LAB 2000

SERVICEMANUAL

	Drawing	
	Schematic	Layout
Theori of function	2KFUN	
Internal connections	2KCON	
Input amplifier	2KINP	2KINP-P
LF-amplifier	2KLF	2KLF-P
HF-amplifier	2KHF	2KHF-P
Led display	2KLED	2KLED-P
Fuse-board Voltage stab	2KFU	2KFU-P
Power Supply	2KPSUA 2KPSUB	2KPSUA-P 2KPSUB-P
Power supply	Old version	

LAB.GRUPPEN

Andersson & Bävholm AB
Gullregnsvägen 16
S-434 44 KUNGSBACKA
SWEDEN
Tel. + 46 300 - 168 23 Fax. + 46 300 - 142 46

LAB 2000C
Theory of function

AC-power is coming in to terminal K1. The voltage is rectified by D1 and filtered by C10, C11. This gives 310V DC to the transformer TR1. The PWM-controller U1 controls the switch Q1-Q3 to give the correct output voltage at terminal J17, J19. When the switch Q1-Q3 i closed, current flows trough transformer, TR1, storing energy. Because of the voltagepolarity, diode D3, D4 are reverse-biased, thus no voltage present at the load. When the switch is open, transformer TR1 reverses polarity because of the collapsing magnetic field, forward-biasing diod D3, D4, and inducing a current flow into the capacitors C12, C14. The reversed voltage is sensed by a winding in TR1 and rectified by diod D8. The PWM-controller adjust the on-time of the switch, by comparing the voltage across C14 with an internal referens, to give a railvoltage of +-136V across the capacitors C12,C14. The voltage can be adjusted by potentiometer TP2. The maximum current in the transformer is sensed over the resistor R6-R8. The voltage across R6-R8 is compared with a referense-voltage, set by TP3, which make it possible to adjust the maximum output power from the powersupply. Normally TP3 is in maximum position, but if something has too be repaird in the amplifier, TP3 is used for "slowstarting" the amplifier.

The inputsignal is connected to the balanced amplifier U1. The gain in this amplifier can be reduced by optoresistor LDR1 to prevent clipping in the output amplifier. From amplifier U1 signal is going to limiter U2, Q1, Q2 passing gaincontrol P1. This limiter together with the phaselineare lowpassfilter U3, U4 limits the slewrate of the signal going to the output amplifier 2KLF, preventing intermodulation in this amplifier if signals of too high frequencies are presented on the input terminal.

The output amplifier 2KLF works as an ordinary power amplifier with the difference that the collectorvoltage to the output transistors is supplied from the switchmode amplifier 2KHF. The base voltage on the output transistors Q26-Q28, Q31-Q33 is sensed by voltage divider R36-R38 and is then sent to the adjustable limiter U3, U4 on the input board, bofore it reaches the input on the switchmode amplifier. Limitlevel is set by the minimum load select-switches (MLS-sv.) to give correct output power in different loads.

The amplifier U1 (U2) on the HF-board makes sure that the output signal on terminal J4 (J8) is a copy of the input signal on terminal J12, by giving correct controvoltage to pulsewidth modulator U3. U3 compares this voltage with an 830Khz triangularwave giving a pulsewide modulated output signal from Q1 (Q7) which is filtered by L1, C1 (L4, C10). The gain from the base of the output transistors in the LF-amplifier to the output of the HF-amplifier is equal to one. TP1 (TP2) is used to add a DC-ofsett on the input of U1 (U2) giving +11V (J4) - 11V (J8) relative output of the LF-amplifier (J6), which is the same as collector-emitter voltage for the output transistors Q26-Q28, Q31-Q33.

HOW TO REPAIR

REQUIRED MEASUREMENT EQUIPMENT:

- Audiogenerator
- AC-voltmeter/THD-meter
- 2 digital voltmeters
- Two channel oscilloscope for audio
- Variac 0-280V, 6A
- 50Mhz oscilloscope, ex. Tek 2225
  with 100x probe ex. Tek P6009

AMPLIFIER

1. Without changing any fuses check the powersupply +136V, -136V, +16V, -16V, +30V. If these aren't OK go to section for reparing power supply.

2. If all fuses are OK, follow the signal from input to output, and repair it in normal way. The best way is to place the amplifier on the front handles, losen the rear panel, and mount it back on distances (delivered with this manual) to make it possible to measure.

3. If there is a fault in the power amplifier stage do as follows:

   3:1 Turn TP1, TP2 on the HF-board, TP3 on the power supply board counter clockwise. (TP1 old PSU clockwise)

   3:2 Short-circuit R38 on LF-board.

   3:3 Disconnect cables from Q28, Q32 collector on the LF-board.

   3:4 Replace broken fuses. (only for the channel you repair)

   3:5 Connect DC-voltmeter (200V) to the positive (nagative) rail voltage.

   3:6 Connect another DC-voltmeter (20V) to the cable disconnected from Q28 (Q32).

   3:7 Turn TP3 (PSU) slowly clockwise, TP1 (old PSU counter clockwise) and watch the voltmeters. Rail voltage should increase rapidly, "collector voltage" should read 0. After turning TP3 maximum 30°, railvoltage should be 136V.

   a. If the railvoltage is zero or very low, check Q1, D1 (Q7, D5) (shorted) on the HF-board..
   If Q1 (Q7) is broken, also replace R3 (R16) and D2 (D6).

   b. If OK (136V) turn TP1 (TP2) slowly maximun clockwise. Voltage measured on the disconnected colectorcable should stop at about 11V.

   c. If OK turn TP1 (TP2) and TP3 counter clockwise. (TP1 old PSU clockwise)

3:8 Repeat from 3:5 for the negative side.

3:9 Reconnect cable to Q28 (Q32)colector.

3:10 Connect dummy load 16Ω to output, and connect an oscilloscope (10V/div) across the load.

3:11 Slowly turn TP3 (PSU) for 136V (-136V) railvoltage.

3:12 Slowly turn TP1 (TP2) clockwise and look at the oscilloscope. There should be no DC on the oscilloscope. If there is DC (⟨1V) repair the positive (negative) output section on the LF-board.

3:13 Turn back TP1 (TP2) and TP3, and disconnet Q28 collector.

3:14 Reconnect Q32 collector and repeat from 3:11 for the negative side.

3:15 Reconnect cables to Q28 and Q32 collector. Turn TP3 for 136V rail voltage. Turn TP1 clockwise, no DC on the oscilloscope. Then slowly turn TP2 clockwise. There can be some oscillation with TP2 in middle position, byt it will stop at further turning.

3:16 Connect 1KHz sine wave to the input of the amplifier. Adjust gain until there is signal on the output. It should be a 10V PK sinewave with no distortion.

3:17 Disconnect short circuit from R38, and the amplifier will work.

POWER SUPPLY

VALID FOR UNITS WITH PSUA AND PSUB BOARDS.

1. Turn TP3 fully counter clockwise.

2. Change F1 on the PSUA.

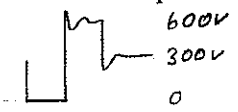
3. Increase the main voltage slowly by the variac.

4. Measure the voltage across C1.
   a. No voltage: - change R5
   b. The current increase quickly: - check D1 - PSUA
   - check Q1, -Q2, Q3 - PSUB

5. It is now possible to increase the voltage across C1 to approx. 310V.

6. Connect an oscilloscope, (100V/div) via an isolation transformer across Q1 collector and emitter.

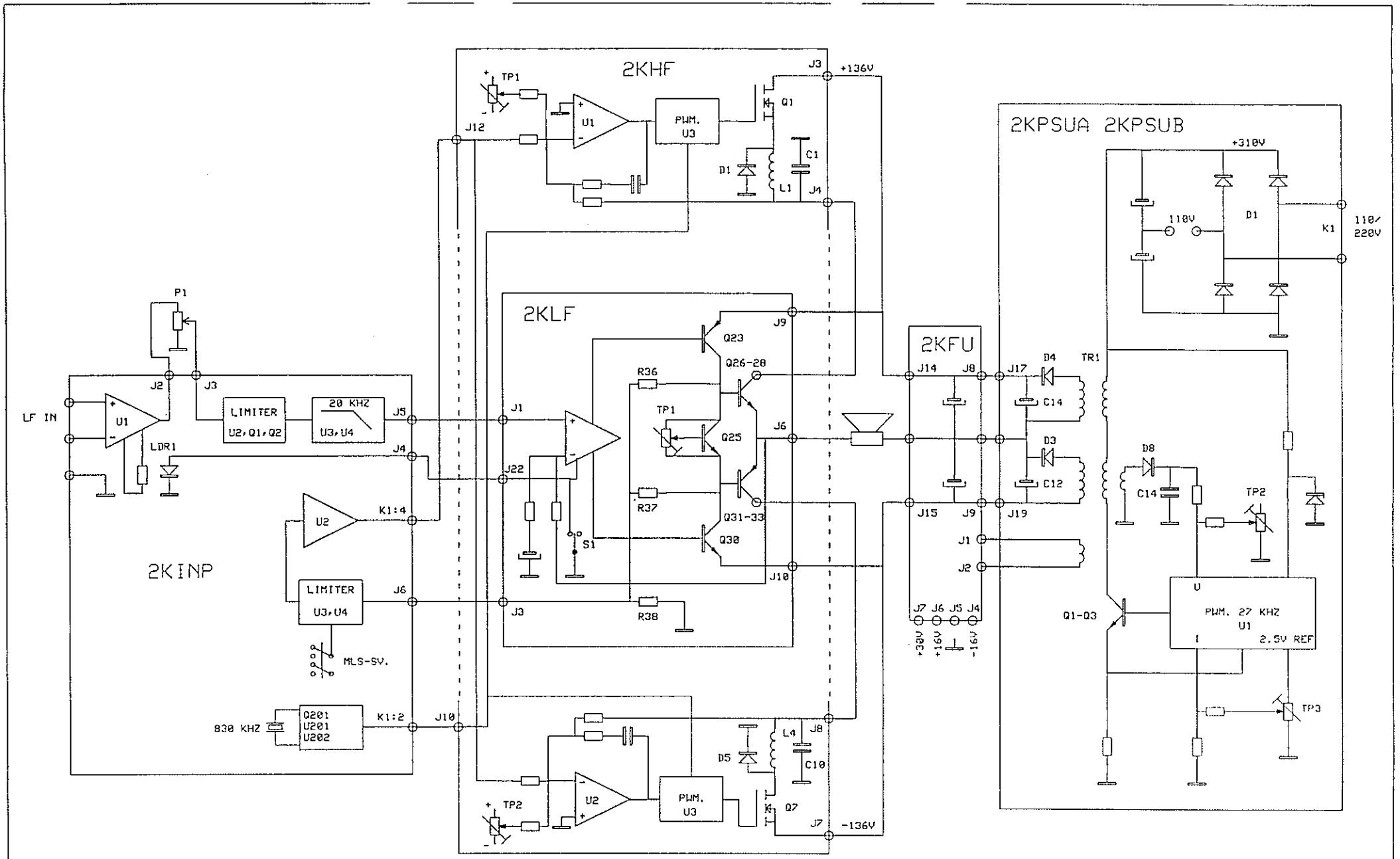
7. Turn TP3 slowly until a pulse is visible on the scope. The frequency is approx. 27kHZ.
   If the graph is seen, go to item 10.



8. If only narrow spikes is seen, check the following components.
   a. D3, D4 - PSUA or the output circuits.
   b. D1 (C5, R1, R2, R3) PSUB
   c. Q1 - PSUA - the softstart circuit will not deliver enough power.
   d. U1 - the output will remain low all the time.

9. If ringing occur after the flyback pulse, it depends on broken D2 or D4, R5/C6.

10. Turn TP3 fully clockwise:
    a. Check the outputvoltage on C12, C14 - PSUA for 136V DC - Adjust witch TP2.
    b. Check the softstart circuit by turning on and off the mainswitch and look at the oscilloscope.
    c. Increase the power by applying an audiosignal to the amplifier and turn up the gaincontrols. - The pulswidth will increase.
    d. Check the over-/ undervoltage protection circuits by turning the variac up to 280 VAC and down to 130 VAC. (No load.)

