EFI SYSTEMS INC.

a performance electronics company

USERS GUIDE FOR:

UEGO 2000

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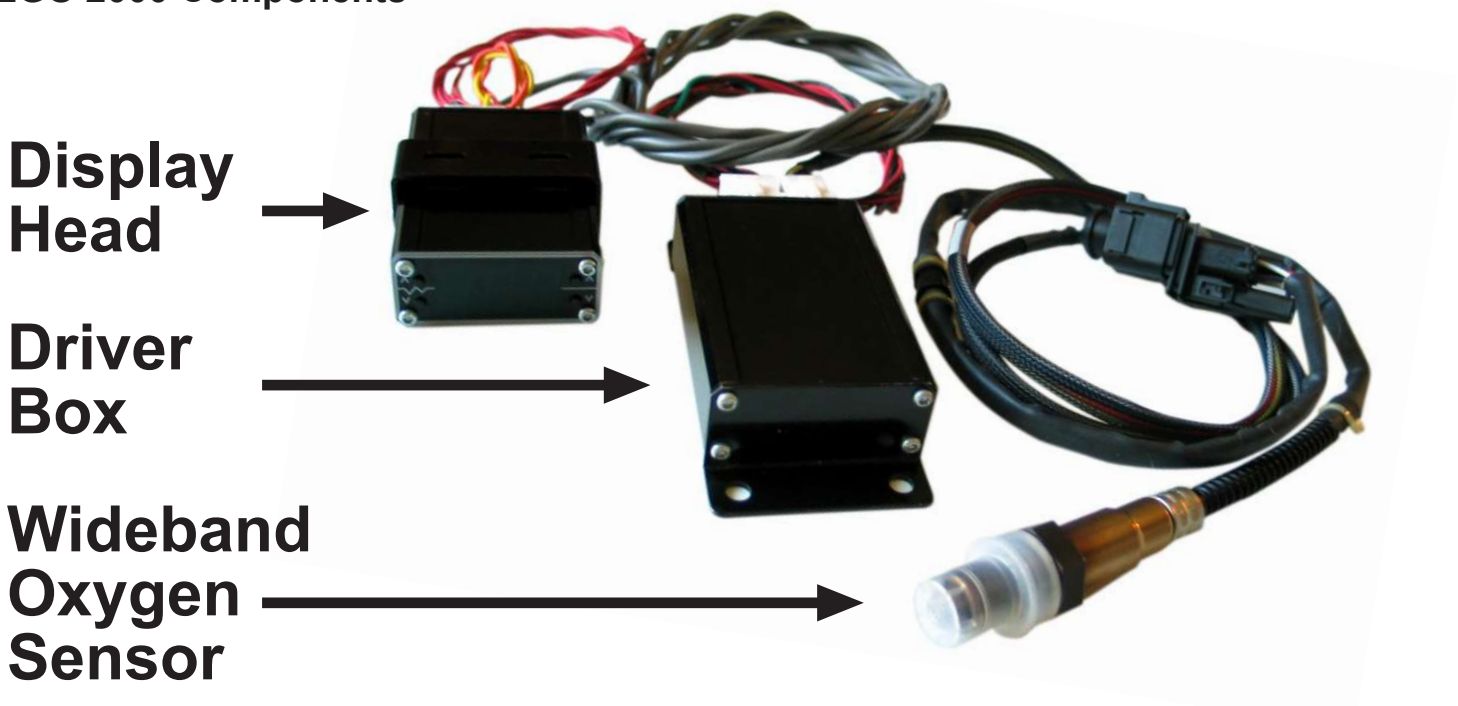
Introduction

Features of the UEGO 2000

The UEGO 2000 is a state-of-the-art product for sensing the engine's air/fuel ratio. It is comprised of three main components: the wideband oxygen sensor, the sensor driver box, and a display head featuring a large, easy to read .56 inch LED display. The UEGO can be used to control a closed-loop fuel injection system without the display head if desired, but the sensor driver must be used. Both the sensor driver and the display head are housed in aluminum extrusion housings appropriate for rigors or the automotive environment.

