UM 4 Dual sensitivity electronic indicator

The UM 4, like the EM 4, is a dual-sensitivity tuning indicator on the screen of which two distinct fluorescent zones are formed. The distribution of light on the screen is such, however, that the variations in the dark sectors spring into view rather more than the fluorescing sectors themselves. During tuning, the variations in the widths of the two dark sectors are not uniform; in fact the sensitivity of one section is very much greater than the other, the angular variation in one being more rapid than in the other.

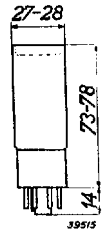
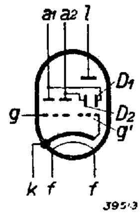
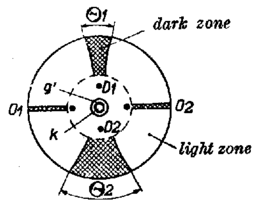


Fig. 1
Dimensions in mm

This effect is obtained by means of two triode sections of different amplification factors, these triodes being mounted one under the other around the cathode. A single grid serves the two units, but the pitch differs between the one system and the other. The two anodes are electrically separated; the upper and smaller one serves the low-gain triode, and the lower and larger anode the high-gain triode. Each anode is connected to a deflector-electrode, as well as to the external contacts.



The anodes of the indicator are both connected to the positive line in the receiver, in series with a 1 Megohm resistance (see also Circuit diagram IV), this potential being applied also to the fluorescent screen. Both the triodes are controlled simultaneously by the negative D.C. voltage on the grid (e.g. the control voltage from a detector diode) and actuated by a certain variation in this grid voltage, the high-gain triode producing a wider variation in the shadow angle behind the deflector electrode than the low-gain unit.



Direction of lines of shadow Θ_1 *and* Θ_2

The UM 4 is so designed that the shadow angles with respect to the two deflectors will be 90° at zero grid voltages with supply voltages of 100 or 200 V. At a negative grid voltage of —4.2 V (V_b = 200 V), the shadow angle on the high-gain side is 5°, whereas on the other side this angle is reached only at —12.5 V: an easily visible indication is thus obtained on weak as well as strong aerial signals.

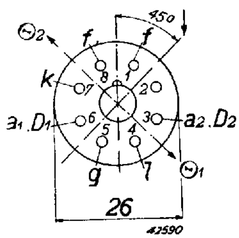


Fig. 2
Arrangement of electrodes and contacts.

Figs 4 and 5 show the characteristics of both sections of the indicator when working on supply voltages of 200 and 100 V respectively, and these clearly illustrate the performance of the tube. The bulb of this indicator, like the EM 4, has been given a re-entrant extremity which, with the lacquered ridge of the glass, presents a dark background behind the aperture through which it is observed. This increases

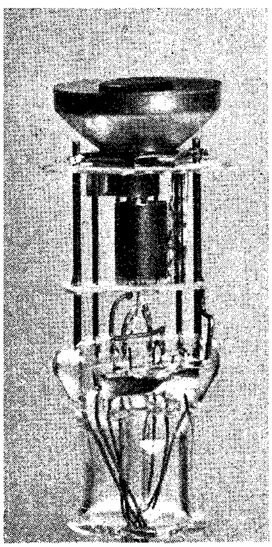


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Fig. 3
Internal construction of the UM 4.

the contrast between the fluorescent light and the background and facilitates observation of variations in the pattern.

HEATER RATINGS

Heater feed: Indirect by AC or DC; series supply.

