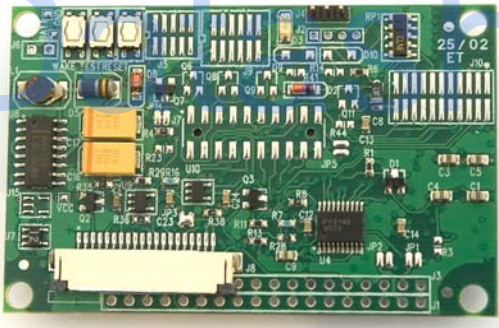


**128 x 32 Cholesteric Display Module and Controller****Display Module****Controller****Demonstration Kit****Product Description**

The **128x32 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 **128x32 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 128x32 controller provides the necessary driving waveforms, temperature compensation, font generation, serial communications interface, automatic sleep mode function, and self-test firmware for the 128x32 display module.

The **128x32 Demonstration Kit** contains everything required to quickly evaluate the features and capabilities of the 128x32 Cholesteric LCD Module. Each demonstration kit contains a 128x32 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 09001701xxx for the 18-pin header 128x32 demonstration kit or part number 09001702xxx for the flex cable 128x32 demonstration kit.

Kent Displays, Inc.  
343 Portage Boulevard  
Kent, OH 44240, USA

Telephone: (330) 673-8784  
Fax: (330) 673-4408  
Sales: [sales@kentdisplays.com](mailto:sales@kentdisplays.com)  
Website: [www.kentdisplays.com](http://www.kentdisplays.com)

## Product Features

### Display Module:

- 128 Columns x 32 Rows
- 54 Dots Per Inch
- Approximate Size 2.75x1.75x0.4 Inches
- Available in Four Colors
- 5V Logic Interface
- Low Profile Modular Design
- Indefinite Image Memory ("No Power")
- Superior Brightness
- Excellent Optical Properties
- Viewing Cone Comparable to Paper
- Full or Partial Screen Update Capability
- Interconnect Options
  - 18 Pin Header to Header
  - 20 Conductor ZIF Flex Cable

### Controller:

- Font Generator & Graphic Image Capability
- Communication Options
  - RS-232 Interface
  - Local Serial Interface (TTL)
- 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:

Display Module – 18-Pin Header	
Part #	Description
01524010166	Module, 128x32 Yellow/Black
01524010167	Module, 128x32 White/Blue
01524010168	Module, 128x32 Yellow-Green/Black
01524010169	Module, 128x32 Green/Black
01524009167	Module, 5V, 128x32 White/Blue <sup>1</sup>

Display Module – Flex Cable	
Part #	Description
01537307166	Module, 128x32 Flex Yellow/Black
01537307167	Module, 128x32 Flex White/Blue
01537307168	Module, 128x32 Flex Yellow-Green/Black
01537307169	Module, 128x32 Flex Green/Black

Controller – 18-Pin Header	
Part #	Description
01012041	Controller, Header RS-232
01012043	Controller, Header Local Serial

Controller - Flex Cable	
Part #	Description
01012051	Controller, Flex RS-232
01012053	Controller, Flex Local Serial

Demonstration Kit – 18-Pin Header	
Part #	Description
09001703166	Demo Kit, 128x32 Yellow/Black
09001703167	Demo Kit, 128x32 White/Blue
09001703168	Demo Kit, 128x32 Yellow-Green/Black
09001703169	Demo Kit, 128x32 Green/Black

Demonstration Kit - Flex Cable	
Part #	Description
09001704166	Demo Kit, 128x32 Flex Yellow/Black
09001704167	Demo Kit, 128x32 Flex White/Blue
09001704168	Demo Kit, 128x32 Flex Yellow-Green/Black
09001704169	Demo Kit, 128x32 Flex Green/Black

Related Items	
Part #	Description
01012301	Communication Cable
03930	Software CD

\*All 128x32 Controllers require a serial communication cable and DC power source for operation.

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

<sup>1</sup> Part # 01524009167 has +5VDC output on pin# 2 of the 18-pin interface header.

