

This information is derived from development samples made available for evaluation. It does not necessarily imply that the device will go into regular production.

## NOTES

- 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).
- 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.  
The tube features internal magnetic correction for orthogonality between x- and y-traces, spot shaping (astigmatism) and eccentricity calibration. Correction is obtained at  $V_{g2,g4} = 1800$  V to 2500 V; optimum at  $V_{g2,g4} = 2200$  V.
- 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  $g2,g4$  for astigmatism correction. The circuit resistance for  $V_{g2,g4}$  should be  $\leq 10$  k $\Omega$ .
- 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.
- 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.
- The tube has a trace rotation coil, fixed onto the lower cone part. The coil has 1000 turns and a typical resistance of 185  $\Omega$  at 20 °C (max. 270  $\Omega$  at 80 °C). Approx. 6,5 mA causes 1° trace rotation. Thus maximum required voltage is approx. 13 V for tube tolerances ( $\pm 5^\circ$ ) and earth magnetic field with reasonable shielding ( $\pm 2^\circ$ ).
- 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  $I_{\ell} = 10$   $\mu$ A.

## INSTRUMENT CATHODE-RAY TUBE

- 14 cm diagonal rectangular flat face
- domed mesh post-deflection acceleration
- 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
- short overall length
- for compact oscilloscopes with up to 150 MHz bandwidth

## QUICK REFERENCE DATA

Final accelerator voltage	$V_{g7(\ell)}$	16,5 kV
First accelerator voltage	$V_{g2,g4}$	2,2 kV
Minimum useful scan area		100 mm x 80 mm
Deflection coefficient horizontal	$M_x$	7,8 V/cm
vertical	$M_y$	4 V/cm (max. 4,2 V/cm)
Photographic writing speed	p.w.s.	2,0 cm/ns

## OPTICAL DATA

Screen type	metal-backed phosphor GH
colour	green
persistance	medium short
Useful screen area	$\geq 102$ mm x 82 mm; note 1 (page 8)
Useful scan area	$\geq 100$ mm x 80 mm
Internal graticule	type 93; see Fig. 5

## HEATING

Indirect by a.c. or d.c.*		
Heater voltage	$V_f$	6,3 V
Heater current	$I_f$	240 mA
Heating time to attain 10% of the cathode current at equilibrium conditions		approx. 5 s

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

blue binder, tab 4

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

Overall length (socket included)  $\leq 338$  mm  
 Faceplate dimensions  $118 \pm 1$  mm x  $98 \pm 1$  mm

**Net mass** approx. 1 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. 6) 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  
 Socket with solder tags type 55589/55594  
 Socket with printed-wiring pins type 55595  
 Side contact connector for  $\phi$  0,6 mm pin (4 required) type 2422 034 11976 (AMP87313)  
 Final accelerator contact connector type 55569  
 Mu-metal shield to be established

**FOCUSING**

electrostatic

**DEFLECTION**

x-plates double electrostatic  
 y-plates symmetrical  
 symmetrical

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

Final accelerator voltage	$V_{g7(\ell)}$	max.	18 kV
Shield voltage	$V_{g5}$	max.	2,5 kV
First accelerator and astigmatism control voltage	$V_{g2,g4}$	max.	2,5 kV
Focusing electrode voltage	$V_{g3}$	max.	2,5 kV
Control grid voltage	$-V_{g1}$	max. min.	200 V 0 V
Cathode to heater voltage			
positive	$V_{kf}$	max.	125 V
negative	$-V_{kf}$	max.	125 V
Heater voltage	$V_f$	max. min.	6,6 V 6,0 V
Voltage between $g4, g5$ and any deflection plate	$\Delta V_{g4,g5,x,y}$	max.	500 V
Grid drive, averaged over 1 ms	$V_d$	max.	25 V
Screen dissipation	$W_\ell$	max.	8 mW/cm <sup>2</sup>
Control grid circuit resistance	$R_{g1}$	max.	1 M $\Omega$

