

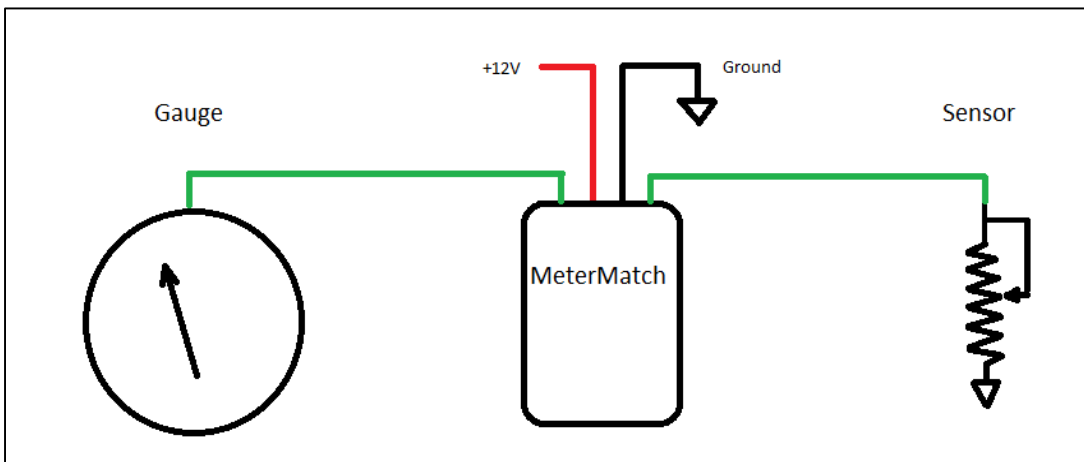
## MeterMatch<sup>TM</sup>

### Overview

MeterMatch<sup>TM</sup> by TechnoVersions LLC is for making analog gauges more accurate, or to allow you to mix and match different gauges and senders. It can be used with many gauges that have resistive senders - such as common fuel, oil-pressure and temperature gauges. In addition, it allows you to have low and/or high set-points that will trigger a bright, blinking LED indicator to alert if the gauge exceeds normal values.



### Theory of Operation



MeterMatch is wired between your sender (sensor) and your gauge. It reads the resistance of the sender, then based on the calibration values, sends a signal to drive your gauge to the desired reading. It treats the input and output entirely separately, so it doesn't care if the input to the gauge is scaled differently than the sender, or even if the sender signal has a reversed sender signal than the gauge - it can correct for that.

To calibrate MeterMatch, you first set the sender to a known value. For example, fill your fuel tank. Set the MeterMatch to program mode, then with **Up** and **Dn** buttons, make your gauge read what you want for that sender value. When you are happy with that, press the **Save** button, and the value is remembered in the MeterMatch. Do the same process with the sender reading a value near the other end of its range, and you are done. MeterMatch interpolates from these values to make the gauge

read proportionately at values above, below, and between the calibration values. If you know the resistance of your sender, you can also calibrate to common end-values of senders, even without the sender being at that specific resistance.

