

Brüel & Kjær

2209

Impulse Precision
Sound Level Meter

valid from serial no. 568347

037-0114



Service

2209

Impulse Precision
Sound Level Meter

valid from serial no. 568347

037-0114

2209	page	date	B & K Sub-Assemblies	page	date
Service Instruction	0-1	8.75	ZC 0007 Input Stage	1	1.74
-	0-2	8.75	ZE 0094 Output Amplifiers	1	8.75
Checking Procedure	1-1	8.75	ZE 0095 Meter Circuit	1	8.75
-	1-2	1.74	ZE 0174 Preamplifier, Filter	1	8.75
Power Supply	2-1	1.74	ZG 0071 Power Supply	1	8.75
Meter Circuit	3-1	1.74	ZL 0032 RMS Circuit	1	1.74
-	3-2	5.72			
-	3-3	5.72			
Output Amplifier	4-1	1.74			
-	4-2	5.72			
Input Amplifier	5-1	8.75			
-	5-2	8.75			
Weighting Network	6-1	8.75			
Circuit Diagram and Parts List	7-1	8.75			

Trouble Shooting

If any faults should occur please check the instrument according to the Adjustment Procedure.

When a fault has been traced and corrected, the voltages and adjustments influenced by the correction must be rechecked. The complete instrument should then be tested to make sure that all basic functions are operative.

The tolerances given in these notes are intended for use as guide for adjustments.

Before correcting any apparent deviation make sure that the measuring instrument has tolerances small enough not to affect the measurement.

Modifications

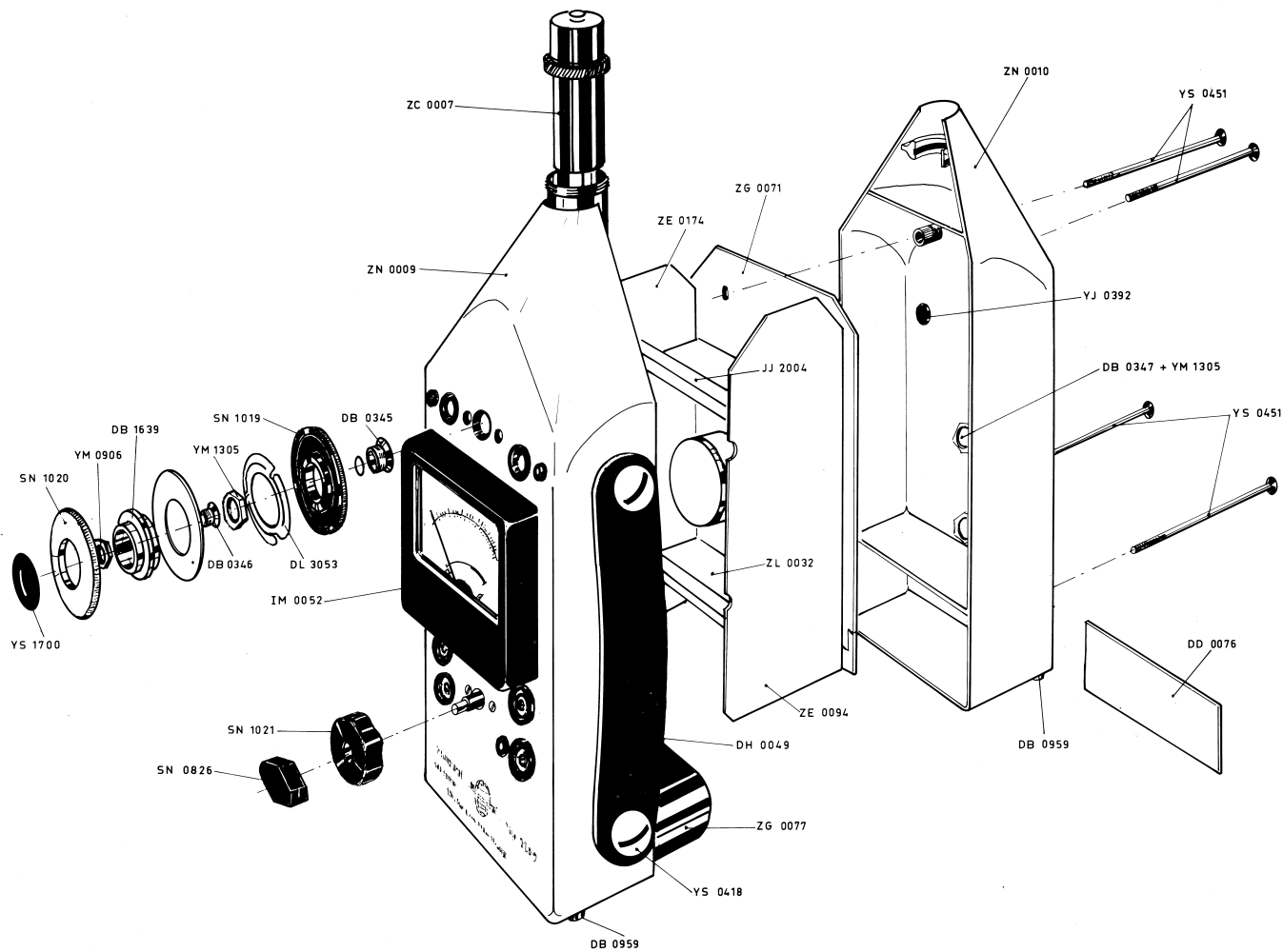
Due to the constant technical progress the instrument will be modified from time to time in order to provide continuously improved performance.

For this reason there may be small differences between the instrument and the Service Instruction.

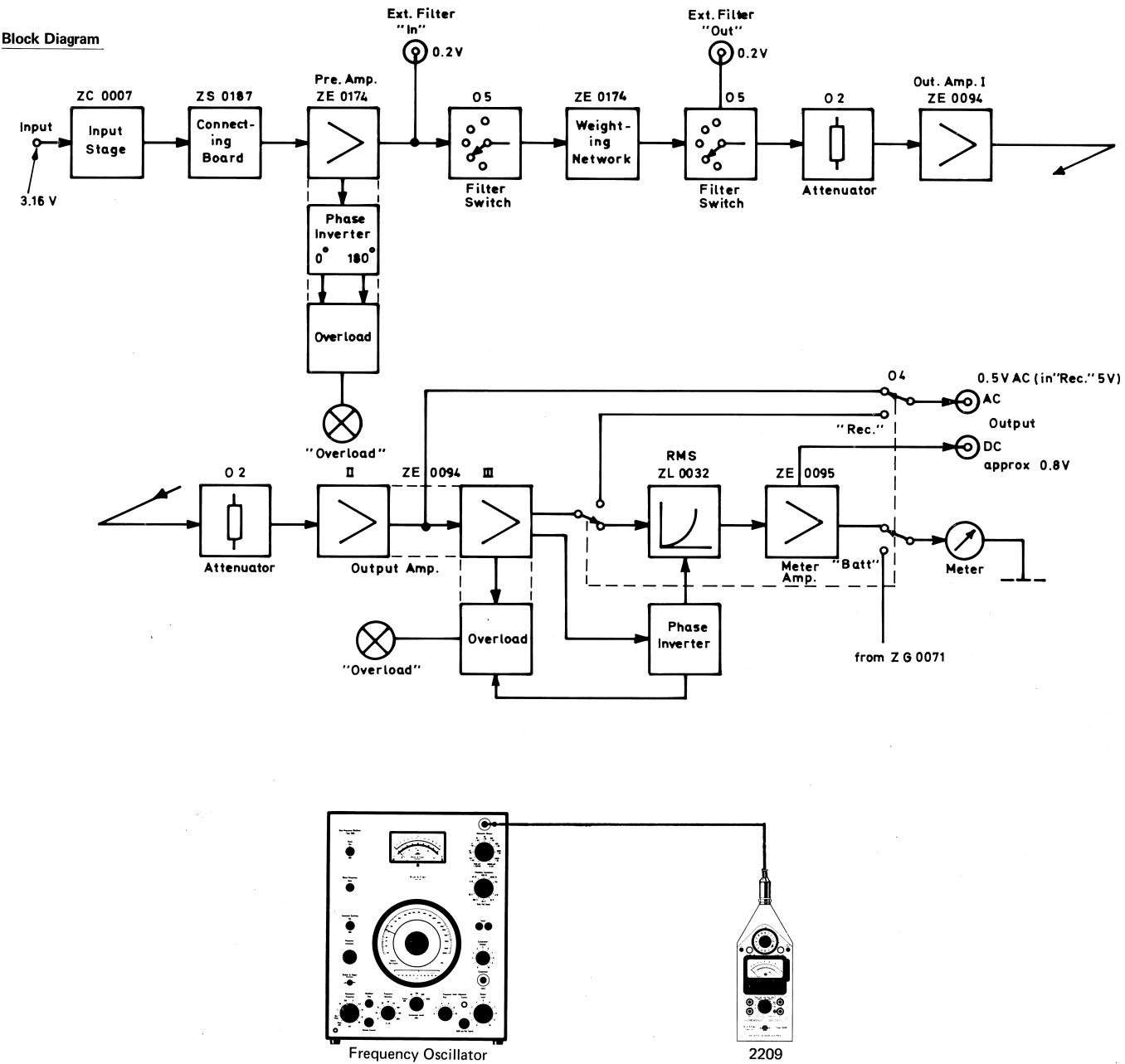
However, the local Representative Service is in possession of all information regarding the modifications that have been made.

Spare Parts

Please state type and serial number of the instrument when ordering spare parts.



Block Diagram



1.1. Sensitivity

- a. RANGE (black): "120"
RANGE (transp.): "120"
FILTER SWITCH: "Lin"
METER SWITCH: "Fast"

Input signal to front end of 2209: 3.16 V, 1000 Hz.

Adjust "Gain Adj." for 10 dB deflection (Adjustment range for "Gain Adj." approx. + 3, -10 dB).

Output voltage on "Ext. Filter In": 0.2 V
"DC Output": Approx. 1 V (measured with High Imp. Voltmeter)
"AC Output": Approx. 0.5 V
"AC Output": 5 V for METER SWITCH in "Rec"

- b. FILTER SWITCH to "A-B-C-D"

Deflection for all ranges: 10 dB ± 0.1 dB.

