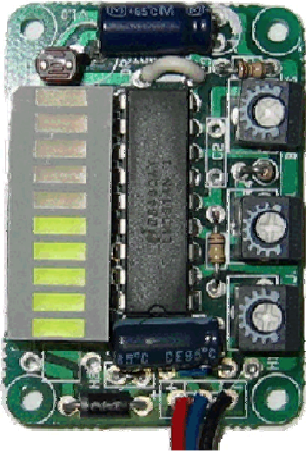


Multipurpose Bargraph Display Meter



The BM Bargraph Meter is a 10-segment display meter for quick visual indication of voltage inputs or battery levels. Its small size, integrated design and various display colors make it easy-to-use and add an appealing look to products. The automatic brightness control is excellent for use in varying light environments. The adjustable display scale range makes it suitable for expanded scale voltmeters or general voltage displays.

Features:

- BAR or DOT mode selection
- Automatic brightness control
- LED power on self-test
- Constant current LED display
- Adjustable input display scale range
- Easy-to-use integrated design
- Small and economical

Benefits:

- Small size for tight installations
- Easy-to-use and setup
- Quick visual indication of signal
- Day/night readability

Applications:

- Voltmeter
- Battery level meter
- Expanded scale meter

Brightness Control (Automatic Brightness Control)

The automatic brightness control uses a photo-resistor to sense the amount of ambient light then it automatically increases/decreases the brightness of the display when the ambient light changes. It will increase the display brightness when the ambient light is bright and decrease when dark. This is useful in varying light conditions such as in a vehicle or other mobile applications. The brightness setting of the LEDs can be set by adjusting the "BRIGHTNESS" control on the Bargraph Meter.

Operation

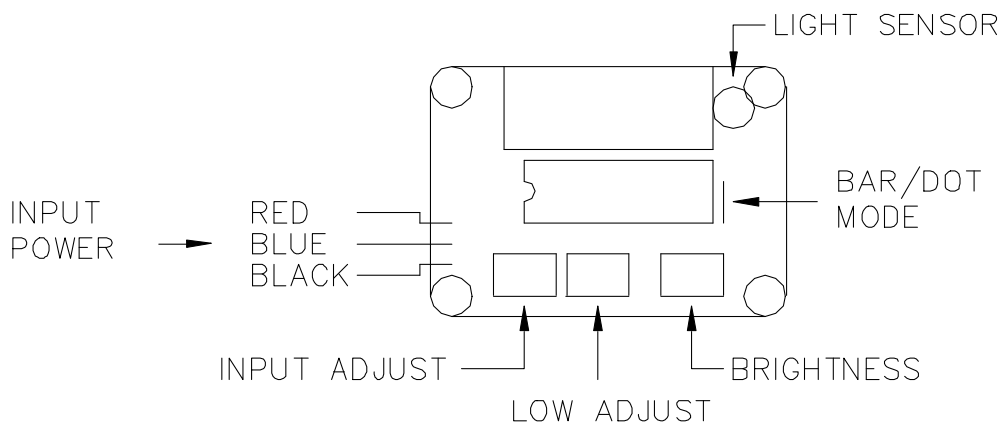
The Bargraph Meter uses the integrated LM3914 10-segment bargraph display driver to provide all the necessary functions. The passive components are used as support and input controls to the display driver. All function controls are adjustable to display the voltage input scale level. The added feature of the LDR photocell makes the unit more suitable for varying light conditions. It is connected in parallel with the LED current limiting resistor. Adjustments on the brightness control set the minimum level on the automatic brightness range. If the adjustment is set close to the maximum, the light sensor will have little effect on the LED brightness. The circuit uses constant current for the LED display. Any voltage variation will not affect the brightness. Total power consumption must be considered since the bargraph display driver and LEDs will get hot at high input voltage and high LED current. See schematic and LM3914 datasheet for more technical information.

Installation

Please read the appropriate data sheet prior to installation for best results. The installation should be made by a person knowledgeable in the product and conforms to all appropriate local codes. Onstate Technologies Inc. will not be responsible for injuries or damages resulting from the improper installation or use of any products sold by Onstate or its retailers. Install the product within its specification limits.

The installation of the Onstate Bargraph Meter is straight-forward. Do not use the product in high temperature or direct sunlight locations. The bargraph and display driver get warm when operation at full brightness and at high input voltages. The display will limit at a maximum brightness to prevent overloading of the display driver.

