ECOTRONS

ALM-ECU integrations

How_to_connect_ALM_to_Ecotrons_ECU_for_tuning

Guide

v1.0

www.ecotrons.com

WARNING!

- Please refer to the ALM manual for details on how to install an ALM. You must make sure the ALM is installed correctly before you connect ALM to the ECU.
- Please refer to the EFI kit installation manual for details on how to install the EFI kit and the ECU. You must make sure the EFI kit is installed correctly before you connect ALM to the ECU.
- You must make sure the engine is running stably before you install the ALM, otherwise the oxygen sensor LSU4.9 could be damaged.
- You must run the engine and ALM together (provide the power supply to ALM only when your engine is running). The easy way is to provide the ALM power via Key-Switch, so as soon as you key off the engine, ALM is powered off too.

  Long time running engine without powering up the ALM, or long time running ALM without engine running could damage your wideband Oxygen sensor!
- If you are not using the ALM for tuning, it is recommended to remove the LSU 4.9 from the exhaust pipe and seal it with the plug, or put back the NB O2 (cheaper).

1. Why use ECU-ALM together for tuning?

1.1 Why need a wideband O2 sensor?

By default, the O2 sensor comes with an Ecotrons EFI kit (if included) is a narrowband O2 sensor. It can only indicate "rich" or "lean" conditions of the air fuel ratios. It can not tell you how rich or how lean the mixture is. And therefore it can not tell you how much more or less fuel you should adjust to get to the AFR you want.

For the narrowband O2 sensor to work, the open-loop fuel controls must be tuned to the vicinity of stoichiometric AFR (14.7 for gasoline), like +/- 0.05~0.15 lambda. Meaning, the lambda fluctuations of open loop fuel controls (without using O2 sensor) has to be in the range of 0.85 to 1.15 or smaller range. Only then the narrow band O2 sensor can be used to fine tune the AFR (lambda) to as close as to 1.0.

In other words, narrow band O2 sensor can only be used for Stoichiometric AFR controls. It can NOT be used for controlling fuel at lean or rich conditions!

The self-tuning capability of Ecotrons EFI kit, by default, if an NB O2 sensor is included, is only possible around the lambda = 1.0. Meaning, to have this self-tuning feature active, you must run the engine in the vicinity of lambda =1.0 and fuel is controlled in the close-loop. And it can only tune the small errors, like +/- 0.1 lambda.

This means, you must tune the fuel to close to lambda = 1.0 in the open loop first!

How to do that?

You need a wideband O2 sensor (and a wideband controller/lambda meter, as we called), to accurately measure the lambda in a wide range, and tune the fuel according to the lambda reading from the lambda meter.

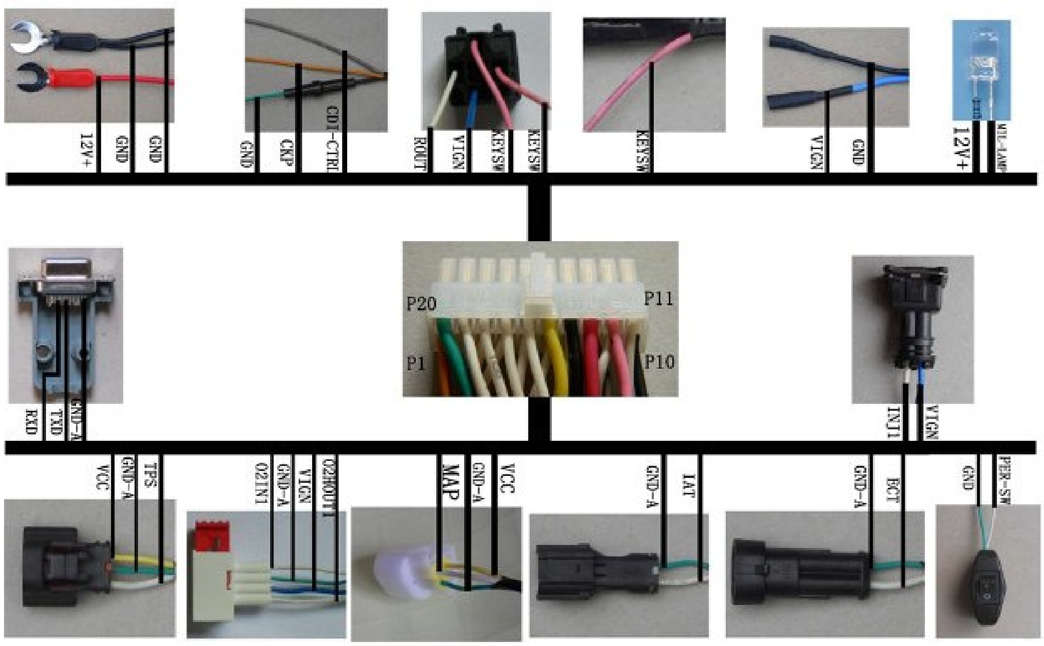
Bosch wideband O2 sensor always needs some kind of special driver circuit to control it. The circuit itself can be complicated. It is very different than the circuit of narrowband O2 sensor. So the same ECU that runs with a NB O2 can NOT run the WB O2 with the same circuit. Meaning, the WB O2 is not compatible with a NB O2!

