



SERVICE MANUAL

FOR

A4-14

A4-14Mk2

A4-14Mk3

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1. TECHNICAL DESCRIPTION

The description below applies to types A4-14 and A4-14Mk2. For type A4-14Mk3 the DIN connectors have been replaced by RCA connectors and the BASS/BLEND, LEFT/RIGHT and AUTO/ON switches have been deleted but other functions still apply.

1.1 Power supply circuits

Unregulated voltages +30V and -30V supply the Power Amplifier and also a regulator for ±15V.

-15V supply tracks +15V in order to avoid transients and oscillations when power is switched on or off. The positive supply must decay faster than the negative supply when power is disconnected, which is assured by a 2.2 kohm dummy load (R101) on the +30V capacitor.

1.2 Automatic ON/OFF

The auto ON/OFF circuits are powered via D201, D202 and C201. The power transformers and the auto ON/OFF circuits are powered as long as the speaker A4-14 is plugged in to a live outlet. The remaining circuits are powered only in "ON" state when relay K101 is closed.

The audio signals enter via pins 3 and 5 in DIN connector J301. The other A4-14 in a stereo pair receives signals via pins 3 and 5 in DIN connector J302. The signals enter the amplifier circuits via pushbutton switches S301 - S302 which select Left or Right Channel.

The input stage of auto ON/OFF, Z202 (1, 2, 3) works as amplifier with gain -7 determined by feedback network R204 and R205. D208 and D209 limit the amplifier signal to ±7V. The second stage, Z201 (1, 2, 3) works as amplifier with gain ~ 2,000 at 500 Hz.

The signal at pin 1 is limited to +7.0V/-7V. Z201 (5, 6, 7) plus transistor V201 works as a schmidt trigger with ON level approx. 7V and OFF level approx. 5V. The input, pin 5, senses a DC voltage which is obtained via diode D211 and capacitor C206.

Transistor V201 drives relay K101, which connects power to the audio circuits in A4-14. When switch S201 is in "AUTO" position, relay K101 will open about 5 minutes after the signal at the input disappeared. The time relay is determined by C206 and R210. During test you may shunt R210 by 100 kohm to obtain shorter OFF-delay.

When switch S201 is in "ON" position, the auto ON/OFF circuits are bypassed and A4-14 remains permanently ON.

A thermistor TS3-75 senses the temperature of the heatsink. When this temperature is too high, the thermistor resistance becomes so low, that relay K101 opens.

1.3 Overload protection for midrange and tweeter

Z202 (4-13) acts as an overload protection device which is actuated if there is risk for damage to the midrange driver or the tweeter.

The voltage across the voice coils are rectified in diodes D220 and D219 and the rectified voltages charge capacitors C211 and C212. The time constants for discharge are longer than the charging time constants. If the voltage at Z202 pins 5 or 6 exceeds a threshold value (approx. 3.4V), the monostable flip-flop Z202 (8-13) is triggered for 10 seconds. This causes V201 to be shut off, so relay K101 opens and A4-14 is deenergized for 10 seconds.

1.4 Signal amplifier circuits

When the Bass-Blend switch is OFF, the signals enter via R302, C302 and R303.

When the Bass-Blend switch is ON, the bass frequency signals in left and right channels are added via filters C301, R301, R304, C303 and R305.

- C301 and R301 is a high-pass filter with cutoff frequency 100 Hz. Lower frequencies are attenuated by a factor of 2.
- R304, C303 and R305 is a low-pass filter with cutoff frequency 100 Hz, and attenuation 1:2 relative filter R302, C302 and R303.

The signals below 100 Hz are summed at Z301, pin 9. Because of the attenuation introduced in each channel, the bass level is the same as when Bass-Blend is not used.

The gain is adjusted by potentiometer R306 in the feedback circuit of operational amplifier number one. After this amplification the signals are split to bass circuits and midrange/tweeter circuits.

1.5 Bass circuits

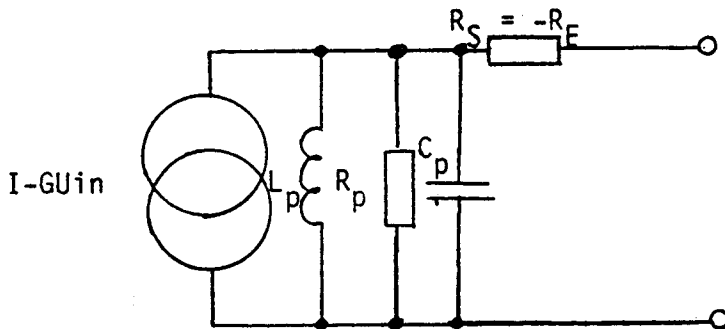
The signal passes the bass control circuits R311, Z301 (12, 13, 14), which controls the signal level to the woofers. The bass control circuits affect higher frequencies (e.g. 100 hz) more than low frequencies (e.g. 30 Hz).

The bass signal then passes via a low-pass link R313, C306 which forms one part of the crossover filter between bass and midrange.

The next link is a high-pass filter, which cuts frequencies below 30 hz 12dB/octave, and is part of the woofer's total transfer function.

1.6 ACE-BASS* Circuit

The power amplifier for the woofer, together with Z302 (1, 2, 3, 5, 6, 7) forms the ACE-BASS*, amplifier, which can be represented by the diagram below



R412 and Z302 (1, 2, 3) sense the voice coil current in the woofers. Z302 (5, 6, 7) acts as a band-pass filter and sums signals from D and F.

The power amplifier for the woofer is inverting and acts as adder for signals from E and F.

The part of the current signal F which is fed back positively produces the negative output resistance R_s .

The parallel resonant circuit L_p , R_p , C_p is formed by negative feedback of the current signal via the band-pass filter.

* ACE-BASS = Amplifier Controlled Euphonic Bass.

1.7 Midrange and treble circuits

From the gain control the signal is also fed to the midrange/treble amplifier. Z301 (5, 6, 7) acts both as high-pass filter for the crossover (C502, R501, R502) and as treble boost filter (R505, R506, C503). The high-pass link C504, R507, R508 forms the second part of the crossover filter between bass and midrange.

