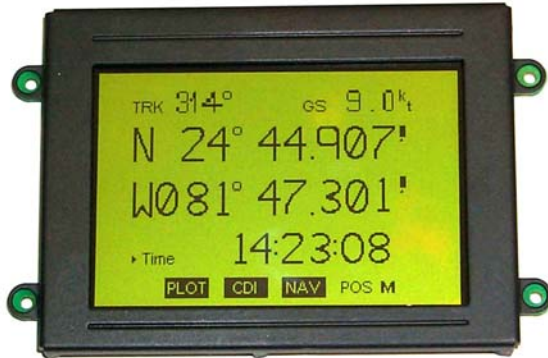
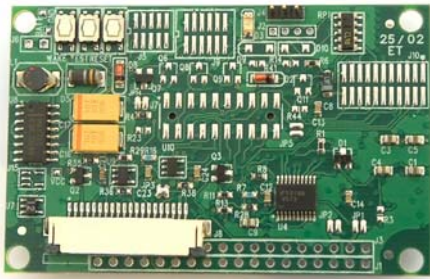


**240x160 (1/8 VGA) Cholesteric Display Module and Controller**

**Display Module**



**Controller**



**Demonstration Kit**



**Product Description**

The **240x160 Display Module** is intended for general purpose graphic and character display applications. All Kent Displays Cholesteric Liquid Crystal Display (ChLCD) products take advantage of the technology's unique "No Power" attribute without compromising superior optical performance even in direct sunlight. Display modules require an external controller to generate driving waveforms and provide temperature compensation.

The **240x160 Controller** is designed for use with a single display module. The controller can be electrically and mechanically mounted directly behind a display module or remotely using a 20-conductor flex cable assembly. The Kent Displays **240x160** controller provides the necessary driving waveforms, temperature compensation, font generation, serial communication interface, automatic sleep mode function, and self-test firmware for the **240x160** display module.

The **240x160 Demonstration Kit** contains everything required to quickly evaluate the features and capabilities of the **240x160** Cholesteric LCD Module. Each demonstration kit contains a display module, controller with attached AA cell holder assembly and batteries, PC to controller serial communication cable, and software CD with user interface software and related documents.

Order part number 09000107xxx for the 5V 240x160 demonstration kit or part number 09000108xxx for the 3V 240x160 demonstration kit.

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Kent, OH 44240, USA

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Website: [www.kentdisplays.com](http://www.kentdisplays.com)

### Product Features

**Display Module:**

- 240 Columns x 160 Rows
- 100 dpi (pixels per inch)
- Approximate Size 3.75x2.25x0.4 Inches
- Available in Four Colors
- 3V or 5V Logic Interface
- Low Profile Modular Design
- Superior Brightness
- Excellent Optical Properties
- Viewing Cone Comparable to Paper
- Full or Partial Screen Update Capability
- 20 Conductor ZIF Flex Cable Interconnect
- Indefinite Image Memory ("No Power")

**Controller:**

- Communication Options
  - RS-232 Interface
  - Local Serial Interface (TTL)
- Font Generator & Graphic Image Capability
- Automatic Sleep Mode
- LED Indicators to Support Operation & Control
- Input Voltage: 3 - 9 VDC
- Built-In Test Mode

### Typical Applications

- Battery Powered Portable Devices
- Machine Interface
- Inventory Tracking Displays
- Instrumentation or Avionics Displays
- Remote Control Display Applications
- Point of Sale Displays

### Ordering Information:

3 Volt Display Modules	
Part #	Description
01521103166	Module, 240x160 3V Yellow/Black
01521103167	Module, 240x160 3V White/Blue
01521103168	Module, 240x160 3V Yellow-Green/Black
01521103169	Module, 240x160 3V Green/Black

5 Volt Display Modules	
Part #	Description
01508705166	Module, 240x160 5V Yellow/Black
01508705167	Module, 240x160 5V White/Blue
01508705168	Module, 240x160 5V Yellow-Green/Black
01508705169	Module, 240x160 5V Green/Black

3 Volt Demonstration Kits	
Part #	Description
09000108166	Demo Kit, 240x160 3V Yellow/Black
09000108167	Demo Kit, 240x160 3V White/Blue
09000108168	Demo Kit, 240x160 3V Yellow-Green/Black
09000108169	Demo Kit, 240x160 3V Green/Black

5 Volt Demonstration Kits	
Part #	Description
09000107166	Demo Kit, 240x160 5V Yellow/Black
09000107167	Demo Kit, 240x160 5V White/Blue
09000107168	Demo Kit, 240x160 5V Yellow-Green/Black
09000107169	Demo Kit, 240x160 5V Green/Black

3 Volt Controller – Flex Cable	
Part #	Description
01012071	Controller, 3V RS-232
01012073	Controller, 3V Local Serial

5 Volt Controller - Flex Cable	
Part #	Description
01012061	Controller, 5V RS-232
01012063	Controller, 5V Local Serial

Related Items	
Part #	Description
01012301	Communication Cable
03930	Software CD

\*All 240x160 Controllers require a serial communication cable and DC power source for operation.

