S E R V I C E M A N U A L

F O R

S U B W O O F E R B 4 - 2 0 0

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1. TECHNICAL DESCRIPTION

The theoretical background for the Ace-Bass principle used in Subwoofer B4-200 is described in AES Preprint No. 1381.

The functions described below are separated by dashed lines on the Circuit Diagram.

1.1 Power Supply

The primary of the power transformer is always conncted to the power cord via a voltage selector and a power fuse (5.0A slow at 117 V, 2.5A slow at 220-250 V). The idle current in this transformer is very low (approx. 25mA at 117 V supply).

The center tapped secondary winding supplies the Automatic ON/OFF via two diodes D202, D211.

Rectifier formed by D101, D102, D103 and D104 supplies + 40 V to the Power Amplifier, and also stabilized ± 15 V via voltage regulators, V101, V103.

It is very important that the -15 V tracks the + 15 V accurately when power is switched on or off. Mistracking can cause transients or oscillations in the electronic circuits.

To maintain tracking of the +15 V and -15 V when power is disconnected, the +40 V must decay faster than the -40 V. For this reason the Power Amplifier is built to always maintain a small positive offset voltage (10-100mV) on its output terminals under operating conditions.

If the B4-200 is tested without any load on the Power Amplifier or with fuses F401, F402 removed, the balance between +15 V and -15 V may be upset during on/off switching. In such cases the operational amplifiers may start oscillating when power is disconnected, so that Automatic ON is acutated. This is normal under these conditions, and the electronics will not be damaged.

1.2 Automatic ON/OFF

This circuit is powered via diodes D202, D211 and capacitor C201.

The power transformer and the Automatic ON/OFF circuit are powered at all times when B4-200 is plugged in to a live outlet. The other circuits in B4-200 are powered only when rectifier circuit is actuated.

The audio signal on left channel is sensed by operational amplifier Z201 (5, 6, 7) which acts as an amplifier with gain 5000 at 500Hz. The amplified voltage (pin 7 Z201) is limited to +7.0 V and -0.7 V by zener diode D208. Operational amplifier Z201 (1, 2, 3) and transistor V202 work as a Schmitt trigger with ON level 7 V and OFF level 5 V. The input (pin 2) senses the voltage from Z201 (5, 6, 7) after rectification in D209 and capacitor C205.

Transistor V202 drives D101, D102, D103, D104 which act as a switchable rectifier. 0 volts on collector V202 causes rectifiers to conduct. i.e. B4-200 is on and a red LED indicates "ON". High level causes B4-200 to switch off.

When auto/on switch is in position "AUTO", B4-200 is switched off about 5 minutes after the audio signal on left channel input disappears. The time delay is determined by C205 and R216. (During testing R216 may be shunted by 100 kohm, so delay time is reduced).

When auto/on switch is in position "ON" the sensing circuits are bypassed, and B4-200 is switched on as soon as it is plugged in to a live outlet.

Temperature sensor TS3-85 senses the temperature of the Power Amplifier heatsink. If this temperature becomes too high, the resistance in TS3-85 drops to a low value, and B4-200 is switched off.

1.3 Input Stage

The audio signals on XLR plug J301 pin 2 (left channel) and pin 5 (right channel) pass through variable high pass filters formed by C302, R305, R306 and C305, R308, R307 and buffer amplifiers Z103 (5, 6, 7) and Z103 (3, 2, 1) to XLR plug J301 pins 3 and 4. From pins 3 and 4, they can be returned to an external power amplifier driving the satellite speakers. The buffer amplifiers provide low output impedance, so cable capacitances will not affect the treble response.

The audio signals are summed by resistors R313, R314 into a summing amplifier.

The signal is passed via a volume control R316 to a second amplifier stage Z101 (12, 13, 14) with 17dB gain.

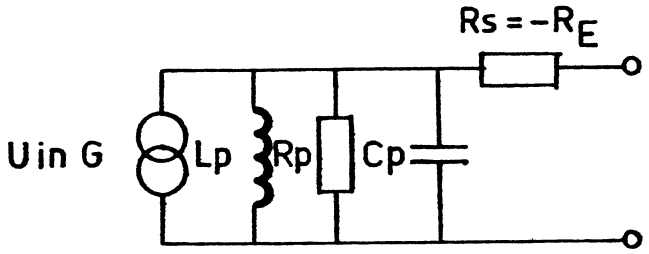
1.4 Filter

The signal from Z101 pin 14 (test point C) passes av variable low pass filter including R328, R329, R330, R331, C307, C313 and Z401 (10, 9, 8), and then on to an amplifier Z101 (2, 3, 1) which feeds the high pass filter with kneepoint 22.8 Hz, as well as the inverting amplifier Z102 (5, 6, 7) which forms the balanced output on XLR contact J301 (slave output).

