electronic tube handbook

ERICSSON TELEPHONES LIMITED

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* DEKATRON and DIGITRON are registered Trade Marks of Erïcsson Telephones Limited.

TUBE DIVISION

BEESTON NOTTINGHAM

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Head Office: 22 LINCOLN'S INN FIELDS LONDON WC2

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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

★ "DEKATRON" TUBES

(Counters and Selectors)

Type	Price
GC10B	29/-
GC10B/L (CV6044)	50/-
GC10B/S (CV2271)	34/-
GC10/4B (CV1739)	38/-
GC10/4B/L (CV6100)	50/-
GC10D (CV5143)	45/-
GC12/4B	50/-
GCA10G	45/-
GS10C/S (CV2325)	35/-
GS10D	45/-
GS10H	30/-
GS12D	65/-
GSA10G	45/-

★ "DIGITRON AND REGISTER TUBES

(Indicator Tubes)

‡ GR2J	40/-
‡ GR7M	45/-
GR10A (CV5291)	35/-
GR10J	32/6
GR10K	32/6
GR10M	32/6
‡ GR10N	80/-

TRIGGER TUBES

‡ GPE120T	10/-
GPE175M	8/6
GTE120Y	5/-
GTE130T	9/-
‡ GTE150Y	5/-
GTE175M	6/6
GTR120W	1/6

SPARK GAP TUBES

GD2V	70/-
‡ GD550W	28/-

★ Registered Trade Mark ‡ Data available on request

CORONA STABILIZER TUBES

Type	Price
GD340W	42/6
GD350X	42/6
GD350Y	30/-

REFERENCE AND STABILIZER TUBES

GD75P	9/-
GD83M	10/-
GD85M/S (CV449)	8/6
GD87M/S (5651 and CV2573)	8/6
GD90M	8/6
GD108M/S (CV1833 and OB2)	8/6
GD150M/S (CV1832 and OA2)	8/6
GD150P/S (CV2225)	8/6
GTR75M/S (CV284)	8/6
GTR83W	5/-
GTR83X	5/-
GTR150W	5/-

REED RELAY INSERTS

‡ MRR1/A	5/-
‡ RR80/30W	6/6

MAINTENANCE TUBES

GC10/2P	60/-
GD85PR/S (CV4048)	15/-
GD85WR	20/-
GD86W/S (CV2321)	15/-
GD100A/S (CV188)	17/6
GD100B/S (CV1070)	17/6
GD120A/S (CV1110 and CV1731)	26/-
GD150A/S (CV216 and OD3)	9/-
GD150M	8/6
GDT120M	10/-
GDT120T	10/-
GR2G	45/-
GR4G	35/-
GR12G	180/-

‡ Data available on request

MAINTENANCE TUBES (continued)

Type	Price
GR2H	45/-
GR12H	180/-
GR10W	45/-
GS10K	50/-
GTR95M/S (CV286)	7/6
GTR120A/S (CV45)	27/-
GTR150M/S (CV287)	9/-
VS10G	200/-
VS10G/M	240/-
VS10H	220/-
VS10K	200/-

INDICATOR SHIELDS FOR USE WITH DEKATRONS

E.T.L. CODE	PRICE Nett (not subject to discount)	FOR USE WITH
N78211 (Bakelite 0-9)	2/-	GC10B, GC10B/S, GC10/4B, GC10D
N79368 (Metal 0-9)	1/-	GC10B, GC10B/S, GC10/4B, GC10D, GS10H
N79369 (Metal 0-11)	1/-	GC12/4B
N80977 (Metal 0-9)	1/-	GS10C/S, GS10D, GR10A
N84538 (Metal 0-11)	1/-	GS12D
N84338 (Metal 0-9)	1/-	GC10/2P

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	For use with Digitron GR10J
HFD13503	3 tube	£2.10.0	
HFD13504	4 tube	£3. 2.6	
HFD13505	5 tube	£3.12.6	

TUBE SOCKETS

TYPE	E.T.L. CODE	PRICE Nett (not subject to discount)		FOR USE WITH
B7G	N77454A	1/3	..	GD75P, GD83M, GD85M/S GD87M, GD90M, GD108M, GD150M, GD150M/S, GD150M/R, GD150P, GDT120M, GPE175M, GTE175M, GTR95M/S, GTR150M/S
I.O.	N77461	1/-	..	GC10B, GC10B/S, GC10B/L, GC10/4B, GC12/4B, GC10D, GD150A/S
B9A	HFD11453	1/3	..	GDT120T, GTE130T, GPE120T,
B12E	N890066) HFD11437)	2/-	..	GR10A, GS10C/S, GS10D, GS10E, GS12D
B13B	HFD13602	2/9	..	GR10M
B17A	HFD13045	2/-	..	GR2G, GR4G, GR10G, GR2H, GR10H, GR10J, GR10K, GR12G, GR12H, GS10H
B17A Printed Circuit	HFD13534	3/6	..	GR2G, GR2H, GR2J, GR4G, GR10G, GR10H, GR10J, GR10K, GR12G, GR12H, GS10H
B27A	N89058A) HFD13238A)	4/-	..	GCA10G, GS10K, GSA10G VS10G, VS10H, VS10K

★ PHOSPHOLITE PANELS

Plain Rectangular Forms

Area	Price
Less than 6 sq. ins.	20/- + 2/- per sq. in.
Up to 100 sq. ins. No side dimension greater than 10 ins.	10/- + 2/- per sq. in.

CIRCULAR FORMS OR PANELS WITH HOLES

Less than 6 sq. ins.	40/- + 2/- per sq. in. + 2/- per hole
Up to 100 sq. ins. No side dimension greater than 10 ins.	30/- + 2/- per sq. in. + 2/- per hole

★ Registered Trade Mark.

★ PHOSPHOTRON DISPLAY PANELS

Type	Price
‡ P23	50/-
‡ P40	100/-
‡ P50	150/-

STATIC INVERTERS

‡ LJEQ2	150/-
‡ LJEQ3	150/-
‡ LJEQF (Filter Unit for above Inverters)	Price on request

★ PHOTACTOR SWITCHES

‡ PH1A	35/-

PHOTO RELAYS

‡ PCR6	30/-
‡ PCR7	30/-

CADMIUM SULPHIDE PHOTOCELLS

‡ K40	10/-
‡ K42	8/-

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.

★ Registered Trade Mark

‡ Data available on request

COLD - CATHODE TUBES

TABLE OF EQUIVALENTS

SEPTEMBER 1964

ERICSSON TELEPHONES LIMITED
ETELCO LTD.

TUBE EQUIVALENTS

Voltage Stabilizers and Reference Tubes * Near Equivalent

Type	CV	English Elect.	G.E.C.	Mullard	U.S.A.
GD75P				75C1	OC2
GTR75M	284			75B1	
GD83M				83A1	
GD85M/S	449	5651/QS1209	QS83/3	85A2	OG3
GD85PR/S	4048	QS1212		M8098	
GD85WR				M8190*	
GD86W/S	2321				
GD87M	2573				5651
GD90M				90C1	
GTR95M/S	286	QS95/10	QS95/10	95A1	
GD100A/S	188	QS92/10			
GD100B/S	1070		ST11	7475	
GD108M	1833	OB2 QS1208		108C1	OB2
GD120A/S	1110 1731		S130		
GTR120A/S	45		S130P		
GD150A/S	216	OB3 QS150/40	QS150/40	150C3	OD3
GD150M/S	1832	OA2 QS1207		150C2 150C4	OA2
GTR150M/S	287	QS150/15	QS150/15	150B3	
GD150P/S	2225	QS1200		150B2	6354
GD150PR/S	4104			M8163	

Trigger Tubes

GPE120T				Z806W*	
GTE130T	2434			Z803U	6779
GTE150Y				Z700U*	
GTE175M	5348				

Multi-Cathode Tubes

GC10B/S	2271			Z303C	6482
GC10B/L	6044				
GC10/4B	1739				6802
GC10/4B/L	6100				
GC10D	5143				
GC10/2P					6879
GS10C/S	2325			Z502S	6476
GR10A	5291			Z503M	
GS10H				Z504S*	

Digitron Tubes

	CV	France (CSF)	Philips	Mullard	Burroughs
GR10M		TA542	Z520M	Z520M	B5031
GR10K	5842				

GENERAL INFORMATION

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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.

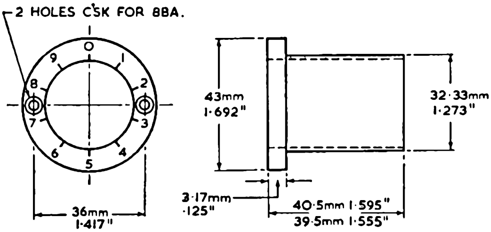
General Tube Index

Tube Type	CV Code	Section	
GC10B	—	Dekatron Tubes	DK-1
GC10B/L	CV.6044	,, ,,	DK-1
GC10B/S	CV.2271	,, ,,	DK-1
GC10/4B	CV.1739	,, ,,	DK-2
GC10/4B/L	CV.6100	,, ,,	DK-1
GC12/4B	—	,, ,,	DK-3
GC10D	CV.5143	,, ,,	DK-4
GC10/2P	—	Maintenance Tubes	MN-2
GCA10G	—	Dekatron Tubes	DK-10
GD2V	—	Spark Gap Tubes	SP-1
GD75P	—	Voltage Stabilizers	ST-8
GD83M	—	Reference Tubes	RF-5
GD85M/S	CV.449 (OG3) Issue 4	,, ,,	RF-2
GD85M/R	—	,, ,,	RF-2
GD85P/RS	CV.4048	,, ,,	RF-2
GD85WR	—	,, ,,	RF-4
GD86W/S	CV.2321	,, ,,	RF-1
GD87M	CV.2573 (5651)	,, ,,	RF.6
GD90M	—	Voltage Stabilizers	ST-6
GD108M	CV.1833 (OB2)	,, ,,	ST-10
GD120A/S	CV.1110	Maintenance Tubes	MN-3
GD150A/S	CV.216 (OD3)	Voltage Stabilizers	ST-3
GD150M	—	,, ,,	ST-5
GD150M/R	—	,, ,,	ST-7
GD150M/S	CV.1832 (OA2)	,, ,,	ST-4
GD150P	CV.2225	,, ,,	ST-9
GD340W	—	Corona Voltage Stabilizers	CS-1
GD350X	—	,, ,,	CS-2
GD350Y	—	,, ,,	CS-2
GDT120M	—	Maintenance Tubes	MN-5
GDT120T	—	,, ,,	MN-6

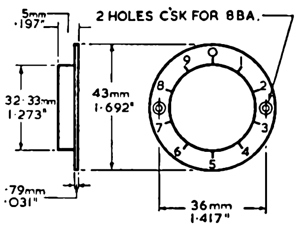
General Tube Index

Escutcheons

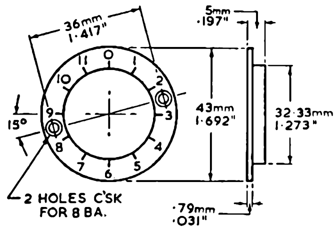
Escutcheons numbered 0—9 and 0—11 are available in the sizes given below. With the exception of N.78211 which is moulded in black bakelite and numbered 0—9, they are made of brass with a matt black tropical finish. The numerals are silk screen printed in white.



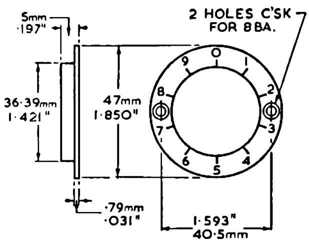
CODE N78211 numbered 0-9



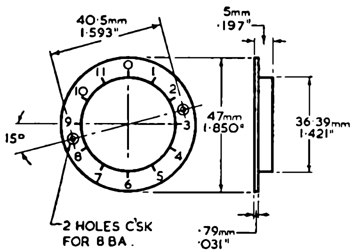
CODE N79368 numbered 0-9



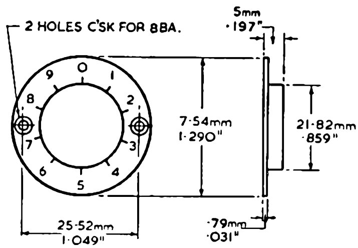
CODE N79369 numbered 0-11



CODE N80977 numbered 0-9
(Used for duodecal tubes)



CODE N84538 numbered 0-11



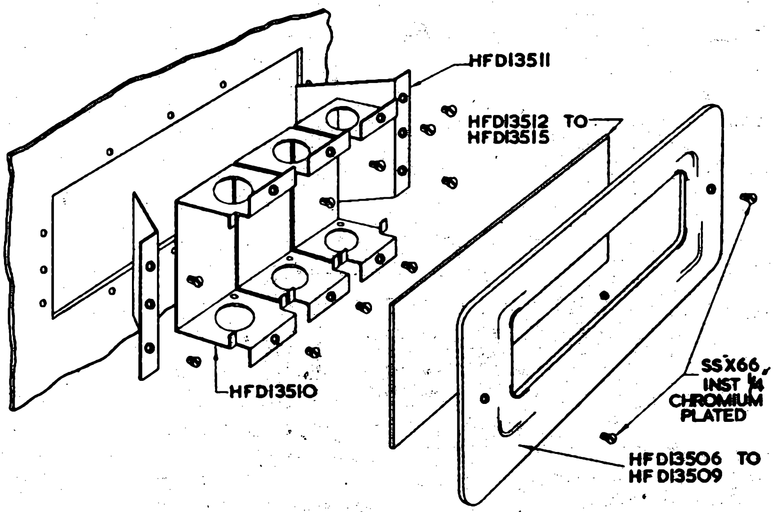
CODE N84338 numbered 0-9
(Used for GC10 2P)

*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.

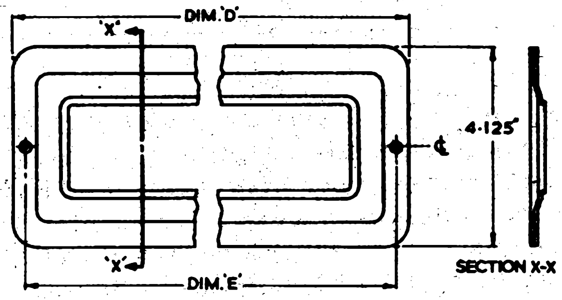
The kits are supplied with all the necessary components, but without tubes, under the following codes.

No. of tubes	Code
2	HFD 13502
3	HFD 13503
4	HFD 13504
5	HFD 13505



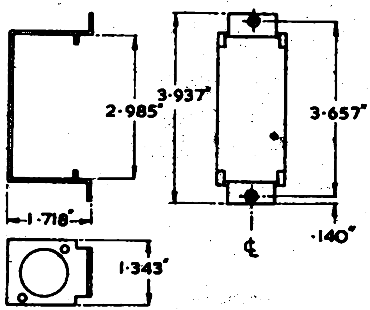
*Registered Trade Mark

DIGITRON ESCUTCHEON UNIT KITS

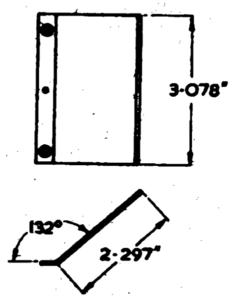


HFD 13506 — HFD 13509
ESCUTCHEON

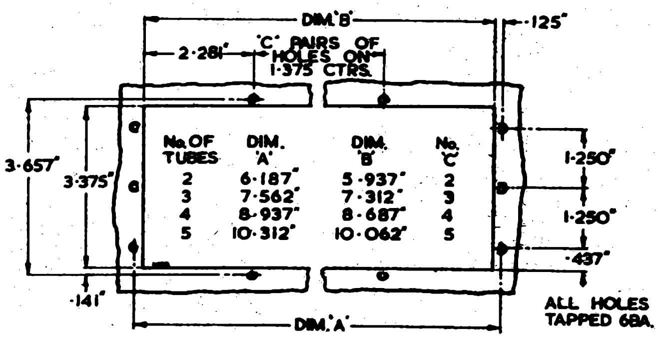
No. OF TUBES	DIM. 'D'	DIM. 'E'	CODE
2	6·812"	6·187"	HFD13506
3	8·187"	7·562"	HFD13507
4	9·562"	8·937"	HFD13508
5	10·937"	10·312"	HFD13509



HFD 13510
MOUNTING BRACKET



HFD 13511
END PLATE



No. OF TUBES	DIM. 'A'	DIM. 'B'	No. 'C'
2	6·187"	5·937"	2
3	7·562"	7·312"	3
4	8·937"	8·687"	4
5	10·312"	10·062"	5

FIXING HOLES & CUT OUT DIMENSIONS

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

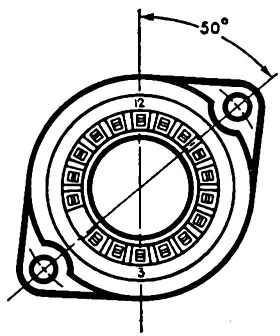
B12E (Duodecal plus bottom cap connector)	Manufactured by:— (*a*) The McMurdo Instrument Co. Ltd. Victoria Works Ashstead, Surrey (*Manufacturer's reference X12E/Mk.* 2 *and X12ER/Mk.* 2) (*b*) Siemens Edison Swan Ltd. Brantwood Road Tottenham, London, N.17 (*Manufacturer's reference VH* 34/1201)

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

BRITISH SERVICES CODE	COMMERCIAL CODE	RELIABLE CODE
CV. 138	EF91/6AM6	CV. 4014
CV. 140	EB91/6AL5	—
CV. 448	OA81/IN476	—
CV. 455	ECC81/12AT7	CV. 4024
CV. 491	ECC82/12AU7	CV. 4003
CV. 2209	6F33	—
CV. 2213	NT2	—

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

GTR95M/S
(CV.286)

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.

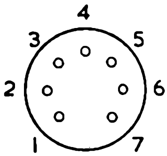
GTR95M/S
(CV.286)

Primed Voltage Stabilizer

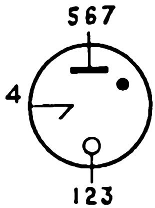
Mechanical Data

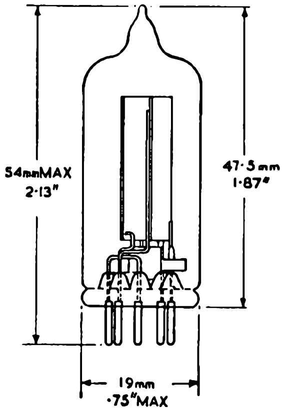
Mounting position	Any
Weight	7.1 g (nominal)
Base	B7G

Base Connections
(underside view)



Pin 1, 2, 3		Cathode
4		Primer
5, 6, 7		Anode





Primed Voltage Stabilizer

GTR150M/S
(CV.287)

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.

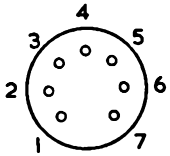
GTR150M/S
(CV.287)

Primed Voltage Stabilizer

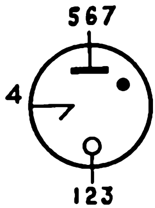
Mechanical Data

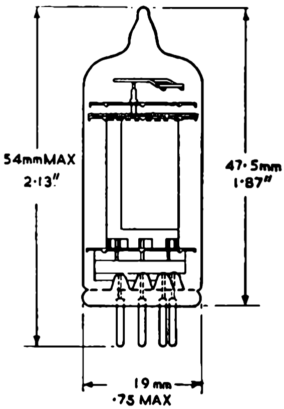
Mounting position	Any
Weight	8·2 g (nominal)
Base	B7G

Base Connections
(underside view)



Pin 1, 2, 3 — Cathode
4 — Primer
5, 6, 7 — Anode





Voltage Stabilizer

GD 150 A/S
(CV.216)

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.)

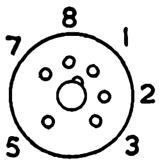
GD150A/S
(CV.216)

Voltage Stabilizer

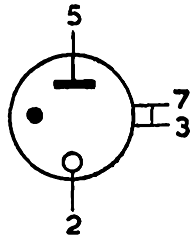
Mechanical Data

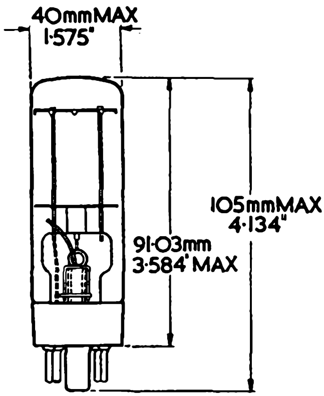
Mounting position	Any
Weight	35 g (nominal)
Base	I.O.

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 —





Voltage Stabilizer

GD150M/S
(CV.1832)

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.

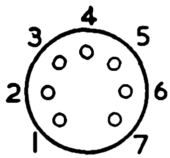
GD150M/S
(CV.1832)

Voltage Stabilizer

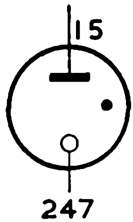
Mechanical Data

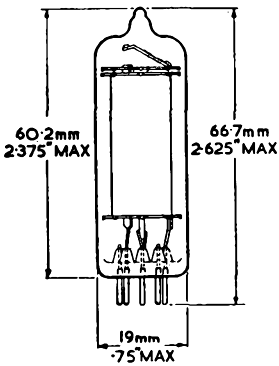
Mounting position	Any
Weight	10 g (nominal)
Base	B7G

Base Connections
(underside view)



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





Voltage Stabilizer

GD150M

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

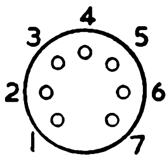
GD150M

Voltage Stabilizer

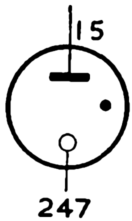
Mechnical Data

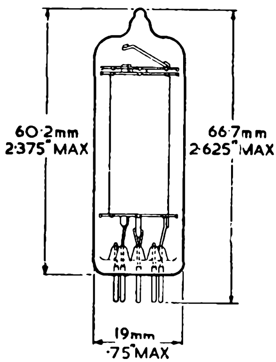
Mounting position	Any
Weight	10 g (nominal)
Base	B7G

Base Connections
(underside view)



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





Voltage Stabilizer

GD90M

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° to +90°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 Ω nom.

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

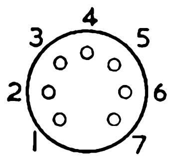
GD 90 M

Voltage Stabilizer

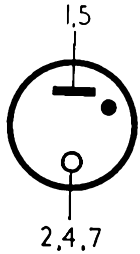
Mechanical Data

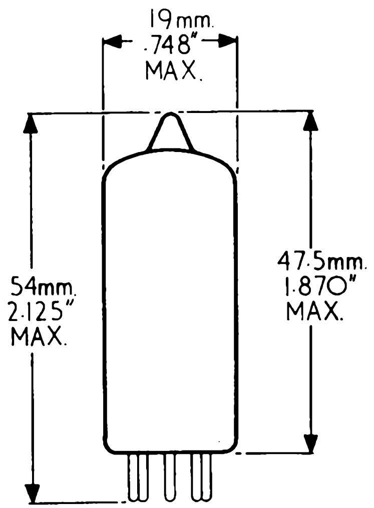
Mounting Position	Any
Base	B7G

Base Connections
(underside view)



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





Voltage Stabilizer

GD 75 P

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	$-55°$ to $+90°$C
Maximum storage temperature	$+70°$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 Ω

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

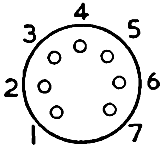
GD 75 P

Voltage Stabilizer

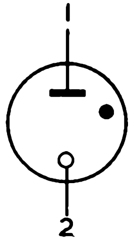
Mechanical Data

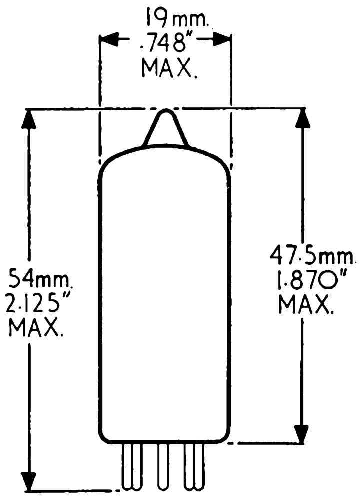
Mounting position	Any
Base	B7G

Base Connections
(underside view)



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





Voltage Stabilizer

GD150P
(CV.2225)

Limit Ratings

Minimum anode current	5 mA
Maximum anode current	15 mA
Minimum anode supply voltage (normal room illumination)	180 V
Ambient temperature limits	– 55° to +90°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 Ω

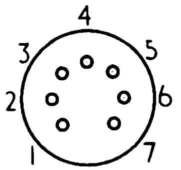
GD150P
(CV.2225)

Voltage Stabilizer

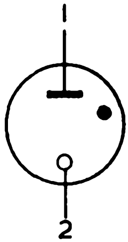
Mechanical Data

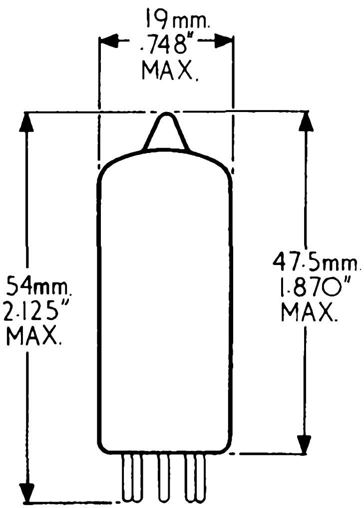
Mounting position	Any
Base	B7G

Base Connections
(underside view)



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





Voltage Stabilizer

GD 108 M (CV.1833)
OB 2

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	75mA
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

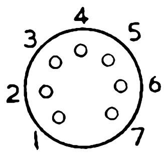
GD108M (CV.1833) — Voltage Stabilizer

OB 2

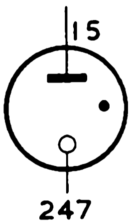
Mechanical Data

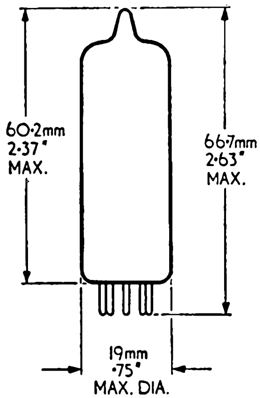
Mounting position	Any
Base	B7G

Base Connections
(underside view)



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





Voltage Stabilizer

GTR 75M
(CV.284)

Limit Ratings

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

Characteristics

Running voltage at 10 mA	70—80 V
Maximum change in V_R 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.

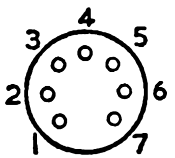
GTR 75M
(CV.284)

Voltage Stabilizer

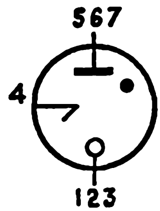
Mechanical Data

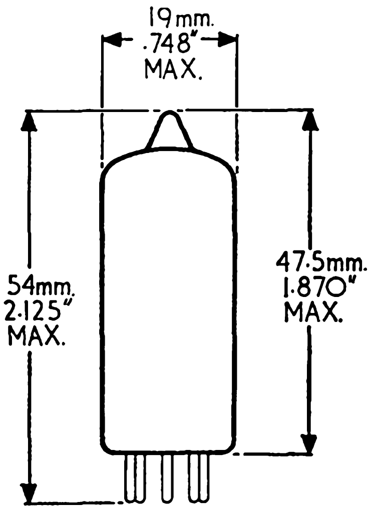
Mounting position	Any
Base	B7G

Base Connections
(underside view)



Pin 1 }
2 } Cathode
3 }
4 Primer
5 }
6 } Anode
7 }





CORONA VOLTAGE STABILIZERS

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Tube Type

CORONA VOLTAGE STABILIZERS

The Va/Ia 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

GD 340 W

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 V_R for a current change of 3 to 12 μA	2V ←
Maximum change in V_R 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.

