



# Unidirectional Cold-Cathode Gas-Filled Decade Counter

Code: G10/241E (CVX2223)

The G10/241E is a single-ended cold-cathode unidirectional gas-filled counter and distributor tube. It has ten cathodes which are used to indicate the number of the count, either visually at low speeds or by means of the voltage developed across the cathode load at high speeds. It is capable of counting pulses at repetition speeds from approximately 0 up to 20 kc/s.

Each cathode provides a voltage output that is sufficient either to operate a coupling tube to the next counter stage or a registering circuit. The tube has been designed so that it is possible to view the discharge directly at low speeds, and so obtain a direct indication of the count. To this end the holes in the anode through which the glow is visible have been numbered.

## DIMENSIONS.

Maximum overall length	77.8	mm
Maximum seated height	50.8	mm
Maximum bulb diameter	41	mm
Base	B12E	
Net weight	66	g

## D.C. CHARACTERISTICS (Nominal).

Anode-cathode breakdown voltage	280	V
Anode-transfer electrode breakdown voltage	280	V
Anode-cathode maintaining voltage (approx.)	180	V
Cathode current	3.7	mA

## MECHANICAL DATA.

Reasonable care must be taken to prevent serious mechanical shocks.

A special socket has been designed for use with this valve (McMurdo type X12E).

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## TYPICAL OPERATING CONDITIONS.

(For pulse repetition frequencies up to 5 kc/s.)

H.T. supply voltage (stabilised)	315 to 345	V
Transfer electrode bias (nominal)	75	V
Shield bias (nominal)	90	V
Anode load (see circuit diagram)	$24 \pm 2\%$	k $\Omega$
Cathode load	$15 \pm 5\%$	k $\Omega$
Cathode load capacitor	$0.005 \pm 20\%$	$\mu$ F
Transfer pulse amplitude (Measured at the input capacitor with G10/241E in circuit.)	$120 \pm 15$	V
Transfer pulse width	$16 \pm 4$	$\mu$ s
Cathode pulse output (min.)	40	V

## CIRCUIT.

A basic operating circuit for 330 volts stabilised H.T. is shown in Fig. 1. The transfer electrode and shield bias are obtained from potentiometers across the power supply.

SenTerCel Unistor type Q3/5 provides D.C. restoration of applied pulses. SenTerCel Unistor type Q6/4 isolates the input circuit from the transfer electrode during quiescent conditions and permits a condition of bias equilibrium across the transfer leak resistor. For the pulse duration the Q6/4 Unistor is in its forward conducting state.

## TIME CONSTANTS OF CATHODE CIRCUITS.

The value of cathode capacitor used should be the maximum permitted for the particular application. When the tube is used as a distributor, this value is set by the circuit requirements for the charge on the cathode capacitor to decay to less than 5 volts during the interval between pulse arrivals. The rise of voltage across the cathode resistor is determined by the time constant of the cathode capacitor and the effective resistance of the anode and cathode resistors in parallel.

In straight counting it is unnecessary to have more than three RC cathode circuits. Under these conditions K1, 3, 5, 7 and 9 and K2, 4, 6 and 8 respectively are joined together; K10 has its own circuit as it is from this cathode that the voltage is taken for operating further circuitry.



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## TRANSFER PULSE AMPLITUDE AND WIDTH.

The broad requirement of the transfer pulse is that it should be of sufficient amplitude to reduce the anode-earth potential to less than 160 volts, and that its width should be such as to ensure that the glow spreads across the transfer electrode surface during that time. It will be seen that the pulse width should be as wide as possible, but it must be directly related to the cathode circuit time constant, since it is necessary to ensure that there is a bias voltage on the previously conducting cathode of at least 33 volts at the end of the pulse.

The lower limit of pulse width is set by the rate of spread of glow over the electrode surface and may be reduced to approximately 4 micro-seconds provided the transfer electrode input impedance is kept small.

The effective length of the pulse is from the time the anode volts start to fall to the time at which the anode-earth voltage reaches 180 volts. At this point the adjacent forward cathode will break down. Any variation in pulse shape should be considered in the light of these requirements.

