



**EL320.240.36 ICEBrite™
Quarter-VGA Small Graphics Display**

USER'S MANUAL

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Revision Control

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EL320.240.36 Quarter-VGA Display

The EL320.240.36 thin film electroluminescent (EL) display is a high-performance alternative to industry-standard quarter-VGA LCDs. The EL320.240.36 utilizes Planar's proprietary Integral Contrast and Brightness Enhancement (ICEBrite™) 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 assembled into a space-saving, rugged package for easy mounting. The EL320.240.36 is easily interfaced using standard 4-bit LCD control signals. Each of the 76,800 pixels is individually addressable to clearly display high information content graphics and text.

Features and Benefits

- Excellent visual performance:
 - High brightness and contrast
 - Wide viewing angle > 160°
- Rapid display response < 1 ms
- Space efficient mechanical package
- Low EMI emissions
- Extremely rugged and durable
- Reliable, long operating life
- 4-bit 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 MOS-FET 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.

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.

Avoid bending the display. 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. The EL320.240.36 mounting tabs were designed for a 3 mm screw. Mounting surfaces should be flat to within ± 0.6 mm (± 0.25 "). Use all the mounting holes provided. Failure to do so will impair the shock and vibration resistance of the final installation.

CAUTION: Properly mounted, this display can withstand high shock loads and 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.

WARNING: These products generate voltages capable of causing personal injury (high voltage up to $235 V_{ac}$). 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 and anti-reflective films.

Avoiding Burn-In

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

Specifications

Performance characteristics are guaranteed when measured at 25°C with rated input voltage unless otherwise specified.

Control Basics

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. Planar does not recommend operation of the display outside these specifications.

Table 1. DC Input Voltage Requirements.

Parameter ¹	Symbol	Min	Typ	Max	Absolute Max
Logic supply voltage	V_L	4.75 V	5 V	5.25 V	6 V
Logic supply current at +5 V	I_L			0.1 A	
Display supply voltage	V_H	10 V	12 V	15 V	15 V
Supply current at +12 V	I_H		0.5 A	1.0 A	
Power consumption 5 V/12 V			7.0 W	12.0 W	

¹ Operating conditions: ambient temperature 25°C, 120 Hz frame rate.

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

Table 2. Video Input Requirements.

Description	Min	Max	Units	Notes
Absolute Input Voltage Range	-0.3	5.5	V	$V_L = 5.0$ V
Video logic high voltage	70%	100%	V_L	All input thresholds are CMOS
Video logic low voltage	0	20%	V_L	
Video logic input current	-	± 10	μ A	
Input capacitance	-	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 display uses the Samtec STMM-110-01-T-D or equivalent. The mating connector is in the Samtec TCSD family of cable strips. The proper connector, user-specified cable length and connector configuration is supplied as a single unit. Consult your Samtec representative (1-800-SAMTEC9) for the cable/connector options.

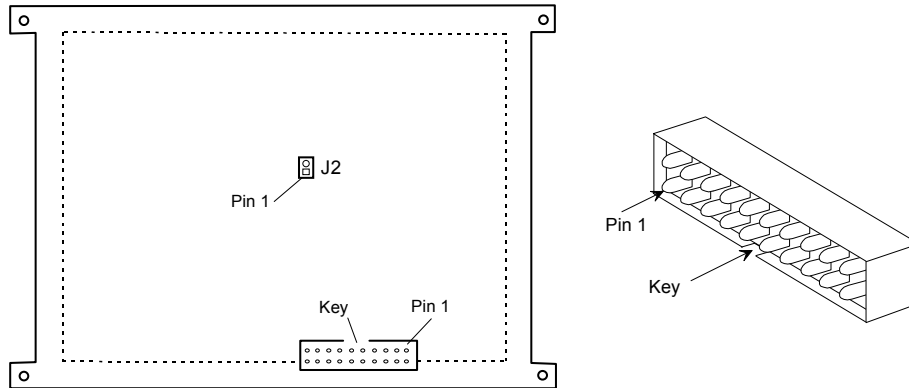


Figure 1. Data/Power Connector

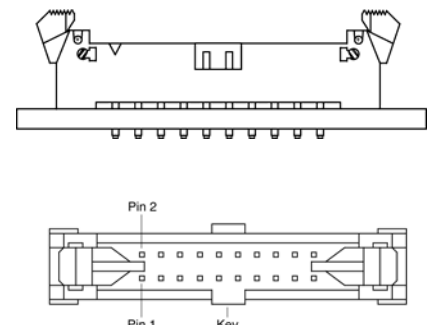
Table 3. Connector Pinouts.

