INSTRUMENT CATHODE-RAY TUBE

- mono accelerator
- 10 cm diagonal rectangular flat face
- short overall length
- high brightness and high resolution
- dynamic deflection defocusing correction
- internal magnetic correction for astigmatism, orthogonality and eccentricity
- low heater power consumption
- for portable oscillopes and read-out devices

QUICK REFERENCE DATA

Final accelerator voltage	$V_{g2(\ell)}$	2 kV	
Minimum useful scan area		70 mm x 56 mm	
Deflection coefficient			
horizontal	M_x	36 V/cm	
vertical	M_y	23 V/cm	

OPTICAL DATA

Screen			
type		GY	
colour		green	
persistence		medium	
Useful screen area		≥ 70 mm x 56 mm	
Useful scan area		≥ 70 mm x 56 mm	
Spot eccentricity			
in horizontal direction		≤ 6 mm	
in vertical direction		≤ 3 mm	note 2

HEATING

Indirect by AC or DC *

Heater voltage	V_f	6.3 V	
Heater current	I_f	0.1 A	
Heating time to attain 10% of the cathode current at equilibrium conditions		approx. 7 s	

* not to be connected in series with other tubes.

MECHANICAL DATA

Dimensions and connections (see also outline drawings)

Overall length (including socket)	≤ 240 mm
Faceplate dimensions	82 ± 0.5 mm x 69 ± 0.5 mm
Net mass	approx. 450 g
Base	12 pin, all glass, JEDEC B12-246

Mounting

The tube can be mounted in any position. It must not be supported by the base alone or near the base region and under no circumstances should the socket be allowed to support the tube.

Accessories

Socket with solder tags	type 55594
Socket with printed-wiring pins	type 55595

FOCUSING	electrostatic
DEFLECTION	double electrostatic
x-plates	symmetrical
y-plates	symmetrical

If use is made of the full deflection capabilities of the tube the deflection plates will block part of the electron beam, hence a low impedance deflection plate drive is desirable.

DYNAMIC DEFLECTION DEFOCUSING CORRECTION

The tube has a special electrode, positioned between the x- and y-plates, for dynamic correction of deflection defocusing, to improve the uniformity of the extremely good line width up to the screen edges. If use is made of this dynamic correction, a negative voltage proportional to, and approx. 50% of, the negative horizontal deflection plate voltage should be applied to this electrode (grid 6). The correction-circuit impedance must be ≤ 100 kΩ. To prevent distortion, the output impedances of the x amplifiers should be ≤ 10 kΩ.
If no correction is required, grid 6 should be connected to mean x-plate potential ($V_{g2(\ell)}$).

Angle between x-and y-traces	90°	note 2
Angle between x-trace and x-axis of the face plate	≤ 5°*	

CAPACITANCES (approximate values)

x_1 to all other elements except x_2	$C_{x1(x2)}$	5 pF
x_2 to all other elements except x_1	$C_{x2(x1)}$	5 pF
y_1 to all other elements except y_2	$C_{y1(y2)}$	3.5 pF
y_2 to all other elements except y_1	$C_{y2(y1)}$	3.5 pF
x_1 to x_2	C_{x1x2}	2.2 pF
y_1 to y_2	C_{y1y2}	1 pF
Control grid to all other elements	C_{g1}	6 pF
Cathode to all other elements	C_k	2.7 pF
Dynamic correction electrode to all other elements	C_{g6}	11 pF

*The tube has a trace rotation coil, fixed onto the lower cone part. The coil has 1000 turns and a typical resistance of 165 Ω at 20 °C (max. 235 Ω at 80 °C). Approx. 5 mA causes 1° trace rotation. Thus maximum required voltage is approx. 11 V for tube tolerances (± 5°) and earth field with reasonable shielding (± 2°).

