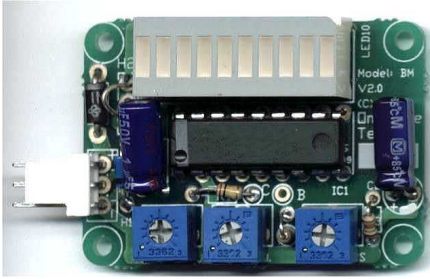


Multi-purpose Bargraph Display Meter



The BM Bargraph Meter is a 10-segment LED display meter for quick visual indication of voltage inputs or signal levels. Its small size, integrated, multi-function design make it very useful as multi-purpose indicators. The bright LED display adds an appealing look. It is compatible with the LM391x series of bargraph display drivers for linear or VU meter applications. The adjustable display scale range makes it suitable for expanded scale voltmeters or general voltage displays.

Features:

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

Benefits:

- Small size for tight installations
- Easy-to-use and setup
- Quick visual indication of signal
- Simple, integrated module

Applications:

- Voltmeter, power meter
- Signal, VU level meter
- Expanded scale meter

Technical Specifications:

Operating voltage:	4.5-15V DC, up to 30V with optional LM7812 regulator.
Dimension:	1.73"x1.22" (44x31mm).
PCB:	1/16" FR4, ROHS, HASL, double-sided, plated holes,
Input signal range (nominal):	0-15V DC
Internal reference voltage:	1.25V
Operating temperature:	-15°C to +45°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:	0.5V
Minimum first segment on:	One tenth of maximum input signal voltage
Accuracy:	+/- 1 Segment (LED) at 100mV differential per segment
Accuracy drift (+45°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.

Operation

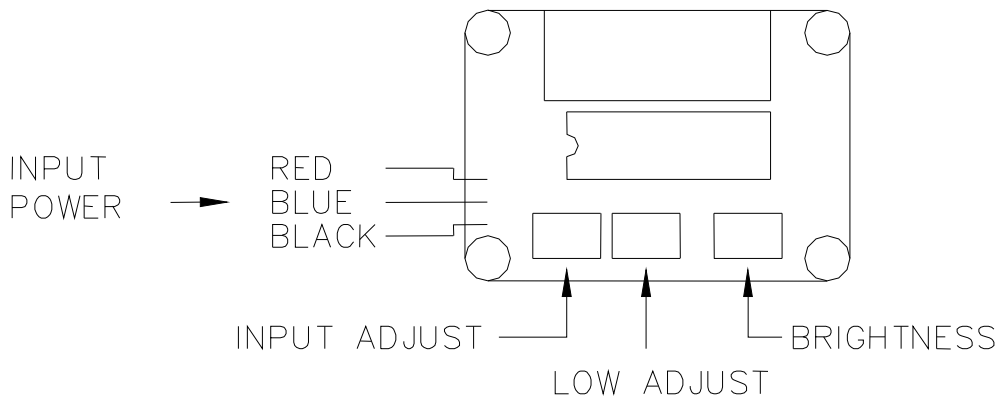
The Bargraph Meter uses the integrated LM3914/15/16 10-segment bargraph display driver to provide all the necessary functions. Passive components are used as support and input controls for the display driver. All function controls are adjustable to display the required voltage input scale levels. See BM Bargraph Meter schematic and LM3914/15/16 datasheets for more technical information.

Installation

Please read the appropriate data sheet prior to installation and setup for best results. The installation should be made by a person knowledgeable in the product and conforms to all appropriate local codes. Onstate Technologies 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 temperatures or direct sunlight locations. The bargraph and display driver get warm when operation at full brightness and at high input voltages. Limit the maximum brightness to within specifications 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.
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 the 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. Adjust 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 1.25 volts. 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 may be difficult to read. Note: The circuit will get warm when used in BAR mode at full power and high operation voltages. To enable DOT mode, remove (cut) the thin jumper wire on the “MODE” designator label on the bottom of the circuit board. See PCB image for more information. Reconnect to enable BAR mode again.

