

ELECTRONIC TUBE REFERENCE

CONSOLIDATED TECHNICAL DATA

12ATP28

1 SECTION
CONSTRUCTION
CATHODERAY

Specialized - Cathode Ray electronic tube

Electrostatically focused and deflected cathode-ray display tube with an aluminized P28 screen, producing yellow-green fluorescence with long persistence and using a 6.3 V, 1.8 A heater.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	—
NOMINAL HEATER	6.3 V / 1.8 A	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION1 Cathode Ray
No fixed ratings recorded.
Representative electron-beam display section; repeated beam systems are electrically similar.

12ATP28 — Three-Beam Electrostatic Cathode-Ray Tube

A 12 7/16-inch diameter, three-beam cathode-ray tube featuring electrostatic focus and deflection, post-acceleration, an aluminized screen, and a long-persistence yellow-green phosphor.

Overview

The **12ATP28** is a multi-beam cathode-ray tube designed for applications requiring the simultaneous display of three independent traces. It incorporates three electrically independent electron gun assemblies (designated Unit A, Unit B, and Unit C) within a single glass envelope. Each gun has its own

cathode, control grid, focusing electrode, and astigmatism adjustment electrode, while sharing a common heater and a common accelerator electrode.

The tube utilizes electrostatic focus and deflection. The integration of a post-deflection accelerator (post-acceleration) allows for maximum deflection sensitivity while maintaining high overall accelerating voltages. To facilitate high-frequency operation, the deflection plate connections are routed directly through the neck of the tube via dedicated contacts, minimizing lead inductance and capacitance. The screen is aluminized to maximize light output and minimize screen charging effects. The 12ATP28 variant is specifically equipped with Phosphor 28, which provides yellow-green fluorescence and phosphorescence with long persistence.

Optical and Screen Characteristics

The 12ATP28 features a flat-faced circular screen with a minimum useful diameter of 11.0 inches. The screen is aluminized to enhance brightness and stability during operation.

The optical characteristics are determined by the Phosphor 28 screen material:

- **Fluorescence:** Yellow-Green
- **Phosphorescence:** Yellow-Green
- **Persistence:** Long

This long-persistence yellow-green characteristic is suitable for applications involving slow-scan displays or where visual retention of transient waveforms is required.

Mechanical Design and Physical Dimensions

The physical structure of the 12ATP28 is substantial, requiring precise alignment of its internal guns, bulb contacts, and base.

Physical Dimensions

- **Overall Length:** $25 \frac{5}{8} \pm \frac{3}{8}$ inches
- **Greatest Diameter of Bulb:** $12 \frac{7}{16} \pm \frac{1}{16}$ inches
- **Minimum Useful Screen Diameter:** 11.0 inches
- **Bulb Contact:** J1-22 (Post-accelerator cap)
- **Neck Contacts:** J1-25 (12 individual caps for deflecting electrodes)
- **Base:** B25-139 (25-pin Penta-Quintal base)
- **Basing:** Special configuration

Alignment Tolerances

To ensure accurate trace registration and geometry, the mechanical alignment of the tube is tightly controlled:

- **Base Alignment:** The D1D2 trace aligns with the base key within ± 10 degrees. A positive voltage applied to D1 deflects the beam approximately toward the base key, while a positive voltage on D3

deflects the beam approximately toward base pin number 23.

- **Bulb Contact Alignment:** The J1-22 post-accelerator cap is located on the same side as the base key. It aligns with the base key within ± 10 degrees and with the D1D2 trace within ± 5 degrees.
- **Trace Alignment:** The angle between the D3D4 and D1D2 traces is maintained at 90 ± 1 degrees for Gun A and Gun B, and 90 ± 2 degrees for Gun C.
- **Neck Contacts:** The 12 J1-25 caps for the deflecting electrodes are positioned around the neck of the tube, spaced 20 degrees apart unless otherwise specified.

Heater and Base Connections

The 12ATP28 contains three separate electron guns that share a common heater and a common accelerator electrode, but have independent connections for their cathodes, control grids, focusing electrodes, and astigmatism adjustment electrodes.

Heater Characteristics

The heaters of all three guns are connected in parallel internally.

