DHM40-93

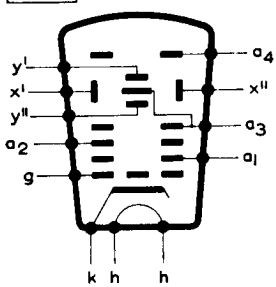
10-93

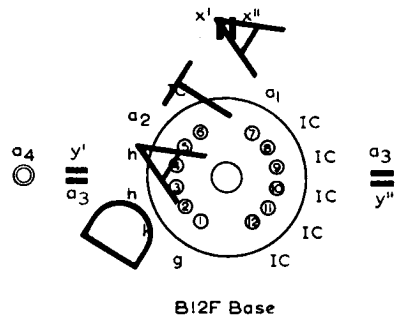
ETEL 4LP1

DUAL TRACE OSCILLOSCOPE TUBE

Dual trace oscilloscope tube with 4-in. diameter flat screen and independent y signal deflections. This tube is fitted with a post deflection accelerator and the deflection plates are brought out to side connections.

ETL11B





B12F Base

GENERAL DATA

Screen type		P1	
Fluorescent colour of screen		green	
Persistence		medium	
Focus		electrostatic	
Deflection		x direction symmetrical electrostatic y direction asymmetrical electrostatic each trace	
Post deflection acceleration		single stage	
Max. overall diameter		108	mm
Max. overall length		393	mm
Weight (approx.)		650 23	g oz
Mounting position		Any—see section on mounting (page 4)	

CATHODE

Indirectly heated—suitable for parallel operation only

Heater voltage	V_h	6.3	V
Heater current	I_h	550	mA

CAPACITANCES

C_{g-all}	4.2 to 5.9	pF
C_{k-all}	3.5 to 4.9	pF
$C_{x'-x"}$	1.4 to 2.0	pF
$C_{x'-all\ (x"\ earthed)}$	2.7 to 3.8	pF
$C_{x"-all\ (x'\ earthed)}$	2.7 to 3.8	pF
$C_{y'-all\ (y"\ earthed)}$	2.5 to 3.8	pF
$C_{y"-all\ (y'\ earthed)}$	2.5 to 3.8	pF
$C_{y'-y"}$ max.	0.1	pF
$C_{y'-x'+x"}$ max.	0.1	pF
$C_{y"-x'+x"}$ max.	0.1	pF

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ETEL 4LP1

DUAL TRACE OSCILLOSCOPE TUBE

LIMITING VALUES (absolute ratings)

Max. first anode voltage	V_{a1} max.	1.7	kV
Min. first anode voltage	V_{a1} min.	600	V
Max. second anode voltage	V_{a2} max.	1.2	kV
Max. third anode voltage	V_{a3} max.	4.0	kV
Min. third anode voltage	V_{a3} min.	600	V
Max. fourth anode voltage (P.D.A.)	V_{a4} max.	8.0	kV
Min. fourth anode voltage	V_{a4} min.	1.0	kV
Max. voltage difference	V_{a4}–V_{a3} max.	4.0	kV
Max. grid voltage	V_g max.	–200	V
Min. grid voltage	V_g min.	–1.0	V
Max. grid resistor	R_{g-k} max.	1.0	MΩ
Max. peak heater to cathode voltage	$v_{h-k(pk)}$ max.	250	V
Max. total anode dissipation	$p_{a(tot)}$ max.	3.0	W
Max. power input to screen	p_t max.	3.0	mW/cm²
Max. resistance from either x plate to a_3	R_{x-a3} max.	2.0	MΩ
Max. resistance from either y plate to a_3	R_{y-a3} max.	1.0	MΩ
Max. voltage between any deflector plate and a_3	V_{x-a3} max. V_{y-a3} max.	1.0	kV
Max. V_{a4} to V_{a3} ratio for full screen x deflection	V_{a4}/V_{a3} max.	2.0	

TYPICAL OPERATING CONDITIONS

First anode voltage	V_{a1}	1.5	kV
*Second anode voltage	V_{a2}	320 to 420	V
Third anode voltage	V_{a3}	1.5	kV
Fourth anode voltage	V_{a4}	3.0	kV
Grid voltage for visual cut-off	V_g	–40 to –95	V
Beam trapping voltage	$V_{x'-a3}$	170 to 290	V
x plate sensitivity	S_x	27	V/cm
y plate sensitivity	S_y	27	V/cm
**Second anode current	I_{a2}	0 to 200	μA

If V_{a1}, V_{a3} and V_{a4} are altered but remain in the same ratio, then the focus, cut-off and trapping voltages and the plate sensitivities will change in the same ratio.