The UEGO 2000 oxygen sensor driver box produces a linear output voltage from .5 to 5 volts proportional to the air/fuel ratio of the exhaust gas that its sensor is reading. The display head converts this voltage signal to a real time display and can log it for later review. The logging feature of the display head allows up to 5 minutes of recording air/fuel and RPM data for playback without the need for a laptop computer or any additional hardware. In addition to the linear .5 to 5 volt wide band output signal which can be used with other data logging systems or engine management systems, the driver box also offers a 0 to .9 volt output for narrow band oxygen sensor applications. The UEGO 2000 narrow band output offers not only a standard 14.7:1 switch point, but also the ability to adjust the switch point (.5v) from 10:1 to 17:1 as described in the driver box operation section.

UEGO 2000 Components



Installation

Installing the Wideband Oxygen Sensor

The wideband oxygen sensor is mounted in the exhaust system in front of any catalytic converters and after any turbochargers; if the engine was originally equipped with an oxygen sensor, this location may be used. If installing the wideband oxygen sensor as a supplemental sensor, or on an engine/exhaust system not originally equipped with an oxygen sensor, it should be located between 18 inches (450 mm) and 36 inches (900 mm) from the exhaust valves. The sensor will work any place in the exhaust, but the farther it is from the exhaust ports, the slower it will respond (however, it should never be mounted closer than 12 inches (300 mm) from an exhaust port). If the engine is equipped with individual exhaust runners (headers), the sensor should be mounted in the collector.

When selecting the location for the sensor, keep in mind that it should be mounted as vertically as possible (i.e. the tip of the sensor, the part in the exhaust stream, should always be **lower** than the body (outside of the exhaust), and in an area that won't be submerged or subjected to direct water spray.

If mounting in an existing sensor location:

1. Remove the original oxygen sensor.
2. Install the wideband oxygen sensor, using a small amount of anti-seize compound on the threads (it may already be applied from the sensor manufacturer). **Be careful NOT to get any anti-seize compound on the sensor's tip area.**

