



DISPLAY MODULE DATASHEET



Datasheet Release 2016-01-25
for
[CFAL5016A-Y](#)

Crystalfontz America, Incorporated

12412 East Saltese Avenue
Spokane Valley, WA 99216-0357

Phone: 888-206-9720

Fax: 509-892-1203

Email: support@crystalfontz.com

URL: www.crystalfontz.com



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GENERAL INFORMATION

Datasheet Revision History

Datasheet Release: 2016-01-25
Preliminary Datasheet was for a green OLED in this series. This datasheet replaces the incorrect datasheet. All specifications except those related to color have not changed.

Preliminary Datasheet Release: 2012-04-25
First datasheet for a new product, the CFAL5016A-Y display module.

Product Change Notifications

To check for Product Change Notifications for this display module, see the Product Notices tab on the product's web page:
<https://www.crystalfontz.com/product/cfal5016ay#pcn>.

Product pages without a Product Notices tab do not have Product Change Notifications.

About Variations

Slight variations (for example, contrast, color, or intensity) between lots are normal.

About Volatility

This display module has volatile memory.



The Fine Print

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DISPLAY MODULE DESCRIPTION

GENERAL SPECIFICATIONS

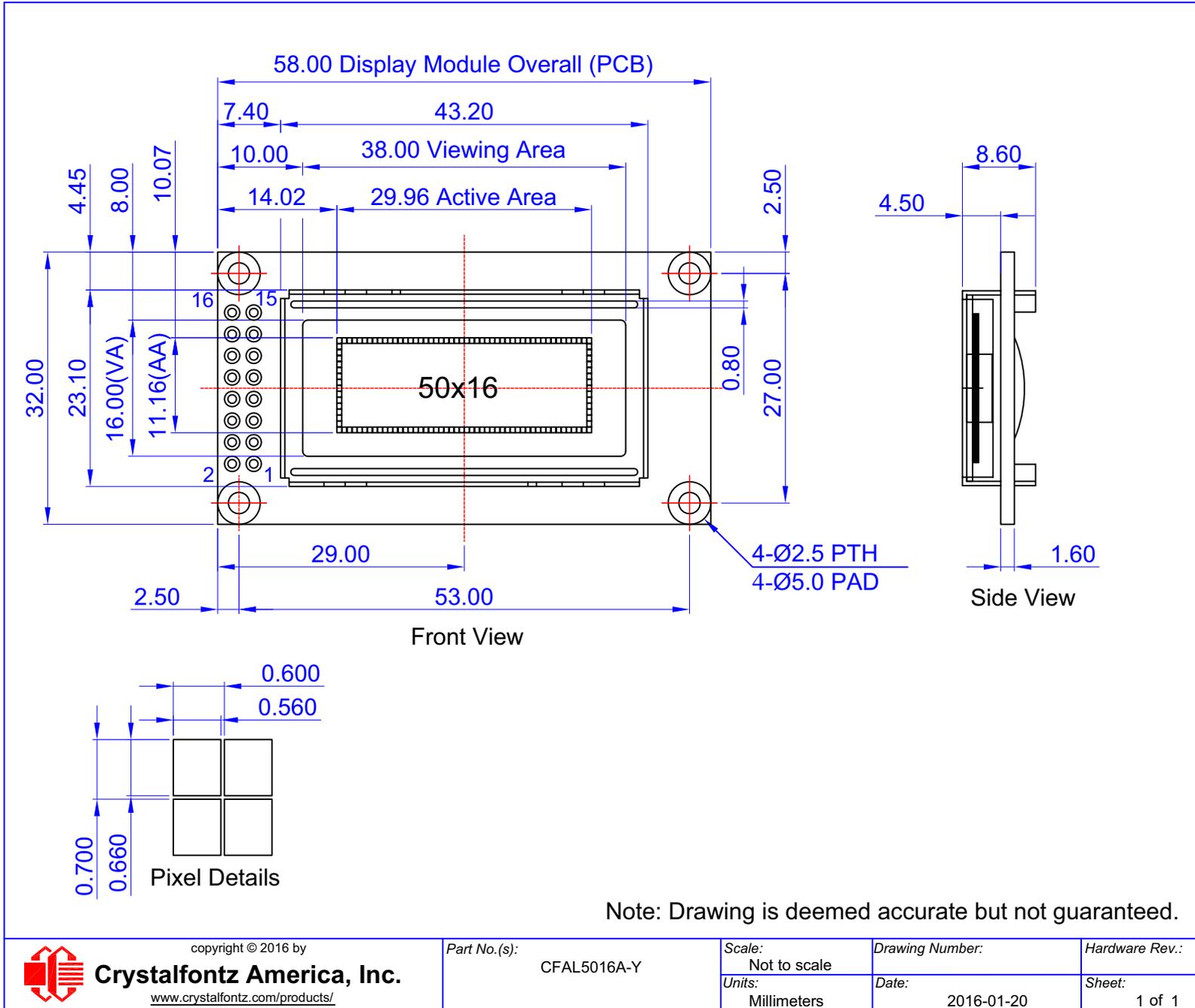
Item	Dimension	Unit
Dot Matrix	50*16 Dots	—
Module dimension	58.0 x 32.0 x 8.6	mm
View area	38.0 x 16.0	mm
Active area	29.96 x 11.16	mm
Dot size	0.56 x 0.66	mm
Dot pitch	0.60x 0.70	mm
Panel Type	OLED , Yellow	
Duty	1/16	

