Service Instructions

2607

Measuring Amplifier

Consisting of

Trouble Shooting

If some sort of trouble occurs with this instrument then first check the D.C. working voltages from the Power Supply.

Then use the Checking Procedure with Block Diagram in order to localize a trouble to be in one certain circuit.

When a fault has been found and remedied the voltages and adjustments which are influenced by the remedy must be rechecked and the Checking Procedure can be used again to tell if all basic functions of the instrument are fulfilled.

The tolerance stated in the instructions can only be used as a guide for adjustment and control, but any deviations must not be corrected without being sure that the tolerances of the instruments used for making the adjustment are so small as to have no influence on the measurements.

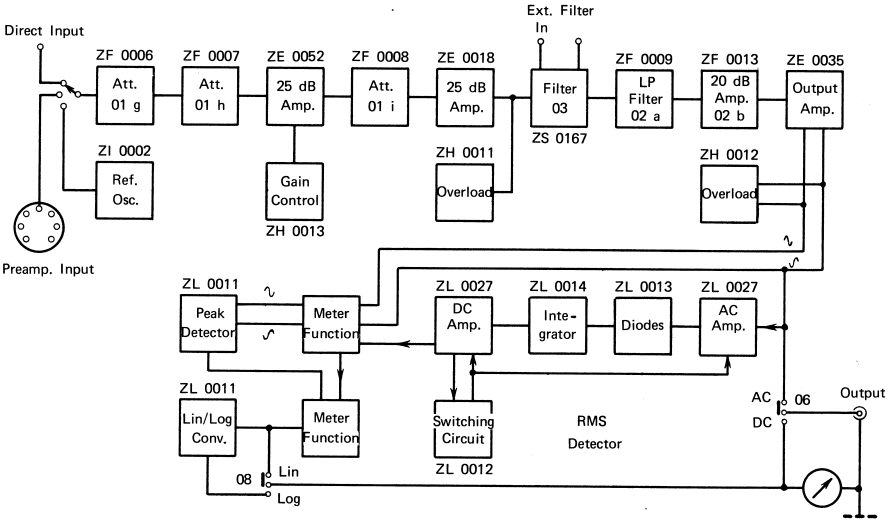
Spare Parts

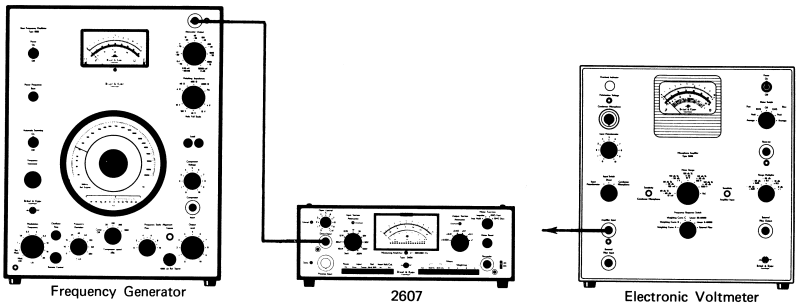
Please state type and serial number of apparatus when spare parts are ordered.

Instruments Necessary for Service and Repair

Multimeter (50 μA)
Frequency Generator (frequency range 2–200000 Hz f.inst. Type 1013 and 1017 (500 kHz for item 4.2)
Electronic Voltmeter (frequency range 2–200000 Hz, sensitivity 100 μV f.s.d.) f.inst. Type 2603 and 2604
Frequency Analyzer f.inst. Type 2107
Oscilloscope
Pulse Generator
High Impedance D.C. Voltmeter (10 mV f.s.d.)

Block Diagram of 2607





Frequency Generator — 2607 — Electronic Voltmeter

1.1 Sensitivity

a.	GAIN CONTROL: "Cal." POWER: "On" INPUT: "Direct" INPUT ATTENUATOR: "0.1 V" OUTPUT ATTENUATOR: "x 1" FILTERS: "All released" METER FUNCTION: "RMS" AVERAGING TIME: "Fast" OUTPUT: "AC"	Input signal to "Direct Input" of 2607: 0.1 V–1000 Hz. Adjust "Sens." for 0.1 V deflection (adjustment range for "Sens." adj. approx. + 4, –10 dB). "Output": 10 V RMS ± 0.5 dB.
b.	OUTPUT to "DC"	"Output": approx. 4.5 V. (The Output impedance is 820Ω). If out of tolerance adjust according to item 3.1.
c.	FILTERS to "A–B–C–D–22.4 Hz–22.4 kHz"	Deflection on 2607 for all positions: 0.1 V ± 0.2 dB
d.	FILTERS to "Ext."	Output voltage on "Ext. Filter Input": 1 V ± 0.5 dB.

continued

1.2 Frequency Response

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

Input signal: 1000 Hz adjusted to give an 18 dB deflection on 2607.

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 BFO).

1.3 Meter Function

a. INPUT: "Direct"
FILTERS: "All released"
METER FUNCTION: "RMS-Lin."
AVERAGING TIME: "Fast"

Input signal: 1000 Hz adjusted to give a 15 dB deflection on 2607.

b. METER FUNCTION to "Impulse"

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".

Deflection 15 dB ± 0.1 dB.

Disconnect the input signal and check that the deflection drops max. 3 dB in one minute.

d. METER FUNCTION to "+ Peak"
"–Peak"
"Max. Peak"

Deflection in all three positions: 18 dB ± 0.1 dB.

e. METER FUNCTION to "RMS"

Adjust the input signal to full scale deflection (10).

f. METER FUNCTION to "RMS-Log"

Deflection: 8 on 10 V scale ± 0.5 dB.

Increasing the input voltage + 10 dB should cause full scale deflection.

Attenuation of –10, –20, –30 and –40 dB should give deflections of 6, 4, 2 and 0 (± 1 dB).

1.4 Averaging Time

a. INPUT: "Direct"
FILTERS: "All released"
METER FUNCTION: "RMS-Lin"
AVERAGING TIME: "Fast"

Input signal: 1000 Hz adjusted to give full scale deflection on 2607.

b. AVERAGING TIME: "Fast to 300 sec."

Same deflection through all positions.

c. AVERAGING TIME: "300 sec."

Disconnect the input signal and turn the "Averaging Time" selector slowly down through the positions.

It should be noticed that the deflection drops faster and faster in each position.

d. AVERAGING TIME to "Fast"

Adjust the input signal to an 18 dB deflection.

When connecting and disconnecting the input signal the overshoot should be 0.6 dB ± 0.5 dB.

e. AVERAGING TIME to "Slow"

Overshoot: 0.6 dB $^{+1}_{-0.5}$ dB

f. AVERAGING TIME to "0.1 sec."

Overshoot: 0–0.2 dB.

1.4 Overload Indicators

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

Input to "Direct Input": 1 kHz–0.1 V RMS corresponding full scale deflection on 2607.

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 of 2607.

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.

1.5 Noise

GAIN CONTROL: "Cal."
INPUT: "Direct"
INPUT ATTENUATOR: "3 mV"
OUTPUT ATTENUATOR: "x 0.003"
FILTERS: "All released"

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

Max. noise with shortconnected input: 7 μV.

1.6 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 each of them.

Leave "Gain Control" in "Cal." and adjust "Sens." for a deflection to the ref. mark on the 2607 meter scale.

b. REF: "Released"

Input signal to "Direct Input": 1 kHz, exactly 100 mV.

Deflection on 2607: 100 mV ± 1%.

If necessary see item 5.7.

1.7 Sensitivity with Microphone

a. 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".

b. REF: "Released"
INPUT ATTENUATOR: "3 V"

Check the sensitivity with a Pistonphone Type 4220 or a similar wellknown sound source. The meter deflection on 2607 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 0052	25 dB Amplifier	Check items 5.1 to 5.8
ZE 0018	25 dB Amplifier	- - - - -
ZE 0035	50 dB Amplifier	Check items 4.1 to 4.8 and 3.1
ZF 0005	Attenuator	No adjustment necessary
ZF 0006	Attenuator	Check item 5.3
ZF 0007	Attenuator	- - -
ZF 0008	Attenuator	- - -
ZF 0009	LP Filter	Check items 4.2 and 4.3
ZF 0013	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 0038	± 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 1.6
ZI 0002	Ref. Oscillator	Check item 5.7
ZL 0011	Peak-Lin/Log	Check items 3.9 to 3.11
ZL 0012	Switching Circuit	Check items 3.4 to 3.6
ZL 0013	Integrator	Check item 3.3
ZL 0014	Diodes	Are adjusted from the factory, evt. check item 3.8
ZL 0027	Amplifier	Check items 3.1, 3.2 and 3.5
ZS 0167	Filter	Adjust according to item 6.1 and check items 6.2 and 6.3

Power Supply 2607.2

valid from serial no. 308927

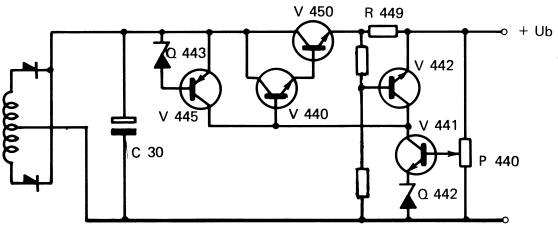
The instrument can be powered either from a Power Line which has 100, 115, 220 or 240 V AC 50–400 Hz or from a DC Supply of 12 V.

Thus the mains transformer T1 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 T1 there are different rectifier circuits giving different D.C. Voltages which are applied to the Voltage Regulators ZG 0005, 0008 and 0038.

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

Simplified Diagram of a Voltage Regulator.



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.

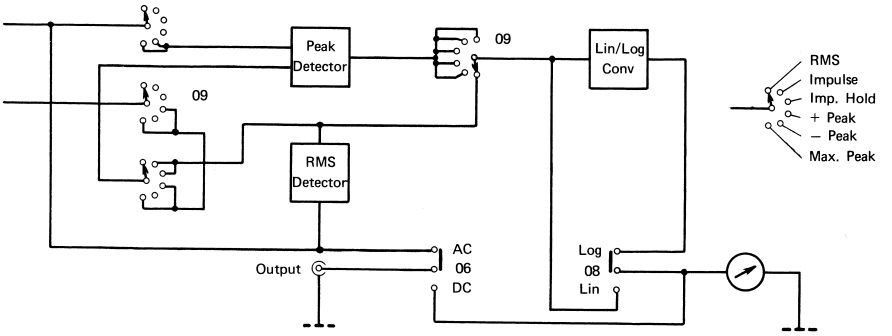
The output voltages from the different Regulators can be seen on the circuit diagram and adjusted on the respective circuit boards. If large adjustments are found necessary the circuits should be examined for faults before any adjustment.

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

Adjustment of:

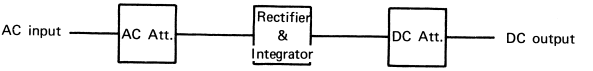
+ 20 V	on V 450_E	at P 440
+12.6 V	on V 383_E	at P 380
+ 200 V	on Pol. Voltage	at P 420

Simplified Diagram of the Meter Functions



The Meter Circuit of 2607 consists basically of a Peak Detector, an RMS Detector and a Lin/Log Converter. The diagram above shows how the "Meter Function" switch directs the signal to the circuits according to the six different Meter modes. In RMS mode the 10 V AC is applied to the RMS Detector, to the Lin/Log Converter and out to the meter. In Impulse and Imp. Hold modes the output of the RMS Detector is applied to the + Peak Detector in order to have the maximum RMS value indicated. In the three Peak modes the + Peak, the –Peak or the Max. Peak can be chosen, and here the RMS Detector is not used at all. In the input stage of the Peak Detector there are attenuators to give the same voltage level on both inputs, but with a phase difference of 180°. Thus all three different Peak modes will give same deflection on a pure sine wave.

The "Recorder Output" can be AC or DC dependent of the setting of 06 and the DC output will follow the meter function to an ordinary linear mode or a logarithmic mode chosen by 08.



The wide dynamic range of the RMS circuit is achieved by means of an AC attenuator on the input of the signal rectifier and a DC attenuator on the output of the rectifier.

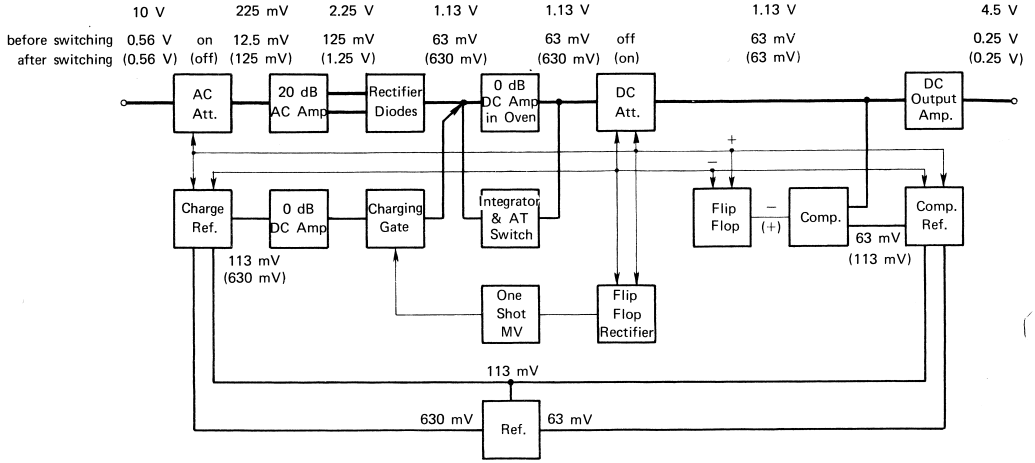
On low input levels there is a low attenuation before the signal rectifier and a high attenuation of the DC output voltage.

On high input levels the AC attenuation is 20 dB more and the DC attenuation 20 dB less than on low input levels.

At the cross-over level an electronic switch circuit sets the attenuators to the correct positions.

continued

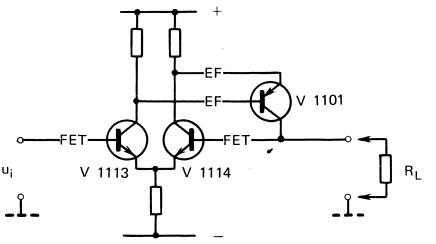
Principle of the RMS Detector



With 10 V AC input to the RMS circuit the AC attenuator has chosen the low output (225 mV) which is applied through a 20 dB symmetric amplifier to the signal rectifier. To the rectifier output (1130 mV) is connected an integrator and a 0 dB DC amplifier in an oven the output of which is led to the DC attenuator. This attenuator is in the high output position and the DC output amplifier will have 1130 mV on the input and 4.5 V on the output. In this position the comparator reference is 63 mV and the comparator output is negative. A negative input to the flip-flop gives the output situations indicated, and these situations set the attenuators, the comp. ref. and the charge ref.

When the 10 V AC input signal is decreased the output voltage from the DC attenuator will decrease as well and when this voltage is approx. 63 mV the comparator will cause a change of the flip-flop situation and the attenuators will make a level change as shown on the block diagram above. At the same time the comp. ref. will change to 113 mV. Thus the level change when decreasing will happen at 63 mV, but when increasing it will happen at 113 mV. When a level change is made the change of the capacitors in the integrator must change value by a factor of 10, this must be done very fast to avoid unstability of the deflection. The charge ref. is controlled from the flip-flop and when the level is changed from f.inst. 63 mV to 630 mV on the integrator the charge ref. will change from 113 mV to 630 mV. Each level change gives a signal to a one shot multivibrator and this opens the charging gate. Thus 630 mV will be applied to the capacitors in the integrator while the gate is open. The pulse duration of the one shot multivibrator is controlled by the "Average Time" switch and so the charging time always corresponds to the value of the capacitors in the integrator.

