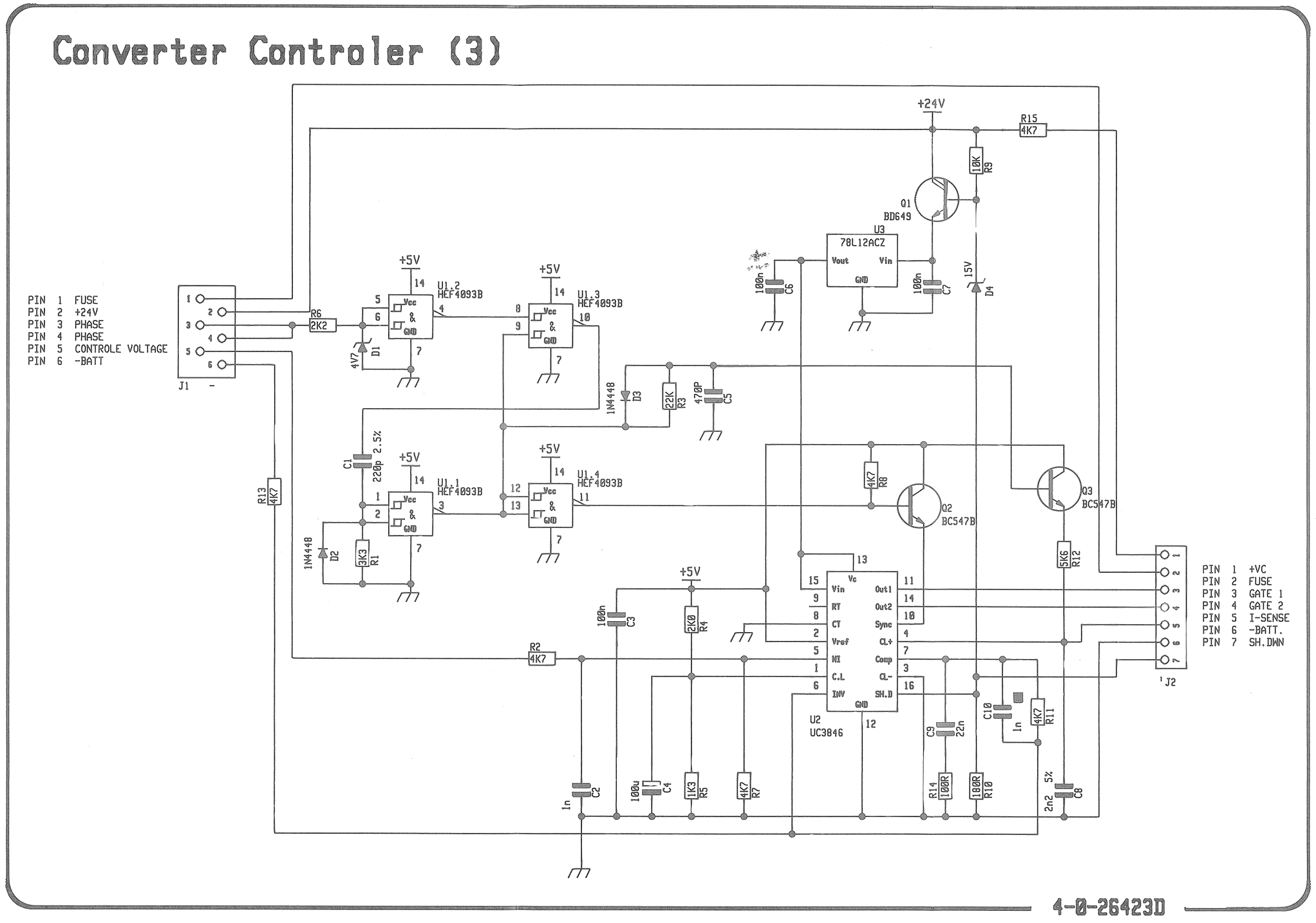


View from component side with upper side tracks.



View from component side with lower side tracks.

5-0-26423C / 4-6-26423C
PART V N2170 / 600W


Converter Controler (3)
PIN 1 FUSE
PIN 2 +24V
PIN 3 PHASE
PIN 4 PHASE
PIN 5 CONTROLE VOLTAGE
PIN 6 -BATT
J1
R6 2K2
D1 4V7
U1.2 HEF4093B
U1.3 HEF4093B
U1.1 HEF4093B
U1.4 HEF4093B
+5V
+24V
R15 4K7
R9 10K
Q1 BD649
U3 78L12ACZ
Vout
Vin
GND
C6 100n
C7 100n
D4 15V
D3 1N4448
R3 22K
C5 470P
C1 220p 2.5%
D2 1N4448
R1 3K3
R13 4K7
R8 4K7
Q2 BC547B
Q3 BC547B
R12 5K6
R2 4K7
C3 100n
R4 2K0
U2 UC3846
Vc
Vin
RT
CT
Vref
NI
C.L
INV
Out1
Out2
Sync
CL+
Comp
CL-
SH.D
C2 1n
C4 100u
R5 1K3
R7 4K7
C9 22n
R14 100R
R10 180R
C10 1n
R11 4K7
C8 2n2 5%
J2
PIN 1 +VC
PIN 2 FUSE
PIN 3 GATE 1
PIN 4 GATE 2
PIN 5 I-SENSE
PIN 6 -BATT.
PIN 7 SH.DWN
4-0-26423D

5.4. CONVERTER (MODULE 4) SP NO. 626424 FOR 42V CONVERTER SP NO. 726424 FOR 28V CONVERTER

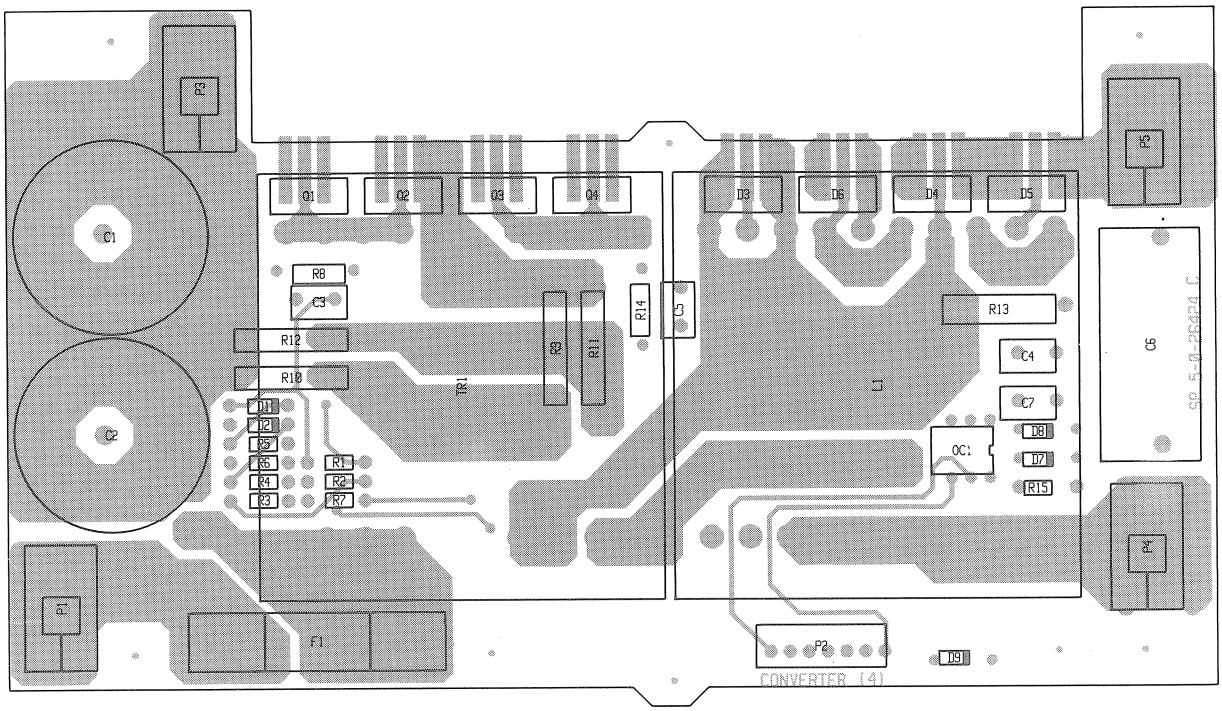
NOTICE:
For the converter module used as 42V converter, D9 must be placed in the module, and if the output voltage exceeds approx. 53V, OC1 conducts and sends a voltage signal to the converter controller module, which immediately shuts down the converter.
For the converter module used as 28V converter, D9 must be removed, which means that the trigger level is approx. 35V.

The gate signals from the converter controller module is connected to the two pairs of output transistors Q1 + Q2 and Q3 + Q4. The diodes D1 and D2 protect the gates against voltage spikes and the resistors R1 and R2 keep the output transistors off, if the connection with converter controller module is missing.
The resistors R3, R4, R5 and R6 protect against oscillation between the two transistors working as a pair.
R8, C3 and R14, C5 remove oscillations caused by leakage inductance of the output transformer.
The resistors R9 to R12 are used as current sense resistors. The signal is connected to the converter controller module via R7.
This resistor forms a lowpass filter together with capacitor C8 on the converter controller module.
A fuse control signal is connected via the converter controller module to the regulator module.
C1 and C2 are the energy reservoir.
The transformer TR1 transforms the pulse width regulated output signal to a higher voltage.
The diodes D3 to D6 form a full wave rectifier and the rectified current is used for charging the inductor L1 during the on period of the output transistors. During the off period, the diodes short–circuit the secondary of the transformer so the current running in L1 is able to continue.
The combination of C4 and R13 remove oscillations caused by the leakage inductance and the diode capacitances.
The capacitor C6 reduces the high frequency ripple.
In case of reverse polarity of the supply voltage the internal reverse diodes of the MOSFET's will blow the fuse F1.
The output of the converter module is connected to the input filter module.
The supply voltage to the converter module comes from the input filter module.
The optocoupler OC1 in conjunction with the diodes D7 to D9 forms an overvoltage protection circuit for the output voltage in case of a failure in the voltage regulation loop.

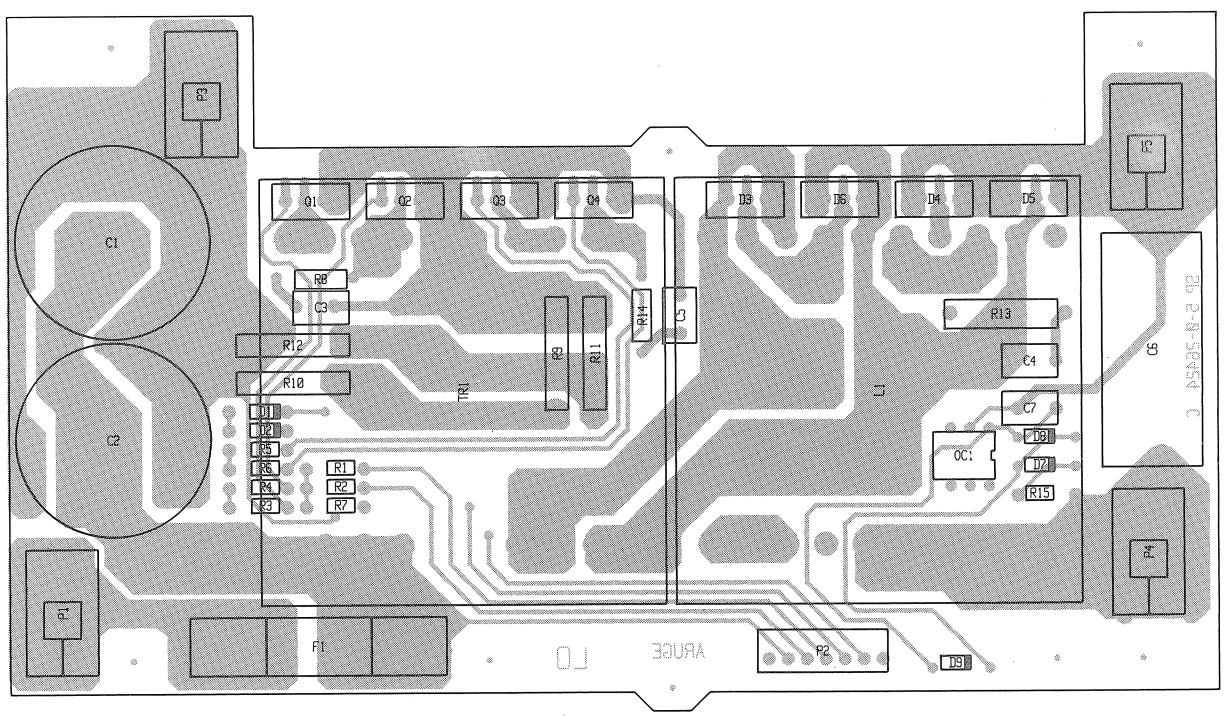
CONVERTER MODULE 4

5.4. CONVERTER (MODULE 4) cont.:

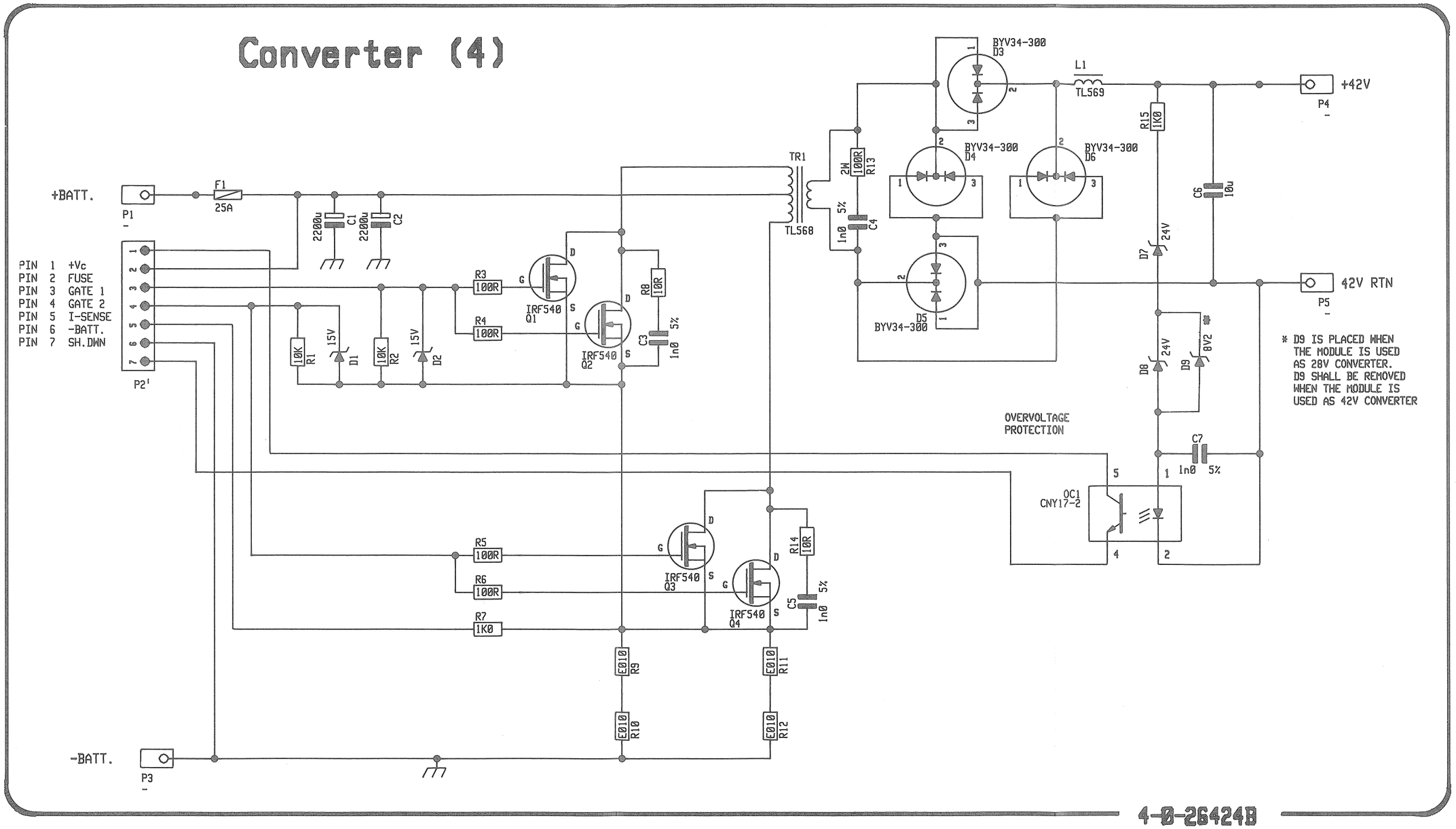
COMPONENT LOCATION CONVERTER MODULE 4.



View from component side with upper side tracks.



View from component side with lower side tracks.


