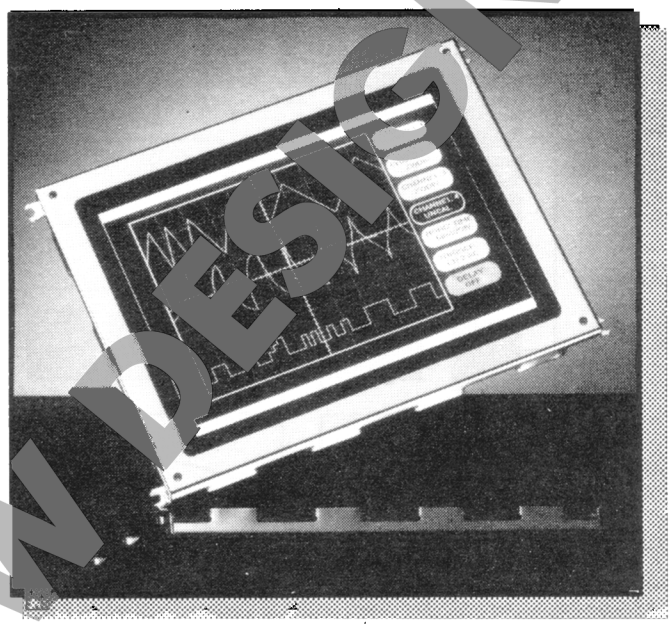
EL Model EL560.400

560 x 400 Pixel Electroluminescent Display

Operations Manual

Product Profile

The EL560.400 is a low power, rugged, high-resolution electroluminescent (EL) flat panel display which replaces the bulky CRT in oscilloscope, spectrum analyzer and logic analyzer product designs. Its compact dimensions save space that can allow addition of features or reductions in overall size. It is designed to function in extreme environments, and the crisp display is viewable under most lighting conditions at wide viewing angles. Its ease of installation reduces system integration costs.



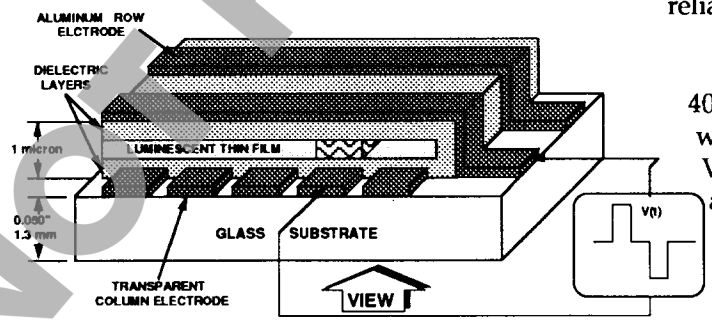
The EL560.400 features a matrix of 560 columns by 400 rows and a resolution of 100 dots per inch. The pixel aspect ratio is 1:1. The CRT-type interface is CMOS-compatible and is designed to match the needs of most systems. This display may be driven at frame rates up to 80 Hz for applications requiring higher brightness.

The EL560.400 display requires +5V/+12VDC or +12VDC only power and four basic signals to operate:

1. Video Data or pixel information (VID)
2. Video Clock, pixel clock, or dot clock (VCLK)
3. Horizontal Sync (HS)
4. Vertical Sync (VS)

EL Technology

The display consists of an electroluminescent glass panel and a mounted circuit board with control electronics.



The EL glass panel is a solid-state device with a thin film luminescent layer sandwiched between transparent dielectric layers and a matrix of row and column electrodes. The row electrodes, in back, are aluminum; the column electrodes, in front, are transparent. The entire thin film device is deposited on a single glass substrate. A circuit board is connected to the back of the glass substrate. Components are mounted on this circuit board within the same area as the electroluminescent viewing area on the glass panel. The circuit board is connected to the glass with metal-on-elastomer interconnect technology. The result is a flat, compact, reliable and rugged display device.

In the EL560.400, the 560 column electrodes and 400 row electrodes are arranged in an X-Y formation with the intersecting areas performing as pixels. Voltage is applied to both the correct row electrode and the correct column electrode to cause a lit pixel. Operating voltages required are provided by a DC/DC converter.