**Display Modules and Controllers**

<b>General Specifications</b>	
<b>Parameter</b>	<b>Description</b>
Display Type	Cholesteric Reflective LCD
Format	128 columns x 32 rows
Resolution	54 dots per inch, or 0.43 mm (horiz.)x0.51 mm (vert.) between pixel center-lines
Image Area	2.16 in x 0.64 in (55.01 mm x 16.29 mm)
Display Module Weight	1.0 oz (28.3 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	0.42 sec (@ 25°C, refer to graph on page 6 for more details)
Sleep Mode Activated After	20 sec

<b>128x32 Display Module Electrical Requirements<sup>2</sup></b>			
<b>Parameter</b>	<b>Minimum</b>	<b>Typical</b>	<b>Maximum</b>
Logic Power Source Voltage ( $V_{CC}$ ) (all display module variations)	4.75 VDC	5.0 VDC	5.25 VDC
Power Source Voltage Range ( $V_{DD}$ ) (all variations except 01524009167)	2.8 VDC	-	10 VDC
Power Source Voltage Range ( $V_{DD}$ ) (01524009167 variation only)	6.0 VDC	-	10 VDC
High Level Logic Input Voltage ( $V_{IH}$ )	4.75 VDC	-	-
Low Level Logic Input Voltage ( $V_{IL}$ )	-	-	0.8 VDC
Average Operating Power @25°C (while driving image) <sup>3</sup>	-	51 mW	-
Average Operating Power @60°C (while driving image) <sup>3</sup>	-	74 mW	-

<b>Controller Electrical Requirements<sup>2</sup></b>			
<b>Parameter</b>	<b>Minimum</b>	<b>Typical</b>	<b>Maximum</b>
Power Source Voltage ( $V_{DD}$ )	2.8 VDC	-	10.0 VDC
Average operating power consumption when updating a display module <sup>3</sup>	-	104 mW	-
Average "Idle" mode power consumption <sup>3</sup>	-	55 mW	-
"Sleep Mode" power consumption display module & controller <sup>3</sup>	-	< 6 $\mu$ W	-

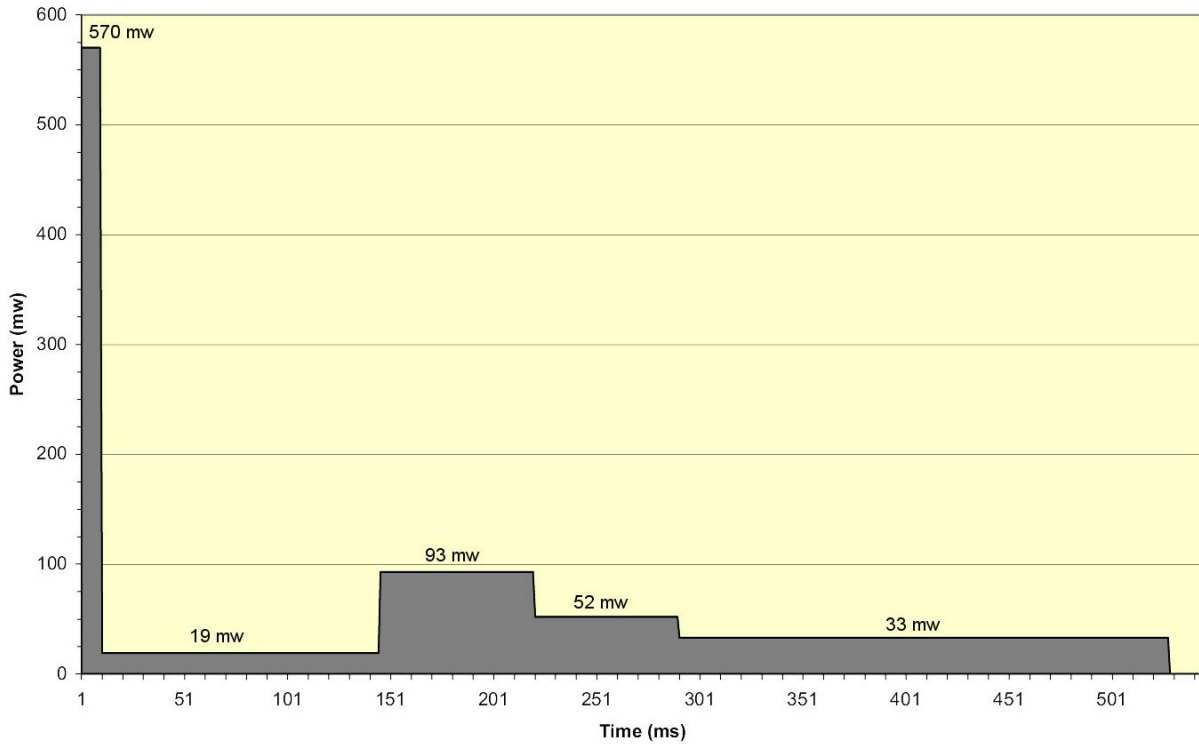
<b>Controller Communication Interface Information</b>	
<b>Parameter</b>	<b>Description</b>
Serial communication format	RS-232: Asynchronous, full duplex, 8 data bits, 1 stop bit, no parity.
Baud rate	38.4 kbps
Protocol format	Kent Displays character/graphics serial protocol. (Refer to Data Sheet 25016 for details).
Mating communication plug	2mm pitched 3-conductor plug, Hirose P/N DF3-3S-2C w/ DFS-2428SC crimped contacts, or equivalent.

