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<td>CS</td>
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<tr>
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<td>RF</td>
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<td>Trigger Tubes</td>
<td>TR</td>
</tr>
<tr>
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<tr>
<td>Down Switching Tubes</td>
<td>RC</td>
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<td>Circuits</td>
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*DEKATRON and DIGITRON are registered Trade Marks of Ericsson Telephones Limited.*

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**Tube Division**

Beepton Nottingham

Telephone Nottingham 254831

Head Office: 22 LINCOLN'S INN FIELDS LONDON WC2

Tube Division Publication B573

Issue 3

Printed by J. W. Ruddock & Sons Ltd., England
ELECTRONIC TUBES,

ELECTROLUMINESCENT DEVICES

AND PHOTOCONDUCTIVE CELLS

DEKATRONS,
DIGITRONS, PHOSPHOTRONS,
PHOSPHOLITES, PHOTACTORS,
REGISTER TUBES,
TRIGGER TUBES,
REFERENCE STABILIZER TUBES,
MIMIC DIAGRAMS and
PHOTOCONDUCTIVE CELLS.

PRICE LIST (NETT)

REVISED 1st. SEPTEMBER 1964

Ericsson Telephones Ltd.
Etelco Limited
Tube and Physics Division
Beeston, Nottingham
England
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**REFERENCE AND STABILIZER TUBES**

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<td>GD90M</td>
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**REED RELAY INSERTS**

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**MAINTENANCE TUBES**

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‡ Data available on request
MAINTENANCE TUBES (continued)

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INDICATOR SHIELDS FOR USE WITH DEKATRONS

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<td>(not subject to discount)</td>
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<tr>
<td>N78211 (Bakelite 0-9)</td>
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<tr>
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RETAINING CLIP FOR USE WITH TROCHOTRONS

HFD13441 2/3 For use with VS10G, VS10H and VS10K

ESCUTCHEON UNITS FOR USE WITH SIDE VIEWING DIGITRONS

| HFD13502  | 2 tube £2. 2.6 |
| HFD13503  | 3 tube £2.10.0  |
| HFD13504  | 4 tube £3. 2.6  |
| HFD13505  | 5 tube £3.12.6  | For use with Digitron GR10J |
## TUBE SOCKETS

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### PHOSPHOLITE PANELS

Plain Rectangular Forms

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<td>Less than 6 sq. ins.</td>
<td>20/- + 2/- per sq. in.</td>
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<tr>
<td>Up to 100 sq. ins.</td>
<td>10/- + 2/- per sq. in.</td>
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</table>

No side dimension greater than 10 ins.

---

### CIRCULAR FORMS OR PANELS WITH HOLES

| Less than 6 sq. ins. | 40/- + 2/- per sq. in. + 2/- per hole |
| Up to 100 sq. ins. | 30/- + 2/- per sq. in. + 2/- per hole |

No side dimension greater than 10 ins.

---

★ Registered Trade Mark
# PHOSPHOTRON DISPLAY PANELS

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## STATIC INVERTERS

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<td>LJEQ3</td>
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<td>LJEQF (Filter Unit for above Inverters)</td>
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## CADMIUM SULPHIDE PHOTOCELLS

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## MIMIC DIAGRAMS

**SPECIAL ELECTROLUMINESCENT LAMP UNITS**

**SPECIAL PHOTACTORS**

**SPECIAL CADMIUM SELENIDE CELLS**

These are produced to customers requirements. We shall be pleased to advise or quote against your specification.
COLD-CATHODE TUBES

TABLE OF EQUIVALENTS

SEPTEMBER 1964

ERICSSON TELEPHONES LIMITED
ETELCO LTD.
## TUBE EQUIVALENTS

### Voltage Stabilizers and Reference Tubes

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### Trigger Tubes

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GENERAL INFORMATION

INDEX

Nomenclature
General Tube Index
Escutcheons
Recommended Components
Nomenclature

All tube types are denoted by a group of letters, followed by a number and a final letter. The first letter gives a general description of the tube, i.e., G = Gas-filled, V = Vacuum.

The second letter, or group of letters, indicates the class of tube.

Thus:—

Diode = D
Triode = T or TR
Tetrode = TE
Pentode = PE
Counter = C
Selector = S
Register = R

The number that follows these letters refers to a significant characteristic of the tube. For example, in counters, selectors and registers it indicates the number of index cathodes; in diodes and voltage stabilizers, the running voltage; and in trigger tubes, the nominal striking voltage of the trigger electrode.

Where a counter has more than one cathode brought out to its individual pin on the tube base, a second figure separated from the first by an oblique stroke indicates the number of these cathodes, e.g., GC10/4B.

The next letter indicates the method of connection to the external circuit and also gives the order of development.

Phenolic Bases = A-F
Glass Button Bases = G-T
Wire-ended = W-Z

The suffix /M applies to Trochotron Beam Switching Tubes provided with magnetic shielding.

The suffix R applies to tubes tested for resistance to vibration and shock.

Tubes tested to Services specifications are coded with the suffix /S.
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Digitron Escutcheon Unit

GI-2-1 ISSUE 4
Escutcheons

Escutcheons numbered 0—9 and 0—11 are available in the sizes given below. With the exception of N.78211 which is moulded in black bakelite and numbered 0—9, they are made of brass with a matt black tropical finish. The numerals are silk screen printed in white.

CODE N78211 numbered 0—9

CODE N79368 numbered 0—9

CODE N79369 numbered 0—11

CODE N80977 numbered 0—9
(Used for duodecimal tabs)

CODE N84538 numbered 0—11

CODE N84338 numbered 0—9
(Used for GG10 2P)
*DIGITRON ESCUTCHEON
UNIT KITS

Escutcheon unit kits are available for use with 30 mm. character height, side-viewing, DIGITRON tubes, in sizes accommodating 2 to 5 tubes. Each kit consists of mounting brackets, valve holders, two end plates, a clear red perspex window, a cream moulded escutcheon and the appropriate number of 6BA screws and nuts. The mounting brackets and end plates are finished matt black.

The kits are supplied with all the necessary components, but without tubes, under the following codes.

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<td>5</td>
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</table>

*Registered Trade Mark
Recommended Components and Tube Equivalents

The following information has been compiled to assist users of our tubes in choosing the correct components for the circuits given in this Technical Handbook. We believe that the information given here will be of particular use to our overseas customers.

Components

Q3/3 Selenium Diode manufactured by:—
Standard Telephones and Cables Ltd.
Rectifier Division
Harlow, Essex

P50A Germanium Junction Photo-Cell is also manufactured by S.T.C. Ltd.

GEX 55/1 Crystal Diode manufactured by:—
G.E.C.
Valve and Electronics Department
Magnet House, Kingsway
London, W.C.2

OA202 Mullard Limited
Mullard House
Torrington Place
London, W.C.1

Tube Sockets

B12E (Duodecal plus bottom cap connector) Manufactured by:—

(a) The McMurdo Instrument Co. Ltd.
Victoria Works
Ashstead, Surrey

(Manufacturer’s reference X12E/Mk. 2 and X12ER/Mk. 2)

(b) Siemens Edison Swan Ltd.
Brantwood Road
Tottenham, London, N.17

(Manufacturer’s reference VH 34/1201)
Recommended Components and Tube Equivalents

Tube Sockets

B12E with two sub-miniature contacts for GS12D tube

Manufactured by:—
Siemens Edison Swan Ltd.
(Manufacturer’s reference VH 39/15)

B17A

Manufacturer’s reference VH 26/1703
E.T.L. code HFD 13045

Printed Circuit Type

E.T.L. code HFD 13534

B27A

Manufacturer’s reference VH 26/2701
E.T.L. code N890858A

B17A  Socket Mounting Position

Tube Equivalents

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<th>COMMERCIAL CODE</th>
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# VOLTAGE STABILIZERS

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VOLTAGE STABILIZERS

These tubes are gas-filled diodes, with a voltage drop between anode and cathode which is, within its working range, relatively independent of the current flowing. They are connected in parallel with the load to be stabilized, with a series resistor common to both load and stabilizer tube.

Before the tube strikes, the voltage on its anode will be some fraction of the supply voltage determined by the ratio of the series resistor and the effective load resistance. When this latter resistance is a minimum, i.e., in the condition for maximum load current, the choice of series resistor for a given supply voltage may be limited by the necessity for sufficient anode voltage to ensure take-over initially. Once the discharge is established, circuit values are chosen to keep the stabilizer anode current within the minimum and maximum ratings.
Primed Voltage Stabilizer

Limit Ratings

Minimum anode current 2 mA
Maximum anode current 10 mA
Minimum anode supply voltage when primer is connected as (1) below 110 V
(2) below 125 V

Primer Connections

1. To +150 V via 270 kΩ, or any other arrangement causing the primer current to be between 150 and 500 μA.
2. Through 3.3 kΩ to the main anode.

Characteristics

Running voltage at 5 mA 90—100 V
Maximum change in $V_R$ for a current change from 2 to 10 mA 5 V
Impedance 350 Ω
Primer striking volts 125 V
Primer $V_R$ before anode take-over 108 V
Maximum noise within the working range 15 mV r.m.s.
Noise at 2 mA Approx. 350 μV r.m.s.
**GTR 95 M/S**

(CV.286)

**Primed Voltage Stabilizer**

**Mechanical Data**

Mounting position
Weight
Base

Any
7.1 g (nominal)
B7G

Base Connections
(underside view)

Pin 1: Cathode
Pin 2: Primer
Pin 3: Anode

4
5
6
7

1

**Dimensions**

54 mm MAX
2.13°

47.5 mm
1.87°

19 mm
73° MAX

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ENGLAND

ISSUE 2
Limit Ratings

Minimum anode current 2 mA
Maximum anode current 20 mA
Minimum anode supply voltage when primer is connected as (1) below 170 V
(2) below 200 V

Primer connections

1. To +240 V via 270 kΩ, or any other arrangement causing the primer current to be between 300 and 500 μA.
2. Through 68 kΩ to the main anode.

Characteristics

Running voltage at 10 mA 145—160 V
Maximum change in running voltage for a current change from 2 to 20 mA 5 V
Impedance 350 Ω
Primer striking volts 200 V
Primer $V_R$ before anode take-over 150 V
Maximum noise within the working range 15 mV r.m.s.
Noise at 2 mA Approx. 550 μV r.m.s.
GTR150 M/S
(CV.287)

Primed Voltage Stabilizer

Mechanical Data

Mounting position
Any

Weight
8.2 g (nominal)

Base
B7G

Base Connections
(underside view)

Pin 1
2
3
4
5
6
7

Cathode
Primer
Anode

Diagram:

54 mm MAX
2.13"

47.5 mm
1.87"

19 mm
0.75 MAX
Voltage Stabilizer

Limit Ratings

Minimum anode current 5 mA
Maximum anode current 40 mA
Minimum anode supply voltage 180 V

N.B.—Equilibrium conditions are reached after operation for 3 minutes.

Characteristics

Minimum running voltage at 5 mA 145 V
Maximum running voltage at 40 mA 162 V
Maximum change in $V_R$ for a current change of 5 to 40 mA 5.5 V
Impedance 250 Ω
Maximum noise within working range 10 mV r.m.s.
Noise at 30 mA 180 μV r.m.s. (nom.)
GD150 A/S
(CV.216)

Voltage Stabilizer

Mechanical Data

Mounting position
Weight
Base

Any
35 g (nominal)
I.O.

Base Connections
(underside view)

Pin 1 —
2 Cathode
3 Internally connected to pin 7
4 —
5 Anode
6 —
7 Internally connected to pin 3
8 —

Diagram of the stabilizer showing pin connections and dimensions.
Voltage Stabilizer

Limit Ratings

Minimum anode current 5 mA
Maximum anode current 30 mA
Minimum anode supply voltage 180 V

Characteristics

Minimum running voltage at 5 mA 142 V
Maximum running voltage at 30 mA 165 V
Maximum change in $V_R$ over a range of 5 to 30 mA 6 V
Maximum noise within the working range 5 mV r.m.s.
GD 150 M/S
(CV.1832)

Voltage Stabilizer

Mechanical Data

Mounting position
Weight
Base

Any
10 g (nominal)
B7G

Base Connections
(underside view)

Pin 1 Anode
2 Cathode
3 Do not connect
4 Cathode
5 Anode
6 Do not connect
7 Cathode

Pin 1: 15
Pin 2: 247

Dimensions:

60.2 mm
2375 MAX

19 mm
-7.5 MAX

66.7 mm
2625 MAX

19 mm
Voltage Stabilizer

GD150 M

Limit Ratings

Minimum anode current 5 mA
Maximum anode current 30 mA
Minimum anode supply voltage 180 V

Characteristics

Minimum running voltage at 5 mA 143 V
Running voltage at 15 mA 145—155 V
Maximum running voltage at 30 mA 156 V
Maximum change in $V_R$ over a range of 5 to 30 mA 5 V
Maximum noise within the working range 5 mV r.m.s.

N.B. ← Indicates a change from previous data sheets
**GD150M**

**Voltage Stabilizer**

**Mechanical Data**

- Mounting position: Any
- Weight: 10 g (nominal)
- Base: B7G

**Base Connections**

(underside view)

- Pin 1: Anode
- Pin 2: Cathode
- Pin 3: Do not connect
- Pin 4: Cathode
- Pin 5: Anode
- Pin 6: Do not connect
- Pin 7: Cathode

**Dimensions**

- 60.2 mm
- 23.75 mm MAX
- 66.7 mm
- 2.625 mm MAX
- 19 mm
- 0.75 mm MAX
Voltage Stabilizer

Limit Ratings

Minimum anode current 1 mA
Maximum anode current 40 mA
Maximum striking voltage (normal room illumination) 115 V
Maximum ambient temperature limits $-55^\circ$ to $+90^\circ$C

Characteristics

Running voltage at 20 mA 86—94 V
Maximum change in $V_R$ for a current change from 1 to 40 mA 14 V
Incremental resistance at 20 mA 350 $\Omega$ nom.

N.B.—Equilibrium conditions are reached after three minutes operation.
GD 90 M

Voltage Stabilizer

Mechanical Data

Mounting Position

Base

Any

B7G

Base Connections
(underside view)

Pin 1 Anode
Pin 2 Cathode
Pin 3 Do not connect
Pin 4 Cathode
Pin 5 Anode
Pin 6 Do not connect
Pin 7 Cathode

Dimensions:

- Diameter: 19 mm (0.748"
- Height: 54 mm (2.125"
- Anode length: 47.5 mm (1.870"

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TELEFUNKEN-ENGLAND
Voltage Stabilizer

Limit Ratings

Minimum anode current 2 mA  
Maximum anode current 60 mA  
Maximum striking voltage (light or dark) 115 V  
Maximum negative anode voltage 50 V  
Bulb temperature limits $-55^\circ$ to $+90^\circ$ C  
Maximum storage temperature $+70^\circ$ C  

Characteristics

Running voltage at 30 mA 75—81 V  
Maximum change in $V_R$ for a current change from 2 to 60 mA 8 V  
Typical incremental resistance over a current range of 10—60 mA 130 $\Omega$  

N.B.—Equilibrium conditions are reached after three minutes operation.
GD 75 P

Voltage Stabilizer

Mechanical Data

Mounting position
Base

Any
B7G

Base Connections
(underside view)

Pin 1: Anode
Pin 2: Cathode
Pin 3: Do not connect
Pin 4: ""
Pin 5: ""
Pin 6: ""
Pin 7: ""

Dimensions:
19 mm, .748" MAX.
54 mm, 2.125" MAX.
47.5 mm, 1.870" MAX.
Voltage Stabilizer

GD150P
(CV.2225)

Limit Ratings

Minimum anode current 5 mA
Maximum anode current 15 mA
Minimum anode supply voltage 180 V
(normal room illumination)
Ambient temperature limits $-55^\circ$ to $+90^\circ$C

Characteristics

Running voltage at 10 mA 145—154 V
Maximum change in $V_R$ over a range of 5 to 15 mA 5 V
Typical incremental resistance 250 $\Omega$
**GD150P (CV.2225)**

**Voltage Stabilizer**

**Mechanical Data**

Mounting position
Base

Base Connections (underside view)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Connection</th>
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<tbody>
<tr>
<td>1</td>
<td>Anode</td>
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<tr>
<td>2</td>
<td>Cathode</td>
</tr>
<tr>
<td>3</td>
<td>Do not connect</td>
</tr>
<tr>
<td>4</td>
<td>Do not connect</td>
</tr>
<tr>
<td>5</td>
<td>Do not connect</td>
</tr>
<tr>
<td>6</td>
<td>Do not connect</td>
</tr>
<tr>
<td>7</td>
<td>Do not connect</td>
</tr>
</tbody>
</table>

Any
B7G

---

1. **Length:** 19 mm (0.748 in) MAX.
2. **Height:** 54 mm (2.125 in) MAX.
3. **Base Diameter:** 47.5 mm (1.870 in) MAX.
Voltage Stabilizer

Limit Ratings

Minimum anode current 5 mA
Maximum anode current 30 mA
Minimum anode supply voltage to ensure striking (Light or dark) 127 V
Maximum negative anode voltage 75 V
Maximum starting current 75 mA
Ambient temperature limits for operation -55 to +90°C.

Characteristics

Minimum running voltage at 5 mA 105 V
Maximum running voltage at 30 mA 112 V
Maximum change in running voltage for a current change from 5 to 30 mA 3.5 V
Maximum noise over the range 50—5,000 c.p.s. for a current range of 30 to 5 mA 5 mV r.m.s.
Typical delay in striking. (In total darkness)
Supply Voltage 130 V 20 mS
Supply Voltage 170 V 5 mS
GDI08M (CV.1833) Voltage Stabilizer

Mechanical Data

Mounting position
Base

Any
B7G

Base Connections (underside view)

Pin 1 Anode
2 Cathode
3 Do not connect
4 Cathode
5 Anode
6 Do not connect
7 Cathode

Dimensions:
- 60.2 mm 2.37" MAX.
- 66.7 mm 2.63" MAX.
- 19 mm 0.75" MAX. DIA.
Voltage Stabilizer

Limit Ratings

Minimum anode current 2 mA
Maximum anode current 22 mA
Minimum anode supply voltage 110 V
(Primer connected to anode via 15kΩ)

Characteristics

Running voltage at 10 mA 70—80 V
Maximum change in VR over a range of 20 to 2 mA 6 V
Maximum noise over the range 50—5,000 c.p.s. for a current range of 20 to 2 mA 15 mV r.m.s.
GTR 75M
(CY.284)

Voltage Stabilizer

Mechanical Data

Mounting position
Base

Any
B7G

Base Connections
(underside view)

Pin 1
2 Cathode
3
4 Primer
5
6 Anode
7

19 mm.
.748" MAX.

54 mm.
2.125" MAX.

47.5 mm.
1.870" MAX.

ST-11-1
CORONA VOLTAGE STABILIZERS

INDEX

Tube Type

GD340W
GD350X
GD350Y
CORONA VOLTAGE STABILIZERS

The Va/la characteristic of a conventional voltage stabilizer tube has a sharp peak at a current of a few micro-amps. At this point the anode voltage reaches a maximum which is called the striking or ignition voltage.

