EL4737HB and EL4737HB-ICE

320 x 128 Pixel Electroluminescent Display

Operations Manual

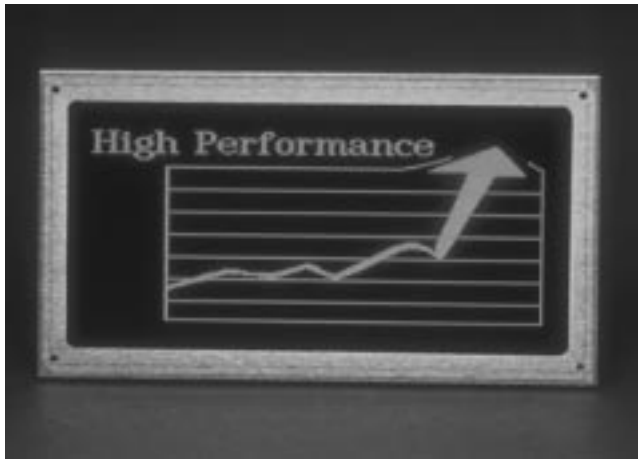
Product Profile

The EL4737HB and the EL4737HB-ICE displays are low power, rugged, high-resolution electroluminescent (TFEL) flat panel displays. They replace the LCD or bulky CRT in instrument product designs. Their compact dimensions save space that can allow addition of features or reductions in overall size. They are designed to function in extreme environments, and the crisp displays are viewable under most lighting conditions at wide viewing angles. Their ease of installation reduces system integration costs.

The EL4737HB and the EL4737HB-ICE are 320 column by 128 row flat panel displays. The pixel aspect ratio is 1:1. The CRT-type interface is TTL-compatible and is designed to match the needs of most systems. These displays also have an interface mode for hardware compatibility with the Hitachi HD61830B or equivalent LCD controller. These displays may be driven at frame rates up to 120 Hz for applications requiring extra brightness.

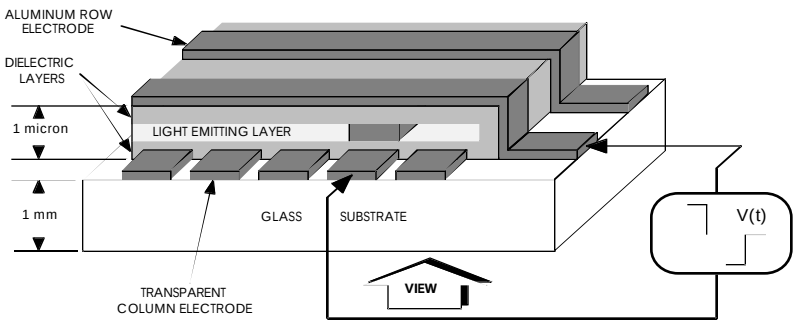
The displays require DC power and four basic signals to operate:

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

A 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.