Pin	Signal	Description	Pin	Signal	Description
1	V_H	+12 V Power	2	V_H	+12 V Power
3	Selftest	Selftest Input ¹	4	TOUCH	Reserved
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

¹ Connect pin 3 to ground for normal display operation.

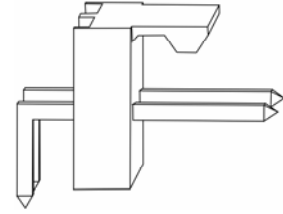
Locking Power and Data Connector

The display may be ordered with an optional 20 pin, 2 mm through-hole locking male header, Samtec EHT-110-01-T-D or equivalent. The locking connector is standard on the Extended Temperature display. The mating connector is in the Samtec TCSD family of cable strips. Compatibility with non-Samtec equivalents should be verified before use.



Dimming Connector J2

An analog dimming circuit is standard on the Industrial and Extended Temperature versions of this display. The J2 dimming connector is a Molex 2-pin, right angle locking male, part number 22-12-2024. The recommended mating connector is a Molex 22-01-3027 (housing) and 08-52-0123 (crimps, 2 per housing).



Additionally the crimp housing will need crimp terminals to connect the wires, Molex 2759 or 6459 can be used. Molex crimp terminal 41527 is recommended for applications with high vibration requirements.

For a discussion of the dimming feature, refer to the Dimming section below, under Optical Performance.

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 is blank. Halting **VS** results in a standby condition to minimize power usage.

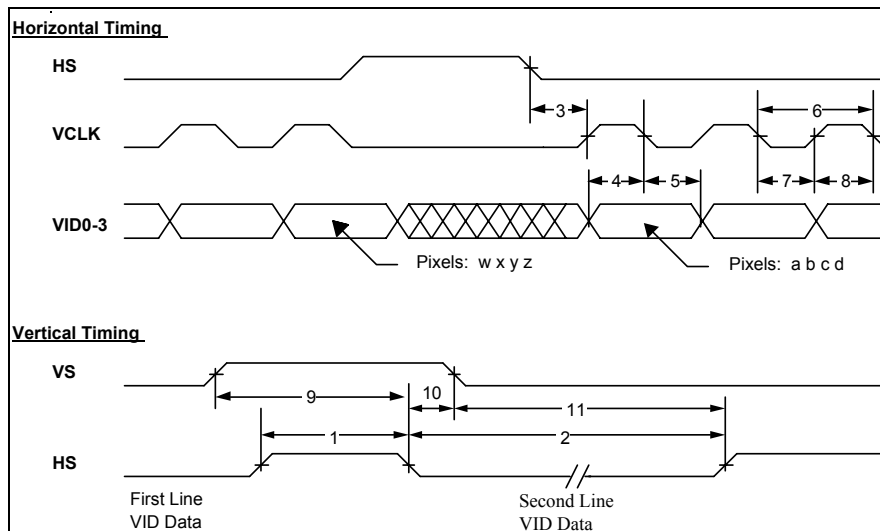


Figure 2. Video Input Timing Diagram.

Timing is compatible with LCD graphics controllers such as the SED 1335 or C & T 65535.

Table 4. Video Input Descriptions.

Num	Description	Symbol	Min.	Typ.	Max.	Units
1	HS high time	tHSh	100			nsec
2	HS low time	tHSl	80			tVCLK
3	HS to VCLK rising edge	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 low	tVShsu	140			nsec
10	VS hold after HS	tVShd	140			nsec
11	VS low setup to HS high	tVSlisu	140			nsec
12	HS period	tHS	34			μsec
	VS period	tVS	240			tHS
	Frame Rate	fVS	0		120	Hz

Input signals **VID₀** through **VID₃** contain the video data for the screen. Pixel information is supplied from left to right and from top to bottom four pixels at a time. Video data for one row is latched on the fall of **HS**.