1.2. Frequency Response

- RANGE (black): "120"
RANGE (transp.): "120"
FILTER SWITCH: "Lin"
METER SWITCH: "Slow"

Frequency: 1000 Hz. Adjust the input voltage for a 9 dB deflection on 2209.
Vary the frequency from 2 Hz (or 10 Hz) - 70 kHz.
Meter deflection: 8-10 dB.

2209.1 Checking Procedure

1.3. Meter Circuit

- a. RANGE (black): "120"
RANGE (transp.): "120"
FILTER SWITCH: "Lin"
METER SWITCH: "Fast"
- Frequency: 1000 Hz. Adjust the input voltage to give exactly 7 dB deflection on 2209.
- b. METER SWITCH: "Peak"
- Meter deflection: 10 dB \pm 0.5 dB.
- c. METER SWITCH: "Imp. (Norm.)"
- Adjust the input voltage to give a 8.6 dB deflection on 2209.
- Disconnect the input signal by depressing "Oscillator Stop" on the Beat Frequency Oscillator and check that the deflection is 0 dB after 2-4 sec.
- d. METER SWITCH: "Imp. (Hold)"
- Connect input signal. Meter deflection: 9 dB.
- Disconnect input signal and check that the deflection drops max. 0.5 dB in one minute.

1.4. Overload Indicators

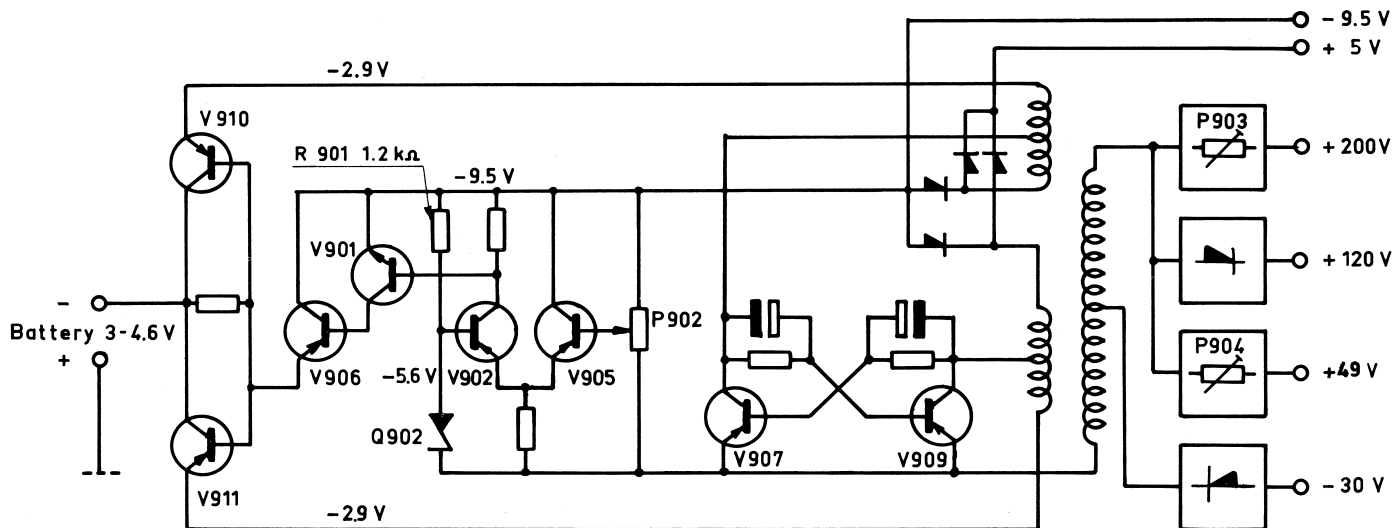
- RANGE (black): "110"
RANGE (transp.): "110"
FILTER SWITCH: "Lin"
METER SWITCH: "Fast"
- Input signal: 7 V, 1000 Hz (corresponding to approx. 17 dB above full scale deflection).
- Depress "Oscillator Stop" on the Beat Frequency Oscillator. When releasing "Oscillator Stop" both "Overload indicators" should light up a few times.

1.5. Noise

- a. RANGE (black): "60"
RANGE (transp.): "10"
FILTER SWITCH: "A"
METER SWITCH: "Slow"
- Connect an Input Adaptor JJ 2615 to Type 2209 and shortcircuit its input.
- Notice! Make sure that the contact surfaces are clean and dustfree.
- Meter deflection: Below 0 dB.
- It is essential that the measurement is carried out in a quiet room. If the Sound Level Meter has been overloaded, the instrument must work for several minutes before the meter reaches its normal deflection.
- b. RANGE (black): "60"
RANGE (transp.): "30"
FILTER SWITCH: "Lin"
METER SWITCH: "Fast"
- Meter deflection: Below 0 dB
- c. RANGE (black): "130"
RANGE (transp.): "80"
FILTER SWITCH: "Lin"
METER SWITCH: "Fast"
- Remove Preamplifier ZC 0007, and measure the noise with open input.
- Meter deflection: Max. 3 dB.

1.6. Sensitivity with Microphone

- a. RANGE (black): "Ref"
RANGE (transp.): "Ref"
FILTER SWITCH: "Lin"
METER SWITCH: "Fast"
- Adjust "Gain Adj." to the correct "Open circuit sensitivity" of the microphone.
- b. RANGE (black) to "120"
- Check the sensitivity with a Pistonphone Type 4220 or Sound Level Calibrator Type 4230. The meter deflection on 2209 should be equal to the Sound Pressure Level produced by the Pistonphone (Remember to correct for the actual static pressure).
- Tolerance: \pm 0.2 dB.



Simplified Diagram of Power Supply ZG 0071

2.1. DC Voltages

METER SWITCH: "Batt"

Normal delay from switching "ON" till the instrument is stabilized is approx. 30 sec.

Check the DC-voltages according to the drawing to the printed circuits XC 0335 showed on ZG 0071.

If the -9.5 V is present and the Oscillator frequency is approx. 2 kHz the transformer can be regarded as an ordinary mains transformer with secondary voltages for the various circuits.

Small deviations in voltages can be adjusted by the potentiometers according to following scheme, whereby greater deviations are rather due to a fault which should be corrected before adjustment.

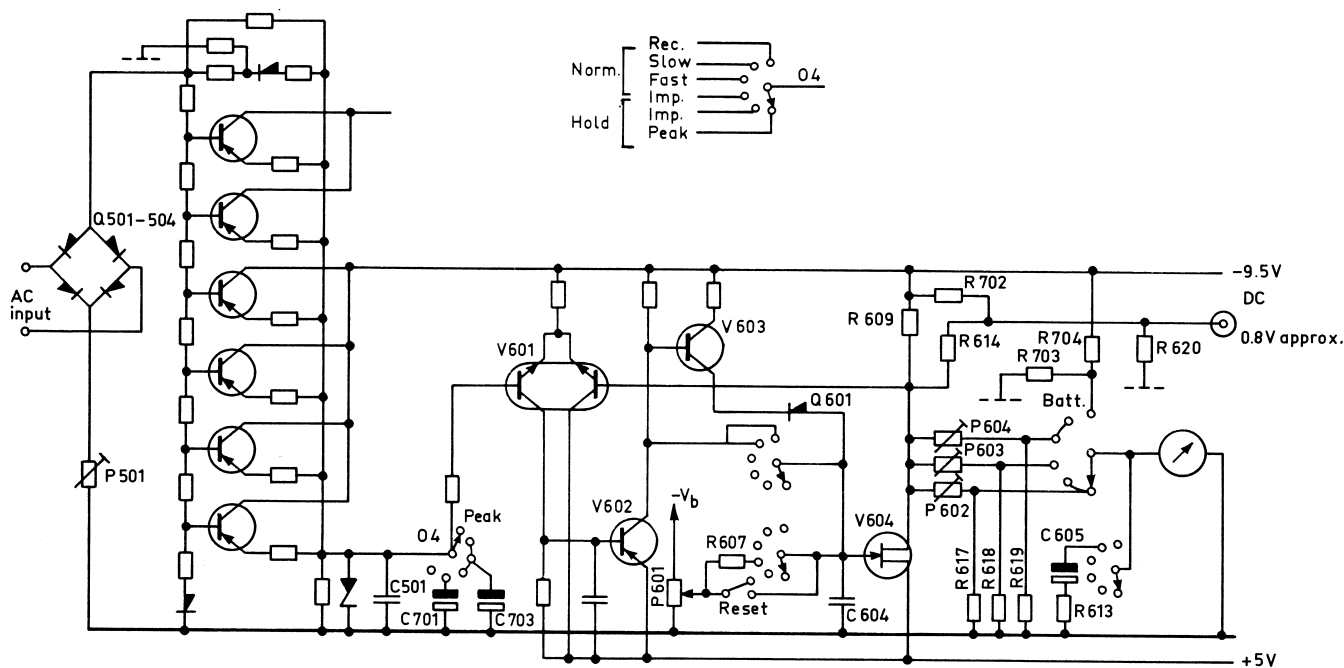
Consumption from the batteries in position "Ref" is approx. 210 mA.
"Ext. Filter" approx 195 mA.

Adjustment of P 902: -9.5 V
P 903: 200 V (Measured with a high impedance voltmeter)
P 904: 49 V

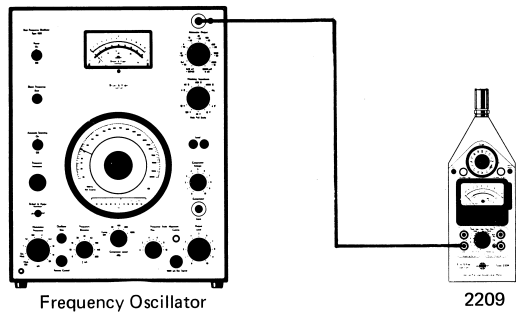
The transistors V 910 and 911 are acting as battery regulators and the emitter voltage on both should be approx. -2.9 V.

If this voltage is -2.9 V and the DC converter is not oscillating disconnect the different loads one by one. If oscillation is impossible even unloaded the transformer or the converter transistors (V 907 and 909) are likely to be defective.

If the -2.9 V is not present examine transistor V 901, 902, 905 or 906 for faults as this is the regulating circuit for V 910 and 911.



