

EL480.60.43

ICEBRITE™ EL DISPLAY



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Revision Control

Date	Description
May 1999	Document number OM305-00

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EL480.60.43 Display

The EL480.60.43 thin film electroluminescent (EL) small graphics display is a low cost, high performance alternative to industry-standard small graphics LCDs. The EL480.60.43 utilizes Planar's proprietary Integral Contrast Enhancement (ICE™) technology to achieve unparalleled image quality without the use of expensive filters. This small graphics display excels in a wide range of ambient lighting environments while effectively eliminating the blooming common to other high-bright displays.

The display consists of an EL glass panel and control electronics connected using elastomeric interconnects into a space-saving, rugged package for easy mounting and includes a DC/DC converter. The EL480.60.43 is easily interfaced using standard 4-bit LCD control signals. Each of the pixels has an aspect ratio of 1:1 (V:H) and is individually addressable to clearly display high information content graphics and text.

Features

- ◆ Excellent visual performance:
 - High brightness and contrast
 - Wide viewing angle > 160°
 - No compensation needed
- ◆ Rapid display response < 1 ms
- ◆ Space-efficient mechanical package
- ◆ Low EMI emissions
- ◆ Extremely rugged and durable
- ◆ Reliable, long operating life with > 50,000 MTBF
- ◆ 4-bit STN LCD-type interface

Installation and Handling

Do not drop, bend or flex the display. Do not allow objects to strike the surface of the display.

CAUTION: The display uses CMOS and power MOSFET devices. These components are electrostatic-sensitive. Unpack, assemble, and examine this assembly in a static-controlled area only. When shipping, use packing materials designed for protection of electrostatic-sensitive components.

CAUTION: To prevent injury in the event of glass breakage, the use of an impact resistant shield or a protective overlay should be used on the viewer side of the display.

Mounting EL Displays

Properly mounted, EL displays can withstand high shock loads as well as severe vibration found in demanding applications. However the glass panel used in an EL display will break if subjected to bending stresses, high impact, or excessive loads.

Stresses are often introduced when a display is mounted into a product. Ideally, the mounting tabs of the display should be the only point of contact with the system. Use a spacer or boss for support; failure to do so will bend the display and cause the glass to break. The instrument enclosure or frame should not flex or distort in such a way that during use the bending loads might be transferred to the display. Mounting surfaces should be flat to within ± 0.6 mm (± 0.025 "). Use all the mounting holes provided. Failure to do so will impair the shock and vibration resistance of the final installation.

The EL480.60.43 is a tab mounted display. Use appropriate length standoffs to assure that screws through the mounting tabs do not introduce bending stresses into the display. Do not deflect the ECB out of its normal plane. The EL480.60.43 mounting tabs were designed for a 3 mm screw.

WARNING: These products generate voltages capable of causing personal injury (high voltage up to 230 V_{AC}). Do not touch the display electronics during operation.

Cable Length

A maximum cable length of 600 mm (24 in.) is recommended. Longer cables may cause data transfer problems between the data transmitted and the display input connector. Excessive cable lengths can pick up unwanted EMI. There are third party products which allow this maximum cable length to be exceeded. Contact Planar Application Engineering for more information.

Cleaning

As with any glass or coated surface, care should be taken to minimize scratching. Clean the display glass with mild, water-based detergents only. Apply the cleaner sparingly to a soft cloth, then wipe the display. Disposable cleaning cloths are recommended to minimize the risk of inadvertently scratching the display with particles embedded in a re-used cloth. Particular care should be taken when cleaning displays with anti-glare or anti-reflective films.

Avoiding Burn-In

As with other light emitting displays, displaying fixed patterns on the screen can cause burn-in, where luminance variations can be noticed. Use a screen saver or image inversion to avoid causing burn-in on the display.

Specifications

The EL panel is a matrix structure with column and row electrodes arranged in an X-Y formation. Light is emitted when an AC voltage of sufficient amplitude is applied at a row-column intersection. The display operation is based on the symmetric, line-at-a-time data addressing scheme.

Power

The supply voltages are shown in Table 1. All internal high voltages are generated from the display supply voltage (V_H). The logic supply voltage (V_L) should be present whenever video input signals or V_H is applied. The minimum and maximum specifications in this manual should be met, without exception, to ensure the long-term reliability of the display.

Performance characteristics are guaranteed when measured at 25 °C with rated input voltage unless otherwise specified. Planar does not recommend operation of the display outside these specifications.

Table 1. DC Input Voltage Requirements.