Simplified Diagram of One Diode

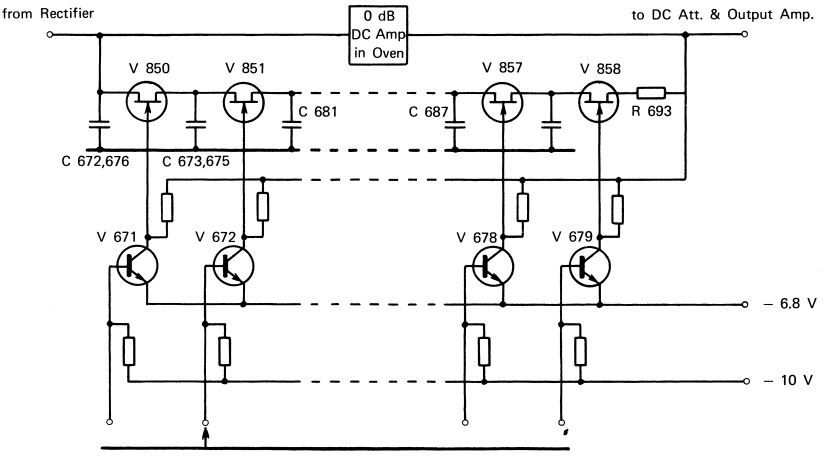


The principle of one diode is shown on the sketch above. When the input base is more positive than the feedback base the output transistor will apply a positive voltage to R_L. The voltage across R_L will be exactly the same as the input voltage because of a 100% feedback. A negative input will cause an open circuit output transistor and the voltage across R_L will be 0 V.

In the practical circuit there are two F.E.T.'s and two emitter followers connected as shown.

The advantage of this circuit compared to an ordinary diode is that this does not load the signal source at all, and any positive input voltage from a few mV to 10 V will generate an output signal of exactly the same value, i.e. a very linear diode.

Simplified Diagram of Integrator ZL 0013



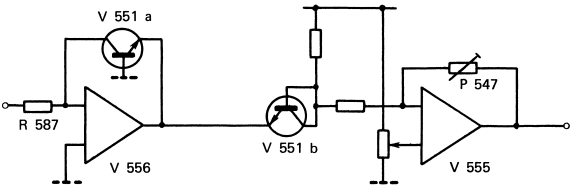
From the signal rectifier a positive DC voltage with ripple is applied to the integrator, which is formed by a number of capacitors in parallel. A smaller and larger number of capacitors will be connected dependent of the position of the "Average Time" selector.

As shown on the simplified diagram above F.E.T.'s are used as gates to connect the capacitors across the output from the rectifier. All F.E.T.'s except one will be shortcircuited at any time and if V 851 is the one which is opencircuit C 672, 676, 673 and 675 will be acting as integrating capacitors. At the same time all the capacitors C 681–690 will have the same voltage due to R 693 and when selecting another average time there will not be any change in deflection at all.

The actual gate function is as follows: All drains and sources of the F.E.T.'s will always be 0 V or positive. When the bases of the switch drivers are not connected to ground the F.E.T. gates will have the same voltage as the drains and sources because the switch drivers are open circuit. But when a base of a switch driver is connected to ground the base is positive related to the –6.8 V on the emitter and the transistor is shortcircuited. Thus the gate of the corresponding F.E.T. will be –6.8 V and the F.E.T. will be open circuited.

The F.E.T.'s V 841–849 shown on the original diagram do not influence the integrator but connect different resistor values giving the time constant for the one shot multivibrator which opens the charging gate.

Simplified Diagram of Lin/Log Converter



The Lin/Log converter utilizes the fact that the relationship between collector current and emitter-base voltage of a transistor is logarithmic for currents in the range of 1 pA to 1 mA.

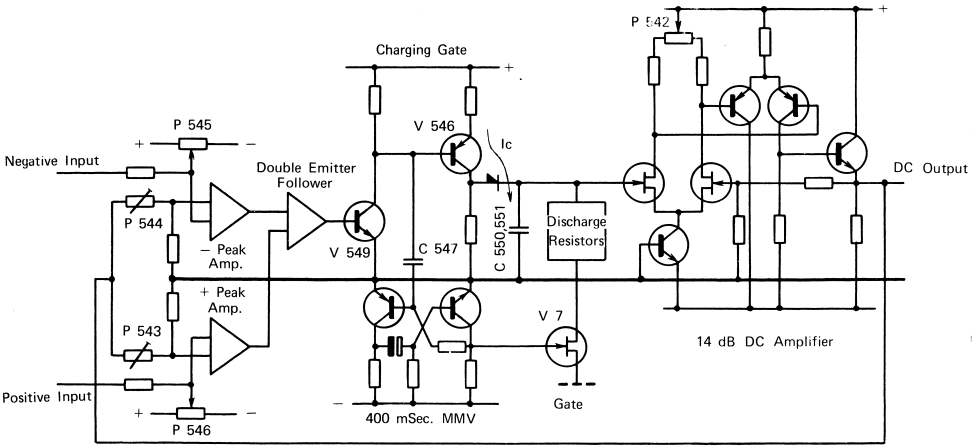
The operational amplifier V 556 gives a logarithmic output voltage for a linear input current because V 551 a is used as a logarithmic feedback element. A feedback applied to the emitter causes the collector current to be equal to the input current through R 587. The linear feedback current through V 551 a forces the base emitter voltage and thus the output voltage of V 556 to have a logarithmic function.

V 551 b is a temperature and level compensation for V 551 a both being in the same housing.

V 555 inverts the output signal to have the same polarity as the input and amplifies the signal to the desired scale factor, which is 90 mV per dB.

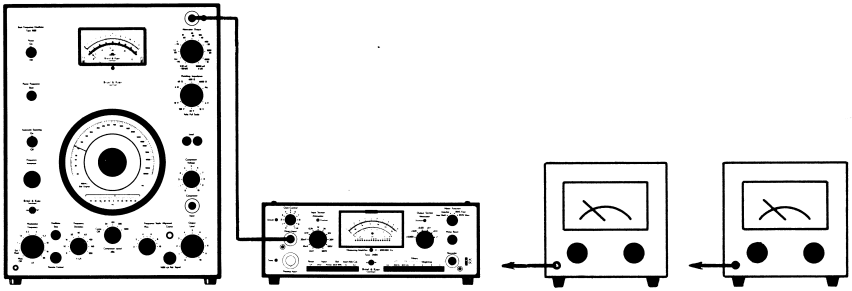
continued

Simplified Diagram of Peak Detector



The Peak Detector has two comparators in the input stage, one working on positive signals, the other one on negative signals. (Polarity related to the input of 2607). There is a feedback from the output amplifier giving the reference to the input comparators and when the input signal is higher than the feedback the comparator will give a logic "1" out through the double emitter follower which is an OR-function. A logical "1" will open V 549 and 546 and C 550 is charged very fast with a linear function. The output of the 14 dB amplifier will follow the capacitor voltage and increase the reference (feed-back) on the input comparator. When the reference reaches the input value the comparators will go to logical "0" and the charging of C 550 will stop. C 550 will then be discharged according to the chosen time constant and when the input level is higher than the reference feed back a charging of C 550 will be started again.

C 550 can be charged from 0 V to full value in 20 µSec., but the moving coil instrument uses 400 mSec. to reach full scale deflection. Thus a 20 uSec. impulse on the input when a fast "Average Time" is chosen would only give a very little deflection on the meter. In order to obtain a correct deflection even on very short pulses there is a delay of 400 mSec. before a discharge of C 550 is started. Each time a signal is given to charge C 550 a monostabil multivibrator is activated through C 547. The multivibrator opens V 7 and thus a discharge of C 550 through the Discharge Resistors does not start until 400 mSec. later. In this way the indicating meter will have time enough to indicate the input impulse correctly.



3.1 RMS Sensitivity

a. INPUT: "Direct"
INPUT ATTENUATOR: "0.1 V"
OUTPUT ATTENUATOR: "x 1"
FILTERS: "All released"
METER FUNCTION: "RMS-Lin."
AVERAGING TIME: "Fast"

Input signal to 2607: 1000 Hz adjusted for exactly 10 V on AC Output.

Check the DC Output: + 4.5 V DC ± 50 mV.

If necessary adjust P 1202 (DC Gain on ZL 0027).

Check that the meter deflection is full scale.

If necessary adjust P 3 (RMS Sens. on XC 0669).

b. METER FUNCTION to "Impulse"

Check that the meter deflection is full scale. (At + 4.5 V DC on Recorder).

If necessary adjust P 2 (Imp. Sens. on XC 0669).

3.2 Liniarity

INPUT: "Direct"
INPUT ATTENUATOR: "0.1 V"
OUTPUT ATTENUATOR: "x 1"
FILTERS: "All released"
METER FUNCTION: "RMS-Lin."
AVERAGING TIME: "Fast"

Input signal: 1000 Hz adjusted to give exactly + 4.5 V DC Output.

Check the DC Output according to the following scheeme.

INPUT ATTENUATOR position	DC Output	Corresponding Dynamic
30 mV	14.2 V ± 0.3 dB	+10 dB
0.1 V	4.5 V	0 dB
0.3 V	1.42 V ± 0.3 dB	−10 dB
1 V	450 mV ± 0.3 dB	−20 dB
3 V	142 mV ± 0.3 dB	−30 dB
10 V	45 mV ± 0.3 dB	−40 dB
30 V	14.2 mV ± 0.5 dB	−50 dB
100 V	Max. 8 mV	−60 dB

If the DC Output is linear on + 10 dB, −10 dB and −20 dB but unlinear from −30 dB to −60 dB adjust P 1201 (DC Balance on ZL 0027).

If the DC output is nonlinear on + 10 dB, −10 dB and −20 dB the trouble will be unliniarity in the Integrator or misalignment of the automatic DC attenuator.

continued

3.3 Check of Integrator ZL 0013

a. INPUT: "Direct"
INPUT ATTENUATOR: "0.1 V"
OUTPUT ATTENUATOR: "x 1"
FILTERS: "All released"
METER FUNCTION: "RMS-Lin."
AVERAGING TIME: "Fast"

Input signal: 1000 Hz approx. 100 mV to give full scale deflection on 2607.

Connect a High Impedance DC Voltmeter to the output of the 0 dB DC amplifier on ZL 0013 (the wire around the oven) and fineadjust the input voltage to give exactly 1 V DC on the Voltmeter.

b. INPUT ATTENUATOR to "1 V"

The DC Voltmeter should indicate exactly 100 mV.

If necessary adjust P 671, 672 (Integrator Balance, fine and coarse).

c. INPUT ATTENUATOR to "0.1 V"

Adjust the input voltage to give exactly 1 V on the DC Voltmeter and repeat the adjustment until complete liniarity over the 20 dB working range.

ATT.: The procedure must be followed very carefully, because the automatic attenuation will take place at 63 mV and this would move the working point up to the upper part of the parabolla.

3.4 Automatic Attenuator

a. INPUT: "Direct"
INPUT ATTENUATOR: "0.1 V"
OUTPUT ATTENUATOR: "x 1"
FILTERS: "All released"
METER FUNCTION: "RMS-Lin."
AVERAGING TIME: "Fast"

Input signal: 1000 Hz adjusted to give an 18 dB deflection on 2607.

b. INPUT ATTENUATOR to "1 V"

Measure the DC Output voltage and write it down.

When switching to "3 V" and back to "1 V" the automatic attenuators will change position and here the DC Output should be exactly the same as before.

When switching to "0.3 V" and back to "1 V" the attenuators will be back in the previous positions again and the output should still be the same.

If necessary adjust P 613 (DC Att. on ZL 0012) and repeat the checks.

3.5 Frequency Response

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

Input signal to Ext. Filter Out. socket: 1000 Hz adjusted to give an 18 dB deflection on 2607.

Attenuate the input voltage 30 dB and vary the input frequency from 1—200 kHz and check that fhe DC output is linear within 0.2 dB (provided that item 4.2 is fulfilled).

If necessary adjust C 631 (Lo on ZL 0012).

Input voltage back to the previous value (18 dB deflection on 2607).

Vary the input frequency from 1—200 kHz and check that the deflection is 18 dB ± 0.2 dB.

If necessary adjust C 630 (Hi on ZL 0012).

3.6 Switching Unstability

a. INPUT ATTENUATOR: "0.1 V"
OUTPUT ATTENUATOR: "x 1"
FILTERS: "All released"
METER FUNCTION: "RMS-Lin."
AVERAGING TIME: "100 sec."

The deflection should be to the Ref. mark on the scale. (Signal input to "Direct" socket).

b. METER FUNCTION to "RMS-Log."
INPUT ATTENUATOR to "1 V"

Watch the drop in deflection carefully and see that the unstability for downwards switching (at 3 on the 10 V scale range) does not exceed 0.1 dB.

c. INPUT ATTENUATOR to "0.3 V"

The unstability for upwards switching (at 4 on the 10 V scale range) should not exceed 0.2 dB.

If necessary adjust as follows:

P 612 (113 mV on ZL 0012) should be adjusted to 113 mV DC on the slider.

P 611 (63 mV on ZL 0012) should be adjusted to 63 mV DC on the slider and then fineadjusted to minimum unstability on the downwards switching. (Attenuator from "1 V" to "0.3 V"). (When fineadjusting note if the jump is going up or down).

3.7 Balance of ZL 0014

Remove ZE 0035.

Put a small piece of insulating tape on pin 3 and shortconnect it to pin 4 (on ZL 0014).

Put ZL 0014 on an extension board (the wire from ZL 0014 should not be connected).

Measure the DC voltage on pin 1: Max. 1 mV.

Measure the DC voltage on pin 2: Max. 1 mV.

If necessary adjust P 1204 (20 dB Balance on ZL 0027) for 0 V DC on pin 1 and P 1203 (0 dB Balance on ZL 0027) for 0 V DC on pin 2.

3.8 RMS Diodes ZL 0014

OUTPUT: "AC"

ZE 0035 still removed. ZL 0014 as in item 3.7.

Connect an Oscilloscope to the housing of V 1101 (on ZL 0014) and apply 1000 Hz 0.5 V to the Output socket of 2607.

Adjust the Oscilloscope (bc Input Mode) to obtain a picture with approx. 10 doublerectified halfwaves show up and note the top level.

Attenuate the input voltage to 40 dB below 0.5 V and increase the sensitivity of the Oscilloscope 40 dB.

The present picture should have the same top level as before (the bottom level does not have to be the same, and the picture does not look as clean as before).

If necessary adjust P 1101 and 1102 (on ZL 0014).

Connect the Oscilloscope to the housing of V 1103 (on ZL 0014) and repeat the procedure for the rest of the diodes. (For the last diode a 10 dB higher input level might be necessary to give a decent picture).

If adjustment of the diodes has been found necessary check and adjust according to item 3.1.

Remove the insulating tape and the shortconnection. Reinstall. ZL 0014.