Remaining components in the filter circuits are part of the Ace-Bass amplifier, and is described in section 1.5.

1.5 Ace-Bass Circuits

The Power Amplifier together with Z102 (1, 2, 3) and Z102 (12, 13, 14) form the Ace-Bass amplifier, which can be represented by the diagram below.



R512, R513 and Z102 (12, 13, 14) sense the current through the drivers. The voltage in test point (I) equals the driver current (1V/1A).

Z102 (2, 3, 1) works as an active bandpass filter, and also sums the signals in test points (F) and (I).

The Power Amplifier is of inverting type, and also acts as a summing amplifier, adding signals (G) and (I).

Part of the driver current signal is fed back positively through the Power Amplifier, which gives the Power Amplifier a negative output resistance Rs. The amount of positive feedback, and thereby, the value of Rs, can be adjusted by trimpot Rrs.

The parallel circuit Lp, Rp, Cp in the Ace-Bass amplifier is accomplished through negative feedback of the driver current signal via the bandpass filter, (Z102 (2, 3, 1)).

1.6 Power Amplifier

The input signal to the Power Amplifier is DC decoupled by capacitor C509, and is amplified linearly to the output (test point H).

The output signal is fed back negatively to the input via R411, C403.

When the output signal is large, negative feedback is also obtained via a diode - resistor network. The amplitude of the output signal is compared to the supply voltages (+40 V) in this network, and about 2 volts before clipping, the output signal is rounded off by the diode network so clipping will be soft.

The differential input stage (V403, V405) is supplied via a current generator (V406). Transistors V401, V402, V404 form a current mirror, so the output stages from V407, V410 are symmetrically driven.

The output stage is of triple darlington type with transistors V412-V419. AC gain is 1. V408 senses the temperature of the output transistors and assures constant bias current.

V409 and V411 filter the supply voltages to the input stages, removing hum and transients.

NOTE: If there is a "click" in B4-200 when it is switched on, the cause could be a short circuit in one of the transistors V409, V411.

2. TROUBLE SHOOTING TIPS

Use + pole of C105 or - pole of C103 as common point for measurements of DC or AC voltages.

2.1 B4-200 Does Not Work

Set Auto/on switch in ON position.

2.1-1 Check that LEDs AUTO and ON are lit.

2.1-2 Check power fuse and fuses F401, F402.

2.1-3 Check that DC voltages are OK.

+40 V : 40±2 V
-40 V : 40±2 V
+15 V : 15±2 V
-15 V : 15±2 V

2.1-4 To localize the fault, connect a tone generator to XLR plug J301, pins 2 and 5 in parallel. Set generator to 5mV, 100Hz sine wave. Turn "sensitivity" (R316) and "crossover frequency - subwoofer" (R329, R330) to max.clockwise position. You should now measure as follows:

Test point	AC Voltages (mV unless otherways noted)								
	20	(30)	[45] Hz		80 Hz			160 Hz	
A	5			5			5		
B	10			10			10		
C	77			77			77		
D	77			74			65		
E	77			74			65		
F	165	(276)	[91]	284	(134)	[93]	251	(125)	[77]
G	94	(181)	[70]	94	(89)	[87]	33	(36)	[33]
H	3.40	(1.82)	[1.68] V	1.41	(1.35)	[1.25] V	0.85	(0.93)	[0.87] V
I	790	(390)	[340]	212	(189)	[164]	187	(205)	[195]
J	77			74			65		
K	0.4	(0.5)	[0.8]	1.4			2.5		

Comments: XX = 20 Hz version
(XX) = 30 Hz version
[XX] = 40 Hz version

Sensitivity and Crossover frequencies in max clockwise position. Input 5 mV to both left and right channels. Bass drivers connected.

2.2 Fuses F401 F402 Blow

2.2-1 Disconnect drivers, and repeat test per 2.1-4. Signal at test point (G) now should be around .5V.

2.2-2 Measure resistance of voice coils in drivers. Should be 6.6 ohm each, 3.3 ohm in parallel.

2.3 Automatic ON/OFF

This can also be checked with the same setup as in 2.1-4.

2.3-1 Set Auto/on switch in position "AUTO".

2.3-2 Signal at pin 7 Z201 should be clipped and measure 7 V peak to peak.

2.3-3 Shunt R216 by 100k ohm to shorten off - delay. Check that ON is actuated when signal from generator exceeds .5mV at 500Hz.

2.4 B4-200 Oscillates Between ON and OFF with no audio signal on input.

2.4-1 Check DC offset at test point (H). Should be between +10mV and +100mV.

If DC offset is outside these limits, fault can be in C509 or in the Power Amplifier. (See also section 1.1).