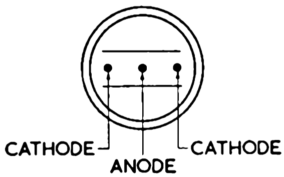
GD340W

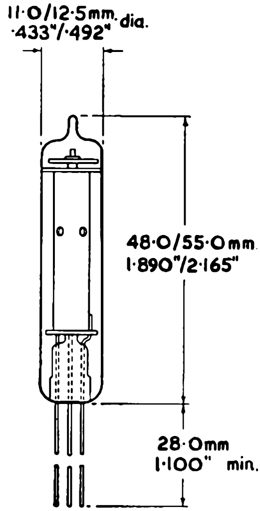
Corona Voltage Stabilizer

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)





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

Corona Voltage Stabilizers

GD350X, GD350Y

Limit Ratings

	GD350X	GD350Y
Minimum tube current	3 μA	3 μA ←
Maximum tube current	200 μA	200 μA

Characteristics

	GD350X	GD350Y
Running voltage at 12 μA	341-359V (350V ± 2½%)	333-367V (350V ± 5%)
Maximum change in V_R for a current change of 3-12 μA	2V	2V ←
Maximum change in V_R for a current change of 12-200 μA	5V	5V

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

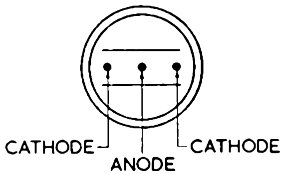
GD350X, GD350Y

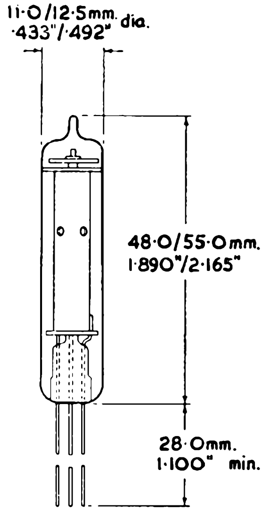
Corona Voltage Stabilizers

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)





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

REFERENCE TUBES

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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 = Supply volts

V_o = Output volts

I_d = Tube current

r_d = 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.

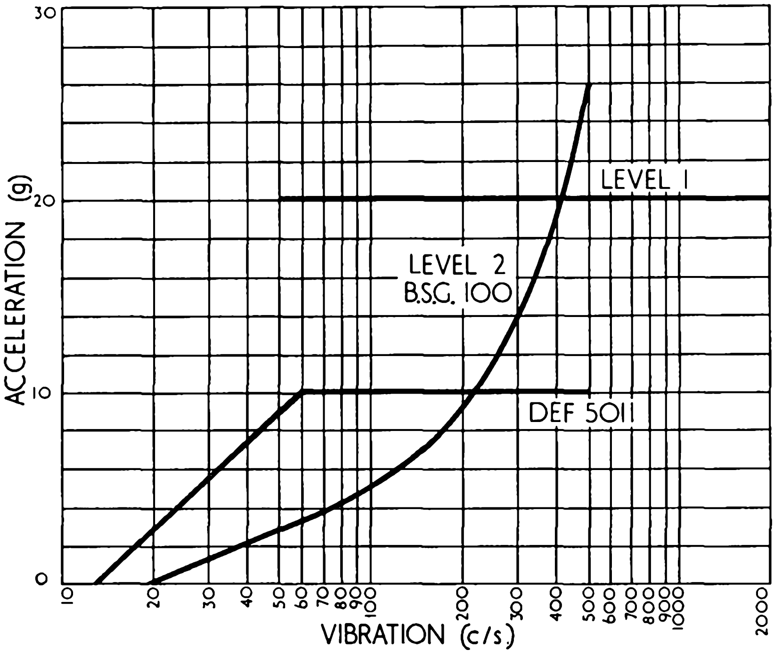


Fig. 1 Vibration Test Level Envelope

Reference Tube

GD 86 W/S
(CV.2321)

Limit Ratings

Minimum anode current	50 μA
Maximum anode current	1·0 mA
Maximum striking voltage (normal room illumination)	125 V
Temperature coefficient (over range 20-100°C.)	—5 mV per °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 Ia/Ea curve for currents greater than 400 μA.

GD 86 W/S
(CV.231)

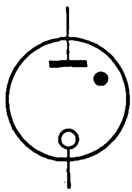
Reference Tube

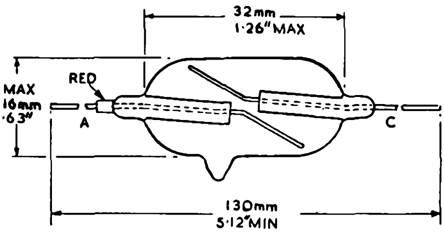
Mechanical Data

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. ($\frac{1}{4}''$) from the glass seal.





Miniature Reference Tube

GD 85 M/S
(CV.449 Issue 4)

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	450 Ω
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.

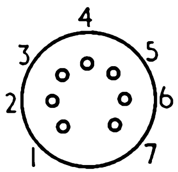
GD85M/S
(CV.449 Issue 4)

Miniature Reference Tube

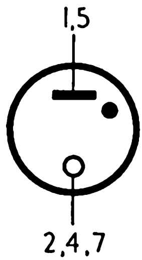
Mechanical Data

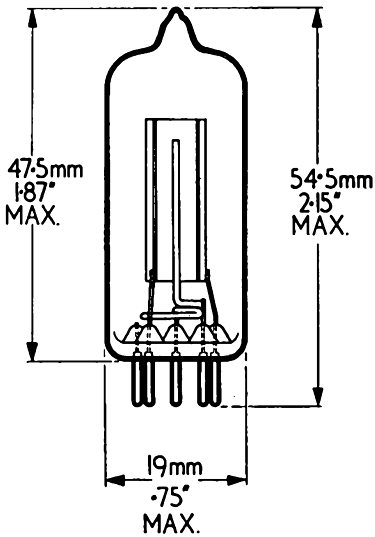
Mounting position	Any
Base	B7G

Base Connections
(underside view)



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





Ruggedized Miniature Reference Tube

GD85M/R

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
Maximum vibration (continuous operation)	2·5 g
Maximum shock (short duration)	500 g

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
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%

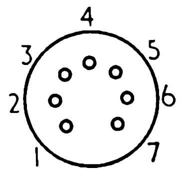
GD 85 M/R

Ruggedized Miniature Reference Tube

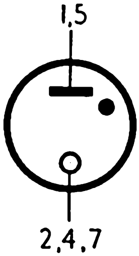
Mechanical Data

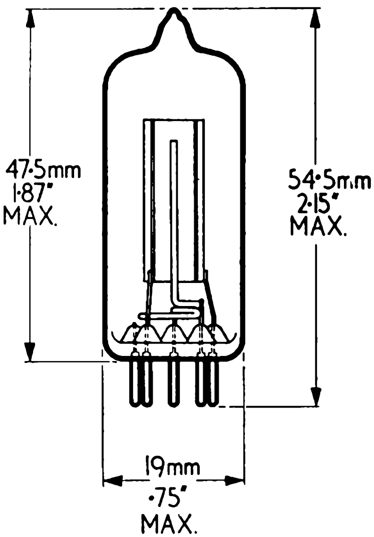
Mounting position	Any
Base	B7G

Base Connections
(underside view)



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





Reliable-Miniature Reference Tube

GD 85P/RS
(CV.4048)

Limit Ratings

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 —55°C to +25°C)	—10 mV/°C
(over range +25°C to +90°C)	—5 mV/°C
Maximum acceleration (continuous operation)	2·5 g
Maximum shock (short duration)	500 g

Characteristics

Running voltage at 6·0 mA	85 ± 2 V
Regulation (5·8 to 6·2 mA)	0·18 V
(1·0 to 10 mA)	4·0 V
Incremental resistance at 6 mA	450 Ω
Maximum voltage jump (Anode resistance 5 kΩ. 1 to 10 mA)	100 mV peak
Maximum variation of running voltage at 6 mA	
During the first 300 hours	0·3%
During the subsequent 10,000 hours	0·2%
Typical drift of running voltage per 1,000 hours after the first 300 hours	0·1%

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

GD 85P/RS
(CV.4048)

Reliable-Miniature Reference Tube

TESTS

To be performed in addition to those applicable in K1001.

Test Conditions—unless otherwise specified.

Va(b) (V)	R lim. (ohms)	Ia (mA)
(Note 1)	5K	6·0 (Note 2)

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.

K1001	Test	Test Conditions	AQL %	Insp. Level	Sym-bol	Limits Min.	Limits Max.	Units	Notes
7·1	Glass Strain	No Voltages	6·5	I					
	Group A								
	Striking Voltage			100%	Va	—	115	V	1
	Maintaining Voltage			100%	Vb	83	87	V	

Reliable-Miniature Reference Tube

GD 85P/RS
(CV.4048)

Tests (*cont.*)

K1001	Test	Test Conditions	AQL %	Insp. Level	Sym-bol	Limits Min.	Limits Max.	Units	Notes
	Regulation (1)	δ Va for change of Ia from 5·8 to 6·2 mA		100%			0·18	V	
	Voltage Jumps	Ia varied from 1·0 to 10·0 mA Ra = 500 ohms		100%			100	mV p/p	2
	Oscillation	Ia varied from 1·0 to 10·0 mA Ra = 500 ohms		100%			5	mV p/p	
	Microphonic Noise	Ra = 500 ohms		100%			15	mV p/p	4
	Leakage Current	Supply Voltage = 55 V d.c. Ra = 1 megohm		100%			5	µA d.c.	

GD85P/RS
(CV.4048)

Reliable-Miniature Reference Tube

Tests (*cont.*)

K1001	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits Min.	Limits Max.	Units	Notes
	Group B								
	Temperature Coefficient (1)	Temperature varied from —55°C to +25°C		TA					3, 6
	Temperature Coefficient (2)	Temperature varied from + 25°C to + 90°C		TA					3, 6
	Striking Voltage	Measure at Temperature = —50°C		TA			115	V	1
	Regulation	δ Va for change of Ia from 1·0 to 10·0 mA Temperature = + 90°C							3, 6

Reliable-Miniature Reference Tube

GD 85P/RS
(CV.4048)

Tests (*cont.*)

K1001	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits Min.	Limits Max.	Units	Notes
	Group C								
	Striking Voltage (Dark Strike)		2·5	I	Va		115	V	5
	Regulation (2)	δ Va for change of Ia from 1·0 to 10·0 mA	2·5	I			4·0	V	
	Group D								
7·2	Base Strain	No voltages	6·5	IA					
11·2	Resonance Search (1)	Ra = 27K Frequency = 25 to 500 c/s		IC					
11·1	Vibration Noise Output		2·5		Va (AC)		5	mV RMS	
	Resonance Search (2)	Ra = 27K Frequency = 500 to 2500 c/s		IC					

GD 85P/RS
(CV.4048)

Reliable-Miniature Reference Tube

Tests (*cont.*)

K1001	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits Min.	Limits Max.	Units	Notes
11·1	Vibration Noise Output		2·5		Va (AC)		15	mV RMS	
11·3	Fatigue Test	Ia = 0 Duration 30 + 30 + 39 hours. Accelera-tion = 5g. Frequency = 170 c/s		IA					
	Post Fatigue Test	**Combined AQL**	4·0						
	Anode Voltage Change		2·5		δ Va		±0·7	V	
11·1	Vibration Noise		2·5				30	mV P/P	

Reliable-Miniature Reference Tube

GD 85P/RS
(CV.4048)

Tests *(cont.)*

K1001	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits Min.	Limits Max.	Units	Notes
11·4	Shock Test	Ia = 0 Acceleration = 500g.		IA					
	Post Shock Test	**Combined AQL**	4·0						
	Anode Voltage Change		2·5	IA	δ Va		± 0·7	V	
11·1	Vibration Noise		2·5				30	mV p/p	
	Group E								
AVI/5	Life Test								
	End Point 1000 Hours								
	Inoperatives		2·5	IA					
	Striking Voltage		2·5		Va		115	V	

GD 85P/RS
(CV.4048)

Reliable-Miniature Reference Tube

Tests (*cont.*)

K1001	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits Min.	Limits Max.	Units	Notes
	Change of maintaining voltage during life		2·5				0·4	V	
	Regulation		2·5				0·18	V	
	Group F								
AIX/ 25	Electrical Re-test after 28 days holding period.			100%					
	Inoperatives		0·5						
	Striking Voltage		0·5	100%			115	V	
	Maintaining Voltage		0·5	100%		83	87	V	
	Regulation (1)	δ Va for change of Ia from 5·8 to 6·2 mA	0·5	100%			0·18	V	

Reliable-Miniature Reference Tube

GD85P/RS
(CV.4048)

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.

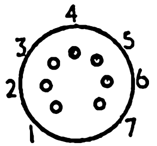
GD85P/RS
(CV.4048)

Reliable-Miniature Reference Tube

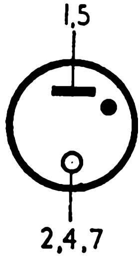
Mechanical Data

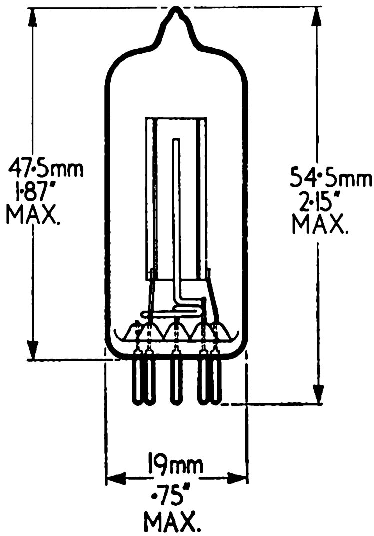
Mounting Position	Any
Base	B7G

Base Connections (underside view)



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





Ruggedized Sub-Miniature Voltage Reference Tube

GD 85 WR

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.

GD 85 WR

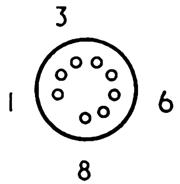
Ruggedized Sub-Miniature Voltage Reference Tube

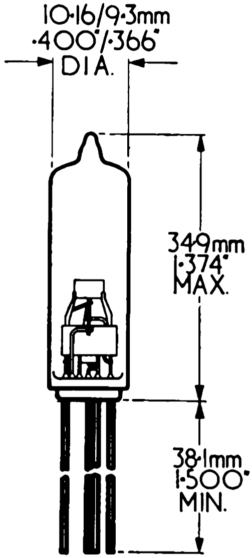
Mechanical Data

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 ($\frac{1}{16}$″) 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

Low Noise Miniature Reference Tube

GD 83 M

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.

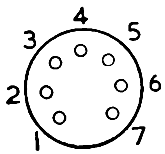
GD 83 M

Low Noise Miniature Reference Tube

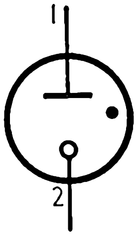
Mechanical Data

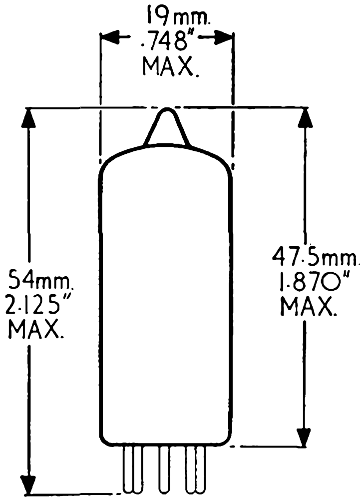
Mounting position	Any
Base	B7G

Base Connections
(underside view)



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





Miniature Voltage Reference Tube

GD87M (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.

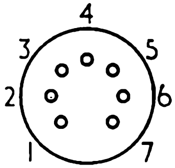
GD 87 M (CV.2573) (5651)

Miniature Voltage Reference Tube

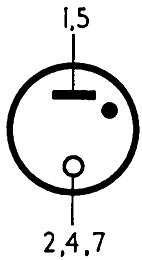
Mechanical Data

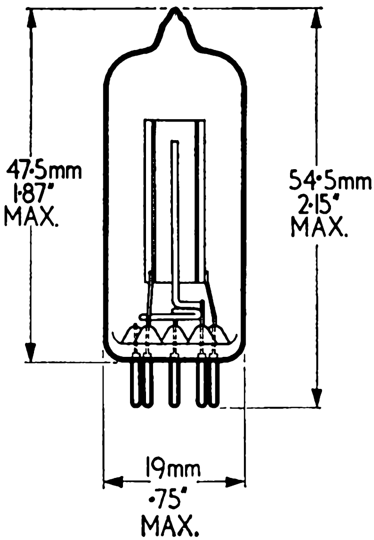
Mounting position	Any
Base	B7G

Base Connections (Underside view)



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





Primed Sub-Miniature Reference Tube

GTR83X

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.

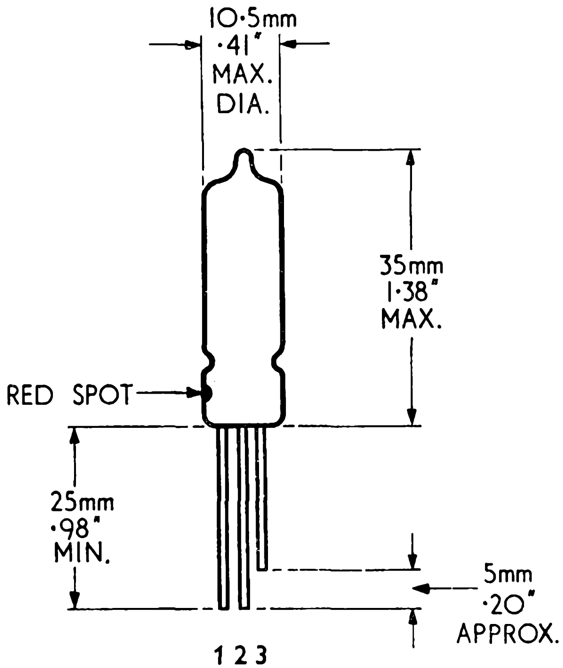
GTR 83 X

Primed Sub-Miniature Reference Tube

Mechanical Data

Base 3 flying leads of 0·4 mm (·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

GTR83W

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%.

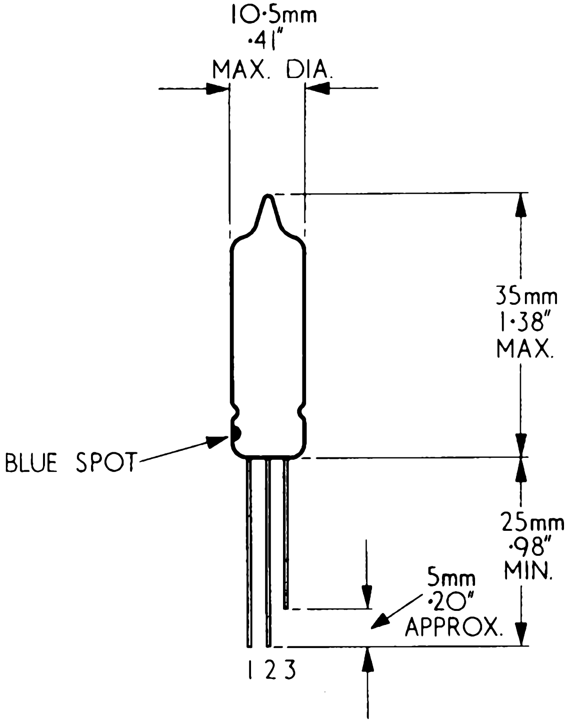
GTR83W

Low Current
Primed Sub-Miniature Reference Tube

Mechanical Data

Base 3 flying leads of 0·4 mm (·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 GTR150W

Limit Ratings

Minimum cathode current	500µA
Maximum cathode current	2 mA
Minimum anode supply voltage:— (in light or dark)	
with primer not connected	210 V
with primer passing 150µA	170 V
Maximum inverse voltage	50 V
Minimum primer supply voltage	175 V

Characteristics

Running voltage at 1mA	145—150 V
Maximum change in running voltage for a current change from 500µA to 1·5 mA	3 V
Typical change in running voltage for a current change from 500µA to 2 mA	4 V
Primer Running Volts	135 V nominal
Noise	15 mV r.m.s. max.

Recommended Operation

Primer connected via 270kΩ either to anode or to anode supply rail.

Supply volts	> 175 V
Cathode current	1 mA

Life

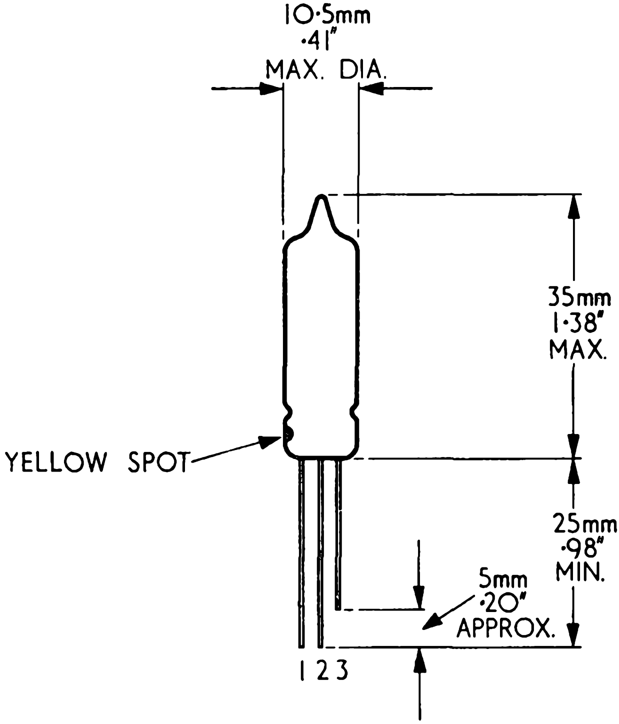
At 1mA, the maximum change in running voltage per 1,000 hours is 1%.

GTR150W Primed Sub-Miniature Reference Tube

Mechanical Data

Base — 3 flying leads of 0·4 mm (·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

INDEX

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

GTE175M

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

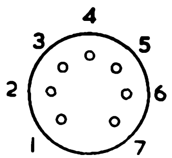
Trigger Tetrode

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

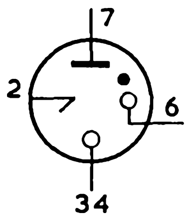
Mechanical Data

Mounting position	Any
Weight	6·5 g (nominal)
Base	B7G

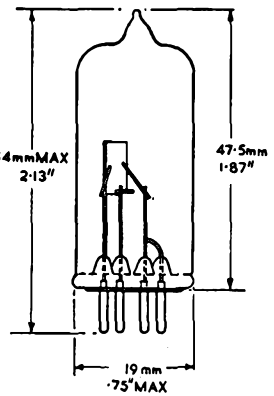
Base Connections
(underside view)



Pin 1, 2	Trigger	T
3, 4	Cathode	K_1
5	Do not connect	
6	Auxiliary cathode	K_2
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

GTE175M

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.

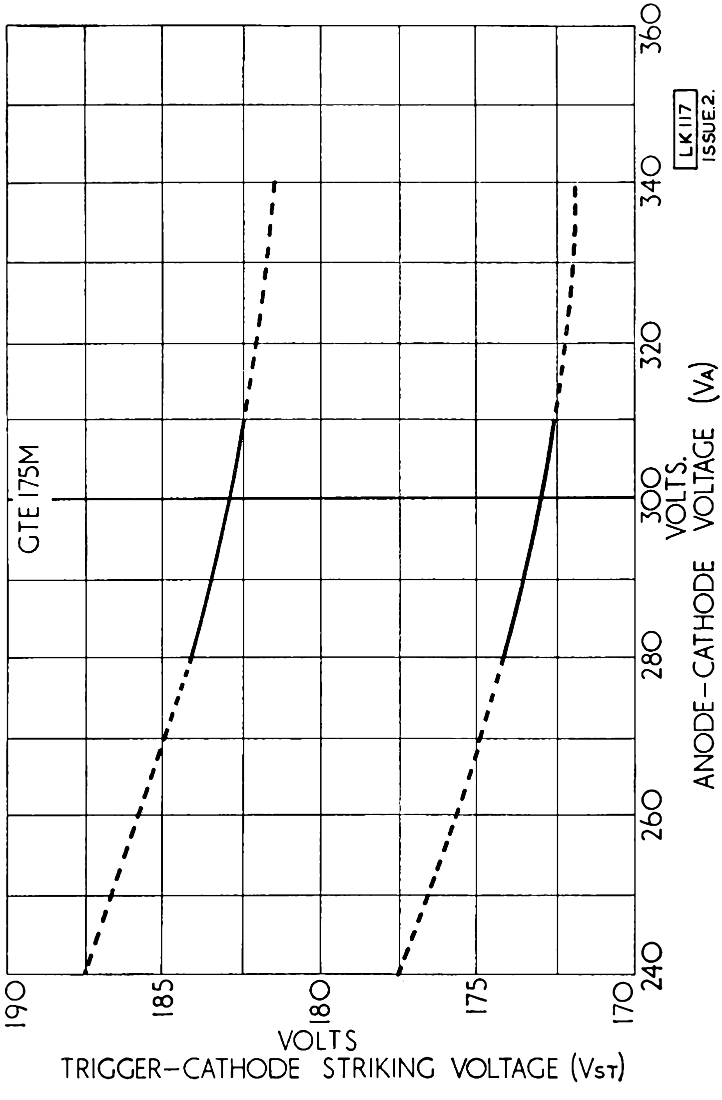
To extinguish the main discharge, the anode-cathode potential must be reduced to below the running voltage (150 V) for a time dependent on the de-ionization characteristic.

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.

GTE 175 M

Trigger Tetrode

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

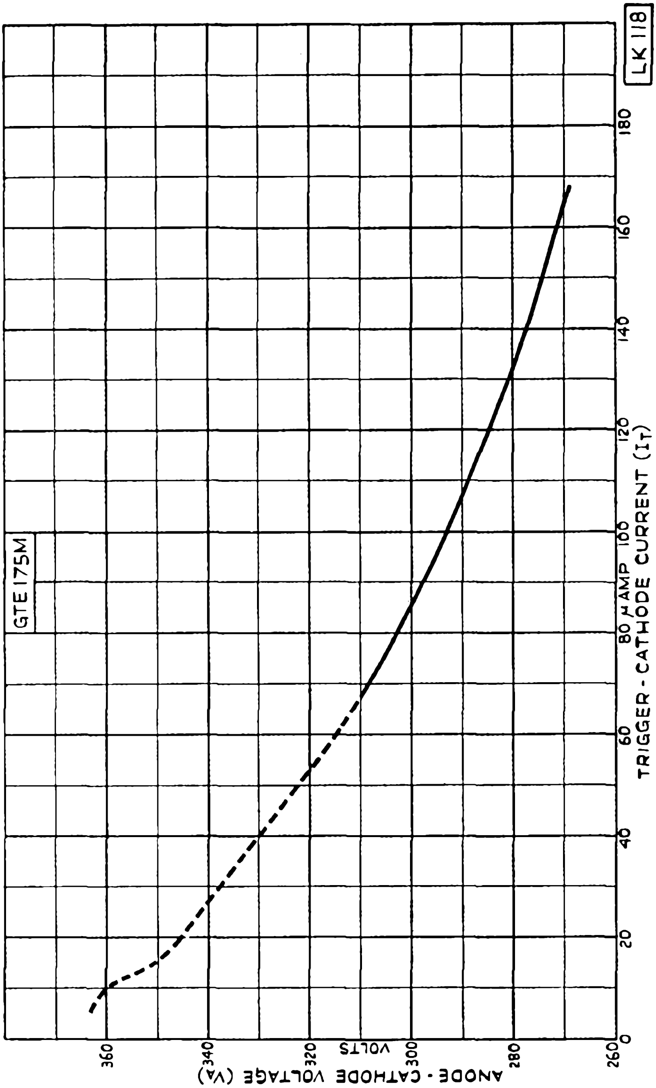


Limits of Trigger Striking Voltage

Trigger Tetrode

GTE175M

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

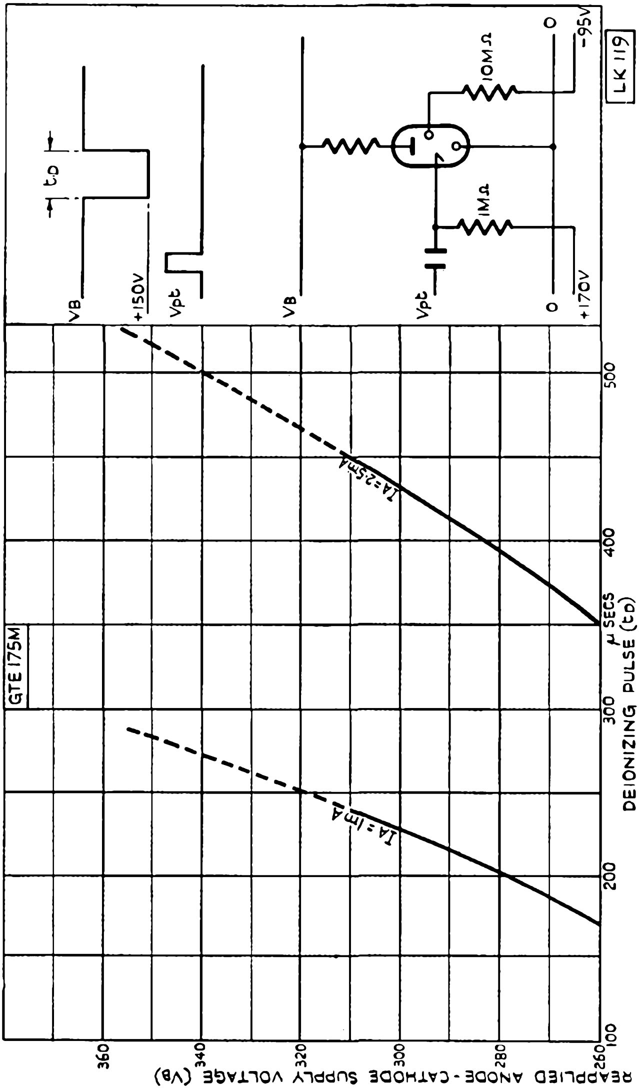


Typical Transfer Characteristic

GTE175M

Trigger Tetrode

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



Typical De-ionization Characteristic

Trigger Tube

GTR120W

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 (Tubes may exhibit jumps of up to 10 V in operation)	95-140 V
Trigger-Cathode running voltage (R_T-220 kΩ)	
Ia=0 mA	63 V nominal ←
Ia=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 120 W

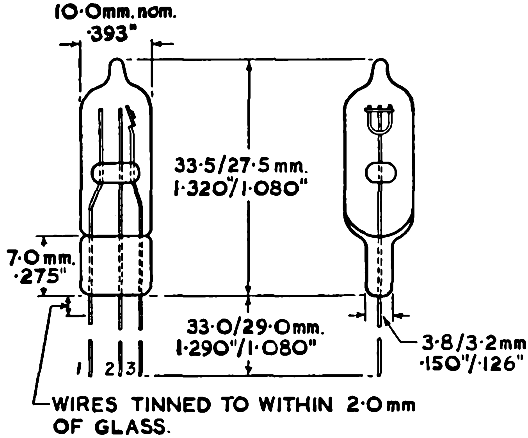
Trigger Tube

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. ($\frac{1}{2}$") from the glass.