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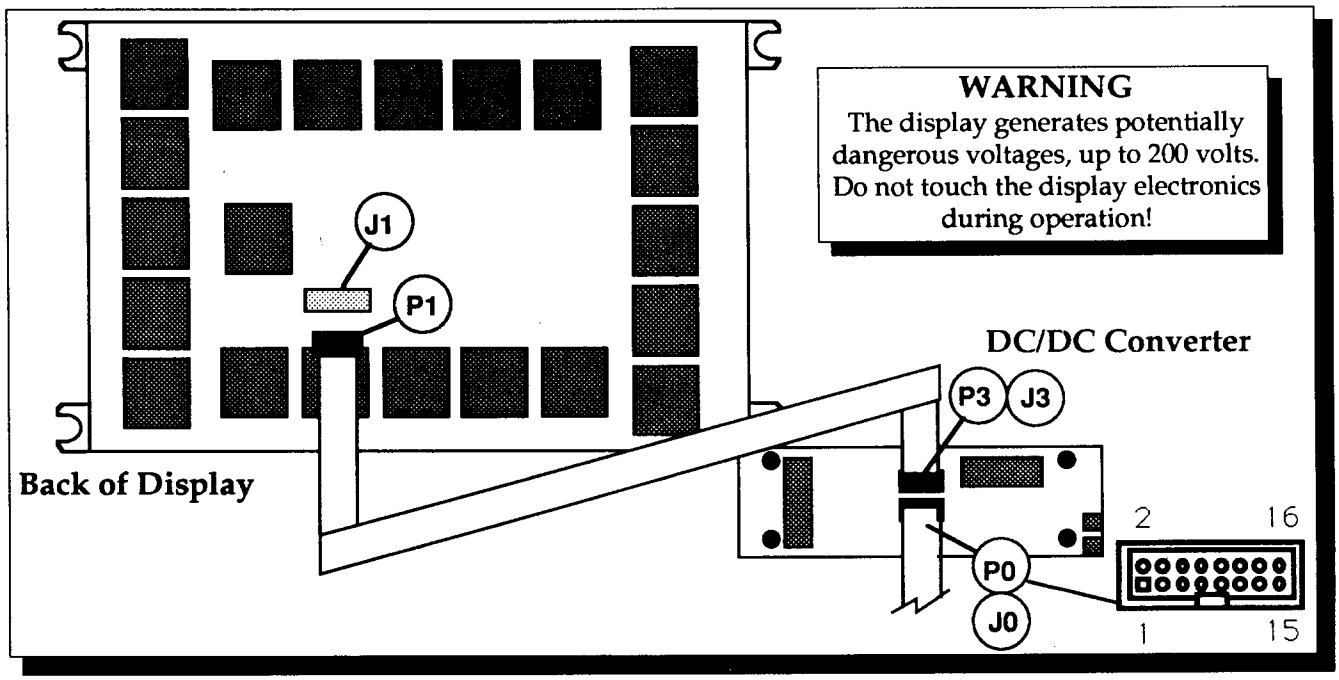
Electrical Characteristics

Display

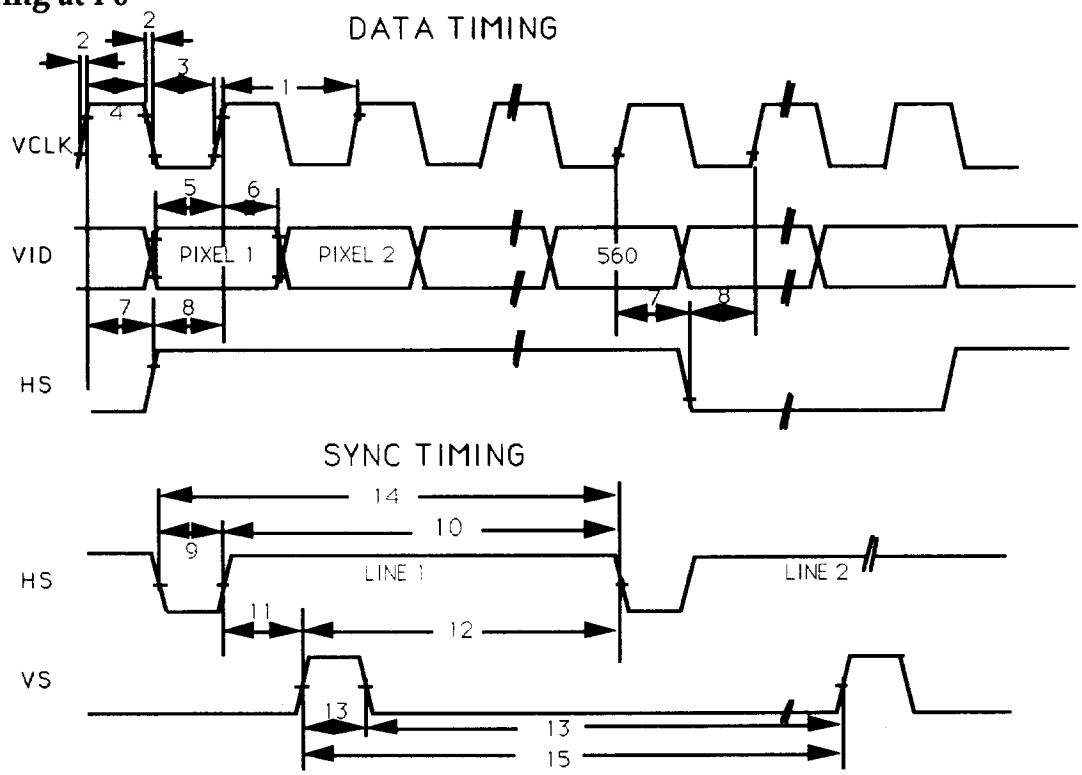
The EL560.400 consists of a display, a DC/DC converter, and interconnecting cables as shown below.