*For focus at intensity of 0.1 candelas. It is recommended that for a full range of grid voltages the available range of V_{a2} should be 150V to 450V with $V_{a1} = V_{a3} = 1.5$kV, $V_{a4} = 3$kV.

**With second anode set for focus and $V_g = -1.0$V.

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DUAL TRACE OSCILLOSCOPE TUBE

DEFLECTION

The tube is designed for symmetrical operation in the x direction, and asymmetrical operation is not recommended.

In the y direction, only asymmetrical operation is possible, since the two deflecting plates are separated by a common beam dividing plate which is connected internally to a_3.

The arrangement of the plates is such that viewing the fluorescent screen with the x plate connection pins vertically downwards a positive voltage on the x′ plate deflects both spots to the left, a positive voltage on the y′ plate deflects one spot upwards and a positive voltage on the y″ plate deflects the other spot downwards.

The x plates are those nearest the screen.

In order to obviate the necessity for pulsing the grid when the tube is used for displaying pulse or single stroke phenomena, a beam trap is incorporated on the x′ plate.When a positive voltage of suitable magnitude is applied to the x′ plate the beam is contained on that plate and a state of mimimum luminance exists.

x plate sensitivity ($V_{a4} = 2V_{a3}$)	S_x max.	$\frac{650}{V_{a3}}$	mm/V
	S_x min.	$\frac{475}{V_{a3}}$	mm/V
y′ plate sensitivity ($V_{a4} = 2V_{a3}$)	$S_{y'}$ max.	$\frac{650}{V_{a3}}$	mm/V
	$S_{y'}$ min.	$\frac{475}{V_{a3}}$	mm/V
y″ plate sensitivity ($V_{a4} = 2V_{a3}$)	$S_{y''}$ max.	$\frac{650}{V_{a3}}$	mm/V
	$S_{y''}$ min.	$\frac{475}{V_{a3}}$	mm/V

PATTERN DISTORTION

With $V_{a4} = 2V_{a3}$, symmetrical x deflection and asymmetrical y deflection, the edges of a nominally square raster lie between concentric 57mm and 60mm squares, i.e., max. total pattern distortion = 2.5%.

RESOLUTION

Under the following operating conditions, the tube resolves 35 lines/cm at the screen centre.

V_{a4}	3.0	kV
V_{a3}	1.5	kV
V_{a2}	Adjusted for focus	
V_{a1}	1.5	kV
V_g	Adjusted to a value corresponding to 0.08cd	
Writing speed	0.6	km/s
Repetition period	10	ms

SPOT ECCENTRICITY

With no post deflection acceleration ($V_{a4} = V_{a3}$) both undeflected spots lie within 8.0mm of the physical screen centre.

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ETEL 4LP1

DUAL TRACE OSCILLOSCOPE TUBE

ORIENTATION AND RECTANGULARITY

The y axis lies within 12° of the line which divides pins 6 and 7, and pins 1 and 12 symmetrically on the base.

The angle between the x axis and either y axis is $90° \pm 1.5°$.

The maximum angle between the two y axes is 1°.

MOUNTING

There is no restriction on the position of mounting.

In mounting the tube the main support should be at the end nearer the screen and so arranged that no stresses are produced in the glass. Adequate precautions should be taken to protect the tube from effects of shock or sudden acceleration. In particular a resilient pad should be provided between the flat face of the tube and any surrounding metal parts.

This tube is not intended to be soldered directly into the wiring. The tube socket and side pin connections should not be rigidly mounted but should have flexible leads and be allowed to move freely.

In most cases it will be necessary to provide a closely fitting magnetic shield surrounding the tube. The tube may then be mounted conveniently by means of resilient rings inside the shield, the shield being rigidly supported by the external apparatus.