- **Heater Voltage:** 6.3 V
- **Heater Current:** $1.8 \pm 10\%$ A
- **Calculated Heater Power:** 11.34 W (calculated as $6.3 \text{ V} * 1.8 \text{ A}$)

Base Pin Connections (B25-139 Bottom View)

The 25-pin Penta-Quintal base provides the following connections:

Pin	Element	Unit A (Gun A)	Unit B (Gun B)	Unit C (Gun C)
1	Heater (Common)	Yes	Yes	Yes
15	Heater (Common)	Yes	Yes	Yes
7	Accelerator (Common)	Yes	Yes	Yes
17	Cathode	Unit A	—	—
24	Cathode	—	Unit B	—
16	Cathode	—	—	Unit C
2	Grid No. 1	Unit A	—	—
14	Grid No. 1	—	Unit B	—
25	Grid No. 1	—	—	Unit C
22	Focusing Electrode	Unit A	—	—

Pin	Element	Unit A (Gun A)	Unit B (Gun B)	Unit C (Gun C)
11	Focusing Electrode	—	Unit B	—
10	Focusing Electrode	—	—	Unit C
6	Astigmatism Adjust	Unit A	—	—
20	Astigmatism Adjust	—	Unit B	—
19	Astigmatism Adjust	—	—	Unit C

Pins not listed in the table are unused or reserved. The accelerator (Pin 7) and the heater (Pins 1 and 15) are common to all three units.

Electrical Ratings

The absolute maximum ratings define the limiting values of operating and environmental conditions under which the tube can be operated safely without damage. All values are specified per gun unless otherwise noted.

Parameter	Absolute Maximum Rating	Unit
Post Accelerator Voltage	15,000	Max. Volts DC
Astigmatism Electrode Voltage	6,000	Max. Volts DC
Accelerator Voltage	6,000	Max. Volts DC
Accelerator Input	6	Max. Watts
Ratio of Post Accelerator to Accelerator Voltage ($E_{b3}/E_{[b2]}$ ($/tubes/B2$))	2.0	Max.
Focusing Electrode Voltage	2,000	Max. Volts DC
Grid No. 1 Voltage (Negative Bias Value)	200	Max. Volts DC
Grid No. 1 Voltage (Positive Bias Value)	0	Max. Volts DC
Grid No. 1 Voltage (Positive Peak Value)	0	Max. Volts DC

Parameter	Absolute Maximum Rating	Unit
Peak Heater-Cathode Voltage (Heater negative wrt cathode)	180	Max. Volts
Peak Heater-Cathode Voltage (Heater positive wrt cathode)	180	Max. Volts
Peak Voltage between Accelerator and any Deflection Electrode	1,250	Max. Volts

Typical Operating Conditions

For optimum performance, the tube is designed to operate at a post-accelerator voltage to accelerator voltage ratio ($E_{b3}/E_{[b2]}(/tubes/B2)$) of 2.0. Operating at other ratios may degrade deflection uniformity and increase pattern distortion.

The typical operating parameters are as follows:

- **Post Accelerator Voltage (E_{b3}):** 10,000 Volts DC
- **Astigmatism Electrode Voltage:** 4,900 to 5,500 Volts DC
- **Accelerator Voltage ($E_{[b2]}(/tubes/B2)$):** 5,000 Volts DC
- **Focusing Electrode Voltage:** 1,275 to 1,725 Volts DC
- **Grid No. 1 Voltage (for visual extinction of undeflected, focused spot):** -64 to -86 Volts DC
- **Focusing Electrode Current (any operating condition):** -15 to +10 μ A

Deflection Factors

The deflection factors represent the voltage required per inch of beam deflection on the screen:

- **Guns "A" and "B":**
 - D1D2: 103 to 127 Volts DC/Inch
 - D3D4: 81 to 99 Volts DC/Inch
- **Gun "C":**
 - D1D2: 103 to 127 Volts DC/Inch
 - D3D4: 67 to 83 Volts DC/Inch

Modulation and Resolution

- **Modulation Voltage (for $I_{b3} = 5 \mu$ ADC):** 30 Volts DC (Max.)
- **Line Width "A" (measured at center):** 0.013 Max. Inch
- **Line Width "B" (measured off-center):** 0.018 Max. Inch
 - *Note on Line Width Measurement:* Line width "B" is measured at a distance of 1.6 inches from the undeflected spot positions for Guns A and B, and at 0.8 inch for Gun C.