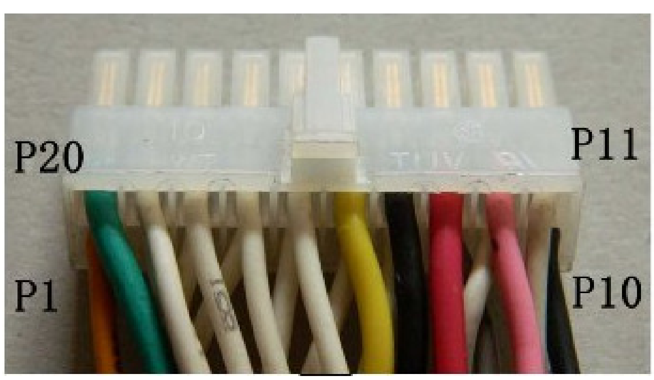
Ecotrons EFI kit does not include a WB O2, by default, because it requires a special driver circuit, and because the WB O2 is much more expensive than the NB O2, which would make the EFI kit not cost effective. Many customers don't really do fine tuning with a WB O2 sensor. That's why the EFI kit does not come with a wideband O2.

2. ECU hardware connections

2.1 ECU main connector pin-out (20-pin)

This wiring schematics is for 4-stroke 1 cylinder engine (1 injector, 1 O2 sensor) settings.
For different engines, like 2-stroke, 1 cylinder, w/ 2 injectors, some pin-out definitions are different. But the Performance Switch pin # is same.