ADDITIONAL FEATURES

- Interface choices are 4-bit and 8-bit parallel, and 3-wire SPI.
- Sample code is available for download under the Datasheets & Files tab on the web page for [CFAL5016A-Y](#).
- The [Winstar Display WS0010 controller](#) interface is very similar to industry standard Hitachi HD44780.
- This display is RoHS compliant. Crystalfontz America Incorporated is ISO 9001:2008 certified.



DISPLAY MODULE OUTLINE DRAWING

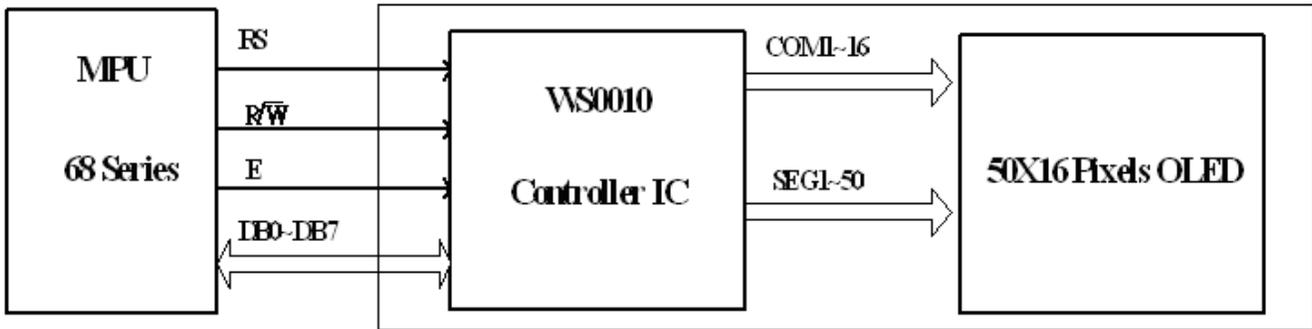


Note: Drawing is deemed accurate but not guaranteed.

<p>copyright © 2016 by Crystalfontz America, Inc. www.crystalfontz.com/products/</p>	Part No.(s): CFAL5016A-Y	Scale: Not to scale	Drawing Number:	Hardware Rev.:
		Units: Millimeters	Date: 2016-01-20	Sheet: 1 of 1



BLOCK DIAGRAM





ADDRESSING

Address Format	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
GXA(Graphic X-axis Address)	1	ADD6	ADD5	ADD4	ADD3	ADD2	ADD1	ADD0
GYA(Graphic Y-axis Address)	0	1	0	0	0	0	0	CGA0

CGA=1	CGA=0	
GXA=10000000 GYA=01000001	GXA=10000000 GYA=01000000	1
GXA=10000001 GYA=01000001	GXA=10000001 GYA=01000000	2
GXA=10000010 GYA=01000001	GXA=10000010 GYA=01000000	3
GXA=10000011 GYA=01000001	GXA=10000011 GYA=01000000	4
⋮	⋮	⋮
⋮	⋮	⋮
GXA=10101110 GYA=01000001	GXA=10101110 GYA=01000000	47
GXA=10101111 GYA=01000001	GXA=10101111 GYA=01000000	48
GXA=10110000 GYA=01000001	GXA=10110000 GYA=01000000	49
GXA=10110001 GYA=01000001	GXA=10110001 GYA=01000000	50