Contact Kent Displays at [sales@kentdisplays.com](mailto:sales@kentdisplays.com) for complete sign assemblies, custom configurations, pricing, and additional information.

## Display Modules and Controllers

General Specifications	
Parameter	Description
Display Type	Cholesteric Reflective LCD
Format	240 columns x 160 rows
Resolution	100 dots per inch, or 0.254 mm (horiz.)x0.254 mm (vert.) between pixel center-lines
Image Area	2.4 in x 1.6 in (61.0 mm x 40.6 mm)
Display Module Weight	1.8 oz (51.0 grams)
Operating Temperature Range	0°C to +60°C (custom operating temperatures available)
Storage Temperature Range	-40°C to +100°C
Full Image Update Rate	1.16 sec (@ 23°C, refer to graph on page 8 for more details)
Maximum Number of Display Modules per Controller	1
Sleep Mode Activated After	20 sec

240x160 3-Volt Display Module Power Requirements <sup>1</sup>			
Parameter	Minimum	Typical	Maximum
Power Source Voltage Range (V <sub>DD</sub> )	2.8 VDC	3.5 VDC	5.0 VDC
High Level Logic Input Voltage (V <sub>IH</sub> )	2.0 VDC	-	5.0 VDC
Low Level Logic Input Voltage (V <sub>IL</sub> )	-	-	0.8 VDC
Average Operating Power @25°C (while driving image)	-	69 mW	-
Average Operating Power @60°C (while driving image)	-	144 mW	-

240x160 5-Volt Display Module Power Requirements <sup>1</sup>			
Parameter	Minimum	Typical	Maximum
Logic Power Source Voltage (V <sub>CC</sub> )	4.75 VDC	5.0 VDC	5.25 VDC
Power Source Voltage Range (V <sub>DD</sub> )	2.8 VDC	3.5 VDC	6.2 VDC
High Level Logic Input Voltage (V <sub>IH</sub> )	4.2 VDC	-	-
Low Level Logic Input Voltage (V <sub>IL</sub> )	-	-	0.8 VDC
Average Operating Power @25°C (while driving image)	-	85 mW	-
Average Operating Power @60°C (while driving image)	-	145 mW	-

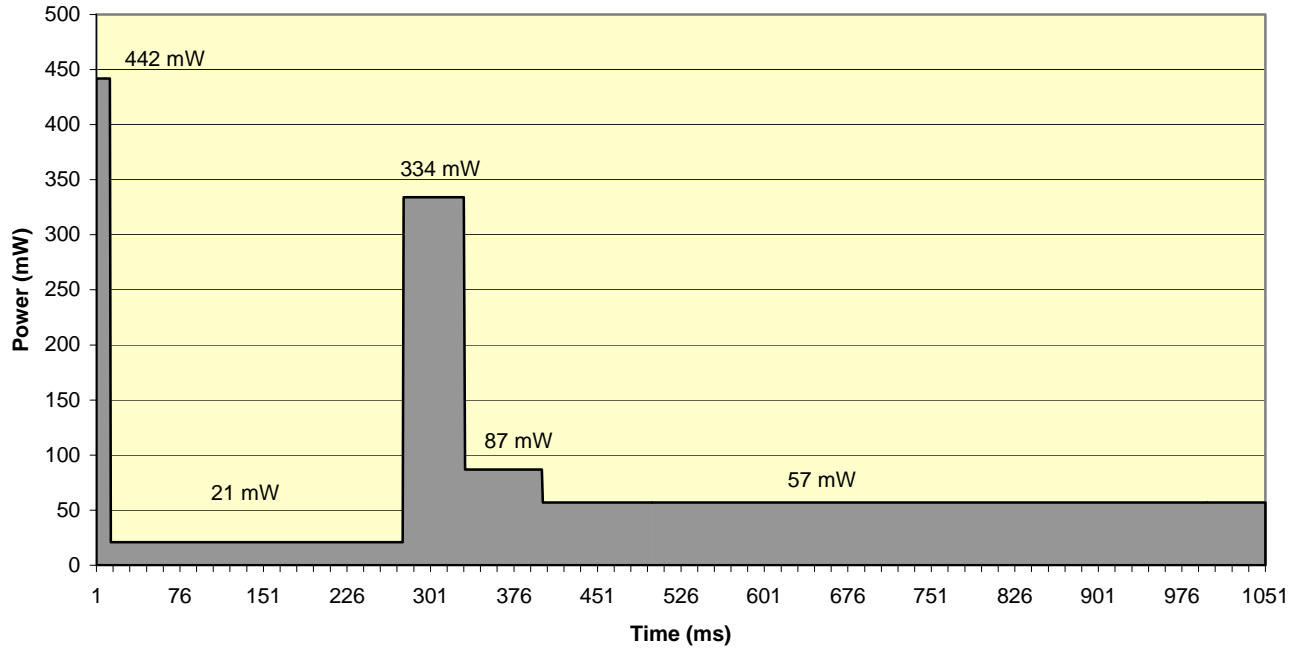
Controller Power Requirements <sup>1</sup>			
Parameter	Minimum	Typical	Maximum
Power Source Voltage (V <sub>DD</sub> )	2.8 VDC	-	5.0 VDC <sup>2</sup>
Average "Wake-up" mode power consumption when updating a display module	-	104 mW	-
Average "Idle" mode power consumption	-	55 mW	-
"Sleep Mode" power consumption display module & controller	-	< 6 μW	-