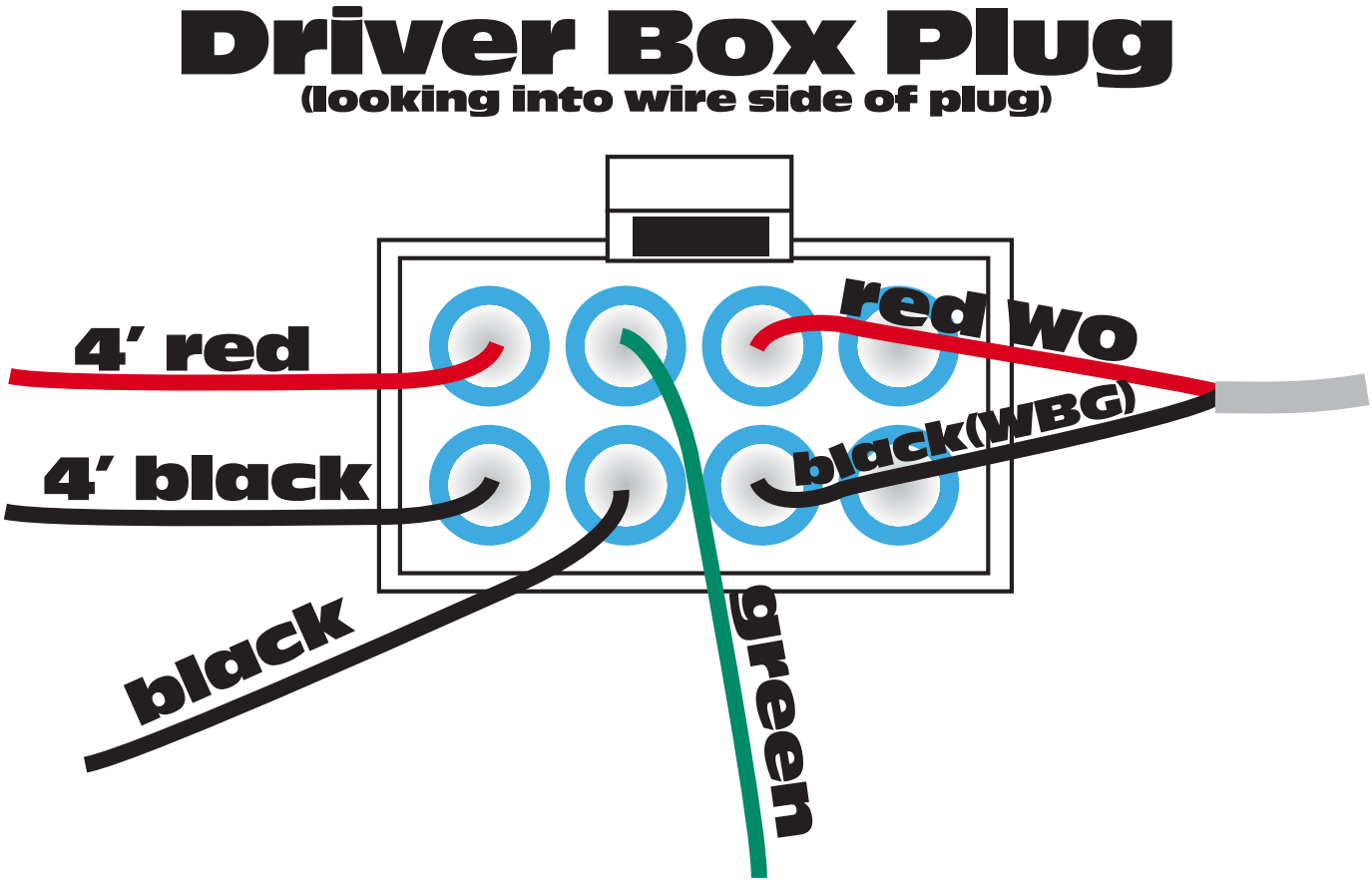
If mounting the sensor in a new location you will need an 18mm x 1.5 threaded bushing. This is available from EFI Systems, Inc., or you may be able to purchase it locally. Then:

1. Drill an 18mm hole in the exhaust system at the location selected.
2. Weld the threaded boss to the exhaust system over the hole.
3. Screw the sensor into the threaded boss using a small amount of anti-seize compound on the threads. **Be careful NOT to get any anti-seize compound on the sensor's tip area.**
4. Route the oxygen sensor's wiring harness in such a way that it will not come in contact with hot exhaust parts or rub on moving engine components. Keep in mind that it must reach the driver box mounting point. Plug in 6-way connector to driver box once driver box has been installed as described below.

Installing the Driver Box

1. Mount the driver box securely in an area with good air circulation. It can be mounted under the hood but should be located as far as possible from any heat source. The driver box cable should point connector end down to prevent water from draining into it.

2. The driver box requires a switched +12v input, preferably one that is “on” only when the engine is running, capable of providing 5 amps current. Wiring the driver to a circuit that is on only when the engine is running will prolong sensor life. It is also important that the driver box not be turned off while the engine is running. Wiring should follow diagram below.

