

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	2KFU	2KFU-P
VOLTAGE STAB		
POWER SUPPLY	2KPSUA 2KPSUB	2KPSUA-P 2KPSUB-P
POWER SUPPLY	OLD VERSION	

LAB.GRUPPEN

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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 is closed, current flows through transformer, TR1, storing energy. Because of the voltage polarity, 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 diode 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 diode D8. The PWM-controller adjusts the on-time of the switch, by comparing the voltage across C14 with an internal reference, to give a rail voltage of $\pm 136V$ 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 reference-voltage, set by TP3, which makes it possible to adjust the maximum output power from the power supply. Normally TP3 is in maximum position, but if something has to be repaired in the amplifier, TP3 is used for "slowstarting" the amplifier.

The input signal 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 gain control P1. This limiter together with the phase-linear lowpass filter U3, U4 limits the slew rate 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 collector voltage 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, before it reaches the input on the switchmode amplifier. Limit level 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 control voltage to pulsewidth modulator U3. U3 compares this voltage with an 830Khz triangular wave giving a pulsewidth 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 offset 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 repairing 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, loosen 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 (negative) 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 maximum clockwise. Voltage measured on the disconnected collector cable 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) collector.
- 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) rail voltage.
- 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 disconnect 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, but 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.

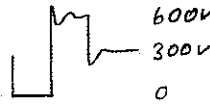
POWER SUPPLY

VALID FOR UNITS WITH PSUA AND PSUB BOARDS.

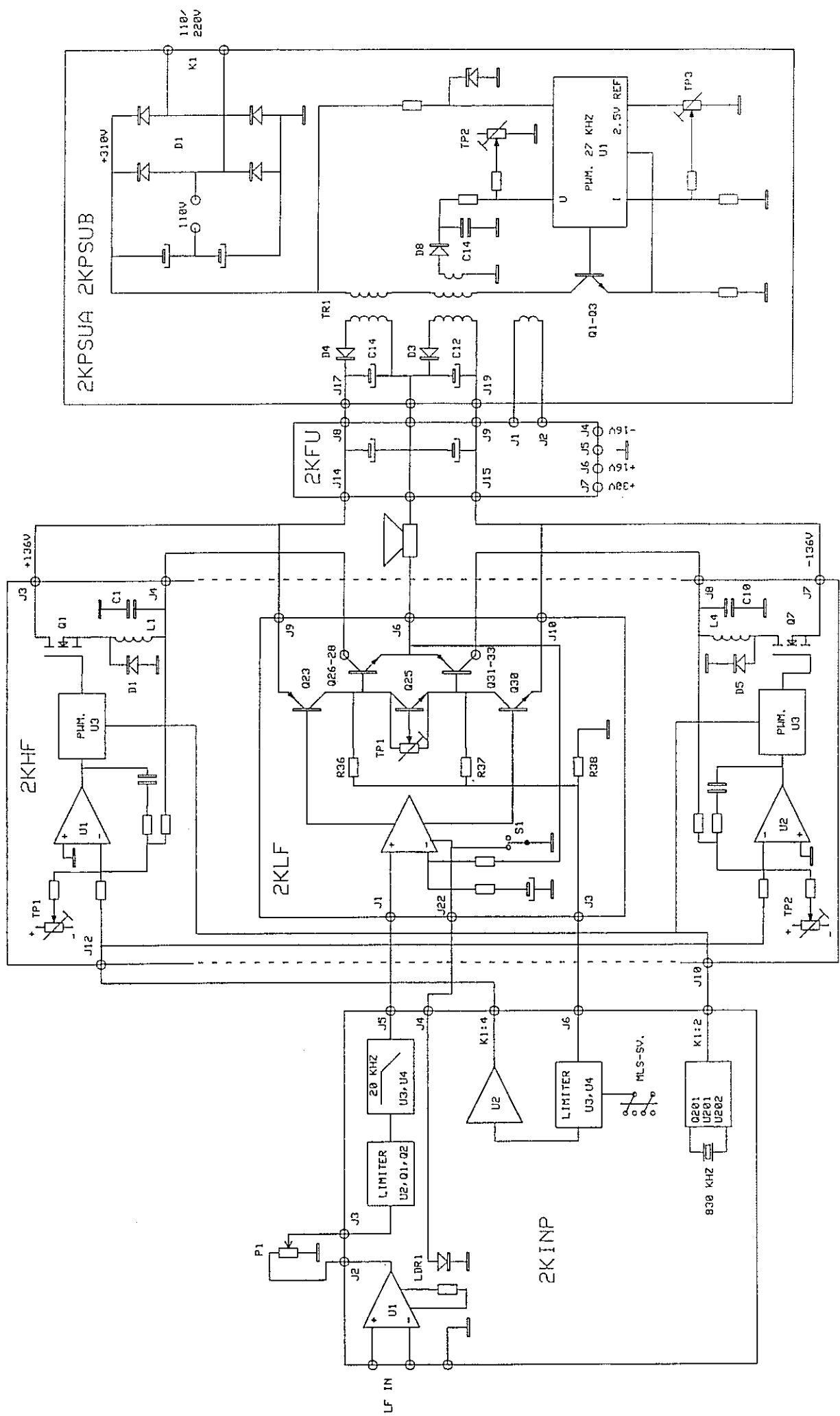
1. Turn TP3 fully counter clockwise.
2. Change F1 on the PSUA.
3. Increase the main voltage slowly by the variac.
4. Measure the voltage across C1.
 - a. No voltage: - change R5
 - b. The current increase quickly: - check D1 - PSUA
- check Q1, -Q2, Q3 - PSUB
5. It is now possible to increase the voltage 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.

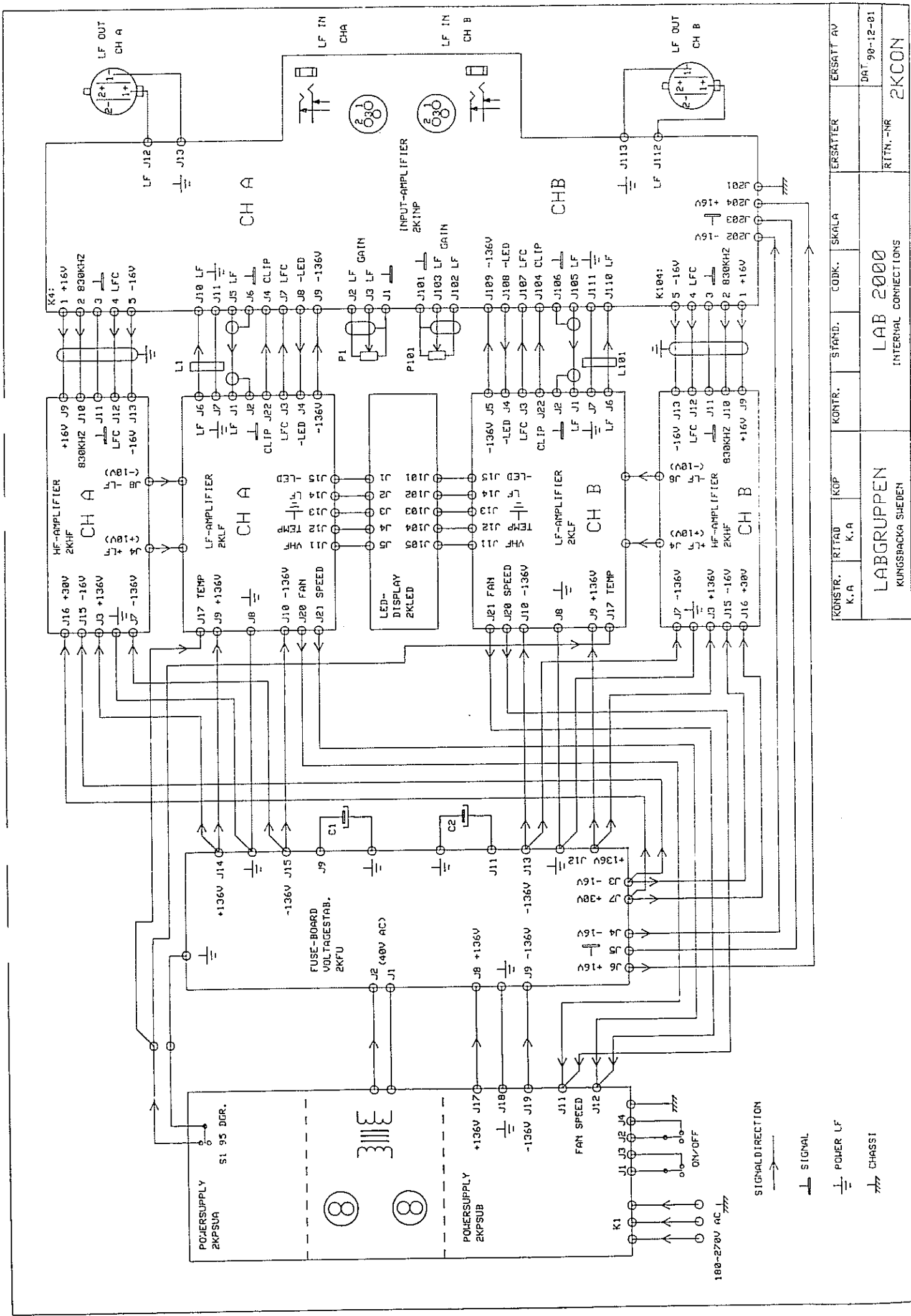
If the graph is seen, go to item 10.



