

Introduction

BI218 is a CCFL inverter which operates the VHB backlights with 8 CCFLs in Landmark 10.4" and 12.1" sunlight readable LCD modules. The inverter has an on-board pulse width modulation (PWM) dimming circuit to provide an extremely wide luminance adjustment range. Over the entire dimming range, there is no noticeable lamp flickering and the uniformity of the backlight is well maintained.

The BI218 inverter has the same dimensions and mounting hole locations as the BI200A. It operates at a 12V DC input and can drive up to 8 CCFLs for a maximum lamp power of 23 Watts. In addition, the inverter has a regulated +5V output which serves as a voltage source for the dimming control circuits, including the DP064 digital potentiometer used to control the screen brightness with a set of push buttons. .

Absolute Maximum Rating

Parameters	Min.	Max.	Units
Inverter Input Voltage (V_{in})	11.0	13.0	Vdc
Operating Temperature Range	0	50	°C
Storage Temperature Range	-20	80	°C

Electrical Characteristics

Parameters	Min.	Typ.	Max.	Units	Conditions
Input Voltage (Vin)	11.5	12	12.5	Vdc	Vin = 12V, Vd = 5V (After 15 minute warm up)
Input Current (I)					
With 10.4" LCD Modules		1.8		Adc	
With 12.1" LCD Modules		2.0		Adc	
Lamp Starting Voltage (Vst)		1,500		Vrms	
Frequency (f)	49	51	53	KHz	
ON/OFF Control					
OFF		0	0.2	Vdc	
ON	4.8	5		Vdc	
Dimming Voltage (Vd)					
Maximum Brightness	4.9	5		Vdc	PWM duty cycle = 100%
Zero Brightness	0.54	0.56	0.58	Vdc	PWM duty cycle = 0%
+5V Output (+5VOUT)	4.85	5	5.25	Vdc	11.5 < Vin < 12.5V
+5V Output Source Current			5	mA	

Connector Pin Assignments

Input Connector CN1	Molex 22-23-2071	Output Connectors CN2 & CN3	Molex 22-23-2111
Pin #	Function	Pin #	Function
1	+5 V Output	3, 5, 7, 9	Lamp Connections
2	+12 V Input	11	Lamp Commons
3	+12 V Input	1, 2, 4, 6, 8, 10	No Connection
4	Dimming Control	Mating Connectors	
5	Ground	Housing for CN1	Molex 22-01-3077
6.	Ground	Housing for CN2, CN3	Molex 22-01-3117
7	On/Off Control	Pins for CN1, CN2, CN3	Molex 08-50-0114

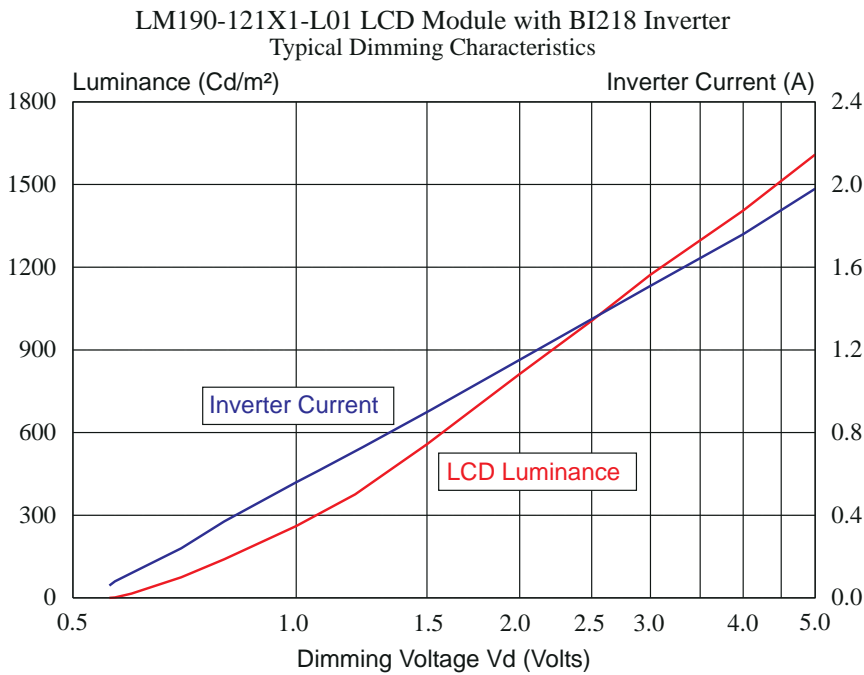
Accessories

- LC07 Inverter input connector (Molex) assembly with 8" long wires.
- DP064 64-level Digital Potentiometer for dimming control with a pair of push buttons.
- PS200 Photosensor for automatic dimming control based on ambient light levels.