Converter (4)
+BATT.
P1
F1
25A
2200u C1
2200u C2
PIN 1 +Vc
PIN 2 FUSE
PIN 3 GATE 1
PIN 4 GATE 2
PIN 5 I-SENSE
PIN 6 -BATT.
PIN 7 SH.DWN
P2
10K R1
15V D1
10K R2
15V D2
R3 100R
R4 100R
IRF540 Q1
IRF540 Q2
R8 10R
C3 1n0 5%
TR1
TL568
2W 100R R13
1n0 5% C4
BYV34-300 D3
BYV34-300 D4
BYV34-300 D5
BYV34-300 D6
L1
TL569
R15 1K0
C6 10u
D7 24V
D8 24V
D9 8V2 *
+42V
P4
42V RTN
P5
* D9 IS PLACED WHEN THE MODULE IS USED AS 28V CONVERTER. D9 SHALL BE REMOVED WHEN THE MODULE IS USED AS 42V CONVERTER
OVERVOLTAGE PROTECTION
C7 1n0 5%
OC1 CNY17-2
R5 100R
R6 100R
R7 1K0
IRF540 Q3
IRF540 Q4
R14 10R
C5 1n0 5%
E010 R9
E010 R10
E010 R11
E010 R12
-BATT.
P3
4-0-26424B

CONTENTS

7. PARTS LISTS

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	P.S.UNIT, DC, 600W, N2170	HF SSB PROGRAMME	ESPERA	0-0-26420	726420
BL1-1	FAN 24VDC	119x119x38mm	PAPST	4124 KX	60.100
-1	INPUT FILTER MODULE 1	N2170	ESPERA	5-0-26421A	626421
-2	28V & 42V REGULATOR MODUL	N2170	ESPERA	5-0-26422B	626422
-3a	CONVERTER CONTROLLER	MODULE (3) N2170	ESPERA	5-0-26423C	626423
-3b	CONVERTER CONTROLLER	MODULE (3) N2170	ESPERA	5-0-26423C	626423
-3c	CONVERTER CONTROLLER	MODULE (3) N2170	ESPERA	5-0-26423C	626423
-3d	CONVERTER CONTROLLER	MODULE (3) N2170	ESPERA	5-0-26423C	626423
-4a	CONVERTER MODULE 4	N2170	ESPERA	5-0-26424C	626424
-4b	CONVERTER MODULE 4	N2170	ESPERA	5-0-26424C	626424
-4c	CONVERTER MODULE 4	N2170	ESPERA	5-0-26424C	626424
-4d	CONVERTER MODULE 4d 28V	N2170	S.P.RADIO A/S	0-0-26424	726424
D2-1	DIODE POWER RECTIFIER	35A 100VDC	INT.RECTIFIER	1N1184R INCL.HARDWARE (1N1185R,-86R,-----,-90R)	25.165
F2-1	FUSE	50A 11x41mm	BOSCH	1 191 017 005 DIN 72 581 - B 50	45.702

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	INPUT FILTER MODULE 1	N2170	ESPERA	5-0-26421A	626421
	INPUT FILTER N2170	MODULE 1		5-0-26421A / 1-0-26421A	51.991
BL1-1	FAN 24VDC	119x119x38mm	PAPST	4124 KX	60.100
C1-1	CAPACITOR ELECTROLYTIC	2200uF -20/+50% 50VDC	ERO	EG 00 MG 422 H	14.725
C2-1	CAPACITOR ELECTROLYTIC	2200uF -20/+50% 50VDC	ERO	EG 00 MG 422 H	14.725
C3-1	CAPACITOR ELECTROLYTIC	2200uF -20/+50% 50VDC	ERO	EG 00 MG 422 H	14.725
C4-1	CAPACITOR ELECTROLYTIC	2200uF -20/+50% 50VDC	ERO	EG 00 MG 422 H	14.725
C5-1	CAPACITOR ELECTROLYTIC	2200uF -20/+50% 50VDC	ERO	EG 00 MG 422 H	14.725
C6-1	CAPACITOR MKT	10uF 10% 63VDC	PHILIPS	2222 373 21106	11.086
C7-1	CAPACITOR MKT	10uF 10% 63VDC	PHILIPS	2222 373 21106	11.086
C8-1	CAPACITOR MKT	10uF 10% 63VDC	PHILIPS	2222 373 21106	11.086
C9-1	CAPACITOR MKT	10uF 10% 63VDC	PHILIPS	2222 373 21106	11.086
C10-1	CAPACITOR MKT	10uF 10% 63VDC	PHILIPS	2222 373 21106	11.086
C11-1	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
D1-1	DIODE RECTIFIER	1N4002 100V/1A	THOMSON	1N4002 (03/04/05/06/07)	25.100
D2-1	DIODE POWER RECTIFIER	35A 100VDC	INT.RECTIFIER	1N1184R INCL.HARDWARE (1N1185R,-86R,-----,-90R)	25.165
F1-1	FUSE 5x20mm	315mA 250V TIME LAG	ELU	179 120 315mAT	45.502
F2-1	FUSE	50A 11x41mm	BOSCH	1 191 017 005 DIN 72 581 - B 50	45.702
P1-1	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P2-1	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P3-1	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P4-1	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P5-1	MULTI PLUG	2x8 POLES PCB VERSION	3M	3599-6002 / 7616-6002 JL	78.249
P6-1	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P7-1	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P8-1	PLUG	2 POLES	AMP	0-826375-2	78.102
P9-1	PLUG 2POLES		MOLEX	39-28-1023	78.215
P10-1	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P11-1	MULTIPLUG	2x6 POLES PCB VERSION	MOLEX	39-28-1123	78.221
P12-1	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P13-1	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
Q1-1	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
R1-1	RESISTOR	10 MILLI OHM 2W	MODULOHM	10U-J-MI-A-1	06.210
R2-1	RESISTOR	10 MILLI OHM 2W	MODULOHM	10U-J-MI-A-1	06.210
R3-1	RESISTOR	10 MILLI OHM 2W	MODULOHM	10U-J-MI-A-1	06.210
R4-1	RESISTOR	10 MILLI OHM 2W	MODULOHM	10U-J-MI-A-1	06.210
R5-1	RESISTOR	10 MILLI OHM 2W	MODULOHM	10U-J-MI-A-1	06.210
R6-1	RESISTOR	10 MILLI OHM 2W	MODULOHM	10U-J-MI-A-1	06.210
R7-1	RESISTOR	10 MILLI OHM 2W	MODULOHM	10U-J-MI-A-1	06.210
R8-1	RESISTOR MF	1k5 OHM 5% 0.33W	PHILIPS	2322 180 73152	02.476

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R9-1	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
RE1-1	RELAY	24VDC 2SH. 2A	ZETTLER	AZ 820-2C-24DE	21.327
TB1-1	THERMAL BREAKER	OFF: 90 centigrade	AIRPAX	67L090	44.075
TR1-1	CHOKE	TL434	B.B.ELEKTRONIK	6-0-24569D	400434
TR2-1	CHOKE	TL434	B.B.ELEKTRONIK	6-0-24569D	400434

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	28V & 42V REGULATOR MODUL	N2170	ESPERA	5-0-26422B	626422
C1-2	CAPACITOR POLYPROPYLENE	1nF 5% 10VDC	ERO	KP 1830-210/01-4-GW	13.398
C2-2	CAPACITOR POLYPROPYLENE	1nF 5% 10VDC	ERO	KP 1830-210/01-4-GW	13.398
C3-2	CAPACITOR POLYPROPYLENE	1nF 5% 10VDC	ERO	KP 1830-210/01-4-GW	13.398
C4-2	CAPACITOR POLYPROPYLENE	1nF 5% 10VDC	ERO	KP 1830-210/01-4-GW	13.398
C5-2	CAPACITOR POLYPROPYLENE	1nF 5% 10VDC	ERO	KP 1830-210/01-4-GW	13.398
C6-2	CAPACITOR POLYPROPYLENE	1nF 5% 10VDC	ERO	KP 1830-210/01-4-GW	13.398
C7-2	CAPACITOR POLYPROPYLENE	1nF 5% 10VDC	ERO	KP 1830-210/01-4-GW	13.398
C8-2	CAPACITOR POLYPROPYLENE	1nF 5% 10VDC	ERO	KP 1830-210/01-4-GW	13.398
C9-2	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C10-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C11-2	CAPACITOR ELECTROLYTIC	100uF 20% 10VDC	ERO	EKI 00 BB 310 C M9	14.607
C12-2	CAPACITOR MKT	1uF 5% 63VDC	PHILIPS	2222 370 79105	11.190
C13-2	CAPACITOR MKT	4n7F 10% 63VDC	PHILIPS	2222 370 88472	11.374
C14-2	CAPACITOR MKT	1uF 5% 63VDC	PHILIPS	2222 370 79105	11.190
C15-2	CAPACITOR MKT	4n7F 10% 63VDC	PHILIPS	2222 370 88472	11.374
C16-2	CAPACITOR POLYPROPYLENE	2n2F 5% 100VDC	* ERO	KP 1830-222/01-4-GW	13.400
C17-2	CAPACITOR ELECTROLYTIC	100uF 20% 10VDC	ERO	EKI 00 BB 310 C M9	14.607
C18-2	CAPACITOR ELECTROLYTIC	100uF 20% 10VDC	ERO	EKI 00 BB 310 C M9	14.607
C19-2	CAPACITOR CERAMIC	100 PF 5% N150 50VDC	KCK	RT-HE80-SK PH 101 J AMMO PACK	15.133
C20-2	CAPACITOR CERAMIC	100 PF 5% N150 50VDC	KCK	RT-HE80-SK PH 101 J AMMO PACK	15.133
C21-2	CAPACITOR POLYPROPYLENE	2n2F 5% 100VDC	* ERO	KP 1830-222/01-4-GW	13.400
C22-2	CAPACITOR ELECTROLYTIC	100uF -20/+50% 63VDC	ERO	EKM 05 DE 310 J 05	14.620
C23-2	CAPACITOR CERAMIC	100 PF 5% N150 50VDC	KCK	RT-HE80-SK PH 101 J AMMO PACK	15.133
C24-2	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C25-2	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C26-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C27-2	CAPACITOR MKT	4n7F 10% 63VDC	PHILIPS	2222 370 88472	11.374
C28-2	CAPACITOR MKT	100nF 5% 63VDC	PHILIPS	2222 370 79104	11.135
C29-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C30-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C31-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
D1-2	DIODE ZENER	5V6 5% 0.4W	PHILIPS	BZX79C5V6	26.530
D2-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D3-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D4-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D5-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D6-2	DIODE ZENER	5V6 5% 0.4W	PHILIPS	BZX79C5V6	26.530
D7-2	DIODE ZENER	9V1 5% 0.4W	PHILIPS	BZX79C9V1	26.546

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
D8-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D9-2	DIODE ZENER	13V 5% 5W	MOTOROLA	1N5350B	26.966
D10-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D11-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D12-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D13-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D14-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D15-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D16-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D17-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D18-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D19-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D20-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D21-2	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
J1-2	SOCKET	2x3 POLES	AMP	0-215079-6	78.192
J2-2	SOCKET	2x3 POLES	AMP	0-215079-6	78.192
J3-2	SOCKET	2x3 POLES	AMP	0-215079-6	78.192
J4-2	SOCKET	2x3 POLES	AMP	0-215079-6	78.192
OC1-2	OPTO COUPLER	CNY17-2	TOSHIBA	CNY 17-2	32.530
OC2-2	OPTO COUPLER	CNY17-2	TOSHIBA	CNY 17-2	32.530
OC3-2	OPTO COUPLER	CNY17-2	TOSHIBA	CNY 17-2	32.530
OC4-2	OPTO COUPLER	CNY17-2	TOSHIBA	CNY 17-2	32.530
P1-2	MULTI PLUG	2x8 POLES PCB VERSION	3M	3599-6002 / 7616-6002 JL	78.249
Q1-2	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
Q2-2	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
Q3-2	TRANSISTOR	BD680	MOTOROLA*	BD680	29.338
Q4-2	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
Q5-2	TRANSISTOR	BC557	MOTOROLA*	BC557 A/B/C	28.087
Q6-2	TRANSISTOR	BC557	MOTOROLA*	BC557 A/B/C	28.087
Q7-2	TRANSISTOR	BC557	MOTOROLA*	BC557 A/B/C	28.087
Q8-2	TRANSISTOR	BC557	MOTOROLA*	BC557 A/B/C	28.087
Q9-2	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
Q10-2	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
Q11-2	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
Q12-2	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
R1-2	RESISTOR MF	1k00 OHM 1% 0.25W	PHILIPS	2322 157 11002	02.200
R2-2	RESISTOR MF	1k00 OHM 1% 0.25W	PHILIPS	2322 157 11002	02.200
R3-2	RESISTOR MF	18k2 OHM 1% 0.6W	PHILIPS	2322 156 11823	03.431
R4-2	RESISTOR MF	18k2 OHM 1% 0.6W	PHILIPS	2322 156 11823	03.431
R5-2	RESISTOR MF	1k00 OHM 1% 0.25W	PHILIPS	2322 157 11002	02.200

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R6-2	RESISTOR MF	1k00 OHM 1% 0.25W	PHILIPS	2322 157 11002	02.200
R7-2	RESISTOR MF	12k OHM 5% 0.4W	PHILIPS	2322 181 53123	01.227
R8-2	RESISTOR MF	12k OHM 5% 0.4W	PHILIPS	2322 181 53123	01.227
R9-2	RESISTOR MF	22k1 OHM 1% 0.25W	PHILIPS	2322 157 12213	02.234
R10-2	RESISTOR MF	22k1 OHM 1% 0.25W	PHILIPS	2322 157 12213	02.234
R11-2	RESISTOR MF	3k01 OHM 1% 0.6W	PHILIPS	2322 156 13012	03.411
R12-2	RESISTOR MF	3k01 OHM 1% 0.6W	PHILIPS	2322 156 13012	03.411
R13-2	RESISTOR MF	27k OHM 5% 0.33W	PHILIPS	2322 180 73273	02.506
R14-2	RESISTOR MF	27k OHM 5% 0.33W	PHILIPS	2322 180 73273	02.506
R15-2	RESISTOR MF	3k01 OHM 1% 0.6W	PHILIPS	2322 156 13012	03.411
R16-2	RESISTOR MF	3k01 OHM 1% 0.6W	PHILIPS	2322 156 13012	03.411
R17-2	RESISTOR MF	2k2 OHM 5% 0.33W	PHILIPS	2322 180 73222	02.480
R18-2	RESISTOR MF	220 OHM 5% 0.33W	PHILIPS	2322 180 73221	02.456
R19-2	RESISTOR MF	220 OHM 5% 0.33W	PHILIPS	2322 180 73221	02.456
R20-2	RESISTOR MF	220 OHM 5% 0.33W	PHILIPS	2322 180 73221	02.456
R21-2	RESISTOR MF	220 OHM 5% 0.33W	PHILIPS	2322 180 73221	02.456
R22-2	RESISTOR MF	470 OHM 5% 0.33W	PHILIPS	2322 180 73471	02.464
R23-2	PRESET CERMET	2k0 OHM 5% 0.5W	BOURNS	3386P-1-202-11	07.887
R24-2	RESISTOR MF	560 OHM 5% 0.4W	PHILIPS	2322 181 53561	01.193
R25-2	PRESET CERMET	2k0 OHM 5% 0.5W	BOURNS	3386P-1-202-11	07.887
R26-2	RESISTOR MF	470 OHM 5% 0.33W	PHILIPS	2322 180 73471	02.464
R27-2	PRESET CERMET	2k0 OHM 5% 0.5W	BOURNS	3386P-1-202-11	07.887
R28-2	RESISTOR MF	470 OHM 5% 0.33W	PHILIPS	2322 180 73471	02.464
R29-2	PRESET CERMET	2k0 OHM 5% 0.5W	BOURNS	3386P-1-202-11	07.887
R30-2	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R31-2	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R32-2	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R33-2	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R34-2	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R35-2	RESISTOR MF	33k OHM 5% 0.33W	PHILIPS	2322 180 73333	02.508
R36-2	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R37-2	RESISTOR MF	33k OHM 5% 0.33W	PHILIPS	2322 180 73333	02.508
R38-2	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R39-2	RESISTOR MF	1k5 OHM 5% 0.33W	PHILIPS	2322 180 73152	02.476
R40-2	RESISTOR MF	470 OHM 5% 0.33W	PHILIPS	2322 180 73471	02.464
R41-2	RESISTOR MF	1k8 OHM 5% 0.33W	PHILIPS	2322 180 73182	02.478
R42-2	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R43-2	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R44-2	RESISTOR MF	1k5 OHM 5% 0.33W	PHILIPS	2322 180 73152	02.476
R45-2	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R46-2	RESISTOR MF	470 OHM 5% 0.33W	PHILIPS	2322 180 73471	02.464
R47-2	RESISTOR MF	1k8 OHM 5% 0.33W	PHILIPS	2322 180 73182	02.478
R48-2	RESISTOR PMF	680 OHM 5% 2W	PHILIPS	2322 191 36801	04.195
R49-2	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R50-2	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R51-2	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R52-2	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R53-2	RESISTOR PMF	680 OHM 5% 2W	PHILIPS	2322 191 36801	04.195
R54-2	RESISTOR PMF	470 OHM 5% 2W	PHILIPS	2322 194 13471	04.191
R55-2	RESISTOR MF	7k5 OHM 5% 0.33W	PHILIPS	2322 180 73752	02.493
R56-2	RESISTOR MF	3k9 OHM 5% 0.33W	PHILIPS	2322 180 73392	02.486
R57-2	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R58-2	RESISTOR MF	10k0 OHM 1% 0.6W	* PHILIPS	2322 156 11003	03.427
R59-2	RESISTOR MF	100k OHM 5% 0.33W	PHILIPS	2322 180 73104	02.520
R60-2	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R61-2	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R62-2	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R63-2	RESISTOR MF	2k2 OHM 5% 0.33W	PHILIPS	2322 180 73222	02.480
R64-2	RESISTOR MF	2k2 OHM 5% 0.33W	PHILIPS	2322 180 73222	02.480
R65-2	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R66-2	RESISTOR MF	33k OHM 5% 0.33W	PHILIPS	2322 180 73333	02.508
R67-2	RESISTOR MF	3k3 OHM 5% 0.33W	PHILIPS	2322 180 73332	02.484
R68-2	RESISTOR MF	47k OHM 5% 0.33W	PHILIPS	2322 180 73473	02.512
R69-2	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R70-2	RESISTOR MF	100k OHM 5% 0.33W	PHILIPS	2322 180 73104	02.520
R71-2	RESISTOR MF	1k5 OHM 5% 0.33W	PHILIPS	2322 180 73152	02.476
R72-2	RESISTOR MF	100k OHM 5% 0.33W	PHILIPS	2322 180 73104	02.520
R73-2	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R74-2	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R75-2	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R76-2	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R77-2	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R78-2	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R79-2	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R80-2	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R81-2	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R82-2	RESISTOR MF	3k3 OHM 5% 0.33W	PHILIPS	2322 180 73332	02.484
R83-2	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R84-2	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R85-2	RESISTOR MF	3k3 OHM 5% 0.33W	PHILIPS	2322 180 73332	02.484
R86-2	RESISTOR MF	3k3 OHM 5% 0.33W	PHILIPS	2322 180 73332	02.484
R87-2	RESISTOR MF	3k3 OHM 5% 0.33W	PHILIPS	2322 180 73332	02.484
R88-2	RESISTOR MF	8k2 OHM 5% 0.33W	PHILIPS	2322 180 73822	02.494
R89-2	RESISTOR MF	8k2 OHM 5% 0.33W	PHILIPS	2322 180 73822	02.494
R90-2	RESISTOR MF	3k3 OHM 5% 0.33W	PHILIPS	2322 180 73332	02.484
R91-2	RESISTOR MF	1k5 OHM 5% 0.33W	PHILIPS	2322 180 73152	02.476
R92-2	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R93-2	RESISTOR MF	1k5 OHM 5% 0.33W	PHILIPS	2322 180 73152	02.476

