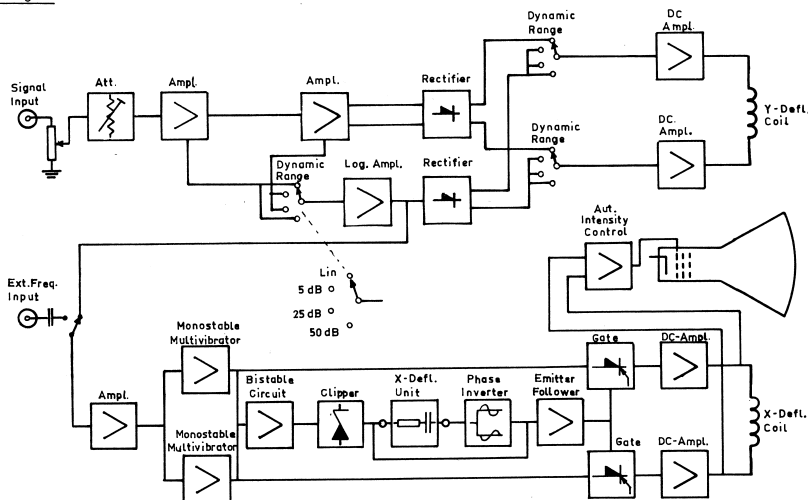


Consisting of:

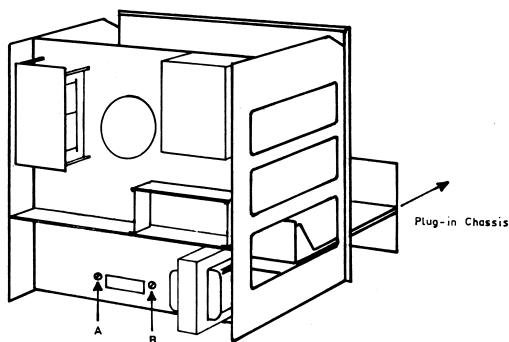
Y-Deflection	4712.1
X-Deflection	4712.2
Cathode Ray Circuit	4712.3
Motor Drive	4712.4
Position of Components	4712.5
Parts List	4712.6
Circuit Diagram	4712.7

Block Diagram:



Removal of the Metal Case

Place the instrument face downwards on a piece of soft material. After removing the four threaded retainers at the back of the instrument, it is possible to slide the case out of the chassis and the front panel.



Removal of Plug-in Chassis

To correct a fault in the Plug-in Chassis, the unit must be taken out. This can be done after the two screws A and B, which hold the plug-in chassis in its place, are removed.

### Trouble Shooting

If the reason for a fault is not an obvious one such as a dead tube, broken down resistor, blown or disconnected fuse etc., then first test the voltages of all the tubes and compare them with the voltages shown in the circuit diagram in order to localize the defect. Should this method of finding the fault prove unsuccessful, then check the instrument by adopting the method described in the adjustment procedure. When the trouble has been found and remedied, the voltages and adjustments which are influenced by the remedy must be rechecked.

The tolerances 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.

The instructions in this Manual are given purely as a guide to the service of equipment. Some faults, as, f. inst. small deviations in tolerances require for their correction special control equipment and extensive experience, and in these cases it is necessary to send the instrument to the factory.

### Spare Parts

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

### Instruments and Accessories Necessary for Service and Repair:

Multimeter (50  $\mu$ A)

Beat Frequency Oscillator type 1022 (+ Motor Drive UM 1014)

(Beat Frequency Oscillator type 1013)

Oscilloscope

Electronic DC-Voltmeter

### 1.1. DC Voltages

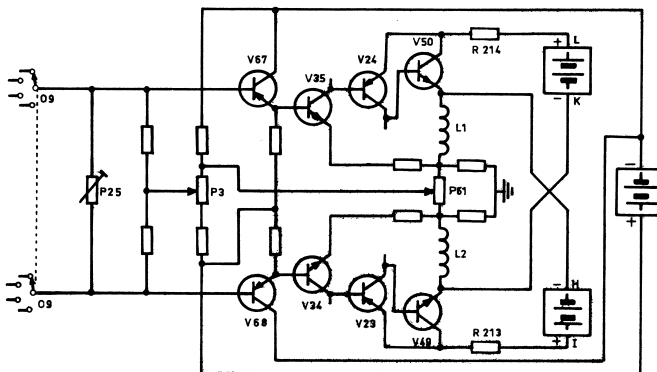
Linear amplifier: V 8 a': 107 - 134 V V 1 a': 50 - 60 V  
(XC 0319) k': 35 - 50 V k': 1.3 - 1.8 V  
a: 60 - 80 V a: 200 - 250 V  
k: 2 - 2.5 V k: 53 - 70 V

Logarithmic amplifier: V 13 collector measuring point D: -25.8 to -26.2 V.  
(XC 0319) If necessary adjust P 27.

V 13 emitter: -24.5 to -25.5 V.  
V 39 emitter, measuring point d: -14 to -18 V  
V 41 collector, measuring point e: -12 to -14.5 V  
V 41 emitter approx.: -2.8 V  
V 42 collector, measuring point f: -12 to -14.5 V  
V 42 emitter approx.: -2.8 V  
V 43 collector, measuring point g: -12 to -14.5 V  
V 43 emitter approx.: -2.8 V  
V 44 collector, measuring point h: -12 to -14.5 V  
V 44 emitter approx.: -2.8 V  
V 45 collector, measuring point i: -13.5 to -16 V  
V 45 emitter approx.: -2.6 V

DC amplifier:  
(4712.5 sheet 4,  
rear view)

across C 10, measuring point K-L: 9-11 V  
" C 9, " " H-I: 9-11 V  
" C 20, " " B-C: 35-45 V unloaded  
" C 31, " " A-ground: 310-335 V



### 1.2. Y-DC Amplifier

INPUT ATTENUATOR: "0 dB"  
INPUT POTENTIOMETER: "10"  
DYNAMIC RANGE: "50 dB"  
VERTICAL SPEED: "Slow"

- a. Connect the input signal to INPUT SIGNAL socket on type 4712.

Adjust the input voltage until the spot is on the 25 dB line (approx. 180 mV) and the frequency to the 1 kHz line. Check the current in the output transistors V 49, V 50 by means of a multimeter connected across the collector resistors.

Voltage across R 213 and R 214: 300 mV.

If necessary adjust P 3 (situated on printed circuit XC 0318).

- b. Increase the input voltage until the spot is on the 50 dB line.

Voltage across resistor R 213: approx. 100 mV

R 214: approx. 425 mV.

- c. Decrease the input voltage until the spot is on the 0 dB line

Voltage across resistor R 213: approx. 425 mV

R 214: approx. 100 mV

The voltage across R 213 for 0 dB deflection and across R214 for 50 dB deflection should be within 5%.

If not adjust P 61 (situated on printed circuit XC 0318).

### 1.3. Vertical Speed

- a. INPUT ATTENUATOR: "0 dB"  
INPUT POTENTIOMETER: "10"  
DYNAMIC RANGE: "50 dB"  
VERTICAL SPEED: "Fast"  
FREQUENCY SCALE: "20-20000 Hz"

Input frequency: 200 Hz.

Adjust input signal to the 25 dB line.

Ripple: max. 1.2 dB.