ELECTRICAL CHARACTERISTICS

ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min	Max	Unit	Notes
Operating Temperature	T _{OP}	-40	+80	°C	
Storage Temperature	T _{ST}	-40	+80	°C	
Supply Voltage For Logic	VDD-V _{SS}	-0.3	5.3	V	

RECOMMENDED DC CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage For Logic	VDD-VSS	—	4.8	5.0	5.3	V
Input High Volt.	V _{IH}	—	0.8 VDD	—	VDD	V
Input Low Volt.	V _{IL}	—	GND	—	0.2 VDD	V
Output High Volt.	V _{OH}	I _{OH} =-0.5mA	0.8 VDD	—	VDD	V
Output Low Volt.	V _{OL}	I _{OL} =0.5mA	GND	—	0.2 VDD	V
50% Check Board Operating Current	I _{DD}	VDD=5V	15	19	24	mA

Note: When you use 5V for Vdd please don't use 3V or 3.3V for logic I/O this will cause module does not work.

ESD (ELECTRO-STATIC DISCHARGE)

The circuitry is industry standard CMOS logic and is susceptible to ESD damage. Please use industry standard anti-static precautions as you would for any other static sensitive devices such as expansion cards, motherboards, or integrated circuits. Ground your body, work surfaces, and equipment.

OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	(V) θ		160			deg
	(H) ϕ		160			deg
Contrast Ratio	CR	Dark	2000:1		—	—
Response Time	T rise	—		10		μ s
	T fall	—		10		μ s
Display with 50% check Board Brightness			100	120		cd/m ²
CIEx(Yellow)		(CIE1931)	0.45	0.47	0.49	
CIEy(Yellow)		(CIE1931)	0.48	0.50	0.52	

Changes in voltage can result in changes in contrast.

INTERFACE DETAILS

ABOUT INTERFACE TYPES

- I want to display video. Which interface is faster, SPI or parallel?
The SPI interface is a clocked interface. Each command or data bit is clocked. With the 8-bit parallel interface, you are able to pass 8 bits of command or data at a time. Using the same controller at the same clock speed, the parallel interface will always be faster.
- What if I need RS-232 serial interface?
Three-wire or four-wire SPI interface is not RS-232 but does not require the control lines that the 8-bit interface does.
- Using the 4-bit parallel or SPI interface, what should be done with pins?
Leave unused pins floating (no connection). See Pin Description table immediately below.