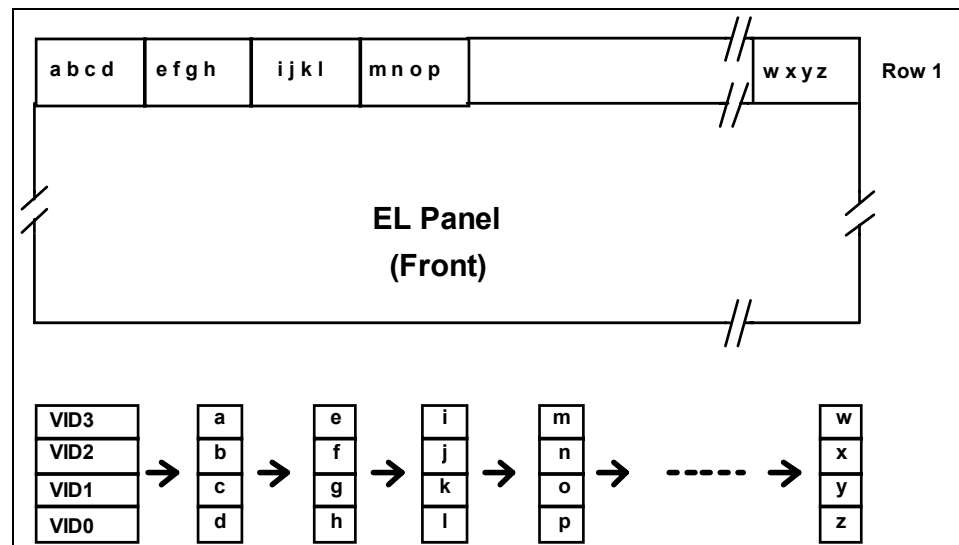


Figure 3. Pixel Location versus Sequence of Data.

Self-Test Mode

The display incorporates a self-test mode composed of two patterns displayed for approximately 30 seconds each, and then repeated. The patterns are as follows: *Full On* and *1 X 1 Checkerboard*. The self-test mode is entered by leaving pin 3 unconnected or pulled high.

Note: Pin 3 must be connected to Ground for normal display operation.

Optical

Table 5. Optical Characteristics.

Luminance		
L_{on} (areal), min	40 cd/m ²	screen center, 120 Hz frame rate
L_{on} (areal), typ	50 cd/m ²	screen center, 120 Hz frame rate
L_{off} (areal), max	0.3 cd/m ²	5 points: center plus four corners measured 1.0 ±0.25" from adjacent bezel edges, @ 120 Hz
Non-uniformity		
All pixels fully lit	35%	Maximum difference two of five points, using the formula: $BNU\% = [1 - (\min_lum / \max_lum)] \times 100\%$
Luminance Variation (Temperature)		
Maximum	±20%	Across operating temperature range
Luminance Variation (Time)		
Maximum	<20%	10,000 hours at 25°C ambient
Viewing Angle		
Minimum	160°	
Contrast Ratio		
Minimum	19:1	@ 500 lux ambient, 120 Hz frame rate
Typical	50:1	

Dimming

There are two standard methods for dimming the EL320.240.36 display. Frame rate dimming allows the brightness of the display to be lowered proportionally by reducing the frame rate. Frame rate dimming is performed within the application by lowering the frame rate of the video input signals. Because brightness is proportional to frame rate, the display can be dimmed by adding pauses between every horizontal period.

The lowest useable frame rate (brightness) is dependent on the perceived flicker of the displayed image, but will most likely be around 60 Hz.

Dimming control circuitry is available on some models of this display. This feature allows manual analog dimming of the brightness from 100% to approximately 5% of the full brightness.

For models which feature analog dimming, connect a 100 kohm logarithmic external potentiometer to the dimming port. Alternatively, an external voltage or current mode D/A converter may be used to facilitate dimming by sinking a

maximum of 250 μ A (for maximum dimming) from pin 1 to pin 2 of the dimming port.

For more information on frame rate dimming please see Planar Application Note #120.

Environmental

Table 6. Environmental Characteristics.