DIMENSIONS AND CONNECTIONS

Dimensions in mm

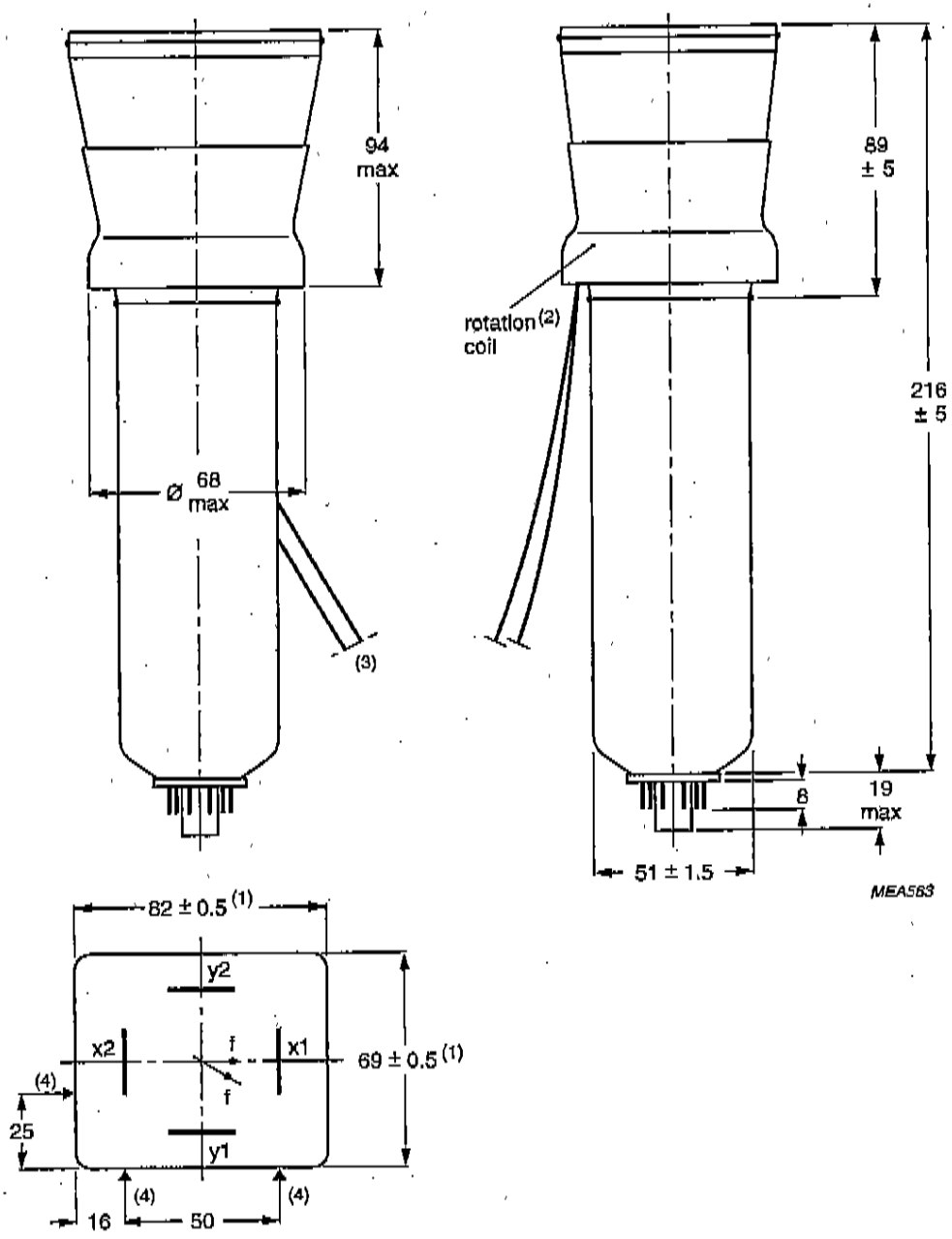

Fig.1 Mechanical outlines.

(1) Dimensions of face plate only. The complete assembly of face plate and cone (frit seal included) will pass through an opening of 85 mm x 72 mm (diagonal 107 mm).
(2) The coil is fixed to the envelope with resin and adhesive tape.
(3) The length of rotation coil connecting leads is min. 350 mm.
(4) Reference points on face plate for screen alignment.

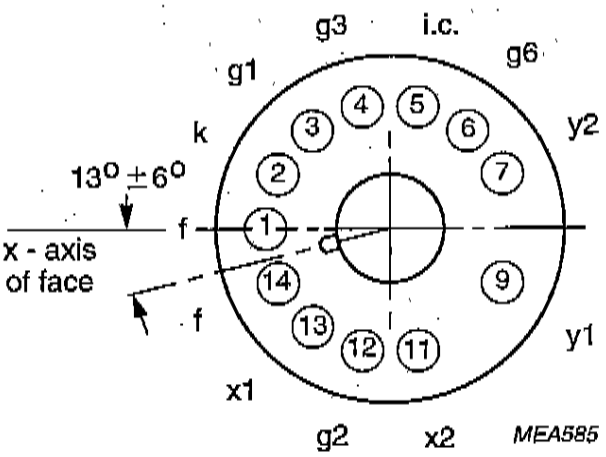

Fig.2 Pin arrangement, bottom view.

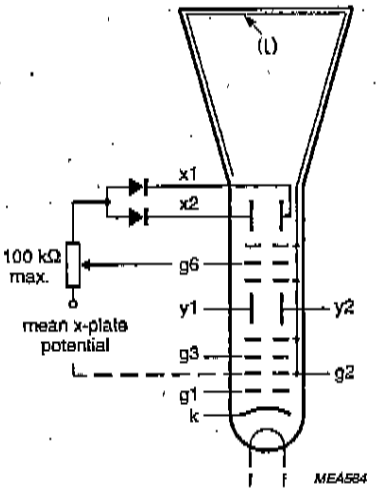

Fig.3 Electrical configuration.