In a corona stabilizer, this sharp peak is widened into a plateau extending from a few micro-amps to a few hundred micro-amps. Within these limits of current, the voltage dropped across the tube is almost constant.

At these currents, the cathode does not glow, but a diffuse corona discharge can be seen around the anode wire.

Corona voltage stabilizers are connected in the same manner as glow stabilizers, but the series and load resistances have much higher values. Two or more tubes can be connected in series when the stabilized voltage required is a multiple of the tube voltage.
Corona Voltage Stabilizer

Limit Ratings

Minimum tube current 3 µA
Maximum tube current 200 µA
Minimum supply voltage 420 V
Maximum capacity in parallel with tube 0.1 µF
Ambient operating temperature −30°C min. to +60°C max.
Temperature coefficient 0.03% per °C approx.

Characteristics

Running voltage at 12µA 330-360V
Maximum change in VR for a current change of 3 to 12 µA 2V
Maximum change in VR for a current change of 12 to 200 µA 5V
Maximum noise output over the working range over a band width of 50 c.p.s. to 100k c.p.s. 100 mV r.m.s.

N.B. Indicates a change from previous data sheets.
Mechanical Data

Mounting position

Any

Weight

6.7 g (nominal)

Base

Pinch foot with flying-leads

(Leads are 0.4 mm. dia. tinned wire)

Base Connections
(underside view)

CATHODE

ANODE

CATHODE

N.B.—To prevent damage to the tube, the leads should not be soldered or bent nearer than 5 mm. (¼") from the glass seal.
Corona Voltage Stabilizers

Limit Ratings

<table>
<thead>
<tr>
<th></th>
<th>GD350X</th>
<th>GD350Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum tube current</td>
<td>3 μA</td>
<td>3 μA</td>
</tr>
<tr>
<td>Maximum tube current</td>
<td>200 μA</td>
<td>200 μA</td>
</tr>
</tbody>
</table>

Characteristics

Running voltage at 12 μA

- GD350X: 341-359V (350V ± 2½%)  
- GD350Y: 333-367V (350V ± 5%)  

Maximum change in $V_R$ for a current change of 3-12 μA

- GD350X: 2V  
- GD350Y: 2V

Maximum change in $V_R$ for a current change of 12-200 μA

- GD350X: 5V  
- GD350Y: 5V

N.B. ← Indicates a change from previous data sheets.
Mechanical Data

Mounting position
Weight
Base

Any
6.7 g. (nominal)
Pinch foot with flying-leads
(Leads are 0.4 mm. dia. tinned wire)

Base Connections
(underside view)

N.B.—To prevent damage to the tube, the leads should not be soldered or bent nearer than 5 mm. ($\frac{1}{4}$") to the glass seal.
### INDEX

<table>
<thead>
<tr>
<th>Tube Type</th>
<th>CV. Code</th>
</tr>
</thead>
<tbody>
<tr>
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<td>CV.2321</td>
</tr>
<tr>
<td>GD85M/S</td>
<td>CV.449 (OG3)</td>
</tr>
<tr>
<td></td>
<td>Issue 4</td>
</tr>
<tr>
<td>GD85M/R</td>
<td>—</td>
</tr>
<tr>
<td>GD85P/RS</td>
<td>CV.4048</td>
</tr>
<tr>
<td>GD85WR</td>
<td>—</td>
</tr>
<tr>
<td>GD83M</td>
<td>—</td>
</tr>
<tr>
<td>GD87M</td>
<td>CV.2573 (5651)</td>
</tr>
<tr>
<td>GTR83X</td>
<td>—</td>
</tr>
<tr>
<td>GTR83W</td>
<td>—</td>
</tr>
<tr>
<td>GTR150W</td>
<td>—</td>
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</tbody>
</table>
REFERENCE TUBES

Reference tubes are special stabilizers having running voltages which (at given currents) remain extremely constant throughout the life of the tubes.

The supply voltage must not be less than the striking voltage of the tube, and a series resistor is required to absorb the difference between the input voltage and the tube running voltage. This resistor should be chosen to pass the sum of the load current and the recommended tube current.

Where the load current can be neglected in comparison with the tube current, it can be shown that variations in the supply voltage are divided by a smoothing factor of

\[ \frac{V_s - V_o}{I_d r_d} + 1 \text{ when they appear across the tube} \]

\[ V_s = \text{Supply volts} \]
\[ V_o = \text{Output volts} \]
\[ I_d = \text{Tube current} \]
\[ r_d = \text{Tube impedance} \]

Therefore it follows that tubes which operate at a low current have a high smoothing factor. Because both the tube and the series resistor dissipate negligible power, the temperature change is very small, and this effect further improves the stability of the output voltage.

The maximum permissible variation of the supply is given by the product of the series resistor and the difference between the maximum and minimum tube currents.

Reliable-Ruggedized Types

One of the trends of modern electronic engineering is an increasing requirement for equipments which are both small and capable of operating under very difficult environmental conditions. Our contribution to this field is a range of sub-miniature reliable ruggedized reference tubes which are given exhaustive vibration tests. These tests comprise resonance search, vibration endurance and vibration fatigue. Two levels of severity of test are recognized, and these levels are shown in Fig. 1. The tubes passing the Level 1 tests are suitable for inclusion in equipment which is likely to encounter the most severe conditions, and requires the highest degree
REFERENCE TUBES

of reliability, i.e., G.W. applications. The tubes passing Level 2 are suitable for use in normally difficult environments such as Civil and Military Aircraft, Ship-borne equipment, or close proximity to vibrating machinery. The same standard of reliability can be expected for both Levels. We shall be pleased to advise customers as to suitability of tubes at other levels and vibration envelopes.

Fig. 1 Vibration Test Level Envelope
Limit Ratings

Minimum anode current 50 μA
Maximum anode current 1.0 mA
Maximum striking voltage (normal room illumination) 125 V
Temperature coefficient —5 mV per °C.
(over range 20-100°C.)

N.B.—Equilibrium conditions are reached after 90 seconds operation.

Characteristics

Running voltage at 500 μA 86 ± 1.5 V
Recommended current range when used as a reference tube 400 μA—1.0 mA
Impedance over range 400 μA—1.0 mA 5,500 Ω
Maximum noise generated by the tube over a band width of 50—5,000 c/s at 500 μA 220 μV r.m.s.
Maximum % variation of $V_R$ during the first 3,000 hours at 500 μA 2%
Typical drift of $V_R$ per 1,000 hours after the first 1,500 hours 0.09%

There is no step or discontinuity in the $I_a/E_a$ curve for currents greater than 400 μA.
Mechanical Data

Mounting position  Any
Weight  7.0 g (nominal)
Connections  Wire leads

The anode lead is taken from the end nearest the exhaust pip, and is marked with a red spot.

To prevent damage to the tube, the leads should not be soldered or bent nearer than 5 mm. (1/4") from the glass seal.
Miniature Reference Tube

Limit Rating

Minimum anode current 1.0 mA
Maximum anode current 10 mA
Maximum striking voltage (normal room lighting 5/50 ft. (candles) 115 V
Maximum temperature coefficient (over range +25 to +85°C) —3.5 mV/°C

Characteristics

Running voltage at 6.0 mA 85 ± 2 V
Regulation (5.8 to 6.2 mA) 0.18 V
Regulation (1.0 to 10 mA) 4.0 V
Maximum incremental resistance at 6.0 mA 450Ω
Maximum voltage jump (anode resistance 5kΩ, 1 to 10 mA) 100 mV peak
Maximum variation of running voltage during a life period of 1,000 hrs. at 6.0 mA 0.5%
Maximum variation of running voltage after the first 300 hrs. at 6.0 mA 0.2%
Minimum short term (100 hrs. max.) variation of running voltage after the first 200 hrs. at 6.0 mA 0.1%

N.B.—Equilibrium conditions are reached after three minutes' operation.
**Mechanical Data**

Mounting position
Base

Base Connections
(underside view)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anode</td>
</tr>
<tr>
<td>2</td>
<td>Cathode</td>
</tr>
<tr>
<td>3</td>
<td>Do not connect</td>
</tr>
<tr>
<td>4</td>
<td>Cathode</td>
</tr>
<tr>
<td>5</td>
<td>Anode</td>
</tr>
<tr>
<td>6</td>
<td>Do not connect</td>
</tr>
<tr>
<td>7</td>
<td>Cathode</td>
</tr>
</tbody>
</table>

Any
B7G

Dimensions:
- 47.5 mm (1.87") MAX.
- 54.5 mm (2.15") MAX.
- 19 mm (-.75") MAX.
Ruggedized Miniature Reference Tube

**Limit Rating**

- Minimum anode current: 1.0 mA
- Maximum anode current: 10 mA
- Maximum striking voltage (normal room lighting 5/50 ft. candles): 115 V
- Maximum temperature coefficient (over range +25 to +85°C): $-3.5 \text{ mV/}^\circ\text{C}$
- Maximum vibration (continuous operation): 2.5 g
- Maximum shock (short duration): 500 g

**Characteristics**

- Running voltage at 6.0 mA: $85 \pm 2 \text{ V}$
- Regulation (5.8 to 6.2 mA): 0.18 V
- Regulation (1.0 to 10 mA): 4.0 V
- Maximum incremental resistance at 6.0 mA: 450Ω
- Maximum voltage jump (anode resistance 5kΩ, 1 to 10 mA): 100 mV peak
- Vibration noise, 20-500 c.p.s. at 2.5 g: 5 mV r.m.s.
  - 500-2,000 c.p.s. at 2.5 g: 15 mV r.m.s.
- Maximum variation of running voltage during a life period of 1,000 hrs. at 6.0 mA: 0.5%
- Maximum variation of running voltage after the first 300 hrs. at 6.0 mA: 0.2%
- Maximum short term (100 hrs. max.) variation of running voltage after the first 300 hrs. at 6.0 mA: 0.1%
GD85 M/R

Ruggedized Miniature Reference Tube

Mechanical Data

Mounting position
Base

Any
B7G

Base Connections
(underside view)

Pin 1 Anode
2 Cathode
3 Do not connect
4 Cathode
5 Anode
6 Do not connect
7 Cathode

47.5 mm
1.87”
MAX.

54.5 mm
2.15”
MAX.

19 mm
.75”
MAX.
Limit Ratings

Minimum anode current  
Maximum anode current  
Maximum striking voltage (normal room lighting 5/50 ft. candles)  
Maximum temperature coefficient  
(over range —55°C to +25°C)  
(over range +25°C to +90°C)  
Maximum acceleration (continuous operation)  
Maximum shock (short duration)  

1·0 mA  
10 mA  
115 V  
—10 mV/°C  
—5 mV/°C  
2·5 g  
500 g

Characteristics

Running voltage at 6·0 mA  
Regulation (5·8 to 6·2 mA)  
(1·0 to 10 mA)  
Incremental resistance at 6 mA  
Maximum voltage jump (Anode resistance 5 kΩ. 1 to 10 mA)  
Maximum variation of running voltage at 6 mA  
During the first 300 hours  
During the subsequent 10,000 hours  
Typical drift of running voltage per 1,000 hours after the first 300 hours

85 ± 2 V  
0·18 V  
4·0 V  
450 Ω  
100 mV peak  
0·3%  
0·2%  
0·1%

N.B.—Equilibrium conditions are reached after three minutes operation at 6·0 mA.
TESTS

To be performed in addition to those applicable in K1001.

Test Conditions—unless otherwise specified.

<table>
<thead>
<tr>
<th>Va(b) (V)</th>
<th>R lim. (ohms)</th>
<th>Ia (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Note 1)</td>
<td>5K</td>
<td>6.0 (Note 2)</td>
</tr>
</tbody>
</table>

A d.c. voltage not exceeding 100 volts shall be applied between Anode and Cathode and shall be increased steadily at a rate not exceeding 25 volts/second until the valve strikes. The ripple content of the supply shall not exceed 0.25%.

After the valve has struck, the supply voltage shall be further increased until the anode current is 6.0 mA. It shall be maintained constant for 3 minutes before any characteristic, other than striking voltage, is measured.

<table>
<thead>
<tr>
<th>K1001</th>
<th>Test</th>
<th>Test Conditions</th>
<th>AQL %</th>
<th>Insp. Level</th>
<th>Symbol</th>
<th>Limits Min.</th>
<th>Limits Max.</th>
<th>Units</th>
<th>Notes</th>
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<tbody>
<tr>
<td>7-1</td>
<td>Glass Strain</td>
<td>No Voltages</td>
<td>6.5</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Group A</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Striking Voltage</td>
<td></td>
<td>100%</td>
<td>Va</td>
<td></td>
<td>115</td>
<td></td>
<td>V</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Maintaining Voltage</td>
<td></td>
<td>100%</td>
<td>Vb</td>
<td>83</td>
<td>87</td>
<td></td>
<td>V</td>
<td></td>
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</tbody>
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# Reliable-Miniature Reference Tube

## Tests (cont.)

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<thead>
<tr>
<th>K1001</th>
<th>Test</th>
<th>Test Conditions</th>
<th>AQL %</th>
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<th>Symbol</th>
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<th>Notes</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Regulation (1)</td>
<td>δ V a for change of I a from 5·8 to 6·2 mA</td>
<td>100%</td>
<td></td>
<td>0·18</td>
<td>V</td>
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<tr>
<td></td>
<td>Voltage Jumps</td>
<td>I a varied from 1·0 to 10·0 mA</td>
<td>100%</td>
<td></td>
<td>100</td>
<td>mV p/p</td>
<td>2</td>
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<tr>
<td></td>
<td></td>
<td>Ra = 500 ohms</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Oscillation</td>
<td>I a varied from 1·0 to 10·0 mA</td>
<td>100%</td>
<td></td>
<td>5</td>
<td>mV p/p</td>
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<tr>
<td></td>
<td></td>
<td>Ra = 500 ohms</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>Microphonic Noise</td>
<td>Ra = 500 ohms</td>
<td>100%</td>
<td></td>
<td>15</td>
<td>mV p/p</td>
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<tr>
<td></td>
<td>Leakage Current</td>
<td>Supply Voltage</td>
<td>100%</td>
<td></td>
<td>5</td>
<td>μA d.c.</td>
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<td></td>
<td></td>
<td>= 55 V d.c.</td>
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<td></td>
<td></td>
<td>Ra = 1 megohm</td>
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<td></td>
<td></td>
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<td>Test Conditions</td>
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<td>Insp. Level</td>
<td>Symbol</td>
<td>Limits Min.</td>
<td>Limits Max.</td>
<td>Units</td>
<td>Notes</td>
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<tr>
<td>Temperature Coefficient (1)</td>
<td>Temperature varied from $-55^\circ C$ to $+25^\circ C$</td>
<td>TA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3, 6</td>
<td></td>
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<tr>
<td>Temperature Coefficient (2)</td>
<td>Temperature varied from $+25^\circ C$ to $+90^\circ C$</td>
<td>TA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3, 6</td>
<td></td>
</tr>
<tr>
<td>Striking Voltage</td>
<td>Measure at Temperature $= -50^\circ C$</td>
<td>TA</td>
<td></td>
<td>115</td>
<td>V</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Regulation</td>
<td>$\delta$ Va for change of Ia from 1.0 to 10.0 mA Temperature $= + 90^\circ C$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3, 6</td>
<td></td>
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</table>
## Reliable-Miniature Reference Tube

### GD 85P/RS

(CV.4048)

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<th>AQL %</th>
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<th>Symbol</th>
<th>Limits</th>
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<th>Notes</th>
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</thead>
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<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td>Max.</td>
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<tr>
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<td>Group C</td>
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<td></td>
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<tr>
<td>Striking Voltage (Dark Strike)</td>
<td></td>
<td>2.5</td>
<td>I</td>
<td>Va</td>
<td>115</td>
<td>V</td>
<td>5</td>
</tr>
<tr>
<td>Regulation (2)</td>
<td>$\delta$ Va for change of $I_a$ from 1.0 to 10.0 mA</td>
<td>2.5</td>
<td>I</td>
<td></td>
<td>4.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Group D</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>7.2</td>
<td>Base Strain</td>
<td></td>
<td>6.5</td>
<td>IA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.2</td>
<td>Resonance Search (1)</td>
<td>No voltages</td>
<td></td>
<td>IC</td>
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<td>Ra = 27K Frequency = 25 to 500 c/s</td>
<td>2.5</td>
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<td>Post Fatigue Test</td>
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**Group E**

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<td>2.5</td>
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<td>Inoperatives</td>
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<tr>
<td></td>
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<td>0.5</td>
<td>100%</td>
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<td>V</td>
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<td></td>
<td>Regulation (1)</td>
<td>0.5</td>
<td>100%</td>
<td></td>
<td>0.18</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

\[ \delta V_a \text{ for change of } I_a \text{ from 5.8 to 6.2 mA} \]

---

**Notes:**

- **AIX/25**
  - Group F
  - Electrical Re-test after 28 days holding period.
  - Inoperatives
  - Striking Voltage
  - Maintaining Voltage
  - Regulation (1)
Reliable-Miniature Reference Tube

Notes

1. Test to be conducted in normal ambient room lighting (5/50 ft. candles).

2. A calibrated amplifier detector with C.R.T. indicator having a substantially linear response over the range 50/5000 c/s is to be connected between the anode and cathode. The anode current is to be varied slowly from 1.0—10.0 mA and back to 1.0 mA at least three times.

3. The tube voltage drop shall be measured at 10°C steps over the temperature range specified.

4. The valve shall be tapped and the noise shall not exceed the limit specified.

5. This test is to be conducted in total darkness after the valves have been held in total darkness for 24 hours.

6. In group B, the first two tests and the last test are under review. Limit figures for these tests will be supplied when known.
GD 85P/RS  
(CV.4048)  

Reliable-Miniature Reference Tube

Mechanical Data

Mounting Position
Base

Any
B7G

Base Connections  
(underside view)

Pin 1 Anode
2 Cathode
3 Do not connect
4 Cathode
5 Anode
6 Do not connect
7 Cathode

Dimensions:

- 47.5 mm / 1.87" MAX.
- 54.5 mm / 2.15" MAX.
- 19 mm / .75" MAX.
Ruggedized Sub-Miniature Voltage Reference Tube

Limit Ratings

Minimum anode current 0.5 mA
Maximum anode current 5.0 mA
Minimum supply voltage
(In total darkness or normal room illumination) 125 V
Maximum temperature coefficient
—60° to +25°C —10 mV/°C
+25° to +90°C —7 mV/°C
Maximum acceleration in accordance with B.S.G.100
—Vibration Grade 1.

Characteristics (at +25°C)

Running voltage at 1.5 mA 85 V + 3 V — 1 V
Regulation 1.2 to 2.0 mA 1 V
0.5 to 5.0 mA 5 V
Maximum noise over working range 2 mV p.p.
Vibration noise
(Acceleration 5g min. at 50 c.p.s.) 50 mV p.p. max.
Voltage Jumps 1.0 to 5.0 mA 5 mV pk. max.
0.5 to 1.0 mA 100 mV pk. max.
**Ruggedized Sub-Miniature Voltage Reference Tube**

**Mechanical Data**

**Mounting position**
- Any

**Base**
- B8D/F (4 wire flying-lead)

*N.B.*—Direct soldered connections to the leads must be at least 5 mm (¼") from the seal and any bending of the leads must be at least 1.5 mm (⅛") from the seal.