	Operating	Non-operating
Temperature		
Standard	0°C to +55°C	-40°C to +85°C
Industrial	-25°C to +65°C	-40°C to +85°C
Extended	-40°C to +65°C	-40°C to +85°C
Humidity		
Non-condensing	93% RH max @40°C, per IEC 68-2-3	
Condensing		95% RH max @55°C, per IEC 68-2-30
Altitude		
Operating/non-operating	0 to 18 km (58k ft) per IEC 68-2-13	
Vibration		
Random	0.02 g ² /Hz, ASD level, 5-500 Hz per IEC 68-2-36, test Fdb.	
Shock		
Operating/non-operating	100 g, 6 ms, half sine wave per IEC 68-2-27, test Ea.	

Reliability

The display MTBF is to be greater than 50,000 hours at 120 Hz with a 90% confidence level at 25°C.

Safety and EMI Performance

The display will not inhibit the end product from obtaining these certifications: CISPR 11 level B, IEC 801-2, and IEC 801-3, EN55022 B or UL1950.

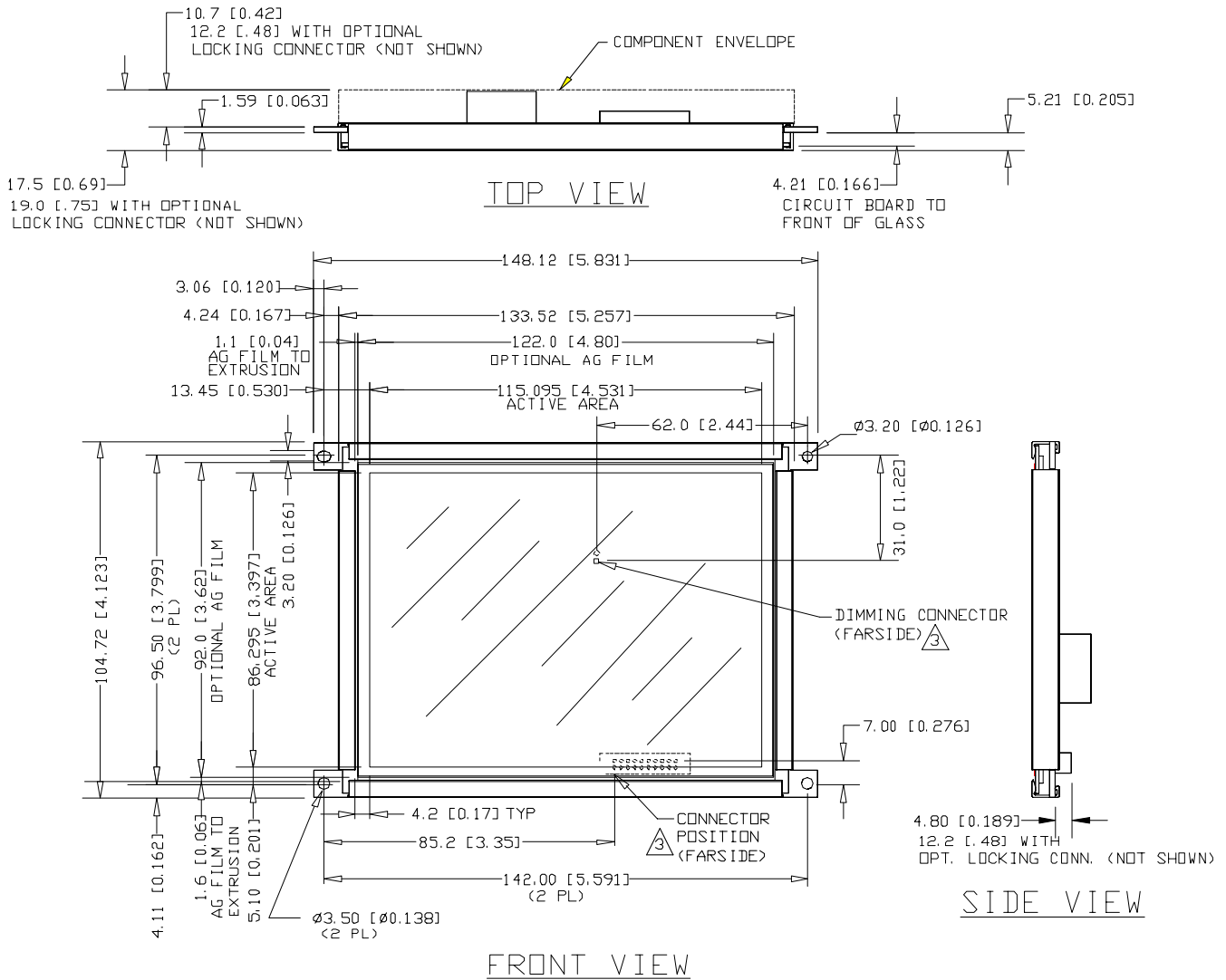
Mechanical Characteristics

Display External Dimensions		
millimeters (inches)	width	148.1 (5.83)
	height	104.7 (4.12)
without locking connector	depth	17.5 (0.62)
	with locking connector	19.0 (0.75)
<hr/>		
Weight (typical)		183 g
<hr/>		
Fill Factor		50.2%
<hr/>		
Display Active Area		
millimeters (inches)	width	115.1 (4.5)
	height	86.3 (3.4)
<hr/>		
Pixel Size		
	width	0.26 (0.01)
	height	0.26 (0.01)

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.

Device designers will need to consider their specific system requirements to determine the spacing necessary to maintain the specified ambient temperature. Air flow and surrounding component materials will affect the depth of the air gap.



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: The dimensions in this drawing are approximate. Please contact Planar Applications Engineering and request the actual drawing prior to beginning your design.

Description of Warranty

Seller warrants that the Goods will conform to published specifications and be free from defects in material for 12 months from delivery. To the extent that Goods incorporate third-party-owned software, Seller shall pass on Seller's licensor's warranty to Buyer subject to the terms and conditions of Seller's license.

Warranty repairs shall be warranted for the remainder of the original warranty period. Buyer shall report defect claims in writing to Seller immediately upon discovery, and in any event, within the warranty period. Buyer must return Goods to Seller within 30 days of Seller's receipt of a warranty claim notice and only after receiving Seller's Return Goods Authorization. Seller shall, at its sole option, repair or replace the Goods.