DEVELOPMENT SAMPLE DATA

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

## Conditions

Final accelerator voltage	$V_{g7(\text{L})}$	16,5 kV	
Mean deflection plate potential		2,2 kV	note 2
Shield voltage for optimum geometry	$V_{g5}$	2,2 kV	note 3
First accelerator and astigmatism control voltage	$V_{g2,g4}$	2,2 kV	note 3
Focusing voltage	$V_{g3}$	400 to 800 V	
Cut-off voltage for visual extinction of focused spot	$-V_{g1}$	50 to 100 V	

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

## Performance

Horizontal deflection coefficient	$M_x$	7,8 V/cm $\pm$ 10%	
Vertical deflection coefficient	$M_y$	4,0 V/cm $\pm$ 5%	
Deviation of deflection linearity		$\leq$ 2 %	note 4
Geometry distortion			note 5
Eccentricity of undeflected spot			
in horizontal direction		$\leq$ 4 mm	
in vertical direction		$\leq$ 2 mm	
Angle between x- and y-traces		90°	note 2
Angle between x-trace and x-axis of internal graticule		$\leq$ 5°	note 6
Luminance reduction with respect to screen centre			
x-axis, outer graticule line		$\leq$ 30 %	
y-axis, outer graticule line		$\leq$ 30 %	
any corner		$\leq$ 50 %	
Grid drive for 10 $\mu$ A screen current	$V_d$	approx. 20 V	
Line width	l.w.	approx. 0,35 mm	note 7
Photographic writing speed ( $V_d = 50$ V; Polaroid 612 film; GH phosphor; F = 1,2; magnification 0,5)	p.w.s.	2,0 cm/ns	

## CAPACITANCES

$x_1$ to all other elements except $x_2$	$C_{x1(x2)}$	2,4 pF
$x_2$ to all other elements except $x_1$	$C_{x2(x1)}$	2,4 pF
$y_1$ to all other elements except $y_2$	$C_{y1(y2)}$	1,9 pF
$y_2$ to all other elements except $y_1$	$C_{y2(y1)}$	1,9 pF
$x_1$ to $x_2$	$C_{x1x2}$	1,8 pF
$y_1$ to $y_2$	$C_{y1y2}$	1,5 pF
Control grid to all other elements	$C_{g1}$	6 pF
Cathode to all other elements	$C_k$	3,2 pF
Focusing electrode to all other elements	$C_{g3}$	5 pF

DEVELOPMENT SAMPLE DATA

\* Notes are on page 8.

