

SP-462

1 Line x 4 Character Alphanumeric Gas Discharge Display

The Babcock Plasmaflex™ SP-462 is a bright, easily read, 16-segment, alphanumeric, dc gas discharge display. It has four, two-inch-high characters, plus periods, commas, and colon. Its 16-segment format provides a display set of 64 commonly used ASCII characters including ten numerals, the upper case alphabet, and many special symbols. Due to its stacking capability, the SP-462 is easily expanded into wider fields of uniformly spaced characters.

The Adaptable One . . .

PLASMAFLEX™
GAS DISCHARGE DISPLAYS

The unsurpassed readability, even in direct sunlight, of the SP-462 is derived from its wide viewing angle, 2-inch high characters, and bright neon-orange color. Easily read from 100 feet or more, the SP-462 display is ideally suited for applications anywhere bright and easily readable messages are needed. The SP-462 is the latest addition to Babcock's 2-inch Plasmaflex™ product family which includes the numeric clock displays, Models SP-431 and SP-431-001.

- 2 in. Character Height
- 150° Viewing Angle
- 175 fL Brightness
- 100 ft. (30 m) Viewing Distance
- Stackable—Horizontally and Vertically
- 16-Segment Format
- Single-In-Line Flexible Leads
- Neon—Orange Color

- Electronically Controlled Signs
- Timing Systems
- Communications Systems
- Alert Indicators
- Machine Control Indicators
- Industrial Clocks
- Counters and Timers
- Status Boards



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TECHNICAL BULLETIN

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SP-462 1 Line x 4 Character Alphanumeric

RELIABILITY

Gas discharge displays have a proven record of long life and operate consistently and dependably. Nominal service life is five years.

The displays require no external heat sink. Brightness is maintained at either high or low ambient temperatures. They dissipate relatively little power for their size and run cool in comparison to other types of displays. They are influenced by neither strong electric or magnetic fields, nor nuclear radiation. They are resistant to attack in most corrosive environments.

APPLICATION GUIDELINES

Mechanical

The display is constructed of a thin, hermetically sealed, glass package, with single, in-line, flexible leads. This simple, 2-element structure is inherently rugged and reliable and will tolerate high temperatures. Because the leads are soldered to thick-film termination pads and reinforced with epoxy which softens above 85°C, the parts should be mounted with minimum stress on the leads before wave soldering.

Room temperature cleaning may be accomplished with Freon T-E35 or T-P35, Ethanol, Isopropanol, or water with a mild detergent.

Contrast Enhancement

Recommended contrast enhancement filters for these displays include the circular polarizing amber or neutral density types offered by the Polaroid Corporation. For a complete discussion of contrast enhancement and visual characteristics of Babcock gas discharge displays, request Design Note 10 (DN-10).



Electrical

The SP-462 screened image display is designed for multiplexed operation. It is also suitable for multiplexed addressing using pulsed dc, where high brightness—up to 175 fL is desired. Steady state direct current must be used to operate the keep-alive. Like segments of each digit are electrically interconnected to form a 16 x N array, where N is the number of characters in the display. Expected operating voltage between any anode and cathode may be calculated using the following model:

$$V_{ak} = 120 + 24[I_{kp}/I_{kp}(TYP)] + 200 I_{kp}(n - 1)$$

where n is the number of active cathodes on per anode.

The keep-alive must be connected through a current limiting resistor when multiplex addressing to ensure that the keep-alive remains conducting during an entire scan. (See Figure 1.)

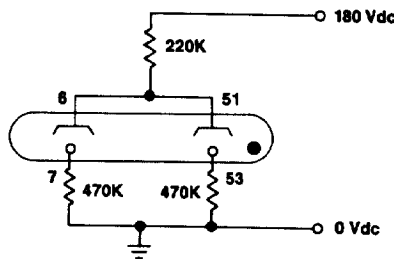


FIGURE 1. Keep-Alive Schematic.

This keep-alive is essential to assure an ample supply of free electrons in the display to ionize the gas and minimize reionization time. Use 50 μA dc in both keep-alives and connect as noted in the figure. (Do not connect both keep-alive cathodes together.) Each keep-alive must have its own current limiting resistor as noted. The recommended value for the common anode resistor and separate cathode resistors are 220K and 470K ohms, respectively. Alternatively, the anodes may be connected through separate 470K ohm resistors to the anode supply voltage.

When multiplexing, use cathode and anode off-bias resistors and design the cathode drive circuit to have an output voltage swing of about 90 volts and adequate switching speed to eliminate the possibility of off-cathodes conducting when the anode voltage has been turned off. (See Figure 2.)