CONNECTIONS

Sockets

The B12F socket can be supplied by the Carr Fastener Co. Ltd., of Staple ford, Notts, type No. VO/842.
The tube manufacturers can supply sample quantities of this socket.

Cavity Cap Connectors

Any commercially available CT8 connector is suitable.
Typical examples are the Carr Fastener 71/529, 71/699, and 71/527.

Side Pin Connectors

There are no connectors specifically intended for use with the side pins of this tube. A standard miniature diode anode clip has been found adequate in many instances and in other applications miniature crystal microphone connectors have been used.

SHIELDING

In view of the high sensitivity of the tube it is advisable to mount it as far as possible from transformers and chokes. If transformers or chokes are in close proximity to the tube, thicker or multiple shields may be required to avoid saturation and trace modulation.

Mumetal shields suitable for use with this tube are made by:

Telegraph Construction and Maintenance Co. Ltd., Crawley, Sussex.	Type C4
Magnetic and Electrical Alloys Ltd., Burnbank, Hamilton, Lanarkshire.	Type ST40

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DUAL TRACE OSCILLOSCOPE TUBE

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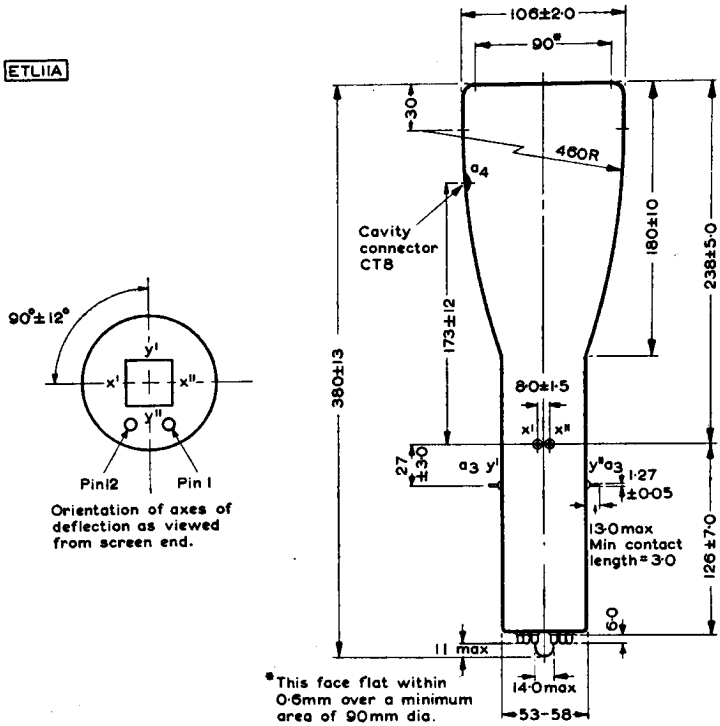

All dimensions in mm

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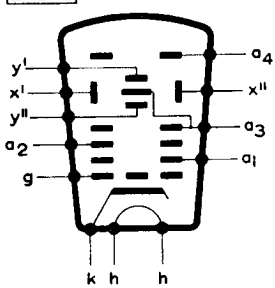
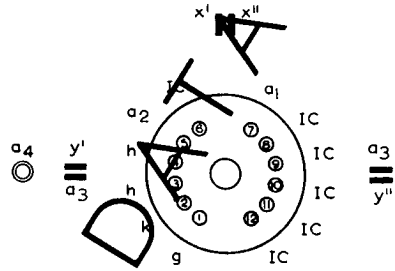
ETEL 4LP1

DUAL TRACE OSCILLOSCOPE TUBE

Dual trace oscilloscope tube with 4-in. diameter flat screen and independent y signal deflections. This tube is fitted with a post deflection accelerator and the deflection plates are brought out to side connections.

