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.

GENERAL DATA

Screen type
Fluorescent colour of screen
Persistence
Focus
Deflection
Post deflection acceleration
Max. overall diameter
Max. overall length
Weight (approx.)
Mounting position

CATHODE

Indirectly heated—suitable for parallel operation only
Heater voltage
Heater current

CAPACITANCES

Cg—all
Cg—all
Cx—all
Cx—all (x' earthed)
Cy—all
Cy—all (y' earthed)
Cy—all (y' earthed)
Cy—all (y earthing)
Cy—x' max.
Cy—y' max.
Cy—y' + x' max.

ELECTRONIC TUBES LTD.
KINGSMEAD WORKS, HIGH WYCOMBE, BUCKS, ENGLAND
Telephone: High Wycombe 2020
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 \( P_s \) max. \( 3.0 \) mW/cm²
Max. resistance from either x plate to a3 \( R_{x-a3} \) max. \( 2.0 \) MΩ
Max. resistance from either y plate to a3 \( R_{y-a3} \) max. \( 1.0 \) MΩ
Max. voltage between any deflector plate and a3 \( V_{x-a3} \) 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 \( I_{a3} \) \( 0 \) 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 \( V_{a3} \) should be 150V to 450V with \( V_{a1} = V_{a3} = 1.5kV \), \( V_{a4} = 3kV \).

**With second anode set for focus and \( V_g = -1.0V \).
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 minimum luminance exists.

\[
\begin{align*}
x \text{ plate sensitivity (} V_{a4} = 2V_{a3} & \text{)} & S_x \text{ max.} & 650 \text{ mm/V} \\
& & S_x \text{ min.} & \frac{V_{a3}}{475} \text{ mm/V} \\
y' \text{ plate sensitivity (} V_{a4} = 2V_{a3} & \text{)} & S_{y'} \text{ max.} & 650 \text{ mm/V} \\
& & S_{y'} \text{ min.} & \frac{V_{a3}}{475} \text{ mm/V} \\
y'' \text{ plate sensitivity (} V_{a4} = 2V_{a3} & \text{)} & S_{y''} \text{ max.} & 650 \text{ mm/V} \\
& & S_{y''} \text{ min.} & \frac{V_{a3}}{475} \text{ mm/V}
\end{align*}
\]

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.

\[
\begin{align*}
V_{a4} & 3.0 \text{ kV} \\
V_{a3} & 1.5 \text{ kV} \\
V_{a2} & \text{Adjusted for focus} \\
V_{a1} & 1.5 \text{ kV} \\
V_r & \text{Adjusted to a value corresponding to 0.08cd} \\
\text{Writing speed} & 0.6 \text{ km/s} \\
\text{Repetition period} & 10 \text{ ms}
\end{align*}
\]

SPOT ECCENTRICITY
With no post deflection acceleration ($V_{a4} = V_{a3}$) both undeflected spots lie within 8.0mm of the physical screen centre.
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°±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 Stapleford, 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:

Telegram Construction and Maintenance Co. Ltd.,
Crawley, Sussex. Type C4

Magnetic and Electrical Alloys Ltd.,
Burnbank, Hamilton, Lanarkshire. Type ST40
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.

GENERAL DATA

- Screen type
- Fluorescent colour of screen
- Persistence
- Focus
- Deflection
- Post deflection acceleration
- Max. overall diameter
- Max. overall length
- Weight (approx.)
- Mounting position

CATHODE

- Indirectly heated, suitable for parallel operation only
- Heater voltage $V_h$
- Heater current $I_h$

CAPACITANCES

- $C_{g-all}$
- $C_{k-all}$
- $C_{x'}-x^*$
- $C_{x'}-all$ (x" earthed)
- $C_{x^*}-all$ (x' earthed)
- $C_{y'}-all$ (y" earthed)
- $C_{y^*}-all$ (y' earthed)
- $C_{y'}-y^*$ max.
- $C_{y'}-x^*+x^*$ max.
- $C_{y^*}-x'+x^*$ max.

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Telephone: High Wycombe 2020
**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 $P_{a(total)}$ max. 3.0 W
- Max. power input to screen $P_s$ 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 $V_{a1}$, $V_{a2}$ 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 $V_{a3}$ should be 150V to 450V with $V_{a1} = V_{a3} = 1.5$ kV, $V_{a3} = 3$ kV.

**With second anode set for focus and $V_g = -1.0$ V.
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The tube is designed for symmetrical operation in the x direction, and asymmetrical operation is not recommended.
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\[
\begin{align*}
x \text{ plate sensitivity (} V_{a4} = 2V_{a3} \text{)} & & S_x \text{ max.} & & 650 \cd S_x \text{ min.} & & 475 \\
& & \frac{V_{a3}}{V_{a3}} & & \frac{V_{a3}}{V_{a3}}
\end{align*}
\]

\[
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y' \text{ plate sensitivity (} V_{a4} = 2V_{a3} \text{)} & & S_{y'} \text{ max.} & & 650 \cd S_{y'} \text{ min.} & & 475 \\
& & \frac{V_{a3}}{V_{a3}} & & \frac{V_{a3}}{V_{a3}}
\end{align*}
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y'' \text{ plate sensitivity (} V_{a4} = 2V_{a3} \text{)} & & S_{y''} \text{ max.} & & 650 \cd S_{y''} \text{ min.} & & 475 \\
& & \frac{V_{a3}}{V_{a3}} & & \frac{V_{a3}}{V_{a3}}
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PATTERN DISTORTION
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\begin{align*}
V_{a4} & & 3.0 & & \text{kV} \\
V_{a3} & & 1.5 & & \text{kV} \\
V_{a2} & & \text{Adjusted for focus} \\
V_{a1} & & 1.5 & & \text{kV} \\
V_\phi & & \text{Adjusted to a value corresponding to 0.08cd} \\
\text{Writing speed} & & 0.6 & & \text{km/s} \\
\text{Repetition period} & & 10 & & \text{ms}
\end{align*}
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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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Crawley, Sussex. Type C4
Magnetic and Electrical Alloys Ltd.,
Burnbank, Hamilton, Lanarkshire. Type ST40
ETEL 4LPI
DUAL TRACE OSCILLOSCOPE TUBE

Orientation of axes of deflection as viewed from screen end.

*This face flat within 0.5mm over a minimum area of 90mm dia.

All dimensions in mm

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