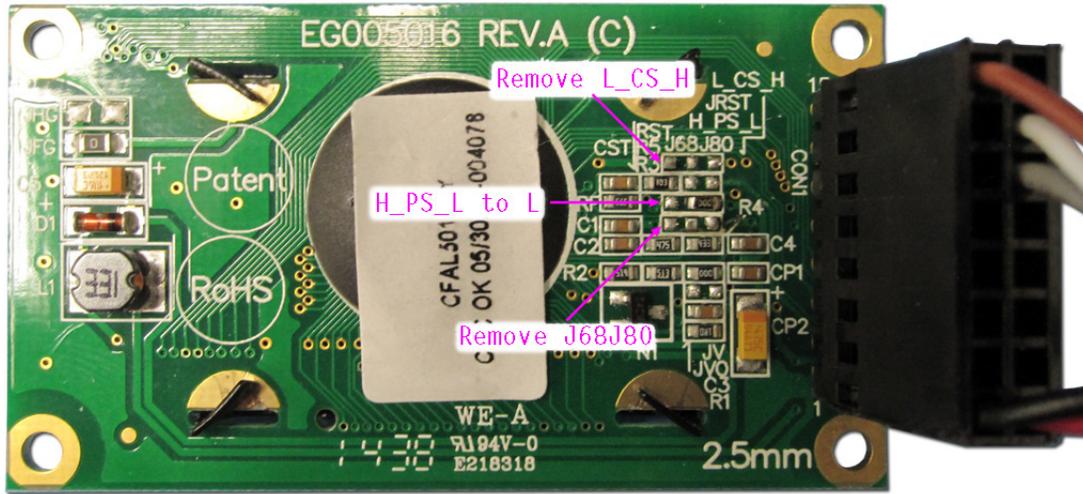


PIN DESCRIPTIONS

PIN	SIGNAL (for Parallel)	LEVEL	DESCRIPTION
1	V _{SS}	0v	Ground
2	V _{DD}	5.0v	Supply voltage for logic
3	NC		No connection
4	RS	H/L	Parallel <i>High</i> : Data <i>Low</i> : Instruction code SPI : No connection
5	R \bar{W}	H/L	Parallel Host interface input. <i>High</i> : Read (Module→Host) <i>Low</i> : Write (Host→Module) SPI : No connection
6	E	H, H→L	Parallel : Chip enable signal SPI : No connection
7-11	DB0-DB4	H/L	Parallel : Data bit 0-4 SPI : No connection
12	DB5	H/L	Parallel : Data bit 5 SPI : SCK
13	DB6	H/L	Parallel : Data bit 6 SPI : MISO
14	DB7	H/L	Parallel : Data bit 7 SPI : MOSI
15			Parallel : No connection SPI : SS
16			No connection



MODIFY PCB COMPONENTS FOR SPI



DRIVER LIBRARIES AND SAMPLE CODE

SOURCES FOR DRIVER LIBRARIES

Driver libraries may save you a lot of time and help you develop a more professional product. Possible library sources are [easyGUI](#), [RAMTEX](#), [Micrium](#), and [Segger](#).

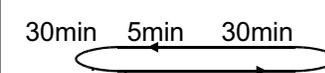
SAMPLE CODE

Sample code for 4-bit and 8-bit parallel plus for SPI interface is available for download under the *Datasheets & Files* tab web page for [CFAL5016A-Y](#).



PRODUCT RELIABILITY AND LONGEVITY

DISPLAY MODULE RELIABILITY TEST RESULTS

Environmental Test			
Test Item	Content of Test	Test Condition	Applicable Standard
High Temperature storage	Endurance test applying the high storage temperature for a long time.	80°C 240hrs	—
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-40°C 240hrs	—
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	80°C 240hrs	—
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-40°C 240hrs	—
High Temperature/Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time.	60°C,90%RH 240hrs	—
Temperature Cycle	Endurance test applying the low and high temperature cycle. -40°C 25°C 80°C 	-40°C/80°C 100 cycles	—
Mechanical Test			
Vibration test	Endurance test applying the vibration during transportation and using.	10~22Hz→1.5mmp-p 22~500Hz→1.5G Total 0.5hr	—
Shock test	Constructional and mechanical endurance test applying the shock during transportation.	50G Half sin wave 11 ms 3 times of each direction	—
Atmospheric pressure test	Endurance test applying the atmospheric pressure during transportation by air.	115mbar 40hrs	—
Others			
Static electricity test	Endurance test applying the electric stress to the terminal.	VS=800V,RS=1.5kΩ CS=100pF 1 time	—

*** Supply voltage for OLED system =Operating voltage at 25°C



Test and measurement conditions

1. All measurements shall not be started until the specimens attain to temperature stability. After the completion of the described reliability test, the samples were left at room temperature for 2 hrs prior to conducting the failure test at 23±5°C; 55±15% RH.
2. All-pixels-on is used as operation test pattern.
3. The degradation of Polarizer are ignored for High Temperature storage, High Temperature/ Humidity Storage, Temperature Cycle

Evaluation criteria

1. The function test is OK.
2. No observable defects.
3. Luminance: > 50% of initial value.
4. Current consumption: within ± 50% of initial value.

APPENDIX:

RESIDUE IMAGE

Because the pixels are lighted in different time, the luminance of active pixels may reduce or differ from inactive pixels. Therefore, the residue image will occur. To avoid the residue image, every pixel needs to be lighted up uniformly.

