Brüel & Kjær

2650

Precision Conditioning Amplifier

Valid from serial no. 453393

037—0211

Service

2650
Precision Conditioning Amplifier

Valid from serial no. 453393

037—0211

Consisting of:

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ZG 0096	1	11.73

Removal of Module Panel

The bottom panel of the instrument is removed by releasing the large finger screw at the bottom of the front panel. Quarter to a half a turn should be adequate to release the catch. The panel is then removed by sliding it towards the rear of the unit.

Top and side plates of the instrument can each be released by unscrewing the fixed screws on the rear of the unit. These plates are also removed by sliding them backwards.

Trouble Shooting

If any problem should occur with this instrument, then check the DC working voltages from the power supply. Then use the block diagram in order to localize the trouble to be located in one specific circuit.

When a fault has been found and corrected, the voltages and adjustments which are influenced by the correction must be rechecked, and the instrument controlled to see if all basic functions are fulfilled.

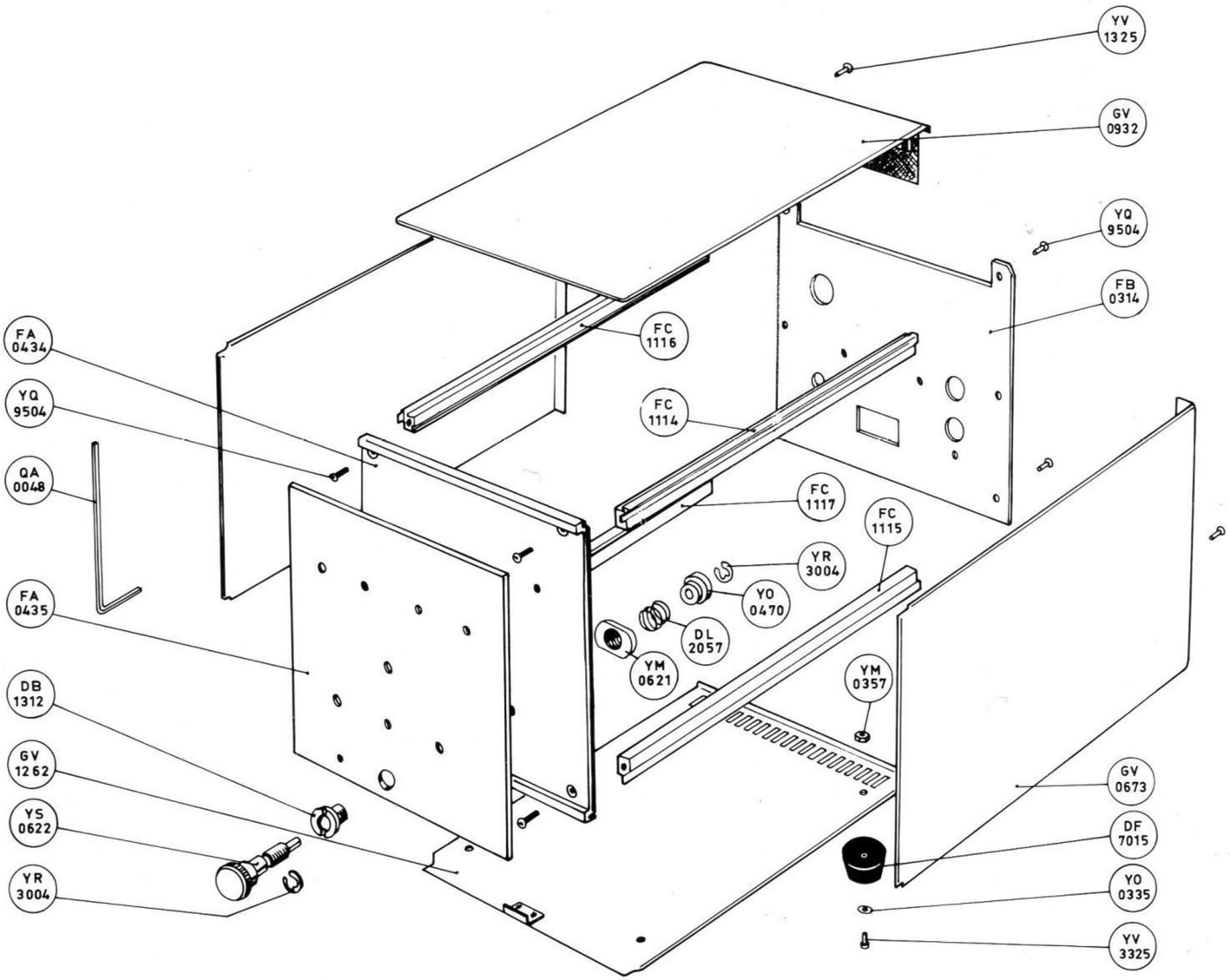
The tolerances stated in the instructions can only be used as a guide for adjustment and control.