DIMENSIONS AND CONNECTIONS

Dimensions in mm

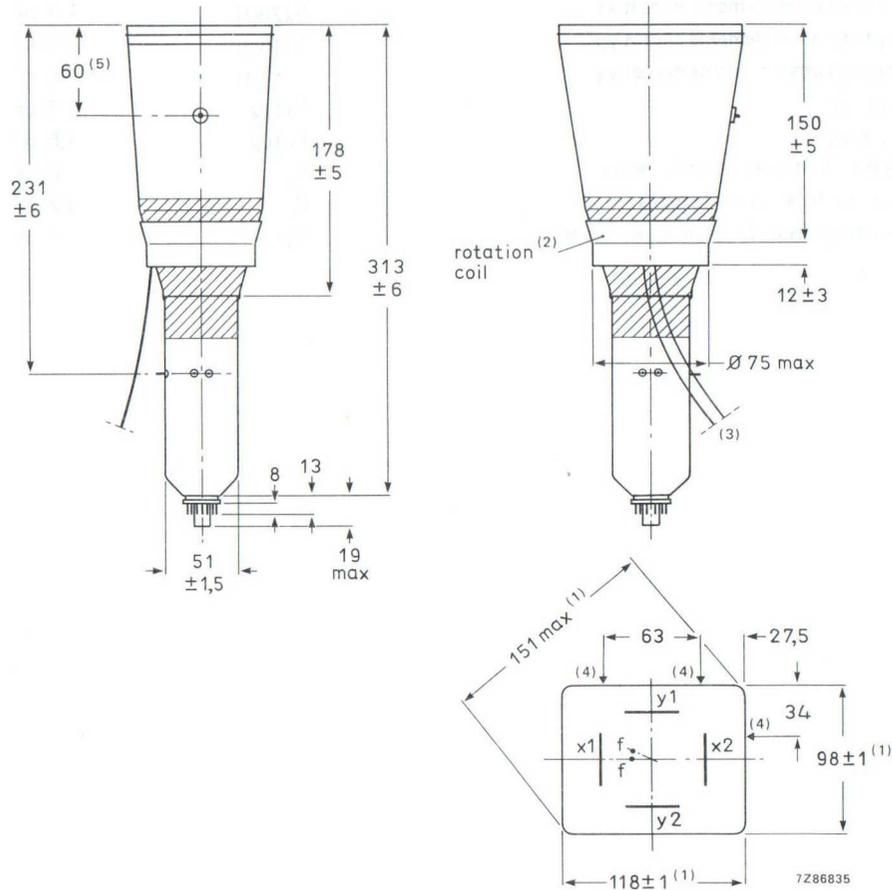


Fig. 1 Outlines.

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.

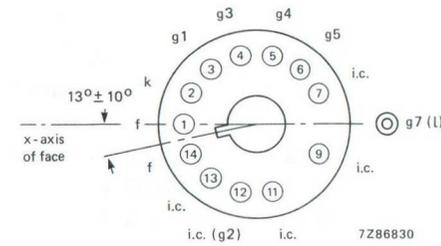


Fig. 2 Pin arrangement; bottom view.

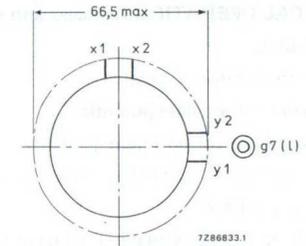


Fig. 3 Side-contact arrangement bottom view.

DEVELOPMENT SAMPLE DATA

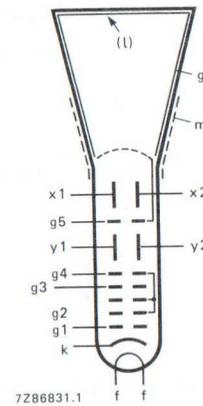


Fig. 4 Electrode configuration.

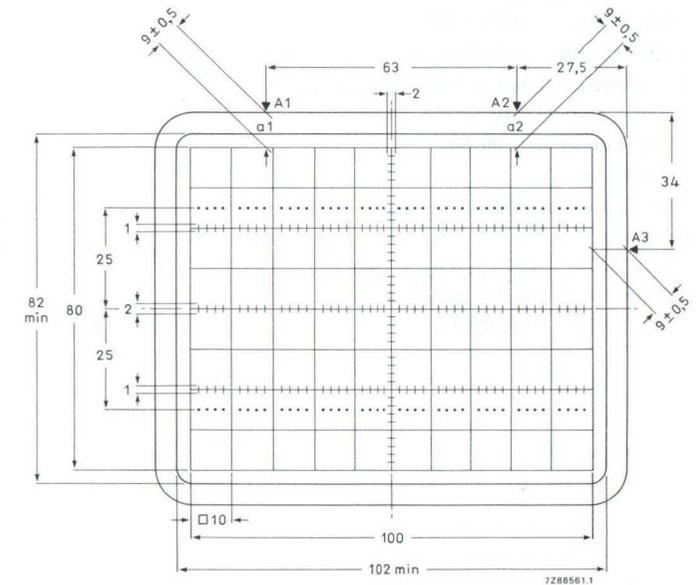


Fig. 5 Front view of tube with internal graticule, type 93. The faceplate reference points A1, A2 and A3 are used for aligning the graticule with the faceplate.  $|a1 - a2| \leq 0,3$  mm.

Line thickness = 0,2 mm; dot diameter = 0,4 mm; colour: red.

