



ELECTRONIC TUBE REFERENCE

18016

Power - Pentode Single (NOT beam) (under 10W) electronic tube

CONSOLIDATED TECHNICAL
DATA

1 SECTION
CONSTRUCTION
PENTODE

Long-life Philips pentode for telephone equipment, supporting professional preamplifier and output-amplifier service.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	—
NOMINAL HEATER	21 V / 335 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION1 Pentode	
TRANSCONDUCTANCE	0.009 S
MAXIMUM PLATE VOLTAGE	150 V
MAXIMUM SCREEN VOLTAGE	150 V
MAXIMUM PLATE DISSIPATION	5.6 W
MAXIMUM SCREEN DISSIPATION	1.2 W
MAXIMUM CATHODE CURRENT	70 mA
<i>Indirectly heated Philips pentode for telephone equipment, with published preamplifier and output-stage operating conditions.</i>	

18016 — Telephone Equipment Pentode

The **18016** is an indirectly heated pentode designed specifically for use in telephone equipment, where it serves as either a pre-amplifier or an output valve. It features a high-voltage heater designed for parallel

AC or DC supply, requiring a nominal 21 V. The tube is constructed with a glass envelope and is documented in multiple basing configurations, including versions with a top cap for the control grid (g_1) and versions with all connections brought out to a multi-pin base.

Construction and Physical Dimensions

The 18016 is housed in a glass envelope with a maximum diameter of 46 mm and a maximum height of 126 mm (excluding the pins). The base height is specified up to a maximum of 18 mm.

Depending on the physical variant of the 18016, the control grid (g_1) is either connected to a top cap on the envelope or brought out directly to one of the base pins. The tube also incorporates an internal shield or metallization (m) to minimize interelectrode coupling.

Heater Ratings

The cathode is indirectly heated and can be operated from either an AC or DC supply in a parallel configuration.

- **Heater Voltage (V_f):** 21 V
- **Heater Current (I_f):** 0.335 A
- **Calculated Heater Power:** $21\text{ V} \times 0.335\text{ A} = 7.035\text{ W}$

Pinout and Basing Configurations

The pin connections for the 18016 vary across different documented configurations.

Top-Cap Configuration A

In this configuration, the control grid (g_1) is located on the top cap of the envelope:

- **Top Cap:** Grid 1 (g_1)
- **Pin 1:** Cathode, Grid 3, and Shield (k, g_3, s)
- **Pin 2:** Heater (f)
- **Pin 3:** Heater (f)
- **Pin 4:** Grid 2 (g_2)
- **Pin 5:** Metal sleeve/shield (m)
- **Pin 7:** Anode (a)

Top-Cap Configuration B

An alternative top-cap arrangement assigns the pins as follows:

- **Top Cap:** Grid 1 (g_1)
- **Pin 1:** Cathode, Grid 3, and Shield (k, g_3, s)
- **Pin 2:** Heater (f)

- **Pin 3:** Heater (f)
- **Pin 4:** Grid 2 (g_2)
- **Pin 5:** No connection
- **Pin 6:** Metal envelope/shield (m)
- **Pin 7:** Anode (a)

Single-Ended Configuration (10-Pin Base)

In this configuration, all electrodes are connected to the base pins, and the control grid is marked with a diamond symbol:

- **Pins 2, 3:** Heater (f, f)
- **Pin 4:** Grid 2 (g_2)
- **Pin 5:** Metallization/Shield (m)
- **Pin 6:** Anode (a)
- **Pin 7:** Cathode, Grid 3, and Screen (k, g_3, s)
- **Pin 10:** Grid 1 (g_1) (marked with a diamond symbol)

Interelectrode Capacitances

The interelectrode capacitances of the 18016 are specified as follows:

- **Anode Capacitance (C_a):** 15 pF
- **Grid 1 Capacitance (C_{g1}):** 14.5 pF
- **Anode to Grid 1 Capacitance (C_{ag1}):** < 0.25 pF
- **Grid 1 to Heater Capacitance (C_{g1f}):** < 0.5 pF

Typical Electrical Characteristics

At a standard operating point, the 18016 exhibits the following typical characteristics:

- **Anode Voltage (V_a):** 125 V
- **Grid 2 Voltage ($V_{[g2]}(/tubes/G2)$):** 125 V
- **Cathode Resistor (R_k):** 115 Ω
- **Anode Current (I_a):** 48 mA
- **Grid 2 Current ($I_{[g2]}(/tubes/G2)$):** 9.5 mA
- **Mutual Conductance (S):** 9 mA/V
- **Amplification Factor (Grid 2 to Grid 1) (μ_{g2g1}):** 9.5
- **Internal Resistance (R_i):** 16.5 k Ω