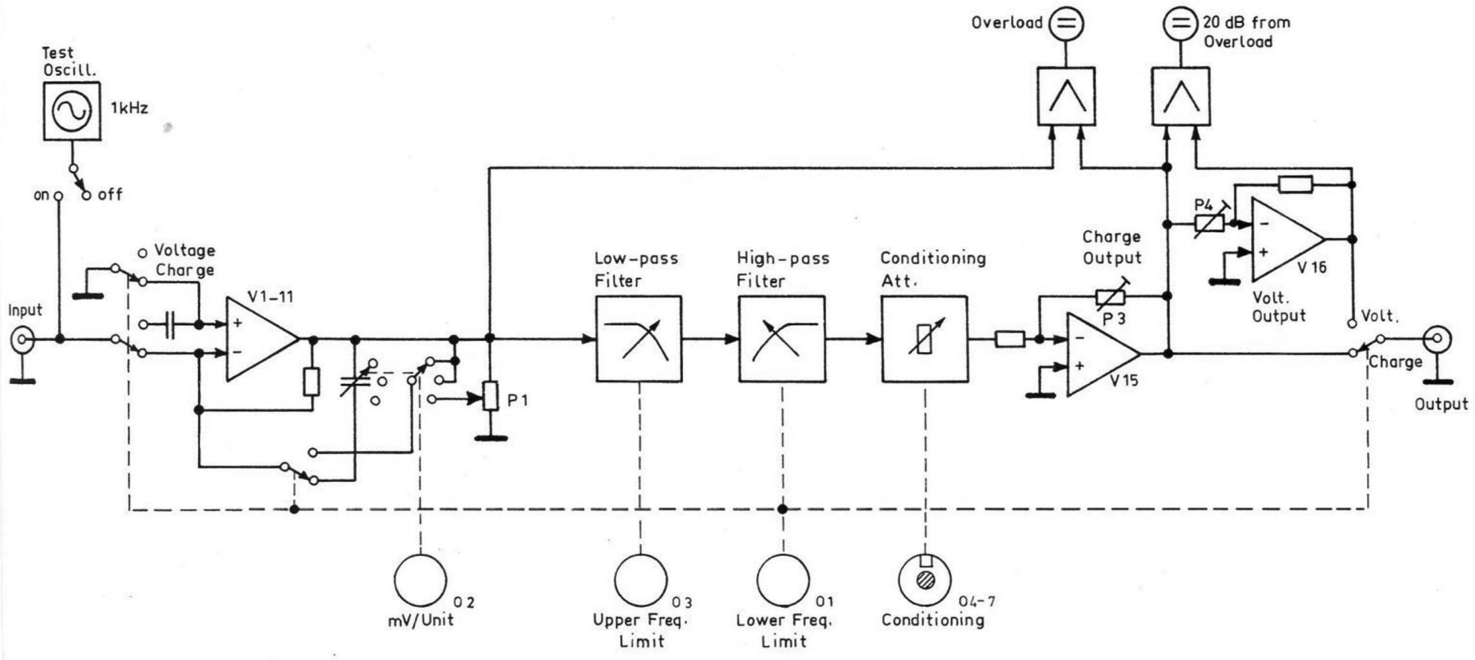
Any deviations must not be corrected without being sure that the tolerances of the instrument used for making the adjustment are so small as to have no influence on the measurement.

The instructions in this manual are given purely as a guide of equipment. Some faults e.g. small deviations in tolerances, require special control equipment and extensive experience to correct. For these cases the instrument must be sent to the factory.

Spare parts

Please state type and serial number of apparatus when spare parts are ordered.


YV 1325
GV 0932
YQ 9504
FB 0314
FC 1116
FA 0434
YQ 9504
FC 1114
QA 0048
FC 1117
FC 1115
YR 3004
FA 0435
YO 0470
DL 2057
YM 0621
YM 0357
DB 1312
GV 1262
GV 0673
YS 0622
DF 7015
YR 3004
YO 0335
YV 3325



The input amplifier consists of V 1 to V 11 and has a positive and a negative input. When the instrument is used in "Charge" mode the positive input is connected to ground through LOWER FREQ. LIMIT switch. The signal input is then the negative input of the amplifier. The feedback path in this mode is capacitive for frequencies above the frequency chosen by LOWER FREQ. LIMIT.

When the instrument is used in "Voltage" mode, the positive input of the amplifier is used as the signal input. The feedback components in this mode are resitive selected by VOLT/UNIT.

From the input amplifier the signal is fed to a low-pass filter, and immediately after this to a high-pass filter. Both filters have the cut-off frequency (—3 dB point) corresponding to the switch position, and a roll-off slope of 12 dB/oct.

The output from the high-pass filter is via the conditioning attenuator fed to the output amplifier. The output amplifier consists of two identical integrated amplifiers V15 and V16. The output from V15 is used when the instrument is switched to "Charge" mode and the output from V16 is used when the instrument is switched to "Voltage" mode.

The reason to split up the output amplifier is the claim to have a possibility to make an adjustment of the amplification when 2650 is used in "Voltage" mode. Furthermore V 16 turn the phase which means that the output signal is in phase with the input signal.

The level detector consists of two trigger circuits, one for positive and negative overload, and one which indicates that the signal level is 20 dB from overload.

Furthermore the instrument consists of a 1 kHz test oscillator. The oscillator is connected to the input through a 1 nF capacitor when INT. TEST SOURCE is positioned in "On". The output from the oscillator is factory adjusted to give 2 Vpp which is equal to 1 pC/mV. The output from the amplifier will then be 2 Vpp or 0,7 V RMS when VOLT/UNIT is positioned in "0,01" and TRANSDUCER SENS. in "10—0—0—0".

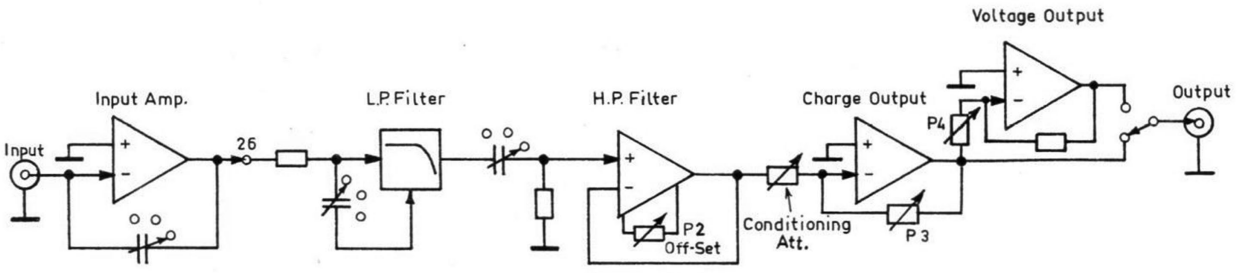
2.1. Power Supply

Voltages valid for 2650 connected to a mains voltage of 220 V:

All voltages are measured with respect to ground.

AC Voltages:	DC Voltages:
pin 6: 47 V.	pin 1: 14,5 – 16 V.
pin 7: 47 V.	pin 2: —14,0 – —15,7 V.
Between pin 11 and 12: 250 V.	pin 9: 98 – 110 V.

2.2. DC Balance



a. Input Amplifier.

TRANSDUCER SENS.: "10—0—0—0" VOLT/UNIT: "0,001 (1—11 pC, mV/g)" LOWER FREQ. LIMIT: "3 Hz/Charge" UPPER FREQ. LIMIT: "Lin." TEST SOURCE: "Off"	DC voltage on terminal 26: max. 100 mV
VOLT/UNIT to "0,1 (1—11 pC, mV/g)"	DC voltage on terminal 26: max. 100 mV

b. Output Amplifier.