Typical Dimming Characteristics

The BI218 inverter uses a voltage from 0.56 to 5V to control a pulse width modulation (PWM) dimming circuit for luminance adjustment. As the dimming voltage (V_d) decreases from 5V, the lamp current waveform is pulse width modulated, and the duty cycle of the PWM waveform reduces from 100% to 0% as the dimming voltage V_d value reduces to 0.56V. In the meantime, both the backlight luminance and the inverter current drop down roughly in proportion to the duty cycle of the PWM waveform. When the duty cycle reaches 0%, the backlight is turned off and the LCD screen is totally dark.

Typical dimming characteristics of a Landmark sunlight readable LCD module are shown in Fig. 2. The LCD luminance and the inverter current vary almost linearly if V_d is plotted in log scale. Thus, it is recommended that a logarithmic dimming voltage generating circuit be used to create a nearly linear luminance adjustment.



In order to fully utilize the available dimming range without turning the LCD totally dark, the minimum dimming voltage (V_d) should be set slightly above 0.56V and then adjusted to 5.0V for maximum brightness. In general, inverters with PWM dimming have a very wide luminance adjustment range. For most practical cases, the BI218 inverter can achieve a maximum dimming ratio of about 200:1. Hence, the luminance of the backlight or the LCD screen can be adjusted from 100% to 0.5%.

Fig. 2. LCD Screen Luminance & Inverter Current vs. Dimming Voltage. LM190-121X1-L01 12.1" Sunlight Readable LCD module.

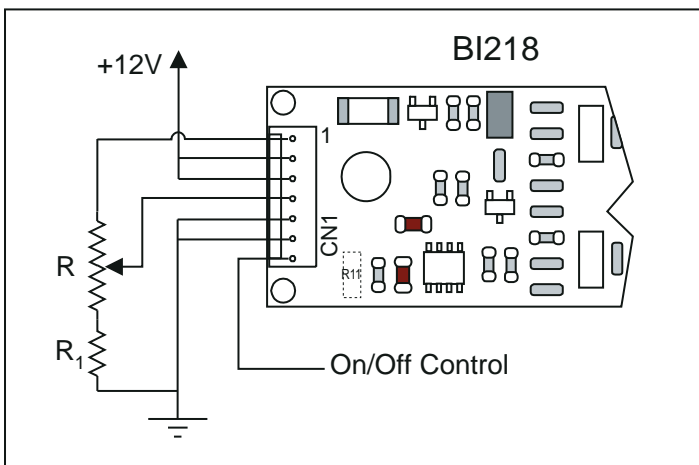


Fig. 3. Dimming control using a potentiometer and a resistor with the on-board +5V supply. For example, if R is a 10 K Ω potentiometer, then using a resistor $R_1 = 1.33$ K Ω will set the minimum V_d value at 0.59V. This will adjust the display to a very low brightness but not turn it to totally dark.

