INSTRUMENT CATHODE-RAY TUBE

14 cm diagonal rectangular flat-faced oscilloscope tube with domed post-deflection acceleration mesh, sectioned y-plates, and metal-backed screen with internal graticule.

QUICK REFERENCE DATA

Final accelerator voltage	$V_{g9(\ell)}$			20	kV
Display area		100	x	80	mm^2
Deflection coefficient, horizontal	M_x			9	V/cm
vertical	M_y			3	V/cm

SCREEN

Metal-backed phosphor

	colour	persistence
D14-240GH/37	green	medium short

Useful screen dimensions	>	100	x	80	mm
Spot eccentricity in horizontal and vertical directions	<			6	mm

Blue Binder, Tab 4

HEATING

Indirect by a.c. or d.c.; parallel supply

Heater voltage	V_f	6,3	V
Heater current	I_f	300	mA

MECHANICAL DATA

Mounting position: any

The tube should not be supported by the base alone and under no circumstances should the socket be allowed to support the tube.

Dimensions and connections

See also outline drawing

Overall length (socket included)	<	385	mm
Face dimensions	<	120 x 100	mm

MECHANICAL DATA (continued)

Net mass	≈ 900 g
Base	14 pin, all glass
Accessories	
Socket (supplied with tube)	type 55566
Side contact connector (12 required)	type 55561
Final accelerator contact connector	note [1]
Mu-metal shield	note [2]

FOCUSING electrostatic

DEFLECTION double electrostatic

x-plates	symmetrical
y-plates	symmetrical
Angle between x and y traces	90°
Angle between x-trace and x-axis of the internal graticule	0°

See also "Correction coils"

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

CAPACITANCES

x_1 to all other elements except x_2	$C_{x_1(x_2)}$	5	pF
x_2 to all other elements except x_1	$C_{x_2(x_1)}$	5	pF
$y_{1.1}$ to all other elements except $y_{2.1}$	$C_{y_{1.1}(y_{2.1})}$	1,2	pF
$y_{2.1}$ to all other elements except $y_{1.1}$	$C_{y_{2.1}(y_{1.1})}$	1,2	pF
x_1 to x_2	$C_{x_1x_2}$	3	pF
$y_{1.1}$ to $y_{2.1}$	$C_{y_{1.1}y_{2.1}}$	0,8	pF
Control grid to all other elements	C_{g_1}	5,5	pF
Cathode to all other elements	C_k	4	pF

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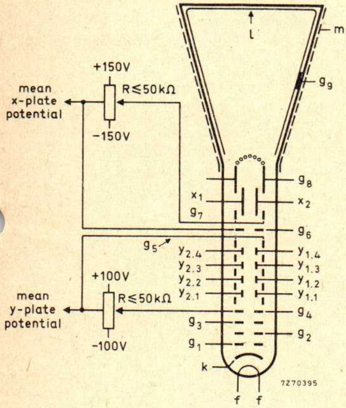
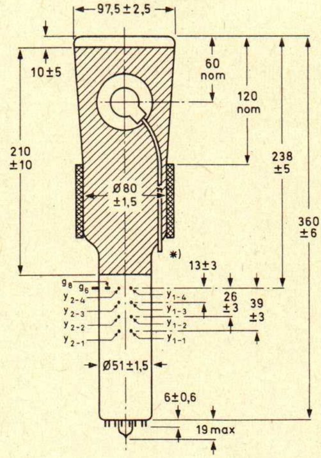
[1]) The connection to the final accelerator electrode is made by means of an EHT cable attached to the tube.

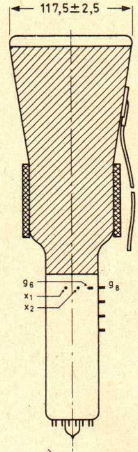
[2]) The diameter of the mu-metal shield should be large enough to avoid damage to the side contacts.

