Brüel & Kjær

Measuring Amplifier
Type 2606

valid from serial no. 454879

0037 – 0079

Service

Measuring Amplifier
Type 2606

valid from serial no. 454879

0037 – 0079

Consisting of:

Trouble Shooting

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

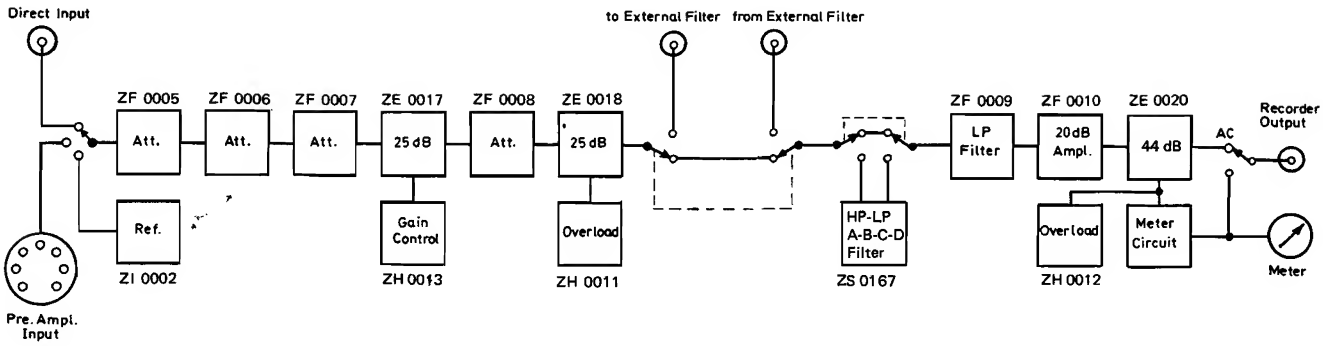
When a fault has been traced and corrected, the voltages and adjustments influenced by the correction must be rechecked. The complete instrument should then be tested according to the Checking Procedure to make sure that all basic functions are operative.

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.

Spare Parts

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



Amplifier section

The first stage of the Input amplifier is a 0 – 90 dB attenuator, which is positioned on three circuit boards, ZF 0005, ZF 0006 and ZF 0007.

The Input attenuator is followed by a low noise 25 dB amplifier ZE 0017 with protection diodes across the input.

Then comes a 0 – 30 dB attenuator ZF 0008 and another 25 dB amplifier ZE 0018.

The resulting Input Amplifier has an amplification of 50 dB and a 0 – 120 dB attenuation.

Furthermore the first 25 dB amplifier can be sensitivity adjusted by means of a "Gain Control" (–12 dB), "Direct Sens." and a "Preamp. Sens." each having an adjustment range of + 4 to –10 dB in respect to normal sensitivity.

An overload indicator ZH 0011 is connected to the output of ZE 0018 in order to indicate when the output voltage is more than 13 dB above 1 V.

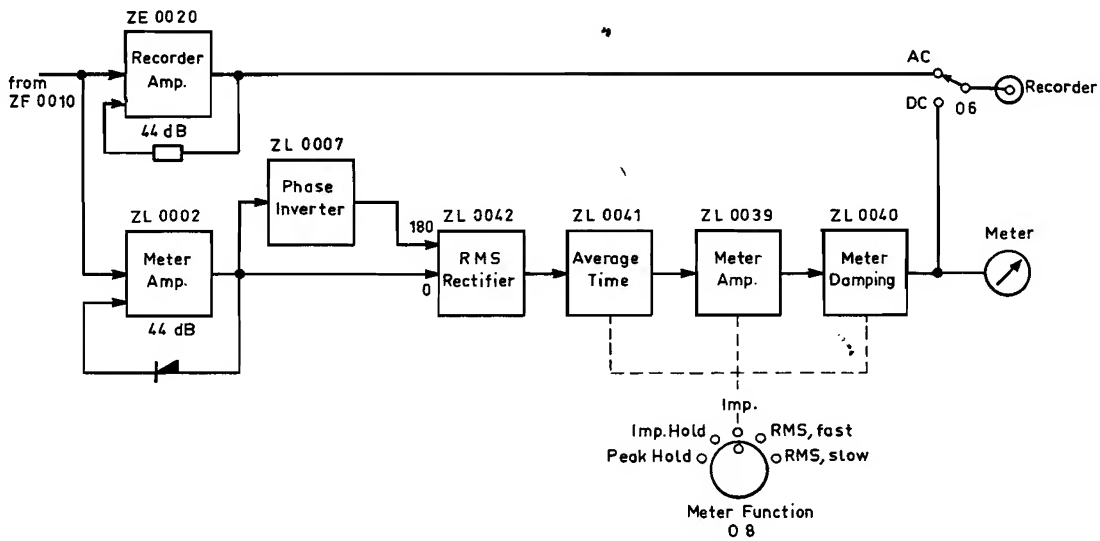
The output of ZE 0018 being low impedance is meant to feed a filter.

The Output Amplifier section consist of a 0 – 20 dB attenuator with a 300 kHz LP filter ZF 0009, a 20 dB amplifier with a 0 – 30 dB attenuator ZF 0010 and a 44 dB output amplifier located on ZE 0020.

This gives a resulting amplification of 64 dB and an attenuation of 0 – 50 dB.

An overload indicator ZH 0012 is connected to the output of ZE 0020.

The last section of the whole amplifier is the Meter section which is later discussed.



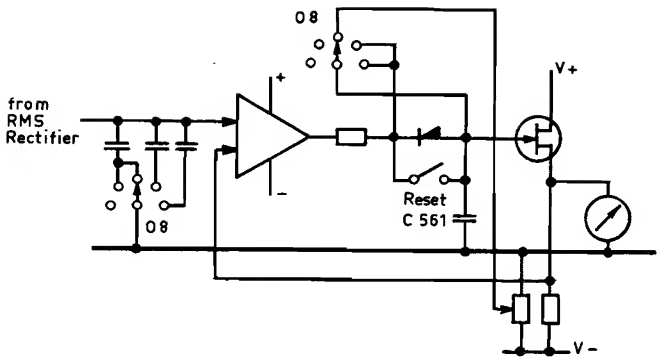
Meter Section

The Meter Section of 2606 consist basically of a Meter Amplifier, a RMS rectifier and a Meter Function circuit.

The signal is first amplified in ZL 0002. To have a large operation temperature range silicon diodes are used in the RMS rectifier ZL 0042.

These diodes have a relatively large voltage drop causing unlinearities in the signal and to compensate for this the Meter Amplifier ZL 0002 uses the same type of diodes in the feedback loop, so a correct signal is passed on to the meter.

valid from serial no 454879

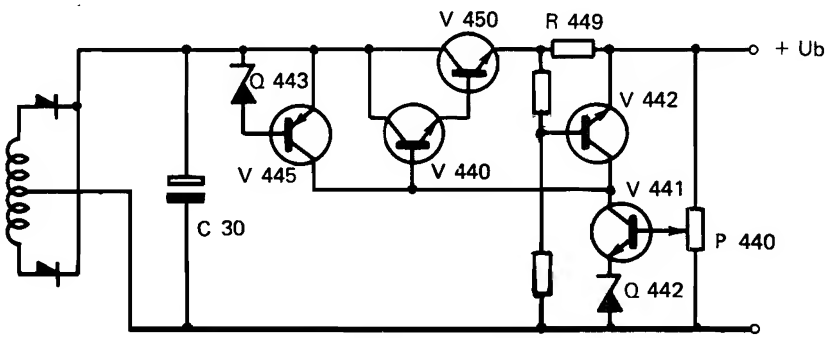


The Meter Function switch selects the different modes. In Hold position the input voltage charges up the capacitor C 561 through a diode. If the signal decreases the diode will cause the voltage across C 561 to be stored. The hold action can be released by the Reset switch. In RMS positions the diode is shortcircuited by the Meter Function switch.

The recorder output signal can be AC or DC dependent of the setting of O 6. Due to the unlinear feedback in Meter Amplifier ZL 0002 an amplifier with a linear feedback ZE 0020 is used as output amplifier for AC recording.

Power Supply

Simplified Diagram of a Voltage Regulator.



The instrument can be powered either from a Power Line which has 100, 115, 220 or 240 V AC 50 – 400 Hz or from a DC Supply of 12 V.

Thus the mains transformer T 1 has two primary windings, one meant for the Power Line operation the other one meant for the 12 V DC Supply which is chopped in a DC/AC Converter ZG 0007.

Connected to the secondary of T 1 there are different rectifier circuits giving different D.C. Voltages which are applied to the Voltage Regulators ZG 0005, 0008 and 0074

These Voltage Regulators are almost identical and their function can be seen from the simplified diagram below.

The function of this Regulator type is that a fixed voltage across Q 442 is compared with the voltage on the base of V 441. A certain difference between these two voltages will give a certain current through V 441. V 445 can be regarded as a collector impedance for V 442 and thus we will have a voltage on the base of V 440 and V 450 of approx. the same value as the output voltage. Now if the output voltage drops, the voltage difference between base and emitter of V 441 will be smaller, the current through V 441 smaller and the base voltage of V 440 and V 450 and the output voltage higher and thus it will regulate until a stabilized condition all the time.

Actually V 445 is not an ordinary collector impedance for V 441, but a constant current source, which means that if we have a constant current through V 441 its collector voltage will be constant as well as independent of hum or unstability across C 30.

Furthermore the Regulator is overload protected by means of V 442 and R 449. V 442 is coupled as a variable impedance from base to emitter of the emitterfollower V 440, 450 and regulated by the bias achieved from the current through R 449. When the impedance of V 442 grows smaller V 440, 450 will be off-biased so that the output voltage and current drops.

The output voltages from the different Regulators can be seen on the circuit diagram and adjusted on the respective circuit boards. If large adjustments are found necessary the circuits should be examined for faults before any adjustment.

The DC/AC Converter ZG 0007 oscillates with a frequency of approx. 60 Hz and the real oscillatortransformer is T 2.

Adjustment of:

+ 20 V	on V 450_E	at P 440
+ 12.6 V	on V 383_E	at P 380
+ 200 V	on Pol. Voltage	at P 420

2.1. Sensitivity

a. GAIN CONTROL: "Cal."
POWER: "On"
INPUT: "Direct"
INPUT ATTENUATOR: "0.1 V"
OUTPUT ATTENUATOR: "x 1"
METER FUNCTION: "RMS–Fast"
RECORDER: "AC"
FILTERS: "All released"

Input signal to "Direct Input" 0.1 V, 1000 Hz.
Adjust "Sens." for full scale deflection on the meter. (Adjustment range for "Sens." adj. approx. +4, –10 dB).

Output voltage on "Recorder" 5 V RMS ± 0.5 dB.

b. RECORDER to "DC"

Output voltage approx. 0.9 V DC. (Measured with a High Impedance Voltmeter.)

c. FILTERS to "A – B – C – D"

Deflection on the meter: 0.1 V ± 0.2 dB.

d. FILTERS to "Ext."

Output voltage on "Ext. Filter In" socket: 1 V ± 0.5 dB

2.2. Frequency Response

INPUT: "Direct"
FILTERS: "All released"
METER FUNCTION: "RMS–Fast"

Input signal to "Direct Input": 1000 Hz. Adjust the input voltage for an 18 dB deflection on the meter.

Vary the frequency from 2 Hz to 200 kHz. Deflection: 18 dB ± 0.5 dB.

From 10 Hz to 50 kHz the tolerance is ± 0.2 dB (+ tolerance of the LF Generator).

2.3. Meter Function

a. INPUT: "Direct"
FILTERS: "All released"
METER FUNCTION: "RMS–Fast"

Input signal to "Direct Input": 1000 Hz. Adjust the input voltage for a 15 dB deflection on the meter.

b. METER FUNCTION to "Impulse"

Meter deflection: 15 dB ± 0.1 dB.
Disconnect the input signal and check that the deflection drops 8.6 dB in 3 sec. ± 0.5 sec.

c. METER FUNCTION to "Imp. Hold"

Connect the previous input signal and shortly depress "Reset".
Meter deflection: 15 dB ± 1 dB.
Disconnect the input signal and check that the deflection drops max. 1.5 dB in one minute.

d. METER FUNCTION to "Peak Hold"

Check as for item c ,but meter deflection: 18 dB.

2.4. Overload Indicators

a. GAIN CONTROL: "Cal."
INPUT: "Direct"
INPUT ATTENUATOR: "0.1 V"
OUTPUT ATTENUATOR: "x 1"
FILTERS: "All released"
METER FUNCTION: "RMS–Fast"

Input to "Direct Input": 1 kHz, 0.1 V RMS corresponding to full scale deflection.

Raise the input signal to 11 dB above 0.1 V: No overload indication.
Raise the input signal to 13 dB above 0.1 V: "Input Overload" indication.

b. FILTERS to "Ext."

Input to "Ext. Filter Out": 1 kHz, 1 V RMS corresponding approx. full scale deflection.

Raise the input signal to 11 dB above 1 V: No overload indication.
Raise the input signal to 13 dB above 1 V: "Output Overload" indication.

2.5. Noise

GAIN CONTROL: "Cal."
INPUT: "Direct"
INPUT ATTENUATOR: "3 mV"
OUTPUT ATTENUATOR: " x 0.01 "
FILTERS: "All released"
METER FUNCTION: "RMS–Fast"

Max. meter deflection for correctly adjusted sensitivity: 14 μV.

Max. meter deflection with shortconnected input: 7 μV.

2.6. Reference

a. GAIN CONTROL: "Cal."
INPUT: "Direct"
INPUT ATTENUATOR: "0.1 V"
OUTPUT ATTENUATOR: "x 1"
FILTERS: "All released"
REF.: "50 mV RMS"

Check the adjustment range of "Sens." and "Gain Control" which should be 10 dB for "Gain Control" and 14 dB for "Sens.".

Leave "Gain Control" in position "Cal." and adjust "Sens." for a deflection to the ref. mark on the 2606 meter scale.

b. REF.: released

Input signal to "Direct Input": 1 kHz, exactly 100 mV.
Meter deflection: 100 mV ± 1%

2.7. Sensitivity with Microphone

GAIN CONTROL: "Cal."
INPUT: "Preamp."
INPUT ATTENUATOR: "0.1 V"
OUTPUT ATTENUATOR: "x 1"
FILTERS: "All released"
REF.: "50 mV RMS"

Adjust "Preamp. Sens." to the correct sensitivity of the microphone and connect a Microphone preamplifier to "Preamp. Input".

