

# NUMITRON Digital Display Devices

## Segmented Incandescent Types

### FEATURES:

- high brightness — fully adjustable
- low voltage operation
- high contrast — segmented digits viewed against a dark background
- compatible with IC Decoder/Drivers such as the RCA CD2500E family
- high-reliability — rugged construction
- wide-spectrum light emission permits unlimited filter selection
- DR2200 Series have a recommended DC segment operating voltage range of 1.5 to 3V
- wide viewing angle
- void of "clutter"
- solderable base pins permits direct PC board mounting
- DR2000 Series fits popular low cost 9-pin miniature socket
- DR2100 and DR2200 Series fit popular TO-5 style, 10-pin socket
- DR2100V1 and DR2200V1 Series have formed lead to facilitate direct PC-board mounting

### MECHANICAL

	DR2000 Series	DR2100 DR2200 Series	DR2100V1 DR2200V1 Series
Mounting Position . . . . .	Any	Any	Any
Maximum Overall Length . . .	1.875 in.	1.660 in.	1.705 in.
Maximum Seated Length . . .	1.625 in.	1.450 in.	1.540 in.
Maximum Diameter . . . . .	0.785 in.	0.485 in.	0.485 in.
Base . . . . .	9-pin min.	9-pin, 0.230 in. pin circle	9-pin, 0.380 in. pin circle

### CHARACTERISTICS

#### ELECTRICAL

	DR2000 Series	DR2100 Series	DR2200 Series	
Recommended DC Segment Operating Voltage Range . . . . .	3.5 to 5.0	3.5 to 5.0	1.5 to 3.0	V
DC Segment Voltage unless otherwise specified . . . . .	4.5	4.5	2.5	/
Segment Current . . . . .	24	24	14	mA
Mean Life Expectancy (at 95% confidence) . . . . .	100 k	100 k	100 k	h
<b>VISUAL</b>				
Viewing Angle (including angle) . . . . .	140	120	120	°
Segment Luminance (typ.) . . . . .	7000	7000	4000	fL
Response Times:				
Ascent to Visibility (typ.) . . . . .	15	15	8	ms
Descent to 50% of Luminance . . . . .	<20	<20	<10	ms
Maximum Segment Deflection				
From a Straight Line . . . . .	0.005	0.004	0.004	in
Contrast Ratio . . . . .	30:1	30:1	20:1	

**Mechanical Characteristics**  
**DR2000 and DR2100 Series**

TEST	CONDITIONS	DC Segment Volts
SHOCK*		
a)	100g, 1 ms, Half-Sine Wave	4.5
b)	50g, 11 ms, Half-Sine Wave	Not Applied
VIBRA-TION		
a)	Variable Frequency: 10 to 44 Hz, 0.1-inch DA	4.5
b)	Variable Frequency: 44 to 200 Hz, 10g	4.5
c)	Variable Frequency: 200 to 800 Hz, 1g	4.5
d)	Variable Frequency: 800 to 2000 Hz, 10g	4.5
e)*	Fatigue: 25 Hz, 2.5g, 96 hr	4.5

**DR2200**  
**Series**

SHOCK*		
a)	200g, 1 ms, Half-Sine Wave	2.5
b)	50g, 11 ms, Half-Sine Wave	Not Applied
VIBRA-TION		
a)	Variable Frequency: 5 to 60 Hz, 0.1-inch DA	2.5
b)	Variable Frequency: 60 to 500 Hz, 20g	2.5
c)*	Fatigue: 25 Hz, 2.5g, 96 hr	2.5

\* Performed in Accordance with MIL-E-1F

The NUMITRON digital display devices will meet the Specifications for operational and crash safety tests; standard environmental vibration for instrument panel location in all types of aircraft, as set by the Radio Technical Commission for Aeronautics (RTCA). Document No. DO-138 Dated June 27, 1968.

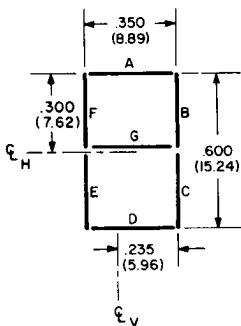
Base Pin Number And Segment Designation Chart

Display	Type	Segment Designations A—H								
		1	2	3	4	5	6	7	8	9
	DR2000 DR2100 DR2200	NC	← COMMON →	E	D	C	G	A	B	F
	DR2010 DR2110 DR2115 DR2210 DR2215	H		E	D	C	G	A	B	F
	DR2020 DR2120 DR2220	NC		NC	NC	NC	D	B	C	A
	DR2030	NC	NC	NC	NC	B	NC	A	NC	
	DR2130 DR2230	NC	NC	NC	NC	NC	B	NC	NC	A

NC = no connection — may be used as tie point.