Heater voltage	V_f	= 12.6 V
Heater current	I_f	= 0.100 A

OPERATING DATA FOR THE TUBE WHEN EMPLOYED AS TUNING INDICATOR

Voltage supply to screen and anode series resistances	$V_s = V_b$	= 100 V	200 V
Anode coupling resistance, high-gain side	R_{a1}	= 1 M ohm	1 M ohm
Anode coupling resistance, low-gain side	R_{a2}	= 1 M ohm	1 M ohm
Screen current at $V_g = 0$ V	I_s	= 0.2 mA	0.55 mA
Grid voltage for a shadow angle of 90° in the high-gain section	$V_g\ (\Theta_1 = 90°)$	= 0 V	0 V
Grid voltage for a shadow angle of 90° in the low-gain section	$V_g\ (\Theta_2 = 90°)$	= 0 V	0 V
Grid voltage for a shadow angle of 0° in the high-gain section	$V_g\ (\Theta_1 = 0°)$	= —2.5 V	—
Grid voltage for a shadow angle of 0° in the low-gain section	$V_g\ (\Theta_2 = 0°)$	= —8 V	—
Grid voltage for a shadow angle of 5° in the high-gain section	$V_g\ (\Theta_1 = 5°)$	= —	—4.2 V
Grid voltage for a shadow angle of 5° in the low-gain section	$V_g\ (\Theta_2 = 5°)$	= —	—12.5 V

Θ_1 = shadow angle of the deflector electrode D_1, measured at the edge of the screen.
Θ_2 = shadow angle of the deflector electrode D_2, measured at the edge of the screen.

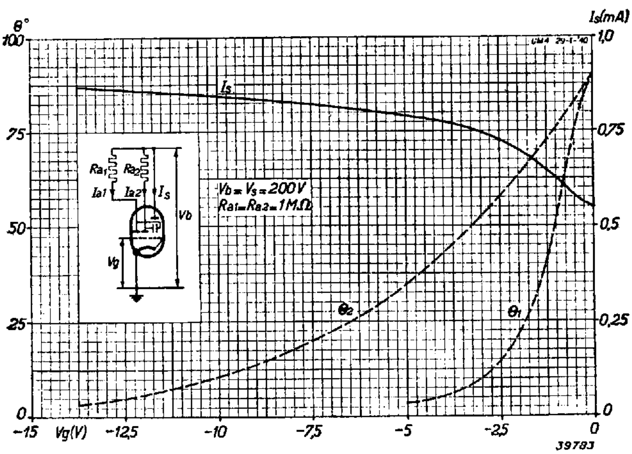

Fig. 4
Shadow angles Θ_1 and Θ_2, measured at the edge of the screen, and screen current *Is* as a function of grid voltage at a supply potential of 200 V.

MAXIMUM RATINGS

V_{a10}	= max. 550 V	V_s	= max. 250 V
V_{a1}	= max. 250 V	V_g (I_g = + 0.3 μA)	= max. —1.3 V
V_{a20}	= max. 550 V	R_{gk}	= max. 3 M Ohms
V_{a2}	= max. 250 V	R_{fk} R_{gk}	= max. 20,000 Ohms
V_{s0}	= max. 550 V	V_{fk}	= max. 150 V[1])

[1]) D.C. voltage or effective value of alternating voltage.

APPLICATIONS

The UM 4 was designed especially for use in AC/DC receivers. It is recommended that the indicator be connected to the grid leak of the detector diode, since connection to the A.G.C. diode in cases where delayed control is applied incurs the disadvantage that the indicator then gives no indication on weak signals, below the level of the delay voltage. As the more sensitive side of the indicator was expressly provided to react on weak signals, including those below the normal delay level (for short wave reception), it is, as stated, better to couple the grid of the UM 4 with the detector diode.

In many cases the signals on the detector diode will however be too strong and it will be found desirable to reduce the direct voltage on the grid leak by means of a potentiometer. Care must be taken at the same time to ensure that the A.C. resistance of the diode circuit is not reduced too much, since otherwise the ratio $\frac{R_w}{R_g}$ becomes unfavourable and the maximum modulation depth at which distortionless detection is possible is also reduced: high-resistance potentiometers should therefore be used (see also Circuit IV).

