

# RADIOMETER

Type OSG42

CATHODE-RAY OSCILLOSCOPE

## Electrical

measuring instruments for  
industrial and scientific work





Type OSG42  
CATHODE-RAY OSCILLOSCOPE

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Type OSG42 CATHODE-RAY OSCILLOSCOPEIntroduction:

The type OSG42 Oscilloscope is an all-round laboratory instrument whose outstanding electrical properties and small dimensions make it a most versatile instrument in lots of cases when an examination of electrical wave forms is required.

The amplifiers for X (horizontal) and Y (vertical) deflection are identical, and their high gain and wide frequency range make the Oscilloscope equally suitable, whether it be for biological examinations, studies of mechanical vibrations, or of radio and TV signals.

The built-in sweep generator will produce recurrent sweeps at frequencies of up to several hundreds kc/s and triggered sweeps can be released by making a contact or by an electric pulse of a few volts.



Section IGENERAL DESCRIPTION

The Oscilloscope incorporates a cathode-ray tube, amplifiers for horizontal and vertical deflection, a sweep generator for producing time base voltages, and a power supply.

- (1) The cathode-ray tube is an RCA type 3RP1 with 75 mm (3 inches) screen diameter. A medium-persistence screen with green fluorescence is used. The anode-cathode voltage is about 650 volts and the tube is completely enclosed in a Mu-metal magnetic shield. In front of the c-r tube screen is placed a graticule which is used at qualitative measurements.

The deflection plates of the c-r tube are normally connected to the X and Y amplifiers. Banana-plug jacks in the side panels provide for direct connection of symmetrical voltages to the deflection plates. The deflection plates are about 270 volts positive with respect to ground, so isolating condensers should be used when connection is made to circuits with d-c path to ground.

The capacity to ground at the plate input terminals is about 15  $\mu$ F each plate. The input resistance is 2 megohms from each plate to +270 volts. The deflection sensitivity at the plate terminals is about 1.8 mm/volt rms for vertical deflection and about 1.2 mm/volt rms for horizontal deflection.

- (2) The X and Y amplifiers are identical 2-stage direct coupled push-pull amplifiers with a maximum overall gain of 300-500 times giving a maximum deflection sensitivity of 0.6-0.8 mm/mV rms in vertical direction and 0.4-0.6 mm/mV rms in horizontal direction. The gain of both amplifiers can be continuously reduced by about 20 dB with a low impedance amplitude control which has practically no influence on the frequency response of the amplifier.

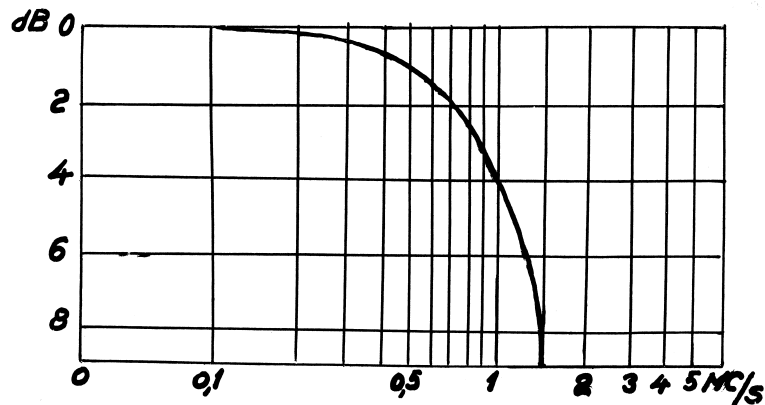


Fig. 1 Typical frequency response curve of amplifier

A typical frequency response curve of the X and Y amplifiers is shown in figure 1 above. The amplifiers are designed to give minimum pulse distortion, i.e. shortest rise time possible combined with a small amount of overshoot. The output voltage of the amplifiers is sufficient to produce a full screen image with negligible distortion. When the image (trace) is expanded beyond the screen limits, the distortion of the on-screen part of the image will still be negligible, i.e. an image that takes up the entire space of the screen of the cathode-ray tube can be enlarged several times both horizontally and vertically. At proper use of the positioning controls a detail of the original image may then be brought onto the screen for a closer inspection.

Both amplifiers are provided with a balancing control which is so set that the manipulation of the AMPLITUDE control does not affect the position of the image.

The amplifiers are provided with a switching system (input attenuator) which connects the input terminals to the amplifier input directly or via an RC compensated attenuator.

The ratios of the X attenuator are 1, 10, and 100, and those of the Y attenuator are 1, 10, 100, and 1000. The attenuators are so designed that they have the same input impedance for all ratio settings. The input impedance is 1 MΩ shunted by 30-35 pF. The input attenuators also provide for the connection of

symmetrical (balanced) input voltages to the X and Y amplifiers and for feeding calibrating voltages of known magnitude to the amplifiers. The calibrating voltages are derived from the power line transformer and the accuracy is of the same order as that of the power line voltage.