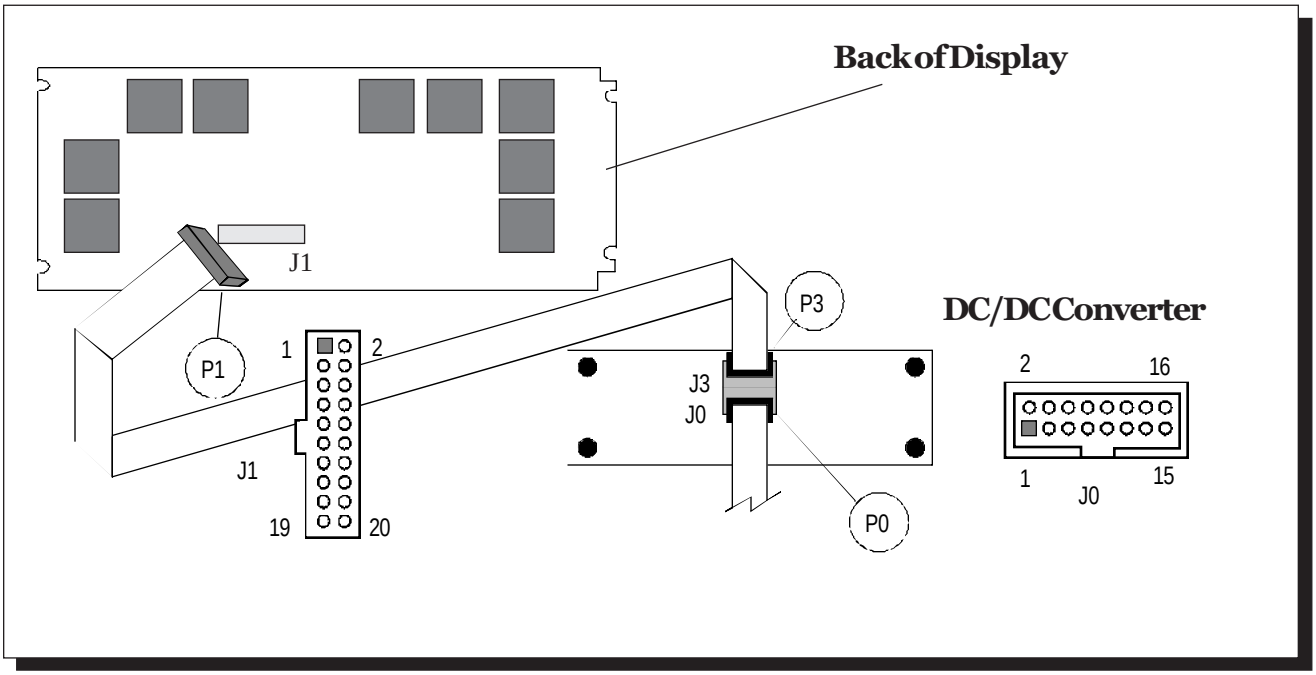
The EL4737HB-ICE display includes a light absorbing Integral Contrast Enhancement (ICE_{TM}) construction of the display glass. ICE_{TM} background significantly improves the luminance contrast of the display in bright ambients, and makes the display easier to read by increasing the crispness of the pixels.

The 320 column electrodes and 128 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. Special operating voltages required are provided by a DC/DC converter.

Electrical Characteristics

Display

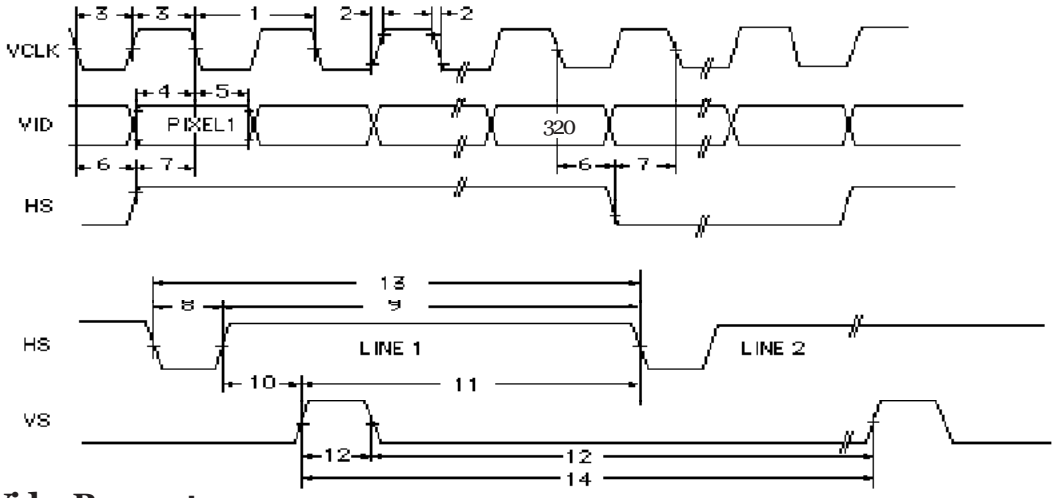
The EL4737HB and EL4737HB-ICE products consist of a display, a DC/DC converter, and interconnecting cable as shown below.