If Goods were repaired, altered or modified by persons other than Seller, this warranty is void. Conditions resulting from normal wear and tear and Buyer's failure to properly store, install, operate, handle or maintain the Goods are not within this warranty. Repair or replacement of Goods is Seller's sole obligation and Buyer's exclusive remedy for all claims of defects. If that remedy is adjudicated insufficient, Seller shall refund Buyer's paid price for the Goods and have no other liability to Buyer.

All warranty repairs must be performed at Seller's authorized service center using parts approved by Seller. Buyer shall pay costs of sending Goods to Seller on a warranty claim and Seller shall pay costs of returning Goods to Buyer. The turnaround time on repairs will usually be 30 working days or less. Seller accepts no added liability for additional days for repair or replacement.

If Seller offers technical support relating to the Goods, such support shall neither modify the warranty nor create an obligation of Seller. Buyer is not relying on Seller's skill or judgment to select Goods for Buyer's purposes. Seller's software, if included with Goods, is sold as is, and this warranty is inapplicable to such software.

SELLER DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Ordering Information

Product	Part Number	Description
EL320.240.36 Standard Product	996-0273-01	5.6" (142 mm) diagonal, quarter VGA display 0° to 55° C operating temperature
EL320.240.36 IN Industrial Product	996-0273-02	5.6" (142 mm) diagonal, quarter VGA display, -25° to +65°C operating temperature, analog dimming standard, locking connector, optional
EL320.240.36 AG	996-0273-60	5.6" (142 mm) diagonal, quarter VGA display 0° to 55° C operating temperature, anti-glare film.
EL320.240.36 ET Extended Temperature	996-0273-03	5.6" (142 mm) diagonal, quarter VGA display, -40° to +65°C operating temperature, analog dimming, locking connector standard

Product	Part Number	Description
EL320.240.36 ET CC	996-0273-30	5.6" (142 mm) diagonal, quarter VGA display, -40° to +65°C operating temperature, analog dimming, locking connector standard, conformal coating.

4-bit LCD interface. 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 with the model number(s), serial 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. An online RMA form may be found on Planar's website – www.planar.com/support.

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