Keep the average cathode current density constant in each cathode to assure uniform brightness and maximum service life. Minimize the number of different current ratios, and thus resistor values, by grouping segments and using the mid-range value as the group ratio. For example:

Group	Segments	Area Ratio
A	A D E H J P Colon	0.50
B	B C F G K M R S	1.00
N & T	N T	1.20
ANNUN.	Decimal Comma	0.27

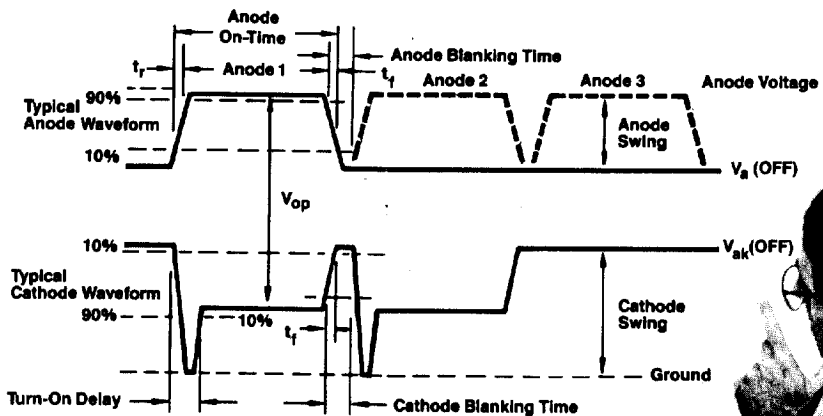
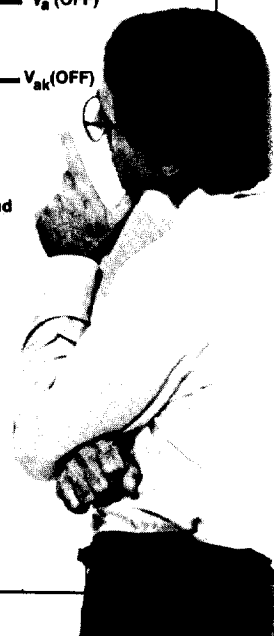


FIGURE 2. Typical Timing Diagram for Multiplex Addressing.

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Tables 1 through 4 contain electrical, optical, and environmental characteristics. Maximum/minimum ratings are limiting operating conditions which, if exceeded, could result in permanent damage to the component, or in severely reduced life.

TABLE 1. MAXIMUM/MINIMUM RATINGS.

RATING	NOTE	MIN	MAX	UNITS
Anode Voltage, Instantaneous	2	—	250	Vdc
Anode Current, Instantaneous	2	—	150	mA
Cathode Current Density	1	—	575	mA/in ²
Operating Temperature		0	+55	°C
Storage Temperature		-40	+70	°C
Lead Soldering Temperature (260°C)			5	sec
Thermal Cycle (-10°C to 70°C)			5	°C/minute

TABLE 2. RECOMMENDED OPERATING CONDITIONS

PARAMETER	NOTE	SYM	MIN	TYP	MAX	UNITS
Anode Supply Voltage	2	V _{bb}	170	180	200	Vdc
Anode Voltage Swing			50	68	90	Vdc
Anode On-Time	3	t _a		2430	T _s /4	μs
Refresh Period	4	T _s		10	12	ms
Interdigit Blanking Time	9	t _b		50		μs
Keep-Alive Current	5			50		μA
Cathode Voltage Swing (Anode Voltage = 180 V)				90		Vdc
Cathode (Off-State) Bias (On-Anode to Off-Cathode Voltage)		V _{ak} (OFF)			105	Vdc

TABLE 3. ELECTRICAL/OPTICAL CHARACTERISTICS

PARAMETER	NOTE	SYM	MIN	TYP	MAX	UNITS
Anode Firing Voltage		V _f			170	Vdc
Cathode Current	6	I _{kp}	4.4	5.9	7.4	mA
Anode-Cathode Voltage Drop		V _{op}	135	144	156	Vdc
Keep-Alive Current	5		25	50	75	μA
Initial Ionization Time					5	sec
Recurrent Turn-On Delay		t _d (ON)		20		μs
Light Output	7	L		175		fL
Service Life	8	MTTF		40K		hrs

TABLE 4. ENVIRONMENTAL CHARACTERISTICS

CHARACTERISTIC	CONDITION	MAXIMUM
Relative Humidity	240 h, 70°C	90%
Altitude		70,000 ft
Vibration	10-50 Hz	.18 in. da
	50-2000 Hz	2 g
Shock	11 ms, half sine	50 g

Definitions

- a. Interdigit Blanking Time, t_b: A time interval inserted between successive anode or cathode pulses in a sequential scan to ensure that glow extinction has occurred.
- b. Turn-On Delay, T_d(ON): The time interval between the application of anode and cathode drive and the beginning of current flow in the display.
- c. Operating Voltage, V_{op}: The voltage drop from anode to cathode at typical cathode current. (See Figure 3.)
- d. Initial Ionization Time. The elapsed time from the first application of voltage to the display after a long off-time (typically overnight), in a totally dark environment, to the first light output.