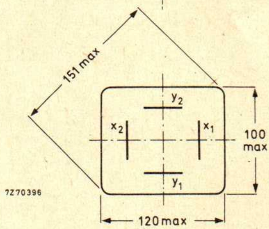
DIMENSIONS AND CONNECTIONS

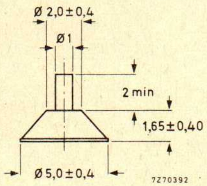
Dimensions in mm



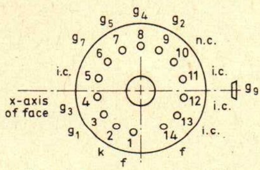




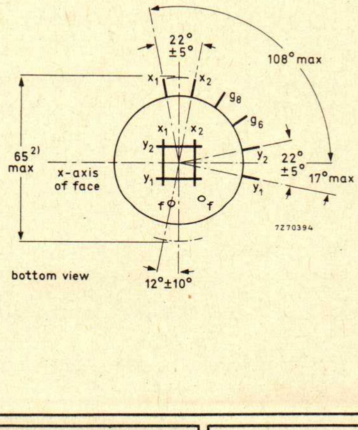




detail of side contact



bottom view



* length of cable approx. 460 mm

TYPICAL OPERATION

Conditions

Final accelerator voltage	$V_{g9(\ell)}$	20	kV	
Post deflection accelerator mesh electrode voltage	V_{g8}	2000	V	
Geometry control electrode voltage	V_{g7}	2000 ± 150	V	1)
Interplate shield voltage	V_{g6}	2000	V	2)
Deflection plate shield voltage	V_{g5}	2000	V	3)
Astigmatism control electrode voltage	V_{g4}	2000 ± 100	V	4)
Focusing electrode voltage	V_{g3}	500 to 800	V	
First accelerator voltage	V_{g2}	2000	V	
Control grid voltage for visual extinction of focused spot	V_{g1}	-55 to -110	V	
Voltage on outer conductive coating	V_m	2000	V	

Performance

Useful scan , horizontal		>	100	mm	5)
vertical		>	80	mm	
Deflection coefficient, horizontal	M_x		9	V/cm	
		<	9,9	V/cm	
vertical	M_y		3	V/cm	
		<	3,3	V/cm	
Line width		≈	0,45	mm	6)
Writing speed		>	1,5	cm/ns	7)
Deviation of linearity of deflection			see note 8	%	
Geometry distortion			see note 9		
Grid drive for 10 μA screen current		≈	20	V	

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1) The geometry control electrode voltage V_{g7} should be adjusted within the indicated range (values with respect to the mean x-plate potential).

2) The interplate shield voltage should be equal to the mean x-plate potential.

3) The deflection plate shield voltage should be equal to the mean y-plate potential. The mean x-plate and y-plate potentials should be equal for optimum performance.

4) The astigmatism control electrode voltage should be adjusted for optimum spot shape. For any necessary adjustment its potential will be within the stated range.

5) If the tube is operated at a ratio $V_{g9(\ell)}/V_{g5} < 10$, the useful scan may be smaller than 100 mm x 80 mm.
The scanned raster can be shifted and aligned with the internal graticule by means of correction coils fitted around the tube.

LIMITING VALUES (Absolute max. rating system)

Final accelerator voltage	$V_{g9(\ell)}$	max.	21	kV
		min.	15	kV
Post defelction acceleration mesh electrode voltage	V_{g8}	max.	2200	V
Geometry control electrode voltage	V_{g7}	max.	2400	V
Interplate shield voltage	V_{g6}	max.	2200	V
Deflection plate shield voltage	V_{g5}	max.	2200	V
Asigmatism control electrode voltage	V_{g4}	max.	2300	V
		min.	1800	V
Focusing electrode voltage	V_{g3}	max.	2200	V
First accelerator voltage	V_{g2}	max.	2200	V
		min.	1900	V
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
Voltage between astigmatism control electrode and any deflection plate	V_{g4}/x	max.	500	V
	V_{g4}/y	max.	500	V
Grid drive, average		max.	30	V
Screen dissipation	W_{ℓ}	max.	8	mW/cm^2
Ratio V_{g9}/V_{g5}	V_{g9}/V_{g5}	max.	10	
		min.	8	

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6) Measured with the shrinking raster method in the centre of the screen, with corrections adjusted for optimum spot size, at a beam current of 10 μA.