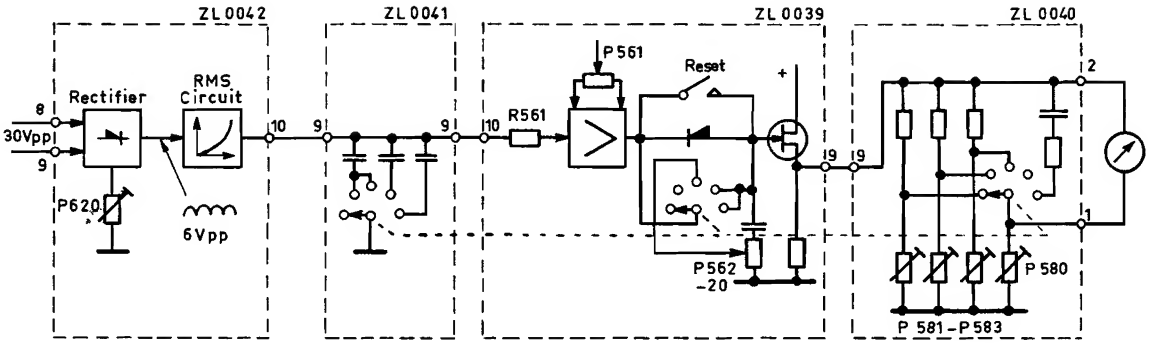
REF.: released
INPUT ATTENUATOR: "3 V"

Check the sensitivity with a Pistonphone Type 4220 or a similar well known sound source. The meter deflection on Type 2606 should be equal to the Sound Pressure Level produced by the pistonphone.
(Remember corrections for the actual static pressure). Tolerance: 0.2 dB (Pol. voltage 200 V ± 1 V).

The following table tells what to care about when replacing printed circuit boards with components:

By replacement of:

ZE	0017	25 dB Amplifier	Check items 5.1 to 5.8
ZE	0018	25 dB Amplifier	Check items 5.1 to 5.8
ZE	0020	50 dB Amplifier	Check items 4.1 to 4.7 and 3.1
ZF	0005	Attenuator	No adjustment necessary
ZF	0006	Attenuator	Check item 5.3
ZF	0007	Attenuator	Check item 5.3
ZF	0008	Attenuator	Check item 5.3
ZF	0009	LP Filter	Check items 4.2 and 4.3
ZF	0010	20 dB Amplifier	Check items 4.3 and 3.1
ZG	0005	+ 12.6 V Regulator	Adjust P 380 for + 12.6 V on V 383_E
ZG	0007	DC/AC Converter	No adjustment necessary
ZG	0008	+ 140 V and Pol. Volt. Reg.	Adjust P 420 for Pol. Volt. 200 V ± 1 V and check + 140 V
ZG	0074	± 20 V Regulator	Adjust P 440 for + 20 V on V 447_E and check −20 V on V 446_E
ZH	0011	Overload Indicator	Check item 5.4
ZH	0012	Overload Indicator	Check item 4.4
ZH	0013	Gain Circuit	Check item 5.7
ZI	0002	Ref. Oscillator	Check item 5.7
ZL	0002	Meter Amplifier	Check items 3.1 to 3.5
ZL	0007	Phase Inverter	Check item 3.2.
ZL	0039	Meter Amplifier	Check items 3.1 to 3.5
ZL	0040	Meter Damping	Check items 3.1 to 3.5
ZL	0041	Average Time	Check items 3.1 to 3.5
ZL	0042	RMS Rectifier	Check items 3.1 to 3.5
ZS	0167	Weighting Network.	Check item 6.2



3.1. Sensitivity Check

a. INPUT: "Direct"
INPUT ATTENUATOR: "1 V"
OUTPUT ATTENUATOR: "x 1"
FILTERS: "All released"
METER FUNCTION: "RMS–Fast"
AC–DC: "AC"

Input signal to "Direct Input": 1000 Hz. Adjust the input to exactly 5 V RMS on "Recorder" output.

Meter deflection: Exactly 1 V (full scale).

b. METER FUNCTION to "Imp. Hold"

Depress "Meter Reset" and release it again.
Meter deflection: 1 V ± 0.05 dB.

3.2. Sensitivity Adjustment

a. INPUT: "Direct"
INPUT ATTENUATOR: "1 V"
OUTPUT ATTENUATOR: "x 1"
FILTERS: "Ext."
METER FUNCTION: "RMS–Fast"
AC–DC: "AC"

Meter deflection: 0 V.
If necessary adjust P 561 (on ZL 0039).

b. METER FUNCTION to "Impulse"
FILTERS: "All released"

Turn P 562 (on ZL 0039) fully counterclockwise and then clockwise until the meter deflection is just below 0 V.

c. METER FUNCTION to "RMS–Fast"

Input signal to "Direct Input": 2 kHz, 1 V.
Check with an oscilloscope that the tops of the rectified signal on the cathodes of Q 624, 625 are equal.
If necessary adjust P 640 (on ZL 0007).

Change the signal frequency to 200 kHz and check the curve again.
If necessary adjust C 640 (on ZL 0007).

Adjust the input voltage at 2 kHz for exactly 5 V on "Recorder" output.
Adjust P 580 (on ZL 0040) for full scale deflection.

d. METER FUNCTION to "Impulse"

Adjust P 583 (on ZL 0040) for full scale deflection.

e. METER FUNCTION to "Imp. Hold"

Depress "Reset" shortly. Adjust P 582 (on ZL 0040) for full scale deflection.

f. METER FUNCTION to "Peak, Hold"

Decrease the input voltage 3 dB.
Depress "Reset" shortly.
Adjust P 581 (on ZL 0040) for full scale deflection.

valid from serial no. 454879

3.3. Overshoot

INPUT: "Direct"
INPUT ATTENUATOR: "1 V"
OUTPUT ATTENUATOR: "x 1"
FILTERS: "All released"
METER FUNCTION: "RMS–Fast"

Input signal to "Direct Input": 1000 Hz.

Adjust the input voltage for a 16 dB deflection on the meter.

Disconnect the input signal shortly and check the overshoot when reconnecting.

Overshoot: 0.1 – 1.1 dB for "RMS fast"
0.1 – 1.6 dB for "RMS slow"

3.4. Meter Decay Time Constant

a. INPUT: "Direct"
INPUT ATTENUATOR: "1 V"
OUTPUT ATTENUATOR: "x 1"
FILTERS: "All released"
METER FUNCTION: "Impulse"

Input signal to "Direct Input": 1000 Hz.

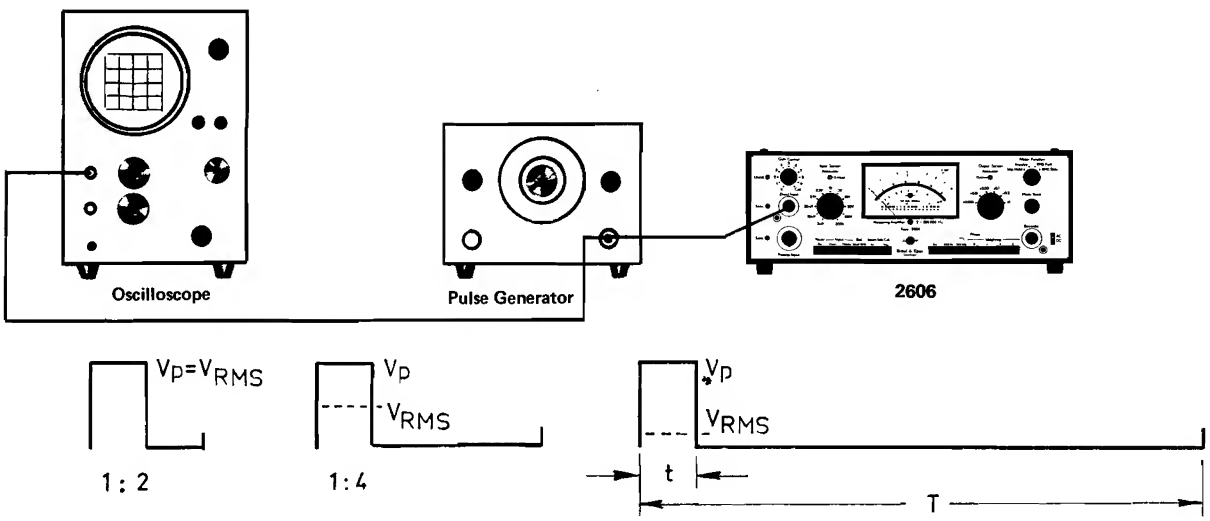
Adjust the input voltage for a 18.7 dB deflection on the meter.

Disconnect the input signal and measure the time it takes the pointer to decrease from 18.7 to 10 dB.
Decay time: 3 sec ± 1 sec.

b. METER FUNCTION to "Imp. Hold"

Connect the input voltage and adjust for a 20 dB deflection.

When the input signal is disconnected the meter deflection must not decrease more than 0.5 dB/20 sec. (at 25°C).



3.5. Check of RMS Indication

INPUT: "Direct"
INPUT ATTENUATOR: "1 V"
OUTPUT ATTENUATOR: "x 1"
FILTERS: "All released"
METER FUNCTION: "RMS Fast"
AC–DC: "AC"

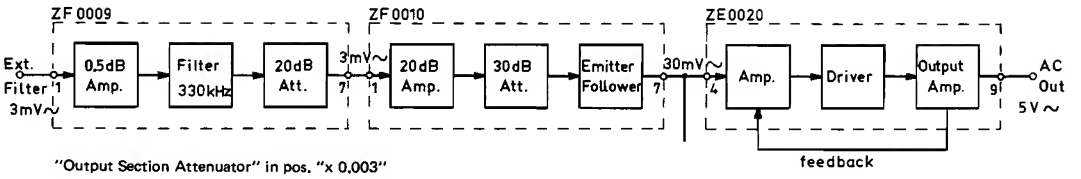
At a pulse duration of 0.1 msec. and a ratio of 1:2 the input voltage to 2606 should be adjusted to give a 10.2 dB deflection.

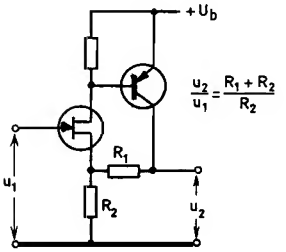
Check the indication for various pulse ratioes according to following scheme.

OUTPUT ATTENUATOR	$\frac{t}{T}$	$\frac{V_p}{V_{RMS}}$	Deflection dB
x 1	1:2	1	10.2
x 0.3	1:5	2	18.1 ± 0.5
x 0.3	1:10	3	15.6 ± 0.5
x 0.3	1:26	5	11.7 ± 0.5
x 0.1	1:100	10	16 ± 0.5
x 0.1	1:200	14	13 ± 1.0
x 0.1	1:400	20	10 ± 1.0
x 0.1	1:900	30	6.5 ± 1.5

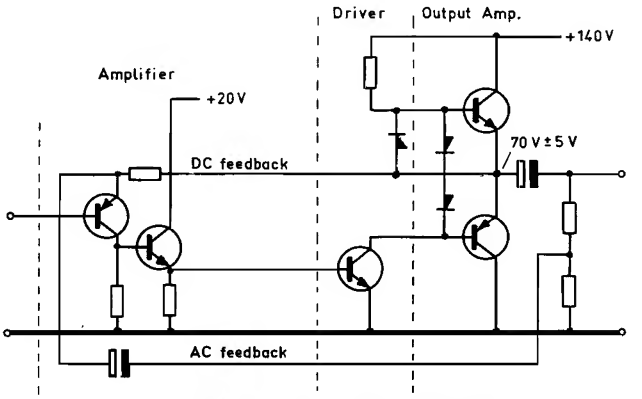
If the indication is out of specification P 620 could be adjusted experimentally but then the whole sensitivity adjustment should be carried out according to item 3.2.

Block Diagram of the Output Amplifiers





Simplified Diagram of Amplifier used in ZF 0009 and ZF 0010.



Simplified Diagram of the Amplifiers used in ZE 0020, ZL 0002 and ZL 0007.

4.1. Sensitivity

FILTERS: "Ext."
OUTPUT ATTENUATOR: "x 1"
AC–DC: "AC"

Input signal to "Ext. Filter Out": 1 kHz, 1 V RMS.

"Recorder" output: 5 V ± 0.5 dB

If not check the 30 mV on V 360 emitter (ZF 0010).

4.2. Frequency Response

FILTERS: "Ext."
OUTPUT ATTENUATOR: "x 1"
AC–DC: "AC"

Input signal to "Ext. Filter Out": 1 kHz. Adjust the input voltage to give 5 V on "Recorder" output.

Vary the frequency from 2 – 200000 Hz.

"Recorder" output: 5 V ± 0.2 dB

If necessary adjust L 280 (on ZF 0009) at 200000 Hz.

At an input frequency of 500 kHz the "Recorder" output voltage should be 15 dB ± 3 dB below 5 V.

4.3. Output Attenuator

FILTERS: "Ext."
OUTPUT ATTENUATOR: "x 1"
METER FUNCTION: "RMS–Lin."
AVERAGING TIME: "Fast"

Input signal to "Ext. Filter Out": 1 kHz. Adjust the input voltage for an 18 dB deflection on the meter.

Check the steps of the output attenuator compared to the attenuator of the LF Generator or a special Attenuator Box.

Tolerance: ± 0.1 dB (+ tolerance of the LF Generator attenuator).

At 200 kHz the tolerance is ± 0.2 dB.

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4.4. Overload Indicator

OUTPUT ATTENUATOR: "x 0.1"
FILTERS: "Ext."
AC–DC: "AC"

Input signal to "Ext. Filter Out": 1 kHz. Adjust the input voltage to give 56 V_p on "Recorder" output.

The "Output Section Overload" should indicate overload within ± 0.5 dB of this condition. From 50 kHz to 200 kHz within 0.8 dB.

Check at 200 kHz if the indication is still correct and with an oscilloscope that the output voltage has not yet been limited.