8. If only narrow spikes is seen, check the following components.
- D3, D4 - PSUA or the output circuits.
 - D1 (C5, R1, R2, R3) PSUB
 - Q1 - PSUA - the softstart circuit will not deliver enough power.
 - 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:
- Check the outputvoltage on C12, C14 - PSUA for 136V DC - Adjust witch TP2.
 - Check the softstart circuit by turning on and off the mainswitch and look at the oscilloscope.
 - Increase the power by applying an audiosignal to the amplifier and turn up the gaincontrols. - The pulswidth will increase.
 - Check the over-/ undervoltage protection circuits by turning the variac up to 280 VAC and down to 130 VAC. (No load.)

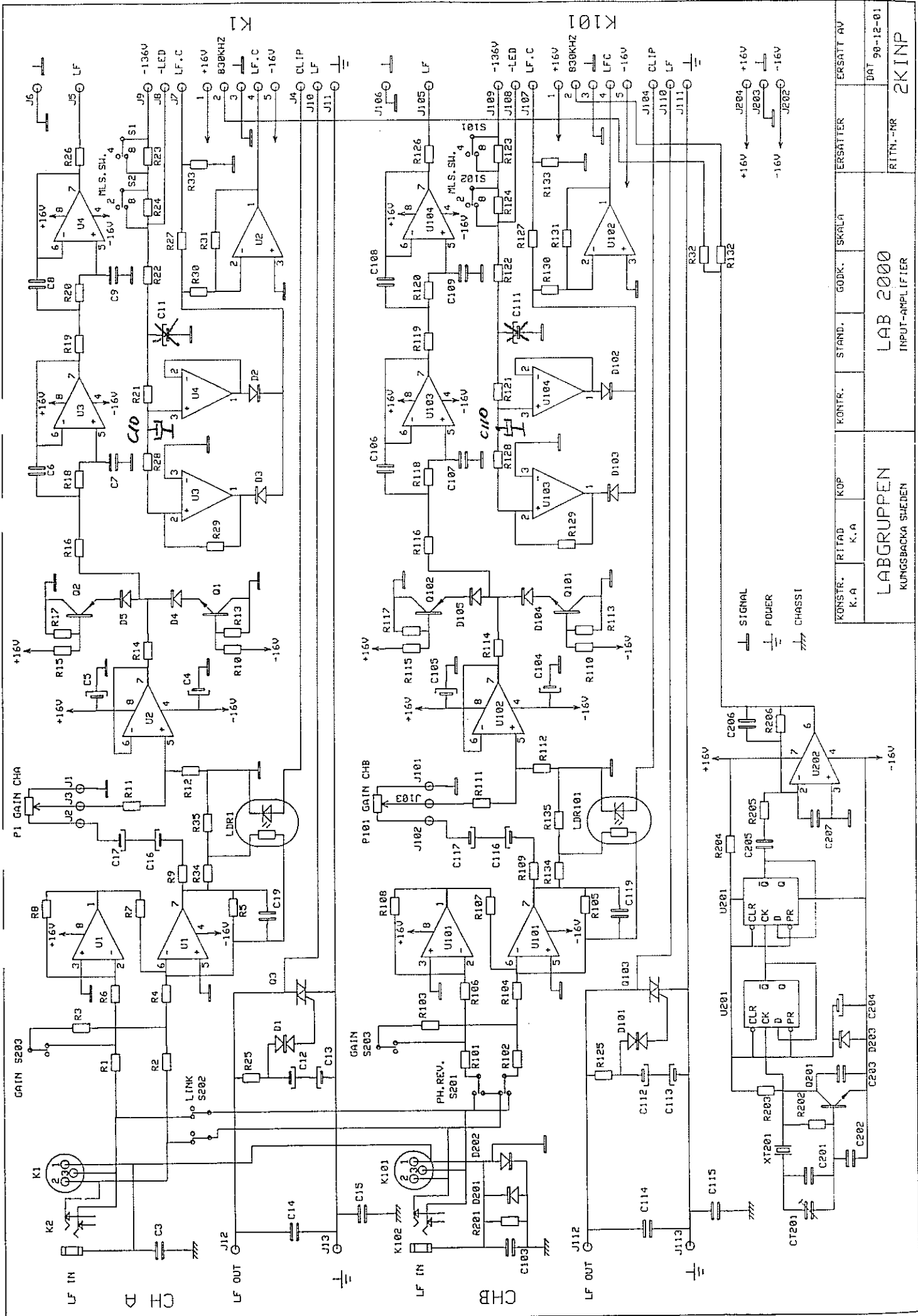


KONSTR. K.A	RITAD K.A	KOP	KONTR.	STAND.	GODK.	SKALA	ERSÄTTAR	ERSÄTT AV
LABGRUPPEN KUNGSBACKA SWEDEN			LAB 2000 THEORY OF FUNCTION			RITH.-NR		2KFUN
								DAT 90-12-01



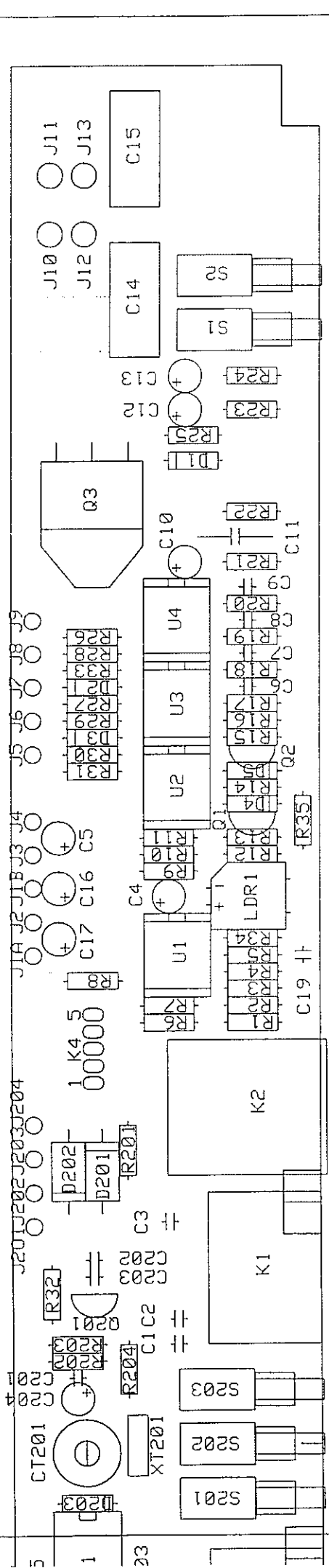
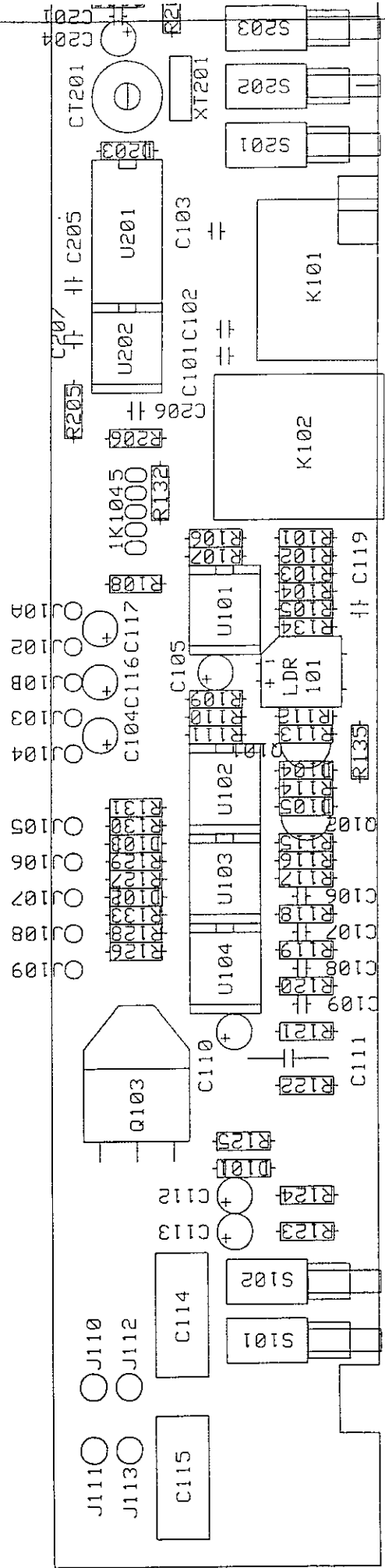
KONSTR. K. A	RITAD K. A	KOP	KONTR.	STAND.	CODK.	SKALA	ERSÄTTAR	ERSÄTT AV	
LABGRUPPEN KUNGSBACKA SÄDEN							LAB 2000 INTERNAL CONNECTIONS	RITN.-NR	DAT. 90-12-01
2KCON									

- SIGNALDIRECTION
- ⊥ SIGNAL
- ⊥ POWER LF
- ⊥ CHASSI



KONSTR. K.A	RITAD K.A	KOP K.A	KONTR. K.A	STAND. K.A	GODK. SKRÅLA	ERSÄTTAR ERSÄTTAR	ERSÄTT AV ERSÄTT AV
LABGRUPPEN KUNGSBACKA SVEDEN						LAB 2000 INPUT-AMPLIFIER	
						RITN.-NR. DAT 90-12-01	2KINP

- SIGNAL
- POWER
- CHASSI



KONSTR. K.A	RITTAÐ K.A	KOP	KONTR.	STAND.	500K.	SKALA	ERSÄTT AV
LABGRUPPEN KUNGSBACKA SVEDEN			LAB 2000 INPUT-AMPLIFIER			RITN.-NR 2KINP-P	
							DAT 90-12-91