\*Specifications are subject to change without prior notice.

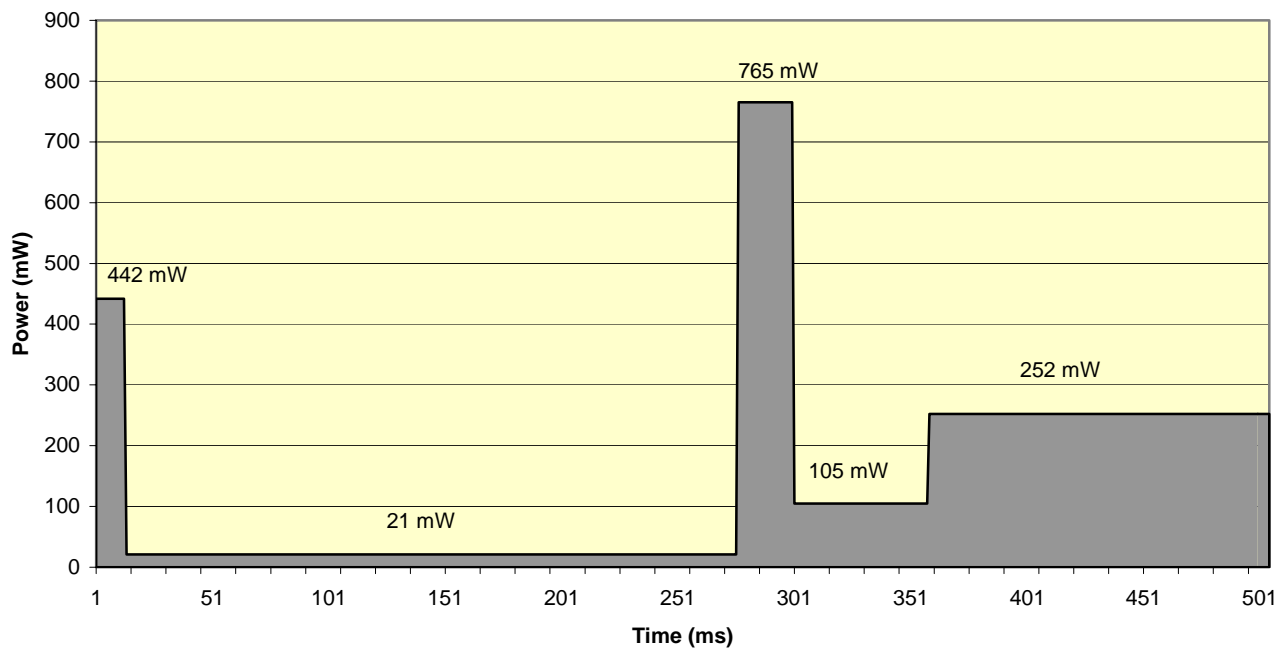
<sup>1</sup> Values given assume 25 °C Temp. unless noted otherwise.

<sup>2</sup> Limited by Display Module V<sub>DD</sub> maximum value.