TRANSDUCER SENS.: "1—0—0—0" VOLT/UNIT: "0,01 (1—11 pC, mV/g)" LOWER FREQ. LIMIT: "3 Hz/Charge" UPPER FREQ. LIMIT: "Lin." TEST SOURCE: "Off"	DC voltage on "Output" : 0 V ± 1 mV If necessary adjust P 2
LOWER FREQ. LIMIT to "3 Hz/Voltage"	DC voltage on "Output" : 0 V ± 7 mV
LOWER FREQ. LIMIT to "2 kHz/Charge"	DC voltage on "Output" : 0 V ± 20 mV
LOWER FREQ. LIMIT to "3 Hz/Charge" CONDITIONING Att. to "10—0—0—0"	DC voltage on "Output" : 0 V ± 10 mV

2.3. Test Oscillator

TRANSDUCER SENS.: "10—0—0—0"
VOLT/UNIT: "0,01 (1—11 pC, mV/g)"
LOWER FREQ. LIMIT: "0,3 Hz/Charge"
UPPER FREQ. LIMIT: "Lin."
INT. TEST SOURCE: "On"

Measure the oscillator voltage on terminal 6: 0,71 V RMS
If necessary adjust P6.

2.4. Sensitivity

TRANSDUCER SENS.: "10—0—0—0"
VOLT/UNIT: "0,01 (1—11 pC, mV/g)"
LOWER FREQ. LIMIT: "0,3 Hz/Charge"
UPPER FREQ. LIMIT: "Lin."
INT. TEST SOURCE: "On"

Measure the signal on "Output" : 0,71 V RMS
If necessary adjust P3.

VOLT/UNIT to "0,1 (1—11 pC, mV/g)"

Measure the signal on "Output" : 7,1 V RMS
If necessary adjust C12.

VOLT/UNIT to "0,01 (1—11 pC, mV/g)"
LOWER FREQ. LIMIT to "0,3 Hz/Voltage"

Measure the signal on "Output" : 0,71 V RMS
If necessary adjust P4.

VOLT/UNIT to "0,1 (1—11 pC, mV/g)"

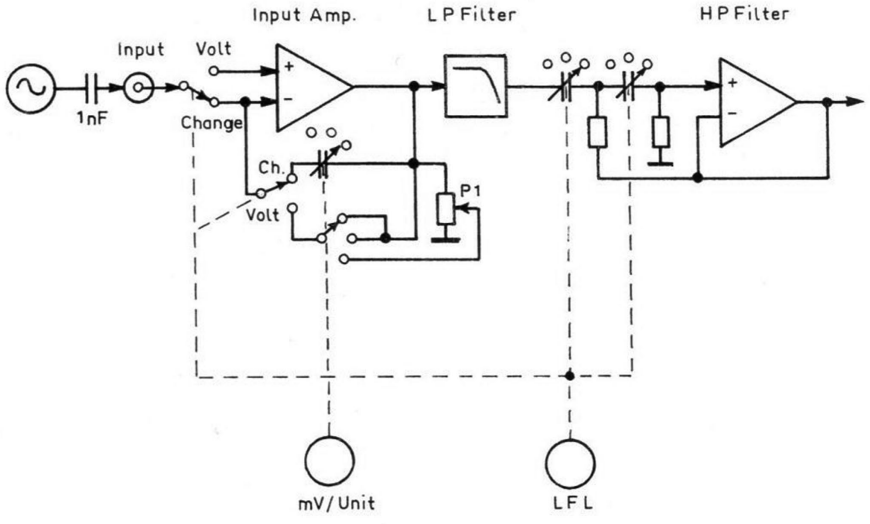
Measure the signal on "Output" : 7,1 V RMS
If necessary adjust P1.

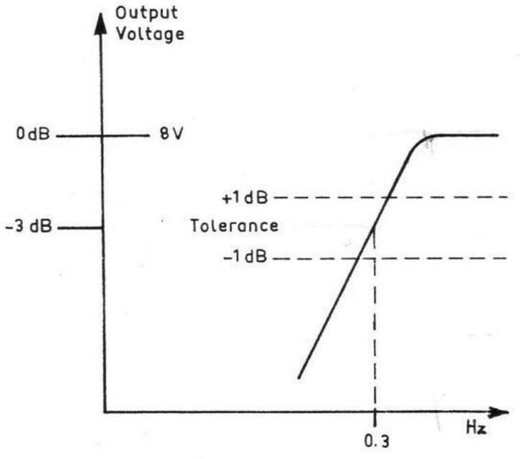
VOLT/UNIT to "0,001 (1—11 pC, mV/g)"

Measure the signal on "Output" : 71 mV RMS
If necessary adjust P5.

2.5. Frequency Response

a. HP Filter





TRANSDUCER SENS.: "10—0—0—0"
UPPER FREQ. LIMIT: "Lin."
INT. TEST SOURCE: "Off"
LOWER FREQ. LIMIT: "0,3/Charge"
VOLT/UNIT: "0,001 (1—11 pC, mV/g)"

Connect a Sine Wave Generator to "Input" through a 1 nF capacitor.
Adjust the input voltage (at 1 kHz) for 1 V on "Output".
Check the output voltage at 0,3 Hz: —3 dB ± 1 dB.

VOLT/UNIT to "0,01 (1—11 pC, mV/g)"

Decrease the input signal 20 dB.
Check the frequency cut-off: —3 dB ± 1 dB.

VOLT/UNIT to "0,1 (1—11 pC, mV/g)"

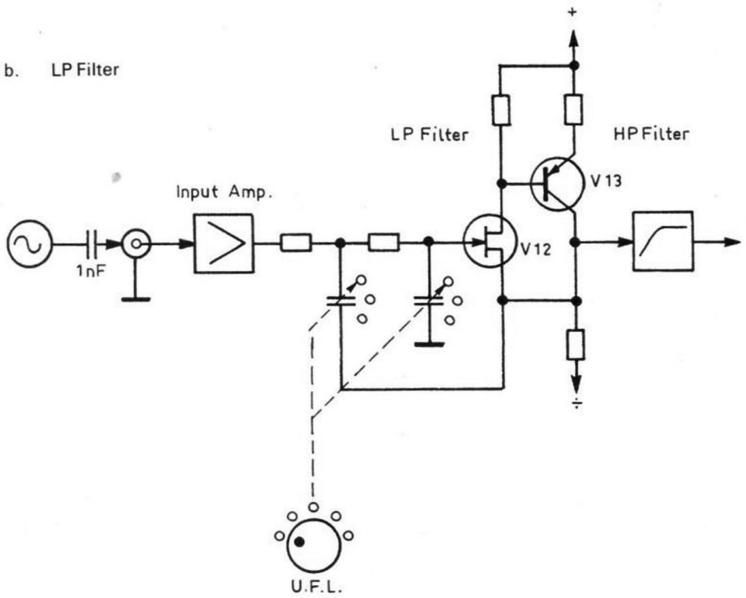
Decrease the input signal 20 dB.
Check the frequency cut-off: —3 dB ± 1 dB.