ETL11B





B12F Base

GENERAL DATA

Screen type		P1	
Fluorescent colour of screen		green	
Persistence		medium	
Focus		electrostatic	
Deflection		x direction symmetrical electrostatic y direction asymmetrical electrostatic each trace	
Post deflection acceleration		single stage	
Max. overall diameter		108	mm
Max. overall length		393	mm
Weight (approx.)		650 23	g oz
Mounting position		Any—see section on mounting (page 4)	

CATHODE

Indirectly heated—suitable for parallel operation only

Heater voltage	V_h	6.3	V
Heater current	I_h	550	mA

CAPACITANCES

C_{g-all}	4.2 to 5.9	pF
C_{k-all}	3.5 to 4.9	pF
$C_{x'-x''}$	1.4 to 2.0	pF
$C_{x'-all\ (x''\ earthed)}$	2.7 to 3.8	pF
$C_{x''-all\ (x'\ earthed)}$	2.7 to 3.8	pF
$C_{y'-all\ (y''\ earthed)}$	2.5 to 3.8	pF
$C_{y''-all\ (y'\ earthed)}$	2.5 to 3.8	pF
$C_{y'-y''}$ max.	0.1	pF
$C_{y'-x'+x''}$ max.	0.1	pF
$C_{y''-x'+x''}$ max.	0.1	pF

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LIMITING VALUES (absolute ratings)

Max. first anode voltage	V_{a1} max.	1.7	kV
Min. first anode voltage	V_{a1} min.	600	V
Max. second anode voltage	V_{a2} max.	1.2	kV
Max. third anode voltage	V_{a3} max.	4.0	kV
Min. third anode voltage	V_{a3} min.	600	V
Max. fourth anode voltage (P.D.A.)	V_{a4} max.	8.0	kV
Min. fourth anode voltage	V_{a4} min.	1.0	kV
Max. voltage difference	V_{a4}–V_{a3} max.	4.0	kV
Max. grid voltage	V_g max.	–200	V
Min. grid voltage	V_g min.	–1.0	V
Max. grid resistor	R_{g-k} max.	1.0	MΩ
Max. peak heater to cathode voltage	$v_{h-k(pk)}$ max.	250	V
Max. total anode dissipation	$p_{a(tot)}$ max.	3.0	W
Max. power input to screen	p_t max.	3.0	mW/cm²
Max. resistance from either x plate to a_3	R_{x-a3} max.	2.0	MΩ
Max. resistance from either y plate to a_3	R_{y-a3} max.	1.0	MΩ
Max. voltage between any deflector plate and a_3	V_{x-a3} max. V_{y-a3} max.	1.0	kV
Max. V_{a4} to V_{a3} ratio for full screen x deflection	V_{a4}/V_{a3} max.	2.0	

TYPICAL OPERATING CONDITIONS

First anode voltage	V_{a1}	1.5	kV
*Second anode voltage	V_{a2}	320 to 420	V
Third anode voltage	V_{a3}	1.5	kV
Fourth anode voltage	V_{a4}	3.0	kV
Grid voltage for visual cut-off	V_g	–40 to –95	V
Beam trapping voltage	$V_{x'-a3}$	170 to 290	V
x plate sensitivity	S_x	27	V/cm
y plate sensitivity	S_y	27	V/cm
**Second anode current	I_{a2}	0 to 200	μA

If V_{a1}, V_{a3} and V_{a4} are altered but remain in the same ratio, then the focus, cut-off and trapping voltages and the plate sensitivities will change in the same ratio.

*For focus at intensity of 0.1 candelas. It is recommended that for a full range of grid voltages the available range of V_{a2} should be 150V to 450V with $V_{a1} = V_{a3} = 1.5$kV, $V_{a4} = 3$kV.

**With second anode set for focus and $V_g = -1.0$V.

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DEFLECTION

The tube is designed for symmetrical operation in the x direction, and asymmetrical operation is not recommended.

In the y direction, only asymmetrical operation is possible, since the two deflecting plates are separated by a common beam dividing plate which is connected internally to a_3.

The arrangement of the plates is such that viewing the fluorescent screen with the x plate connection pins vertically downwards a positive voltage on the x′ plate deflects both spots to the left, a positive voltage on the y′ plate deflects one spot upwards and a positive voltage on the y″ plate deflects the other spot downwards.

The x plates are those nearest the screen.