\*Specifications are subject to change without prior notice.

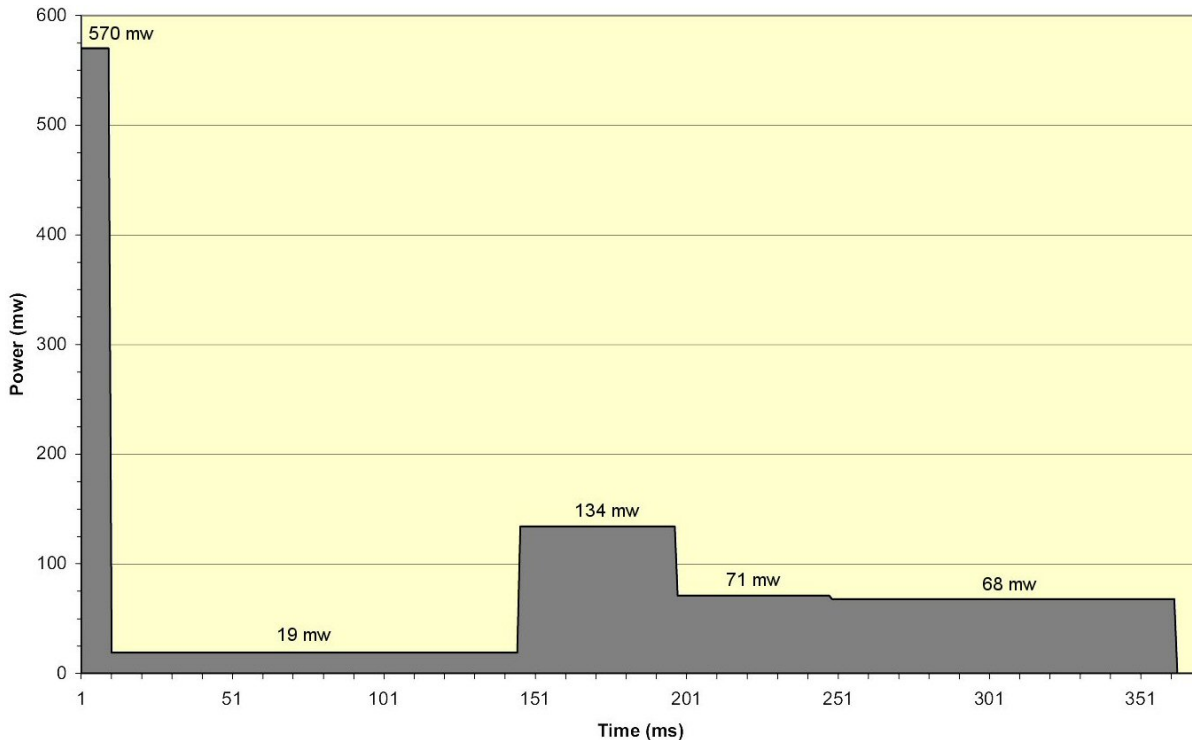
<sup>2</sup> Values given assume 25 °C Temp.

