Perfect Tuning

Universal Gauge

User Manual v1.0

For gauge hardware revision 4, software version 7

Table of content

Warning

All parts are sold for OFF ROAD RACE-ONLY ground-vehicle use only.

Race parts are inherently dangerous and may cause injury or damage if improperly modified or altered before use. Perfect Tuning will not be held liable for and will not pay you for any injuries or damage caused by misuse, modification, redesign, or alternation of any of our products. Perfect Tuning will not be held in any way responsible for any incidental or consequential damages including direct or indirect labour, towing, lodging, garage, repair, medical, or legal expense in any way attributable to the use of any item in our catalogue or to the delay or inconvenience caused by the necessity of replacing or repairing any such item.

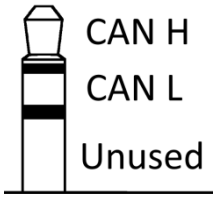
1 Wiring

1.1 Black 8 conductor cable

Color	Function
Red	12v (+). Always install the gauge on a fused supply like a 5A fuse.
Brown	Vehicle Ground (-)
White	0-5v analog input 1
Yellow	0-5v analog input 2
Pink	0-5v analog input 3
Gray	Digital input
Blue	5v output
Green	Digital output. Connected to ground when output is enabled.

1.2 Stereo cable:

Color	Function
Red	CAN Bus H
Blue	CAN Bus L
Black	Unused



MS3 users: always double-check that SPR1 and SPR2 are connected to JS6 and JS8 inside the ECU. Refer to the MS3 hardware manual section 3.4.12 for more information. http://www.msextra.com/manuals/ms3manuals/

2 Menus and buttons

There are two buttons to navigate through the different menus of the gauge and edit basic settings.

Press left to move to the left or to go up and press the right button to move to the right or go down.

Press both buttons to select or enter. It's not possible to go back. If you entered a menu by error, press both buttons until you're back to the previous screen or power off the gauge.

2.1 Real-Time Display Screens

Almost the real time screens are configurable. First, validate that "Screen designer" is enabled in the Settings menu. Then where a value is displayed, press both buttons to open the screen designer. A rectangle will appear around the value that is selected. Press both buttons to edit this value and a list of inputs will appear. Select the desired value with left and right button and press both to select the value.

2.2 Settings

This section will describe each configuration screen.

2.2.1 LED Brightness

Use this menu to enable or disable automatic light adjustment. It's possible to specify the led intensity during day and night. Depending on the LEDs intensity, light can be reflected into the light sensor. If you have this issue, it's suggested to disable the automatic dimming of the LEDs.

2.2.2 Units

This screen is used to select the displayed units for different values on the screen. Do not mix up pressure and MAP. Units are different.

2.2.3 Input Configuration

Configure the three 0-5v analog inputs by selecting which input to configure, then select the sensor. For advanced or custom configuration, see the Wi-Fi section.

2.2.4 Wi-Fi hotspot

Advanced configuration of the gauge is made over the configuration web page. Press both buttons to enable the Wi-Fi hotspot. This will create a Wi-Fi network named PerfectTuning-XXXX (where XXXX will vary on every gauge). The hotspot is not password protected and this is why it cannot be left always active. Leaving this screen will disable the hotspot. Once connected to the PerfectTuning-XXXX hotspot, open a web navigator (chrome is recommended) and navigate to the address 192.168.0.1. This will bring the configuration webpage. See the Wi-Fi section for more information.

2.2.5 Safe Mode

Safe mode is for firmware upgrade recovery in case of problems. Safe mode can also be accessed by pressing both buttons while powering the gauge.

2.2.6 Edit text color

Change the text color in the menus and in few real-time display values.

2.2.7 Disable / Enable screen designer

The screen designer is used to select which value is displayed in the real time screens. To prevent editing these values, disable the screen designer.

2.2.8 Select boot mode

There is 9 different boot sequences that are available to execute when the gauge is powered up.

2.2.9 CAN bus Device ID

CAN bus identification number of the gauge. Set to 0 if no communication is required over CAN bus. This will also hide all the Megasquirt items in the real-time screens selection list. Use the default value “2“ to enable CAN bus communication unless you know what you’re doing.