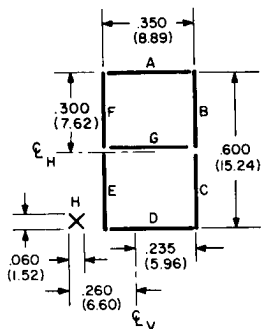
Segment Dimensions and Designations

**DR2000**



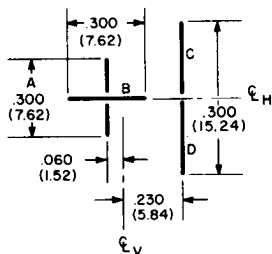
92CS-15754R1

**DR2010**



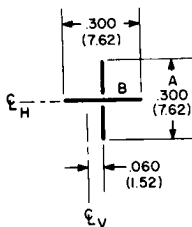
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**DR2020**



92CS-15756R1

**DR2030**



92CS-15757R1

$\epsilon_H$  = Horizontal center line of display (bulb outline dimension F) with pin No. 3 toward viewer. Segment "G" is 0.030" above  $\epsilon_H$ .

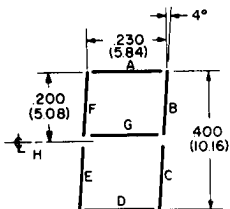
$\epsilon_V$  = Vertical center line of device.

DR2100 and DR2200 series; vertical center line of display coincides with vertical center line of device.

Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated.

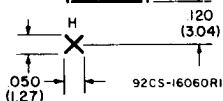
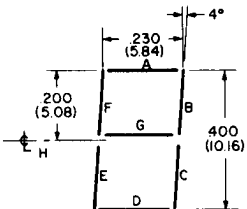
Segment Dimensions And Designations – Cont'd

DR2100  
DR2200



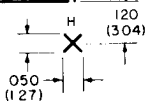
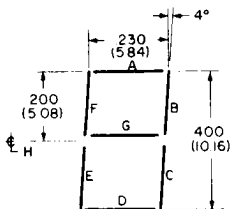
92CS-16059RI

DR2110  
DR2210



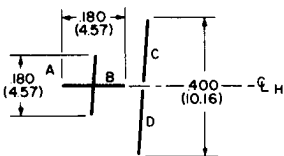
92CS-16060RI

DR2115  
DR2215



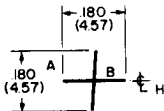
92CS-18023RI

DR2130  
DR2230



92CS-16061RI

DR2120  
DR2220



92CS-16062RI

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## OPERATING CONSIDERATIONS

### Integrated Circuit Decoder/Driver

The NUMITRON series devices are compatible with the RCA Integrated Circuit Decoder/Driver types CD2500E and CD2501E. The integrated circuit decoder/driver accepts four inputs in BCD (8-4-2-1 code) and decodes them into outputs representing a decimal number from 0 to 9 on a 7-segment display. For basic interconnection of decoder/driver and the NUMITRON display devices see Fig. 4.

### Mounting Arrangements

The NUMITRON devices are designed for mounting in either commercially available sockets or directly on printed circuit boards. The DR2000 series devices fit into a standard 9-pin miniature electron tube socket. A commercial PC board socket which permits 0.8-inch center-to-center mounting is available. (See Hardware and Accessories.) The DR2100 and DR2200 series devices are available in two versions: straight leads and V1 versions with formed leads: The straight lead versions may be mounted on 0.5-inch centers directly on PC boards or may be used with standard TO-5 style, 10-pin sockets. The V1 versions facilitate direct PC board mounting on 0.5-inch centers. To use the light shield, DR3000<sup>+</sup>, the center-to-center mounting must be increased to 0.515-inch.

Figure 5 shows the base diagram and pin-circle dimensions for the various NUMITRON devices.

### Character Formation

The following chart gives the base pin connections for forming the various character displays for each device. Pin No. 2 is the common connection for all segments in each device. For example, to form a numeral one using type DR2000, connect the segment voltage between pin No. 2 (common) and pin Nos. 5 and 8.