**240x160 3-Volt Display Module Update Cycle Power @25°C**

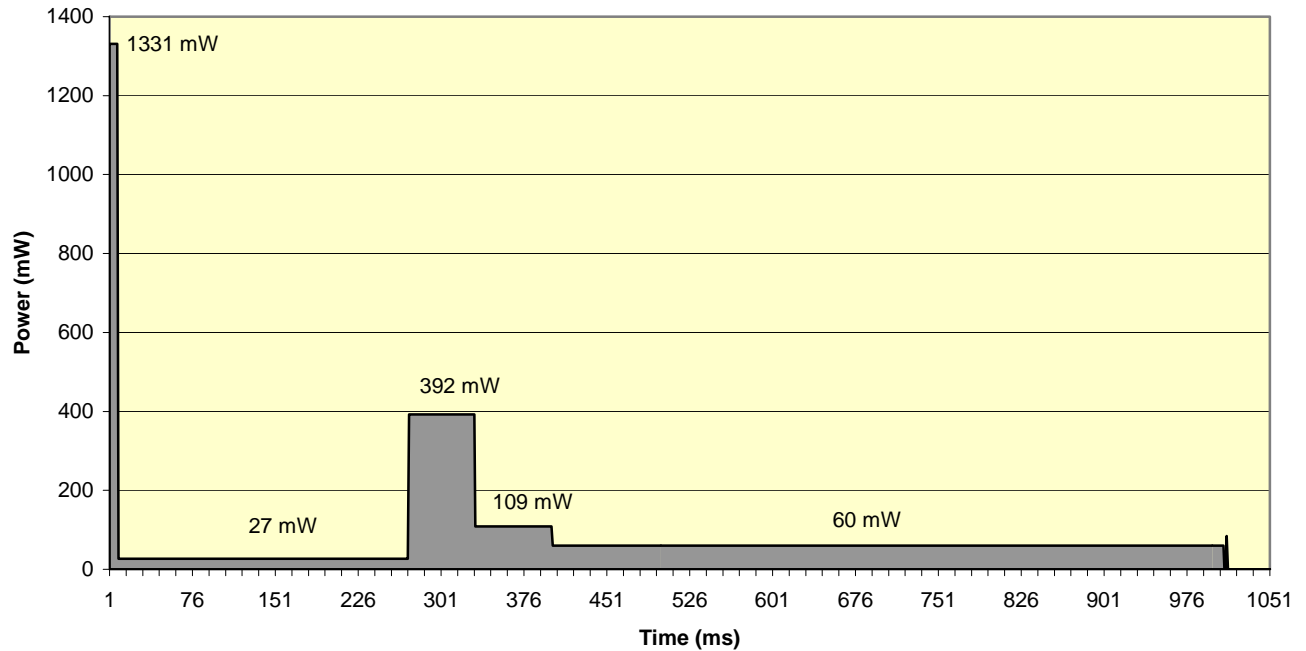


**240x160 3-Volt Display Module Update Cycle Power @60°C**

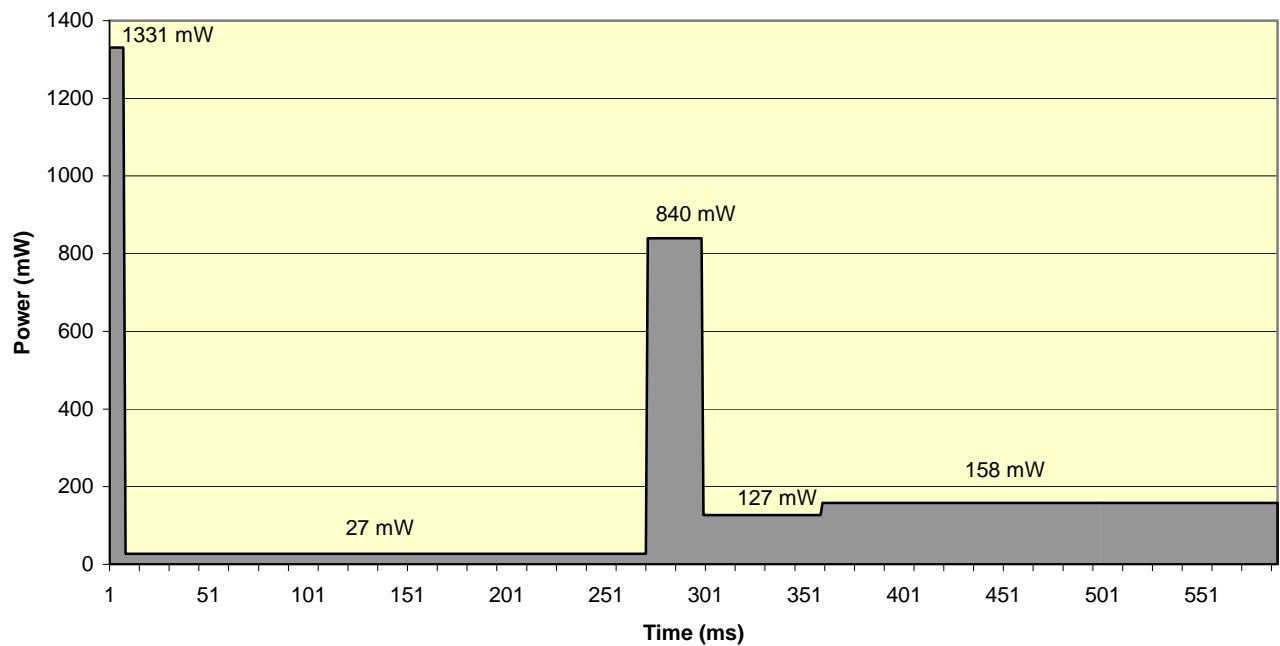


**Note:** Graphs above represent power required for a single full screen update. Initial power surge corresponds to capacitive loading in power supply circuit. Average power consumed during display update is 69 mW at 25°C and 144 mW at 60°C.

**240x160 5-Volt Display Module Update Cycle Power @25°C**



**240x160 5-Volt Display Module Update Cycle Power @60°C**



**Note:** Graphs above represent power required for a single full screen update. Initial power surge corresponds to capacitive loading in power supply circuit. Average power consumed during display update is 85 mW at 25°C and 145 mW at 60°C.

**Controller:**

<b>Controller Communication Interface Information</b>	
<b>Parameter</b>	<b>Description</b>
Serial communication format	RS-232: Asynchronous, full duplex, 8 data bits, 1 stop bit, no parity.
Baud rate	19.2 kbps
Protocol format	Kent Displays character/graphics serial protocol. (Refer to Data Sheet 25016 for details).
