Introduction

The HB-17”-800 is a 17" high efficiency sunlight readable LCD module. The module uses the AU M170EG02 TFT color LCD glass and a New super-bright very high brightness backlight.

At the maximum backlight power of 55 Watts, the HB-17”-800module delivers a LCD screen brightness of 800 cd/m^2 (nits). At this brightness level, the display is highly readable under direct sunlight. With a wide dimming range inverter such as New Maxbright MH-N12, the screen brightness can be adjusted down to about 7 cd/m^2. In coupled with the wide viewing angle and wide color gamut, the HB-17”-800LCD module provides a superb image quality at SXGA(1280 x 1024) resolution under ambient conditions ranging from full sunlight to total darkness.

Characteristics

Parameters	Typical Value	Units	Conditions
LCD Screen Luminance	800	cd/m^2	White (LCD in OFF state)
Luminance Uniformity	20% or better		Note 3
Backlight Power Consumption	55	Watts	Excluding inverter losses
Screen Dimming Ratio	200:1		With BI220A inverter
Typical LCD Contrast Ratio	500:1		White vs. Black (measured in the dark at the normal direction)
Typical Viewing Angles			
3:00 to 9:00 direction	± 70	Degrees	Contrast ratio ⩾10
6:00 to 12:00 direction	± 70	Degrees	Contrast ratio ⩾10
3:00 to 9:00 direction	± 60	Degrees	Contrast ratio ⩾10
6:00 to 12:00 direction	± 70	Degrees	Contrast ratio ⩾10
LCD Screen Chromaticity			
White	(0.339, 0.362)		Note 4
Red	(0.651, 0.336)		Note 4
Green	(0.277, 0.614)		Note 4
Blue	(0.141, 0.079)		Note 4
LCD Module Weight	1400(A/B)	Grams	
LCD Module Dimensions	See P.7		
Operating Temperature	-20 to 55	Degrees	
Storage Temperature	-20 to 60	Degrees	

Note 1: Please refer to the AU M170EG02 data sheets for detailed LCD electrical specifications and general precautions .

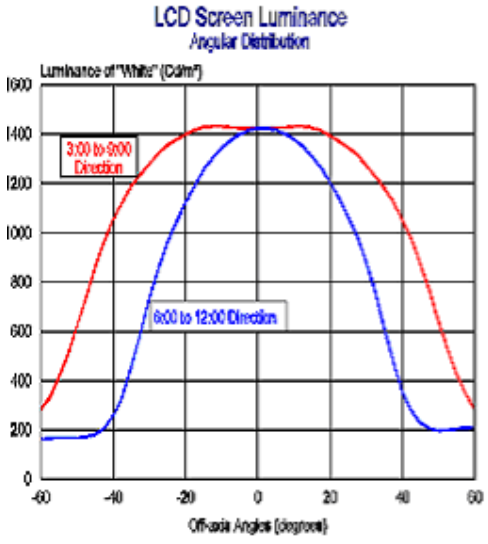
Note 2: All data is measured at 25^{o}C ± 2^{o}C ambient temperature.

Note 3: Uniformity = (Lmax - Lmin) / (Lmax + Lmin) where Lmax (Lmin) is the maximum (minimum) luminance measured with a 10 mm diameter meter aperture over the LCD active area except the last 10 mm area from the edges.

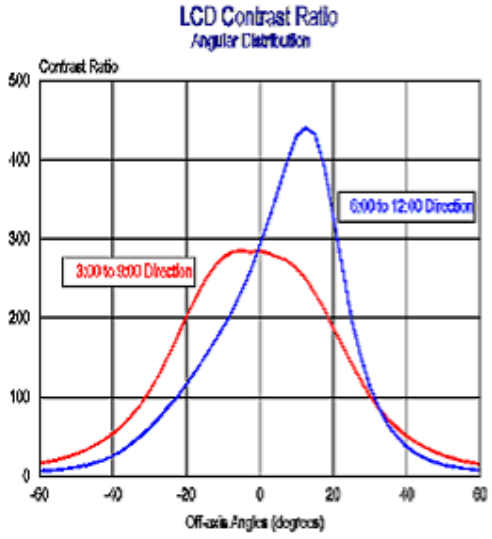
Note 4: Measured at the direction normal (perpendicular) to the LCD

LCD Module Optical Performances

The typical screen luminance and contrast ratio for the HB-17”-800sunlight readable LCD module are shown in the figures below:



The LCD screen luminance is measured with the LCD in the “Off” state (i.e. the pixels are not energized). This is the “White” state with maximum luminance. Very often, this “Off” state is brighter than the “White” color displayed on the screen when the video signal is on. This difference may be caused by the graphic card and/or the controller card driving the display. When the LCD is properly driven, the difference between the “Off” state and the “White” color displayed on the screen should be less than 10%.



