

Installation

1. Disconnect vehicle battery before installation.
2. Mount gauge in 52.4mm diameter hole. Secure with supplied bracket and hardware.
3. Wire gauge as shown in diagram.

Red Wire (Power):

Connect to a fused and switched +12v source powered by ignition switch. Place a 3 amp automotive fuse (available commercially) in line with this connection to protect your gauge. Vehicles without alternators connect this wire to a separate switch or direct to the vehicle's master cutoff switch. (See Sensor Heating Element Section)

Black Wire (Ground):

Connect to good engine ground.

Brown Wire (Optional Peak/Recall & Warning WOT Switch):

Connect to Wide Open Throttle Switch. Required for Peak Recall Functionality.

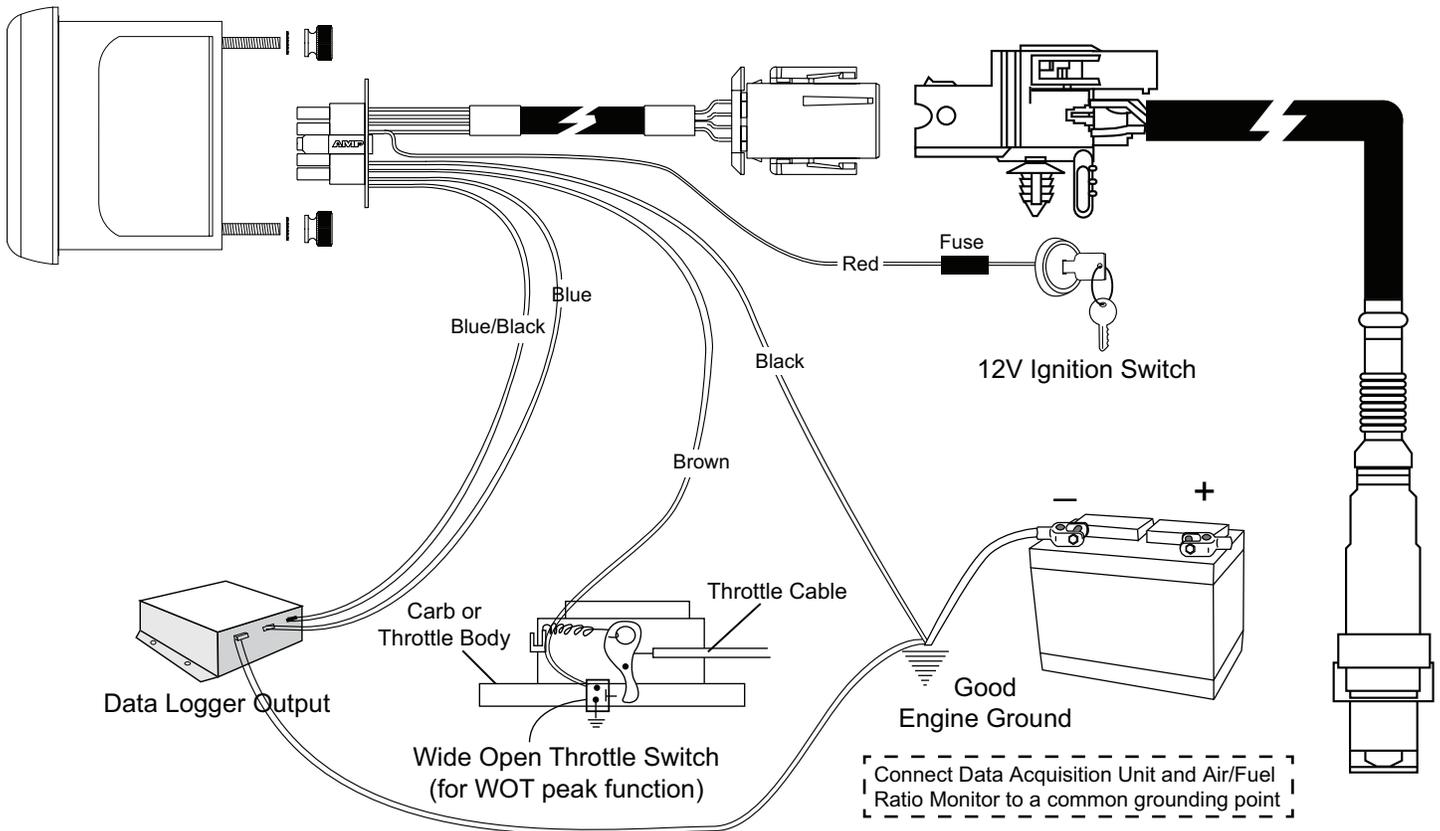
Blue Wire (Optional Data Logger Signal Output):

Connect to signal input(+) OR Engine Management System or Data Acquisition unit.