If necessary adjust P 480 (on ZH 0012) until correct indication.

4.5. Output Impedance

OUTPUT ATTENUATOR: "x 1"
FILTERS: "Ext."
AC–DC: "AC"

Input signal: 1 kHz. Adjust the input voltage to give exactly 5 V on "Recorder" output.

Load the "Recorder" output with a resistor of 1 kΩ.

The "Recorder" voltage should drop max. 0.5 dB corresponding an output impedance of 50 Ω.

The above mentioned check should be made at 200 kHz as well.

4.6. Distortion

OUTPUT ATTENUATOR: "x 1"
FILTERS: "Ext."
AC–DC: "AC"

Input signal to "Ext. Filter Out": 1 kHz. Adjust the input voltage to give 5 V on "Recorder" output.

Measure the distortion at 1 kHz: max. 0.1%.
50 kHz: max. 0.3%.

4.7. Noise and Hum

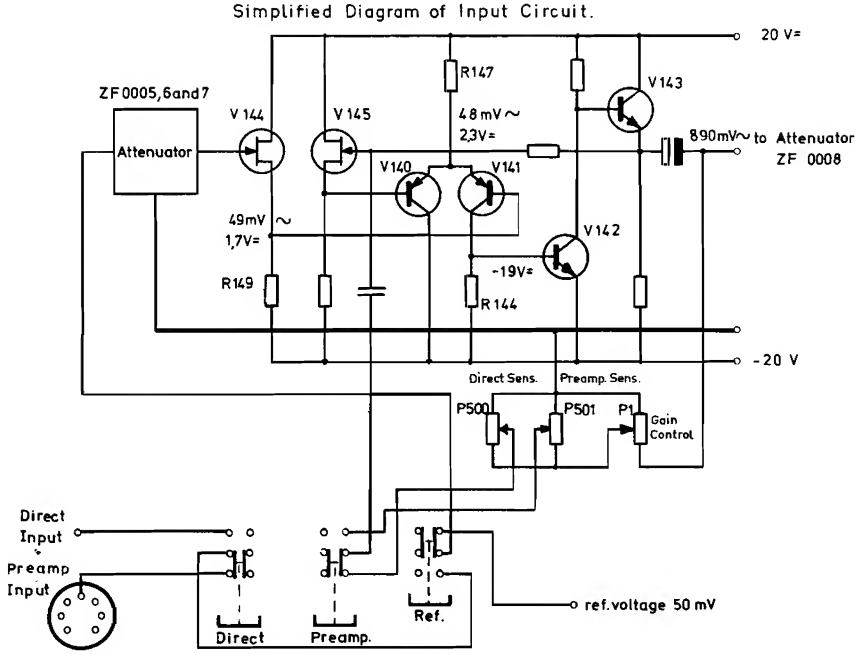
FILTERS: "Ext."
AC–DC: "AC"

Shortconnect "Ext. Filter Out" socket.
Connect a Frequency Analyzer to "Recorder" output.

Check noise and hum according to following scheme:

	FILTERS				
	all released			22.4 Hz	22.4 kHz
OUTPUT ATTENUATOR: "x 0.003"	20 mV	10 mV	20 mV	80 mV	80 mV
OUTPUT ATTENUATOR: "x 1"	1 mV	1 mV	1 mV	3 mV	3 mV
Frequency Analyzer to:	50 Hz	100 Hz	150 Hz		
	Selective			linear	

Simplified Diagram of Input Circuit.



5.1. Sensitivity

GAIN CONTROL: "Cal."
INPUT: "Direct"
INPUT ATTENUATOR: "0.1 V"
FILTERS: "Ext."

Input signal to 2606 "Direct Input": 1 kHz – 100 mV.
Output voltage on "Ext. Filter In" socket: 1 V ± 0.5 dB (for correctly adjusted sensitivity).
The DC voltage on "Ext. Filter In" socket should be 1 V ± 1.5 V.

5.2. Frequency Response

GAIN CONTROL: "Cal."
INPUT: "Direct"
INPUT ATTENUATOR: "0.1 V"
FILTERS: "Ext."

a. Connect an LF generator directly to an electronic voltmeter and check the frequency response of these two instruments alone. Evt. note the deviation from linear.

b. Input signal to "Direct Input": 1 kHz adjusted to give 1 V on "Ext. Filter In" socket.

Vary the frequency from 2 Hz to 200 kHz.
Voltage on "Ext. Filter In" socket: 1 V $^{+\ 0.1}_{-0.2}$ dB (+ tolerance of the voltmeter).
If necessary adjust C 160 at 200 kHz (ZE 0018).

5.3. Input Attenuator

GAIN CONTROL: "Cal."
INPUT: "Direct"
INPUT ATTENUATOR: "0.1 V"
FILTERS: "Ext."

Input signal to "Direct Input": 1 kHz. Adjust the input voltage to give 1 V on "Ext. Filter In" socket.
Check the steps of the input attenuator compared to the attenuator of the LF generator or a special attenuator box.
Tolerance: ± 0.1 dB (+ tolerance of the LF generator attenuator).
At 200 kHz the tolerance is ± 0.2 dB.
If necessary adjust C 220 – 223 (ZF 0006).

5.4. Overload Indicator

GAIN CONTROL: "Cal."
INPUT: "Direct"
INPUT ATTENUATOR: "0.1 V"
FILTERS: "Ext."

Input signal to "Direct Input": 1 kHz. Adjust the input voltage to give 1 V on "Ext. Filter In" socket.
The "Input Section Overload" should indicate overload within ± 0.5 dB of this condition.

Check at 200 kHz if the indication is still correct and with an oscilloscope that the output has not yet been limited.
If necessary adjust P 460 (on ZH 0011) until correct overload indication.

5.5. Output Impedance

GAIN CONTROL: "Cal."
INPUT: "Direct"
INPUT ATTENUATOR: "0.1 V"
FILTERS: "Ext."

Input to "Direct Input": 1 kHz. Adjust the input voltage to give 1 V on "Ext. Filter In" socket.
Load the socket with a resistor of 200 Ω.

The "Ext. Filter In" output voltage should drop max. 0.5 dB corresponding to an output impedance of 10 Ω.

The above mentioned check should be made at 200 kHz as well.

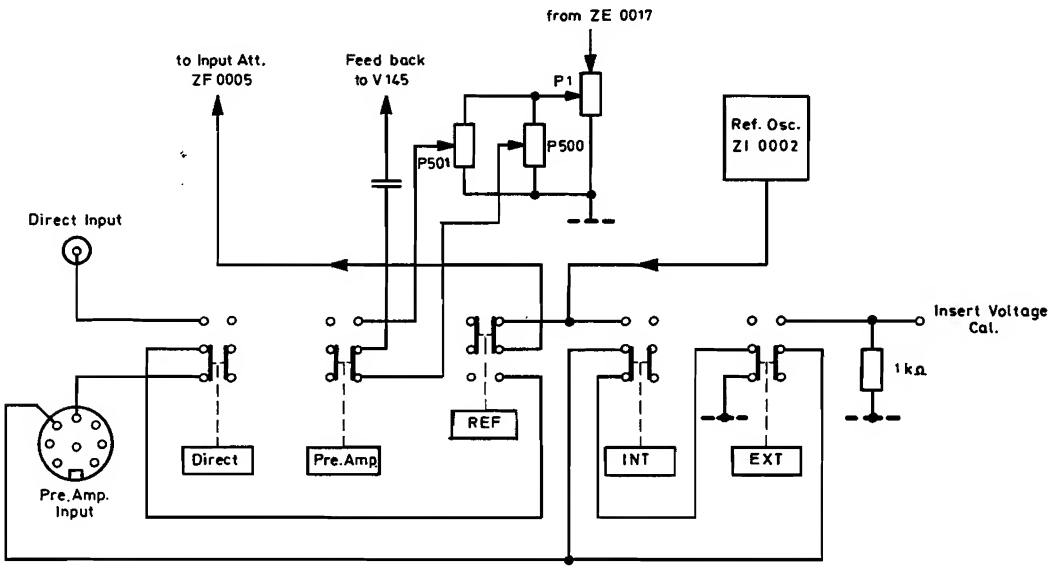
5.6. Distortion

GAIN CONTROL: "Cal."
INPUT: "Direct"
INPUT ATTENUATOR: "0.1 V"
FILTERS: "Ext."

Input signal to "Direct Input": 1 kHz. Adjust the input voltage to give 1 V RMS on "Ext. Filter In" socket.

Measure the distortion at 1 kHz: max. 0.01%.
50 kHz: max. 0.03%.

Simplified Diagram of the Calibration Facilities



5.7. Reference

a. GAIN CONTROL: "Cal."
INPUT: "Direct"
INPUT ATTENUATOR: "0.1 V"
OUTPUT ATTENUATOR: "x 1"
FILTERS: "All released"
METER FUNCTION: "RMS–Fast"

Input signal to "Direct" input: 1 kHz exactly 100 mV.
Adjust "Direct Sens." to full scale deflection.

b. REF. to "50 mV RMS"

The 2606 meter should deflect to the ref. mark.
If necessary adjust P 520 on ZI 0002.

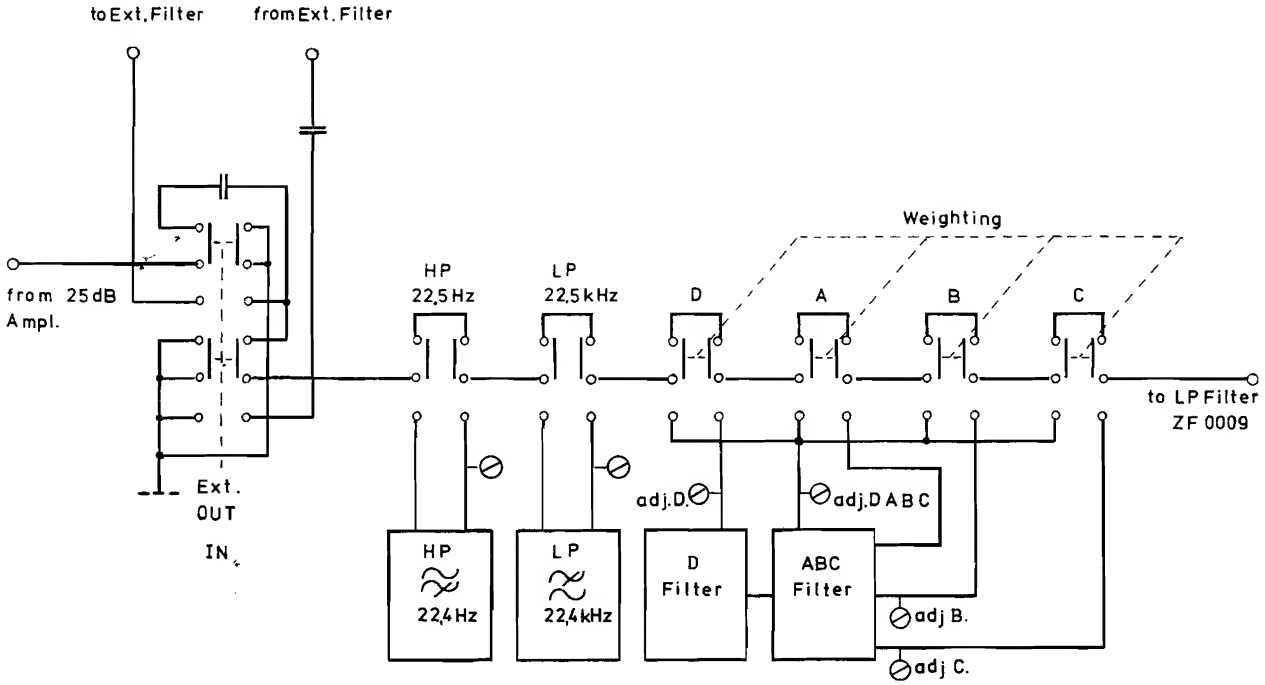
Check the frequency and evt. the distortion with a Frequency Analyzer connected to the housing of V 520. (ZI 0002)
Frequency: 1000 Hz. Distortion: max. 2%.

5.8. Hum

GAIN CONTROL: "Cal."
INPUT: "Direct"

Measure the hum at the "Ext. Filter In" socket selectively according to following scheme:

	Input shortconnected			Input open		
INPUT ATTENUATOR	50 Hz	100 Hz	150 Hz	50 Hz	100 Hz	150 Hz
3 mV	250 μV	100 μV	250 μV	630 μV	630 μV	630 μV
10 mV – 300 V	80 μV	35 μV	80 μV	210 μV	210 μV	210 μV



6.1. Network Level at 1000 Hz

a. INPUT ATTENUATOR: "30 mV"
REF.: "50 mV"
OUTPUT ATTENUATOR: "x 1"
METER FUNCTION: "RMS-Fast"
FILTERS: All released

Adjust "Gain Control" to 18 dB deflection on the meter.

Check if the deflection is 18 dB ± 0.2 dB in all Filter positions.

If not adjust:

22.4 Hz	filter level	by P 701	
22.4 kHz	filter level	by P 700	
A-B-C-D	network levels	by P 705	on ZS 0167
B	network level	by P 704	
C	network level	by P 703	
D	network level	by P 702	

6.2. Network Characteristic

GAIN CONTROL: "Cal"
INPUT ATTENUATOR: "0.1 V"
INPUT: "Direct"
OUTPUT ATTENUATOR: "x 1"
METER FUNCTION: "RMS-Fast"

Input signal to "Direct Input": 1000 Hz. Adjust the input voltage for an 18 dB deflection.

