SYLVANIA

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6476

MECHANICAL DATA

Mounting Position	Any (Count is Read from Top of Tube
Zero Position (Cathode No. 10)	Aligned with Pin 12 ±10°

ELECTRICAL DATA

RATINGS (Absolute Values)

Total Anode Current	0.60 Ma.	Max.
Voltage Between Electrodes (Other Than Anode)	140 Volts	Max.
Supply Voltage (Anode to Cathode)	350 Volts	Min.
Input Frequency	4,000 P.P.S.	Max.

TYPICAL OPERATION

DC Supply Voltage	400 Volts
Anode Resistor	0.47 Megohm
Nominal Tube Drop (Under These Conditions)	191 Volts
Cathode Resistor	68,000 Ohms
Output Voltage (Developed Across Cathode Resistor)	28 Volts

APPLICATION DATA

The Sylvania Type 6476 is a cold cathode, bidirectional decade counter tube. It is designed for use in medium speed decimal counting apparatus such as scalers, computers and dividers. The count is determined by noting the position of the glow on any one of the ten radially spaced cathodes around an axially positioned anode. The multiple output cathode arrangement allows the selection of pre-set conditions with the addition of suitable external circuitry.

PRINCIPLES OF OPERATION

General Principles

The 6476 operates on the principle that the ionization or starting voltage of gas filled tubes is lowered if ions or electrons are already present in the anode-cathode gap. Under these conditions, a glow discharge can then be made to move from one cathode to an adjacent one by means of a relatively small negative voltage pulse on the new cathode, provided that electrons or ions are able to diffuse into this new anode-cathode gap. If a series of cathodes are present about a common anode, the discharge can be made to move in succession along the cathode series by a successive application of voltage pulses to each cathode.

Details of Operation

The 6476 has 30 cathodes equally spaced on a circle about a central anode disc. The cathodes are divided into 10 main or output cathodes and 20 intermediate guide cathodes — two of which are located between every main cathode interval, see Fig. 1.

(Continued on reverse)

QUICK REFERENCE DATA

The Sylvania Type 6476 is a multiple output cold cathode, bidirectional decade counter. The 6476 is similar to the Type 6482 which has a single output cathode.



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ELECTRONICS DIVISION
WOBURN, MASS.

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FEBRUARY 1955

PRINCIPLES OF OPERATION (cont'd.)

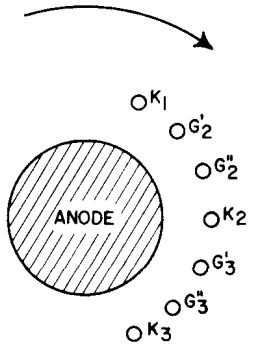


FIG. 1 — ELECTRODE ARRANGEMENT

The two guide cathodes are necessary to make certain that the glow always moves in the desired direction and does not return to the original cathode upon removal of the voltage from the new cathode. A description of the transfer mechanism from one main cathode to the next adjacent one will make this clearer. Assuming that a glow is present on K_1, a negative pulse on the G'_2 (Fig. 2) will move the glow to G'_2. At the end of this pulse, a second negative pulse is applied to G''_2 moving the glow on to G''_2. Because the guide cathodes are normally biased above the main cathodes, (Fig. 2), removal of the negative pulse from G" means that the glow will go to a main cathode. The preferential influence of the ionization near K_2 causes the glow to settle on K_2 rather than return to K_1. The glow will remain on K_2 until the sequence is reepated for the next set of cathodes. In practice, all of the G' electrodes are connected together as are also all of the G" electrodes, Fig. 3. Although the negative transfer pulse is applied to all ten guide cathodes simultaneously, the priming influence of the discharge moves the glow to the guide cathode which is closest to the discharge.

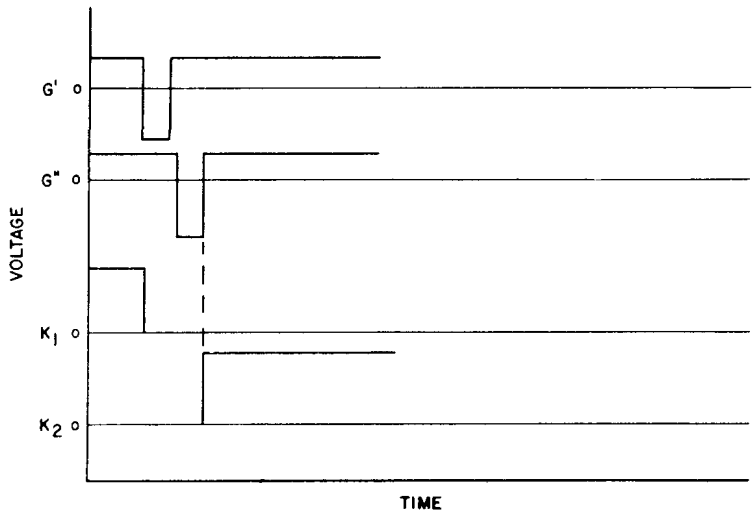


FIG. 2 — VOLTAGE-TIME CHARACTERISTICS

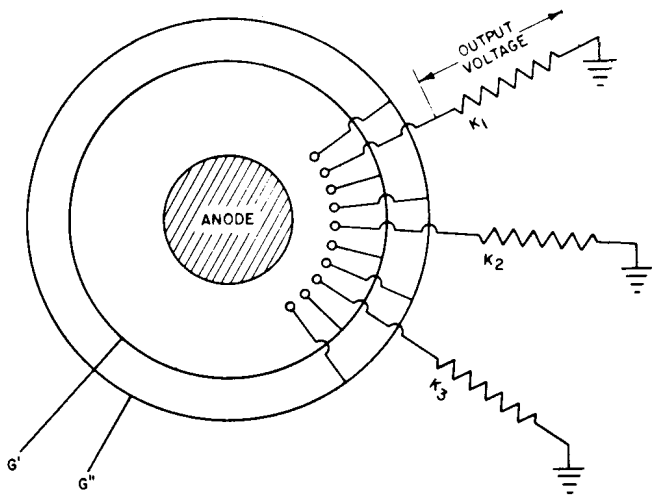


FIG. 3 — ELECTRODE ARRANGEMENT WITH CIRCUIT CONNECTIONS

An output pulse can be obtained from each main cathode as the glow moves onto it. If preferred, an output can be derived from selective cathodes only. It should also be noted that reversal of the pulse sequence applied to G′ and G″ will reverse the direction of the glow transfer.

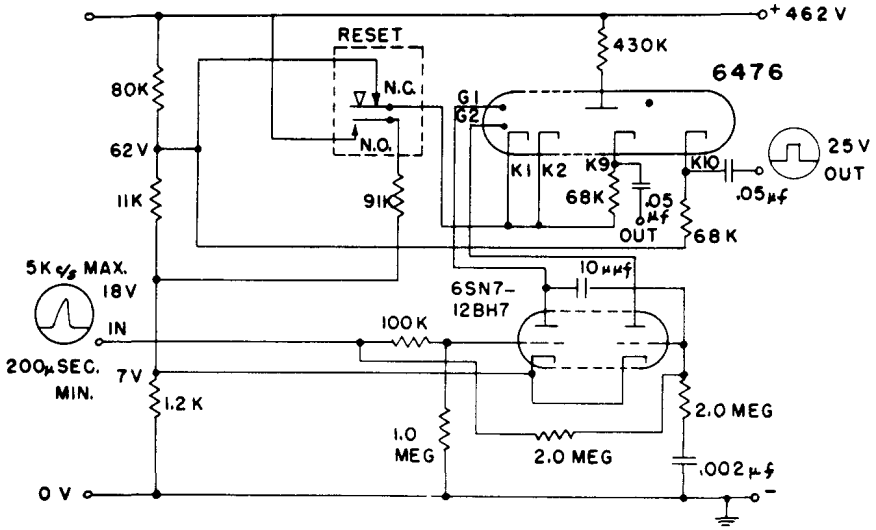
The glow is restricted to one main cathode only when the anode voltage is first applied by the action of the anode resistor (Fig. 3) which immediately lowers the voltage across the anode-cathode gap to the maintaining value. This is below the starting voltage of the other main cathodes or the transfer voltage of the guide cathodes.

The driving circuit given below offers certain advantages over the previously published circuits.

TYPICAL DRIVING CIRCUIT

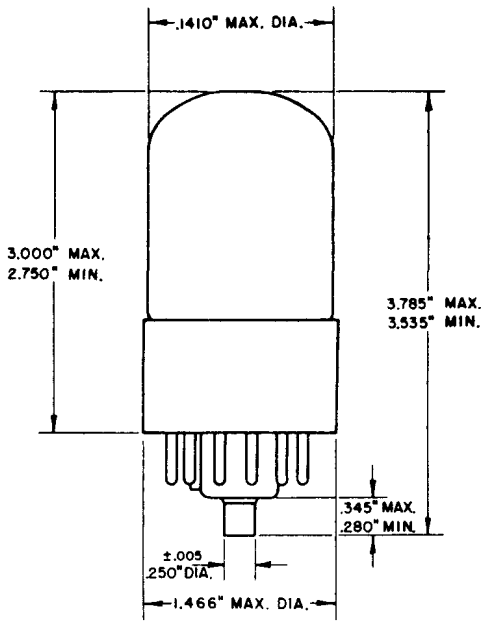
The important feature of the new circuit is that it provides an essentially square wave pulse to the guide pins. A square wave driving pulse assures stable operation throughout the life of the 6476 in spite of small changes which may occur in the guide voltages.

NOTE: The B+ of the driver is obtained through the guide to anode capacity of the counter tube.

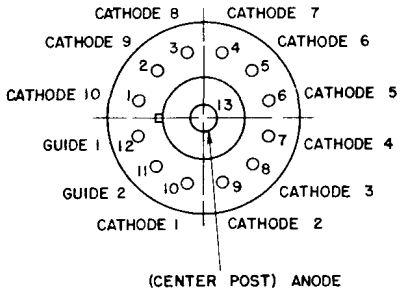


W55001

OUTLINE DRAWING



BASE CONNECTIONS



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6482

MECHANICAL DATA

Mounting Position . . . . Any (Count is Read From Top of Tube)
Zero Position (Output Cathode) . . . . Aligned with Pin #6 ± 12°

ELECTRICAL DATA

RATINGS (Absolute Values)

Total Anode Current	0.60 Ma	Max.
Voltage Between Electrodes (Other Than Anode)	140 Volts	Max.
Supply Voltage (Anode to Cathode)	350 Volts	Min.
Input Frequency	4,000 P.P.S.	Max.

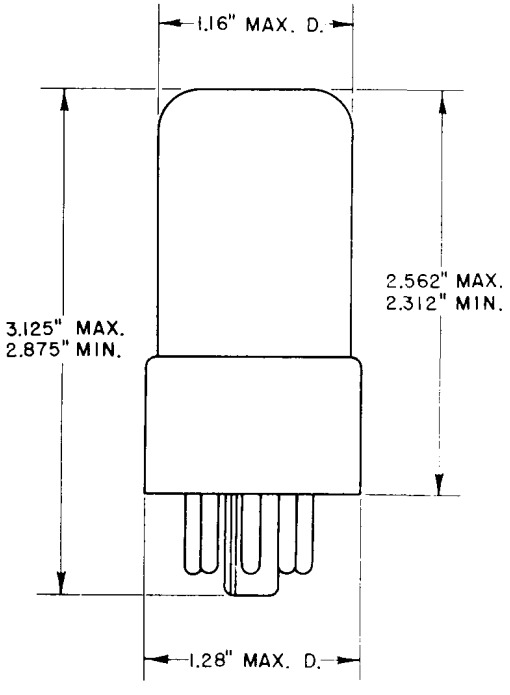
TYPICAL OPERATION

DC Supply Voltage	400 Volts
Anode Resistor	0.47 Megohm
Nominal Tube Drop (Under These Conditions)	191 Volts
Cathode Resistor	68,000 Ohms
Output Voltage (Developed Across Cathode Resistor)	15 Volts

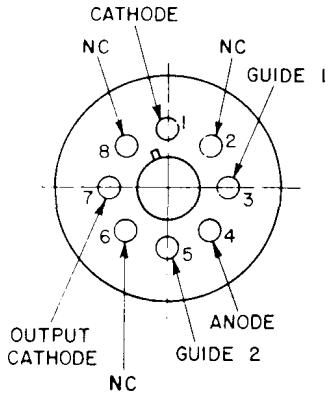
APPLICATION DATA

The Sylvania Type 6482 is a cold single output cathode, bidirectional, decade counter tube. It is designed for use in medium speed decimal counting apparatus such as scalers, computers and dividers. The count is determined by noting the position of the glow on any one of the ten radially spaced cathodes around an axially positioned anode.

OUTLINE DRAWING



BASE CONNECTIONS



QUICK REFERENCE DATA

Cold single output cathode, bidirectional decade counter tube. The 6482 is similar to the 6476 which has a multiple output cathode.



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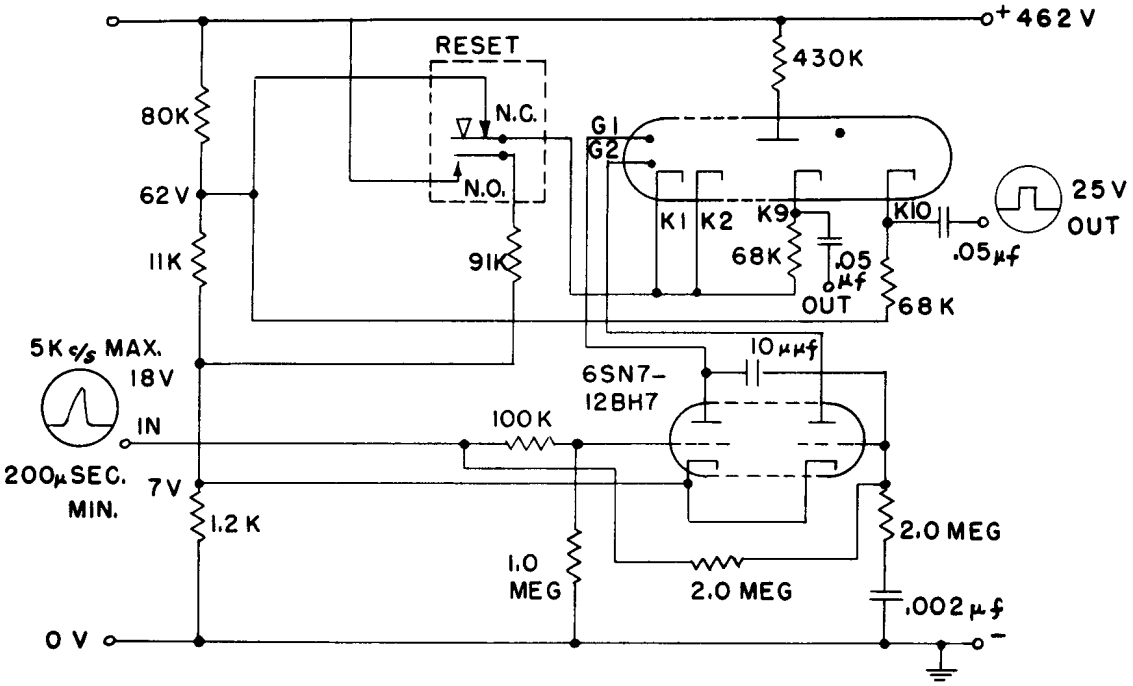
3-55

SYLVANIA
6482

The driving circuits given on this and the following page for Sylvania glow transfer counter tube types 6476 and 6482 offer certain advantages over the previously published circuits.

The important feature of the new circuits is that they provide an essentially square wave pulse to the guide pins. A square wave driving pulse assures stable operation throughout the life of the 6476 and 6482 tubes in spite of small changes which may occur in the guide voltages.

Note: The B+ of the driver is obtained through the guide to anode capacity of the counter tube.



6476 GLOW TRANSFER COUNTER TUBE DRIVER CIRCUIT

NL6844Aφ

NUMERICAL INDICATOR

engineering data report

6844A

(BD-302) NIXIE*

The 6844A (BD-302) is an improved version of the type 6844. This tube is a gas-filled, cold cathode, 10-digit ("O" through "9"), numerical indicator tube, having a common anode with a suppressor screen to minimize darkening of the viewing dome. This tube features a cup design providing a non-glare background. It is intended for use as a direct in-line read-out device.

MECHANICAL DATA
(SEE FIGURE 1)

Overall Length	1.380" Max.
Seated Height	1.125" Max.
Bulb Diameter	1.080" Max.
Envelope Connections	See Figure 2
Height of Numerals	0.610" Nom.
Numerical Design (Human Engineering)	See Figure 3
Socket, 13-Pin (#HSK-106 or HSK-112)	See Figure 4
Weight	1 oz. Max.
Mounting Position	See Note 1
Cathode(s)	Glow Discharge
Shock	350 G's (30° Hammer)
Vibration	10 G's, 60 Cps.
Temperature	—65° C. through +70° C., Note 2
Altitude	70,000 Feet

ELECTRICAL DATA

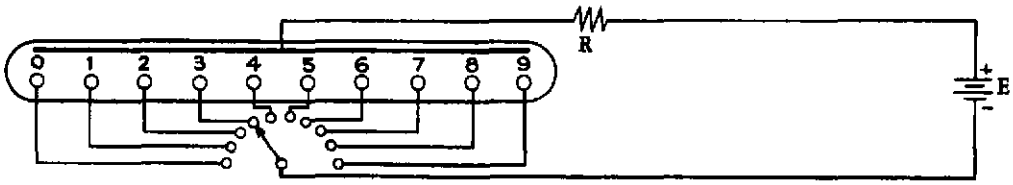
1. ABSOLUTE RATINGS:

Ionization Voltage	170 Vdc Minimum
Anode Current	
Peak	4.0 MA
Average	2.5 MA Max.
Individual Cathode Wattage	0.4 Watts Max.

2. TEST CONDITIONS: (See Typical Circuit)

Anode Supply Voltage	170 Vdc
Anode Series Resistor	15 K Ohms
Anode Current	1.5 MA Min. 2.5 MA Max.

TYPICAL CIRCUIT



(SEE NOTE 3)

RECOMMENDED OPERATING CONDITIONS	E	R
	170V	15K
	250V	47K
	300V	75K

NOTES

(1) The tube socket is oriented with respect to the viewing position so that A — A', intersecting the center of Pins 1 and 8 is vertical with Pin 8 on top. This orients the numerals in the correct vertical position. The numbers are viewed through the top of the tube.

(2) From +30° C. to +70° C., no significant change in cathode current occurs. From +30° C. to —65° C. an increase in cathode (Up to 50%) may be expected.

(3) Recommend highest voltage available be selected with corresponding series resistor.

* Reg. Trade Mark.

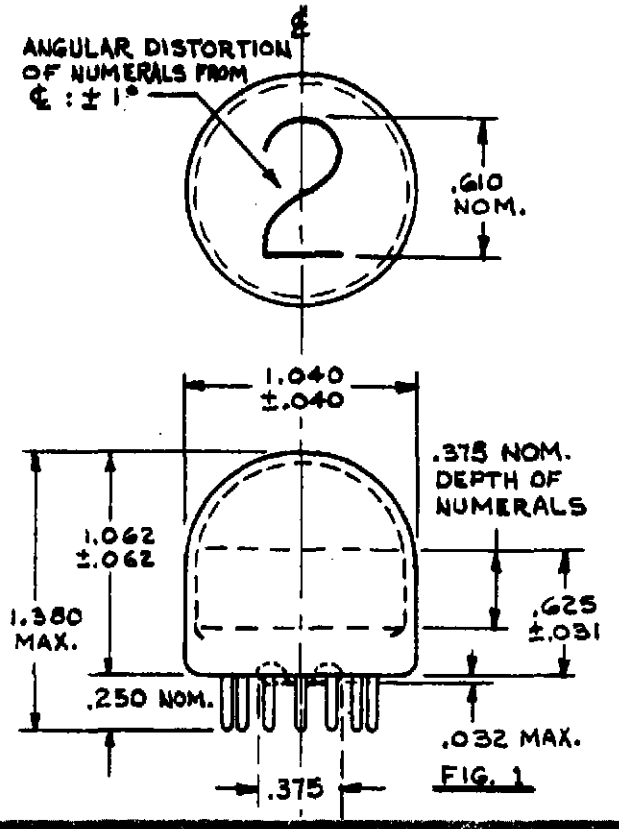
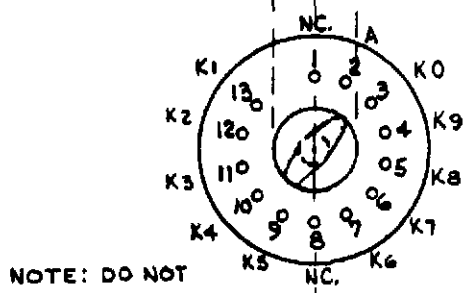


FIG. 1



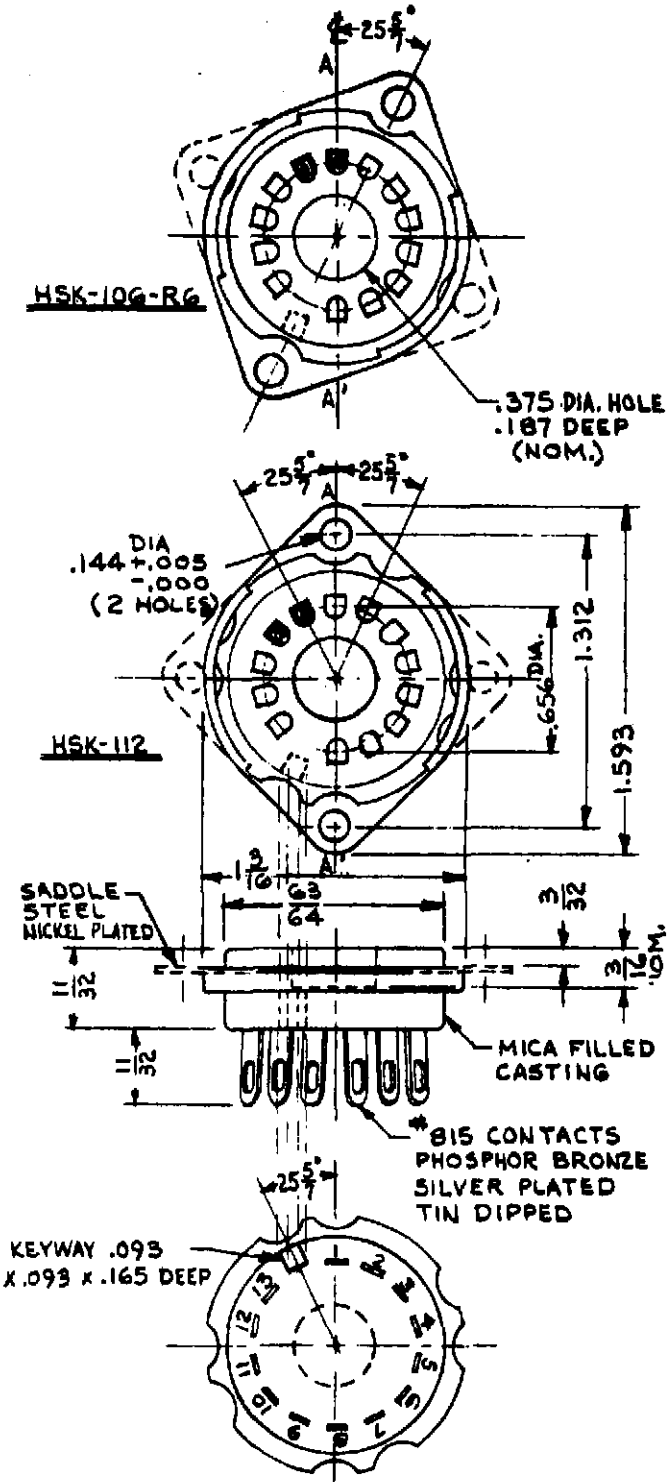
BOTTOM VIEW

FIG. 2

1234567890

(REF. WADC TR 54-160 APPENDIX PAGE 102)

FIG. 3



BOTTOM VIEW

FIG. 4

Electronic Tube Division

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Plainfield, New Jersey

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NL6844Aφ

NUMERICAL INDICATOR

engineering data report

6844A

(BD-302) NIXIE*

The 6844A (BD-302) is an improved version of the type 6844. This tube is a gas-filled, cold cathode, 10-digit ("O" through "9"), numerical indicator tube, having a common anode with a suppressor screen to minimize darkening of the viewing dome. This tube features a cup design providing a non-glare background. It is intended for use as a direct in-line read-out device.

MECHANICAL DATA
(SEE FIGURE 1)

Overall Length	1.380" Max.
Seated Height	1.125" Max.
Bulb Diameter	1.080" Max.
Envelope Connections	See Figure 2
Height of Numerals	0.610" Nom.
Numerical Design (Human Engineering)	See Figure 3
Socket, 13-Pin (#HSK-106 or HSK-112)	See Figure 4
Weight	1 oz. Max.
Mounting Position	See Note 1
Cathode(s)	Glow Discharge
Shock	350 G's (30° Hammer)
Vibration	10 G's, 60 Cps.
Temperature	—65° C. through +70° C., Note 2
Altitude	70,000 Feet

ELECTRICAL DATA

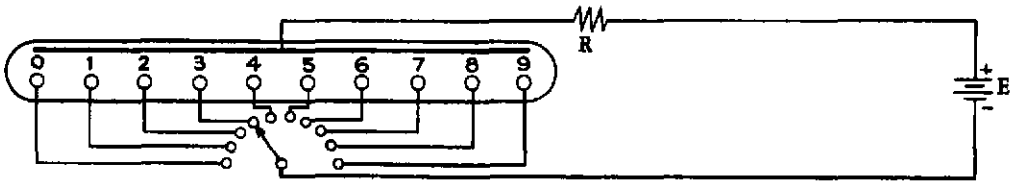
1. ABSOLUTE RATINGS:

Ionization Voltage	170 Vdc Minimum
Anode Current	
Peak	4.0 MA
Average	2.5 MA Max.
Individual Cathode Wattage	0.4 Watts Max.

2. TEST CONDITIONS: (See Typical Circuit)

Anode Supply Voltage	170 Vdc
Anode Series Resistor	15 K Ohms
Anode Current	1.5 MA Min. 2.5 MA Max.

TYPICAL CIRCUIT



(SEE NOTE 3)

RECOMMENDED OPERATING CONDITIONS	E	R
	170V	15K
	250V	47K
	300V	75K

NOTES

(1) The tube socket is oriented with respect to the viewing position so that A — A', intersecting the center of Pins 1 and 8 is vertical with Pin 8 on top. This orients the numerals in the correct vertical position. The numbers are viewed through the top of the tube.

(2) From +30° C. to +70° C., no significant change in cathode current occurs. From +30° C. to —65° C. an increase in cathode (Up to 50%) may be expected.

(3) Recommend highest voltage available be selected with corresponding series resistor.

* Reg. Trade Mark.

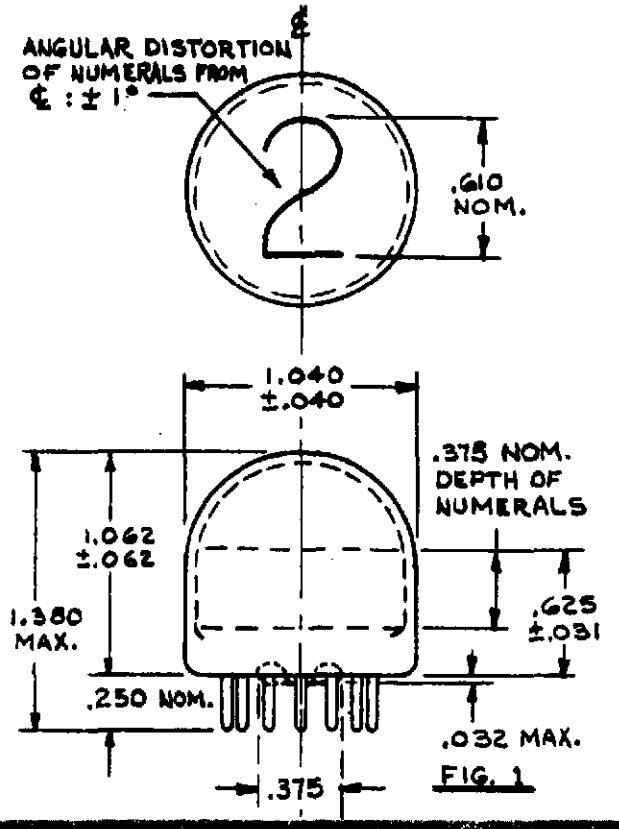
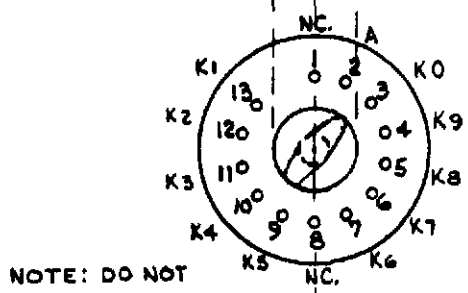


FIG. 1



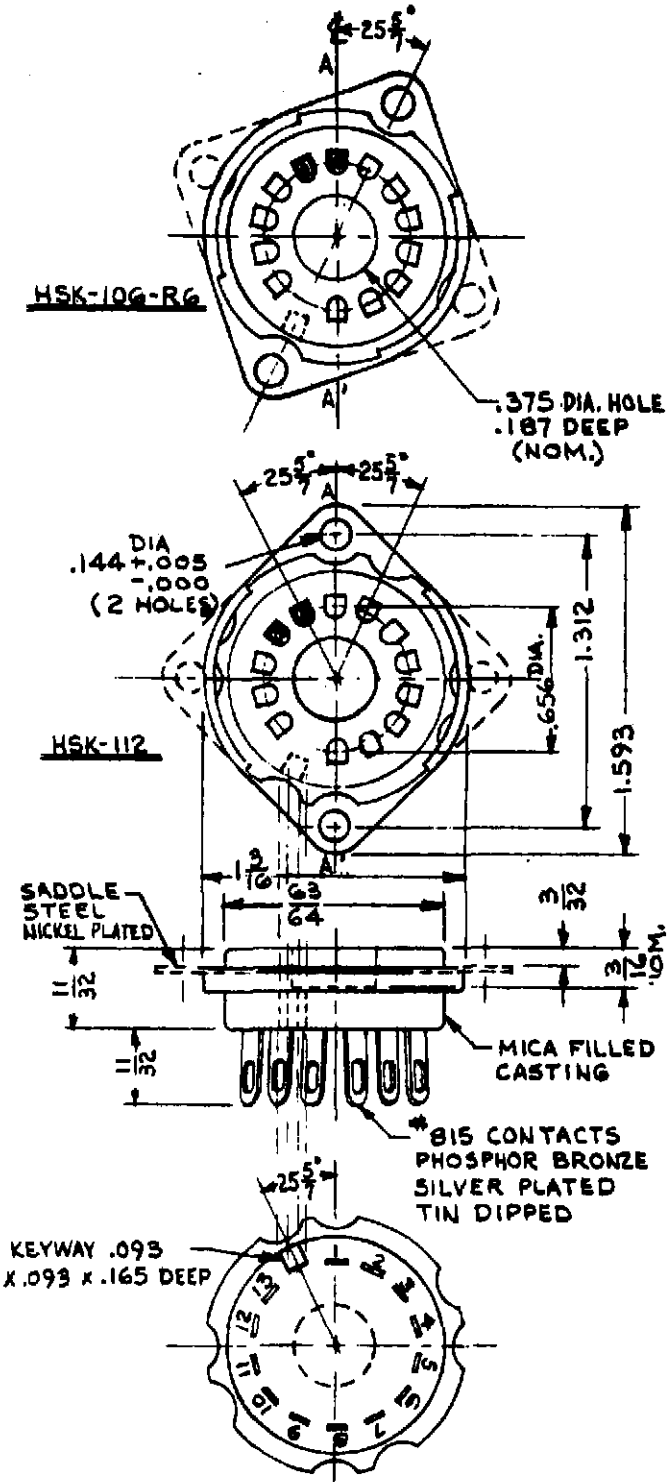
BOTTOM VIEW

FIG. 2

1234567890

(REF. WADC TR 54-160 APPENDIX PAGE 102)

FIG. 3



BOTTOM VIEW

FIG. 4

Electronic Tube Division

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Plainfield, New Jersey

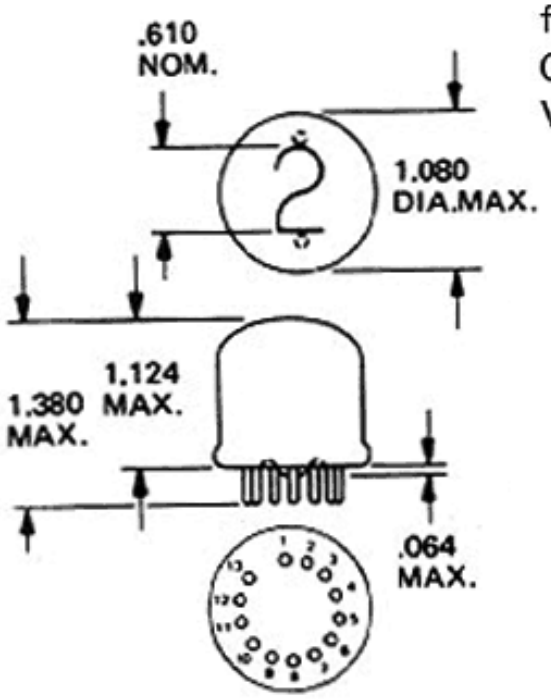
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B-5093 SPECIAL CHARACTER NIXIE INDICATOR TUBE

Available in round and rectangular configurations. Use for desk top displays and bench test equipment.

Character Size . . . . . 0.6"

Viewing Distance . . . . . 30.0'



Type B5093 (round)

PIN CONNECTIONS

Pin No.	Numeral
1—	IC
2—	anode
3—	I
4—	+
5—	C
6—	B
7—	S
8—	IC
9—	G
10—	S
11—	D
12—	O
13—	Q

ELECTRICAL DATA/STANDARD TUBES

(See Note 1) (See Notes 2 & 3)

	B5093 Round
Absolute Ratings	
Ionization Voltage (Max)	170 Vdc
Supply Voltage (Min)	170 Vdc
Cathode Current (Peak)	3.5 ma
Test Conditions	
Supply Voltage	170 Vdc
Series Resistor	10K
Cathode Current	
(Min)	1.5 ma
(Max)	3.0 ma
Sockets	
Standard Wiring	SK112
Printed Circuit	SK130

NOTES

1. The minimum supply voltage should be +170 Vdc, however, the use of the highest voltage available with an appropriate series resistor is recommended to provide: 1) greater tolerance of B+ & Rp; 2) more uniform brightness; 3) more constant current operation; 4) improved operation with temperature and 5) improved life.
2. Special NIXIE tubes such as regular life wide angle types and weldable or tin dipped flying lead types are also available.
3. Special character NIXIE tubes such as + and — tubes, tubes with alphabet characters, and symbols (μ, mV) are also available.

NL6844Aφ

NUMERICAL INDICATOR

engineering data report

6844A

(BD-302) NIXIE*

The 6844A (BD-302) is an improved version of the type 6844. This tube is a gas-filled, cold cathode, 10-digit ("O" through "9"), numerical indicator tube, having a common anode with a suppressor screen to minimize darkening of the viewing dome. This tube features a cup design providing a non-glare background. It is intended for use as a direct in-line read-out device.

MECHANICAL DATA
(SEE FIGURE 1)

Overall Length	1.380" Max.
Seated Height	1.125" Max.
Bulb Diameter	1.080" Max.
Envelope Connections	See Figure 2
Height of Numerals	0.610" Nom.
Numerical Design (Human Engineering)	See Figure 3
Socket, 13-Pin (#HSK-106 or HSK-112)	See Figure 4
Weight	1 oz. Max.
Mounting Position	See Note 1
Cathode(s)	Glow Discharge
Shock	350 G's (30° Hammer)
Vibration	10 G's, 60 Cps.
Temperature	—65° C. through +70° C., Note 2
Altitude	70,000 Feet

ELECTRICAL DATA

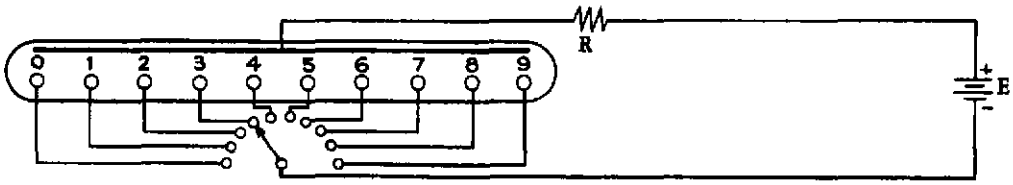
1. ABSOLUTE RATINGS:

Ionization Voltage	170 Vdc Minimum
Anode Current	
Peak	4.0 MA
Average	2.5 MA Max.
Individual Cathode Wattage	0.4 Watts Max.

2. TEST CONDITIONS: (See Typical Circuit)

Anode Supply Voltage	170 Vdc
Anode Series Resistor	15 K Ohms
Anode Current	1.5 MA Min. 2.5 MA Max.

TYPICAL CIRCUIT



(SEE NOTE 3)

RECOMMENDED OPERATING CONDITIONS	E	R
	170V	15K
	250V	47K
	300V	75K

NOTES

(1) The tube socket is oriented with respect to the viewing position so that A — A', intersecting the center of Pins 1 and 8 is vertical with Pin 8 on top. This orients the numerals in the correct vertical position. The numbers are viewed through the top of the tube.

(2) From +30° C. to +70° C., no significant change in cathode current occurs. From +30° C. to —65° C. an increase in cathode (Up to 50%) may be expected.

(3) Recommend highest voltage available be selected with corresponding series resistor.

* Reg. Trade Mark.

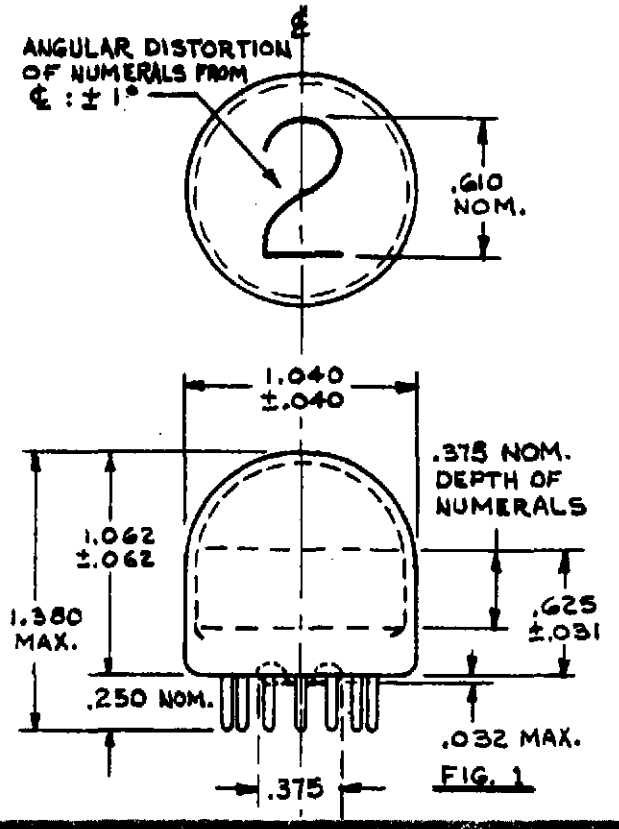
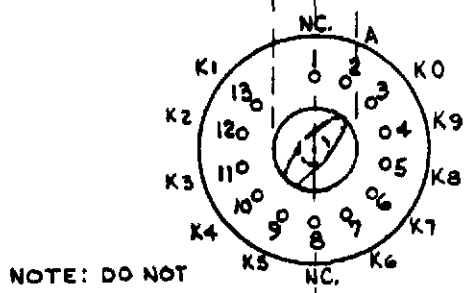


FIG. 1



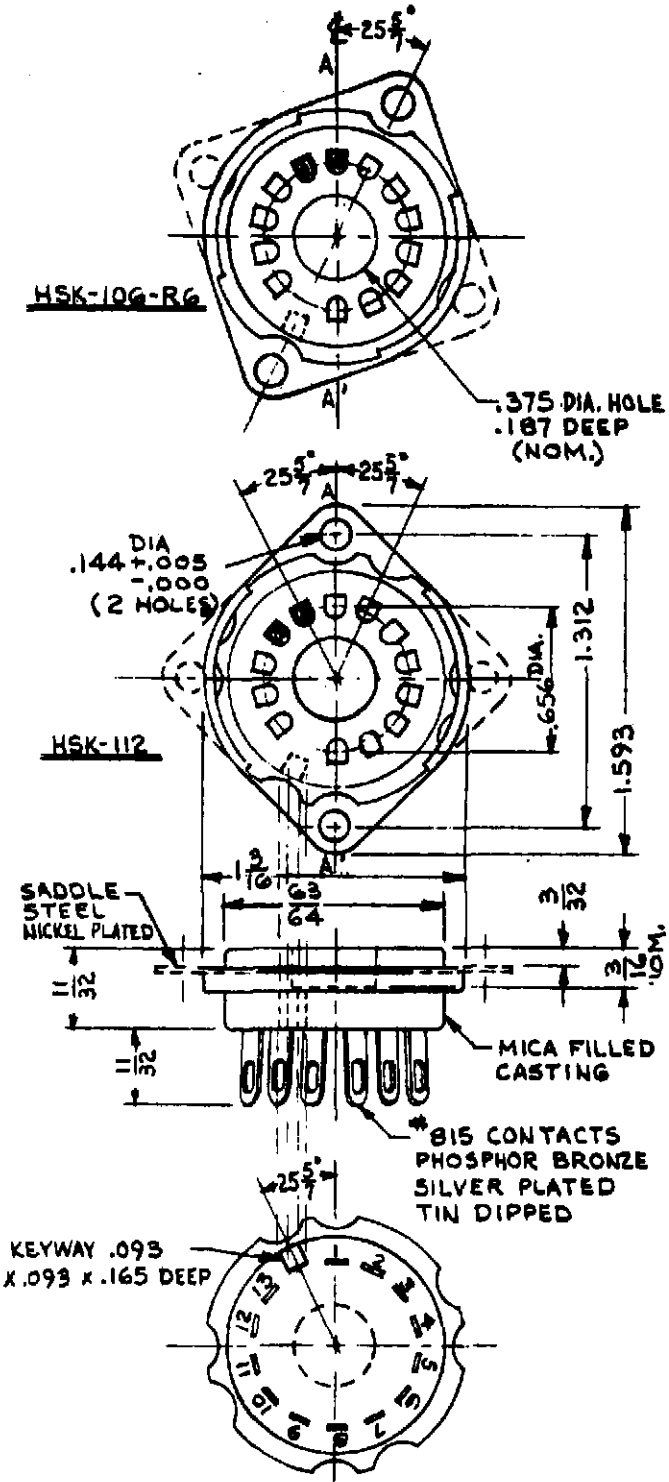
BOTTOM VIEW

FIG. 2

1234567890

(REF. WADC TR 54-160 APPENDIX PAGE 102)

FIG. 3



BOTTOM VIEW

FIG. 4

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Plainfield, New Jersey

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RODAN

INDICATOR TUBE

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

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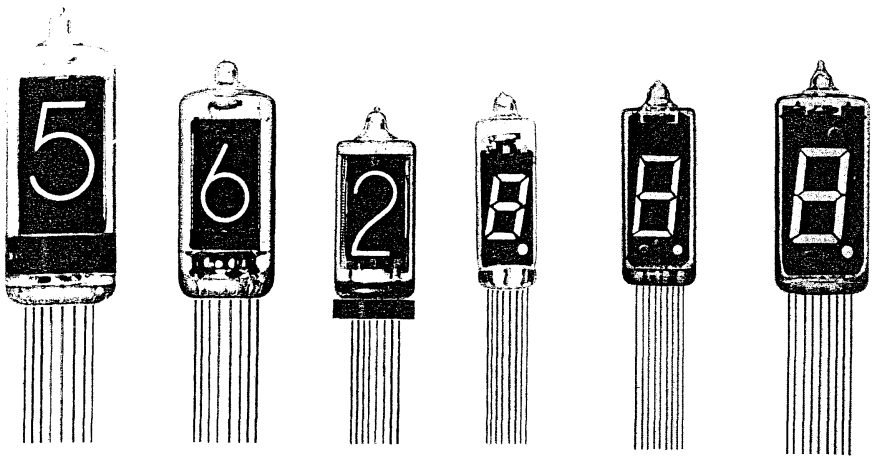
+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

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+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH



CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



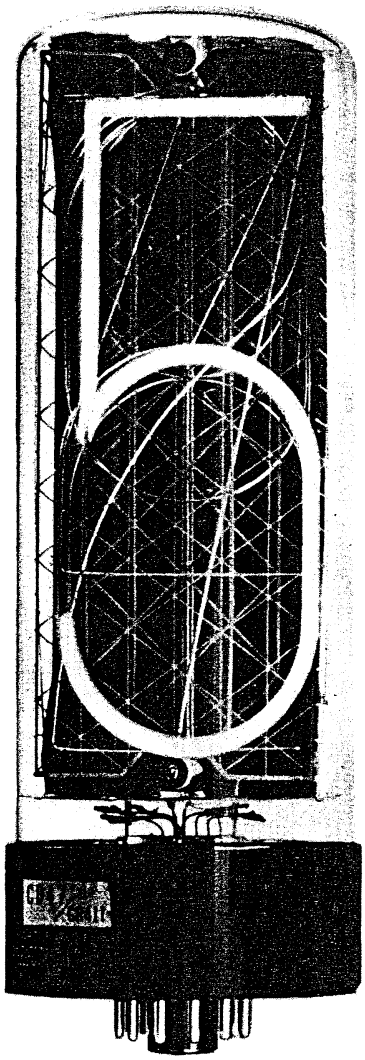
CD13



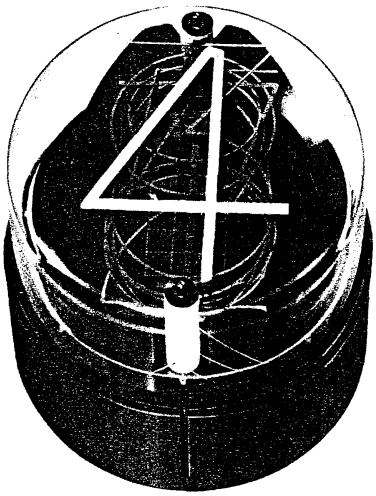
CD12



CD24



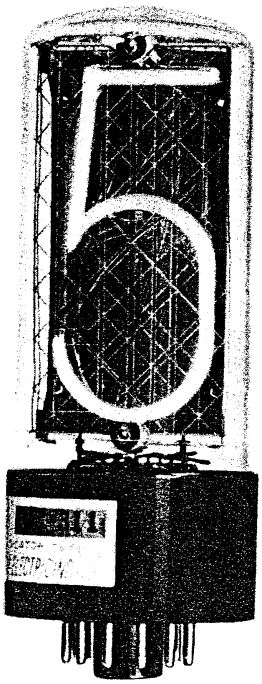
GR-414



CD27



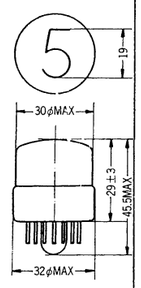
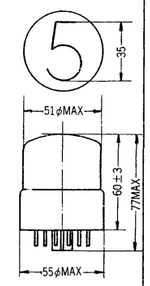
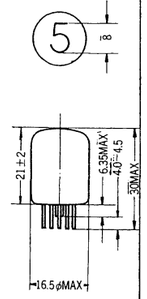
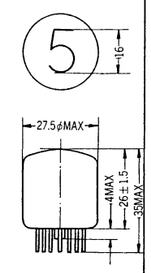
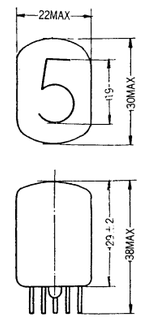
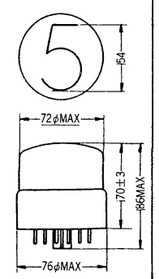
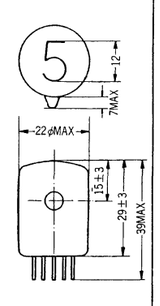
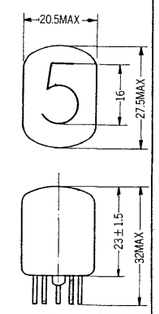
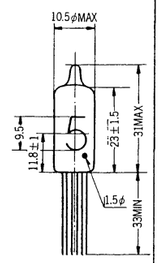
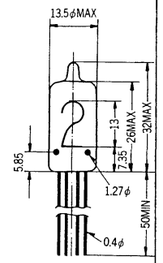
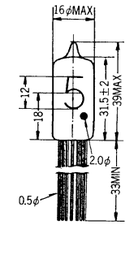
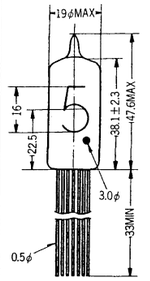
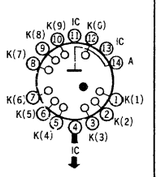
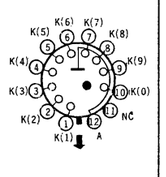
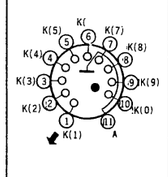
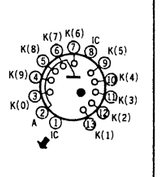
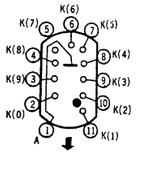
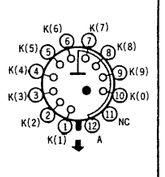
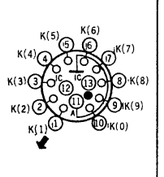
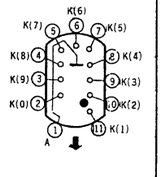
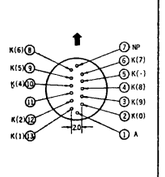
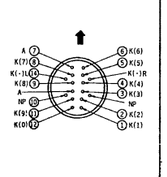
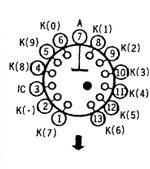
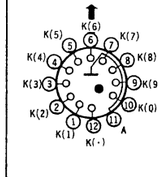
CD11



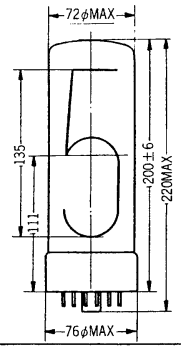
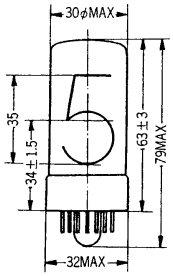
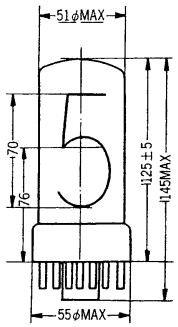
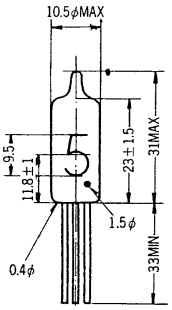
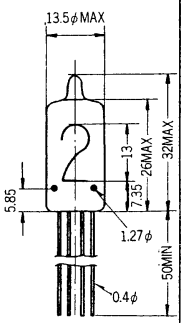
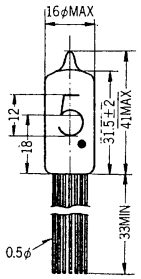
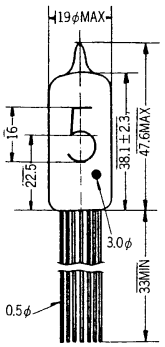
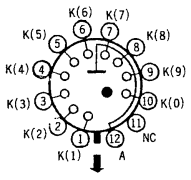
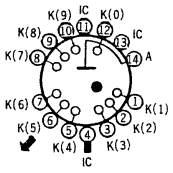
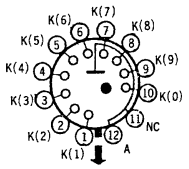
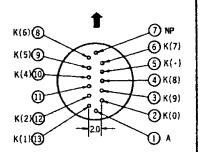
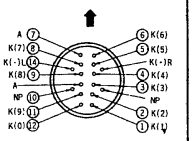
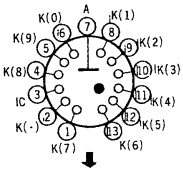
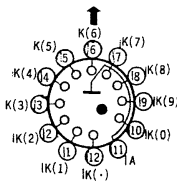
GR-311



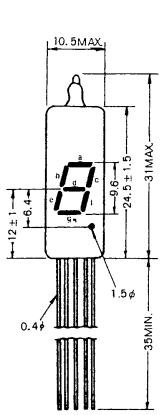
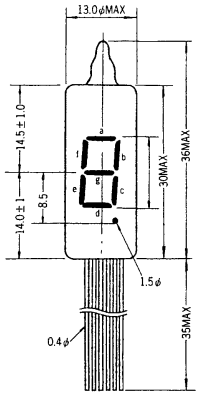
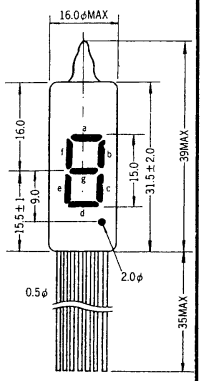
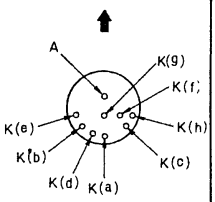
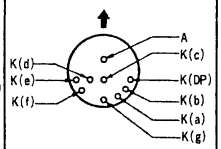
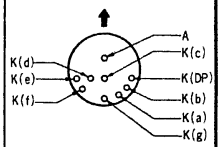
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

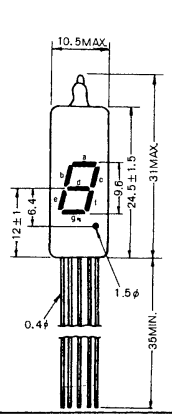
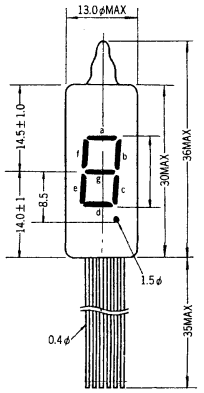
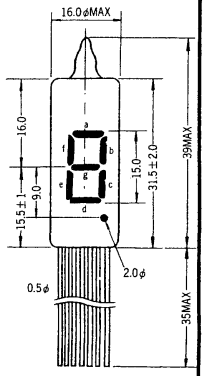
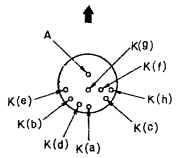
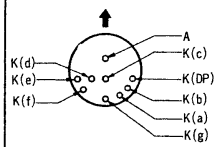
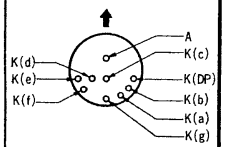
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

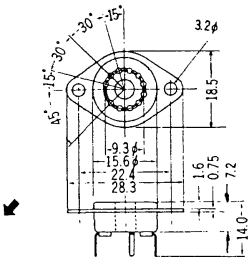
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

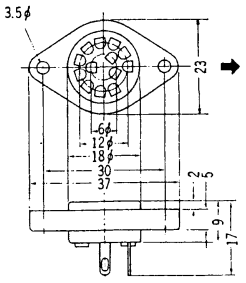
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

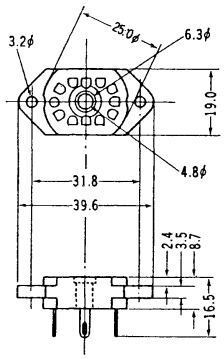
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



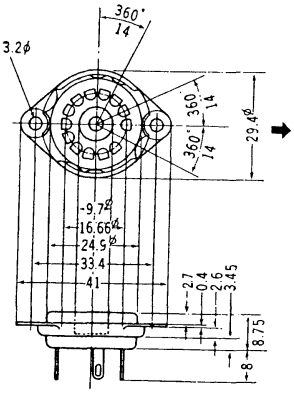
TSM-11P
CD 13



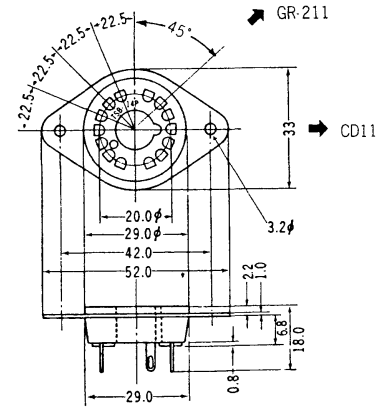
TSM-13P
CD 28



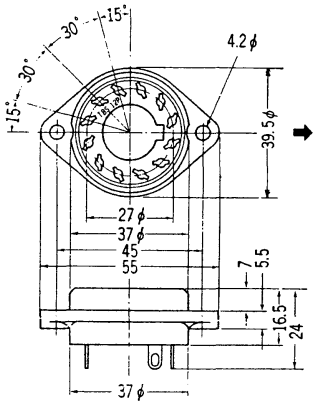
TSR-11P
CD 25, CD 43



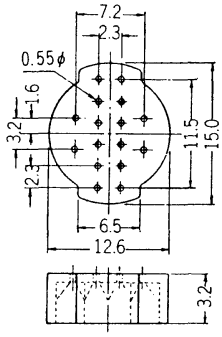
TSB-13P
CD 24



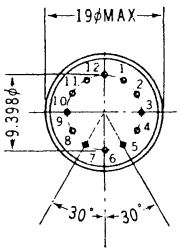
TSB-14P
CD11, GR-211



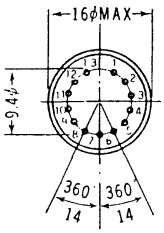
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

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RODAN

INDICATOR TUBE

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

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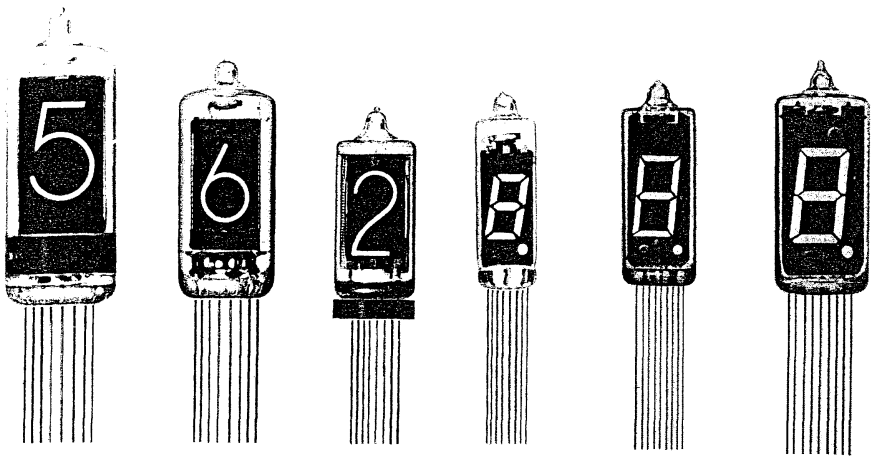
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+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH



CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



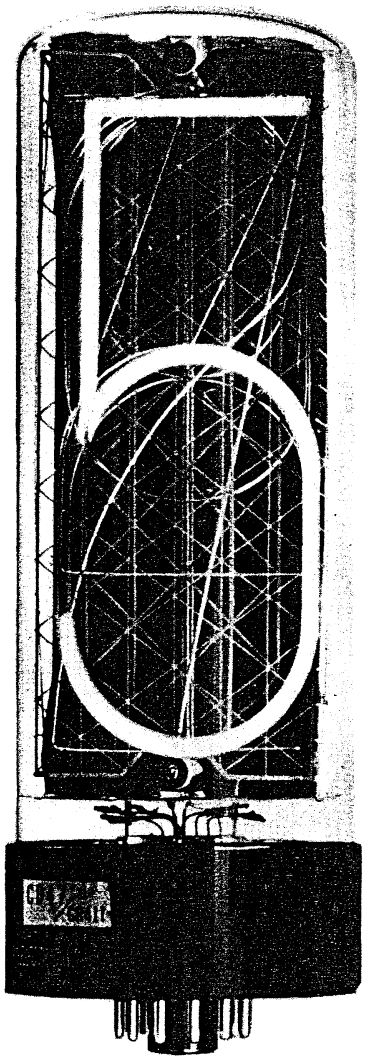
CD13



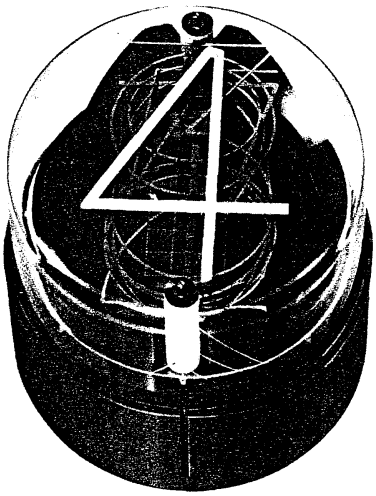
CD12



CD24



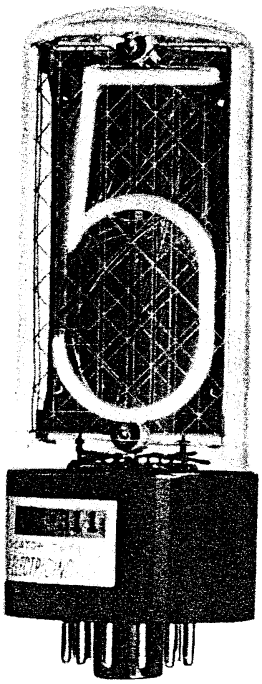
GR-414



CD27



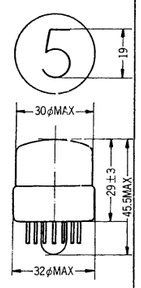
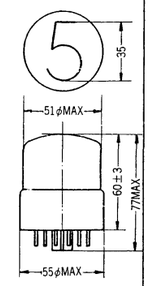
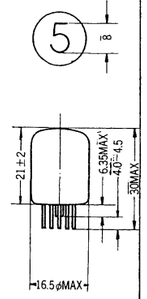
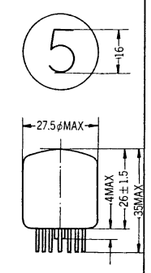
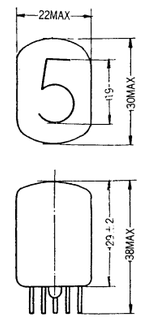
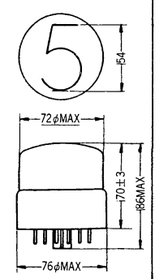
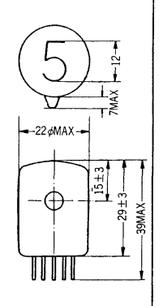
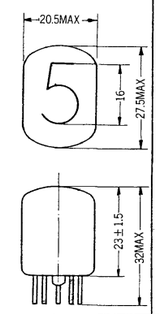
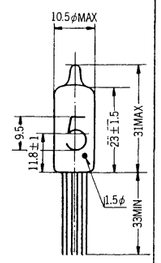
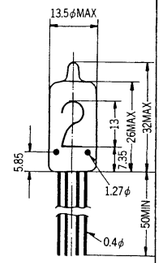
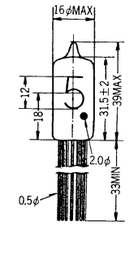
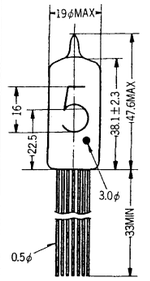
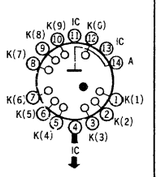
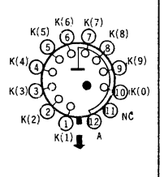
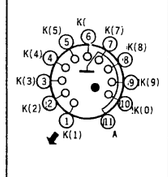
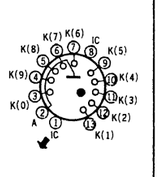
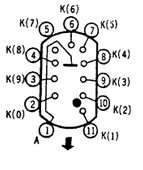
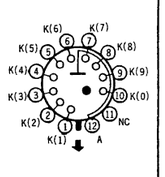
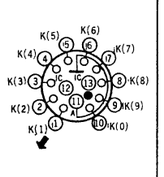
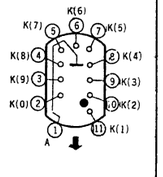
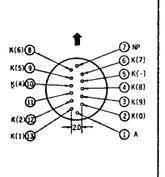
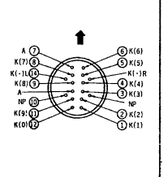
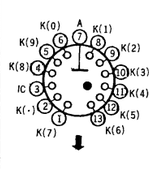
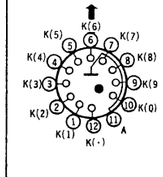
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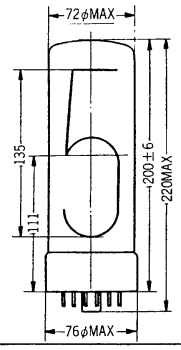
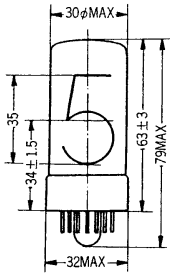
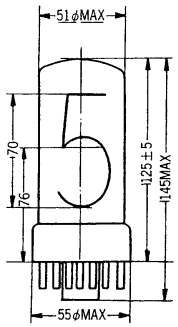
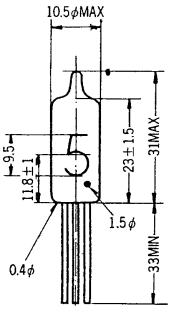
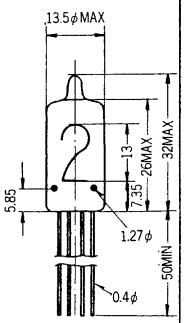
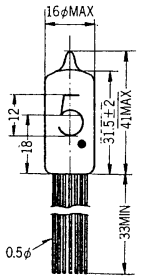
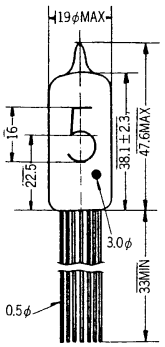
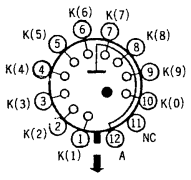
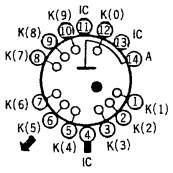
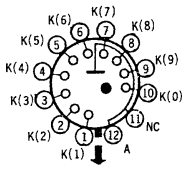
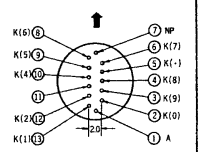
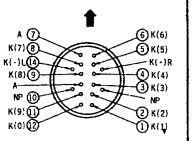
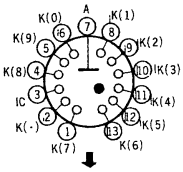
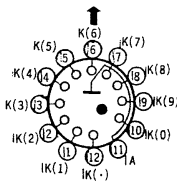
GR-311



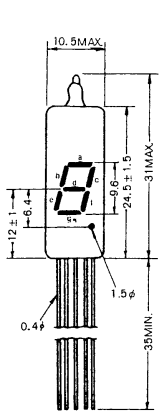
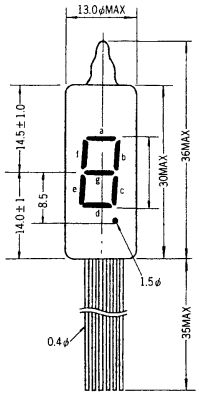
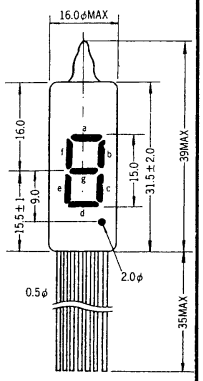
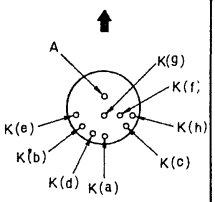
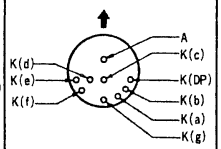
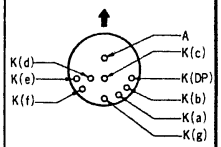
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

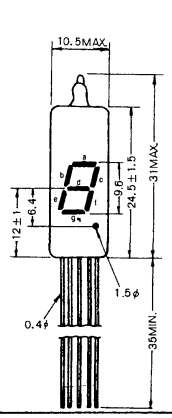
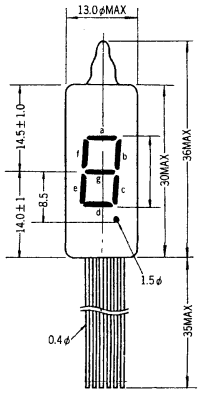
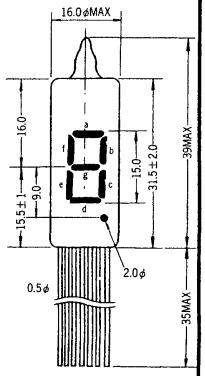
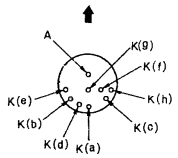
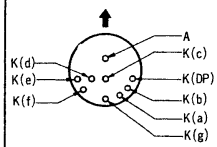
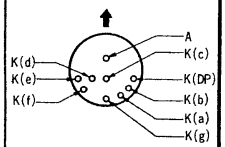
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

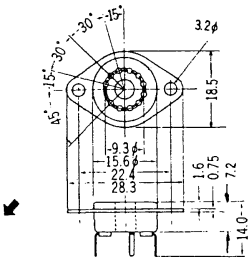
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

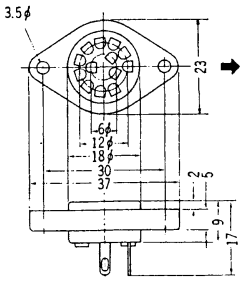
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

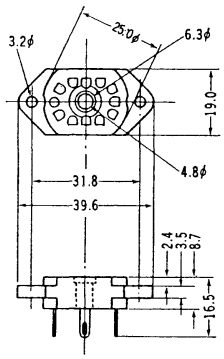
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



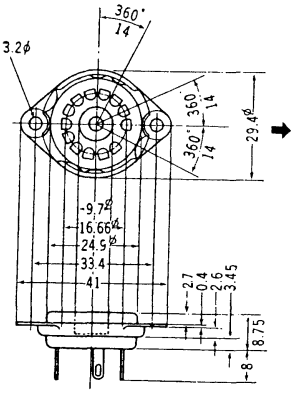
TSM-11P
CD 13



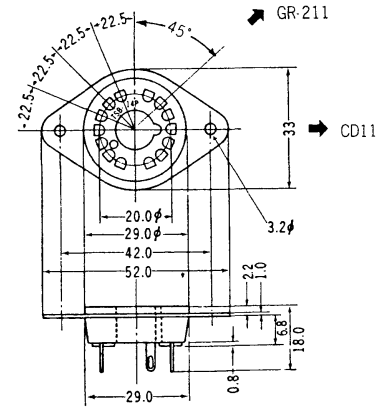
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CD 28



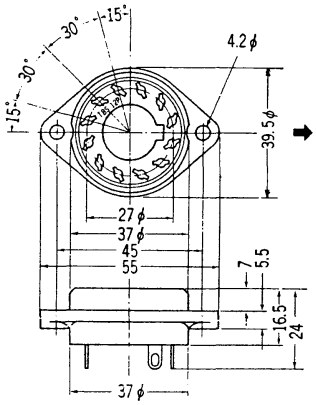
TSR-11P
CD 25, CD 43



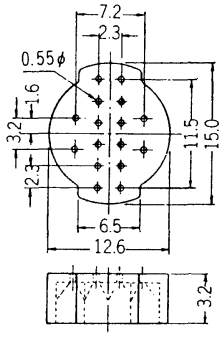
TSB-13P
CD 24



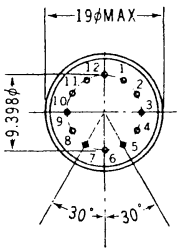
TSB-14P
CD11, GR-211



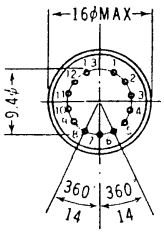
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

RODAN **OKAYA ELECTRIC INDUSTRIES CO., LTD.**
1—8—3, SHIBUYA, SHIBUYA-KU, TOKYO 150, JAPAN

DISTRIBUTED BY:

CAT.NO ED4907-AA-I

RODAN

INDICATOR TUBE

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

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+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

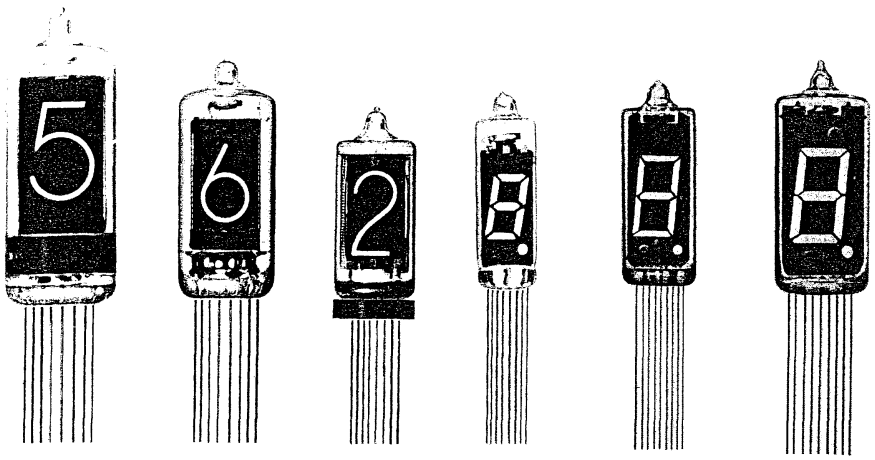
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+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH



CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



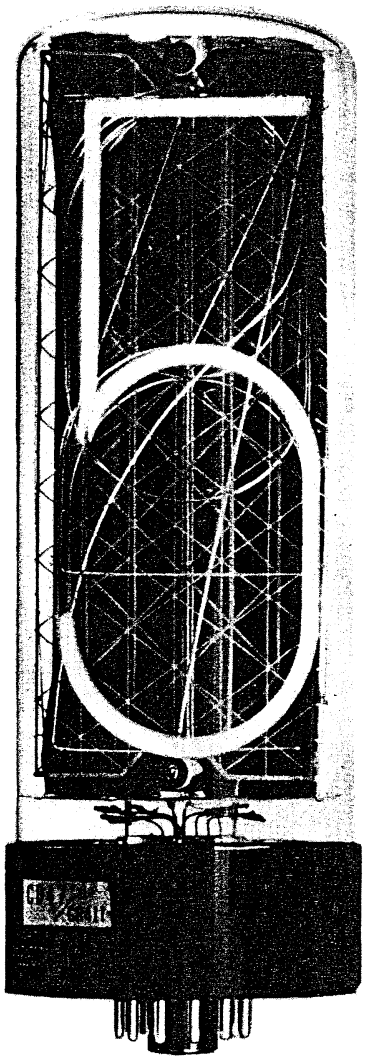
CD13



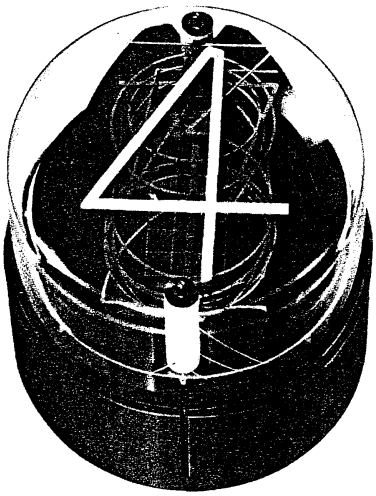
CD12



CD24



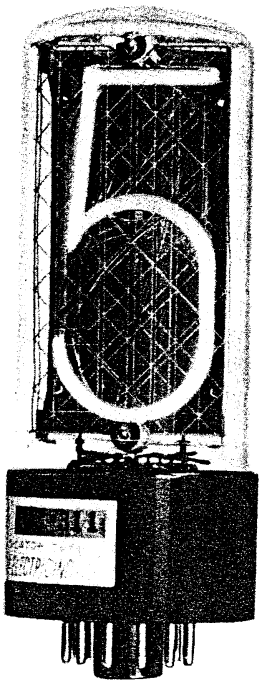
GR-414



CD27



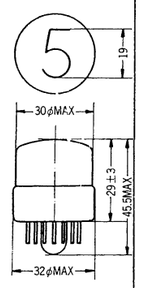
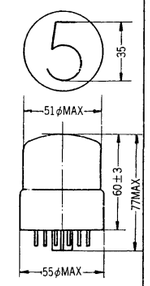
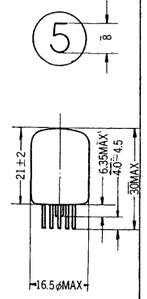
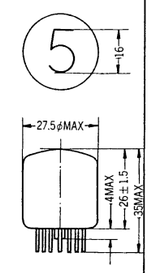
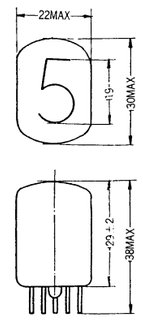
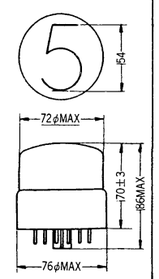
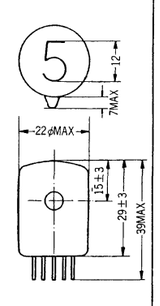
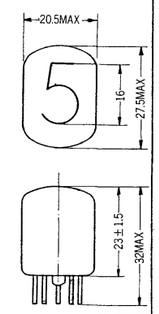
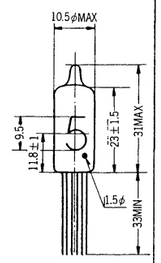
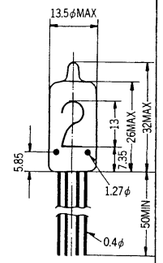
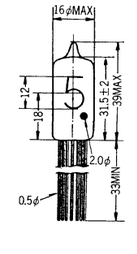
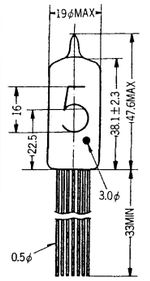
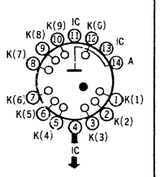
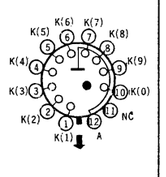
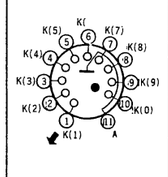
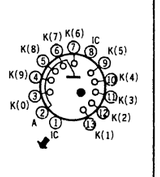
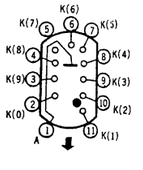
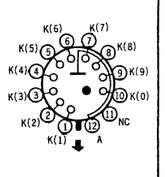
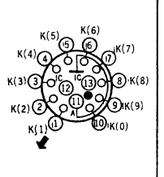
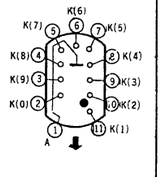
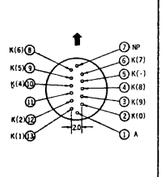
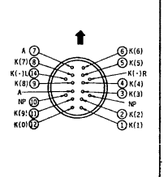
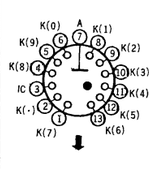
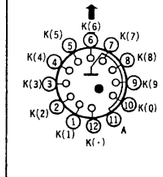
CD11



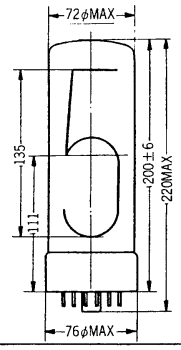
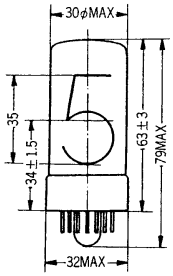
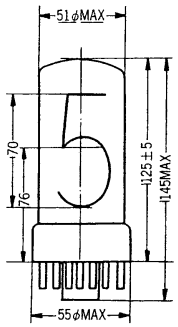
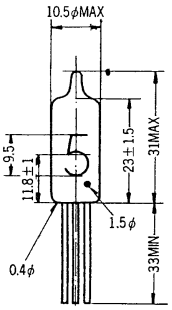
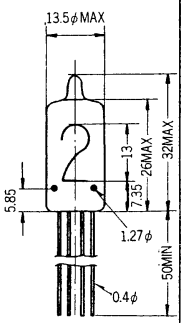
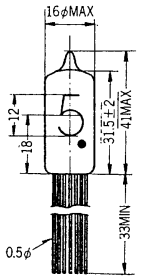
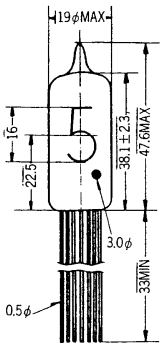
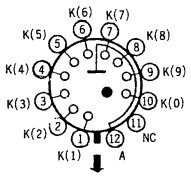
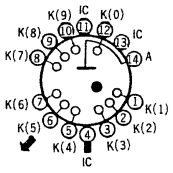
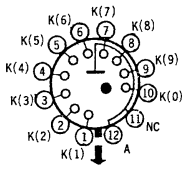
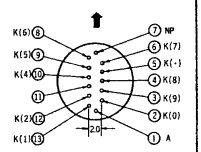
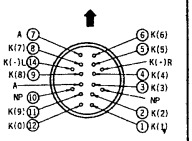
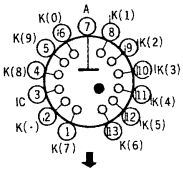
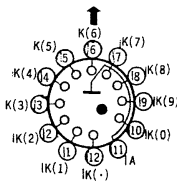
GR-311



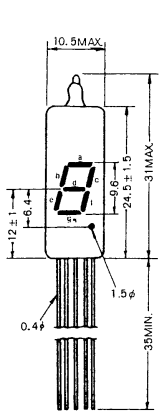
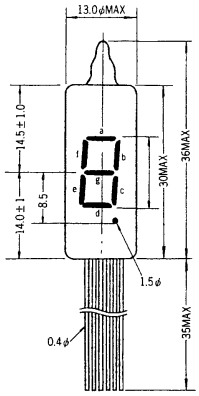
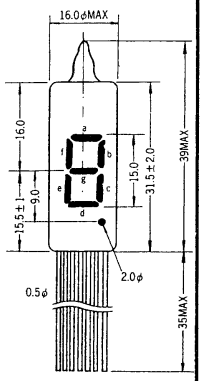
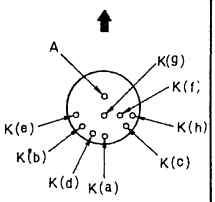
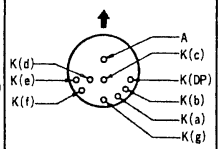
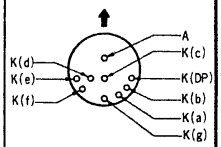
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

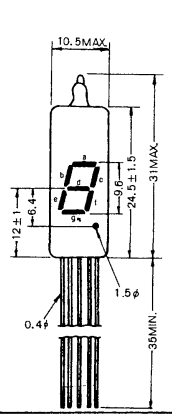
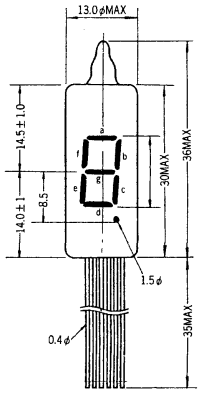
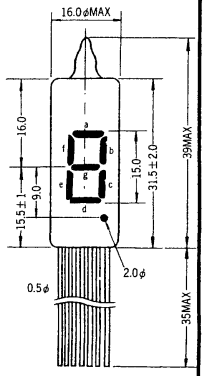
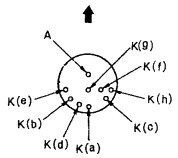
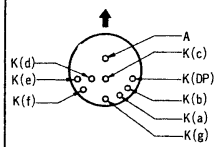
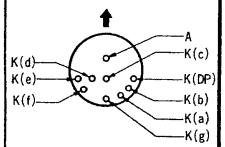
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

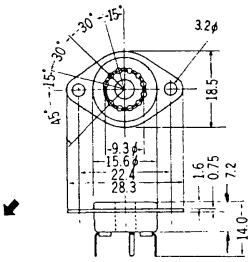
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

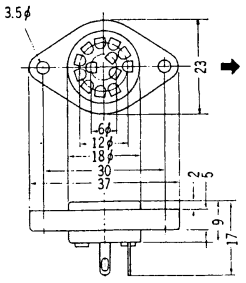
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

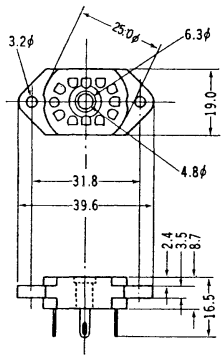
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



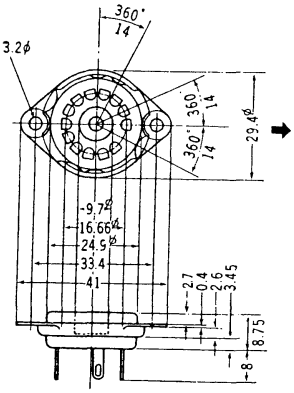
TSM-11P
CD 13



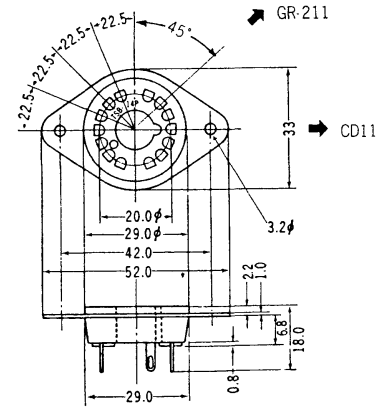
TSM-13P
CD 28



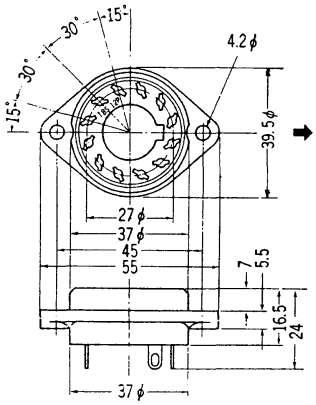
TSR-11P
CD 25, CD 43



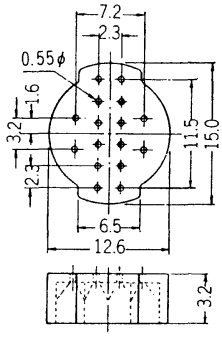
TSB-13P
CD 24



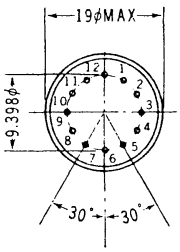
TSB-14P
CD11, GR-211



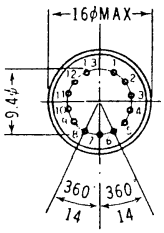
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

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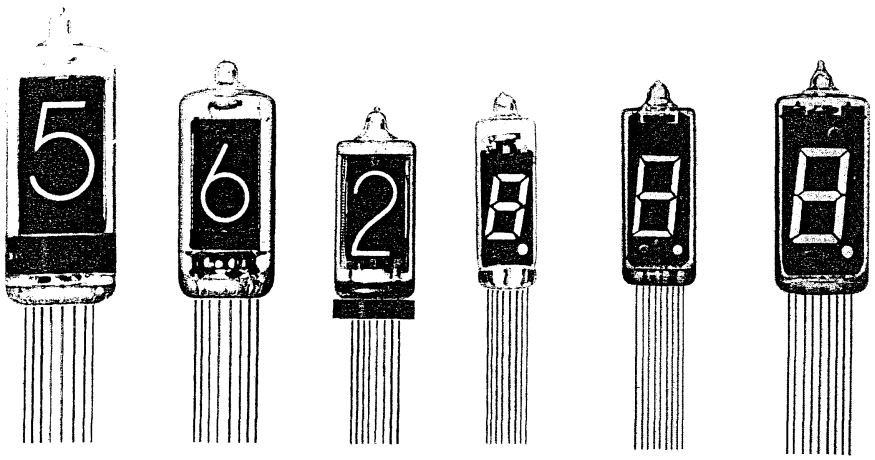
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CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



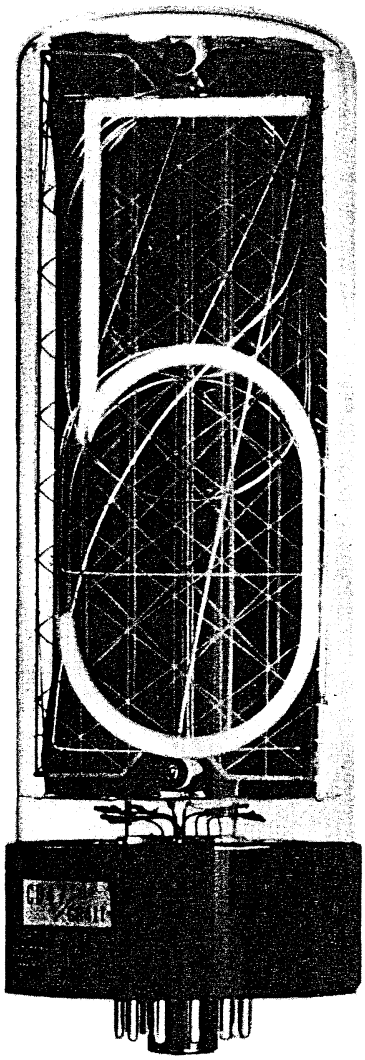
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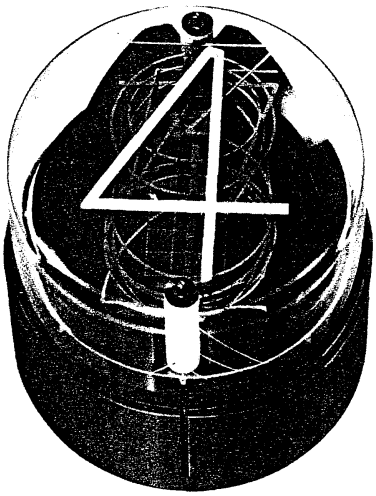
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CD24



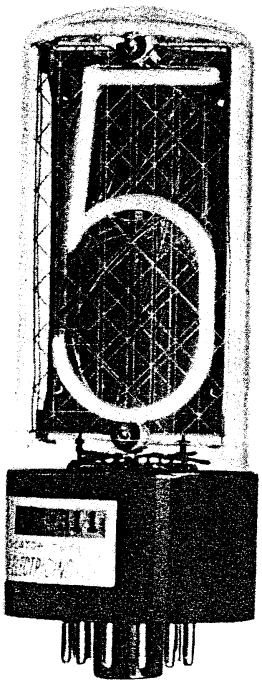
GR-414



CD27



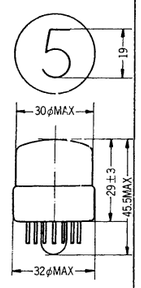
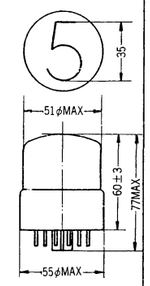
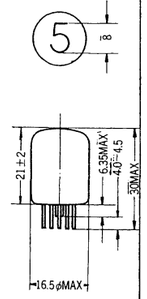
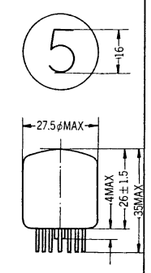
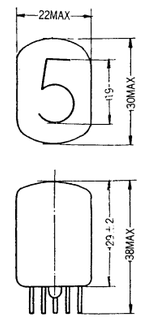
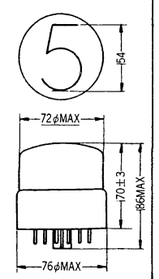
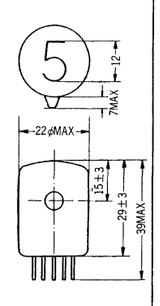
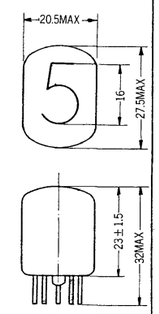
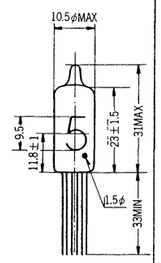
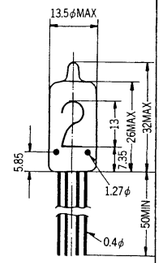
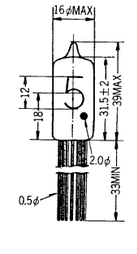
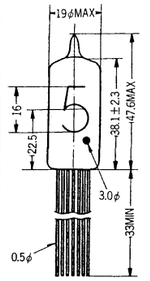
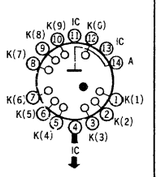
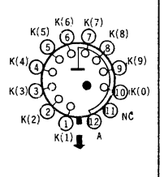
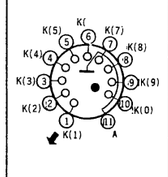
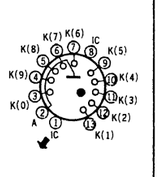
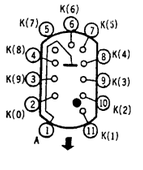
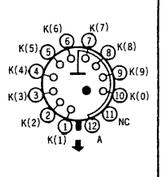
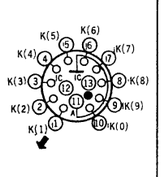
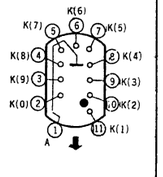
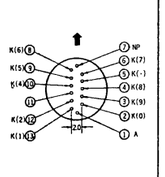
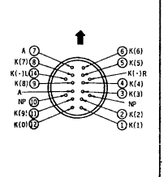
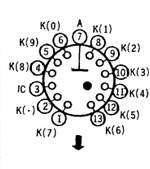
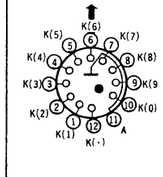
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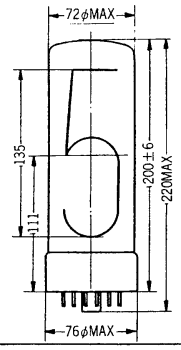
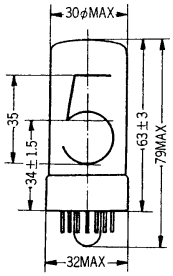
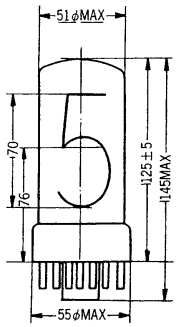
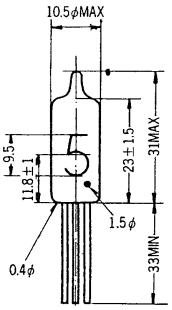
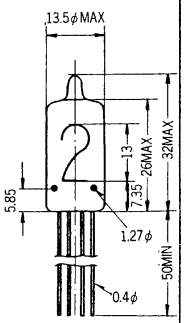
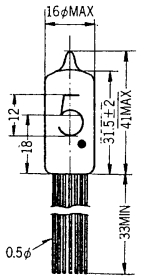
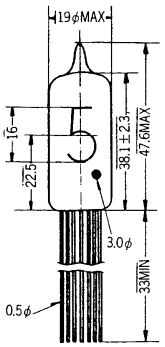
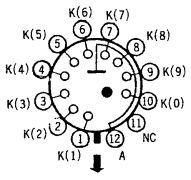
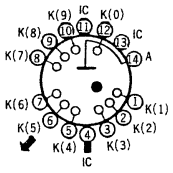
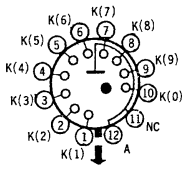
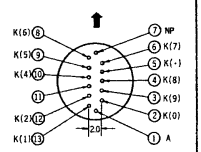
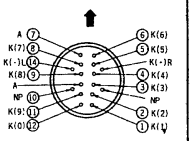
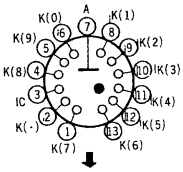
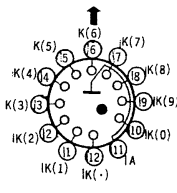
GR-311



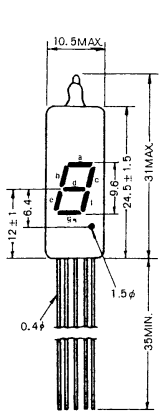
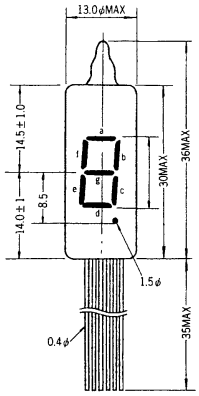
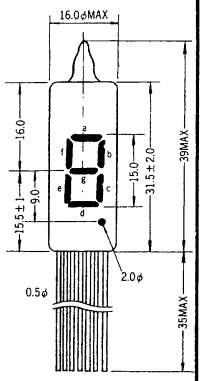
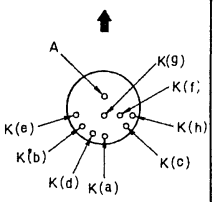
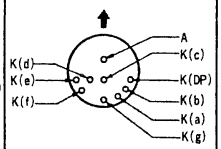
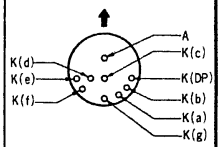
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

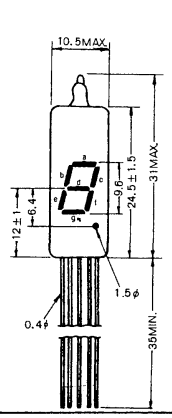
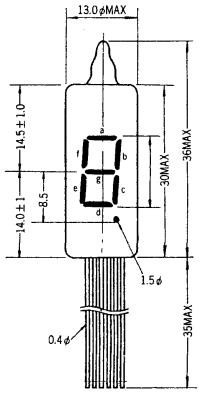
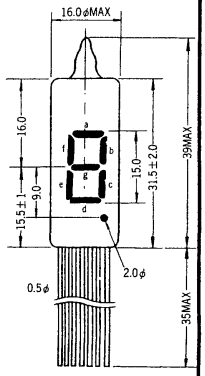
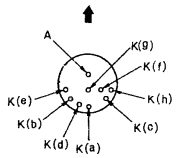
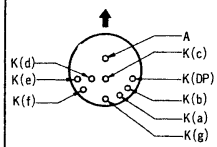
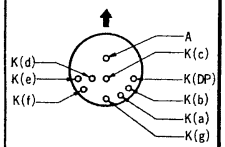
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

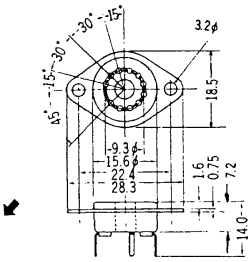
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

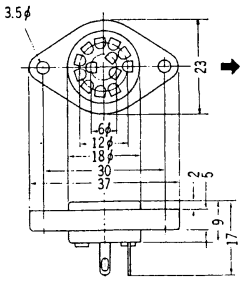
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

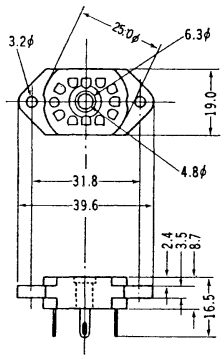
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



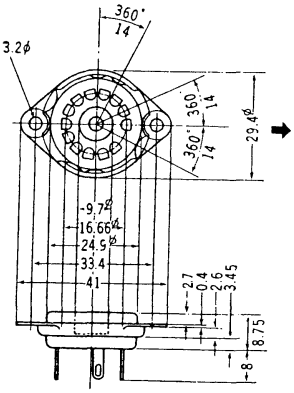
TSM-11P
CD 13



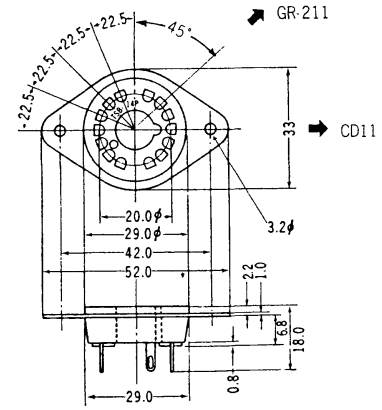
TSM-13P
CD 28



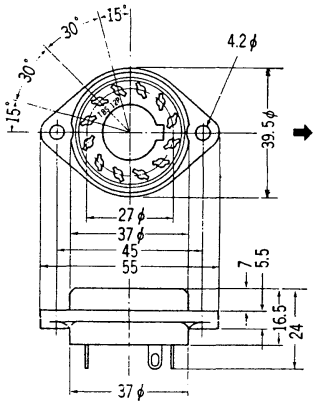
TSR-11P
CD 25, CD 43



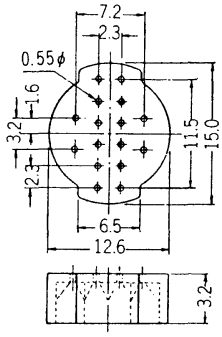
TSB-13P
CD 24



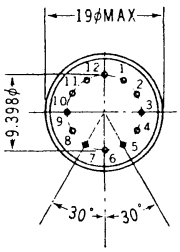
TSB-14P
CD11, GR-211



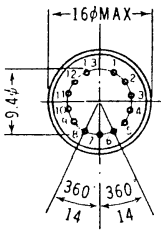
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

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RODAN

INDICATOR TUBE

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

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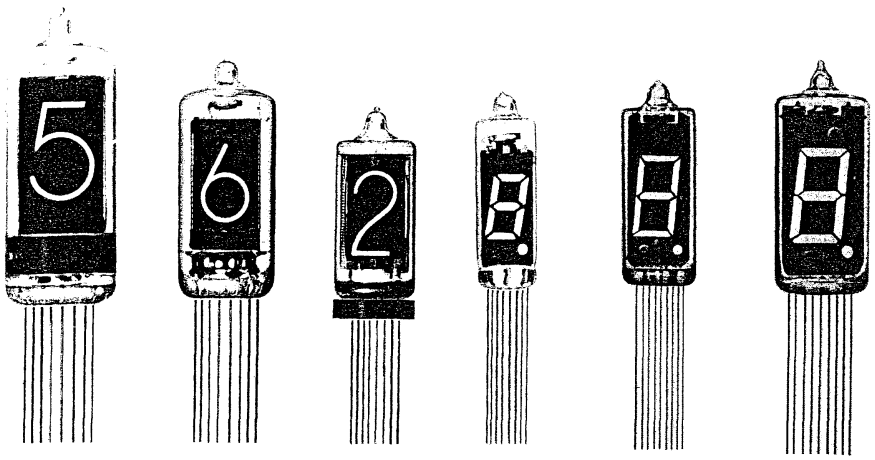
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+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH



CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



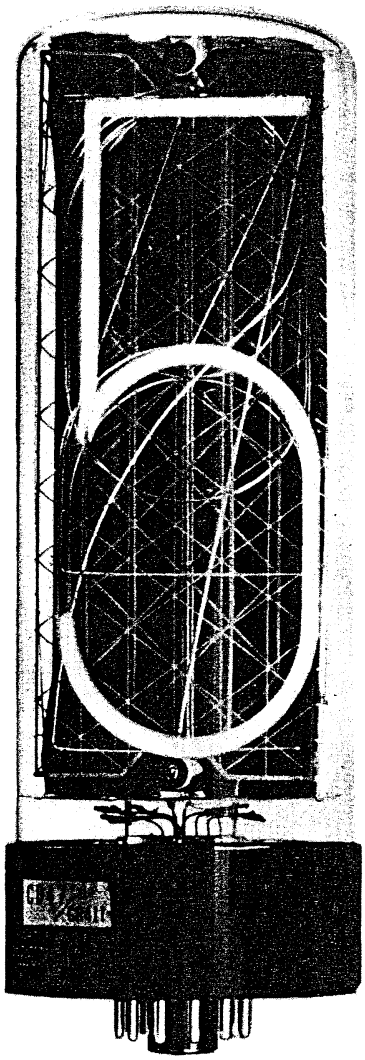
CD13



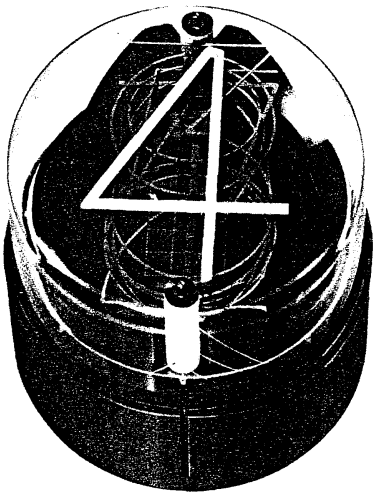
CD12



CD24



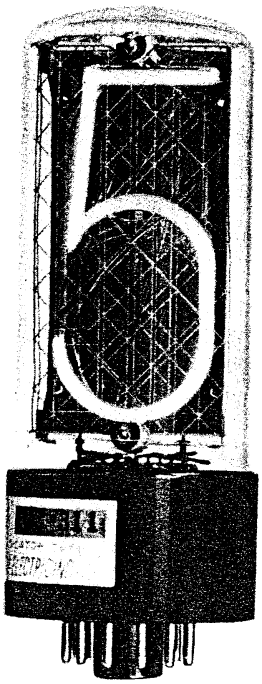
GR-414



CD27



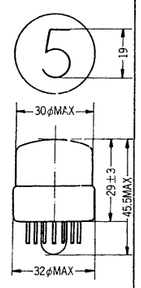
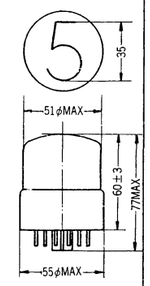
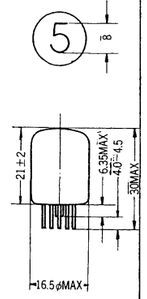
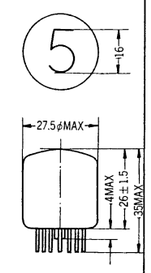
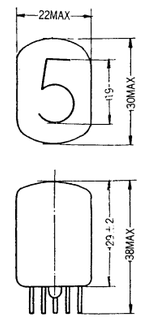
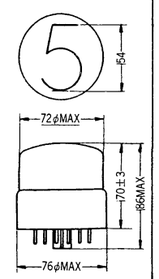
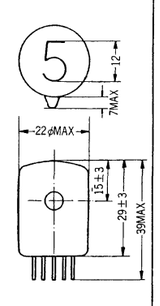
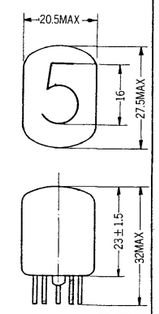
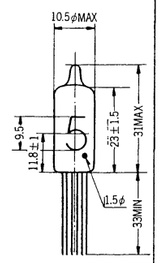
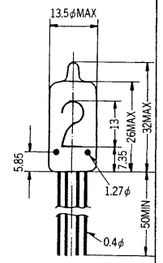
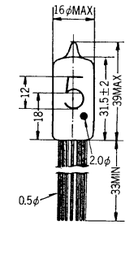
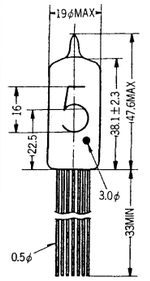
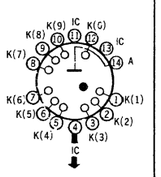
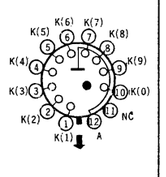
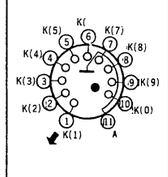
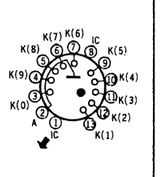
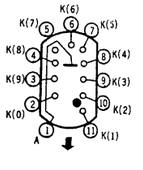
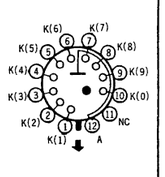
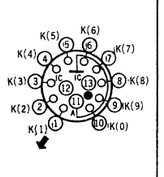
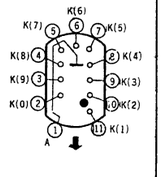
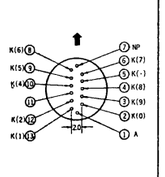
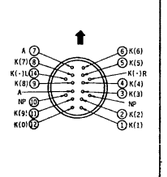
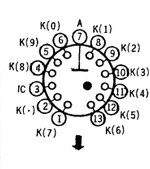
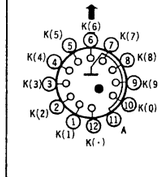
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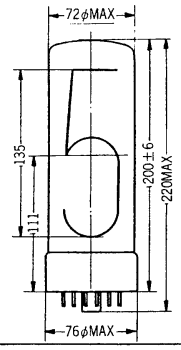
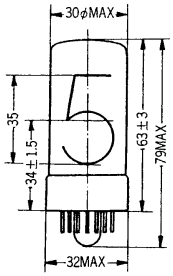
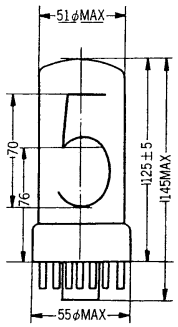
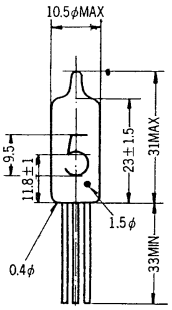
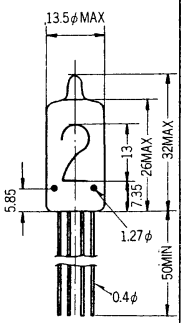
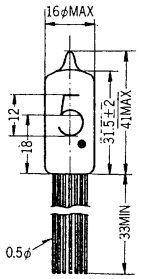
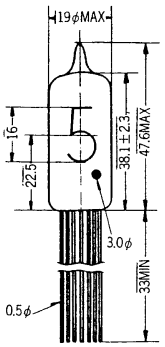
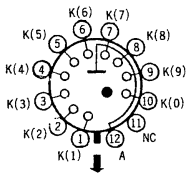
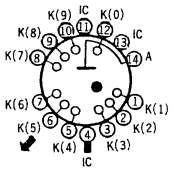
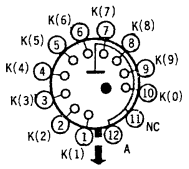
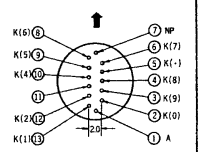
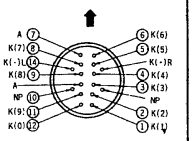
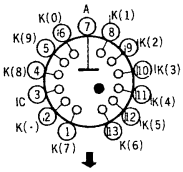
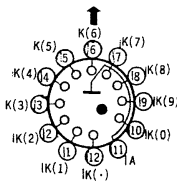
GR-311



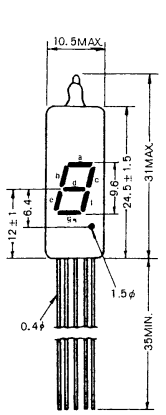
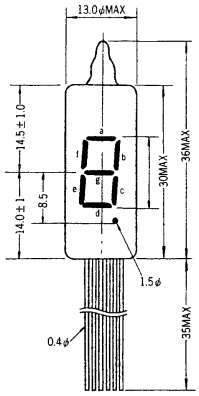
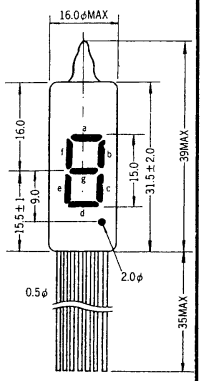
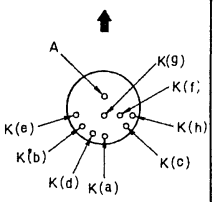
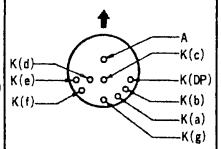
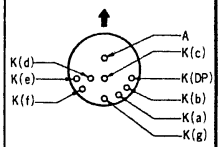
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

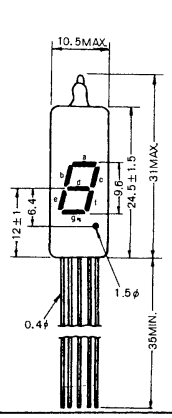
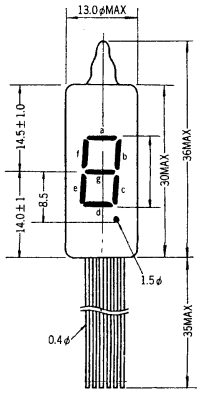
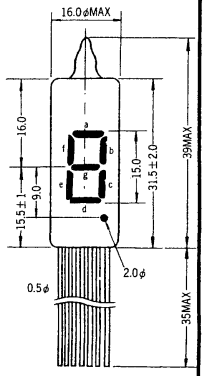
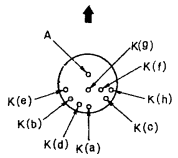
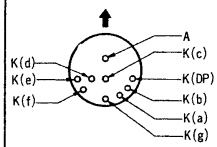
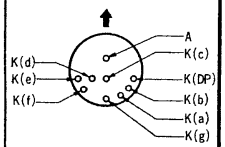
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

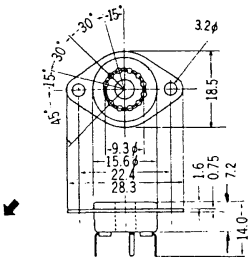
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

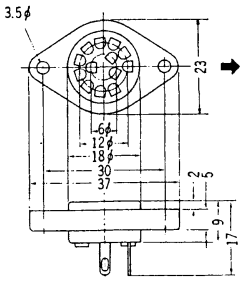
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

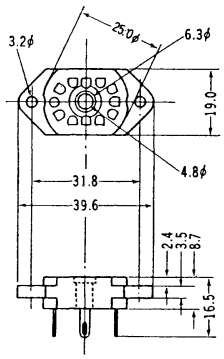
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



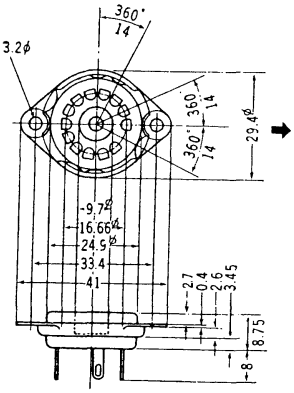
TSM-11P
CD 13



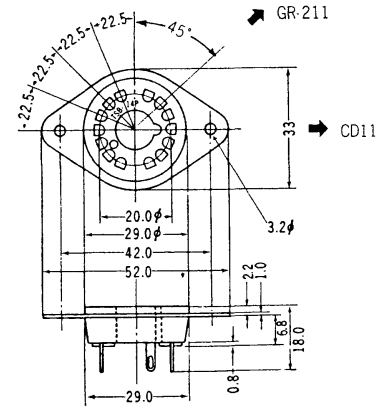
TSM-13P
CD 28



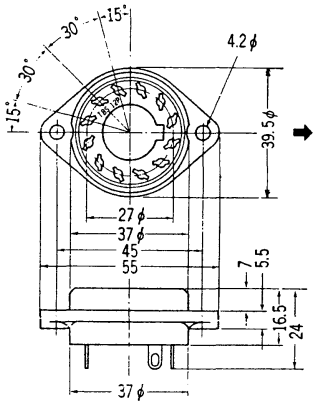
TSR-11P
CD 25, CD 43



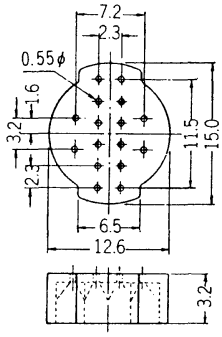
TSB-13P
CD 24



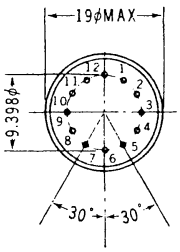
TSB-14P
CD11, GR-211



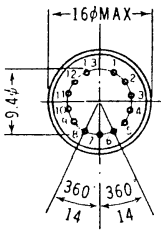
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

RODAN **OKAYA ELECTRIC INDUSTRIES CO., LTD.**
1—8—3, SHIBUYA, SHIBUYA-KU, TOKYO 150, JAPAN

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CAT.NO ED4907-AA-I

RODAN

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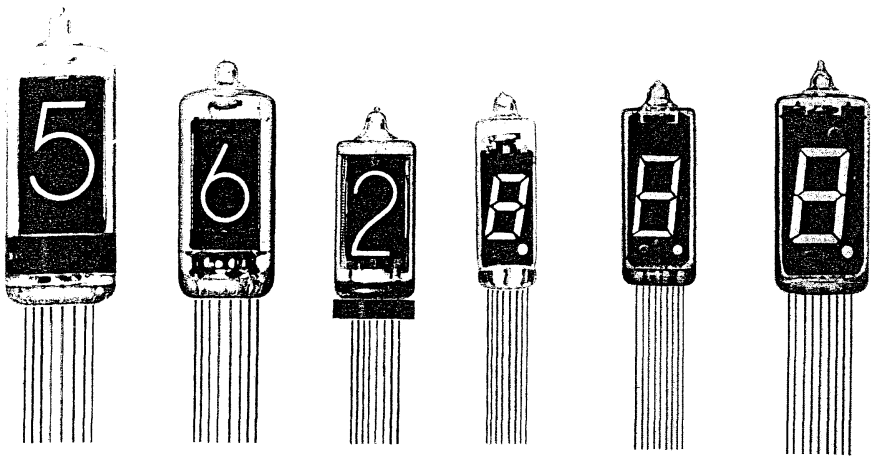
+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH



CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



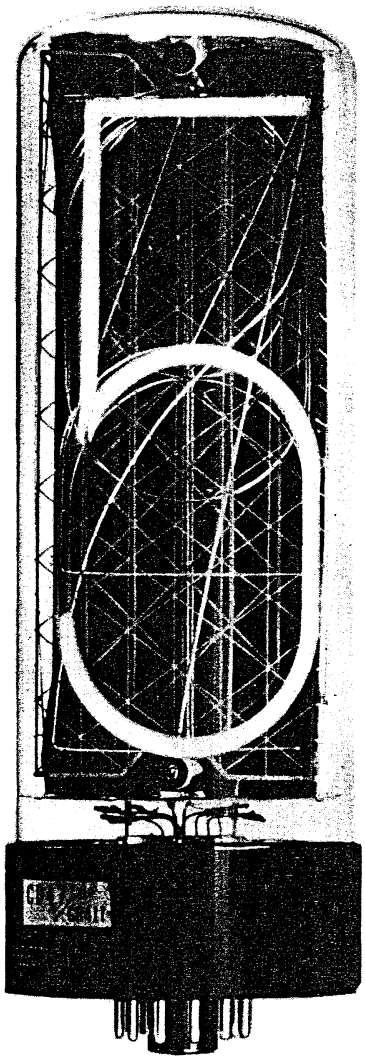
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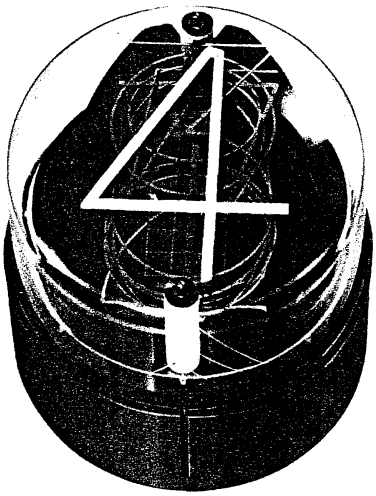
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CD24



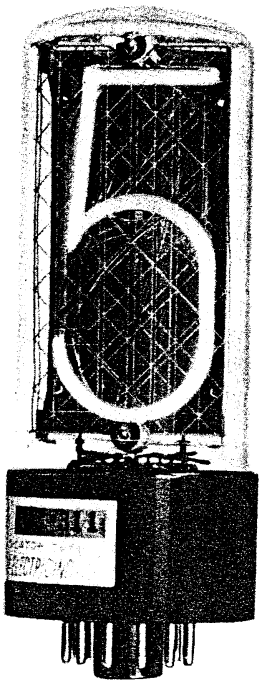
GR-414



CD27



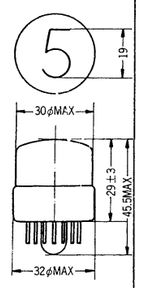
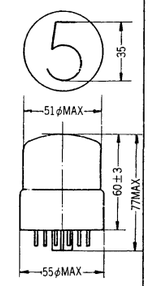
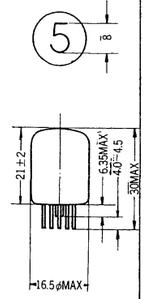
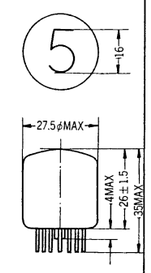
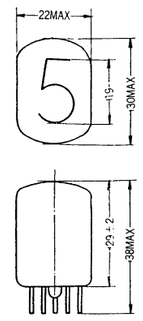
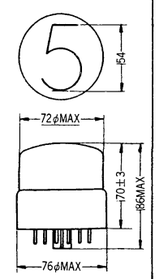
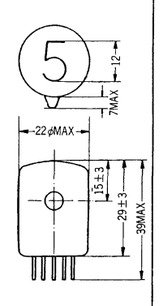
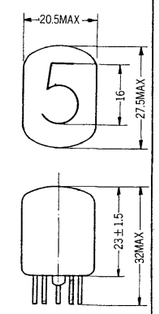
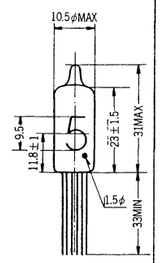
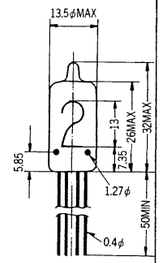
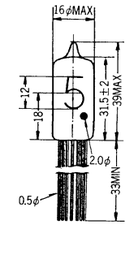
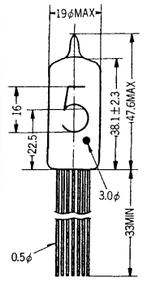
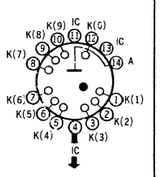
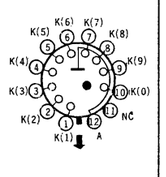
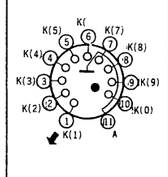
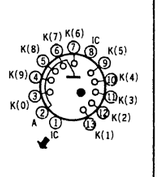
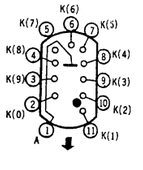
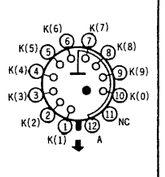
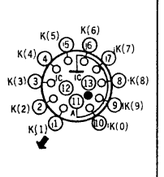
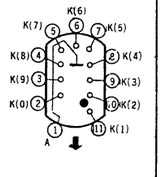
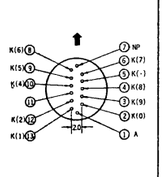
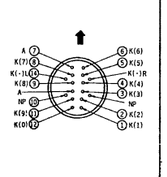
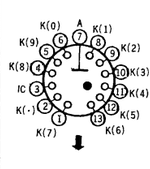
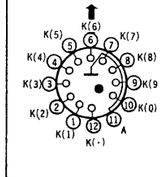
CD11



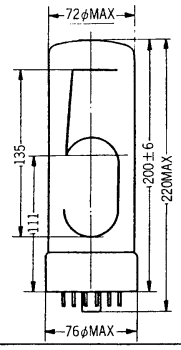
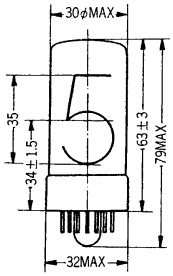
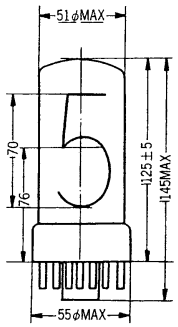
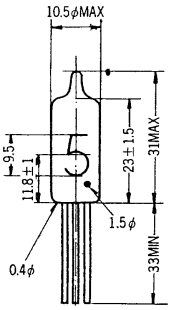
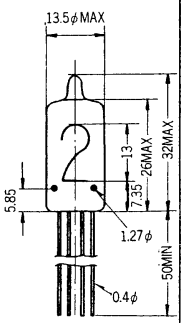
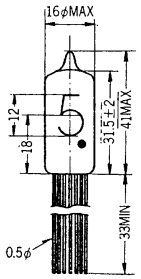
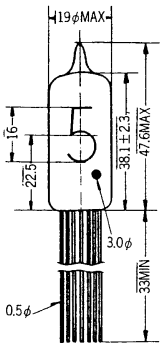
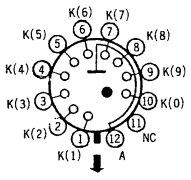
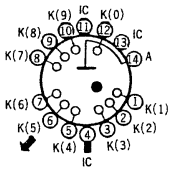
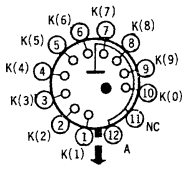
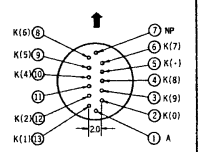
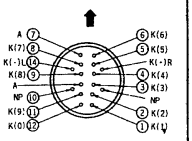
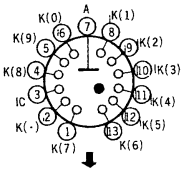
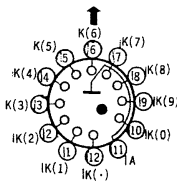
GR-311



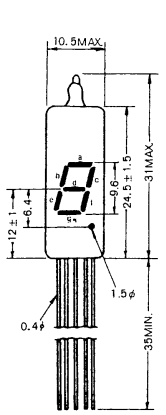
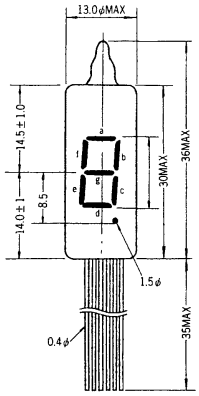
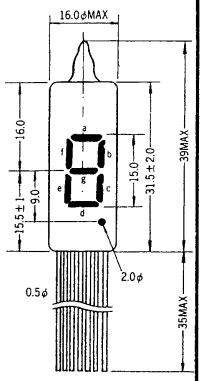
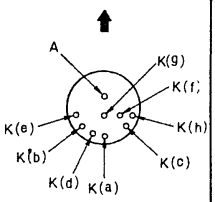
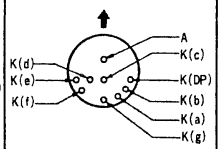
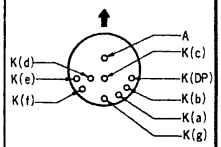
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

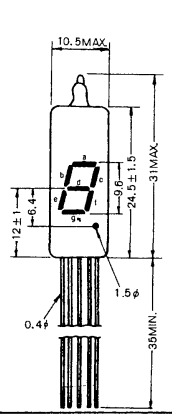
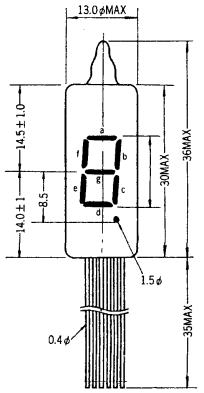
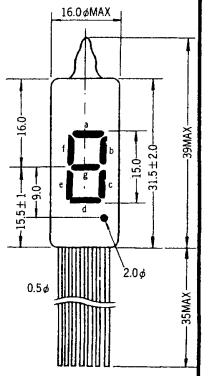
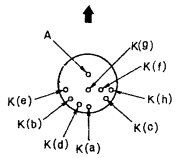
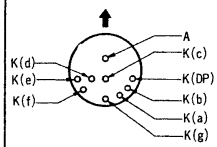
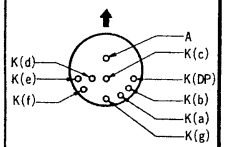
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

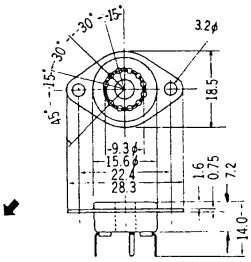
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

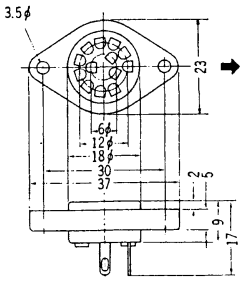
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

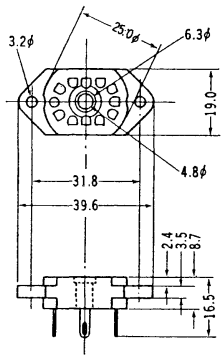
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



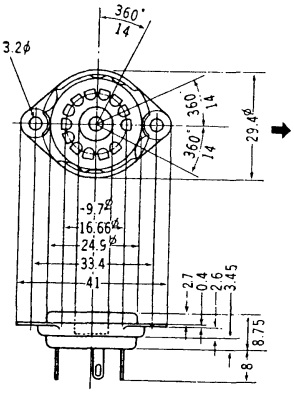
TSM-11P
CD 13



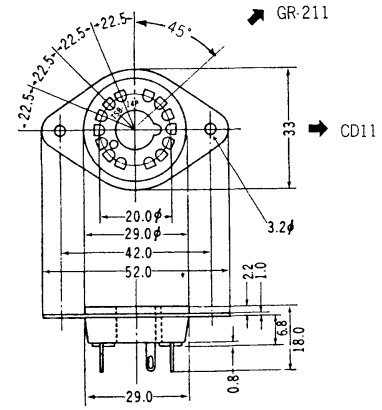
TSM-13P
CD 28



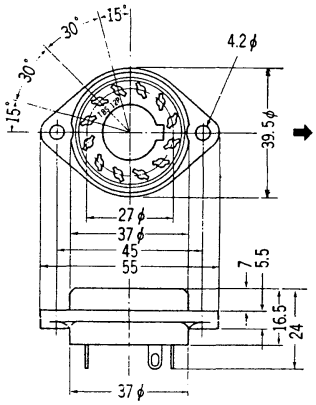
TSR-11P
CD 25, CD 43



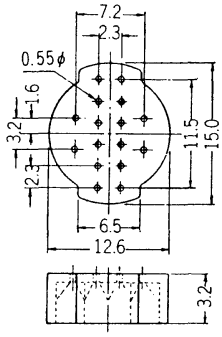
TSB-13P
CD 24



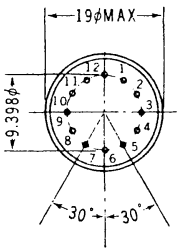
TSB-14P
CD11, GR-211



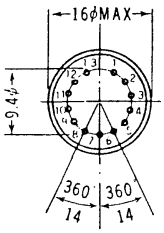
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

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RODAN

INDICATOR TUBE

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

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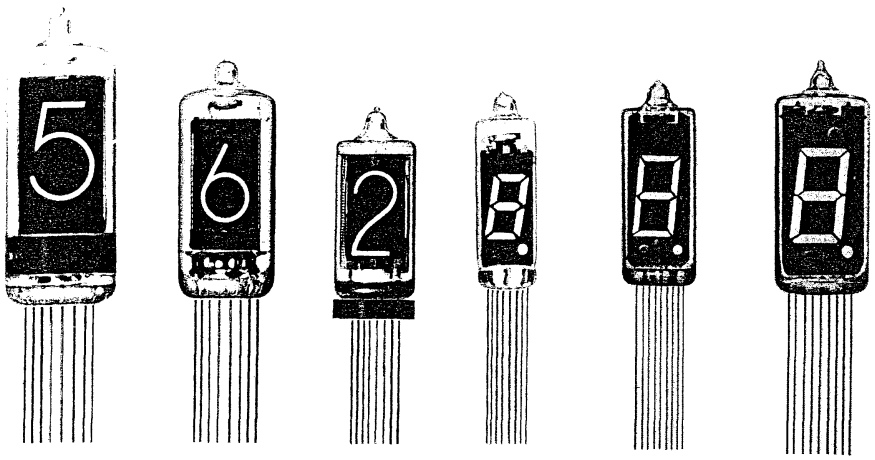
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+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH



CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



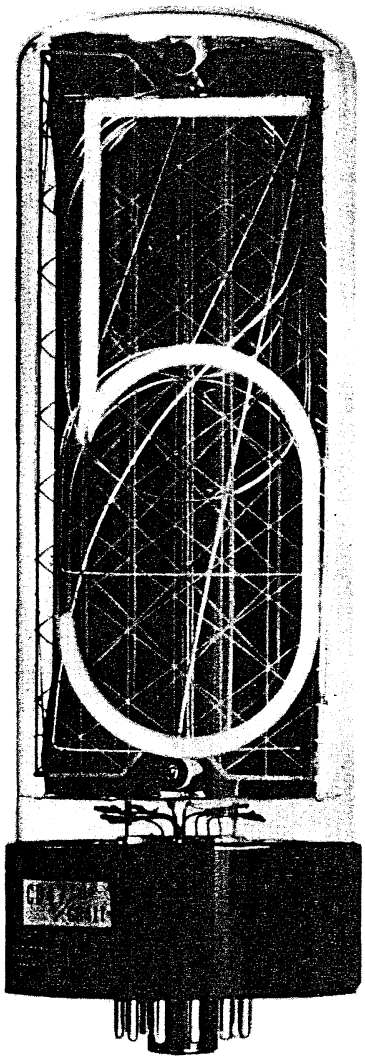
CD13



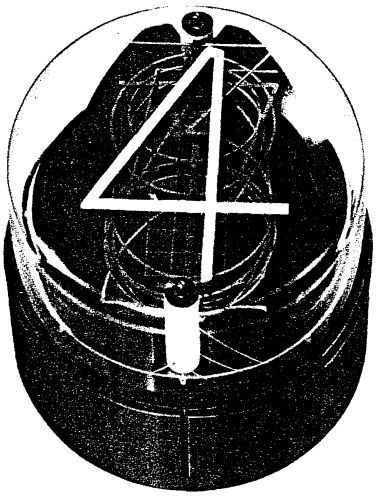
CD12



CD24



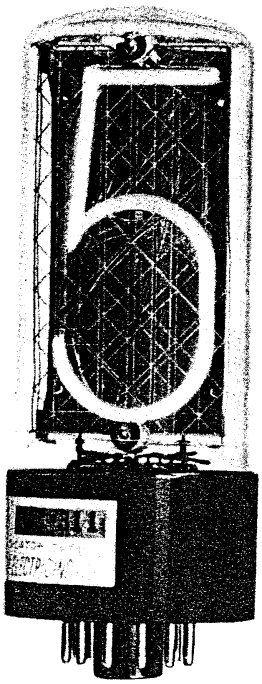
GR-414



CD27



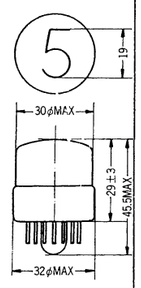
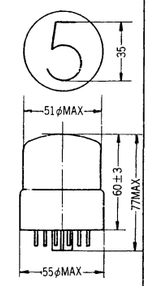
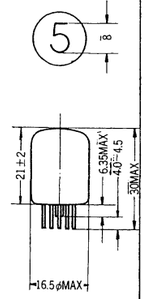
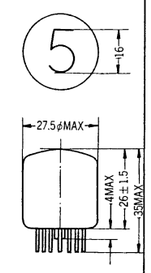
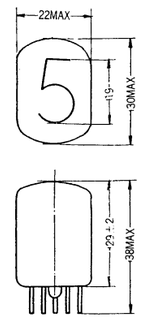
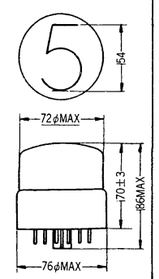
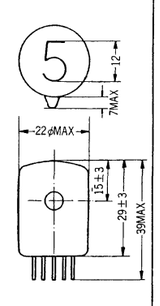
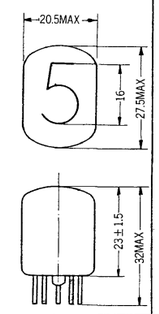
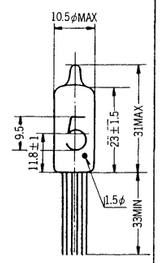
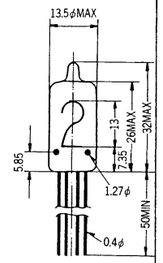
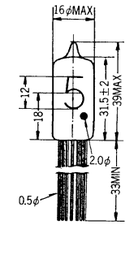
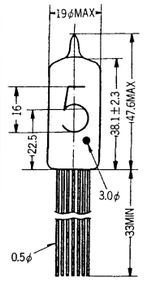
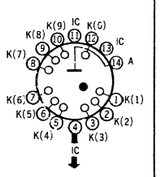
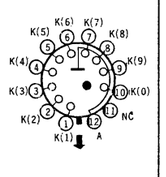
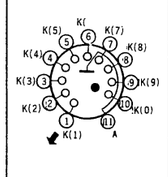
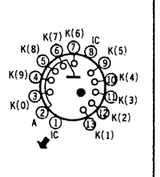
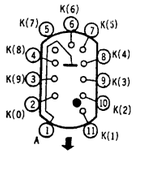
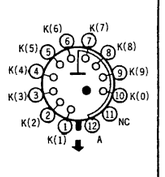
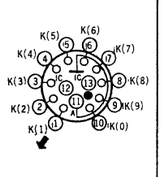
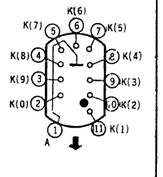
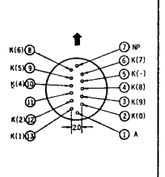
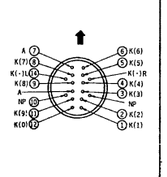
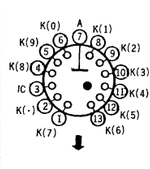
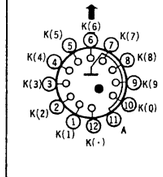
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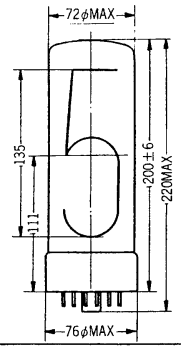
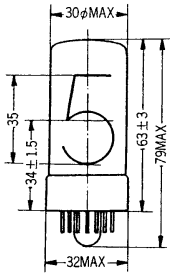
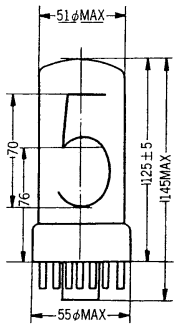
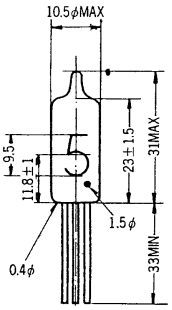
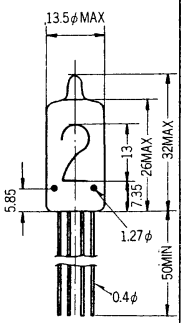
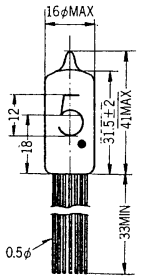
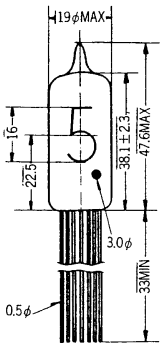
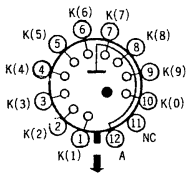
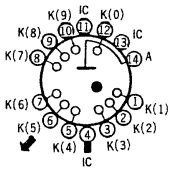
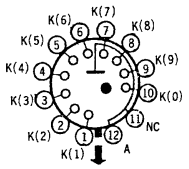
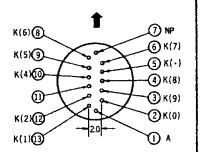
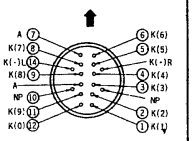
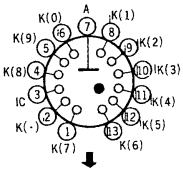
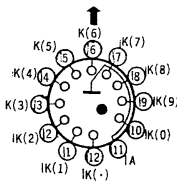
GR-311



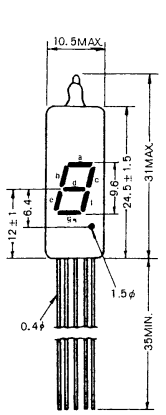
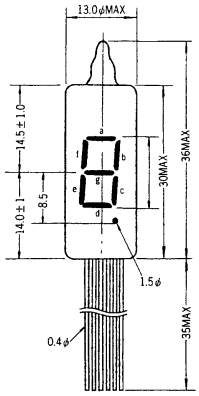
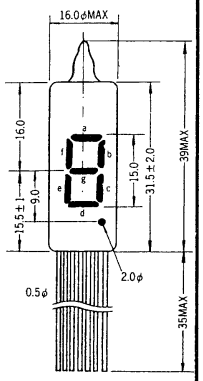
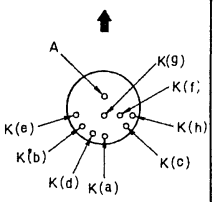
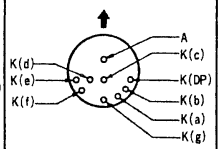
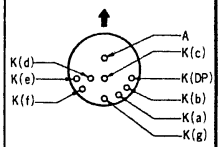
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

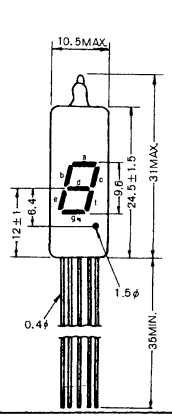
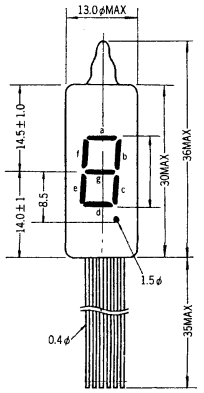
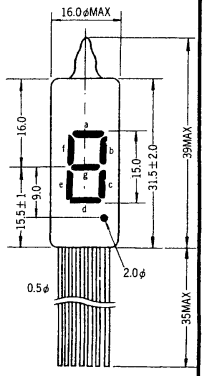
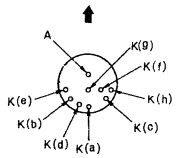
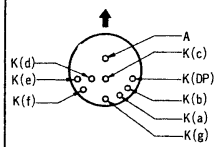
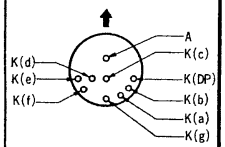
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

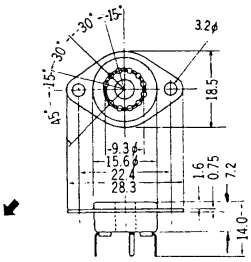
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

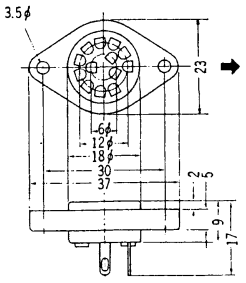
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

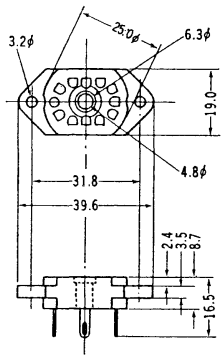
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



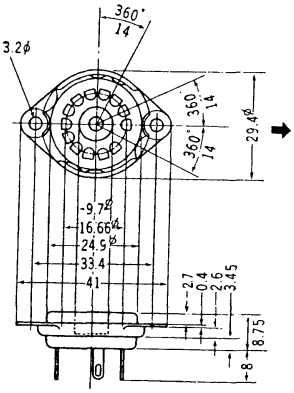
TSM-11P
CD 13



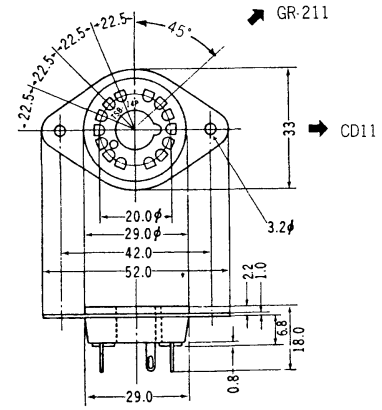
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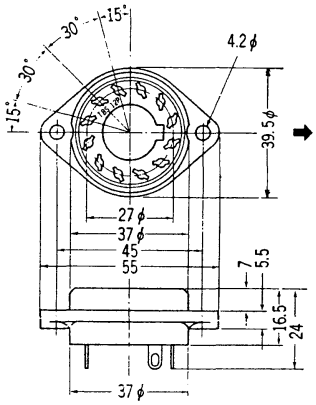
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CD 25, CD 43



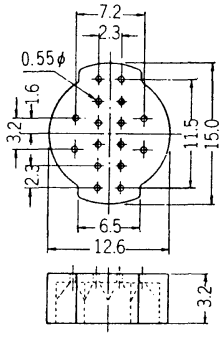
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CD 24



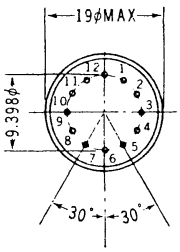
TSB-14P
CD11, GR-211



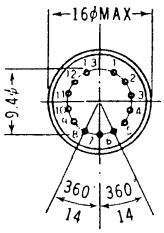
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

RODAN **OKAYA ELECTRIC INDUSTRIES CO., LTD.**
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RODAN

INDICATOR TUBE

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

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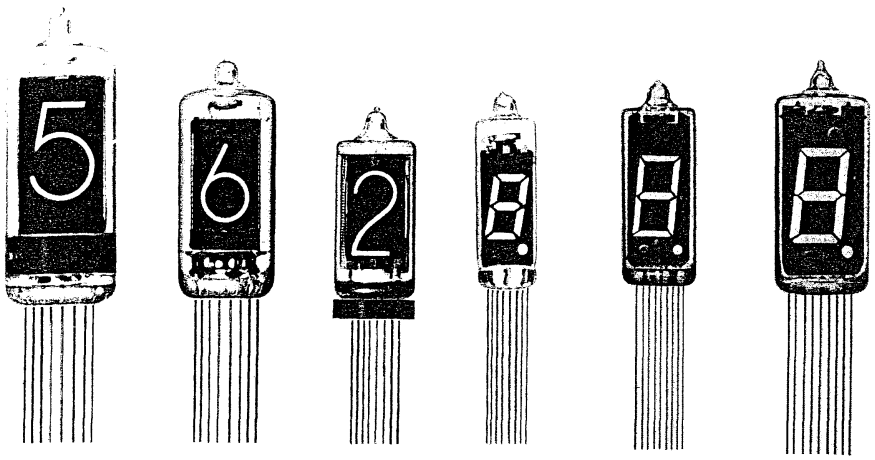
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+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH



CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



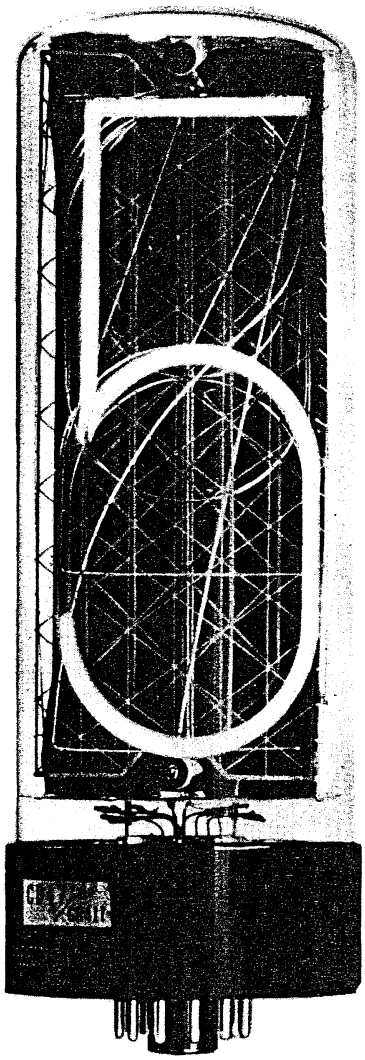
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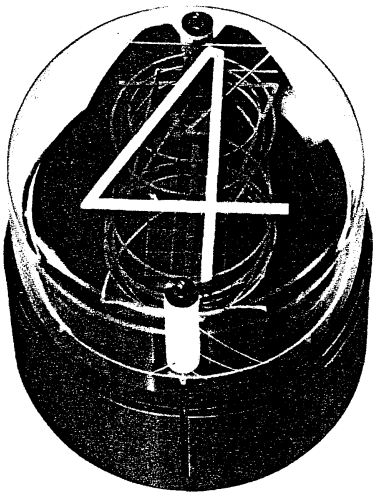
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CD24



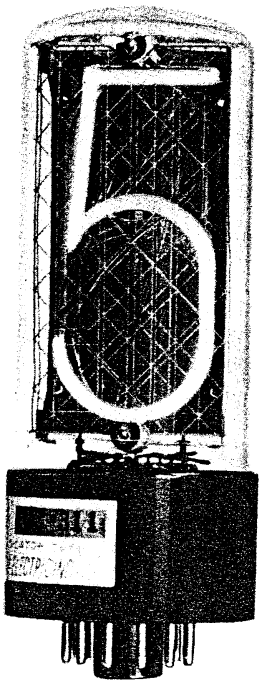
GR-414



CD27



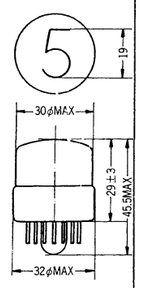
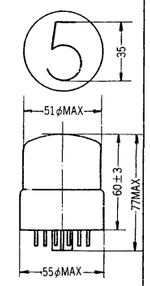
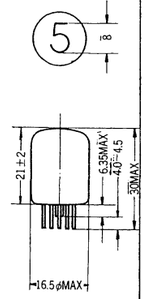
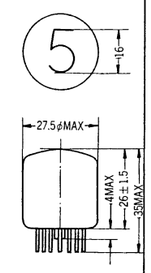
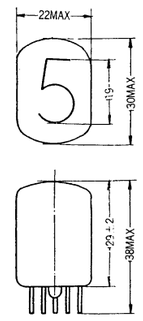
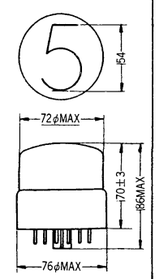
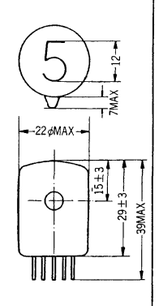
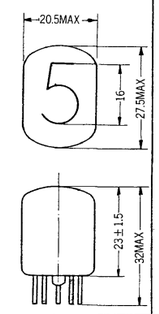
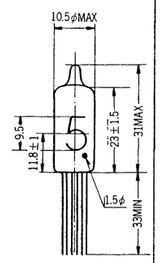
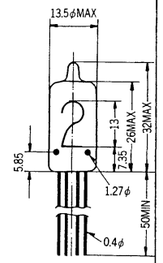
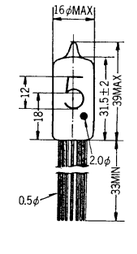
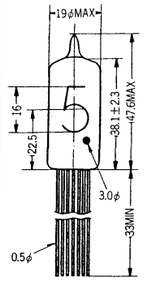
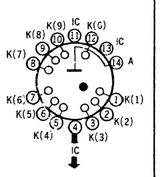
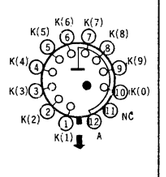
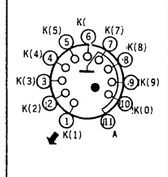
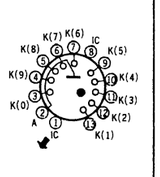
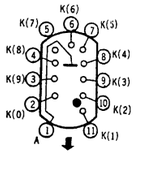
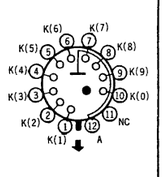
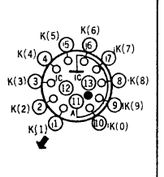
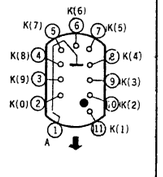
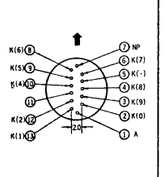
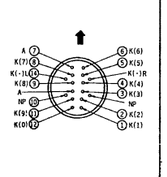
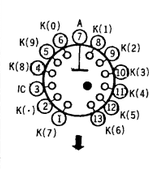
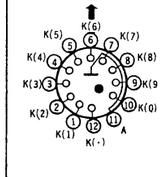
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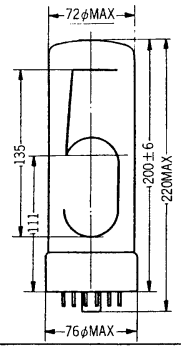
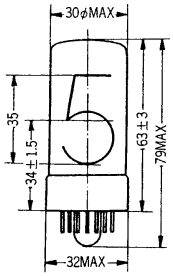
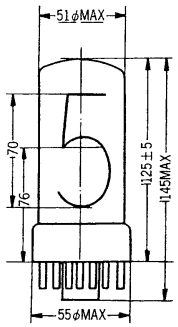
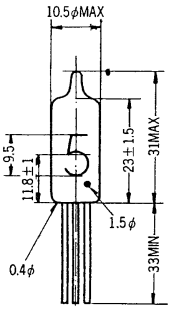
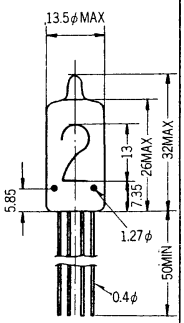
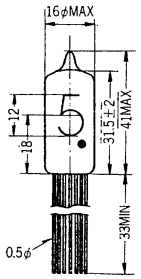
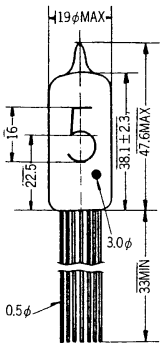
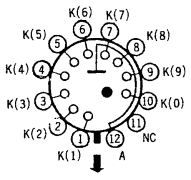
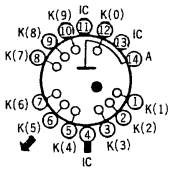
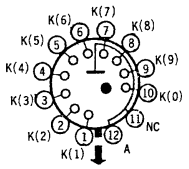
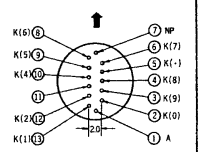
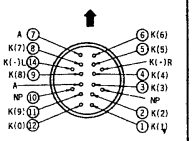
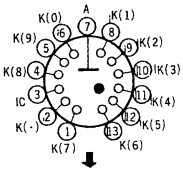
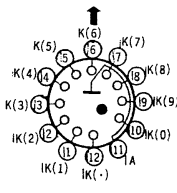
GR-311



