

## INSTRUMENT CATHODE-RAY TUBE

- 10cm diagonal rectangular flat face
- domed mesh post-deflection acceleration
- short tube max. 220 mm
- high precision by permanent magnetic correction system
- low heater power consumption
- very high brightness
- for small oscilloscopes with up to 50 MHz bandwidth and read-out devices

### QUICK REFERENCE DATA

Final accelerator voltage	$V_{g7(1)}$	10 kV
First accelerator voltage	$V_{g2,4}$	1 kV
Minimum useful scan area		70 mm x 56 mm
Deflection coefficient		
horizontal	$M_x$	16,5 V/cm
vertical	$M_y$	11 V/cm

### OPTICAL DATA

Screen type	metal backed phosphor GH (P31)
colour	green
persistence	medium short
Useful screen area	$\geq 70$ mm x 56 mm (note 1)
Useful scan area	$\geq 70$ mm x 56 mm
Internal graticule	type 125 (see Fig.4)

### 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.

# D10-390GH/D9A

Customer specification for TOKIMEC INC.

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## MECHANICAL DATA

Dimensions and connections (see also outline drawings)

Overall length (socket included)	max. 220 mm
Faceplate dimensions	82 ± 0.5 mm x 69 ± 0.5 mm
Net mass (including trace rotation coil)	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 socket and not by the base region alone. The reference points on adjoining edges of the faceplate (see Fig.4) enable the tube to be positioned accurately in the front panel, with optimum alignment of the internal graticule with respect to the bezel.

## Accessories

Socket with solder tags	type 55594
Socket with printed wiring pins	type 55595
Final accelerator contact connector	type 55569
Mu metal shield	type 55461

## FOCUSING

electrostatic

## DEFLECTION

double electrostatic

x plates

symmetrical

y plates

symmetrical

**CAPACITANCES \***

$x_1$ to all other elements except $x_2$	$C_{x_1(x_2)}$	4 pF
$x_2$ to all other elements except $x_1$	$C_{x_2(x_1)}$	4 pF
$y_1$ to all other elements except $y_2$	$C_{y_1(y_2)}$	3 pF
$y_2$ to all other elements except $y_1$	$C_{y_2(y_1)}$	3 pF
$x_1$ to $x_2$	$C_{x_1x_2}$	2 pF
$y_1$ to $y_2$	$C_{y_1y_2}$	1 pF
Control grid to all other elements	$C_{g1}$	6 pF
Cathode to all other elements	$C_k$	3 pF
Focus electrode to all other elements	$C_{g9}$	5 pF
Final accelerator electrode to all other elements	$C_{g7}$	240 pF