Input to the Display at P0

Pins	Signal	Symbol	Description
1, 2	Voltage	VH	+12V. See also the descriptions of DC power requirements on page 4.
3, 4	Voltage	VL	optional +5V input, see page 4.
5, 6	not connected		
7, 8, 10 12, 14, 16	Ground	GND	Signal return.
9	Vertical Sync	VS	A new frame is initiated by the high state of VS. To properly sync the EL display, VS must transition high during the HS high time of line 1. This signal passes directly from the user to the display via the DC/DC converter. It is not buffered or terminated within the DC/DC converter.
11	Horizontal Sync	HS	HS high time brackets the active pixel data for a horizontal scan line. HS high time must be an even multiple of 8 tVCLK. The last 560 pixels prior to the falling edge of HS will be visible on the display. This signal passes directly from the user to the display via the DC/DC converter. It is not buffered or terminated within the DC/DC converter. For the best shadow performance (luminance variation versus pattern), HS high time should be equal to or only marginally greater than 560 tVCLK.
13	Video Clock	VCLK	VCLK provides the necessary signal to latch in the information present on VID. The VID and HS signals are referenced to VCLK. Data latch occurs on the rising edge of VCLK. This signal passes directly from the user to the display via the DC/DC converter. It is not buffered or terminated within the DC/DC converter.
15	Video Data	VID	VID contains the serial video data to be displayed. A logic high corresponds to a lit pixel. Pixel information on VID is supplied from left to right and from top to bottom; the first bit of data on VID after HS goes high is displayed as the pixel at the upper left corner of the display. Bit number 560 is at the upper right corner. Bit number 561 is directly beneath pixel number 1 and so on. This signal passes directly from the user to the display via the DC/DC converter. It is not buffered or terminated within the DC/DC converter.

■ Video Timing at P0



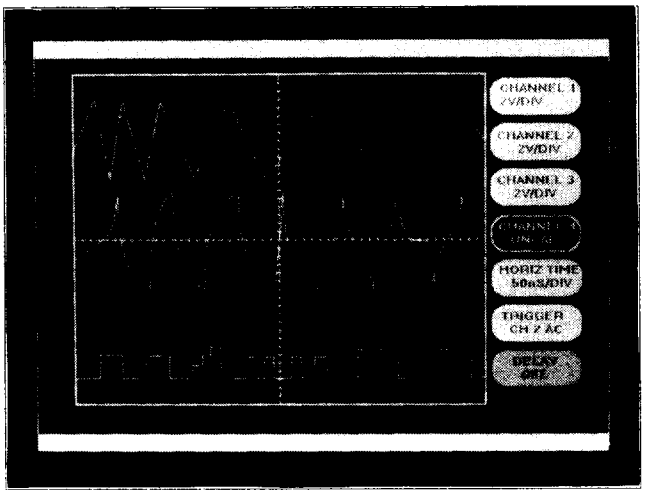
■ Video Parameters

Parameter (Symbol)		Min.	Max.	Units
1 Video clock period	(tVCLK)	50	—	ns
2 VCLK rise, fall time	(tDR)	—	10	ns
3 VCLK low time	(tWL)	20	—	ns
4 VCLK high time	(tWH)	20	—	ns
5 VID setup to VCLK	(tDS)	16	—	ns
6 VID hold from VCLK	(tDH)	10	—	ns
7 HS hold from VCLK	(tHSH)	10	—	ns
8 HS setup to VCLK rise	(tHSS)	16	—	ns