The X amplifier is used as a sweep voltage amplifier when the X attenuator is set at the proper position.

- (3) The sweep generator will furnish either recurrent (periodical) or triggered (driven) sawtooth voltages.

(3a) Recurrent sweep

The sweep generator is a two-tube, cathode-coupled multivibrator circuit (tubes 5b and 6a) as shown in the diagram below.

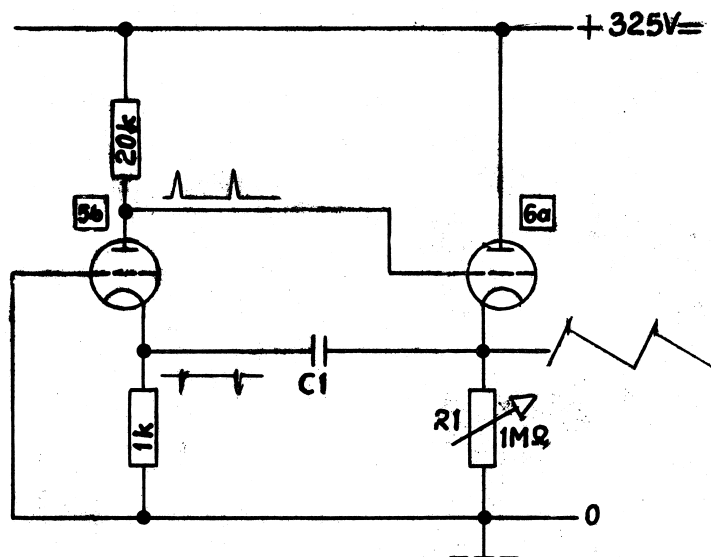


Fig. 2 Recurrent sweep generator without linearizer tube

The condenser C1 is discharged through resistor R1 until tube 6a starts conducting. A positive signal is then passed to the cathode of tube 5b, and the anode current of this tube is reduced, which results in the grid of tube 6a becoming more positive, thus increasing the anode current of this tube still further and charging condenser C1. As the overall gain of the



circuit exceeds unity, the effect is cumulative and the cathode voltage of tube 6a rapidly reaches a maximum while the anode current of tube 5b returns to its original value. This circuit condition then remains until the charge of the condenser C1 has leaked sufficiently away through R1 to start the flow of anode current again in tube 6a.

The charging of the condenser C1, which corresponds to the fly-back of the light spot of the c-r tube may be started a fraction of a cycle earlier by a small negative signal applied to the grid of tube 5b. The grid of this tube is therefore used as a synchronizing electrode when the sweep generator is used as a recurrent-sweep generator.

The discharge of condenser C1 through resistor R1 will only give a linear sweep voltage across C1 if the voltage across resistor R1 is constant. To ensure this a cathode-coupled linearizer tube 6b is incorporated (see fig. 4). This tube has a grid to cathode gain of approximately 0.97 or very close to unity. It is coupled to the sweep generator circuit in such a way that it tends to keep a constant voltage across resistor R1. The linearization improvement obtained is about 30 times. The diode tube 7b is a clamping diode which keeps the upper limit of the sawtooth voltage at a constant level. The cathode of tube 6b is coupled to the X amplifier input through an attenuating and balancing network.

The charging current of the condenser C1 will develop a negative pulse at the anode of tube 6a when a resistor R2 (see fig. 4) is placed in the anode supply circuit. This negative pulse (blanking pulse) can be fed to the grid of the c-r tube and the light will be suppressed during the fly-back period. The time constant of the coupling condenser and grid resistor of the c-r tube is too small to give effective blanking at the lowest sweep frequencies, while the wiring capacity and electrode capacities make blanking ineffective at the highest sweep frequencies.

(3b) Triggered sweep

When used as a triggered time base generator the sweep generator must be brought to reside in a stable condition where the condenser C1 is charged so that it is ready for a sweep without delay. The stopping or locking in this condition is accomplished by making tube 5b part of a multivibrator with the stable regime coinciding with the charged condition of condenser C1.