NOTE: If a large DC voltage has appeared at the ouput of the Power Amplifier (caused by a fault), C509 will probably be leaky, and it should be replaced.

3. ADJUSTMENTS

After certain repairs have been made in B4-200, the following adjustments must be performed.

3.1 Bias Adjustments in Power Amplifier

After repairs have been made in the Power Amplifier, the bias current must be readjusted.

Measure the voltage between emitters on V416 - V417 (no signal on input terminals). Adjust trimpot Rqc (425) till voltage reads 10-15mV. (This corresponds to a bias current of 50mA).

Make a final adjustment after B4-200 has been ON for a few minutes, so the bias current has reached steady state value.

NOTE: When replacing power transistors, temperature sensor on V408 heatsink compound (and isolating shims) must be used.

3.2 Negative Output Resistance (Rs) in Ace-Bass Amplifier

Whenever a driver element or any of resistors R508 - R513 in the current sensing circuit has been replaced, the negative output resistance must be reset to equal the positive resistance of parallel voice coils in the drivers.

3.2-1 Set jumper below trimpots in position "TRIM", and disconnected one speaker cable from the circuit board.

3.2-2 Connect a tone generator to the input (J301, pin 2 or pin 5), and an AC voltmeter across the amplifier output.

3.2-3 Set generator to 20.3+ .5Hz, and adjust level until voltmeter at amplifier output reads -16dBU (123mV).

3.2-4 Reconnect the speaker cable to the circuit board (so drivers are connected to amplifier output), and adjust trimpot R_{rs} till voltmeter reads OdBU (775mV).

NOTE 1: Voice coils of drivers must be at room temperature when R_{rs} is set.

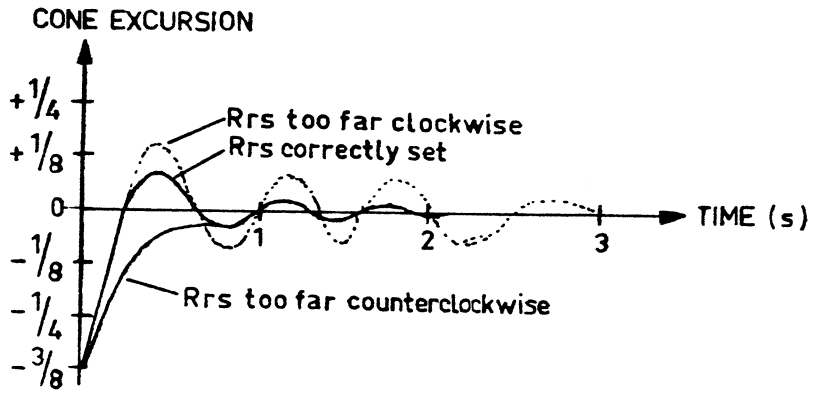
NOTE 2: Voltages in 3.2-3 and 3.2-4 are correct. Negative output impedance of Ace-Bass amplifier makes output voltage larger when amplifier load increases.

3.2-5 Reset jumper in "RUN" position.

NOTE: Do not touch trimpot RA (R504). This adjustment requires calibrated microphone equipment and can only be made at the factory. Ra only effects the sound pressure level at 20Hz. Change of one driver will cause maximum .5dB change in this level (typically less than .20dB), so no correction is required in the field.

3.2-6 Check for correct setting of Rrs as follows:

- Push the cone of forward facing driver inwards, and release it suddenly.
- Compare the movement of the cone with the curve below, and fine-adjust Rrs if required.



4. SPARE PARTS

Spare parts for B4-200 can be obtained from Audio Pro Sweden, or from Distributors and Service Centers.

When ordering spare parts, please refer to serial number of B4-200, and component number per diagram 2-142003.

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

Denna handling får ej utan vårt medgivande delges annan, kopieras eller eljest obehörigen användas. Överträdelse harav beivras med stöd av gällande lag.

Nätdel
Power supply

Effektsteg
Power amplifier

AC-checkpoints
20(30)(45)Hz 80 Hz 16 kHz

A	5 mV	5 mV	5 mV
B	10 mV	10 mV	10 mV
C	77 mV	77 mV	77 mV
D	77 mV	74 mV	65 mV
E	77 mV	74 mV	65 mV
F	[illegible]	[illegible]	[illegible]
G	[illegible]	[illegible]	[illegible]
H	[illegible]	[illegible]	[illegible]
I	[illegible]	[illegible]	[illegible]
J	77 mV	74 mV	65 mV
K	0,4 (0,5) [0,1]	1,4 mV	1,5 mV

SENSITIVITY AND CROSSOVER FREQUENCIES in max. position.
Input 5mV to both left and right channels. Bass drivers connected.