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R94-2	RESISTOR MF	1k5 OHM 5% 0.33W	PHILIPS	2322 180 73152	02.476
R95-2	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R96-2	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R97-2	RESISTOR MF	1k5 OHM 5% 0.33W	PHILIPS	2322 180 73152	02.476
U1-2	DUAL OP AMP	LM358N	TEXAS	LM358P	31.100
U2-2	DUAL OP AMP	LM358N	TEXAS	LM358P	31.100
U3-2	DUAL OP AMP	LM358N	TEXAS	LM358P	31.100
U4-2	DUAL OP AMP	LM358N	TEXAS	LM358P	31.100
U5-2	DUAL OP AMP	LM358N	TEXAS	LM358P	31.100
U6-2	DUAL OP AMP	LM358N	TEXAS	LM358P	31.100
U7-2	CD4047B		??????	CD4047B	33.165
U8-2	INTEGRATED CIRCUIT	MC14017BCP	PHILIPS*	HEF4017BP	33.085
U9-2	QUAD 2-INP.NAND SCHM.TRI	MC14093BCP	SIGNETICS*	HEF 4093 BP	33.300

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	CONVERTER CONTROLLER	MODULE (3) N2170	ESPERA	5-0-26423C	626423
C1-3	CAPACITOR POLYPROPYLENE	220pF 2.5% 100VDC	* WIMA	FKP2 220pF/2.5%/100V AMMO PACK H=18.5mm	13.394
C2-3	CAPACITOR POLYPROPYLENE	1nF 5% 10VDC	ERO	KP 1830-210/01-4-GW	13.398
C3-3	CAPACITOR MKT	100nF 5% 63VDC	PHILIPS	2222 370 79104	11.135
C4-3	CAPACITOR ELECTROLYTIC	100uF 20% 10VDC	ERO	EKI 00 BB 310 C M9	14.607
C5-3	CAPACITOR CERAMIC	470pF 10% 500VDC	NKE	DT35-0465 758L 471BK 500V FLAT PACK	16.095
C6-3	CAPACITOR MKT	100nF 5% 63VDC	PHILIPS	2222 370 79104	11.135
C7-3	CAPACITOR MKT	100nF 5% 63VDC	PHILIPS	2222 370 79104	11.135
C8-3	CAPACITOR POLYPROPYLENE	2n2F 5% 100VDC	* ERO	KP 1830-222/01-4-GW	13.400
C9-3	CAPACITOR MKT	22nF 10% 100VDC	PHILIPS	2222 370 88223	11.175
C10-3	CAPACITOR POLYPROPYLENE	1nF 5% 10VDC	ERO	KP 1830-210/01-4-GW	13.398
D1-3	DIODE ZENER	4.7V 5% 0.4W	PHILIPS	BZX79C4V7	26.524
D2-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D3-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D4-3	DIODE ZENER	15V 5% 0.4W	PHILIPS	BZX79C15	26.561
J1-3	SOCKET	2x3 POLES	AMP	0-215079-6	78.192
J2-3			AMP	0-0164711-7	78.035
R1-3	RESISTOR MF	3k3 OHM 5% 0.33W	PHILIPS	2322 180 73332	02.484
R2-3	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R3-3	RESISTOR MF	22k OHM 5% 0.33W	PHILIPS	2322 180 73223	02.504
R4-3	RESISTOR MF	2k0 OHM 1% 0.6W	* PHILIPS	2322 156 12002	03.403
R5-3	RESISTOR MF	1k3 OHM 1% 0.6W	* PHILIPS	2322 156 11302	03.402
R6-3	RESISTOR MF	2k2 OHM 5% 0.33W	PHILIPS	2322 180 73222	02.480
R7-3	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R8-3	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R9-3	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R10-3	RESISTOR MF	180 OHM 5% 0.33W	PHILIPS	2322 180 73181	02.454
R11-3	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R12-3	RESISTOR MF	5k6 OHM 5% 0.33W	PHILIPS	2322 180 73562	02.490
R13-3	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R14-3	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R15-3	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
Q1-3	TRANSISTOR AF POWER	DARLINGTON NPN BD649/901	PHILIPS	BD649	29.085
Q2-3	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
Q3-3	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
U1-3	QUAD 2-INP.NAND SCHM.TRI	MC14093BCP	SIGNETICS*	HEF 4093 BP	33.300
U2-3	CURRENT MODE PWM CONTROL.	UC3846	UNITRODE	UC3846	31.486
U3-3	VOLTAGE REGULATOR	12V 5% 0.1A	MOTOROLA	MC78L12ACP	31.139

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	CONVERTER MODULE 4	N2170	ESPERA	5-0-26424C	626424
C1-4	CAPACITOR ELECTROLYTIC	2200uF -20/+50% 63VDC	PHILIPS	2222 021 48222	14.733
C2-4	CAPACITOR ELECTROLYTIC	2200uF -20/+50% 63VDC	PHILIPS	2222 021 48222	14.733
C3-4	CAPACITOR POLYPROPYLENE	1nF 5% 10VDC	ERO	KP 1830-210/01-4-GW	13.398
C4-4	CAPACITOR POLYPROPYLENE	1nF 5% 10VDC	ERO	KP 1830-210/01-4-GW	13.398
C5-4	CAPACITOR POLYPROPYLENE	1nF 5% 10VDC	ERO	KP 1830-210/01-4-GW	13.398
C6-4	CAPACITOR MKT	10uF 10% 63VDC	PHILIPS	2222 373 21106	11.086
C7-4	CAPACITOR POLYPROPYLENE	1nF 5% 10VDC	ERO	KP 1830-210/01-4-GW	13.398
D1-4	DIODE ZENER	15V 5% 0.4W	PHILIPS	BZX79C15	26.561
D2-4	DIODE ZENER	15V 5% 0.4W	PHILIPS	BZX79C15	26.561
D3-4	DIODE DUAL	2x10A/300VDC TO-220	PHILIPS	BYV34-300 (-400;-500)	27.158
D4-4	DIODE DUAL	2x10A/300VDC TO-220	PHILIPS	BYV34-300 (-400;-500)	27.158
D5-4	DIODE DUAL	2x10A/300VDC TO-220	PHILIPS	BYV34-300 (-400;-500)	27.158
D6-4	DIODE DUAL	2x10A/300VDC TO-220	PHILIPS	BYV34-300 (-400;-500)	27.158
D7-4	DIODE ZENER	24V 5% 0.4W BZX79C24	PHILIPS	BZX79C24	26.572
D8-4	DIODE ZENER	24V 5% 0.4W BZX79C24	PHILIPS	BZX79C24	26.572
D9-4	DIODE ZENER	8V2 5% 0.4W	PHILIPS	BZX79C8V2	26.542
F1-4	25A M6,3x32	FUSE	WICKMANN	314025	45.632
L1-4	SMPS CHOKE FOR N2170	TL569	S.P.RADIO	6-0-27005	400569
OC1-4	OPTO COUPLER	CNY17-2	TOSHIBA	CNY 17-2	32.530
P1-4	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P2-4			AMP	0-0164713-7	78.040
P3-4	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P4-4	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P5-4	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
Q1-4	TRANSISTOR POWER MOSFET	N-CHANNEL 100V/27A/85mOHM	MOTOROLA	IRF540	29.402
Q2-4	TRANSISTOR POWER MOSFET	N-CHANNEL 100V/27A/85mOHM	MOTOROLA	IRF540	29.402
Q3-4	TRANSISTOR POWER MOSFET	N-CHANNEL 100V/27A/85mOHM	MOTOROLA	IRF540	29.402
Q4-4	TRANSISTOR POWER MOSFET	N-CHANNEL 100V/27A/85mOHM	MOTOROLA	IRF540	29.402
R1-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R2-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R3-4	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R4-4	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R5-4	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R6-4	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448
R7-4	RESISTOR MF	1kO OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R8-4	RESISTOR MF	10 OHM 5% 0.4W	PHILIPS	2322 181 53109	01.150
R9-4	RESISTOR	10 MILLI OHM 2W	MODULOHM	10U-J-MI-A-1	06.210
R10-4	RESISTOR	10 MILLI OHM 2W	MODULOHM	10U-J-MI-A-1	06.210
R11-4	RESISTOR	10 MILLI OHM 2W	MODULOHM	10U-J-MI-A-1	06.210
R12-4	RESISTOR	10 MILLI OHM 2W	MODULOHM	10U-J-MI-A-1	06.210
R13-4	RESISTOR PMF	100 OHM 5% 2W	PHILIPS	2322 194 13101	04.175

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R14-4	RESISTOR MF	10 OHM 5% 0.4W	PHILIPS	2322 181 53109	01.150
R15-4	RESISTOR MF	1kO OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
TR1-4	SMPS TRAFO FOR N2170	TL568	S.P.RADIO	6-0-27004	400568

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	CONVERTER MODULE 4d 28V	N2170	S.P.RADIO A/S	0-0-26424	726424
-4d	CONVERTER MODULE 4	N2170	ESPERA	5-0-26424C	626424
D9-4	DIODE ZENER	8V2 5% 0.4W	PHILIPS	BZX79C8V2	26.542

INSTRUCTION BOOK FOR POWER SUPPLY UNIT 220V AC 600W
(N2171) SP NO. 726430

CONTENTS

1. INTRODUCTION
1.1. PRINCIPLE OF OPERATION AND BLOCK DIAGRAM

2. INSTALLATION
2.1. ELECTRICAL CONNECTION AND ASSEMBLING
2.1.1. CONNECTION TO N2171 600W
2.1.2. CONNECTION TO N2171 DUAL

3. SERVICE
3.1. MAINTENANCE
3.2. RECOMMENDED TEST EQUIPMENT
3.3. TROUBLE SHOOTING
3.4. PERFORMANCE CHECK
3.4.1. PERFORMANCE CHECK OF 28V AND 42V OUTPUT VOLTAGES
3.4.2. PERFORMANCE CHECK OF 42V CURRENT LIMITER
3.5. NECESSARY CHECK AND ADJUSTMENT AFTER REPAIR

4. MECHANICAL DESCRIPTION
4.1. MECHANICAL DISASSEMBLING AND MODULE LOCATION

5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS
5.1. 28V REGULATOR (MODULE 1) SP NO. 626431
5.2. 42V REGULATOR (MODULE 2) SP NP. 626432
5.3. MAIN SCHEMATIC DIAGRAM

6.

7. PARTS LISTS

CONTENTS

1. INTRODUCTION

1.1. PRINCIPLE OF OPERATION AND BLOCK DIAGRAM

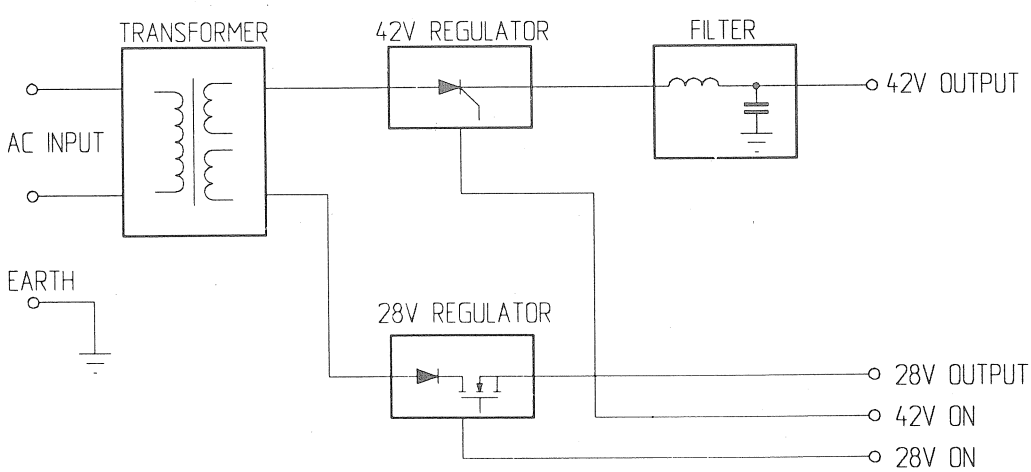
1. INTRODUCTION

This section gives you all necessary information to make service of this unit down to component level.

1.1. PRINCIPLE OF OPERATION

The power supply N2171 is an insulated thyristor rectifier with two thyristors placed on the secondary side of a main transformer to minimize the interference into the mains.
The mains voltage is transformed down to two secondary voltages. One for producing a 28V DC voltage and the other for producing a 42V DC voltage. The 28V output voltage is stabilized by an ordinary series regulator module with MOSFET's.
The 42V output is stabilized by a regulator module which contains a thyristor regulated rectifier bridge. This module measures the output voltage and controls the turn–on time for the thyristors. The output from the rectifier is incomplete sine waves.
These pulses are then filtered by an output LC–filter to give a DC voltage.
The 42V module has a current limiter which reduces the output voltage if the current is too high.
Both the 28V and the 42V outputs can be switched on and off separately and is controlled by a microprocessor.
To cool the power supply, a blower is switched on simultaneously with both output voltages. If the temperature gets too high when only the 28V is switched on, a thermal breaker turns on the blower. In case of blower failure another thermal breaker turns off the 28V until the temperature is low again.

