



ELECTRONIC TUBE REFERENCE

1300Q

Specialized - Cathode Ray electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
CATHODERAY

Flat-faced rectangular general-purpose oscilloscope CRT with an aluminized screen, mesh post-deflection acceleration, and deflection blanking. Its 13 cm diagonal display and high-voltage final acceleration support bright, well-defined instrument traces.

GENERAL CHARACTERISTICS

BASE DESIGNATION	B12F	BASE PINS	12
NOMINAL HEATER	6.3 V / 300 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 0 Cathode Ray	
MAXIMUM PLATE VOLTAGE	12000 V
<i>Final/fourth anode absolute maximum 12 kV; other CRT electrode ratings preserved as parameters.</i>	

1300Q — Instrument Cathode Ray Tube

The **1300Q** is a 13 cm diagonal (5¼-inch) flat-faced rectangular instrument cathode ray tube designed by The M-O Valve Company Limited (GEC) for use in general-purpose oscilloscopes. It features an aluminized screen, mesh post-deflection acceleration (p.d.a.), and dedicated deflection blanking. The tube is constructed with side-connected deflection plates to minimize interelectrode capacitance and optimize high-frequency performance.

Screen and Phosphor Options

The 1300Q is available with different phosphor screens to suit specific display requirements. The two primary variants are:

- **1374Q**: Features a green fluorescence and green phosphorescence screen with a short persistence of 1 to 5 milliseconds. This corresponds to the E.I.A. phosphor code **P31** (Pro Electron code **GH**, GEC code **74**).
- **1396Q**: Features a bluish-white fluorescence and yellowish-green phosphorescence screen with a long persistence of 10 to 60 seconds. This corresponds to the E.I.A. phosphor code **P7** (Pro Electron code **GM**, GEC code **96**).

The preferred type is the **1374Q/G8**, which is a special-purpose variant supplied with a specialized internal graticule. This graticule is designed for measuring the distortion of pulse trains on telegraph lines, featuring dedicated markings for "EARLY", "O", and "LATE". Other custom graticules are available to special order.

Mechanical Construction and Mounting

The 1300Q features a flat rectangular faceplate with a maximum diagonal of 133 mm, a maximum width of 126 mm, and a maximum height of 88 mm. The overall length of the tube is 314 ± 5 mm, and the neck has a maximum diameter of 58 mm (increasing to a maximum of 60 mm over correction magnets, where used). The tube weighs approximately 800 grams.

Mounting and Handling

The tube can be mounted in any position. However, it must not be supported by the base alone. The recommended mounting practice is to hold the tube in a suitable rubber mask at the screen and secure it with a clamp around the magnetic shield near the base. The socket must have sufficient freedom of movement to accommodate the maximum overall tube length and base orientation tolerances.

Care must be taken not to expose the tube to strong magnetic fields during operation or storage, as this can permanently affect beam alignment and performance.

Base Connections and Pinout

The tube utilizes a **B12F** base for its primary electrical connections, supplemented by a side contact (CT8) for the high-voltage fourth anode (a_4) and several side pins on the neck for the deflection plates and internal shield.

B12F Base Pinout

The pin connections, viewed from the base of the tube, are as follows:

Pin	Connection	Description
1	g_1	Control grid
2	k	Cathode
3	h	Heater
4	h	Heater

Pin	Connection	Description
5	a_2	Focus electrode
6	g_3	Beam alignment electrode
7	g_2	Blanking electrode
8	a_3	Third anode
9	s_3	Contrast (mesh) electrode
10	a_1	First anode
11	s_2	Geometry correction electrode
12	IC	Internal connection (do not connect)

Auxiliary Connections

- **Side Contact (CT8):** Fourth anode (a_4)
- **Side Pins (Neck):** Deflector plates y_1 , y_2 , x_1 , x_2 , and the internal pole pieces/inter-plate shield (s_1). These side pins have a diameter of 1 mm, with a minimum spacing of 6 mm between adjacent pins.

Electrical Characteristics and Capacitances

Heater Ratings

The 1300Q is equipped with an indirectly heated cathode.

