**Litton Industries**
Electronic Display Laboratory, 1476 Sixty-sixth Street
Emeryville, California • Telephone Olympic 8-3831

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**Development Tube: Model PDF 10-1X**

**Single-Gun Color Tube**

**Round Metal Shell**

**Aluminized Screen**

**Two-Color Persistent Phosphors**

**Active Screen Area Over 6½" Diameter**

**Screen Voltage Up to 18,000 Volts**

High resolution is afforded by phosphor strips of approximately 8 mils width on 12½ mil centers, or 80 color strips per inch. Sensitivity to external magnetic fields is low, and operation is not adversely affected by the earth’s magnetic field due to changes in aircraft course or altitude. Simple circuitry is adequate for power supplies and color switching. Color convergence is inherent in the tube independent of circuit adjustment.

**Design Alternates**

Instead of P-25 orange and P-2 green, both long persistence phosphors, tubes can be furnished with P-25 orange and P-7 yellow-green. P-7 is a cascade type with blue backing, having a fast decay blue and long persistence yellow-green, both characteristics can be utilized, or either can be filtered out by external filters. Other phosphors can be furnished on request. Design modifications of the Litton Model PDF 10-1X Chromatron indicator can be produced on special order. Among the features which may be varied are: (1) number of phosphor lines per inch, (2) two-color or three-color screens of various persistence, (3) screen area, (4) envelope size, shape and length, (5) deflection: magnetic or electrostatic, (6) focus: magnetic or electrostatic.

**Applications**

Suggested applications include: target identification, moving target identification (MTI), IFF, anti-jamming, navigational beacons, terrain clearance, plane elevation indicator, collision course indicator, etc.

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**Data**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deflection Angle (Approx.)</td>
<td>34°</td>
</tr>
<tr>
<td>Length</td>
<td>20½ in.</td>
</tr>
<tr>
<td>Weight</td>
<td>11½ lbs.</td>
</tr>
</tbody>
</table>

*MAXIMUM RATINGS*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen (ultraviolet) voltage (Note 1)</td>
<td>18,000 DC</td>
</tr>
<tr>
<td>Grid #3 voltage</td>
<td>8,000 DC</td>
</tr>
<tr>
<td>Grid #2 voltage</td>
<td>600 DC</td>
</tr>
<tr>
<td>Color selector voltage</td>
<td>600 peak</td>
</tr>
<tr>
<td>Color grid to phosphor plate</td>
<td>13,500 DC</td>
</tr>
<tr>
<td>Seeker voltage (Note 2)</td>
<td>350 DC</td>
</tr>
<tr>
<td>Grid #1 voltage:</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>200</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>6 DC</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2</td>
</tr>
<tr>
<td>Peak heater — cathode voltage:</td>
<td></td>
</tr>
<tr>
<td>Heater reg. with respect to cathode during equip. warm-up period not to exceed 15 seconds</td>
<td>410 DC</td>
</tr>
<tr>
<td>After equip. warm-up</td>
<td>180 DC</td>
</tr>
<tr>
<td>Heater pos. with respect to cathode *design-center values</td>
<td>180 DC</td>
</tr>
</tbody>
</table>

**Typical Operation**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen (ultraviolet) voltage (Note 3)</td>
<td>16,000 DC</td>
</tr>
<tr>
<td>Grid #3 voltage</td>
<td>3,500 to 5,500 DC</td>
</tr>
<tr>
<td>Color selector voltage</td>
<td>200 peak</td>
</tr>
<tr>
<td>Seeker voltage</td>
<td>100 to 300 DC</td>
</tr>
<tr>
<td>Grid #2 voltage</td>
<td>300 DC</td>
</tr>
<tr>
<td>Grid #1 voltage (Note 4)</td>
<td>-50 to 105 DC</td>
</tr>
<tr>
<td>Focusing coil current (Note 5)</td>
<td>60 to 80 ms DC</td>
</tr>
<tr>
<td>Circuit values:</td>
<td></td>
</tr>
<tr>
<td>Grid #1 circuit resistance</td>
<td>1.5 megs. max.</td>
</tr>
</tbody>
</table>

**Notes**

1. Screen (ultraviolet) voltage is defined as the total accelerating DC potential between the cathode and the phosphor plate. This anode voltage provides the high potential necessary for the function of post-deflection focusing.