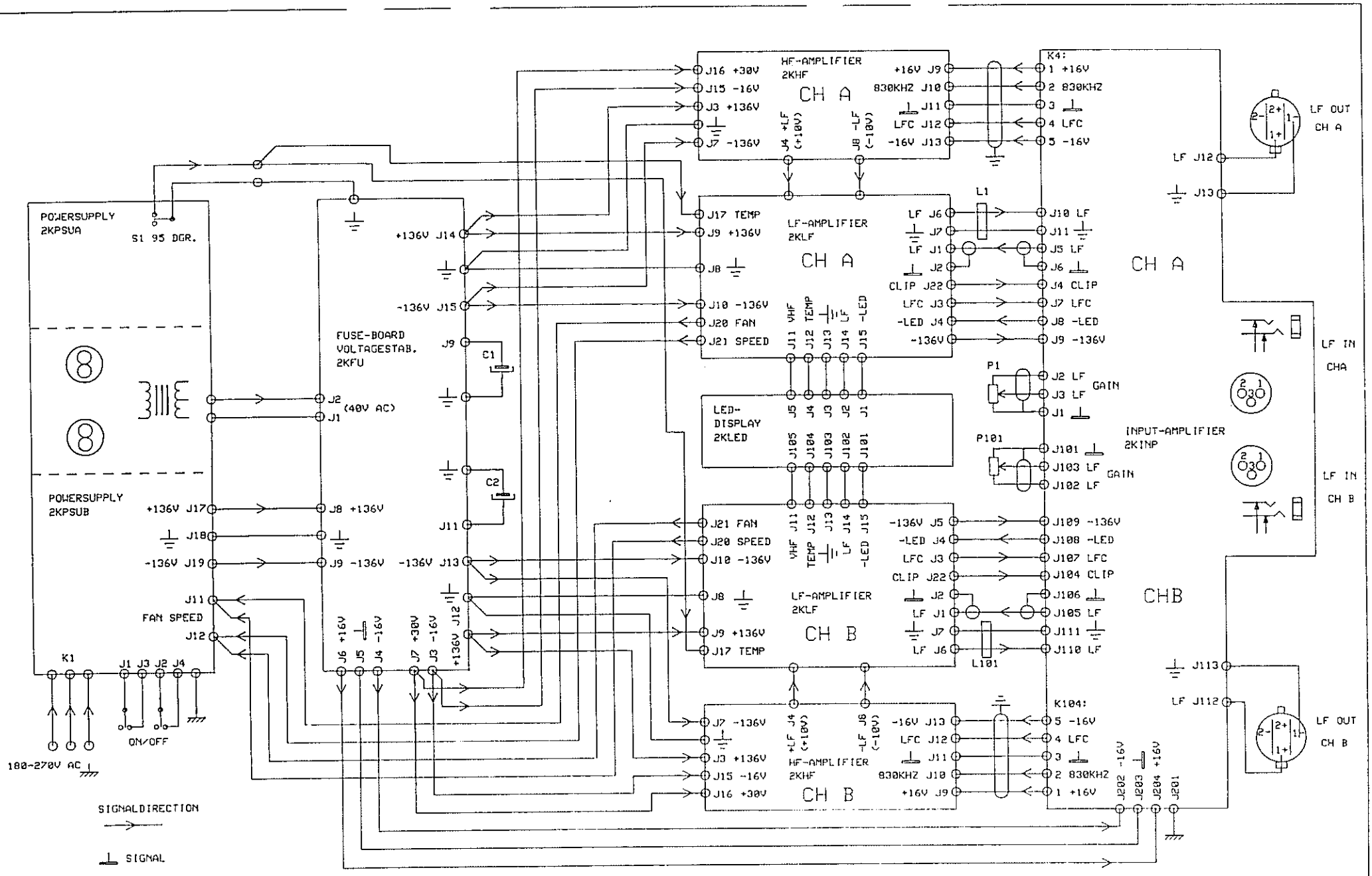


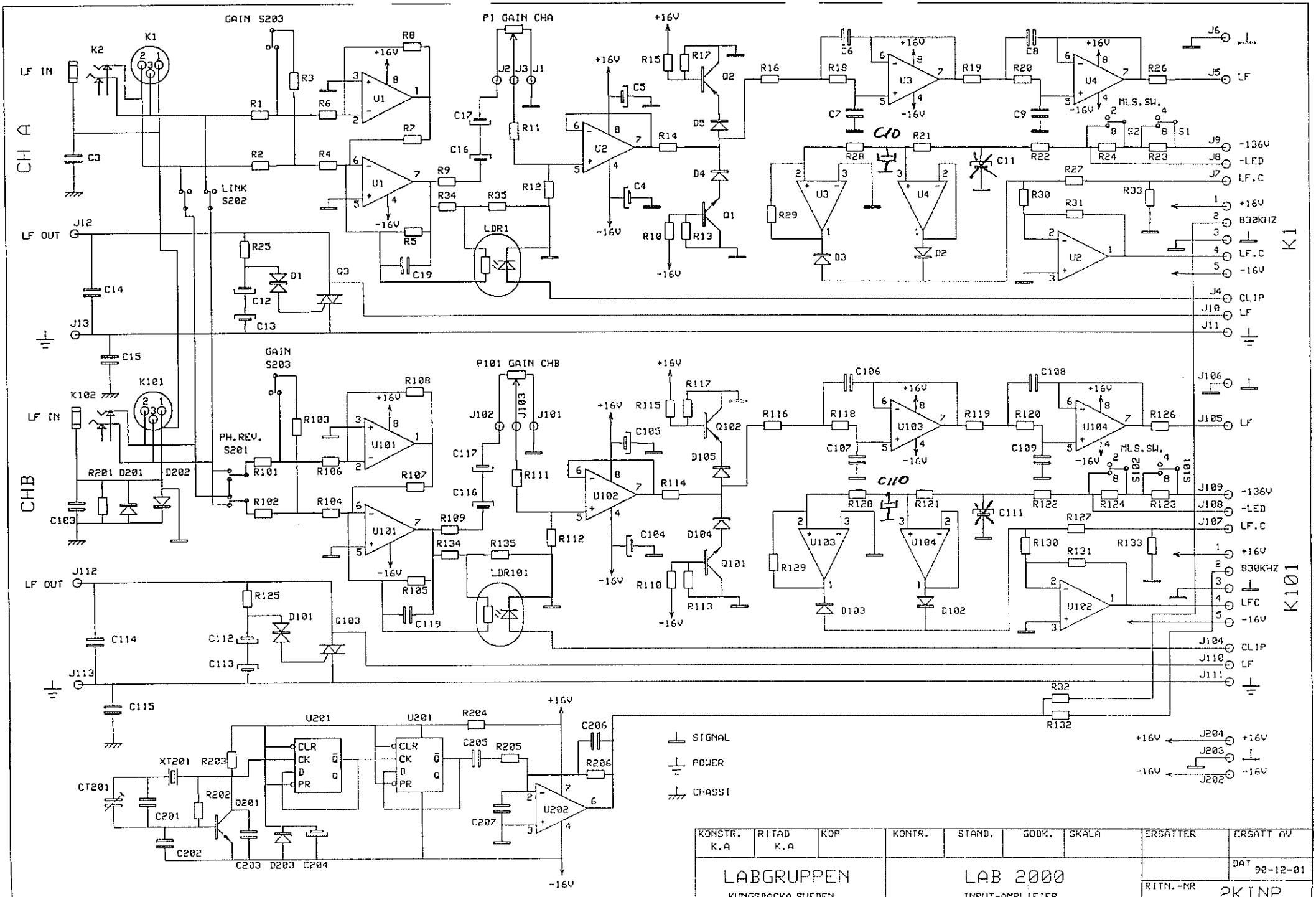
KONSTR.	RITAD	KOP	KONTR.	STAND.	GODK.	SKALA	ERSATTER	ERSATT AV
K.A	K.A							DAT 90-12-01

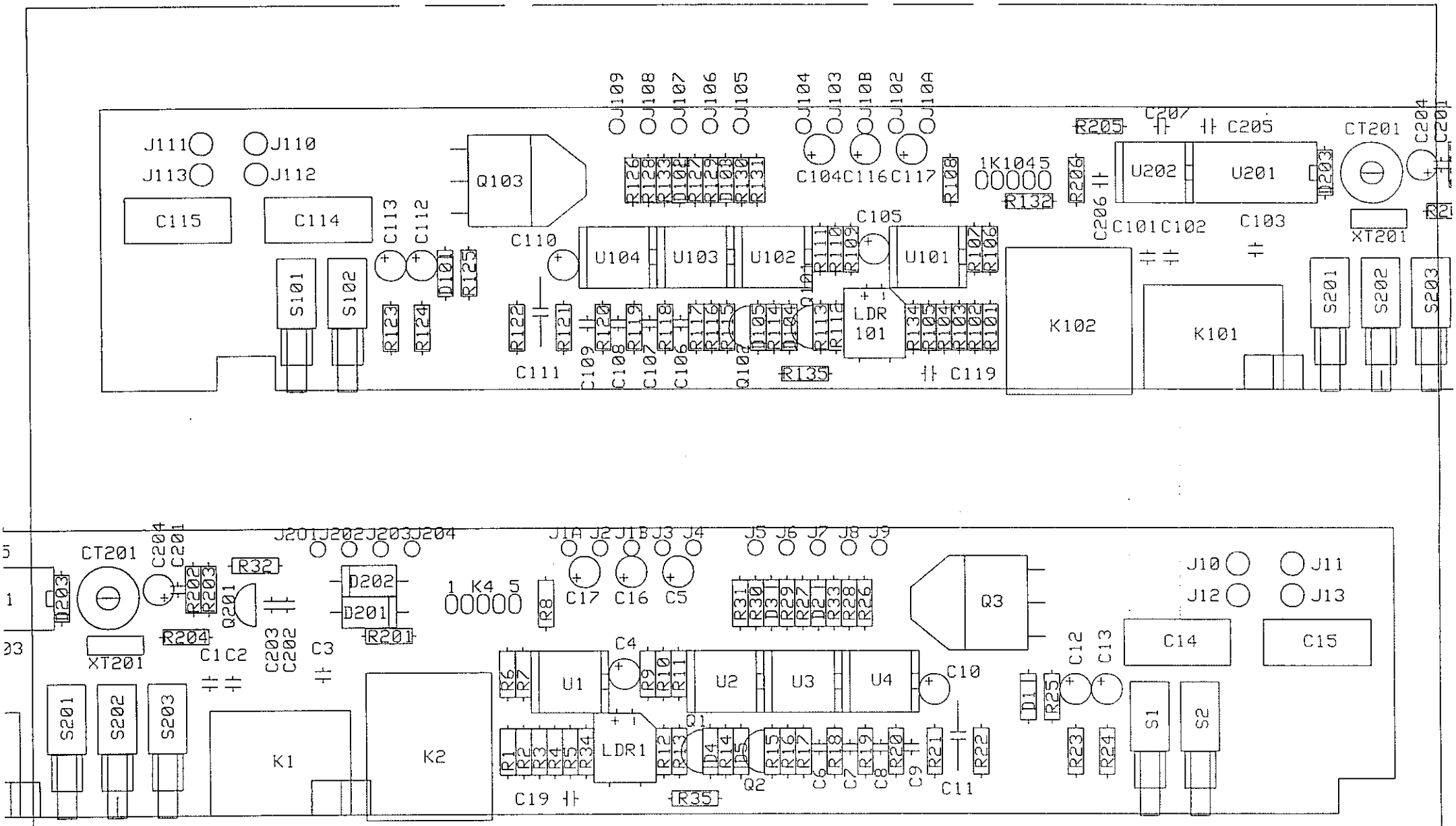
LABGRUPPEN
KUNGSBACKA SWEDEN

LAB 2000
THEORY OF FUNCTION

RITN.-NR 2KFUN


POWERSUPPLY
2KPSUA
S1 95 DGR.
FUSE-BOARD
VOLTAGESTAB.
2KFU
POWERSUPPLY
2KPSUB
(40V AC)
FAN SPEED
ON/OFF
180-270V AC
K1
HF-AMPLIFIER
2KHF
CH A
LF-AMPLIFIER
2KLF
CH A
LED-
DISPLAY
2KLED
LF-AMPLIFIER
2KLF
CH B
HF-AMPLIFIER
2KHF
CH B
INPUT-AMPLIFIER
2KINP
CH A
CH B
K4:
K104:
GAIN
LF OUT
CH A
LF OUT
CH B
LF IN
CHA
LF IN
CH B
SIGNALDIRECTION
SIGNAL
POWER LF
CHASSI
KONSTR. K.A
RITAD K.A
KONTR.
STAND.
GODK.
SKALA
ERSÄTTER
ERSATT AV
DAT 90-12-01
LABGRUPPEN
KUNGSBACKA SWEDEN
LAB 2000
INTERNAL CONNECTIONS
RITN.-NR 2KCON


CH A
CHB
K1
K101
LF IN
LF OUT
GAIN S203
P1 GAIN CHA
P101 GAIN CHB
LINK S202
PH.REV. S201
MLS.SW.
LDR1
LDR101
+16V
-16V
SIGNAL
POWER
CHASSI
J6
J5 LF
J9 -136V
J8 -LED
J7 LF.C
J4 CLIP
J10 LF
J11
J106
J105 LF
J109 -136V
J108 -LED
J107 LF.C
J104 CLIP
J110 LF
J111
J204 +16V
J203
J202 -16V
830KHZ
LFC
KONSTR. K.A
RITAD K.A
KOP
KONTR.
STAND.
GODK.
SKALA
ERSÄTTER
ERSATT AV
DAT 90-12-01
LABGRUPPEN
KUNGSBACKA SWEDEN
LAB 2000
INPUT-AMPLIFIER
RITN.-NR 2KINP



KONSTR.	RITAD	KOP	KONTR.	STAND.	GODK.	SKALA	ERSÄTTER	ERSATT AV
K.A	K.A							DAT 90-12-01

LABGRUPPEN
KUNGSBACKA SWEDEN

LAB 2000
INPUT-AMPLIFIER

RITN.-NR 2KINP-P

LAB 2000 INPUT **Component-list Channel A** **(Ch. B add 100)**

Resistors

R1 10 kΩ 1%
R2 10 kΩ 1% gain
R3 13 kΩ 1% 33 dB
5.3 kΩ 1% 29 dB
3.3 kΩ 1% 26 dB
2.1 kΩ 1% 23 dB
R4 10 kΩ 1%
R5 66 kΩ 1%
R6 10 kΩ 1%
R7 22 kΩ 1%
R8 22 kΩ 1%
R9 100 Ω
R10 47 kΩ 1%
R11 1 kΩ 1%
R12 47 kΩ 1%
R13 18 kΩ 1%
R14 1 kΩ 1%
R15 47 kΩ 1%
R16 10 kΩ 1%
R17 18 kΩ 1%
R18 10 kΩ 1%
R19 10 kΩ 1%
R20 10 kΩ 1%
R21 780 kΩ 1%
R22 100 Ω
R23 1.6 kΩ 1W
R24 4.7 kΩ 1W on legs
R25 120 kΩ
R26 100 Ω
R27 10 kΩ 1%
R28 47 kΩ 1%
R29 47 kΩ 1%
R30 10 kΩ 1%
R31 10 kΩ 1%
R32 100 Ω
R33 2 kΩ 1%
R34 10 kΩ 1%
R35 1 kΩ 1%

Optoresistor

LDR1 VTL5C4

Potentiometers

P1 4.7 kΩ 1%

Transistors

Q1 BC 547
Q2 BC 557
Q3 Q 4025R6

Capacitors

C1 -
C2 -
C3 0.1 µF 50V
C4 10 µF 50V
C5 10 µF 50V
C6 470 pF 5%
C7 470 pF 5%
C8 680 pF 5%
C9 220 pF 5%
C10 0.47 µF 50V
C11 -
C12 4.7 µF 50V
C13 4.7 µF 50V
C14 0.47 µF 250V
C15 2.2 µF 63V
C16 10 µF 50V
C17 10 µF 50V
C18 -
C19 22 pF