Adjustment of: P501 RMS Balance
P601 OV DC on V 604 source
P602 Sensitivity "Hold"
P603 Sensitivity "Impulse"
P604 Sensitivity "Fast" and "Slow"
R703 Battery Indication



3.1. Sensitivity Check

- | | | |
|----|------------------------------|---|
| a. | RANGE (black): "120" | Frequency 1000 Hz. Adjust the input voltage for 5 V _{RMS} on "AC output" socket. |
| | RANGE (transp.): "120" | |
| | FILTER SWITCH: "Ext. Filter" | |
| | METER SWITCH: "Rec" | |
| b. | METER SWITCH: "Fast" | Meter deflection: Exactly 10 dB. |
| c. | METER SWITCH: "Imp. (Norm)" | Meter deflection: Exactly 10 dB. |
| d. | METER SWITCH: "Imp. (Hold)" | Depress "Meter Reset" and release it again.
Meter deflection: 10 dB. |

3.2. Sensitivity Adjustment

- | | | |
|----|------------------------------|---|
| a. | RANGE (black): "120" | Frequency: 1000 Hz. Adjust the input voltage for 5 V _{RMS} on "AC Output" socket. |
| | RANGE (transp.): "120" | |
| | FILTER SWITCH: "Ext. Filter" | Check with an oscilloscope that the double rectified curves on the cathodes of Q 503 and Q 504 are equal. (ZL 0032) |
| | METER SWITCH: "Rec" | |
| b. | METER SWITCH: "Fast" | If necessary adjust P 803. (ZE 0094) . |

2209.3 Meter Circuit

- c. METER SWITCH: "Imp"

Disconnect input signal.
Unsolder one end of diode Q 601. Adjust P 601 (ZE 0095) for 0 V ± 5 mV on V 604 source.

Connect input signal.
Adjust P 603 for full scale deflection (10 dB).
- d. METER SWITCH: "Fast"

When connecting input signal the deflection on 2209 should be exactly 10 dB.

If necessary adjust P 604.
- e. METER SWITCH: "Imp. Hold"

Depress "Meter Reset" shortly and check the meter deflection: 10 dB.

If necessary adjust P 602.
- f. METER SWITCH: "Peak Hold"

Adjust for a meter deflection: 10 dB.

Switch Meter Switch to "Fast" and check deflection: 7 dB.
- g. METER SWITCH: "Batt"

With a battery voltage of 3.0 V – 3.1 V the meter should deflect to the lower mark of the battery scale.

If necessary change in value of R 703.

3.3. Overshoot

- RANGE (black): "120"

RANGE (transp.): "120"

FILTER SWITCH: "Ext. Filter"

METER SWITCH: "Fast"

Frequency: 1000 Hz. Adjust input voltage for an 6 dB deflection on 2209.

Disconnect the input signal shortly by depressing the "Oscillator Stop" on the Frequency Oscillator and check the overshoot.

Overshoot: 0.1–1.1 dB for METER SWITCH in "Fast"
0.1–1.6 dB for METER SWITCH in "Slow"
max. 0.1 dB for METER SWITCH in "Imp. Hold"*)
- *) Before "Oscillator Stop" is released for check of overshoot depress "Meter Reset" on 2209.

3.4. Meter Decay Time Constants

- a. RANGE (black): "120"

RANGE (transp.): "120"

FILTER SWITCH: "Ext. Filter"

METER SWITCH: "Imp"

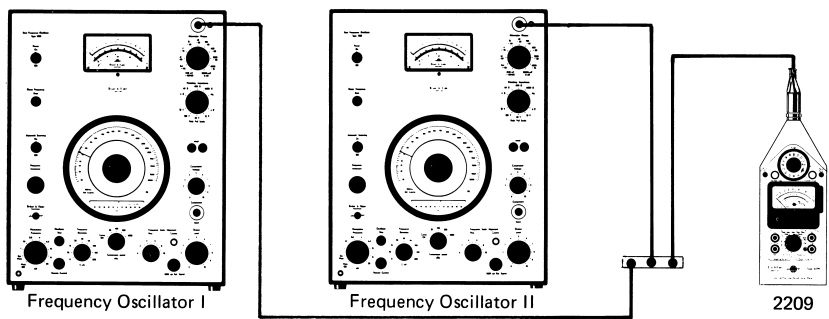
Frequency: 1000 Hz. Adjust the input voltage for an 8.6 dB deflection on 2209.

Disconnect the input signal and measure the time it takes for the pointer to decrease from 8.6 to 0 dB.

Tolerance: 3 ± 0.5 sec.
- b. METER SWITCH: "Imp. Hold"

Adjust the input voltage for 10 dB deflection on 2209.

When the input signal is disconnected the meter deflection must not decrease more than 0.5 dB in one minute. (Only valid for 20°C and max. 60% relative humidity).



3.5. Check of RMS Rectifier

- a.

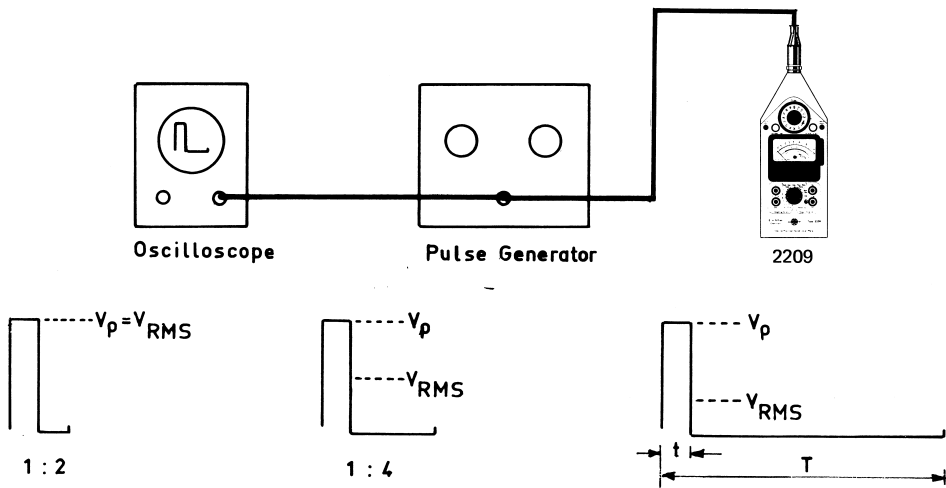
RANGE (black):
RANGE (transp.):
FILTER SWITCH:
METER SWITCH:

"120"
"120"
"Lin"
"Fast"
- a.

Depress "Oscillator Stop" on Frequency Oscillator II and adjust output of Frequency Oscillator I to give a 7 dB deflection on 2209.
- b.

Depress "Oscillator Stop" on Frequency Oscillator I and adjust output of Frequency Oscillator II to give a 7 dB deflection on 2209.

With signal from both oscillators the deflection on 2209 should be 10 dB \pm 0.1 dB (evt. unlinearity of 2209 meter scale 0.2 dB).



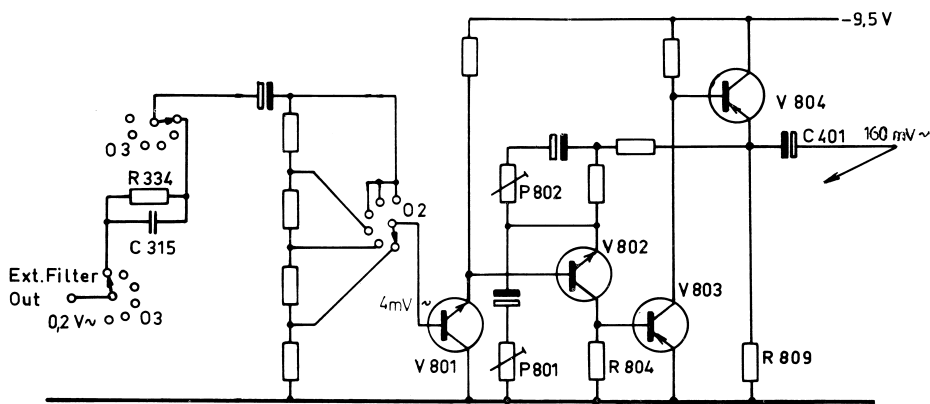
3.6. Check of RMS Indication

- RANGE (black):
RANGE (transp.):
FILTER SWITCH:
METER SWITCH:

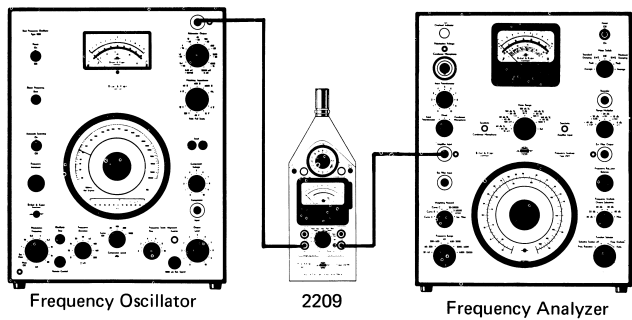
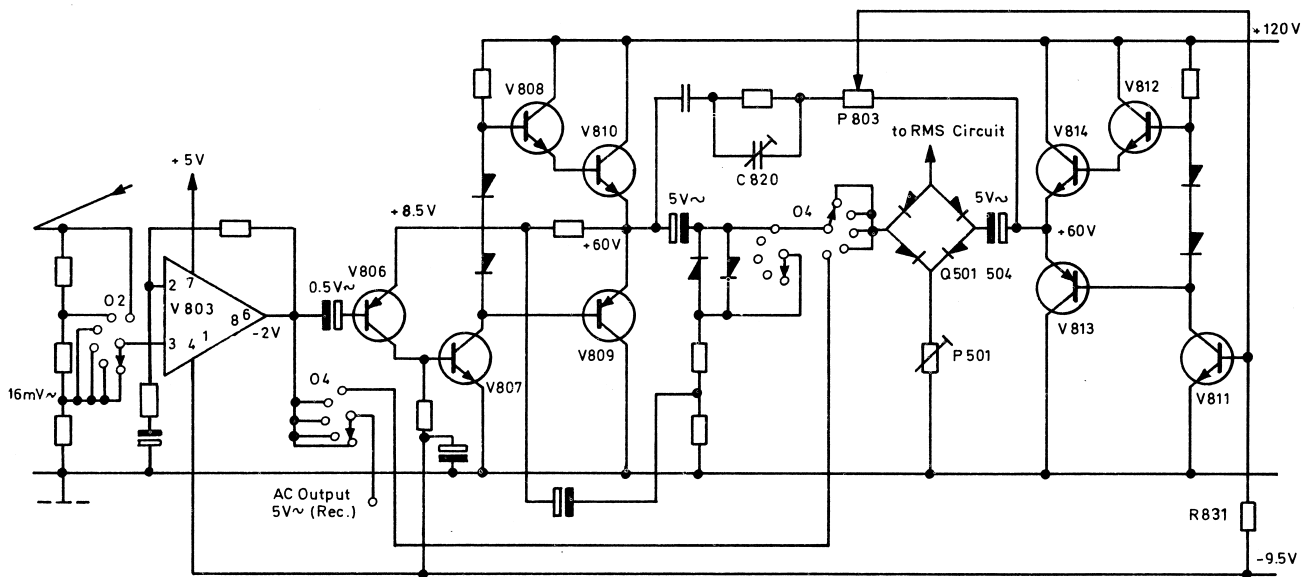
"120 dB"
"120 dB"
"Lin"
"Slow"
- At a pulse duration of 0.1 m Sec. and a ratio of 1.2 the input voltage to 2209 should be adjusted to give a 0.2 dB deflection.