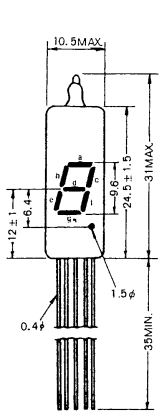
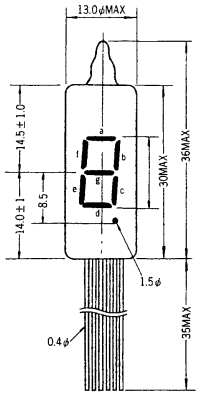
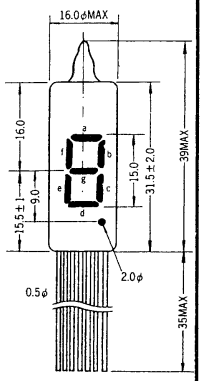
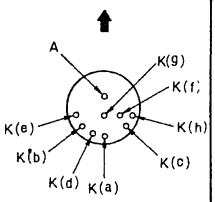
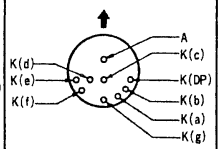
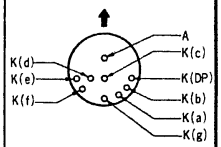
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

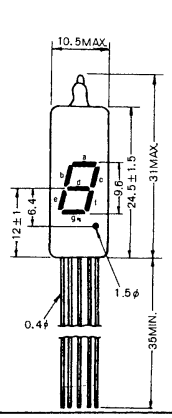
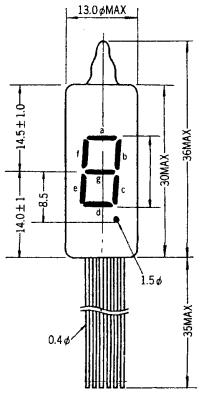
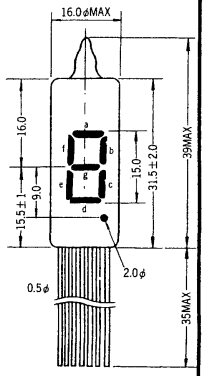
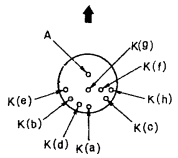
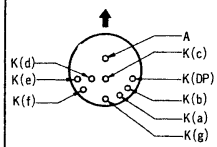
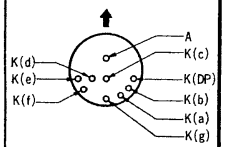
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

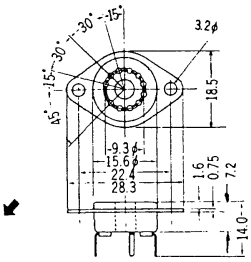
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

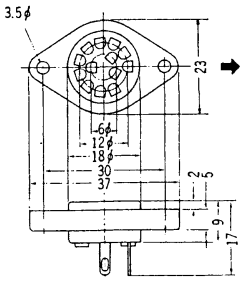
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

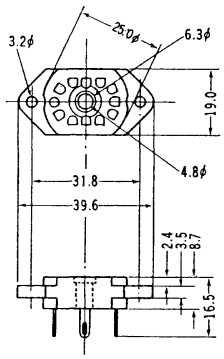
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



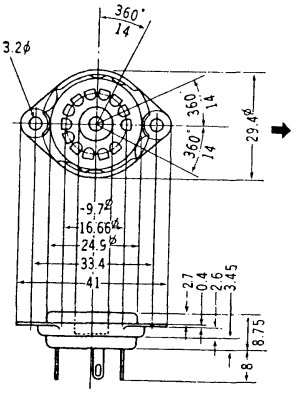
TSM-11P
CD 13



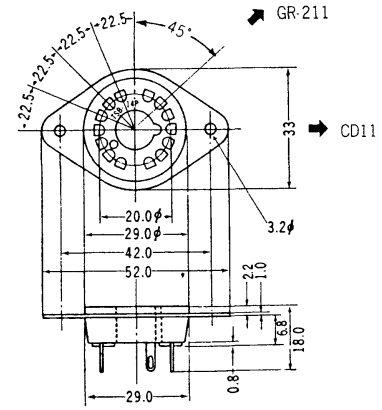
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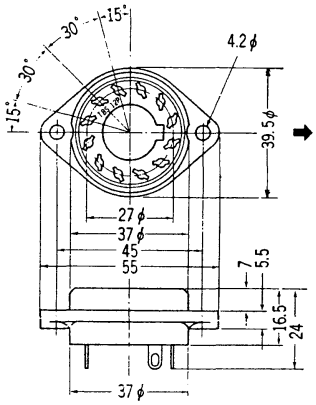
TSR-11P
CD 25, CD 43



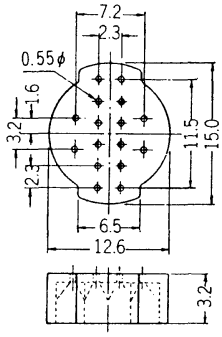
TSB-13P
CD 24



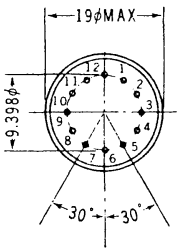
TSB-14P
CD11, GR-211



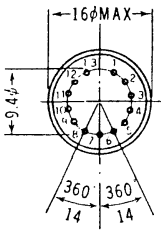
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

RODAN **OKAYA ELECTRIC INDUSTRIES CO., LTD.**
1—8—3, SHIBUYA, SHIBUYA-KU, TOKYO 150, JAPAN

DISTRIBUTED BY:

CAT.NO ED4907-AA-I

RODAN

INDICATOR TUBE

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

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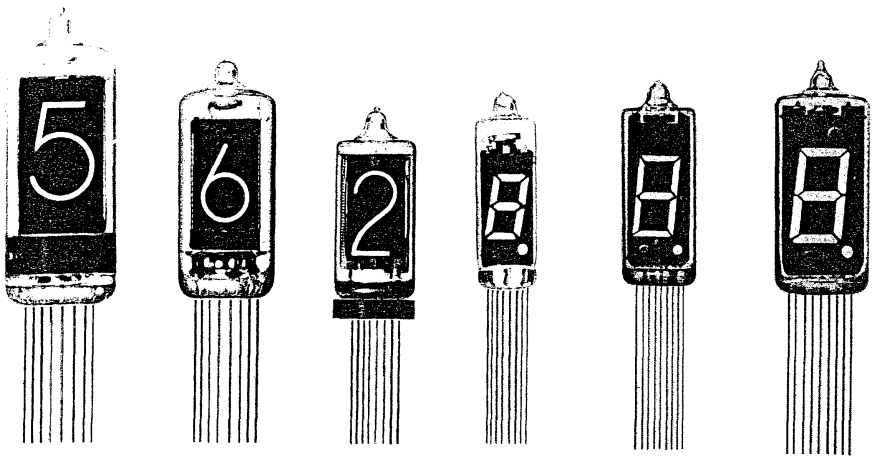
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+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH



CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



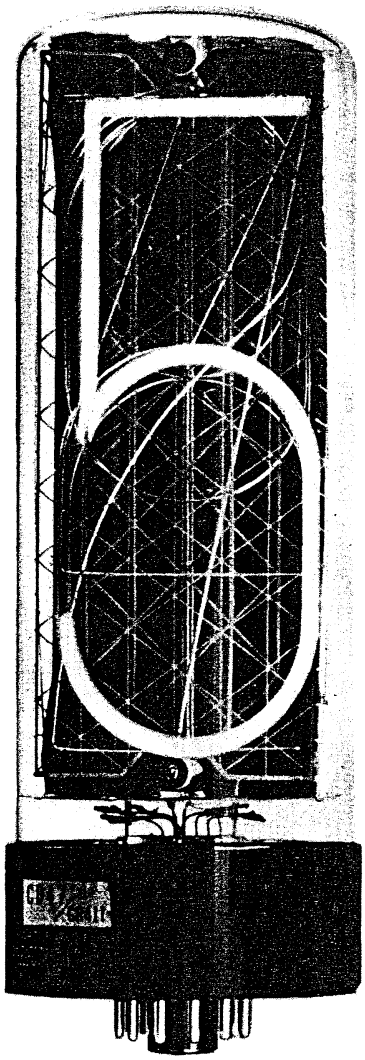
CD13



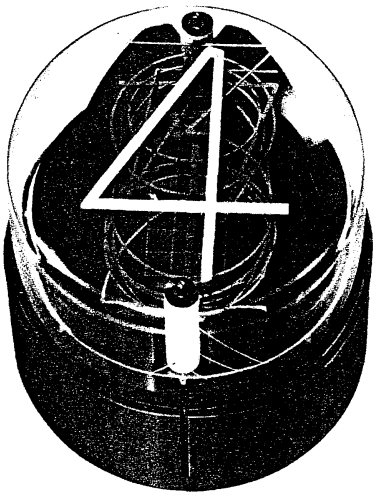
CD12



CD24



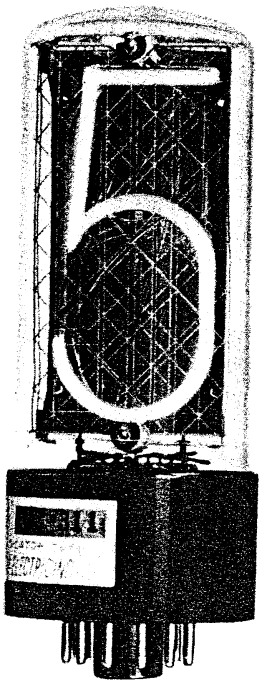
GR-414



CD27



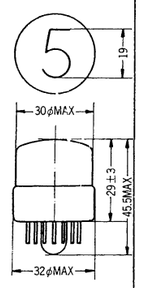
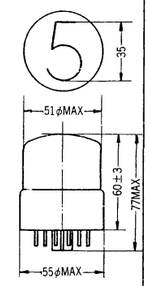
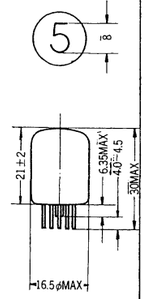
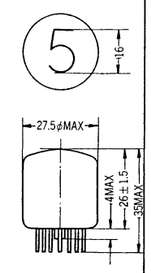
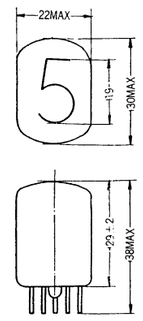
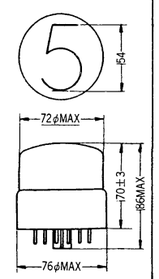
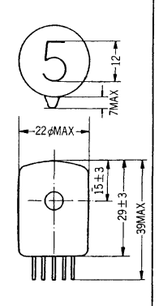
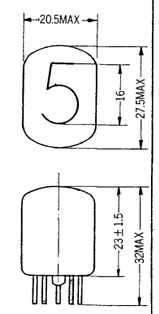
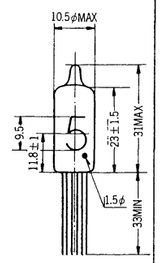
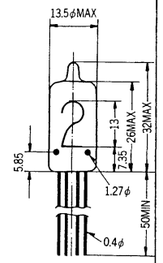
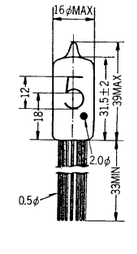
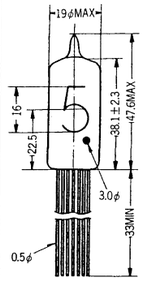
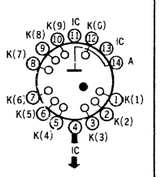
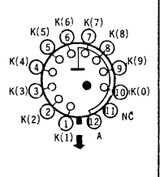
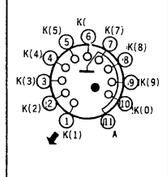
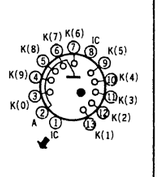
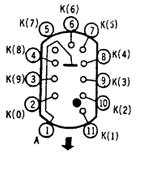
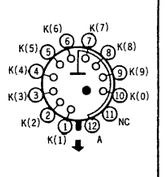
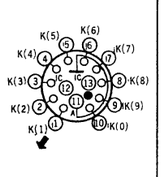
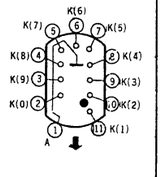
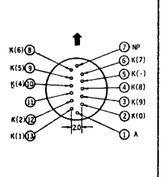
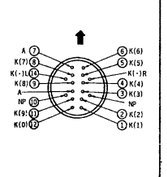
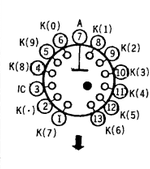
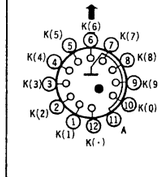
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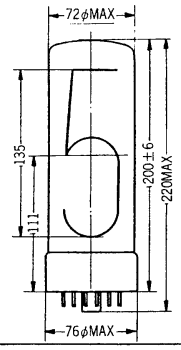
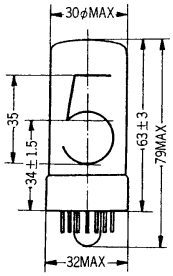
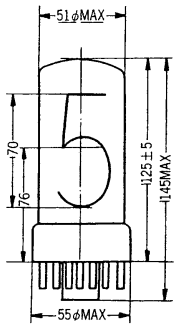
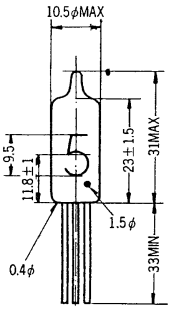
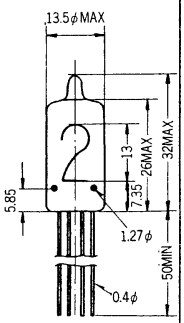
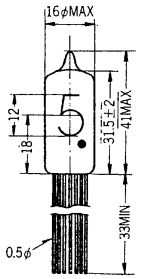
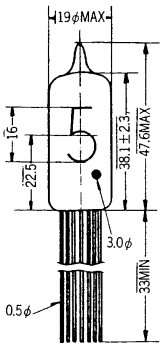
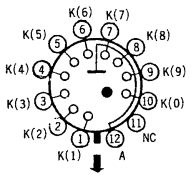
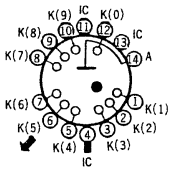
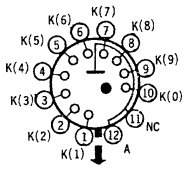
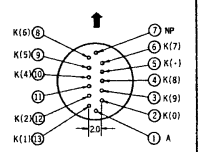
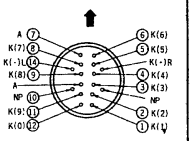
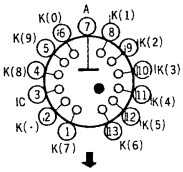
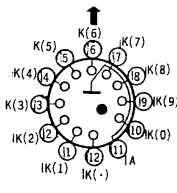
GR-311



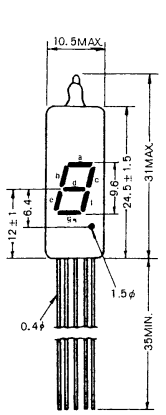
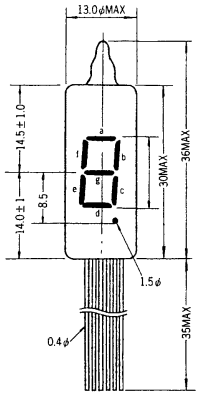
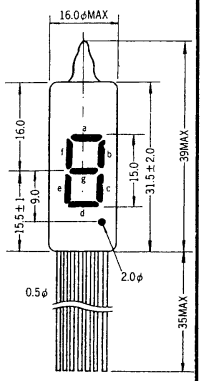
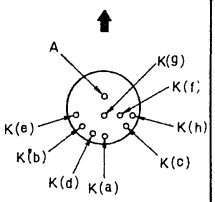
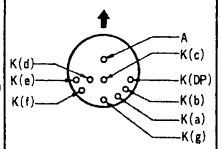
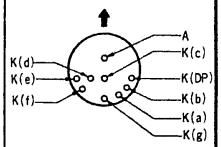
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

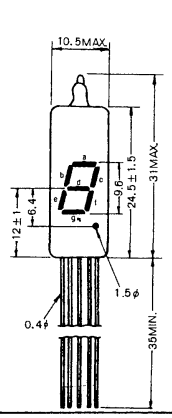
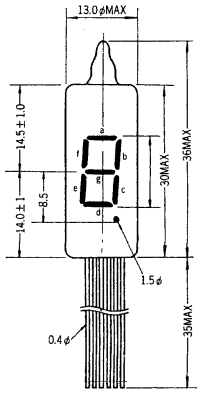
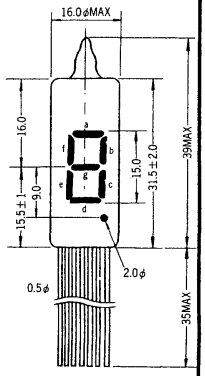
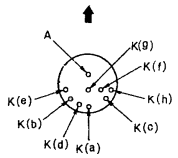
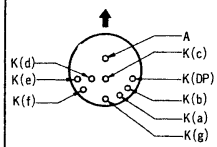
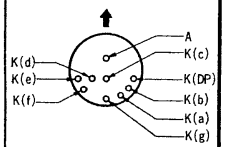
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

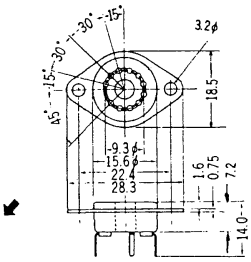
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

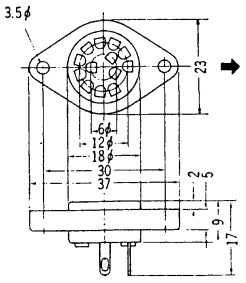
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

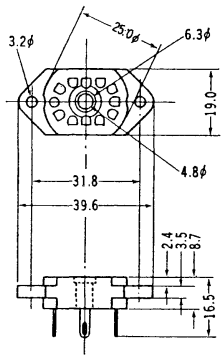
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



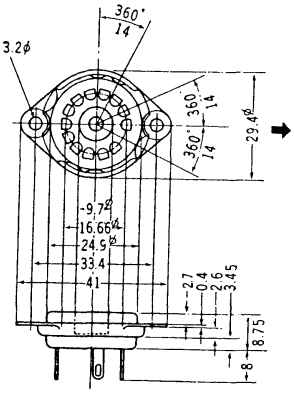
TSM-11P
CD 13



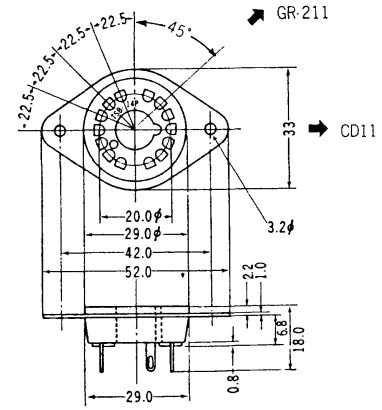
TSM-13P
CD 28



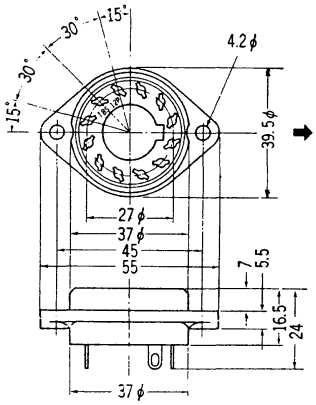
TSR-11P
CD 25, CD 43



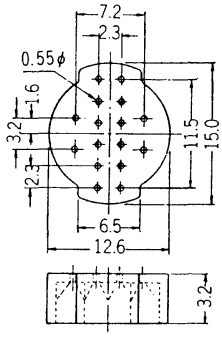
TSB-13P
CD 24



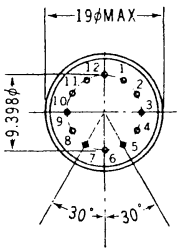
TSB-14P
CD11, GR-211



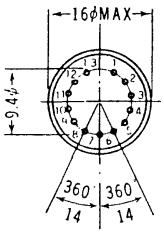
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

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+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

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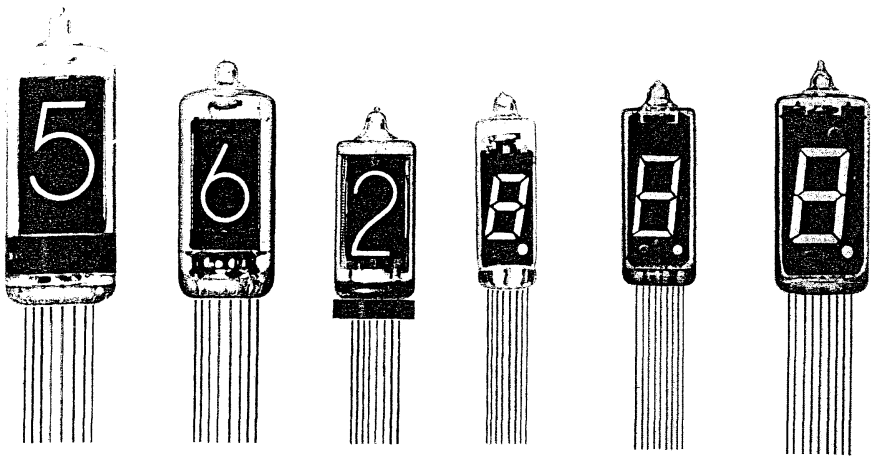
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+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH



CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



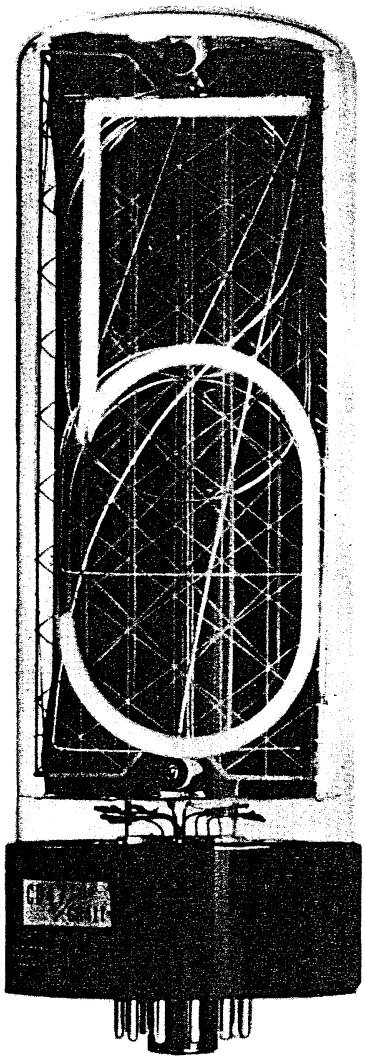
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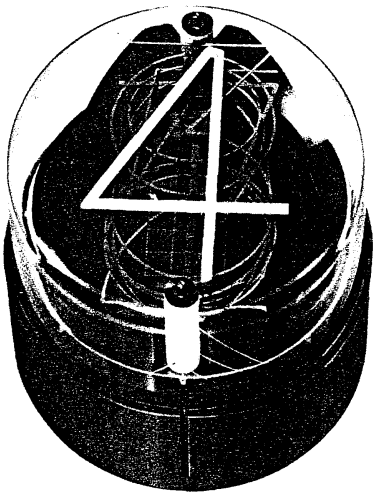
CD12



CD24



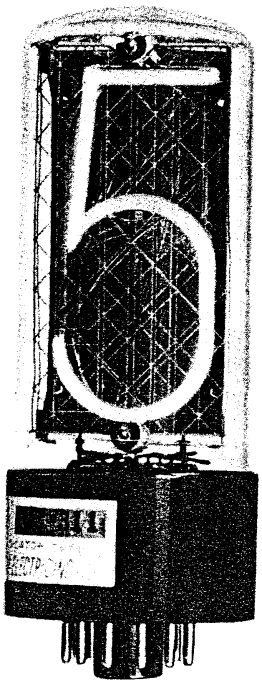
GR-414



CD27



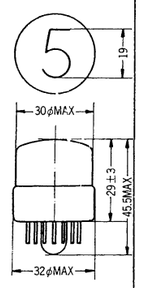
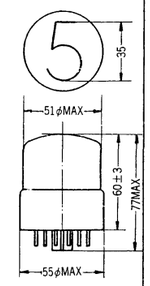
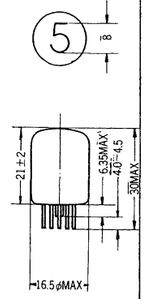
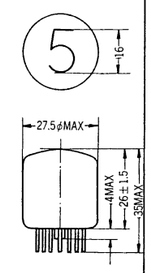
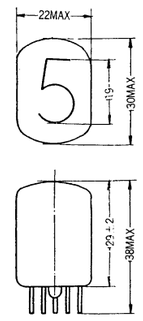
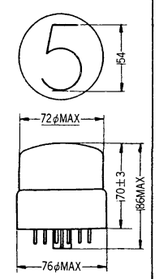
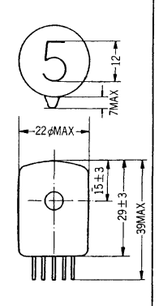
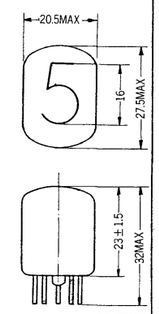
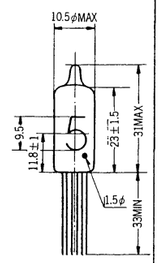
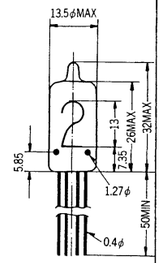
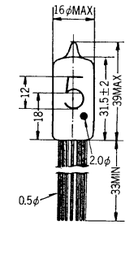
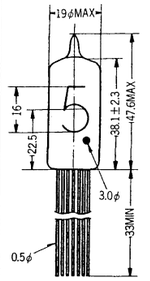
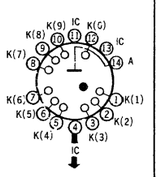
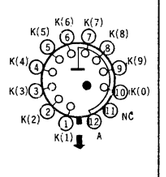
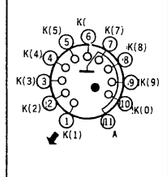
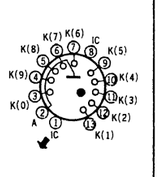
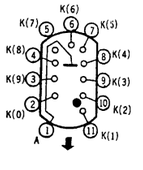
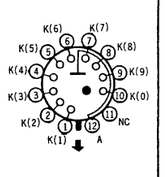
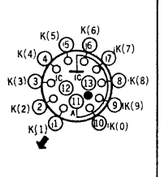
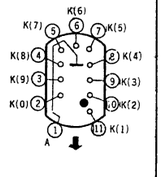
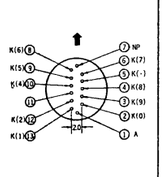
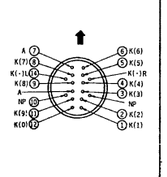
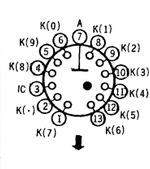
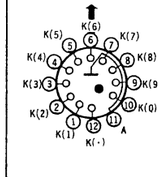
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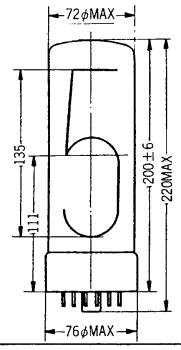
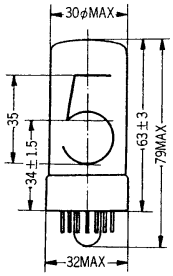
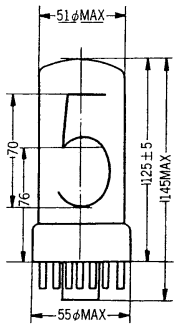
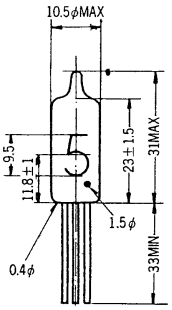
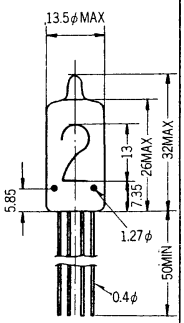
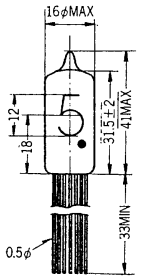
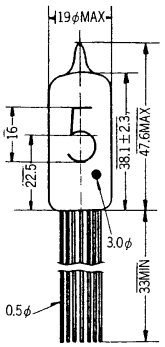
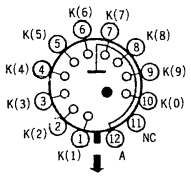
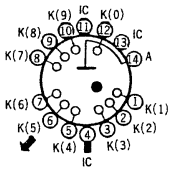
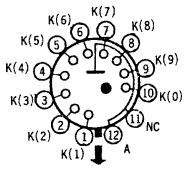
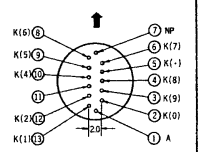
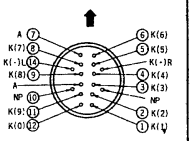
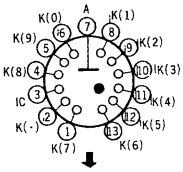
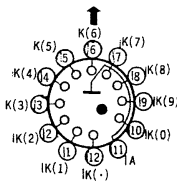
GR-311



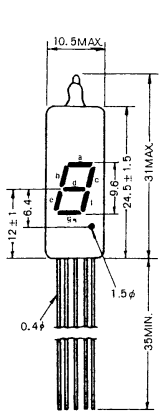
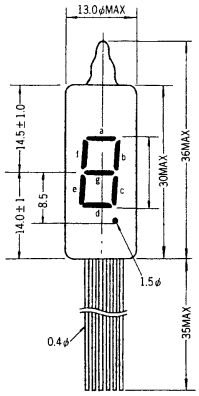
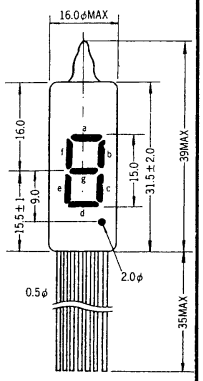
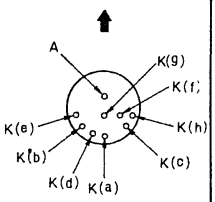
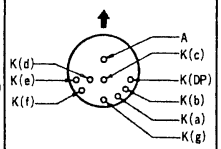
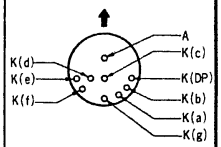
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

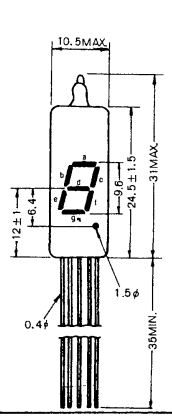
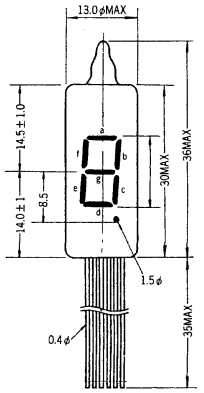
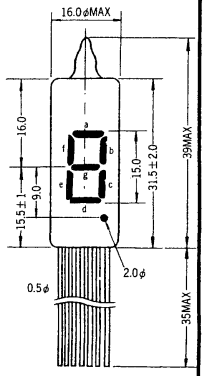
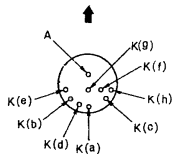
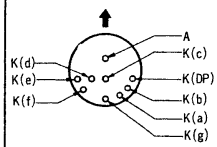
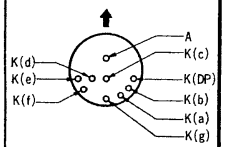
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

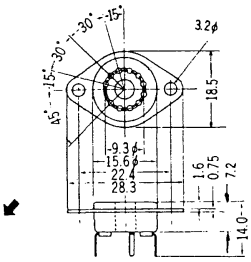
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

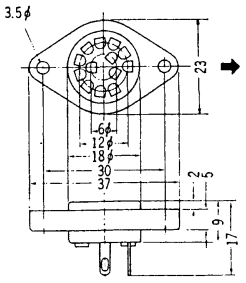
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

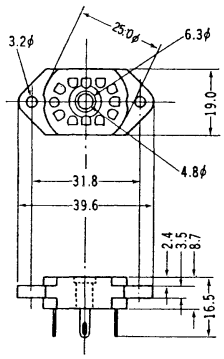
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



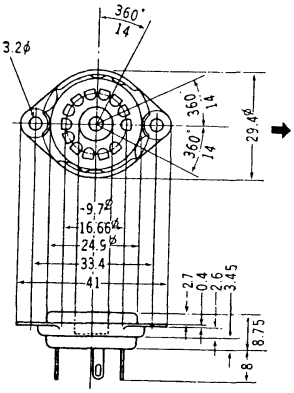
TSM-11P
CD 13



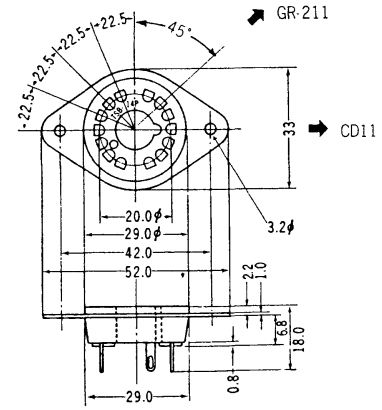
TSM-13P
CD 28



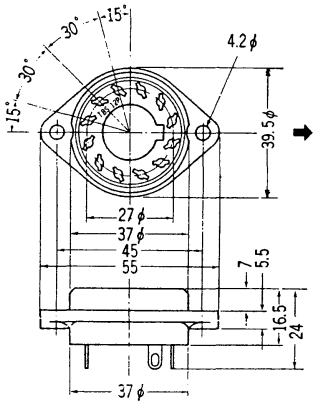
TSR-11P
CD 25, CD 43



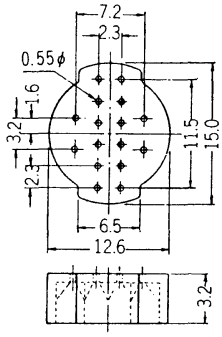
TSB-13P
CD 24



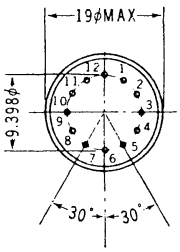
TSB-14P
CD11, GR-211



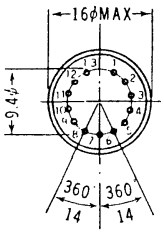
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

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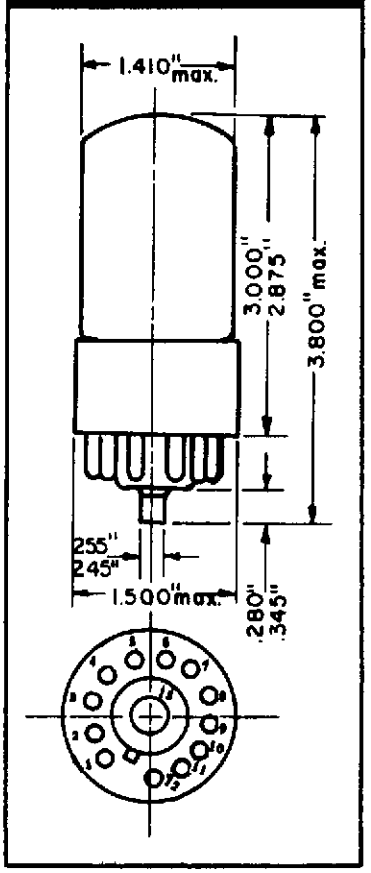
TECHNICAL INFORMATION

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Excellence in Electronics

TYPE CK6476

The CK6476 is a cold cathode gas-filled 4KC medium speed bidirectional ring stepping decade counter tube. This type features direct visual neon glow readout or electrical readout in the form of a voltage from any of the cathode leads. Negligible power dissipation, short resolution time, simple low cost circuitry, and no moving parts make this a very reliable counter device. Some of the many uses for this type include counting, timing, sampling, frequency dividing, coding matrixing, telemetering, and controlling.



MECHANICAL DATA

ENVELOPE: T-11 Glass

BASE: Modified Duo-Decal

TERMINAL CONNECTIONS:

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

MOUNTING POSITION: Any (Visual Readout From Top Of Tube)

ZERO POSITION: Cathode #10 (Aligned with Pin Number 12 ± 10°)

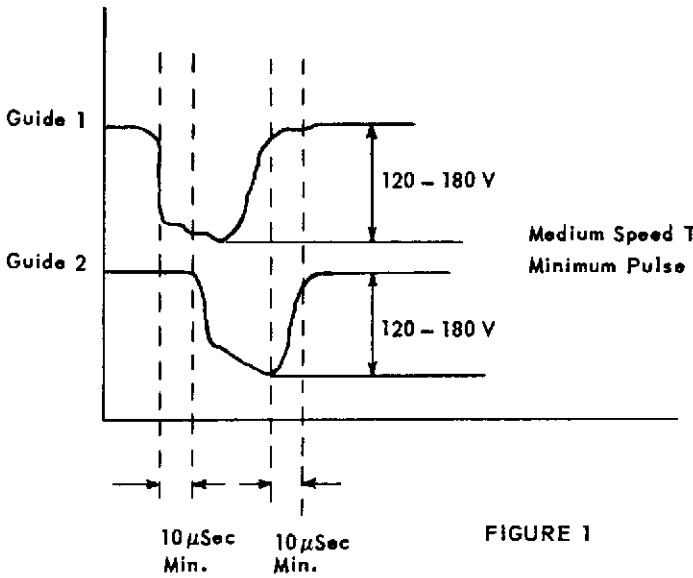
ELECTRICAL DATA (Note 1)

RATINGS – ABSOLUTE MAXIMUM VALUES

Total Anode Current	0.50 Ma
Voltage Between Electrodes (Excluding Anode)	140 volts
Supply Voltage (Anode to Cathode)	350 volts min.
Input Frequency	5000 cps

CHARACTERISTICS AND TYPICAL OPERATION:

DC Supply Voltage	425 volts
Anode Resistor	0.82 megohms
Nominal Tube Drop	195 volts
Cathode Resistor	100 Kohms
Output Voltage (Across Cathode Resistor)	30 volts



Medium Speed Tubes 30–40 μSec Minimum Pulse Widths

FIGURE 1

Printed in U.S.A.

Tentative Data

INDUSTRIAL COMPONENTS DIVISION

55 CHAPEL ST., NEWTON 58, MASS.

APPLICATION NOTES

CONSTRUCTION

The Raytheon decade counter tube consists of thirty (30) thin rod shaped cathodes surrounding a circular anode, all of which are set in a glass envelope employing rare gases at low pressure. The thirty (30) cathodes are identical in construction and are radially spaced concentric to the anode. The cathodes are connected in groups of threes; main cathode, guide 1 cathode and guide 2 cathode. The guide 1's are connected together internally and are brought out to one of the base pins. The guide 2's are similarly connected and brought out to another base pin. The main cathodes may be brought out individually or connected in groups depending on the tube type. Conduction occurs between the anode and the most negative cathode pin causing an orange colored glow at the tip of that cathode. This glow can be viewed from the top of the tube or may be read as a voltage developed across a cathode resistor.

OPERATION

In operation the main cathodes are at a more negative potential than the guide pins. When a negative input pulse (more negative than the cathode) is applied to guide 1 the glow is transferred from the initial cathode (Ko) to guide 1. A similar pulse applied to guide 2 transfers the pulse to guide 2. When the potential of guide 2 returns to a value more positive than the main cathodes the glow transfers to the next closest main cathode. In order to insure reliable operation the phase relationship between pulses should be such that the pulse to guide 2 should overlap the pulse to guide 1. This overlap should have a minimum value of 10 microseconds for medium speed tubes and 2 microseconds for high speed tubes. Typical wave shapes are shown in figure 1 for a medium speed tube.

RESETTING

Usually the counting in a decade counter tube starts from a particular initial main cathode, and after the completion of a count it is desired to return the glow to the initial cathode. This may be accomplished two ways, (1) by opening the negative connection to all main cathodes and guides except the zero cathode, or (2) by pulsing the zero cathode 120-180 volts negative. Either method should cause the zero cathode to become 120 to 180 volts negative with respect to all other cathodes. It may become necessary in certain applications to reset the glow at such a speed so as not to lose count. Therefore, it is recommended that the reset pulse width be the same as the count signal pulse width received from the drivers.

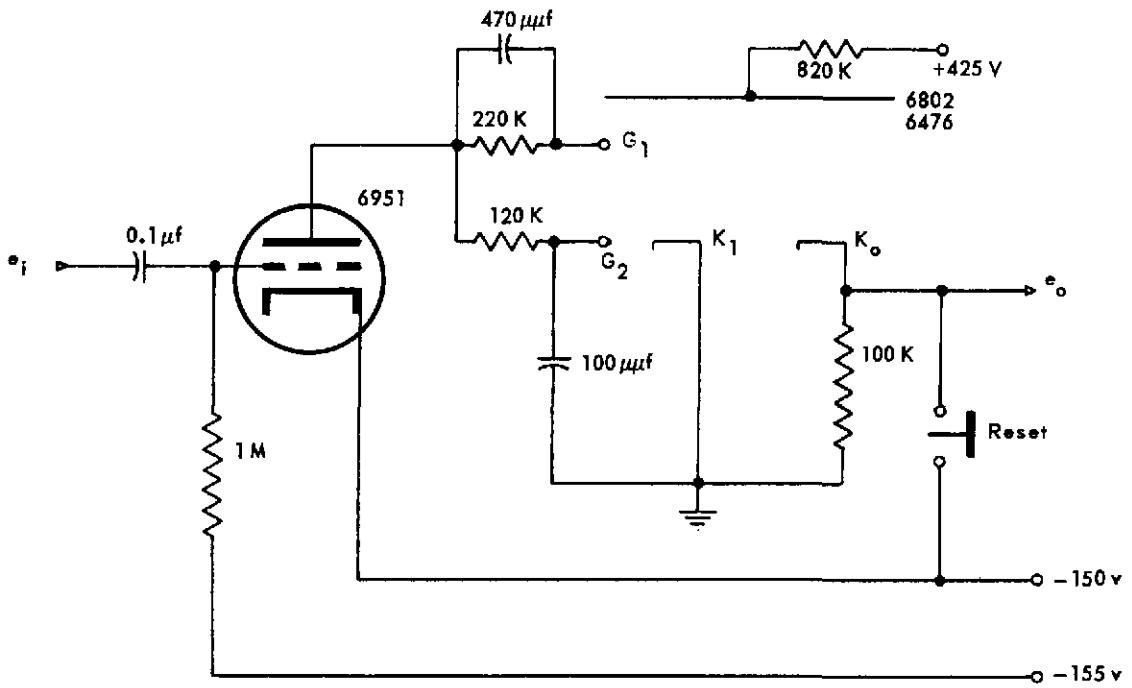
APPLICATION NOTES (Cont'd)

RESETTING (Cont'd)

When several tubes are used in cascade the reset for the first tube should be such that it is made to the zero cathode. The succeeding tubes should be set for the number 9 cathodes in order to account for the pulse passed to these tubes when the preceeding tubes are reset. This procedure will position the glow at all zero cathodes when the reset is complete.

DRIVE CIRCUITS

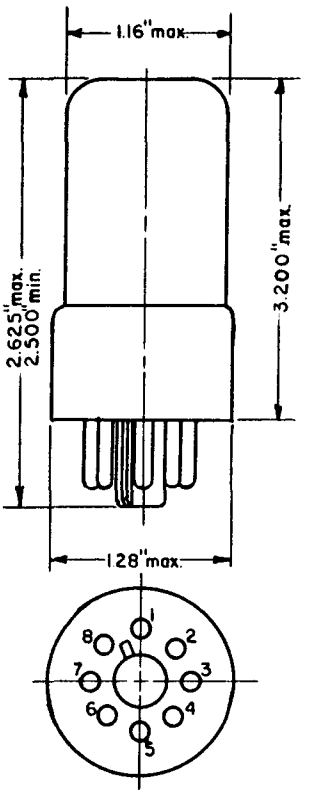
The circuit shown in figure 2 is that of a typical 0-4 KC medium speed drive circuit. The RC integrator network causes a delayed pulse to guide 2 and allows the initial pulse to be applied directly to guide 1. This allows a single negative pulse to step the glow instead of incurring the expense of generating two separate pulses. When the glow steps to the zero cathode (Ko) an output pulse in the form of a negative voltage is developed across the 100K cathode resistor. This pulse may then be used as the input pulse to a succeeding drive circuit. The order in which guide 1 and guide 2 receive the input pulses derermines the direction of rotation of the neon glow.



Excellence in Electronics

TYPE CK6802

The 6802 is a cold cathode gas-filled 4KC medium speed bi-directional ring stepping decade counter tube. This type features direct visual neon glow readout on any of the ten radially spaced cathodes or electrical output in the form of a voltage from cathode numbers 0, 5, 8, and 9. Negligible power dissipation, short resolution time, simple low cost circuitry, and no moving parts make this a very reliable counter device. Some of the many uses for this type include; counting, timing, sampling, frequency dividing, coding, matrixing, telemetering, and controlling.



MECHANICAL DATA

ENVELOPE: T-9 Glass

BASE: Intermediate Shell Octal 8-Pin

TERMINAL CONNECTIONS:

Pin 1 Common Cathodes	Pin 5 Guide 2
Pin 2 Cathode #5	Pin 6 Cathode #9
Pin 3 Guide 1	Pin 7 Cathode #0
Pin 4 Anode	Pin 8 Cathode #8

MOUNTING POSITION: Any (Visual Readout From Top Of Tube)

ZERO POSITION: Cathide #0 (Aligned With Pin #6 ± 10°)

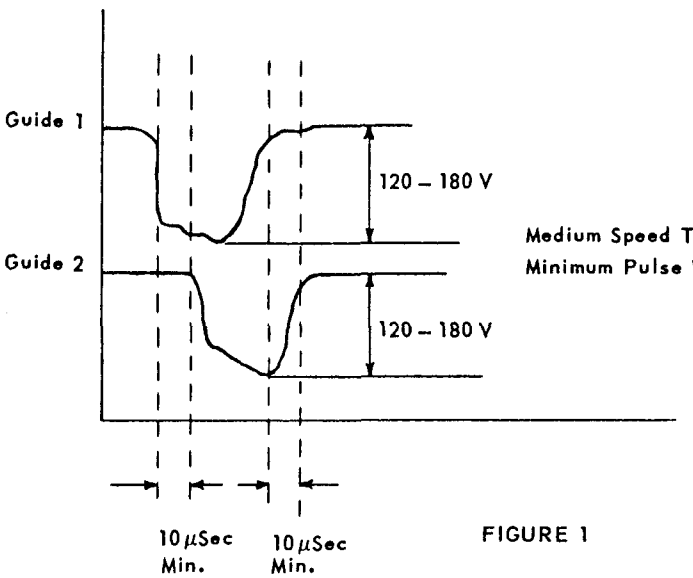
ELECTRICAL DATA (Note 1)

RATINGS-ABSOLUTE MAXIMUM VALUES:

Total Anode Current	0.5 Ma
Voltage Between Electrodes (Excluding Anode)	140 volts
Supply Voltage (Anode to Cathode)	350 volts min.
Input Frequency	5000 cps

CHARACTERISTICS AND TYPICAL OPERATION:

DC Supply Voltage	425 volts
Anode Resistor	0.82 megohms
Nominal Tube Drop	195 volts
Cathode Resistor	100 Kohms
Output Voltage (Across Cathode Resistor)	30 volts



Medium Speed Tubes 30-40 μSec Minimum Pulse Widths

FIGURE 1

Tentative Data

INDUSTRIAL COMPONENTS DIVISION

Printed in U.S.A.

APPLICATIONS NOTES

CONSTRUCTION

The Raytheon decade counter tube consists of thirty (30) thin rod shaped cathodes surrounding a circular anode, all of which are set in a glass envelope employing rare gases at low pressure. The thirty (30) cathodes are identical in construction and are radially spaced concentric to the anode. The cathodes are connected in groups of threes; main cathode, guide 1 cathode and guide 2 cathode. The guide 1's are connected together internally and are brought out to one of the base pins. The guide 2's are similarly connected and brought out to another base pin. The main cathodes may be brought out individually or connected in groups depending on the tube type. Conduction occurs between the anode and the most negative cathode pin causing an orange colored glow at the tip of that cathode. This glow can be viewed from the top of the tube or may be read as a voltage developed across a cathode resistor.

OPERATION

In operation the main cathodes are at a more negative potential than the guide pins. When a negative input pulse (more negative than the cathode) is applied to guide 1 the glow is transferred from the initial cathode (K0) to guide 1. A similar pulse applied to guide 2 transfers the pulse to guide 2. When the potential of guide 2 returns to a value more positive than the main cathodes the glow transfers to the next closest main cathode. In order to insure reliable operation the phase relationship between pulses should be such that the pulse to guide 2 should overlap the pulse to guide 1. This overlap should have a minimum value of 10 microseconds for medium speed tubes and 2 microseconds for high speed tubes. Typical wave shapes are shown in figure 1 for a medium speed tube.

RESETTING

Usually the counting in a decade counter tube starts from a particular initial main cathode, and after the completion of a count it is desired to return the glow to the initial cathode. This may be accomplished two ways, (1) by opening the negative connection to all main cathodes and guides except the zero cathode, or (2) by pulsing the zero cathode 120-180 volts negative. Either method should cause the zero cathode to become 120 to 180 volts negative with respect to all other cathodes. It may become necessary in certain applications to reset the glow at such a speed so as not to lose count. Therefore, it is recommended that the reset pulse width be the same as the count signal pulse width received from the drivers. When several tubes are used in cascade the reset for the first tube should be such that it is made to the zero cathode.

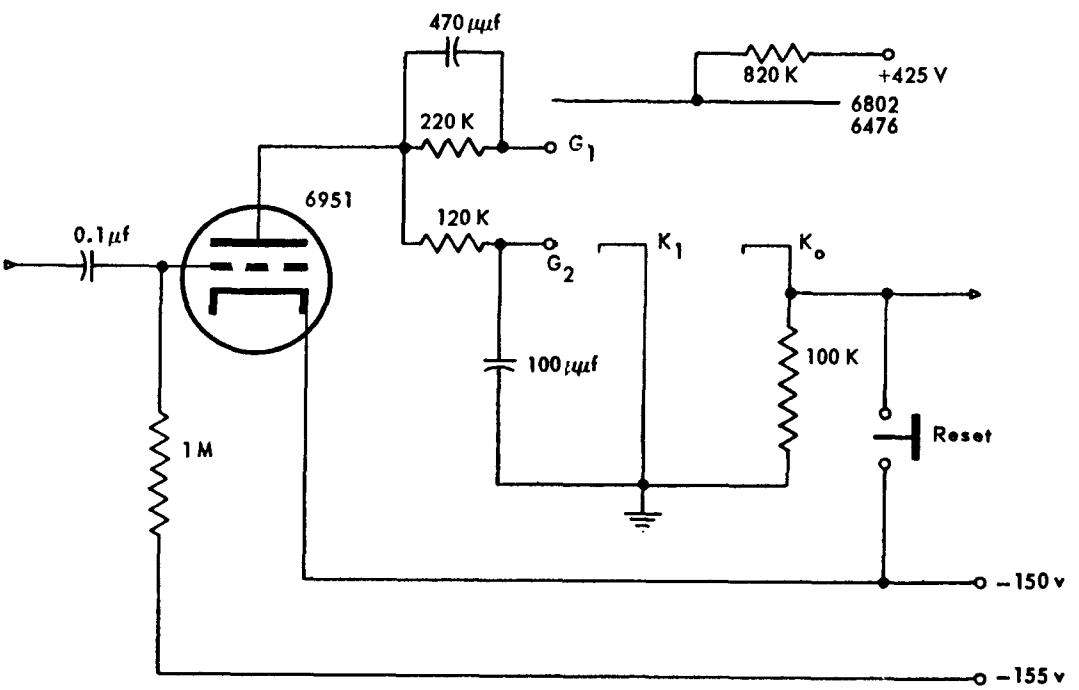
APPLICATION NOTES (Cont'd)

RESETTING (Cont'd)

The succeeding tubes should be set for the number 9 cathodes in order to account for the pulse passed to these tubes when the preceeding tubes are reset. This procedure will position the glow at all zero cathodes when the reset is complete.

DRIVE CIRCUITS

The circuit shown in figure 2 is that of a typical 0-4KC medium speed drive circuit. The RC integrator network causes a delayed pulse to guide 2 and allows the initial pulse to be applied directly to guide 1. This allows a single negative pulse to step the glow instead of incurring the expense of generating two separate pulses. When the glow steps to the zero cathode (Ko) an output pulse in the form of a negative voltage is developed across the 100K cathode resistor. This pulse may then be used as the input pulse to a succeeding drive circuit. The order in which guide 1 and guide 2 receive the input pulses determines the direction of rotation of the neon glow.



RAYTHEON

TECHNICAL INFORMATION SERVICE

Technical Information

CK6909

DECADE COUNTER

The CK6909 is a cold cathode gas-filled 100 KC high speed bi-directional ring stepping decade counter tube. This type features direct visual neon glow readout on any of the ten radially spaced cathodes or electrical output in the form of a voltage from cathode numbers 0, 5, 8, and 9. Negligible power dissipation, short resolution time, simple low cost circuitry, and no moving parts make this a very reliable counter device. Some of the many uses for this type include; counting, timing, sampling, frequency dividing, coding, matrixing, telemetering, and controlling.

ELECTRICAL DATA

RATINGS—ABSOLUTE MAXIMUM VALUES:

Total Anode Current	1.2 Ma
Voltage Between Electrodes (Excluding Anode)	140 volts
Supply Voltage (Anode to Cathode)	400 volts
Input Frequency	100,000 cps

CHARACTERISTICS AND TYPICAL OPERATION:

DC Supply Voltage	450 volts
Anode Resistor	0.27 megohms
Nominal Tube Drop	235 volts
Cathode Resistor	24 Kohms
Output Voltage (Across Cathode Resistor)	15 volts

MECHANICAL DATA

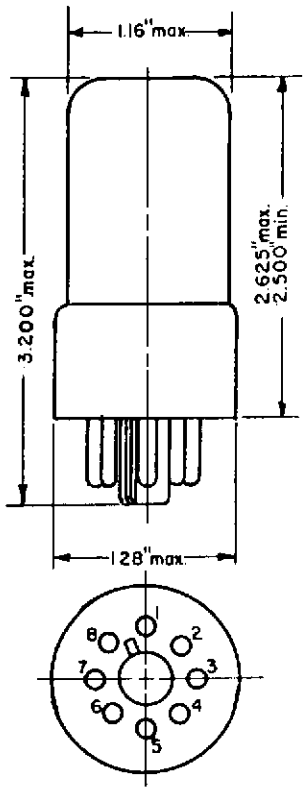
ENVELOPE ..... T-9 Glass

BASE ..... Intermediate Shell Octal 8-Pin

MOUNTING POSITION ..... Any (Visual Readout from Top of Tube)

ZERO POSITION ..... Cathode #0 (Aligned With Pin #6 ± 10°)

PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS:

Pin 1 Common Cathodes
Pin 2 Cathode #5
Pin 3 Guide 1
Pin 4 Anode
Pin 5 Guide 2
Pin 6 Cathode #9
Pin 7 Cathode #0
Pin 8 Cathode #8

APPLICATION NOTES

CONSTRUCTION

The Raytheon decade counter tube consists of thirty (30) thin rod shaped cathodes surrounding a circular anode, all of which are set in a glass envelope employing rare gases at low pressure. The thirty (30) cathodes are identical in construction and are radially spaced concentric to the anode. The cathodes are connected in groups of threes; main cathode, guide 1 cathode and guide 2 cathode. The guide 1's are connected together internally and are brought out to one of the base pins. The guide 2's are similarly connected and brought out to another base pin. The main cathodes may be brought out individually or connected in groups depending on the tube type. Conduction occurs between the anode and the most negative cathode pin causing an orange colored glow at the tip of that cathode. This glow can be viewed from the top of the tube or may be read as a voltage developed across a cathode resistor.

OPERATION

In operation the main cathodes are at a more negative potential than the guide pins. When a negative input pulse (more negative than the cathode) is applied to guide 1 the glow is transferred from the initial cathode (K0) to guide 1. A similar pulse applied to guide 2 transfers the pulse to guide 2. When the potential of guide 2 returns to a value more positive than the main cathodes the glow transfers to the next closest main cathode. In order to insure reliable operation the phase relationship between pulses should be such that the pulse to guide 2 should overlap the pulse to guide 1. This overlap should have a minimum value of 10 microseconds for medium speed tubes and 2 microseconds for high speed tubes. Typical wave shapes are shown in figure 1 for a high speed tube.

RESETTING

Usually the counting in a decade counter tube starts from a particular initial main cathode, and after the completion of a count it is desired to return the glow to the initial cathode. This may be accomplished two ways, (1) by opening the negative connection to all main cathodes and guides except the zero cathode, or (2) by pulsing the zero cathode 120-180 volts negative. Either method should cause the zero cathode to become 120 to 180 volts negative with respect to all other cathodes. It may become necessary in certain applications to reset the glow at such a speed so as not to lose count. Therefore, it is recommended that the reset pulse width be the same as the count signal pulse width received from the drivers. When several tubes are used in cascade the reset for the first tube should be such that it is made to the zero cathode.

APPLICATION NOTES (Cont'd.)

RESETTING (Cont'd)

The succeeding tubes should be set for the number 9 cathodes in order to account for the pulse passed to these tubes when the preceeding tubes are reset. This procedure will position the glow at all zero cathodes when the reset is complete.

DRIVE CIRCUITS

The circuit shown in figure 2 is that of a typical 0-30 KC medium speed drive circuit. The RC integrator network causes a delayed pulse to guide 2 and allows the initial pulse to be applied directly to guide 1. This allows a single negative pulse to step the glow instead of incurring the expense of generating two separate pulses. When the glow steps to the zero cathode (Ko) an output pulse in the form of a negative voltage is developed across the 100K cathode resistor. This pulse may then be used as the input pulse to a succeeding drive circuit. The order in which guide 1 and guide 2 receive the input pulses determines the direction of rotation of the neon glow.

Figure 3 is that of a typical 0-100 Kc high speed drive circuit. The sinewave input is fed directly to one side of the 5814 amplifier tube and hence to the 1st guide electrode. The other guide electrode is fed from the same input waveform but it is first passed through a phase changing network. This is an active filter using one section of another 5814. The tube provides a 180° phase shift which is increased to 270° by the small 10 uuf capacity. This waveform then mixes with the signal input to provide a resultant sinewave of the same fundamental frequency as the input but with a phase lag. This lag is sufficient to permit consistent operation of the counter tube.

DECADE COUNTER

FIGURE 1

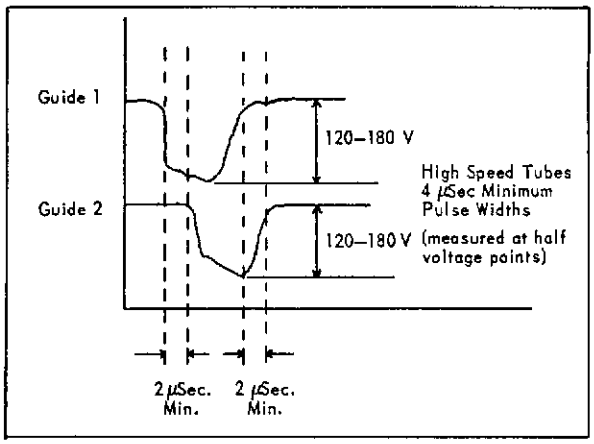


FIGURE 2

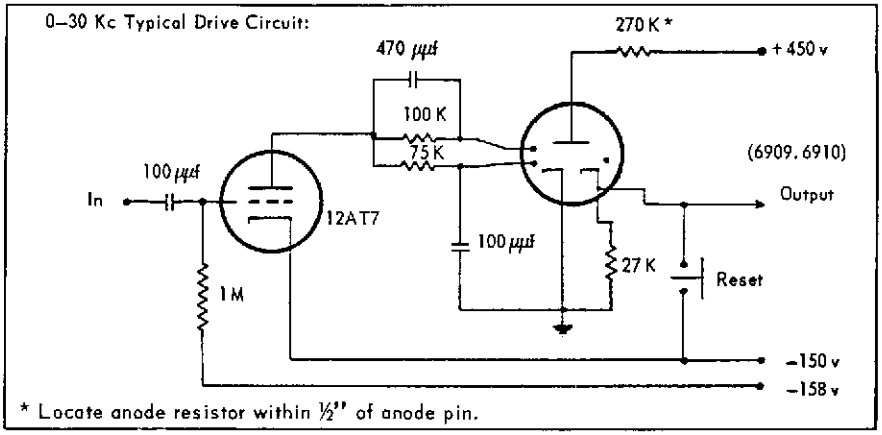
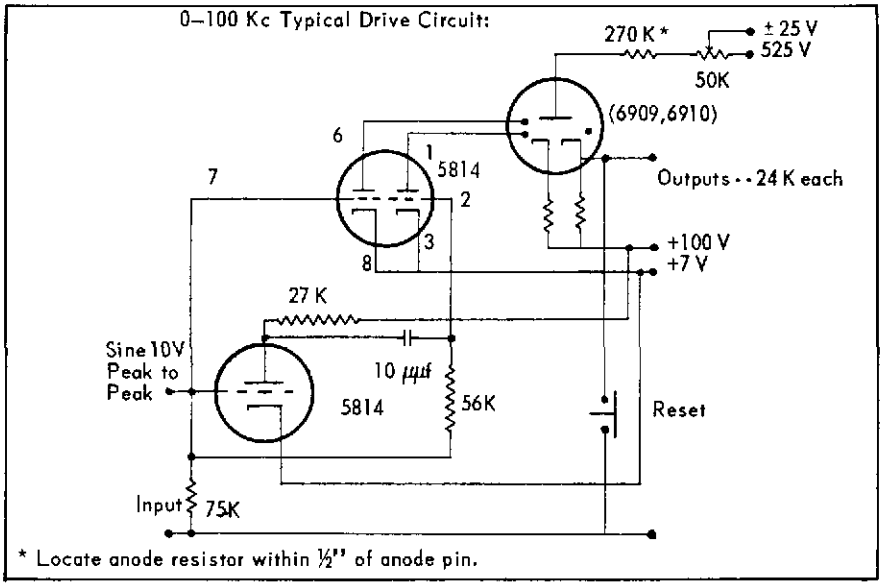


FIGURE 3



RAYTHEON

TECHNICAL INFORMATION SERVICE

Technical Information

CK6910

DECADE COUNTER

The CK6910 is a cold cathode gas-filled 100 KC high speed bidirectional ring stepping decade counter tube. This type features direct visual neon glow readout or electrical readout in the form of a voltage from any of the cathode leads. Negligible power dissipation, short resolution time, simple low cost circuitry, and no moving parts make this a very reliable counter device. Some of the many uses for this type include counting, timing, sampling, frequency dividing, coding, matrixing, telemetering, and controlling.

ELECTRICAL DATA

RATINGS—ABSOLUTE MAXIMUM VALUES:

Total Anode Current	1.2 Ma
Voltage Between Electrodes (Excluding Anode)	140 volts
Supply Voltage (Anode to Cathode)	400 volts
Input Frequency	100,000 cps

CHARACTERISTICS AND TYPICAL OPERATION:

DC Supply Voltage	450 volts
Anode Resistor	0.27 megohms
Nominal Tube Drop	235 volts
Cathode Resistor	24 K ohms
Output Voltage (Across Cathode Resistor)	15 volts

MECHANICAL DATA

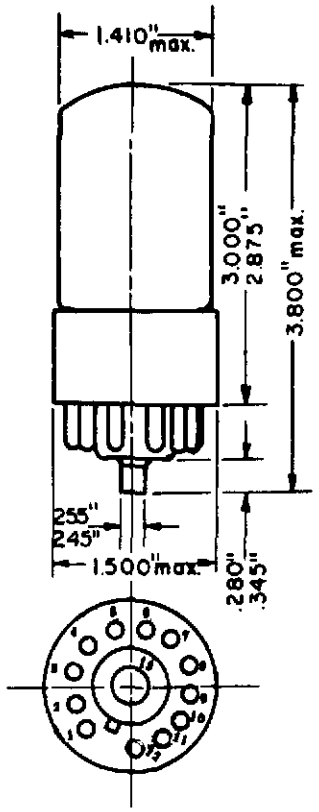
ENVELOPE:..... T-11 Glass

BASE:..... Modified Duo-Decal

MOUNTING POSITION..... Any
(Visual Readout From Top Of Tube)

ZERO POSITION..... Cathode #10
(Aligned with Pin Number 12 ± 10°)

PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS:

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

APPLICATION NOTES

CONSTRUCTION

The Raytheon decade counter tube consists of thirty (30) thin rod shaped cathodes surrounding a circular anode, all of which are set in a glass envelope employing rare gases at low pressure. The thirty (30) cathodes are identical in construction and are radially spaced concentric to the anode. The cathodes are connected in groups of threes; main cathode, guide 1 cathode and guide 2 cathode. The guide 1's are connected together internally and are brought out to one of the base pins. The guide 2's are similarly connected and brought out to another base pin. The main cathodes may be brought out individually or connected in groups depending on the tube type. Conduction occurs between the anode and the most negative cathode pin causing an orange colored glow at the tip of that cathode. This glow can be viewed from the top of the tube or may be read as a voltage developed across a cathode resistor.

OPERATION

In operation the main cathodes are at a more negative potential than the guide pins. When a negative input pulse (more negative than the cathode) is applied to guide 1 the glow is transferred from the initial cathode (Ko) to guide 1. A similar pulse applied to guide 2 transfers the pulse to guide 2. When the potential of guide 2 returns to a value more positive than the main cathodes the glow transfers to the next closest main cathode. In order to insure reliable operation the phase relationship between pulses should be such that the pulse to guide 2 should overlap the pulse to guide 1. This overlap should have a minimum value of 10 microseconds for medium speed tubes and 2 microseconds for high speed tubes. Typical wave shapes are shown in figure 1 for a high speed tube.

RESETTING

Usually the counting in a decade counter tube starts from a particular initial main cathode, and after the completion of a count it is desired to return the glow to the initial cathode. This may be accomplished two ways, (1) by opening the negative connection to all main cathodes and guides except the zero cathode, or (2) by pulsing the zero cathode 120-180 volts negative. Either method should cause the zero cathode to become 120 to 180 volts negative with respect to all other cathodes. It may become necessary in certain applications to reset the glow at such a speed so as not to lose count. Therefore, it is recommended that the reset pulse width be the same as the count signal pulse width received from the drivers.

APPLICATION NOTES (Cont'd.)

RESETTING (Cont'd)

When several tubes are used in cascade the reset for the first tube should be such that it is made to the zero cathode. The succeeding tubes should be set for the number 9 cathodes in order to account for the pulse passed to these tubes when the preceeding tubes are reset. This procedure will position the glow at all zero cathodes when the reset is complete.

DRIVE CIRCUITS

The circuit shown in figure 2 is that of a typical 0-30 KC medium speed drive circuit. The RC integrator network causes a delayed pulse to guide 2 and allows the initial pulse to be applied directly to guide 1. This allows a single negative pulse to step the glow instead of incurring the expense of generating two separate pulses. When the glow steps to the zero cathode (Ko) an output pulse in the form of a negative voltage is developed across the 100K cathode resistor. This pulse may then be used as the input pulse to a succeeding drive circuit. The order in which guide 1 and guide 2 receive the input pulses determines the direction of rotation of the neon glow.

Figure 3 is that of a typical 0-100 Kc high speed drive circuit. The sinewave input is fed directly to one side of the 5814 amplifier tube and hence to the 1st guide electrode. The other guide electrode is fed from the same input waveform but it is first passed through a phase changing network. This is an active filter using one section of another 5814. The tube provides a 180^{o} phase shift which is increased to 270^{o} by the small 10 uuf capacity. This waveform then mixes with the signal input to provide a resultant sinewave of the same fundamental frequency as the input but with a phase lag. This lag is sufficient to permit consistent operation of the counter tube.

DECADE COUNTER

FIGURE 1

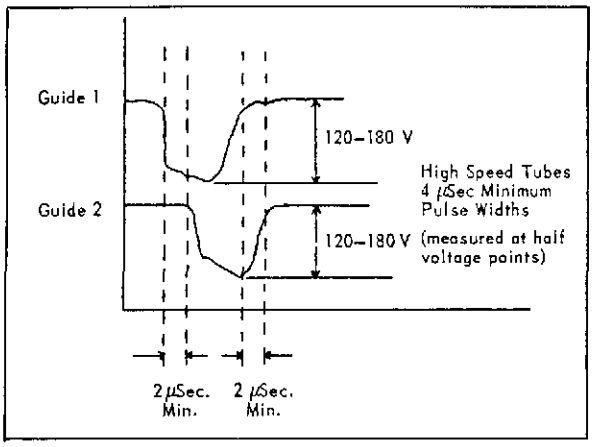


FIGURE 2

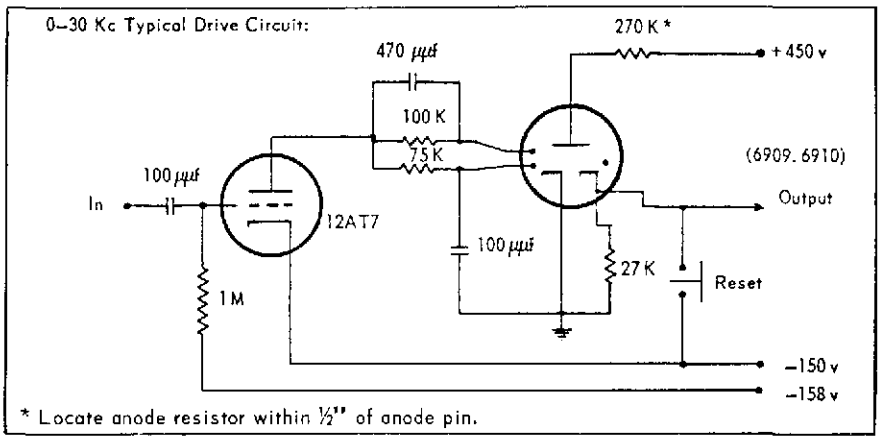
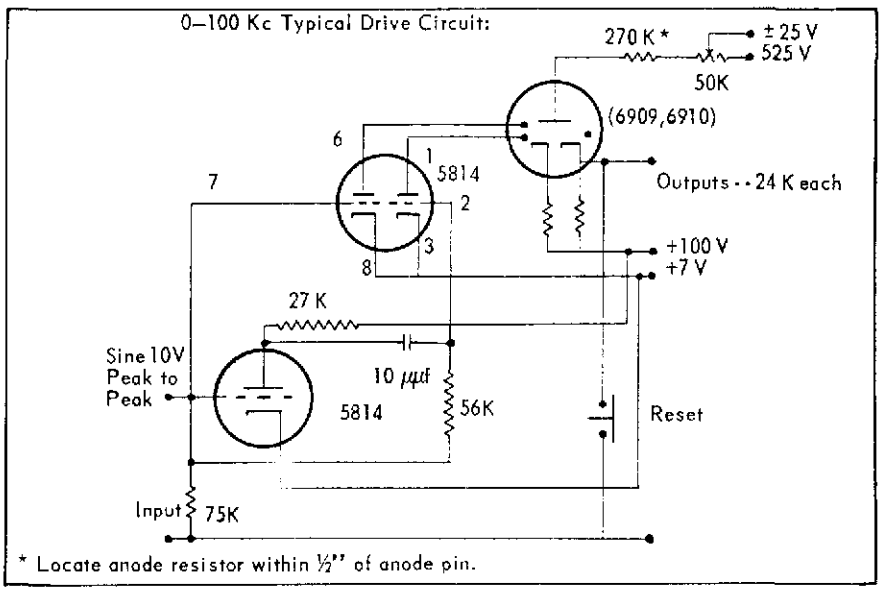


FIGURE 3



RAYTHEON

TECHNICAL INFORMATION SERVICE

Technical Information

CK 7978

DECADE COUNTER

The CK7978 is a cold cathode gas-filled 5 KC medium speed bi-directional ring stepping decade counter tube. This type features direct visual neon glow readout or electrical readout in the form of a voltage from any of the cathode leads. Negligible power dissipation, short resolution time, simple low cost circuitry, and no moving parts make this a very reliable counter device. Some of the many uses for this type include counting, timing, sampling, frequency dividing, coding, matrixing, telemetering, and controlling.

ELECTRICAL DATA

RATINGS—ABSOLUTE MAXIMUM VALUES:

Total Anode Current Maximum	0.60	Ma
Total Anode Current Minimum	0.30	Ma
Voltage Between Electrodes (Excluding Anode)	200	volts
Supply Voltage (Anode to Cathode)—Minimum	350	volts
Minimum Transfer Voltage	35	volts
Input Frequency	5000	cps

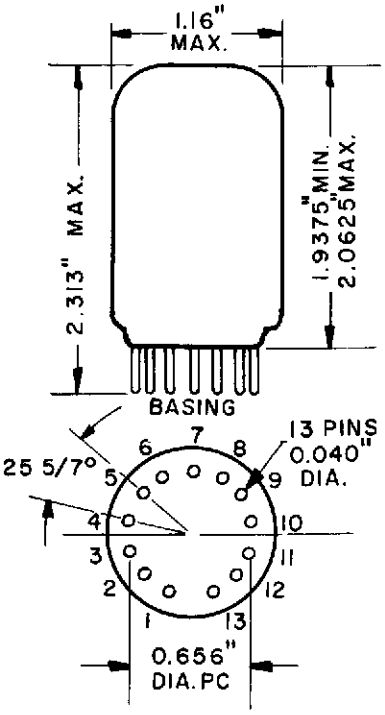
CHARACTERISTICS AND TYPICAL OPERATION:

DC Supply Voltage	425	volts
Anode Resistor	0.68	megohms
Nominal Tube Drop	190	volts
Guide Bias—Minimum	35	volts
Cathode Resistor	100	K ohms
Output Voltage (Across Cathode Resistor)	30	volts
Double Pulse Drive Amplitude—Minimum	−75	volts
Double Pulse Drive Duration—Minimum	60	μsec.
Double Pulse Drive Overlap	10	μsec.
Reset Pulse Width—Minimum	50	μsec.
Forced Reset Pulse Amplitude—Minimum	−120	volts

MECHANICAL DATA

ENVELOPE.....T-9 Glass
BASE .....13 Pin
MOUNTING POSITION.....Any
(Visual Readout From top of Tube)
ZERO POSITION ..... Cathode #0 (Aligned with Pin Number 8 ±10°)

PHYSICAL DIMENSIONS



TERMINAL CONNECTIONS

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

Printed in U.S.A.

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

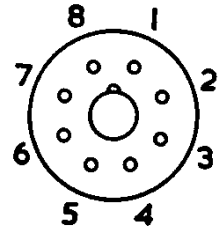
GC 10/4B
(CV.1739)

Bi-directional 10-way Computing Tube with Intermediate Outputs

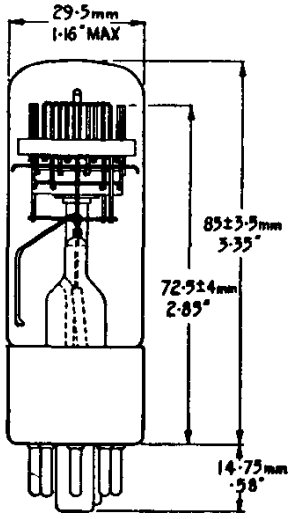
Mechanical Data

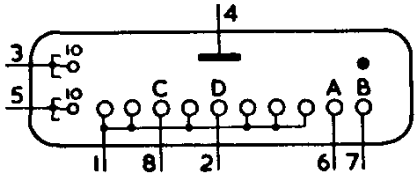
Mounting position	Any. For visual indication the tube is viewed through the dome of the bulb.
Alignment	Cathode " B " is aligned with pin No. 6 to an accuracy of ± 12°.
Weight	43 g (nominal).
Escutcheons	N.78211 Bakelite, or N.79368 Brass.
Base	I.O.

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 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.**

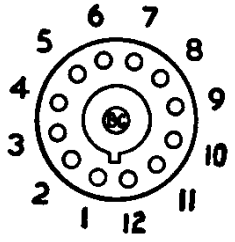
GS10C/S
(CV.2325)

Bi-directional 10-way Selector Tube

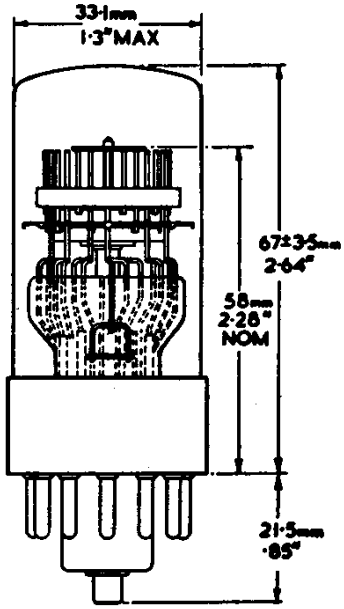
Mechanical Data

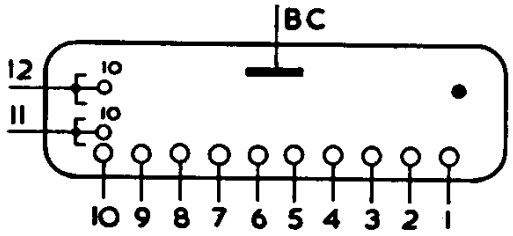
Mounting position	Any. For visual indication the tube is viewed through the dome of the bulb.
Alignment	Cathode No. 1 is aligned with pin No. 11 to an accuracy of ± 12°.
Weight	53 g. (nominal).
Escutcheon	N.80977
Base	Duodecal with bottom cap.

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





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

GC10D (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	$-\left(144\ \text{V} \begin{smallmatrix}+\ 50\ \text{V}\\ -\ 12\ \text{V}\end{smallmatrix}\right)$
**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.

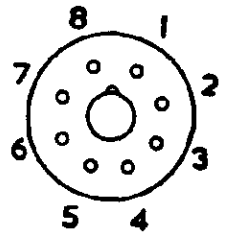
GC 10 D
(CV.5143)

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

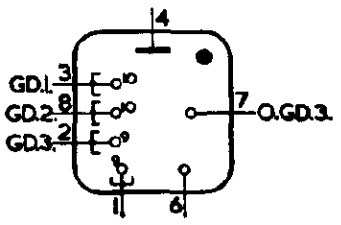
Mechanical Data

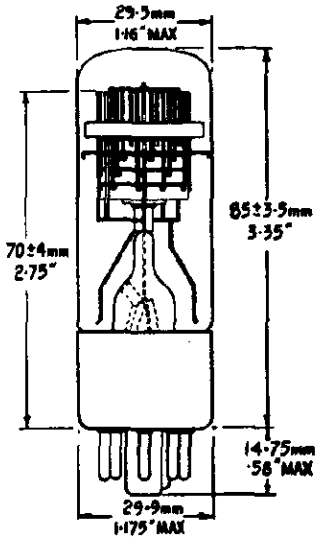
Mounting position	Any. For visual indication, the tube is viewed through the dome of the bulb.
Alignment	Cathode " O " is aligned with pin No. 6 to an accuracy of ± 12°.
Weight	44 g (nominal).
Escutcheons	N.78211 Bakelite *or* N.79368 Brass
Base	I.O.

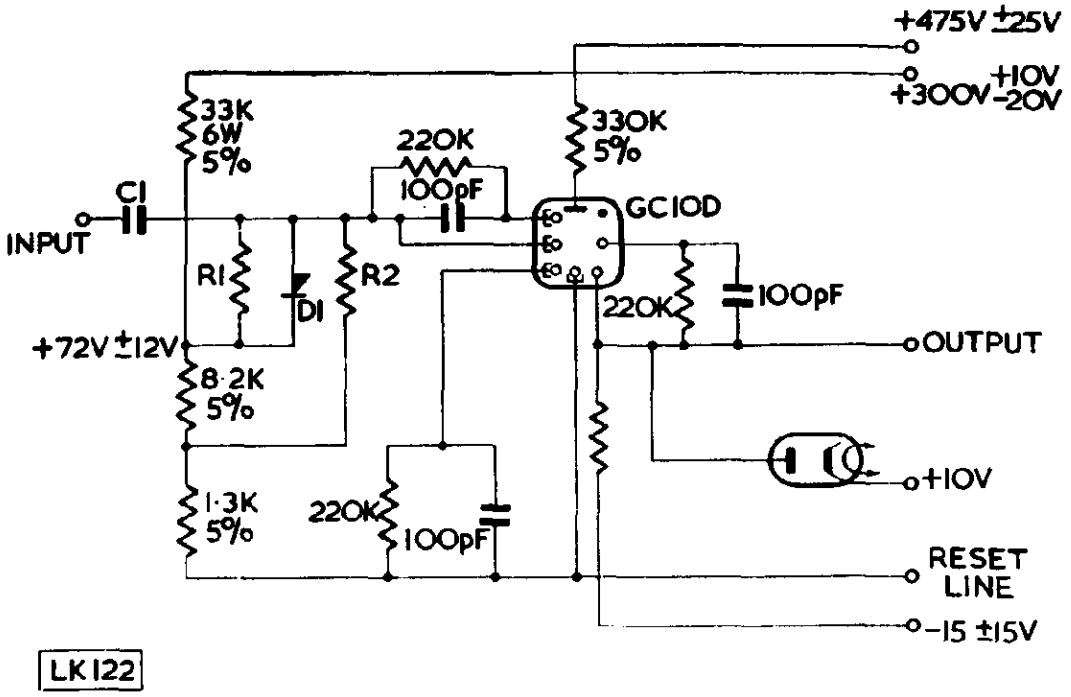
Base Connections
(underside view)



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

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

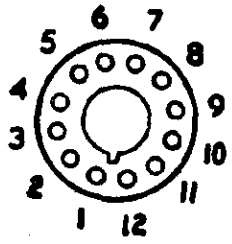
(CV5291)

10-way Register Or Indicator Tube

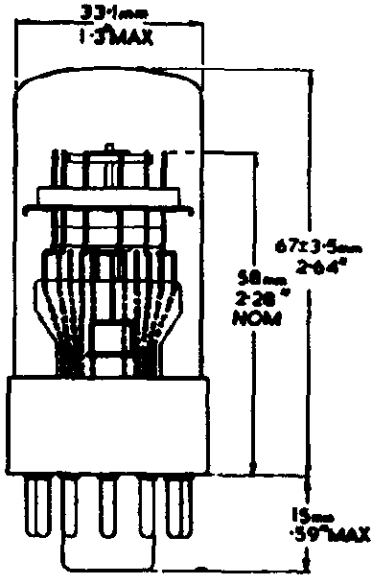
Mechanical Data

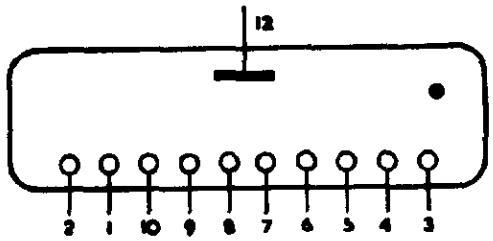
Mounting position	Any. The tube is viewed through the dome of the bulb.
Alignment	Cathode No. 2 is aligned with pin No. 11 to an accuracy of ± 12°.
Weight	50 g.
Escutcheon	N.80977.
Base	Duodecal.

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 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

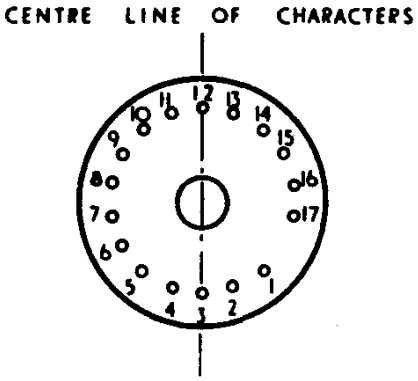
GR10K (CV.5842)

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

Mechanical Data

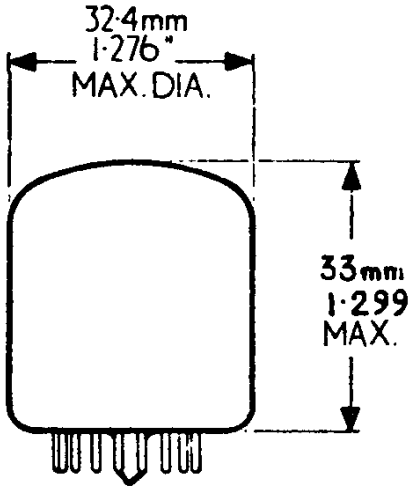
Mounting position	Any
Base	B17A
Socket	B17A

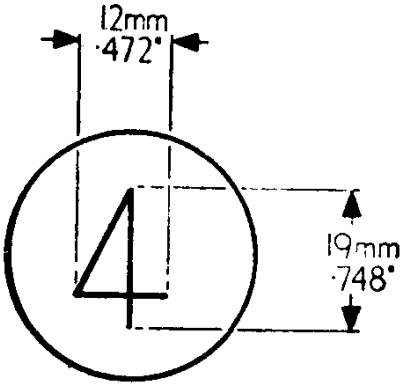
Base Connections
(underside view)

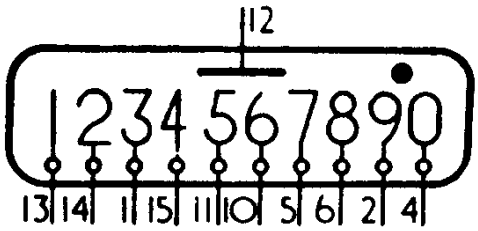


Pin 1 Cathode 3
2 Cathode 9
4 Cathode 0
5 Cathode 7
6 Cathode 8
10 Cathode 6
11 Cathode 5
12 Anode
13 Cathode 1
14 Cathode 2
15 Cathode 4

Note: All other pins are to be left unconnected.

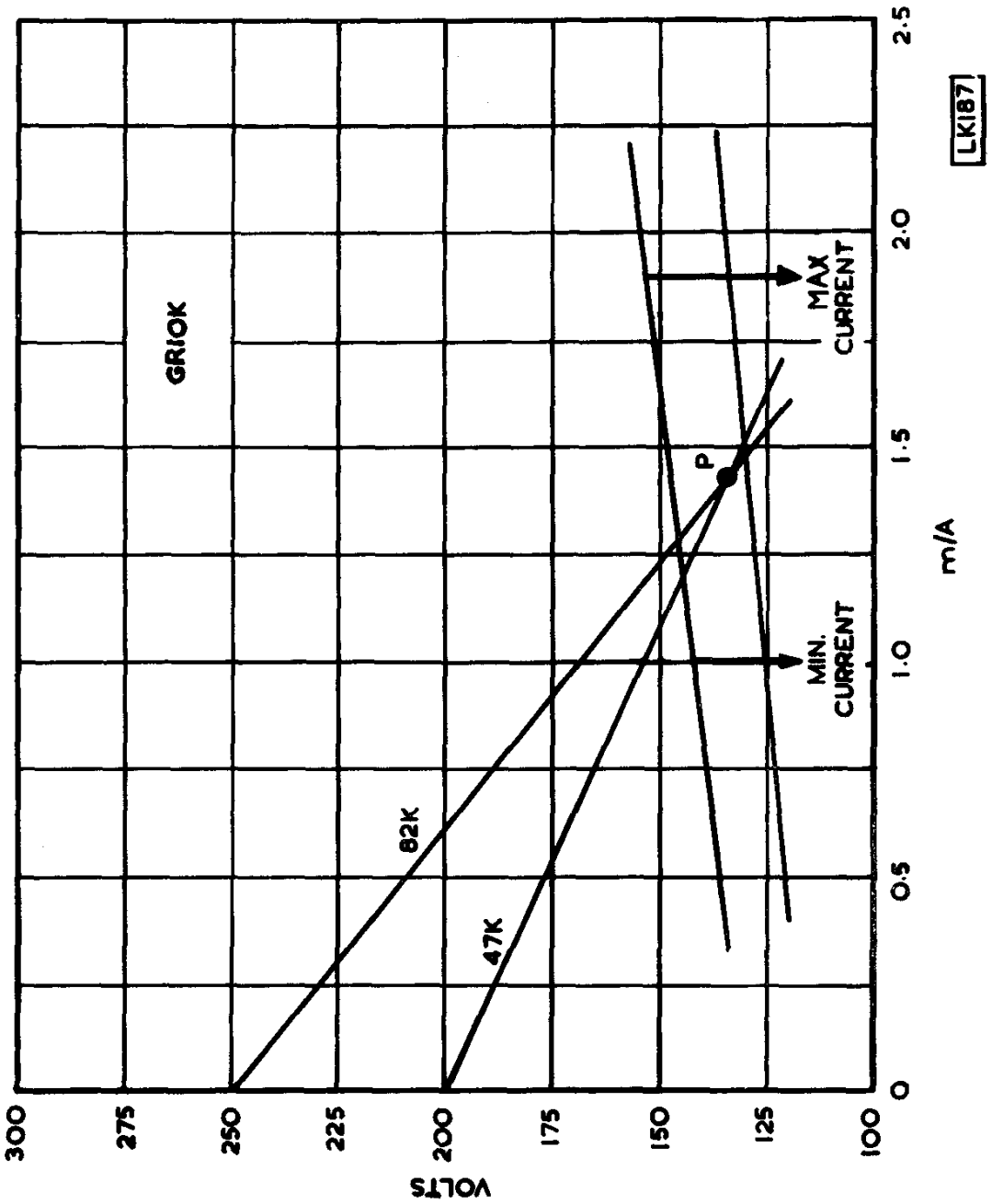






*DIGITRON - Long Life 10 Digit End-Viewing Cold-Cathode Numerical Register Tube

GR10K
(CV. 5842)



Operating Characteristics

*Registered Trade Mark

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.	Limits 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

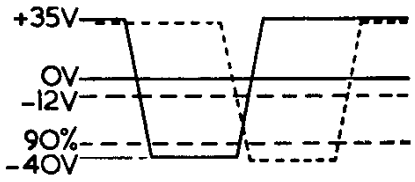


Fig. 1

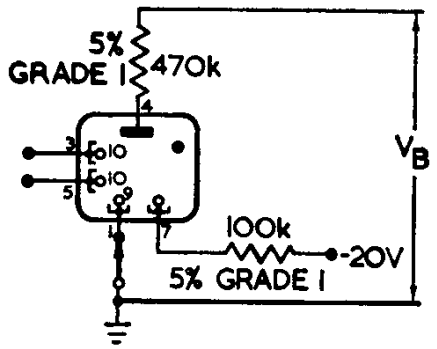


Fig. 2

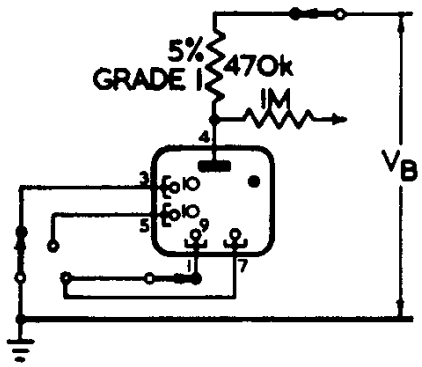


Fig. 3

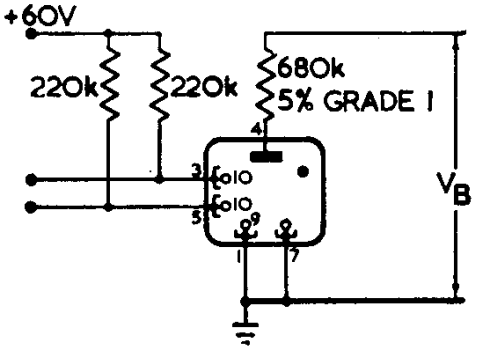


Fig. 4

Scale-of-ten Counter

Specially processed for long life

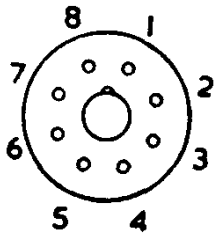
GC10B/L, GC10/4B/L

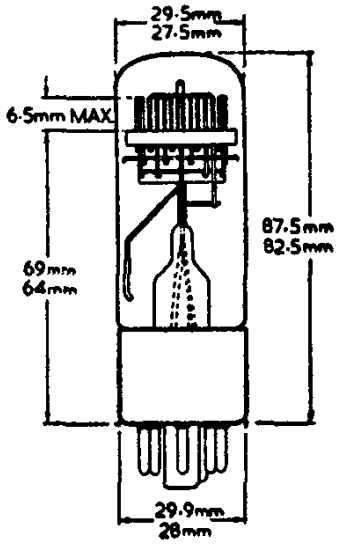
(CV.6044) (CV.6100)

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.

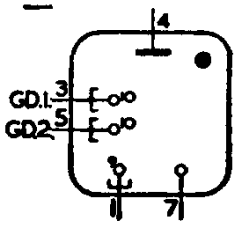
Base Connections (underside view)





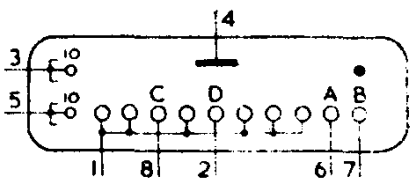
GC10B/L

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



GC10/4B/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"



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.	Limits 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

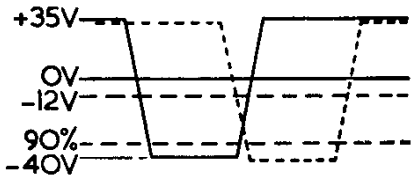


Fig. 1

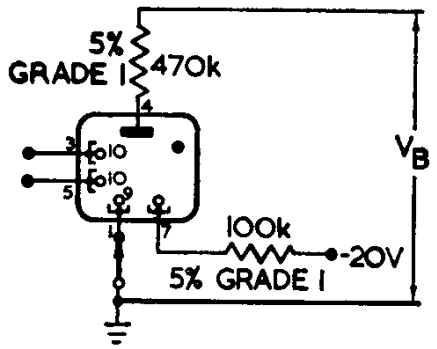


Fig. 2

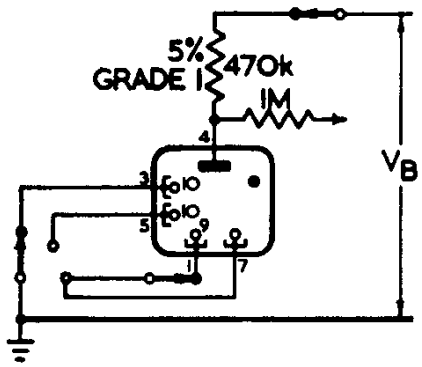


Fig. 3

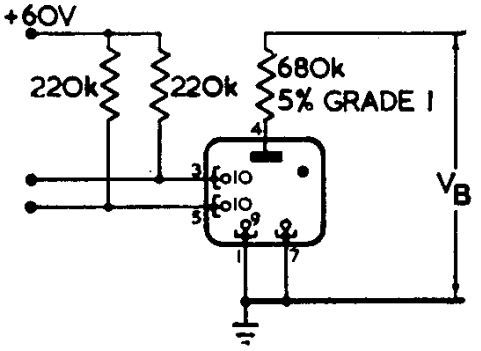


Fig. 4

Scale-of-ten Counter

Specially processed for long life

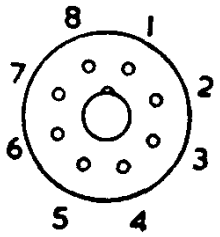
GC10B/L, GC10/4B/L

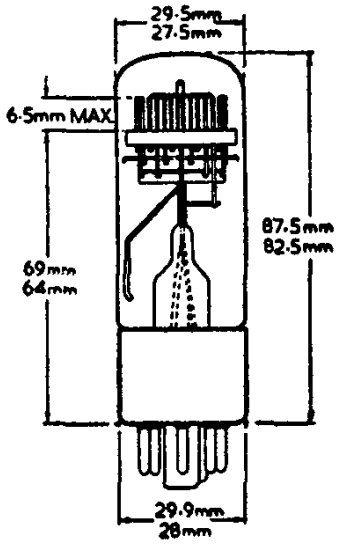
(CV.6044) (CV.6100)

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.

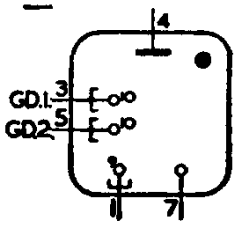
Base Connections (underside view)





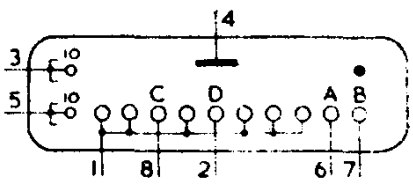
GC10B/L

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



GC10/4B/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"



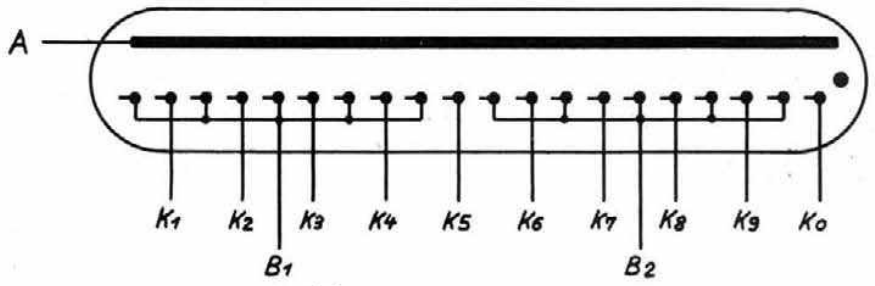
		Type DZ 10
CERBERUS	DEKADISCHE ZAEHLROEHRE DZ 10	Nr. 2.13.10 D
		Ausgabe 10.53 · Blatt 1

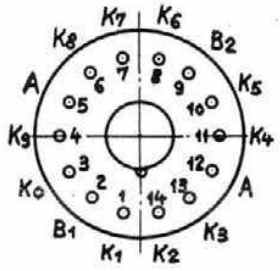
Kaltkathodenzählröhre mit 10 einzeln herausgeführten Hauptkathoden, aufgebaut auf einem Diheptalsockel. Ablesung des Zählergebnisses optisch an der Röhre oder elektrisch an Ablesewiderständen in den Kathodenzuleitungen. Maximale Zählgeschwindigkeit: 3000 Impulse pro Sekunde.

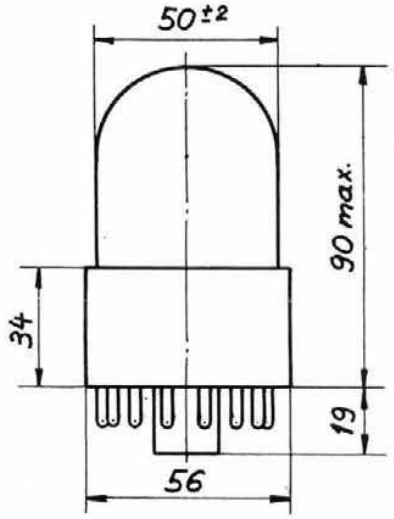
K_0 - K_9 : Hauptkathoden

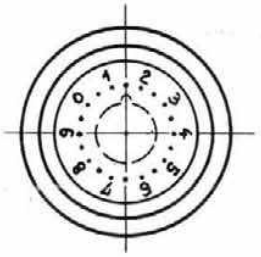
B_1 & B_2 : Hilfskathodengruppen

A : Anode



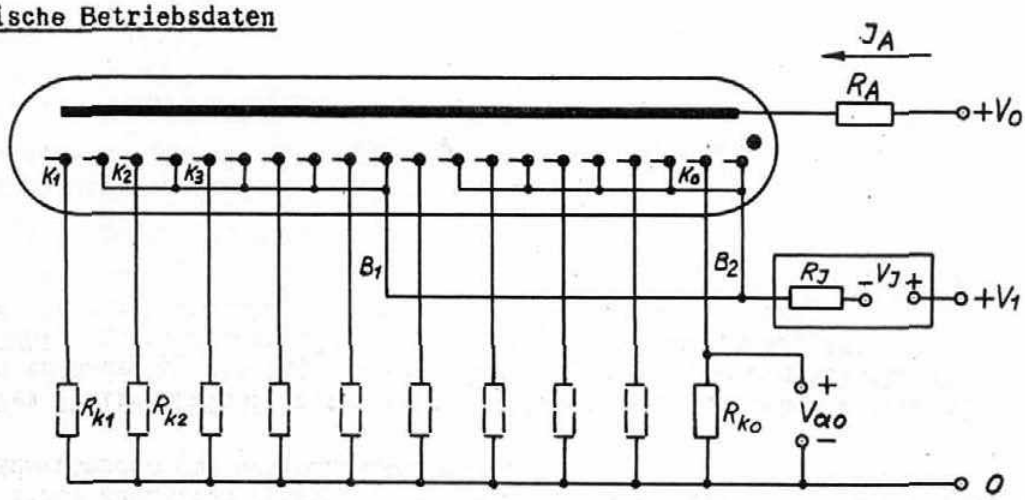






Kenndaten und Grenzbetriebsdaten		min.	normal	max.	
Zündspannung Kathoden-Anode	V_{ZA}	160 V	175 V	200 V	
Brennspannung Kathoden-Anode bei 4 mA	V_{BA}	110 V	112 V	115 V	
Zählgeschwindigkeit		-		3000 Hz	1)
Anodenstrom, Mittelwert	J_A	2 mA		8 mA	
Anodenstrom, Spitzenwert (max.1 sek.)		-		20 mA	
Anodenspeisespannung	V_0	220 V		400 V	
Ausgangsspannung an Ablesewiderstand	V_a	-		35 V	2)
Spannung für Nullstellung oder Vorwahl		80 V		-	
Transferspannung zwischen zwei benachbarten Kathoden	V_T	25 V		80 V	
Dauer des Transferimpulses (Spannung zwischen K und B > 25 V)	T_J	$1{,}5.10^{-4}$ sek.		-	
Anstieg des Transferimpulses		-		10^6 V/sek	
Leistung des Transferimpulses	P_J	100 mW		1 W	

Typische Betriebsdaten



Speisespannung	V_0	300 V	
Anodenstrom	J_A	4 mA	
Anodenwiderstand	R_A	47 KΩ	
Kathodenwiderstand	R_K	3,3 KΩ	1)
Ueberbrückungskapazität	C_K	0,25 µF	1)
Ausgangsspannung	V_a	13 V	3)
Vorspannung der B-Gruppen	V_1	25 V	4)
Spannung des Transferimpulses	V_J	50 V	
Innenwiderstand der Impulsquelle	R_J	< 4 KΩ	5)

Nullstellung oder Vorwahl einer bestimmten Zahl erfolgt durch kurzzeitiges Anlegen einer negativen Spannung von mindestens 80 V auf die Kathodenseite des Ablesewiderstandes der betreffenden Stufe.

1) Bei Zählgeschwindigkeiten unter 1000 Impulsen pro Sekunde sind die Ablesewiderstände R_{K1} bis R_{K9} nur erforderlich, wenn eine elektrische Ablesung des Zählresultates oder die Vorwahl irgendeiner Zahl nötig ist. Bei Zählgeschwindigkeiten über 1000 Hz sind in allen Kathodenzuleitungen R-C Glieder einzuschalten.

2) Bei entsprechender positiver Vorspannung der Hilfskathodengruppen.

3) Die Ausgangsspannung V_{ao} kann an das Gitter einer Penthode gegeben werden, in deren Anodenkreis die Transferspannung für die nächste Stufe abgenommen wird.

4) Niederohmig verfügbar oder kapazitiv überbrückt (Kapazität je nach Dauer der Transferimpulse).

5) Bei höherem Innenwiderstand muss mehr Impulsspannung zur Verfügung stehen.

Montage: In jeder Lage.

Anwendungsbeispiele: Industrielle Zähl- und Steuergeräte. Frequenzteilung, Zeitmessung.

TYMCZASOWA KARTA KATALOGOWA

ELW 1

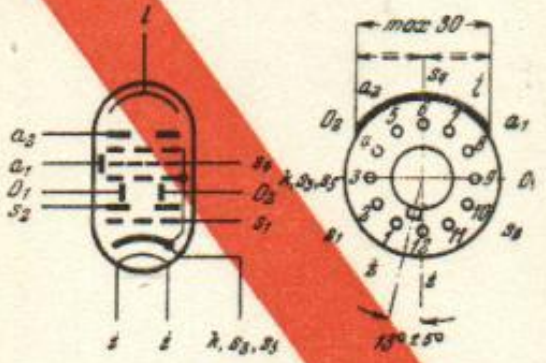
DEKADOWA LAMPA LICZĄCA

Lampa ELW1 jest dekadową lampą liczącą przeznaczoną do pracy w układach zliczających z szybkością $\leqslant$ 30000 imp/sek*).

Wykonanie: bańka — szklana,
cokół — duodekal,
katoda — tlenkowa pośrednio żarzona.

Pozycja pracy lampy: dowolna.

*) Przy zastosowaniu specjalnych układów szybkość liczenia może wynosić max. 100000 imp./sek.



Wszystkie wymiary w milimetrach

PRZEMYSŁOWY INSTYTUT ELEKTRONIKI

ZAKŁAD DOŚWIADCZALNY — WARSZAWA, DŁUGA 44/50

PIE

Przed zastosowaniem opisanego w tej karcie wyrobu należy sprawdzić w Zakładzie Doświadczalnym PIE jego dane techniczne i możliwości dostawy.

ELW 1

DANE TECHNICZNE

DANE TYPOWE

Napięcie żarzenia	$U_z = 6{,}3$ V
Prąd żarzenia	$I_z = 0{,}3$ A
Pojemności elektrody badanej względem wszystkich pozostałych	$C_{a2} = 10{,}5$ pF
	$C_{D1} = 3{,}5$ pF
	$C_{D2} = 3{,}8$ pF
	$C_{a1} = 4{,}9$ pF
	$C_{s1} = 6{,}8$ pF
	$C_{s4} = 7{,}7$ pF

DANE TYPOWEGO UKŁADU PRACY

Napięcie zasilania	$U_B = 300$ V
Napięcie siatki pierwszej	$U_{s1} = 11{,}9 \pm 0{,}15$ V
Napięcie siatki drugiej	$U_{s2} = 300$ V
Napięcie płytki odchylającej czynnej	$U_{D1} = 156 \pm 1{,}5$ V
Napięcie ekranu luminującego	$U_l = 300$ V
Prąd katody	$I_k = 0{,}95$ mA
Prąd siatki drugiej	$I_{s2} = 0{,}1$ mA

PRZEMYSŁOWY INSTYTUT ELEKTRONIKI

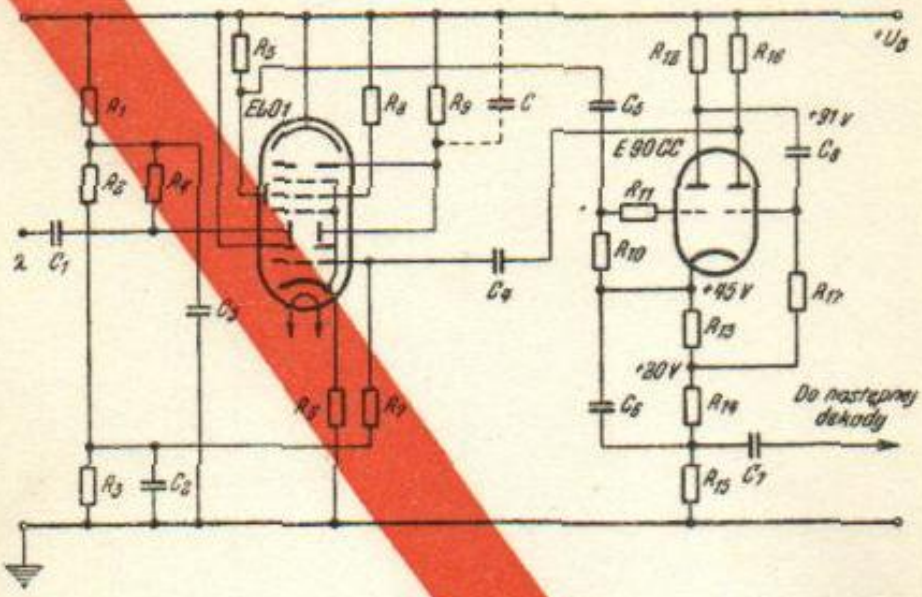
ZAKŁAD DOŚWIADCZALNY

PIE

WARSZAWA, DŁUGA 44/50

ELW 1

TYPOWY UKŁAD PRACY



$R_1 = 68$	kΩ ± 1%	$R_6 = 15$	kΩ ± 1%
$R_2 = 68$	kΩ ± 1%	$R_7 = 0{,}33$	MΩ ± 10%
$R_3 = 5{,}6$	kΩ ± 1%	$R_8 = 47$	kΩ ± 5%
$R_4 = 15$	kΩ ± 2%	$R_9 = 1$	MΩ ± 1%
$R_5 = 39$	kΩ ± 10%		

Uwagi:

Częstotliwość graniczna podanego układu liczącego wynosi $\leqslant$ 30000 imp/sek. Podane wartości napięć odniesiono do ziemi. Przy zastosowaniu oporów R_1; R_2; R_3 o dokładności 1% napięcie zasilania U_B może być niestabilizowane, a dopuszczalne wahania mogą wynosić ± 10%.

Pojemność szkodliwa C winna być przez krótki montaż sprowadzona do wartości minimalnej.

PRZEMYSŁOWY INSTYTUT ELEKTRONIKI

ZAKŁAD DOŚWIADCZALNY — WARSZAWA, DŁUGA 44/50

PIE

ELW 1

$R_{10} = 0{,}56$	MΩ ± 10%	$C_1 =$	
$R_{11} = 5{,}6$	kΩ ± 10%	$C_2 = 0{,}39$	μF ± 20%
$R_{12} = 39$	kΩ ± 2%	$C_3 = 0{,}15$	μF ± 20%
$R_{13} = 4{,}7$	kΩ ± 2%	$C_4 = 6800$	pF ± 10%
$R_{14} = 2{,}7$	kΩ ± 2%	$C_5 = 220$	pF ± 10%
$R_{15} = 1$	kΩ ± 1%	$C_6 = 68$	pF ± 2%
$R_{16} = 3{,}3$	kΩ ± 2%	$C_7 = 680$	pF ± 5%
$R_{17} = 0{,}15$	MΩ ± 2%	$C_8 = 68$	pF ± 2%

Uwaga:

$C_1 = 6800$ pF ± 10% gdy układ formujący z lampą E90CC znajduje się na wejściu, $C_1 = 680$ pF ± 5% gdy układ formujący z lampą E90CC znajduje się między dekadami.

DANE DOPUSZCZALNE

Napięcie zasilania U_B = max. 400 V

DANE ZAKŁÓCAJĄCYCH PÓL MAGNETYCZNYCH

Dopuszczalne natężenie zakłócających pól magnetycznych w jakimkolwiek kierunku wynosi max. 2 gausy.

DANE OŚWIETLENIA

W celu uzyskania dobrego odczytu oświetlenie ekranów luminujących lampy ELW1 powinno wynosić 40÷400 luxów.

PRZEMYSŁOWY INSTYTUT ELEKTRONIKI
ZAKŁAD DOŚWIADCZALNY
WARSZAWA, DŁUGA 41/50
PIE

ELW 1

KSZTAŁT IMPULSÓW WEJŚCIOWYCH

Amplituda dodatniego impulsu wchodzącego na płytkę D_1 powinna wynosić 13,6 V $\pm$ 15%, a kształt winien odpowiadać podanemu na rysunku.



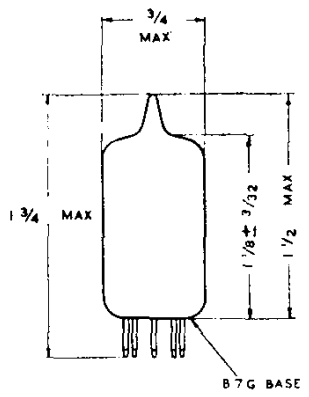
$\operatorname{tg} \alpha > 20 \times 10^6$ V/sek

$\operatorname{tg} \beta < 1{,}2 \times 10^6$ V/sek

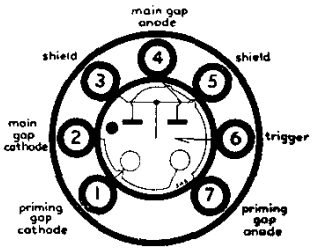
PRZEMYSŁOWY INSTYTUT ELEKTRONIKI

ZAKŁAD DOŚWIADCZALNY WARSZAWA, DŁUGA 44/50

PIE



TYPE G1/371K HIGH SPEED PRIMED-TRIGGER COLD-CATHODE TUBE



The G1/371K is a high-speed primed-trigger tube developed for use with the G10/241E Unidirectional Cold-Cathode Gas Filled Decade Counter for which a single cathode trigger tube is required as a coupling element between tubes. Its speed and general characteristics, however, make it a useful general component. It also has features which make it specially suitable for use in circuits where a high input impedance is required.

MAIN ELECTRODE CHARACTERISTICS

Maximum pulse current output	15	mA
Maximum D.C. current output	10	mA
Minimum D.C. current output	2	mA
Anode supply voltage range	270 to 360	V
Main gap maintaining voltage	175 to 185	V
Maximum cathode voltage output	140	V
Shield voltage applied through 50 kΩ	150	V
Trigger Bias (for V_a up to 325 V)	0 to 165	V
Trigger Bias (for V_a up to 360 V)	60 to 165	V
††Trigger breakdown potential on application of a 25 micro-second square pulse based on maximum bias	12 to 26	V
*De-ionisation Time (max.)	30	μ sec
†Transfer Time (nom.)	0.5	μ sec

DIRECT INTERELECTRODE CAPACITANCES

Trigger to cathode	3.0	pF
Trigger to all other electrodes	5.0	pF

PRIMING GAP CHARACTERISTICS

Priming gap current	0.2 to 0.5	mA
Anode feed resistance	390	kΩ
Cathode resistance to earth or main gap cathode potential	56	kΩ

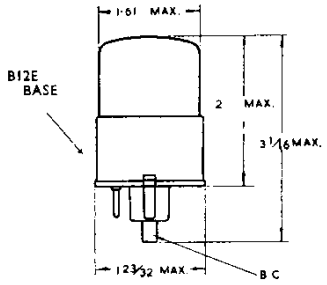
The priming gap cathode must not be more than 140 volts negative to the main cathode at any time.

* De-ionisation time to be short enough to permit a re-application of the nominal working voltage (90 per cent of maximum, i.e. 325 volts) 30 micro-seconds after the extinguishing of a D.C. discharge of maximum rated current by means of a rectangular pulse applied to the anode. The base of the extinguishing pulse shall be 20 volts below the V_m of the main gap, all other electrodes may be at potentials within their working range.

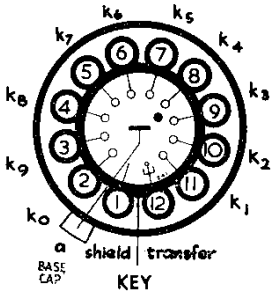
† This is the time interval between current flowing in the trigger cathode circuit as the result of applying a trigger pulse, and conduction starting in the main anode-cathode gap.

†† For pulse widths of less than 25 μ sec, the triggering pulse ← amplitude is an inverse function of the pulse width.

For details of circuitry, apply to Standard Telephones & Cables Ltd., Special Valve Sales, Connaught House, Aldwych, London, W.C.2.



TYPE **G10/241E** UNIDIRECTIONAL COLD-CATHODE GAS-FILLED DECADE COUNTER



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

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

D.C. CHARACTERISTICS (Nominal)

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

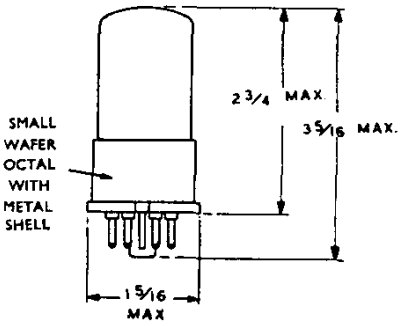
A special socket has been designed for use with this valve (McMurdo type X12E).

continued overleaf

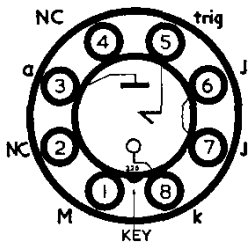
TYPICAL OPERATING CONDITIONS
(For pulse repetition frequencies up to 5 kc/s.)

H.T. supply voltage (stabilised)	315 to 345	V
Transfer electrode bias (nominal)	75	V
Shield bias (nominal)	90	V
Anode load	24 ±2%	kΩ
Cathode load	15 ± 5%	kΩ
Cathode load capacitor	0.005 ± 20%	μF
Transfer pulse amplitude	120 ± 15	V
(Measured at the input capacitor with G10/241E in circuit.)		
Transfer pulse width	16 ± 4	μs
Cathode pulse output (min.)	40	V

For full technical details for this valve, apply Standard Telephones & Cables Ltd., Special Valve Sales, Connaught House, Aldwych, London, W.C.2.



TYPE **G150/2D**
COLD CATHODE GAS-FILLED TRIODE



The G150/2D is a cold cathode, three-electrode, gas-filled triode. It has an activated cathode giving a low maintaining voltage, together with a good life performance.

CHARACTERISTICS

Minimum control gap breakdown voltage	60		V
Maximum control gap breakdown voltage	80		V
Nominal control gap maintaining voltage } At 20 mA Cathode Current ...	60		V
Maximum control gap maintaining voltage } At 20 mA Cathode Current ...	70		V
Minimum main gap breakdown voltage	150		V
Minimum main gap maintaining voltage } At 20 mA Cathode Current ...	60		V
Maximum main gap maintaining voltage } At 20 mA Cathode Current ...	77		V
Recommended value of operating current for relay operation	20		mA
Recommended value of operating current for counter applications	2		mA

MAXIMUM RATINGS

Maximum peak cathode current	50	mA
Maximum average cathode current	30	mA

DYNAMIC CHARACTERISTICS

Transfer

For general dynamic behaviour, see curves at the end of this data.

MAINTENANCE TYPE ONLY

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.

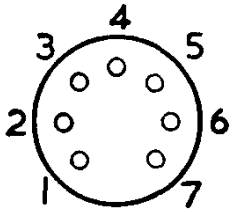
GC10/2P

Miniature Bi-directional 10-way Computing Tube

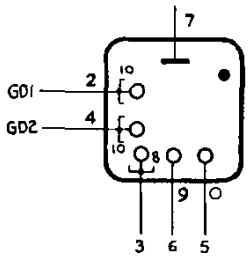
Mechanical Data

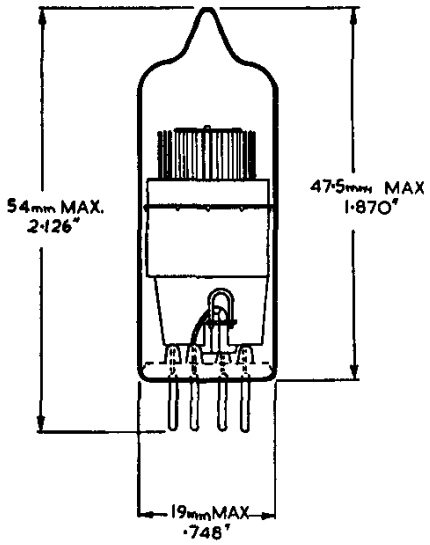
Mounting position	Any. For visual indication the tube is viewed through the dome of the bulb.
Alignment	Cathode "O" is approximately aligned with pin No. 5.
Weight	13 g (nominal).
Escutcheon	N.84338.
Base	B7G

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





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

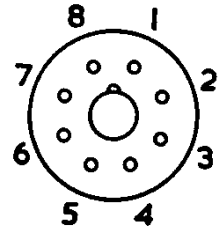
GC 10/4B
(CV.1739)

Bi-directional 10-way Computing Tube with Intermediate Outputs

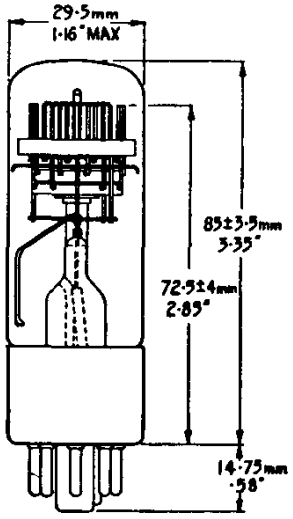
Mechanical Data

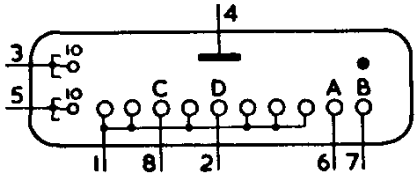
Mounting position	Any. For visual indication the tube is viewed through the dome of the bulb.
Alignment	Cathode " B " is aligned with pin No. 6 to an accuracy of ± 12°.
Weight	43 g (nominal).
Escutcheons	N.78211 Bakelite, or N.79368 Brass.
Base	I.O.

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 "





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.	Limits 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

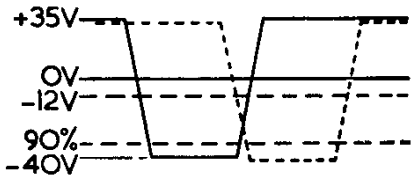


Fig. 1

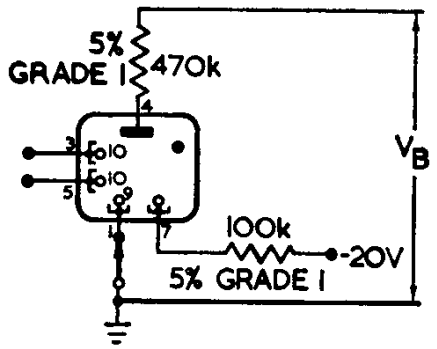


Fig. 2

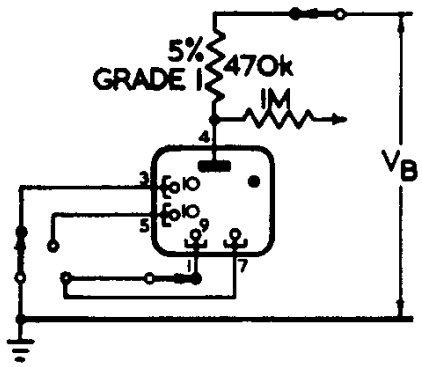


Fig. 3

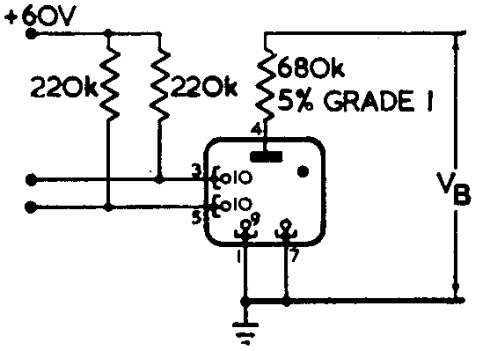


Fig. 4

Scale-of-ten Counter

Specially processed for long life

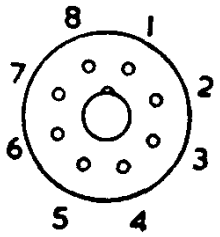
GC10B/L, GC10/4B/L

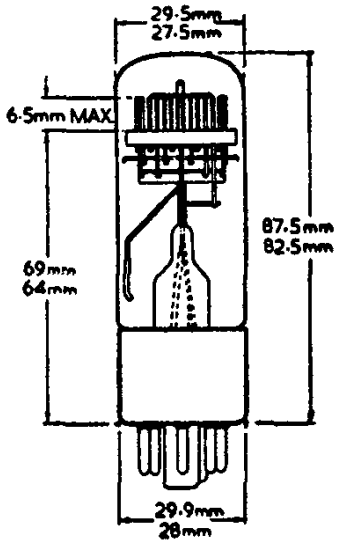
(CV.6044) (CV.6100)

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.

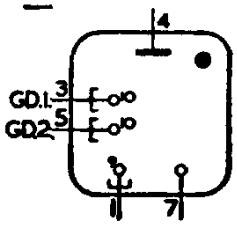
Base Connections (underside view)





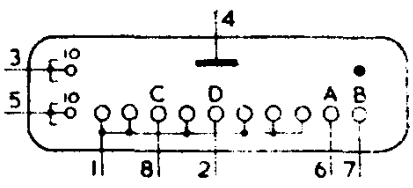
GC10B/L

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



GC10/4B/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"



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.	Limits 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

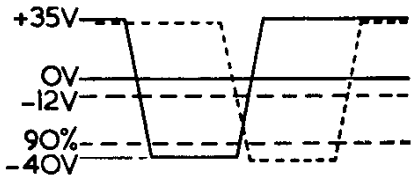


Fig. 1

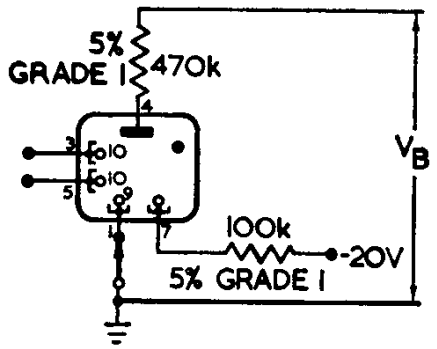


Fig. 2

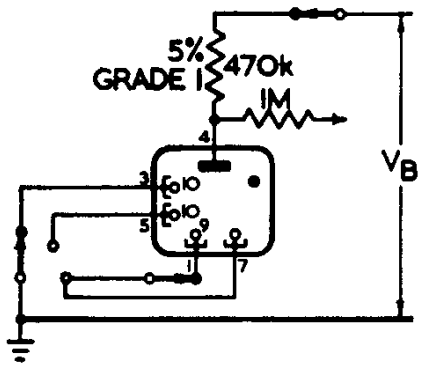


Fig. 3

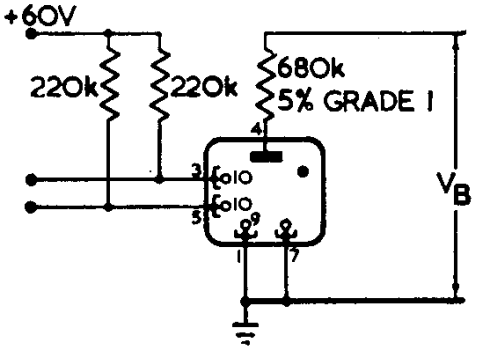


Fig. 4

Scale-of-ten Counter

Specially processed for long life

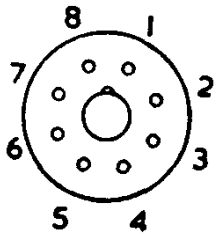
GC10B/L, GC10/4B/L

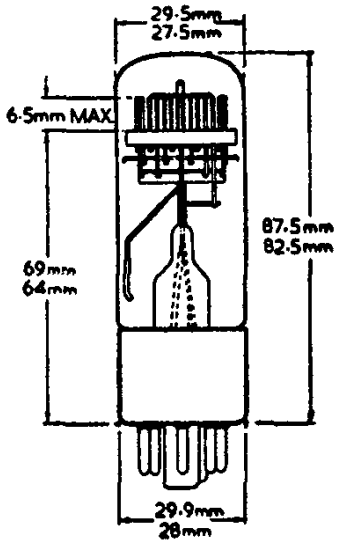
(CV.6044) (CV.6100)

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.

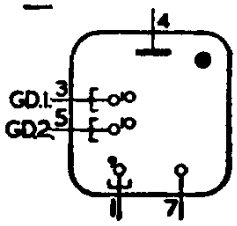
Base Connections (underside view)





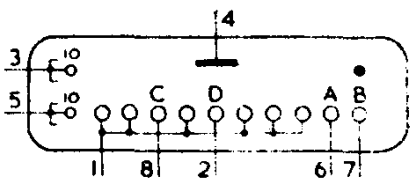
GC10B/L

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



GC10/4B/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"



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

GC10D (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	$-\left(144\ \text{V} \begin{smallmatrix}+\ 50\ \text{V}\\ -\ 12\ \text{V}\end{smallmatrix}\right)$
**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.

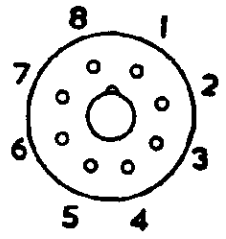
GC 10 D
(CV.5143)

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

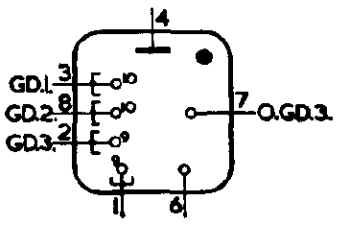
Mechanical Data

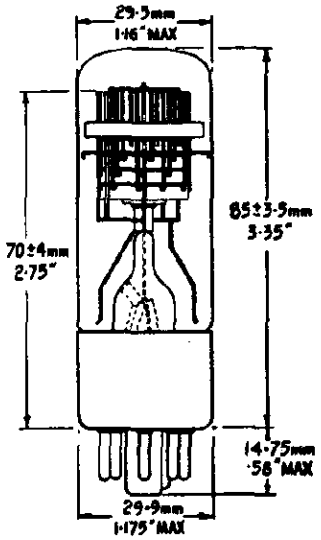
Mounting position	Any. For visual indication, the tube is viewed through the dome of the bulb.
Alignment	Cathode " O " is aligned with pin No. 6 to an accuracy of ± 12°.
Weight	44 g (nominal).
Escutcheons	N.78211 Bakelite *or* N.79368 Brass
Base	I.O.

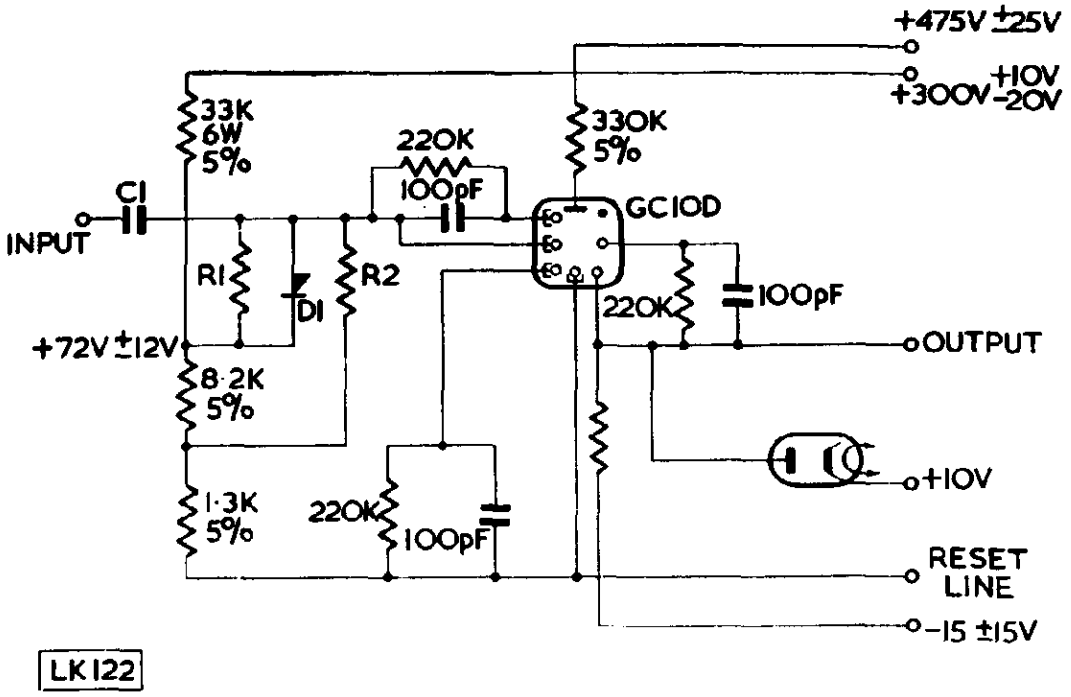
Base Connections
(underside view)



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 12-way Computing Tube with Intermediate Outputs

GC12/4B

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

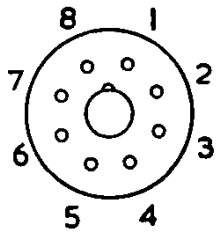
GC12/4B

Bi-directional 12-way Computing Tube with Intermediate Outputs

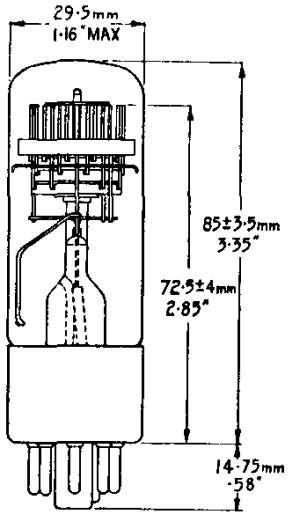
Mechanical Data

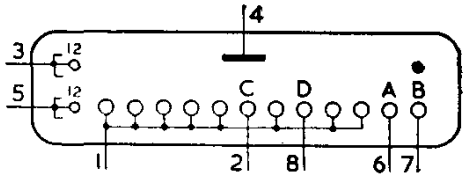
Mounting position	Any. For visual indication the tube is viewed through the dome of the bulb.
Alignment	Cathode " B " is aligned with pin No. 6 to an accuracy of ± 10°.
Weight	43 g (nominal).
Escutcheon	N79369 Brass
Base	I.O.

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 "





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

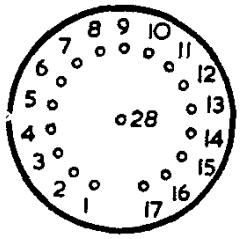
GCA10G GSA10G

UNDER REVISION

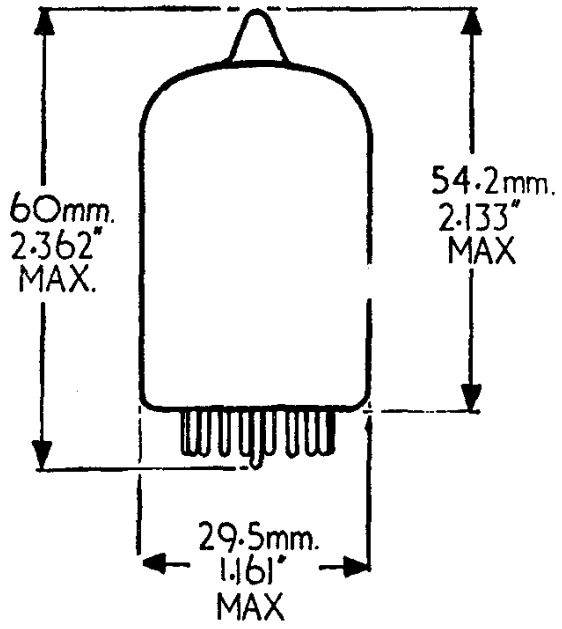
Mechanical Data

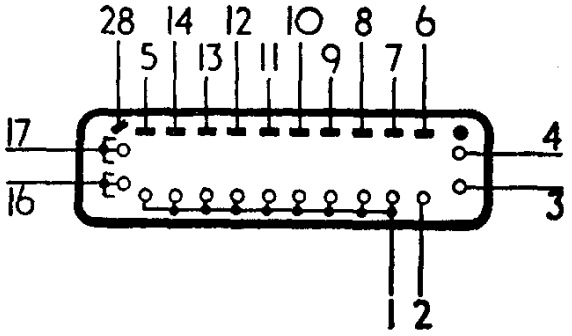
Mounting position	Any. For visual indication the tube may be viewed through the dome of the bulb.
Alignment	Cathode '0' is aligned to pin 3 with an accuracy of ± 5°
Base	Modified B26A
Socket	B27A

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



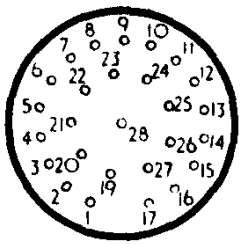


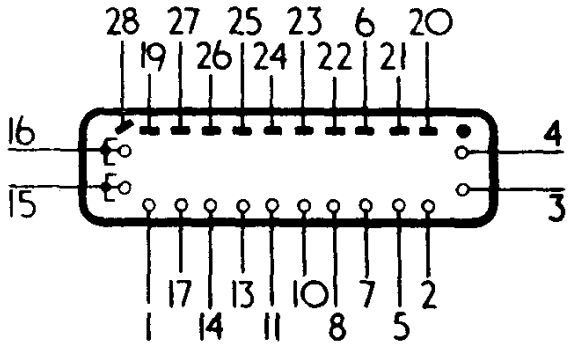
GCA10G
GSA10G

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

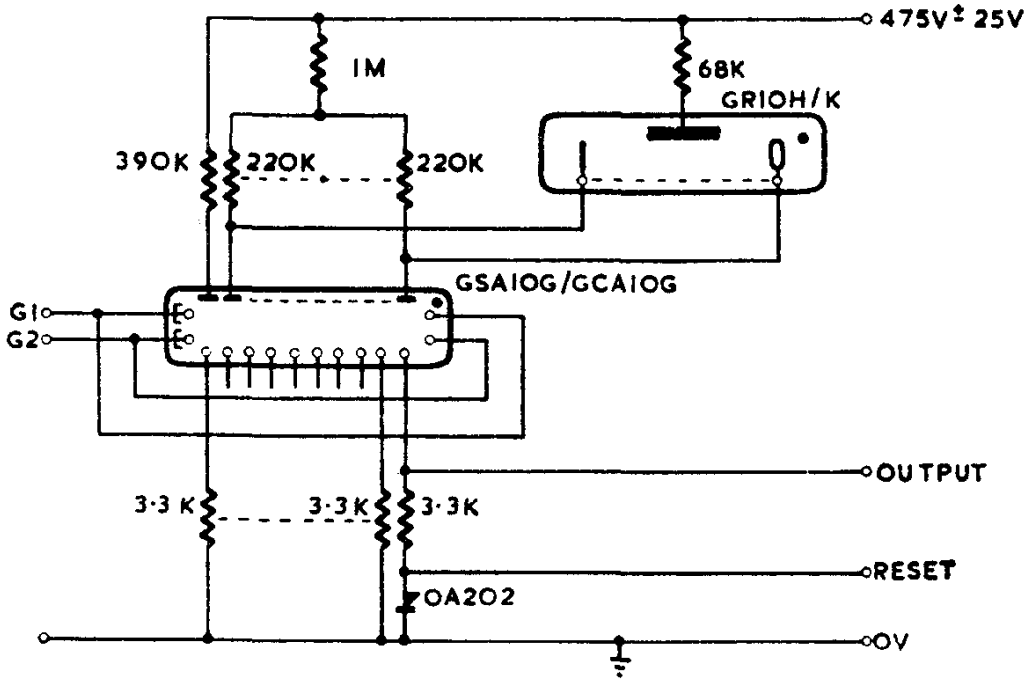


Fig. 1 Dekatron with Digitron Readout.

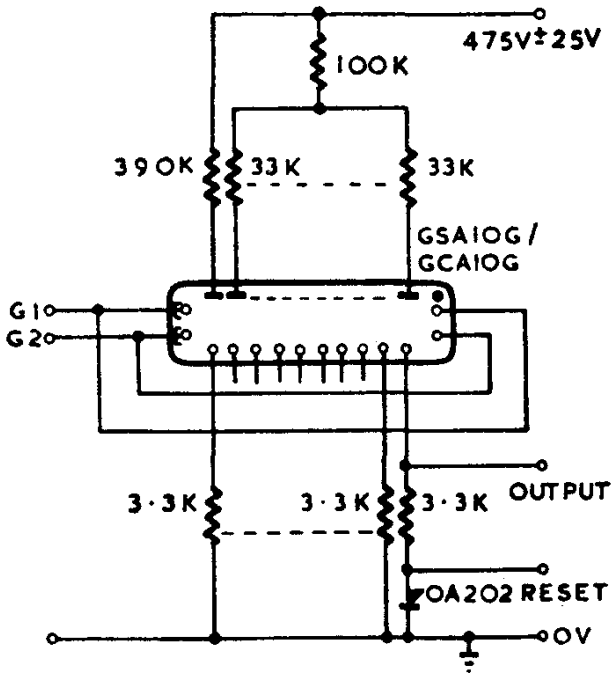


Fig. 2 Dekatron without Digitron Readout.

GCA10G
GSA10G

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

UNDER REVISION

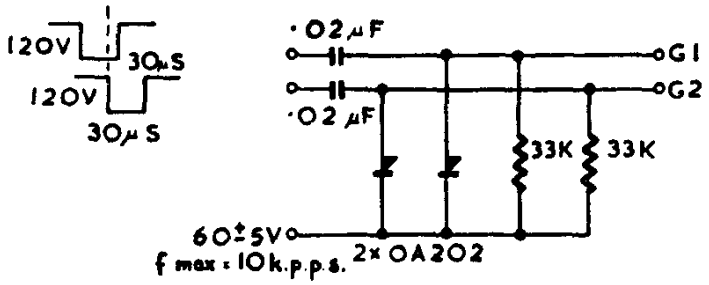


Fig. 3 Paired Pulse Drive.

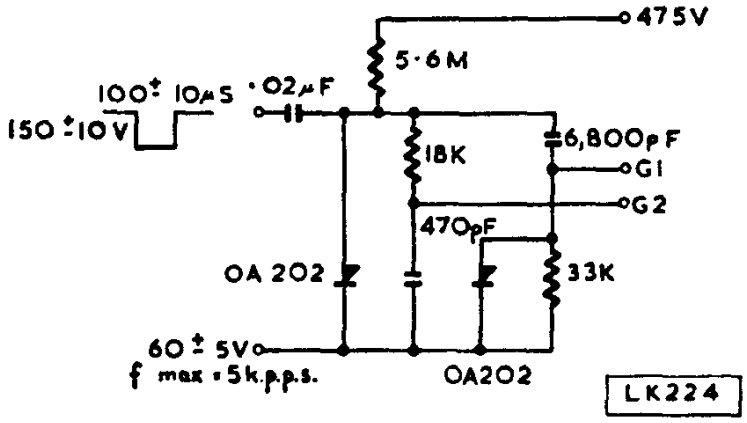


Fig. 4 Single Pulse Drive.

N.U. ENGINEERING BULLETIN

ELECTRONIC COMPONENTS

N.U. INDITRON

TYPE GI-10

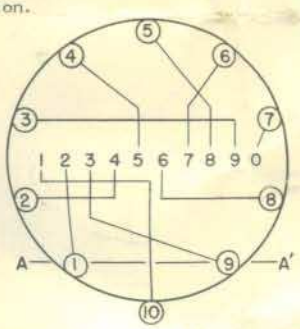
The function of this tube is to portray the digits 0--9, one at a time, in any selected order as controlled by an external switching circuit.

The selected numeral form appears as a brilliant, sharp cathode glow in the characteristic orange-red color of Neon gas discharges. The numeral forms are arranged in a stack on planes approximately 0.050 in. apart in order from 1 to 0 starting at the bottom. Ten input leads are used; one for each numeral. A system of shared parallel load resistors is required.

BASING

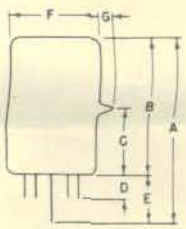
Any standard 9-pin miniature socket containing a center shield may be used, such as Amphenol 59-409. Pin No.10 makes contact to this center shield which is used as the socket connecting terminal.

The socket is oriented with respect to viewing position so that line A——A' intersecting the centers of pins No.1 and 9 is horizontal. This orients the numerals in the correct vertical position.



PHYSICAL CHARACTERISTICS

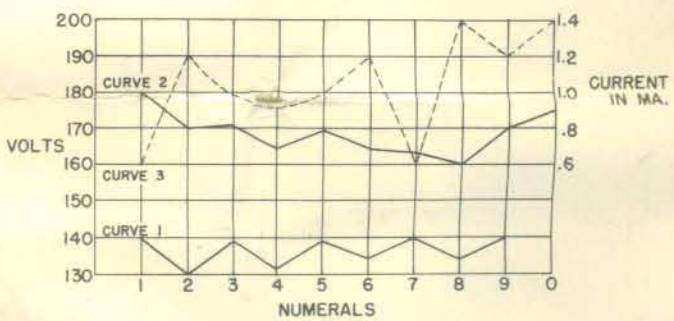
A:	Overall Height.....	2.05	±0.05 in.
B:	Bulb Height.....	1.50	±0.05 in.
C:	Tubulation Height..	0.75	±0.05 in.
D:	Pin Length.....	0.24	±0.02 in.
E:	Center Pin Length..	0.56	±0.02 in.
F:	Bulb Diameter.....	0.820	±0.02 in.
G:	Tubulation Length..	.175	±0.03 in.



ELECTRICAL CHARACTERISTICS

The ignition and operating voltages vary somewhat from digit to digit in the tube and depend somewhat on both the immediate and long-term operating history, however, the characteristics remain quite constant under all conditions.

The following curves depict typical operating characteristics. Specific values in other tubes may vary by a factor of ±10-15 percent.



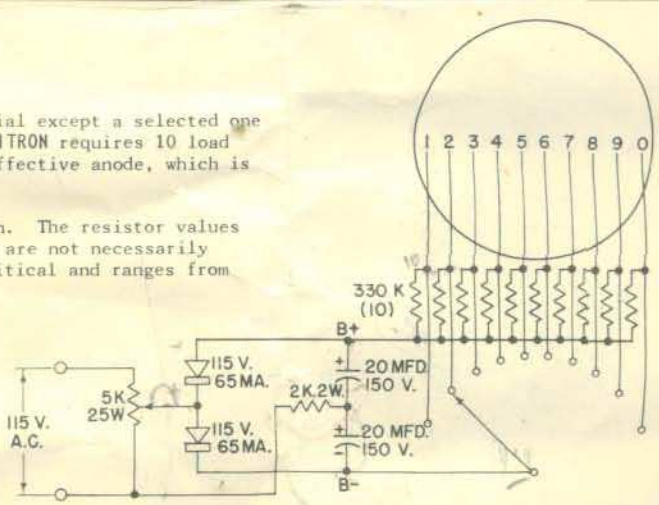
CURVE 1 – OPERATING VOLTAGE
CURVE 2 – BREAKDOWN VOLTAGE
CURVE 3 – OPERATING CURRENT

APPLICATION TO CIRCUITS

All of the characters in this tube must be held at anode potential except a selected one which is switched to ground by some external circuit. Each INDITRON requires 10 load resistors, nine of which are always parallel connected to the effective anode, which is the combined effect of the nine unswitched elements.

A recommended circuit for mechanical switching is given herewith. The resistor values are those used with satisfactory results in this laboratory but are not necessarily optimized. The applied DC voltage for best operation is not critical and ranges from 160 - 190 volts.

The current drawn in operation by the different digits is from 1 to 2 ma. If these values are exceeded the life of the tube will be materially shortened. The voltage supply should be adjusted until the largest number, the "0" or "8" is just covered with glow.

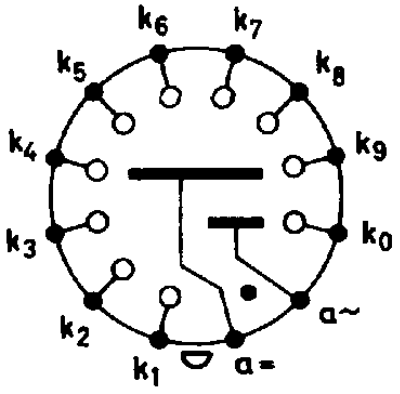


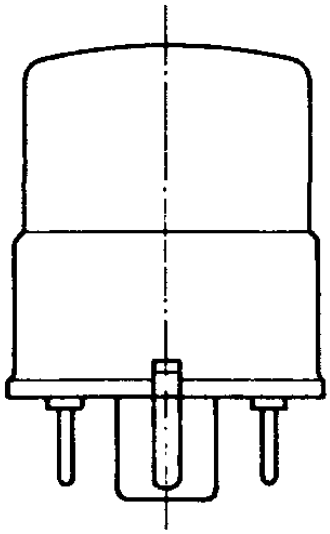
ISSUED MAY 1954

NATIONAL UNION ELECTRIC CORPORATION

RESEARCH DIVISION: • 350 SCOTLAND ROAD • ORANGE, N. J.

LORENZ	Ziffernanzeigeröhre Nodistron Gasgefüllte Kaltkatodenröhre	**GN 1** - Vorläufig -





Gewicht ca. 57 g

1. Betriebswerte [1) 2)]

a) für Gleichspannung

Anodenspannung	U_a	200	250	300	V
Anodenwiderstand	R_a	18	33	47	kΩ
Katodenstrom	I_k	3,5	3,5	3,5	mA

b) für Halbwellen-Wechselspannung

Anodenspannung	U_a	220	240	300	V
Anodenwiderstand	R_a	8,2	10	22	kΩ
Katodenstrom	I_k	3	3	3	mA

c) für Wechselspannung

Anodenspannung	U_a	220	240	300	V
Anodenwiderstand	R_a	27	33	56	kΩ
Katodenstrom	I_k	3	3	3	mA

1) Die Röhre darf nicht ohne Anodenwiderstand betrieben werden. Außerdem ist zur gleichmäßigen Ausleuchtung der Ziffern in die Katode 1 ein Widerstand von ca. 80 % des Anodenwiderstandes einzuschalten.

2) Bei Wechselspannungsbetrieb ist die Gleichstromanode a = über 220 kΩ mit der Wechselstromanode a~ zu verbinden.

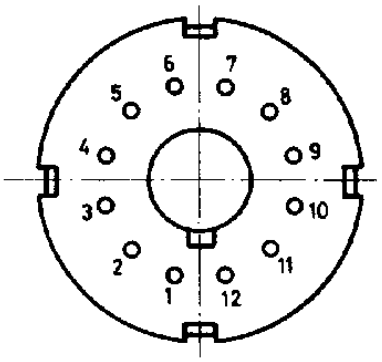
2. Grenzwerte

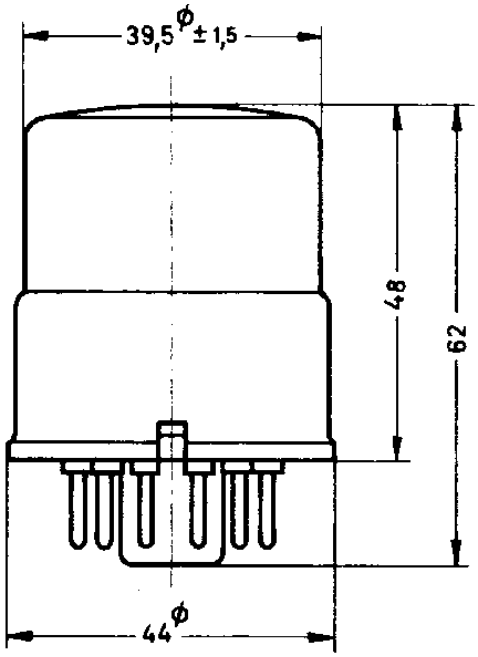
Minimale Speisespannung	U_{Bmin}	200	V
Maximaler Anodenstrom	I_{amax}	5	mA
Minimaler Anodenstrom	I_{amin}	2,5	mA
Minimale Löschspannung	U_{emin}	120	V

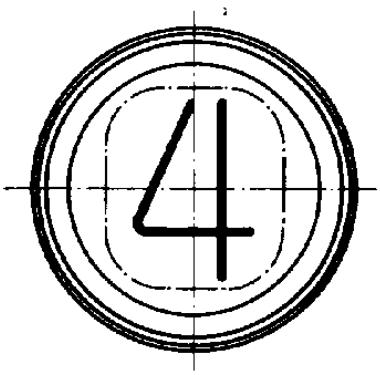
3. Besondere Hinweise

Als Speisespannung soll die höchste im Gerät verfügbare Spannung mit einem entsprechend bemessenen Anodenwiderstand verwendet werden, um die Unterschiede im Strom und damit in der Helligkeit infolge Streuung und Lebensdauer der Röhre möglichst gering zu halten.

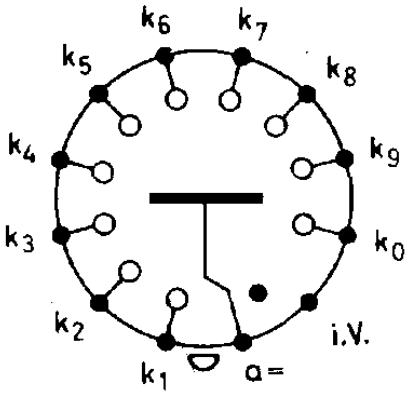
Die Schaltung soll so ausgelegt sein, daß die nicht betriebenen Katoden entweder abgeschaltet sind oder auf ein Potential gelegt werden, daß sie nicht als Anoden gegenüber der betriebenen Katode wirken können.

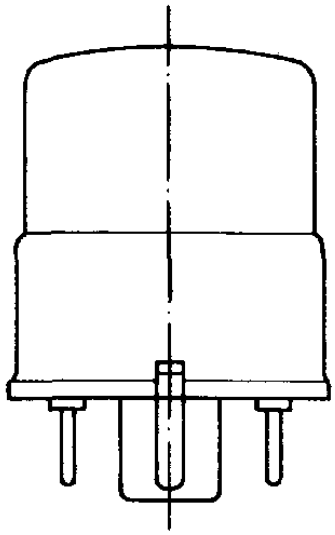

6
7
5
8
4
9
3
10
2
11
1
12


39,5Ø ± 1,5
48
62
44Ø


4

LORENZ	Ziffernanzeigeröhre Nodistron Gasgefüllte Kaltkatodenröhre	**GN2** - Vorläufig -





Gewicht ca. 60 g

1. Betriebswerte [1)]

a) für Gleichspannung

Anodenbetriebsspannung	U_{Ba}	200	250	300	V
Anodenwiderstand	R_a	18	33	47	kΩ
Katodenstrom	I_k	3,5	3,5	3,5	mA

b) für Halbwellen-Wechselspannung

Anodenbetriebsspannung	U_{Ba}	220	240	300	V
Anodenwiderstand	R_a	8,2	10	22	kΩ
Katodenstrom	I_k	3	3	3	mA

2. Grenzwerte

Minimale Speisespannung	U_{Bmin}	200	V
Maximaler Anodenstrom	I_{amax}	5	mA
Minimaler Anodenstrom	I_{amin}	2,5	mA
Minimale Löschspannung	U_{emin}	110	V

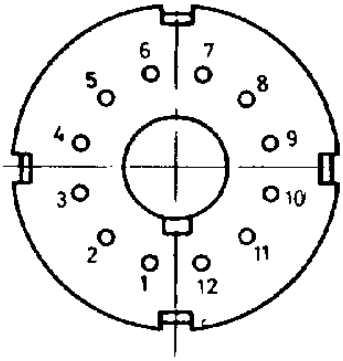
3. Besondere Hinweise

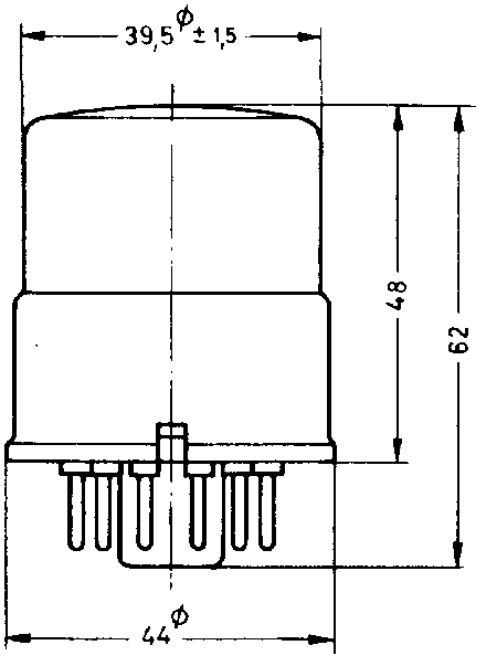
Als Speisespannung soll die höchste im Gerät verfügbare Spannung mit einem entsprechend bemessenen Anodenwiderstand verwendet werden, um die Unterschiede im Strom und damit in der Helligkeit infolge Streuung und Lebensdauer der Röhre möglichst gering zu halten.