Parameter (Symbol)		Min.	Max.	Units
9 HS low time (VCLK must be running)	(tHS low)	8	—	tVCLK
10 HS high time	(tHS high)	560		tVCLK
11 VS hold from HS	(tVSD)	0	—	ns
12 VS setup to HS	(tHSD)	60	—	ns
13 VS high/low time	(tVS h/l)	1	—	tVCLK
14 HS period	(tHS)	31.2	—	µs
15 VS period	(tVS)	401	—	tHS
Frame Rate	(fVS)	—	80	Hz

■ Video Electrical Specifications

Symbol	Parameter	Min.	Max.	Units
VL	maximum input voltage		5.25	V
VIL	low-level input voltage	- 0.3	0.9	V
VIH	high-level input voltage	3.7	5.0	V
IIL	low-level input current	—	- 0.4	mA
IIH	high-level input current	—	10	µA
VOH	output high voltage @ IOH=0.4 mA	2.0		V
VOL	output low voltage @ IOL = 2.1 mA		0.4	V



Full active display area showing a typical mix of text and graphics

DC/DC Converter - PS512-3

The display and the separate DC/DC converter are calibrated together at the factory. Replacements to these matched units must be adjusted according to specifications. Consult Planar for design specifications.

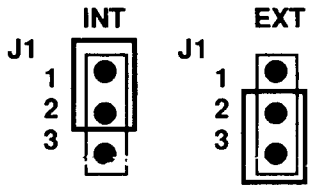
DC Power Consumption

Power is dependent on the actual text or graphics displayed. For a typical screen of text and graphics, power is under 6 watts. Maximum power is under 9 watts at 60 Hz frame rate and under 11 watts at 80 Hz.

DC Power Input Specifications

Description	Min.	Nom.	Max.	Units
Input voltage (VH)	10.8	12.0	13.2	VDC
Input voltage absolute max. (VH)	—	—	15.0	VDC
Input current (IH) VH=Min, 80 Hz frame rate	—	—	1.4	A
Optional 5V (VL)	4.75	5.0	5.25	VDC
Absolute max. (VL)	—	—	7.5	VDC
Input current (IL)	—	—	0.06	A

J1 Jumper Function on PS512-3



EXT = +5V (VL) supplied by customer from an external source.

INT = +5V (VL) generated from VH within the DC/DC converter.

DC/DC Converter Calibration - PS512-3

The DC/DC converter cannot be tested separately. It requires an active low enable signal from the display to activate the high voltage section. The display provides this signal after detecting the presence of video signals at its input.

The DC/DC converter has been properly calibrated at the factory to the EL display by means of a voltage output adjustment. The converter should not need adjustment in the field. If the DC/DC converter and display become separated the following procedure can be used to reset the proper voltage setting:

1. Ensure power to the DC/DC converter is off.

2. Turn the trimpot R25 on the DC/DC converter fully counterclockwise (ccw). Do not adjust R28.

3. Connect the DC/DC converter to the display using the flat cable.

4. Apply a full on video pattern to the display (full white field). At the factory, calibration is done with all pixels on.

5. Set the DVM to measure a 250VDC voltage.

6. Connect the DVM positive and negative leads to the V(ALL ON) and GND test points shown in the drawing of the DC/DC converter on p. 7.

7. Apply power to the DC/DC converter.

8. Note the voltage statement onthe display as shown:

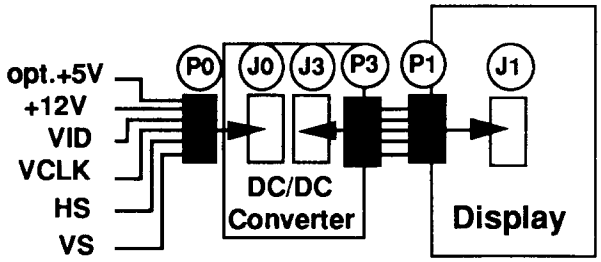
PS SN: _____
V(ALL ON):+_____

9. Adjust trimpot R25 on the DC/DC converter clockwise (cw) until the voltage reading of the DVM is equal to the V (ALL ON) voltage ±1V, as specified on the display. Do not exceed 235V. Do not adjust R28.