Lead Wires

1—Anode

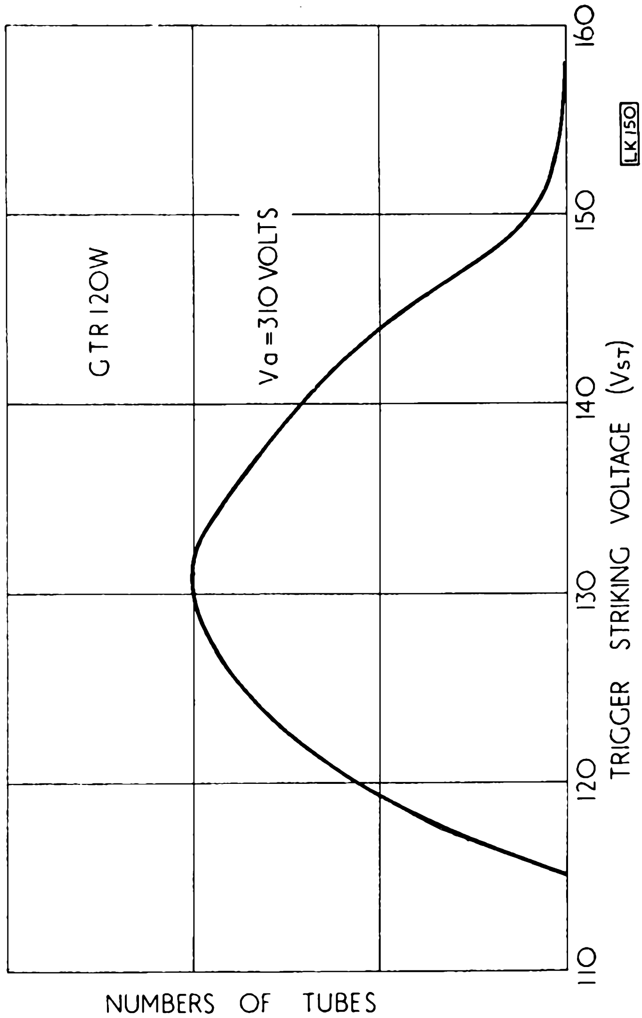
2—Trigger

3—Cathode

Trigger Tube

GTR120W

An inexpensive sub-miniature tube especially designed for computer applications



Distribution of Trigger Striking Volts

Trigger Pentode

GPE175M

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 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 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

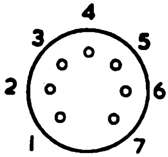
Trigger Pentode

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

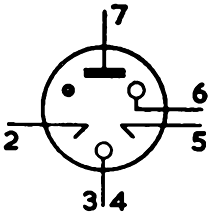
Mechanical Data

Mounting position	Any
Weight	6·5 g (nominal)
Base	B7G

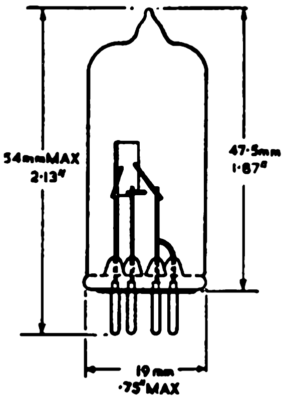
Base Connections (underside view)



Pin 1, 2 } Trigger T_1
3, 4 } Cathode K_1
5 Trigger T_2
6 Auxiliary cathode K_2
7 Main anode A



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



Trigger Pentode

GPE175M

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.

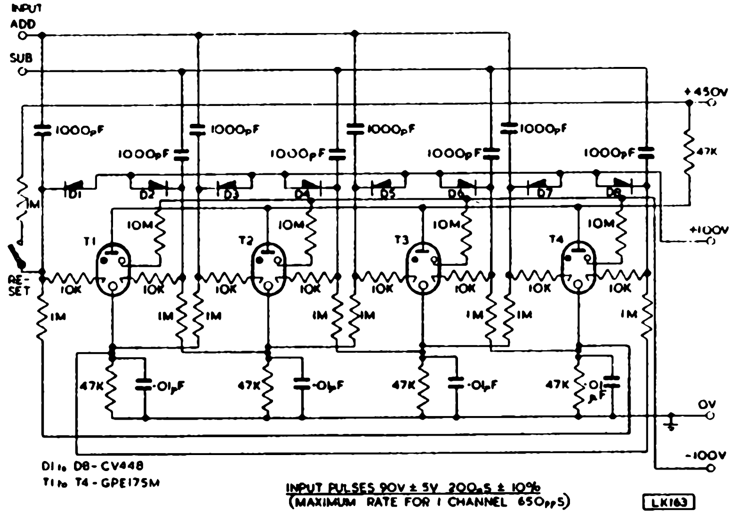
When the tube is not conducting, the triggers are isolated from each other, but when anode current flows, both triggers have a low impedance to cathode and to each other.

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

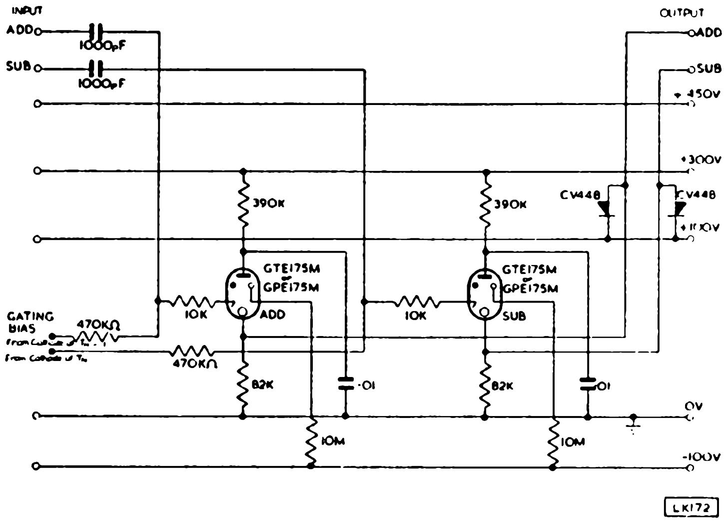
GPE175M

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

Primed Trigger Tube

Close Tolerance Tube with stable characteristics intended for quadrant I operation

GTE130T
(CV.2434)

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 Va = 280 V		±128 V	
Minimum trigger voltage necessary to cause breakdown in all tubes Va = 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	
	Peak	100 mA	←
Minimum auxiliary anode supply voltage		150 V	

Characteristics

Anode to cathode running volts (*Note* 2)			105 V nom.	
De-ionization time	Ik (pk)	0—20 mA	3·5 mS nom.	
		20—100 mA		←
		(*Note* 3)	12 mS nom.	←
Ionization time		$V_T = V_{TS} + 0{\cdot}5$ V	2 mS nom.	
		$V_T = V_{TS} + 4{\cdot}0$ V	0·1 mS nom.	

Trigger transfer characteristics

Current triggering

Trigger Current necessary for anode takeover, with no trigger capacitor (Va = 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)

Va = 170 V	2,700 pf.
Va = 200 V	1,000 pf.
Va = 240 V	500 pf.

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

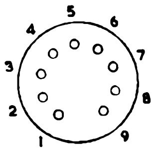
GTE130T
(CV.2434)

Close Tolerance Tube with stable characteristics intended for quadrant I operation

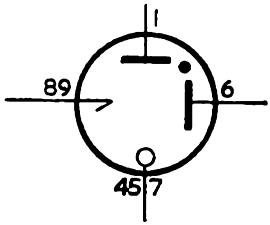
Mechanical Data

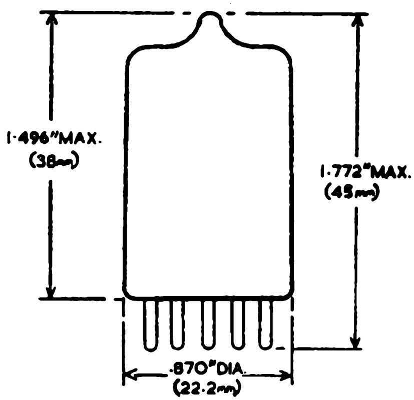
Mounting position	Any
Base	B9A

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





Primed Sub-Miniature Trigger Tube GTE120Y

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	2×10^{-8} A
Minimum anode voltage to take-over the trigger discharge:—	
(*a*) $I_t = 30\mu A$	200 V
(*b*) $C_t = 470pF$, $R_t = 1M\Omega$	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

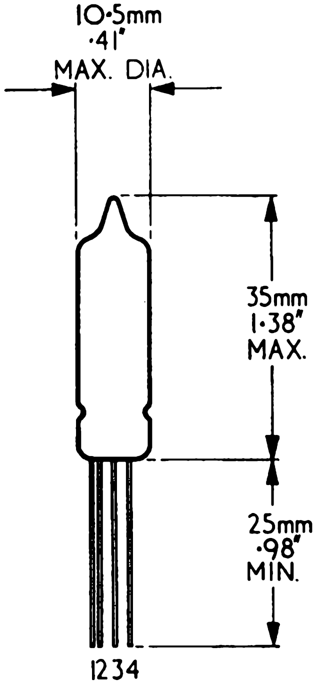
For short pulses, or slowly changing trigger voltage such as occurs in R.C. timers, the primer must be connected. For d.c. switching applications the primer is not required.

GTE120Y Primed Sub-Miniature Trigger Tube

Mechanical Data

Base 4 flying leads of 0·4 mm (·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

INDEX

Tube Type	CV. Code
GC10B	—
GC10B/S	CV.2271
GC10B/L	CV.6044
GC10/4BL	CV.6100
GC10/4B	CV.1739
GC12/4B	—
GC10D	CV.5143
GCA10G	—
GSA10G	—
GS10C/S	CV.2325
GS12D	—
GS10D	—
~~GS10E~~	
GS10H	—

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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

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 anti-clockwise 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

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.

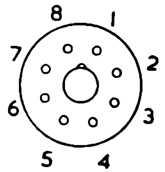
GC10B, GC10B/S (CV.2271)

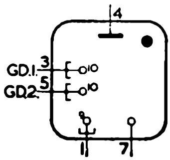
Scale-of-ten Counters

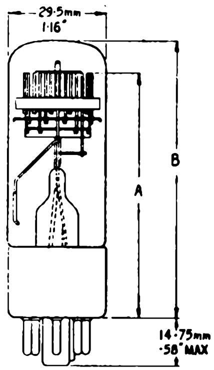
Mechanical Data

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
Base	I.O.

Base Connections
(underside view)







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

Dimension	*Nominal*	GC10B		GC10B/S	
		Min.	*Max.*	*Min.*	*Max.*
A	72·5 mm. (2·85")	68·5 mm.	76·5 mm.	69·5 mm.	75·5 mm.
B	85 mm. (3·35")	81·5 mm.	88·5 mm.	82·5 mm.	87·5 mm.

Scale-of-ten Counter

Specially processed for long life

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

Limit Ratings

	Rectangular Pulse Drive	Sine Wave Drive
Max. speed	4,000 p.p.s.	4,000 c.p.s.
Max. striking voltage	350 V	350 V
Max. anode current	550 µA	550 µA
Min. anode current	250 µA	250 µA
Max. input signal peak to peak	140 V	171 V
*Max. guide bias	60 V	
Max. K_o bias	—20 V	
Max. K_o load	100 kΩ	
Max. guide bias resistance	220 kΩ	

Characteristics

Running voltage at 450 µA	190 V	190 V

Recommended Operating Conditions

Supply voltage	400 V	400 V
Anode resistor	470 kΩ	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_o	—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.

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

Scale-of-ten Counter
Specially processed for long life

	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits Min.	Limits Max.	Units	Notes
	GROUP A Acceptance Tests								
a	Insulation	To be measured between any one electrode and parallel combination of all the others at 170 V.		100%		100		MΩ	1
b	Striking Voltage	A — K_o V_b = 350 V		100%	V_s				1, 3
c	Scaling Accuracy	V_b = 400 V V_1 = +35 V V_2 = −40 V T = 60µS Frequency = 4·0 kc/s		100%					1, 2
d	Running Voltage	V_b = 400 V		100%	V_r	184	194	V	1, 4
	GROUP B Life Test								
		Combined AQL	1·5	IA					
a	Survival running life test	V_b = 500 V V_1 = +35 V V_2 = —40 V T = 60 µS							5, 7
	Tests to be performed at end of survival running test								
b	Scaling Accuracy	V_b = 400 V V_1 = +35 V V_2 = —40 V T = 60 µS Frequency = 4·0 kc/s							2
c	Running Voltage	V_b = 400 V			V_r	176	206	V	4

Scale-of-ten Counter

Specially processed for long life

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

	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits Min.	Max.	Units	Notes
	GROUP C								
	Electrical Retest								6
	Not more than 7 days prior to application for Services final approval								
a	Scaling Accuracy	V_b = 400 V V_1 = +35 V V_2 = −40 V T = 60 μS Frequency = 4·0 kc/s		100%					2
b	Running Voltage	V_b = 400 V		100%	V_r	184	194		4

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. $K_{1\text{-}9}$ 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 $K_{1\text{-}9}$ 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_o and $K_{1\text{-}9}$ 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 ± 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 V which will be reduced to +35 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

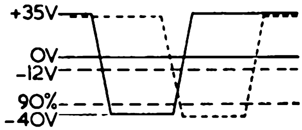


Fig. 1

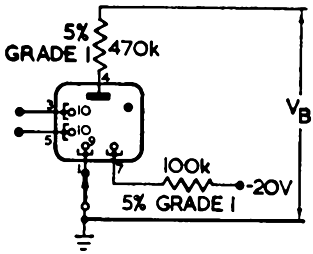


Fig. 2

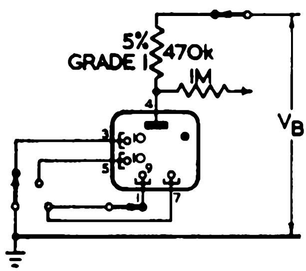


Fig. 3

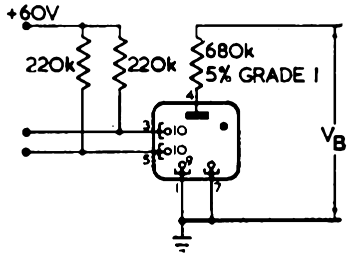


Fig. 4

Scale-of-ten Counter

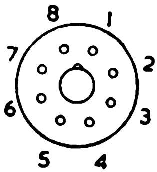
Specially processed for long life

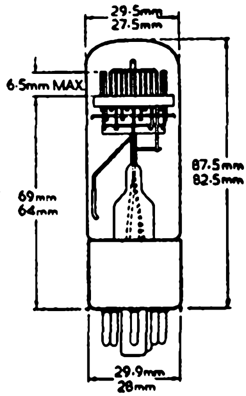
GC10B/L, GC10/4B/L
(CV.6044) (CV.6100)

Mechanical Data

Mounting position	Any
	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°.
Escutcheons	N78211 Bakelite, or N79368 Brass
Base	I.O.

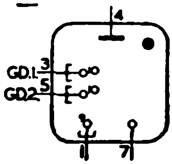
Base Connections (underside view)





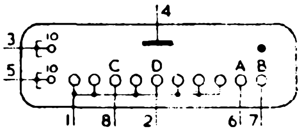
GC 10 B/L

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 "



Bi-directional 10-way Computing Tube with Intermediate Outputs

GC10/4B
(CV.1739)

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	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 :—

A	B	C	D	
0	1	4	6	Clockwise, A zero
0	9	6	4	Anti-clockwise, A zero
9	**0**	**3**	**5**	**Clockwise, B zero**
1	**0**	**7**	**5**	**Anti-clockwise, B zero**
6	7	0	2	Clockwise, C zero
4	3	0	8	Anti-clockwise, C zero
4	5	8	0	Clockwise, D zero
6	5	2	0	Anti-clockwise, D zero

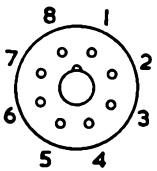
GC 10/4 B
(CV.1739)

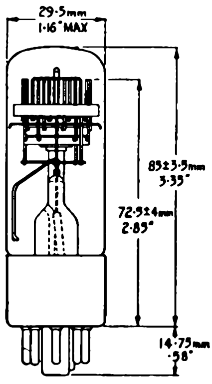
Bi-directional 10-way Computing Tube with Intermediate Outputs

Mechanical Data

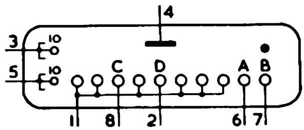
Mounting position	Any. For visual indication the tube is viewed through the dome of the bulb.
Alignment	Cathode " B " is aligned with pin No. 6 to an accuracy of $\pm$ 12°.
Weight	43 g (nominal).
Escutcheons	N.78211 Bakelite, or N.79368 Brass.
Base	I.O.

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 "



Bi-directional 12-way Computing Tube with Intermediate Outputs

GC 12/4 B

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	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 :—

A	B	C	D	
0	1	7	9	Clockwise, A zero
0	11	5	3	Anti-clockwise, A zero
11	0	6	8	Clockwise, B zero
1	0	6	4	Anti-clockwise, B zero
5	6	0	2	Clockwise, C zero
7	6	0	10	Anti-clockwise, C zero
3	4	10	0	Clockwise, D zero
9	8	2	0	Anti-clockwise, D zero

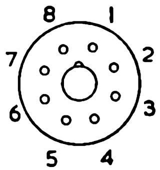
GC12/4B

Bi-directional 12-way Computing Tube with Intermediate Outputs

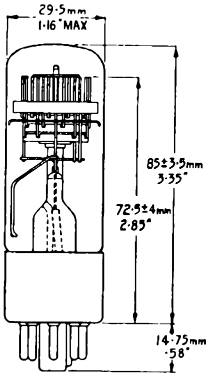
Mechanical Data

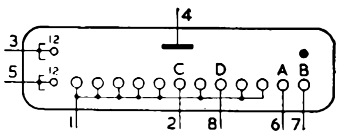
Mounting position	Any. For visual indication the tube is viewed through the dome of the bulb.
Alignment	Cathode " B " is aligned with pin No. 6 to an accuracy of $\pm$ 10°.
Weight	43 g (nominal).
Escutcheon	N79369 Brass
Base	I.O.

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 "





Scale-of-ten Counter Tube For Single-pulse Operation

GC 10 D (CV.5143)

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	$-\left(144\ \mathrm{V}\ {+50\ \mathrm{V} \atop -12\ \mathrm{V}}\right)$
**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 ¼" (or 5 mm.) from tag 4 on the valve holder.

** The maximum is limited by the repetition rate.

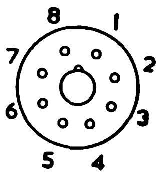
GC 10 D
(CV.5143)

Scale-of-ten Counter Tube For Single-pulse Operation

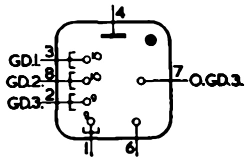
Mechanical Data

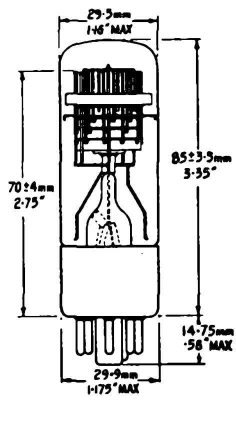
Mounting position	Any. For visual indication, the tube is viewed through the dome of the bulb.
Alignment	Cathode " O " is aligned with pin No. 6 to an accuracy of $\pm$ 12°.
Weight	44 g (nominal).
Escutcheons	N.78211 Bakelite or N.79368 Brass
Base	I.O.

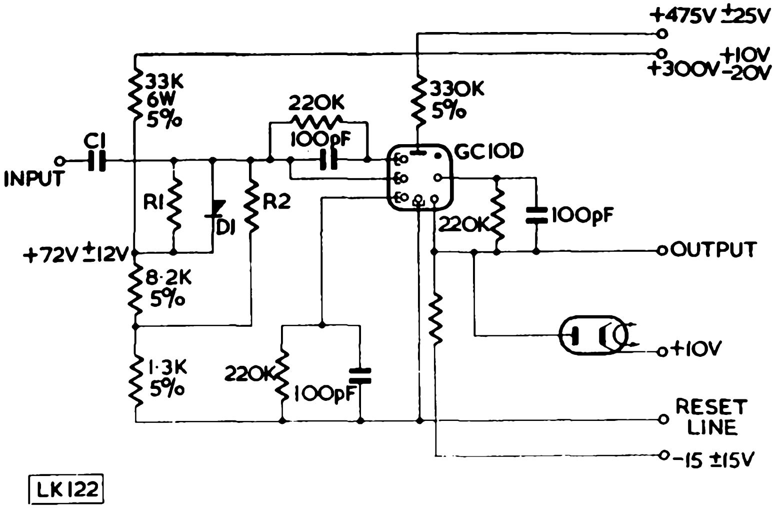
Base Connections
(underside view)



Pin	1	Common cathodes
	2	3rd Guides
	3	1st Guides
	4	Anode
	5	—
	6	Output cathode
	7	Output 3rd Guide
	8	2nd Guides







Drive	*Input*		C1	R1	R2	D1
	Duration	*Amplitude*				
Random pulse	> 25 μS	145 +50 V −12 V	·02 μF	1MΩ	Not reqd.	Q3/3
Sine wave	—	65—100 V r.m.s.	To suit lowest frequency	Not reqd.	100kΩ	Not reqd.

Sine-wave or random-pulse drive for GC10D

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

GCA10G
GSA10G

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 kp/s
Maximum counting rate single pulse drive	5 kp/s
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

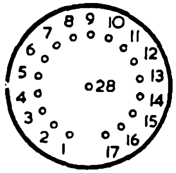
GCA10G GSA10G

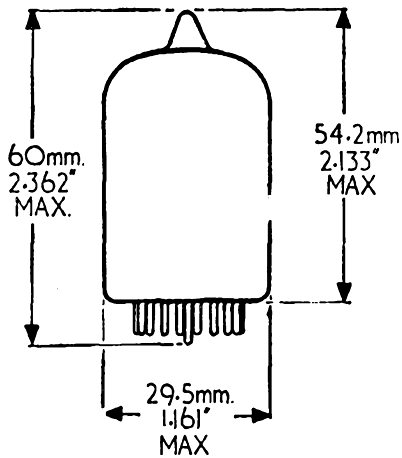
UNDER REVISION

Mechanical Data

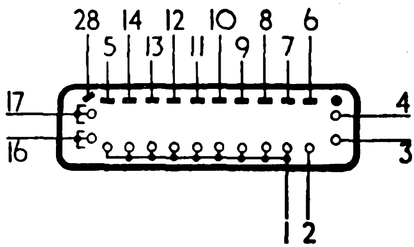
Mounting position	Any. For visual indication the tube may be viewed through the dome of the bulb.
Alignment	Cathode '0' is aligned to pin 3 with an accuracy of ± 5°
Base	Modified B26A
Socket	B27A

GCA10G Base Connections (underside view)





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

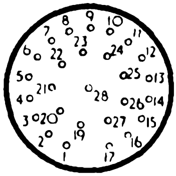


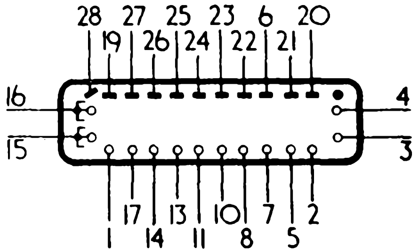
GCA10G GSA10G

Bi-directional 10-way Counter/Selector 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

GCA10G GSA10G

UNDER REVISION

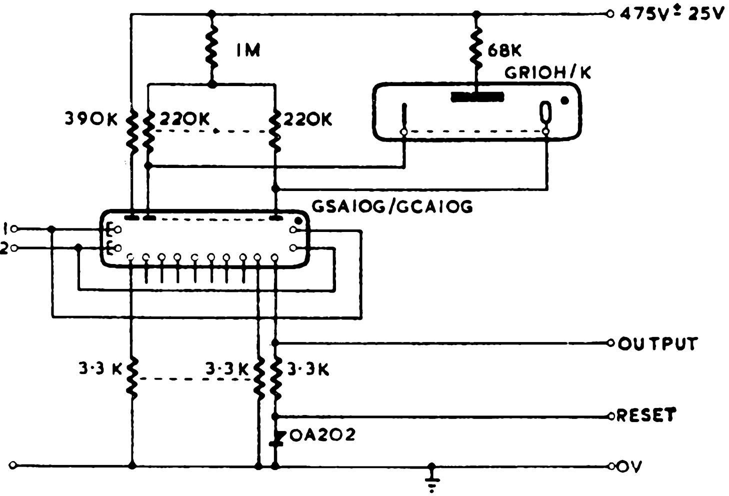


Fig. 1 Dekatron with Digitron Readout.

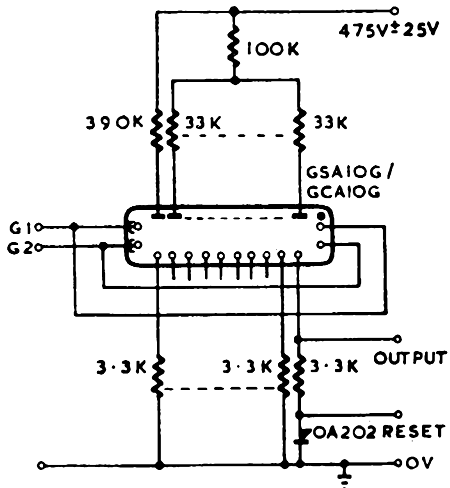


Fig. 2 Dekatron without Digitron Readout.

GCA10G GSA10G

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

UNDER REVISION

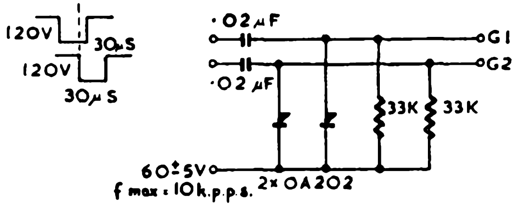


Fig. 3 Paired Pulse Drive.

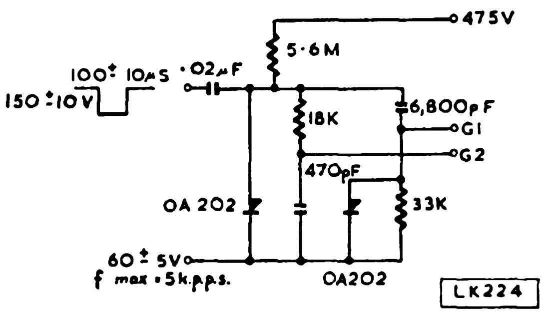


Fig. 4 Single Pulse Drive.

Bi-directional 10-way Selector Tube

GS10C/S (CV.2325)

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-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 680 kΩ resistor.

