



**SERVICE MANUAL**  
**FOR**  
**SUBWOOFER B2-70**

## **LIST OF CONTENTS**

### **1. TECHNICAL DESCRIPTION**

- 1.1 Power Supply
- 1.2 Automatic ON/OFF
- 1.3 Input stage
- 1.4 Filter
- 1.5 ACE-Bass circuits
- 1.6 Power amplifier

### **2. TROUBLE SHOOTING TIPS**

- 2.1 B2.70 Does not work
- 2.2 Fuses F501, F502 blow
- 2.3 Automatic ON/OFF faulty
- 2.4 B2-70 oscillates

### **3. ADJUSTMENTS**

- 3.1 Bias current in Power Amplifier
- 3.2 Negative output resistance

### **4. SPARE PARTS**

### **5. ENCLOSURES**

- 5.1 Circuit diagram 55 21295-01
- 5.2 Component layout

## 1. TECHNICAL DESCRIPTION

The theoretical background for the ACE-Bass principle used in Subwoofer B2-70 is described in AES preprint No. 1381.

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

### 1.1 Power supply

The primary of the transformer is always connected to the power cord via a voltage selector and a power fuse ( 4.0 A slow at 117 V, 2.0 A slow at 220-250 V ). The idle current in this transformer is very low.

The center tapped secondary winding supplies the automatic ON/OFF via two diodes D201, D202 and a double rectifier D101 via a switch K101. This switch is operated by a relay in the automatic ON/OFF circuits.

Rectifier D101 supplies +-40V to the Power Amplifier, and also stabilized +-15V via voltage regulators, V101, V103.

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

To maintain tracking of the +15V and -15V when power is disconnected, the +40V must decay faster than the -40V. 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 B2-70 is tested without any load on the Power Amplifier, or with fuses F501, F502 removed, the balance between +15V and -15V may be upset during on/off switching. In such cases the operational amplifier may start oscillating when power is disconnected, so that automatic ON is actuated. This is normal under these conditions, and the electronics will not be damaged.

## 1.2 Automatic ON/OFF

This circuit is powered via diodes D201, D202 and capacitor C201.

The power transformer and the Automatic ON/OFF circuit are powered at all times when B2-70 is plugged into a live outlet. The other circuits in B2-70 are powered only when relay K101 is actuated.

The audio signal on left channel is sensed by operational amplifier Z201 (2,3,1) which acts as an amplifier with gain 2000 at 150Hz. The amplified voltage (point H) is limited to +7.0V and -0.7V by zener diode D208.

Operational amplifier Z201 (6,5,7) and transistor V201 work as a schmitt trigger with ON level 7.5V and OFF level 5.6V. The input (pin 5) senses the voltage from Z201 (2,3,1) after rectification in D209 and capacitor C206.

Transistor V201 drives relay K101 and red LED indicating "ON".

When push switch S201 is in position "AUTO", relay K101 is deenergized about 5 minutes after the audio signal on the left channel input disappears. The time delay is determined by C206 and R210. ( During testing R210 may be shunted by 100 kohm so delay time is reduced ).

When push switch S201 is in position "ON" the sensing circuits are bypassed, and relay K101 is energized as soon as B2-70 is plugged into a live outlet.

Temperature sensor TS3-85 senses the temperature of the power amplifier heatsink. If this temperature becomes too high the resistance in the TS3-85 drops to a low value, and relay K101 is deenergized. ( 85°)

## 1.3 Input stage

The audio signals on DIN plug J301 pin 1 (left channel) (A) and pin 4 (right channel) pass through variable high pass filters formed by C303, R315, R317 and C304, R316, R317 and buffer amplifiers V303, V301 and V304, V302 to DIN plug J301 pins 3 and 5. From pins 3 and 5, 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 effect the treble response.

The audio signals on DIN plug J301 pins 1 and 4, are summed by resistors R318, R319 into a first active low pass filter with kneepoint 138Hz and 10dB gain at 100Hz (when channels are in parallel).

