

ELECTRONIC TUBE REFERENCE

0A4G

Specialized - Switching Tube electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION
CONSTRUCTION
THYRATRON

Cold-cathode gas relay tube for heaterless electronic control. Gas ionization provides abrupt conduction for relay, trigger, and switching circuits.

GENERAL CHARACTERISTICS

BASE DESIGNATION	4V	BASE PINS	4
NOMINAL HEATER	0 V / 0 mA	PARALLEL HEATER	- / -
HEATING	Indirect; cold cathode	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

4V - TERMINAL PINOUT

TERMINAL	SECTION	ELEMENT	STATUS
PIN2 - K	A	K - Cathode	CONNECTED
PIN5 - P	A	P - Plate (Anode)	CONNECTED
PIN7 - G1	A	G1 - Control Grid	CONNECTED

SECTION RATINGS

SECTION1 Thyratron	
MAXIMUM PLATE VOLTAGE	225 V
MAXIMUM CATHODE CURRENT	25 mA
Published handbook ratings and operating characteristics reviewed.	

0A4G — Cold-Cathode Gas Triode Relay Tube

Overview

The **0A4G** (also written as **0A4-G**) is a cold-cathode, gas-filled glow-discharge triode designed primarily for relay service, carrier-current remote control systems, and calculating machines. Because it utilizes a cold cathode, the tube requires no heater or filament power, resulting in zero standby power consumption when the tube is inactive.

The primary operating mechanism of the 0A4G relies on a starter-anode (or starter-electrode) to initiate a glow discharge with a very small amount of electrical energy. Once initiated, this discharge ionizes the internal gas, allowing a much larger current to flow through the main anode-to-cathode circuit. This characteristic makes the 0A4G highly practical for remote control of line-operated electrical devices using radio-frequency (RF) impulses transmitted directly over existing power lines. Additionally, the 0A4G can be configured for use as a voltage regulator or as a relaxation oscillator.

Physical Construction and Basing

The 0A4G is constructed within an **ST-12** glass bulb and features a **Small Shell Octal 6-Pin** base (also designated as the **4V**, **G-4V**, or **8CT** basing arrangement). The physical dimensions of the tube are characterized by:

- **Maximum overall length:** 4-1/8 inches
- **Maximum diameter:** 1-9/16 inches

The tube can be mounted and operated in **any position**.

The underside view of the octal socket connections reveals the following pin assignments:

- **Pin 1:** No Connection (NC)
- **Pin 2:** Cathode (K)
- **Pin 3:** No Connection (NC)
- **Pin 5:** Anode ([P2](#))
- **Pin 7:** Starter-Anode (P1)
- **Pin 8:** No Connection (NC)

The locating key of the octal base is positioned between Pin 1 and Pin 8.

Electrical Characteristics and Operating Principles

The 0A4G functions by separating the initiation of the gas discharge from the main conduction path. Under normal standby conditions, the voltage applied between the main anode and the cathode is kept below the level required to cause spontaneous breakdown.

Breakdown Voltages and Operating Drops

The electrical behavior of the tube is defined by several critical voltage thresholds and operating drops:

Parameter	Value
Peak Anode Breakdown Voltage (Starter-anode tied to cathode)	225 V minimum
Peak Positive Starter-Anode Breakdown Voltage	70 V minimum / 90 V maximum
Starter-Anode Drop (During conduction)	~55 to 60 V
Anode Drop (During main conduction)	~70 V
Extinction Voltage	< 60 V

Spontaneous breakdown between the main anode and cathode will not occur below 225 V if the starter-anode is tied to the cathode. However, if a positive potential between 70 V and 90 V (typically around 85 V) is applied to the starter-anode relative to the cathode, a localized glow discharge is initiated between these two electrodes.

Transition and Conduction

Once the starter-anode discharge is established, it produces free ions within the gas-filled envelope. If the main anode is at a sufficient positive potential, these ions enable the discharge to transfer to the main anode-to-cathode path. For this transition to occur reliably at an anode potential of 140 peak volts, the starter-anode current must reach a transition threshold:

- **Maximum transition starter-anode current:** 100 μ A
- **Recommended practical starter-anode current:** At least 200 μ A

During active conduction, the voltage drop across the starter-anode to cathode is approximately 60 V (with some sources listing a starter-anode drop of 55 V), while the main anode-to-cathode operating drop stabilizes at approximately 70 V.

To extinguish the discharge and return the tube to its non-conducting state, the anode voltage must be reduced below the extinction voltage of 60 V.

Maximum Ratings and Typical Operating Conditions

The 0A4G must be operated within its absolute limits to prevent damage and ensure reliable relay action.

Maximum Ratings (Relay Service)

- **Maximum Peak Cathode Current:** 100 mA
- **Maximum D-C (Average) Cathode Current:** 25 mA
- **Maximum Peak Inverse Anode Voltage:** 225 V

Typical AC Operation

When operated directly from a standard AC power line, the typical operating parameters are:

- **Anode-Supply Voltage (RMS):** 105 to 130 V
- **Maximum Peak AC Starter-Anode Voltage:** 70 V
- **Minimum Peak RF Starter-Anode Voltage:** 55 V
- **Minimum Combined Peak Voltage (AC + RF):** 110 V

The combined peak voltage is a calculated sum of the peak AC bias voltage and the peak RF control signal voltage: $\text{Sum Voltage} = \text{Peak AC Voltage} + \text{Peak RF Voltage} \geq 110 \text{ V}$ This ensures that the combined potentials reliably exceed the starter-anode breakdown threshold under low line-voltage conditions.

