



ELECTRONIC TUBE REFERENCE

18AJ10

Power - Pentode (NOT beam) electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

PENTODE-PENTODE

Compactron combining a dual-control FM detector pentode with a separate audio power pentode for television sound output.

GENERAL CHARACTERISTICS

BASE DESIGNATION	12E2	BASE PINS	12
NOMINAL HEATER	18 V / 315 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Dissimilar

SECTION RATINGS

SECTION1 Pentode	
PLATE RESISTANCE	33000 Ω
TRANSCONDUCTANCE	0.0056 S
MAXIMUM PLATE VOLTAGE	165 V
MAXIMUM SCREEN VOLTAGE	150 V
MAXIMUM PLATE DISSIPATION	6 W
MAXIMUM SCREEN DISSIPATION	1.26 W
MAXIMUM CATHODE CURRENT	60 mA
<i>Power pentode section; Class A audio-output data published.</i>	

SECTION2 Pentode	
PLATE RESISTANCE	180000 Ω
TRANSCONDUCTANCE	0.0024 S
MAXIMUM PLATE VOLTAGE	300 V
MAXIMUM PLATE DISSIPATION	1.7 W
MAXIMUM SCREEN DISSIPATION	1 W
<i>Sharp-cutoff dual-control pentode; 0.0024 A/V is grid-1 transconductance; grid-3 transconductance also published.</i>	

18AJ10 — Dual-Control Pentode and Power Pentode Compactron

A multi-unit Compactron vacuum tube containing a sharp-cutoff, dual-control pentode and a power pentode, designed for television receiver applications.

Overview

The **18AJ10** is a multi-unit vacuum tube of the Compactron design, housed in a T-9 glass envelope with an E12-70 button 12-pin base. It integrates two distinct pentode sections within a single envelope: Section 1 is a power pentode designed for audio-frequency output amplifier service in television receivers, and Section 2 is a sharp-cutoff, dual-control pentode designed for FM detector service in television receivers. The tube features a series-string heater rated at 18 volts and 0.315 amperes, with a controlled warm-up time.

Construction, Heater, and Pinout

The 18AJ10 is constructed in a T-9 glass envelope using the E12-70 button 12-pin base. It can be operated in any position. The heater is designed for series-string operation, with a nominal voltage of 18 V (for a bogey tube at 0.315 A) and a controlled average warm-up time of 11 seconds.

Heater and Physical Characteristics

Parameter	Value
Heater Voltage (AC or DC)	18 V (at 0.315 A)
Heater Current	0.315 $\pm$ 0.02 A
Average Heater Warm-up Time	11 s
Envelope	T-9 Glass
Base	E12-70 Button 12-Pin

Parameter	Value
Operating Position	Any

Pin Connections (EIA 12EZ Basing Diagram)

The 12-pin base configuration provides separate connections for the two sections, with Section 2 sharing its cathode connection with an internal shield, and Section 1 sharing its cathode with its beam plates.

- **Pin 1:** Heater
- **Pin 2:** Cathode (Section 2) and Internal Shield
- **Pin 3:** Grid Number 1 (Section 2)
- **Pin 4:** No Connection
- **Pin 5:** Grid Number 3 (Suppressor) (Section 2)
- **Pin 6:** Grid Number 2 (Screen) (Section 2)
- **Pin 7:** Plate (Section 2)
- **Pin 8:** Grid Number 1 (Section 1)
- **Pin 9:** Cathode and Beam Plates (Section 1)
- **Pin 10:** Grid Number 2 (Screen) (Section 1)
- **Pin 11:** Plate (Section 1)
- **Pin 12:** Heater

Direct Interelectrode Capacitances

The direct interelectrode capacitances, measured approximately without an external shield, are as follows:

Section-to-Section Coupling

- **Plate, Section 1 to Plate, Section 2 (1p to 2p):** 0.17 pF

Section 1 (Power Pentode)

- **Grid-Number 1 to Plate (1g1 to 1p):** 0.24 pF
- **Input (1g1 to h + 1k + 1g2 + b.p. + 2k + i.s.):** 9.5 pF
- **Output (1p to h + 1k + 1g2 + b.p. + 2k + i.s.):** 10 pF