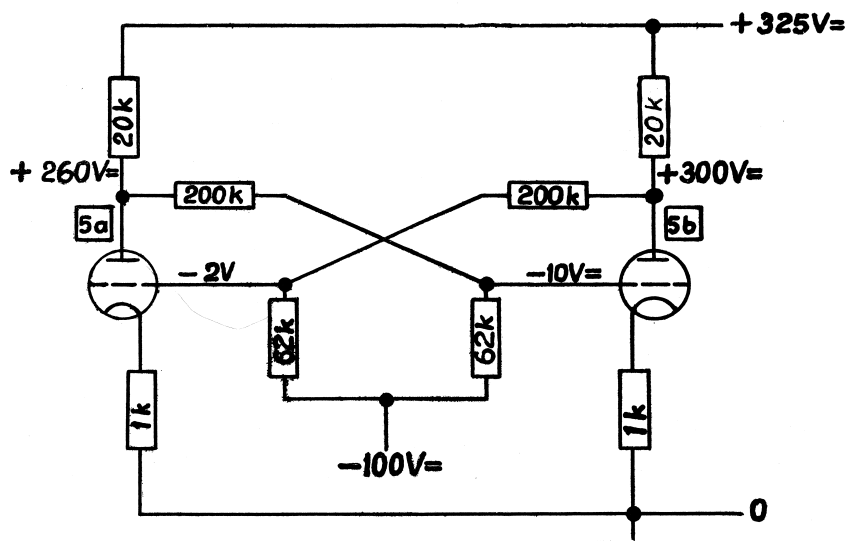


Fig. 3 Stable multivibrator

The two-tube multivibrator (tubes 5a and 5b) is direct coupled and the different electrode potentials are so adjusted that one tube is practically cut off while the other tube is conducting (see fig. 3). The multivibrator is symmetrical and in principle it has two stable conditions. If a negative pulse is fed to the grid of the conducting triode (tube 5a in fig. 3), a cumulative action of short duration will be started and make the circuit flip over to the other stable condition. The same result can, of course, be obtained by carrying a positive pulse to the cathode of the conducting triode.

In the actual circuit where tubes 5a and 5b form one anode-coupled stable multivibrator and tubes 5b and 6a form another cathode-coupled unstable multivibrator. The mode of operation of the combined circuit will be as follows (see fig. 4):

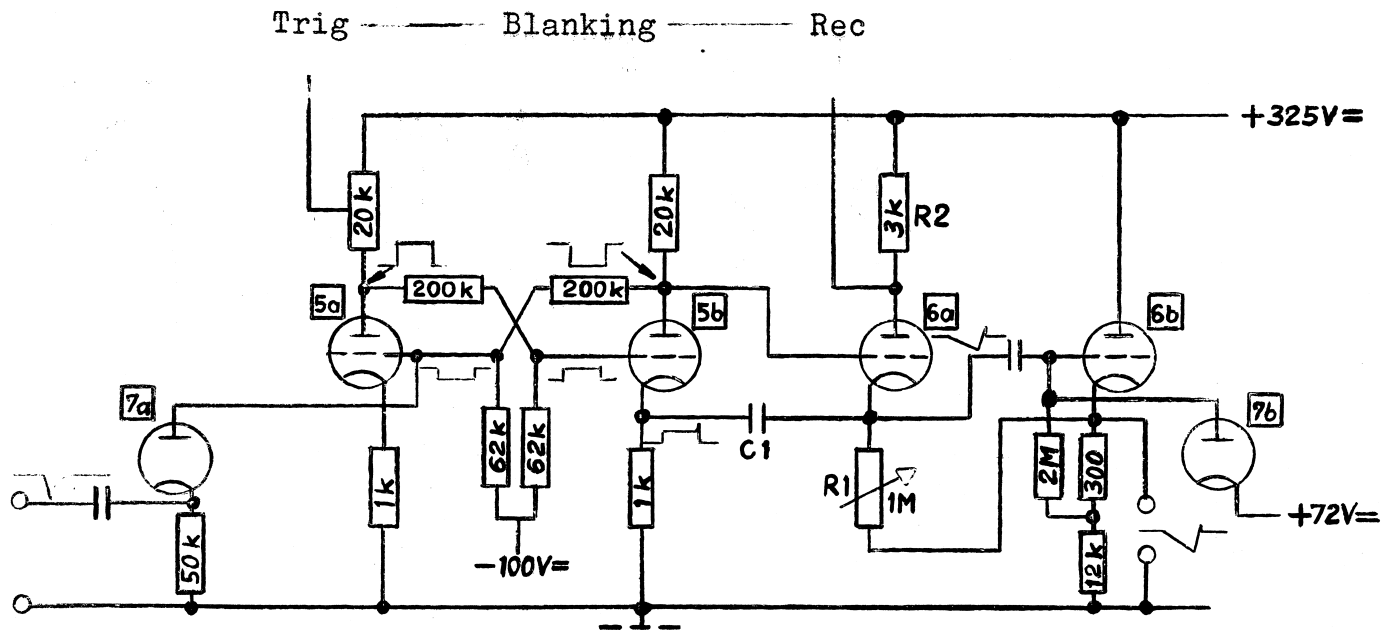


Fig 4 Triggered sweep generator

If tube 5b happens to be conducting, the sweep generator 5b-6a will operate (discharge of C1 will proceed) until tube 6a starts conducting and the anode current of tube 5b is reduced as explained under (3a). When this current is reduced, the multivibrator 5a-5b will flip over so that tube 5a is conducting and tube 5b is cut off. This is a stable condition, because multivibrator 5b-6a is locked when tube 5b remains cut off.