- b. VERTICAL SPEED to "Slow"

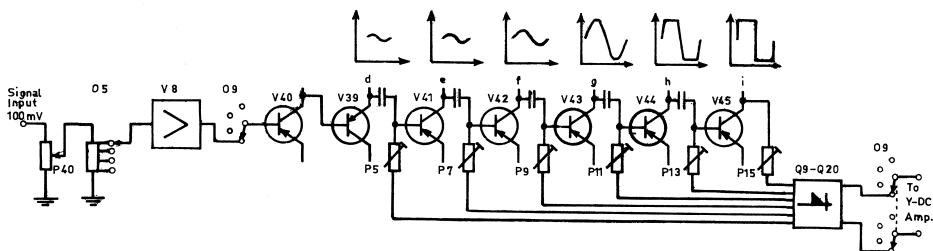
Input frequency: 20 Hz.

Ripple: max. 1.2 dB.

- c. INTENSITY to "10"

Change the input voltage  $\pm 10$  dB.

Overshoot: max. 10%



### 1.4. Logarithmic Amplifier 50 dB Range

INPUT ATTENUATOR: "0 dB"  
INPUT POTENTIOMETER: "10"  
DYNAMIC RANGE: "50 dB"  
VERTICAL SPEED: "Slow"

- a. Input signal: 10 mV, 630 Hz.

Measure the RMS voltage at measuring point i: approx. 7.5 V.

The spot should be on the 0 dB line.

If necessary adjust P 30. (situated on printed circuit XC 0324)

- b. Increase the input voltage 50 dB.

The spot should be on the 50 dB line.

If necessary adjust P 25 (situated on printed circuit XC 0318).

- c. Depress OSCILLATOR STOP on type 1022. The spot should drop down below the frame followed by one jump, not reaching the zero line. If it does, check the DC voltages in the logarithmic amplifier (measuring point d-i).

The DC voltages must not change if the OSCILLATOR STOP is depressed.

If necessary adjust potentiometers P 19-24 (situated on printed circuit XC 0319).

- d. Increase the input voltages stepwise (10 dB steps) from 10 mV and check that the steps of the spot are correct.

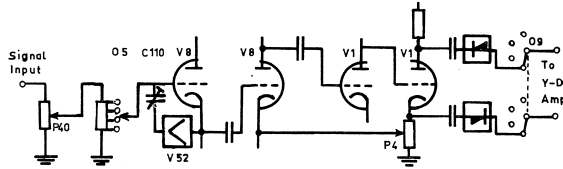
If necessary adjust potentiometer: P 15 P 13 P 11 P 9 P 7 P 5  
position: 0 dB 10 dB 20 dB 30 dB 40 dB 50 dB  
(situated on printed circuit XC 0319).

- e. Increase the input voltage stepwise (1 dB steps) and check that the steps from 0-5 dB are correct.

Tolerance:  $\pm 1$  mm.

If necessary adjust P 15 and P 25.

NB. Whenever one of the potentiometers is adjusted check item 1.4 again, and if P 25 is adjusted check also item 1.5, 1.6 and 1.7.



### 1.5. Linear Amplifier

INPUT ATTENUATOR: "0 dB"  
INPUT POTENTIOMETER: "10"  
DYNAMIC RANGE: "Lin."  
VERTICAL SPEED: "Slow"

Input signal: 100 mV, 630 Hz.

The spot should be on the 5 dB line (50 dB scale).  
If necessary adjust P 29.

Increase the input voltage to 1 V.

The spot should be on the 50 dB line (50 dB scale).

If necessary adjust P 4 (situated on printed circuit XC 0319).

Adjustment of P 4 and P 29 should be repeated until both positions are correct.

Check also position of the spot for Voltage: 200, 400, 600, 800 mV

Position: 10, 20, 30, 40 dB (50dB scale)

Tolerance:  $\pm 1.5$  mm.

### 1.6. Logarithmic Amplifier 25 dB Range

INPUT ATTENUATOR: "0 dB"  
INPUT POTENTIOMETER: "10"  
DYNAMIC RANGE: "25 dB"  
VERTICAL SPEED: "Slow"

- a. Input signal: 10 mV, 630 Hz.

The spot should be on the 0 dB line.

If necessary adjust first P18 for an output voltage on V45 collector (measuring point i): approx. 7.5 V RMS, then P 31 until the spot is on the 0 dB line.  
(situated on printed circuit XC 0319)

- b. Increase the input voltage stepwise (5 dB) and check that the steps on the screen are correct.

Tolerance:  $\pm 1$  mm.

If necessary adjust potentiometer: P 16 P 14 P 12 P 10 P 8 P 6  
position: 0 dB 5 dB 10 dB 15 dB 20 dB 25 dB  
(situated on printed circuit XC 0319).

If adjustment range of P 6 - 16 is too narrow adjust P 25 and repeat item 1.4. (situated on printed circuit XC 0318).

- c. Increase the voltage stepwise (1 dB steps) and check that the steps from 0 to 5 dB are correct.

Tolerance:  $\pm 1$  mm.

If necessary adjust P 16 and P 31.

- d. Increase the voltage stepwise (1 dB steps) and check that the steps from 20 to 25 dB are correct.

Tolerance:  $\pm 1$  mm.

If necessary adjust P 6 and P 18.

NB. Whenever one of the potentiometers is adjusted check item 1.6 again.

### 1.7. Logarithmic Amplifier 5 dB Range

INPUT ATTENUATOR: "0 dB"  
INPUT POTENTIOMETER: "10"  
DYNAMIC RANGE: "5 dB"  
VERTICAL SPEED: "Slow"

- a. Input signal 100 mV, 630 Hz.

The spot should be on the 0 dB line.

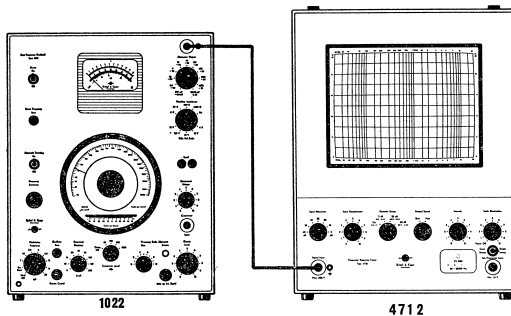
If necessary adjust first P 26 for an output voltage on V 45 collector (measuring point i) to 6.5 V RMS. Then adjust P 37 until the spot is on the 0 dB line. (situated on printed circuit XC 0319)

- b. Increase the input voltage stepwise (1 dB) and check that the steps from 0 dB to 5 dB are correct.

Tolerance:  $\pm 1$  mm.

If necessary adjust P 37 and P 26.

- c. Increase the input voltage stepwise (0.1 dB) and check that the steps from 0 to 0.5 dB are correct.  
Tolerance:  $\pm 0.05$  dB.
- NB. Whenever one of the potentiometers is adjusted check item 1.7 again.



#### 1.8. Frequency Response

INPUT ATTENUATOR: "10"  
INPUT POTENTIOMETER: "10"  
DYNAMIC RANGE: "25 dB"  
VERTICAL SPEED: "Slow"

- a. Input frequency: 1000 Hz.  
Adjust input signal until the spot is on the 10 dB line.  
Vary the frequency from 20 to 20000 Hz.  
The spot shall still be at the 10 dB line.  
Tolerance:  $\pm 0.1$  dB (+ tolerance of type 1022: 0.3 dB).  
Ripple at 20 Hz: max. 1.2 dB.
- b. If the spot is not within the tolerances or if the input frequency is higher than 20 kHz it is necessary to connect an input signal 1 V, 1 kHz to EXT. FREQUENCY INPUT which will keep the spot fixed on the 1 kHz line during checking and adjustment.

Check the frequency response for all positions of DYNAMIC RANGE.