Check the network characteristic according to following scheme:

Freq. Hz	Curve D		Curve A		Curve B		Curve C	
	Meter Defl.	OUTPUT ATT	Meter Defl.	OUTPUT ATT	Meter Defl.	OUTPUT ATT	Meter Defl.	OUTPUT ATT
16	11.5 – 17.5	x 0.03	∞ – 4.3	x 0.01	6.5 – 12.5	x 0.1	16.5 – 22.5	x 0,3
31.5	8.9 – 11.9	x 0,1	7.1 – 10.1	x 0.03	9.4 – 12.4	x 0.3	13.5 – 16.5	x 1
63	14.9 – 17.9	x 0.1	10.3 – 13.3	x 0.1	17.2 – 20.2	x 0.3	15.7 – 18.7	x 1
125	11 – 13	x 0.3	10.9 – 12.9	x 0.3	12.8 – 14.8	x 1	16.8 – 18.8	x 1
250	15.1 – 17.1	x 0.3	8.4 – 10.4	x 1	15.7 – 17.7	x 1	17 – 19	x 1
500	17 – 19	x 0.3	13.8 – 15.8	x 1	16.7 – 18.7	x 1	17 – 19	x 1
1000	17 – 19	x 0.3	17 – 19	x 1	17 – 19	x 1	17 – 19	x 1
2000	13 – 15	x 1	18.2 – 20.2	x 1	16.9 – 18.9	x 1	16.8 – 18.8	x 1
4000	17.9 – 19.9	x 1	18 – 20	x 1	16.3 – 18.3	x 1	16.2 – 18.2	x 1
8000	11 – 15.5	x 1	13.9 – 18.4	x 1	12.1 – 16.1	x 1	12 – 16.5	x 1
16000	∞ – 16.6	x 0.3	∞ – 14.4	x 1	∞ – 12.6	x 1	∞ – 22.5	x 0.3
20000	∞ – 12.9	x 0.3	∞ – 11.7	x 1	∞ – 19.9	x 0.3	∞ – 19.8	x 0.3

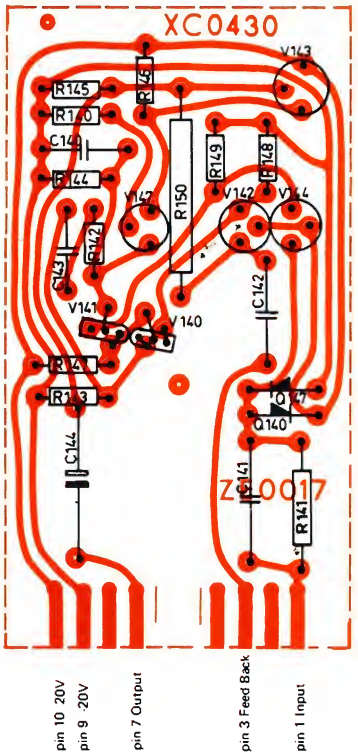
22.4 Hz Filter: Deflection 15 dB ± 0.5 dB at 22.4 Hz.
22.4 kHz Filter: Deflection 15 dB ± 0.5 dB at 22.4 kHz.

BRÜEL & KJÆR
Nærum – Denmark

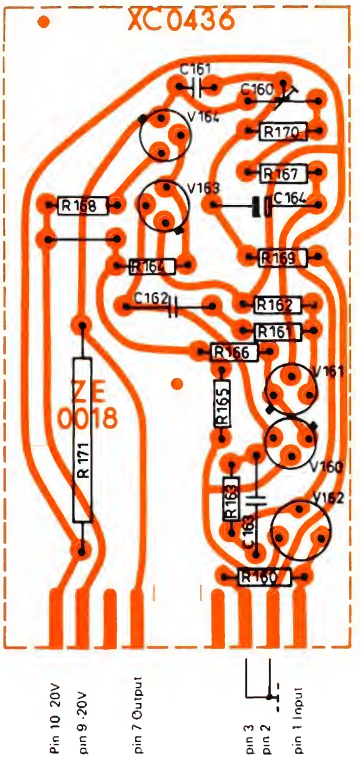
Layout Diagrams with Parts List

ZE 0017
ZE 0018
ZE 0020

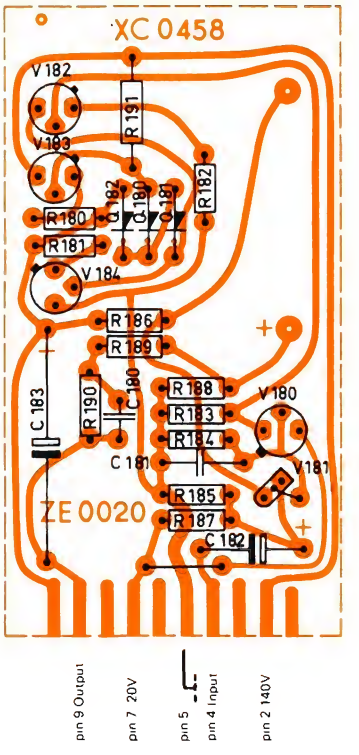
Amplifiers



ZE 0017 25 dB Amplifier



ZE 0018 25 dB Amplifier



ZE 0020 44 dB Amplifier

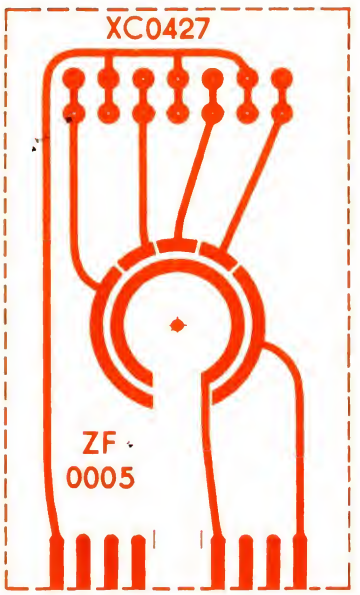
CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
ZE 0017 25 dB Amplifier					
C 140	Polystyrene			470 pF/125 V	CT 1111
C 141	Polyester			22 nF/400 V	CS 0105
C 142	-			0.15 µF/100 V	CS 0337
C 143	Polystyrene			620pF/125 V	CT 1109
C 144	Electrolytic			25 µF/ 25 V	CE 2002
Q 140,141	Silicon	50 V/150 mA		BAX 13	QV 0223
R 140	Carbon	1/4 W	5%	47 Ω	RB 1470
R 141	Metal	-	1%	8.25 kΩ	RF 0118
R 142	-	-	-	475 Ω	RF 2475
R 143,144	-	-	-	2.21 kΩ	RF 3221
R 145	-	-	-	3.09 kΩ	RF 3309
R 146	-	-	-	5.62 kΩ	RF 3562
R 147	-	-	-	26.7 kΩ	RF 4267
R 148	-	-	-	39.2 kΩ	RF 4392
R 149	-	-	-	60.4 kΩ	RF 4604
R 150	Carbon	1/2 W	10%	20MΩ	
V 140,141	Silicon	PNP		2 N 4289	VB 0049
V 142,143	-	NPN		BF 173	VB 0065
V 144,145	F.E.T. (paired)	N		E 102	VB 1010
	Printed Circuit Board				XC 0430
ZE 0018 Amplifier					
C 160	Ceramic trim.			6–25 pF/250 V	CV 0037
C 161	-			10 pF/400 V	CK 1100
C 162	Polystyrene			200pF/125 V	CT 1118
C 163	-			620pF/125 V	CT 1109
C 164	Electrolytic			12.5 µF/ 25 V	CE 0416

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
R 160	Carbon	1/8 W	10%	10MΩ	RA 0025
R 161	-	1/4 W	5%	470 Ω	RB 2470
R 162,163	-	-	-	4.7 kΩ	RB 3470
R 164	-	-	-	10 kΩ	RB 4100
R 165	-	-	-	47 kΩ	RB 4470
R 166	-	-	-	68 kΩ	RB 4680
R 167	-	-	-	470 kΩ	RB 5470
R 168	Metal	-	1%	182 Ω	RF 2182
R 169	-	-	-	619 Ω	RF 2619
R 170	-	-	-	11 kΩ	RF 4110
R 171	Carbon	1/2 W	2%	800 Ω	
V 160,161	Silicon	NPN		BC 107	VB 0032
V 162	F.E.T.	N		E 102 Sel.	VB 1024
V 163,164	Silicon	PNP		2 N 2905	VB 0059
	Printed Circuit Board				XC 0436
ZE 0020 Amplifier					
C 180	Ceramic			1 pF/400 V	CK 0100
C 181	Polystyrene			100 pF/125 V	CT 1133
C 182	Electrolytic			12.5 µF/ 25 V	CE 0416
C 183	-			20 µF/100 V	CE 0602
C 184	-			400 µF/ 10 V	CE 0305
Q 180,181	Silicon	100 V/300 mA		BAX 16	QV 0217
Q 182	-	100 V/225 mA		EC 401	QV 0213

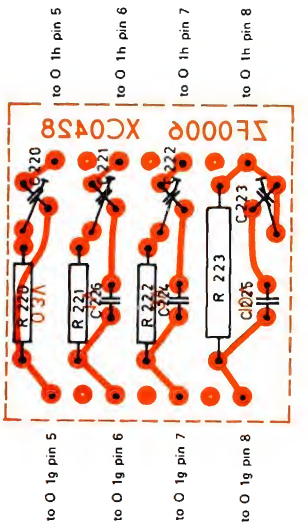
R 180	Carbon	1/4 W	5%	22 Ω	RB 1220
R 181	-	-	-	56 Ω	RB 1560
R 182	-	-	-	120 Ω	RB 2120
R 183	-	-	-	1 kΩ	RB 3100
R 184	-	-	-	10 kΩ	RB 4100
R 185	-	-	-	100 kΩ	RB 5100
R 186	-	-	-	470 kΩ	RB 5470
R 187	-	-	-	820 kΩ	RB 5820
R 188	Metal	-	1%	464 Ω	RF 2464
R 189	-	-	-	4.64 kΩ	RF 3464
R 190	-	-	-	95.3 kΩ	RF 4953
R 191	Carbon	1/3 W	5%	31.6 kΩ	

V 180	Silicon	NPN	BC 107	VB 0032
V 181	-	PNP	2 N 4289	VB 0049
V 182,183	-	NPN	BF 178	VB 0052
V 184	-	PNP	MM 4003	VB 0068
	Printed Circuit Board			XC 0458

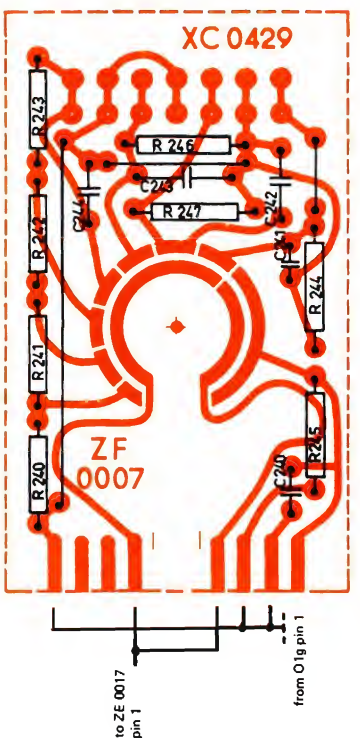
Layout Diagrams with Parts List



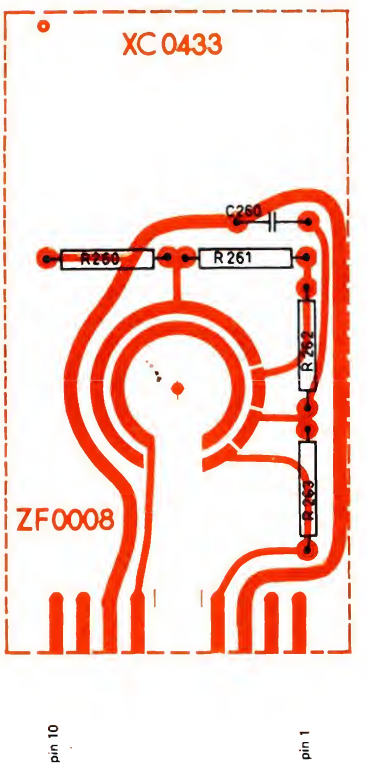
ZF 0005 Attenuator



ZF 0006 Attenuator



ZF 0007 Attenuator



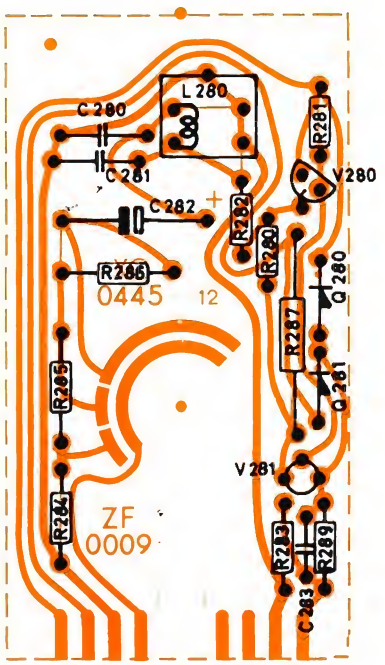
ZF 0008 Attenuator

2606 from serial no. 454879

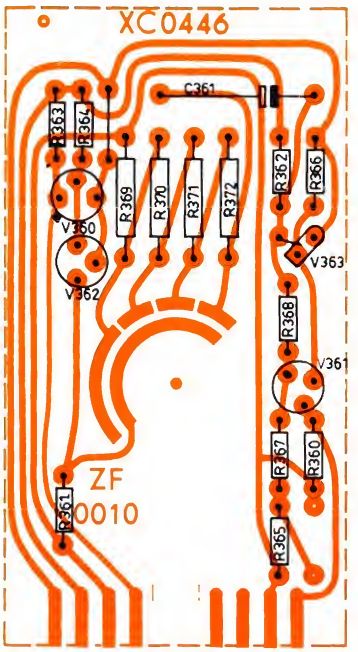
CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
ZF 0006 Attenuator					
C 220-223	Ceramic trim.		4.5–20pF/160 V		CV 0020
C 224,225	Ceramic		22 pF/400 V		CK 1220
C 226	-		47 pF/400 V		CK 1470
R 220	Metal	1/4 W	1/2%	684 kΩ	RF 6009
R 221	-	-	-	900 kΩ	RF 6014
R 222	-	-	-	968.4 kΩ	RF 6015
R 223	-	-	-	990 kΩ	RF 6016
	Printed Circuit Board				XC 0428
ZF 0007 Attenuator					
C 240	Ceramic		3.9 pF/400 V		CK 0390
C 241	-		10 pF/400 V		CK 1100
C 242	-		47 pF/400 V		CK 1470
C 243	-		270 pF/400 V		CK 2270
C 244	-		800 pF/400 V		CK 2800
R 240	Metal	1/4 W	1/2%	316 Ω	RF 6000
R 241	-	-	-	684 Ω	RF 6002
R 242	-	-	-	2.162 kΩ	RF 6005
R 243	-	-	-	6.84 kΩ	RF 6007
R 244	-	-	-	316 kΩ	RF 6008
R 245	-	-	-	1MΩ	RF 6010
R 246	-	-	-	31.6 kΩ	RF 6012
R 247	-	-	-	100 kΩ	RF 6013
	Printed Circuit Board				XC 0429