The power amplifier is of the inverting type, and acts as operational amplifier for the treble control R510, which is active above 5kHz.

1.8 Power stage for woofers

The signal is coupled via C703 to the input of the power amplifier.

From the output, the signal is fed back negatively via R709 and C704. When the signal amplitudes are large, negative feedback also is provided via a network of resistors and diodes. The output signal is compared to the supply voltage, and a couple of volts before clipping will occur, the signal will be rounded by the diode network so the clipping is soft.

The input stage consists of a differential stage V702 and V707 fed via a constant-current generator, V701.

The output stage is of Darlington design with transistors V710-V711 and has AC gain -1. V707 senses the temperature of the output transistors so that the bias current is constant.

V705 and V709 filter the supply voltage for the input stage, eliminating hum and other kinds of noise. (If A4-14 "pops" when switched on, one of these transistors is probably shorted).

No-signal DC-levels of voltages and currents are shown in the circuit diagram enclosed.

To avoid on-and-off transients, the bass amplifier is active only when the supply voltages exceed +17V, so that the operational amplifiers always work properly when the bass amplifier is active. When diode D712 starts conducting, the constant current generator V701 starts working, and via V712 activates the current generator V706. The amplifier is inactive when these current generators are shut off.

1.9 Power amplifier for midrange and tweeter

The power amplifier is similar to the bass amplifier but the diode network for soft clipping is not included. The voltage-delayed on-function is also eliminated, so this power amplifier is active at low supply voltages.

The signal from the power amplifier is split in passive crossover filters L602, C616, C617 to midrange and C614, C615 and L601 to the tweeter.

2. FAULT FINDING

A4-14 does not work;

- * Set auto ON/OFF in position ON.
- * Check that both the green and red LED are lit.
- * Check the power fuses and fuses F601, 602, 701 and 702.
- * Measure supply voltages $+33V \pm 2.5$, $-33V \pm 2.5V$, $+15V \pm 2V$, $-15V \pm 2V$.

To localize the fault, connect test instruments as follows:

- Tone generator to J301 pins 3 and 5. Adjust till B is 42mV. Sensitivity in Max position, bass and treble pots in center position. Compare to voltage levels according to table in circuit diagram.

If fuses F601, 602, 702 blow during measurement per Section 1.4, you may disconnect the woofers and replace midrange driver and tweeter by 5-10 ohm resistors. Test again per Section 1.4 (signal levels in points E, F, G, K and J will of course be different).

Auto ON/OFF can also be tested with set-up per 1.4.

- Set auto ON/OFF in AUTO.

The signal at Z201 pin 1 should be 7V p-p and the signal Z201 pin 7 should be 15V DC.

Relay K101 should close at 15mV/500 Hz in (R210 may be shunted by 100 kohm to reduce the off delay)

3. ADJUSTMENT

3.1 Bias current in power amplifiers

After replacing any output transistor in any of the power amplifiers, the bias current must be readjusted. Setting of bias current should be done while heatsinks are at room temperature, that is immediately after A4-14 is turned on.

Set potentiometer R722 or R617 till DC voltage between emitters of V710, V711 reads 10mV or voltage between V610, V611 reads of 20mV, which corresponds to 23mA bias current.

NOTE: When output transistors are replaced, heat sink compound must be applied to both sides of the insulations washers and to the temperature compensating transistors. Check that insulation is adequate and that the power transistors are mounted flat against the heatsink. The heatsink must be screwed on to the PC card before the transistors are soldered in.

3.2 Negative output resistance

After replacing a woofer, or any of the current sensing resistors R408-R412, the negative output resistance must be re-adjusted.

The woofers must be properly mounted in the cabinet, their voice coils must be connected, and the bass adjustment potentiometer R311 must be in centre position. Voice coils must be cold (at room temperature).

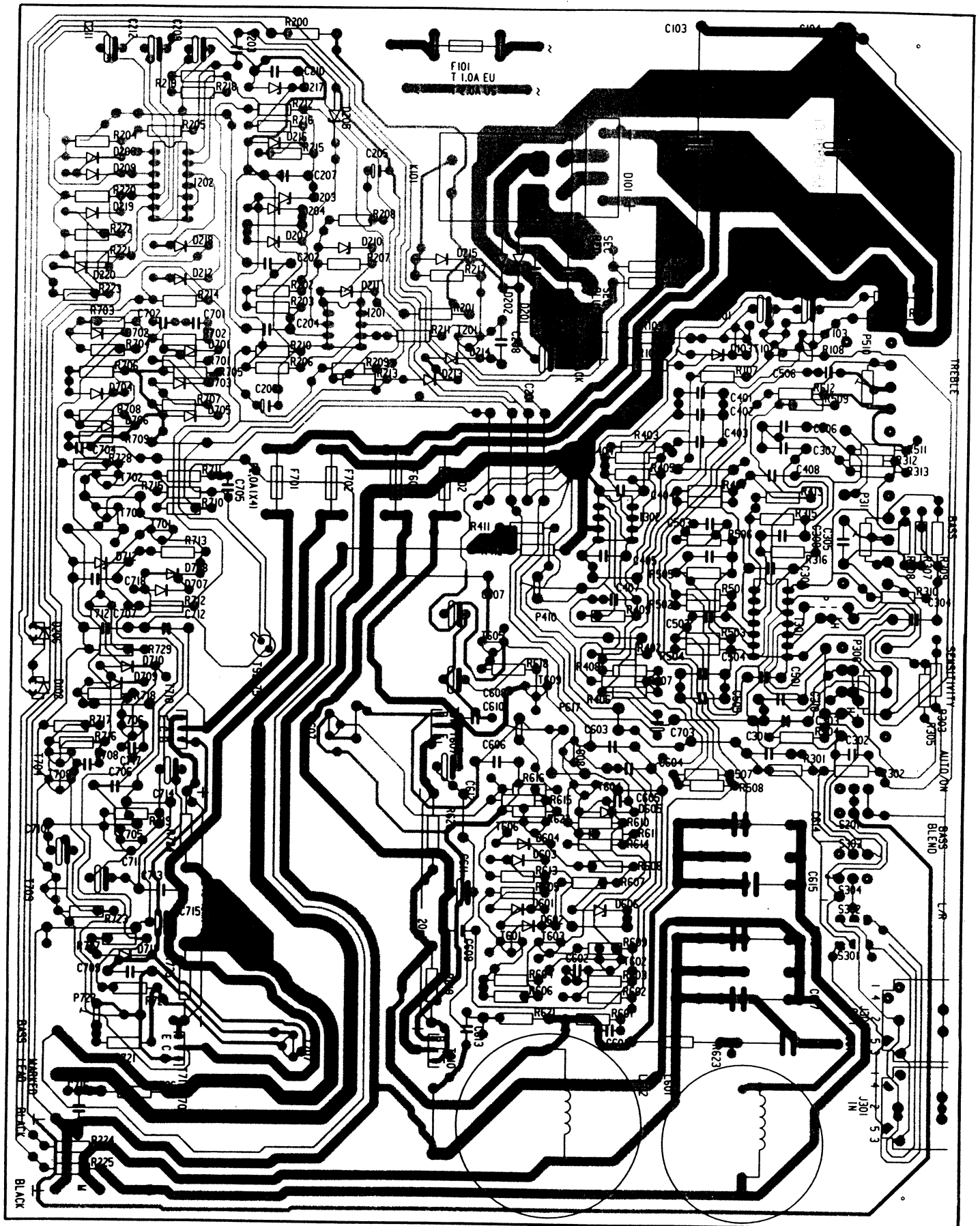
Apply an input signal of 60Hz \pm 1 Hz and adjust signal generator till test point G reads 0dB (=0.775V). Change frequency to 180 Hz \pm 3 Hz without changing the signal level of the signal generator, and set potentiometer R410 till voltage at test point G is -5.5dB (5.5dB below 60 Hz).