Tolerance:	Frequency			
	20 Hz	50 kHz	100 kHz	200 kHz
Linear	$\pm 0.1$ dB	$\pm 0.1$ dB	$\pm 0.1$ dB	$\pm 0.2$ dB
Logarithmic	$\pm 0.1$ dB	$\pm 0.1$ dB	$\pm 0.2$ dB	$\pm 0.3$ dB

If necessary adjust C 110 (tolerance of type 1022: 0.3 dB  
type 1013: 0.5 dB).

#### 1.9. Input Attenuator

INPUT ATTENUATOR: "60 dB"  
INPUT POTENTIOMETER: "10"  
DYNAMIC RANGE: "50 dB"  
VERTICAL SPEED: "Slow"

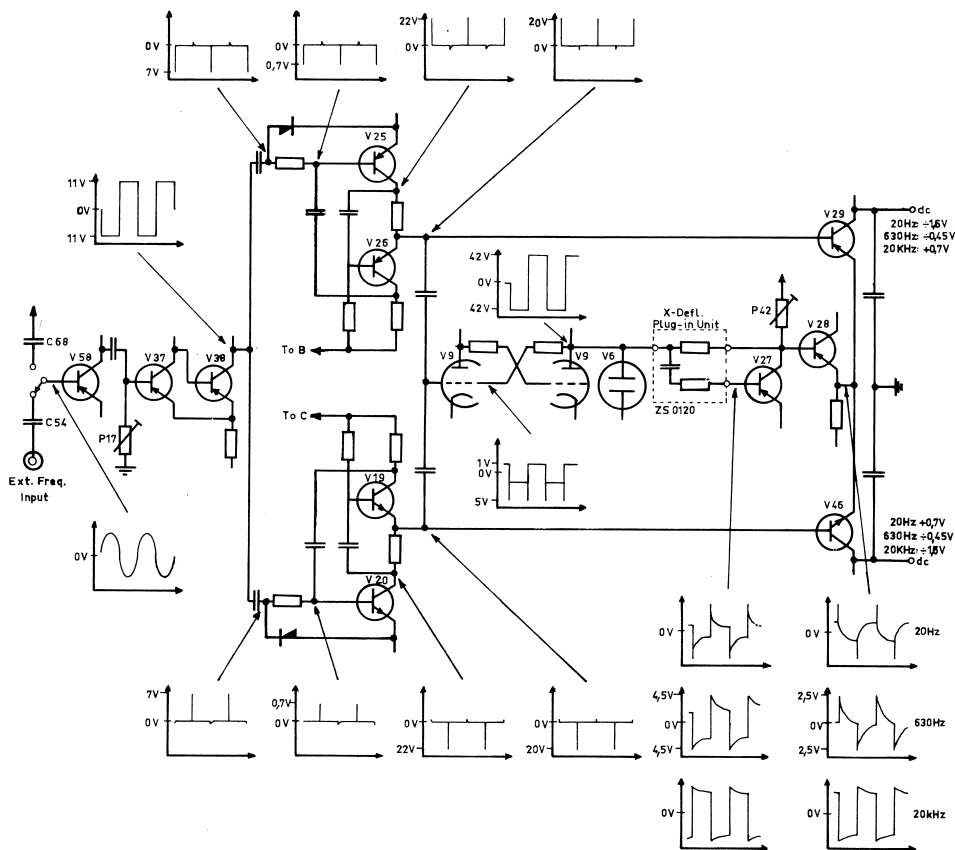
Input frequency: 1000 Hz. Adjust the input voltage until the spot is on the 0 dB line.

Check all positions of INPUT ATTENUATOR by comparison with type 1022.  
Tolerance:  $\pm 0.1$  dB (+ tolerance type 1022: 0.2 dB).

#### 1.10. Hum in Linear and Log. Ampl.

INPUT ATTENUATOR: "0 dB"  
INPUT POTENTIOMETER: "10"  
DYNAMIC RANGE: "25 dB"  
VERTICAL SPEED: "Slow"

Input voltage: 10 mV.  
Set the frequency a little above the main frequency.  
Max. vertical movement:  $\pm 1$  mm.



## 2.1. DC Voltages

Bistable circuit: V 9 a': 3-7 V a': 70-90 V  
a: 106-116 V or a: 23-27 V

Emitter follower: across C 42 measuring point a: -19 to -22 V  
V 27 " " b: -4 to -5 V  
V 28 " " c: -14 to -16 V  
should be measured without x-deflection plug-in unit inserted.

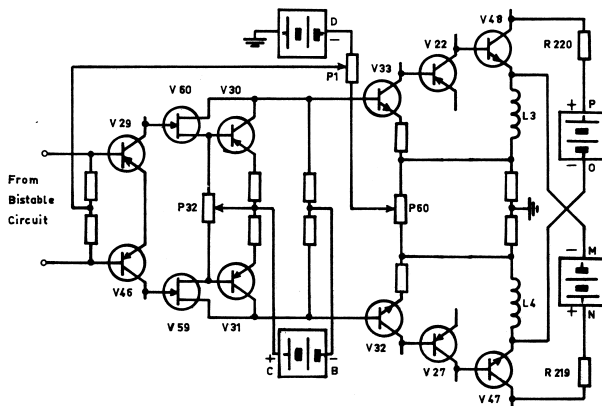
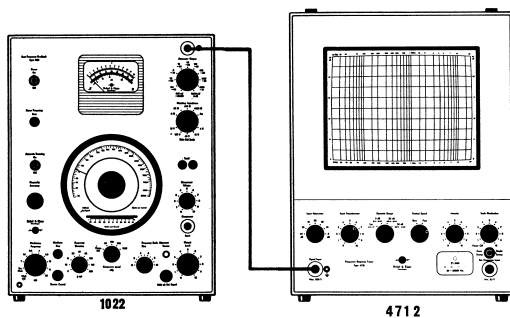
DC-Amplifier: across C 8 measuring point O-P: Approx. 15-17 V  
C 7 " " M-N: Approx. 15-17 V  
Q 67-68 " " B-C: 22-26 V  
between midpoint Q 67-68 and ground: -2 to -2.5 V.

If the voltage from the stabilized power supply is incorrect, check item 1.1.

## 2.2. Frequency Sensing

DYNAMIC RANGE: "Lin."

- a. Input signal to EXT. FREQ. INPUT socket: 1 V, 1000 Hz.  
Connect an oscilloscope to V 38 collector and check the square-wave signal.  
If unsymmetrical adjust P 17 (situated on printed circuit XC 0320).  
Increase the input voltage to 5 V-50 V and check that the wave form is still symmetric.  
Possible reasons for fault: Defective diodes Q 30, 31.
- b. Input signal: 5 V, 20000 Hz.  
Check the negative pulses on V 19 emitter and the positive pulses on V 26 emitter.  
Pulse height: approx. 20 V.  
Pulse width : approx. 15  $\mu$ sec. and equal within 10%.
- c. Input signal: 5 V, 1000 Hz.  
Connect an oscilloscope to V9 plate (pin 6) and check the square-wave signal.  
It should be symmetric and the voltage should be 82-87 V p-p.  
Change frequency to 20000 Hz. The waveform should still be symmetric.  
Tolerance:  $\pm$  10%.