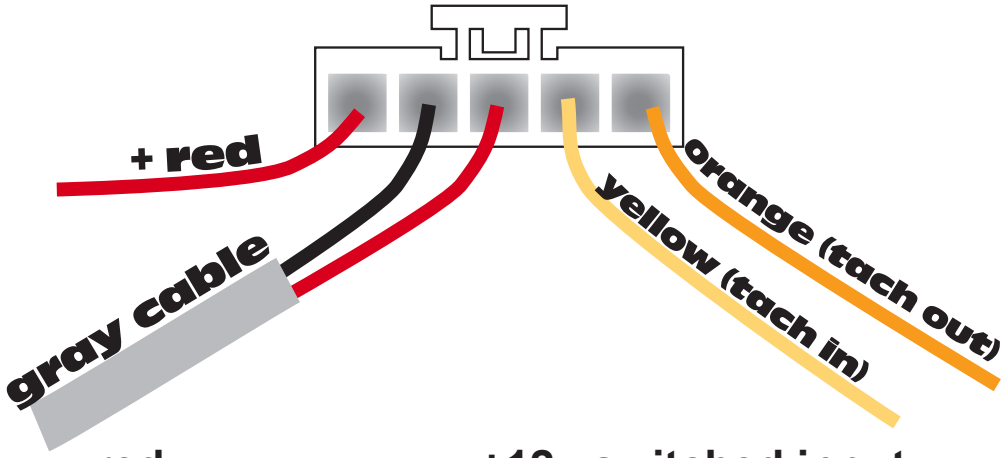


4’ red	=	switched +12v input
4’ black	=	driver box ground (good engine ground)
green	=	narrow band output (see page 10)
black	=	narrow band output ground
red (WO)	=	wide band output (to display or ECU)
blk (WBG)	=	wide band ground

Installing the Display Head

1. The display head may be mounted anywhere direct sunlight won't strike the face of the display so that it is easy to read.
2. Route the gray cable with the white connector from the driver box through the fire wall and connect it to the display head.
3. Connect the red wire to a +12v switched circuit fused for 3 amps. The orange and yellow wires are used for tachometer input and output. The yellow input wire is where the display head gets the RPM signal that it can display and data log. The optional orange tach output wire can be used to provide a tach output for data log playback, which is described on page 8. See diagrams below.

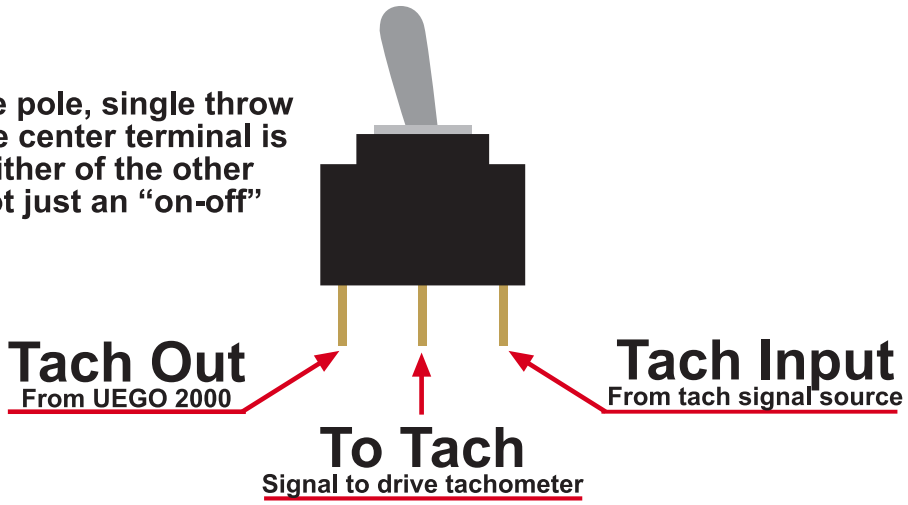
Display Head Plug



red	=	+12v switched input
gray cable	=	input from driver box
yellow	=	tach in
orange	=	tach out

Optional toggle switch required to use tach playback

Use a "double pole, single throw switch" where center terminal is switched to either of the other terminals. Not just an "on-off" switch.