**Base Connections**
(underside view)

1. Cathode
2. Lead omitted
3. Anode
4. Lead omitted
5. Lead omitted
6. Cathode
7. Lead omitted
8. Anode

![Diagram of the base connections and the tube dimensions](image-url)
Low Noise
Miniature Reference Tube

Limit Ratings
Minimum anode current 3.5 mA
Maximum anode current 6.0 mA
Minimum anode supply voltage (Note 1) 130 V
Maximum negative anode voltage 50 V
Maximum starting current (Note 2) 10 mA
Maximum bulb temperature (Note 3)
During operation 150°C
During storage and standby 100°C

Characteristics (at preferred operating current of 4.5 mA)
(Note 4))
Initial values (measured at 25 to 30°C)
Running voltage 83.0 to 84.5 V
*Incremental resistance
  Maximum 350 Ω
  Minimum 110 Ω
*Maximum voltage jump (3.5—6.0 mA)
  1 mV
Typical r.m.s. noise voltage (30 c/s—10 kc/s) 100 μV
*Nominal temperature coefficient over the range
  25 to 120°C  (Note 6) —2.5 mV/°C
*See Note 5.

Life Performance
Typical variations of running voltage at 25°C over
the period indicated.
For continuous operation at 4.5 mA
  0—300 hours  0 to +0.35 V
  300—2,500 hours  0 to +0.2 V
  2,500—10,000 hours +0.05 to +0.35 V

For storage or standby, the variations that can be expected up to
3,000 hours are negligible.

Notes
(1) This value holds good over life, in light or dark. In total darkness an
ignition delay of up to 5 seconds may occur.
(2) To be restricted for long life to approximately 30 seconds once or twice
in each 8 hours use.
(3) During conduction the bulb temperature is approximately 20°C above
ambient temperature.
(4) Equilibrium conditions are reached within 1 minute.
(5) Information to date indicates that these values hold good with little or
no change over life.
(6) The characteristics curve connecting temperature coefficient and bulb
temperature is continuous and repeatable.
GD 83 M

Low Noise
Miniature Reference Tube

Mechanical Data

Mounting position

Base

Base Connections
(underside view)

Pin 1  Anode
2  Cathode
3
4
5  Do not connect
6
7

Any

B7G

19 mm
.748”
MAX.

54 mm
2.125”
MAX.

47.5 mm
1.870”
MAX.

RF-5-1
Miniature Voltage Reference Tube

GD 87M (CV.2573)

(5651)

Limit Ratings

- Minimum anode current: 1.5 mA
- Maximum anode current: 3.5 mA
- Maximum striking voltage (in either normal room illumination or in total darkness after 24 hours in the dark): 115 V

Characteristics

- Running voltage at 1.5 mA: 82 V min.
- Running voltage at 3.5 mA: 92 V max.
- Regulation (1.5 to 3.5 mA): 3.0 V max.
- Voltage jumps (1.5 to 3.5 mA): 100 mV max.
GD 87M (CV.2573) (5651) Miniature Voltage Reference Tube

Mechanical Data

Mounting position
Base

Any
B7G

Base Connections
(Underside view)

1 Anode
2 Cathode
3 Do not connect
4 Cathode
5 Anode
6 Do not connect
7 Cathode

1,5

2,4,7

475mm 187° MAX.
54.5mm 215° MAX.
19mm 75° MAX.
Primed Sub-Miniature Reference Tube

Limit Ratings

- Minimum anode current: 0.5 mA
- Maximum anode current: 2.5 mA
- Minimum anode supply voltage: 130 V
- Minimum primer supply voltage (Rp = 390 kΩ): 150 V

Characteristics

- Running voltage at 0.5 mA: 82–86 V
- *Regulation (0.5 — 2.5 mA): 4.5 V
- Jump noise (2.5 — 0.5 mA): 1 mV ptp. max.
- Anode takeover voltage (Vp 150 V, Rp 390 kΩ): 90 V max.

*The tube characteristics are reasonably linear between 0.5 and 2.5 mA providing that the primer is passing at least 150 μA.
GTR83X

Primed Sub-Miniature Reference Tube

Mechanical Data

Base

3 flying leads of 0.4 mm (0.0157") dia.
tinned copper

Anode lead is indicated by a red spot adjacent to the lead-out wire.

1. Anode
2. Cathode
3. Primer
Low Current
Primed Sub-Miniature Reference Tube

Limit Ratings

Minimum cathode current 50μA
Maximum cathode current 250μA
Minimum anode supply voltage:— (in light or dark)
  with primer not connected 135 V
  with primer passing 10μA 95 V
Minimum primer supply voltage 150 V
Maximum primer series resistance 5.6 MΩ

Characteristics

Running voltage at 50μA 82—86 V
*Maximum change in running voltage for a
  current change from 50μA to 250μA 5.0 V
Primer Running Volts 95 V nominal
Noise 1 mV p.t.p. max.

* The tube characteristic is linear and jump-free.

Recommended Operation

Primer connected via 2.7MΩ to anode supply rail
Supply volts > 150 V
Cathode current 100μA

Life

At 100μA, the maximum change in running voltage per 1,000 hours is 1%.
GTR83W
Low Current
Primed Sub-Miniature Reference Tube

Mechanical Data

Base
3 flying leads of 0.4 mm (0.0157") dia.
tinned copper

Anode lead is indicated by a blue spot adjacent to the lead-out wire.

1. Anode
2. Cathode
3. Primer
Primed Sub-Miniature Reference Tube

Limit Ratings

Minimum cathode current
Maximum cathode current
Minimum anode supply voltage:— (in light or dark)
  with primer not connected
  with primer passing 150μA
Maximum inverse voltage
Minimum primer supply voltage

500μA
2 mA
210 V
170 V
50 V
175 V

Characteristics

Running voltage at 1mA
Maximum change in running voltage for a current change from 500μA to 1.5 mA
Typical change in running voltage for a current change from 500μA to 2 mA
Primer Running Volts
Noise

145—150 V
3 V
4 V
135 V nominal
15 mV r.m.s. max.

Recommended Operation

Primer connected via 270kΩ either to anode or to anode supply rail.
Supply volts
Cathode current

> 175 V
1 mA

Life

At 1mA, the maximum change in running voltage per 1,000 hours is 1%.
Mechanical Data

Base

3 flying leads of 0.4 mm (-0.0157") dia.
tinned copper

Anode lead is indicated by a yellow spot adjacent to the lead-out wire.

1. Anode
2. Cathode
3. Primer
## TRIGGER TUBES

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TRIGGER TUBES

These tubes consist basically of two discharge gaps: from main anode (A) to main cathode (K), and from trigger (T) to main cathode (K). The tube geometry is such that the gap A—K has a substantially higher striking voltage than the shorter gap T—K. A fixed potential, less than the breakdown voltage of the main gap but greater than its running voltage, is applied between A and K through a resistor which prevents the anode current from exceeding the permitted maximum.

If, with the main gap connected as described, a potential greater than the trigger striking voltage is applied to the trigger (T), a small current will flow and cause the breakdown voltage of the main gap to fall below the applied voltage. Current then flows in the A—K circuit, setting up a self-sustaining discharge, and the T—K circuit can then be disconnected without affecting the main discharge.

The preferred method of using these tubes is to return the trigger through a high resistance to a potential just less than the trigger striking voltage. A fraction of a micro-amp. of current flows, and produces a voltage across the leak, so that the potential at the trigger electrode is slightly less than the fixed bias. The valve can then be fired by a small positive pulse a.c. coupled to the trigger electrode. The minimum pulse duration depends mainly on the availability of free electrons in the tube. These may be produced by cosmic rays, radio-active materials, light, or a subsidiary source of ionization.
Trigger Tetrode
Designed for Dekatron coupling circuits
and as a general purpose trigger tube

Limit Ratings
Maximum anode voltage to prevent self ignition in all tubes (trigger voltage + 173 V) +310 V
Minimum trigger voltage necessary to cause trigger breakdown in all tubes (anode voltage 300 V) +183 V
Maximum trigger voltage at which trigger breakdown will not occur in any tube (anode voltage 300 V) +173 V
During the first 3,000 hours of operating life the trigger breakdown voltage will not drift outside the limit ratings specified above.
Maximum trigger to anode voltage +200 V
Minimum trigger to cathode current necessary to cause transfer in all tubes (anode voltage 300 V) 100 µA
Minimum trigger to cathode current necessary to cause transfer in all tubes, with 100 pF capacitor between cathode and trigger (anode voltage 300 V) 8 µA
Maximum cathode current
Peak—maximum duration 20 µS 50 mA ←
—maximum duration 50 mS in 10 S 6 mA ←
D.C. 3.5 mA ←
Maximum speed of operation, determined by circuit conditions Approx. 1,000 c.p.s.

Characteristics
Anode running voltage at 2.5 mA 150 ± 5 V
Trigger running voltage 135 V nom.
Auxiliary cathode current (Aux. cathode returned to a minimum of —95 V via 10 MΩ) 25 µA nom.
De-ionization time 600 µS max.
Minimum current at which all tubes will remain conducting (Ra 470 kΩ) 200 µA

Recommended Operating Conditions
Anode supply voltage 280—310 V
Anode to cathode current 2.5 mA
Trigger bias with respect to cathode
   Trigger leak less than 470 kΩ 165 V max. ←
   Trigger leak greater than 470 kΩ 170 V max.
Minimum pulse required for operation (Pulse duration 100 µS) + 25 V

N.B. ← Indicates a change from previous data sheets.
GTE175M

Trigger Tetrode
Designed for Dekatron coupling circuits
and as a general purpose trigger tube

Mechanical Data

Mounting position
Any

Weight
6.5 g (nominal)

Base
B7G

Base Connections
(underside view)

Pin 1 Trigger T
2
3 Cathode K₁
4
5 Do not connect
6 Auxiliary cathode K₂
7 Main anode A

N.B.—This tube must not be enclosed in a metal screen or can.
Trigger Tetrode
Designed for Dekatron coupling circuits
and as a general purpose trigger tube

Notes on Operation

Rectangular pulses of at least 100 μS duration are applied via a 1,000 pF capacitor to the trigger, which is returned through 1MΩ to ±170 V bias. The tube will not fire with pulses of amplitude less than 5 V and will fire with pulses greater than 25 V.

To extinguish the main discharge, the anode-cathode potential must be reduced to below the running voltage (150 V) for a time dependent on the de-ionization characteristic.

Alternatively the tube may be extinguished by means of a capacitor in parallel with the A—K gap forming a self-quenching circuit. A typical example is the Cold Cathode coupling circuit used with the 4 kc/s Dekatron tubes.
Trigger Tetrode

Designed for Dekatron coupling circuits and as a general purpose trigger tube

Limits of Trigger Striking Voltage
Trigger Tetrode

Designed for Dekatron coupling circuits
and as a general purpose trigger tube

Typical Transfer Characteristic
Trigger Tetrode

Designed for Dekatron coupling circuits and as a general purpose trigger tube

Typical De-ionization Characteristic
Trigger Tube
An inexpensive sub-miniature tube especially designed for computer applications

Limit Ratings
- Maximum anode voltage to prevent self-ignition in all tubes (trigger voltage 0 V) +310 V
- Maximum trigger-cathode voltage at which breakdown will not occur in any tube
  Cathode 0, Trigger +110, Anode +310
  Cathode 0, Trigger —100, Anode +150
- Minimum trigger voltage necessary to cause breakdown in all tubes (anode voltage 290 V) +170 V
- Maximum cathode current 9 mA
- Minimum cathode current 3 mA

Characteristics
- Anode-Cathode running voltage at 4.5 mA 95-140 V
  (Tubes may exhibit jumps of up to 10 V in operation)
- Trigger-Cathode running voltage (R_T=220 kΩ)
  I_a=0 mA 63 V nominal ←
  I_a=4.5 mA 73 V nominal ←
- Trigger current required to cause the anode to take-over the discharge (anode voltage 290 V) 25 μA nominal ←
- De-ionization time 3 mS
- Ionization time (with trigger pulsed to +200 V) 90 μS max

Recommended Operating Conditions
- Anode supply voltage 180-310 V
- Cathode current 4.5 mA
- Trigger bias with respect to cathode
  (Trigger resistor 220 kΩ) 100 V
- Minimum trigger coupling capacitor
  (Trigger resistor exceeding 200 kΩ) 150 pF
- Minimum ambient illumination 5 ft. candles

N.B.—If tubes stand in the off condition for 150 hours or more, self-ignition may occur at anode voltages above 280, unless a current of 3 mA is passed through all tubes for at least 1 second before commencing normal operation of the circuit.

N.B. ← Indicates a change from previous data sheets.
GTR 120W

Trigger Tube
An inexpensive sub-miniature tube especially designed for computer applications

Mechanical Data

Mounting position
Any
Weight
2.2 g (nominal)
Base
3 flying leads of 0.35 mm. dia.
(28 s.w.g.) tinned copper

N.B.—It is recommended that the wires are not soldered or bent nearer than 10 mm. (1/4") from the glass.

Wires tinned to within 2.0 mm of glass.

Lead Wires
1—Anode
2—Trigger
3—Cathode

TR-2-1

ISSUE 3
Trigger Tube
An inexpensive sub-miniature tube especially designed for computer applications

Distribution of Trigger Striking Volts
Trigger Pentode

Primed trigger tube with two trigger electrodes suitable for use in bi-directional ring counters and in "OR" gates

Limit Ratings

Maximum anode voltage to prevent self ignition in all tubes (trigger voltage + 173 V) +310 V
Minimum trigger voltage necessary to cause either trigger to breakdown in all tubes (anode voltage 300 V) +183 V
Maximum trigger voltage at which trigger breakdown will not occur in any tube (anode voltage 300 V) +173 V

(During the first 3,000 hours of operating life the trigger breakdown voltage will not drift outside the limit ratings specified above.)

Maximum trigger to anode voltage +200 V
Minimum trigger to cathode current necessary to cause transfer in all tubes (anode voltage 300 V) 100 μA
Minimum trigger to cathode current necessary to cause transfer in all tubes, with 100 pF capacitor between cathode and trigger (anode voltage 300 V) 8 μA

Maximum cathode current
Peak—maximum duration 20 μS 50 mA
—maximum duration 50 μS in 10 S 6 mA
D.C. 3.5 mA

Maximum speed of operation, determined by circuit conditions Approx. 1,000 c.p.s.

Characteristics

Anode running voltage at 2.5 mA 150 ± 5 V
Trigger running voltage 135 V nom.
Auxiliary cathode current (Aux. cathode returned to a minimum of —95 V via 10 MΩ) 25 μA nom.
De-ionization time 600 μS max.
Minimum current at which all tubes will remain conducting (Ra 470 kΩ) 200 μA

Recommended Operating Conditions

Anode supply voltage 280—310 V
Anode to cathode current 2.5 mA
Trigger bias with respect to cathode
   Trigger resistor less than 470 kΩ 165 V max.
   Trigger resistor greater than 470 kΩ 170 V max.
Minimum pulse required for operation (Pulse duration 100 μS) +25 V
**GPE175M**

**Trigger Pentode**

Primed trigger tube with two trigger electrodes suitable for use in bi-directional ring counters and in “OR” gates

**Mechanical Data**

Mounting position
Weight
Base

Any
6.5 g (nominal)
B7G

**Base Connections**

(underside view)

Pin 1 Trigger T₁
2 Cathode K₁
3 Trigger T₂
4 Auxiliary cathode K₂
5 Main anode A

*N.B.—This tube must not be enclosed in a metal screen or can.*
Trigger Pentode

Primed trigger tube with two trigger electrodes suitable for use in bi-directional ring counters and in “OR” gates

Notes on Operation

Rectangular pulses of at least 100 μS duration are applied via a 1,000 pF capacitor to the triggers which are returned through 1 MΩ to +170 V bias. The tube will not fire with pulses of amplitude less than 5 V and will fire with pulses greater than 25 V.

To extinguish the main discharge, the anode-cathode potential must be reduced to below the running voltage (150 V) for a time dependent on the de-ionization characteristic. (600 μS minimum).

Alternatively the tube may be extinguished by means of a capacitor in parallel with the A-K gap forming a self-quenching circuit.

When the tube is not conducting, the triggers are isolated from each other, but when anode current flows, both triggers have a low impedance to cathode and to each other.

Typical bi-directional ring counter and coupling circuits are shown overleaf.
Trigger Pentode

Primed trigger tube with two trigger electrodes suitable for use in bi-directional ring counters and in "OR" gates

Four Stage Bi-directional Ring Counter using GPE175M tubes

Coupling Circuit for Bi-directional Counter LK163
Limit Ratings

Maximum anode voltage to prevent self ignition in all tubes  
+290 V

Maximum trigger to cathode voltage at which breakdown will not occur in any tube $V_a = 280$ V  
±128 V

Minimum trigger voltage necessary to cause breakdown in all tubes $V_a = 280$ V  
+137 V

Maximum increase in trigger striking volts when anode voltage is changed from 290 V to 170 V  
1.0%

Maximum peak positive trigger current (Note 1)  
8.0 mA

Maximum cathode current  
d.c.  
25 mA

Pea$k  
100 mA

Minimum auxiliary anode supply voltage  
150 V

Characteristics

Anode to cathode running volts (Note 2)  
105 V nom.

De-ionization time $I_k (pk)$  
0—20 mA  
3.5 mS nom.

20—100 mA  
(Note 3)  
12 mS nom.

Ionization time  
$V_T = V_{TS} + 0.5$ V  
2 mS nom.

$V_T = V_{TS} + 4.0$ V  
0.1 mS nom.

Trigger transfer characteristics

Current triggering

Trigger Current necessary for anode takeover, with no trigger capacitor ($V_a = 240$ V)  
25 μA

N.B. ← Indicates a change from previous data sheets.
Characteristics (cont.)

Capacitive triggering (High impedance source)
Minimum trigger capacitor to ensure anode take-over (Note 4)

\[
\begin{align*}
V_a &= 170 \text{ V} \quad 2,700 \text{ pf.} \\
V_a &= 200 \text{ V} \quad 1,000 \text{ pf.} \\
V_a &= 240 \text{ V} \quad 500 \text{ pf.}
\end{align*}
\]

Recommended Operating Conditions

Anode supply voltage 170—290 V
Auxiliary anode series resistor (Note 5) 10 MΩ

Notes

1. During anode conduction the trigger is held by the discharge at 90 V above the cathode potential and if the trigger input voltage is raised or lowered about this potential, trigger current will flow. In the condition where the voltage is below 90 V current flows in a reverse direction and the trigger acts as a cathode. This condition is harmful to the tube and in applications such as those where the anode and trigger are extinguished by relay contacts it is desirable to extinguish the main anode discharge before the trigger discharge. If the trigger supply voltage rises above 90 V the tube will not be affected, providing the resultant forward current is limited to the value stated.