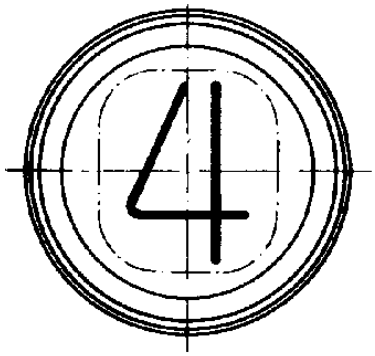
Die Schaltung soll so ausgelegt sein, daß die nicht betriebenen Katoden entweder abgeschaltet sind oder auf ein Potential gelegt werden, daß sie nicht als Anoden gegenüber der betriebenen Katode wirken können.

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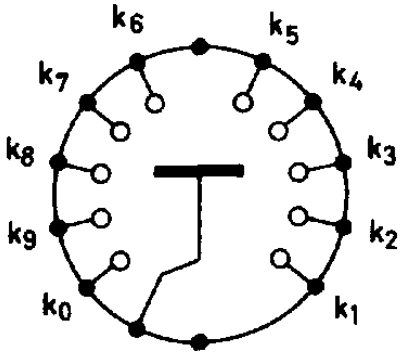
1) Die Röhre darf nicht ohne Anodenwiderstand betrieben werden. Außerdem ist zur gleichmäßigen Ausleuchtung der Ziffern in der Katode 1 ein Widerstand von ca. 80% des Anodenwiderstandes einzuschalten.

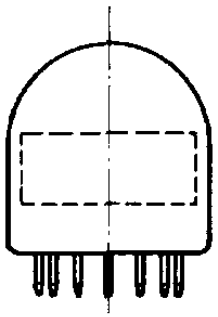

6
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3
10
2
11
1
12


39,5 Φ ± 1,5
48
62
44 Φ


4

LORENZ	Ziffernanzeigeröhre gasgefüllte Kaltkatodenröhre	**GN3** vorläufig





Gewicht ca. 10 g

1. Betriebswerte für Gleichspannung

Anodenbetriebsspannung	U_{Ba}	170	250	300	V
Anodenwiderstand	R_a	15	56	82	kΩ
Katodenstrom	I_k	2	2	2	mA

2. Grenzwerte

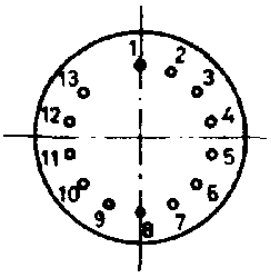
Minimale Speisespannung	U_{Bmin}	170	V
Minimale Löschspannung	U_{emin}	100	V
Maximaler Katodenspitzenstrom	I_{kspmax}	4	mA
Mittlerer Katodenstrom	I_k	2	mA

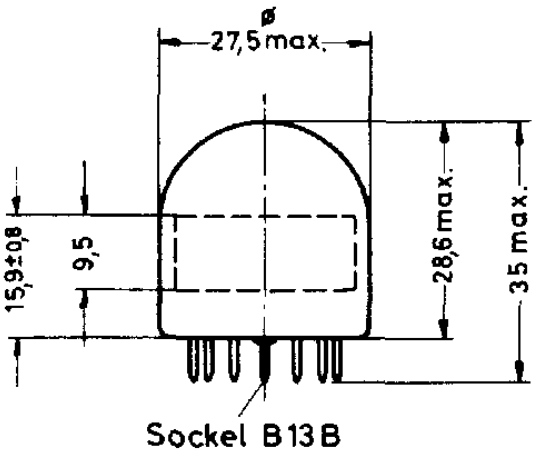
3. Besondere Hinweise

Als Speisespannung soll die höchste im Gerät verfügbare Spannung mit einem entsprechend bemessenen Anodenwiderstand verwendet werden, um die Unterschiede im Strom und damit in der Helligkeit infolge Streuung und Lebensdauer der Röhre möglichst gering zu halten.

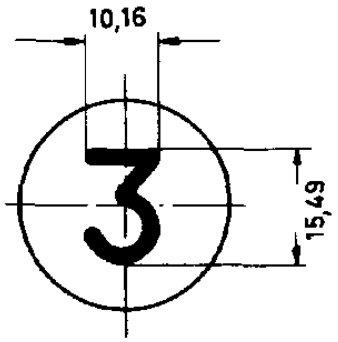
Die Schaltung soll so ausgelegt sein, daß die nicht betriebenen Katoden entweder abgeschaltet oder auf ein Potential gelegt werden, daß sie nicht als Anoden gegenüber der betriebenen Katode wirken können.

Zur Erreichung einer langen Lebensdauer wird ein fortlaufender Wechsel der gezündeten Katoden empfohlen. Bei Dauerbetrieb sollten die Katoden mindestens einmal innerhalb 24 Stunden gewechselt werden.

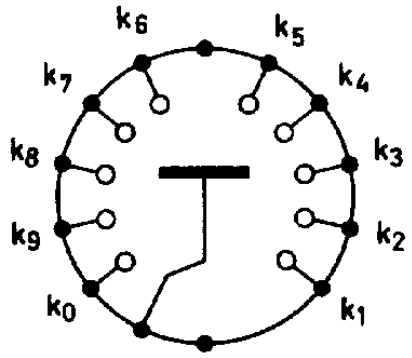

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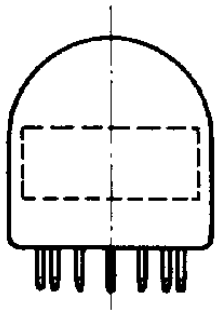

ø 27,5 max.
15,9±0,8
9,5
28,6 max.
35 max.

Sockel B13B


10,16
3
15,49

LORENZ	Ziffernanzeigeröhre Gasgefüllte Kaltkatodenröhre	**GN4** - Vorläufig -





Gewicht ca. 10 g

1. Betriebswerte für Gleichspannung[1)]

Anodenbetriebsspannung	U_{Ba}	170	250	300	V
Anodenwiderstand	R_a	15	56	82	kΩ
Katodenstrom	I_k	2	2	2	mA

2. Grenzwerte

Minimale Speisespannung	U_{Bmin}	170	V
Minimale Löschspannung	U_{emin}	100	V
Maximaler Katodenspitzenstrom	I_{kspmax}	4	mA
Mittlerer Katodenstrom	I_k	3	mA
Minimaler Katodenstrom für volle Ausleuchtung	I_k	1,5	mA

3. Besondere Hinweise

Zur Erhöhung des Kontrastes ist der Röhrenkolben als Orange-Filter eingefärbt.

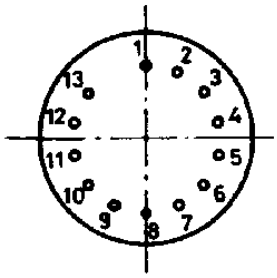
Als Speisespannung soll die höchste im Gerät verfügbare Spannung mit einem entsprechend bemessenen Anodenwiderstand verwendet werden, um die Unterschiede im Strom und damit in der Helligkeit infolge Streuung und Lebensdauer der Röhre möglichst gering zu halten.

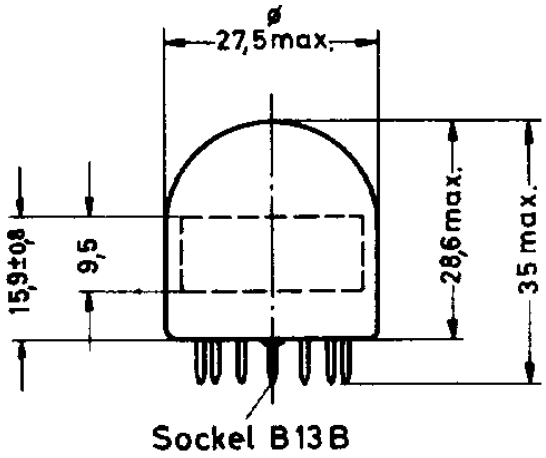
Die Schaltung soll so ausgelegt sein, daß die nicht betriebenen Katoden entweder abgeschaltet oder auf ein Potential gelegt werden, daß sie nicht als Anoden gegenüber der betriebenen Katode wirken können.

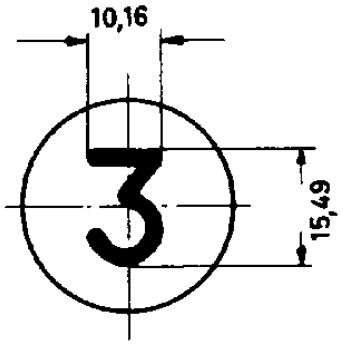
Zur Erreichung einer langen Lebensdauer wird ein fortlaufender Wechsel der gezündeten Katoden empfohlen. Bei Dauerbetrieb sollten die Katoden mindestens einmal innerhalb 100 Stunden gewechselt werden.

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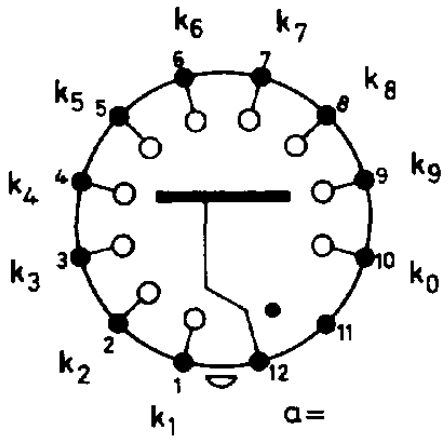
1) Die Röhre darf nicht ohne Anodenwiderstand betrieben werden.

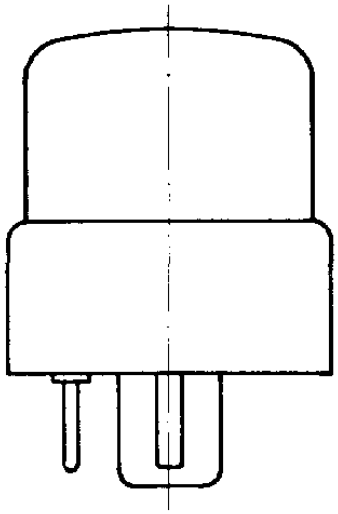

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ø 27,5 max.
15,9±0,8
9,5
28,6 max.
35 max.
Sockel B13B


10,16
3
15,49

LORENZ	Ziffernanzeigeröhre	GN5 GN5A - Vorläufig -





Gewicht ca.

1. Betriebswerte für Gleichspannung[1)]

Anodenbetriebsspannung	U_{Ba}	200	250	300	400	V
Anodenwiderstand	R_a	18	33	47	75	kΩ
Katodenstrom	I_k	3,5	3,5	3,5	3,5	mA

2. Grenzwerte

Minimale Speisespannung	U_{Bmin}	200	V
Minimale Löschspannung	U_{emin}	100	V
Maximaler Anodenstrom	I_{amax}	5	mA
Minimaler Anodenstrom	I_{amin}	2,5	mA

3. Besondere Hinweise

Als Speisespannung soll die höchste im Gerät verfügbare Spannung mit einem entsprechend bemessenen Anodenwiderstand verwendet werden, um die Unterschiede im Strom und damit in der Helligkeit infolge Streuung und Lebensdauer der Röhre möglichst gering zu halten.

Die Schaltung soll so ausgelegt sein, daß die nicht betriebenen Katoden entweder abgeschaltet sind oder auf ein Potential gelegt werden, daß sie nicht als Anoden gegenüber der betriebenen Katode wirken können.

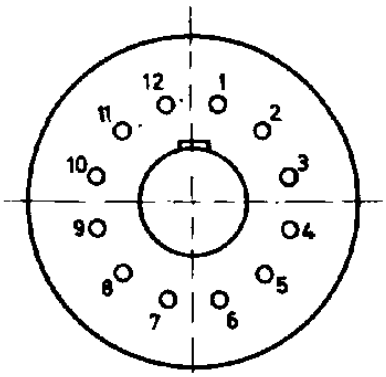
Die Katode Nr. 1 ist so ausgelegt, daß die Verwendung eines Ausgleichwiderstandes zur Begrenzung des Stromes an dieser Katode entfällt.

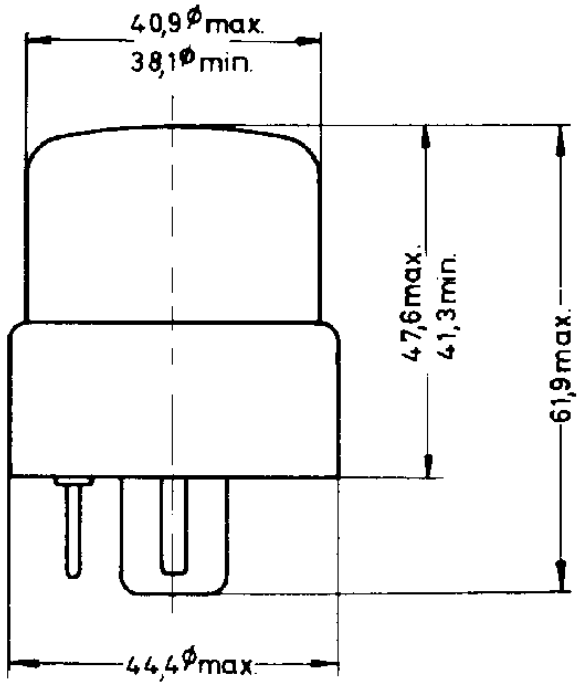
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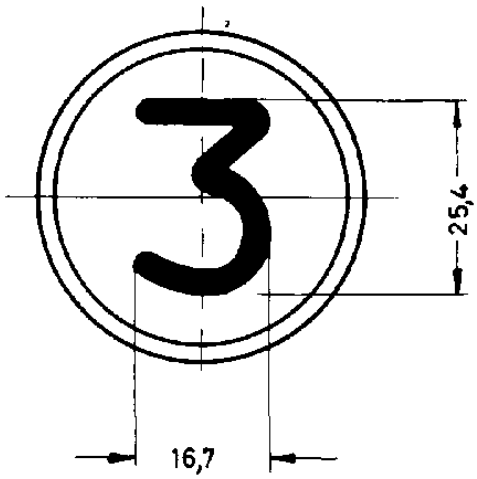
1) Die Röhre darf nicht ohne Anodenwiderstand betrieben werden.

Zur Erreichung einer langen Lebensdauer sollen die Katoden wechselweise betrieben werden. Ist ein Dauerbetrieb unvermeidlich, sollte mindestens einmal innerhalb 24 Stunden ein Umschalten auf eine andere Katode erfolgen.

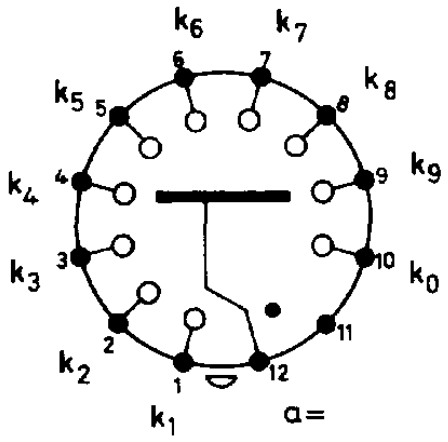
Die GN 5 hat zur Erhöhung des Kontrastes einen rot eingefärbten Röhrenkolben, während die GN 5 A einen Klarglaskolben hat, für den äußere Filter verwendet werden können.

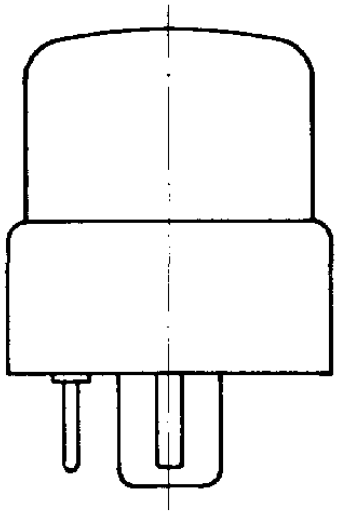

12
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40,9Ø max.
38,1Ø min.
47,6max.
41,3min.
61,9max.
44,4Ø max.


3
25,4
16,7

LORENZ	Ziffernanzeigeröhre	GN5 GN5A - Vorläufig -





Gewicht ca.

1. Betriebswerte für Gleichspannung[1)]

Anodenbetriebsspannung	U_{Ba}	200	250	300	400	V
Anodenwiderstand	R_a	18	33	47	75	kΩ
Katodenstrom	I_k	3,5	3,5	3,5	3,5	mA

2. Grenzwerte

Minimale Speisespannung	U_{Bmin}	200	V
Minimale Löschspannung	U_{emin}	100	V
Maximaler Anodenstrom	I_{amax}	5	mA
Minimaler Anodenstrom	I_{amin}	2,5	mA

3. Besondere Hinweise

Als Speisespannung soll die höchste im Gerät verfügbare Spannung mit einem entsprechend bemessenen Anodenwiderstand verwendet werden, um die Unterschiede im Strom und damit in der Helligkeit infolge Streuung und Lebensdauer der Röhre möglichst gering zu halten.

Die Schaltung soll so ausgelegt sein, daß die nicht betriebenen Katoden entweder abgeschaltet sind oder auf ein Potential gelegt werden, daß sie nicht als Anoden gegenüber der betriebenen Katode wirken können.

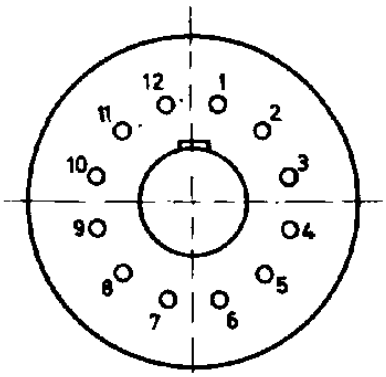
Die Katode Nr. 1 ist so ausgelegt, daß die Verwendung eines Ausgleichwiderstandes zur Begrenzung des Stromes an dieser Katode entfällt.

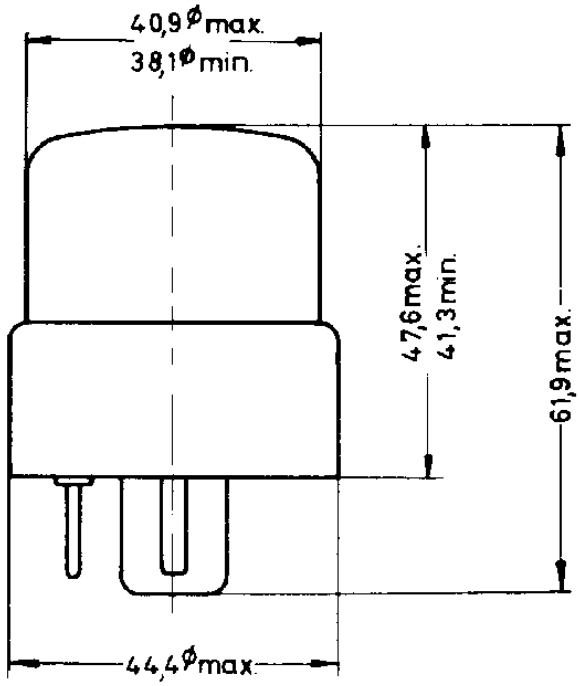
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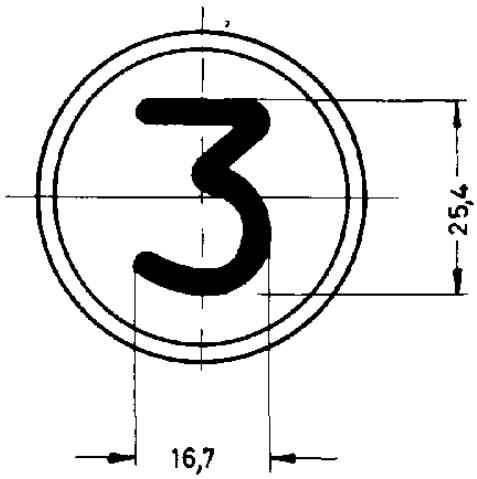
1) Die Röhre darf nicht ohne Anodenwiderstand betrieben werden.

Zur Erreichung einer langen Lebensdauer sollen die Katoden wechselweise betrieben werden. Ist ein Dauerbetrieb unvermeidlich, sollte mindestens einmal innerhalb 24 Stunden ein Umschalten auf eine andere Katode erfolgen.

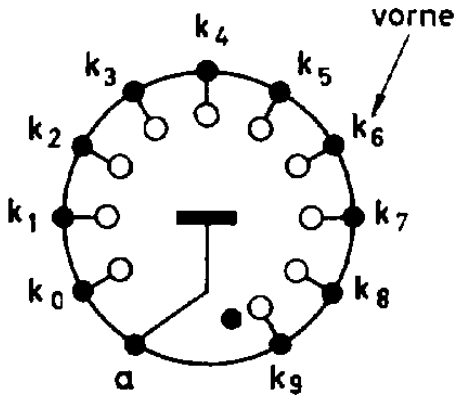
Die GN 5 hat zur Erhöhung des Kontrastes einen rot eingefärbten Röhrenkolben, während die GN 5 A einen Klarglaskolben hat, für den äußere Filter verwendet werden können.


12
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8
5
7
6


40,9Ø max.
38,1Ø min.
47,6max.
41,3min.
61,9max.
44,4Ø max.


3
25,4
16,7

LORENZ	Ziffernanzeigeröhre Gasgefüllte Kaltkatodenröhre	**GN6** - Vorläufig -



Gewicht ca. 8 g



Abmessungen siehe Blatt 2

1. Betriebswerte für Gleichspannung[1)]

Anodenbetriebsspannung	U_{Ba}	200	300	400	V
Anodenwiderstand	R_a	33	100	150	kΩ
Katodenstrom	I_k	1,7	1,6	1,7	mA

2. Grenzwerte

Minimale Speisespannung	U_{Bmin}	200	V
Minimale Löschspannung	U_{emin}	115	V
Mittlerer Katodenstrom	I_k	2,5	mA
Minimaler Katodenstrom für volle Ausleuchtung	I_{kmin}	1,25	mA

3. Besondere Hinweise

Zur Erhöhung des Kontrastes ist der Röhrenkolben als Orange-Filter eingefärbt.

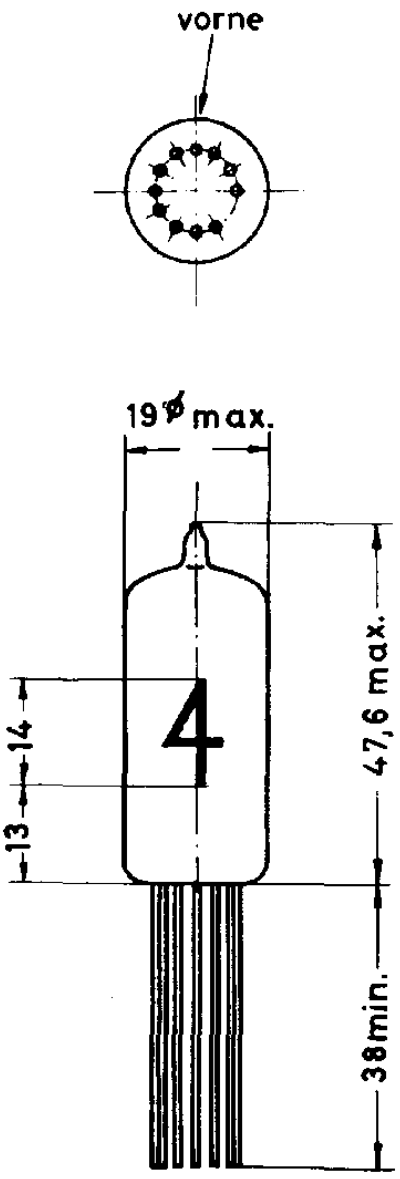
Als Speisespannung soll die höchste im Gerät verfügbare Spannung mit einem entsprechend bemessenen Anodenwiderstand verwendet werden, um die Unterschiede im Strom und damit in der Helligkeit infolge Streuung und Lebensdauer der Röhre möglichst gering zu halten.

Die Schaltung soll so ausgelegt sein, daß die nicht betriebenen Katoden entweder abgeschaltet oder auf ein solches Potential gelegt werden, daß sie nicht als Anoden gegenüber der betriebenen Katode wirken können.

Zur Erreichung einer langen Lebensdauer wird ein fortlaufender Wechsel der gezündeten Katoden empfohlen. Bei Dauerbetrieb sollten die Katoden mindestens einmal innerhalb 100 Stunden umgeschaltet werden.

---

1) Die Röhre darf nicht ohne Anodenwiderstand betrieben werden.


vorne
19 Ø max.
47,6 max.
14
13
38 min.
4

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

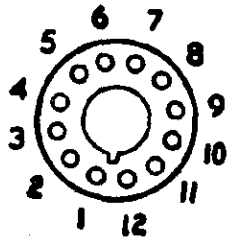
(CV5291)

10-way Register Or Indicator Tube

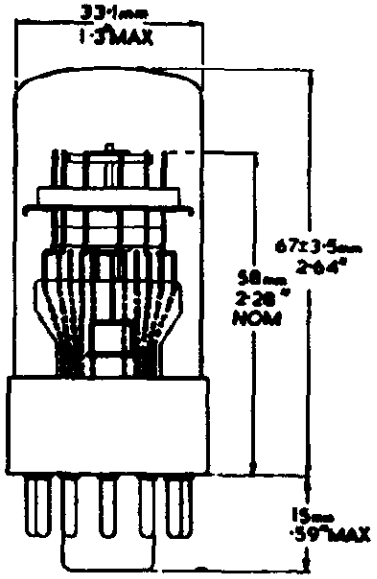
Mechanical Data

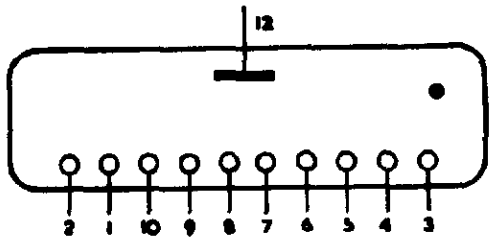
Mounting position	Any. The tube is viewed through the dome of the bulb.
Alignment	Cathode No. 2 is aligned with pin No. 11 to an accuracy of ± 12°.
Weight	50 g.
Escutcheon	N.80977.
Base	Duodecal.

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—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

MAINTENANCE TYPE ONLY

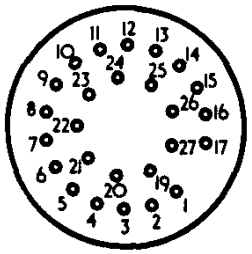
GR10G

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

Mechanical Data

Mounting position	Any
Base	B26A
Socket	B17, B26A or B27A

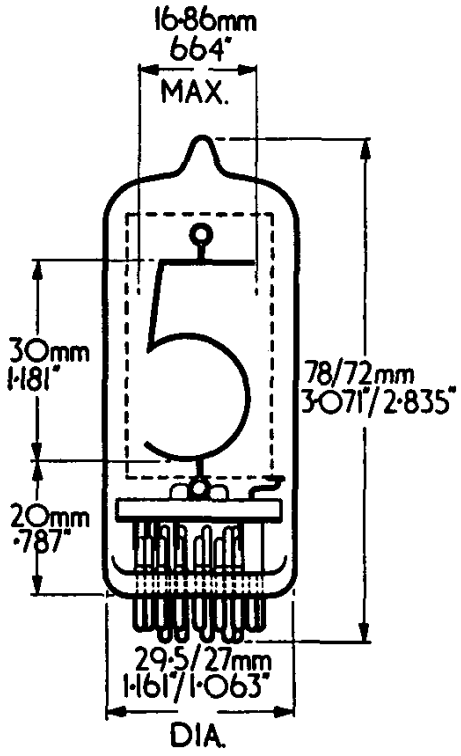
Base Connections
(underside view)

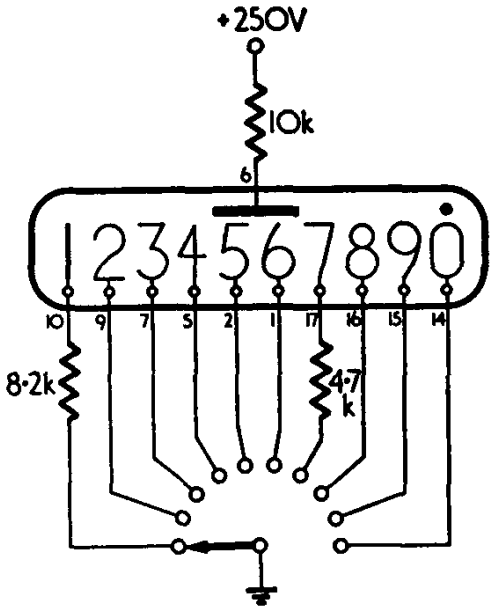


FRONT

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

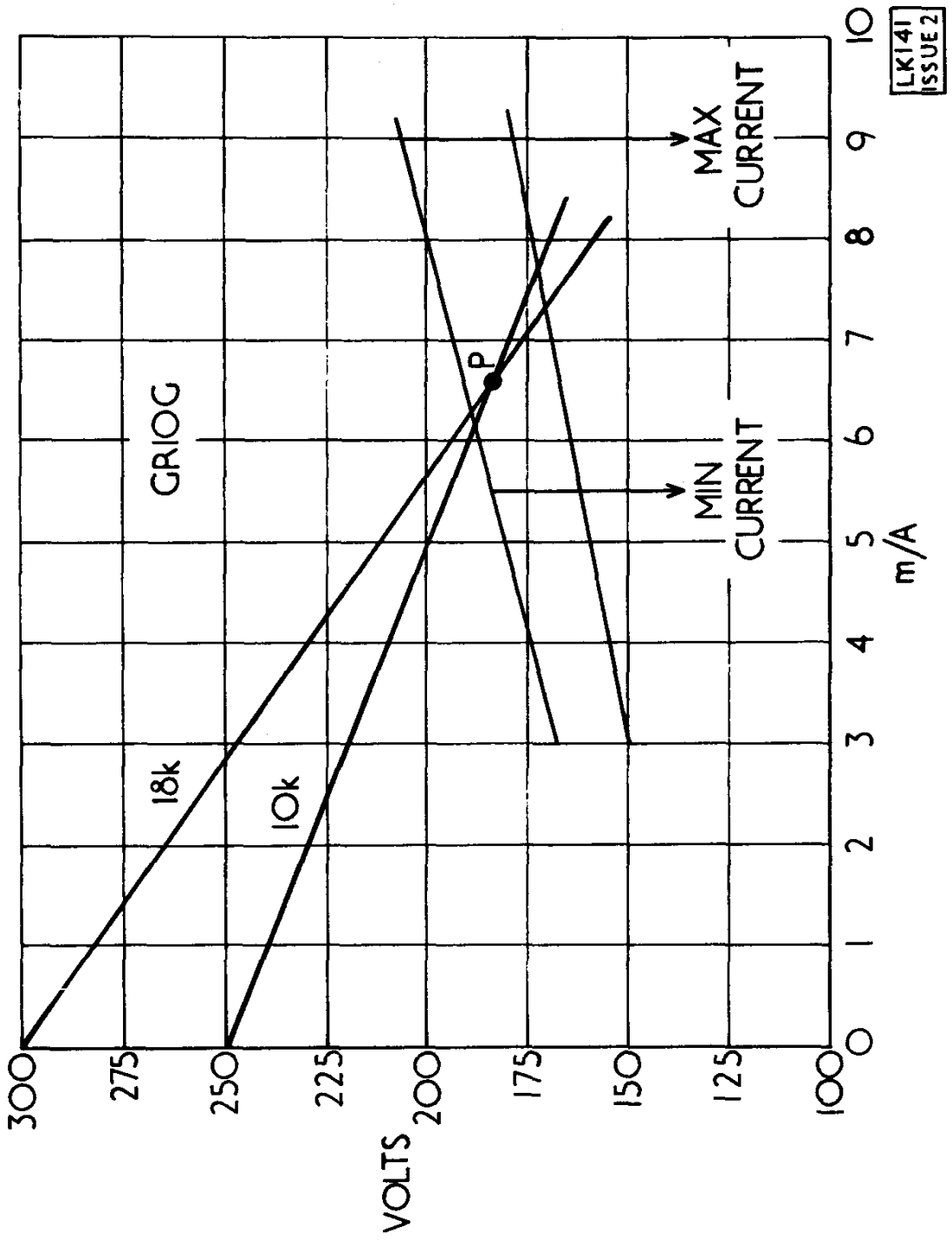
Note—All other pins are to be left unconnected.





*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 kΩ	250 V
R_a = 47 kΩ	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

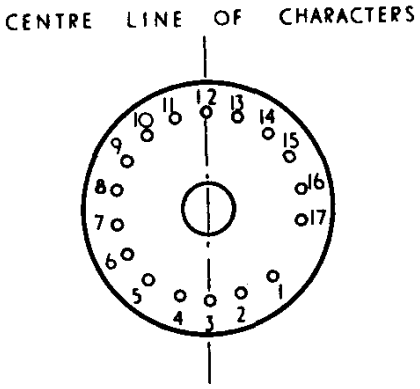
GR10H

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

Mechanical Data

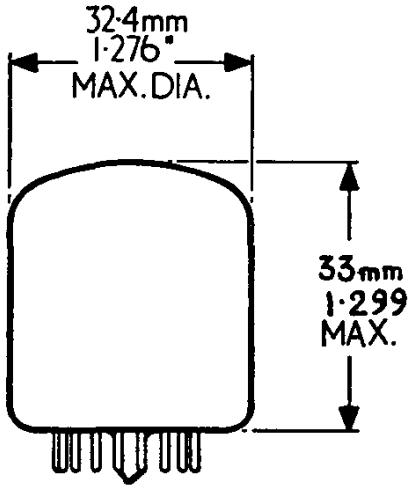
Mounting position	Any
Base	B17A
Socket	B17A

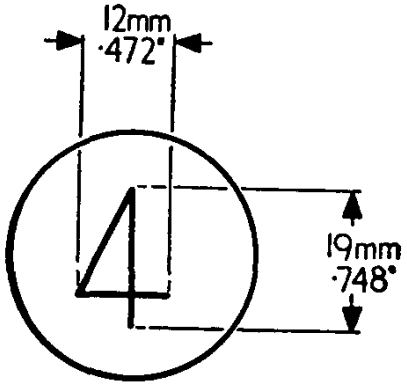
Base Connections
(underside view)

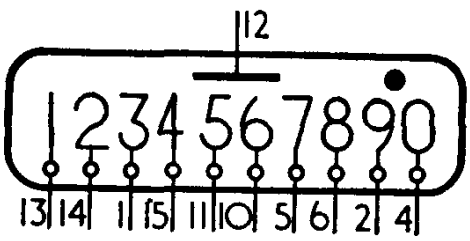


Pin 1 Cathode 3
2 Cathode 9
4 Cathode 0
5 Cathode 7
6 Cathode 8
10 Cathode 6
11 Cathode 5
12 Anode
13 Cathode 1
14 Cathode 2
15 Cathode 4

Note: All other pins are to be left unconnected.

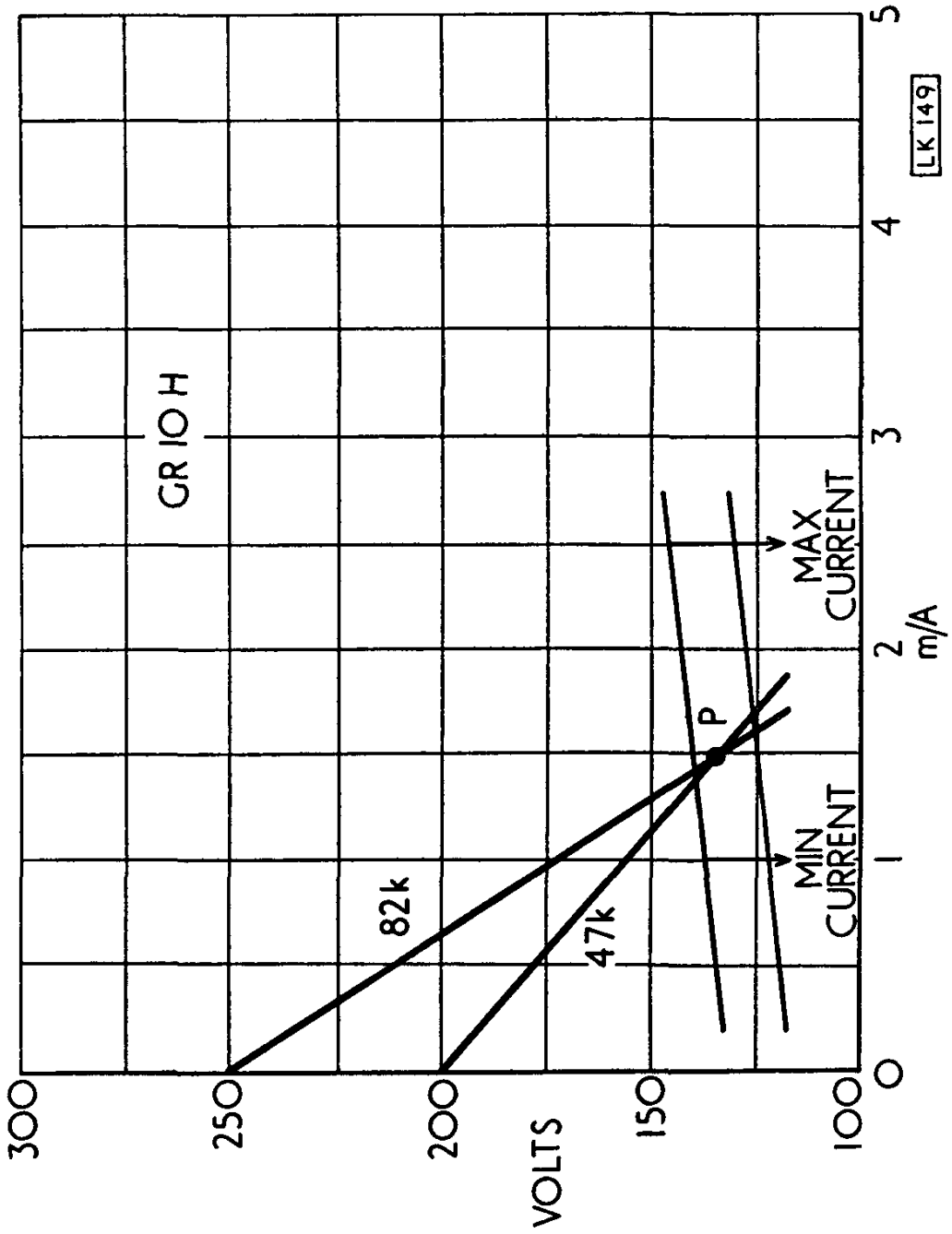






*DIGITRON – 10 Digit End-Viewing Cold-Cathode Numerical Register Tube

GR10H



Operating Characteristics

*Registered Trade Mark

*DIGITRON - 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

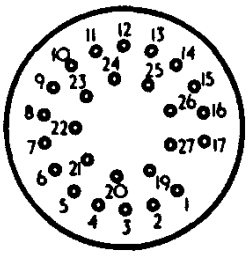
GR10J

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

Mechanical Data

Mounting position	Any
Base	B26A
Socket	B17A, B26A or B27A

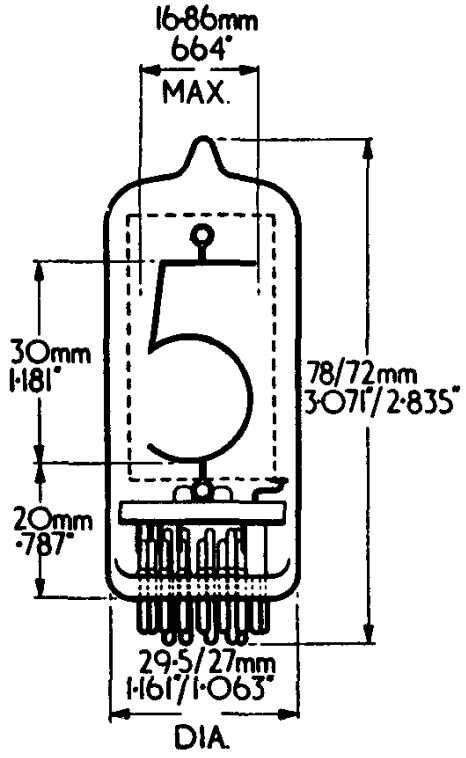
Base Connections
(underside view)

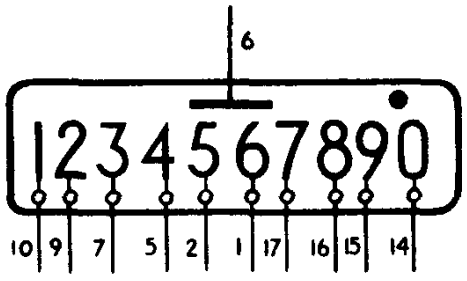


FRONT

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

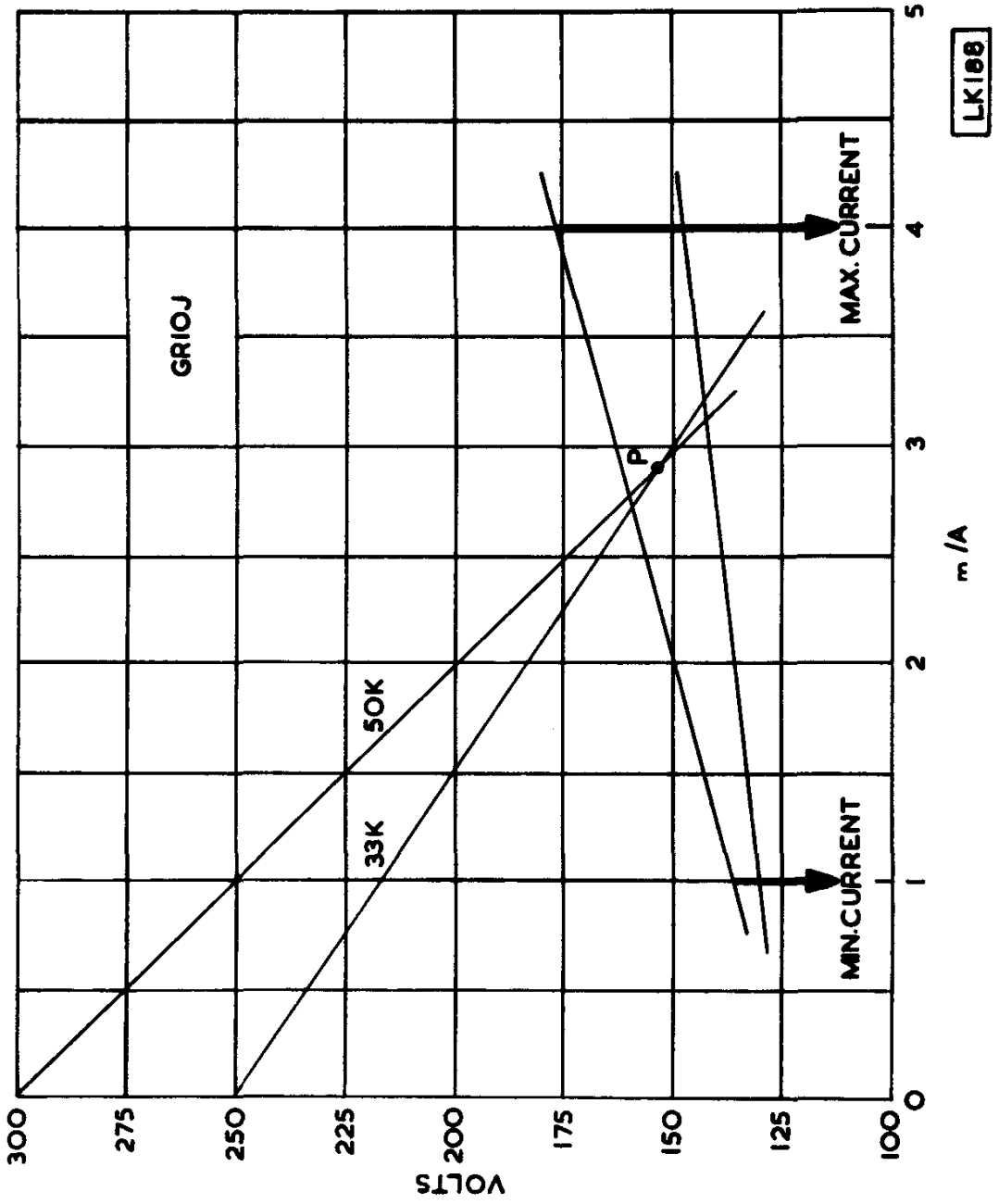
Note: All other pins are to be left unconnected.





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

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

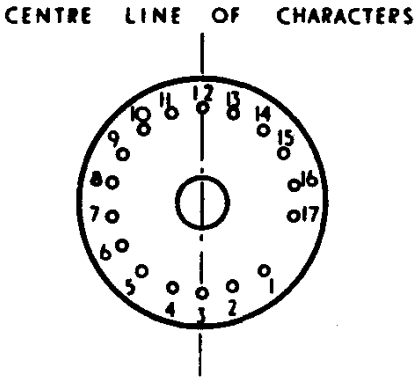
GR10K (CV.5842)

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

Mechanical Data

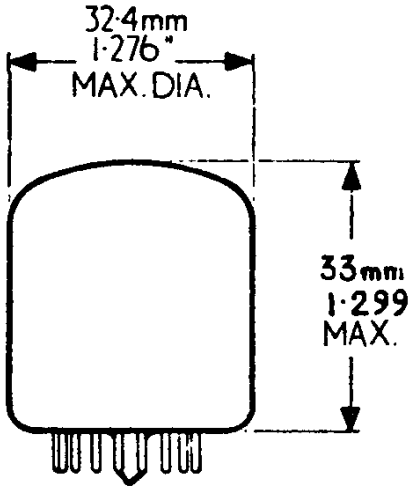
Mounting position	Any
Base	B17A
Socket	B17A

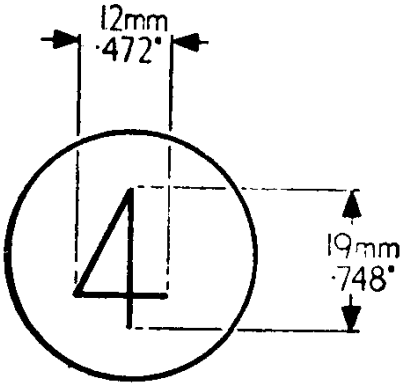
Base Connections
(underside view)

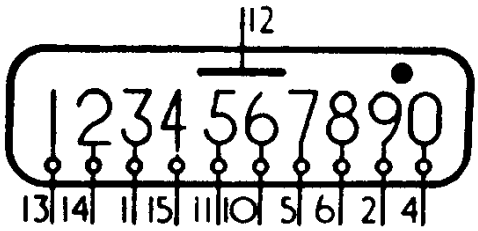


Pin 1 Cathode 3
2 Cathode 9
4 Cathode 0
5 Cathode 7
6 Cathode 8
10 Cathode 6
11 Cathode 5
12 Anode
13 Cathode 1
14 Cathode 2
15 Cathode 4

Note: All other pins are to be left unconnected.

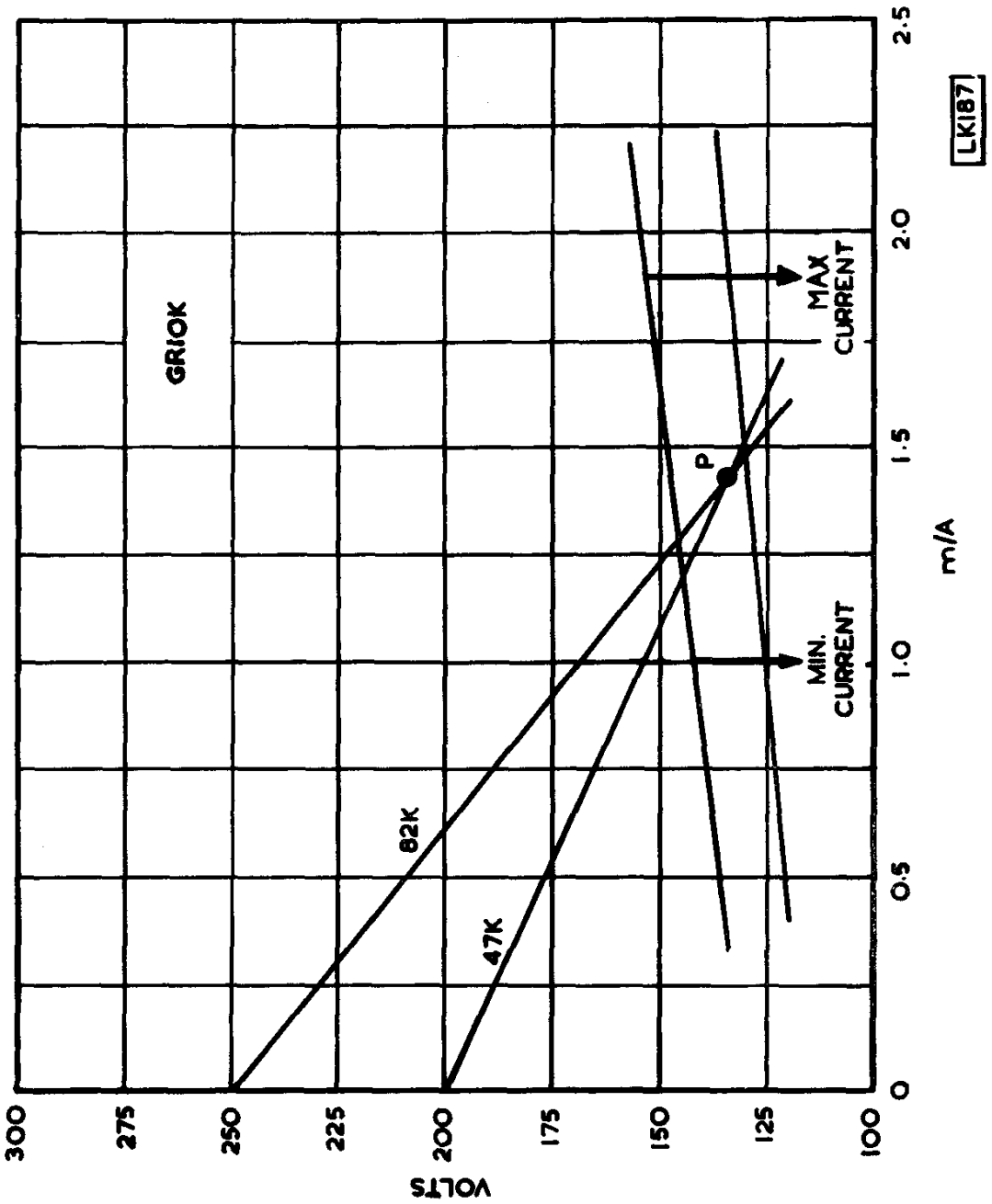






*DIGITRON - Long Life 10 Digit End-Viewing Cold-Cathode Numerical Register Tube

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.

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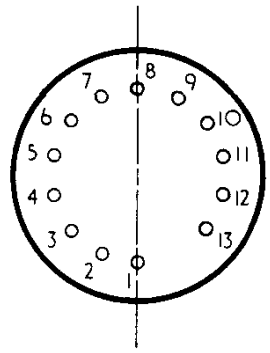
*DIGITRON—Long Life 10 Digit End-Viewing Cold Cathode Numerical Register Tube

GR10M

Mechanical Data

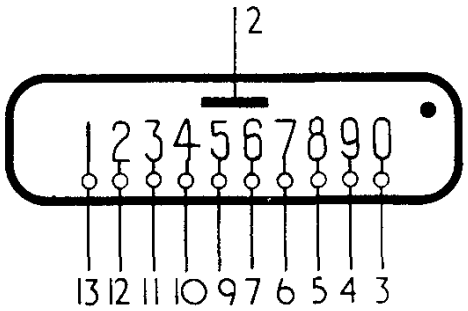
Mounting position	Any
Base	B13B
Socket	B13B

Base Connections
(underside view)

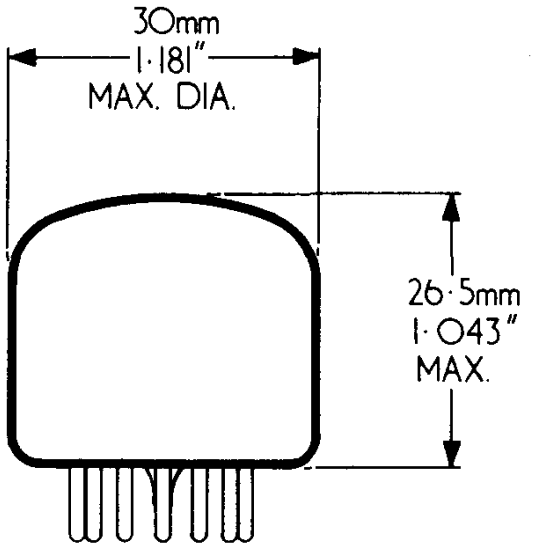


Pin	2	Anode
	3	Cathode 0
	4	Cathode 9
	5	Cathode 8
	6	Cathode 7
	7	Cathode 6
	9	Cathode 5
	10	Cathode 4
	11	Cathode 3
	12	Cathode 2
	13	Cathode 1

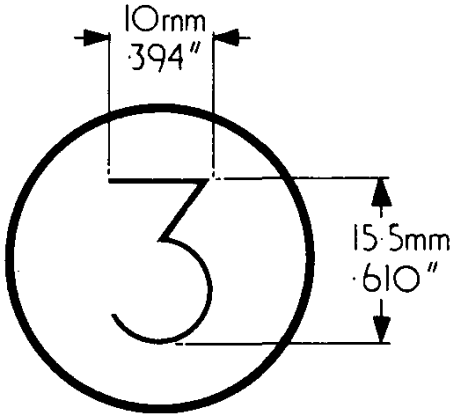
Note—All other pins are to be left unconnected



CENTRE LINE OF CHARACTERS



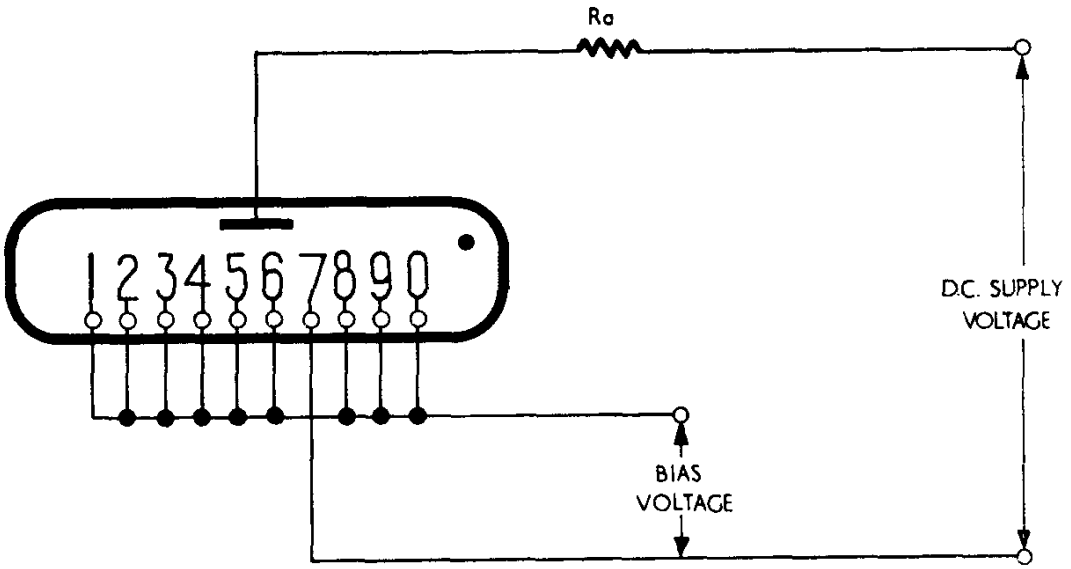
The dome of the tube is filter coated



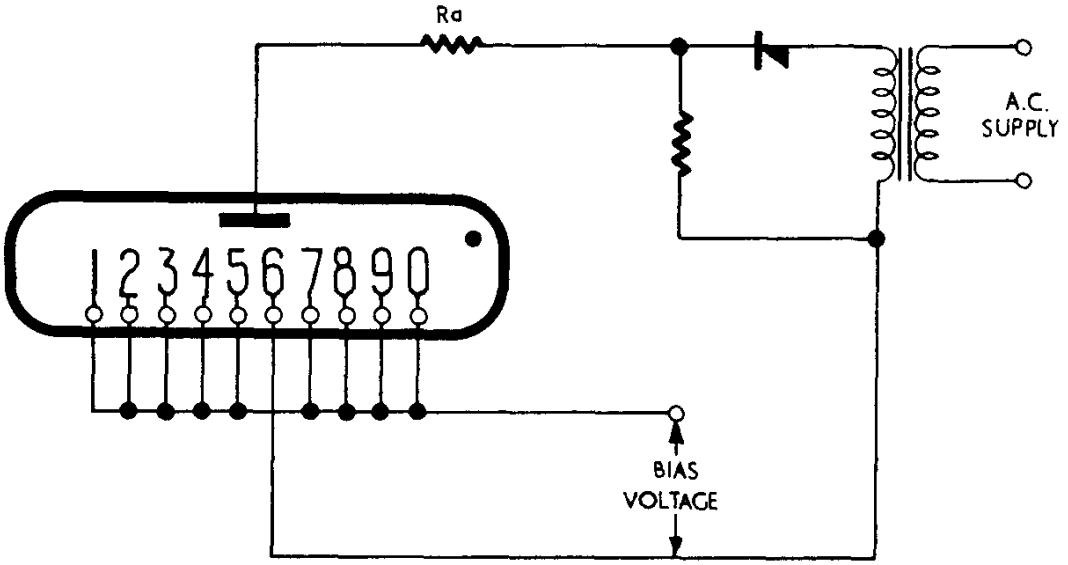
* Registered Trade Mark

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

GR10M



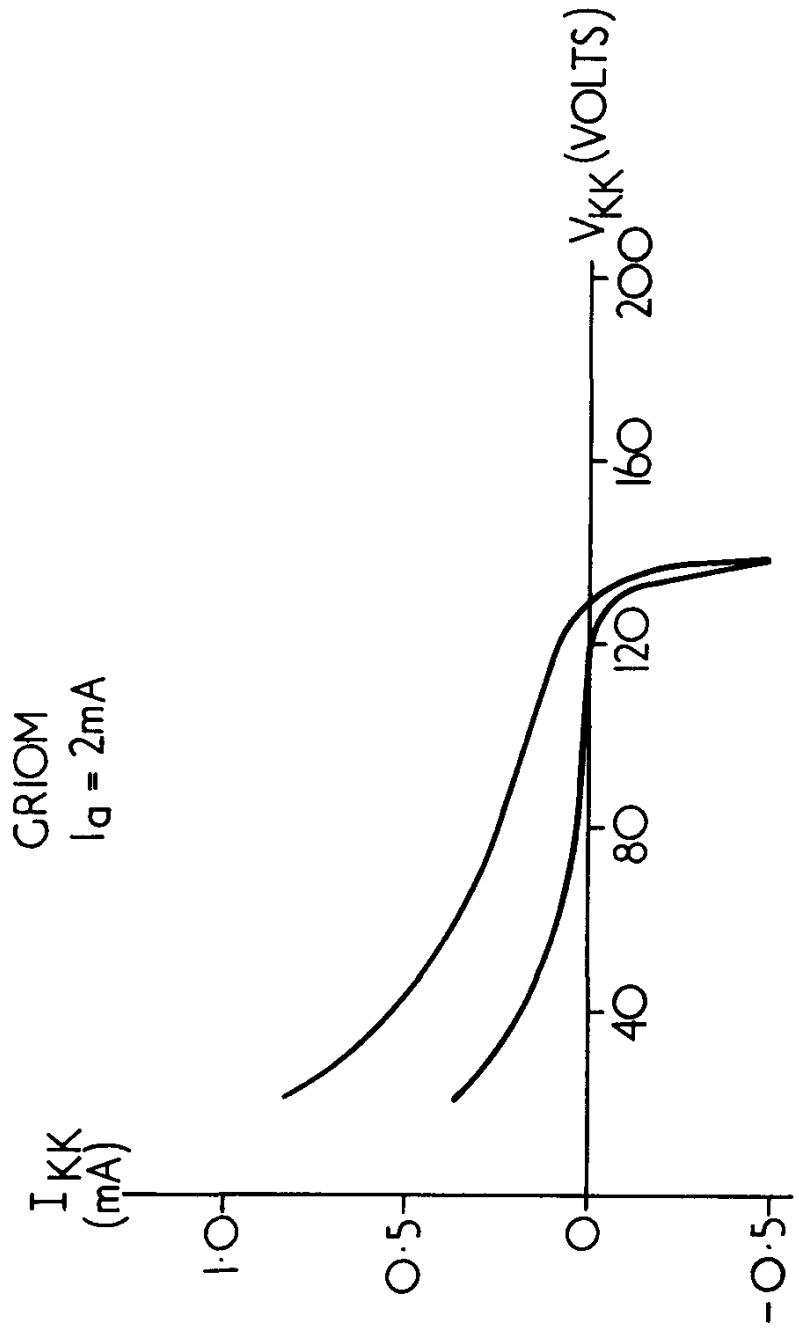
Typical Circuit for D.C. Operation



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

MAINTENANCE TYPE ONLY

*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.

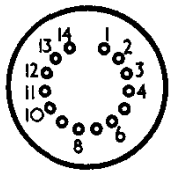
* Registered Trade Mark

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

Mechanical Data

Mounting position	Any
Base	Flying lead

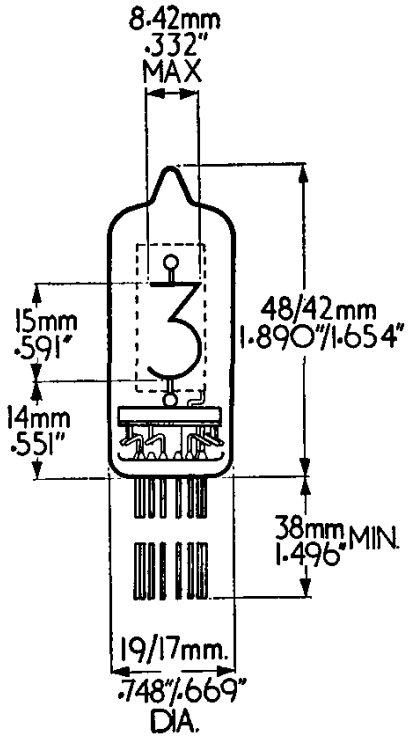
Base Connections
(underside view)

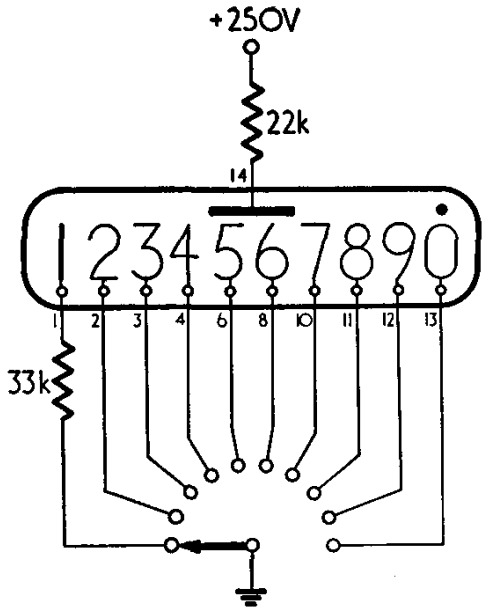


FRONT

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

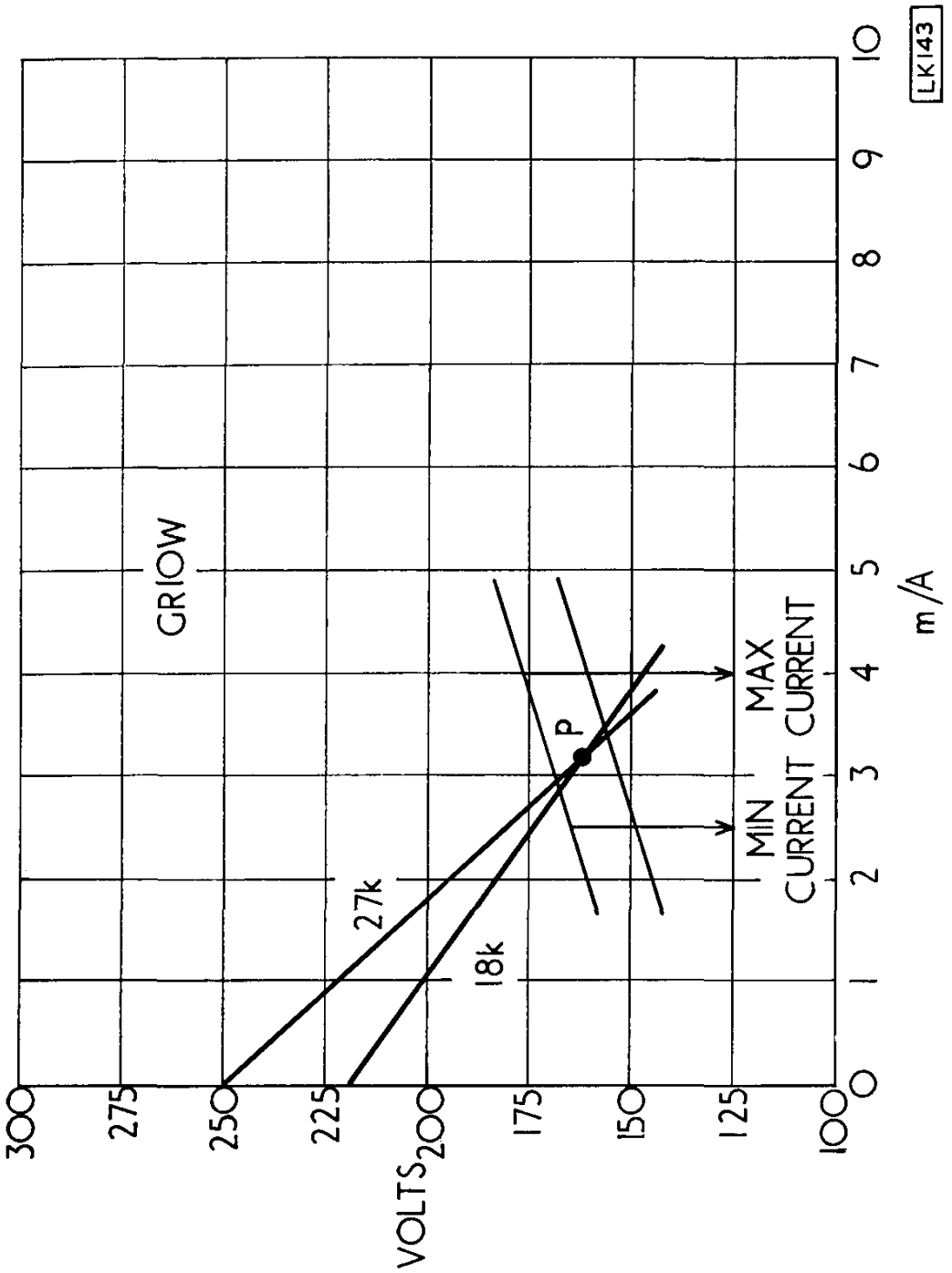
N.B.—To prevent damage to the tube, the leads should not be soldered or bent nearer than 5 mm ($\frac{1}{4}$") from the glass seal.





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

GR10W



Operating Characteristics

*Registered Trade Mark

RODAN

INDICATOR TUBE

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

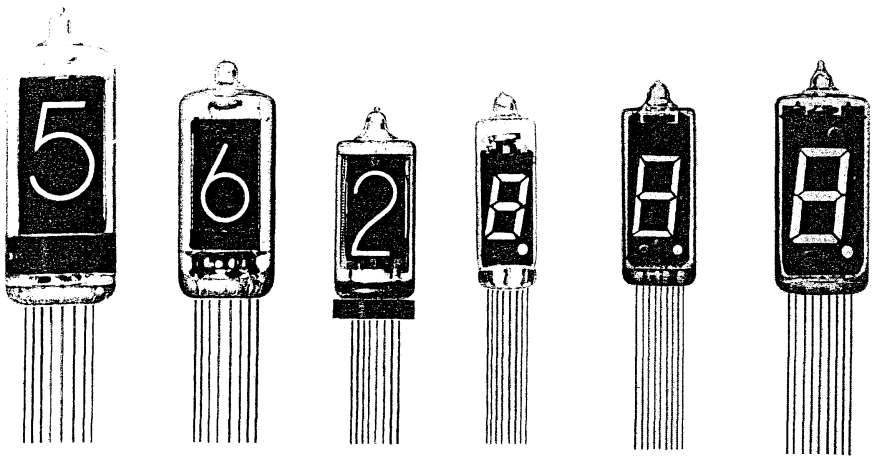
+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH



CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



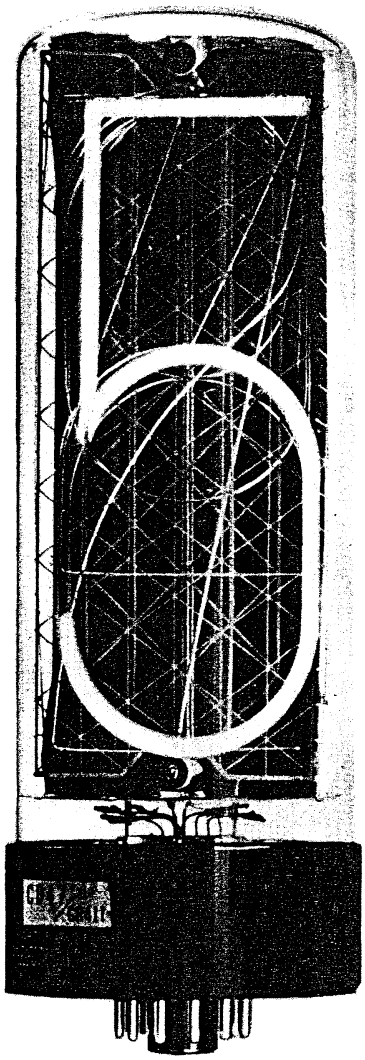
CD13



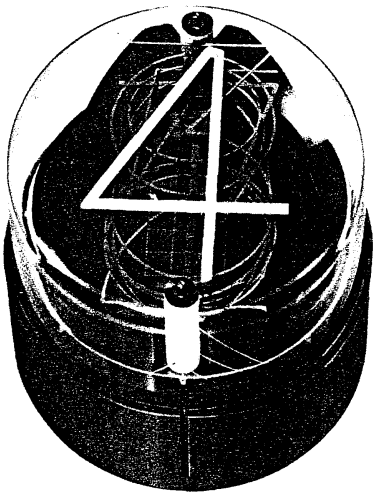
CD12



CD24



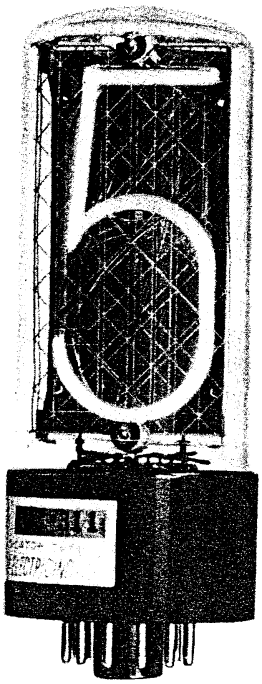
GR-414



CD27



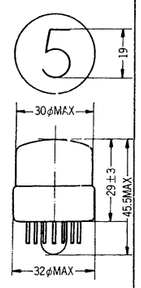
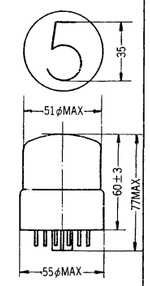
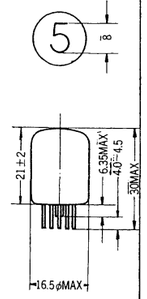
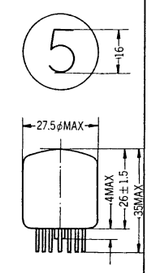
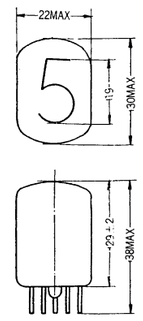
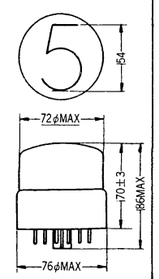
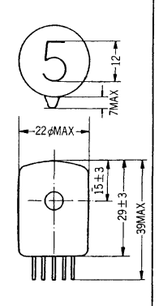
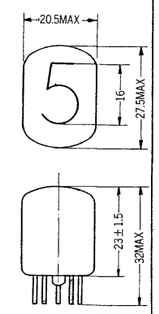
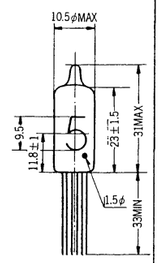
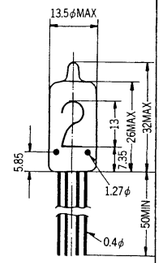
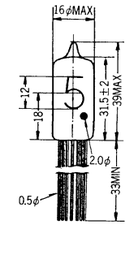
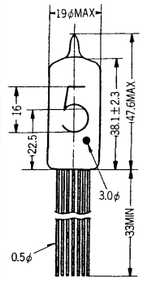
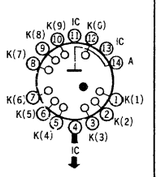
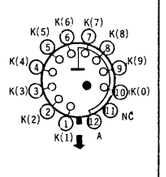
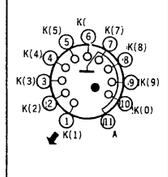
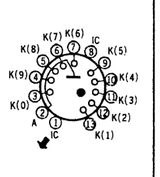
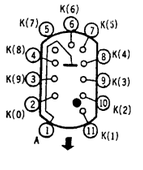
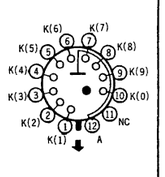
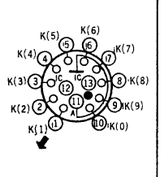
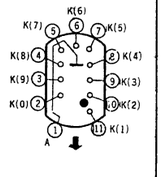
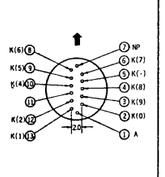
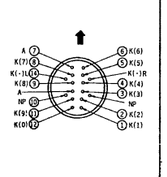
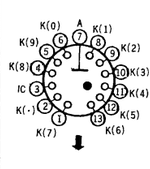
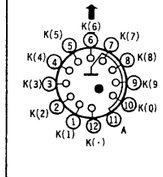
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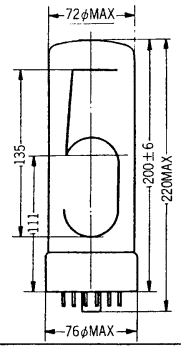
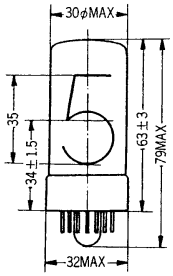
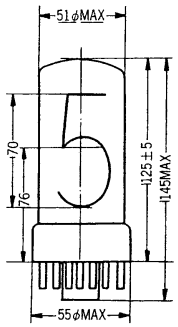
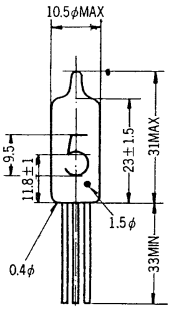
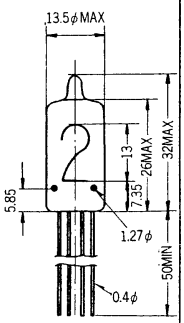
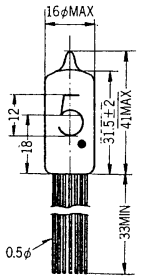
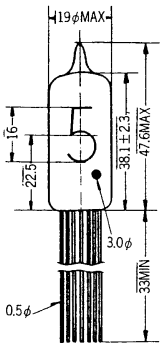
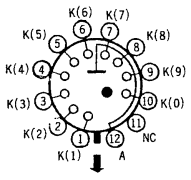
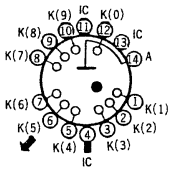
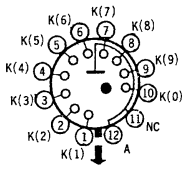
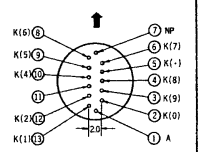
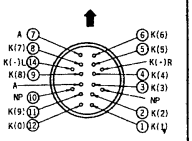
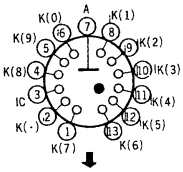
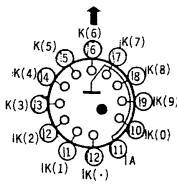
GR-311



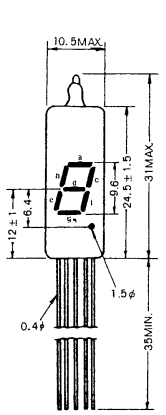
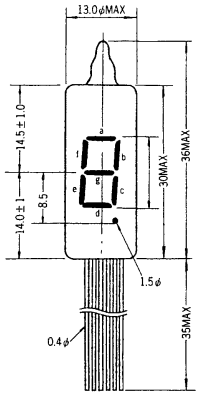
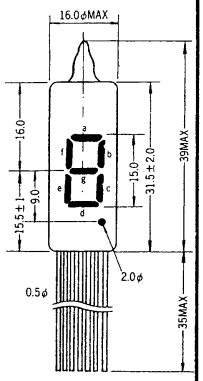
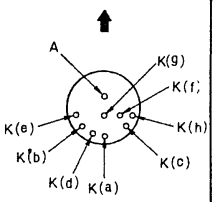
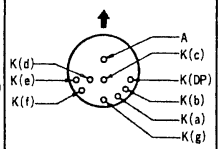
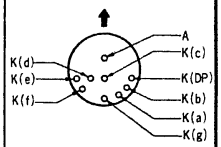
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

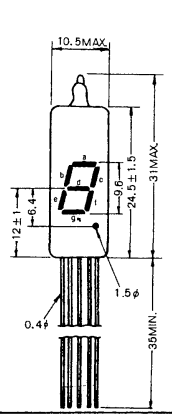
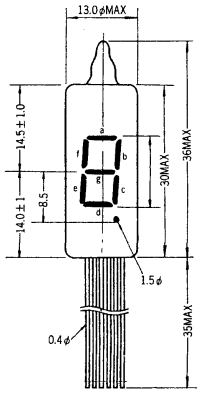
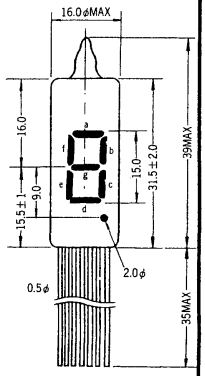
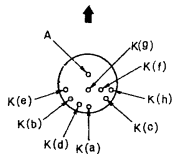
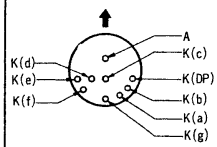
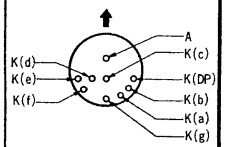
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

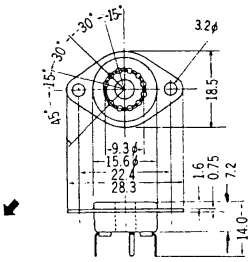
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

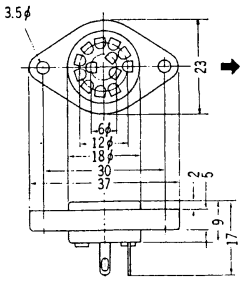
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

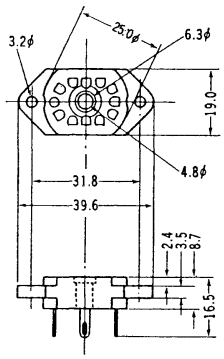
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



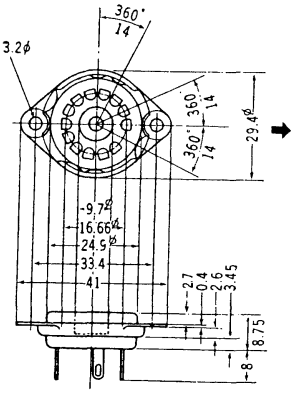
TSM-11P
CD 13



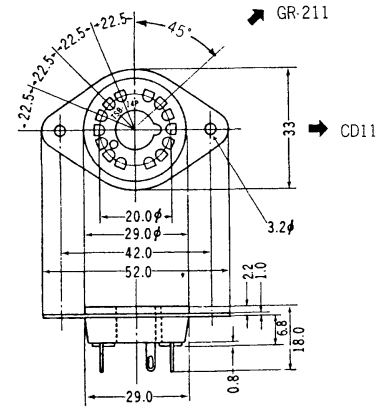
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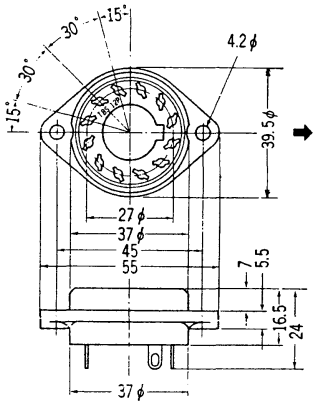
TSR-11P
CD 25, CD 43



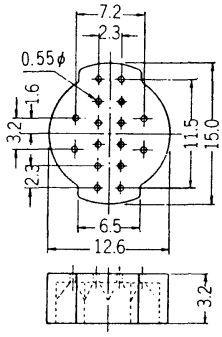
TSB-13P
CD 24



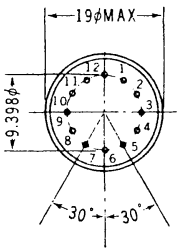
TSB-14P
CD11, GR-211



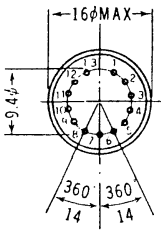
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

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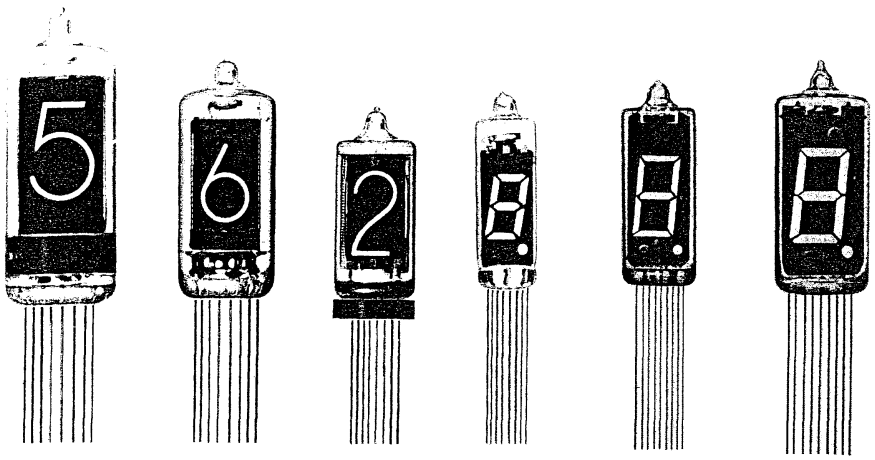
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+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH



CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



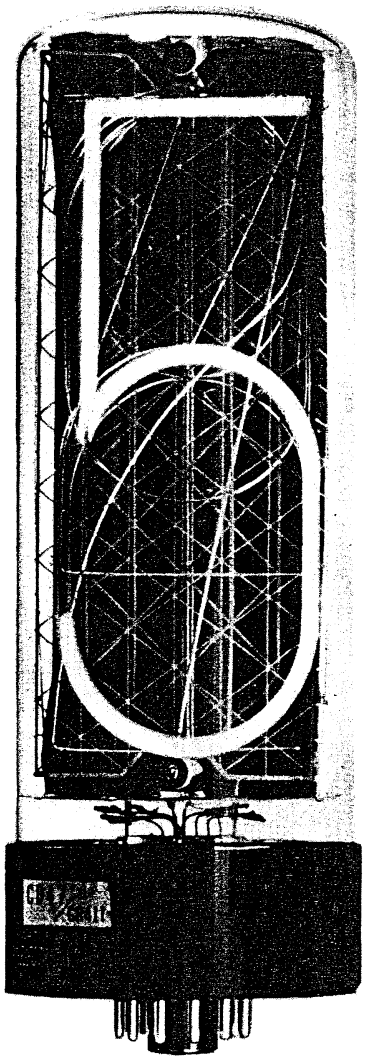
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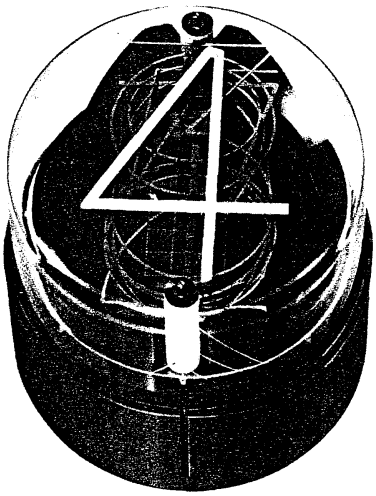
CD12



CD24



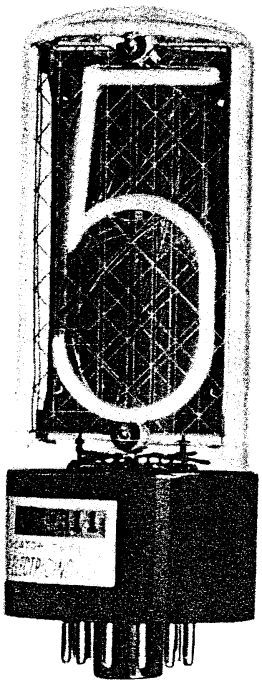
GR-414



CD27



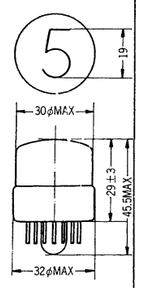
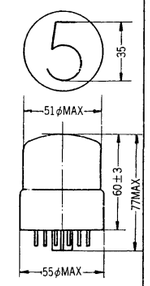
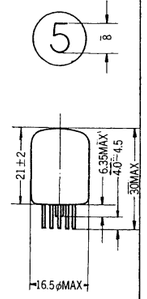
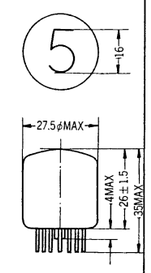
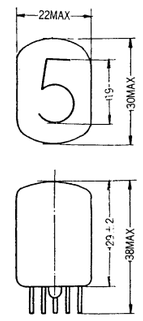
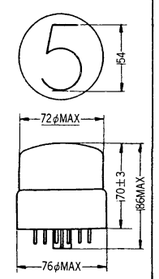
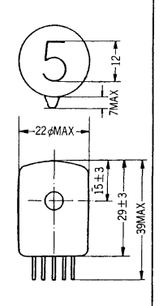
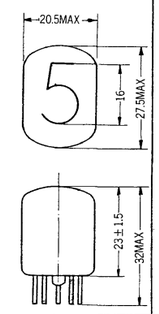
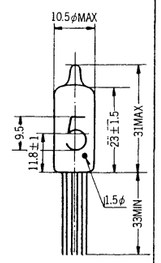
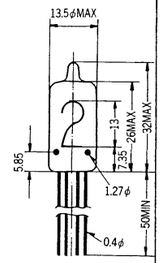
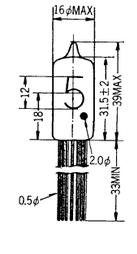
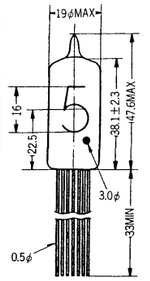
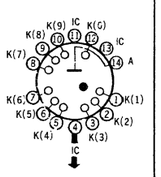
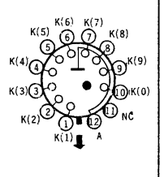
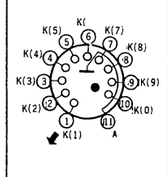
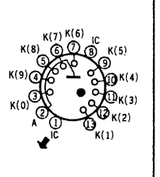
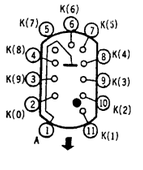
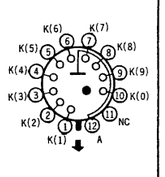
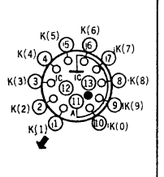
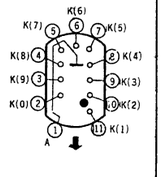
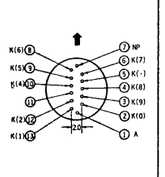
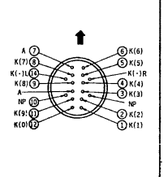
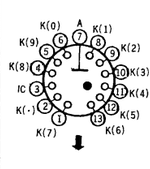
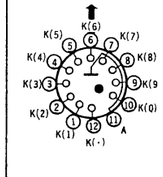
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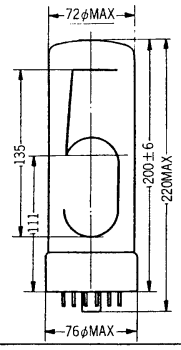
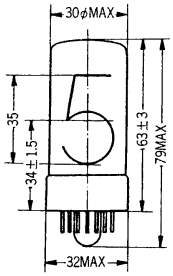
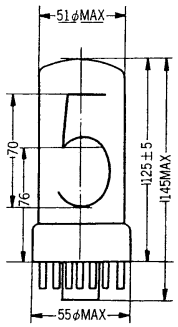
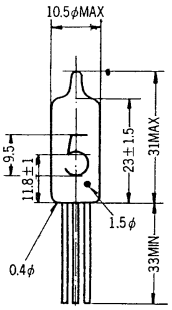
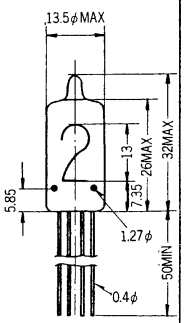
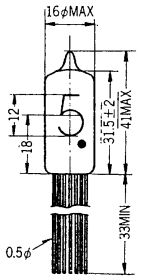
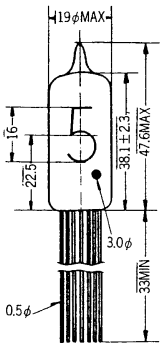
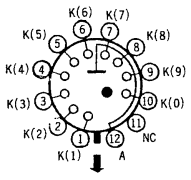
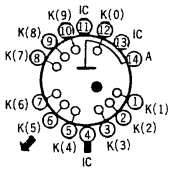
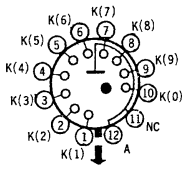
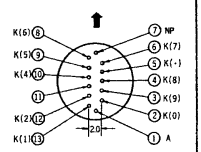
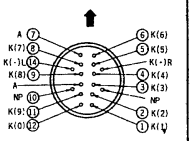
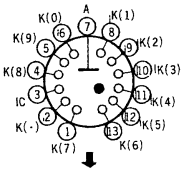
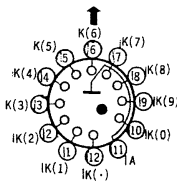
GR-311



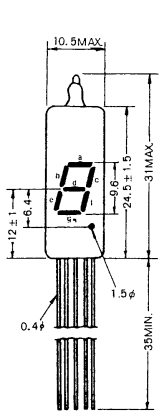
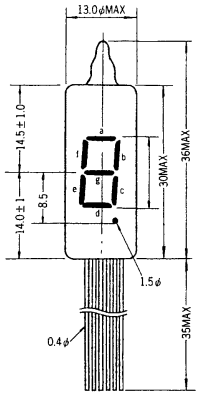
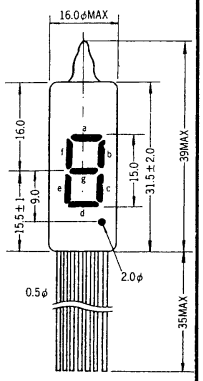
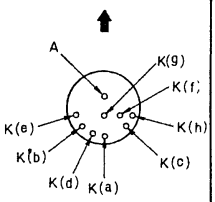
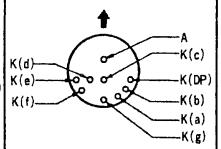
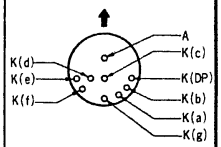
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

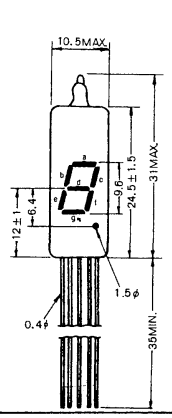
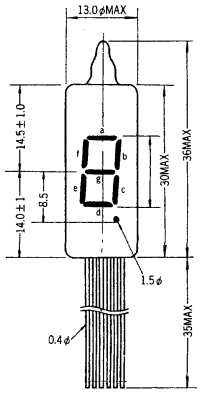
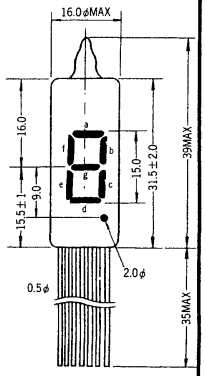
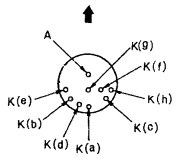
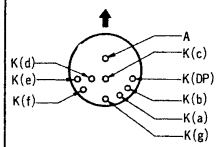
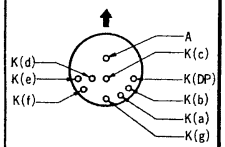
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

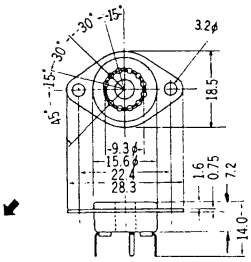
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

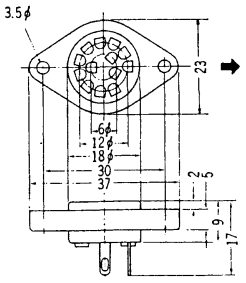
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

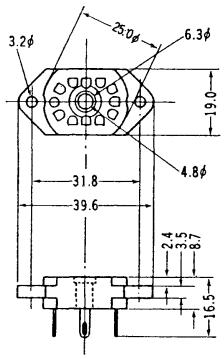
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



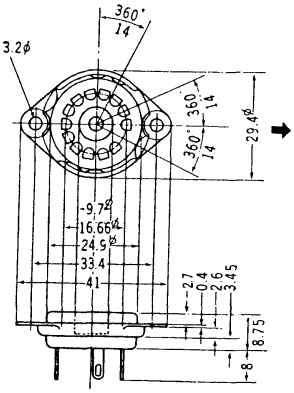
TSM-11P
CD 13



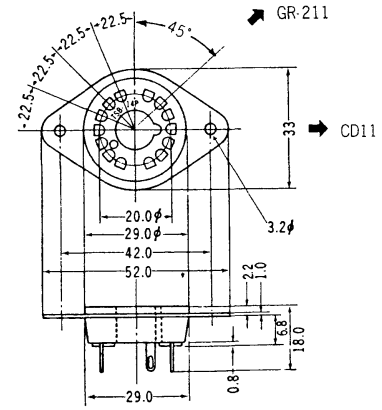
TSM-13P
CD 28



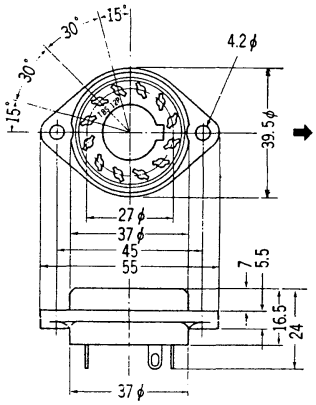
TSR-11P
CD 25, CD 43



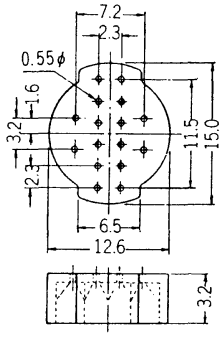
TSB-13P
CD 24



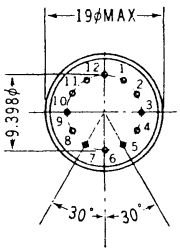
TSB-14P
CD11, GR-211



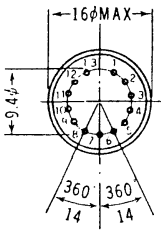
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

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RODAN

INDICATOR TUBE

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

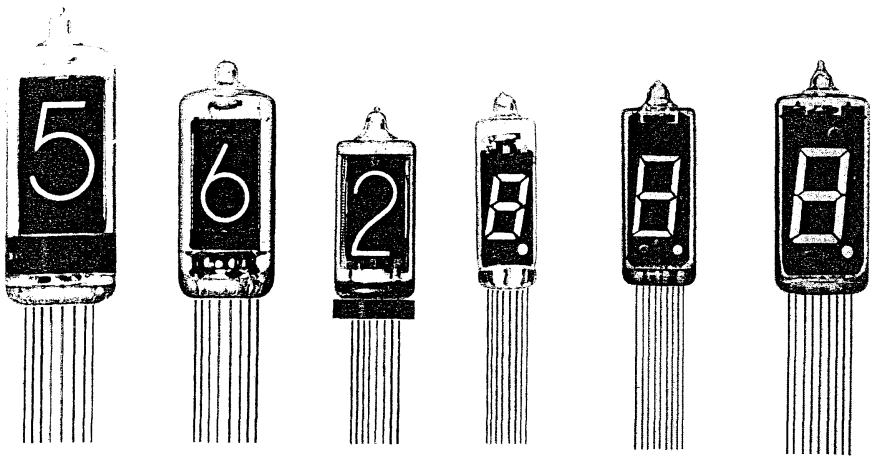
+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH



CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



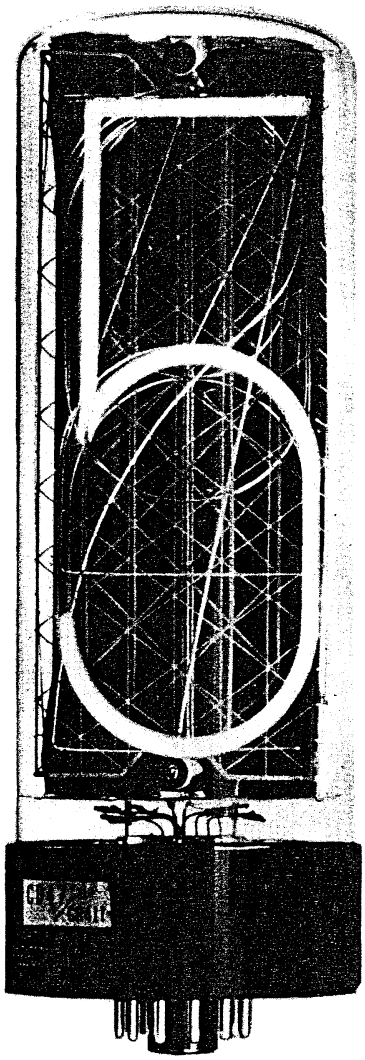
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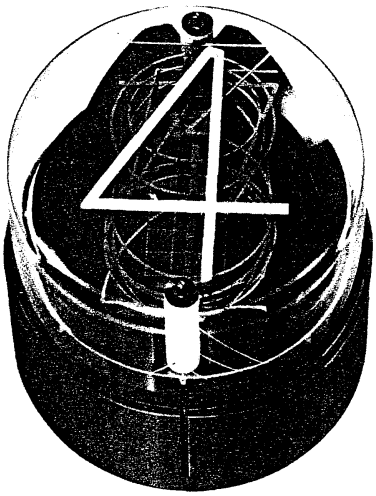
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CD24



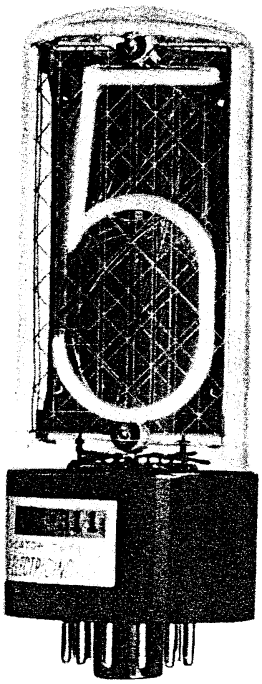
GR-414



CD27



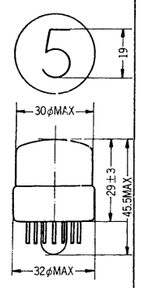
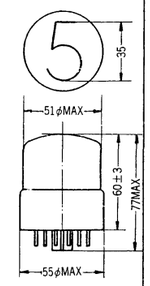
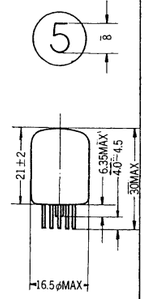
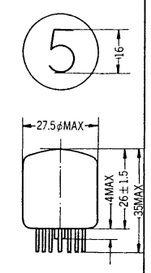
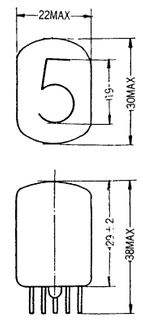
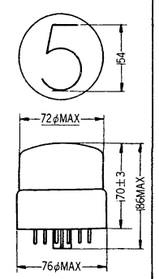
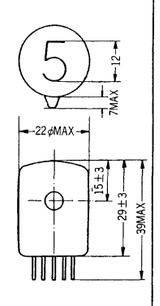
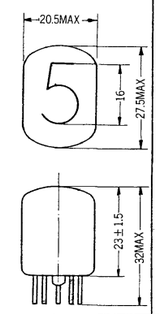
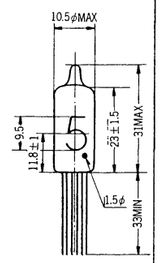
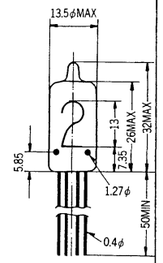
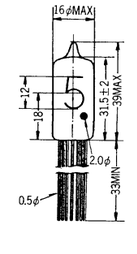
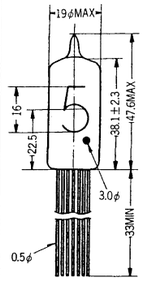
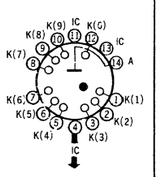
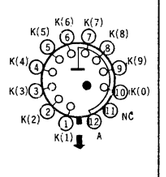
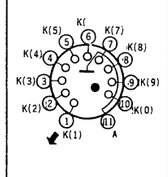
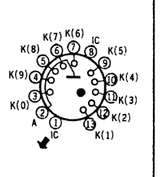
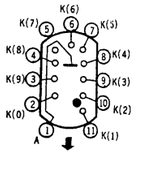
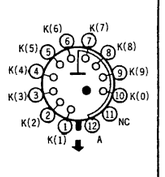
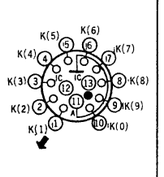
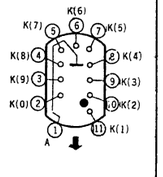
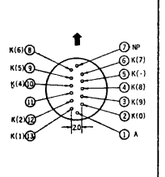
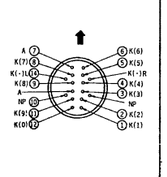
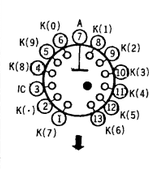
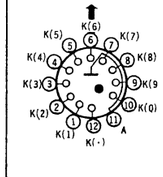
CD11



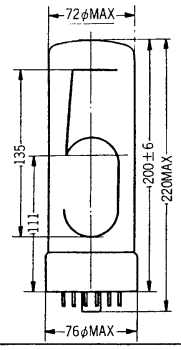
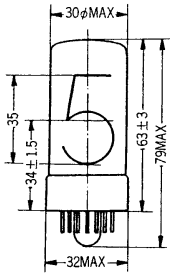
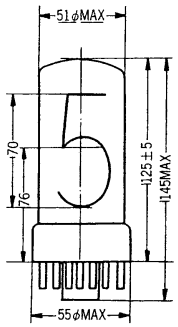
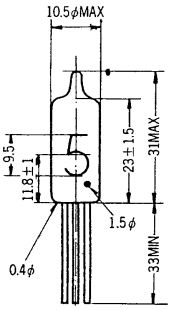
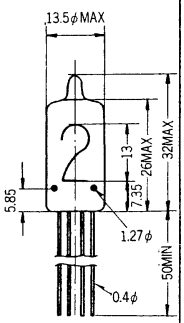
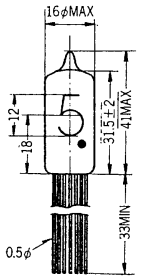
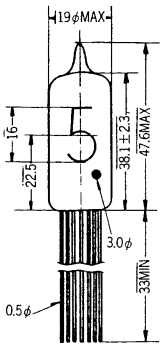
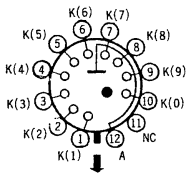
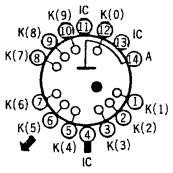
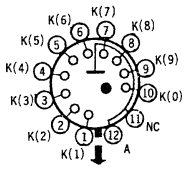
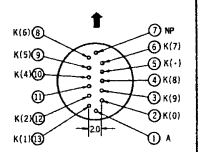
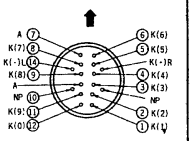
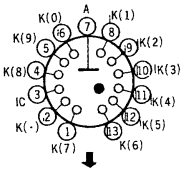
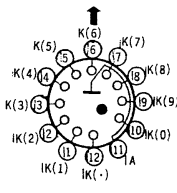
GR-311



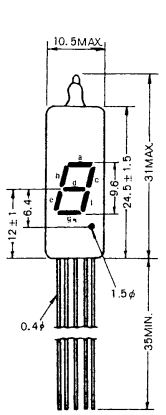
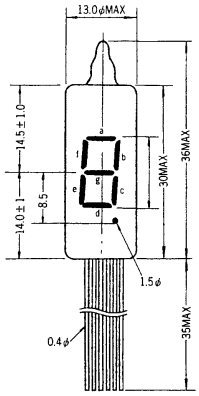
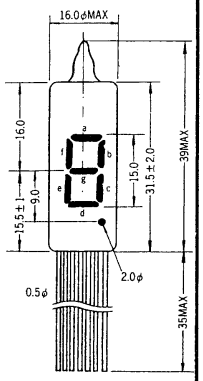
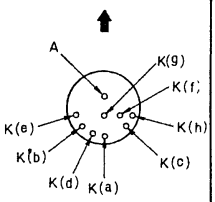
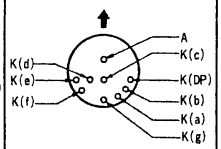
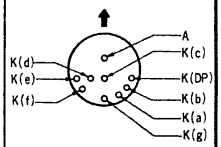
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

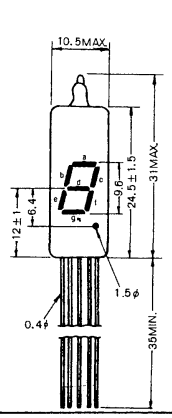
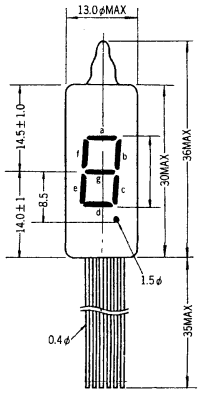
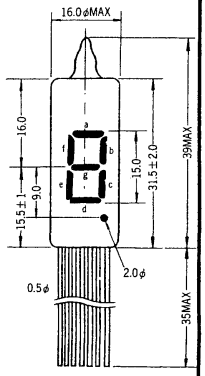
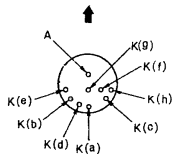
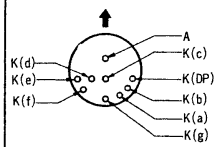
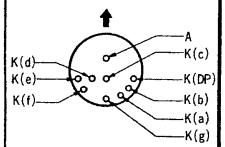
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

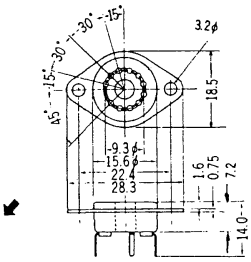
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

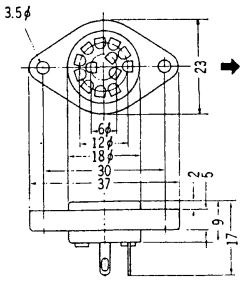
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

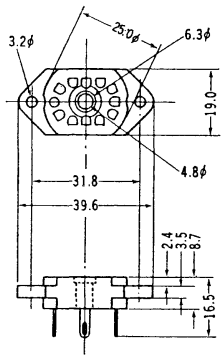
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



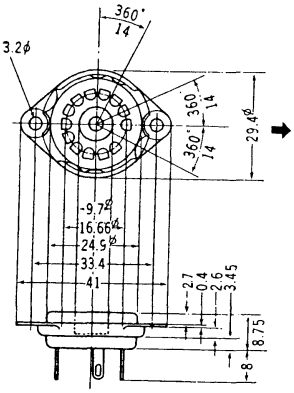
TSM-11P
CD 13



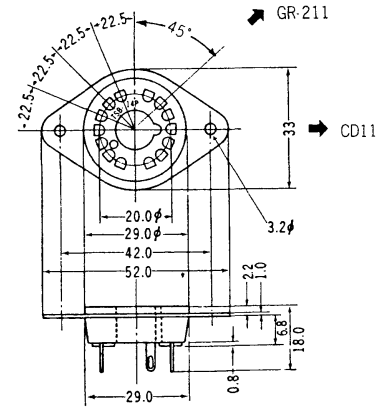
TSM-13P
CD 28



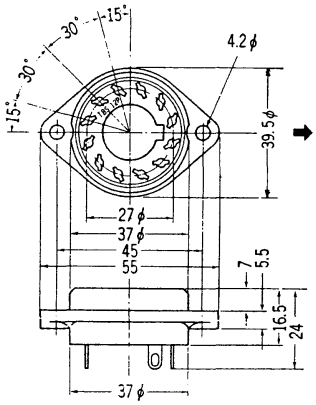
TSR-11P
CD 25, CD 43



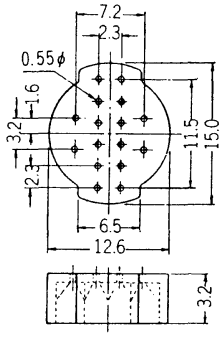
TSB-13P
CD 24



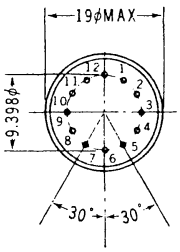
TSB-14P
CD11, GR-211



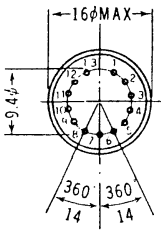
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

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1—8—3, SHIBUYA, SHIBUYA-KU, TOKYO 150, JAPAN

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RODAN

INDICATOR TUBE

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

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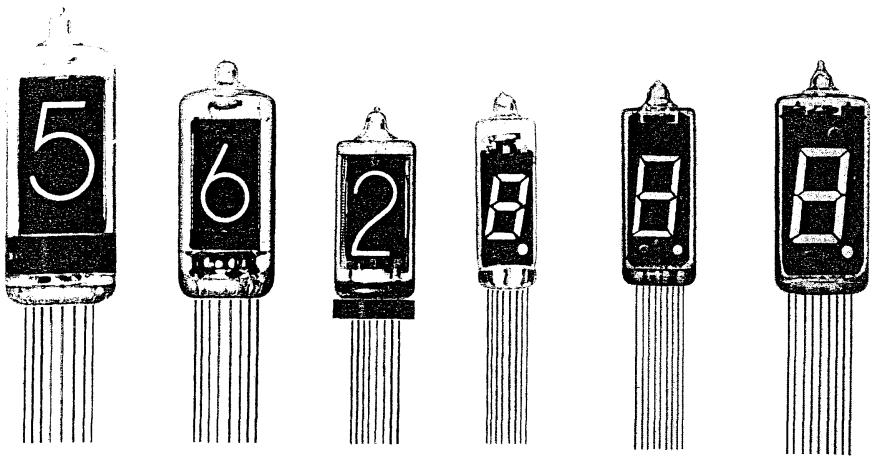
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+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH



CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



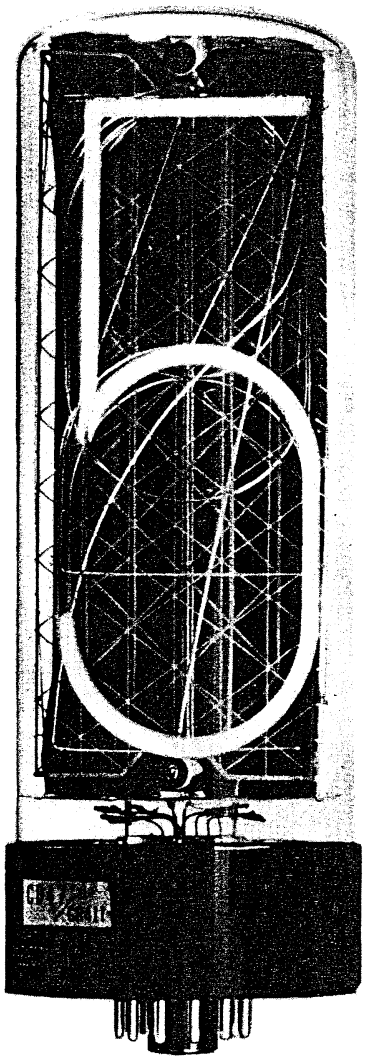
CD13



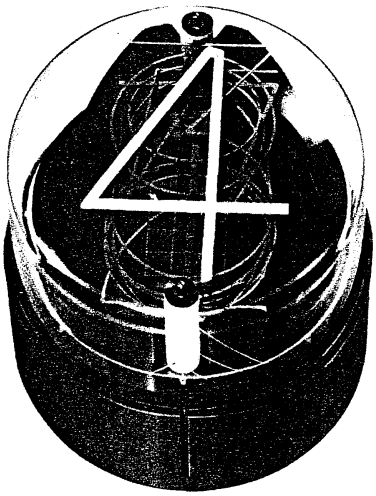
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CD24



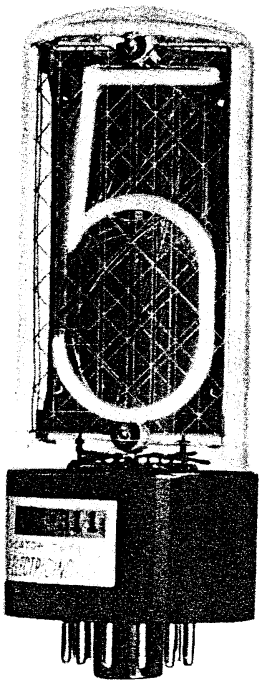
GR-414



CD27



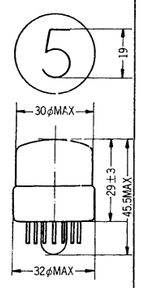
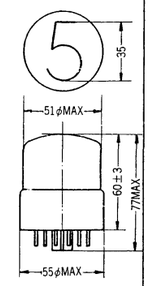
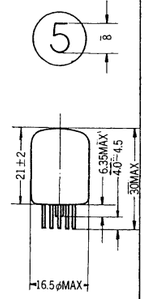
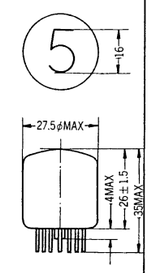
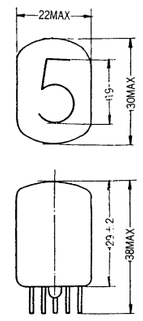
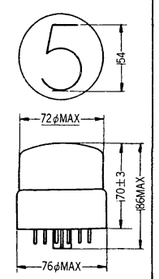
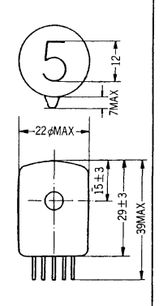
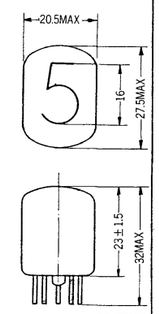
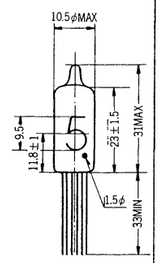
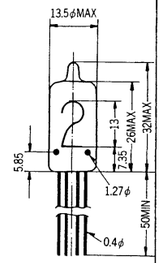
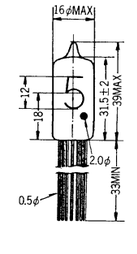
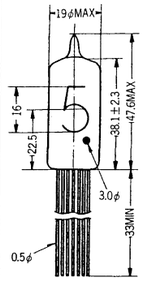
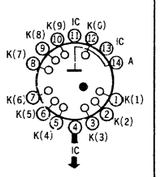
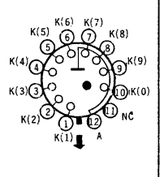
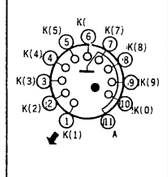
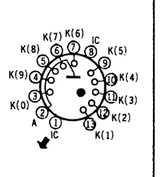
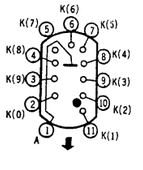
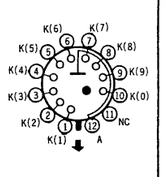
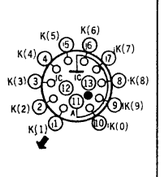
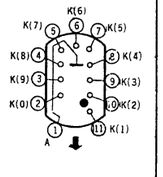
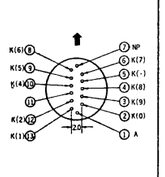
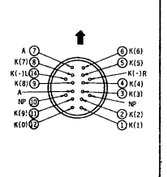
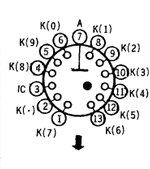
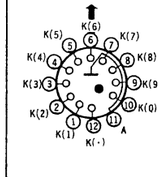
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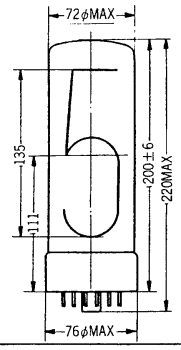
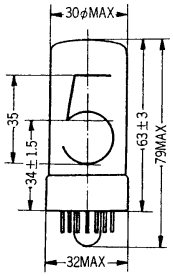
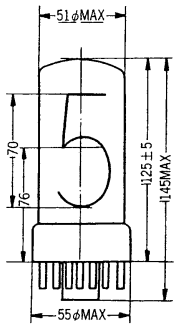
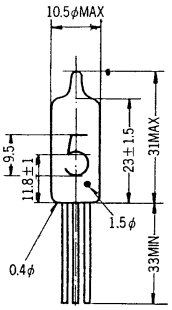
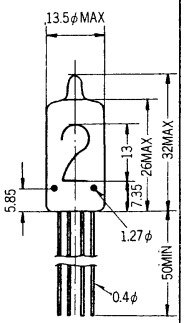
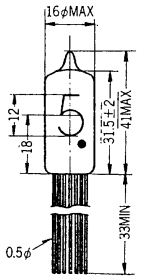
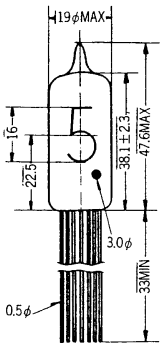
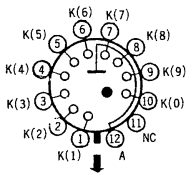
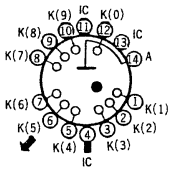
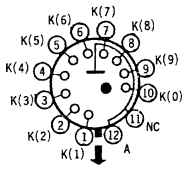
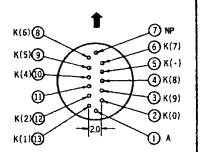
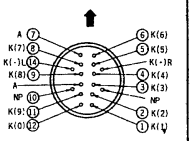
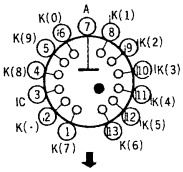
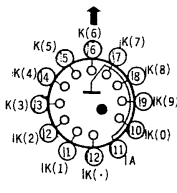
GR-311



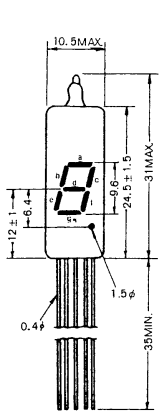
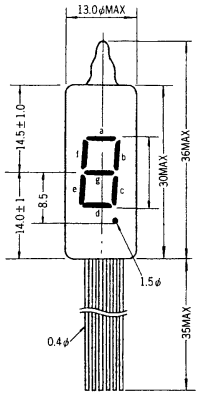
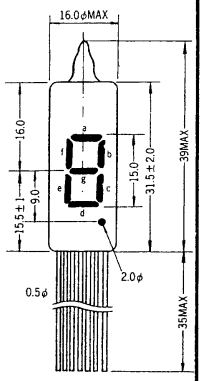
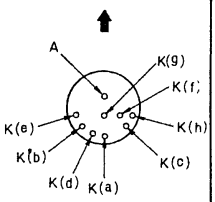
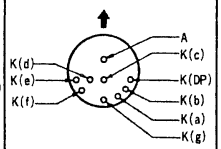
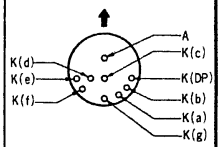
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

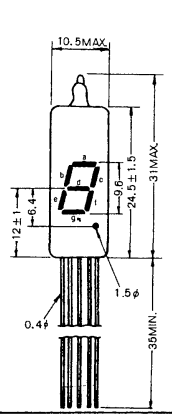
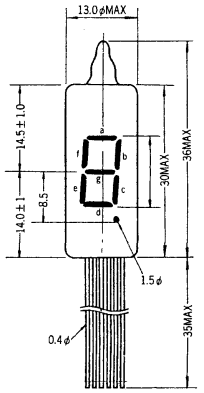
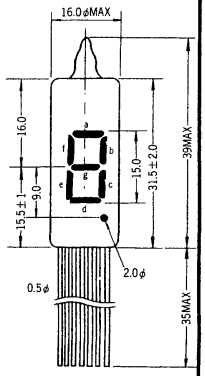
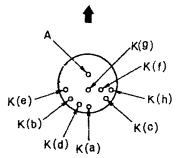
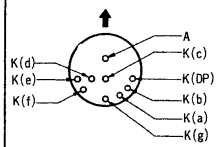
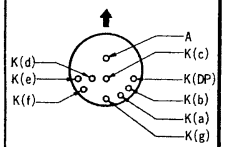
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

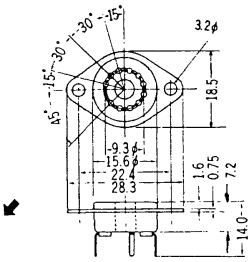
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

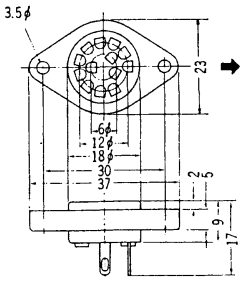
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

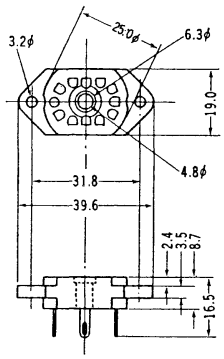
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



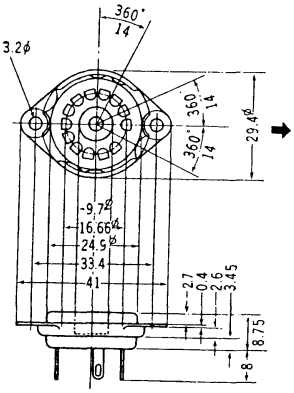
TSM-11P
CD 13



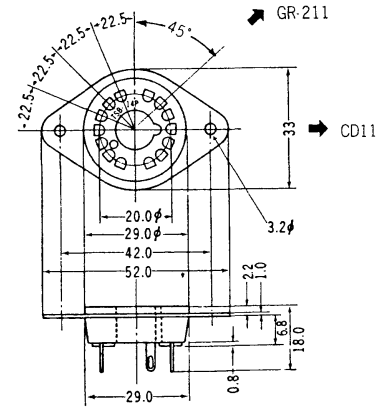
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CD 28



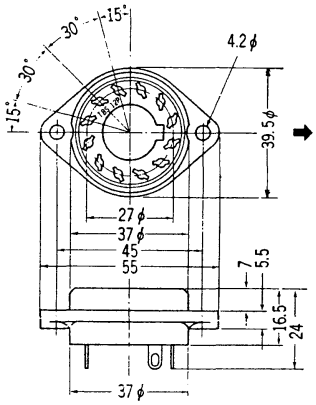
TSR-11P
CD 25, CD 43



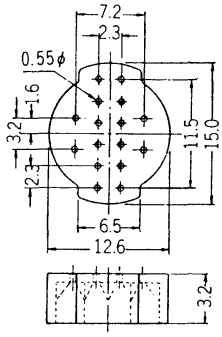
TSB-13P
CD 24



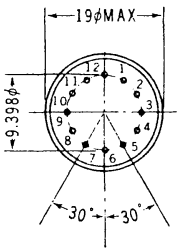
TSB-14P
CD11, GR-211



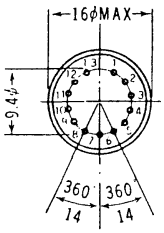
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

RODAN **OKAYA ELECTRIC INDUSTRIES CO., LTD.**
1—8—3, SHIBUYA, SHIBUYA-KU, TOKYO 150, JAPAN

DISTRIBUTED BY:

CAT.NO ED4907-AA-I

RODAN

INDICATOR TUBE

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

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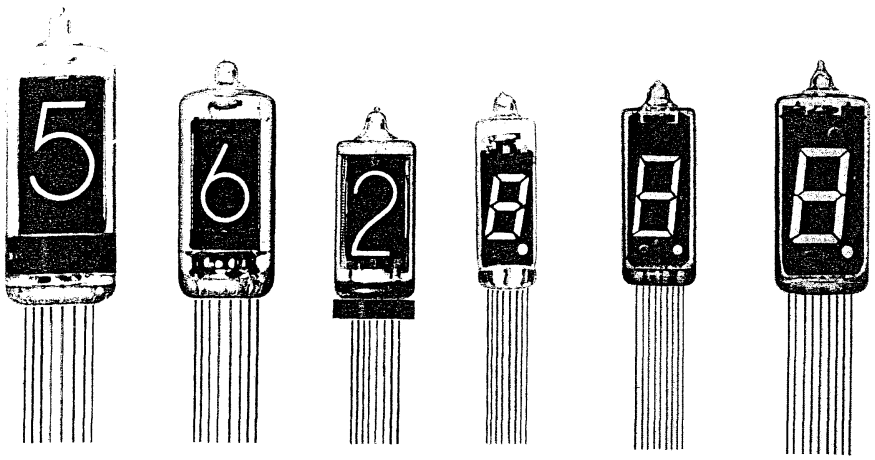
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+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH



CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



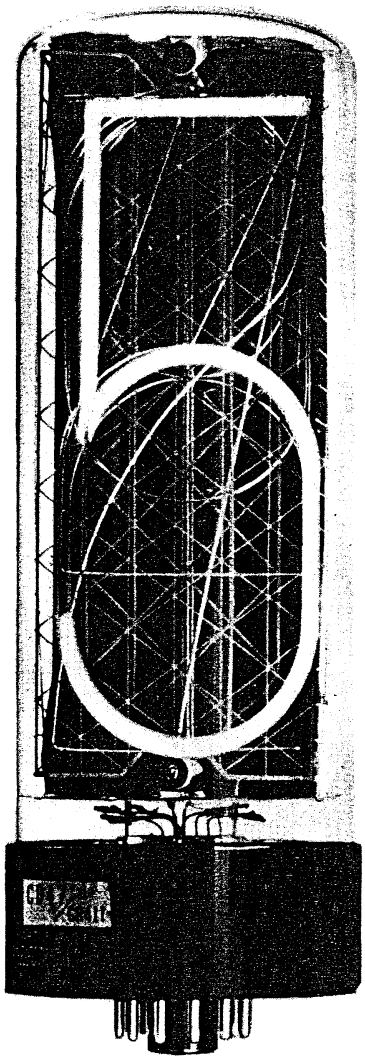
CD13



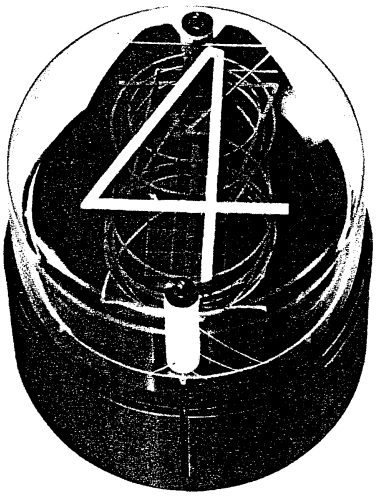
CD12



CD24



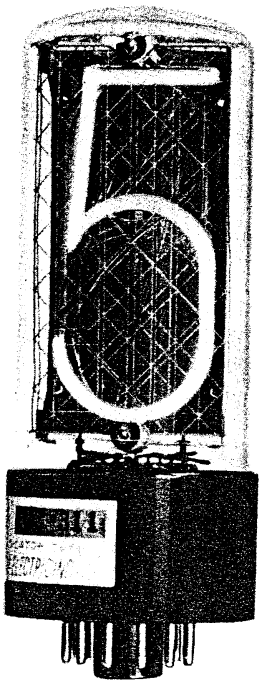
GR-414



CD27



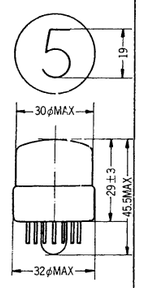
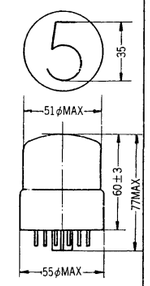
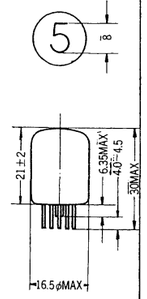
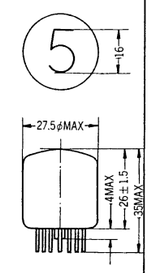
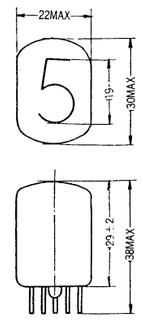
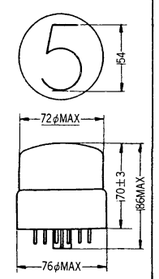
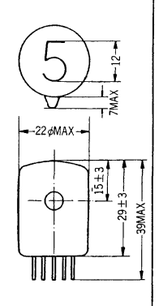
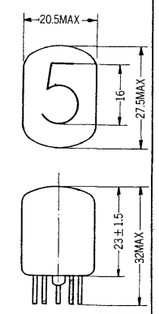
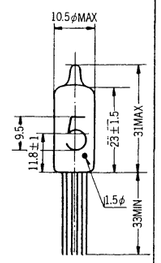
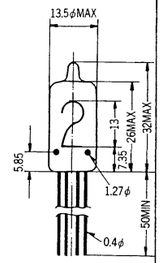
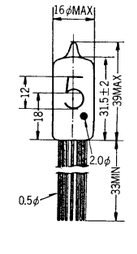
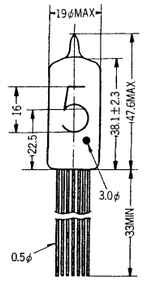
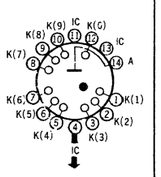
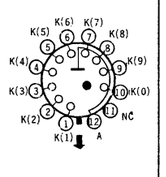
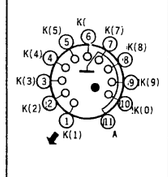
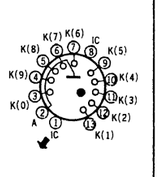
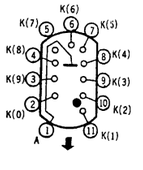
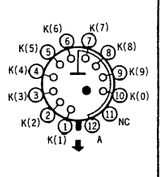
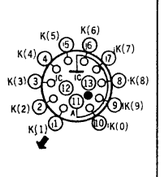
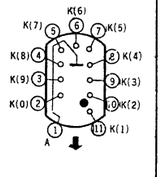
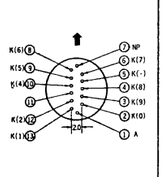
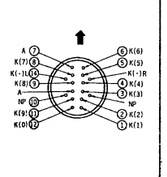
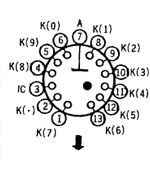
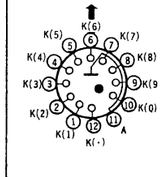
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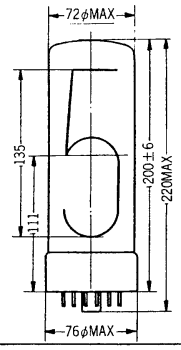
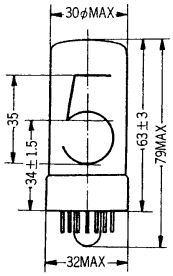
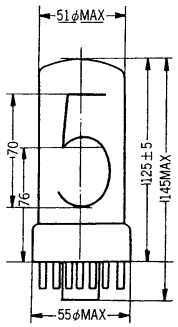
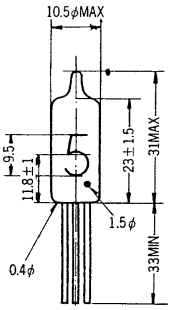
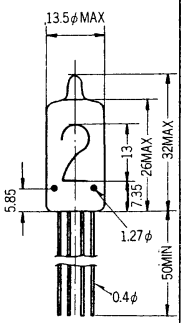
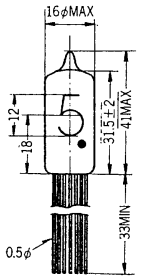
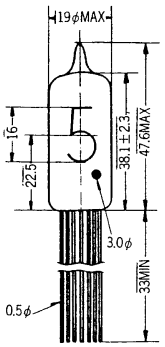
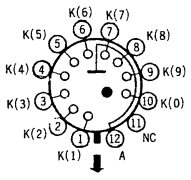
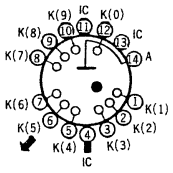
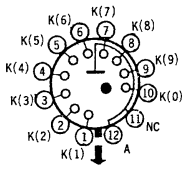
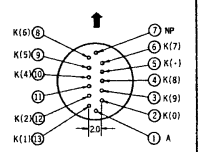
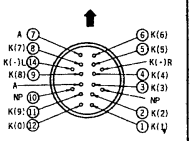
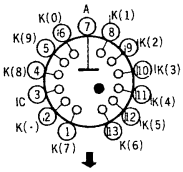
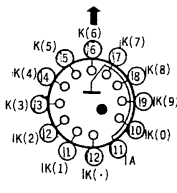
GR-311



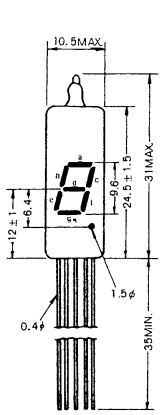
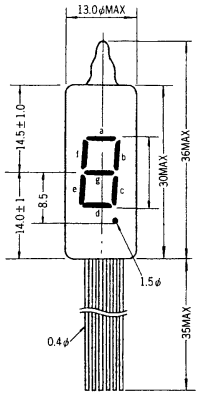
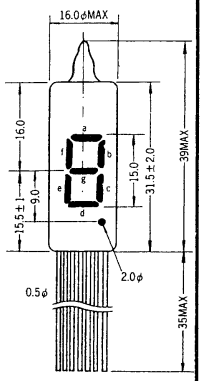
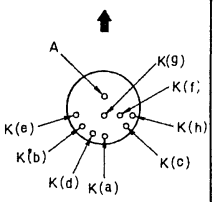
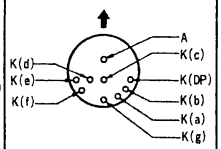
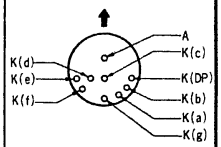
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

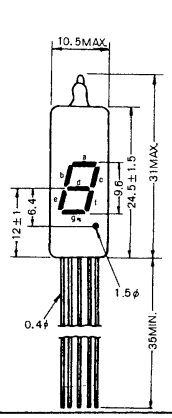
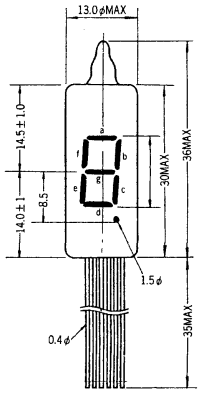
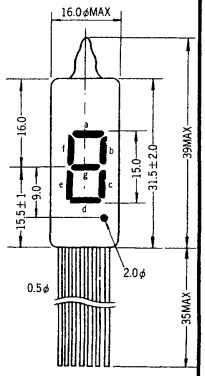
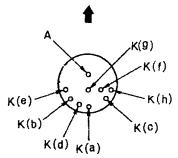
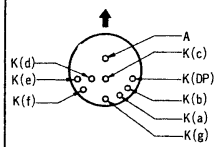
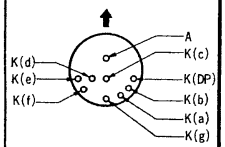
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

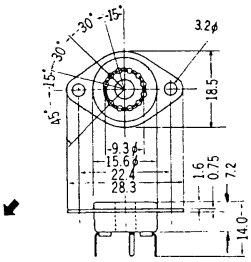
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

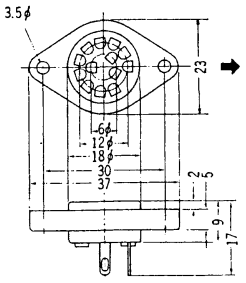
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

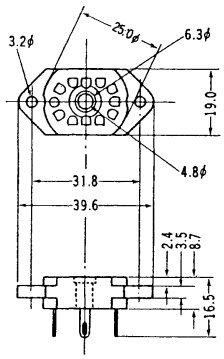
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



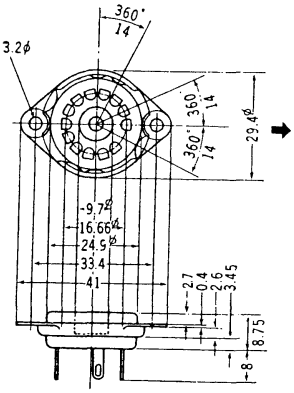
TSM-11P
CD 13



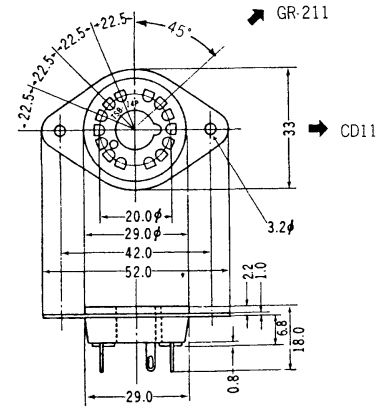
TSM-13P
CD 28



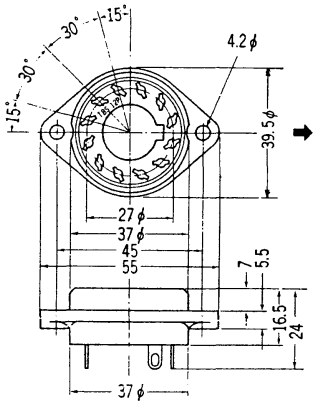
TSR-11P
CD 25, CD 43



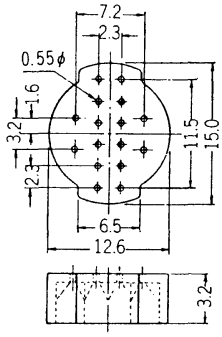
TSB-13P
CD 24



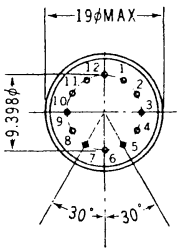
TSB-14P
CD11, GR-211



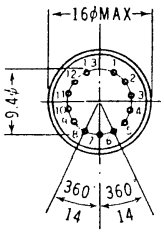
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

RODAN **OKAYA ELECTRIC INDUSTRIES CO., LTD.**
1—8—3, SHIBUYA, SHIBUYA-KU, TOKYO 150, JAPAN

DISTRIBUTED BY:

CAT.NO ED4907-AA-I

[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

[redacted]
MAINTENANCE TYPE ONLY

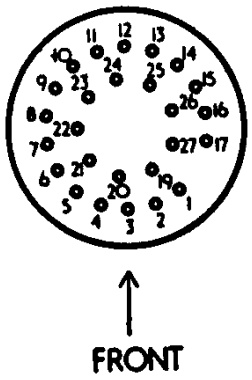
GR 12 G
GR 12 H

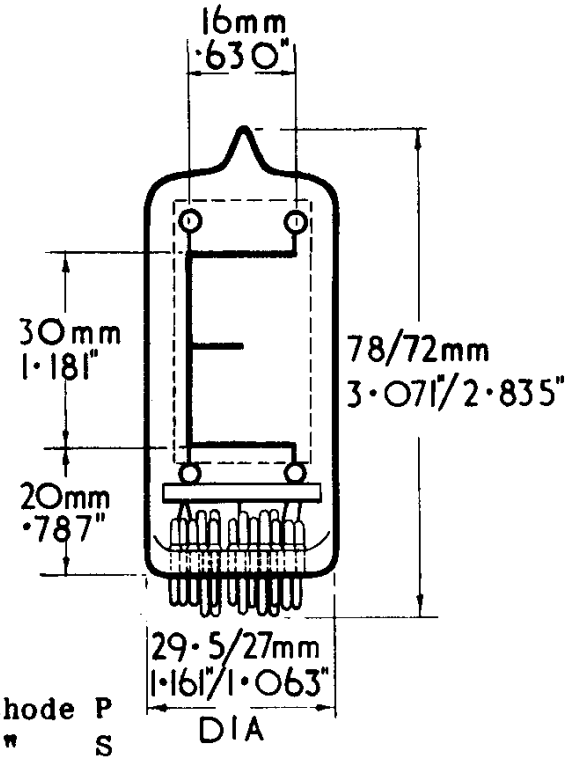
DIGITRONS - 12 Character Side-Viewing Cold-Cathode Letter Tubes

Mechanical Data

Mounting Position	Any
Base	B26A
Socket	B17, B26A or B27A

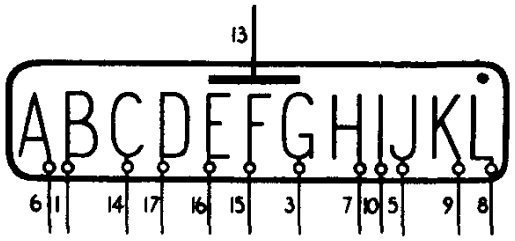
Base Connections
(Underside view)



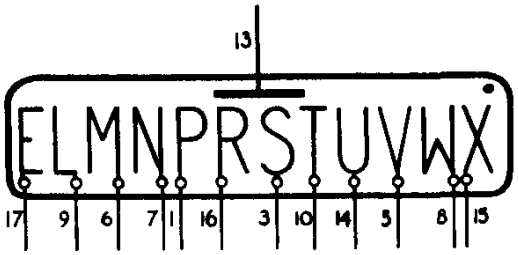


G12G			GR12H		
Pin 1	Cathode	B	Pin 1	Cathode	P
3	"	G	3	"	S
5	"	J	5	"	V
6	"	A	6	"	M
7	"	H	7	"	N
8	"	L	8	"	W
9	"	K	9	"	L
10	"	I	10	"	T
13	Anode		13	Anode	
14	Cathode	C	14	Cathode	U
15	"	F	15	"	X
16	"	E	16	"	R
17	"	D	17	"	E

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



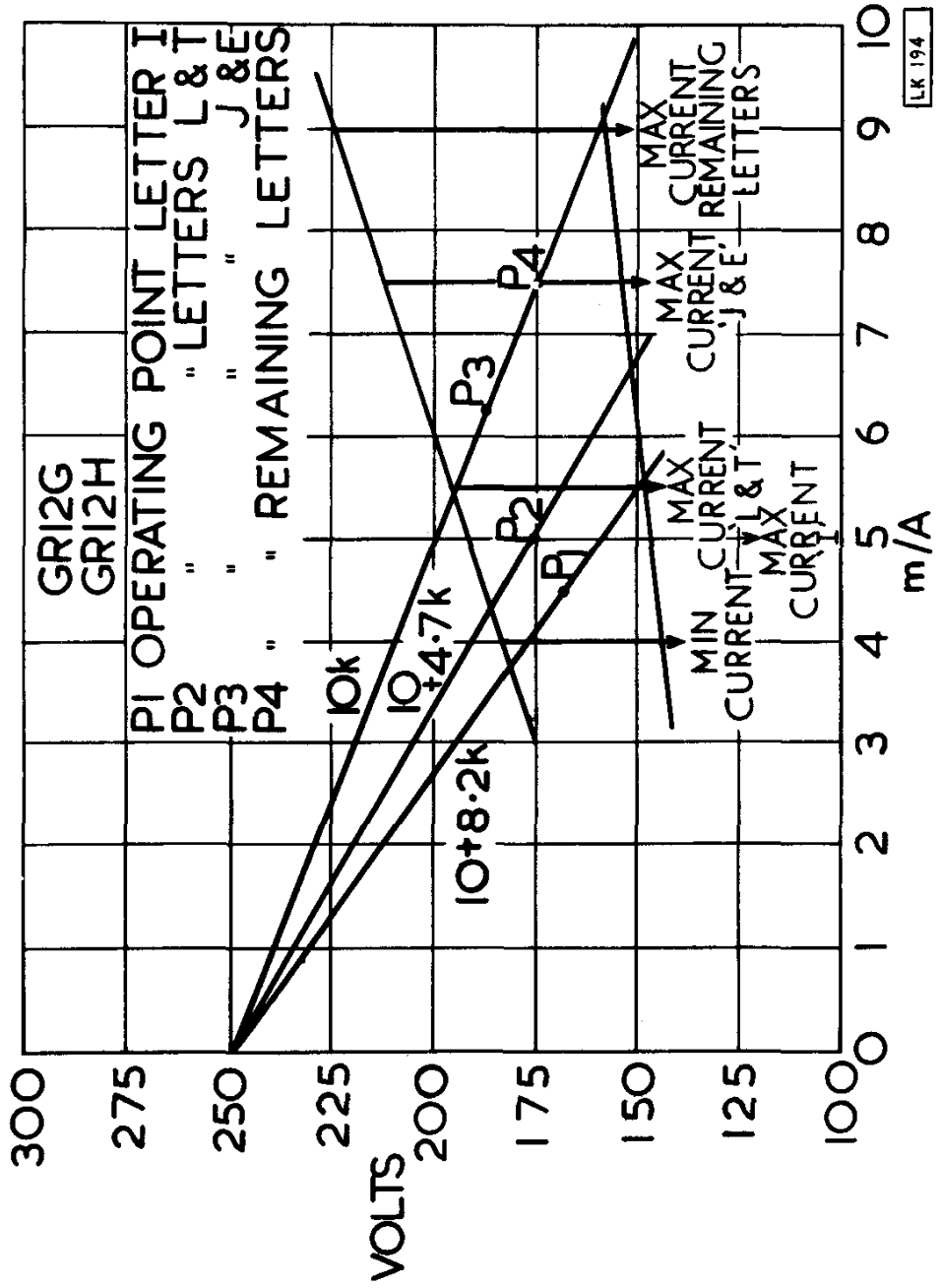
GR 12 G



GR 12 H

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

GR 12 G
GR 12 H



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

[redacted]
MAINTENANCE TYPE ONLY

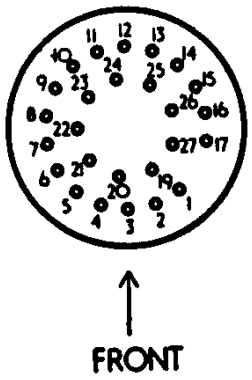
GR 12 G
GR 12 H

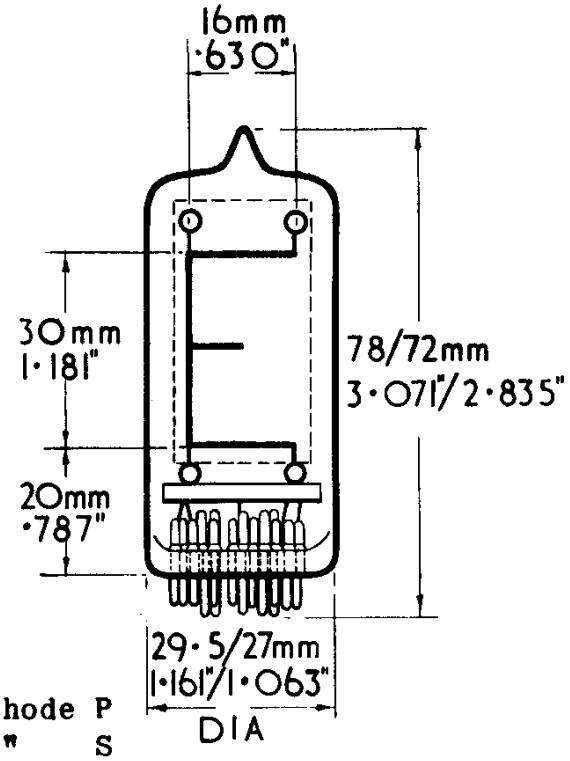
DIGITRONS - 12 Character Side-Viewing Cold-Cathode Letter Tubes

Mechanical Data

Mounting Position	Any
Base	B26A
Socket	B17, B26A or B27A

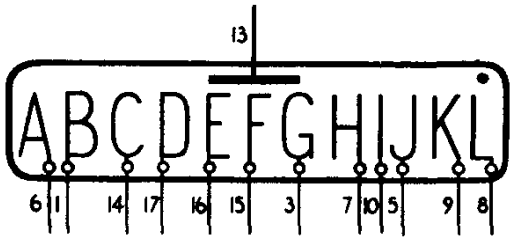
Base Connections
(Underside view)



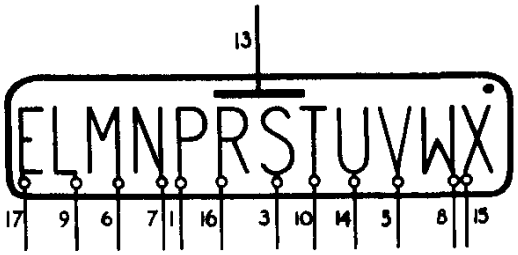


G12G			GR12H		
Pin 1	Cathode	B	Pin 1	Cathode	P
3	"	G	3	"	S
5	"	J	5	"	V
6	"	A	6	"	M
7	"	H	7	"	N
8	"	L	8	"	W
9	"	K	9	"	L
10	"	I	10	"	T
13	Anode		13	Anode	
14	Cathode	C	14	Cathode	U
15	"	F	15	"	X
16	"	E	16	"	R
17	"	D	17	"	E

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



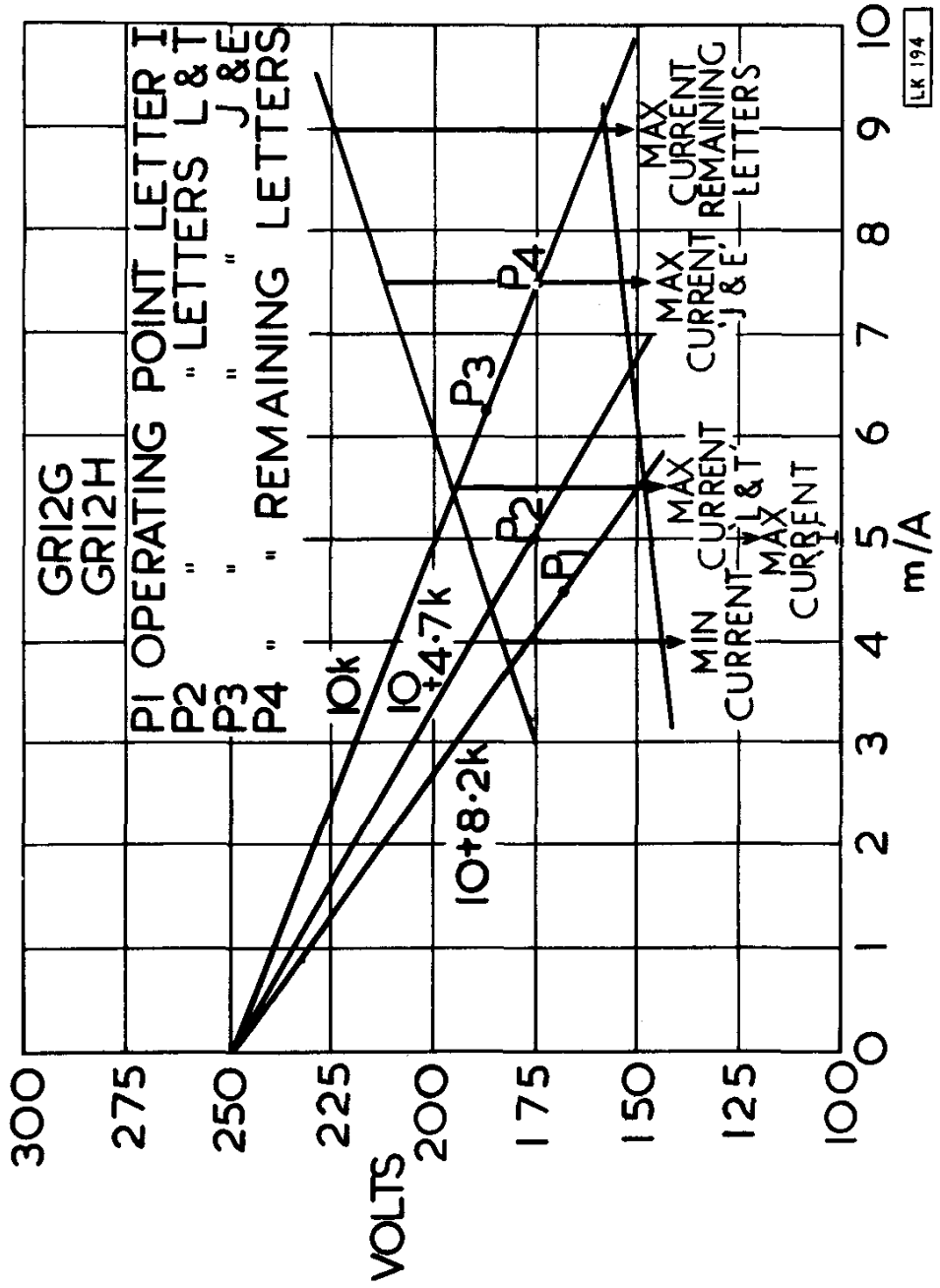
GR 12 G



GR 12 H

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

GR 12 G
GR 12 H



Operating Characteristics

* Registered Trade Mark

RODAN

INDICATOR TUBE

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

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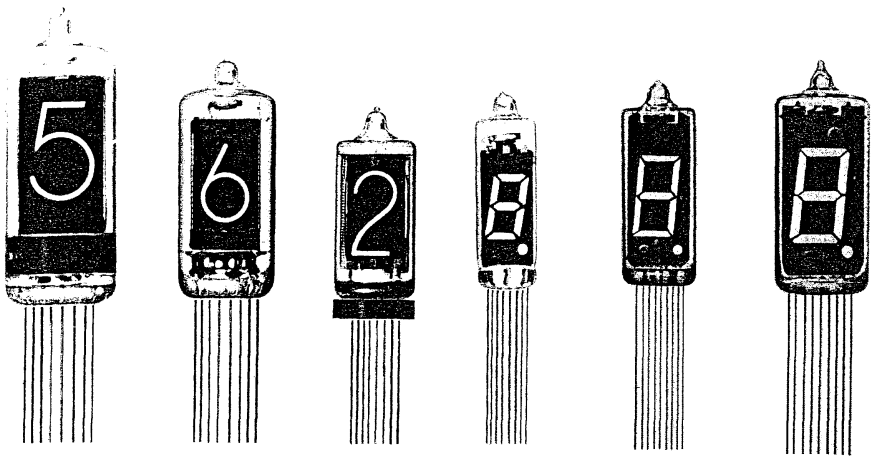
+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH



CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



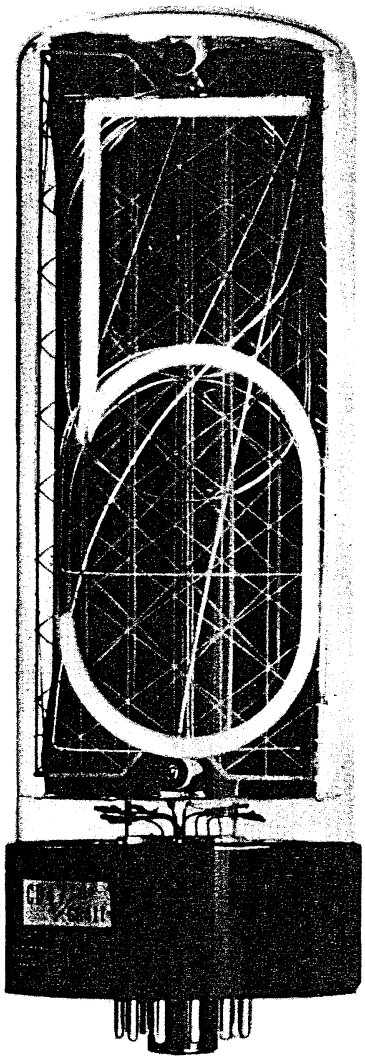
CD13



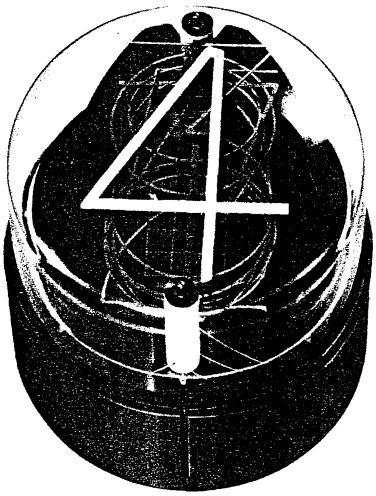
CD12



CD24



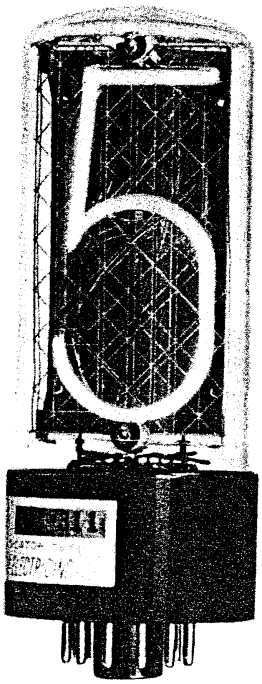
GR-414



CD27



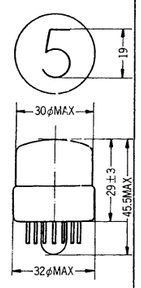
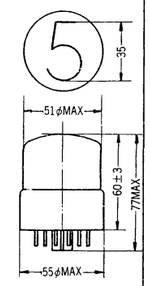
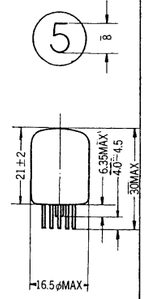
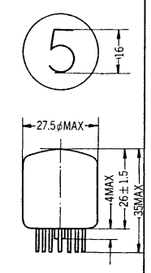
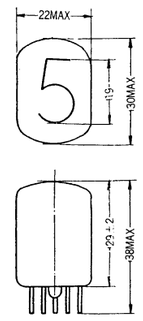
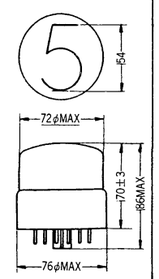
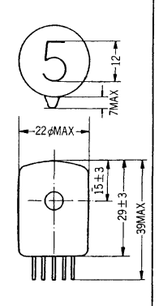
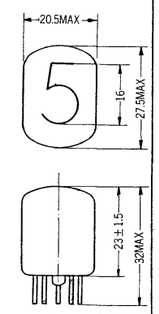
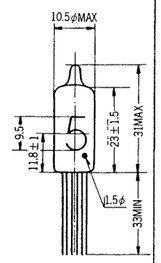
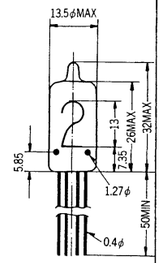
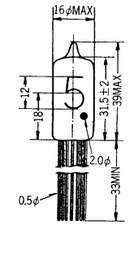
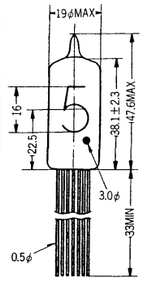
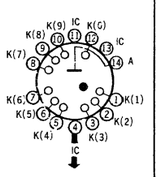
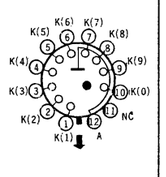
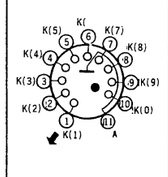
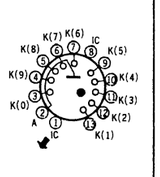
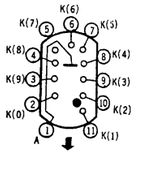
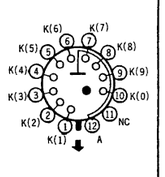
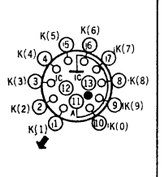
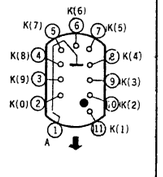
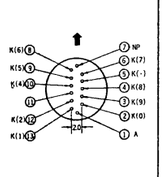
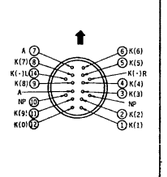
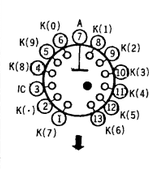
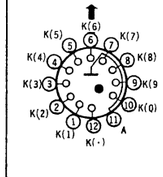
CD11



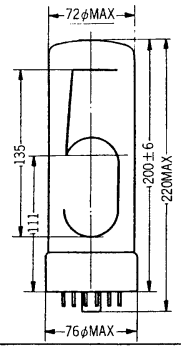
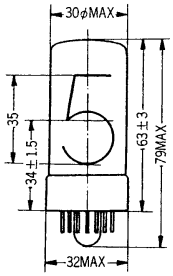
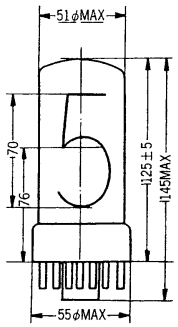
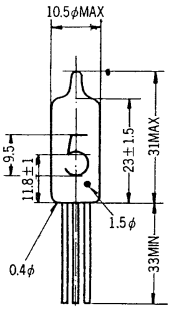
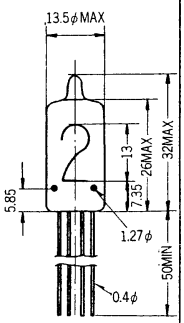
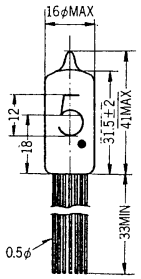
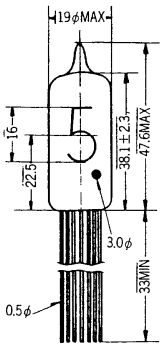
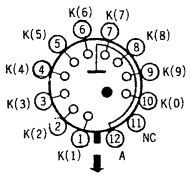
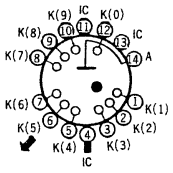
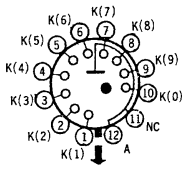
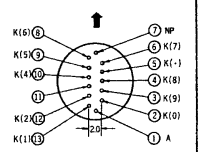
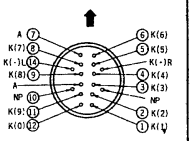
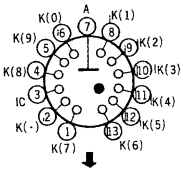
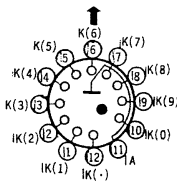
GR-311



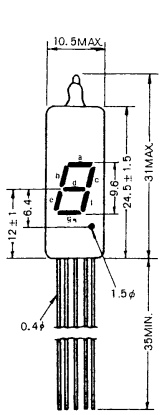
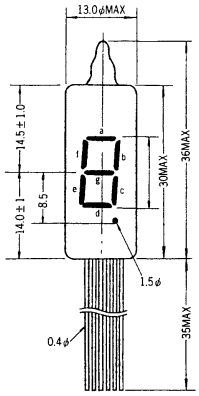
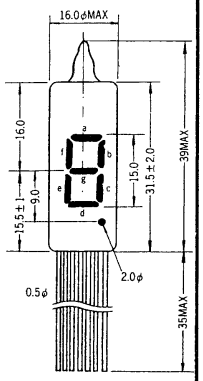
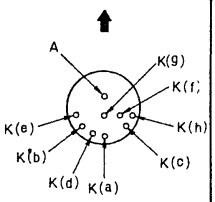
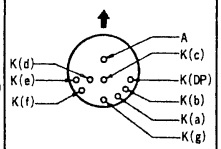
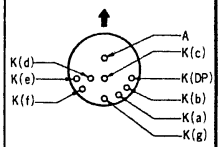
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

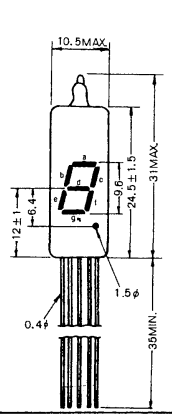
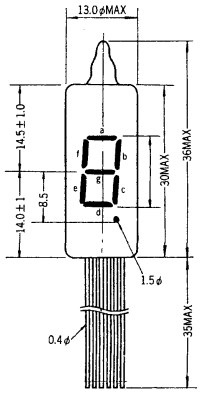
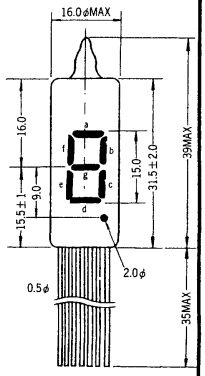
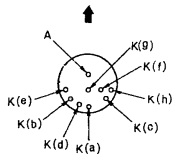
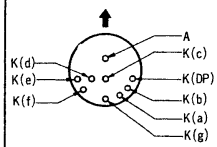
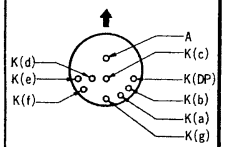
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

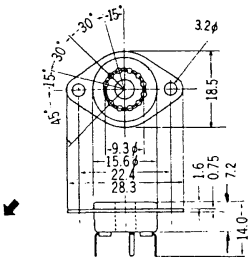
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

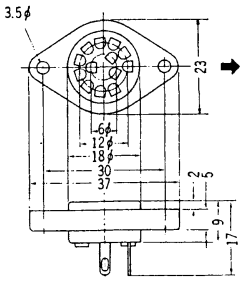
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

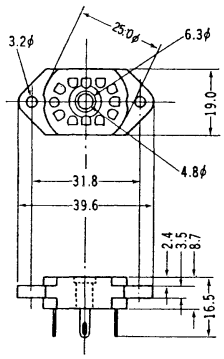
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



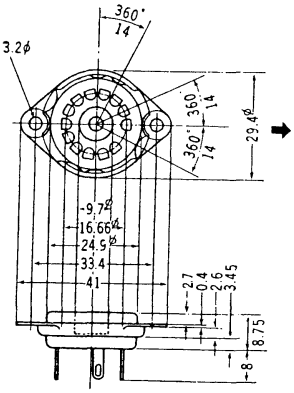
TSM-11P
CD 13



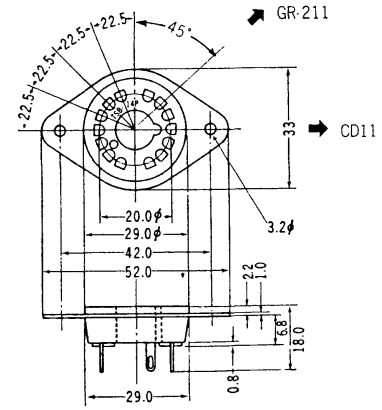
TSM-13P
CD 28



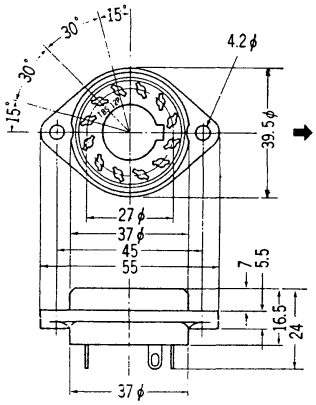
TSR-11P
CD 25, CD 43



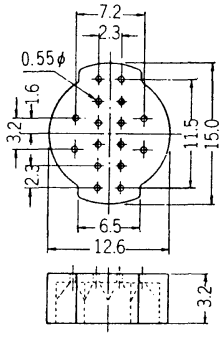
TSB-13P
CD 24



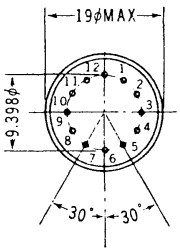
TSB-14P
CD11, GR-211



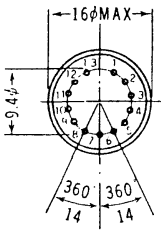
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

RODAN **OKAYA ELECTRIC INDUSTRIES CO., LTD.**
1—8—3, SHIBUYA, SHIBUYA-KU, TOKYO 150, JAPAN

DISTRIBUTED BY:

CAT.NO ED4907-AA-I

*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

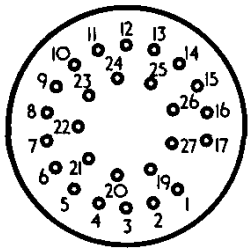
GR2G

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

Mechanical Data

Mounting position	Any
Base	B26A
Socket	B17A, B26A or B27A

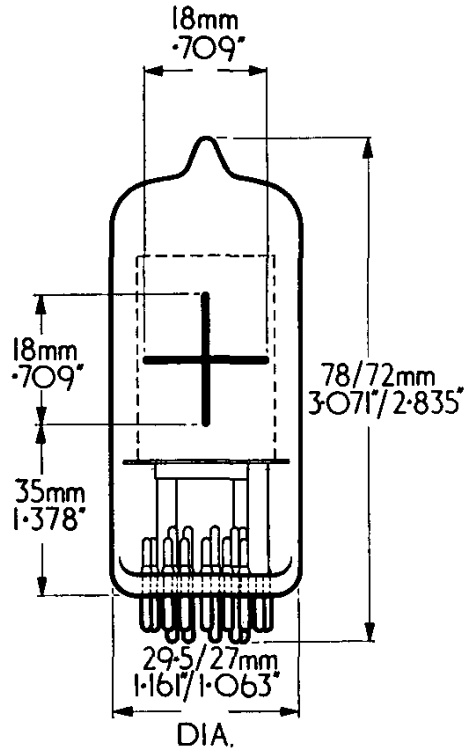
Base Connections
(underside view)

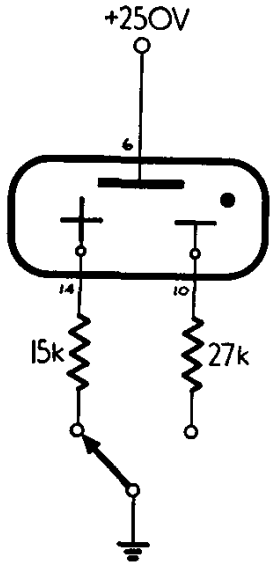


FRONT

Pin 6 Anode
Pin 10 —
Pin 14 +

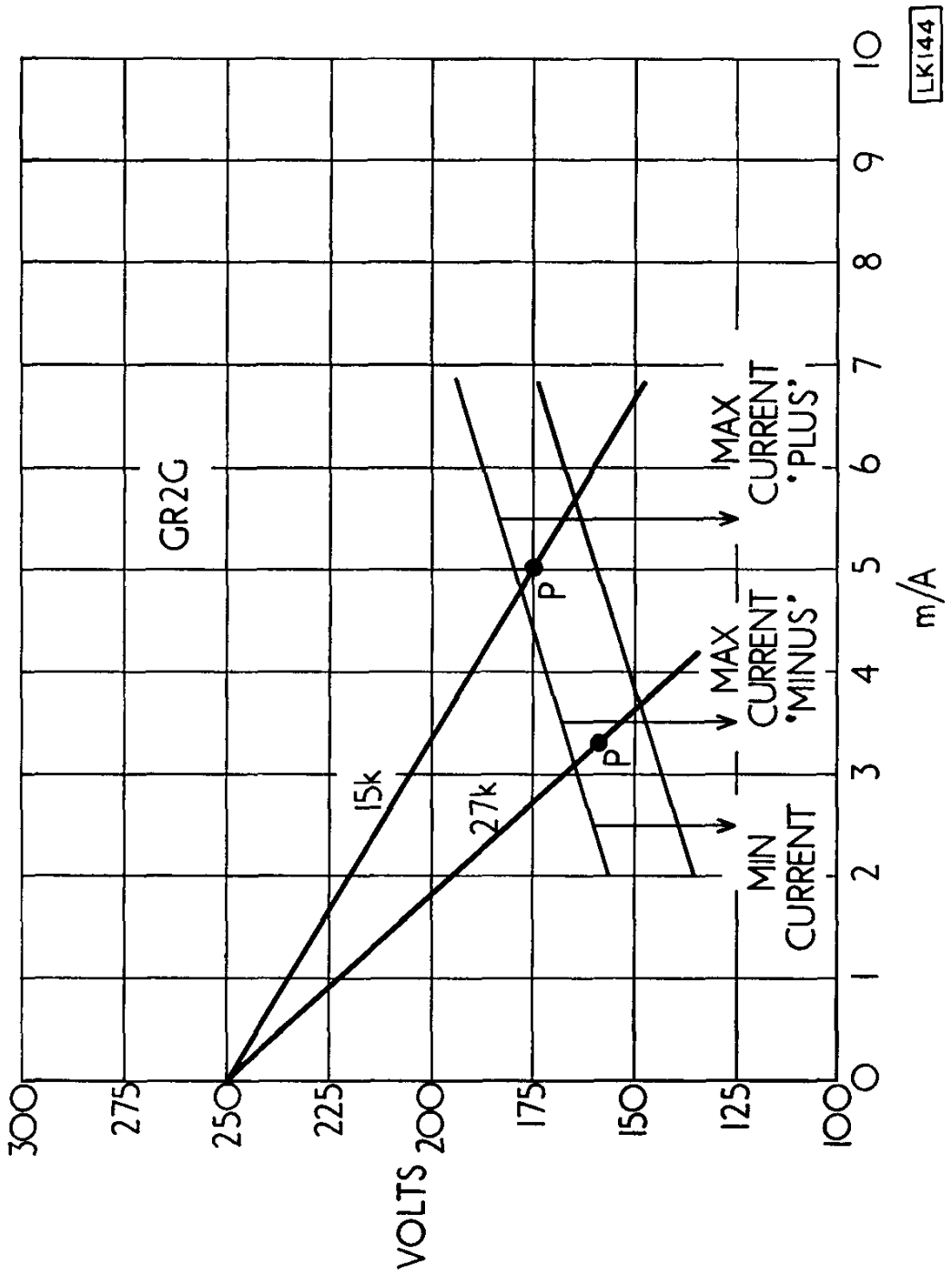
Note—All other pins are to be left unconnected.