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	+5V optional input, see page 4.
5	Scan Mode	SMODE	Mode 1 (Standard timing) is selected by taking pin 5 high (or left unconnected). Mode 2 (LCD timing) is selected by pulling pin 5 low. 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.
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 be high at the end 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	Mode 1: HS high time brackets the active pixel data for a horizontal scan line. Mode 2: HS marks the last pixel of a horizontal scan line. HS high time should be less than 1 tVCLK. In either mode, HS period must be an even multiple of 4 tVCLK. The last 320 pixels prior to the falling edge of HS will be visible on the display. This signal passes directly from the video source to the display via the DC/DC converter. It is not buffered or terminated within the DC/DC converter.
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, which must continuously run. Data latching occurs on the falling edge of VCLK. This signal passes directly from the video source 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 at the beginning of a frameis displayed as the pixel at the upper left corner of the display. Bit number 320 is at the upper right corner. Bit number 321 is directly beneath pixel number 1 and so on. This signal passes directly from the video source to the display via the DC/DC converter. It is not buffered or terminated within the DC/DC converter.

■ Video Timing at P0
Standard Video Timing (Mode 1)



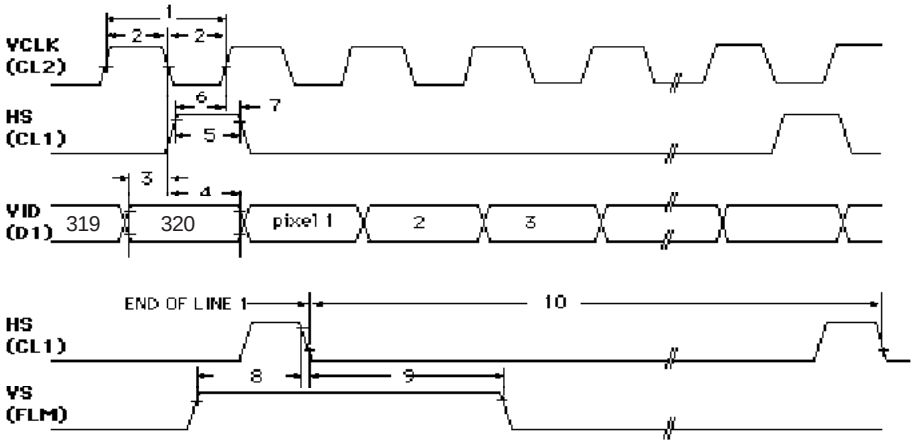
■ Mode 1 Video Parameters

Parameter (Symbol)		Min.	Max.	Units
1 Video clock period	(tVCLK)	195	—	ns
2 VCLK rise/fall time	(tDR/tDF)	—	15	ns
3 VCLK low time	(tWL)	100	—	ns
VCLK high time	(tWH)	100	—	ns
4 VID setup to VCLK	(tDS)	50	—	ns
5 VID hold from VCLK	(tDH)	50	—	ns
6 HS hold from VCLK	(tHSH)	50	—	ns
7 HS setup to VCLK fall	(tHSS)	50	—	ns

Parameter (Symbol)		Min.	Max.	Units
8 HS low time[1]	(tHSlow)	8	—	tVCLK
9 HS high time	(tHShigh)	320	—	tVCLK
10 VS hold from HS	(tVSD)	0	—	ns
11 VS setup to HS	(tHSD)	60	—	ns
12 VS high/low width	(tVSh/l)	1	—	tVCLK
13 HS period[1]	(tHS)	65	—	µs
14 VS period	(tVS)	128	—	tHS
Frame Rate	(1/VS period)	—	120	Hz

[1] VCLK must be running during HS low time.