If a negative signal is now applied to the triggering diode 7a, a single sweep cycle will be released in the following way:

- 1) The multivibrator circuit 5a-5b is initiated to flip over to the condition where tube 5a is cut off and tube 5b is conducting. This lowers the anode voltage of tube 5b, and the discharge of condenser C1 will start through R1.
- 2) The rate of discharge is determined by the capacitance of C1, the resistance of R1, and the voltage across R1. The discharge will continue until the potential of the cathode



of tube 6a has decreased to such a magnitude that the tube starts conducting.

- 3) The anode current of tube 5b is now reduced, and the multivibrator 5a-5b will flip over so that 5b is cut off and the circuit will remain in this stable condition with tube 5b cut off and condenser C1 charged until another trigger signal is fed to the cathode of diode 6a.

It will be seen that tube 5a is cut off during the discharge period of C1. In this period the anode potential of the tube is increased so that a positive rectangular pulse is produced. When this pulse (or part of it) is fed to the grid of the cathode-ray tube, the light intensity will be increased.

The light intensity control can then be so set that the light is only visible during the actual sweep period.

#### (3c) Synchronization

When recurrent sweeps are used, the sweep generator may be synchronized either by the signal under observation (internal synchronization), by an external sync. signal, by the making or breaking of an external contact, or by an internally supplied voltage of power line frequency. With a sync. polarity control the sync. signal polarity and amplitude may be selected.

When triggered sweeps are used, a sweep may be released by a negative pulse or by making an external contact. The sync. amplitude can be adjusted with the sync. polarity control.

The trigger pulse should have a peak value of at least 5 volts and its duration must be shorter than a sweep period, as otherwise another sweep may be released by the same pulse after the completion of the first sweep released.

#### (4) Intensity modulation

The light intensity may be modulated by an externally supplied a-c voltage. 5 to 10 volts peak is sufficient to fully modulate the intensity.

(5) Power supply

The necessary supply voltages are obtained from a 50-500 c/s power line source. A voltage selector can be set to the following line voltages: 110, 127, 150, 200, 220, or 240 volts a-c.

A full-wave vacuum tube rectifier supplies +350 volts d-c for the amplifiers and the sweep generator, and a full wave selenium rectifier supplies -400 volts d-c from the same transformer winding.

Section IIOPERATING INSTRUCTIONS(1) Connecting to the power line

The instrument is set at 220 volt line voltage when it leaves the factory. The voltage selector can be set to 110, 127, 150, 200, 220, or 240 volt line voltage. It is accessible when the instrument is removed from the cabinet. The line frequency may be 50-500 c/s.

Remove all screws along the edge of the cabinet and the two plug buttons in each side panel before removing the instrument from the cabinet.

(2) Balancing the amplifiers

When the instrument is set at the correct line voltage and has been switched on for 5-10 minutes the balancing of the Y amplifier is set as follows:

- 1) Set the ATTENUATOR of the X amplifier to the calibrating voltage, "100 mV RMS"
- 2) Set the ATTENUATOR of the Y amplifier to "100"
- 3) Turn the Y AMPLITUDE to the extreme right
- 4) Set the Y POSITION so that the horizontal line is positioned at the center of the screen. Adjust to an adequate light intensity with INTENSITY and to optimal focusing with FOCUS.
- 5) Now turn Y AMPLITUDE to the extreme left, and the line on the screen will probably move up or down.
- 6) Then set Y BALANCE so that the line does not move when the Y AMPLITUDE is being rotated.

The amplifier is balanced in the same way except that X and Y of the above description are interchanged.



When the X and Y amplifiers have been balanced and INTENSITY and FOCUS have been adjusted, the instrument is ready for use.

(3) Calibrating the amplifiers

By means of the calibrating voltages the AMPLITUDE control can be so set that the voltage measured can be read directly on the screen of the c-r tube. Example:

Set Y ATTENUATOR to "280 mV PEAK". Set Y AMPLITUDE so that the total height of the image on the screen will be e.g. 14 divisions. One division then corresponds to  $280:14=20$  mV peak voltage, when the Y ATTENUATOR is set at position "1". In position "10" one division corresponds to  $20 \times 10 = 200$  mV peak voltage and so on. The calibration applies only when the line voltage is sinusoidal.

(4) Horizontal and vertical deflection

When examining unsymmetrical (unbalanced) voltages, the voltage is applied between the chassis and terminal  $Y_1$  ( $X_1$  respectively), at measurements of d-c voltages or voltages that are a mixture of d-c and a-c voltage. If an image of the a-c voltage alone is desired, the chassis and the terminal  $Y'_1$  ( $X'_1$  respectively) is used. The maximum voltage that may be applied to  $X_1$ ,  $X'_1$ ,  $Y_1$ , and  $Y'_1$  is 500 volts. The attenuators reduce the input voltages fed to the Oscilloscope in steps of 20 dB (10 times), and the continuous control AMPLITUDE covers about 20 db.