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

GR2G



Operating Characteristics

*Registered Trade Mark

[redacted]

MAINTENANCE TYPE ONLY

* 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

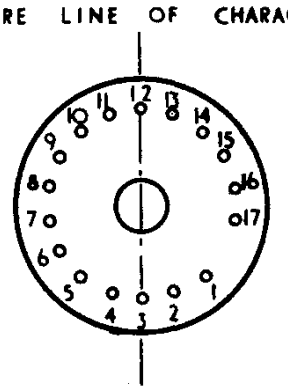
Mechanical Data

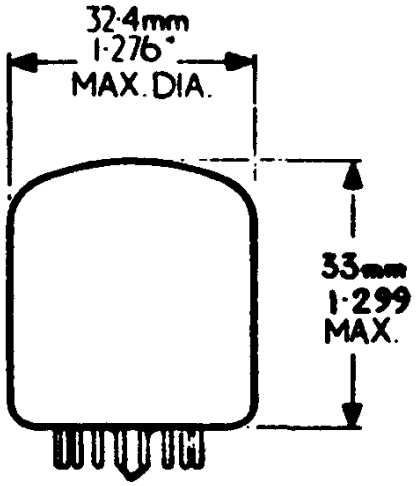
Mounting Position	Any

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

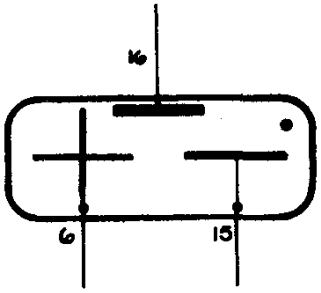
Base Connections
(underside view)

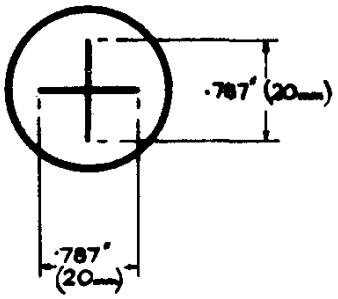




Pin 16 Anode
Pin 6 +
Pin 15 -

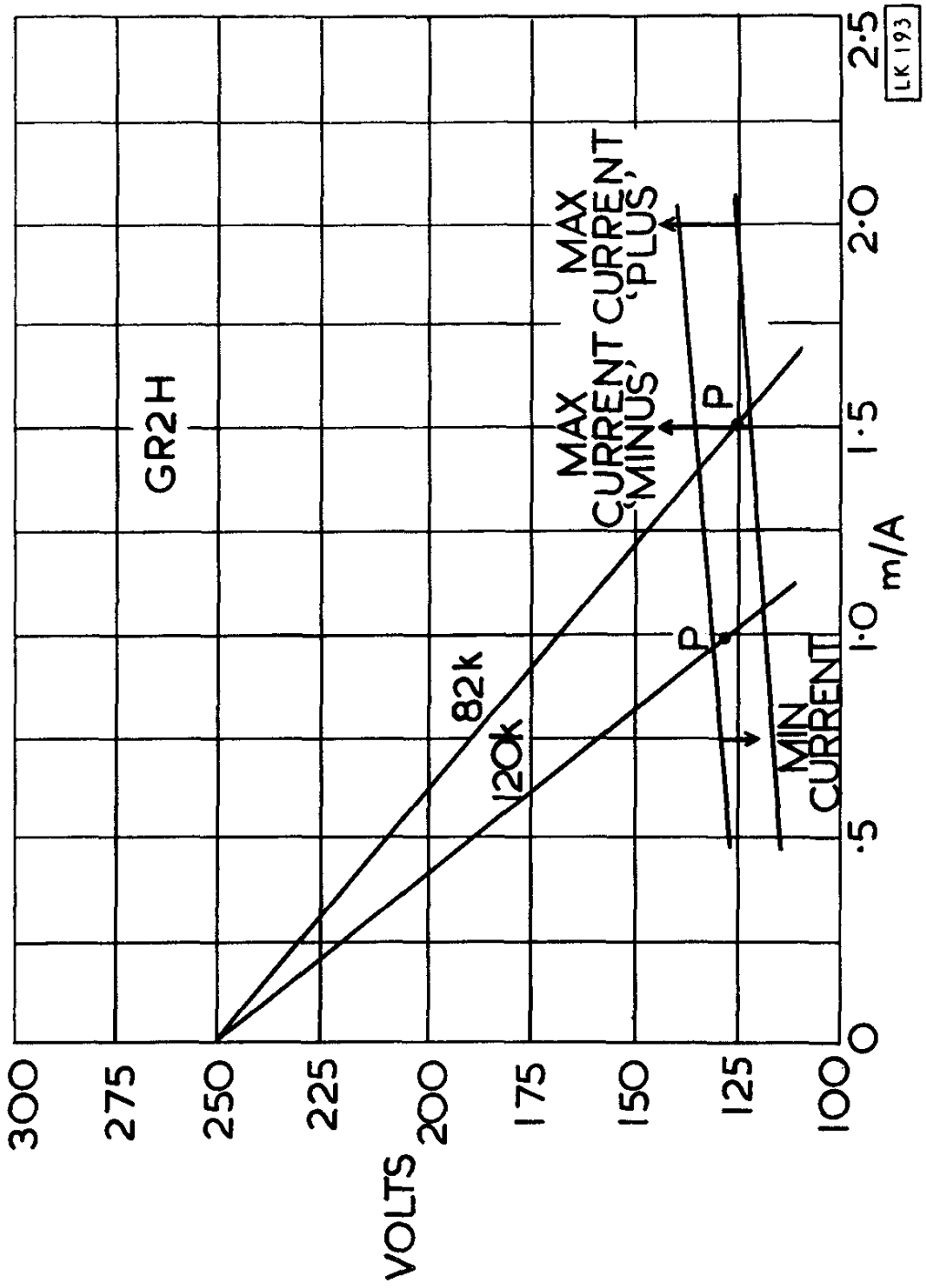
Note - All other pins are to be left unconnected.





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

GR 2 H



Operating Characteristics

* Registered Trade Mark

RODAN

INDICATOR TUBE

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

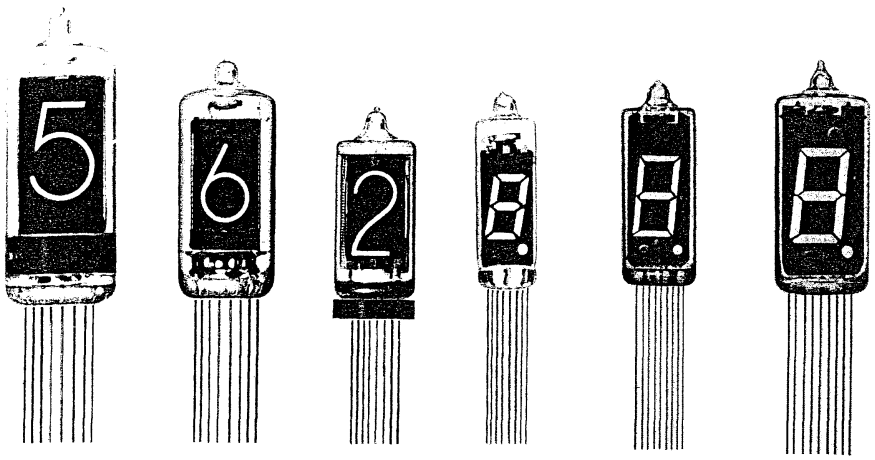
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+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH



CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



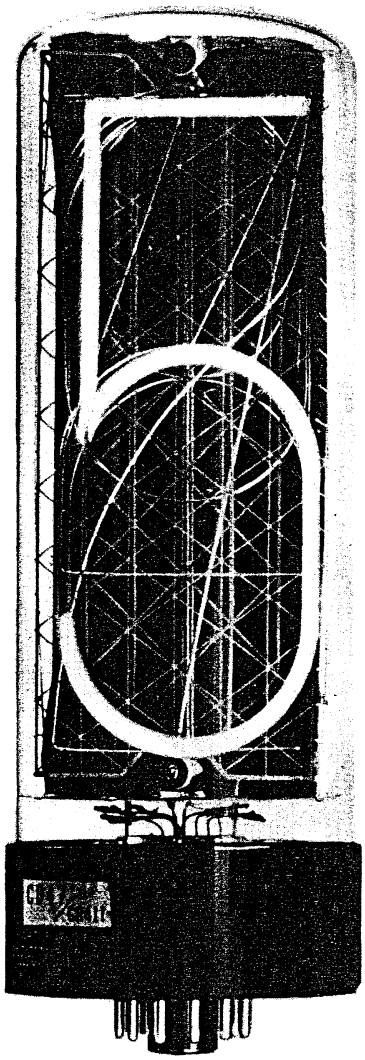
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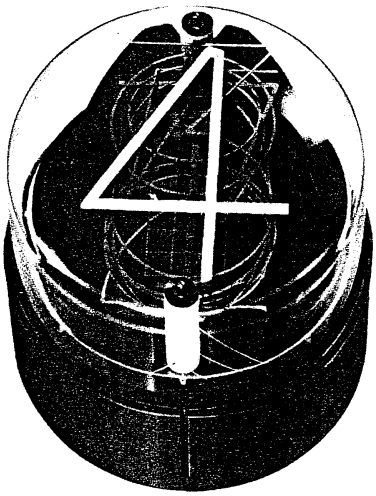
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CD24



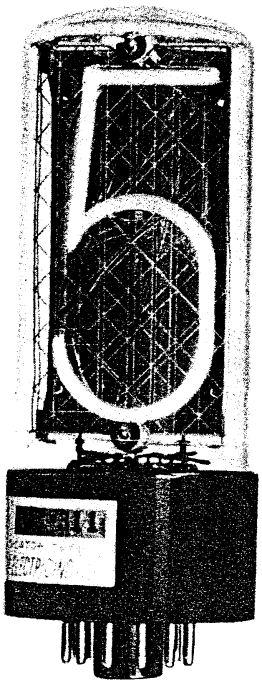
GR-414



CD27



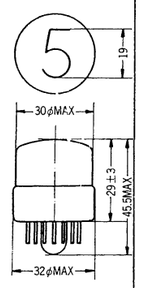
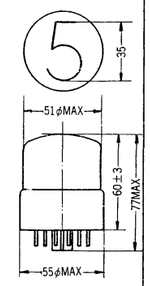
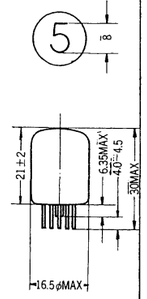
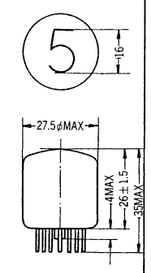
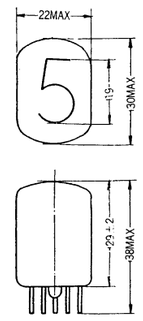
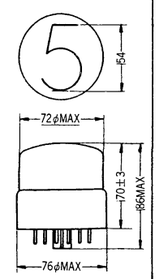
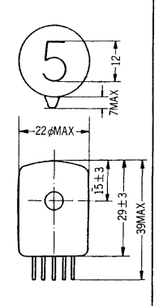
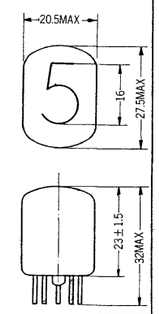
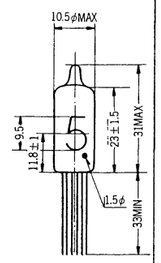
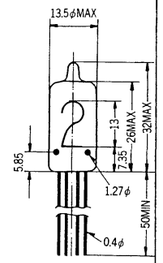
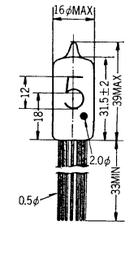
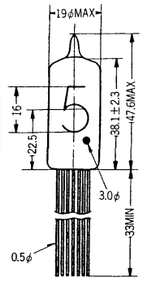
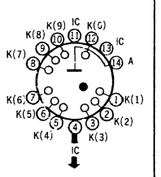
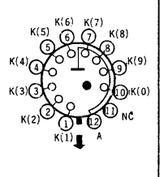
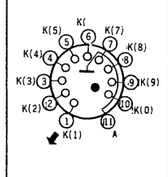
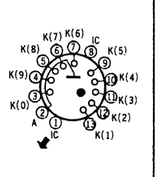
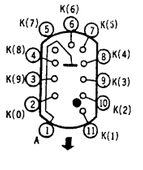
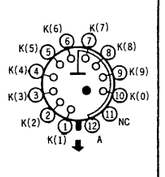
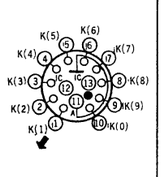
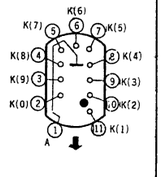
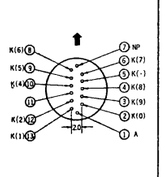
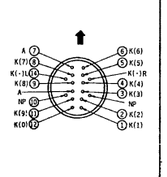
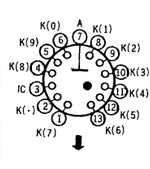
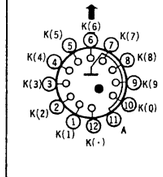
CD11



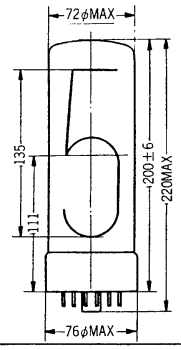
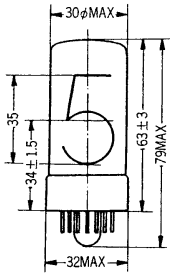
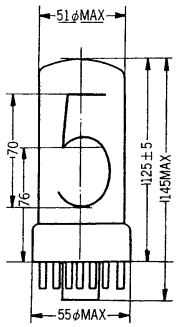
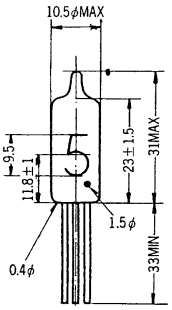
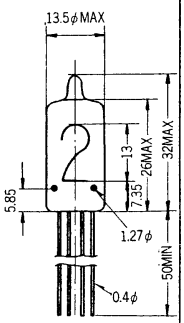
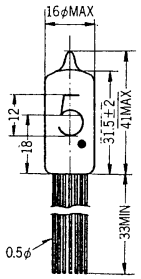
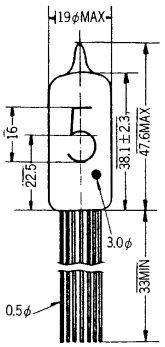
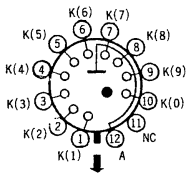
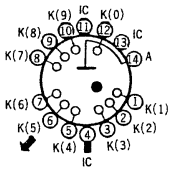
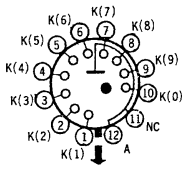
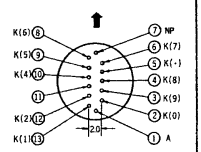
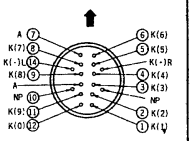
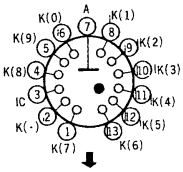
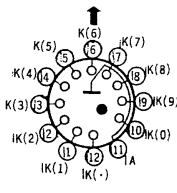
GR-311



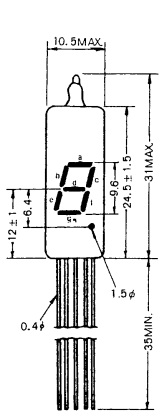
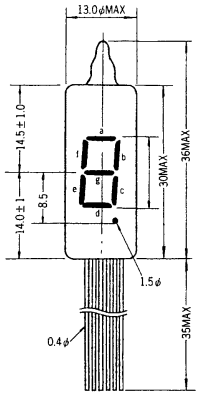
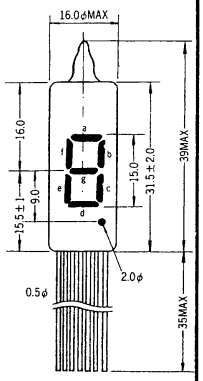
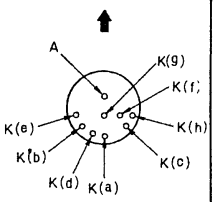
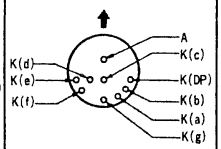
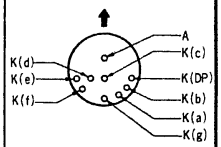
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

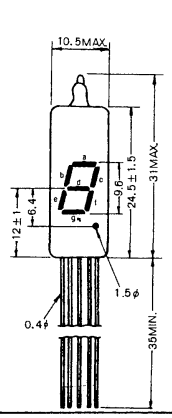
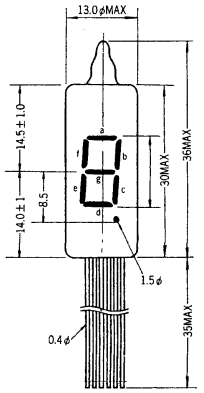
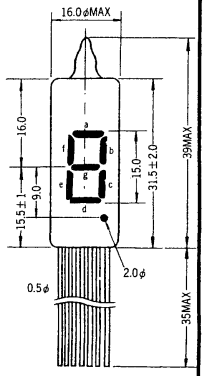
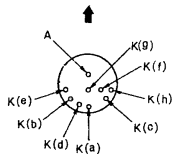
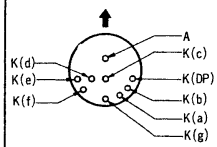
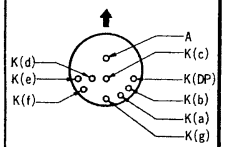
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

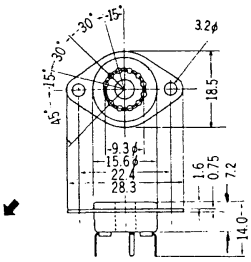
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

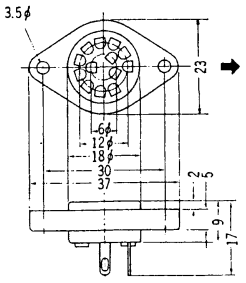
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

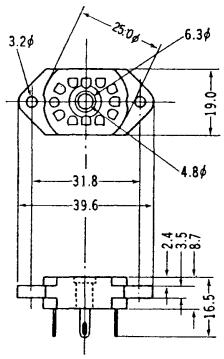
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



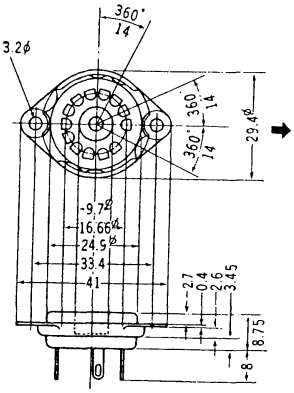
TSM-11P
CD 13



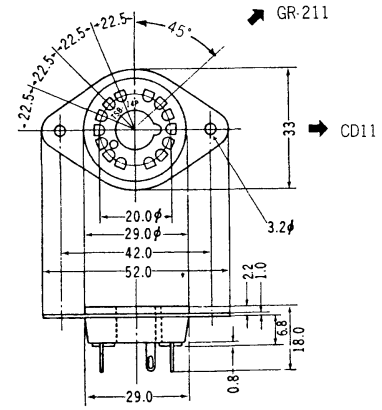
TSM-13P
CD 28



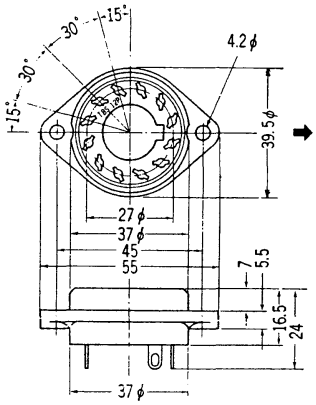
TSR-11P
CD 25, CD 43



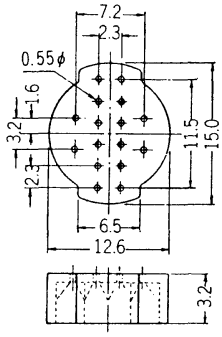
TSB-13P
CD 24



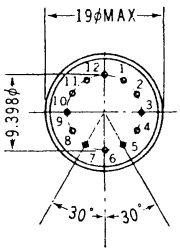
TSB-14P
CD11, GR-211



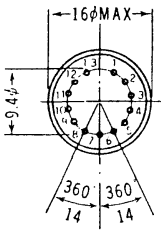
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

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RODAN

INDICATOR TUBE

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

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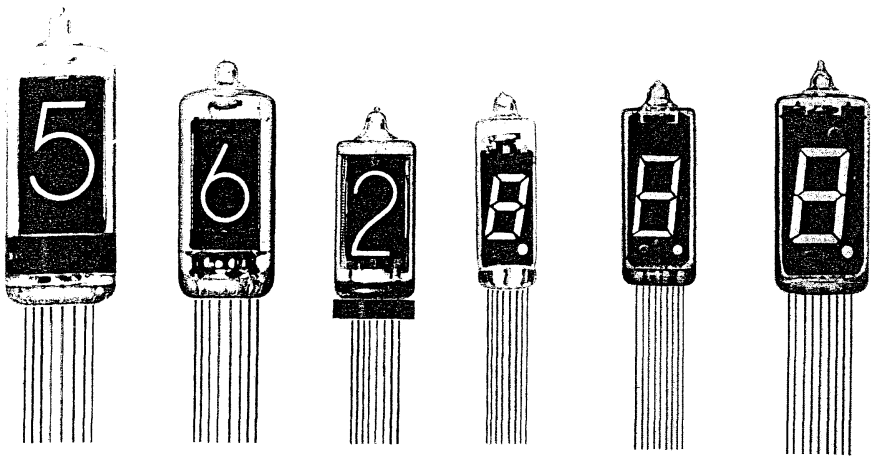
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+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH



CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



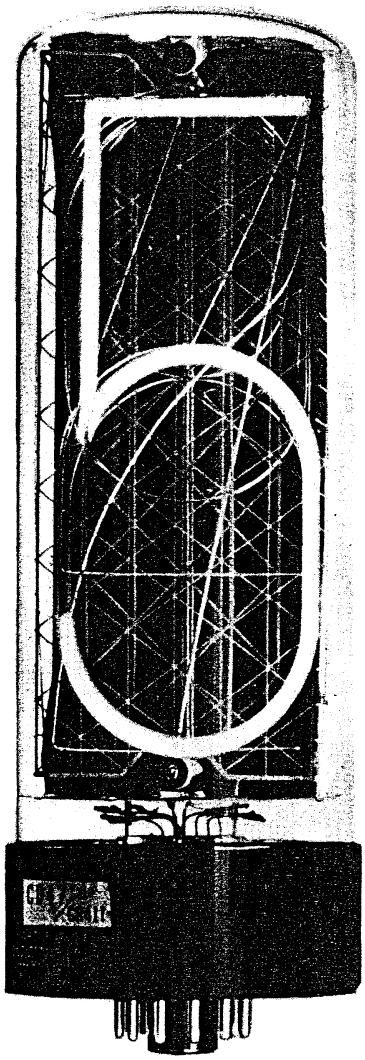
CD13



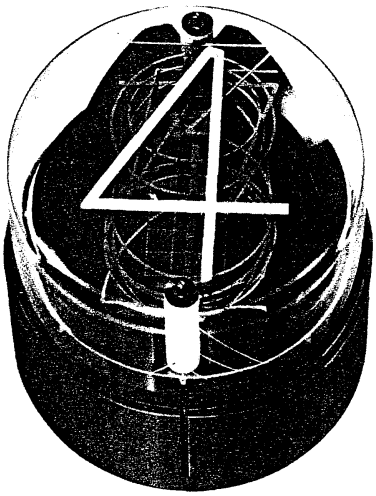
CD12



CD24



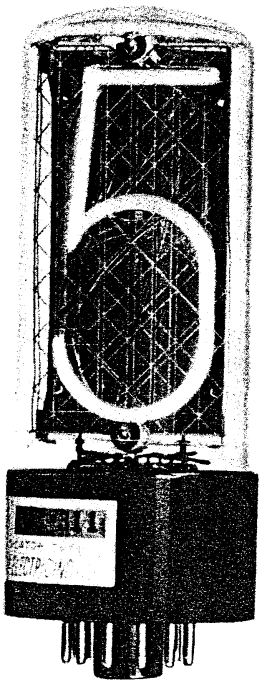
GR-414



CD27



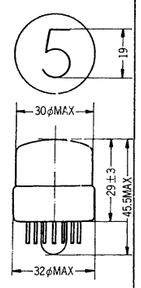
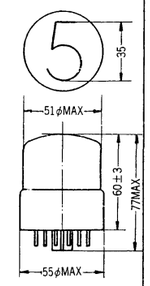
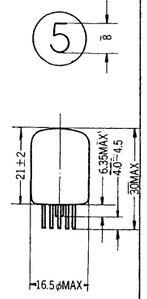
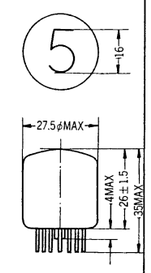
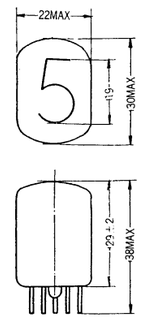
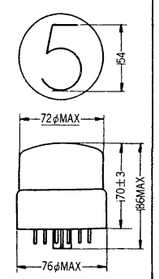
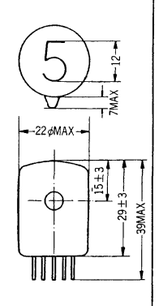
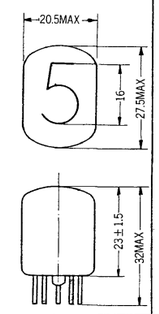
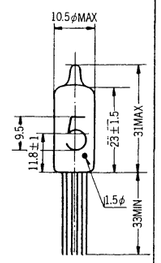
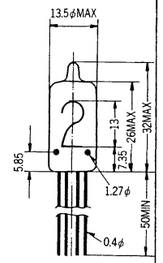
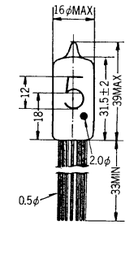
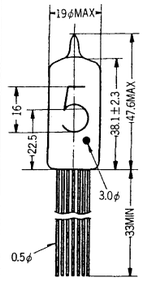
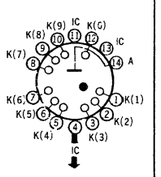
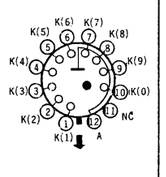
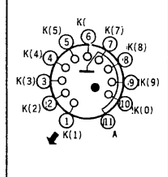
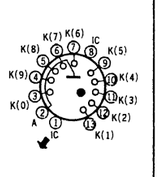
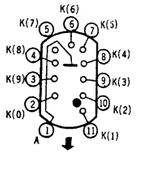
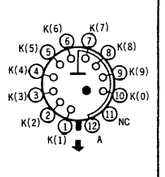
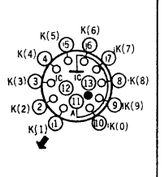
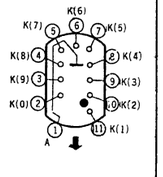
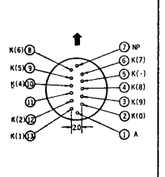
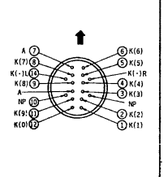
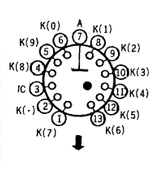
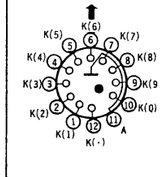
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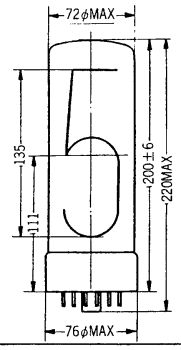
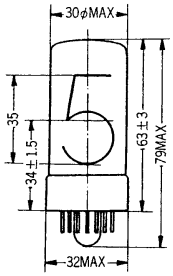
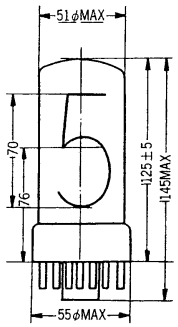
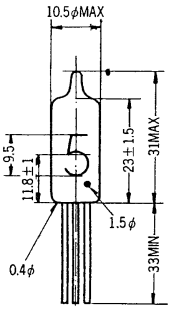
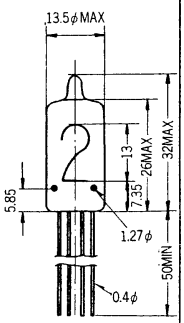
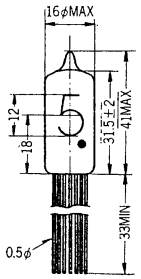
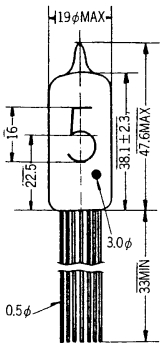
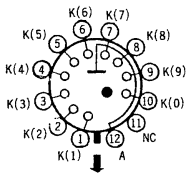
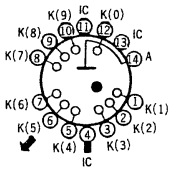
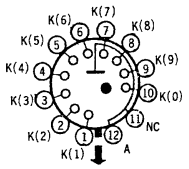
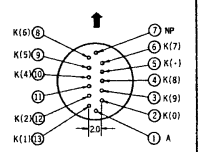
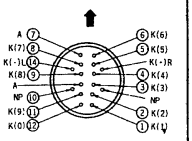
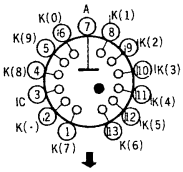
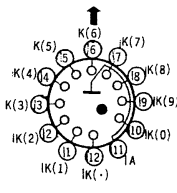
GR-311



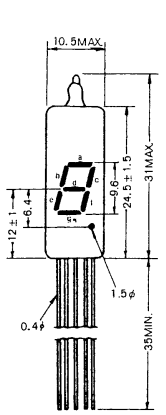
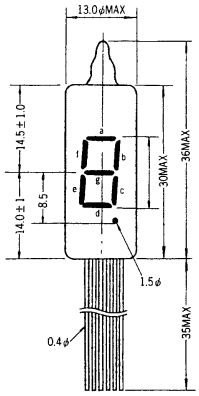
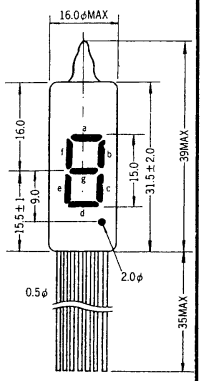
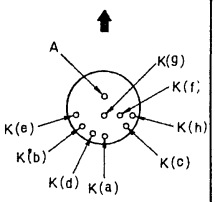
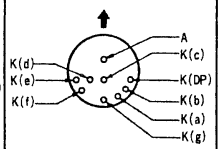
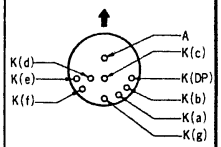
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

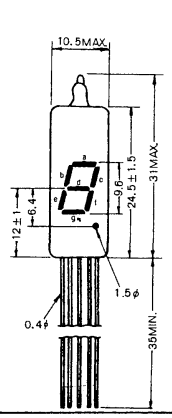
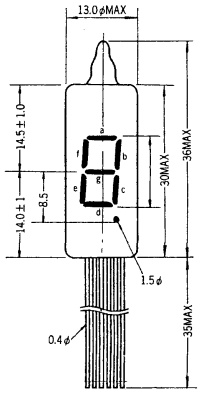
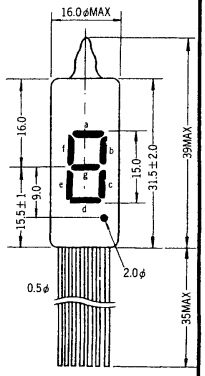
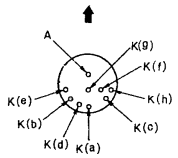
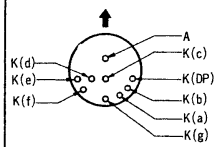
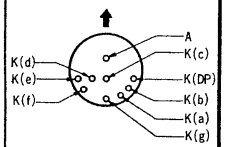
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

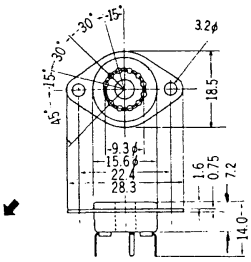
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

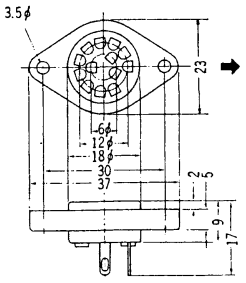
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

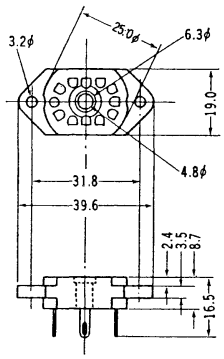
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



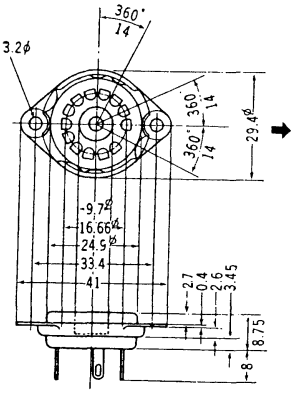
TSM-11P
CD 13



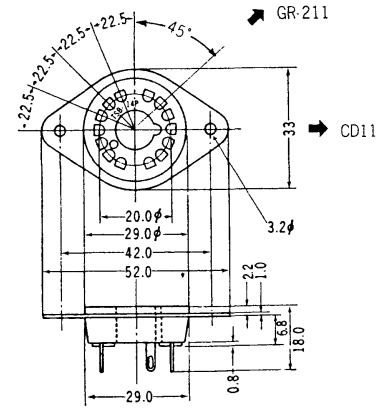
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CD 28



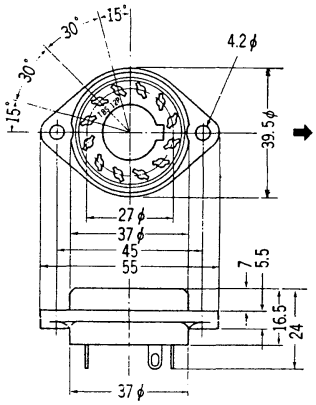
TSR-11P
CD 25, CD 43



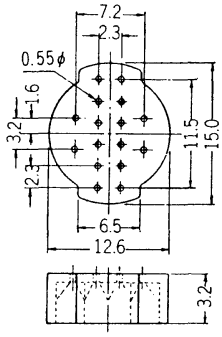
TSB-13P
CD 24



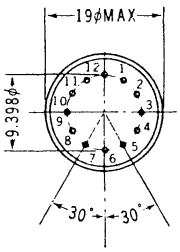
TSB-14P
CD11, GR-211



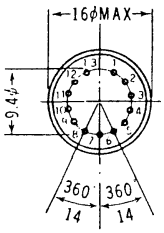
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

RODAN **OKAYA ELECTRIC INDUSTRIES CO., LTD.**
1—8—3, SHIBUYA, SHIBUYA-KU, TOKYO 150, JAPAN

DISTRIBUTED BY:

CAT.NO ED4907-AA-I

*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

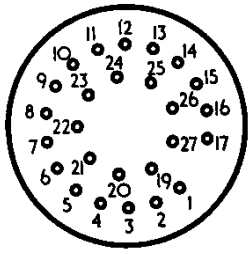
GR4G

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

Mechanical Data

Mounting position	Any
Base	B26A
Socket	B17, B26A or B27A

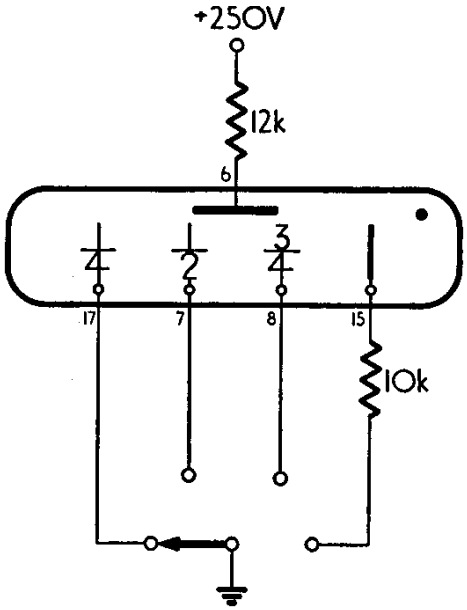
Base Connections
(underside view)

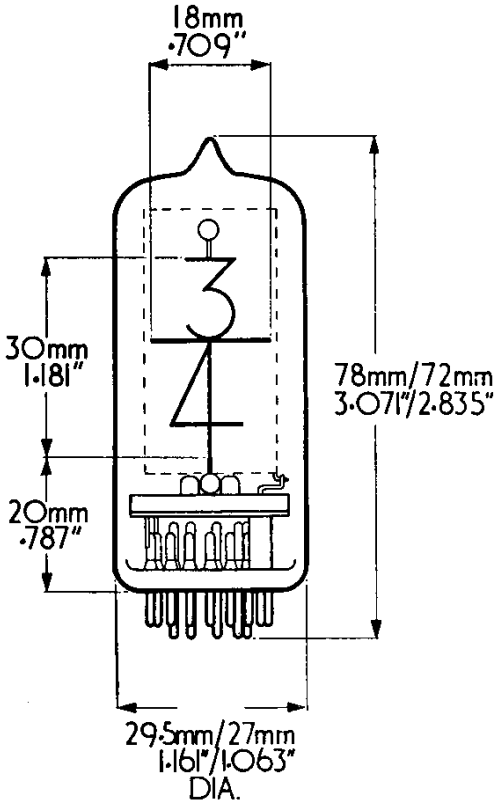


FRONT

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

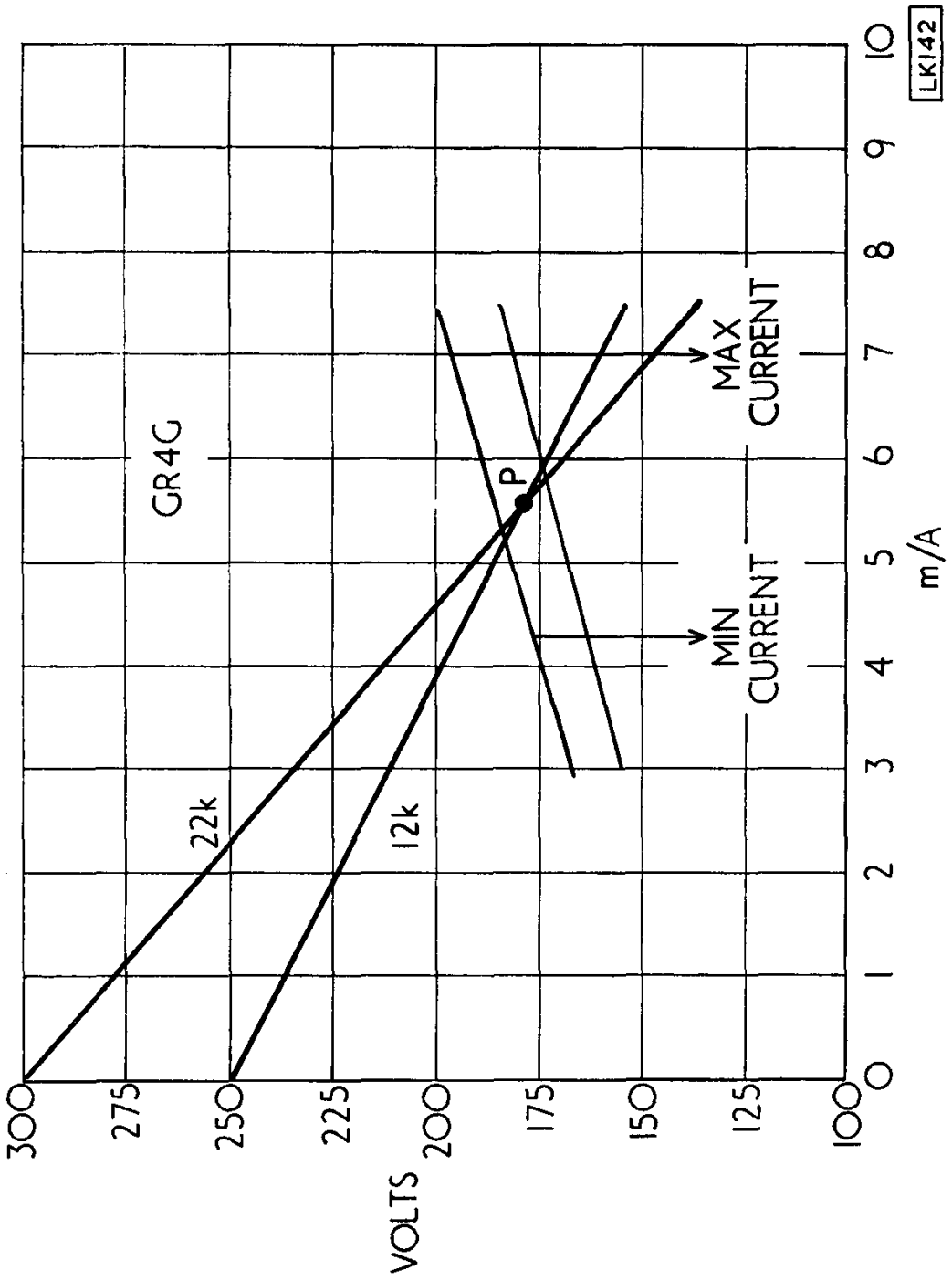
All other pins to be left unconnected.





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

GR4G



Operating Characteristics

*Registered Trade Mark

TENTATIVE DATA SHEET

*DIGITRON—Long Life 7 Character End-Viewing GR 7M Cold Cathode Register Tube Containing

Characters +, −, V, A, Ω, %, and ~

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

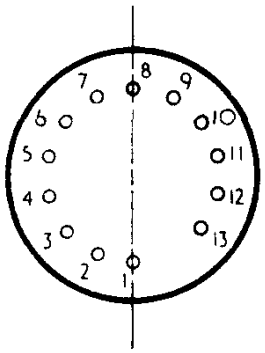
GR 7 M *DIGITRON—Long Life 7 Character End-Viewing Cold-Cathode Register Tube Containing Characters +, −, V, A, Ω, %, and ~

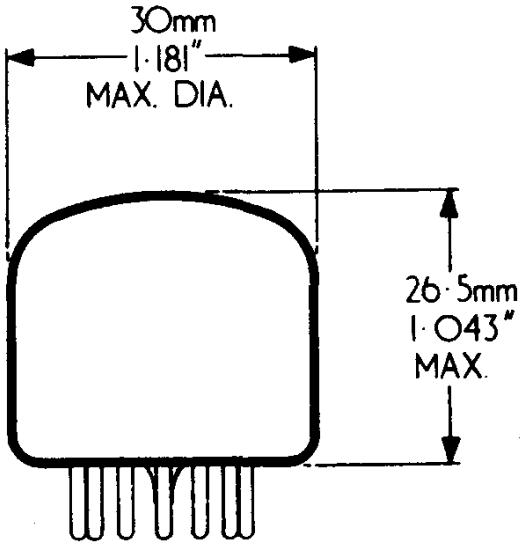
Mechanical Data

Mounting position	Any
Base	B13B
Socket	B13B

Base Connections
(underside view)

CENTRE LINE OF CHARACTERS

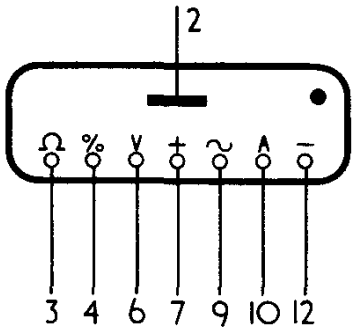


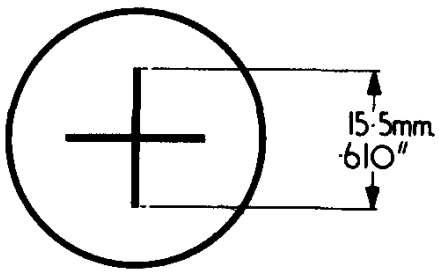


Pin 2 Anode
3 Cathode Ω
4 Cathode %
6 Cathode V
7 Cathode +
9 Cathode ~
10 Cathode A
12 Cathode −

Note - All other pins are to be left unconnected.

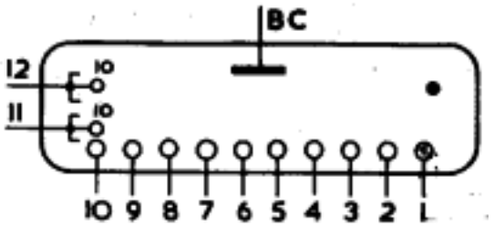
The dome of the tube is filter coated





* Registe :d Trade Mark

bi-directional 10-way selector tube GS10C



(Specification CV. 2325)

Characteristics

Counting rate :—

Sine wave and rectangular pulse drive circuits	0—4,000 ppS

Limit Ratings

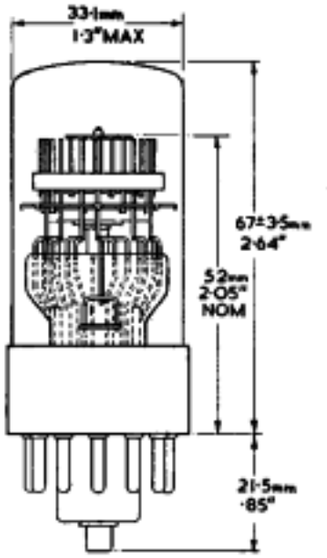
Maximum total anode current	550 μA
Minimum total anode current	250 μA
Minimum supply voltage, anode to cathode (normal room illumination)	400 V
Maximum potential difference between guides and cathodes	140 V

Recommended Operating Conditions

Anode current	325 μA ± 20%
Running voltage at this current	192 V
Cathode load resistors (see curve, page 29).	0—270 kΩ

The required anode current may be obtained from a 475 V supply via a 680 kΩ resistor.

Mounting position	Any. For visual indication, the tube is viewed through the dome of the bulb.
Alignment	Cathode No. 1 is lined up 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 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.**

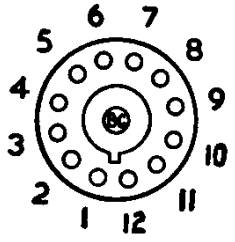
GS10C/S
(CV.2325)

Bi-directional 10-way Selector Tube

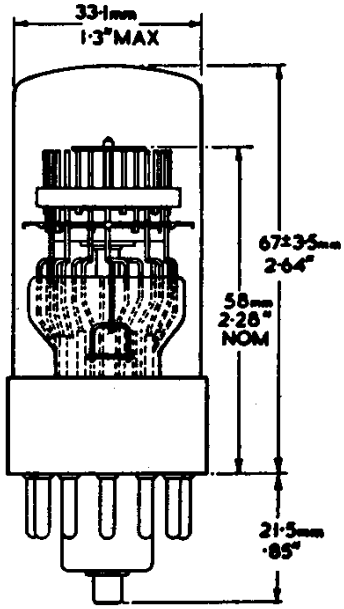
Mechanical Data

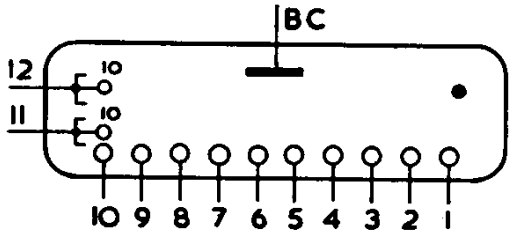
Mounting position	Any. For visual indication the tube is viewed through the dome of the bulb.
Alignment	Cathode No. 1 is aligned with pin No. 11 to an accuracy of ± 12°.
Weight	53 g. (nominal).
Escutcheon	N.80977
Base	Duodecal with bottom cap.

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 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.

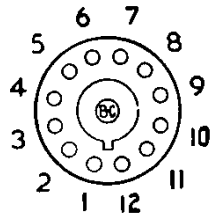
GS10D

Bi-directional 10-way Selector Tube

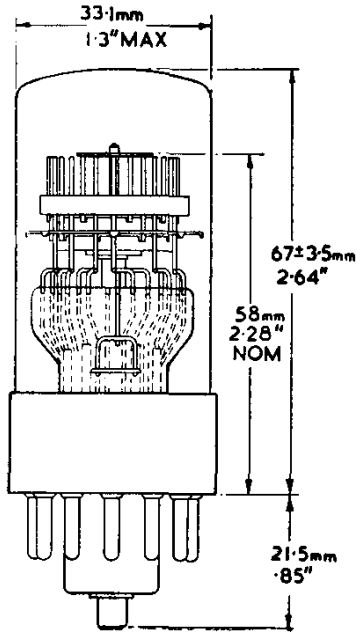
Mechanical Data

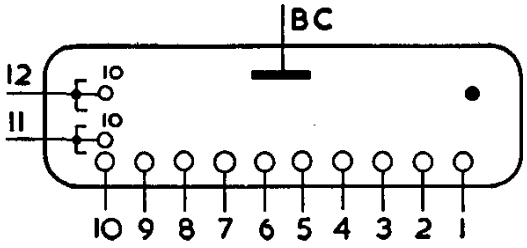
Mounting position	Any. For visual indication the tube is viewed through the dome of the bulb.
Alignment	Cathode 1 is aligned with pin No. 11 to an accuracy of ± 12°.
Weight	53 g (nominal)
Base	Duodecal with bottom cap.
Escutcheon	N80977.

Base Connections (underside view)



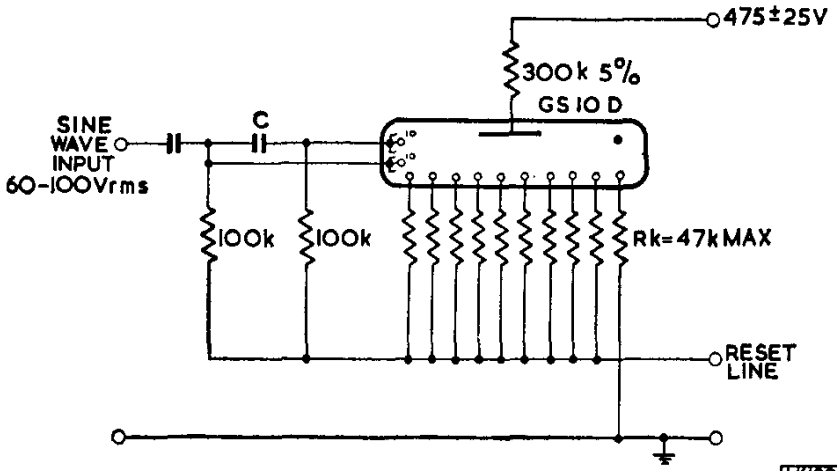
Pin	1	Cathode 0
	2	,, 9
	3	,, 8
	4	,, 7
	5	,, 6
	6	,, 5
	7	,, 4
	8	,, 3
	9	,, 2
	10	,, 1
	11	2nd Guides
	12	1st Guides
B.C.		Anode





Bi-directional 10-way Selector Tube

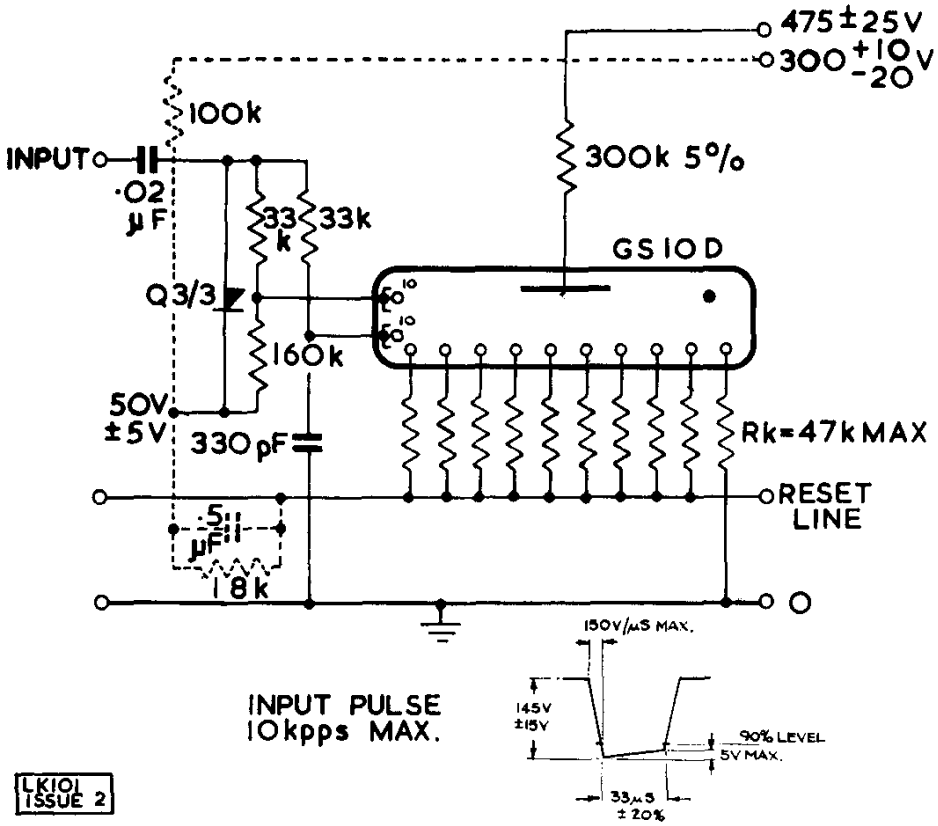
GS10D



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

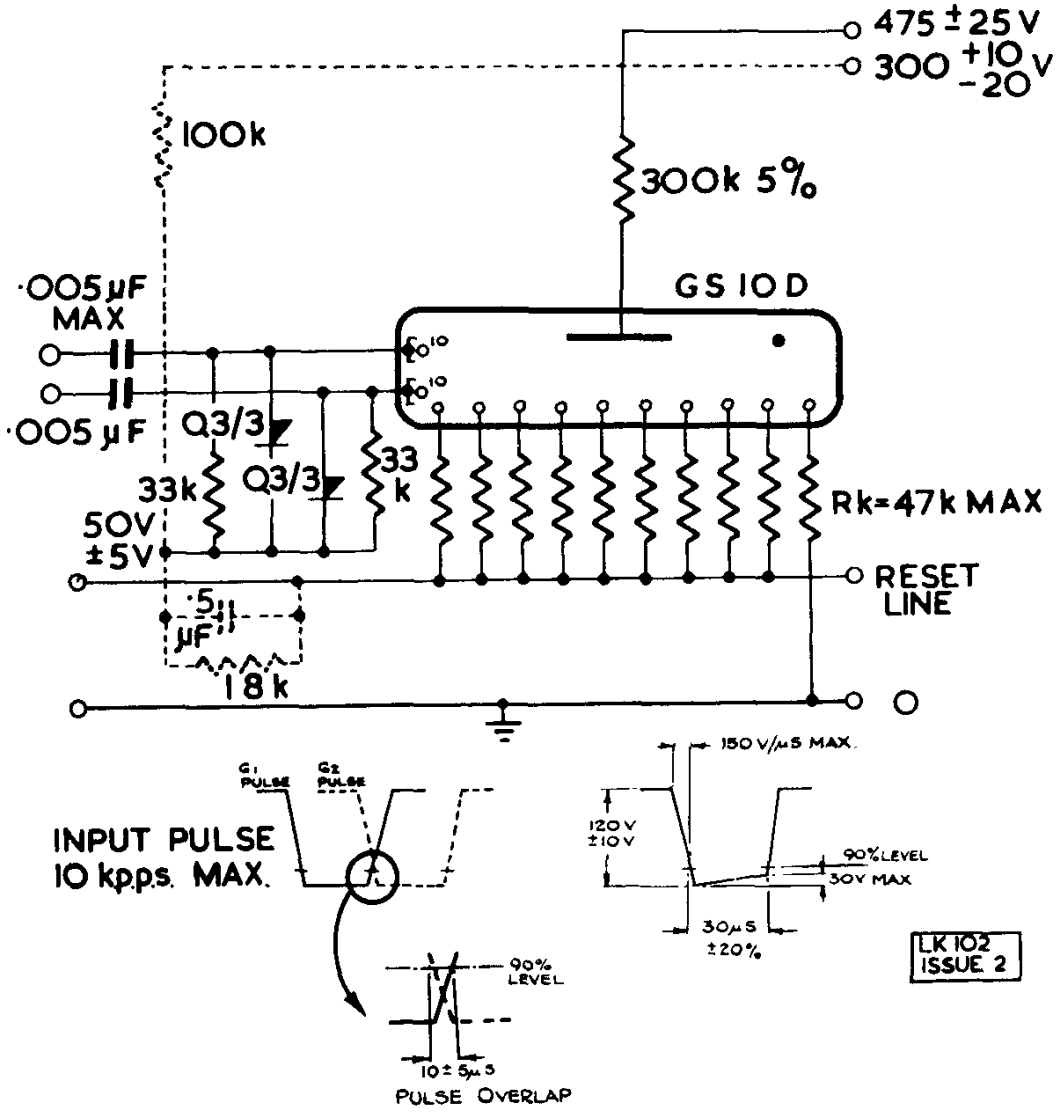


LK101 ISSUE 2

Integrated-Pulse Drive

GS10D

Bi-directional 10-way Selector Tube



Paired-Pulse Drive

GS10E DEKATRON TUBE

PERFORMANCE DATA AND BASE CONNECTIONS

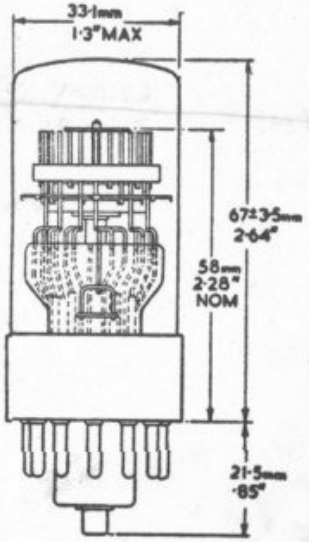
Mechanical Data

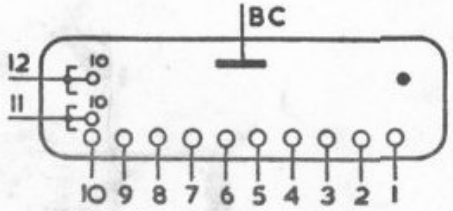
Mounting position	Any. For visual indication the tube is viewed through the dome of the bulb.
Alignment	Cathode 1 is aligned with pin No. 11 to an accuracy of ± 12°.
Weight	53 g (nominal)
Base	Duodecal with bottom cap.
Escutcheon	N80977.

Base Connections (underside view)



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





Limit Ratings

Maximum operating speed: sine wave and rectangular pulses	10 kc/s
V_a minimum	440 V
I_a maximum	0·9 mA
I_a minimum	0·7 mA
Maximum cathode voltage excursion	35 V
Minimum voltage between Vk and Vg (Vg—Vk)	10 V

Recommended Operating Conditions

Anode supply voltage	475 V
Anode current	0·8 mA
Anode resistor	240 kΩ 5%
Cathode voltage ($V_G = 50 \pm 5$ V)	35 V max.
Pulse Amplitude—Double Pulse ($V_G = 50 \pm 5$ V $R_G = 33$ kΩ)	—120 V min.
Pulse Duration— ,, ,, ,, ,,	25 μS min.
Pulse Overlap— ,, ,, ,, ,,	7 ± 3 μS
Pulse Amplitude—Integrated Pulse Drive	—130 V min.
Pulse Duration— ,, ,, ,, ,,	25 μS min.

PROOPS BROTHERS LIMITED
52 Tottenham Court Road
London W. 1.

Bi-directional 10-way Selector Dekatron with Routing Guides

GS10H

Although the seated height of this tube is less than $1\frac{1}{2}$", 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 $\frac{1}{4}$" (5 mm) from the anode tag on the valve holder.

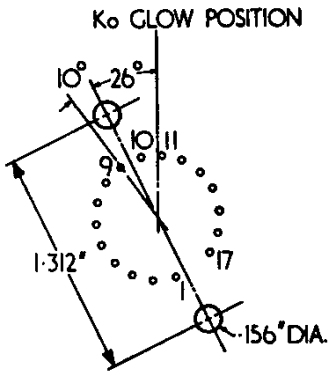
GS10H

Bi-directional 10-way Selector Dekatron with Routing Guides

Mechanical Data

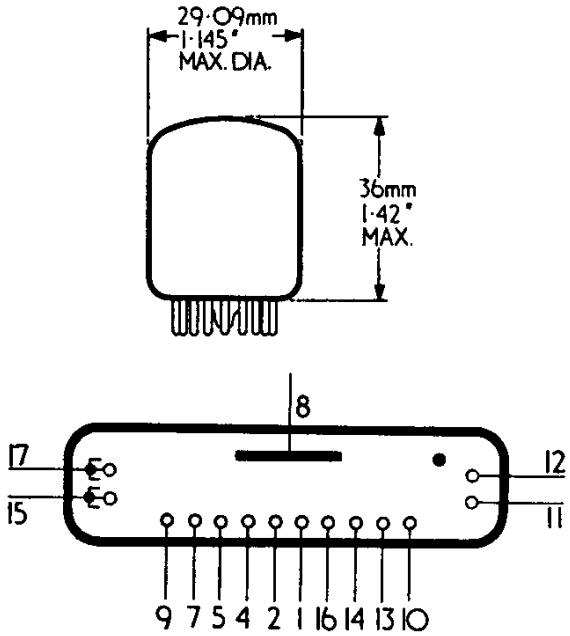
Mounting position	Any For visual indication the tube is viewed through the dome of the bulb.
Alignment	Cathode 1 is aligned with pin 9 ± 3°.
Base	B17A
Escutcheon	N79368
Valveholder, printed circuit	E.T.L. code HFD 13534
Valveholders, tags	A.E.I. type VH26/1703 E.T.L. code HFD 13045

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

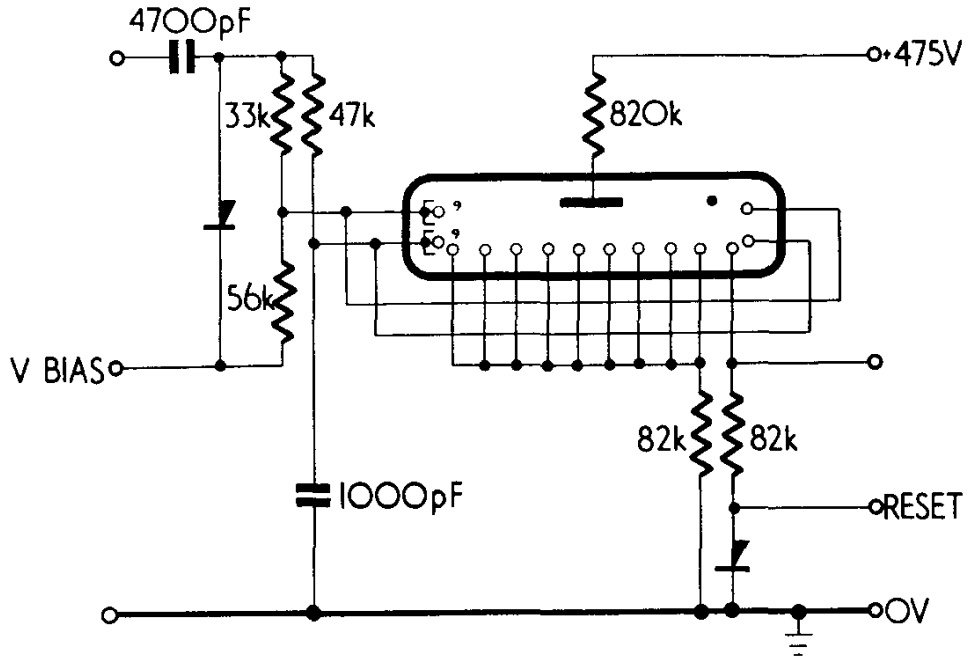


Fig. 1 Integrated Pulse Drive

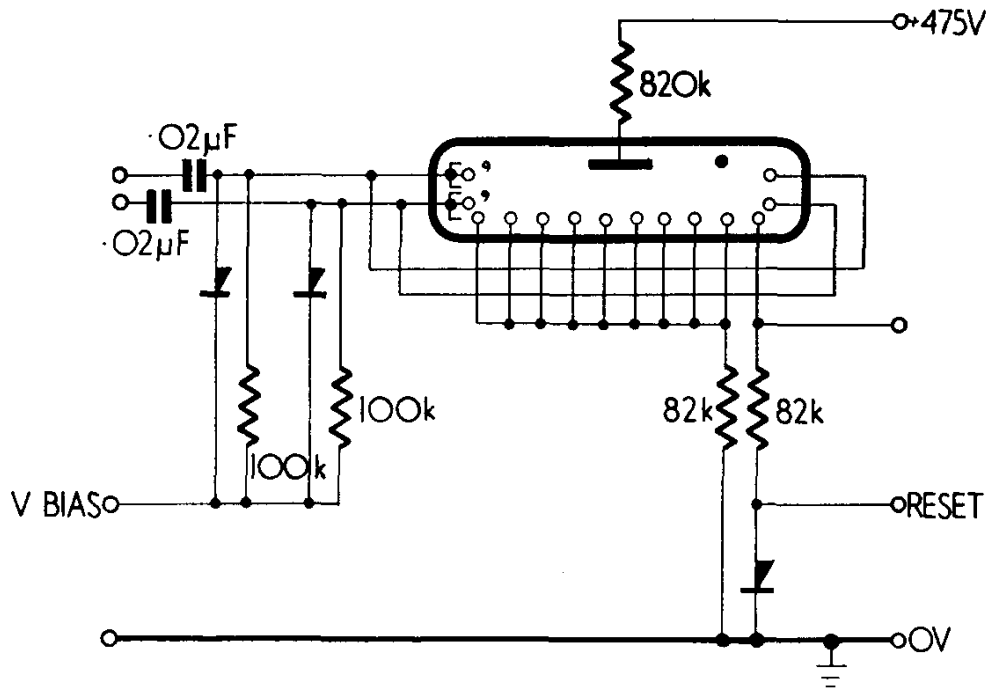
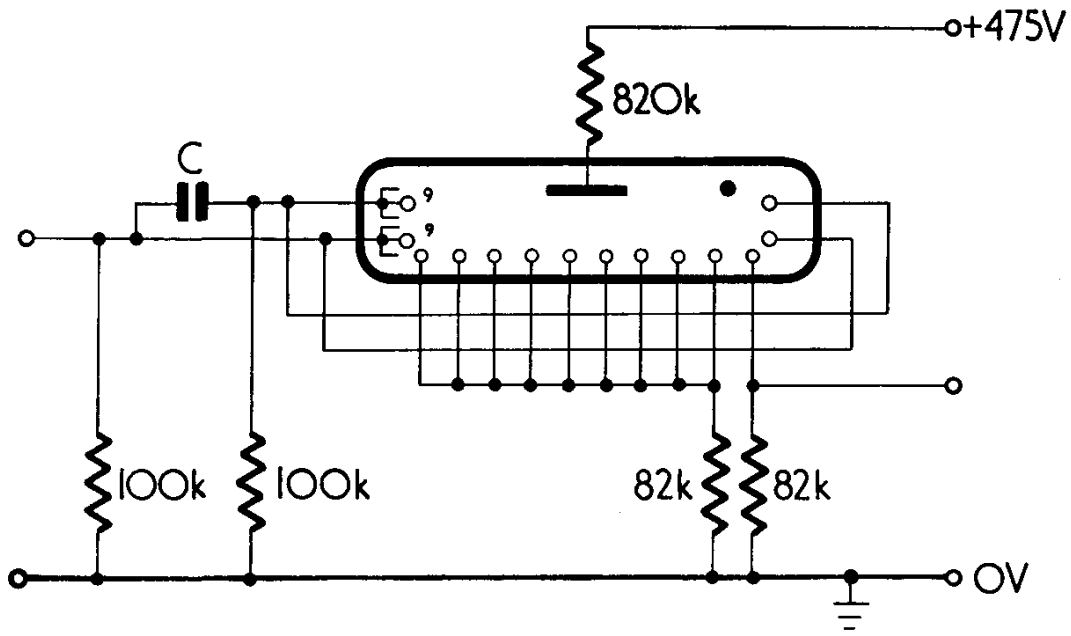


Fig. 2 Double Pulse Drive

GS10H

Bi-directional 10-way Selector Dekatron with Routing Guides

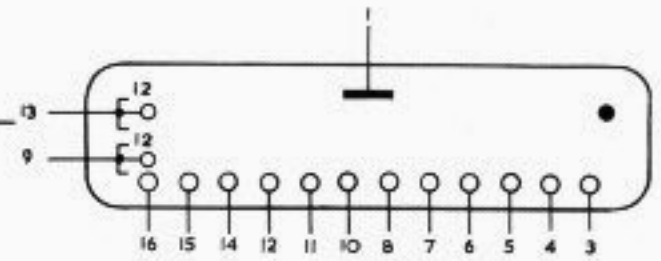


f	4 kc/s	2 kc/s	1 kc/s	500 c/s	200 c/s	100 c/s	50 c/s
C	680 pF	·002μF	·005μF	·01μF	·02μF	·05μF	·1μF

Fig. 3 Sine Wave Drive

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

...rectional 12-way selector tube GS12C



Characteristics

Counting rate :

Sine wave and rectangular pulse drive circuits	0—4,000 ppS

Limit Ratings

Maximum total anode current	550 μA
Minimum total anode current	250 μA
Minimum supply voltage, anode to cathode (normal room illumination)	350 V
Maximum potential difference between guides and cathodes	140 V

MAINTENANCE TYPE ONLY SEE GS12D DATA

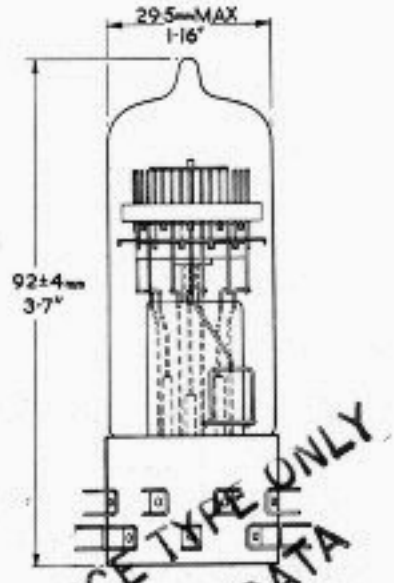
Recommended Operating Conditions

Anode current	325 μA. ± 20%
Running voltage at this current	192 V
Cathode load resistors (see curve, page 29)	0—270 kΩ

The required anode current may be obtained from a 475 V supply via a 680 kΩ resistor.

Mechanical Data

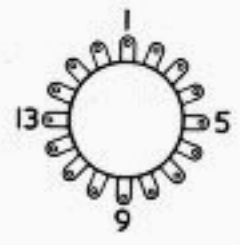
Mounting position	Any
Weight	43 g. (nominal)
Escutcheon	N.79369



MAINTENANCE TYPE ONLY SEE GS12D DATA

Base — 16 solder tags on phenolic tube.
It is intended that leads should be soldered directly to the tags.

Base Connections (underside view)



Tag		Colour of Sleeving
1	Anode	Red
2	—	
3	Cathode 0	Black
4	,, 11	—
5	,, 10	Black
6	,, 9	—
7	,, 8	Black
8	,, 7	—
9	2nd Guides	Yellow or Green
10	Cathode 6	—
11	,, 5	Black
12	,, 4	—
13	1st Guides	Yellow or Green
14	Cathode 3	—
15	,, 2	Black
16	,, 1	—

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

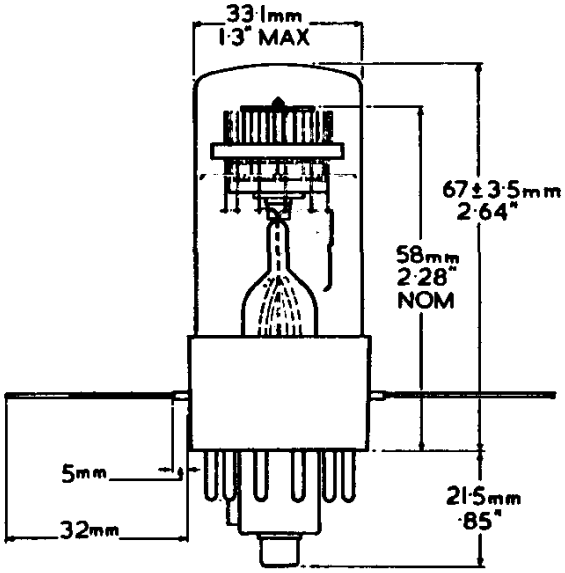
Mounting position	Any. For visual indication the tube is viewed through the dome of the bulb.
Alignment	Cathode No. 1 is aligned with pin No. 12 to an accuracy of ± 10°.
Weight	50 g (nominal).
Escutcheon	N.84538.
Base	Duodecal with bottom cap and two flying leads.

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

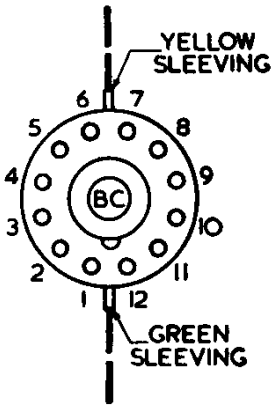
** This does not apply in the case of the sine wave drive.

GS12D

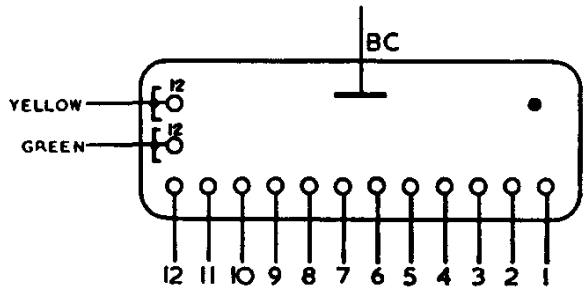
Bi-directional 12-way Selector Tube



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 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

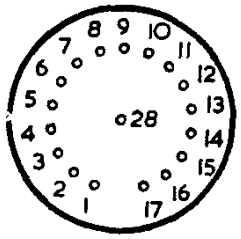
GCA10G GSA10G

UNDER REVISION

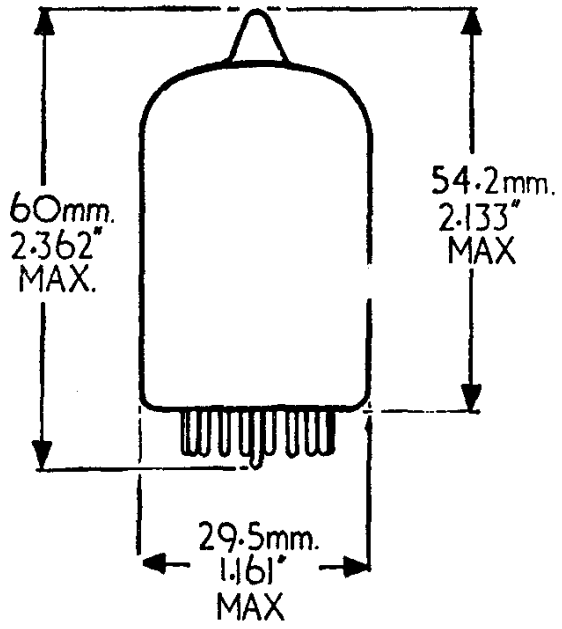
Mechanical Data

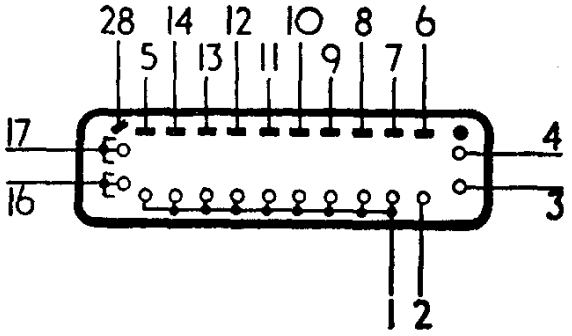
Mounting position	Any. For visual indication the tube may be viewed through the dome of the bulb.
Alignment	Cathode '0' is aligned to pin 3 with an accuracy of ± 5°
Base	Modified B26A
Socket	B27A

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



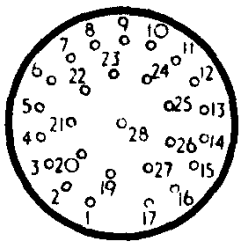


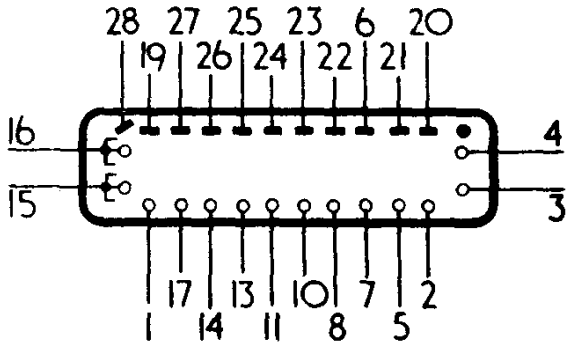
GCA10G
GSA10G

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

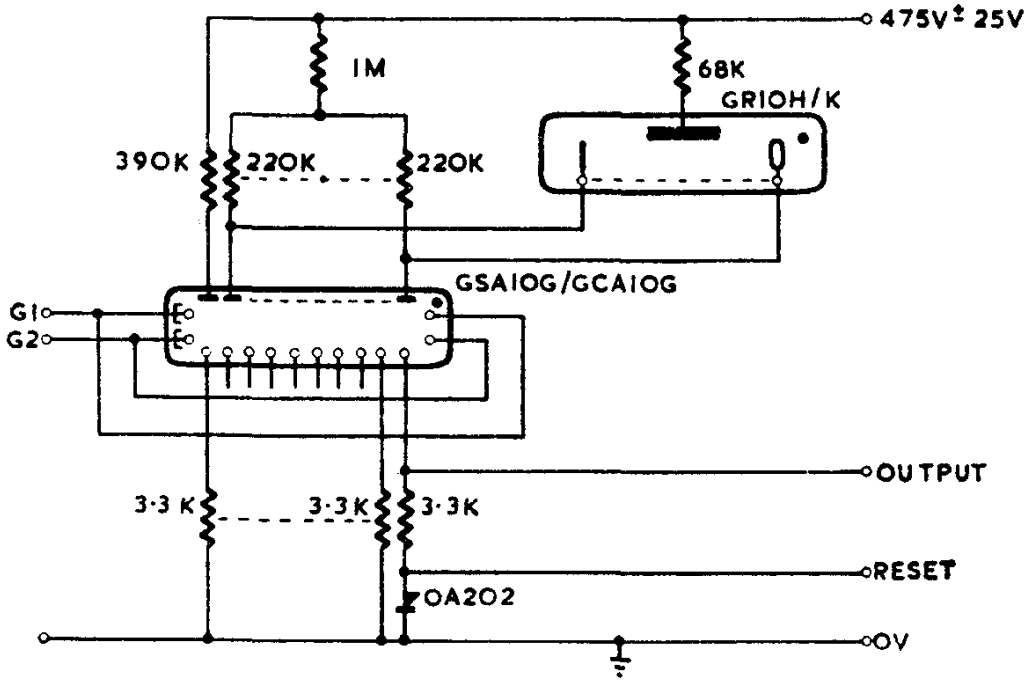


Fig. 1 Dekatron with Digitron Readout.

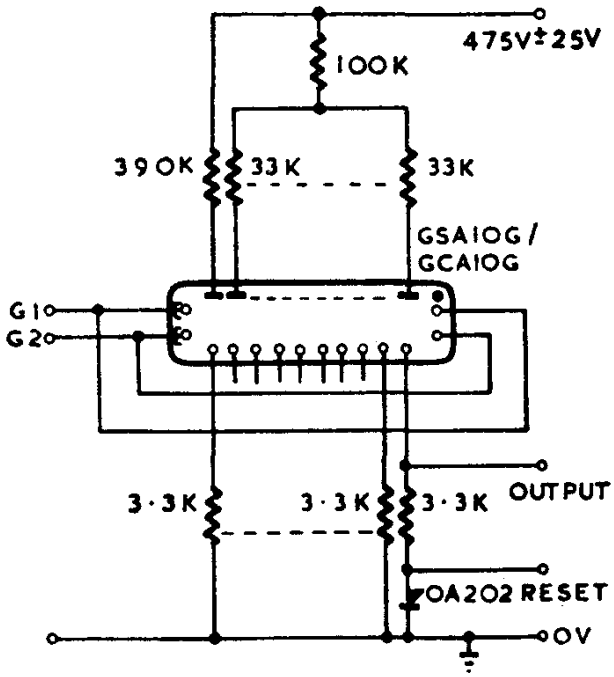


Fig. 2 Dekatron without Digitron Readout.

GCA10G
GSA10G

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

UNDER REVISION

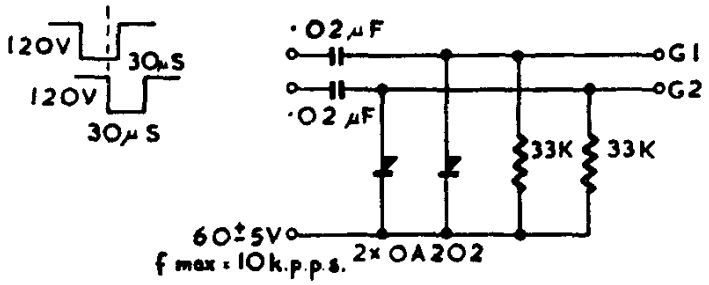


Fig. 3 Paired Pulse Drive.

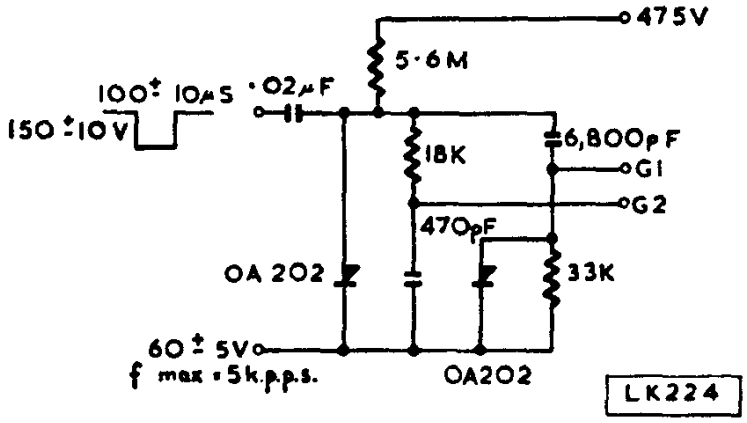


Fig. 4 Single Pulse Drive.

附：SZ3-1，SZ4-1辉光放电显示管的符号有以下几种

+	−	÷	X	Y	Z	∿
A	MA	mA	μA	V	mV	KV
C	KC	MC	Hz	MHz	KHz	Ω
KΩ	MΩ	W	KW	S	mS	μS
m	Km	cm	mm	μm	g	Kg
KG	T	Kgm	H	mH	μH	HG
Hp	F	μF	P_F	P	R	θ
α	μ	η	%	I_C	I_d	I_g
I_L	I_V	I_r	I_o	V_H	V_L	M^3

5/M	CH_4	m/s	°C	CO	Co	Mn
Si	Cr	Ni	Mo	Cu	湿	节

φ32特圆辉光放电符号管有以下几种

A	mA	μA	V	mV	μV	W
Ω	KΩ	MΩ	%			

注意事项

1. 使用数码管时不宜长期停留在某一数字显示；
2. SZ3-1管座型号是GZC13-1，SZ4-1管座为GZS11-J；
3. 符号管基本参数与相应型号数码管相同，符号管可预先定制。

风光

SZ3-1 SZ4-1

辉光放电显示管说明书

上海电子管三厂

上海北苏州路470号　电报挂号：5538

电话：总机240639

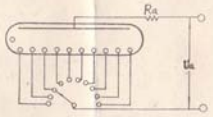
一、基本参数

参数名称	符号	单位	最小	标准	最大
阳极供给直流电压	Ua	伏特	—	170	—
起辉电压	Uz	伏特	—	—	150
熄灭电压	Ux	伏特	100	—	—
阴极电流	Ik	毫安	1.5	2	3
限流电阻	Ra	千欧姆	—	20	—
寿命	T	小时	1000		
重量	G	克	—	—	15
显示高度	h	毫米		15.5	

二、使用极限值

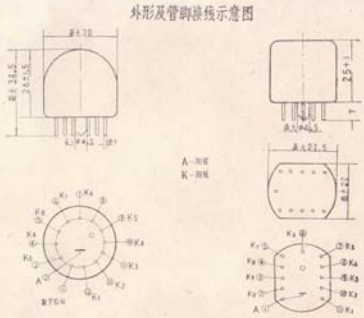
	阳极电压(伏特)	阴极电流(毫安)	阳极耗散功率(瓦)	阳极峰值电流(毫安)
最大值	250	3	0.35	15

基本回路及 Ua 和 Ra 的典型值



阳极供给直流电压	Ua	伏特	170	210	250	280
限流电阻	Ra	千欧姆	20	42	62	82

外形及管脚接线示意图



附：SZ3-1，SZ4-1辉光放电显示管的符号有以下几种

+	−	÷	X	Y	Z	∿
A	MA	mA	μA	V	mV	KV
C	KC	MC	Hz	MHz	KHz	Ω
KΩ	MΩ	W	KW	S	mS	μS
m	Km	cm	mm	μm	g	Kg
KG	T	Kgm	H	mH	μH	HG
Hp	F	μF	P_F	P	R	θ
α	μ	η	%	I_C	I_d	I_g
I_L	I_V	I_r	I_o	V_H	V_L	M^3

5/M	CH_4	m/s	°C	CO	Co	Mn
Si	Cr	Ni	Mo	Cu	湿	节

φ32特圆辉光放电符号管有以下几种

A	mA	μA	V	mV	μV	W
Ω	KΩ	MΩ	%			

注意事项

1. 使用数码管时不宜长期停留在某一数字显示；
2. SZ3-1管座型号是GZC13-1，SZ4-1管座为GZS11-J；
3. 符号管基本参数与相应型号数码管相同，符号管可预先定制。

风光

SZ3-1 SZ4-1

辉光放电显示管说明书

上海电子管三厂

上海北苏州路470号　电报挂号：5538

电话：总机240639

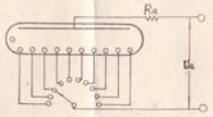
一、基本参数

参数名称	符号	单位	最小	标准	最大
阳极供给直流电压	Ua	伏特	—	170	—
起辉电压	Uz	伏特	—	—	150
熄灭电压	Ux	伏特	100	—	—
阴极电流	Ik	毫安	1.5	2	3
限流电阻	Ra	千欧姆	—	20	—
寿命	T	小时	1000		
重量	G	克	—	—	15
显示高度	h	毫米		15.5	

二、使用极限值

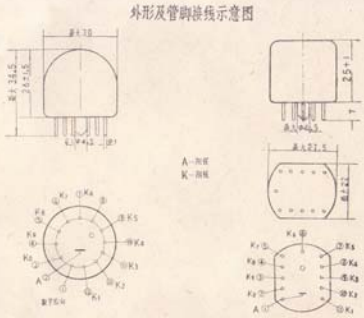
	阳极电压(伏特)	阴极电流(毫安)	阳极耗散功率(瓦)	阳极峰值电流(毫安)
最大值	250	3	0.35	15

基本回路及 Ua 和 Ra 的典型值

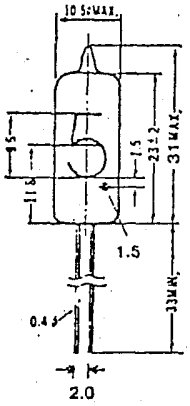


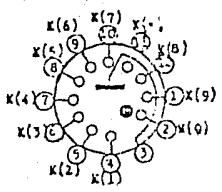
阳极供给直流电压	Ua	伏特	170	210	250	280
限流电阻	Ra	千欧姆	20	42	62	82

外形及管脚接线示意图

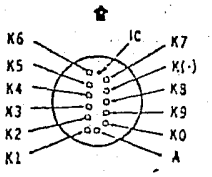


ANSCHLUSSBILD LD 8007 / GR 110





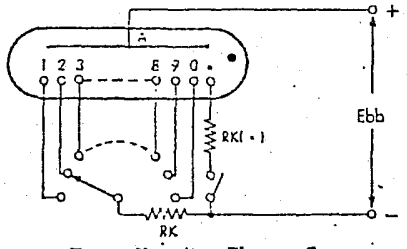
LD 8007



GR 110

Technische Test-Daten:

DC. Application

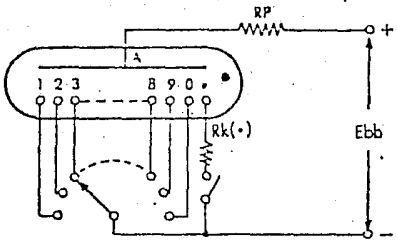


Test Circuit Figure 3.

Typical Operating Condition

Ebb	190	200	230	Vdc
Rk	27	33	47	KΩ
Rk(·)	150	180	270	KΩ

Time Sharing Application



Test Circuit Figure 4.

Typical Operating Condition

Ebb	190	200	230	V
Rp	8.2	10	18	KΩ
Rk(·)	47	62	108	KΩ

Pin Layout

Pin Layout (TOP View)

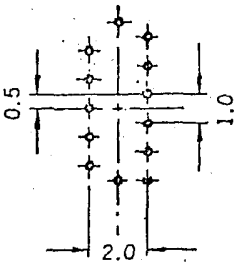


Figure 6.

Pin Connection

Pin Connection (Bottom Vie

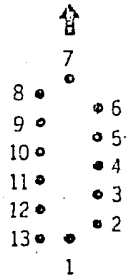


Figure 7.

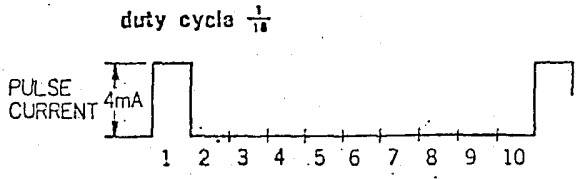


Figure 5.

Pin	Connections
1	ANODE
2	NUMERAL 0
3	NUMERAL 9
4	NUMERAL 8
5	DEC PT
6	NUMERAL 7
7	IC
8	NUMERAL 6
9	NUMERAL 5
10	NUMERAL 4
11	NUMERAL 3
12	NUMERAL 2
13	NUMERAL 1

RODAN

INDICATOR TUBE

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

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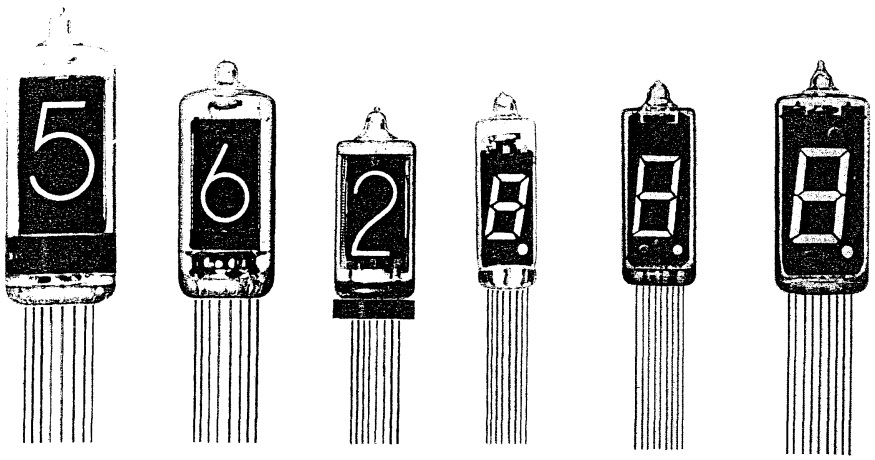
+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH



CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



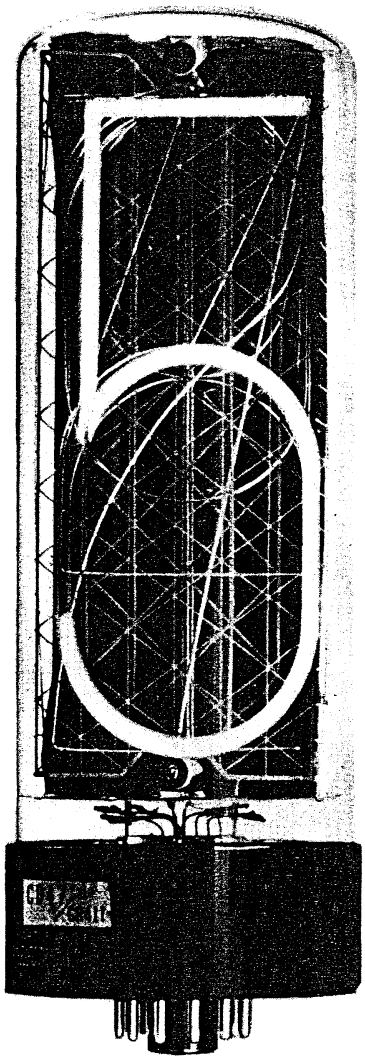
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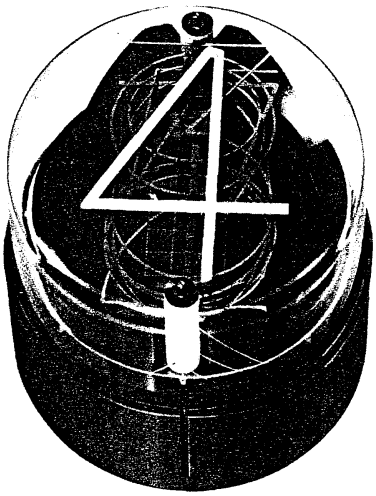
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CD24



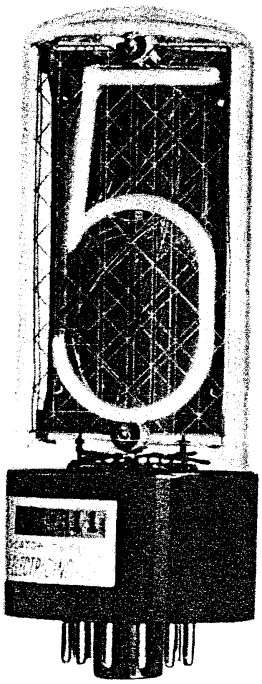
GR-414



CD27



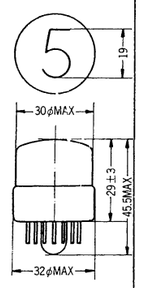
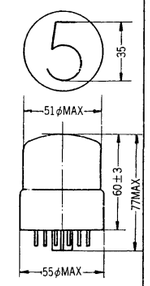
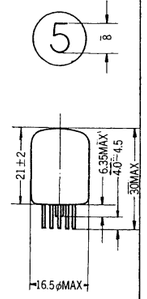
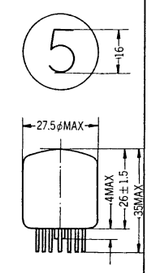
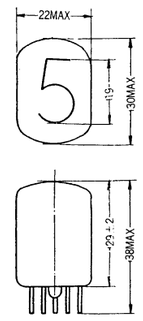
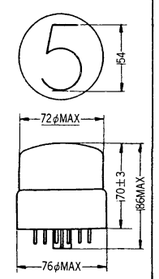
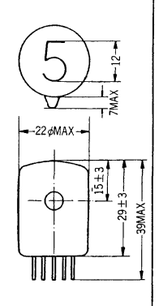
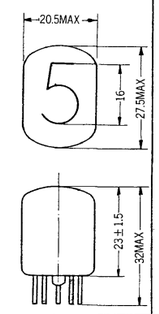
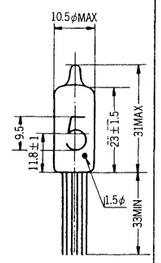
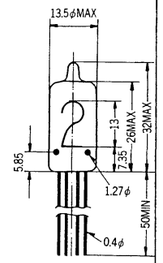
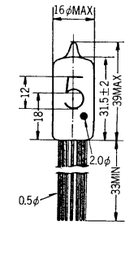
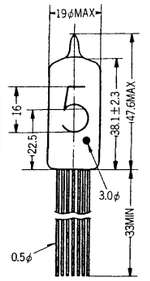
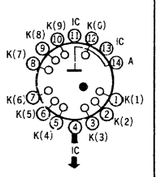
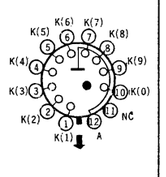
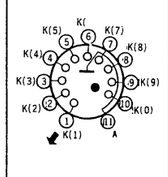
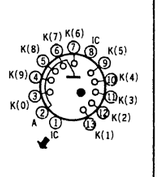
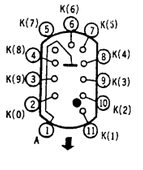
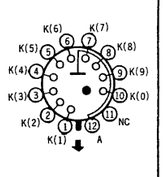
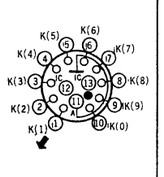
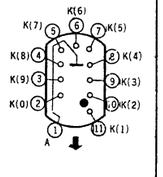
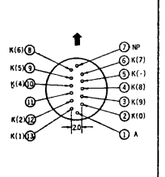
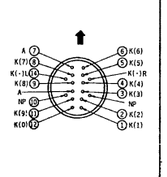
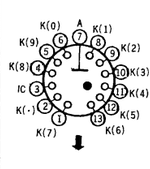
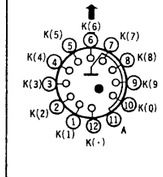
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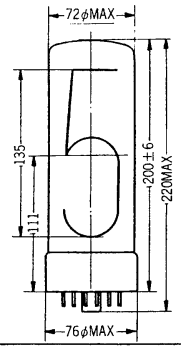
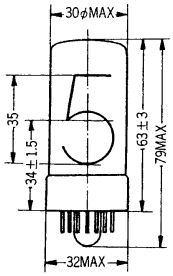
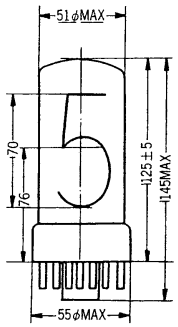
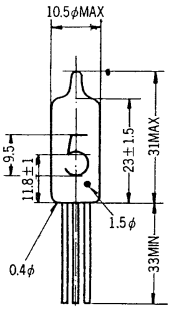
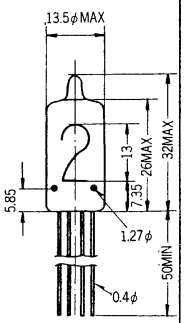
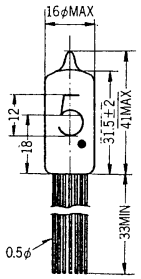
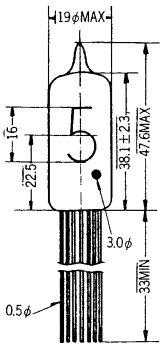
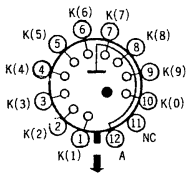
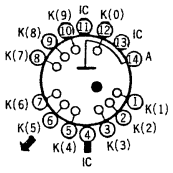
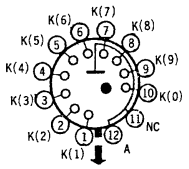
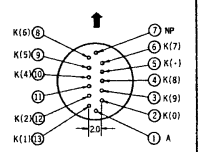
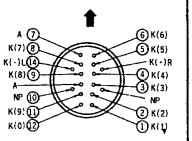
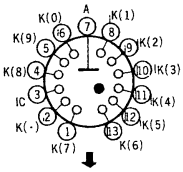
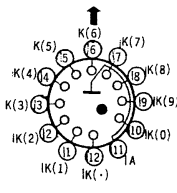
GR-311



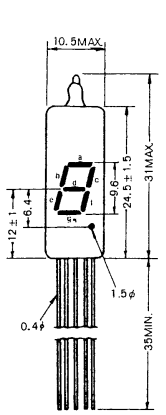
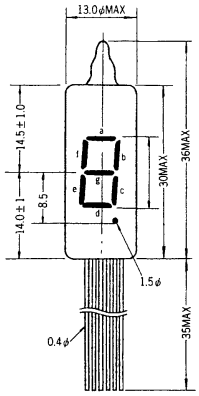
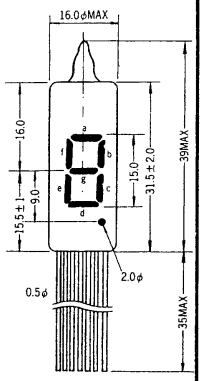
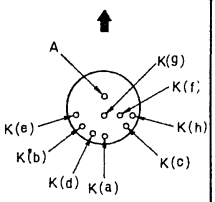
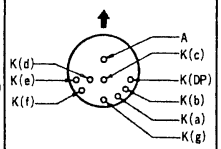
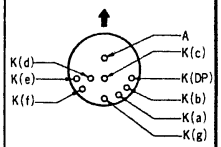
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

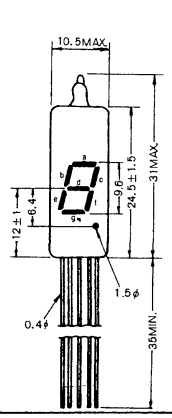
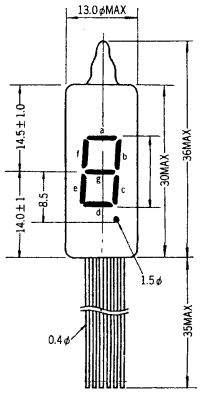
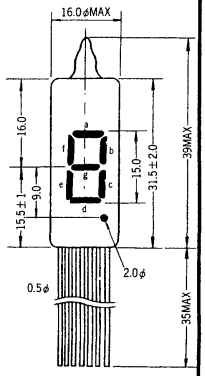
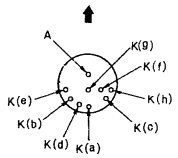
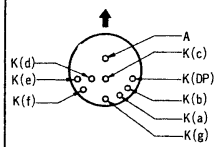
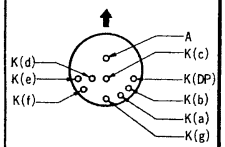
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

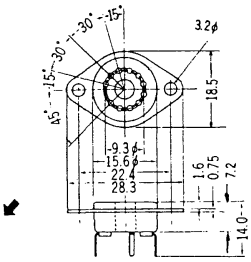
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

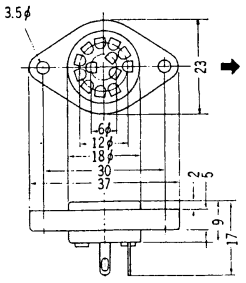
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

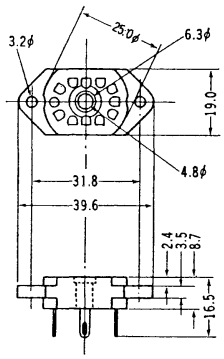
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



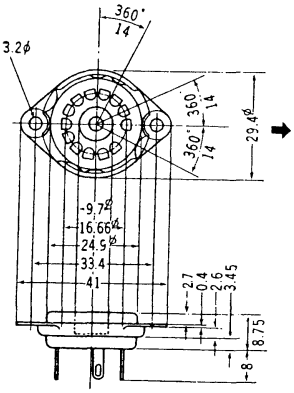
TSM-11P
CD 13



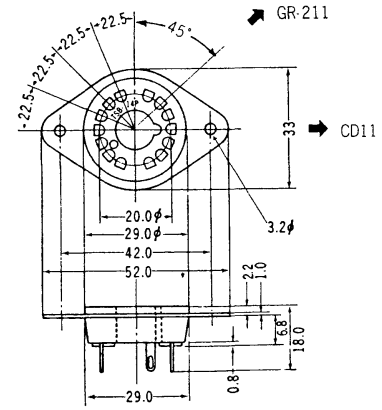
TSM-13P
CD 28



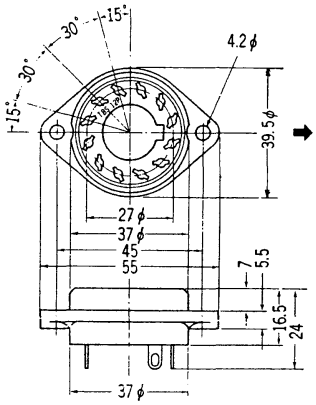
TSR-11P
CD 25, CD 43



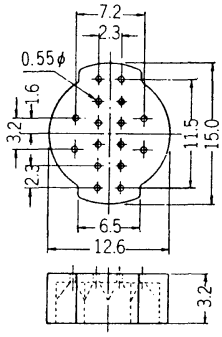
TSB-13P
CD 24



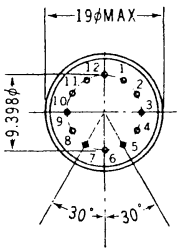
TSB-14P
CD11, GR-211



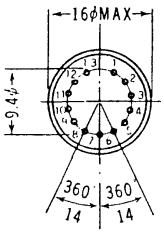
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

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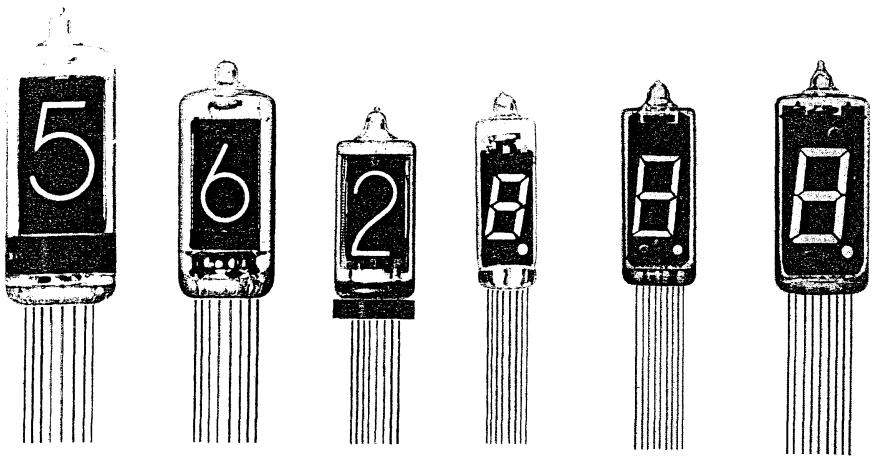
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CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



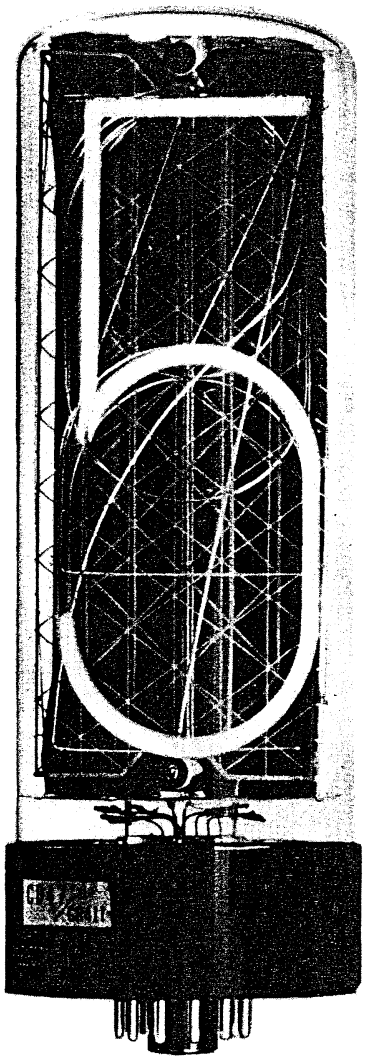
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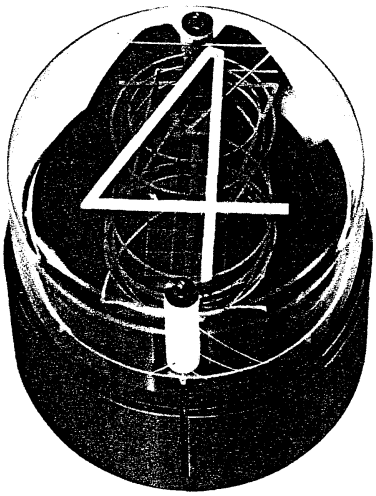
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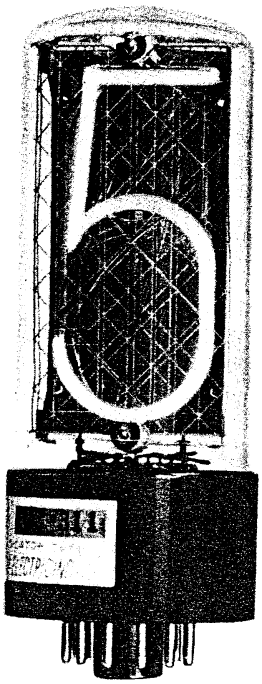
GR-414



CD27



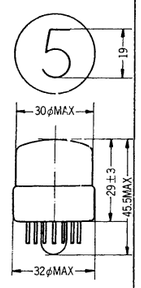
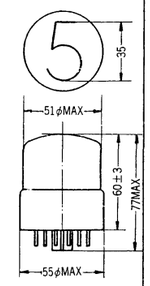
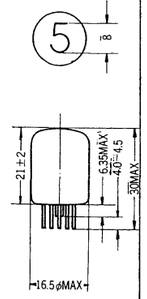
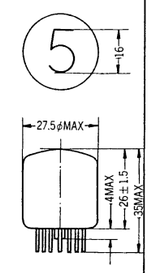
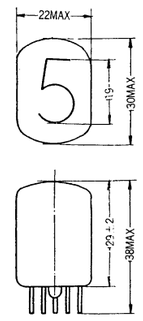
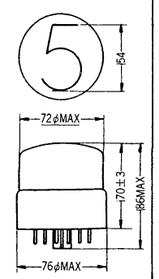
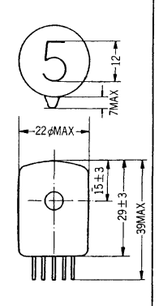
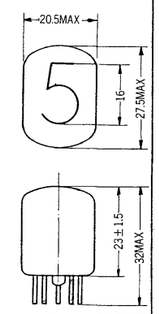
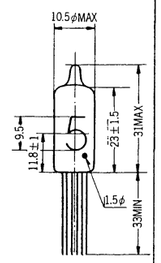
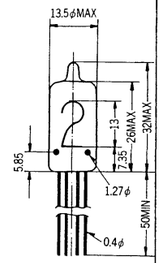
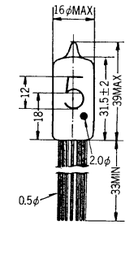
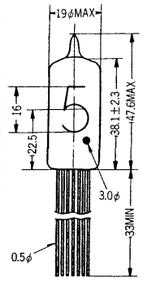
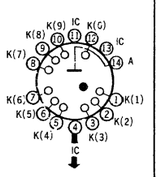
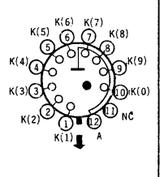
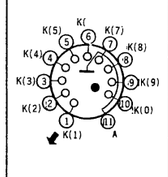
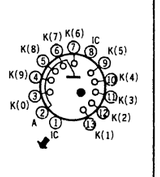
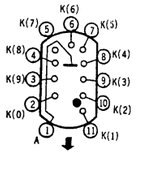
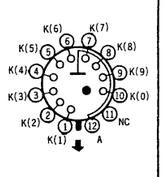
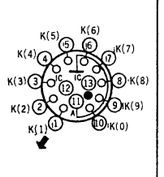
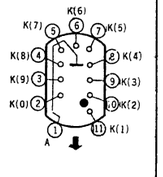
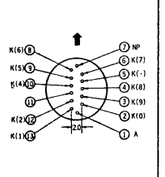
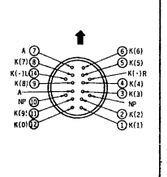
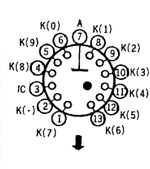
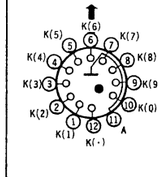
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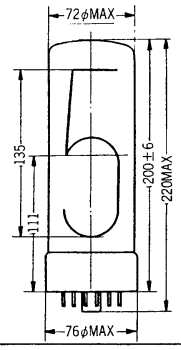
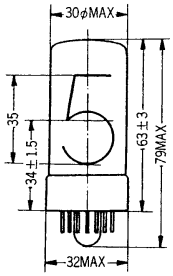
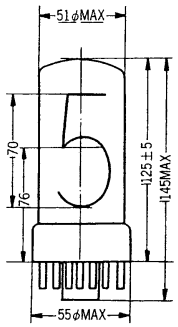
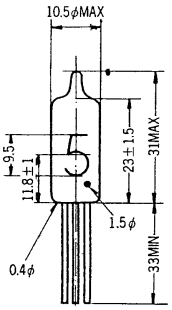
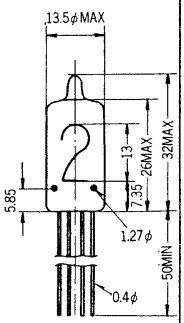
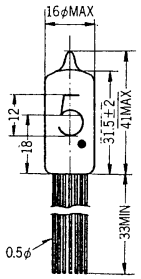
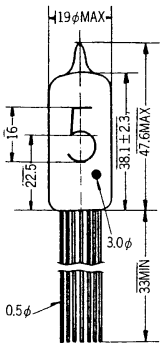
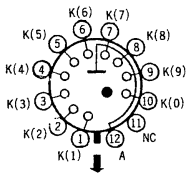
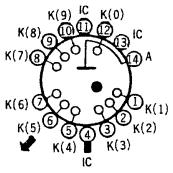
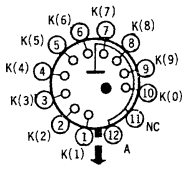
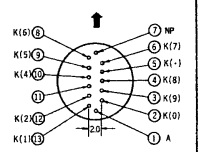
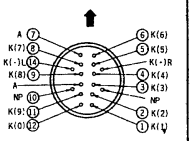
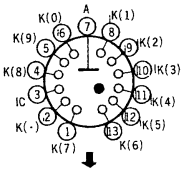
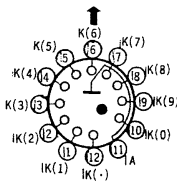
GR-311



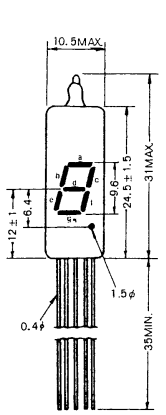
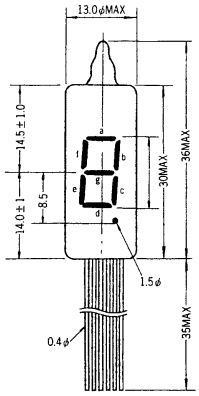
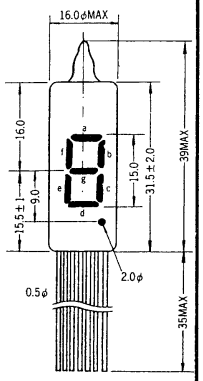
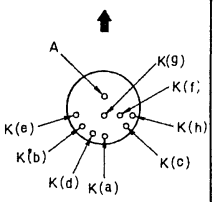
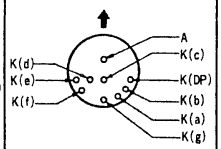
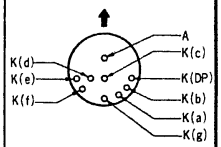
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

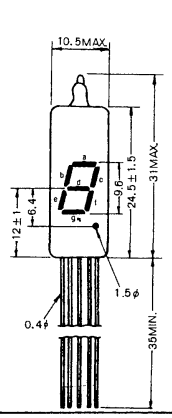
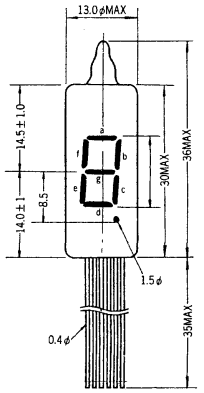
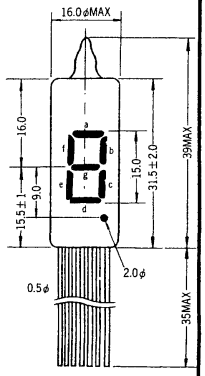
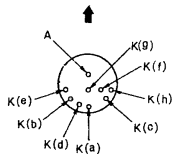
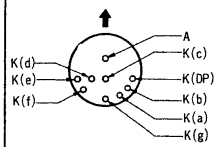
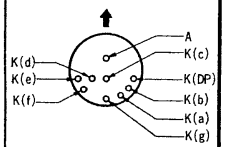
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

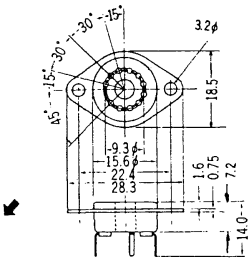
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

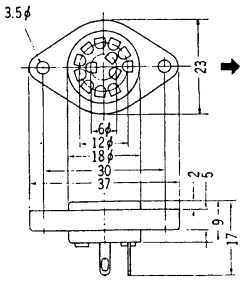
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

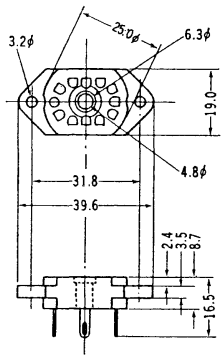
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



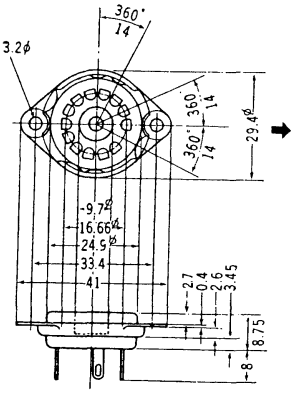
TSM-11P
CD 13



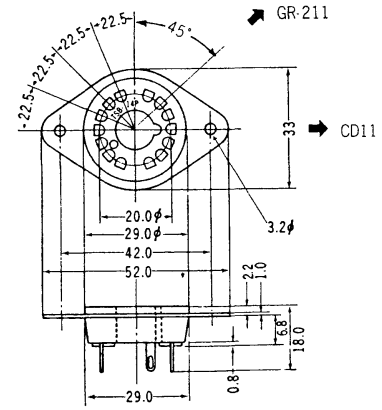
TSM-13P
CD 28



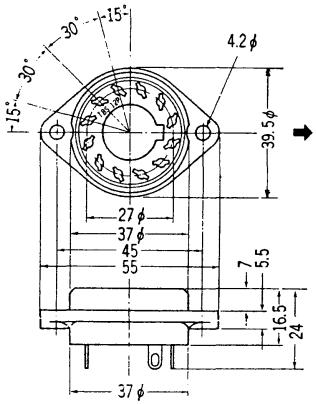
TSR-11P
CD 25, CD 43



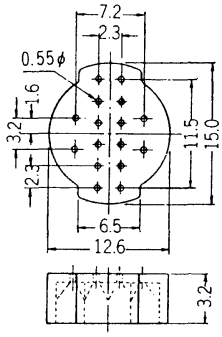
TSB-13P
CD 24



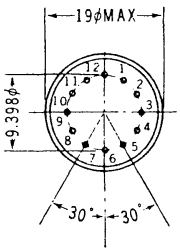
TSB-14P
CD11, GR-211



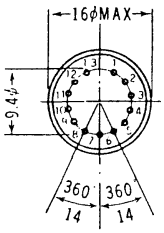
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

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+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

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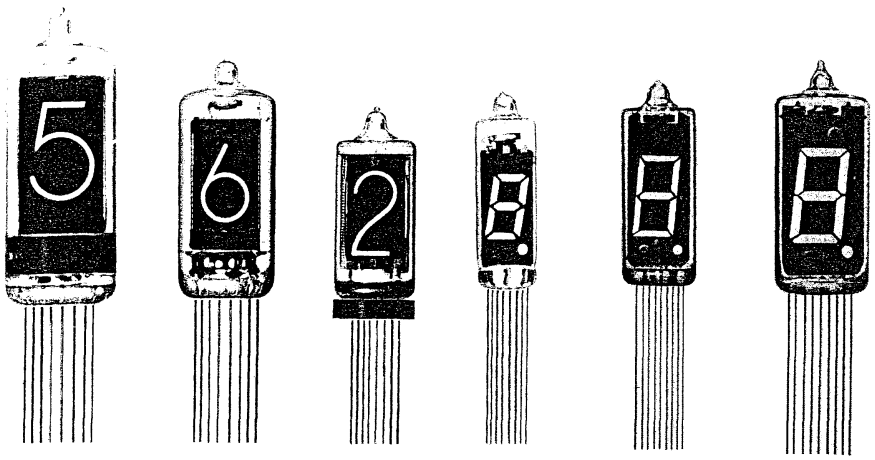
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+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH

+ − × ÷ 1234567890 KC KV KΩ 1234567890 % °C PH



CD66
CD66P

GR-111
GR-111P

GR-116D
GR-116P

MG-17G

MG-137

MG-157



CD28



CD25



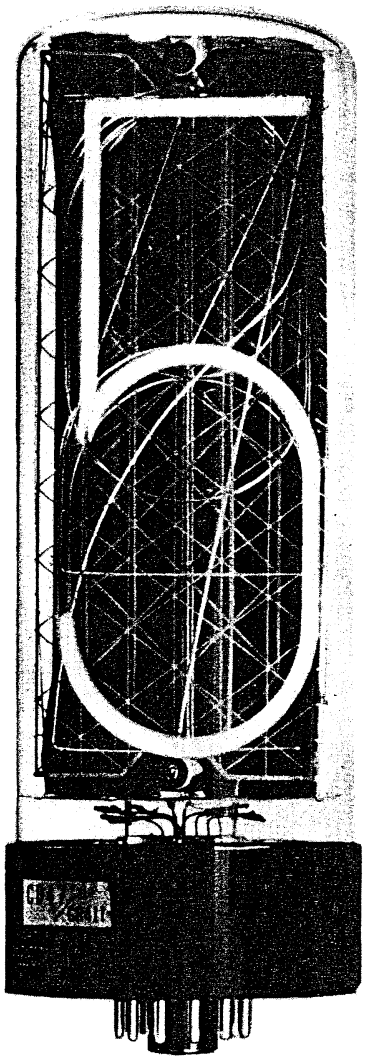
CD13



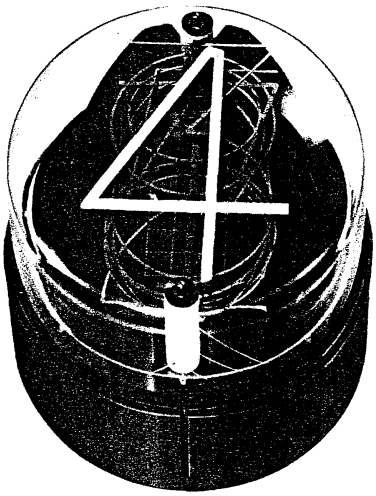
CD12



CD24



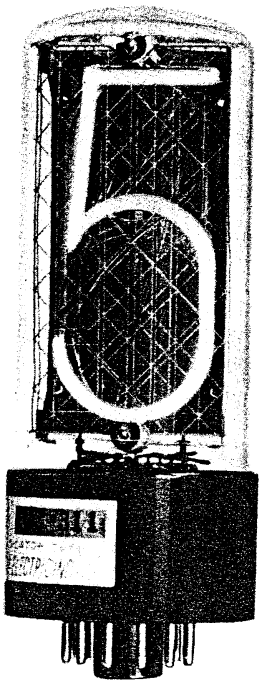
GR-414



CD27



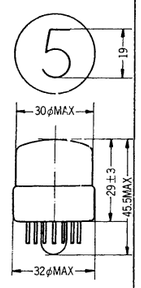
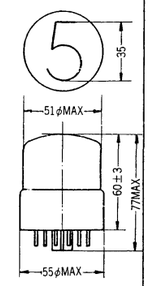
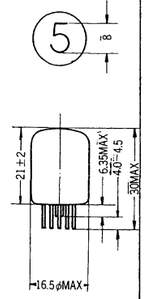
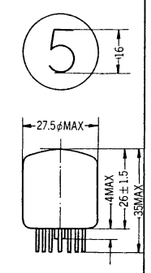
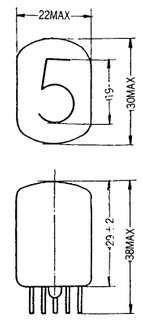
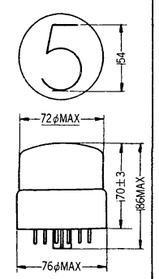
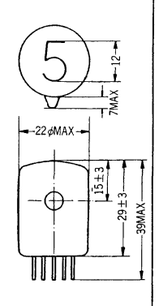
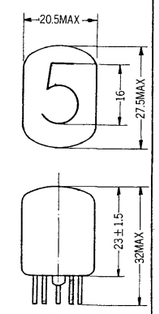
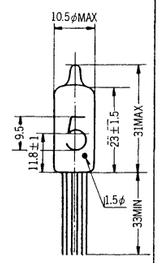
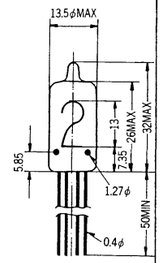
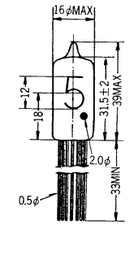
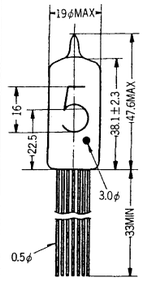
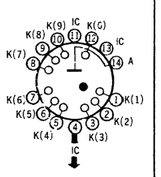
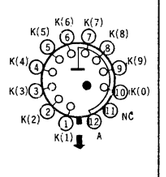
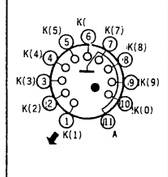
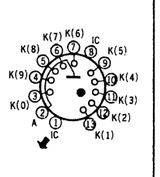
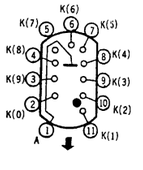
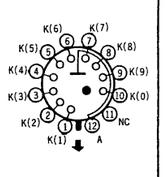
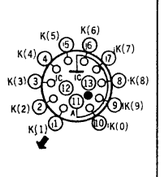
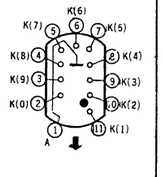
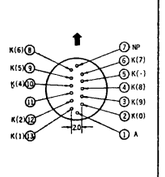
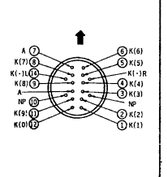
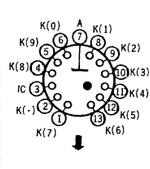
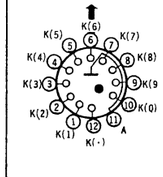
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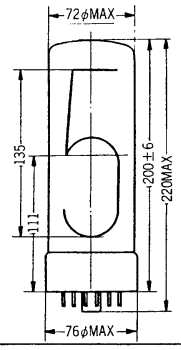
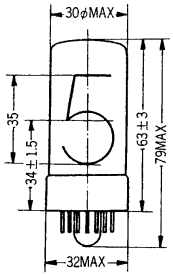
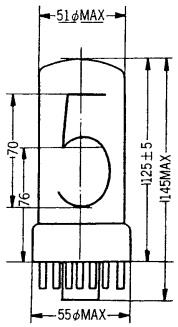
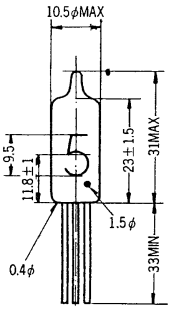
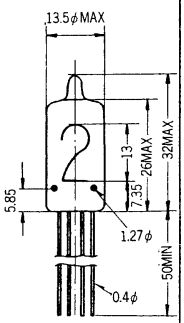
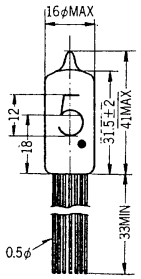
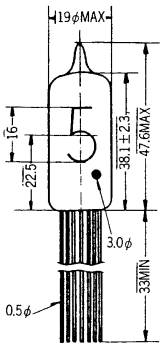
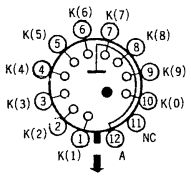
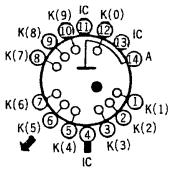
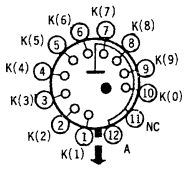
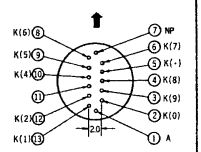
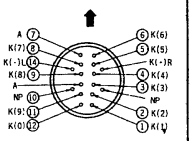
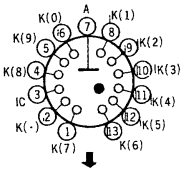
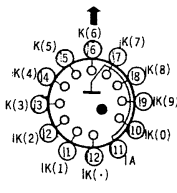
GR-311



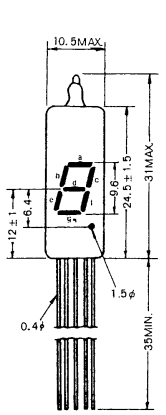
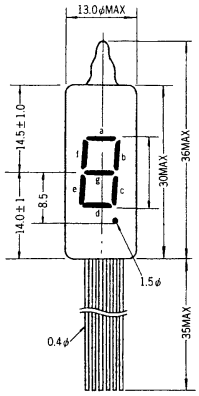
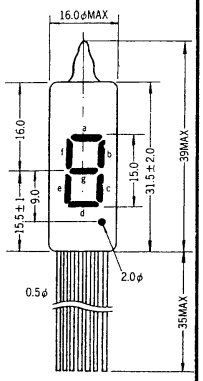
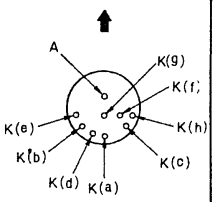
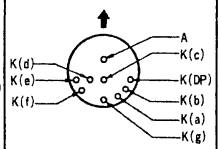
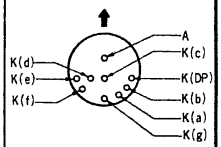
GR-211

	TOP VIEW TYPE (DC OPERATION)								SIDE VIEW TYPE			
REFERENCE NUMBER	**CD11**	**CD12**	**CD13**	**CD24**	**CD25**	**CD27**	**CD28**	**CD43**	**GR-110**	**GR-116D**	**GR-111**	**CD66**
Outline Drawing												
Pin Connections A : ANODE K : CATHODE IC : INTER CONNECTION NP : NO PIN NC : NO CONNECTION												
Socket	TSB—14P	TSB—12P	TSM—11P	TSB—13P	TSR—11P	TSB—12P	TSM—13P	TSR—11P				
Construction	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
ELECTRICAL SPECIFICATIONS	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
Supply Voltage (Vdc) Ebb	170 — —	200 — —	170 — —	170 — —	170 — —	200 — —	170 — —	170 — —	170 — —	175 — —	170 — —	170 — —
Ionization Voltage (Vdc) Ez	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170	— — 170
Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	1.5 2.5 3.5 (Ebb=170Vdc, Rp= 10kΩ)	3.5 5.0 6.5 (Ebb=200Vdc, Pp=12kΩ)	0.6 0.9 1.2 (Ebb=170Vdc, Pp=33kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.5 2.5 3.5 (Ebb=170Vdc, Rp=10kΩ)	7.5 10 12.5 (Ebb=200Vdc, Rp=5kΩ)	1.0 1.8 2.5 (Ebb=170Vdc, Rp=15kΩ)	1.5 2.25 3.0 (Ebb=170Vdc, Rp=10kΩ)	1.2 1.9 2.6 (Ebb=190Vdc, Rk=27kΩ) 0.15 0.3 0.5 (Ebb=190Vdc RK(·)=180kΩ)	2.2 3 3.8 (Ebb=180Vdc, Rk=15kΩ) 0.2 0.4 0.6 (Ebb=180Vdc RK(·)=100kΩ)	1.5 2.25 3.0 (Ebb=190Vdc, Rp=20kΩ) — 0.4 —	1.5 2.25 3.0 (Ebb=170Vdc, Rp=12kΩ) 0.3 0.5 0.7 (Ebb=170Vdc RK(·)=50kΩ)
Average Each Cathode Power Dissipation (w) Numerical Cathode Pk Decimal Point Pk(·)	— — 0.5	— — 1	— — 0.2	— — 0.5	— — 0.5	— — 2	— — 0.4	— — 0.5	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1	— — 0.5 — — 0.1
ABSOLUTE RATINGS												
Peak Cathode Current (mAdc) Numerical Cathode ik Decimal Point ik(·)	— — 4.0	— — 10	— — 1.5	— — 3.5	— — 4.0	— — 12.5	— — 3	— — 3.5	3.0 0.8	4 1.3	— — 3.5 — — 1.0	— — 3.5 — - 1.0
Range of Average Cathode Current (mAdc) Numerical Cathode Decimal Point	1.5 ～ 3.5	3.5 ～ 6.5	0.6 ～ 1.2	1.5 3.0	1.5 ～ 3.5	7.5 ～ 12.5	1.0 ～ 2.5	1.5 ～ 3.0	1.2 ～ 2.6 0.15 ～ 0.5	2.2 ～ 3.8 0.2 ～ 0.6	1.5 ～ 3.0 0.2 ～ 0.6	1.5 ～ 3.0 0.3 ～ 0.7
Ambient Temperature (for storage) Ts (deg C)	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
Operating Ambient Temperature Tc (deg C)	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
MECHANICAL DATA												
Maximum Viewing Angle (deg) (approx)	160	160	160	160	160	160	160	160	90	100	100	100
Weight (g) (approx)	25	75	4	12	13	130	9	10	2.3	4 (INCL. STAND-OFF)	7	10
TYPICAL OPERATING CONDITIONS												
Supply Voltage (Vdc)	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	170 200 250 300	200 250 300	170 200 250 300	170 200 250 300	190 200 230	180 200	190 200 250 300	190 200 250 300
Anode Series Resistor (KΩ)	10 22 42 62	12 22 32	33 65 120 180	10 24 47 68	10 22 43 62	5 10 15	15 35 65 100	10 24 47 68	Rk27 33 47	Rk 15 20	Rp20 24 47 68	Rk20 24 47 68
Decimal Point Series Resistor (KΩ)									180 200 300	100 150		91 110 200 300
Pulse Duration (mS)												

(DC OPERATION) (PULSE OPERATION)

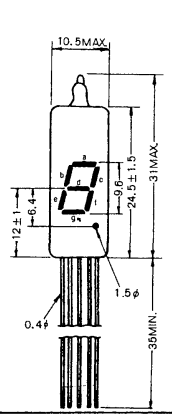
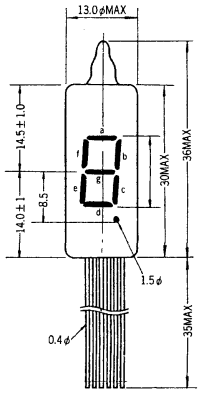
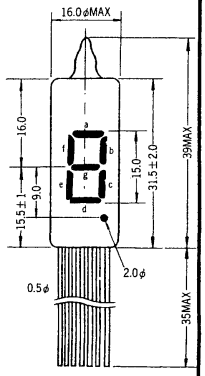
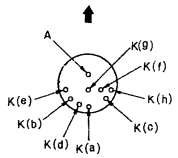
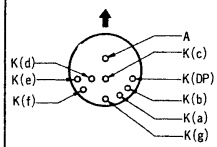
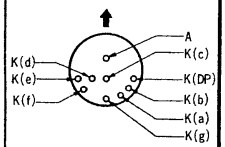
GR-414	GR-211	GR-311	GR-110	GR-116p	GR-111p	CD66P
						
						
TSB－12P	TSB－14P	TSB－12P				
0～9	0～9	0～9	0～9 Decimal Point	0～9 Decimal Point Left·Right	0～9 Decimal Point	0～9 Decimal Point
MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.	MIN. ST. MAX.
250 — —	200 — —	200 — —	190 — —	175 —	190 — —	190 — —
— — 200	— — 170	— — 170	— — 170	— — 170	— — 170	— — 190
17.5 25 32.5 (Ebb=250Vdc, Rp=5.1kΩ)	3.5 5 6.5 (Ebb=200Vdc, Rp=12kΩ)	12 15 18 (Ebb=215Vdc, Rp=5kΩ)	5 (duty 1/10 Ebb=190Vdc Rp=6.8kΩ)	14 (duty 1/20 Ebb=200Vdc Rp=2.5kΩ)	5.5 (duty 1/10 Ebb=190Vdc Rp=5kΩ)	15 (duty 1/10 Ebb=190Vdc Rp=2kΩ)
			0.9	4	0.9	3
— — 5	— — 1	— — 2.5	— — 0.3	— — 0.45	— — 0.45	— — 0.5
			— — 0.1	— — 0.1	— — 0.1	— — 0.1
— — 35	— — 10	— — 18	2.4 ～ 8	11 ～ 17	3 ～ 8	9 ～ 20
			0.4 ～ 2	1 ～ 6	0.7 ～ 1.5	1 ～ 6
17.5 ～ 32.5	3.5 ～ 6.5	10.0 ～ 18.0	0.25 ～ 0.8	0.5 ～ 1.9	0.3 ～ 0.8	1 ～ 2
			0.04 ～ 0.2	0.05 ～ 0.6	0.07 ～ 0.15	0.1 ～ 0.5
−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70	−65 ～ +70
−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55	−10 ～ +55
120 230	120 35	120 125	90 2.3	100 4 (INCL. STAND-OFF)	100 7	100 9
250 300 Rp 5.1 6.8	200 250 300 Rp 12 22 32	200 250 300 Rp4.3 7.5 11	190 200 230 Rk6.8 9.1 15 36 47 82 0.05 ～ 0.5	200 235 Rp 2.5 5 0.05 ～ 0.5	190 200 250 300 Rp5 7 18 27 0.05 ～ 0.5	190 200 250 Rp 2 2.7 7.4 0.05 ～ 0.5

(DC OPERATION)

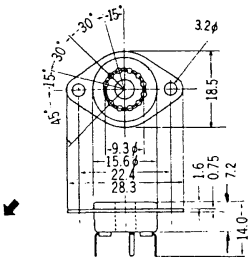
REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I.C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

		MG-17G			MG-137			MG-157		
		MIN.	ST.	MAX.	MIN.	ST.	MAX.	MIN.	ST.	MAX.
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	180			170			170		
	Ionization Voltage (Vdc) Ez			160			170			170
	Cathode Current (mAdc)	0.28	0.35	0.42	0.35	0.45	0.55	0.4	0.6	0.8
	Numerical Cathode ik									
	Decimal Point ik(·)	0.14	0.18	0.22	0.08	0.10	0.12	0.1	0.15	0.2
ABSOLUTE RATINGS	Peak Cathode Current(mAdc)	1.6			0.6			1.0		
	Numerical Cathode ik									
	Decimal Point ik(·)	0.6			0.15			0.3		
	Range of Average Cathode Current (mAdc)	0.2	~	0.6	0.3	~	0.6	0.3	~	1.0
	Numerical Cathode									
	Decimal Point	0.1	~	0.4	0.07	~	0.15	0.07	~	0.3
	Ambient Temperature (for storage) Ts (deg C)	−65	~	+70	−65	~	+70	+65	~	+70
	Operating Ambient Temperature Tc (deg C)	−10	~	+60	−10	~	+60	+10	~	+60
MECHANICAL DATA	Maximum Viewing Angle (deg)		120			120			120	
	Weight (g) (approx)		3			4			6	
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	180	200	250 300	170	190	210	170	190	210
	Anode Series Resistor (KΩ)	110	160	300 430	62	100	130	62	110	150
	Decimal Point Series Resistor (KΩ)	240	330	620 910	240	360	510	270	470	680

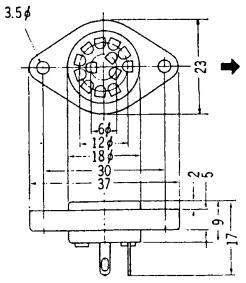
(PULSE OPERATION)

REFERENCE NUMBER (7 Segment)	MG-17G	MG-137	MG-157
Outline Drawing			
Pin Connections A : ANODE K : CATHODE I C : INTER CONNECTION NP : NO PIN NC : NO CONNECTION			
Socket			
Construction			

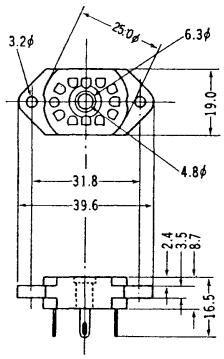
		MG-17G	MG-137	MG-157
ELECTRICAL SPECIFICATIONS	Supply Voltage (Vdc) Ebb	MIN. ST. MAX. 190	MIN. ST. MAX. 180	MIN. ST. MAX. 180
	Ionization Voltage (Vdc) Ez	170	180	180
	Cathode Current (mAdc) Numerical Cathode ik	1.2mA	2mA	1.75mA
	Decimal Point ik(·)	0.4mA	0.5mA	0.6mA
		(duty 1/10 Ebb=200vdc Rk=43kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=200vdc Rk=30kΩ Rk(·)=120kΩ)	(duty 1/10 Ebb=280kΩ Rk=36kΩ Rk(·)=100kΩ)
ABSOLUTE RATINGS	Peak Cathode Current(mAdc) Numerical Cathode ik	1 ~ 4	1 ~ 4	1.0 ~ 4.0
	Decimal Point ik(·)	0.4 ~ 1.5	0.35 ~ 1.0	0.35 ~ 1.0
	Range of Average Cathode Current (mAdc) Numerical Cathode	0.04 ~ 0.6	0.04 ~ 0.6	0.1 ~ 0.6
	Decimal Point	0.02 ~ 0.4	0.02 ~ 0.4	0.04 ~ 0.15
	Ambient Temperature (for storage) Ts (deg C)	50 ~ 300	50 ~ 500	50 ~ 500
	Operating Ambient Temperature Tc (deg C)	−65 ~ +70	−65 ~ +70	−65 ~ +70
		−10 ~ +60	−10 ~ +60	−10 ~ +55
MECHANICAL DATA	Maximum Viewing Angle (deg) (approx)	120	120	120
	Weight (g) (approx)	3	4	6
TYPICAL OPERATING CONDITIONS	Supply Voltage (Vdc)	190 200 250	180 200 220	180 200 220
	Anode Series Resistor (KΩ)	36 43 82	20 30 40	24 36 47
	Decimal Point Series Resistor (KΩ)	90 120 240	82 120 150	68 100 120
	Pulse Duration (mS)			



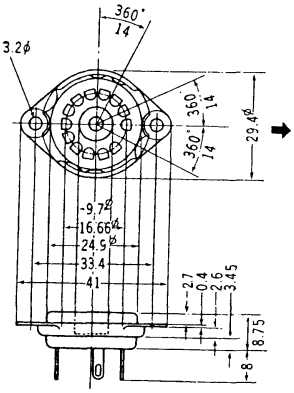
TSM-11P
CD 13



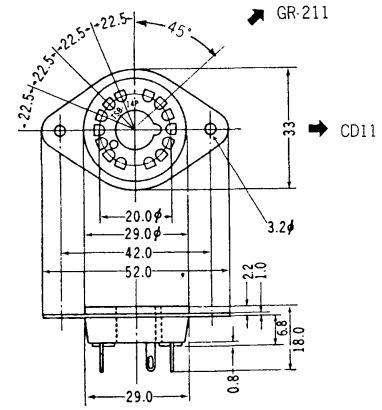
TSM-13P
CD 28



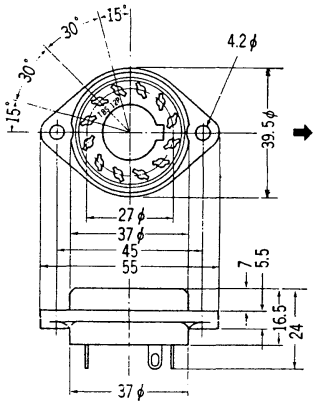
TSR-11P
CD 25, CD 43



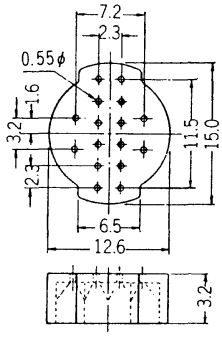
TSB-13P
CD 24



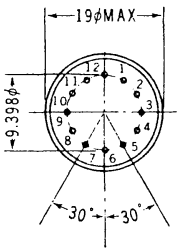
TSB-14P
CD11, GR-211



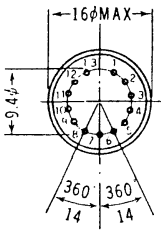
TSB-12P
CD12.CD27 · GR-414 GR-311



GR-116D
GR-116P



CD 66
CD 66p



GR-111
GR-111p

RODAN **OKAYA ELECTRIC INDUSTRIES CO., LTD.**
1—8—3, SHIBUYA, SHIBUYA-KU, TOKYO 150, JAPAN

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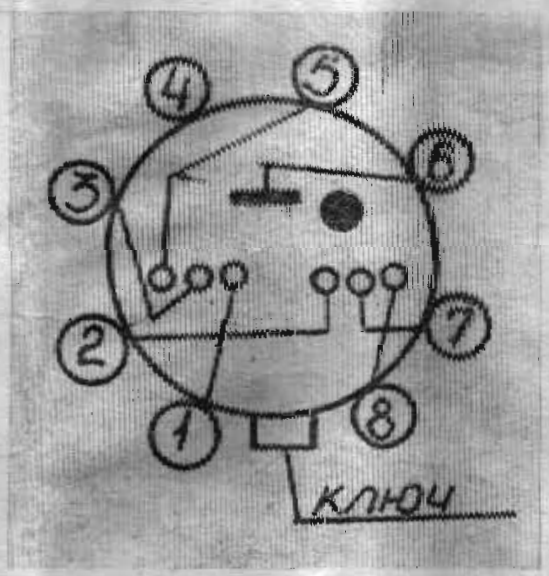
ДЕКАТРОН ОГ3

ЭТИКЕТКА



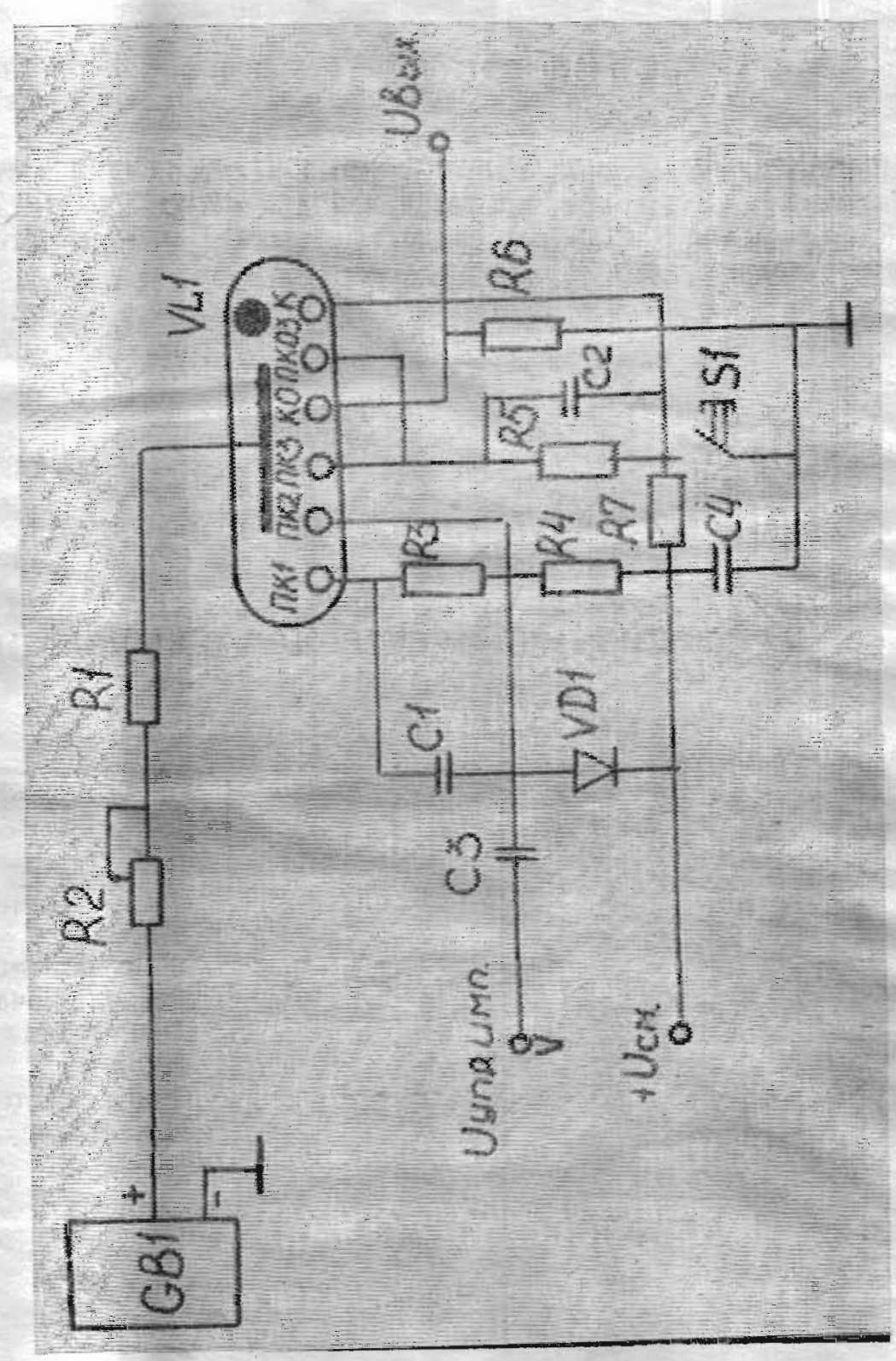
Одноимпульсный газоразрядный счетный декатрон ОГ3 в стеклянном оформлении, с цоколем, предназначен для испольдования в счетных, счетно-решающих и других радиотехнических и электротехнических устройствах.