3.9 Lin/Log Converter

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

Adjust "Gain Control" for 4.5 V DC Output (and full scale deflection).

b. METER FUNCTION to "RMS-Log"

DC Output should be 3.60 V (and 8 V deflection on the 10 V range).

If necessary adjust P 547 (FSD Log on ZL 0011).

c. METER FUNCTION to "RMS-Lin."
INPUT ATTENUATOR to "3 V"

Fine adjust "Gain Control" for 45 mV DC Output.

d. METER FUNCTION to "RMS-Log"

DC Output should be 0 V ± 10 mV (and 0 V deflection on 2607 meter).

If necessary adjust P 541 (0 Log on ZL 0011).

All the above mentioned procedure should be repeated as the two adjustments influence each others.

continued

3.10 Peak-Check

a.	INPUT: "Direct" INPUT ATTENUATOR: "30 mV" REF: "50 mV RMS" FILTERS: "All released" OUTPUT ATTENUATOR: "x 1" METER FUNCTION: "RMS-Lin." AVERAGING TIME: "1 sec."	Adjust "Gain Control" for a 14 dB deflection (ref. mark).
b.	METER FUNCTION to "+ Peak"	Deflection: 17 dB ± 0.1 dB.
c.	METER FUNCTION to "–Peak"	Deflection: 17 dB: ± 0.1 dB.
d.	METER FUNCTION to "+ Peak"	Adjust "Gain Control" for 4.5 V DC Output (f.s.d.).
e.	INPUT ATTENUATOR to "1 V"	DC Output: 142.3 mV ± 5 mV.
f.	METER FUNCTION to "–Peak"	DC Output: 142.3 mV ± 5 mV.

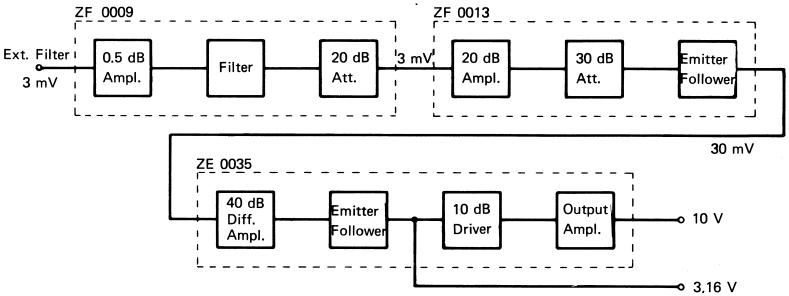
If the instrument is out of tolerance somewhere in the checking procedure follow item 3.11 for adjustment of the Peak circuit.

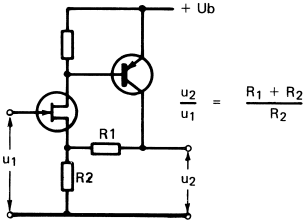
3.11 Peak Adjustment

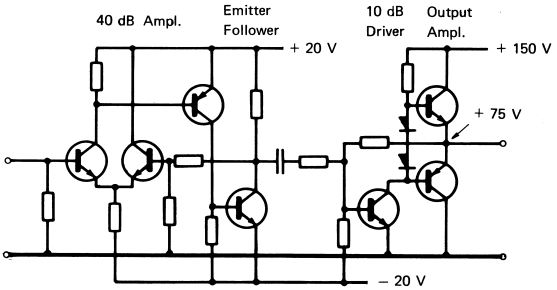
a.	INPUT: "Direct" REF: "50 mV RMS" INPUT ATTENUATOR: "30 mV" OUTPUT ATTENUATOR: "x 1" METER FUNCTION: "+ Peak-Lin." AVERAGING TIME: "1 sec."	Remove Output Amplifier ZE 0035. Turn P 545 and 546 (–30 dB Level on ZL 0011) to a fully anticlockwise position and P 543 and 544 (Top Level on ZL 0011) to mid position. Adjust P 542 (DC Balance on ZL 0011) for –3 mV ± 2 mV DC Output.
b.	METER FUNCTION to "RMS-Lin."	Put ZE 0035 back and adjust "Gain Control" for a 14 dB deflection.
c.	METER FUNCTION to "+ Peak"	Adjust P 543 (Top Level +) for a 17 dB deflection.
d.	METER FUNCTION to "–Peak"	Adjust P 544 (Top Level –) for a 17 dB deflection. Adjust "Gain Control" for 4.5 V DC Output.
e.	INPUT ATTENUATOR to "1 V"	Adjust P 545 (–30 dB Level –) for 142.3 mV DC Output ± 3 mV.
f.	METER FUNCTION to "+ Peak"	Adjust P 546 (–30 dB Level +) for 142.3 mV DC Output ± 3 mV.
g.	METER FUNCTION to "RMS" INPUT ATTENUATOR to "30 mV"	Adjust "Gain Control" for a 14 dB deflection and repeat the adjustments through items c to f because the Top Level and –30 dB adjustments influence each others.

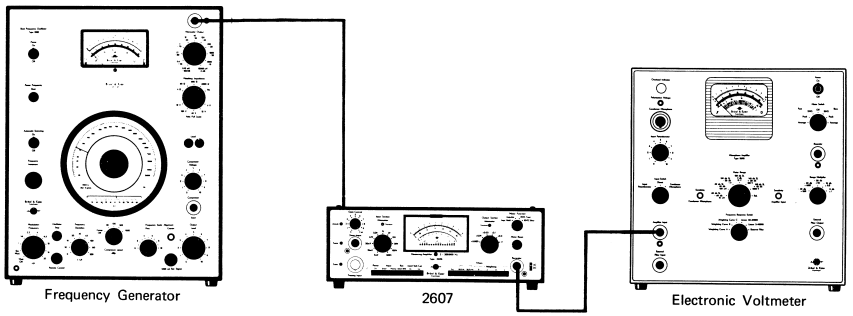
After adjustments in the Peak circuit ZL 0011 check item 3.1 b.

Block Diagram of the Output Amplifiers









4.1 Sensitivity

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

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

"AC Output": 10 V ± 0.5 dB.

If not check the 30 mV on V 360 emitter.

continued

4.2 Frequency Response

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

Input signal to "Ext. Filter Out": 1 kHz adjusted to give 10 V on "Output".

Vary the frequency from 2–200000 Hz.

"Output" voltage: 10 V ± 0.2 dB.

If necessary adjust Ċ (on ZE 0035) at 200000 Hz.

4.3 Output Attenuator

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

Input signal: 1 kHz adjusted to give 18 dB deflection on 2607.

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

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

At 200 kHz the tolerance is ± 0.2 dB.

4.4 Overload Indicator

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

Input signal to "Ext. Filter Out": 1 kHz adjusted to give exactly 56 V peak on "Output".

The "Output 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 voltage has not yet been limited.

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

4.5 Output Impedance

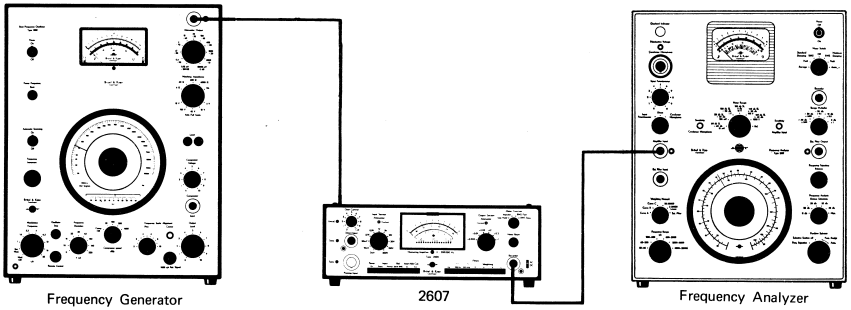
OUTPUT ATTENUATOR: "x 1"
FILTERS: "Ext."
AC–DC: "AC"

Input signal: 1 kHz adjusted to give exactly 10 V RMS on "Output".

Load the "Output" with a resistor of 1 kΩ.

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

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



Frequency Generator — 2607 — Frequency Analyzer

4.6 Distortion

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

Adjust a 1 kHz input signal to give 10 V RMS on "Output".

Set the Frequency Analyzer to Rejection Mode at 1 kHz and check the distortion which can be measured down to 0.25% only with these instruments.

However the tolerance for 2607 is 0.1% at 1 kHz and 0.3% at 50 kHz but to measure this a more complex set up is necessary.

4.7 Noise and Hum

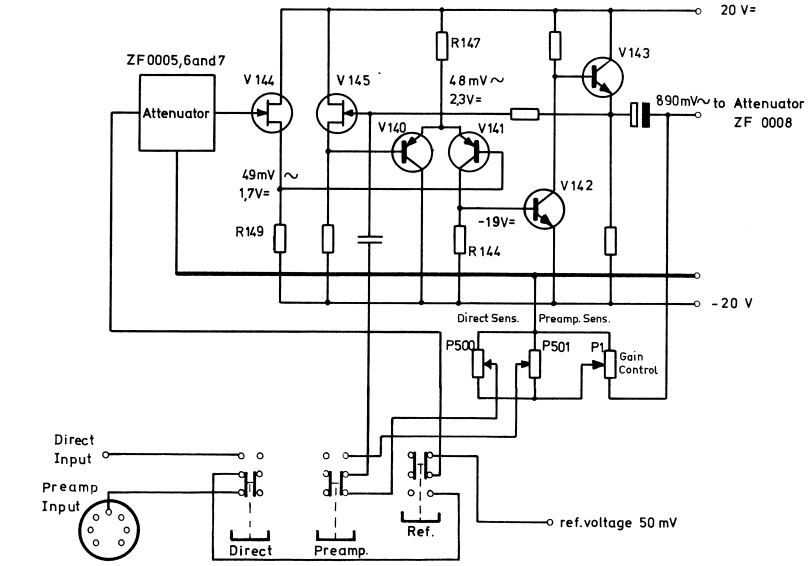
FILTERS: "Ext."
AC–DC: "AC"

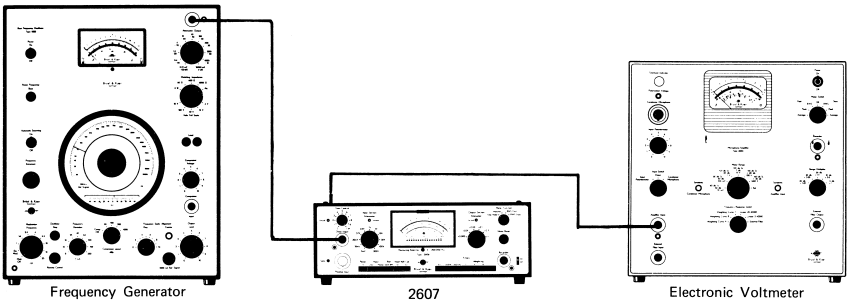
Shortconnect "Ext. Filter Out" socket.

Check noise and hum according to following scheeme:

OUTPUT ATTENUATOR	Without Filters			With Filters like follows			
	50 Hz	100 Hz	150 Hz	22.4 Hz	22.4 kHz	D	C
x 0.003	30 mV	20 mV	30 mV	160 mV	160 mV	400 mV	80 mV
x 1	2 mV	2 mV	2 mV	6 mV	6 mV	20 mV	6 mV

Simplified Diagram of Input Circuit.





Frequency Generator 2607 Electronic Voltmeter

5.1 Sensitivity

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

Input signal to 2607 "Direct Input": 1 kHz–100 mV.

Voltmeter connected to "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 the BFO direct to the Electronic Voltmeter and check the frequency response of these two instruments alone. Evt. note the deviation from linear.

b. Then apply 1 kHz to "Direct Input" of 2607 and adjust the voltage to give 18 dB deflection (± 1 V range) on the voltmeter connected to "Ext. Filter In" of 2607.

Vary the frequency from 2 Hz to 200 kHz.

Deflection on the voltmeter: 18 dB $^{+0.1}_{-0.2}$ dB. (+ tolerance of the voltmeter).

If necessary adjust C 160 at 200 kHz.

continued

5.3 Input Attenuator

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

Input signal: 1 kHz adjusted to give 18 dB deflection on the voltmeter connected to "Ext. Filter In" socket.

Check the steps of the input attenuator compared to the attenuator of the BFO or a special Attenuator Box.

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

At 200 kHz the tolerance is ± 0.2 dB.

If necessary adjust C 220–223.

5.4 Overload Indicator

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

Input signal: 1 kHz adjusted to give exactly 5.6 peak on "Ext. Filter In".

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 480 (on ZH 0011) until correct overload indication.

5.5 Output Impedance

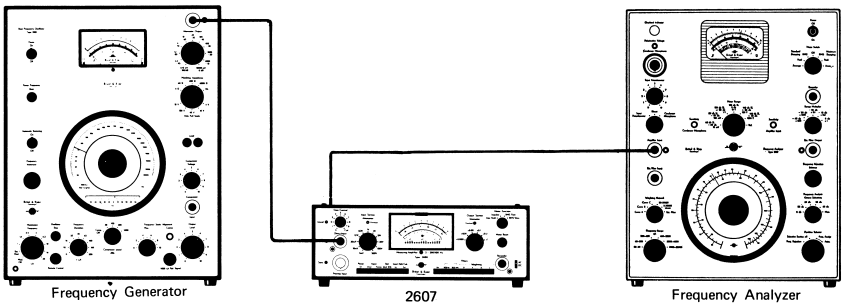
GAIN CONTROL: "Cal."
INPUT: "Direct"
INPUT ATTENUATOR: "0.1 V"
FILTERS: "Ext."

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

Load the socket with a resistor of 200Ω.

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

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



Frequency Generator — 2607 — Frequency Analyzer

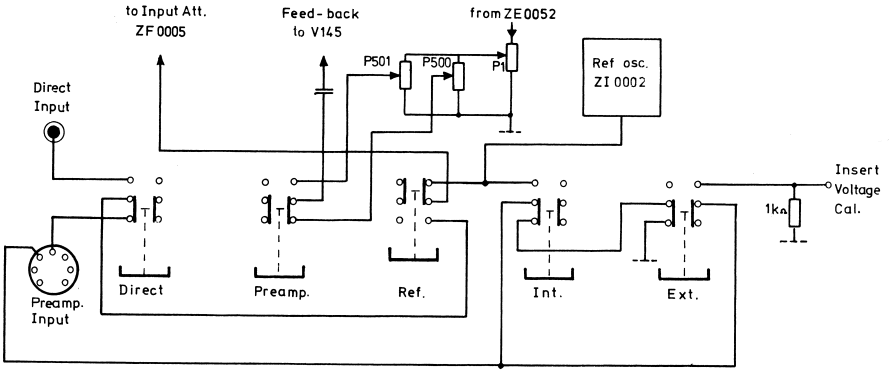
5.6 Distortion

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

Adjust a 1 kHz input signal to give 1 V RMS on "Ext. Filter In" socket.

Set the Frequency Analyzer to Rejection Mode at 1 kHz and check the distortion, which can only be measured down to 0.25% with these instruments.

The tolerance for Type 2607 is 0.01% at 1 kHz and 0.03% at 50 kHz, but to measure this a much more complex set up is necessary.



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"
AVERAGING TIME: "Fast"

Input signal: 1000 Hz exactly 100 mV RMS.

Adjust "Sens." to full scale deflection.

b. REF: to "50 mV RMS"

The 2607 meter should deflect 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 P 520.