## NOTES

- 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).
- 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.  
The tube features internal magnetic correction for orthogonality between x- and y-traces, spot shaping (astigmatism) and eccentricity calibration.
- 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  $g4$  for astigmatism correction. The circuit resistance for  $V_{g4}$  should be  $\leq 10 \text{ k}\Omega$ .
- 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.
- 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.
- The tube has a trace rotation coil, fixed onto the lower cone part. The coil has 1000 turns and a typical resistance of  $185 \pm 25 \Omega$  at 20 °C, which increases by approx. 0,4%/K for rising temperature. Approx. 6,5 mA causes 1° trace rotation. Thus maximum required voltage is approx. 13 V for tube tolerances ( $\pm 5^\circ$ ) and earth magnetic field with reasonable shielding ( $\pm 2^\circ$ ).
- 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  $I_{\phi} = 10 \mu\text{A}$ .
- The X-ray dose rate remains below the acceptable value of 36 pA/kg (0,5 mR/h), when the tube is used within its limiting values (beam current  $I_{\phi} \leq 100 \mu\text{A}$ ).

Data based on pre-production

## INSTRUMENT CATHODE-RAY TUBE

- 14 cm diagonal rectangular flat face
- domed mesh post-deflection acceleration
- 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
- short overall length
- for compact oscilloscopes with up to 150 MHz bandwidth

## QUICK REFERENCE DATA

Final accelerator voltage	$V_{g7(\lambda)}$	16,5 kV
First accelerator voltage	$V_{g4}$	2,2 kV
Minimum useful scan area		100 mm x 80 mm
Deflection coefficient		
horizontal	$M_x$	8,3 V/cm
vertical	$M_y$	4 V/cm (max. 4,2 V/cm)
Photographic writing speed	p.w.s.	2,0 cm/ns

## OPTICAL DATA

Screen	metal-backed phosphor
type	GH
colour	green
persistence	medium short
Useful screen area	$\geq 102 \text{ mm} \times 82 \text{ mm}$ ; note 1 (page 8)
Useful scan area	$\geq 100 \text{ mm} \times 80 \text{ mm}$
Internal graticule	type 93; see Fig. 5

## HEATING

Indirect by a.c. or d.c.*		
Heater voltage	$V_f$	6,3 V
Heater current	$I_f$	240 mA
Heating time to attain 10% of the cathode current at equilibrium conditions		approx. 5 s

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

blue binder, tab 4

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

Overall length (socket included)  $\leq 338$  mm  
 Faceplate dimensions  $118 \pm 0,5$  mm x  $98 \pm 0,5$  mm

**Net mass** approx. 1 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. 6) 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  
 Socket with solder tags type 55594  
 Socket with printed-wiring pins type 55595  
 Side contact connector for  $\phi$  0,6 mm pin (4 required) type 55596 (AMP87313)  
 Final accelerator contact connector type 55569/55597  
 Mu-metal shield to be established

**FOCUSING**

electrostatic

**DEFLECTION**

x-plates double electrostatic  
 y-plates symmetrical

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

Final accelerator voltage	$V_{g7(\ell)}$	max.	18 kV	note 8
Shield voltage	$V_{g5}$	max.	3,3 kV	
First accelerator and astigmatism control voltage	$V_{g4}$	max.	3,3 kV	
Focusing electrode voltage	$V_{g3}$	max.	2,5 kV	
Control grid voltage	$-V_{g1}$	max. min.	200 V 0 V	
Cathode to heater voltage				
positive	$V_{kf}$	max.	125 V	
negative	$-V_{kf}$	max.	125 V	
Heater voltage	$V_f$	max. min.	6,6 V 6,0 V	
Voltage between g2 and g4	$\Delta V_{g2,g4}$	max.	2 kV	
Voltage between g4,g5 and any deflection plate	$\Delta V_{g4,g5,x,y}$	max.	500 V	
Grid drive, averaged over 1 ms	$V_d$	max.	25 V	
Screen dissipation	$W_{\ell}$	max.	8 mW/cm <sup>2</sup>	
Control grid circuit resistance	$R_{g1}$	max.	1 M $\Omega$	