Go back and forth between 60 Hz and 180 Hz and readjust if required until the difference is stable at **3.5 dB**.

4. SPARE PARTS

Spare parts can be obtained from Audio Pro Sweden, or from Distributors and Service Centres.

When ordering spare parts, please refer to serial number of speaker, and component number per circuit diagram 2-141504, 5520991-01 resp. 1-80226.



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Antal/Qty		Pos./Item	Benämning/Description		Material/Detalj
C	B	A	Ritad/Drawn	Kontr./Checked	Dat./Date
			KN		840507
A4-14					
COMPONENT LAYOUT					

Enclosure 5.4



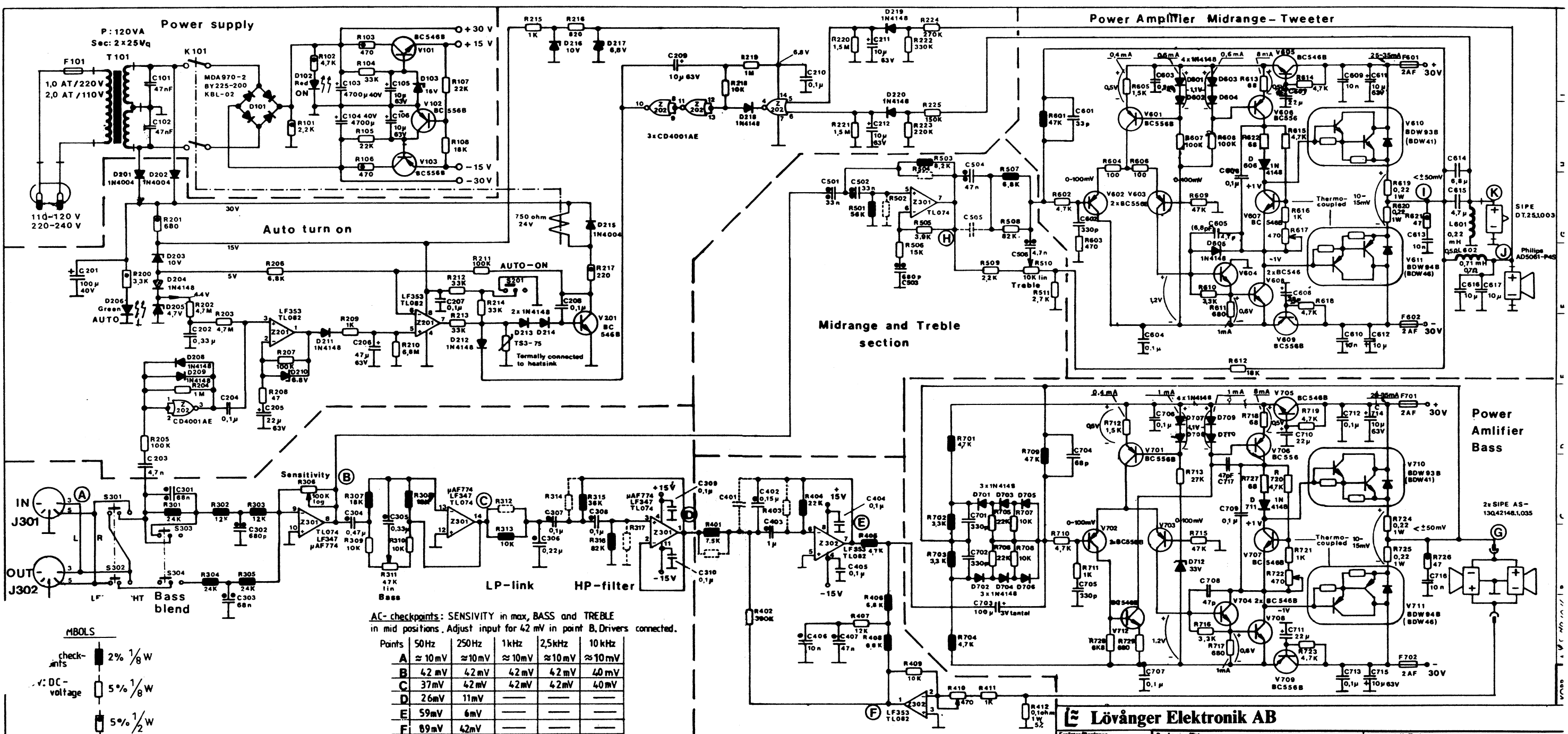
Ritn.-nr/Drg No.	Rev. No.
4-80150	

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Material ordered with reference to this specification shall in every respect meet the requirements and data stated herein.