If necessary adjust the frequency of ZI 0002 to 1000 Hz.

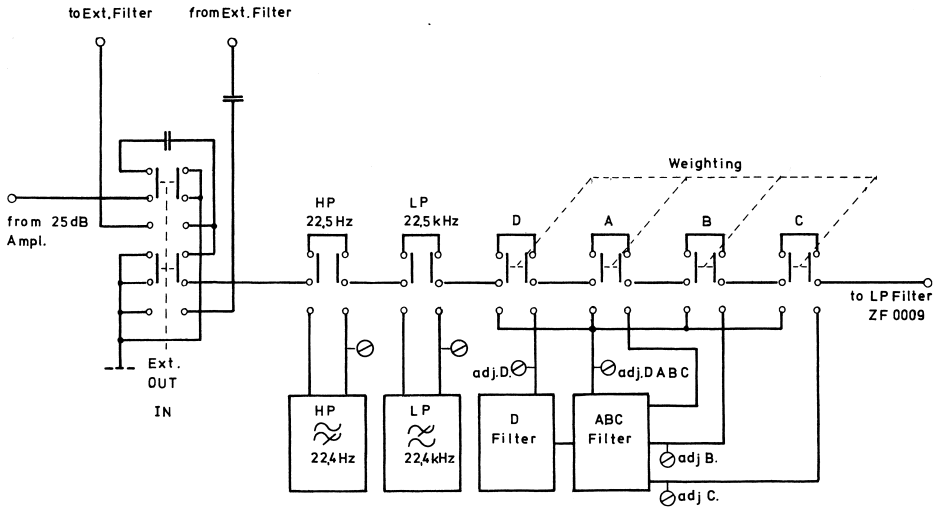
Max. distortion 2%.

5.8 Hum

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

Measure the hum selectively according to following scheeme:

	Input shortconnected			Input open		
INPUT ATTENUATOR	50 Hz	100 Hz	150 Hz	50 Hz	100 Hz	150 Hz
3 mV	300 µV	100 µV	300 µV	630 µV	630 µV	630 µV
10 mV	100 µV	35 µV	100 µV	210 µV	210 µV	210 µV
30 mV–300 V	60 µV	50 µV	60 µV	60 µV	50 µV	60 µV



6.1 1000 Hz Level

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

Adjust "Gain Control" to 18 dB deflection on 2607.

FILTER to "22.4 Hz", "22.4 kHz" and "D–A–B–C" positions.

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

If not adjust.

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

continued

6.2 Network Curves

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

Input signal: 1 kHz adjusted to give 18 dB deflection on 2607.

Check the network characteristic according to following scheeme.

Hz	Curve "A"		Curve "B"		Curve "C"		Curve "D"	
	Defl. on 2607 (dB)	Attenuator Position	Defl. on 2607 (dB)	Attenuator Position	Defl. on 2607 (dB)	Attenuator Position	Defl. on 2607 (dB)	Attenuator Position
10	8.4–12.4	100 µV	7.8–11.8	3 mV	11.7–15.7	30 mV	8.7–11.7	10 mV
100	18.4–19.4	10 mV	11.9–12.9	100 mV	17.2–18.2	100 mV	9.8–10.8	100 mV
1.000	17.9–18.1	100 mV	17.9–18.1	100 mV	17.9–18.1	100 mV	17.9–18.1	100 mV
10.000	15.0–16.0	100 mV	13.2–14.2	100 mV	13.1–14.1	100 mV	17.8–18.8	100 mV
100.000	Max. 18.0	3 mV	Max. 13.0	3 mV	Max. 13.0	3 mV	Max. 18.0	10 mV

6.3 Filter Curves

a. GAIN CONTROL: "Cal."
INPUT ATTENUATOR: "0.1 V"
INPUT: "Direct"
OUTPUT ATTENUATOR: "x 1"
METER FUNCTION: "RMS"
AVERAGING TIME: "Fast"

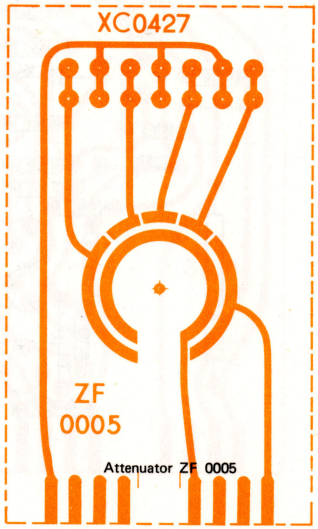
Input signal: 1 kHz adjusted to give 18 dB deflection on 2607.

b. FILTERS: "22.4 Hz in"

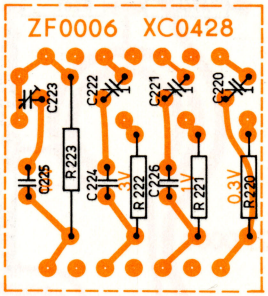
At 22.4 Hz the deflection should be 15 dB ± 1 dB.

c. FILTERS: "22.4 kHz in"

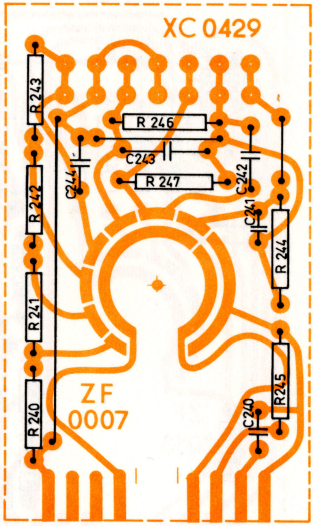
At 22.4 kHz the deflection should be 15 dB ± 1 dB.



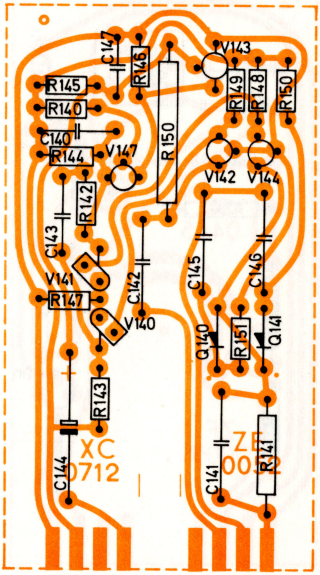
Attenuator ZF 0005



Attenuator ZF 0006

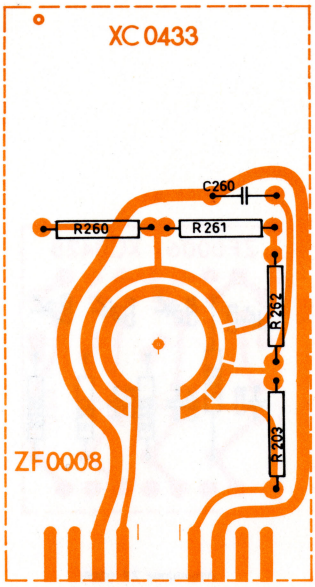


Attenuator ZF 0007

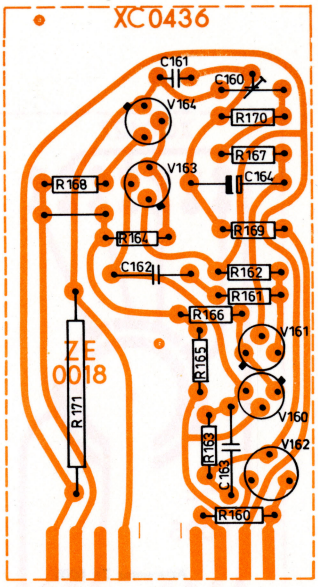


25 dB Amplifier ZE 0052

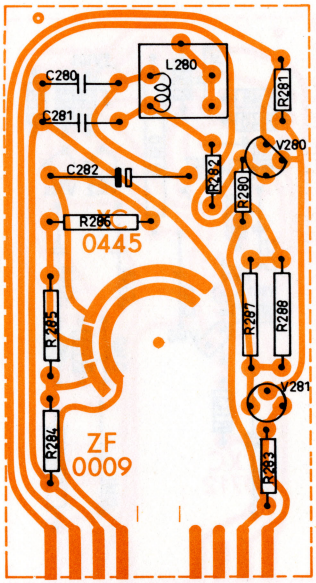
continued



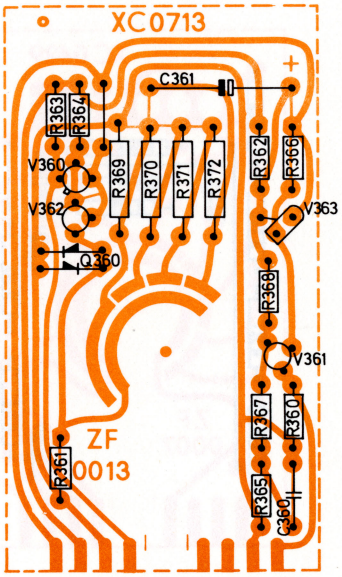
Attenuator ZF 0008



25 dB Amplifier ZE 0018



Attenuator ZF 0009



20 dB Amplifier ZF 0013

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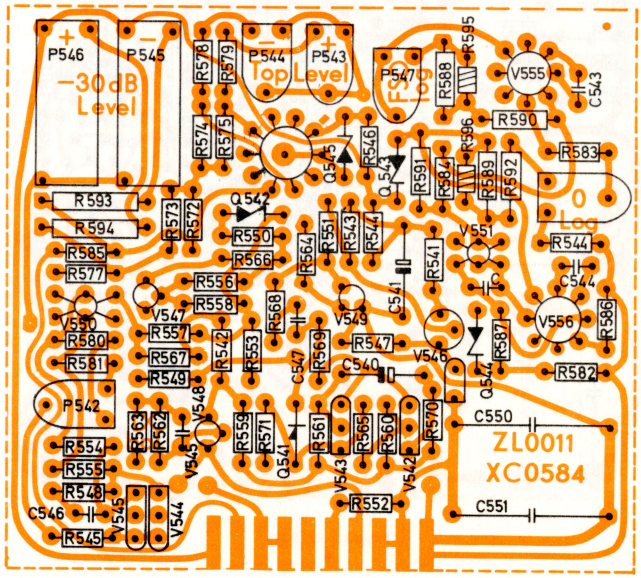
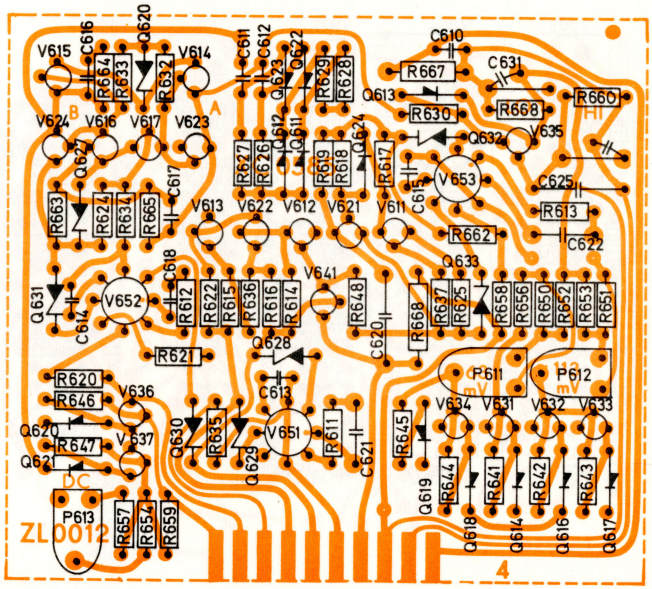
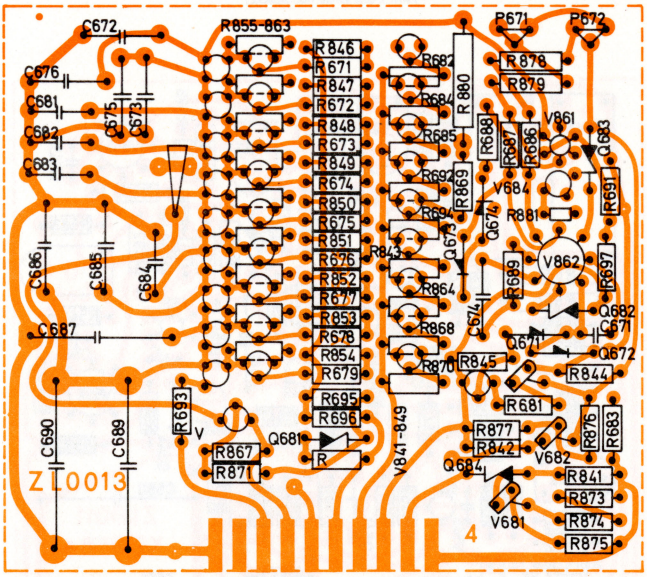


Peak Detector and Lin/Log. Converter ZL 0011

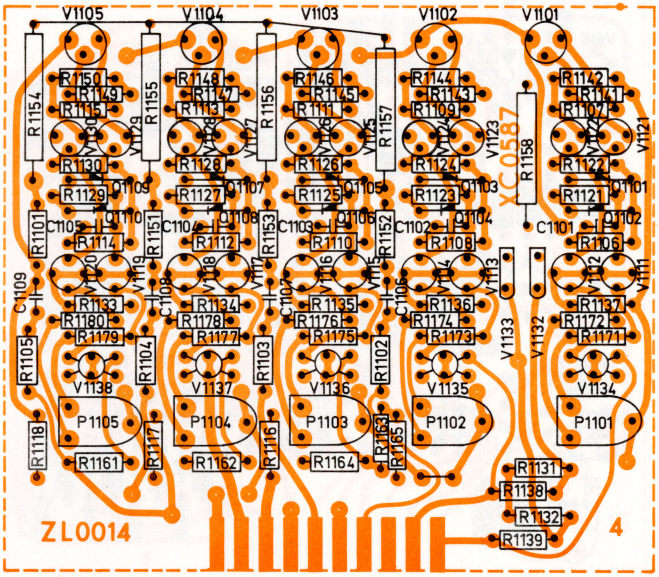


Automatic Range Selector ZL 0012

continued



Integrator ZL 0013



Diodes ZL 0014

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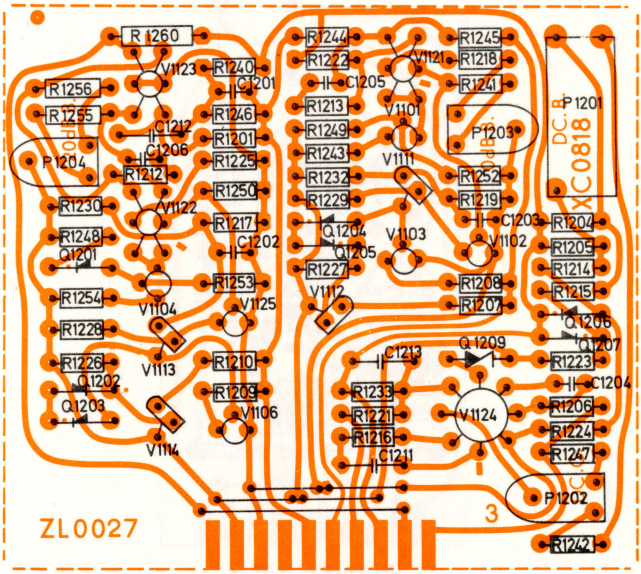
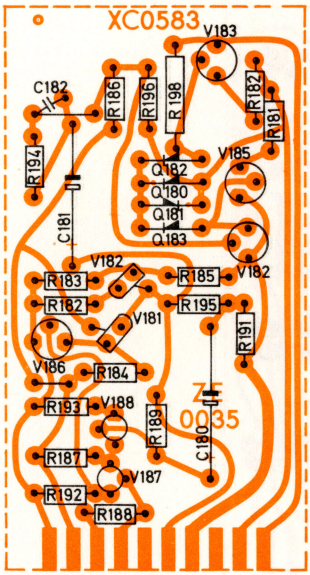
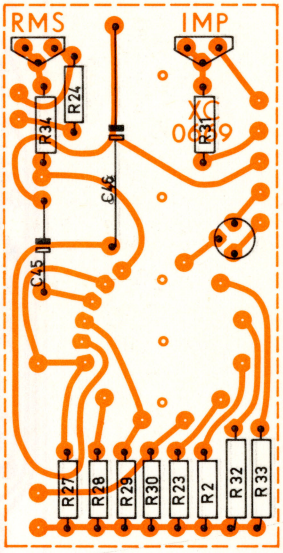