LED Self-test

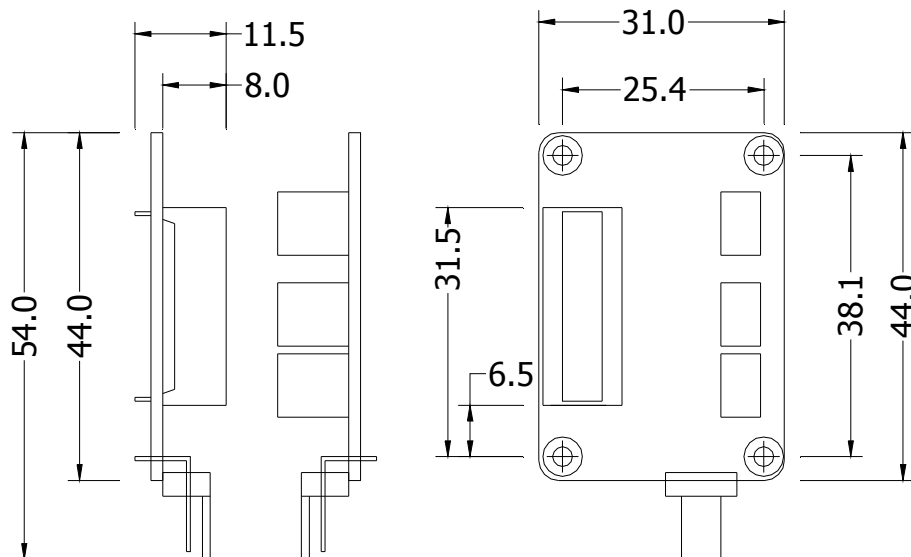
When the circuit powers up, all the LEDs will turn on for a brief second to confirm they all work. Then it will settle to the actual scale reading. This may take a few seconds.

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 0.5V. Adjust R2 for different input differentials.

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 Examples:

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.

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.

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.

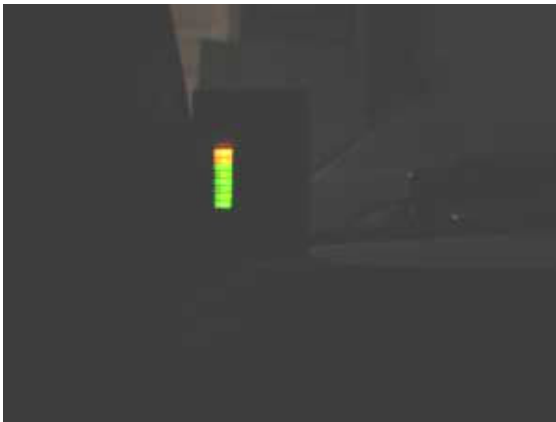


Figure 1. Display mounted in vehicle. Display at night.

The meter is mounted on the dash of a car. It is recommended to mount the display away from sunlight or bright light for easier display reading. 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. A light dependent resistor (PC) can be added and connected parallel to VR3 for automatic brightness control.