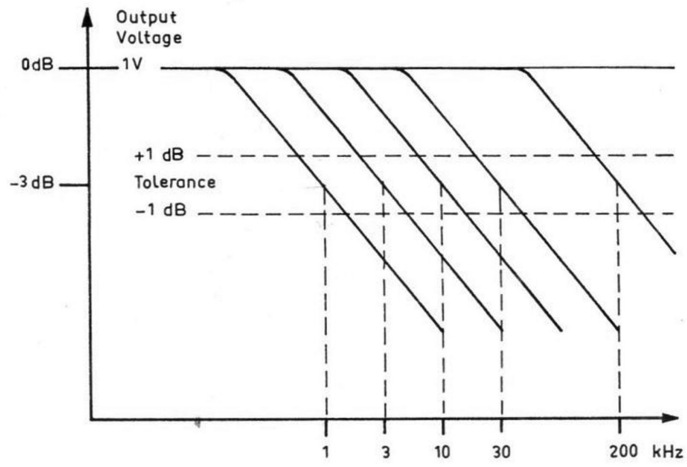
VOLT/UNIT to "0,01 (1—11 pC, mV/g)"
LOWER FREQ. LIMIT to "0,3/Volt"

Adjust the input frequency for an output voltage of —3 dB

Check the input frequency to be within 0,15 — 0,25 Hz.

b. LP Filter





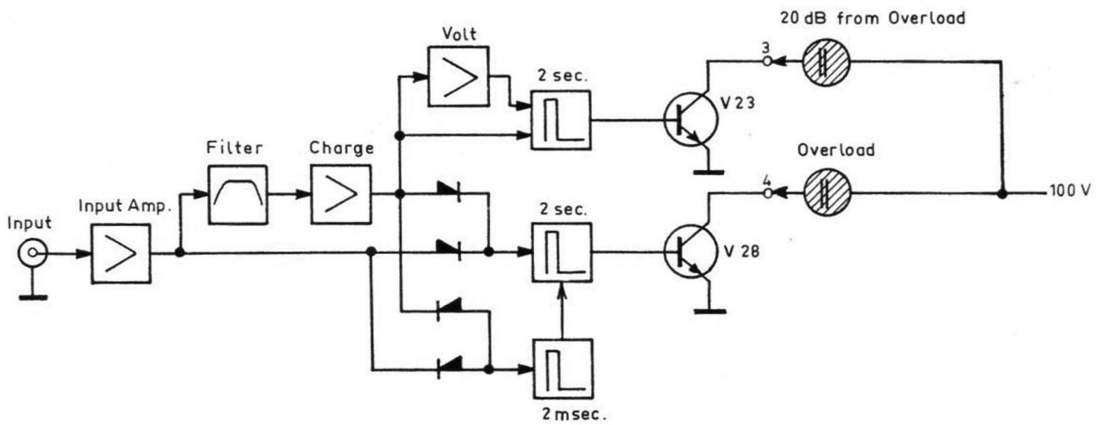
TRANSDUCER SENS.: "10—0—0—0"
LOWER FREQ. LIMIT: "0,3/Charge"
INT. TEST SOURCE: "Off"
VOLT/UNIT: "0,01 (1—11 pC, mV/g)"
UPPER FREQ. LIMIT: "Lin."

Connect a Sine Wave Generator to "Input" through a 1 nF capacitor.

Adjust the input voltage (at 1 kHz) to 1 V on "Output".

Check the frequency response for all positions of UPPER FREQ. LIMIT switch.

2.6. Overload Indicator



TRANSDUCER SENS.: "10—0—0—0"
UPPER FREQ. LIMIT: "Lin."
INT. TEST SOURCE: "Off"
LOWER FREQ. LIMIT: "0,3/Voltage"
VOLT/UNIT: "0,01 (1—11 pC, mV/g)"

Connect a Sine Wave generator to "Input" and an oscilloscope to "Output"

Increase the input voltage (at 1 kHz) and check that the indicator lamp "20 dB from Overload" lights up when the output voltage reachs 2 Vpp.

Increase the input voltage 20 dB and check that the indicator lamp "Overload" lights up.

Check that the output voltage has not yet been limited.

2.7. Noise

TRANSDUCER SENS.: "1—0—0—0"
UPPER FREQ. LIMIT: "Lin."
LOWER FREQ. LIMIT: "0,3 Hz/Voltage"
INT. TEST SOURCE: "Off"
VOLT/UNIT: "0,1 (1—11 pC, mV/g)"

The instrument should be mounted with side- top- and bottom-plates.

Connect "Input" to ground though a capacitor of 1 nF. Solder the capacitor in a standard plug JP 0028 to prevent pick-up noise.

Connect an Electronic Voltmeter to "Output" and measure the noise signal: max. 1 mV (bandwidth 2—200000 Hz).

Remove JP 0028 and screw on the screening cap YM 0420.

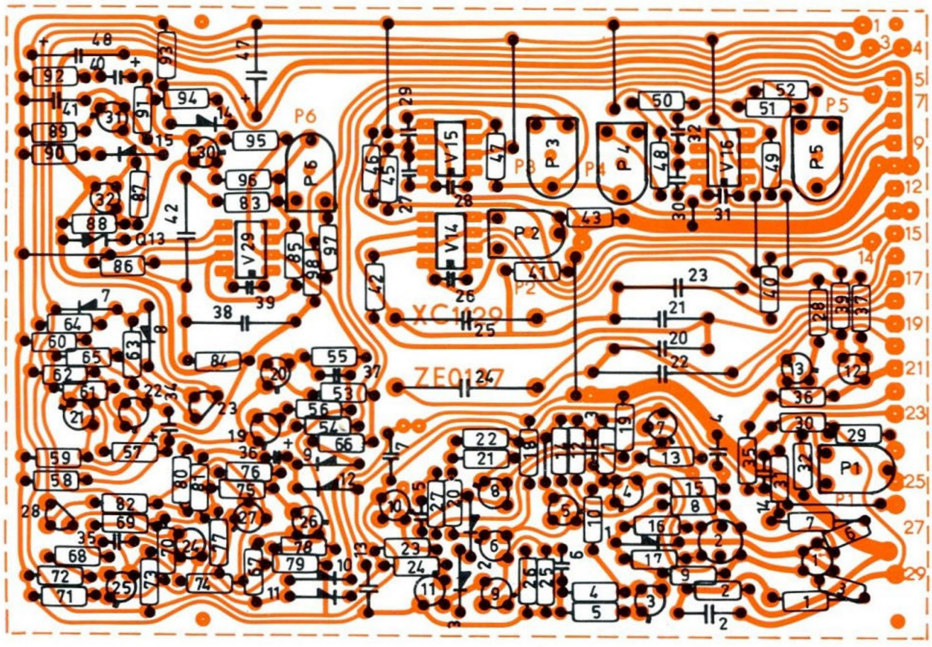
Max. noise signal on "Output": 200 μV (bandwidth 2—20000 Hz).

