How to Make Your Stock 79-98 Mustang Temperature and Oil Pressure Gauges Accurate
Mark Olson
Accutach Co.
R 1.2 © 2014

It has driven me crazy for years to have a poor temperature gauge in the perfect stock OEM location, and having to have an accurate temperature gauge where I have to take my eyes far off the road. And the oil pressure gauge is a simple pressure switch idiot light in gauge form.

My frustration led me to work for a couple of years on a potential solution, but I was having software issues. Then I ran across a product called MeterMatch from TechnoVersions (http://www.technoversions.com).
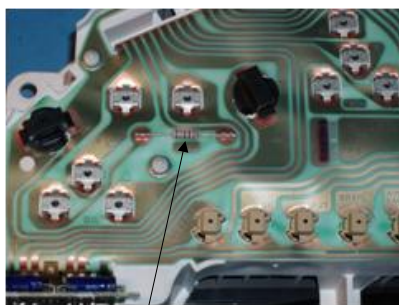

After working with the owner, he was able to tweak his product to make it work very well with the temperature and oil pressure gauges in 1979-1998 Mustang instrument clusters with battery voltages from 5V to 16V. MeterMatch is a small unit that will read a sensor, and then drive a gauge needle to a predetermined point on the gauge based on the sensor reading. Users can calibrate the gauge at 4 points, and the unit will interpolate between them, tuning the stock OEM gauges into pretty accurate devices. The MeterMatch unit can also flash an idiot light when a temperature threshold that you set is exceeded or when the oil pressure falls below a pressure threshold that you set.

This document will explain how to calibrate and install a MeterMatch unit for your Mustang's temperature gauge, and then how to calibrate and install one for your oil pressure gauge.
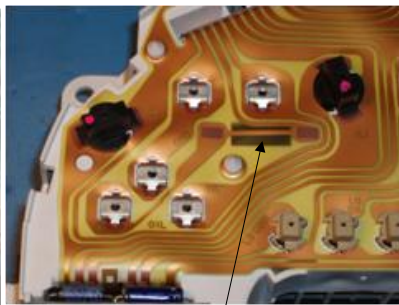
Gauge Background Information

Mustang gauges (other than the volt gauge) consist of one set of windings connected between power and ground. That set of winding creates a reference magnetic field. There is a second winding that is connected to power and the signal input to the gauge. The sensor connects the gauge input to ground through a variable resistor. As the sensor resistance goes down, more current flows through the second winding. The magnetic field of the second winding interacts with the field from the reference winding. The more current that flows through the gauge input, the more the gauge needle deflects, and the less current that flows, the less the needle deflects. When zero current flows through the input, there is no needle deflection and when the same amount of current flows though the input as flows through the reference winding, you get maximum needle deflection of 90 degrees.
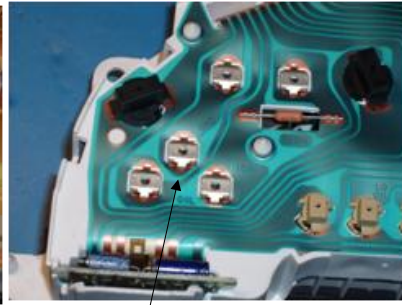
The temperature gauges in all of the clusters behave in the same way, covering the entire 90 degree range, and they respond well to being driven by a MeterMatch unit. The oil pressure gauges are a different matter. The oil pressure sender for oil pressure gauges from 1994 to 1998 are simple 6 PSI pressure switches. When the oil pressure is below 6 PSI the switch is an open circuit and above 6 PSI the switch grounds the signal to the engine block, providing maximum current. With maximum current, the gauge needle would peg at 90 degrees, so Ford added a 20 ohm resistor to the back of the instrument cluster in the oil pressure signal circuit to limit the maximum needle deflection to the high-normal range. Somewhere very near the end of 1996, Ford changed the oil pressure gauge windings in order to make it so that the gauges will not travel the full 90 degrees with maximum current, thus allowing them to save a few pennies by eliminating the 20 ohm resistor on the back of the cluster.
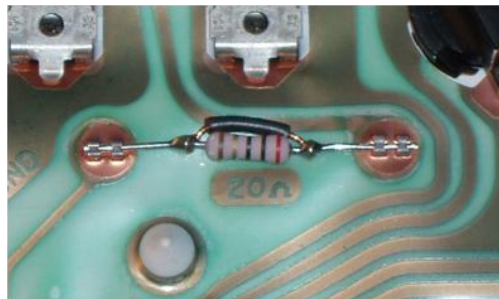

96 & Older Gauge with
20 Ohm resistor

97 Gauge with shorting
trace instead of a resistor

98 Gauge with no place
for a resistor

If you try to use a MeterMatch unit with an unmodified oil pressure gauge, it will work, but the maximum needle movement the MeterMatch will be able to drive will be from no deflection to the high-normal range of the scale. If you are ok with this, simply calibrate the oil pressure gauge over the reduced range.

With a 1994 to late 1996 cluster with the 20 ohm resistor, all you need to do to allow the MeterMatch to drive the gauge to the maximum 90 degree deflection is to short out the 20 ohm resistor on the back of the cluster.

With a late 1996 to 1998 cluster, there is no resistor, so the only way to get full needle deflection is to replace the oil pressure gauge with one from a 1994 to late 1996 cluster, or to replace the oil pressure gauge with a temperature gauge from any cluster from 1994 to 1998.

Before you start

First, the disclaimer: I have done my best to ensure that this solution will result in pretty accurate instrumentation, you use this at your own risk. I am not responsible if anything goes wrong and your engine overheats or blows up.