2.2.10 General Info

This menu display general gauge information like hardware version, software version and serial number that can be useful for support.

2.2.11 Factory Reset

Reset all settings to factory default.

3 CAN Bus

Actually, the Perfect Tuning Universal Gauge is only supporting Megasquirt 3 and MS3Pro.

AEM, ECU Master, ProEFI and more will come later.

3.1 CAN bus resistor

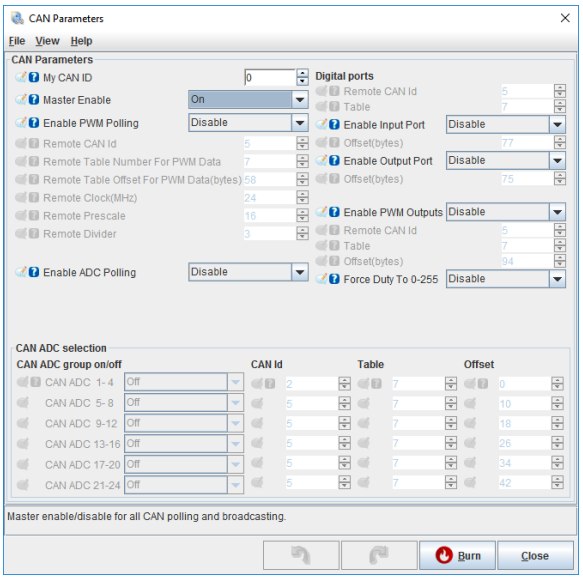
On the back of the gauge, in the hole there is a jumper for the 120 ohms end of bus resistor. To disconnect the 120 ohms resistor, remove the jumper. Unless there is more than 1 device connected to the CAN bus, leave the jumper installed.

3.2 Display values from ECU over CAN bus

This manual is valid for the gauge software version 7 and Megasquirt 3 or MS3Pro version 1.4.1.

No special configuration is required. Go in TunerStudio and confirm that the ECU Can ID is 0 in “CAN-bus/Testmodes”, “CAN Parameters” and Master Enable is at ON. Leave other settings disabled. Do not

enable Dash broadcasting or CAN Real time data broadcasting.

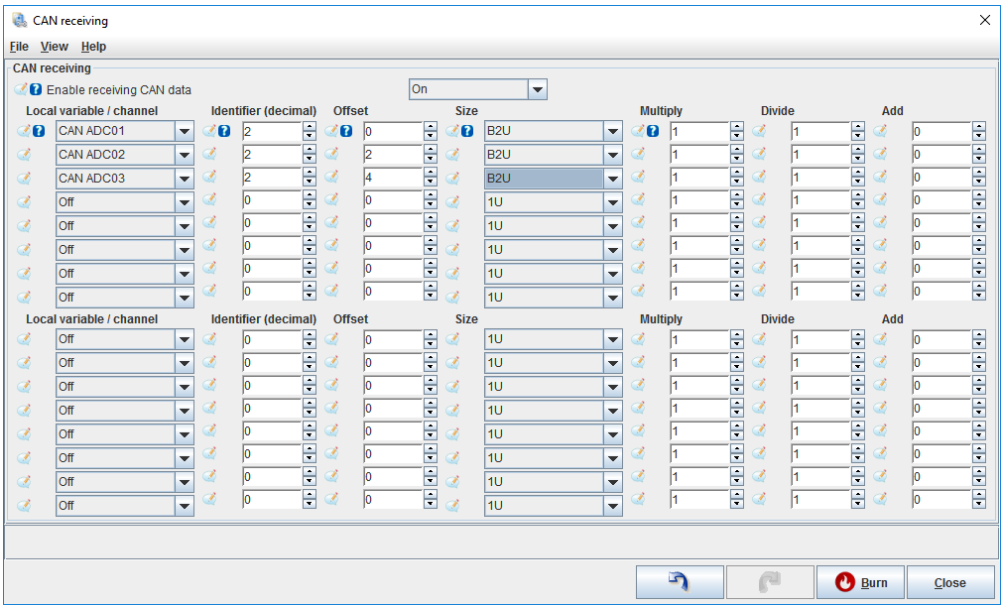


Here are the values that can be displayed on the software version 7 of the gauge with a Megasquirt 3 version 1.4.1. This might change in other versions.

