



ELECTRONIC TUBE REFERENCE

1AH5

Voltage - Pentode or Tetrode (under 100V) electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

DIODE-PENTODE

Directly heated battery diode-pentode combining radio signal detection with subsequent low-frequency voltage amplification. The diode recovers the received signal while the pentode provides AF gain in economical portable receivers.

GENERAL CHARACTERISTICS

BASE DESIGNATION	TDJ	BASE PINS	7
NOMINAL HEATER	1.4 V / 25 mA	PARALLEL HEATER	– / –
HEATING	Direct	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Dissimilar

SECTION RATINGS

SECTION1 Diode	
MAXIMUM CATHODE CURRENT	0.2 mA
NOMINAL OUTPUT CURRENT	200 mA
<i>Published Ferranti ratings and characteristics promoted where applicable; additional operating and application data retained as parameters.</i>	

SECTION2 Pentode	
TRANSCONDUCTANCE	0.00017 S
MAXIMUM PLATE VOLTAGE	90 V
MAXIMUM SCREEN VOLTAGE	90 V
MAXIMUM PLATE DISSIPATION	0.03 W
MAXIMUM SCREEN DISSIPATION	0.01 W
MAXIMUM CATHODE CURRENT	0.25 mA
<i>Published Ferranti ratings and characteristics promoted where applicable; additional operating and application data retained as parameters.</i>	

1AH5 — Miniature Diode-Pentode Vacuum Tube

A directly heated, low-drain miniature diode-pentode vacuum tube designed for detector and audio-frequency (A.F.) amplifier service in battery-operated receivers.

Overview

The **1AH5** (often printed as **1AH5**) is a miniature, directly heated vacuum tube containing a combined single diode and a pentode section within a single glass envelope. It is electrically equivalent to the **DAF96**. Designed primarily for portable, battery-operated radio receivers, the 1AH5 features an extremely low-drain filament that can be operated from series or parallel direct-current (DC) supplies.

The pentode section is optimized for high-gain voltage amplification, while the independent diode section is situated at the negative end of the filament and is intended for signal detection or automatic volume control (AVC) functions. The tube is housed in a standard miniature 7-pin (B7G) all-glass envelope and can be mounted in any position.

Physical Specifications and Base Connections

The 1AH5 utilizes a standard T5 1/2 glass bulb and a miniature button 7-pin base with a JETEC 7DJ basing designation. Its physical dimensions are highly compact to suit portable equipment:

Physical Parameter	Metric Value	Imperial Value
Maximum Overall Length	54.5 mm	2 5/32 in (2.205 in)
Maximum Seated Height	47.5 mm	1 7/8 in (1.955 in)
Bulb Length (excluding tip)	—	1.580 in ± 0.094 in
Maximum Diameter	19.0 mm	3/4 in (0.750 in)

The bottom-view pin connections are assigned as follows:

- **Pin 1:** Filament Negative (-), Suppressor Grid (g_3)
- **Pin 2:** Internal Connection (I.C.) / Not Connected
- **Pin 3:** Diode Anode (a_d) / Diode Plate
- **Pin 4:** Screen Grid (g_2) / Grid No. 2
- **Pin 5:** Anode (a_p) / Plate
- **Pin 6:** Control Grid (g_1) / Grid No. 1
- **Pin 7:** Filament Positive (+)

Filament Ratings

The 1AH5 features a coated filament designed for highly efficient battery operation. The filament can be configured for either series or parallel DC supply systems:

- **Series Supply:** Nominal filament voltage (V_f) of **1.3 V** at a current (I_f) of **24 mA**.
- **Parallel Supply:** Nominal filament voltage (V_f) of **1.4 V** at a current (I_f) of **25 mA**. The permissible filament voltage range is **1.1 V to 1.6 V**.

The diode plate is physically positioned at the negative end of the filament (near Pin 1) to minimize the negative bias effect of the filament voltage drop on the diode detection threshold.

Maximum Ratings

The absolute and design-center maximum ratings for the 1AH5 must be strictly observed to prevent premature failure or degradation of the tube.

Pentode Section

- **Maximum H.T. Supply Voltage:** 120 V
- **Maximum Battery Voltage:** 90 V (with an absolute permissible maximum of 110 V)
- **Maximum Anode Voltage (V_a):** 90 V
- **Maximum Screen Grid Voltage ($V_{[g2]}$ (/tubes/ G_2)):** 90 V
- **Maximum Anode Dissipation (P_a):** 30 mW (0.03 W)
- **Maximum Screen Grid Dissipation ($P_{[g2]}$ (/tubes/ G_2)):** 10 mW (0.01 W)
- **Maximum Cathode Current (I_k):** 0.25 mA
- **Maximum Control Grid Circuit Resistance (R_{g1-f}):**
 - **3 M Ω** under standard conditions (with $I_k < 0.25$ mA)
 - Up to **10 M Ω** or **22 M Ω** when utilizing grid-current biasing, provided the cathode current is limited to **0.1 mA**
- **Grid Current Starting Point:** Control grid voltage (V_{g1}) is a maximum of **0 V** (or **-0.2 V** in some rating systems) when the control grid current (I_{g1}) reaches **+0.3 μ A**.

