

## INSTRUMENT CATHODE-RAY TUBE

- 14 cm diagonal rectangular flat face
- domed mesh post-deflection acceleration
- symmetrical helix system for vertical deflection
- internal magnetic lens system for correction of orthogonality, astigmatism and eccentricity
- quick-heating cathode
- side contacts to deflection plates
- internal graticule
- high sensitivity and high brightness
- for oscilloscopes with up to 500 MHz bandwidth

### QUICK REFERENCE DATA

|                            |             |                          |
|----------------------------|-------------|--------------------------|
| Final accelerator voltage  | $V_{g7(l)}$ | 24 kV                    |
| First accelerator voltage  | $V_{g2}$    | 3 kV                     |
| Minimum useful scan area   |             | 100 mm x 80 mm           |
| Deflection coefficient     |             |                          |
| horizontal                 | $M_x$       | 7,3 V/cm (max. 8,0 V/cm) |
| vertical                   | $M_y$       | 2,9 V/cm (max. 3,0 V/cm) |
| Photographic writing speed | p.w.s. min. | 3 cm/ns                  |

### OPTICAL DATA

|                    |   |
|--------------------|---|
| Screen             | metal-backed phosphor                     |
| type               | GH  |
| colour             | green                                     |
| persistence        | medium short                              |
| Useful screen area | $\geq 102$ mm x 82 mm; note 1 (last page) |
| Useful scan area   | $\geq 100$ mm x 80 mm                     |
| Internal graticule | type 123; see Fig. 5                      |

### HEATING

Indirect by a.c. or d.c.\*

|   |         |        |
|---|---------|--------|
| Heater voltage  | $V_f$   | 6,3 V  |
| Heater current  | $I_f$   | 0,24 A |
| Heating time to attain 10% of the cathode current at equilibrium conditions | approx. | 5 s    |

\* Not to be connected in series with other tubes.

**MECHANICAL DATA****Dimensions and connections** (see also outline drawings)

Overall length (socket included)

≤ 419 mm

Faceplate dimensions

118 ± 1,0 mm x 98 ± 1,0 mm

**Net mass**

approx. 1,2 kg

**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. 5) enable the tube to be mounted accurately in the front panel, thus providing optimum alignment of the internal graticule.

**Accessories**

Pin protector (required for shipping)

supplied with tube

Side pin protection band

3322 027 10200

Socket with solder tags

type 55594

Socket with printed-wiring pins

type 55595

Side contact connector for  $\phi$  0,65 mm pin (2 required)

type 55596 (cat. no. 9390 299 90002)

Side contact connector for  $\phi$  0,45 mm pin (4 required)

to be established

Final accelerator contact connector

connection to final accelerator electrode is made via an EHT cable attached to the tube

Mu-metal shield

to be established

**FOCUSING**

electrostatic

**DEFLECTION**

double electrostatic

x-plates

symmetrical

y-plates

symmetrical (helix system)