You will need to identify what kind of oil pressure gauge you have. If you have a 1994 or 1995 cluster, you will have the 20 ohm resistor. If you have a 1997 or 1998 cluster, you will not have the resistor, and will need an older oil pressure gauge or any temperature gauge to replace the oil pressure gauge. If you have a 1996 cluster, you will need to pull the cluster to see if you have the resistor or not, but I believe most 1996 clusters will have the resistor. FYI, there is no difference in the temperature or oil pressure gauges between V6, GT and Cobra clusters, so you can use a gauge from any type of donor cluster.

If you have a cluster with the resistor, you will need a short piece of wire to solder across the resistor. If you have a cluster without the resistor, you will need an oil pressure gauge from an older donor cluster which has the resistor, or a temperature gauge from any donor cluster.

You will need to buy a MeterMatch (http://www.technoversions.com/MeterMatchHome.html) for the temperature gauge and a MeterMatch for the oil pressure gauge. Be sure to carefully read the MeterMatch Instruction manual (http://www.technoversions.com/MeterMatchInstructionManual.pdf) before you begin.

You will need to buy an Autometer 0-100 PSI sender, part number 2242.

You will need a handful of alligator clipleads for use in calibrating the MeterMatch units, along with three wires long enough to reach from the front of the engine to the steering wheel. That will allow you to sit in your car with the key on, looking at the gauges while you are calibrating.

You will need a 100 ohm multi-turn pot for simulating a temperature sensor to known values for the calibration process. A Bourns 3006P-1-101LF will work fine. I get mine from Digikey.

You will need a 500 ohm multi-turn pot for simulating an oil pressure sensor to known values for the calibration process. A Bourns 3006P-1-501LF will work fine. Again, I get mine from Digikey.

You will need a very small flat-blade screwdriver to attach the wires to the MeterMatch units and to turn the calibration pots.

You will need to have a decent digital voltmeter to use during the calibration process.

You will need a few short bits of wire to integrate the MeterMatch to the cluster harness.

You will need a soldering iron and some rosin core solder for splicing wires.

You will need some shrink tubing and a heat gun for insulating your splices.

You will need some zip-ties or Velcro to secure the MeterMatch units inside the dash.
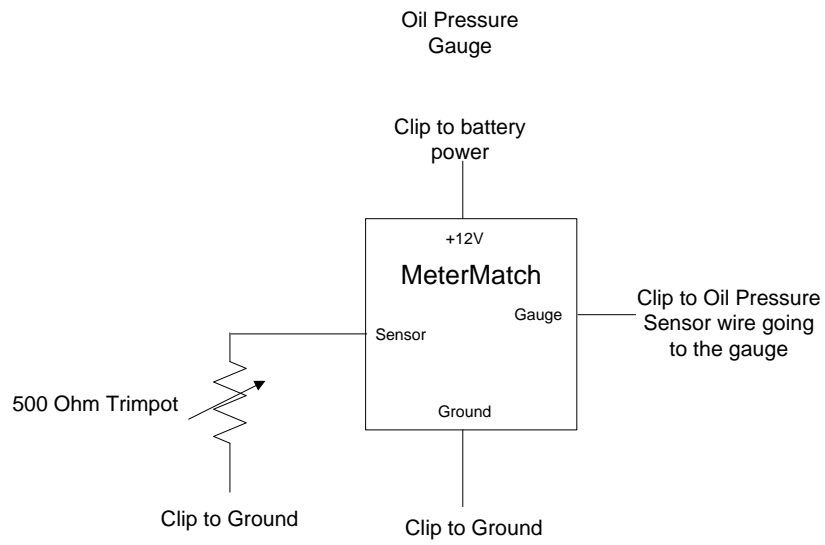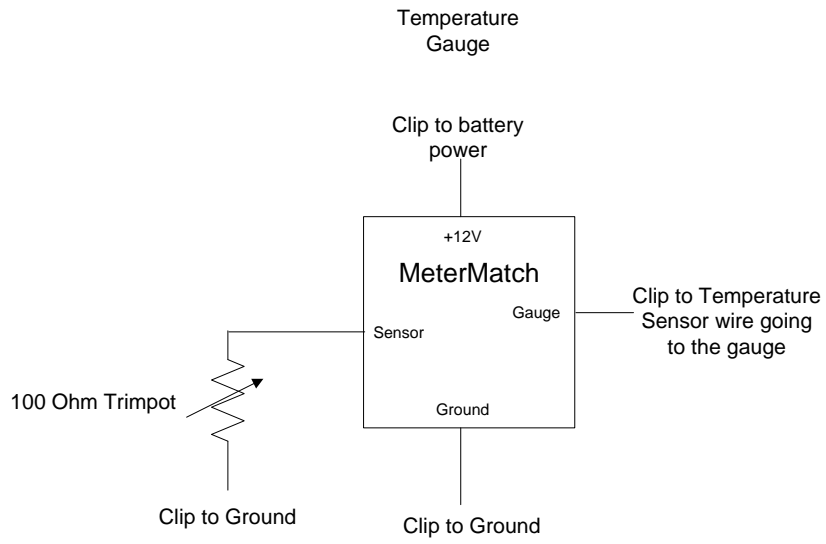
It is possible to have custom gauge faces made for your cluster with calibrated scales for the temperature and oil pressure gauges. Contact Scott Hrbacek at www.customgaugefaces.com. If you choose to have custom gauge faces made, you should install them before you start the calibration process. Should you decide to install custom gauge faces later, you will need to repeat this calibration process.

Sensor Installation

You will need to replace your stock oil pressure sender with an Autometer 2242 Oil Pressure sender. You will not need to replace the stock Ford temperature gauge sensor.

Calibration Schematics:

These schematics will be helpful for the MeterMatch calibration section which follows.