Value	Description
RPM	Engine rotation speed
IAT	Intake temperature
Coolant	Coolant temperature
MAP (kpa)	Manifold air pressure in KPA
MAP (PSI)	Manifold air pressure in PSI
AFR	Air/fuel ratio
AFRT	Air/fuel ratio EGO target
TPS	Throttle position
Gear	Transmission gear
V. Speed	Vehicle speed
Ign. Adv.	Ignition advance
Batt V.	Voltage battery at the ECU. Different than Batt which is voltage at the gauge.
Fuel eco.	Fuel economy in GPM or l/100 km.
Knock	Knock indicator
Baro	Barometer reading
Boost Duty	Boost control duty cycle
Sensor 1	Generic analog sensors value
…	…
Sensor 16	

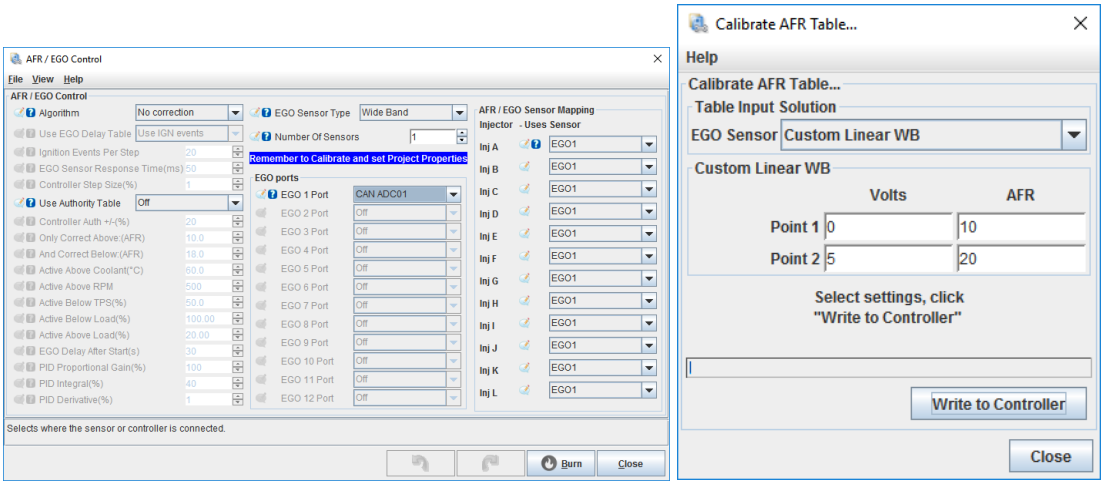
3.3 Sending gauge analog inputs values over CAN bus

The gauge is always broadcasting analog inputs 1, 2 and 3 over CAN bus. To display and log these values in a Megasquirt 3 or MS3Pro ecu, go to “CAN-bus/Testmodes”, “CAN Receiving”. Enable Can receiving. In the “Identifier (decimal)” column, enter the gauge CAN bus ID (see Settings section). See image below