2. Oscillations of up to 10 V pk to pk superimposed on the running voltage.

3. In self extinguishing circuits the deionization time is much shorter.

4. To limit the positive peak current a resistor of 2-2 kΩ is required for trigger capacitors between 4,700 and 15,000 pf., and a resistor of 5-6 kΩ for trigger capacitors of over 15,000 pf.

5. It is recommended that the auxiliary anode resistor is soldered direct to pin 6. Stray capacitance between the auxiliary anode and the cathode must be kept to a minimum.
Primed Trigger Tube
Close Tolerance Tube with stable characteristics intended for quadrant I operation

Mechanical Data
Mounting position
Base

Any
B9A

Base connections (underside view)

Pin 1 Main anode
2 Do not connect
3 Do not connect
4 Cathode
5 Cathode
6 Auxiliary anode
7 Cathode
8 Trigger
9 Trigger

Dimensions:
- 1.496" MAX. (38 mm)
- 1.772" MAX. (45 mm)
- .870" DIA. (22.2 mm)
Primed Sub-Miniature Trigger Tube

Limit Ratings

Maximum anode voltage to prevent self ignition in all tubes + 275 V
Minimum trigger voltage necessary to cause trigger breakdown in all tubes + 122 V
Maximum trigger voltage at which trigger breakdown will not occur in any tube + 114 V
Minimum primer supply voltage (light or dark, either positive or negative to cathode) 220 V
Preferred continuous cathode current 1—5 mA

A current of 0.5—1mA may be used if a rise of up to 10% in trigger striking voltage in 1,000 hours of conduction can be accommodated.

Pulse currents greater than 5mA are permitted. The manufacturers will be pleased to advise on specific cases.

Characteristics

Anode running voltage at 2mA 103—110 V
Trigger running voltage 95 V nominal
Primer current 8μA nominal

Primer connected to 250V via 10MΩ. The resistor must be wired directly to the lead, keeping stray capacitance to a minimum.

Typical trigger current at a voltage just less than the striking voltage 2 x 10⁻⁸ A

Minimum anode voltage to take-over the trigger discharge:—
(a) Iₜ = 30μA 200 V
(b) Cₜ = 470pF, Rₜ = 1MΩ 150 V

Ionization time, trigger pulsed to 5 V more positive than its striking voltage:—
(a) with primer conducting 100μS
(b) primer not connected 5mS

For short pulses, or slowly changing trigger voltage such as occurs in R.C. timers, the primer must be connected. For d.c. switching applications the primer is not required.
**Mechanical Data**

Base  
4 flying leads of 0.4 mm (0.0157") dia. tinned copper wire.

The spacing between primer and cathode leads is much less than the other two spacings.

1. Primer
2. Cathode
3. Anode
4. Trigger
## DEKATRON TUBES

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<tr>
<td>GC10D</td>
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<tr>
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<tr>
<td>GS12D</td>
<td>—</td>
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<td>GS10D</td>
<td>—</td>
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<td>GS10E</td>
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</tr>
<tr>
<td>GS10H</td>
<td>—</td>
</tr>
</tbody>
</table>

"Dekatron" is a Registered Trade Mark of Ericsson Telephones Limited.
DEKATRON TUBES

These are multi-electrode, gas-filled, cold-cathode, glow-transfer tubes used for the counting of electrical impulses and displaying the state of the count. The impulses may be produced by a wide variety of sources such as the closure of contacts, interruption of a light beam, tachometer generator, ionization chamber, etc. Dekatron tubes are also a convenient method of counting down from one frequency to another, or of measuring frequency by counting the number of cycles of a waveform which occur during a known time interval.

The Double-Pulse Dekatron Principle

A scale-of-10 Dekatron consists basically of 30 cold-cathode diodes in one envelope. The diode cathodes are rod shaped and arranged around a circular disc anode.

Ten of the electrodes are known as cathodes, ten as first guides, and ten as second guides. Nine of the cathodes are internally connected, the tenth, brought out to a separate connection in the base of the tube, is the output cathode. All the ten first guides are connected together as are the ten second guides. The cathodes, first guides and second guides are intermeshed in cyclic order. When a high potential (400—500 V) is applied to the tube, with a high resistance in the anode circuit to limit the current to a suitable value, one of the anode-cathode gaps is ionized and a “negative glow” around the particular cathode is visible through the dome of the envelope.

In the quiescent state the cathodes are at earth potential, and the first and second guides are biased positively. If the first guides are pulsed negatively the guide adjacent to the glowing cathode becomes ionized, and because the anode potential will tend to “follow” the potential of the most negative electrode, the glowing cathode is extinguished and the discharge transfers to the first guide. This process is repeated by making the second guides negative and returning the first guides to the positive bias. The glow discharge will then transfer from the first guide to the adjacent second guide. When the second guides are returned to the positive bias the glow will transfer to the next cathode which will then be negative with respect to the guides.

cont’d
DEKATRON TUBES

Therefore, by applying successive pairs of negative pulses to the first and second guides in that order, it is possible to transfer the glow discharge from cathode to cathode in a clockwise or additive direction. If the pulses be applied in the reverse order, the circulation is anticlockwise or subtractive.

The output cathode is connected to the earthed main cathode ring by a load resistor, and when the discharge invests this cathode, current will flow through the resistor, developing a positive voltage of 30 to 40 volts across it. This voltage can be used as a signal to indicate that the discharge has completed one revolution of the tube, and with suitable amplification it can be used to drive a further Dekatron.

Dekatron Computing Tubes

For multi-decade subtraction, the negative carry must take place on cathode 9 and the direction sensing circuits usually require at least one intermediate output. The computing tubes, therefore, besides being tested in both directions, have four individual cathodes A, B, C and D, brought out to pins on the valve base. The remaining cathodes are internally connected to the common ring which is wired to earth. The spacing of the output cathodes is so arranged that, by making the appropriate cathode act as zero, an output pulse can be obtained at any intermediate count. The method of connection is shown in the table on the relevant data sheet.

Dekatron Selector Tubes

These retain all the essentials of the Dekatron counting tubes whilst having the additional property of access to all the cathodes. The selector tubes have found many uses in frequency dividers, batching counters, generators of staircase waveforms, and in marking one selected lead from a group.

Single Pulse Dekatron Counters

Unlike other Dekatrons, these tubes require only a single pulse for each count. They are similar in appearance to double-pulse counters, but have three guide electrodes instead of two between successive cathodes.

cont'd
DEKATRON TUBES

The negative input pulses are applied via a high resistance to the first guides and directly to the second guides. These two groups of guides are normally biased positively with respect to the earthed cathodes. The cathodes are preceded by the third guides, which are connected to earth through a high resistance. The receipt of an input pulse transfers the glow from a cathode to a first guide, and the anode current by flowing through the first guide resistor, raises the voltage of the guide. When the potential difference between first and second guides is equal to the transfer voltage, the glow moves (auto-transfers) to the second guide, where it rests until the pulse voltage is removed. The return of the first and second guides to the positive bias potential moves the glow to the third guide, and again an auto-transfer takes place to the cathode, so completing one count. The rate of change of voltage on the guides is kept to a suitable figure by small capacitors in parallel with the auto-transfer resistors.

N.B.—Additional information on the use of Dekatron tubes is given in the following data sheets and in the Circuit Section.

LICENCE

The manufacture and use of "Dekatron" tubes is covered by one or more of the following United Kingdom Patents or applications:—

712,171  712,175  712,177  712,215
712,229  721,058  734,611  751,952
960,927  768,550  777,562  778,114
784,033  785,021  787,246  13961/58

These patents cover any circuit using cold-cathode ring counter tubes with guide electrodes. Purchasers of our tubes are granted a free licence to use any such circuits with "Dekatron" tubes.
Limit Ratings

Maximum counting rate: sine wave and rectangular pulses 4,000 p.p.s.
Maximum total anode current 550 µA
Minimum total anode current 250 µA
Minimum anode supply voltage (normal room illumination) 350 V
Maximum potential difference between guides and cathodes 140 V
Maximum output cathode load 150 kΩ
Maximum output pulse available with 150 kΩ cathode load resistor 35 V

Characteristics

Running voltage at 300 µA (GC10B/S) 191 ± 5 V

Recommended Operating Conditions

* Anode current 310 µA ± 20%
** Guide Bias +18 V
  Bias on output cathode resistor —20 V
  Forced resetting pulse —120 V
  Double pulse drive-amplitude —80 V ± 10 V
  Double pulse drive-durations 60 µS
  Integrated pulse drive-amplitude —145 V ± 15 V
  Integrated pulse drive-duration 80 µS
  Sine wave drive-amplitude 40—70 V r.m.s.

* The required anode current may be obtained from a 475 V supply via an 820 kΩ resistor.
** This does not apply in the case of the sine-wave drive.
Mechanical Data

Mounting position

Any
For visual indication the tube is viewed through the dome of the bulb.

Alignment

Cathode "O" is aligned with pin 6 to an accuracy of ±12°.

Weight

43 g (nominal)

Escutcheons

N.78211 Bakelite, or

N.79368 Brass

I.O.

Base

Base Connections (underside view)

Pin 1 Common cathodes
2
3 1st Guides
4 Anode
5 2nd Guides
6
7 Cathode "O"
8

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Nominal</th>
<th>GC10B</th>
<th>GC10B/S</th>
</tr>
</thead>
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<tr>
<td></td>
<td></td>
<td>Min.</td>
<td>Max.</td>
</tr>
<tr>
<td>A</td>
<td>72.5 mm. (2.85&quot;)</td>
<td>68.5 mm.</td>
<td>76.5 mm.</td>
</tr>
<tr>
<td>B</td>
<td>85 mm. (3.35&quot;)</td>
<td>81.5 mm.</td>
<td>88.5 mm.</td>
</tr>
</tbody>
</table>
Scale-of-ten Counter
Specially processed for long life

**GC10 B/L, GC10/4B/L**
(CV.6044)  
(CV.6100)

**Limit Ratings**

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<tr>
<th></th>
<th>Rectangular Pulse Drive</th>
<th>Sine Wave Drive</th>
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<tr>
<td>Max. speed</td>
<td>4,000 p.p.s.</td>
<td>4,000 c.p.s.</td>
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<tr>
<td>Max. striking voltage</td>
<td>350 V</td>
<td>350 V</td>
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<tr>
<td>Max. anode current</td>
<td>550 μA</td>
<td>550 μA</td>
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<tr>
<td>Min. anode current</td>
<td>250 μA</td>
<td>250 μA</td>
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<tr>
<td>Max. input signal peak to peak</td>
<td>140 V</td>
<td>171 V</td>
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<tr>
<td><em>Max. guide bias</em></td>
<td>60 V</td>
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</tr>
<tr>
<td>Max. $K_0$ bias</td>
<td>—20 V</td>
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</tr>
<tr>
<td>Max. $K_0$ load</td>
<td>100 kΩ</td>
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</tr>
<tr>
<td>Max. guide bias resistance</td>
<td>220 kΩ</td>
<td></td>
</tr>
</tbody>
</table>

**Characteristics**

- Running voltage at 450 μA
  - 190 V  
  - 190 V

**Recommended Operating Conditions**

- Supply voltage
  - 400 V
- Anode resistor
  - 470 kΩ
- Signal amplitude
  - —120 V
- 55 V r.m.s.
- Both Guides
  - Pulse duration
    - 80 μS
- Both Guides
  - Signal delay, 2nd guide
    - 80 μS
  - Signal delay, 2nd guide
    - 45°
- *Bias voltage
  - 35 V  
  - 9 V
- Both Guides
  - Bias voltage $K_0$
    - —10 V  
    - —10 V
  - Output cathode load
    - 33 kΩ  
    - 33 kΩ

* With rectangular pulse drive with a variable mark/space ratio this guide bias must be maintained, e.g., by D.C. restoration.
<table>
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<th>Test Conditions</th>
<th>AQL %</th>
<th>Insp. Level</th>
<th>Symbol</th>
<th>Limits</th>
<th>Units</th>
<th>Notes</th>
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<td>Acceptance Tests</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>Insulation</td>
<td>To be measured between anyone electrode and parallel combination of all the others at 170 V.</td>
<td>100%</td>
<td>100</td>
<td>MΩ</td>
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<tr>
<td>b</td>
<td>Striking Voltage</td>
<td>( A = K_o )  ( V_b = 350 \text{ V} )</td>
<td>100%</td>
<td>( V_s )</td>
<td></td>
<td>1, 3</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>Scaling Accuracy</td>
<td>( V_b = 400 \text{ V} )  ( V_1 = +35 \text{ V} )  ( V_2 = -40 \text{ V} )  ( T = 60 \mu\text{S} )  Frequency = 4-0 kc/s</td>
<td>100%</td>
<td>( V_r )</td>
<td>184</td>
<td>194</td>
<td>V</td>
</tr>
<tr>
<td>d</td>
<td>Running Voltage</td>
<td>( V_b = 400 \text{ V} )</td>
<td>100%</td>
<td>( V_r )</td>
<td>176</td>
<td>206</td>
<td>V</td>
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<td>GROUP B</td>
<td>Life Test</td>
<td>Combined AQL</td>
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<td>IA</td>
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<tr>
<td>a</td>
<td>Survival running life test</td>
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<tr>
<td>Tests to be performed at end of survival running test</td>
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<td></td>
</tr>
<tr>
<td>b</td>
<td>Scaling Accuracy</td>
<td>( V_b = 400 \text{ V} )  ( V_1 = +35 \text{ V} )  ( V_2 = -40 \text{ V} )  ( T = 60 \mu\text{S} )  Frequency = 4-0 kc/s</td>
<td>100%</td>
<td>( V_r )</td>
<td></td>
<td></td>
<td>2</td>
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<tr>
<td>c</td>
<td>Running Voltage</td>
<td>( V_b = 400 \text{ V} )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>
Scale-of-ten Counter
Specially processed for long life

GC10B/L, GC10/4B/L
(CV.6044) (CV.6100)

<table>
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<th>Test</th>
<th>Test Conditions</th>
<th>AQL %</th>
<th>Inspect. Level</th>
<th>Symbol</th>
<th>Limits</th>
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<th>Notes</th>
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<td>Electrical Retest</td>
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<td></td>
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<tr>
<td>prior to application</td>
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<td>a Scaling Accuracy</td>
<td>$V_b = 400 \text{ V}$</td>
<td>100%</td>
<td></td>
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<td></td>
<td>2</td>
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<tr>
<td></td>
<td>$V_1 = +35 \text{ V}$</td>
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<td>$T = 60 \mu \text{s}$</td>
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<td>Frequency $= 4-0 \text{ kc/s}$</td>
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<tr>
<td>b Running Voltage</td>
<td>$V_b = 400 \text{ V}$</td>
<td>100%</td>
<td>$V_r$</td>
<td>184</td>
<td>194</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

NOTES

1. Tests of Group A are to be applied directly after completion of manufacture.

2. The tube shall scale without error the first applications of test signals (illustrated in Fig. 1). Test signals are to be applied for at least 1/10th second. The test circuit of Fig. 2 is applicable.

3. $K_{1.9}$ 1st guide and 2nd guide electrodes to be disconnected. Illuminations of tube to be 5—50 ft. candles. Tube to conduct in less than 10 seconds.

4. The $K_{1.9}$ 1st guide and 2nd guide electrodes will be successively earthed through a suitable make before break type switch to cause 30 gaps to conduct in turn. The running voltage across each gap shall be within the specified limits. For this test the $K_0$ and $K_{1.9}$ electrode will be commoned. The test circuit to Fig. 3 is applicable. The measurement of the running volts is to be made between 0.1 and 2.0 seconds after the contacts of the make before break type switch have broken.

5. The tubes selected for this test are to be run in the circuit shown in Fig. 4. One application of the pulses shown in Fig. 1 is to be made every $85 \pm 5$ hours. The tube is to receive 20 such pulses and then be removed. A tube which fails to step on the application of the test pulses shall be rejected. The normal guide bias is to be $+60 \text{ V}$ which will be reduced to $+35 \text{ V}$ immediately prior to the application of pulses.

6. During the period between the completion of Group A tests and the commencement of Group C tests no further processing shall be applied.

7. A lot shall consist of not more than one calendar month’s production or 1301 whichever is the greater. For lots of 800 and less sampling codes shall be as for lots 801—1300.
GC10B/L, GC10/4B/L
(CV.6044) (CV.6100)

Scale-of-ten Counter
Specially processed for long life

Fig. 1

Fig. 2

Fig. 3

Fig. 4
Scale-of-ten Counter
Specially processed for long life

GC10B/L, GC10/4B/L
(CV.6044) (CV.6100)

Mechanical Data

Mounting position
Any

Alignment
For visual indication the tube is viewed through the dome of the bulb.

Escutcheons
Cathode "O" is aligned with pin 6 to an accuracy of ±12°.

Base
N78211 Bakelite, or N79368 Brass

Base Connections (underside view)

GC 10 B, L

Pin 1 Common cathodes
2 —
3 1st Guides
4 Anode
5 2nd Guides
6 —
7 Cathode "O"
8 —

GC 10/4 B/L

Pin 1 Common cathodes
2 Cathode "5"
3 1st Guides
4 Anode
5 2nd Guides
6 Cathode "9"
7 Cathode "0"
8 Cathode "3"

ISSUE 2

DK-1-4
Limit Ratings

Maximum counting rate: sine wave and rectangular pulses 4,000 p.p.s.
Maximum total anode current 550 µA
Minimum total anode current 250 µA
Minimum anode supply voltage (normal room illumination) 350 V
Maximum potential difference between guides and cathodes 140 V
Maximum output cathode load 150 kΩ

Characteristics

Running voltage at 300 µA 191 V approx.

Recommended Operating Conditions

*Anode current 310 µA ± 20%

**Guide bias +20 V +40 V
Bias on output cathode resistor —20 V Zero
Resultant pulse 40 V
Forced resetting pulse —120 V
Double pulse drive-amplitude —80 V ± 10 V
Double pulse drive-durations 60 µS
Integrated pulse drive-amplitude —145 V ± 15 V
Integrated pulse drive-duration 80 µS
Sine wave drive-amplitude 40—70 V r.m.s.

* The required anode current may be obtained from a 475 V supply via a 820 kΩ resistor.
** This does not apply in the case of the sine wave drive.

The following table shows the number of input pulses for which outputs may be obtained for both directions of drive and with each cathode used as the zero electrode.