Ind. values must be checked before use.

Denote pin numbers, etc. Overstriked.



AC-checkpoints: SENSIVITY in max, BASS and TREBLE in mid positions. Adjust input for 42 mV in point B. Drivers connected.

Points	50Hz	250Hz	1kHz	2,5kHz	10kHz
A	≈ 10mV	≈ 10mV	≈ 10mV	≈ 10mV	≈ 10mV
B	42 mV	42 mV	42 mV	42 mV	40 mV
C	37mV	42mV	42mV	42mV	40mV
D	26mV	11mV			
E	59mV	6mV			
F	89mV	42mV			
G	800mV	190mV			
H		60mV	45mV	4mV	45mV
I		210mV	320mV	330mV	330mV
J		195mV	214mV	105mV	3mV
K			40mV	255mV	370mV

ACE-Bass circuit
Adjust R410 for 7,3dB lower level at 180±3 Hz compared to 60±1 Hz in point G. Bass drivers in box must be connected.

Lövånger Elektronik AB

Erställt/Replaces	Benämning/Title	Uppgjord för/Project
Uppgjord/By Made by Datum Sture B790521	CIRCUIT DIAGRAM	Audio pro A4-14 Mini-Ace
Granskad/Checked Datum	Godkänd/Approved	Scale
1 at angle projection	790920 Folle Celery	Ritningsnummer/Drawing nr 2-141502

POWER SUPPLY

POWER AMPLIFIER
MIDRANGE - TWEETER

PROJ. _____ TITLE _____

DESIGNED BY _____ DATE _____

SCALE _____

REV. _____

DATE _____

BY _____

CHKD BY _____

APP. _____

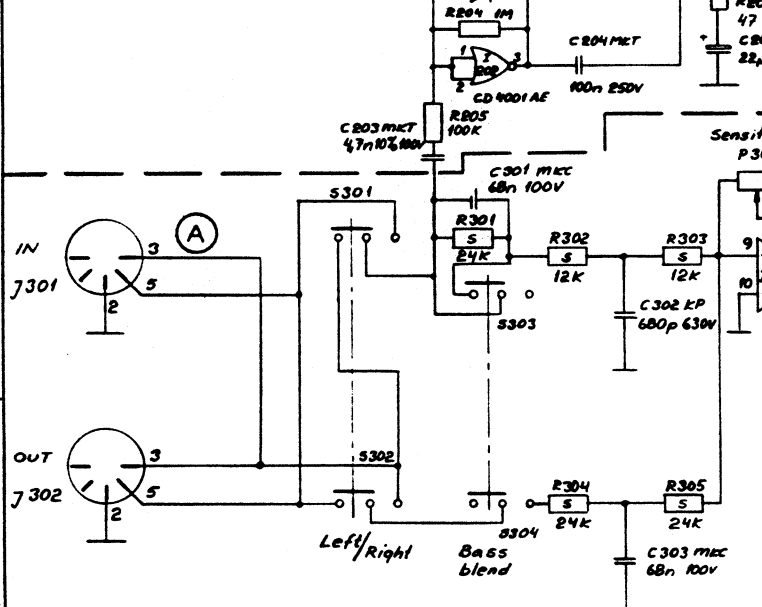
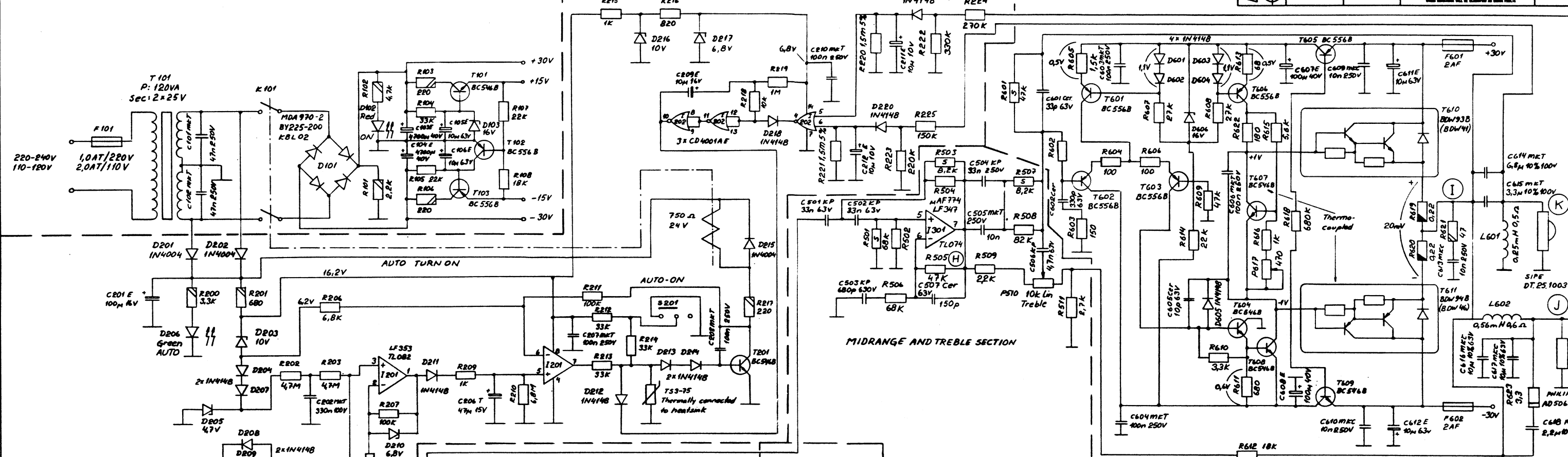
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DATE _____



AC CHECKPOINTS (mV)
SENSITIVITY in max, BASS and TREBLE in mid positions. Adjust input for 42 mV in point (B). Drivers connected.