Display Head Operation

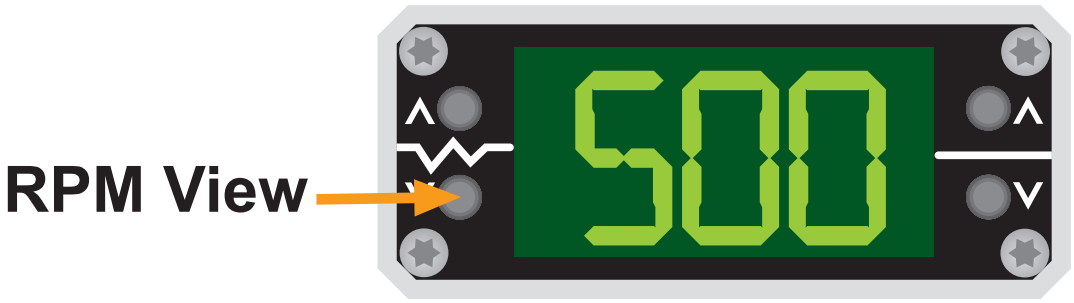
Description

The UEGO 2000 has 3 modes of operation for the display head; display, playback and setup. Each mode has individual features covered in the following sections.

The display head consists of a 3-digit numeric display and 4 control buttons: Left Up (Lup), Left Down (Ldwn), Right Up (Rup) and Right Down (Rdwn). These are illustrated below:

Display Mode

Each time the display head is powered up, it will begin in “display” mode (as illustrated above). After a brief warm-up period, the display will begin to read live air/ fuel ratio data from the oxygen sensor. While in the Display Mode, you can view RPM data (if optional wiring is connected) and start and stop data log recording. Pressing the Ldwn button will change the display to the RPM view. Since the display face uses 3 large digits for easy viewing, RPM is shown with the last (smallest) digit deleted. 1000 RPM will read 100, 2000 RPM will read 200, etc.



Press Ldwn for RPM view – 5000 RPM shown

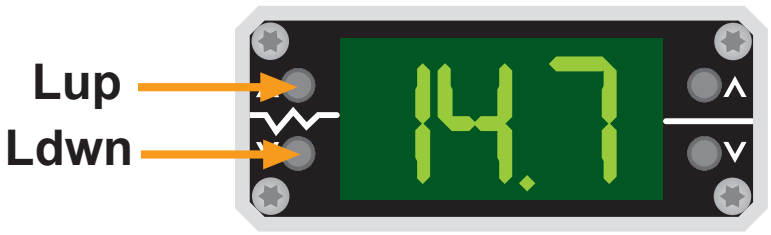
To return to live air/fuel ratio view, press the Lup button. To start a data log recording, press both right buttons at the same time (Rup & Rdwn). The display will flicker slightly to indicate that it is recording. Pressing the Left buttons (Lup & Ldwn) at the same time will stop the recording and return the display to regular live display mode.

Playback Mode

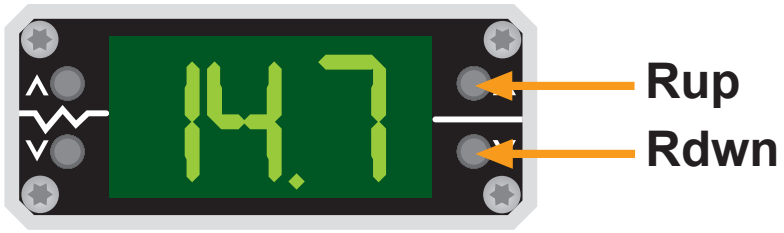
Playback mode is used to replay or review air/fuel data that has been logged into the UEGO 2000's memory. To enter Playback Mode, press the Ldwn & Rup buttons at the same time from the display mode screen. Once in Playback mode, the Lup and Ldwn buttons alternate between air/fuel data and RPM data just as they do in Display mode. The Rup button advances the recording by one frame of data, and Rdwn steps back one step. Holding the Rup button for 3 seconds instructs the display to automatically play (autoplay) the entire recording frame by frame for review – the decimal point will flash to let you know that the data is playing frame by frame. Autoplay can be stopped by pressing the Rdwn button for 1 second. When the end of the stored data is reached, SP will be displayed on the screen. Holding Rup and Rdwn for 3 seconds will reset the data log to the beginning. The log can then be reviewed as many times as necessary for tuning purposes. Data is stored in the system even with power turned off as long as a new recording has not been started. To return to Display mode, simply press the Ldwn & Rdwn buttons at the same time. The following illustrations show this process step-by-step.