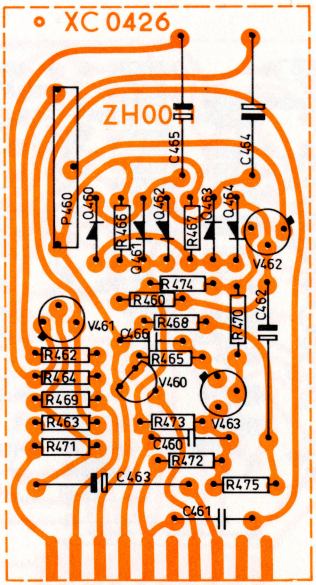
Amplifiers ZL 0027



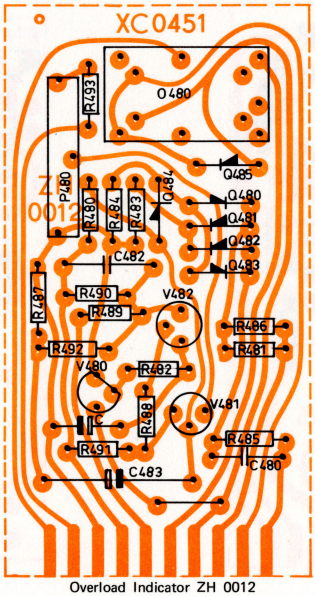
50 dB Amplifier ZE 0035



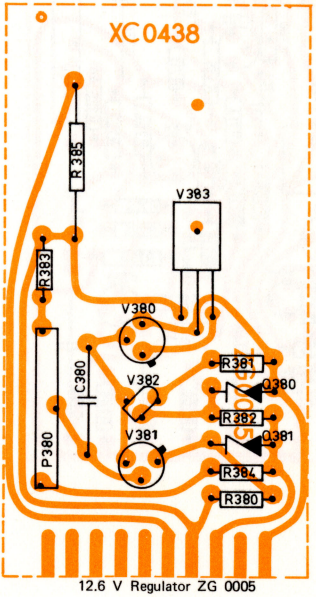
Meter Sensitivity



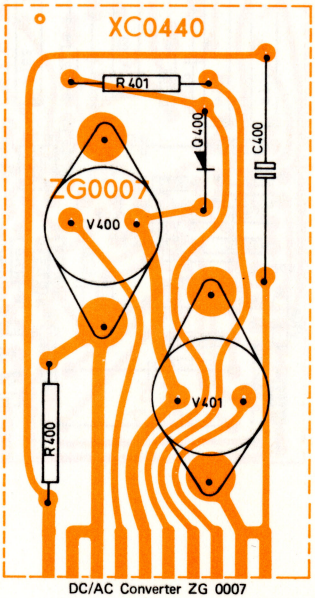
Overload Indicator ZH 0011



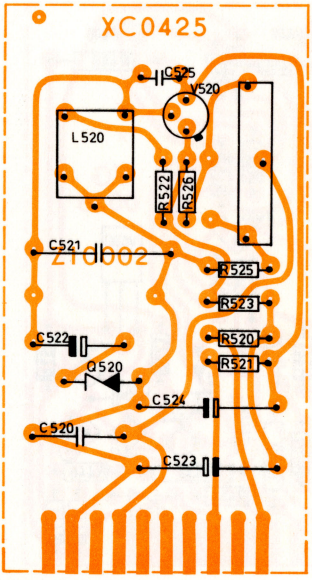
Overload Indicator ZH 0012



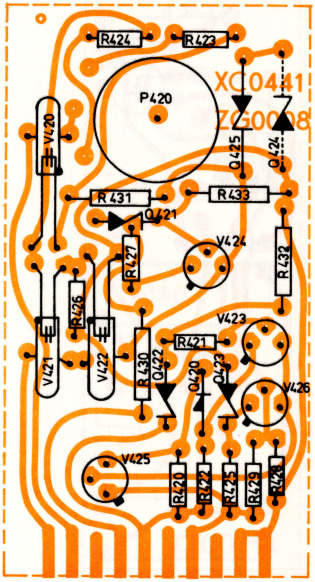
12.6 V Regulator ZG 0005



DC/AC Converter ZG 0007

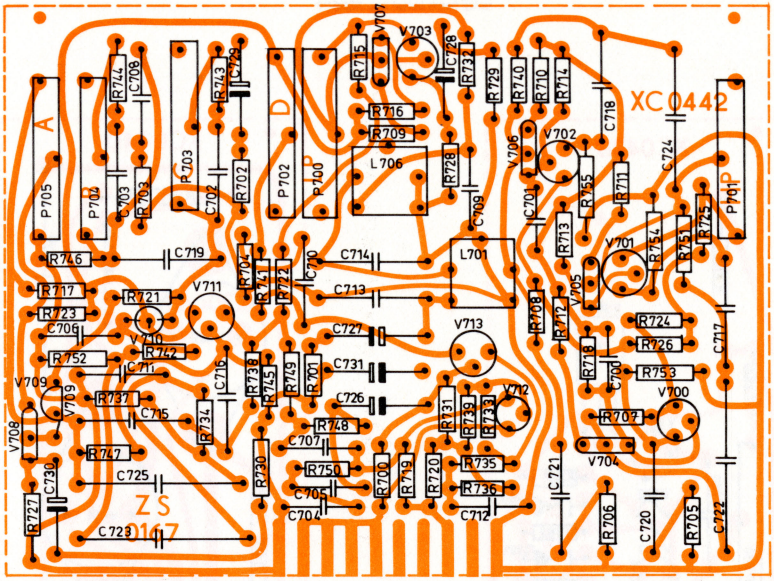


Ref. Oscillator ZI 0002

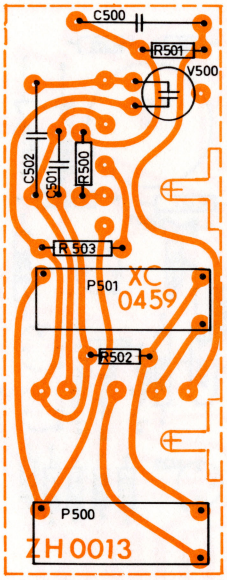


140 V. Pol. Volt. Reg. ZG 0008

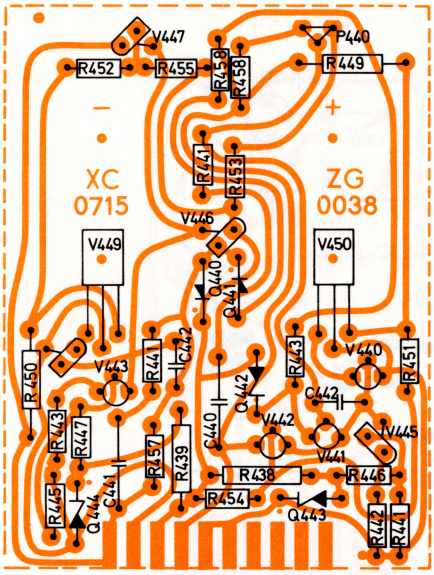
continued



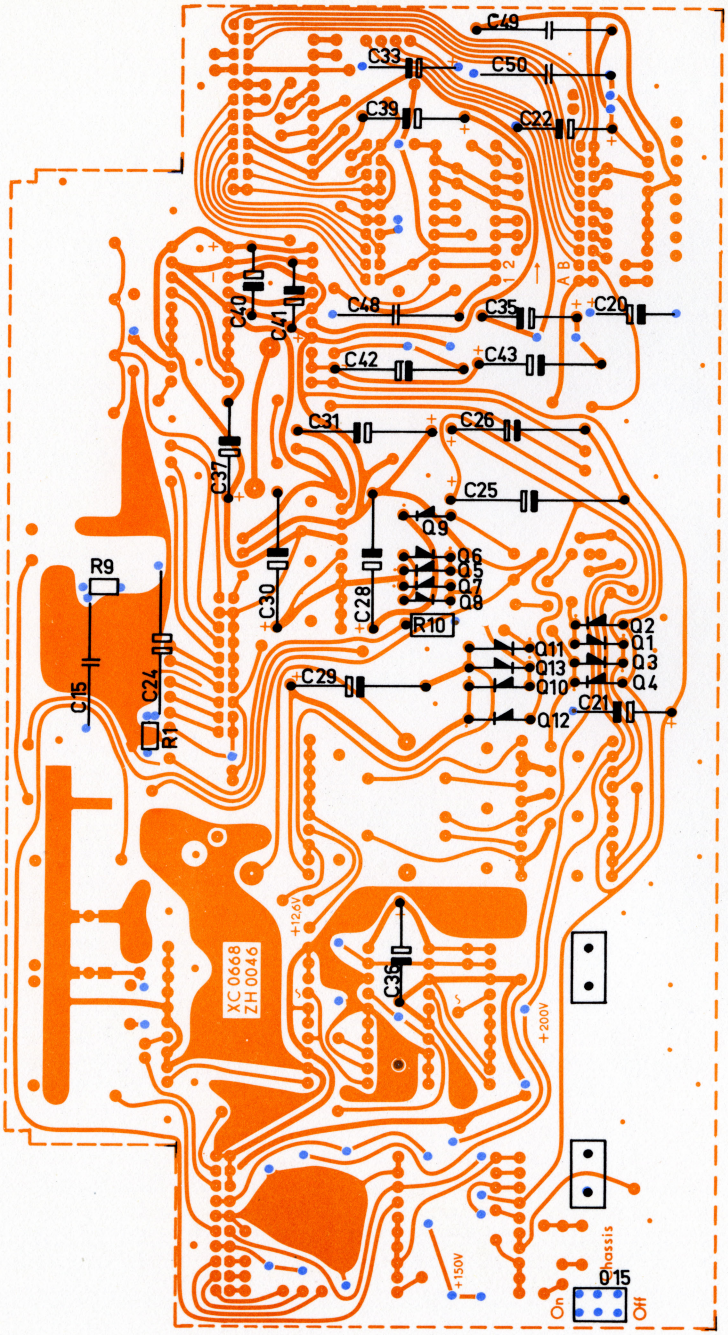
Filter Circuits ZS 0167



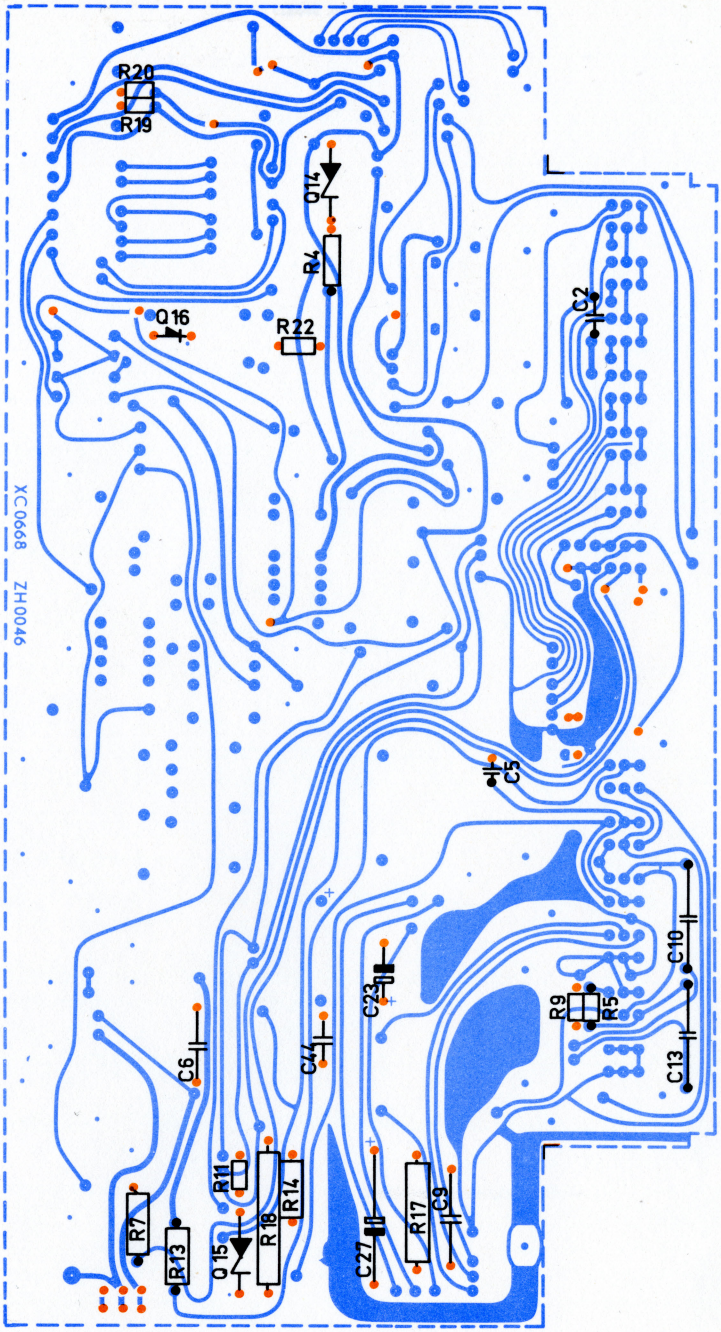
Gain Control Circuit ZH 0013



20 V Regulator ZG 0038



Interconnecting Board ZH 0046
Bottom View



Interconnecting Board ZH 0046

Top View

CIRCUIT DIAGRAM REF.	COMPONENT TYPE		STOCK REF.
CAPACITORS:			
C 2	Ceramic	33 pF/400 V	CK 1330
C 5	-	4.7 nF/100 V	CK 0096
C 6	Polycarbonate	0.1 µF/250 V	CS 0013
C 7	-	0.1 µF/400 V	CS 0113
C 9	-	0.22 µF/400 V	CS 0117
C 10	-	0.33 µF/400 V	CS 0119
C 12,13	-	1.5 µF/100 V	CS 0343
C 15	-	5.6 µF/100 V	CS 0346
C 20-22	Electrolytic	4.7 µF/180 V	CE 0608
C 23	-	10 µF/ 25 V	CE 0427
C 24	-	10 µF/ 25 V	CE 0428
C 25	-	16 µF/550 V	CE 0915
C 26	-	22 µF/250 V	CE 0805
C 27	-	47 µF/180 V	CE 0611
C 28	-	220 µF/ 63 V	CE 0521
C 29-31	-	470 µF/ 40 V	CE 0426
C 35	-	200 µF/ 10 V	CE 0306
C 36-39	-	100 µF/ 35 V	CE 0443
C 40-41	-	10 µF/ 25 V	CE 0427
C 42,43	-	32 µF/150 V	CE 2038
C 44	Ceramic	56 pF/400 V	CK 1560
C 45	Electrolytic	32 µF/ 4 V	CE 0100
C 46	-	1000 µF/ 6.4 V	CE 0210
C 48-50	Polycarbonate	2.2 µF/100 V	CS 0344
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	620 pF/125 V	CT 1109
C 144	Electrolytic	25 µF/ 40 V	CE 0424
C 145,146	Polyester	0.15 µF/100 V	CS 0337
C 147	Ceramic	100 pF/400 V	CK 2100
C 160	Trimmer	6- 25 pF	CV 0037
C 161	Ceramic	12 pF/400 V	CK 0095
C 162	Polystyrene	200 pF/125 V	CT 1118
C 163	-	620 pF/125 V	CT 1109
C 164	Electrolytic	10 µF/ 30 V	CE 0427
C 180,181	-	100 µF/ 6.4 V	CE 0207
C 182	Trimmer	6–25 pF	CV 0037
C 220-223	-	4.5–20 pF	CV 0020
C 224,225	Ceramic	22 pF/400 V	CK 1220
C 226	-	47 pF/400 V	CK 1470
C 240	-	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/ 63 V	CK 2800
C 260	-	39 pF/400 V	CK 1390
C 280	Polystyrene	1 nF/ 63 V	CT 1132
C 281	-	470 pF/125 V	CT 1111
C 282	Electrolytic	220 µF/ 12 V	CE 0315
C 360	Polyester	10 nF/250 V	CS 0403
C 361	Electrolytic	220 µF/125 V	CE 0315
C 380	Polyester	10 nF/250 V	CS 0001
C 400	Electrolytic	10 µF/ 70 V	CE 0517
C 440,441	Polycarbonate	1 µF/100 V	CS 0384
C 442,443	Ceramic	4.7 nF/500 V	CK 3470
C 460	-	1 nF/500 V	CK 3100
C 461	-	4.7 nF/500 V	CK 3470
C 462	Electrolytic	1.5 µF/180 V	CE 0609
C 463	-	50 µF/ 20 V	CE 0314
C 464,465	-	100 µF/ 15 V	CE 0317
C 466	Tantalum	47 µF/ 4 V	CF 0013
C 480	Ceramic	80 pF/400 V	CK 1800
C 481	-	8 pF/400 V	CK 0820
C 482	Polycarbonate	0.1 µF/100 V	CS 0334
C 483	Electrolytic	1.5 µF/180 V	CE 0609
C 484	Tantalum	47 µF/ 4 V	CF 0013
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
C 520	-	47 nF/250 V	CS 0009
C 521	Polycarbonate	0.33 µF/100 V	CS 0340
C 522	Electrolytic	2.2 µF/ 40 V	CE 0423
C 523,524	-	25 µF/ 40 V	CE 0424
C 525	Ceramic	390 pF/400 V	CK 2391
C 540	Electrolytic	8 µF/ 40 V	CE 0414
C 541	-	12.5 µF/ 25 V	CE 0416
C 543,544	Ceramic	39 pF/400 V	CK 1391
C 545	-	82 pF/400 V	CK 1820
C 546	-	120 pF/400 V	CK 2122
C 547	-	1 nF/400 V	CK 3101
C 548	-	8.2 nF/ 40 V	CK 3820
C 550,551	Polycarbonate	1.5 µF/100 V	CS 0343
C 610	Ceramic	6.8 pF/400 V	CK 0680
C 611,612	-	120 pF/400 V	CK 2122
C 613-618	-	220 pF/400 V	CK 2222
C 620	Polycarbonate	0.33 µF/100 V	CS 0350
C 621,622	-	10 nF/100 V	CS 0394
C 625	Polystyrene	1% 390 pF/100 V	CT 1120
C 630,631	Trimmer	10–60 pF	CV 0032
C 671	Ceramic	220 pF/400 V	CK 2222
C 672,673	Polystyrene	1% 2.2 nF/ 63 V	CT 1126
C 674,676	-	1% 3.3 nF/ 63 V	CT 1544
C 681	Polycarbonate	22 nF/100 V	CS 0393
C 682	-	68 nF/100 V	CS 0392
C 683	-	0.22 µF/100 V	CS 0389
C 684	-	0.68 µF/ 63 V	CS 0348
C 685,686	-	2.2 µF/ 63 V	CS 0349
C 687	-	6.8 µF/ 63 V	CS 0397
C 689,690	-	10 µF/ 63 V	CS 0398
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	-	43 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	Polyester	0.68 µF/100 V	CS 0342
C 726	Electrolytic	2.2 µF/ 40 V	CE 0423
C 727-730	-	10 µF/ 10 V	CE 0212
C 731	-	10 µF/ 30 V	CE 0427
C 1101-1109	Ceramic	120 pF/400 V	CK 2122
C 1201	-	15 pF/400 V	CK 1150
C 1202-1203	-	120 pF/400 V	CK 2122
C 1204	-	220 pF/400 V	CK 2222
C 1205	-	560 pF/400 V	CK 2561
C 1206	-	1 nF/400 V	CK 3101
C 1211	Polycarbonate	10 nF/100 V	CS 0394
C 1212	-	0.68 µF/ 63 V	CS 0348
C 1213	-	0.22 µF/100 V	CS 0389

continued

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
RESISTORS:					
R 1	Carbon	1/4 W	5%	22 Ω	RB 1220
R 2,3	-	1/8 W	10%	10 M Ω	RA 0025
R 4	-	1/3 W	5%	800 Ω	
R 5	-	1/4 W	-	10 k Ω	RB 4100
R 7	-	-	-	47 k Ω	RB 4470
R 8	-	-	-	56 Ω	RB 1560
R 9	-	-	-	100 k Ω	RB 5100
R 10,11	-	-	-	220 k Ω	RB 5220
R 12	-	1/3 W	-	300 Ω	
R 13	-	-	-	1 k Ω	
R 14	-	-	-	12 k Ω	
R 15	-	-	-	27 k Ω	
R 16	-	-	-	75 k Ω	
R 17	-	1/2 W	10%	20 M Ω	
R 18	-	1 W	-	39 k Ω	
R 19,20	-	1/4 W	5%	100 Ω	RB 2100