Number of pulses to give output from :

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>4</td>
<td>6</td>
<td>Clockwise, A zero</td>
</tr>
<tr>
<td>0</td>
<td>9</td>
<td>6</td>
<td>4</td>
<td>Anti-clockwise, A zero</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td><strong>Clockwise, B zero</strong></td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>7</td>
<td>5</td>
<td>Anti-clockwise, B zero</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>0</td>
<td>2</td>
<td>Clockwise, C zero</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>0</td>
<td>8</td>
<td>Anti-clockwise, C zero</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>8</td>
<td>0</td>
<td>Clockwise, D zero</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>Anti-clockwise, D zero</td>
</tr>
</tbody>
</table>
### Mechanical Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting position</td>
<td>Any. For visual indication the tube is viewed through the dome of the bulb.</td>
</tr>
<tr>
<td>Alignment</td>
<td>Cathode &quot;B&quot; is aligned with pin No. 6 to an accuracy of ± 12°.</td>
</tr>
<tr>
<td>Weight</td>
<td>43 g (nominal).</td>
</tr>
<tr>
<td>Escutcheons</td>
<td>N.78211 Bakelite, or N.79368 Brass.</td>
</tr>
<tr>
<td>Base</td>
<td>I.O.</td>
</tr>
</tbody>
</table>

#### Base Connections (underside view)

Pin 1 Common cathodes  
2 Cathode "D"  
3 1st Guides  
4 Anode  
5 2nd Guides  
6 Cathode "A"  
7 Cathode "B"  
8 Cathode "C"  

![Base Connections Diagram]

![Tube Diagram]
Bi-directional 12-way Computing Tube with Intermediate Outputs

Limit Ratings
Maximum counting rate: sine wave and rectangular pulses 4,000 p.p.s.
Maximum total anode current 550 µA
Minimum total anode current 250 µA
Minimum anode supply voltage (normal room illumination) 350 V
Maximum potential difference between guides and cathodes 140 V
Maximum output cathode load 150 kΩ

Characteristics
Running voltage at 300 µA 191 V approx.

Recommended Operating Conditions
*Anode current 310 µA ± 20%
**Guide bias +20 V +40 V
Bias on output cathode resistor —20 V Zero
Resultant pulse 40 V
Forced resetting pulse —120 V
Double pulse drive-amplitude —80 V ± 10 V
Double pulse drive-durations 60 µS
Integrated pulse drive-amplitude —145 V ± 15 V
Integrated pulse drive-duration 80 µS
Sine wave drive-amplitude 40—70 V r.m.s.

* The required anode current may be obtained from a 475 V supply via an 820 kΩ resistor.
** This does not apply in the case of the sine wave drive.

The following table shows the number of input pulses for which outputs may be obtained for both directions of drive and with each cathode used as the zero electrode.

Number of pulses to give output from:

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>0</td>
<td>11</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
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<td>8</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
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<td>2</td>
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<tr>
<td>7</td>
<td>6</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>8</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>
GC 12/4B

Bi-directional 12-way Computing Tube with Intermediate Outputs

Mechanical Data

Mounting position
Any.
For visual indication the tube is viewed through the dome of the bulb.

Alignment
Cathode "B" is aligned with pin No. 6 to an accuracy of ± 10°.

Weight
43 g (nominal).

Escutcheon
N79369 Brass

Base
I.O.

Base Connections
(underside view)

Pin 1 Common cathodes
2 Cathode "C"
3 1st Guides
4 Anode
5 2nd Guides
6 Cathode "A"
7 Cathode "B"
8 Cathode "D"
Limit Ratings

Maximum counting rate: any wave shape 20 kp/s
Maximum total anode current 1.2 mA
Minimum total anode current 700 µA
Minimum anode supply voltage
(normal room illumination) 420 V
Maximum potential difference between guides and cathodes 180 V

The output cathode must not rise above the potential of the commoned cathodes by more than 10 volts, and may be made more than 30 volts negative only when resetting.

Characteristics

Running voltage at 800 µA 215 V approx.

Recommended Operating Conditions

*Anode current 800 µA
Output cathode load 82 kΩ
Forced resetting pulse —140 V
Random pulse drive-amplitude —(144 V + 50 V) —12 V

**Random pulse drive-duration 25 µS min.
**Random pulse drive-quiescent time 25 µS min.
Random pulse drive—guide bias +72 ± 12 V
Sine wave drive-amplitude 65—100 V r.m.s.
Sine wave drive—guide bias +12 ± 2 V

* The required anode current may be obtained from a 475 V supply via a 330 kΩ resistor.

Note—To reduce the effect of stray capacity to a minimum it is essential that the anode resistor be wired not more than 1/2" (or 5 mm.) from tag 4 on the valve holder.

** The maximum is limited by the repetition rate.
Mechanical Data

Mounting position
Any.
For visual indication, the tube is viewed through the dome of the bulb.

Alignment
Cathode "O" is aligned with pin No. 6 to an accuracy of ± 12°.

Weight
44 g (nominal).

Escutcheons
N.78211 Bakelite or N.79368 Brass

Base
I.O.

Base Connections
(underside view)

Diagram showing pin connections:
- Pin 1: Common cathodes
- Pin 2: 3rd Guides
- Pin 3: 1st Guides
- Pin 4: Anode
- Pin 5: —
- Pin 6: Output cathode
- Pin 7: Output 3rd Guide
- Pin 8: 2nd Guides

Diagram of the tube showing dimensional specifications:
- Height:
  - 14.75 mm
  - 1.75" MAX
- Diameter:
  - 29.5 mm
  - 1.16" MAX
  - 25.5 mm
  - 1.00" MAX
- Other dimensions:
  - 70.14 mm
  - 2.75"
  - 85.25 mm
  - 3.35"
Scale-of-ten Counter Tube
For Single-pulse Operation

+475V ±25V
+10V
+300V-20V

LK122

<table>
<thead>
<tr>
<th>Drive</th>
<th>Input</th>
<th>C1</th>
<th>R1</th>
<th>R2</th>
<th>D1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random pulse</td>
<td>&gt; 25 µS</td>
<td>-02 µF</td>
<td>1MΩ</td>
<td>Not reqd.</td>
<td>Q3/3</td>
</tr>
<tr>
<td>Sine wave</td>
<td>145 ±50 V, -12 V</td>
<td>65–100 V r.m.s.</td>
<td>To suit lowest frequency</td>
<td>100kΩ</td>
<td>Not reqd.</td>
</tr>
</tbody>
</table>

Sine-wave or random-pulse drive for GC10D
Bi-directional 10-way Counter/Selector
Dekatron with Auxiliary Anodes
and Routing Guides

UNDER REVISION

The cathodes of the counter tube are arranged with 1—9 commoned internally and '0' brought out to a separate connection in order to provide a transfer pulse when the tubes are cascaded. In the case of the Selector tube the cathodes are all brought out to separate base connections. In both tube types additional output electrodes in the form of ten auxiliary anodes placed between the main anode and the cathodes are also brought out to connections in the base. The electrodes can be used to provide negative pulses suitable for the direct operation of a Digitron register tube. The routing guides between '9' and '0' are brought out to separate connections to facilitate bi-directional counting.

Limit Ratings

- Maximum counting rate paired pulse drive: 10 kps
- Maximum counting rate single pulse drive: 5 kps
- Minimum main anode supply voltage: 440 V
- Maximum main anode current: 0.9 mA
- Minimum main anode current: 0.5 mA
- Maximum auxiliary anode current: 2.5 mA
- Maximum cathode current: 3.0 mA
- Minimum cathode current: 2.3 mA
- Maximum cathode load: 3.3 kΩ
- Maximum routing guide resistor: 4.7 kΩ

*The maximum main and auxiliary anode currents cannot occur with the same operating conditions. The sum of these two currents should not exceed the maximum cathode current.

The current through the auxiliary anodes may be varied by changing the Digitron anode resistor, and similarly, the Dekatron main anode/cathode current can be varied by changing its anode resistor. The two currents are substantially independent of each other.
GCA10G
GSA10G

Bi-directional 10-way Counter/Selector
Dekatron with Auxiliary Anodes
and Routing Guides

UNDER REVISION

Characteristics

Main anode to cathode running voltage 240 V nom.
Auxiliary anode voltage when conducting 225 V nom.

Recommended Operating Conditions

Main anode supply voltage 475 ± 25 V
Main anode current 0.62 mA
Auxiliary anode current 2.0 mA
Cathode load resistor 3.3 kΩ
Main anode resistor 390 kΩ
Auxiliary anode resistors (Digitron readout Fig. 1) 220 kΩ
Auxiliary biasing resistor (Digitron readout Fig. 1) 1 MΩ
Auxiliary anode resistors (no readout Fig. 2) 33 kΩ
Auxiliary anode biasing resistor (no readout Fig. 2) 100 kΩ
Forced resetting pulse amplitude —100 V nom.
Forced resetting pulse duration 50 μS min.
Paired pulse drive Fig. 3 amplitude 120 V nom.
Paired pulse drive Fig. 3 duration 30 μS
Paired pulse drive Fig. 3 guide two delay 28 μS
Single pulse drive Fig. 4 amplitude 150 V nom.
Single pulse drive Fig. 4 duration 100 μS nom.
Bi-directional 10-way Counter/Selector
Dekatron with Auxiliary Anodes
and Routing Guides

TENTATIVE DATA SHEET

GCA10G
GSA10G

UNDER REVISION

Mechanical Data

Mounting position

Alignment

Base
Socket

GCA10G Base Connections
(underside view)

Any.

For visual indication the tube may be viewed through the dome of the bulb.

Cathode '0' is aligned to pin 3 with an accuracy of ± 5°

Modified B26A
B27A

Pin 1  Commoned Cathode 1-9
2  Cathode 0
3  Routing Guide 2
4  Routing Guide 1
5  Auxiliary Anode 1
6  Auxiliary Anode 0
7  Auxiliary Anode 9
8  Auxiliary Anode 8
9  Auxiliary Anode 7
10  Auxiliary Anode 6
11  Auxiliary Anode 5
12  Auxiliary Anode 4
13  Auxiliary Anode 3
14  Auxiliary Anode 2
15  Do not connect
16  Guide 2
17  Guide 1
28  Main Anode
GCA10G  Bi-directional 10-way Counter/Selector
GSA10G  Dekatron with Auxiliary Anodes
         and Routing Guides

UNDER REVISION

GSA10G Base Connections
(Underside View)

Pin 1  Cathode 1  Pin 10  Cathode 6  Pin 20  Auxiliary Anode 0
     2  Cathode 0    11  Cathode 5    21  Auxiliary Anode 9
     3  Routing Guide 2  12  Do not connect  22  Auxiliary Anode 7
     4  Routing Guide 1  13  Cathode 4    23  Auxiliary Anode 6
     5  Cathode 9  14  Cathode 3    24  Auxiliary Anode 5
     6  Auxiliary Anode 8  15  Guide 2  25  Auxiliary Anode 4
     7  Cathode 8  16  Guide 1    26  Auxiliary Anode 3
     8  Cathode 7  17  Cathode 2    27  Auxiliary Anode 2
     9  Do not connect  19  Auxiliary Anode 1  28  Main Anode
Bi-directional 10-way Counter/Selector
Dekatron with Auxiliary Anodes
and Routing Guides

Fig. 1 Dekatron with Digitron Readout.

Fig. 2 Dekatron without Digitron Readout.
GCA10G  
GSA10G  
Bi-directional 10-way Counter/Selector  
Dekatron with Auxiliary Anodes  
and Routing Guides

UNDER REVISION

Fig. 3  Paired Pulse Drive.

Fig. 4  Single Pulse Drive.
Limit Ratings

Maximum counting rate: sine wave and rectangular pulses 4,000 p.p.s.
Maximum total anode current 550 µA
Minimum total anode current 250 µA
Minimum anode supply voltage (normal room illumination) 400 V
Maximum potential difference between cathodes and guides 140 V
Maximum output cathode load 150 kΩ
Maximum output available at 4 kc/s with a 150 kΩ cathode load resistor 35 V

Characteristics

Running voltage at 325 µA 192 V approx.

Recommended Operating Conditions

* Anode current 325 µA ± 20%
** Guide bias +36 V
Forced resetting pulse —120 V
Double pulse drive-amplitude —80 V ± 10 V
Double pulse drive-duration 60 µS
Integrated pulse drive-amplitude —145 V ± 15 V
Integrated pulse drive-duration 80 µS
Sine wave drive-amplitude 40—70 V r.m.s.

* The required anode current may be obtained from a 475 V supply via a 680 kΩ resistor.
** This does not apply in the case of the sine wave drive.
Bi-directional 10-way Selector Tube

Mechanical Data

Mounting position

Any.
For visual indication the tube is viewed through the dome of the bulb.

Alignment

Cathode No. 1 is aligned with pin No. 11 to an accuracy of ± 12°.

Weight

53 g. (nominal).

Escutcheon

N.80977

Base

Duodecal with bottom cap.

Base Connections

(underside view)

Pin 1 Cathode 0
2 " " 9
3 " " 8
4 " " 7
5 " " 6
6 " " 5
7 " " 4
8 " " 3
9 " " 2
10 " " 1
11 2nd Guides
12 1st Guides
B.C. Anode

334mm
1-3/8"MAX

67.35mm
2-5/8"NOM

215mm
8-1/4"

DK-11-1

ISSUE 2
Limit Ratings

Maximum counting rate: sine wave and rectangular pulses 4,000 p.p.s.
Maximum total anode current 350 μA
Minimum total anode current 190 μA
Minimum anode supply voltage (normal room illumination) 400 V
Maximum potential difference between cathodes and guides 140 V
Maximum output cathode load 270 kΩ
Maximum output available across a 270 kΩ cathode load resistor 35 V

Characteristics

Running voltage at 270 μA 191 V

Recommended Operating Conditions

*Anode current 270 μA ± 20%
**Guide bias +36 V
Forced resetting pulse —120 V
Double pulse drive-amplitude —80 V ± 10 V
Double pulse drive-durations 60 μS
Integrated pulse drive-amplitude —145 V ± 15 V
Integrated pulse drive-duration 80 μS
Sine wave drive-amplitude 40—70 V r.m.s.

Mechanical Data

Mounting position Any.
For visual indication the tube is viewed through the dome of the bulb.
Alignment Cathode No. 1 is aligned with pin No. 12 to an accuracy of ± 10°.
Weight 50 g (nominal).
Escutcheon N.84538.
Base Duodecal with bottom cap and two flying leads.

* The required anode current may be obtained from a 475 V supply via a 910 kΩ resistor.
** This does not apply in the case of the sine wave drive.
Bi-directional 12-way Selector Tube

Base Connections (underside view)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Cathode 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
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<tr>
<td>3</td>
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</tr>
<tr>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
</tr>
</tbody>
</table>

Bottom Cap " Anode

Lead between pins 6 and 7 with yellow sleeving 1st Guides

Lead between pins 12 and 1 with green sleeving 2nd Guides
Bi-directional 10-way
Selector Tube

Limit Ratings

Maximum counting rate:
Continuous sine wave drive 20 kp/s
Rectangular pulse drive 10 kp/s
Maximum total anode current 900 µA
Minimum total anode current 700 µA
Minimum supply voltage, anode to cathode
(normal room illumination) 440 V
Maximum potential between guides and cathodes 180 V
Maximum output pulse available with 47k cathode
load resistor 35 V

Characteristics
Running voltage at 800 µA 208 V approx.

Recommended Operating Conditions

*Anode current 800 µA
**Guide bias ±50 ± 5 V
Cathode load resistors 47 kΩ max. ←
Forced resetting pulse —140 V
***Double pulse drive—amplitude —120 V ± 10 V
Double pulse drive—duration 30 µS ± 20%
Double pulse drive—pulse overlap at the 90% pulse level 10 ± 5 µS ←
****Integrated pulse drive—amplitude —145 V ± 15 V
Integrated pulse drive—duration 33 µS ± 20% ←
Sine wave drive—amplitude 60—100 V r.m.s. ←

* The required anode current may be obtained from a 475 V supply via a 300 kΩ ± 5% resistor.

Note—To reduce the effect of stray capacity to a minimum it is essential that the anode resistor be wired not more than ½” (5 mm) from the anode tag on the valve holder.

** This does not apply in the case of the sine wave drive. See circuit LK.100, Issue 2.

*** The pulses should have a rise time of less than 150 V/µS and a droop of less than 30 V. See circuit LK.102, Issue 2.

**** The pulse should have a rate of rise of less than 150 V/µS and a droop of less than 5 V. See circuit LK.101, Issue 2.

N.B. ← Indicates a change from previous data sheet.
Bi-directional 10-way Selector Tube

**Mechanical Data**

**Mounting position**
Any.
For visual indication the tube is viewed through the dome of the bulb.

**Alignment**
Cathode 1 is aligned with pin No. 11 to an accuracy of ± 12°.

**Weight**
53 g (nominal)

**Base**
Duodecal with bottom cap.

**Escutcheon**
N80977.

**Base Connections**
(underside view)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Cathode 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
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<tr>
<td>4</td>
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<td>2</td>
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<tr>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>2nd Guides</td>
</tr>
<tr>
<td>12</td>
<td>1st Guides</td>
</tr>
<tr>
<td>B.C.</td>
<td>Anode</td>
</tr>
</tbody>
</table>

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DK-13-1

ISSUE 3
Bi-directional 10-way Selector Tube

**Continuous Sine-Wave Drive**

**Integrated-Pulse Drive**
GS 10 D

Bi-directional 10-way Selector Tube

INPUT PULSE
10 kpps. MAX.

Paired-Pulse Drive
Bi-directional 10-way Selector  
Dekatron with Routing Guides

Although the seated height of this tube is less than 1 1/2", the electrical characteristics are similar to the Dekatrons with phenolic bases.

Limit Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum counting rate</td>
<td>5000 p.p.s.</td>
</tr>
<tr>
<td>Maximum anode current</td>
<td>370 μA</td>
</tr>
<tr>
<td>Minimum anode current</td>
<td>250 μA</td>
</tr>
<tr>
<td>Minimum supply voltage (normal room illumination)</td>
<td>380 V</td>
</tr>
<tr>
<td>Maximum potential difference between electrodes other than anode</td>
<td>140 V</td>
</tr>
<tr>
<td>Maximum cathode output voltage</td>
<td>28 V</td>
</tr>
</tbody>
</table>

Characteristics

Running voltage at 310 μA 187 V nominal

Recommended Operating Conditions for a maximum counting rate of 4000 p.p.s.*

** Cathode resistors 82 KΩ

*** Anode resistor 820 KΩ

Supply voltage, with 1% anode resistor 475 V ± 10%  
with 5% anode resistor 475 V ± 5%

Guide Bias  + 35 V

Forced resetting pulse — 120 V

Double Pulse Circuit, Fig. 2

Pulse amplitudes — 70 ± 7 V

Pulse durations 80 ± 5 μS

Integrated Pulse Circuit, Fig. 1

Input pulse amplitude — 145 ± 15 V

Input pulse duration 75 μS min.

1/3f secs max.

Continuous Sine Wave Circuit, Fig. 3

Amplitude 55 ± 15 V r.m.s.

* The manufacturers will design circuits to suit individual cases where the counting rate exceeds 4 kps.

** Each cathode must have a return path to the negative rail via 82 KΩ, even though an output pulse is not required.

*** To reduce the effect of stray capacity to a minimum, it is essential that the anode resistor be wired not more than 1/4" (5 mm) from the anode tag on the valve holder.
**GS10H**

**Bi-directional 10-way Selector**

**Dekatron with Routing Guides**

**Mechanical Data**

- **Mounting position**: Any
  - For visual indication the tube is viewed through the dome of the bulb.
  - Cathode 1 is aligned with pin 9 ± 3°.
- **Base**: B17A
- **Escutcheon**: N79368
- **Valveholder, printed circuit**: E.T.L. code HFD 13534
- **Valveholders, tags**: A.E.I. type VH26/1703
  - E.T.L. code HFD 13045

Valveholder connections and fixing (under-chassis view).