СХЕМА СОЕДИНЕНИЯ ЭЛЕКТРОДОВ С ВЫВОДАМИ



Обозначение вывода	Наименование электрода
1	3-ий подкатод
2	Катод
3	2-ой подкатод
4	не подключать
5	1-ый подкатод
6	Анод
7	0-ой подкатод 3
8	0-ой катод

СХЕМА ЭЛЕКТРИЧЕСКАЯ ПРИНЦИПИАЛЬНАЯ ВКЛЮЧЕНИЯ ДЕКАТРОНА



R1 — резистор 200 кОм ±5% (Резистор монтировать непосредственно на ламповой панели. Допускается вместо резисторов R1 и R2 устанавливать один, величина которого должна обеспечить рабочий ток декатрона в пределах норм.

R2 — резистор переменный 330 кОм±20%;
R3, R5 — резистор 220 кОм±5%;
R4 —резистор 47 кОм±5%;
R6 — резистор 30 кОм±5%;
R7 — резистор 10 кОм±5%;
C1, C2 — конденсатор 100 пФ±10%, 250В;
C3 — конденсатор 0,01 мкФ±10%, 250В;
C4 — конденсатор 1500 пФ, 250В;
S1 — кнопочный выключатель;

VD1 — диод Д7Е или аналогичный ему при эксплуатации при скорости счета более 2 кГц;

VL1 — испытуемый декатрон;

GB1— источник выпрямленного и стабилизированного напряжения 450В с плавной регулировкой в пределах 350—450В.

Основные электрические параметры

Коэффициент пересчета 10

Допустимые режимы эксплуатаци

Наименование параметра	Норма	Примечание
Амплитуда импульса управляющего напряжения, В	110—140	1
Время перегрузки, мин, не более	5	
Длительность импульса управляющего напряжения, мкс	17—22	
Напряжение смещения на управляющих электродах, В	40—50	
Скорость счета, Гц	1—20000	
Ток рабочий, мА	0,6—0,8	2
Ток перегрузки, мА, не более	1,5	
Время готовности (в темноте), с, не более	5	

ПРИМЕЧАНИЕ. 1. Допускается запуск декатрона импульсами управляющего напряжения иной формы и амплитуды (например, треугольной или колокообразной) при этом максимальная скорость счета может быть снижена.

2. Допускается использование декатрона в более широком токовом диапазоне рабочего тока без гарантии максимальной скорости счета.

Драгоценных металлов не содержится.

Указания по эксплуатации

1. Рабочее положение декатрона — любое, охлаждение естественное.

2. Напряжение смещения на управляющих электродах относительно индикаторных катодов устанавливать в отсутствие импульсов, управляющего напряжения.

3. После эксплуатации при скорости счета менее 1 Гц декатроны рекомендуется тренировать (прокручивать в схеме) при скорости счета более 100 Гц, время тренировки—не менее 20 мин.

4. Декатроны рекомендуется использовать при скорости счета не менее 2 Гц и не более 20 кГц.

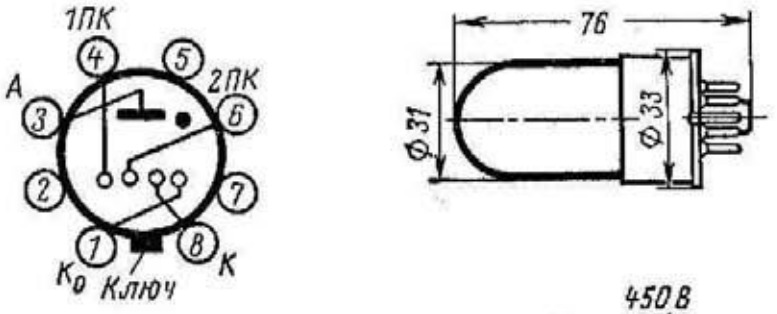
5. Для улучшения световой индикации рекомендуется не использовать направленного естественного или рабочего освещения. С этой же целью рекомендуется применять экранировку от внешнего освещения.

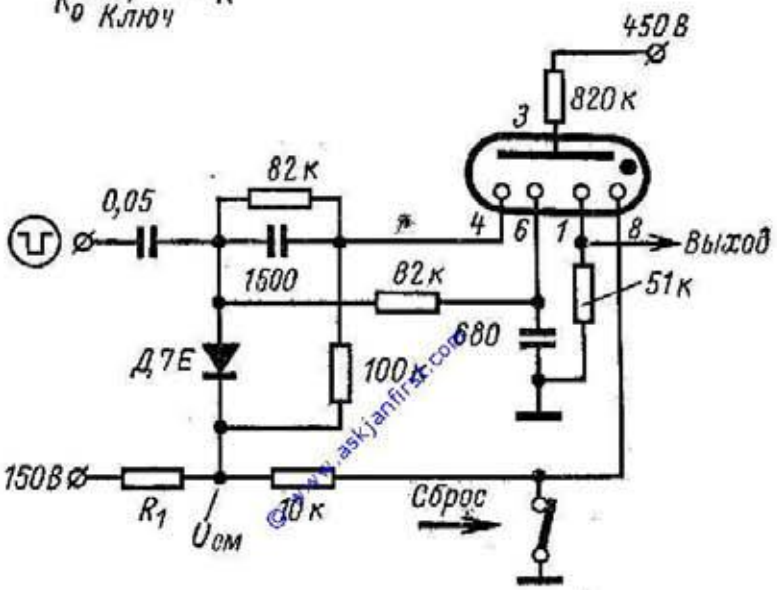
Технические условия 3.394.075 ТУ1

ОГ4

Декатрон двухимпульсный счетный для работы в счетных и счетно-решающих устройствах.

Цвет свечения — оранжево-красный. Индикация производится через купол баллона. Оформление — стеклянное, с цоколем (РШ5-1). Масса 70 г.





Типовая схема включения декатрона ОГ4. Включение диода необходимо на частотах свыше 500 Гц; сопротивление резистора R_1 подбирается.

Основные параметры

при $U_{пит.а} = 450$ В, $U_{плк} = 35$ В, $U_{вх} = 175$ В, $\tau_{их} = 160$ мкс, $\tau_{фр} = 15$ мкс

Коэффициент пересчета	10
Напряжение зажигания в темноте	$\leqslant$ 420 В
Напряжение зажигания на свету	$\leqslant$ 375 В
Время запаздывания зажигания	$\leqslant$ 5 с
Падение напряжения между анодом и катодом	125 В
Напряжение импульса сброса (при $\tau = 10$ мкс)	150 В
Ток анода	0,4 мА
Долговечность	$\geqslant$ 1000 ч
Критерий долговечности: коэффициент пересчета	10

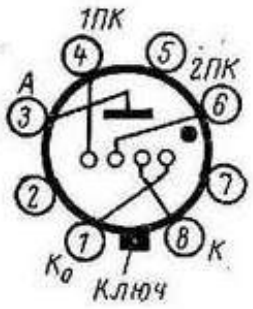
Предельные эксплуатационные данные

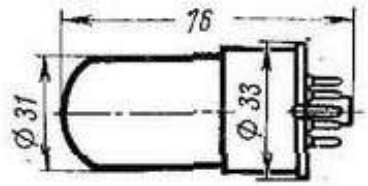
	Мин.	Макс.
Напряжение питающей сети, В	425	475
Напряжение смещения на подкатодах, В	30	40
Ток анода, мА	—	0,5
Данные управляющих импульсов:		
частота (скорость счета), Гц	0,01*	2000
напряжение, В	150	200
длительность, мкс	160	500
длительность фронта, мкс	10	30
Напряжение выходного импульса, В	0	15
Рабочая температура окружающей среды, °С	—60	+70

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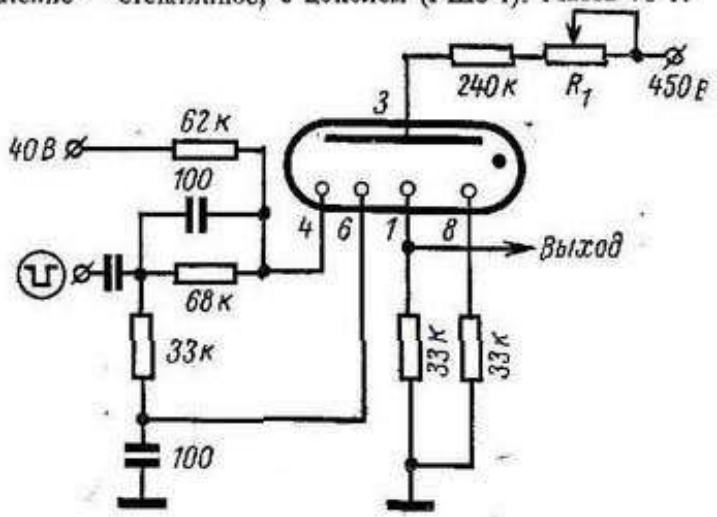
ОГ7

Декатрон двухимпульсный счетный для работы в счетных и счетно-решающих устройствах.





Цвет свечения — синий. Индикация производится через купол баллона.
Оформление — стеклянное, с цоколем (РШ5-1). Масса 70 г.



Типовая схема включения декатрона ОГ7. Сопротивление резистора R_1 подбирается в пределах 5—82 кОм.

Основные параметры

при $U_{анит.а} = 450$ В, $U_{пдк} = 40$ В, $U_{вх} = 150$ В, $\tau_{вх} = 7$ мкс, $\tau_{фр} = 0{,}5$ мкс

Коэффициент пересчета	10
Напряжение зажигания в темноте	$\leqslant 500$ В
Напряжение зажигания на свету	$\leqslant 430$ В
Время запаздывания зажигания	$\leqslant 5$ с
Падение напряжения между анодом и катодом	245 ± 20 В
Напряжение импульса сброса	$\leqslant 130$ В
Ток анода	$0{,}8^{+0{,}05}_{-0{,}1}$ мА
Долговечность	$\geqslant 500$ ч
Критерий долговечности: коэффициент пересчета	10

Предельные эксплуатационные данные

	Мин.	Макс.
Напряжение анода, В	435	—
Напряжение смещения на подкатодах, В	36	44
Ток анода, мА	0,7	0,85
Данные управляющих импульсов:		
частота (скорость счета), Гц	0,01	50 000
напряжение, В	130	150
длительность, мкс	7	—
Напряжение импульса сброса, В	130	170
Напряжение выходного импульса, В	0	15
Рабочая температура окружающей среды, °С	—60	+70

Счетный декатрон типа ОГ8

Вр. ТУ № СУЗ.39[illegible] ТУ

Газоразрядный счетный декатрон, в стеклянном оформлении, с октальным цоколем, с выводами нулевого, третьего, пятого и девятого катодов, предназначенный для устройств широкого применения.

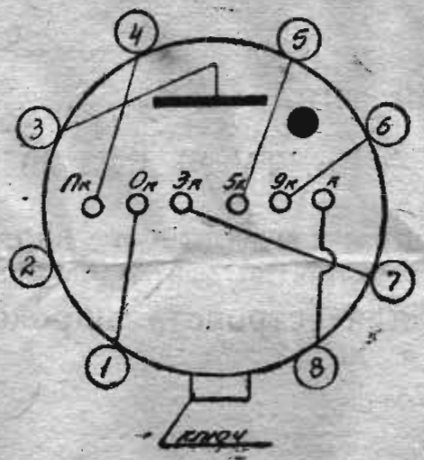
I. Основные технические данные

Напряжение источника питания, в . . .	500
Напряжение зажигания (наибольшее), в	480
Напряжение горения, в	255—295
Коэффициент пересчета	10
Наибольшая скорость счета, гц	100000
Наименьшая скорость счета, гц	0,01
Амплитуда управляющего импульса, в .	80—110
Смещение на подкатод, в	30
Высота декатрона (наибольшая), мм . .	76
Диаметр баллона (наибольший), мм . .	30,5
Долговечность не менее, час.	500

II. Предельно-допустимые значения

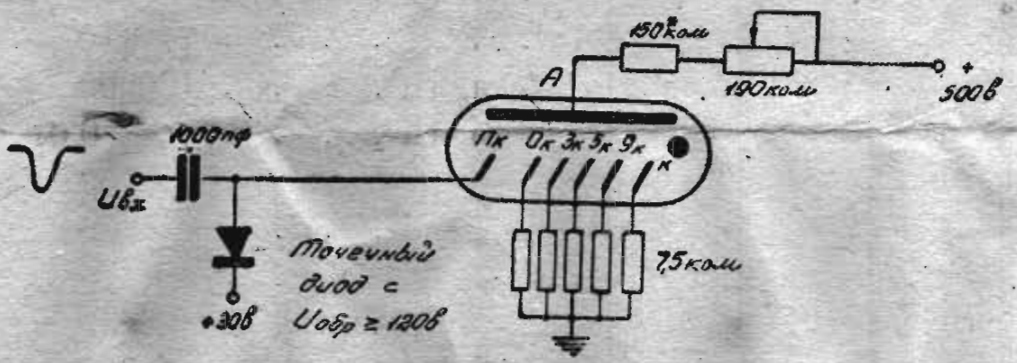
Наибольший анодный ток, ма	1,3
Наименьший анодный ток, ма	1,1
Суммарное время работы при $i<0,01$, час.	25
Наименьшая длительность управляющих импульсов на уровне 0,5 амплитуды, мксек	3
Фронт управляющих импульсов, мксек .	0,3÷1
Максимальные сопротивления в цепях катодов, ком	7,5
при этом наименьшая амплитуда выходного импульса, в	7
Амплитуда импульса сброса, в	75—125

Схема соединения электродов со штырьками



Обозн. штырьков	Наименование электродов	
1	Нулевой катод	0 К
2	Не подключен	—
3	Анод	А
4	Подкатод	ПК
5	Пятый катод	5 К
6	Девятый катод	9 К
7	Третий катод	3 К
8	Катоды (Общий вывод)	К

Принципиальная схема включения декатрона



Просим по окончании эксплуатации ламп возвратить этикетку по адресу: Москва, Е-23, Московский электроламповый завод, ОТК, сообщив следующие сведения:

Число фактических часов работы _____

Основные данные режима эксплуатации _____

Причина выхода из строя _____

Сведения дал _____

Адрес потребителя _____

_____

Дата _____ Подпись _____

_____

* Монтировать непосредственно на панели декатрона.

SZ3—1 SZ4—1辉光放电显示管

产品说明书

SZ3—1 SZ4—1数字指示管是冷阴极辉光放电管，为橙红色端面显示，具有亮度高，显示清晰，耗电少．消电离快等优点。主要用于各种数字、符号显示仪器仪表设备。

一、基本参数

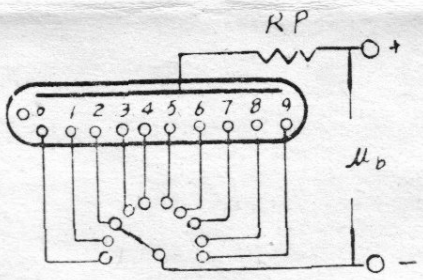
参数名称	符号	单位	最小	标准	最大
阳极供给直流电压	Ub	伏特	—	170	—
起辉电压	$U_{\text{起}}$	伏特	—	—	170
熄灭电压	Ux	伏特	100	—	—
阴极电流*	Ik	毫安	1.5	2	3
限流电阻	Rp	千欧姆	—	20	—
寿命	T	小时	500	—	—
重量	G	克	—	—	15
显示高度	h	毫米	—	15.5	—

*Ub =170V　Rp =20千欧姆的阴极电流

二、使用极限值

	阳极电压（伏特）	阴极电流（毫安）	阳极耗散功率（瓦）	阴极峰值电流（毫安）
最大值	250	3	0.35	15

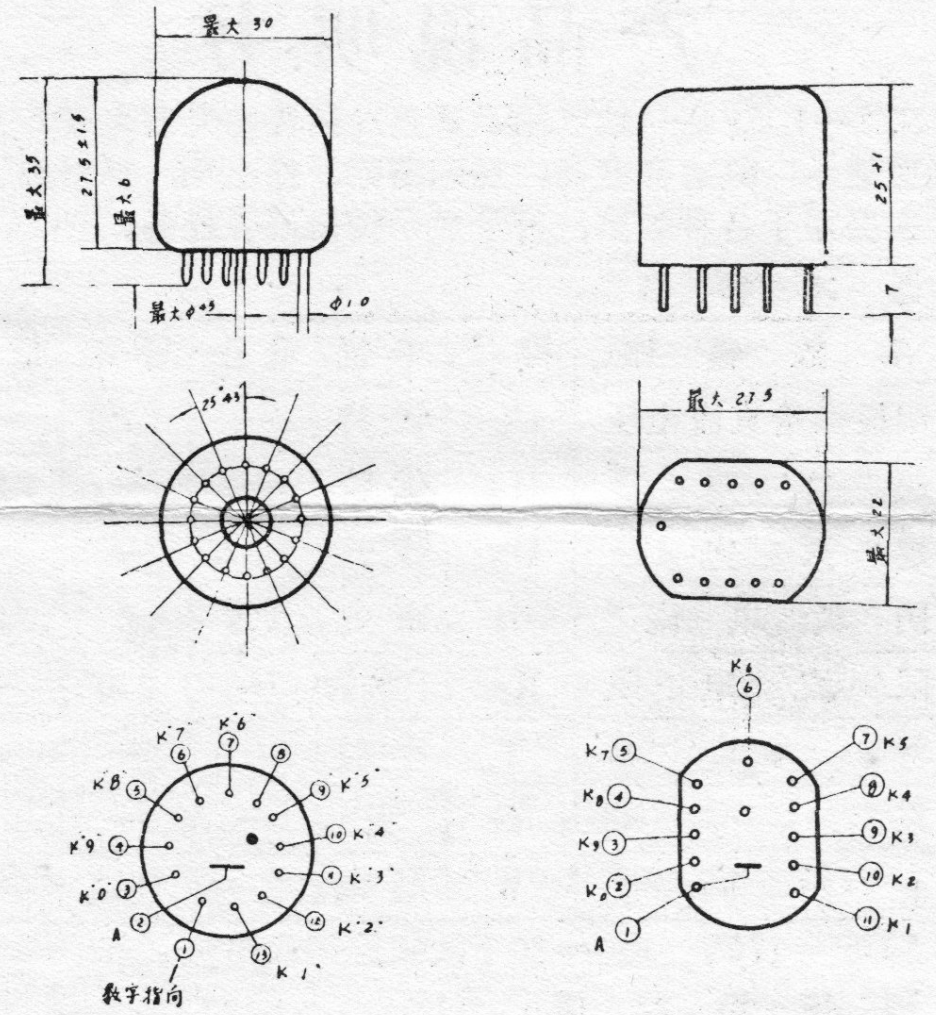
三、基本回路及Ub 和Rp 的典型值



基本回路

阳极供给直流电压	Ub	伏特	170	210	250	280
限流电阻	Rp	千欧姆	20	42	62	82

四、外形及管脚接线示意图



SZ3—1　　SZ4—1

注：插座：SZ3—1特制13脚管座

SZ4—1特制11脚管座

①……⑬为管脚　A为阳极　K为阴极

K_0，K_1……K_p 为显示数字

使 用 注 意 事 项

1.使用数字管时其参数不应超过允许使用极限值。

2.使用数字管时不宜长期停留在某一数字指示。

3.使用数字管时可以在任意位置。

上海电子管三厂

地　址：上海北苏州路470号

电　话：240639　电报挂号：5538

SZ3—1 SZ4—1辉光放电显示管

产品说明书

SZ3—1 SZ4—1数字指示管是冷阴极辉光放电管，为橙红色端面显示，具有亮度高，显示清晰，耗电少．消电离快等优点。主要用于各种数字、符号显示仪器仪表设备。

一、基本参数

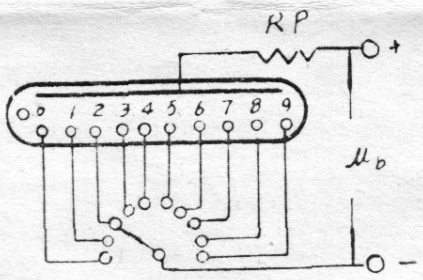
参数名称	符号	单位	最小	标准	最大
阳极供给直流电压	Ub	伏特	—	170	—
起辉电压	$U_{\text{起}}$	伏特	—	—	170
熄灭电压	Ux	伏特	100	—	—
阴极电流*	Ik	毫安	1.5	2	3
限流电阻	Rp	千欧姆	—	20	—
寿命	T	小时	500	—	—
重量	G	克	—	—	15
显示高度	h	毫米	—	15.5	—

*Ub =170V　Rp =20千欧姆的阴极电流

二、使用极限值

	阳极电压（伏特）	阴极电流（毫安）	阳极耗散功率（瓦）	阴极峰值电流（毫安）
最大值	250	3	0.35	15

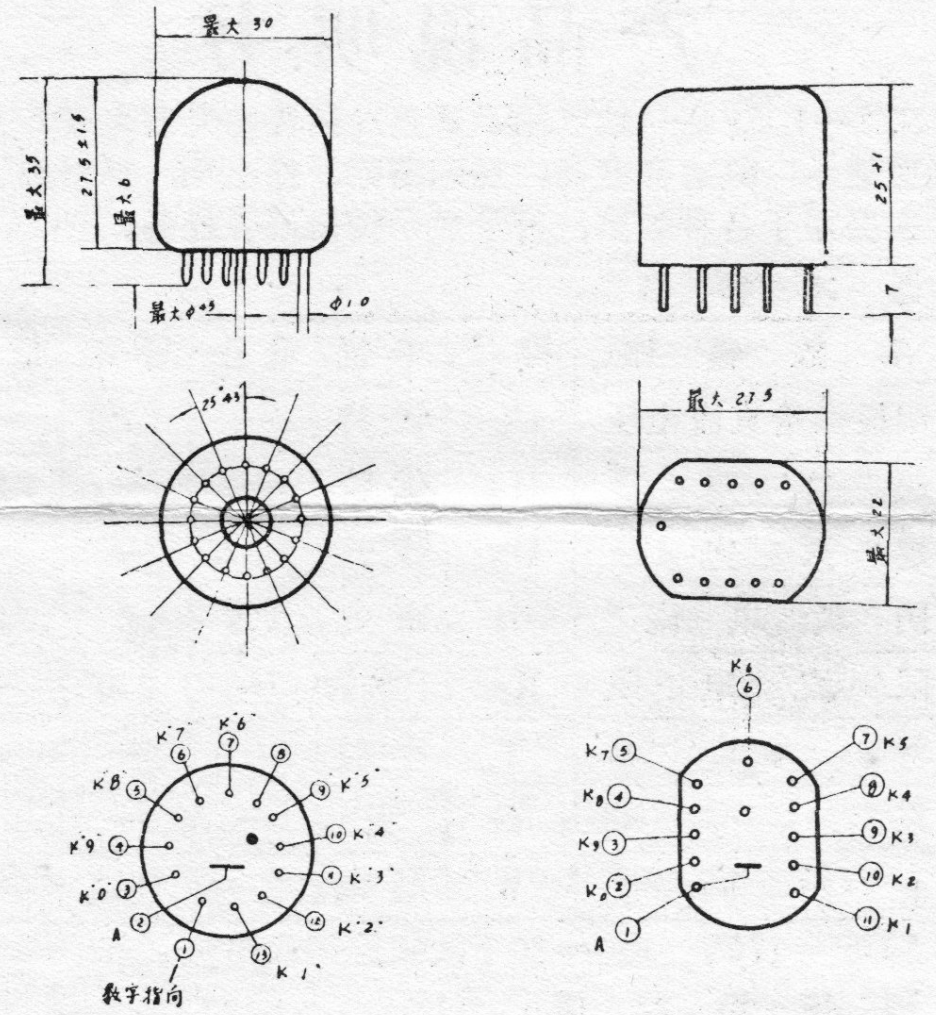
三、基本回路及Ub 和Rp 的典型值



基本回路

阳极供给直流电压	Ub	伏特	170	210	250	280
限流电阻	Rp	千欧姆	20	42	62	82

四、外形及管脚接线示意图



SZ3—1　　SZ4—1

注：插座：SZ3—1特制13脚管座

SZ4—1特制11脚管座

①……⑬为管脚　A为阳极　K为阴极

K_0，K_1……K_p 为显示数字

使 用 注 意 事 项

1.使用数字管时其参数不应超过允许使用极限值。

2.使用数字管时不宜长期停留在某一数字指示。

3.使用数字管时可以在任意位置。

上海电子管三厂

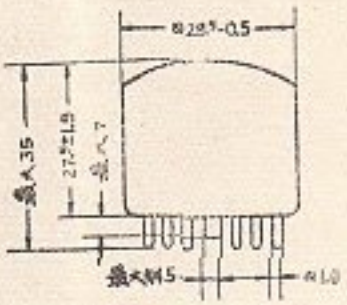
地　址：上海北苏州路470号

电　话：240639　电报挂号：5538

产品说明书

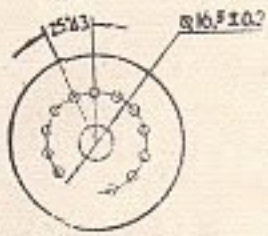
SZ—8型数字指示管

产品序号_____ 分技术条件编号_____

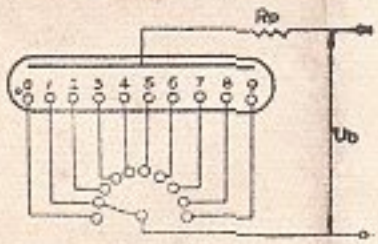




电极引管脚连接图



管底视图



基本回路

构　　造	端面表示型
表 示 色	桔 红 色
阴　　极	冷 阴 极
显示内容	0 ～ 9

电气参数

参数名称	符号	单位	最小	标准	最大
阳极供给直流电压	Ub	伏特	170	——	——
辉光放电起辉电压		伏特	——	——	160
阳 极 电 流	Ia	毫安	1	2	3
限 流 电 阻	Rp	千欧姆	——	20	——
寿　　命	h	小时	——	500	——
插　　座				特制十三脚	

检验日期_____ 检验者_____

注：本产品除显示内容0～9外，并能采用各种符号的产品。

无锡电子管厂

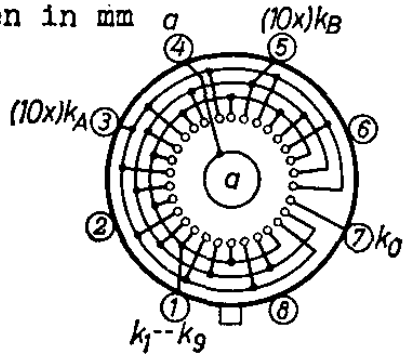
PHILIPS Z303C

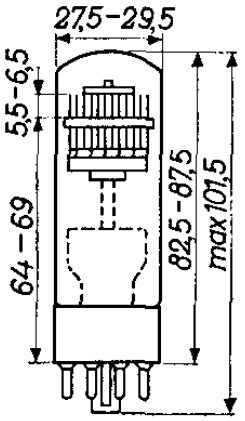
Cold cathode gas-filled BI-DIRECTIONAL DECADE COUNTER TUBE. This tube has ten main cathodes, nine of which are brought out together and one separately. It gives visual indication and operates at speeds up to 4 kc/s.

TUBE COMPTEUR BI-DIRECTIONNEL À DÉCADES avec cathodes froides et remplissage gazeux. Le tube a dix cathodes principales, dont neuf sont sorties simultanément et une séparément. Il donne une indication visuelle et fonctionne à une vitesse jusqu'à 4 kHz.

Gasgefüllte DEKADISCHE ZÄHLRÖHRE FÜR VORWÄRTS- UND RÜCKWÄRTSZÄHLUNG mit kalten Katoden. Die Röhre hat zehn Hauptkatoden, von denen neun gemeinsam und eine separat ausgeführt sind. Sie gibt optische Anzeigung und kann mit Geschwindigkeiten bis zu 4 kHz arbeiten

Dimensions in mm
Dimensions en mm
Abmessungen in mm





Base, culot, Sockel; Octal

Mounting position: any
For visual indication the tube is viewed through the dome of the envelope. k_0 is aligned with pin 6 to within ± 12°

Montage: à volonté
Pour l'indication visuelle le tube est vu à travers le dôme de l'enveloppe. k_0 est alignée à la broche 6 au-dedans de ± 12°.

Einbau: beliebig.
Die Röhre wird durch den Dom der Umhüllung abgelesen. Die Lage von k_0 fällt innerhalb ± 12° mit Stift 6 zusammen

---

[1]) Page 2; Seite 2
At lower frequencies a lower value can be used down to an absolute minimum of + 18 V.
Aux fréquences plus basses une valeur plus basse peut être utilisée jusqu'à un minimum absolu de +18 V.
Bei niedrigeren Frequenzen kann ein niedrigerer Wert verwendet werden bis zu einem absoluten Minimalwert von +18 V.

Typical characteristics
Caractéristiques types
Kenndaten

Counting rate (sine or pulse drive) Taux de comptage (commande par tension sinusoïdale ou par impulsions) Zählgeschwindigkeit (Steuerung durch Sinus- oder Impulsspannungen)	= max. 4 kc/s
Time difference between two successive input signals Différence de temps entre deux signaux consécutifs Zeitabstand zwischen zwei aufeinanderfolgenden Signale	= min. 250 µsec
V_a (I_k = 300 µA)	= 186-196 V
Pulse required for forced resetting to k_o Impulsion nécessaire pour la remise en position de k_o Impuls für die Rückstellung von k_o	= min. 120 V

Limiting values (Absolute limits)
Caractéristiques limites (Limites absolues)
Grenzdaten (Absolute Grenzwerte)

V_b	= min. 350 V
Voltage between any two electrodes (except anode) Tension entre deux électrodes quelconques (sauf l'anode) Spannung zwischen zwei beliebigen Elektroden (mit Ausnahme der Anode)	= max. 140 V
V_{kA}, V_{kB} — For pulse drive and integrated pulse drive at 4 kc/s Commande par impulsions ou par impulsions integrées à 4 kHz Bei Impulssteuerung oder integrierter Impulssteuerung bei 4 kHz	= min. +35 V [1]
$-V_{k_o}$	= max. 20 V
Pulse width Largeur des impulsions Breite der Impulsen	= min. 65 µsec
Current of main and auxiliary cathodes Courant des cathodes principales et auxiliaires Strom der Haupt- und Hilfskatoden	= max. 550 µA = min. 250 µA

[1]) See page 1; voir page 1; siehe Seite 1

Operating characteristics
Caractéristiques d'utilisation
Betriebsdaten

V_b	=	475 V
V_{ko}	=	-12 V
R_a	=	820 kΩ
R_{ko}	=	120 kΩ
I_a	=	340 µA
V_{op}	=	35 V

For double pulse drive
Pour commande par impulsion double
Für Steuerung mittels Doppelimpulsen

$V_{kA} = V_{kB}$ = +40 V

Pulse amplitude
Amplitude des impulsions = 100 V
Impulsamplitude

Pulse width
Largeurs des impulsions = 75 µsec
Impulsbreite

For integrated pulse drive (fig. 1)
Pour commande par impulsions intégrées (fig. 1)
Für integrierte Impulssteuerung (Abb. 1)

$V_{kA} = V_{kB}$ = +40 V

Pulse width
Largeur des impulsions = 75 µsec
Impulsbreite

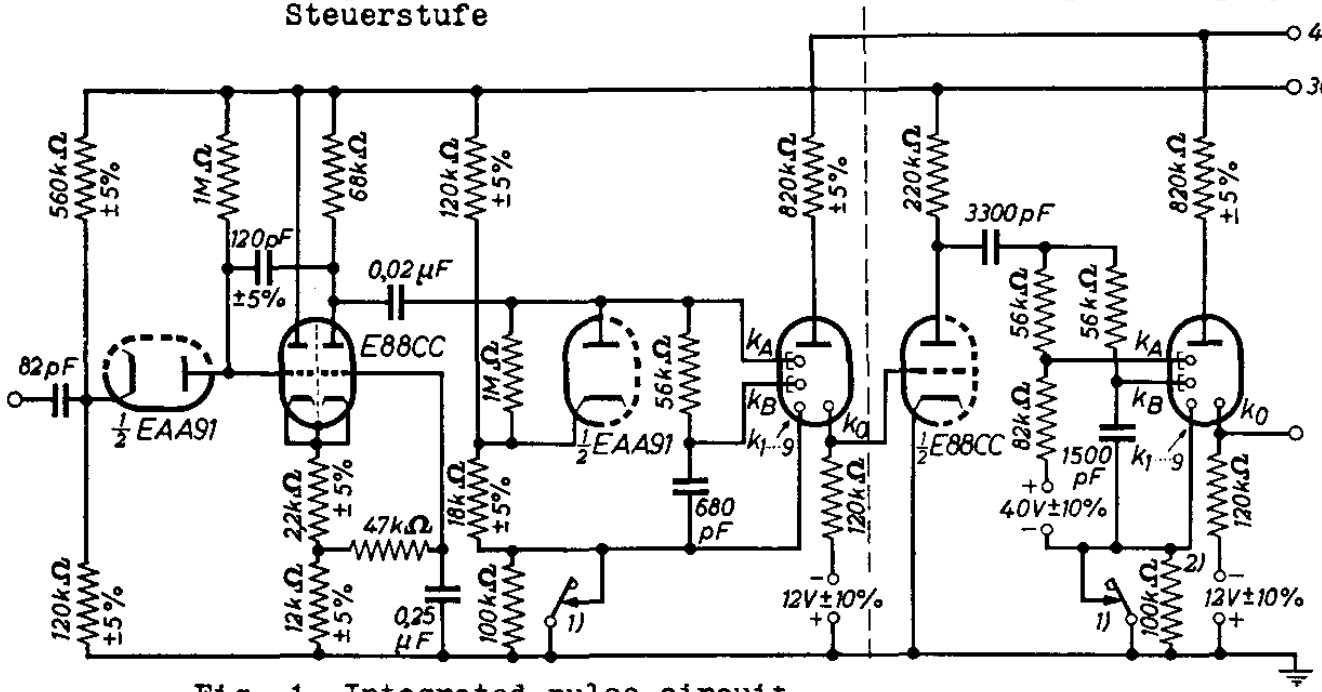


Fig. 1. Integrated pulse circuit
Fig. 1. Circuit pour commande par impulsions intégrées
Abb. 1. Schaltung für integrierte Impulssteuerung

Input pulse ≧ 30 V; rise time: dV/dT ≧ 10^8 V/sec.
Impulsion d'entrée ≧ 30 V; temps de montée: dV/dT ≧ 10^8 V/sec.
Eingangsimpuls ≧ 30 V; Anstiegszeit: dV/dT ≧ 10^8 V/Sek

All components ± 10% unless otherwise stated
Toutes les pièces de ± 10% sauf indication différente
Alle Unterteile ± 10% wenn nicht anders angegeben

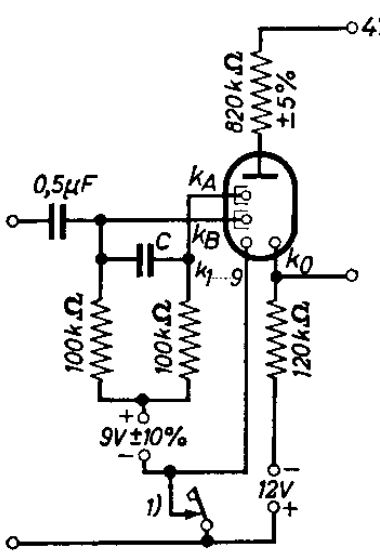
1)2) See page 5
Voir page 5
Siehe Seite 5

Operating characteristics (continued)
Caractéristiques d'utilisation (suite)
Betriebsdaten (Fortsetzung)

For sine wave drive
Pour commande par tension sinusoïdale
Für Steuerung mit Sinusspannung

$V_{kA} = V_{kB} = + 10$ V

Sine wave drive voltage
Tension de commande sinusoïdale = 40-70 V_{eff}
Sinusförmige Steuerspannung



All components ± 10% unless otherwise stated
Toutes les pièces de ± 10% sauf indication différente
Alle Unterteile ± 10% wenn nicht anders angegeben

f(c/s)	50	100	200	500	1000	2000	4000
C(µF)	0,1	0,05	0,02	0,01	0,005	0,002	0,00068

[1]) For resetting to zero these switches should be opened
Pour la remise à zéro il faut ouvrir ces interrupteurs
Für die Rückstellung auf Null müssen diese Schalter geöffnet werden

[2]) This resistor is required only wenn the 40 V bias is obtained from a potential divider across the high tension line
Cette résistance est requise seulement si la polarisation de 40 V est obtenue à l'aide d'un diviseur de potentiel à travers la ligne de haute tension
Dieser Widerstand ist nur erforderlich wenn die 40 V-Vorspannung mittels eines Spannungsteilers über die Hochspannung erhalten wird

PHILIPS

Electronic Tube

HANDBOOK

Z303C

page	sheet	date
1	1	1961.05.05
2	2	1961.05.05
3	3	1961.05.05
4	4	1961.05.05
5	5	1961.05.05
6	FP	1999.12.24

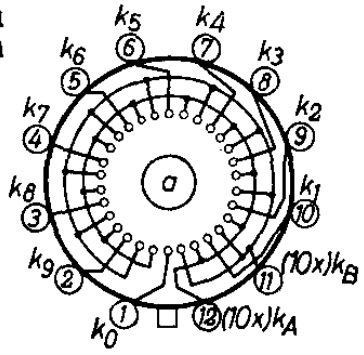
PHILIPS Z502S

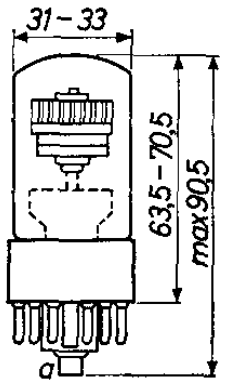
Cold cathode gas-filled BI-DIRECTIONAL DECADE SELECTOR TUBE. This tube has ten main cathodes, which are brought out separately. It gives visual indication and operates at speeds up to 4 kc/s.

TUBE COMPTEUR BI-DIRECTIONNEL À DÉCADES avec cathodes froides et remplissage gazeux. Le tube a dix cathodes, qui ont été sorties séparément. Il donne une indication visuelle et fonctionne a une vitesse jusqu'à 4 kHz

Gasgefüllte DEKADISCHE ZÄHLRÖHRE FÜR VORWÄRTS- UND RÜCKWÄRTSZÄHLUNG mit kalten Katoden. Die Röhre hat zehn Hauptkatoden, die separat ausgeführt sind. Sie gibt optische Anzeigung und kann mit Geschwindigkeiten bis zu 4 kHz betrieben werden

Dimensions in mm
Dimensions en mm
Abmessungen in mm





Base : Duodecal with additional bottom cap (anode)
Culot : Duodecal avec coiffe additionnelle au fond (anode)
Sockel: Duodecal mit zusätzlicher Kappe am Boden (Anode)

Mounting position: arbitrary
For visual indication the tube is viewed through the dome of the envelope. k_1 is aligned with pin 11 to within ± 12°

Montage: à volonté
Pour l'indication visuelle le tube est vu à travers le dôme de l'enveloppe. k_1 est alignée à la broche 11 au-dedans de ± 12°

Einbau: beliebig
Die Röhre wird durch den Dom der Umhüllung abgelesen. Die Lage von k_1 fällt innerhalb ±12° mit stift 11 zusammen

---

[1]) Page 2; Seite 2

At lower frequencies a lower value can be used down to an absolute minimum of + 18 V.

Aux fréquences plus basses une valeur plus basse peut être utilisée jusqu'à un minimum absolu de + 18 V.

Bei niedrigeren Frequenzen kann ein niedrigerer Wert verwendet werden bis zu einem absoluten Minimalwert von + 18 V.

Typical characteristics
Caractéristiques types
Kenndaten

Counting rate (Sine or pulse drive) Taux de comptage (commande par tension sinusoïdale ou par impulsions) Zählgeschwindigkeit (Steuerung durch Sinus- oder Impulsspannungen)	= max. 4 kc/s
Time difference between two successive input signals Différence de temps entre deux signaux consécutifs Zeitabstand zwischen zwei aufeinanderfolgenden Signale	= min. 250 µsec
V_a (I_k = 300 µA)	= 186-196 V
Pulse required for forced resetting to any main cathode Impulsion nécessaire pour la remise en position d'une cathode quelconque Impuls für die Rückstellung einer beliebigen Katode	= min. 120 V

Limiting values (Absolute limits)
Caractéristiques limites (Limites absolues)
Grenzdaten (Absolute Grenzwerte)

V_b	= min. 350 V
Voltage between any two electrodes (except anode) Tension entre deux électrodes quelconques (sauf l'anode) Spannung zwischen zwei beliebigen Elektroden (mit Ausnahme der Anode)	= max. 140 V
V_{kA}, V_{kB} — For pulse drive and integrated pulse drive at 4 kc/s Commande par impulsions ou par impulsions integrées à 4 kHz Bei Impulssteuerung oder integrierter Impulssteuerung bei 4 kHz	= min. +35 V [1]
$-V_{k0}, -V_{k1}, \ldots\ldots -V_{k9}$	= max. 20 V
Pulse width Largeur des impulsions Breite der Impulsen	= min. 65 µsec
Current of main and auxiliary cathodes Courant des cathodes principales et auxiliaires Strom der Haupt- und Hilfskatoden	= max. 550 µA = min. 250 µA

[1]) See page 1; voir page 1; siehe Seite 1

Operating characteristics
Caractéristiques d'utilisation
Betriebsdaten

V_b	=	475 V
V_{ko}	=	-12 V
R_a	=	820 kΩ
R_{ko}	=	120 kΩ
I_a	=	340 µA
V_{op}	=	35 V

For double pulse drive
Pour commande par impulsion double
Für Steuerung mittels Doppelimpulsen

$V_{kA} = V_{kB}$ = +40 V

Pulse amplitude
Amplitude des impulsions = 100 V
Impulsamplitude

Pulse width
Largeurs des impulsions = 75 µsec
Impulsbreite

For integrated pulse drive (fig. 1)
Pour commande par impulsions intégrées (fig. 1)
Für integrierte Impulssteuerung (Abb. 1)

$V_{kA} = V_{kB}$ = +40 V

Pulse width
Largeur des impulsions = 75 µsec
Impulsbreite

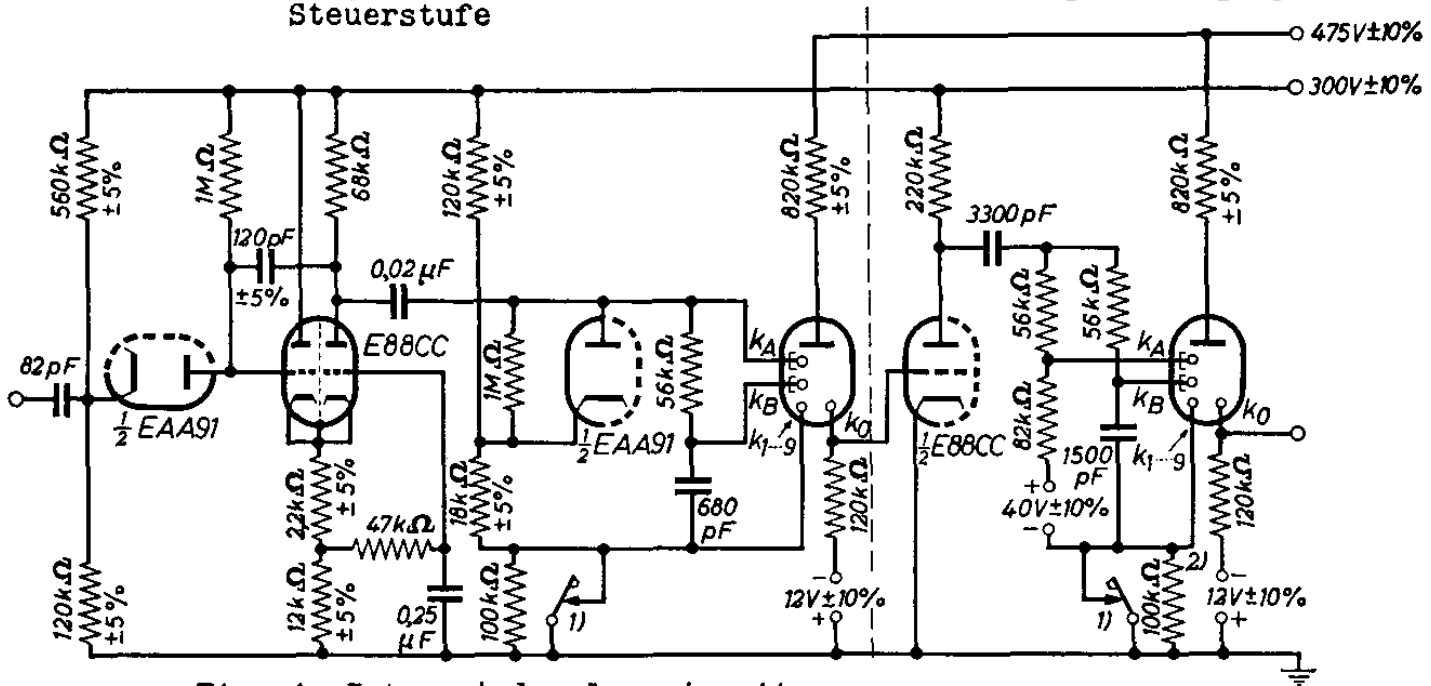


Fig. 1. Integrated pulse circuit
Fig. 1. Circuit pour commande par impulsions intégrées
Abb. 1. Schaltung für integrierte Impulssteuerung

Input pulse ≧ 30 V; rise time: $dV/dT \geq 10^8$ V/sec.
Impulsion d'entrée ≧ 30 V; temps de montée: $dV/dT \geq 10^8$ V/sec.
Eingangsimpuls ≧ 30 V; Anstiegszeit: $dV/dT \geq 10^8$ V/Sek

All components ± 10% unless otherwise stated
Toutes les pièces de ± 10% sauf indication différente
Alle Unterteile ± 10% wenn nicht anders angegeben

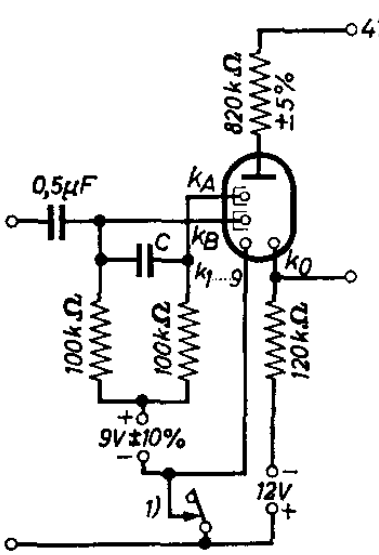
1)2) See page 5
Voir page 5
Siehe Seite 5

Operating characteristics (continued)
Caractéristiques d'utilisation (suite)
Betriebsdaten (Fortsetzung)

For sine wave drive
Pour commande par tension sinusoïdale
Für Steuerung mit Sinusspannung

$$V_{kA} = V_{kB} = + 10 \text{ V}$$

Sine wave drive voltage
Tension de commande sinusoïdale = 40-70 V_{eff}
Sinusförmige Steuerspannung



All components ± 10% unless otherwise stated
Toutes les pièces de ± 10% sauf indication différente
Alle Unterteile ± 10% wenn nicht anders angegeben

f(c/s)	50	100	200	500	1000	2000	4000
C(µF)	0,1	0,05	0,02	0,01	0,005	0,002	0,00068

[1]) For resetting to zero these switches should be opened
Pour la remise à zéro il faut ouvrir ces interrupteurs
Für die Rückstellung auf Null müssen diese Schalter geöffnet werden

[2]) This resistor is required only wenn the 40 V bias is obtained from a potential divider across the high tension line
Cette résistance est requise seulement si la polarisation de 40 V est obtenue à l'aide d'un diviseur de potentiel à travers la ligne de haute tension
Dieser Widerstand ist nur erforderlich wenn die 40 V-Vorspannung mittels eines Spannungsteilers über die Hochspannung erhalten wird

PHILIPS

Electronic Tube

HANDBOOK

Z502S

page	sheet	date
1	1	1961.05.05
2	2	1961.05.05
3	3	1961.05.05
4	4	1961.05.05
5	5	1961.05.05
6	FP	1999.12.24

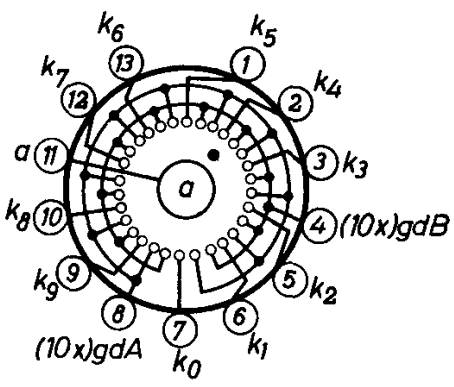
COUNTER AND SELECTOR TUBE

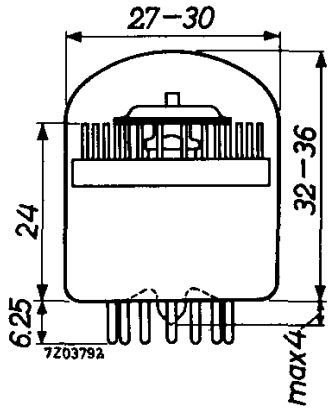
Cold cathode gas-filled bi-directional 10 output selector tube.
The Z504S gives visual indication and operates at speeds up to 5 kHz.

QUICK REFERENCE DATA			
Maximum counting speed		5	kHz
Supply voltage	V_{ba}	475	V
Output, current		340	μA
voltage		35	V
Indication	position of glow; end viewing		

DIMENSIONS AND CONNECTIONS

Base: B13B





K_0 is aligned with pin 7 to within $\pm 3^{o}$

Mounting position: any

This tube has been designed to close tolerances so that no individual adjustment is necessary to align the bulb with the escutcheon.

Accessories

Socket	2422 505 00001
Escutcheon	type 56062

General note

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

CHARACTERISTIC RANGE VALUES FOR EQUIPMENT DESIGN

(initial and during life)

IGNITION REQUIREMENTS				
Anode supply voltage	V_{ba}		375 to 1000	V
Time constant rise of anode supply voltage when switching on				
V_{ba} < 550 V			1.0	ms [1]
V_{ba} > 550 V			6.0	ms [1]
DISCHARGE AT REST ON A MAIN CATHODE				
Maintaining voltage of anode to main cathode at I_a = 340 μA, V_{gdB} = 25 to 50 V		See also page 8		
maximum	V_m	max.	205	V
minimum	V_m	min.	185	V
Cathode current				
maximum (except during reset)	I_k	max.	525	μA
minimum	I_k	min.	250	μA
recommended	I_k		340	μA
Guide supply voltage				
maximum	$V_{b_{gd}}$	max.	60	V
minimum	$V_{b_{gd}}$	min.	25	V
Resistance between guides and guide supply	R_{gd}	max.	220	kΩ
Cathode potential (except during reset)				
Non conducting cathode	$-V_k$	max.	14	V
Conducting cathode	V_k max. V_{g_d}	min.	10	V [2]
	$-V_k$	max.	0	V

For notes see page 5

STEPPING REQUIREMENTS

See also pages 6 and 7

Discharge dwell time			
main cathode		min. 75	μs
guide A cathode		min. 60	μs
guide B cathode		min. 60	μs
Interval between trailing edge of guide A pulse and leading edge of guide B pulse (double rectangular pulse drive)		max. 3	μs
Negative guide voltage to step the discharge from a main cathode to an adjacent guide cathode		max. 140 min. 45	VminusV_{g_d} V
Voltage difference required to step the discharge from a guide cathode to the adjacent guide cathode		max. 140 min. 45	V V [3]
Positive supply voltage to step the discharge from a guide cathode to the adjacent main cathode		max. 50 min. 25	V V
Main cathode potential			
Non conducting cathodes	$-V_k$	max. 14	V
Conducting cathode	V_k	V_{g_d} minus 10	V [2]
	$-V_k$	max. 0	V

For notes see page 5

RESETTING REQUIREMENTS

	Reset to cathodes					
	7, 8, 9, 0, 1, 2, 3			4, 5, 6		
Main cathode voltage	$-V_k$	max.	240	140		V
pulse duration > 1 ms	$-V_k$	min.	120	120 [4]		V
pulse duration $\geq$ 200 μs	$-V_k$	min.	130	-		V
Pulse duration		min.	200	-		μs
Reset cathode current	I_k	max.	800	650		μA [5]

LIFE AND RELIABILITY

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

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

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

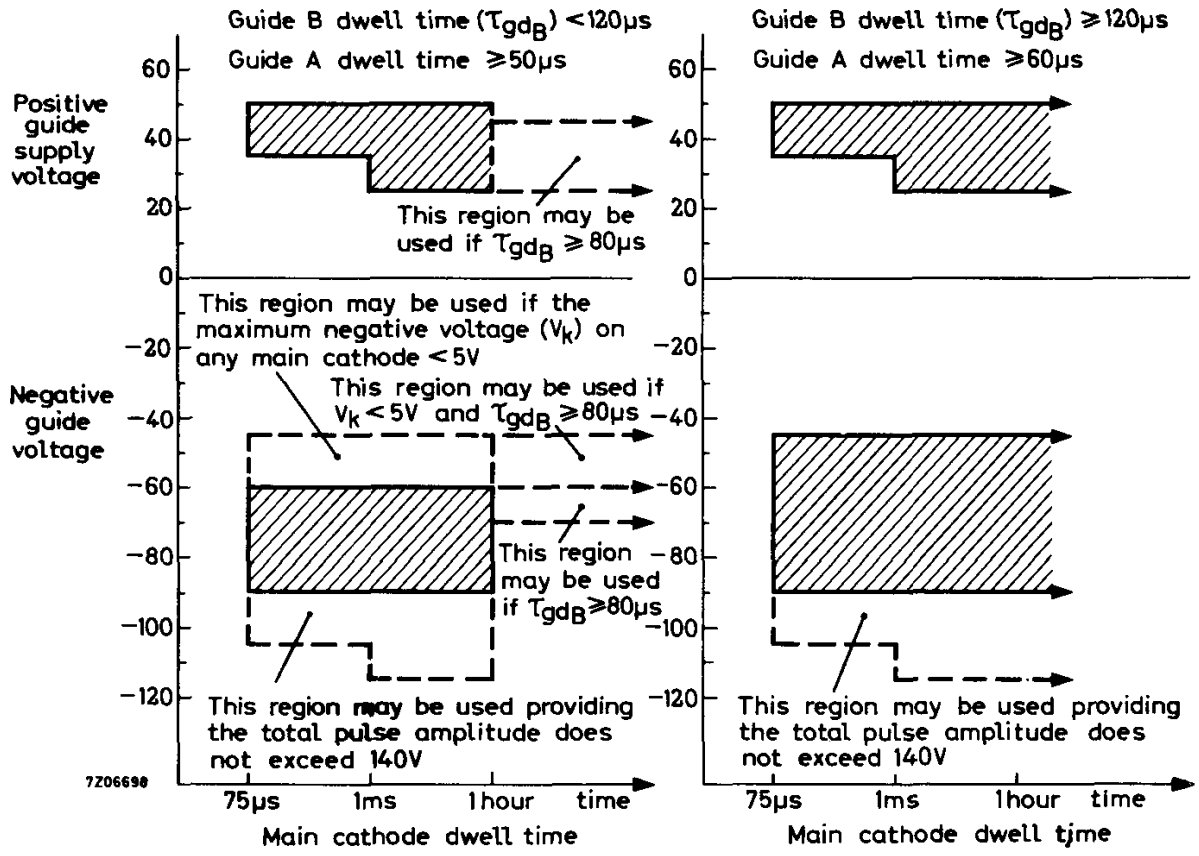
For notes see page 5

LIMITING VALUES (Absolute maximum rating system)

Continuous main cathode current (except during reset)	I_k	max.	525	μA
Reset cathode current				
Cathodes 7, 8, 9, 0, 1, 2, 3	I_k	max.	800	μA [5]
Cathode 4, 5, 6	I_k	max.	650	μA [5]
Voltage between any two main or guide cathodes (except during reset)		max.	140	V
Positive guide supply voltage	$V_{b_{gd}}$	max.	140	V
Ambient temperature, operation and stand-by	t_{amb}	max.	50	°C [6]

NOTES

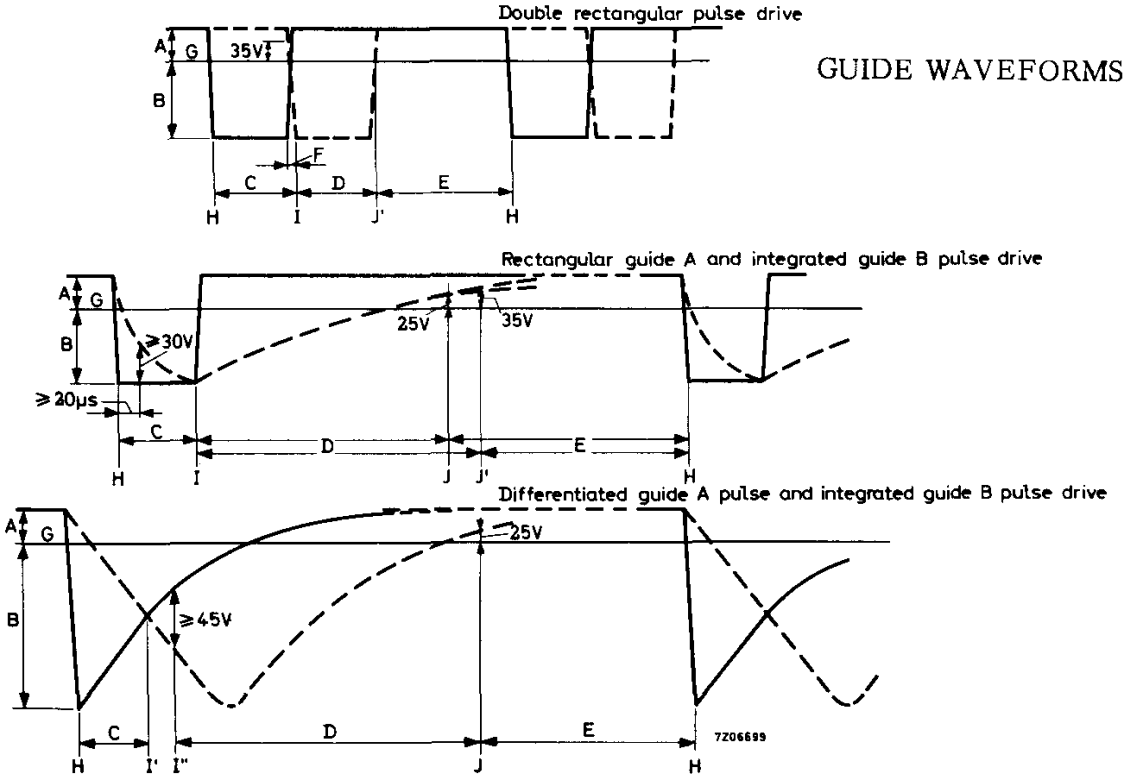
1. If the power supply does not have a suitable time constant as one of its characteristics, it can be conveniently obtained by inserting a resistor in series with the supply voltage and a capacitor to earth (4.7 kΩ and 0.25 μF for 1.0 ms, 6.8 kΩ and 1.0 μF for 6.0 ms).
2. This value should not exceed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



GUIDE OPERATING VOLTAGES

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

GUIDE WAVEFORMS



A Positive guide supply voltage

B Negative guide voltage

C Guide A dwell time

D Guide B dwell time

E Main cathode dwell time

F Interval between trailing edge of guide A pulse and leading edge of guide B pulse

G Potential of most positive main cathode supply voltage

H Discharge transfers from main cathode to guide A cathode

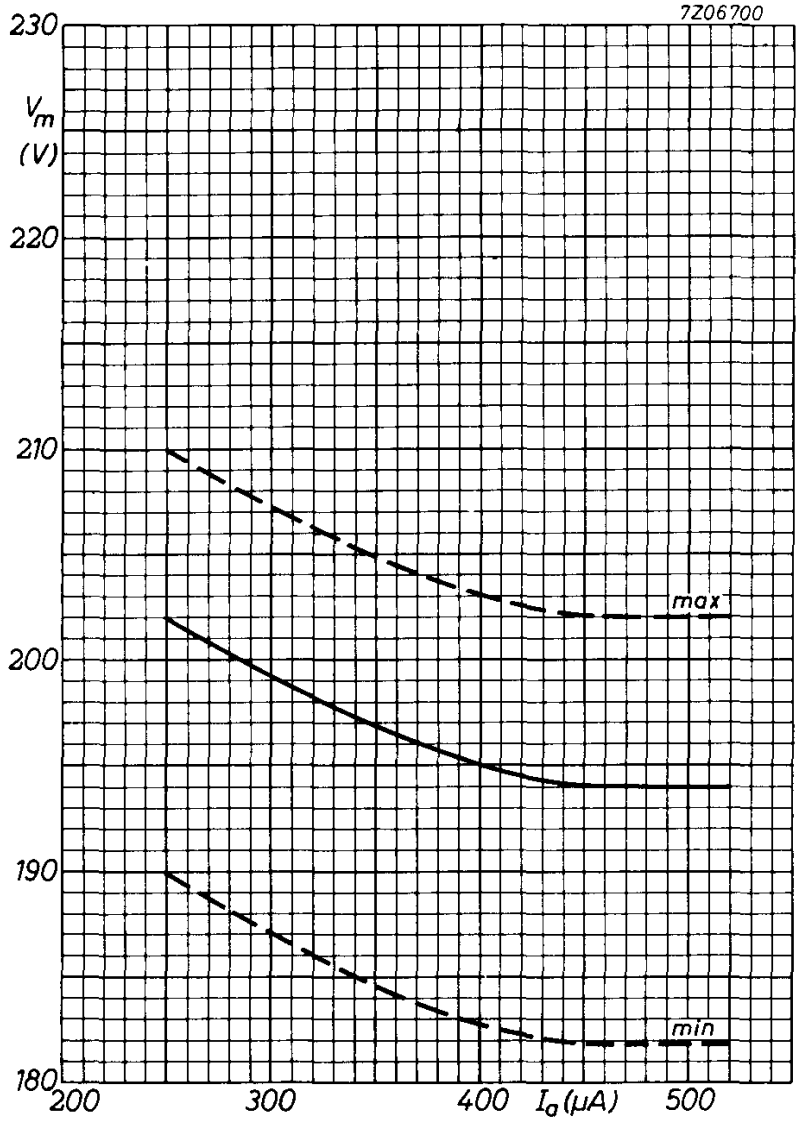
I Discharge transfers from guide A cathode to guide B cathode

I' Earliest instant for discharge transfer from guide A cathode to guide B cathode

I'' Latest instant for discharge transfer from guide A cathode to guide B cathode

J Latest instant for discharge transfer from guide B cathode to main cathode, for a main cathode dwell time > 1 ms

J' Latest instant for discharge transfer from guide B cathode to main cathode dwell time ≤ 1 ms



Anode to main cathode maintaining voltage plotted against anode current

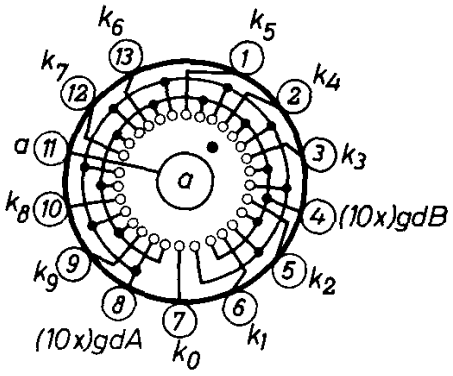
SELECTOR TUBE

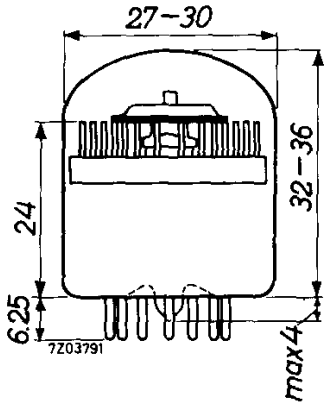
Cold cathode gas-filled bi-directional decade selector and counting tube.
This tube has ten main cathodes, all of which are brought out separately.
The Z505S gives visual indication and operates at speeds up to 50 kHz.

QUICK REFERENCE DATA			
Maximum counting speed		50	kHz
Supply voltage	V_{ba}	500	V
Output, current		800	μA
voltage		24	V
Indication		position of glow; end viewing	

DIMENSIONS AND CONNECTIONS

Base: B13B





K_0 is aligned with pin 7 to within $\pm 3^o$

Mounting position: any

This tube has been designed to close tolerances so that no individual adjustment is necessary to align the bulb with the escutcheon.

Accessories

Socket	type 2422 505 00001
Escutcheon	type 55062

General note

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

CHARACTERISTICS AND RANGE VALUES FOR EQUIPMENT DESIGN

(initial and during life)

Ignition requirements				
Anode supply voltage	V_{ba}	400 to 1000		V
Time constant of rise of anode supply voltage		min.	2	ms [1]
Discharge at rest on a main cathode				
Maintaining voltage of anode to main cathode at I_a = 0.8 mA, V_{bgd} = 55 V				
maximum	V_m	max.	275	V
minimum	V_m	min.	240	V
Cathode current,				
recommended	I_k		0.8	mA
maximum	I_k	max.	1.0	mA
minimum	I_k	min.	0.6	mA
Guide supply voltage				
maximum	V_{bgd}	max.	65	V
minimum	V_{bgd}	min.	40	V
Resistance between guides and guide supply	R_{gd}	max.	22	kΩ
Cathode potential (except during reset)				
non conducting cathode	$-V_k$	max.	14	V
conducting cathode, positive	V_k	max.	28	V [2]
negative	$-V_k$	max.	0	V
Stepping requirements See also page 4				
Discharge dwell time,				
main cathode		min.	8.0	μs
Guide A		min.	6.0	μs
Guide B		min.	6.0	μs
Interval between trailing edge of guide A pulse and leading edge of guide B pulse (double rectangular pulse drive)		max.	0.3	μs
Guide voltage to step the discharge from a main cathode to an adjacent guide cathode	$-V_{gd}$	max. min.	80 30	V V

[1][2] See page 5

CHARACTERISTICS AND RANGE VALUES FOR EQUIPMENT DESIGN (continued)

Voltage difference required between a guide and the adjacent guide in order to step the discharge	$V_{gd\text{-}gd}$	max. min.	140 30	V V 3)
Guide supply voltage to step the discharge from a guide to the next main cathode	V_{bgd}	max. min.	65 40	V V
Cathode potential				
non conducting cathodes	$-V_k$	max.	14	V
conducting cathode, positive	V_k	max.	28	V 2)
negative	$-V_k$	max.	0	V
Resetting requirements 4)				
Cathode voltage	$-V_k$	max. min.	140 100	V V 5)

LIFE

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

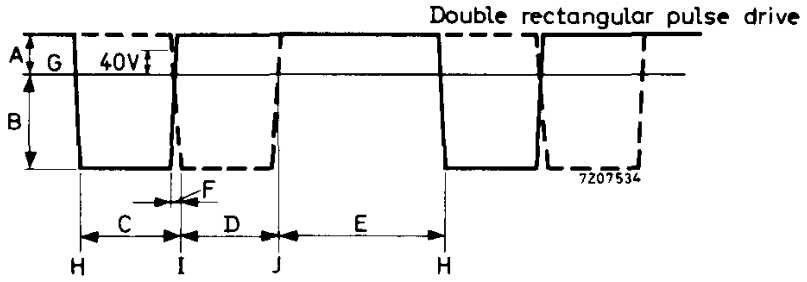
Anode current	I_a	0.8	mA
Guide supply voltage	V_{bgd}	60	V
Guide voltage for transfer	V_{gd}	-50	V
Output cathode (k_o) voltage,			
non conducting	V_o	5.0	V
conducting	V_o	-5.0	V
Guide A dwell time		6.0	μs
Guide B dwell time		6.0	μs
Cathode dwell time		8.0	μs
Temperature		20 ± 5	°C

2) 3) 4) 5) See page 5

LIMITING VALUES (Absolute max. rating system)

Anode supply voltage	V_{ba}	max.	1000	V
Cathode current (except during reset)	I_k	max.	1.0	mA
Voltage between any two main or guide cathodes (except during reset)		max.	140	V
Guide supply voltage	V_{bgd}	max.	65	V
Reset voltage, negative		max.	140	V
Ambient temperature	t_{amb}	max.	50	^oC [1])

GUIDE WAVEFORMS



A Positive guide supply voltage

B Negative guide voltage

C Guide A dwell time

D Guide B dwell time

E Main cathode dwell time

F Interval between trailing edge of guide A pulse and leading edge of guide B pulse

G Potential of most positive main cathode supply voltage

H Discharge transfers from main cathode to guide A

I Discharge transfers from guide A to guide B

J Latest instant for discharge transfer from guide B to main cathode, dwell time $\leq 500\ \mu s$.

[1]) It is preferable to store the tube as near as possible to room temperature.

NOTES

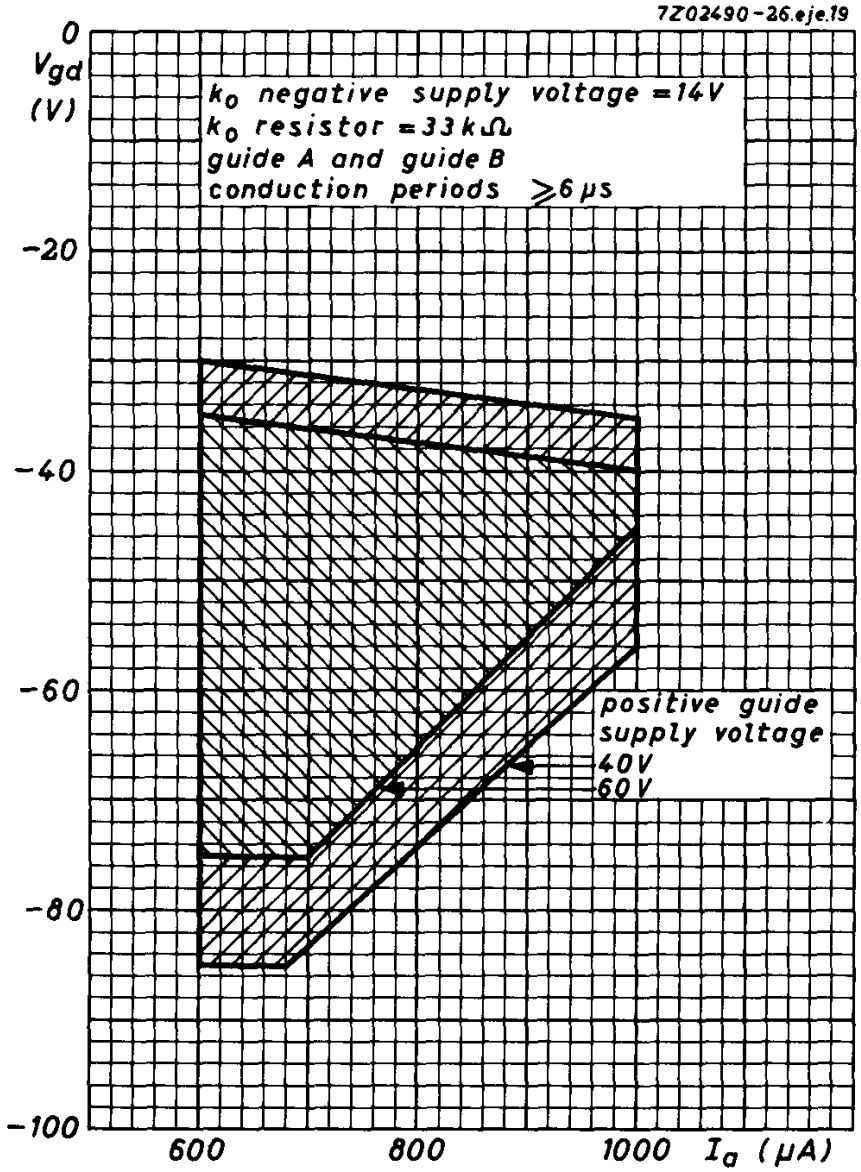
1) If the power supply does not have a time constant of 2 ms as one of its characteristics, it can conveniently be obtained by inserting a resistor in series with the anode supply and a capacitor to the negative return.
(4.7 kΩ and 0.5 μF for 2 ms).

2) The maximum voltage difference between any two main cathodes except during reset must not exceed 28 V.

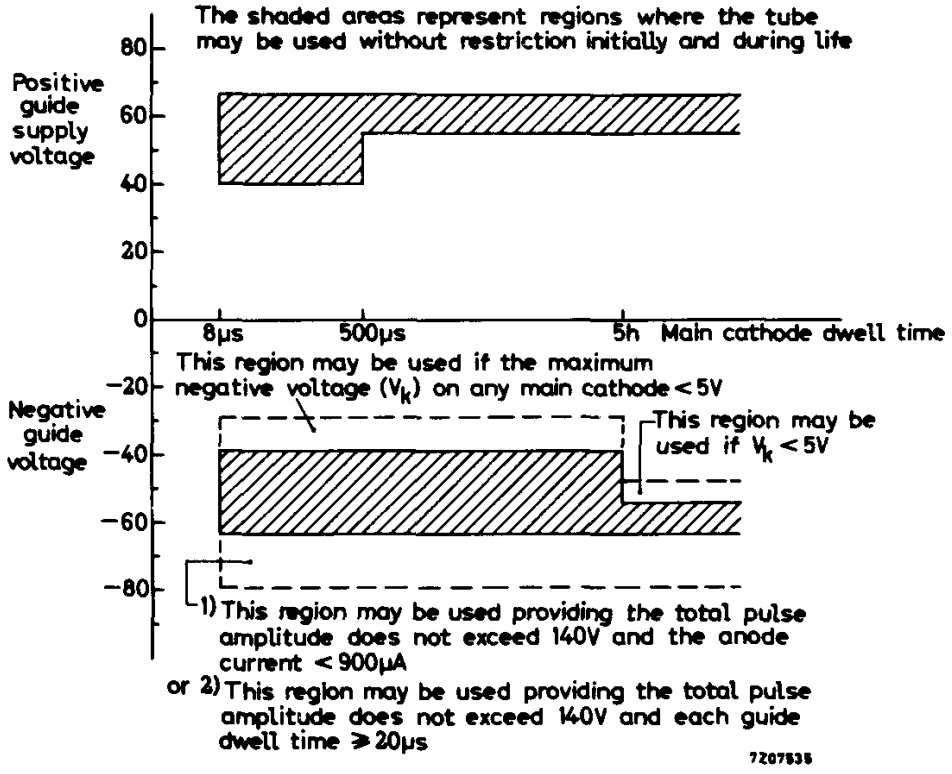
3) The adjacent guide (the cathode to which the discharge is being transferred) must also be 30 V negative with respect to the most positive main cathode supply voltage.

4) The high current which passes during reset should not be allowed to flow more than a few seconds.

5) If the cathode current falls below 0.7 mA when the guide voltage applied to the tube approaches the minimum value of 40 V the negative voltage required for resetting may rise to 110 V.



Guide voltage to ensure stepping.
The area of operation is increased with the use of larger pulse periods



Guide operating voltages

PHILIPS

Z 510M

Cold-cathode gas-filled DECADE NUMERICAL INDICATOR TUBE with the figures 0 to 9 in red neon colour
TUBE INDICATEUR DE NUMEROS DECIMAUX à cathode froide et à remplissage de gaz, avec les chiffres de 0 jusqu'à 9 en couleur rouge de neon
Gasgefüllte KALTKATODENRÖHRE ZUR ANZEIGUNG DER DEZIMALEN ZAHLEN, mit den Ziffern von 0 bis 9 in roter Neonfarbe

Typical characteristics
Caractéristiques types
Kenndaten

V_{ign} = max. 160 V

Extinguishing voltage
Tension d'extinction = min. 100 V
Löschspannung

Operating characteristics
Caractéristiques d'utilisation
Betriebsdaten

V_{ba} =	170	250	300	350 V
V_{arc} =	127	127	127	127 V
R_a =	15	56	82	100 kΩ

Note: Optimum life performance is obtained when a constant current circuit is used providing a cathode current between 2.0 and 2.5 mA.
Observation: La durée optimum est obtenue en utilisant un montage à courant constant avec une intensité de courant cathodique entre 2,0 et 2,5 mA.
Bemerkung: Die optimale Lebensdauer wird erhalten indem ein konstanter Stromkreis mit einem Katodenstrom zwischen 2,0 und 2,5 mA verwendet wird.

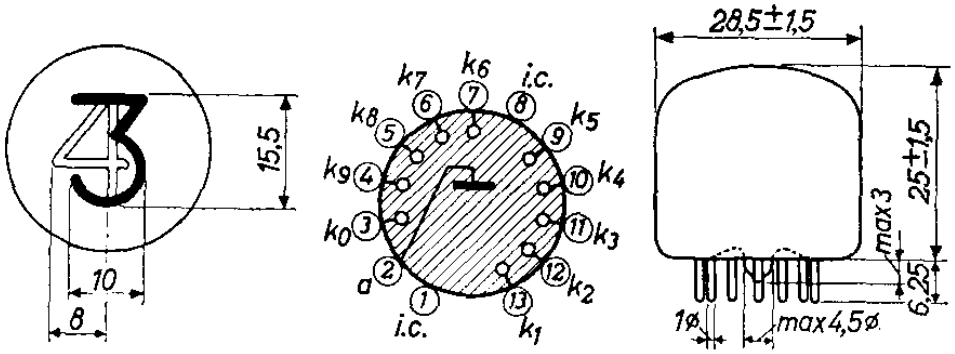
Limiting values (Absolute limits)
Caractéristiques limites (Limites absolues)
Grenzdaten (Absolute Grenzwerte)

I_k (T_{av} = max. 0,02 sec)	= max. 3 mA [1])
I_k	= min. 1,5 mA [1])
I_{kp}	= max. 15 mA [1])
t_{amb}	= -65 °C/+70 °C

[1]) Each digit; chaque chiffre; jede Ziffer

Z 510M PHILIPS

Dimensions in mm; Dimensions en mm; Abmessungen in mm



Diameter of the pitch circle of the base pins 16.65 mm
Diamètre du cercle primitif des broches 16,65 mm
Durchmesser des Teilkreises der Stifte 16,65 mm

The figures may show an inclination of max. 3°
Les chiffres peuvent avoir une inclinaison de 3° au max.
Die Ziffern können eine Neigung von max. 3° zeigen

Socket
Support B8 700 67
Fassung

Mounting position: arbitrary
Montage: arbitrairement
Einbau: beliebig

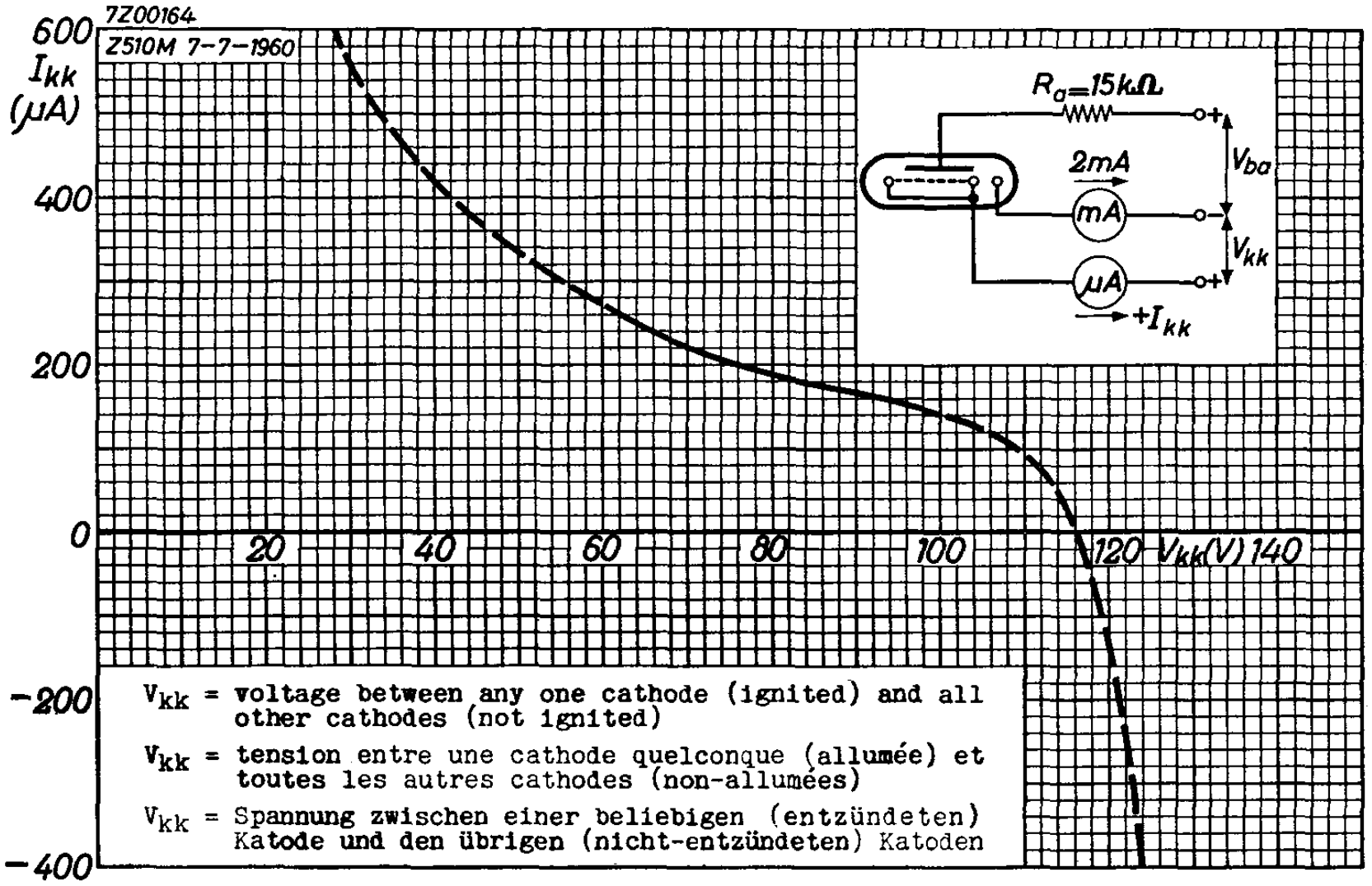
Remark: The current I_{kk} (see page B) shall not exceed 300 µA; otherwise the not ignited cathodes become hazy
Observation: Le courant I_{kk} (voir page B) ne dépassera pas une intensité de 300 µA; sinon les cathodes non-allumées deviennent visibles
Bemerkung: Der Strom I_{kk} (siehe Seite B) soll 300 µA nicht überschreiten, da sonst die nicht-entzündeten Katoden sichtbar werden

9.9.1960

PHILIPS

Z 510M

A



V_{kk} = voltage between any one cathode (ignited) and all other cathodes (not ignited)

V_{kk} = tension entre une cathode quelconque (allumée) et toutes les autres cathodes (non-allumées)

V_{kk} = Spannung zwischen einer beliebigen (entzündeten) Katode und den übrigen (nicht-entzündeten) Katoden



Z510M

page	sheet	date
1	1	1960.09.09
2	2	1960.09.09
3	A	1960.09.09
4	B	1960.09.09
5	FP	1999.12.24

PHILIPS Z520M

Cold-cathode gasfilled DECADE NUMERICAL INDICATOR TUBE with very long life. The figures 0 to 9 light in bright red colour with improved contrast due to filter-coating of the bulb.

TUBE INDICATEUR DE NUMÉROS DÉCIMAUX à cathode froide et à remplissage de gaz de très longue durée. Les chiffres de 0 jusqu'à 9 sont montrés en couleur rouge clair avec contraste amélioré par une couche filtrante à l'ampoule.

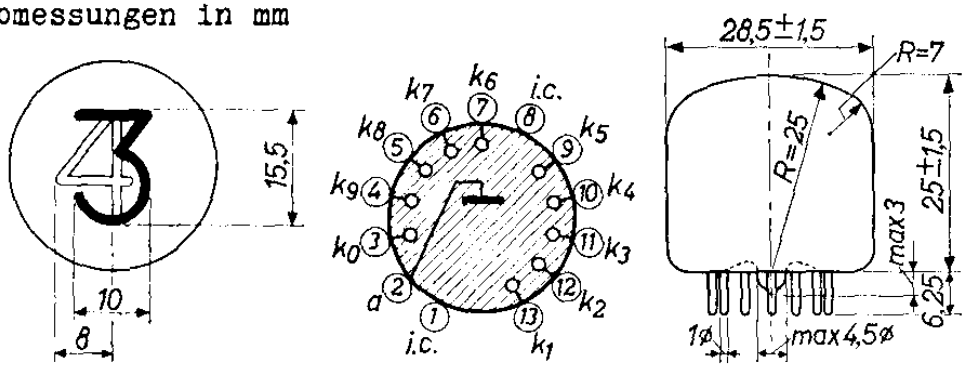
Gasgefüllte KALTKATODENRÖHRE ZUR ANZEIGUNG DER DEZIMALEN ZAHLEN mit sehr langer Lebensdauer. Die Ziffern 0 bis 9 werden in hellroter Farbe mit durch eine Filterschicht am Kolben verbessertem Kontrast gezeigt.

Application: The tube is designed to convert electrical information into optical signals. The figures become visible at the same spot, so making possible "in-line" read-out. The tube can e.g. be used in digital voltmeters, cash registers, calculating machines, etc. It may be controlled by mechanical switches, transistors, cold-cathode trigger tubes, beam switching tubes, photo-conductive devices, etc.

Application: Le tube est conçu pour la transformation d'information électrique en signaux optiques. Les chiffres sont montrés au même endroit, faisant possible une lecture en ligne d'un nombre. Le tube peut être utilisé par exemple dans les voltmètres numériques, les caisses enregistreuses, les machines à calculer, etc. Il peut être commandé par moyen de commutateurs mécaniques, de transistors, de tubes de déclenchement à cathode froide, de tubes commutateurs par faisceau électronique, de cellules photo-conductives, etc.

Anwendung: Die Röhre ist geeignet für die Umwandlung von elektrischen in optische Signale. Die Ziffern werden alle an derselben Stelle gezeigt, so dass eine Zahl geradlinig abgelesen werden kann. Die Röhre kann z.B. in numerischen Voltmetern, Registrierkassen, Rechenmaschinen, u.ä. verwendet werden. Sie kann von mechanischen Schaltern, Transistoren, Relaisröhren, Elektronenstrahl-Schaltröhren, Photoleitern, u.s.w. gesteuert werden.

Dimensions in mm
Dimensions en mm
Abmessungen in mm



Socket; support; Fassung B8 700 67

Mounting position: any. The tube is viewed through the dome of the envelope
Montage: arbitrairement. Le tube est vu à travers le dôme de l'enveloppe
Einbau: willkürlich. Die Röhre wird durch den Dom der Umhüllung abgelesen.

Diameter of the pitch circle of the base pins 16.65 mm
Diamètre du cercle primitif des broches 16,65 mm
Durchmesser des Teilkreises der Stifte 16,65 mm

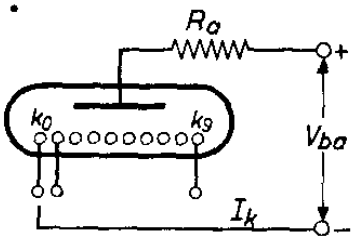
The figures may show an inclination of max. 3°
Les chiffres peuvent avoir une inclinaison de 3° au max.
Die Ziffern können eine Neigung von max. 3° zeigen

Life expectancy (under recommended operating conditions)
Durée prévue (sous les conditions de fonctionnement conseillées)
Lebensdauer (unter den empfohlenen Betriebsbedingungen)

Continuous display of one digit Présentation continue d'un chiffre Fortwährende Anzeige einer Ziffer	min. 5000	hrs. Stunden
Sequentially changing the display from one digit to the others every 100 hrs. or less Changement consécutif d'un chiffre aux autres chaque 100 heures ou moins Jede 100 Stunden oder nach kürzerer Zeit Wechsel der Anzeige von einer Ziffer nach einer der anderen	30000	hrs. Stunden

Operating characteristics
Caractéristiques d'utilisation
Betriebsdaten

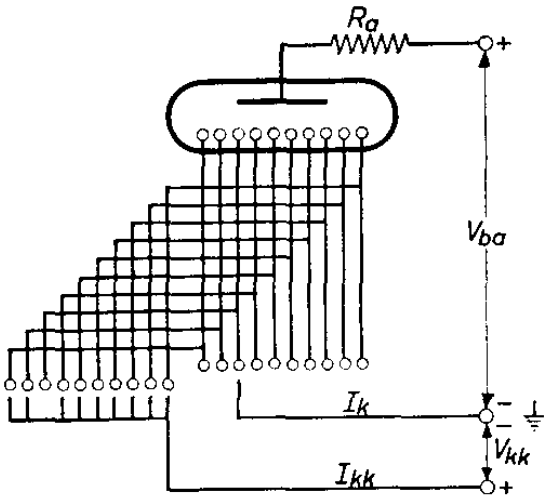
I. Static operation; fonctionnement statique; statischer Betrieb (See also page A; voir aussi page A; siehe auch Seite A).



V_{ba} =	170	250	300	350 V
R_a =	15	56	82	100 kΩ
V_a =	140	140	140	140 V

Operating characteristics (continued)
Caractéristiques d'utilisation (suite)
Betriebsdaten (Fortsetzung)

II. Static operation with cathode bias (See also page B.)
Fonctionnement statique avec polarisation cathodique (Voir aussi page B)
Statischer Betrieb mit Katodenvorspannung (Siehe auch Seite B)



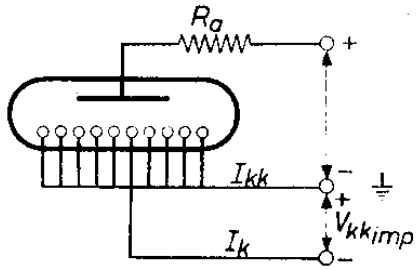
The cathode-bias voltage is the potential difference V_{kk} between the "off" cathodes and the "on" cathode. With low values of V_{kk} the current I_{kk} to the "off" cathodes wil increase and the readability of the "on" cathode will be affected. For this reason V_{kk} should not be lower than 60 V.

La polarisation cathodique est la différence de potentiel V_{kk} entre les cathodes hors circuit et la cathode en circuit. Aux valeurs basses de V_{kk} le courant I_{kk} des cathodes hors circuit augmentera et la lisibilité de la cathode en circuit est diminuée. Pour cette raison la valeur de V_{kk} ne doit pas être plus petite que 60 V.

Die Katodenvorspannung ist der Potentialunterschied V_{kk} zwischen den nicht-gezündeten Katoden und der gezündete Katode. Bei niedrigen Werten von V_{kk} wird der Strom I_{kk} der nicht-gezündeten Katoden grösser werden und die Leserlichkeit der gezündeten Katode slechter. Aus diesem Grunde soll V_{kk} nicht niedriger als 60 V sein.

Operating characteristics (continued)
Caractéristiques d'utilisation (suite)
Betriebsdaten (Fortsetzung)

III. Pulsed operation
Fonctionnement par impulsions
Impulsbetrieb



For information please apply to the manufacturer
Pour plus de renseignements prière de s'adresser au fabricant
Für Näheres soll den Hersteller zu Rate gezogen werden

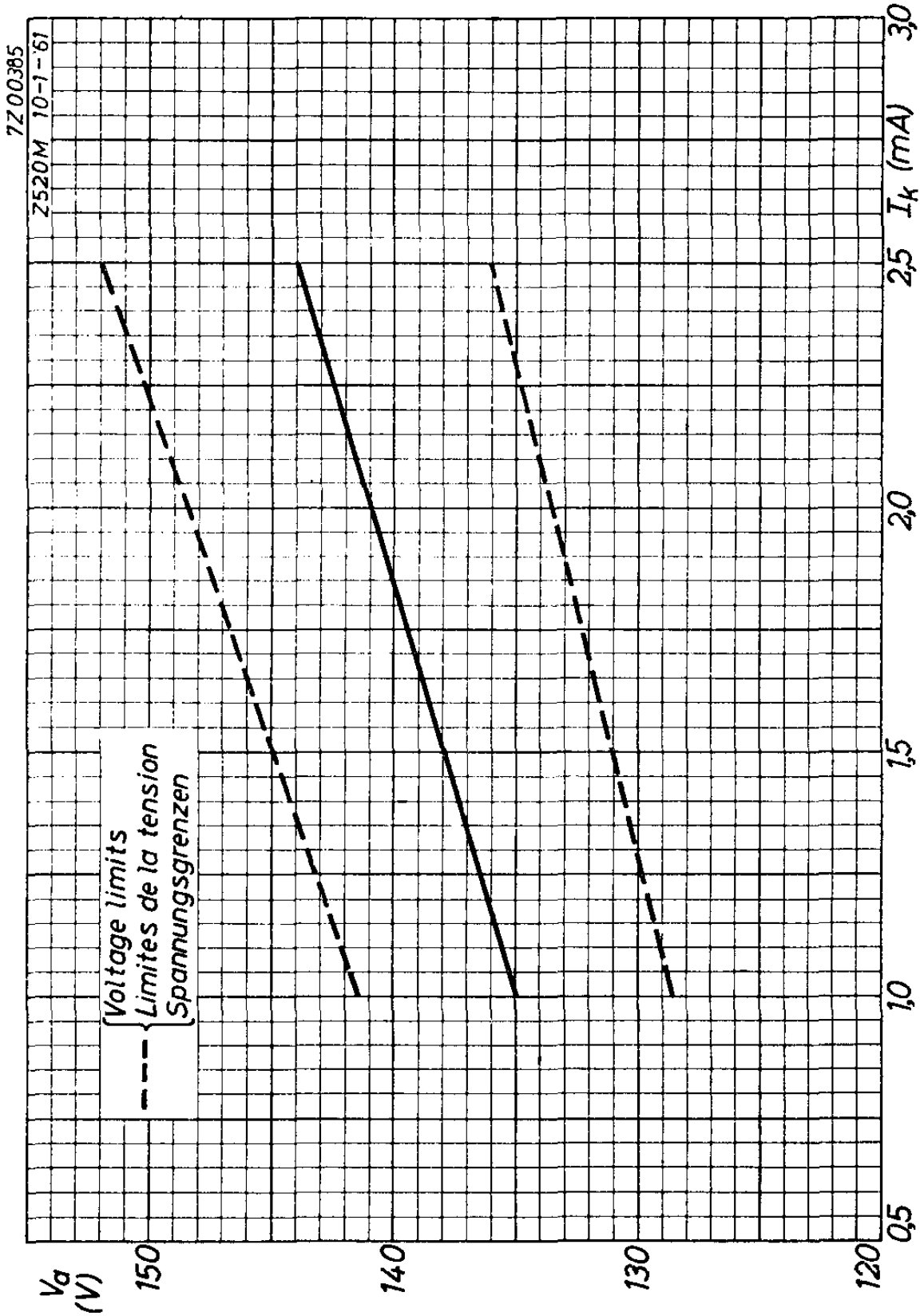
Limiting values (Absolute limits)
Caractéristiques limites (Limites absolues)
Grenzdaten (Absolute Grenzwerte)

Voltage necessary for ignition Tension requise pour l'amorçage Zur Zündung erforderliche Spannung	= min. 160 V
Extinguishing voltage Tension d'extinction Löschspannung	= max. 120 V
I_k Each digit Chaque chiffre Jede Ziffer	= max. 2,5 mA [1]
I_k For complete glow of each digit Pour l'éclairage complet de chaque chiffre Für völlige Aufleuchtung jeder Ziffer	= min. 1,0 mA [1]
I_{kp}	= max. 15 mA
Voltage between anode and "off" cathodes Tension entre l'anode et les cathodes hors circuit Spannung zwischen der Anode und den nicht-gezündeten Katoden	= max. 120 V
t_{amb}	= max. 75 °C

[1]) T_{av} = max. 0,1 sec

PHILIPS

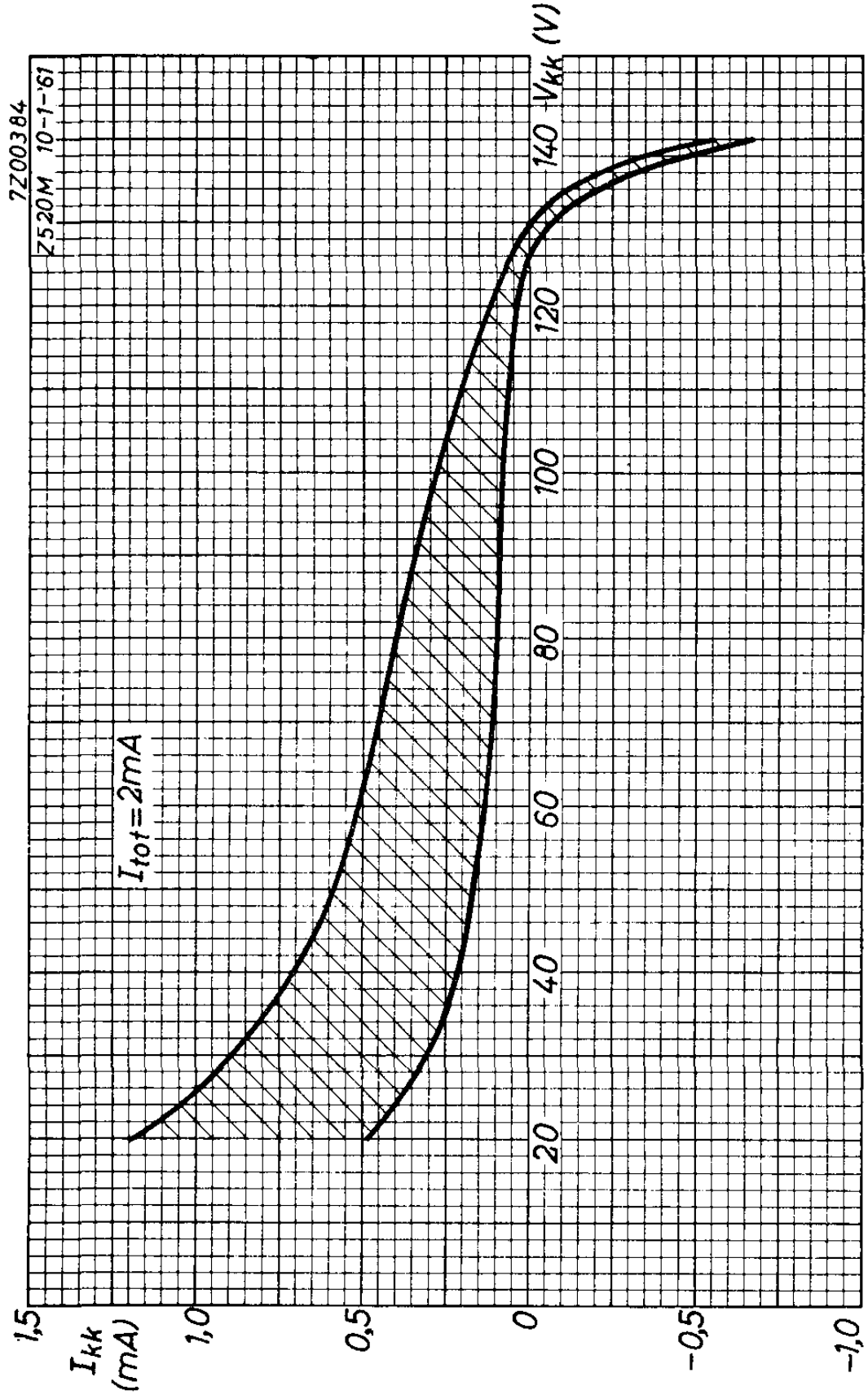
Z520M



6.6.1961

A

Z520M PHILIPS



PHILIPS

Electronic Tube

HANDBOOK

Z520M

page	sheet	date
1	1	1961.06.06
2	2	1961.06.06
3	3	1961.06.06
4	4	1961.06.06
5	A	1961.06.06
6	B	1961.06.06
7	FP	2000.01.14

INDICATOR TUBE

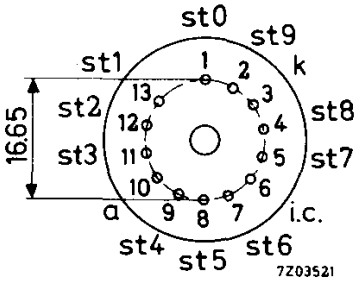
Cold cathode numerical indicator tube for top viewing.

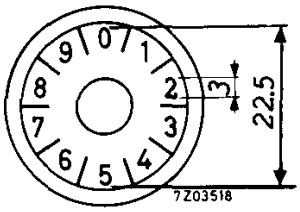
Formely Z550M

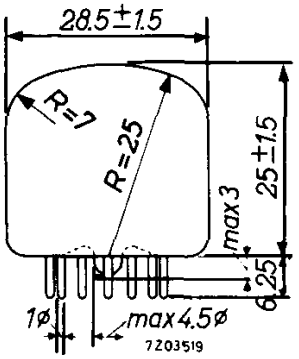
QUICK REFERENCE DATA			
Numeral height		3	mm
Numerals	1 2 3 4 5 6 7 8 9 0		
Supply voltage	V_{ba}	90	Va.c.
Cathode current	I_k	3	mA
Starter selecting voltage		5	V

DIMENSIONS AND CONNECTIONS Dimensions in mm

Base: B13B







GENERAL

The 3 mm high numerals are displayed in radial form.
The tube is primarily intended for use in circuits with transistor control.

PRINCIPLE OF OPERATION

The pulsating d.c. supply voltage (preferably half sine waves) causes one of the ten pure molybdenum cathode positions to glow. This position will be determined by the voltage level of corresponding starter being a few volts above the level of the remaining starters.

ACCESSORIES

Socket 2422 505 00001 or 2422 505 00002

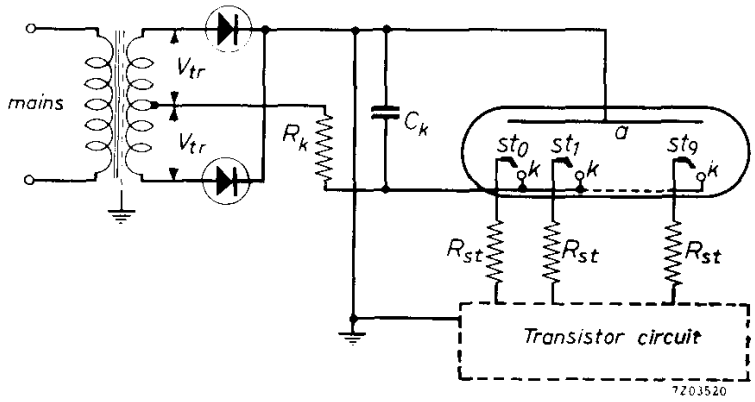
MOUNTING POSITION

Any

The numerals are viewed through the dome of the envelope.
The numerals appear upright when the tube is mounted with the line through pins 1 and 8, vertical pin 1 being uppermost.
Number 0 is aligned with pin 1 to within 3°.

CHARACTERISTICS AND OPERATING CONDITIONS

Recommended circuit



Transformer secondary voltage	V_{tr}	110	V ± 10% [1]
Cathode resistor	R_k	10	kΩ ± 5%
Starter series resistor	R_{st}	330	kΩ [2]
Shunting capacitor	C_k	33	nF [1]
Starter selecting voltage	V_{st-st}	See sheet 4 upper figure and [2] on page 3	
Starter current	I_{st}	50	μA
Maintaining voltage	V_m	84	V
Recommended cathode current	I_k	3	mA

[1] The rectified a.c. voltage should be free from spikes.
A shunting capacitor C_k of 33 nF serves this purpose.

[2] This resistor should be mounted close to the tube socket.

LIFE EXPECTANCY at recommended operating conditions and room temperature

Continuous display of one digit	1000	h	[1]
Sequentially changing the display from one digit to the others every 100 h or less	min. 20 000	h	

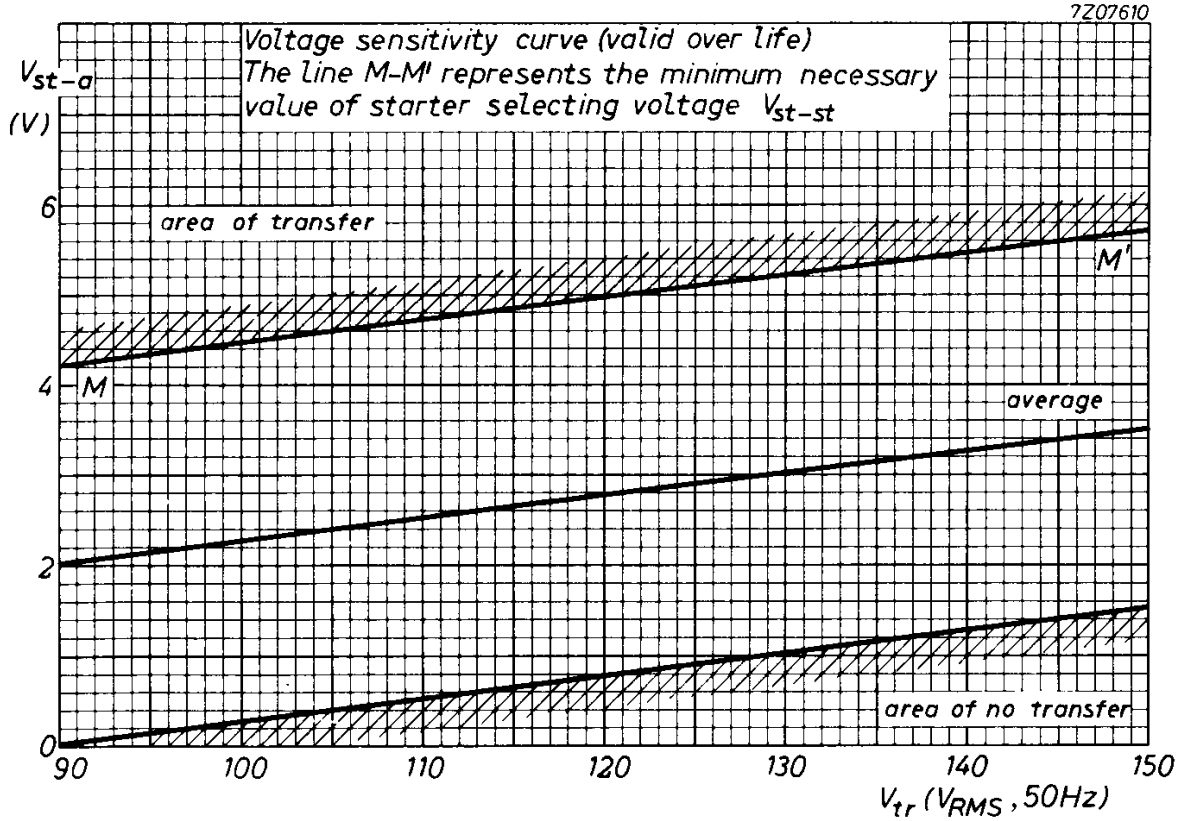
The criterium for the end of life point is given by the minimum value of starter selecting voltage V_{st-st} shown on sheet 4 upper figure.

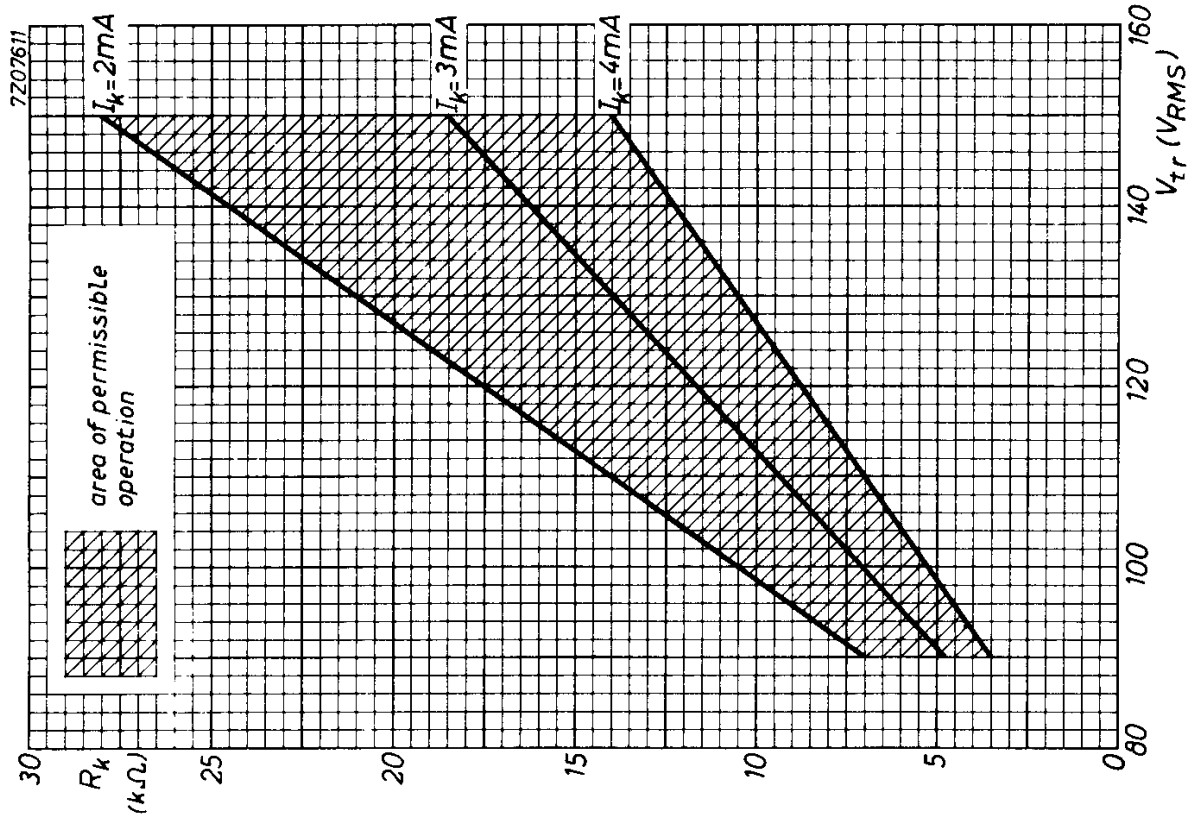
LIMITING VALUES (Absolute max. rating system)

A.C. supply voltage	V_{tr}	min.	90	$V_{r.m.s.}$
See also sheet 4 lower figure	V_{tr}	max.	150	$V_{r.m.s.}$
Frequency of mains supply	f		40 to 100	Hz
Cathode current (average)	I_k	min.	2	mA
		max.	4	mA
Starter selecting voltage	V_{st-st}	min.	see sheet 4 upper figure [2]	
		max.	30	V
Starter circuit resistance	R_{st}	min.	100	kΩ
		max.	470	kΩ
Envelope temperature	t_{bulb}	min.	−55	°C
		max.	+70	°C

[1] Under conditions of longer continuous display on one digit it is recommended to apply a starter selecting voltage V_{st-st} greater than the minimum value, as indicated on sheet 4 upper figure.

[2] The common starter bias potential may deviate by a maximum of ± 5 V from the anode potential.


7Z07610
Voltage sensitivity curve (valid over life)
The line M-M' represents the minimum necessary value of starter selecting voltage V_{st-st}
V_{st-a} (V)
area of transfer
M
M'
average
area of no transfer
0
2
4
6
90
100
110
120
130
140
150
V_{tr} (V_{RMS}, 50Hz)


7Z07611
I_k=2mA
I_k=3mA
I_k=4mA
area of permissible operation
R_k (kΩ)
30
25
20
15
10
5
0
80
100
120
140
160
V_{tr} (V_{RMS})

INDICATOR TUBE

Long life cold cathode ten digit indicator tube for side viewing

QUICK REFERENCE DATA				
Numeral height		approx.	14	mm
Numerals		0 1 2 3 4 5 6 7 8 9		
Decimal point		to the left of the numerals		
Supply voltage	V_{b_a}	min.	170	V
Anode current, average	I_a		2.5	mA
peak	I_{a_p}	max.	12	mA

GENERAL

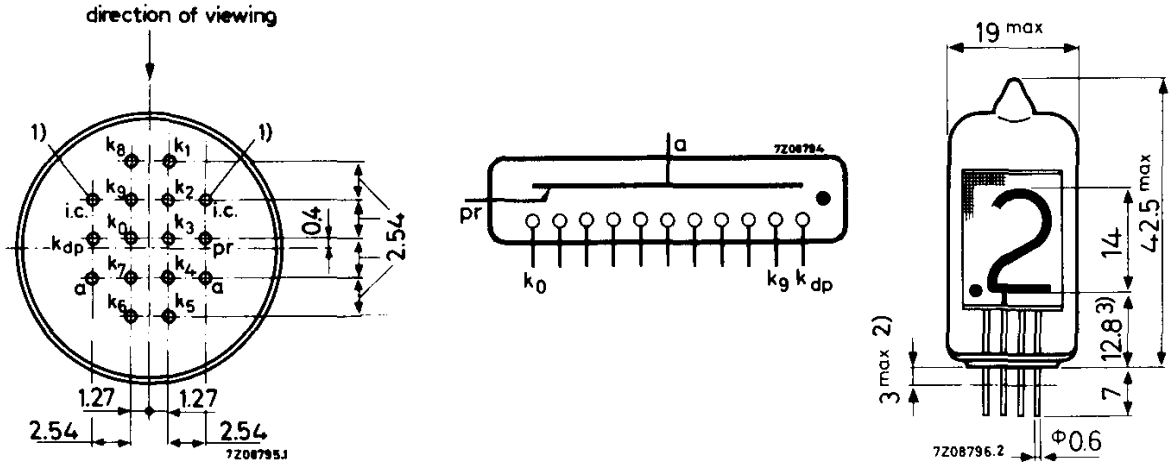
The numerals are 14 mm high and appear on the same base line allowing in-line read out. The ZM1000R is provided with a red contrast filter.

PRINCIPLE OF OPERATION

The tube contains ten cathodes in the form of ten numerals and one in the form of a decimal point; a primer, and one common anode. By applying a suitable voltage between the anode and one of the cathodes the corresponding numeral or the decimal point will be covered by a red neon glow.
The primer allows ionization without delay in strobe type or blanking applications.

DIMENSIONS AND CONNECTIONS

Dimensions in mm



1) Length of i.c. pins max. 2.8 mm.
2) Not tinned.
3) Standard deviation 0.13 mm

The deviations of the axis of the pins with respect to the true geometrical position cover an area of max. 0.3 mm diameter. The pin configuration is compatible with the reference grid for printed wiring according to IEC Publication 97 (0.1 in).

Mounting position: Any

Soldering

The pins may be dip-soldered at a solder temperature of max. 240 °C for maximum 10 seconds up to a point 5 mm from the seals.

Natural frequency

The natural frequencies of the numeral cathodes lie within the range from 300 Hz to 800 Hz.

ACCESSORIES

55701 Printed wiring mounting board (19 x 100 mm) on which the ZM1000 can be soldered; afterwards the combination can be mounted on a vertical printed wiring board carrying, e.g., the drive circuit. Can also be used with the snap-fit tube holder 55703.

55702 Tube socket (for 0.1 in grid). Phenolic. Tinned contacts.

55703 Snap-fit tube holder.

55704 Set of one left-hand and one right-hand end piece to complete the snap-fit indicator tube assembly.

CHARACTERISTICS AND OPERATING CONDITIONS

Ignition voltage	V_{ign}	max. 170	V
Maintaining voltage	V_m	see page 4	
Anode current for coverage	I_a	min. 1.5	mA
(with or without decimal point and $V_{kk} = V_{kk_{min}} - V_{fl}$, see page 5)	I_a	max. 4.5	mA
Cathode selecting voltage	V_{kk}	see page 5	
Cathode resistor, decimal point	R_{dp}	100	kΩ ± 10% [1]
Primer resistor	R_{pr}	10	MΩ ± 10%
Extinction voltage	V_{ext}	min. 118	V

[1]) Lower values of this resistor are permitted. The anode current should be increased by the increase of decimal point current resulting from the decrease of this resistor.

Typical operation over full temperature range 0 °C to +70 °C.

D.C. operation see pages 4, 5, 6 and 7.

Pulse operation

Peak currents up to 12 mA can be allowed provided the average current value does not exceed 2.5 mA.
To avoid excessive glow on "off" cathodes, the cathode selecting voltage should exceed 65 V. Minimum pulse duration 100 μs.
For further information consult the manufacturer.

LIFE EXPECTANCY at I_a = 2.5 mA

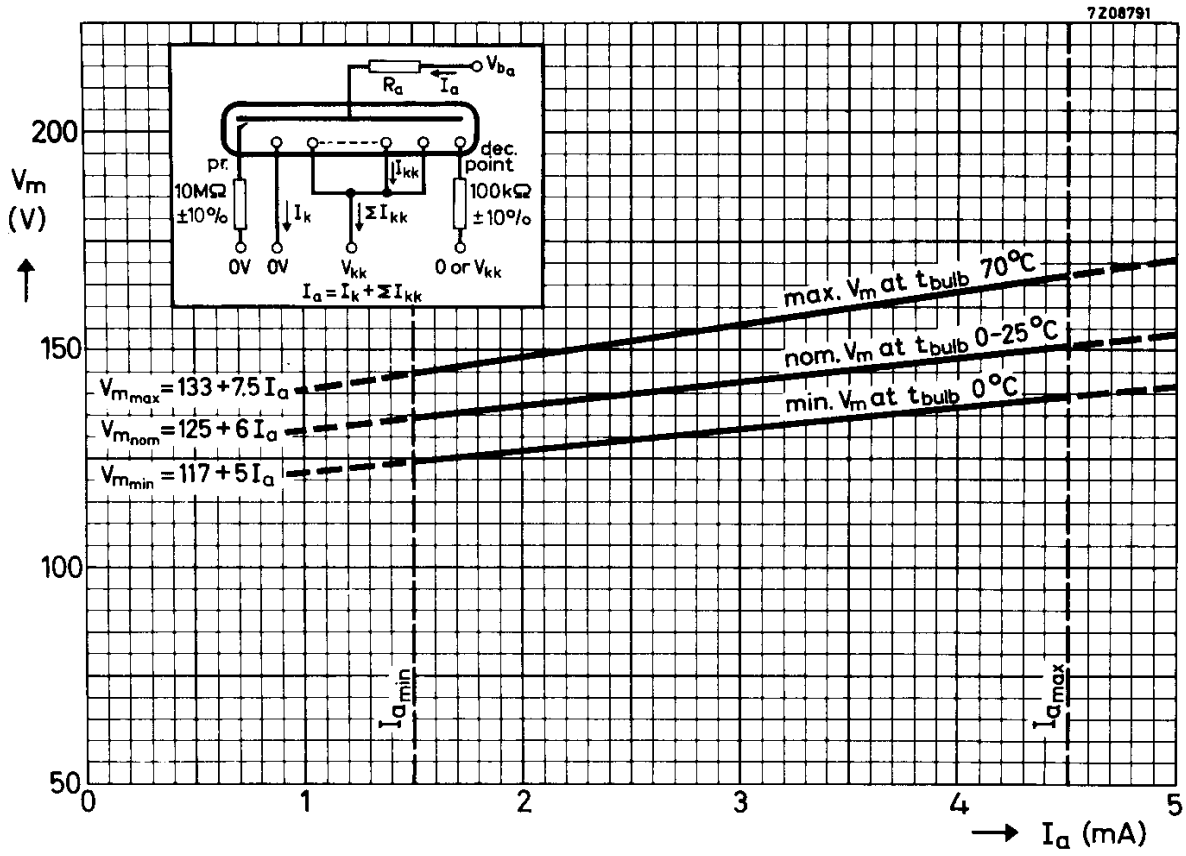
This tube is manufactured on the same physical principles as other tubes in this category and it is expected that the life will be comparable, viz:

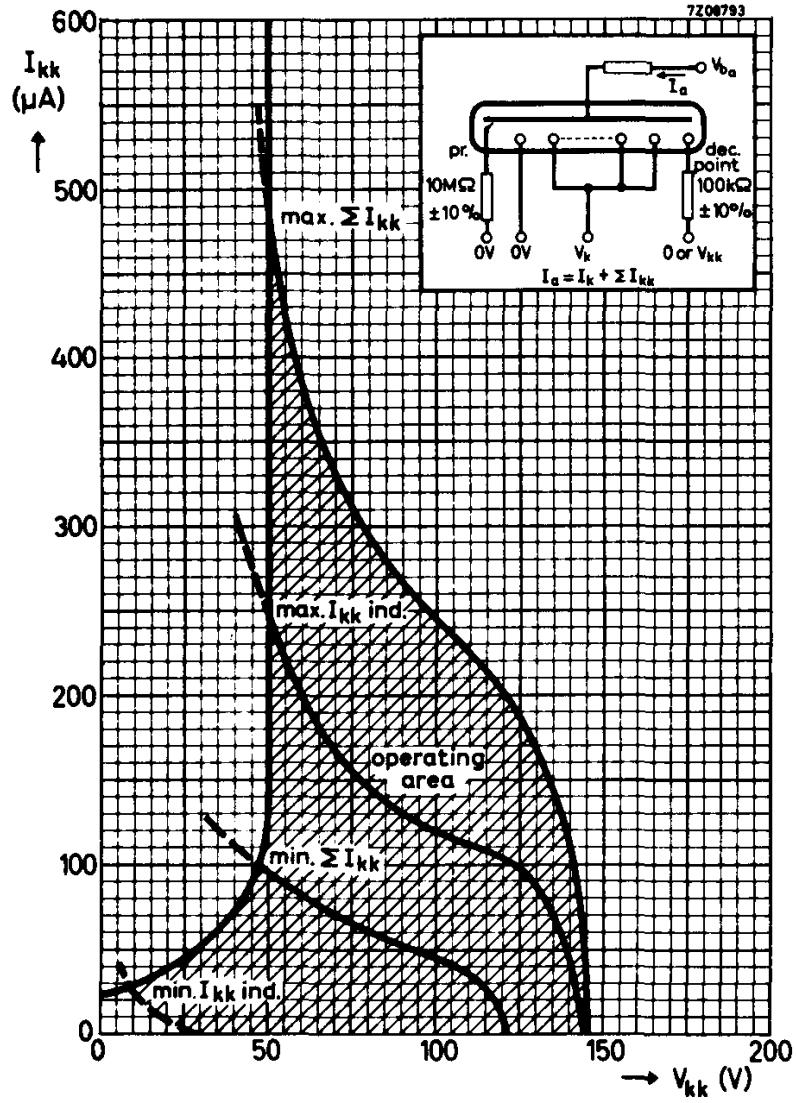
sequentially changing the display from one digit to the others every 1000 h or less		100 000	h
Mean time between failures	min.	200 000	h

LIMITING VALUES (Absolute max. rating system)

Anode voltage necessary for ignition	V_a	min.	170	V
Anode current,				
average during any conduction period	I_a	min.	1.5	mA
average (T_{av} = 20 ms)	I_a	max.	4.5	mA
peak	I_{a_p}	max.	12	mA
Cathode selecting voltage	V_{kk}	see page 5		
Bias voltage between anode and "off" cathodes	V_{bias}	max.	$V_{floating}$	
Ambient temperature	t_{amb}	min.	−50 °C [1]	
	t_{amb}	max.	+70 °C	

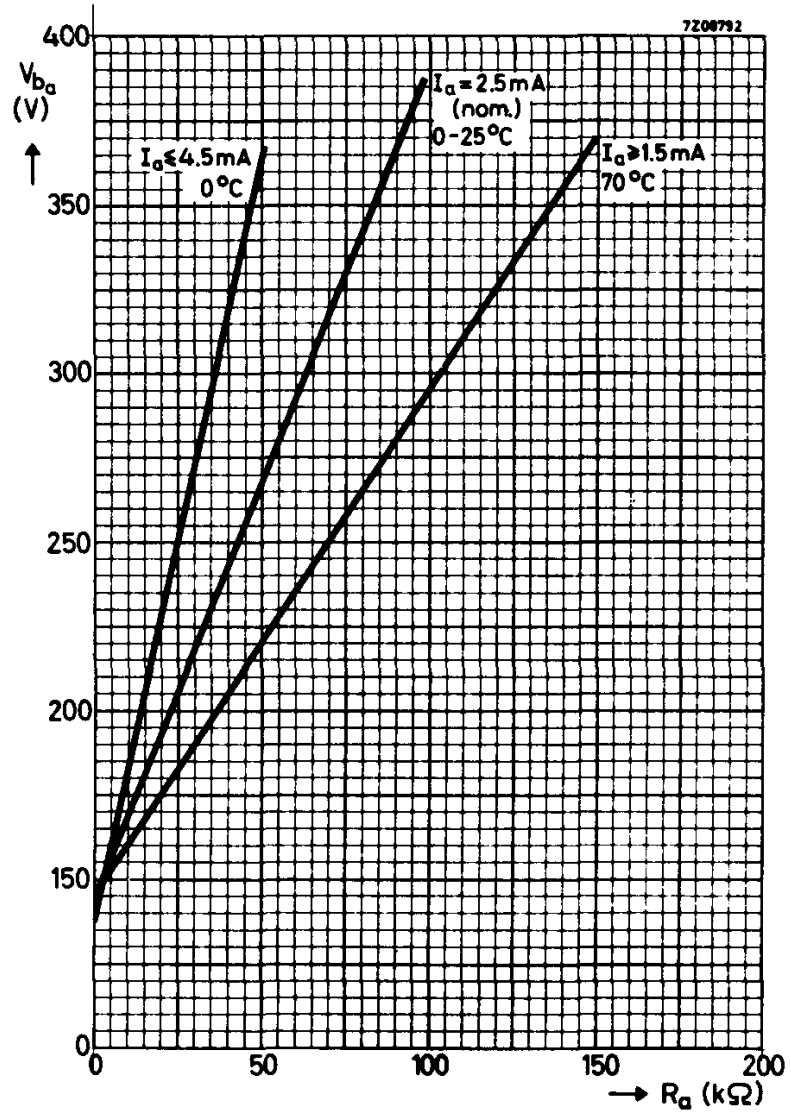
[1]) Bulb temperatures below 10 °C result in a reduced life expectancy and changes in characteristics (see page 4).
For equipment to be used over a wide temperature range, "constant current operation" (high supply voltage with a high anode series resistor) is recommended.


7Z08791
V_{b_a}
R_a
I_a
dec. point
pr.
10MΩ ±10%
100kΩ ±10%
I_{kk}
I_k
ΣI_{kk}
0V 0V V_{kk} 0 or V_{kk}
$I_a = I_k + \Sigma I_{kk}$
V_m (V)
200
150
100
50
max. V_m at t_{bulb} 70°C
nom. V_m at t_{bulb} 0-25°C
min. V_m at t_{bulb} 0°C
$V_{m_{max}} = 133 + 7.5\,I_a$
$V_{m_{nom}} = 125 + 6\,I_a$
$V_{m_{min}} = 117 + 5\,I_a$
$I_{a_{min}}$
$I_{a_{max}}$
0 1 2 3 4 5
I_a (mA)

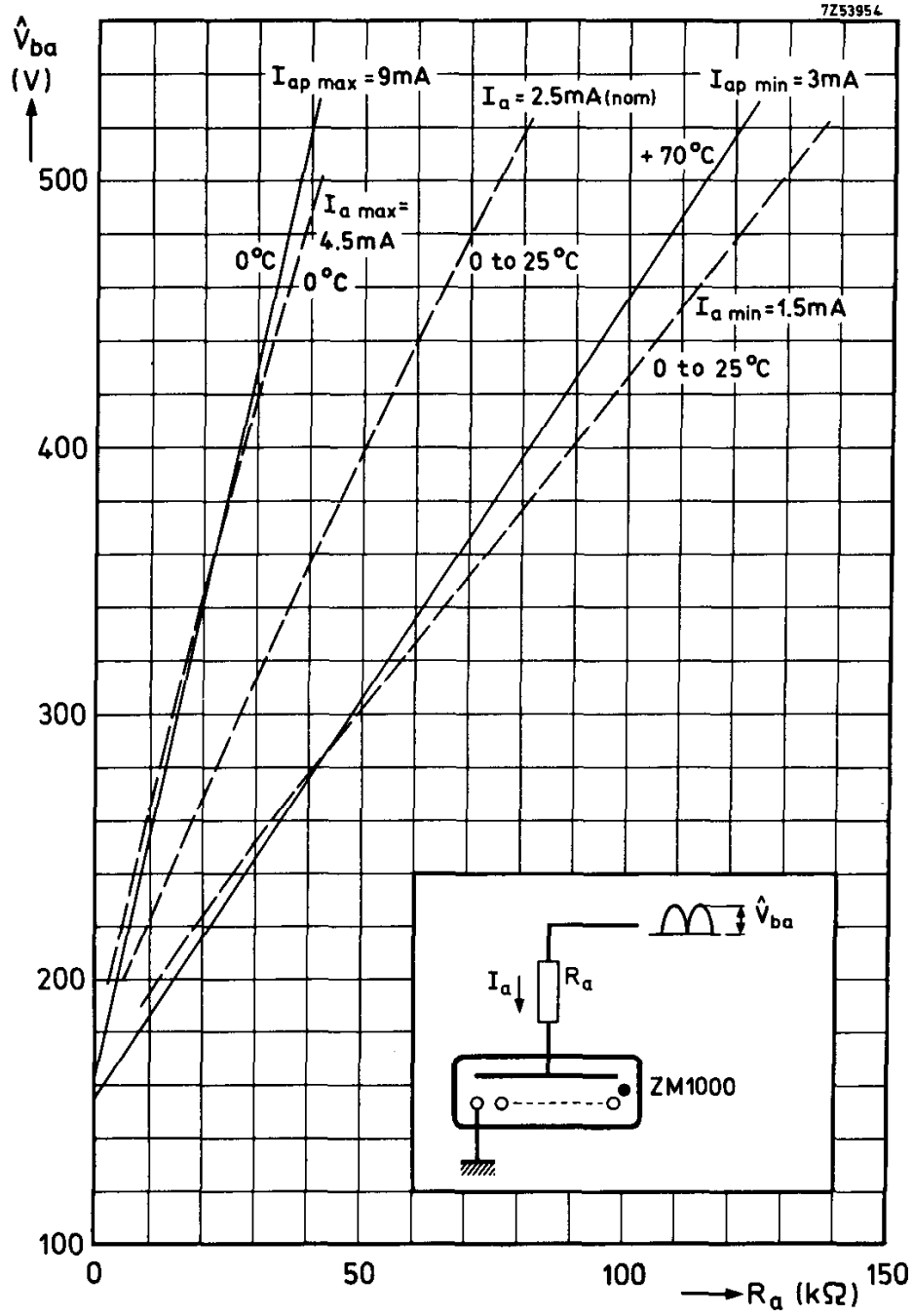


I_{kk} individual and ΣI_{kk} versus cathode selecting voltage V_{kk} at I_a = 2.5 mA.
I_{kk} and ΣI_{kk} are proportional to the anode current within the operating range of I_a and with V_{kk} = 0 V to 100 V.

The curves are valid for instantaneous values and for average values of anode current.



Graph denoting the relationships of D.C. anode supply voltage and required anode resistor to remain within the recommended operating region.


7Z53954
$\hat{V}_{ba}$ (V)
$I_{ap\ max}$ = 9mA
I_a = 2.5mA (nom)
$I_{ap\ min}$ = 3mA
+ 70 °C
$I_{a\ max}$ = 4.5mA
0 °C
0 °C
0 to 25 °C
$I_{a\ min}$ = 1.5mA
0 to 25 °C
500
400
300
200
100
0
50
100
150
R_a (kΩ)
$\hat{V}_{ba}$
I_a
R_a
ZM1000

PHILIPS

Data handbook

Electronic components and materials

ZM1000 ZM1000R

page	sheet	date
1	1	1970.04
2	2	1969.03
3	3	1970.04
4	4	1969.03
5	5	1969.03
6	6	1969.03
7	7	1969.03
8	FP	2000.04.21

INDICATOR TUBE

Long life cold cathode ten digit indicator tube for side viewing

QUICK REFERENCE DATA				
Numeral height		approx.	14	mm
Numerals		0 1 2 3 4 5 6 7 8 9		
Decimal point		to the left of the numerals		
Supply voltage	V_{b_a}	min.	170	V
Anode current, average	I_a		2.5	mA
peak	I_{a_p}	max.	12	mA

GENERAL

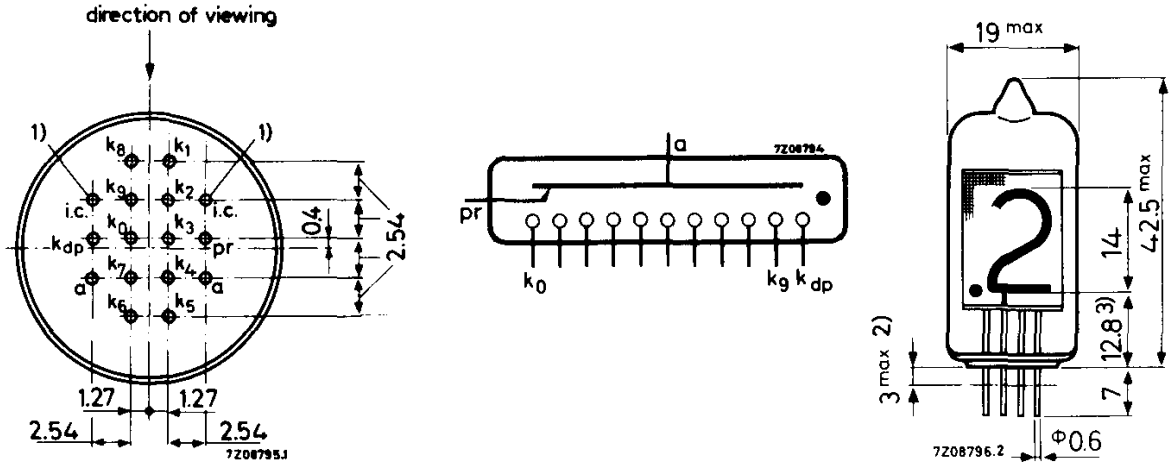
The numerals are 14 mm high and appear on the same base line allowing in-line read out. The ZM1000R is provided with a red contrast filter.

PRINCIPLE OF OPERATION

The tube contains ten cathodes in the form of ten numerals and one in the form of a decimal point; a primer, and one common anode. By applying a suitable voltage between the anode and one of the cathodes the corresponding numeral or the decimal point will be covered by a red neon glow.
The primer allows ionization without delay in strobe type or blanking applications.

DIMENSIONS AND CONNECTIONS

Dimensions in mm



1) Length of i.c. pins max. 2.8 mm.
2) Not tinned.
3) Standard deviation 0.13 mm

The deviations of the axis of the pins with respect to the true geometrical position cover an area of max. 0.3 mm diameter. The pin configuration is compatible with the reference grid for printed wiring according to IEC Publication 97 (0.1 in).

Mounting position: Any

Soldering

The pins may be dip-soldered at a solder temperature of max. 240 °C for maximum 10 seconds up to a point 5 mm from the seals.

Natural frequency

The natural frequencies of the numeral cathodes lie within the range from 300 Hz to 800 Hz.

ACCESSORIES

55701 Printed wiring mounting board (19 x 100 mm) on which the ZM1000 can be soldered; afterwards the combination can be mounted on a vertical printed wiring board carrying, e.g., the drive circuit. Can also be used with the snap-fit tube holder 55703.

55702 Tube socket (for 0.1 in grid). Phenolic. Tinned contacts.

55703 Snap-fit tube holder.

55704 Set of one left-hand and one right-hand end piece to complete the snap-fit indicator tube assembly.

CHARACTERISTICS AND OPERATING CONDITIONS

Ignition voltage	V_{ign}	max. 170	V
Maintaining voltage	V_m	see page 4	
Anode current for coverage	I_a	min. 1.5	mA
(with or without decimal point and $V_{kk} = V_{kk_{min}} - V_{fl}$, see page 5)	I_a	max. 4.5	mA
Cathode selecting voltage	V_{kk}	see page 5	
Cathode resistor, decimal point	R_{dp}	100	kΩ ± 10% [1]
Primer resistor	R_{pr}	10	MΩ ± 10%
Extinction voltage	V_{ext}	min. 118	V

[1]) Lower values of this resistor are permitted. The anode current should be increased by the increase of decimal point current resulting from the decrease of this resistor.

Typical operation over full temperature range 0 °C to +70 °C.

D.C. operation see pages 4, 5, 6 and 7.