Parameter	Symbol	Min	Typ	Max	Absolute Max
Input voltage (nom=12.0 V)	V_H	8.0 V	---	18.0 V	20.0 V
12 V Input Current	I_{Hmax}	---	---	0.65 A	---
Input voltage (nom=5.0 V)	V_L	4.75 V	---	5.25 V	6.0 V
5 V Input Current	I_{Lmax}	---	---	0.10 A	---
Power consumption @ 60 Hz	---	0.7 W*	2.2 W	---	3.0 W
Power consumption @ 360 Hz	---	3.0 W*	6.2 W	---	11.0 W

* Display in stand-by mode

CAUTION: Absolute maximum ratings are those values beyond which damage to the device may occur.

Table 2. Video Input Requirements.

Description	Symbol	Min	Max	Units	Notes
Absolute Max. Input Voltage	V _{Imax}	-0.5	V _L +.5	V	V _L = 5.0 V
Video logic high voltage	V _{IH}	70%	100%	V _L	All input thresholds are CMOS
Video logic low voltage	V _{IL}	0	20%	V _L	
Video logic input current	I _{IL}	-10	+10	μA	
Input capacitance	C _{IN}	–	15	pF	

There is no overcurrent protection on either the V_H or V_L inputs to protect against catastrophic faults. Planar recommends the use of a series fuse on the 12 volt supply (V_H). A general guideline is to rate the fuse at 1.8 to 2 times the display maximum current rating.

Connector

The standard display has a single connector, 20-pin, 2 mm pitch. The display uses the Samtec EHT-110-01-S-D-SM locking connector or an equivalent connector matching the pinouts in Table 3. The mating connector is available through Samtec as an IDC cable assembly (Series TCSD-10-S-XX.X-). Consult your Samtec representative (1-800-SAMTEC9) for cable and connector options.

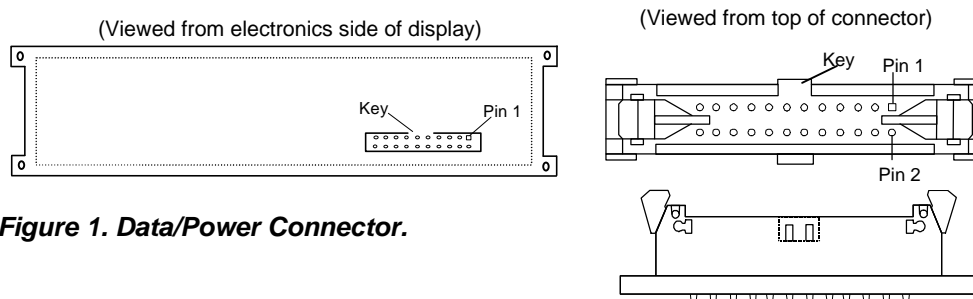


Figure 1. Data/Power Connector.

Table 3. Connector Pinouts.

Pin	Signal	Description	Pin	Signal	Description
1	V _H	+12 V Power	2	V _H	+12 V Power
3	SLFTST	Selftest	4	LUMA	
5	V _L	+5 V Power	6	GND	Ground
7	VS	Vertical Sync	8	GND	Ground
9	HS	Horizontal Sync	10	GND	Ground
11	VCLK	Video Clock	12	GND	Ground
13	VID ₀	Video Data	14	GND	Ground
15	VID ₁	Video Data	16	GND	Ground
17	VID ₂	Video Data	18	GND	Ground
19	VID ₃	Video Data	20	GND	Ground

Interface Information

Planar EL Small Graphics Displays (SGD) incorporate an interface that is similar to many LCD interfaces. This interface is supported by a variety of off-the shelf chip sets which take care of all display control functionality, freeing the system processor for other tasks. Designers select the chip set that best suits their particular architecture and price point. This 4-bit LCD-type video interface provides a low cost, flexible method for controlling display brightness and power consumption.

Video Input Signals

The end of the top line of a frame is marked by **VS**, vertical sync signal as shown in Figure 2. The end of each row of data is marked by **HS**.

The VS signal may be independently set to a CMOS low level at any time for longer than one frame period. During the time of VS inactivity the display will be blank. Halting VS results in a standby condition which minimizes power consumption.