At measurements of symmetrical (balanced) voltages the terminals  $Y_1$  and  $Y_2$  ( $X_1$  and  $X_2$  respectively) are used, and the attenuator is set to "SYM". At such measurements the chassis must be connected to a point with a voltage of approximately the mean value of the voltages that are fed to  $Y_1$  and  $Y_2$  ( $X_1$  and  $X_2$ ). When the attenuator is set at "SYM", only the continuous AMPLITUDE control is operative.

When the bright plug buttons in the side panels are removed, the jacks, which are connected directly to the deflection plates of the cathode-ray tube, are accessible. When a banana plug is inserted in these jacks, the internal amplifier is

disengaged so that only the positioning voltages (POSITION) are transmitted through a 2 MΩ resistor. Note: The jacks carry a voltage of about 270 volts to the chassis, so that series condensers are to be used if the jacks are connected to circuits with d-c connection to chassis or to ground.

(5) Using the sweep generator (time base)

The sweep generator is coupled to the X amplifier when the X ATTENUATOR is set to "SWEEP GEN.". When the "SWEEP GEN." switch is set to "RECURRENT", the sweep generator will produce sweep voltages with a frequency that is determined by means of the knobs RANGE and MULTIPLIER. When the MULTIPLIER switch is set to position "EXternal CONDenser", sweep frequencies up to 300 kc/s may be generated at a somewhat reduced sweep length. If a condenser is connected to the EXT. COND. terminals, sweep frequencies lower than 10 c/s may be obtained. A frequency range of for example 3-10 c/s may be obtained with an external condenser of 3 microfarads. The voltage rating of the condenser should be at least 350 volts d-c.

The length of the sweep (on the screen) is controlled by means of the X AMPLITUDE knob. The sweep frequency can be synchronized in accordance with the setting of the knob SYNC. SELECTOR. In position "INT." (internal) the synchronizing voltage is drawn from the output voltage of the Y amplifier. In position "EXT." (External) the voltage is drawn from the jacks marked "EXT. SYNC.". In position "LINE" the synchronizing voltages are drawn from the built-in line transformer so that the sweep generator can be synchronized with the frequency of the line voltage. In all cases the magnitude and phase of the synchronizing voltage is controlled by means of the knob SYNC. POLARITY. When this knob is at its center position (0), the synchronisation is minimum.

When synchronizing recurrent sweep with negative pulses, the knob must be turned counter clockwise. When synchronizing with positive pulses it must be turned clockwise. It is re-

commended to find the optimal setting of the SYNC. POLARITY knob by experimenting. Never use an unnecessarily strong synchronization, as this may involve distortion of the curve forms under observation.

A synchronizing pulse may be produced by the making or breaking of a contact between the terminal EXT. SYNC., DC and ground. The voltage at the terminal is about 30 volts positive to ground. The switch current is less than one milliamp.

When the SWEEP GENERATOR switch is set to "TRIGGERED", the sweep generator is brought to a stop so that the cathode-ray is positioned at the left-hand side of the screen. A sweep may then be released by feeding a negative pulse (not less than 5 volts peak) to the EXT. SYNC. jack marked AC. The SYNC. SELECTOR must be set at "EXT." and SYNC. POLARITY is turned clockwise until sufficient trigger voltage is obtained. The sweep speed across the screen is controlled by means of the RANGE and MULTIPLIER knobs, but a synchronizing pulse is required each time a sweep is to be released. The trigger pulse must, as previously mentioned, be of such a form that it has substantially faded away before a sweep is completed, as otherwise a subsequent sweep will be started by the same pulse. If required, a shaping of the trigger pulse may generally be obtained by simply differentiating the trigger voltage with an adequately small series condenser. The input impedance at the EXT. SYNC. jacks is about 30 kilohms at triggered sweep. An excellent trigger pulse may also be produced by momentarily connecting the jack EXT. SYNC., DC to the chassis of the instrument. This may often be used to advantage in case a sweep is released by the making of a contact.

- (6) Intensity modulation of the cathode-ray may be made by means of an a-c voltage fed to the jack INTENSITY MODULATION when at the same time the sliding contact above the jack is set to "EXTernal". A square wave of 5-10 volts peak is most suitable for intensity modulation. The sweep generator will blank the return-trace of the light beam at recurrent sweep when



the sliding contact is set to "INT." intensity modulation. At triggered sweep the beam will be intensified during the sweep period when the intensity modulation switch is set to "INT.". When turning down the INTENSITY control, the beam will then be visible only during the actual sweep period.