Diode Section

- **Maximum Peak Inverse Voltage (P.I.V.):** 100 V
- **Maximum Mean Diode Current:** 0.2 mA
- **Maximum Peak Diode Current:** 1.2 mA

Electrical Characteristics

Under typical static operating conditions, the pentode section of the 1AH5 exhibits the following characteristics:

- **Anode Voltage (V_a):** 67.5 V
- **Screen Grid Voltage ($V_{[g2]}(/tubes/G2)$):** 67.5 V
- **Control Grid Voltage (V_{g1}):** -1.5 V
- **Anode Current (I_a):** 170 μ A (0.17 mA)
- **Screen Grid Current ($I_{[g2]}(/tubes/G2)$):** 55 μ A (0.055 mA)
- **Mutual Conductance (g_m):** 170 μ A/V (170 μ mhos)
- **Inner Amplification Factor (*extinner* μ or μ_{g1-g2}):** 16

Resistance-Coupled Audio Frequency Amplifier Operation

The 1AH5 is primarily employed as a resistance-coupled audio-frequency voltage amplifier. It can be operated in either a standard pentode configuration or a triode-strapped configuration (where the screen grid $g2$ is connected directly to the anode).

The typical operating examples below are based on supply voltages of **64 V** or **85 V** (derived from nominal battery voltages of 67.5 V or 90 V, reduced by the negative bias required for the subsequent output stage).

Pentode Connection

In this configuration, the control grid resistor (R_{g1-k}) is **10 M Ω** , the anode load resistor (R_a) is **1.0 M Ω** , and the output voltage (V_o) is maintained at **5 V r.m.s.**

Parameter	64 V Supply (2.7 M Ω Screen Feed)	64 V Supply (3.3 M Ω Screen Feed)	85 V Supply (2.7 M Ω Screen Feed)	85 V Supply (3.3 M Ω Screen Feed)
Screen Feed Resistor ($R_{[g2]}(/tubes/G2)$)	2.7 M Ω	3.3 M Ω	2.7 M Ω	3.3 M Ω
Anode Current (I_a)	42 μ A	32 μ A	64 μ A	50 μ A

Parameter	64 V Supply (2.7 MΩ Screen Feed)	64 V Supply (3.3 MΩ Screen Feed)	85 V Supply (2.7 MΩ Screen Feed)	85 V Supply (3.3 MΩ Screen Feed)
Screen Current ($I_{g2}(/tubes/G2)$)	13 μA	9 μA	21 μA	15 μA
Following Grid Resistor (R_g)	1.0 / 2.0 / 2.2 MΩ	2.0 MΩ	1.0 / 2.0 / 2.2 MΩ	2.0 MΩ
Stage Gain (Amplification)	50 / 57 / 63	52	55 / 65 / 70	62
Total Harmonic Distortion	3.5% / 3.5% / 2.0%	2.5%	1.4% / 2.0% / 2.4%	1.2%

Specifically, the 3.3 MΩ screen feed resistor is typically decoupled by a 0.47 μF capacitor.

Triode Connection

When triode-connected (screen grid g_2 tied to the anode), the control grid resistor (R_{g1-k}) is **10 MΩ**, and the output voltage (V_O) is **5 V r.m.s.**

Supply Voltage	Anode Load (R_a)	Following Grid (R_g)	Cathode Current (I_k)	Stage Gain	Distortion
64 V	0.22 MΩ	1.0 MΩ	135 μA	11.0	3.0%
64 V	0.47 MΩ	1.0 MΩ	70 μA	12.0	2.5%
64 V	1.0 MΩ	2.2 MΩ	40 μA	13.0	2.5%
85 V	0.22 MΩ	1.0 MΩ	210 μA	11.0	2.0%
85 V	0.47 MΩ	1.0 MΩ	110 μA	12.5	1.5%
85 V	1.0 MΩ	2.2 MΩ	56 μA	13.5	2.0%

Interelectrode Capacitances

The direct interelectrode capacitances of the 1AH5, measured without an external shield, are as follows:

- **Input Capacitance (Grid No. 1 to all other elements except Plate):** 1.8 pF to 2.1 pF
- **Output Capacitance (Plate to all other elements except Grid No. 1):** 2.7 pF to 2.9 pF
- **Plate to Grid No. 1 Capacitance (C_{a-g1}):** max. 0.3 pF
- **Diode Plate to all other elements:** 1.0 pF to 1.1 pF
- **Diode Plate to Pentode Plate (C_{ad-ap}):** max. 0.9 pF

- **Diode Plate to Pentode Grid No. 1 (C_{ad-g1}):** max. 0.03 pF

These low internal capacitances, particularly the extremely low coupling capacitance between the diode plate and the pentode control grid (0.03 pF), ensure excellent isolation between the detector and audio amplifier stages, minimizing RF feedback and unwanted signal leakage.

Qualitative Curve Observations and Microphony

Plate Characteristics

The plate current (I_a) versus plate voltage (V_a) curves, plotted at a nominal filament voltage of 1.4 V and a screen grid voltage ($V_{[g2]}/\text{/tubes/G2}$) of 67.5 V, demonstrate classic pentode behavior.