<sup>3</sup> Measurements taken @ $V_{DD}$  = 3VDC

128x32 Display Module Update Cycle Power @25°C



128x32 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 51 mW at 25°C and 74 mW at 60°C.

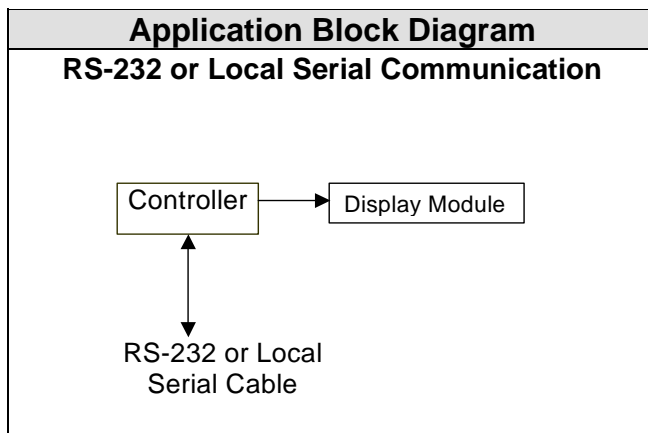
**Display Interface Connector (J1) – 015240xx (Header)**

Pin#	Symbol	Description
1	V <sub>DD</sub>	Power Source (+) Termination (battery or host system power input).
2	*V <sub>CC</sub>	+5V Input for Display (all variations except 01524009167); <i>*+5V Output on 01524009167 only.</i>
3	V <sub>SS</sub>	Ground Return Termination Point.
4	D0/ROW_DATA	Data Input 0 on module data bus, (Row Data Input).
5	D1	Data Input 1 on module data bus.
6	D2	Data Input 2 on module data bus.
7	D3	Data Input 3 on module data bus.
8	D4	Data Input 4 on module data bus.
9	D5	Data Input 5 on module data bus.
10	D6	Data Input 6 on module data bus.
11	D7	Data Input 7 on module data bus.
12	EN_PWR	Enable Module Power; Turns display on/off; >1.4V to activate
13	ENABLE	When low (disabled), all voltage outputs to display are disabled.
14	RCLK/T_ERASE	Row Clock/Transparent Erase; Clocks data present on D0, (row data input, triggered at trailing edge). Also increases image contrast via transparent erase process.
15	PHASE	Phase or Framing; Controls polarity and frequency of waveform driving display
16	C_CLK	Column Clock; Clocks data present on 8-bit bus interface, (triggered at trailing edge).
17	LATCH	Latch; Presents column image data to the display. Also zeros the column data pointer, (triggered at trailing edge).
18	TEMP	Temperature Output from Display; Analog signal representing current display temperature.