Diodes

D1 HS10
D2 1N 4148
D2 1N 4148
D3 1N 4148
D4 1N 4148
D5 1N 4148

Switches

S1 Alps SPPJ3
S2 Alps "

Integrated circuits

U1 NE 5532
U2 NE 5532
U3 TL 072
U4 TL 072

Connectors

K1 3-pole XLR chassie
K2 3-pole Telejack
K3 Speak-on NL-4MP
K4 5-pole pinheader

Channel A and B

Resistors

R201 10 Ω
R202 220 kΩ
R203 1 Ω
R204 2.2 kΩ
R205 1.6 kΩ 1%
R206 22 kΩ 1%

Capacitors

C201 22 pF
C202 220 pF
C203 68 pF
C204 10 µF 25V
C205 1 nF
C206 68 pF 5%
C207 220 pF

Diodes

D201 1N 5404
D202 1N 5404
D203 5.6V Zener

Transistors

Q201 BC 547

Integrated circuits

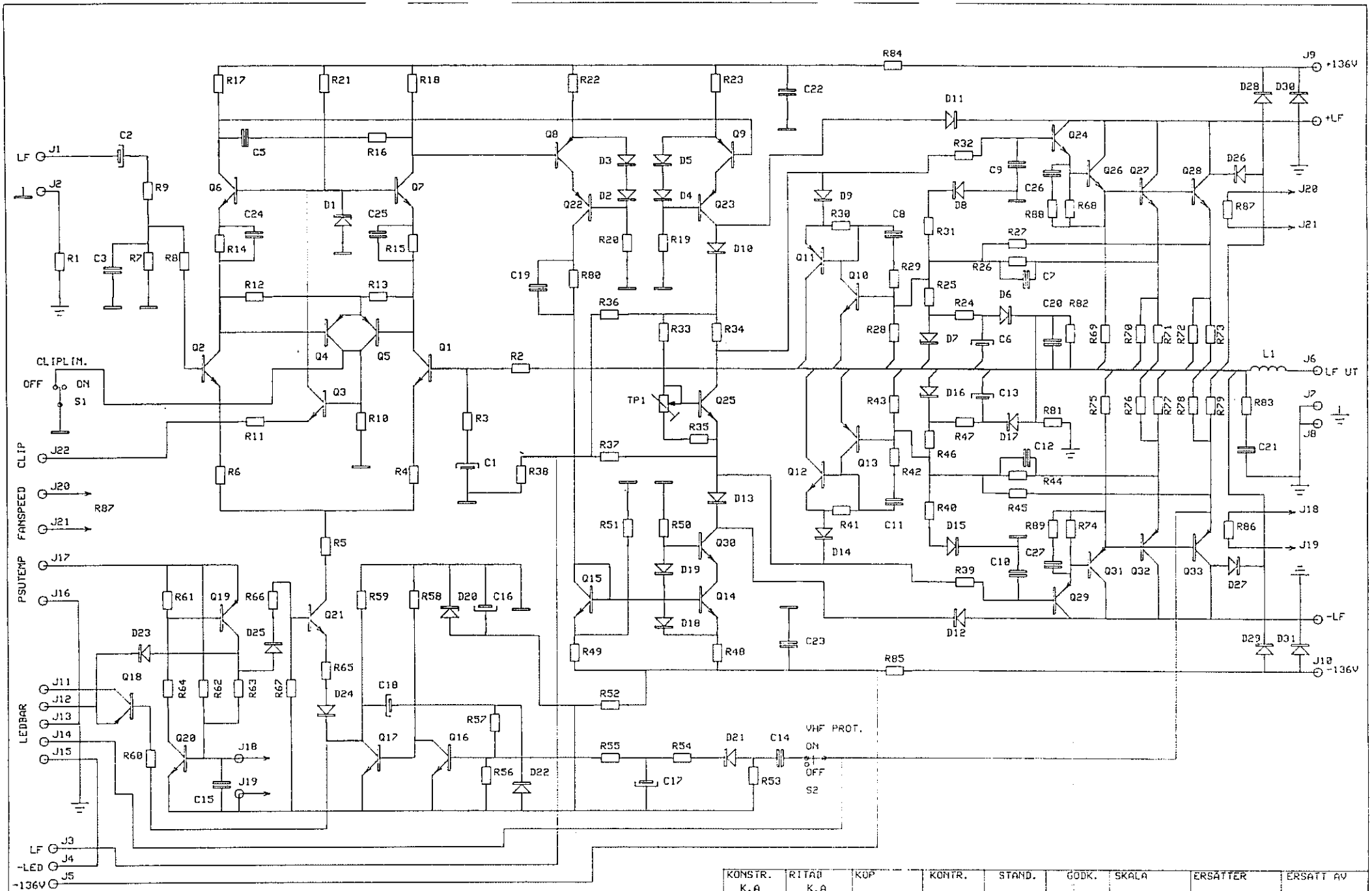
U201 74HC74
U202 LM 318

Crystals

X201 3.2768 mHz

Switches

S201 Alps SPPJ3
S202 Alps "
S203 Alps "

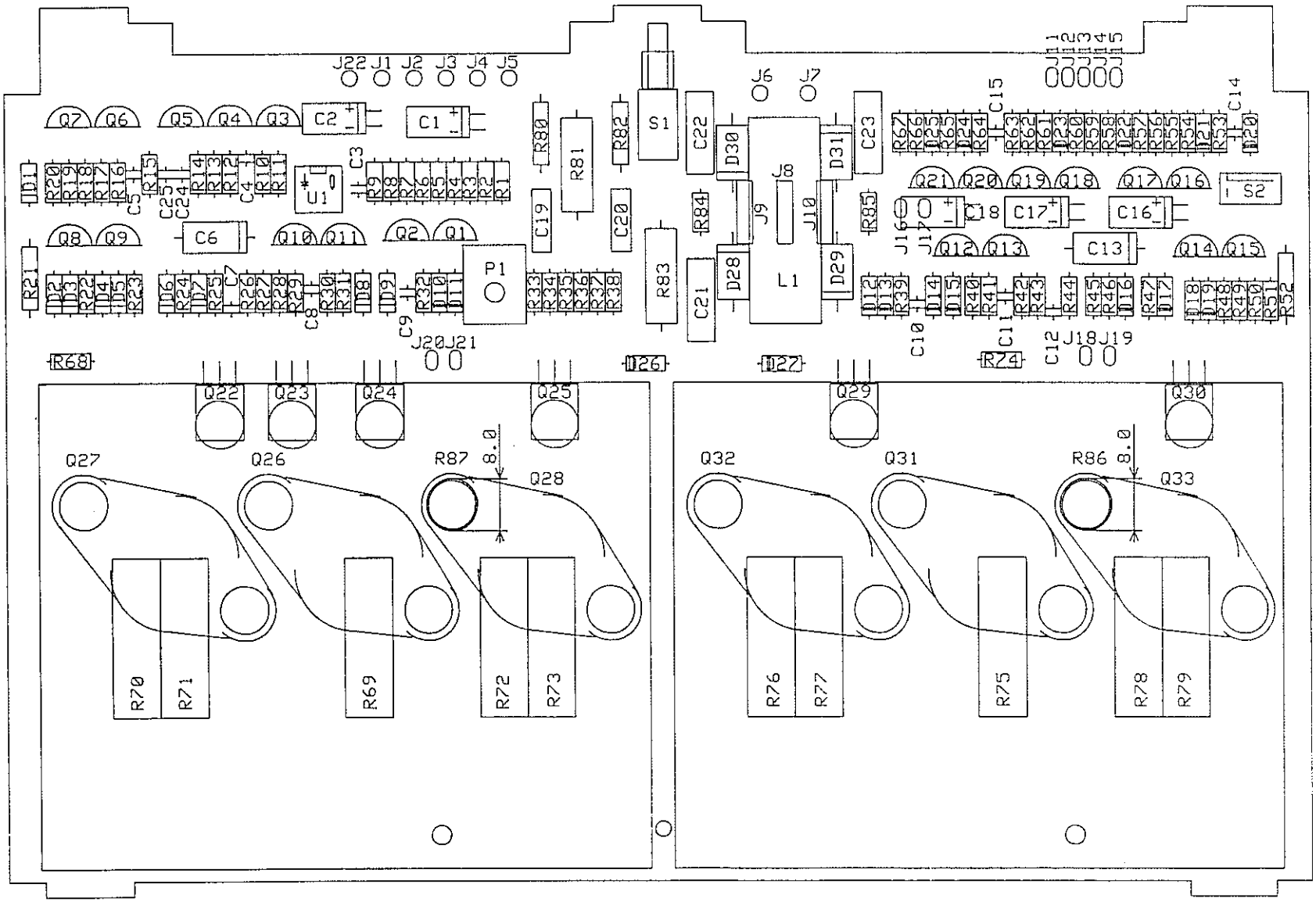


KONSTR.	RITAD	KOP	KONTR.	STAND.	GODK.	SKALA	ERSÄTTER	ERSATT AV
K.A	K.A							DAT 98-12-01

LABGRUPPEN
KUNGSBACKA SWEDEN

LAB 2000
LF-AMPLIFIER

RITN.-NR 2KLF



KONSTR.	RITAD	KOP	KONTR.	STAND.	GODK.	SKALA	ERSÄTTER	ERSATT AV
K.A	K.A							DAT 98-12-01
LABGRUPPEN KUNGSBACKA SWEDEN			LAB 2000 LF-AMPLIFIER				RITN.-NR	2KLF-P

LAB 2000 LF component-list

Resistors

R1 10 Ω
R2 27 kΩ 1%
R3 1 kΩ 1%
R4 180 Ω 1%
R5 1.8 kΩ 1%
R6 180 Ω 1%
R7 27 kΩ 1%
R8 10 Ω
R9 1 kΩ 1%
R10 100 kΩ
R11 1.8 kΩ 1%
R12 27 kΩ 1%
R13 27 kΩ 1%
R14 3.3 kΩ 1%
R15 3.3 kΩ 1%
R16 4.7 kΩ 1%
R17 3.3 kΩ 1%
R18 3.3 kΩ 1%
R19 100 kΩ
R20 100 kΩ
R21 18 kΩ 2W
R22 100 Ω 1%
R23 100 Ω 1%
R24 10 kΩ 1% 0.7W
R25 82 kΩ 1%
R26 4.7 kΩ 1%
R27 4.7 kΩ 1%
R28 1.8 kΩ 1%
R29 10 kΩ 1%
R30 4.7 kΩ
R31* 294 kΩ 1%
R32 220 Ω
R33 3.3 kΩ 1%
R34 10 Ω
R35 680 Ω
R36 22 kΩ 1% 0.7W
R37 22 kΩ 1% 0.7W
R38 22 kΩ
R39 220 Ω
R40* 294 kΩ 1%
R41 4.7 kΩ
R42 10 kΩ 1%
R43 1.8 kΩ 1%
R44 4.7 kΩ 1%
R45 4.7 kΩ 1%
R46 82 kΩ 1%
R47 10 kΩ 1% 0.7W
R48 100 Ω 1%
R49 100 Ω 1%
R50 100 kΩ
R51 100 kΩ
R52 18 kΩ 2W
R53 10 kΩ 1%
R54 10 kΩ 1%
R55 220 kΩ
R56 100 kΩ
R57 220 kΩ
R58 56 kΩ
R59 56 kΩ
R60 27 kΩ 1%
R61 3.3 kΩ 1%
R62 330 kΩ 1%
R63 2.2 MΩ
R64 22 kΩ 1%
R65 2.7 kΩ 1%
R66 100 kΩ
R67 56 kΩ
R68 47 Ω
R69 4.7 Ω 5W
R70 0.22 Ω 5W
R71 0.22 Ω 5W
R72 0.22 Ω 5W
R73 0.22 Ω 5W
R74 47 Ω
R75 4.7 Ω 5W
R76 0.22 Ω 5W
R77 0.22 Ω 5W
R78 0.22 Ω 5W
R79 0.22 Ω 5W
R80 6.8 kΩ 3W
R81 820 Ω 6W
R82 1.5 kΩ 3W
R83 10 Ω 3W
R84 10 Ω
R85 10 Ω
R86 150 kΩ NTC
R87 150 kΩ NTC
R88 4.7Ω
R89 4.7Ω

Trim potentiometers

TP1 250 Ω

Capacitors

C1 47 µF 50V
C2 4.7 µF 50V
C3 150 pF ker
C4 -
C5 680 pF
C6 1 µF 100V
C7 2.2 nF 63V
C8 1 nF
C9 680 pF
C10 680 pF
C11 1 nF
C12 2.2 nF 63V
C13 1 µF 100V
C14 68 pF
C15 0.1 µF 40V
C16 220 µF 16V
C17 4.7 µF 50V
C18 10 µF 50V
C19 22 nF 250V
C20 47 nF 250V
C21 0.1 µF 250V
C22 0.1 µF 250V
C23 0.1 µF 250V
C24 4.7 nF
C25 4.7 nF
C26 0.1 µF
C27 0.1 µF

Diods

D1 15 V Zener
D2 1N 4148
D3 1N 4148
D4 1N 4148
D5 1N 4148
D6 1N 4004
D7 27 V Zener
D8 BAV 21
D9 1N 4148
D10 1N 4148
D11 BAV 21
D12 BAV 21
D13 1N 4148
D14 1N 4148
D15 BAV 21
D16 27 V Zener
D17 1N 4004
D18 1N 4148
D19 1N 4148
D20 15 V Zener
D21 1N 4004
D22 1N 4148
D23 1N 4148
D24 1N 4148
D25 1N 4148
D26 1N 4004
D27 1N 4004
D28 BYW 95C
D29 BYW 95C
D30 1N 5404
D31 1N 5404