** This does not apply in the case of the sine wave drive.

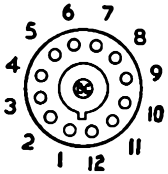
GS10C/S
(CV.2325)

Bi-directional 10-way Selector Tube

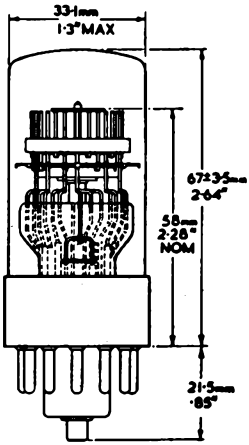
Mechanical Data

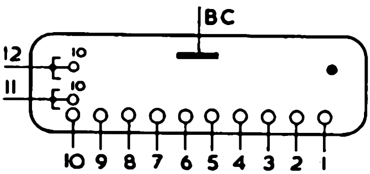
Mounting position	Any. For visual indication the tube is viewed through the dome of the bulb.
Alignment	Cathode No. 1 is aligned with pin No. 11 to an accuracy of ± 12°.
Weight	53 g. (nominal).
Escutcheon	N.80977
Base	Duodecal with bottom cap.

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





Bi-directional 12-way Selector Tube

GS12D

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

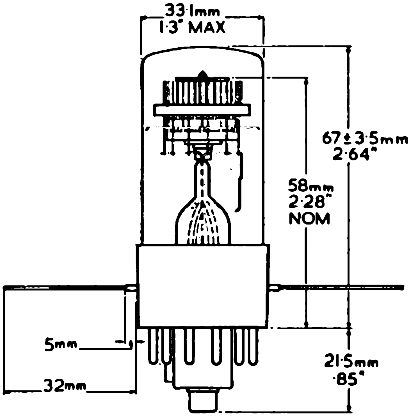
Mounting position	Any. For visual indication the tube is viewed through the dome of the bulb.
Alignment	Cathode No. 1 is aligned with pin No. 12 to an accuracy of ± 10°.
Weight	50 g (nominal).
Escutcheon	N.84538.
Base	Duodecal with bottom cap and two flying leads.

* The required anode current may be obtained from a 475 V supply via a 910 kΩ resistor.

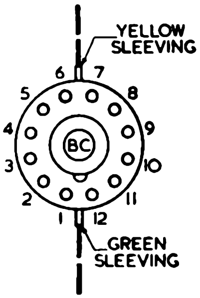
** This does not apply in the case of the sine wave drive.

GS 12 D

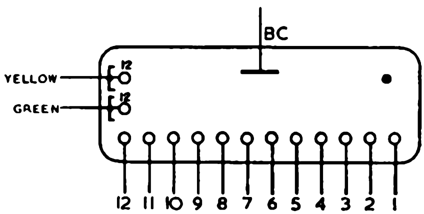
Bi-directional 12-way Selector Tube



Base Connections
(underside view)



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

GS10D

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 ¼" (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.

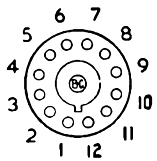
GS10D

Bi-directional 10-way Selector Tube

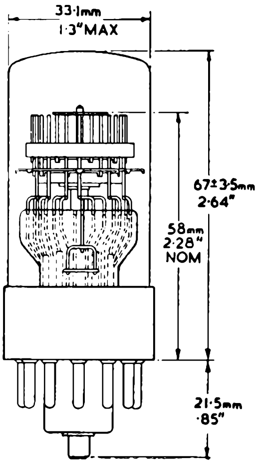
Mechanical Data

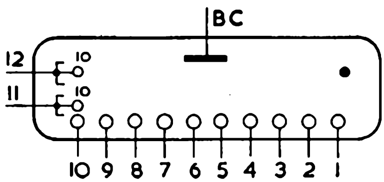
Mounting position	Any. For visual indication the tube is viewed through the dome of the bulb.
Alignment	Cathode 1 is aligned with pin No. 11 to an accuracy of $\pm$ 12°.
Weight	53 g (nominal)
Base	Duodecal with bottom cap.
Escutcheon	N80977.

Base Connections
(underside view)



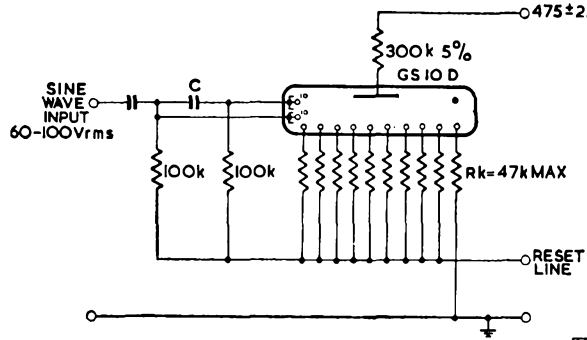
Pin 1	Cathode	0
2	,,	9
3	,,	8
4	,,	7
5	,,	6
6	,,	5
7	,,	4
8	,,	3
9	,,	2
10	,,	1
11	2nd Guides	
12	1st Guides	
B.C.	Anode	





Bi-directional 10-way Selector Tube

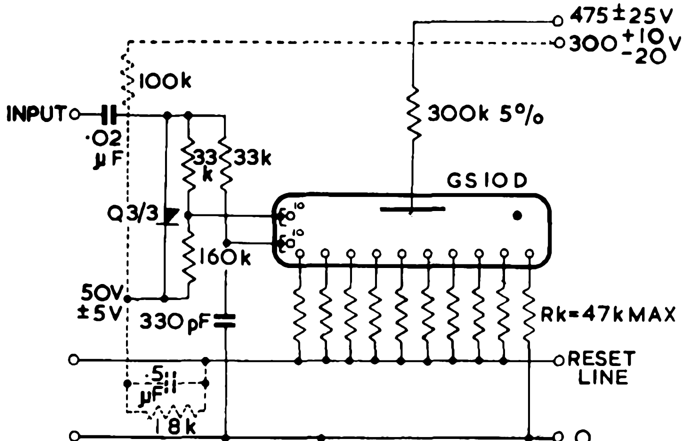
GS10D



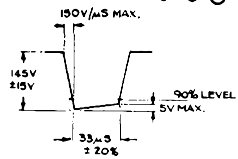
LK100 ISSUE 2

FREQUENCY	20 kc/s	15 kc/s	10 kc/s	5 kc/s	2 kc/s	1 kc/s	500 c/s	200 c/s	100 c/s	50 c/s
C	270 pF	330 pF	470 pF	680 pF	·002 μF	·005 μF	·01 μF	·02 μF	·05 μF	·1 μF

Continuous Sine-Wave Drive



INPUT PULSE
10kpps MAX.

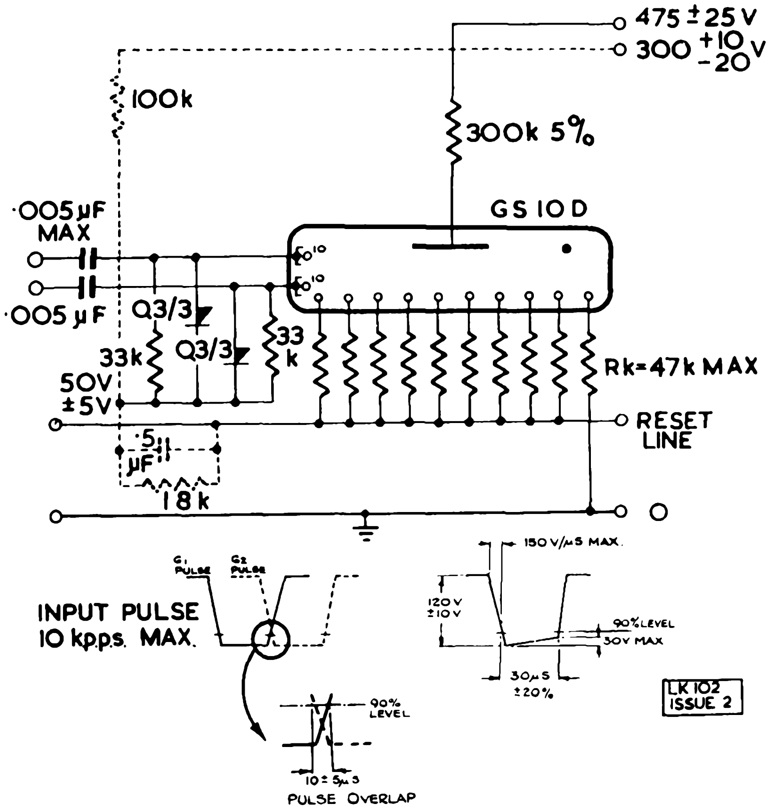


LK101 ISSUE 2

Integrated-Pulse Drive

GS10D

Bi-directional 10-way Selector Tube



Paired-Pulse Drive

Bi-directional 10-way Selector Dekatron with Routing Guides

GS10H

Although the seated height of this tube is less than 1½", the electrical characteristics are similar to the Dekatrons with phenolic bases.

Limit Ratings

Maximum counting rate	5000 p.p.s.
Maximum anode current	370 μA
Minimum anode current	250 μA
Minimum supply voltage (normal room illumination)	380 V
Maximum potential difference between electrodes other than anode	140 V
Maximum cathode output voltage	28 V

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 ¼" (5 mm) from the anode tag on the valve holder.

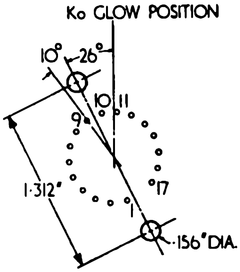
GS10H

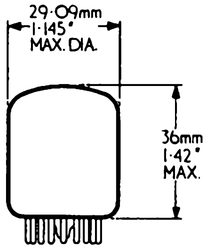
Bi-directional 10-way Selector Dekatron with Routing Guides

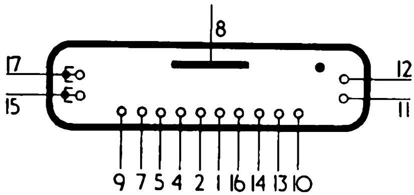
Mechanical Data

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

Bi-directional 10-way Selector Dekatron with Routing Guides

GS10H

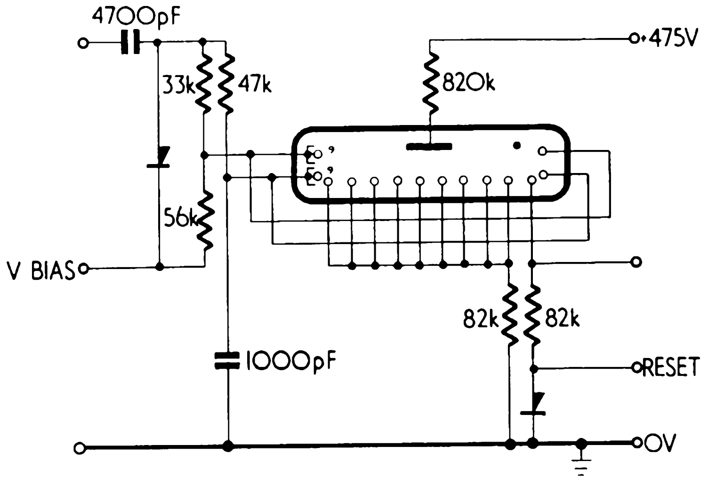


Fig. 1 Integrated Pulse Drive

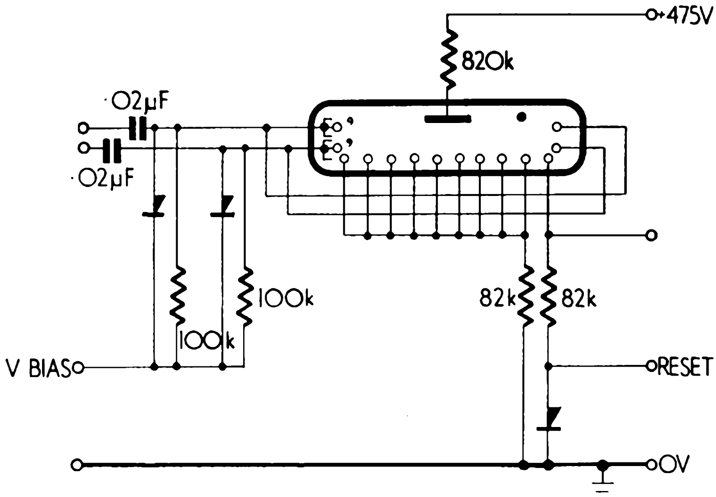
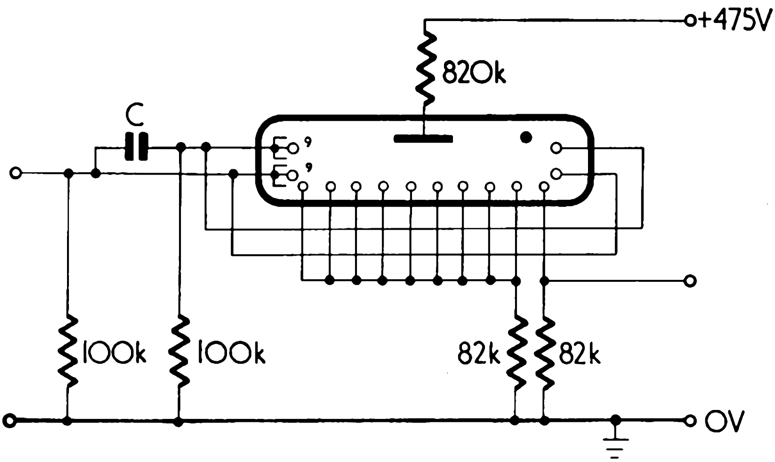


Fig. 2 Double Pulse Drive

GS10H

Bi-directional 10-way Selector Dekatron with Routing Guides



f	4 kc/s	2 kc/s	1 kc/s	500 c/s	200 c/s	100 c/s	50 c/s
C	680 pF	·002μF	·005μF	·01μF	·02μF	·05μF	·1μF

Fig. 3 Sine Wave Drive

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

INDEX

TROCHOTRON, 10-way Beam Switching Tube

VS10G

(CV5290)

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 V	65 V
	V_S = 85 V	45 V
Minimum input duration		0·5 μS

Characteristics (V_S = 108 V, R_S = 100 kΩ)

Holding spade current	1·2 mA nom.
Target current	10·0 mA nom.

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

V_S	108 V
R_S	100 kΩ ± 10%

(Each spade must be connected to a separate load resistor with not more than ½″ (10 mm) of connecting lead).

V_T	108 V
R_T	4·7 kΩ

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

Trochotron, 10-way Beam Switching Tube

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

$V_{SG} = \frac{V_S}{2}$	54 V ←
V_{SG} pulse amplitude	−54 V ←
t pulse	0·5 μS
R_{SG}	22 kΩ ←
C input	330 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.

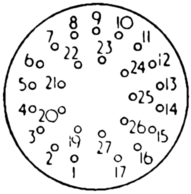
Mechanical Data

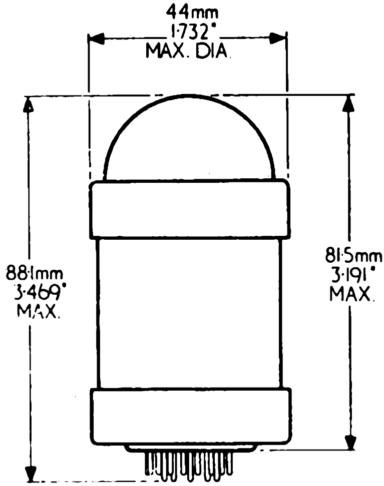
Mounting position	Any: providing that the tube is kept at least 2″ from any magnetic material or 4″ from a similar tube, a strong magnet or a mu-metal screen.
Weight	185 g
Base	B26A

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

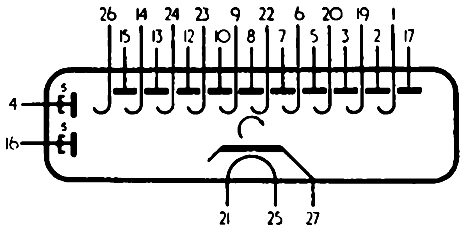
Mechanical Data—*cont.*

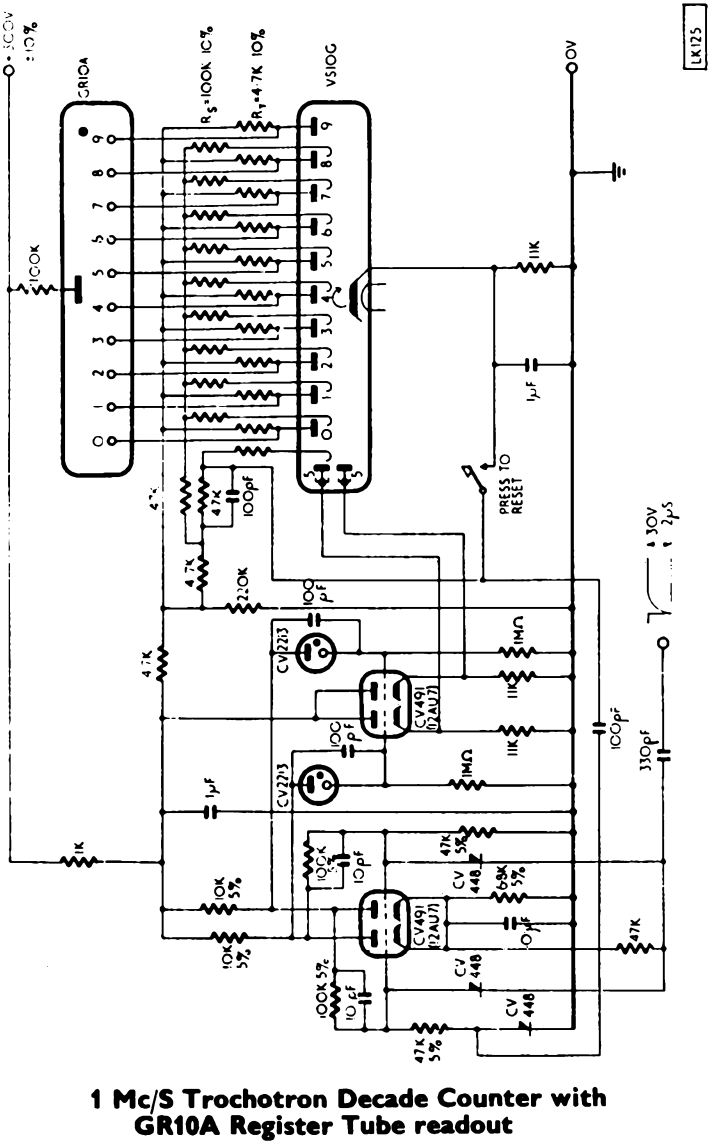
Base Connections
(underside view)



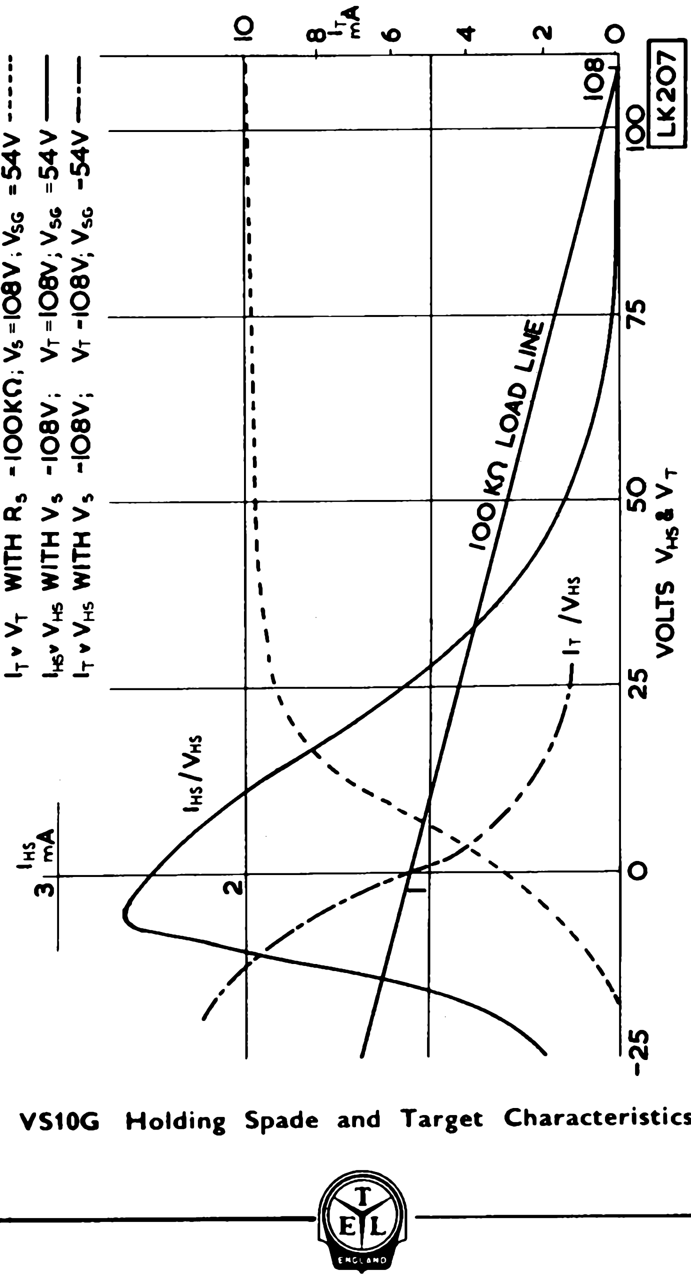


Pin	
1	Spade 0
2	Target 9
3	Target 8
4	Odd Switching grids
5	Target 7
6	Spade 7
7	Target 6
8	Target 5
9	Spade 5
10	Target 4
11	Do not connect
12	Target 3
13	Target 2
14	Spade 2
15	Target 1
16	Even switching grids
17	Target 0
19	Spade 9
20	Spade 8
21	Heater
22	Spade 6
23	Spade 4
24	Spade 3
25	Heater
26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





1 Mc/S Trochotron Decade Counter with GR10A Register Tube readout



VS10G Holding Spade and Target Characteristics

~~TENTATIVE DATA SHEET~~

High Current 10-way Trochotron Beam Switching Tube

VS 10 H (VX.9210)

Cathode		Indirectly heated
Heater	Vh	6·3 V
	Ih	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	75 V
	125 V	55 V
	80 V	45 V
Minimum spade resistor (R_S min.)		
	V_S = 140 V	56 kΩ
	125 V	68 kΩ
	80 V	82 kΩ
Maximum spade resistor (R_S max.)		
	V_S = 140 V	150 kΩ
	125 V	175 kΩ
	80 V	270 kΩ
Minimum resolution time (for groups of pulses not exceeding nine in number)		250 *n*S
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	2·0 mA nom.
	125 V	1·0 mA nom.
	80 V	0·2 mA nom.

VS10H
(VX.9210)

High Current 10-way Trochotron Beam Switching Tube

Recommended Operating Conditions for 1 Mc/S Operation

V_S	125 V
R_S	100 kΩ

(Each spade must be connected to a separate load resistor with not more than ½″ (10 mm) of connecting lead).

V_T	125 V
R_T	4·7 kΩ

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

Minimum pulse—duration	0·25 μS
Minimum pulse—amplitude	$-(V_{SG} + 5)$ V

For 2 Mc/S Operation

V_S	125 V
R_S	82 kΩ

(Each Spade must be connected to a separate load resistor with not more than ½″ (10 mm) of connecting lead).

V_T	125 V
R_T	4·7 kΩ

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

Minimum pulse—duration	0·25 μS
Minimum pulse—amplitude	$-(V_{SG} + 5)$ V

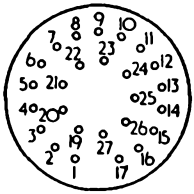
High Current 10-way Trochotron Beam Switching Tube

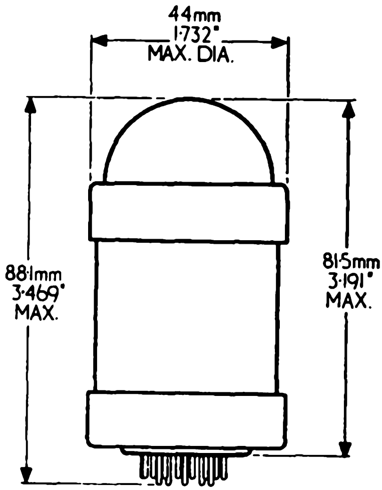
VS10H
(VX.9210)

Mechanical Data

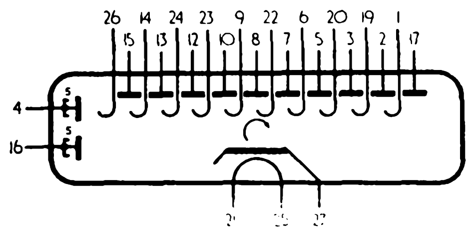
Mounting position	Any: providing that the tube is kept at least 2″ from any magnetic material or 4″ from a similar tube, a strong magnet or a mu-metal screen.
Weight	220 g
Base	B26A
Sockets	B26A or B27A

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



DIGITRON AND REGISTER TUBES

INDEX

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 thermionic 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.

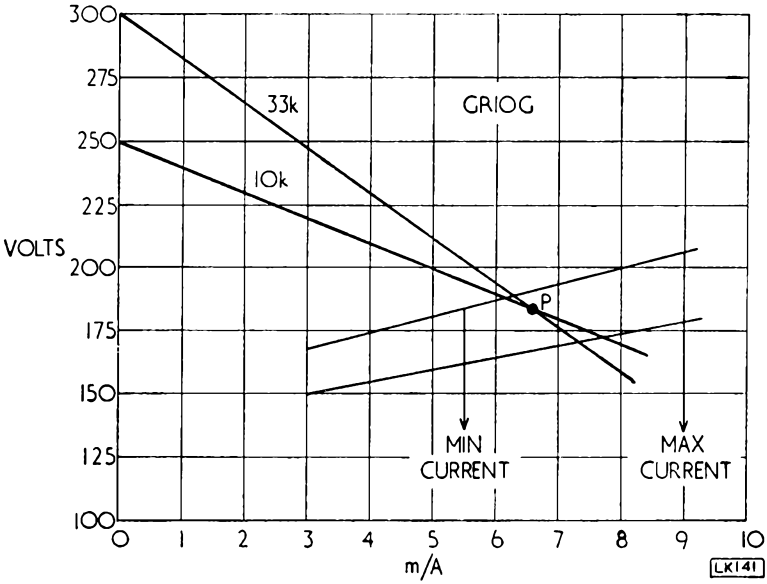


Fig. 1 Digitron Operating Characteristics

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 D gitrons 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 :—

$$E_1 \geqslant E_s + (E_2 - E_o).$$

$$E_1 \leqslant I_a R_a + (E_2 - \frac{n-1}{n} E_o) + E_x.$$

where E_1 = Anode supply voltage of register tube.

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

cont'd

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.

10-way Register Or Indicator Tube

GR10A

(CV5291)

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.

GR10A

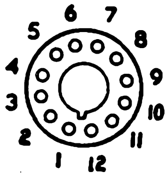
(CV5291)

10-way Register Or Indicator Tube

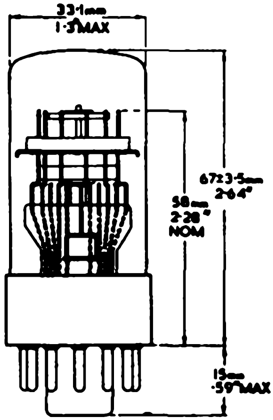
Mechanical Data

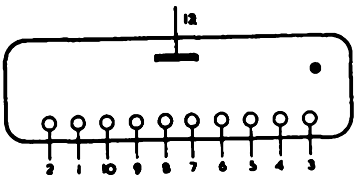
Mounting position	Any. The tube is viewed through the dome of the bulb.
Alignment	Cathode No. 2 is aligned with pin No. 11 to an accuracy of $\pm$ 12°.
Weight	50 g.
Escutcheon	N.80977.
Base	Duodecal.

Base Connections (underside view)



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





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

GR10J

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 = 33kΩ	250 V

A.C. operation

(Unsmoothed half-wave rectifier 50 c.p.s. a.c.)