7) Writing speed measuring conditions:

Film	Polaroid 410 (10 000 ASA)
Lens	F 1/1, 2
Object to image ratio	1/0, 5
Modulation	ΔV_{g1} = 55 V

8) The deflection coefficient over each division will not differ more than 5% from that over any other division, all these deflection coefficients being measured per division along the axes.

9) A graticule, consisting of concentric rectangles of 95 mm x 75 mm and 93 mm x 73, 6 mm is aligned with the electrical x- axis of the tube. With optimum corrections applied, the edges of a raster will fall between these rectangles.

CORRECTION COILS

On request a correction coil unit can be made available consisting of:

1. a pair of coils L1 and L2 which enable the angle between the x and y traces at the centre of the sceen to be made exactly 90° (orthogonality correction).
2. a pair of coils L3 and L4 which enable the scanned area to be shifted up and down (vertical shift).
3. a coil L5 for image rotation which enables the alignment of the x trace with the x lines of the graticule.

Orthogonality (coils L1 and L2)

The current required under typical operating conditions with mu-metal shield being used is < 8 mA for complete correction of orthogonality.
The resistance of each coil is ≈ 160 Ω.

Shift (coils L3 and L4)

The current required under typical operating conditions with mu-metal shield being used is < 12 mA for a maximum shift of 5 mm.
The resistance of each coil is ≈ 160 Ω.

Image rotation (coil L5)

The image rotation coil is wound concentrically around the tube neck. Under typical operating conditions 27 ampere-turns are required for the maximum rotation of 5°.
The coil has 1560 turns. This means that a current of < 18 mA is required.
The resistance of the coil is ≈ 185 Ω.

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	colour	persistence
D14-240GH/37	green	medium short

Useful screen dimensions	>	100 x 80	mm
Spot eccentricity in horizontal and vertical directions	<	6	mm

Blue Binder, Tab 4

HEATING

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Heater voltage	V_f	6,3	V
Heater current	I_f	300	mA

MECHANICAL DATA

Mounting position: any

The tube should not be supported by the base alone and under no circumstances should the socket be allowed to support the tube.

Dimensions and connections

See also outline drawing

Overall length (socket included)	<	385	mm
Face dimensions	<	120 x 100	mm

MECHANICAL DATA (continued)

Net mass	≈ 900 g
Base	14 pin, all glass
Accessories	
Socket (supplied with tube)	type 55566
Side contact connector (12 required)	type 55561
Final accelerator contact connector	note [1])
Mu-metal shield	note [2])

FOCUSING	electrostatic
DEFLECTION	double electrostatic
x-plates	symmetrical
y-plates	symmetrical
Angle between x and y traces	90°
Angle between x-trace and x-axis of the internal graticule	0°

See also "Correction coils"

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

CAPACITANCES

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x_2 to all other elements except x_1	$C_{x_2(x_1)}$	5	pF
$y_{1.1}$ to all other elements except $y_{2.1}$	$C_{y_{1.1}(y_{2.1})}$	1,2	pF
$y_{2.1}$ to all other elements except $y_{1.1}$	$C_{y_{2.1}(y_{1.1})}$	1,2	pF
x_1 to x_2	$C_{x_1x_2}$	3	pF
$y_{1.1}$ to $y_{2.1}$	$C_{y_{1.1}y_{2.1}}$	0,8	pF
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[1]) The connection to the final accelerator electrode is made by means of an EHT cable attached to the tube.

[2]) The diameter of the mu-metal shield should be large enough to avoid damage to the side contacts.