2. Seeker voltage is defined as the DC potential between the color selectors and Grid #3. This voltage is such that the color selectors are negative with respect to Grid #3, and is adjusted for optimum color purity.

3. Color purity is determined by the optimum ratio of the anode voltage to the Grid #3 voltage, seeker voltage, and focus coil positioning.

4. For visual extinction of focused spot.

5. With the JETEC focus coil #109 located so that the center of the focus coil gap is located four inches behind the yoke reference line.
CHROMATRON® TYPE PDF 10-1X
DIMENSIONAL OUTLINE

REFERENCE LINE, DETERMINED BY POSITION WHERE YOKE REFERENCE LINE GAUGE (JELECT No.110) WILL REST ON CONE

H.V. (SCREEN) FEED-THRU

COLOR SELECTORS FEED-THRU

METAL FLANGE

COLOR SELECTOR CONTACTS

PIN 1 — HEATER
PIN 2 — GRID NO. 1
PIN 10 — GRID NO. 2
CS1, CS2 — COLOR SELECTORS
H.V. — HIGH VOLTAGE (SCREEN)

PIN 12 — HEATER
PIN 11 — CATHODE
FLANGE — GRID NO. 3
DEVELOPMENT TUBE: MODEL PDF 10-2X
SINGLE-GUN COLOR TUBE
ROUND METAL SHELL
TWO-COLOR PERSISTENT PHOSPHORS
PHOSPHORS ON RELATIVELY FLAT FACE
ALUMINIZED SCREEN
ACTIVE SCREEN AREA OVER 7½” DIAMETER
SCREEN VOLTAGE UP TO 18,000 VOLTS

High resolution is afforded by phosphor strips of approximately 8 mils width on 12½ mil centers, or 80 color strips per inch. Sensitivity to external magnetic fields is low, and operation is not adversely affected by the earth's magnetic field due to changes in aircraft course or attitude. Simple circuitry is adequate for power supplies and color switching. Color convergence is inherent in the tube, independent of circuit adjustment.

DESIGN ALTERNATES

Instead of P-25 orange and P-2 green, both long persistence phosphors, tubes can be furnished with P-25 orange and P-7 yellow-green. P-7 is a cascade type with blue backing having a fast decay blue and long persistence yellow-green; both characteristics can be utilized, or either one can be filtered out by external filters. Other phosphors can be furnished on request.

Design modifications of the Litton Model PDF 10-2X Chromatron indicator can be produced on special order. Among the features which may be varied are: (1) number of phosphor lines per inch, (2) two-color or three-color screens of various persistence, (3) screen area, (4) envelope size, shape and length, (5) deflection: magnetic or electrostatic, (6) focus: magnetic or electrostatic.

APPLICATIONS
Suggested applications include: target identification, moving target identification (MTI), IFF, anti-jamming, navigational beacons, terrain clearance, plane elevation indicator, collision course indicator, etc.

DATA

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deflection Angle (Approx.)</td>
<td>34°</td>
</tr>
<tr>
<td>Length</td>
<td>19 3/4 in.</td>
</tr>
<tr>
<td>Weight</td>
<td>8 1/2 lbs.</td>
</tr>
<tr>
<td>Maximum Ratings</td>
<td></td>
</tr>
<tr>
<td>Screen voltage (ultor) voltage</td>
<td>max. volts</td>
</tr>
<tr>
<td>Grid #3 voltage</td>
<td>18,000 DC</td>
</tr>
<tr>
<td>Grid #2 voltage</td>
<td>8,000 DC</td>
</tr>
<tr>
<td>Color selector voltage</td>
<td>600 DC</td>
</tr>
<tr>
<td>Color grid to phosphor plate</td>
<td>400 peak</td>
</tr>
<tr>
<td>Seeker voltage (Note 2)</td>
<td>13,500 DC</td>
</tr>
<tr>
<td>Grid #1 voltage:</td>
<td></td>
</tr>
<tr>
<td>*negative bias value</td>
<td>200</td>
</tr>
<tr>
<td>*positive bias value</td>
<td>0 DC</td>
</tr>
<tr>
<td>*positive peak value</td>
<td>2</td>
</tr>
<tr>
<td>Peak heater - cathode voltage:</td>
<td></td>
</tr>
<tr>
<td>Heater seg. with respect to cathode</td>
<td>410 DC</td>
</tr>
<tr>
<td>equip. warm-up period not to exceed 15 seconds</td>
<td>140 DC</td>
</tr>
<tr>
<td>Heater pos. with respect to cathode</td>
<td>140 DC</td>
</tr>
</tbody>
</table>