\*

Approximate values

DIMENSIONS AND CONNECTIONS

Dimensions in mm

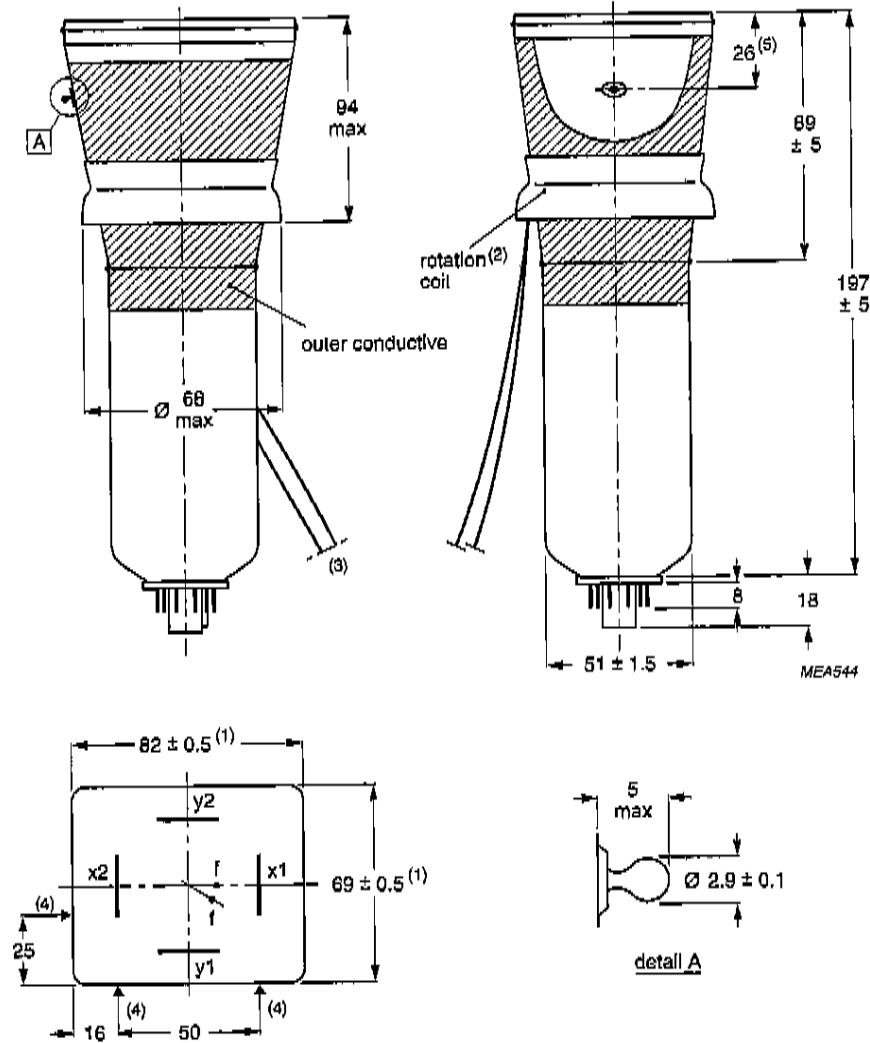


Fig.1 Mechanical outlines.

- (1) Dimensions of faceplate only. The complete assembly of faceplate 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 silicone rubber and adhesive tape.
- (3) The length of rotation coil connecting leads is min. 350 mm.
- (4) Reference points on faceplate for graticule alignment.(see Fig.4)
- (5) The centre of the final accelerator contact is situated within a square of 7 mm x 7 mm around the indicated position.

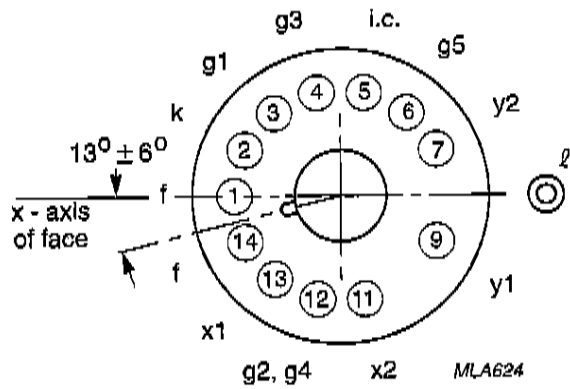
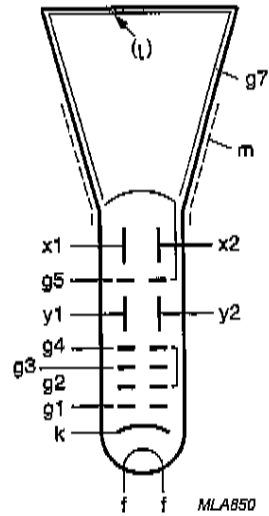


Fig.2 Pin arrangement, bottom view.



Internal graticule

Line thickness = 0.125 mm , Logo = 0.3mm ; colour N 1.5.