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
ZF 0008 Attenuator					
C 260	Ceramic		39 pF/400 V		CK 1390
R 260	Metal	1/4 W	1/2%	462 Ω	RF 6001
R 261	-	-	-	1 kΩ	RF 6003
R 262	-	-	-	3.16 kΩ	RF 6006
R 263	-	-	-	10 kΩ	RF 6011
	Printed Circuit Board				XC 0433

Layout Diagrams with Parts List



ZF 0009 LP Filter



ZF 0010 20 dB Amplifier

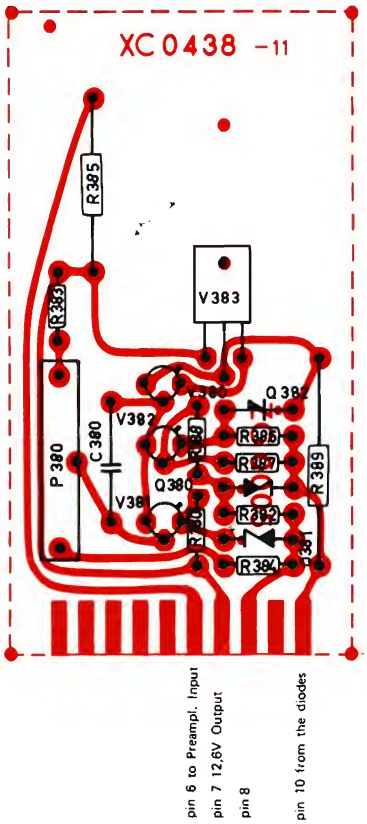
CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
ZF 0009					
C 280	Polystyrene			1 nF/ 63 V	CT 1132
C 281	-			0.47 nF/125 V	CT 1111
C 282	Electrolytic			200 µF/ 10 V	CE 0306
C 283	Polyester			10 nF/250 V	CS 0403
Q 280,281	Silicon	50 V/150 mA		BAX 13	QV 0223
R 280	Carbon	1/4 W	5 %	47 Ω	RB 1470
R 281	-	-	-	2.2 kΩ	RB 3220
R 282	Metal	-	1 %	715 Ω	RF 2715
R 283	-	-	-	147 kΩ	RF 5147
R 284	-		1/2%	1.462 kΩ	RF 6004
R 285	-	-	-	3.16 kΩ	RF 6006
R 286	-	-	-	10 kΩ	RF 6011
R 287	Carbon	1/2 W	5%	1.25 kΩ	
R 289	Metal	1/4 W	1%	31.5 kΩ	RF 4316
L 280	300 kHz LP Filter			0.518 mH	LB 0666
V 280	Silicon	PNP		2 N 3702	VB 0038
V 281	FET	N		2 N 4302	VB 1025
	Printed Circuit Board				XC 0445

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
ZF 0010					
C 360	Polyester			10 nF/250 V	CS 0403
C 361	Electrolytic			200 µF/ 10 V	CE 0306
R 360,361	Carbon	1/8 W	10%	10MΩ	RA 0025
R 362	-	1/4 W	5%	4.7 kΩ	RB 3470
R 363	-	-	-	10 kΩ	RB 4100
R 364	-	-	-	47 kΩ	RB 4470
R 365	Metal	-	1%	162 Ω	RF 2162
R 366	-	-	-	2.21 kΩ	RF 3221
R 367	-	-	-	3.01 kΩ	RF 3301
R 368	-	-	-	31.6 kΩ	RF 4316
R 369	-	-	1/2%	462 Ω	RF 6001
R 370	-	-	-	1 kΩ	RF 6003
R 371	-	-	-	3.16 kΩ	RF 6006
R 372	-	-	-	10 kΩ	RF 6011
V 360	Silicon	NPN		BC 107	VB 0032
V 361	FET	N		E 102	VB 1009
V 362	-	N		2 N 4302	VB 1025
V 363	Silicon	PNP		2 N 4289	VB 0049
	Printed Circuit Board				XC 0446

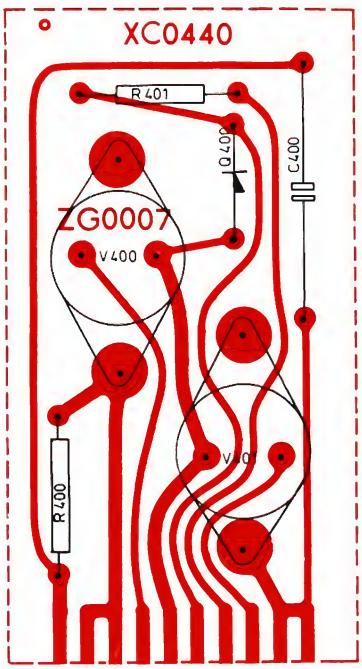
Layout Diagrams with Parts List

Power Supplies

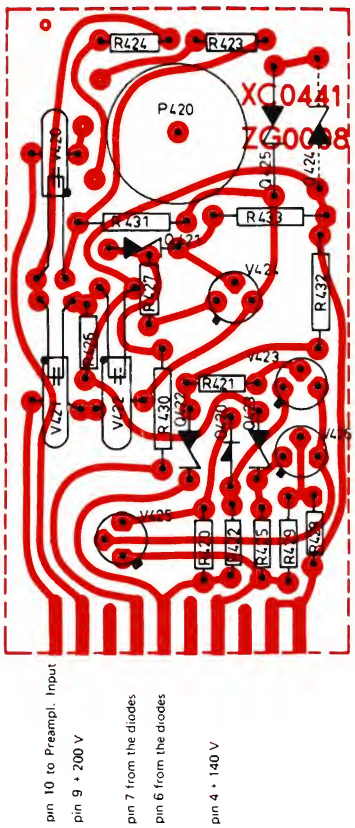
ZG 0005
ZG 0007
ZG 0008
ZG 0074



ZG 0005 + 12.6 V reg.



ZG 0007 DC/AC Converter



ZG 0008 + 140 V and Pol. reg.

ZG 0005 + 12.6 V reg.

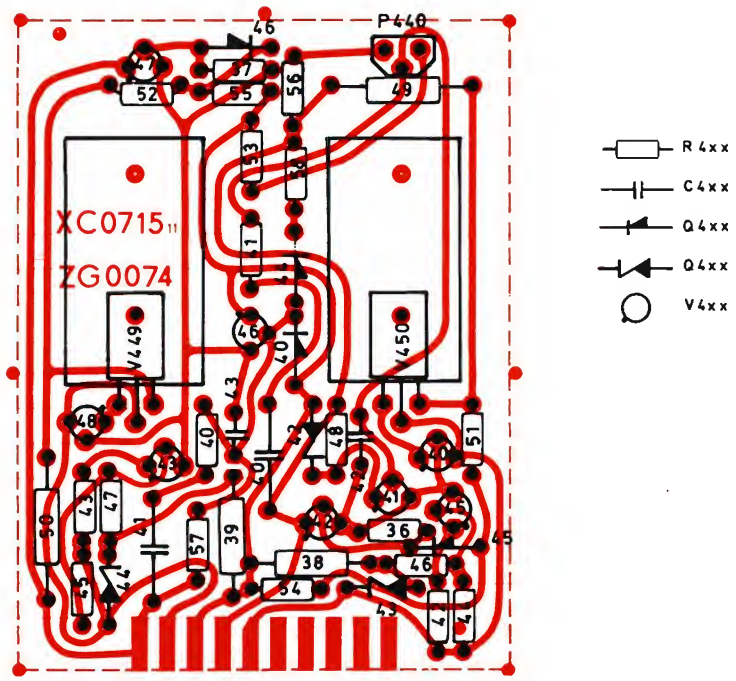
C 380	Polyester	10 nF/250 V		CS 0001
P 380	Voltage adj.		2 kΩ	PG 2203
Q 380	Zener	5.0–6.2 V/50 mA	ZG 6.2	QV 1322
Q 381	-	6.1–7.5 V/40 mA	ZG 6.8	QV 1106
Q 382	Silicon	150 V/300 mA	BAX 16	QV 0217
R 380	Carbon	1/4 W 5%	1 kΩ	RB 3100
R 382	-	- -	2.7 kΩ	RB 3270
R 384	-	- -	4.7 kΩ	RB 3470
R 385	Wire	5.5 W 10%	30 Ω	RX 0309
R 386	Carbon	1/4 W 5%	390 Ω	RB 2390
R 387	-	- -	2.7 kΩ	RB 3270
R 388	-	- -	47 kΩ	RB 3470
R 389	-	1/2 W -	10 Ω	
V 380,381	Silicon	NPN	BC 107	VB 0032
V 382	-	PNP	BC 177	VB 0071
V 383	-	NPN	2 N 4922	VB 0063
	Printed Circuit Board			XC 0438

ZG 0007 DC/AC Converter

C 400	Electrolytic	10 µF/ 70 V		CE 0517
Q 400	Si. diode	400 V/ 1 A	1 N 4004	QV 0237
R 400	Wire	5.5 W 10%	22 Ω	RX 0311
R 401	-	- -	120 Ω	RX 0307
V 400-401	Si. trans.	NPN	2 N 3055	VB 0519
	Printed Circuit Board			XC 0440

ZG 0008 + 140 V and Pol. reg.

P 420	Pol. Volt adj.		25 kΩ	PH 3250
Q 420	Silicon	150 V/300 mA	BAX 16	QV 0217
Q 421	Zener	6.6–7.0 V/ 40 mA	ZG 6.8	QV 1008
Q 422	-	6.1–7.5 V/ 40 mA	ZG 6.8	QV 1106
Q 423	-	27 – 30 V/ 9 mA	MZ 28	QV 1108
Q 424,425	-	143 –158 V/ 6.2 mA	1 N 3048 B	QV 1317
R 420	Carbon	1/4 W 5%	270 Ω	RB 2270
R 421	-	- -	1.5 kΩ	RB 3150
R 422	-	- -	5.6 kΩ	RB 3560
R 423,424	-	- -	47 kΩ	RB 4470
R 425	-	- -	120 kΩ	RB 5120
R 426	-	- -	1MΩ	RB 6100
R 427	Metal	- 1%	649 Ω	RF 2649
R 428	-	- -	30.9 kΩ	RF 4309
R 429	-	- -	121 kΩ	RF 5121
R 430	Carbon	1/3 W 5%	1.8 kΩ	
R 431	-	- -	22 kΩ	
R 432	-	- -	200 kΩ	
R 433	-	- -	330 kΩ	
V 420-422	Neon stab 81 V/3.2 mA		ZZ 1000	VA 0088
V 423,424	Silicon	PNP	MM 4003	VB 0068
V 425,426	-	NPN	2 N 3440	VB 0250
	Printed Circuit Board			XC 0441



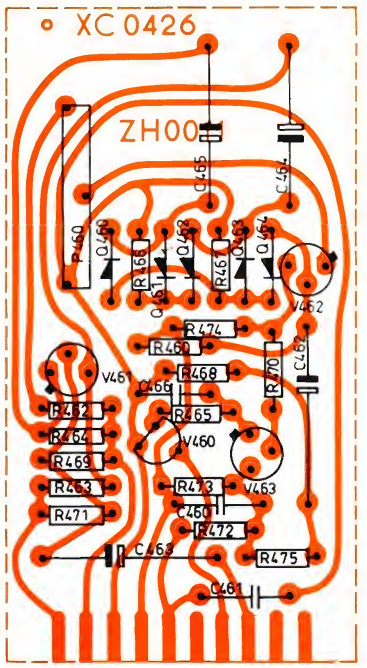
ZG 0074

20 V Regulator

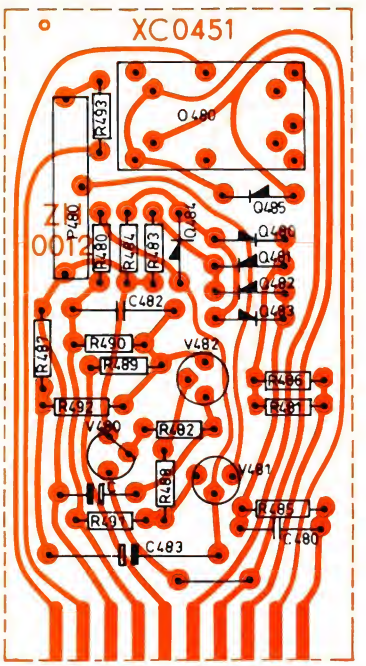
CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
C 440,441	Polycarbonate			1 µF/100 V	CS 0384
C 442,443	Ceramic			4.7 nF/500 V	CK 3470
P 440	Cermet	0.5 W	lin.	1 kΩ	PG 2109
Q 440,441	Si. diode	150 V/ 0.3 A		BAX 16	QV 0217
Q 442	Ze. diode	6.8 V/0.25W		ZG 6.8	QV 1106
Q 443,444	-	6.2 V/0.25W		ZG 6.2	QV 1322
Q 445,446	Si. diode	150 V/ 0.3 A		BAX 16	QV 0217
R 436,437	Carbon	1/4 W	5%	8.2 kΩ	RB 3820
R 438,439	-	1/3 W	-	3.9 kΩ	
R 440-443	-	1/4 W	-	470 Ω	RB 2470
R 444,445	-	-	-	1.2 kΩ	RB 3120
R 446,447	-	-	-	4.7 kΩ	RB 3470
R 448	-	-	-	3.3 kΩ	RB 3330

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
R 449,450	Wire	1 W	5%	2 Ω	RO 1106
R 451,452	Metal	1/4 W	-	140 Ω	RF 2140
R 453	-	-	-	2.49 kΩ	RF 3249
R 454,455	-	-	-	4.02 kΩ	RF 3402
R 456	-	-	-	4.75 kΩ	RF 3475
R 457	-	-	-	11.5 kΩ	RF 4115
R 458	-	-	-	12.1 kΩ	RF 4121
V 440-443	Si. trans.	NPN		BC 107	VB 0032
V 445-448	-	PNP		BC 177	VB 0071
V 449	-	PNP		2 N 4919	VB 0061
V 450	-	NPN		2 N 4922	VB 0063
	Printed Circuit Board				XC 0715