P1 CKP

-- Crank Position Sensor, connect to ignition pickup sensor signal

P2 MIL-LAMP

--Malfunction Indicator Lamp

P3 MAP

-- Manifold Air Pressure Sensor input

P4 IAT

--intake air temp

P5 RXD

--Send Data to RS232

P6 TXD

--Receive Data from RS232

P7 ROUT

--Power Relay LS Driver output

P8 CDI-CTRL

--CDI control output from ECU

P9 INJ1

--Injector 1 LS Driver output

P10 GND

--Power Ground

P11 O2HOUT1

--O2 Sensor Heater LS Driver output

P12 KEYSW

--Key On Switch

P13 12V+

--Reverse Battery Protected Supply

P14 GND

--Power Ground

P15 VCC

-- +5 Volt supply output

P16 ECT

-- engine (coolant) temp

P17 TPS

--Throttle Position Sensor input

P18 O2IN

-- Oxygen Sensor input

P19 PER-SW

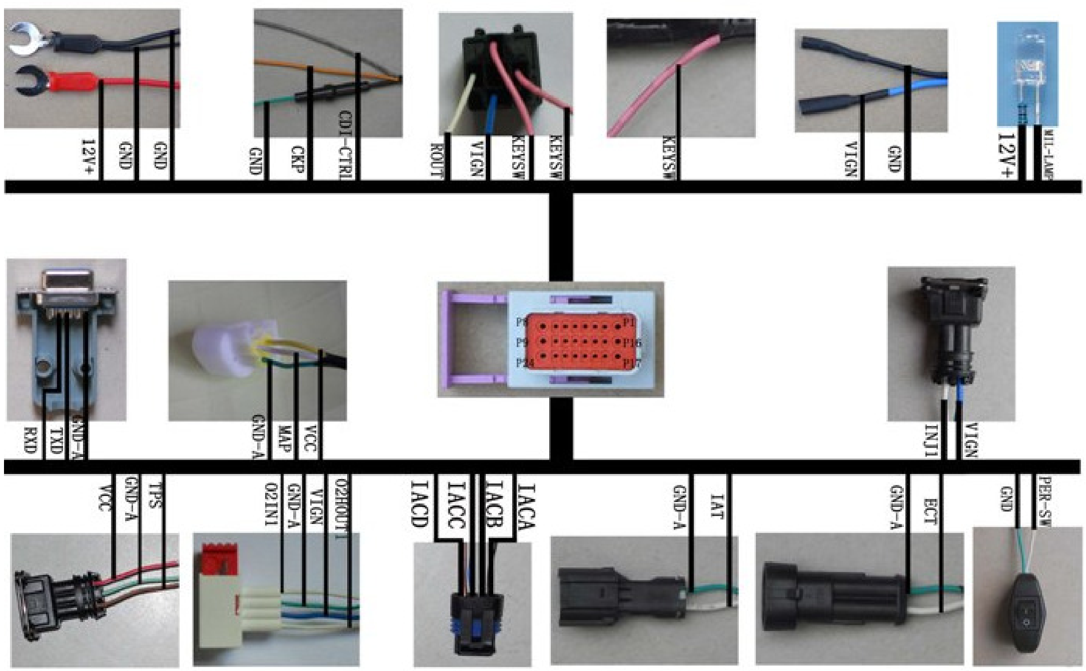
-- Performance Switch

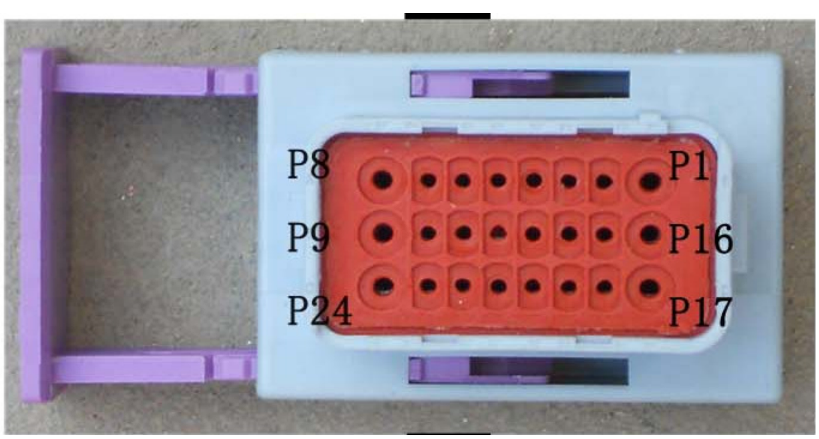
P20 GND-A

-- Analog Ground

2.2 ECU main connector pin-out (24-pin)

This wiring schematics is for 4-stroke 2 cylinder engine (2 injectors, 2 O2 sensors) settings.
For different engines, like 2-stroke, 2 cylinders, w/ 2 injectors, some pin-out definitions are different. But the Performance Switch pin # is same.





