APSX WIDEBAND D2 AFR CONTROLLER GAUGE

Installation and User Manual

APSX WIDEBAND D2 Manual V1.0

What do you expect from a Wide-Band controller?

You purchased a wideband gauge!

BENCH TEST BEFORE INSTALLING IT!
USE A RELIABLE 12V POWER > 5AMP

Stock (OEM)ECU or Aftermarket-ECU?

Stock (OEM) ECU

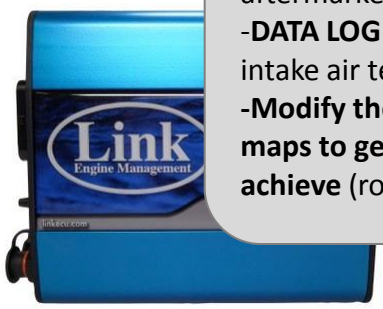
-**KEEP** original O2 sensor in place
-**WELD** bung on exhaust for wideband sensor

-**MONITOR** AFR for Engine Health Check at cruising *(closed loop)*
-Expect 1 sec fluctuations frequency due to stock (OEM) ECU (about 13-17AFR range)
-At full throttle *(open loop)*, the ECU does not use sensor info. Just tries to keep the engine around 13AFR or lower pre-set AFR values.
-**LIMITED** tuning options

Aftermarket ECU

MegaSquirt, Link, Adaptronic, EcuTek, EFILive, HPTuners, ViPEC…

-**REPLACE** the original O2 sensor with wideband sensor



-**MONITOR AND FEED** AFR to aftermarket ECU for tuning
-**DATA LOG** with MAP, AFR, RPM and intake air temperature
-Modify the engine readings / data maps to get the results you want to achieve (road tune or dyno tune)

APSX WB WIDEBAND

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APSX WIDEBAND D2

Overpaying is over.

The 52mm (2-1/16") APSX WIDEBAND D2 AFR CONTROLLER Gauge features a clear LED readout and sweeping color-coded LED display. It provides immediate reference to the engine air fuel ratio (or lambda) in real-time.

The D2 gauge is ideal for all vehicles including carbureted applications and engine dynamometers. Analog output is 0-5V and can be used with data loggers or aftermarket ECUs including the MegaSquirt PNP and others. In addition, a digital output is also available for real-time monitoring via PC or display.