Temperature
Gauge

Clip to battery
power

+12V

MeterMatch

Gauge

Sensor

Clip to Temperature
Sensor wire going
to the gauge

100 Ohm Trimpot

Ground

Clip to Ground

Clip to Ground

Oil Pressure
Gauge

Clip to battery
power

+12V

MeterMatch

Gauge

Sensor

Clip to Oil Pressure
Sensor wire going
to the gauge

500 Ohm Trimpot

Ground

Clip to Ground

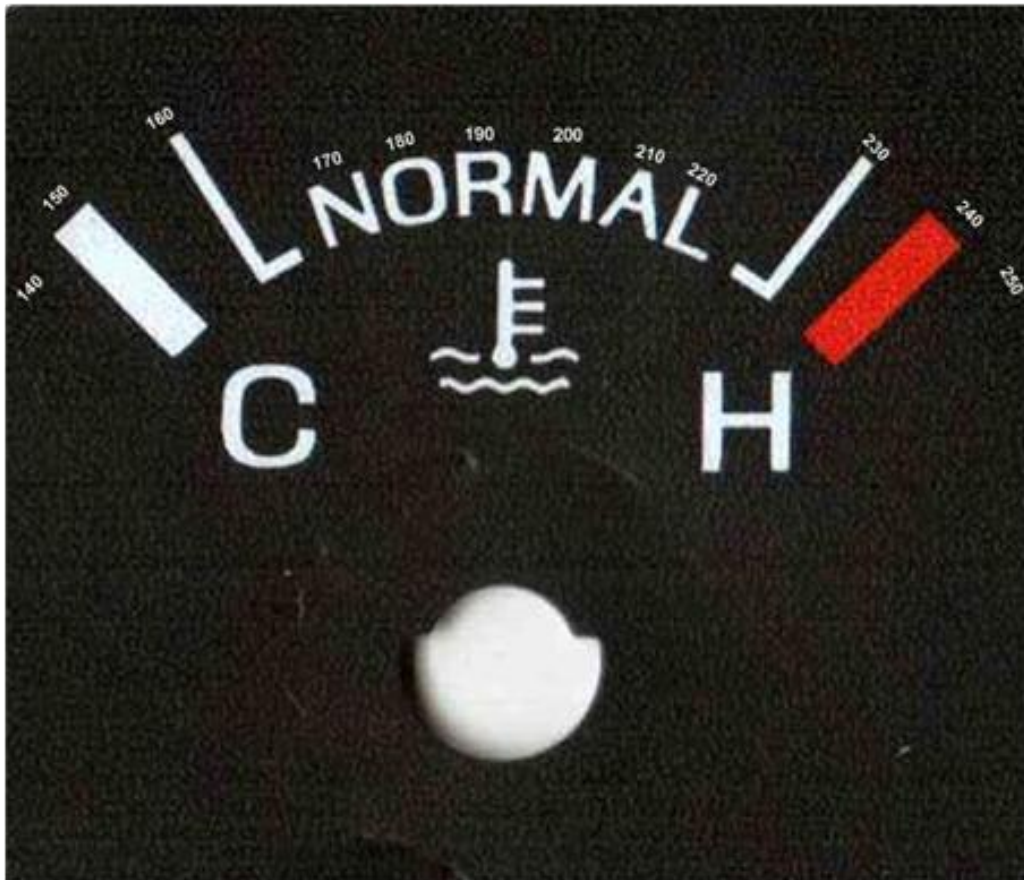Clip to Ground

MeterMatch Calibration Process

There are two things that need to be considered about calibration of a MeterMatch unit, the characterization of the sensor and then what values to assign to the markings on the gauge.

I have characterized the resistance of the stock Ford temperature gauge sensor vs temperature in *F, and will share the data that I took. I also characterized the resistance of an Autometer 2242 0-100 PSI Oil Pressure Sensor vs pressure and will share that data as well. This will allow you to start with known resistance values for the calibration points you choose for your gauges. Ford has published the PCM temperature sensor voltages if you decide to use that sensor instead of the temperature gauge sensor.

I will use my target temperatures in the calibration example below. Feel free to change the temperatures if you choose to. Just pick the correct corresponding voltages from the table below when you do your calibration.
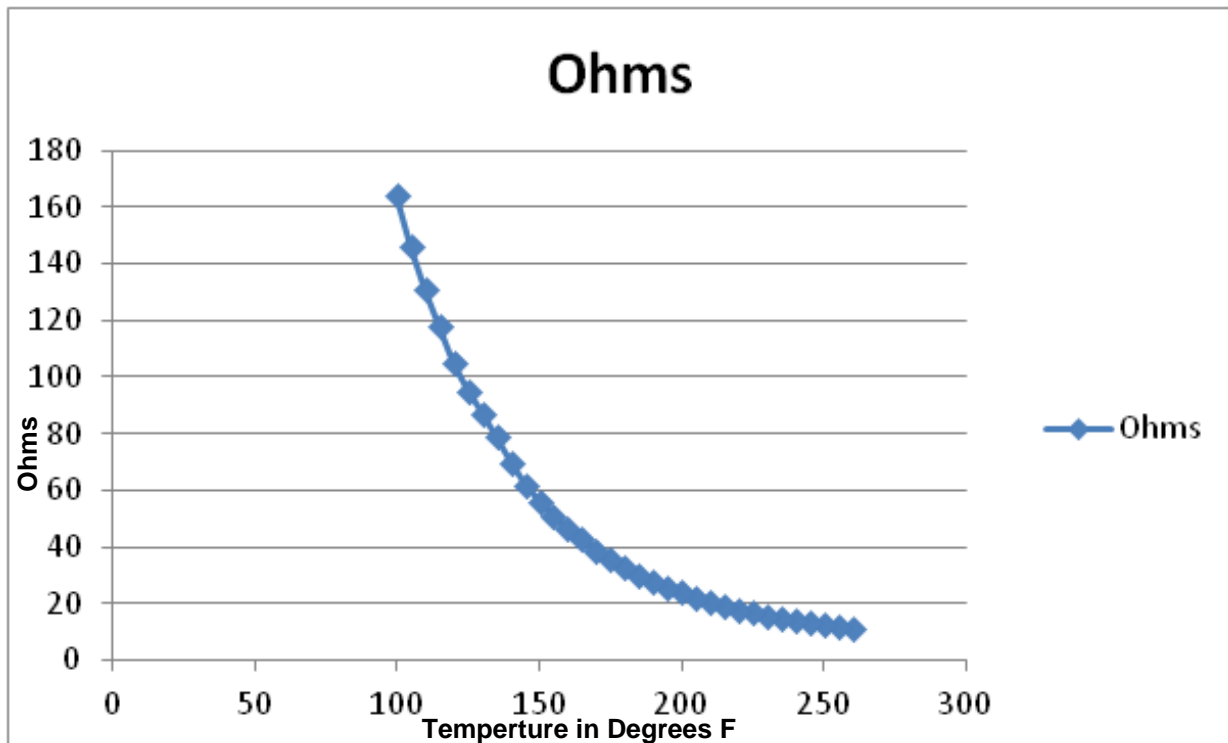
Calibrating the temperature gauge

