

DECADE SELECTOR AND COUNTING TUBE

Z504S

QUICK REFERENCE DATA

Short construction, bi-directional cold cathode, 10 output selector tube with neon type glow.

Maximum counting speed	5.0	kc/s
Supply voltage	475	V
Output		
voltage	35	V
current	340	μ A
Indication	Self indicating	

No individual adjustment is necessary to align the bulb with the escutcheon.

This data should be read in conjunction with OPERATING NOTES - STEPPING TUBES which precede this section of the handbook.

CHARACTERISTICS AND RANGE VALUES FOR EQUIPMENT DESIGN (at an ambient temperature between 10° and 50°C unless otherwise stated.)

The values given state the range over which the tube will operate both initially and during life. No allowance has been made for supply voltage and component variations.

All voltages are referred to the most positive supply voltage to which any main cathode (not guide cathode) is returned.

IGNITION REQUIREMENTS

Anode supply voltage range $V_{a(b)}$ 375 to 1000 V

Minimum time constant of rise
of anode supply voltage (see note 1)

$V_{a(b)} < 550V$	1.0	ms
$V_{a(b)} \geq 550V$	6.0	ms

DISCHARGE AT REST ON A MAIN CATHODE

Maintaining voltage of anode to
main cathode (see curve on page C1)
($I_a = 340\mu A$, $V_{GDB} = +25$ to $+50V$)

Typical maximum	205	V
Typical minimum	185	V
Main cathode current		
maximum (except during reset)	525	μA
minimum	250	μA
recommended	340	μA
Positive guide supply voltage V_{GDB}		
maximum	60	V
minimum	25	V
Maximum resistance between guides and guide supply	220	k Ω
Main cathode potential (except during reset)		
Non-conducting cathode		
maximum negative voltage	14	V
Conducting cathode		
maximum positive voltage (see note 2)	V_{GDB} minus 10	V
maximum negative voltage	0	V

STEPPING REQUIREMENTS

This section should be considered in conjunction with the figures given on pages D7 and D8.

Minimum discharge dwell time		
Main cathode	75	μs
guide A cathode	60	μs
guide B cathode	60	μs
Maximum interval between trailing edge of guide A pulse and leading edge of guide B pulse (double rectangular pulse drive)	3.0	μs



DECADE SELECTOR AND COUNTING TUBE

Z504S

Negative guide voltage to step the discharge from a main cathode to an adjacent guide cathode.

maximum	140 minus V_{GDB}	V
minimum	45	V

Voltage difference required between a guide cathode and the adjacent guide cathode in order to step the discharge.

maximum	140	V
minimum (see note 3)	45	V

Positive guide supply voltage to step the discharge from a guide cathode to the next cathode.

maximum	50	V
minimum	25	V

Main cathode potential

Non-conducting cathodes

maximum negative voltage	14	V
--------------------------	----	---

Conducting cathode

maximum positive voltage		
(see note 2)	V_{GDB} minus 10	V
maximum negative voltage	0	V

RESETTING REQUIREMENTS

	Reset to Cathodes	
	(7, 8, 9, 0, 1, 2, 3)	(4, 5, 6)
Maximum permitted negative		
main cathode voltage	240	140
Minimum negative main cathode		
voltage		
pulse duration $>1.0\text{ms}$	120	120 (see note 4)
pulse duration $\geq 200\mu\text{s}$	130	-
Minimum pulse duration h	200	-
Maximum reset cathode		
current (see note 5)	800	650



With this tube an average failure rate of less than 0.5%/1000 hours has been obtained. When operated continuously this failure rate applies for a period in excess of 25000 hours, but the visual read-out may be impaired after the first 15000 hours.

These figures have been obtained under the following typical conditions

Anode current	340	μA
Positive guide supply voltage	40	V
Negative guide voltage for transfer	80	V
Output cathode (K_0) voltage		
Non-conducting	-12	V
Conducting	0	V
Guide A dwell time	110	μs
Guide B dwell time	250 to 650	μs
Counting speed	0.2 p.p.h. to 500	p.p.s.
Temperature	$20 \pm 5^\circ\text{C}$	

A typical tube can be expected to count correctly with the above conditions after standing on one main cathode for a period of approximately 4500 hours.