Control Adjustments



Input connector wiring

RED: +4.5V-15V DC

BLK: - POWER GROUND

BLUE: INPUT SIGNAL VOLTAGE

INPUT ADJUST	Adjusts the maximum input level (10 th LED).
LOW ADJUST	Adjusts the minimum start level (first LED).
BRIGHTNESS	Sets the minimum brightness level of the display.
BAR/DOT MODE	Remove/cut for bar mode (2 LED may be on due to internal hysteresis).
LIGHT SENSOR	Automatically changes display brightness.
INPUT POWER	Input power connector.

Setting up display scale.

Eg. 12V Lead acid battery. 13V=alive, 12V=dead. For a battery at no external load.

1. Turn " INPUT ADJ. "all the way clockwise and " LOW ADJ. " in the middle.
2. Set the power supply input voltage to the full scale that you want to read. (eg. 13.0V maximum)
3. Adjust the " INPUT ADJ. " just until the 10th LED turns on (full scale). Do not adjust any more past that mark, the full scale reading will not be as accurate. Note: The LEDs may all turn on quickly.
4. Set the power supply input voltage to the minimum level (first LED on) that you want to read. (eg. 12.0V)
5. Adjust the " LOW ADJ. " until the first LED turns on.
6. Set the input voltage to full scale again (eg. 13V). Reconfirm that the display reads the correct scale. Readjust the variable resistors for a more accurate reading if desired.

Low Adjust

The “LOW ADJ.” sets the minimum input voltage on the display. Adjust it to set the starting voltage (first LED) on the display. Check the voltage at the input with a voltmeter to confirm the required voltage. The full voltage scale (10th LED on) is approximately 1.25volts. It is internally set as reference on the circuit and the high reference voltage. Turning the variable resistor clockwise on “LOW ADJ” will decrease the minimum input reference voltage (tied to internal reference voltage).

BAR/DOT Mode selection

The circuit is preset in the BAR mode. All the LEDs will turn on above a certain voltage. In DOT mode, only one LED will usually turn on. Two or three LEDs may also turn on due to the internal hysteresis and low input voltage variations (oscillations). Using DOT mode will conserve power but will not give as an appealing or easy-to-read display. Note: The circuit will get warm when used in BAR mode with full power and high voltages. To enable DOT mode, remove (cut) the jumper wire on the “BAR/DOT” designator label on the circuit board. Reconnect to enable BAR mode again.

LED Self-test

When the circuit powers up, all the LEDs will turn on for a brief second to confirm they work. Then it will settle to the actual scale reading. This may take a few seconds.

Setup

The internal circuit high input reference voltage (full scale) is fixed at approximately 1.25 volts. Only the low reference voltage (first LED) needs be adjusted (LOW ADJ). The minimum input voltage to display a full-scale reading is 1.3V. The minimum differential input voltage is 0.25V.

Technical Specifications:

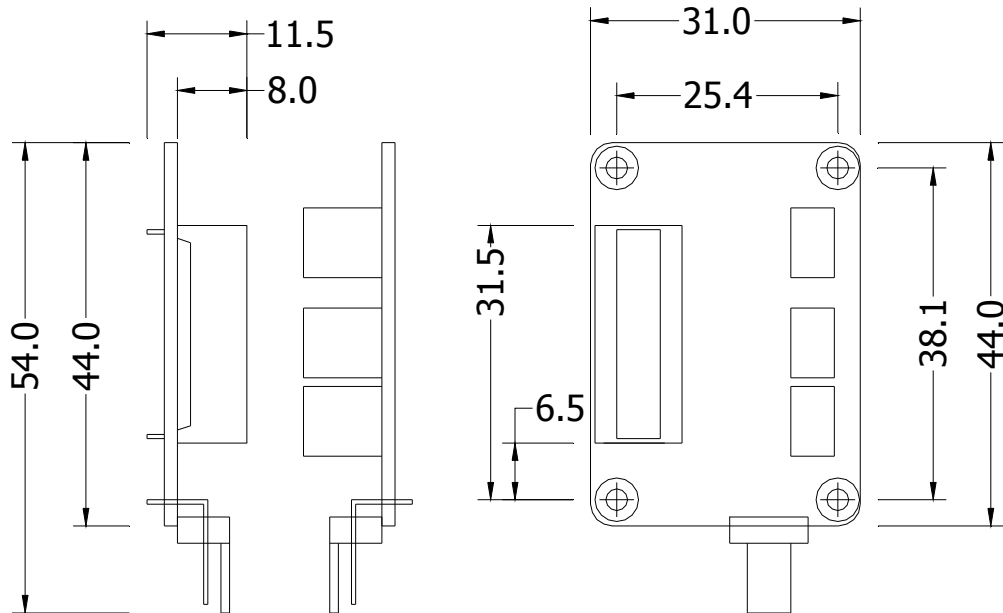
Operating voltage:	4.5-15V DC
Input signal range (nominal):	0-15V DC
Internal reference voltage:	1.25V
Operating temperature:	-15 ^o C to +45 ^o C
Standby current (LEDs off):	8mA
Input current into signal pin:	<0.07mA (approx. 70K Ohms resistance)
Maximum current (BAR mode):	120mA
Maximum current (DOT mode):	20mA, current limited.
Minimum full scale input voltage:	1.3V
Minimum input differential voltage:	250mV
Minimum first segment on:	One tenth of maximum input signal voltage
Accuracy:	+/- 1 Segment (LED) at 100mV differential per segment
Accuracy drift (+45 ^o C)	+ 1 segment (LED) at 100mV differential per segment