10. Calibration is complete.

Interconnections

J0 Connector: T & B Ansley 609-1627 or equivalent
P0 Mating Connector: T & B Ansley 609-1630 or equivalent.
J3 Connector: T & B Ansley 609-2027 or equivalent.
P3 Mating Connector: T & B Ansley 609-2030 or equivalent
J1 Connector: T & B Ansley 609-2027 or equivalent
J1 Mating Connector: T & B Ansley 609-2030 or equivalent



Operational Specifications

■ Environmental

Temperature

Operating	0°C to +55°C
Operating Survival	-20°C to +70°C
Storage	-40° to 75°C

Humidity per IEC 68-2-3 & 30

Operating	93% RH, 40°C (non-condensing)
Non-operating	95% RH, 30°-60°C (condensing)

Altitude per IEC 68-2-13

Operating	16,000 ft. (4,877 m) above sea level
Non-Operating	58,000 ft. (17,678 m) above sea lvl

Vibration (Random) per IEC 68-2-36, Test Fdb

20–500 Hz:

ASD Level	$0.02g^2/Hz$, 30 minutes each axis

Shock (Operating) per IEC 68-2-27, Test Ea

Magnitude	50 g peak acceleration
Duration	4 ms (half sine wave)
Number of tests	3 on each of 6 surfaces

Mean Time to Failure

Greater than 30,000 hours

Electromagnetic Compatibility

The display is capable of being operated in a final product that complies with FCC Docket, Part 15, Subpart J, class B; VDE 0871, Level B; and FTZ 1046/84. The bezel is electrically conductive and isolated from the display circuit nodes.

■ Optical

Display Color

Peak wavelength (typ) 585 nm, Yellow-Orange

Pixel Luminance

ON luminance	Typ.	Min.
at 60 Hz frame rate	46 fL (158)	31fL (106 cd/m^2)
at 80 Hz frame rate	60 fL (206)	41 fL (142 cd/m^2)

Luminance measured at center of display screen, full ON pattern, 25°C ambient.

OFF luminance 0.3 fL maximum (0.7 cd/m^2)
Luminance measured at center of display screen, 60 Hz frame rate, full OFF pattern, 25°C ambient.

ON luminance uniformity, maximum difference ≤26%
Measured between any two of five points (corners and center): Non-uniformity %= (1 - min luminance/max luminance) x 100.

ON luminance variation (temp.) max. variation ±15% from 25°C over 0°C to +55°C range.

ON luminance variation (time), max. difference ±10% at 25°C within 10,000 hours.

Fill Factor

49% luminance area/total active area.

Viewing Angle

Greater than 160° viewing cone.

Optional Filter

For best overall performance in high or low light levels, an amber or neutral gray circular polarizing filter with anti-reflective coating or etch is the usual choice. This filter will make the reflective electrodes of the display darker and will improve the contrast ratio. The anti-reflective coating on the filter should face the user, and the tape side of the filter should face the display.

■ Safety and Health

Safety

The display will not inhibit the end product from obtaining any of the following certifications: UL114/478, CSA 154, IEC 380.

Health

An inert, non-toxic, silicon-based oil is used in the construction of the electroluminescent panel.

Installation and Handling

■ Unpacking

Electrostatic Caution

The Planar display and DC/DC converter assemblies use CMOS and power MOS-FET devices. These components are electrostatic sensitive. Unpack, assemble and examine these assemblies in a static-controlled area only. When shipping either assembly, use packing materials designed for protection of electrostatic-sensitive components.

Unpack and check contents of shipping container against invoice in a static-controlled area. Use anti-static bags for storage of displays and DC/DC converters awaiting assembly processes. Any discrepancies in materials received and invoiced should be noted to Planar within 10 days.

■ Mounting and Connector Locations

As shown on Page 7, this display has four mounting tabs, two on each side of the display. When mounting the display, use all four of these tabs; failure to do so will invalidate the product warranty. To avoid breaking the glass, use appropriate length standoffs and avoid deflecting the mounting holes out of the plane of the display when tightening the mounting hardware. The vibration and shock specifications listed on Page 5 are accurate only if all four mounting tabs are used.

■ Cleaning

Display Face	Any non-abrasive mild glass cleaner can be used.
Filter	Do not clean a Planar-supplied acrylic filter with alcohol.
Circuit Boards	Only isopropyl alcohol should be used on the ECB assemblies.