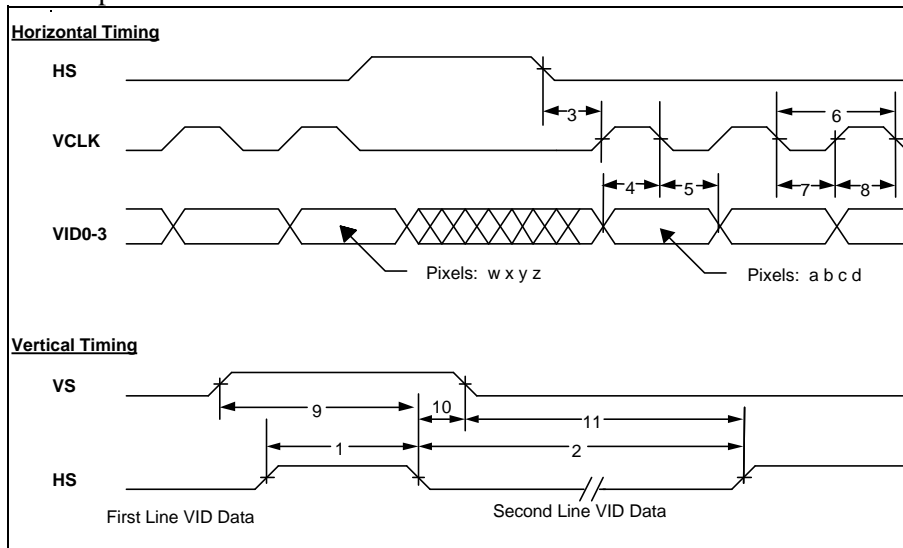


Figure 2. Video Input Timing Diagram.

Timing is compatible with LCD graphics controllers such as the SMOS 1351 display controller.

Table 4. Video Input Descriptions.

Num	Description	Symbol	Min.	Typ.	Max.	Units
1	HS high time	tHSh	100			nsec
2	HS low time	tHSl	120			tVCLK
3	HS to VCLK rise	tHSsu	95			nsec
4	VID setup to VCLK	tVIDsu	50			nsec
5	VID hold from VCLK	tVIDhd	50			nsec
6	Video clock period	tVCLK	140			nsec
	VCLK rise, fall time	tVCLKrf		10	15	nsec
7	VCLK low width	tVCLKl	30			nsec
8	VCLK high width	tVCLKh	30			nsec
9	VS high setup to HS high	tVShsu	140			nsec
10	VS hold after HS	tVShd	140			nsec
11	VS low setup to HS high	tVSl-su	140			nsec
12	HS period	tHS	46			µsec
	VS period	tVS	60			tHS
	Frame Rate		50		360	Hz

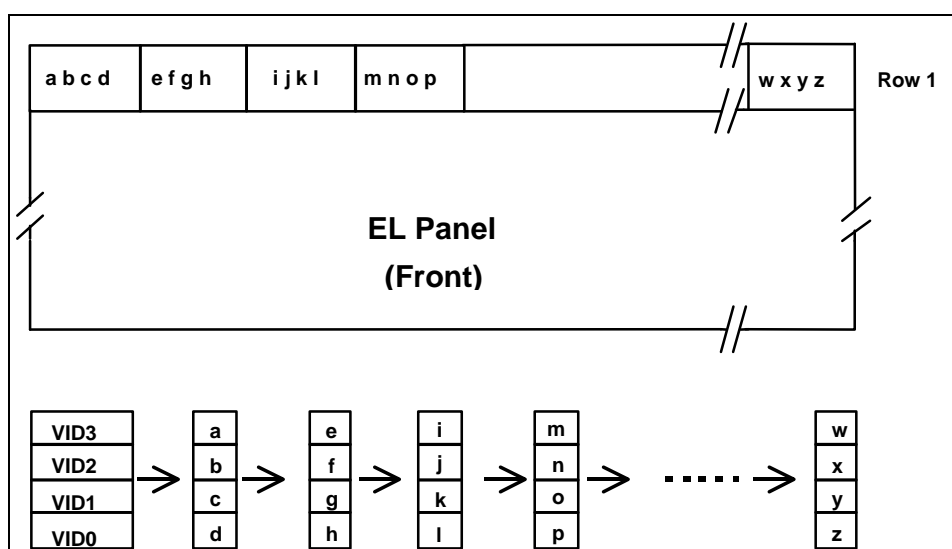


Figure 3. Pixel Location versus Sequence of Data.

Dimming

The dimming control circuitry on the display allows the user to adjust the luminance from 5% to 100% of the maximum brightness.

To control the display luminance, connect a 100 K(ohm) variable logarithmic potentiometer between ground and the dimming pin. The full resistance of 100 K(ohm) will result in 100% of the maximum luminance. Reducing the resistance will reduce the luminance, with resistance of 0 K(ohm) yielding roughly 5% of the maximum luminance.

Alternatively an external voltage or current-mode D/A converter may be used to dim the display by sinking a maximum of 250 uA for maximum dimming from

pin 4 to ground. When left open, the luminance will remain at the maximum level.