Check the indication for various pulse ratio according to following scheme.

RANGE (black)	$\frac{t}{T}$	$\frac{V_p}{V_{RMS}}$	Indication
120 dB	1 : 2	1	0.2 dB
110 dB	1 : 5	2	8.1 dB \pm 0.5 dB
110 dB	1 : 10	3	5.6 dB \pm 0.5 dB
110 dB	1 : 26	5	1.7 dB \pm 0.5 dB
100 dB	1 : 100	10	6 dB \pm 0.5 dB
100 dB	1 : 200	14	3 dB \pm 1 dB
100 dB	1 : 400	20	0 dB \pm 1 dB
100 dB	1 : 900	30	-3.5 dB \pm 1.5 dB



Adjustment of: P801 Sensitivity
P802 Sensitivity at 2 Hz
P803 Symmetric Output
P501 RMS Balance



4.1. DC-Voltages

METER SWITCH: "Rec"

The DC-voltages across R 809 should be approx. 4 V negative.

If necessary change in value of R 804.

From midpoint R 826, R 827 to ground the voltage should be 57–63 V.

If necessary change in value of R 822 (56–120 kΩ).

From midpoint R 835, R 836 to ground the voltage should be 57–63 V.

If necessary change in value of R 831 (47–82 kΩ).

2209.4 Output Amplifier

4.2. Sensitivity

- a. RANGE (black): "120"
RANGE (transp.): "120"
FILTER SWITCH: "Ext. Filter"
METER SWITCH: "Rec"

Input signal: 0.2 V, 1000 Hz.

Output voltage on "AC Output" socket: 5 V.

If necessary adjust P 801 (ZE 0094).

- b. METER SWITCH to "Fast"

Connect an Oscilloscope to Q 503, Q 504 (ZL 0032) and check that the two rectified curves are of the same height.

If necessary adjust P 803 (ZE 0094).

Change the signal frequency to 70 kHz and check the curves again.

If necessary adjust the height by C 820.

4.3. Attenuators

- RANGE (black): "120"
RANGE (transp.): "120"
FILTER SWITCH: "Ext. Filter"
METER SWITCH: "Fast"

Frequency: 1000 Hz. Adjust the input voltage for an 8 dB deflection on 2209.

Check all attenuator steps of RANGE (transparent) by comparison to the attenuator of the Frequency Oscillator.

Tolerance: 0.2 dB (+ tolerance of Frequency Oscillator).

4.4. Output Impedance

- RANGE (black): "120"
RANGE (transp.): "120"
METER SWITCH: "Rec"

Frequency: 1000 Hz. Adjust the input voltage for an output voltage of 5 V on "AC Output" socket.

Load the "AC Output" with a resistor of 10 k Ω and check that the output voltage is not decreasing more than 0.2 dB.

4.5. Overload

- RANGE (black): "110"
RANGE (transp.): "110"
FILTER SWITCH: "Ext. Filter"
METER SWITCH: "Rec"

Input signal: 7 V \pm 1 dB, 1000 Hz. (Corresponding to 17 dB above full scale deflection).

- a. Disconnect the input signal by depressing "Oscillator Stop" on the Frequency Oscillator. When releasing "Oscillator Stop" the "Overload Output" should light up a few times.
- b. Connect an Oscilloscope to "AC Output" socket and check that the signal is not limited.

4.6. Noise and Hum

- a. RANGE (black): "120"
RANGE (transp.): "120"
FILTER SWITCH: "Ext. Filter"
METER SWITCH: "Rec"

Disconnect input signal to 2209. During measurement 2209 should be in its case and connected to ground.

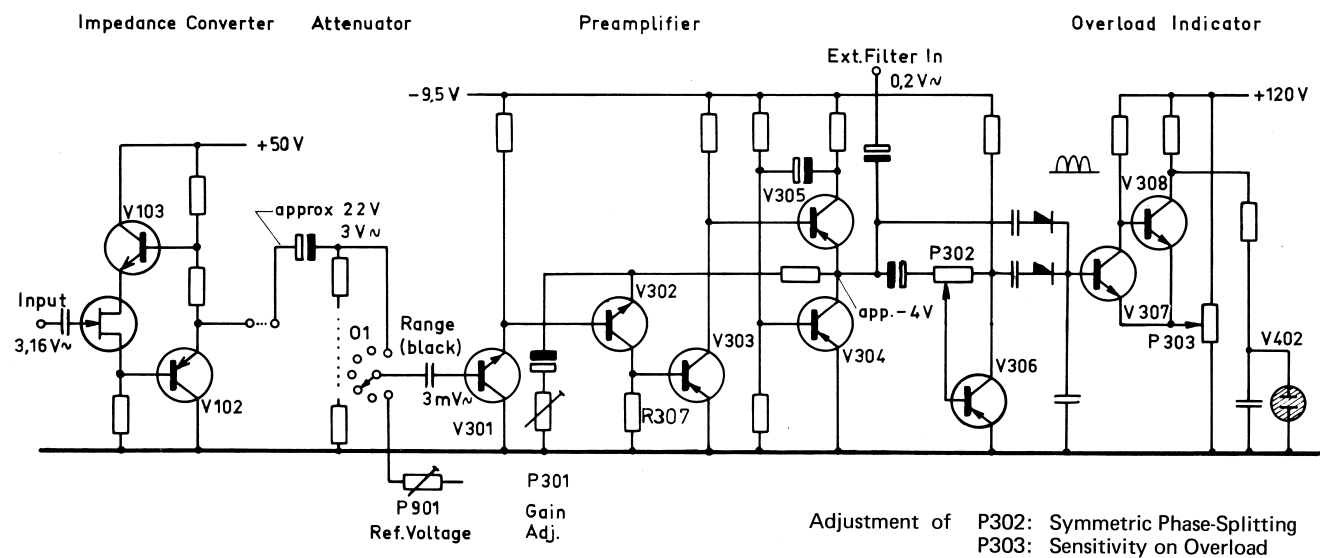
Hum from the DC converter (approx. 2 kHz) and 2nd and 3rd harmonic selectively measured max. 1.5 mV.

Noise (2–40 000 Hz): max. 14 mV.

- b. RANGE (transp.) to "70"

Hum: max. 50 mV.

Noise: max. 300 mV.



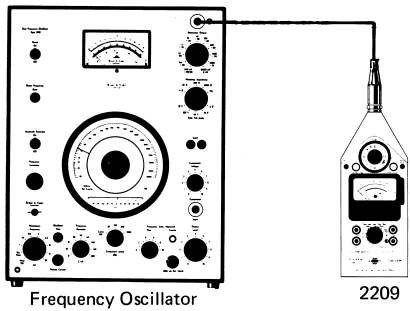
Simplified Diagram of Input Amplifier ZE 0014

5.1. DC-voltages

METER SWITCH: "Rec"

The midpoint of the output stage of the preamplifier (V 305_c, V 304_c) should be approx. 4 V negative. (ZE 0174)

If necessary change in value of R 307 (5.6–10 kΩ).



5.2. Sensitivity — Reference

- a. RANGE (black): "120"
RANGE (transp.): "120"
FILTER SWITCH: "Lin"
METER SWITCH: "Fast"

Input signal: Exactly 2.24 V (10 V — 13 dB) at 1000 Hz.

Adjust P 301 "Gain Adj." for 7 dB deflection on 2209.

Adjustment range for P 301: The total red scale area.

- b. RANGE (black) to "Ref"

Adjust reference voltage P 901 (XC 0335) for a deflection to 50 on the red scale mV per N/m² (corresponding 7 dB).

5.3. Frequency Response

- RANGE (black): "120"
RANGE (transp.): "120"
FILTER SWITCH: "Lin"
METER SWITCH: "Fast"

- a. Turn the screw for low frequency cut-off (on Connecting Board ZS 0187) fully clockwise.

Frequency: 1000 Hz. Adjust the input voltage for an 8 dB deflection on 2209.

Vary the frequency from 2 — 70 000 Hz.

Deflection on 2209: 7 — 9 dB (+ tolerance of Frequency Oscillator: 0.5 dB).

If necessary the low frequency response can be corrected by adjusting the interrelationship between P 801 and P 802 (ZE 0094) but in this case check item 4.2 again. The high frequency response can be corrected by changing the value of C 819 (0–10 pF).

Frequency response for Input Amplifier on "Ext. Filter In" socket.

- 5 — 70 000 Hz tolerance: 0 to –0.5 dB
2 — 5 Hz tolerance: 0 to 1 dB

- b. Turn the screw fully counter clockwise and check that the lower limit frequency is changed from 2 Hz to approx. 15 Hz.