Valveholder requires 1-0" dia. hole in chassis.

**Pin**
- 1 Cathode 6
- 2 Cathode 5
- 3 Do not connect
- 4 Cathode 4
- 5 Cathode 3
- 6 Do not connect
- 7 Cathode 2
- 8 Anode
- 9 Cathode 1

**Pin**
- 10 Cathode 0
- 11 Routing Guide 2
- 12 Routing Guide 1
- 13 Cathode 9
- 14 Cathode 8
- 15 Commoned Guide 2
- 16 Cathode 7
- 17 Commoned Guide 1
Fig. 1  Integrated Pulse Drive

Fig. 2  Double Pulse Drive
GS10H

Bi-directional 10-way Selector
Dekatron with Routing Guides

Fig. 3  Sine Wave Drive

All diodes type 0A202 or equivalent.
Components and Voltages 10% tol. unless specified in data.
## INDEX

<table>
<thead>
<tr>
<th>Tube Type</th>
<th>CV. Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>VS10G</td>
<td>CV.5290</td>
</tr>
<tr>
<td>VS10H</td>
<td>CV.6103</td>
</tr>
</tbody>
</table>
Cathode: Indirectly heated

Heater:
- Vh = 6.3 V
- Ih = 0.5 A

Limit Ratings:
- Maximum heater to cathode voltage: ±150 V
- Maximum spade to cathode voltage (V_s max.): 125 V
- Minimum spade to cathode voltage (V_s min.): 85 V
- Minimum target to cathode voltage (V_T min.): 50 V
- Maximum target to cathode voltage (V_T max.): 300 V
- Minimum switching-grid to cathode voltage (V_{sg} min.):
  - \( V_s = 125 \text{ V} \) → 65 V
  - \( V_s = 85 \text{ V} \) → 45 V

- Minimum input duration: 0.5 μS

Characteristics (\( V_s = 108 \text{ V}, \ R_s = 100 \text{ kΩ} \))
- Holdingode current: 1.2 mA nom. →
- Target current: 10.0 mA nom. →

Recommended Operating Conditions (for counting up to 1 Mc/s):
- \( V_s = 108 \text{ V} \) →
- \( R_s = 100 \text{ kΩ} \pm 10\% \)

(Each spade must be connected to a separate load resistor with not more than \( \frac{1}{2}'' \) (10 mm) of connecting lead).

- \( V_T = 108 \text{ V} \) →
- \( R_T = 4.7 \text{ kΩ} \)

(Any number of target connections may be taken to a common target resistor).
Recommended Operating Conditions (for counting up to 1 Mc/S)  

\[ V_{SG} = \frac{V_S}{2} \]

- \( V_{SG} \) pulse amplitude: \(-54 \text{ V}\)
- \( t_{pulse} \): \(0.5 \mu\text{S}\)
- \( R_{SG} \): \(22 \text{ k\Omega}\)
- \( C_{input} \): \(330 \text{ pF}\)

Alternatively d.c. coupling may be used as shown in circuit LK. 125

*Note:* The spade resistance is the total resistance, including resistors for beam formation etc.

Mechanical Data

Mounting position: Any: providing that the tube is kept at least 2" from any magnetic material or 4" from a similar tube, a strong magnet or a mu-metal screen.

- Weight: \(185 \text{ g}\)
- Base: B26A

N.B. \(\leftarrow\) Indicates a change from previous data sheets.
Mechanical Data—cont.

Base Connections (underside view)

Pin 1 Spade 0
2 Target 9
3 Target 8
4 Odd Switching grids
5 Target 7
6 Spade 7
7 Target 6
8 Target 5
9 Spade 5
10 Target 4
11 Do not connect
12 Target 3
13 Target 2
14 Spade 2
15 Target 1
16 Even switching grids
17 Target 0
18 Spade 9
19 Spade 8
20 Heater
21 Spade 6
22 Spade 4
23 Spade 3
24 Heater
25 Spade 1
26 Cathode
27
TROCHOTRON, 10-way Beam Switching Tube

1 Mc/S Trochotron Decade Counter with GR10A Register Tube readout
High Current 10-way Trochotron
Beam Switching Tube

VS 10H
(VX.9210)

Cathode
Indirectly heated

Heater
Vh  6.3 V
Lh  0.55 V

Limit Ratings
Maximum heater to cathode voltage  ± 150 V
Maximum spade to cathode voltage ($V_s$ max.)  + 145 V
Minimum spade to cathode voltage ($V_s$ min.)  + 80 V
Minimum target to cathode voltage ($V_T$ min.)  + 50 V
Maximum target to cathode voltage ($V_T$ max.)  + 300 V
Minimum switching-grid to cathode voltage
($V_{SG}$ min.)  $V_s = 140$ V
125 V  55 V
80 V  45 V
Minimum spade resistor ($R_s$ min.)  $V_s = 140$ V
125 V  68 kΩ
80 V  82 kΩ
Maximum spade resistor ($R_s$ max.)  $V_s = 140$ V
125 V  175 kΩ
80 V  270 kΩ

Minimum resolution time (for groups of pulses not exceeding nine in number)  250 nS
Maximum switching speed (for regular spaced pulses)  2 Mc/S

Characteristics
Holding spade current  1.0 mA nom.
Target spade current  $V_s = 140$ V  18.0 mA nom.
125 V  10.0 mA nom.
80 V  6.5 mA nom.
Switching grid current on switching
$V_s = 140$ V
125 V  1.0 mA nom.
80 V  0.2 mA nom.
Recommended Operating Conditions for
1 Mc/S Operation

\[ \begin{align*}
V_S & = 125 \text{ V} \\
R_S & = 100 \text{ k\textOmega} \\
V_T & = 125 \text{ V} \\
R_T & = 4.7 \text{ k\textOmega}
\end{align*} \]

(Each spade must be connected to a separate load resistor with not more than \( \frac{1}{2} \)" (10 mm) of connecting lead).

Minimum pulse—duration \( 0.25 \mu \text{S} \)
Minimum pulse—amplitude \( -(V_{SG} + 5) \text{ V} \)

For 2 Mc/S Operation

\[ \begin{align*}
V_S & = 125 \text{ V} \\
R_S & = 82 \text{ k\textOmega} \\
V_T & = 125 \text{ V} \\
R_T & = 4.7 \text{ k\textOmega}
\end{align*} \]

(Each Spade must be connected to a separate load resistor with not more than \( \frac{1}{2} \)" (10 mm) of connecting lead).

Minimum pulse—duration \( 0.25 \mu \text{S} \)
Minimum pulse—amplitude \( -(V_{SG} + 5) \text{ V} \)
High Current 10-way Trochotron
Beam Switching Tube

VS 10 H
(VX.9210)

Mechanical Data

Mounting position

Any: providing that the tube is kept at least 2" from any magnetic material or 4" from a similar tube, a strong magnet or a mu-metal screen.

Weight

220 g

Base

B26A

Sockets

B26A or B27A

Base Connections
(underside view)

Pin 1 Spade 0
2 Target 9
3 Target 8
4 Odd Switching grids
5 Target 7
6 Spade 7
7 Target 6
8 Target 5
9 Spade 5
10 Target 4
11 Do not connect
12 Target 3
13 Target 2
14 Spade 2
15 Target 1
16 Even Switching grids
17 Target 0
19 Spade 9
20 Spade 8
21 Heater
22 Spade 6
23 Spade 4
24 Spade 3
25 Heater
26 Spade 1
27 Cathode

44mm
1732" MAX. DIA.

881mm
3469" MAX.

815mm
3191" MAX.

26 14 24 25 9 22 6 20 19 2 1

4 5

16
# INDEX

<table>
<thead>
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<th>CV. Code</th>
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<td>CV.5291</td>
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<tr>
<td>GR10J</td>
<td>—</td>
</tr>
<tr>
<td>GR10K</td>
<td>CV.5842</td>
</tr>
<tr>
<td>GR10M</td>
<td>—</td>
</tr>
</tbody>
</table>

Digitron Escutcheon Unit

"Digitron" is a registered Trade Mark of Ericsson Telephones Limited
DIGITRON TUBES

The Digitron is a gas-filled tube in which the cathodes are shaped to form characters. The selected cathode is made to glow by a switched connection to one side of a power supply—the anode being connected through a load resistor to the other.

The switch may be mechanical—uniselector, relay, etc., or it may be electronic in the form of a trigger tube, Trochotron-Beam Switching Tube, Transistor or a thermonic tube.

The current to operate the tube must be within two limits, firstly it must be sufficient to cover the whole of the selected cathode with glow and secondly it must be less than the maximum specified current. If this maximum current is exceeded then the life of the tube will be adversely affected.

![Graph](graph.png)

**Fig. 1** Digitron Operating Characteristics

Reference to Fig. 1 shows a typical method of specifying the characteristics. The parallel lines are the upper and lower limits of running voltage over the operational current range.

The recommended operating point is indicated as 'P' and load lines may then be drawn from the available supply voltage through the point 'P'. The slope of this line gives the required anode load resistor.

*cont'd*
DIGITRON TUBES

In certain tubes it is desirable to include additional resistors in cathodes which have smaller than average areas, i.e., 1 and 7 in the GR10G. This is to ensure that the average life of each character is approximately the same.

It is possible to prevent cathodes from glowing by connecting them to a small positive voltage—the Pre-bias Voltage. This varies from about 25 volts minimum to 100 volts maximum. A selected cathode may be made to glow by applying a negative voltage of amplitude equal to the pre-bias voltage. Details of the recommended pre-bias voltage will be found in the particular tube data where applicable.

Digitrons are essentially constant current tubes and operate best under these conditions. An ideal combination is that of Trochotron and Digitron, otherwise the tubes should be operated from as high a supply voltage as possible in order to minimise individual characteristic variations.

The range of Digitrons includes end and side-viewing number tubes, a fraction tube and sign tubes.

REGISTER TUBES

In order to count pulses at rates greater than 20 kp/s, it is essential to precede the Dekatron scaler with hard valve decades. To preserve uniformity of display, the register tube has been introduced. Like a Dekatron it has a common anode and ten cathodes, but there are no guides. The difference between striking and extinction voltage of the gaps is of the order of 25 volts which can be readily obtained from a coincidence matrix fed by the binary decade. Thus it is possible to have a uniform presentation even though the scaler may contain both Dekatrons and hard valve decades.

A conventional binary scale of sixteen modified by feedback into a scale of ten has eight anodes each with two stable potentials. It is possible to select ten combinations of at most four anodes which are all in the low potential state at one count only. These are connected via isolating resistors to one cathode of the register tube the anode of which is connected to some higher voltage determined by the following equations:

\[
E_1 \geq E_s + (E_2 - E_o).
\]

\[
E_1 \leq I_a R_a + (E_2 - \frac{n-1}{n} E_o) + E_x.
\]

where \( E_1 \) = Anode supply voltage of register tube.

\( E_2 \) = Anode voltage of non-conducting tube of binary pair.

cont'd
REGISTER TUBES

$E_o =$ Peak-to-peak output pulse from binary pairs.
$E_s =$ Striking voltage of register tube.
$E_x =$ Extinction voltage of register tube.

$n =$ The greatest number of scaler anodes controlling one register cathode (normally $n = 4$).

The register tube cathode is required to glow when all its four associated anodes are low, and must not glow when three are low and one is high. Thus the amplitude of the binary anode swings must be at least four times the difference between the striking and extinguishing voltages of the cold cathode diodes forming the register tube. The recommended circuit and base connections have been designed to allow the maximum tolerance in operating conditions, and to this end some cathodes are connected to more scaler anodes than is needed to satisfy the normal glow conditions.

The de-ionization time of the gas limits the rate at which the circulation of the glow will follow the counter. At speeds greater than some 50 kp/s the discharge will completely extinguish, but when the pulse rate drops to a lower value the tube will strike again and display the correct count.
Limit Ratings

Minimum anode to cathode voltage to ensure breakdown (normal room illumination) 129 V

Maximum voltage across tube and 500 kΩ resistors to ensure tube extinguishes 105 V

Maximum potential difference between any two cathodes (Cathode resistors min. value of 300 kΩ) 120 V

Maximum total anode current 250 μA

Minimum total anode current 50 μA

Characteristics

Running voltage at 60 μA 108 V approx.

Recommended Operating Conditions

Anode current 60 μA

To ensure correct operation the cathode potential must change by a voltage $V_o$ where:—

$$ V_o > V_s - V_x $$

$$ > 129 - 105, \text{ i.e., } 24 \text{ volts} $$

$V_s = $ Striking voltage

$V_x = $ Extinction voltage

N.B. ← Indicates a change from previous data sheets.
Mechanical Data

Mounting position  Any.
The tube is viewed through the dome of the bulb.

Alignment  Cathode No. 2 is aligned with pin No. 11 to an accuracy of ± 12°.

Weight  50 g.

Escutcheon  N.80977.

Base  Duodecal.

Base Connections (underside view)

Pin 1  Cathode 1
2    "    9
3    "    8
4    "    7
5    "    6
6    "    5
7    "    4
8    "    3
9    "    2
10   "    1
11   "    0
12   Anode

Diagram of the tube and base connections.
Limit Ratings

Maximum cathode current 4 mA
Minimum voltage necessary to ensure breakdown 150 V

Characteristics

Nominal running voltage 145 V
A cathode left floating will assume some potential between that of the anode and the glowing cathode.

Recommended Operating Conditions

Under the recommended d.c. operating conditions with the characters switched sequentially every 24 hours, an average life of 10,000 hours can be expected.

D.C. operation
Anode supply voltage \( Ra = 33k\Omega \) 250 V

A.C. operation
(Unsmoothed half-wave rectifier 50 c.p.s. a.c.)
Anode supply voltage - \( Ra = 39k\Omega \) 200-220V r.m.s.
\( Ra = 47k\Omega \) 220-250V r.m.s.

Filters

For many applications the use of a light filter may be advantageous. 'Circular polarized' filters (Type HNCP, supplied by Polarizers (U.K.) Ltd., 28, Stamford Street, London, S.E. 1) eliminate reflected light and improve contrast. Coloured filters of glass, Perspex or Gelatine can also be used to advantage, amber or red tinted filters making Long Life Digitrons appear identical with other Digitrons.

*Registered Trade Mark
DIGITRON - Long Life 10 Digit Side-Viewing
Cold-Cathode Numerical Register Tube

Mechanical Data

Mounting position
Base      Any
Socket    B26A
          B17A, B26A or B27A

Base Connections
(underside view)

Pin 1 Cathode 6
2 Cathode 5
5 Cathode 4
6 Anode
7 Cathode 3
9 Cathode 2
10 Cathode 1
14 Cathode 0
15 Cathode 9
16 Cathode 8
17 Cathode 7

Note: All other pins are to be left unconnected.
*DIGITRON - Long Life 10 Digit Side-Viewing
Cold-Cathode Numerical Register Tube

Operating Characteristics

* Registered Trade Mark
*DIGITRON - Long Life 10 Digit End-Viewing
Cold-Cathode Numerical Register Tube

GR10K
(CV.5842)

Limit Ratings

Maximum cathode current  1.8 mA
Minimum voltage to ensure breakdown  150 V

Characteristics

Nominal running voltage at 1.4 mA  140 V
A cathode left floating will assume some potential between that of the anode and the glowing cathode.

Recommended Operating Conditions

Under the recommended d.c. operating conditions with the cathodes switched sequentially every 24 hours, an average life of 10,000 hours can be expected.
D.C. operation
Anode supply voltage \( Ra = 82k \Omega \)  250 V
\( Ra = 47k \Omega \)  200 V
A.C. operation
(Unsmoothed half-wave rectified 50 c.p.s. a.c.)
Anode supply voltage - \( Ra = 82k \)  200-220V r.m.s.
\( Ra = 120k \)  220-250V r.m.s.

Filters

For many applications the use of a light filter may be advantageous. 'Circular polarized' filters (Type HNCP, supplied by Polarizers (U.K.) Ltd., 28, Stamford Street, London, S.E. 1) eliminate reflected light and improve contrast. Coloured filters of glass, Perspex or Gelatine can also be used to advantage, amber or red tinted filters making Long Life Digitrons appear identical with other Digitrons.

*Registered Trade Mark
GR 10K
(CV. 5842)

DIGITRON - Long Life 10 Digit End-Viewing
Cold-Cathode Numerical Register Tube

Mechanical Data

Mounting position
Base
Socket

Any
B17A
B17A

Base Connections
(underside view)

CENTRE LINE OF CHARACTERS

Pin
1 Cathode 3
2 Cathode 9
4 Cathode 0
5 Cathode 7
6 Cathode 8
10 Cathode 6
11 Cathode 5
12 Anode
13 Cathode 1
14 Cathode 2
15 Cathode 4

Note: All other pins are to be left unconnected.
*DIGITRON - Long Life 10 Digit End-Viewing Cold-Cathode Numerical Register Tube

GR10K
(CV. 5842)

Operating Characteristics

*Registered Trade Mark
*DIGITRON—Long Life 10 Digit End-Viewing Cold Cathode Numerical Register Tube

Characteristics and Recommended Operating Conditions
(at room temperature unless otherwise stated)
- Minimum anode to cathode voltage to ensure breakdown (see Note 1) 170 V
- Nominal running voltage at 2 mA 140 V
- D.C. Operation—Recommended Cathode Current 2 mA
- Minimum positive bias on non-conducting cathodes (See Note 2) 60 V
- Half wave A.C. supply
  - Recommended Cathode Current, average peak 1.5 mA 7 mA
- Minimum positive bias on non-conducting cathodes (See Note 2) 40 V
- Life expectancy (2 mA cathode current) (See Note 3)
  - Continuous ionisation of one cathode > 5,000 hours
  - Sequentially switching cathodes every 100 hours or less > 30,000 hours

Absolute Maximum Ratings
- Cathode current (each digit)—
  - Maximum average (averaging time = 20 mS) 2.5 mA
  - Maximum peak 10 mA
  - Minimum for D.C. operation 1.0 mA
- Bulb temperature—
  - Maximum +70°C
  - Minimum (See Note 3) −50°C

Notes—
1. At temperatures below 0°C anode supply should be at least 200 V.
2. Under limit conditions some deterioration of the glow appearance may occur during life. To minimise this, the voltage between the conducting and non-conducting cathodes should be as high as possible.
3. At −50°C the life expectancy of the tube is reduced.

* Registered Trade Mark
**DIGITRON—Long Life 10 Digit End-Viewing Cold Cathode Numerical Register Tube**

**GR10M**

**Mechanical Data**

Mounting position
Base
Socket

Base Connections (underside view)

CENTRE LINE OF CHARACTERS

Pin 2 Anode
3 Cathode 0
4 Cathode 9
5 Cathode 8
6 Cathode 7
7 Cathode 6
9 Cathode 5
10 Cathode 4
11 Cathode 3
12 Cathode 2
13 Cathode 1

Note—All other pins are to be left unconnected

* Registered Trade Mark
DIGITRON—Long Life 10 Digit End-Viewing Cold-Cathode Numerical Register Tube

Typical Circuit for D.C. Operation

Typical Circuit for A.C. Operation

*Registered Trade Mark
GR10M

*DIGITRON—Long Life 10 Digit End-Viewing Cold-Cathode Numerical Register Tube

Sum of the Total Probe Current to all Non-Illuminating Cathodes Plotted against Cathode Bias Voltage.