Circuit and Layout Diagrams with Parts List

ZE 0137

Conditioning Amplifier

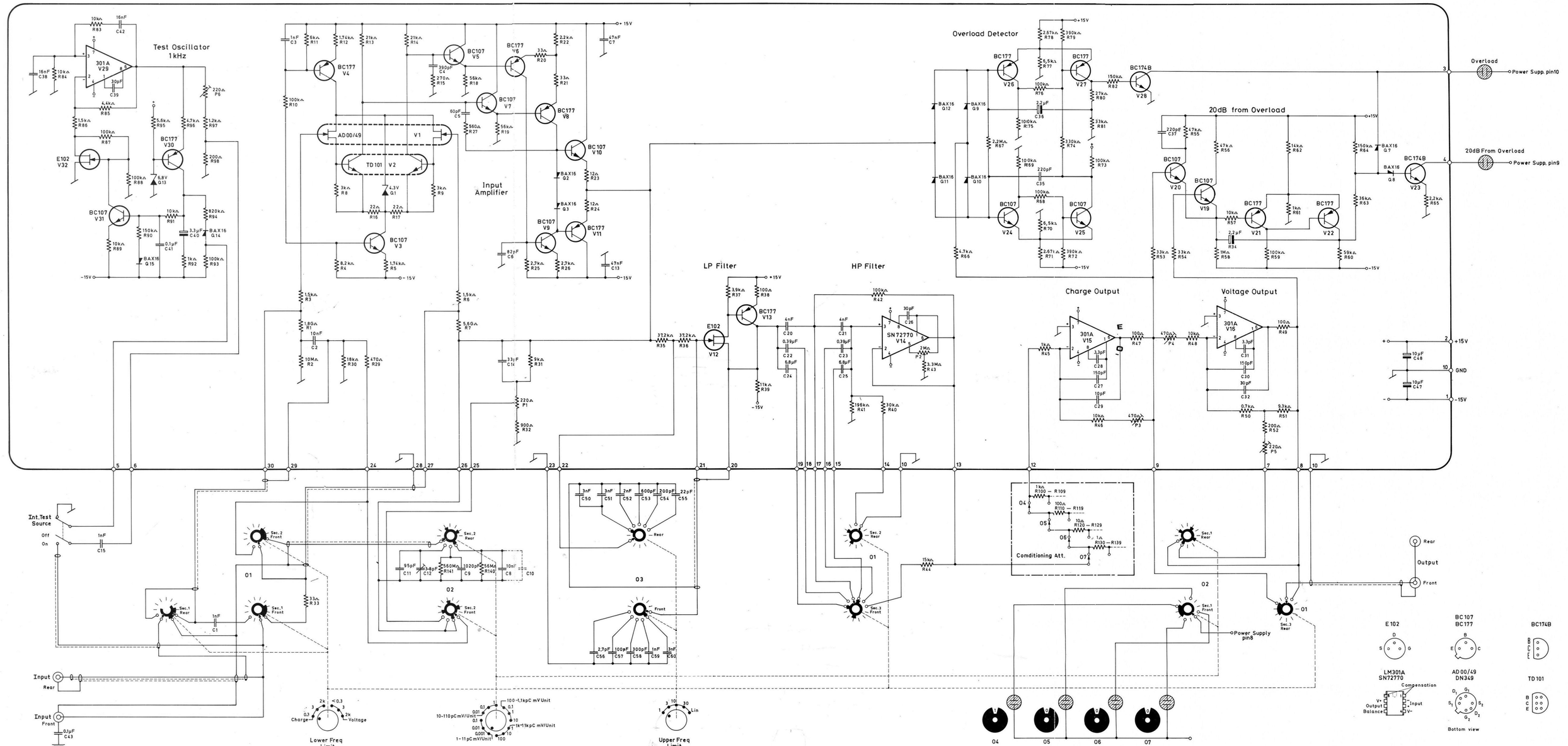
R
C
Q
V



viewed from the printed circuit side

CIRCUIT DIAGRAM REF.	COMPONENT TYPE			STOCK REF.
C 2	Polyester		10 nF/250 V	CS 0394
C 3	Ceramic		1 nF/400 V	CK 3101
C 4	-		390 pF/400 V	CK 2391
C 5	-		60 pF/400 V	CK 1600
C 6	-		82 pF/ 63 V	CK 1820
C 7-13	-		47 nF/ 30 V	CK 4470
C 14	-		33 pF/400 V	CK 1330
C 20,21	Polystyrene		4 nF/ 30 V	CT 1536
C 22,23	Polycarbonate		390 nF/100 V	CS 0341
C 24,25	-		6,8 µF/ 63 V	CS 0397
C 26	Ceramic		30 pF/400 V	CK 0105
C 27	-		150 pF/400 V	CK 2151
C 28	-		3,3 pF/250 V	CK 0331
C 29	-		10 pF/400 V	CK 1100
C 30	-		150 pF/400 V	CK 2151
C 31	-		3,3 pF/250 V	CK 0331
C 32	-		30 pF/400 V	CK 0105
C 34	Tantalum		2,2 µF/ 35 V	CF 0022
C 35	Ceramic		220 pF/400 V	CK 2220
C 36	Tantalum		2,2 µF/ 35 V	CF 0022
C 37	Ceramic		220 pF/400 V	CK 2220
C 38	Polystyrene		16 nF/ 63 V	CT 1539
C 39	Ceramic		33 pF/400 V	CK 1330
C 40	Tantalum		3,3 µF/ 16 V	CF 0014
C 41	Polycarbonate		100 nF/100 V	CS 0409
C 42	Polystyrene		16 nF/ 63 V	CT 1539
C 47,48	Electrolytic		5 µF/ 70 V	CE 0416
P 1	Trimmer	Cermet	lin. 220 Ω	PG 1221
P 2	-	Carbon	- 2 MΩ	PG 5202
P 3,4	-	Cermet	- 470 Ω	PG 1504
P 5,6	-	-	- 220 Ω	PG 1221
Q 1	Zener	ZF 4,3	4,0-4,6/ 5 mA	QV 1110
Q 2,3	Si.	BAX 16	150 V/300 mA	QV 0217
Q 7-12	-	BAX 16	150 V/300 mA	QV 0217
Q 13	Zener	ZG 6,8	6,0-7,5 V/ 5 mA	QV 1106
Q 14,15	Si.	BAX 16	150 V/300 mA	QV 0217