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

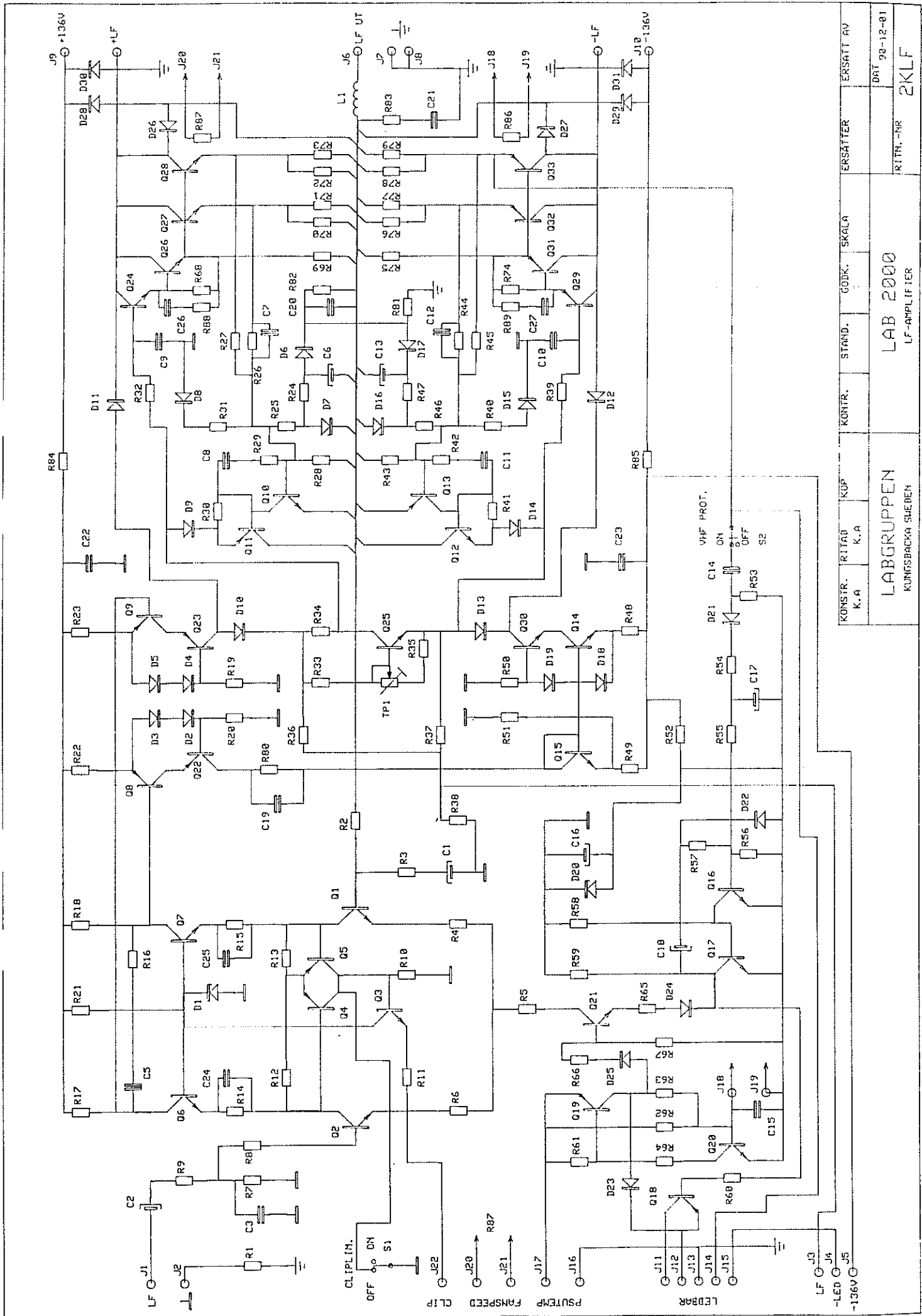
U201 74HC74
 U202 LM 318

Crystals

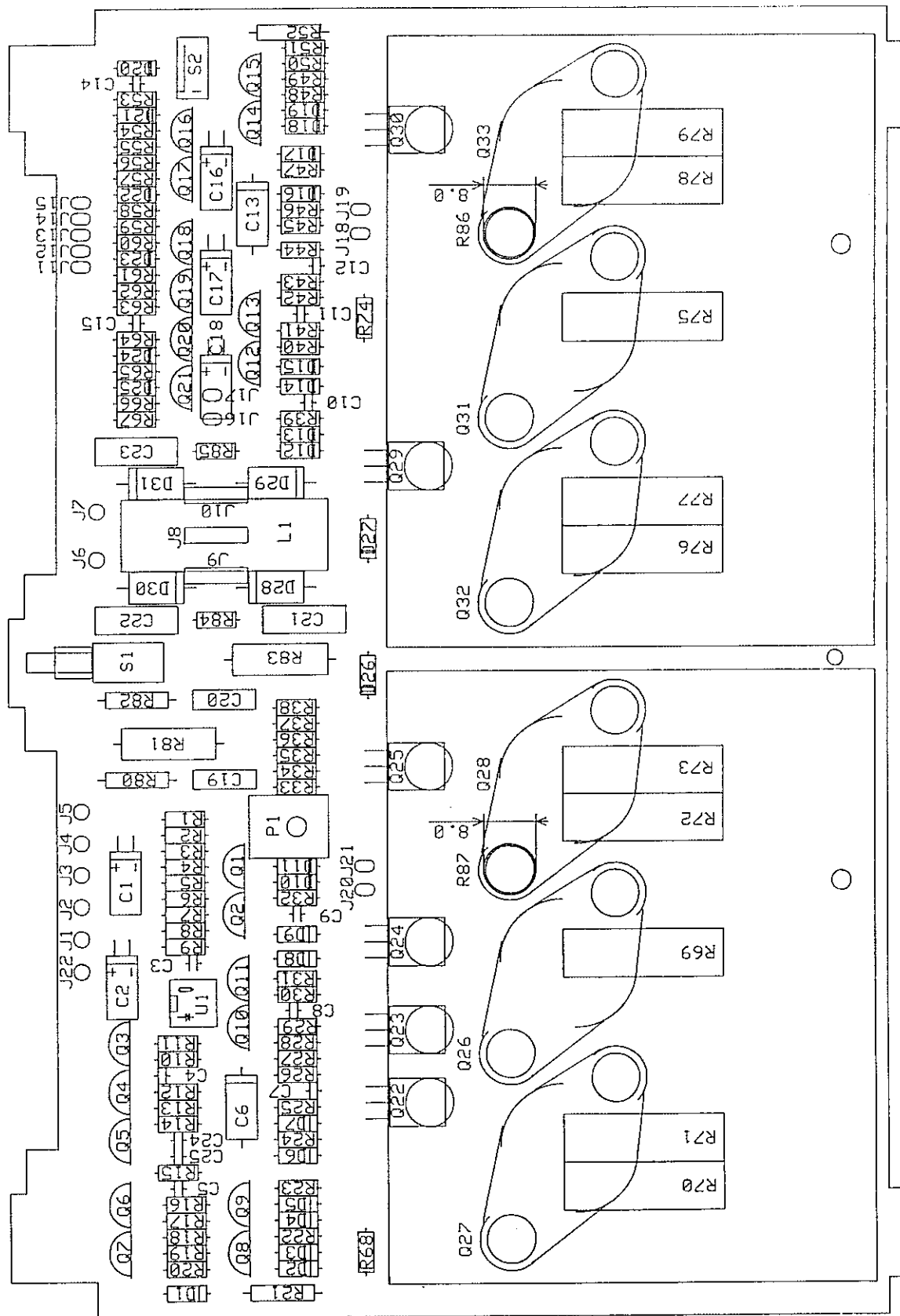
X201 3.2768 mHz

Switches

S201 Alps SPPJ3
 S202 Alps "
 S203 Alps "



KONSTR.	RITTAJ	KOP	KONTR.	STAND.	GÖDK.	SKALA	ERSÄTT	ERSÄTT AV
K.A	K.A							
LABGRUPPEN			LAB 2000			RITN. -NR		
KUNGSBACKA SVEDEN			LF-AMPLIFIER			DAT 98-12-81		
						2KLF		



KONSTR.	RITAD	KOP	KONTR.	STAND.	GÖDK.	SKALA	ERSÄTTAR	ERSÄTT AV
K.A	K.A							
LABGRUPPEN			LAB 2000				RITN.-NR	2KLF-P
KUNGSBACKA SVEDEN			LF-AMPLIFIER					98-12-01

LAB 2000 LF component-list

Resistors

R1 10 Ω
R2 27 k Ω 1%
R3 1 k Ω 1%
R4 180 Ω 1%
R5 1.8 k Ω 1%
R6 180 Ω 1%
R7 27 k Ω 1%
R8 10 Ω
R9 1 k Ω 1%
R10 100 k Ω
R11 1.8 k Ω 1%
R12 27 k Ω 1%
R13 27 k Ω 1%
R14 3.3 k Ω 1%
R15 3.3 k Ω 1%
R16 4.7 k Ω 1%
R17 3.3 k Ω 1%
R18 3.3 k Ω 1%
R19 100 k Ω
R20 100 k Ω
R21 18 k Ω 2W
R22 100 Ω 1%
R23 100 Ω 1%
R24 10 k Ω 1% 0.7W
R25 82 k Ω 1%
R26 4.7 k Ω 1%
R27 4.7 k Ω 1%
R28 1.8 k Ω 1%
R29 10 k Ω 1%
R30 4.7 k Ω
R31* 294 k Ω 1%
R32 220 Ω
R33 3.3 k Ω 1%
R34 10 Ω
R35 680 Ω
R36 22 k Ω 1% 0.7W
R37 22 k Ω 1% 0.7W
R38 22 k Ω
R39 220 Ω
R40* 294 k Ω 1%
R41 4.7 k Ω
R42 10 k Ω 1%
R43 1.8 k Ω 1%
R44 4.7 k Ω 1%
R45 4.7 k Ω 1%
R46 82 k Ω 1%
R47 10 k Ω 1% 0.7W
R48 100 Ω 1%
R49 100 Ω 1%
R50 100 k Ω
R51 100 k Ω
R52 18 k Ω 2W
R53 10 k Ω 1%
R54 10 k Ω 1%