R 21	-	1/3 W	-	100 k Ω	
R 22	-	-	-	220 k Ω	RB 5220
R 23	-	1/8 W	10%	3.3 M Ω	RA 0022
R 24	-	1/4 W	5%	820 Ω	RB 2820
R 25	-	-	-	5.6 k Ω	RB 3560
R 26	-	-	-	18 k Ω	RB 4180
R 27	-	-	-	33 k Ω	RB 4330
R 28	-	-	-	100 k Ω	RB 5100
R 29	-	-	-	330 k Ω	RB 5330
R 30	-	-	-	1 M Ω	RB 6100
R 31	Metal	-	1%	1.5 k Ω	RF 3150
R 32	Carbon	-	10%	33 M Ω	RH 0016
R 33	-	-	-	100 M Ω	RH 0004
R 34	Metal	-	1%	7.68 k Ω	RF 3768
R 140	Carbon	-	5%	47 Ω	RB 1470
R 141	Metal	1/2 W	1%	8.25 k Ω	RF 0118
R 142	-	1/4 W	-	475 Ω	RF 2475
R 143,144	-	-	-	2.21 k Ω	RF 3221
R 145	-	-	-	3.09 k Ω	RF 3309
R 146	-	-	-	5.62 k Ω	RF 3562
R 147	-	-	-	26.7 k Ω	RF 4267
R 148	-	-	-	39.2 k Ω	RF 4392
R 149	-	-	-	60.4 k Ω	RF 4604
R 150	Carbon	1/2 W	10%	20 M Ω	
R 151,152	-	1/4 W	5%	100 Ω	RB 2100
R 160	-	1/8 W	10%	10 M Ω	RA 0025
R 161	-	1/4 W	5%	470 Ω	RB 2470
R 162,163	-	-	-	4.7 k Ω	RB 3470
R 164	-	-	-	10 k Ω	RB 4100
R 165	-	-	-	47 k Ω	RB 4470
R 166	-	-	-	68 k Ω	RB 4680
R 167	-	-	-	470 k Ω	RB 5470
R 168	Metal	-	1%	182 Ω	RF 2182
R 169	-	-	-	619 Ω	RF 2619
R 170	-	-	-	11 k Ω	RF 4110
R 171	Carbon	1/2 W	5%	1 k Ω	
R 180,181	-	1/4 W	-	33 Ω	RB 1330
R 182	-	-	-	100 Ω	RB 2100
R 183	-	-	-	1.2 k Ω	RB 3120
R 184	-	-	-	4.7 k Ω	RB 3470
R 185,186	-	-	-	18 k Ω	RB 4180
R 187	-	-	-	22 k Ω	RB 4220
R 188	-	-	-	100 k Ω	RB 5100
R 189	-	-	-	1 M Ω	RB 6100

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
RESISTORS:					
R 191	Metal	1/4 W	1%	365 Ω	RF 2365
R 192,193	-	-	-	1.1 k Ω	RF 3110
R 194	-	-	-	16.9 k Ω	RF 4169
R 195	-	-	-	37.4 k Ω	RF 4374
R 196	-	-	-	59 k Ω	RF 4590
R 198	Carbon	1/3 W	5%	33 k Ω	
R 280	-	1/4 W	-	47 Ω	RB 1470
R 281	-	-	-	2.2 k Ω	RB 3220
R 282	Metal	-	1%	715 Ω	RF 2715
R 283	-	-	-	147 k Ω	RF 5147
R 287,288	Carbon	1/3 W	5%	2.7 k Ω	
R 360,361	-	1/8 W	10%	10 M Ω	RA 0025
R 362	Carbon	1/4 W	5%	4.7 k Ω	RB 3470
R 363	-	-	-	10 k Ω	RB 4100
R 364	-	-	-	47 k Ω	RB 4470
R 365	Metal	-	1%	162 Ω	RF 2162
R 366	-	-	-	2.21 k Ω	RF 3221
R 367	-	-	-	3.01 k Ω	RF 3301
R 368	-	-	-	31.6 k Ω	RF 4316
R 380	Carbon	-	5%	1 k Ω	RB 3100
R 381,382	-	-	-	2.7 k Ω	RB 3270
R 383,384	-	-	-	4.7 k Ω	RB 3470
R 385	Wire	5.5 W	10%	30 Ω	RX 0309
R 400	-	-	-	22 Ω	RX 0311
R 401	-	-	-	120 Ω	RX 0307
R 420	Carbon	1/4 W	5%	270 Ω	RB 2270
R 421	-	-	-	1.5 k Ω	RB 3150
R 422	-	-	-	5.6 k Ω	RB 3560
R 423,424	-	-	-	47 k Ω	RB 4470
R 425	-	-	-	120 k Ω	RB 5120
R 426	-	-	-	1 M Ω	RB 6100
R 427	Metal	-	1%	649 Ω	RF 2649
R 428	-	-	-	30.9 k Ω	RF 4309
R 429	-	-	-	121 k Ω	RF 5121
R 430	Carbon	1/3 W	5%	1.8 k Ω	
R 431	-	-	-	22 k Ω	
R 432	-	-	-	200 k Ω	
R 433	-	-	-	316 k Ω	
R 438,439	-	-	-	3.9 k Ω	
R 440,443	-	1/4 W	-	470 Ω	RB 2470
R 444,445	-	-	-	1.2 k Ω	RB 3120
R 446,447	-	-	-	4.7 k Ω	RB 3470
R 448	-	-	-	3.3 k Ω	RB 3330
R 449,450	Metal	-	1%	6.19 Ω	RF 0619
R 451,452	-	-	-	432 Ω	RF 2432
R 453	-	-	-	2.49 k Ω	RF 3249
R 454,455	-	-	-	4.02 k Ω	RF 3402
R 456	-	-	-	4.75 k Ω	RF 3475
R 457	-	-	-	11.5 k Ω	RF 4115
R 458	-	-	-	12.1 k Ω	RF 4121
R 460	Carbon	1/8 W	10%	10 M Ω	RA 0025
R 462	-	1/4 W	5%	1.8 k Ω	RB 3180
R 463,464	-	-	-	2.7 k Ω	RB 3270
R 465	-	-	-	3.3 k Ω	RB 3330
R 466,467	-	-	-	10 k Ω	RB 4100
R 468	-	-	-	47 k Ω	RB 4470
R 469,470	-	-	-	100 k Ω	RB 5100
R 471	-	-	-	180 k Ω	RB 5180
R 472	-	-	-	220 k Ω	RB 5220
R 473	-	-	-	330 k Ω	RB 5330

continued

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
RESISTORS:					
R 474	Carbon	1/4 W	5%	390 k Ω	RB 5390
R 475	-	-	-	820 k Ω	RB 5820
R 480	-	1/8 W	10%	10 M Ω	RA 0025
R 482	-	1/4 W	5%	3.3 k Ω	RB 3330
R 483,484	-	-	-	4.7 k Ω	RB 3470
R 485	-	-	-	10 k Ω	RB 4100
R 486,487	-	-	-	47 k Ω	RB 4470
R 488	-	-	-	100 k Ω	RB 5100
R 489	-	-	-	220 k Ω	RB 5220
R 490	-	-	-	330 k Ω	RB 5330
R 491	-	-	-	390 k Ω	RB 5390
R 492	-	-	-	820 k Ω	RB 5820
R 493	Metal	-	1%	2 k Ω	RF 3200
R 500	-	-	-	665 Ω	RF 2665
R 501	-	-	-	1.62 k Ω	RF 3162
R 502	-	-	-	1.82 k Ω	RF 3182
R 503	-	-	-	3.92 k Ω	RF 3392
R 520,521	Carbon	-	5%	470 Ω	RB 2470
R 522	-	-	-	1.8 k Ω	RB 3180
R 523	-	-	-	6.8 k Ω	RB 3680
R 525	Metal	-	1%	787 Ω	RF 2787
R 526	-	-	-	54.9 k Ω	RF 4549
R 541	Carbon	-	5%	10 Ω	RB 1100
R 542	-	-	-	47 Ω	RB 1470
R 543	-	-	-	270 Ω	RB 2270
R 544	-	-	-	330 Ω	RB 2330
R 545	-	-	-	470 Ω	RB 2470
R 546	-	-	-	560 Ω	RB 2560
R 547-549	-	-	-	1 k Ω	RB 3100
R 550	-	-	-	1.2 k Ω	RB 3120
R 551	-	-	-	1.8 k Ω	RB 3180
R 552	-	-	-	3.3 k Ω	RB 3330
R 553	-	-	-	6.8 k Ω	RB 3680
R 554-557	-	-	-	10 k Ω	RB 4100
R 558	-	-	-	12 k Ω	RB 4120
R 559	-	-	-	15 k Ω	RB 4150
R 560-564	-	-	-	18 k Ω	RB 4180
R 565,566	-	-	-	22 k Ω	RB 4220
R 567	-	-	-	39 k Ω	RB 4390
R 568	-	-	-	47 k Ω	RB 4470
R 569	-	-	-	100 k Ω	RB 5100
R 570,571	-	-	-	180 k Ω	RB 5180
R 572,573	Metal	-	1%	887 Ω	RF 2887
R 574,575	-	-	-	1 k Ω	RF 3100
R 576	-	-	-	1.91 k Ω	RF 3191
R 577	-	-	-	4.53 k Ω	RF 3453
R 578,579	-	-	-	8.06 k Ω	RF 3806
R 580,581	-	-	-	9.53 k Ω	RF 3953
R 582-584	-	-	-	10 k Ω	RF 4100
R 585	-	-	-	17.8 k Ω	RF 4178
R 586,587	-	-	-	31.6 k Ω	RF 4316
R 588,589	-	-	-	110 k Ω	RF 5110
R 590	-	-	-	237 k Ω	RF 5237
R 591,592	-	-	-	294 k Ω	RF 5294
R 593,594	-	-	-	1 M Ω	RF 6010
R 595,596	NTC	1/2 W		150 k Ω	RN 0005
R 611-613	Carbon	1/4 W	5%	1.5 k Ω	RB 3150
R 614-616	-	-	-	2.2 k Ω	RB 3220
R 617,618	-	-	-	4.7 k Ω	RB 3470
R 619-622	-	-	-	5.6 k Ω	RB 3560
R 624	-	-	-	8.2 k Ω	RB 3820
R 625-627	-	-	-	10 k Ω	RB 4100
R 628-630	-	-	-	15 k Ω	RB 4150