Anode supply voltage -	Ra = 39kΩ	200-220V r.m.s.
	Ra = 47kΩ	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

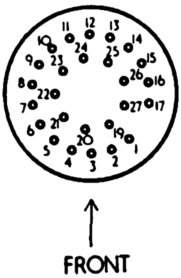
GR10J

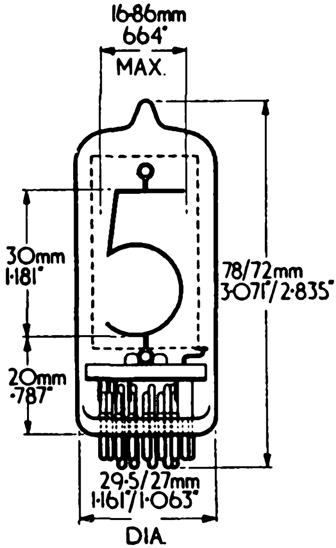
DIGITRON - Long Life 10 Digit Side-Viewing Cold-Cathode Numerical Register Tube

Mechanical Data

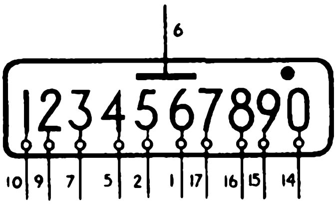
Mounting position	Any
Base	B26A
Socket	B17A, B26A or B27A

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

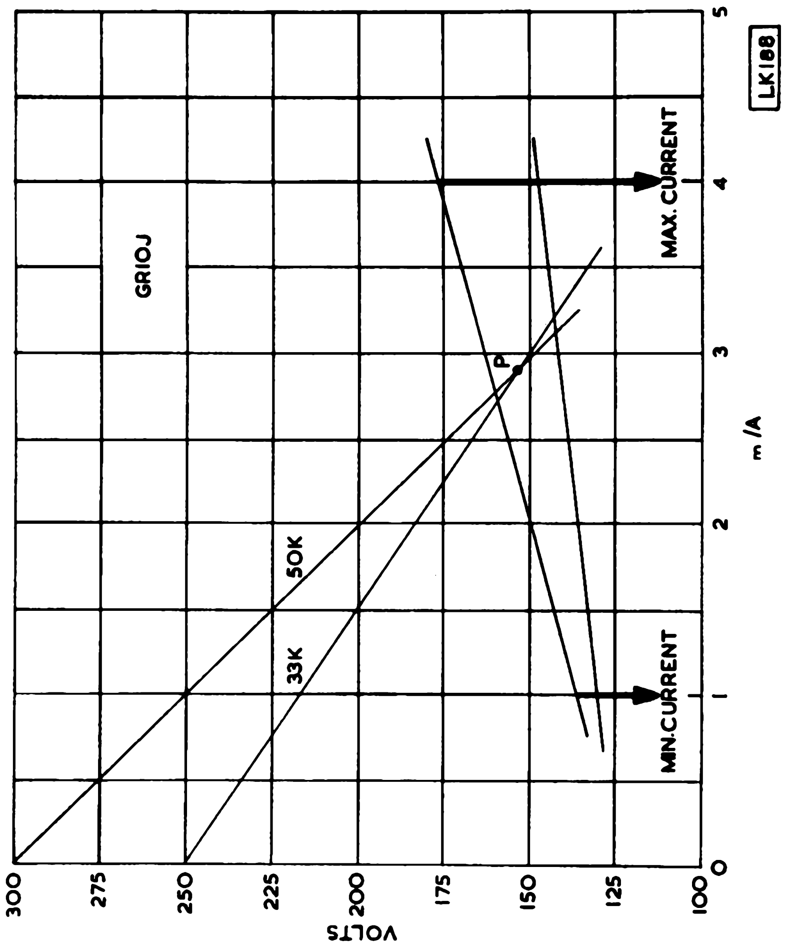


Note: All other pins are to be left unconnected.

TENTATIVE DATA SHEET

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

GR10J



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 = 82kΩ	250 V
	Ra = 47kΩ	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

TENTATIVE DATA SHEET

GR10K
(CV.5842)

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

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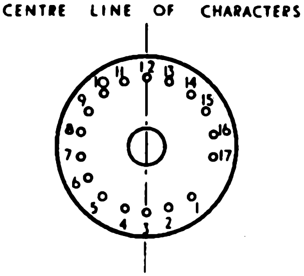
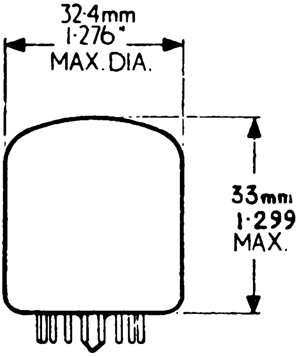
Mechanical Data

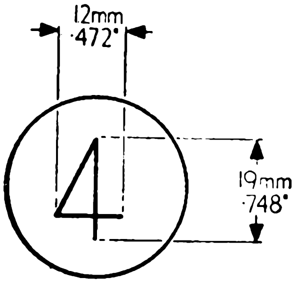
Mounting position	Any
Base	B17A
Socket	B17A

Base Connections
(underside view)

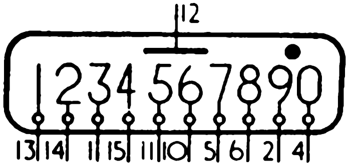




Pin 1 Cathode 3
2 Cathode 9
4 Cathode 0
5 Cathode 7
6 Cathode 8
10 Cathode 6
11 Cathode 5
12 Anode
13 Cathode 1
14 Cathode 2
15 Cathode 4



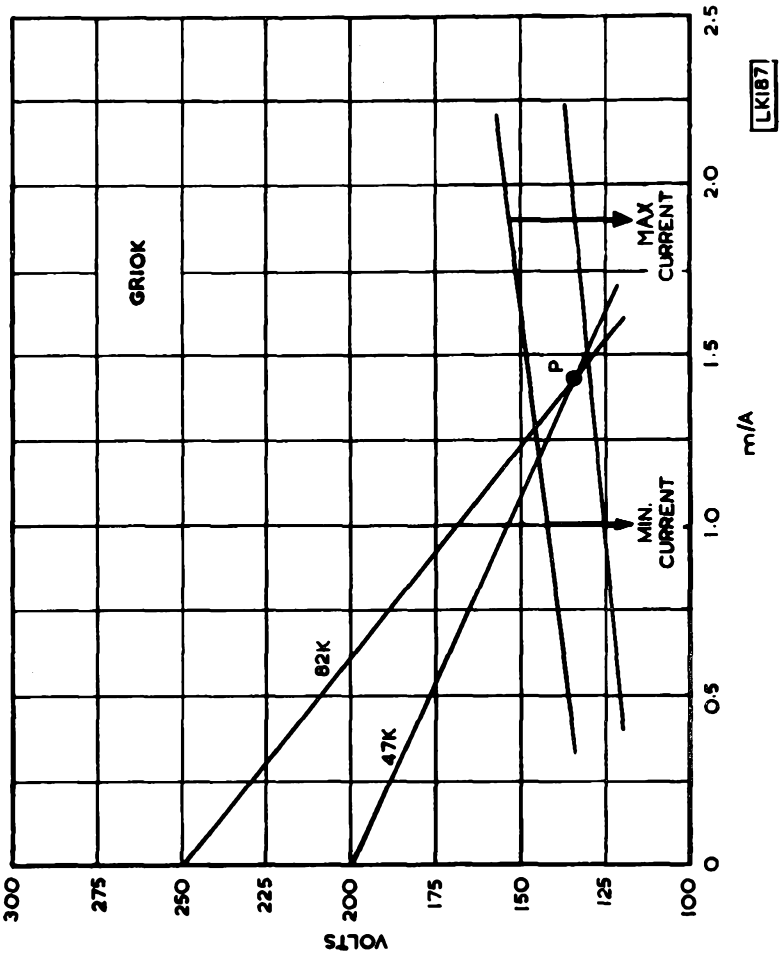
Note: All other pins are
to be left unconnected.



TENTATIVE DATA SHEET

*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

GR10M

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	1·5 mA
peak	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

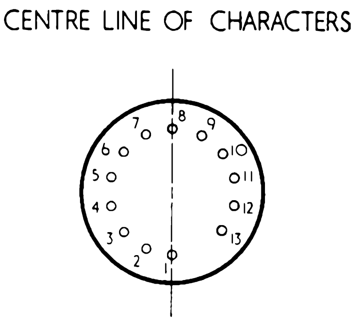
*DIGITRON—Long Life 10 Digit End-Viewing Cold Cathode Numerical Register Tube

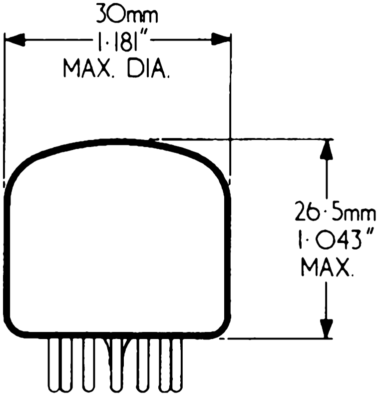
GR10M

Mechanical Data

Mounting position	Any
Base	B13B
Socket	B13B

Base Connections
(underside view)

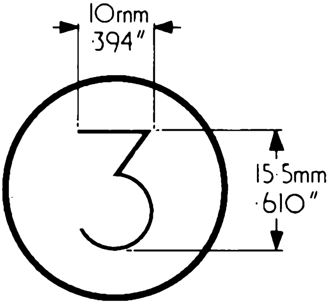


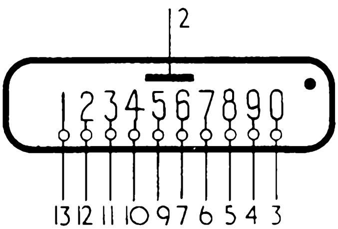


Pin 2 Anode
3 Cathode 0
4 Cathode 9
5 Cathode 8
6 Cathode 7
7 Cathode 6
9 Cathode 5
10 Cathode 4
11 Cathode 3
12 Cathode 2
13 Cathode 1

Note—All other pins are to be left unconnected

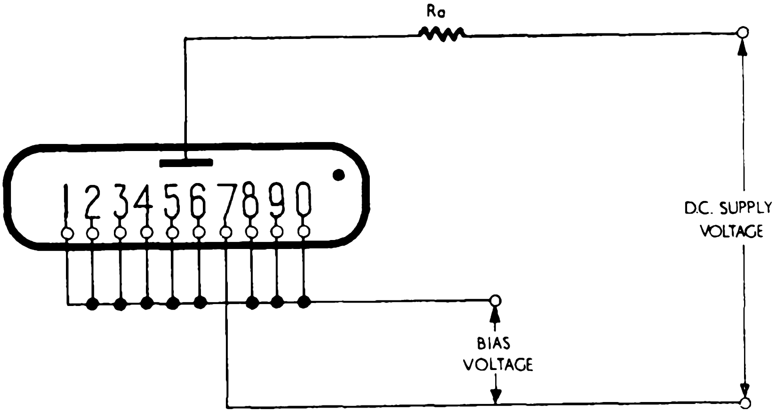
The dome of the tube is filter coated



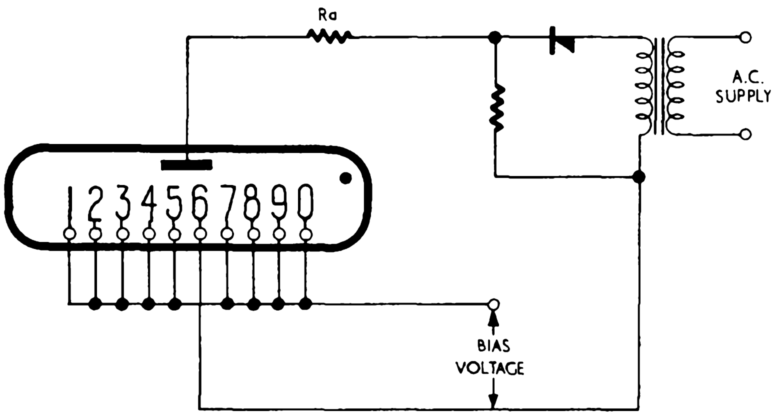


* Registered Trade Mark

*DIGITRON—Long Life 10 Digit End-Viewing Cold-Cathode Numerical Register Tube GR10M



Typical Circuit for D.C. Operation

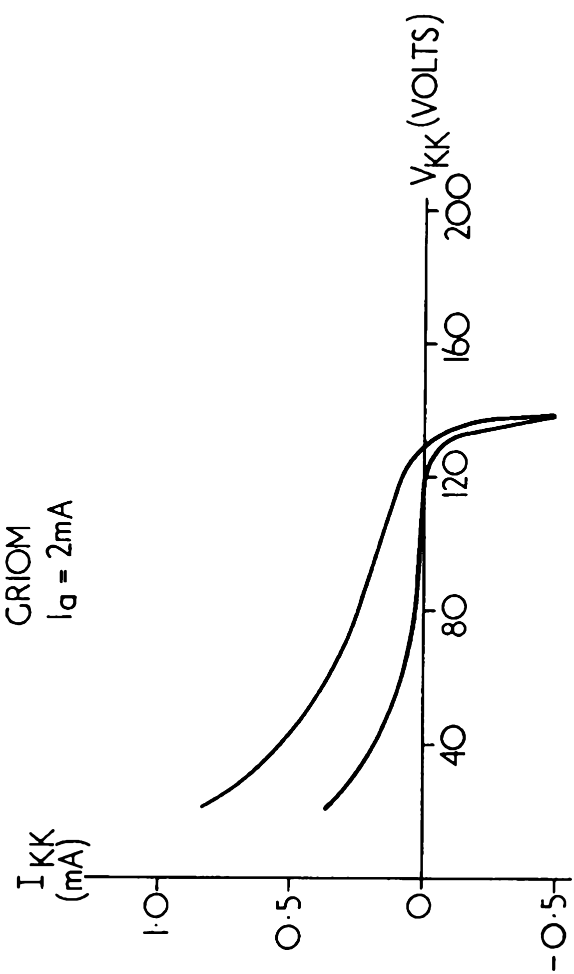


Typical Circuit for A.C. Operation

*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

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

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

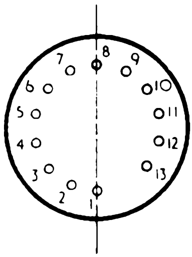
GR 7 M *DIGITRON–Long Life 7 Character End-Viewing Cold-Cathode Register Tube Containing Characters +, –, V, A, Ω, %, and ~

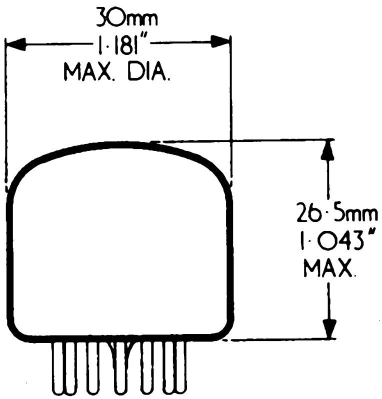
Mechanical Data

Mounting position	Any
Base	B13B
Socket	B13B

Base Connections
(underside view)

CENTRE LINE OF CHARACTERS

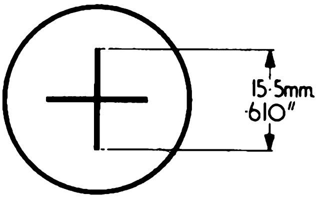


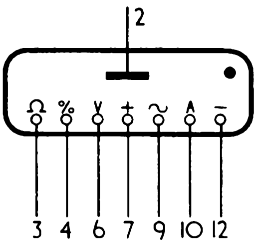


Pin 2 Anode
3 Cathode Ω
4 Cathode %
6 Cathode V
7 Cathode +
9 Cathode ~
10 Cathode A
12 Cathode –

The dome of the tube is filter coated

Note - All other pins are to be left unconnected.





* Registe :d Trade Mark

CIRCUITS

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

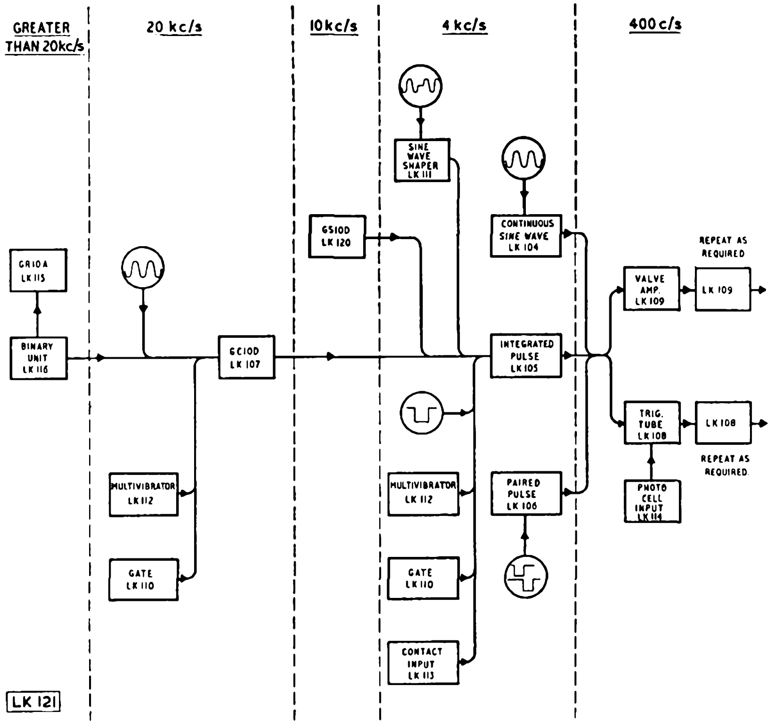
To enable counters to be set at zero, two h.t. negative lines should be provided. One directly earthed receives the returns from

cont'd

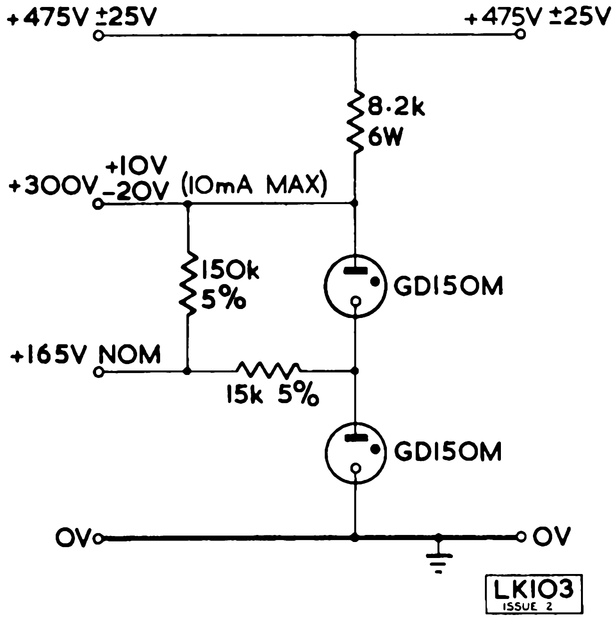
the Dekatron output cathodes (or the potential dividers feeding them), the cathodes of any coupling tubes and the negative bias supplies for these tubes. The other line, described as the reset line, takes all the remaining returns and is connected to earth via a resistor which is shorted during counting.

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.

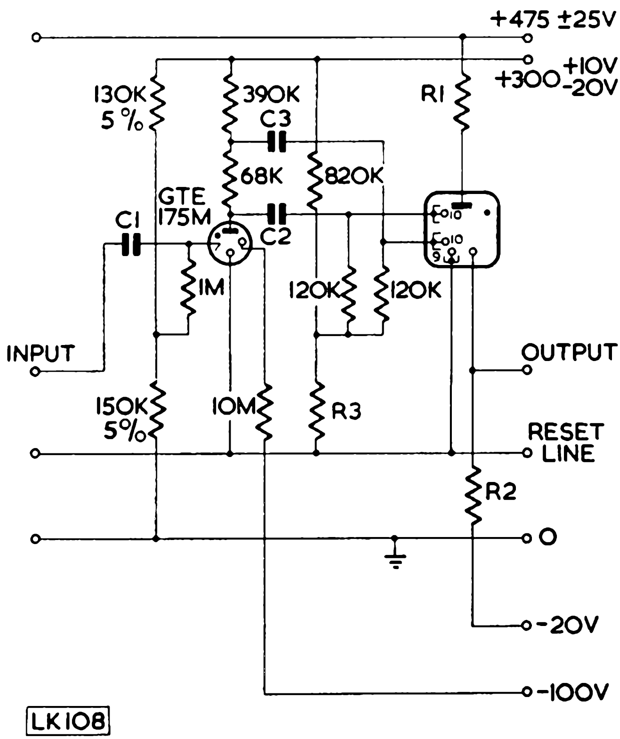


Dekatron Block Schematic Circuits



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



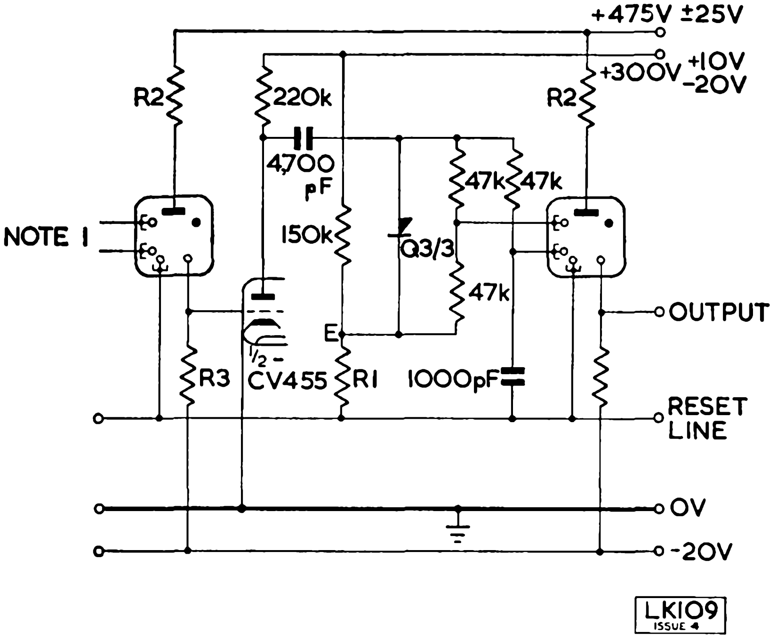
	Counters	Selectors
R1	820 kΩ	680 kΩ
*R2	150 kΩ max.	150 kΩ max.
R3	39 kΩ	47 kΩ

	Input to previous stage	
	Rect. Pulses	*Sine Wave*
C1	·001 µF	·01 µF
C2	·001 µF	·001 µF
C3	·002 µF	·002 µF

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

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

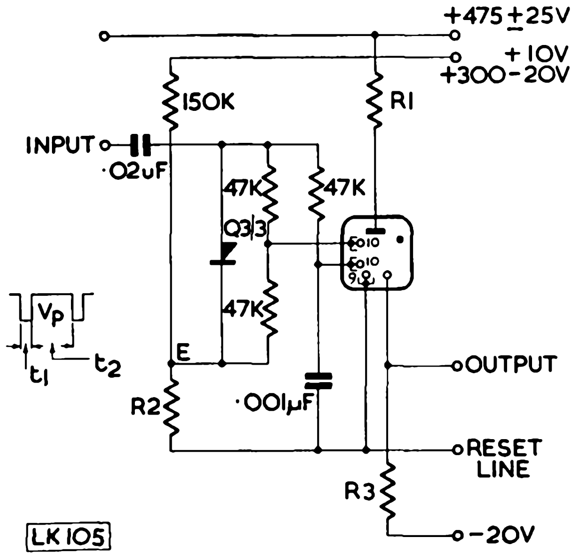
Circuits



	Counters	GS10C	GS12D
R1	10 kΩ	22 kΩ	22 kΩ
R2	820 kΩ	680 kΩ	910 kΩ
R3	150 kΩ	150 kΩ	270 kΩ
E	+18 V	+36 V	+36 V

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

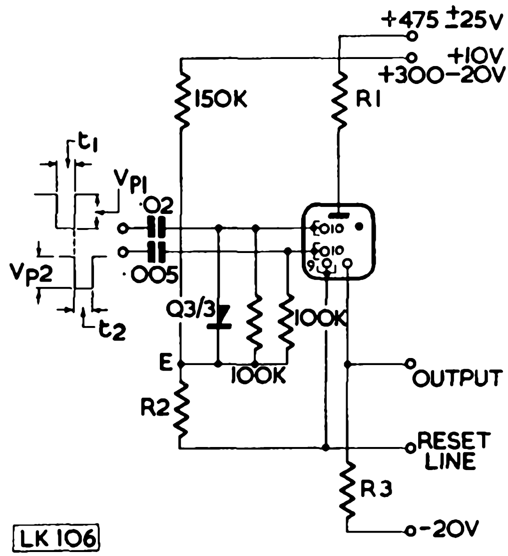


	Counters	Selectors
R1	820 kΩ	680 kΩ
R2	10 kΩ	22 kΩ
R3	150 kΩ max.	150 kΩ max.
E	+18 V	+36 V

$V_P = -145 \pm 15$ V $\quad t_1 = > 80\ \mu S \quad t_2 = > 170\ \mu S$

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

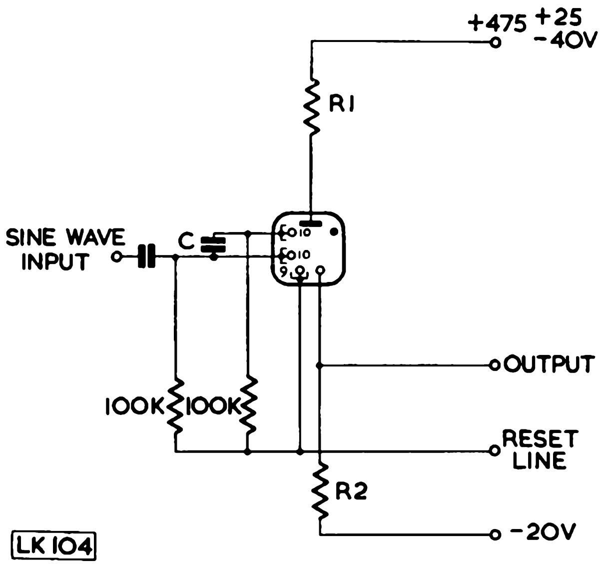
Integrated-pulse Drive for 4 k/cs Dekatron



	Counters	Selectors
R1	820 kΩ	680 kΩ
R2	10 kΩ	22 kΩ
R3	150 kΩ max.	150 kΩ max.
E	+18 V	+36 V

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

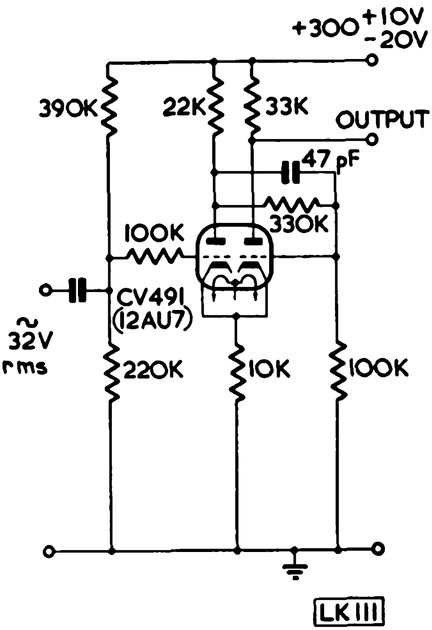
Paired-pulse Drive for 4 kc/s Dekatron



	Counters	*Selectors*
R1 **R2**	**820 kΩ** **150 kΩ max.**	**680 kΩ** **150 kΩ max.**

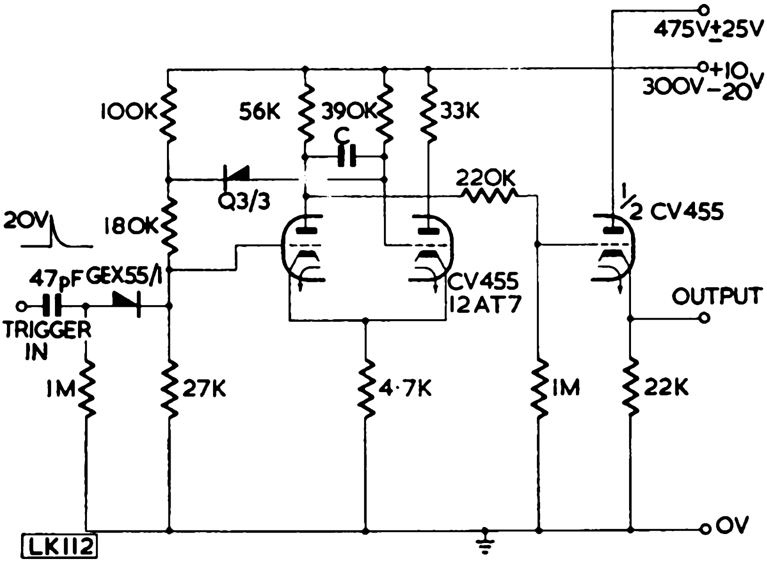
Frequency	**4 kc/s**	**2 kc/s**	**1 kc/s**	**500 c/s**	**200 c/s**	**100 c/s**	**50 c/s**
C	**680 pF**	**·002 μF**	**·005 μF**	**·01 μF**	**·02 μF**	**·05 μF**	**·1 μF**
Drive Amplitude	**40—70 V r.m.s.**						

Continuous Sine-wave Drive for 4 kc/s Dekatron



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.

