



ELECTRONIC TUBE REFERENCE

10SP4

Specialized - Cathode Ray electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

CATHODERAY

Ten-inch P4 white-screen cathode-ray display tube with electrostatic focusing and magnetic deflection. The aluminized screen, roughly 50-degree deflection, and high anode-voltage capability suit bright direct-view monitor and display service.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	6
NOMINAL HEATER	6.3 V / 600 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 Cathode Ray	
MAXIMUM PLATE VOLTAGE	20000 V
MAXIMUM SCREEN VOLTAGE	410 V
<i>CRT-specific ratings, operating conditions, capacitances, focus/deflection, cutoff, optical, and screen data are retained in section parameters.</i>	

10SP4 — Monitor Kinescope

The **10SP4** is a 10-inch, direct-viewed, round glass cathode-ray tube designed primarily for monitor applications. It features electrostatic focusing, magnetic deflection, and an aluminized screen. The tube incorporates a spherical gray filterglass faceplate to enhance picture contrast and minimize ambient light reflections.

Overview

The 10SP4 is designed for high-performance monitoring service. It utilizes a spherical faceplate with a light transmission rating of approximately 76%. The screen is coated with an aluminized P4-sulfide type phosphor, which exhibits white fluorescence, white phosphorescence, and a short-to-medium persistence characteristic.

With a nominal deflection angle of 50 degrees, the 10SP4 employs magnetic deflection and electrostatic focusing. It does not require an ion trap. The tube is capable of operating in any physical orientation.

Construction and Mechanical Specifications

The 10SP4 is constructed with a round glass bulb (J84) and a spherical faceplate. The physical dimensions and mechanical installation requirements are highly specific:

- **Overall Length:** 16-5/8 inches $\pm$ 3/8 inch
- **Greatest Diameter of Bulb:** 10-1/2 inches $\pm$ 1/16 inch
- **Minimum Useful Screen Diameter:** 9-1/8 inches
- **Picture Size:** 8 inches x 6 inches (within the minimum useful screen area)
- **Weight:** Approximately 10 lbs

Mounting and Installation Constraints

To prevent mechanical stress and ensure safe operation, several installation rules must be observed:

1. **Base Socket:** The socket for the Small-Shell Duodecal 6-Pin base (JETEC No. B6-63) must not be rigidly mounted. It must have flexible leads and be allowed to move freely. The bottom circumference of the base shell is designed to fall within a 1-7/8 inch diameter circle concentric with the bulb axis.
2. **Tube Support:** The tube support must be kept at least 2 inches away from the bulb terminal (ultor cap). A 1-1/2 inch region is designated for the tube support on the neck.
3. **Reference Line:** The reference line of the bulb is determined by the position where a JETEC No. 112 reference-line gauge (1.500 inches $\pm$ 0.003 inch / -0.000 inch internal diameter, 2 inches long) rests on the bulb cone.
4. **Terminal Alignment:** The plane passing through the tube axis and Pin 6 may vary from the plane through the tube axis and the ultor terminal by an angular tolerance of ± 10 degrees. The ultor terminal is located on the same side of the neck as Pin 6.

Electrical Characteristics and Basing

The 10SP4 is equipped with an indirectly heated, coated unipotential cathode. The electrical specifications and interelectrode capacitances are as follows:

Heater and Cathode Ratings

- **Heater Voltage:** 6.3 V (AC or DC)
- **Heater Current:** 0.6 A (nominal)

- **Cathode:** Unipotential

Direct Interelectrode Capacitances

- **Grid No. 1 to all other electrodes:** 6 μF (approximate)
- **Cathode to all other electrodes:** 5 μF (approximate)

Basing Configuration

The tube uses a Small-Shell Duodecal 6-Pin base with a JETEC No. B6-63 designation and a 12Q basing arrangement (viewed from the bottom):

Pin / Cap	Connection
Pin 1	Heater
Pin 2	Grid No. 1 (Control Grid)
Pin 6	Grid No. 3 (Focusing Electrode)
Pin 10	Grid No. 2 (Screen Grid / Accelerator)
Pin 11	Cathode
Pin 12	Heater
Cap	Ultor (Grid No. 4, Collector / Anode)

The ultor connection is made via a Recessed Small Cavity cap (JETEC No. J1-21).