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
R 1	Carbon	1/4 W	10%	1,8 GΩ	RH 0019
R 2	-	1/8 W	10%	10 MΩ	RA 0025
R 3	Metal	1/4 W	1%	1,5 kΩ	RF 3150
R 4	-	-	-	8,25 kΩ	RF 3825
R 5	-	-	-	1,74 kΩ	RF 3174
R 6	-	-	-	1,5 kΩ	RF 3150
R 7	Carbon	1/4 W	20%	5,6 GΩ	RH 0911
R 8,9	Metal	-	1%	3,01 kΩ	RF 3301
R 10	-	-	-	100 kΩ	RF 5100
R 11	-	-	-	6,04 kΩ	RF 3604
R 12	-	-	-	1,74 kΩ	RF 3174
R 13,14	-	-	-	21,5 kΩ	RF 4215
R 15	Carbon	-	5%	270 Ω	RB 2270
R 16,17	-	-	-	22 Ω	RB 1220
R 18,19	-	-	-	56 kΩ	RB 4560
R 20,21	-	-	-	33 Ω	RB 1330
R 22	-	-	-	2,2 kΩ	RB 3220
R 23,24	-	-	-	12 Ω	RB 1120
R 25,26	-	-	-	2,7 kΩ	RB 3270
R 27	-	-	-	560 Ω	RB 2560
R 29	-	-	-	470 Ω	RB 2470
R 30	-	-	-	18 kΩ	RB 4180
R 31	Metal	-	1%	9,09 kΩ	RF 3909
R 32	-	-	-	909 Ω	RF 2909
R 35,36	-	-	-	37,4 kΩ	RF 4374
R 37	Carbon	-	5%	3,9 kΩ	RB 3390
R 38	-	-	-	100 Ω	RB 2100
R 39	Metal	-	1%	11 kΩ	RF 4110
R 40	-	-	-	30 kΩ	RF 4301
R 41	-	-	-	196 kΩ	RF 5196
R 42	-	-	-	100 kΩ	RF 5100
R 43	Carbon	1/8 W	10%	3,3 MΩ	RA 0022
R 45	Metal	1/4 W	1%	1 kΩ	RF 0296
R 46	-	-	-	10,0 kΩ	RF 4100
R 47	Carbon	-	5%	100 Ω	RB 2100
R 48	Metal	-	1%	10,0 kΩ	RF 4100
R 49	Carbon	-	5%	100 Ω	RB 2100


Test Oscillator 1kHz
Input Amplifier
Overload Detector
20dB from Overload
LP Filter
HP Filter
Charge Output
Voltage Output
Overload
Power Supp. pin10
20dB From Overload
Power Supp. pin9
+15V
GND
-15V
Int.Test Source
Off
On
Input Rear
Input Front
Lower Freq Limit 01
Upper Freq Limit 03
Conditioning
04
05
06
07
Conditioning Att.
Power Supply pin8
Output
Rear
Front
E102
BC107 BC177
BC174B
LM301A SN72770
AD00/49 DN349
TD101
Bottom view
453393-ZE0137-17,10,1973-2650

ZE 0137

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
R 50	Metal	-	1%	698 Ω	RF 2698
R 51	-	-	-	9,31 kΩ	RF 3931
R 52	-	-	-	200 Ω	RF 2200
R 53,54	Carbon	-	5%	33 kΩ	RB 4330
R 55,56	-	-	-	47 kΩ	RB 4470
R 57	-	-	-	10 kΩ	RB 4100
R 58	-	-	-	1 MΩ	RB 6100
R 59	-	-	-	100 kΩ	RB 5100
R 60	Metal	-	1%	59 kΩ	RF 4590
R 61	-	-	-	1,3 kΩ	RF 3130
R 62	-	-	-	14 kΩ	RF 4140
R 63	-	-	-	36,5 kΩ	RF 4365
R 64	Carbon	-	5%	150 kΩ	RB 5150
R 65	-	-	-	2,2 kΩ	RB 3220
R 66	Carbon	1/4 W	5%	4,7 kΩ	RB 3470
R 67	-	-	-	2,2 MΩ	RB 6220
R 68,69	-	-	-	100 kΩ	RB 5100
R 70	Metal	-	1%	6,49 kΩ	RF 3649
R 71	-	-	-	2,67 kΩ	RF 3267
R 72	Carbon	-	5%	390 kΩ	RB 5390
R 73	-	-	-	100 kΩ	RB 5100
R 74	-	-	-	330 kΩ	RB 5330
R 75,76	-	-	-	100 kΩ	RB 5100
R 77	Metal	-	1%	6,49 kΩ	RF 3649
R 78	-	-	-	2,67 kΩ	RF 3267
R 79	Carbon	-	5%	390 kΩ	RB 5390
R 80	-	-	-	2,7 kΩ	RB 4270
R 81	-	-	-	33 kΩ	RB 4330
R 82	-	-	-	150 kΩ	RB 5150
R 83,84	Metal	-	1%	10,0 kΩ	RF 4100
R 85	-	-	-	4,42 kΩ	RF 3442
R 86	Carbon	-	5%	1,5 kΩ	RB 3150
R 87,88	-	-	-	100 kΩ	RB 5100
R 89	-	-	-	10 kΩ	RB 4100
R 90	-	-	-	150 kΩ	RB 5150
R 91	-	-	-	10 kΩ	RB 4100
R 92	-	-	-	1 kΩ	RB 3100
R 93	-	-	-	100 kΩ	RB 5100
R 94	-	-	-	820 kΩ	RB 5820
R 95	-	-	-	5,6 kΩ	RB 3560
R 96	-	-	-	4,7 kΩ	RB 3470
R 97	-	-	-	1,2 kΩ	RB 3120
R 98	-	-	-	200 Ω	RB 2220