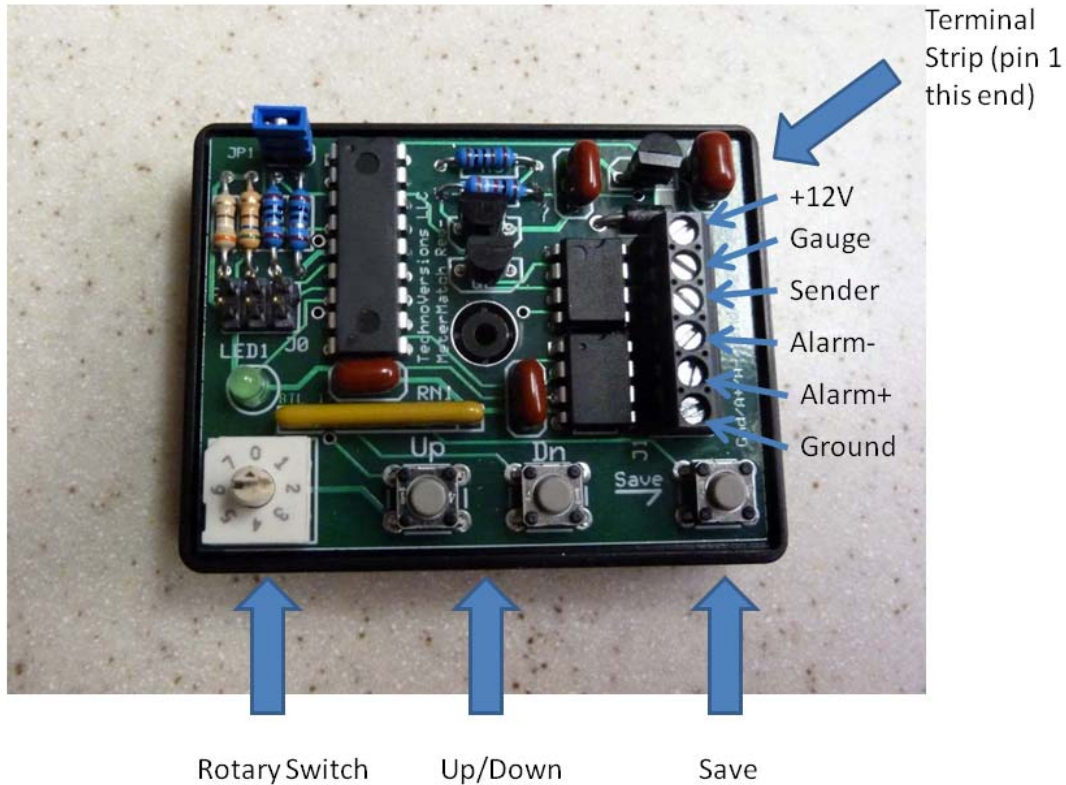
The basic process of having the gauge read properly from calibration points near each end of the range is fine for most applications, but you can be more sophisticated if you wish. For example, what if your fuel tank is large at the bottom, and small at the top? In this case, it won't read properly throughout the range. MeterMatch provides two additional calibration points between the endpoints. So, in this case, you could have an additional calibration point where the tank changes size. Another use for these points would be if your tank is cylindrical (like a truck fuel tank) so the gauge is inaccurate at both sides of center. Here, you can add additional calibration points (for example at 30% and 70%) and the accuracy is drastically improved

## Optional Alarm Indicator



MeterMatch allows you to set a lower and higher alarm set-point. These are set just like the calibration points (you use the **Up/Dn** buttons to set the gauge to the point at which the alarm happens), but instead of affecting the meter reading, they set a signal to turn on an optional LED. This bright LED is programmed to flash, and can be mounted near the meter to alert the driver to take a look at the gauge. You can use none, either, or both set-points.

## Installation



MeterMatch is contained in a plastic enclosure that is 1.85" by 2.4" x .93". To install and calibrate it, you will need to expose the circuit by removing the small Phillips-head screw in the bottom center of the enclosure. Take care that the circuit board doesn't touch any metal which could short things out, and when finally installed, make sure it is in a dry spot that doesn't get overly hot.

It is wired by connecting to a screw-terminal strip inside. You will need a small straight-blade screwdriver. It accommodates wire sizes from #16 AWG to #28 AWG. Wires on the larger end of this range are recommended.

MeterMatch only requires four wires, and all these signals are usually available near the back of the gauge. The signals are:

|       |   |
|-------|---|
| Pin 1 | +12V (switched by ignition)                     |
| Pin 2 | Input signal to gauge (output from MeterMarch)  |
| Pin 3 | Output signal from sender (input to MeterMatch) |
| Pin 6 | Ground  |

## Calibration

Once wired, it is necessary to calibrate your MeterMatch.