Here are the target temperatures I have chosen to correspond to the different markings on the stock temperature gauge.

Here is a table with the resistances of the OEM Ford temperature gauge sensor and the MeterMatch input voltages vs temperature in degrees F: (The MeterMatch uses a 255 Ohm pullup resistor to 5V on the input.)

*F	Ohms	Volts		*F	Ohms	Volts
260	11.5	0.22		175	35.7	0.61
255	11.9	0.22		170	38.9	0.66
250	12.5	0.23		165	43	0.72
245	13.1	0.24		160	46.5	0.77
240	13.9	0.26		155	51	0.83
235	14.7	0.27		150	56	0.9
230	15.7	0.29		145	62	0.98
225	16.7	0.31		140	70	1.08
220	17.9	0.33		135	79	1.18
215	19.1	0.35		130	87	1.27
210	20.6	0.37		125	95	1.36
205	22.1	0.4		120	105	1.46
200	24	0.43		115	118	1.58
195	25.8	0.46		110	131	1.7
190	27.9	0.49		105	146	1.82
185	30.3	0.53		100	164	1.96
180	32.7	0.57				

Here is that data in chart form:

Here are the steps to calibrate the temperature gauge to your cluster:

1. Take the small Philips screw out of the bottom of the MeterMatch box and remove the MeterMatch circuit board from the box. Keep the circuit board on a piece of cardboard during the rest of the calibration process to ensure it does not short out on anything.

2. Strip both ends of 4 short pieces of wire and attach them to the MeterMatch power, ground, input and output terminals.

3. Unplug the temperature gauge sensor connector at the coolant crossover tube.

4. Connect a cliplead to the coolant temperature signal wire (Red/White). If you have the two pin style connector, be careful not to short the signal pin to the ground pin with the alligator clip.

5. Connect clipleads to each of the battery power and ground terminals at the battery. Make sure you don't accidentally ground the power wire while you are doing this.

6. Connect wires long enough to reach into near the steering wheel to each of the three clipleads.

7. Connect a cliplead between the long power wire and the MeterMatch power wire.

8. Connect a cliplead between the long ground wire and the MeterMatch ground wire.

9. Connect a cliplead between the long signal wire and the MeterMatch output wire.

10. Connect a cliplead between the middle terminal of the 100 Ohm trimpot and the MeterMatch ground wire.

11. Connect a cliplead between an end terminal of the 100 Ohm trimpot and the MeterMatch input wire.

12. Connect your voltmeter across the ground wire and the MeterMatch input wire. Turn the ignition switch to the On position. (You are now ready to start calibrating.)

13. Set the MeterMatch switch to 0. Disconnect the power to the Metermatch. Hold down the Up button and reconnect the power to the MeterMatch. Release the Up button. This sets it into voltage compensation mode, needed for use with 94-96 Mustang clusters.

14. Set the MeterMatch switch to 4. Using the trimpot, set the voltage of the MeterMatch input to the temperature of the C mark, in my case 150*F, 0.90V. Using the Up and Down buttons, move the needle to the C mark. Press the Save button to set the low calibration point.

15. Set the MeterMatch switch to 1. Using the trimpot, set the voltage of the MeterMatch input to the temperature of the H mark, in my case 240*F, 0.26V. Using the Up and Down Buttons, move the needle to the H mark. Press the Save button to set the high calibration point.

16. Set the MeterMatch switch to 2. Using the trimpot, set the voltage of the MeterMatch input to the temperature of the letter L , in my case 220*F, 0.33V. Using the Up and Down Buttons, move the needle to the letter L. Press the Save button to set the mid-high calibration point.

17. Set the MeterMatch switch to 3. Using the trimpot, set the voltage of the MeterMatch input to the temperature of the letter N , in my case 170*F, 0.66V. Using the Up and Down Buttons, move the needle to the letter N. Press the Save button to set the mid-low calibration point.

18. Set the MeterMatch switch to 0. If you plan to use the alarm output to flash a light if the temperature gets too high, you will need to set the alarm threshold. Using the trimpot, set the needle to the point at which you want the idiot light to start to flash (or use a voltage from the table). I set mine to between the 220 and 230 marks on the gauge, at about 0.31V. Set the Metermatch switch to 5 and press the Save button. That saves the Alarm High calibration point.