R55 220 k Ω
R56 100 k Ω
R57 220 k Ω
R58 56 k Ω
R59 56 k Ω
R60 27 k Ω 1%
R61 3.3 k Ω 1%
R62 330 k Ω 1%
R63 2.2 M Ω
R64 22 k Ω 1%
R65 2.7 k Ω 1%
R66 100 k Ω
R67 56 k Ω
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 k Ω 3W
R81 820 Ω 6W
R82 1.5 k Ω 3W
R83 10 Ω 3W
R84 10 Ω
R85 10 Ω
R86 150 k Ω NTC
R87 150 k Ω NTC
R88 4.7 Ω
R89 4.7 Ω

Trim potentiometers

TP1 250 Ω

Capacitors

C1 47 μ F 50V
C2 4.7 μ F 50V
C3 150 pF ker
C4 -
C5 680 pF
C6 1 μ F 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 μ F 100V
C14 68 pF
C15 0.1 μ F 40V
C16 220 μ F 16V
C17 4.7 μ F 50V
C18 10 μ F 50V
C19 22 nF 250V
C20 47 nF 250V
C21 0.1 μ F 250V
C22 0.1 μ F 250V
C23 0.1 μ F 250V
C24 4.7 nF
C25 4.7 nF
C26 0.1 μ F
C27 0.1 μ F