- **Heater Voltage:** 6.3 V
- **Heater Current:** 300 mA
- **Calculated Heater Power:** 1.89 W (calculated as $6.3\text{ V} \times 0.3\text{ A}$)

Typical Capacitances

The typical interelectrode capacitances of the tube are:

Electrode Pair / Group	Capacitance
Cathode to all other electrodes	4.4 pF
Control grid to all other electrodes	8.3 pF
Blanking plate to all other electrodes	6.9 pF
Deflector plate y_1 to y_2	1.0 pF

Electrode Pair / Group	Capacitance
Deflector plate y_1 to all electrodes except y_2	2.8 pF
Deflector plate y_2 to all electrodes except y_1	2.8 pF
Deflector plate x_1 to x_2	1.5 pF
Deflector plate x_1 to all electrodes except x_2	5.3 pF
Deflector plate x_2 to all electrodes except x_1	5.3 pF

Absolute Maximum Ratings

The absolute maximum and minimum ratings represent the limiting values of operation for the 1300Q. All voltage ratings are referenced to the cathode unless otherwise specified.

Parameter	Symbol	Minimum	Maximum	Unit
Fourth anode voltage	V_{a4}	5.0	12	kV
Third anode voltage	V_{a3}	0.9*	2.0	kV
Ratio of fourth to third anode voltage	V_{a4}/V_{a3}	—	10	—
Focus voltage	V_{a2}	—	1.0	kV
First anode voltage	V_{a1}	0.9*	2.0	kV
Control grid voltage	$-V_{g1}$	1.0	200	V
Blanking plate to first anode voltage	V_{g2-a1}	-200	+200	V
Heater to cathode voltage	V_{h-k}	—	± 125	V
Y plate to third anode voltage	V_{y-a3}	—	500	V
X plate to third anode voltage	V_{x-a3}	—	500	V

Parameter	Symbol	Minimum	Maximum	Unit
Heater to cathode circuit resistance	R_{h-k}	—	100	k Ω
Grid to cathode circuit resistance	R_{g1-k}	—	1.0	M Ω
Y deflector plate circuit resistance	R_{y-a3}	—	100	k Ω
X deflector plate circuit resistance	R_{x-a3}	—	250	k Ω

Note: For the special-purpose 1374Q/G8 variant, the minimum limit for both V_{a3} and V_{a1} is reduced to 0.65 kV.

Equipment Design Range and Typical Operation

Equipment Design Range

The equipment design range values are expressed as ratios relative to the operating potentials of the anodes:

- **Focus Voltage (V_{a2}):** 28 to 143 V per kV of V_{a3}
- **Control Grid Voltage for Spot Cut-off ($-V_{g1}$):** 50 to 93 V per kV of V_{a1}
- **Blanking Voltage (V_{g2-a1}):** +50 to -50 V per kV of V_{a3} (for visual extinction of the trace at a beam current of 5 μ A; negative blanking is recommended)
- **Y Deflection Factor (D_y):** 4.2 to 5.7 V/cm per kV of V_{a3}
- **X Deflection Factor (D_x):** 11.4 to 14.3 V/cm per kV of V_{a3}
- **Astigmatism Correction Voltage (V_{a3-y} mean):** -60 to +30 V per kV of V_{a3}
- **Pattern Correction Voltage (V_{s2-x} mean):** -50 to +50 V per kV of V_{a3}

Typical Operating Conditions

Under typical operating conditions, all potentials are referenced to the cathode:

- **Fourth Anode Voltage (V_{a4}):** 10 kV
- **Third Anode Voltage (V_{a3}):** 1.0 kV
- **Focus Voltage (V_{a2}):** 28 to 143 V
- **First Anode Voltage (V_{a1}):** 1.0 kV
- **Control Grid Voltage for Spot Cut-off ($-V_{g1}$):** 50 to 93 V
- **Nominal Blanking Plate Voltage ($V_{[g2]}(/tubes/G2)$):** 1.0 kV
- **Nominal Beam Alignment Voltage (V_{g3}):** 1.0 kV
- **Nominal Internal Pole Pieces Voltage (V_{s1}):** 1.0 kV

- **Nominal Mesh Voltage (V_{s3}):** 0.975 kV
- **Nominal Geometry Correction Voltage (V_{s2}):** 1.0 kV
- **Maximum Y Deflection Factor (D_y):** 5.7 V/cm
- **Maximum X Deflection Factor (D_x):** 14.3 V/cm
- **Typical Line Width (74 Screen):** 0.35 mm (measured via shrinking raster at a beam current $I_b = 5 \mu\text{A}$)

Note: The special-purpose 1374Q/G8 tube typically operates at scaled potentials of 7.0 kV for V_{a4} and 0.7 kV for V_{a3} and V_{a1} .