19. Set the MeterMatch switch back to 0. Run the trimpot up and down the scale setting the voltages to the ones corresponding to the marks on the gauge.   Make sure the needle points at the correct marks on the gauge. If you are not happy, repeat steps 14 to 19.

20. You are now done with the temperature gauge calibration process. Put the circuit board back into its box and mark it with the word "Temp".

Calibrating the Oil Pressure Gauge

Prior to calibrating the oil pressure gauge, you will need to remove the light switch knob, the cluster bezel and the instrument cluster. There are many how-tos and videos for this on the internet. Do a search.

If you have an older cluster with a 20 ohm resistor on the back, carefully solder a short piece of wire across the resistor, shorting it out. If you have a cluster without a 20 ohm resistor, replace the oil pressure gauge with one from an older cluster or with a temperature gauge mechanism from any cluster. Then plug the instrument cluster connectors back in without reinstalling the cluster.

If you replace the gauge mechanism, you will need to ensure that the needle is replaced at the correct angle. With the needle off, power up the cluster with the oil pressure sender unhooked. Replace the needle with the needle pointing just slightly below the L mark. If you make it too low, it will not go beyond the H mark during the calibration process. If you find this is the case during the calibration process, remove the needle and repeat this process, moving the needle closer to the L mark.
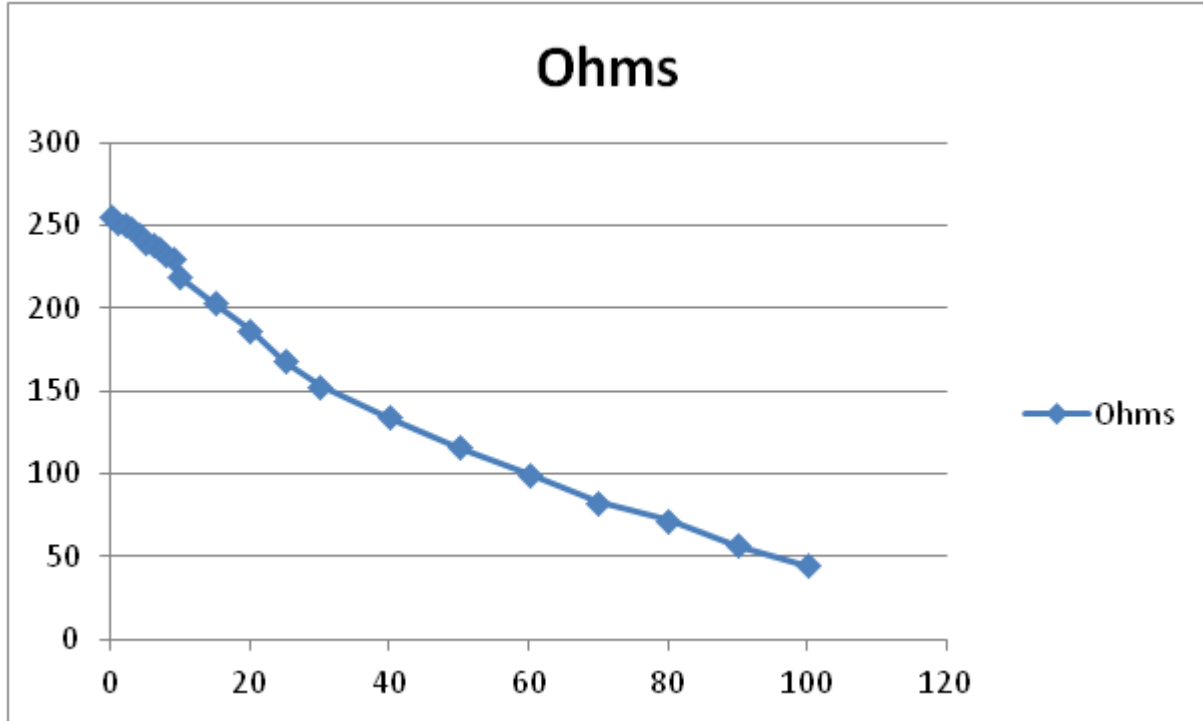
Here are the target pressures I have chosen to correspond to the different markings on the stock temperature.

Here is a table with the resistances of the Autometer 2242 sensor and the MeterMatch input voltages vs pressure in PSI: (The MeterMatch uses a 255 Ohm pullup resistor to 5V on the input.)

PSI	Ohms	Volts		PSI	Ohms	Volts
100	45	0.75		10	219	2.31
90	57	0.91		9	230	2.37
80	72	1.1		8	233	2.39
70	83	1.23		7	236	2.4
60	100	1.41		6	238	2.41
50	116	1.56		5	240	2.42
40	134	1.72		4	245	2.45
30	153	1.88		3	248	2.47
25	168	1.99		2	250	2.48
20	187	2.12		1	252	2.49
15	203	2.22		0	256	2.5

Here is that data in chart form:

Here are the steps to calibrate the oil pressure gauge to your cluster:

1. Remove the instrument cluster and short out the 20 Ohm resistor or replace the oil pressure gauge depending on what type of cluster you have.

2. Plug the cluster back into the cluster harness.

3. Take the small Philips screw out of the bottom of the second MeterMatch box and remove the MeterMatch circuit board from the box. Keep the circuit board on a piece of cardboard during the rest of the calibration process to ensure it does not short out on anything.

4. Strip both ends of 4 short pieces of wire and attach them to the MeterMatch power, ground, input and output terminals.