## 2.3. X-DC Amplifier

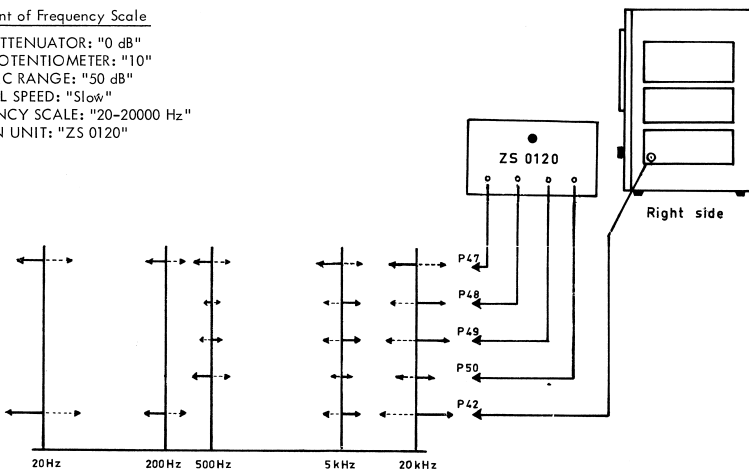
INPUT ATTENUATOR: "0 dB"  
INPUT POTENTIOMETER: "10"  
DYNAMIC RANGE: "50 dB"

- a. Input signal 180 mV, 1000 Hz.  
Remove the x-deflection plug-in unit.  
The spot should be at the 630 Hz (20-20000 Hz scale).  
If necessary adjust P 32 (situated on printed circuit XC 0320).

- b. Replace the x-deflection plug-in unit (ZS 0120).  
Adjust input frequency to the spot on the 630 line.  
Check the current in the output transistors V 47-48 by means of a multimeter connected across the collector resistors.  
Voltage across R 219, R 220: 900 mV.  
Tolerance:  $\pm 5\%$ .  
If necessary adjust P 1 (situated on printed circuit XC 0320).
  - c. Change the frequency until the spot is on the 20 Hz line.  
Check the voltage across collector resistor: R 220: approx. 200 mV  
R 219: approx. 1200 mV
  - d. Change the frequency until the spot is on the 20000 Hz line.  
Check the voltage across collector resistor R 220: approx. 1200 mV  
R 219: approx. 200 mV
- The voltage across R 220 at 20000 Hz and R 219 at 20 Hz should be within 5%.  
If not adjust P 60 (situated on printed circuit XC 0318).

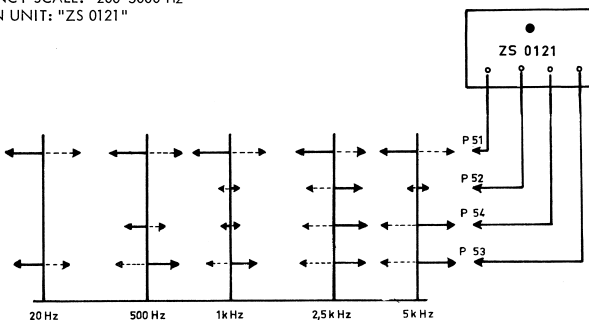
#### 2.4. Adjustment of Frequency Scale

- a. INPUT ATTENUATOR: "0 dB"  
INPUT POTENTIOMETER: "10"  
DYNAMIC RANGE: "50 dB"  
VERTICAL SPEED: "Slow"  
FREQUENCY SCALE: "20-20000 Hz"  
PLUG-IN UNIT: "ZS 0120"



Movement of the spot for clockwise adjustment:  $\longrightarrow$   
counter clockwise adjustment:  $\dashrightarrow$

- b. FREQUENCY SCALE: "200-5000 Hz"  
PLUG-IN UNIT: "ZS 0121"



Movement of the spot for clockwise adjustment:  $\longrightarrow$   
counter clockwise adjustment:  $\dashrightarrow$

### 3.1. DC Voltages

E.H.T. Supply:  $V_2 a_1$ : 280-320 V  
(XC 0365)  $g_2$ : 110-125 V

$V_3 a$ : 280-320 V  
 $g_2$ : 90-140 V

Across R 228: 20-30 V, when the oscillator is working,  
otherwise the voltage is approx. 60 V.

Aut. Brightness Regulator:

(XC 0363)  $V_{16}$  collector: -9 to -11

" "  $V_{17}$  " : -9 to -11

(XC 0362)  $V_{63}$  " : 100 V, X-deflection Plug-in Unit removed

" "  $V_{64}$  " : 100 V, " " " " "

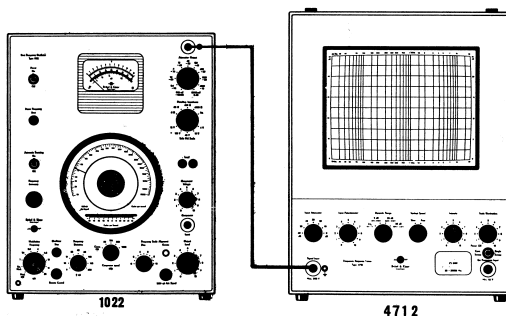
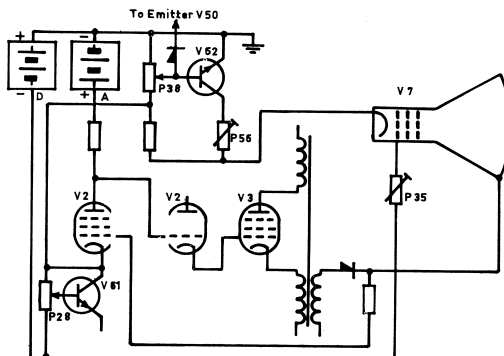
Cathode Ray Tube:  $V_7 g$ : -10.5 to -13<sup>x)</sup>

$k$ : 22 to 33<sup>x)</sup> depending on setting of P 56

(Intensity)  $a_1$ : 250 to 290 " " P 39

(Fokus)  $a_2$ : 0 to 320 " " P 36

E.H.T.: 9.9 to 10.1 KV adjusted by P 28



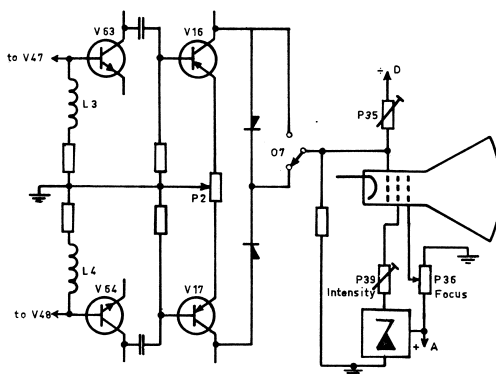
### 3.2. Blanking Level

INPUT ATTENUATOR: "0 dB"  
INPUT POTENTIOMETER: "10"  
DYNAMIC RANGE: "50 dB"  
BLANKING LEVEL: "Low"

Input signal: 40 mV, 10000 Hz.  
Measure the cathode voltage on V 7, pin 7<sup>x)</sup>: approx. 20 V.