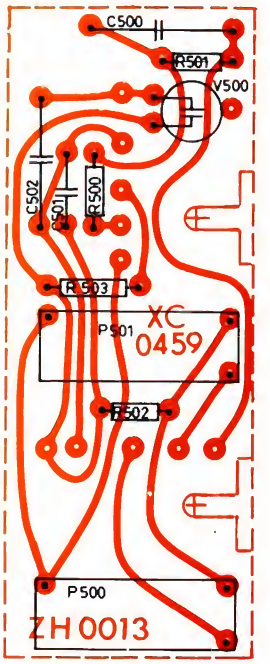
Layout Diagrams with Parts List



Overload Indicator ZH 0011



Overload Indicator ZH 0012



Gain Circuit ZH 0013

ZH 0011 Overload Indicator

C 460	Ceramic			1 nF/500 V	CK 3100
C 461	-			4.7 nF/500 V	CK 3470
C 462	Electrolytic			2 µF/ 64 V	CE 0401
C 463	-			50 µF/ 25 V	CE 8965
C 464,465	-			100 µF/ 15 V	CE 0310
C 466	Tantalum			47 µF/ 4 V	CF 0013
P 460	Overload adj.			2 kΩ	PG 2203
Q 460-464	Si. diodes	150 V/300 mA		BAX 16	QV 0217
R 460	Carbon	1/8 W	10%	10MΩ	RA 0025
R 462	-	1/4 W	5%	1.8 kΩ	RB 3180
R 463,464	-	-	-	2.7 kΩ	RB 3270
R 465	-	-	-	3.3 kΩ	RB 3330
R 466,467	-	-	-	10 kΩ	RB 4100
R 468	-	-	-	47 kΩ	RB 4470
R 469,470	-	-	-	100 kΩ	RB 5100
R 471	-	-	-	180 kΩ	RB 5180
R 472	-	-	-	220 kΩ	RB 5220
R 473	-	-	-	330 kΩ	RB 5330
R 474	-	-	-	390 kΩ	RB 5390
R 475	-	-	-	820 kΩ	RB 5820
V 460	Si. trans.	NPN		2 N 3704	VB 0028
V 461,462	-	NPN		BC 107	VB 0032
V 463	-	NPN		BF 178	VB 0052
	Printed Circuit Board				XC 0426

ZH 0012 Overload Indicator

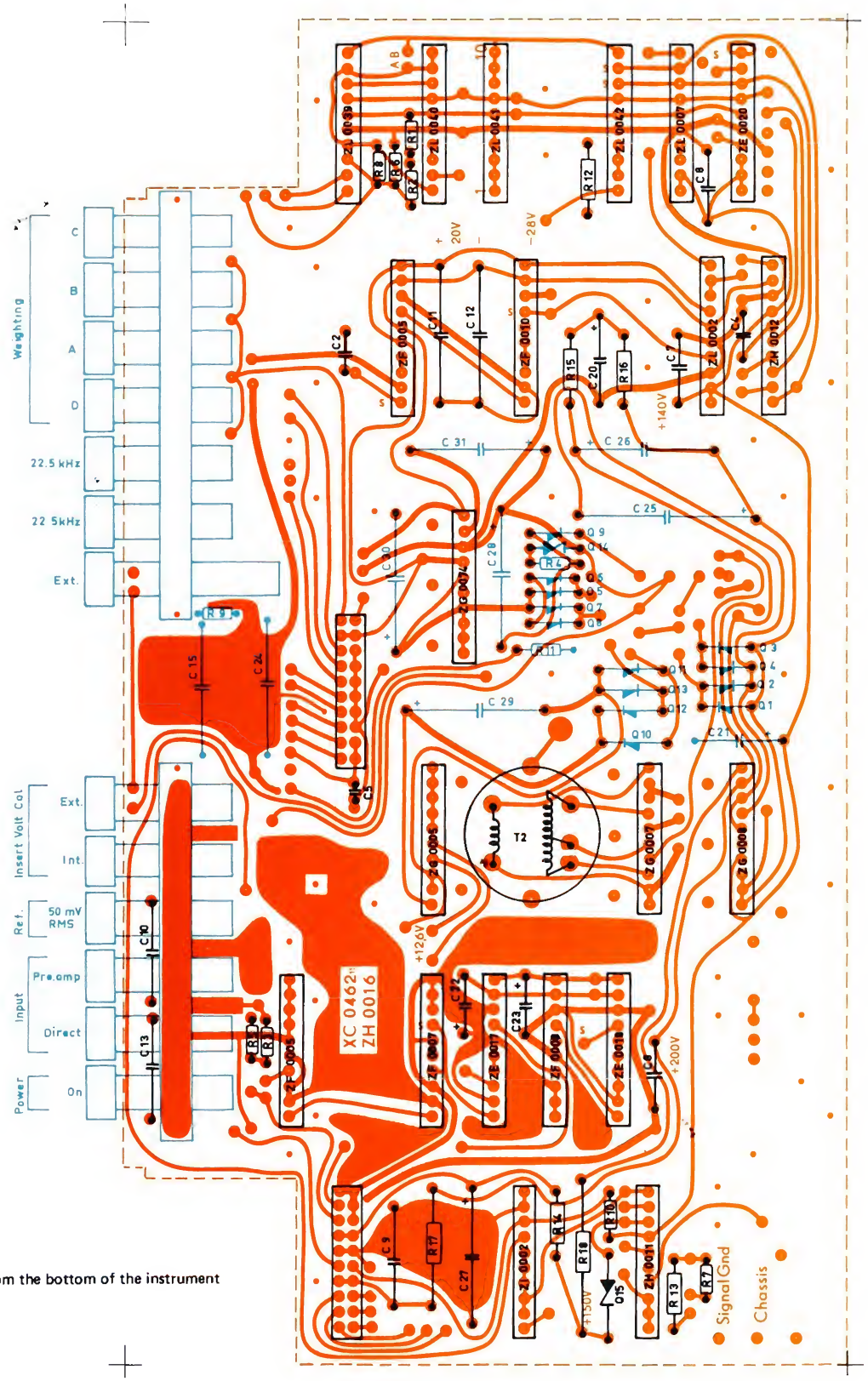
C 480,481	Ceramic			8 pF/400 V	CK 0820
C 482	Polycarbonate			100 nF/250 V	CS 0402
C 483	Electrolytic			2 µF/ 64 V	CE 0401
C 484	Tantalum			47 µF/ 4 V	CF 0013
C 485	Polycarbonate			100 nF/250 V	CS 0402
O 480	Mini relay				OC 0021
P 480	Overload adj.			2 kΩ	PG 2203
Q 480-485	Silicon	150 V/300 mA		BAX 16	QV 0217
R 480	Carbon	1/8 W	10%	10MΩ	RA 0025
R 482	-	1/4 W	5%	3.3 kΩ	RB 3330
R 483,484	-	-	-	4.7 kΩ	RB 3470
R 485-487	-	-	-	47 kΩ	RB 4470
R 488	-	-	-	100 kΩ	RB 5100
R 489	-	-	-	220 kΩ	RB 5220
R 490	-	-	-	330 kΩ	RB 5330
R 491	-	-	-	390 kΩ	RB 5390
R 492	-	-	-	820 kΩ	RB 5820
R 493	Metal	1/4 W	1%	2 kΩ	RF 3200
V 480	Silicon	NPN		2 N 3704	VB 0028
V 481	-	NPN		BC 107	VB 0032
V 482	-	NPN		BF 178	VB 0052
	Printed Circuit Board				XC 0451

ZH 0013 Gain Circuit

C 500	Ceramic			100 pF/400 V	CK 2100
C 501	-			4.7 nF/500 V	CK 3470
C 502	Polyester			10 nF/250 V	CS 0001
P 500,501	Sensitivity adj.			20 kΩ	PG 3203
R 500	Metal	1/4 W	1%	665 Ω	RF 2665
R 501	-	-	-	1.62 kΩ	RF 3162
R 502	-	-	-	1.82 kΩ	RF 3182
R 503	-	-	-	3.92 kΩ	RF 3392
V 500	Neon lamp 0.8 mA/220 V				VS 0015
	Printed Circuit Board				XC 0459

Layout Diagram with Parts List

Interconnecting Board



Viewed from the bottom of the instrument

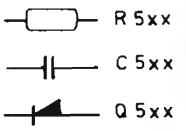
Black components are mounted on the top side.
Blue components are mounted on the bottom side.

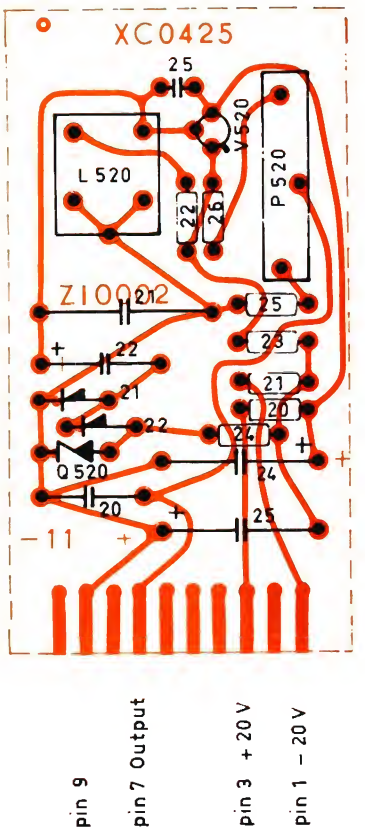
ZH 0016 Interconnecting Board

CIRCUIT DIAGR. REF.	COMPONENT TYPE				STOCK REF.
C 2	Ceramic			33 pF/400 V	CK 1330
C 4	-			4.7 nF/500 V	CK 3470
C 5	-			4.7 nF/100 V	CK 0096
C 6-8	Polycarbonate			0.1 µF/250 V	CS 0013
C 9	-			0.22 µF/400 V	CS 0117
C 10	-			0.33 µF/400 V	CS 0119
C 11,12	-			1 µF/250 V	CS 0025
C 13	-			1.5 µF/100 V	CS 0343
C 15	-			5.6 µF/100 V	CS 0346
C 20,21	Electrolytic			4 µF/250 V	CE 2034
C 22,23	-			8 µF/ 40 V	CE 0414
C 24	-			22 µF/ 25 V	CE 0428
C 25	-			16 µF/550 V	CE 0915
C 26,27	-			32 µF/250 V	CE 0711
C 28	-			220 µF/ 63 V	CE 0617
N 1,2,3	Power Switch				NT 0021
O 3	Filters				OJ 0002
O 4	Input Calibration				OJ 0001
Q 1-4	Si. diode	1200 V/150 mA		BYX 10	QV 0025
Q 5-13	-	400 V/ 1 A		1 N 4004	QV 0237
Q 14	Ze. diode	27- 30 V/ 5 mA		MZ 28	QV 1108
Q 15	-	143-158 V/ 5 mA		ZD 150	QV 1317
R 1,2	Carbon	1/8 W	10%	6.8MΩ	RA 0023
R 3	-	-	-	10MΩ	RA 0025
R 4	-	1/4 W	5%	2.7 kΩ	RB 3270
R 5	-	-	-	10 kΩ	RB 4100
R 6	-	-	-	39 kΩ	RB 4390
R 7	-	-	-	47 kΩ	RB 4470
R 8	-	-	-	68 kΩ	RB 4680
R 9	-	-	-	100 kΩ	RB 5100
R 10,11	-	-	-	220 kΩ	RB 5220
R 12	-	1/3 W	-	300 Ω	
R 13	-	-	-	1 kΩ	
R 14	-	-	-	12 kΩ	
R 15	-	-	-	27 kΩ	
R 16	-	-	-	75 kΩ	
R 17	-	1/2 W	10%	20MΩ	
R 18	-	1 W	-	39 kΩ	
T 2	DC / AC Converter Coil				TO 0002
	10 pin socket				JJ 1002
	2 x 10 pin socket				JJ 2002

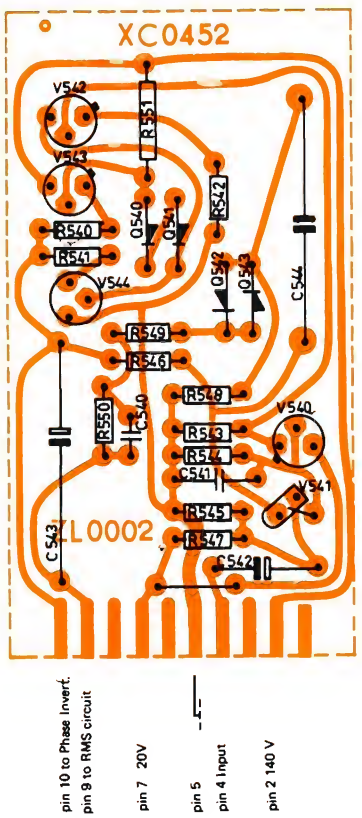
Layout Diagram with Parts List

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
C 520	Polycarbonate			47 nF/100 V	CS 0009
C 521	-			0.33 µF/250 V	CS 0035
C 522	Electrolytic			2 µF/ 64 V	CE 0401
C 523,524	-			33 µF/40 V	CE 0438
C 525	Ceramic			390 pF/400 V	CK 2391
L 520	Osc. Coil			75 mH	LB 0660
P 520	Ref. adj.			500 Ω	PG 1502
Q 520	Zener	8.5 - 9.6 V/	5 mA	ZF 9.1	QV 1109
Q 521,522	Silicon	150 V/300 mA		BAX 16	QV 0217
R 520,521	Carbon	1/4 W	5%	470 Ω	RB 2470
R 522	-	-	-	1.8 kΩ	RB 3180
R 523,524	-	-	-	6.8 kΩ	RB 3680
R 525	Metal	-	1%	619 Ω	RF 2619
R 526	-	-	-	54.9 kΩ	RF 4549
V 520	Si. trans	NPN		BC 107 b	VB 0257
	Printed Circuit Board				XC 0425