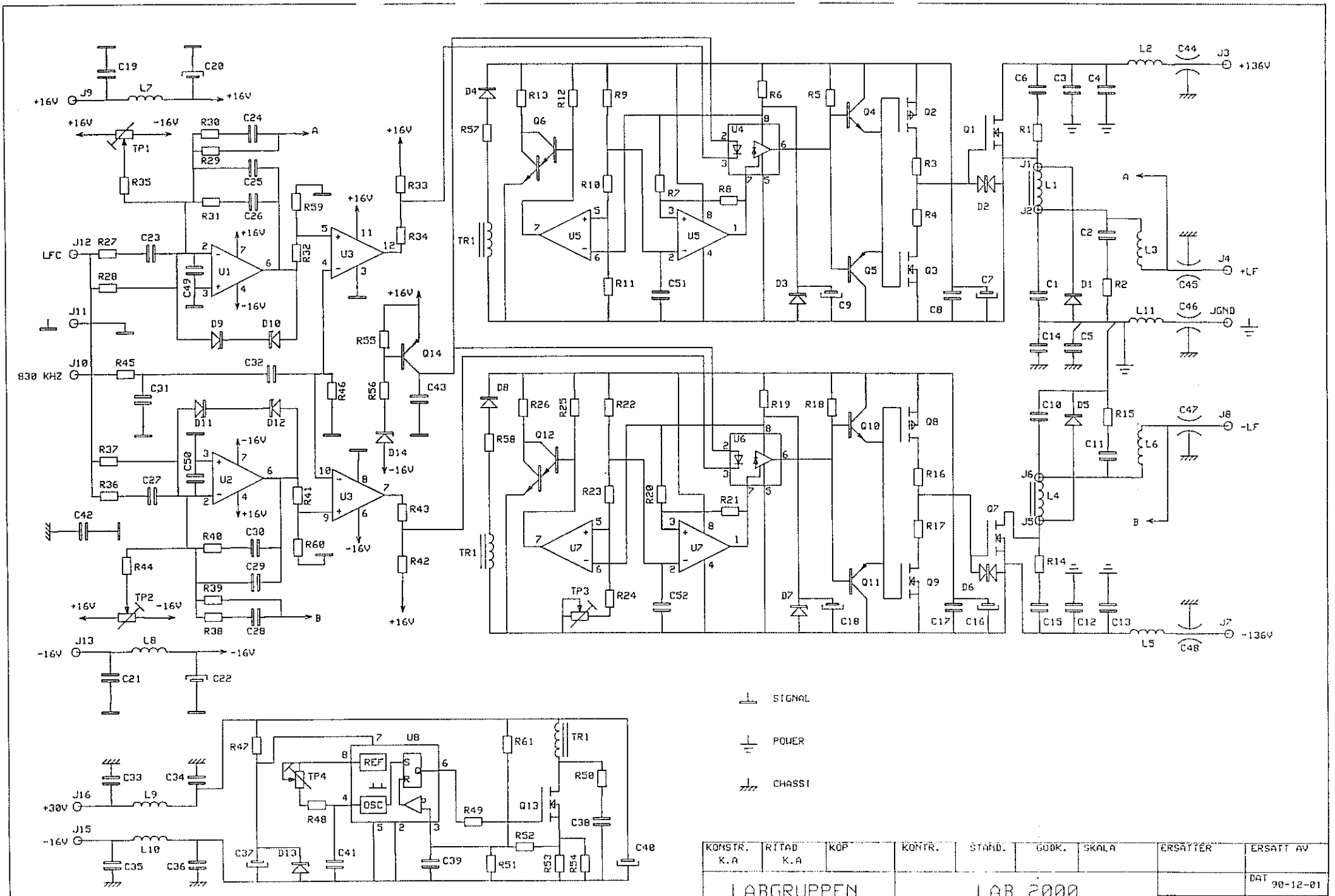
Transistors

Q1 BC 547
matched
Q2 BC 547
matched
Q3 BC 547
Q4 BC 557
Q5 BC 557
Q6 MPSA 42
Q7 MPSA 42
Q8 BC 557
Q9 BC 557
Q10 BC 547
Q11 BC 557
Q12 BC 547
Q13 BC 557
Q14 BC 547
Q15 BC 547
Q16 BC 547
Q17 BC 547
Q18 BC 557
Q19 BC 557
Q20 BC 547
Q21 BC 547
Q22 MJE 350
Q23 MJE 350
Q24 MJE 340
Q25 MJE 340
Q26 MJ 15024
Q27 MJ 15024
Q28 MJ 15024
Q29 MJE 350
Q30 MJE 340
Q31 MJ 15025
Q32 MJ 15025
Q33 MJ 15025

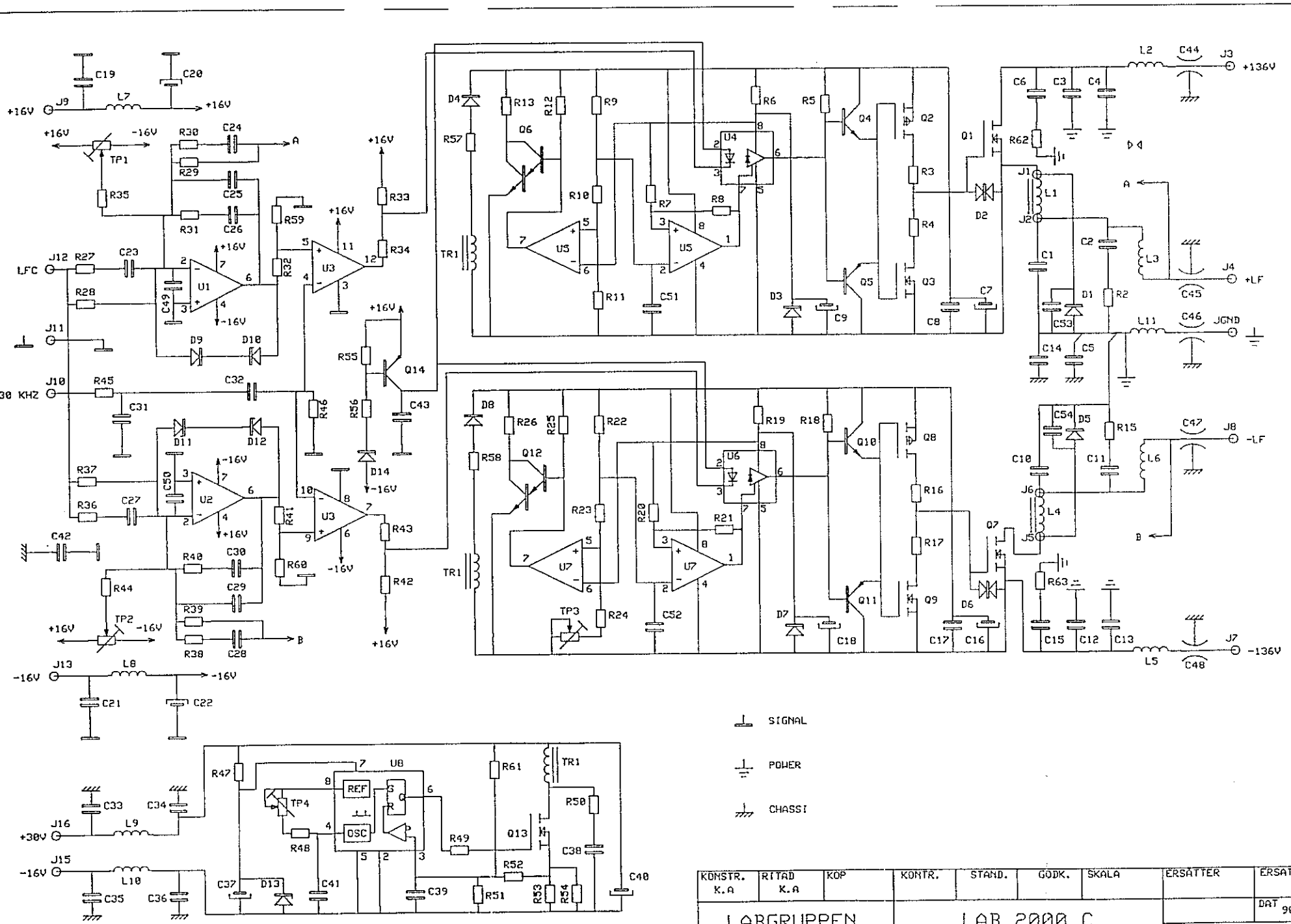
Inductors

L1 9.5 µH

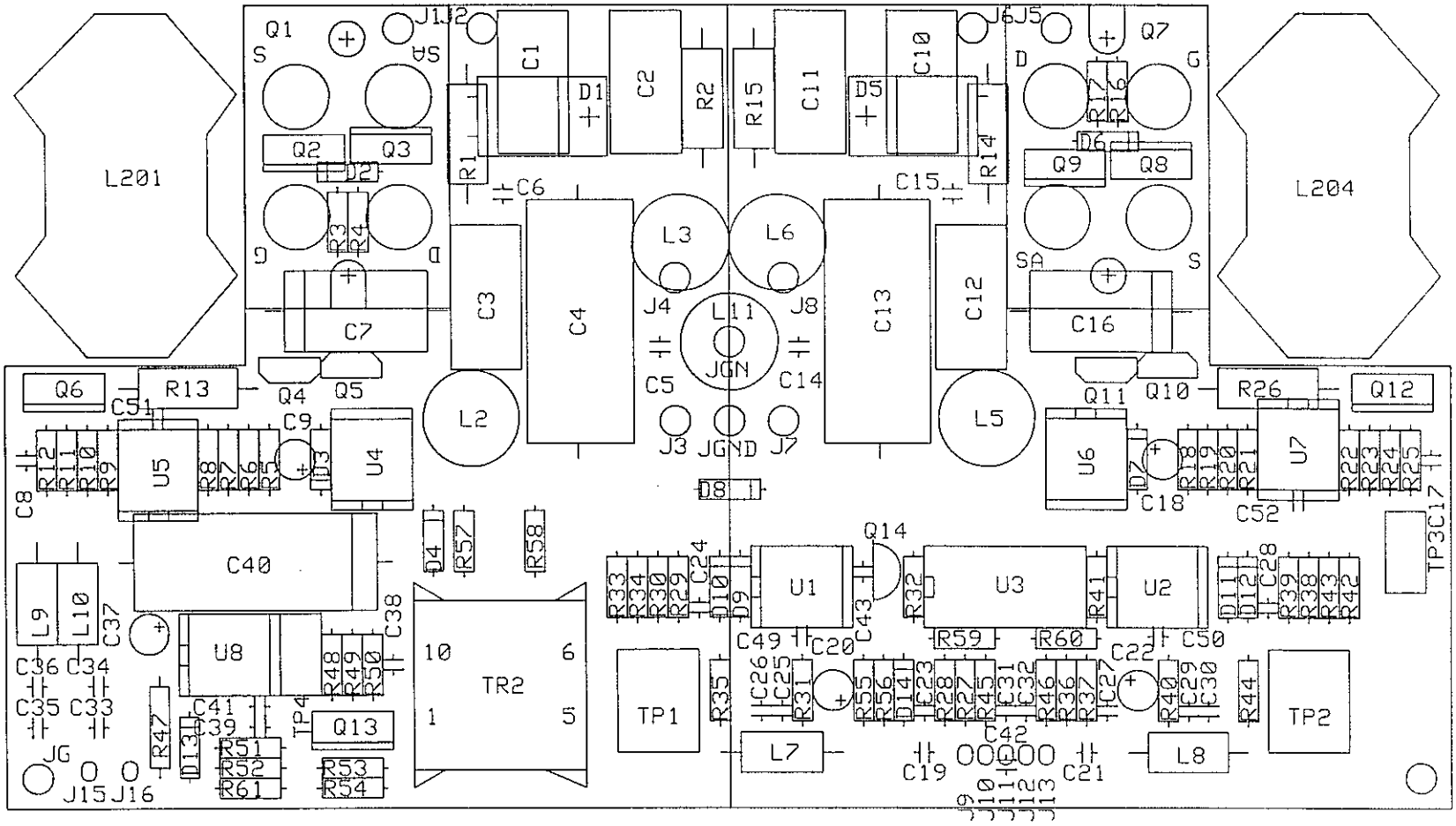
* Until 9503
R31 150 kΩ 1%
R40 150 kΩ 1%