- *Compromise Focus:* At no point within the specified scan area of any gun shall the line width exceed 0.030 inch when compromise focus and astigmatism adjustments are used.

Maximum Circuit Values

- **Grid No. 1 Circuit Resistance:** 1.5 Max. Megohms
- **Resistance in any Deflecting-Electrode Circuit:** 1.0 Max. Megohms
 - *Note:* It is recommended that the deflecting-electrode circuit resistances be approximately equal. Higher resistance values up to 5.0 megohms may be used for low beam current operation.

Multi-Beam Alignment and Raster Geometry

Because the 12ATP28 contains three independent electron guns, precise positioning and scanning geometry are critical to prevent overlap or distortion.

Spot Positions

When the deflecting electrodes are connected to the accelerator and the tube is shielded against external magnetic and electrical influences, the focused, undeflected spots center within a 7/16-inch radius circle centered about their nominal positions:

- **Gun A Spot Position:** 2 5/32 inches to the right of the vertical centerline.
- **Gun B Spot Position:** 3/4 inch to the left of the vertical centerline.
- **Gun C Spot Position:** 2 5/32 inches to the left of the vertical centerline.

Useful Scan Areas

Each gun has a defined useful scan area on the screen:

- **Gun A:** 6.75 x 4.31 inches
- **Gun B:** 6.75 x 4.31 inches
- **Gun C:** 6.75 x 2.15 inches

Raster Pattern Distortion and Boundaries

The raster geometry is defined by specific rectangular boundaries:

- **Gun A:** All portions of a raster pattern, adjusted so its widest points just touch the sides of a 6.95 x 4.41-inch rectangle, will fall within the area bounded by that 6.95 x 4.41-inch rectangle and an inscribed 6.55 x 4.21-inch rectangle. The horizontal trace of Gun A, when passing through the tube face center, must fall entirely within a 6.95 x 0.063-inch rectangle centered about the horizontal trace.
- **Gun B:** All portions of a raster pattern, adjusted so its widest points just touch the sides of a 6.95 x 4.44-inch rectangle, will fall within the area bounded by that 6.95 x 4.44-inch rectangle and an inscribed 6.55 x 4.18-inch rectangle.
- **Gun C:** All portions of a raster pattern, adjusted so its widest points just touch the sides of a 7.15 x 2.27-inch rectangle, will fall within the area bounded by that 7.15 x 2.27-inch rectangle and an inscribed 6.35 x 2.01-inch rectangle.

Direct Interelectrode Capacitances

The maximum direct interelectrode capacitances for each gun assembly are:

Capacitance Parameter	Maximum Value	Unit
Cathode to all other electrodes	7.0	pF
Grid No. 1 to all other electrodes	7.0	pF
<u>D1</u> to <u>D2</u>	5.0	pF
D3 to D4	5.0	pF
<u>D1</u> to all other electrodes	9.9	pF
<u>D2</u> to all other electrodes	9.9	pF
D3 to all other electrodes	8.6	pF
D4 to all other electrodes	8.6	pF

These low capacitances, combined with the direct neck connections for the deflection plates, support high-frequency deflection and minimize crosstalk between the independent channels.

Technical Summary

The **12ATP28** is a highly specialized, three-beam, electrostatic focus and deflection cathode-ray tube featuring a 12 7/16-inch diameter faceplate and a long-persistence Phosphor 28 screen. It is designed to operate with a nominal 6.3 V heater supply drawing 1.8 A, and features a common accelerator and common heater alongside independent control grids, cathodes, focusing, and astigmatism electrodes for each of its three guns.

With a maximum post-accelerator rating of 15,000 V DC and a typical operating ratio of 2.0 between the post-accelerator and accelerator voltages, the tube delivers high deflection sensitivity and excellent trace resolution. Its mechanical design incorporates a 25-pin B25-139 base and 12 J1-25 neck contacts for direct deflection plate connection, ensuring optimal performance in multi-channel high-frequency display systems.



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	1.8 A	—
Focusing Method	Electrostatic text	—
Deflection Method	Electrostatic text	—
Phosphor	P28 text	—
Fluorescence	Yellow-green text	—
Persistence	Long text	—
Screen Construction	Aluminized/metal-backed text	—

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