- For control grid bias (V_{g1}) steps from 0 V to -3 V (in 0.5 V increments), the curves exhibit a distinct "knee" at low plate voltages. At $V_{g1} = 0$ V, the plate current rises sharply below 20 V, reaching the knee and flattening to approximately 0.55 mA at a plate voltage of 100 V.
- At a moderate bias of $V_{g1} = -1.0$ V, the plate current saturates and flattens around 0.25 mA.
- As the bias is increased to $V_{g1} = -3.0$ V, the plate current is nearly cut off, approaching 0 mA.

Transfer Characteristics

The transfer curves (plotting I_a and $I_{[g2]}/\text{/tubes/G2}$ against V_{g1}) at $V_a = 67.5$ V and $V_{[g2]}/\text{/tubes/G2} = 67.5$ V show a smooth, continuous decrease in both currents as the grid bias becomes more negative, with complete cutoff occurring between -3 V and -4 V.

Microphony

Due to its robust miniature construction, the 1AH5 does not require special anti-microphonic mounting precautions in typical receiver circuits, provided the input signal voltage is at least **20 mV** for a corresponding output of **50 mW** at the receiver's power output stage.

Technical Summary

The **1AH5** is a highly efficient, **directly heated miniature diode-pentode** designed for battery-operated portable receivers. Combining a high-gain pentode voltage amplifier and an independent detector diode in a single **B7G** glass envelope, it operates on a low-drain filament requiring only **24-25 mA** at **1.3-1.4 V**.

With a maximum plate voltage rating of **90 V** and an anode dissipation limit of **30 mW**, the pentode section provides a mutual conductance of **170 $\mu\text{A/V}$** and an inner amplification factor of **16** under typical conditions. When configured as a resistance-coupled A.F. amplifier, the 1AH5 can deliver stage gains of up to **70** in pentode mode and up to **13.5** in triode-connected mode, with low harmonic distortion. Its low interelectrode capacitances and minimal microphonic sensitivity make it an exceptionally reliable choice for compact, low-power detector and preamplifier applications.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1961 Ferranti Technical Handbook

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

1961 FERRANTI TECHNICAL HANDBOOK

Section 1 · Diode

APPLICATION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Application	Detector diode	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak diode current	1.2 mA	—

1961 FERRANTI TECHNICAL HANDBOOK

Section 2 · Pentode

APPLICATION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Application	AF amplifier	—

SOURCE OPERATING CONDITIONS

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1999 Philips 0-D

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

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Section 1 · Diode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Diode plate to pentode plate max	0.9 pF	Diode plate to pentode plate max. 0.9 uuF

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Diode plate to pentode grid max	0.03 pF	Diode plate to pentode grid max. 0.03 uuF

1999 PHILIPS 0-D

Section 2 · Pentode

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Filament voltage	1.4 V	Filament voltage 1.4 volts
Filament current	25 mA	Filament current 25 ma
Grid No.1 to all other elements	2.1 pF	Grid No.1 to all other elements 2.1 uuF
Cathode current max	0.25 mA	Cathode current max. 0.25 ma
Supply voltage3) 64	85 V	Supply voltage3) 64 85 volts
Grid No.2 resistor4) 3.3	3.3 megohms	Grid No.2 resistor4) 3.3 3.3 megohms
Grid No.1 resistor 10	10 megohms	Grid No.1 resistor 10 10 megohms
Plate current 32	50 pa	Plate current 32 50 pamps
Grid No	2 c	Grid No.2 current 9 15 pamps
Grid No	15 pa	Grid No.2 current 9 15 pamps
voltage of	5 V	voltage of 5 volts 2.5 102 4
2) Only for grid biasing. voltage is	110 V	2) Only for grid biasing. voltage is 110 volts.
3) Based on a battery voltage of 67.5 or	90 V	3) Based on a battery voltage of 67.5 or 90 volts de-
Grid No2 voltage	675 V	Grid No2 voltage =675 volts

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Battery voltage max	90 V	Battery voltage max. 90 volts 1)
Plate voltage max	90 V	Plate voltage max. 90 volts
Plate dissipation max	0.03 watt	Plate dissipation max. 0.03 watt
Grid No	2 V	Grid No.2 voltage max. 90 volts
Grid No	90 V	Grid No.2 voltage max. 90 volts
Grid No.2 dissipation max	0.01 watt	Grid No.2 dissipation max. 0.01 watt
No	1 V	No.1 voltage when grid No.1 current max. -0.2 volt

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
No	1 c	No.1 voltage when grid No.1 current max. -0.2 volt
No	-0.2 V	No.1 voltage when grid No.1 current max. -0.2 volt
Grid No	1 c	Grid No.1 circuit resistance max. 10 megohms)
Grid No	10 megohms	Grid No.1 circuit resistance max. 10 megohms)
Peak inverse plate voltage max	100 V	Peak inverse plate voltage max. 100 volts
Plate current max	0.2 mA	Plate current max. 0.2 ma
Peak plate current max	1.2 mA	Peak plate current max. 1.2 ma

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