*Registered Trade Mark
Characteristics & Recommended Operating Conditions
(at room temperature unless otherwise stated)

Minimum anode to cathode voltage to ensure breakdown 160V
Nominal running voltage at 2mA 140V
D.C. Operation -
Recommended Cathode Current 2mA
Min. Positive bias on non-conducting cathodes
(See Note 1) 60V
Half-wave A.C. Supply -
Recommended Cathode Current, average 1.5mA
peak 7mA
Min. Positive bias on non-conducting cathodes
(See Note 1) 40V
Life Expectancy (2mA Cathode Current)
Continuous ionisation of one Cathode >5,000 hours
Sequentially Switching Cathodes every 100 hours or less >30,000 hours

Absolute Maximum Ratings

Cathode current (each character) -
Maximum average (averaging time = 20mS) 2.5mA
Maximum peak 10mA
Minimum for D.C. operation 1.0mA
Bulb temperature -
Maximum +70°C
Minimum -50°C

Notes: -
(1) Under limit conditions some deterioration of the glow appearance may occur during life. To minimise this, the voltage between the conducting and non-conducting cathodes should be as high as possible.

* Registered Trade Mark
GR 7 M *DIGITRON—Long Life 7 Character End-Viewing Cold-Cathode Register Tube Containing Characters +, −, V, A, Ω, %, and ~

Mechanical Data
Mounting position
Base
Socket

Any
B13B
B13B

Base Connections
(underside view)

CENTRE LINE OF CHARACTERS

Pin 2 Anode
3 Cathode Ω
4 Cathode %
6 Cathode V
7 Cathode +
9 Cathode ~
10 Cathode A
12 Cathode −

Note - All other pins are to be left unconnected.

The dome of the tube is filter coated

* Registe :d Trade Mark
Dekatron Circuits

The recommended Dekatron drive and coupling circuits are given in the following pages together with a number of suitable pulse shaping circuits. Although in the majority of cases the Dekatron counter symbol has been used, the drive circuits are equally applicable to computing and selector tubes, when the anode resistor and guide bias are correctly chosen. To compensate for the reduction in tube current which would occur in selectors, the anode resistor is reduced by an amount approximately equal to the cathode resistors.

In all the double-pulse Dekatron circuits except those with a sine wave input, the guides are taken to a positive bias which should not be less than the maximum positive potential reached by the output cathode(s). For counters this value is approximately +18 volts and for selectors approximately +36 volts.

The guides of a single pulse Dekatron operate with a positive bias of 72 volts, although the output cathode of this tube should not be allowed to rise more than +10 volts above the earthed common cathodes.

Wherever possible, the circuits which follow have been designed to operate with potentials of +475 V, +300 V, —20 V and —100 V supplies. To provide these supplies an arrangement comprising two 150 volt stabilizers has been given enabling +300 volts to be obtained from a 475 volt power supply. The —20 volts can be obtained from a potential divider across a —100 volt power unit, and the impedance of the —20 volts supply must not be greater than 4 kΩ.

Resetting

To enable counters to be set at zero, two h.t. negative lines should be provided. One directly earthed receives the returns from

cont’d
CIRCUITS

the Dekatron output cathodes (or the potential dividers feeding
them), the cathodes of any coupling tubes and the negative bias
supplies for these tubes. The other line, described as the reset line,
takes all the remaining returns and is connected to earth via a resistor
which is shorted during counting.

Operation of a key or relay which removes the short allows
current from the counters and biasing resistors to flow through the
unshorted resistor. This raises the potential of all the Dekatron’s
electrodes except the one to which it is desired to reset.

The value of the reset resistor depends on the number of decades
and couplings used, and should be chosen to produce a p.d. of 100
volts.
Dekatron Block Schematic Circuits
The above circuit uses two GD.150M tubes to provide a stabilized +300 V supply from +475 V. The +165 V supply is used for trigger bias with GTE.175M trigger tubes in Dekatron coupling circuits.

**Stabilized Voltage Supplies for use with Dekatron Circuits**
**Circuits**

Cold-cathode Trigger Tube Circuit for coupling two 4 kc/s Dekatrons (0-500 "carries" per second)

* The cathode load resistor of the previous stage must not be < 150 kΩ

<table>
<thead>
<tr>
<th>Counters</th>
<th>Selectors</th>
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<tr>
<td>R1 820 kΩ</td>
<td>680 kΩ</td>
</tr>
<tr>
<td>*R2 150 kΩ max.</td>
<td>150 kΩ max.</td>
</tr>
<tr>
<td>R3 39 kΩ</td>
<td>47 kΩ</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input to previous stage</th>
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</thead>
<tbody>
<tr>
<td>Rect. Pulses</td>
</tr>
<tr>
<td>C1 -0.001 μF</td>
</tr>
<tr>
<td>C2 -0.001 μF</td>
</tr>
<tr>
<td>C3 -0.002 μF</td>
</tr>
</tbody>
</table>
Circuits

NOTE 1

<table>
<thead>
<tr>
<th>Counters</th>
<th>GS10C</th>
<th>GS12D</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>10 kΩ</td>
<td>22 kΩ</td>
</tr>
<tr>
<td>R2</td>
<td>820 kΩ</td>
<td>680 kΩ</td>
</tr>
<tr>
<td>R3</td>
<td>150 kΩ</td>
<td>150 kΩ</td>
</tr>
<tr>
<td>E</td>
<td>+18 V</td>
<td>+36 V</td>
</tr>
</tbody>
</table>

NOTE:—Suitable input circuits are LK105 and LK106. Sine wave drive LK104 may be used at a minimum frequency of 400 c.p.s.

Amplifier for Coupling two Double-pulse Dekatrons
$V_p = -145 \pm 15 \text{ V}$  \hspace{1cm}  \tau_1 = > 80 \mu\text{s}  \hspace{1cm}  \tau_2 = > 170 \mu\text{s}$

**NOTE:**—When this circuit is used to precede circuit LK 109 (Triode Amplifier Cct.) the .02 \mu F input capacitor should be reduced to 4,700 \mu F

**Integrated-pulse Drive for 4 k/cs Dekatron**
Circuits

LK 106

<table>
<thead>
<tr>
<th>Counters</th>
<th>Selectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>820 kΩ</td>
</tr>
<tr>
<td>R2</td>
<td>10 kΩ</td>
</tr>
<tr>
<td>R3</td>
<td>150 kΩ max.</td>
</tr>
<tr>
<td>E</td>
<td>+18 V</td>
</tr>
<tr>
<td></td>
<td>680 kΩ</td>
</tr>
<tr>
<td></td>
<td>22 kΩ</td>
</tr>
<tr>
<td></td>
<td>150 kΩ max.</td>
</tr>
<tr>
<td></td>
<td>+36 V</td>
</tr>
</tbody>
</table>

\[ V_{P1} = V_{P2} = -80 \pm 10 \text{ V} \quad t_1 = t_2 = > 60 \mu \text{S} \]

Paired-pulse Drive for 4 kc/s Dekatron
Counters | Selectors
---|---
| R1 | 820 kΩ | 680 kΩ |
| R2 | 150 kΩ max. | 150 kΩ max. |

<table>
<thead>
<tr>
<th>Frequency</th>
<th>4 kc/s</th>
<th>2 kc/s</th>
<th>1 kc/s</th>
<th>500 c/s</th>
<th>200 c/s</th>
<th>100 c/s</th>
<th>50 c/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>680 pF</td>
<td>-0.002 μF</td>
<td>-0.005 μF</td>
<td>-0.01 μF</td>
<td>-0.02 μF</td>
<td>-0.05 μF</td>
<td>-0.1 μF</td>
</tr>
<tr>
<td>Drive Amplitude</td>
<td>40—70 V r.m.s.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In the continuous sine-wave drive circuit LK.104 the correct phase relationship is not achieved until a few cycles have elapsed. In order to count trains of sine-waves it is necessary to convert them into pulses suitable for the integrated pulse drive LK.105. The above circuit fulfils this requirement.

**Sine-wave Shaping Circuit**
The above circuit is designed to feed either the integrated pulse drive LK.105, or the GC10D single pulse drive LK.107. Triggering is achieved with a short positive pulse of amplitude greater than 20 V.

**Multivibrator Pulse Shaping Circuit**
Gate Circuit for use with Single and Double-pulse Dekatron Drive Circuits
In order to prevent spurious counting due to contact bounce, it is essential to precede the integrated pulse drive LK.105 with a quenching circuit.

Contact Input
This circuit has been designed for use with either a P50A, germanium junction photo-cell, or an OCP71, photo-transistor. A positive going pulse is produced at the output whenever the light focused on the cell is interrupted. This pulse is suitable for driving the cold-cathode coupling circuit LK.108. The 150 V supply rail should be stabilized and may be obtained from the stabilizing circuit LK.103.

Photo-cell Input for 4 kc/s Dekatron
The grid and cathode of the pulse amplifier are used as a limiting diode for the GS10D output cathode voltage.

**Coupling Circuit from GS10D to GS10C or other 4 kc/s Dekatron**
The grid and cathode of the pulse amplifier are used as a limiting diode for the GC10D output cathode voltage.

If a —20V rail is available, the junction A of the 470k resistor and 47pf capacitor may be taken to this supply and the CV.455 cathode taken to the 0V rail, eliminating the cathode potential divider.
Detail of Binary Counting Stage with Pulse Amplifier for Driving GC10D Circuit LK107
GR10A Connected to Conventional Decade Scaler
To zero the circuit S.1A and S.1B should be operated together. The same contacts may also be used to zero cascaded decades.

**Trigger Tube Ring Counter**
incorporating *Digitron Readout 1kp.p.s. max.*

* Registered Trade Mark
To zero the circuit S.1A and S.1B should be operated together. The same contacts may also be used to zero cascaded decades.

**Trigger Tube Ring Counter**
Max. Frequency 1 kc/s
Twin Photo Input to Reversible *Dekatron

Note:—Ratio of Light/Dark Approx. 1 : 2

*Registered Trade Mark
Reversible Drive and Coupling Circuit
for GCA10G/GSA10G
GCA10G/GSA10G Transistor Drive and Coupling Circuits

### Transformer Details

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### Circuit Diagram

- **Components:**
  - Resistors (e.g., 1k, 2.2k, 33k, 47k)
  - Capacitors (e.g., 0.1uF, 0.001uF)
  - Transistors (e.g., OC77, OC83)
- **Inputs:**
  - POWER
- **Outputs:**
  - OUTPUT
- **Other Notes:**
  - UNDER REVISION
  - ISSUE 2

---

**Notes:**

- MAX COUNT RATE:
  - 2Kpps: OC77
  - 5Kpps: OC83

---
GCA10G/GSA10G Pentode Coupling Circuit
*Digitron Display from 1-2-4-8 Binary Coded Decimal Input

* Registered Trade Mark
*Digitron Display from 1-2-4-2 Binary Coded Decimal Input

* Registered Trade Mark
This circuit accepts pulses as small as 25 V, 100 $\mu$S into 1 M$\Omega$; and operates a 50 V, 25 mA relay or electromagnetic counter for approx. 50 mS. The value of C determines the duration of the relay energizing pulse. Maximum speed 15 p.p.s.

**Electronic to Electro-magnetic Coupling Circuit**
Timing period = 1.6 R.C. secs.  R in MΩ  
R max. = 470MΩ  C in μF  
C min. = 470pF  

Simple R.C. Timer for Nominal 240 V A.C. Operation
Max. speed 5 kp.p.s.—For speeds below 250 p.p.s. Diodes marked * can be omitted. 
Min. Dekatron Cathode Voltage 20 V. 
No Connection is necessary to the ‘O’ position of the selector switch ‘A’ wafers. 

Pre-set Batch Counter-using Ring Counter Coincidence Circuit
Prospective users are invited to contact the Research Laboratory of the Tube Division when planning apparatus using Spark Gap Tubes. These are not held in stock, but are designed to meet each customer’s requirements.

The tubes are available either as diodes or triggered gaps, and can be manufactured with striking voltages better than $\pm 5\%$ of the nominal voltage over the range 500 V to 50 kV, with peak currents of many thousands of amperes.

The size of the tubes depends on the rating, but an average tube is approximately 2.25 cm. ($\frac{7}{8}$") diameter and 5.0 cm. (2") long, exclusive of end caps or flying leads.
Discharge Tube

GD 2 V

Breakdown Voltage 2 kV ± 100 V
Maximum discharge energy 16J
Maximum storage capacitor 8 μF
Insulation at 1.5 kV 10MΩ min.

HOLE TAPPED
6BA .156 DEEP

48.4/45.7mm
1.905'/1.800'

30.48/27.94mm
1.200'/1.100'
DIA.

9.65/9.4mm
380/370'
DIA.

41.55/39.5mm
1.635'/1.555'

NOTES

(1) When the applied voltage has a very fast rise time, it is essential that some light reaches the tube. For slow capacitor charging waveforms, the tube may be used in complete darkness.

(2) As supplied, the gap is symmetrical. Discharges introduce asymmetry, and the life will be shortened if the polarity is changed after some discharges have taken place.

(3) The standard tube has one end cap and one tapped hole. End caps with threaded stud suitable for fitting into the tapped hole will be supplied on request.
TENTATIVE DATA SHEET

SPARK GAP

Striking Voltage - 500-630V
Max. Discharge Energy - 1.5J
Leakage current at 450V - <1μA
Max. Repetition Rate - 10 p/sec.

Typical number of discharges - $40 \times 10^6$ (in circuit below with discharge energy of 0.07J and rate of 1 per sec.)

![Circuit Diagram]

$\text{HT+}$

$0.5 \mu\text{f}$

$\text{GD550W}$

$E$

2.625" max

1.125" min.

1.14" max. dia.
MAINTENANCE TUBES

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*These tubes have been superseded by, or are being superseded by, new and improved tubes.

The data sheets have been included for the benefit of engineers who have to maintain equipment containing the above tubes or modify equipment to current tube types.

Once the present stocks are exhausted it will not be possible to accept further orders.
Miniature Bi-directional
10-way Computing Tube

Limit Ratings
Maximum counting rate: sine wave and rectangular pulses 1,000 p.p.s.
Minimum counting rate 1 p.p. hour
Maximum total anode current 500 µA
Minimum total anode current 315 µA
Minimum anode to cathode supply voltage (normal room illumination) 320 V
Maximum potential difference between cathodes and guides 140 V
Maximum output cathode load 150 kΩ
Output pulse produced across the above 35 V

Characteristics
Running voltage at 350 µA 190 V approx.

Recommended Operating Conditions
* Anode current 350 µA ± 10%
* Guide bias +18 V
** Bias on output cathode resistor −20 V
Forced resetting pulse −120 V
Double pulse drive—amplitude −80 V ± 10 V
Double pulse drive—durations 300 µS
Integrated pulse drive—amplitude −145 V ± 15 V
Integrated pulse drive—duration 350 µS
Integrated pulse drive—min. quiescent time 650 µS
Sine wave drive—amplitude 40—75 V r.m.s.

* The required anode current may be obtained from a 475 V supply via an 820 kΩ resistor.
** This does not apply in the case of the sine wave drive.
GC10/2P  Miniature Bi-directional 10-way Computing Tube

Mechanical Data

Mounting position
Any.
For visual indication the tube is viewed through the dome of the bulb.

Alignment
Cathode "O" is approximately aligned with pin No. 5.

Weight
13 g (nominal).

Escutcheon
N.84338.

Base
B7G

Base Connections (underside view)

Pin 1 Do not connect
2 1st Guides
3 Common cathodes
4 2nd Guides
5 Cathode 0
6 Cathode 9
7 Anode

Dimensions:

54 mm MAX. 476 mm MAX
2126° 1870°

19 mm MAX.

748°
Voltage Stabilizer

Limit Ratings

Minimum anode current
Maximum anode current
Minimum anode supply voltage

10 mA
75 mA
180 V

Characteristics

Running voltage at 75 mA
Maximum change in $V_R$ for a current change from 10 to 75 mA

115—135 V
10 V

N.B. Equilibrium conditions are reached after 10 minutes operation.
**GD120 A/S**
(CV.1110)

**Voltage Stabilizer**

**Mechanical Data**

- **Mounting position**: Any.
- **Weight**: 54 g (nominal).
- **Base**: British 4 pin.

**Base Connections** (underside view)

- **Pin 1**: Anode
- **Pin 2**: Cathode
- **Pin 3**: No connections
- **Pin 4**: No connections

[Diagram of the tube with dimensions:]
- **52mm MAX.**
- **109.7mm MAX.**
- **153mm**

---

**MN-3-1**

**ISSUE 3**
**Primed Voltage Stabilizer**

**GTR 120 A/S**

**(CV.45)**

**Limit Ratings**

- Minimum anode current: 10 mA
- Maximum anode current: 75 mA
- Minimum anode supply voltage when the primer is connected as (1) below: 135 V
- Minimum anode supply voltage when the primer is connected as (2) below: 190 V

**Primer Connections**

(1) To +190 V via 47 kΩ or any other arrangement causing the primer current to be approx. 1·3 mA.
(2) Through 15 kΩ to the main anode.

**Characteristics**

- Running voltage at 75 mA: 115—135 V
- Maximum change in $V_R$ for a current change from 10 to 75 mA: 10 V
- Primer striking voltage: 190 V
- Primer running voltage: 120 V (nominal)

*Note.*—Equilibrium conditions are reached after 10 minutes operation.
**Mechanical Data**

**Mounting position**
- Any

**Weight**
- 54 g (nominal)

**Base**
- British 4 pin

**Base Connections (underside view)**

Pin 1: Anode  
Pin 2: Cathode  
Pin 3: No connection  
Pin 4: Primer

**Dimensions**
- 52 mm MAX.  
- 2.05"  
- 109.7 mm MAX.  
- 4.287"  
- 15.3 mm  
- .602"
Primed Trigger Tube

An inexpensive trigger tube with light diode suitable for operation in poor light conditions

Limit Ratings

Maximum anode voltage to prevent self-ignition in all tubes (Trigger voltage 0 V) +340 V
Maximum trigger to cathode voltage at which breakdown will not occur in any tubes (anode voltage 315 V)
Cathode 0 V, Trigger +105 V
Trigger 0 V, Cathode +70 V
Minimum trigger voltage necessary to cause breakdown in all tubes (anode voltage 315 V) +155 V
Maximum cathode current 9 mA
Minimum cathode current 3 mA
Minimum supply voltage for priming diode 315 V

Characteristics

Anode running voltage at 4.5 mA 94—130 V
(N.B.—Tubes may exhibit jumps of up to 20 V in operation).

Deionization time \( (I_a = 4.5 \text{ mA}) \) 3 mS max. ←
Ionisation time \( (V_T = 175 \text{ V pulse}) \) 500 μS max.

Recommended Operating Conditions

Anode supply voltage 315 V
Cathode current 3.4 mA
Anode load resistor 47 kΩ
Trigger bias with respect to cathode +80 V
(Trigger resistor 330 kΩ)

Light anode to be connected via 10 MΩ to +315 V.
Light cathode to be connected via 10 MΩ to 0 V.