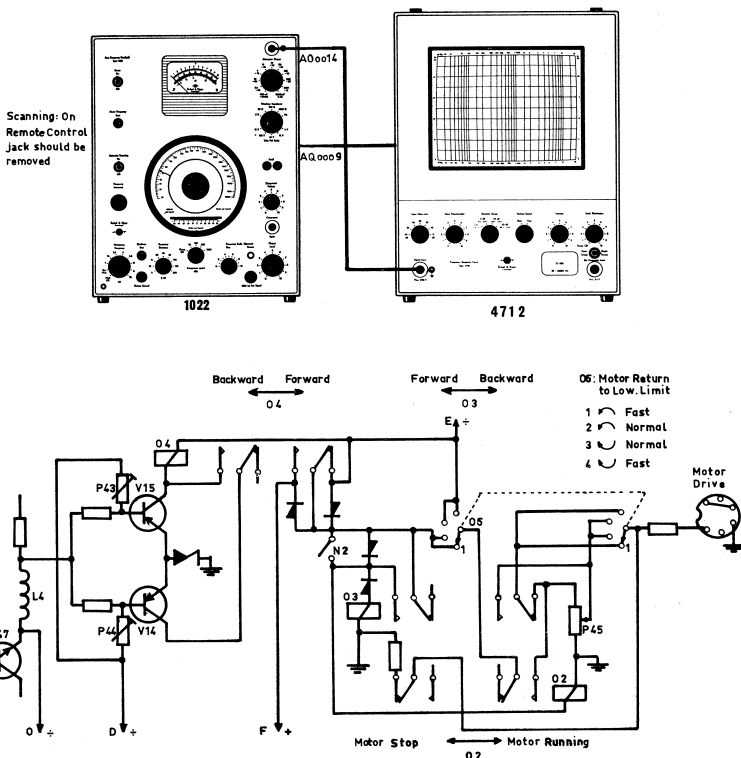
Check the regulation range of P 38.  
Turn slowly P 38 from LOW to HIGH until the spot disappears. The setting of P 38 should now be within the upper 2/3rd and the cathode voltage should rise approx. 14 V.

<sup>x)</sup> Measured by means of an electronic DC voltmeter.



## 4.1. DC Voltage

Across C 21, measuring point F: 30 to 35 V  
C 23 " " E: -30 to -36 V



## 4.2. Sweep Limits

SWEEP SPEED: "Mid. position"  
UPPER: "1/3rd from High"  
LOWER: "1/3rd from Low"  
RETURN MODE: "Normal, left side"  
PLUG-IN UNIT: "ZS 0120"  
FREQ. SCALE: "20-20000 Hz"

- a. Connect Motor Drive UM 1014 on type 1022 to MOTOR DRIVE socket on type 4712 (cable AQ 0009).

Set Sweep in position CONT. SWEEP and check adjustment range for sweep limit potentiometers.

- b. Adjust sweep limit potentiometer LOWER to 20 Hz.  
Turn potentiometer UPPER to LOW and check sweep limit: 70 Hz or lower.  
Turn potentiometer UPPER clockwise and check that sweep limit 20000 Hz is obtained a little before stop (HIGH).
- c. Adjust sweep limit potentiometer UPPER to 20000 Hz.  
Turn potentiometer LOWER to HIGH and check sweep limit: 10 kHz or higher.  
Turn potentiometer LOWER anticlockwise and check that sweep limit 20 Hz is obtained a little before stop (LOW).

#### 4.3. Return Mode

- a. SWEEP SPEED: "Mid. position"  
RETURN MODE: "Normal, left side"

Set Sweep Start in position CONT. SWEEP and adjust sweep limit to approx. 200-2000 Hz.

- b. RETURN MODE to "Fast, left side"

The Motor Drive should go slowly from 200 to 2000 Hz and return fast (anti-clockwise).

- c. RETURN MODE to "Normal, right side"

The Motor Drive should go slowly clockwise independent of the sweep limits.

- d. RETURN MODE to "Fast, right side"

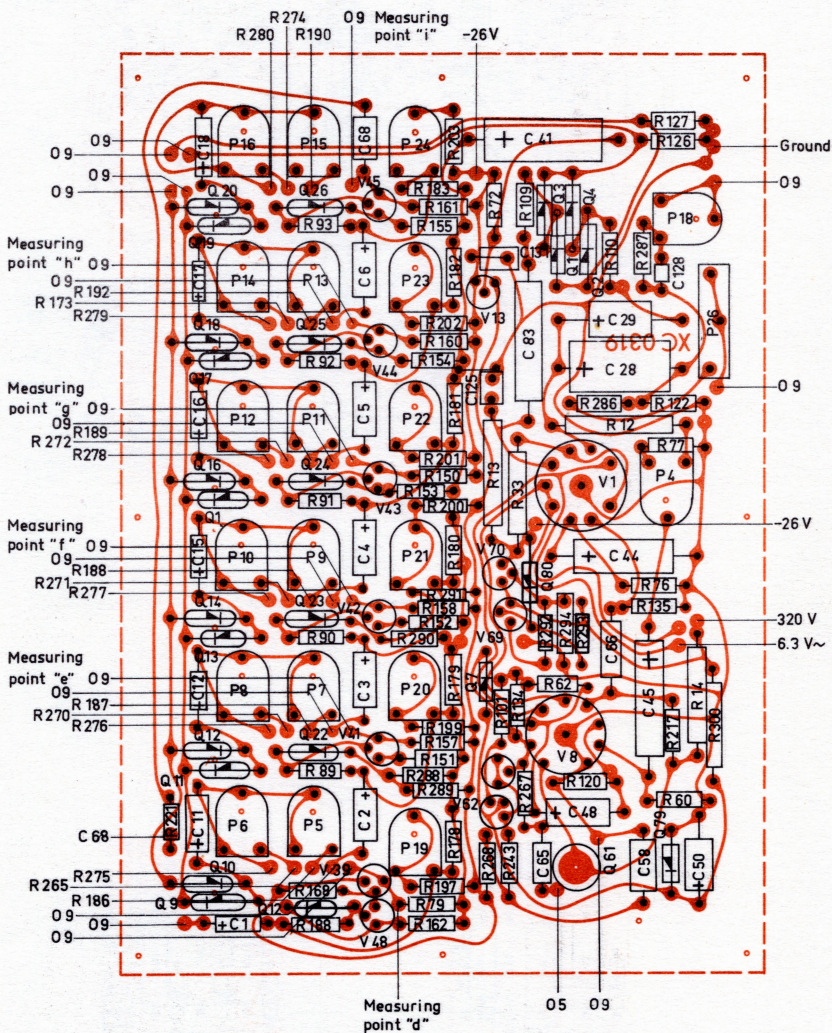
The Motor Drive should go slowly from all little before 20 Hz to sweep limit adjusted by UPPER and return fast (clockwise).

#### 4.4. Sweep Speed

- SWEEP SPEED: "Low"  
RETURN MODE: "Normal, right side"

- a. Set Sweep Start in position CONT. SWEEP and check the time for sweep limits 20-20000 Hz: approx. 40 sec.

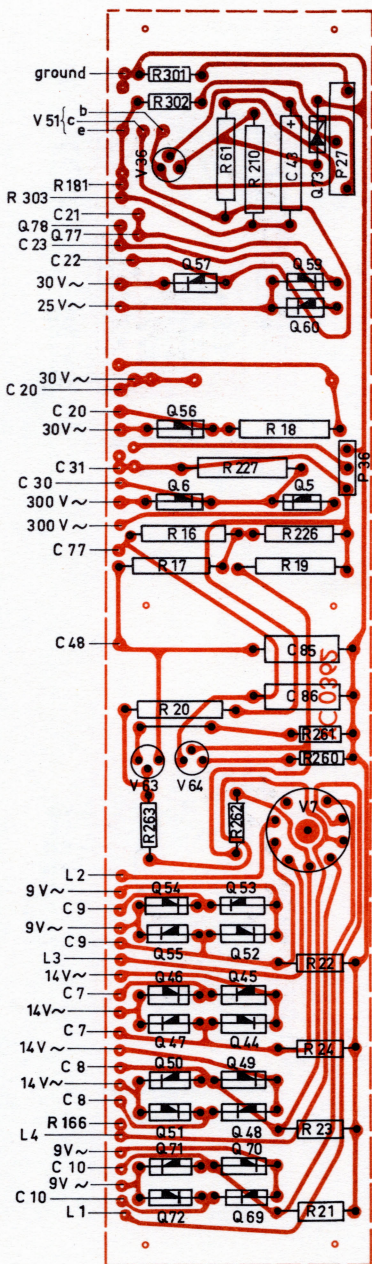
- b. Turn SWEEP SPEED to HIGH and check the time again: approx. 6 sec.