Blue/Black Wire (Optional Data Logger Signal Ground):

Connect to signal input(-) on Engine Management system or Data Acquisition Unit.

WARNING
Sensor Will Get Very Hot During Operation.



Mounting Sensor

The heated oxygen sensor comes with a stainless steel weld-in bung, plug, and wiring harness with a weather pack connector. The oxygen sensor should be installed as close to the cylinder head as is reasonably possible so that the sensor reaches operating temperature quickly. If long tube headers are used, the oxygen sensor should be installed in the collector. If cast iron manifold(s) or shorty headers are used, install the sensor in the pipe just below the manifold. In multi-bank applications mounting in the left or right side is acceptable. Turbocharged applications should have sensor installed 4-5" after turbo on the down pipe.

STACK recommends welding supplied stainless steel bung into exhaust pipe with a TIG welder.

1. Exhaust pipe prior to sensor should not contain any pockets, projections, protrusions, edges, flex-tubes etc. to avoid accumulation of condensation. A downwards slope of the pipe is recommended. If exhaust pipe is parallel to the ground, sensor must be installed in top half of pipe to avoid damage due to condensation.
2. Tightening torque: 30-44 ft lbs/ 40-55 Nm.
3. Avoid excessive heating of sensor cable. Route sensor cable away from exhaust pipe.
4. Maximum temperature of sensor on outside of exhaust fitting should not exceed 500°C / 900°F.

This product can be used with the following fuels:

Fuels	Stoichiometric Air / Fuel Ratio
Unleaded Petrol	14.7:1
Methanol	6.4:1
Ethanol	9.0:1
LPG (Propane)	15.5:1
CNG	17.2:1

NOTE: OK for use with Nitrous Oxide.

NOTE: Stoichiometric Air / Fuel Ratio is the chemically correct ratio where theoretically all of the oxygen and all of the fuel are consumed. The mixture is neither rich or lean.

Operation Guide

This product has many features that can be adjusted for your specific application. Use the MODE (-) and SELECT (+) buttons to navigate menu options, confirm selections, and fine tune options to your needs.

Acronyms:

A list of acronyms and abbreviated defined below in order to help you more clearly understand the menu operations! functions, and components available on your Stack Air/Fuel gauge:

BGD - Bar Graph Display. This is the curved, multi-colour LED radial display used to indicate how "Rich" or "Lean" the current Air Fuel or BG Lambda reading is relative to your Stoichiometric point with respect to your upper and lower range tolerances.

SSD - Seven Segment Display. This is the digital numeric display that indicates your current Air Fuel or Lambda reading. This display is also used to help you navigate and make changes to your settings.

AFR - Air / Fuel Ratio. This is shown as a numeric value on the SSD characterised by only having a single decimal place (i.e. 14.7). This value is also visually represented on the BGD indicating whether the value is "Rich" or "Lean" of the selected Stoichiometric value and relative to the upper and lower range tolerances. AFR as the name implies represents the ratio of Air to Fuel being mixed and consumed, in real time, by the engine / vehicle upon which this instrument has been installed.

λ Lambda, is an alternate way of expressing AFR, assuming that the Stoichiometric point selected equals one and readings "rich" or "lean" will be expressed as values above or below one, characterise by a value displayed with two decimal places (i.e. 1.00). The gauge can display data in either AFR or Lambda as needed by the user.

Real-Time Mode: Guide

Real-Time mode is the default mode of operation for this product. When Real-Time mode is active, the instrument will display the current air/fuel ratio in either AFR or Lambda.

To toggle between AFR and Lambda display types, press the SELECT (+) button. Remember that AFR values have a single decimal place (i.e. 14.7), and that Lambda values have two decimal places (i.e. 1.00).

Menu Options:

There are several other features provided by your Stack Wideband Air/Fuel Ratio gauge. Use the **MODE (-)** button to navigate through the following options in order:

- Peak/Recall - SSD will display "P"
- Alarm/Warning - SSD will display "ALr"
- Stoichiometric AFR Setting - SSD will display "AFr"
- BGD Range – SSD will display "dSP"
- Auto-Dim – SSD will display "Br"
- Heater – SSD will display "Htr"

Once the desired option is displayed on the gauge, press the **SELECT(+)** button to confirm your selection. Specific Menu options are outlined in the following section.