Section 2 (Dual-Control Pentode)

- **Grid-Number 1 to Plate (2g1 to 2p):** 0.036 pF
- **Grid-Number 3 to Plate (2g3 to 2p):** 3.0 pF
- **Grid-Number 1 to All Except Plate (2g1 to h + 2k + 2g2 + 2g3 + i.s.):** 7.0 pF
- **Grid-Number 3 to All (2g3 to h + 2k + 2g1 + 2g2 + 2p + i.s.):** 7.8 pF
- **Grid-Number 1 to Grid-Number 3 (2g1 to 2g3):** 0.14 pF

Design-Maximum Ratings

The 18AJ10 ratings are defined under the Design-Maximum System. These limits must not be exceeded under the worst-case operating conditions.

Section 1 (Power Pentode)

- **Plate Voltage:** 165 V
- **Screen Voltage (Grid Number 2):** 150 V
- **Plate Dissipation:** 6.0 W
- **Screen Dissipation:** 1.25 W
- **DC Cathode Current:** 60 mA
- **Grid-Number 1 Circuit Resistance (with Cathode Bias):** 1.0 M Ω

Section 2 (Dual-Control Pentode)

- **Plate Voltage:** 300 V
- **Suppressor Voltage (Grid Number 3):**
 - Positive (DC + Peak): 25 V
 - Negative (DC + Peak): 100 V
- **Screen Supply Voltage:** 300 V
- **Screen Voltage:** Subject to Screen Rating Chart (Maximum 1.0 W dissipation up to 165 V, derating linearly to 0 W at 300 V)
- **Positive DC Grid-Number 1 Voltage:** 0 V
- **Negative DC Grid-Number 1 Voltage:** 50 V
- **Plate Dissipation:** 1.7 W
- **Suppressor Dissipation:** 0.1 W
- **Screen Dissipation:** 1.0 W
- **Suppressor Circuit Resistance:** 0.5 M Ω
- **Grid-Number 1 Circuit Resistance:**
 - With Fixed Bias: 0.25 M Ω
 - With Cathode Bias: 0.5 M Ω

Heater-Cathode Voltage Limits (Both Sections)

- **Heater Positive with respect to Cathode:**
 - DC Component: 100 V
 - Total DC and Peak: 200 V
- **Heater Negative with respect to Cathode:**
 - Total DC and Peak: 200 V

Typical Characteristics and Class A1 Operation

Each section operates under distinct typical conditions optimized for its intended application.

Section 1 (Power Pentode Class A1 Amplifier)

In typical audio-frequency output service, Section 1 operates with the following parameters:

- **Plate Voltage:** 145 V
- **Screen Voltage:** 110 V
- **Grid-Number 1 Voltage:** -7.0 V
- **Peak AF Grid-Number 1 Voltage:** 7.0 V
- **Plate Resistance (Approximate):** 33,000 Ω
- **Transconductance:** 5,600 μmhos
- **Zero-Signal Plate Current:** 34 mA
- **Maximum-Signal Plate Current:** 39 mA
- **Zero-Signal Screen Current:** 6.5 mA
- **Maximum-Signal Screen Current:** 9.3 mA
- **Load Resistance:** 2,500 Ω
- **Total Harmonic Distortion (Approximate):** 12%
- **Maximum-Signal Power Output:** 1.45 W

Section 2 (Dual-Control Pentode)

In typical FM detector service, Section 2 operates with the following parameters:

- **Plate Voltage:** 150 V
- **Suppressor Voltage (Grid Number 3):** 0 V
- **Screen Voltage:** 100 V
- **Cathode-Bias Resistor:** 180 Ω
- **Plate Resistance (Approximate):** 0.18 M Ω (180,000 Ω)
- **Grid-Number 1 Transconductance:** 2,400 μmhos
- **Grid-Number 3 Transconductance:** 750 μmhos
- **Plate Current:** 2.8 mA
- **Screen Current:** 3.5 mA
- **Grid-Number 1 Voltage (Approximate, for $I_b = 20 \mu\text{A}$):** -4 V
- **Grid-Number 3 Voltage (Approximate, for $I_b = 50 \mu\text{A}$):** -3.5 V

