

Ten-inch cathode-ray display tube documented for high-voltage screen operation. The available manufacturer material identifies it as a specialized CRT; sparse surviving data support a conservative display classification without assigning undocumented application-specific properties.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	1
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	
AMPLIFICATION FACTOR	100
Values promoted from published ratings/characteristics where identifiable.	

10UP7A — Electrostatic Focus Magnetic Deflection Cathode Ray Tube

The **10UP7A** is a 10-inch aluminized electrostatic focus and magnetic deflection cathode-ray tube designed specifically for radar applications. It features a high-resolution electron gun and a low-voltage electrostatic focus lens designed to operate at or near cathode potential. This configuration provides substantially automatic focus that remains independent of variations in the accelerator voltage.

Overview and Screen Characteristics

The 10UP7A is engineered with a metallized (aluminized) screen. This design enhances light output, improves image contrast, and minimizes screen charging effects during operation.

The tube is closely related to the **10UP14A**, sharing the same physical dimensions, electrostatic focusing method, and magnetic deflection system. However, they are distinguished by their phosphor screen characteristics:

- **10UP7A Phosphor:** Utilizes Phosphor #7, which exhibits blue fluorescence and yellow phosphorescence with a long persistence. This long-persistence characteristic is highly suited for radar sweep applications where target trails must remain visible between scans.
- **10UP14A Phosphor:** Utilizes Phosphor #14, which exhibits blue fluorescence and orange phosphorescence with a medium-long persistence.

Both types feature a nominal deflection angle of 50 degrees.

Mechanical Specifications and Physical Dimensions

The physical construction of the 10UP7A is designed to accommodate precise mounting and high-voltage insulation:

- **Overall Length:** 17 5/8 ± 3/8 inches
- **Maximum Diameter:** 10 1/2 ± 1/16 inches
- **Minimum Useful Screen Diameter:** 9 inches
- **Neck Diameter:** 1 7/16 ± 1/16 inches
- **Base:** Small Shell Duodecal 6-Pin (B6-63)
- **Anode Cap:** Recessed Small Cavity (J1-21)

The bulb cone is treated with an anti-corona coating to prevent high-voltage discharge. Due to the nature of this coating, a handling caution is specified: the tube must not be handled by the portion of the bulb carrying the anti-corona coating.

The mechanical reference line of the tube is established by the position where a ring gauge with a 1.5000-inch (+0.003" / -0.000") internal diameter and a length of 2 inches rests on the bulb cone.

Pinout and Terminal Connections

The 10UP7A utilizes a Small Shell Duodecal 6-pin base. The terminal connections, viewed from the bottom of the tube, are assigned as follows:

Pin / Cap	Connection
Pin 1	Heater
Pin 2	Grid #1 (Control Grid)
Pin 6	Grid #4 (Focusing Electrode)
Pin 10	Grid #2 (Screen Grid)
Pin 11	Cathode

Pin / Cap	Connection
Pin 12	Heater
Cap	Grids #3 and #5 (Collector / Anode)

For proper circuit operation, the cathode should be returned either to one side of the heater transformer winding or to its center tap.

Electrical Characteristics and Design Center Maximum Ratings

The electrical parameters of the 10UP7A are divided into heater specifications, interelectrode capacitances, and maximum operating limits.

Heater and Capacitance Data

The heater is designed for AC or DC operation:

- **Heater Voltage:** 6.3 V
- **Heater Current:** $0.6 \pm 10\%$ A
- **Calculated Heater Power:** $6.3 \text{ V} \times 0.6 \text{ A} = 3.78 \text{ W}$ (nominal calculation)
- **Peak Heater-Cathode Voltage:** 180 V DC maximum (with heater either negative or positive with respect to the cathode)

The direct interelectrode capacitances are approximately:

- **Grid #1 to all other electrodes:** 6.5 pF
- **Cathode to all other electrodes:** 5 pF

Design Center Maximum Ratings

These ratings represent the absolute limits within which the tube must be operated to prevent damage or premature degradation:

- **Collector Voltage:** 12,000 V DC
- **Grid #4 Voltage (Focusing Electrode):** -500 to +1000 V DC
- **Grid #2 Voltage:** 700 V DC
- **Grid #1 Voltage (Negative-Bias Value):** 180 V DC
- **Grid #1 Voltage (Positive-Bias Value):** 0 V DC
- **Grid #1 Voltage (Positive-Peak Value):** 0 V DC
- **Grid #1 Circuit Resistance:** 1.5 max. Megohms

When operating at or near the maximum collector voltage rating, the effective resistance of the collector supply must be high enough to limit the total collector input power to a maximum of 6 watts.