- e. Anode Firing Voltage, V_f: The minimum voltage required to start ionization in the display. (See Figure 3.)
- f. Threshold Voltage, V_{ak}(OFF): The anode to cathode voltage at which the display conduction drops below 10 μA when moving left along the operation curve. (See Figure 3.)
- g. Rise and fall times (t_r and t_f) are measured between the 10% and 90% points. Both anode and cathode t_r and t_f should not exceed 5 μs.
- h. Anode Supply Voltage: Voltage available from anode to cathode to ionize the plasma.



Notes:

1. Current density is the cathode current divided by the cathode area. The minimum cathode current density is the peak current density that just causes a segment to have a uniform glow. See Figure 3.
2. The anode supply voltage must be current limited to the maximum specified anode current. Cathode resistors or current limited anode drivers are recommended.
3. The anode on-time is the actual conduction time. Its maximum value should not exceed one-fourth the refresh period, T_s.
4. Operating the device at refresh rates 80 Hz or higher will help ensure flicker-free performance.
5. Use of the keep-alive cathode is recommended in all multiplexed and dimming applications. The keep-alive current must be dc and not pulsed ac.
6. All segment currents must be ratioed in accordance with the tabulation shown in Figure 4. All cathodes should have individual means of current limiting (resistor or current sink).
7. Light output is measured on a Pri-chard spectrophotometer using a 2-minute aperture, photoptic filter at 25% duty cycle and typical cathode currents. The keep-alive current is 50 μA dc. Light output (luminance) in footlamberts can be calculated:

$$L = 120 I_{kp} / R_{ka} (t_r / T_s)$$

where I_{kp} is the peak cathode current in mA, R_{ka} is the ratio of the cathode area to the b-segment area, t_a is the anode on-time, and T_s is the refresh period.

8. Service life is a strong function of operating temperature and cathode current density. A Mean-Time-To-Failure (MTTF) specification is typical for ambient operating conditions and typical cathode currents. Service life is defined as the length of time it takes for the display to reach half brightness.
9. The cited blanking time assumes typical b-segment cathode current with 180 Vdc supply. Actual blanking requirements may vary depending on the mode of multiplex operation, the segment current used, and the supply voltage used.