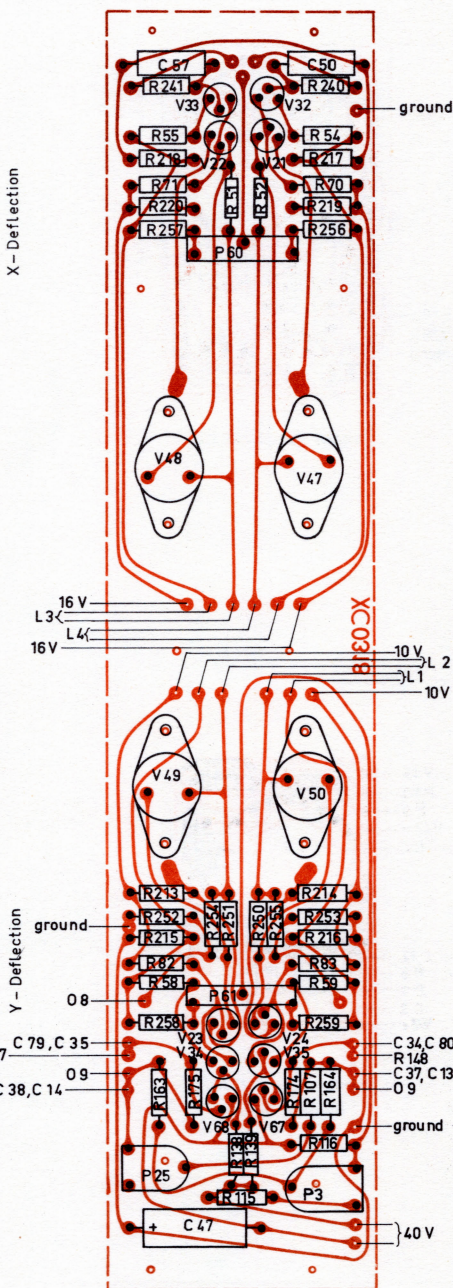
Printed Circuit XC 0319

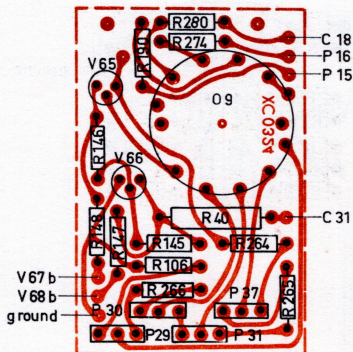
Logarithmic Amplifier    Linear Amplifier



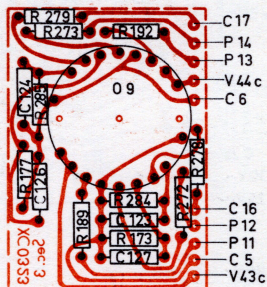


Printed Circuit XC 0362  
Power Supply

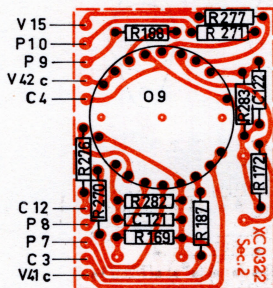




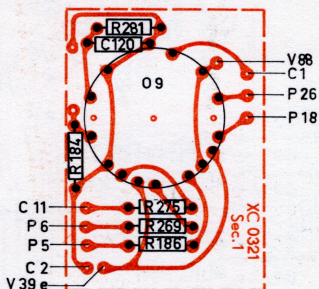
Printed Circuit XC0324



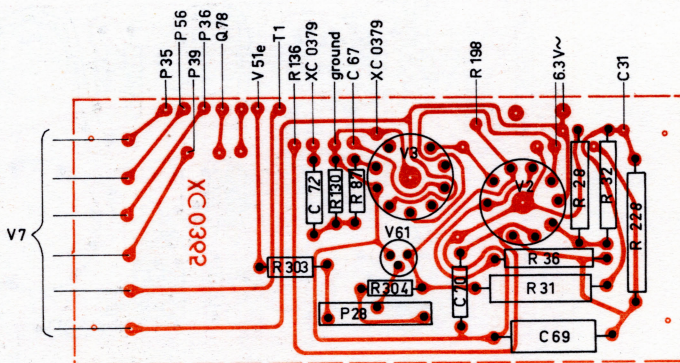
Printed Circuit XC0323  
Dynamic Range



Printed Circuit XC0322  
Dynamic Range

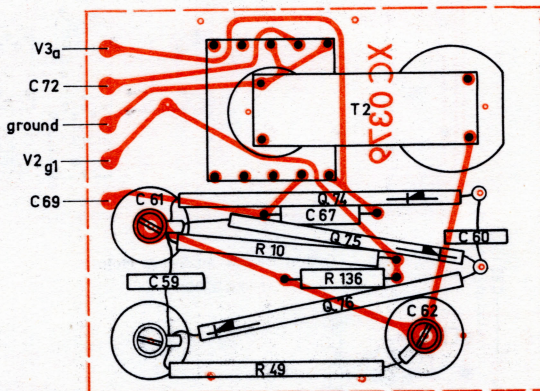


Printed Circuit XC0321  
Dynamic Range



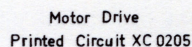
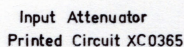
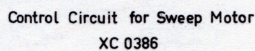
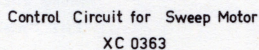
Printed Circuit XC 0365