2209.5 Input Amplifier

5.4. Attenuator

- RANGE (black): "120"
RANGE (transp.): "120"
FILTER SWITCH: "Lin"
METER SWITCH: "Fast"
- RANGE (black) through all positions

Frequency: 1000 Hz. Adjust the input voltage for an 8 dB deflection on 2209.

Check all attenuator steps of RANGE (black) by comparison to the attenuator of the Frequency Oscillator.

Tolerance: ± 0.2 dB (+ tolerance of Frequency Oscillator: 0.2 dB).

5.5. Output Impedance

- RANGE (black): "120"
RANGE (transp.): "120"
FILTER SWITCH: "Lin"
METER SWITCH: "Fast"

Frequency: 1000 Hz. Adjust the input voltage for a 10 dB deflection on 2209.

Connect a $500\ \Omega$ resistor across "Ext. Filter In" socket.

Meter deflection: 9.9–10 dB.

5.6. Overload

- RANGE (black): "110"
FILTER SWITCH: "Ext. Filter"

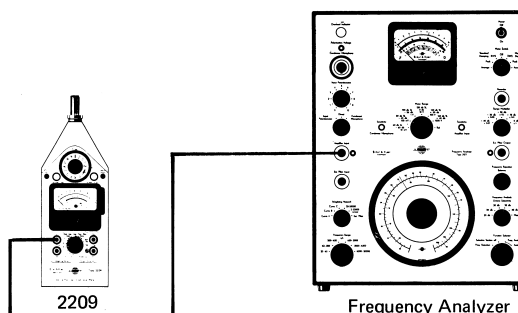
Frequency: 1000 Hz. Adjust the input voltage for an output voltage on "Ext. Filter In" socket of $1.4\text{ V} \pm 1\text{ dB}$ (corresponding to 17 dB above 0.2 V).

- Check with an Oscilloscope that the output voltage is not visible distorted.
- Check with an Oscilloscope that the rectified sine waves measured across C 310 are of the same height.

If necessary adjust P 302 (ZE 0174)

Disconnect the input signal by depressing "Oscillator Stop" on the Frequency Oscillator. When releasing it again the "Overload Input" should light up a few times.

If necessary adjust P 303 (ZE 0174)



5.7. Noise-Hum

- RANGE (black): "Ref"
RANGE (transp.): "Ref"
FILTER SWITCH: "Lin"
METER SWITCH: "Fast"
03 in position: 15 Hz
- RANGE (black) to "60"
RANGE (transp.) to "30"
- FILTER SWITCH to "A"
RANGE (transp.) to "10"

Connect an Input Adaptor JJ 2615 to Type 2209 and shortcircuit its input.

The apparatus must be in its case and evt. connected to ground.

Adjust "Gain Adj." for a deflection to 50 mV per N/m^2 .

Meter deflection: max. 0 dB.

Meter deflection: max. 0 dB.

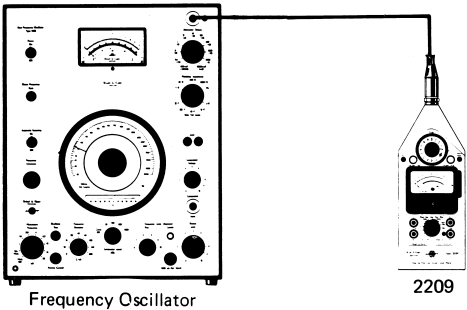
If the meter deflection exceeds the limit, check noise and hum for

Input Amplifier by measuring the output voltage on "Ext. Filter" socket. Check hum level measured selectively at the fundamental frequency of the DC-converter (approx. 2 kHz) and 2nd and 3rd harmonic.

Hum: max. 44 μV .

Noise: max. 200 μV (Measured with Frequency Analyzer (2107) in lin. 2 – 40 000 Hz).

Output Amplifier check item 4.6.



6.1. 1000 Hz Level

- a.
RANGE (black): "120"
RANGE (transp.): "120"
FILTER SWITCH: "Lin"
METER SWITCH: "Fast"

Frequency: 1000 Hz. Adjust the input voltage to give exactly 8 dB deflection on 2209.
- b.
FILTER SWITCH in position "A-B-C-D"

Check that the deflection is 8 dB ± 0.1 dB in all positions.

If the deflection exceeds the limits adjust
- A curve by P 304 ZE 0174
B curve by P 305 -
C curve by P 306 -
D curve by P 307 -

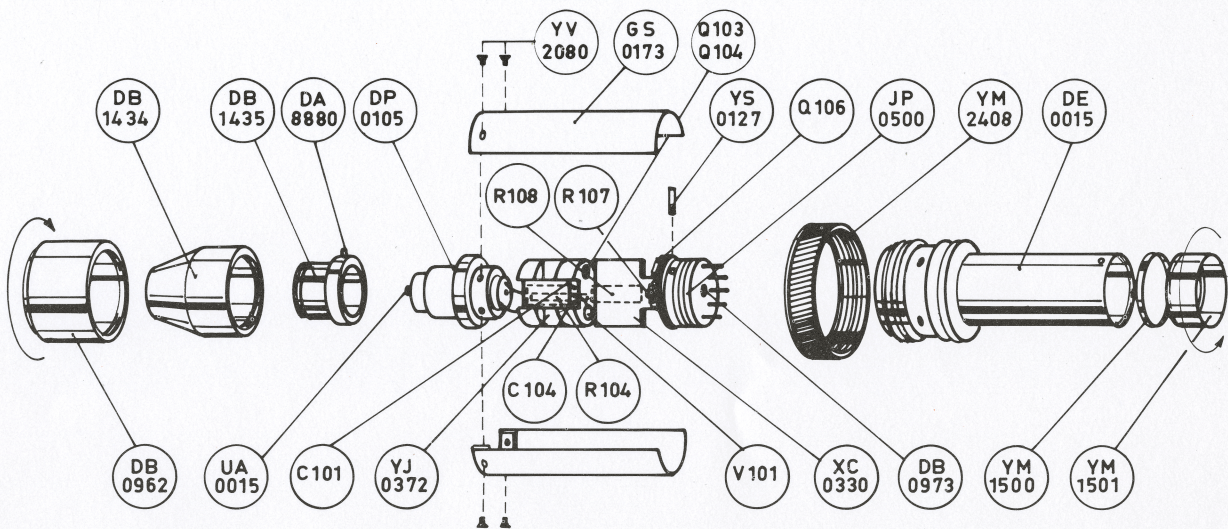
6.2. Network Curves

- a.
RANGE (black): "120"
RANGE (transp.): "120"
FILTER SWITCH: "Lin"
METER SWITCH: "Fast"

Frequency: 1000 Hz. Adjust the input voltage to give 8 dB deflection on 2209.

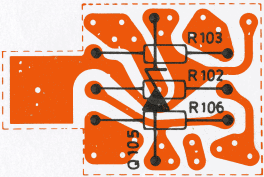
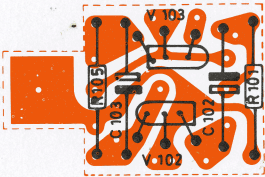
Check the filter curves according to following scheme.

Hz	Curve "A"		Curve "B"		Curve "C"		Curve "D"		
	Defl. on 2209	RANGE (transp.)	Defl. on 2209	RANGE (transp.)	Defl. on 2209	RANGE (transp.)	Defl. on 2209	RANGE (transp.)	RANGE (black)
10			-2.2-1.8	90	1.7-5.7	110		100	120
16	-0.7-3.3	70	-2.5-1.5	100	-2.5-1.5	120	3.9-6.9	100	120
20	7.5-9.5	70	2.8-4.8	100	0.8-2.8	120	6.4-8.4	100	120
31.5	7.6-9.6	80	-0.1-1.9	110	4.0-6.0	120	0.3-2.3	110	120
125	1.4-2.4	110	3.3-4.3	120	7.3-8.3	120	2.0-3.0	120	120
500	4.3-5.3	120	7.2-8.2	120	7.5-8.5	120	7.2-8.2	120	120
1k	7.9-8.1	120	7.9-8.1	120	7.9-8.1	120	7.9-8.1	120	120
2k	8.7-9.7	120	7.4-8.4	120	7.3-8.3	120	4.4-6.4	130	130
4k	8.5-9.5	120	6.8-7.8	120	6.7-7.7	120	8.6-9.6	130	130
8k	6.4-7.4	120	4.5-5.6	120	4.5-5.5	120	3.0-4.0	130	130
20k	7.7-9.7	110	5.9-7.9	110	5.8-7.8	110	4.3-6.3	120	120



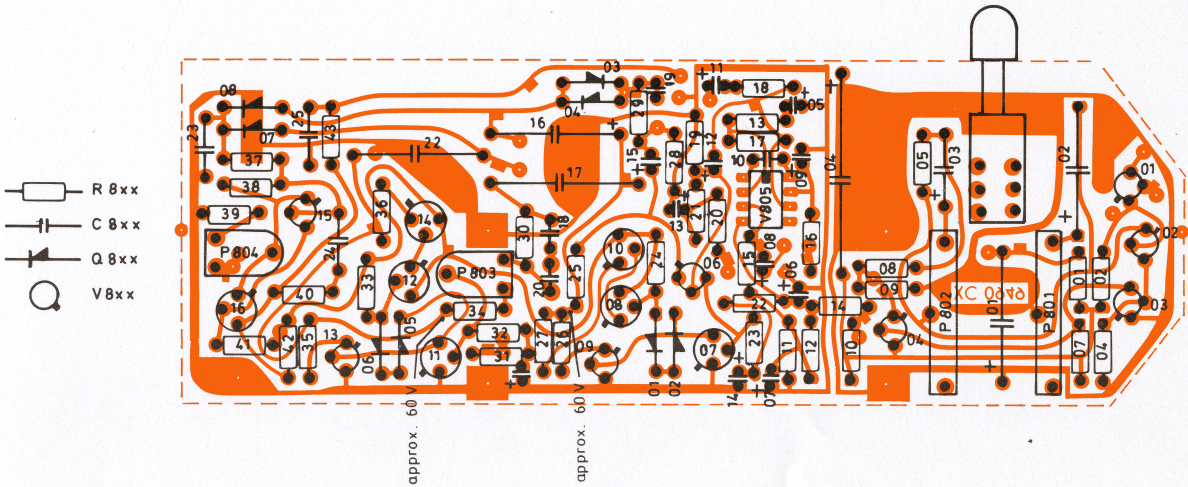
Attention: Do not open the preamplifier ZC 0007 unless it is strictly necessary.