Maximum Ratings

The maximum ratings for the 10SP4 are defined under two different rating systems depending on the manufacturer's documentation. These values must be strictly observed to prevent damage to the tube.

Parameter	Design-Center Maximums	Absolute Maximums
Ultor / Anode Voltage	20,000 V	22,000 V
Grid No. 3 Voltage	3,000 V	3,300 V
Grid No. 2 Voltage	410 V	450 V
Grid No. 1 Negative Bias Value	125 V	140 V
Grid No. 1 Positive Bias Value	0 V	0 V

Parameter	Design-Center Maximums	Absolute Maximums
Grid No. 1 Positive Peak Value	2 V	2 V
Peak Heater-Cathode Voltage (Heater negative)		
<i>During warm-up (first 15 seconds)</i>	410 V	450 V
<i>After warm-up period</i>	180 V	200 V
Peak Heater-Cathode Voltage (Heater positive)	180 V	200 V

Operating Conditions and Equipment Design Ranges

The 10SP4 is designed to operate over a range of ultor and grid voltages. For any ultor voltage (E_{c4}) between 10,000 and 20,000 volts, and Grid No. 2 voltage (E_{c2}) between 150 and 410 volts, the following design ranges apply:

- **Grid No. 3 Focusing Voltage:** 11.7% to 15.9% of the ultor voltage (E_{c4}) for focus with an ultor current of 100 μ A.
- **Grid No. 1 Cutoff Voltage:** 9% to 24% of the Grid No. 2 voltage (E_{c2}) for visual extinction of an 8" x 6" raster.
- **Grid No. 2 Current:** -15 to +15 μ A.
- **Alignment Magnet Field Strength:** 0 to 8 gauss (using an adjustable centering magnet).
- **Maximum Grid No. 1 Circuit Resistance:** 1.5 Megohms.

Typical Operating Examples

The following examples illustrate the application of these design ranges under specific operating voltages:

Parameter	Example A	Example B	Units
Ultor / Anode Voltage	12,000	14,000	V
Grid No. 2 Voltage	200	200	V
Grid No. 3 Voltage for Focus	1400 to 1900	1640 to 2225	V
Grid No. 1 Voltage for Cutoff	-18 to -48	-18 to -48	V

Parameter	Example A	Example B	Units
Grid No. 3 Current (at $I_b = 100 \mu\text{A}$)	—	25 (Max)	μA

Note on Cutoff: The Grid No. 1 voltage range of -18 to -48 V is specified for the visual extinction of a focused raster. Extinction of a stationary focused spot requires the bias to be approximately 5 volts more negative (i.e., -23 to -53 V).

Operational Considerations

- **Voltage Limits:** Brilliance and definition decrease as the ultor voltage is reduced. In general, the ultor voltage should not be operated below 10,000 volts.
- **Grid No. 3 Current:** The current flowing into Grid No. 3 increases as the ultor voltage is decreased.

Safety and X-Ray Precautions

When operating the 10SP4 at high voltages, safety precautions regarding X-ray radiation must be taken. X-ray radiation shielding may be necessary to protect personnel from prolonged exposure at close range if the tube is operated at voltages higher than 16,000 volts or the maximum rated anode voltage, whichever is less.

Performance and Grid-Drive Characteristics

The performance of the 10SP4 is characterized by its grid-drive relationships, which describe how highlight brightness, ultor current, and Grid No. 3 current behave as a function of the video signal voltage applied relative to the raster cutoff point.

- **Highlight Brightness:** At an ultor voltage of 12,000 V and a Grid No. 2 voltage of 200 V, the highlight brightness of an 8" x 6" raster rises smoothly with the video signal. It reaches approximately 180 foot-lamberts at a video drive of 32 volts.
- **Ultor Current:** The ultor current increases non-linearly with video drive. At a Grid No. 2 voltage of 200 V, the current reaches approximately 380 μA at 35 V of drive. Increasing the Grid No. 2 voltage shifts the drive requirements: at a Grid No. 2 voltage of 300 V, the current reaches 600 μA at 46 V of drive, and at 400 V, it reaches 780 μA at 58 V of drive.
- **Grid No. 3 Current:** Grid No. 3 current also rises with video drive. Under a 12,000 V ultor supply, the maximum Grid No. 3 current reaches approximately 100 μA at 30 V drive (with Grid No. 2 at 200 V), 600 μA at 46 V drive (with Grid No. 2 at 300 V), and 950 μA at 58 V drive (with Grid No. 2 at 400 V).