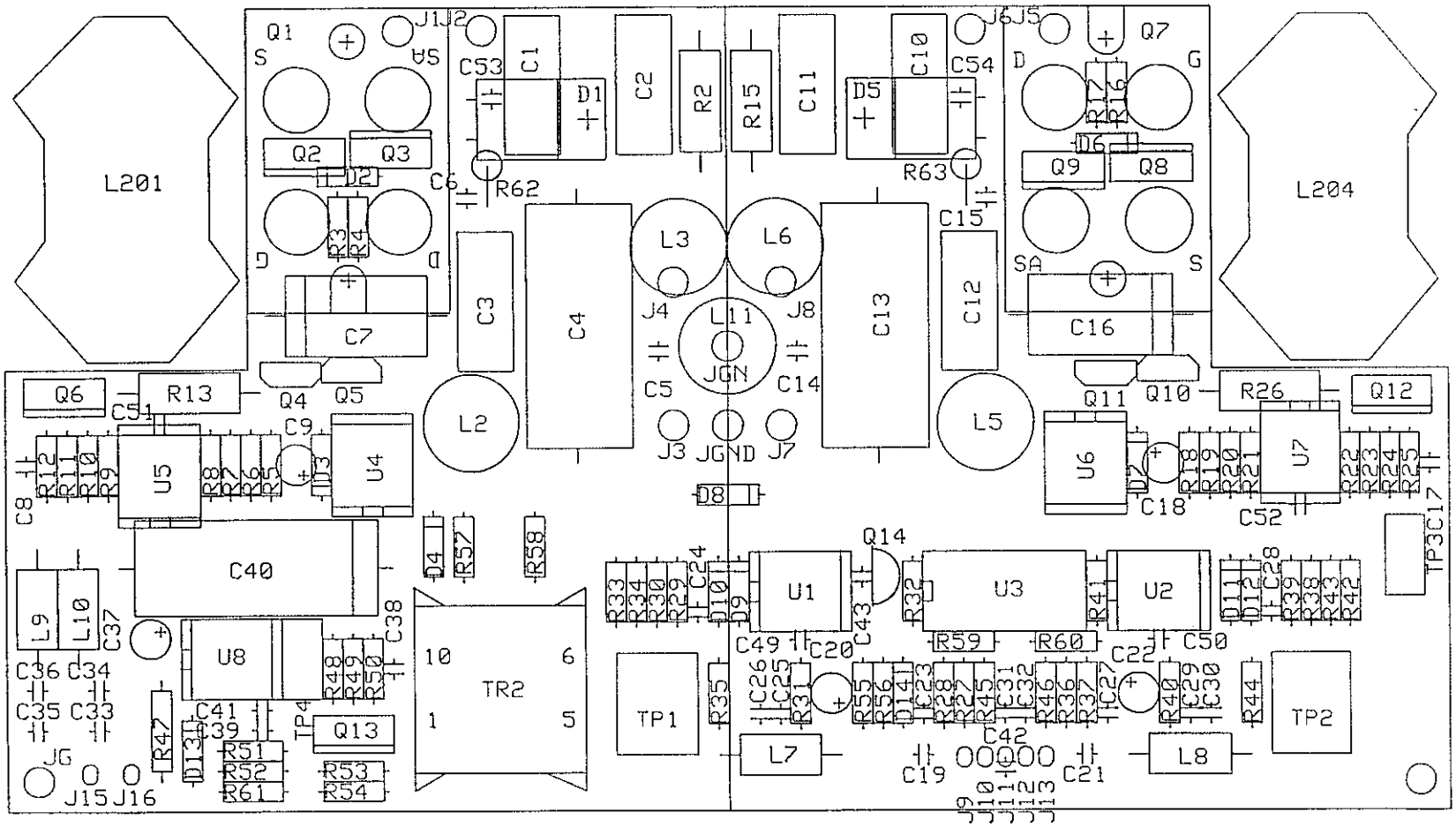
KONSTR.	RITAD	KOP	KONTR.	STAND.	GODK.	SKALA	ERSATTER	ERSATT AV
K.A	K.A							DAT 90-12-01
LABGRUPPEN KUNGSBACKA SWEDEN			LAB 2000 HF-AMPLIFIER				RITN.-NR	2KHF


SIGNAL
POWER
CHASSI
LABGRUPPEN
KUNGSBACKA SWEDEN
LAB 2000 C
HF-AMPLIFIER
2KHF
90-12-01

15A



KONSTR.	RITAD	KOP	KONTR.	STAND.	GODK.	SKALA	ERSÄTTER	ERSATT AV
K.A	K.A							DAT 90-12-01
LABGRUPPEN KUNGSBACKA SWEDEN			LAB 2000 HF-AMPLIFIER					RITN.-NR 2KHF-P



KONSTR.	RITAD	KOP	KONTR.	STAND.	GODK.	SKALA	ERSÄTTER	ERSATT AV
K.A	K.A							DAT 90-12-01
LABGRUPPEN KUNGSBACKA SWEDEN			LAB 2000 C HF-AMPLIFIER					RITN.-NR 2KHF-P

LAB 2000 HF **Component-list**

Resistors

R1* -
R2 4.7 Ω 6W on legs
R3# 4.7 Ω
R4# 1 Ω 0.7W
R5 680 Ω
R6 47 Ω
R7 2.2 kΩ 1%
R8 22 kΩ
R9 820 Ω
R10 47 Ω
R11 2.2 kΩ 1%
R12 4.7 kΩ 1%
R13 15 Ω 6W on legs
R14* -
R15 4.7 Ω 6W on legs
R16# 4.7 Ω
R17# 1 Ω 1W
R18 680 Ω
R19 47 Ω
R20 2.2 kΩ 1%
R21 22 kΩ
R22 820 Ω
R23 47 Ω
R24 1.8 kΩ 1%
R25 4.7 kΩ 1%
R26 15 Ω 6W on legs
R27 220 Ω 1%
R28 1.8 kΩ 1%
R29 27 kΩ 1%
R30 220 Ω 1%
R31 4.7 kΩ 1%
R32 4.7 kΩ
R33 330 Ω
R34 1.2 kΩ
R35 39 kΩ 1%
R36 220 Ω 1%
R37 1.8 kΩ 1%
R38 220 Ω 1%
R39 27 kΩ 1%
R40 4.7 kΩ 1%
R41 4.7 kΩ 1%
R42 330 Ω
R43 1.2 kΩ
R44 39 kΩ 1%
R45 2.2 kΩ 1%
R46 2.2 kΩ 1%
R47 820 Ω 2W
R48 12 kΩ
R49 47 Ω
R50 27 Ω
R51 1 kΩ
R52 1 kΩ
R53 2.2 Ω
R54 2.2 Ω
R55 2.2 kΩ1%
R56 2.2 kΩ 1%
R57 1 Ω 1W
R58 1 Ω 1W
R59 2.2 kΩ 1%
R60 2.2 kΩ 1%
R61 100 kΩ
R62 2.2 Ω 2W from 94
R63 2.2 Ω 2W from 94

Trim potentimeters

TP1 25 kΩ
TP2 25 kΩ
TP3 1 kΩ
TP4 10 kΩ

Capacitors

C1 0.33 µF 250V
C2 0.33 µF 250V
C3 0.33 µF 250V
C4 4.7 µF 160V
C5 1 µF 63V
C6 1 nF 200V
C7 470 µF 10V
C8 0.1 µF 63V
C9 10 µF 50V
C10 0.33 µF 250V
C11 0.33 µF 250V
C12 0.33 µF 250V
C13 4.7 µF 160V
C14 1 µF 63V
C15 1 nF 200V
C16 470 µF 10V
C17 0.1 µF 63V
C18 10 µF 50V
C19 0.1 µF 63V
C20 10 µF 50V
C21 0.1 µF 63V
C22 10 µF 50V
C23 4.7 nF 5%
C24 220 pF 5%
C25 150 pF 5%
C26 560 pF 5%
C27 4.7 nF 5%
C28 270 pF 5%
C29 220 pF 5%
C30 560 pF 5%
C31 68 pF
C32 1 nF 100V
C33 0.1 µF 63V
C34 0.1 µF 63V
C35 0.1 µF 63V
C36 0.1 µF 63V
C37 10 µF 50V
C38 1 nF 100V
C39 220 pF
C40 470 µF 63V
C41 1 nF
C42 0.1 µF 63V
C43 0.1 µF 63V
C44 1.5 nF feed through
C45 1.5 nF feed through
C46 1.5 nF feed through
C47 1.5 nF feed through
C48 1.5 nF feed through
C49 220 pF
C50 220 pF
C51 1 nF
C52 1 nF
C53 470 pF 200V from 94
C54 470 pF 200V from 94

Diods

D1 BYW 81PI200
D2 BZW 06P15B
D3 5.6V Zener
D4 BYV 100-100
D5 BYW 81PI200
D6 BZW 06P15B
D7 5.6V Zener
D8 BYV 100-100
D9 12V Zener
D10 12V - " -
D11 12V - " -
D12 12V - " -
D13 18V Zener 1.3W
D14 27V Zener

Transistors

Q1# TSD 4M350
Q2 IRF 9530
Q3 BUZ 71
Q4 ZTX 650
Q5 ZTX 750
Q6 Tip 120
Q7# TSD 4M350
Q8 IRF 9530
Q9 BUZ 71
Q10 ZTX 650
Q11 ZTX 750
Q12 Tip 120
Q13 IRF 730
Q14 BC 557

Integrated circuits

U1 LM 318
U2 LM 318
U3 LM 319
U4 HCPL 2400
U5 LM 393
U6 HCPL 2400
U7 LM 393
U8 UC 3842

Inductors

L1 14 µH
L2 1 µH
L3 1 µH
L4 14 µH
L5 1 µH
L6 1 µH
L7 47 µH
L8 47 µH
L9 47 µH
L10 47 µH
L11 1 µH

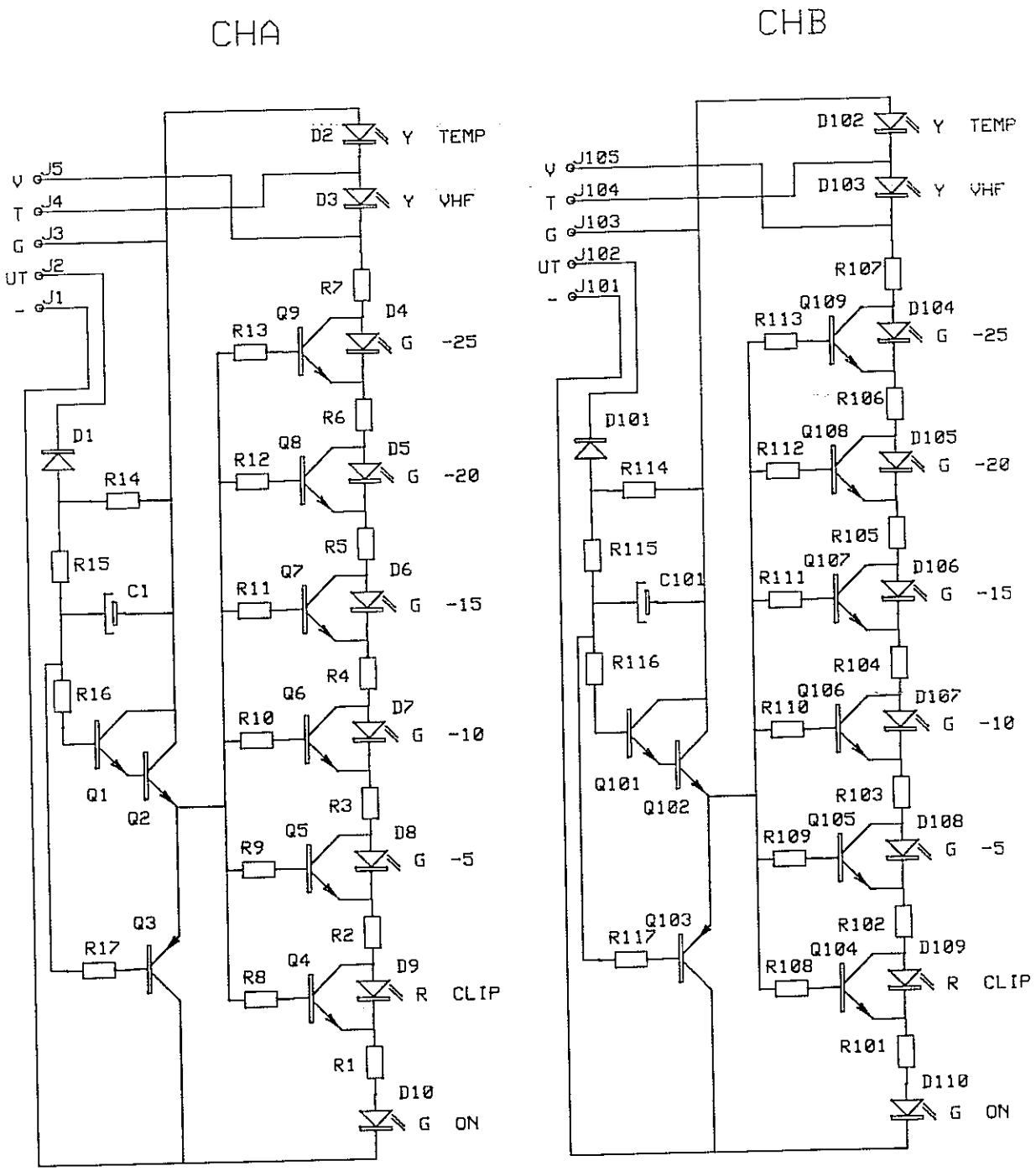
Transformers

TR1 EF20 N27

* Until 94

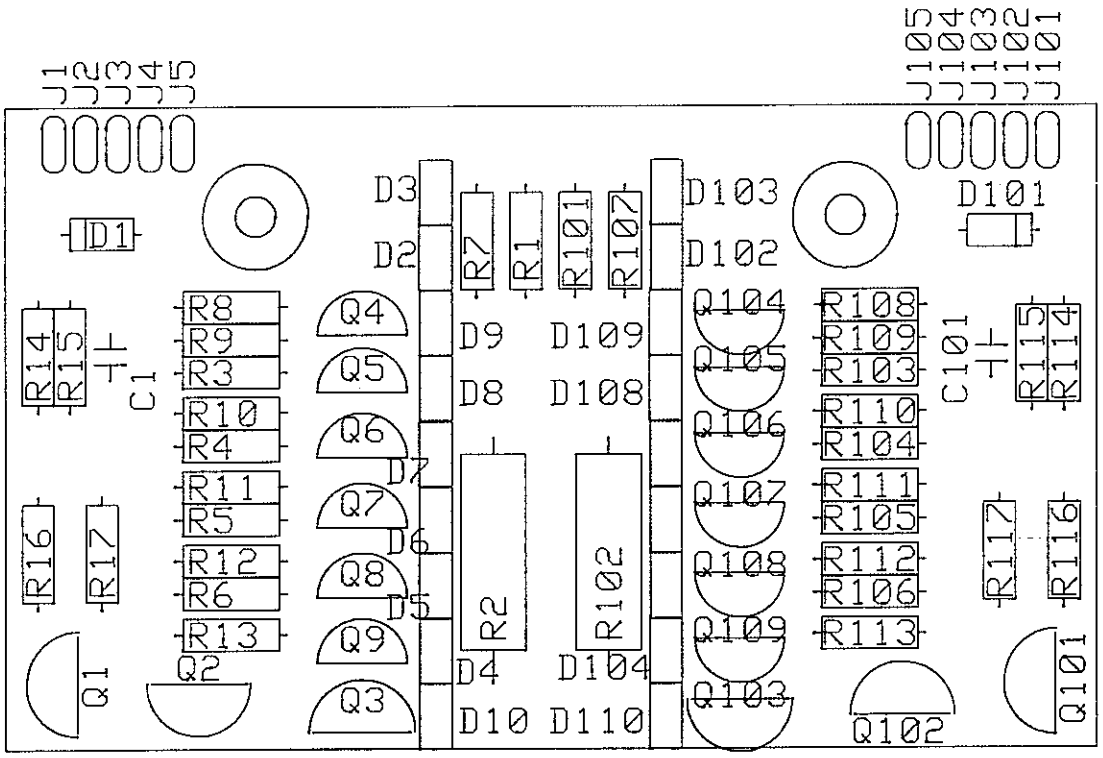
R1 4.7 Ω 6W on legs
R14 4.7 Ω 6W on legs