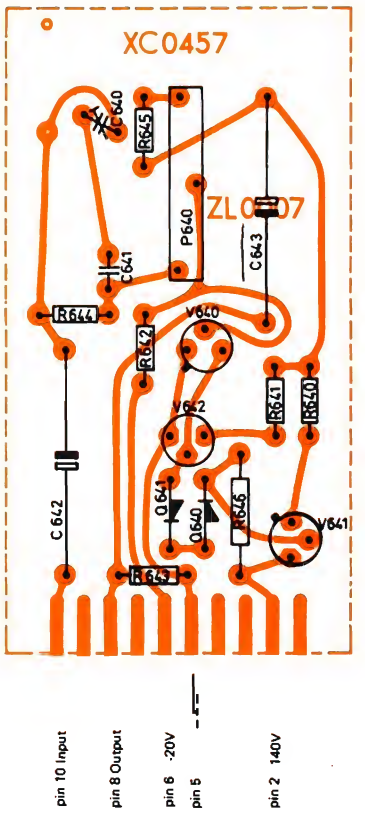




Layout Diagrams with Parts List



ZL 0002 44 dB Amplifier



ZL 0007 Phase Inverter

ZL 0002 44 dB amplifier

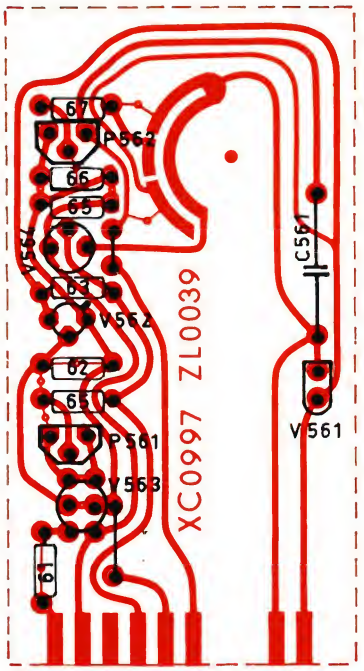
C 540	Ceramic			1 pF/400 V	CK 0100
C 541	Polystyrene			100 pF/125 V	CT 1133
C 542	Electrolytic			12.5 µF/ 25 V	CE 0416
C 543	·			22 µF/100 V	CE 0616
C 544	·			400 µF/ 10 V	CE 0305
Q 540,541	Si.	150 V/300 mA		BAX 16	QV 0217
Q 542,543	·	100 V/225 mA		BAY 72	QV 0219
R 540,541	Carbon	1/4 W	5%	100 Ω	RB 2100
R 542	·	·	·	120 Ω	RB 2120
R 543	·	·	·	1 kΩ	RB 3100
R 544	·	·	·	10 kΩ	RB 4100
R 545	·	·	·	100 kΩ	RB 5100
R 546	·	·	·	470 kΩ	RB 5470
R 547	·	·	·	820 kΩ	RB 5820
R 548	Metal	·	1%	464 Ω	RF 2464
R 549	·	·	·	4.64 kΩ	RF 3464
R 550	·	·	·	95.3 kΩ	RF 4953
R 551	Carbon	·	5%	31.6 kΩ	
V 540	Silicon	NPN		BC 107	VB 0032
V 541	·	PNP		2 N 4289	VB 0049
V 542,543	·	NPN		BF 178	VB 0052
V 544	·	PNP		2 N 4889	VB 0058
	Printed Circuit Board				XC 0452

ZL 0007 Phase Inverter

C 640	Ceramic			3.1 pF/160 V	CV 0030
C 641	·			22 pF/400 V	CK 1220
C 642,643	Electrolytic			20 µF/100 V	CE 0616
P 640	Gain adj.			10 kΩ	PG 3107
Q 640,641	Silicon	100 V/300 mA		BAX 16	QV 0217
R 640,641	Carbon	1/4 W	5%	100 Ω	RB 2100
R 642	·	·	·	18 kΩ	RB 4180
R 643	·	·	·	100 kΩ	RB 5100
R 644,645	Metal	·	1%	47.5 kΩ	RF 4475
R 646	Carbon	1/3 W	5%	31.6 kΩ	
V 640,641	Silicon	NPN		BF 178	VB 0052
V 642	·	PNP		2 N 4889	VB 0058
	Printed Circuit Board				XC 0457

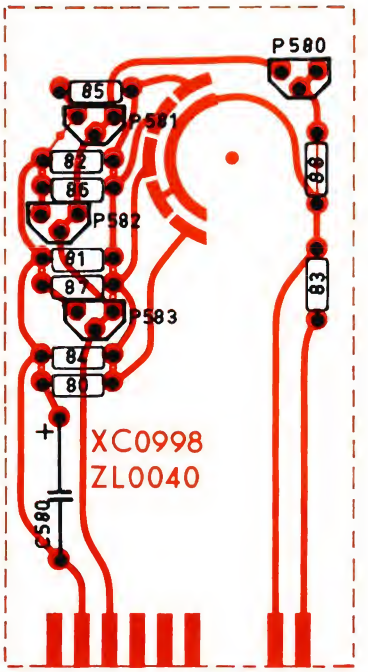
Layout Diagrams with Parts List

Meter Circuit



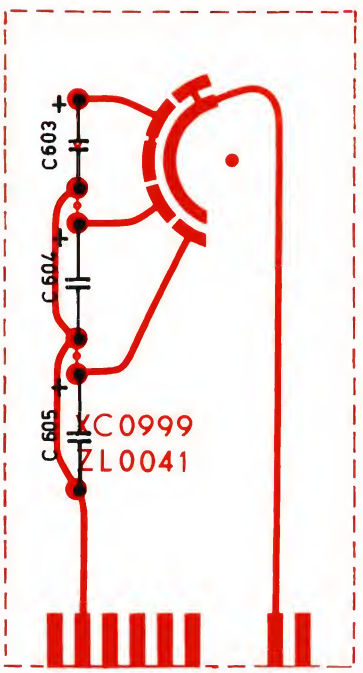
ZL 0039 Meter Ampl.

R 5xx

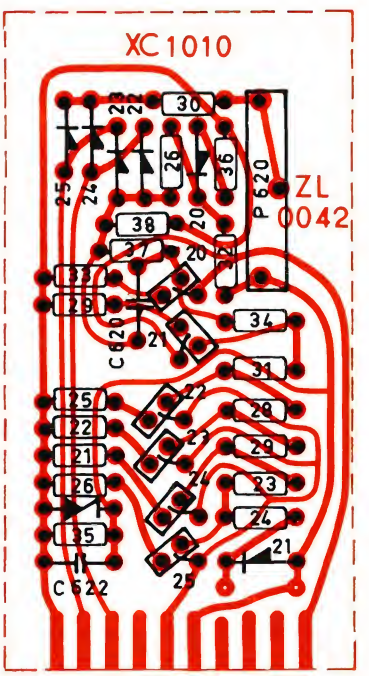


ZL 0040 Meter Damping

R 5xx



ZL 0041 Average Time



ZL 0042 RMS Rectifier

R 6xx V 6xx

ZL 0039

C 561	Polycarbonate			0.33 µF/100 V	CS 0340
P 561	Trimmer		lin.	220 Ω	PG 1220
P 562	-		-	10 kΩ	PG 3110
R 561	Carbon	1/4 W	5%	1 kΩ	RB 3100
R 562	-	-	-	6.8 kΩ	RB 3680
R 563	-	-	-	22 kΩ	RB 4220
R 564	-	-	-	39 kΩ	RB 4390
R 565	-	-	-	82 kΩ	RB 4820
R 566	-	-	-	100 kΩ	RB 5100
R 557	-	-	-	8.2MΩ	RB 6820
V 561	Silicon	NPN		2 N 4292	VB 0050
V 562	-	NPN		BC 107	VB 0257
V 563	-	PNP		TD 401	VB 5303
V 564	FET	N-channel		E 102	VB 1028
	Printed Circuit Board				XC 0997

ZL 0040

C 580	Electrolytic			50 µF/ 6.4 V	CE 0204
P 580	Trimmer		lin.	4.7 kΩ	PG 2471
P 581,582	-		-		PG 4107
P 583	-		-	220 kΩ	PG 4203
R 580	Carbon	1/4 W	5%	2.7 kΩ	RB 3270
R 581	-	-	-	22 kΩ	RB 4220
R 582	-	-	-	27 kΩ	RB 4270
R 583	-	-	-	68 kΩ	RB 4680
R 584	-	-	-	82 kΩ	RB 4820
R 585,586	-	-	-	180 kΩ	RB 5180
R 587	-	-	-	680 kΩ	RB 5680
R 588	-	-	-	30.1 kΩ	RF 4301
	Printed Circuit Board				XC 0998

ZL 0041

C 603	Tantalum	3.3 µF/ 15 V		CF 0025
C 604	-	6.8 µF/ 35 V		CF 0002
C 605	-	56 µF/ 6 V		CF 0001
	Printed Circuit Board			XC 0999

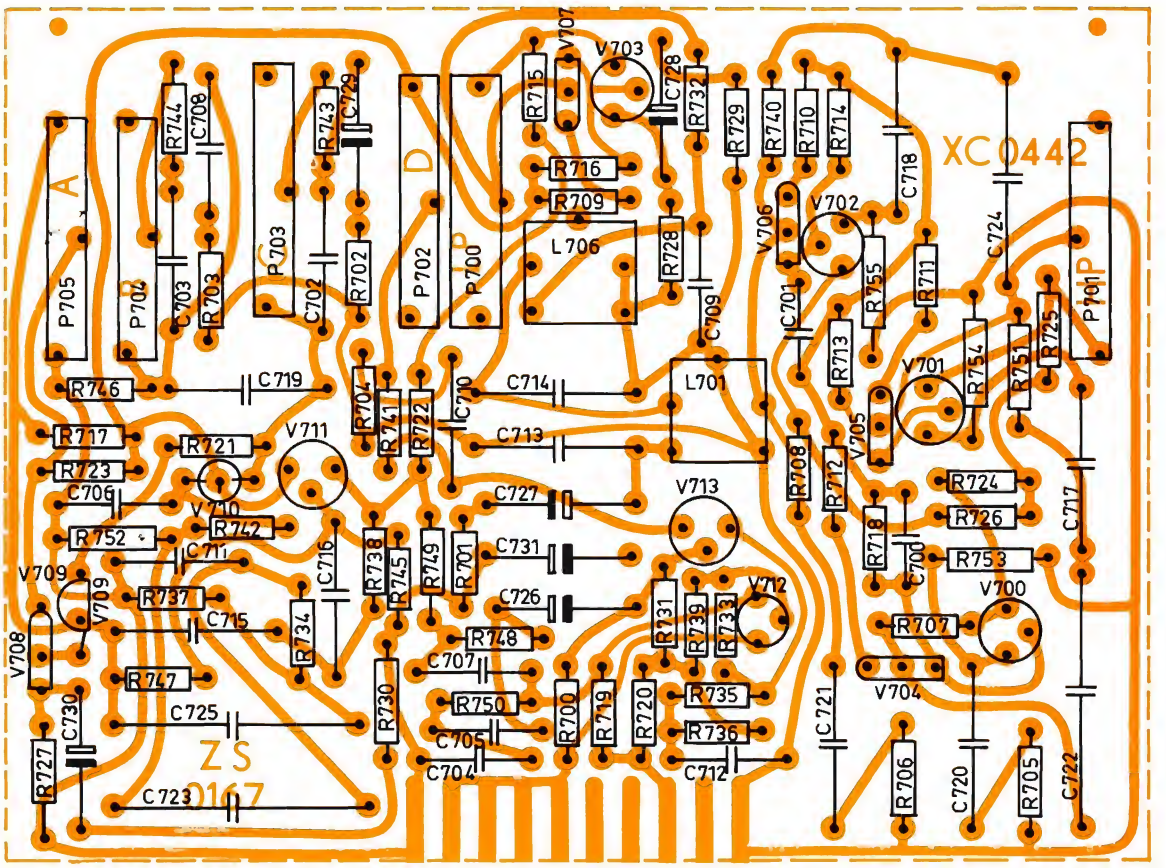
ZL 0042

C 620	Ceramic			15 pF/400 V	CK 1150
C 622	-			120 pF/400 V	CK 2121
P 620	Trimmer		lin.	2 kΩ	PG 2203
Q 620	Germanium	100 V/ 30 mA		SFD 108	QV 0099
Q 621	Silicon	100 V/225 mA		BAY 72	QV 0219
Q 622-625	-	150 V/300 mA		BAX 16	QV 0217
Q 621	Zener	5.9-6.5 V		ZP 6.2	QV 1334
R 620	Metal	1/4 W	1%	15.4 Ω	RF 1154
R 621	-	-	-	100 Ω	RF 2100
R 622	-	-	-	422 Ω	RF 2422
R 623,624	-	-	-	1.1 kΩ	RF 3110
R 625	-	-	-	1.27 kΩ	RF 3127
R 626	-	-	-	2.02 kΩ	RF 3200
R 627	-	-	-	2.21 kΩ	RF 3221
R 628	-	-	-	3.01 kΩ	RF 3301
R 629	-	-	-	3.16 kΩ	RF 3316
R 630,631	-	-	-	5.23 kΩ	RF 3523
R 632	-	-	-	8.06 kΩ	RF 3806
R 633	-	-	-	11.1 kΩ	RF 4110
R 634	-	-	-	11.8 kΩ	RF 4118
R 635	-	-	-	20.0 kΩ	RF 4200
R 636	-	-	-	21.5 kΩ	RF 4215
R 637	-	-	-	31.6 kΩ	RF 4316
R 638	-	-	-	68.1 kΩ	RF 4681
V 620-625	Silicon	PNP		2 N 4289	VB 0049
	Printed Circuit Board				XC 1010