Diodes

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

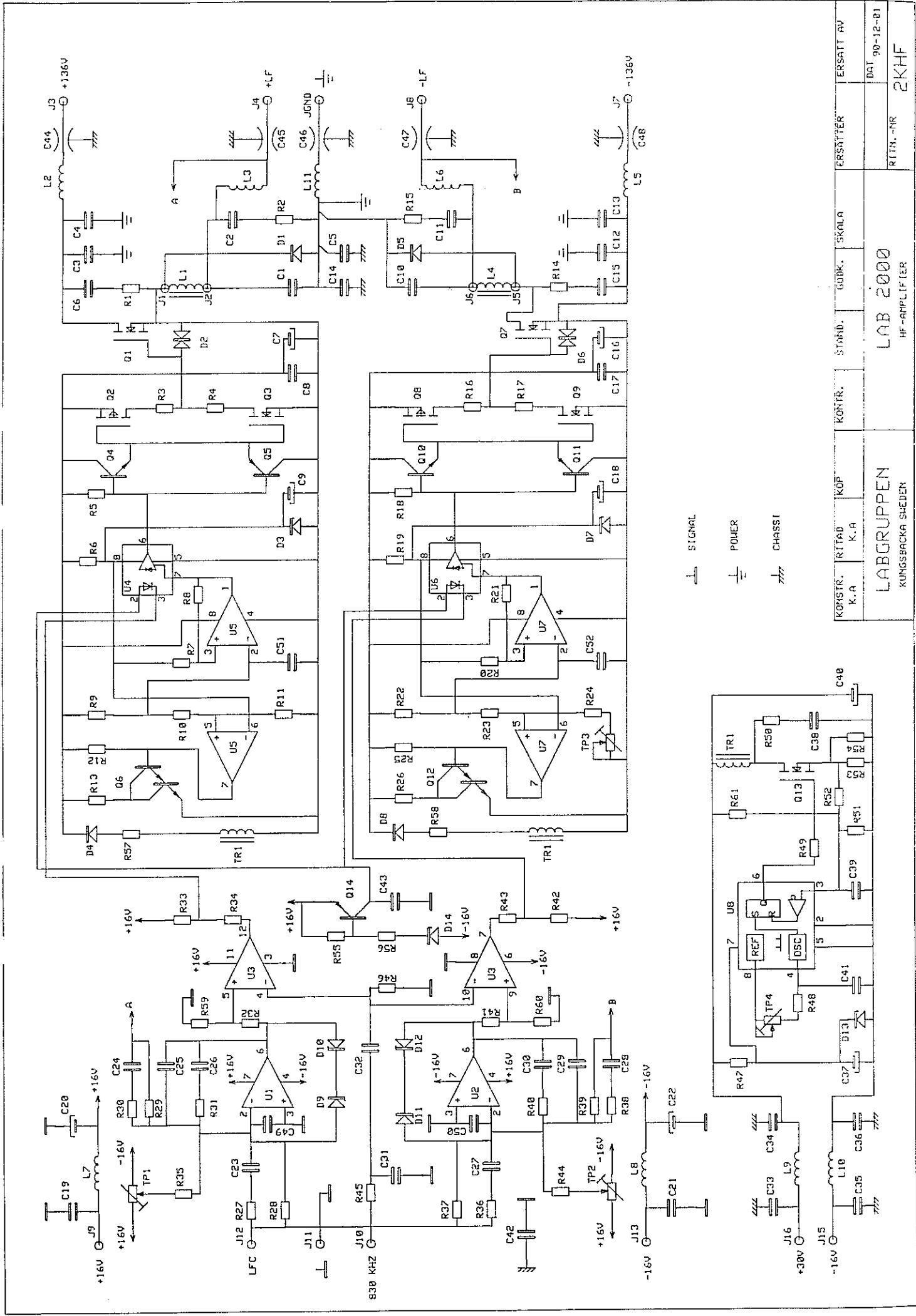
Inductors

L1 9.5 μ H

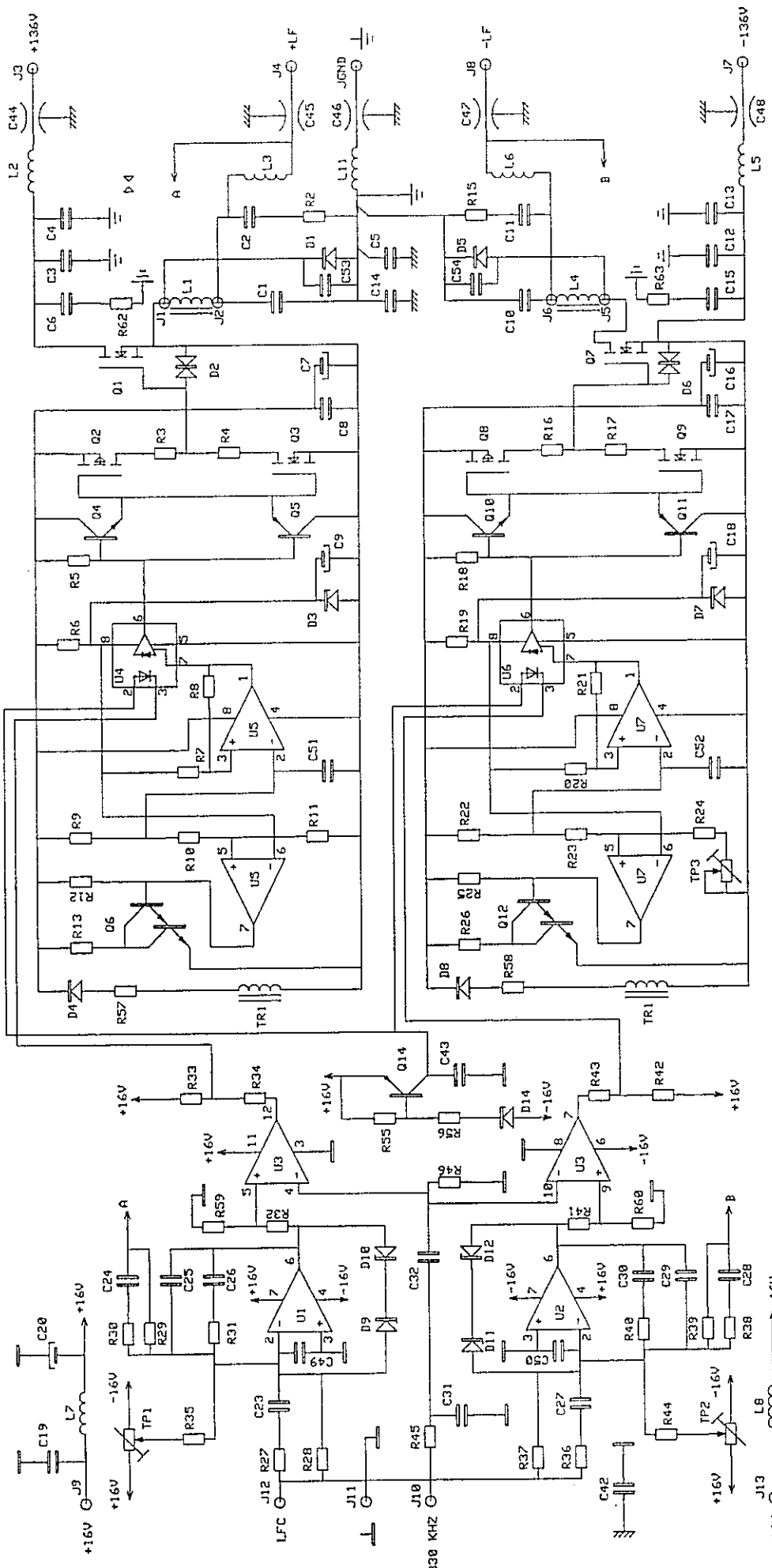
* Until 9503

R31 150 k Ω 1%

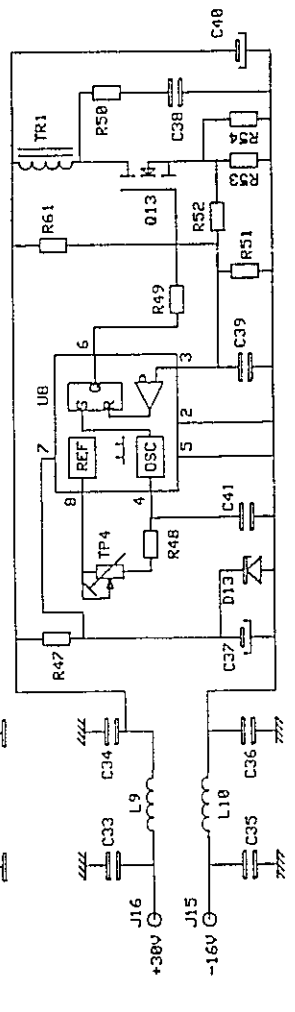
R40 150 k Ω 1%



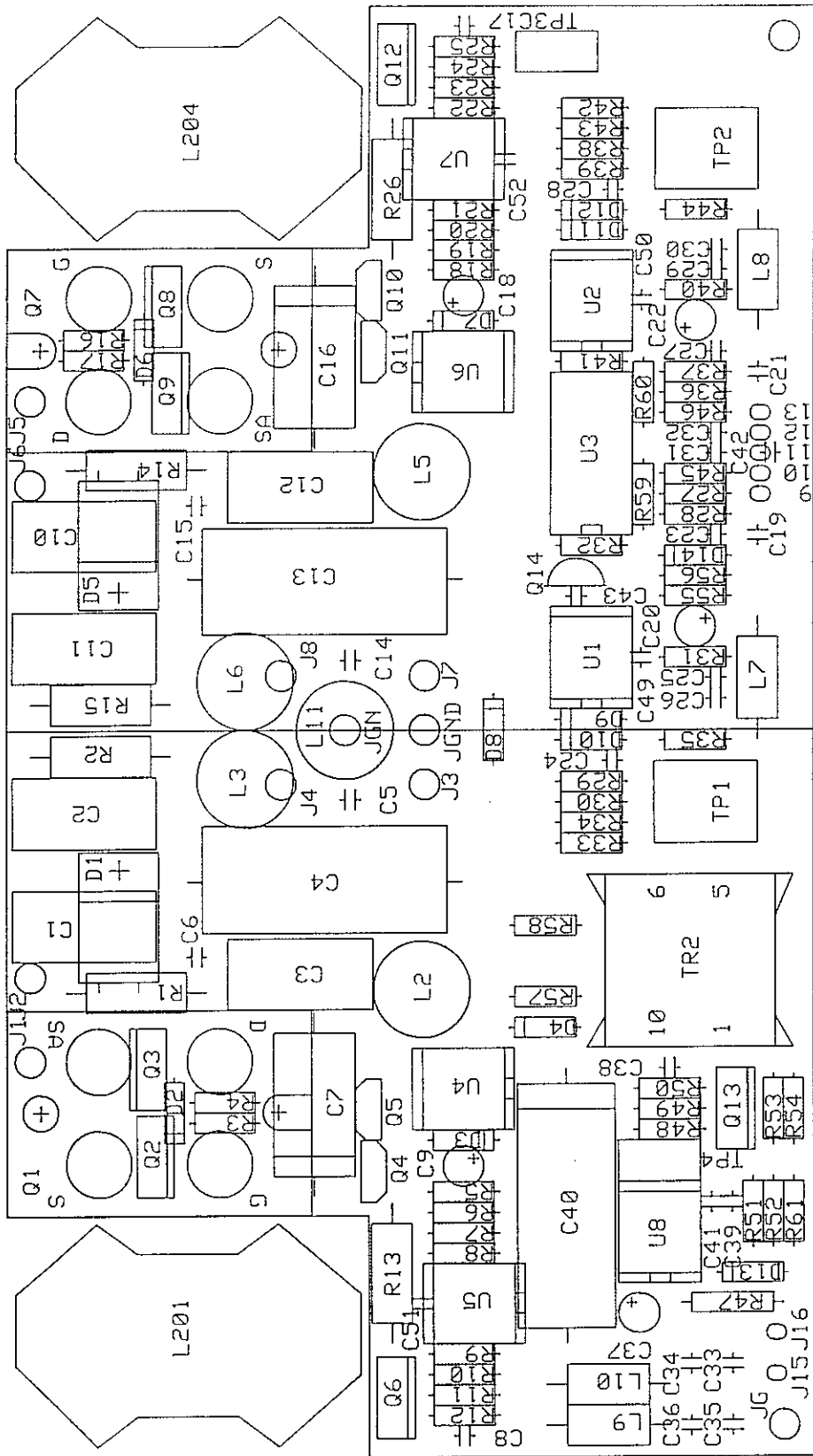
KONSTR.	RITAB	KOP	STAND.	GODK.	SKOLA	ERSÄTT	AV
K.A	K.A					ERSÄTT	
LABGRUPPEN						DAI	90-12-01
KUNGSBACKA SVEDEN						RITN.-NR	2KH



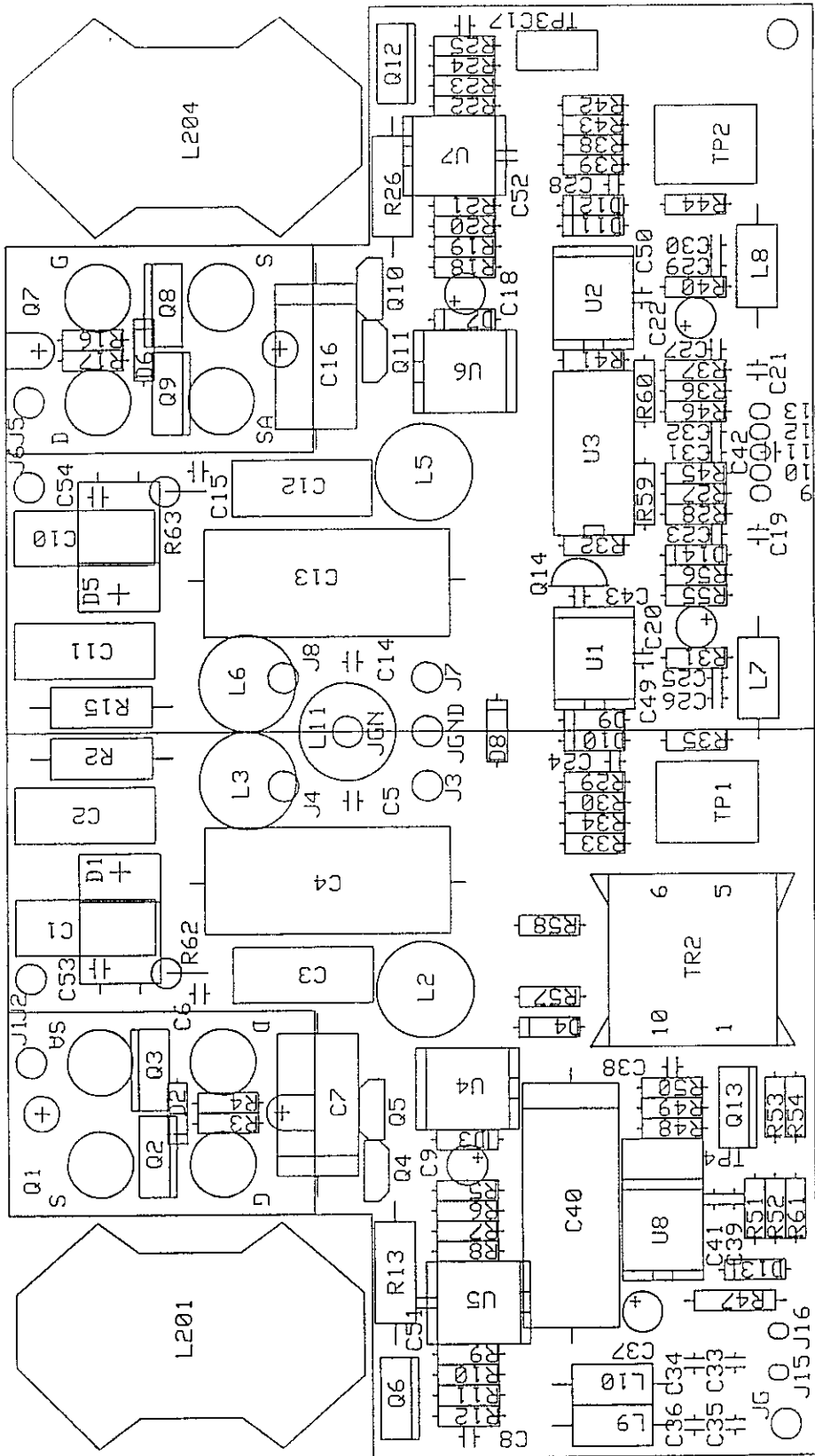
- SIGNAL
- POWER
- CHASSI



KONSTR. K. A	ERTAD K. A	KOP	KONTR.	STAND.	GODK.	SKALA	ERSÄTTER	ERSÄTT AV	
LABGRUPPEN KUNGSBACKA SVEDEEN							LAB 2000 C HF-AMPLIFIER	RITN.-NR	2KHF
								DAT	98-12-01



KONSTR. K.A	RITAD K.A	KÖP	KONTR.	STAND.	GÖDK.	SKALA	ERSÄTTAR	ERSÄTT AV
LABGRUPPEN			LAB 2000			HF-AMPLIFIER		
KUNGSBACKA SVEDEN								RTTN.-NR 2KHF-P
								DAT 90-12-01



KONSTR. K.A.	RITFAD K.A.	KOP	KONTR.	STAND.	GODK.	SKALA	ERSÄTTAR	ERSÄTT AV
LABGRUPPEN KUNGSBACKA SIEDEN			LAB 2000 C HF-AMPLIFIER					DAT 90-12-81
							RITN.-NR	2KHF-P