Aut tillslag / on off

Ingångssteg
Input stage

Filter

ACE-Bas-krets
ACE-Bass circuit

SYMBOLS
Λ AC-checkpoints
0,5V DC idling voltage
4 mA DC idling current

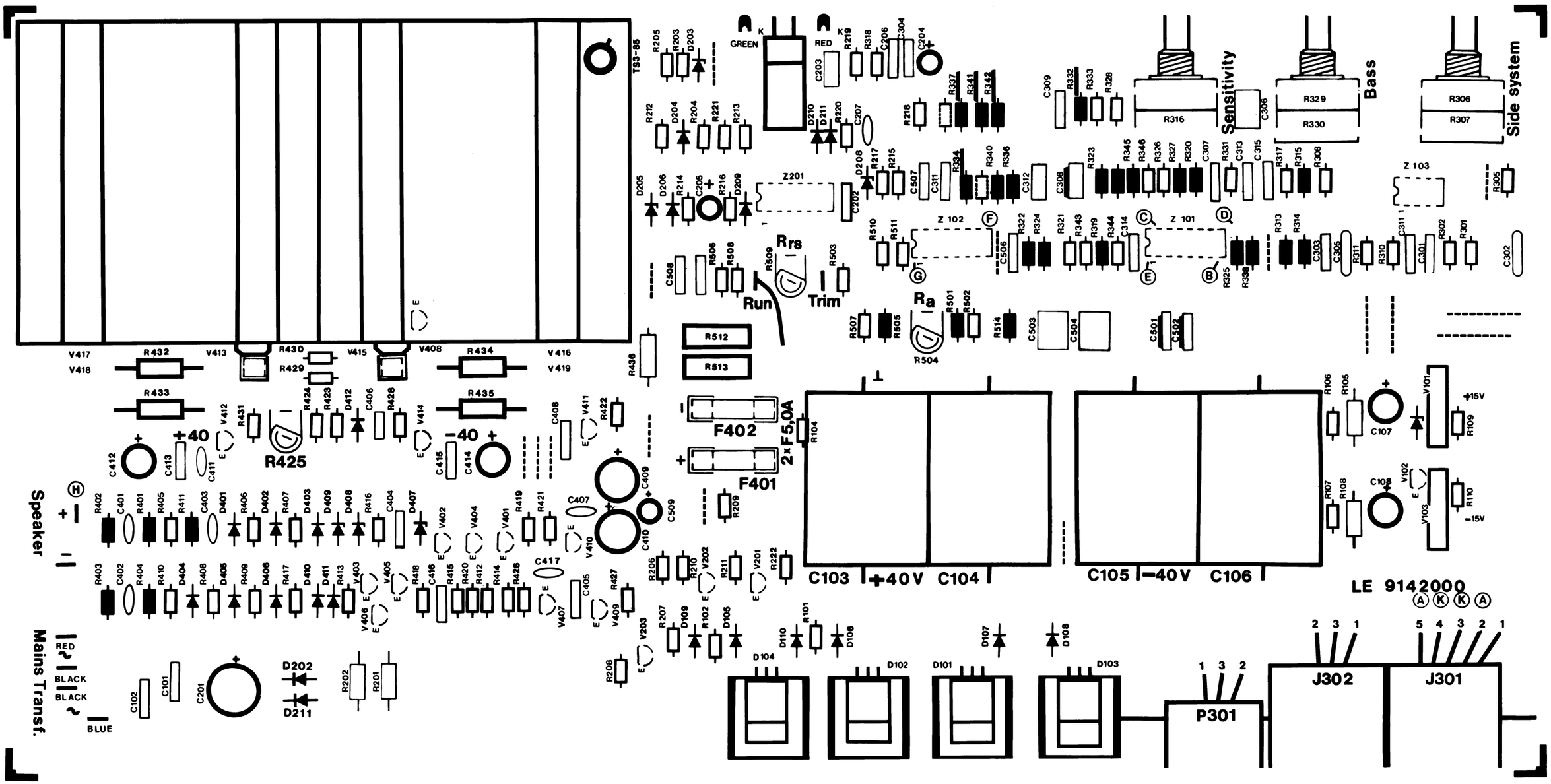
Monteras kylfläns * Monted on heatsink

Polypropylene or other approved capacitor

4 x KDH 825WFX 8Ω

Lövånger Elektronik AB	
Ersatter Replaces	Benämning/Title: KRETSSCHEMA / CIRCUIT DIAGRAM
Uppgj. av/Made by: FoC 811020	Uppdrag for Project: B4-200, 20Hz (30Hz), [45Hz]
Granskad/Checked:	
1:st angle projection	Godkänd/Approved: Folke Carlsson
Skala/Scale:	Ritningsnummer/Drawing no: 2-142003

Enclosure 5.1
Circuit diagram 2-142003



Enclosure 5.2
Component layout 3-142002