If no selection is desired, you may continue to press **MODE (-)** until you return to Real-Time Mode or press neither button for 3 seconds and the gauge will return to Real-Time Mode on its own.

Wide Open Throttle Peak/Recall Mode:

WOT Peak/Recall mode provides you with a quick and easy way to find out exactly how "Lean" your engine / vehicle got during the last pull, run, or race. This value is recorded when the Brown Wire in the instrument harness is connected to a good engine ground via a normally open, momentary closed wide open throttle switch (not included, see wiring diagram). This allows peak readings to be sampled only during wide open throttle conditions. If the Air / Fuel Monitor gauge will not be used with a Wide Open Throttle switch, connect the brown wire permanently to a good engine ground to continuously monitor for peak conditions.

To View:

- From Real-Time Mode, press **MODE (-)** to scroll until the display indicates "P", then press **SELECT (+)** to display your Peak.

To Clear:

- When the Peak value is displayed, press **SELECT (+)** to clear your Peak value and return to Real-Time Mode. The SSD will display "---" once the peak has been cleared and until a new peak value has been recorded.

If neither button is pressed for 3 seconds after the Peak Value is displayed, the gauge will return to Real-Time Mode.

Wide Open Throttle Alarm/Warning Mode:

Alarm/Warning mode enables you to program a visual alert point into the gauge in order to warn you of when air/fuel mixtures are running dangerously lean in your vehicle's engine. The visual alarm or warning activates when the AFR or Lambda reading reaches or exceeds your programmed alarm point. When the alarm activates the BGD will blink rapidly to warn the driver of the Alarm condition. Similar to Peak/Recall Mode, this function only operates when the Brown wire is grounded via a normally open, momentary closed, wide open throttle switch (not included, see wiring diagram).

To View your current Alarm Point Setting:

- From Real-Time Mode, press **MODE (-)** to scroll until the display indicates "ALr", then press **SELECT (+)** to display your current Alarm set point.

If neither button is pressed for 3 seconds after the Alarm Point Setting is displayed, the gauge will return to Real-Time Mode.

To Change your Alarm Point Setting:

- When the current Alarm set point is displayed, press **SELECT (+)** to increase your alarm point setting, and **MODE (-)** to decrease your alarm point setting.
- After you have selected your new alarm set point, the gauge will flash your new set point 5 times on the display and then the SSD will display "S C" for Save/Cancel.
- To confirm your new alarm point setting, press **MODE (-)**. This will save your Alarm set point changes and return the gauge to Real-Time mode.
- To cancel the changes and return to your previous set point, press **SELECT (+)**. This will cancel the Alarm set point changes and return the gauge to Real-Time mode.

Stoichiometric AFR Setting Mode:

The Stoichiometric AFR setting allows you to adjust the gauge scale for alternate fuel types such as Ethanol. As a default this product is set up for petrol, with a stoichiometric AFR point of 14.7:1. If you would like to adjust this product for use on an alternate fuel type or would merely like to adjust the “center” point of your BGD, please follow the instructions below.

To view your current Stoichiometric AFR setting:

- From Real-Time Mode, press **MODE (-)** to scroll until the display indicates “AFr”, then press **SELECT (+)** to display your current Stoichiometric set point.

If neither button is pressed for 3 seconds after the Alarm Point Setting is displayed, the gauge will return to Real-Time Mode.

To Change your Stoichiometric AFR setting:

- When the current Stoichiometric set point is displayed, press **SELECT (+)** to increase your Stoichiometric AFR setting, and **MODE (-)** to decrease your Stoichiometric AFR setting.
- After you have selected your new Stoichiometric set point, the gauge will flash your new set point 5 times on the display and then the SSD will display “S C” for Save/Cancel.
- To confirm your new Stoichiometric setting, press **MODE (-)**. This will save your Stoichiometric set point changes and return the gauge to Real-Time mode.
- To cancel the changes and return to your previous set point, press **SELECT (+)**. This will cancel the Stoichiometric set point changes and return the gauge to Real-Time mode.