#Transistor Q1, Q7	R3	R16	R4	R17
TSD4M350	4.7 Ω	4.7 Ω	1 Ω	1 Ω
APT4M90JN	6.8 Ω	6.8 Ω	1 Ω	1 Ω
MPT53N50E	4.7 Ω	4.7 Ω	0 Ω	0 Ω



KONSTR.	RITAD	KOP	KONTR.	STAND.	GODK.	SKALA	ERSÄTTER	ERSÄTT AV
K.A	K.A							

LABGRUPPEN KUNGSBACKA SWEDEN	LAB 2000 LED.DISPLAY		DAT 90 12 01
		RITN.-NR	2KLED



KONSTR.	RITAD	KOP	KONTR.	STAND.	GODK.	SKALA	ERSÄTTER	ERSATT AV
K.A	K.A							

LABGRUPPEN KUNGSBACKA SWEDEN	LAB 2000 LED.DISPLAY		DAT 90 12 01
		RITN.-NR	2KLED-P

LAB 2000 LED **Component-list** **Channel A** **(Ch. B add 100)**

Resistors

R1 680 Ω
R2 2.7 kΩ 3W
R3 1.2 kΩ 1W
R4 680 Ω
R5 330 Ω
R6 120 Ω
R7 220 Ω
R8 33 kΩ
R9 33 kΩ
R10 33 kΩ
R11 33 kΩ
R12 33 kΩ
R13 33 kΩ
R14 33 kΩ
R15 120 Ω
R16 2.7 kΩ
R17 2.7 kΩ

Capacitors

C1 4.7 µF 100V

Diods

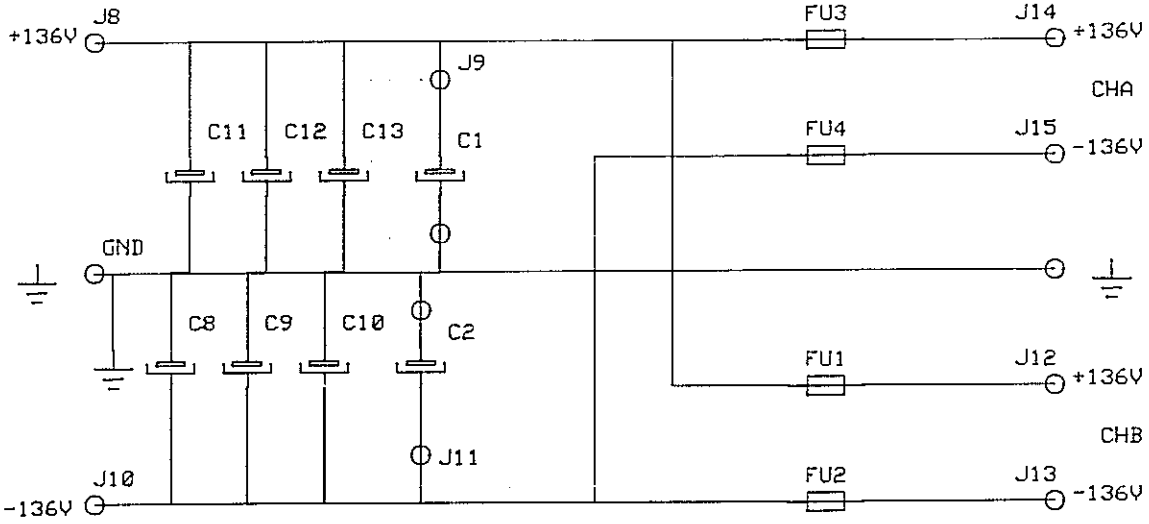
D1 1N 4004
D2 Led Y
D3 Led Y
D4 Led G
D5 Led G
D6 Led G
D7 Led G
D8 Led G
D9 Led R
D10 Led G

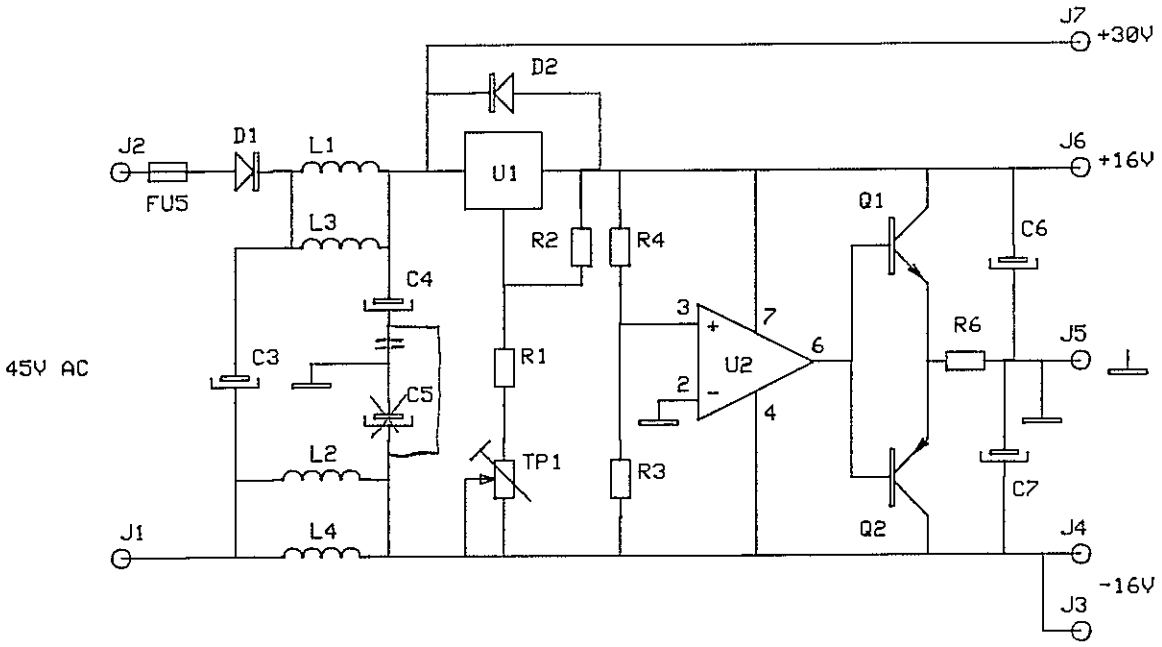
Transistors

Q1 MPSA 42
Q2 MPSA 42
Q3 MPSA 92
Q4 BC 547
Q5 BC 547
Q6 BC 547
Q7 BC 547
Q8 BC 547
Q9 BC 547

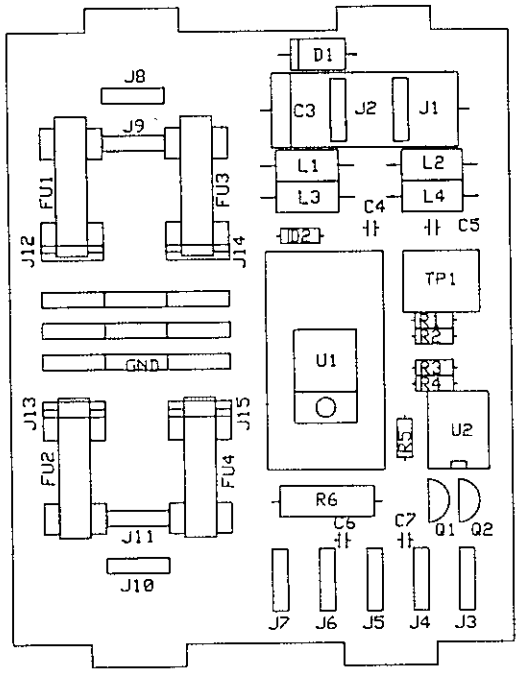
C1,C2 USED FOR SERIELNR._____ _____

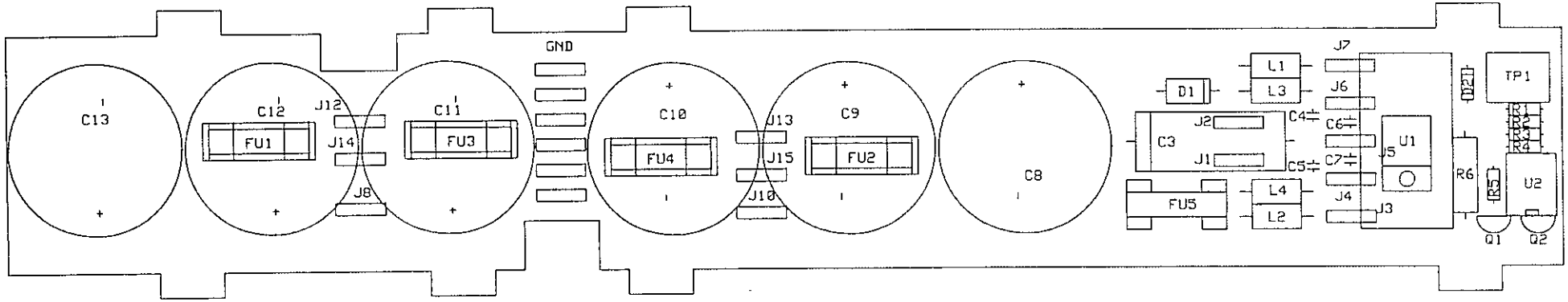
C8-C13 USED FOR SERIELNR._____ _____





KONSTR. K.A	RITAD K.A	KOP	KONTR.	STAND.	GODK.	SKALA	ERSÄTTER	ERSATT AV
LABGRUPPEN KUNGSBACKA SWEDEN			LAB 2000 FUSE-BOARD VOLTAGESTABB.-BOARD				DAT 90 12 01 RITN.-NR 2KFU	





KONSTR.	RITAD	KOP	KONTR.	STAND.	GODK.	SKALA	ERSÄTTER	ERSATT AV
K.A	K.A							DAT 90-12-01

LABGRUPPEN
KUNGSBACKA SWEDEN

LAB 2000
FUSE-BOARD VOLTAGESTABB.-BOARD

RITN.-NR 2KFU-P

LAB 2000 FU component-list

Resistors

R1 5.6 kΩ
R2 270 Ω
R3 10 kΩ 1%
R4 10 kΩ 1%
R5 1 kΩ
R6 150 Ω 3W

Trim potentiometers

TP1 2.5 kΩ

Capacitors

C1 8200 µF 160V
C2 8200 µF 160V
C3 470 µF 63V
C4* 33 µF 63V
C5* -
C6* 22 µF 50V
C7* 22 µF 50V
C8 2200 µF 160V
C9 2200 µF 160V
C10 2200 µF 160V
C11 2200 µF 160V
C12 2200 µF 160V
C13 2200 µF 160V