Note: Do not use in wet or damp locations. Do not exceed the specifications of the unit. The unit should be mounted away from sunlight for easier viewing of the display.



Mounting hole dimensions

All units in mm. Mounting dimensions are 38.1 X 25.4 mm hole spacing, 2.4mm holes. Use M2 or #2 bolts. The connector for input/output connection is a standard 0.1" spacing 3 pin male.



Application Example:

Expanded scale meters

Expanded scale meters give a quick indication of battery voltage. The BM-series can be set to read the voltage between a maximum and minimum level. Any reading on the display will give an approximate voltage. See installation section for calibration and use settings.

Example 1. 12 Volt lead-acid battery monitor.

The voltage setting is with light load and connected to charger. Set maximum voltage to 13.8V for full scale. Set minimum voltage to 12.0V. At over 13.8V=charging, 13.2V=full, 12V=low.

Example 2. 5 Volt NiCd battery monitor.

Set maximum voltage to 5.25V for full scale (100% live). Set minimum voltage to 4.8V (~10% live). If the load is high with high internal voltage, a different scale will be required.

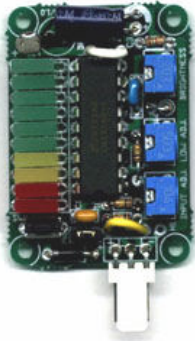
Power Level Indicator

The Bargraph Meters are also good for power level indicators. Individually coloured LEDs can be used to display a certain scale for easier status indication.

Example 3. A car throttle sensor gives 5V at full and 1V at idle.

Set the maximum to 5V to indicate the throttle is at full. Set the minimum to 1V to indicate idle. Use red, green or yellow LEDs at the required voltage to indicate condition.

Application: To use the Bargraph Meter model to indicate the throttle position of a motor vehicle.



The BM Bargraph Meter with individual LEDs set for normal (green), caution (yellow) and warning (red) is used to indicate the throttle position of a motor vehicle. The meter gives a good indication of where the throttle is at. The fuel consumption can be reduced slightly to get better mileage by reducing the throttle by a small amount while maintaining the same speed. The display looks very nice at night or when covered from ambient light.



Figure 1. Display mounted in vehicle



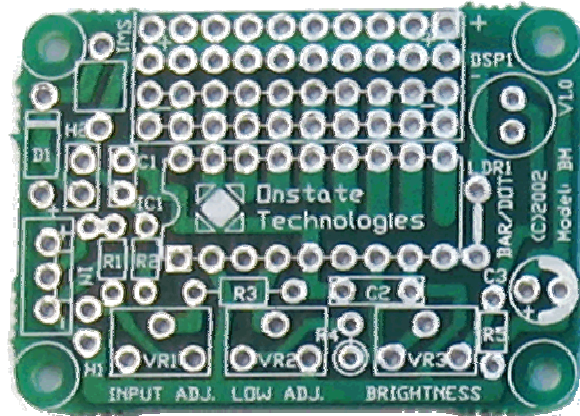
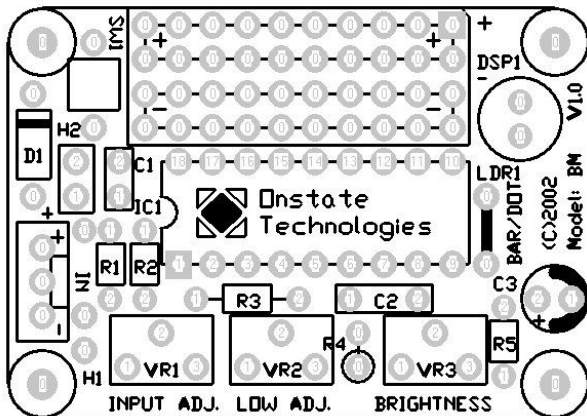
Figure 2. Display at night