V 1	FET	N	DN 349	VB 1048
V 2	Silicon	NPN	TD 101	VB 5300
V 3	-	-	BC 107	VB 0032
V 4	-	PNP	BC 177	VB 0071
V 5	-	NPN	BC 107	VB 0032
V 6	-	PNP	BC 177	VB 0071
V 7	-	NPN	BC 107	VB 0032
V 8	-	PNP	BC 177	VB 0071
V 9,10	-	NPN	BC 107	VB 0032
V 11	-	PNP	BC 177	VB 0071
V 12	FET	N	E 102	VB 1028
V 13	Silicon	PNP	BC 177	VB 0071
V 14	Op. Ampl.		SN 72770	VE 0035
V 15,16	-		LM 301 AN	VE 0017
V 19,20	Silicon	NPN	BC 107	VB 0032
V 21,22	-	PNP	BC 177	VB 0071
V 23	-	NPN	BC 174	VB 0537
V 24,25	-	-	BC 107	VB 0032
V 26,27	-	PNP	BC 177	VB 0071
V 28	-	NPN	BC 174 B	VB 0537
V 29	Op. Ampl.		LM 301 AN	VE 0017
V 30	Silicon	PNP	BC 177	VB 0071
V 31	-	NPN	BC 107	VB 0032
V 32	FET	N	E 102	VB 1052

Printed Circuit Board XC 1129

Parts shown on the circuit diagram but not included in ZE 0137

CIRCUIT DIAGRAM REF.	COMPONENT TYPE		STOCK REF.
C 1	Polystyrene	1,1 nF/ 63 V	CT 1148
C 8	Mica	10 nF/ 50 V	CM 0013
C 9	-	1020 pF/ 50 V	CM 0014
C 11	-	95 pF/ 50 V	CM 0015
C 12	Trimmer	3,8 pF/ 63 V	CV 0027
C 15	Polystyrene	1 nF/ 63 V	CT 1170
C 43	Polycarbonate	100 nF/100 V	CS 0334
C 50,51	Polystyrene	3 nF/ 30 V	CT 1157
C 52	-	2 nF/ 63 V	CT 1123
C 52	-	620 pF/100 V	CT 1109
C 54	-	200 pF/100 V	CT 1118
C 55	Ceramic	22 pF/400 V	CK 1220
C 56	-	27 pF/400 V	CK 0270
C 57	Polystyrene	100 pF/500 V	CT 0103
C 58	-	300 pF/100 V	CT 1112
C 59	-	1 nF/ 63 V	CT 1132
C 60	-	3 nF/ 30 V	CT 1157

O 1	Selector (Lower Freq. Limit)		OH 3035
	Above with components		OE 0131
O 2	Selector (Volt/Unit)		OH 3036
	Above with components		OE 0132
O 3	Selector (Upper Freq. Limit)		OH 3044
	Above with components		OE 0133
O 4-7	Selector (Transducer Sensitivity)		OI 0018
O 4	With components	1 kΩ	OE 0130
O 5	With components	100 Ω	OE 0129
O 6	With components	10 Ω	OE 0128
O 7	With components	1 Ω	OE 0127
	Mains socket		OA 0037

R 33	Carbon	1/4	5%	33 Ω	RB 1330
R 44	-	-	-	15 kΩ	RB 4150

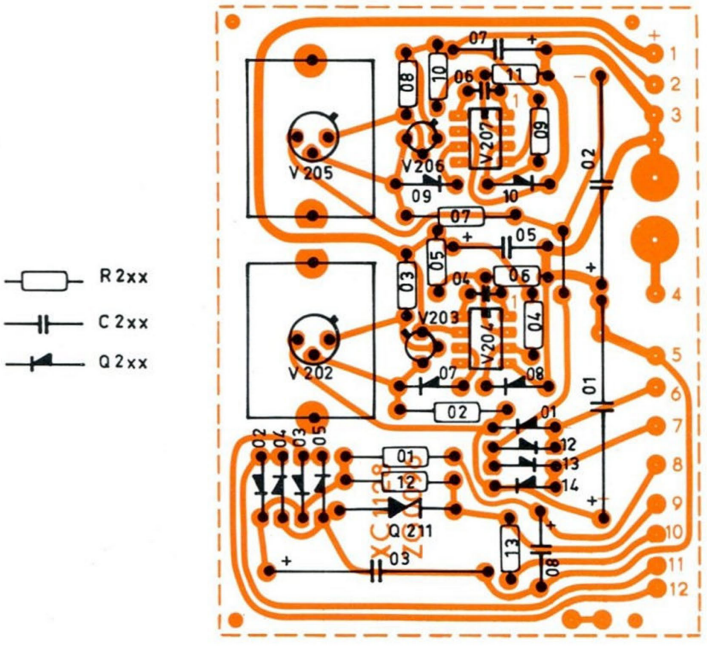
Miniature socket	JJ 0031
Coaxial socket	JJ 0108
BNC socket	JJ 0130
Toggle switch (Int. Test Source)	NN 0047
Sensitivity Dial (0-9)	SD 0019
Sensitivity Dial (1-10)	SD 0020
Knob for above	SN 0039
Knob 20 mm	SN 2021
Neon Lamp	VS 0003