5. Unplug the oil pressure gauge sensor connector at the sensor.

6. Connect a cliplead to the oil pressure signal wire (White/Red).

7. Connect clipleads to each of the battery power and ground terminals at the battery. Make sure you don't accidentally ground the power wire while you are doing this.

8. Connect wires long enough to reach into near the steering wheel to each of the three clipleads.

9. Connect a cliplead between the long power wire and the MeterMatch power wire.

10. Connect a cliplead between the long ground wire and the MeterMatch ground wire.

11. Connect a cliplead between the long signal wire and the MeterMatch output wire.

12. Connect a cliplead between the middle terminal of the 500 Ohm trimpot and the MeterMatch ground wire.

13. Connect a cliplead between an end terminal of the 500 Ohm trimpot and the MeterMatch input wire.

14. Connect your voltmeter across the ground wire and the MeterMatch input wire. Turn the ignition switch to the On position. (You are now ready to start calibrating.)

15. Set the MeterMatch switch to 0. Disconnect the power to the MeterMatch. Hold down the Up button and reconnect the power to the MeterMatch. Release the Up button.   This sets it into voltage compensation mode, needed for use with 94-96 Mustang clusters.
16. Set the MeterMatch switch to 4. Using the trimpot, set the voltage of the MeterMatch input to the pressure of the L mark, in my case 5 PSI, 2.42V. Using the Up and Down buttons, move the needle to the L mark. Press the Save button to set the low calibration point.
17. Set the MeterMatch switch to 1. Using the trimpot, set the voltage of the MeterMatch input to the pressure of the H mark, in my case 90 PSI, 0.91V. Using the Up and Down Buttons, move the needle to the H mark. Press the Save button to set the high calibration point.
18. Set the MeterMatch switch to 2. Using the trimpot, set the voltage of the MeterMatch input to the pressure of the letter L , in my case 70 PSI, 1.23V. Using the Up and Down Buttons, move the needle to the letter L. Press the Save button to set the mid-high calibration point.
19. Set the MeterMatch switch to 3. Using the trimpot, set the voltage of the MeterMatch input to the pressure of the letter N , in my case 20 PSI, 2.12V. Using the Up and Down Buttons, move the needle to the letter N. Press the Save button to set the mid-low calibration point.

20. Set the MeterMatch switch to 0. If you plan to use the alarm output to flash a light if the oil pressure gets too low, you will need to set the alarm threshold. Using the trimpot, set the needle to the point at which you want the idiot light to start to flash (or use a voltage from the table). I set mine to 6 PSI (2.41V). Set the Metermatch switch to 6 and press the Save button. That saves the Alarm Low calibration point.

21. Set the MeterMatch switch back to 0. Run the trimpot up and down the scale setting the voltages to the ones corresponding to the marks on the gauge.   Make sure the needle points at the correct marks on the gauge. If you are not happy, repeat steps 14 to 19.

22. You are now done with the oil pressure gauge calibration process. Put the circuit board back into its box and mark it with the word "oil".

All of my oil pressure gauge marks were calibrated at the pressure I had targeted except for the low-normal tic mark. I had targeted 10 PSI but it came in at 15 PSI.
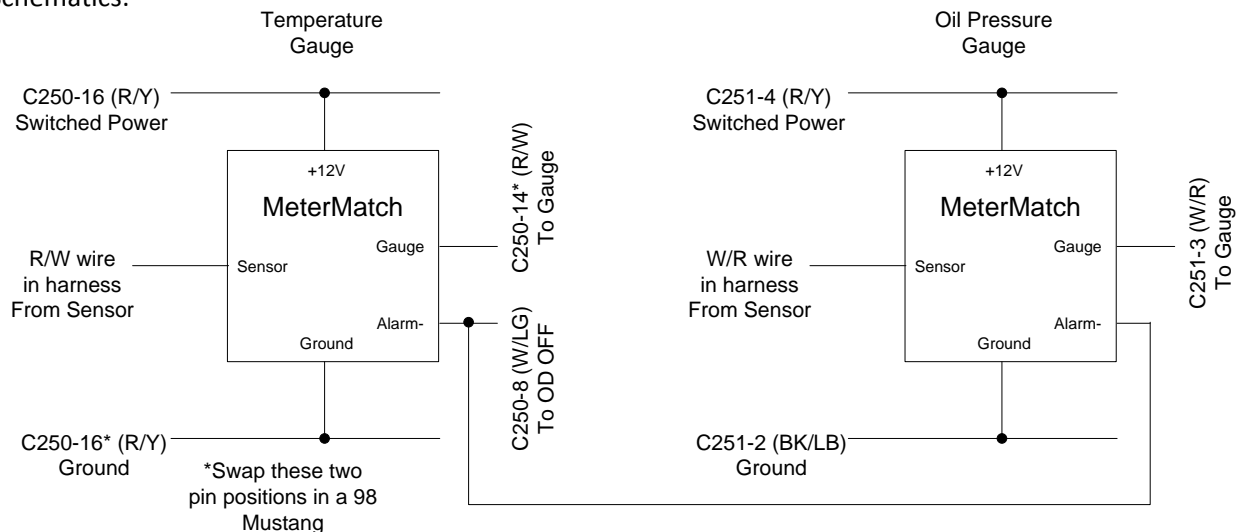
Installation in the Car

Since my 96 Cobra has a manual transmission, I have an OD OFF idiot light that is unused. So I use the OD OFF light as a shared idiot light for the temperature and oil pressure MeterMatch units. You can use a different idiot light such as the seat belt light if you would like to, or you can use one or two LEDs as described in the MeterMatch Instruction Manual. Or you can run without an alarm light.