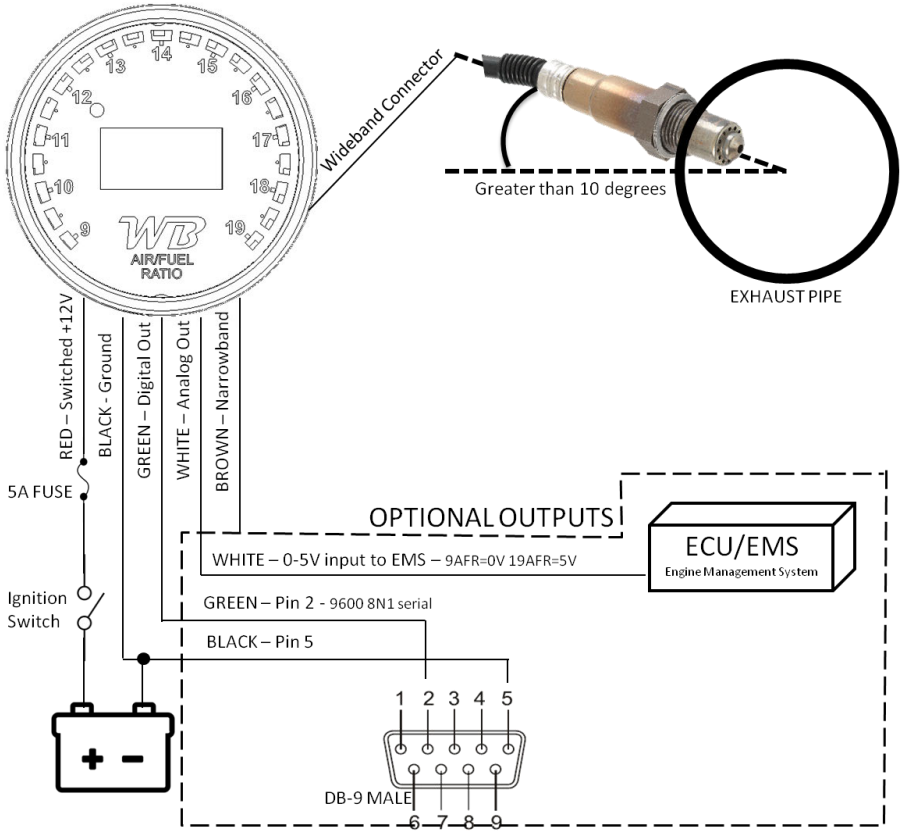
Features

- One of the five bright LED color options (Red / Green / Orange / Blue / White)
- Fast response, 30 msec
- Configurable four types of fuel (E85, Diesel, Gasoline, Methanol) and lambda display (Faceplates for fuel types are sold as accessories)
- Sweeping LED "needle" indicator from rich (green) then normal (orange) to lean (red)
- Fail safe connector
- Two faceplates (black / white) options
- Multiple outputs for digital (to PC), 0-5V analog (to data logger/EMS), narrowband for simulation and extra switch options
- 2-1/16" (52mm) outer diameter mounting and supports Bosch LSU4.2 sensor

Package Includes

APSX_D2:	D2 AFR CONTROLLER GAUGE
APSX_D2CABLE:	D2 HARNESS
BUNG:	STEEL M18 X 1.5mm WELD-IN BUNG AND PLUG
BOSCH_LSU4_2:	BOSCH WIDEBAND O2 SENSOR (#17014) LSU 4.2

Wiring Diagram

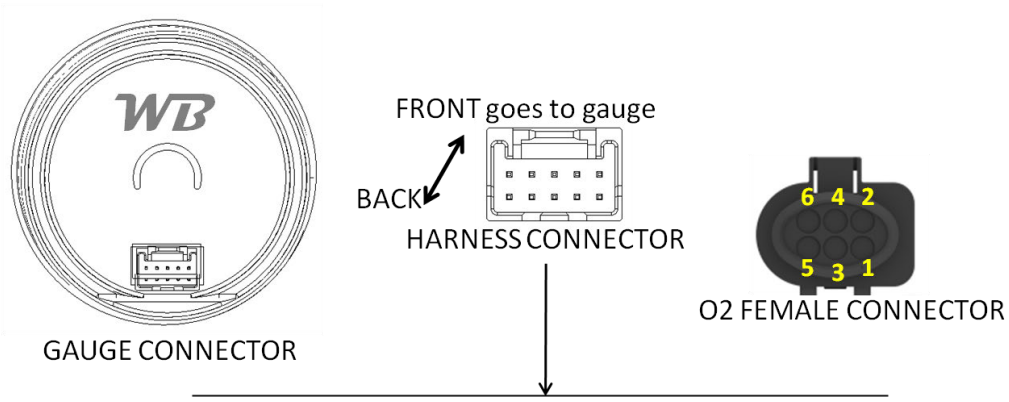


Warnings on Wiring

· As a general rule, never route the harness close to ignition wires.
· Route the harness very carefully to avoid chafing or undue strain.
· Secure wiring to vehicle with wire ties with special attention to the sensor harness routing beneath the vehicle and in the engine compartment.
· Take care when routing sensor harness near hot exhaust components.
· Use a 5A inline fuse on the switched 12V power supply line (RED - Power/IO).
· Avoid cutting or extending the sensor harness.
· Use appropriate gauge wire (20 AWG or thicker) when extending wires, especially RED (Switched 12V with min 3A) or BLACK (Ground) of the Power/IO harness.
· Ensure all connections are secure and insulated from shorts to adjacent wires and the vehicle structure. Utilize proper crimping and solder/heat shrink techniques.

Connectors

APSX WIDEBAND D2 comes with a harness that is connected to the gauge as shown below. Wideband connector goes and clicks to Bosch (#17014) LSU4.2 O2 sensor connector. The other branch of the harness has the power/IO features. At minimum, switched 12V RED (5A fuse) and ground BLACK wires need to be connected as explained above.



On O2 Sensor Female Conn	1	5	6	4	3
UPPER ROW - O2 Sensor	**black**	**Brown**	**red**	**white**	**Green**
LOWER ROW - Power / IO	**white**	**brown**	**green**	**red**	**Black**
	analog	NB	digital	12V	Ground

Calibration

Please note that all APSX WIDEBAND products are tested and calibrated just before they are shipped from Cincinnati, OH validating that they are working properly. No need any calibration when first use. However if there is any change in setups and environment being used (altitude, temperature etc.), it should be open air calibrated.