In order to obviate the necessity for pulsing the grid when the tube is used for displaying pulse or single stroke phenomena, a beam trap is incorporated on the x′ plate.When a positive voltage of suitable magnitude is applied to the x′ plate the beam is contained on that plate and a state of mimimum luminance exists.

x plate sensitivity ($V_{a4} = 2V_{a3}$)	S_x max.	$\frac{650}{V_{a3}}$	mm/V
	S_x min.	$\frac{475}{V_{a3}}$	mm/V
y′ plate sensitivity ($V_{a4} = 2V_{a3}$)	$S_{y'}$ max.	$\frac{650}{V_{a3}}$	mm/V
	$S_{y'}$ min.	$\frac{475}{V_{a3}}$	mm/V
y″ plate sensitivity ($V_{a4} = 2V_{a3}$)	$S_{y''}$ max.	$\frac{650}{V_{a3}}$	mm/V
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PATTERN DISTORTION

With $V_{a4} = 2V_{a3}$, symmetrical x deflection and asymmetrical y deflection, the edges of a nominally square raster lie between concentric 57mm and 60mm squares, i.e., max. total pattern distortion = 2.5%.

RESOLUTION

Under the following operating conditions, the tube resolves 35 lines/cm at the screen centre.

V_{a4}	3.0	kV
V_{a3}	1.5	kV
V_{a2}	Adjusted for focus	
V_{a1}	1.5	kV
V_g	Adjusted to a value corresponding to 0.08cd	
Writing speed	0.6	km/s
Repetition period	10	ms

SPOT ECCENTRICITY

With no post deflection acceleration ($V_{a4} = V_{a3}$) both undeflected spots lie within 8.0mm of the physical screen centre.

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ORIENTATION AND RECTANGULARITY

The y axis lies within 12° of the line which divides pins 6 and 7, and pins 1 and 12 symmetrically on the base.

The angle between the x axis and either y axis is $90° \pm 1.5°$.

The maximum angle between the two y axes is 1°.

MOUNTING

There is no restriction on the position of mounting.

In mounting the tube the main support should be at the end nearer the screen and so arranged that no stresses are produced in the glass. Adequate precautions should be taken to protect the tube from effects of shock or sudden acceleration. In particular a resilient pad should be provided between the flat face of the tube and any surrounding metal parts.

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Cavity Cap Connectors

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Side Pin Connectors

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SHIELDING

In view of the high sensitivity of the tube it is advisable to mount it as far as possible from transformers and chokes. If transformers or chokes are in close proximity to the tube, thicker or multiple shields may be required to avoid saturation and trace modulation.

Mumetal shields suitable for use with this tube are made by:

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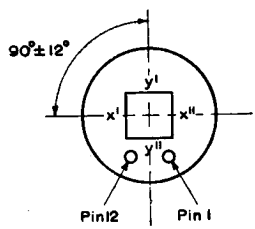
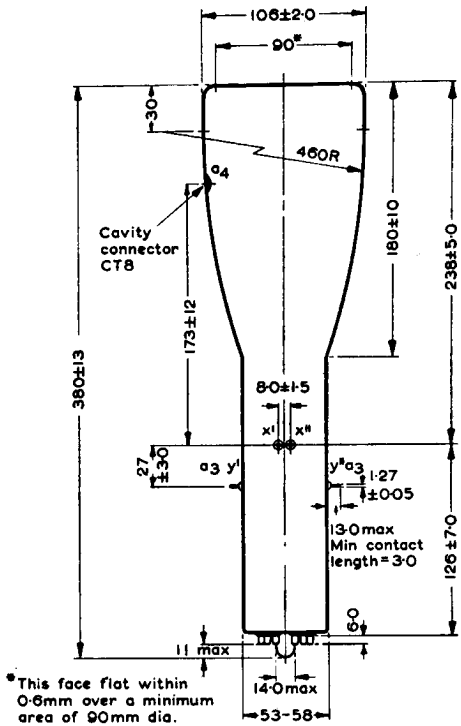
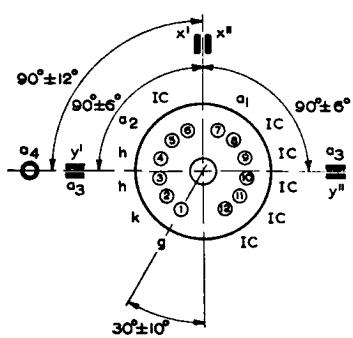
DUAL TRACE OSCILLOSCOPE TUBE

ETL11A



Orientation of axes of deflection as viewed from screen end.





B12F Base

All dimensions in mm

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