



ELECTRONIC TUBE REFERENCE

11TU7

Nixie electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

NIXIE

Gas-filled cold-cathode decade counting tube that transfers a glow through ten positions to count pulses from zero through nine.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	—
NOMINAL HEATER	— / —	PARALLEL HEATER	— / —
HEATING	Indirect; cold cathode	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 Nixie

No fixed ratings recorded.

Published ratings and characteristics promoted from the approved TESLA source.

11TU7 — Decadic Gas-Filled Counting Tube

The **TESLA 11TU7** is a cold-cathode, gas-filled decadic counting tube (dekatron) designed for use in electronic counting instruments and decimal scaling circuits. It is capable of counting electrical pulses at frequencies ranging from **0 to 20 kc/s** (kilocycles per second). The device provides a direct visual indication of the count through the position of the glow discharge on its cathodes, making it a self-indicating decimal counter.

The 11TU7 is designed to replace foreign equivalents, specifically the **G10/241E** and the **CV 2223**.

Construction and Operating Principle

The 11TU7 is housed in a glass envelope containing a central anode and two concentric rings of cathodes:

- **Main Routing Cathodes (Směrovací katody):** There are ten main routing cathodes, designated k_0 through k_9 . Each of these cathodes is electrically independent and brought out to its own individual pin on the base. The zero cathode (k_0) is specifically utilized for resetting and synchronization purposes.
- **Transfer Cathodes (Přenášeční katody):** There are ten transfer (or guide) cathodes situated between the main routing cathodes. These transfer cathodes are internally connected together and brought out to a single common pin on the base.

The anode is positioned centrally and is brought out to a center contact (spigot) located on the guide key of the base. A shield is also incorporated into the structure and is connected to its own dedicated pin to prevent spurious ionization and stabilize the discharge path.

During operation, a glow discharge is established between the anode and one of the main routing cathodes. When a counting pulse is applied, the discharge is transferred sequentially via the transfer cathodes to the adjacent main routing cathode, thereby advancing the count.

Base, Pinout, and Physical Dimensions

The tube features a bakelite **duodecal** base with twelve pins, designated as a modified **K 12/27 ČSN 35 8909** configuration. The physical dimensions and mechanical specifications of the tube are as follows:

- **Maximum overall height:** 72 mm
- **Maximum bulb diameter:** 41 mm
- **Maximum base diameter:** 43.5 mm
- **Maximum weight:** 70 g

The pin connections, viewed from the bottom of the base, are arranged as follows:

- **Pins 1 to 8:** Routing cathodes k_1 to k_8
- **Pin 9:** Routing cathode k_9
- **Pin 10:** Zero routing cathode k_0 (nultá katoda)
- **Pin 11:** Common transfer cathode k_p (přenášeční katoda)
- **Pin 12:** Shield s (stínění)
- **Center Contact (on the guide key):** Anode a

Electrical Characteristics and Operating Points

The electrical characteristics of the 11TU7 define its ignition, conduction, and output capabilities under specified test conditions.

Characteristic Values

At a nominal supply voltage of $U_b = 320\text{V}$, the tube exhibits the following typical characteristics:

- **Maximum ignition voltage of the main path (U_{nz}):** 300 V
- **Maximum discharge (arc) voltage of the main path (U_{arc}):** 180 V

- **Minimum voltage across the cathode resistor (U_{Rk}):** 40 V
- **Typical cathode current (I_k):** 3.7 mA

Typical Operating Values (for switching speeds up to 5 kc/s)

For operation in circuits with counting rates up to 5 kc/s, the following typical operating parameters are specified:

- **Supply voltage (U_b):** 325 to 345 V
- **Auxiliary cathode voltage (U_{lp}):** 75 V
- **Shield voltage (U_s):** 90 V
- **Anode load resistor (R_a):** $24 \text{ k}\Omega \pm 2\%$
- **Cathode resistor (R_k):** $15 \text{ k}\Omega \pm 5\%$
- **Cathode capacitor (C_k):** $5 \text{ nF} \pm 20\%$ (equivalent to 5 nF)
- **Transfer pulse amplitude (U_{psqcap}):** $120 \pm 15 \text{ V}$
- **Pulse duration (t_{sqcap}):** $16 \pm 4 \mu\text{s}$
- **Output pulse voltage at the cathode (U_{ksqcap}):** 40 V

Limiting Values and Operational Constraints

To ensure reliable operation and prevent premature degradation of the tube, the following absolute limiting values (Mezní hodnoty) must be strictly observed:

- **Minimum supply voltage (U_b):** 325 V
- **Continuous current of the main path (I_a):**
 - Minimum: 2.4 mA
 - Maximum: 5.0 mA
- **Shield electrode voltage (U_s):**
 - Minimum: 75 V
 - Maximum: 110 V
- **Maximum switching frequency (f):** 20 kc/s

Operational Constraints and Maintenance

A critical operational constraint of the 11TU7 dekatron is the prevention of "prolonged burning" on a single cathode path. If the glow discharge remains stationary on one cathode for an extended period, the cathode material can sputter unevenly, leading to a degradation of the ignition characteristics of the adjacent cathodes.

To mitigate this:

1. If stationary operation is unavoidable, the cathode current must be kept at its absolute minimum value (near the 2.4 mA limit).

2. It is highly recommended to periodically subject the dekatron to continuous cyclic loading (active counting) at a frequency between **50 and 5000 c/s** (Hz) to evenly distribute wear and maintain stable, uniform cathode surfaces.

Application and Circuit Considerations

The 11TU7 is primarily employed in decimal scaling units, frequency dividers, and digital measuring instruments.

High-Speed Operation (up to 20 kc/s)

Typical application circuits are designed for different maximum counting speeds. For high-speed operation up to 20 kc/s, specialized drive circuitry is required. These circuits utilize precise pulse-shaping networks to control the transfer cathodes.

- Resistors used in these critical timing and biasing networks must have a high precision of *pm1*.
- Capacitors must have a tolerance of *pm20*.

Synchronization and Oscilloscope Interface

In multi-stage counting systems or when monitoring the operation of the dekatron, synchronization is essential. The 11TU7 provides a dedicated output pulse from the zero cathode (*k0*). This pulse is specifically intended to be used for synchronizing the time base of oscilloscopes or triggering subsequent counting stages (such as next-decade dekatrons or auxiliary electronic switches).

Technical Summary

The **TESLA 11TU7** is a specialized, gas-filled, cold-cathode decadic counting tube (dekatron) designed for decimal pulse counting up to **20 kc/s**. It features ten individual main routing cathodes, a common transfer cathode system, and an integrated shield, all housed in a glass envelope with a modified 12-pin duodecal base. The anode is uniquely terminated at the center contact of the base's guide key.

With a typical operating supply voltage of **325 to 345 V** and a continuous anode current range of **2.4 to 5.0 mA**, the 11TU7 provides a reliable, self-indicating counting solution. To maintain its operational longevity, designers must avoid prolonged stationary glow discharge on a single cathode and ensure periodic cyclic operation. The 11TU7 serves as a direct replacement for the foreign **G10/241E** and **CV 2223** types, offering robust performance in vintage and specialized industrial instrumentation.



SOURCE OPERATING CONDITIONS

SOURCE PDF

195X Tesla

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

195X TESLA
Section 1 · Nixie

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
SwitchingFrequencyMaximum	20 kHz	—
Cathode Current	3.7 mA	—

TUBE TINKER

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and their source documents.

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