Point	50Hz	250Hz	1kHz	2.5kHz	10kHz
A	10mV	18mV	10mV	10mV	10mV
B	42	42	42	42	40
C	36	42	42	42	42
D	28	16			
E	63	8			
F	130	52			
G	930	240			
H		71	53	60	65
I		210	320	400	460
J		200	250	117	35
K			29	240	530

0.5W 5% Resistor

0.3W 2% (1%) Resistor

0.3W 5% Resistor

2W 5% Resistor

1W 5% Resistor

m2-Pol. polyester 5% Capacitor

KP-Polypropylene 5% Capacitor

mcc-Polycarbonate 5% Capacitor

E-Electrolytic Capacitor

T-Tantalum Capacitor

Cer-Ceramic 2% Capacitor

ACE-Bass circuit
Adjust R410 for 5.5 dB lower level at 1803Hz compared to 601Hz in point (E). Bass drivers in box must be connected.

Enclosure 5.3

1 84-04-26 12V Table added.

DATE _____

SCALE _____

REV. _____

DATE _____

BY _____

CHKD BY _____

APP. _____

DATE _____

BY _____

CHKD BY _____

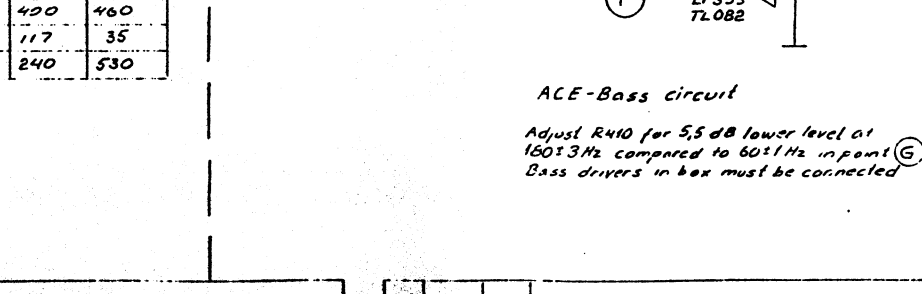
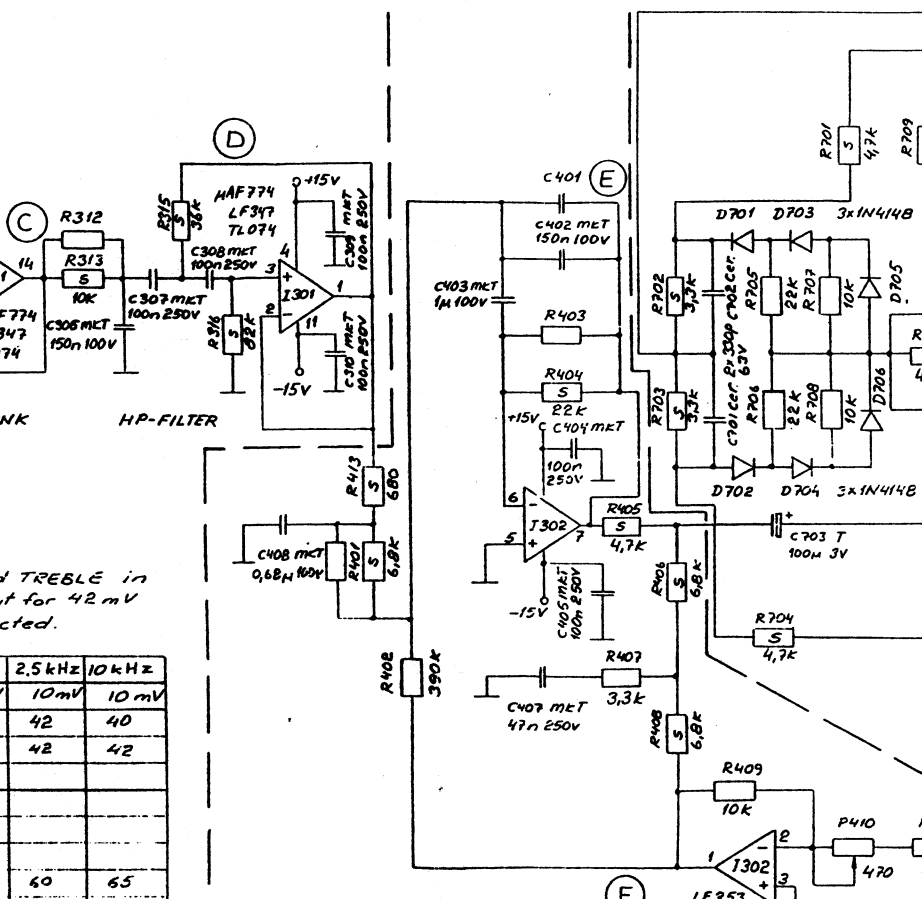
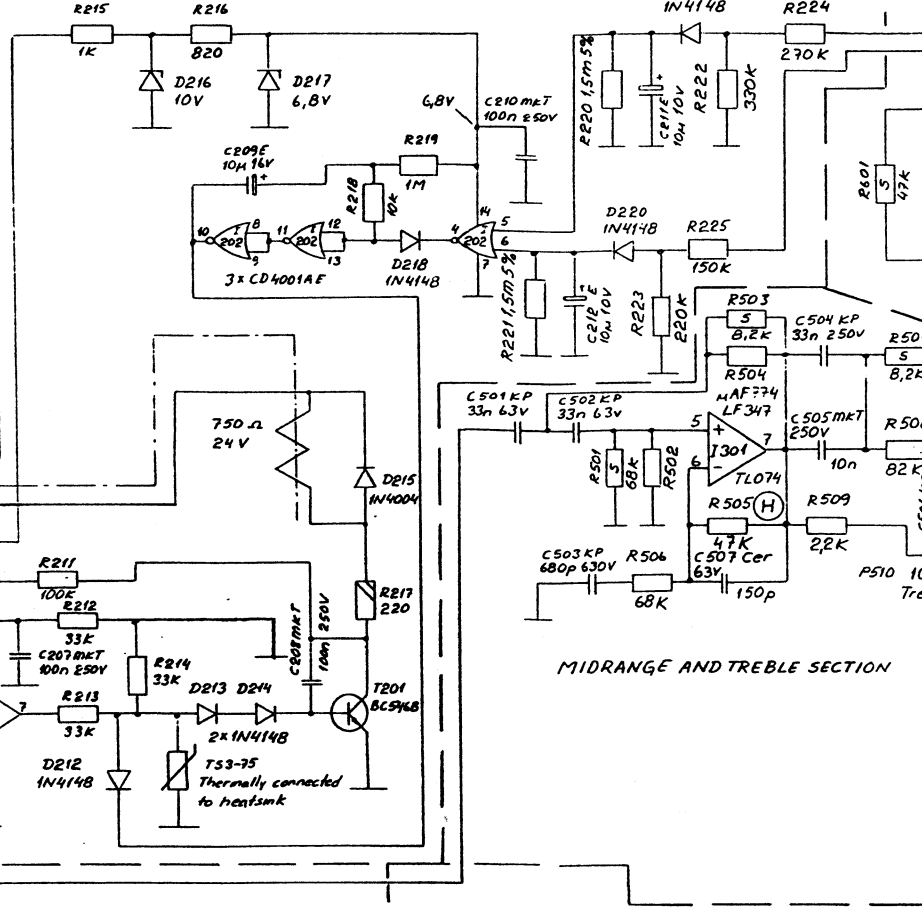
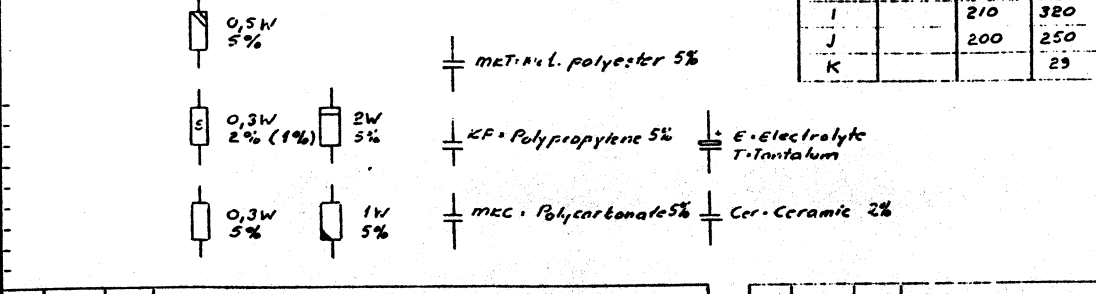
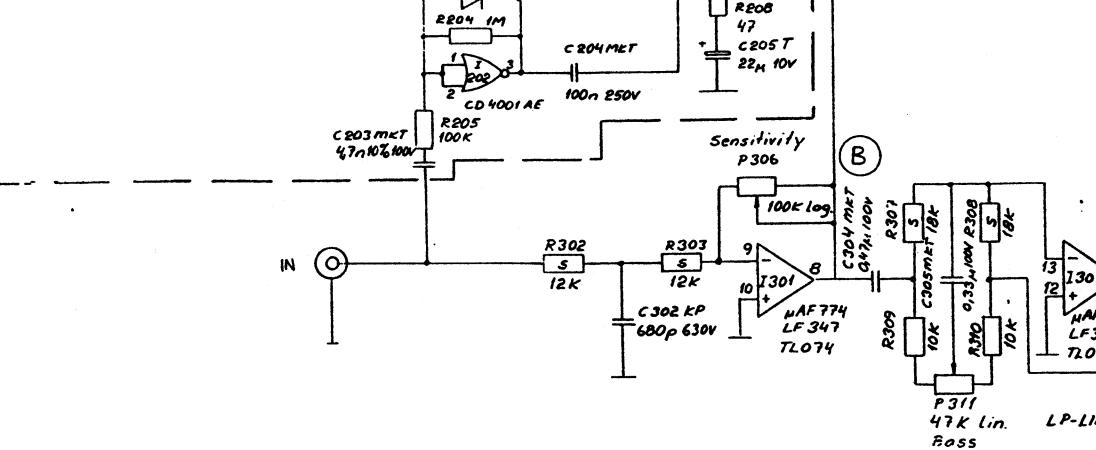
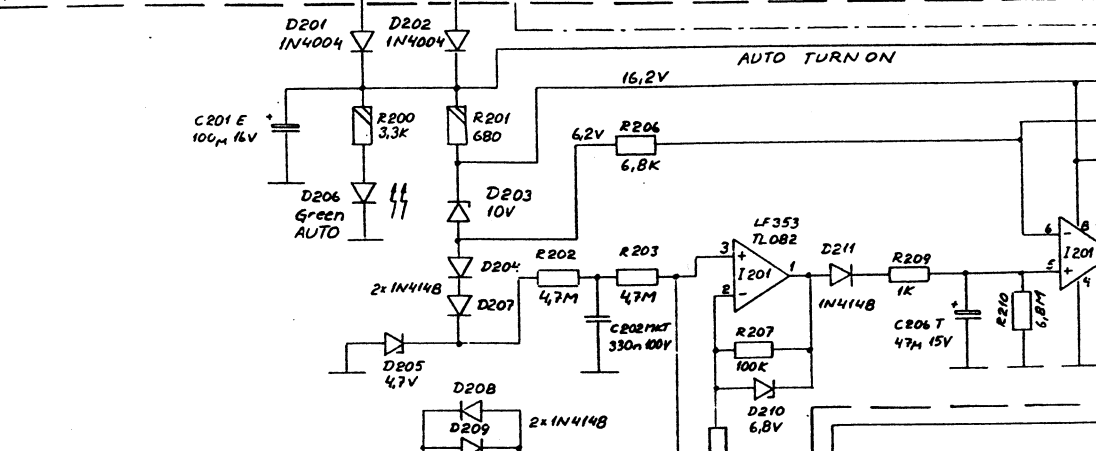
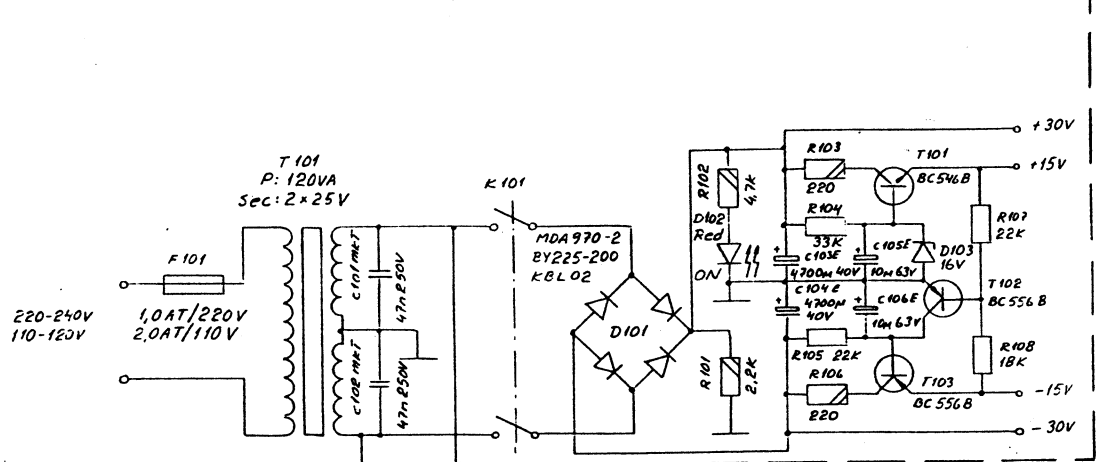
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DATE _____