BLOCKDIAGRAMME FOR N2171



CONTENTS

2. INSTALLATION

2.1. ELECTRICAL CONNECTION AND ASSEMBLING

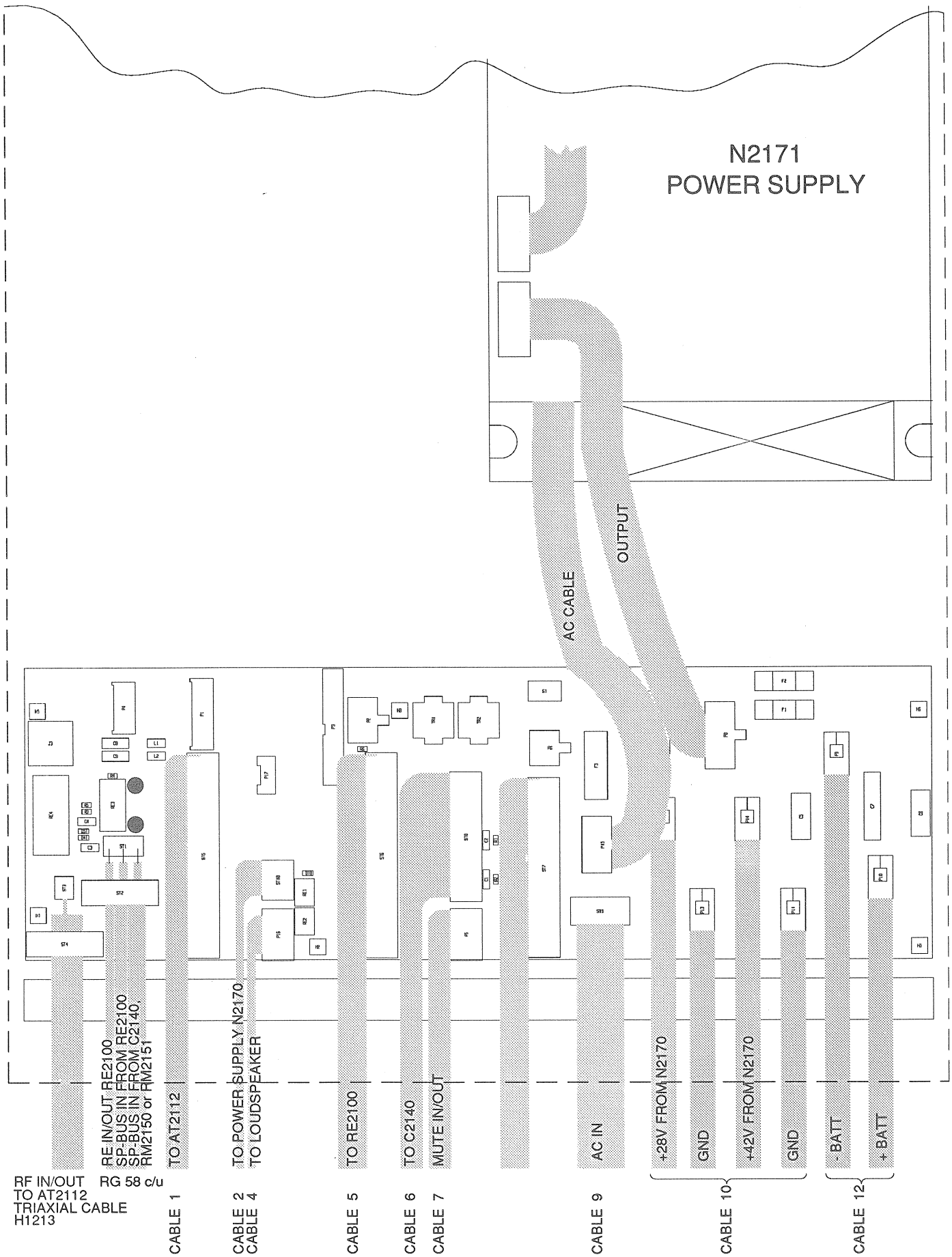
For 600W HF SSB: Cable dimensions and connections, see book for 600W Part I.

For 1200W HF SSB: Cable Dimensions and connections, see book for 1200W Part I.

2.1.1. CONNECTION TO N2171 600W

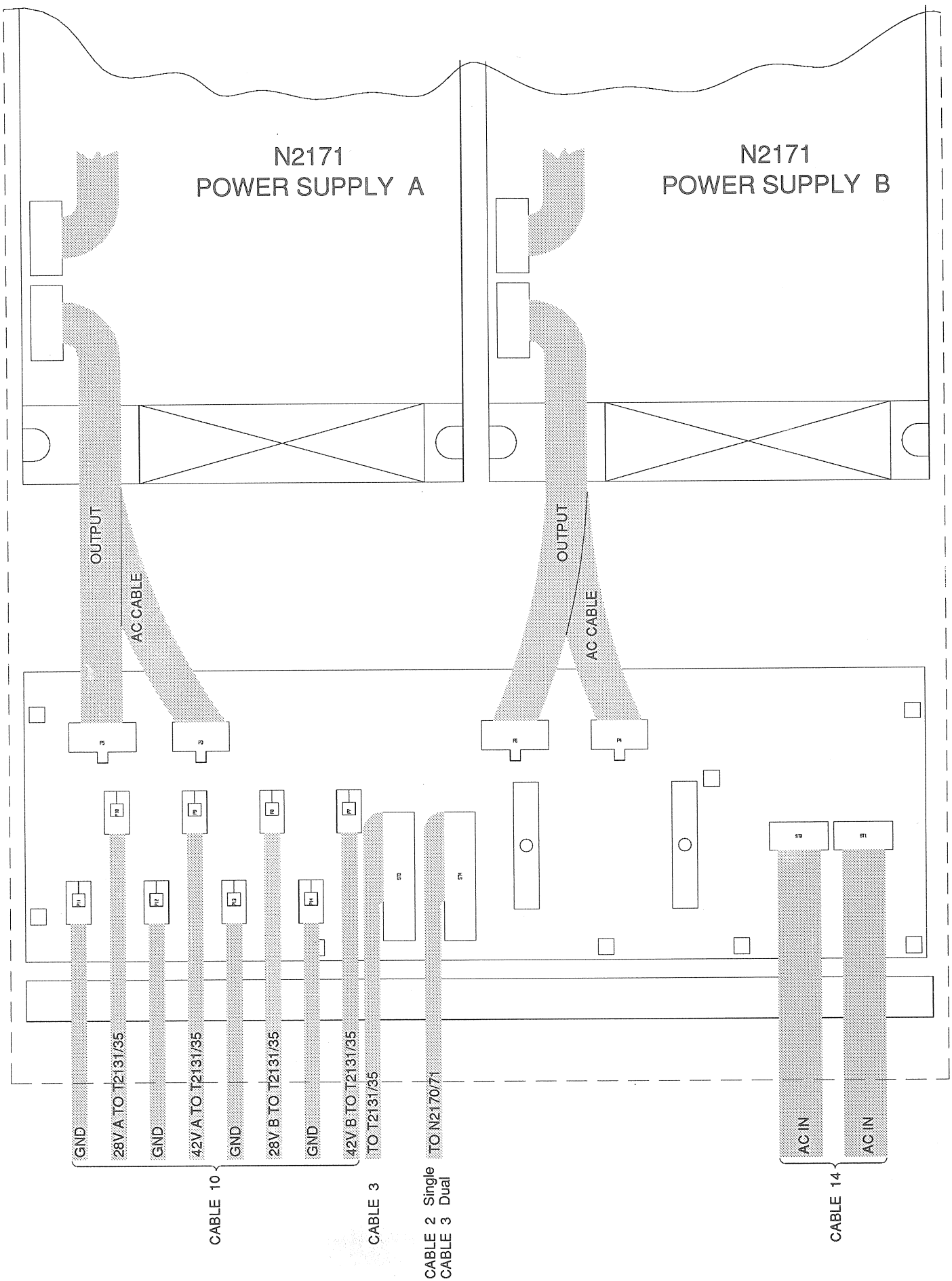
2.1.2. CONNECTION TO N2171 DUAL

2.1.1. CONNECTION TO N2171 600W



FOR CABLE DIMENSIONS: SEE PART I

2.1.2. CONNECTION TO N2171 DUAL



FOR CABLE DIMENSIONS: SEE PART I

CONTENTS

3. SERVICE
3.1. MAINTENANCE
3.2. RECOMMENDED TEST EQUIPMENT
3.3. TROUBLE SHOOTING
3.4. PERFORMANCE CHECK
3.4.1. PERFORMANCE CHECK OF 28V AND 42V OUTPUT VOLTAGES
3.4.2. PERFORMANCE CHECK OF 42V CURRENT LIMITER
3.5. NECESSARY CHECK AND ADJUSTMENT AFTER REPAIR

3. SERVICE

3.1. MAINTENANCE

When the SAILOR N2171 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 section 3.4. PERFORMANCE CHECK.
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 3.5. NECESSARY ADJUSTMENT AND CHECK AFTER REPAIR.

3.2. RECOMMENDED TEST EQUIPMENT

Multimeter	Philips PM2518X
Oscilloscope	Philips PM3214

3.3. TROUBLE SHOOTING

Trouble shooting, repair and check of the N2171 should only be performed by persons, who have the sufficient technical knowledge and the necessary test equipment at their disposal.
To do some service on the 28V regulator (module 1), the blower frame can be turned upwards and placed in a service position (see chapter 4.1. MECHANICAL DISASSEMBLING AND MODULE LOCATION). When placed in service position, AC mains may be connected and the N2171 can work normally even with full load.

1. The 28V output is too high:
   a) A regulator FET (Q1 to Q4) is short-circuited.
   b) Regulation circuit is out of order.

2. No output voltage at 28V and 42V output:
   a) Fuse F1 or fuse F2 is blown.

3. No 28V output:
   a) The thermal breaker TB1-3 is activated (maybe blower failure), heatsink too hot.

4. The blower is always running:
   a) The 28V is loaded too much in receive mode for the set, which activates the thermal breaker TB2-3. With normal load (less than 3A) on the 28V output in receive mode, the blower starts and stops frequently.
   b) The 42V regulator module is always switched on.
   c) Failure in the blower circuit, the transistor Q6-1 is short-circuited.

3.4. PERFORMANCE CHECK

To handle the performance check in an easy way it is recommended to connect the N2171 to a disconnected connection board (module 5 or module 13).

Any value, which differs too much from the values given in this chapter, should lead to a repair of the circuit or module in question.
Hints to locate some faults are given in the chapter 3.3. TROUBLE SHOOTING.

3.4.1. PERFORMANCE CHECK OF 28V AND 42V OUTPUT

1. Connect the N2171 to the AC mains, which it is strapped for. See 5.3. MAIN SCHEMATIC DIAGRAM. Normally the N2171 is strapped for 220V AC.

2. Connect a small dummy load to the 42V output. A resistor of 330 ohm/6W is sufficient to get a proper regulation.

3. To switch on the outputs, an external 15V supply can be connected to the 28V ON, and the 42V ON terminals.
An alternative is to connect a wire to the 15V regulator U1–2 pin 3 and then connect it to the 28V ON and the 42V ON terminals.

4. With a voltmeter across the outputs, read the 28V output to 27.0V ±1V with no load connected.
Read the 42V output to 42.2V ±0,5V.
Check that the blower is running while the outputs are switched on.

3.4.2. PERFORMANCE CHECK OF 42V CURRENT LIMITER

1. A new dummy load of 1,46 ohm/1000W is connected to the 42V output. It can be made by parallelling several resistors.

2. Switch on <u>both</u> outputs to start the blower.
With a voltmeter read the 42V output to 36,5 ±1V. The output current is then limited to 25A.
If load is suddenly removed, the 42V output voltage can rise to approx. 50V for a while. This is normal and do no harm.
Check with an oscilloscope the output ripple to max. 2,5V_{pp} at full load.

3. There is no current limiter for the 28V output, but the 28V regulator module should be able to deliver 7,5A with a voltage drop of approx. 1V.
Check with an oscilloscope the output ripple to max. 0,3V_{pp} at full load.

3.5. NECESSARY CHECK AND ADJUSTMENT AFTER REPAIR

Change or repair of the 28V regulator (module 1) or the 42V regulator (module 2):

Execute chapter 3.4.1. PERFORMANCE CHECK OF 28V AND 42V OUTPUT and adjust if necessary the 42V to 42,2 ±0,2V DC with R11–2.
There is no adjustment for the 28V output.
Execute chapter 3.4.2. PERFORMANCE CHECK OF 42V CURRENT LIMITER and adjust if necessary the 42V current limiter with R42–2 to give an output voltage of 36,5V ±0,2V DC at a full load of 25A.
Check with an oscilloscope the output ripple to max. 2,5V_{pp} at full load.
Check also the 28V output ripple to max. 0,3V_{pp} at a load of 7,5A.

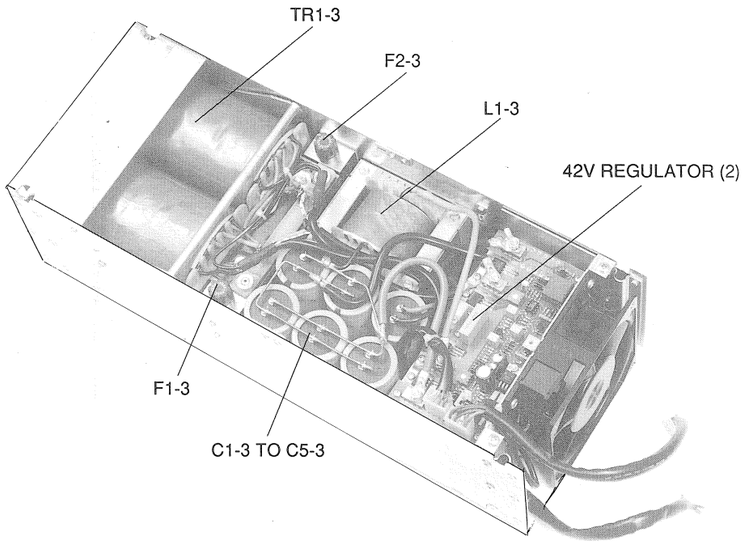
CONTENTS

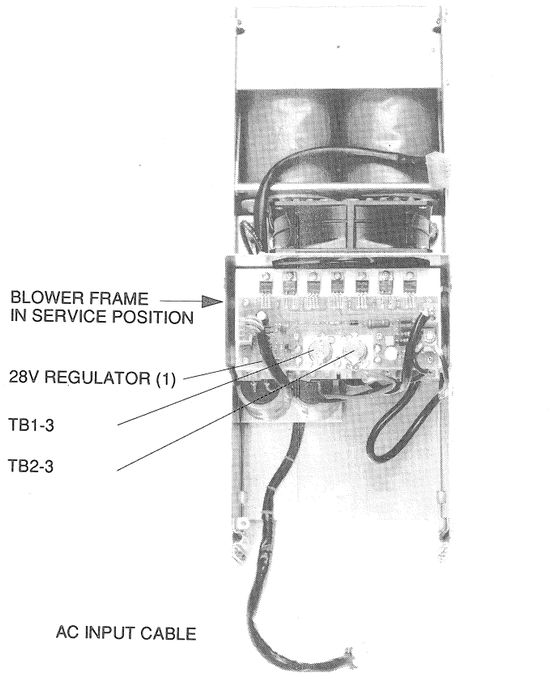
4. MECHANICAL DESCRIPTION

4.1. MECHANICAL DISASSEMBLING AND MODULE LOCATION

4. MECAHNICAL DESCRIPTION

4.1. MECHANICAL DISASSEMBLING AND MODULE LOCATION





CONTENTS

5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS
5.1. 28V REGULATOR (MODULE 1) SP NO. 626431
5.2. 42V REGULATOR (MODULE 2) SP NP. 626432
5.3. MAIN SCHEMATIC DIAGRAM

5.1. 28V REGULATOR (MODULE 1) SP NO. 626431

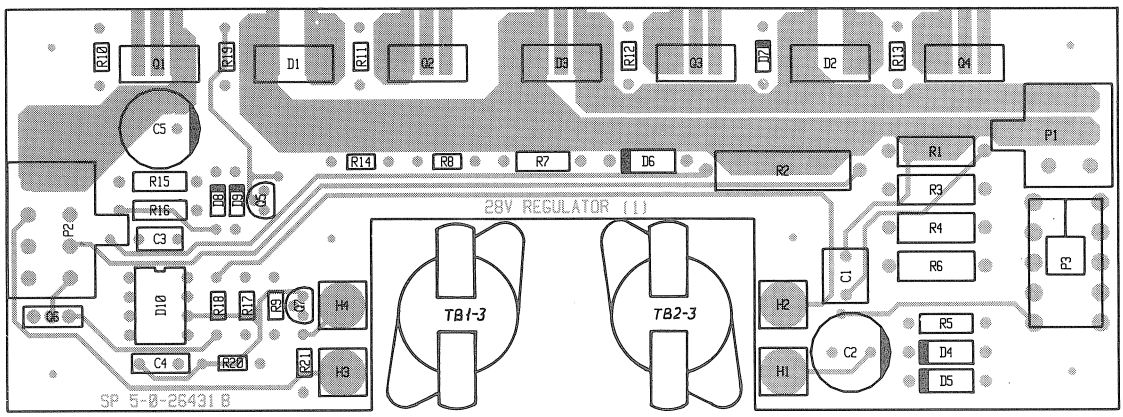
The 32V AC from the mains transformer TR1–3 is led to the bridge rectifier D1, D2 and D3. The current is led to a smoothing capacitor C6–3 and to the regulator FET's Q1 to Q4, which control the output voltage, determined by the resistors R15 and R16.
If the output voltage increases, it causes the regulator diode D10 to open more, which will lower the gate voltages to the FET's. The FET's will close more and the output voltage falls.
If the output voltage should decrease, the circuit works in the opposite way. It is necessary that the gate voltage is higher than the output voltage. This is done by connecting D4 and D5 to the 54V AC from the mains transformer TR1–3 and stabilizing it by means of R4, R6, C2 and D6. The gate voltage can be turned on or off by means of Q5 and Q7, and thus also the output voltage. The 28V on/off signal is produced by the TX processor.

The diodes D7 and D8 are protecting diodes.
The resistors R1, R2 and R3 reduce the input voltages for the 15V regulator U1–2 placed in the 42V regulator module.
The transistor Q6 turns on the blower BL1–3 when the 42V output is switched on. If the temperature of the 28V regulator heatsink exceeds 70°C, the thermal breaker TB2–3 switches on and turns on the blower by means of Q6, until the temperature is below 55°C. If the heatsink temperature exceeds 90°C, in case of blower failure, the thermal breaker TB1–3, switches off and the 28V output will then turn off until the temperature is below approx. 75°C.