Qualitative Curve Observations and Circuit Design

The electrical behavior of both sections is further clarified by their characteristic curves:

Section 1 (Power Pentode)

- **Plate Characteristics:** The plate current curves exhibit a distinct "knee" around 30 V to 50 V of plate voltage. The curves are plotted for Grid-Number 1 bias values ranging from 0 V down to -20 V.
- **Transfer Characteristics:** Both plate and screen currents rise sharply as the Grid-Number 1 voltage approaches 0 V. Higher screen voltages ([Ec2](#)) yield significantly higher overall currents, demonstrating the strong influence of screen potential on the space charge.

Section 2 (Dual-Control Pentode)

- **Screen Rating Chart:** The screen grid is protected by a defined operating boundary. Screen dissipation is limited to 1.0 W up to a screen voltage of 165 V, above which it derates linearly to 0 W at 300 V.
- **Plate Characteristics:**
 - When Grid-Number 1 voltage (E_{c1}) is held at 0 V and screen voltage ([Ec2](#)) is at 100 V, varying the suppressor grid voltage (E_{c3}) from +3.0 V to -6.0 V controls the plate current. This demonstrates typical dual-control pentode behavior, where the suppressor grid acts as an effective control element.
 - When suppressor voltage (E_{c3}) is held at 0 V and screen voltage ([Ec2](#)) is at 100 V, varying Grid-Number 1 voltage (E_{c1}) from +3.0 V to -3.0 V shows strong control over plate current.
- **Transfer Characteristics:**
 - The transfer curves of plate and screen currents versus Grid-Number 1 voltage (E_{c1}) show a sharp cutoff characteristic, with plate current dropping to near zero around -4 V to -5 V.
 - The transfer curves of plate and screen currents versus suppressor voltage (E_{c3}) show that as E_{c3} goes positive, plate current rises while screen current decreases. This indicates that the suppressor grid controls the division of current between the plate and the screen grid.

Technical Summary

The **18AJ10** is a versatile Compactron tube combining a **power pentode (Section 1)** and a **sharp-cutoff, dual-control pentode (Section 2)** in a single T-9 glass envelope. Designed for television receiver applications, it serves as an audio-frequency output amplifier and an FM detector. The tube features an **18 V, 0.315 A** heater with an 11-second average warm-up time, suitable for series-string heater circuits. With its independent pentode sections, the 18AJ10 provides a compact, dual-purpose solution for television audio and detection stages.

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 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater Warmup Time	11 s	Average
Typical Plate Voltage	145 V	ClassA Section1
Typical Screen Voltage	110 V	ClassA Section1
Typical Grid1 Voltage	-7 V	ClassA Section1
Zero Signal Plate Current	34 mA	ClassA Section1
Maximum Signal Plate Current	39 mA	ClassA Section1
Zero Signal Screen Current	6.5 mA	ClassA Section1
Maximum Signal Screen Current	9.3 mA	ClassA Section1
Load Resistance	2500 ohm	ClassA Section1
Total Harmonic Distortion	12 %	ClassA Section1
Maximum Signal Power Output	1.45 W	ClassA Section1

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid1 To Plate Capacitance	0.24 pF	Section1
Input Capacitance	9.5 pF	Section1
Output Capacitance	10 pF	Section1
Plate To Plate Coupling Capacitance	0.17 pF	Section1 to Section2

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CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid1 To Plate Capacitance	0.036 pF	Section2
Grid1 To Grid3 Capacitance	0.14 pF	Section2

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Typical Plate Voltage	150 V	Section2
Typical Screen Voltage	100 V	Section2
Cathode Bias Resistance	180 ohm	Section2

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Grid3 Transconductance	750 uS	Section2
Typical Plate Current	2.8 mA	Section2
Typical Screen Current	3.5 mA	Section2

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