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 k Ω 1%
 R8 22 k Ω
 R9 820 Ω
 R10 47 Ω
 R11 2.2 k Ω 1%
 R12 4.7 k Ω 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 k Ω 1%
 R21 22 k Ω
 R22 820 Ω
 R23 47 Ω
 R24 1.8 k Ω 1%
 R25 4.7 k Ω 1%
 R26 15 Ω 6W on legs
 R27 220 Ω 1%
 R28 1.8 k Ω 1%
 R29 27 k Ω 1%
 R30 220 Ω 1%
 R31 4.7 k Ω 1%
 R32 4.7 k Ω
 R33 330 Ω
 R34 1.2 k Ω
 R35 39 k Ω 1%
 R36 220 Ω 1%
 R37 1.8 k Ω 1%
 R38 220 Ω 1%
 R39 27 k Ω 1%
 R40 4.7 k Ω 1%
 R41 4.7 k Ω 1%
 R42 330 Ω
 R43 1.2 k Ω
 R44 39 k Ω 1%
 R45 2.2 k Ω 1%
 R46 2.2 k Ω 1%
 R47 820 Ω 2W
 R48 12 k Ω
 R49 47 Ω
 R50 27 Ω
 R51 1 k Ω
 R52 1 k Ω
 R53 2.2 Ω
 R54 2.2 Ω
 R55 2.2 k Ω 1%

R56 2.2 k Ω 1%
 R57 1 Ω 1W
 R58 1 Ω 1W
 R59 2.2 k Ω 1%
 R60 2.2 k Ω 1%
 R61 100 k Ω
 R62 2.2 Ω 2W from 94
 R63 2.2 Ω 2W from 94

Trim potentiometers

TP1 25 k Ω
 TP2 25 k Ω
 TP3 1 k Ω
 TP4 10 k Ω

Capacitors

C1 0.33 μ F 250V
 C2 0.33 μ F 250V
 C3 0.33 μ F 250V
 C4 4.7 μ F 160V
 C5 1 μ F 63V
 C6 1 nF 200V
 C7 470 μ F 10V
 C8 0.1 μ F 63V
 C9 10 μ F 50V
 C10 0.33 μ F 250V
 C11 0.33 μ F 250V
 C12 0.33 μ F 250V
 C13 4.7 μ F 160V
 C14 1 μ F 63V
 C15 1 nF 200V
 C16 470 μ F 10V
 C17 0.1 μ F 63V
 C18 10 μ F 50V
 C19 0.1 μ F 63V
 C20 10 μ F 50V
 C21 0.1 μ F 63V
 C22 10 μ F 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 μ F 63V
 C34 0.1 μ F 63V
 C35 0.1 μ F 63V

C36 0.1 μ F 63V
 C37 10 μ F 50V
 C38 1 nF 100V
 C39 220 pF
 C40 470 μ F 63V
 C41 1 nF
 C42 0.1 μ F 63V
 C43 0.1 μ F 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

Diodes

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 μ H
L2 1 μ H
L3 1 μ H
L4 14 μ H
L5 1 μ H
L6 1 μ H
L7 47 μ H
L8 47 μ H
L9 47 μ H
L10 47 μ H
L11 1 μ H

Transformers

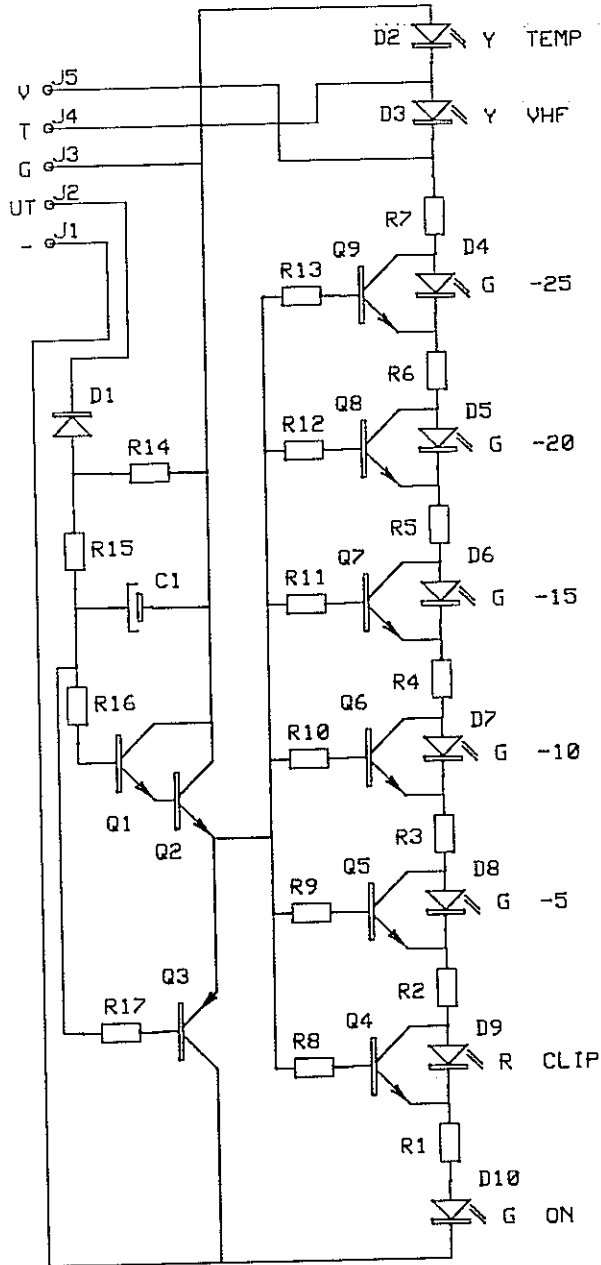
TR1 EF20 N27

* Until 94

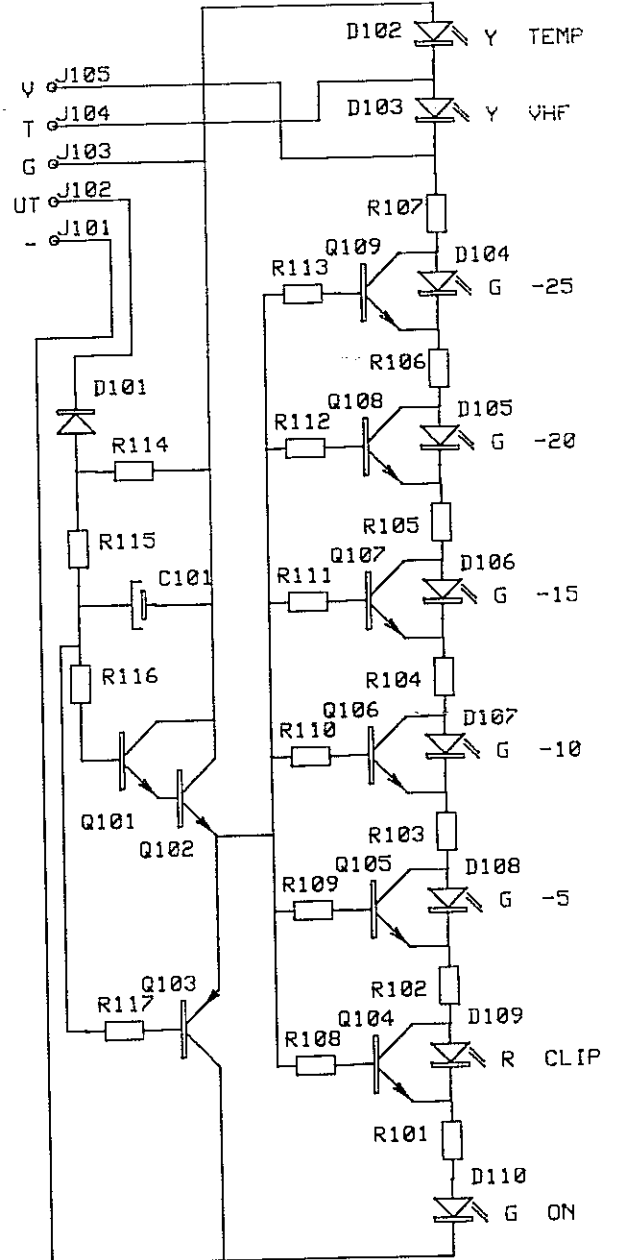
R1 4.7 Ω 6W on legs
R14 4.7 Ω 6W on legs