BGD Range Setting Mode:

The Bar Graph Display (BGD) Range Setting Mode allows you to fine tune the resolution of this instrument for your specific application. With upper and lower set point adjustability, you can set the BGD to utilize the exact range that the engine / vehicle operates within and see exactly how rich or lean you are running in relation to your current set up and tune. Adjusting your BGD limits also adjusts the scaling of the 0-4v data logger output supplied from the gauge. The selected low set point of the BGD Range becomes the 0v value of the data logger output. The selected high set point of the BGD Range becomes the 4v value of the data logger output. Whenever you change these points, the instrument adjusts the data logger output so that the 0-4v signal is always linear between your chosen set points.

To view your current BGD Range HI / Lean setting or LO / Rich setting:

- From Real-Time Mode, press **MODE (-)** to scroll until the display indicates “dSP”, then press **SELECT (+)** to display your current BGD Range set point.
- The SSD of your display will show “HI” in the display to indicate that you will be viewing the “above Stoichiometric” or “Lean” upper range boundary.
- If you would like to view the LO / Rich setting, press **MODE (-)** when “HI” is shown on the SSD. The SSD should now indicate “LO”.
- When the desired setting, “HI” or “LO”, is displayed, confirm this selection by pressing **SELECT (+)**. The upper or lower BGD range value will then be displayed in the SSD of your gauge corresponding to your selection.
 - **Note:** When your selection is made and the numeric range value is shown, LEDs in the BGD will light to indicate which set point you are viewing. If the LEDs to the left of center or Stoichiometric are lit, you are viewing the “LO” or Rich set point. If the LEDs to the right of center or Stoichiometric are lit, you are viewing the “HI” or Lean set point.

If neither button is pressed for 3 seconds after the BGD Range “HI” Setting is displayed, the gauge will return to Real-Time Mode.

To Change your BGD Range setting:

- When the current BGD Range “HI” or “LO” set point is displayed, press **SELECT (+)** to increase your chosen BGD Range setting, and **MODE (-)** to decrease your BGD Range setting.
- After you have selected your new BGD Range set point, the gauge will flash your new set point 5 times on the display and then the SSD will display “S C” for Save/Cancel.
- To confirm your new BGD Range setting, press **MODE (-)**. This will save your BGD Range set point changes and return the gauge to Real-Time mode.
- To cancel the changes and return to your previous set point, press **SELECT (+)**. This will cancel the BGD Range set point changes and return the gauge to Real-Time mode.

Auto-Dim Mode:

This product incorporates an Auto-Dimming feature that allows it to adjust automatically for varying lighting conditions. This is accomplished with a sensor light embedded in the dial. You may enable or disable this feature depending upon your viewing preference. When Auto-Dim mode is disabled, the product and LED's operate at maximum brightness regardless of background lighting conditions. The auto-dim mode is set to "off" from the factory.

To view your current Auto-Dim setting:

- From Real-Time Mode, press **MODE (-)** to scroll until the display indicates "Br" for brightness, then press **SELECT (+)** to display your current Auto-Dim setting which will be indicated as either "ON" or "OFF" in the SSD.

If neither button is pressed for 3 seconds after the Auto-Dim Setting is displayed, the gauge will return to Real-Time Mode.

To Change your Auto-Dim setting:

- When the current Auto-Dim setting is displayed, press **MODE (-)** to toggle between "On" and "OFF".
- After you have selected your new Auto-Dim setting, the gauge will flash your new setting 5 times on the display and then the SSD will display "S C" for Save/Cancel.
- To confirm your new Auto-Dim setting, press **MODE (-)**. This will save your Auto-Dim setting changes and return the gauge to Real-Time mode.
- To cancel the changes and return to your previous set point, press **SELECT (+)**. This will cancel the Auto-Dim setting changes and return the gauge to Real-Time mode.

Heater Control Mode:

All O₂ sensors must be heated before an accurate signal is produced. Potential sensor damage can occur if the gauge begins to heat the sensor before the engine is running due to condensation that forms on the sensor tip and in the exhaust. To accommodate this, an internal trigger within the gauge will automatically begin heating the sensor when 13.5 volts or higher is seen on the Red wire ("Normal" operating mode). While the gauge does not require 13.5 volts to operate (12 volts will suffice), this voltage is used to indicate to the gauge that the engine is running, as most regulated charging systems will maintain 14 volts or higher. Once the gauge sees 13.5 volts, it will begin heating the sensor and transition from (---) to a 20 second countdown on the seven-segment display. When the countdown is complete, the sensor is heated, and the gauge will begin reading air/fuel ratio in real-time.