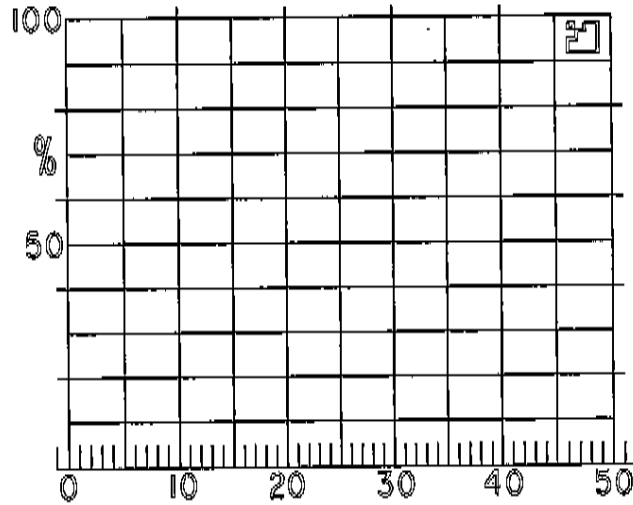


Fig.4 Internal graticule, type D9.

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## TYPICAL OPERATION (voltages are with respect to the cathode)

### Conditions

Final accelerator voltage	$V_{g7(l)}$	10 kV	
Mean deflection plate potential		1 kV	note 2
Shield voltage for optimum geometry	$V_{g5}$	1 kV	note 3
First accelerator and astigmatism control voltage	$V_{g2,4}$	1 kV	note 3
Focusing voltage	$V_{g3}$	150 to 250 V	
Cut-off voltage for visual extinction of focused spot	$-V_{g1}$		45 to 90 V

Outer conductive coating (m) and mu-metal shield to be earthed

## PERFORMANCE

Horizontal deflection coefficient	$M_x$	16.5 V/cm $\pm$ 10 %	
Vertical deflection coefficient	$M_y$	11 V/cm $\pm$ 5 %	
Deviation of deflection linearity		< 2%	note 4
Geometry distortion			note 5
Eccentricity of undeflected spot			
in horizontal direction		< 4 mm	
in vertical direction		< 2 mm	
Angle between x and y traces		90°	note 5
Angle between x-trace and x-axis of internal graticule		< 5°	note 7
Luminance reduction with respect to screen centre			
x axis, outer graticule line		< 30%	
y axis, outer graticule line		< 30%	
any corner		< 50%	
Grid drive for 10 $\mu$ A screen current	$V_d$	approx. 15 V	Fig. 5
Line width			
at 10 $\mu$ A	l.w.	approx. 0.23 mm	note 8
at 25 $\mu$ A	l.w.	approx. 0.30 mm	note 8

**LIMITING VALUES** (Absolute maximum rating system)

Final accelerator voltage		$V_{g7(l)}$	max. 15 kV	Fig. 6
Shield voltage		$V_{g5}$	max. 2 kV	
First accelerator and astigmatism control voltage		$V_{g2,4}$	max. 2 kV	
Focusing electrode voltage		$V_{g3}$	max. 2 kV	
Control grid voltage		$-V_{g1}$	max. 200 V min. 0 V	
Cathode to heater voltage				
positive		$V_{kf}$	max. 125 V	
negative		$-V_{kf}$	max. 125 V	
Heater voltage		$V_f$	max. 6.6 V min. 6.0 V	
Voltage between $g_{4,5}$ and any deflection plate		$V_{g4,g5,x,y}$	max. 500 V	
Grid drive, averaged over 1 ms		$V_d$	max. 25 V	
Screen dissipation		$W_1$	max. 8 mW/cm <sup>2</sup>	
Control grid circuit resistance		$R_{g1}$	max. 1 M $\Omega$	

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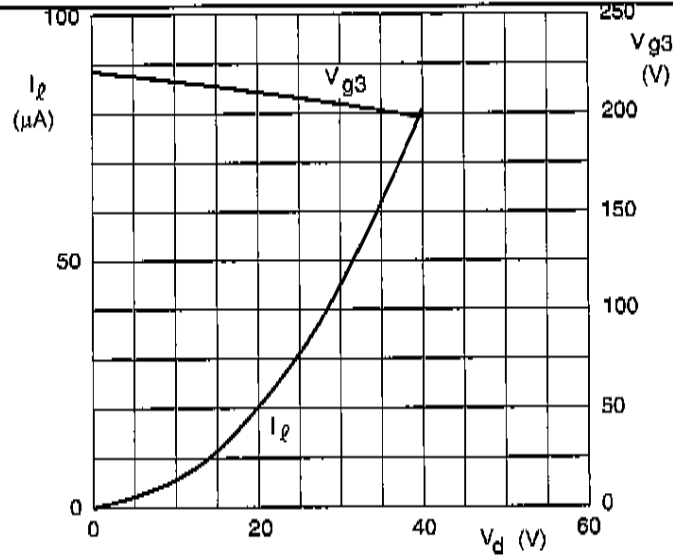