Press both Ldwn & Rup to enter Playback mode

Once in Playback mode, Lup & Ldwn alternate between air/fuel and RPM data

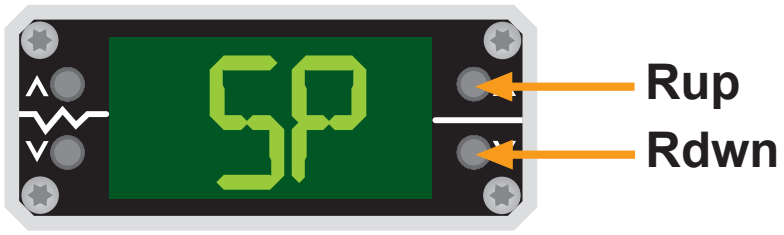


The Rup button advances recording by one frame of data



The Rdwn steps back one step
Hold the Rup button 3 seconds to play entire recording
Stop autoplay by pressing Rdwn for 1 second

SP will be displayed when end of stored data is reached



Hold Rup and Rdwn for 3 seconds to reset data log to the beginning

Press Ldwn and Rdwn to return to Display mode

Setup Mode

Setup mode is used to select air/fuel display preference, RPM input signal calibration (1-12 cylinder) and memory overwrite parameters (stop at end of available memory or erase old data and write over with new). To enter setup mode, press the Lup and Rup buttons at the same time. Once in setup mode, the left buttons determine which setup parameter is currently being modified. The right buttons allow changing of the currently displayed parameter. Pressing Lup and Ldwn for 3 seconds returns you to display mode.

Parameter 1 - Display Choice

Options -	**To Display**	**Select**
	A/F ratio of gasoline	14.7
	lambda	1.00
	A/F ratio of alcohol	6.40

Parameter 2 - RPM Input Divider

Options - C.01 - C.12
Allows the user to select the number of input pulses provided by the engine, per engine revolution. 1-12 pulses per revolution available. See Appendix A for common applications.

Parameter 3 - Memory Start/Stop Option

Options - SP. or Run
SP. sets the display head to stop logging when available memory is full. You will be able to replay the first 5 minutes your data log.

Run allows the unit to overwrite the data, pushing out the oldest. This option allows you to replay the last 5 minutes of logging previous to pushing the logging stop buttons.

Tach Playback

If an optional switch was wired into the tach signal as shown on page 4, the UEGO 2000 can play back the RPM portion of a data log recording on many types of tachometers while displaying logged air/fuel data on the display head. This switch should remain in the “tach input” position for normal tach operation and data logging. When reviewing logged data, switch to the “tach out” side so that the logged RPM can be displayed on the tach while air/fuel data from each indicated RPM is shown on the display head.

