



ELECTRONIC TUBE REFERENCE

13PGA

Voltage - Radio Detector Converter electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

HEPTODE

Variable-mu heptode frequency changer for superheterodyne receivers. Its multi-grid construction combines oscillator and mixer action, translating incoming RF signals to the receiver intermediate frequency while permitting gain control in the converter stage.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	—
NOMINAL HEATER	13 V / 200 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Capable
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 Heptode	
MAXIMUM PLATE VOLTAGE	250 V
MAXIMUM SCREEN VOLTAGE	100 V
<i>Cossor 13PGA indirectly heated variable-mu pentagrid (heptode) frequency changer for AC/DC or DC superheterodyne receivers using 200 mA series-heater strings. Nominal heater 13 V, 0.2 A. Maximum modulator-anode voltage 250 V, modulator-screen voltage 100 V and oscillator-anode voltage 200 V. Variable modulator-grid bias -1.5 to -20 V. Conversion conductance is application-specific and is not equivalent to intrinsic static transconductance. The manufacturer emphasizes single-valve oscillator/mixer operation and low oscillator pulling.</i>	

13PGA — Pentagrid Frequency Changer

Overview

The **13PGA** (also referred to as the **13 P.G.A.**) is an indirectly heated, variable-mu pentagrid frequency changer developed by Cossor. It belongs to a specialized series of Cossor valves featuring 0.2 A heaters,

designed primarily for series-string operation in AC/DC or DC mains radio receivers.

As a single-valve frequency changer, the 13PGA combines the functions of a local oscillator and a mixer within a single envelope. This design eliminates the need for external coupling components, which are typically required in two-valve frequency-changing systems to inject the oscillator output into the detector circuit.

Heater and Power Supply

The 13PGA is designed to operate in series-connected heater chains, which are common in transformerless AC/DC or DC mains receivers. Its heater specifications are:

Parameter	Value
Nominal Heater Voltage	13 V (approx.)
Nominal Heater Current	0.2 A
Calculated Heater Power	2.6 W

Calculation: The nominal heater power is calculated as: $P = V * I = 13 \text{ V} * 0.2 \text{ A} = 2.6 \text{ W}$.

Electrical Specifications and Operating Limits

The 13PGA operates with separate voltage limits for its modulator and oscillator sections. The maximum ratings and variable operating ranges specified for the valve include:

Parameter	Value
Maximum Modulator Anode Voltage	250 V
Maximum Modulator Screen Voltage	100 V
Modulator Grid Voltage (Variable)	-1.5 V to -20 V
Maximum Oscillator Anode Voltage	200 V

The variable modulator grid voltage range of -1.5 V to -20 V reflects the variable-mu (remote cut-off) characteristic of the control grid (grid 4), which allows for effective automatic volume control (AVC) or manual gain control without introducing excessive distortion.

Circuit Application and Performance

In superheterodyne receiver designs, the 13PGA serves as a single-valve frequency changer. A key advantage of this pentagrid design is its inherent freedom from "whistles" (spurious responses or image interference) at various tuning points across the band. In alternative frequency-changing systems, preventing these whistles typically requires highly selective and complex aerial tuning circuits.

The conversion conductance of the 13PGA is optimized to provide stable and satisfactory performance in standard AC/DC receivers. Its conversion conductance is intentionally lower than that of its 4-volt, 1-ampere counterpart, the **41 M.P.G.** (also referred to as the 41 MPG). This design choice was made because the typical receiver circuits utilizing the 13PGA cannot readily accommodate an excessively high conversion conductance without stability issues.

Modulator Grid Characteristics and Curves

The relationship between the modulator grid voltage (V_{g4}) and the modulator anode current is highly dependent on the bias applied to the oscillator grid (V_{g1}). Under typical operating conditions with a modulator anode voltage of 250 V, a screen voltage of 100 V, and an oscillator anode voltage of 200 V, the following qualitative behaviors are observed:

- **Anode Current Control:** At a modulator grid voltage (V_{g4}) of 0 V, the modulator anode current is at its maximum, ranging from approximately 14.5 mA when the oscillator grid voltage (V_{g1}) is at 0 V, down to approximately 3.5 mA when V_{g1} is biased at -8 V.
- **Variable-Mu Action:** As the modulator grid voltage (V_{g4}) is made more negative, the modulator anode current decreases gradually. This smooth, non-abrupt reduction in current confirms the remote cut-off (variable-mu) nature of grid 4.
- **Cut-off Region:** For all typical oscillator grid voltages, the modulator anode current is reduced to very low levels (under 2 mA) as V_{g4} approaches -15 V, and is nearly completely cut off (less than 1 mA) when V_{g4} reaches -20 V.

Related Designations

The 13PGA is closely related to the **41 M.P.G.**, which is described as its 4-volt, 1-ampere counterpart. While they share similar pentagrid frequency-changing principles, the 41 M.P.G. features a higher conversion conductance and is designed for AC-only receivers with parallel-connected heaters, whereas the 13PGA is optimized for series-run AC/DC or DC applications with a 0.2 A current-regulated heater chain. These differences in heater ratings and conversion conductance mean they are not direct plug-in substitutes.

Technical Summary

The **13PGA** is a 13-volt, 0.2-ampere indirectly heated pentagrid frequency changer designed by Cossor for series-heater operation in AC/DC and DC superheterodyne receivers. By combining the mixer and oscillator functions into a single envelope, it eliminates the need for external coupling components to inject the local oscillator signal. With a maximum modulator anode voltage of 250 V, a maximum screen voltage of 100 V, and a maximum oscillator anode voltage of 200 V, the valve provides stable frequency conversion. Its variable-mu modulator grid (V_{g4}), operating over a range of -1.5 V to -20 V, ensures effective gain control while maintaining freedom from spurious whistles without requiring highly selective preselector 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 · Heptode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Oscillator anode maximum voltage	200 V	Published datasheet value
Modulator grid variable bias minimum	-20 V	Published datasheet value
Modulator grid variable bias maximum	-1.5 V	Published datasheet value

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