DISPLAY MODULE RELIABILITY

PART NUMBER	SPECIFICATION
CFAL5016A-Y	Brightness will be >50% of a new display module's initial brightness for at least 50,000 hours of operation when supply to each at recommended Recommended DC Characteristics (Pg. 8) .
<i>Under operating and storage temperature specification limitations, humidity non-condensing) RH up to 65%, and no exposure to direct sunlight. Value listed above is approximate and represents typical lifetime.</i>	

DISPLAY MODULE LONGEVITY (EOL / REPLACEMENT POLICY)

Crystalfontz is committed to making all of our display modules available for as long as possible. Occasionally, a supplier discontinues a component, or a process used to make the module becomes obsolete, or the process moves to a more modern manufacturing line. In order to continue making the module, we will do our best to find an acceptable replacement part or process which will make the “replacement” fit, form, and function compatible with its predecessor.

We recognize that discontinuing a display module may cause problems for some customers. However, rapidly changing technologies, component availability, or low customer order levels may force us to discontinue (“End of Life”, EOL) a module. For example, we must occasionally discontinue a module when a supplier discontinues a component or a manufacturing process becomes obsolete. When we discontinue a module, we will do our best to find an acceptable replacement module with the same fit, form, and function.

In most situations, you will not notice a difference when comparing a “fit, form, and function” replacement display module to the discontinued module it replaces. However, sometimes a change in component or process for the replacement module results in a slight variation, perhaps an improvement, over the previous design.

Although the replacement display module is still within the stated datasheet specifications and tolerances of the discontinued module, changes may require modification to your circuit and/or firmware. Possible changes include:



- *Controller.* A new controller may require minor changes in your code.
- *Component tolerances.* Display module components have manufacturing tolerances. In extreme cases, the tolerance stack can change the visual or operating characteristics.

Please understand that we avoid changing a display module whenever possible; we only discontinue a module if we have no other option. We publish Part Change Notices (PCN) as soon as possible.

CARE AND HANDLING PRECAUTIONS

For optimum operation of the display module and to prolong its life, please follow the precautions below.

Excessive voltage will shorten the life of the display module. You must drive the display module within the specified voltage limit. See [Absolute Maximum Ratings \(Pg. 8\)](#).

HANDLING CAUTION FOR DISPLAY MODULES SHIPPED IN TRAYS

If you receive display modules packed in trays, handle trays carefully by supporting the entire tray. Trays were made to immobilize the display modules inside their packing carton. Trays are not designed to be rigid. Do not carry trays by their edges; trays and display modules may be damaged.

ESD (ELECTRO-STATIC DISCHARGE)

The circuitry is industry standard CMOS logic and is susceptible to ESD damage. Please use industry standard anti-static precautions as you would for any other static sensitive devices such as expansion cards, motherboards, or integrated circuits. Ground your body, work surfaces, and equipment.

DESIGN AND MOUNTING

- The controller/driver maintains its internal operating modes until something happens to change it. Excessive external noise can change these internal modes. In your packaging and system design, suppress or prevent the noise from influencing the controller. Also, refresh the operating modes periodically to prevent the effects of unanticipated noise.
- The exposed surface of the “glass” is actually a polarizer laminated on top of the glass. To protect the soft plastic polarizer from damage, the display module ships with a protective film over the polarizer. Please peel off the protective film slowly. Peeling off the protective film abruptly may generate static electricity.
- The polarizer is made out of soft plastic and is easily scratched or damaged. When handling the display module, avoid touching the polarizer. Finger oils are difficult to remove.
- To protect the soft plastic polarizer from damage, place a transparent plate (for example, acrylic, polycarbonate, or glass) in front of the display module, leaving a small gap between the plate and the display surface. We use Lexan, which is readily available and works well.
- Do not disassemble or modify the display module.
- The display module can be mounted vertically onto a front panel using a variety of methods. If the enclosure is plastic, it can be molded to have the display module snap into place. A metal enclosure can use a milled faceplate with mounting tabs to secure the display module. Adhesives can be used, as long as they are not similar to “super-glue” because these emit vapors that can damage the display module over time.
- Do not reverse polarity to the power supply connections. Reversing polarity will immediately ruin the display module.



- Use care to keep the exposed terminals clean. Contamination, including fingerprints may make soldering difficult, and the reliability of the soldered connection poor.

AVOID SHOCK, IMPACT, TORQUE, OR TENSION

- Do not expose the display module to strong mechanical shock, impact, torque, or tension.
- Do not drop, toss, bend, or twist the display module.
- Do not place weight or pressure on the display module.