Dimming Control Circuits

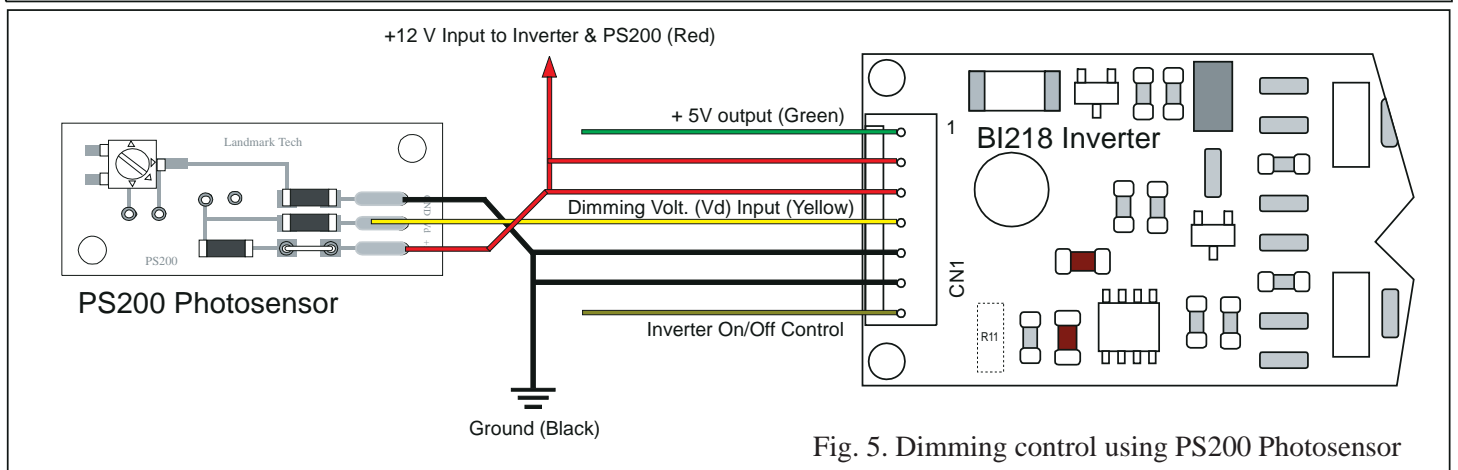
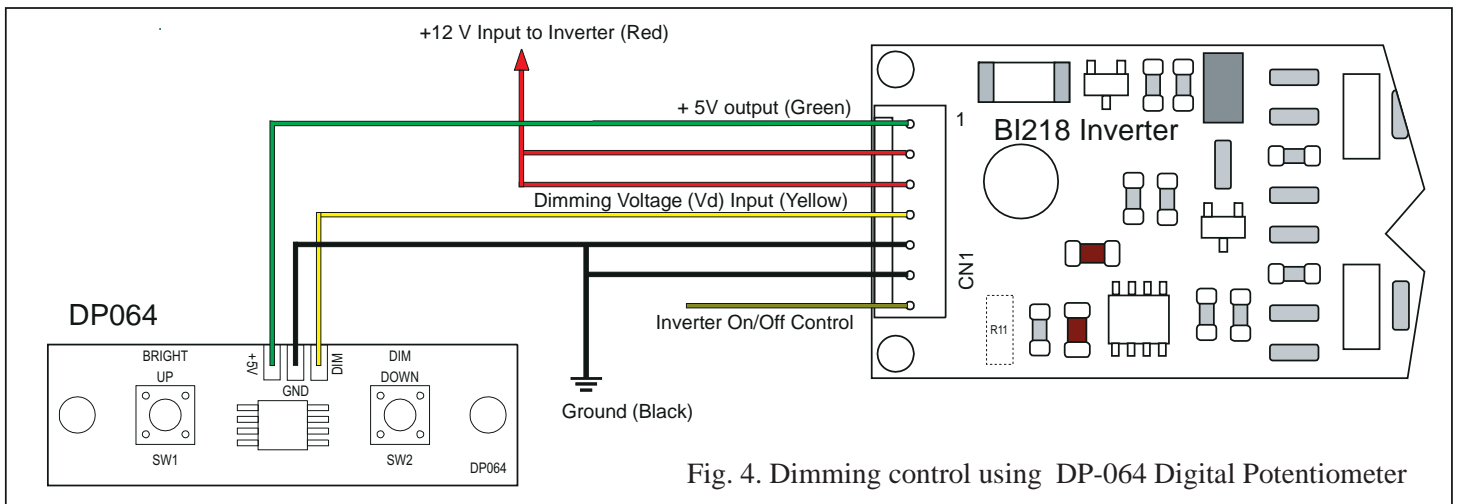
The dimming voltage V_d can be generated simply by using a potentiometer with a series resistor (Fig. 3). The inverter provides a +5V source (pin #1 of the input connector CN1) to power this dimming circuit. When using this dimming control circuit, please make sure that the maximum current drain from this +5V source is kept at or less than 5 mA.

In Fig. 3, a series resistor R_1 is added to control the minimum dimming such that the backlight is not completely turned off. It is also possible to add another resistor above the potentiometer to limit the maximum dimming voltage in order to limit the maximum screen luminance. This option runs the LCD at a lower screen brightness and reduces the backlight power to relax the thermal issues and/or to increase the lamp life beyond the specified value.

With the BI218 inverter, using an R_1 value of 1.33K Ω will set the minimum V_d to about 0.59V. Over the full potentiometer adjustment, a luminance adjustment range of close to 200:1 can be achieved. Use a logarithmic potentiometer to obtain a linear luminance adjustment.

Alternatively, the DP-064 digital potentiometer can be used to provide 64 levels of brightness adjustments with two push buttons (Fig. 4). With the BI218 inverter, the DP-064 can provide a dimming range of about 100:1 with nearly linear luminance adjustment. Please refer to the DP-064 data sheets for details.

In addition, PS200 photosensor can be used with the BI218 to control the brightness automatically in response to the ambient light levels (Fig. 5). For details, please refer to the PS200 data sheets.



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