BRÜEL & KJÆR
Nærum - Denmark

Circuit and Layout Diagram with Parts List

ZG 0096

Power Supply

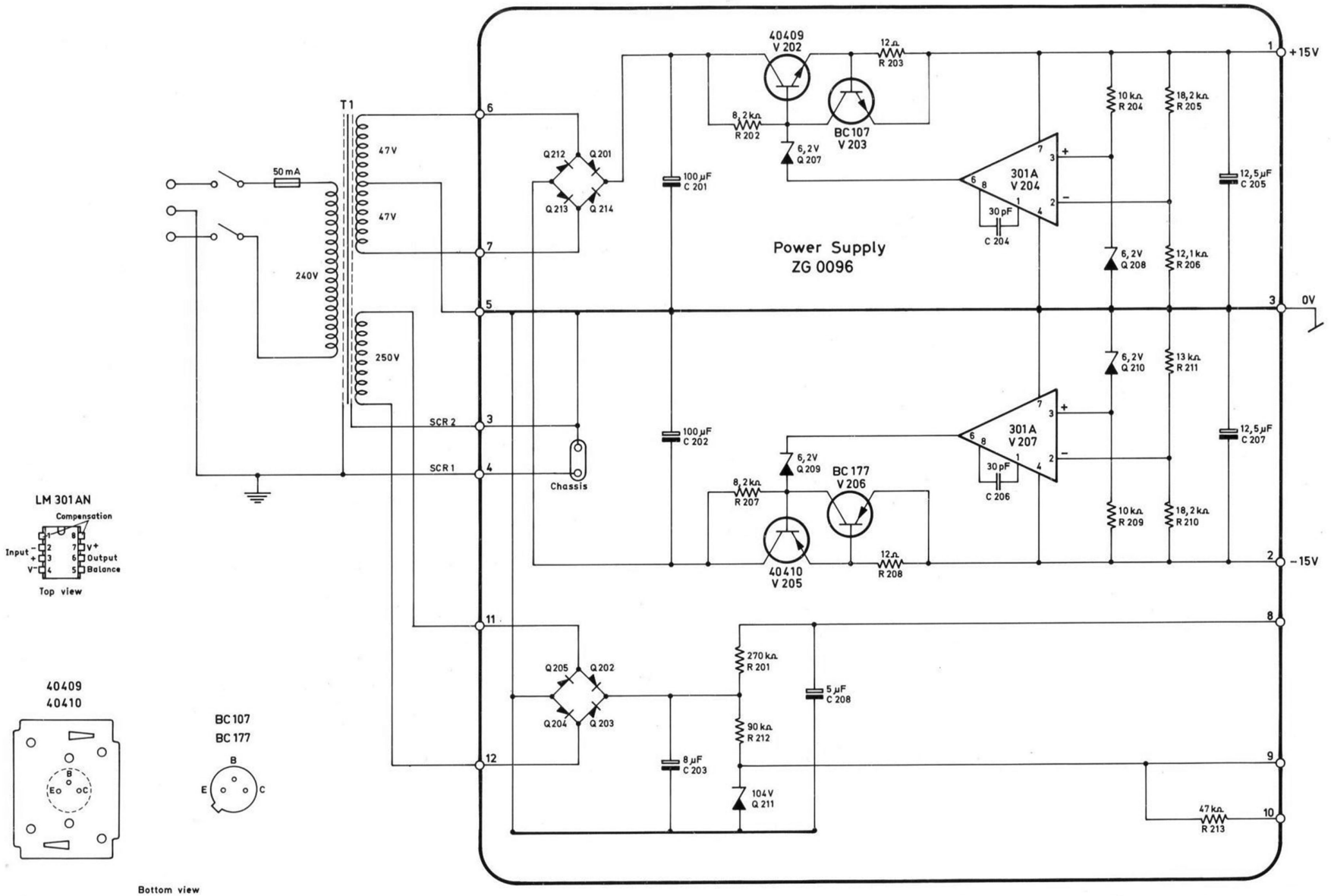


viewed from the printed circuit side

Parts shown on the circuit diagram but not included in ZG 0096

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
C 201,202	Electrolytic			100 µF/100 V	CE 0612
C 203	-			10 µF/350 V	CE 0919
C 204	Ceramic			300 pF/400 V	CK 0105
C 205	Electrolytic			10 µF/ 25 V	CE 0416
C 206	Ceramic			3000 V	CK 0105
C 207	Electrolytic			10 µF/ 25 V	CE 0416
C 208	-			5 µF/ 70 V	CE 0200
Q 201	Si.	1N 4004		400 V/ 1 A	QV 0237
Q 202-205	-	BYX 10		1200 V/150 mA	QV 0025
Q 207	Zener	ZF 6,2		5,9-6,5 V/ 5 mA	QV 1333
Q 208	-	ZP 6,2		5,9-6,5 V/ 5 mA	QV 1334
Q 209	-	ZF 6,2		5,9-6,5 V/ 5 mA	QV 1333
Q 210	-	ZP 6,2		5,9-6,5 V/ 5 mA	QV 1334
Q 211	-	ZF 104		101-107 V/ 5 mA	QV 1323
Q 212-214	Si.	1N 4004		400 V/ 1 A	QV 0237
R 201	Carbon	1/3 W	5%	270 kΩ	
R 202	-	-	-	8,2 kΩ	
R 203	-	1/4 W	-	12 Ω	RB 1120
R 204	-	-	-	10 kΩ	RB 4100
R 205	Metal	-	1%	18,2 kΩ	RF 4182
R 206	-	-	-	12,1 kΩ	RF 4121
R 207	Carbon	1/3 W	5%	8,2 kΩ	
R 208	-	1/4 W	-	12 Ω	RB 1120
R 209	-	-	-	10 kΩ	RB 4100
R 210	Metal	-	1%	18,2 kΩ	RF 4182
R 211	-	-	-	13 kΩ	RF 4130
R 212	Carbon	1/3 W	5%	90 kΩ	
R 213	-	1/4 W	-	47 kΩ	RB 4470
V 202	Silicon		NPN	40409	VB 0509
V 203	-		-	BC 107	VB 0032
V 204	Op. Ampl.			LM 301 AN	VE 0017
V 205	Silicon		PNP	40410	VB 0073
V 206	-		-	BC 177	VB 0071
V 207	Op. Ampl.			LM 301 AN	VE 0017
	Printed Circuit Board				XC 1128 ZG 0096

CIRCUIT DIAGRAM REF.	COMPONENT TYPE	STOCK REF.
	Power Transformer	TN 0088
	Fuse 50 mA Slow	VF 0016
	Fuse socket	JS 0019
	On-Off switch (Mains Power)	NN 0014


Power Supply
ZG 0096
T1
50 mA
240V
47V
47V
250V
SCR 2
SCR 1
Chassis
Q212
Q201
Q213
Q214
Q205
Q202
Q204
Q203
100 µF
C 201
100 µF
C 202
8 µF
C 203
40409
V 202
12 Ω
R 203
8,2 kΩ
R 202
BC107
V 203
6,2V
Q 207
40410
V 205
BC 177
V 206
6,2V
Q 209
8,2 kΩ
R 207
12 Ω
R 208
301A
V 204
30 pF
C 204
301A
V 207
30 pF
C 206
10 kΩ
R 204
18,2 kΩ
R 205
6,2V
Q 208
12,1 kΩ
R 206
6,2V
Q 210
13 kΩ
R 211
10 kΩ
R 209
18,2 kΩ
R 210
12,5 µF
C 205
12,5 µF
C 207
270 kΩ
R 201
90 kΩ
R 212
5 µF
C 208
104V
Q 211
47 kΩ
R 213
+15V
0V
-15V
LM 301 AN
Compensation
Input
Output
Balance
Top view
40409
40410
BC107
BC 177
Bottom view