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
RESISTORS:					
R 632-634	Carbon	1/4 W	5%	27 k Ω	RB 4270
R 635,636	-	-	-	33 k Ω	RB 4330
R 637	-	-	-	150 k Ω	RB 5150
R 641-648	-	-	-	220 k Ω	RB 5220
R 650,651	Metal	-	1%	4.99 Ω	RF 0499
R 652	-	-	-	18.7 Ω	RF 1187
R 653	-	-	-	32.4 Ω	RF 1324
R 654	-	-	-	121 Ω	RF 2121
R 655	-	-	-	162 Ω	RF 2162
R 656	-	-	-	182 Ω	RF 2182
R 657	-	-	-	432 Ω	RF 2432
R 658	-	-	-	634 Ω	RF 2634
R 659	-	-	-	909 Ω	RF 2909
R 660	-	-	-	5.90 k Ω	RF 3590
R 662	-	-	-	19.6 k Ω	RF 4196
R 663	-	-	-	22.1 k Ω	RF 4221
R 664,665	-	-	-	61.9 k Ω	RF 4619
R 666	-	-	-	71.5 k Ω	RF 4715
R 667	-	-	-	215 k Ω	RF 5215
R 668	Carbon	-	10%	20 M Ω	RH 0002
R 671-679	-	1/8 W	-	2.2 M Ω	RA 0015
R 681	-	1/4 W	5%	47 Ω	RB 1470
R 682	-	-	-	100 Ω	RB 2100
R 683	-	-	-	150 Ω	RB 2150
R 684	-	-	-	330 Ω	RB 2330
R 685-688	-	-	-	1 k Ω	RB 3100
R 689	-	-	-	1.5 k Ω	RB 3150
R 691	-	-	-	2.2 k Ω	RB 3220
R 692	-	-	-	3.3 k Ω	RB 3330
R 693	-	-	-	4.7 k Ω	RB 3470
R 694-697	-	-	-	10 k Ω	RB 4100
R 698	-	-	-	12 k Ω	RB 4120
R 700	-	1/8 W	10%	4.7 M Ω	RA 0004
R 701,702	-	1/4 W	5%	1 M Ω	RB 6100
R 703-706	-	1/8 W	10%	10 M Ω	RA 0025
R 707,708	-	1/4 W	5%	120 Ω	RB 2120
R 709	-	-	-	270 Ω	RB 2270
R 710-712	-	-	-	1 k Ω	RB 3100
R 713-720	-	-	-	4.7 k Ω	RB 3470
R 721	-	-	-	15 k Ω	RB 4150
R 722-726	-	-	-	39 k Ω	RB 4390
R 727,728	-	-	-	270 k Ω	RB 5270
R 729,730	-	-	-	330 k Ω	RB 5330
R 731	-	-	-	820 k Ω	RB 5820
R 732	Metal	-	1%	2.80 k Ω	RF 3280
R 733	-	-	-	3.24 k Ω	RF 3324
R 734	-	-	-	4.02 k Ω	RF 3402
R 735,736	-	-	-	4.99 k Ω	RF 3499
R 737	-	-	-	11.5 k Ω	RF 4115
R 738	-	-	-	12.4 k Ω	RF 4124
R 739	-	-	-	13 k Ω	RF 4130
R 740	-	-	-	16.5 k Ω	RF 4165
R 741	-	-	-	22.1 k Ω	RF 4221
R 742	-	-	-	23.7 k Ω	RF 4237
R 743,744	-	-	-	31.6 k Ω	RF 4316
R 745	-	-	-	37.4 k Ω	RF 4374
R 746	-	-	-	41.2 k Ω	RF 4412
R 747,748	-	-	-	68.1 k Ω	RF 4681
R 749,750	-	-	-	82.5 k Ω	RF 4825
R 751	-	-	-	121 k Ω	RF 5121
R 752,753	-	-	-	147 k Ω	RF 5147
R 754	Carbon	1/3 W	-	499 k Ω	
R 755	-	-	-	630 k Ω	

continued

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
RESISTORS:					
R 841	Carbon	1/3 W	1%	18 k Ω	RB 4180
R 842,843	-	-	-	33 k Ω	RB 4330
R 844,845	-	-	-	47 k Ω	RB 4470
R 846-864	-	-	-	100 k Ω	RB 5100
R 867	-	-	-	220 k Ω	RB 5220
R 868	-	-	-	330 k Ω	RB 5330
R 869	-	-	-	680 k Ω	RB 5680
R 870,871	-	-	-	1 M Ω	RB 6100
R 873	Metal	-	1%	2.49 k Ω	RF 3249
R 874	-	-	-	5.11 k Ω	RF 3511
R 875	-	-	-	11.8 k Ω	RF 4118
R 876	-	-	-	48.7 k Ω	RF 4487
R 877	-	-	-	30.9 k Ω	RF 4309
R 878,879	Matched pair	-	-	68 k Ω	RF 9003
R 880	Carbon	1 W	2%	12.2 M Ω	RH 0012
R 881	NTC	1/2 W		15 k Ω	RN 0010
R 1101	Carbon	1/4 W	5%	47 Ω	RB 1470
R 1102-05	-	-	-	120 Ω	RB 2120
R 1106-15	-	-	-	220 Ω	RB 2220
R 1116-18	-	-	-	1.2 k Ω	RB 3120
R 1121-30	-	-	-	2.2 k Ω	RB 3220
R 1131,32	-	-	-	12 k Ω	RB 4120
R 1133-37	-	-	-	22 k Ω	RB 4220
R 1138,39	-	-	-	82 k Ω	RB 4820
R 1141-50	-	-	-	100 k Ω	RB 5100
R 1151	-	-	-	330 k Ω	RB 5330
R 1152	-	-	-	560 k Ω	RB 5560
R 1153	-	-	-	820 k Ω	RB 5820
R 1154	-	1 W	1%	900 k Ω	RH 0010
R 1155	-	-	-	4.4 M Ω	RH 0011
R 1156	-	-	2%	17 M Ω	RH 0013
R 1157	-	-	-	22.8 M Ω	RH 0015
R 1158	-	1/3 W	-	20.4 k Ω	
R 1161	Metal		1%	422 Ω	RF 2422
R 1162	-	1/4 W	-	464 Ω	RF 2464
R 1163	-	-	-	619 Ω	RF 2619
R 1164	-	-	-	732 Ω	RF 2732
R 1165	-	-	-	2.55 k Ω	RF 3255
R 1171-80	-	-	-	68.1 k Ω	RF 4681
R 1201	Carbon	1/8 W	10%	10 M Ω	RA 0025
R 1204,05	-	1/4 W	5%	18 Ω	RB 1180
R 1206	-	-	-	47 Ω	RB 1470
R 1207-10	-	-	-	100 Ω	RB 2100
R 1212	-	-	-	220 Ω	RB 2220
R 1213	-	-	-	330 Ω	RB 2330
R 1214,15	-	-	-	680 Ω	RB 2680
R 1216	-	-	-	1.5 k Ω	RB 3150
R 1217,18	-	-	-	2.2 k Ω	RB 3220
R 1219	-	-	-	3.9 k Ω	RB 3390
R 1221,22	-	-	-	5.6 k Ω	RB 3560
R 1223,24	-	-	-	10 k Ω	RB 4100
R 1225	-	-	-	33 k Ω	RB 4330
R 1226	-	-	-	39 k Ω	RB 4390
R 1227	-	-	-	68 k Ω	RB 4680
R 1228	-	-	-	82 k Ω	RB 4820
R 1229	-	-	-	100 k Ω	RB 5100
R 1230	-	-	-	220 k Ω	RB 5220
R 1232	-	-	-	330 k Ω	RB 5330
R 1233	-	-	-	1 M Ω	RB 6100
R 1240	Metal	-	1%	1.18 k Ω	RF 3118
R 1241	-	-	-	2.21 k Ω	RF 3221
R 1242	-	-	-	4.99 k Ω	RF 3499
R 1243	-	-	-	9.31 k Ω	RF 3931
R 1244-46	-	-	-	10.5 k Ω	RF 4105

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
RESISTORS:					
R 1247	Metal	1/4 W	1%	15.8 k Ω	RF 4158
R 1248	-	-	-	23.2 k Ω	RF 4232
R 1249	-	-	-	24.9 k Ω	RF 4249
R 1250	-	-	-	33.2 k Ω	RF 4332
R 1252,53	-	-	-	75.0 k Ω	RF 4750
R 1254	-	-	-	95.3 k Ω	RF 4953
R 1255,56	Matched pair		-	68 k Ω	RF 9003
R 1260	Carbon	1/4 W	10%	20 M Ω	RH 0002

ATTENUATOR RESISTORS:

Please state serial number of apparatus when ordering attenuator resistors, or order one set of resistors.

R 220	Metal	1/2%	684 k Ω	RF 6009
R 221	-	-	900 k Ω	RF 6014
R 222	-	-	968.4 k Ω	RF 6015
R 223	-	-	990 k Ω	RF 6016
R 240	-	-	316 Ω	RF 6000
R 241	-	-	684 Ω	RF 6002
R 242	-	-	2.162 k Ω	RF 6005
R 243	-	-	6.84 k Ω	RF 6007
R 244	-	-	316 k Ω	RF 6008
R 245	-	-	1 M Ω	RF 6010
R 246	-	-	31.6 k Ω	RF 6012
R 247	-	-	100 k Ω	RF 6013
R 260	-	-	462 Ω	RF 6001
R 261	-	-	1 k Ω	RF 6003
R 262	-	-	3.16 k Ω	RF 6006
R 263	-	-	10 k Ω	RF 6011
R 284	-	-	1.462 k Ω	RF 6004
R 285	-	-	3.16 k Ω	RF 6006
R 286	-	-	10 k Ω	RF 6011
R 369	-	-	462 Ω	RF 6001
R 370	-	-	1 k Ω	RF 6003
R 371	-	-	3.16 k Ω	RF 6006
R 372	-	-	10 k Ω	RF 6011

TRANSISTORS etc.:

V 7	F.E.T.	N	E 102	VB 1027
V 140,141	Silicon	PNP	2 N 4289	VB 0049
V 142,143	-	NPN	BF 173	VB 0065
V 144,145	F.E.T.	N	E 102	VB 1010
V 160,161	Silicon	NPN	BC 107	VB 0032
V 162	F.E.T.	N	E 102	VB 1024
V 163,164	Silicon	PNP	2 N 2905	VB 0059
V 180,181	-	PNP	2 N 4289	VB 0049
V 182,183	-	NPN	BF 178	VB 0052
V 185	-	PNP	MM 4003	VB 0068
V 186	-	PNP	2 N 2905	VB 0059
V 187,188	-	NPN	BC 107 b	VB 0257
V 280	-	PNP	2 N 3702	VB 0038
V 281	F.E.T.	N	E 102	VB 1025
V 360	Silicon	NPN	BC 107	VB 0032
V 361	F.E.T.	N	E 102	VB 1009
V 362	-	N	E 102	VB 1025
V 363	Silicon	PNP	2 N 4289	VB 0049
V 380,381	-	NPN	BC 107	VB 0032
V 382	-	PNP	2 N 4289	VB 0049
V 383	-	NPN	2 N 4922	VB 0063
V 400,401	-	NPN	2 N 3055	VB 0519

continued

TRANSISTORS:

CIRCUIT DIAGRAM REF.	COMPONENT TYPE			STOCK REF.
V 420-422	Stabilizer		ZZ 1000	VA 0088
V 423,424	Silicon	PNP	MM 4003	VB 0068
V 425,426	-	NPN	2 N 3440	VB 0250
V 440-443	-	NPN	BC 107	VB 0032
V 445-448	-	PNP	2 N 4289	VB 0049
V 449	-	PNP	2 N 4919	VB 0061
V 450	-	NPN	2 N 4922	VB 0063
V 460	-	NPN	2 N 3704	VB 0028
V 461,462	-	NPN	BC 107	VB 0032
V 463	-	NPN	BF 178	VB 0052
V 480	-	NPN	2 N 3704	VB 0028
V 481	-	NPN	BC 107	VB 0032
V 482	-	NPN	BF 178	VB 0052
V 520	-	NPN	BC 107 b	VB 0257
V 541-545	-	PNP	2 N 4289	VB 0049
V 546	-	PNP	2 N 2905	VB 0059
V 547,548	-	NPN	BC 107 b	VB 0257
V 549	-	NPN	BSX 20	VB 0513
V 550	F.E.T. double	N	DN 349	VB 1005
V 551	Silicon double	NPN	BCY 87	VB 5302
V 555,556	Op. Amp.		LM 301 A	VE 0006
V 557	Comparator		LM 711 C	VE 0011
V 611-617	Silicon	NPN	BC 107	VB 0032
V 621-624	-	PNP	BC 177	VB 0071
V 631-637	F.E.T.		NF 510	VB 1021
V 641	F.E.T.	N	E 102	VB 1027
V 651-653	Op. Amp.		LM 709 A	VE 0010
V 671-680	Silicon	NPN	BC 107	VB 0032
V 681-683	-	PNP	BC 177	VB 0071
V 684	-	NPN	2 N 911	VB 0521
V 700-703	F.E.T.	N	E 102	VB 1025
V 704-708	Silicon	PNP	2 N 4289	VB 0049
V 709	-	NPN	2 N 3707	VB 0254
V 710	F.E.T.	N	E 102	VB 1009
V 711-713	Silicon	NPN	BC 107 b	VB 0257
V 841-849	F.E.T.		NF 510	VB 1021
V 850-859	F.E.T.		NF 510	VB 1034
V 861	F.E.T. double	N	DN 349	VB 1005
V 862	Op. Amp.		LM 709 A	VE 0010
V 1101-05	Silicon	PNP	2 N 2905	VB 0059
V 1111-20	-	NPN	BF 173	VB 0515
V 1121-30	-	NPN	BC 107	VB 0032
V 1132,33	-	PNP	2 N 4289	VB 0049
V 1134-38	F.E.T. double	N	DN 349	VB 1017
V 1201-06	Silicon	NPN	BC 107	VB 0032
V 1211-14	-	PNP	BC 177	VB 0071
V 1221,22	Silicon double	NPN	BCY 89	VB 5304
V 1223	F.E.T. double	N	DN 349	VB 1005
V 1224	Op. Amp.		LM 709 A	VE 0010