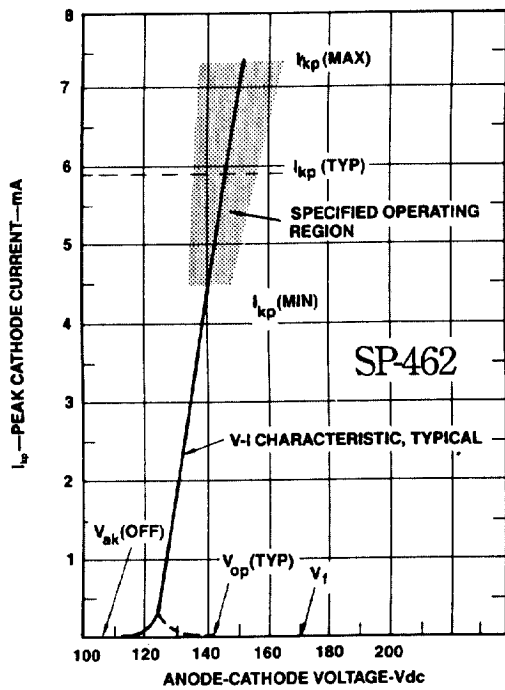


FIGURE 3. Typical V-I Characteristics



PIN NO.	FUNCTION	RATIO	PIN NO.	FUNCTION	RATIO
1	ANODE 1	—	31	N/A	—
2	N/A	—	32	COLON ANODE	—
3	A	.560	33	N/A	—
4	B	1.000	34	K	1.020
5	N/A	—	35	M	1.010
6	K/A ANODE	—	36	N	1.170
7	K/A CATHODE	.021	37	N/A	—
8	N/A	—	38	N/A	—
9	C	1.070	39	N/A	—
10	D	.560	40	N/A	—
11	E	.510	41	ANODE 3	—
12	F	1.070	42	N/A	—
13	N/A	—	43	N/A	—
14	N/A	—	44	N/A	—
15	N/A	—	45	N/A	—
16	N/A	—	46	N/A	—
17	N/A	—	47	P	.540
18	ANODE 2	—	48	R	1.070
19	N/A	—	49	S	1.030
20	N/A	—	50	N/A	—
21	N/A	—	51	K/A ANODE	—
22	N/A	—	52	N/A	—
23	N/A	—	53	K/A CATHODE	.021
24	N/A	—	54	N/A	—
25	N/A	—	55	T	1.170
26	G	1.020	56	DECIMAL	.270
27	H	.500	57	COMMA	.270
28	J	.520	58	N/A	—
29	N/A	—	59	N/A	—
30	COLON CATHODE	.540	60	N/A	—
			61	ANODE 4	—

FIGURE 4. SP-462 Pin Assignments and Cathode Area Ratios

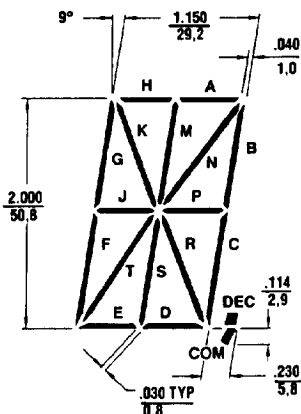


FIGURE 5. 16-Segment Font

Ordering Information

The SP-462 display can be ordered by contacting your local representative or distributor who handles Babcock Display Products, Inc. If you do not know your representative or distributor, contact Babcock Display Products directly.

When ordering or requesting information, refer to the specific model numbers listed.

This document is designed to assist a purchaser to make an independent determination as to the suitability of these products for his application. Therefore, performance under any use conditions must be based upon the purchaser's independent conclusions, and no conclusion, representation or warranty is made or implied as to the suitability of any of these devices for a particular requirement or use, due to the wide variety of possible applications, and/or conditions beyond our control.

Limited Warranty

The SP-462 display has a one year limited warranty. Disassembly or alteration of the product will void the warranty. Damaged displays should be returned to the factory for analysis. Contact the factory for further details.

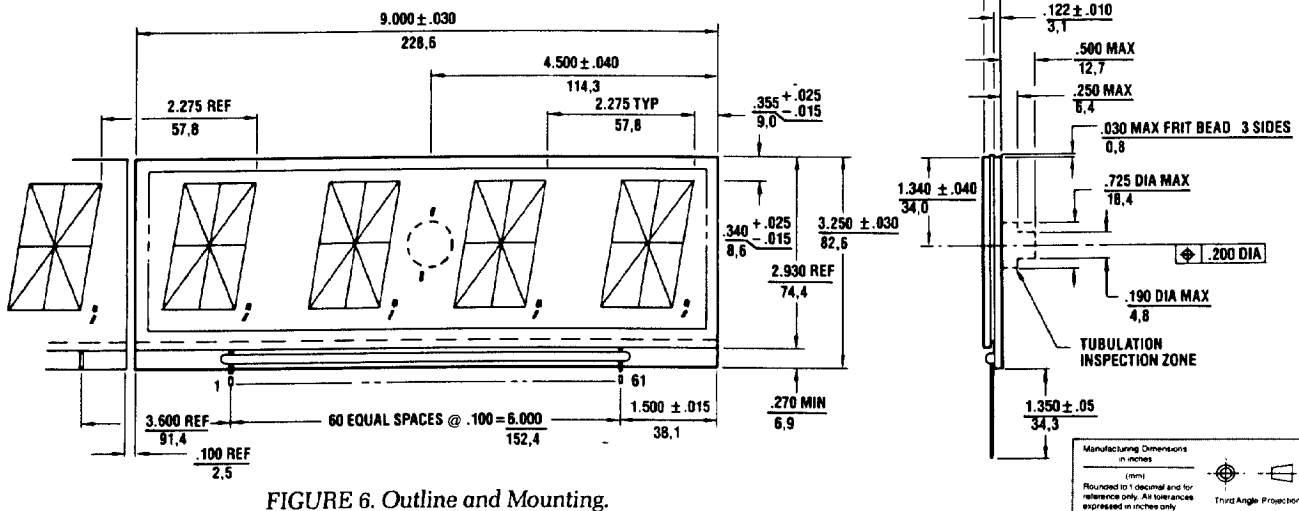


FIGURE 6. Outline and Mounting.

14930 East Alondra Blvd.
La Mirada, CA 90638-5752
phone (714) 994-6500 • sales fax (714) 994-3013

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