

**31B81**

**CATHODE RAY TUBE—ALL ELECTROSTATIC  $3\frac{1}{2}$ " DIA.**  
**Post Deflection Acceleration**  
**For High Precision Instruments**

**GENERAL**

The 31B81 is a flat screen Cathode Ray Tube with post-deflection acceleration. It is suitable for high precision instruments.

**RATING**

|                                                 |                  |               |
|-------------------------------------------------|------------------|---------------|
| Heater Voltage                                  | $V_h$            | 6.3 V         |
| Heater Current                                  | $I_h$            | 0.5 A         |
| Maximum Final Anode Voltage                     | $V_{a4(max)}$    | 8 kV          |
| Minimum Final Anode Voltage                     | $V_{a4(min)}$    | 2 kV          |
| Maximum Third Anode Voltage                     | $V_{a3(max)}$    | 4 kV          |
| Minimum Third Anode Voltage                     | $V_{a3(min)}$    | 1 kV          |
| Maximum Second Anode Voltage                    | $V_{a2(max)}$    | 2 kV          |
| Maximum First Anode Voltage                     | $V_{a1(max)}$    | 2.5 kV        |
| Minimum First Anode Voltage                     | $V_{a1(min)}$    | 1 kV          |
| Maximum Negative Grid Voltage                   | $V_g(max)$       | -200 V        |
| Minimum Negative Grid Voltage<br>(cathode hot)  | $V_g(min)$       | 0* V          |
| Maximum Positive Grid Voltage<br>(cathode cold) | $V_g(max)$       | 200 V         |
| Maximum X1 Plate/X2 Plate<br>Voltage            | $V_{x1-x2(max)}$ | 1 kV          |
| Maximum Y1 Plate/Y2 Plate<br>Voltage            | $V_{y1-y2(max)}$ | 1 kV          |
| Maximum Heater/Cathode<br>Voltage               | $V_{h-k(max)}$   | 150 V         |
| Maximum X Plate/Third<br>Anode Resistance       | $R_{x-a3(max)}$  | 5 M $\Omega$  |
| Maximum Y Plate/Third<br>Anode Resistance       | $R_{y-a3(max)}$  | 5 M $\Omega$  |
| Maximum Grid/Cathode<br>Resistance              | $R_{g-k(max)}$   | 2 M $\Omega$  |
| Minimum Heater/Cathode<br>Resistance            | $r_{h-k(min)}$   | 2† M $\Omega$ |
| Minimum Grid/Cathode<br>Resistance              | $r_{g-k(min)}$   | 10 M $\Omega$ |

\* The Grid must not become positive with respect to cathode.

† Heater 100V negative to cathode.

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## INTER-ELECTRODE CAPACITANCES (pF)

|                                                         |                       |     |
|---------------------------------------------------------|-----------------------|-----|
| Cathode/All other electrodes                            | $c_{k-all}$           | 8   |
| Grid/All other electrodes                               | $c_{g-all}$           | 17  |
| X1 Deflecting Plate/X2 Deflecting Plate                 | $c_{x1-x2}$           | 2.5 |
| Y1 Deflecting Plate/Y2 Deflecting Plate                 | $c_{y1-y2}$           | 3   |
| X1 Deflecting Plate/All other electrodes except X2      | $c_{x1-all, less x2}$ | 8   |
| X2 Deflecting Plate/All other electrodes except X1      | $c_{x2-all, less x1}$ | 8   |
| Y1 Deflecting Plate/All other electrodes except Y2      | $c_{y1-all, less y2}$ | 7.5 |
| Y2 Deflecting Plate/All other electrodes except Y1      | $c_{y2-all, less y1}$ | 7.5 |
| Y1 Deflecting Plate/X1 or X2 Deflecting Plate (approx.) | $c_{y1-x1 or x2}$     | 0.1 |
| Y2 Deflecting Plate/X1 or X2 Deflecting Plate (approx.) | $c_{y2-x1 or x2}$     | 0.2 |

## CHARACTERISTICS

|                                                      |          |                      |      |
|------------------------------------------------------|----------|----------------------|------|
| Second Anode Voltage (focus anode)                   | $V_{a2}$ | 350                  | V    |
| Grid Bias Voltage for cut off at $V_{a1}=1kV$        | $V_g$    | -35                  | V    |
| $V_{a1}=2kV$                                         | $V_g$    | -70                  | V    |
| $V_{a1}=2.5kV$                                       | $V_g$    | -87                  | V    |
| X Plate Sensitivity ( $V_{a4}=V_{a3}$ )              | $S_x$    | $\frac{800}{V_{a3}}$ | mm/V |
| Y Plate Sensitivity ( $V_{a4}=V_{a3}$ )              | $S_y$    | $\frac{520}{V_{a3}}$ | mm/V |
| X Plate Sensitivity ( $V_{a4}=2V_{a3}$ )             | $S_x$    | $\frac{620}{V_{a3}}$ | mm/V |
| Y Plate Sensitivity ( $V_{a4}=2V_{a3}$ )             | $S_y$    | $\frac{400}{V_{a3}}$ | mm/V |
| Grid Voltage (Drive) at $I_{a4}=25\mu A, V_{a1}=2kV$ | $V_g$    | <32                  | V    |

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The undeflected spot will fall within a circle of 5 mm radius from the centre of the tube face.