The O2 sensor should be exposed to free air for the first time calibration, if needed. Hold the button back of D2, you will see display unit counting from 1 to 6.

Hold the button until you see 6 and release it to complete the calibration. This should take less than 60 seconds.

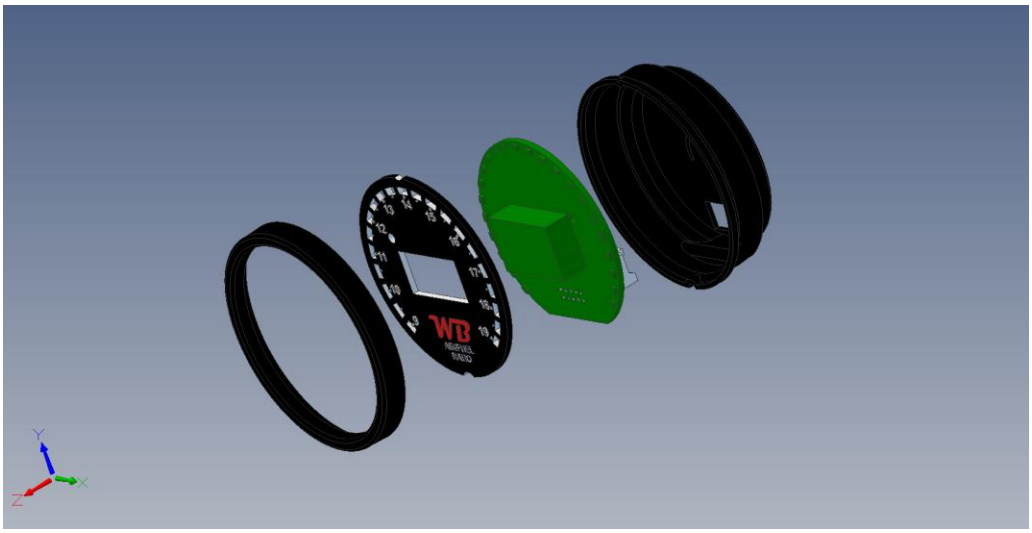
Once it calibrated, display reads 19.0 at gasoline settings. You can now connect the O2 Sensor onto the exhaust pipe.

For the factory settings, disconnect power, hold the switch while turning the power on and wait for 3 blinks. You should re-calibrate after this action.

Faceplate / Bezel Assembly and Disassembly

The default gauge comes with a black faceplate and black bezel. There is a white faceplate is available as an accessory or an option. When you want to use D2 with different fuel types or lambda scale, you can replace the faceplate accordingly to lambda, diesel, E85 etc…

Disassemble is so easy since there are only four parts involves as seen on the picture below. They are a bezel, faceplate, PCB electronic board and a case. No screws, no buttons or brackets are involved.



Just pop the bezel out first. Either push the faceplate out from the connector at the back or pull it out from the front side via tweezers or small screwdriver. Take the PCB board out when you need to replace it with a new one.

O2 Sensor Installation on a Exhaust Pipe

The bung should be installed (welded) from the side so that the sensor orientation is greater than 10 degrees but not greater than 45 degrees from horizontal line. That helps for perfect condensation drainage from the sensor. Otherwise the sensor may prematurely die.

Wideband O2 Sensors

Handle with caution! They become hot quickly. They can burn the human skin and can start a fire.

At the end they are sensors and they are very sensitive to harsh usage. So please handle with care. NO WARRANTY is offered for the sensor. Because it is impossible to verify the user's operating conditions for the sensor.