Diods

D1 BYW 98-200
D2 1N 4004

Transistors

Q1 BC 337
Q2 BC 327

Integrated circuits

U1 LM 317
U2 uA 741

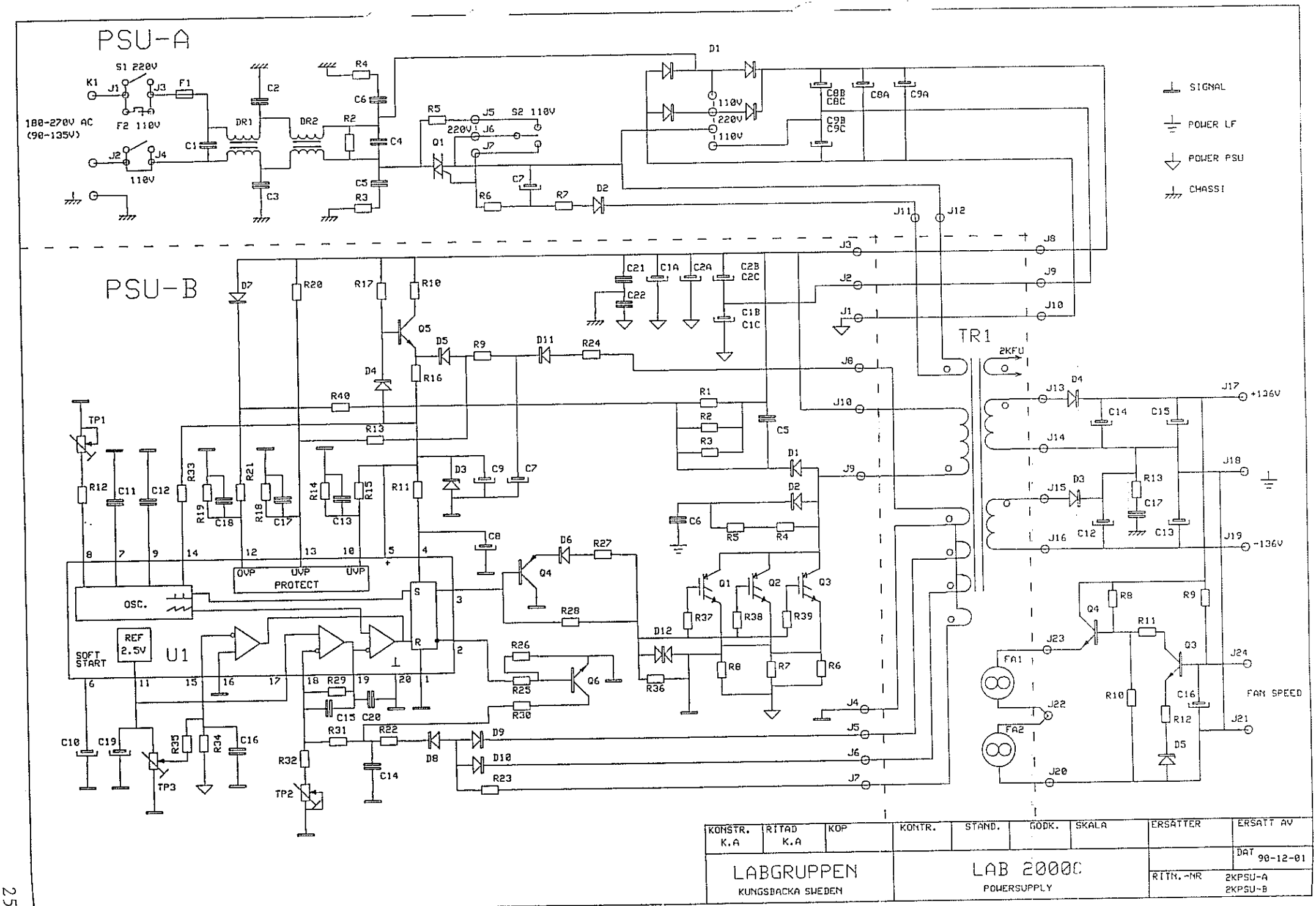
Fuses

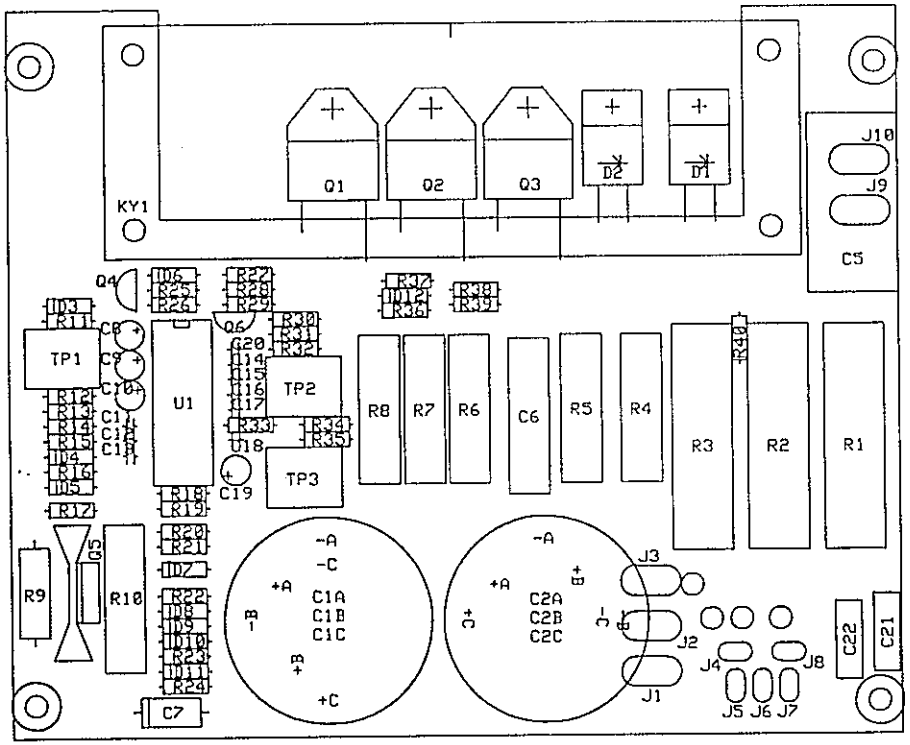
FU1 F 10A
FU2 F 10A
FU3 F 10A
FU4 F 10A

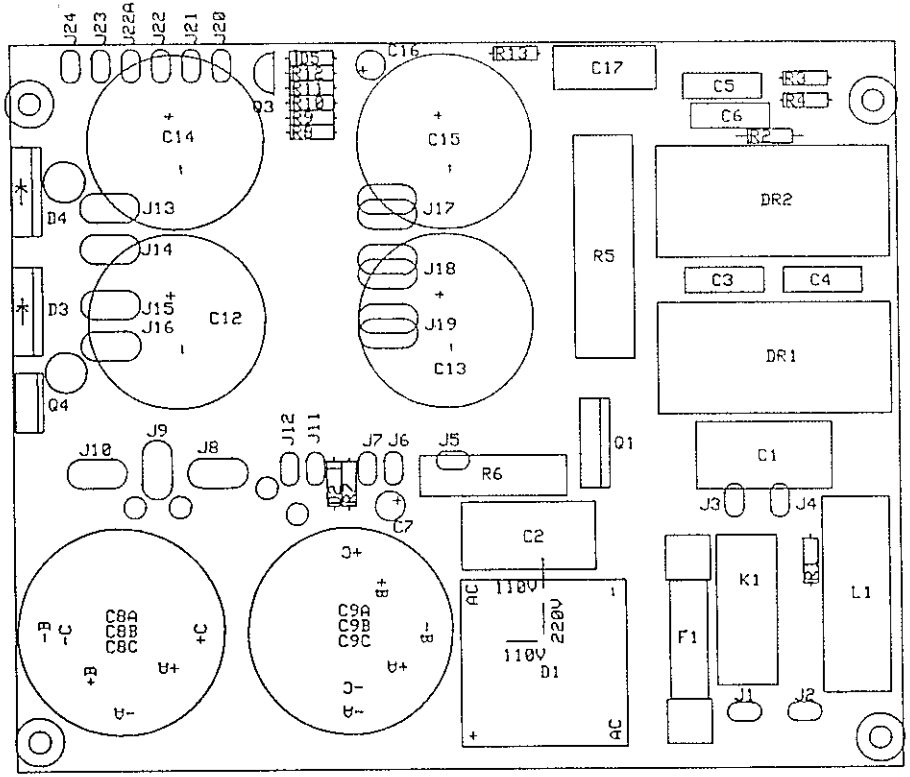
Inductors

L1 47 µH
L2 47 µH
L3 47 µH
L4 47 µH

* Until 9411
C4 10 µF 50V
C5 10 µF 50V
C6 10 µF 50V
C7 10 µF 50V


PSU-A
PSU-B
S1 220V
S2 110V
F1
F2 110V
180-270V AC
(90-135V)
DR1
DR2
SIGNAL
POWER LF
POWER PSU
CHASSI
TR1
2KFU
+136V
-136V
OSC.
REF
2.5V
SOFT
START
U1
OVP
UVP
UVP
PROTECT
FA1
FA2
FAN SPEED
KONSTR.
K.A
RITAD
K.A
KOP
KONTR.
STAND.
GODK.
SKALA
ERSÄTTER
ERSATT AV
DAT
90-12-01
LABGRUPPEN
KUNGSBACKA SWEDEN
LAB 2000C
POWERSUPPLY
RITN.-NR
2KPSU-A
2KPSU-B





KONSTR.	RITAD	KOP	KONTR.	STAND.	GODK.	SKALA	ERSÄTTER	ERSÄTT AV
K.A	K.A							DAT 90-12-01
LABGRUPPEN KUNGSBACKA SWEDEN			LAB 2000C POWERSUPPLY				RITN.-NR	2KPSU-A-P 2KPSU-B-P

LAB 2000C SWITCH-TRANSISTOR BOARD PSUB component-list 941028

230V AC

Resistors

R1	18 kΩ 9W
R2	18 kΩ 9W
R3	18 kΩ 9W
R4	100 Ω 5W
R5	100 Ω 5W
R6	0.1 Ω 4W
R7	0.1 Ω 4W
R8	0.1 Ω 4W
R9	1.5 kΩ 2W
R10	4.7 kΩ 5W
R11	4.7 Ω
R12	15 kΩ 1%
R13	82 kΩ 1%
R14	36.5 kΩ 1%
R15	15 kΩ 1%
R16	180 Ω
R17	220 kΩ 1% (long legs)
R18	4.7 kΩ 1%
R19	4.7 kΩ 1%
R20	432 kΩ 1%
R21	750 kΩ 1%
R22	82 Ω
R23	2.2 kΩ
R24	4.7 Ω
R25	15 kΩ 1%
R26	1 kΩ 1%
R27	4.7 Ω
R28	33 Ω
R29	1 MΩ 1%
R30	30 kΩ
R31	220 kΩ 1%
R32	36.5 kΩ 1%
R33*	294 kΩ 1%
R34*	3.3 kΩ 1%
R35*	3.3 kΩ 1%
R36	15 kΩ 1%
R37	4.7 Ω
R38	4.7 Ω
R39	4.7 Ω
R40	1 MΩ 1%

Trim potentiometers

TP1	10 kΩ
TP2	10 kΩ
TP3*	10 kΩ

Capacitors

C1a#	220 µF 385V
C2a#	220 µF 385V
C5	0.6 µF 500V
C6	2.2 nF 1.5 kV
C7	10 µF 63V
C8	10 µF 50V
C9	10 µF 50V
C10	4.7 µF 50V
C11	1 nF
C12	330 pF
C13	10 nF
C14	10 nF
C15	330 pF
C16*	330 pF
C17	10 nF
C18	1 nF
C19	10 µF 50V
C20	1 nF
C21*	1.5 nF Y
C22*	1.5 nF Y

Diods

D1	BYT 12PI 1000
D2*	BYT 12PI 1000
D3	15V 1.3W Zener
D4	5.6V 0.4W Zener
D5	1N 4148
D6	BYW 26C
D7	1N 4004
D8	1N 4148
D9	1N 4148
D10	1N 4148
D11	BYW 26C
D12	BZW 06P15B

Integrated circuits

U1	TDA 4718A

Transistors

Q1	BUP 307
Q2	BUP 307
Q3	BUP 307
Q4	BC 327
Q5	TIP 50
Q6	BC547

Switches

S2	Tempswitch 95°C

#110V AC

C1b	1500 µF 200V
C2b	1500 µF 200V

* Until 9410

R34	1 kΩ
R35	1 kΩ
TP3	2.5 kΩ
C16	1 nF
C21	2.2 nF Y
C22	2.2 nF Y

* Until 94xx

D2	BYR 29-800F

* Until 9506

R33	270 KΩ 1%

LAB 2000C RECTIFIER BOARD PSUA component-list 941028

230V AC

Resistors

R1	-
R2	1 MΩ 500V
R3	33 Ω
R4	33 Ω
R5	47 Ω 9W
R6	150 Ω 5W
R7	2.2 Ω 1W
R8	47 kΩ 1%
R9	390 kΩ
R10	39 kΩ 1%
R11	6.8 kΩ
R12	1.8 Ω
R13	4.7 Ω

Capacitors

C1*	0.47 µF X
C2*	1.5 nF Y
C3*	1.5 nF Y
C4	0.22 µF X
C5*	1.5 nF Y
C6*	1.5 nF Y
C7	100 µF 50V
C8a	220 µF 385V
C9a	220 µF 385V
C12	1800 µF 100V
C13	1800 µF 100V
C14	1800 µF 100V
C15	1800 µF 100V
C16	22 µF 16V
C17	2.2 µF 63V

Diods

D1	600V 35A
D2	BYW26C
D3	BYT30PI400
D4	BYT30PI400
D5	5.6V Zener

Transistors

Q1	Q6025J6
Q2	-
Q3	BC 546
Q4	BDX53

Fuse

F1	Fuse F15A

Switch

S1	Arcolectric 8550VB

Chokes

DR1	2.7mH 8A 220V
DR2	2.7mH 8A 220V

*Until 9410

C1	0.22 µF X
C2	2.2 nF Y
C3	2.2 nF Y
C5	2.2 nF Y
C6	2.2 nF Y

LAB 1200C, LAB 1300C, LAB 1600, LAB 2000C
POWER SUPPLY component-list PSUC

Resistors

R1	-
R2	1 MΩ 500V
R3	33 Ω
R4	33 Ω
R5#	47 Ω 9W
R6#	150 Ω 5W
R7	2.2 Ω 1W
R8	See below
R9	"
R10	"
R11	"
R12	"
R13	4.7 Ω
R14	See below
R15	"
R16	"

Capacitors

C1	0.47 µF
C2#	0.22 µF
C3#	1.5 nF Y
C4	1.5 nF Y
C5#	1.5 nF Y
C6#	1.5 nF Y
C7	100 µF 50V
C8a#	220 µF 385V
C9a#	220 µF 385V
C12	See below
C13	"
C14	"
C15	"
C16	22 µF 16V
C17	2.2 µF 63V
C18	See below
C19	"