#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

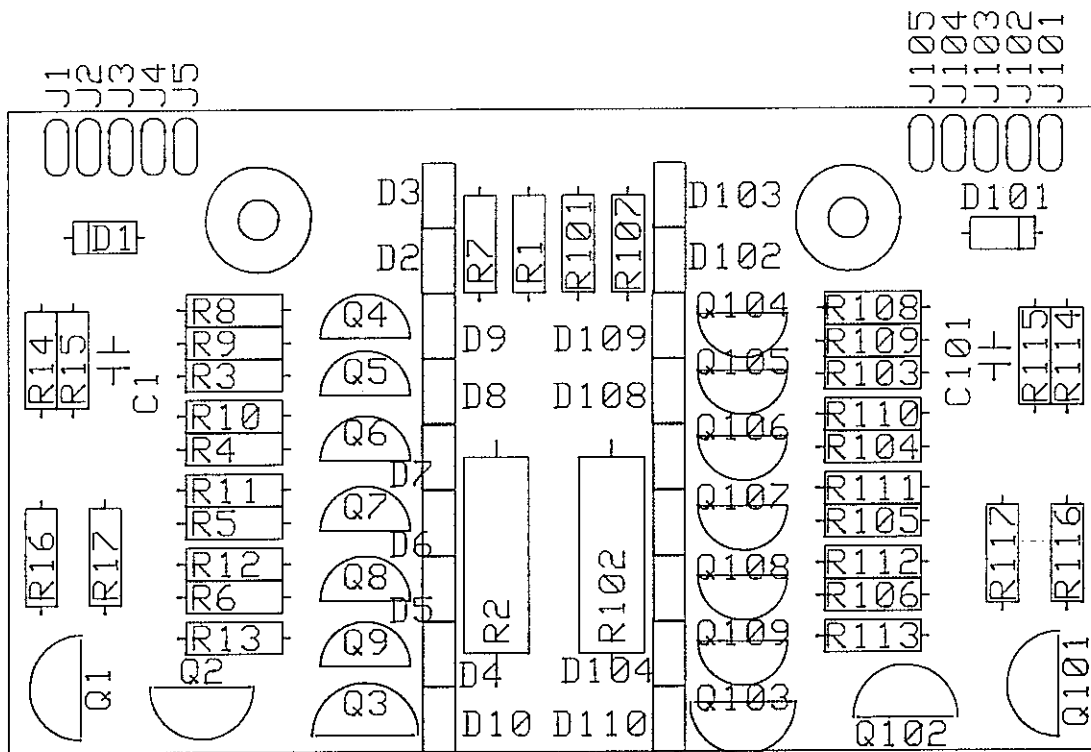
CHA



CHB



KONSTR. K.A	RITAD K.A	KOP	KONTR.	STAND.	GODK.	SKALA	ERSÄTTER	ERSÄTT AV
LABGRUPPEN KUNGSBACKA SWEDEN							LAB 2000 LED.DISPLAY	
							RITN.-NR	DAT 90 12 01 2KLED



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

Resistors

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

Capacitors

C1 4.7 μ F 100V

Diodes

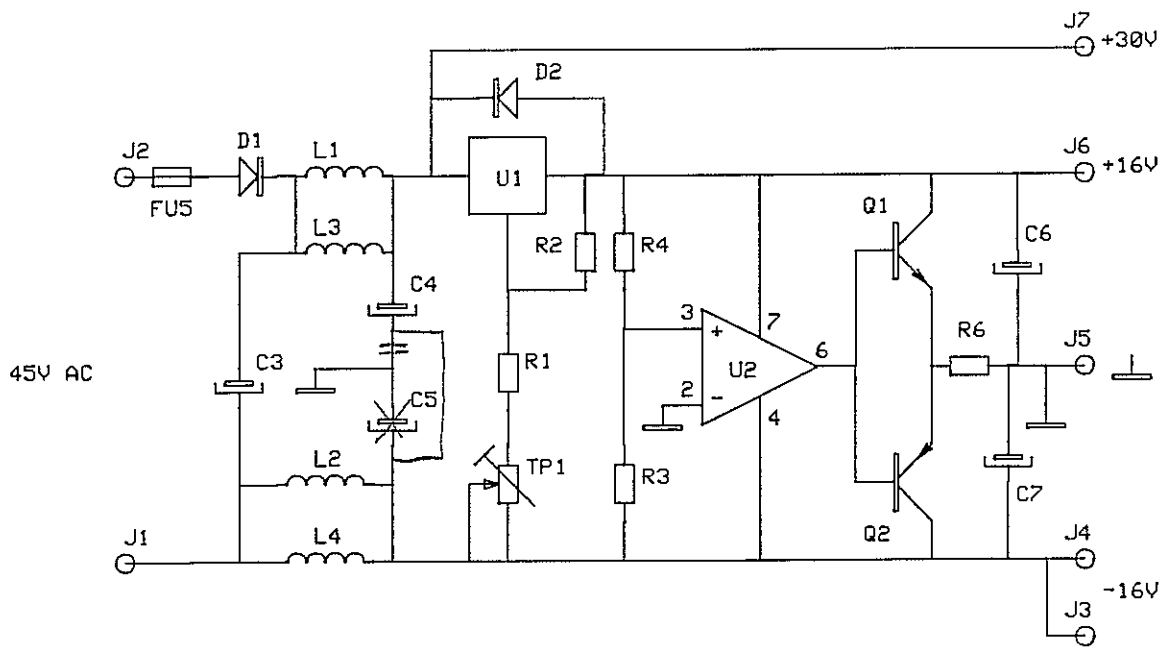
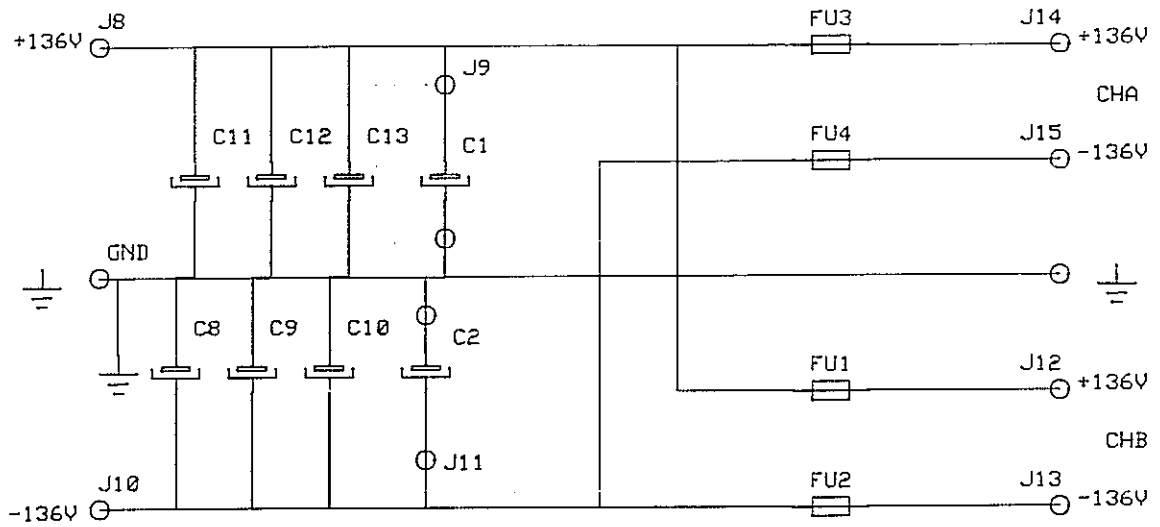
D1 1N 4004
D2 Led Y
D3 Led Y
D4 Led G
D5 Led G
D6 Led G
D7 Led G
D8 Led G
D9 Led R
D10 Led G

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	ERSÄTT AV
LABGRUPPEN KUNGSBACKA SWEDEN							LAB 2000 FUSE-BOARD VOLTAGESTABB.-BOARD	
							DAT 90 12 01	
							RITN.-NR 2KFU	