The inherent contrast ratio (CR) of the LCD is the luminance ratio between the “White” and the “Black” states measured in a darkroom. In outdoor environments, the contrast ratio of the display drops significantly due to the reflections and glare caused by ambient illumination at the front surface of the LCD and other layers, such as a touch screen or a protective window.

Backlight Lamp Connections

The very high brightness backlight in HB-17”-800 module utilizes a total of 12 CCFLs to

achieve the required luminance. The lamps are electrically connected in two separate groups.

Group1 Connectors		Group2 Connectors	
Group1A	To	Group2A	To
1	Lamp#1	1	Lamp#7
2	Lamp#2	2	Lamp#8
3	COMMON	3	COMMON
Group1B		Group2B	
1	Lamp#3	1	Lamp#9
2	Lamp#4	2	Lamp#10
Group1C		Group2C	
1	Lamp#5	1	Lamp#11
2	Lamp#6	2	Lamp#12

Group 1 contains lamps #1, #2, #3, #4, #5 and #6 and group 2 contains lamps #7, #8, #9, #10, #11, and #12. The lamps are oriented in the horizontal direction with the #1 lamp at the top side of the LCD. The lead wires connecting the lamps are terminated with two Molex connectors. The figure on the left shows the connector pin out assignments.

Back light Lamp Driving Specifications

It is recommended that an inverter with a 1,300 Vrms starting voltage be used to run the very high brightness backlight on the HB-17”-800module. The lamp voltage and current at full LCD screen brightness are listed below:

Operating Voltage	580	Vrms
Lamp Current	5.8	mArms

At this driving condition, the backlight delivers a LCD Screen brightness of 800 cd/m^2 with a power consumption about 55 Watts. Since most inverters have an efficiency between 75 - 80%, the total DC power input to the inverter is about 68 to 73 Watts. When the backlight is dimmed down, the power consumption decreases.

It is quite difficult to measure the lamp current accurately. As a result, if you intend to run the HB-17”-800very high brightness backlight with your own inverter, please measure the screen brightness instead. Turn on the inverter to operate the backlight without powering up the LCD. Make sure that the room temperature is about 25 °C and run the backlight for at least 30 minutes before measuring the screen brightness. If the measured screen brightness exceeds the specified value by a significant margin, for example more than 15%, the lamps are over-driven. Over-driving the lamps can cause a significant reduction in backlight life.

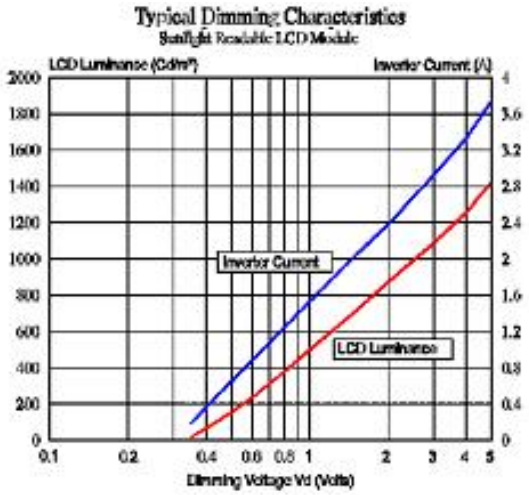
The New Maxbright MH-N12 are inverters specifically tuned for driving the very high brightness backlight in all 17" sunlight readable LCD modules. The inverter has a PWM (pulse width modulation) dimming circuit that provides a 200:1 dimming ratio (i.e. screen luminance adjustable from 800 to about 7 nits).