Mating communication plug	2mm pitched 3-conductor plug, Hirose P/N DF3-3S-2C w/ DFS-2428SC crimped contacts, or equivalent.

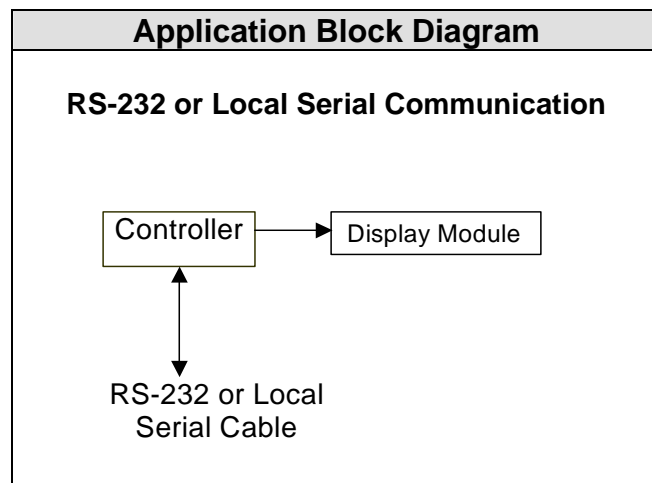
<b>Power Interface Connection: J6</b>		
<b>Pin #</b>	<b>Symbol</b>	<b>Description</b>
1	+ Power	Positive power termination.
2	- Power (Return)	Negative power termination.

<b>Local Serial Communication Header Interface: J4</b>		
<b>Pin #</b>	<b>Symbol</b>	<b>Description</b>
1	RX_DATA	Module receive- data input termination (RS-232).
2	Ground	Ground termination point
3	TX_DATA	Module transmit- data output termination

<b>Local On-Board Controls</b>	
<b>Symbol</b>	<b>Description</b>
"RESET"	Controller reset button.
"TEST"	Controller diagnostic button for onboard test initiation.
"WAKE"	Module local wakeup button.
"LED"	Diagnostic LED output for onboard feedback.

**Display Module Only (Customer Supplied Controller):**

<b>Display Module Interface Connection</b>		
<b>Pin #</b>	<b>Symbol</b>	<b>Description</b>
1	+ Power	Positive power termination.
2	- Power (Return)	Negative power termination.