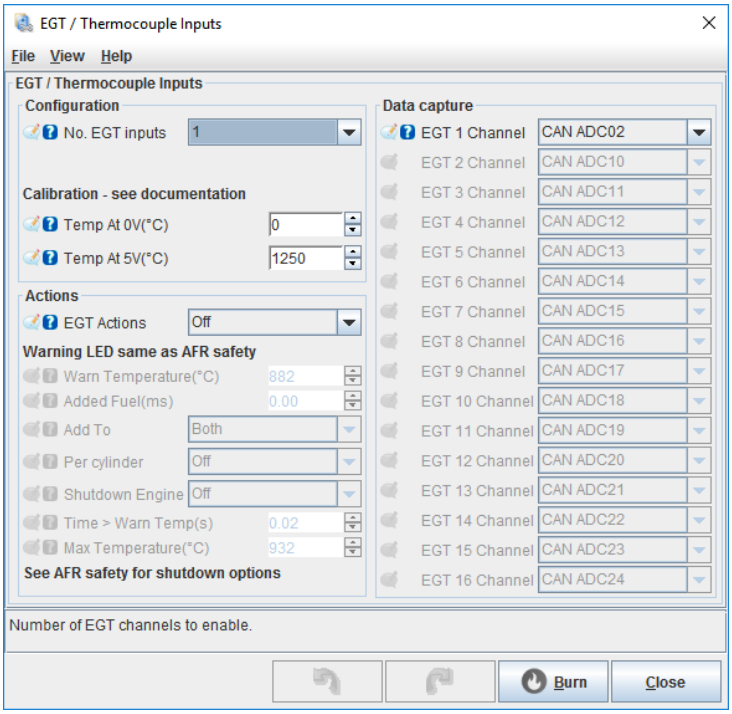
3.3.1 AFR

To display AFR values from the gauge in the Megasquirt ECU, enable CAN receiving like above. The value is sent using 10 bits ADC format: 0 = 10AFR, 1023 = 20 AFR. In TunerStudio, go to “Fuel Settings”, “AFR/EGO Control”. In the EGO Ports sections, select CAN ADC0X for the EGO 1 Port. Then go to “Tools”, “Calibrate AFR table” and select “Custom linear WB”. 0v = 10 AFR, 5v = 20 AFR.



3.3.2 EGT

To display EGT values from the gauge in a Megasquirt ECU, enable CAN receiving like above. The value is sent using 10 bits ADC format: 0 = 0 Celsius, 1023 = 1250 Celsius. In TunerStudio, go to “Advanced Engine”, “EGT / Thermocouple inputs”. In the calibration filed, enter 0v = 0C (or 32F) and 5v = 1250C (or 2282F). Then select CAN ADC0X in the EGT 1 Channel.

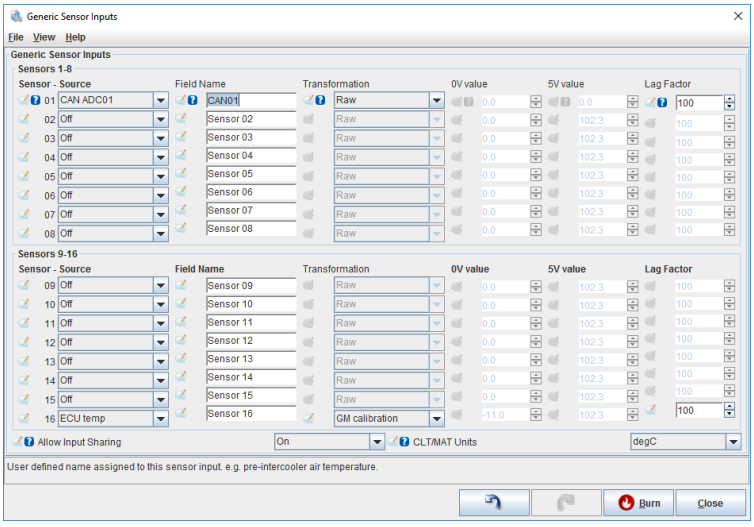


3.3.3 Other values

To log any other gauge values in a Megasquirt ECU, enable CAN receiving like above. Then, in TunerStudio, go to “Advanced Engine”, Generic Sensor Inputs. Select CAN ADC0X as the source. Give a custom name.

Some values are sent without decimal with no multiplier like temperature and pressure. In this case, use a raw transformation. Other values will use an x10 multiplier. Use a linear transformation and set 0v Value to 0 and 5v value to 102.3

Use a lag factor of 100.



4 WiFi

4.1 How to connect and access the gauge configuration webpage

The gauge can be configured with any recent smartphone, tablet or laptop that is able to browse a webpage. Only one connection at the same time is supported.

First, go to "**Settings"** on the gauge, and enable the "**Wi-Fi hotspot"**.

Connect to the PerfectTuning-XXXX WiFi hotspot on your device.