**Display Interface Connector (J1) – 015373xx (Flex)**

Pin#	Symbol	Description
19	V <sub>DD</sub>	Power Source (+) Termination (battery or host system power input).
20	V <sub>CC</sub>	+5V Input for Display
17 & 18	V <sub>SS</sub>	Ground Return Termination Point.
16	D0/ROW_DATA	Data Input 0 on module data bus, (Row Data Input).
15	D1	Data Input 1 on module data bus.
14	D2	Data Input 2 on module data bus.
13	D3	Data Input 3 on module data bus.
12	D4	Data Input 4 on module data bus.
11	D5	Data Input 5 on module data bus.
10	D6	Data Input 6 on module data bus.
9	D7	Data Input 7 on module data bus.
7	EN_PWR	Enable Module Power; Turns display on/off; >2.2V to activate
6	ENABLE	When low (disabled), all voltage outputs to display are disabled.
5	RCLK/T_ERASE	Row Clock/Transparent Erase; Clocks data present on D0, (row data input, triggered at trailing edge). Also increases image contrast via transparent erase process.
4	PHASE	Phase or Framing; Controls polarity and frequency of waveform driving display
3	C_CLK	Column Clock; Clocks data present on 8-bit bus interface, (triggered at trailing edge).
2	LATCH	Latch; Presents column image data to the display. Also zeros the column data pointer, (triggered at trailing edge).
8	TEMP	Temperature Output from Display; Analog signal representing current display temperature.

\*Refer to Kent Displays, Inc. document # 25036 (128x32 interface Document) for additional information



**Controller:**

**Power Interface Connection: J6**

Pin #	Symbol	Description
1	+ Power	Positive power termination.
2	- Power (Return)	Negative power termination.

**Local Serial Communication Header Interface: J4**

Pin #	Symbol	Description
1	RX_DATA	Module receive- data input termination (RS-232).
2	Ground	Ground termination point
3	TX_DATA	Module transmit- data output termination

**Local On-Board Controls**

Symbol	Description
"RESET"	Controller reset button.
"TEST"	Controller diagnostic button for onboard test initiation.
"WAKE"	Module local wakeup button.
"LED"	Diagnostic LED output for onboard feedback.

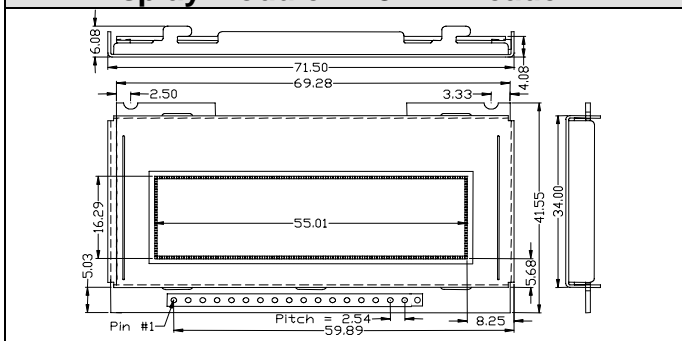
**Display Module Only (Customer Supplied Controller):**

**Display Module Interface Connection**

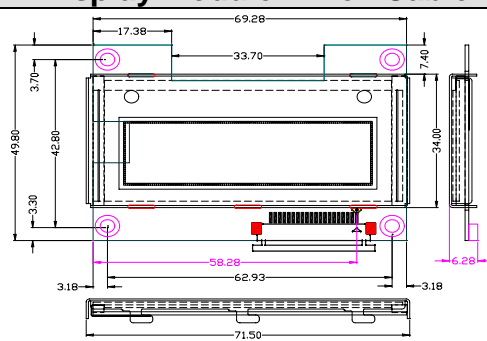
Pin #	Symbol	Description
1	+ Power	Positive power termination.
2	- Power (Return)	Negative power termination.