CIRCUIT DIAGRAM

A4-14 Mk2

2205016

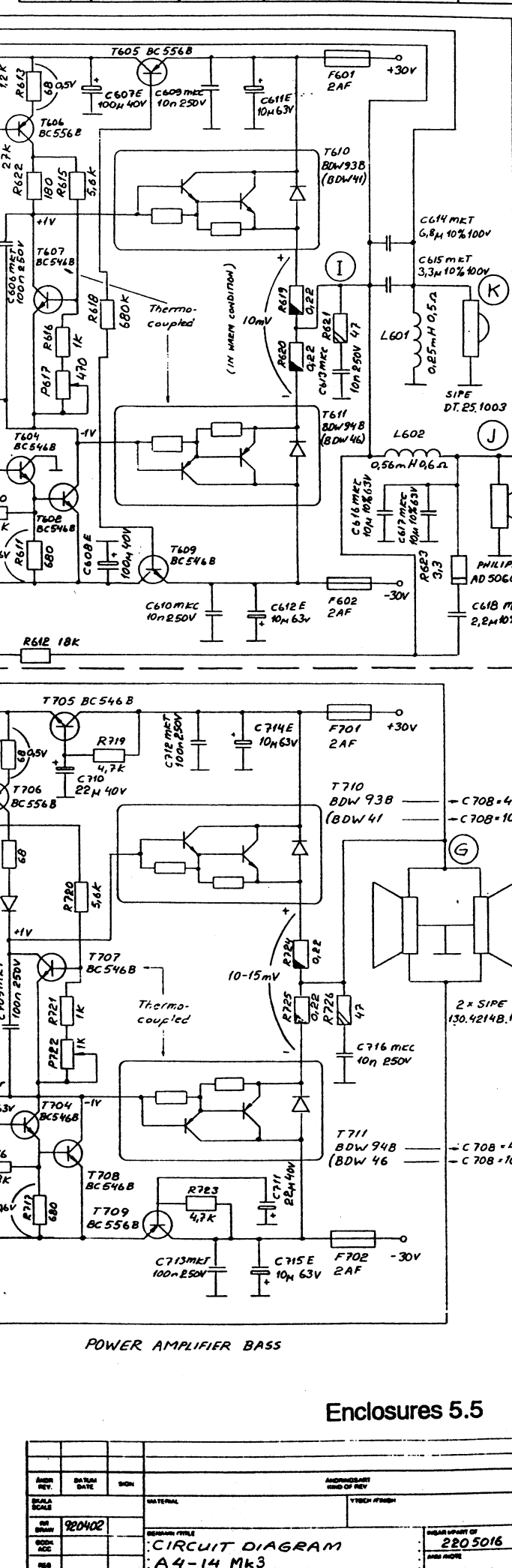


AC CHECKPOINTS (mV)
SENSITIVITY in max, BASS and TREBLE in mid positions. Adjust input for 42 mV in point (B). Drivers connected.

Point	50Hz	250Hz	1kHz	2.5kHz	10kHz
A	10 mV	10 mV	10 mV	10 mV	10 mV
B	42	42	42	42	40
C	36	42	42	42	42
D	28	16			
E	63	8			
F	130	52			
G	330	240			
H		71	53	60	65
I		210	380	420	460
J		200	250	117	35
K			29	240	530

- 0.5W 5%
- 0.3W 2% (1%)
- 0.3W 5%
- 2W 5%
- 1W 5%
- MET: M.L. polyester 5%
- KP: Polypropylene 5%
- MKC: Polycarbonate 5%
- E: Electrolyte
- T: Tantalum
- Cer: Ceramic 2%