Characteristic impedance of helix system

 $(2 \times 165 \Omega) \pm 3\%$ 

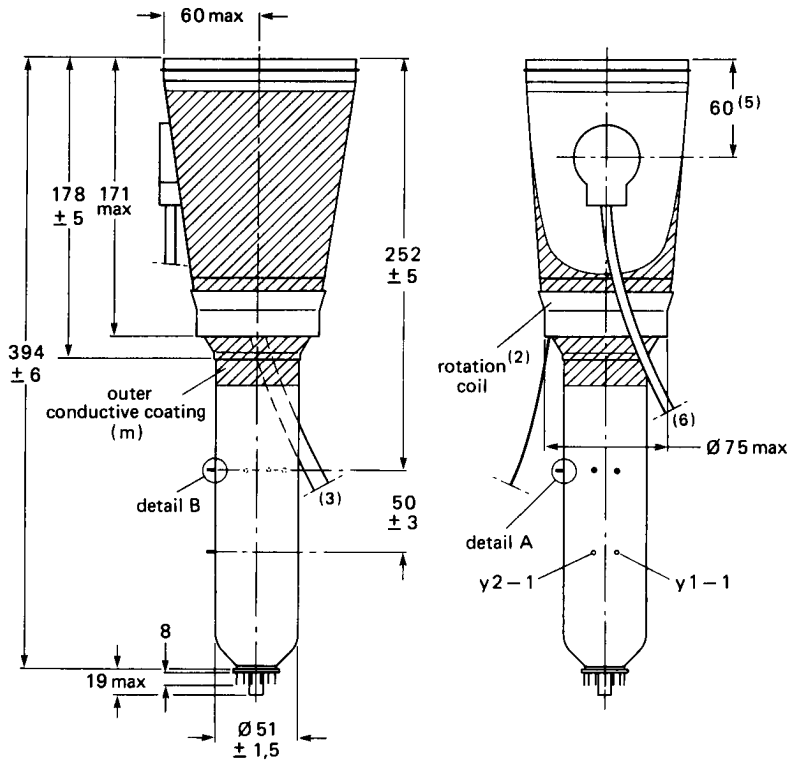
Bandwidth of helix system (−3 dB)

approx. 1000 MHz

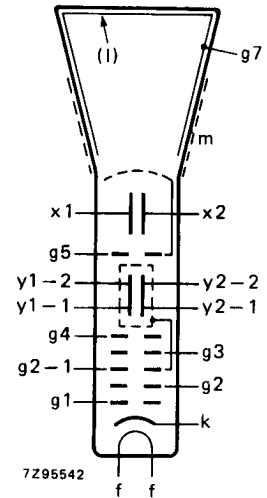
**CAPACITANCES**

|  |              |          |
|--|--------------|----------|
| $x_1$ to all other elements except $x_2$ | $C_{x1(x2)}$ | 3,2 pF   |
| $x_2$ to all other elements except $x_1$ | $C_{x2(x1)}$ | 3,2 pF   |
| $x_1$ to $x_2$                           | $C_{x1x2}$   | 3,0 pF   |
| $x_1$ to $y_1$                           | $C_{x1y1}$   | < 0,2 pF |
| $x_2$ to $y_1$                           | $C_{x2y1}$   | < 0,2 pF |
| $x_1$ to $y_2$                           | $C_{x1y2}$   | < 0,2 pF |
| $x_2$ to $y_2$                           | $C_{x2y2}$   | < 0,2 pF |
| Control grid to all other elements       | $C_{g1}$     | 6,2 pF   |
| Cathode to all other elements            | $C_k$        | 3,8 pF   |
| Focusing electrode to all other elements | $C_{g3}$     | 7,6 pF   |

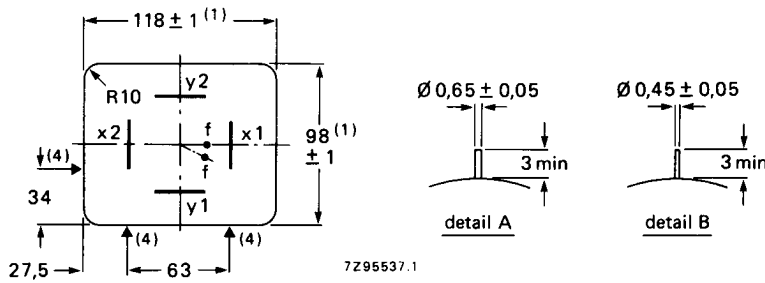
**DIMENSIONS AND CONNECTIONS**



Dimensions in mm



**Fig. 2 Electrode configuration.**



**Fig. 1 Outlines.**

- (1) Dimensions of faceplate only. The complete assembly of faceplate and cone (frit seal included) will pass through an opening of 122 x 102 mm (diagonal 153 mm).
- (2) The coil is fixed to the envelope with resin and adhesive tape.
- (3) The length of the connecting leads of the rotation coil is min. 350 mm.
- (4) Reference points on faceplate for graticule alignment (see Fig. 5).
- (5) The centre of the final accelerator contact is situated within a square of 10 mm x 10 mm around the indicated position.
- (6) The length of the E.H.T. cable is min. 900 mm.