**Mechanical Dimensions:**

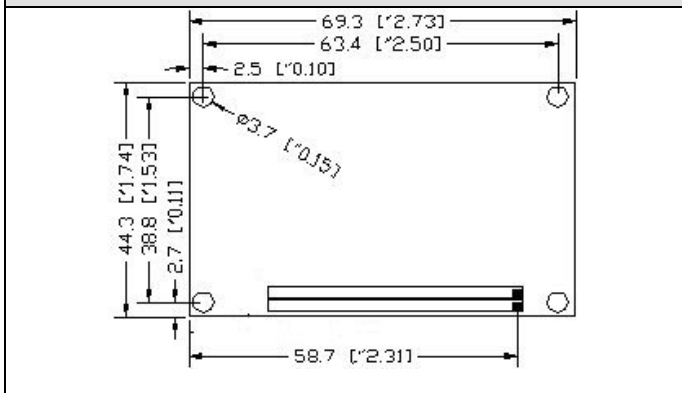
**Display Module – 18-Pin Header**



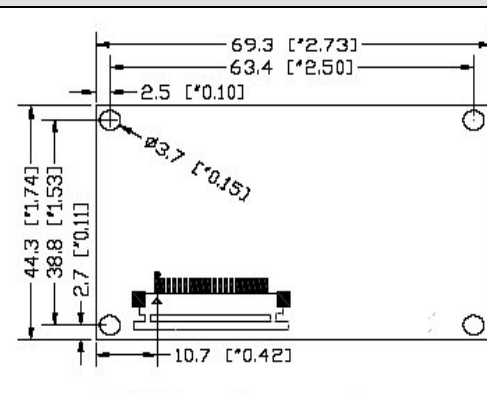
**Display Module – Flex Cable**



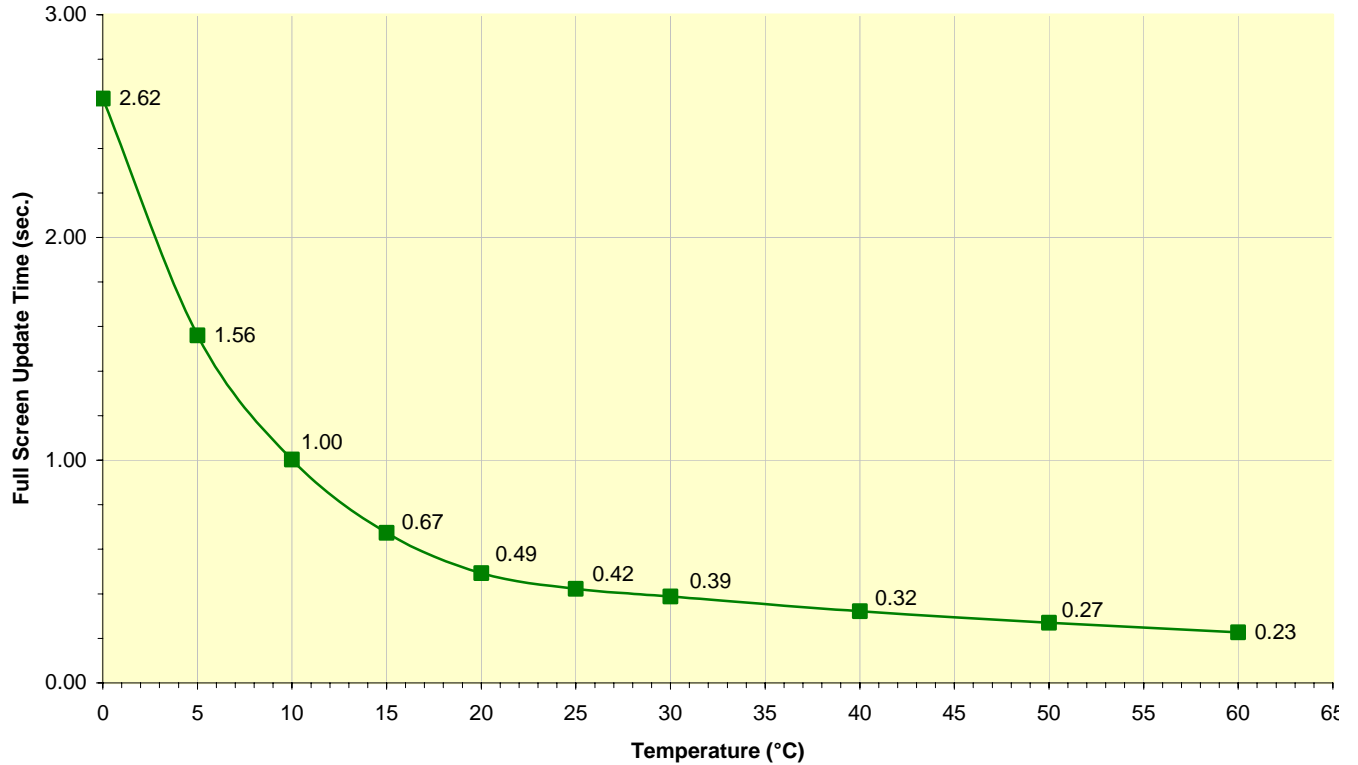
**Controller – 18-Pin Header**



**Controller – Flex Cable**



128x32 Module Total Update Time



The chart above illustrates the average full screen update times with respect to temperature for all color variants of the 128x32 display module. The update time is approximately 0.4 seconds at room temperature (23°C).