After repair it is necessary to clean all the parts with a mixture of 10% methylated alcohol and 90% Freon. When the circuit is completely dry, and clean, it should be coated with a mixture of 4% silicone oil (f. inst. Wacher WS 60) and 96% trichlorethylene. After coating the circuit is dried at a temperature of 120°C for one hour and immediately remounted.

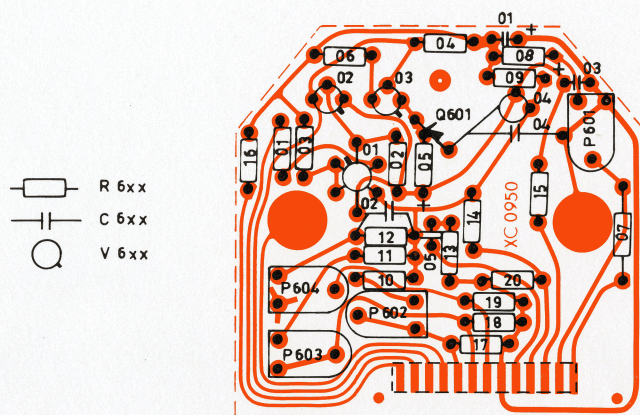


CIRCUIT DIAGRAM REF.	COMPONENT TYPE			STOCK REF.	
C 101	Glass	1 nF/300 V		CG 0001	
C 102,103	Tantalum	6.8 μF/ 6 V		CF 0030	
C 104	Glass	300 pF/300 V		CG 0002	
Q 103,104	Si. trans.	NPN	SF115	VB 0533	
Q 105	Zener	53–60 V/ 2 mA	BZX79 C56	QV 1327	
Q 106	Si. trans.	150 V/0.3 A	BAX 16	QV 0217	
R 101	Carbon	1/8 W	5%	8.2MΩ	RH 0910
R 102	-	-	10%	10MΩ	RH 0902
R 103	-	-	5%	180 kΩ	RA 0042
R 104	-	-	20%	1.8 GΩ	RH 0019
R 105	-	-	5%	3.3 kΩ	RA 0005
R 106	-	-	-	47 kΩ	RA 0011

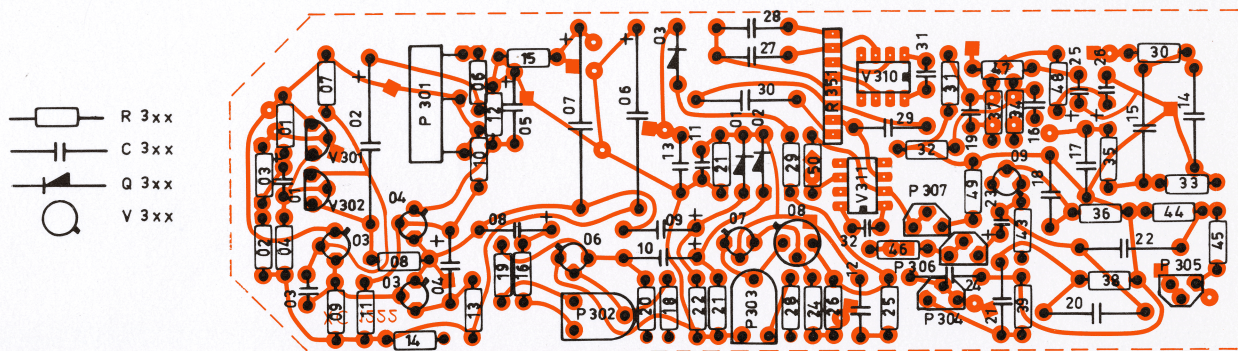
CIRCUIT DIAGRAM REF.	COMPONENT TYPE			STOCK REF.	
R 107	Metal	1/4 W	1%	22.1 kΩ	RF 4221
R 108	Carbon	-	10%	100MΩ	RH 0907
R 109	Metal	-	1%	60.4 Ω	RF 1604
R 110	-	-	-	2 kΩ	RF 3200
V 101	FET	N-channel	U2002	VB 1037	
V 102	Si. trans.	PNP	BCW 62 B	VB 0111	
V 103	-	NPN	BCW 82 B	VB 0578	
	Printed Circuit Board			XC 0330	
	Protection Cap			DZ 9025	



CIRCUIT DIAGRAM REF.	COMPONENT TYPE			STOCK REF.	CIRCUIT DIAGRAM REF.	COMPONENT TYPE			STOCK REF.
C 801	Electrolytic	330 μ F/ 10 V		CE 0211	R 814	Carbon	1/4 W	5%	10 Ω
C 802	Tantalum	330 μ F/ 6 V		CF 0005	R 815	-	-	-	82 k Ω
C 803	-	6.8 μ F/ 6 V		CF 0006	R 816	-	-	-	10 Ω
C 804	Electrolytic	470 μ F/ 10 V		CE 0305	R 817	Metal	-	1%	100 k Ω
C 805	Tantalum	100 μ F/ 3 V		CF 0019	R 818	-	-	-	604 Ω
C 806	-	33 μ F/ 10 V		CF 0034	R 819	Carbon	-	5%	330 k Ω
C 807	-	6.8 μ F/ 16 V		CF 0035	R 820	-	-	-	1.5M Ω
C 808	-	15 μ F/ 16 V		CF 0028	R 821	-	-	-	150 k Ω
C 809	-	33 μ F/ 10 V		CF 0034	R 822	-	1/8 W	10%	56-120 k Ω
C 810	Ceramic	2.7 pF/400 V		CK 0270	R 823	-	1/4 W	5%	6.8 k Ω
C 811	Tantalum	100 μ F/ 3 V		CF 0019	R 824	-	-	-	220 k Ω
C 812	-	6.8 μ F/ 16 V		CF 0035	R 825	-	-	-	470 k Ω
C 813,814	-	2.2 μ F/ 35 V		CF 0022	R 826,827	-	-	-	270 Ω
C 815	-	33 μ F/ 10 V		CF 0034	R 828	Metal	-	1%	8.45 k Ω
C 816	Electrolytic	22 μ F/100 V		CE 0616	R 829	-	-	-	90.9 k Ω
C 817	Polyester	0.68 μ F/100 V		CS 0342	R 830	Carbon	-	5%	330 k Ω
C 818	Ceramic	6.8 pF/400 V		CK 0680	R 831	-	-	-	47-82 k Ω
C 819	-	4.7 pF/400 V		CK 0470	R 832	-	-	-	10 k Ω
C 820	Trimmer	3-8 pF/ 63 V		CV 0027	R 833	-	-	-	220 k Ω
C 821	Tantalum	2.2 μ F/ 35 V		CF 0022	R 834	-	-	-	330 k Ω
C 822	Electrolytic	22 μ F/100 V		CE 0616	R 835,836	-	-	-	270 Ω
C 823	Ceramic	1nF/500 V		CK 3100	R 837	-	-	-	4.7 k Ω
C 824,825	Polyester	0.1 μ F/250 V		CS 0402	R 838	-	-	-	2.2M Ω
P 801	Trimmer	Wire	500 Ω	PG 1502	R 839	-	-	-	180 k Ω
P 802	-	-	5 k Ω	PG 2505	R 840	-	-	-	4.7M Ω
P 803	-	Cermet	47 k Ω	PG 3471	R 841	-	1/8 W	10%	3.9M Ω
P 804	-	Carbon	25 k Ω	PG 3256	R 842	-	1/4 W	5%	1.5M Ω
					R 843	-	1/8 W	10%	3.9M Ω
Q 801,802	Si.	150 V/300 mA	BAX 16	QV 0217	V 801, 802	Si. trans	NPN		BC 549
Q 803,804	-	100 V/225 mA	BAY 72	QV 0219	V 803, 804	-	PNP		BC 179
Q 805-808	-	150 V/300 mA	BAX 16	QV 0217	V 805	Op. Ampl.			LM 301
					V 806	Si. trans.	PNP		BC 179
R 801	Carbon	1/4 W	5%	22 k Ω	RB 4220	-	NPN		BF 258
R 802	-	-	-	270 k Ω	RB 5270	-	PNP		2N 4889
R 804	-	-	-	18 k Ω	RB 4180	-	NPN		BF 258
R 805	Metal	-	1%	10 k Ω	RF 4100	-	PNP		2N 4889
R 807	Carbon	-	5%	47 k Ω	RB 4470	-	NPN		BF 258
R 808	Metal	-	1%	10 k Ω	RF 4100	-	-		BC 109
R 809	Carbon	-	5%	4.7 k Ω	RB 3470	-	-		BF 258
R 810	-	-	-	220 Ω	RB 2220	-	-		
R 811	-	-	-	270 k Ω	RB 5270	-	-		
R 812	-	-	-	1M Ω	RB 6100	-	-		
R 813	Metal	-	1%	3.24 k Ω	RF 3324	-	-		
						Meter Reset Switch			NN 0019
						Printed Circuit Board			XC 0949