Open the browser used to navigate the internet and type 192.168.0.1

Google Chrome web browser is recommended and only one connection is supported.

The home web page will appear.

In rare occasion, it's possible that some device have trouble connecting to the hotspot. Specifying a fixed IP of 192.168.0.2 might help or try rebooting the gauge.

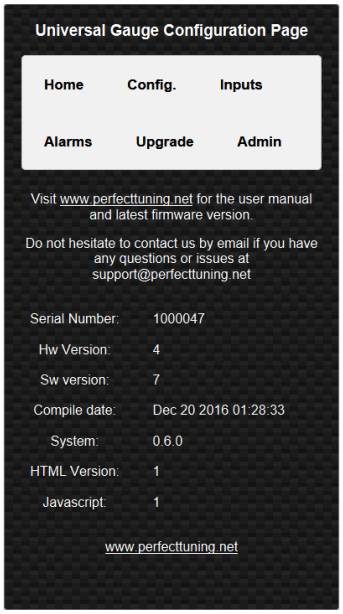
4.2 Help

Click on the question mark logo  in the web pages for more information about each option.

4.3 Web pages

4.3.1 Home

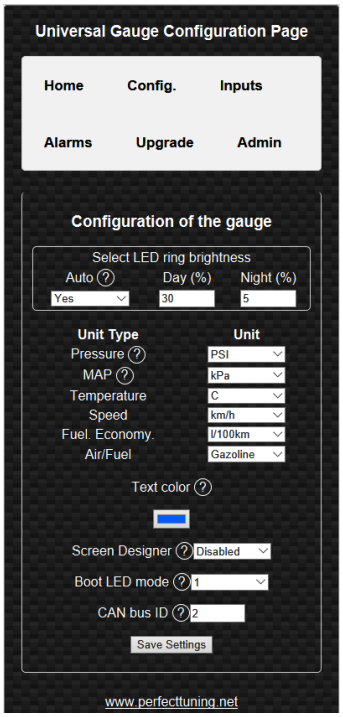
The home page display information related to the gauge like the serial number, software version, hardware version, html version, JavaScript version and system version.



4.3.2 Config.

The configuration page allows changing general settings of the gauge like units, LED ring intensity and more. The color tool is not available on IOS devices like iPhones and iPads. IOS users must enter the text color value in hexadecimal.

Always hit “Save Settings” before going to another page.

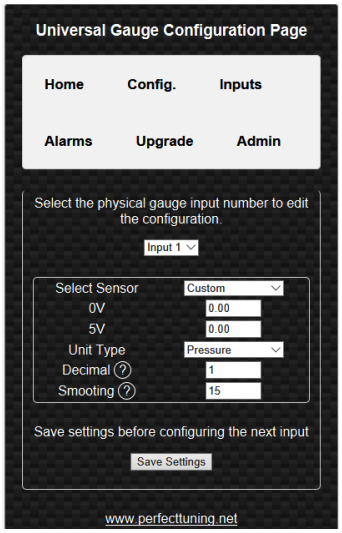


4.3.3 Inputs

The input page allows editing the analog input configuration. It is possible to select between the different supported sensors or enter custom values for a different sensor. Custom thermistor tables are not supported.

Smoothing is important. The default value is 100. 100 mean no smoothing. 15 mean maximum smoothing. Change this setting to smooth or increase response of the analog inputs.

Always hit ”Save Settings” before configuring next input.

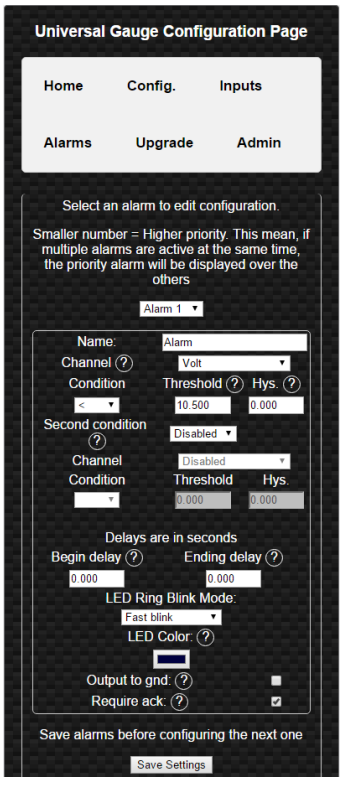


4.3.4 Alarms

This page is used to configure up to 16 alarms on the gauge. Each alarm can contain 2 conditions. Each field is explained by clicking on the question mark logo.