In applications where a standard charging system is not used (vehicles without a regulated alternator, for example) there is an override available that will allow sensor heating to occur without the gauge reading a 13.5 volt trigger. This can be accomplished while the seven-segment display shows (---) (thereby overriding "Normal" operating mode) or set to trigger when 12 volts is applied on the Red wire ("On" operating mode).

To View your current Heater Operating Mode:

- From Real-Time Mode, press **MODE (-)** to scroll until the display indicates "Htr", then press **SELECT (+)** to display your current Heater Operating Mode.
- If neither button is pressed for 3 seconds after the Heater Operating Mode is displayed, the gauge will return to Real-Time Mode.

To Override "Normal" Operating Mode:

- While displaying (---), press any button to begin the 20-second heater process.

To Switch Between Heater Operating Modes:

- When the current heater operating mode is displayed (either "Nor" or "On"), press **SELECT (+)** to choose the current setting or **MODE (-)** to switch to the alternate setting.
- After you have selected your new Heater Operating Mode, the SSD will display "S C" for Save/Cancel.
- To confirm your new Heater Operating Mode, press **MODE (-)**. This will save your current Heater Operating Mode and return the gauge to Real-Time mode.
- To cancel the changes and return to your previous Heater Operating Mode, press **SELECT (+)**. This will cancel the Heater Operating Mode change and return the gauge to Real-Time mode.

Data Logger Output Range:

The Stack Wideband Air / Fuel gauge has a signal output for supplying information to a Data Logger or engine management system. The signal provided is a linear 0-4v output. See the BGD Range Setting Mode for information about how to define the air/fuel mixture values for low (0v) and high (4v) ranges of the output in order to scale this linear signal output for best operation with your Data Logger or engine management.

Warning

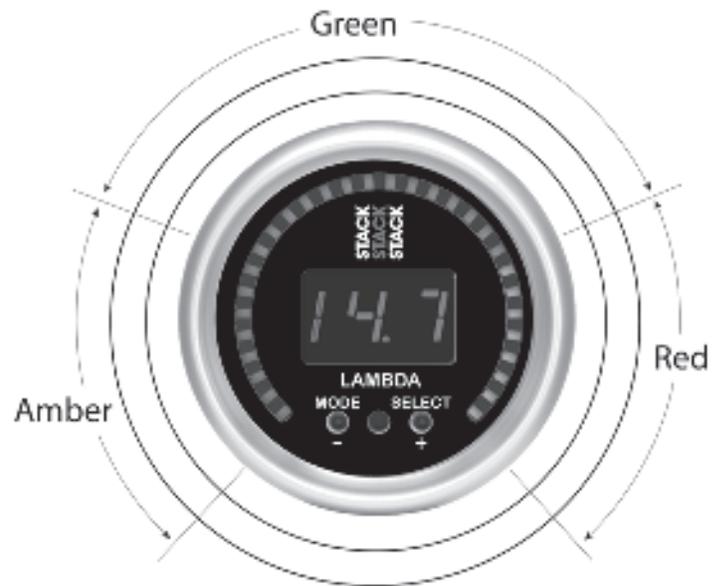
Fouling and/or permanent damage to the oxygen sensor over time will result if used with any of the following:

- **Leaded petrol and fuel additives containing lead**
- **2 cycle petrol (petrol/oil mix)**
- **Diesel Fuel**
- **Nitromethane**
- **Excessively rich mixtures**

If the Air/Fuel Ratio Monitor responds sluggish, the oxygen sensor is probably partially fouled and should be replaced.

LED Chart

Lean Range	Eight red LED's
Stoichiometric Range	Fourteen green LED's
Rich Range	Eight amber LED's



Warranty

Stack Limited warrants this product (excepting associated sensors which are consumable items) to be free from defects caused by faulty materials or poor workmanship for 1 year from the date of consumer purchase. This warranty applies only to the original purchaser of product and is non-transferable. All implied warranties shall be limited in duration to the said warranty periods above. Breaking the instrument seal, improper use or installation, accident, water damage, abuse, unauthorized repairs or alterations voids this warranty. Stack Limited disclaims any liability for consequential damages due to breach of any written or implied warranty on all products manufactured by Stack Limited.

www.stackltd.com

Stack Ltd. Wedgwood Road, Bicester OX26 4UL UK