Typical Operation and Performance

Under typical operating conditions, the 10UP7A provides a highly focused, high-resolution spot. The standard operating parameters are:

- **Collector Voltage:** 10,000 V DC
- **Grid #4 Voltage (Focusing Electrode):** -150 to +150 V DC
- **Grid #2 Voltage:** 300 V DC
- **Grid #1 Voltage (for Visual Extinction):** -28 to -72 V DC

Focus and Resolution Performance

The focusing electrode (Grid #4) voltage is adjusted within the -150 to +150 V range to achieve the best overall focus. This is evaluated with a collector current of 100 μ A, using a 525-line interlaced and synchronized 6 $\times$ 8 inch raster pattern with interlaced line blanking. Under these conditions, the visual extinction of the focused pattern occurs within the specified Grid #1 voltage range.

The resolution is characterized by the line width:

- **Maximum Line Width:** 0.015 inch

The line width is determined via a specific calculation: the pattern width is adjusted to 90% of the minimum useful screen diameter, and the line width is calculated as the merged raster height divided by the number of active lines (262.5), measured at the center of the tube face with a collector current of 100 μ A (measured before blanking is applied).

Spot Alignment

When the tube is properly shielded from external magnetic fields, the undeflected, focused spot is highly centered. The center of the undeflected spot will fall within a circle of 1/2-inch radius concentric with the center of the tube face.

To maintain acceptable brilliance and definition, the collector voltage should generally not be operated below 7,000 volts, as performance degrades significantly below this threshold.

Technical Summary

The **10UP7A** is a specialized 10-inch cathode-ray tube designed for high-resolution radar display systems. By combining a low-voltage electrostatic focusing lens with magnetic deflection, it achieves stable focus characteristics that are largely immune to fluctuations in the high-voltage collector supply. Its aluminized screen with Phosphor #7 provides the long-persistence yellow phosphorescence required for tracking radar targets. Operating with a standard 6.3 V heater, a typical collector voltage of 10,000 V, and a maximum line width of 0.015 inch, the 10UP7A delivers the precise spot alignment and high contrast necessary for demanding military and industrial radar applications.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1938 Raytheon

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

1938 RAYTHEON

Section 1 · Cathode Ray

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater Voltage	6.3 volts	Heater Voltage 6.3 volts
Heater Current	10 amps	Heater Current 0.6+10% amps,
Heater Negative with Respect to Cathode	180 volts	Heater Negative with Respect to Cathode 180 volts DC
Heater Positive with Respect to Cathode	180 volts	Heater Positive with Respect to Cathode 180 volts DC
)® —	150 volts	)® —15Q to +150 volts DC
Grid #	300 volts	Grid #2 Voltage 300 volts DC
Grid #	72 volts	Grid #1 Voltage ® ~28 to ~72 volts DC

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Collector Voltage A	0 volts	Collector Voltage A 12,000 volts DC
Grid #	1000 volts	Grid #4 Voltage (Focusing Electrode) —500 to +1000 volts DC
Crid #	700 volts	Crid #2 Voltage 700 volts DC
Negative —~Bias Value	180 volts	Negative —~Bias Value 180 volts DC
Positive —Bias Value *	0 volts	Positive —Bias Value * 0 volts DC
Positive— Peak Value	0 volts	Positive— Peak Value 0 volts DC
power to	6 watts	power to 6 watts.
decreasing collector voltages. In general collector voliage should not be less than	0 volts	decreasing collector voltages. In general collector voliage should not be less than 7,000 volts.

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