Self-Test Mode

The display incorporates a self-test mode composed of a 1 x 2 checkerboard and full-on pattern displayed at 360 Hz. Upon power up, the 1 x 2 pattern is displayed for several seconds, then the full-on pattern is displayed continuously. The self-test mode is entered by leaving the SELFTTEST pin pulled high. For normal operation the SELFTTEST pin must be pulled to a logic low. If the SELFTTEST pin is pulled high during normal operation, the display will enter the self-test mode.

Optical

Table 5. Optical Characteristics.

Luminance		
L_{on} (areal), min	15.4 cd/m ²	@ 60 Hz, screen center
	92.5 cd/m ²	@ 360 Hz, screen center
L_{on} (areal), typ	21 cd/m ²	@ 60 Hz, screen center
	125 cd/m ²	@ 360 Hz, screen center
L_{off} (areal), max	0.17 cd/m ²	3 points: all pixels off, 25 °C, 360 Hz
Non-uniformity		
All pixels fully lit	26%	Maximum difference two of three points, using the formula: $LNU\% = [1 - (\min_lum / \max_lum)] \times 100$
Luminance Variation (Temperature)		
Maximum	± 25%	Across operating temperature range
Luminance Variation (Time)		
Maximum	< 20%	10,000 hours at 25 °C ambient
Pattern Shadowing		
	< 20%	Across all refresh rates
Viewing Angle		
Minimum	>160°	
Contrast Ratio (Typical)		
	32:1	60 Hz frame rate @ 500 lux ambient
	158:1	360 Hz frame rate @ 500 lux ambient
	11:1	360 Hz frame rate @ 10,000 lux ambient

Generating Grayscale

The EL480.60.43 is a monochrome display but will display dithered gray scale when driven by a suitably equipped video controller.

Environmental

Table 6. Environmental Characteristics.

	Operating	Non-operating
Temperature	-40 °C to +85 °C*	-55 °C to +105 °C
Humidity		
Non-condensing	to 93% RH max @40 °C, per IEC 68-2-3	
Condensing		to 95% RH max @25-55 °C, per IEC 68-2-30
Altitude		
Tested per IEC 68-2-13 Operating/non-operating	0 to 58,000 ft (84kPa to 8kPa)	
Vibration		
Random Operating/non-operating	0.02g ² /Hz, 5-500 Hz, 30 minutes on each axis, per IEC 68-2-34	
Shock		
Operating/non-operating	100 g, 6 ms duration, half sine wave per IEC 68-2-27	

* Refer to *Table 7. Frame Rate vs. Temperature* below

Table 7. Frame Rate vs. Temperature.

Display Ambient Temperature	Maximum Frame Rate
85 °C	240 Hz
65 °C	360 Hz

Reliability

The display MTBF is demonstrated to be greater than 50,000 hours at 360 Hz with a 90% confidence level at 25 °C.

Safety and EMI Performance

The display is capable of operating in a final product that complies with FCC Part 15 (Subpart J, Class B), EN55022 (Level B), and IEC801-2 when housed in a suitable enclosure.

The display is a recognized component under UL1950 by Underwriters Laboratories. The display will not inhibit the end product from complying with EN60950, 1992 A1, A2, 1993 A3, or CSA 22.2 #950-95.