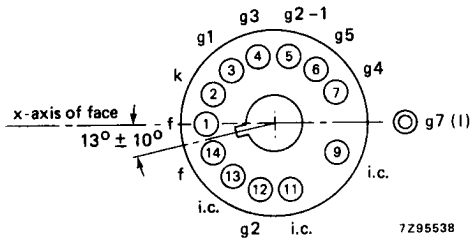


Fig. 3 Pin arrangement; bottom view.

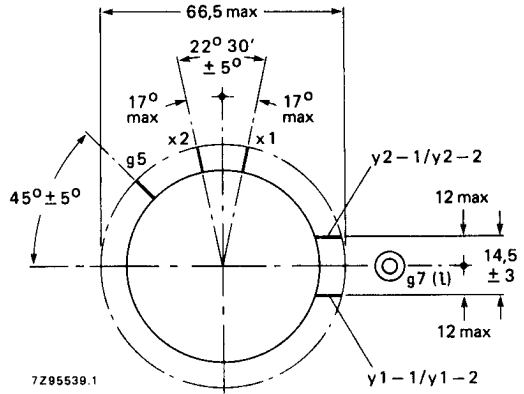


Fig. 4 Side-contact arrangement, bottom view.

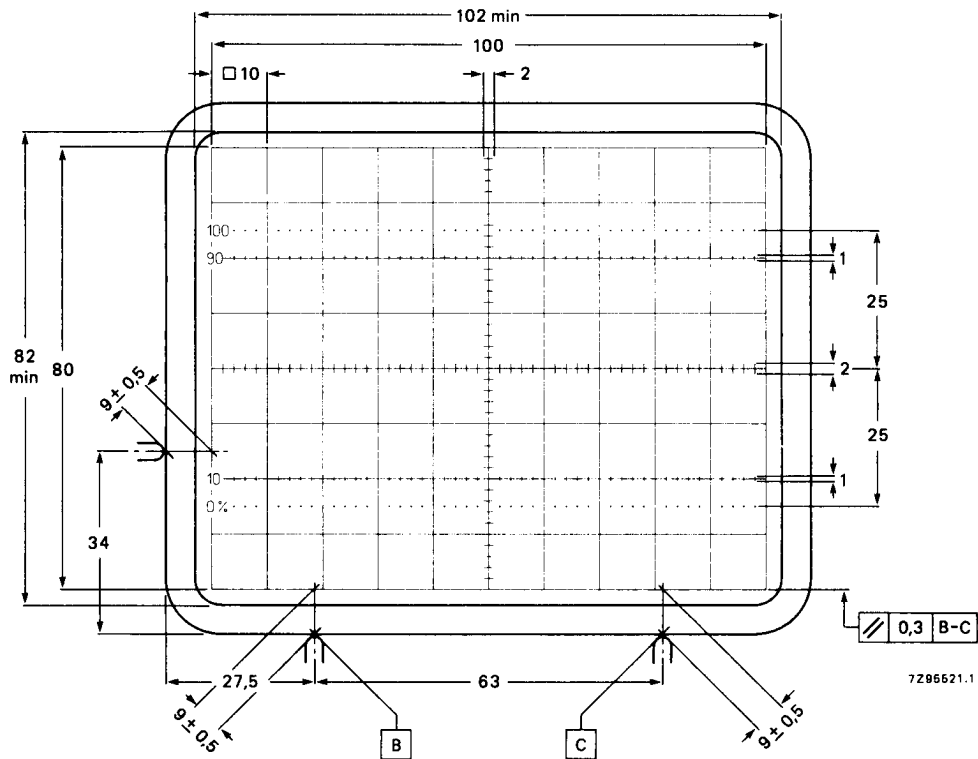


Fig. 5 Front view of tube with internal graticule, type 123 (final accelerator contact at left-hand side). The faceplate reference points are used for aligning the graticule with the faceplate. Line thickness = 0,2 mm; dot diameter = 0,4 mm; colour: red.