Circuit-Specific Operating Conditions

Pre-Amplifier Service

When operated as a pre-amplifier, the 18016 is configured with an anode load resistor (R_a) of 3.3 k Ω under the following conditions:

- **Anode Voltage (V_a):** 125 V
- **Grid 2 Voltage ($V_{[g2]}(/tubes/G2)$):** 125 V
- **Cathode Resistor (R_k):** 115 Ω
- **Anode Current (I_a):** 48 mA
- **Grid 2 Current ($I_{[g2]}(/tubes/G2)$):** 9.5 mA
- **Mutual Conductance (S):** 9 mA/V
- **Internal Resistance (R_i):** 16.5 k Ω
- **Voltage Gain (V_o/V_i):** 3.15 N (Nepers)
- **Maximum Grid 1 Resistor (R_{g1}):**
 - **Automatic Bias:** 1 M Ω
 - **Fixed Grid Bias:** 0.5 M Ω

Output Valve Service

When used as an output stage, the tube operates with the same DC bias conditions but is optimized for power delivery into a 3.3 k Ω load:

- **Anode Voltage (V_a):** 125 V
- **Grid 2 Voltage ($V_{[g2]}(/tubes/G2)$):** 125 V
- **Cathode Resistor (R_k):** 115 Ω
- **Anode Current (I_a):** 48 mA
- **Grid 2 Current ($I_{[g2]}(/tubes/G2)$):** 9.5 mA
- **Mutual Conductance (S):** 9 mA/V
- **Internal Resistance (R_i):** 16.5 k Ω
- **Output Power (W_o):** 0.8 W
- **Total Distortion (d_{tot}):** < 3%
- **Maximum Grid 1 Resistor (R_{g1}):**
 - **Automatic Bias:** 0.3 M Ω
 - **Fixed Grid Bias:** 0.15 M Ω

Limiting Values (Absolute Maxima)

The following maximum ratings must not be exceeded under any operating conditions:

- **Cold Anode Voltage (V_{a0}):** Max 300 V

- **Anode Voltage (V_a):** Max 150 V
- **Anode Dissipation (W_a):** Max 5.6 W
- **Cold Grid 2 Voltage (V_{g20}):** Max 300 V
- **Grid 2 Voltage ($V_{[g2]}(/tubes/G2)$):** Max 150 V
- **Grid 2 Dissipation ($W_{[g2]}(/tubes/G2)$):** Max 1.2 W
- **Cathode Current (I_k):** Max 70 mA
- **Grid 1 Voltage (V_{g1} at $I_{g1} = +0.3 \mu\text{A}$):** Max -1.3 V
- **Heater-to-Cathode Voltage (V_{fk}):** Max 50 V
- **Heater-to-Cathode Resistance (R_{fk}):** Max 3 k Ω

Technical Summary

The **18016** is a specialized telephone-equipment pentode designed for high-reliability pre-amplifier and output applications. Operating with a 21 V, 0.335 A heater, it provides a mutual conductance of 9 mA/V and an internal resistance of 16.5 k Ω at a typical anode and screen potential of 125 V. The tube is capable of delivering 0.8 W of output power with less than 3% total distortion when configured as an output valve, or achieving a gain of 3.15 Nepers in pre-amplifier service. Its robust design is reflected in its strict limiting values, including a maximum anode dissipation of 5.6 W and a maximum cathode current of 70 mA.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1957 Philips Receiving and Amplifying Tubes

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

1957 PHILIPS RECEIVING AND AMPLIFYING TUBES

Section 1 · Pentode

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Anode Voltage	125 V	—
Screen Voltage	125 V	—
Anode Current	48 mA	—
Screen Current	9.5 mA	—



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1963 Philips Electron Tubes Handbook V1

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

1963 PHILIPS ELECTRON TUBES HANDBOOK V1

Section 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	125 V	TelephoneAmplifier
Screen voltage	125 V	TelephoneAmplifier
Cathode resistor	115 ohm	TelephoneAmplifier
Plate current	48 mA	TelephoneAmplifier
Screen current	9.5 mA	TelephoneAmplifier

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Output power	0.8 W	OutputValve

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Transconductance	9000 μ S	—
Plate resistance	0.0165 M Ω m	—

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Anode capacitance	15 pF	—
Control-grid capacitance	20 pF	—
Anode-to-control-grid capacitance	0.7 pF	Maximum where stated
Control-grid-to-heater capacitance	1.5 pF	Maximum where stated


SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1999 Philips 0-D

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

1999 PHILIPS 0-D

Section 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	21 V	Nominal
Heater current	335 mA	Nominal
Maximum plate voltage	150 V	Maximum
Maximum screen voltage	150 V	Maximum

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate resistance	16500 Ω m	Typical
Transconductance	9000 μ S	Typical