The signal from the first low pass filter is passed via a volume control R322 to a second amplifier stage Z301 (10,9,8) with 26dB gain at 100Hz.

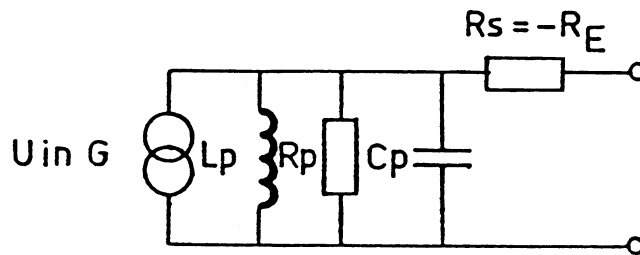
## 1.4 Filter

The signal from Z301 pin 7 (test point C) passes a variable low pass filter including R401, R402, R403, C401, C402, and Z401 (9,10,8), and then on to a fixed high filter with kneepoint 20.8Hz. The output terminal is test point (E).

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 Z401 (2,3,1) and Z401 (13,12,14) for the ACE-Bass amplifier, which can be represented by the diagram below.



R418 and Z401(13,12,14) sense the current through the drivers. The voltage in test point (J) equals the driver current ( $1V/1A$ ).

Z401 (2,3,1) works as an active bandpass filter, and also sums the signals in test points (E) and (J).

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

The parallel circuit  $L_p$ ,  $R_p$ ,  $C_p$  in the ACE-Bass amplifier is accomplished through negative feedback of the driver current signal via the bandpass filter, Z401(2,3,1).

## 1.6 Power Amplifier

The input signal to the Power Amplifier is DC decoupled by capacitor C414, and is amplified linearly to the output (test point G).

The output signal is fed back negatively to the input via R511, C503.

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 (V503, V506) is supplied via a current generator (V504). Transistors V501, V502, V505 form a current mirror, so the output stages from V507, V509 are symmetrically driven.

The output stage is of triple darlington type with transistors V512-V517. AC gain is 1. V508 senses the temperature of the output transistors and assures constant bias current.

V510 and V511 filter the supply voltages to the input stages, removing hum and transients.

**NOTE:** If there is a "click" in B2-70 when it is switched on, the cause could be a short circuit in one of the transistors V510, V511.

## 2. TROUBLE SHOOTING TIPS

Use J07 or J08 as common point for measurements of DC or AC voltages.

### 2.1 B2-70 Does Not Work

Set push button switch in ON position.

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

2.1-2 Check power fuse and fuses F501, F502.

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 DIN plug J303, pins 1 and 4 in parallel. Set generator to 5mV, 100Hz sine wave. Turn "sensitivity" (R322) and "crossover frequency - subwoofer" (R402) to max. clockwise position. You should now measure as follows:

Test Point	AC Volts	DC Volts
A	approx. 5mV	
B	approx. 13mV	
C	approx. 275mV	
D	approx. 255mV	
E	approx. 255mV	
F	approx. 95mV	
G	approx. 1650mV	
H	approx. 3.9V	approx. +7.3V
I		approx. +21V
J	approx. 340mV	

## 2.2 Fuses F501, F502 Blow

- 2.2-1 Disconnect drivers, and repeat test per 2.1-4.  
Signal at test point (G) now should be around 1V.
- 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 push button switch in position "AUTO".
- 2.3-2 Signal at test point (H) should be clipped and measure 4V peak to peak. (Oscilloscope) Signal at test point (I) should be about 21 V DC.
- 2.3-3 Shunt R210 by 100k ohm shorten off - delay. Check that ON is actuated when signal from generator exceeds 0.5mV at 500Hz.

## 2.4 B2-70 Oscillates

B2-70 Oscillates between ON and OFF with no audio signal on input.

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

**NOTE:** If DC offset is outside these limits, fault can be in C414 or in the Power Amplifier (caused by a fault), C414 will probably be damaged, and it should always be replaced. If V516 or V517 has blown always check C414.