**TYPICAL OPERATION** (voltages with respect to cathode)\***Conditions**

|   |              |               |        |
|---|--------------|---------------|--------|
| Final accelerator voltage                                   | $V_{g7(l)}$  | 24 kV         |        |
| First accelerator voltage                                   | $V_{g2}$     | 3 kV          |        |
| Second accelerator voltage                                  | $V_{g2-1}$   | 3 kV          |        |
| Focusing voltage  | $V_{g3}$     | 700 to 1100 V | Fig. 6 |
| Astigmatism control voltage                                 | $V_{g4}$     | 3 kV          | note 2 |
| Shield voltage for optimum geometry                         | $V_{g5}$     | 3 kV          | note 3 |
| Deviation of mean $\gamma$ -plate potential from $V_{g2-1}$ | $V_{\gamma}$ | max. 0,5 V    | note 4 |
| Cut-off voltage for visual extinction of focused spot       | $-V_{g1}$    | 80 to 130 V   |        |

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

Grid  $g5$  has two connections; the socket connection to be used for applying shield voltage  $V_{g5}$ , the side pin connection to be used for proper earthing of  $g5$  via a spark gap.

**Performance**

|  |        |                    |           |
|--|--------|--------------------|-----------|
| Horizontal deflection coefficient  | $M_x$  | 7,3 V/cm $\pm$ 10% |           |
| Vertical deflection coefficient  | $M_y$  | typ. 2,9 V/cm      |           |
|  |        | $\geq$ 2,7 V/cm    |           |
|  |        | $\leq$ 3,0 V/cm    |           |
| Deviation of deflection linearity  | $\leq$ | 3 %                | note 5    |
| Geometry distortion  |        |                    | note 6    |
| Eccentricity of undeflected spot with respect to internal graticule  |        |                    |           |
|  |        |                    |           |
| in horizontal direction  | $\leq$ | 4 mm               |           |
| in vertical direction  | $\leq$ | 2 mm               | note 2    |
| Angle between x- and y-traces  |        | $90 \pm 0,5^\circ$ | note 2    |
| Angle between x-trace and x-axis of internal graticule   | $\leq$ | $5^\circ$          | note 7    |
| Luminance reduction with respect to screen centre  |        |                    |           |
|  |        |                    |           |
|  |        |                    |           |
| x-axis, at a scan of $\pm$ 50 mm   | $\leq$ | 30 %               |           |
| y-axis, at a scan of $\pm$ 40 mm   | $\leq$ | 30 %               |           |
| any corner   | $\leq$ | 50 %               |           |
| Grid drive for 10 $\mu$ A screen current   | $V_d$  | approx. 20 V       |           |
| Line width   | l.w.   | approx. 0,37 mm    | note 8    |
| Photographic writing speed ( $V_d = 75$ V;<br>Polaroid 612 film; GH phosphor;<br>F = 1,2; magnification 0,5) | p.w.s. |                    |           |
|  |        | min.               | 3,0 cm/ns |

\* Notes are on last page.