■ Avoiding Burn-in

As with any other display, it is prudent to use screen-saver software to avoid burn-in of images that remain on the screen for extended periods.

Mechanical Characteristics

■ Display External Dimensions

Height	5.51 in.	140.0 mm
Width	7.11 in.	180.6 mm
	7.51 in.	190.8 mm including tabs
Depth	0.67 in.	17.0 mm
Weight	13 oz.	369 grams

Recommended air gap behind display places total depth at 0.67 in (17 mm).

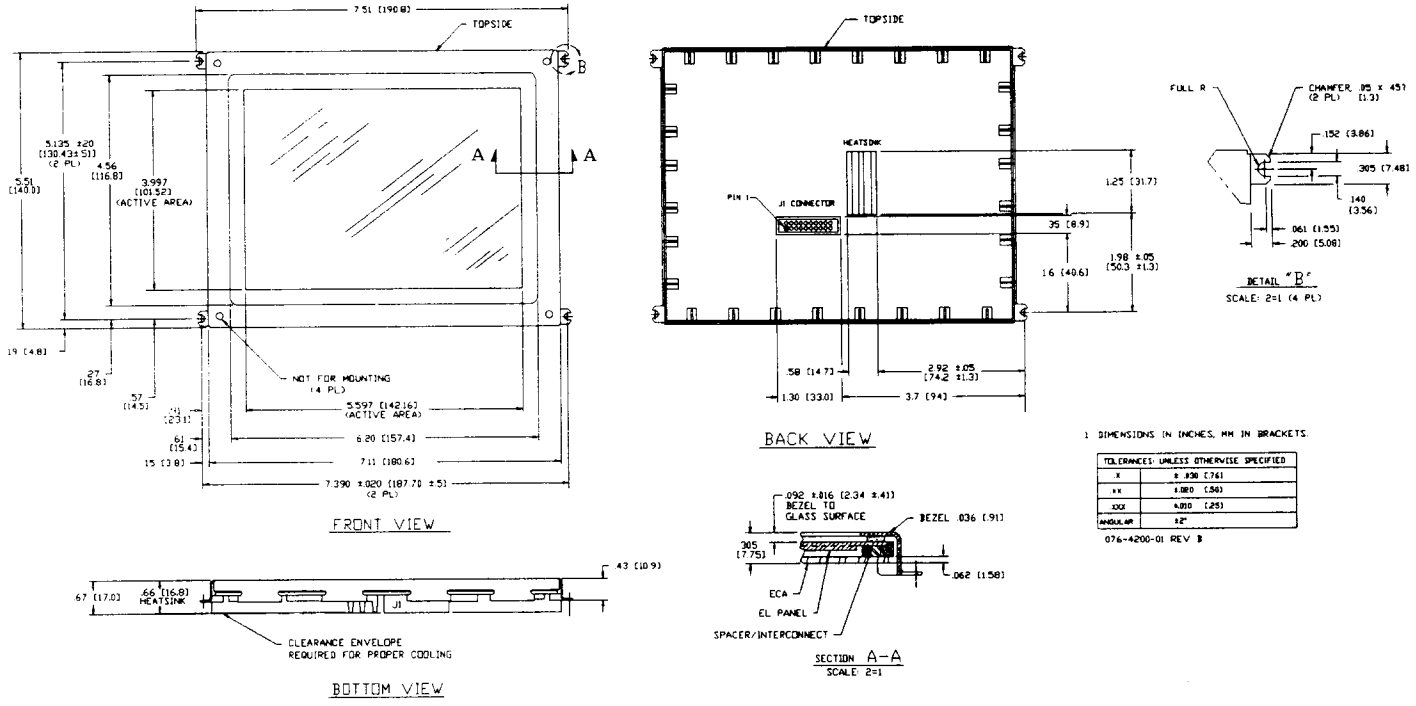
■ DC/DC Converter Characteristics

Height	2.00 in.	50.8 mm
Width	5.25 in.	133.4 mm
Depth	0.765 in.	19.43 mm
Weight	5 oz.	141.7 grams