N.B. ← Indicates a change from previous data sheets.
**Primed Trigger Tube**

An inexpensive trigger tube with light diode suitable for operation in poor light conditions

**Mechanical Data**

**Mounting position**

Base

**Base Connections**
(underside view)

1. Trigger
2. Cathode
3. Do not connect
4. Light cathode
5. Light anode
6. Anode

**Dimensions**

- 1.181" (30mm)
- 1.417" NOM. (36mm)
- 0.689 DIA. (17.5 mm)

**References**

MN-5-1 ISSUE 3
Primed Trigger Tube

An inexpensive trigger tube with light diode suitable for operation in poor light conditions

Distribution of Trigger Striking Volts
Primed Trigger Tube

A high current inexpensive trigger tube with light diode suitable for operation in poor light conditions

Limit Ratings

Maximum anode voltage to prevent self-ignition in all tubes (trigger voltage 0 V) 400 V
Maximum trigger to cathode voltage at which breakdown will not occur in any tubes (anode voltage 315 V)

Cathode 0 V, Trigger +100 V
Trigger 0 V, Cathode +80 V

Minimum trigger voltage necessary to cause breakdown in all tubes (anode voltage 315 V) +155 V

Maximum cathode current (D.C.) 25 mA
Maximum cathode current (peak) max. duration 100 mS. 60 mA
Minimum cathode current 5 mA
Minimum supply voltage for priming diode 315 V

Characteristics

Anode running voltage at 25 mA 94—130 V ←
(N.B.—Tubes may exhibit jumps of up to 20 V in operation at low currents)
Deionization time \((I_a = 25 \text{ mA})\) 5 mS max. ←
Ionization time \((V_T = 175 \text{ V pulse})\) 1 mS

Recommended Operating Conditions

Anode supply voltage 315 V
Cathode current 25 mA
Anode load resistor 8·2 kΩ
Trigger bias with respect to cathode
(Trigger resistor 100 kΩ) +80 V
Light anode to be connected via 10 MΩ to +315 V
Light cathode to be connected via 10 MΩ to 0 V

N.B. ← Indicates a change from previous data sheets.
Primed Trigger Tube

A high current inexpensive trigger tube with light diode suitable for operation in poor light conditions

Mechanical Data

Mounting position
Any

Base
B9A

Base Connections
(underside view)

1. Anode
2. Do not connect
3. Trigger
4. Cathode
5. Do not connect
6. Light cathode
7. Light anode
8. Anode

Diagram with dimensions:
- Anode height: 1.185" (30.1 mm)
- Anode diameter: 0.800" (20.32 mm)
- Anode maximum height: 1.772" (45 mm)
*DIGITRON–2 Character Side-Viewing
Cold-Cathode + and — Register Tube

Limit Ratings

Maximum cathode current (+ sign) 5 mA
Maximum cathode current (— sign) 3 mA
Minimum voltage necessary to ensure breakdown 180 V

Characteristics

Nominal running voltage 168 V
A cathode left floating will assume some potential between that of the anode and the glowing cathode.

Recommended Operating Conditions

Under the recommended D.C. operating conditions with the characters switched sequentially every 24 hours, an average life of 4,000 hours can be expected.

Anode supply voltage 250 V
Cathode + series resistor 15kΩ
Cathode — series resistor 27kΩ

* Registered Trade Mark
GR2G

DIGITRON—2 Character Side-Viewing Cold-Cathode + and — Register Tube

Mechanical Data

Mounting position
Base
Socket

Any
B26A
B17A, B26A or B27A

Base Connections (underside view)

Pin 6 Anode
Pin 10 —
Pin 14 +

Note—All other pins are to be left unconnected.
*DIGITRON—2 Character Side-Viewing Cold-Cathode + and − Register Tube

Operating Characteristics

*Registered Trade Mark
Limit Ratings

Maximum cathode current (+ sign) 2 mA
Maximum cathode current (- sign) 1.5 mA
Minimum voltage necessary to ensure breakdown 150V

Characteristics

Nominal running voltage 130V
A cathode left floating will assume some potential between that of the anode and glowing cathode

Recommended Operating Conditions

Anode supply voltage 250V
Cathode + series resistor 82kΩ
Cathode - series resistor 120kΩ
MAINTENANCE TYPE ONLY
DIGITRON -2 Character End-Viewing
Cold-Cathode + and - Register Tubes

Mechanical Data

Mounting Position

Any

The characters are viewed through the dome of the bulb. They will appear upright (within ± 10°) when the tube is mounted with the line through pins 3 and 12 vertical, pin 12 being uppermost.

Base
Socket

B17
B17A

Base Connections (underside view)

Pin 16 Anode
Pin 6 +
Pin 15 -

Note - All other pins are to be left unconnected.
* DIGITRON -2 Character End-Viewing
Cold-Cathode + and - Register Tubes

Operating Characteristics

* Registered Trade Mark
Limit Ratings

Maximum cathode current—1 5 mA
Maximum cathode current—\( \frac{1}{4}, \frac{1}{2}, \frac{3}{4} \) 7 mA
Minimum voltage necessary to ensure breakdown 200 V

Characteristics

Nominal running voltage \( I_a = 5 \text{ mA} \) 170 V
A cathode left floating will assume some potential between that of the anode and the glowing cathode.

Recommended Operating Conditions

Under the recommended D.C. operating conditions with the characters switched sequentially every 24 hours, an average life of 3,500 hours can be expected.

D.C. operation
Anode supply voltage — \( R_a = 12k\Omega \) 250 V

A.C. operation
(Unsmoothed half-wave rectified 50 c.p.s. A.C.)
Anode supply voltage — \( R_a = 12k\Omega \) 200-220 V r.m.s.
\( R_a = 18k\Omega \) 220-250 V r.m.s.
Cathode 1 equalizing resistor 10kΩ

* Registered Trade Mark
DIGITRON–4 Character Side Viewing Cold-Cathode Fraction Register Tube

Mechanical Data

Mounting position
Base
Socket

Any
B26A

B17, B26A or B27A

Base Connections
(underside view)

Pin 6 Anode
7 1/2
8 4/5
15 1
17 1/4

All other pins to be left unconnected.
*DIGITRON—4 Character Side-Viewing
Cold-Cathode Fraction Register Tube

Operating Characteristics
*Registered Trade Mark
**Limit Ratings**

- Maximum cathode current: 9 mA
- Minimum voltage necessary to ensure breakdown: 220 V

**Characteristics**

- Nominal running voltage: 180 V
- A cathode left floating will assume some potential between that of the anode and the glowing cathode.

**Recommended Operating Conditions**

Under the recommended D.C. operating conditions with the characters switched sequentially every 24 hours, an average life of 5,000 hours can be expected.

**D.C. operation**
- Anode supply voltage — $Ra = 10k\Omega$: 250 V

**A.C. operation**
- (Unsmoothed half-wave rectified 50 c.p.s. A.C.)
- Anode supply voltage — $Ra = 12k\Omega$: 200-220 V r.m.s.
- $Ra = 18k\Omega$: 220-250 V r.m.s.

- Cathode 1 equalizing resistor: 8.2kΩ
- Cathode 7 equalizing resistor: 4.7kΩ

* Registered Trade Mark
**Mechanical Data**

**Mounting position**
- Any
- B26A
- B17, B26A or B27A

**Base Connections**
(underside view)

- Pin 1: Cathode 6
- Pin 2: Cathode 5
- Pin 3: Cathode 4
- Pin 4: Anode
- Pin 5: Cathode 3
- Pin 6: Cathode 2
- Pin 7: Cathode 1
- Pin 8: Cathode 0
- Pin 9: Cathode 9
- Pin 10: Cathode 8
- Pin 11: Cathode 7

**Note**—All other pins are to be left unconnected.
*DIGITRON—10 Digit Side-Viewing
Cold-Cathode Numerical Register Tube

Operating Characteristics

*Registered Trade Mark
Limit Ratings

Maximum cathode current 2.5 mA
Minimum voltage to ensure breakdown 150 V

Characteristics

Nominal running voltage at 2 mA 140 V
Minimum pre-bias voltage (glowing cathode at 0 V) +25 V
Maximum pre-bias voltage (glowing cathode at 0 V) +100 V

A cathode left floating will assume some potential between that of the anode and the glowing cathode. Pre-biasing ensures that the non-glowing electrodes are clamped at a predetermined level and cathodes are selected bringing them to the 0 V line.

Recommended Operating Conditions

Under the recommended operating conditions, with the cathodes switched sequentially every 24 hours, an average life of 4000 hours can be expected.

D.C. operation
Anode supply voltage—\( R_a = 82 \, k\Omega \) 250 V
\( R_a = 47 \, k\Omega \) 200 V

A.C. operation
(Unsmoothed half-wave rectified 50 c.p.s. A.C.)
Anode supply voltage—\( R_a = 120 \, k \) 220-250 V r.m.s.
\( R_a = 82 \, k \) 200-220 V r.m.s.

*Registered Trade Mark
**MECHANICAL DATA**

**Mounting position**
- Any
  - Base: B17A
  - Socket: B17A

**Base Connections**
- (underside view)

---

**Pin 1** Cathode 3
2 Cathode 9
4 Cathode 0
5 Cathode 7
6 Cathode 8
10 Cathode 6
11 Cathode 5
12 Anode
13 Cathode 1
14 Cathode 2
15 Cathode 4

*Note: All other pins are to be left unconnected.*
MAINTENANCE TYPE ONLY

*DIGITRON - 10 Digit End-Viewing
Cold-Cathode Numerical Register Tube

GR10H

Operating Characteristics

*Registered Trade Mark
*DIGITRON—10 Digit Side-Viewing Miniature Cold-Cathode Numerical Register Tube, with flying leads

**Limit Ratings**

- Maximum cathode current: 4 mA
- Minimum voltage necessary to ensure breakdown: 220 V

**Characteristics**

- Nominal running voltage: 160 V
- A cathode left floating will assume some potential between that of the anode and the glowing cathode.

**Recommended Operating Conditions**

Under the recommended D.C. operating conditions with the characters switched sequentially every 24 hours, an average life of 3,000 hours can be expected.

- **D.C. operation**
  - Anode supply voltage: $Ra = 18k\Omega$, 220 V

- **A.C. operation**
  - (Unsmoothed half-wave rectified 50 c.p.s. A.C.)
  - Anode supply voltage: $Ra = 27k\Omega$, 200-220 V r.m.s.
  - $Ra = 47k\Omega$, 220-250 V r.m.s.

* Registered Trade Mark
**GR10W DIGITRON—10 Digit Side-Viewing Miniature Cold-Cathode Numerical Register Tube, with flying leads**

### Mechanical Data

**Mounting position**
- Base

**Base Connections (underside view)**

**Lead**
1. Cathode 1
2. Cathode 2
3. Cathode 3
4. Cathode 4
5. Omitted
6. Cathode 5
7. Omitted
8. Cathode 6
9. Omitted
10. Cathode 7
11. Cathode 8
12. Cathode 9
13. Cathode 0
14. Anode

**Any Flying lead**

---

*N.B.*—To prevent damage to the tube, the leads should not be soldered or bent nearer than 5 mm (1/4") from the glass seal.
*DIGITRON—10 Digit Side-Viewing Miniature Cold-Cathode Numerical Register Tube, with flying leads

Operating Characteristics

*Registered Trade Mark
GR12G Tube contains the letters A to L inclusive
GR12H Tube contains the letters L to X excluding P and Q but additionally including E.

Limit Ratings

Maximum cathode current: -
Letter I 5 mA
Letters L and T 5.5 mA
Letters J and F 7.5 mA
Remaining letters 9.0 mA

Minimum voltage necessary to ensure breakdown 220V

Characteristics

Nominal running voltage: -
Letter I at 4.5 mA 170V
Letters L and T at 5.0 mA 175V
Letters J and F at 6.25 mA 185V
Remaining letters at 7.5 mA 175V

A cathode left floating will assume some potential between that of the anode and the glowing cathode.

It should be noted that non-glowing cathodes must not be returned to a bias rail, but should be left disconnected.

Recommended Operating Conditions

D.C. operation
Anode Supply Voltage - Ra = 10KΩ 250V

A.C. operation
(Unsmoothed half-wave rectified 50 c.p.s. A.C.)
Anode Supply Voltage - Ra = 12KΩ 200-220V r.m.s.
Ra = 18KΩ 220-250V r.m.s.

Cathode equalizing resistors (Va = 250V only).
Letter I 8.2KΩ
Letters L and T 4.7KΩ
DIGITRONS - 12 Character Side-Viewing
Cold-Cathode Letter Tubes

Mechanical Data

Mounting Position
Base
Socket

Base Connections
(Underside view)

G12G

Pin 1  Cathode B  Pin 1  Cathode P
3  "  G  3  "  S
5  "  J  5  "  V
6  "  A  6  "  W
7  "  H  7  "  N
8  "  L  8  "  W
9  "  K  9  "  T
10 "  I  10 "  T
13 Anode  13 Anode
14 Cathode C  14 Cathode U
15 "  F  15 "  X
16 "  E  16 "  R
17 "  D  17 "  E

Note: Pins 2, 4, 11 and 12 must be left unconnected.
Operating Characteristics

* Registered Trade Mark
Magnetically Screened High Current
10-way Trochotron Beam Switching Tube

Electrical Characteristics identical to the VS10 G

**Mechanical Data**

- **Mounting position**: Any. This tube may be mounted in close proximity to similar tubes, and to magnetic material.
- **Weight**: 670 g
- **Base**: B26A
- **Sockets**: B26A or B27A

**Base Connections (underside view)**

```
  8  9  10  11
  7  6  22  23
  0  21  04 012
  5  0  10 014
  0  20 020 015
  3  0  27 016
  2  1 17
```

**3D Diagram**

- 75 mm 2.953" MAX. DIA.
- 88.1 mm 3.469" MAX.
- 81.5 mm 3.219" MAX.
Low Voltage 10-way Trochotron
Beam Switching Tube

Cathode
Indirectly heated

Heater
Vh 6.3 V
Lh 0.5 A

Limit Ratings
Maximum heater to cathode voltage ± 75 V
Maximum spade to cathode voltage ($V_s$ max.) 32 V
Minimum spade to cathode voltage ($V_s$ min.) 28 V
Maximum target to cathode voltage ($V_T$ max.) 150 V
Minimum target to cathode voltage ($V_T$ min.) 14 V
Minimum switching-grid to cathode voltage ($V_{SG}$ min.) 15 V
Minimum spade resistor $V_s = 28$ V 100 kΩ
Maximum spade resistor $V_s = 28$ V 150 kΩ

Characteristics ($V_s = 30$ V, $R_s = 150$ kΩ)
Holding spade current 400 μA nom.
Target current 1.7 mA nom.

Recommended Operating Conditions
(for counting up to 1 Mc/S)

$$V_s = 30 \text{ V}$$
$$R_s = 150 \text{ kΩ } \pm 10\%$$

(Each spade must be connected to a separate spade resistor with not more than $\frac{1}{2}$" (10 mm) of connecting lead).

$$V_T = 30 \text{ V}$$
$$R_T = 6.8 \text{ kΩ}$$

(Any number of targets may be taken to a common target resistor).

$$V_{SG} = 15 \text{ V}$$
$$V_{SG} \text{ pulse amplitude} = -17 \text{ V}$$
$$t \text{ pulse} = 0.5 \mu\text{S}$$
$$R_{SG} = 47 \text{ kΩ}$$
$$C \text{ input coupling} = 330 \text{ pF}$$
Low Voltage 10-way Trochotron
Beam Switching Tube

Mechanical Data

Mounting position
Any: providing that the tube is kept at least 2" from any magnetic material or 4" from a similar tube, a strong magnet or a mu-metal screen.

Weight
220 g

Base
B26A

Sockets
B26A or B27A

Base Connections (underside view)

Pin
1 Spade 0
2 Target 9
3 Target 8
4 Odd Switching grids
5 Target 7
6 Spade 7
7 Target 6
8 Target 5
9 Spade 5
10 Target 4
11 Do not connect
12 Target 3
13 Target 2
14 Spade 2
15 Target 1
16 Even Switching grids
17 Target 0
19 Spade 9
20 Spade 8
21 Heater
22 Spade 6
23 Spade 4
24 Spade 3
25 Heater
26 Spade 1
27 Cathode

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REFERENCES

The list of articles which follows has been included to give existing and prospective users of Dekatron tubes an insight into the wide range of applications in which the tubes have been used. It is anticipated that these references will be of particular value to lecturers and students of electronic engineering.

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(2) An Electronic Digital Computer.
R. C. M. Barnes and others, Electronic Engineering, August 1951.

(3) The Single Pulse Dekatron.

(4) New Trigger Circuits for use with Cold Cathode Counting Tubes.

(5) A Dekatron C.R.O. Time Marker.

(6) An Electronic Batching Counter.

(7) Measurement of the Size Distribution of Spray Particles.
L. K. Wheeler and E. S. Trickett, Electronic Engineering, October 1953.

(8) Polycathode Counter Tube Applications.
J. H. L. McAuslan and K. J. Brimley, Electronics, November 1953.

(9) Selective Calling for Radio-Telephone Systems.

(10) Time Marker for Electrocardiography.

(11) A High-Speed Precision Tachometer.

(12) Decimal Counting Tubes.

(13) Cold-Cathode Counting Tubes in Cascade.

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(15) An Accurate Voltage Integrator for Magnetic Field Measurements.

(16) A Cold-Cathode Scaling Unit.

(17) A Low-Frequency Pulse Train Generator.

(18) A Scaler for the Measurement of Half Life in the Range 3 seconds to 30 minutes.

(19) Counting Circuit Batches Components.

(20) Multi-Electrode Counting Tubes.

(21) A High-Speed Revolution Counter.

(22) Automatic Tare Allowance, Control, and Printing for Dial Weighing-Machines.

(23) The Dekatron in Nuclear Instrumentation.

(24) The Use of Cold-Cathode Counting Tubes for the Control of Resistance Welding.

(25) Aerosoloscope Counts Particles in Gas.

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(27) Air Speed-Record Electronic Timing.

(28) An Electronic Timing Unit.

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(32) Counter Circuits Analyses Ignition.

(33) Automatic Counting Techniques as Applied to Comparison Measurement.

(34) A Very High Speed Precision Tachometer.

(35) A Versatile Pulse Pattern Generator.

(36) A Decimal Product Accumulator.

(37) Transistor Circuits for use with Cold-Cathode Gas-Filled Multi-Cathode Counter Valves.

(38) A Low Cost Cold-Cathode Trigger Tube.

(39) Dekatrons and Electro-Mechanical Registers operated by Transistors.

(40) A Reversible Dekatron Counter.

(41) The Use of Dekatrons for Pulse Distribution.

(42) Circuit for a Reversible Dekatron Counter.
K. F. Bacon, Electronic Engineering (Correspondence), March 1959.

(43) A Transistor Characteristic Curve Tracer.
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(44) An Electronic Clock Coder for Radio Beacons.

(45) The Digitron.