DIODES:

CIRCUIT DIAGRAM REF.	COMPONENT TYPE			STOCK REF.
Q 1-4	Silicon	BYX 10	1200 V/150 mA	QV 0025
Q 5-9	-	1 N 681	300 V/200 mA	QV 0209
Q 10-13	-	ER 21	200 V/600 mA	QV 0502
Q 14	Zener	5331	30 V/ 30 mA	QV 1318
Q 15	-	1 N 3048 B	150 V/ 6 mA	QV 1317
Q 16	Silicon	BAX 16	150 V/300 mA	QV 0217
Q 140,141	-	EC 401	100 V/225 mA	QV 0213
Q 180,181	-	13 P 2	200 V/ 40 mA	QV 0022
Q 182,183	-	BAX 16	150 V/300 mA	QV 0217
Q 360,361	-	EC 401	100 V/225 mA	QV 0213

DIODES:

CIRCUIT DIAGRAM REF.	COMPONENT TYPE			STOCK REF.
Q 380	Zener	ZG 5.6	5.6 V/ 46 mA	QV 1105
Q 381	-	ZG 6.8	6.8 V/ 40 mA	QV 1106
Q 400	Silicon	ER 1	50 V/600 mA	QV 0501
Q 420	-	BAX 16	150 V/300 mA	QV 0217
Q 421	Zener	ZG 6.8	6.8 V/ 40 mA	QV 1008
Q 422	-	ZG 6.8	6.8 V/ 40 mA	QV 1106
Q 423	-	MZ 28	28.5 V/ 10 mA	QV 1108
Q 424,425	-	1 N 3048 B	150 V/ 6 mA	QV 1317
Q 440,441	Silicon	BAX 16	150 V/300 mA	QV 0217
Q 442	Zener	ZG 6.8	6.8 V/ 40 mA	QV 1106
Q 443,444	-	ZF 6.2	6.2 V/ 45 mA	QV 1322
Q 460-464	Silicon	BAX 16	150 V/300 mA	QV 0217
Q 480-485	-	BAX 16	150 V/300 mA	QV 0217
Q 520	Zener	ZG 6.8	6.8 V/ 40 mA	QV 1106
Q 541	Silicon	BAX 13	50 V/150 mA	QV 0223
Q 542	Zener	ZG 6.8	6.8 V/ 40 mA	QV 1008
Q 543,544	-	ZG 5.6	5.6 V/ 46 mA	QV 1105
Q 545	-	1 N 716	12 V/ 20 mA	QV 1117
Q 611-613	Germ.	OA 47	25 V/110 mA	QV 0094
Q 614-624	Silicon	BAX 16	150 V/300 mA	QV 0217
Q 626-633	Zener	ZG 6.8	6.8 V/ 40 mA	QV 1106
Q 671-674	Silicon	BAX 16	150 V/300 mA	QV 0217
Q 681-683	Zener	ZG 6.8	6.8 V/ 40 mA	QV 1106
Q 684	-	ZG 5.6	5.6 V/ 46 mA	QV 1107
Q 1101-10	Silicon	BAX 16	150 V/300 mA	QV 0217
Q 1201-07	-	BAX 16	150 V/300 mA	QV 0217
Q 1209	Zener	1 N 716	12 V/ 20 mA	QV 1117

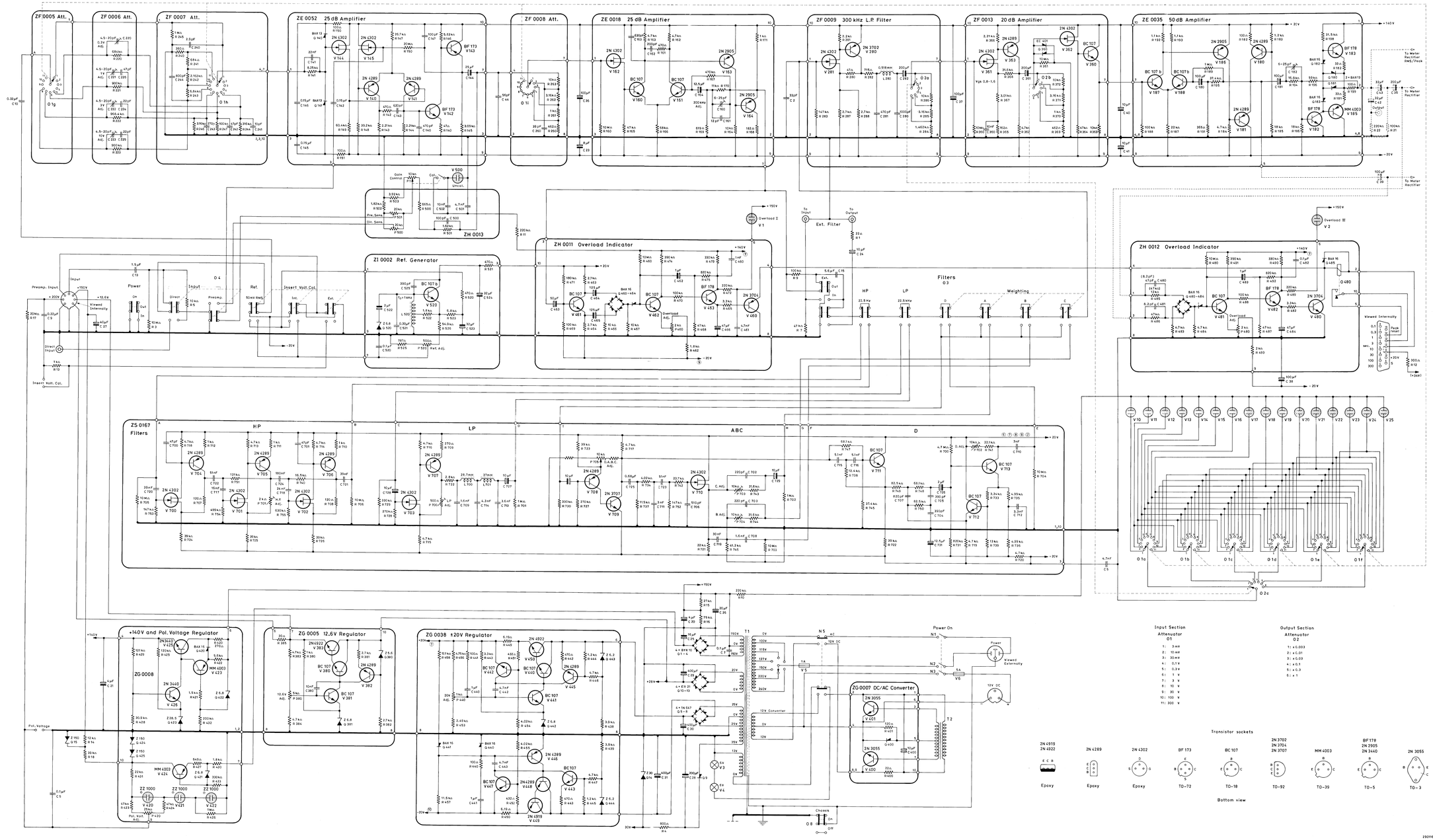
POTENTIOMETERS:

P 1	Gain Control	Carbon	10 kΩ PQ 3103
P 2	Imp. Sens.		2.2 kΩ PG 2207
P 3	RMS Sens.		2.2 kΩ PG 2207
P 380	12.6 V Adj.		5 kΩ PG 2505
P 420	Pol. Volt. Adj.		25 kΩ PH 3250
P 440	20 V Adj.		1 kΩ PG 2109
P 460	Overload Adj.		2 kΩ PG 2203
P 480	Overload Adj.		2 kΩ PG 2203
P 500	Dir. Sens.		20 kΩ PG 5203
P 501	Pre. Sens.		20 kΩ PG 3203
P 520	Ref. Adj.		500 Ω PG 1502
P 541	0 Log		470 Ω PG 1504
P 542	DC Balance		470 Ω PG 1504
P 543	Top Level +		1 kΩ PG 2108
P 544	- - -		1 kΩ PG 2108
P 545	–30 dB Level –		25 kΩ PG 3251
P 546	- - - +		25 kΩ PG 3251
P 547	FSD Log		47 kΩ PG 3471
P 611	63 mV		22 Ω PG 0222
P 612	113 mV		22 Ω PG 0222
P 613	DC Att.		470 Ω PG 1504
P 671	Integrator Balance,	fine	470 Ω PG 1471
P 672	- -	coarse	4.7 kΩ PG 2471
P 700	L.P. Adj.		500 Ω PG 1502
P 701	H.P. Adj.		2 kΩ PG 2203
P 702	D Adj.		10 kΩ PG 3107
P 703	C Adj.		10 kΩ PG 3107
P 704	B Adj.		10 kΩ PG 3107
P 705	D.A.B.C.Adj.		10 kΩ PG 3107
P 1101	Diode adj.		4.7 kΩ PG 2470
P 1102	- -		4.7 kΩ PG 2470

continued

CIRCUIT DIAGRAM REF.	COMPONENT TYPE		STOCK REF.
POTENTIOMETERS:			
P 1103	Diode adj.	4.7 kΩ	PG 2470
P 1104	- -	4.7 kΩ	PG 2470
P 1105	- -	4.7 kΩ	PG 2470
P 1201	DC Balance	500 Ω	PG 1501
P 1202	DC Gain	1 kΩ	PG 2108
P 1203	0 dB Balance	2.2 kΩ	PG 2207
P 1204	20 dB Balance	4.7 kΩ	PG 2470
SWITCHES AND RELAYS:			
N 1,2,3	Power Switches (micro)		NT 0021
N 5	12 V DC/AC		NN 0564
N 6	Meter Reset		NT 0028
O 1	Input Attenuator		OE 0011
O 2	Output Attenuator		OH 3010
O 3	Filter Switch (7 button)		OJ 0002
O 4	Input Switch (6 button)		OJ 0001
O 5	Main Voltage Selector		OA 0021
O 6-7	Slide Switches		NN 0031
O 8	-		NN 0032
O 9	Meter Function		OH 3008
O 10	Averaging Time		OH 3009
O 480	Overload Relay		OC 0021
SOCKET AND RELAYS:			
	Connectors for ZF 0005 and ZF 0007		JJ 0706
	Connectors for ZF 0006		JJ 0707
	Female Connector for ZL 0013		JJ 0043
	Male Connector for ZL 0014		JP 0043
	Multisocket, 10-pole (single)		JJ 1002
	Multisocket, 10-pole (double)		JJ 2002
	Multisocket, 12-pole (double)		JJ 2403
	Multisocket, 15-pole		JJ 1504
	Multiplug, 15-pole for above		JP 1501
	Screened socket		JJ 0108
	Preamplifier socket		JJ 0105
	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
COILS AND TRANSFORMERS:			
L 280	500 kHz LP Filter	0.518 mH	LB 0666
L 520	Ref. Oscillator	75 mH	LB 0660
L 700	22.4 kHz LP Filter	28.7 mH	LB 0658
L 701	22.4 kHz LP Filter	37 mH	LB 0659
T 1	Power Transformer		TN 0043
T 2	DC/AC Converter		TO 0002
LAMPS AND FUSES:			
V 1,2	Overload Lamps	220 V/ 0.8 mA	VS 0015
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

CIRCUIT DIAGRAM REF.	COMPONENT TYPE	without comp.	with comp.
PRINTED CIRCUITS:			
	25 dB Amplifier	XC 0436	ZE 0018
	50 dB Amplifier	XC 0583	ZE 0035
	25 dB Amplifier	XC 0712	ZE 0052
	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 0713	ZF 0013
	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 0038
	Overload Indicator I	XC 0426	ZH 0011
	Overload Indicator II	XC 0451	ZH 0012
	Gain Control Circuit	XC 0459	ZH 0013
	Interconnecting Board	XC 0668	ZH 0046
	Ref. Oscillator	XC 0425	ZI 0002
	Peak Detector, Lin/Log. Conv.	XC 0584	ZL 0011
	Automatic Range Selector	XC 0585	ZL 0012
	Integrator	XC 0586	ZL 0013
	Diodes	XC 0587	ZL 0014
	Amplifiers	XC 0818	ZL 0027
	Filter Circuit	XC 0442	ZS 0167
	Meter Sensitivity	XC 0669	
MISCELLANEOUS:			
	Power Cord Eur.		AN 0005
	Power Cord U.S.A.		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 0028
	Spring for Main Switch		OD 0177
	Contact Slider for Rotary Switches		OD 0179
	M 3 Allen Screw for above		YQ 2003
	1.5 mm Allen Key for do.		QA 0042
	Knob 20 mm		SN 2022
	Knob 31.5 mm		SN 3222
	Retaining Ring for 31.5 mm Knob		DB 0674
	M 4 Allen Screw for do.		YQ 2083
	2 mm Allen Key for above		QA 0043
	Metal Cabinet		KQ 0090
	Mahogany Cabinet		KA 0000
	Retaining Nut for Cabinets		YM 0425
SCALES:			
	Voltage and dB, lin.		SA 0051
	dB and Voltage, lin.		SA 0052
	dB and Voltage, log.		SA 0053
	Absorbtion Coefficient		SA 0054
	Power Spectral Density		SA 0055
	1" Microphone		SA 0056
	1/2" Microphone		SA 0057
	6–17 mV/g Accelerometer		SA 0058
	dB Lin/Log		SA 0059
	1/4" Microphone		SA 0060
	1/8" Microphone		SA 0083
	dB/dB m		SA 0084
	Degree Scale 400° – 100 deviations		SA 0087



BRÜEL & KJÆR
Nærum - Denmark

Circuit Diagram
valid from serial no. 308927

2607.9
sheet 1

Amplifier Section

2607.9-10.70

2901IC-02.11.70 - Amplifier Section - 2607

BRÜEL & KJÆR
Nærum - Denmark

Circuit Diagram

valid from serial no. 308927

2607.9

sheet 2

Meter Section

E 102 — Epoxy
2N 4289 — Epoxy
BSX 20, 2N 911, BC 107, BC 177 — TO - 18
NF 510 — TO - 18
BCY 87, BCY 89 — TO - 71
DN 349 — TO - 71
BF 173 — TO - 72
2N 2905 — TO - 5
LM 709A — TO - 71 — Frequency Compensation for Output / Frequency Compensation for Input
LM 301 A — TO - 71 — Balance / Compensation
LM 711 C — TO - 71 — Strobe / Ground

Note: Pin 5 connected to case

Peak Detector and Lin-to-log Converter
ZL 0011

Integrator
ZL 0013

Integrator Balance

Automatic Range Selector
ZL 0012

Amplifier Circuit
ZL 0027

Diode Circuit
ZL 0014

Diode 1
Diode 2
Diode 3
Diode 4
Diode 5