TYPICAL OPERATION

Conditions

Accelerator voltage	$V_{g2(\ell)}$	2 kV	note 1
Astigmatism control voltage	$\Delta V_{g2(\ell)}$	0 V	note 2
Focus electrode voltage	V_{g3}	220 to 360 V	
Cut-off voltage for visual extinction of focused spot	$-V_{g1}$	22 to 65 V	

PERFORMANCE

Useful scan			
horizontal		≥ 70 mm	
vertical		≥ 56 mm	
Deflection coefficient			
horizontal	M_x	36 ± 10% V/cm	
vertical	M_y	23 ± 5% V/cm	
Line width at 10 μA beam current	l.w.	approx. 0.2 mm	note 3
Deviation of deflection linearity		≤ 2%	note 4
Geometry distortion			note 5
Eccentricity of undeflected spot with respect to internal graticule			
horizontal		≤ 4 mm	
vertical		≤ 2 mm	
Angle between x- and y-traces		90°	note 2
Angle between x-trace and x-axis of the internal graticule		≤ 5°	
Grid drive voltage for 10 μA screen current	V_d	approx. 11 V	

LIMITING VALUES (Absolute maximum rating system)

Accelerator voltage	$V_{g2(\ell)}$	max. 2.2 kV
Focusing electrode voltage	V_{g3}	max. 2.2 kV
Voltage between accelerator electrode and grid 6	$V_{g2/g6}$	max. ± 500 V
Voltage between accelerator electrode and any deflection plate	$V_{g2/x/y}$	max. ± 500 V
Control grid voltage	$-V_{g1}$	max. 200 V min. 0 V
Cathode to heater voltage positive negative	 V_{kf} $-V_{kf}$	 max. 125 V max. 125 V
Grid drive, averaged over 1 ms	V_d	max. 20 V
Screen dissipation	W_ℓ	max. 3 mW/cm^2
Control grid circuit resistance	R_{g1}	max. 1 MΩ

NOTES

1. The mean x-plate potential and the mean y-plate potential should be equal to $V_{g2(\ell)}$.
2. The tube features internal magnetic correction for astigmatism, orthogonality and eccentricity calibration.
3. Measured with the shrinking raster method within the useful scan under typical operating conditions, adjusted for optimum focus and dynamic correction applied.
   As the construction of the tubes does not permit a direct measurement of the beam current, this current should be determined as follows:

   a) Under typical operating conditions, apply a small raster display (no overscan), adjust V_{g1} for a beam current of approx. 10 µA and adjust V_{g3} for smallest spot size at the centre of the screen. When measuring the beam current, grid 6 should be connected to g_2-potential and the diodes should be disconnected from the x-plates.

   b) Under these conditions, but without raster, the deflection plate voltages should be changed to: $V_{y1} = V_{y2} = 2$ kV; $V_{x1} = 1.3$ kV; $V_{x1} = 1.7$ kV, thus directing the total beam current to x_2. Measure the current on x_2 and adjust V_{g1} for $I_{x2} = 10$ µA.

   c) Set again for the conditions under a), without touching V_{g1} control. The screen current of the resulting raster display is now 10 µA.
   Adjust V_{g3} for optimum focus in the centre of the screen and apply dynamic correction to grid 6 for optimum vertical line width.
4. The sensitivity at a deflection of less than 75% of the useful scan will not differ from the sensitivity at a deflection of 25% of the useful scan by more than the indicated value.
5. A graticule consisting of concentric rectangles of 70 mm x 56 mm and 68.4 x 54.4 mm is aligned with the faceplate reference points. With optimum trace rotation correction, horizontal and vertical lines will fall between these rectangles.

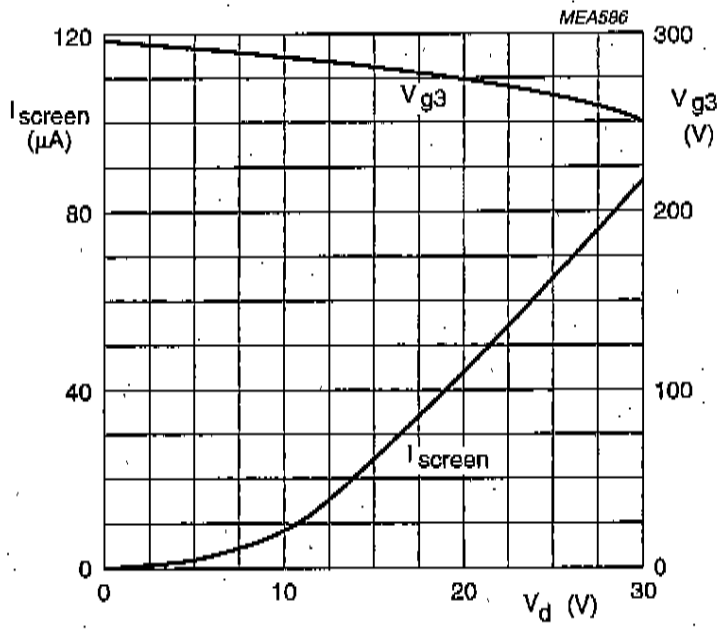

Fig.4 Screen current (I_{screen}) and focusing voltage (V_{g3}) as a function of grid drive voltage (V_d); typical curves