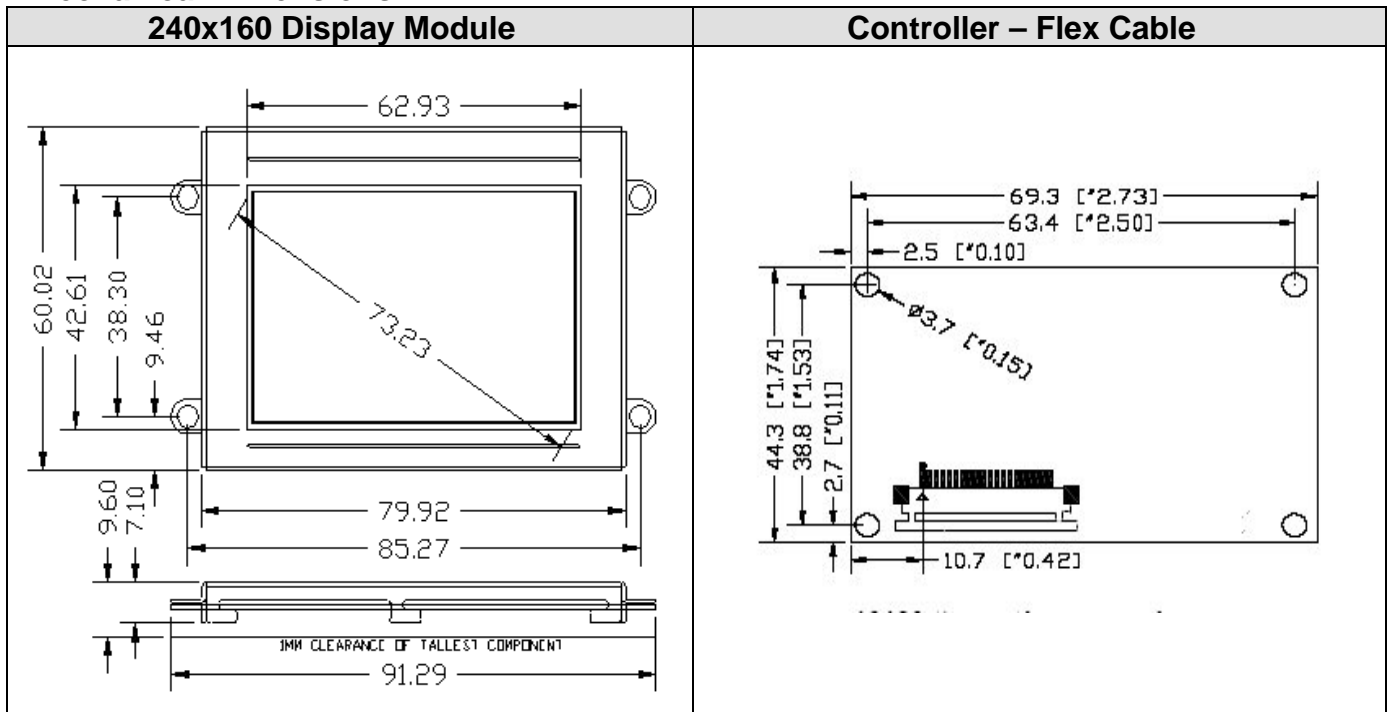


**Display Interface Connector (J1) – 015087xx (5 Volt) & 015211xx (3 Volt)**

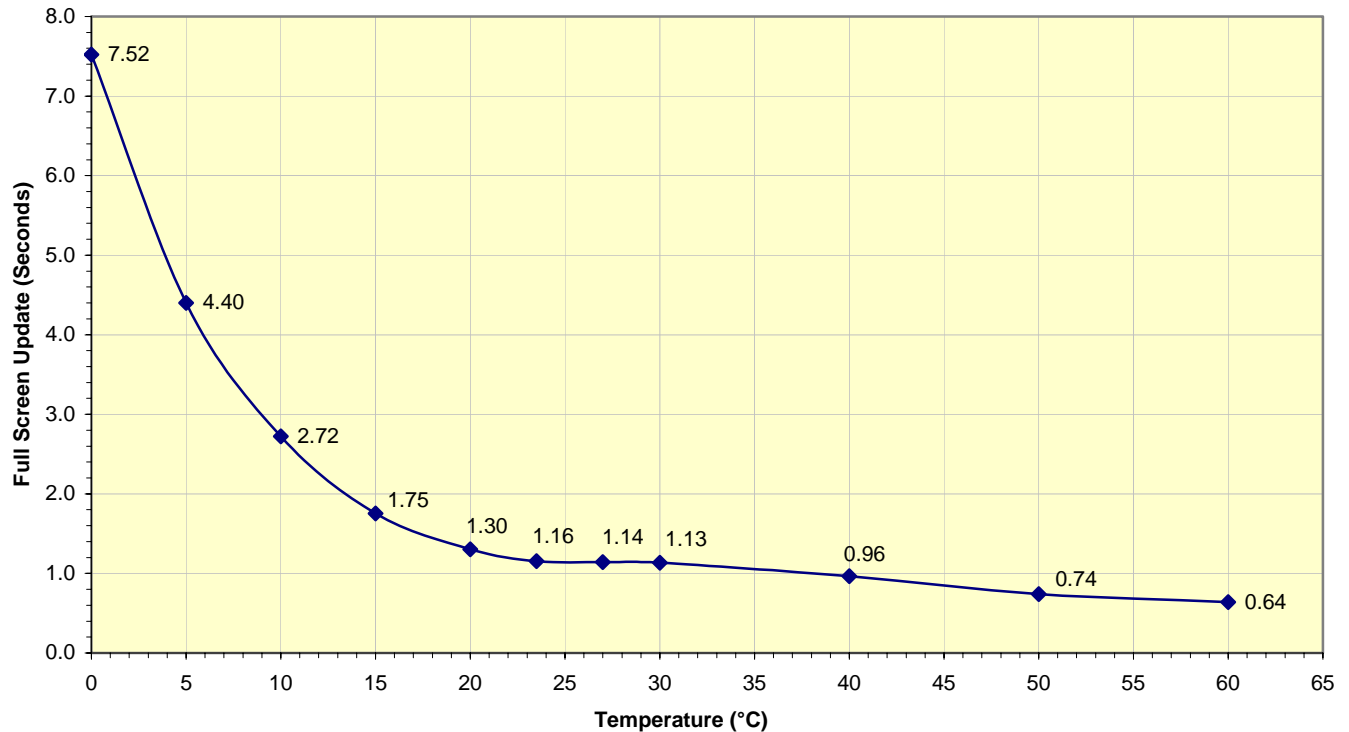
Pin#	Symbol	Description
1	HVC_CTL	Input: High Voltage Converter Control. Logic High will lower converter amplitude (utilized during transparent bulk erase operation).
2	LATCH	Input: Latch. Used to present column image data to ChLCD material, and to zero the column data pointer (triggered at trailing edge).
3	C_CLK	Input: Column Clock. Used to clock data present on the 8-bit data bus interface (triggered at trailing edge).
4	PHASE	Input: Phase or Framing. Dictates polarity and frequency of waveform to ChLCD material.
5	R_CLK	Input: Row Clock. Used to clock data present on the row data input, D7 (triggered at trailing edge).
6	ENABLE	Input: Enable. When disabled (low), all driver outputs at a ground potential.
7	EN_PWR	Input: Enable High Voltage Power. Used to turn on/off the display DC-DC converter circuit (positive logic input).
8	TEMP_CTL	Output: Temperature output of ChLCD material. Analog signal representative of ChLCD material temperature.
9	D7, Row Data	Input: Data element 7 of column data bus. Row Data input.
10	D6	Input: Data element 6 of column data bus.
11	D5	Input: Data element 5 of column data bus.
12	D4	Input: Data element 4 of column data bus.
13	D3	Input: Data element 3 of column data bus.
14	D2	Input: Data element 2 of column data bus.
15	D1	Input: Data element 1 of column data bus.
16	D0	Input: Data element 0 of column data bus.
17	Vss	PWR: Power Ground Return Termination Point.
18	Spare	N/A: This pin is reserved for future use. Leave pin unconnected.
19	Vdd	PWR: Positive DC Power Source Termination.
20	Vcc	PWR: Positive 5V (15083) 3.3V(15211) Logic Level Power Source Termination.

\*Refer to Kent Displays, Inc. document # 25008 (1/8 VGA Interface Document) for additional information

**Mechanical Dimensions:**



**240 x 160 (1/8 VGA) Module Total Update Time**



The chart above illustrates average computed full screen update times with respect to temperature for the 240x160 display module (3V & 5V). The update time is approximately 1.16 seconds at room temperature (23°C).