### 3. ADJUSTMENTS

After certain repairs have been made in B2-70, 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 V516 - V517 (no signal on input terminals of B2-70). Adjust trimpot (R525) till voltage reads 10-15mV. (This corresponds to a bias current of 50mA).

Make final adjustment after B2-70 has been ON for a few minutes, so the bias current has reached steady state value.

**NOTE:** When replacing power transistors, temperature sensor on V508, heatsink compound (and isolating shims) must be used.

#### 3.2 Negative Output Resistance ( $R_s$ ) in ACE-BASS Amplifier

Whenever a driver element or any of resistors R413 - R418 in the current sensing circuit has been replaced, the negative output resistance must be reset to equal the positive resistance of the parallel voice coils in the drivers.

- 3.2-1 Set jumper below trimpots in position "TRIM", and disconnect one speaker cable from the circuit board.
- 3.2-2 Connect a signal generator to the input (J301, pin 1 or pin 4), and an AC voltmeter across the amplifier output.
- 3.2-3 Set signal generator to  $20.3 \pm 0.5$ Hz, 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 0dBu (775mV).

**NOTE1:** Voice coils of drivers must be at room temperature when Rrs is set.

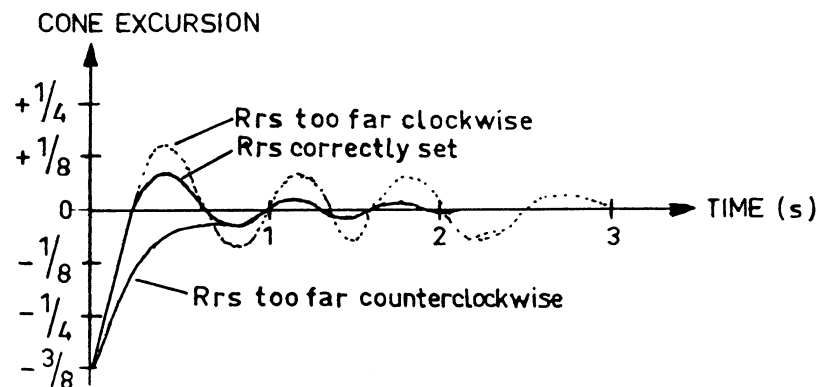
**NOTE2:** Voltages in 3.2-3 and 3.2-4 are correct. Negative output impedance of ACE-Bass amplifier makes output voltage larger when amplifier load increases.

3.2-5 Reset jumper in "RUN" position.

**NOTE:** Do not touch trimpot Ra (R410). 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 0.5dB change in this level (typically less than 0.20dB), 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.