Display and Correction Adjustments

To achieve optimal focus, geometry, and alignment, several correction potentials and external fields should be applied:

Astigmatism Correction

Astigmatism is corrected by adjusting the potential on the third anode (a_3) relative to the mean potential of the y deflector plates. A range of adjustment from -60 to +30 V per kV of V_{a3} must be provided in the circuit design.

Axis Alignment

The electrical x-axis of the tube lies within $\pm 5^\circ$ of the physical major axis of the faceplate. This can be aligned precisely by applying an axial magnetic field from a close-fitting coil placed around the cone of the tube. The maximum ampere-turns required for this alignment coil is calculated as:

$$\text{Maximum Ampere-Turns} = 14\sqrt{V_{a4}}$$

For a typical fourth anode voltage (V_{a4}) of 10 kV, the calculated maximum required field strength is $14\sqrt{10} \approx 44.3$ ampere-turns.

Beam Alignment

Due to the close spacing of the deflector plates required to achieve high deflection sensitivity, some tubes may exhibit a tendency toward x-plate cut-off within the specified minimum window size. This is corrected by centralizing the undeflected beam between the x-plates using a potential applied to the beam-aligning electrode (g_3). An adjustment range of ± 50 V per kV of V_{a1} with respect to a_1 should be provided.

Beam Blanking

When g_2 blanking is not utilized, pins 7 and 10 must be joined externally. Under typical operating conditions ($V_{a1} = V_{a3} = 1.0$ kV) and at a beam current of $5 \mu\text{A}$, applying a potential of 50 V (preferably negative with respect to a_1) to the blanking electrode g_2 will completely cut off the beam. The blanking electrode must not be used as a brightness control.

Background Suppression and Contrast

Background illumination can be reduced and display contrast improved by applying a potential of -25 V to the mesh electrode (s_3) with respect to the geometry correction electrode (s_2).

Display Characteristics

When typical operating potentials and pattern corrections are applied, the display exhibits the following characteristics:

- **Pattern Distortion:** The edges of a test raster will lie between two concentric rectangles measuring 100 mm × 60 mm and 98 mm × 58.5 mm. The angle between the x and y axes is $90^\circ \pm \frac{3}{4}^\circ$ measured at the center of the faceplate.
- **Deflection Linearity:** The deflection factor for a deflection of less than 75% of the useful scan will not differ from that for a deflection of 25% by more than 3%.
- **Spot Position:** The focused, undeflected spot falls within an 8 mm × 20 mm rectangle centered at the geometric center of the faceplate, with the larger dimension aligned along the x-axis.
- **Orientation:** Looking at the screen with pins 1 and 12 uppermost, a positive voltage applied to x_1 deflects the beam to the left, and a positive voltage applied to y_1 deflects the beam upwards.
- **Minimum Scanned Area:** The minimum scanned area is 10.0 cm along the x major axis and 6.0 cm along the y minor axis, centered within 3 mm of the major and minor axes of the tube face.

Technical Summary

The **1300Q** is a high-performance, flat-faced rectangular instrument cathode ray tube featuring a 13 cm diagonal screen, mesh post-deflection acceleration, and side-connected deflection plates. Operating with a 6.3 V, 300 mA heater, the tube is optimized for general-purpose oscilloscopes and specialized pulse-train distortion measurements (specifically via the **1374Q/G8** variant with its integrated telegraph line graticule).

With a typical fourth anode voltage of 10 kV and a third anode voltage of 1.0 kV, the tube provides excellent deflection sensitivity (maximum $D_y = 5.7$ V/cm, $D_x = 14.3$ V/cm) and a generous minimum scanned area of 10.0 cm × 6.0 cm. Comprehensive correction electrodes for astigmatism, geometry, beam alignment, and background suppression ensure a highly linear, sharp, and high-contrast display.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

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

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Section 0 · Cathode Ray

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Third Anode Voltage Maximum	2000 V	—
First Anode Voltage Maximum	2000 V	—
Typical Fourth Anode Voltage	10000 V	TypicalOperation
Typical Third Anode Voltage	1000 V	TypicalOperation

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Y Deflection Factor Maximum	5.7 V/cm	TypicalOperation
X Deflection Factor Maximum	14.3 V/cm	TypicalOperation

TUBE TINKER

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