Sensor life gets shorter with the followings:

- Leaded fuel
- Silicone
- Oil
- Coolants
- Excessive rich AFR
- 2 stroke engines
- Damaging by dropping to ground or hitting hard to other surfaces
- Thermal shock
- Extreme exhaust temperatures (above 930 Celsius or 1700 F)
- Unheated (no powered) sensor left in exhaust pipe stream

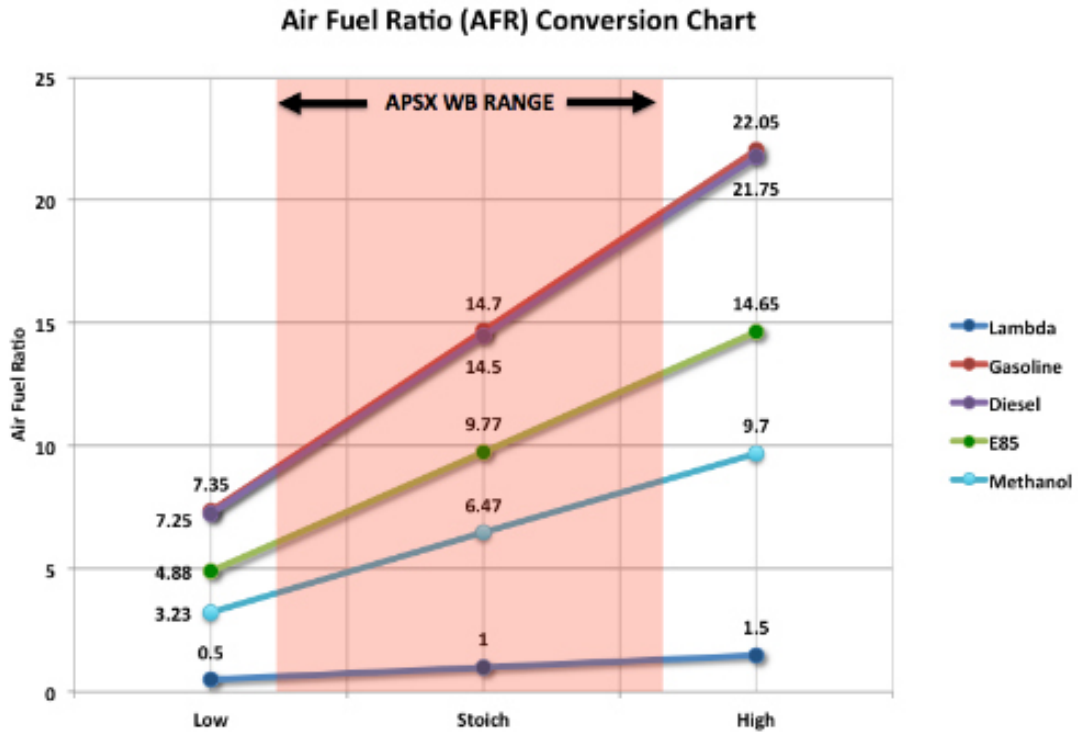
Gauge Installation on a Pod

The APSX WIDEBAND gauges are universal 52mm (2-1/16") diameter in size. They can be "pushed-in" to a universal 52mm pod. If the fitment is not solid, a black tape can be applied on the perimeter of the gauge and re-insert it back to pod for a nice and snug fit.

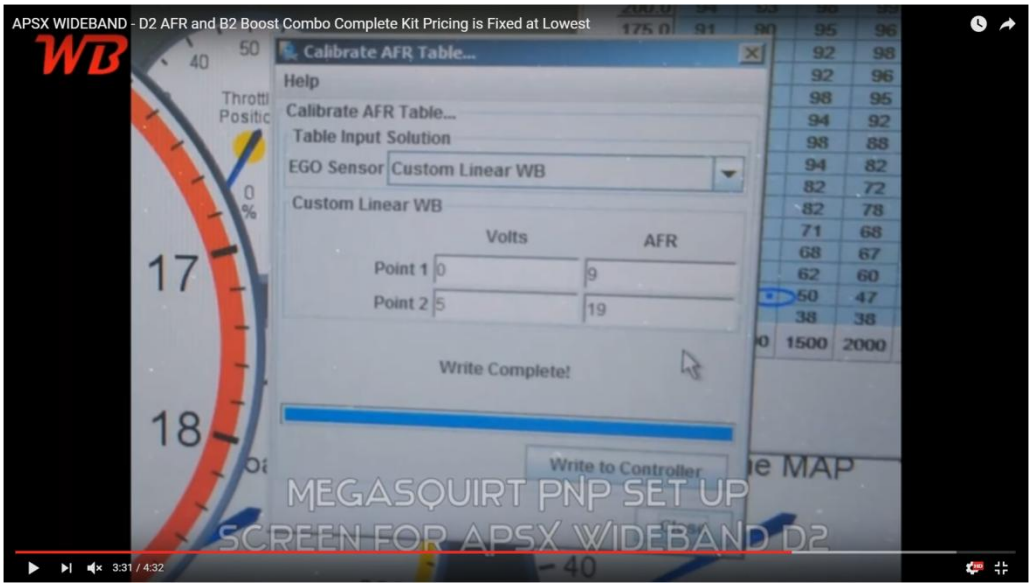
Analog Output (White Wire)

0-5V analog output scaling formula for Gasoline AFR = (2 * Volts) + 9. It is Lambda = (0.136 * Volts) + 0.61.

