



ELECTRONIC TUBE REFERENCE

1603HB

Specialized - Cathode Ray electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

CATHODERAY

Electrostatically focused, magnetically deflected CRT explicitly intended for radar, monitor, and display service, using an orange very-long-persistence H phosphor and typically operated at 12 kV.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	—
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 1 Cathode Ray	
MAXIMUM PLATE VOLTAGE	15000 V
<i>Published Ferranti ratings, capacitances, and typical operating data promoted where applicable; additional electrical values retained as parameters.</i>	

1603HB — Radar Display Tube

The **1603HB** (also designated as **16/03HB** by its manufacturer, Ferranti) is a 16-inch diameter cathode-ray radar display tube designed for professional radar applications. It features a metal-backed screen, magnetic deflection, and low-voltage electrostatic focusing. The tube is characterized by its orange fluorescence and very long persistence orange afterglow, utilizing a Type 'H' phosphor.

Construction and Physical Characteristics

The 1603HB is constructed with a glass envelope having a maximum overall length of 485 mm (with a tolerance of ± 10 mm) and a nominal screen diameter of 406 mm (± 3 mm). The deflection angle of the

tube is 70 degrees. The face of the screen has a radius of curvature of 700 mm, while the neck has a diameter of 37 mm (± 1 mm).

The tube features an external conductive coating that can be utilized for Extra High Tension (E.H.T.) smoothing. The physical mounting position is flexible, permitting mounting in any position except vertically with the screen facing downwards.

Phosphor and Screen Characteristics

The 1603HB is equipped with a Type 'H' metal-backed screen. This phosphor is highly sensitive and is liable to burn if operated with a stationary or slow-moving spot, even when the beam current is kept at low values.

A closely related variant, the **16/03JB**, shares the same physical dimensions and electrical ratings but utilizes a Type 'J' phosphor, which exhibits blue fluorescence, a yellow afterglow, and long persistence.

Parameter	16/03HB	16/03JB
Phosphor Type	Type 'H'	Type 'J'
Fluorescence	Orange	Blue
Afterglow	Orange	Yellow
Persistence	Very long	Long

Heater and Base Connections

The tube is equipped with an indirectly heated cathode. The heater is designed for AC or DC operation.

Heater Specifications

- **Heater Voltage:** 6.3 V
- **Heater Current:** 0.3 A

Base and Pin Configuration

The 1603HB uses a **B12A (Duodecal)** base and a **CT8 Cavity Type** anode cap for the high-voltage connection. The base connections, viewed from the underside of the base, are as follows:

Pin	Connection
Pin 1	Heater
Pin 2	Grid (Modulator)
Pin 3	No Pin
Pin 4	No Pin

Pin	Connection
Pin 5	No Pin
Pin 6	3rd Anode
Pin 7	No Connection
Pin 8	No Pin
Pin 9	No Pin
Pin 10	1st Anode
Pin 11	Cathode
Pin 12	Heater
Side Contact	2nd Anode + 4th Anode

Electrical Ratings and Operating Limits

The operating limits and absolute maximum ratings for the 1603HB must be strictly observed to prevent damage to the tube and to ensure reliable operation.

Voltage and Impedance Ratings

- **Maximum First Anode (A_1) Voltage:** 500 V
- **Minimum First Anode (A_1) Voltage:** 200 V
- **Maximum Second and Fourth Anode ($A_2 + A_4$) Voltage:** 15 kV
- **Minimum Second and Fourth Anode ($A_2 + A_4$) Voltage:** 8 kV
- **Maximum Positive Third Anode (A_3) Voltage:** +500 V
- **Maximum Negative Third Anode (A_3) Voltage:** -500 V
- **Maximum Heater-to-Cathode Voltage (V_{h-k}):** 200 V
- **Maximum Grid-to-Cathode Resistance (R_{g-k}):** 1.5 M Ω
- **Maximum Heater-to-Cathode Resistance (R_{h-k}):** 1.0 M Ω

The modulator (grid) should never be allowed to become positive with respect to the cathode during normal operation. The only exception is during the brief period immediately following switch-off, during which the grid potential may be allowed to rise to a maximum of +1 V.

Typical Operating Conditions

Under typical operating conditions, the electrostatic focusing and grid bias are adjusted as follows:

- **Heater Voltage:** 6.3 V
- **First Anode (A_1) Voltage:** 300 V

- **Second and Fourth Anode ($A_2 + A_4$) Voltage:** 12 kV
- **Third Anode (A_3) Voltage for Focus:** -300 V to +300 V
- **Grid Voltage (V_g) for Visual Cut-off:** -30 V to -90 V

The third anode (A_3) acts as the low-voltage electrostatic focusing electrode, requiring an adjustable voltage within the range of -300 V to +300 V to achieve a sharp focus. The control grid (modulator) voltage required to achieve visual cut-off of the electron beam ranges from -30 V to -90 V.

Interelectrode Capacitances

The interelectrode capacitances of the 1603HB are specified as follows:

- **Cathode to all other electrodes (C_{k-all}):** < 8 pF
- **Grid to all other electrodes (C_{g-all}):** < 8 pF
- **Anode to external conductive coating ($C_{a-ext.coating}$):** Approximately 1500 pF

The substantial capacitance between the anode and the external conductive coating (approximately 1500 pF) allows this coating to be effectively utilized as a smoothing capacitor for the Extra High Tension (E.H.T.) power supply.

Technical Summary

The **1603HB** is a specialized 16-inch radar display tube featuring magnetic deflection and low-voltage electrostatic focus. It is designed with a Duodecal (B12A) base, a CT8 cavity-type anode cap, and an external conductive coating suitable for E.H.T. smoothing. Operating with a 6.3 V, 0.3 A heater, the tube utilizes a Type 'H' phosphor screen characterized by orange fluorescence and very long orange afterglow. Due to the burning characteristics of the Type 'H' phosphor, care must be taken to avoid stationary or slow-moving spots. The tube's electrical design supports high-voltage operation up to 15 kV on the combined second and fourth anodes, with focusing controlled by the third anode over a range of -300 V to +300 V.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1963 Ferranti

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

1963 FERRANTI

Section 1 · Cathode Ray

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Focusing method	Electrostatic	—
Deflection method	Magnetic	—
Fluorescence	Orange	—
Persistence	Very long	—

CONSTRUCTION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Phosphor type	H	—

APPLICATION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Application	Radar / monitor / display CRT	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
First-anode voltage maximum	500 V	—
Second/fourth-anode voltage maximum	15000 V	—
Third-anode positive voltage maximum	500 V	—
Third-anode negative voltage maximum	-500 V	—
Heater-cathode voltage maximum	200 V	—
First-anode operating voltage	300 V	—

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Second/fourth-anode operating voltage	12000 V	—
Third-anode focus voltage minimum	-300 V	—
Third-anode focus voltage maximum	300 V	—

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Cathode-to-all capacitance maximum	8 pF	—
Grid-to-all capacitance maximum	8 pF	—
External-coating capacitance approximate	1500 pF	—

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