The rotary switch  positions are used as follows:

|   |                                    |
|---|------------------------------------|
| 0 | Normal Operation after calibration |
| 1 | High calibration point             |
| 2 | Mid-high calibration point         |
| 3 | Mid-low calibration point          |
| 4 | Low calibration point              |
| 5 | Alarm high calibration point       |
| 6 | Alarm low calibration point        |

In addition to the terminal strip and rotary switch, you will find three push-buttons:

|                                     |   |
|-------------------------------------|---|
| <input type="button" value="Up"/>   | Moves the meter needle one direction            |
| <input type="button" value="Dn"/>   | Moves the meter needle the other direction      |
| <input type="button" value="Save"/> | Stores the calibration point presently selected |

### Standard calibration process (sender resistance not known):

1. Set your sender to a point near one end of the value being measured (we'll start at the top in this example, but order is unimportant).
2. Set the rotary switch  to position "1" (High Calibration Point). The LED in MeterMatch will light up.
3. Use the / buttons to make your gauge read the appropriate setting for the present sender output. Depending on the gauge, the buttons may work backwards, but don't worry about that - just make the gauge read the desired value. MeterMatch will work properly even if polarity is reversed between the gauge and sender. Some meters are well-dampened so this process can take a little time. It doesn't hurt to tap lightly on the gauge too.
4. Press the  button to save this calibration point. The LED on MeterMatch will go out momentarily to indicate that the value is being saved, then turn back on.

*Note: Calibration doesn't need to be done at the extreme high and low sensor points, but most accuracy is achieved when near the limits of the readings.*

Repeat these steps but with the sender set to a position for the other end of measurement, the rotary switch  to "4" (Low Calibration Point), and then use the / buttons until gauge is reading appropriately, then press  again.

Finally, set the MeterMatch rotary switch  back to "0" (Normal Operation), put the cover back on, and enjoy using your calibrated gauge.

You can go back and reset any point using the same process, it will simply over-write the data for that point stored previously. If you would like to erase a point (for example a point or limit you don't want to use any more): with no power applied, set the rotary switch  to the position reflecting the point you want to erase, hold down the  button, then turn power on.

**IMPORTANT:** After initial calibration, be sure to check at least one midpoint value to ensure that the reading is correct. If not, the sender and/or gauge may be non-linear, leading to inaccuracy. In this case, accuracy can be enhanced by using one or more additional calibration points.

### Alternate calibration process (sender resistance known):

If you know the resistance of your sender, you can use that to help do calibration. You will need to know the sender range (end-points) in Ohms. For example if the sender might be 240 Ohms ( $\Omega$ ) when the reading is low, and 33 Ohms when the reading is high. If you have this data, there are two ways that you can use it for calibration:

**Method 1:** Connect a resistor (available at places such as Radio Shack) of the desired value on the MeterMatch sender input pin (pin 3) to ground, then perform calibration at that point just as with the standard calibration process previously shown.

**Method 2:** You can have MeterMatch calibrate to some internally stored resistance values. To use these, do the following:

1. Power up MeterMatch
2. Set the rotary switch  to zero (normal operation)
3. Press and hold the  button. The LED will illuminate.
4. While the  button is being held down, press the  button, the number of times shown in this table. Each time you press the  button the LED will blink the number of times that it has been pressed. For example after you have pressed it twice, it will blink twice. You can start over at any time by releasing the  button.

| Number of "Up" Button Pushes | Sender Resistance Simulated (Ohms) |
|------------------------------|------------------------------------|
| 1                            | 0                                  |
| 2                            | 10                                 |
| 3                            | 33                                 |
| 4                            | 73                                 |
| 5                            | 90                                 |
| 6                            | 180                                |
| 7                            | 240                                |

5. Release the **Save** button, then use the standard calibration procedure (rotary switch **⊖** to which point you are setting, **Up/Dn** buttons to make gauge read the desired setting, then **Save**.) When the **Save** button is pressed (and the rotary switch **⊖** is not set to 0), MeterMatch will use the resistance value you just entered, and then reset itself to back normal operation (measuring the connected sender resistance).

### Calibration Checking and Enhancement

Feel free to use a combination of these calibration methods. For example, you might initially calibrate to the published resistance values of your sender, then when the opportunity comes to improve accuracy, recalibrate a point. Using the fuel gauge, for example, recalibrate the end-point when you run out of gas, or fill up the tank. Whenever you return to a position of the rotary dial, you can overwrite the data that was previously programmed.