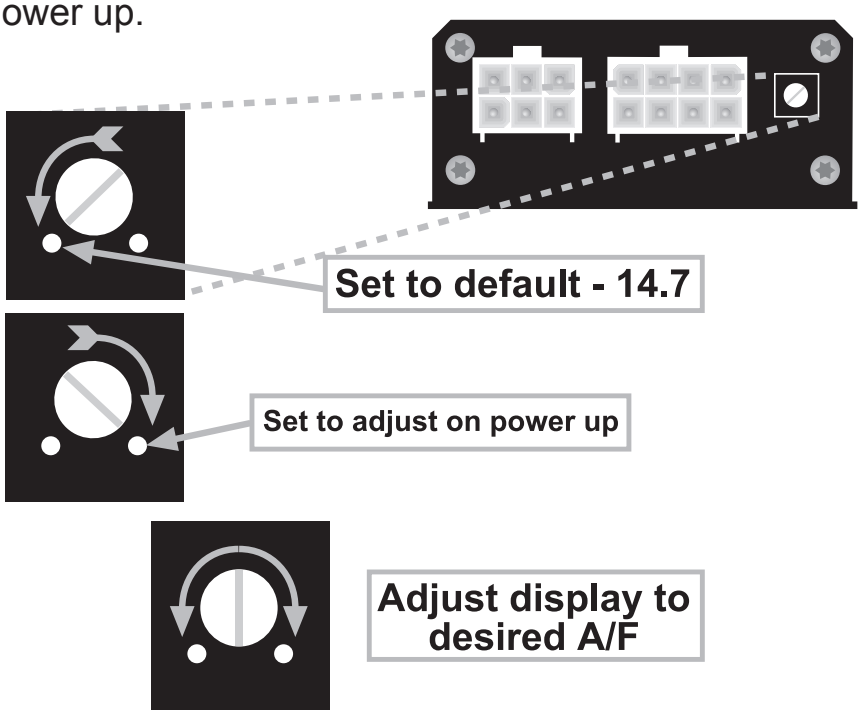
Driver Box

Description

The UEGO 2000 driver box is used to maintain the temperature of the oxygen sensor and convert the sensor's output to a .5 to 5 volt signal that is normally read by the Display Head and converted to a air/fuel ratio display. This output voltage can also be used by many aftermarket engine management systems to control fuel delivery. The Driver Box also has the ability to provide a narrow band voltage output signal (0-.9volt) as well. A unique feature of the UEGO 2000 is that this signal can be altered so that the narrow band output signal's midpoint (or "switch" point) of .5 volts can be set to occur at any air/fuel ratio between 10:1 to 17:1. This can be an important feature when using a factory engine management system for racing purposes. The factory ECU will now see .5 volts as whatever air/fuel ratio the UEGO 2000 is set to rather than the standard 14.7:1 output of a narrow band oxygen sensor. **This feature should never be used with street driven vehicles that have catalytic converters installed – they could possibly overheat and be damaged!**

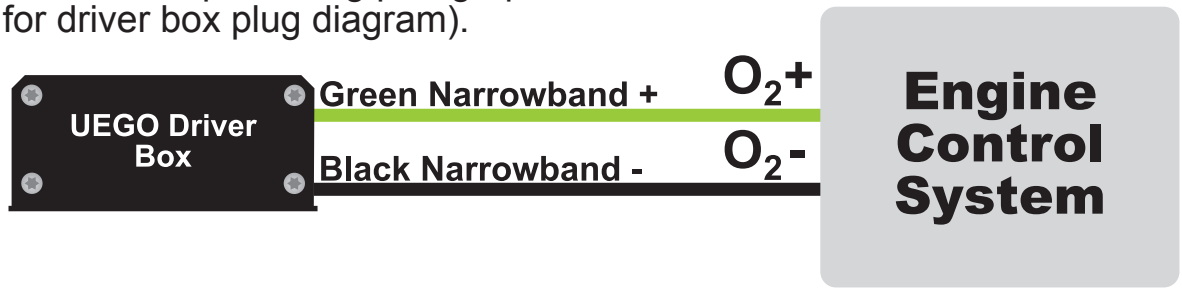
Operation

For the "standard" 14.7:1 narrow band output, turn the small white knob or "pot" on the rear of the driver box to the full counterclockwise position. This should be done with care using a thumbnail or very gently with a pocket screwdriver so as not to damage the internal electronics. To adjust the narrow band output to your desired switch point, turn the UEGO 2000 off, turn the white pot fully clockwise, then turn the UEGO 2000 power back on – the UEGO driver box will now show the adjustable narrow band set point on the display head. By turning the pot and watching the display, the switch point can be set to any air/fuel value other than full lean or full rich. The chosen value will be used after the next power up.