## SWITCHING-ON AND RE-SETTING.

Breakdown will probably occur at a cathode other than the desired one and occasionally breakdown may occur at two cathodes simultaneously, which prevents glow stepping, when the tube is switched on initially.

A method of obtaining breakdown at a single specific cathode is to switch on the 330 volt H.T. supply with the common transfer leak resistor and all cathodes, except that required for initial discharge, disconnected. After a glow has been initiated at this cathode, the common transfer leak resistor and all other cathodes may be reconnected into the circuit. Re-setting may also be accomplished in this manner.

## GENERAL REMARKS.

The anode resistor should be mounted as near the anode as possible, and stray capacitances kept to a minimum. Stray capacitances affect the rate of rise of anode voltage with the trailing edge of the pulse, and it is desirable that this should be as rapid as possible.

The input impedance which this circuit with the G10/241E inserted offers to the pulse source is approximately 13 kilohms. The pulse source should be matched to this load value.

There are no photoelectric effects and consequently the valve may be used in bright sunlight, darkness, artificial lighting, etc., without any change in characteristics.

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## RECOMMENDED CIRCUIT VALUES FOR OPERATING G10/241E AT SPEEDS UP TO 5 Kc/s

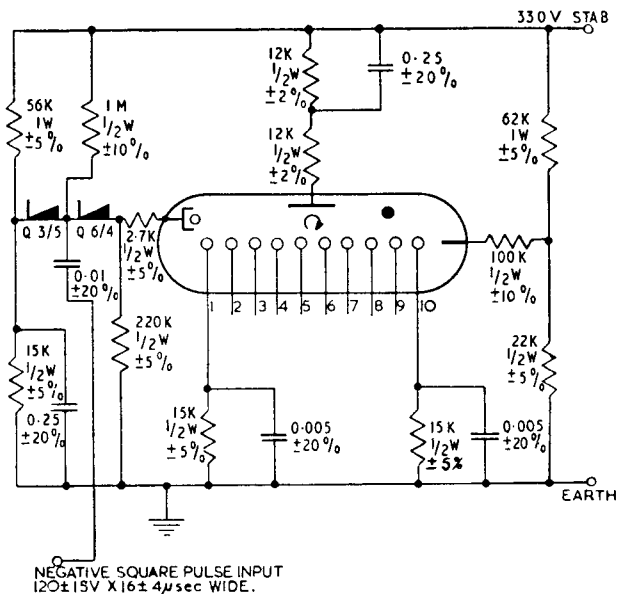
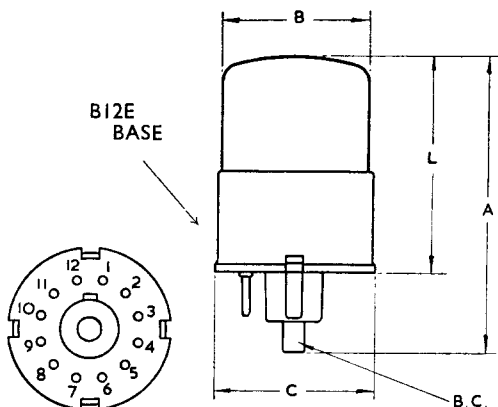


FIG. 1



# Unidirectional Cold-Cathode Gas-Filled Decade Counter

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BASING ARRANGEMENT			
PIN No.	ELECTRODE	PIN No.	ELECTRODE
1	SHIELD	7	CATHODE 5
2	CATHODE 0	8	" 4
3	"	9	" 3
4	"	8	10 " 2
5	"	7	11 " 1
6	"	6	12 TRANSFER.
B.C. ANODE.			

DIM.	MILLIMETRES	INCHES
A	77.8 MAX.	3 <sup>1</sup> / <sub>16</sub> MAX.
B	41.0 MAX.	1.61 MAX.
C	43.7 MAX.	1 <sup>23</sup> / <sub>32</sub> MAX.
L	50.8 MAX.	2 MAX.

NOTE: BASIC FIGURES ARE INCHES.