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

Final accelerator voltage	$V_{g7(\ell)}$	16,5 kV	
Mean deflection plate potential		2,2 kV	note 2
Shield voltage for optimum geometry	$V_{g5}$	2,2 kV	note 3
First accelerator and astigmatism control voltage	$V_{g4}$	2,2 kV	note 3
Focusing voltage	$V_{g3}$	400 to 800 V	
Grid 2 voltage	$V_{g2}$	2,2 kV	
Cut-off voltage for visual extinction of focused spot	$-V_{g1}$	50 to 100 V	

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

**Performance**

Horizontal deflection coefficient	$M_x$	8,3 V/cm $\pm$ 10%	
Vertical deflection coefficient	$M_y$	4,0 V/cm $\pm$ 5%	
Deviation of deflection linearity		$\leq$ 2 %	note 4
Geometry distortion			note 5
Eccentricity of undeflected spot in horizontal direction		$\leq$ 4 mm	
in vertical direction		$\leq$ 2 mm	
Angle between x- and y-traces		90°	note 2
Angle between x-trace and x-axis of internal graticule		$\leq$ 5°	note 6
Luminance reduction with respect to screen centre x-axis, outer graticule line		$\leq$ 30 %	
y-axis, outer graticule line		$\leq$ 30 %	
any corner		$\leq$ 50 %	
Grid drive for 10 $\mu$ A screen current	$V_d$	approx. 20 V	
Line width	l.w.	approx. 0,35 mm	note 7
Photographic writing speed ( $V_d = 50$ V; Polaroid 612 film; GH phosphor; F = 1,2; magnification 0,5)	p.w.s.	2,0 cm/ns	

**CAPACITANCES**

$x_1$ to all other elements except $x_2$	$C_{x1(x2)}$	2,4 pF
$x_2$ to all other elements except $x_1$	$C_{x2(x1)}$	2,4 pF
$y_1$ to all other elements except $y_2$	$C_{y1(y2)}$	1,9 pF
$y_2$ to all other elements except $y_1$	$C_{y2(y1)}$	1,9 pF
$x_1$ to $x_2$	$C_{x1x2}$	1,8 pF
$y_1$ to $y_2$	$C_{y1y2}$	1,5 pF
Control grid to all other elements	$C_{g1}$	6 pF
Cathode to all other elements	$C_k$	3,2 pF
Focusing electrode to all other elements	$C_{g3}$	5 pF

\* Notes are on page 8.