Pulse operation

Peak currents up to 12 mA can be allowed provided the average current value does not exceed 2.5 mA.
To avoid excessive glow on "off" cathodes, the cathode selecting voltage should exceed 65 V. Minimum pulse duration 100 μs.
For further information consult the manufacturer.

LIFE EXPECTANCY at I_a = 2.5 mA

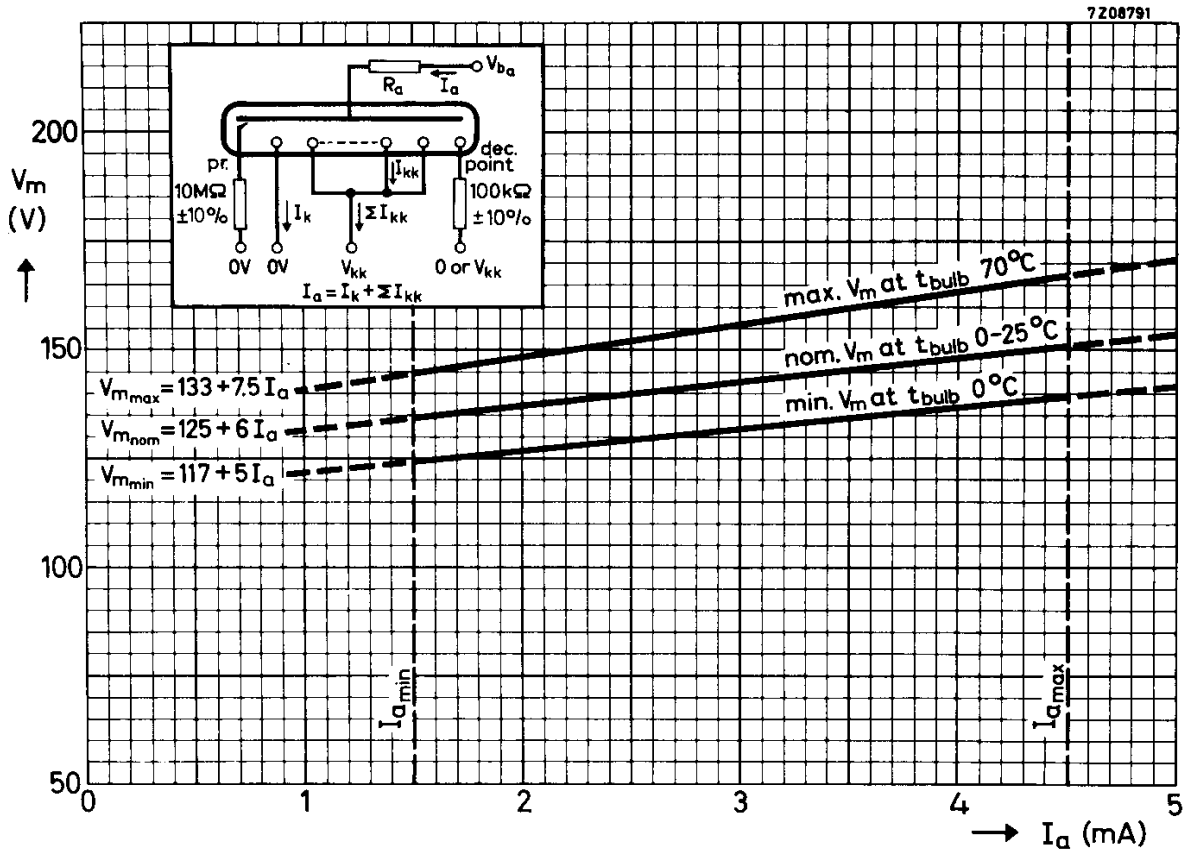
This tube is manufactured on the same physical principles as other tubes in this category and it is expected that the life will be comparable, viz:

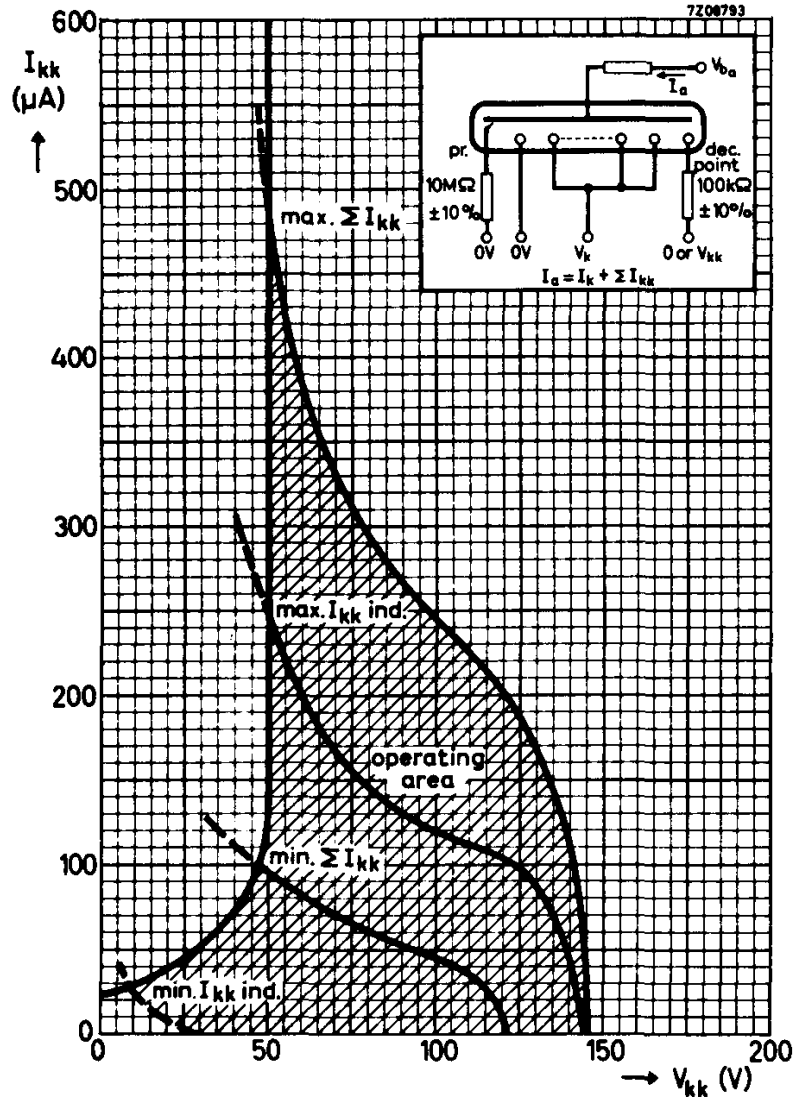
sequentially changing the display from one digit to the others every 1000 h or less		100 000	h
Mean time between failures	min.	200 000	h

LIMITING VALUES (Absolute max. rating system)

Anode voltage necessary for ignition	V_a	min.	170	V
Anode current,				
average during any conduction period	I_a	min.	1.5	mA
average (T_{av} = 20 ms)	I_a	max.	4.5	mA
peak	I_{a_p}	max.	12	mA
Cathode selecting voltage	V_{kk}	see page 5		
Bias voltage between anode and "off" cathodes	V_{bias}	max.	$V_{floating}$	
Ambient temperature	t_{amb}	min.	−50 °C [1]	
	t_{amb}	max.	+70 °C	

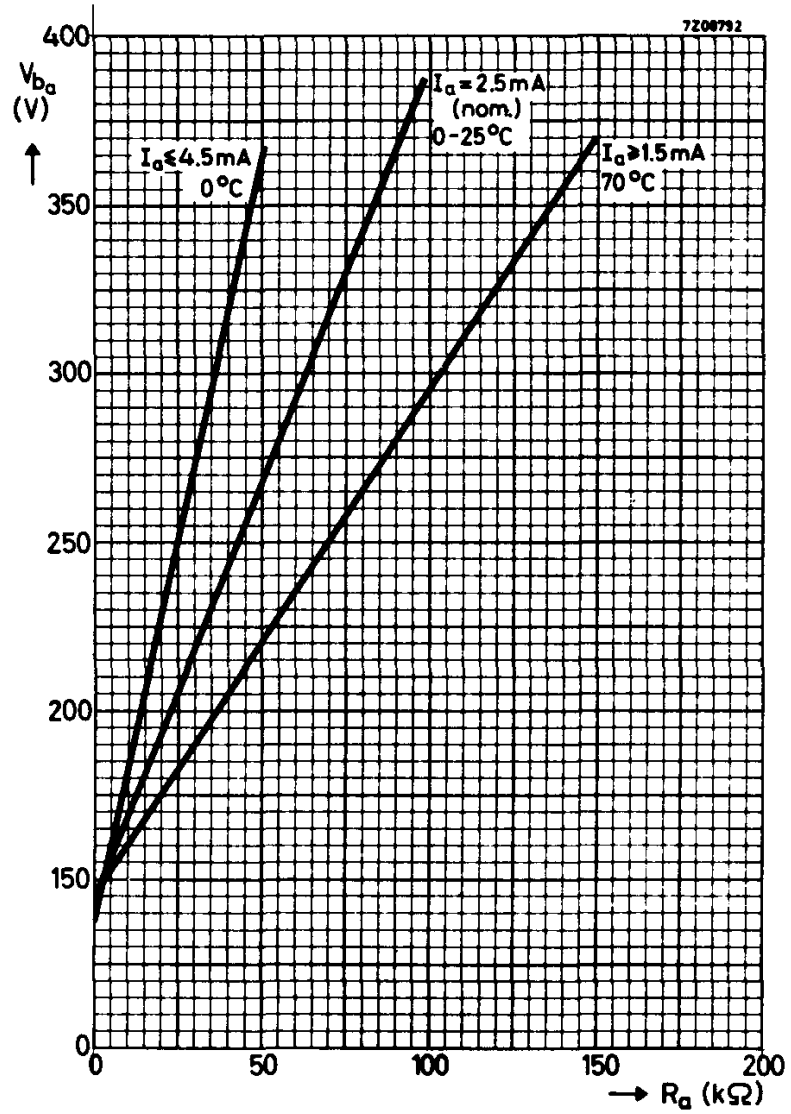
[1]) Bulb temperatures below 10 °C result in a reduced life expectancy and changes in characteristics (see page 4).
For equipment to be used over a wide temperature range, "constant current operation" (high supply voltage with a high anode series resistor) is recommended.


7Z08791
V_{b_a}
R_a
I_a
dec. point
pr.
10MΩ ±10%
100kΩ ±10%
I_{kk}
I_k
ΣI_{kk}
0V 0V V_{kk} 0 or V_{kk}
$I_a = I_k + \Sigma I_{kk}$
V_m (V)
200
150
100
50
max. V_m at t_{bulb} 70°C
nom. V_m at t_{bulb} 0-25°C
min. V_m at t_{bulb} 0°C
$V_{m_{max}} = 133 + 7.5\,I_a$
$V_{m_{nom}} = 125 + 6\,I_a$
$V_{m_{min}} = 117 + 5\,I_a$
$I_{a_{min}}$
$I_{a_{max}}$
0 1 2 3 4 5
I_a (mA)

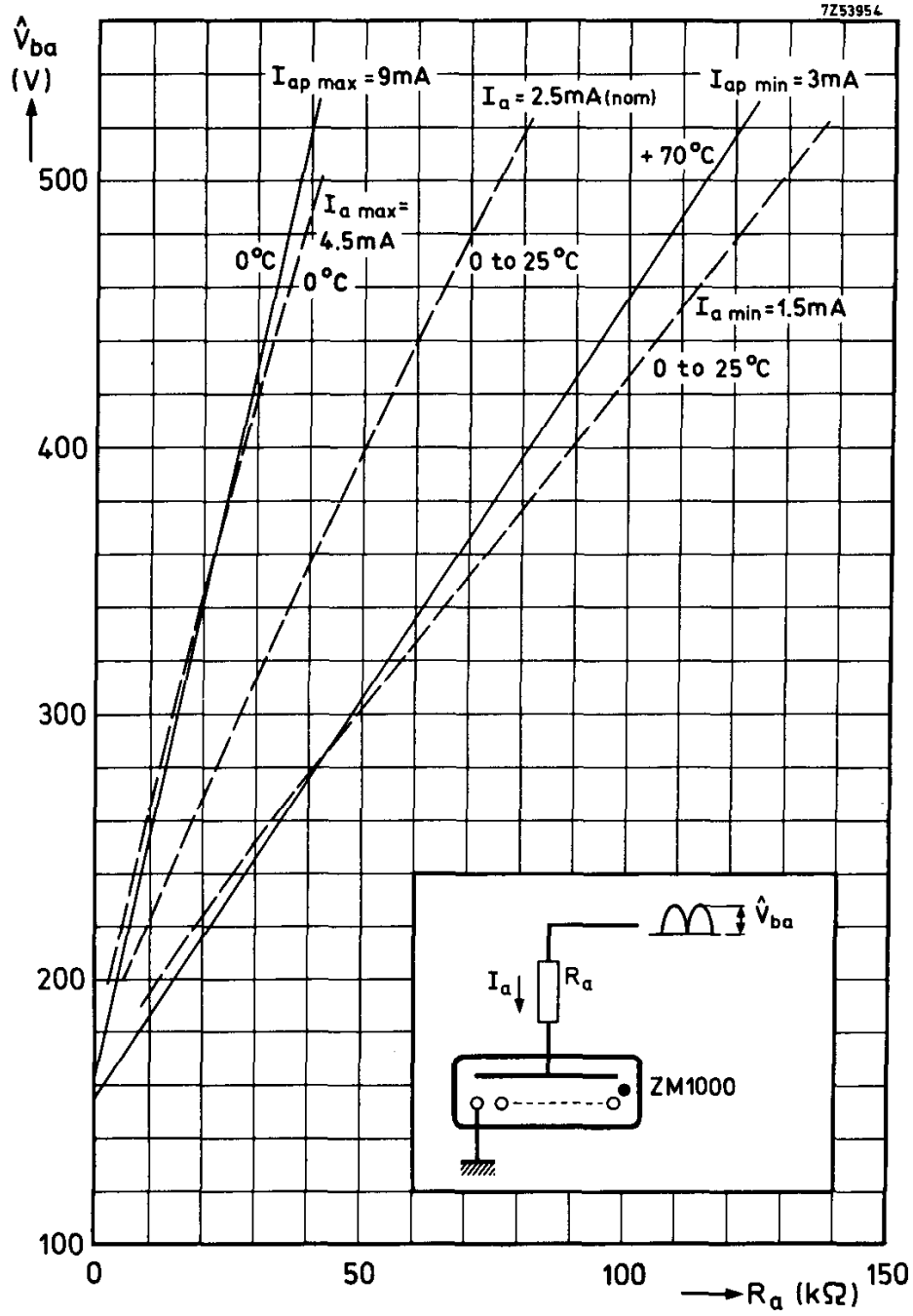


I_{kk} individual and ΣI_{kk} versus cathode selecting voltage V_{kk} at I_a = 2.5 mA.
I_{kk} and ΣI_{kk} are proportional to the anode current within the operating range of I_a and with V_{kk} = 0 V to 100 V.

The curves are valid for instantaneous values and for average values of anode current.



Graph denoting the relationships of D.C. anode supply voltage and required anode resistor to remain within the recommended operating region.


7Z53954
$\hat{V}_{ba}$ (V)
$I_{ap\ max}$ = 9mA
I_a = 2.5mA (nom)
$I_{ap\ min}$ = 3mA
+ 70 °C
$I_{a\ max}$ = 4.5mA
0 °C
0 °C
0 to 25 °C
$I_{a\ min}$ = 1.5mA
0 to 25 °C
500
400
300
200
100
0
50
100
150
R_a (kΩ)
$\hat{V}_{ba}$
I_a
R_a
ZM1000

PHILIPS

Data handbook

Electronic components and materials

ZM1000 ZM1000R

page	sheet	date
1	1	1970.04
2	2	1969.03
3	3	1970.04
4	4	1969.03
5	5	1969.03
6	6	1969.03
7	7	1969.03
8	FP	2000.04.21

INDICATOR TUBE

Long-life cold-cathode character indicator tube for side viewing.

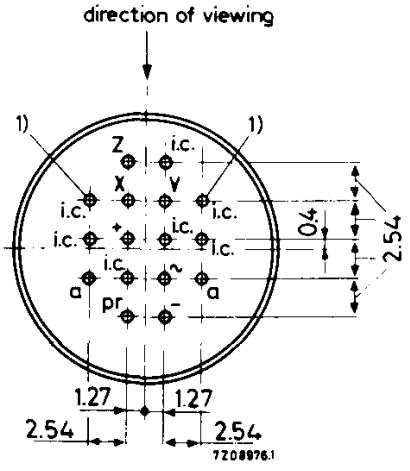
QUICK REFERENCE DATA			
Character height	approx. 10 to 14		mm
Characters	+, −, ~, X, Y, Z		
Supply voltage	V_{b_a} min.	170	V
Anode current	I_a	2.5	mA

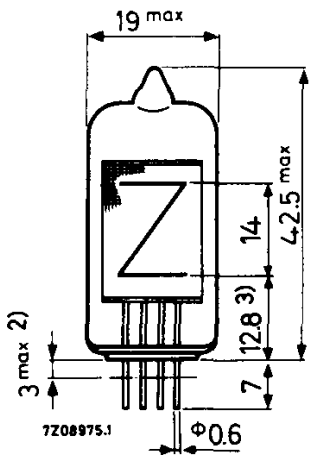
GENERAL

Character indicator tube to be used in conjunction with ZM1000 numerical indicator tube for in-line read-out in e.g. digital instruments or numerical control applications. The ZM1001R is provided with a red contrast filter.

DIMENSIONS AND CONNECTIONS

Dimensions in mm





Mounting and Accessories: see ZM1000

CHARACTERISTICS, OPERATING CONDITIONS AND LIMITING VALUES

These are essential the same as of type ZM1000

---

1) Length of these i.c. pins max. 2.8 mm
2) Not tinned
3) Standard deviation 0.13 mm

INDICATOR TUBE

Long-life cold-cathode character indicator tube for side viewing.

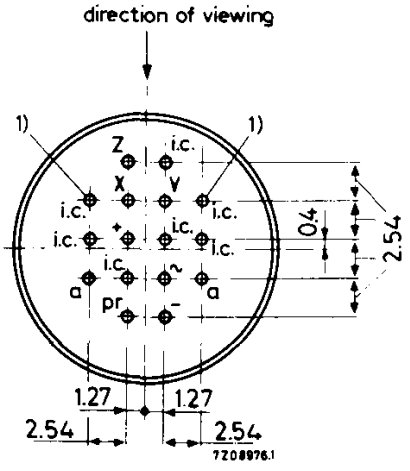
QUICK REFERENCE DATA			
Character height	approx. 10 to 14		mm
Characters	+, −, ~, X, Y, Z		
Supply voltage	V_{b_a} min.	170	V
Anode current	I_a	2.5	mA

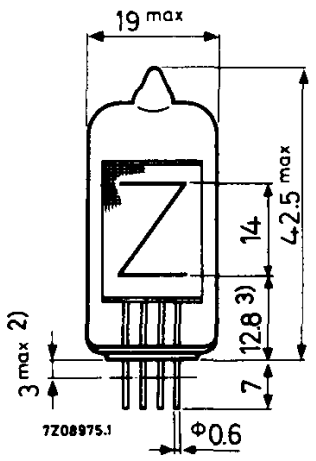
GENERAL

Character indicator tube to be used in conjunction with ZM1000 numerical indicator tube for in-line read-out in e.g. digital instruments or numerical control applications. The ZM1001R is provided with a red contrast filter.

DIMENSIONS AND CONNECTIONS

Dimensions in mm





Mounting and Accessories: see ZM1000

CHARACTERISTICS, OPERATING CONDITIONS AND LIMITING VALUES

These are essential the same as of type ZM1000

---

1) Length of these i.c. pins max. 2.8 mm
2) Not tinned
3) Standard deviation 0.13 mm

INDICATOR TUBE

Long-life cold-cathode character indicator tube for side viewing.

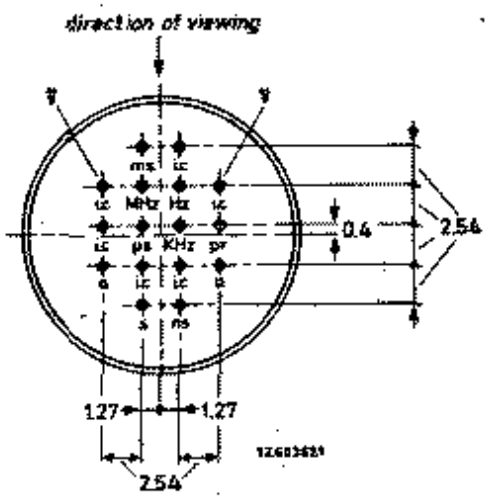
QUICK REFERENCE DATA				
Character height		approx. 9 to 13		mm
Characters		ns, µs, ms, s, Hz, kHz, MHz		
Supply voltage	V_{ba}	min.	170	V
Anode current	I_a		4	mA

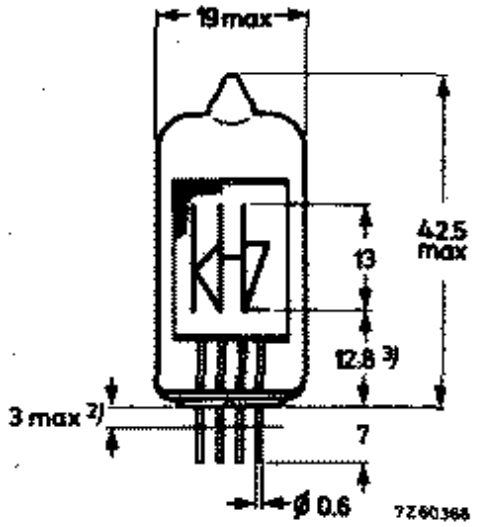
GENERAL

Character indicator tube to be used in conjunction with ZM1000 numerical indicator tube for in-line read-out in e.g. digital instruments such as frequency and time interval measuring apparatus.

DIMENSIONS AND CONNECTIONS

Dimensions in mm





Mounting and Accessories: see ZM1000

1) Length of these i.c. pins max. 2,8 mm
2) Not tinned
3) Standard deviation 0.13 mm

INDICATOR TUBE

Long-life cold-cathode ten-digit indicator tube for side viewing.
The tube is designed for time-sharing (pulse) applications.

QUICK REFERENCE DATA				
Numeral height		approx.	14	mm
Numerals	0 1 2 3 4 5 6 7 8 9			
Decimal point	to the left of the numerals			
Supply voltage	V_{b_a}(pulse)	min.	170	V
Anode current, peak	I_{a_p}	min.	6	mA
	I_{a_p}	max.	20	mA
average	I_a	max.	2.5	mA

GENERAL

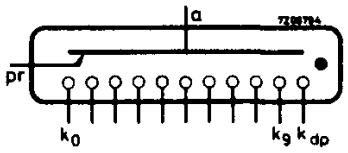
The numerals are 14 mm high and appear on the same base line allowing in-line read-out. The ZM1005R is provided with a red contrast filter. The ZM1005 is identical to the ZM1005R but has no filter.

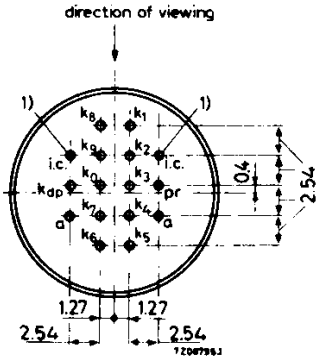
PRINCIPLE OF OPERATION

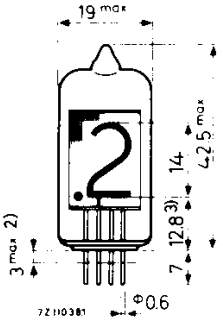
The tube contains ten cathodes in the form of ten numerals and one in the form of a decimal point; a primer, and one common anode. By applying a suitable voltage between the anode and one of the cathodes the corresponding numeral or the decimal point will be covered by a red neon glow.
The primer allows ionization without delay in strobe type or blanking applications.

DIMENSIONS AND CONNECTIONS

Dimensions in mm







The deviation of the axes of the pins with respect to the true geometrical position cover an area of 0.3 mm diameter. The pin configuration is compatible with the reference grid for printed wiring according to IEC Publication 97 (0.1 in).

Mounting position: any

Soldering

The pins may be dip-soldered at a solder temperature of max. 240 °C for maximum 10 seconds up to a point 3 mm from the seals.

Natural frequency

The natural frequencies of the numeral cathodes lie within the range from 300 Hz to 800 Hz.

ACCESSORIES

55701 Printed-wiring mounting board (19 mm x 100 mm) on which the ZM1005 can be soldered; afterwards the combination can be mounted on a vertical printed-wiring board carrying, e.g., the drive circuit. Can also be used with the snap-fit tube holder 55703.

55702 Tube socket (for 0.1 in grid). Phenolic. Tinned contacts.

55703 Snap-fit tube holder.

55704 Set of one left-hand and one right-hand end piece to complete the snap-fit indicator tube assembly.

---

1) i.c. pins max. length 2.8 mm
2) Not tinned
3) Standard deviation 0.13 mm

CHARACTERISTICS AND OPERATING CONDITIONS

Ignition voltage	V_{ign}	max.	170	V
Maintaining voltage	V_m	see page 4		
Anode current, average (T_{av} = max. 20 ms)	I_a	max.	2.5	mA
peak	I_{ap}	min.	6	mA
(with or without decimal point)	I_{ap}	max.	20	mA
Pulse duration	T_{imp}	min.	50	μs [1]
Cathode selecting voltage (see also page 4)	V_{kk}	min.	70	V [2]
	V_{kk}	max.	115	V
Cathode resistor, decimal point	R_{dp}		10	k$\Omega\pm$10% [3]
Primer resistor (anode to primer supply voltage min. 170 V)	R_{pr}		10	M$\Omega\pm$10%
Extinguishing voltage	V_{ext}	min.	118	V

LIFE EXPECTANCY at I_a = 2 mA

The life expectancy is dependent on the instantaneous and average values of anode current:

sequentially changing the display from one digit to the others every 100 h or less, I_{ap} = 10 mA	100 000	h
I_{ap} = 20 mA	20 000	h
Mean time between failures	min. 200 000	h

LIMITING VALUES (Absolute max. rating system)

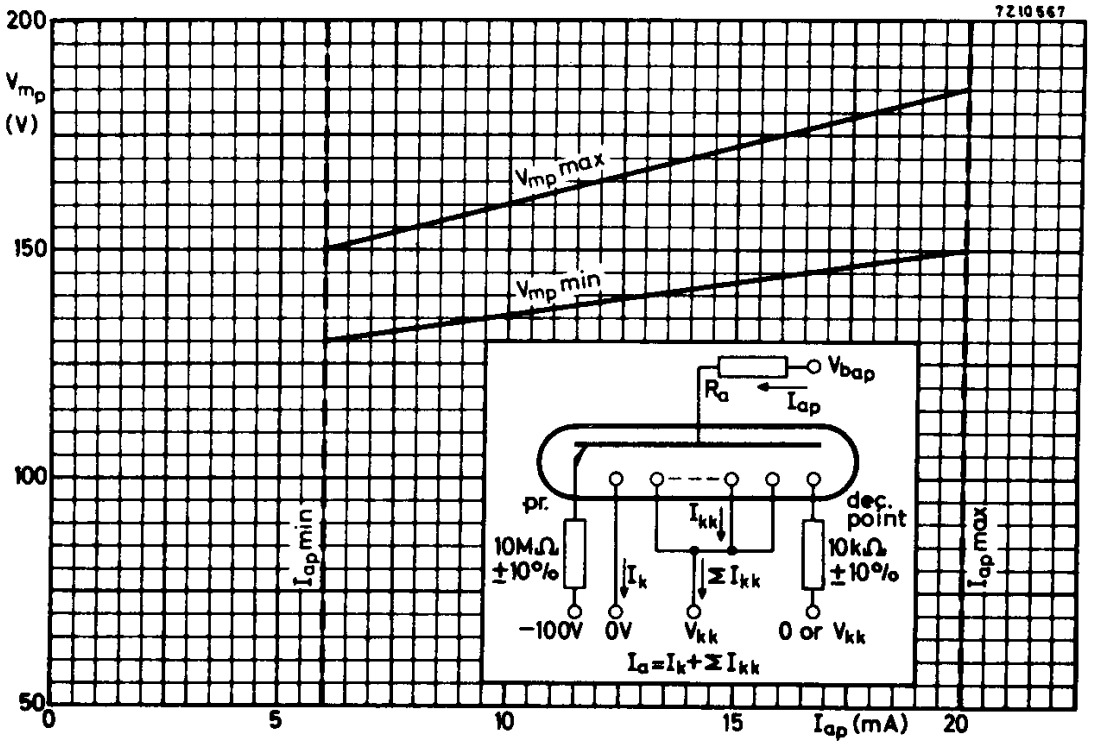
Anode voltage necessary for ignition, pulse	V_{ap}	min.	170	V
Anode current, average (T_{av} = 20 ms)	I_a	max.	2.5	mA
peak	I_{ap}	min.	6	mA
	I_{ap}	max.	20	mA
Pulse duration	T_{imp}	min.	10	μs
Cathode selecting voltage	V_{kk}	min.	70	V
	V_{kk}	max.	115	V
"Off" anode voltage	$V_{a"off"}$	max.	115	V
Ambient temperature	t_{amb}	min.	-50	°C [4]
	t_{amb}	max.	+70	°C

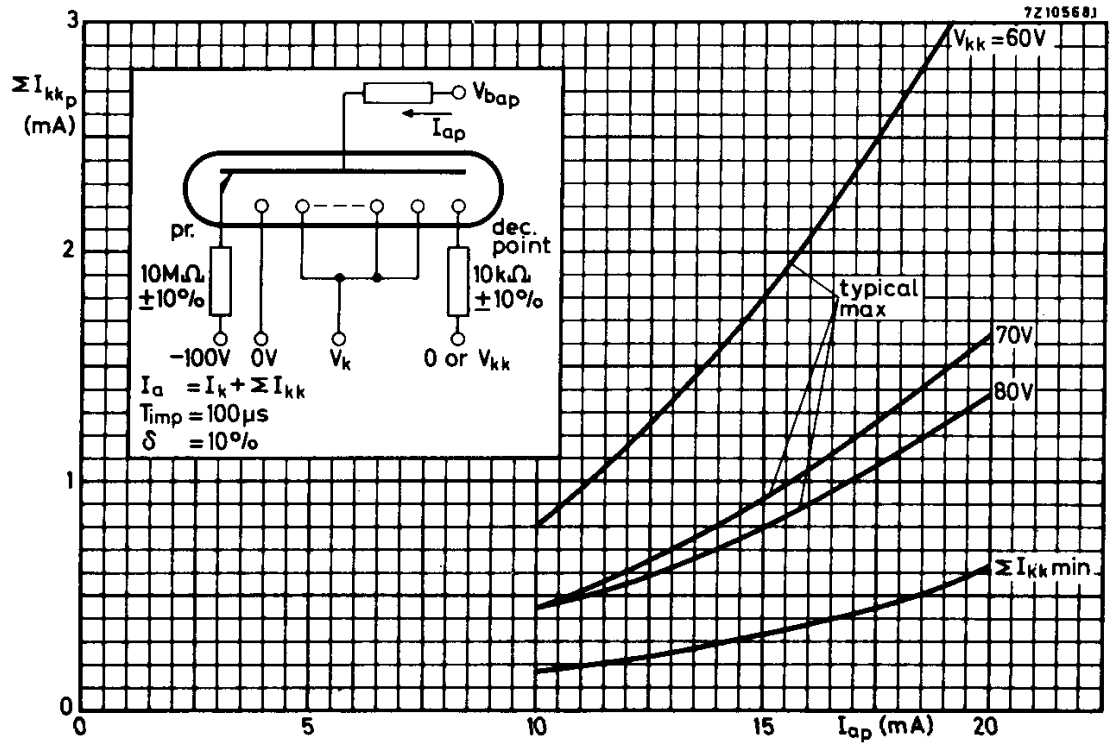
1) Pulse durations down to 10 μs are allowed provided the minimum peak anode current is not less than 10 mA.

2) Lower values of V_{kk} result in increasing background glow impairing readability.

3) The decimal point cathode may not be operated without extra current limiting resistor unless a numeral cathode is operated simultaneously.

4) Bulb temperatures below 10 °C result in a reduced life expectancy and changes in characteristics.
For equipment to be used over a wide temperature range, "constant current operation" is recommended.


7Z10567
200
V_{mp} (V)
150
100
50
V_{mp} max
V_{mp} min
I_{ap} min
I_{ap} max
V_{bap}
R_a
I_{ap}
pr.
dec. point
I_{kk}
10MΩ ±10%
10kΩ ±10%
I_k
ΣI_{kk}
−100V
0V
V_{kk}
0 or V_{kk}
$I_a = I_k + \Sigma I_{kk}$
0
5
10
15
I_{ap} (mA)
20


7Z10568J
3
ΣI_{kk_p} (mA)
2
1
0
V_{kk} =60V
typical max
70V
80V
ΣI_{kk} min
V_{bap}
I_{ap}
pr.
dec. point
10MΩ ±10%
10kΩ ±10%
−100V
0V
V_k
0 or V_{kk}
$I_a = I_k + \Sigma I_{kk}$
T_{imp} = 100µs
δ = 10%
0
5
10
15
I_{ap} (mA)
20

INDICATOR TUBE

Long-life cold-cathode ten-digit indicator tube for side viewing.
The tube is designed for time-sharing (pulse) applications.

QUICK REFERENCE DATA				
Numeral height		approx.	14	mm
Numerals	0 1 2 3 4 5 6 7 8 9			
Decimal point	to the left of the numerals			
Supply voltage	V_{b_a}(pulse)	min.	170	V
Anode current, peak	I_{a_p}	min.	6	mA
	I_{a_p}	max.	20	mA
average	I_a	max.	2.5	mA

GENERAL

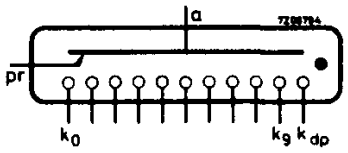
The numerals are 14 mm high and appear on the same base line allowing in-line read-out. The ZM1005R is provided with a red contrast filter. The ZM1005 is identical to the ZM1005R but has no filter.

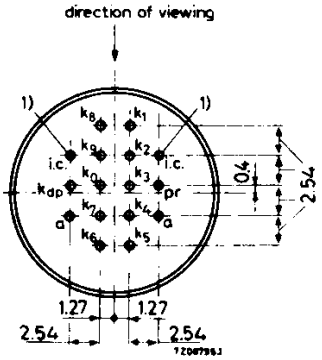
PRINCIPLE OF OPERATION

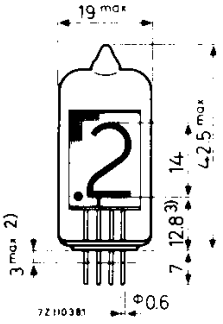
The tube contains ten cathodes in the form of ten numerals and one in the form of a decimal point; a primer, and one common anode. By applying a suitable voltage between the anode and one of the cathodes the corresponding numeral or the decimal point will be covered by a red neon glow.
The primer allows ionization without delay in strobe type or blanking applications.

DIMENSIONS AND CONNECTIONS

Dimensions in mm







The deviation of the axes of the pins with respect to the true geometrical position cover an area of 0.3 mm diameter. The pin configuration is compatible with the reference grid for printed wiring according to IEC Publication 97 (0.1 in).

Mounting position: any

Soldering

The pins may be dip-soldered at a solder temperature of max. 240 °C for maximum 10 seconds up to a point 3 mm from the seals.

Natural frequency

The natural frequencies of the numeral cathodes lie within the range from 300 Hz to 800 Hz.

ACCESSORIES

55701 Printed-wiring mounting board (19 mm x 100 mm) on which the ZM1005 can be soldered; afterwards the combination can be mounted on a vertical printed-wiring board carrying, e.g., the drive circuit. Can also be used with the snap-fit tube holder 55703.

55702 Tube socket (for 0.1 in grid). Phenolic. Tinned contacts.

55703 Snap-fit tube holder.

55704 Set of one left-hand and one right-hand end piece to complete the snap-fit indicator tube assembly.

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1) i.c. pins max. length 2.8 mm
2) Not tinned
3) Standard deviation 0.13 mm

CHARACTERISTICS AND OPERATING CONDITIONS

Ignition voltage	V_{ign}	max.	170	V
Maintaining voltage	V_m	see page 4		
Anode current, average (T_{av} = max. 20 ms)	I_a	max.	2.5	mA
peak	I_{ap}	min.	6	mA
(with or without decimal point)	I_{ap}	max.	20	mA
Pulse duration	T_{imp}	min.	50	μs [1]
Cathode selecting voltage (see also page 4)	V_{kk}	min.	70	V [2]
	V_{kk}	max.	115	V
Cathode resistor, decimal point	R_{dp}		10	k$\Omega\pm$10% [3]
Primer resistor (anode to primer supply voltage min. 170 V)	R_{pr}		10	M$\Omega\pm$10%
Extinguishing voltage	V_{ext}	min.	118	V

LIFE EXPECTANCY at I_a = 2 mA

The life expectancy is dependent on the instantaneous and average values of anode current:

sequentially changing the display from one digit to the others every 100 h or less, I_{ap} = 10 mA	100 000	h
I_{ap} = 20 mA	20 000	h
Mean time between failures	min. 200 000	h

LIMITING VALUES (Absolute max. rating system)

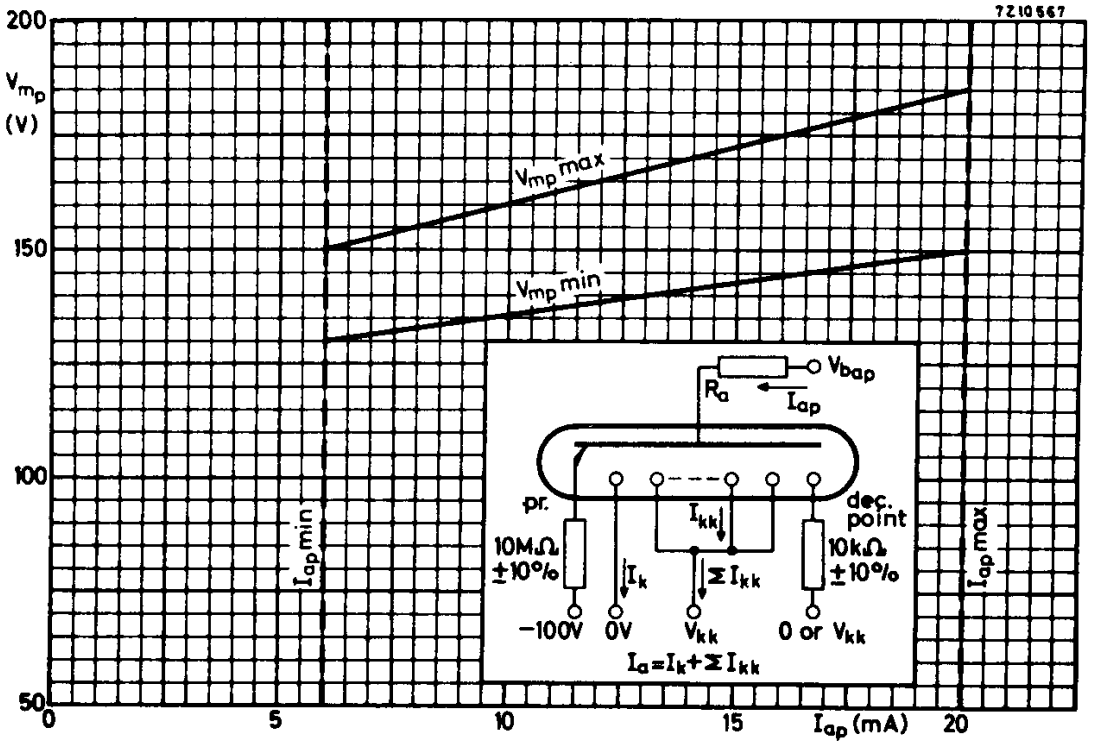
Anode voltage necessary for ignition, pulse	V_{ap}	min.	170	V
Anode current, average (T_{av} = 20 ms)	I_a	max.	2.5	mA
peak	I_{ap}	min.	6	mA
	I_{ap}	max.	20	mA
Pulse duration	T_{imp}	min.	10	μs
Cathode selecting voltage	V_{kk}	min.	70	V
	V_{kk}	max.	115	V
"Off" anode voltage	$V_{a"off"}$	max.	115	V
Ambient temperature	t_{amb}	min.	-50	°C [4]
	t_{amb}	max.	+70	°C

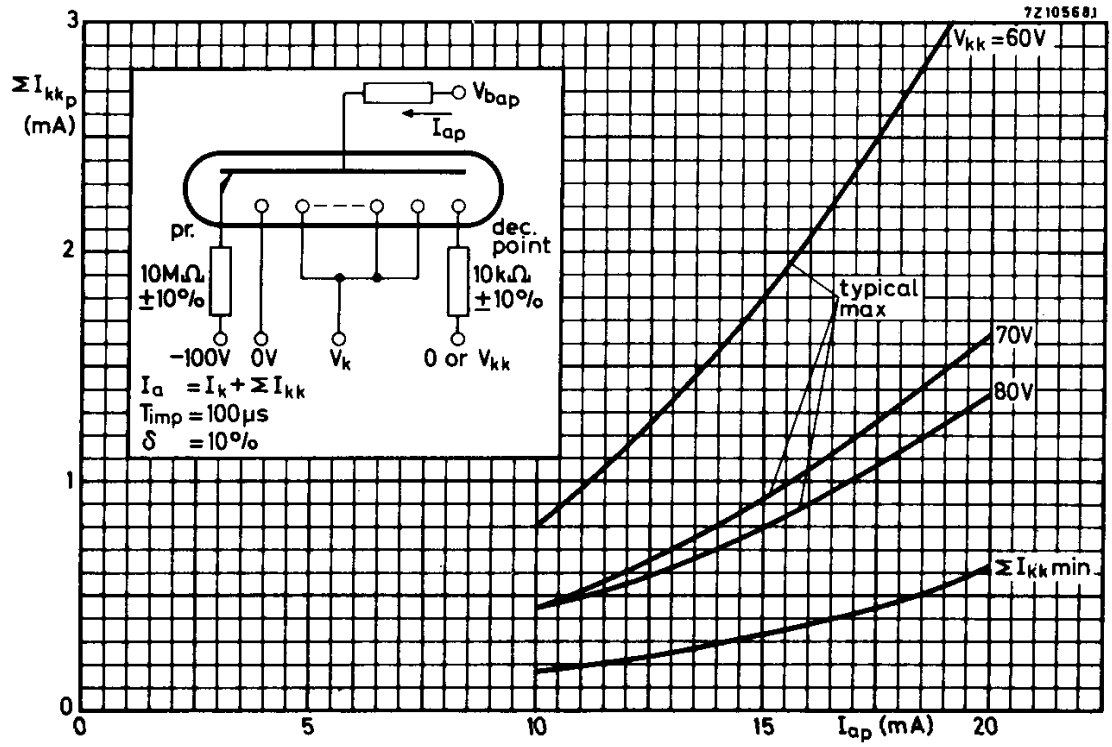
1) Pulse durations down to 10 μs are allowed provided the minimum peak anode current is not less than 10 mA.

2) Lower values of V_{kk} result in increasing background glow impairing readability.

3) The decimal point cathode may not be operated without extra current limiting resistor unless a numeral cathode is operated simultaneously.

4) Bulb temperatures below 10 °C result in a reduced life expectancy and changes in characteristics.
For equipment to be used over a wide temperature range, "constant current operation" is recommended.


7Z10567
200
V_{mp} (V)
150
100
50
V_{mp} max
V_{mp} min
I_{ap} min
I_{ap} max
V_{bap}
R_a
I_{ap}
pr.
dec. point
I_{kk}
10MΩ ±10%
10kΩ ±10%
I_k
ΣI_{kk}
−100V
0V
V_{kk}
0 or V_{kk}
$I_a = I_k + \Sigma I_{kk}$
0
5
10
15
I_{ap} (mA)
20


7Z10568J
3
ΣI_{kk_p} (mA)
2
1
0
V_{kk} =60V
typical max
70V
80V
ΣI_{kk} min
V_{bap}
I_{ap}
pr.
dec. point
10MΩ ±10%
10kΩ ±10%
−100V
0V
V_k
0 or V_{kk}
$I_a = I_k + \Sigma I_{kk}$
T_{imp} = 100µs
δ = 10%
0
5
10
15
I_{ap} (mA)
20

INDICATOR TUBE

Long life cold-cathode ten-digit indicator tube for side-viewing.

QUICK REFERENCE DATA			
Numeral height	approx.	14	mm
Numerals	0 1 2 3 4 5 6 7 8 9		
Decimal point	to the left of the numerals		
Supply voltage	V_{ba} min.	170	V
Anode current	I_a	2,5	mA

GENERAL

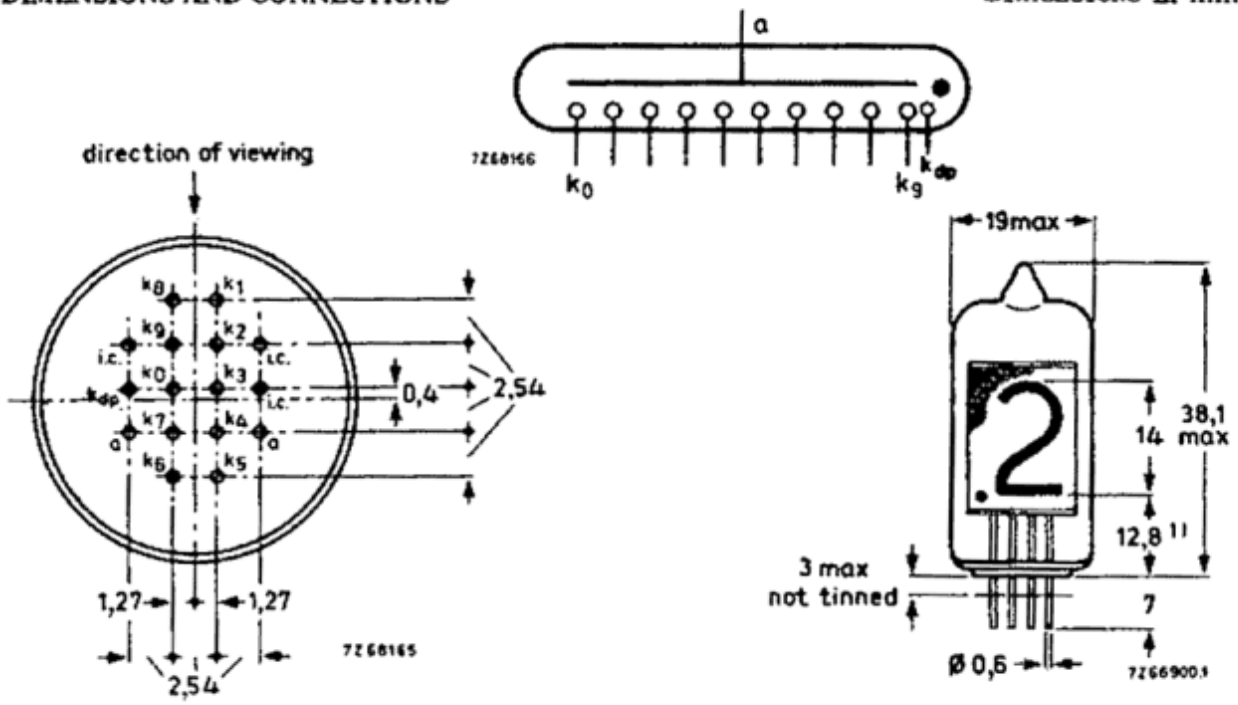
The numerals are 14 mm high and appear on the same base line allowing in-line read out.

PRINCIPLE OF OPERATION

By applying a suitable voltage between the anode and one of the cathodes the corresponding numeral or the decimal point will be covered by a red neon glow.

DIMENSIONS AND CONNECTIONS

Dimensions in mm



1) Standard deviation 0,13 mm

INDICATOR TUBE

Long life cold-cathode nine digit indicator tube for side-viewing.

QUICK REFERENCE DATA				
Numeral height		approx.	14	mm
Numerals		0 1 2 3 4 5 6 7 8		
Supply voltage	V'_{ba}	min.	170	V
Anode current	I_a		2,5	mA

GENERAL

The numerals are 14 mm high and appear on the same base line allowing in-line read out.

PRINCIPLE OF OPERATION

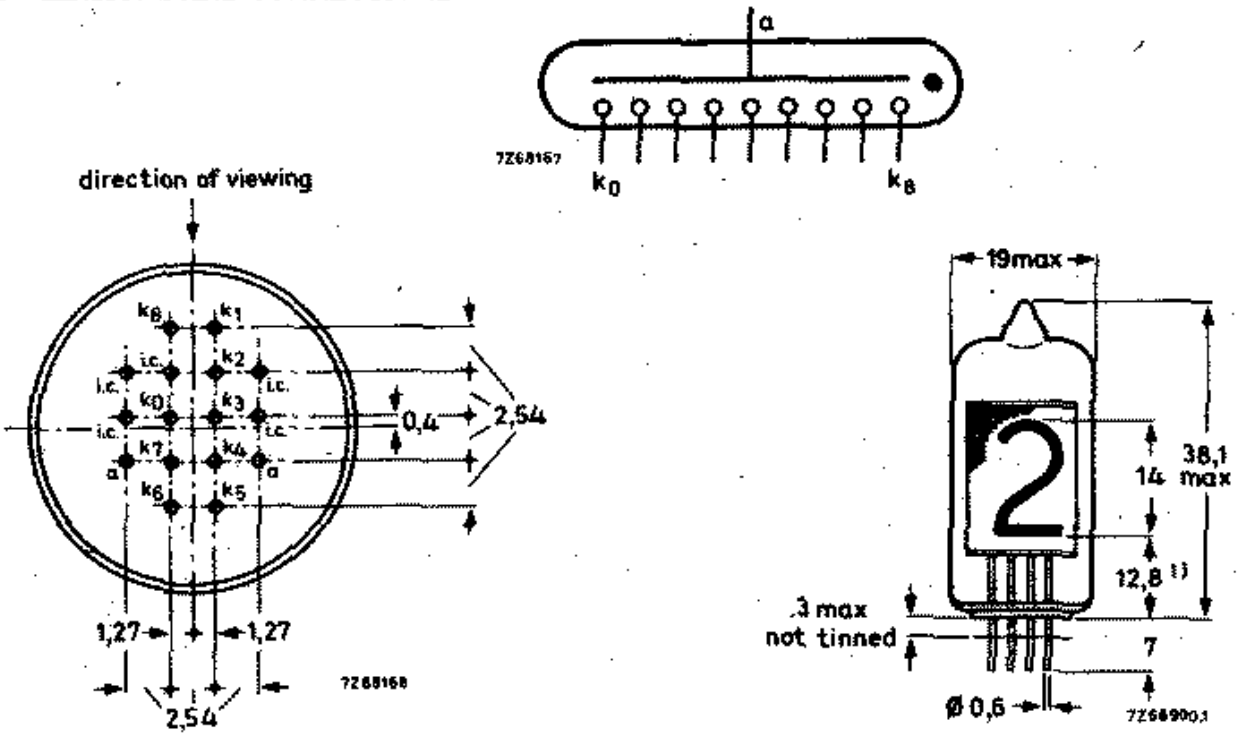
By applying a suitable voltage between the anode and one of the cathodes the corresponding numeral will be covered by a red neon glow.

CHARACTERISTICS, OPERATING CONDITIONS AND LIMITING VALUES

These are essentially the same as of type ZM1010.

DIMENSIONS AND CONNECTIONS

Dimensions in mm



1) Standard deviation 0,13 mm

INDICATOR TUBE

Long life cold-cathode eight-digit indicator tube for side-viewing.

QUICK REFERENCE DATA				
Numeral height		approx.	14	mm
Numerals		1 2 3 4 5 6 7 8		
Supply voltage	V_{ba}	min.	170	V
Anode current	I_a		2,5	mA

GENERAL

The numerals are 14 mm high and appear on the same base line allowing in-line read out.

PRINCIPLE OF OPERATION

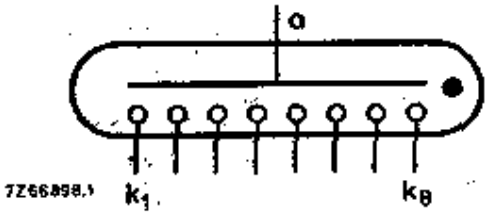
By applying a suitable voltage between the anode and one of the cathodes the corresponding numeral will be covered by a red neon glow.

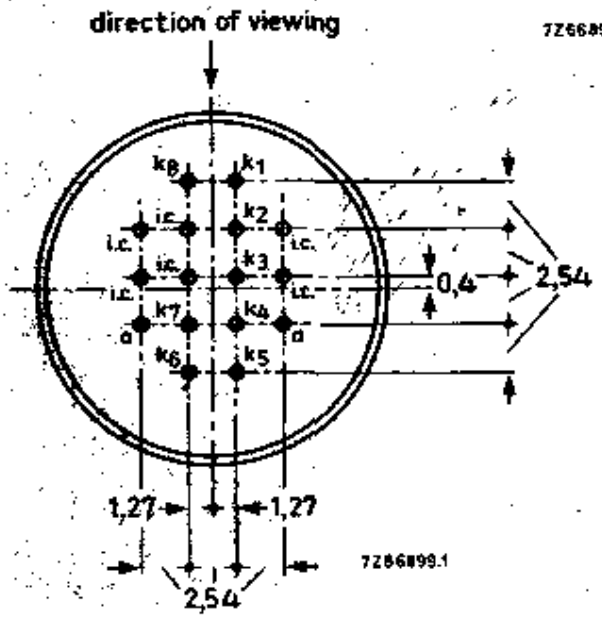
CHARACTERISTICS, OPERATING CONDITIONS AND LIMITING VALUES

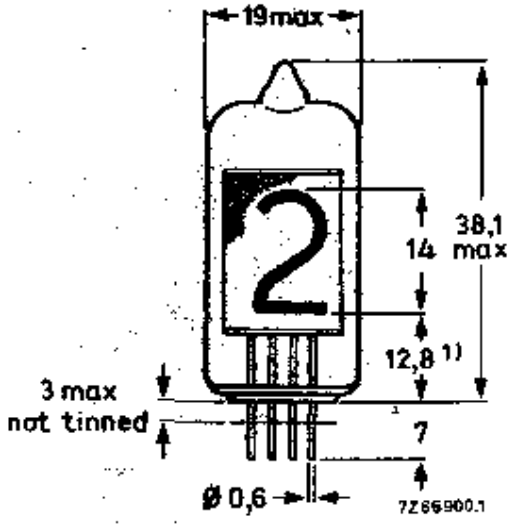
These are essentially the same as of type ZM1010.

DIMENSIONS AND CONNECTIONS

Dimensions in mm







1) Standard deviation 0,13 mm

INDICATOR TUBE

Long life cold-cathode seven-digit indicator tube for side-viewing.

QUICK REFERENCE DATA				
Numeral height		approx.	14	mm
Numerals		0 1 2 3 4 5 6		
Supply voltage	V_{ba}	min.	170	V
Anode current	I_a		2,5	mA

GENERAL

The numerals are 14 mm high and appear on the same base line allowing in-line read out.

PRINCIPLE OF OPERATION

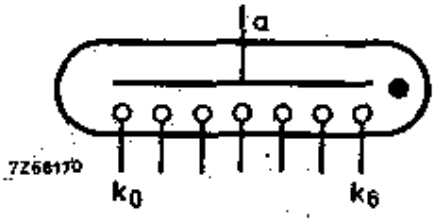
By applying a suitable voltage between the anode and one of the cathodes the corresponding numeral will be covered by a red neon glow.

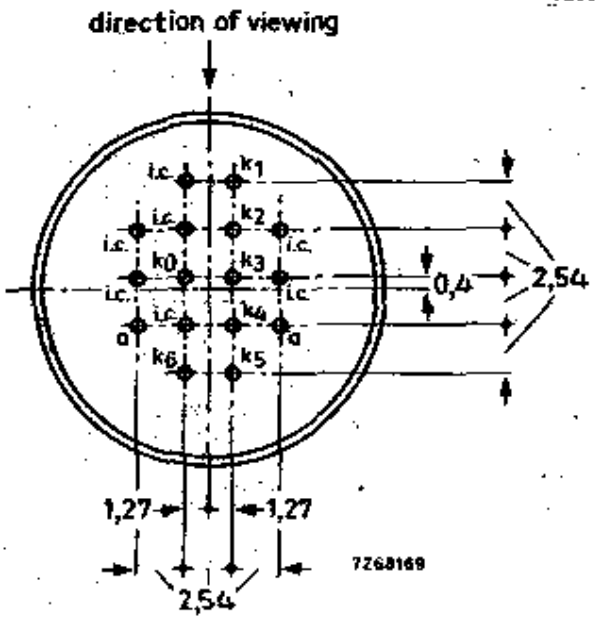
CHARACTERISTICS, OPERATING CONDITIONS AND LIMITING VALUES

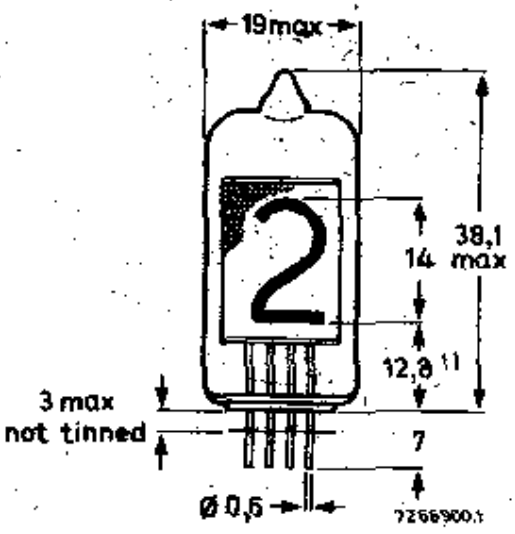
These are essentially the same as of type ZM1010.

DIMENSIONS AND CONNECTIONS

Dimensions in mm







[1]) Standard deviation 0,13 mm.

INDICATOR TUBE

Long life cold-cathode six-digit indicator tube for side-viewing

QUICK REFERENCE DATA				
Numeral height		approx.	14	mm
Numerals		1 2 3 4 5 6		
Supply voltage	V_{ba}	min.	170	V
Anode current	I_a		2,5	mA

GENERAL

The numerals are 14 mm high and appear on the same base line allowing in-line read out.

PRINCIPLE OF OPERATION

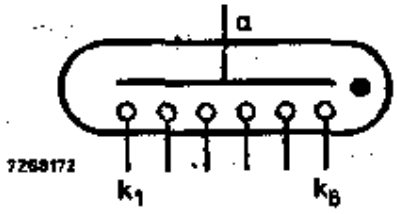
By applying a suitable voltage between the anode and one of the cathodes the corresponding numeral will be covered by a red neon glow.

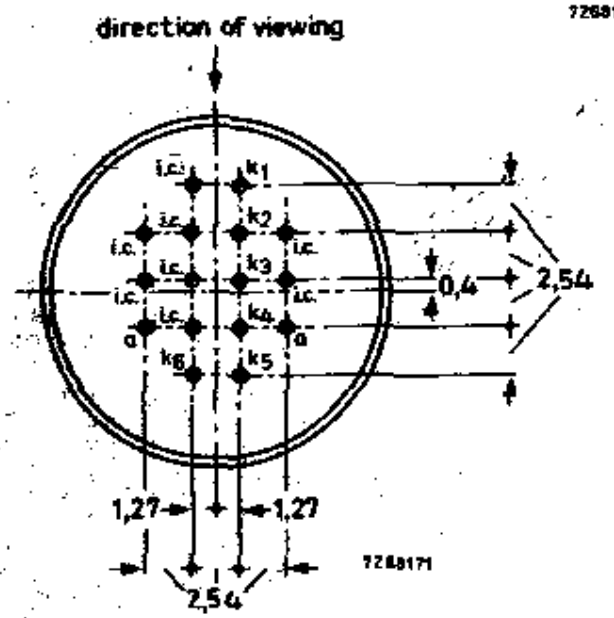
CHARACTERISTICS, OPERATING CONDITIONS AND LIMITING VALUES

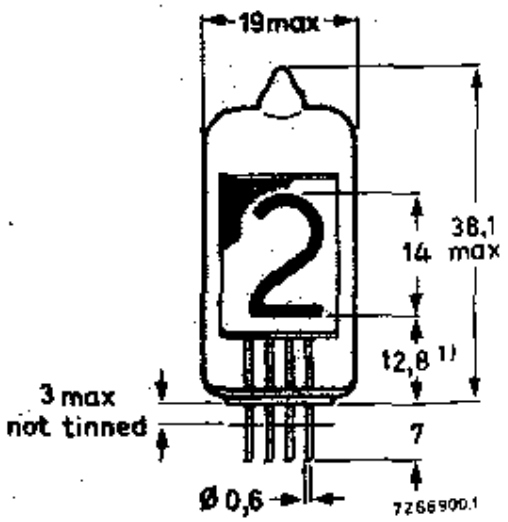
These are essentially the same as of type ZM1010.

DIMENSIONS AND CONNECTIONS

Dimensions in mm







1) Standard deviation 0,13 mm

INDICATOR TUBE

Long life cold cathode ten digit numeral indicator tube for top viewing.

QUICK REFERENCE DATA			
Numeral height		15	mm
Numerals	1 2 3 4 5 6 7 8 9 0		
Supply voltage	min.	170	V
Anode current		2	mA

GENERAL

The numerals are 15 mm high and appear on the same base line allowing in-line read out. The ZM1020 is provided with a red contrast filter.

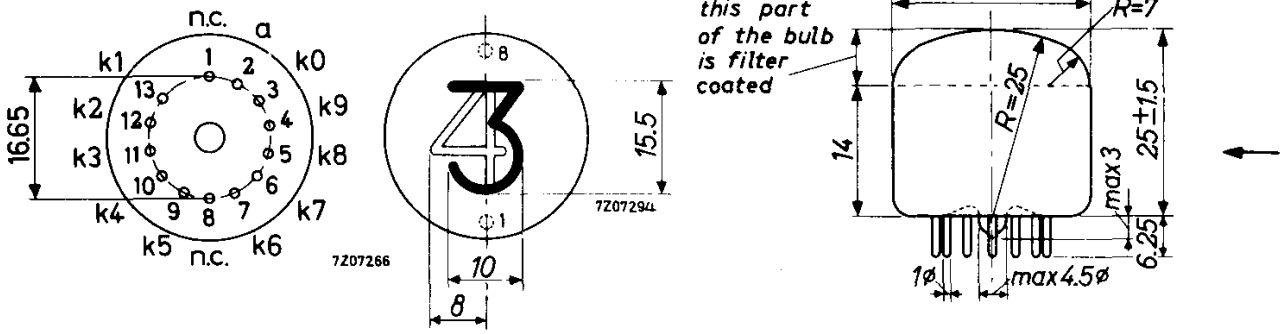
PRINCIPLE OF OPERATION

The tube contains ten cathodes in the form of ten figures and one common anode. By applying a suitable voltage between the anode and one of the ten cathodes the corresponding numeral will be covered by a red neon glow.

DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: B13B



Mounting position: any

The numerals are viewed through the dome of the envelope. The numerals will appear upright (within 1.5°) when the tube is mounted with the line through pins 1 and 8 vertical, pin 8 being uppermost.

Accessories

Socket	type	2422 505 00001 or 2422 505 00002

CHARACTERISTICS AND OPERATING CONDITIONS

(Valid over life and full temperature range)

Ignition voltage	V_{ign}	max. 170 V
Maintaining voltage	V_m	see sheet 4
Anode current for coverage,		
averaged during any conduction period	I_a	min. 1 mA
Anode current,		
average (T_{av} = max. 20 ms)	I_a	max. 3 mA
peak	I_{ap}	max. 6 mA
Cathode selecting voltage	V_{kk}	see sheet 5
Extinguishing voltage	V_{ext}	min. 118 V

Typical operation [1])

D.C. operation

See sheets 5 and 6

A.C. operation

See sheets 5 and 7

[1]) Bulb temperatures below 10 °C result in a reduced life expectancy and changes in characteristics (see sheet 4).
In designing equipment to be used over a wide temperature range the use of "constant current operation" (high supply voltage with a high anode series resistor) is recommended.

LIFE EXPECTANCY AND RELIABILITY (at I_a = 2 mA)

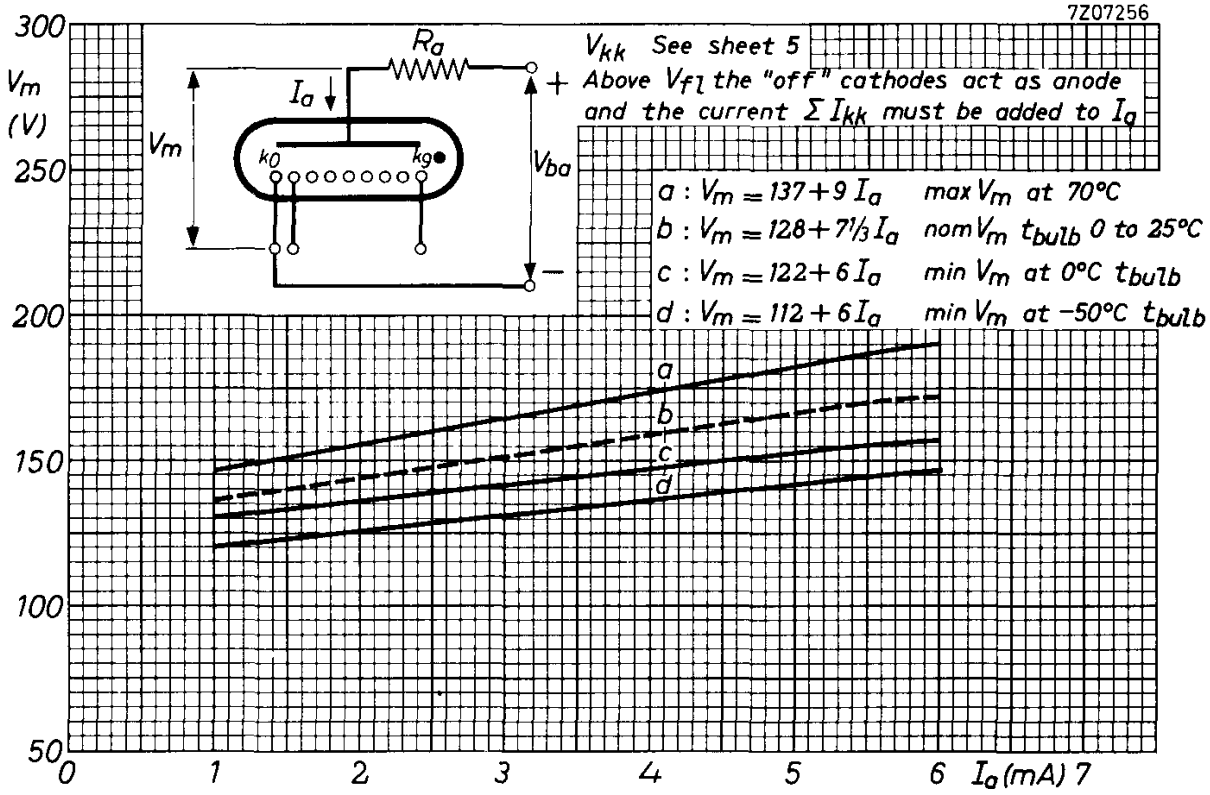
Sequentially changing the display from one digit to the others every 1000 h. or less	100.000 h

The reliability has been assessed in a life test programme totalling 4.5×10^6 tube hours. The longest test period was 50.000 hrs on 47 tubes. No failures have been found. The Mean Time between Failures is better than 10^6 hrs which corresponds with a failure rate of less than 0.1 % per 1000 hrs at a confidence level of 95 %.

LIMITING VALUES (Absolute max. rating system)

Anode voltage necessary for ignition	V_a	min. 170	V
Anode current, D.C.	I_a	min. 1	mA
rectified A.C. and pulse	I_{a_p}	min. 2	mA
average (T_{av} = max. 20 ms)	I_a	max. 3	mA
peak	I_{a_p}	max. 10	mA [1]
Cathode selecting voltage	V_{kk}	see lines N and W on sheet 5	
Bias voltage between anode and "off" cathodes (see sheet 5)	V_{bias}	max.	$V_{floating}$
Ambient temperature	t_{amb}	min. -50 max. +70	°C °C

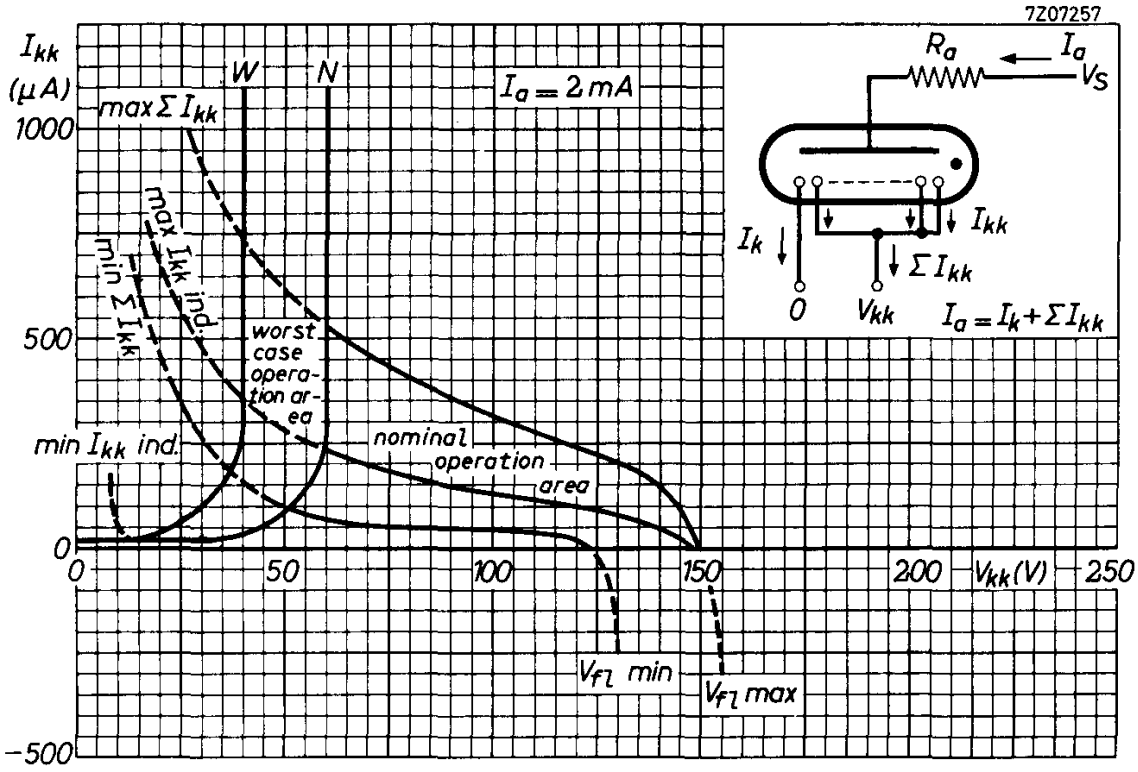
[1]) Above I_a = 6 mA the connecting wires and eyelets may be covered by the glow.


7Z07256
300
V_m (V)
250
200
150
100
50
0
1
2
3
4
5
6
7
I_a (mA)
R_a
I_a
V_m
V_{ba}
k0
kg
+
−
V_{kk} See sheet 5
Above V_{f1} the "off" cathodes act as anode and the current ΣI_{kk} must be added to I_a
a : $V_m = 137 + 9\,I_a$ max V_m at 70°C
b : $V_m = 128 + 7\frac{1}{3}\,I_a$ nom V_m t_{bulb} 0 to 25°C
c : $V_m = 122 + 6\,I_a$ min V_m at 0°C t_{bulb}
d : $V_m = 112 + 6\,I_a$ min V_m at −50°C t_{bulb}
a
b
c
d

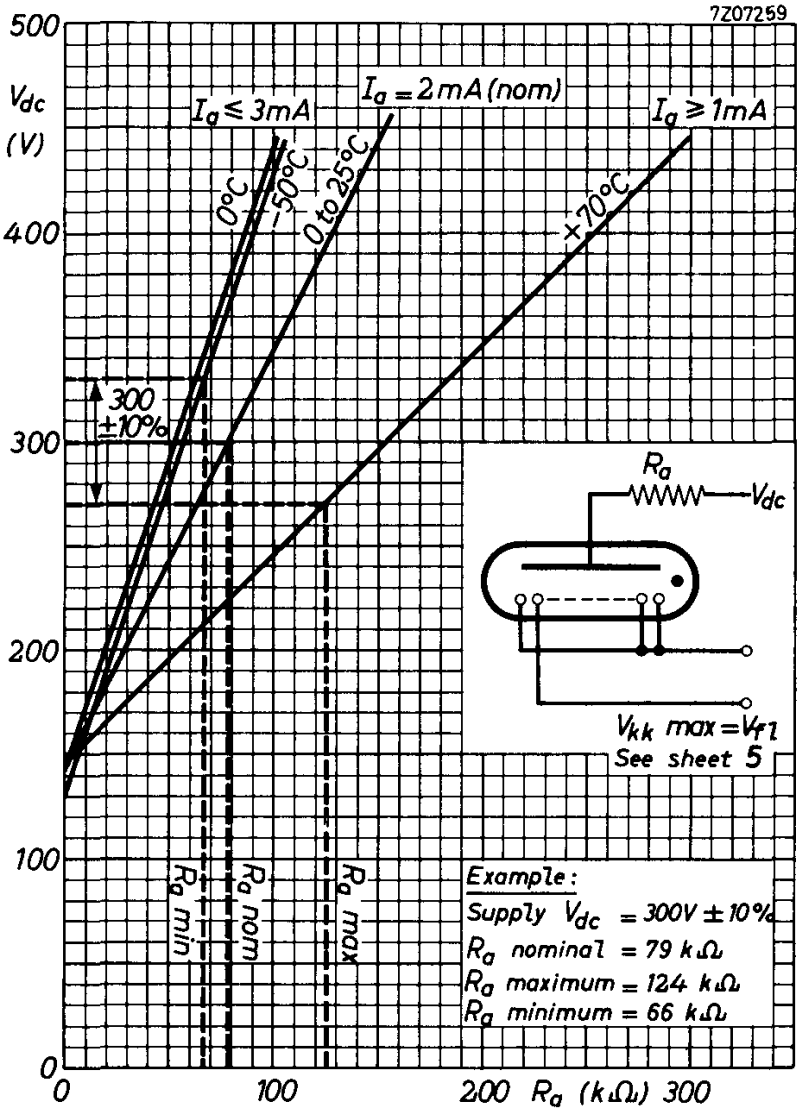
I_{kk} individual and ΣI_{kk} versus cathode selecting voltage V_{kk} at I_a = 2 mA.
I_{kk} and ΣI_{kk} are proportional to anode current in the range V_{kk} = 0 to 100 V.

The range of V_{fl} (I_{kk} = 0) shifts to the right/left at increasing/decreasing anode current (8 V/mA).

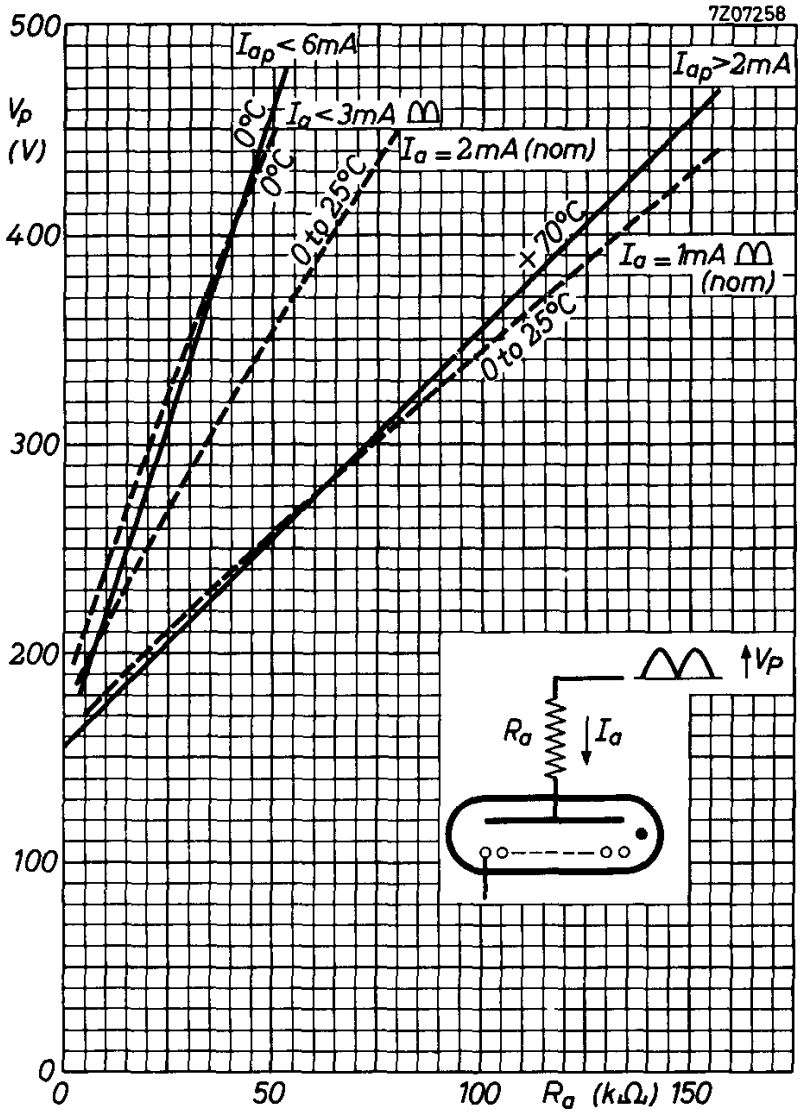
The curves are valid for instantaneous and for average values of anode current.



For low cathode selecting voltages the current I_{kk} to the "off" cathodes will increase and the readability of the "on" cathode will be affected. It is therefore recommended to use a nominal operating point to the right of line N.
Under the worst operating conditions the operating point should never reach the area left of line W.



Graph denoting the relationship of D.C. anode supply voltage and required anode resistor to remain within the recommended operating region.



Graph denoting the relationship of the peak value of full-wave unsmoothed rectified A.C. anode supply voltage and the required anode resistor to remain within the recommended operating area.

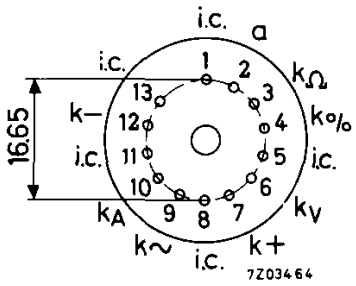
INDICATOR TUBE

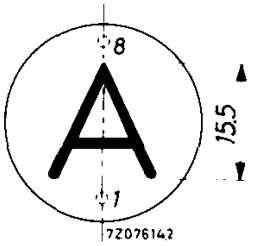
The type ZM1023 is electrically identical with type ZM1021 but has no filter coating.
The use of a separate blue absorbing e.g. circular polarized amber filter is recommended.

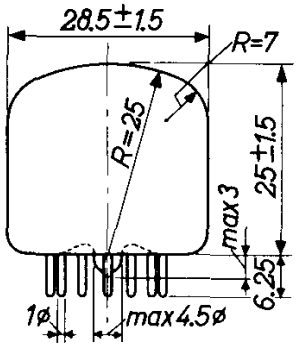
DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: B13B







PHILIPS

Data handbook

Electronic components and materials

ZM1023

page	sheet	date
1	1	1969.03
2	FP	2000.04.17

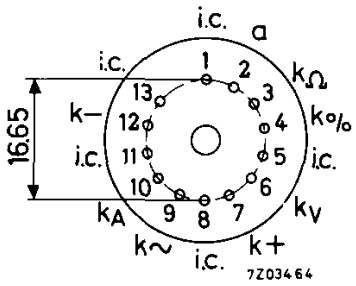
INDICATOR TUBE

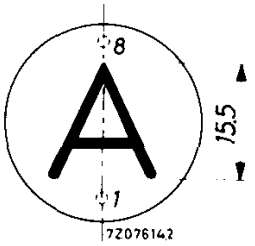
The type ZM1023 is electrically identical with type ZM1021 but has no filter coating.
The use of a separate blue absorbing e.g. circular polarized amber filter is recommended.

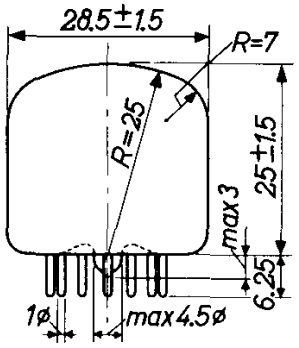
DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: B13B







PHILIPS

Data handbook

Electronic components and materials

ZM1023

page	sheet	date
1	1	1969.03
2	FP	2000.04.17

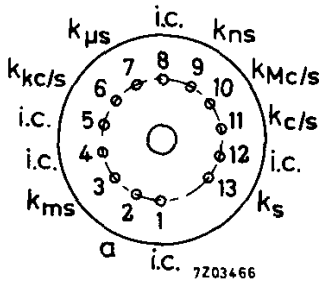
INDICATOR TUBE

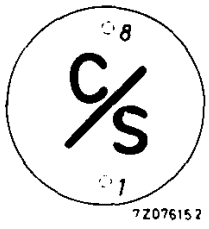
The type ZM1025 is electrically identical with type ZM1024 but has no filter coating.
The use of a separate blue absorbing, e.g. circular polarized, filter is recommended.

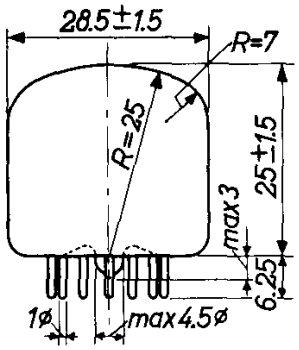
DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: B13B







PHILIPS

Data handbook

Electronic components and materials

ZM1025

page	sheet	date
1	1	1969.03
2	FP	2000.04.17

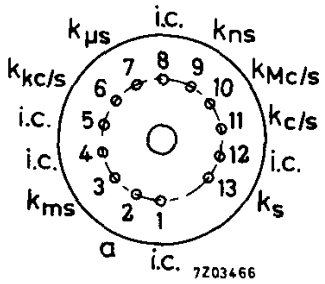
INDICATOR TUBE

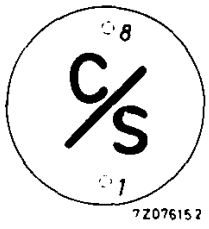
The type ZM1025 is electrically identical with type ZM1024 but has no filter coating.
The use of a separate blue absorbing, e.g. circular polarized, filter is recommended.

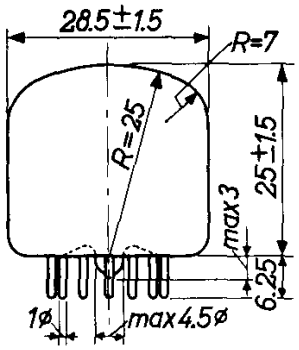
DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: B13B







PHILIPS

Data handbook

Electronic components and materials

ZM1025

page	sheet	date
1	1	1969.03
2	FP	2000.04.17

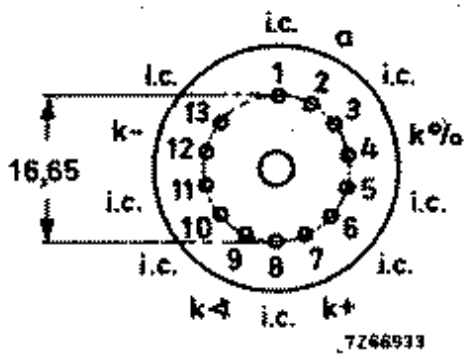
INDICATOR TUBE

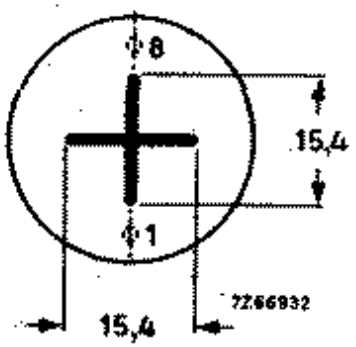
Cold cathode sign indicator tube.
The use of a separate blue absorbing, e.g. circular polarized, amber filter is recommended.

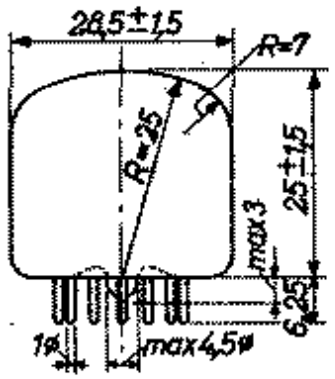
QUICK REFERENCE DATA		
Sign height	15	mm
Signs	4 % + -	
Supply voltage	min. 170	V
Anode current	2	mA

DIMENSIONS AND CONNECTIONS Dimensions in mm

Base: B13B







CHARACTERISTICS, OPERATING CONDITIONS, AND LIMITING VALUES

These are essentially the same as for type ZM1020.

INDICATOR TUBE

Cold cathode gas-filled biquinary numerical indicator tube for side viewing.

QUICK REFERENCE DATA			
Numerical height		15.5	mm
Numerals		0 1 2 3 4 5 6 7 8 9	
Supply voltage	V_{ba}	> 170	V
Anode current	I_a	4	mA
Cathode selecting voltage	V_{kk}	50	V
Extinction voltage	V_{ext}	110	V
Screen supply voltage	V_{bs}	50	V
"Off" anode supply voltage	V_{ba} "off"	100	V

GENERAL

The numerals are 15.5 mm high and appear on the same base line allowing in-line read-out. The ZM1030 is provided with a red contrast filter.

PRINCIPLE OF OPERATION

A transparent screen divides the tube into two sections:

- The front section, containing the front- or "odd" anode and the cathode numerals 1-3-5-7-9.
- The rear section, containing the rear- or "even" anode and the cathode numerals 0-2-4-6-8.

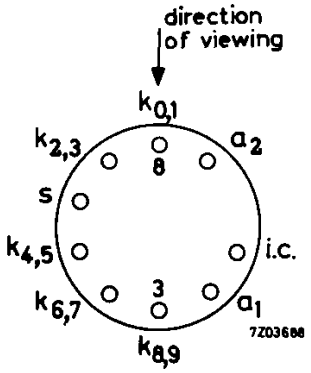
The cathodes are internally connected in pairs: 0-1, 2-3, 4-5, 6-7, 8-9.
By applying a suitable voltage between a cathode pair and the "odd" anode the "odd" cathode of that pair will be covered by a red neon glow.
Switching from one number of a pair to the other of that pair is accomplished by decreasing the voltage on the operating anode and simultaneously increasing the voltage on the other anode. [1])

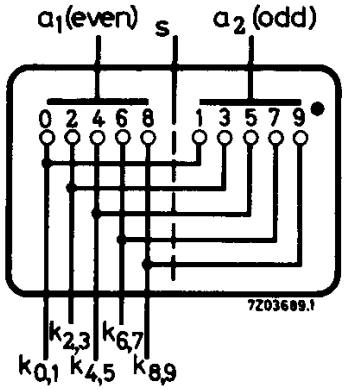
[1]) When mechanical or low speed switching is used, a "make before break" arrangement is preferred. During switching the shield connection and the shield supply should be maintained.

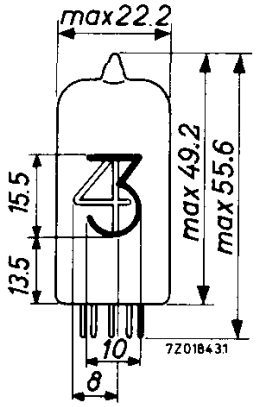
DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: Noval







Mounting position

When mounted with the base down the viewing direction will coincide with the line from pin 8 throught pin 3 ($\pm 5^{o}$).

CHARACTERISTICS, RANGE VALUES AND OPERATING CONDITIONS

Reference point for all electrode voltages is the "on" cathode.
During operation no electrode should be left floating. See fig.1

Ignition voltage	V_{ign}	< 170	V
Maintaining voltage	V_m	See page 5 and 6	
Anode current,			
average during any conduction period	I_a	> 3	mA
Anode current,			
average, T_{av} = 20 ms	I_a	< 5	mA
peak, 50 to 60 pps	I_{a_p}	< 12	mA
Cathode selecting voltage [1]	V_{kk}	> 40 < 110	V [2] V
"Off" anode supply voltage	V_{ba} "off"	> 85 < 115	V V
Screen voltage	V_s	See page 8	
Extinction voltage	V_{ext}	> 110	V

[1]) The cathode selecting voltage is the voltage difference V_{kk} used for discrimination between the "off" cathodes and the "on" cathode.

[2]) At low values of V_{kk}, the contrast of the display will be reduced due to glow on adjacent numerals. This will not affect the life of the tube.

Operating conditions

D.C. operation	V_{ba} R_a	200 15	220 20	250 27	300 39	V kΩ
A.C. operation half wave rectified 50 to 60 c/s	V_{ba} R_a	170 10	220 18	250 24	300 33	V kΩ
full wave rectified 100 to 120 c/s	V_{ba} R_a	170 15	220 27	250 33	300 47	V kΩ

LIFE EXPECTANCY at I_a = 4 mA

Sequentially changing the display from one digit to another every 500 hours or less — 50 000 hours

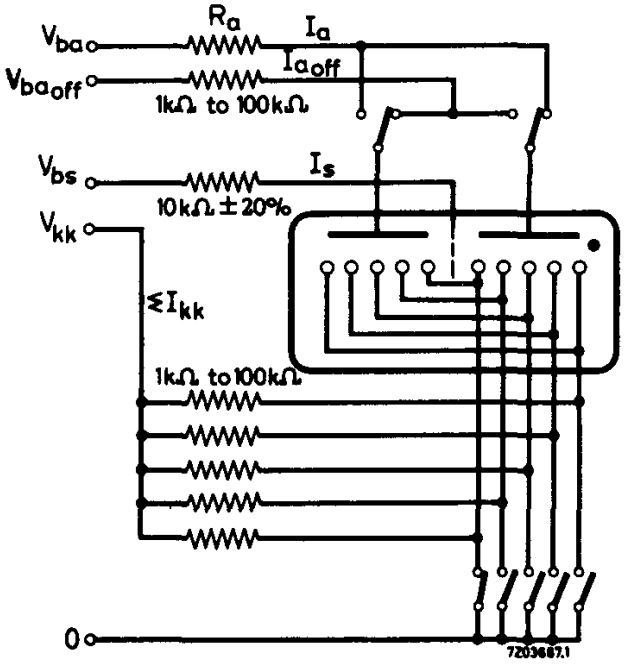


Fig.1

LIMITING VALUES (Absolute max. rating system) See fig.1

Anode voltage necessary for ignition	V_a	min. 170 V	4)
Anode current,			
average during any conduction period	I_a	min. •3 mA	
average T_{av} = max. 20 ms	I_a	max. 5 mA	
peak	I_{ap}	max. 12 mA	
Cathode selecting voltage 1)	V_{kk}	min. 40 V max. 110 V	2)
"Off" anode supply voltage	V_{ba} "off"	min. 85 V max. 115 V	
Screen voltage	V_s	min. 40 V max. 80 V	
Bulb temperature,			
storage	t_{bulb}	max. +70 °C min. −55 °C	
operation	t_{bulb}	max. +70 °C min. +15 °C	3)

REMARK $I_a = I_k + I_{kk} + I_s$

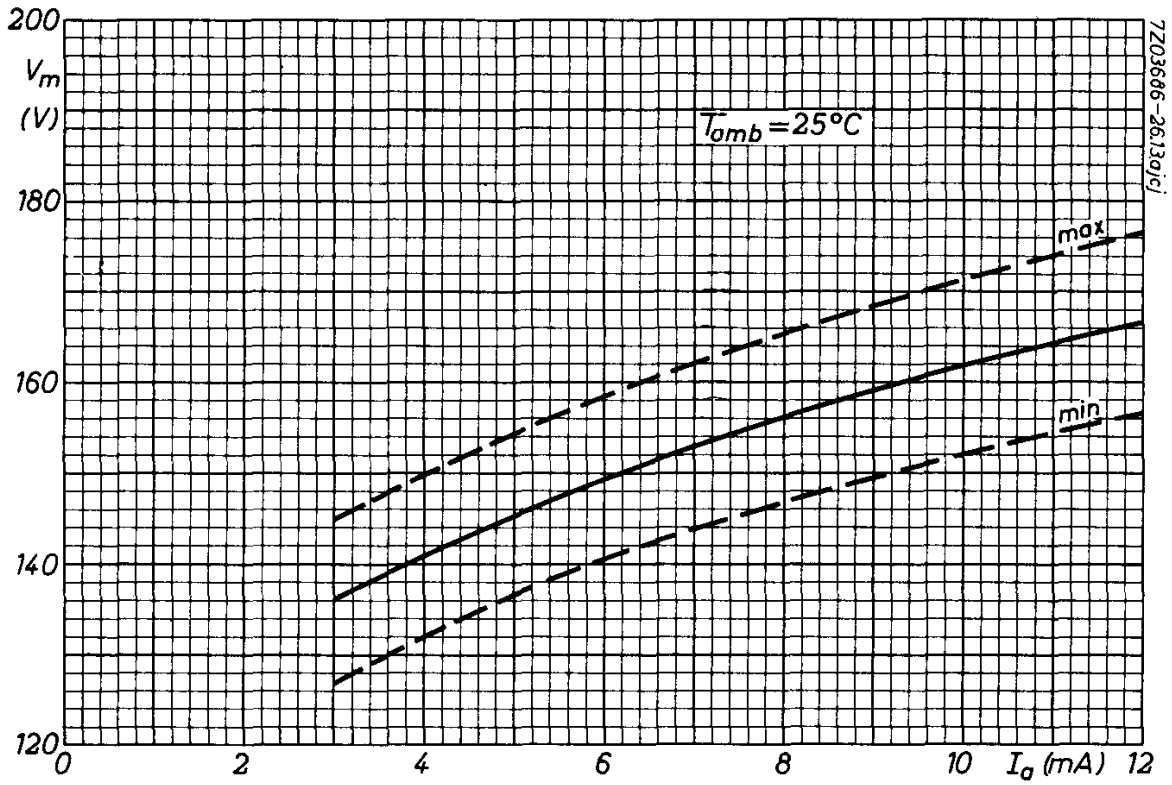
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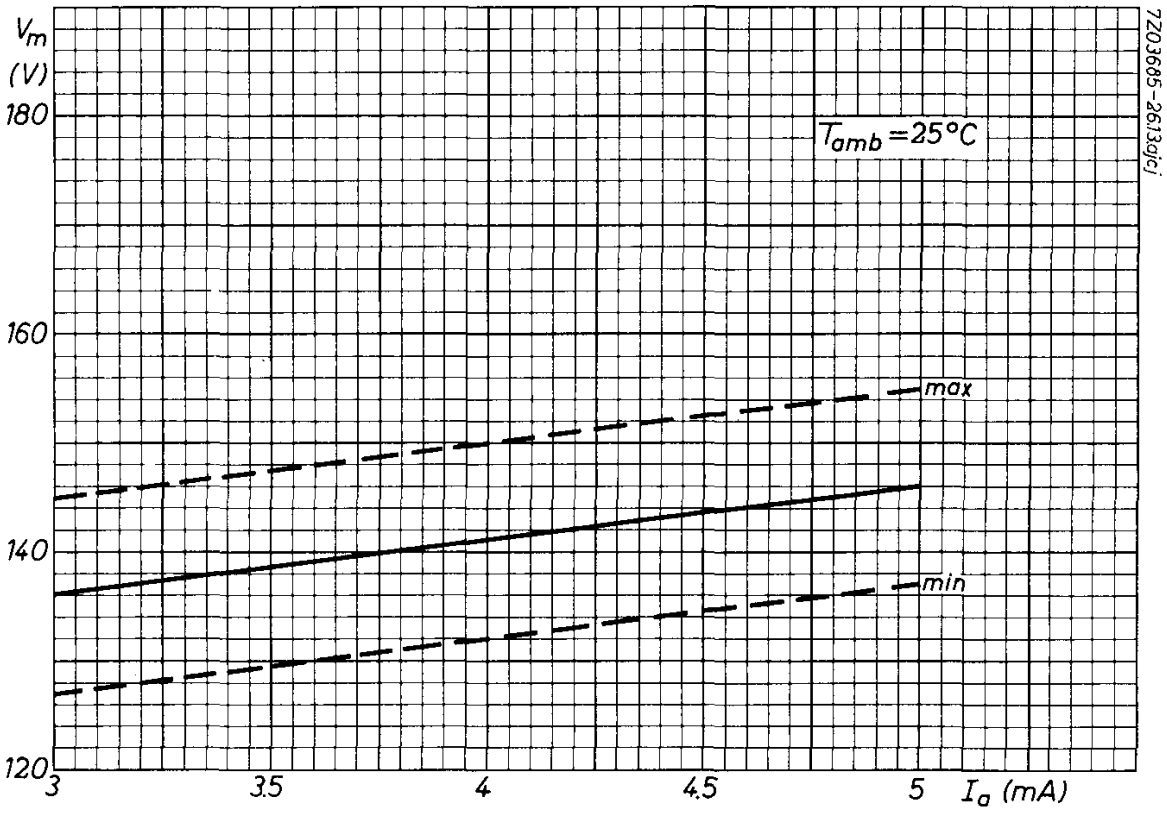
1) The cathode selecting voltage is the voltage difference V_{kk} used for discrimination between the "off" cathodes and the "on" cathode.

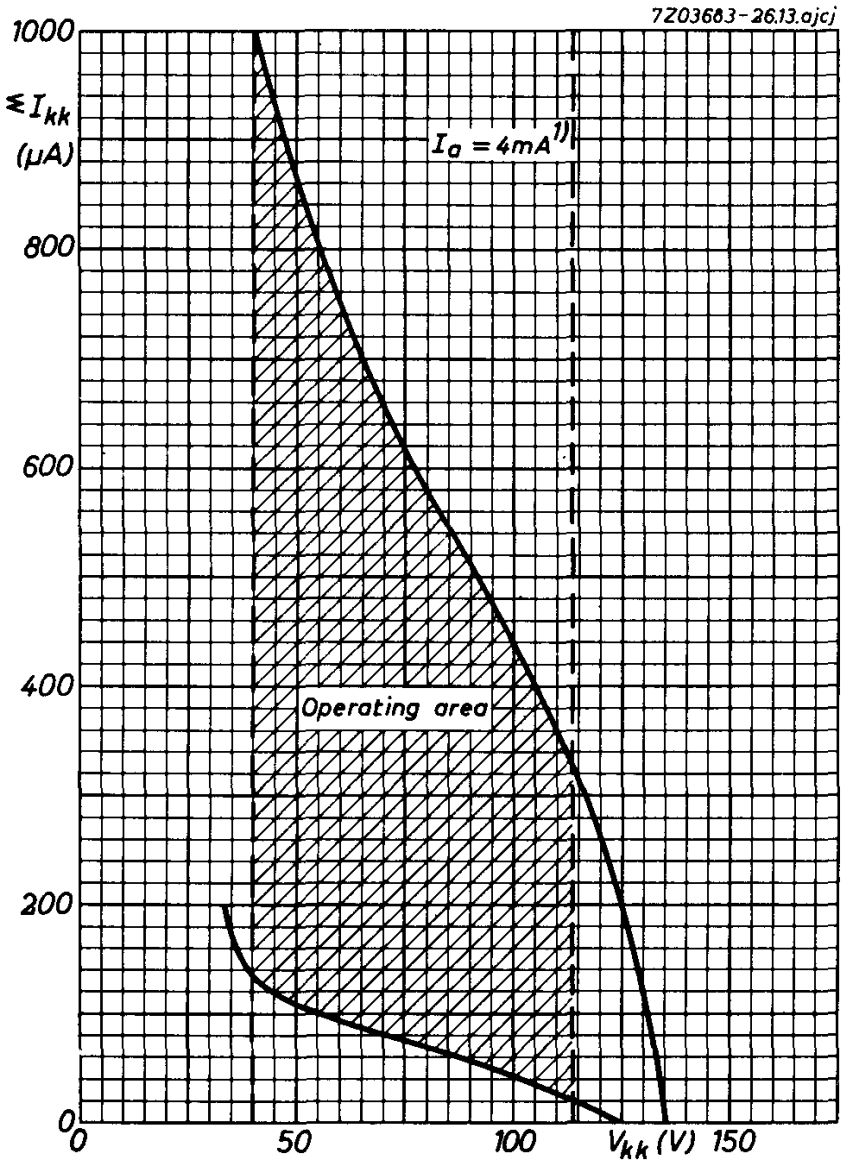
2) At low values of V_{kk}, the contrast of the display will be reduced due to glow on adjacent numerals. This will not affect the life of the tube.

3) Bulb temperatures below 15 °C result in a reduced life expectancy, larger spread and changes in characteristics. See also note 4).

4) The minimum supply voltage should be as stated. However the use of the highest voltage available with the appropriate series resistor to maintain the anode current within the specified limit is recommended. The use of "constant current operation" (high supply voltage with high resistor) is recommended when designing equipment operation over a wide temperature range.


200
V_m
(V)
180
160
140
120
0
2
4
6
8
10
I_a (mA)
12
T_{amb} = 25°C
max
min
7Z03686-26.13ajcj

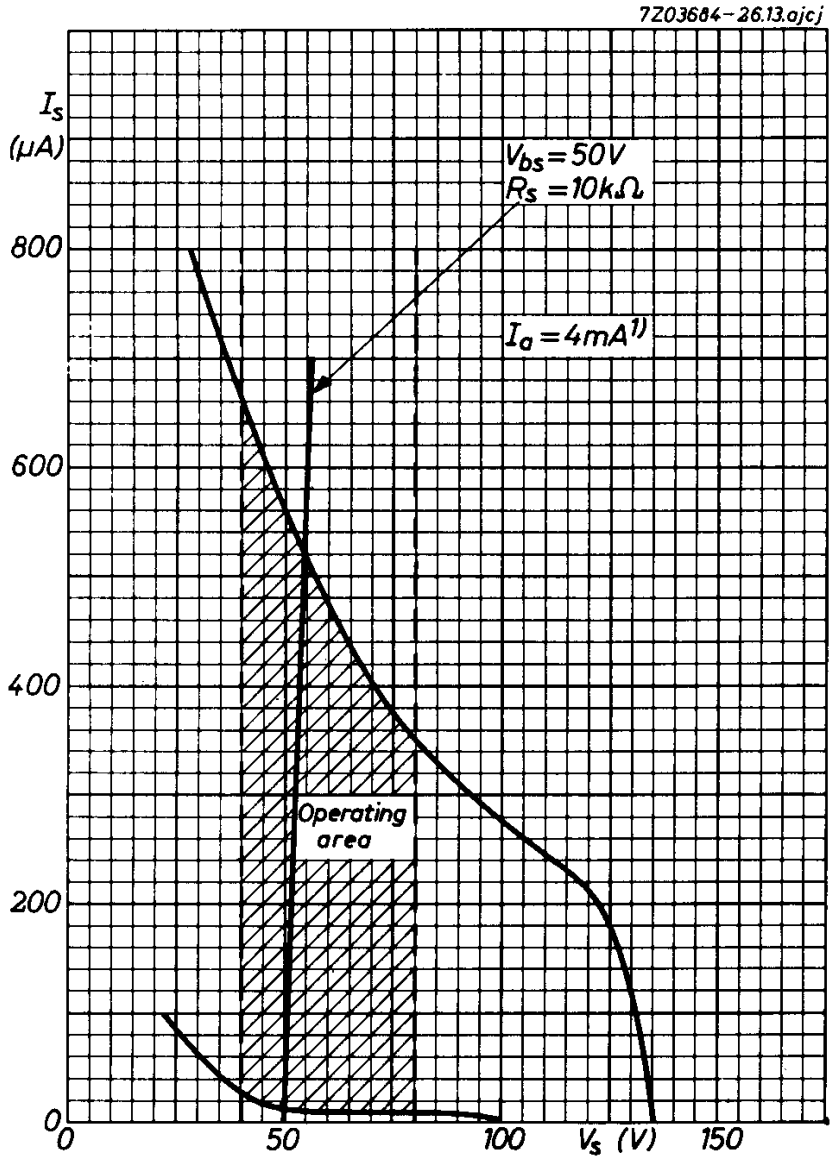

V_m
(V)
180
160
140
120
3
3.5
4
4.5
5
I_a (mA)
T_{amb} = 25°C
max
min
7Z03685-2613ajcj



The max. value of I_{kk} to any one pair of numbers will be 55% of I_{kk}.

---

1) The values of I_{kk} varies with anode current. Each mA increase or decrease of I_a results in max. 40% increase or decrease respectively of I_{kk}.



[1]) The value of I_S varies with anode current. Each mA increase or decrease of I_a results in max. 30% increase or decrease respectively of I_S.

PHILIPS

Data handbook

PHILIPS Electronic components and materials

ZM1030

page	sheet	date
1	1	1969.03
2	2	1970.04
3	3	1969.03
4	4	1969.03
5	5	1969.03
6	6	1969.03
7	7	1969.03
8	8	1969.03
9	FP	2000.04.21

INDICATOR TUBE

Cold cathode sign indicator tube for side viewing.

QUICK REFERENCE DATA			
Sign height		15	mm
Signs		+ − ~	
Supply voltage	V_{ba}	min. 170	V
Anode current	I_a	3	mA

GENERAL

This tube has the same physical dimensions as the biquinary numerical indicator tube ZM1030. The ZM1031/01 is provided with a red contrast filter.

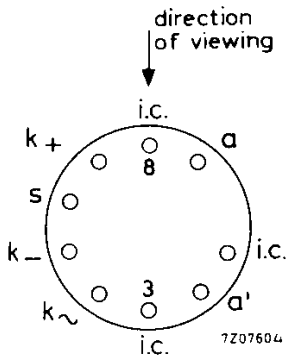
PRINCIPLE OF OPERATION

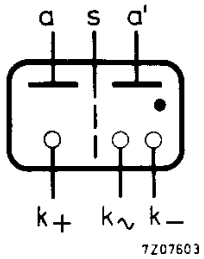
The tube contains two anodes and three cathodes in the form of the signs, and a shield. The anodes and the shield should be interconnected externally. See Fig.1, page 2.
By applying a suitable voltage between the required sign and the interconnected anodes, the sign will be covered by a red neon glow.

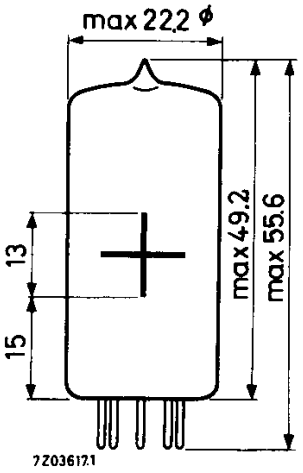
DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: Noval







Mounting position: any

The signs are viewed through the side of the envelope.

CHARACTERISTICS AND OPERATING CONDITIONS

Ignition voltage	V_{ign}	<	170	V
Maintaining voltage at I_a = 3 mA	V_m		140	V
Anode current,				
average during any conduction period for coverage	I_a	>	2	mA
→ average, T_{av} = 20 ms	I_a	<	4	mA
peak	I_{a_p}	<	10	mA
Incremental resistance	r_a		4.5	kΩ

LIMITING VALUES (Absolute max. rating system)

Anode voltage necessary for ignition	V_a	min.	170	V
Anode current,				
average during any conduction period	I_a	min.	2	mA
average (T_{av} = 20 ms)	I_a	max.	4	mA
peak	I_{a_p}	max.	10	mA
Bulb temperature	t_{bulb}	min.	-55	°C [1]
		max.	+70	°C

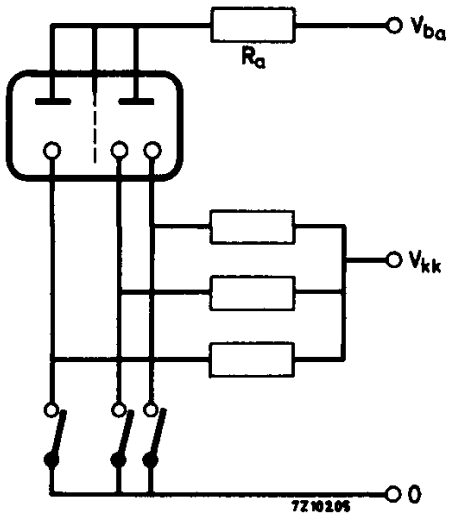


Fig.1

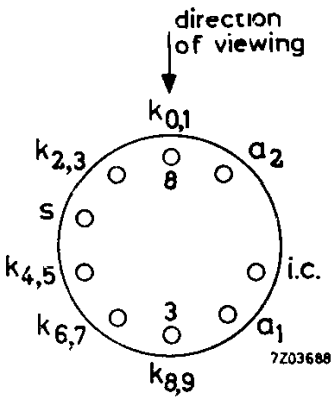
[1]) Below 10 °C the life expectancy is substantially reduced.

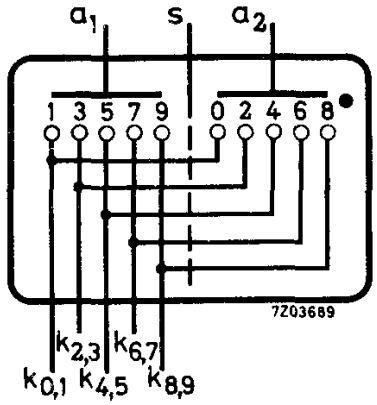
INDICATOR TUBE

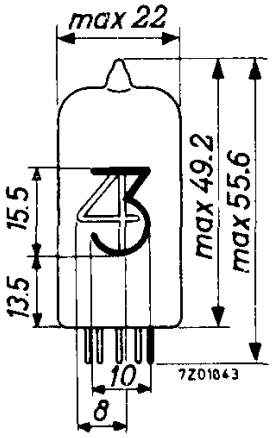
The type ZM1032 is electrically identical with type ZM1030 but has no filter coating.
The use of a separate blue absorbing e.g. circular polarized amber filter is recommended.

DIMENSIONS AND CONNECTIONS

Dimensions in mm







7Z2 5255

INDICATOR TUBE

Cold cathode ten digit numeral indicator tube for side viewing.

QUICK REFERENCE DATA			
Numeral height		30	mm
Numerals	1 2 3 4 5 6 7 8 9 0		
Supply voltage	V_{ba} min.	170	V
Cathode current	I_k	4.5	mA

GENERAL

The numerals are 30 mm high and appear on the same base line allowing in-line read out. The ZM1040 is provided with a red contrast filter.

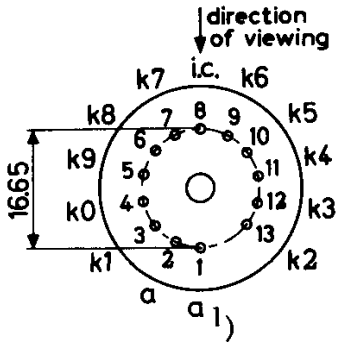
PRINCIPLE OF OPERATION

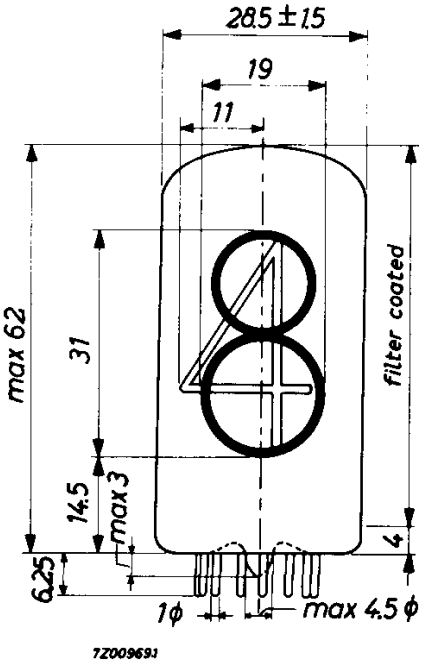
The tube contains ten cathodes in the form of ten figures and one common anode. By applying a suitable voltage between the anode and one of the ten cathodes the corresponding numeral will be covered by a red neon glow.

DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: B13B





1) Pins 1 and 2 to be interconnected externally.

Mounting position: any

The numerals are viewed through the side of the envelope. The numerals will appear upright (within 1.5°) when the tube is mounted vertically.

Accessories		
Socket	type	2422 505 00001 or 2422 505 00002

CHARACTERISTICS AND OPERATING CONDITIONS

Ignition voltage	V_{ign}	max.	170	V
Maintaining voltage	V_m	see sheet 5		
Cathode current for coverage,				
average, during any conduction period	I_k	min.	3	mA
Cathode current,				
average (T_{av} = 20 ms)	I_k	max.	6	mA
peak	I_{kp}	max.	20	mA
Cathode selecting voltage	V_{kk}	see sheet 6		
Extinguishing voltage	V_{ext}	min.	120	V

Typical operation at temperatures t_{amb} = 10 to 50 °C

D.C. operation with or without V_{kk}

(See fig.1 and 3 and sheets 5 and 6)

Anode supply voltage	V_{ba}	200	250	300	350	V
Maintaining voltage	V_m	140±10	140±10	140±10	140±10	V
Anode series resistor	R_a	15	27	39	47	kΩ
Cathode selecting voltage	V_{kk}			min.	60	V [1]

A.C. half-wave rectified operation with or without V_{kk}

(See fig.2 and 4 and sheet 5)

Secondary transformer voltage	V_{tr}	170	220	250	300	V
Anode series resistor	R_a	5.6	12	18	27	kΩ
Cathode selecting voltage	V_{kk}			min.	60	V [1]

[1] With low cathode selecting voltages the current I_{kk} to the "off" cathodes will increase and the readability of the "on" cathode will be affected. It is therefore recommended to use a voltage V_{kk} in excess off the stated minimum value.

LIFE EXPECTANCY at I_k = 4.5 mA

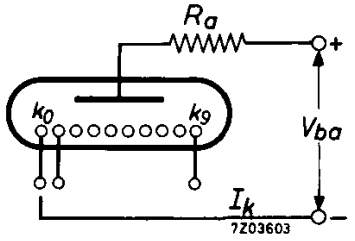
Sequentially changing the display from one digit to the others every 1000 hours or less			100 000	h

LIMITING VALUES (Absolute max. rating system)

Anode voltage necessary for ignition	V_a	min.	170	V
Cathode current,				
average during any conduction period	I_k	min.	3	mA
average (T_{av} = 20 ms)	I_k	max.	6	mA
peak	I_{k_p}	max.	20	mA
Cathode selection voltage	V_{kk}	min.	60	V
Bias voltage between anode and "off" cathodes	V_{bias}	max.	120	V
Bulb temperature	t_{bulb}	min. max.	0 +70	°C [1] °C

[1]) Bulb temperatures below 0 °C result in a reduced life expectancy and changes in characteristics (see sheet 7)
In designing equipment to be used over a wide temperature range the use of "constant current operation" (high supply voltage with a high anode series resistor) is recommended.

Fig.1



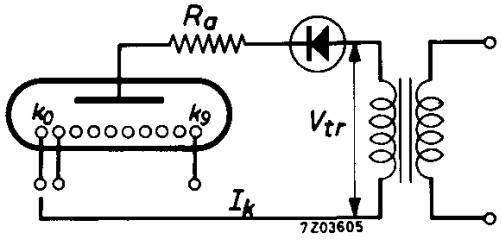


Fig.2

Fig.3

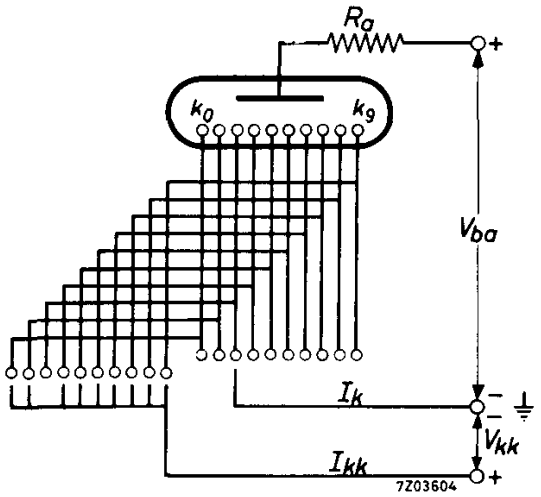
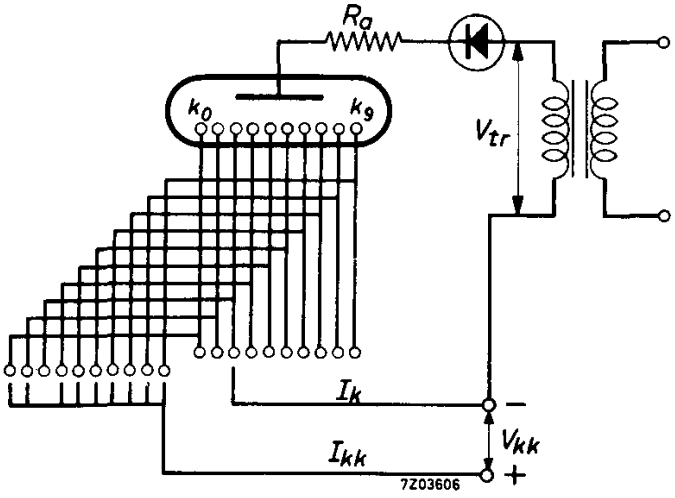
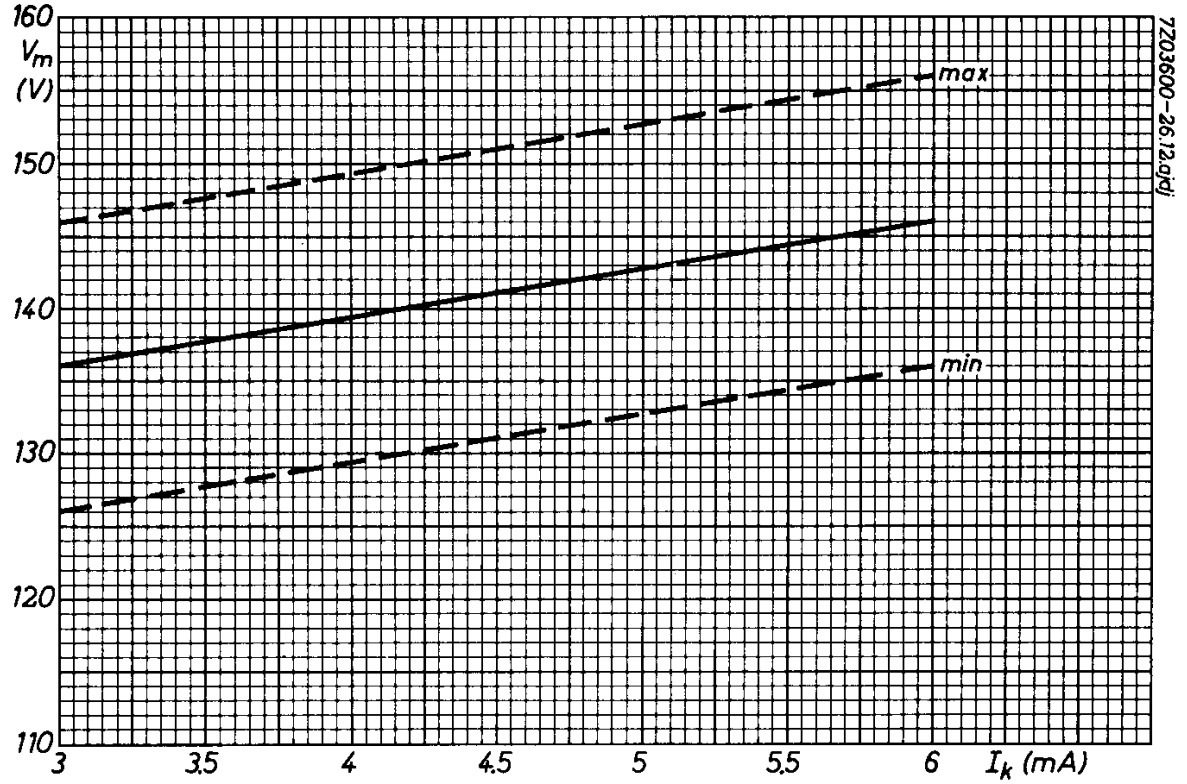
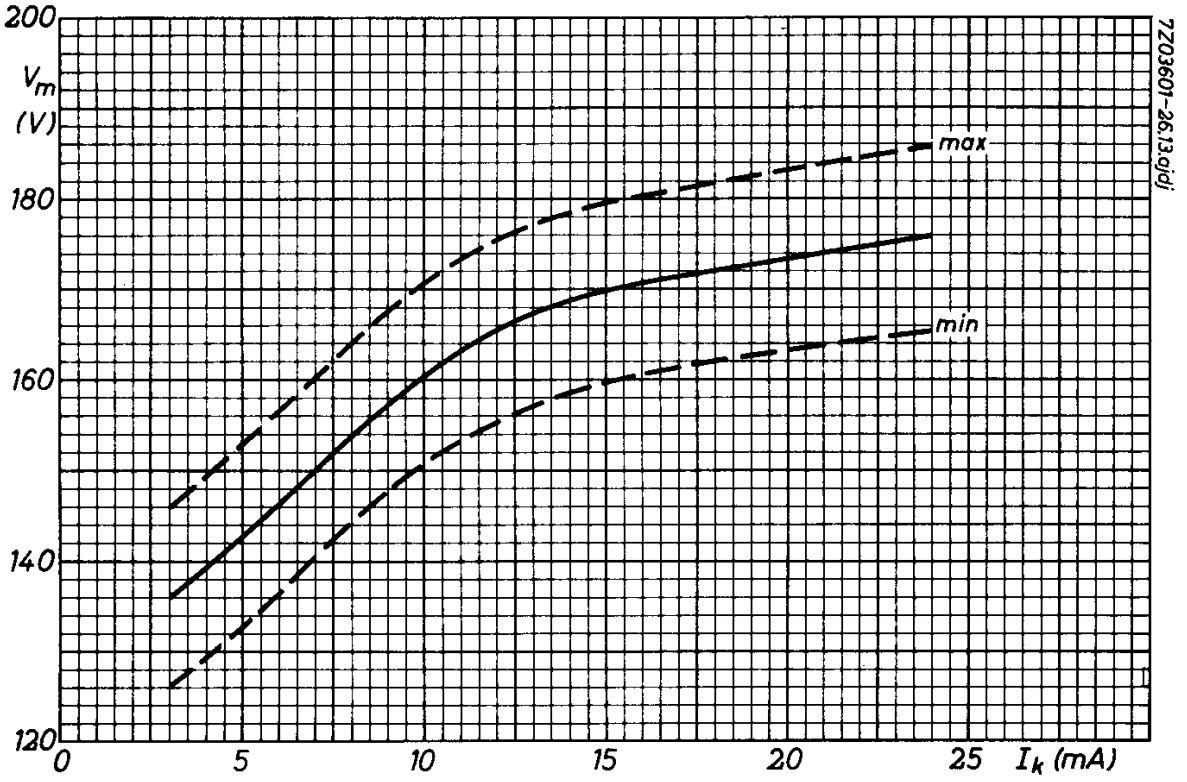
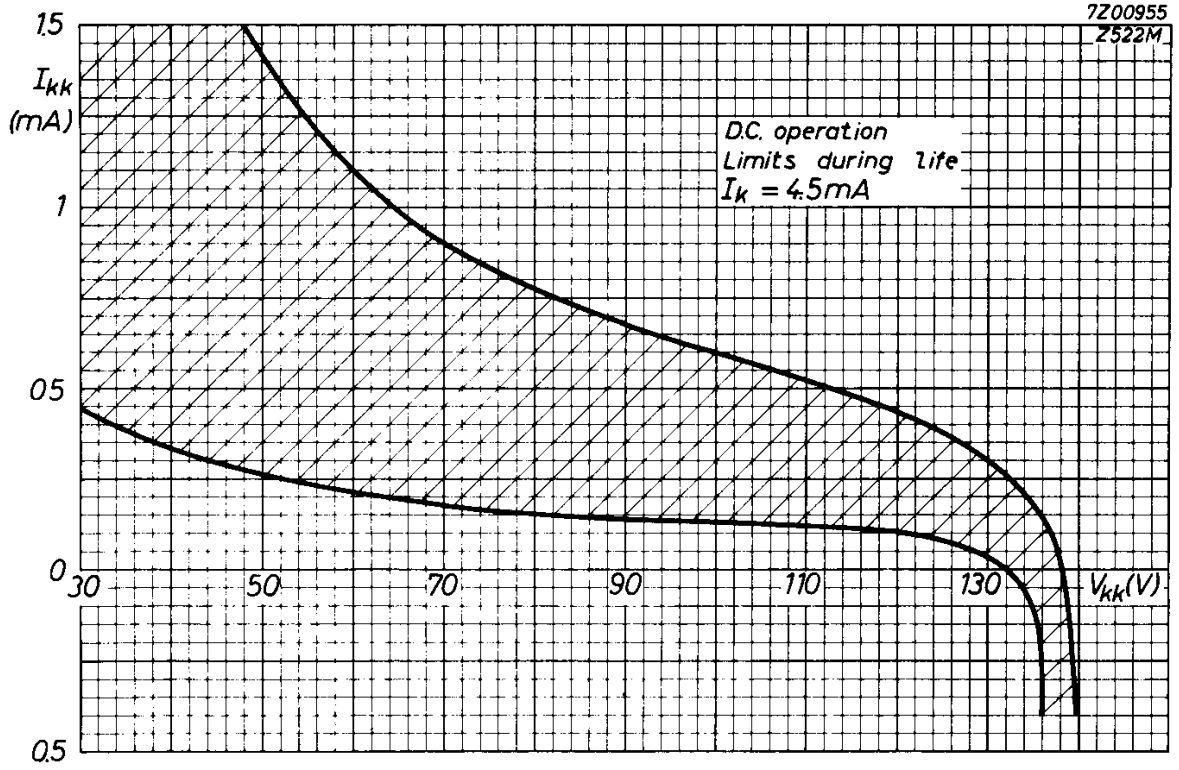


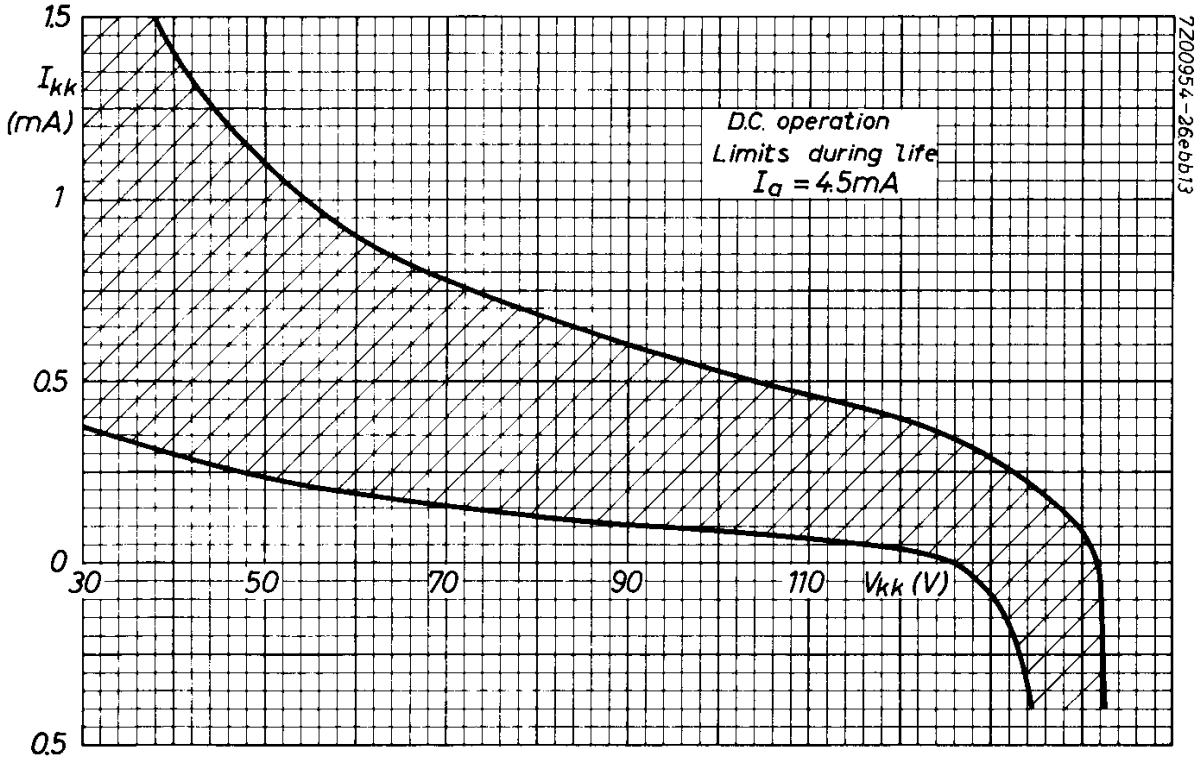
Fig.4

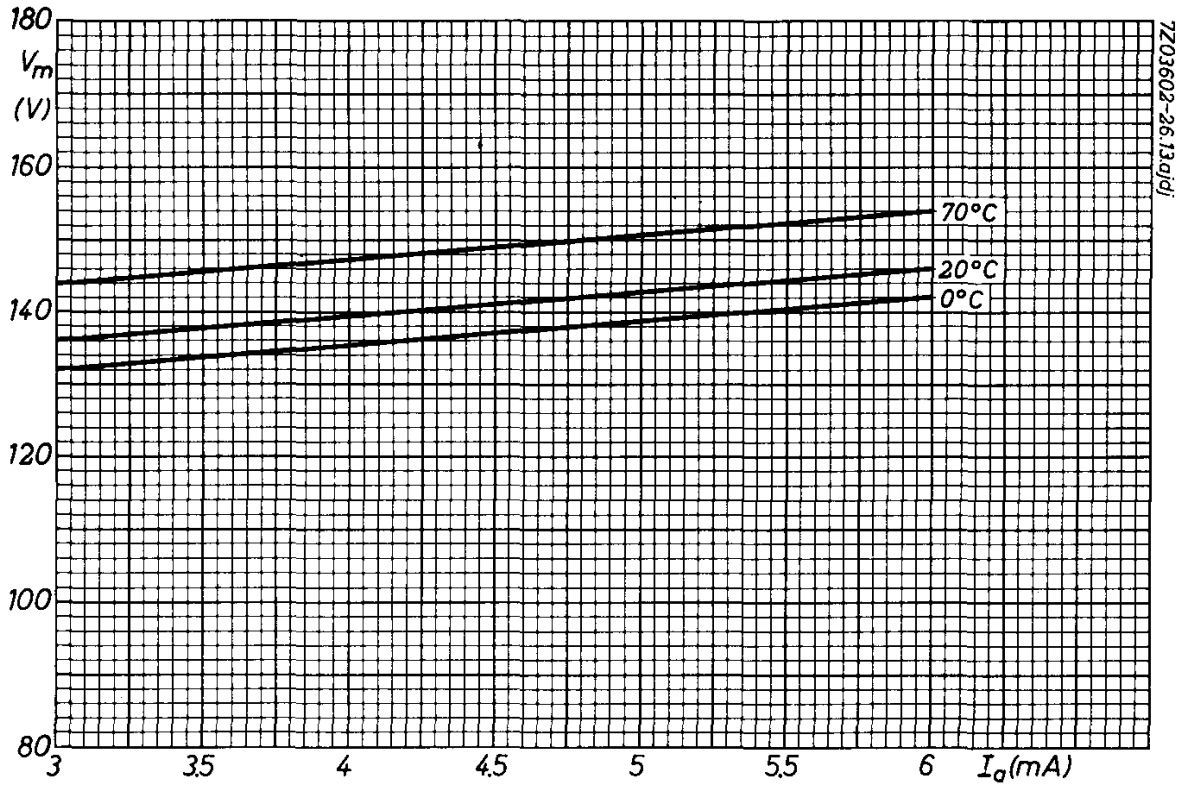



160
V_m
(V)
150
140
130
120
110
3
3.5
4
4.5
5
5.5
6
I_k (mA)
max
min
7Z03600-26.12.ajdj


200
V_m
(V)
180
160
140
120
0
5
10
15
20
25
I_k (mA)
max
min
7Z03601-26.13.ajdj


7Z00955
Z522M
1.5
I_{kk}
(mA)
1
0.5
0
0.5
30
50
70
90
110
130
V_{kk}(V)
D.C. operation
Limits during life
I_k = 4.5mA


1.5
I_{kk}
(mA)
1
0.5
0
0.5
30
50
70
90
110
V_{kk} (V)
D.C. operation
Limits during life
I_a = 4.5mA
7Z00954-26ebb13


180
V_m
(V)
160
140
120
100
80
3
3.5
4
4.5
5
5.5
6
I_a(mA)
70°C
20°C
0°C
ZZ0902-26.13.ds/j

PHILIPS

Data handbook

PHILIPS Electronic components and materials

ZM1040

page	sheet	date
1	1	1970.04
2	2	1970.04
3	3	1969.09
4	4	1969.09
5	5	1969.03
6	6	1969.03
7	7	1969.03
8	FP	2000.04.21

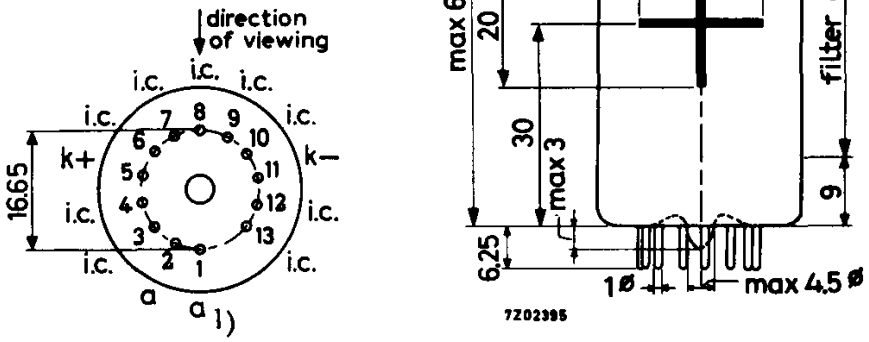
INDICATOR TUBE

Cold cathode sign indicator tube for side viewing.

QUICK REFERENCE DATA		
Sign height	20	mm
Signs	+ −	
Supply voltage	170	V
Cathode current	4.5	mA

DIMENSIONS AND CONNECTIONS Dimensions in mm

Base: B13B



GENERAL

The tube has the same physical dimensions as the ZM1040 numeral indicator tube. The ZM1041 is provided with a red contrast filter.

1) Pins 1 and 2 to be interconnected externally.

CHARACTERISTICS

Ignition voltage	V_{ign}	max. 170	V
Maintaining voltage	V_m	see sheets 3 and 4	
Extinguishing voltage	V_{ext}	min. 120	V
"Off" cathode probe current characteristic		see sheet 4	

PRINCIPLE OF OPERATION

The tube contains two cathodes, in the form of the signs + and −, and a common anode. By applying a suitable voltage between the anode and one of the cathodes the corresponding sign will be covered by a red neon glow.

ACCESSORIES

Socket 2422 505 00001, 2422 505 00002 or 2422 505 00003

MOUNTING POSITION

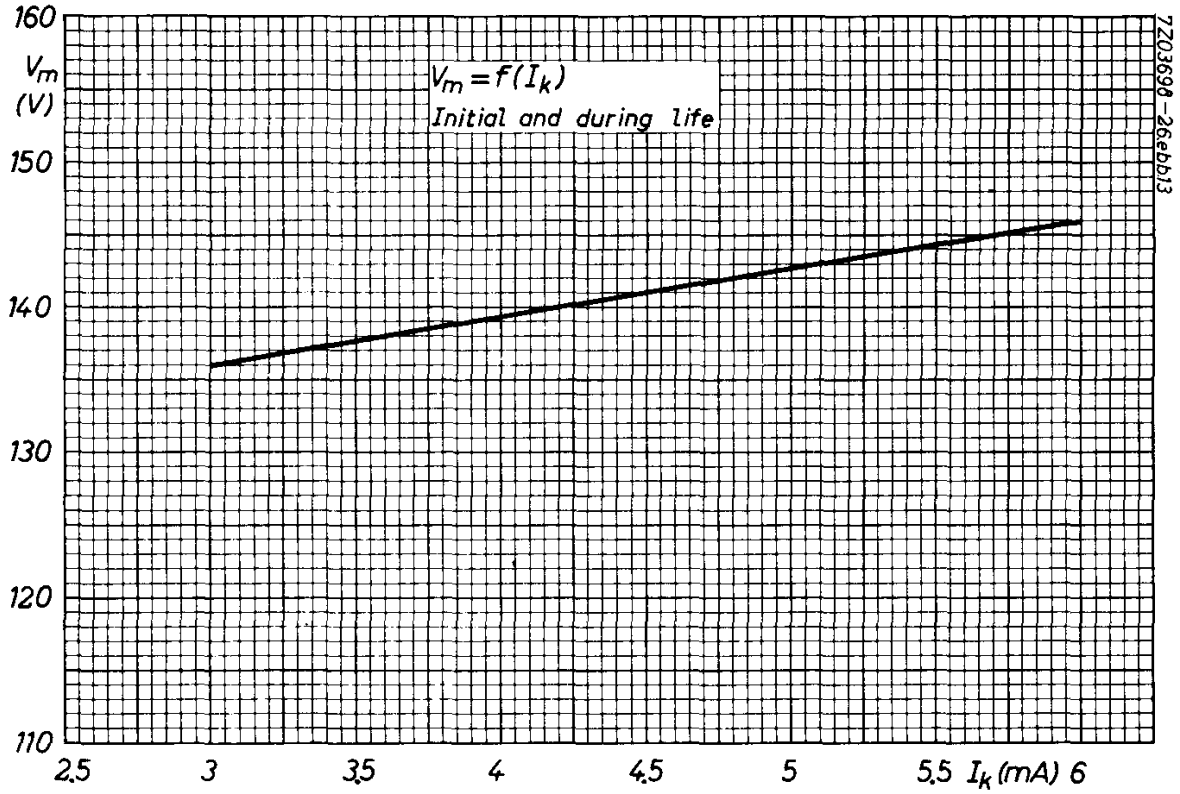
Any

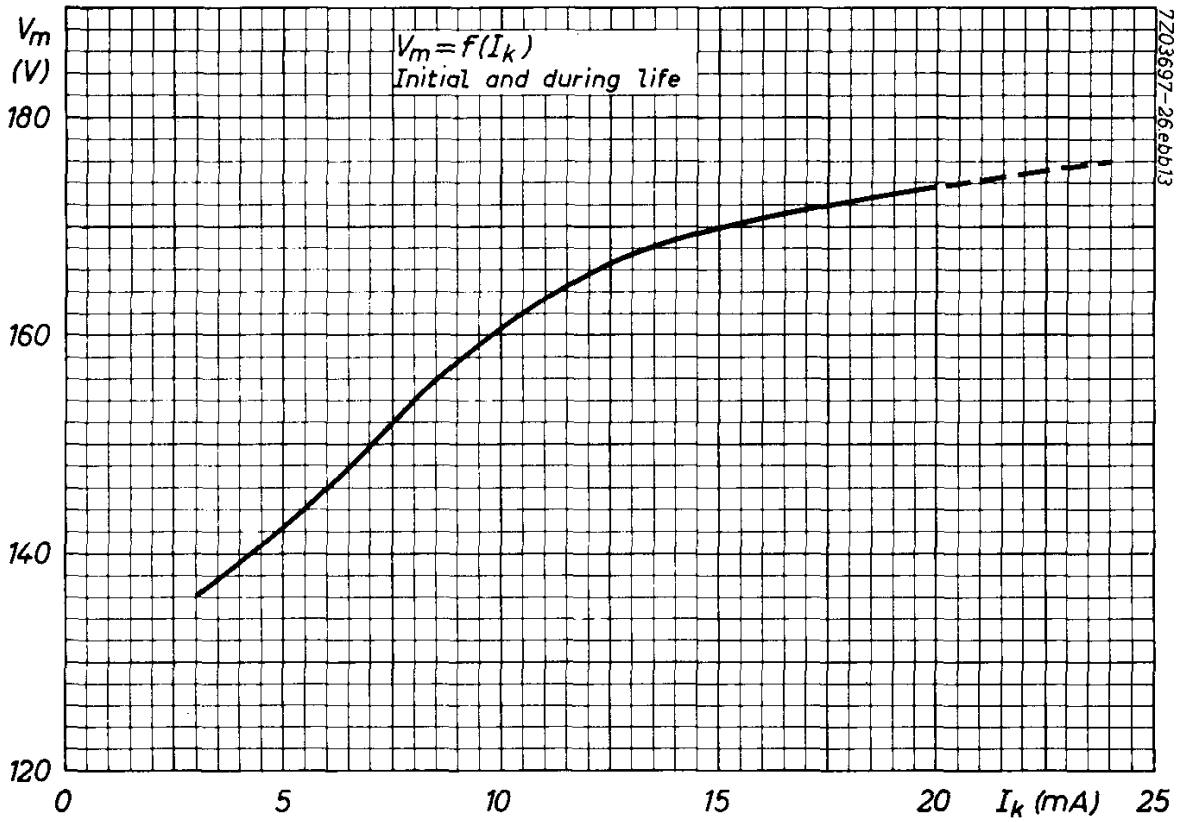
The signs are viewed through the side of the envelope.

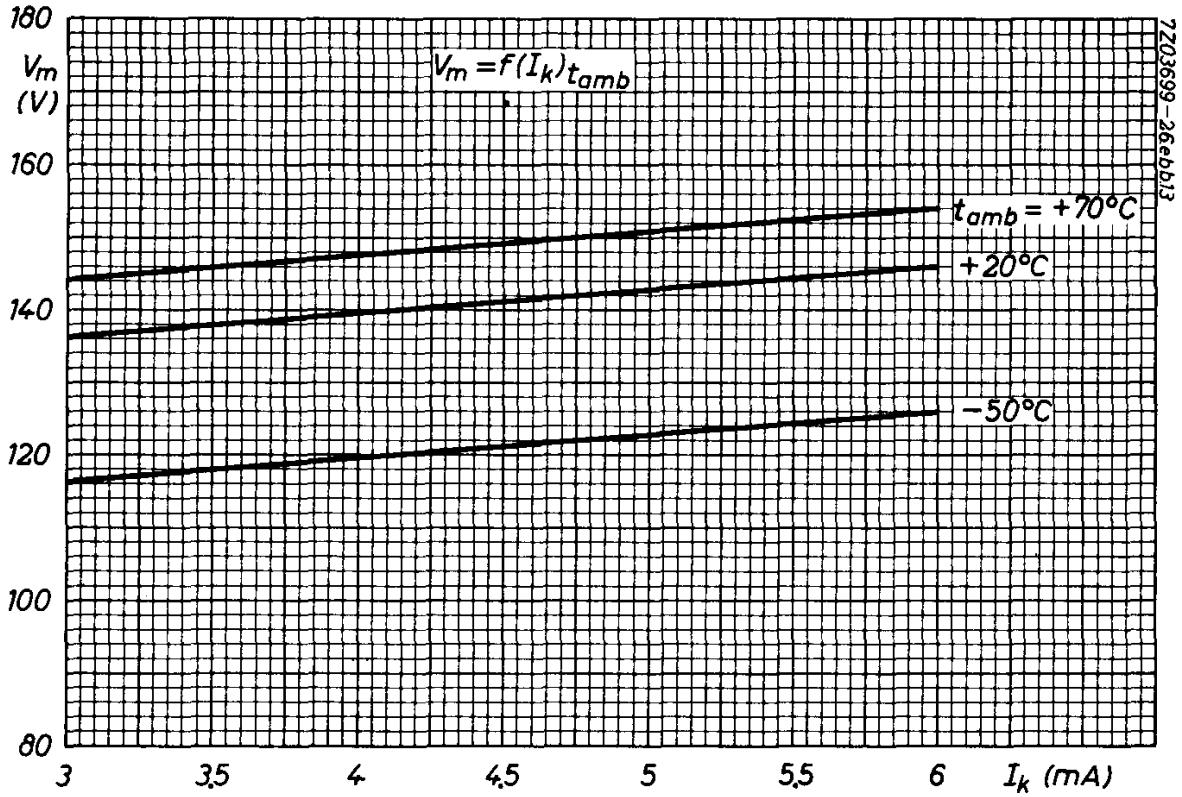
LIMITING VALUES (Absolute max. rating system)

Anode voltage necessary for ignition	V_a	min.	170	V
Cathode current,				
average during any conduction period	I_k	min.	3	mA
average (T_{av} = 20 ms)	I_k	max.	6	mA
peak	I_{kp}	max.	20	mA
Impulse duration	T_{imp}	min.	80	μs
Cathode selecting voltage	V_{kk}	min.	60	V
Bias voltage between anode and "off" cathode	V_{bias}	max.	120	V
Bulb temperature	t_{bulb}	max.	+70	°C 1)
		min.	−50	°C

1) Bulb temperatures below 10 °C result in a reduced life expectancy and changes in characteristics (see sheet 4).
In designing equipment to be used within a wide temperature range the use of "constant current operation" (high supply voltage with a high anode series resistor) is recommended.


160
V_m
(V)
150
140
130
120
110
$V_m = f(I_k)$
Initial and during life
7Z03698-26ebb13
2.5
3
3.5
4
4.5
5
5.5
I_k (mA)
6


V_m
(V)
180
160
140
120
$V_m = f(I_k)$
Initial and during life
7Z03697-26ebb13
0
5
10
15
20
I_k (mA)
25


180
V_m (V)
160
140
120
100
80
$V_m = f(I_k)t_{amb}$
t_{amb} = +70°C
+20°C
−50°C
3
3,5
4
4,5
5
5,5
6
I_k (mA)
7Z03699-26ebb13

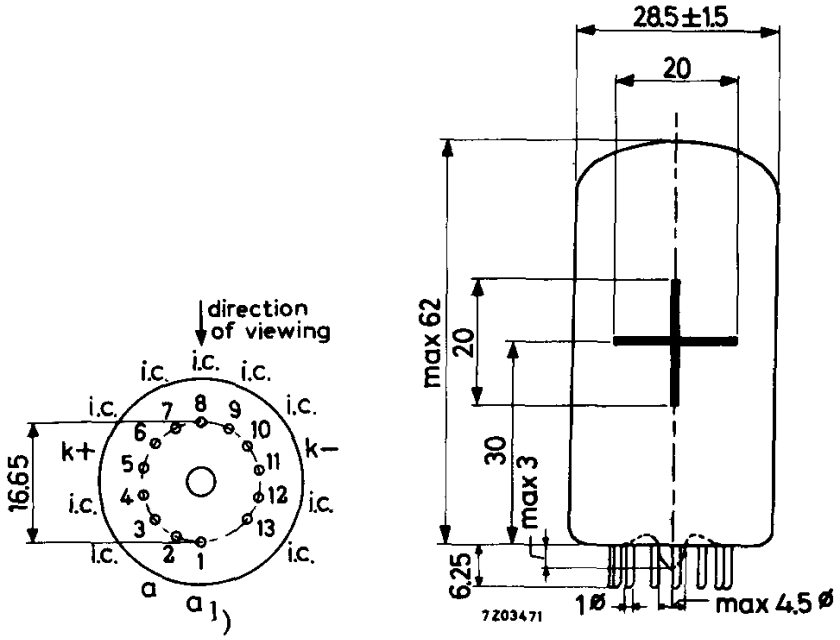
INDICATOR TUBE

The type ZM1043 is electrically identical with type ZM1041 but has no filter coating. The use of a separate blue absorbing, e.g. circular polarized amber filter is recommended.

DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: B13B



1) Pins 1 and 2 to be interconnected externally.

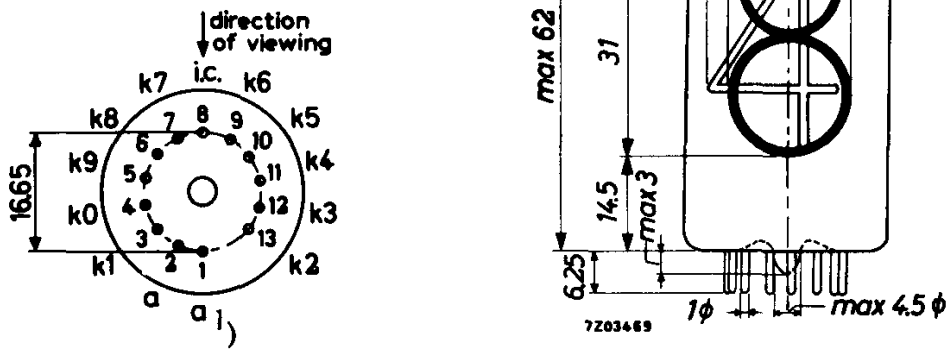
INDICATOR TUBE

The type ZM1042 is electrically identical with type ZM1040 but has no filter coating.
The use of a separate blue absorbing, e.g. circular polarized amber filter is recommended.

DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: B13B



1) Pins 1 and 2 to be interconnected externally.

PHILIPS

Data handbook

Electronic components and materials

ZM1042

page	sheet	date
1	1	1969.09
2	FP	2000.04.21

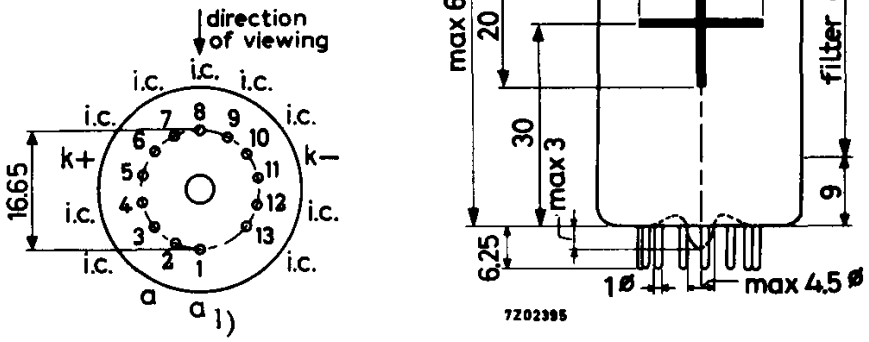
INDICATOR TUBE

Cold cathode sign indicator tube for side viewing.

QUICK REFERENCE DATA		
Sign height	20	mm
Signs	+ −	
Supply voltage	170	V
Cathode current	4.5	mA

DIMENSIONS AND CONNECTIONS Dimensions in mm

Base: B13B



GENERAL

The tube has the same physical dimensions as the ZM1040 numeral indicator tube. The ZM1041 is provided with a red contrast filter.

1) Pins 1 and 2 to be interconnected externally.

CHARACTERISTICS

Ignition voltage	V_{ign}	max. 170	V
Maintaining voltage	V_m	see sheets 3 and 4	
Extinguishing voltage	V_{ext}	min. 120	V
"Off" cathode probe current characteristic		see sheet 4	

PRINCIPLE OF OPERATION

The tube contains two cathodes, in the form of the signs + and −, and a common anode. By applying a suitable voltage between the anode and one of the cathodes the corresponding sign will be covered by a red neon glow.

ACCESSORIES

Socket 2422 505 00001, 2422 505 00002 or 2422 505 00003

MOUNTING POSITION

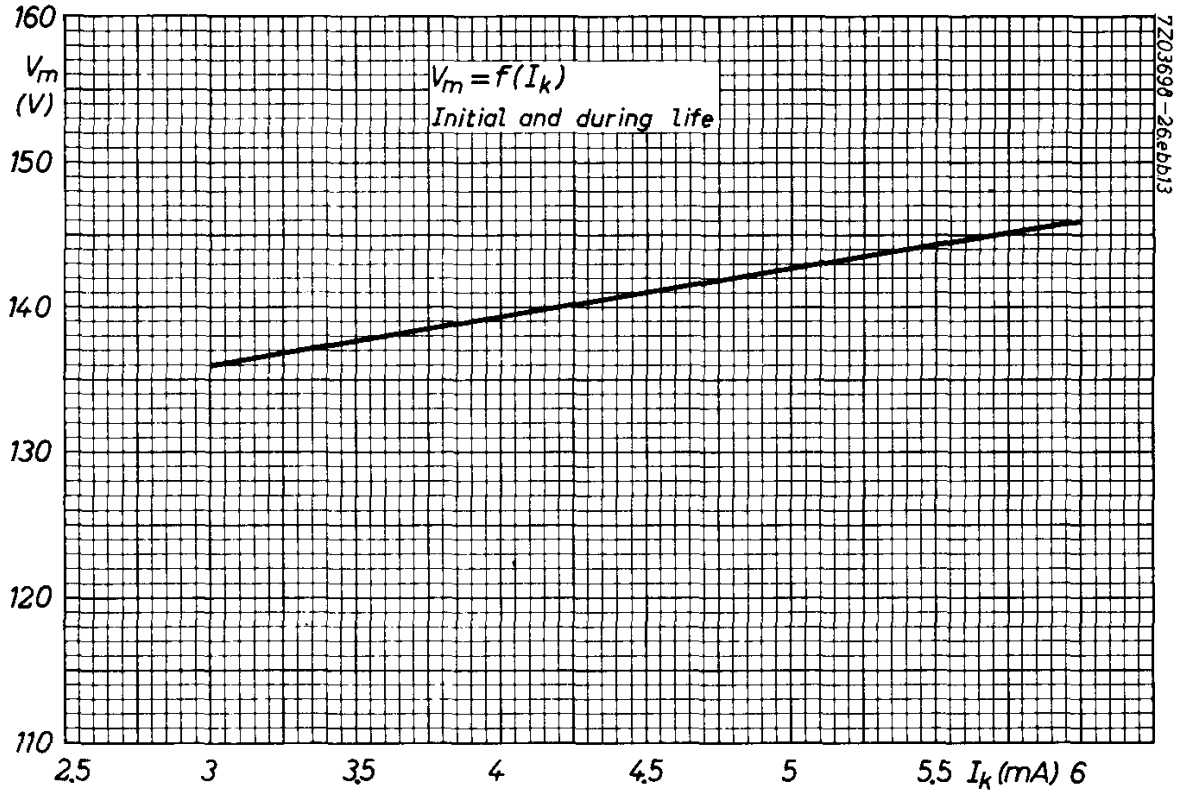
Any

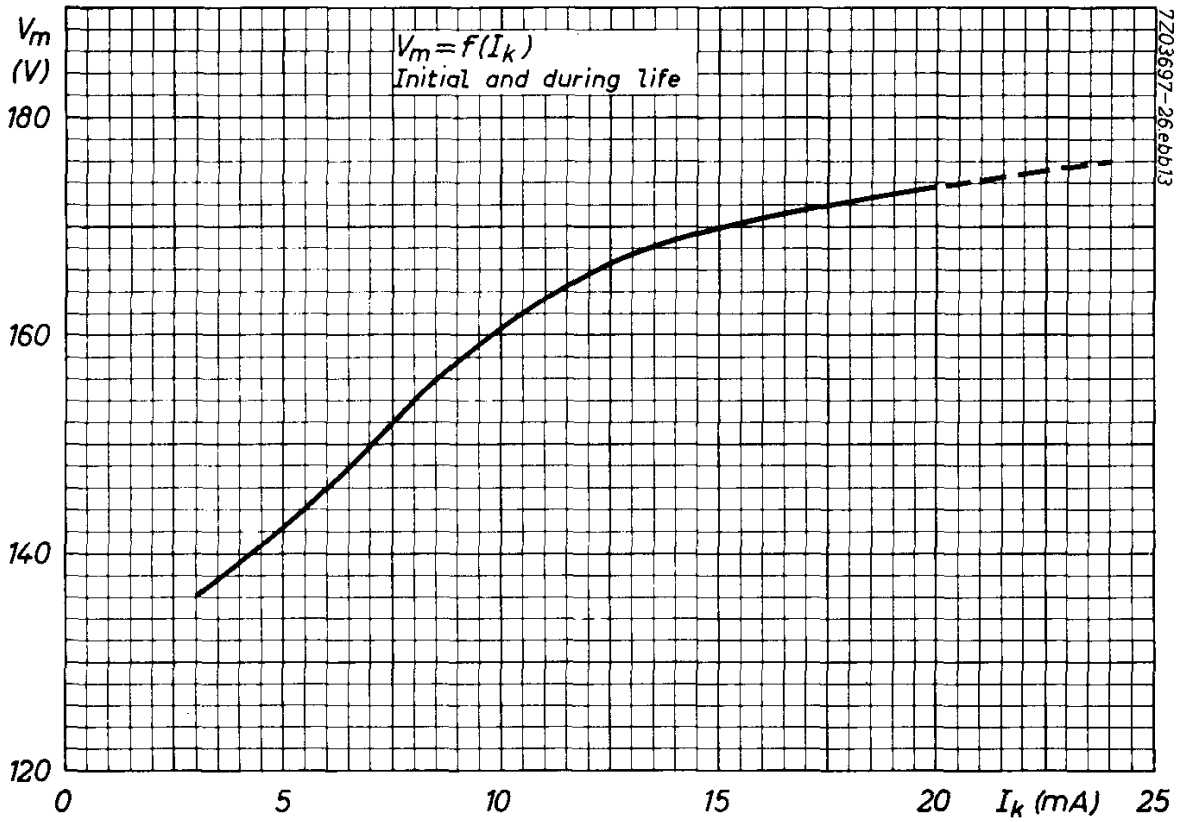
The signs are viewed through the side of the envelope.