■ Video Timing at P0
for Hitachi 61830B LCD Controller (Mode



■ Mode 2 Video Parameters

Parameter (Symbol)		Min.	Max.	Units
1 Video clock (CL2) period	(tVCLK)	195	630	ns
VCLK rise/fall time	tDR/tDF	—	15	ns
2 VCLK low time	(tWL)	100	—	ns
VCLK high time	(tWH)	100	—	ns
3 VID setup to VCLK	(tDS)	50	—	ns
4 VID hold from VCLK	(tDH)	50	—	ns
5 HS (CL1) high time	(tHS high)	100	tVCLK	ns

Parameter (Symbol)		Min.	Max.	Units
6 HS setup time	(tHSS)	100	tWL	ns
7 HS hold from VCLK	(tHSH)	0	tWH	ns
8 VS (FLM) setup to HS	(tHSD)	400	—	ns
9 VS hold from HS	(tVSD)	1000	—	ns
HS (CL1) period	(tHS)	320	—	tVCLK
VS period	(tVS)	128	—	tHS
Frame Rate	(1/VS period)	—	120	Hz

Video Electrical Specifications

Symbol	Parameter	Min.	Max.	Units
	maximum input voltage	—	5.5	V
VIL	low-level input voltage	- 0.3	0.8	V
VIH	high-level input voltage	2.4	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

Note: All inputs are TTL-compatible CMOS with 24KΩ pull-up resistors and 100Ω series resistors (to minimize under- and over-shoot of input signals).

DC/DC Converter - PS512-1

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

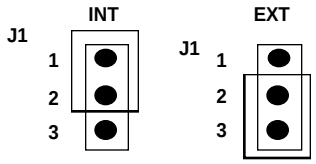
■ DC Power Consumption

Power is dependent on the actual text or graphics displayed. For a typical screen of text and graphics, power is under 2.7 watts. Maximum power is 3.7 watts at 60 Hz frame rate and maximum power is 6.9 watts at 120 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, 240 Hz frame rate	—	—	0.52	A
Optional 5V (VL)	4.75	5.0	5.25	VDC
Absolute max. (VL)	—	—	7.5	VDC
Input current (IL)	—	—	0.05	A

■ J1 Jumper Function



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

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

■ DC/DC Converter Calibration - PS512-1

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 set the converter to the proper voltage:

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

2. Turn trimpot on the DC/DC converter fully counterclockwise (ccw).

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 positive lead of the DVM to HV2 test point. Connect the ground lead of the DVM to GND test point on the DC/DC converter.

7. Apply power to the DC/DC converter.

8. Note the voltage statement is on the display. A sample is shown at right:

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

9. Adjust trimpot R20 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 R19.

10. Calibration is complete.

Operational Specifications

Environmental

Temperature

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

Humidity

95% relative humidity (non-condensing) as verified by MIL-STD-202F method 106E

Altitude

Operating	15,000 ft. (4,572 m) above sea level
Non-Operating	50,000 ft. (17,678 m)above sea level

Test limits 8 hours

Vibration (Operating)

5-25Hz:

Sweeptime	10 min ea. axis, 1 min sweep rate
Amplitude	0.100 inches p-p displacement
Dwell at resonance	15 min each axis

25-55Hz:

Sweeptime	5 min ea. axis, 3.2 min sweep rate
Amplitude	0.060 inches p-p displacement
Dwell at resonance	15 min each axis

IIf no resonance is found, dwell is performed at 55Hz, 0.0600 inches p-p displacement, for 15 minutes.

Vibration (Non-operating)

55-500Hz:

Sweeptime	120 min ea. axis, 3.2 min sweep rate
Amplitude	3 g peak acceleration
Dwell at resonance	30 min each axis

Dwell is performed at all resonances of g(out)/g(in) ^{3} 5.

Shock

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.

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

Optical

Display Color

Peak wavelength (typ) 585 nm, Yellow-Orange

Pixel Luminance

ON luminance	Typ.	Min.
EL4737HB		
at 60 Hz	50 fL (171)*	30fL(103)*
at 120 Hz	100 fL (342)*	60fL(206)*
EL4737HB-ICE		
at 60 Hz	16.5fL (56)*	9.9fL(34)*
at 120 Hz	33.0fL(112)*	19.8fL (68)*

*cd/m^2

Luminance measured at center of display screen, full ON pattern, 25°C ambient. Note: the Hitachi 61830B LCD controller is limited in frame rate and will not drive the display to its maximum brightness potential.