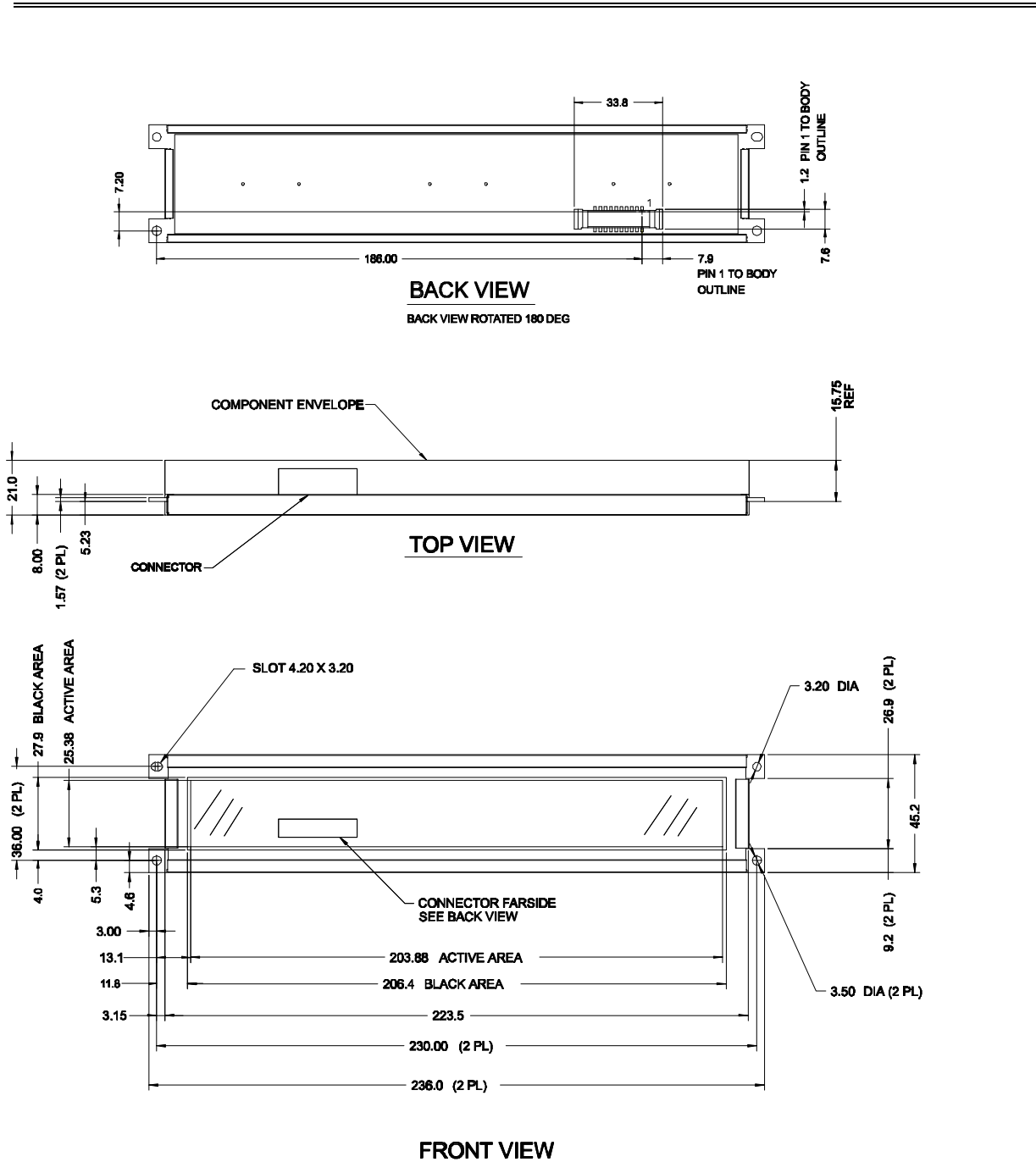
Mechanical Characteristics

Display External Dimensions		
millimeters (inches)	Width	236.0 (9.17) nominal
	Height	45.2 (1.81) nominal
	Depth	21.0 (1.25) nominal
<hr/>		
Weight	147 g (5.185 oz), nominal	
<hr/>		
Fill Factor	49.8%	
<hr/>		
Display Active Area		
millimeters (inches)	Width	203.88 (8.03) nominal
	Height	25.38 (0.99) nominal
<hr/>		
Pixel Size		
millimeters (inches)	Width	0.30 (0.0118) nominal
	Height	0.30 (0.0118) nominal
<hr/>		
Pixel Pitch		
millimeters (inches)	Horizontal	.425 (0.0167) nominal
	Vertical	.425 (0.0167) nominal
<hr/>		

Component Envelope

The component envelope shown in Figure 4 illustrates the distance components extend behind the display. Tall components do not necessarily fill this area. Planar reserves the right to relocate components *within* the constraints of the component envelope without prior customer notification. For this reason, Planar advises users to design enclosure components to be outside the component envelope.

An air gap of at least 5 mm is recommended to dissipate heat from display components. Device designers will need to consider their specific system requirements to determine the necessary spacing.



Dimensions in are millimeters; inches in brackets.

Tolerances unless specified

.x ± 0.50 [0.02]

.xx ± 0.25 [0.01]

Figure 4. Display Dimensions.

Note: This is not a controlled version of the mechanical drawing. Prior to beginning your design, please contact Planar Applications Engineering for the current detailed drawing.

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 non-conformance 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 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.

Ordering Information

Product	Part Number	Features
EL480.60.43	996-0265-01	Standard version
EL480.60.43 CC	996-0265-02	EL480.60.43 with conformal coating

Design and specifications are subject to change without notice.

Planar Systems continues to provide optional, and in many cases custom, features to address the specific customer requirements. Consult Planar Sales for pricing, lead time and minimum quantity requirements.

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. with the model number(s) and serial 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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OM305-00