Alarms with a smaller number have higher priority.

Always hit “Save Settings” before configuring next alarm.



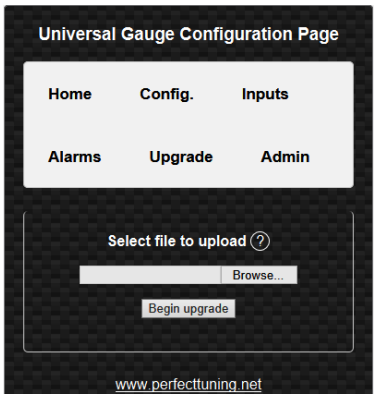
4.3.5 Upgrade

This page is used to do a firmware upgrade of the gauge. On IOS devices, this is tricky because the IOS devices cannot store a .bin file easily, the user must save the firmware file in iCloud first. And then select the file from there. Press “Begin upgrade” and accept the warning popup. Wait and don’t do anything else. The device will reboot when the upgrade is finished.

Optional: This page can also be used to change the boot logo image.

There is no support regarding changing the boot image and if there is any problem related to this, this won’t be covered under the warranty.

Create a .bmp file with 24bits color depth in paint with a dimension of 160x128 pixels. Name this file boot.bmp and use the upgrade tab to upload the file to the gauge.



4.3.6 Admin

The admin page is used to do a factory reset of the gauge.

The WiFi credentials section is for support and advanced users only. These settings are not related to the Wi-Fi hotspot SSID and password so do not try to change this.

5 Alarms

The alarms are not configurable directly on the gauge. See the Wi-Fi section of the user manual to understand how to connect to the web interface of the gauge and configure the alarms.

An alarm can be ignored by pressing any button. Pressing both buttons when an alarm is active will disable the alarm until next reboot.

Alarms are only displayed when the real time screens are active. The alarms won't be generated if the gauge is in the settings menu.

In each alarm configuration, it's possible to set a custom name.
Then select on which channel this alarm will be set. Select a condition (< Smaller, > Bigger, = Equal), a threshold value and a hysteresis value.

Second condition is use to make combination of condition to generate an alarm. The condition "AND" (condition 1 AND condition 2 must be active for the alarm to be generated) or "Or" (condition 1 or condition 2 must be active to generate the alarm) can be selected.

A begin and ending delay can be specified in seconds.

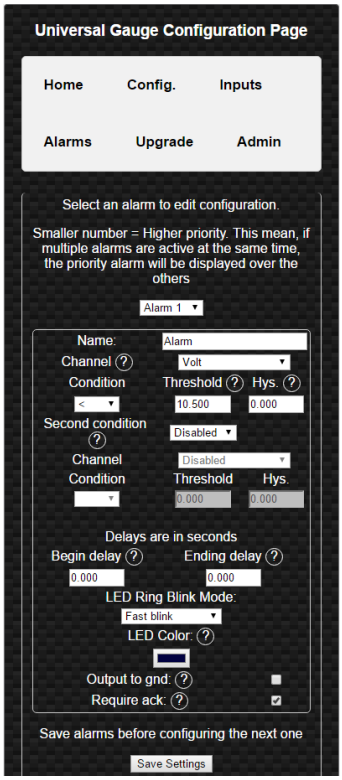
Select the LED ring mode (fast blink, slow blink, solid, off) and LED ring color.

The output to ground check box can be used to ground the digital output when the alarm is active.

Require Ack is used to leave the alarm active as long as the user doesn't acknowledge the alarm by pressing a button on the gauge.

Eg: Channel is MAP (PSI). Condition is bigger, threshold is set to 20 and hysteresis is set to 1. Begin delay is set to 1 and end delay is set to 0.