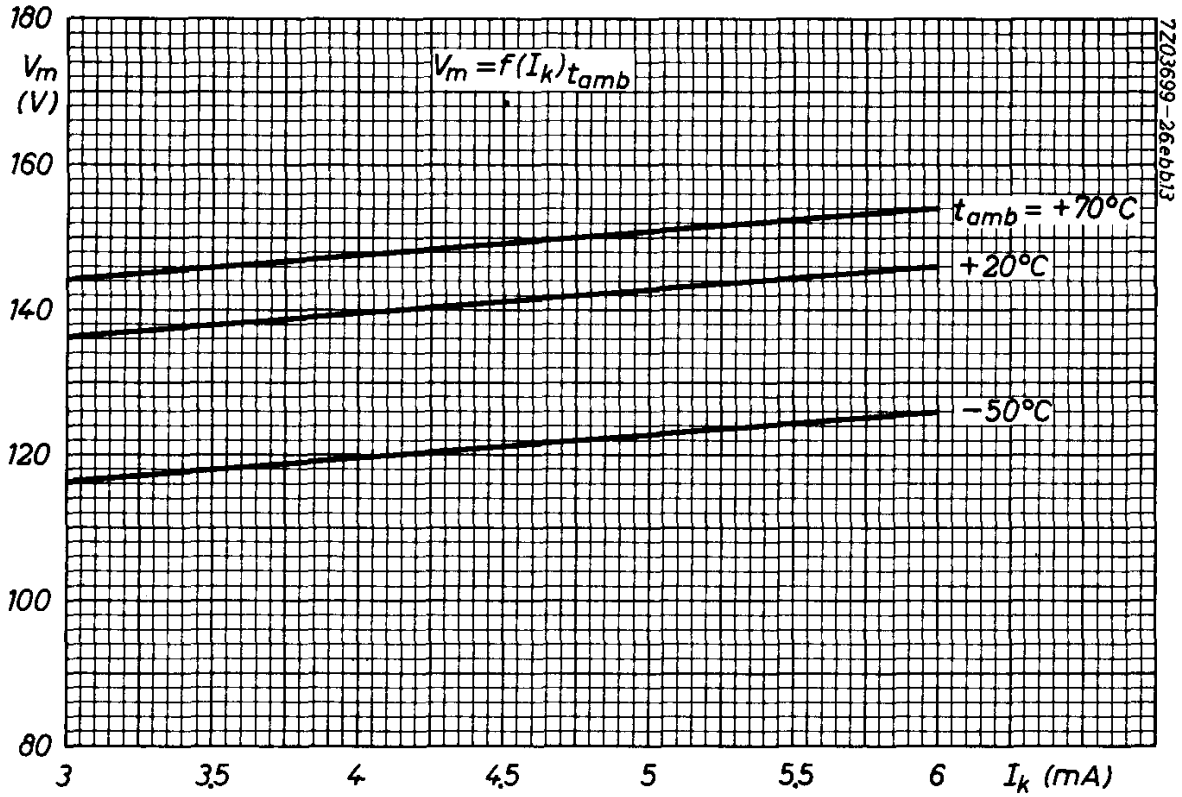
LIMITING VALUES (Absolute max. rating system)

Anode voltage necessary for ignition	V_a	min.	170	V
Cathode current,				
average during any conduction period	I_k	min.	3	mA
average (T_{av} = 20 ms)	I_k	max.	6	mA
peak	I_{kp}	max.	20	mA
Impulse duration	T_{imp}	min.	80	μs
Cathode selecting voltage	V_{kk}	min.	60	V
Bias voltage between anode and "off" cathode	V_{bias}	max.	120	V
Bulb temperature	t_{bulb}	max.	+70	°C 1)
		min.	−50	°C

1) Bulb temperatures below 10 °C result in a reduced life expectancy and changes in characteristics (see sheet 4).
In designing equipment to be used within a wide temperature range the use of "constant current operation" (high supply voltage with a high anode series resistor) is recommended.


160
V_m
(V)
150
140
130
120
110
$V_m = f(I_k)$
Initial and during life
7Z03698-26ebb13
2.5
3
3.5
4
4.5
5
5.5
I_k (mA)
6


V_m
(V)
180
160
140
120
$V_m = f(I_k)$
Initial and during life
7Z03697-26ebb13
0
5
10
15
20
I_k (mA)
25


180
V_m (V)
160
140
120
100
80
$V_m = f(I_k)t_{amb}$
t_{amb} = +70°C
+20°C
−50°C
3
3,5
4
4,5
5
5,5
6
I_k (mA)
7Z03699-26ebb13

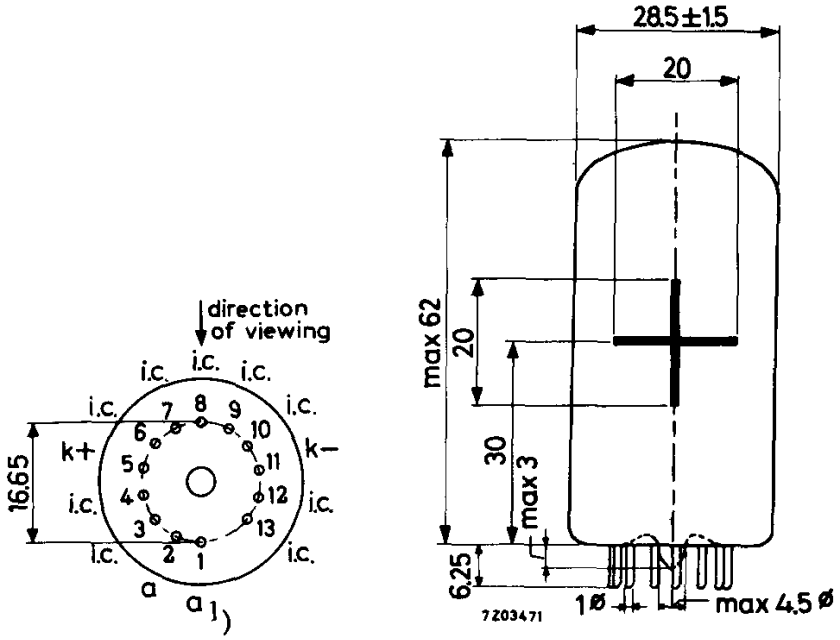
INDICATOR TUBE

The type ZM1043 is electrically identical with type ZM1041 but has no filter coating. The use of a separate blue absorbing, e.g. circular polarized amber filter is recommended.

DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: B13B



1) Pins 1 and 2 to be interconnected externally.

INDICATOR TUBE

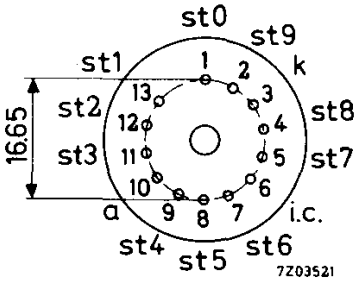
Cold cathode numerical indicator tube for top viewing.

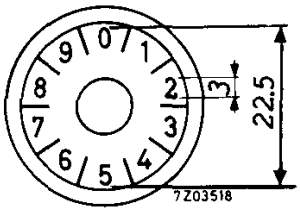
Formely Z550M

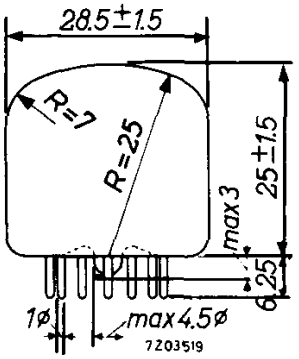
QUICK REFERENCE DATA			
Numeral height		3	mm
Numerals	1 2 3 4 5 6 7 8 9 0		
Supply voltage	V_{ba}	90	Va.c.
Cathode current	I_k	3	mA
Starter selecting voltage		5	V

DIMENSIONS AND CONNECTIONS Dimensions in mm

Base: B13B







GENERAL

The 3 mm high numerals are displayed in radial form.
The tube is primarily intended for use in circuits with transistor control.

PRINCIPLE OF OPERATION

The pulsating d.c. supply voltage (preferably half sine waves) causes one of the ten pure molybdenum cathode positions to glow. This position will be determined by the voltage level of corresponding starter being a few volts above the level of the remaining starters.

ACCESSORIES

Socket 2422 505 00001 or 2422 505 00002

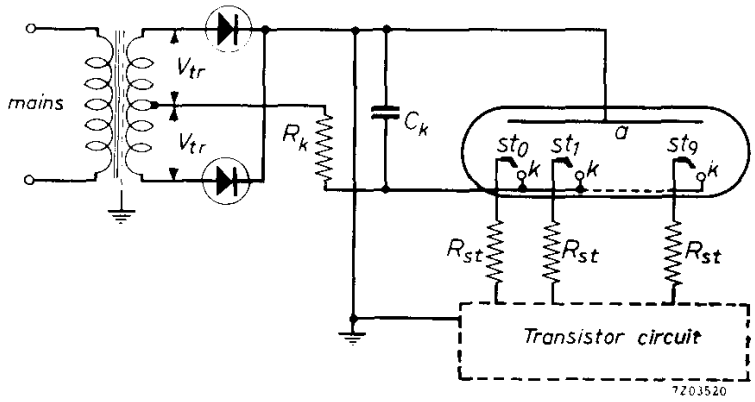
MOUNTING POSITION

Any

The numerals are viewed through the dome of the envelope.
The numerals appear upright when the tube is mounted with the line through pins 1 and 8, vertical pin 1 being uppermost.
Number 0 is aligned with pin 1 to within 3°.

CHARACTERISTICS AND OPERATING CONDITIONS

Recommended circuit



Transformer secondary voltage	V_{tr}	110	V ± 10% [1]
Cathode resistor	R_k	10	kΩ ± 5%
Starter series resistor	R_{st}	330	kΩ [2]
Shunting capacitor	C_k	33	nF [1]
Starter selecting voltage	V_{st-st}	See sheet 4 upper figure and [2] on page 3	
Starter current	I_{st}	50	μA
Maintaining voltage	V_m	84	V
Recommended cathode current	I_k	3	mA

[1] The rectified a.c. voltage should be free from spikes.
A shunting capacitor C_k of 33 nF serves this purpose.

[2] This resistor should be mounted close to the tube socket.

LIFE EXPECTANCY at recommended operating conditions and room temperature

Continuous display of one digit	1000	h	[1]
Sequentially changing the display from one digit to the others every 100 h or less	min. 20 000	h	

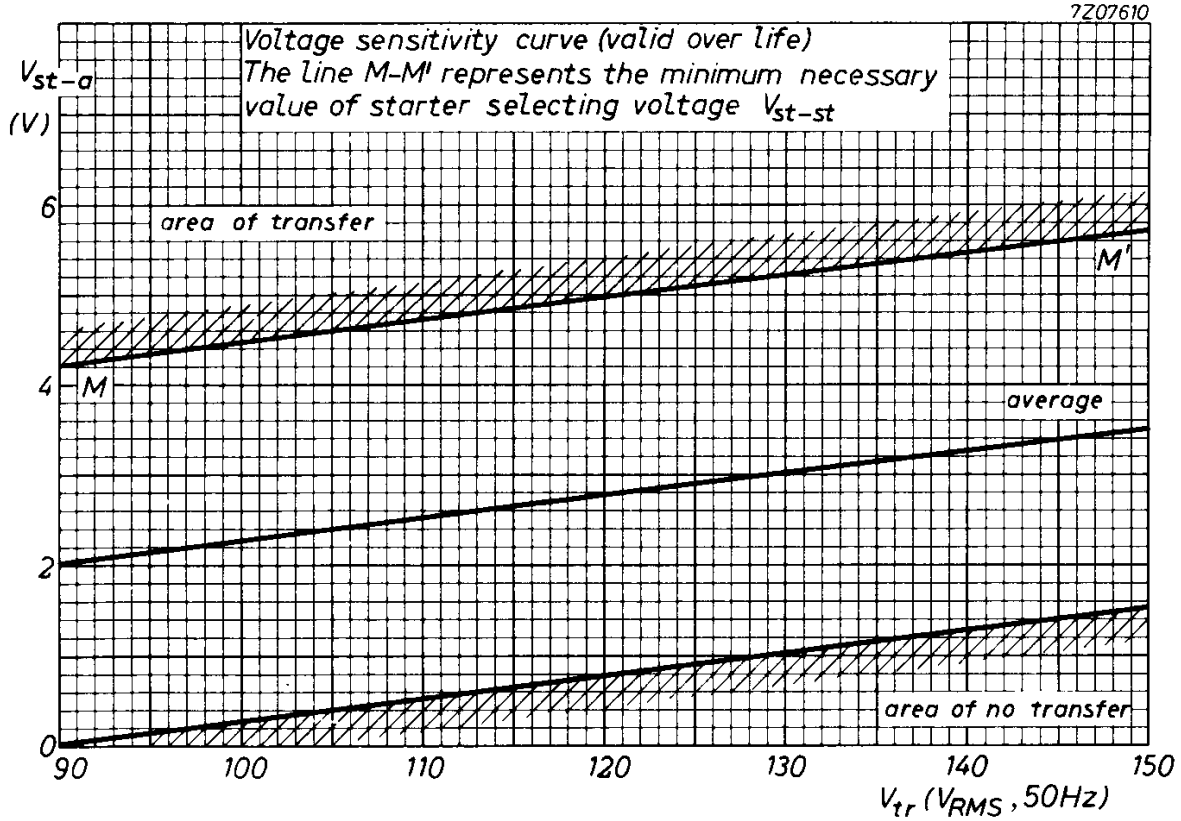
The criterium for the end of life point is given by the minimum value of starter selecting voltage V_{st-st} shown on sheet 4 upper figure.

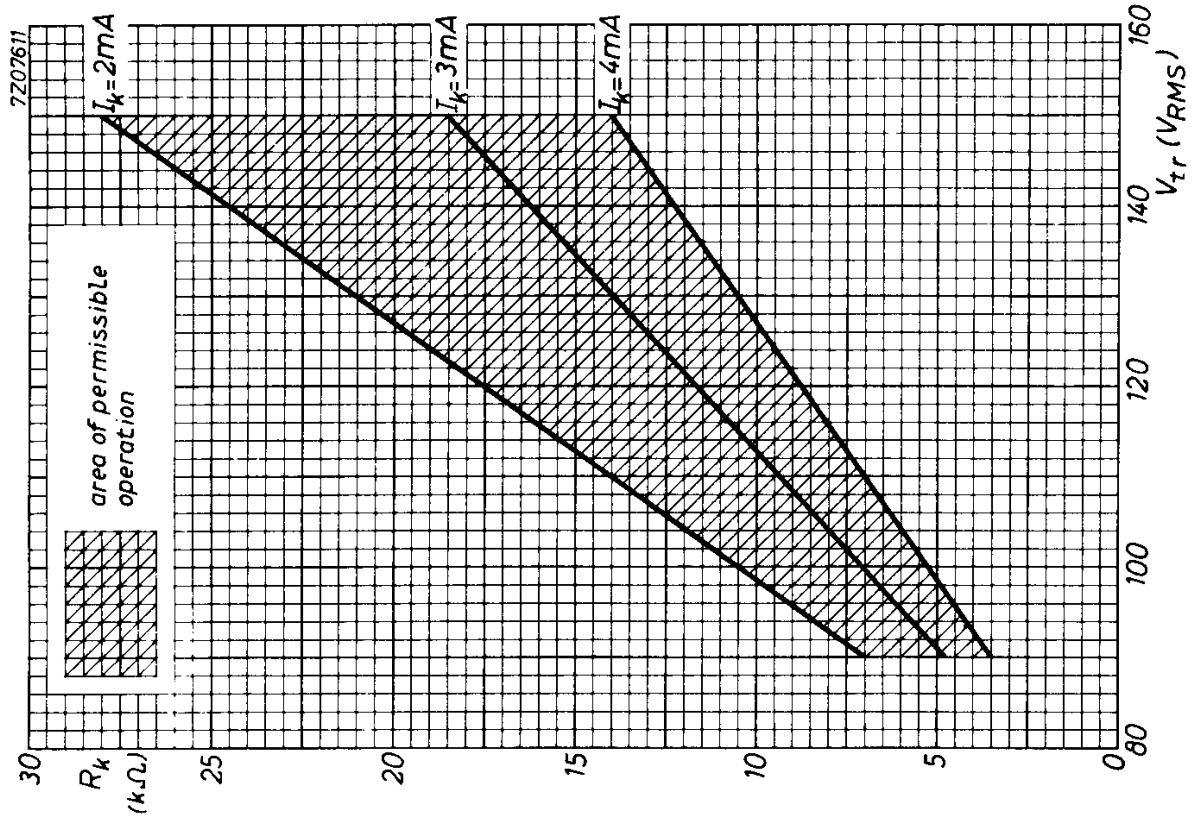
LIMITING VALUES (Absolute max. rating system)

A.C. supply voltage	V_{tr}	min.	90	$V_{r.m.s.}$
See also sheet 4 lower figure	V_{tr}	max.	150	$V_{r.m.s.}$
Frequency of mains supply	f		40 to 100	Hz
Cathode current (average)	I_k	min.	2	mA
		max.	4	mA
Starter selecting voltage	V_{st-st}	min.	see sheet 4 upper figure [2]	
		max.	30	V
Starter circuit resistance	R_{st}	min.	100	kΩ
		max.	470	kΩ
Envelope temperature	t_{bulb}	min.	−55	°C
		max.	+70	°C

[1] Under conditions of longer continuous display on one digit it is recommended to apply a starter selecting voltage V_{st-st} greater than the minimum value, as indicated on sheet 4 upper figure.

[2] The common starter bias potential may deviate by a maximum of ± 5 V from the anode potential.

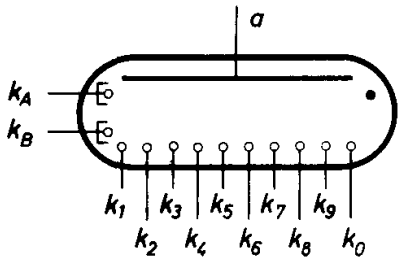

7Z07610
Voltage sensitivity curve (valid over life)
The line M-M' represents the minimum necessary value of starter selecting voltage V_{st-st}
V_{st-a} (V)
area of transfer
M
M'
average
area of no transfer
0
2
4
6
90
100
110
120
130
140
150
V_{tr} (V_{RMS}, 50Hz)


7Z07611
I_k=2mA
I_k=3mA
I_k=4mA
area of permissible operation
R_k (kΩ)
30
25
20
15
10
5
0
80
100
120
140
160
V_{tr} (V_{RMS})

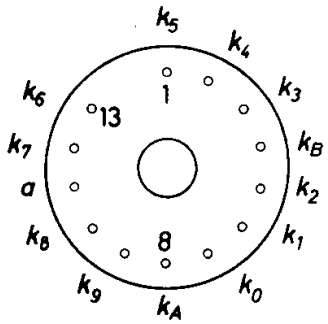
ZM 1070
Z 504 S

DEKADISCHE ZÄHL-, ANZEIGE- und SCHALTRÖHRE

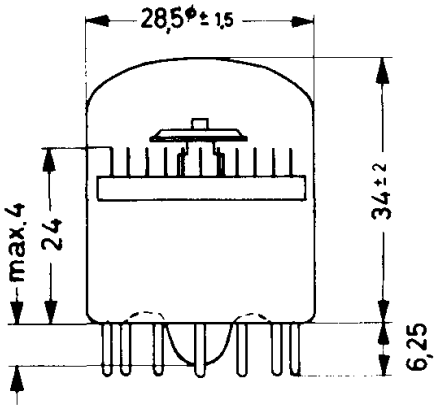
mit kalten Katoden und Edelgasfüllung, für Vorwärts- und Rückwärtszählung.
Die Katoden k_1 bis k_0 sind getrennt herausgeführt [1], die Anzeige erfolgt durch Glimmlichtbedeckung der jeweiligen Katode.



Sockel:	Spezial 13p
Fassung:	B8 700 67
Zahlenmaske:	56 072
Einbau:	beliebig, die Lage der Katode k_0 ist durch Stift 7 (Toleranz ± 3°) festgelegt.



Abmessungen in mm:



[1]) Werden weniger als 10 Ausgangskatoden benötigt, so sind die nichtbenutzten Katoden auf Nullpotential zu legen.

ZM 1070

Kenndaten: (t_{ugb} = 25 °C)

bei Steuerung durch impulsförmiges Eingangssignal

Zählfrequenz	≦	5	kHz
Impulsabstand	≧	200	µs
Entladungsdauer, beliebig an $k_A, k_B, k_1 \ldots k_0$	≧	60	µs
Signalspannung für k_A, k_B	≧	-45	V
Rückstellspannung für $k_1 \ldots k_0$		-120...-225	V [1]
Brennspannung zwischen a und $k_1 \ldots k_0$ bei U_{ba} = 475 V, R_a = 820 kΩ	≈	195	V

Grenzdaten: (absolute Werte)

Anodenspeisespannung	U_{ba}	= min.	375	V [2]
		max.	550	V
Zeitkonstante der Speisespannung	U_{ba}	= min.	1	ms
Vorspannung für k_A, k_B		= min.	35	V [3]
		max.	60	V
Spannung zwischen k_A und k_B oder zwei beliebigen $k_1 \ldots k_0$		= max.	140	V [4]
neg. Vorspannung an beliebiger $k_1 \ldots k_0$	$-U_k$	= max.	20	V
Katodenstrommittelwert	I_k	= min.	0,250	mA
		max.	0,525	mA
Umgebungstemperatur	t_{ugb}	= max.	50	°C

[1]) Der Rückstellimpuls soll eine Anstiegs- und Abfallzeitkonstante von min. 1 ms haben.

[2]) Beim Einschalten soll die minimale Zeitkonstante der Speisespannung 1 ms betragen; dieser Wert kann nötigenfalls durch ein RC-Glied von 4,7 kΩ und 0,2 µF nachgebildet werden.

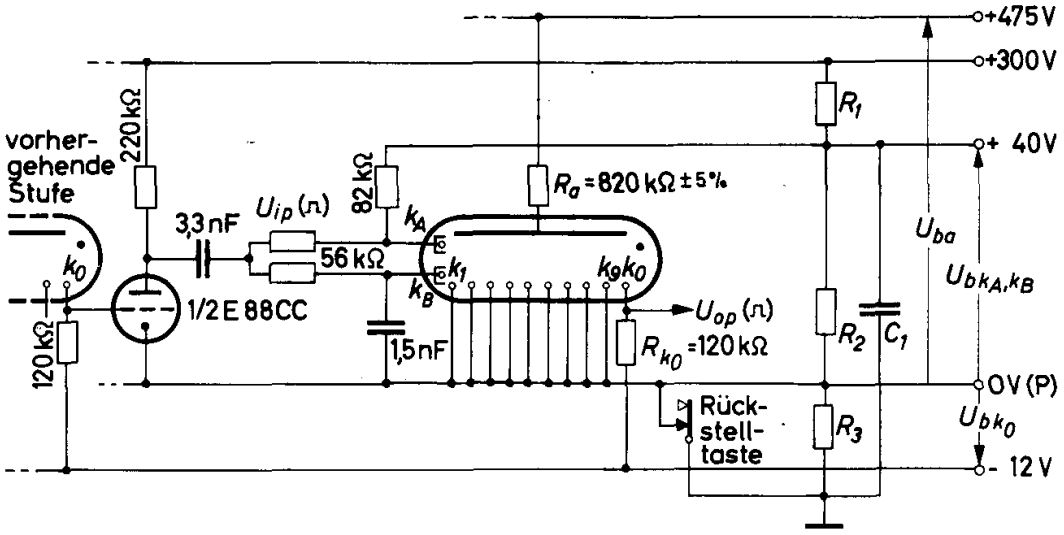
[3]) bei 5000 Zählungen/s; für 1000 Zählungen/s ist U_{kA}, U_{kB} = min. 25 V.

[4]) ausgenommen Rückstellung

Betriebsdaten:

Anodenspeisespannung	U_{ba}	=		475		V [1]
Anodenwiderstand	R_a	=		820		kΩ
Anodenstrom	I_a	=		0,340		mA
Zählimpuls	$U_{i\ p}$	=		-100		V
Impulsdauer	t_p	=		75		µs [2]
Vorspannung für k_A, k_B	$U_{bkA,kB}$	=		40		V
Vorspannung für $k_1 \ldots k_0$	$U_{bk1\ldots k0}$	=	0	0	-12	V
Katodenwiderstand für $k_1 \ldots k_0$	$R_{k1\ldots k0}$	=	0	82	120	kΩ [3]
Ausgangsimpuls	$U_{o\ p}$	=	0	23	35	V

Koppelstufe für ZM 1070:



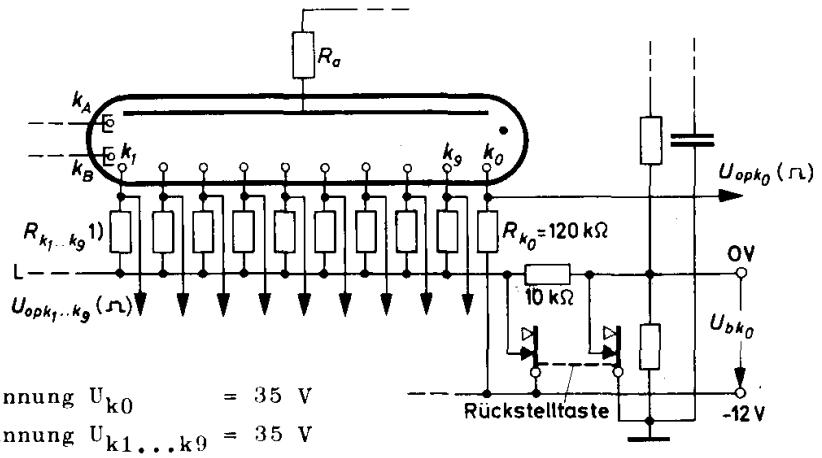
Der Spannungsteiler R_1 (82 kΩ ± 7 %), R_2 (12 kΩ ± 7 %), R_3 (56 kΩ ± 7 %), C_1 (0,2 µF) dient zur Festlegung der Vorspannung für k_A und k_B und der Rückstellspannung; der Spannungsteiler kann für maximal 5 Stufen verwendet werden (Abnahme an Punkt P).

[1]) Beim Einschalten soll die minimale Zeitkonstante der Speisespannung 1 ms betragen; dieser Wert kann nötigenfalls durch ein RC-Glied von 4,7 kΩ und 0,2 µF nachgebildet werden.

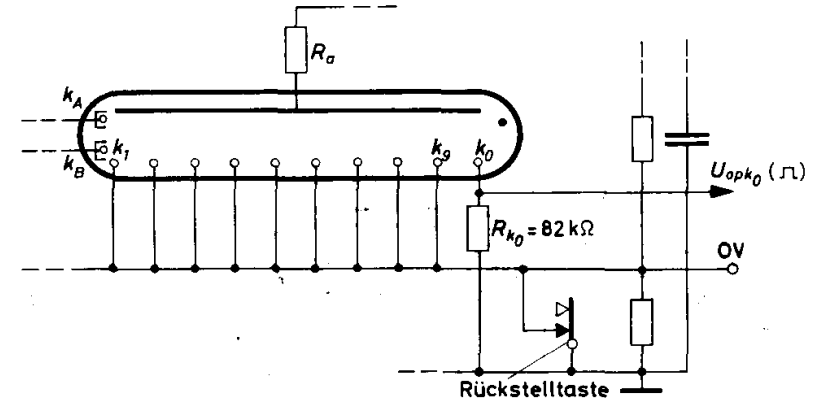
[2]) Bei Zählfrequenzen < 4000 Zählungen/s kann ein entsprechend größerer Wert gewählt werden.

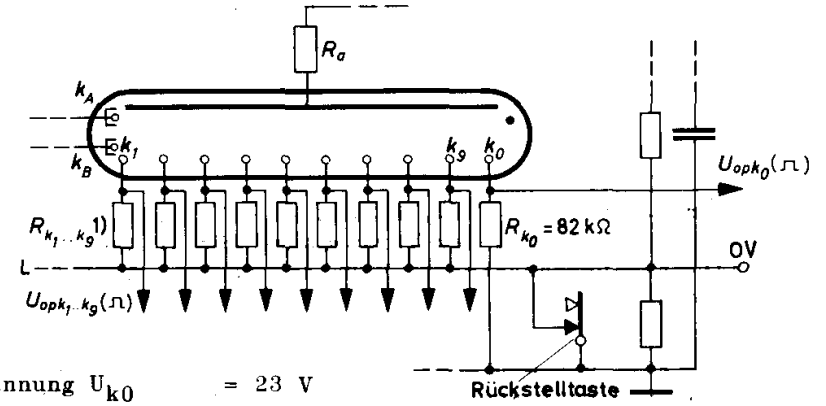
[3]) Werden die Katoden ohne Vorspannung betrieben, so können die Katodenwiderstände entfallen; bei einer Vorspannung von -12 V soll R_k > 47 kΩ sein.

Beispiele für Anschluß der Katoden:



Ausgangsspannung U_{k0} = 35 V
Ausgangsspannung $U_{k1...k9}$ = 35 V





Ausgangsspannung U_{k0} = 23 V
Ausgangsspannung $U_{k1...k9}$ = 23 V

Diese Schaltungen können nicht unmittelbar an die Koppelstufe angeschlossen werden.

---

1) Nur diejenigen Katoden k1...k9, von denen Ausgangsimpulse abgenommen werden sollen, sind über separate Widerstände mit dem Punkt L zu verbinden.

INDICATOR TUBE

Cold cathode ten digit side viewing numeral indicator tube

QUICK REFERENCE DATA				
Numeral height			13	mm
Numerals	1 2 3 4 5 6 7 8 9 0			
Supply voltage	V_b	min.	170	V
Cathode current	I_k		2	mA
Distance between mounting centres		min.	19	mm

GENERAL

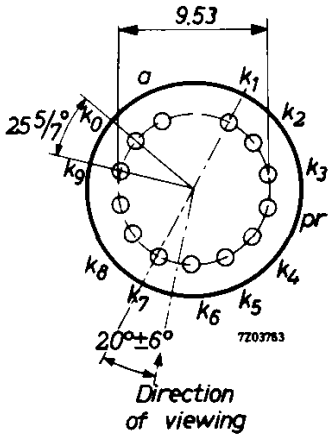
The numerals are 13 mm high and appear on the same base line allowing in-line read out. The ZM1080 is provided with a red contrast filter.
The ZM1082 is identical to the ZM1080 but has no filter.

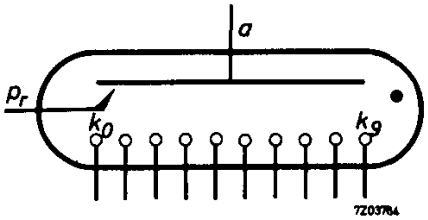
PRINCIPLE OF OPERATION

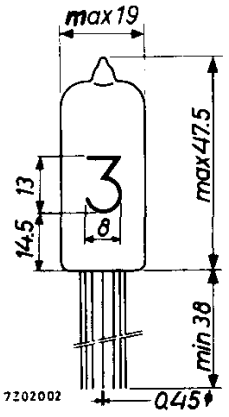
The tube contains ten cathodes in the form of ten figures and one common anode. By applying a suitable voltage between the anode and one of the ten cathodes the corresponding figure will be covered by a red neon glow.

DIMENSIONS AND CONNECTIONS

Dimensions in mm







Mounting position: any

The numbers are viewed through the side of the envelope. The numbers will appear upright (within $\pm 3^{o}$) when the tube is mounted vertically.
Care should be taken not to bend the leads nearer than 1.5 mm from the seals.
The leads are tinned and may be dip soldered to a minimum of 5 mm from the seals at a solder temperature of 240 °C for a maximum of 10 seconds.
The tube may be soldered directly into the circuit but heat conducted to the glass to metal seals should be kept to a minimum by the use of a thermal shunt.

CHARACTERISTICS AND RANGE VALUES FOR EQUIPMENT DESIGN

Initially and during life at 20 °C to 50 °C unless otherwise stated.

Ignition			
Anode voltage	V_a	> 170	V
Ignition delay time		See page 4	1)
Conduction			
D.C. operation			
Cathode current 1)	I_k	< 3.5	mA
Cathode current for coverage	I_k	> 1.5	mA
Maintaining voltage at I_k = 2 mA (See also page 5)	V_m	140	V
Probe current to individual non-conducting cathodes	I_{kk}	See page 6	
Pulse operation			
Cathode current, peak	I_{k_p}	< 12	mA
average, T_{av} = 20 ms	I_k	< 2.5	mA
Average cathode current for satisfactorily display	I_k	> 0.8	mA
Pulse duration	T_{imp}	< 20 > 100	ms μs
Maintaining voltage	V_m	See page 5	
Probe current to individual non-conducting cathodes	I_{kk}	See pages 6 and 7	

EXTINCTION

Anode voltage to ensure extinction	V_a	< 115	V

1) For reduced ignition delay times, a small continuous priming current may be taken from lead 4. This can be obtained from a supply voltage of -180 V with respect to the "on" cathode via a resistor of 18 MΩ.

LIFE EXPECTANCY

Under recommended operating conditions and t_{amb} = room

Continuous display of one digit [1])		>	5000	h
Sequentially changing the display from one digit to another every 100 hours or less		>	30 000	h

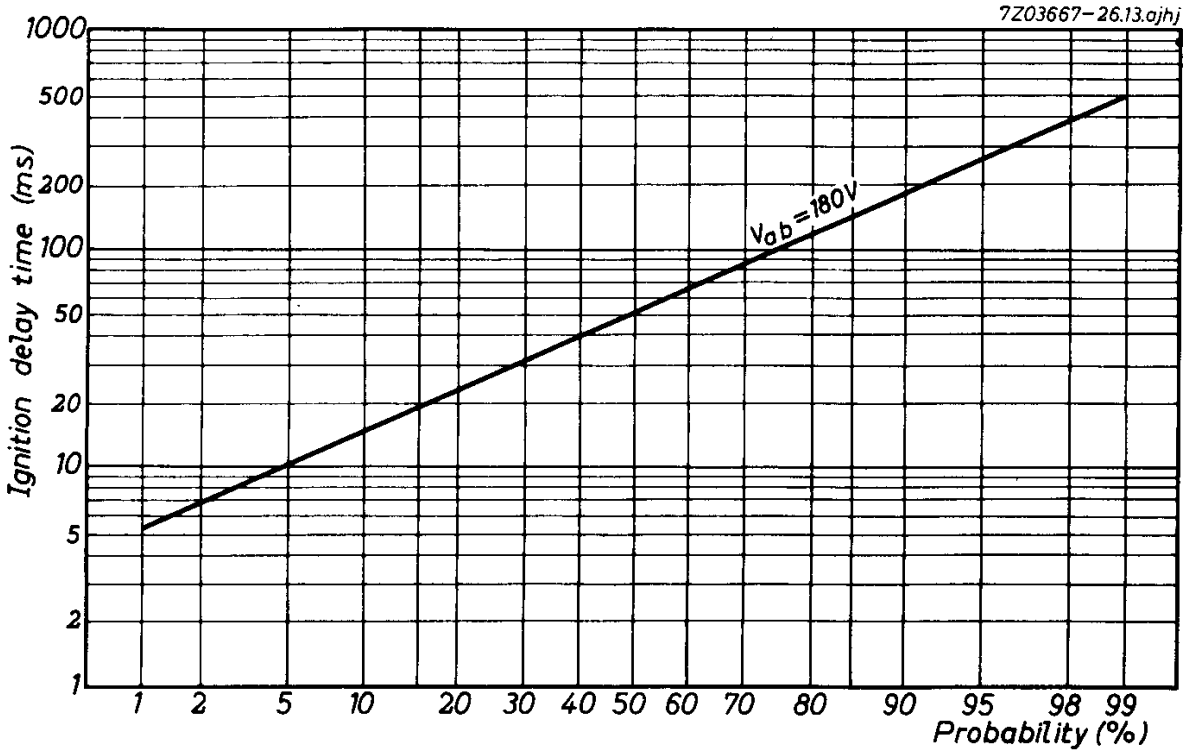
LIMITING VALUES (Absolute max. rating system)

Cathode current (each digit)

average, T_{av} = max. 20 ms	I_k	max.	3.5	mA
peak	I_{kp}	max.	12	mA
average during any conduction period	I_k	min.	1.5	mA
Bulb temperature	t_{bulb}	max.	+70	°C
		min.	−50	°C [2])
Anode voltage necessary for ignition	V_a	min.	170	V

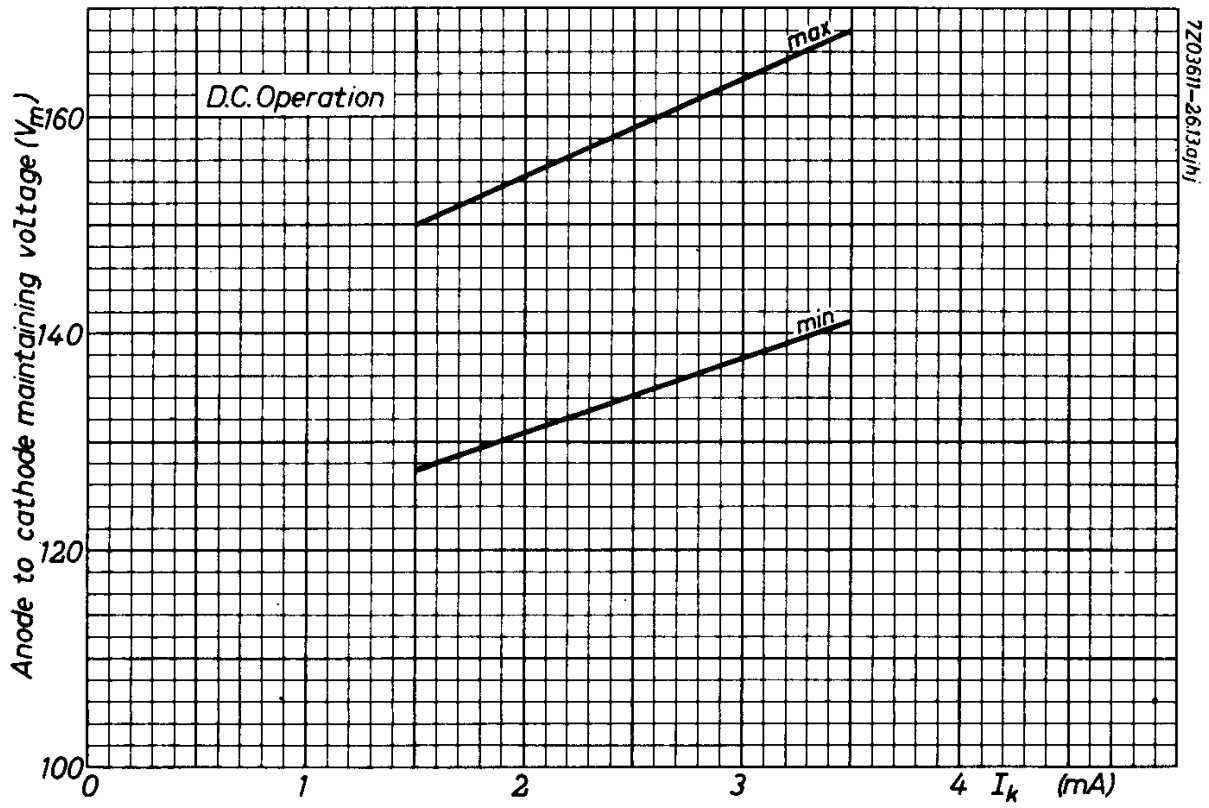
[1]) The life expectancy figures given above relate to operation with d.c. cathode currents between 1.5 mA to 2.5 mA and at all permitted pulsed cathode currents.
When a d.c. cathode current range of 1.5 mA to 3.5 mA is used, the life expectancy exceeds 3000 hours with continuous display of one digit.

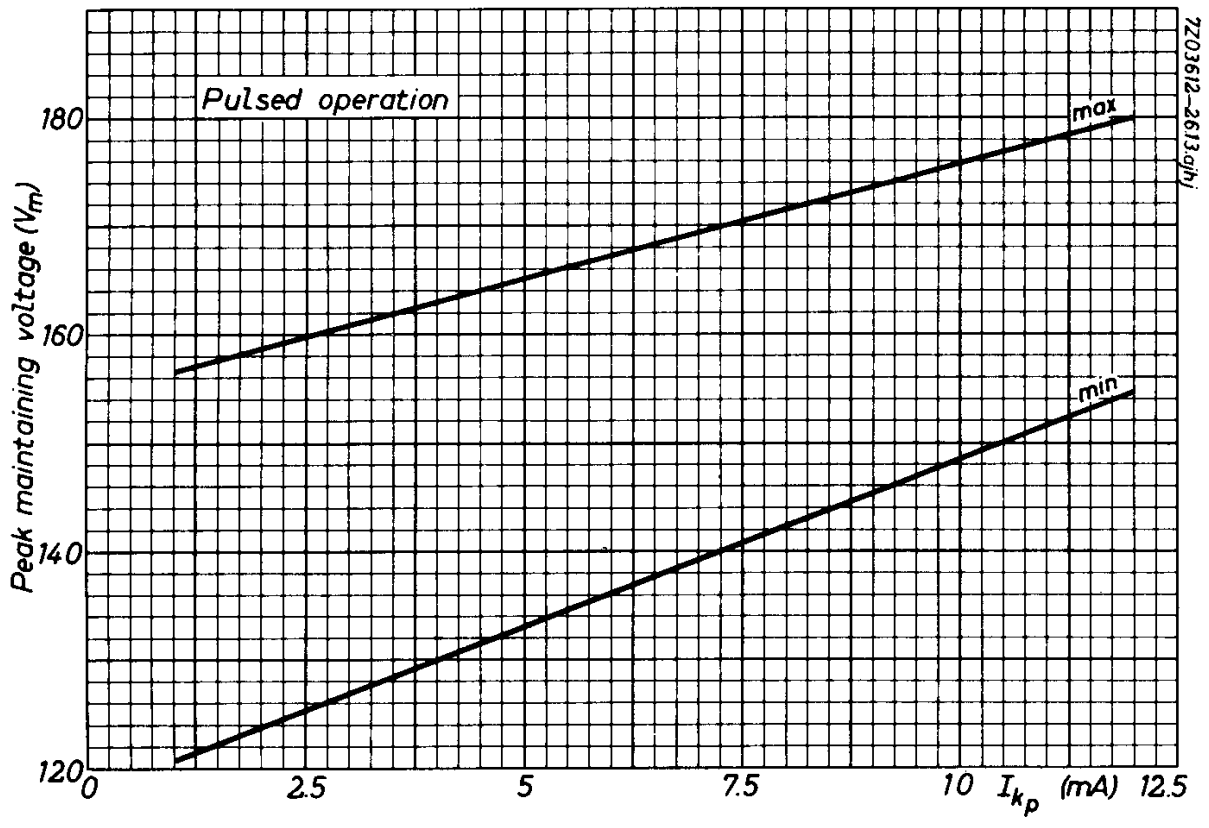
[2]) For bulb temperatures below 0 °C the life expectancy of the tube is substantially reduced.

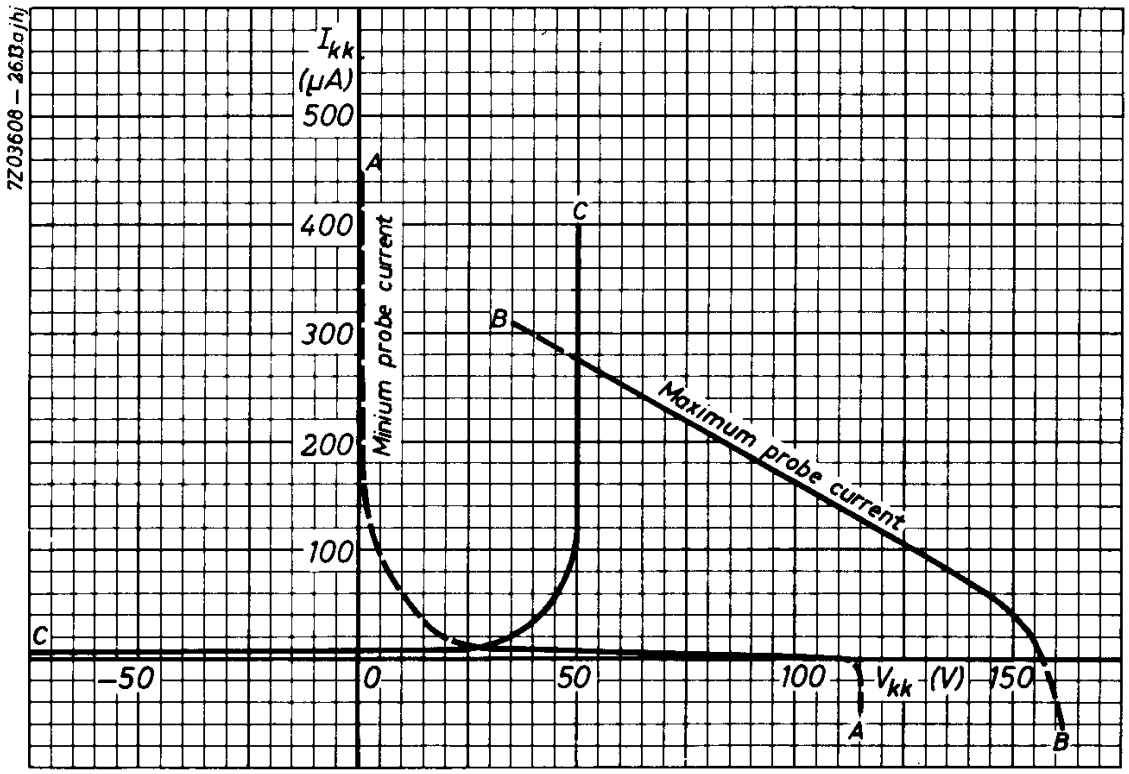


CUMULATIVE DISTRIBUTION OF IGNITION DELAY TIME

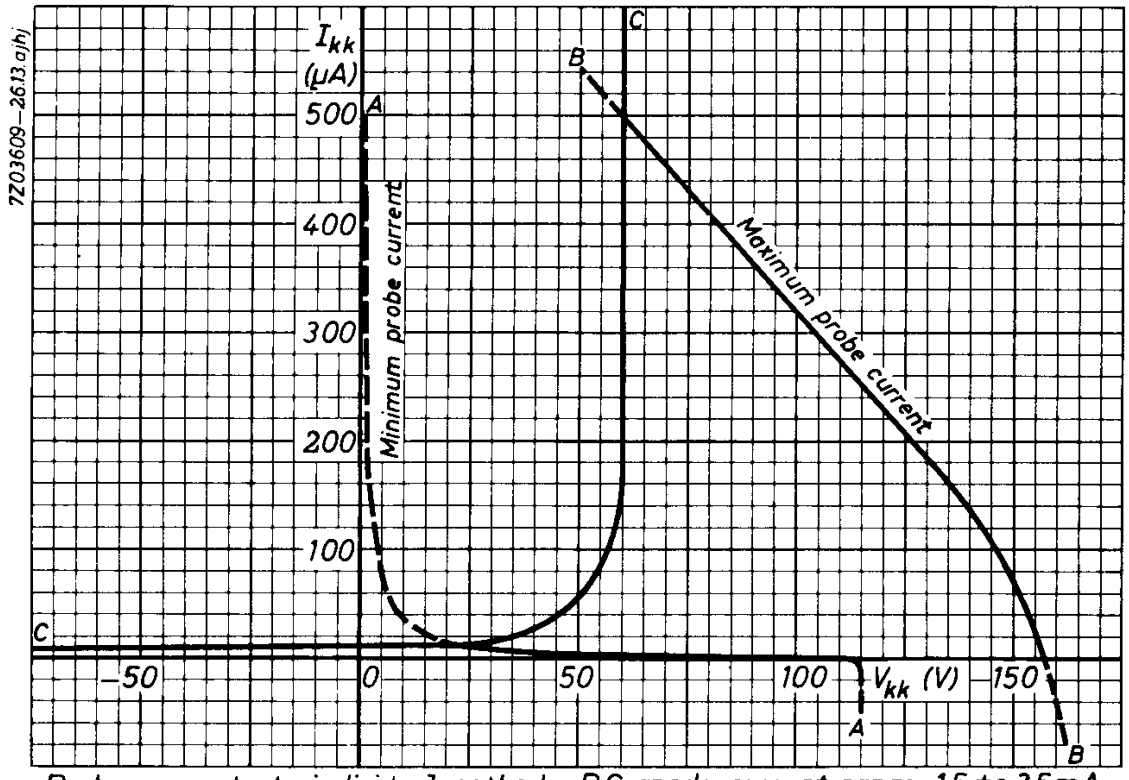
This curve shows the probability that a tube will ignite in less than the time shown after a non-conduction period of a few seconds. The ignition delay time will be appreciably reduced when the interval between conduction periods is less than 100 milliseconds. In general, an increase in the supply voltage will reduce the ignition delay time.


D.C. Operation
max
min
Anode to cathode maintaining voltage (V_m)
160
140
120
100
0
1
2
3
4 I_k (mA)
7Z03611-2613.ajhj

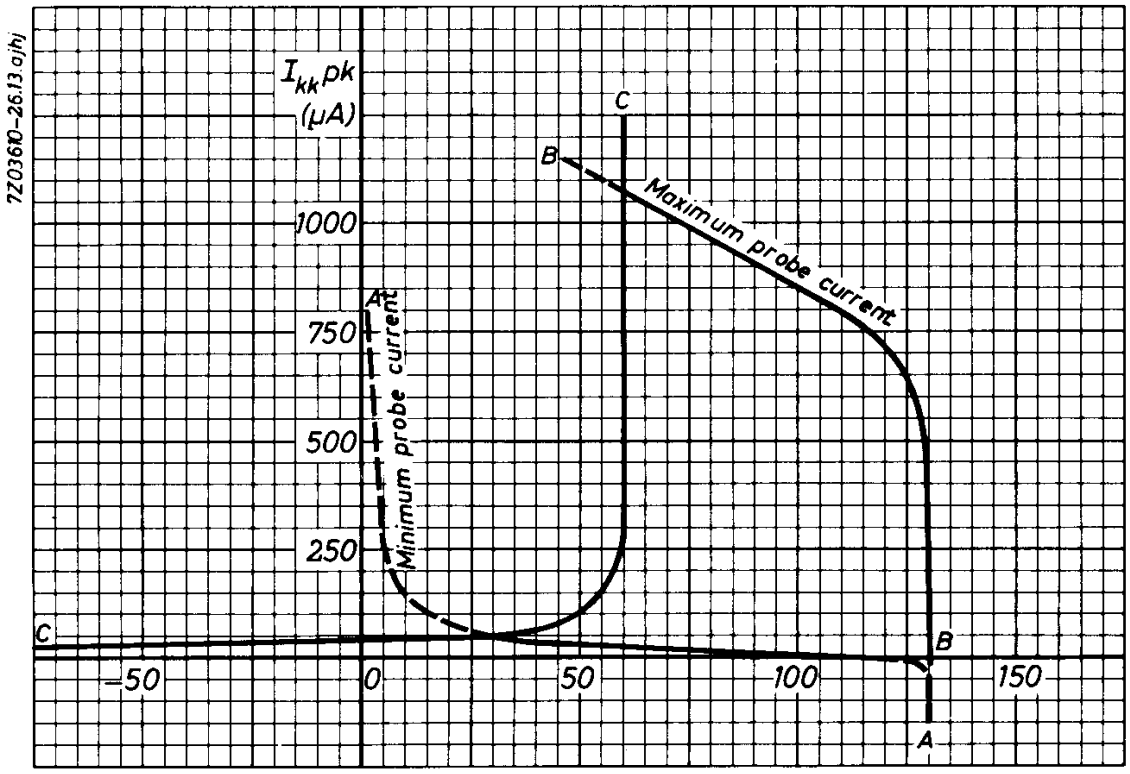

Pulsed operation
max
min
Peak maintaining voltage (V_m)
180
160
140
120
0
2.5
5
7.5
10 I_{kp} (mA) 12.5
7Z03612-2613.ajhj



Probe currents to individual cathodes. D.C. anode current range 1.5 to 2.5mA



Probe currents to individual cathodes. D.C. anode current range 1.5 to 3.5mA



Peak probe currents to individual cathodes. Pulsed anode current 10mA Duty factor 0.1

PROBE CURRENT CURVES

The boundaries A-A and B-B of the graphs represent, for the shown anode current ranges, the range of probe currents to individual non-conducting cathodes plotted against the voltage difference between the non-conducting cathodes and the conducting cathode.

For optimum display, the probe current to any non-conducting cathode should be as low as possible. In addition, reverse probe current should not be permitted.

These conditions can be satisfied in two ways:

(1) With a low impedance voltage source connected to the non-conducting cathodes. For example, when using a current range of 1.5 to 2.5 mA and a voltage between 50 and 115 V is required.

(2) With a separate high impedance connected to each non-conducting cathode and returned to a voltage source of less than 115 V. In this case the load line of the voltage source must lie to the right of boundary C-C.

INDICATOR TUBE

Cold cathode side viewing character indicator tube.

QUICK REFERENCE DATA			
Character height		10.5	mm
Characters		− + ~	
Supply voltage	V_b	min. 170	V
Cathode current	I_k	2	mA

GENERAL

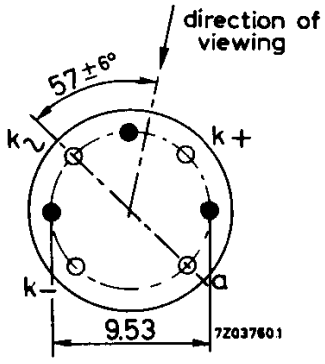
The ZM1081 is provided with a red contrast filter
The ZM1083 is identical to the ZM1081 but has no filter.

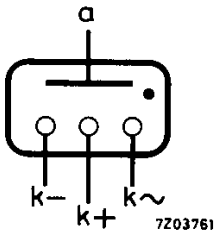
PRINCIPLE OF OPERATION

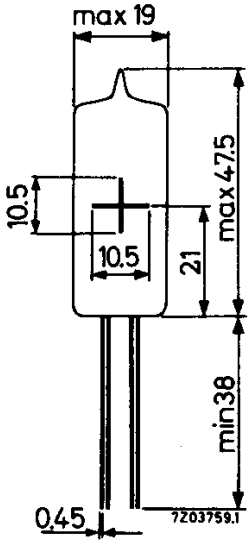
The tube contains 3 cathodes in the form of the characters −, + and ~ and one common anode.
By applying a suitable voltage between the anode and one of the three cathodes the corresponding character will be covered by a red neon glow.

DIMENSIONS AND CONNECTIONS

Dimensions in mm







Mounting position: any

The characters are viewed through the side of the envelope.
The characters will appear upright (within $\pm 2^{o}$) when the tube is mounted vertically.

Care should be taken not to bend the leads nearer than 1.5 mm from the seals.

The leads are turned and may be dip soldered to a minimum of 5 mm from the seals at a solder temperature of 240 °C for a maximum of 10 seconds.

CHARACTERISTICS, OPERATING CONDITIONS AND LIMITING VALUES

These are essential the same as of type ZM1080.

PHILIPS

Data handbook

Electronic components and materials

ZM1081 ZM1083

page	sheet	date
1	1	1970.04
2	2	1970.04
3	FP	2000.04.21

INDICATOR TUBE

Cold cathode ten digit side viewing numeral indicator tube

QUICK REFERENCE DATA				
Numeral height			13	mm
Numerals	1 2 3 4 5 6 7 8 9 0			
Supply voltage	V_b	min.	170	V
Cathode current	I_k		2	mA
Distance between mounting centres		min.	19	mm

GENERAL

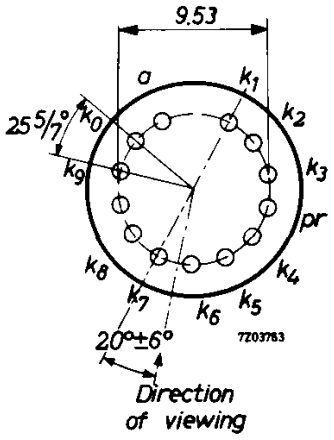
The numerals are 13 mm high and appear on the same base line allowing in-line read out. The ZM1080 is provided with a red contrast filter.
The ZM1082 is identical to the ZM1080 but has no filter.

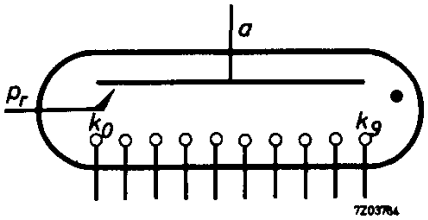
PRINCIPLE OF OPERATION

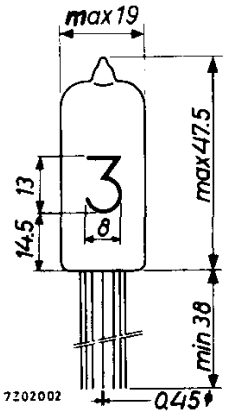
The tube contains ten cathodes in the form of ten figures and one common anode. By applying a suitable voltage between the anode and one of the ten cathodes the corresponding figure will be covered by a red neon glow.

DIMENSIONS AND CONNECTIONS

Dimensions in mm







Mounting position: any

The numbers are viewed through the side of the envelope. The numbers will appear upright (within $\pm 3^{o}$) when the tube is mounted vertically.
Care should be taken not to bend the leads nearer than 1.5 mm from the seals.
The leads are tinned and may be dip soldered to a minimum of 5 mm from the seals at a solder temperature of 240 °C for a maximum of 10 seconds.
The tube may be soldered directly into the circuit but heat conducted to the glass to metal seals should be kept to a minimum by the use of a thermal shunt.

CHARACTERISTICS AND RANGE VALUES FOR EQUIPMENT DESIGN

Initially and during life at 20 °C to 50 °C unless otherwise stated.

Ignition			
Anode voltage	V_a	> 170	V
Ignition delay time		See page 4	1)
Conduction			
D.C. operation			
Cathode current 1)	I_k	< 3.5	mA
Cathode current for coverage	I_k	> 1.5	mA
Maintaining voltage at I_k = 2 mA (See also page 5)	V_m	140	V
Probe current to individual non-conducting cathodes	I_{kk}	See page 6	
Pulse operation			
Cathode current, peak	I_{k_p}	< 12	mA
average, T_{av} = 20 ms	I_k	< 2.5	mA
Average cathode current for satisfactorily display	I_k	> 0.8	mA
Pulse duration	T_{imp}	< 20 > 100	ms μs
Maintaining voltage	V_m	See page 5	
Probe current to individual non-conducting cathodes	I_{kk}	See pages 6 and 7	

EXTINCTION

Anode voltage to ensure extinction	V_a	< 115	V

1) For reduced ignition delay times, a small continuous priming current may be taken from lead 4. This can be obtained from a supply voltage of -180 V with respect to the "on" cathode via a resistor of 18 MΩ.

LIFE EXPECTANCY

Under recommended operating conditions and t_{amb} = room

Continuous display of one digit [1])		>	5000	h
Sequentially changing the display from one digit to another every 100 hours or less		>	30 000	h

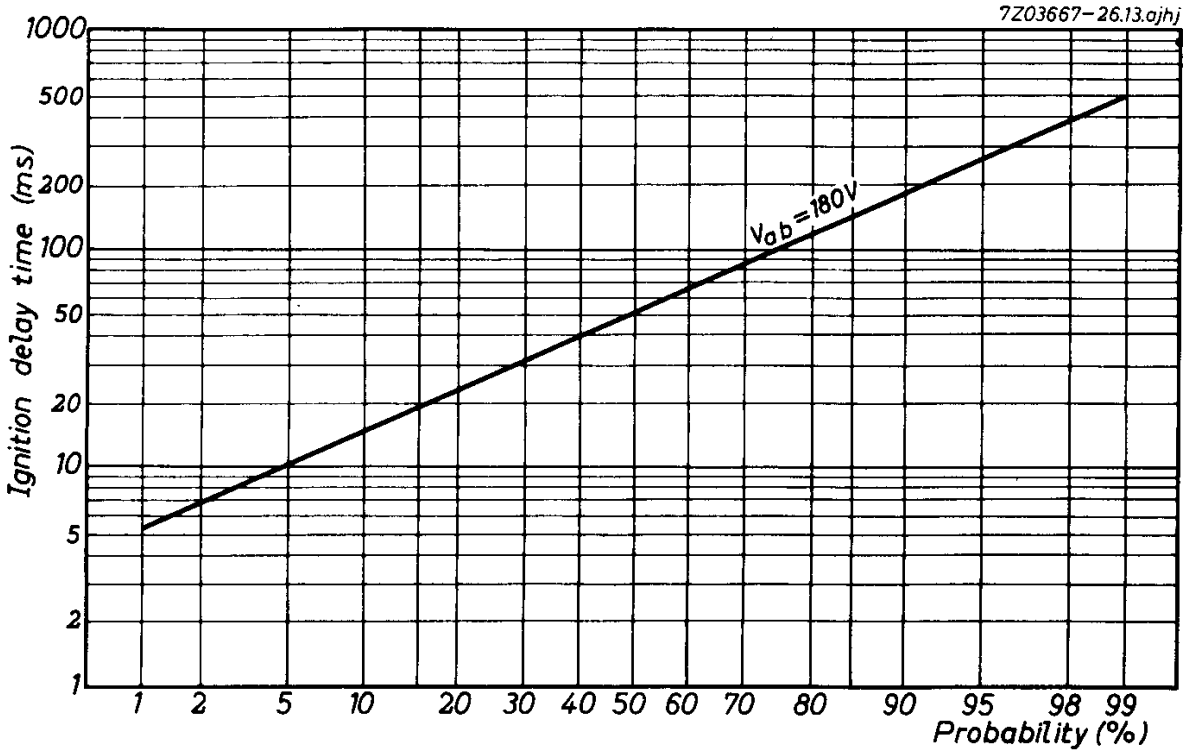
LIMITING VALUES (Absolute max. rating system)

Cathode current (each digit)

average, T_{av} = max. 20 ms	I_k	max.	3.5	mA
peak	I_{kp}	max.	12	mA
average during any conduction period	I_k	min.	1.5	mA
Bulb temperature	t_{bulb}	max.	+70	°C
		min.	−50	°C [2])
Anode voltage necessary for ignition	V_a	min.	170	V

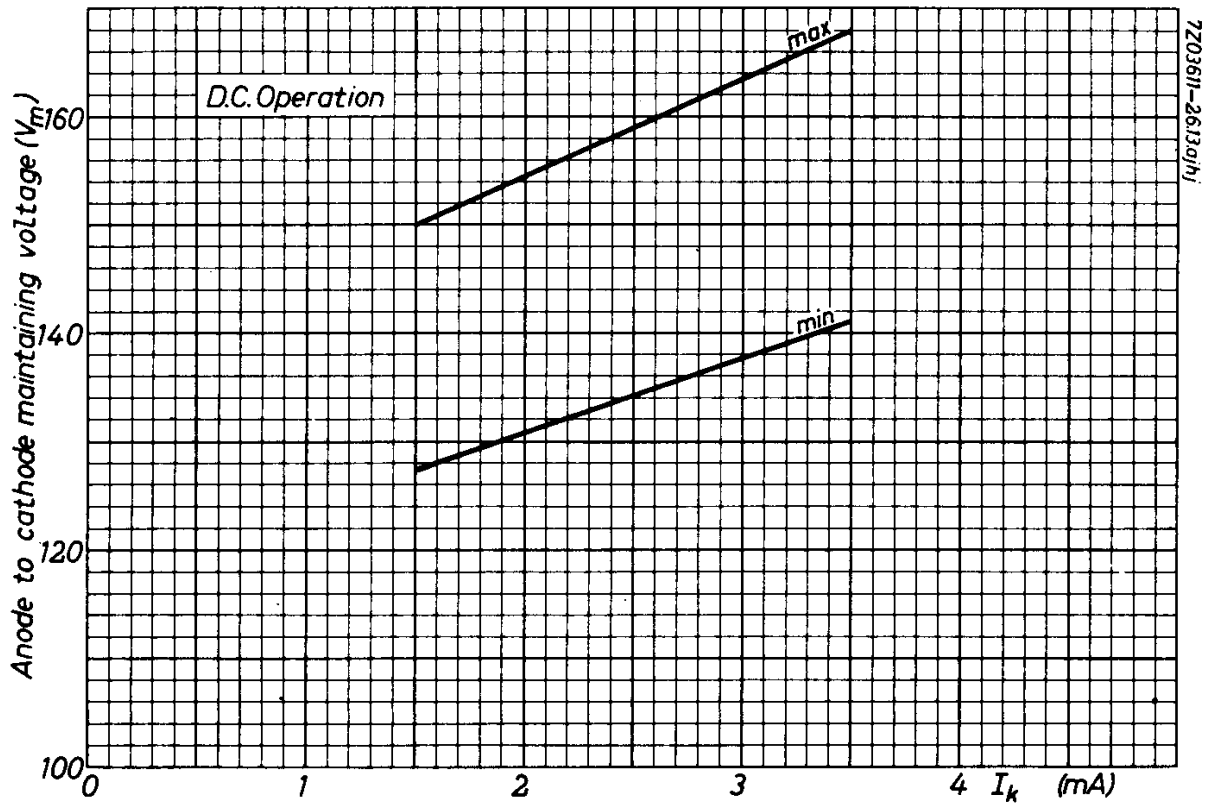
[1]) The life expectancy figures given above relate to operation with d.c. cathode currents between 1.5 mA to 2.5 mA and at all permitted pulsed cathode currents.
When a d.c. cathode current range of 1.5 mA to 3.5 mA is used, the life expectancy exceeds 3000 hours with continuous display of one digit.

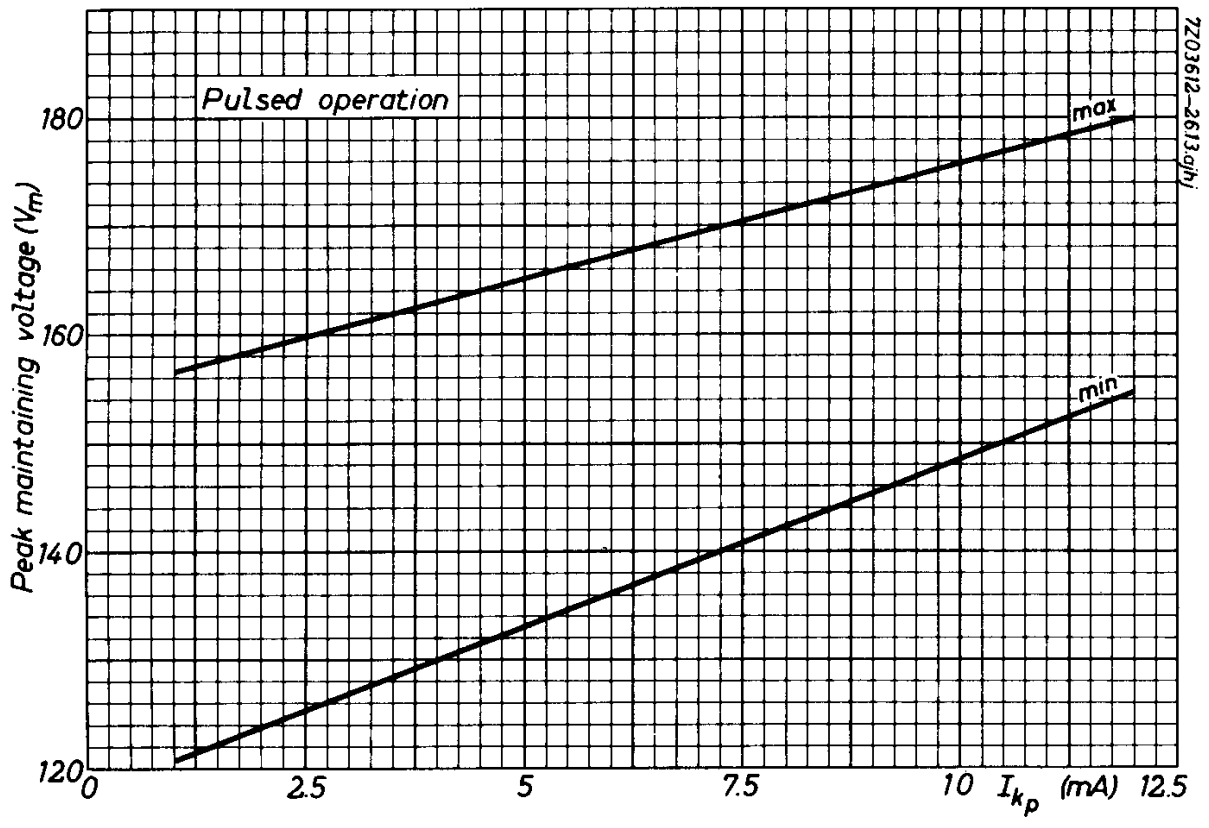
[2]) For bulb temperatures below 0 °C the life expectancy of the tube is substantially reduced.

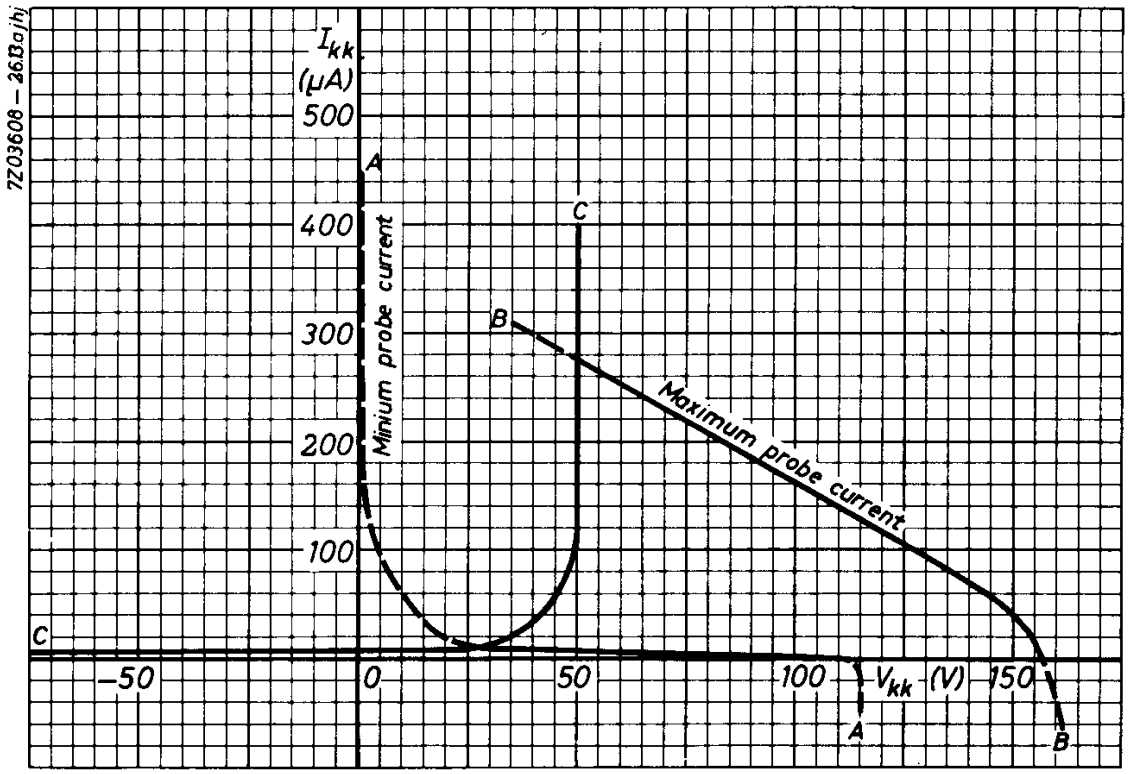


CUMULATIVE DISTRIBUTION OF IGNITION DELAY TIME

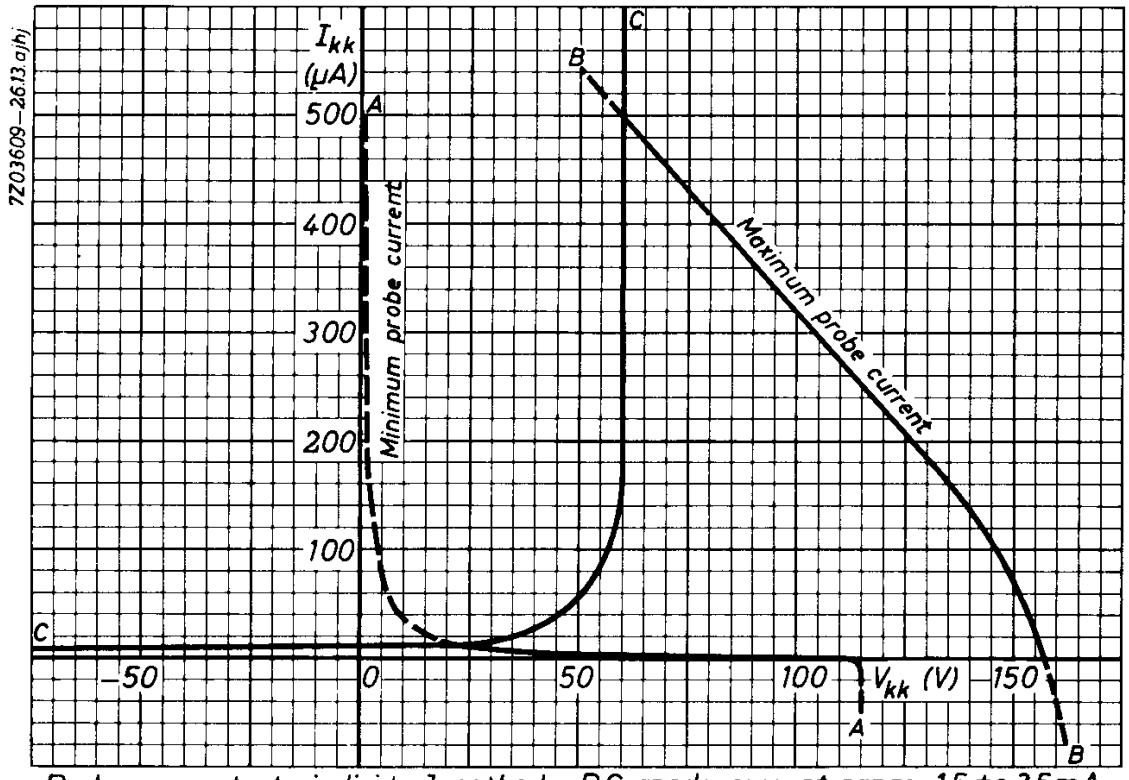
This curve shows the probability that a tube will ignite in less than the time shown after a non-conduction period of a few seconds. The ignition delay time will be appreciably reduced when the interval between conduction periods is less than 100 milliseconds. In general, an increase in the supply voltage will reduce the ignition delay time.


D.C. Operation
max
min
Anode to cathode maintaining voltage (V_m)
160
140
120
100
0
1
2
3
4 I_k (mA)
7Z03611-2613.ajhj

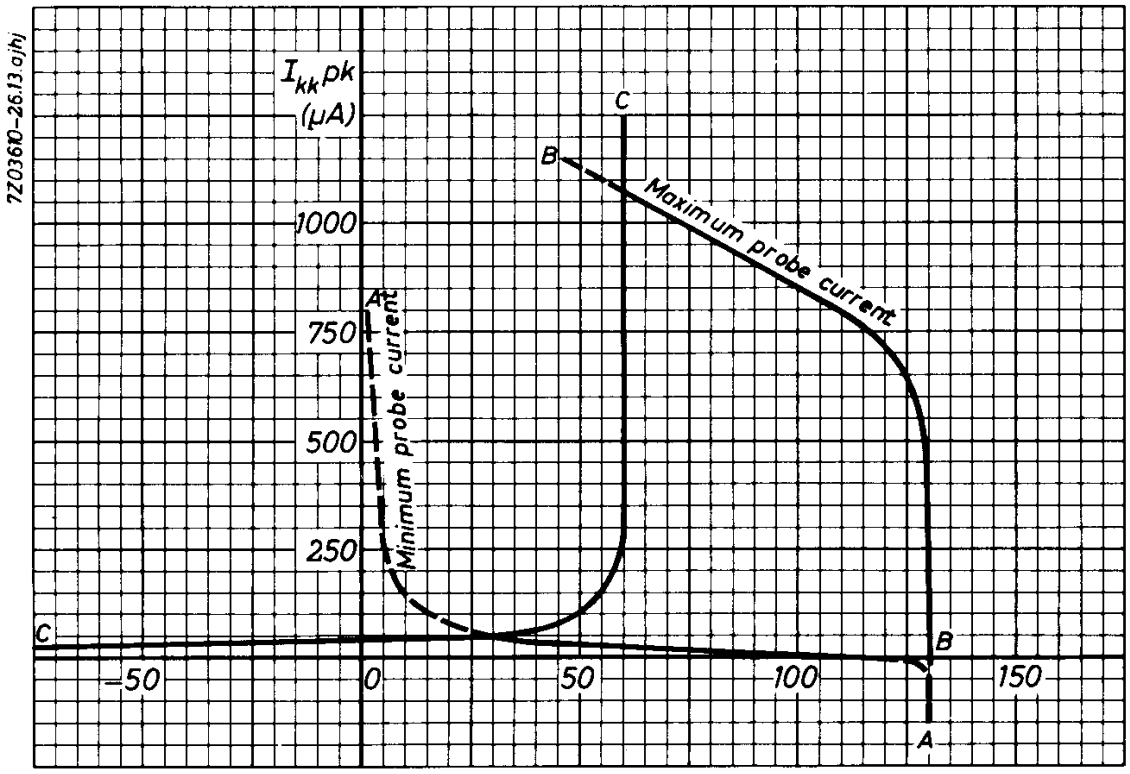

Pulsed operation
max
min
Peak maintaining voltage (V_m)
180
160
140
120
0
2.5
5
7.5
10 I_{kp} (mA) 12.5
7Z03612-2613.ajhj



Probe currents to individual cathodes. D.C. anode current range 1.5 to 2.5mA



Probe currents to individual cathodes. D.C. anode current range 1.5 to 3.5mA



Peak probe currents to individual cathodes. Pulsed anode current 10mA Duty factor 0.1

PROBE CURRENT CURVES

The boundaries A-A and B-B of the graphs represent, for the shown anode current ranges, the range of probe currents to individual non-conducting cathodes plotted against the voltage difference between the non-conducting cathodes and the conducting cathode.

For optimum display, the probe current to any non-conducting cathode should be as low as possible. In addition, reverse probe current should not be permitted.

These conditions can be satisfied in two ways:

(1) With a low impedance voltage source connected to the non-conducting cathodes. For example, when using a current range of 1.5 to 2.5 mA and a voltage between 50 and 115 V is required.

(2) With a separate high impedance connected to each non-conducting cathode and returned to a voltage source of less than 115 V. In this case the load line of the voltage source must lie to the right of boundary C-C.

INDICATOR TUBE

Cold cathode side viewing character indicator tube.

QUICK REFERENCE DATA			
Character height		10.5	mm
Characters		− + ~	
Supply voltage	V_b	min. 170	V
Cathode current	I_k	2	mA

GENERAL

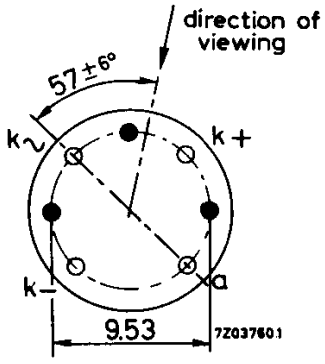
The ZM1081 is provided with a red contrast filter
The ZM1083 is identical to the ZM1081 but has no filter.

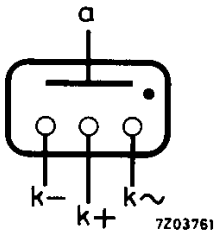
PRINCIPLE OF OPERATION

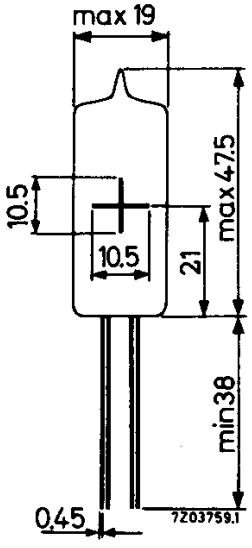
The tube contains 3 cathodes in the form of the characters −, + and ~ and one common anode.
By applying a suitable voltage between the anode and one of the three cathodes the corresponding character will be covered by a red neon glow.

DIMENSIONS AND CONNECTIONS

Dimensions in mm







Mounting position: any

The characters are viewed through the side of the envelope.
The characters will appear upright (within $\pm 2^{o}$) when the tube is mounted vertically.

Care should be taken not to bend the leads nearer than 1.5 mm from the seals.

The leads are turned and may be dip soldered to a minimum of 5 mm from the seals at a solder temperature of 240 °C for a maximum of 10 seconds.

CHARACTERISTICS, OPERATING CONDITIONS AND LIMITING VALUES

These are essential the same as of type ZM1080.

PHILIPS

Data handbook

Electronic components and materials

ZM1081 ZM1083

page	sheet	date
1	1	1970.04
2	2	1970.04
3	FP	2000.04.21

INDICATOR TUBE

Long life cold cathode ten digit numeral indicator tube for top viewing.
The rectangular envelope allows for close tube-to-tube spacing, both in the horizontal and vertical axes.

QUICK REFERENCE DATA				
Numeral height			15.5	mm
Numerals	1 2 3 4 5 6 7 8 9 0			
Supply voltage	V_{ba}	min.	170	V
Cathode current	I_k		2.5	mA
Distance between mounting centres		min.	20	mm
Viewing angle			90	o

GENERAL

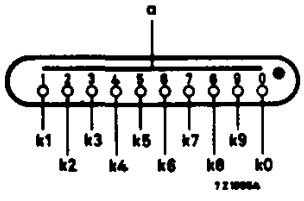
The numerals are 15.5 mm high and appear on the same base line allowing in-line read out.

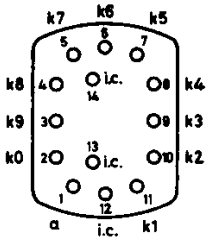
PRINCIPLE OF OPERATING

The tube contains ten cathodes in the form of ten figures and one common anode. By applying a suitable voltage between the anode and one of the ten cathodes the corresponding figure will be covered by a red neon glow.

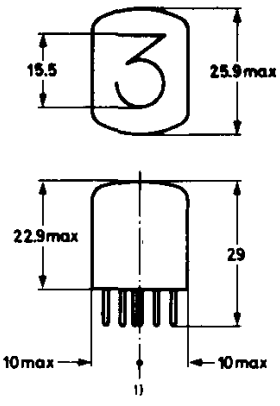
DIMENSIONS AND CONNECTIONS

Dimensions in mm





special 14 pin base



1) Centre line through pins 6 and 12 (Note: distance between centre lines of adjacent tubes must be at least 20 mm)

Mounting position: any

The numerals are viewed through the top of the envelope. The numerals will appear upright (within $\pm 3^0$) when the tube is mounted with the line through pins 6 and 12 vertical, pin 6 uppermost.

Accessory

Socket	type	55705

CHARACTERISTICS AND OPERATING CONDITIONS (at 20 °C to 50 °C)

Ignition voltage	V_{ign}	min. 170	V
Ignition delay		see page 3	
Maintaining voltage		see page 4	
Cathode current, recommended	I_k	2.5	mA
Cathode current for coverage average during any conduction period	I_k	min. 1.5	mA
D.C. operation		see pages 5 to 9	
Extinguishing voltage	V_{ext}	118	V

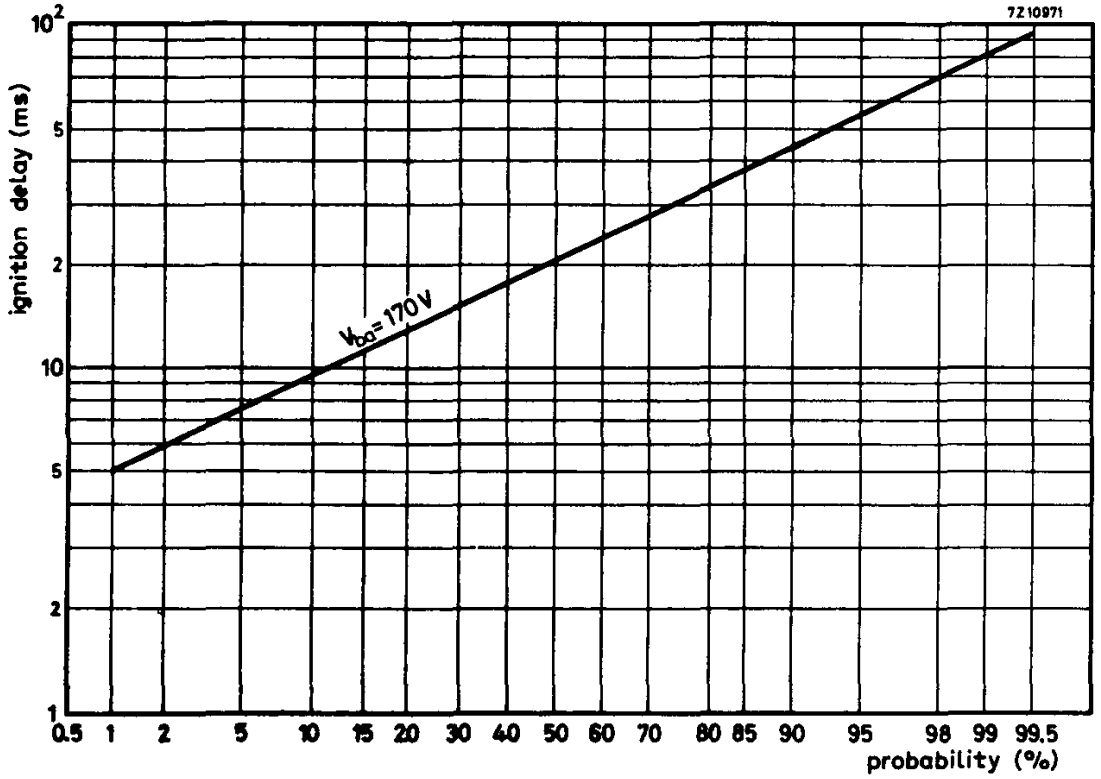
LIFE EXPECTANCY at I_k = 2.5 mA and room temperature 1)

Continuous display of one numeral	> 5 000	h
Sequentially changing the display from one numeral to another, every 100 hrs or less	> 30 000	h

LIMITING VALUES (Absolute max. rating system)

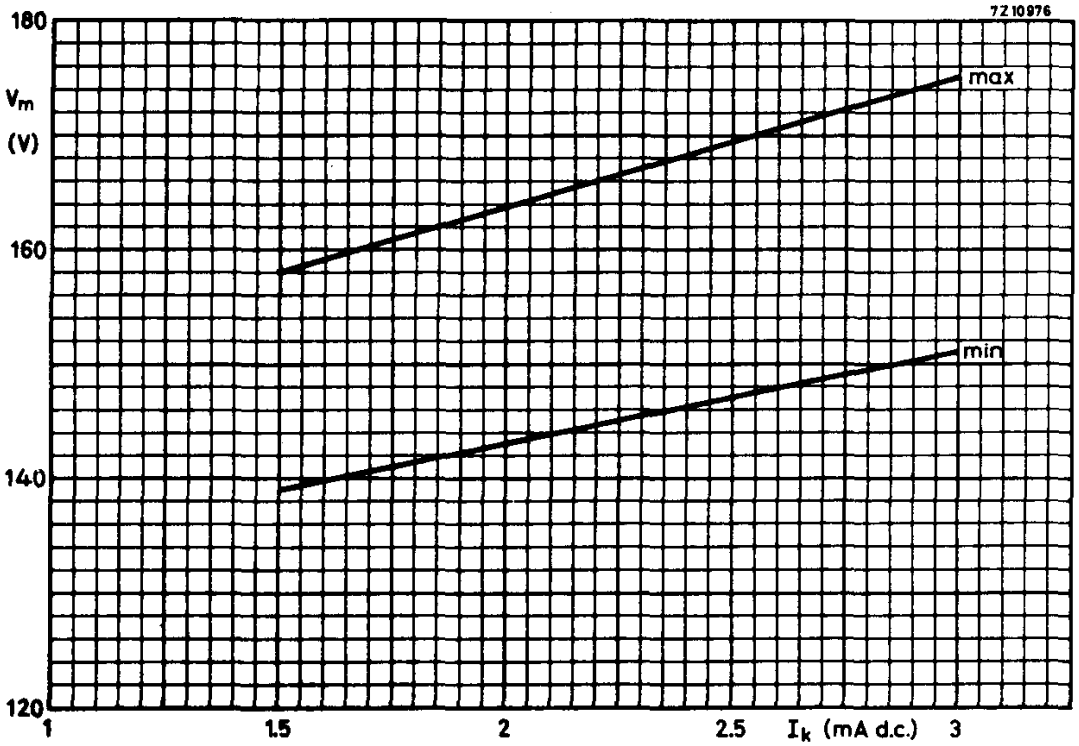
Cathode current (each digit),			
average, T_{av} = max. 20 ms	I_k	max. 3.0	mA
peak	I_{kp}	max. 3.5	mA
average during any conduction period	I_k	min. 1.5	mA
Anode voltage necessary for ignition	V_a	min. 170	V
Bulb temperature	t_{bulb}	max. +70	°C
	t_{bulb}	min. -10	°C 1)

1) For bulb temperatures below +10 °C the life expectancy of the tube is substantially reduced.



CUMULATIVE DISTRIBUTION OF IGNITION DELAY

This curve shows the probability that a tube will ignite in less than the time shown after a non-conduction period of a few seconds. The ignition delay will be appreciably reduced when the interval between conduction periods is less than 100 milliseconds. In general, an increase in the supply voltage will reduce the ignition delay.

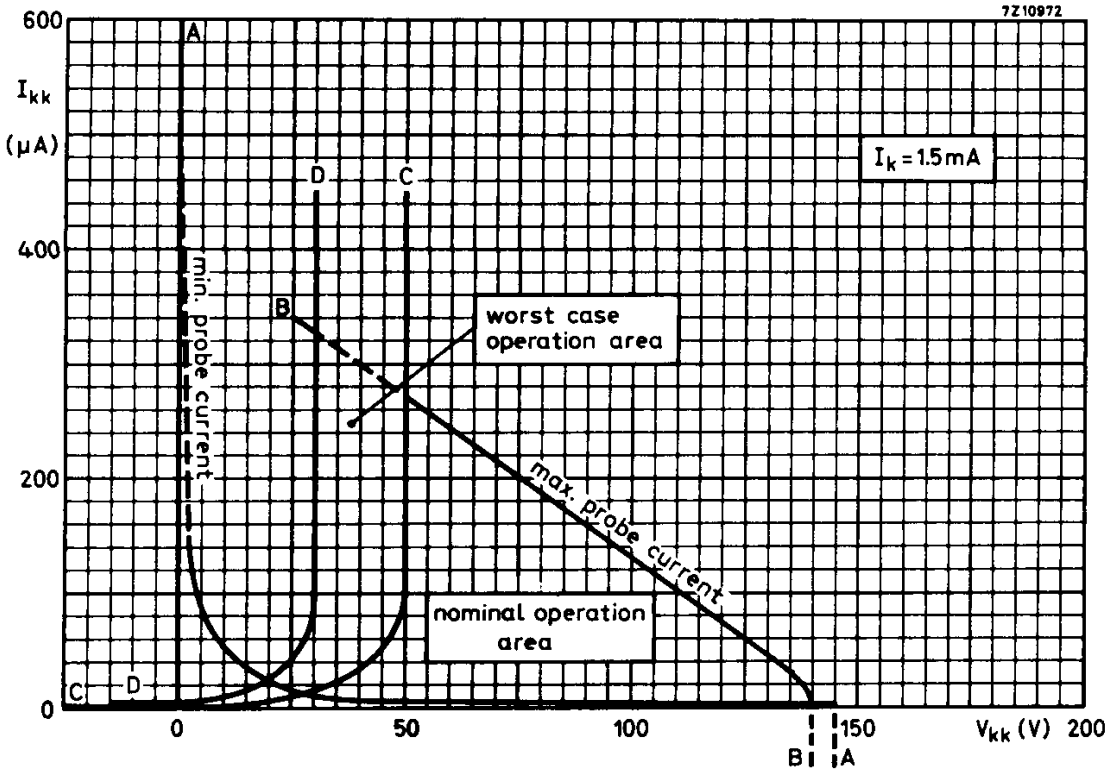


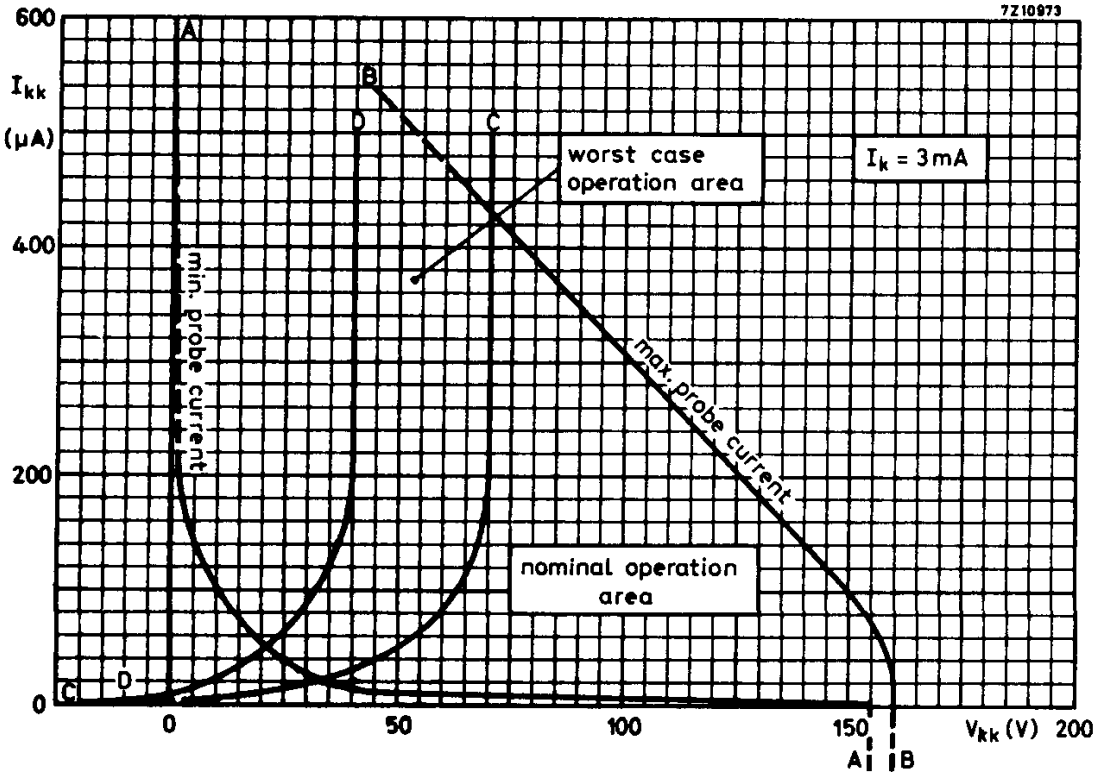
ANODE-TO-CATHODE MAINTAINING VOLTAGE
AS A FUNCTION OF CATHODE CURRENT

NOTE

PROBE CURRENT CURVES

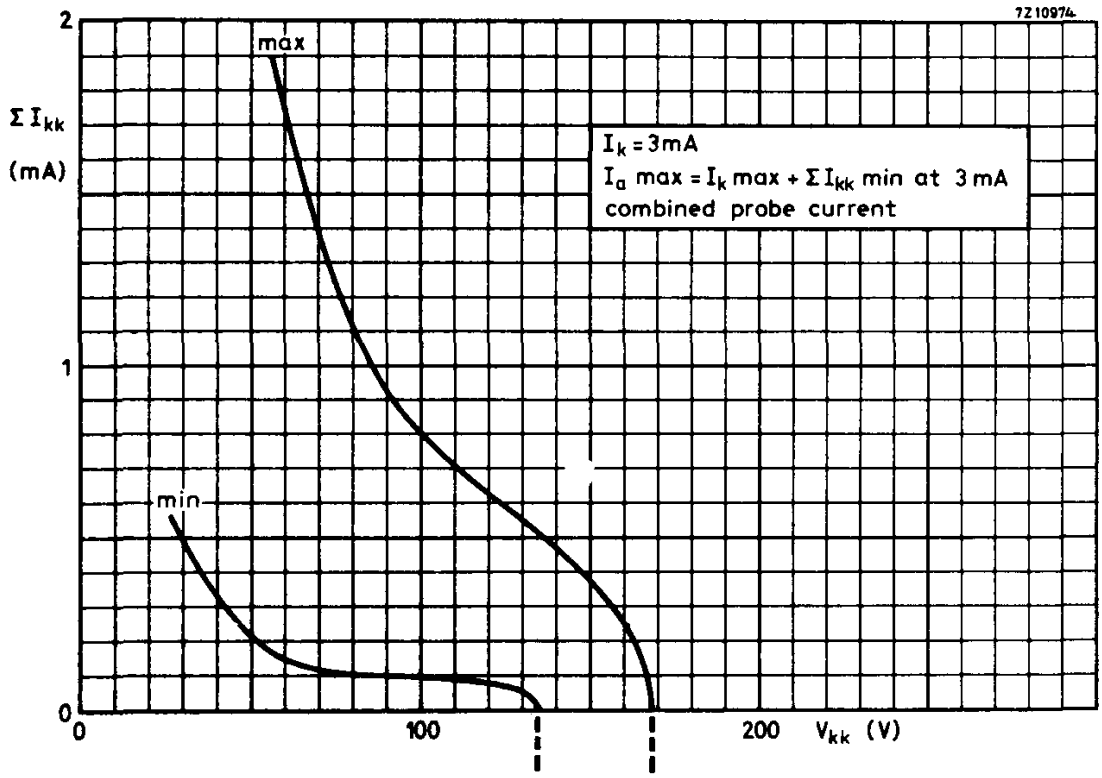
For low cathode selecting voltages (V_{kk}) *the current* I_{kk} *to the non-conducting cathode will increase, and the readability of the conducting cathode will be affected.* It is therefore recommended to use a nominal operating point to the right of line C-C. Under the worst operating conditions the operating point should never reach the area left of the line D-D.

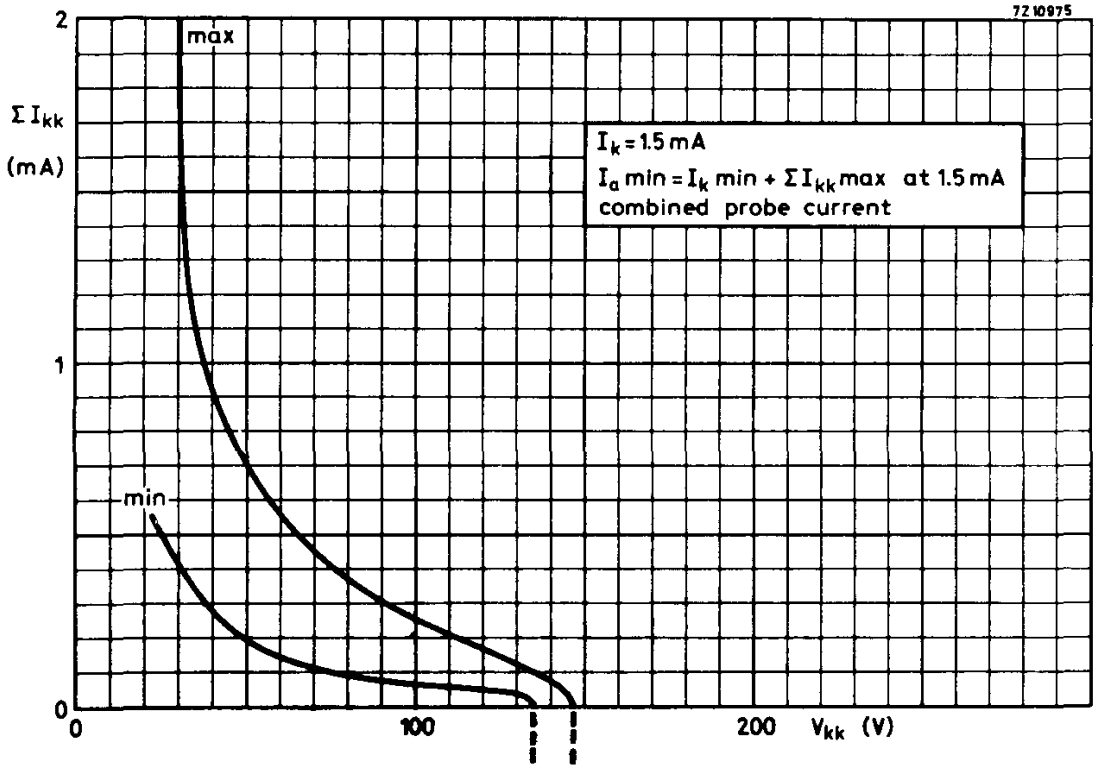




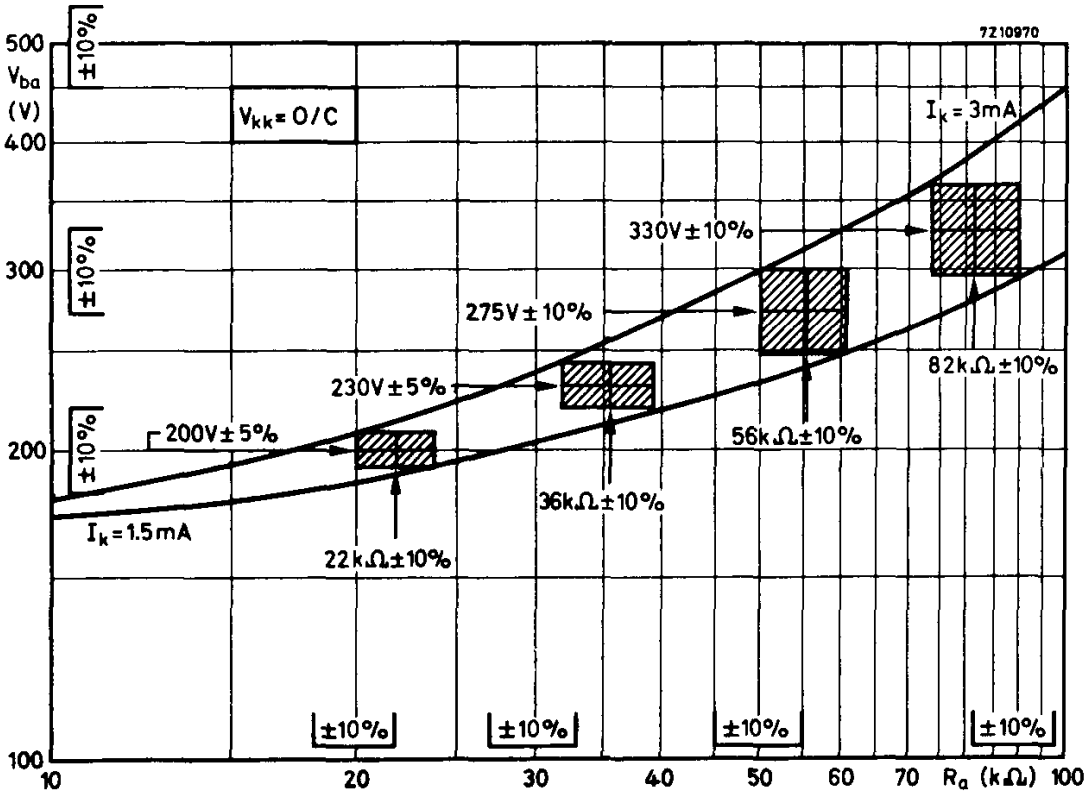
PROBE CURRENTS TO INDIVIDUAL NON-CONDUCTING CATHODES

See note page 4





COMBINED PROBE CURRENT TO ALL NON-CONDUCTING CATHODES



D.C. SUPPLY VOLTAGE AS A FUNCTION OF ANODE LOAD RESISTOR:

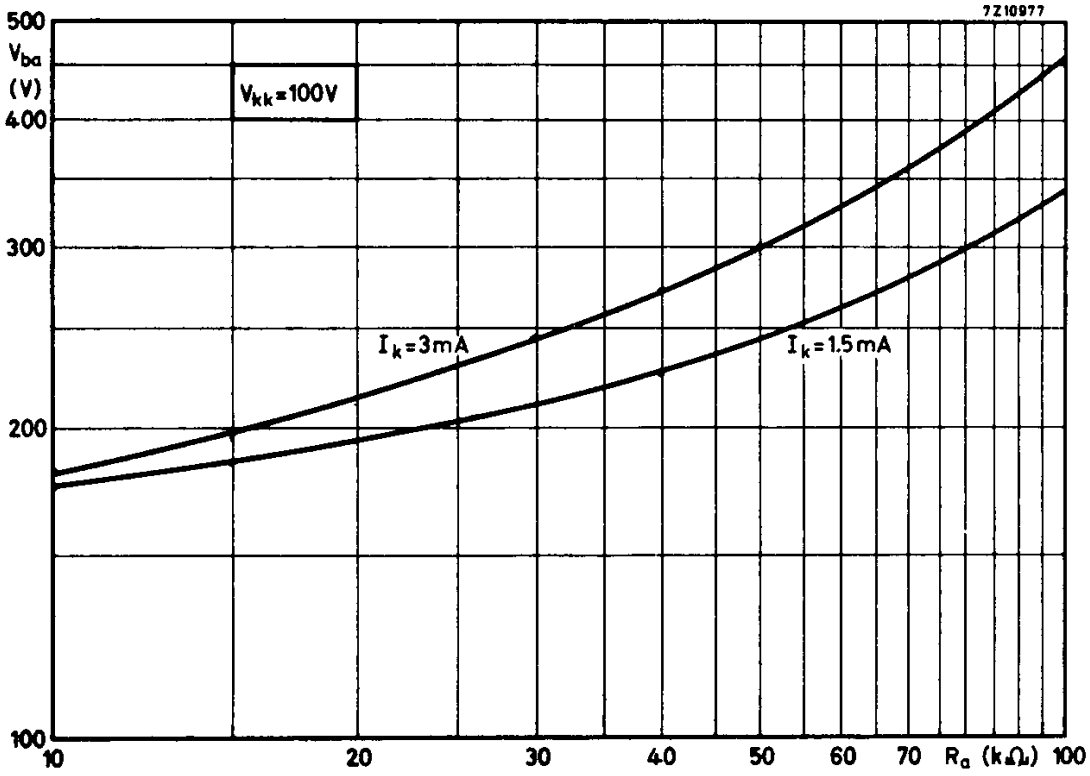
NON-CONDUCTING CATHODES OPEN CIRCUIT

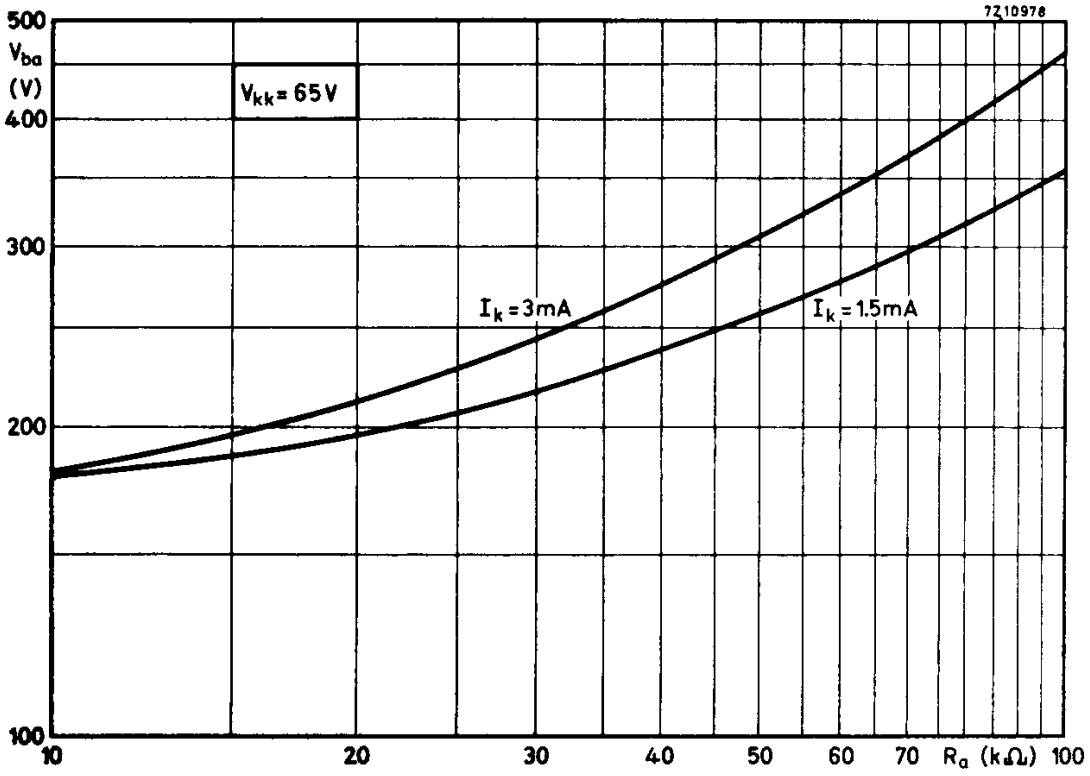
NOTE - SUPPLY VOLTAGE/LOAD RESISTOR

The graphs on pages 7 to 9 give the relationship between the d.c. anode supply voltage and the required anode load resistor for fixed values of V_{kk} (voltage difference between conducting and non-conducting cathodes).

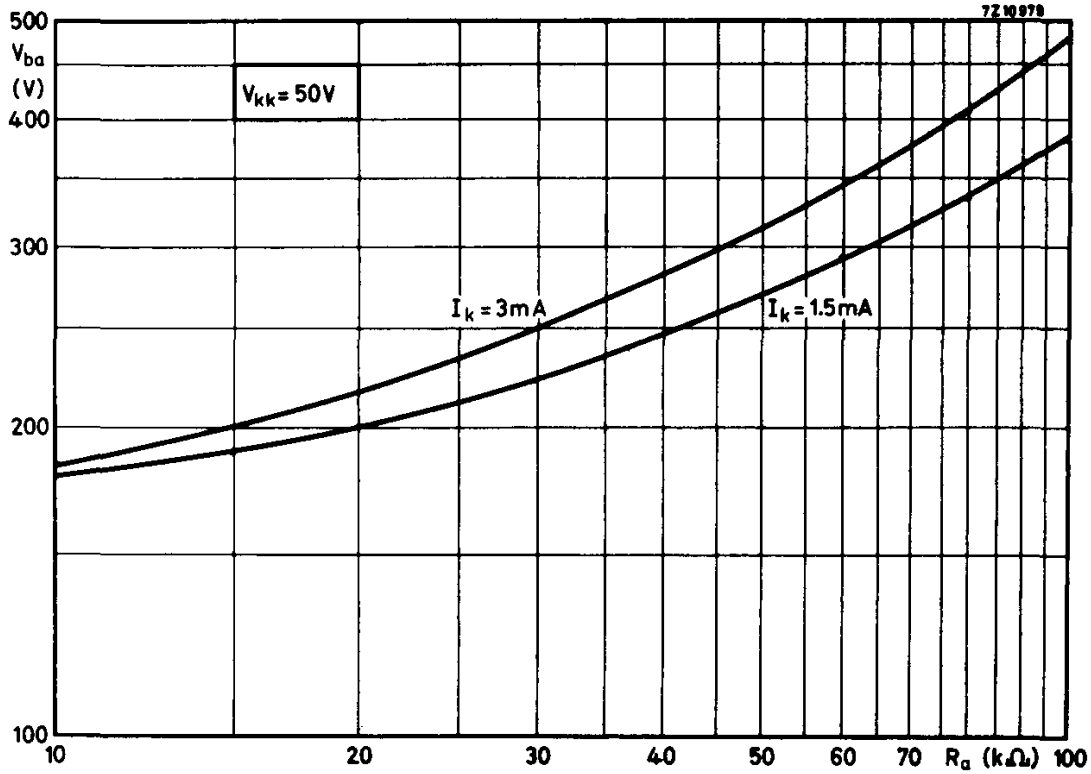
Each graph is plotted on log-log graph paper; therefore a given tolerance expressed as a percentage can be represented as a fixed length at any point on the x and y axis. This is shown on the graph above by taking points on each axis with a fixed tolerance. Examples are shown on the graph above of the supply voltages and load resistors with tolerances expressed as a percentage so as to remain within the recommended operating region.

On page 9 details are given of the method of calculating corresponding values of supply voltage and anode load resistor, for fixed values of V_{kk}.





D.C. SUPPLY VOLTAGE AS A FUNCTION OF ANODE LOAD RESISTOR



D.C. SUPPLY VOLTAGE AS A FUNCTION OF ANODE LOAD RESISTOR

NOTE - The supply voltage/load resistor curves are derived from:

$$V_{ba} = I_a . R_a + V_m \text{ (General formula)}$$

$$V_{ba} = \left[I_k + \Sigma I_{kk}\right] R_a + V_m$$

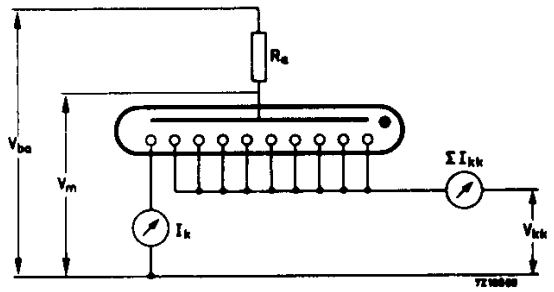
The value of I_{kk} will depend on the bias voltage V_{kk}.

Supply voltage required to work above the minimum value of I_k:

$$V_{ba} = \left[1.5 \text{ mA} + \Sigma I_{kk} \text{ max. at } I_k = 1.5 \text{ mA}\right] R_a + 158 \text{ V}$$

Supply voltage required to work below the maximum value of I_k:

$$V_{ba} = \left[3.0 \text{ mA} + \Sigma I_{kk} \text{ min. at } I_k = 3.0 \text{ mA}\right] R_a + 151 \text{ V}$$



INDICATOR TUBE

Long life cold cathode ten digit numeral indicator tube for side viewing.

QUICK REFERENCE DATA			
Numeral height		15.5	mm
Numerals	1 2 3 4 5 6 7 8 9 0		
Supply voltage	V_{ba}	min. 170	V
Cathode current	I_k	2.5	mA
Distance between mounting centres		min. 19	mm

GENERAL

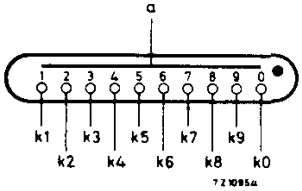
The numerals are 15.5 mm high and appear on the same base line allowing in-line read out. The ZM1170 is provided with a red contrast filter. The ZM1172 is identical to the ZM1170, but has no filter.

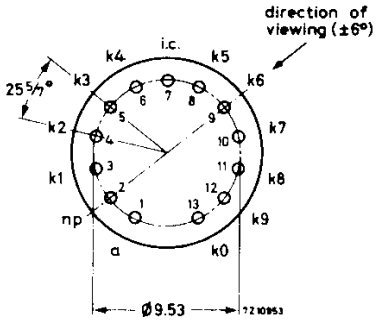
PRINCIPLE OF OPERATION

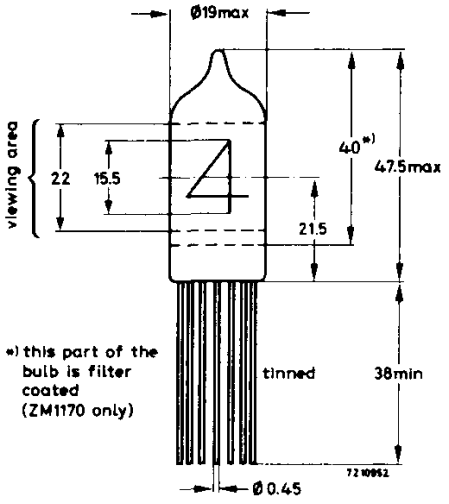
The tube contains ten cathodes in the form of ten figures and one common anode. By applying a suitable voltage between the anode and one of the ten cathodes the corresponding figure will be covered by a red neon glow.

DIMENSIONS AND CONNECTIONS

Dimensions in mm







Mounting position: any

The numerals will apear upright (within $\pm 3^{o}$) when the tube is mounted vertically, base down.

Soldering

The tube may be soldered directly into the circuit, but heat conduction to the glass-to-metal seals should be kept to a minimum by the use of a thermal shunt.
The leads may be dip-soldered to a minimum of 5 mm from the seals at a solder temperature of 240 °C for a maximum of 10 s.

Note

Care should be taken not to bend the leads nearer than 1.5 mm from the seals.

For electrical data please refer to type ZM1230

INDICATOR TUBE

Long life cold cathode ten digit numeral indicator tube for side viewing.

QUICK REFERENCE DATA			
Numeral height		15.5	mm
Numerals	1 2 3 4 5 6 7 8 9 0		
Supply voltage	V_{ba}	min. 170	V
Cathode current	I_k	2.5	mA
Distance between mounting centres		min. 19	mm

GENERAL

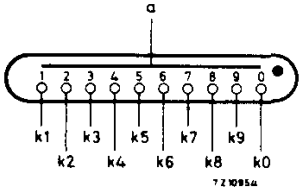
The numerals are 15.5 mm high and appear on the same base line allowing in-line read out. The ZM1170 is provided with a red contrast filter. The ZM1172 is identical to the ZM1170, but has no filter.

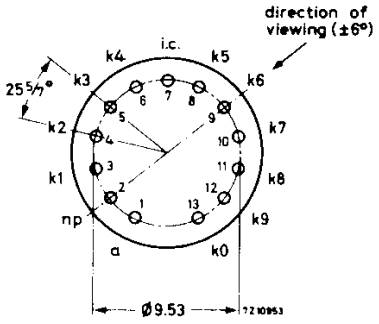
PRINCIPLE OF OPERATION

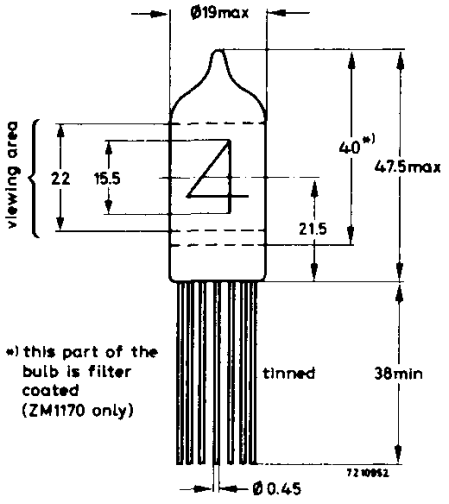
The tube contains ten cathodes in the form of ten figures and one common anode. By applying a suitable voltage between the anode and one of the ten cathodes the corresponding figure will be covered by a red neon glow.

DIMENSIONS AND CONNECTIONS

Dimensions in mm







Mounting position: any

The numerals will apear upright (within $\pm 3^{o}$) when the tube is mounted vertically, base down.

Soldering

The tube may be soldered directly into the circuit, but heat conduction to the glass-to-metal seals should be kept to a minimum by the use of a thermal shunt.
The leads may be dip-soldered to a minimum of 5 mm from the seals at a solder temperature of 240 °C for a maximum of 10 s.

Note

Care should be taken not to bend the leads nearer than 1.5 mm from the seals.

For electrical data please refer to type ZM1230

INDICATOR TUBE

Long life cold cathode ten digit numeral indicator tube for side viewing.

QUICK REFERENCE DATA			
Numeral height		15.5	mm
Numerals	0 1 2 3 4 5 6 7 8 9		
Decimal point	*see "General"*		
Supply voltage	min.	170	V
Numeral cathode current		2.5	mA
Decimal point cathode current		0.5	mA
Distance between mounting centres	min.	19	mm

GENERAL

The numerals are 15.5 mm high and appear on the same base line allowing in-line read out. The four types are electrically identical but differ in the position of the decimal point and the inclusion of a red contrast filter.

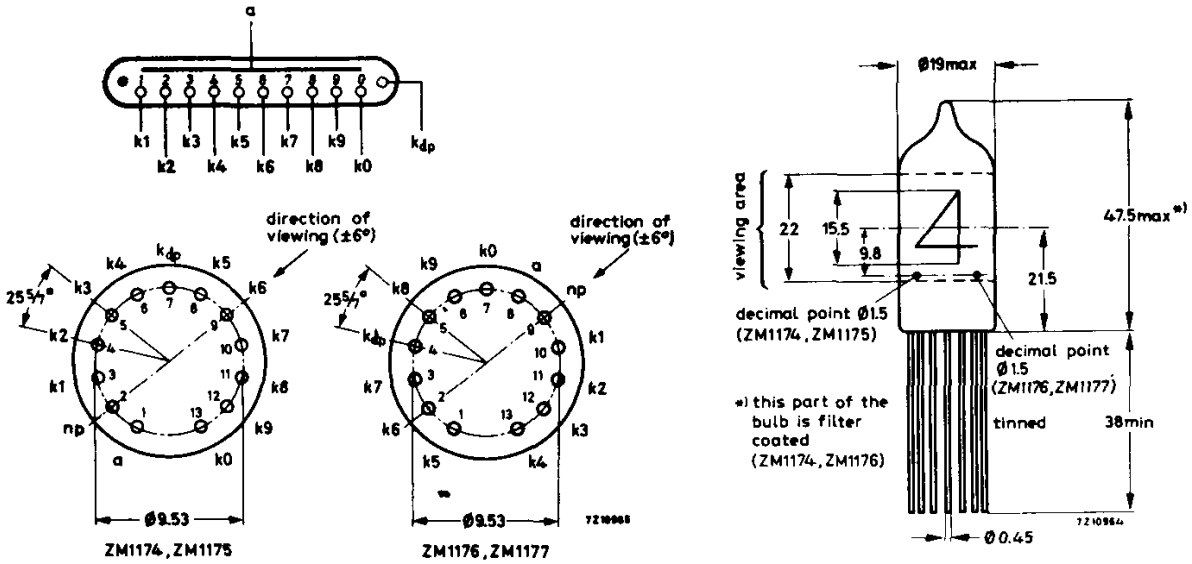
ZM1174 Decimal point on the left hand side. Red contrast filter.
ZM1175 Decimal point on the left hand side. No filter.
ZM1176 Decimal point on the right hand side. Red contrast filter.
ZM1177 Decimal point on the right hand side. No filter.

PRINCIPLE OF OPERATION

The tube contains ten cathodes in the form of ten figures and one in the form of a decimal point, and a common anode. By applying a suitable voltage between the anode and one of the cathodes the corresponding figure or decimal point will be covered by a red neon glow.

DIMENSIONS AND CONNECTIONS

Dimensions in mm



Data based on pre-production tubes.

Mounting position: any

The numerals and the decimal point are viewed through the side of the envelope. The numerals will appear upright (within ± 3 °) when the tube is mounted vertically, base down.

Soldering

The tube may be soldered directly into the circuit, but heat conduction to the glass-to-metal seals should be kept to a minimum by the use of a thermal shunt.
The leads may be dip-soldered to a minimum of 5 mm from the seals at a solder temperature of 240 °C for a maximum of 10 s.

Note

Care should be taken not to bend the leads nearer than 1.5 mm from the seals.

CHARACTERISTICS AND OPERATING CONDITIONS (at 20 °C to 50 °C)

Ignition voltage	V_{ign}	max.	170	V
Mainting voltage	V_m		see page 3	
Numeral cathode current,				
recommended average	I_k		2.5	mA
average (T_{av} = 10 ms)	I_k	max.	3.5	mA
average, averaged over any conduction period	I_k	min.	1.5	mA 1)
peak	I_{kp}	max.	12	mA
Decimal point cathode current				
recommended average	I_{kdp}		0.5	mA
average, averaged over any conduction period	I_{kdp}	min.	0.05	mA 2)
peak	I_{kdpp}	max.	2.5	mA
Extinguishing voltage	V_{ext}		115	V

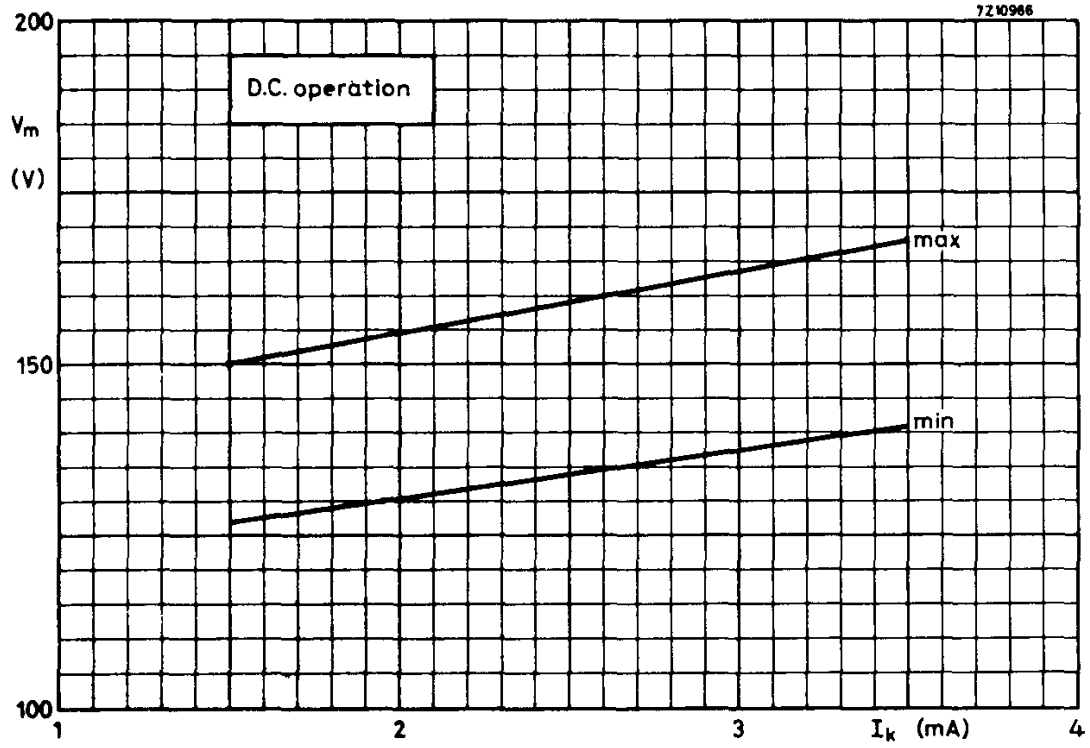
LIFE EXPECTANCY at I_k = 2.5 mA and room temperature. 3)

Continuous display of one numeral	>	5000	h
Sequentially changing the display from one numeral to another, every 100 h or less	>	30 000	h

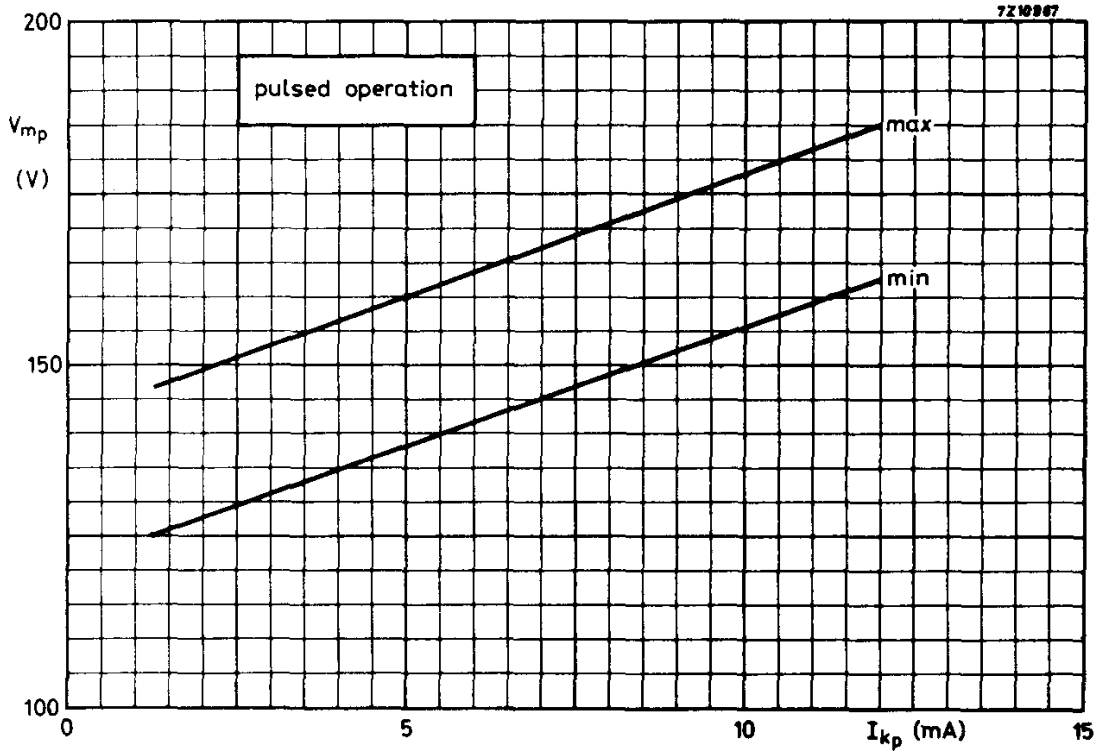
LIMITING VALUES (Absolute max. rating system)

Numeral cathode current				
average, T_{av} = 10 ms	I_k	max.	3.5	mA
peak	I_{kp}	max.	12	mA
average during any conduction period	I_k	min.	1.5	mA
Pulse duration	T_{imp}	min.	100	μs
Bulb temperature	t_{bulb}	max.	+70	°C
	t_{bulb}	min.	-50	°C 3)

1) This value applies, irrespective of wether the decimal point is running or not.
2) These conditions are automatically satisfied when the decimal point is directly connected to the numeral cathode carrying the main discharge. When the decimal point is connected in this way the max. decimal point current is 0.15 mA at a numeral cathode current of 1.5 mA.
3) For bulb temperatures below 0 °C the life expectancy of the tube is substantially reduced.



ANODE-TO-CATHODE MAINTAINING VOLTAGE
AS A FUNCTION OF CATHODE CURRENT



PEAK ANODE-TO-CATHODE MAINTAINING VOLTAGE
AS A FUNCTION OF PEAK CATHODE CURRENT

INDICATOR TUBE

Long life cold cathode ten digit numeral indicator tube for side viewing.

QUICK REFERENCE DATA			
Numeral height		15.5	mm
Numerals	0 1 2 3 4 5 6 7 8 9		
Decimal point	*see "General"*		
Supply voltage	min.	170	V
Numeral cathode current		2.5	mA
Decimal point cathode current		0.5	mA
Distance between mounting centres	min.	19	mm

GENERAL

The numerals are 15.5 mm high and appear on the same base line allowing in-line read out. The four types are electrically identical but differ in the position of the decimal point and the inclusion of a red contrast filter.

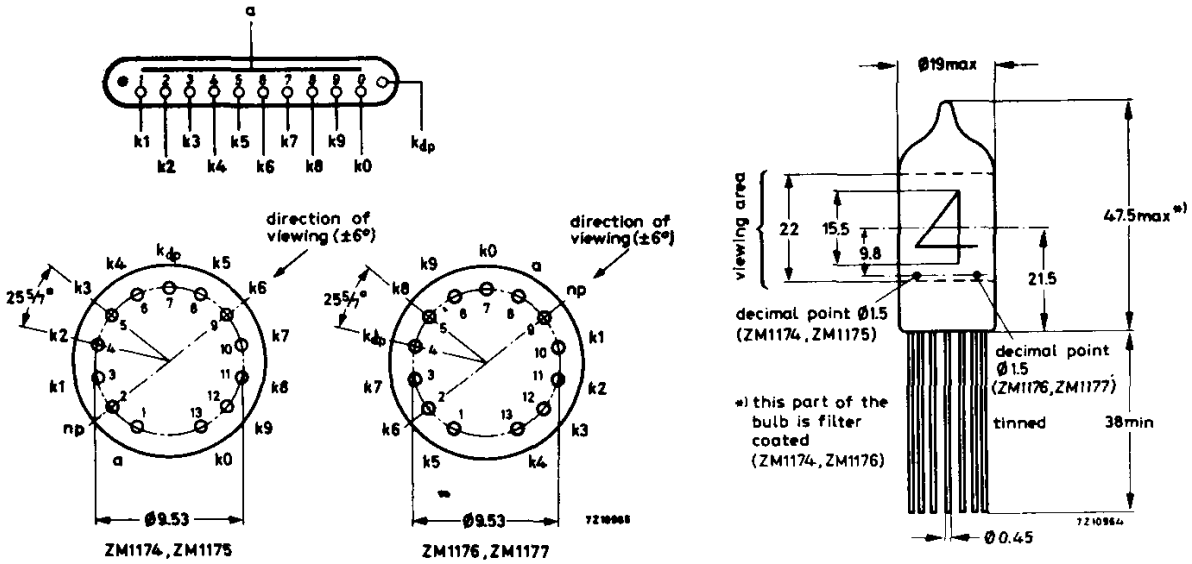
ZM1174 Decimal point on the left hand side. Red contrast filter.
ZM1175 Decimal point on the left hand side. No filter.
ZM1176 Decimal point on the right hand side. Red contrast filter.
ZM1177 Decimal point on the right hand side. No filter.

PRINCIPLE OF OPERATION

The tube contains ten cathodes in the form of ten figures and one in the form of a decimal point, and a common anode. By applying a suitable voltage between the anode and one of the cathodes the corresponding figure or decimal point will be covered by a red neon glow.

DIMENSIONS AND CONNECTIONS

Dimensions in mm



Data based on pre-production tubes.

Mounting position: any

The numerals and the decimal point are viewed through the side of the envelope. The numerals will appear upright (within ± 3 °) when the tube is mounted vertically, base down.

Soldering

The tube may be soldered directly into the circuit, but heat conduction to the glass-to-metal seals should be kept to a minimum by the use of a thermal shunt.
The leads may be dip-soldered to a minimum of 5 mm from the seals at a solder temperature of 240 °C for a maximum of 10 s.

Note

Care should be taken not to bend the leads nearer than 1.5 mm from the seals.

CHARACTERISTICS AND OPERATING CONDITIONS (at 20 °C to 50 °C)

Ignition voltage	V_{ign}	max.	170	V
Mainting voltage	V_m		see page 3	
Numeral cathode current,				
recommended average	I_k		2.5	mA
average (T_{av} = 10 ms)	I_k	max.	3.5	mA
average, averaged over any conduction period	I_k	min.	1.5	mA 1)
peak	I_{kp}	max.	12	mA
Decimal point cathode current				
recommended average	I_{kdp}		0.5	mA
average, averaged over any conduction period	I_{kdp}	min.	0.05	mA 2)
peak	I_{kdpp}	max.	2.5	mA
Extinguishing voltage	V_{ext}		115	V

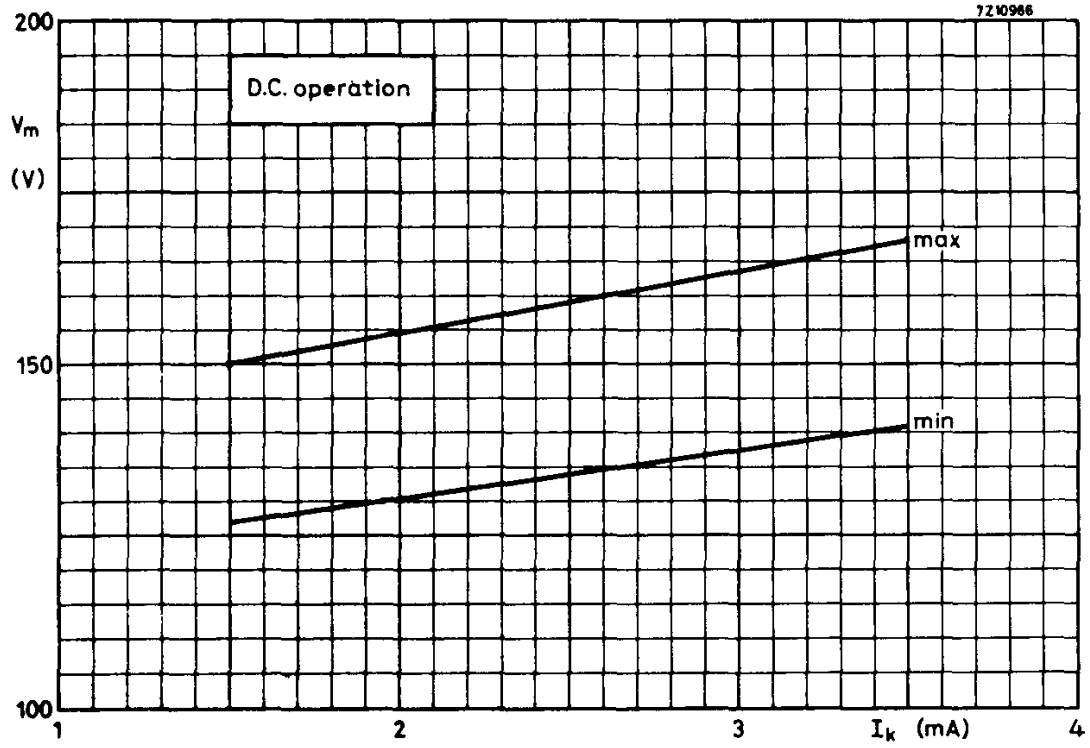
LIFE EXPECTANCY at I_k = 2.5 mA and room temperature. 3)

Continuous display of one numeral	>	5000	h
Sequentially changing the display from one numeral to another, every 100 h or less	>	30 000	h

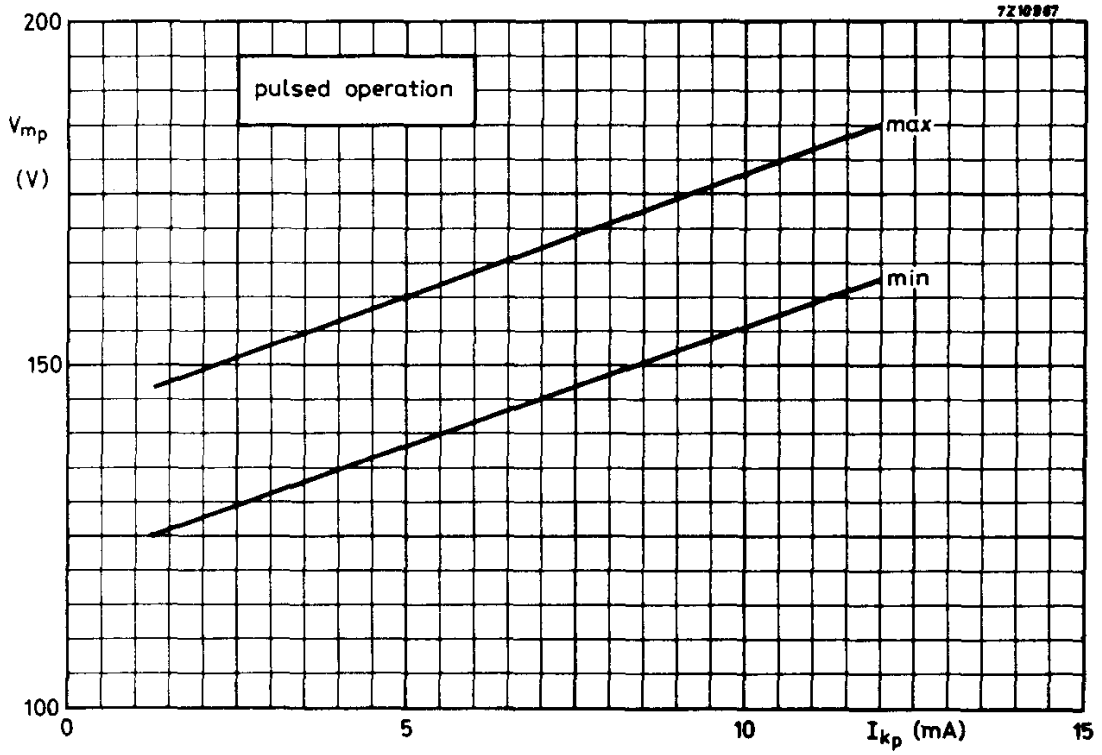
LIMITING VALUES (Absolute max. rating system)

Numeral cathode current				
average, T_{av} = 10 ms	I_k	max.	3.5	mA
peak	I_{kp}	max.	12	mA
average during any conduction period	I_k	min.	1.5	mA
Pulse duration	T_{imp}	min.	100	μs
Bulb temperature	t_{bulb}	max.	+70	°C
	t_{bulb}	min.	-50	°C 3)

1) This value applies, irrespective of wether the decimal point is running or not.
2) These conditions are automatically satisfied when the decimal point is directly connected to the numeral cathode carrying the main discharge. When the decimal point is connected in this way the max. decimal point current is 0.15 mA at a numeral cathode current of 1.5 mA.
3) For bulb temperatures below 0 °C the life expectancy of the tube is substantially reduced.



ANODE-TO-CATHODE MAINTAINING VOLTAGE
AS A FUNCTION OF CATHODE CURRENT



PEAK ANODE-TO-CATHODE MAINTAINING VOLTAGE
AS A FUNCTION OF PEAK CATHODE CURRENT

INDICATOR TUBE

Long life cold cathode ten digit numeral indicator tube for side viewing.

QUICK REFERENCE DATA			
Numeral height		15.5	mm
Numerals	0 1 2 3 4 5 6 7 8 9		
Decimal point	*see "General"*		
Supply voltage	min.	170	V
Numeral cathode current		2.5	mA
Decimal point cathode current		0.5	mA
Distance between mounting centres	min.	19	mm

GENERAL

The numerals are 15.5 mm high and appear on the same base line allowing in-line read out. The four types are electrically identical but differ in the position of the decimal point and the inclusion of a red contrast filter.

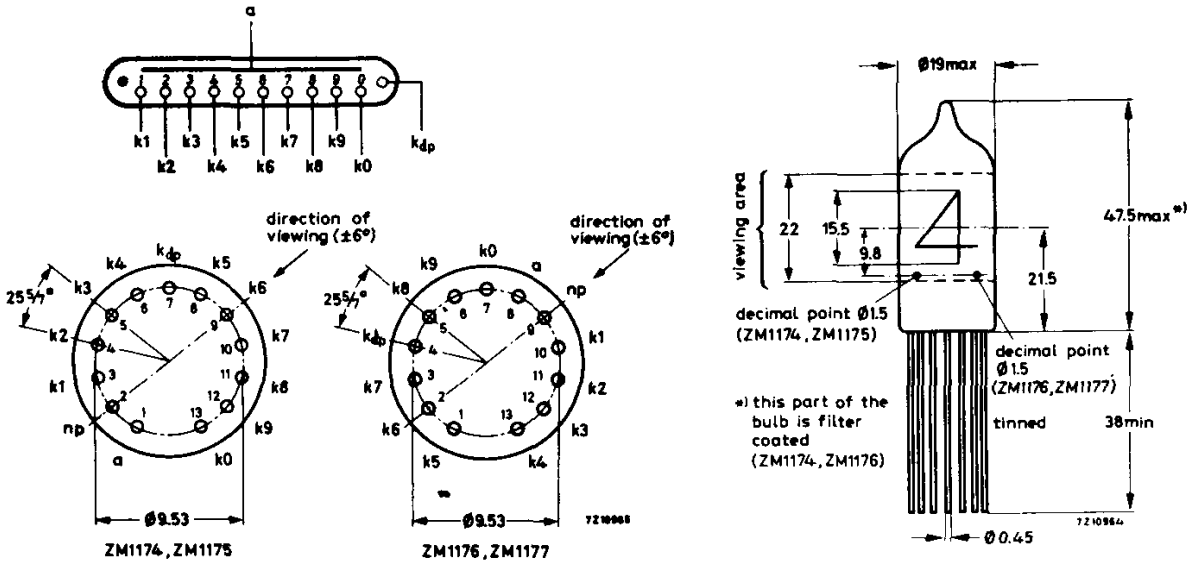
ZM1174 Decimal point on the left hand side. Red contrast filter.
ZM1175 Decimal point on the left hand side. No filter.
ZM1176 Decimal point on the right hand side. Red contrast filter.
ZM1177 Decimal point on the right hand side. No filter.

PRINCIPLE OF OPERATION

The tube contains ten cathodes in the form of ten figures and one in the form of a decimal point, and a common anode. By applying a suitable voltage between the anode and one of the cathodes the corresponding figure or decimal point will be covered by a red neon glow.

DIMENSIONS AND CONNECTIONS

Dimensions in mm



Data based on pre-production tubes.

Mounting position: any

The numerals and the decimal point are viewed through the side of the envelope. The numerals will appear upright (within ± 3 °) when the tube is mounted vertically, base down.

Soldering

The tube may be soldered directly into the circuit, but heat conduction to the glass-to-metal seals should be kept to a minimum by the use of a thermal shunt.
The leads may be dip-soldered to a minimum of 5 mm from the seals at a solder temperature of 240 °C for a maximum of 10 s.

Note

Care should be taken not to bend the leads nearer than 1.5 mm from the seals.

CHARACTERISTICS AND OPERATING CONDITIONS (at 20 °C to 50 °C)

Ignition voltage	V_{ign}	max.	170	V
Mainting voltage	V_m		see page 3	
Numeral cathode current,				
recommended average	I_k		2.5	mA
average (T_{av} = 10 ms)	I_k	max.	3.5	mA
average, averaged over any conduction period	I_k	min.	1.5	mA 1)
peak	I_{kp}	max.	12	mA
Decimal point cathode current				
recommended average	I_{kdp}		0.5	mA
average, averaged over any conduction period	I_{kdp}	min.	0.05	mA 2)
peak	I_{kdpp}	max.	2.5	mA
Extinguishing voltage	V_{ext}		115	V

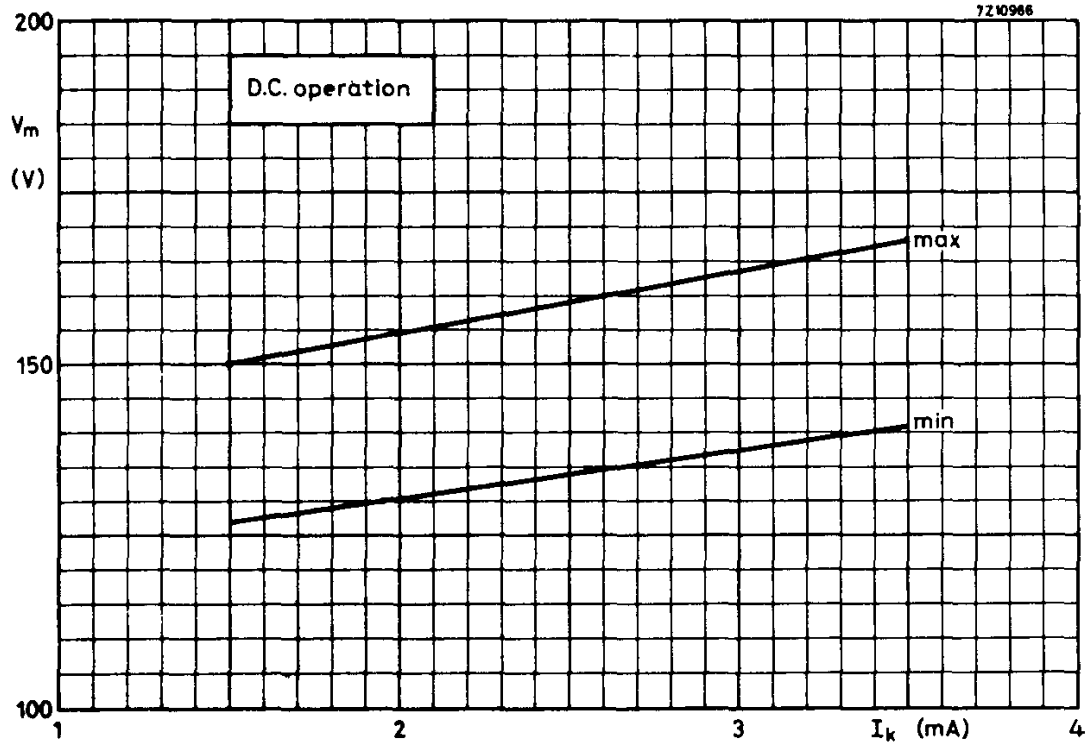
LIFE EXPECTANCY at I_k = 2.5 mA and room temperature. 3)

Continuous display of one numeral	>	5000	h
Sequentially changing the display from one numeral to another, every 100 h or less	>	30 000	h

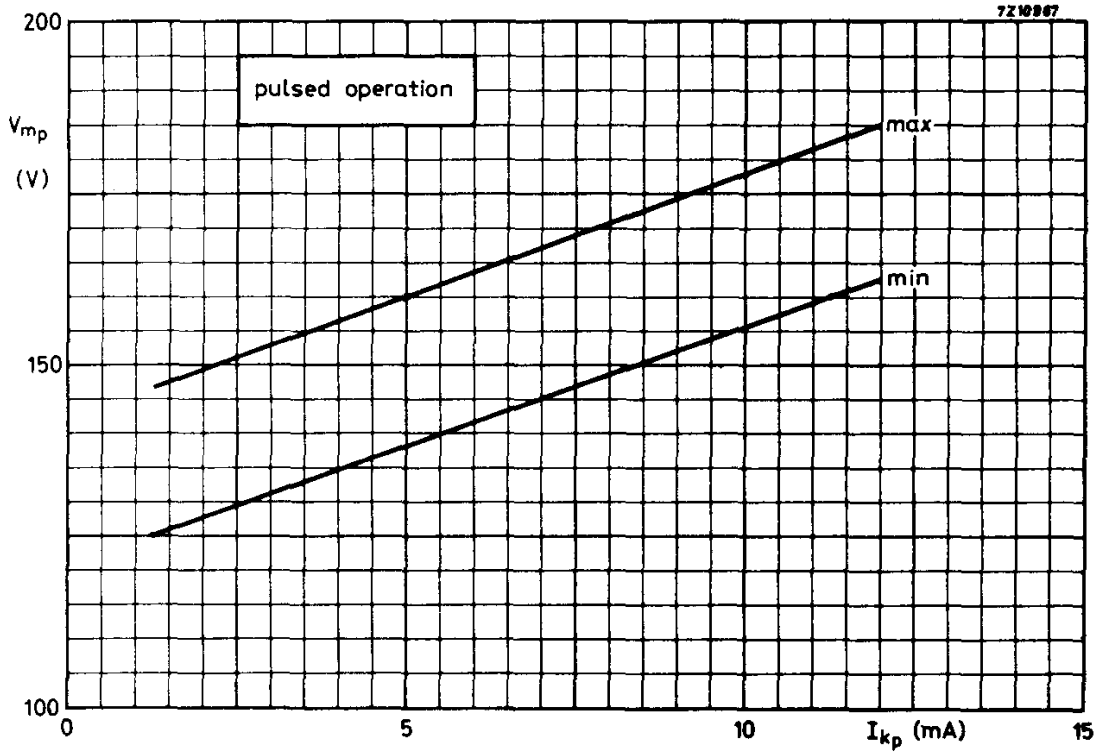
LIMITING VALUES (Absolute max. rating system)

Numeral cathode current				
average, T_{av} = 10 ms	I_k	max.	3.5	mA
peak	I_{kp}	max.	12	mA
average during any conduction period	I_k	min.	1.5	mA
Pulse duration	T_{imp}	min.	100	μs
Bulb temperature	t_{bulb}	max.	+70	°C
	t_{bulb}	min.	-50	°C 3)

1) This value applies, irrespective of wether the decimal point is running or not.
2) These conditions are automatically satisfied when the decimal point is directly connected to the numeral cathode carrying the main discharge. When the decimal point is connected in this way the max. decimal point current is 0.15 mA at a numeral cathode current of 1.5 mA.
3) For bulb temperatures below 0 °C the life expectancy of the tube is substantially reduced.