The meter is mounted on the dash of a car. It is recommended to mount the display away from sunlight or bright light as it is hard to read the display. A voltage is tapped from the throttle position sensor with an output of 0-5V. The meter is then setup to display the voltage of the sensor at full throttle.

Bargraph Meter design information:

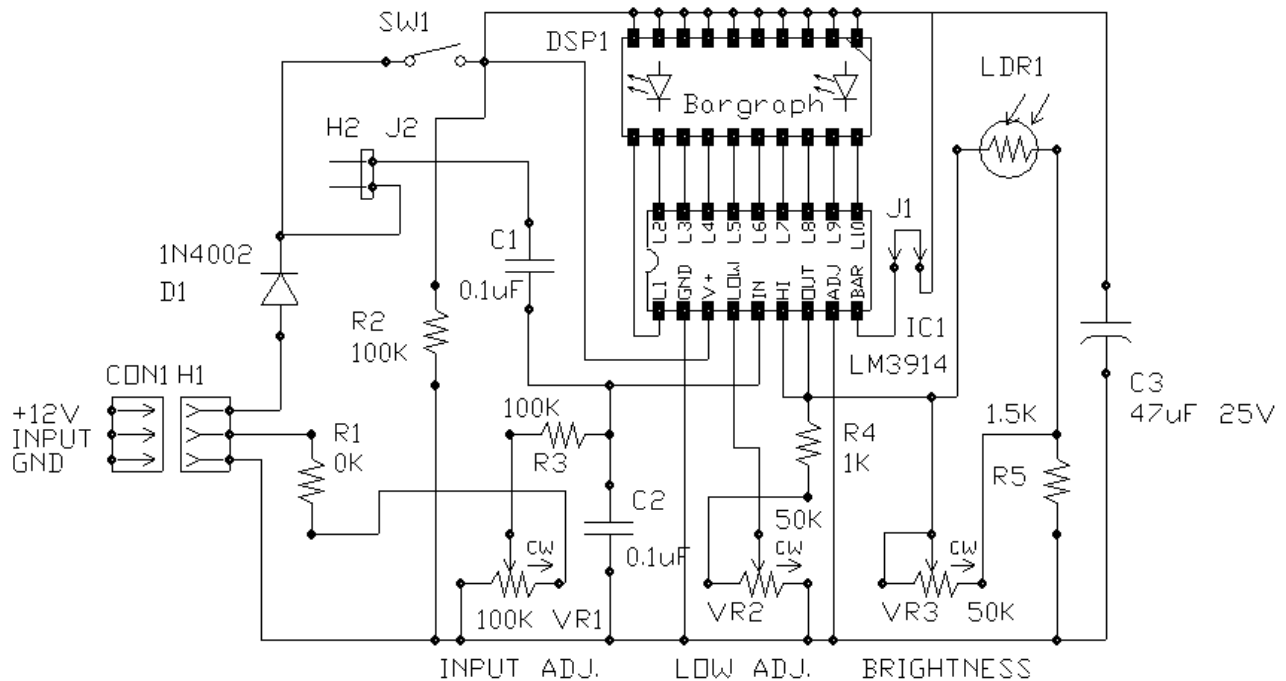
PCB specification:

1. 1/16" glass fiber. FR4 type
2. through-hole plated
3. double-sided copper traces
4. thick copper traces
5. tin coated holes
6. robust design



Top silkscreen (legend) layer for Bargraph Meter

Schematic of Bargraph Meter



All resistors are 1/8W

LDR photoresistor is Digi-Key part PDV-P9203-ND, 5k-20k

PCB is Onstate model PCB-BMBM.