Layout Diagram with Parts List

ZS 0167

Weighting Network



CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
C 700,701	Ceramic			47 pF/400 V	CK 1470
C 702,703	Polystyrene			220 pF/125 V	CT 0501
C 704,705	-			390 pF/ 63 V	CT 1531
C 706	-			510 pF/125 V	CT 1135
C 707	-			820 pF/ 63 V	CT 1532
C 708,709	-			1.6 nF/ 63 V	CT 1152
C 710,711	-			3 nF/ 63 V	CT 1157
C 712	-			3.3 nF/ 63 V	CT 1544
C 713	-			3.6 nF/ 30 V	CT 1506
C 714	-			4.3 nF/ 30 V	CT 1507
C 715,716	-			5.1 nF/ 63 V	CT 1124
C 717	-			16 nF/ 30 V	CT 1539
C 718	-			24 nF/ 30 V	CT 1540
C 719	-			30 nF/ 30 V	CT 1519
C 720,721	-			39 nF/ 30 V	CT 1541
C 722,723	-			51 nF/ 30 V	CT 1542
C 724	-			180 nF/ 63 V	CT 1527
C 725	Polycarbonate			0.68 µF/ 63 V	CS 0342
C 726	Electrolytic			2 µF/ 64 V	CE 0401
C 727-731	-			12 µF/ 25 V	CE 0416
P 700	L.P. adj.			500 Ω	PG 1502
P 701	H.P. adj.			2 kΩ	PG 2203
P 702-704	D-A-C adj.			10 kΩ	PG 3107
P 705	D-A-B-C adj.			500 Ω	PG 1502
R 701,702	Carbon	1/4 W	5%	1MΩ	RB 6100
R 703-706	-	1/8 W	10%	10MΩ	RA 0025
R 707,708	-	1/4 W	5%	120 Ω	RB 2120
R 709	-	-	-	270 Ω	RB 2270
R 710-712	-	-	-	1 kΩ	RB 3100
R 713-720	-	-	-	4.7 kΩ	RB 3470
R 721	-	-	-	22 kΩ	RB 4220
R 722-726	-	-	-	39 kΩ	RB 4390

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
R 727	Carbon	1/4 W	5%	270 kΩ	RB 5270
R 729	Metal	-	1%	147 kΩ	RF 5147
R 730	Carbon	-	5%	330 kΩ	RB 5330
R 731	-	-	-	820 kΩ	RB 5820
R 732	Metal	-	1%	2.80 kΩ	RF 3280
R 733	-	-	-	3.24 kΩ	RF 3324
R 734	-	-	-	4.02 kΩ	RF 3402
R 735,736	-	-	-	4.99 kΩ	RF 3499
R 737	-	-	-	11.5 kΩ	RF 4115
R 738	-	-	-	12.4 kΩ	RF 4124
R 739	-	-	-	13 kΩ	RF 4130
R 740	-	-	-	16.5 kΩ	RF 4165
R 741	-	-	-	22.1 kΩ	RF 4221
R 742	-	-	-	23.7 kΩ	RF 4237
R 743,744	-	-	-	31.6 kΩ	RF 4316
R 745	-	-	-	37.4 kΩ	RF 4374
R 746	-	-	-	41.2 kΩ	RF 4412
R 747,748	-	-	-	68.1 kΩ	RF 4681
R 749,750	-	-	-	82.5 kΩ	RF 4825
R 751	-	-	-	121 kΩ	RF 5121
R 752,753	-	-	-	147 kΩ	RF 5147
R 754	Carbon	1/3 W	-	499 kΩ	
R 755	-	-	-	630 kΩ	
R 757	-	1/4 W	5%	1.5 kΩ	RB 3150
R 758	-	-	-	8.2 kΩ	RB 3820
V 700-703	FET	N		2 N 4302	VB 1025
V 704-708	Si. trans.	PNP		2 N 4289	VB 0049
V 709	-	NPN		2 N 3707	VB 0254
V 710	FET	N		E 102 spec.	VB 1009
V 711-713	Si. trans.	NPN		BC 107	VB 0257
	Printed Circuit Board				XC 0442

CIRCUIT DIAGRAM REF.	COMPONENT TYPE		STOCK REF.
Lamps and Fuses			
V 1,2	Overload Lamps	220 V/ 0.8 mA	VS 1003
V 3,4	Dial Lamps	6.3 V/250 mA	VS 1273
V 5	Fuse (Main Voltage)	1 A	VF 0008
V 6	Fuse (Battery Voltage)	5 A	VF 0015
V 10-25	Range Lamps	65 V/ 0.3 mA	VS 0016
V 500	Uncal. Lamp	220 V/ 0.8 mA	VS 0015
Potentiometers			
P 1	Gain Control Carbon	10 kΩ	PQ 3103
Switches			
N 4	"Meter Reset"		NT 0023
N 5	"AC – DC" Mains		NN 0571
O 1	"Input Attenuator"		OE 0011
O 2	"Output Attenuator"		OT 0003
O 5	"Voltage Selector"		OA 0045
O 6	"AC – DC" Output		NN 0031
O 8	"Meter Function"		OK 0016
Sockets and Relays			
	8 pin DIN plug		JP 0802
	7 pin DIN plug		JP 0703
	Screened socket (for B & K plug)		JJ 0108
	Socket 3-pin		JJ 4700
	Plug 3-pin		JP 4701
	Banana socket, isolated		JT 8344
	Banana socket		JT 6204
	Fuse socket		JS 0019
	Neon Lamp retainers		JO 0016
	Scale Lamp socket		JO 0023
Miscellaneous			
	Power Cord EUR		AN 0010
	Power Cord USA		AN 0006
	Screened Cable		AO 0013
	Rubber Feet, rear		DF 7015
	Rubber Feet, front		DF 7018
	Front Stand		DV 0050
	Side Handles		DH 0052
	Guides for P.C. Boards		DZ 9013
	Locking Arm for P.C. Boards		DZ 9015
	Retaining Pin for above		YN 0063
	Moving Coil Instrument (0.5 mA)		IM 0018
	Contact Slider for Rotary Switches		OD 0179
	M3 Allen Screw for above		YQ 2003
	1.5 mm Allen key for above		QA 0042
	Knob, 20 mm		SN 2022
	Knob, 31.5 mm		SN 3222
	Retaining Ring for 31.5 mm knob		DB 0674
	M4 Allen screw for above		YQ 2083
	2 mm Allen key for above		QA 0043

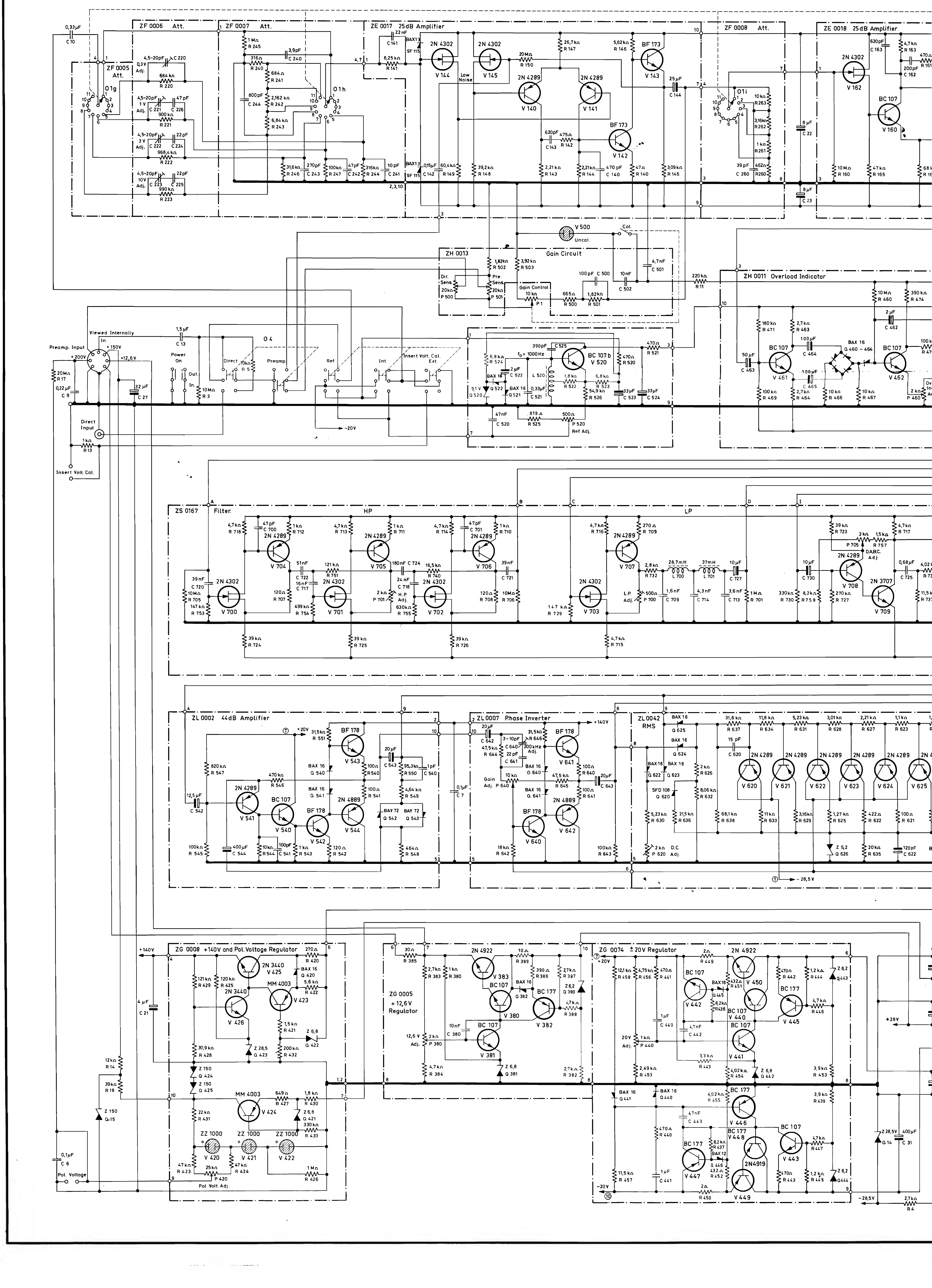
CIRCUIT DIAGRAM REF.	COMPONENT TYPE	STOCK REF.
	Metal Cabinet	KQ 0110
	Mahogany Cabinet	KA 0026
	Retaining Nut for Cabinet	YM 0425
T 1	Power Transformer	TN 0072
T 2	DC/AC Converter	TO 0002
	Dust Cover	KF 0025

Printed Circuit Boards

	without comp.	with comp.
25 dB Amplifier	XC 0430	ZE 0017
44 dB Amplifier	XC 0436	ZE 0018
25 dB Amplifier	XC 0458	ZE 0020
Attenuator input	XC 0427	ZF 0005
Attenuator input	XC 0428	ZF 0006
Attenuator input	XC 0429	ZF 0007
Attenuator output	XC 0433	ZF 0008
Low Pass Filter	XC 0445	ZF 0009
20 dB Amplifier	XC 0446	ZF 0010
12.6 V Regulator	XC 0438	ZG 0005
DC/AC Converter	XC 0440	ZG 0007
140 V Pol. Volt. Reg.	XC 0441	ZG 0008
20 V Regulator	XC 0715	ZG 0074
Overload Indicator 1	XC 0426	ZH 0011
Overload Indicator 2	XC 0451	ZH 0012
Gain Control Circuit	XC 0459	ZH 0013
Interconnecting Board	XC 0462	ZH 0016
Ref. Oscillator	XC 0425	ZI 0002
44 dB Amplifier	XC 0452	ZL 0002
Phase Inverter	XC 0457	ZL 0007
Meter Amplifier	XC 0997	ZL 0039
Meter Damping	XC 0998	ZL 0040
Average Time	XC 0999	ZL 0041
RMS Rectifier	XC 1010	ZL 0042
Filter Circuit	XC 0442	ZS 0167
Extended Circuit Board	XC 0711	AR 0010

Scales

dB scale	SA 0038
1" Microphone scale	SA 0039
1/2" Microphone scale	SA 0040
Acceleration scale	SA 0071
Degree scale	SA 0086


ZF 0005 Att.
ZF 0006 Att.
ZF 0007 Att.
ZE 0017 25dB Amplifier
ZF 0008 Att.
ZE 0018 25dB Amplifier
ZH 0013 Gain Circuit
V 500 Uncal.
Cal.
Gain Control
ZH 0011 Overload Indicator
Preamp. Input
Viewed Internally
Direct Input
Insert Volt. Cal.
Power On
O 4
Direct
Preamp
Ref
Int
Insert Volt. Cal. Ext.
Ref Adj.
ZS 0167 Filter
HP
LP
H.P. Adj.
L.P. Adj.
D.A.B.C. Adj.
ZL 0002 44dB Amplifier
ZL 0007 Phase Inverter
ZL 0042 RMS
D.C. Adj.
Gain Adj. P 640
ZG 0008 +140V and Pol. Voltage Regulator
ZG 0005 +12,6 V Regulator
ZG 0074 ±20V Regulator
Pol. Voltage
Pol. Volt. Adj.
+140V
+200V
+150V
+12,6 V
+20V
-20V
+28V
-28,5 V

ZF 0008 Att.

ZE 0018 25dB Amplifier

ZF 0009 LP Filter

ZF 0010 20dB Amplifier

Gain Circuit

ZH 0011 Overload Indicator

Filters

LP

A B C

D

ZL 0042 RMS

ZL 0041 Averaging Time

ZL 0039 Meter Amplifier

ZL 0040 Meter Damping

ZG 0074 ±20V Regulator

ZG 0007 DC/AC Converter

Chassis

Signal Ground

Input Section

Attenuator
01

1: 3 mV
2: 10 mV
3: 30 mV
4: 0.1 V
5: 0.3 V
6: 1 V
7: 3 V
8: 10 V
9: 30 V
10: 100 V
11: 300 V

Output Section

Attenuator
02

1: x 0.003
2: x 0.01
3: x 0.03
4: x 0.1
5: x 0.3
6: x 1

Meter Function

08

1: Imp. Hold
2: Impulse
3: RMS Fast
4: RMS Slow

Transistor sockets

2N 4919
2N 4922

2N 4889

E 102
2N 4302

2N 4289
2N 4292

2N 3704
2N 3707

BF 173

SA 2738

BC 107
BF 178
2N 2905
2N 3440
MM 4003

2N 5067

Bottom view

		21-03-1973	453554
20-03-1969	256267	03-03-1972	391782
29-01-1970	256267	09-05-1972	391782
23-03-1972	373240	30-08-1972	418095

Brüel & Kjær
Copenhagen

Measuring Amplifier 2–200000 Hz
Type 2606