### Installing/Programming the Alarm Indicator

The optional LED Alarm Indicator can be mounted near the gauge being controlled.

The LED is installed by drilling a 9/16" hole in the instrument panel. 12" leads are then wired to the terminal strip in the MeterMatch. *Be careful when installing the LED since the leads are not particularly strong, and can be pulled loose from the LED.* The darker of the two wires (cathode lead) coming from the LED is installed in terminal strip pin 4, and the lighter-colored wire (anode side) is connected to pin 5. It won't hurt anything if you accidentally reverse these wires, but the LED won't light.

|       |                        |
|-------|------------------------|
| Pin 4 | LED negative (cathode) |
| Pin 5 | LED positive (anode)   |

You can program the upper and lower alarm points with rotary switch **⊖** positions 5 and 6 respectively. Set the rotary switch **⊖**, use the **Up/Dn** buttons to set the desired gauge reading at the set-point, then press **Save**. MeterMatch doesn't care what value the sender is at while programming the alarm points - it is only interested in what you make the gauge read with the **Up/Dn** buttons. As a result, ensure that you have calibrated your gauge accurately (rotary switch **⊖** positions 1-4), or your alarm will not be accurate either.

These points can also be erased using the same procedure as normal cal points. Depending on how your gauge works, you may find that the low and high alarm set-points are reversed in operation from what you expect. If that's the case, simply reverse the calibration (use high for low and vice-versa).

If you have more than one MeterMatch installed, you can logic "or" the LED signals so that if any of the alarm signals become true, they will set off a single LED. Simply connect the LED positive

(anode) to any one of the MeterMatch circuits, then connect all of the MeterMatch LED negative (cathode) wires to the LED negative side wire.

## **Return Policy**

If a MeterMatch unit does not work properly in your application, and is not damaged, TechnoVersions will allow return for full refund of purchase cost, exclusive of any shipping charges. Claim for such must occur within 30 days of product shipment from TechnoVersions. Ship the unit back to TechnoVersions along with a description of the problem and proof of purchase. TechnoVersions will remit the refund via US Mail or PayPal (at TechnoVersions discretion) within 10 working days of product receipt.

## **Limited Warranty**

TechnoVersions LLC provides a limited warranty for MeterMatch. If a unit should fail within 180 days from time of shipment from TechnoVersions, it can be returned for repair or replacement at TechnoVersions discretion. Products subject to abuse (as determined by TechnoVersions) are excluded from this limited warranty. TechnoVersions LLC makes no other claims as to suitability and excludes any liability for direct, indirect or consequential damages. Exclusive remedy is limited to product replacement or repair. Cost of shipping the product to TechnoVersions is at the customer's expense, but the replacement/repared MeterMatch will be shipped to customer via USPS or UPS ground at TechnoVersions expense. When returning MeterMatch to TechnoVersions, include a description of the fault to help facilitate repair.

## MeterMatch™ Specifications

|                          |  |
|--------------------------|--|
| Size                     | 1.85"x2.4"x0.93"   |
| Weight                   | 1.2 Oz   |
| Connections              | 1x6 screw terminal strip accepting #16-#28 AWG wires   |
| Sender Input             | Ohmmeter reading of sender input to ground   |
|                          | Max current/voltage through sender 20mA/5Vdc   |
|                          | Resolution approximately 1 $\Omega$ for readings less than 100 $\Omega$ .                          |
|                          | Range 0-3,000 $\Omega$   |
| Gauge output             | Constant-current sink  |
|                          | Full output range resolution better than 1%, actual resolution depends upon working range of gauge |
| Input/Output Translation | Meter output current based on linear interpolation of sender resistance calibration points.        |
|                          | Four calibration points provided, minimum of two necessary for operation.                          |
| LED Output               | Programmed blinking  |
|                          | Source impedance to anode 400 $\Omega$ , open-collector to cathode                                 |
| Controls                 | Up, Down, Save buttons   |
|                          | 8-Position rotary switch   |

(MeterMatch Instruction Manual - Rev 3/2012)