## Digital Character Formation

Display	Device Pin Number				
	Pin No. 2 Common For All Types				
	DR2000 DR2100 DR2200	DR2010 DR2110 DR2115 DR2210 DR2215	DR2020 DR2120 DR2220	DR2030	DR2130 DR2230
0	3,4,5,7, 8,9	3,4,5,7, 8,9			
1	5,8	5,8	6,8		
2	3,4,6, 7,8	3,4,6, 7,8			
3	4,5,6, 7,8	4,5,6, 7,8			
4	5,6,8,9	5,6,8,9			
5	4,5,6, 7,9	4,5,6, 7,9			
6	3,4,5,6, 7,9	3,4,5,6, 7,9			
7	5,7,8	5,7,8			
8	3,4,5,6, 7,8,9	3,4,5,6, 7,8,9			
9	4,5,6,7, 8,9	4,5,6,7, 8,9			
+			7,9	6,8	7,9
-			7	6	7
decimal		1			

### **Power Supply Requirements**

The NUMITRON Series devices do not require critical voltage regulation over the useable operating range. As is the case with any incandescent type device, dc voltage operation above the recommended value may result in reduced life expectancy. For multiplex operation, segment voltage above the normal range may be used provided that the appropriate duty factor is observed. (See NUMITRON Display Device Booklet, NUM-421).

### **Display**

Because these NUMITRON devices have a wide-band light spectrum emission, filters can be used to produce any desired color display. (See Hardware and Accessories.) A display having a broader stroke can be obtained with an etched glass such as "Trusite"\* or a diffused filter. For a larger size display, a Fresnel lens may be used.

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\*Trademark "Trusite" Dearborn Glass Co., Chicago, Illinois.

## **Hardware and Accessories**

### **Sockets**

Noval 9-pin Types

DR2000 Series

- Methode Electronics, Inc., M8610 (For 0.8-inch centers) and P460 (standard)
- Cinch Mfg. Co., 121-51-00-040 (standard)

TO-5 10-Lead Types

DR2100, DR2200 Series

- Methode Electronics, Inc., M8620
- Cinch Mfg. Co., 133-99-92-054 and 133-99-92-065  
133-99-92-065 (spread-lead socket)

### **Filters**

Polaroid Corp., Cambridge Mass. 02139

Circular Polarizer:

Standard and Diffused Surface for Broader Stroke

Panelgraphic Corp., West Caldwell, N.J. 07006

Chromafilter CF-131: Anti-Reflection Filters

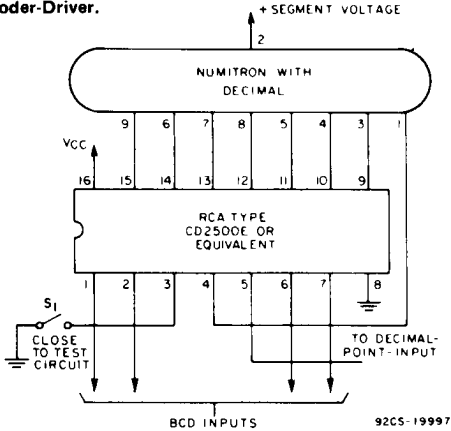
### **Plastic Light Shield to Reduce Side Reflections**

DR2100, DR2200 Series

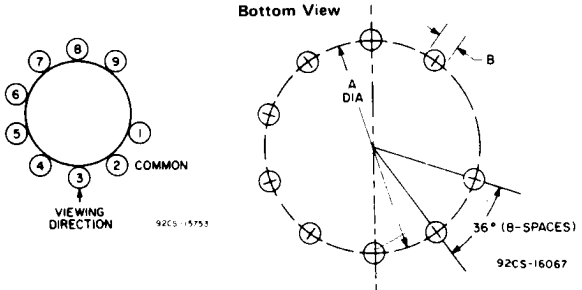
- RCA DS3000
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**Basic Interconnection Circuit of NUMITRON Device and Decoder-Driver.**



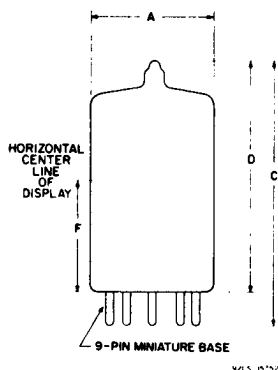
**Base Diagram and Pin Circle Dimensions — All Series.**