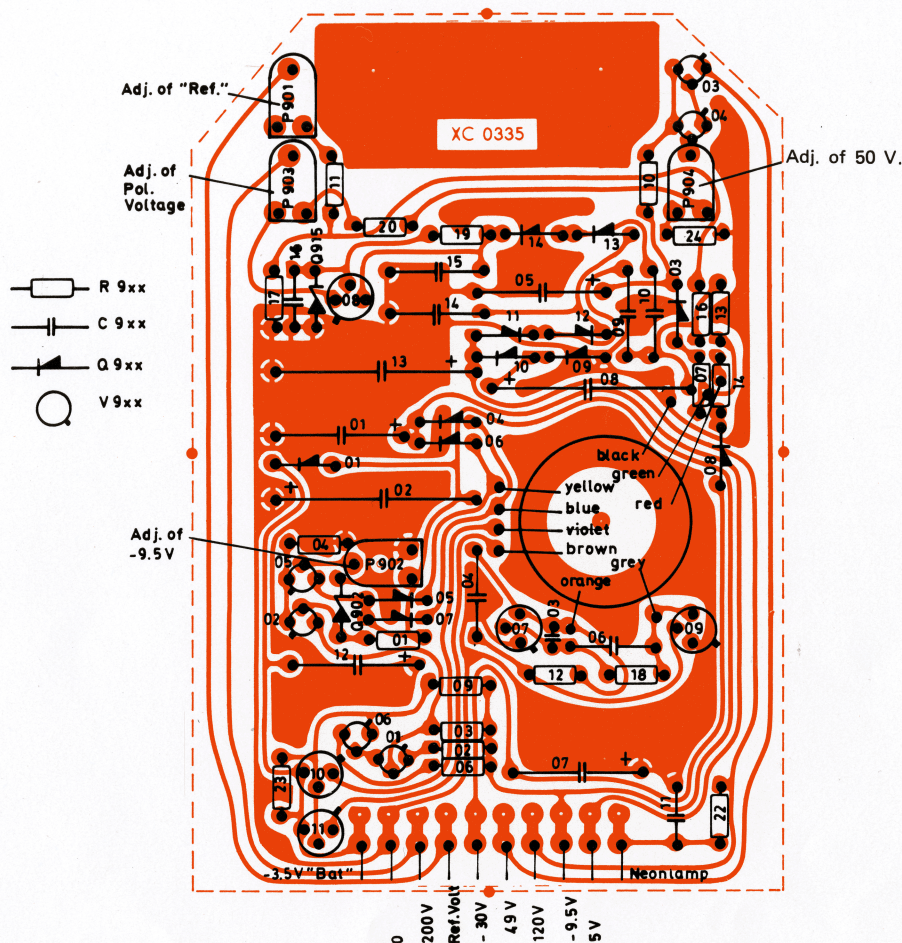
CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.	CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
C 601	Tantalum		33 μ F/ 10 V	CF 0034		R 611	Metal	1/4 W	1%	26.7 k Ω	RF 4267
C 602	—		1 μ F/ 35 V	CF 0062		R 612	-	-	-	29.4 k Ω	RF 4294
C 603	—		33 μ F/ 10 V	CF 0034		R 613	Carbon	-	5%	1 k Ω	RB 3100
C 604	Polyester		0.15 μ F/100 V	CS 0337		R 614	-	-	-	68 k Ω	RB 4680
C 605	Tantalum		68 μ F/ 3 V	CF 0011		R 615,616	-	-	-	10 Ω	RB 1100
						R 617	-	-	-	15 — 18 k Ω	
P 601	Trimmer	Cermet	22 k Ω	PG 3221		R 618	-	-	-	33 k Ω	RB 4330
P 602-604	-	-	10 k Ω	PG 3109		R 619	-	-	-	33 — 82 k Ω	
						R 620	-	-	-	39 k Ω	RB 4390
Q 601	Si. trans.	NPN	SF 115	VB 0533							
						V 601	Si. trans.	dual NPN		BCY 89	VB 5304
R 601	Carbon	1/4 W	5% 100 Ω	RB 2100		V 602	-	PNP		2 N 2894	VB 0093
R 602	Metal	-	1% 4,32 k Ω	RF 3432		V 603	-	PNP		BC 179 B	VB 0100
R 603	-	-	- 18,2 k Ω	RF 4182		V 604	FET	N-channel		E 102	VB 1053
R 604	Carbon	-	5% 33 k Ω	RB 4330							
R 605	-	-	- 220 k Ω	RB 5220				14-pin Connector			JP 1401
R 606	-	-	- 68 Ω	RB 1680							
R 607	-	-	- 18M Ω	RH 0908				Printed Circuit Board			XC 0950
R 608	Metal	-	1% 100 k Ω	RF 5100							
R 609	-	-	- 18.2 k Ω	RF 4182							
R 610	-	-	- 24.9 k Ω	RF 4249							



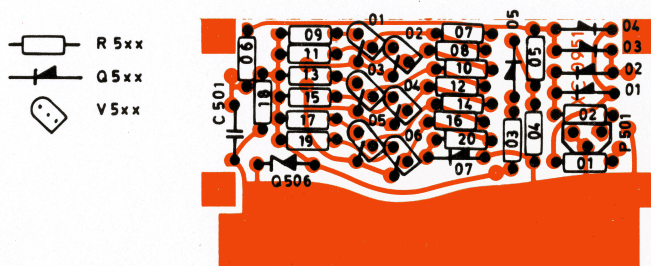
C 301	Tantalum	6,8 μ F/ 16 V	CF 0035	R 309	Carbon	1/4 W	5%	47 k Ω	RB 4470	
C 302	Electrolytic	1000 μ F/ 6,3 V	CE 0210	R 310	-	-	-	33 k Ω	RB 4330	
C 303	Ceramic	3,9 pF/400 V	CK 0390	R 311	-	-	-	100 k Ω	RB 5100	
C 304	Electrolytic	22 μ F/ 10 V	CE 0203	R 312	-	-	-	680 Ω	RB 2680	
C 305	-	47 μ F/ 10 V	CE 0204	R 313	-	-	-	470 Ω	RB 2470	
C 306,307	-	470 μ F/ 10 V	CE 0305	R 314	-	-	-	220 Ω	RB 2220	
C 308-310	-	22 μ F/ 10 V	CE 0203	R 315	-	-	-	10 k Ω	RB 4100	
C 311	Ceramic	470 pF/400 V	CK 2470	R 316	-	-	-	100 k Ω	RB 5100	
C 312,313	Polyester	100 nF/250 V	CS 0402	R 318	-	-	-	220 k Ω	RB 5220	
C 314	-	20 nF/ 63 V	CT 1125	R 319	-	-	-	100 k Ω	RB 5100	
C 315	Polycarbonate	0,47 μ F/100 V	CS 0234	R 320	-	-	-	22 k Ω	RB 4220	
C 316	Ceramic	100 pF/400 V	CK 2101	R 321,322	-	-	-	47 k Ω	RB 4470	
C 317	Polyester	5,1 nF/ 63 V	CT 1179	R 323	-	-	-	2,2 M Ω	RB 6220	
C 318	Polycarbonate	47 nF/250 V	CS 0235	R 324,325	-	-	-	4,7 M Ω	RB 6470	
C 319	Ceramic	82 pF/400 V	CK 1820	R 326	-	-	-	1,5 M Ω	RB 6150	
C 320	Polyester	20 nF/ 63 V	CT 1125	R 328	-	-	-	10 k Ω	RB 4100	
C 321	Polystyrene	5,1 nF/ 63 V	CT 1179	R 329	-	1/3 W	10%	3,9 M Ω	RA 0039	
C 322	Polyester	20 nF/ 63 V	CT 1125	R 330	Metal	1/4 W	1%	475 Ω	RF 2475	
C 323	Tantalum	6,8 μ F/ 16 V	CF 0035	R 331,332	-	-	-	221 k Ω	RF 5221	
C 324	Polystyrene	390 pF/125 V	CT 1120	R 333	-	-	-	18,7 k Ω	RF 4187	
C 325,326	Tantalum	33 μ F/ 40 V	CF 0034	R 334	-	-	-	57,6 k Ω	RF 4576	
C 327-329	Polystyrene	4,3 nF/ 63 V	CT 1178	R 335	-	-	-	2,26 k Ω	RF 3226	
C 330	Polystyrene	9,1 nF/ 63 V	CT 1513	R 336	-	-	-	150 k Ω	RF 5150	
C 331	Ceramic	5,6 pF/400 V	CK 0560	R 337	-	-	-	57,6 k Ω	RF 4576	
C 332	-	15 pF/400 V	CK 1150	R 338	-	-	-	59 k Ω	RF 4590	
				R 339	-	-	-	68,1 k Ω	RF 4681	
P 301	Trimmer	Wire	1 k Ω	PG 2106	R 343	Carbon	-	5%	47 k Ω	RB 4470
P 302	-	Cermet	25 k Ω	PG 3256	R 344	Metal	-	1%	63,4 k Ω	RF 4634
P 303	-	-	10 k Ω	PG 3103	R 345,346	-	-	-	64,9 k Ω	RF 4649
P 304 – 307	-	-	22 k Ω	PG 3224	R 347,348	Carbon	-	5%	10 Ω	RB 1100
				R 349	Metal	-	1%	90,9 k Ω	RF 4909	
Q 301,302	Germ.	SFD108	100 V/30 mA	QV 0099	R 350	-	-	-	127 k Ω	RF 5127
Q 303	Silicon	BAX16	150 V/300 mA	QV 0217	R 351	Resistor Array				RZ 0045
					V 301,302	Silicon	NPN	BC549		VB 0580
R 301	Carbon	1/4 W	5%	180 k Ω	RB 5180	V 303-306	Silicon	PNP	BC179	VB 0100
R 302	-	-	-	2,2 M Ω	RB 6220	V 307	-	NPN	BC109	VB 0047
R 303	-	-	-	1 M Ω	RB 6100	V 308	-	-	BF258	VB 0552
R 304	-	-	-	270 k Ω	RB 5270	V 309	-	NPN	BC109	VB 0100
R 306	Metal	-	1%	182 Ω	RF 2182	V 310	Op. Ampl.		LM301	VE 0017
R 307	Carbon	-	5%	6,8 k Ω	RB 3680	V 311	-		LM308	VE 0046
R 308	Metal	-	1%	22,1 k Ω	RF 4221					