If the UM 4 is to be employed in an AC/DC receiver operating on low mains voltages, a sufficiently high voltage for the fluorescent screen must nevertheless be ensured, or the brightness of the light-pattern will fall short of requirements. At a supply voltage of 100 V it will be noticed, moreover, that the working of the high-sensitivity side of the indicator is not so effective as usual, for which reason it is better, in the case of receivers intended for use mainly on a 100 V supply, to interconnect the two anodes of the triodes and feed these through a common resistance of 1 M Ohm. Figs 6 and 7 show the characteristic curves thus obtained in respect of V_b = 100 V and 200 V. The variations in the shadow angle can then be clearly observed, even at lower values of the control voltage on the grid.

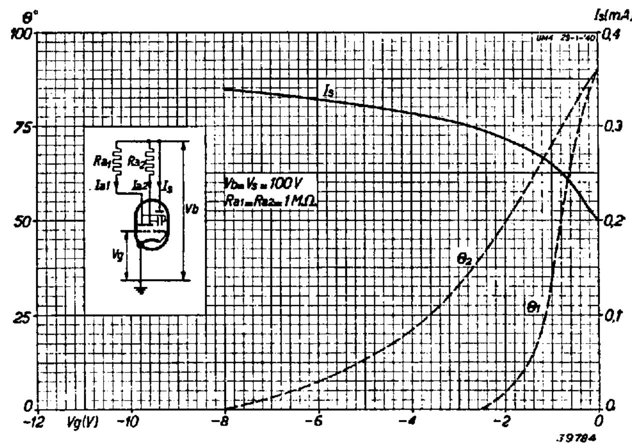

Fig. 5
Shadow angles Θ_1 and Θ_2, measured at the edge of the screen, and screen current I_s as a function of grid voltage on a supply voltage of 100 V.

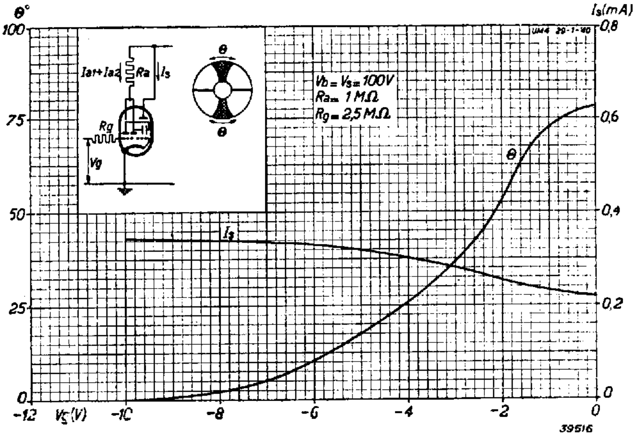

Fig. 6
Shadow angle Θ of the two sectors, and screen current *Is* as a function of grid voltage, with the two anodes of the triodes fed in parallel through a 1 M Ohm resistance, on a supply of 100 V.

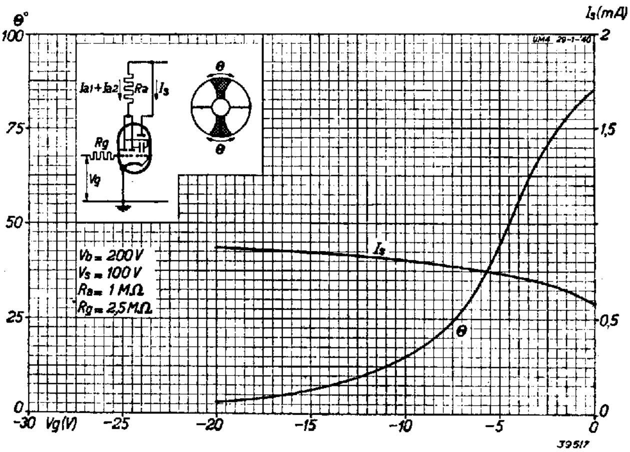

Fig. 7
Shadow angle Θ of the two sectors,and screen current *Is* as a function of grid voltage, with the two anodes of the triodes fed in parallel through a 1 M Ohm resistance, on a supply of 200 V.