ABSOLUTE MAXIMUM RATINGS

Maximum continuous main cathode current (except during reset)	525	μA
Maximum reset cathode current (cathodes 7, 8, 9, 0, 1, 2, 3)	800	μA
(cathodes 4, 5, 6)	650	μA
Maximum voltage between any two main or guide cathodes (except during reset)	140	V
Maximum positive guide supply voltage	60	V
Maximum ambient temperature for operation and standby (see note 6)	50	$^\circ\text{C}$

DECADE SELECTOR AND COUNTING TUBE

Z504S

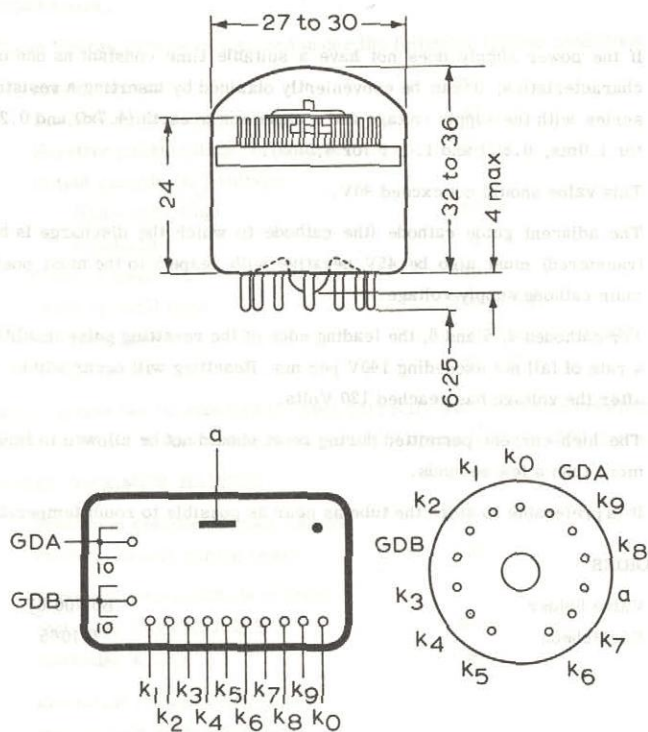
NOTES

1. If the power supply does not have a suitable time constant as one of its characteristics, it can be conveniently obtained by inserting a resistor in series with the supply voltage and a capacitor to earth ($4.7k\Omega$ and $0.25\mu F$ for 1.0ms, $6.8k\Omega$ and $1.0\mu F$ for 6.0ms).
2. This value should not exceed 40V.
3. The adjacent guide cathode (the cathode to which the discharge is being transferred) must also be 45V negative with respect to the most positive main cathode supply voltage.
4. For cathodes 4, 5 and 6, the leading edge of the resetting pulse should have a rate of fall not exceeding 140V per ms. Resetting will occur within 1ms after the voltage has reached 120 Volts.
5. The high current permitted during reset should not be allowed to flow for more than a few seconds.
6. It is preferable to store the tube as near as possible to room temperature.