For each MeterMatch, you will need to access switched power, ground and the signal wire behind the cluster. There is one signal wire, switched power and ground in each side of the cluster harness.   The OD OFF wire is in the bundle behind the temperature gauge.

Please refer to the cluster pinout page on the Accutach Co. web site: http://www.accutach.com/Pages/94to98ClusterPinouts.aspx   It would be convenient to print this page for reference while you work on the wiring. Note that two of the temperature gauge pins are reversed on the 1998 clusters as compared to the 94-97 clusters. Those pins are C250-14 and C250-15. The wire colors are the same, only the pin positions have been reversed.

Schematics:

Installation of the Temperature Gauge Unit

1. Unhook the battery prior to modifying the instrument cluster wiring.

2. Remove the instrument cluster from the car. You will see a black connector on the left (C250) and a white connector on the right (C251). We will start with the black connector (C250) to install the temperature unit first.

3. Assuming you have a car with a manual transmission and will be using the OD OFF light as the MeterMatch alarm light, Cut the W/LG OD OFF signal wire and add a short piece of wire and a longer piece of wire to it on the connector side of the wire. The longer piece of wire needs to be long enough to reach from the black connector to near the white connector. Solder and shrink wrap the splice. Shrink wrap the other side of the cut wire to prevent any accidental shorting. If you choose to use an LED, mount the LED and run the LED wiring now. If you are not running an alarm light, you can skip this step. FYI, the short pieces of wire need to be long enough to ensure the MeterMatch boxes clear the support structures behind the cluster. I kept my wire short and I had trouble getting the boxes to fit into the spaces behind the cluster.

Space behind
the cluster

4. Splice a short piece of wire to the R/Y IGN wire. Solder and use shrink tubing. This will supply power for the temp gauge unit.
5. Splice a short piece of wire to the O/Y Ground wire. Solder and use shrink tubing. This will supply ground for the temp gauge unit.
6. Cut the R/W signal wire. Solder (and shrink wrap) a short piece of wire to the connector side of that wire and solder (and shrink wrap) a short piece of wire to the other side of that cut wire.
7. Take the PCB out of the MeterMatch plastic case and unscrew all of the wire terminals except for the Alarm + terminal. Tighten that screw in order to prevent it from vibrating out to cause problems.
8. Insert the short power wire (R/Y) in the 12V terminal and tighten the screw.
9. Insert the short signal wire from the cluster connector (R/W) into the Gauge terminal and tighten the screw.
10. Insert the short signal wire from the harness side (R/W) into the Sender terminal and tighten the screw.
11. Insert the short OD OFF wire (W/LG) into the Alarm- terminal and tighten the screw.
12. Insert the short Ground wire (O/Y) into the Ground terminal and tighten the screw.
13. Put the MeterMatch PCB into the MeterMatch case and tighten the screw. Don't drop the screw into the dash or you will waste a lot of time looking for it, as I did. ☺

14. Zip tie the MeterMatch unit to the harness wire back up inside the cavity behind the cluster. Zip tie the wires into a bundle to keep them neat. Now you will move to the white connector behind the oil pressure gauge to install the oil pressure gauge unit:

Installation of the Temperature Gauge Unit

1. Splice a short piece of wire to the R/Y IGN wire. Solder and use shrink tubing. This will supply power for the oil pressure gauge unit.
2. Splice a short piece of wire to the BK/LB Ground wire. Solder and use shrink tubing. This will supply Ground for the oil pressure gauge unit.
3. Cut the W/R signal wire. Solder (and shrink wrap) a short piece of wire to the connector side of that wire and solder (and shrink wrap) a short piece of wire to the other side of that cut wire.
4. Take the PCB out of the MeterMatch plastic case and unscrew all of the wire terminals except for the Alarm + terminal. Tighten that screw in order to prevent it from vibrating out to cause problems.
5. Insert the short power wire (R/Y) in the 12V terminal and tighten the screw.
6. Insert the short signal wire from the cluster connector (W/R) into the Gauge terminal and tighten the screw.
7. Insert the short signal wire from the harness side (W/R) into the Sender terminal and tighten the screw.
8. Insert the short OD OFF wire (W/LG) into the Alarm- terminal and tighten the screw.
9. Insert the short Ground wire (BK/LB) into the Ground terminal and tighten the screw.
10. Put the MeterMatch PCB into the MeterMatch case and tighten the screw.
11. Zip tie the MeterMatch unit to the harness wire back up inside the cavity behind the cluster. Zip tie the wires into a bundle to keep them neat:

12. Replace the instrument cluster into the dash. Replace the bezel and the light switch knob.

Details of my splices

I like to make it easy to revert back to stock, so I decided to harvest a couple of cluster connectors from a junkyard car. I opened the junkyard connectors and extracted the pins and wires for the pins I needed to modify in my car. You can read how to open the connector and extract the pins here: http://www.accutach.com/Pages/ClusterConnectorRepinning.aspx

I soldered the spliced wires to the wires near the pins:

I de-pinned the connectors in my car. I soldered the wires that need to go into the harness to the crimps of the pins I just took out of the connector, and then shrink wrapped the entire pin.

I then slid the junkyard pins into my connectors, making sure they went back into the correct pin locations. This is what it looked like after I was done:

The units in operation

I have tested the units in the car and I am very happy with the results. Here is the oil pressure gauge with the key on and engine off:

FYI, the OD OFF is flashing since the oil pressure is at 0.

Here is the oil pressure with the engine cold at idle:

Here is the oil pressure with the engine warmed up at idle:

Here is the temperature gauge with key on, engine off and cold:

Here are all of the gauges with the engine warmed up and idling:

Test drives with the temperature gauge compared to my PLX Devices DM-200 OBD2 gauge showed that my calibration below 200 degrees reads a little bit lower than target, but is is accurate at 200 degrees. I will need to wait until summer to check higher temperatures.