When external intensity modulation is employed, care should be taken not to drive the grid of the c-r tube positive with respect to cathode, as this may damage the tube.

The input impedance of the INTENSITY MODULATION terminals is 2 megohms.

Section IIIM A I N T E N A N C E

To remove the Oscilloscope from the cabinet, remove the screws along the edge of the cabinet and the two plug-buttons in each side panel.

The operating instructions contain a wiring diagram showing all switches in the extreme left-hand position and stating the operating voltages. These values are mean values from measurements on a series of oscilloscopes.  $V=$  denotes d-c voltage to ground, and  $V\sim$  denotes a-c voltage to ground. The measurements were made with a vacuum-tube voltmeter with negligible consumption. Two voltages are stated at several points in the sweep generator circuit. The first voltage applies at triggered sweeps when no trigger voltage is present. The second voltage is the mean d-c voltage at recurrent sweeps.

If the light spot cannot be positioned on the cathode-ray screen, turn the light INTENSITY control almost to the extreme right and the FOCUS control to midway position. Make an electrical connection between the two X deflection plates and another connection between the two Y deflection plates at the side terminals. If a normal light spot appears at the center of the screen, the voltages of the amplifier-tube electrodes should be checked and compared with the voltage values in the circuit diagram. If no light appears, check the positive and negative supply voltage (+350V= and -400V=) and the electrode voltages of the cathode-ray tube.

(1) Typical tube defects

Under ordinary usage the life of the tubes in the Oscilloscope is consistent with that obtained in other applications. Certain tube defects cause characteristic symptoms, such as:

- a) A horizontal line (zero level line) moves up or down when the Y ATTENUATOR is turned from position "10" to position "1" or "SYM.". This is usually due to excessive grid current in tube No. 1 which should be replaced.

Movement of the trace in horizontal direction when the X ATTENUATOR is turned from "10" to "1" or "SYM." is probably due to excessive grid current in tube No. 3.

- b) Due to the high input impedance the input terminals of the X and Y amplifier will usually pick up some hum voltage (a-c voltage of power-line frequency) which will cause some deflection when the amplifier in question is set to maximum gain. However, this deflection should disappear when the terminals are shielded or the gain is decreased. If this is not the case, it is generally due to a defective input tube in the amplifier in question.
- c) If, at recurrent sweeps, the sweep generator seems to be synchronized with the power line frequency although the SYNC. POLARITY control is set at "0", this may be due to hum voltages developed in one of the tubes No. 5, 6, or 7.
- d) If correct balancing of one of the amplifiers cannot be obtained with the appropriate balancing control it is usually due to too much difference between the characteristics of the two triode units of the input tube, and another tube should be tried.

## (2) Tube replacement

To remove the cathode-ray tube, the light shield must be removed and the clamping clip at the tube socket must be loosened. The tube can then be pushed out of the magnetic shield.

The c-r tube and tubes No. 2, 4, 7, and 8 may be replaced right away. However, due to d-c amplifiers used, it is usually neces-

sary to make some adjustments when the amplifier input tubes No. 1 and 3 have been replaced.

If tube No. 1 has been replaced, proceed as follows: Turn Y ATTENUATOR to position "100", X ATTENUATOR to "CAL., 100 mV RMS", and Y AMPLITUDE to maximum. With the Y POSITION control set midway, adjust P1 (Y position, coarse, screw driver adjustment) so that the horizontal line on the screen is centered vertically. After balancing the Y amplifier (Sect. II, (2)) it may be necessary to repeat the adjustment of P1. If the horizontal line moves in vertical direction when the Y ATTENUATOR is switched from position "100" to position "1" or "SYM." it is usually due to excessive grid current in tube No. 1.

If tube No. 3 is replaced, the adjustment of P2 (X position, coarse) is made in the same way except that X and Y of the above description are interchanged.

Readjustment of the potentiometers P3 and P4 (Focus, coarse) may be necessary when tube No. 1 or 3 has been replaced. P3 and P4 should be so set that the mean voltage of the deflection plates is the same (about +270 volts) as the voltage of anode No. 2, i.e. pin No. 8 of the c-r tube. This setting should coincide with the optimal light spot focusing on all parts of the c-r tube screen.

After replacement of tubes No. 5 or 6 in the sweep generator, the setting of potentiometer P6 and P7 should be checked. Set the SWEEP GEN. switch to position "TRIGGERED", the MULTIPLIER to position "30-100 c/s", the RANGE control to "0", the SYNC. SELECTOR to "EXT.", and the SYNC. POLARITY to "0". Tubes No. 5 and 7 are now removed and P7 is turned to the extreme right. P6 is then adjusted until the voltage difference between pin 2 and pin 7 (the triode grids) on the socket of tube No. 5 is less than 0.5 volt. This is the correct setting of P6. The voltage should be measured with a voltmeter having a resistance of at least 10 k $\Omega$  per volt. Make sure that the voltages between pin 2 and chassis and between pin 7 and chassis are equal within 0.5 volts. The voltage at the pins should be between +10 volts and -20 volts with respect to chassis.