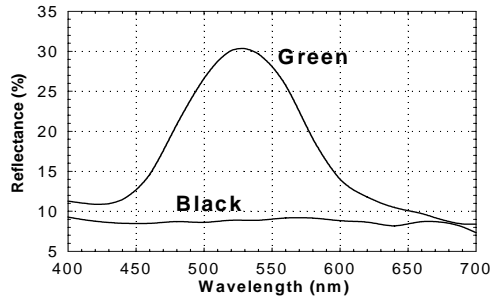
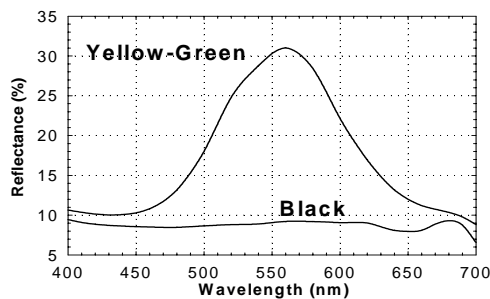
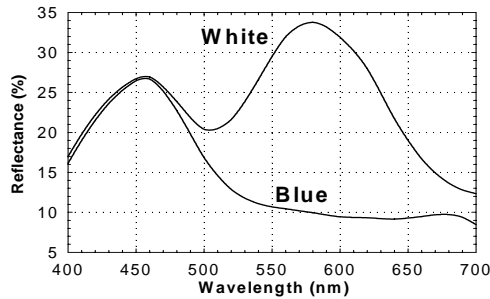
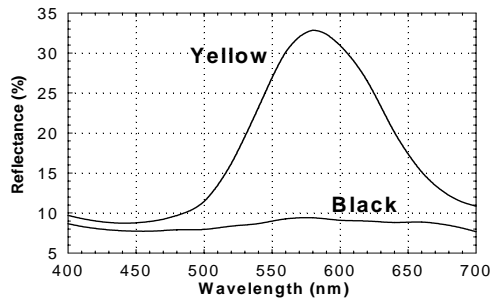
**FRONT COVER MATERIAL SELECTION:**

The following front cover requirements are necessary to insure image quality during the life of the 240x160 display module:

1. Cholesteric Liquid Crystal materials require protection from UV light. A UV blocking material with a minimum 98% cutoff at 380nm and lower spectral components is required.
2. The finished product design should incorporate a transparent cover such as acrylic, polycarbonate, etc., to protect the viewing area of the display. Place the protective cover as close to the display module as possible. The protective cover should be of sufficient thickness to resist flexing, or if flexed should not touch the surface of the display. Acrylite® OP-3 P-99 matte finish and Acrylite® OP-3 material without matte finish are examples of a recommended protective cover material.

Adding an anti-glare and/or anti-reflective surface film or finish (e.g. Acrylite® OP-3 P-99) to the viewing side of the protective cover may improve the optical performance in certain display applications and lighting conditions.

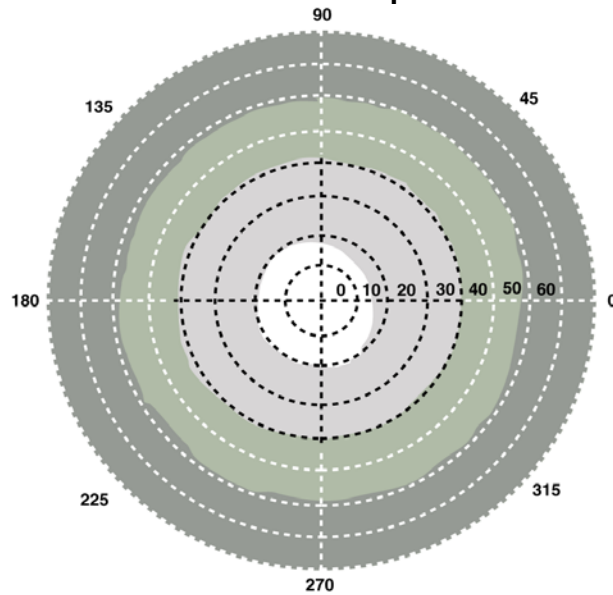
### Optical Characteristics for Standard Color Configurations



The above reflectance curves are from a single pixel. Actual reflectance will vary depending on display resolution, aperture ratio, and other factors.

The graphs to the left outline the spectral reflectance characteristics for a given display pixel when switched to either of the two possible stable states: reflective planar or transparent focal conic. The top line in each chart outlines the reflective characteristic of the planar state. The bottom line outlines the reflective characteristic of the transparent focal conic state. Graphs for the 4 standard color combinations are illustrated.

### Contrast Ratio Polar Representation



As illustrated in the polar graph above, all Kent Displays' ChLCD products have a 360-degree viewing cone. When measured normal to the plane of the display, the monochromatic contrast ratio is as high as 25:1 with a peak reflectivity approaching 35% of the incident light. The contrast ratio reduces as the viewing angle approaches the plane of the display but is still excellent at 11:1. Since no polarizers are used, display contrast reduces uniformly in all azimuthal directions when the viewing angle is increased.

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