Printed Circuit Board

XC 1222

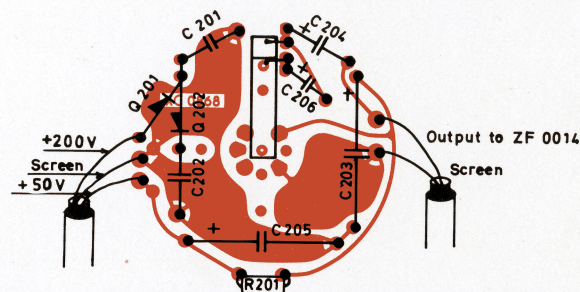


CIRCUIT DIAGRAM REF.	COMPONENT TYPE		STOCK REF.		CIRCUIT DIAGRAM REF.	COMPONENT TYPE		STOCK REF.	
C 901	Electrolytic	220 μ F/ 6.3 V	CE 0208		R 901	Carbon	1/4 W 5%	1.2 k Ω	RB 3120
C 902	-	470 μ F/ 10 V	CE 0305		R 902	-	-	220 Ω	RB 2220
C 903	Ceramic	2.2 nF/100 V	CK 9103		R 903	-	-	5.6 k Ω	RB 3560
C 904	Electrolytic	10 μ F/ 25 V	CE 0416		R 904	-	-	15 k Ω	RB 4150
C 905	-	47 μ F/ 63 V	CE 0509		R 906,907	-	-	1 k Ω	RB 3100
C 906	-	10 μ F/ 25 V	CE 0416		R 909	-	-	10 k Ω	RB 4100
C 907	-	6.8 μ F/ 40 V	CE 0453		R 910	-	-	1 k Ω	RB 3100
C 908	-	22 μ F/100 V	CE 0616		R 911	-	-	270 k Ω	RB 5270
C 909	Polyester	47 nF/250 V	CS 0063		R 912	-	-	1 k Ω	RB 3100
C 910	-	10 nF/400 V	CS 0101		R 913,914	-	-	470 Ω	RB 2470
C 911	-	100 nF/250 V	CS 0402		R 916	-	-	1M Ω	RB 6100
C 912	Electrolytic	100 μ F/6.3 V	CE 0207		R 917	-	-	3.9 k Ω	RB 3390
C 913	-	33 μ F/160 V	CE 2038		R 918	-	-	1 k Ω	RB 3100
C 914	Polyester	47 nF/250 V	CS 0063		R 919	-	1/8 W 10%	10M Ω	RA 0025
C 915	Polyester	10 nF/400 V	CS 0101		R 920	-	1/4 W 5%	4.7M Ω	RB 6470
C 916	-	47 nF/250 V	CS 0401		R 922	-	1/8 W 10%	10M Ω	RA 0025
P 901, 902	Trimmer	Cermet	100 k Ω	PG 4108	R 923	-	1/4 W 5%	10 k Ω	RB 4100
P 903	-	Carbon	2M Ω	PG 5202	R 924	-	-	1.8M Ω	RA 0021
P 904	-	-	1M Ω	PG 5102	V 901	Si. trans.	NPN	BC 109	VB 0047
Q 901	Si.	150 V/300 mA	BAX 16	QV 0217	V 902	-	PNP	BC 179	VB 0100
Q 902	Zener	5-6.2 V/ 5 mA	BZX 79	QV 1105	V 903,904	-	NPN	BC 109	VB 0047
Q 903	Si.	150 V/300 mA	BAX 16	QV 0217	V 905,906	-	PNP	BC 179	VB 0100
Q 904-907	Ge.	100 V/ 30 mA	SFD 108	QV 0099	V 907	Ge. trans.	PNP	ASY 80	VB 0069
Q 908-914	Si.	150 V/300 mA	BAX 16	QV 0217	V 908	Si. trans.	NPN	BF 258	VB 0552
Q 915	Zener	210 — 230 V/4,7 mA	MZ 22 BA	QV 1326	V 909	Ge. trans.	PNP	ASY 80	VB 0069
					V 910, 911	-	PNP	ASY76	VB 0056
						Converter Transformer			LB 0630
						Printed Circuit Board			XC 0335



CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.	CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
C 501	Polystyrene	510 pF/	63 V		CT 1135	R 507	Metal	1/4 W	1%	31.6 kΩ	RF 4316
						R 508	-	-	-	11.8 kΩ	RF 4118
P 501	Trimmer	Carbon	2 kΩ		PG 2206	R 509	-	-	-	11 kΩ	RF 4110
						R 510	-	-	-	5.23 kΩ	RF 3523
Q 501-504	Si.	100 V/225 mA	BAY 72	QV 0219	R 511	-	-	-	-	3.16 kΩ	RF 3316
Q 505	Si.	15 V/ 30 mA	SFD 121	QV 0100	R 512	-	-	-	-	3.01 kΩ	RF 3301
Q 506	Zener	5,9 – 6,2 V/ 5 mA	ZP 6.2	QV 1334	R 513	-	-	-	-	1.27 kΩ	RF 3127
Q 507	Si.	100 V/225 mA	BAY 72	QV 0219	R 514	-	-	-	-	2.21 kΩ	RF 3221
					R 515	-	-	-	-	422 kΩ	RF 2422
					R 516	-	-	-	-	1.1 kΩ	RF 3110
					R 517	-	-	-	-	100 Ω	RF 2100
R 501	Metal	1/4 W	1%	100 Ω	RF 2100	R 518	-	-	-	20 kΩ	RF 4200
R 502	-	-	-	5.23 kΩ	RF 3523	R 519	-	-	-	15.4 Ω	RF 1154
R 503	-	-	-	24.9 kΩ	RF 4249	R 520	-	-	-	1.1 kΩ	RF 3110
R 504	-	-	-	8.06 kΩ	RF 3806	V 501-506	Silicon	PNP		BC 212	VB 0049
R 505	-	-	-	2 kΩ	RF 3200						
R 506	-	-	-	68.1 kΩ	RF 4681		Printed Circuit Board				XC 0951

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
C 201,202	Polyester	0,1 μ F/250 V			CS 0013
C 203	Electrolytic	68 μ F/ 63 V			CE 0513
C 204	Tantalum	3.9 μ F/ 35 V			CF 0015
C 205	Electrolytic	68 μ F/ 63 V			CE 0513
C 206	Tantalum	0.15 μ F/ 35 V			CF 0033
C 401	-	47 μ F/ 6.3 V			CF 0023
C 402,403	-	2.2 μ F/ 35 V			CF 0022
C 701	-	47 μ F/ 6 V			CF 0017
C 703	-	3.3 μ F/ 15 V			CF 0025
O 1,2	Attenuator Switch				OR 2204
O 3	Switch 10 Hz — 20 Hz (ZS 0187)				OD 0207 OD 0208
O 4,5	Meter and Filter Switch				OG 3003
	Dry Cell 1.5 V				QB 0004
Q 201,202	Si. diode	BAX 16	150 V/300 mA		QV 0217
R 201	Carbon	1/4 W	5%	4.7 k Ω	RB 3470
R 401	Metal	-	1%	3.32 k Ω	RF 3332
R 402	-	-	-	10 k Ω	RF 4100
R 403	-	-	-	31.6 k Ω	RF 4316
R 404	-	-	-	100 k Ω	RF 5100
R 405	-	-	-	1 k Ω	RF 3100
R 406	-	-	-	3.16 k Ω	RF 3316
R 407	-	-	-	1.5 k Ω	RF 3150
R 408	-	-	-	10 k Ω	RF 4100
R 409	-	-	-	316 Ω	RF 2316
R 410	-	-	-	10 k Ω	RF 4100
R 411	-	-	-	100 Ω	RF 2100
R 412	-	-	-	31.6 k Ω	RF 4316
R 413, 414	-	-	9,24 k Ω	39.2 k Ω	RF 4392
	-	-	-	12.1 k Ω	RF 4121
R 415	Carbon	-	-	10 k Ω	RB 4100
	Metal	-	46,2 Ω	46.6 Ω	RF 1464
R 416	-	-	1%	100 k Ω	RF 5100
R 701	Carbon	-	5%	220 k Ω	RB 5220
R 702	-	-	-	6.8 M Ω	RH 0904
R 703	Metal	-	-	15-47 k Ω	
R 704	-	-	1%	69.8 k Ω	RF 4698
V 401,402	Neon lamp				VS 8011
V 701	-				VS 0013
	Battery Cover				DD 0076
	Carrying Strap				DH 0049
					+YS 0418
	Spring for Scales				OL 3053
	Cabinet Top Half				FA 0409
	Cabinet Bottom Half				FB 0197
	Moving Coil Instrument				IM 0052
	Coax Socket				JJ 0006
	14-pin Connector Socket for ZE 0095				JJ 1406
	20-pin - - - JP 2100				JJ 2095
	27-pin - - - JP 2702				JJ 2702
	10-pin - Plug - ZG 0071				JP 1001
	21-pin - - - JJ 2004				JP 2100
	27-pin - - - JJ 2702				JP 2702
	Socket for ZC 0007				JY 0009
	Meter Reset Switch				NN 0019
	Knob for Filter Switch				SN 0826
	Knob for Attenuator, black				SN 1019
					+DB 0345
					+YM 1305
					+DL 3053
	Meter				IM 0052



CIRCUIT DIAGRAM REF.	COMPONENT TYPE		STOCK REF.
	Knob for Attenuator, transp.		SN 1020
			+DB 0965
			+DB 0346
			+YM 0906
			+YS 1700
			SN 1021
	Knob for Meter Switch		
	10 — 130 dB	1 A	
	20 — 140 dB	1 B	SA 0012
	30 — 140 dB	2 A	
	40 — (160 dB)	2 B	SA 013
	50 — 160 dB	3 A	
	10 μ V — 10 V	3 B	SA 0014
	$3 \cdot 10^{-1} - 3 \cdot 10^5$	4 A	
	$10^{-1} - 10^5$	4 B	SA 0015
	$3 \cdot 10^{-2} - 3 \cdot 10^4$	5 A	
	$10^{-2} - 10^4$	5 B	SA 0016
	$3 \cdot 10^{-3} - 3 \cdot 10^3$	6 A	
	$10^{-3} - 10^3$	6 B	SA 0017
	$3 \cdot 10^{-4} - 3 \cdot 10^2$	7 A	
	$10^{-4} - 10^2$	7 B	SA 0018
	$3 \cdot 10^{-5} - 30$	8 A	
	$10^{-5} - 10$	8 B	SA 0019
	$3 \cdot 10^{-6} - 3$	9 A	
	$10^{-6} - 1$	9 B	SA 0020
	$3 \cdot 10^{-7} - 3 \cdot 10^{-1}$	10 A	
	$10^{-7} - 10^{-1}$	10 B	SA 0021
	Scale, blank		SA 0024
	Meter, Filter Switch		OE 0071
	Input Stage		ZC 0007
	Output Amplifiers		ZE 0094
	Meter Circuit		ZE 0095
	Preamplifier, Filter		ZE 0174
	Attenuators		ZF 0014
	Power Supply		ZG 0071
	RMS Circuit		ZL 0032
	Input Connector		p.c. board XC 0868
			with comp. ZS 0187