Tubes No. 5 and 7 are now inserted in their sockets again and the voltmeter is connected between chassis and pin 3 (cathode) of tube No. 5. Potentiometer P7 is turned counter clockwise until pin 3 of tube No. 5 is 1.8 volts positive with respect to ground. This is the correct setting of P7.

- (3) Adjustment of P7 may occasionally be necessary to compensate for changes in tube characteristics and components, resulting from aging, etc. Such occasional adjustments can be made without removing the Oscilloscope from the cabinet if the following procedure is observed: Set the Y ATTENUATOR to a calibrating voltage, e.g. "100 mV RMS". Set the SWEEP MULTIPLIER to "30-100 c/s", the SWEEP RANGE to "5" (midway position), the SYNC. SELECTOR to "EXT.", the SYNC. POLARITY to "0", and the SWEEP GENERATOR switch to "RECURRENT". Connect the EXT. SYNC., DC terminal to the chassis terminal. With the X AMPLITUDE control the sweep length is adjusted to 15 divisions on the c-r tube screen.

Set the SWEEP GENERATOR switch to "TRIGGERED" and turn the SYNC. POLARITY about 45 degrees in clockwise direction. Turn potentiometer P7 to the extreme right. P7 can be reached with a screw driver through the hole closest to the front plate in the bottom of the cabinet.

Now slowly turn P7 counter clockwise, simultaneously making and breaking the connection between chassis and the EXT. SYNC., DC terminal several times so as to produce a series of trigger pulses. At a certain position of P7 the making of the connection will release a sweep having a length of 18-20 divisions on the c-r tube screen. This is the correct position of P7. Note: The position of potentiometers P6 and P7 has no influence on the operation of the sweep generator when it is set to "RECURRENT" sweeps.

(4) Fuse replacement and normal current consumption

The fuse mounted on the voltage selector is the power line fuse. A 2-amp fuse can be used for power line voltages between 110 and 240 volts a-c.

Separate fuses are used for the positive and the negative d-c supply voltages. The fuse for the positive supply (marked "plate voltage") should be rated for 0.2-0.3 amp, and that of the negative supply (marked "c-r tube") should be rated for 0.2 amp.

The total primary consumption of the Oscilloscope at 220 volts a-c power line voltage is 290 mA~. The total consumption from the +350 volt supply is 65-70 mA=, and the total consumption from the -400 volt supply is 12-15 mA.



Section IV  
S P E C I F I C A T I O N S

Cathode-ray tube:

Diameter of screen: 75 mm (3 inches)

Plate voltage: 650 volts

Deflection sensitivity horizontal: 1.2 mm/volt rms  
" " vertical: 1.8 mm/volt rms

Vertical amplifier:

Maximum deflection sensitivity: 0.6-0.8 mm/mV rms

Frequency range: dc - 1 Mc (3 dB) - 1.4 Mc (6 dB)

Attenuator: 1:1, 1:10, 1:100, 1:1000 stepwise + 1:12 continuously

Input: single ended (with attenuator) or double ended without attenuator

Input impedance:  $1\text{ M}\Omega \neq 35\text{ pF}$

Calibration: 2 voltages, power line frequency

Horizontal amplifier:

Maximum deflection sensitivity: 0.4-0.6 mm/mV rms

Attenuator: 1:1, 1:10, 1:100 stepwise + 1:12 continuously. Other data identical with those of the vertical amplifier.

Sweep system, recurrent sweep:

Frequency range: 10-300,000 sweeps per second. With external condenser the sweep frequency range may be extended down to 1 sweep per second.

Synchronization:

- 1) Internal from signal being observed
- 2) External, 0.1 volt or larger
- 3) Power line frequency
- 4) By making or breaking an external contact

Blanking: effective at sweep frequencies from 10 c/s to 100 kc/s

Sweep system, triggered sweep:

Sweep speed: From 500 mm/sec (with external condenser from 50 mm/sec) to 10 mm/ $\mu$ sec

Trigger requirements: 5-10 volts negative peak or making of external contact

Light intensification during the actual sweep period is effective at sweep durations from 0.1 sec to 30  $\mu$ sec

Light intensity modulation:

10 volts peak sufficient for 100% intensity modulation

Input impedance 2 M $\Omega$   $\neq$  25 pF

Max. trace expansion and positioning range:

3 times screen diameter in vertical and horizontal direction

Power supply:

110, 127, 150, 200, 220, and 240 volts, 50-500 cycles

Consumption 60 watts

Case size:

16 cm wide, 24 cm high, 35 cm deep

Weight:

9 kilos

Tubes:

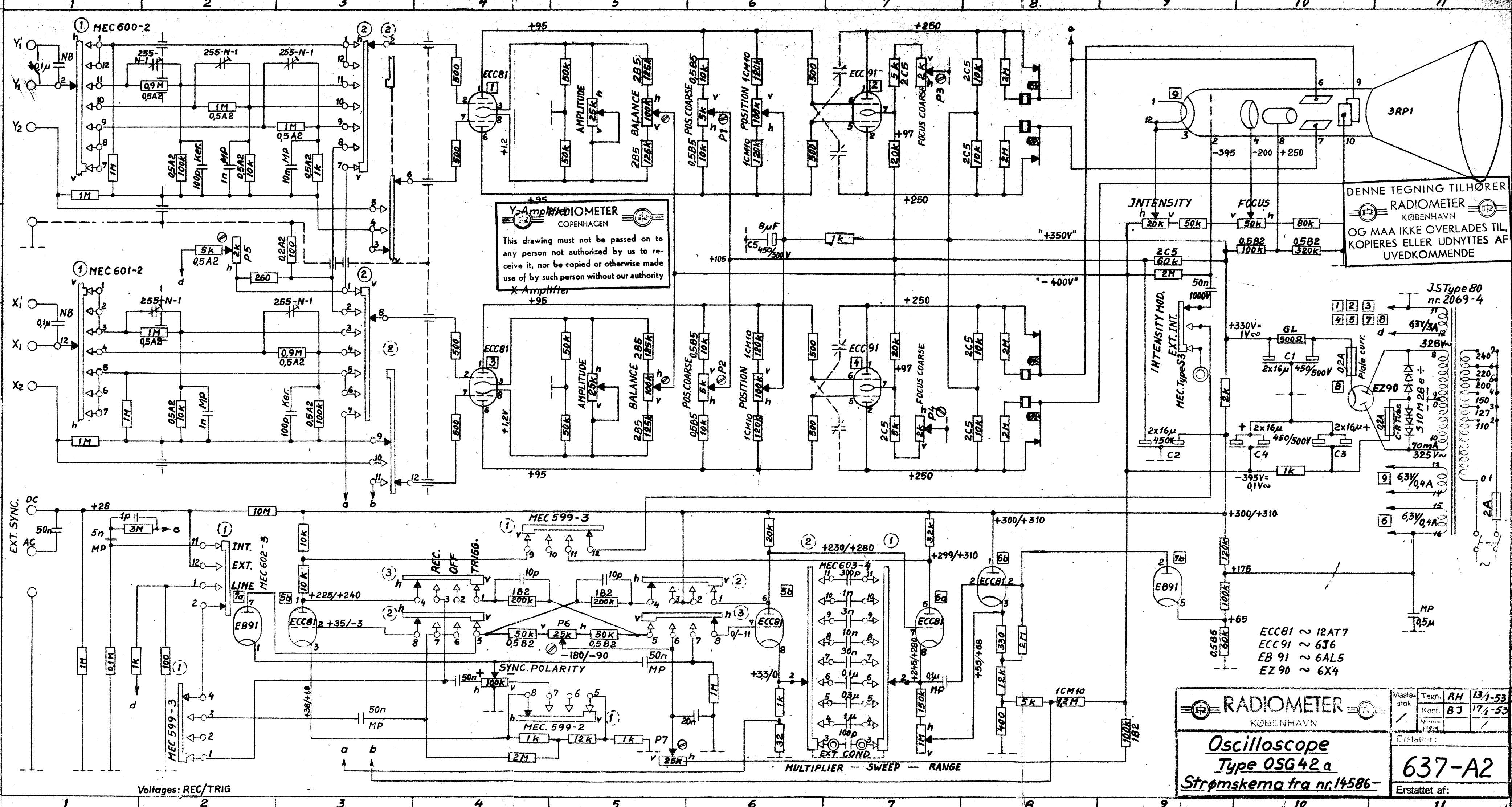
1 EB91 or 6AL5

4 ECC81 " 12AT7

2 ECC91 " 6J6

1 EZ90 " 6X4

1 cathode-ray tube 3RP1



Y Amplifier  
COPENHAGEN  
This drawing must not be passed on to any person not authorized by us to receive it, nor be copied or otherwise made use of by such person without our authority  
X Amplifier

DENNE TEGNING TILHØRER  
RADIOMETER  
KØBENHAVN  
OG MAA IKKE OVERLADES TIL, KOPIERES ELLER UDNYTTES AF UVEDKOMMENDE

RADIOMETER  
KØBENHAVN

Oscilloscope  
Type 0SG42a  
Strømskema fra nr. 14586

Måle- stok	Teen. Konf.	RH BJ	13/1-53 17/1-53
Erstatning:			637-A2
Erstattet af:			

Voltages: REC/TRIG

MULTIPLIER - SWEEP - RANGE