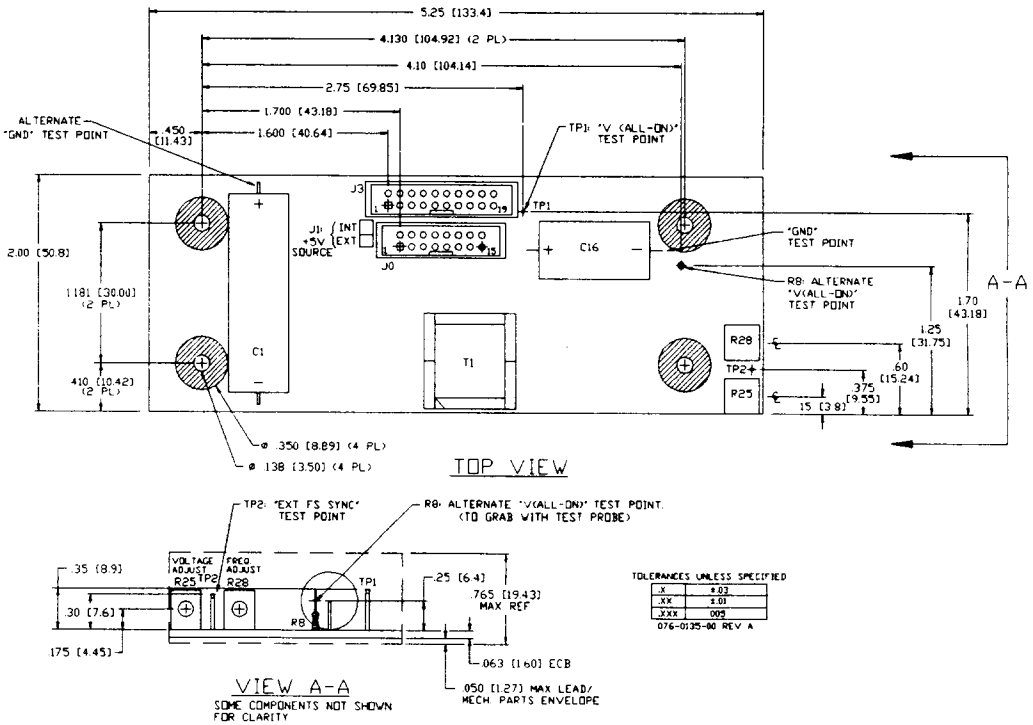
■ Display Viewing Area Characteristics

Active area			
	Height	3.997 in	101.52 mm
	Width	5.597 in	142.16 mm
Pixel pitch			
	Height	0.010 in	0.254 mm
	Width	0.010 in	0.254 mm
Pixel size			
	Height	0.007 in	0.178 mm
	Width	0.007 in	0.178 mm
Pixel matrix		560 horizontal by 400 vertical	

Display External Dimensions



DC/DC Converter - PS512-3



Description of Warranty

This description is not the full warranty, and should not be construed as a substitute for the full warranty. A copy of the full warranty is available upon request.

Planar warrants that the goods it sells will be free of defects in materials and workmanship, and that these goods will substantially conform to the specifications furnished by Planar, and to any drawings or specifications furnished to the Seller by the Buyer if approved by the Seller. This warranty is effective only if Planar receives notice of such defect or nonconformance during the period of warranty, which begins the day of delivery.

The goods Planar sells are warranted for a period of one year unless otherwise agreed to by Planar and the Buyer. The Buyer must return the defective or non-conforming goods, upon request, to Planar not later than 30 days after Planar's receipt of notice of the alleged defect or non-compliance. Buyer shall prepay transportation charges, and Planar shall pay for return of the goods to the Buyer. No goods are to be returned to Planar without prior written permission.

The warranty does not apply in cases of improper or inadequate maintenance by the Buyer, unauthorized modification of the goods, operation of the goods outside their environmental specifications, neglect or abuse of the goods, or modification or integration with other goods not covered by a Planar warranty when such modification or integration increases the likelihood of damage of the goods.

Easy to Use

There are many options available which make Planar flat panel displays easy to use, easy to interface, and easy to package. Examples of options which are typically available include filters, touch panels and interface cards. Call Planar for complete information and availability.

Support and Service

Planar is a U.S. company based in Beaverton, Oregon with manufacturing facilities and sales support in both Oregon and in Finland. Full application engineering support and service are available to make the integration of Planar displays as simple and quick as possible for our customers.

RMA Procedure: For a Returned Material Authorization number, please contact Planar Systems, Inc., or Planar International's Customer Service Department, with the model number(s) and original purchase order number(s). When returning goods for repair, please include a brief description of the problem, and mark the outside of the shipping container with the RMA number.

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Ordering Information

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