Diods

D1	600V 35A
D2	BYW26C
D3	BYT30PI400
D4	BYT30PI400
D5	5.6V Zener
D6	See below

Fuses

F1#	See below

Transistors

Q1#	Q6025J6
Q2	-
Q3	BC 546
Q4	See below

DR1#	2.7mH 8A 220V
DR2#	2.7mH 8A 220V

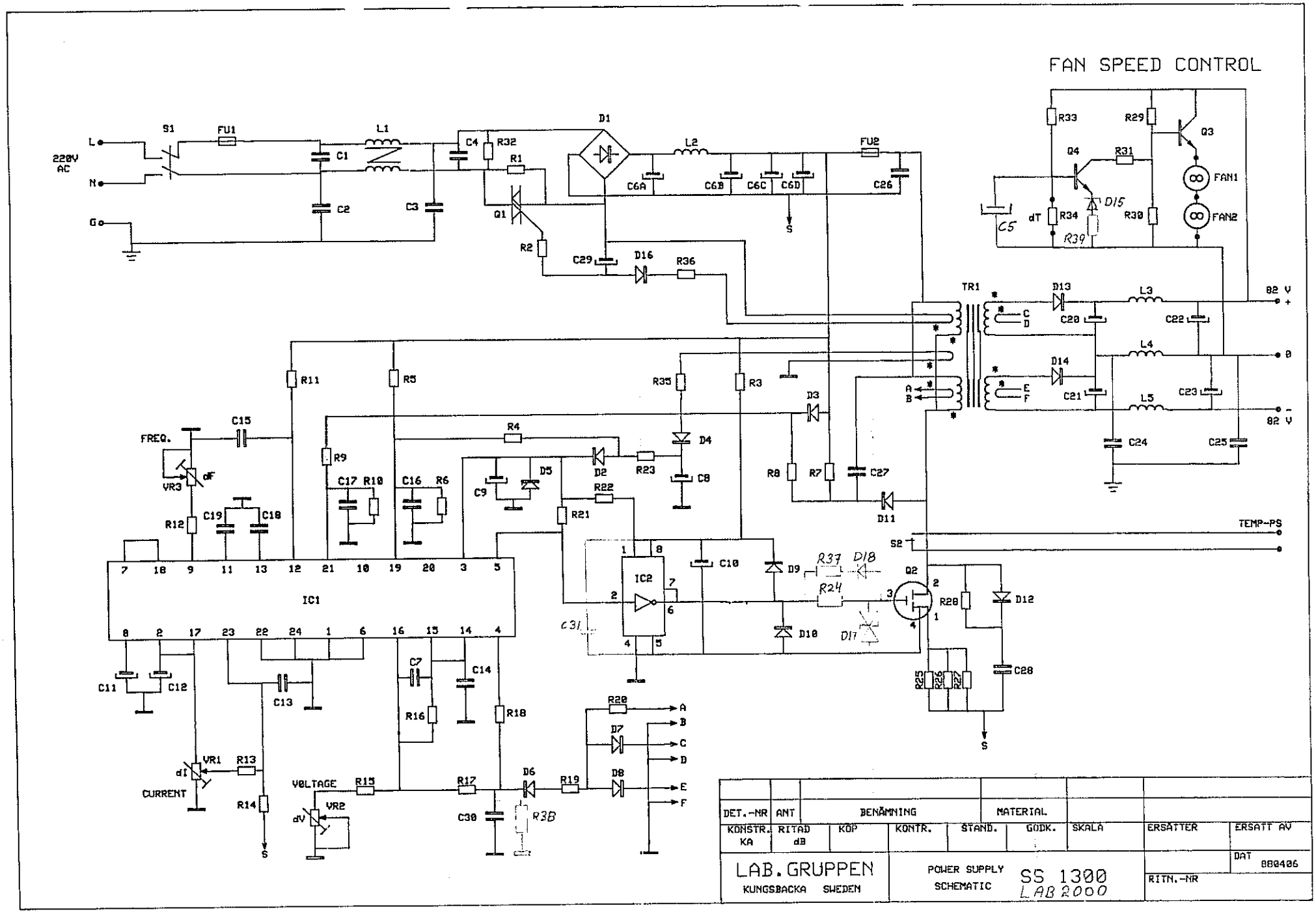
Switches

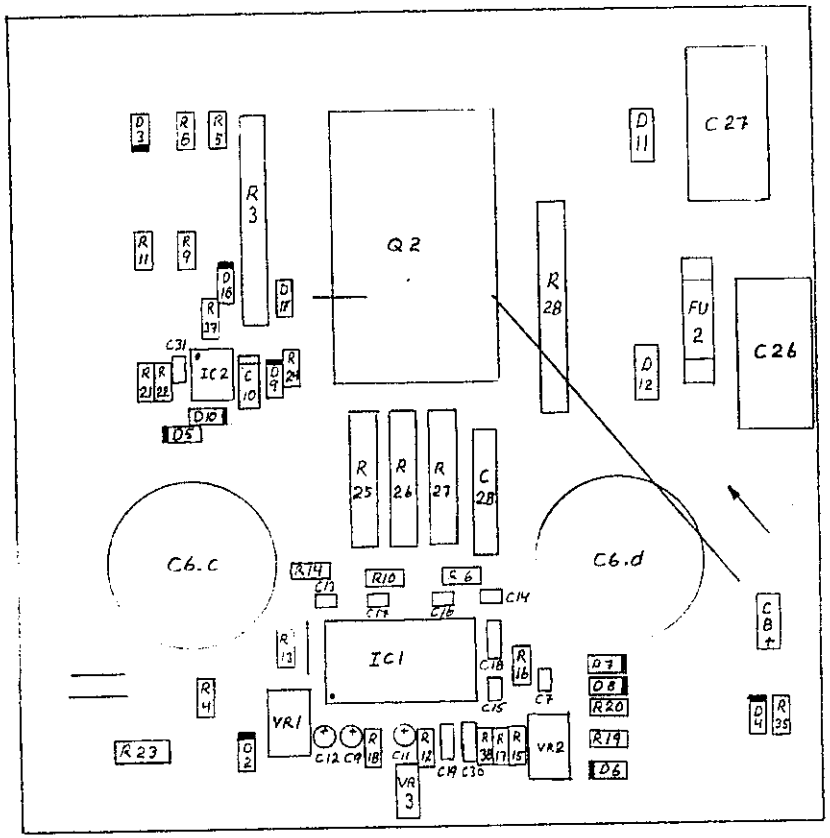
S1	Arcolectric 8550VB
S3	Comepa 4JT95 ARIUI 95°C

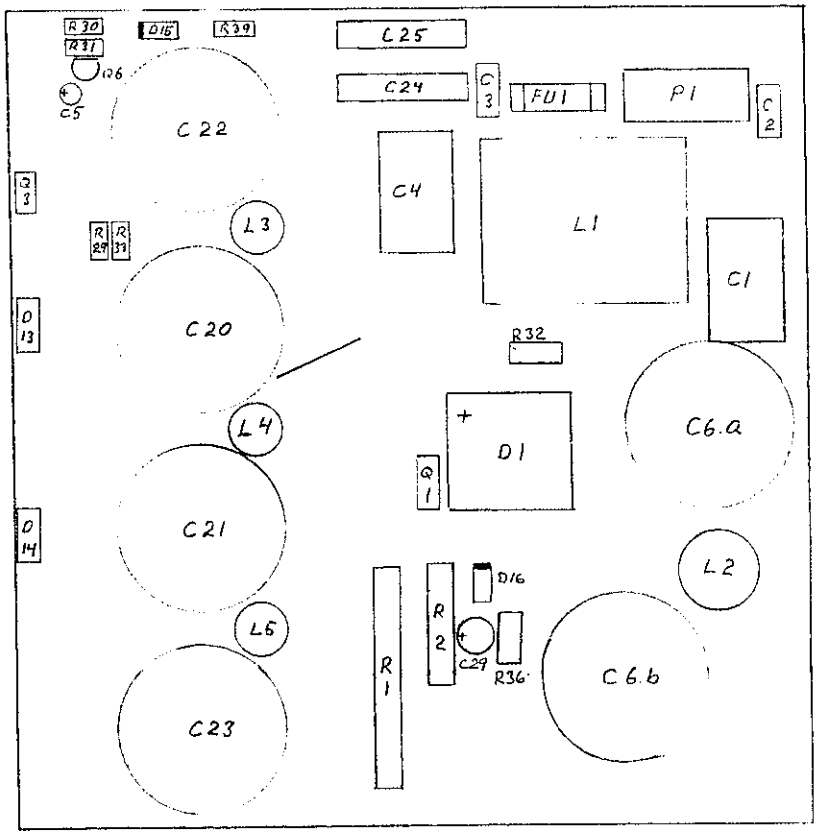
110V AC

R5	22 Ω 9W
R6	180 Ω 0.7W
C2	4.7 nF Y
C3	4.7 nF Y
C5	4.7 nF Y
C6	4.7 nF Y
C8b	1500 µF 200V
C9b	1500 µF 200V
Q1	Relay SDS JrlaF-TM-24
S2	Marquart 1803.0102
DR1	1.4mH 16A 110V
DR2	1.4mH 16A 110V

	1200C	1300C	1600	2000C
R8	4.7 kΩ 1%	0 Ω	8.2 kΩ 1%	0 Ω
R9	1 MΩ	470 kΩ	150 kΩ	390 kΩ
R10	39 kΩ 1%	4.7 kΩ 1% 0.7W long leg	39 kΩ 1%	47 kΩ 1%
R11	18 kΩ 1%	1.8 kΩ	18 kΩ 1%	6.8 kΩ
R12	4.7 kΩ 1%	0 Ω	4.7 kΩ	1.8 kΩ
R14	2.2 Ω 2W	-	2.2 Ω 2W	-
R15	2.2 Ω 2W	-	2.2 Ω 2W	-
R16	-	18 kΩ 1%	-	39 kΩ 1%
C12	3900 µF 100V	3900 µF 100V	3900 µF 100V	1800 µF 160V
C13	3900 µF 100V	3900 µF 100V	3900 µF 100V	1800 µF 160V
C14	3900 µF 100V	3900 µF 100V	3900 µF 100V	1800 µF 160V
C15	3900 µF 100V	3900 µF 100V	3900 µF 100V	1800 µF 160V
C18	4.7 µF 400V	-	4.7 µF 400V	-
C19	4.7 µF 400V	-	4.7 µF 400V	-
D6	62 V ±2% Zener	-	62 V ±2% Zener	-
F1 220V	T10AH250V	T8AH250V	T10AH250V	T10AH250V
F1# 110V	T20A	T20A	T20A	T30A
Q4	BDX53F	TIP41	BDX53F	BDX53F


FAN SPEED CONTROL
220V AC
L
N
G
S1
FU1
L1
C1
C2
C3
C4
R32
R1
Q1
R2
D1
C6A
L2
C6B
C6C
C6D
FU2
C26
S
C29
D16
R36
R33
R29
Q3
Q4
R31
FAN1
FAN2
C5
dT
R34
D15
R39
R30
TR1
D13
L3
C20
C22
82 V +
0
L4
D14
C21
L5
C23
82 V -
C24
C25
R11
R5
R35
R3
D3
R4
D4
R9
D2
R23
C8
C15
FREQ.
VR3
dF
C17
R10
C16
R6
C9
D5
R22
R21
R8
R7
C27
D11
R12
C19
C18
TEMP-PS
S2
IC1
IC2
C10
D9
R37
D18
R24
Q2
R28
D12
C31
D10
D17
C28
R25
R26
R27
C11
C12
C13
C7
C14
R16
R18
VR1
dI
CURRENT
R13
R14
VOLTAGE
R15
R17
D6
R19
R20
D7
D8
A
B
C
D
E
F
VR2
dV
C30
R38
DET.-NR
ANT
BENÄMNING
MATERIAL
KONSTR. KA
RITAD dB
KÖP
KONTR.
STAND.
GODK.
SKALA
ERSÄTTER
ERSATT AV
DAT 880406
LAB. GRUPPEN
KUNGSBACKA SWEDEN
POWER SUPPLY SCHEMATIC
SS 1300
LAB 2000
RITN.-NR





Dat.-nr	Ant.	Benämning	Material	Mod.-nr Ämne Dimension	Anm.
Konstr. L-7	Ritad L-7	Kop.	Kontr.	Stand.	Godk.	Skala	Ersätter	Ersatt av 890424
LAB. GRUPPEN	NÄTDEL SS 1300 LAB 2000 KOMPONENT PLACERING							Dat. 870629
								Ritn.-nr

Nr	Ant.	Ändring och/eller medd.-nr	Datum	Inl.	Godk.

LAB 2000 PSU Old version component-list

Resistors

R1 47 Ω 9W
R2 220 Ω 4W
R3 12 kΩ 9W
R4 22 kΩ 1%
R5 220 kΩ 1% 0.7W
R6 2.2 kΩ 1%
R7 3.3 kΩ 50W
R8 294 kΩ 1% 0.7W
R9 330 kΩ 1% 0.7W
R10 2.2 kΩ 1%
R11 8.2 mΩ 1% 0.5W
R12 15 kΩ 1%
R13 1 kΩ 1%
R14 1 kΩ 1%
R15 36.5 kΩ 1%
R16 1 mΩ 1%
R17 220 kΩ 1%
R18 39 kΩ 1%
R19 -
R20 2.2 kΩ 1%
R21 2.2 kΩ 1%
R22 4.7 Ω
R23 390 Ω 4W
R24 27 Ω
R25 0.1 Ω 4W
R26 0.1 Ω 4W
R27 0.1 Ω 4W
R28 220 Ω 9W
R29 18 kΩ 1W
R30 18 kΩ 1W
R31 3.3 kΩ
R32 1.5 mΩ 400V
R33 390 kΩ
R34 -
R35 4.7 Ω
R36 2.2 Ω 1W
R37 4.7 Ω
R38 330 kΩ 1%
R39 1 kΩ

Trim potentiometers

VR1 2.5 kΩ
VR2 10 kΩ
VR3 10 kΩ

Capacitors

C1 0.22 µF X
C2 4.7 nF Y
C3 4.7 nF Y
C4 0.22 µF X
C5 47 µF 50V R
C6a 220 µF 385V
C6b 220 µF 385V
C6c 220 µF 385V
C6d 220 µF 385V
C7 390 pF
C8 10 µF 63V A
C9 10 µF 50V R
C10 10 µF 63V A
C11 4.7 µF 50V R C12 10 µF 50V R
C13 1 nF
C14 390 pF
C15 10 nF
C16 10 nF
C17 560 pF
C18 1 nF
C19 1 nF
C20 1000 µF 200V
C21 1000 µF 200V
C22 1000 µF 200V
C23 1000 µF 200V
C24 2.2 µF 100V
C25 -
C26 0.6 µF 600V X
C27 0.6 µF 600V X
C28 4.7 nF 2K V
C29 100 µF 40V R
C30 10 nF
C31 0.1 µF

Diods

D1 KBPC 3506
D2 IN 4148
D3 IN 4004
D4 BYV26C
D5 12V 1W
D6 IN 4148
D7 1N 4148
D8 1N 4148
D9 1N 5818
D10 1N 5818
D11 BYR29-800F
D12 BYR29-800F
D13 BYT30P-400
D14 BYT30P-400
D15 5.6V 0.4W
D16 BYW26C
D17 BZW06P15B
D18 BYW26C

Transistors

Q1 Q6025-W6
Q2 BSM181
Q3 TIP41C
Q4 BC546

Integrated circuits

IC1 TDA 4700
IC2 TSC429CPA

Inductors

L1 Mainsfilter
L2 2 layer choke
L3 1 layer choke
L4 1 layer choke
L5 1 layer choke

Transformer

TR1 UI93/104/30

Switches

S1 Marquardt 1802.0102
S2 Tempswitch 80°

Fuses

FU1 F15A

Fans

F1 Fan
F2 Fan