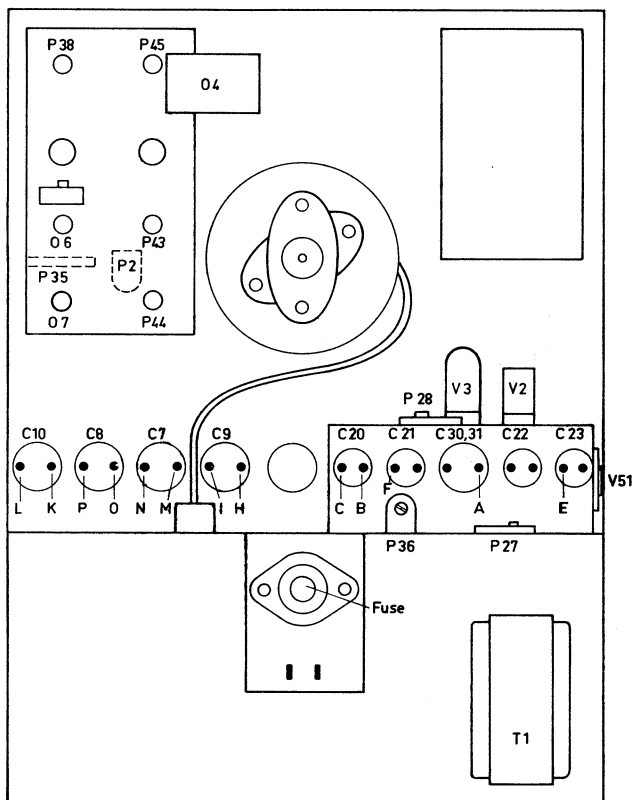
EHT Power Supply



Printed Circuit XC 0379

EHT Circuit





Rear View

CIRCUIT DIAGRAM REF.	COMPONENT TYPE	STOCK REF.	CIRCUIT DIAGRAM REF.	COMPONENT TYPE	STOCK REF.
<u>CAPACITORS:</u>			<u>SWITCHES:</u>		
C 1	Electrolytic	50 µF/6.4 V CE 0204	N 2	Sweep Start	NN 0007
C 2-6	"	25 µF/ 25 V CE 2002	N	Ext. Freq. Input	NT 0011
C 7, 8	"	5000 µF/ 25 V CE 0420	O 2-4	Relay	OC 0011
C 9, 10	"	5000 µF/ 15 V CE 0301	O 5	Attenuator	OR 4712
C 11, 12	"	12.5 µF/ 25 V CE 0416	O 6	Sweep Mode	OS 4709
C 13, 14	"	4 µF/ 50 V CE 0404	O 7	Return trace	OT 4709
C 15-18	"	12.5 µF/ 25 V CE 0416	O 8	Vertical speed	OU 4709
C 20-23	"	800 µF/ 64 V CE 0516	O 9	Dynamic Range	OV 4712
C 26	"	8 µF/350 V CE 0802	<u>POTENTIOMETERS:</u>		
C 28	"	20 µF/100 V CE 0602	P 1	Trimmer	carbon lin. 470 Ω PG 1500
C 29	"	4 µF/250 V CE 2034	P 2	"	" " 470 Ω PG 1500
C 30, 31	"	2 x 50 µF/450 V CE 0909	P 3	"	" " 100 Ω PG 1100
C 34, 35	"	4 µF/ 50 V CE 0404	P 4	"	" " 1 kΩ PG 2100
C 37, 38	"	32 µF/ 25 V CE 0407	P 5-17	"	" " 2 kΩ PG 2201
C 41, 42	"	250 µF/ 25 V CE 0413	P 18	"	" " 5 kΩ PG 2500
C 43	"	64 µF/ 64 V CE 0513	P 19-24	"	" " 10 kΩ PG 3102
C 44	"	250 µF/ 6 V CE 8944	P 25	"	" " 20 kΩ PG 3201
C 45	"	100 µF/ 25 V CE 0415	P 26	"	wire " 10 kΩ PG 3107
C 46	"	20 µF/ 64 V CE 8949	P 27	"	" " 2 kΩ PG 2203
C 47	"	250 µF/ 25 V CE 0413	P 28	"	" " 5 kΩ PG 2505
C 48	"	32 µF/ 64 V CE 0509	P 29, 31	"	carbon " 1 kΩ PG 2104
C 49	"	5 µF/ 35 V CE 0406	P 32	"	" " 50 kΩ PG 3501
C 50	Polyester	32 µF/ 64 V CE 0509	P 35	"	" " 200 kΩ PG 4202
C 51	Ceramic	10 nF CK 4100	P 36	"	" " 1 MΩ PG 5104
C 52	"	± 5% 25 pF CK 0091	P 37	"	" " 1 kΩ PG 2104
C 53	"	27 pF/400 V CK 1270	P 38	Blanking level	wire " 25 kΩ PH 3250
C 54	Electrolytic	10 µF/ 15 V CE 0001	P 39	Intensity	carbon " 100 kΩ PP 4105
C 55	Metal	2.2 µF/100 V CP 0014	P 40	Input	" " 100 kΩ PP 4105
C 56, 57	Polyester	0.47 µF/125 V CS 0021	P 42	Trimmer	wire " 1 kΩ PQ 2100
C 58	"	0.22 µF/250 V CS 0017	P 43, 44	"	" " 500 Ω PQ 1509
C 59, 60	Ceramic	180 pF/ 8 kV CK 2181	P 45	"	" " 100 Ω PR 1109
C 61, 62	"	500 pF/20 kV CK 2500	P 46	Scale ill.	" " 10 Ω PS 0109
C 65	Polyester	0.1 µF/250 V CS 0013	P 47-53	Trimmer	carbon " 25 kΩ PG 3250
C 66	"	22 nF/250 V CS 0005	P 54	"	" " 50 kΩ PG 3504
C 67	Polystyrene	12.5 nF/ CT 3235	P 56	"	" " 100 kΩ PG 4103
C 68	Polyester	0.22 µF/250 V CS 0017	P 60, 61	"	" " 10 Ω PG 0100
C 69	"	0.47 µF/400 V CS 0121	<u>RECTIFIERS:</u>		
C 70	"	1.8 nF/400 V CS 0125	Q 1-4	Silicon	200 V/ 40 mA QV 0022
C 72	"	4.7 nF/400 V CS 0122	Q 5, 6	"	1200 V/0.15 A QV 0025
C 73-76	"	100 nF/250 V CS 0402	Q 7	"	200 V/ 40 mA QV 0022
C 77, 78	"	0.22 µF/250 V CS 0017	Q 9-20	Germanium	45 V/ 0.1 A QV 0078
C 79, 80	"	0.47 µF/125 V CS 0021	Q 21-28	"	115 V/0.15 A QV 0085
C 82	"	1 µF/250 V CS 0025	Q 30, 31	Silicon	275 V/ 30 mA QV 0209
C 83	"	2 µF/250 V CS 0028	Q 32, 33	"	200 V/ 40 mA QV 0022
C 84	"	0.22 µF/250 V CS 0017	Q 36-40	"	275 V/ 30 mA QV 0209
C 85, 86	"	0.47 µF/125 V CS 0021	Q 41-55	"	50 V/ 0.6 A QV 0501
C 90, 91	Polystyrene	50 pF/500 V CT 0101	Q 56, 57, 59, 60	"	200 V/ 0.6 A QV 0502
C 92, 93	"	100 pF/500 V CT 0103	Q 61	Zener	120 V/ 5 mA QV 1004
C 94, 95	"	2% 4 nF CT 3225	Q 62, 63	"	12 V/ 5 mA QV 1112
C 96	"	1% 344 pF CT 3038	Q 66	"	6.7 V/ 10 mA QV 1324
C 97	"	2.5% 675 pF CT 3242	Q 67, 68	"	12 V/ 75 mA QV 1313
C 98	"	1% 1.98 nF CT 1303	Q 69-72	"	50 V/ 0.6 A QV 0501
C 99	"	1% 3.09 nF CT 1200	Q 73	Zener	618 V/ 30 mA QV 1106
C 100	"	+0%, -2% 10 nF CT 3331	Q 74-76	Selenium	6750 V/ 0.3 mA QV 0024
C 101	"	1% 63 nF CT 3364	Q 77, 78	Silicon	1200 V/0.15 mA QV 0025
C 102	"	1% 16.4 nF CT 3528	Q 79	Zener	24 V QV 1005
C 110	Trimmer	4.5-20 pF CV 0020	Q 80	"	7 V/ 10 mA QV 1007
C 120-124	Ceramic	27 pF CK 1270	<u>RESISTORS:</u>		
C 125	"	60 pF/400 V CK 1600	R 1, 2	Metal	1/4 W ± 1% 6.2 kΩ RF 0201
C 126	"	100 pF CK 2100	R 3	"	" " 4 kΩ RF 0209
C 127	"	82 pF CK 1820	R 4	"	" " 169 kΩ RF 0202
C 128	"	100 pF CK 2100			
C 129	Polyester	10 nF/250 V CS 0403			
C 130	Ceramic	2.2 pF CK 0220			
C 130	"	6.8 pF CK 0680			