When the MAP value will go over 20 psi for at least 1 second the alarm will be generated. Because there is a hysteresis value set to 1. The value must go under 19 psi for 0 seconds for the alarm to end. When the alarm is active, the LED ring will blink in red quickly. As soon as the value is under 19 psi, the gauge will display the previous real time screen.



6 Accessories and Sensors

6.1 Perfect Tuning Wideband controller:

Wires color of the Perfect Tuning wideband controller.

Color	Function
Red	12v with 5A fuse.
White	Power ground. Connect to the same ground of the gauge.
Black	Sensor ground. Connect to the same ground of the gauge.
Green	0-5v linear output connected to any analog inputs of the gauge.
Orange	Narrowband output is unused

Blue	Led output for the heater is unused.

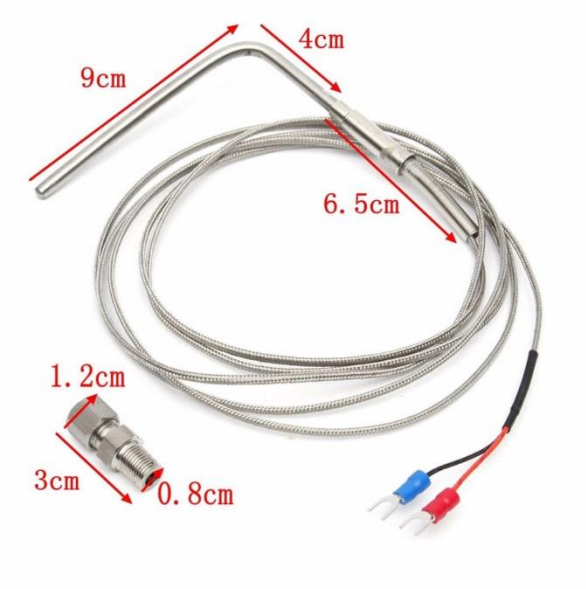
6.1.1 Calibration procedure

When the wideband sensor is selected in the Inputs configuration menu, a reboot will be required for calibration. This will work only with the Perfect Tuning wideband controller. To cancel this calibration, press both buttons during the calibration sequence.

6.2 EGT

Power the EGT-K controller VCC pin to 12v and GND to ground. Connect the OUT1 to any analog input of the gauge (white, yellow or pink wire) and the output GND to the black wire of the gauge.

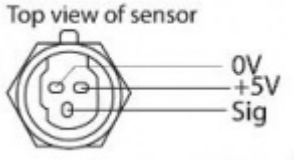
Connect the EGT probe black wire to the TC1- pin and red wire to TC1+.



6.3 Oil pressure sensor

The oil pressure sensor is compatible with oil, fuel, water or air pressure.
Accuracy: within 1.5% of reading (full scale).
Thread: 1/8”-27 NPT.
Wiring connector: water sealed quick disconnect. Mating connector and wire harness (pigtail) are included.

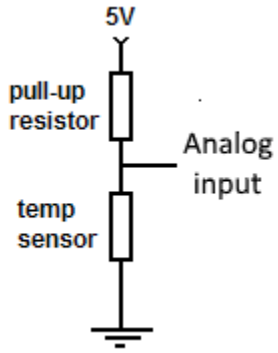
Red	5v (blue wire of the gauge)
Black	Ground (black wire of the gauge)
Blue	Signal (white, yellow or pink wire of the gauge).



6.4 Oil, coolant and air temperature sensor

Thermistors must be connected with a 1k provided pull up resistor to 5v and grounded at the same place where the gauge is grounded.

Resistor is connected to the blue wire of the gauge (5v output) and the other side is connected to any input (white, yellow or pink wire). Thermistor is connected to the same analog input and the other pin to the black wire of the gauge. The polarity of the resistor and thermistor is not important.