Fox Body Clusters

For completeness, I tested the MeterMatch units with the 89 Fox Body Mustang GT cluster I have on my bench. The Meter Match units worked equally well with that cluster as well.
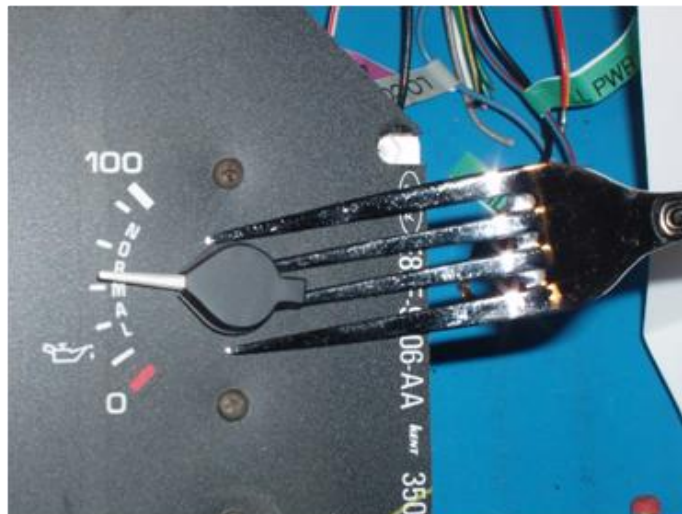
The Fox Body oil pressure sensor also will need to be replaced with an Autometer 2242 sensor.

The needle on the Fox oil pressure gauge has a small plastic pin pointing down under the needle on the side opposite the pointer. The pin fits into a semicircular slot in the gauge face, and limits the travel of the needle to the high-normal level. If you cut off that plastic pin, you can use the MeterMatch to get full travel on the Fox oil pressure gauge too.
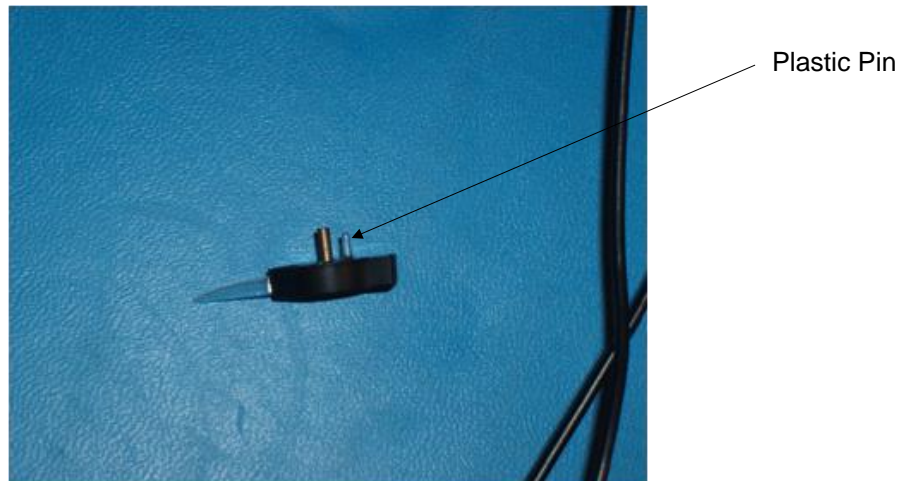
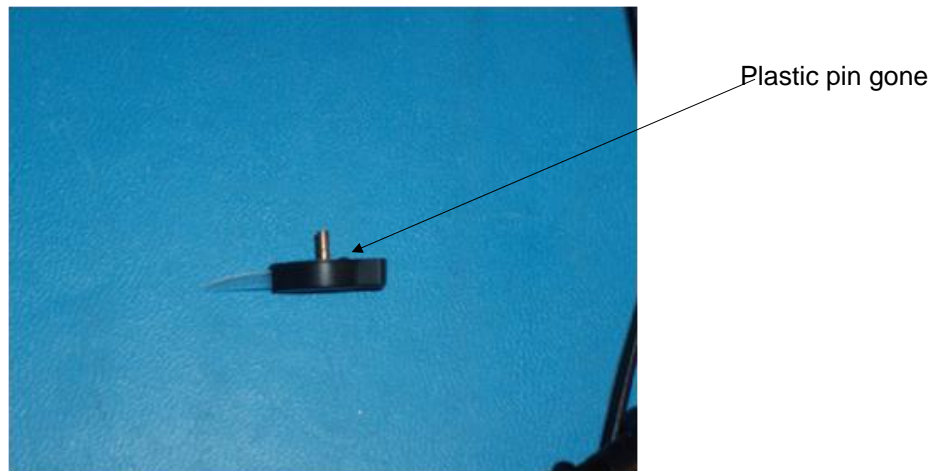First, take the covers off of the cluster to expose the needle:

Using a common dinner fork, carefully pry the needle off of the shaft:

Note the plastic pin that needs to be removed:

Plastic Pin

Cut the plastic pin off of the needle:

Plastic pin gone

Make sure you carefully shave the remnant of the cut off pin off with an Exacto knife or the pin remnant may still limit the needle travel if you push it too far back on the shaft.

In order to ensure you get the needle back onto the shaft at the correct angle, power up the cluster with the temperature sensor unhooked. Then put the needle back on the shaft with the needle at or just a touch below the 0 mark.

Then reinstall the cluster covers and you are ready to install the MeterMatch units in your Fox Body Mustang following the directions above. You will need to figure out how you want to map your gauge marks to specific temperatures and pressures.

Good Luck.