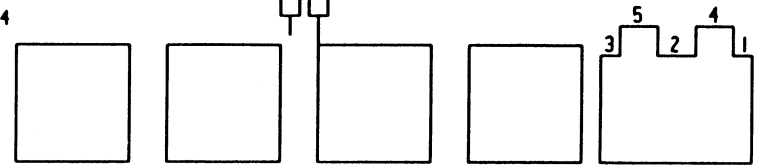
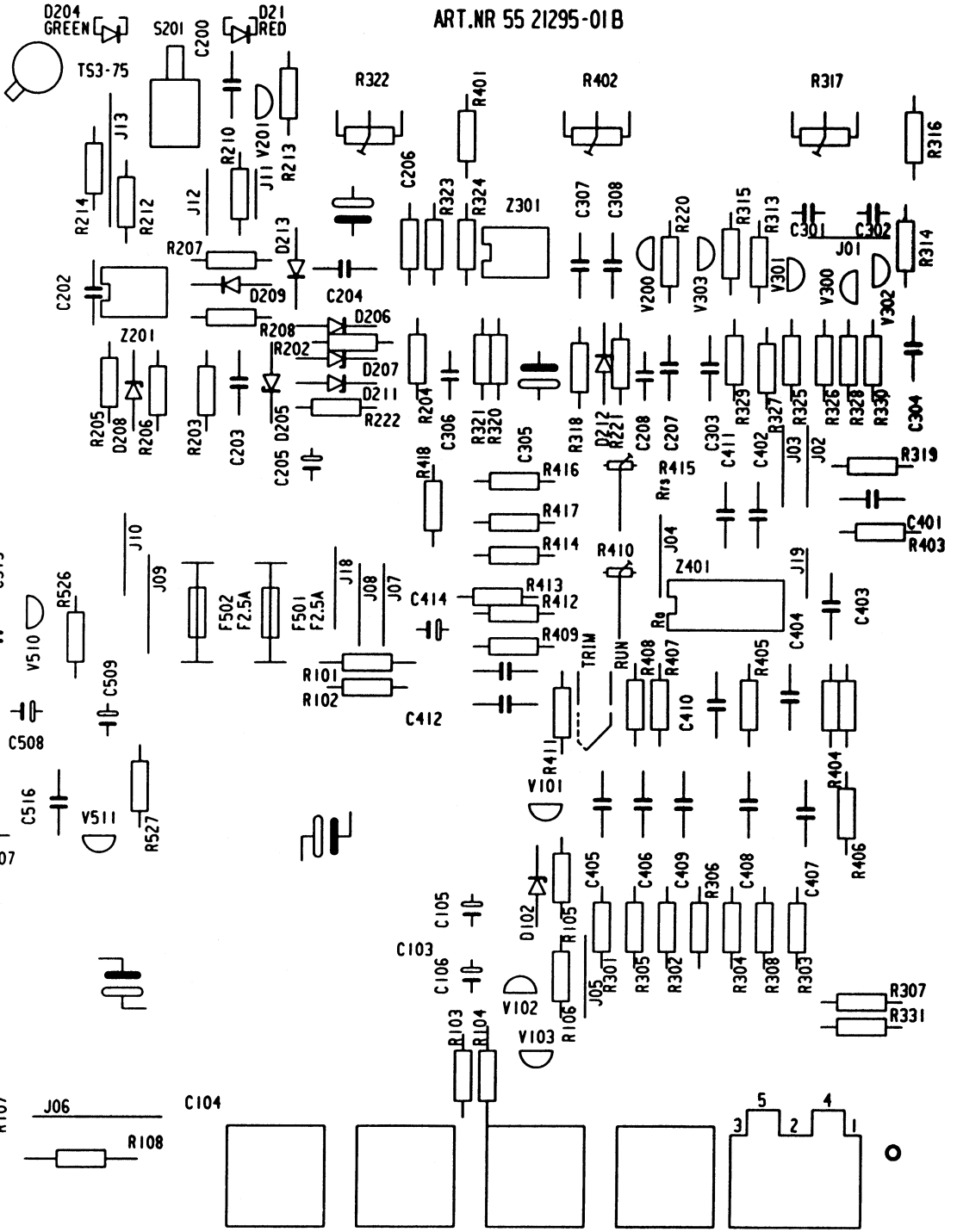