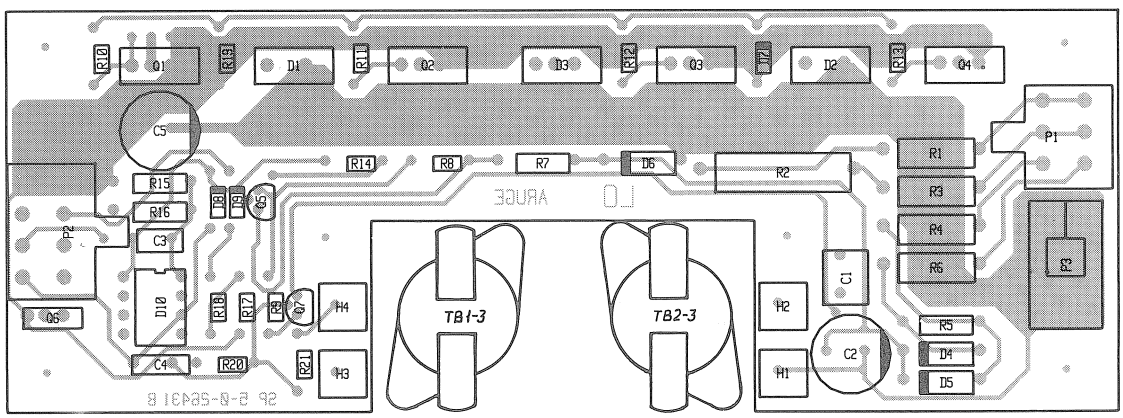
28V REGULATOR MODULE 1

5.1. 28V REGULATOR (MODULE 1) cont.:

COMPONENT LOCATION 28V REGULATOR MODULE 1.

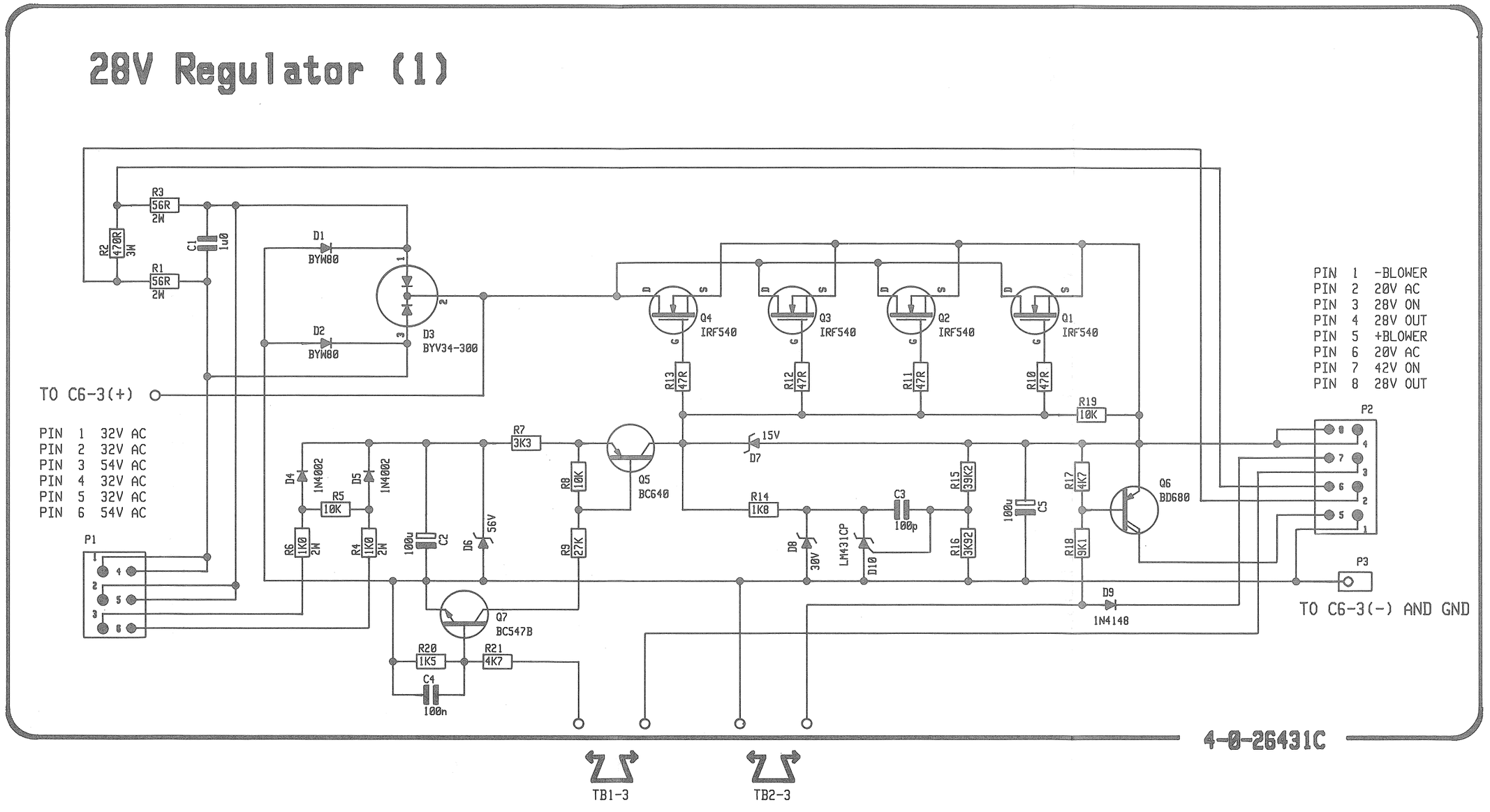


View from component side with upper side tracks.



View from component side with lower side tracks.

5.1. 28V REGULATOR (MODULE 1) cont.:



5.2. 42V REGULATOR (MODULE 2) SP NO. 626432

From the mains transformer TR1–3 the 54V AC is led to the rectifier bridge consisting of D23 and D24, Q1 and Q2. The current is then led to the output smoothing filter L1–3 and C1–3 to C5–3 which reduces the output ripple on the 42V output.
The module produces the necessary pulses to the thyristors Q1 and Q2 which are the stabilizing elements for the 42V output voltage.

20V AC from the mains transformer TR1–3 is rectified by the diodes D3 and D4. This full wave rectified sine wave is then peak rectified by D5 and C2 and led to U1. This is a fixed 15V voltage regulator, which delivers all the supply current to the other components on the board. The full wave rectified sine wave is in addition led to the base of Q8 through R4. Q1 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 Q7 is conducting and discharges C4 through D7. C4 is discharged down to approx. 0.7V, the forward voltage of D7. The voltage on pin 3 on U2,1 is then nearly zero.

When Q7 stops conducting, this voltage rises instantly with two forward diode voltages from D6 and D7. C4 starts to be charged by R8 and D6. The voltage on pin 3 now rises with a nearly constant slope. Q7 starts discharging C4 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 R16, D17 and D18 by U2,1. If the ramp voltage is smaller than the control voltage, the output pin 1 of U2,1 is low. The combination of Q4 and Q6 makes a 7 kHz astable multivibrator. The diodes D8 and D9 eliminate the influence of spreads in base–emitter break–down voltages of the transistors.

This 7 kHz is gated together with the signal from the comparator U2,1 and fed to Q3. If the voltage on pin 1 at U2,1 is low, the 7 kHz signal is not allowed to pass to Q3. D12 ensures a proper turn on and off of Q3, which acts as a constant AC current source to the trigger transformer TR1. The current is determinated by the supply voltage, R26, R29 and D12 to approx. 100 mA. The combination D13 and D14 demagnitizes TR1.

The current signal is amplified by a factor 3:1:1 by TR1, rectified by D19 and D20 and led to the thyristors. R32 and R33 prevent false triggering of the thyristors.

The control voltage can never be less than approx. 0.7V due to R27 and R28, but the ramp voltage is always less than 0.7V every time the mains frequency is zero crossing. Therefore, pin 1 at U2,1 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.

If the on/off terminal pin 6 in P5 is floating, the transistor Q5 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 U2,1 is then permanently low, and no trigger signal is led to the thyristors. If the on/off terminal is connected to 15V, Q5 is reverse biased by means of Q9 and has no influence on the control voltage.

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

The 42V output voltage is sensed by the common mode amplifier U3,1 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 from D15, divided by R10, R11, and R12. The difference is amplified by U3,2 (voltage error amplifier) and led by D16 and D17 to the control voltage point.

The output current is sensed by R45 to R49 to create a sense voltage. This voltage is compared with a reference voltage produced by D21, R41, R42, and R43 in the common mode amplifier U2,2. The two resistors R34 and R36 offset the amplifier to ensure that the input common mode voltage range of U2,2 is not exceeded. The error voltage is fed to the control voltage point at D18.

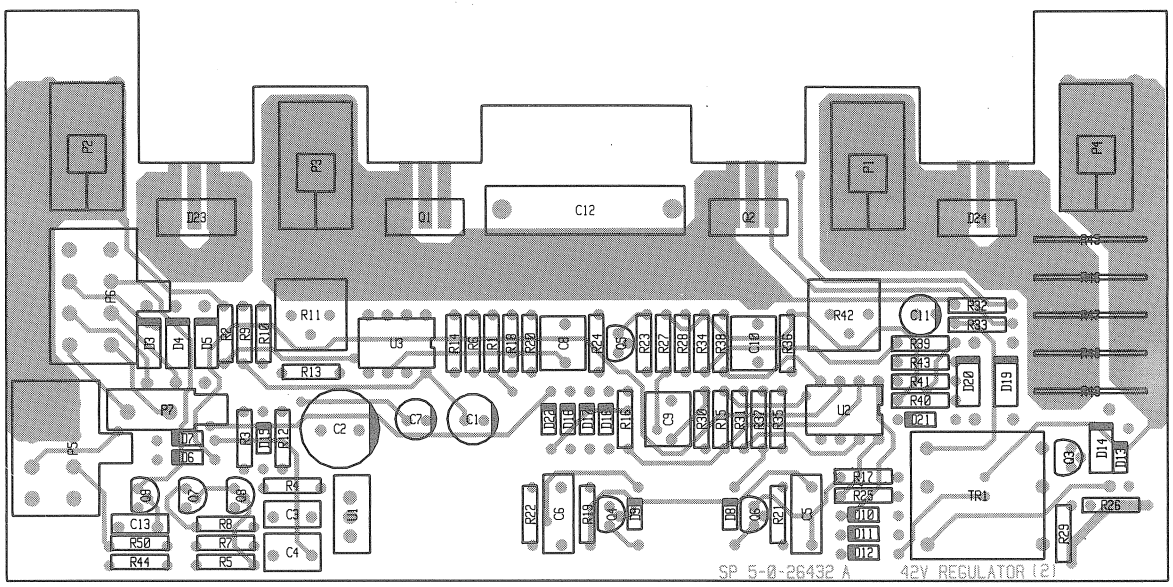
The diodes D16, D17, and D18 ensure that the highest voltage of the error voltages has the highest priority.

The output voltage is adjusted by R11
The output current is adjusted by R42.

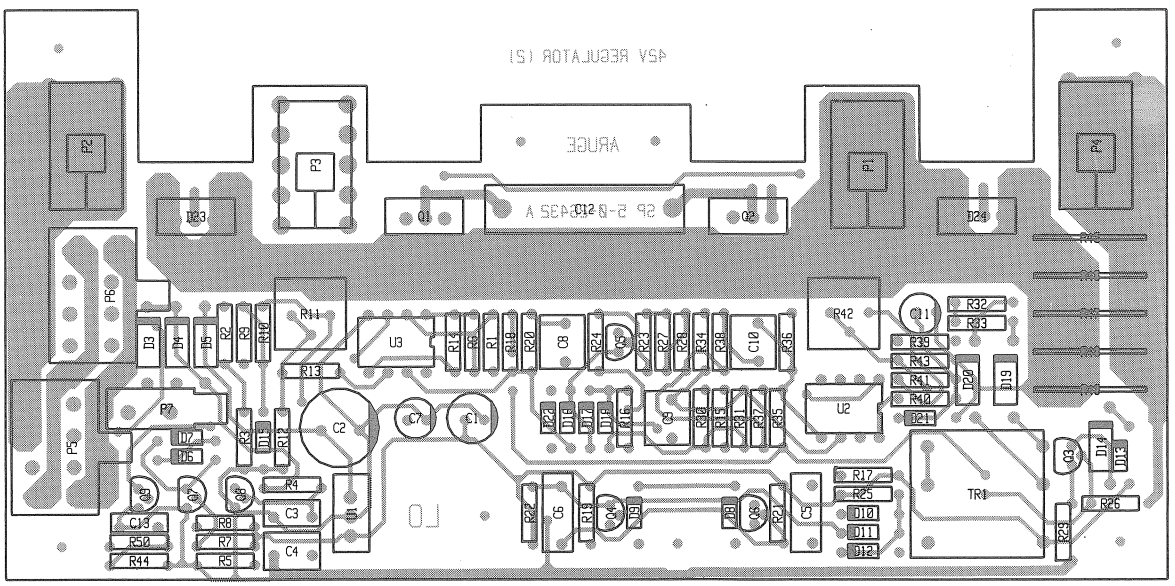
42V REGULATOR MODULE 2

5.2. 42V REGULATOR (MODULE 2) cont.:

COMPONENT LOCATION 42V REGULATOR MODULE 2.