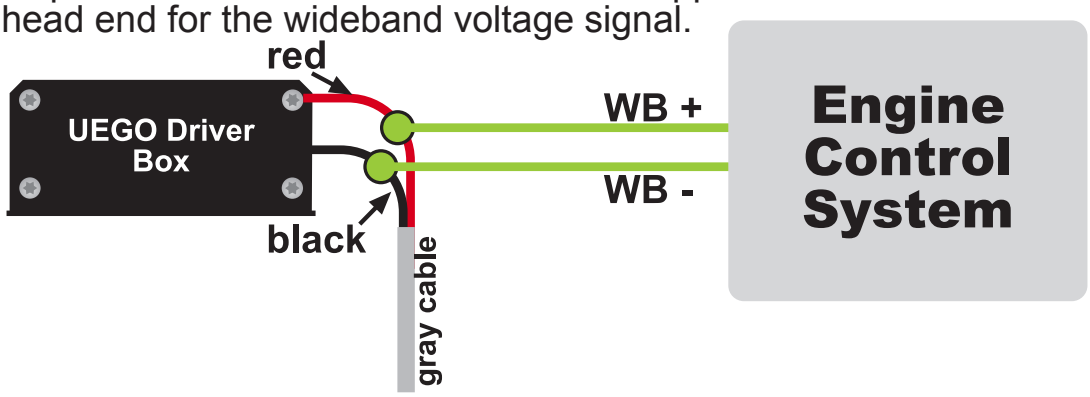


Using the UEGO 2000 Outputs for Closed Loop Fueling

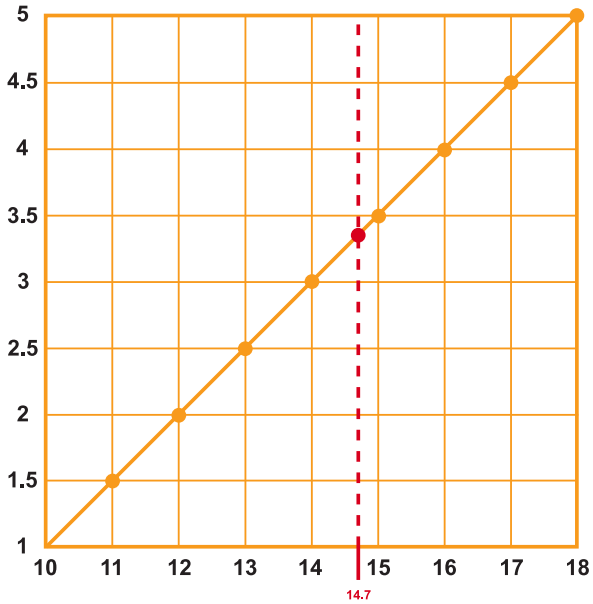
Many engine management or fuel injection systems can use an oxygen sensor input to make small adjustments to their fuel output based on air/fuel ratio measurement in the exhaust systems that accept a 0-.9volt input where the target or “switch point” is adjusted as described in the preceding paragraph. Connections should be make as such: (see page 3 for driver box plug diagram).



For engine management systems that allow a .5-5volt oxygen input, the red and black wideband output wires from the driver box can be tapped into either at the driver box end or display head end for the wideband voltage signal.



Most aftermarket engine control systems need to know how the input voltage correlates to actual air/fuel ratio. This is usually done with a table in the system’s calibration software (see your specific system’s manual for details). The exact voltage to air/fuel ratio is determined by the following expression:
Vout (voltage from the UEGO 2000) x 2 + 8 = A/F of gasoline
For example, 1volt output from the driver box would equal:
1 volt x 2 + 8 = 10 or an air/fuel ratio of 10:1
Voltage can be determined from air/fuel as well:
(A/F - 8)/2 = volts
Therefore:
14.7 would be (14.7 - 8)/2 = 3.35 volts



Appendix A

RPM Divider Chart

Selection	Common Applications - RPM Input
1	Most “coil-on-plug” applications. This is where each cylinder has its own coil that fires once per 2 engine revolutions (4 cycle engines fireonce every 2 revolutions)
2	“Wasted spark” type ignition systems. For instance, one coil fires 2 cylinders. The coil fires twice per engine cycle or once per engine revolution. Also useD for 4 cylinder distributor engines.
3	Ignition system fires three times per revolution. 6 cylinder engines.
4	Most 8 cylinder distributor engines. 4 spark events per engine revolution.
5-12	Engines that have anywhere from 5 to 12 spark events per engine revolution. (12 cylinder engine with distributor would = 6)