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

|   |                        |           |                      |        |
|---|------------------------|-----------|----------------------|--------|
| Final accelerator voltage                         | $V_{g7(\ell)}$         | max.      | 26 kV                | Fig. 7 |
| First accelerator voltage                         | $V_{g2}$               | max.      | 3,4 kV               |        |
| Focusing electrode voltage                        | $V_{g3}$               | max.      | 3,4 kV               |        |
| Control grid voltage                              | $-V_{g1}$              | max.      | 200 V                |        |
|   |                        | min.      | 0 V                  |        |
| Cathode to heater voltage                         | $V_{kf}$               | max.      | 125 V                |        |
|   |                        | $-V_{kf}$ | max.                 | 125 V  |
| Heater voltage                                    | $V_f$                  | max.      | 6,6 V                |        |
|   |                        | min.      | 6,0 V                |        |
| Voltage between g4,g5<br>and any deflection plate | $\Delta V_{g4,g5,x,y}$ | max.      | 500 V                |        |
| Grid drive, averaged over 1 ms                    | $V_d$                  | max.      | 30 V                 |        |
| Screen dissipation                                | $W_\ell$               | max.      | 8 mW/cm <sup>2</sup> |        |
| Control grid circuit resistance                   | $R_{g1}$               | max.      | 1 M $\Omega$         |        |

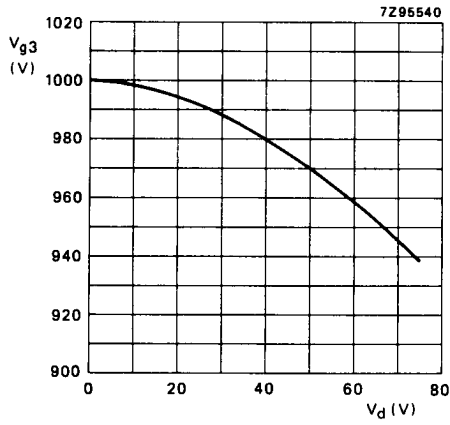


Fig. 6 Focusing voltage ( $V_{g3}$ ) as a function of grid drive voltage ( $V_d$ ); typical curve.

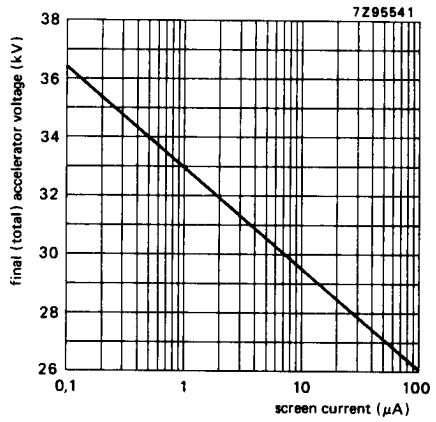


Fig. 7 0,5 mR/h isoexposure-rate limit curve, measured according to EIA standard RS-502 (formerly TEPAC104).



## NOTES

1. As the frit seal is visible through the faceplate, and not necessarily aligned with the internal graticule, application of an external passe-partout with open area of max. 102 mm x 82 mm is recommended. The internal graticule is aligned with the faceplate by using the faceplate reference points (see Fig. 5).
2. The tube features internal magnetic correction for orthogonality between x- and y-traces, spot shaping (astigmatism) and eccentricity calibration. Correction is obtained at  $V_{g2-1,g4} = 2500$  to 3300 V; optimum at  $V_{g2-1,g4} = 3000$  V.
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 -50 V with respect to mean y-potential will be required on g4 for astigmatism correction. The circuit resistance for  $V_{g4}$  should be  $\leq 10$  k $\Omega$ .
4. Deviation of mean y-plate potential with respect to  $V_{g2-1}$  will introduce spot distortion.
5. Deviation of linearity is defined as the proportional deviation of the deflection coefficient over any division on the x-axis and y-axis from the average values over the central eight (horizontal) and central six (vertical) divisions respectively.
6. A graticule consisting of concentric rectangles of 100 mm x 80 mm and 98 mm x 78 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 1000 turns and a resistance of  $185 \pm 20 \Omega$  at 20 °C, which increases by approx. 0,4%/K for rising temperature. Approx. 6,7 mA causes 1° trace rotation.
8. Measured with the shrinking raster method in the centre of the screen under typical operating conditions, adjusted for optimum spot size at a beam current  $I_{\varrho} = 10 \mu\text{A}$ .