TYPICAL OPERATION

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen voltage (Note 1)</td>
<td>16,000 DC</td>
</tr>
<tr>
<td>Grid #3 voltage (Note 3)</td>
<td>3,500 to 15,500 DC</td>
</tr>
<tr>
<td>Color selector voltage</td>
<td>200 peak</td>
</tr>
<tr>
<td>Seeker voltage</td>
<td>100 to 300 DC</td>
</tr>
<tr>
<td>Grid #2 voltage</td>
<td>300 DC</td>
</tr>
<tr>
<td>Grid #1 voltage (Note 4)</td>
<td>–50 to –165 DC</td>
</tr>
<tr>
<td>Focusing coil current (Note 5)</td>
<td>60 to 80 ma DC</td>
</tr>
<tr>
<td>Circuit values:</td>
<td></td>
</tr>
<tr>
<td>Grid #1 circuit resistance</td>
<td>1.5 megs. max.</td>
</tr>
</tbody>
</table>

NOTES

1. Screen (ultor) voltage is defined as the total accelerating DC potential between the cathode and the phosphor plate. This anode voltage provides the high potential necessary for the function of post-deflection focusing.

2. Seeker voltage is defined as the DC potential between the color selectors and Grid #3. This voltage is such that the color selectors are negative with respect to Grid #3, and is adjusted for optimum color purity.

3. Color purity is determined by the optimum ratio of the anode voltage to the Grid #3 voltage, seeker voltage, and focus coil positioning.

4. For visual extinction of focused spot.

5. With the JETEC focus coil #109 located so that the center of the focus coil gap is located four inches behind the yoke reference line.
CHROMATRON® TYPE PDF 10-2X

DIMENSIONAL OUTLINE

REFERENCE LINE, DETERMINED BY POSITION WHERE YOKE REFERENCE LINE GAUGE (JECTEC NO.110) WILL REST ON CONE

COLOR SELECTOR FEED THRU (2)

HIGH VOLTAGE (SCREEN) FEED THRU.

COLOR SELECTOR CONTACTS

METAL FLANGE

H.V.

PIN 1 — HEATER
PIN 2 — GRID NO.1
PIN 10 — GRID NO.2
CS₁, CS₂ — COLOR SELECTORS
H.V. — HIGH VOLTAGE (SCREEN)

PIN 12 — HEATER
PIN 11 — CATHODE
FLANGE — GRID NO.3
LITTON INDUSTRIES
Electronic Display Laboratory, 1476 Sixty-sixth Street
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DEVELOPMENT TUBE: MODEL PDF 12-2X
SINGLE-GUN COLOR TUBE
ROUND METAL SHELL
THREE-COLOR PERSISTENT PHOSPHORS
PHOSPHORS ON RELATIVELY FLAT FACE
ALUMINIZED SCREEN
ACTIVE SCREEN AREA OVER 10" DIAMETER
SCREEN VOLTAGE UP TO 18,000 Volts
High resolution is afforded by phosphor strips of approximately
7.5 miles width on 8 mil centers, or 125 color strips per inch.
Sensitivity to external magnetic fields is low. Simple circuitry is
adequate for power supplies and color switching. Color
convergence is inherent in the tube, independent of circuit
adjustment.

DESIGN ALTERNATES
The normally furnished P-25 orange, P-2 green, and a specially
developed blue (all long persistence phosphors which give a
capability of blending colors to achieve distinct hues) may be
replaced by other phosphors of various hue or persistence charac-
teristics upon request.