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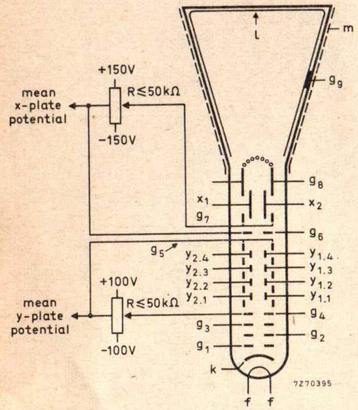
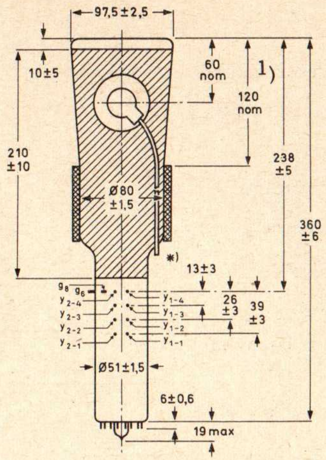
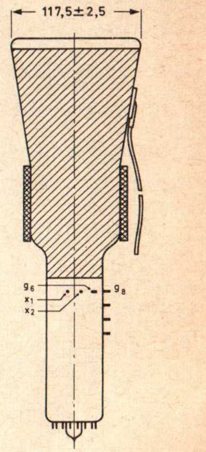
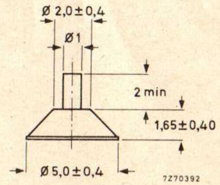
DIMENSIONS AND CONNECTIONS

Dimensions in mm

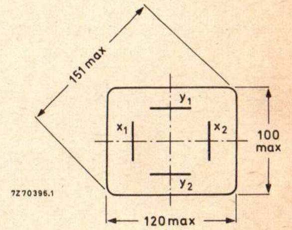


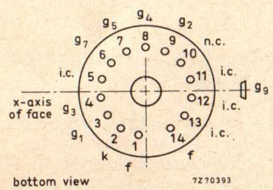




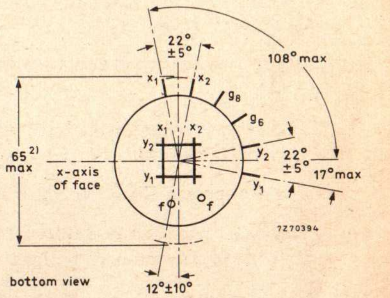


detail of side contact





bottom view



bottom view

1) Recommended position of correction coils.
2) See page 2.
*) Length of cable approx. 460 mm.

TYPICAL OPERATION

Conditions

Final accelerator voltage	$V_{g9(\ell)}$	20	kV	
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Focusing electrode voltage	V_{g3}	500 to 800	V	
First accelerator voltage	V_{g2}	2000	V	
Control grid voltage for visual extinction of focused spot	V_{g1}	-55 to -110	V	
Voltage on outer conductive coating	V_m	2000	V	

Performance

Useful scan, horizontal		>	100	mm	5)
vertical		>	80	mm	
Deflection coefficient, horizontal	M_x		9	V/cm	
		<	9,9	V/cm	
vertical	M_y		3	V/cm	
		<	3,3	V/cm	
Line width		≈	0,45	mm	6)
Writing speed		>	1,5	cm/ns	7)
Deviation of linearity of deflection			see note 8	%	
Geometry distortion			see note 9		
Grid drive for 10 μA screen current		≈	20	V	

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Asigmatism control electrode voltage	V_{g4}	max.	2300	V
		min.	1800	V
Focusing electrode voltage	V_{g3}	max.	2200	V
First accelerator voltage	V_{g2}	max.	2200	V
		min.	1900	V
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
Voltage between astigmatism control electrode and any deflection plate	$V_{g4/x}$	max.	500	V
	$V_{g4/y}$	max.	500	V
Grid drive, average		max.	30	V
Screen dissipation	W_ℓ	max.	8	mW/cm²
Ratio V_{g9}/V_{g5}	V_{g9}/V_{g5}	max.	10	
		min.	8	

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6) Measured with the shrinking raster method in the centre of the screen, with corrections adjusted for optimum spot size, at a beam current of 10 μA.

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Lens	F 1/1,2
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8) The deflection coefficient over each division will not differ more than 5% from that over any other division; all these deflection coefficients being measured per division along the axes.

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