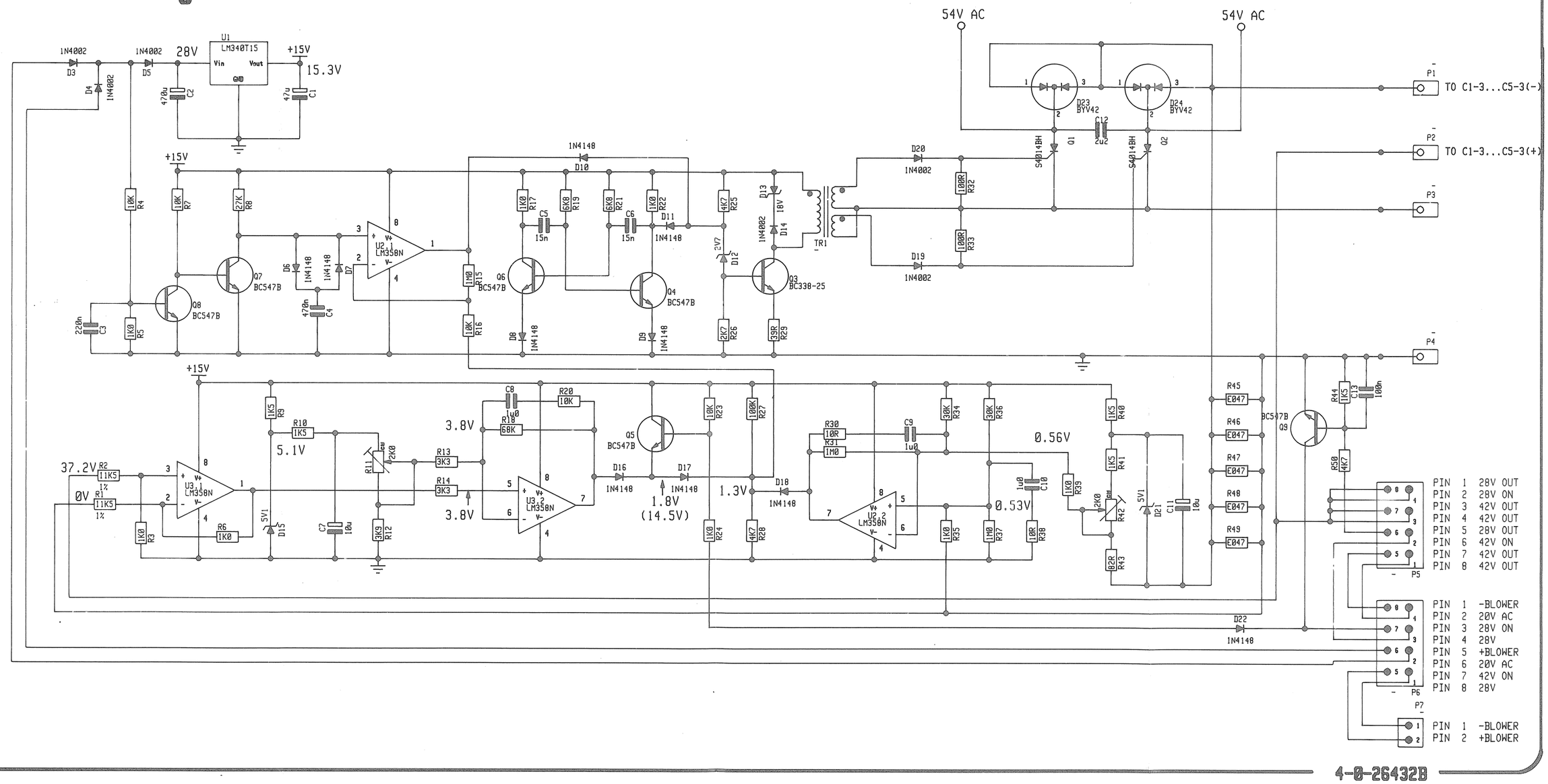


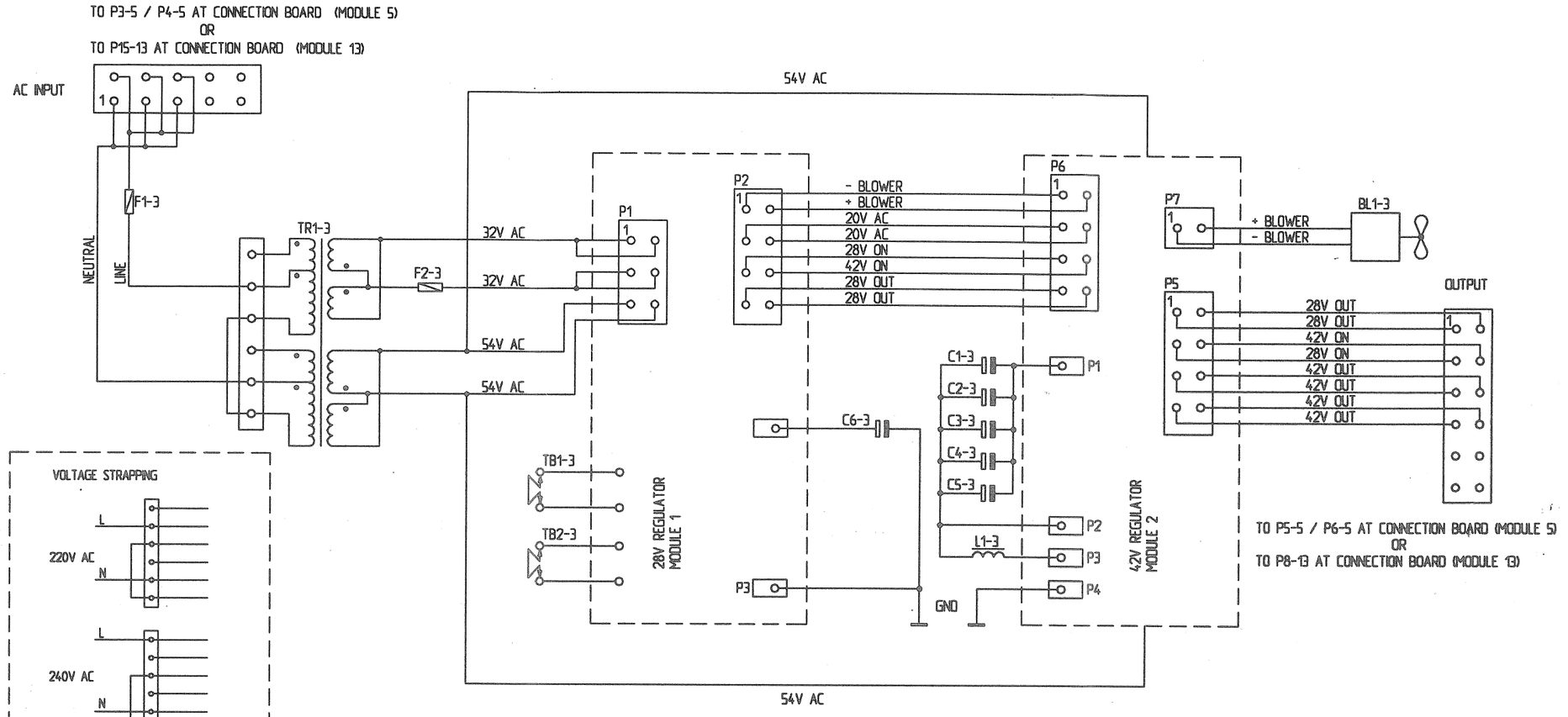
View from component side with upper side tracks.



View from component side with lower side tracks.

42V Regulator Unit (2)




TO P3-5 / P4-5 AT CONNECTION BOARD (MODULE 5)
OR
TO P15-13 AT CONNECTION BOARD (MODULE 13)
AC INPUT
NEUTRAL
LINE
F1-3
TR1-3
F2-3
32V AC
32V AC
54V AC
54V AC
P1
54V AC
P2
- BLOWER
+ BLOWER
20V AC
20V AC
28V ON
42V ON
28V OUT
28V OUT
P6
P7
+ BLOWER
- BLOWER
BL1-3
P5
OUTPUT
28V OUT
28V OUT
42V ON
28V ON
42V OUT
42V OUT
42V OUT
42V OUT
C1-3
C2-3
C3-3
C4-3
C5-3
C6-3
P1
P2
P3
P4
L1-3
TB1-3
TB2-3
28V REGULATOR
MODULE 1
42V REGULATOR
MODULE 2
P3
GND
TO P5-5 / P6-5 AT CONNECTION BOARD (MODULE 5)
OR
TO P8-13 AT CONNECTION BOARD (MODULE 13)
54V AC
VOLTAGE STRAPPING
220V AC
240V AC
110V AC
127V AC
L
N

CONTENTS

7. PARTS LISTS

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	P.S.UNIT, AC, 600W, N2171	**HF SSB PROGRAMME**	**ESPERA**	**0-0-26430**	**726430**
VARIOUS	**1 POLE FUSEHOLDER**	**342.014**	**WICKMANN**	**342.014**	**78.393**
-1	28V REGULATOR UNIT	MODULE (1) N2171	ESPERA	5-0-26431B	626431
-2	42V REGULATOR UNIT	MODULE (2) N2171	ESPERA	5-0-26432A	626432
BL1-3	FAN 24VDC	119x119x38mm	PAPST	4124 KX	60.100
C1-3	CAPACITOR ELECTROLYTIC	10000uF -10/+50% 63VDC	PHILIPS	2222 050 68103 & 4322 043 05581 & 4322 043 05561	14.870
C2-3	**CAPACITOR ELECTROLYTIC**	**10000uF -10/+50% 63VDC**	**PHILIPS**	**2222 050 68103 & 4322 043** 05581 & 4322 043 05561	**14.870**
C3-3	CAPACITOR ELECTROLYTIC	10000uF -10/+50% 63VDC	PHILIPS	2222 050 68103 & 4322 043 05581 & 4322 043 05561	14.870
C4-3	CAPACITOR ELECTROLYTIC	10000uF -10/+50% 63VDC	PHILIPS	2222 050 68103 & 4322 043 05581 & 4322 043 05561	14.870
C5-3	CAPACITOR ELECTROLYTIC	10000uF -10/+50% 63VDC	PHILIPS	2222 050 68103 & 4322 043 05581 & 4322 043 05561	14.870
C6-3	CAPACITOR ELECTROLYTIC	10000uF -10/+50% 63VDC	PHILIPS	2222 050 68103 & 4322 043 05581 & 4322 043 05561	14.870
F1-3	**FUSE**	**8AM 6.3x32mm**	**LITTELFUSE**	**311008** RS.143-150	**45.628**
F2-3	FUSE	15AM Ø6.3x32mm	WICKMANN	19 341-15	45.630
L2-3	CHOKE FIXED	2mH/23A 50Hz	DANTRAFO A/S	6-0-26931 Art.Nr: DT2247	20.256
TB1-3	THERMAL BREAKER	OFF:88 ON:77	* COMEPA	25 2 98 21 088 077 MARKED 910	44.001
TB2-3	THERMAL BREAKER	ON:70 OFF:55	* COMEPA	25 0 98 21 070 055 MARKED 915	44.011
TR1-3	**TRANSFORMER MAINS**	**N2171 1k3VA**	**DANTRAFO A/S**	**6-0-26932 Art.Nr: DT2246**	**22.512**

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	28V REGULATOR UNIT	**MODULE (1) N2171**	**ESPERA**	**5-0-26431B**	**626431**
C1-1	**CAPACITOR MKT**	**1uF 5% 63VDC**	**PHILIPS**	**2222 370 79105**	**11.190**
C2-1	CAPACITOR ELECTROLYTIC	100uF -20/+50% 63VDC	ERO	EKM 05 DE 310 J 05	14.620
C3-1	CAPACITOR CERAMIC	100pF 5% NPO 50VDC	KCK	RT-HE80 SK CH 101 J AMMO PACK	15.136
C4-1	CAPACITOR MKT	100nF 5% 63VDC	PHILIPS	2222 370 79104	11.135
C5-1	CAPACITOR ELECTROLYTIC	100uF -20/+50% 63VDC	ERO	EKM 05 DE 310 J 05	14.620
D1-1	**DIODE F.REC**	**7A/150V**	**THOMSON-CSF**	**BYW80-150**	**27.625**
D2-1	DIODE F.REC	7A/150V	THOMSON-CSF	BYW80-150	27.625
D3-1	DIODE DUAL	2x10A/300VDC TO-220	PHILIPS	BYV34-300 (-400;-500)	27.158
D4-1	DIODE RECTIFIER	1N4002 100V/1A	THOMSON	1N4002 (03/04/05/06/07)	25.100
D5-1	DIODE RECTIFIER	1N4002 100V/1A	THOMSON	1N4002 (03/04/05/06/07)	25.100
D6-1	**DIODE ZENER**	**56V 5%**	**THOMSON-CSF**	**BZV47C56**	**26.788**
D7-1	DIODE ZENER	15V 5% 0.4W	PHILIPS	BZX79C15	26.561
D8-1	DIODE ZENER	30V 5% 0.4W	PHILIPS	BZX79C30	26.578
D9-1	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D10-1	DIODE SHUNT REGULATOR	PROGRAMMABLE	MOTOROLA	TL431CP	26.997
P1-1	**MULTIPLUG**	**2x3 POLES PCB VERSION**	**MOLEX**	**39-28-1063**	**78.217**
P2-1	MULTIPLUG	2x4 POLES PCB VERSION	MOLEX	39-28-1083	78.218
P3-1	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
Q1-1	TRANSISTOR POWER MOSFET	N-CHANNEL 100V/27A/85mOHM	MOTOROLA	IRF540	29.402
Q2-1	TRANSISTOR POWER MOSFET	N-CHANNEL 100V/27A/85mOHM	MOTOROLA	IRF540	29.402
Q3-1	**TRANSISTOR POWER MOSFET**	**N-CHANNEL 100V/27A/85mOHM**	**MOTOROLA**	**IRF540**	**29.402**
Q4-1	TRANSISTOR POWER MOSFET	N-CHANNEL 100V/27A/85mOHM	MOTOROLA	IRF540	29.402
Q5-1	TRANSISTOR	BC640	PHILIPS	BC640	28.124
Q6-1	TRANSISTOR	BD680	MOTOROLA*	BD680	29.338
Q7-1	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
R1-1	**RESISTOR PMF**	**56 OHM 5% 2W**	**PHILIPS**	**2322 194 13569**	**04.149**
R2-1	RESISTOR PMF	470 OHM 5% 3W	PHILIPS	2322 195 13471	04.691
R3-1	RESISTOR PMF	56 OHM 5% 2W	PHILIPS	2322 194 13569	04.149
R4-1	RESISTOR PMF	1k0 OHM 5% 2W	PHILIPS	2322 194 13102	04.200
R5-1	RESISTOR MF	10k OHM 5% 0.4W	PHILIPS	2322 181 53103	01.225
R6-1	**RESISTOR PMF**	**1k0 OHM 5% 2W**	**PHILIPS**	**2322 194 13102**	**04.200**
R7-1	RESISTOR MF	3k3 OHM 5% 0.4W	PHILIPS	2322 181 53332	01.212
R8-1	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R9-1	RESISTOR MF	27k OHM 5% 0.33W	PHILIPS	2322 180 73273	02.506
R10-1	RESISTOR MF	47 OHM 5% 0.33W	PHILIPS	2322 180 73479	02.440
R11-1	**RESISTOR MF**	**47 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73479**	**02.440**
R12-1	RESISTOR MF	47 OHM 5% 0.33W	PHILIPS	2322 180 73479	02.440
R13-1	RESISTOR MF	47 OHM 5% 0.33W	PHILIPS	2322 180 73479	02.440
R14-1	RESISTOR MF	1k8 OHM 5% 0.33W	PHILIPS	2322 180 73182	02.478
R15-1	RESISTOR MF	39k2 OHM 1% 0.6W	PHILIPS	2322 156 13923	03.439

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R16-1	**RESISTOR MF**	**3k92 OHM 1% 0.6W**	**PHILIPS**	**2322 156 13922**	**03.409**
R17-1	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R18-1	RESISTOR MF	9k1 OHM 5% 0.33W	PHILIPS	2322 180 73912	02.495
R19-1	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R20-1	RESISTOR MF	1k5 OHM 5% 0.33W	PHILIPS	2322 180 73152	02.476
R21-1	**RESISTOR MF**	**4k7 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73472**	**02.488**

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	42V REGULATOR UNIT	**MODULE (2) N2171**	**ESPERA**	**5-0-26432A**	**626432**
C1-2	**CAPACITOR ELECTROLYTIC**	**47uF 20% 25VDC**	**ERO**	**EKI 00 BB 247 E M9**	**14.524**
C2-2	CAPACITOR ELECTROLYTIC	470uF -20/+50% 40VDC	ERO	EKM 05 FG 347 G 05	14.650
C3-2	CAPACITOR MKT	220nF 10% 63VDC	PHILIPS	2222 370 78224	11.095
C4-2	CAPACITOR MKT	470nF 20% 63VDC	ERO	MKT 1826-447/06 6-G	11.188
C5-2	CAPACITOR MKT	15nF 5% 250V	ERO	MKT1818	11.170
C6-2	**CAPACITOR MKT**	**15nF 5% 250V**	**ERO**	**MKT1818**	**11.170**
C7-2	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ERO	EKI 00 AA 210 F M9	14.512
C8-2	CAPACITOR MKT	1uF 5% 63VDC	PHILIPS	2222 370 79105	11.190
C9-2	CAPACITOR MKT	1uF 5% 63VDC	PHILIPS	2222 370 79105	11.190
C10-2	CAPACITOR MKT	1uF 5% 63VDC	PHILIPS	2222 370 79105	11.190
C11-2	**CAPACITOR ELECTROLYTIC**	**10uF 20% 35VDC**	**ERO**	**EKI 00 AA 210 F M9**	**14.512**
C12-2	CAPACITOR POLYESTER	2.2uF 10% 100V	PHILIPS*	2222 344 25225	11.142
C13-2	CAPACITOR MKT	100nF 5% 63VDC	PHILIPS	2222 370 79104	11.135
D3-2	DIODE RECTIFIER	1N4002 100V/1A	THOMSON	1N4002 (03/04/05/06/07)	25.100
D4-2	DIODE RECTIFIER	1N4002 100V/1A	THOMSON	1N4002 (03/04/05/06/07)	25.100
D5-2	**DIODE RECTIFIER**	**1N4002 100V/1A**	**THOMSON**	**1N4002 (03/04/05/06/07)**	**25.100**
D6-2	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
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 ZENER	2V7 5% 0.4W	PHILIPS	BZX79C2V7	26.506
D13-2	DIODE ZENER	18V 5% 0.4W BZX79C18	PHILIPS	BZX79C18	26.564
D14-2	DIODE RECTIFIER	1N4002 100V/1A	THOMSON	1N4002 (03/04/05/06/07)	25.100
D15-2	**DIODE ZENER**	**5.1V 5% 0.4W**	**PHILIPS**	**BZX79C5V1**	**26.527**
D16-2	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D17-2	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D18-2	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D19-2	DIODE RECTIFIER	1N4002 100V/1A	THOMSON	1N4002 (03/04/05/06/07)	25.100
D20-2	**DIODE RECTIFIER**	**1N4002 100V/1A**	**THOMSON**	**1N4002 (03/04/05/06/07)**	**25.100**
D21-2	DIODE ZENER	5.1V 5% 0.4W	PHILIPS	BZX79C5V1	26.527
D22-2	DIODE	1N4148 HIGH SPEED	PHILIPS	1N4148-143	25.131
D23-2	DIODE DUAL	2x15A/200V TO-220	PHILIPS	BYV42-200	27.161
D24-2	DIODE DUAL	2x15A/200V TO-220	PHILIPS	BYV42-200	27.161
P1-2	**CONNECTION ELEMENT**	**FOR M5 SCREW**	**ESPERA**	**1-0-25860**	**225860**
P2-2	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P3-2	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P4-2	CONNECTION ELEMENT	FOR M5 SCREW	ESPERA	1-0-25860	225860
P5-2	MULTIPLUG	2x4 POLES PCB VERSION	MOLEX	39-28-1083	78.218
P6-2	**MULTIPLUG**	**2x4 POLES PCB VERSION**	**MOLEX**	**39-28-1083**	**78.218**