Circuit Applications and Design Considerations

Carrier-Current Remote Control Relay

The classic application of the 0A4G is a line-operated remote control relay. In this circuit, the full AC line voltage (typically 115 V AC) is applied directly across the main anode and cathode through a relay coil (S).

A resistive voltage divider (bleeder system) consisting of a **15,000 Ω (1/2 watt)** resistor (R_1) and a **10,000 Ω (1/2 watt)** resistor (R_2) is connected across the AC line. This divider maintains the starter-anode at an AC bias potential just below the minimum breakdown voltage (70 V peak).

A series-tuned LC circuit, consisting of an inductance (L) and a capacitor (C), is connected in series with the line and tuned to the specific frequency of the RF control carrier.

1. **Standby State:** In the absence of an RF signal, the starter-anode voltage remains below the breakdown threshold, and no current flows through the tube or the relay.
2. **Triggered State:** When an RF carrier of the resonant frequency is impressed on the power line, a resonant voltage appears across L and C . The voltage across capacitor C increases the negative potential peaks on the cathode, which effectively increases the potential difference between the cathode and the starter-anode.
3. **Breakdown and Transfer:** This increased potential initiates a discharge between the cathode and the starter-anode. The resulting ionization allows the discharge to transfer to the main anode.
4. **Relay Activation:** Current flows through the main anode circuit, energizing the relay coil (S) to close a local circuit. An optional capacitor (such as a 25 μF capacitor) may be placed across the relay coil to smooth the half-wave rectified current.
5. **Automatic Reset:** Because the anode is supplied with AC, the anode voltage drops below the extinction threshold (and reverses polarity) during the negative half of each AC cycle. Consequently, the 0A4G automatically ceases to conduct and resets as soon as the RF carrier signal is removed.

DC Operation

The 0A4G can also be operated from a DC power source. However, because DC voltage does not pass through zero, the tube will not automatically extinguish once triggered. The main anode current will continue to flow indefinitely even after the starter-anode signal is removed. To reset the circuit, an

external mechanism (such as a normally closed switch or relay contact) must be provided to open the anode circuit or reduce the anode potential below 60 V.

Design Precautions

When designing circuits around the 0A4G, two opposing conditions must be carefully balanced:

- **High Line-Voltage Safety:** At the highest expected line voltage, the AC bias voltage delivered to the starter-anode by the bleeder circuit must not be high enough to cause spontaneous breakdown in the absence of a signal.
- **Low Line-Voltage Reliability:** At the lowest expected line voltage, the RF carrier signal must provide a high enough peak voltage (minimum 55 V peak) to ensure that the sum of the AC bias and RF voltages reliably triggers the starter-anode.

Breakdown Characteristics and Quadrants

The breakdown behavior of the 0A4G is highly dependent on the polarities of the starter-anode and the main anode relative to the cathode. These relationships are mapped across four quadrants:

- **First Quadrant (Starter-Anode Positive, Anode Positive):** This is the intended operating region. The tube exhibits stable, predictable breakdown characteristics. Breakdown between the cathode and starter-anode occurs at approximately 85 V, which successfully initiates the main anode discharge if the anode potential is adequate.
- **Other Quadrants (Negative Polarities):** Operating the tube in quadrants where the starter-anode or the main anode is negative relative to the cathode results in highly unstable and unpredictable breakdown behavior. Circuit designs should avoid these regions.

Related Designations

- **1C21:** The 1C21 is a cold-cathode glow-discharge tube that is physically and electrically similar to the 0A4G, but it is specifically designed and rated for DC operation only.
- **5823:** The 5823 is a miniature 7-pin cold-cathode relay tube. While it performs a similar 'on-off' control function for low-current circuits, it utilizes a different physical structure and a miniature 7-pin base rather than the octal configuration of the 0A4G.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1940 RCA

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

1940 RCA

Section 1 · Thyatron

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
StarterAnodeRFVoltageMinimum	55 V peak	—
AnodeVoltageMinimum	110 V peak	—



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

195X General Electric Essential Characteristics

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

195X GENERAL ELECTRIC ESSENTIAL CHARACTERISTICS

Section 1 · Thyatron

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak cathode current	100 mA	GasTriodeService
DC cathode current	25 mA	GasTriodeService

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Starter anode drop	55 V	GasTriodeService
Anode drop	70 V	GasTriodeService



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

195X Raytheon Special Purpose Tubes

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

195X RAYTHEON SPECIAL PURPOSE TUBES

Section 1 · Thyatron

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum peak inverse anode voltage	225 V	—
Maximum peak cathode current	100 mA	—
Maximum average cathode current	25 mA	—

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak starter-anode breakdown voltage	75–90 V	—



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1960 RCA Industrial and Communications Types

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

1960 RCA INDUSTRIAL AND COMMUNICATIONS TYPES

Section 1 · Thyatron

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak Inverse Anode Voltage	225 V	—
PeakCathodeCurrentMaximum	100 mA	—

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
StarterElectrodeBreakdownVoltageMinimum	75 V	—
StarterElectrodeBreakdownVoltageMaximum	90 V	—

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