ACCESSORIES

Valve holder
Escutcheon

B8 700 67
101065

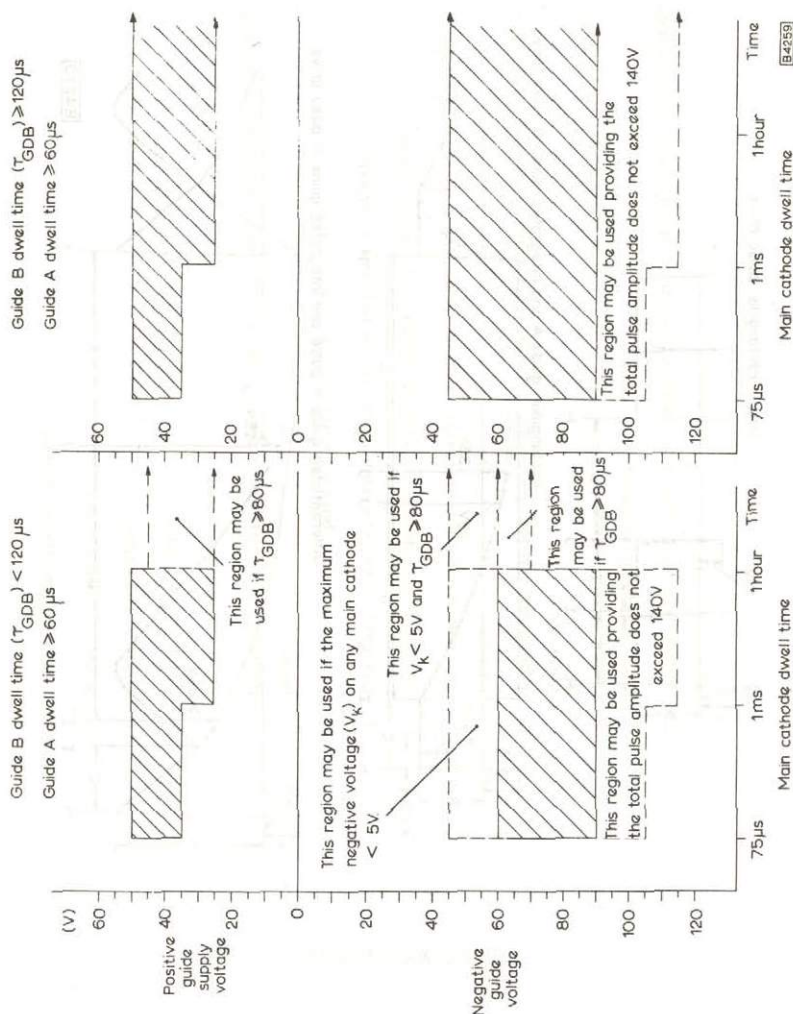


BI3B Base

All dimensions in mm

k_0 is aligned with pin 7 to within $\pm 3^\circ$

9129



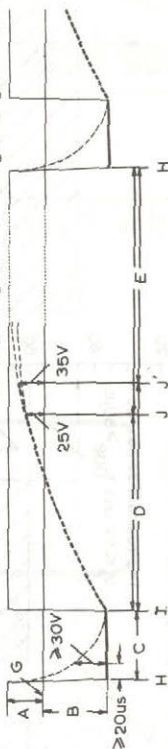
GUIDE OPERATING VOLTAGES

The shaded areas represent regions where the tube may be used without restriction initially and during life

