

Electrostatically focused and deflected cathode-ray display tube using an aluminized P2 screen, providing yellow-green to green fluorescence with long persistence.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	—
NOMINAL HEATER	6.3 V / 600 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION1 Cathode Ray
No fixed ratings recorded.
Cathode-ray display/electron-gun section.

10ALP2 Cathode-Ray Tube

The **10ALP2** is a 10-inch diameter, single-beam cathode-ray tube (CRT) featuring electrostatic focus and electrostatic deflection. Manufactured by Allen B. Du Mont Laboratories, the tube is designed for high-voltage, high-precision display applications. It incorporates a specialized Dimagnal collar-base to minimize overall length and features a metal-backed screen with a P2 phosphor configuration to optimize performance during transient studies.

Design and Construction

The 10ALP2 is engineered to deliver high precision with minimized pattern and deflection distortions. This is achieved through the use of specially designed deflection plates that enhance deflection uniformity across the screen.

Dimagnal Collar-Base

Unlike standard CRTs that require bulky external sockets and bases, the 10ALP2 utilizes a specialized **Dimagnal collar-base**. All electrical leads are brought out directly through this collar. This design choice eliminates the additional physical length typically occupied by standard bases and sockets, resulting in a highly compact display assembly suitable for space-constrained equipment.

Metal-Backed Screen and P2 Phosphor

The tube features a metal-backed screen that serves two primary functions:

1. **Increased Light Output:** The reflective metal backing directs light forward, maximizing the brightness of the display.
2. **Spurious Charge Prevention:** During successive electrical transients, spurious charges can build up on an unbacked screen, distorting subsequent traces. The metal backing prevents this charge accumulation, making the 10ALP2 highly suited for the study of single transients or low-repetition-rate signals.

The **P2 phosphor** screen is characterized by the following optical properties:

- **Fluorescent Color:** Green
- **Phosphorescent Color:** Green
- **Persistence:** Long
- **Faceplate Light Transmission:** Approximately 67% at the center

Mechanical Specifications and Basing

The physical dimensions and alignment tolerances of the 10ALP2 are tightly controlled to support high-precision mounting and calibration.

Physical Dimensions

- **Overall Length:** 20 $\pm$ 1/4 inches
- **Greatest Diameter of Bulb:** 10 1/2 $\pm$ 1/8 inches
- **Minimum Useful Screen Diameter:** 9 inches
- **Base:** Special Dimagnal 22-Pin Collar Base
- **Basing Configuration:** 22A

Base and Trace Alignment

- **D1D2 Trace Alignment:** The trace produced by deflecting electrodes D1 and D2 aligns with the collar index pin (Pin No. 1) and the tube axis within $\pm$ 10 degrees.
- **Deflection Direction:**
 - A positive voltage applied to D1 deflects the electron beam approximately toward collar Pin No. 1.
 - A positive voltage applied to D3 deflects the electron beam approximately toward collar Pin No. 18.
- **Trace Orthogonality:** The angle between the D3D4 and D1D2 traces is 90 $\pm$ 1 degrees.

Pin Connection Table (22A Basing)

The 22-pin collar base provides the following electrical connections (viewed from the bottom):

Pin Number	Element Connection
1	Accelerator
3, 4	Deflecting Electrode <u>D1</u>
5, 6	Deflecting Electrode <u>D2</u>
9	Focusing Electrode
11, 14	Heater & Cathode
12, 13	Grid No. 1
15	Heater
18, 19	Deflecting Electrode D3
20, 21	Deflecting Electrode D4

Note: Unlisted pins have no active internal connections.

Electrical Ratings and Capacitances

The 10ALP2 is rated under the absolute maximum rating system. Operating the tube beyond these limits may cause permanent damage or degrade performance.

Absolute Maximum Ratings

- **Heater Voltage:** 6.3 Volts
- **Heater Current (at 6.3 V):** 0.6 $\pm$ 10% Ampere
- **Accelerator Voltage:** 10,000 Max. Volts DC
- **Accelerator Input:** 6 Max. Watts
- **Focusing Electrode Voltage:** 3,500 Max. Volts DC
- **Grid No. 1 Voltage:**
 - **Negative Bias Value:** 300 Max. Volts DC
 - **Positive Bias Value:** 0 Max. Volts DC
 - **Positive Peak Value:** 0 Max. Volts
- **Peak Heater-Cathode Voltage:**
 - **Heater Negative with Respect to Cathode (Warm-up, $\leq 15s$):** 410 Max. Volts
 - **Heater Negative with Respect to Cathode (After Warm-up):** 180 Max. Volts
 - **Heater Positive with Respect to Cathode:** 180 Max. Volts
- **Peak Voltage between Accelerator and any Deflection Electrode:** 1,800 Max. Volts

Direct Interelectrode Capacitances (Approximate)

- **Cathode to all other electrodes:** 7.9 pF
- **Grid No. 1 to all other electrodes:** 9.6 pF
- **D1 to D2:** 5.2 pF
- **D3 to D4:** 2.3 pF
- **D1 to all other electrodes:** 11.0 pF
- **D2 to all other electrodes:** 11.0 pF
- **D3 to all other electrodes:** 5.9 pF
- **D4 to all other electrodes:** 5.9 pF

Typical Operating Conditions and Performance

Under typical operating conditions, the 10ALP2 is operated with an accelerator voltage of 8,000 Volts. The performance parameters at this operating point are detailed below.