Modified designs of the Litton developed CHROMATRON dis-
play tubes can be produced on special order. Among the features
which may be varied are: (1) number of phosphor lines per inch,
(2) two-color or three-color screens of various persistent-
color screens, (4) envelope size, shape, and length. (5) deflec-
tion: magnetic or electrostatic. (6) focus: magnetic or elec-
trostatic.

APPLICATIONS
Suggested applications include: target identification, moving tar-
get identification (MTI), IF, anti-jamming, navigational bea-
cons, terrain clearance, plane elevation indicator, collision course
indicator, etc.

GENERAL
Heater voltage (AC or DC) 6.3 volts
Heater current 0.6 amperes
Direct Electrode Capacitances:
Grid #1 to all other electrodes 6 uuf
Cathode to all other electrodes 5 uuf
Color selectors to each other 1700 uuf
Phosphors (long persistence):
Single color (31 strips/inch) P-25 orange, *blue
Double color (62 strips/inch) P-2 green
Focusing Method Electrostatic
Color Selection Method Electrostatic
Deflection Method Magnetic
Deflection Angle (Approx.) 55°
Length 18 in.
Weight 0.14 lbs.

**MAXIMUM RATINGS**
Screen (ultror) voltage (Note 1) max. volts
Grid #3 voltage 18,000 DC
Grid #2 voltage 8,000 DC
Color selector voltage 600 DC
Color grid to phosphor plate 400 peak
Seeker voltage (Note 2) 13,500 DC
Grid #1 voltage:
Negative bias value 350 DC
Positive bias value 0 DC
Positive peak value 150 DC
Focus electrode voltage
Peak heater — cathode voltage:
Heater neg. with respect to cathode 0 DC
Heater pos. with respect to cathode 110 DC
Twist coil current — milliamps (Note 3)
**design-center values**
180 DC
230 DC

TYPICAL OPERATION
Screen (ultror) voltage 15,000 DC
Grid #3 voltage (Note 4) 4,000 DC
Color selector voltage 265 peak
Seeker voltage 100 to 390 DC
Grid #2 voltage 390 DC
Grid #1 voltage (Note 5) 28 to 72 DC
Focus electrode current
Focus electrode voltage
Twist coil current-milliamps
Circuit values:
Grid #1 circuit resistance 1.5 meg. max.

NOTES
1. Screen (ultror) voltage is defined as the total accelerating DC
potential between the cathode and the phosphor plate. This
anode voltage provides the high potential necessary for the func-
tion of post-deflection focusing.

2. Seeker voltage is defined as the DC potential between the
color selectors and Grid #3. This voltage is such that the color
selectors are negative with respect to Grid #3, and is adjusted
for optimum color purity.

3. Twist coil: a 13° ID coil composed of 100 turns of #25 copper
wire, mounted peripherally around the viewing panel, coaxial
with the tube, neutralizes earth's field effects.

4. Color purity is determined by the optimum ratio of the
anode voltage to the Grid #3 voltage, seeker voltage, and beam
centering adjustment.

5. For visual extinction of focused spot.
CHROMATRON® TYPE PDF 12-2X

DIMENSIONAL OUTLINE

REFERENCE LINE, DETERMINED BY POSITION
WHERE YOKE REFERENCE LINE GAUGE (JECTEC NO. 110)
WILL REST ON CONE

COLOR SELECTOR
FEED THRU (2)

HIGH VOLTAGE (SCREEN) FEED THRU

12.0 DIA.

9.875 SCREEN DIA.

55°

2.500 4.375 7.40

18 ±

COLOR SELECTOR CONTACTS

METAL FLANGE

H.V.

PIN 1 — HEATER
PIN 2 — GRID NO. 1
PIN 6 — FOCUS ELECTRODE
PIN 10 — GRID NO. 2
CS₁, CS₂ — COLOR SELECTORS
H.V. — HIGH VOLTAGE (SCREEN)

PIN 12 — HEATER
PIN 11 — CATHODE
FLANGE — GRID NO. 3

BOTTOM VIEW
DEVELOPMENT TUBE: MODEL PDF 22-250A
SINGLE-GUN PICTURE TUBE
RECTANGULAR GLASS SHELL
SHIELDED FOR RADIATION SUPPRESSION
LARGE, BRIGHT DISPLAY AT 25 KV OR LESS

The full 4:3 aspect ratio rectangular shape allows reproduction of the transmitted picture without waste of screen area, or sacrifice of transmitted information, and permits use of a cabinet having about 20 percent less height than is required for a round tube with equal width. The single-gun construction provides bright pictures without color fringing when displaying black and white or color pictures. Need for static and dynamic electrical and mechanical convergence equipment and adjustments is eliminated, greatly simplifying set design, tube installation and the adjustments for optimum performance.