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
P7-2	**PLUG 2POLES**		**MOLEX**	**39-28-1023**	**78.215**
Q1-2	TRANSISTOR SCR.	200V/40A rms TO 220	TAG	S4014BH (S4014 DH/MH/NM)	29.930
Q2-2	TRANSISTOR SCR.	200V/40A rms TO 220	TAG	S4014BH (S4014 DH/MH/NM)	29.930
Q3-2	TRANSISTOR AF	BC338-25 NPN TO-92	PHILIPS	BC338-25	28.058
Q4-2	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
Q5-2	**TRANSISTOR AF**	**BC547B NPN TO-92**	**PHILIPS**	**BC547B**	**28.067**
Q6-2	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
Q7-2	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
Q8-2	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
Q9-2	TRANSISTOR AF	BC547B NPN TO-92	PHILIPS	BC547B	28.067
R1-2	**RESISTOR MF**	**11k5 OHM 1% 0.25W**	**PHILIPS**	**2322 157 11153**	**02.230**
R2-2	RESISTOR MF	11k5 OHM 1% 0.25W	PHILIPS	2322 157 11153	02.230
R3-2	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R4-2	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R5-2	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R6-2	**RESISTOR MF**	**1k0 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73102**	**02.472**
R7-2	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R8-2	RESISTOR MF	27k OHM 5% 0.33W	PHILIPS	2322 180 73273	02.506
R9-2	RESISTOR MF	1k5 OHM 5% 0.33W	PHILIPS	2322 180 73152	02.476
R10-2	RESISTOR MF	1k5 OHM 5% 0.33W	PHILIPS	2322 180 73152	02.476
R11-2	**PRESET CERMET**	**2k0 OHM 5% 0.5W**	**BOURNS**	**3386P-1-202-11**	**07.887**
R12-2	RESISTOR MF	3k9 OHM 5% 0.33W	PHILIPS	2322 180 73392	02.486
R13-2	RESISTOR MF	3k3 OHM 5% 0.33W	PHILIPS	2322 180 73332	02.484
R14-2	RESISTOR MF	3k3 OHM 5% 0.33W	PHILIPS	2322 180 73332	02.484
R15-2	RESISTOR MF	1M OHM 5% 0.33W	PHILIPS	2322 180 73105	02.544
R16-2	**RESISTOR MF**	**10k OHM 5% 0.33W**	**PHILIPS**	**2322 180 73103**	**02.496**
R17-2	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R18-2	RESISTOR MF	68k OHM 5% 0.33W	PHILIPS	2322 180 73683	02.516
R19-2	RESISTOR MF	6k8 OHM 5% 0.33W	PHILIPS	2322 180 73682	02.492
R20-2	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R21-2	**RESISTOR MF**	**6k8 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73682**	**02.492**
R22-2	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R23-2	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R24-2	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R25-2	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R26-2	**RESISTOR MF**	**2k7 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73272**	**02.482**
R27-2	RESISTOR MF	100k OHM 5% 0.33W	PHILIPS	2322 180 73104	02.520
R28-2	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
R29-2	RESISTOR MF	39 OHM 5% 0.33W	PHILIPS	2322 180 73399	02.438
R30-2	RESISTOR MF	10 OHM 5% 0.33W	PHILIPS	2322 180 73109	02.424
R31-2	**RESISTOR MF**	**1M OHM 5% 0.33W**	**PHILIPS**	**2322 180 73105**	**02.544**
R32-2	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 180 73101	02.448

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R33-2	**RESISTOR MF**	**100 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73101**	**02.448**
R34-2	RESISTOR MF	30k OHM 5% 0.33W	PHILIPS	2322 180 73303	02.507
R35-2	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R36-2	RESISTOR MF	30k OHM 5% 0.33W	PHILIPS	2322 180 73303	02.507
R37-2	RESISTOR MF	1M OHM 5% 0.33W	PHILIPS	2322 180 73105	02.544
R38-2	**RESISTOR MF**	**10 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73109**	**02.424**
R39-2	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R40-2	RESISTOR MF	1k5 OHM 5% 0.33W	PHILIPS	2322 180 73152	02.476
R41-2	RESISTOR MF	1k5 OHM 5% 0.33W	PHILIPS	2322 180 73152	02.476
R42-2	PRESET CERMET	2k0 OHM 5% 0.5W	BOURNS	3386P-1-202-11	07.887
R43-2	**RESISTOR MF**	**82 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73829**	**02.446**
R44-2	RESISTOR MF	1k5 OHM 5% 0.33W	PHILIPS	2322 180 73152	02.476
R45-2	RESISTOR	47m OHM 5% 0.6W	MODULOHM I/S	98247/47U-J-MI-A-1	06.233
R46-2	RESISTOR	47m OHM 5% 0.6W	MODULOHM I/S	98247/47U-J-MI-A-1	06.233
R47-2	RESISTOR	47m OHM 5% 0.6W	MODULOHM I/S	98247/47U-J-MI-A-1	06.233
R48-2	**RESISTOR**	**47m OHM 5% 0.6W**	**MODULOHM I/S**	**98247/47U-J-MI-A-1**	**06.233**
R49-2	RESISTOR	47m OHM 5% 0.6W	MODULOHM I/S	98247/47U-J-MI-A-1	06.233
R50-2	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 180 73472	02.488
TR1-2	TRANSFORMER	3:1:1	SCHAFFNER	IT 244	22.000
U1-2	VOLTAGE REGULATOR	FIXED 15V/1A	MOTOROLA	MC7815CT	31.090
U2-2	**DUAL OP AMP**	**LM358N**	**TEXAS**	**LM358P**	**31.100**
U3-2	DUAL OP AMP	LM358N	TEXAS	LM358P	31.100

INSTRUCTION BOOK FOR AERIAL COUPLER AT2112
SP NO. 802112

CONTENTS

1. GENERAL DESCRIPTION
1.1. PRINCIPLE OF OPERATION AND BLOCK DIAGRAM

2. INSTALLATION MECHANICAL
2.1. DIMENSIONS AND DRILLING PLAN

3. INSTALLATION ELECTRICAL
3.1. CABLE SPECIFICATIONS FOR CUSTOMER SUPPLIED CABLES
3.2. ELETRICAL CONNECTIONS

4. MECHANICAL DESCRIPTION
4.1. MECHANICAL DISASSEMBLING AND MODULE LOCATION

5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS
5.1. AERIAL CURRENT DETECTOR UNIT (MODULE 1) SP NO. 626641
5.2. MAIN SCHEMATIC DIAGRAM AT2112

6.

7. PARTS LISTS

AT2112 INSTRUCTION BOOK FOR AERIAL COUPLER AT2112

CONTENTS

1. GENERAL DESCRIPTION

1.1. PRINCIPLE OF OPERATION AND BLOCK DIAGRAM

AT2112

1. GENERAL DESCRIPTION

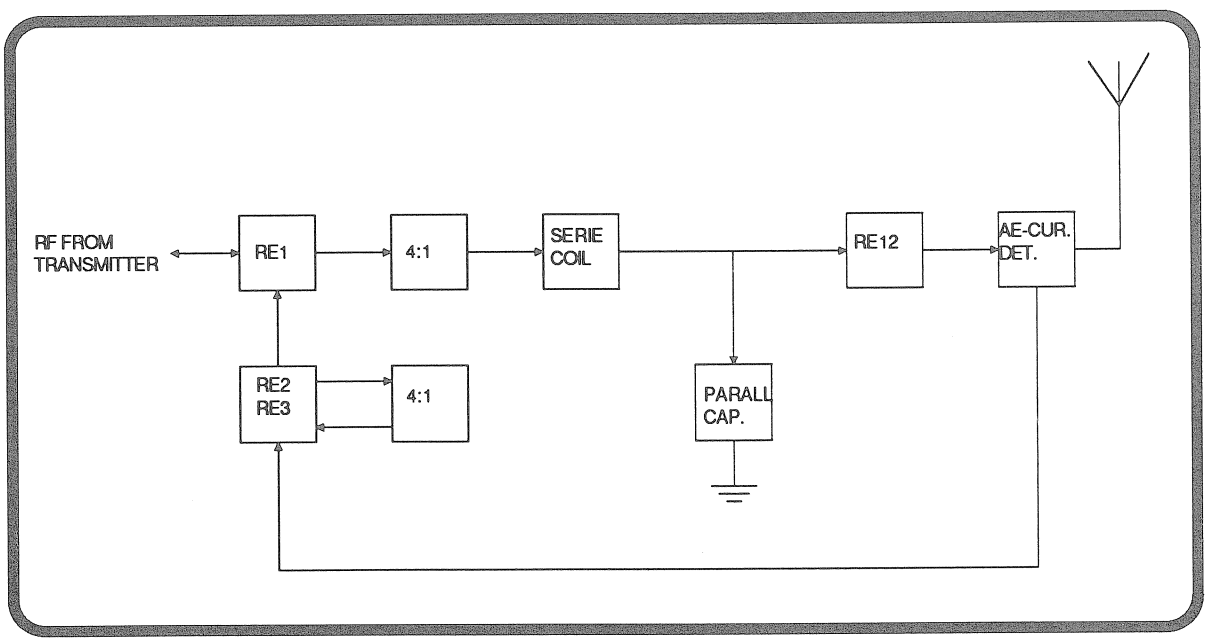
This instruction book consists of one general section with description down to unit level, and one section for each unit in the system with description of the units down to component level.

This section gives you all necessary information to install the system and make service down to unit level.

1.1. PRINCIPLE OF OPERATION

The aerial coupler is controlled from the TX processor.
The aaerial coupler tunes the aerial impedance to fit the 50 ohm impedance of the PA unit.
The impedance is measured at the output of the PA unit. It is always possible to tune an SWR less than 2, typically SWR = 1.4.

The aerial coupler has three main parts, a 4:1 impedance transformer at the input of the coupler, then a series coil, which can be tuned in steps as well as continuously, and at last a parallel capacitor, which can be tuned in steps. The value of the coil and the capacitor is controlled in the TX processor.
The aerial coupler has an impedance matching transformer (TR1–1) for the receiver for frequencies lower than 4 MHz.
At the output there is a current transformer (TR2–1) and a detector. The output voltage is fed to the aerial current meter at RE2100.

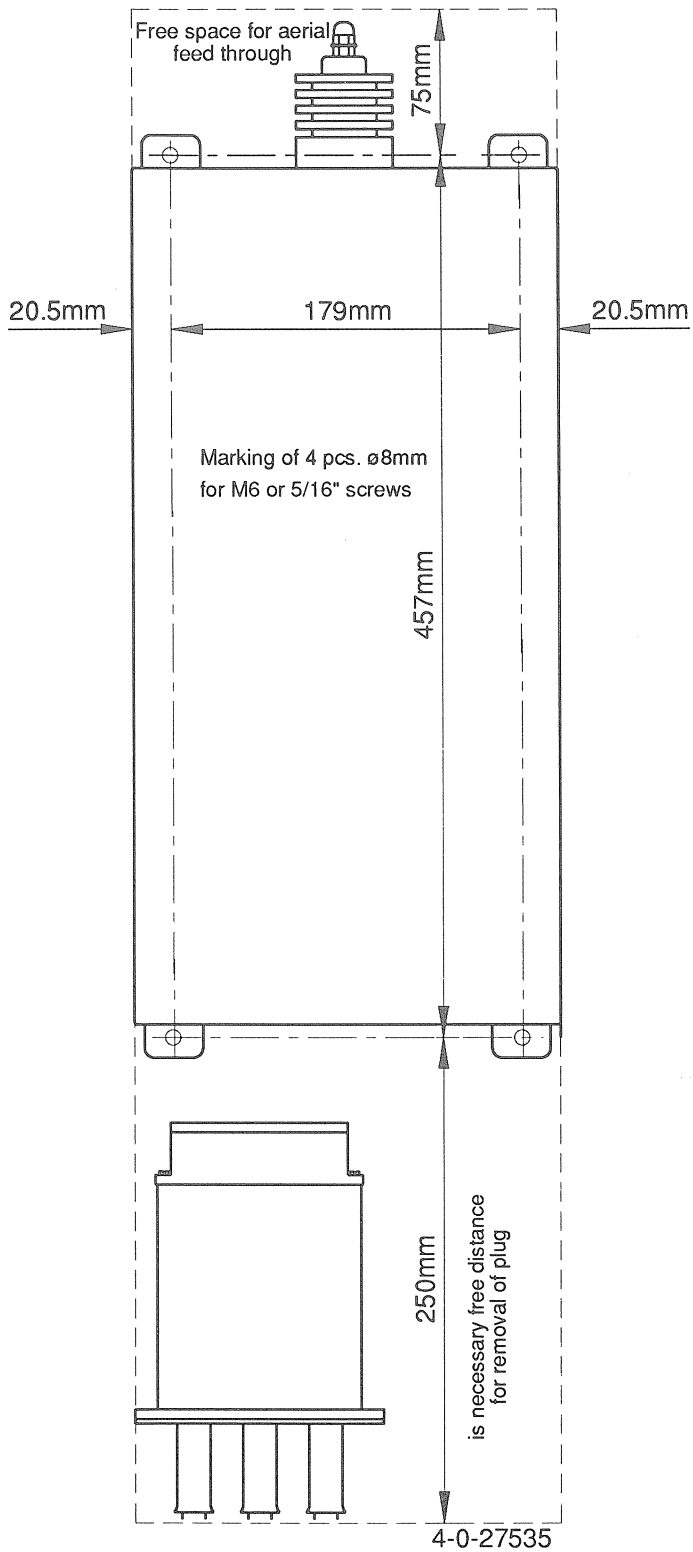


CONTENTS

2. INSTALLATION MECHANICAL
2.1. DIMENSIONS AND DRILLING PLAN

AT2112

AT2112


Free space for aerial feed through
75mm
20.5mm
179mm
20.5mm
Marking of 4 pcs. ø8mm
for M6 or 5/16" screws
457mm
250mm
is necessary free distance
for removal of plug
4-0-27535

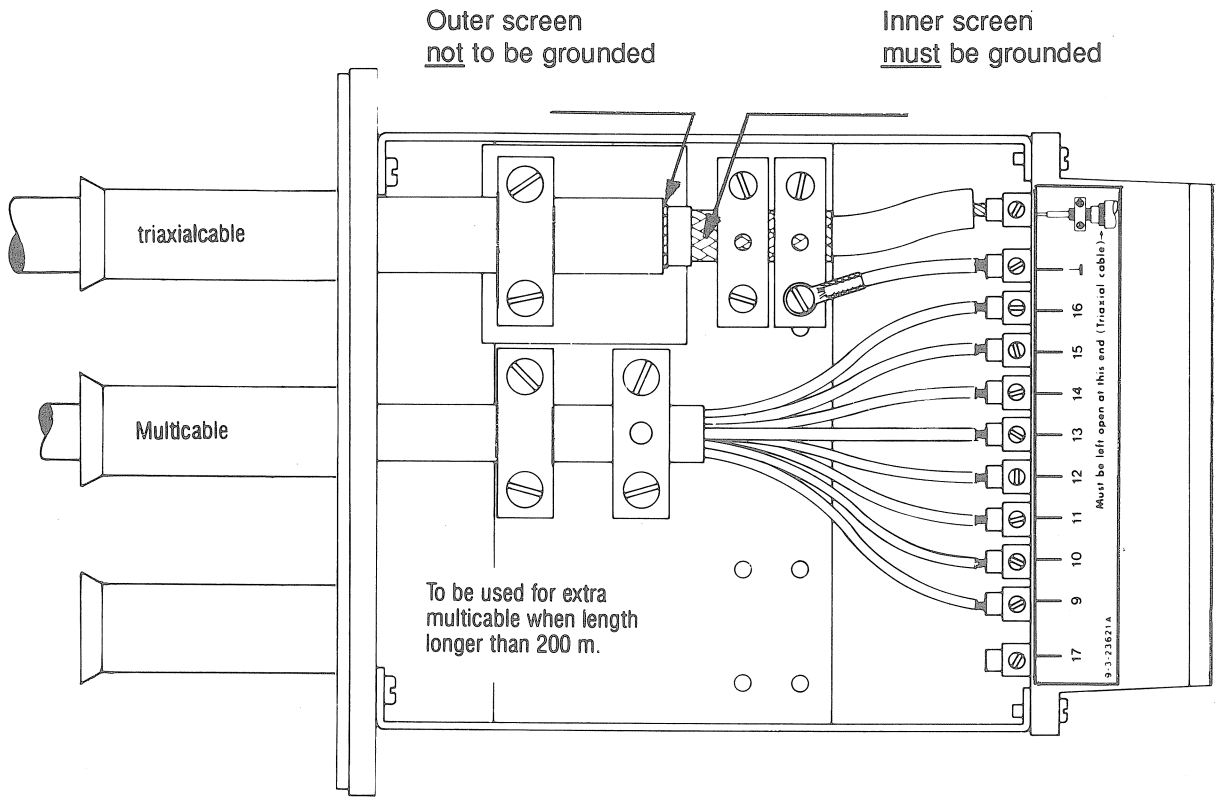
CONTENTS

3. INSTALLATION ELECTRICAL
3.1. CABLE SPECIFICATIONS FOR CUSTOMER SUPPLIED CABLES
3.2. ELETRICAL CONNECTIONS

AT2112

3.2. ELETRICAL CONNECTIONS

CABLE MOUNTING DETAILS FOR AT2112

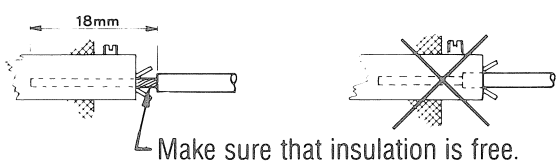


MULTICABLE:
Lead 9-16 incl. to be connected on this side. Lead 1-8 incl. to be connected on rear side.The numbers in plug for AT2112 correspond with the numbers on the supply terminal block at the connection board in question (control 1, control 2, etc.).