OFF luminance		
EL4737HB	0.3 fL maximum	(0.7)*
EL4737HB-ICE	0.1 fL maximum	(0.25)*

Luminance measured at center of display screen, 60 Hz frame rate, full OFF pattern, 25°C ambient.

ON luminance uniformity, maximum difference $\leq$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.

Luminanace Contrast Ratio

8:1 min, @ 500 lux
3:1 min, @ 2000 lux

Fill Factor

66.8% luminance area/total active area.

Viewing Angle

Greater than 160° viewing angle.

ICE$_{TM}$

Integral Contrast Enhancemen (ICE$_{TM}$) incorporates a new thin film layer in the EL structure which significantly reduces light reflections from the display's rear electrode. The EL4737HB-ICE is the ICE$_{TM}$ version of the EL4737HB display, and offers the following performance advantages:

-inherently higher display contrast
-crisper display images
-a lower cost display solution

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 play when tightening the mounting hardware. The vibration and shock specifications listed on Page 5 are valid only if all four mounting tabs are used.

■ Cleaning

Display Face	Any non-abrasive mild glass cleaner can be used.
Circuit Boards	Only isopropyl alcohol should be used on the ECB assemblies.

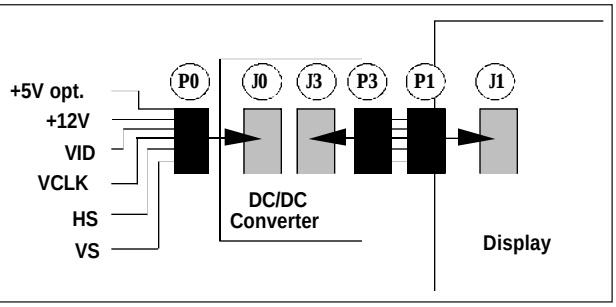
Caution

Properly mounted, this display can withstand high shock loads as well as severe vibration in aggressive environments. However, the glass panel used in this display will break when subjected to bending stresses, high impact or excessive loads.

To prevent injury in the event of glass breakage, a protective overlay should be used on the viewer side of the display.

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 609-2627 or equivalent.
J1 Connector: 3M 50226-B002 or equivalent
P3 Mating Connector: T & B Ansley 609-2630 or equivalent
P1 Connector: 3M 3399-7626 or equivalent



Mechanical Characteristics

Display External Dimensions

Height	3.870 in.	98.29 mm
Width	7.878 in.	200.10 mm
including tabs	8.300 in.	210.8 mm
Depth	0.575 in.	14.60 mm
Weight (max)	10.5 oz.	298 grams

Recommended air gap behind display places total depth at 0.75 in. (19.04 mm).

DC/DC Converter Characteristics

Height	2.00 in.	50.8 mm
Width	5.25 in.	133.4 mm
Depth	0.75 in.	19.1 mm
Weight	3.0 oz.	85 grams

Display Viewing Area Characteristics

Active area		
Width	6.647 in	168.83 mm
Height	2.653 in	67.39 mm
Pixel pitch		
Width	0.021 in	0.533 mm
Height	0.021 in	0.533 mm
Pixel size		
Width	0.0170 in	0.432 mm
Height	0.0170 in	0.432 mm
Pixel matrix		
Width	320 pixels	
Height	128 pixels	

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.

Display External Dimensions

Please contact Planar Applications Engineering foe a mailed or faxed copy of this page with the drawings included.

DC/DC Converter - PS512-1

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 nonconforming 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.

Represented by:

Easy to Use

There are many options available which make Planar flat panel displays easy to use, easy to interface, and easy to package. Call Planar for complete information.

Support and Service

Planar is a U.S. company based in Beaverton, Oregon and Espoo, Finland with a world-wide sales distribution network. 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.

Registered Trademarks

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Ordering Information

EL4737HB	EL display with separate DC/DC converter & interconnecting cable.
EL4737HB-ICE	ICE$_{TM}$ display with seperate DC/DC converter & interconnecting cable.

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