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1965 Sylvania Electronic Tubes Vol3

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

1965 SYLVANIA ELECTRONIC TUBES VOL3

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	Magnetic text	—
Deflection Angle	50 deg	Approximate
Phosphor	Aluminized P4 text	—
Fluorescence	White text	—
Persistence	Short to Medium text	—
Light Transmittance	76 percent	Approximate
Cathode-to-All Capacitance	5 pF	Approximate
Grid1-to-All Capacitance	6 pF	Approximate

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum Anode Voltage	22000 V	—
Maximum Grid3 Voltage	3300 V	—
Maximum Grid2 Voltage	450 V	—
Maximum Grid1 Negative Bias	140 V	—
Maximum Grid1 Positive Peak	2 V	—
Maximum Heater-Cathode Voltage During Warmup	450 V	Duration<=15s
Maximum Heater-Cathode Voltage After Warmup	200 V	—
Anode Voltage	14000 V	—

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid3 Focus Voltage Minimum	1640 V	—
Grid3 Focus Voltage Maximum	2225 V	—
Grid2 Voltage	200 V	—
Grid1 Cutoff Voltage Minimum	-48 V	—
Grid1 Cutoff Voltage Maximum	-18 V	—
Maximum Grid3 Current	25 uA	AnodeCurrent=100uA
Maximum Grid1 Circuit Resistance	1.5 Mohm	—



SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

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1971 RCA HB3 Binder 1 of 7

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

1971 RCA HB3 BINDER 1 OF 7

Section 1 · Cathode Ray

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Voltage	6.3 V	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
Current	0.6	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
Grid No.1 to all other electrodes	6	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
Light transmission (Approx.)	76	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
Deflection A°qle (Approx.)	50	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
Minimum Useful Screen Diameter — published value 1	9	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Minimum Useful Screen Diameter – published value 2	1	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
Minimum Useful Screen Diameter – published value 3	8	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
Picture Size (Within minimum useful screen area) – published value 1	8	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
Picture Size (Within minimum useful screen area) – published value 2	6	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
and grid-No.2 voltage (Ecz) between 150 and qio voCts	15 V	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
current of 100 μ a – published value 1	100 V	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
current of 100 μ a – published value 2	11.7 V	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
current of 100 μ a – published value 3	15.9 V	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
Grid-No.2 Current – published value 1	-15	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
Grid-No.2 Current – published value 2	15	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
andgrid-No.2 voltage of	20 V	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
current of 100 μ a – published value 1	1400 V	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
current of 100 μ a – published value 2	1900 V	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
current of 100 μ a – published value 3	1640 V	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
current of 100 μ a – published value 4	2225 V	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
In general, the ultor voltage should not be less than 10,000 volts – published value 1	10 V	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
In general, the ultor voltage should not be less than 10,000 volts – published value 2	0 V	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
73~fi – published value 1	73	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
73~fi – published value 2	3	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
73~fi – published value 3	9	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
ULTOR (GRID-N~ 4-AND	4	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
'GRID-N°3 VOLTS ADJUSTED TO GIVE FOCUS	3 V	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
GRID-N+:3 VOLTS	3 V	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
ULTOR (GRID-N' 4 AND	4	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
ULTOR VOLTAGE	20000 V	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
GRID-No.3 VOLTAGE	3000 V	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
GRID-No.2 VOLTAGE	410 V	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater positive with respect to cathode	180 V	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
Grid-No.1-Circuit Resistance – published value 1	1 mA	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.
Grid-No.1-Circuit Resistance – published value 2	5 mA	Published CRT datasheet value; multiple numbers on one source row represent its separate limits or operating conditions.

TUBE TINKER

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