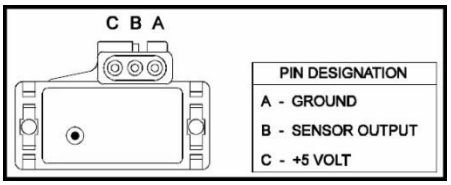
Configuration:

- Select “Oil temp” if the sensor looks like this  even sensor is used as coolant temp sensor.
- Select GM CLT if the sensor looks like this: 
- Select GM IAT if the sensor looks like this: 

6.5 Map sensors

6.5.1 GM 3 bar map sensor

The GM 3 bar (29 psi) and 4 bar (44 psi) must be connected this way. The 5v out is available on the blue wire of the gauge. NEVER CONNECT THE MAP SENSOR TO 12v. The ground pin must be connected to the black wire of the gauge. Sensor output can be connected to any of the three analog inputs of the gauge (white, yellow or pink).



6.6 12v Buzzer

A 12v buzzer can be used with the gauge to generate a sound when an alarm occurs. Connect the red wire of the buzzer to the positive 12v of the gauge and connect the black wire of the buzzer to the Output pin of the gauge (green).

Red	Connect to 12v
Black	Connect to gauge output green wire

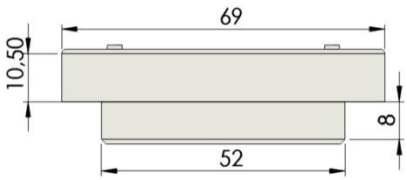
7 12 Month Limited Warranty

Perfect Tuning warrants to the consumer that all products will be free from defects in material and workmanship for a period of twelve (12) months from the date of the original purchase. Products that fail within this 12-month warranty period will be repaired or replaced at Perfect Tuning's option, when determined by Perfect Tuning that the product failed due to defects in material or workmanship. This warranty is limited to the repair or replacement of the Perfect Tuning part. In no event shall this warranty exceed the original purchase price of the Perfect Tuning part nor shall Perfect Tuning be responsible for special, incidental or consequential damages or cost incurred due to the failure of this product. Warranty claims to Perfect Tuning must be transportation prepaid and accompanied with dated proof of purchase. This warranty applies only to the original purchaser of products and is non-transferable. All implied warranties shall be limited in duration to the said 12-month warranty period. Improper use or installation, accident, abuse, unauthorized repairs or alterations voids this warranty. Perfect Tuning disclaims any liability for consequential damages due to a breach of any written or implied warranty on all products manufactured by Perfect Tuning. Warranty returns will only be accepted by Perfect Tuning when accompanied by a valid Return Merchandise Authorization (RMA) number. Products must be received by Perfect Tuning within 30 days of the date the RMA is issued. Oxygen sensors are considered wear items and are not covered under warranty. Please note that before

Perfect Tuning can issue an RMA for any electronic product, it is first necessary for the installer or end user to contact the us at support@perfecttuning.net to discuss the problem. Under no circumstances should a system be returned or a RMA requested before the above process transpires. Perfect Tuning will not be responsible for electronic products that are installed incorrectly, installed in a non-approved application, misused, or tampered with. Any Perfect Tuning electronics product can be returned for repairs if it is out of the warranty period. There is a minimum charge of $50.00 for inspection and diagnosis of Perfect Tuning electronic parts. Parts used in the repair of Perfect Tuning electronic components will be extra. Perfect Tuning will provide an estimate of repairs and receive written or electronic authorization before repairs are made to the product

8 Dimensions

The gauge fits in a 52 mm pod but the overall dimension is 69 mm



9 Contact

If you found a bug, have suggestions, issues, or questions, you can contact us at support@perfecttuning.net. We can give remote desktop and phone support. Just contact us by email first.

10 Compatible accessories:

- Wideband controller with Bosch LSU 4.9 sensor.
- Fast response GM intake air temperature sensor (open element IAT)
- GM intake air temperature sensor or coolant temperature sensor (close element).
- Generic oil or coolant temperature sensor (1/8 NPT).
- Exhaust gas temperature sensor. Up to 1250 Celsius with interface board.
- Oil, fuel, air, water pressure sensor in different range from 100 psi to 2500.
- MAP sensors 1, 3 or 4 bar.
- Dash mount gauge holder

Visit http://perfecttuning.net for more information or contact us at support@perfecttuning.net.