Operating the Backlight with MH-N12A Inverters

The New Maxbright MH-N12 is specially tuned to operate the high brightness backlight in all 17" sunlight readable LCD modules. The inverter has an on-board pulse width modulation (PWM) dimming circuit to provide an extremely wide range of luminance adjustments. Over the entire dimming range, there is no noticeable lamp flickering and the uniformity of the backlight is well maintained.

MH-N12 inverters operate at a 12V DC input. The nominal lamp starting voltage is 1,300 Vrms. It also has a regulated +5V output which serves as a voltage source for the dimming control circuit.

The figure on the right shows the typical LCD screen luminance as a function of the dimming voltage (Vd) input. The dimming characteristics are quite linear with the Vd scale in logarithm. Thus, in order to achieve a nearly linear luminance control, a logarithmic dimming voltage generation circuit should be used.



Thermal Management

This high brightness backlight consumes a significant amount of power and as a result, the LCD temperature of a sunlight readable module will be higher than normal. In addition, the front surface of an LCD is a good sunlight absorber. Placing an LCD under strong direct sunlight can cause a significant temperature rise even without the extra heating from the backlight power.

The exact amount of temperature rise due to these two factors depends on how the LCD module is mounted and also depends on the heat dissipation design. For example, if the LCD is mounted vertically, a significant portion of the high brightness backlight heat will be dissipated into the air without heating up the LCD panel, and as a result, the LCD temperature rising will be low. On the other hand, if the LCD module is mounted horizontally,

then almost all of the backlight heat rises to warm the LCD panel. However, if a small fan or a heat sink is mounted onto the high brightness backlight, the temperature rise of the LCD panel can be reduced significantly.

With the HB-17”-800module operating at its maximum brightness, the LCD temperature rise due to the high brightness backlight is about 15 to 20 ^{o}C. On the other hand, the absorption of direct sunlight, in the extreme cases, can heat up the LCD by more than 40 ^{o}C! As a result, it is recommended that the LCD temperature be measured at full display brightness in your equipment under actual operating environments (for example, on a summer day with full sunshine). The cooling solution should then be designed accordingly. Please refer to the AU M170EN05 LCD data sheet for thermal specifications. Make sure that the specified maximum LCD temperature is not exceeded.

If the thermal issue becomes difficult to resolve, New Maxbright recommends a “de-rated lamp current mode” operation. By limiting the lamp current to, for example, 50% of its full level, the power consumption of the backlight is reduced to about 22.5 Watts. Consequently, the thermal issue may be relaxed. In the meantime, the LCD screen luminance reduces to 400 nits that may be adequate for most applications. Please refer to Technical Note for further details.

Backlight Life

The half brightness life of the very high brightness backlight attached to the HB-17”-800sunlight readable LCD module is rated at 30,000 hours. The half brightness life is the number of operating hours before the backlight luminance (so as the LCD luminance) drops down to 50% of its initial value.

For a well made backlight, its life is mainly determined by the lamp life. Lamp life depends strongly on the lamp current. The recommended lamp current for full LCD screen luminance is 5.8 mArms. At this level, the half brightness life of the lamps is rated at 30,000 hours.

In actual applications, a very bright sunlight readable display will most likely be dimmed down during dusk and at night. For example, if the screen brightness of the LCD module is dimmed down to half of its full level, the lamp current decreases to 2.9 mA and the lamp life increases to about 65,000 hours. Therefore, the actual operating lifetime of the very high brightness backlight in an HB-17”-800LCD module is expected to exceed 30,000 hours under most practical situations. For more detailed information on backlight life issues and actual test data on Maxbright backlights, please refer to Technical Note MBT0801.

The “de-rated lamp current mode” operation recommended to alleviate the thermal management issue has the extra benefit of resulting in a longer backlight life. By limiting the

backlight luminance to, for example, 2/3 of its full level, the maximum lamp current is reduced to about 3.8 mA and the backlight life is extended to about 40,000 hours.

Disclaimer

New Maxbright reserves the right to make changes to this document and the product that it describes without notice. In addition, New Maxbright shall not be liable for technical or editorial errors or omissions made herein; nor for incidental or consequential damages resulting from the furnishing, performance, or use of this product. New Maxbright takes no responsibility for damage caused by improper use of this product that does not meet the conditions for use specified in this specification sheet.

Mechanical Specifications