APSX WIDEBAND VOLT vs AFR READING CONVERSIONS					
VOLTS	LAMBDA	AFR GAS	METHANOL	E85	DIESEL
-	0.61	9.00	3.96	5.98	8.88
0.50	0.68	10.00	4.40	6.64	9.86
1.00	0.75	11.00	4.84	7.31	10.85
1.50	0.82	12.00	5.28	7.97	11.83
2.00	0.88	13.00	5.72	8.64	12.82
2.50	0.95	14.00	6.16	9.30	13.81
2.85	1.00	14.70	6.47	9.77	14.50
3.00	1.02	15.00	6.60	9.96	14.79
3.50	1.09	16.00	7.04	10.63	15.78
4.00	1.16	17.00	7.48	11.29	16.77
4.50	1.22	18.00	7.92	11.96	17.75
5.00	1.29	19.00	8.36	12.62	18.74



Please refer to drawing on page 2 for analog output connections for ECU data logging. There are 256 steps involved that means 0.04 AFR per step between 0V and 5V. The picture below shows the set up screen for MegaSquirt.



Digital Output (Green Wire)

The digital output is for monitoring the readings from a PC or from APSX G1 LED display. Please refer to drawing on page 2 for digital output connections via DB-9 connector to a PC. Baud rate is 9600 bps, data bits is 8, no parity and stop bits is 1 (9600 8N1).

1- Wire the DB-9 pin numbers 2 and 3.
2- Run ontrak application.
3- Select and open the related port.
4- Write some letters on the black area on the software.
5- If you see a repeat of the letters then all is correct. (When you type "A", it should display another "A" next to it immediately.)

If not, check comport numbers. Go to device manager and change the port number to something lower than 9.

We use single byte protocol. It is not ASCII. If it reads 1 then device is not ready. Otherwise it should read 90 to 190.
90 = 9.0 AFR
190 = 19.0 AFR
147 = 14.7 AFR

This will be only for gasoline even if you change the fuel type to others.

FAQ & Troubleshooting

What are the minimum wiring needed to start using the gauge?
The RED and BLACK should be connected. The rest of the wires can be secured away.

DO I need to calibrate right after out of the box?
No.

The display shows 8.88 when connected or at full throttle.
There may be several reasons. Please check the voltage level and verify if it is min 12V and 3A. Use a scope to monitor if there are any voltage spikes in the system. You can apply a min 35V capacitor to smooth out the spikes.

My gauge got stuck at A1, A2, 9 or 19AFR.
Check your sensor location and the sensor itself if there are any contaminations built up on it. Perform a factory reset if the problem persists. For the factory settings, disconnect power, hold the switch while turning the power on and wait for 3 blinks. You should re-calibrate after this action. If still having the issue, please take a clear and close picture of the PCB board for a remote inspection by following the directions above to disassemble the gauge.

Can I extend the wires in my sensor harness?
Yes. Please follow the guidelines listed on page 2.

Can I install D2 to my motorcycle?
If you are going to install the D2 to a motorcycle permanently you can follow the guidelines below.

- Temperature of the location. <700C
- 6 inches, away from the end pipe
- Ability to install 10 degree above horizontal in the desired location

We are mainly experienced on cars and know that motorcycles are pain in the ass in terms of voltage spikes. But as a general rule nobody should wire anything close to ignition wires even in cars.

- check voltage spikes by using a scope not voltmeter
- isolate the O2 sensor area from the voltage spikes

- check your ground and be sure that you get the max grounding possible
- if needed use a metal sleeve on the gauge wire and ground it
- keep trying other solutions....

Any plans for introducing LSU4.9 sensor with the D2?
We still believe LSU4.2 market is much bigger. Plus it is more reliable when you perform open air calibration rather than relying on self calibration. We do not plan to utilize LSU4.9 sensor soon.