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CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.	CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
<b>RESISTORS:</b>						V 21-24	Silicon Trans. PNP	2N4289			VB 0049
R 219, 220	Wire	5.5 W	5%	4.7 Ω	RX 0318	V 25	"	PNP	2N3702		VB 0038
R 223, 224	"	1 W	10%	4 Ω	RR 0004	V 26-28	"	PNP	2N4289		VB 0049
R 225	"	5.5 W	"	6.2 kΩ	RX 0303	V 29	"	PNP	BCY90		VB 0051
R 226	"	"	"	12 kΩ	RX 0316	V 30, 31	"	PNP	2N4289		VB 0049
R 227	"	"	"	680 Ω	RX 0317	V 32-35	"	NPN	2N3704		VB 0028
R 228	"	8 W	"	1.5 kΩ	RX 0405	V 36-45	"	PNP	2N4289		VB 0049
R 229	"	"	"	27 kΩ	RX 0407	V 46	"	NPN	2N1613		VB 0026
R 230	"	5.5 W	"	30 Ω	RX 0309	V 47-50	"	NPN	40363		VB 0255
R 240, 241	Carbon	1/3 W	"	2 kΩ		V 51	Germanium Trans.	ASZ16(TI 3028)			VB 0029
R 242	"	"	"	25 kΩ		V 52	Silicon Trans. PNP	2N4289			VB 0049
R 243	"	"	"	6.3 kΩ		V 53	Fuse	1 Amp.			VF 0008
R 250, 251	"	"	"	315 Ω		V 54-57	Scale Lamp	6 V/0.25 Amp.			VS 1273
R 252, 253	"	"	5%	31.5 Ω		V 58	Silicon Trans. PNP	2N4289			VB 0049
R 254, 255	"	"	"	125 Ω		V 59, 60	Field-effect Transistor matched pair				VB 1045
R 256, 257	"	"	10%	10 Ω		V 61-64	Silicon Trans. NPN	2N3440			VB 0250
R 258, 259	"	"	"	10 Ω		V 65	"	PNP	2N4289		VB 0049
R 260, 261	"	"	5%	750 Ω		V 66	"	NPN	2N3704		VB 0028
R 262, 263	"	"	2%	5 kΩ		V 67, 68	"	PNP	2N4289		VB 0049
R 264	"	"	"	3.5 kΩ		V 69, 70	"	NPN	BF178		VB 0052
R 265	"	"	"	12 kΩ							
R 266	"	"	"	1.6 kΩ							
R 267	"	"	10%	5 kΩ							
R 268	"	"	"	200 Ω							
R 269	"	"	2%	9 kΩ							
R 270	"	"	"	8.5 kΩ							
R 271	"	"	"	9.5 kΩ							
R 272	"	"	"	10.5 kΩ							
R 273	"	"	"	14 kΩ							
R 274	"	"	"	12 kΩ							
R 275	"	"	"	2.5 kΩ							
R 276	"	"	1%	3.28 kΩ							
R 277	"	"	"	2.18 kΩ							
R 278	"	"	"	2.63 kΩ							
R 279	"	"	"	3.43 kΩ							
R 280	"	"	"	2.69 kΩ							
R 281	"	"	2%	8.7 kΩ							
R 282	"	"	"	10.2 kΩ							
R 283	"	"	"	9.1 kΩ							
R 284	"	"	"	8.9 kΩ							
R 285	"	"	"	5.9 kΩ							
R 286	Metal	1/4 W	± 1%	6.2 kΩ	RF 0201						
R 287	Carbon	1/3 W	2%	8 kΩ							
R 288	"	"	"	300 Ω							
R 289	"	"	"	8 kΩ							
R 290	"	"	"	300 Ω							
R 291	"	"	"	10 kΩ							
R 292	"	"	"	1.9 kΩ							
R 293	"	"	10%	50 kΩ							
R 294	"	1 W	"	100 kΩ							
R 295, 296	Metal	1/4 W	"	200MΩ	RH 0005						
R 297, 298	Carbon	1/3 W	"	25 Ω							
R 299	"	"	"	1.25 kΩ							
R 300	"	1/2 W	"	250 kΩ							
R 301	Metal	"	± 1%	1.54 kΩ	RF 0215						
R 302	"	1/4 W	"	4 kΩ	RF 0209						
R 303	"	1/2 W	± 2%	12 kΩ	RF 0304						
R 304	"	"	"	33 kΩ	RF 0305						
R 305	Carbon	1/8 W	"	4.7 Ω	RA 0203						
<b>TUBES and TRANSISTORS:</b>											
V 1	Twin Triode			ECC82/12AU7	VA 0011						
V 2	Triode Pentode			ECF82/6U8	VA 0014						
V 3	Pentode			EL84/6BQ8	VA 0023						
V 6	Stabilizer			85A2	VA 0056						
V 7	Cathode Ray Tube			M.36-11 GM	VA 0076						
V 8, 9	Twin Triode			ECC88/6DJ8	VA 0073						
V 13-17	Silicon Trans.			PNP 2N4289	VB 0049						
V 19, 20	"			NPN2N3704	VB 0028						
<b>PRINTED CIRCUIT:</b>											
							Plug-in Unit Z5 0120				XC 0108
							" " Z5 0121				XC 0109
							UM 1014 Motor Drive				XC 0205
							DC Amplifier				XC 0318
							Lin., Log. and Y-Amplifier				XC 0319
							Frequency Sensing Circuit				XC 0320
							Dynamic Range sec. 1				XC 0321
							" " sec. 2				XC 0322
							" " sec. 3				XC 0323
							" "				XC 0324
							Power Supply				XC 0362
							Control Circuit Sweep Motor				XC 0363
							Attenuator O 5				XC 0364
							E.H.T. Generator				XC 0365
							E.H.T. Power Supply				XC 0379
							Control Circuit Sweep Motor				XC 0386
							XC 0318 with components				802 4712
							XC 0319	"			801 4712
							XC 0320	"			803 4712
							XC 0321	"			815 4712
							XC 0322	"			816 4712
							XC 0323	"			819 4712
							XC 0324	"			825 4712
							XC 0362	"			809 4712
							XC 0363	"			810 4712
							XC 0364	"			806 4712
							XC 0365	"			808 4712
							XC 0379	"			814 4712
							XC 0386	"			811 4712
<b>MISCELLANEOUS:</b>											
							Back Plate				FB 0101
							Bakelite Knob				SN 3222
							Knob Retaining-ring				DB 0674
							Umbraco Screw				YQ 2083
							Deflection Coil				LB 1019
							Drive Belt for UM 1014				DX 0023
							E.H.T. Transformer				TH 0002
							E.H.T. Cable				AP 3002
							E.H.T. Plug				JP 0100
							Front Plate				FA 0089
							Handle				DH 0052
							Motor				UM 0009
							Plastic Cover				KF 0034
							Plug 3-pole				JP 4701
							Plug 30-pole				JP 3000
							Plug Screened				JP 0018

CIRCUIT DIAGRAM REF.	COMPONENT TYPE	STOCK REF.
<u>MISCELLANEOUS:</u>		
T 1	Power Cord, EUR	AN 0005
	Power Cord, USA	AN 0006
	Power Transformer	TN 0019
	Power Voltage Selector	JS 0005
	Relay-Socket for O 4	JJ 0008
	Relay-Socket for O 2, O 3	JJ 0012
	Rubber Feet	DF 7010
	Scale, blank	SA 0512
	Scale, 20-20000 Hz	SA 0510
	Scale, 200-5000 Hz	SA 0509
	Socket, screened (Signal Input)	JJ 0115
	Socket, screened (Ext.Freq.Input)	JJ 0119
	Socket, mounted on XC 0363	JJ 1200
	Socket 30-pole	JJ 3000
	Socket 6-pole	JJ 4704
	Socket 3-pole	JJ 4700
	Steel Ball for UM 1014	DQ 0014
	Spring for frame	DL 0156
	Spring for frame	DL 0157