CAUTION

All electronics may contain harmful substances. Avoid contamination by using care to avoid damage during handling. If any residues, gases, powders, liquids, or broken fragments come in contact with your skin, eyes, mouth, or lungs, immediately contact your local poison control or emergency medical center.

HOW TO CLEAN

1. Turn display module off.
2. Use the removable protective film to remove smudges (for example, fingerprints) and any foreign matter. If you no longer have the protective film, use standard transparent office tape (for example, Scotch® brand “Crystal Clear Tape”).
3. If the polarizer is dusty, you may carefully blow it off with clean, dry, oil-free compressed air.
4. If you must clean with a liquid, never use glass cleaners, as they may contain ammonia or alcohol that will damage the polarizer over time. Never apply liquids directly on the polarizer. Long contact with moisture may permanently spot or stain the polarizer. Use filtered water to slightly moisten a clean lint-free microfiber cloth designed for cleaning optics. (For example, use a cloth sold for cleaning plastic eyeglasses.)
5. The plastic is easily scratched or damaged. Use a light touch as you clean the polarizer. Wipe gently.
6. Use a dry microfiber cloth to remove any trace of moisture before turning on the TFT.
7. Gently wash the microfiber cloths in warm, soapy water and air dry before reuse.

OPERATION

- We do not recommend connecting this display module to a PC's parallel port as an end product. This display module is not “user friendly” and connecting it to a PC's parallel port is often difficult, frustrating, and can result in a “dead” display module due to mishandling. For more information, see our forum thread at <http://www.crystalfontz.com/forum/showthread.php?s=&threadid=3257>.
- Your circuit should be designed to protect the display module from ESD and power supply transients.
- Changes in voltage can result in changes in contrast.
- Observe the operating temperature limitations, non-condensing with minimal fluctuations. Operation outside of these limits may shorten life and/or harm the display module. Changes in temperature can result in changes in contrast.
 - At lower temperatures of this range, response time is delayed.
 - At higher temperatures of this range, display becomes dark. (You may need to adjust the contrast.)
- Operate away from dust, moisture, and direct sunlight.

STORAGE AND RECYCLING

- Store in an ESD-approved container away from dust, moisture, and direct sunlight, fluorescent lamps, or any strong ultraviolet radiation.



- Observe the storage temperature limitations with minimal fluctuations. Rapid temperature changes can cause moisture to form, resulting in permanent damage.
- Do not allow weight to be placed on the display modules while they are in storage.
- Please recycle your outdated CrystalFontz display modules at an approved facility.



QUALITY ASSURANCE STANDARDS

INSPECTION CONDITIONS

- Environment
 - Temperature: 25±5°C
 - Humidity: 30~85% RH (non-condensing)
- For visual inspection of active display area
 - Source lighting: two 20-Watt or one 40-Watt fluorescent light
 - Display adjusted for best contrast
 - Viewing distance: 30±5 cm (about 12 inches)
 - Viewing angle: inspect at 45° angle of vertical line right and left, top and bottom

COLOR DEFINITIONS

We try to describe the appearance of our modules as accurately as possible. For the photos, we adjust for optimal appearance. Actual display appearance may vary due to (1) different operating conditions, (2) small variations of component tolerances, (3) inaccuracies of our camera, (4) color interpretation of the photos on your monitor, and/or (5) personal differences in the perception of color.

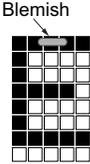
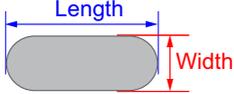
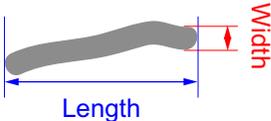
DEFECTS CLASSIFICATION

Defects are defined as:

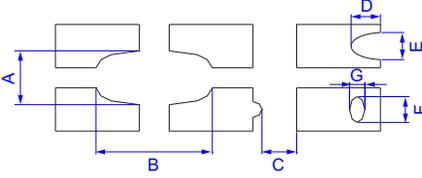
- Major Defect: results in failure or substantially reduces usability of unit for its intended purpose.
- Minor Defect: deviates from standards but is not likely to reduce usability for its intended purpose.