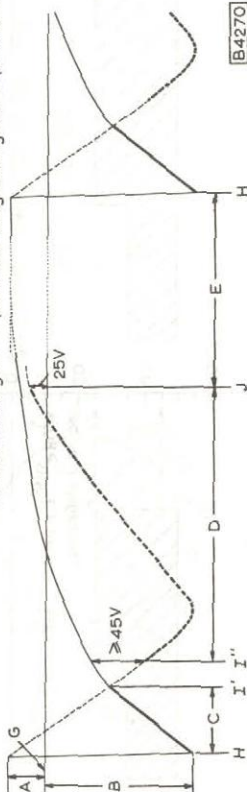
Double rectangular pulse drive



Rectangular guide A and integrated guide B pulse drive



Differentiated guide A pulse and integrated guide B pulse drive



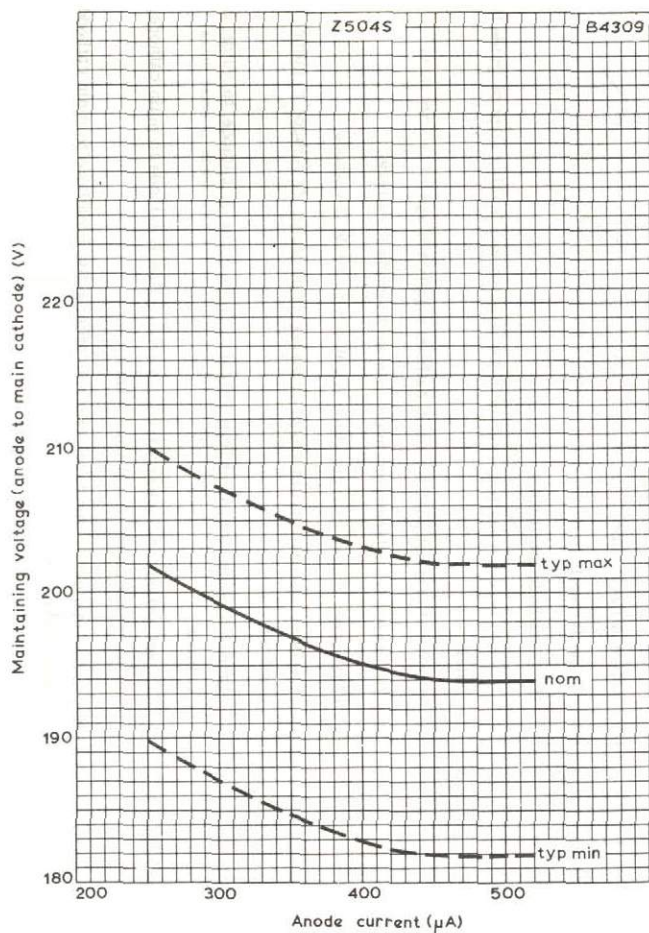
B4270

GUIDE WAVEFORMS

DECADE SELECTOR AND COUNTING TUBE

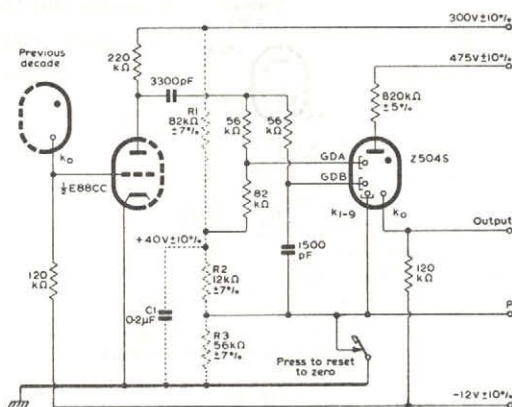
Z504S

- A Positive guide supply voltage
- B Negative guide voltage
- C Guide A dwell time
- D Guide B dwell time
- E Main cathode dwell time
- F Interval between trailing edge of guide A pulse and leading edge of guide B pulse
- G Potential of most positive main cathode supply voltage
- H Discharge transfers from main cathode to guide A cathode
- I Discharge transfers from guide A cathode to guide B cathode
- I' Earliest instant for discharge transfer from guide A cathode to guide B cathode
- I'' Latest instant for discharge transfer from guide A cathode to guide B cathode
- J Latest instant for discharge transfer from guide B cathode to main cathode, for a main cathode dwell time $> 1\text{ms}$
- J' Latest instant for discharge transfer from guide B cathode to main cathode dwell time $\leq 1\text{ms}$



ANODE TO MAIN CATHODE MAINTAINING VOLTAGE PLOTTED
AGAINST ANODE CURRENT

APPLICATION DATA



All components $\pm 10\%$ unless otherwise stated

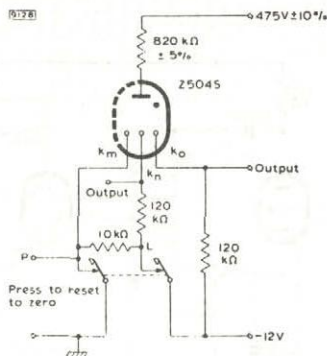
9131

Fig. 1

Coupling stage suitable for use with Z504S

The potential divider R1, R2, R3 and C1 is used to define the positive guide bias and the reset voltages. The potential divider may be used as a common supply for up to five further coupling stages.

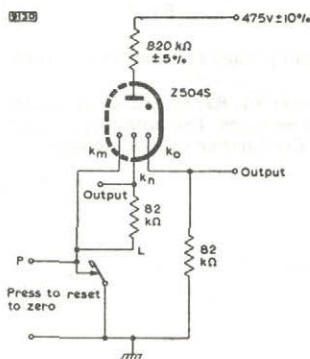
Two circuits illustrating alternative methods of connecting the main cathodes of Z504S are shown in figure 2.



All components $\pm 10\%$ unless otherwise stated

Fig. 2a

This circuit gives an output of 35V from k_0 and outputs of 35V from each of the cathodes in group k_n .



All components $\pm 10\%$ unless otherwise stated

Fig. 2b

This circuit gives an output of 23V from k_0 and outputs of 23V from each of the cathodes in group k_n . This circuit cannot be directly coupled to the coupling stage in figure 1.

In the two circuits in figure 2, k_m refers to the main cathodes from which no output is required, whilst k_n refers to the main cathodes, excepting k_0 from which an output pulse is required. Each cathode in the k_n group must be connected to point L via a separate resistor.