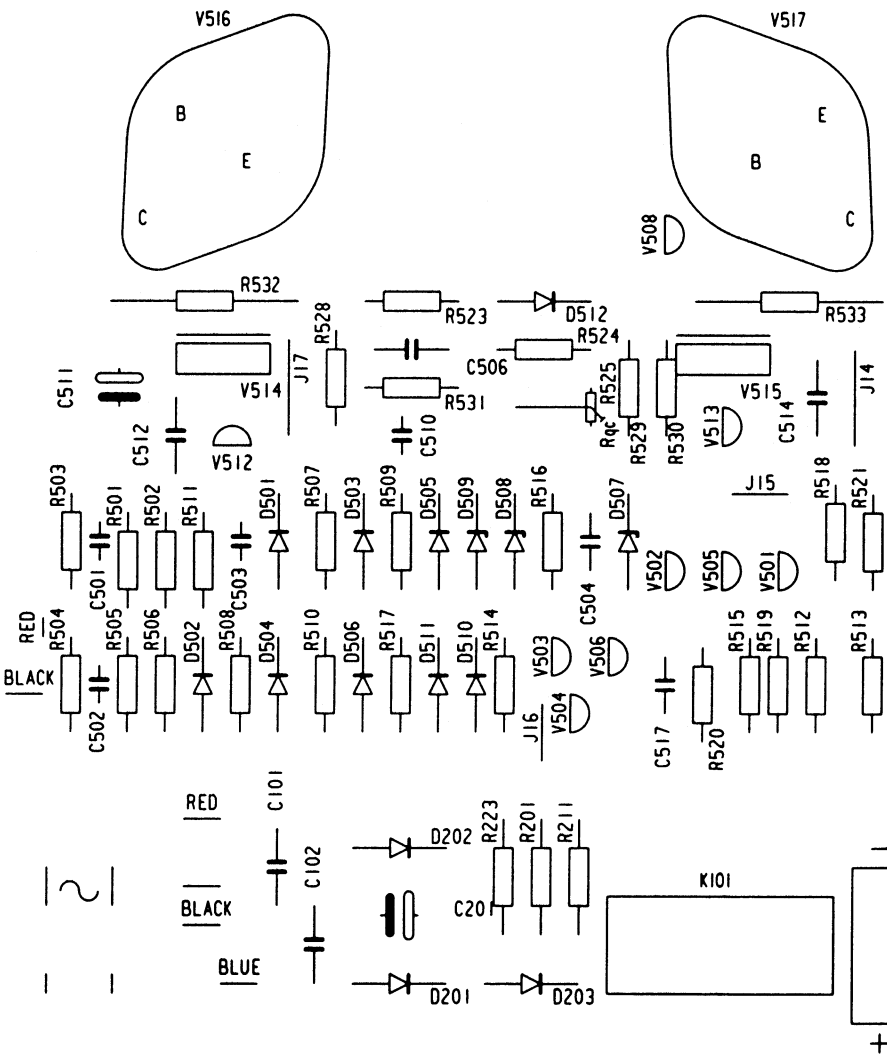