Fig.5 Screen current ( $I_l$ ) and focusing voltage ( $V_{g3}$ ) as a function of grid drive voltage ( $V_d$ ) at  $V_{g2,g4} = 1000$  V; typical curves.

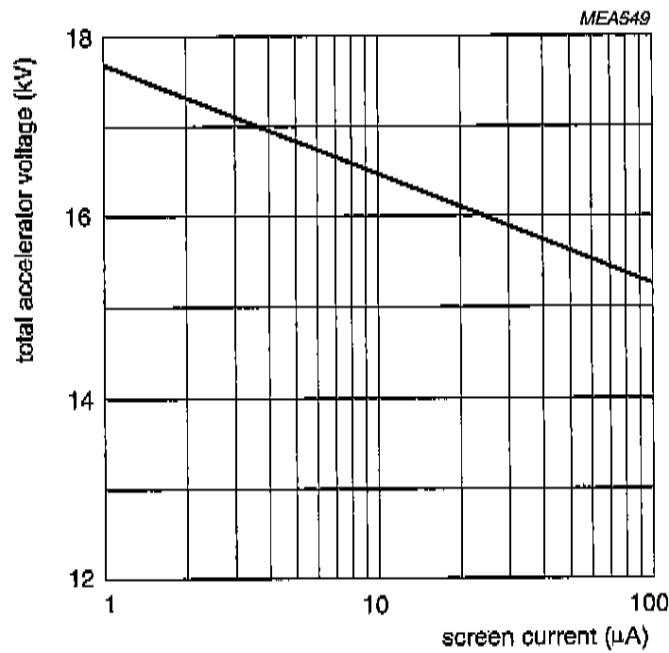


Fig.6 Isoexposure-rate limit curve for 0.5 mR/h, measured in accordance with EIA RS-502.



**NOTES**

1. Because the frit seal is visible through the faceplate, and not necessarily aligned with the internal graticule, application of an external mask, or bezel, with open area of max. 70 mm x 56 mm is recommended. The internal graticule is aligned with the faceplate by using the faceplate reference points (see Fig.4).
2. The deflection plates must be operated symmetrically: floating mean x- or y-potentials will result into non-uniform line width and geometry distortion. The mean x- and y-potentials should be equal; under this condition the tube will be within the specification without corrections for astigmatism and geometry (see also note 5).
3. For some applications a mean x-potential up to 50 V positive with respect to mean y-potential is inevitable. In this case  $V_{g5}$  must be made equal to mean x-potential, and a range of 0 to - 25 V with respect to mean y-potential will be required on  $g_{2,4}$  for astigmatism correction. The circuit resistance for  $V_{g2,4}$  should be  $< 10 \text{ k}\Omega$  and  $< 25 \text{ k}\Omega$  for  $V_{g5}$ .
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. The tube is adjusted by internal permanent magnetic elements for optimum geometry (orthogonality, trapezium and barrel/pin-cushion), brightness uniformity, eccentricity of undeflected spot, and astigmatism.
6. A graticule consisting of concentric rectangles of 68 x 54.4 mm and 66.8 x 53.2 mm is aligned with the internal graticule. With optimum trace rotation correction the edges of a raster will fall between these rectangles.
7. The tube has a trace rotation coil, fixed onto the lower cone part. The coil has a maximum resistance of  $235 \Omega$  at  $80^\circ \text{ C}$ . The maximum required voltage is approx. 8 V for tube tolerances ( $\pm 5^\circ$ ) and earth magnetic field with reasonable shielding ( $\pm 2^\circ$ ).
8. Measured with the shrinking raster method in the centre of the screen under typical operating conditions, adjusted for optimum spot size.

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