ANODE-TO-CATHODE MAINTAINING VOLTAGE
AS A FUNCTION OF CATHODE CURRENT



PEAK ANODE-TO-CATHODE MAINTAINING VOLTAGE
AS A FUNCTION OF PEAK CATHODE CURRENT

INDICATOR TUBE

Long life cold cathode ten digit numeral indicator tube for side viewing.

QUICK REFERENCE DATA			
Numeral height		15.5	mm
Numerals	0 1 2 3 4 5 6 7 8 9		
Decimal point	*see "General"*		
Supply voltage	min.	170	V
Numeral cathode current		2.5	mA
Decimal point cathode current		0.5	mA
Distance between mounting centres	min.	19	mm

GENERAL

The numerals are 15.5 mm high and appear on the same base line allowing in-line read out. The four types are electrically identical but differ in the position of the decimal point and the inclusion of a red contrast filter.

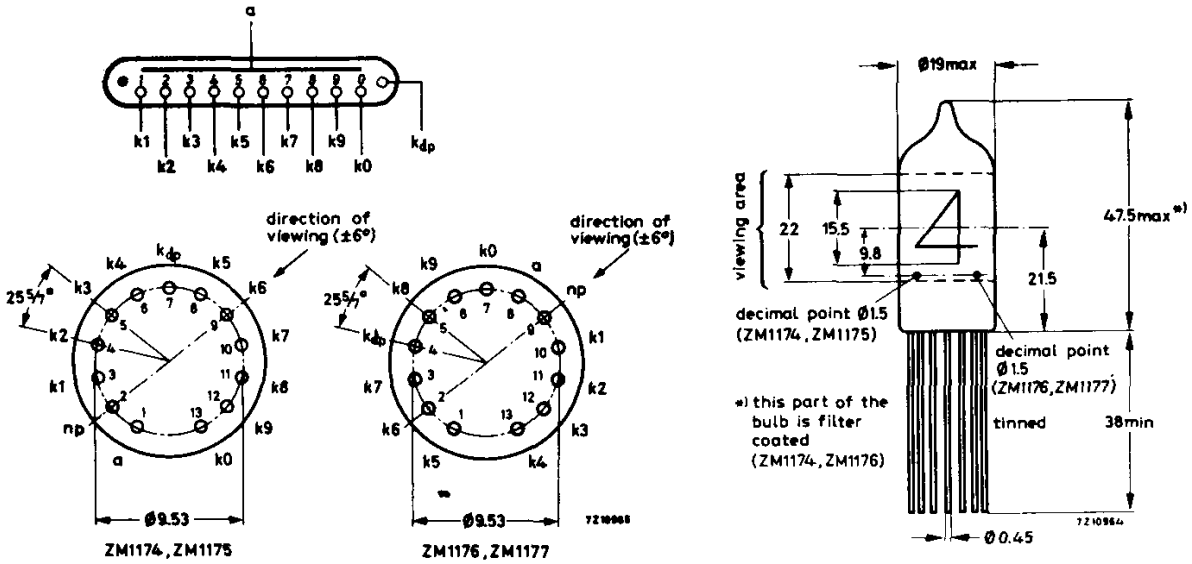
ZM1174 Decimal point on the left hand side. Red contrast filter.
ZM1175 Decimal point on the left hand side. No filter.
ZM1176 Decimal point on the right hand side. Red contrast filter.
ZM1177 Decimal point on the right hand side. No filter.

PRINCIPLE OF OPERATION

The tube contains ten cathodes in the form of ten figures and one in the form of a decimal point, and a common anode. By applying a suitable voltage between the anode and one of the cathodes the corresponding figure or decimal point will be covered by a red neon glow.

DIMENSIONS AND CONNECTIONS

Dimensions in mm



Data based on pre-production tubes.

Mounting position: any

The numerals and the decimal point are viewed through the side of the envelope. The numerals will appear upright (within ± 3 °) when the tube is mounted vertically, base down.

Soldering

The tube may be soldered directly into the circuit, but heat conduction to the glass-to-metal seals should be kept to a minimum by the use of a thermal shunt.
The leads may be dip-soldered to a minimum of 5 mm from the seals at a solder temperature of 240 °C for a maximum of 10 s.

Note

Care should be taken not to bend the leads nearer than 1.5 mm from the seals.

CHARACTERISTICS AND OPERATING CONDITIONS (at 20 °C to 50 °C)

Ignition voltage	V_{ign}	max.	170	V
Mainting voltage	V_m		see page 3	
Numeral cathode current,				
recommended average	I_k		2.5	mA
average (T_{av} = 10 ms)	I_k	max.	3.5	mA
average, averaged over any conduction period	I_k	min.	1.5	mA 1)
peak	I_{kp}	max.	12	mA
Decimal point cathode current				
recommended average	I_{kdp}		0.5	mA
average, averaged over any conduction period	I_{kdp}	min.	0.05	mA 2)
peak	I_{kdpp}	max.	2.5	mA
Extinguishing voltage	V_{ext}		115	V

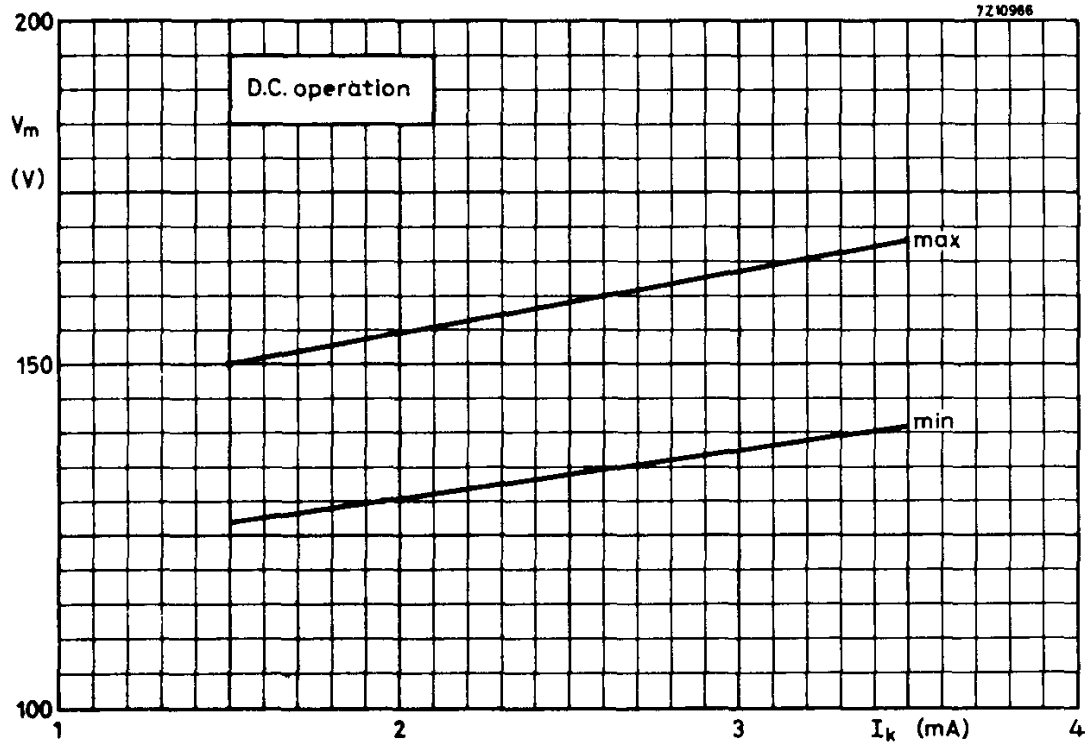
LIFE EXPECTANCY at I_k = 2.5 mA and room temperature. 3)

Continuous display of one numeral	>	5000	h
Sequentially changing the display from one numeral to another, every 100 h or less	>	30 000	h

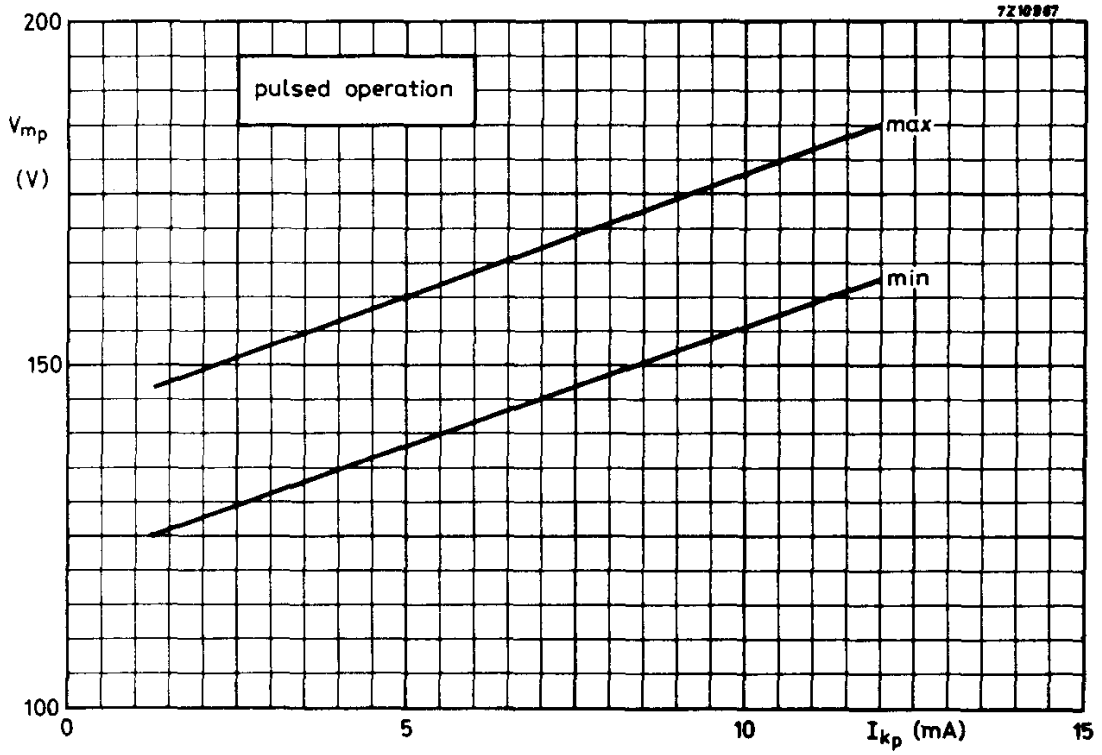
LIMITING VALUES (Absolute max. rating system)

Numeral cathode current				
average, T_{av} = 10 ms	I_k	max.	3.5	mA
peak	I_{kp}	max.	12	mA
average during any conduction period	I_k	min.	1.5	mA
Pulse duration	T_{imp}	min.	100	μs
Bulb temperature	t_{bulb}	max.	+70	°C
	t_{bulb}	min.	-50	°C 3)

1) This value applies, irrespective of wether the decimal point is running or not.
2) These conditions are automatically satisfied when the decimal point is directly connected to the numeral cathode carrying the main discharge. When the decimal point is connected in this way the max. decimal point current is 0.15 mA at a numeral cathode current of 1.5 mA.
3) For bulb temperatures below 0 °C the life expectancy of the tube is substantially reduced.



ANODE-TO-CATHODE MAINTAINING VOLTAGE
AS A FUNCTION OF CATHODE CURRENT



PEAK ANODE-TO-CATHODE MAINTAINING VOLTAGE
AS A FUNCTION OF PEAK CATHODE CURRENT

SIEMENS

DEKADISCHE ZIFFERN-ANZEIGERÖHRE

ZM 1180
ZM 1182

Bestell-Nr.
Q73-X4873
Q73-X4874

Art und Verwendung

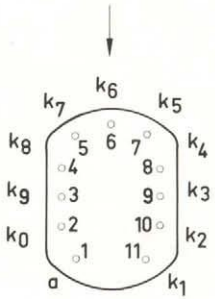
Dekadische Ziffern-Anzeigeröhre in Rechteck-Ausführung mit Gasfüllung und kalter Kathode. Direkte Anzeige der frontal sichtbaren Ziffern von 0 bis 9 bei einer Ziffernhöhe von 16 mm durch Glimmlicht.

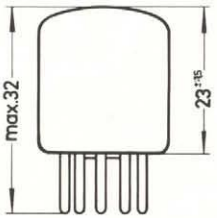
Die Anzeige kann durch (Relais-) Kontakte, Verstärkerröhren, Transistoren, Relaisröhren, Fotowiderstände, Elektronenstrahl-Schaltröhren usw. ausgelöst werden.

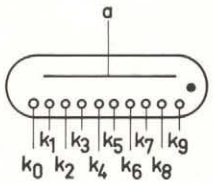
Zur Kontrastverbesserung ist die ZM 1180 mit einem Farbfilterüberzug versehen.

Qualitätsmerkmale

Lange Lebensdauer









Maße in mm

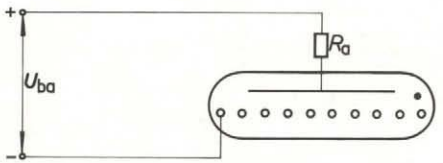
Sockel: Spezial 11 p
Fassung: Rö Fsg 1014 für Verdrahtung, Bestell-Nr. Q81-X114
Rö Fsg 1017 zur Verwendung in gedruckten Schaltungen, Bestell-Nr. Q81-X117
Rö Fsg 1018 Winkelfassung, Bestell-Nr. Q81-X118
Gewicht: etwa 10 g
Einbau: beliebig, Stift 6 liegt oben, bezogen auf leserichtige Stellung der Ziffern.

Kenndaten

	min	nom	max	
U_z			180	V
U_{arc} (I_k = 2, 25 mA)		145		V
I_k	1, 5		3, 0	mA
$U_{lösch}$	115			V

Betriebsdaten

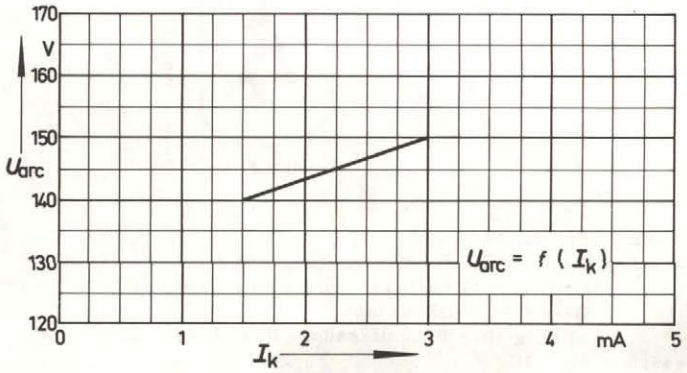
Gleichstrombetrieb



U_{ba}	200	250	300	V
R_a	24	47	68	kΩ
U_{arc}	145	145	145	V

Empfohlener Betrieb $U_{ba} \geqq 200$ V

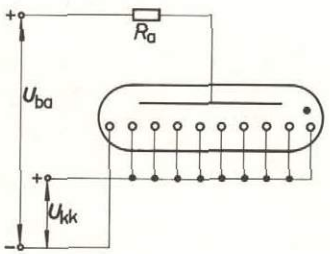
Bei Forderung nach sehr kurzer Zündzeit wird empfohlen, eine Kathode (Ziffer 0) über einen Widerstand von etwa 50 MΩ dauernd an die gewählte Betriebsspannung zu legen.



Gleichstrombetrieb mit Vorspannung

$U_{kk} \geqq 60$ V 1)

Die Vorspannung U_{kk} ist die Spannung zwischen der ein- und den ausgeschalteten Kathoden. Bei kleiner Vorspannung U_{kk} erhöht sich der Strom zu den ausgeschalteten Kathoden und dadurch wird die Lesbarkeit der Ziffern beeinträchtigt.



Grenzdaten (absolute Werte)

U_{ba}	min	180	V	
I_{ksp}	max	3, 5	mA	2)
I_k	min	1, 5	mA	
I_k	max	3, 0	mA	
U_{kk}	max	115	V	3)
U_{kk}	min	40	V	3)
t_{kolb}	max	70	°C	
t_{kolb}	min	- 20	°C	4)

Besondere Angaben

Lebensdauer - Erwartung

> 5000 Stunden bei Dauerbetrieb einer Ziffer (bei I_k = 2, 25 mA)
> 50000 Stunden bei wechselnder Anzeige; Zeichenwechsel nach weniger als 100 Stunden.

1) Empfohlener Wert

2) t_p max 20 ms

3) Falls die nicht gezündeten Kathoden nicht völlig frei liegen, müssen sie gegen die gezündete Kathode eine positive Vorspannung U_{kk} in den angegebenen Grenzen erhalten. Empfohlener Wert $\geqq$ 60 V, bei niedrigeren Spannungswerten von U_{kk} wird die Lesbarkeit beeinträchtigt.

4) Unterhalb 0 °C ist mit einem Ansteigen des Kathodenstromes und damit verbundener Verkürzung der Lebensdauer zu rechnen.

SIEMENS

DEKADISCHE ZIFFERN-ANZEIGERÖHRE

ZM 1180
ZM 1182

Bestell-Nr.
Q73-X4873
Q73-X4874

Art und Verwendung

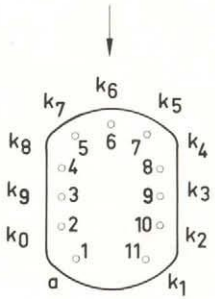
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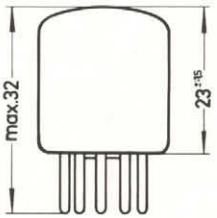
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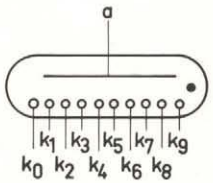
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Qualitätsmerkmale

Lange Lebensdauer









Maße in mm

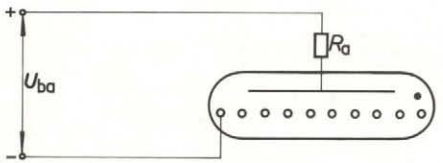
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Gewicht: etwa 10 g
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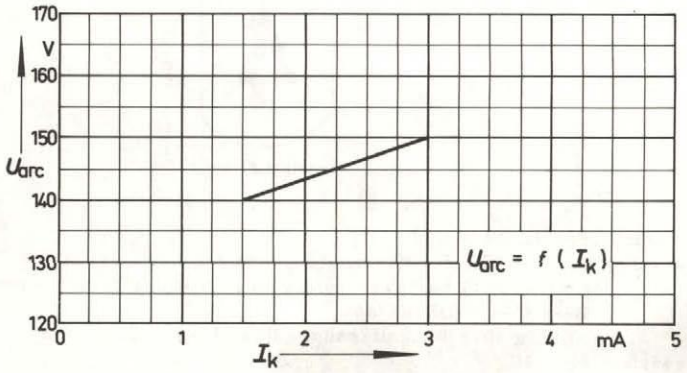
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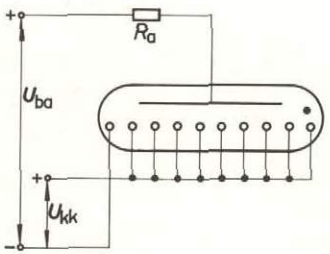
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Gleichstrombetrieb mit Vorspannung

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t_{kolb}	min	- 20	°C	4)

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> 50000 Stunden bei wechselnder Anzeige; Zeichenwechsel nach weniger als 100 Stunden.

1) Empfohlener Wert

2) t_p max 20 ms

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4) Unterhalb 0 °C ist mit einem Ansteigen des Kathodenstromes und damit verbundener Verkürzung der Lebensdauer zu rechnen.

A 14-Decade Numerical Indicator Tube



ZM 1200 numerical indicator tube, about three-quarters actual size.

The ZM1200 cold-cathode indicator tube recently introduced by Philips displays fourteen decades in a space just over 14 cm long. The size and spacing of its characters — 10 mm high by 7 mm wide, on 10 mm pitch — are designed for easiest reading at about arm's length, as in desk-top calculators and similar equipment.

Not only size, but also simplicity give it a distinct advantage over single-decade tubes. The double-ended envelope has only 27 connection pins, as compared with the 168 that would be needed for an equivalent display with conventional indicator tubes. Moreover, for the sake of strength and reliability, the number of welded connections inside the envelope has been kept to a minimum; wherever possible, electrically connected elements have been formed from the same parent material.

For compatibility with the present trend in calculating and display equipment, it is designed for sequential drive, similar cathodes of the fourteen decades being connected in common and each decade having a separate anode. With the anodes and cathodes held at a quiescent bias, digits are selected by applying coincident pulses to the cathode rail of the desired digit and the anode of the desired decade. Brightness can be controlled by changing either the amplitude or duration of the pulses; to illuminate all fourteen decades with an intensity of 600 cd/m² a driving power of less than 2 W is required. A single screen electrode keeps adjoining decades from interfering with each other, and even at a cycling frequency as low as 70 Hz there is no noticeable flicker.

Besides the ten cathodes for delineating the digits 0 to 9, each decade incorporates provision for a decimal point at the lower right and a pointing-off sign at the upper right. For ease of reading, any number can be pointed off in arbitrary groups to the left and right of the decimal.

Reliability of the ZM 1200 Indicator Tube

In response to the item in Vol. 29, No. 1, several readers have made inquiries about the 14-decade numerical indicator tube ZM1200. Besides asking about price and availability, some of them have raised questions about the reliability of the tube. As one reader put it, "... if one cathode fails the whole tube would seem to be crippled, and presumably it isn't a cheap one to replace". The point is well taken and the fact that others have also raised it makes it worth further discussion in these pages. What follows is quoted from a letter written in answer to one inquiry.

Operating limits

Your most important question is, "If one cathode fails, surely the whole tube must be replaced?" That's true, but how likely is such a failure? The life expectancy quoted in the published data is 50 000 operating hours under typical conditions, i.e. within the quoted limit values and assuming no long-term uninterrupted lighting of a single digit. What "long-term" means in this context is 1000 hours or more, which would amount to six weeks, day and night. In the kind of equipment the ZM1200 is meant for — desk calculators, accounting machines, small computers — that sort of usage is very uncommon. Even in the unlikely event that someone *were* to calculate uninterruptedly for six weeks, I think you'll agree that it would have to be a very unusual calculation indeed to keep any digit unchanged in the input or output register for that long! (Of course, there might be persistent zeros in one or more of the left-hand decades, but if the equipment were designed for suppression of insignificant zeros — which is the present trend — that wouldn't matter.)

Cathode sputtering

The reason for the limitation on uninterrupted lighting of a single digit is easy to explain. It's not the lighted digit that's likely to suffer so much as the unlighted ones. A lighted digit is subject to continuous ion bombardment which cleans its surface by sputtering away any impurities that may have collected there. However, the sputtered material has to settle somewhere, and where it settles mostly is on nearby unlighted digits, increasing their work function. If the unlighted digits are brought into service before too long, no harm is done; the material deposited on them is soon sputtered away. But

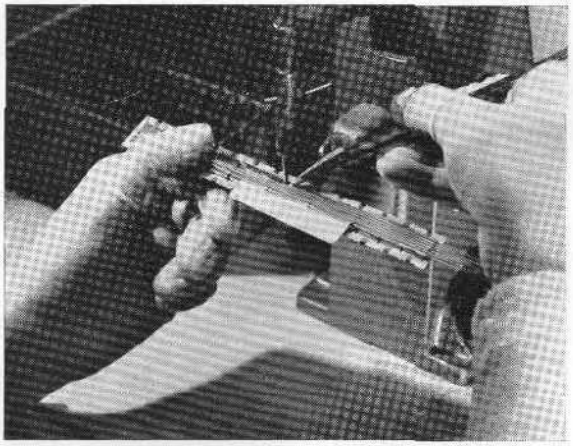


Fig. 1. Separately insulated leads are spot-welded to the anodes that underlie each of the fourteen decades.

if one digit is kept lighted uninterruptedly for, say, three months, some other digit in that decade is likely not to light as well as it should when at last it is wanted.

As for wasting of a continuously lighted digit, that doesn't seem to come into consideration at all. The rate of sputtering depends, of course, on the peak current and the gas pressure in the tube, but so far we haven't been able to find measurable wasting even of digits that have been operated for several thousands of hours continuously. This correlates well with our experience with conventional



Fig. 2. A Jacob's ladder worked by a foot switch presents numerical cathodes to the assembler in the order in which they are to be fitted over the anodes. Mica insulating frames (alongside the assembly jig) are placed between each pair of electrodes.

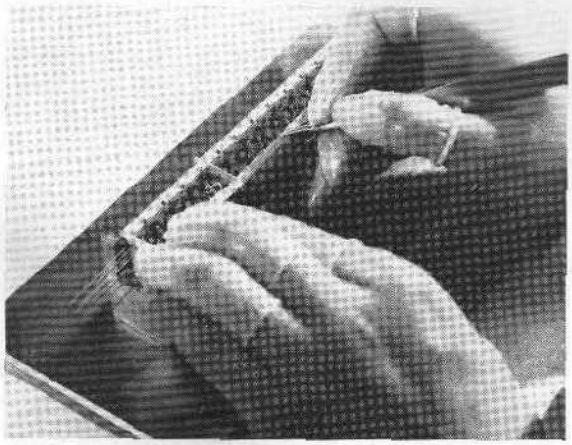


Fig. 3. Mica partitions, inserted after all electrodes are in place, divide the structure into separate cells for each decade; one such partition can be seen above, between the cells of the fourth and fifth decades.

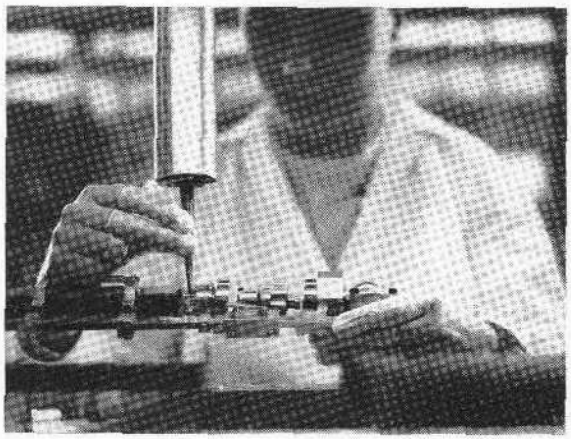


Fig. 4. The completed electrode assembly is spot-welded to the pins of the base. The jig in which the welding operation is carried out ensures concentricity of base and envelope.



Fig. 5. A fixture guides the electrode and base assembly into the glass envelope. Air blown in at the far end of the envelope sweeps detrital flakes of mica towards the entry for extraction by an annular suction nozzle.

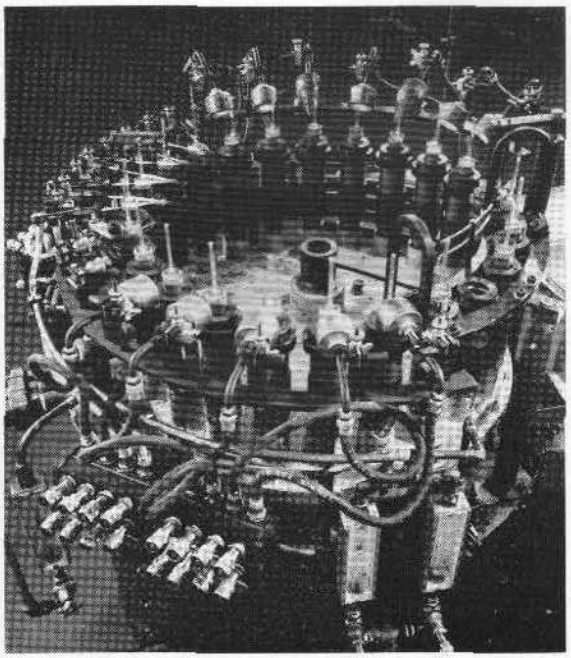


Fig. 6. Fusing the bases to the envelopes; in the machine shown the tubes enter near the three o'clock position and move anti-clockwise through the several steps of the fusing operation.

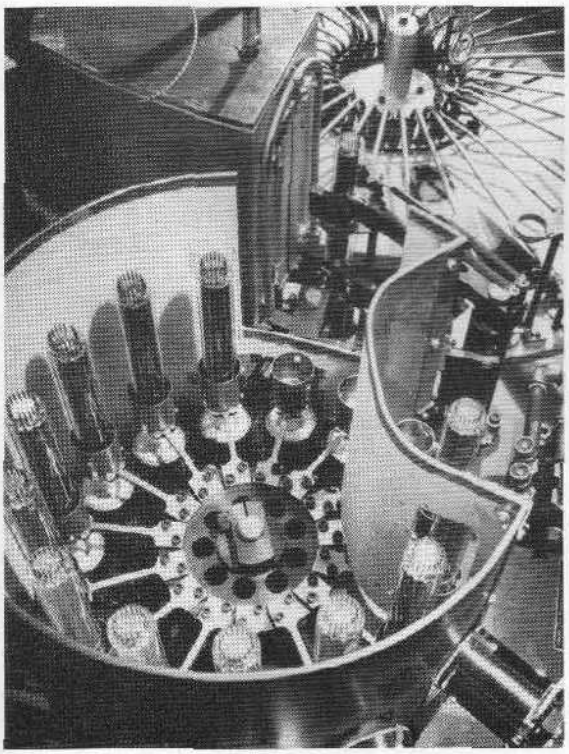


Fig. 7. As the tubes emerge from the outgassing oven (upper left) they are filled with neon-argon and sealed; in the circular structure in the foreground the glass of the base is tempered to develop a favourable stress pattern.

indicator tubes; even in specimens that have operated continuously with one digit lighted for several years, wasting has never been a problem.

What has been a problem with conventional tubes has been darkening of the envelope after they have been operated for several thousand hours under the pulsed conditions that are usual in desk calculators. Conventional tubes can be replaced one at a time when that happens, but if a ZM1200 were to darken, say, in the most used decades, it would seem that the user would either have to put up with it or replace the whole tube. We thought of that and took steps to make sure it wouldn't happen.

In the first place, the gas pressure in the ZM1200 is much higher than in a conventional indicator tube, so the rate of sputtering is proportionately lower. (The high pressure also accounts for the comparatively low operating voltage and the unusual sharpness with which the numerals are defined.)

In the second place, it is designed to operate at

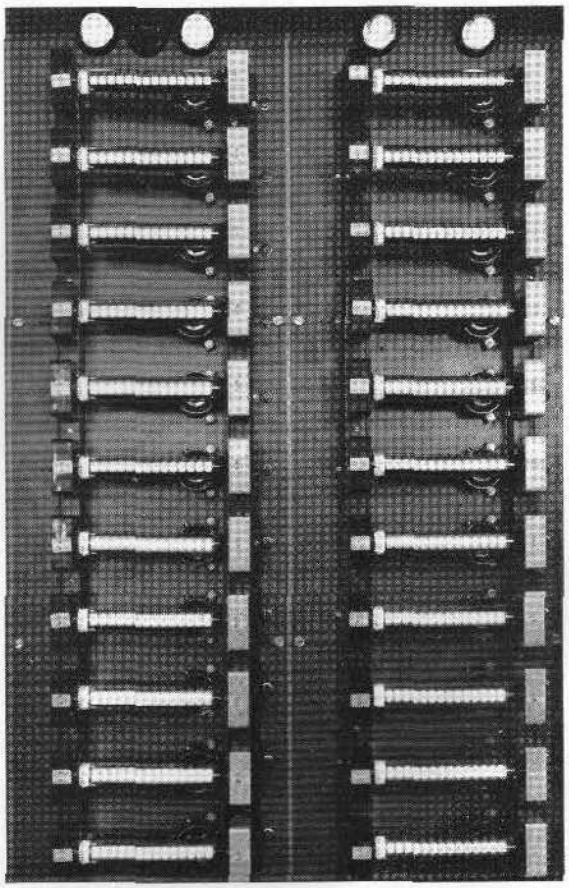


Fig. 8. To clean the cathodes and purge the filling gas of residual impurities the tubes are overdriven until their characteristics are stabilized in the required operating range. In the photo, rapid cycling blurs the individual digits.

much lower peak currents (about 9 mA per decade, or about half as much as a conventional tube), which further reduces the sputtering rate. In the third place, the digits are spaced comparatively far from the glass of the envelope, so the sputtered material has ample opportunity to settle before it gets that far.

And finally, a double mesh screen between the digits and the glass creates a very effective barrier to trap sputtered material before it can reach the glass. In tubes that have been operating continuously at *maximum peak current* for more than eight months in our laboratory there is still no trace of any darkening or deposit on the glass.

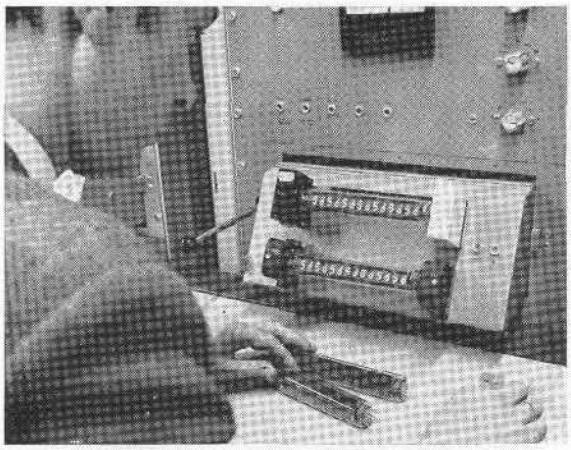


Fig. 9. All tubes are fully inspected and tested before being passed for delivery.

Mechanical reliability

Of course, you may say, there is still the possibility that some little thing will come unstuck inside the tube and it will have to be thrown away. We can't deny that there *is* that possibility, but the probability of its happening is very slight.

Because the tube is designed for sequential drive it has fourteen anodes — one for each decade — but only twelve cathodes, which means that the number of welded joints is kept to an absolute minimum. All the numeral 1 cathodes are formed from a single sheet of metal, all the numeral 2s from another, and so on, through the decimal points and pointing-off signs. Each sheet is strengthened by an integral frame that completely surrounds it, and they are all isolated from each other by intermediate layers of mica. It's a very compact and sturdy construction. Repeated shock tests at 50 g and vibration tests at 50 Hz have never succeeded in shaking anything loose.

Test results

The ZM1200 is still too new for statistically significant conclusions to be inferred from the test results so far available. Judging from our experience with other numerical indicator tubes and from life tests on very early development samples of the ZM1200 we feel quite confident about quoting an expected failure rate of less than 0.2% per 1000 hours. What we can say for certain is that in the more than 25 000 hours of testing to date there has not been a single failure. This covers a total of 11 tubes under test at various currents from 6.5 mA to 11.5 mA, two of them having been in continuous operation for more than 6000 hours each. Regular testing of samples taken from stock has uncovered no evidence of any deterioration in storage, nor have specimens that have been cooked for 24 hours at 200 °C shown any signs of gas contamination or other degradation.

Though the testing to date has not been extensive enough to enable us to calculate a Mean Time Between Failures with a reasonably high confidence level (after all, we haven't had any failures yet), it has at least been convincing enough to give us no hesitation in backing the ZM1200 with a one year guarantee. And we fully expect it to outlive that guarantee by a factor as high as ten, by which time the equipment it is fitted in will very probably have been retired.

Ziffern-Anzeige-Röhre mit Dezimalpunkt vor Ziffer

Numerals indicating tube with decimal point before numeral

Vorläufige technische Daten · Tentative data

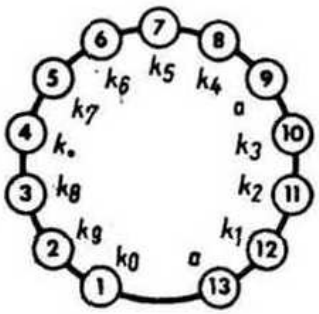
Mit Farbfilter-Überzug · With color filter film	**ZM 1210**
Ohne Farbfilter-Überzug · Without color filter film	**ZM 1212**

Ziffern · Numerals	0 ... 9
Zeichenhöhe · Height of symbol	15,5
Auslesung · Read out	seitlich · at side

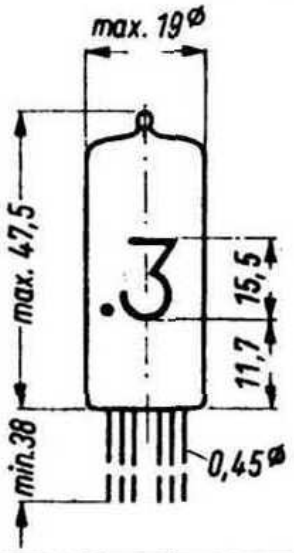
Allgemeine Daten · General data		min.	mittel	max.	
Zündspannung Breakdown voltage	U_Z			170	V
Brennspannung Operating voltage	U_{aB}		140		V
Ziffer 0...9 bei 2 mA					
Dezimalpunkt bei 0,4 mA					
Kathodenstrom					
Ziffer 0...9	I_k	1,5		3	mA
Dezimalpunkt	I_k	0,3		0,6	mA

Absolute Grenzwerte · Absolute maximum ratings			
Betriebsspannung Supply voltage	U_b	min. 170	V
Kathodenvorspannung Cathodes bias voltage	U_{kk}	40... 120	V
Kathodenimpulsstrom Cathode pulse current	I_{kp}	15	mA
Kolbentemperatur Bulb temperature	t_{Kolben}	−50...+70	°C

Sockelschaltung
Base connection







Abmessungen
Dimensions

Gewicht · Weight
ca. 8 g

Ziffern-Anzeige-Röhre mit Dezimalpunkt vor Ziffer

Numerals indicating tube with decimal point before numeral

Vorläufige technische Daten · Tentative data

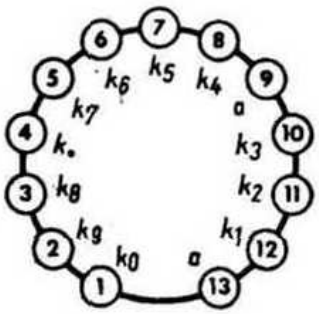
Mit Farbfilter-Überzug · With color filter film	**ZM 1210**
Ohne Farbfilter-Überzug · Without color filter film	**ZM 1212**

Ziffern · Numerals	0 ... 9
Zeichenhöhe · Height of symbol	15,5
Auslesung · Read out	seitlich · at side

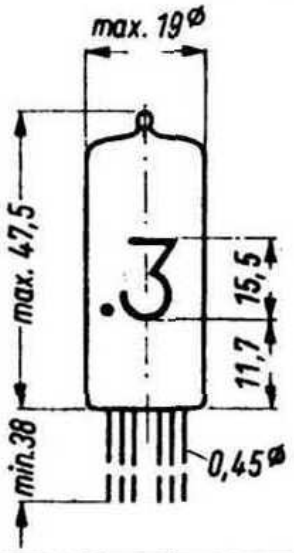
Allgemeine Daten · General data		min.	mittel	max.	
Zündspannung Breakdown voltage	U_Z			170	V
Brennspannung Operating voltage	U_{aB}		140		V
Ziffer 0...9 bei 2 mA					
Dezimalpunkt bei 0,4 mA					
Kathodenstrom					
Ziffer 0...9	I_k	1,5		3	mA
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Absolute Grenzwerte · Absolute maximum ratings			
Betriebsspannung Supply voltage	U_b	min. 170	V
Kathodenvorspannung Cathodes bias voltage	U_{kk}	40... 120	V
Kathodenimpulsstrom Cathode pulse current	I_{kp}	15	mA
Kolbentemperatur Bulb temperature	t_{Kolben}	−50...+70	°C

Sockelschaltung
Base connection







Abmessungen
Dimensions

Gewicht · Weight
ca. 8 g

INDICATOR TUBE

Long life cold cathode ten digit numeral indicator tube for side viewing.

QUICK REFERENCE DATA				
Numeral height			15.5	mm
Numerals	1 2 3 4 5 6 7 8 9 0			
Supply voltage	V_{ba}	min.	170	V
Cathode current	I_k		2.5	mA
Distance between mounting centres		min.	19	mm

GENERAL

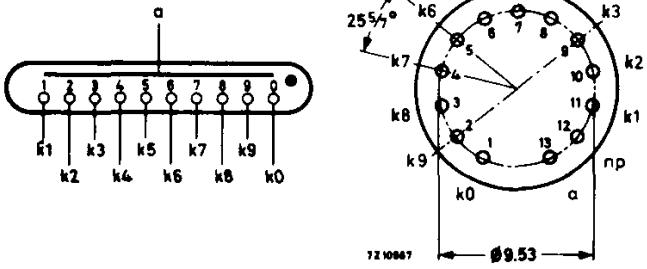
The numerals are 15.5 mm high and appear on the same base line allowing in-line read out. The ZM1230 is provided with a red contrast filter. The ZM1232 is identical to the ZM1230 but has no filter.

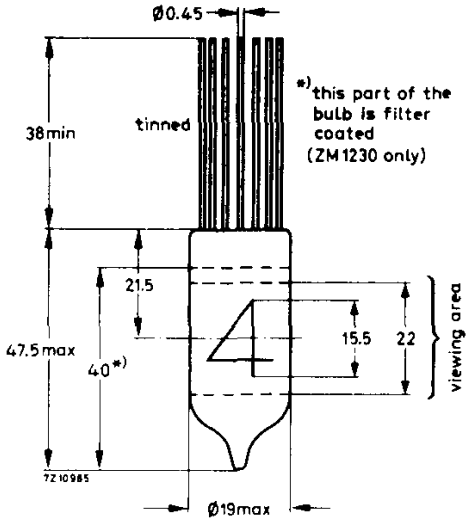
PRINCIPLE OF OPERATION

The tube contains ten cathodes in the form of ten figures and one common anode. By applying a suitable voltage between the anode and one of the ten cathodes the corresponding figure will be covered by a red neon glow.

DIMENSIONS AND CONNECTIONS

Dimensions in mm





Mounting position: any

The numerals will appear upright (within $\pm 3^{o}$) when the tube is mounted vertically, base up.

Soldering

The tube may be soldered directly into the circuit, but heat conduction to the glass-to-metal seals should be kept to a minimum by the use of a thermal shunt.
The leads may be dip-soldered to a minimum of 5 mm from the seals at a solder temperature of 240 °C for a maximum of 10 s.

Note

Care should be taken not to bend the leads nearer than 1.5 mm from the seals.

CHARACTERISTICS AND OPERATING CONDITIONS (at 20 °C to 50 °C)

Ignition voltage	V_{ign}	min.	170	V
Ignition delay	see page 3			
Maintaining voltage	see page 4			
Cathode current, recommended	I_k		2.5	mA
Cathode current for coverage, average during any conduction period	I_k	min.	1.5	mA
D.C. operation	see pages 4 to 9			
Pulse operation	see pages 4, 10, 11 and 12			
Extinguishing voltage	V_{ext}		115	V

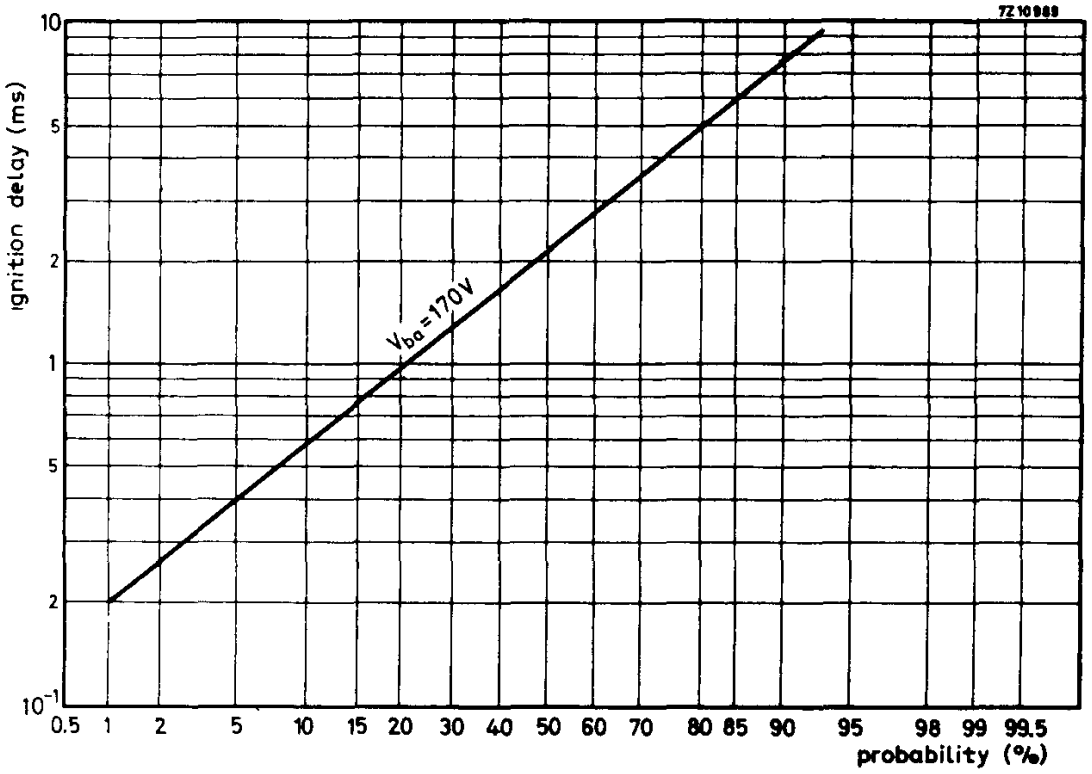
LIFE EXPECTANCY at I_k = 2.5 mA and room temperature [1])

Continuous display of one numeral	>	5 000	h
Sepuentially changing the display from one numeral to another, every 100 hrs or less	>	30 000	h

LIMITING VALUES (Absolute max. rating system)

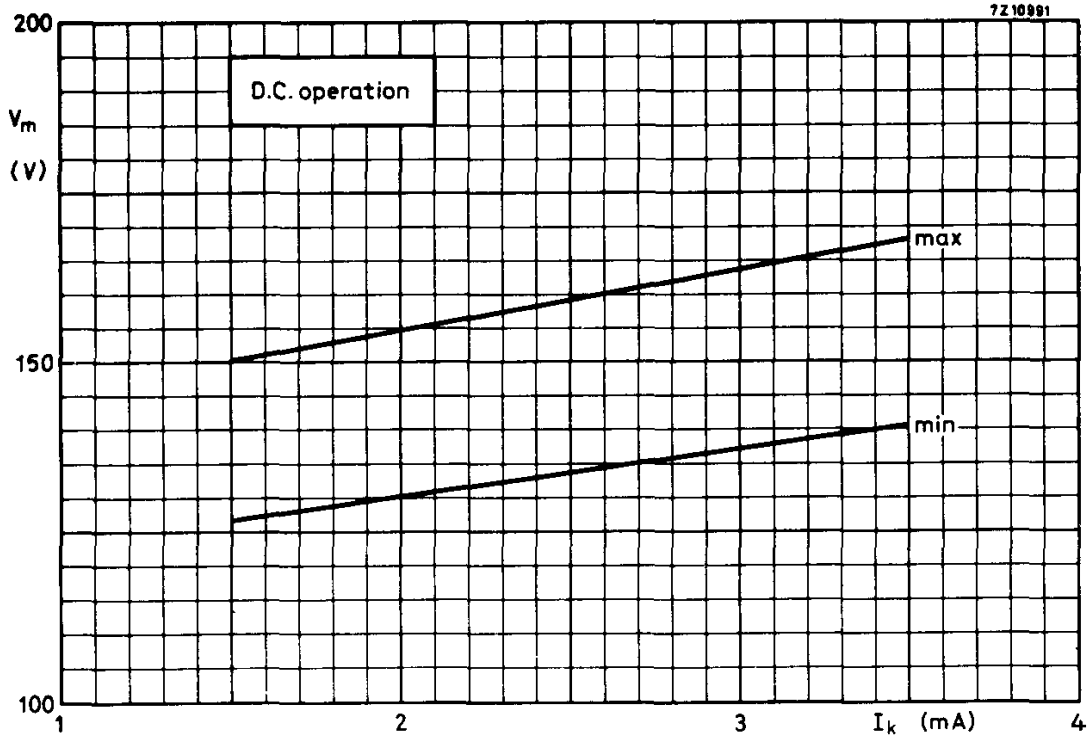
Cathode current (each digit), average, T_{av} = max. 10 ms	I_k	max.	3.5	mA
peak	I_{k_p}	max.	12	mA
average during any conduction period	I_k	min.	1.5	mA
Anode voltage necessary for ignition	V_a	min.	170	V
Pulse duration	T_{imp}	min.	100	μs
Bulb temperature	t_{bulb}	max.	+70	°C
	t_{bulb}	min.	−50	°C [1])

[1]) For bulb temperatures below 0 °C the life expectancy of the tube is substantially reduced.

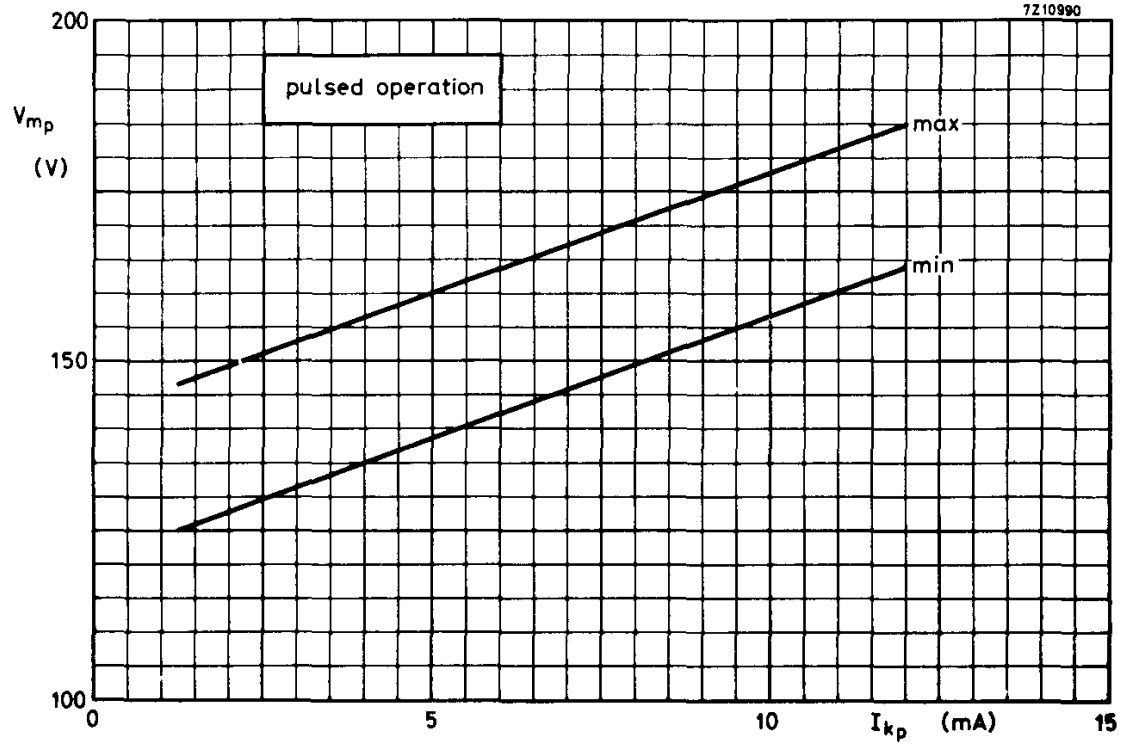


CUMULATIVE DISTRIBUTION OF IGNITION DELAY

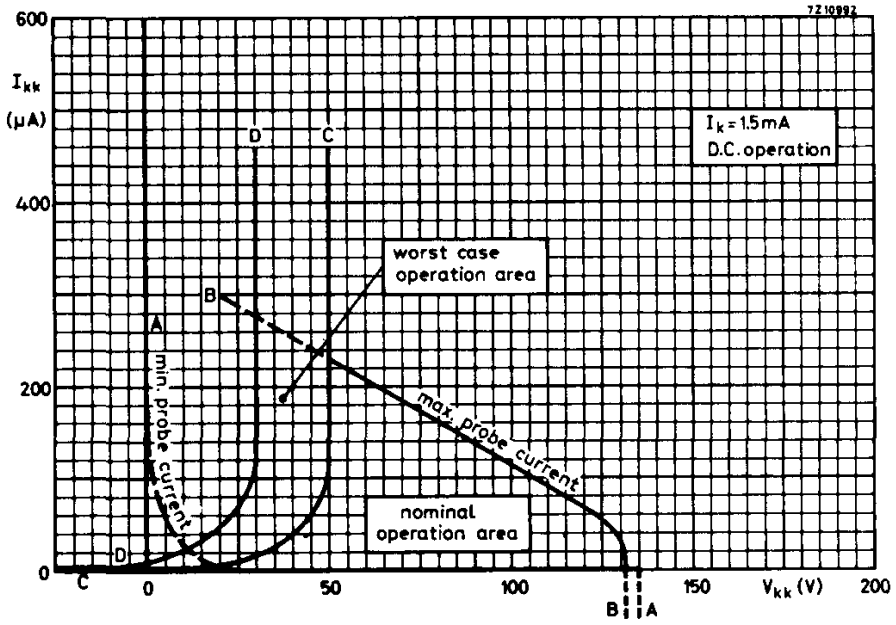
This curve shows the probability that a tube will ignite in less than the time shown after a non-conduction period of a few periods. The ignition delay will be appreciably reduced when the interval between conduction periods is less than 100 milliseconds. In general, an increase in the supply voltage will reduce the ignition delay.

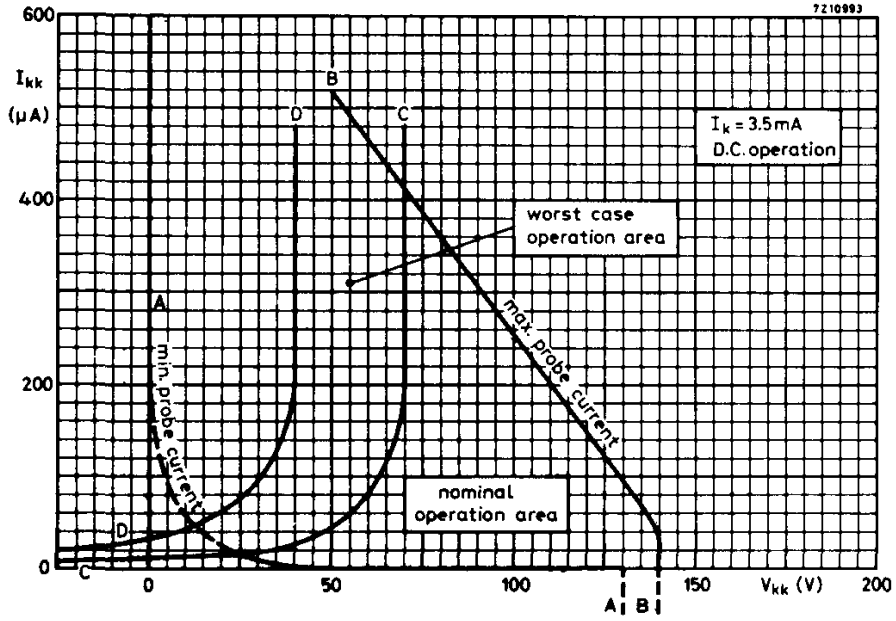


ANODE-TO-CATHODE MAINTAINING VOLTAGE
AS A FUNCTION OF CATHODE CURRENT



PEAK ANODE-TO-CATHODE MAINTAINING VOLTAGE
AS A FUNCTION OF PEAK CATHODE CURRENT





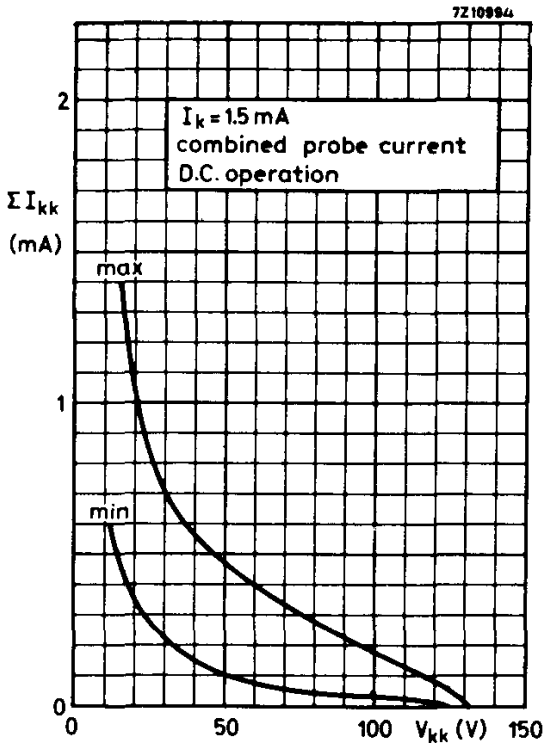
PROBE CURRENT TO INDIVIDUAL NON-CONDUCTING CATHODES

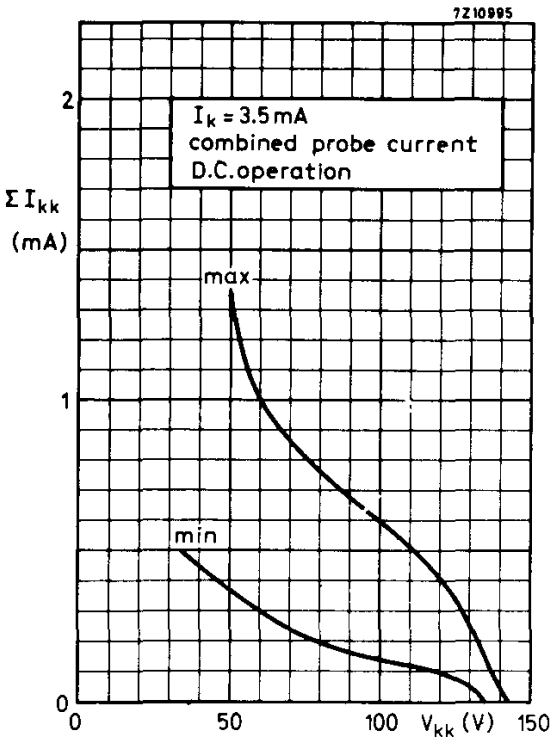
The boundaries A-A and B-B of the graphs represent, for the shown cathode current range, the range of probe current (I_{kk}) to individual non-conducting cathodes plotted against the voltage difference between the non-conducting cathodes and the conducting cathode (V_{kk}).

For low cathode selecting voltages (V_{kk}) the current I_{kk} to the non-conducting cathode will increase, and the readability conducting cathode will be affected.

It is therefore recommended to use a nominal operating point to the right of line C-C.

Under the worst operating conditions the operating point should never reach the area left of the line D-D.





COMBINED PROBE CURRENT TO ALL NON-CONDUCTING CATHODES

Sum of the probe currents to the non-conducting cathodes (I_{kk}) plotted against the voltage difference between the non-conducting cathodes and the conducting cathode (V_{kk}), showing the minimum and maximum values of probe current for a particular cathode current (I_k).

SUPPLY VOLTAGE/LOAD RESISTOR

The graphs on pages 8, 9 and 12 give the relationship between the anode supply voltage and the required anode load resistor for fixed values of V_{kk} (voltage difference between conducting cathode and non-conducting cathodes).

Each graph is plotted on log-log graph paper; therefore a given tolerance expressed as a percentage can be represented as a fixed length at any point on the x and y axes. This is shown on the first graph by taking points on each axis with a fixed tolerance.

Examples are shown on the first graph of the supply voltages and load resistors with tolerance expressed as a percentage so as to remain within the recommended operating region.

The curves are derived from:-

$$V_{ba} = I_a \cdot R_a + V_m$$

$$I_a = I_k + \Sigma I_{kk}$$

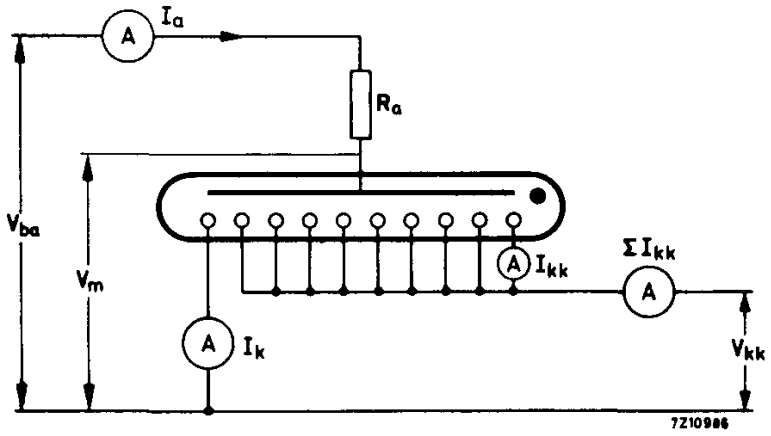
$$V_{ba} = (I_k + \Sigma I_{kk})\, R_a + V_m$$

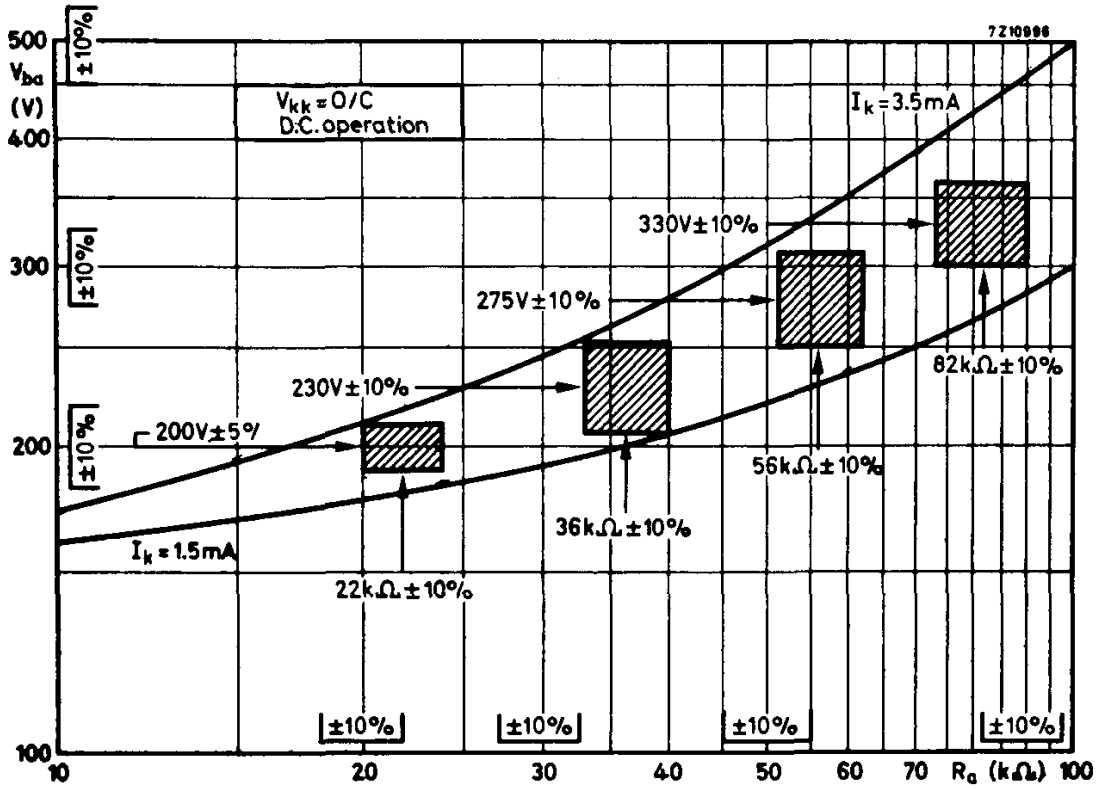
For a given value of R_a, the minimum supply voltage limit to ensure that the cathode current exceeds I_k min. is given by:

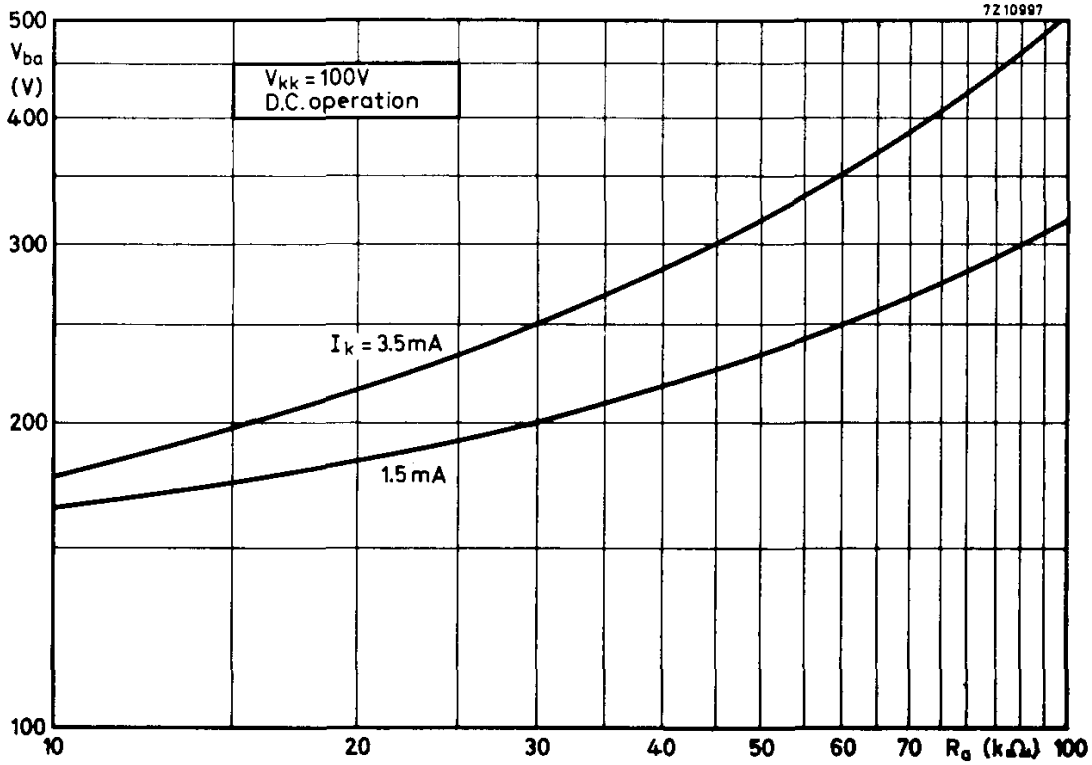
$$V_{ba}\ \text{min.} = \left[I_k\ \text{min.} + \Sigma I_{kk}\ \text{max. (at } I_k\ \text{min.)}\right] R_a + V_m\ \text{max. (at } I_k\ \text{min.)}$$

For the same value of R_a, the maximum supply voltage limit to ensure that the cathode current does not exceed I_k max. is given by:

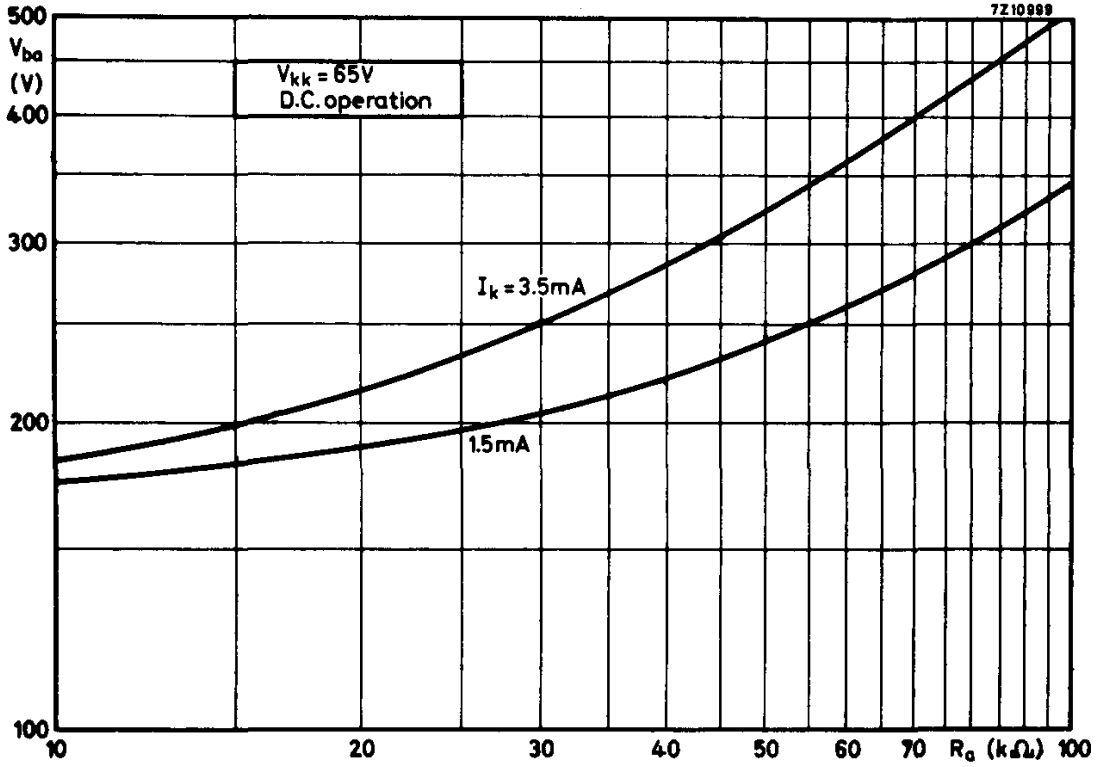
$$V_{ba}\ \text{max.} = \left[I_k\ \text{max.} + \Sigma I_{kk}\ \text{min. (at } I_k\ \text{max.)}\right] R_a + V_m\ \text{min. (at } I_k\ \text{max.)}$$

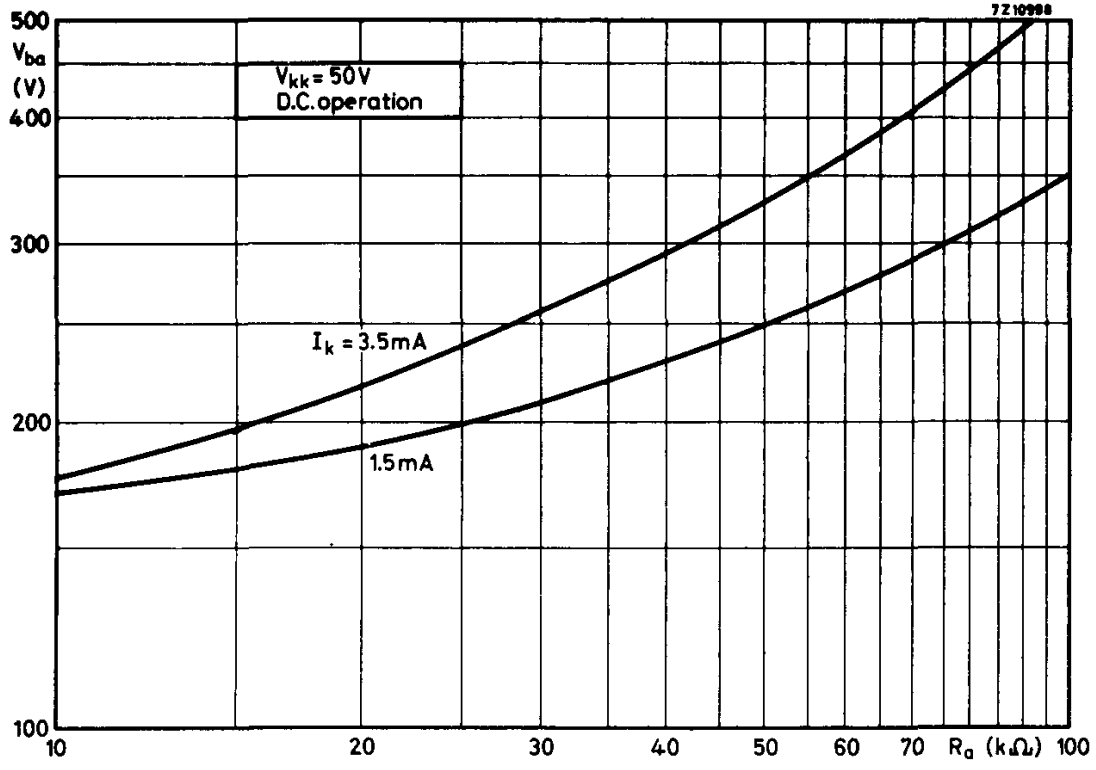




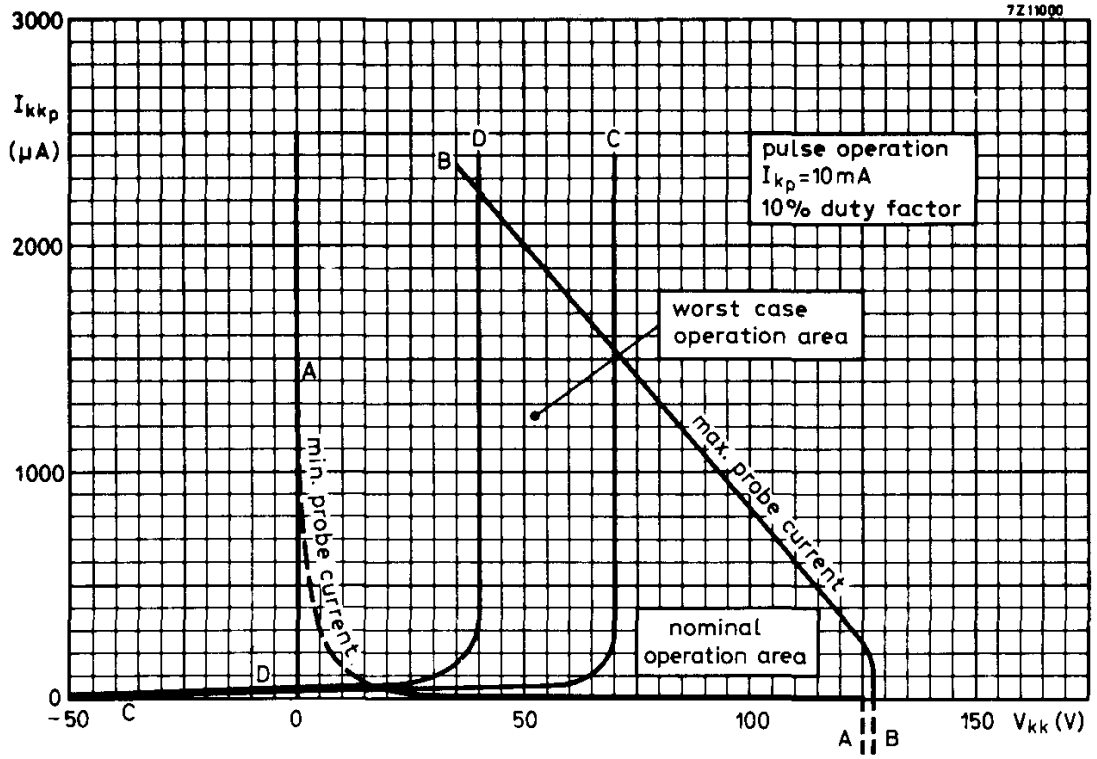


D.C. SUPPLY VOLTAGE PLOTTED AGAINST ANODE LOAD RESISTOR



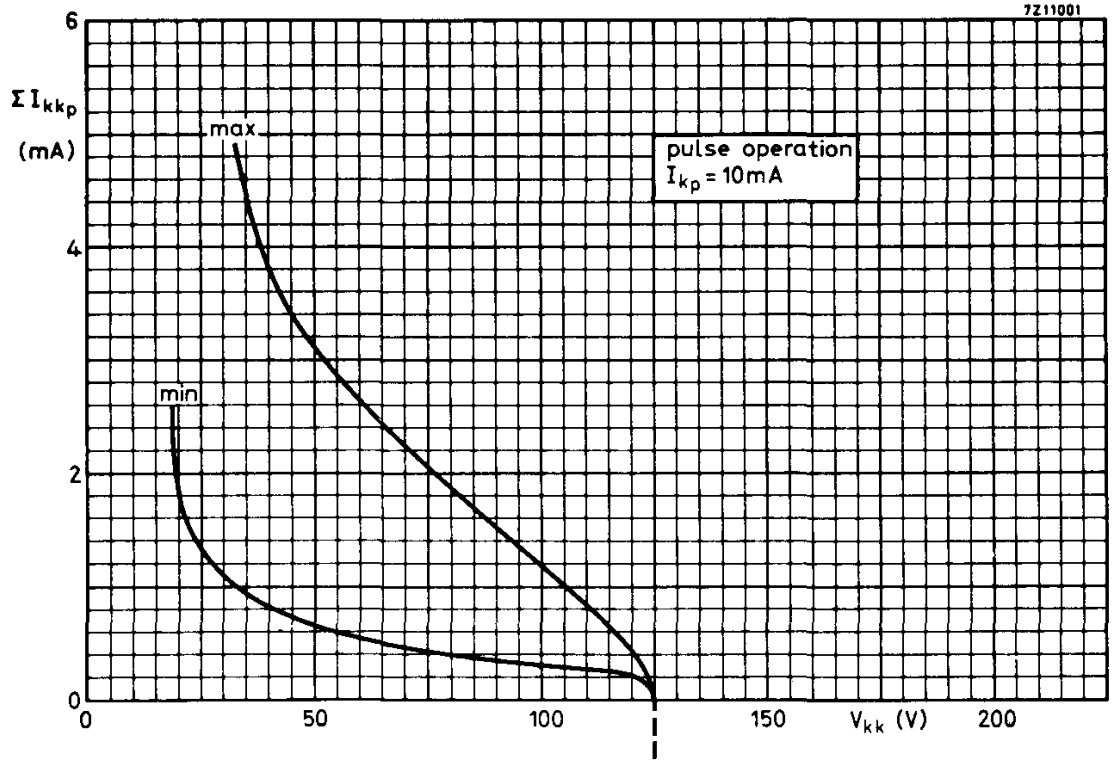


D.C. SUPPLY VOLTAGE AS A FUNCTION OF ANODE LOAD RESISTOR



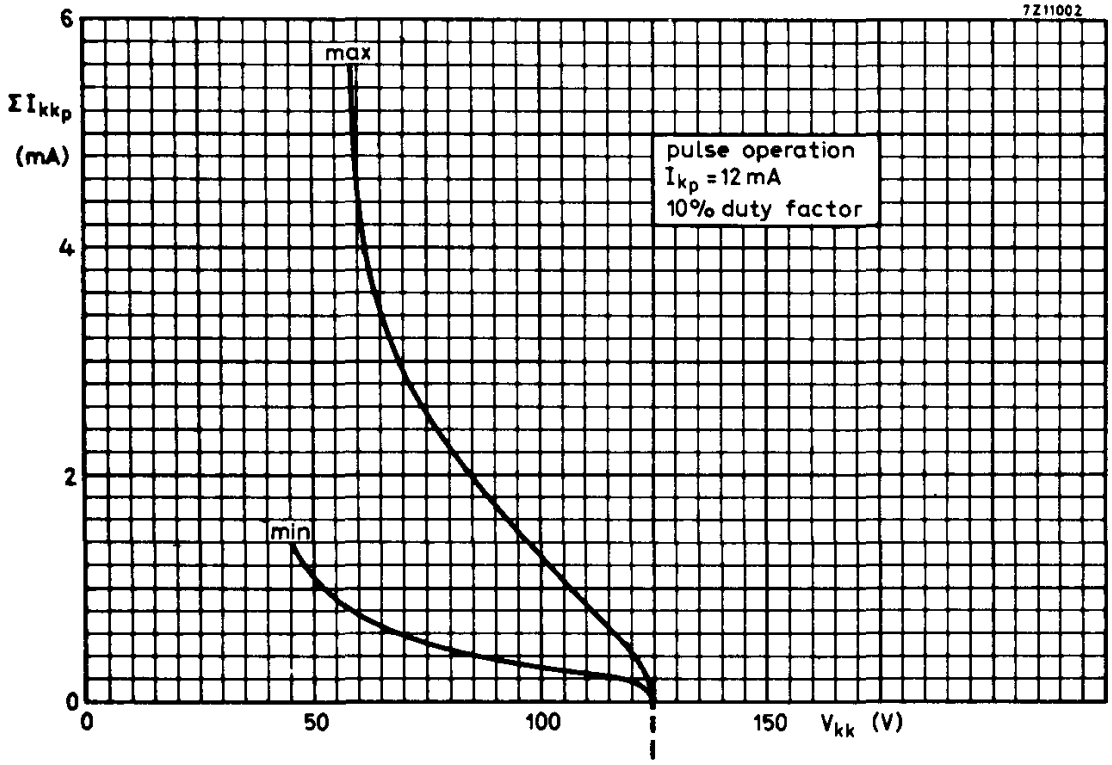
PEAK PROBE CURRENT TO INDIVIDUAL NON-CONDUCTING CATHODES

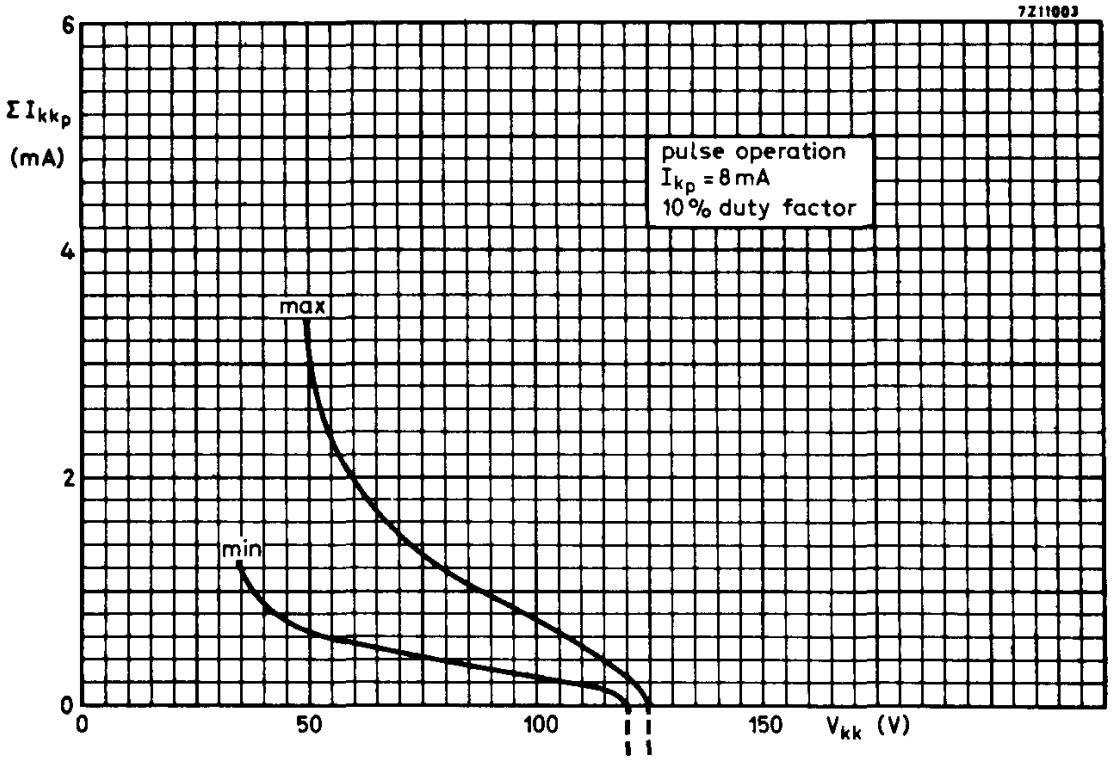
See also page 5



COMBINED PEAK PROBE CURRENT TO ALL NON-CONDUCTING CATHODES

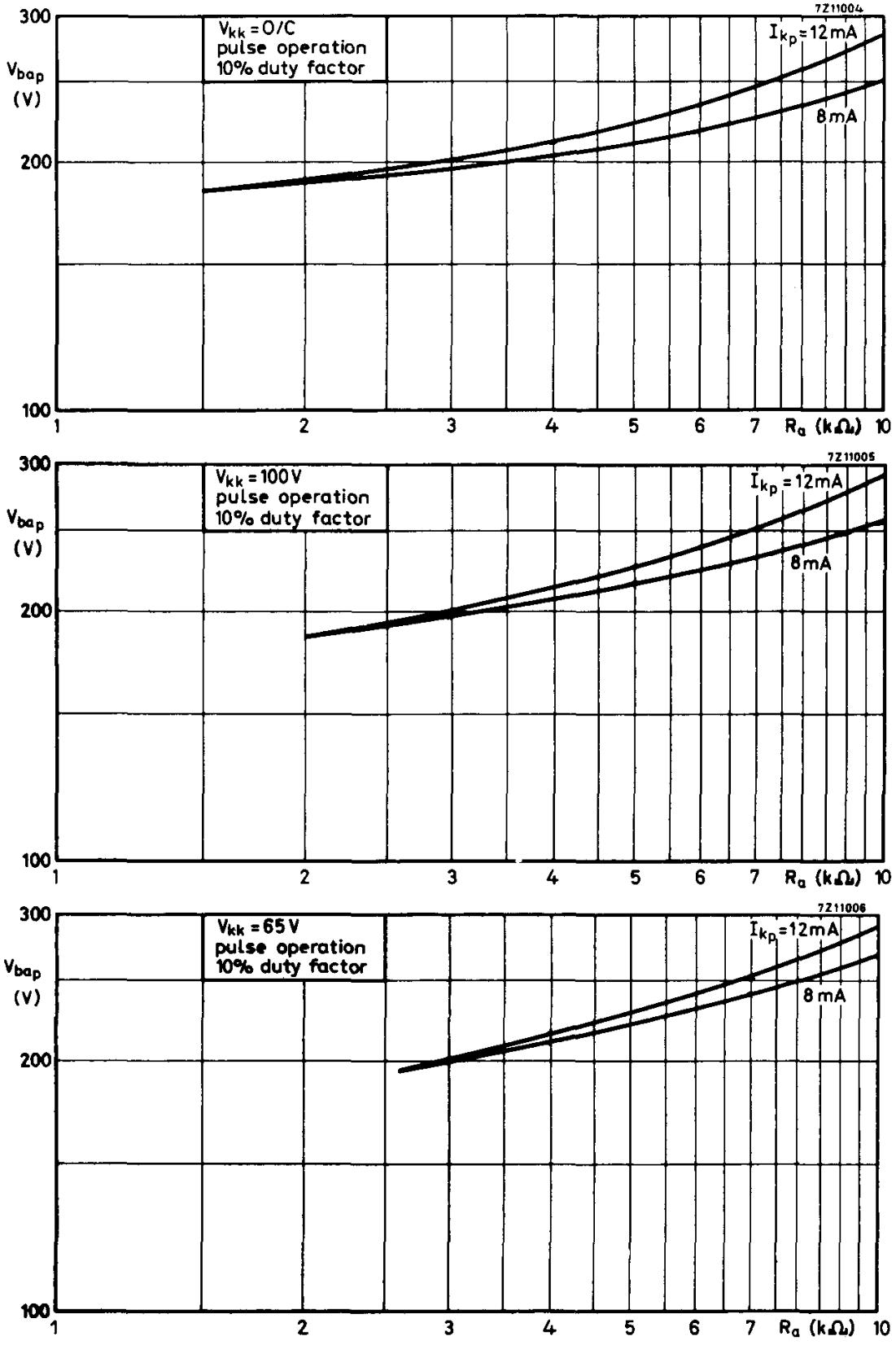
See also page 6





COMBINED PEAK PROBE CURRENT TO ALL NON-CONDUCTING CATHODES

See also page 6



PEAK SUPPLY VOLTAGE AS A FUNCTION OF ANODE LOAD RESISTOR

INDICATOR TUBE

Long life cold cathode ten digit numeral indicator tube for side viewing.

QUICK REFERENCE DATA				
Numeral height			15.5	mm
Numerals	1 2 3 4 5 6 7 8 9 0			
Supply voltage	V_{ba}	min.	170	V
Cathode current	I_k		2.5	mA
Distance between mounting centres		min.	19	mm

GENERAL

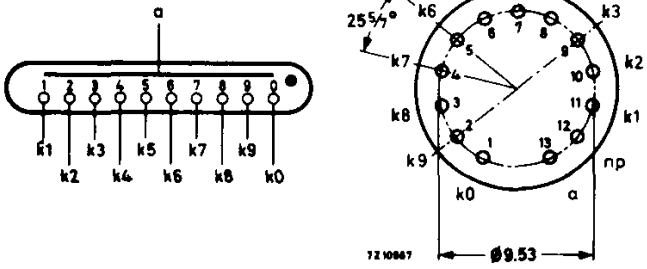
The numerals are 15.5 mm high and appear on the same base line allowing in-line read out. The ZM1230 is provided with a red contrast filter. The ZM1232 is identical to the ZM1230 but has no filter.

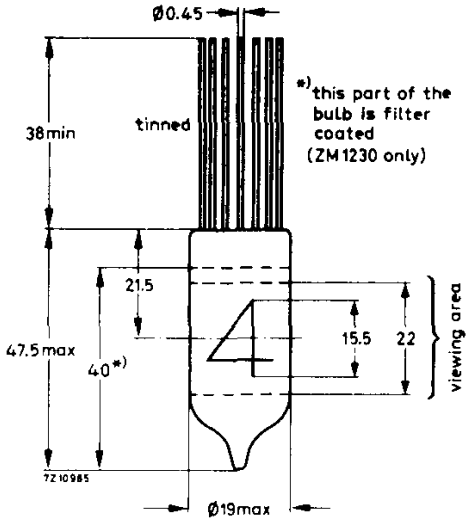
PRINCIPLE OF OPERATION

The tube contains ten cathodes in the form of ten figures and one common anode. By applying a suitable voltage between the anode and one of the ten cathodes the corresponding figure will be covered by a red neon glow.

DIMENSIONS AND CONNECTIONS

Dimensions in mm





Mounting position: any

The numerals will appear upright (within $\pm 3^{o}$) when the tube is mounted vertically, base up.

Soldering

The tube may be soldered directly into the circuit, but heat conduction to the glass-to-metal seals should be kept to a minimum by the use of a thermal shunt.
The leads may be dip-soldered to a minimum of 5 mm from the seals at a solder temperature of 240 °C for a maximum of 10 s.

Note

Care should be taken not to bend the leads nearer than 1.5 mm from the seals.

CHARACTERISTICS AND OPERATING CONDITIONS (at 20 °C to 50 °C)

Ignition voltage	V_{ign}	min.	170	V
Ignition delay	see page 3			
Maintaining voltage	see page 4			
Cathode current, recommended	I_k		2.5	mA
Cathode current for coverage, average during any conduction period	I_k	min.	1.5	mA
D.C. operation	see pages 4 to 9			
Pulse operation	see pages 4, 10, 11 and 12			
Extinguishing voltage	V_{ext}		115	V

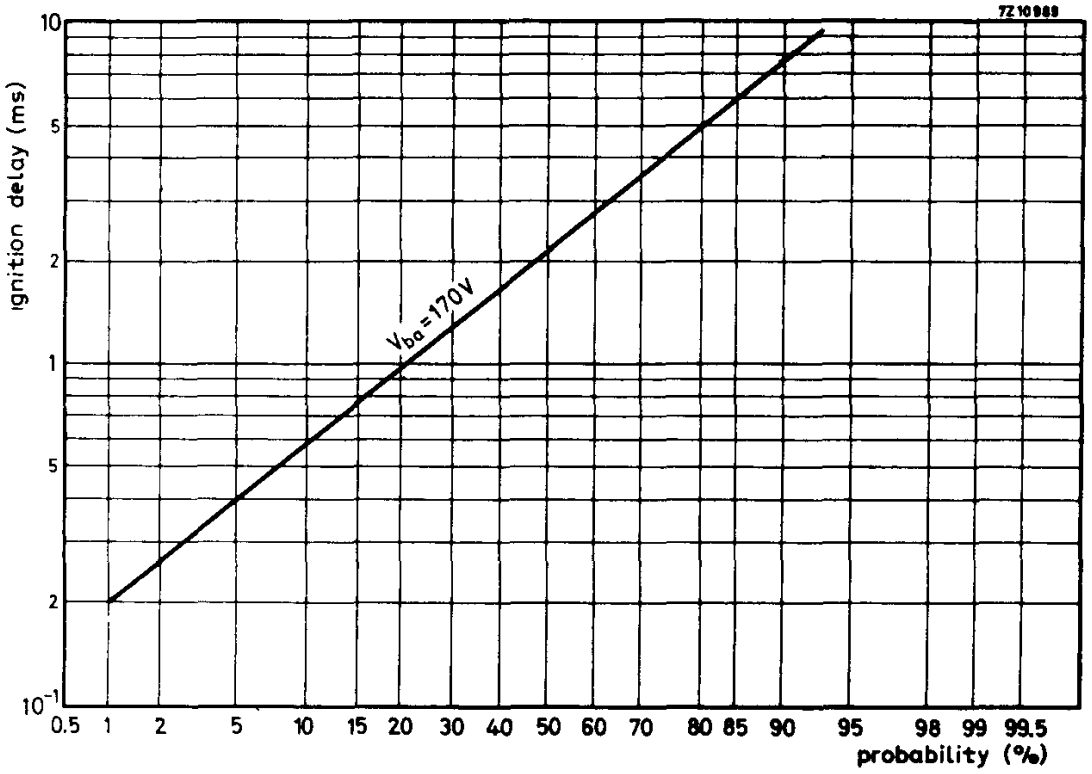
LIFE EXPECTANCY at I_k = 2.5 mA and room temperature [1])

Continuous display of one numeral	>	5 000	h
Sepuentially changing the display from one numeral to another, every 100 hrs or less	>	30 000	h

LIMITING VALUES (Absolute max. rating system)

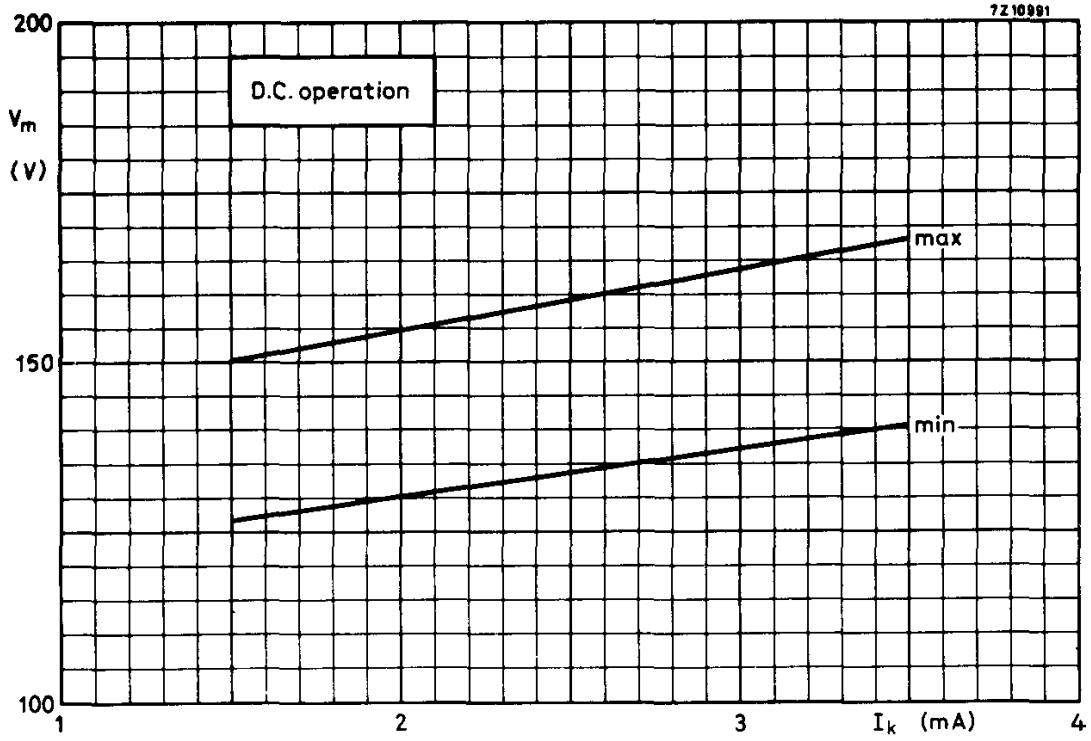
Cathode current (each digit), average, T_{av} = max. 10 ms	I_k	max.	3.5	mA
peak	I_{k_p}	max.	12	mA
average during any conduction period	I_k	min.	1.5	mA
Anode voltage necessary for ignition	V_a	min.	170	V
Pulse duration	T_{imp}	min.	100	μs
Bulb temperature	t_{bulb}	max.	+70	°C
	t_{bulb}	min.	−50	°C [1])

[1]) For bulb temperatures below 0 °C the life expectancy of the tube is substantially reduced.

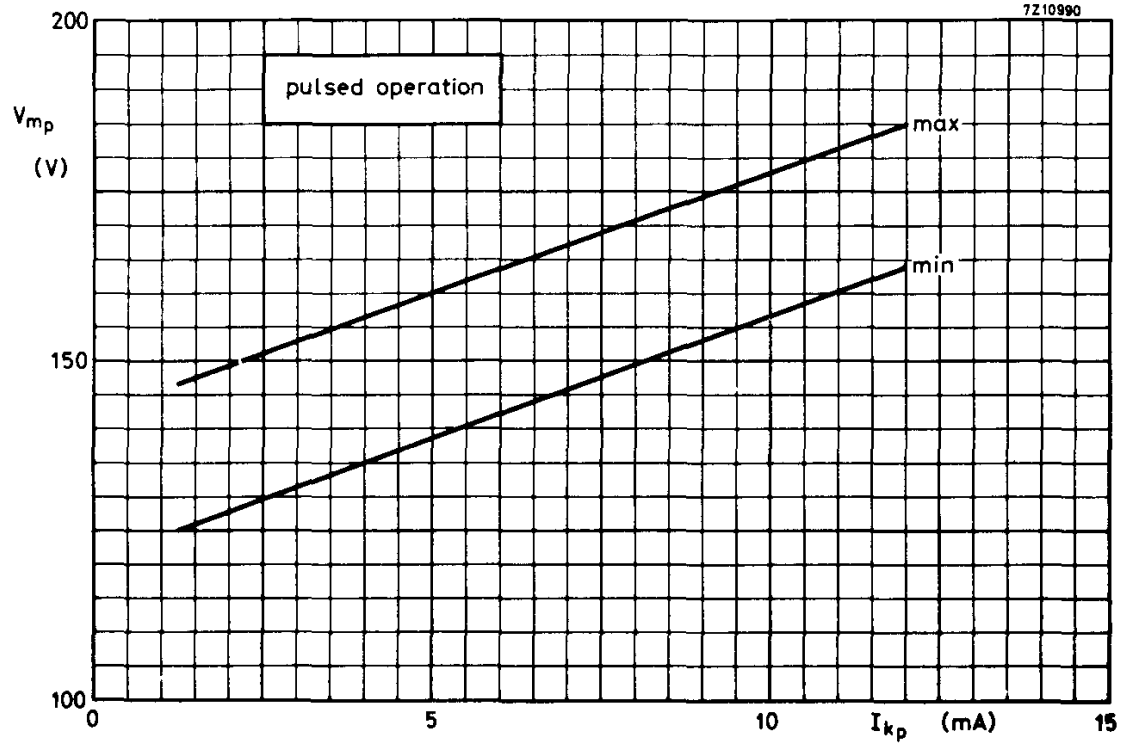


CUMULATIVE DISTRIBUTION OF IGNITION DELAY

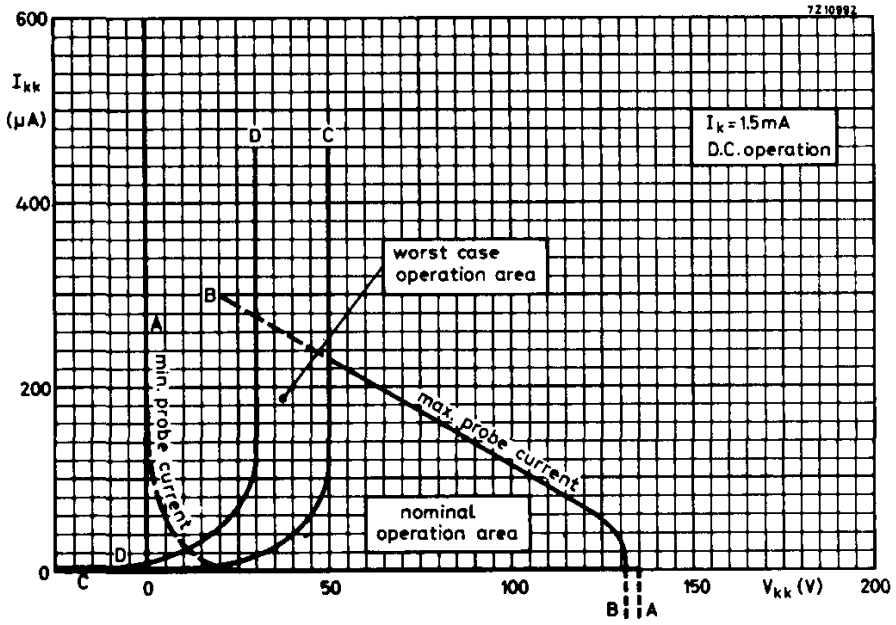
This curve shows the probability that a tube will ignite in less than the time shown after a non-conduction period of a few periods. The ignition delay will be appreciably reduced when the interval between conduction periods is less than 100 milliseconds. In general, an increase in the supply voltage will reduce the ignition delay.

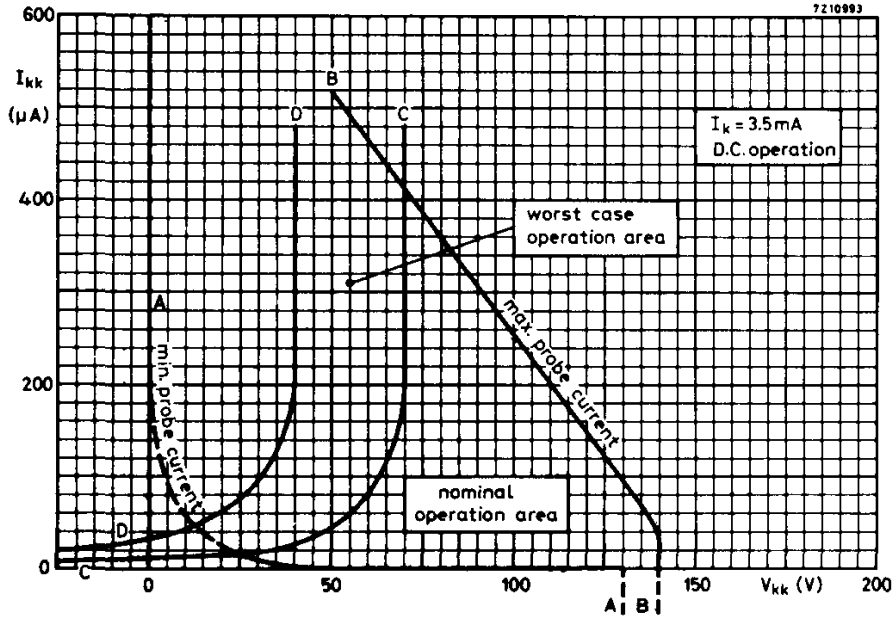


ANODE-TO-CATHODE MAINTAINING VOLTAGE
AS A FUNCTION OF CATHODE CURRENT



PEAK ANODE-TO-CATHODE MAINTAINING VOLTAGE
AS A FUNCTION OF PEAK CATHODE CURRENT





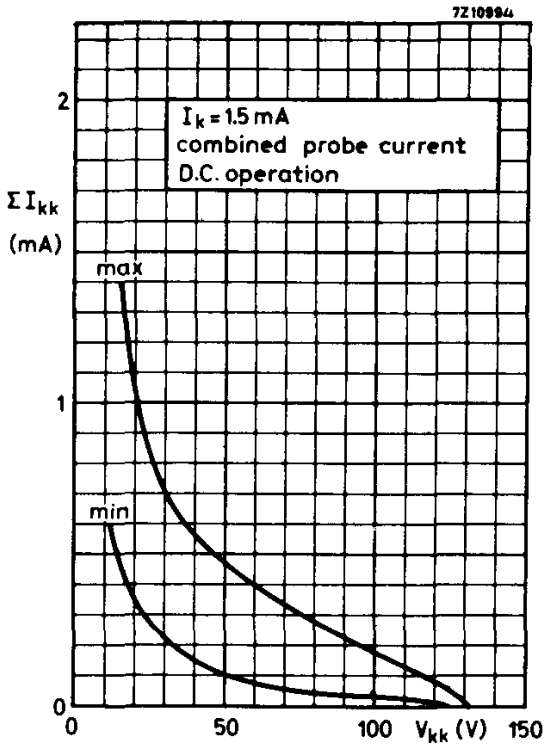
PROBE CURRENT TO INDIVIDUAL NON-CONDUCTING CATHODES

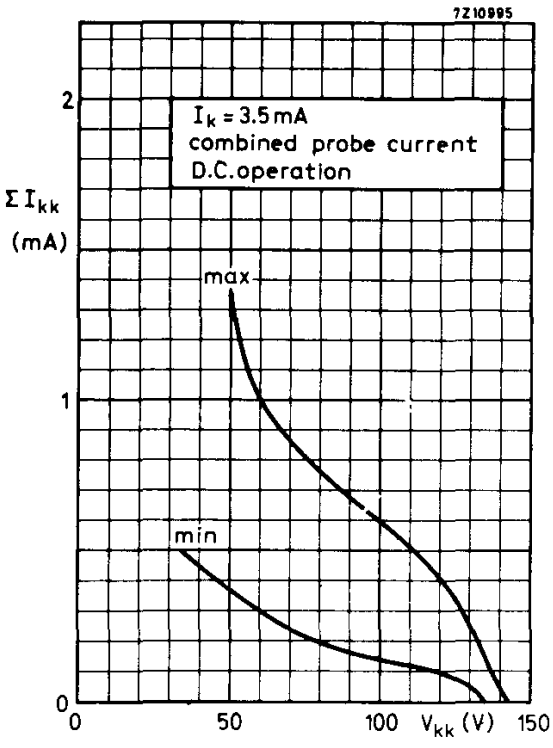
The boundaries A-A and B-B of the graphs represent, for the shown cathode current range, the range of probe current (I_{kk}) to individual non-conducting cathodes plotted against the voltage difference between the non-conducting cathodes and the conducting cathode (V_{kk}).

For low cathode selecting voltages (V_{kk}) the current I_{kk} to the non-conducting cathode will increase, and the readability conducting cathode will be affected.

It is therefore recommended to use a nominal operating point to the right of line C-C.

Under the worst operating conditions the operating point should never reach the area left of the line D-D.





COMBINED PROBE CURRENT TO ALL NON-CONDUCTING CATHODES

Sum of the probe currents to the non-conducting cathodes (I_{kk}) plotted against the voltage difference between the non-conducting cathodes and the conducting cathode (V_{kk}), showing the minimum and maximum values of probe current for a particular cathode current (I_k).

SUPPLY VOLTAGE/LOAD RESISTOR

The graphs on pages 8, 9 and 12 give the relationship between the anode supply voltage and the required anode load resistor for fixed values of V_{kk} (voltage difference between conducting cathode and non-conducting cathodes).

Each graph is plotted on log-log graph paper; therefore a given tolerance expressed as a percentage can be represented as a fixed length at any point on the x and y axes. This is shown on the first graph by taking points on each axis with a fixed tolerance.

Examples are shown on the first graph of the supply voltages and load resistors with tolerance expressed as a percentage so as to remain within the recommended operating region.

The curves are derived from:-

$$V_{ba} = I_a \cdot R_a + V_m$$

$$I_a = I_k + \Sigma I_{kk}$$

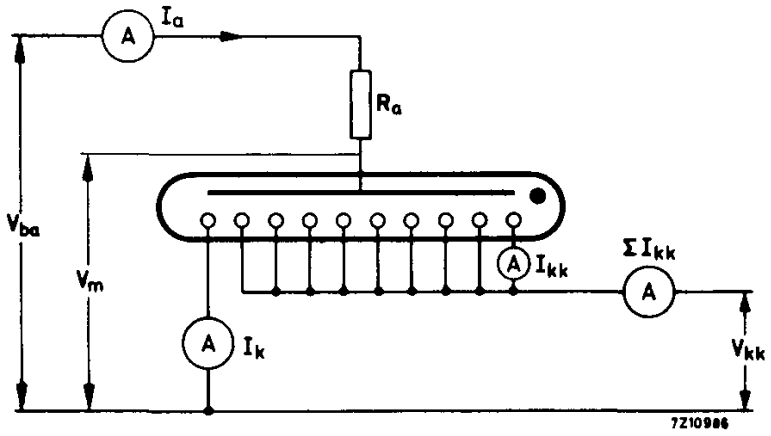
$$V_{ba} = (I_k + \Sigma I_{kk})\, R_a + V_m$$

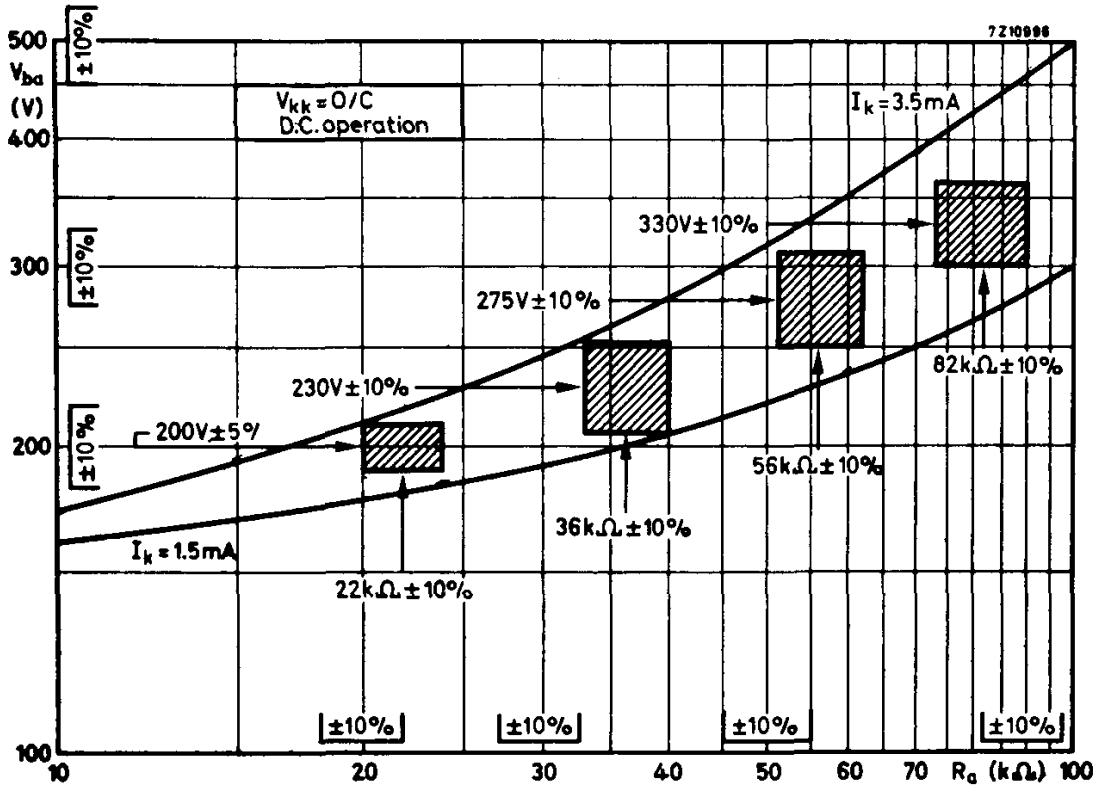
For a given value of R_a, the minimum supply voltage limit to ensure that the cathode current exceeds I_k min. is given by:

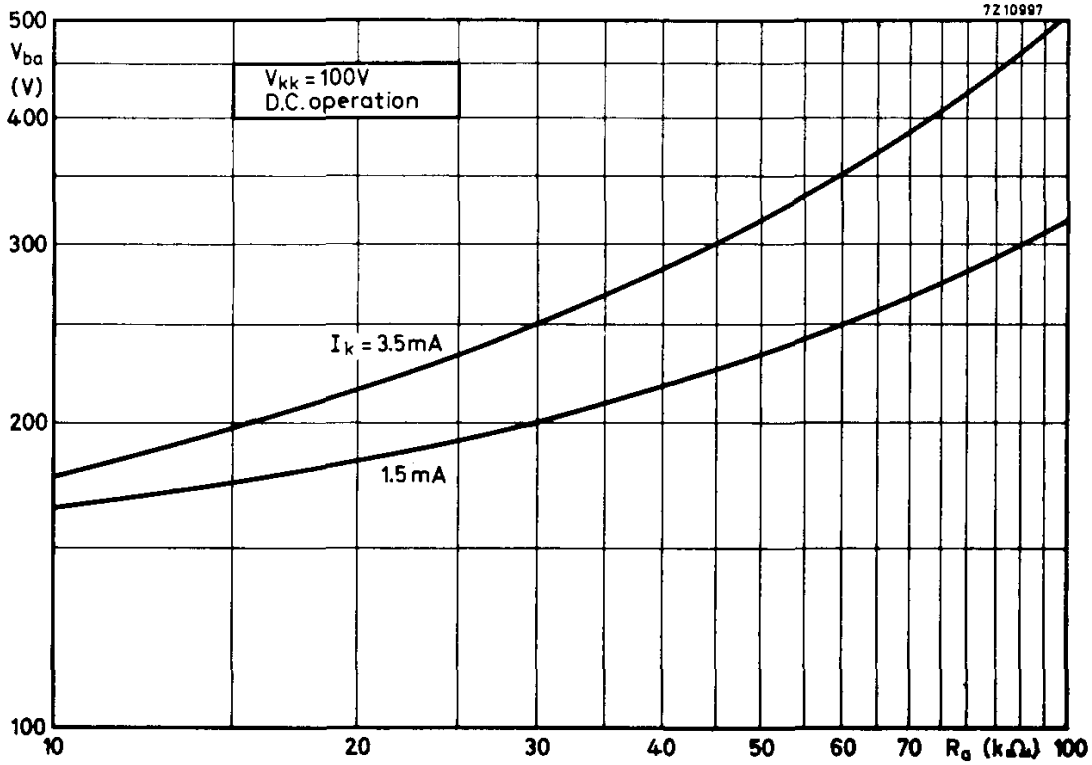
$$V_{ba}\ \text{min.} = \left[I_k\ \text{min.} + \Sigma I_{kk}\ \text{max. (at } I_k\ \text{min.)}\right] R_a + V_m\ \text{max. (at } I_k\ \text{min.)}$$

For the same value of R_a, the maximum supply voltage limit to ensure that the cathode current does not exceed I_k max. is given by:

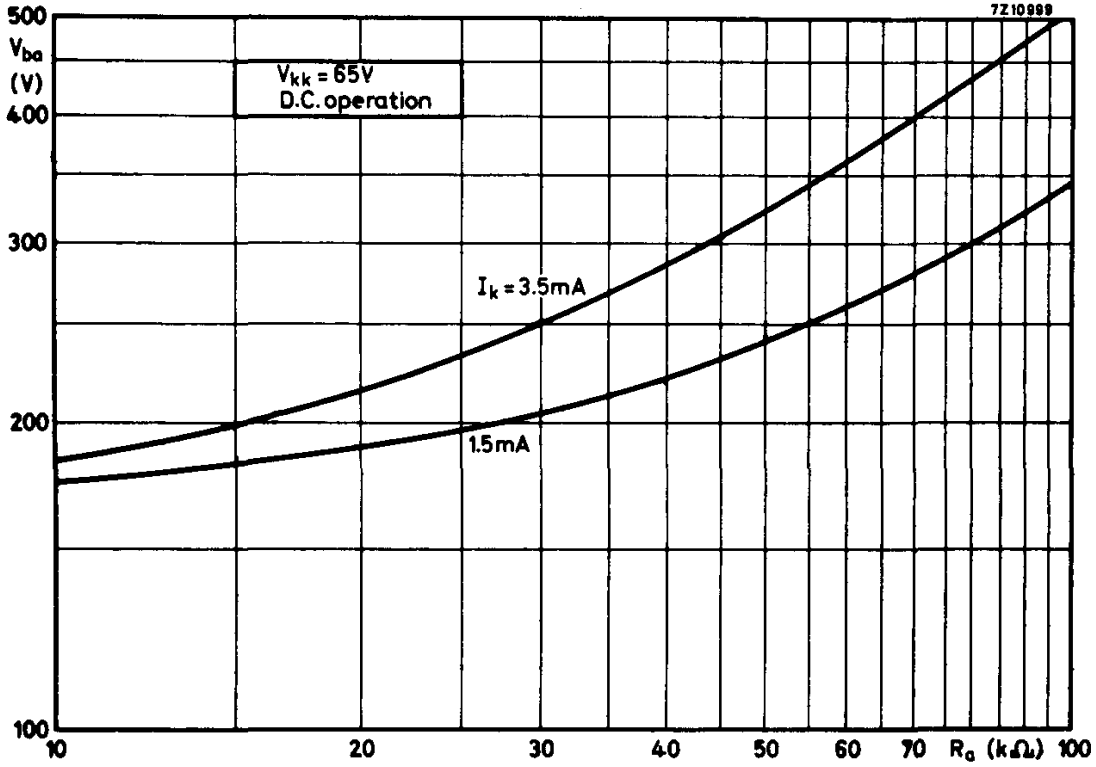
$$V_{ba}\ \text{max.} = \left[I_k\ \text{max.} + \Sigma I_{kk}\ \text{min. (at } I_k\ \text{max.)}\right] R_a + V_m\ \text{min. (at } I_k\ \text{max.)}$$

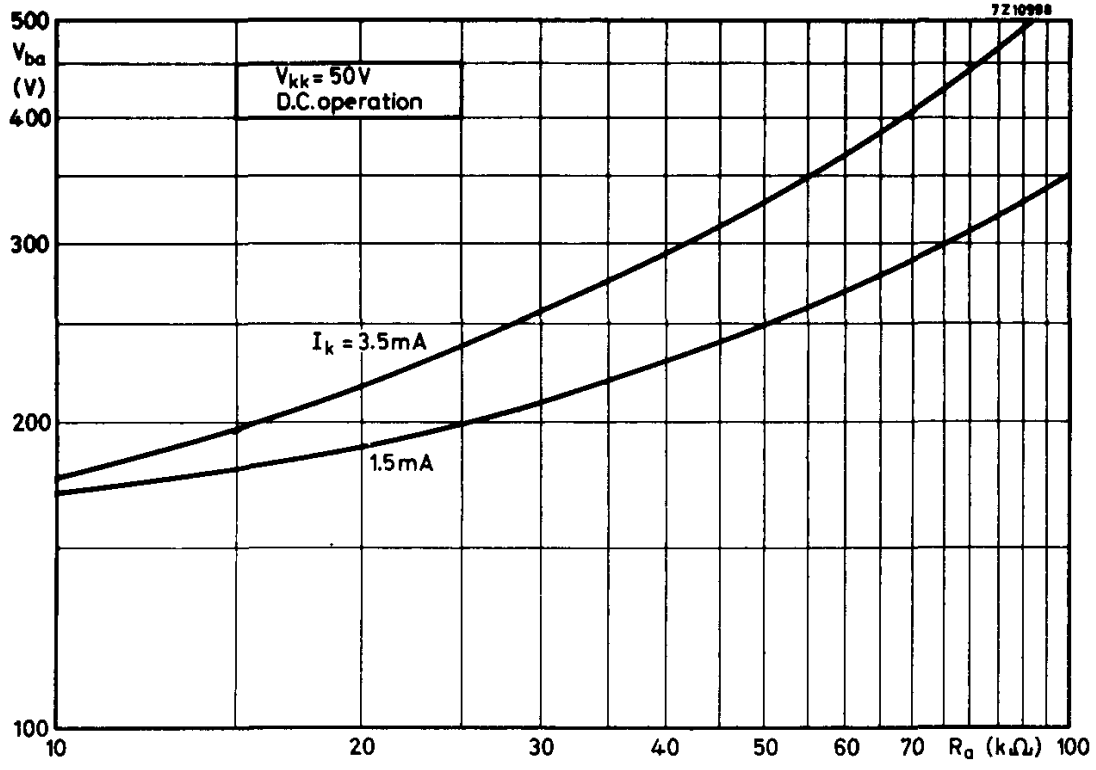




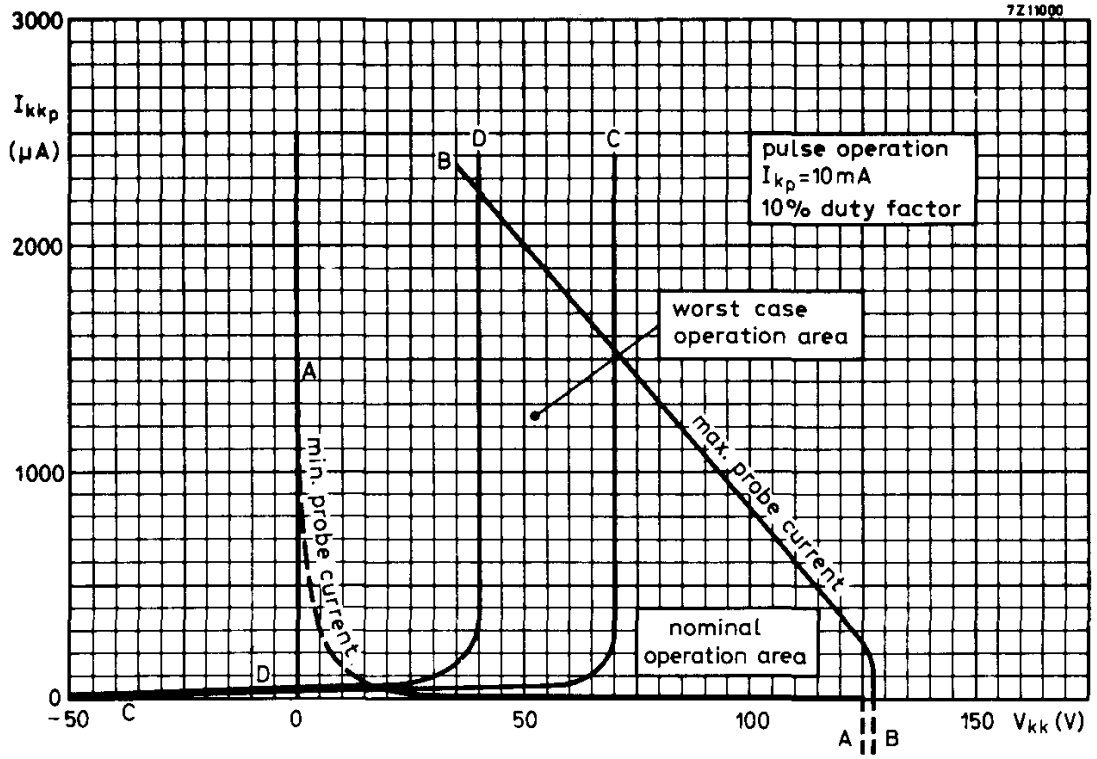


D.C. SUPPLY VOLTAGE PLOTTED AGAINST ANODE LOAD RESISTOR



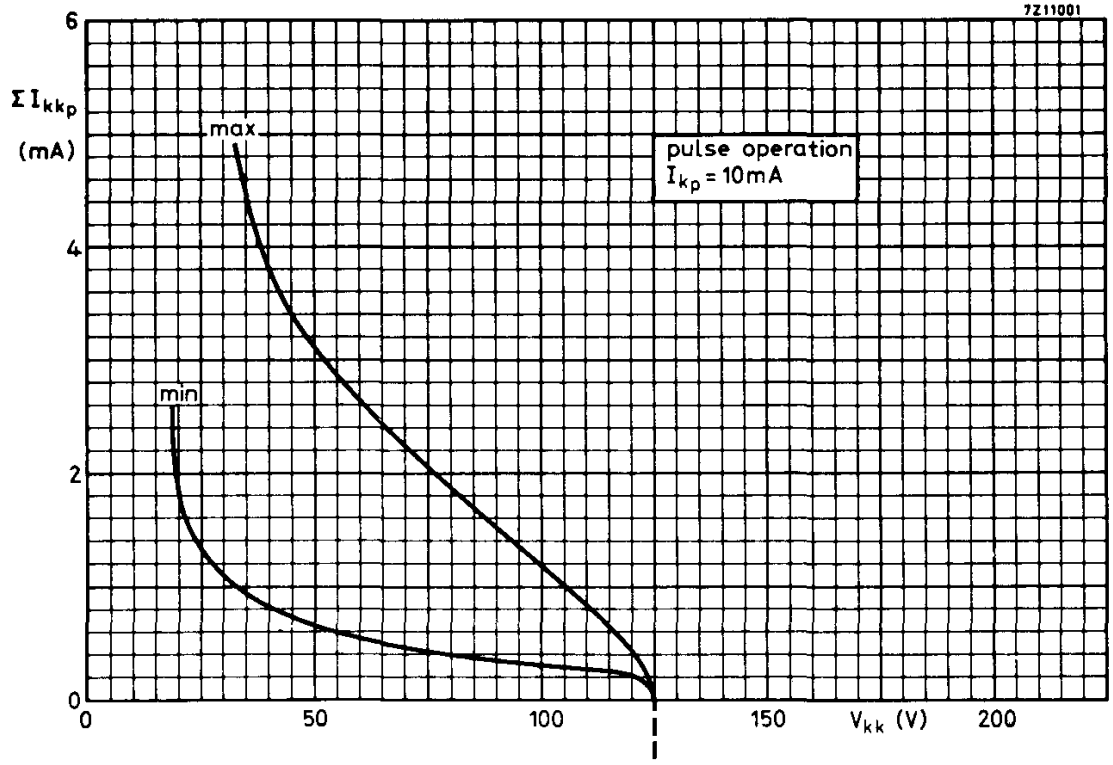


D.C. SUPPLY VOLTAGE AS A FUNCTION OF ANODE LOAD RESISTOR



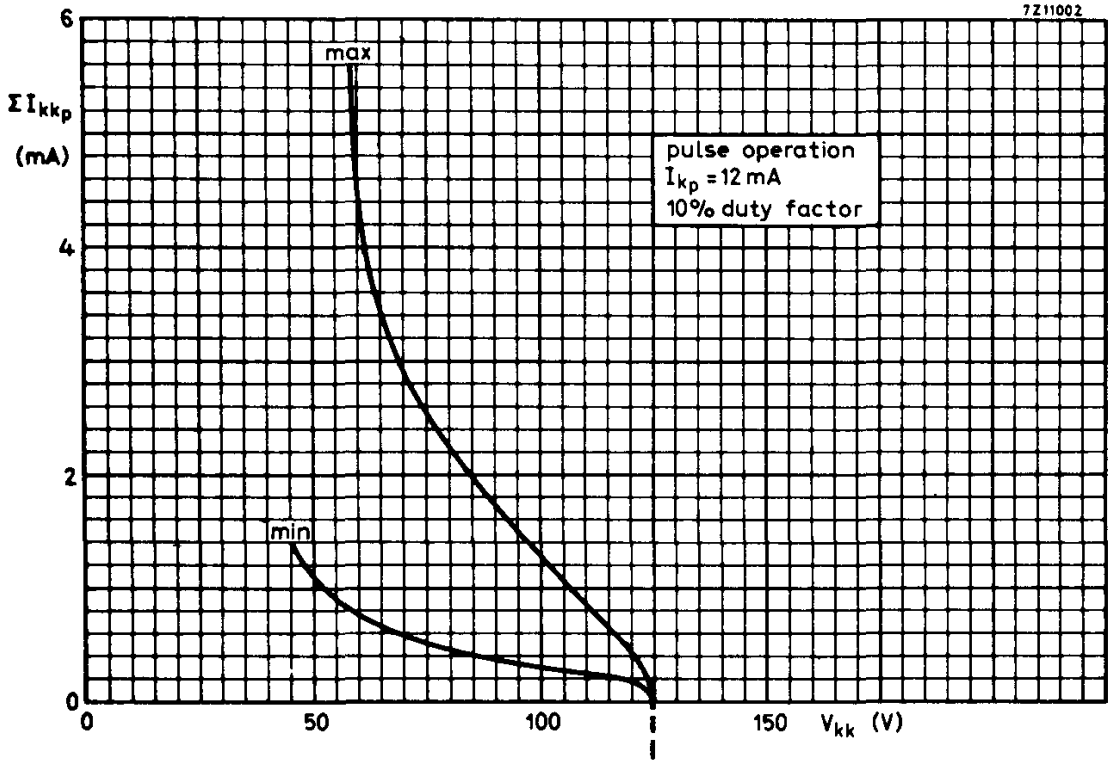
PEAK PROBE CURRENT TO INDIVIDUAL NON-CONDUCTING CATHODES

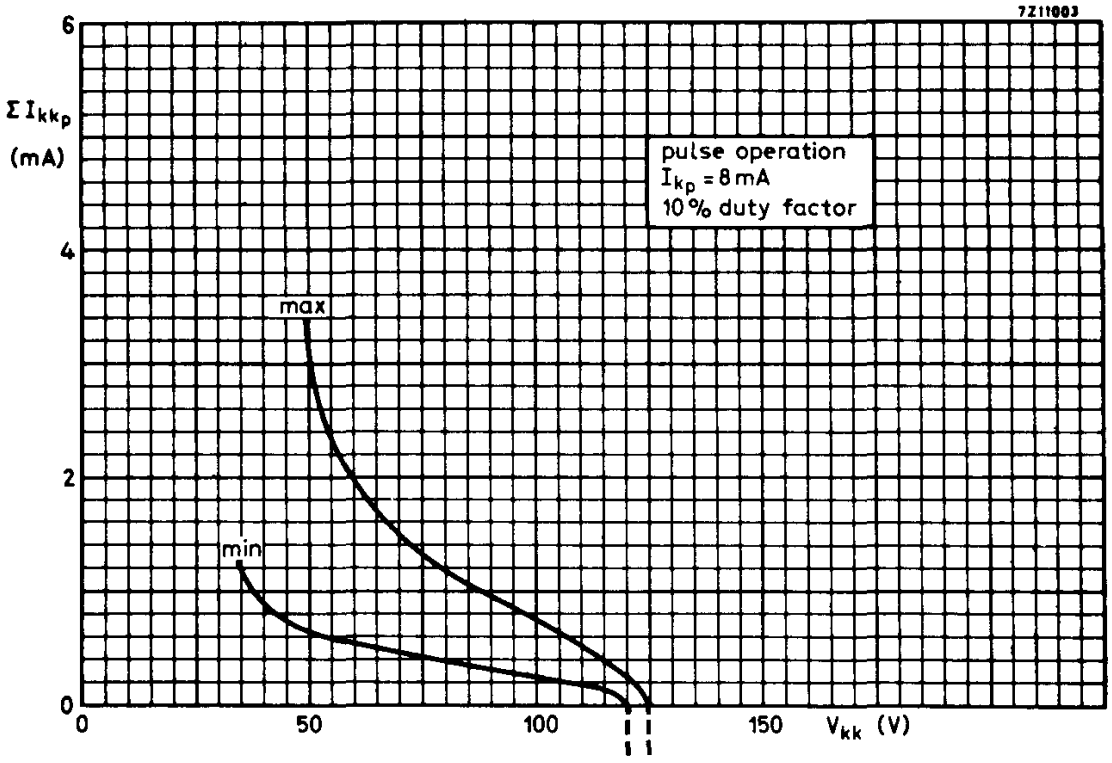
See also page 5



COMBINED PEAK PROBE CURRENT TO ALL NON-CONDUCTING CATHODES

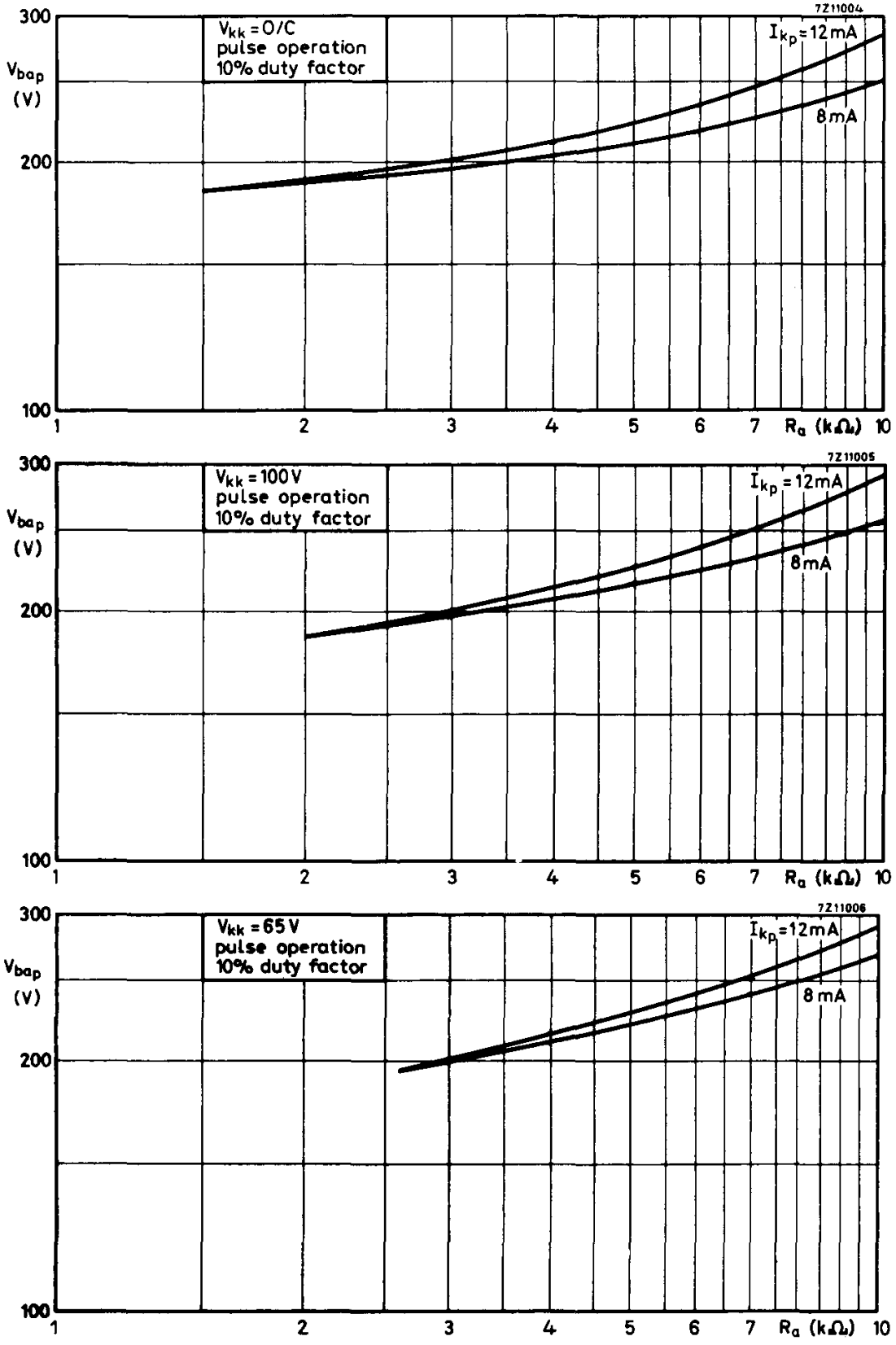
See also page 6





COMBINED PEAK PROBE CURRENT TO ALL NON-CONDUCTING CATHODES

See also page 6



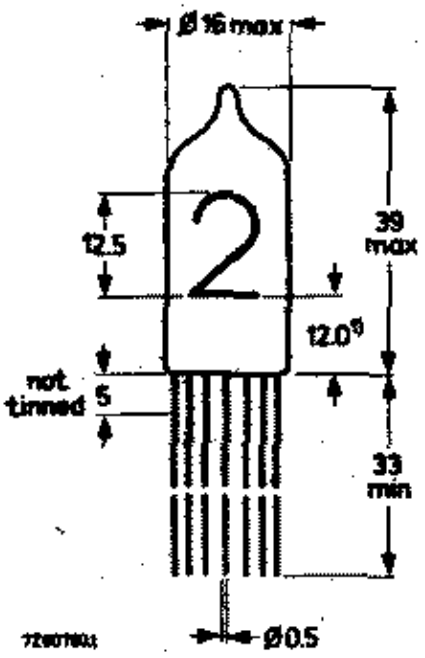
PEAK SUPPLY VOLTAGE AS A FUNCTION OF ANODE LOAD RESISTOR

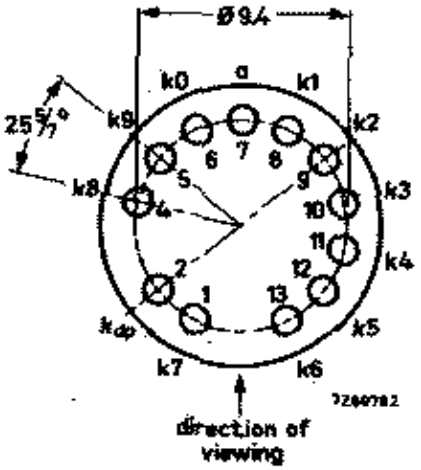
INDICATOR TUBE

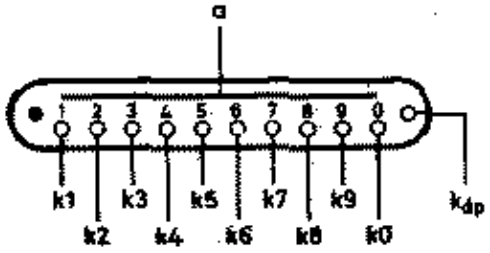
Long-life cold-cathode ten-digit indicator tube for side viewing.
The tube is designed for time-sharing (pulse) applications.

QUICK REFERENCE DATA				
Numeral height		approx.	12,5	mm
Numerals		0 1 2 3 4 5 6 7 8 9		
Decimal point		to the right of the numerals		
Supply voltage	V_{b_a}(pulse)	min.	190	V
Cathode current, peak	I_{k_p}	min.	2	mA
	I_{k_p}	max.	8	mA
average	I_k	max.	0,5	mA

DIMENSIONS AND CONNECTIONS Dimensions in mm







Mounting position: any

Soldering
The leads may be dip-soldered at a solder temperature of max. 240 °C for maximum 10 s up to a point 5 mm from the seals.

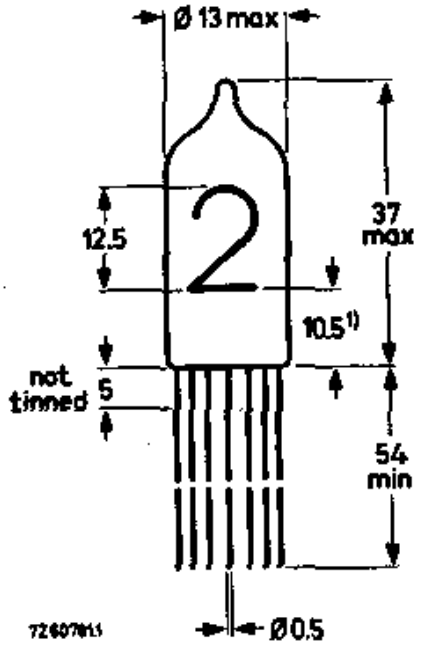
[1]) *Standard deviation 0, 13 mm*

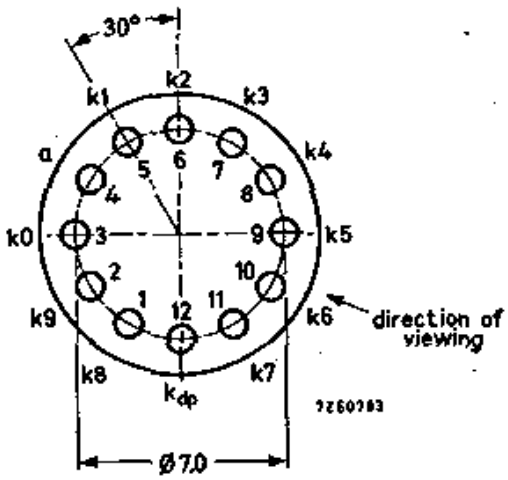
INDICATOR TUBE

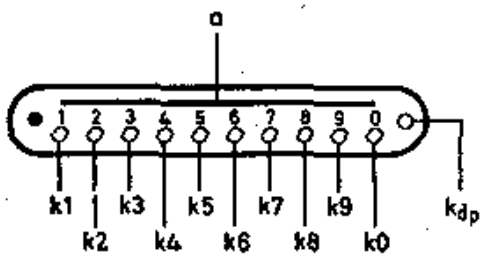
Long-life cold-cathode ten-digit indicator tube for side viewing.
The tube is designed for time-sharing (pulse) applications.

QUICK REFERENCE DATA				
Numeral height		approx.	12,5	mm
Numerals		0 1 2 3 4 5 6 7 8 9		
Decimal point		to the right of the numerals		
Supply voltage	$V_{ba(pulse)}$	min.	170	V
Cathode current, peak	I_{kp}	min.	7	mA
	I_{kp}	max.	19	mA
average	I_k	max.	1,7	mA

DIMENSIONS AND CONNECTIONS Dimensions in mm







Mounting position: any

Soldering
The leads may be dip-soldered at a solder temperature of max. 240 °C for maximum 10 s up to a point 5 mm from the seals.

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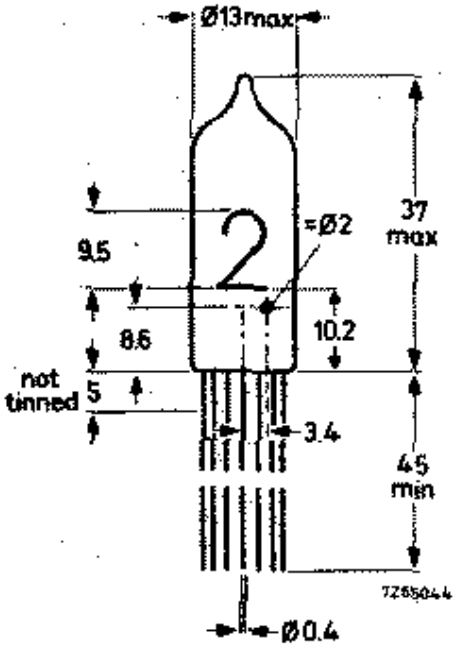
[1]) Standard deviation 0, 13 mm

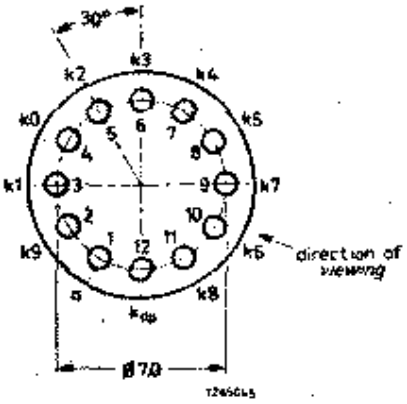
INDICATOR TUBE

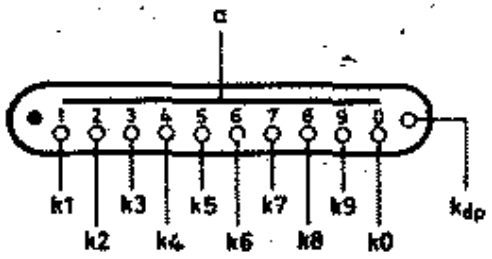
Long-life cold cathode ten-digit indicator tube for side viewing.

QUICK REFERENCE DATA				
Numeral height		approx.	9,5	mm
Numerals		1 2 3 4 5 6 7 8 9 0		
Decimal point		to the right of the numerals		
Supply voltage	$V_{b_{a(pulse)}}$	max.	170	V
Cathode current, peak	I_{k_p}	max.	11	mA
average	I_k	max.	1,1	mA

DIMENSIONS AND CONNECTIONS Dimensions in mm







Mounting position: any

Soldering

The leads may be dip-soldered at a solder temperature of max. 240 °C for maximum 10 s up to a point 5 mm from the seals.



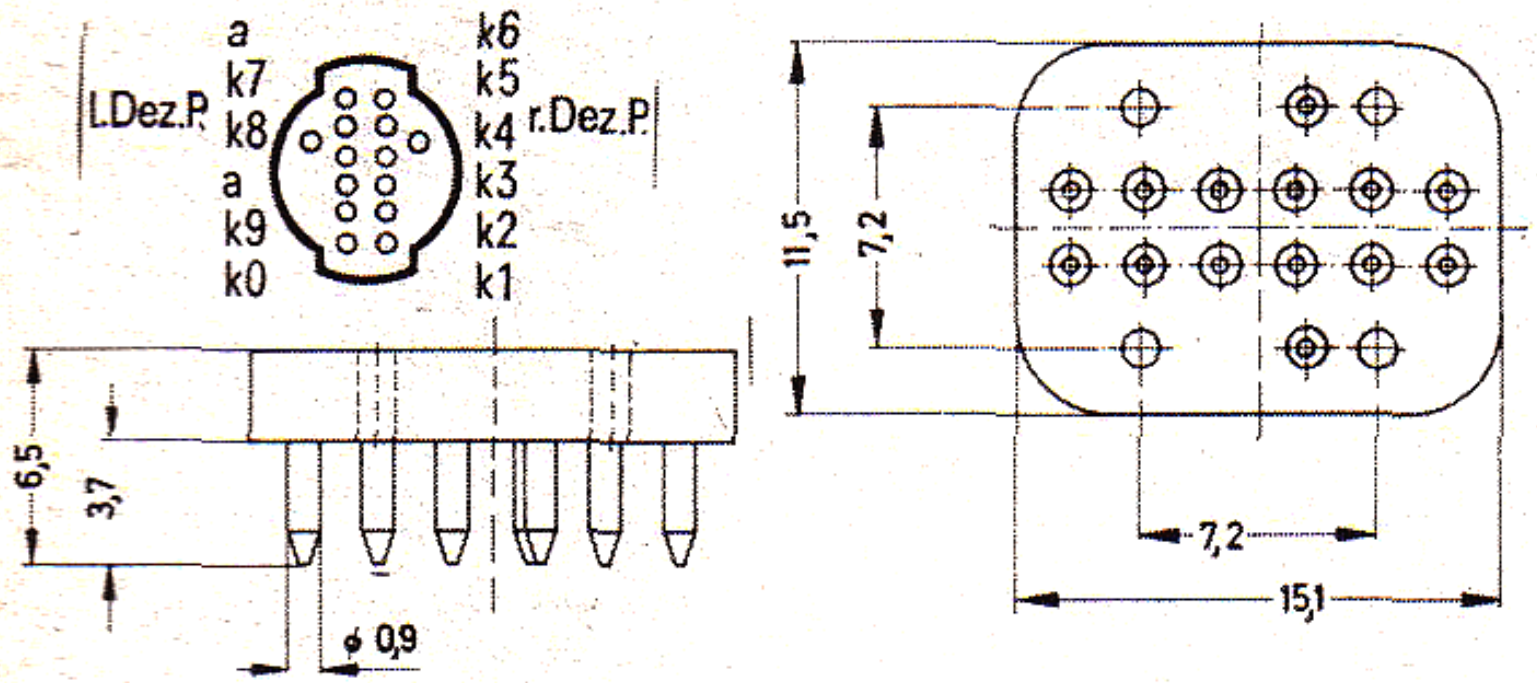
SIEMENS-Ziffernanzeigeröhre ZM 1334, mit rotem Farbfilterüberzug, Anzeigeziffern 0–9 m. Dezimalpunkt links u. rechts, Ziffernhöhe 13,1 mm, besonders für TTL-Ansteuerung geeignet (auch Röhren- u. Schalteransteuerung), sehr konturenscharfe Anzeige.

Kenndaten: Zündspannung 175 V, Löschspannung 115 V, Katodenstrom b. Impulsbetrieb 0,7 mA (Punkt 0,1 mA), Katodenstrom 14 mA sp (Punkt 2 mA sp).

Grenzdaten: Speisespannung 175 V, min. Katodenstrom 11 mA sp (Punkt 1 mA sp), max. Katodenstrom 1,6 mA (Punkt 0,16 mA) mittel, Kolbentemperatur – 20 bis + 70 °C.

Maße: max. Höhe 30,5 mm, max. Durchmesser 13 mm.

Preis ZM 1334, mit langen Anschlußdrähten und Distanzscheibe .... 1 St. **DM 10.90** 10 St. **DM 98.–**



Für ZM 1334:

Fassung Fsg 1019, für gedruckte Schaltung

1 St. **DM 2.80** 10 St. **DM 24.–**

ZM 1350

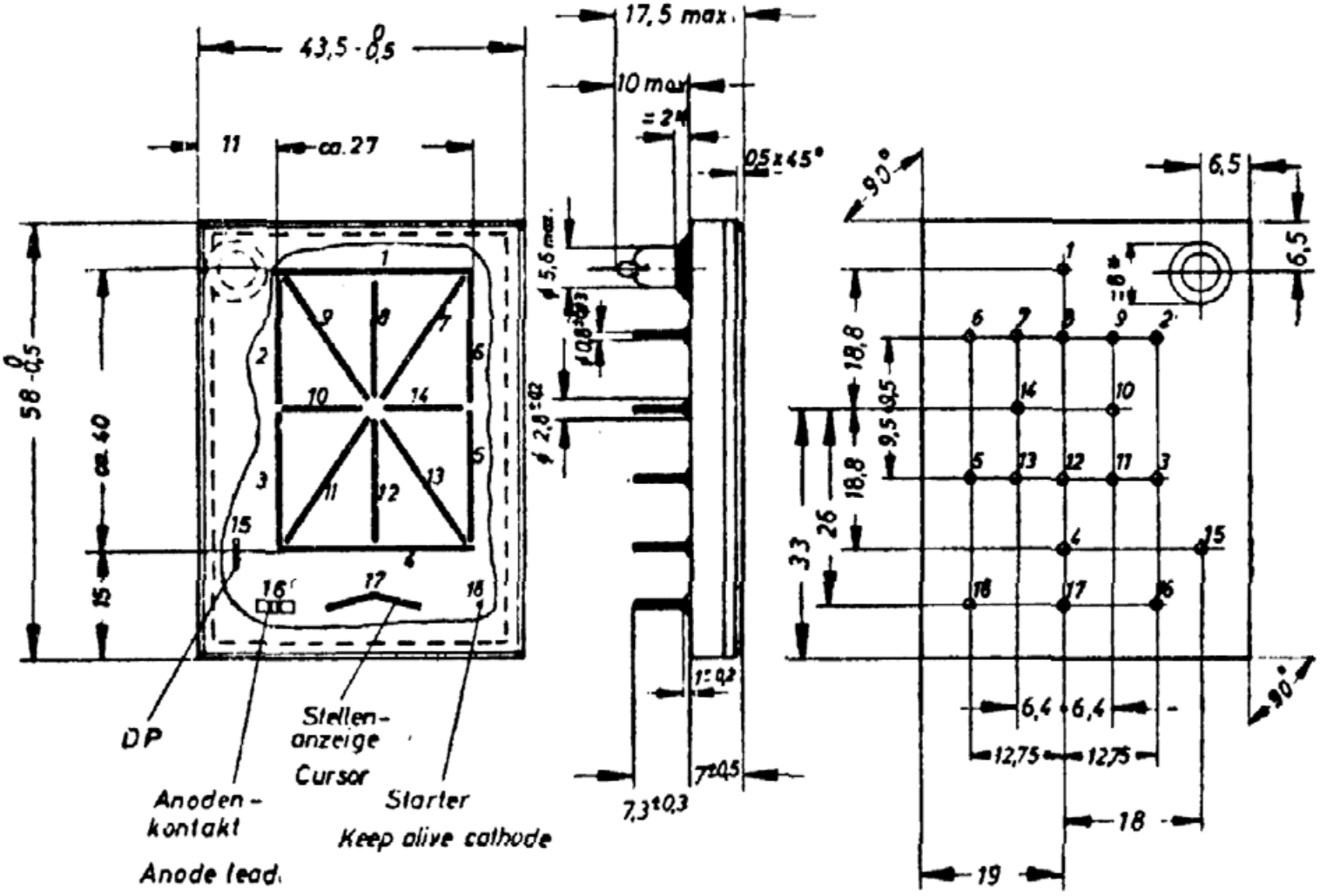
Planares Gasentladungs-Informationsanzeigeelement
Planar gas discharge information display

Elektrische und optische Kenndaten · Electrical and optical data

Starterzündspannung Ignition voltage on keep alive cathode	U_{STZ}		ca. 160	V
Anodenzündspannung Anode firing voltage	U_{AZ}		ca. 130	V
Anodenbrennspannung Anode to cathode voltage drop	U_{ABRN}		ca. 128	V
Anodenlöschspannung Anode breakdown voltage	U_{AL}		ca. 125	V
Zündverzögerungszeit · Delay time				
erstmalige Zündung · initial firing	t_z [1]		20	µs
wiederholte Zündung · repeated firing	t_z [2]		6...20	µs
Leuchtdichte · Brightness	L [3]		1700	cd/m²
Grenzwerte · Maximum ratings				
Kathodenstrom (Segment 7) Cathode current (segment 7)		min.	max.	
Gleichstrombetrieb DC operation	I_K	0,8	1,5	mA
Multiplexbetrieb Multiplex operation	I_K [4]		5	mA
Halbwellenbetrieb (sinusförmig) Half-wave operation (sinusoidal)	I_K		2	mA
Gehäusetemperatur Envelope temperature				
Betrieb · Operation	ϑ_B	0	70	°C
Lagerung · Storage	ϑ_L	−30	80	°C

[1] Starterstrom (Segment 18) · Keep alive current (segment 18): $I_K = 30$ µA
[2] Bedingung für Segment 7 · Conditions at segment 7:
$U_B = 175$ V, $I_K = 1$ mA, $t_p = 200$ µs, $t_p/T = 1/10$
[3] Bedingung für Segment 7 · Conditions at segment 7: $I_K = 1$ mA
[4] Pulszeit · Pulse time: $0{,}1\text{ ms} \leq t_p \leq 10\text{ ms}$
Wiederholfrequenz · Refresh rate: $50\text{ Hz} \leq f \leq 2\text{ kHz}$

Abmessungen · Dimensions



* Anglasung Pumpstengel

Tip off stem