#### **4. SPARE PARTS**

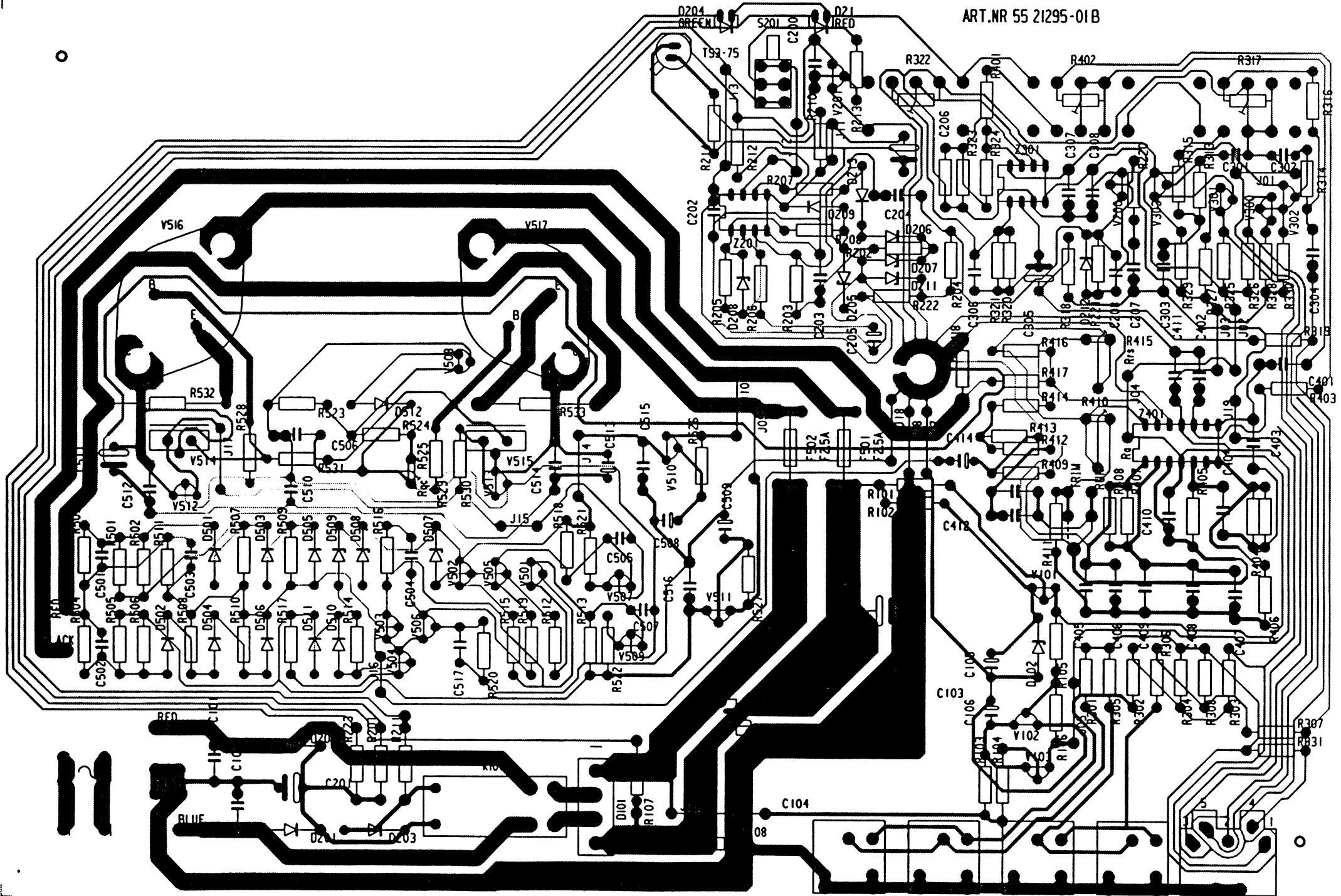
Spare parts for B2-70 can be obtained from distributors and service centers.

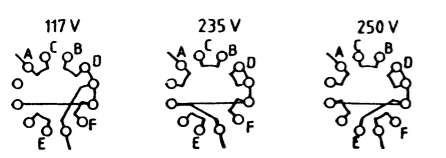
When ordering spare parts, please refer to component number per diagram 55 21295-01.