Typical Operating Point (at 8,000 V Accelerator)

- **Accelerator Voltage:** 8,000 Volts
- **Focusing Electrode Voltage:** 2,250 to 3,100 Volts
- **Grid No. 1 Voltage (for visual extinction of undeflected, focused spot):** -155 to -205 Volts
- **Deflection Factors:**
 - **D1 and D2:** 155 to 189 Volts DC/Inch
 - **D3 and D4:** 151 to 185 Volts DC/Inch
- **Deflection Factor Uniformity:** 1.5% Maximum
- **Deflection Defocusing Ratio:** 1:3 Maximum
- **Pattern Distortion:** 2% Maximum
- **Modulation:** 20 Max. Volts DC (measured at an anode current Ib3 of 2 μ ADC in accordance with MIL-E-1 specifications)
- **Line Width "A":** 0.012 Max. Inches (measured at an anode current Ib3 of 2 μ ADC in accordance with MIL-E-1 specifications)
- **Focusing Electrode Current:** -15 to +10 μ A (for any operating condition)
- **Spot Position (focused and undeflected):** Within a 20-mm square (centered with respect to the tube face with the tube shielded)

Proportional Operating Guidelines

For accelerator voltages other than the typical 8,000 V, the operating parameters scale proportionally. The following formulas can be used to calculate the required voltages and deflection factors:

- **Focusing Electrode Voltage:** 28% to 38.8% of Accelerator Voltage
- **Grid No. 1 Voltage:** 1.94% to 2.56% of Accelerator Voltage
- **D1 and D2 Deflection Factor:** 19.4 to 23.6 Volts DC per Inch per Kilovolt of Accelerator Voltage
- **D3 and D4 Deflection Factor:** 18.9 to 23.1 Volts DC per Inch per Kilovolt of Accelerator Voltage

Proportional Calculations Example

If the Accelerator Voltage is set to 10,000 V (10 kV):

- **Focusing Electrode Voltage Range:**
 - Minimum = $10,000 * 0.28 = 2,800 \text{ V}$
 - Maximum = $10,000 * 0.388 = 3,880 \text{ V}$
- **Grid No. 1 Voltage Range:**
 - Minimum = $10,000 * 0.0194 = 194 \text{ V}$
 - Maximum = $10,000 * 0.0256 = 256 \text{ V}$
- **D1 and D2 Deflection Factor Range:**
 - Minimum = $19.4 * 10 = 194 \text{ V DC/Inch}$
 - Maximum = $23.6 * 10 = 236 \text{ V DC/Inch}$
- **D3 and D4 Deflection Factor Range:**
 - Minimum = $18.9 * 10 = 189 \text{ V DC/Inch}$
 - Maximum = $23.1 * 10 = 231 \text{ V DC/Inch}$

Circuit Design and Operational Constraints

To ensure stable operation and prevent damage to the tube, specific circuit resistance limits must be observed.

- **Grid No. 1 Circuit Resistance:** Must not exceed 1.5 Megohms.
- **Deflecting Electrode Circuit Resistance:** Must not exceed 5.0 Megohms in any deflecting electrode circuit.
- **Resistance Balance:** It is recommended that the deflecting-electrode circuit resistances be approximately equal to maintain deflection symmetry and minimize distortion.
- **Beam Current Density:** To prevent phosphor burning, the minimum beam current densities necessary for the application should always be used.

Technical Summary

The **10ALP2** is a high-precision, 10-inch electrostatic focus and deflection cathode-ray tube designed by Allen B. Du Mont Laboratories. Featuring a compact Dimagnal 22-pin collar-base and a metal-backed screen with a long-persistence green P2 phosphor, it is optimized for high-voltage operation and the study of single or low-repetition-rate transients. Operating typically at an accelerator voltage of 8,000 V, it provides highly uniform deflection, low pattern distortion (2% max), and a narrow line width (0.012 inches max) for precise visual analysis.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1960 Du Mont

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1960 DU MONT

Section 1 · Cathode Ray

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater Voltage	6.3 V	—
Heater Current	600 mA	—
Focusing Method	Electrostatic text	—
Deflection Method	Electrostatic text	—
Phosphor	P2 text	—
Fluorescence	Yellow-green/green text	—
Persistence	Long text	—
Screen Construction	Aluminized/metal-backed text	—