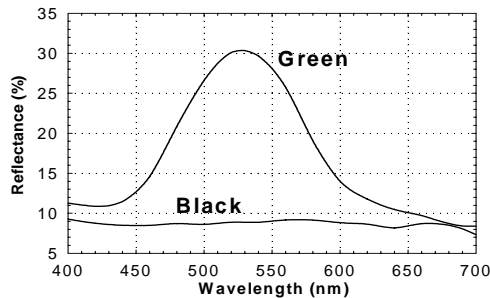
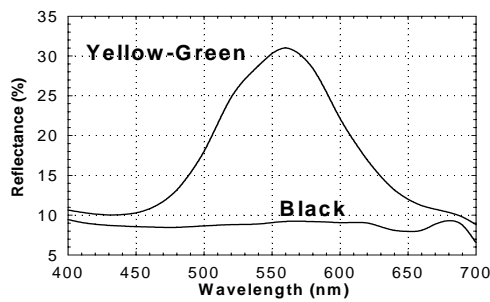
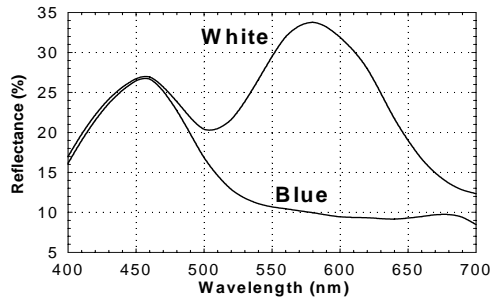
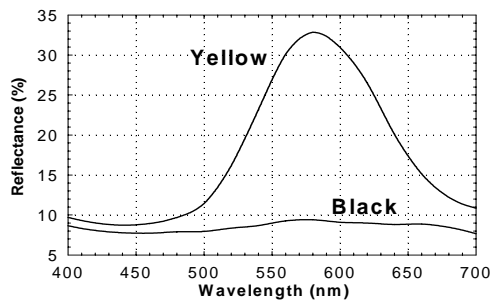
**FRONT COVER MATERIAL SELECTION:**

The following front cover requirements are necessary to insure image quality during the life of the 128x32 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.

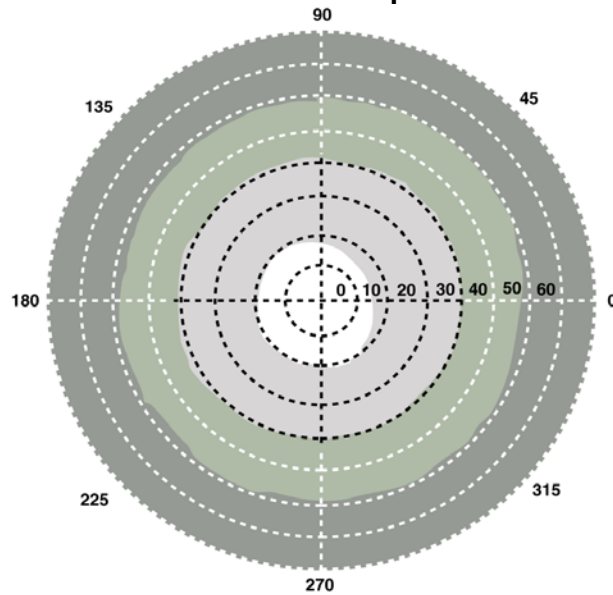
### Optical Characteristics for Standard Color Configurations



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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