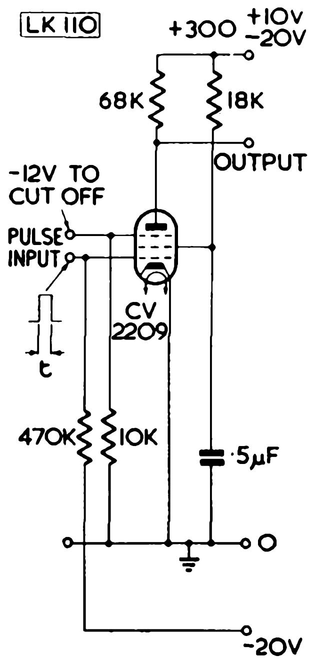
Sine-wave Shaping Circuit



Output Pulse	C
25 μS 80 μS	100 pF 470 pF

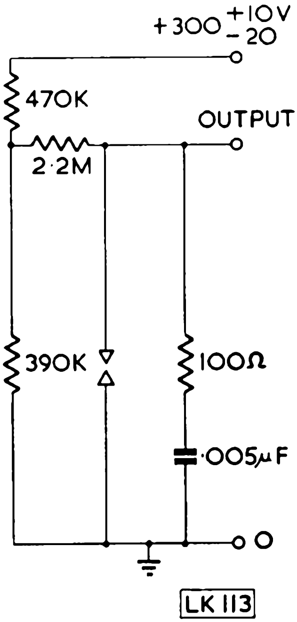
The above circuit is designed to feed either the integrated pulse drive LK.105, or the GC10D single pulse drive LK.107. Triggering is achieved with a short positive pulse of amplitude greater than 20 V.

Multivibrator Pulse Shaping Circuit



GC10D	GS10D	4 kc/s Dekatron
25 μS	35 μS	80 μS
Pulse Amplitude > +20 V		

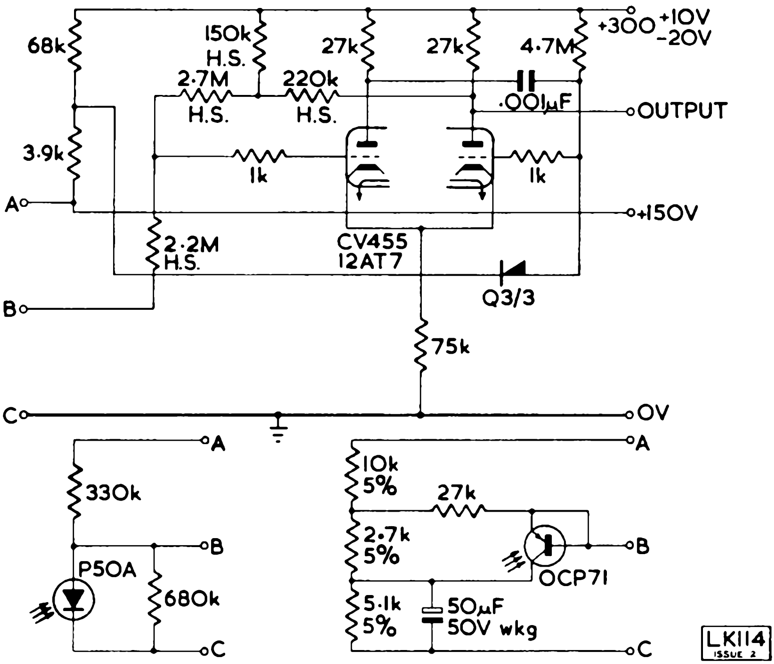
Gate Circuit for use with Single and Double-pulse Dekatron Drive Circuits



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.

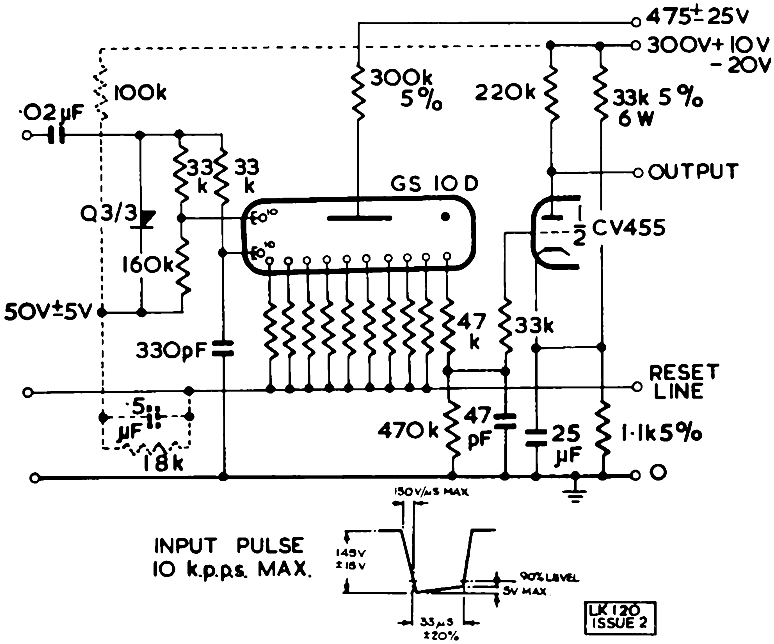
Contact Input

Circuits



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.

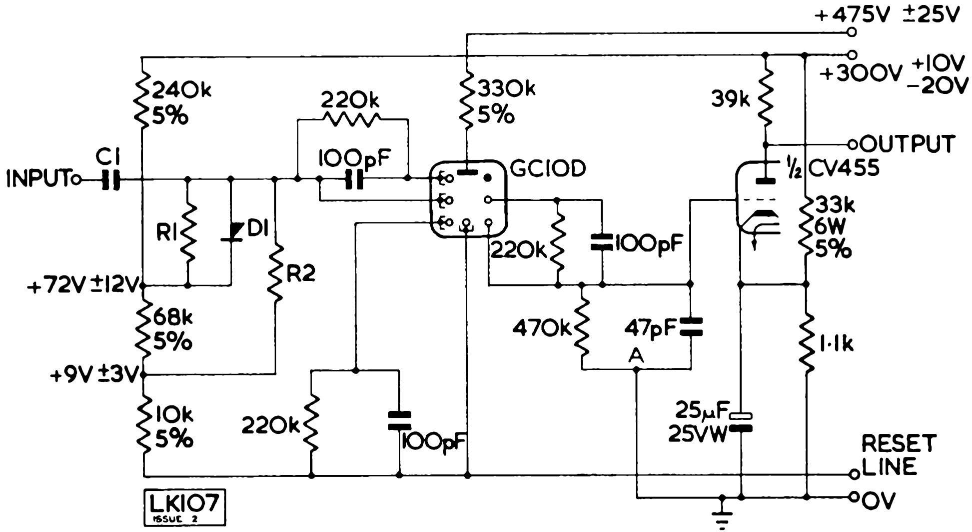
Photo-cell Input for 4 kc/s Dekatron



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

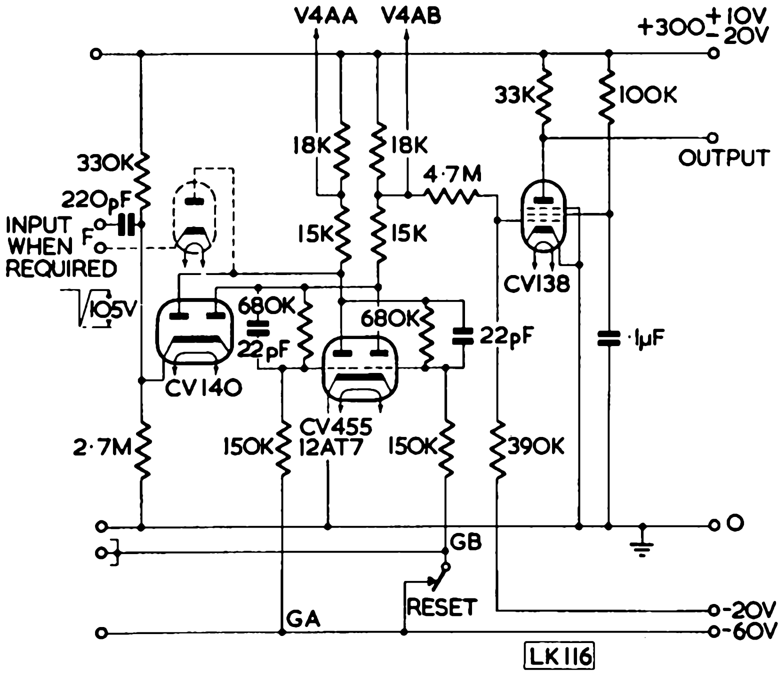
GC10D Single-pulse Drive with Coupling suitable for Integrated-pulse Drive LK105



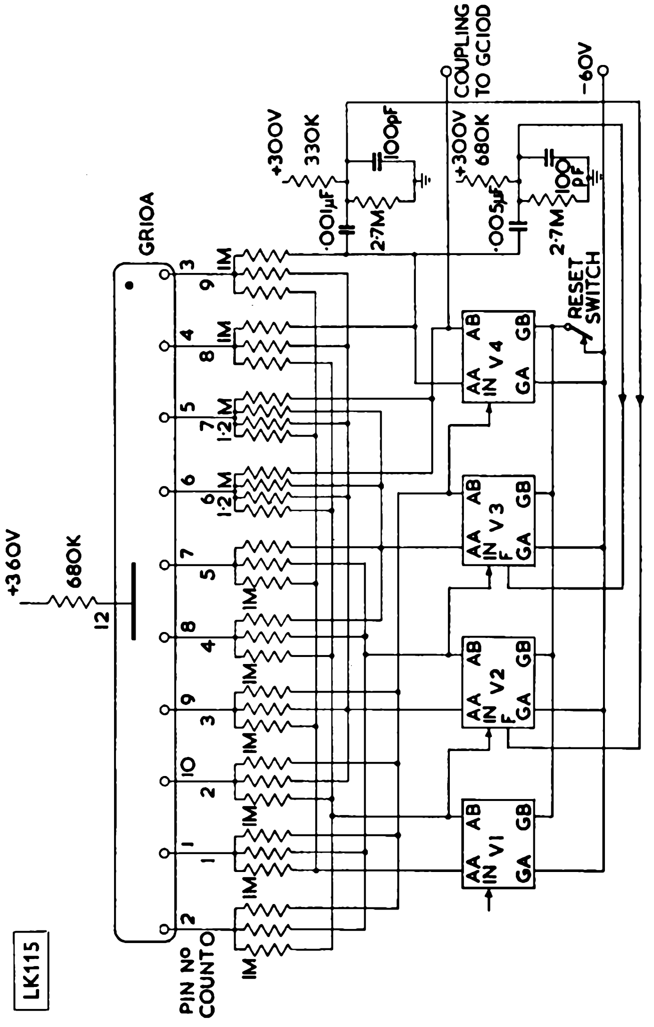
Drive	Input		C1	R1	R2	D1
	Duration	Amplitude				
Random pulse	> 25 μS	145 V + 50 V −12 V	·02 μF	1 MΩ	Not req'd.	Q3/3
Sine-wave	—	65—100 V r.m.s.	To suit lowest frequency	Not req'd.	100 kΩ	Not req'd.

The grid and cathode of the pulse amplifier are used as a limiting diode for the GC10D output cathode voltage.

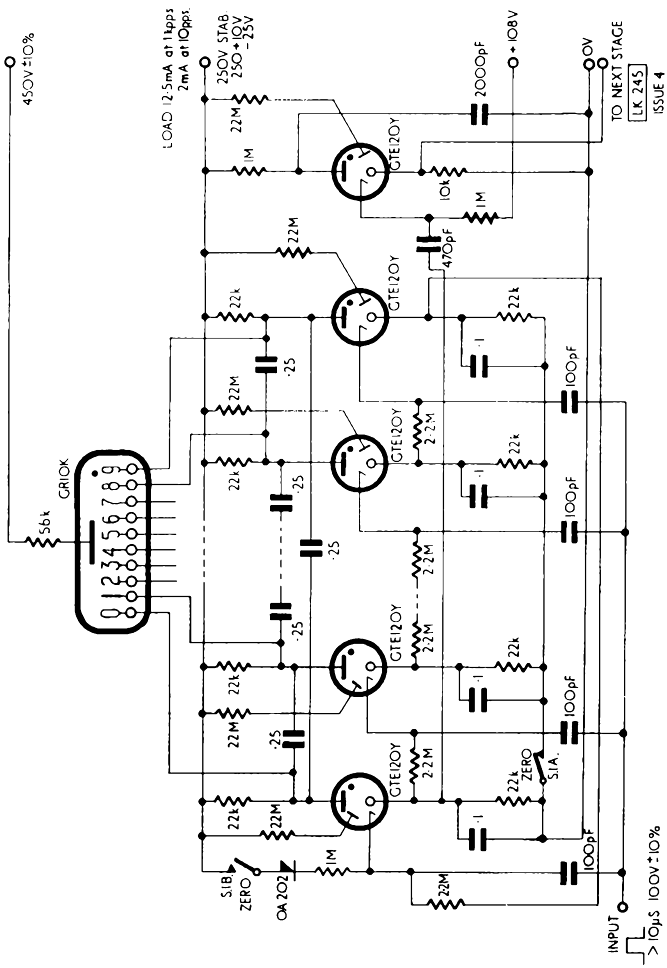
If a —20V rail is available, the junction A of the 470k resistor and 47pf capacitor may be taken to this supply and the CV.455 cathode taken to the 0V rail, eliminating the cathode potential divider.



Detail of Binary Counting Stage with Pulse Amplifier for Driving GC10D Circuit LK107



GR10A Connected to Conventional Decade Scaler

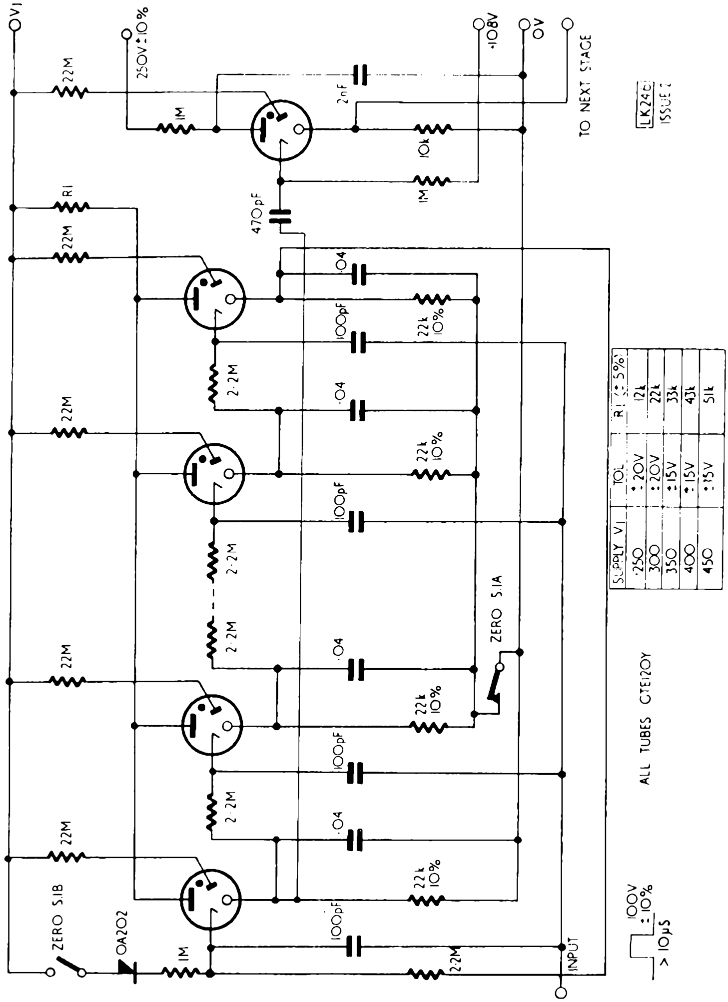


To zero the circuit S.1A and S.1B should be operated together.
The same contacts may also be used to zero cascaded decades.

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

* Registered Trade Mark

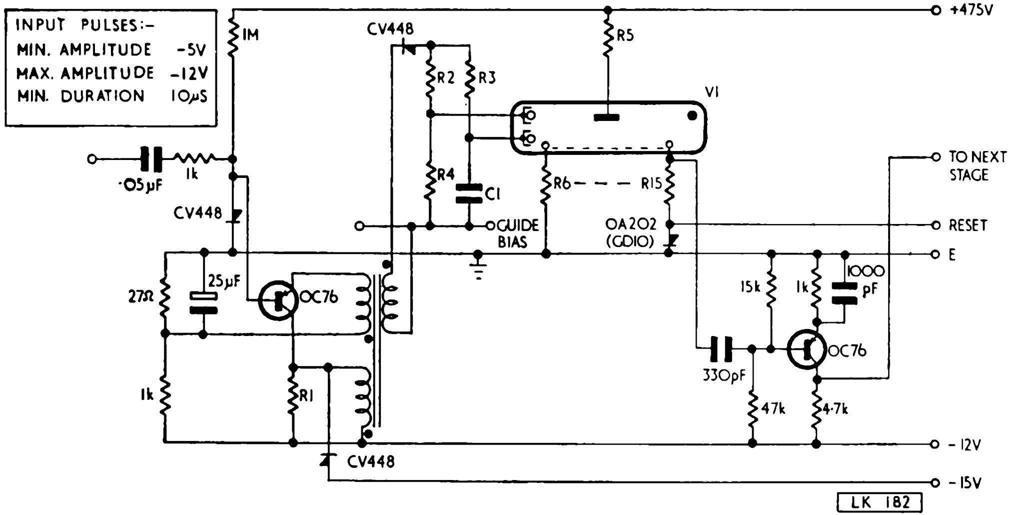
Circuits



SUPPLY V1	TOL.	R1 (± 5%)
250	± 20V	12k
300	± 20V	22k
350	± 15V	33k
400	± 15V	43k
450	± 15V	51k

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



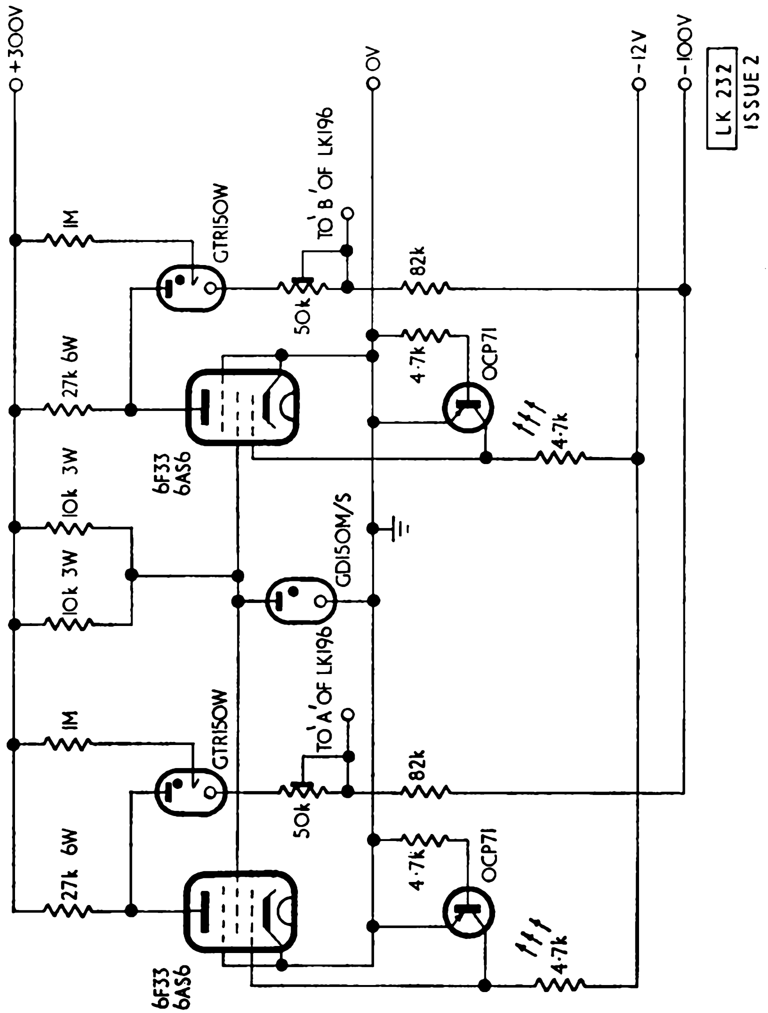
TRANSFORMER DETAILS

4 kc/s DEKATRONS		10 kc/s DEKATRONS	
3/16" STACK 8 THOU. MUMETAL LAMINATIONS RCL 191 TYPE 421		1/4" STACK 4 THOU. MUMETAL LAMINATIONS RCL 191 TYPE 450	
COLLECTOR WIND.	100 T	COLLECTOR WIND.	45 T
EMITTER WIND.	20 T	EMITTER WIND.	7 T
OUTPUT WIND.	906 T	OUTPUT WIND.	515 T

	V1	R1	R2	R3	R4	R5	R6-15	C1	GUIDE BIAS
4 kc/s DEKATRONS	GC10B etc.	4.7k	47k	47k	47k	820k	150k max.	1000 pF	+18V
	GS10C	,,	,,	,,	,,	680k	,,	,,	+36V
	GS12D	,,	,,	,,	,,	,,	270k max.	,,	,,
10 kc/s DEKATRONS	GS10D	NOT REQ'D	33k	33k	160k	300k	47k max.	330 pF	+50V
	GS10E		,,	,,	,,	240k	39k max.	,,	,,

Transistor Blocking Oscillator Drive of *Dekatrons

*Registered Trade Mark

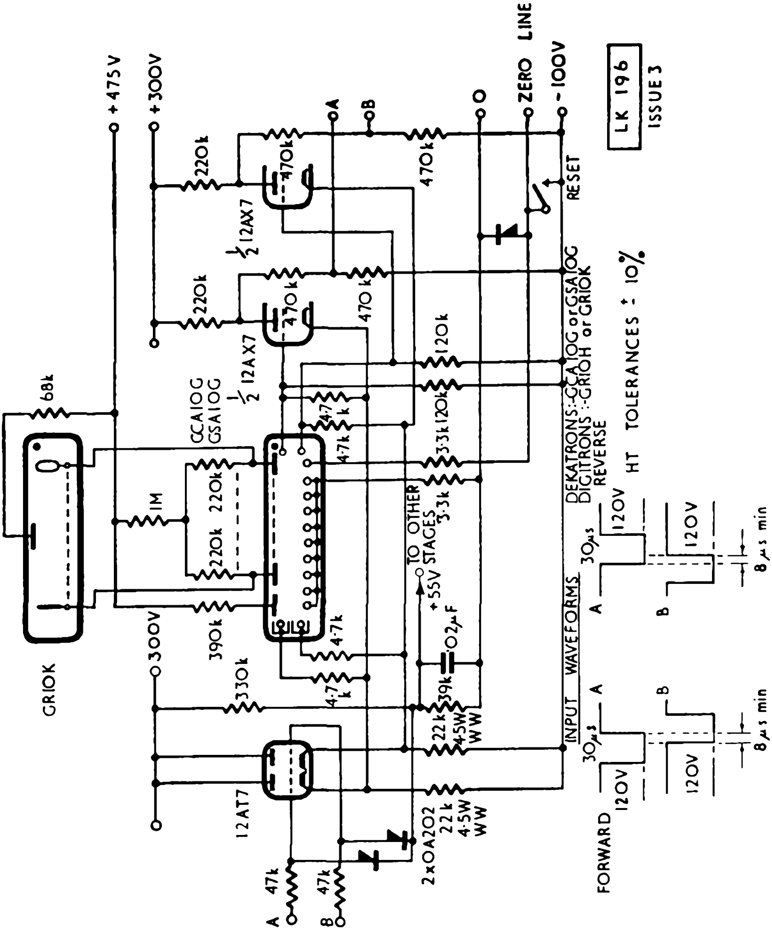


Twin Photo Input to Reversible *Dekatron

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

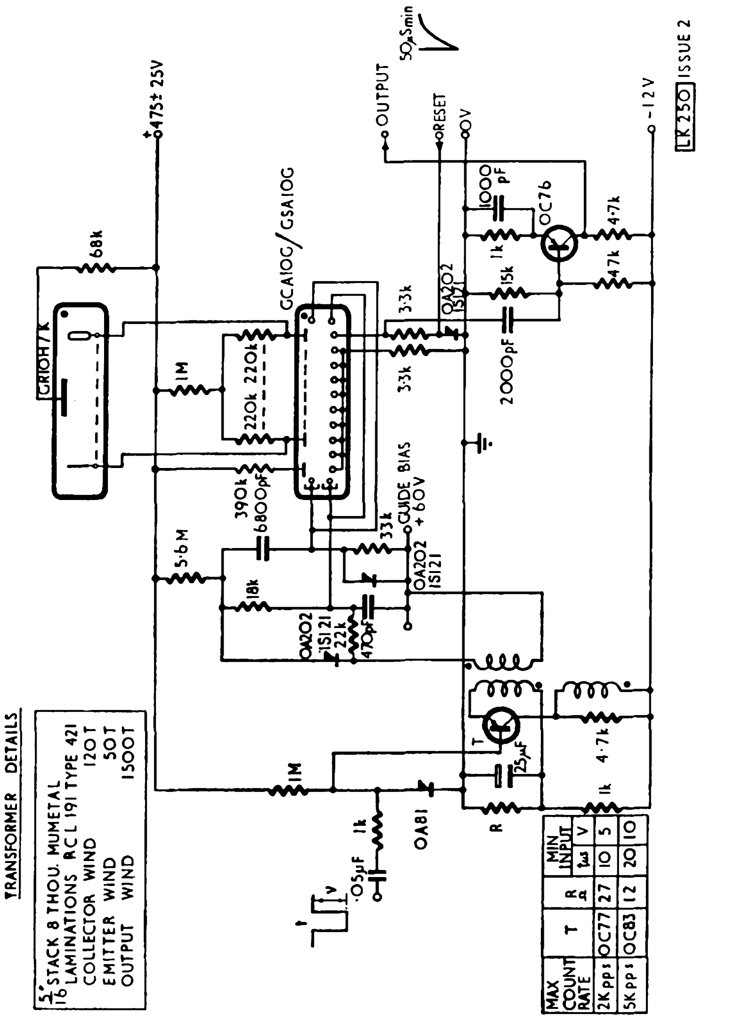
*Registered Trade Mark

UNDER REVISION



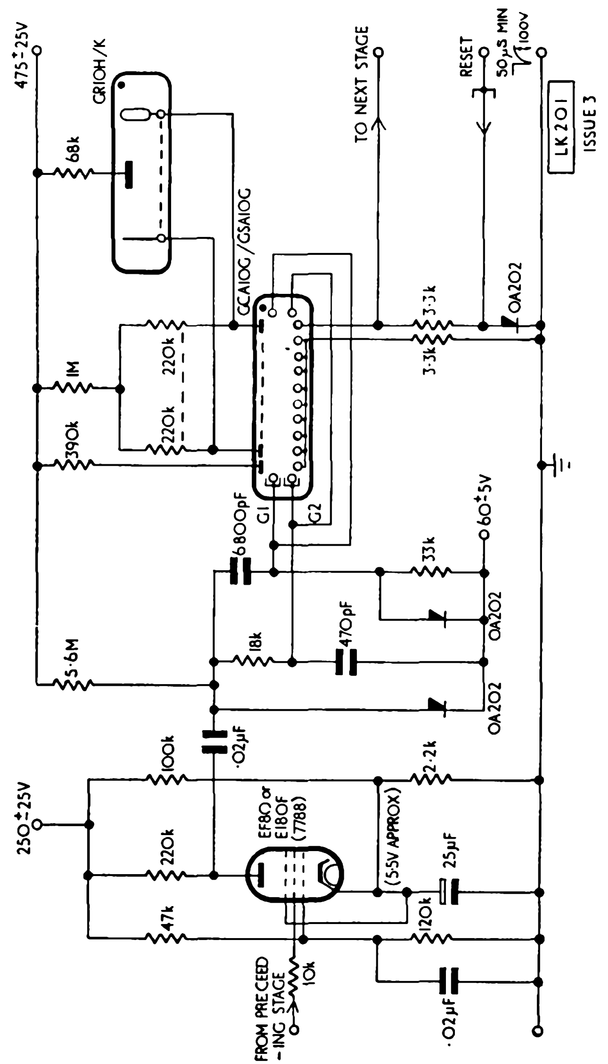
Reversible Drive and Coupling Circuit for GCA10G/GSA10G