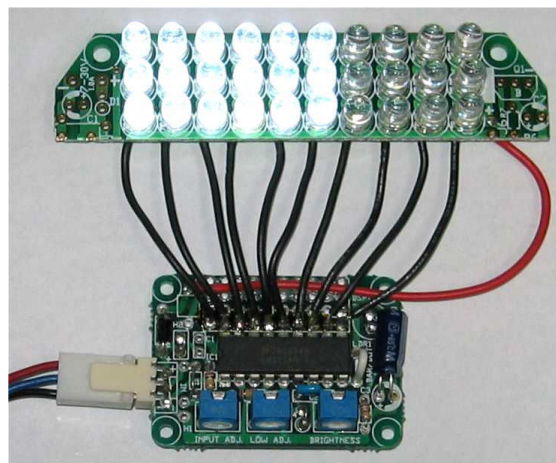


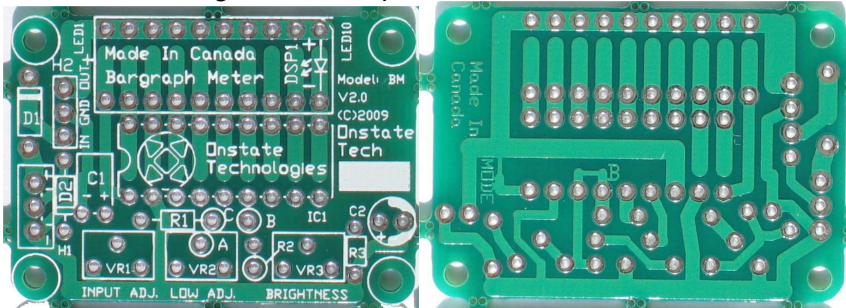
Figure 2. Large 10-segment display with custom array.

An external custom LED display is used for large display applications.

Bargraph Meter design information:

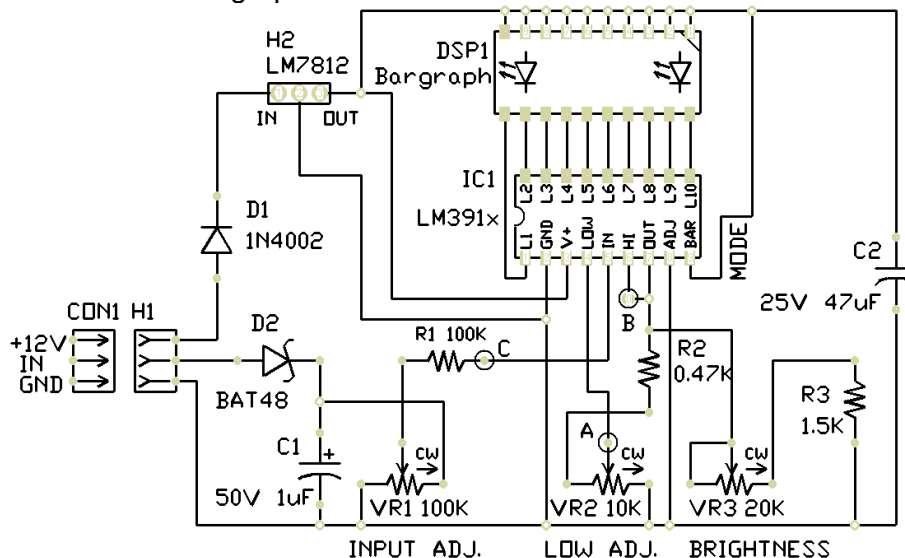
PCB specification:

1. 1/16" glass fiber. FR4 type, ROHS and lead-free
2. Through-hole plated, HASL coated holes
3. Thick copper traces, double-sided copper traces
4. Robust design, reliable operation



Top silkscreen (legend) layer and bottom trace layer for Bargraph Meter.

Schematic of Bargraph Meter



All components are available from Digi-Key (digi-key.com) All resistors are 1/8W. VRs are Bourns 3362P series. PCB is Onstate model PCB-BMBM-2.

For Cascading Bargraph Meters:

1. High ref. of low bargraph (1st) must be connected to low ref. of 2nd bargraph.
2. Both signal inputs must be connected together only 1 adjustment VR1 is required.
3. Lower bargraph (1st) setup. Cut signal trace at pin #6 to pin #7 (location B). Solder jumper wire location B (1st) to location A (2nd).
4. High bargraph (2nd) setup. Remove VR2. (low ref. adj). Remove R1. Connect both inputs together (location C).

Automatic LED brightness:

A light dependent resistor (PDV-P9203-ND) can be added and connected parallel to VR3 for automatic brightness control.

D2 (BAT48) and C1 may be removed for more sensitive and faster display response. LM7812 may be used for high operation voltage applications (15-30V DC). Bypass LM7812 in/out pin when not used.