The Plate sensitivity for a deflection of less than 75% of the useful scan will not differ from that for 25% by more than 2%.

The edges of a raster with mean dimensions which are 75% of the useful scan will not deviate from the mean rectangle by more than  $2\frac{1}{2}$ %.

The minimum useful screen area is a circle of 3.7 cm radius.

Orthogonality of deflection axes is  $\pm 1\%$ .

**DEFLECTION DISTORTION**

In any Cathode Ray Tube using a simple post-deflection accelerator, the application of the accelerating potential results in deflection distortion, which becomes more pronounced as the ratio of  $V_{a4}/V_{a3}$  is increased.

It is recommended that for work involving the measurement of relative deflection amplitudes directly on the tube face this ratio should not exceed 2 : 1.

**ORIENTATION**

Looking at the screen with the spigot key upward, a positive potential applied to X1 will deflect the spot to the left and a positive potential applied to Y1 will deflect the spot upward.

**MAGNETIC SHIELDING**

The magnetic shield should be of high permeability material, of a thickness determined by the magnetic field at the tube position. The shield should be earthed. To obtain optimum results equipment containing Cathode Ray Tubes should always be designed to minimise the magnetic field around the tubes, as magnetic shielding can never be completely effective. In addition to the more obvious deflection effects of alternating fields, steady magnetic fields from smoothing chokes, magnetised steel components, etc., can produce spot distortion or low gun efficiency.

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**DIMENSIONS**

|                         |       |
|-------------------------|-------|
| Maximum Overall Length  | 360mm |
| Maximum Screen Diameter | 92mm  |
| Maximum Neck Diameter   | 52mm  |

**MOUNTING**

The tube should not be supported by the base alone, but should preferably be held in a rubber-lined clamping ring at the screen end together with a similar clamp round the magnetic screen close to the base.

The socket should have sufficient freedom of movement to accommodate the tube overall length tolerance and a small amount of lateral float to ensure good pin contact without straining the base.

**SCREEN PHOSPHORS**

| Type | Colour           | Persistence  | Application             |
|------|------------------|--------------|-------------------------|
| T1   | Green            | Medium       | Visual                  |
| T3   | Blue Actinic     | Short        | Photographic            |
| T4   | White            | Medium Short | Visual/<br>Photographic |
| T6   | Yellow Afterglow | Long         | Visual                  |
| T7   | Orange Afterglow | Very Long    | Visual                  |

**TYPICAL OPERATION**

|                                    |          |           |
|------------------------------------|----------|-----------|
| Final Anode Voltage                | $V_{a4}$ | 4 kV      |
| Third Anode Voltage                | $V_{a3}$ | 2 kV      |
| Second Anode Voltage               | $V_{a2}$ | 350 V     |
| First Anode Voltage                | $V_{a1}$ | 2 kV      |
| Grid Voltage                       | $V_g$    | -60 V     |
| Third Anode Current                | $I_{a3}$ | 1 $\mu$ A |
| Final Anode Current<br>(=I screen) | $I_{a4}$ | 2 $\mu$ A |

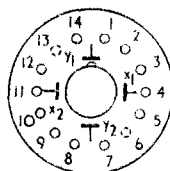
The Line width at  $I_{\text{screen}} = 0.5 \mu\text{A}$  is 0.3mm measured on a circle 50mm diameter.

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SIDE CONTACT—CT8

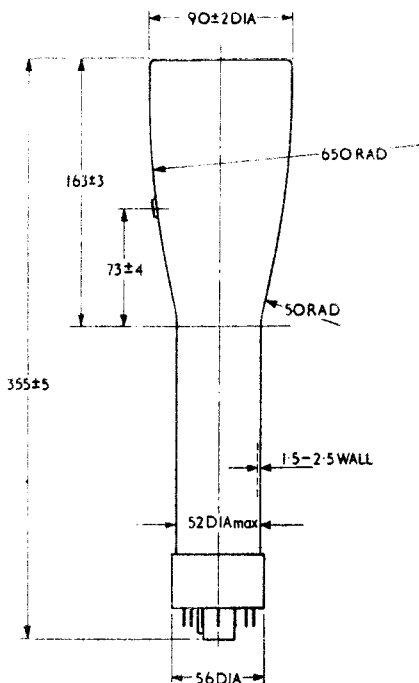
BASE—B14A (Diheptal)



Viewed from free end of pins.

## CONNECTIONS

|        |                    |    |
|--------|--------------------|----|
| Pin 1  | Heater             | h  |
| Pin 2  | Cathode            | k  |
| Pin 3  | Grid               | g  |
| Pin 4  | First Anode        | a1 |
| Pin 5  | Second Anode       | a2 |
| Pin 6  | No pin             | NP |
| Pin 7  | Deflector Plate Y1 | Y1 |
| Pin 8  | Deflector Plate Y2 | Y2 |
| Pin 9  | Third Anode        | a3 |
| Pin 10 | Deflector Plate X2 | x2 |
| Pin 11 | Deflector Plate X1 | x1 |
| Pin 12 | No Connection      | NC |
| Pin 13 | No Pin             | NP |
| Pin 14 | Heater             | h  |
| Cap    | Final Anode        | a4 |

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All Dimensions in mm.