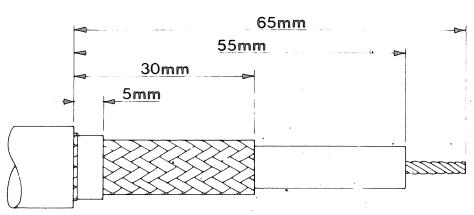
MULTICABLE: Max. diameter ⌀ 14.5 mm.

length	type
1 - 100 m	16 x 0.5²
100 - 200 m	18 x 0.5²
	Terminal 15 have 3 leads in parallel.

WIRE STRIPPING FOR MULTICABLE.



WIRE STRIPPING FOR TRIAXIAL CABLE H1213.



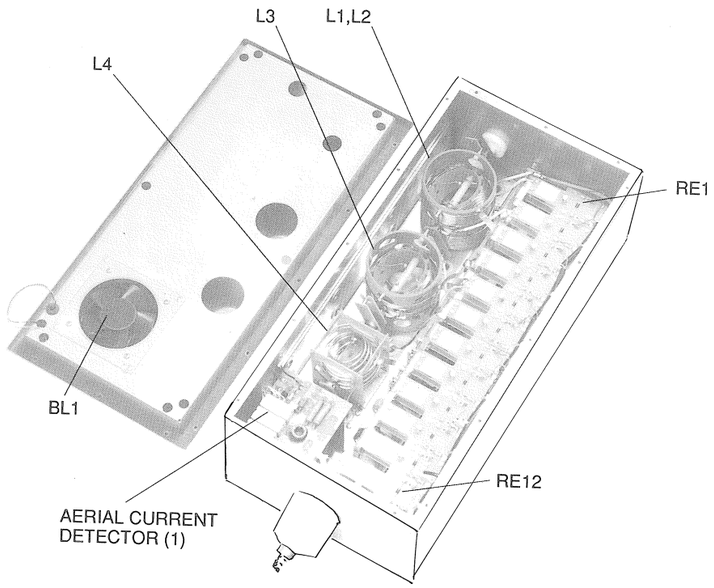
CONTENTS

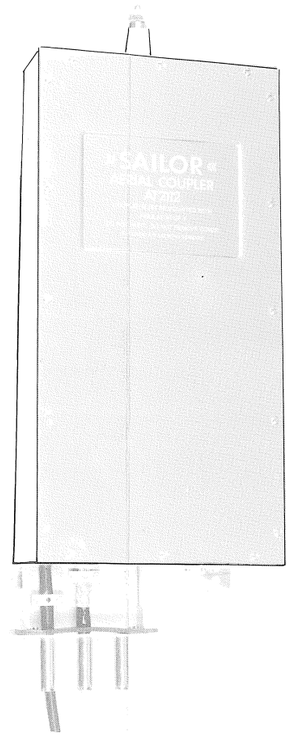
4. MECHANICAL DESCRIPTION
4.1. MECHANICAL DISASSEMBLING AND MODULE LOCATION

AT2112

4. MECHANICAL DESCRIPTION

4.1. MECHANICAL DISASSEMBLING AND MODULE LOCATION





AT2112 501123
AT2112 501134

CONTENTS

5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS

5.1. AERIAL CURRENT DETECTOR UNIT (MODULE 1) SP NO. 626641

5.2. MAIN SCHEMATIC DIAGRAM AT2112

AT2112

5. CIRCUIT DESCRIPTION

5.1. AERIAL CURRENT DETECTOR UNIT (MODULE 1) SP NO. 626641

RECEIVE MODE

The signal from the aerial passes through RE12 to RE2. RE2 and RE3 are not activated if the receive frequency is less than 4 MHz. If the frequency is higher than 4 MHz, RE2 and RE3 are activated and the signal passes through TR1. TR1 is an impedance matching transformer, giving an improved sensitivity of the receiver.
RE1 is not activated and the signal is fed from RE3 direct to the receiver.

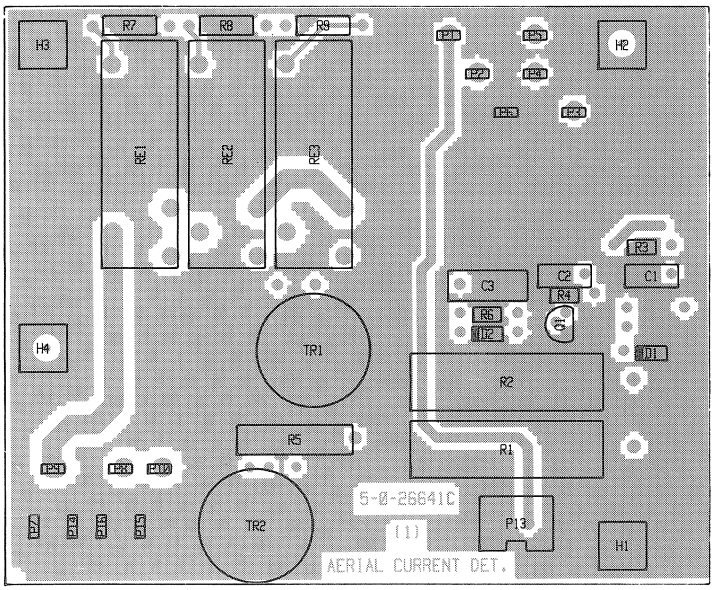
TRANSMIT MODE

The signal from the transmitter is fed to RE1, which is activated and thus feeds the signal to TR1 on the chassis. Then through the impedance matching network of the aerial coupler to the aerial current transformer TR2 and to the aerial.
The optocoupler OC1 sends out a high signal for very 180° rotation of the coil. This signal is loaded to the TX processor.

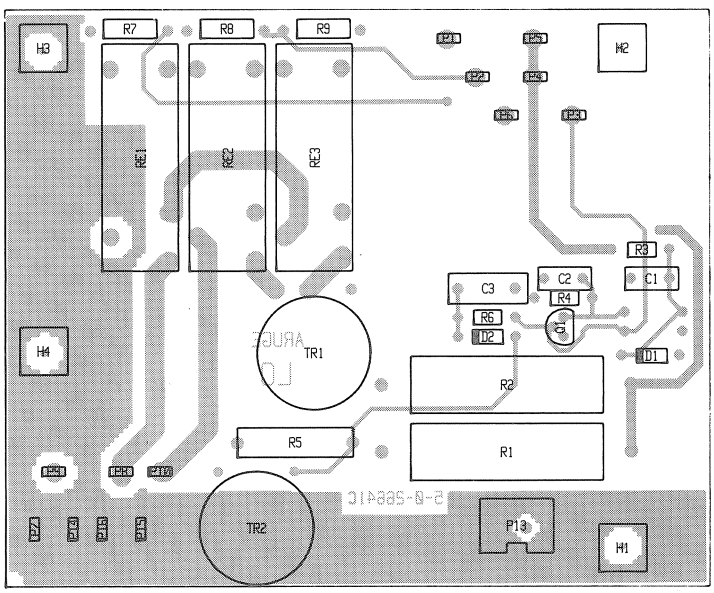
AERIAL CURRENT DETECTOR MODULE 1

5.2. AERIAL CURRENT DETECTOR (MODULE 1) cont.:

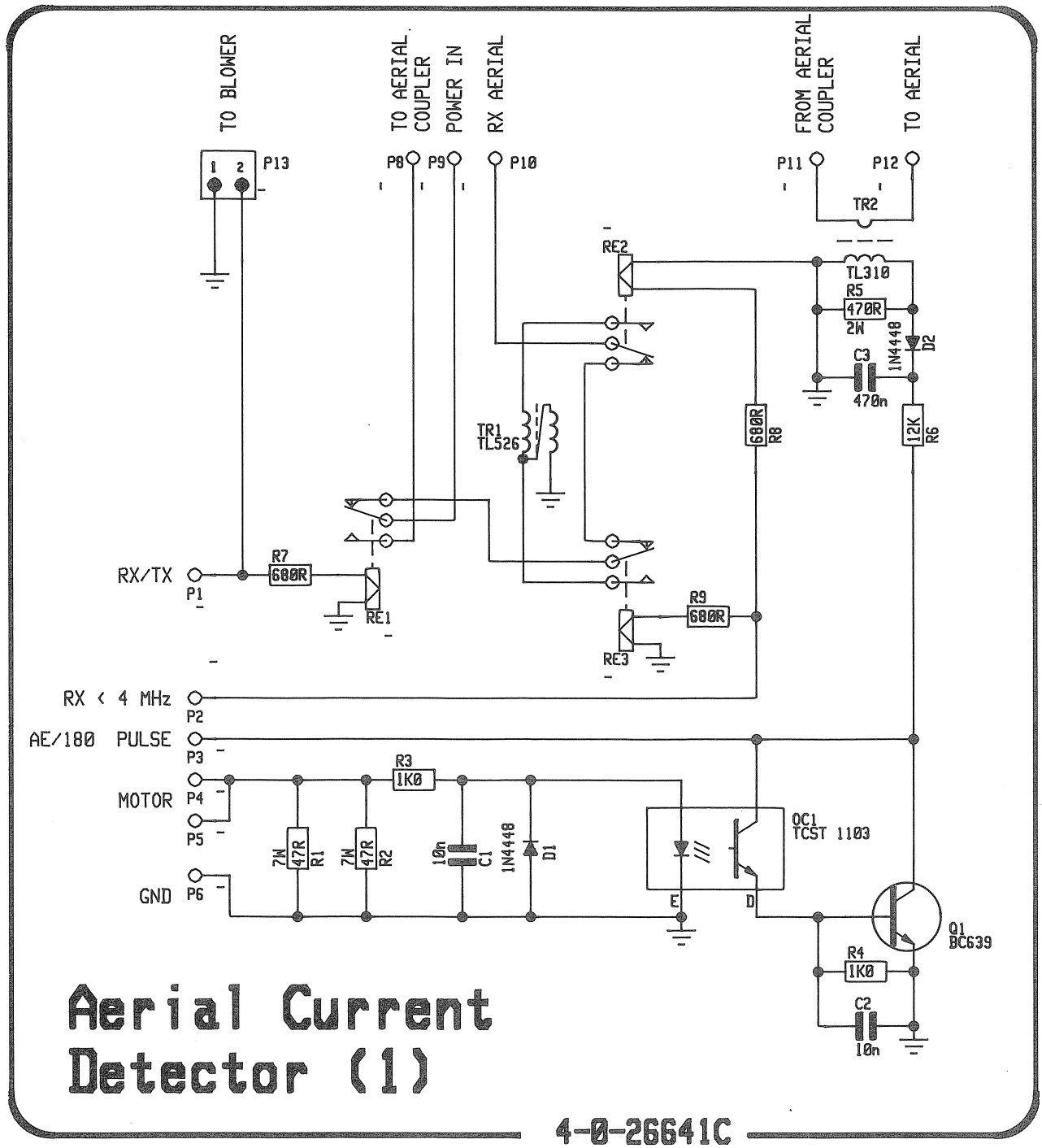
COMPONENT LOCATION AERIAL CURRENT DETECTOR MODULE 1.



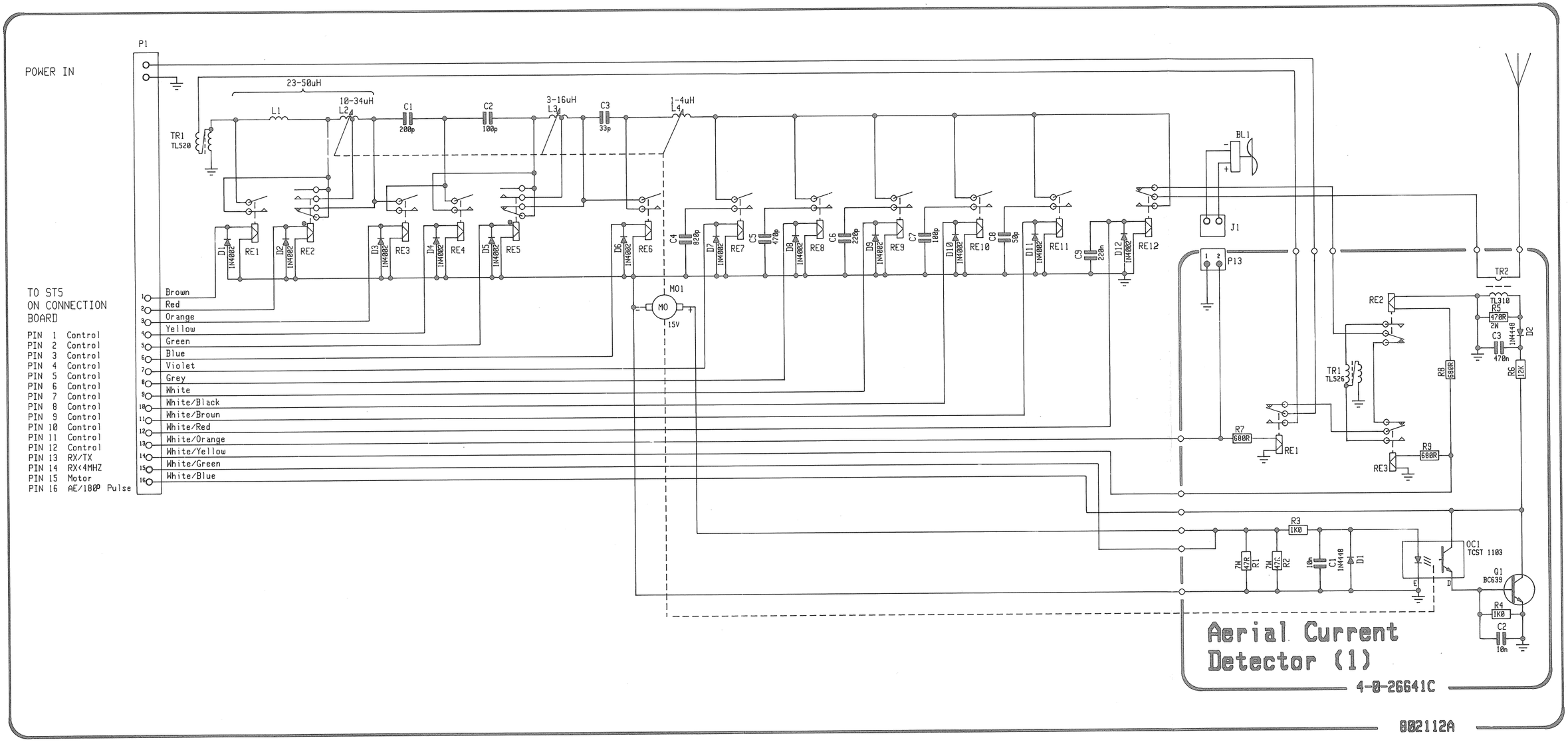
View from component side with upper side tracks.



View from component side with lower side tracks.



4-0-26641C
AT2112



4-0-26641C / 802112A
AT2112

CONTENTS

7. PARTS LISTS

AT2112

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	AERIAL CURRENT DET.MODULE	**AT2112**	**ESPERA**	**5-0-26641C**	**626641**
C1-1	**CAPACITOR CERAMIC**	**10nF -20/+80% CL2 50VDC**	**KCK**	**RT-HE70 SK YF 103 Z AMMO PACK**	**15.170**
C2-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	KCK	RT-HE70 SK YF 103 Z AMMO PACK	15.170
C3-1	CAPACITOR MKT	470nF 10% 63V	ERO*	MKT 1818-447/065	11.185
D1-1	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
D2-1	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.146
OC1-1	**PHOTO INTERRUPTER**		**TELEFUNKEN**	**TCST 1103**	**32.521**
P13-1	PLUG	2 POLES	AMP	0-826375-2	78.102
Q1-1	TRANSISTOR AF	NPN BC639 TO-92	PHILIPS	BC639	28.120
R1-1	RESISTOR	47 OHM 5% 7W	PHILIPS	2322 329 07479	05.866
R2-1	RESISTOR	47 OHM 5% 7W	PHILIPS	2322 329 07479	05.866
R3-1	**RESISTOR MF**	**1k0 OHM 5% 0.33W**	**PHILIPS**	**2322 180 73102**	**02.472**
R4-1	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R5-1	RESISTOR PMF	470 OHM 5% 2W	PHILIPS	2322 194 13471	04.191
R6-1	RESISTOR MF	12k OHM 5% 0.33W	PHILIPS	2322 180 73123	02.498
R7-1	RESISTOR MF	680 OHM 5% 0.4W	PHILIPS	2322 181 53681	01.195
R8-1	**RESISTOR MF**	**680 OHM 5% 0.4W**	**PHILIPS**	**2322 181 53681**	**01.195**
R9-1	RESISTOR MF	680 OHM 5% 0.4W	PHILIPS	2322 181 53681	01.195
RE1-1	RELAY	12VDC 1SH. 8A.	SCHRACK	RY S 12 012	21.031
RE2-1	RELAY	12VDC 1SH. 8A.	SCHRACK	RY S 12 012	21.031
RE3-1	RELAY	12VDC 1SH. 8A.	SCHRACK	RY S 12 012	21.031
TR1-1	**TRANSFORMER**	**TL526**	**S.P.RADIO**	**6-0-25867B**	**400526**
TR2-1	TRANSFORMER	TL310	BB	6-0-23162E	400310