ART.NR 55 21295-01B



ART.NR 55 21295-01B

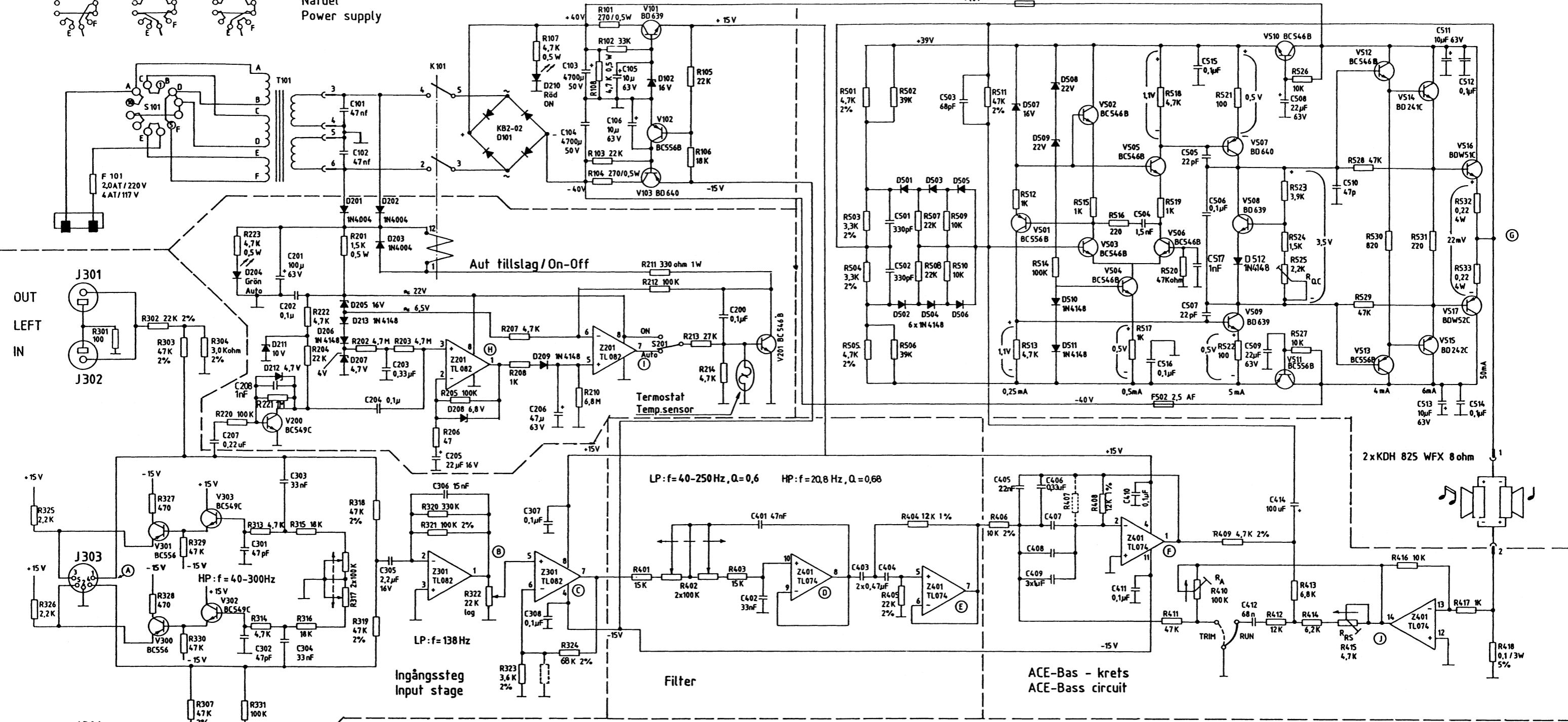




Nät-del  
Power supply

Effektsteg  
Power amplifier

PHOJ. TOLERANSER OM EJ ANNAET AN ANGIVET I TOLERANSER UNLESS OTHERWISE STATED. MATT DIM. VINKEL ANGLE. [2]



OUT LEFT IN J301 J302  
IN RIGHT OUT J304 J305

MÄTFÖRUTSÄTTNINGAR: FREKVENNS 100 Hz  
TEST CONDITIONS: FREQUENCY 100 Hz

R322/R402 PÅ MAX. Ra OCH Rrs JUSTERAD  
R322/R402 AT MAX. Ra AND Rrs ADJUSTED

HÖGTALARE ANSLUTNA  
SPEAKERS CONNECTED

MÄTPUNKT TESTPOINT	AC VOLTS	DC VOLTS
A	approx. 5mV	
B	approx. 13mV	
C	approx. 275mV	
D	approx. 255mV	
E	approx. 255mV	
F	approx. 95mV	
G	approx. 1650mV	
H	approx. 3.9mV	+7.3V
I		+21 V
J	approx. 340mV	

B 860401 TO R408 R404 C405 Från 15k, 10k, 470nF Till 12k, 12k, 22nF C406 Till 330nF C409 Till 1uF  
A 860320 TO F101 Från 2.5AT / 5AT Till 2.0 AT / 4 AT

850927 KT  
851112 SD  
851115 PL

KRETSHEMA B2-70  
CIRCUIT DIAGRAM

55 21295-01

Laser Electronics AB

ANDR. REV.	DATUM	SKID.	ANDRINGSART	SKID OF REV.