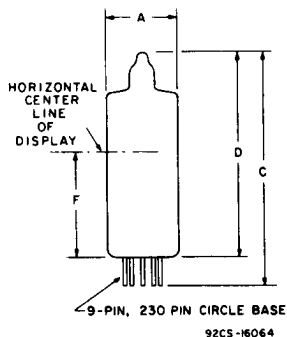
NUMITRON SERIES	DIMENSION (INCHES)		
	A NOMINAL	MIN.	MAX.
DR2000	0.468	0.038	0.042
DR2100 and DR2200	0.230	0.018	0.022
DR2100V1 and DR2200V1	0.380	0.018	0.022

**Dimensional Outlines**

**DR2000 Series**



**DR2100,  
DR2200 Series**

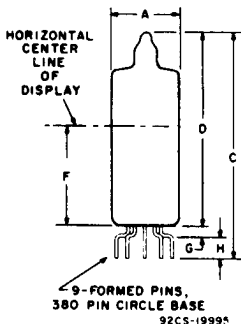


DI- MEN- SION	DR2000 Series				DR2100 and DR2200 Series			
	INCHES		MILLIMETERS		INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
A		0.800		20.32		0.485		12.32
C		1.875		47.62		1.660		42.16
D		1.625		41.27		1.450		36.83
F	0.700	0.730	17.78	18.54	0.625	0.655	15.87	16.64

MILLIMETER DIMENSION DERIVED FROM INCH DIMENSION

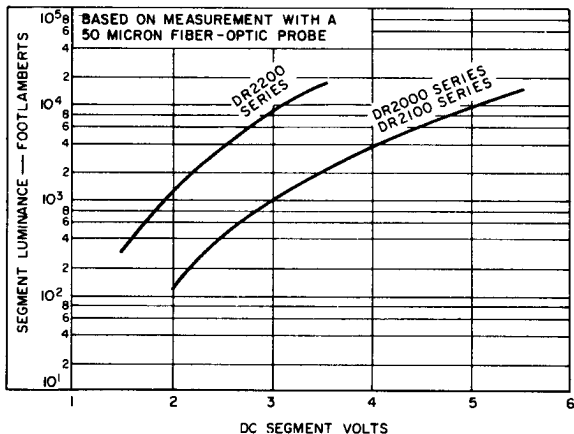
Dimensional Outlines – Cont'd

DR2100V1,  
DR2200V1 Series



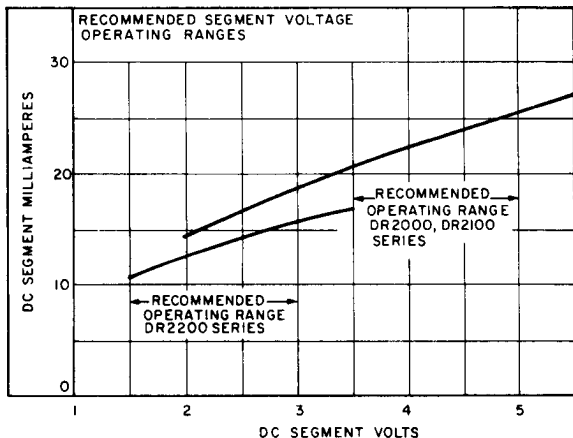
DI- MEN- SION	DR2100V1 and DR2200V1 Series			
	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A		0.485		12.32
C		1.705		43.30
D		1.450		36.83
F	0.625	0.655	15.87	16.64
G	0.060	0.090	1.52	2.28
H	0.135	0.165	3.43	4.19

Segment Luminance Characteristics



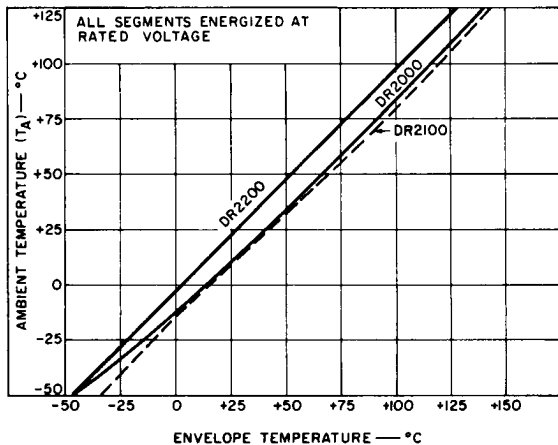
92CS-15750RI

Segment Current Characteristics



92CS-15758R1

Envelope Temperature Characteristics



92CS-16063R2