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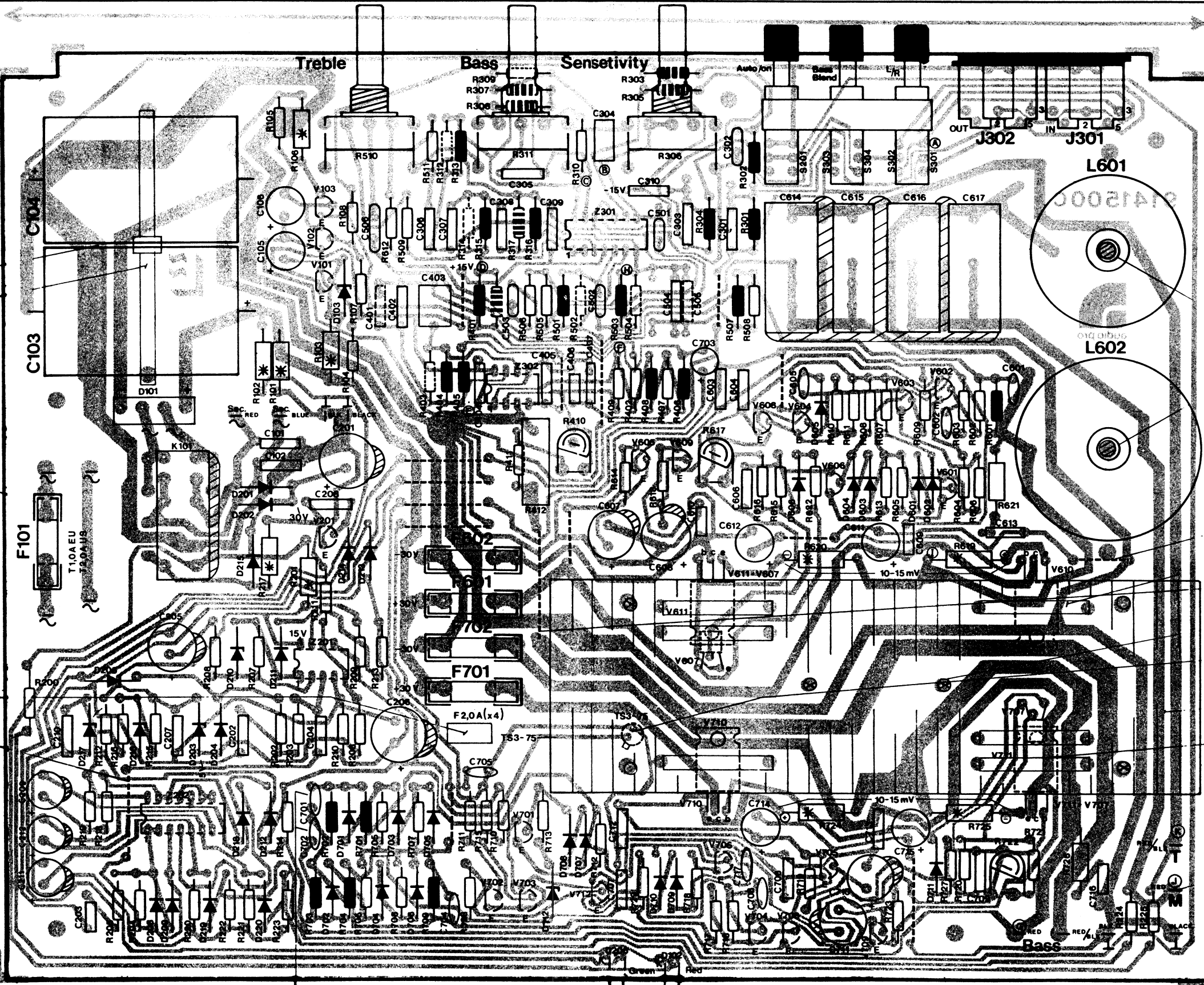
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2			

ENCLOSURE 5.5
CIRCUIT DIAGRAM
A4-14 Mk3
2205016

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*Monteras upplyftade från kortet (10st motstånd)
 *Install at distance from card (10 resistors)
 R410 R617 R722 läses med lack efter trimning
 lock with varnish after adjustment

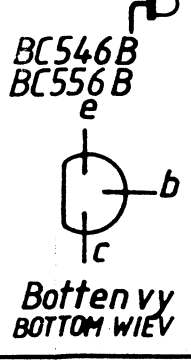
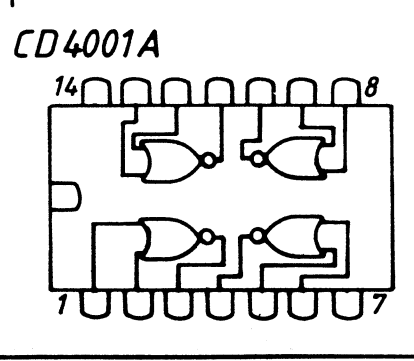
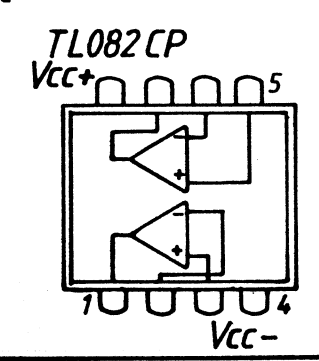
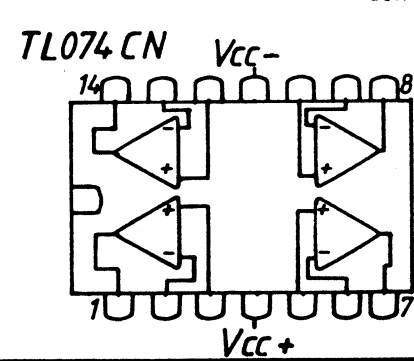


- 14
- 4
- 6
- 11
- 8

- 16
- 17
- 5 x 8
- 12
- 10
- 13
- 3
- 7
- 9
- 15
- 1
- 2

Limmas med 3140

C701 C702 monteras upplyftade och bockade



Botten vy
BOTTOM VIEW

Lövänger Elektronik AB		Enclosure 5.2	
Ersätter/Replaces	Benämning/Title	Uppgjord för/Project	
Uppgj. av/Made by	Datum	audio pro	
MG 790827		A4-14	
Granskad/Checked	Datum	Scale	
		1:1	
1 st angle projection	Godkänd/Approved	Ritningsnummer/Drawing nr	
	790828 Folke Carls	3-141504	