UNDER REVISION

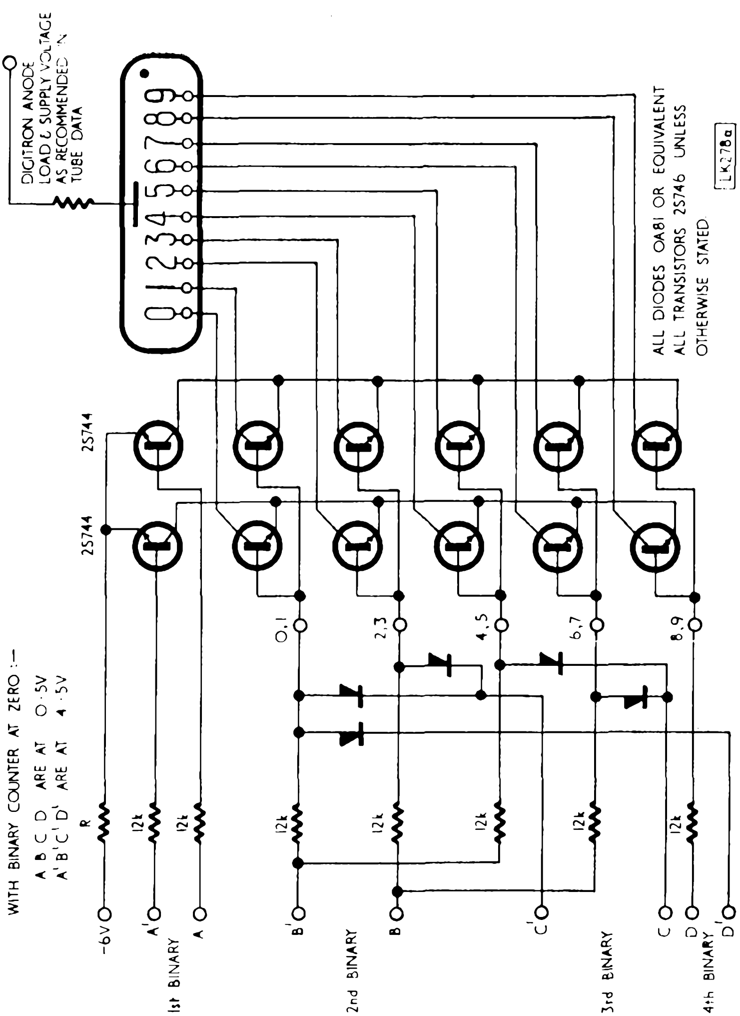


GCA10G/GSA10G Transistor Drive and Coupling Circuits

UNDER REVISION



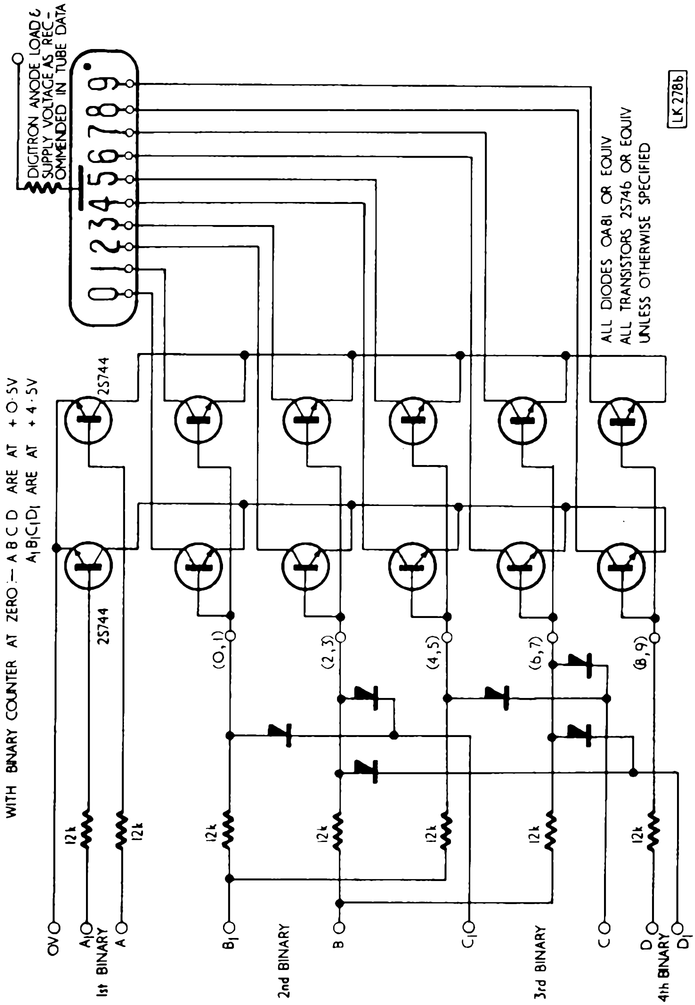
GCA10G/GSA10G Pentode Coupling Circuit



***Digitron Display from 1-2-4-8 Binary Coded Decimal Input**

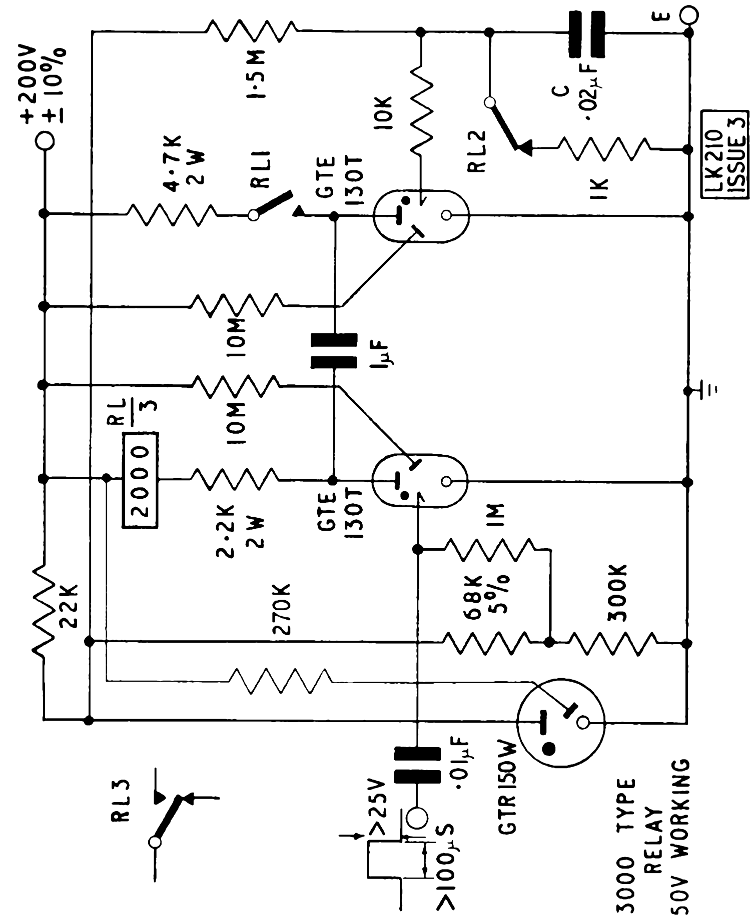
* Registered Trade Mark

Circuits



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

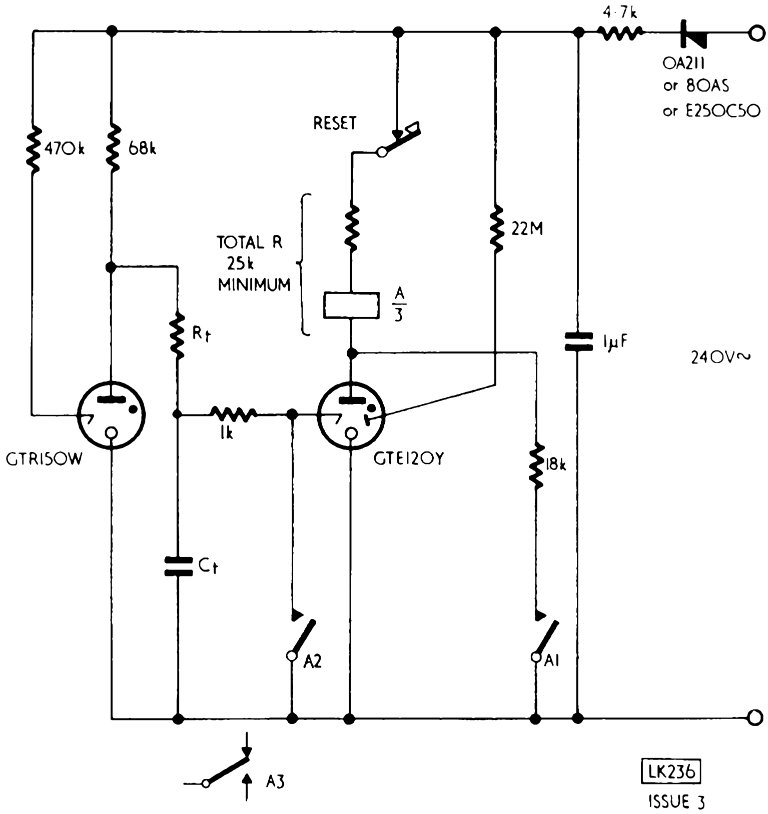
* Registered Trade Mark



This circuit accepts pulses as small as 25 V, 100 μS into 1 MΩ; 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

Circuits

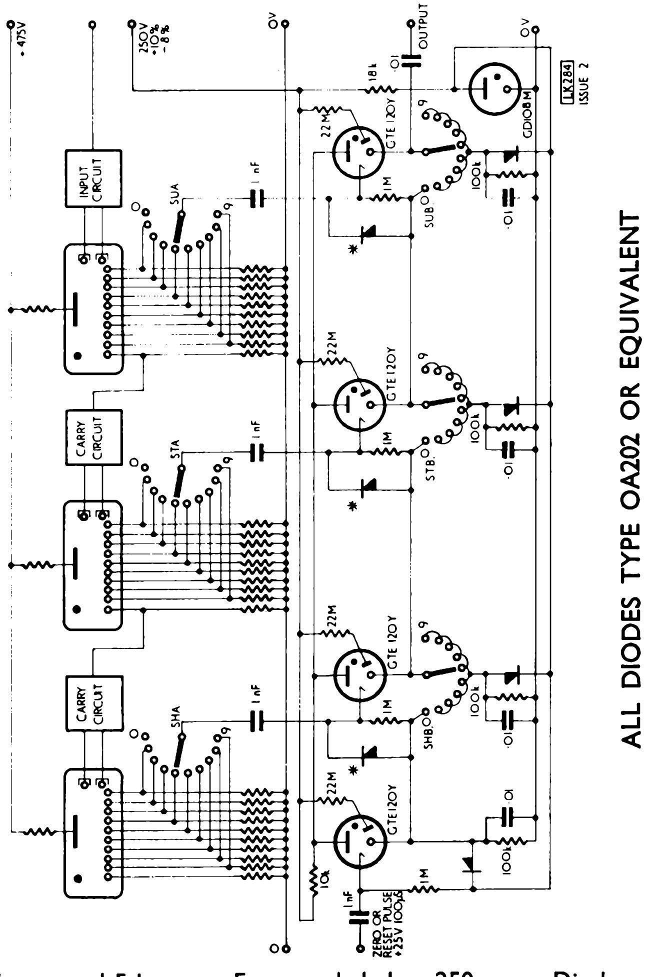


Timing period = 1·6 R.C. secs. R in MΩ, C in µF

R max. = 470MΩ C min. = 470pF

Simple R.C. Timer for Nominal 240 V A.C. Operation

Circuits



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

SPARK GAP TUBES

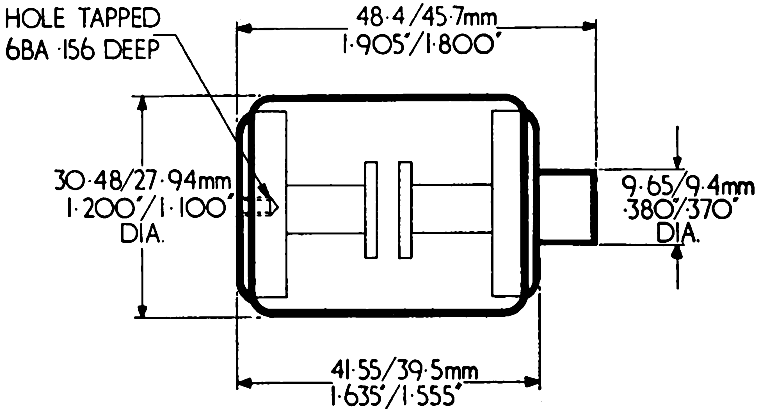
Prospective users are invited to contact the Research Laboratory of the Tube Division when planning apparatus using Spark Gap Tubes. These are not held in stock, but are designed to meet each customer's requirements.

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 GD2V

Breakdown Voltage	2 kV ± 100 V
Maximum discharge energy	16J
Maximum storage capacitor	8 μF
Insulation at 1·5 kV	10MΩ min.



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.

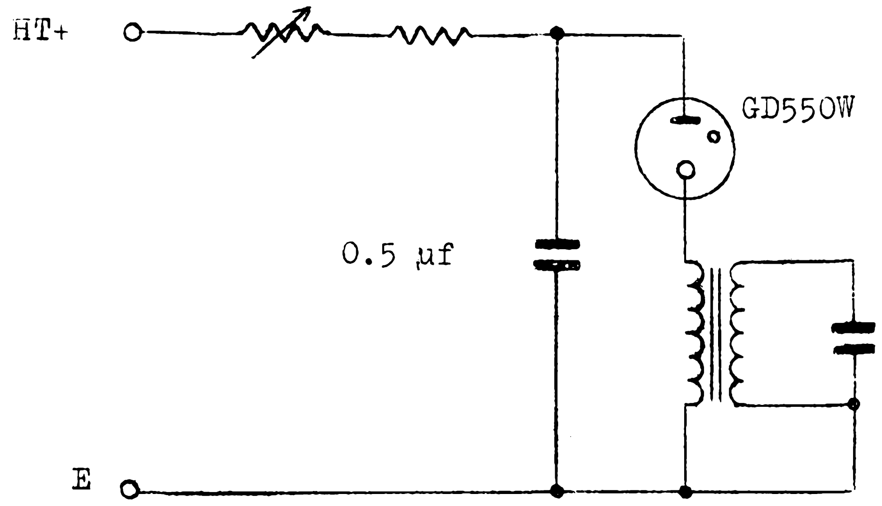
(2) As supplied, the gap is symmetrical. Discharges introduce asymmetry, and the life will be shortened if the polarity is changed after some discharges have taken place.

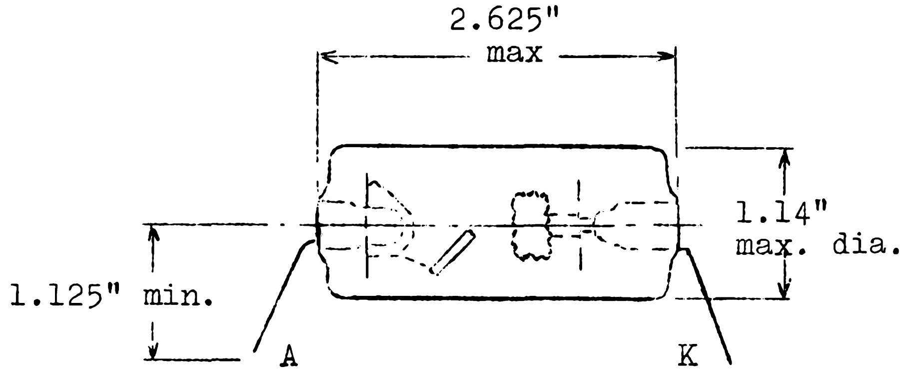
(3) The standard tube has one end cap and one tapped hole. End caps with threaded stud suitable for fitting into the tapped hole will be supplied on request.

SPARK GAP GD550W

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

Typical number of discharges - 40×10^6 (in circuit below with discharge energy of .07J and rate of 1 per sec.)





MAINTENANCE TUBES

INDEX

*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

GC10/2P

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.

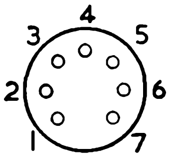
GC10/2P

Miniature Bi-directional 10-way Computing Tube

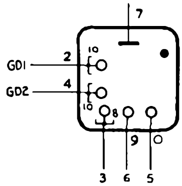
Mechanical Data

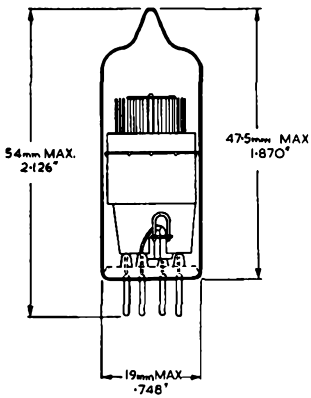
Mounting position	Any. For visual indication the tube is viewed through the dome of the bulb.
Alignment	Cathode "O" is approximately aligned with pin No. 5.
Weight	13 g (nominal).
Escutcheon	N.84338.
Base	B7G

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





Voltage Stabilizer

GD120 A/S
(CV.1110)

Limit Ratings

Minimum anode current	10 mA
Maximum anode current	75 mA
Minimum anode supply voltage	180 V

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

N.B. Equilibrium conditions are reached after 10 minutes operation.

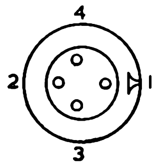
GD120 A/S
(CV.1110)

Voltage Stabilizer

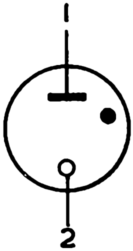
Mechanical Data

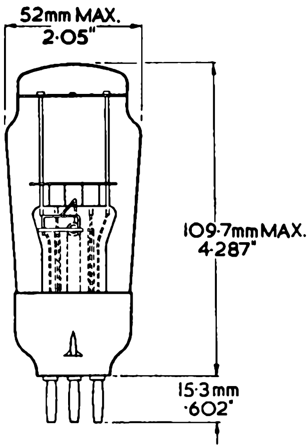
Mounting position	Any.
Weight	54 g (nominal).
Base	British 4 pin.

Base Connections
(underside view)



Pin 1	Anode
2	Cathode
3, 4	No connections





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)

N.B.—Equilibrium conditions are reached after 10 minutes operation.

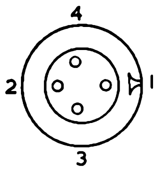
GTR 120 A/S
(CV.45)

Primed Voltage Stabilizer

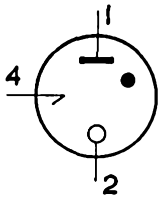
Mechanical Data

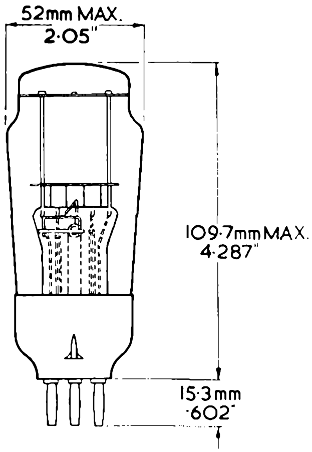
Mounting position	Any
Weight	54 g (nominal)
Base	British 4 pin

Base Connections
(underside view)



Pin 1 Anode
2 Cathode
3 No connection
4 Primer





MAINTENANCE TYPE ONLY

Primed Trigger Tube

GDT120M

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 (*N.B.*—Tubes may exhibit jumps of up to 20 V in operation).	94—130 V
Deionization time (I_a = 4·5 mA)	3 mS max. ←
Ionisation time (V_T = 175 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 (Trigger resistor 330 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.

GDT120M

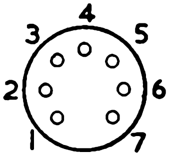
Primed Trigger Tube

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

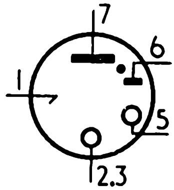
Mechanical Data

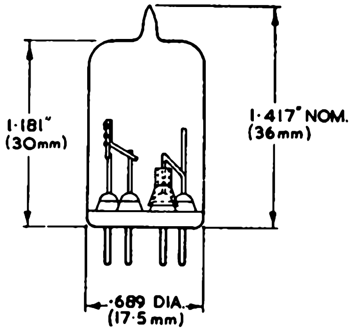
Mounting position	Any
Base	B7G

Base Connections
(underside view)



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

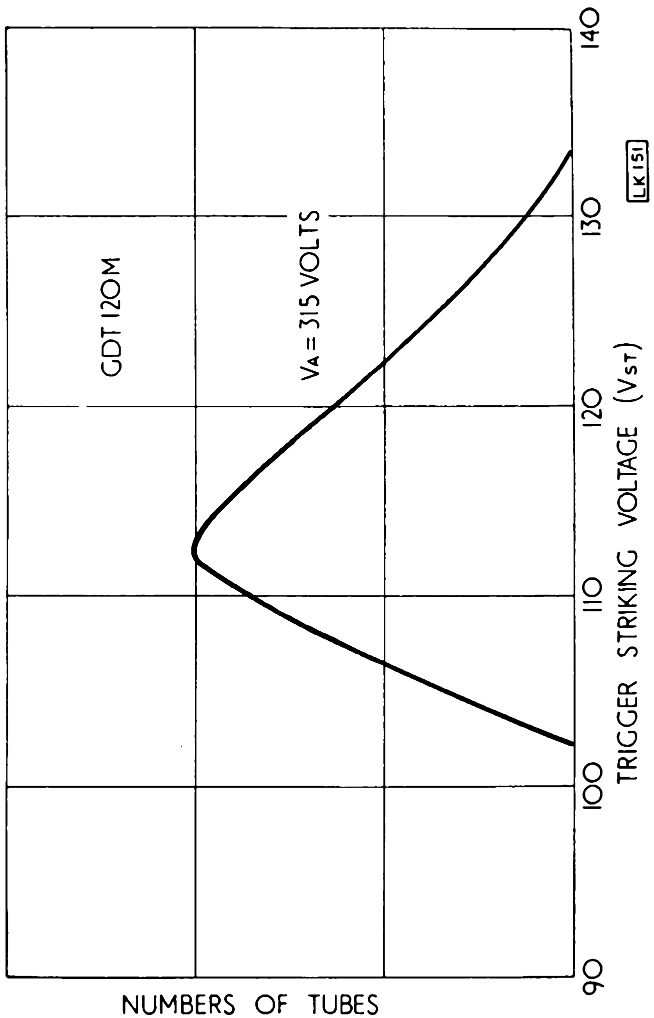




Primed Trigger Tube

GDT120M

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



Distribution of Trigger Striking Volts

Primed Trigger Tube

GDT 120 T

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 (*N.B.*—Tubes may exhibit jumps of up to 20 V in operation at low currents)	94–130 V ←
Deionization time ($I_a = 25$ mA)	5 mS max. ←
Ionization time ($V_T = 175$ 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.

[redacted] [redacted]

GDT 120 T

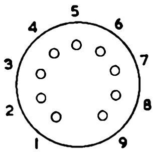
Primed Trigger Tube

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

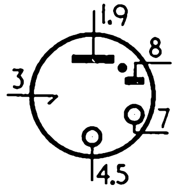
Mechanical Data

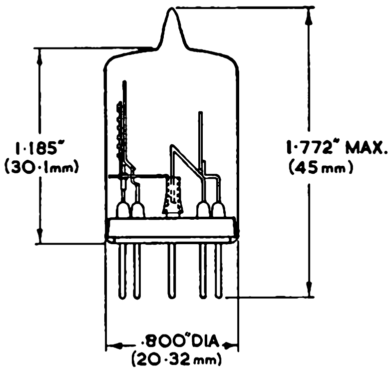
Mounting position	Any
Base	B9A

Base Connections
(underside view)



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





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

GR2G

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

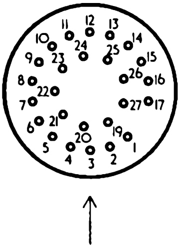
GR2G

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

Mechanical Data

Mounting position	Any
Base	B26A
Socket	B17A, B26A or B27A

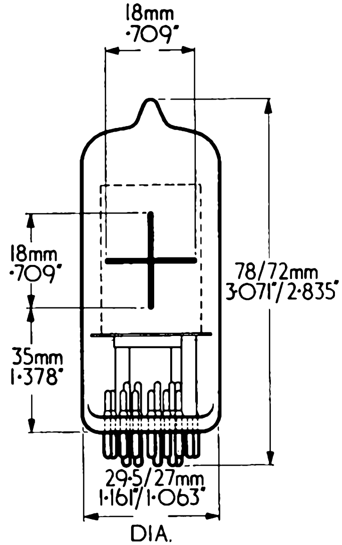
Base Connections
(underside view)

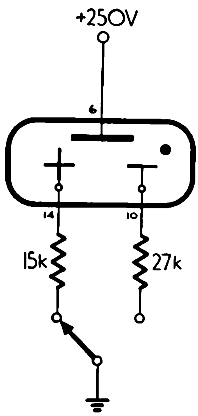


FRONT

Pin 6 Anode
Pin 10 —
Pin 14 +

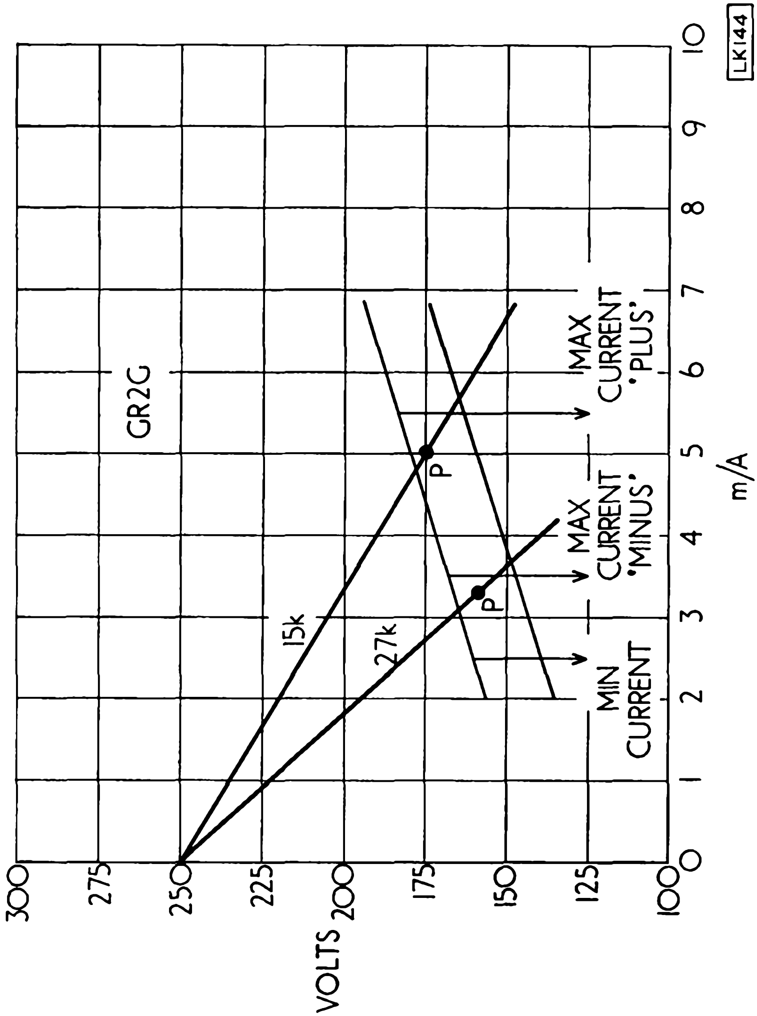
Note—All other pins are to be left unconnected.





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

GR2G



Operating Characteristics

*Registered Trade Mark

* DIGITRON -2 Character End-Viewing Cold-Cathode + and - Register Tubes

GR 2 H

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

* Registered Trade Mark

[redacted]

MAINTENANCE TYPE ONLY

GR 2 H

DIGITRON -2 Character End-Viewing Cold-Cathode + and - Register Tubes

Mechanical Data

Mounting Position — Any

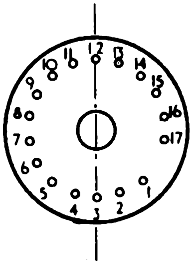
The characters are viewed through the dome of the bulb. They will appear upright (within ± 10°) when the tube is mounted with the line through pins 3 and 12 vertical, pin 12 being uppermost.

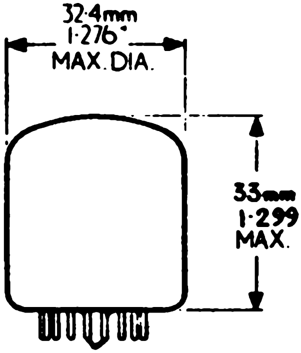
Base — B17

Socket — B17A

Base Connections
(underside view)

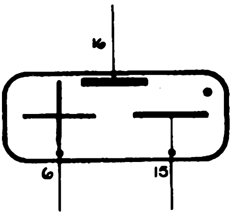
CENTRE LINE OF CHARACTERS

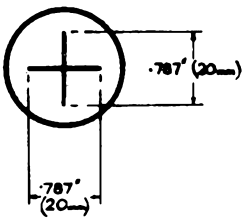




Pin 16 Anode
Pin 6 +
Pin 15 -

Note - All other pins are to be left unconnected.