ACCEPTANCE STANDARDS

#	DEFECT TYPE	ACCEPTANCE STANDARDS CRITERIA			MAJOR/ MINOR	
1	Electrical defects	1. No display, display malfunctions, or shorted segments. 2. Current consumption exceeds specifications.			Major	
2	Viewing area defect	Viewing area does not meet specifications).			Major	
3	Contrast adjustment defect	Contrast adjustment fails or malfunctions.			Major	
4	Blemishes or foreign matter on display segments		<i>Defect Size (mm)</i>	<i>Acceptable Qty</i>	Minor	
			≤0.3	3		
			≤2 defects within 10 mm of each other			
5	Other blemishes or foreign matter outside of display segments	Defect size = (A + B)/2 	<i>Defect Size (mm)</i>	<i>Acceptable Qty</i>	Minor	
			≤0.15	Ignore		
			0.15 to 0.20	3		
			0.20 to 0.25	2		
			0.25 to 0.30	1		
6	Dark lines or scratches in display area		<i>Defect Width (mm)</i>	<i>Defect Length (mm)</i>	<i>Acceptable Qty</i>	Minor
			≤0.03	≤3.0	3	
			0.03 to 0.05	≤2.0	2	
			0.05 to 0.08	≤2.0	1	
			0.08 to 0.10	≤3.0	0	
			≥0.10	>3.0	0	
7	Bubbles between polarizer film and glass		<i>Defect Size (mm)</i>	<i>Acceptable Qty</i>	Minor	
			≤0.20	Ignore		
			0.20 to 0.40	3		
			0.40 to 0.60	2		
			≥0.60	0		



#	DEFECT TYPE	ACCEPTANCE STANDARDS CRITERIA (Continued)	MAJOR / MINOR								
8	Display pattern defect	 <table border="1"> <thead> <tr> <th>Dot Size (mm)</th> <th>Acceptable Qty</th> </tr> </thead> <tbody> <tr> <td>$((A+B)/2) \leq 0.2$</td> <td rowspan="5"> ≤ 3 total defects ≤ 2 pinholes per digit </td> </tr> <tr> <td>$C > 0$</td> </tr> <tr> <td>$((D+E)/2) \leq 0.25$</td> </tr> <tr> <td>$((F+G)/2) \leq 0.25$</td> </tr> <tr> <td></td> </tr> </tbody> </table>	Dot Size (mm)	Acceptable Qty	$((A+B)/2) \leq 0.2$	≤ 3 total defects ≤ 2 pinholes per digit	$C > 0$	$((D+E)/2) \leq 0.25$	$((F+G)/2) \leq 0.25$		Minor
Dot Size (mm)	Acceptable Qty										
$((A+B)/2) \leq 0.2$	≤ 3 total defects ≤ 2 pinholes per digit										
$C > 0$											
$((D+E)/2) \leq 0.25$											
$((F+G)/2) \leq 0.25$											
9	Backlight defects	<ol style="list-style-type: none"> 1. Light fails or flickers.* 2. Color and luminance do not correspond to specifications.* 3. Exceeds standards for display's blemishes or foreign matter (see test 5, Pg. 18), and dark lines or scratches (see test 6, Pg. 18). <p><i>*Minor if display functions correctly. Major if the display fails.</i></p>	Minor								
10	COB defects	<ol style="list-style-type: none"> 1. Pinholes > 0.2 mm. 2. Seal surface has pinholes through to the IC. 3. More than 3 locations of sealant beyond 2 mm of the sealed areas. 	Minor								
11	PCB defects	<ol style="list-style-type: none"> 1. Oxidation or contamination on connectors.* 2. Wrong parts, missing parts, or parts not in specification.* 3. Jumpers set incorrectly. 4. Solder (if any) on bezel, LED pad, zebra pad, or screw hole pad is not smooth. <p><i>*Minor if display functions correctly. Major if the display fails.</i></p>	Minor								
12	Soldering defects	<ol style="list-style-type: none"> 1. Unmelted solder paste. 2. Cold solder joints, missing solder connections, or oxidation.* 3. Solder bridges causing short circuits.* 4. Solder balls. <p><i>*Minor if display functions correctly. Major if the display fails.</i></p>	Minor								