DIMENSIONS AND CONNECTIONS

Dimensions in mm

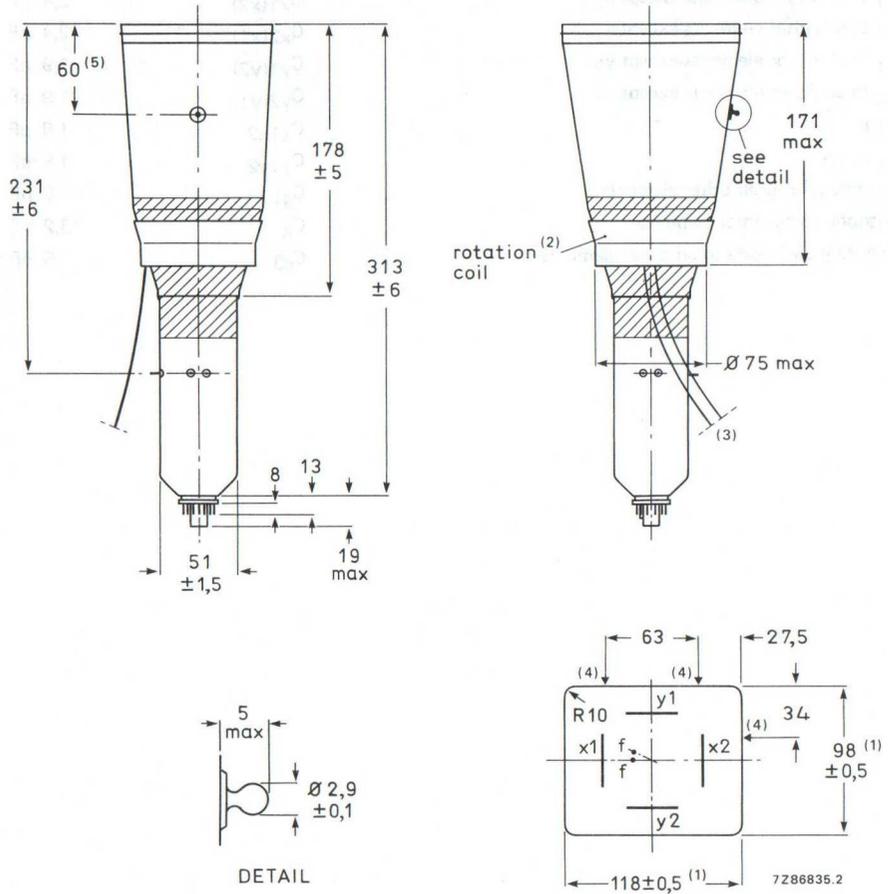


Fig. 1 Outlines.

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.

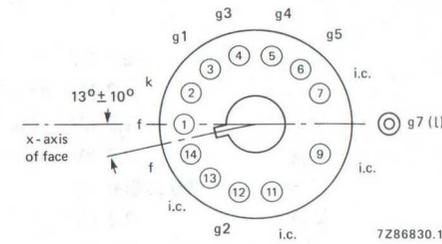


Fig. 2 Pin arrangement; bottom view.

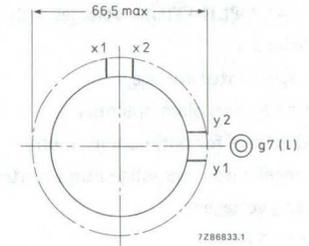


Fig. 3 Side-contact arrangement bottom view.

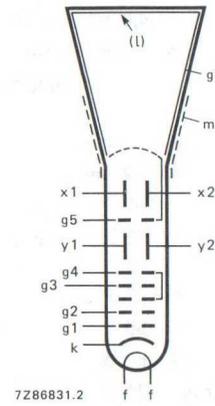


Fig. 4 Electrode configuration.

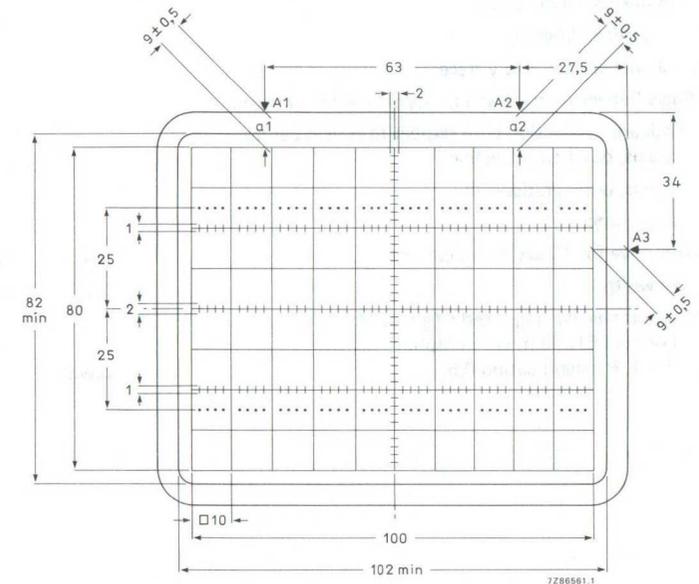


Fig. 5 Front view of tube with internal graticule, type 93. The faceplate reference points A1, A2 and A3 are used for aligning the graticule with the faceplate.  $|a1 - a2| \leq 0,3$  mm.

Line thickness = 0,2 mm; dot diameter = 0,4 mm; colour: red.