LAB 2000 FU component-list

Resistors

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

Trim potentiometers

TP1 2.5 k Ω

Capacitors

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

Diodes

D1 BYW 98-200
D2 1N 4004

Transistors

Q1 BC 337
Q2 BC 327

Integrated circuits

U1 LM 317
U2 μ A 741

Fuses

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

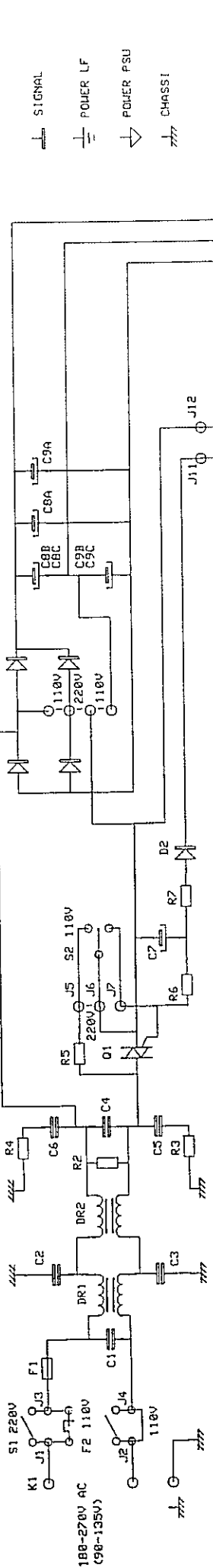
Inductors

L1 47 μ H
L2 47 μ H
L3 47 μ H
L4 47 μ H

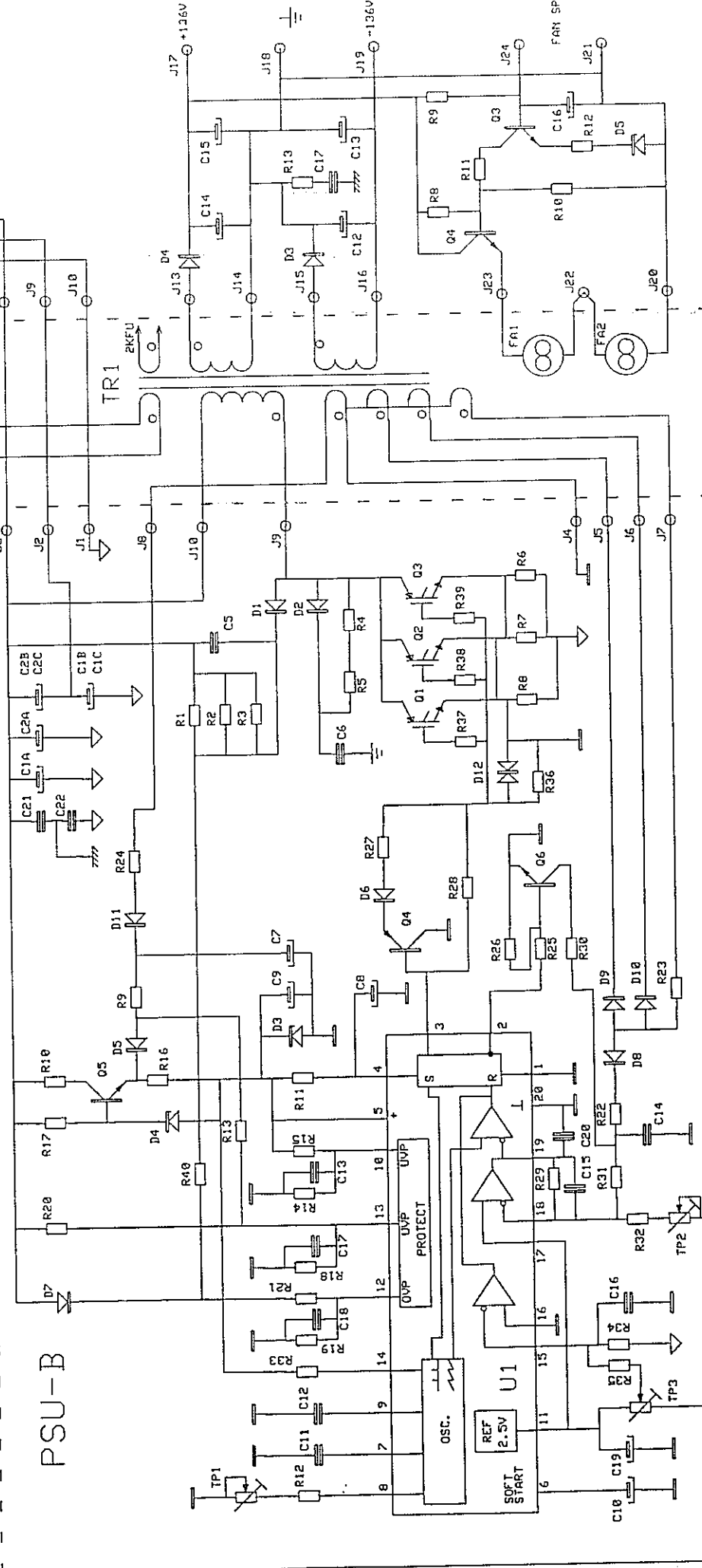
* Until 9411

C4 10 μ F 50V
C5 10 μ F 50V
C6 10 μ F 50V
C7 10 μ F 50V

PSU-A

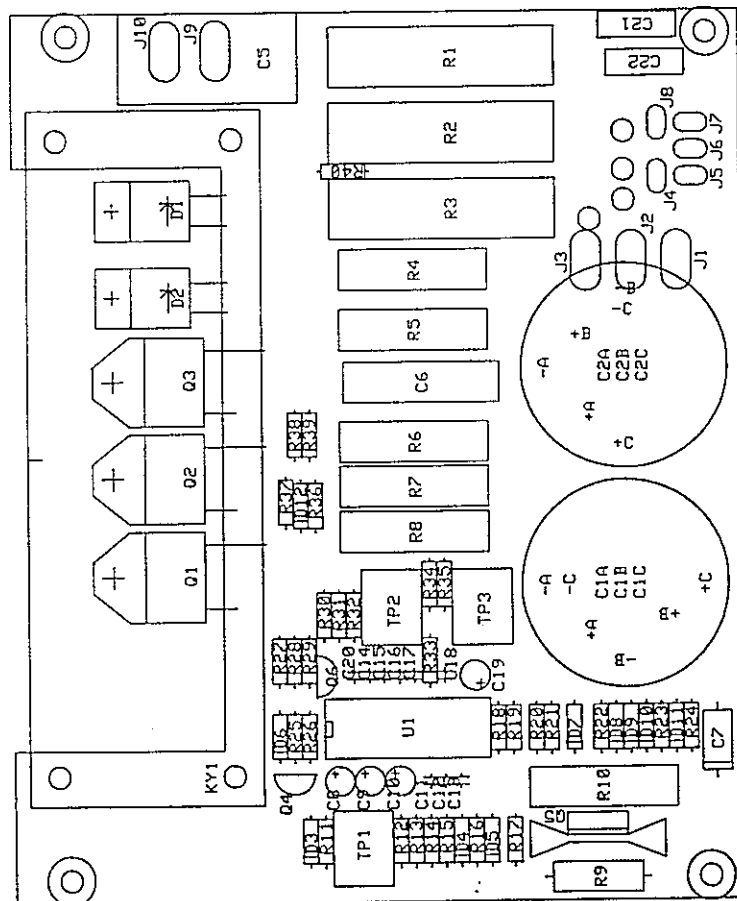
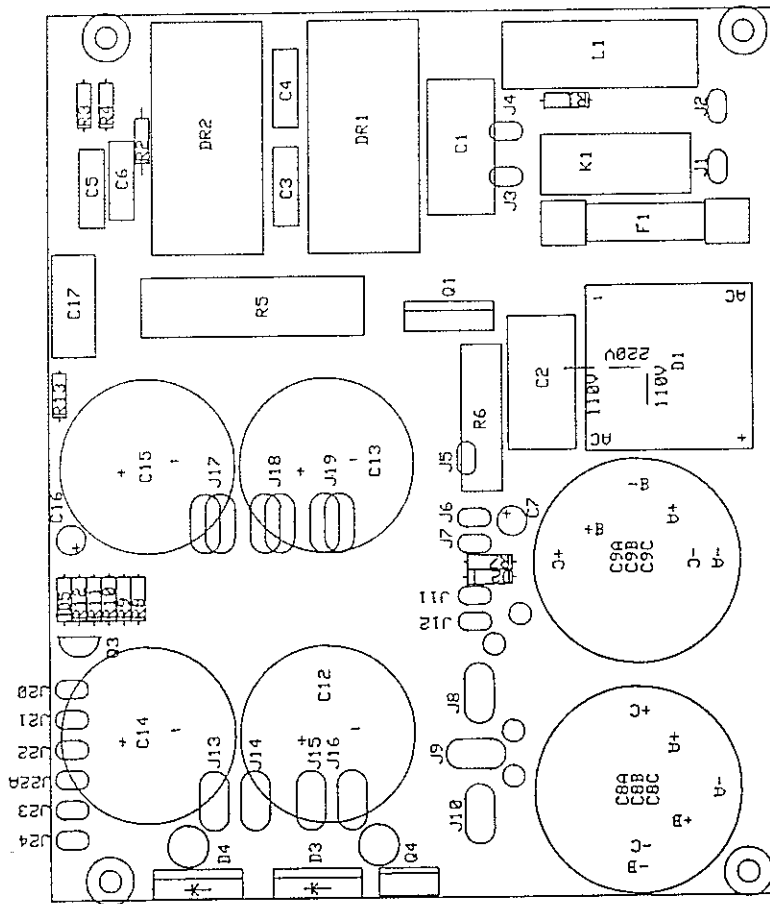


PSU-B



- SIGNAL
- POWER LF
- POWER FSU
- CHASSIS

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



KONSTR. K.A.	RITAD K.A.	KOP	KONTR.	STAND.	GÖDK.	SKALA	ERSÄTT	ERSÄTT AV
LABGRUPPEN		LAB 2000C						
KUNGSBACKA SVEDETI		POWERSUPPLY						
								ERSÄTT AV
								DAT 90-12-01
								2KFSU-A-P
								2KFSU-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

Diodes

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%
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LAB 2000C RECTIFIER BOARD PSUA component-list 941028

230V AC

Resistors

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

Transistors

Q1	Q6025J6
Q2	-
Q3	BC 546
Q4	BDX53

Fuse

F1	Fuse F15A
----	-----------

Switch

S1	Arcoelectric 8550VB
----	---------------------

Capacitors

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

Chokes

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

*Until 9410

C1	0.22 μ F X
C2	2.2 nF Y
C3	2.2 nF Y
C5	2.2 nF Y
C6	2.2 nF Y

Diodes

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

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

Resistors

R1	-
R2	1 M Ω 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	"

C16	22 μ F 16V
C17	2.2 μ F 63V
C18	See below
C19	"

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 μ F 200V
C9b	1500 μ F 200V
Q1	Relay SDS JrlaF-TM-24
S2	Marquart 1803.0102
DR1	1.4mH 16A 110V
DR2	1.4mH 16A 110V

Diodes

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

Fuses

F1#	See below
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Capacitors

C1	0.47 μ F
C2#	0.22 μ F
C3#	1.5 nF Y
C4	1.5 nF Y
C5#	1.5 nF Y
C6#	1.5 nF Y
C7	100 μ F 50V
C8a#	220 μ F 385V
C9a#	220 μ F 385V
C12	See below
C13	"
C14	"
C15	"

Transistors

Q1#	Q6025J6
Q2	-
Q3	BC 546
Q4	See below
DR1#	2.7mH 8A 220V
DR2#	2.7mH 8A 220V

Switches

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

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

Resistors

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

Trim potentiometers

VR1 2.5 k Ω
 VR2 10 k Ω
 VR3 10 k Ω

Capacitors

C1 0.22 μ F X
 C2 4.7 nF Y
 C3 4.7 nF Y
 C4 0.22 μ F X
 C5 47 μ F 50V R
 C6a 220 μ F 385V
 C6b 220 μ F 385V

C6c 220 μ F 385V
 C6d 220 μ F 385V
 C7 390 pF
 C8 10 μ F 63V A
 C9 10 μ F 50V R
 C10 10 μ F 63V A
 C11 4.7 μ F 50V R C12 10
 μ F 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 μ F 200V
 C21 1000 μ F 200V
 C22 1000 μ F 200V
 C23 1000 μ F 200V
 C24 2.2 μ F 100V
 C25 -
 C26 0.6 μ F 600V X
 C27 0.6 μ F 600V X
 C28 4.7 nF 2K V
 C29 100 μ F 40V R
 C30 10 nF
 C31 0.1 μ F

Diodes

D1 KBPC 3506
 D2 1N 4148
 D3 1N 4004
 D4 BYV26C
 D5 12V 1W
 D6 1N 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