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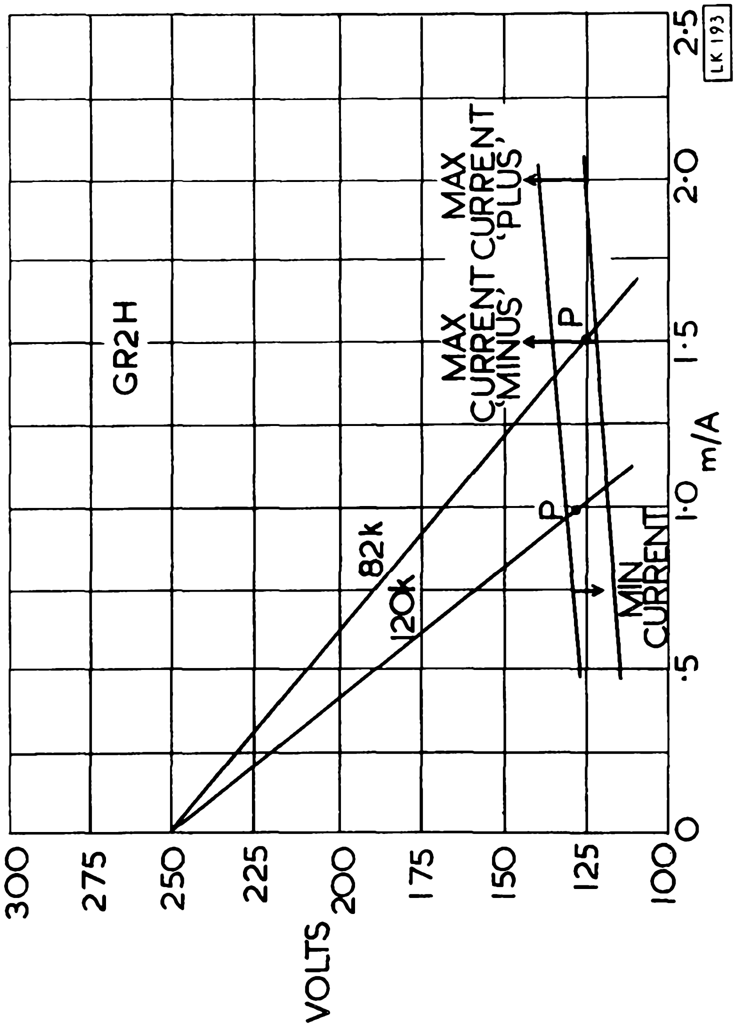
• DIGITRON -2 Character End-Viewing Cold-Cathode + and - Register Tubes **GR 2 H**



Operating Characteristics

• Registered Trade Mark

*DIGITRON—4 Character Side Viewing Cold-Cathode Fraction Register Tube

GR4G

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 Ia = 5 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 — Ra = 12kΩ	250 V

A.C. operation

(Unsmoothed half-wave rectified 50 c.p.s. A.C.)

Anode supply voltage — Ra = 12kΩ	200-220 V r.m.s.
Ra = 18kΩ	220-250 V r.m.s.
Cathode 1 equalizing resistor	10kΩ

* Registered Trade Mark

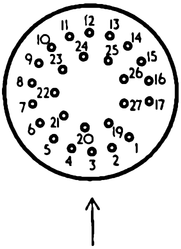
GR4G

DIGITRON—4 Character Side Viewing Cold-Cathode Fraction Register Tube

Mechanical Data

Mounting position	Any
Base	B26A
Socket	B17, B26A or B27A

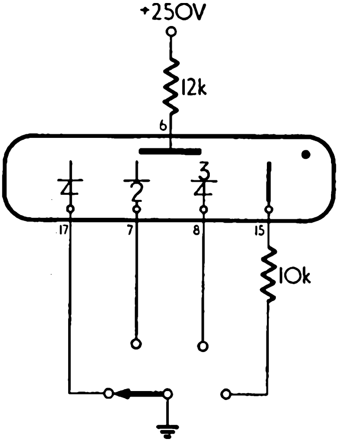
Base Connections
(underside view)

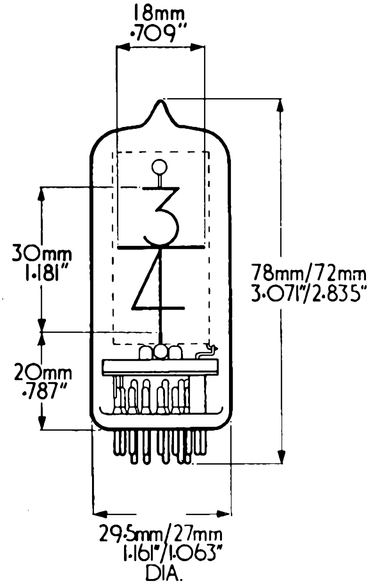


FRONT

Pin	
6	Anode
7	$\frac{1}{2}$
8	$\frac{3}{4}$
15	1
17	$\frac{1}{4}$

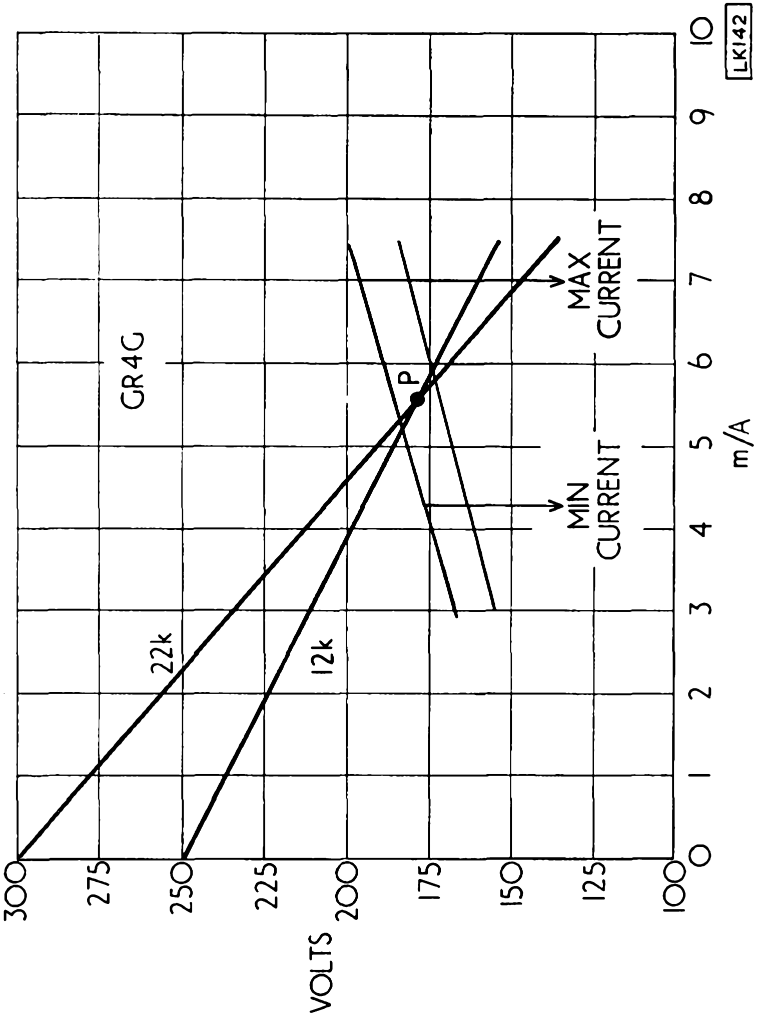
All other pins to be left unconnected.





*DIGITRON—4 Character Side-Viewing Cold-Cathode Fraction Register Tube

GR4G



Operating Characteristics

*Registered Trade Mark

*DIGITRON—10 Digit Side-Viewing Cold-Cathode Numerical Register Tube

GR10G

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 = 10kΩ	250 V

A.C. operation

(Unsmoothed half-wave rectified 50 c.p.s. A.C.)

Anode supply voltage — Ra = 12kΩ	200-220 V r.m.s.
Ra = 18kΩ	220-250 V r.m.s.

Cathode 1 equalizing resistor	8·2kΩ
Cathode 7 equalizing resistor	4·7kΩ

* Registered Trade Mark

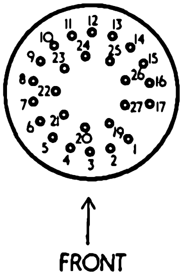
GR10G

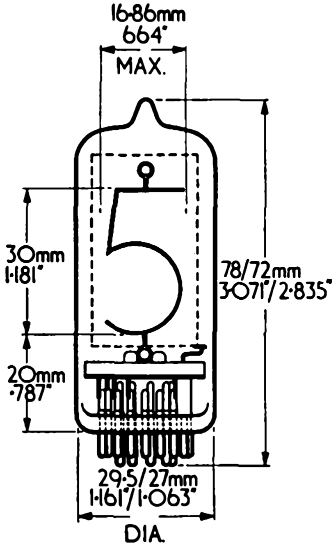
DIGITRON—10 Digit Side-Viewing Cold-Cathode Numerical Register Tube

Mechanical Data

Mounting position	Any
Base	B26A
Socket	B17, B26A or B27A

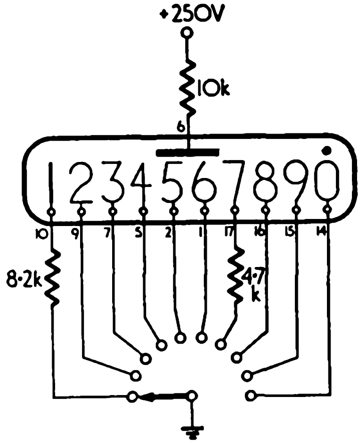
Base Connections
(underside view)





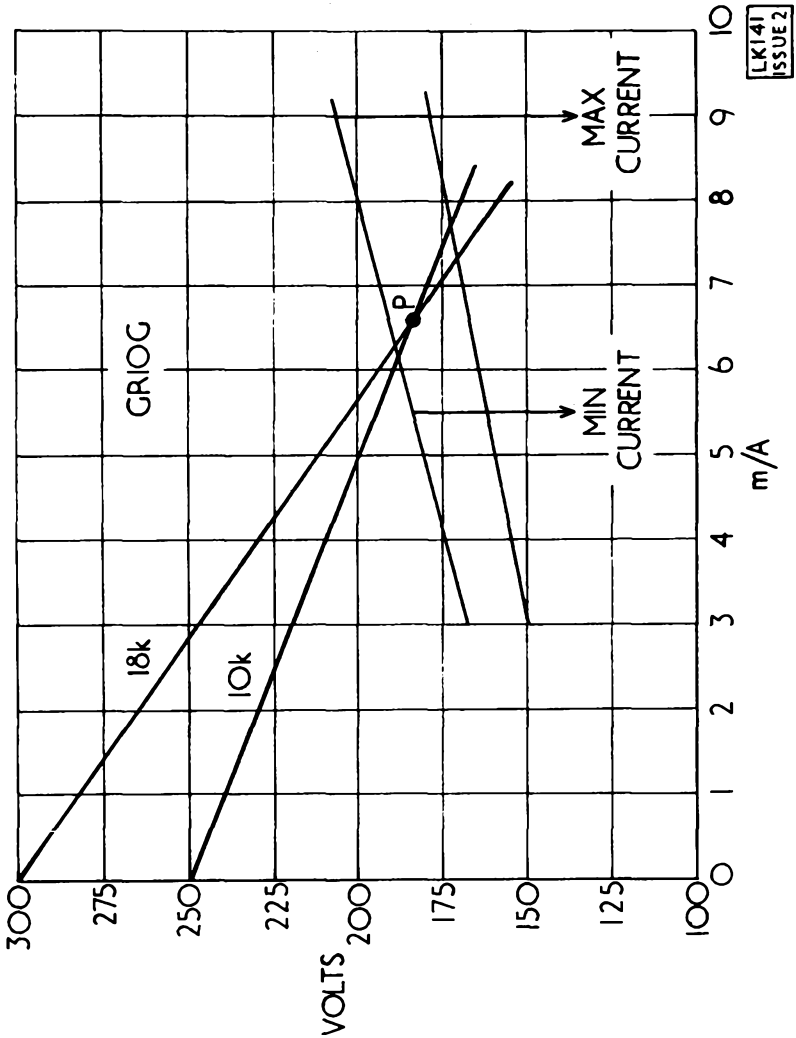
Pin	1	Cathode 6
	2	Cathode 5
	5	Cathode 4
	6	Anode
	7	Cathode 3
	9	Cathode 2
	10	Cathode 1
	14	Cathode 0
	15	Cathode 9
	16	Cathode 8
	17	Cathode 7

Note—All other pins are to be left unconnected.



*DIGITRON — 10 Digit Side-Viewing Cold-Cathode Numerical Register Tube

GR10G



Operating Characteristics

*Registered Trade Mark

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

GR10H

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

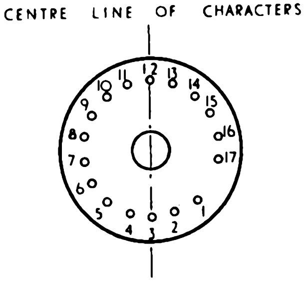
GR10H

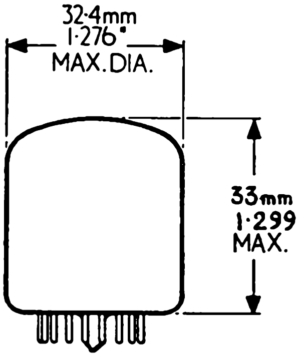
*DIGITRON – 10 Digit End-Viewing Cold-Cathode Numerical Register Tube

Mechanical Data

Mounting position	Any
Base	B17A
Socket	B17A

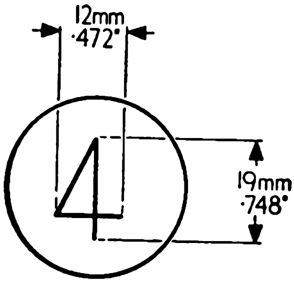
Base Connections
(underside view)

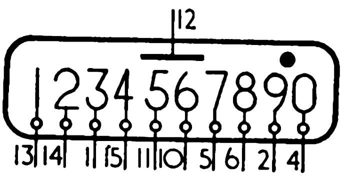




Pin 1 Cathode 3
2 Cathode 9
4 Cathode 0
5 Cathode 7
6 Cathode 8
10 Cathode 6
11 Cathode 5
12 Anode
13 Cathode 1
14 Cathode 2
15 Cathode 4

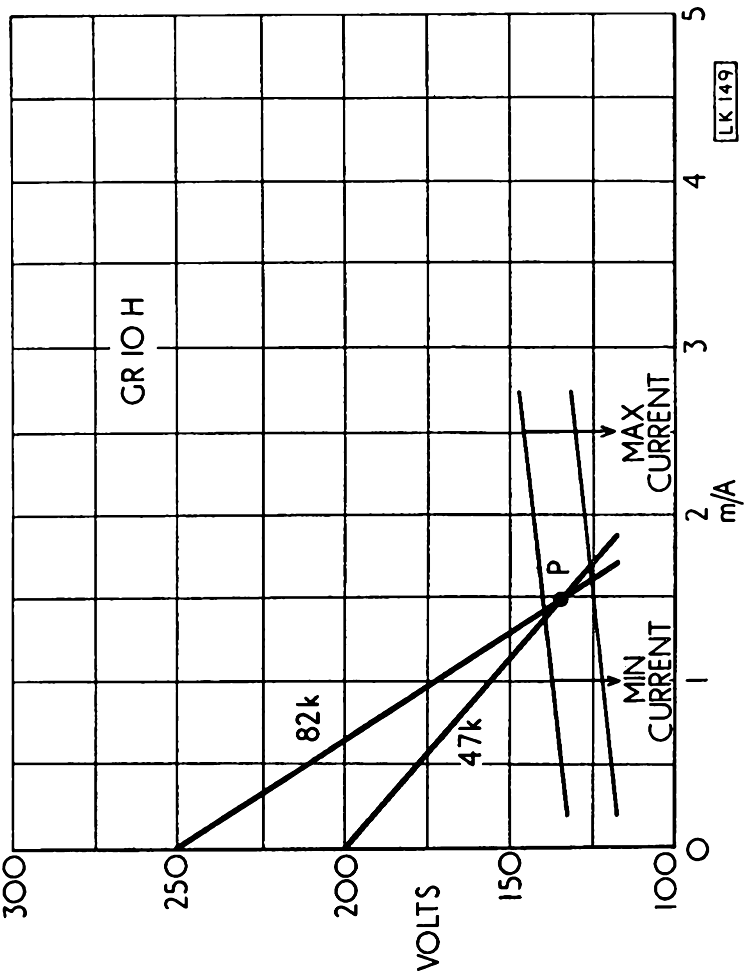
Note: All other pins are to be left unconnected.





*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 GR10W

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~~ 2.000 hours can be expected.

D.C. operation

Anode supply voltage — Ra = 18kΩ	220 V

A.C. operation

(Unsmoothed half-wave rectified 50 c.p.s. A.C.)

Anode supply voltage — Ra = 27kΩ	200-220 V r.m.s.
Ra = 47kΩ	220-250 V r.m.s.

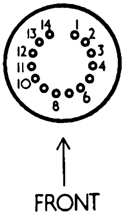
* Registered Trade Mark

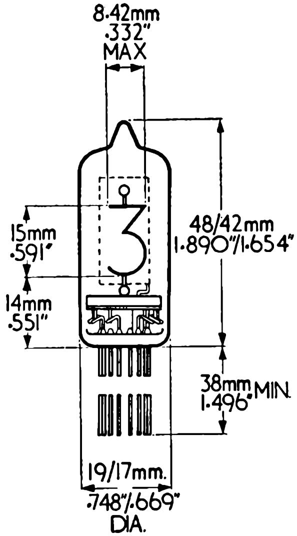
GR10W DIGITRON—10 Digit Side-Viewing Miniature Cold-Cathode Numerical Register Tube, with flying leads

Mechanical Data

Mounting position	Any
Base	Flying lead

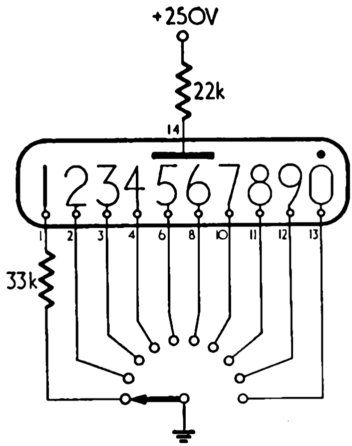
Base Connections
(underside view)





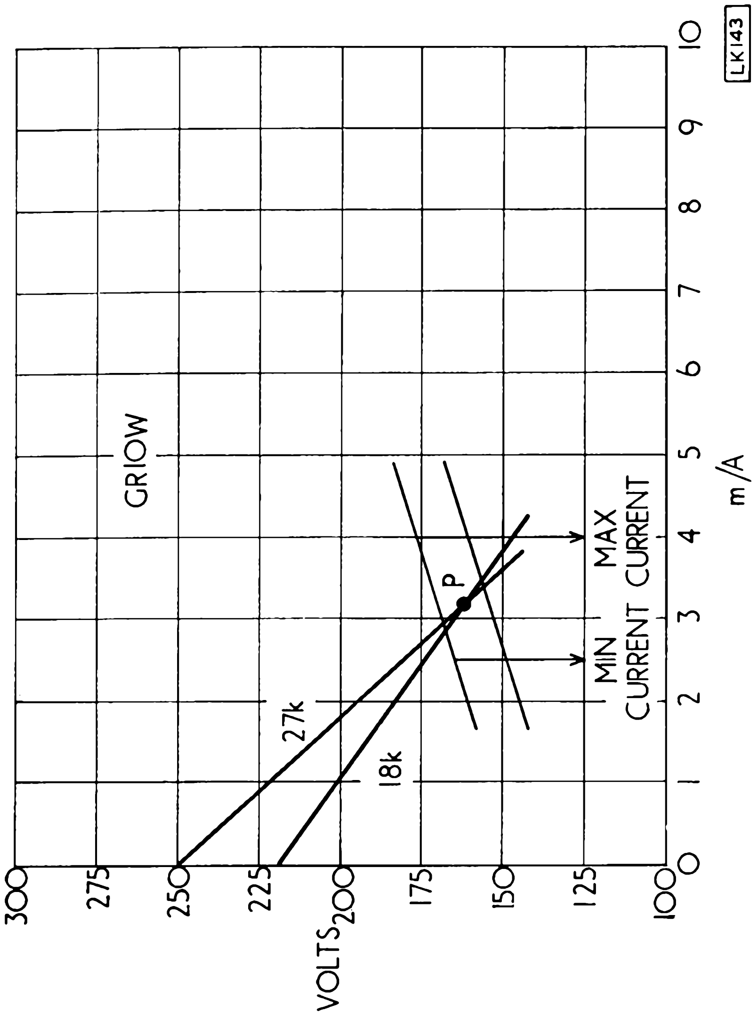
Lead	1	Cathode 1
	2	Cathode 2
	3	Cathode 3
	4	Cathode 4
	5	Omitted
	6	Cathode 5
	7	Omitted
Lead	8	Cathode 6
	9	Omitted
	10	Cathode 7
	11	Cathode 8
	12	Cathode 9
	13	Cathode 0
	14	Anode

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



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

GR10W



Operating Characteristics

*Registered Trade Mark

[redacted]

MAINTENANCE TYPE ONLY

* DIGITRONS - 12 Character Side-Viewing Cold-Cathode Letter Tubes

GR 12 G
GR 12 H

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

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* Registered Trade Mark

[redacted]

MAINTENANCE TYPE ONLY

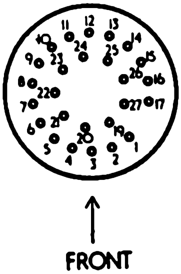
GR 12 G
GR 12 H

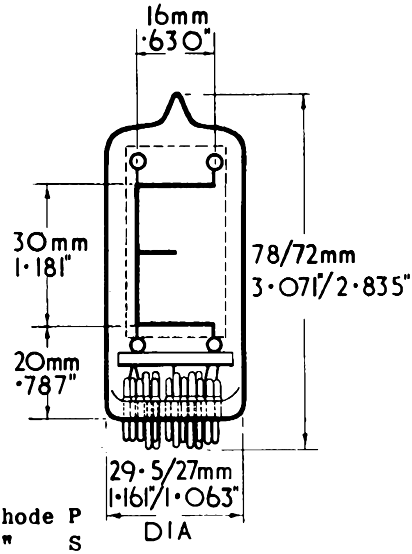
DIGITRONS -12 Character Side-Viewing Cold-Cathode Letter Tubes

Mechanical Data

Mounting Position	Any
Base	B26A
Socket	B17, B26A or B27A

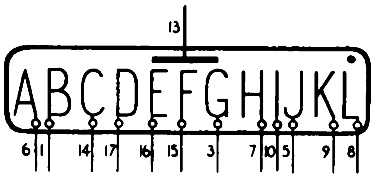
Base Connections
(Underside view)



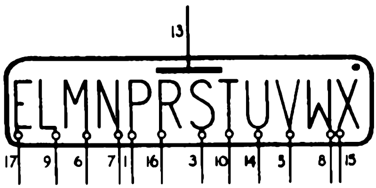


G12G			GR12H		
Pin 1	Cathode	B	Pin 1	Cathode	P
3	"	G	3	"	S
5	"	J	5	"	V
6	"	A	6	"	M
7	"	H	7	"	N
8	"	L	8	"	W
9	"	K	9	"	L
10	"	I	10	"	T
13	Anode		13	Anode	
14	Cathode	C	14	Cathode	U
15	"	F	15	"	X
16	"	E	16	"	R
17	"	D	17	"	E

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



GR 12 G



GR 12 H

R[redacted]

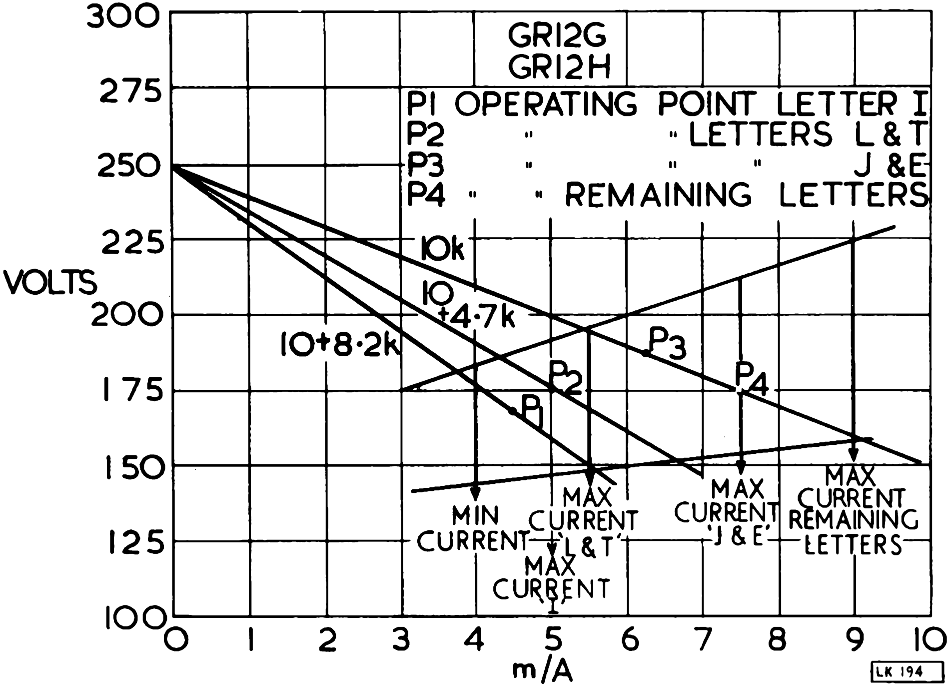
[redacted]

MAINTENANCE TYPE ONLY

* DIGITRONS -12 Character Side-Viewing Cold-Cathode Letter Tubes

GR 12 G
GR 12 H

Operating Characteristics



* Registered Trade Mark

Magnetically Screened High Current 10-way Trochotron Beam Switching Tube

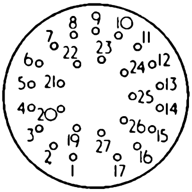
VS10G/M

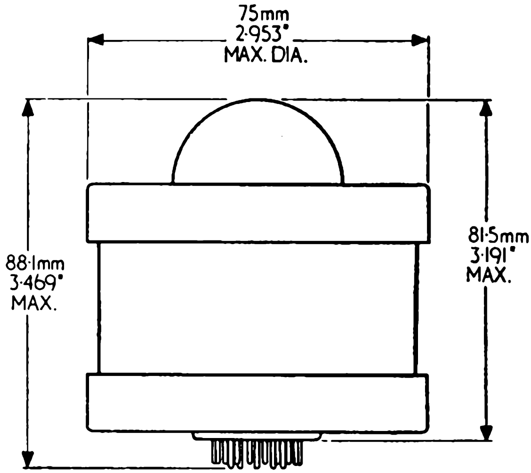
Electrical Characteristics identical to the VS10G

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)





Low Voltage 10-way Trochotron Beam Switching Tube

VS10K

Cathode

Indirectly heated

Heater

	Vh	6·3 V
	Ih	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 V
R_S	150 kΩ ± 10%

(Each spade must be connected to a separate spade resistor with not more than ½" (10 mm) of connecting lead).

V_T	30 V
R_T	6·8 kΩ

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

V_{SG}	15 V
V_{SG} pulse amplitude	– 17 V
t pulse	0·5 μS
R_{SG}	47 kΩ
C input coupling	330 pF

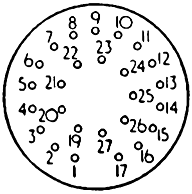
VS10K

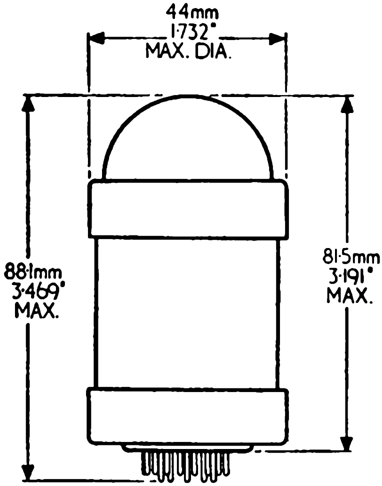
Low Voltage 10-way Trochotron Beam Switching Tube

Mechanical Data

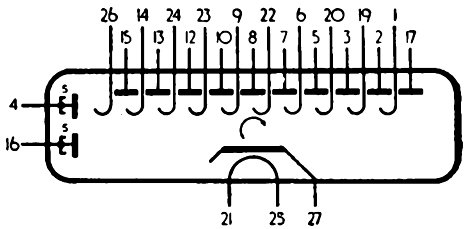
Mounting position	Any: providing that the tube is kept at least 2″ from any magnetic material or 4″ from a similar tube, a strong magnet or a mu-metal screen.
Weight	220 g
Base	B26A
Sockets	B26A or B27A

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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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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