Inherent tolerances of the tube permit auxiliary deflection to the rear of the primary deflection yoke, which may be used for character or symbol formation without adverse effect on color purity. Additional information on deflection components for this application will be furnished on request.

DESIGN ALTERNATES
Instead of the P-22 color television phosphors, long persistence phosphors, or a combination of short and long persistence phosphors may be utilized. Design modifications of the Litton Model PDF 22-250A CHROMATRON color tube, which can be produced on special order, include 2-color or 3-color screens, and either magnetic or electrostatic focus.

RATINGS (DESIGN CENTER VALUES)

<table>
<thead>
<tr>
<th>Item</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen (ullor) voltage (Note 1)</td>
<td>25,000 DC</td>
</tr>
<tr>
<td>Grid #3 voltage</td>
<td>8,000 DC</td>
</tr>
<tr>
<td>Grid #2 voltage</td>
<td>1,000 DC</td>
</tr>
<tr>
<td>Color selector voltage, CSI-CS2</td>
<td>600 peak</td>
</tr>
<tr>
<td>Color selector grid to screen</td>
<td>20,000 DC</td>
</tr>
<tr>
<td>Seeker voltage (Note 2)</td>
<td>400 DC</td>
</tr>
<tr>
<td>Grid #1 voltage:</td>
<td></td>
</tr>
<tr>
<td>Negative bias value</td>
<td>125</td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0</td>
</tr>
<tr>
<td>Positive peak value</td>
<td>2</td>
</tr>
<tr>
<td>Peak heater – cathode voltage</td>
<td></td>
</tr>
<tr>
<td>Heater seg. with respect to cathode</td>
<td>410 DC</td>
</tr>
<tr>
<td>during equip. warm-up period not to exceed 15 seconds</td>
<td></td>
</tr>
<tr>
<td>After equip. warm-up</td>
<td>180 DC</td>
</tr>
<tr>
<td>Heater pos. with respect to cathode</td>
<td>180 DC</td>
</tr>
</tbody>
</table>

TYPICAL OPERATION

<table>
<thead>
<tr>
<th>Item</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen voltage</td>
<td>25,000 DC</td>
</tr>
<tr>
<td>Grid #3 voltage (Note 1)</td>
<td>6,700-7,500 DC</td>
</tr>
<tr>
<td>Color selector voltage, CSI-CS2</td>
<td>260 rms</td>
</tr>
<tr>
<td>Seeker voltage</td>
<td>100-300 DC</td>
</tr>
<tr>
<td>Grid #2 voltage</td>
<td>330 DC</td>
</tr>
<tr>
<td>Grid #1 voltage (Note 4)</td>
<td>-50 to -105 DC</td>
</tr>
<tr>
<td>Focusing coil current (Note 5)</td>
<td>58 to 74 DC</td>
</tr>
<tr>
<td>Circuit values:</td>
<td></td>
</tr>
<tr>
<td>Grid #1 circuit resistance</td>
<td>1.5 megs. max.</td>
</tr>
</tbody>
</table>

NOTES

1. Screen (ullor) voltage is defined as the total accelerating DC potential between the cathode and the phosphor plate. This screen voltage also provides a high potential for the function of post deflection focusing (PDF).
2. Seeker voltage is the DC potential making the color selectors negative with respect to grid #3, and is used as a color purity adjustment.
3. Color purity is determined primarily by the correct ratio of screen voltage to grid #3 voltage. The final seeker voltage adjustment as in Note 2 above; the tilt of the focus coil with respect to the tube axis, and twist coil current (ref. operational instructions), are also factors. For switched fields (normally red and blue), the proper setting of color selector voltage provides color purity.
4. For visual extinction of focused spot.
5. With JETEC focus coil #109 located so that the center of the focus coil gap is three inches behind the yoke reference line.