P1 O2HOUT1

--O2 Sensor 1 Heater LS Driver output

P2 12V+

--Reverse Battery Protected Supply

P3 GND

--Power Ground

P4 VCC

-- +5 Volt supply output

P5 RXD

--Send Data to RS232

P6 PER-SW

-- Performance Swith

P7 TPS

--Throttle Position Sensor input

P8 GND-A

-- Analog Ground

P9 MIL-LAMP

--Malfunction Indicator Lamp

P10 MAP

-- Manifold Air Pressure Sensor input

P11 O2IN2

--Oxygen Sensor 2 input

P12 TXD

--Receive Data from RS232

P13 IAT

--intake air temp

P14 KEYSW

--Key On Swith

P15 INJ2

--Injector 2 LS Driver output

P16 INJ1

--Injector 1 LS Driver output

P17 GND

--Power Ground

P18 CDI-CTRL

--CDI control output from ECU

P19 NC

--No connection

P20 ROUT

--Power Relay LS Driver output

P21 ECT

-- engine (coolant) temp

P22 O2HOUT2

--O2 Sensor 2 Heater LS Driver output

P23 O2IN1

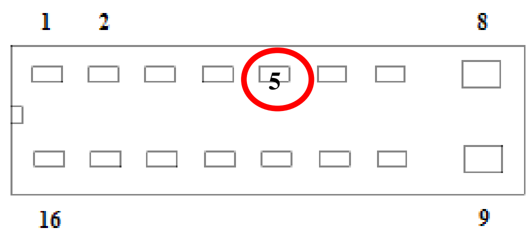
-- Oxygen Sensor 1 input

P24 CKP

-- Crank Position Sensor, connect to ignition pickup sensor signal

3. ALM hardware connections

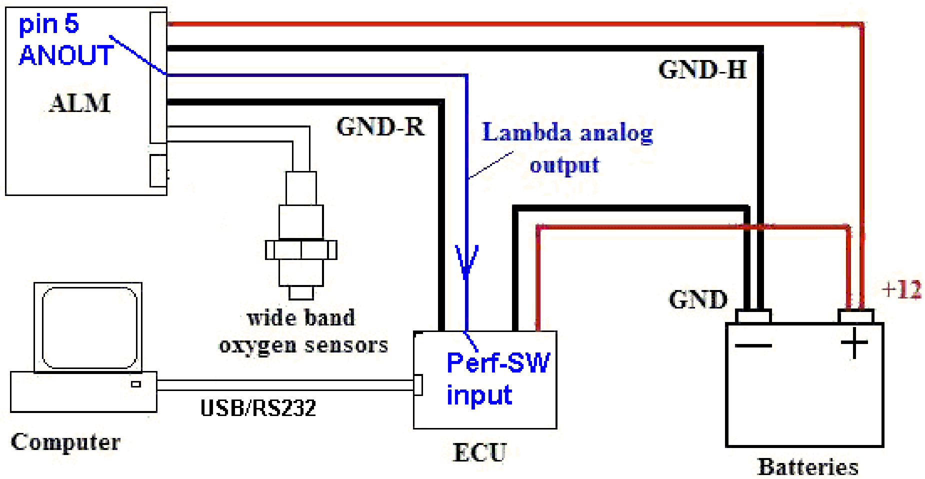
3.1 ALM main connector pin-out



Pin#	Name	Descrition	Minimum	Maximum
1	H-	Heater minus: to LSU4.9 pin 3 (White)	——	——
2	UN	Nernst Voltage: to LSU4.9 pin 6 (Black)	——	——
3	IP	Pump Current: to LSU4.9 pin 1 (Red)	——	——
4	RPM	Spark signal input	——	——
5	ANOUT	Lambda linear analog output (fine)	0V	5V
6	NO2OUT	Simulated narrow band oxygen sensor output	0.1V	1V
7	H+	Heater plus: to LSU4.9 pin4 (Grey)	——	——
8	GND-R	Ground (Reference ground)	——	——
9	+12V	+12V Power supply	9V	15V
10	NC	Not connected	——	——
11	GAUGE	coarse analog output to the gauge (optional)	0.1V	1V
12	Vin2	analog input 2 (optional MAP sensor)	0V	5V
13	Vin1	analog input 1 (optional EGT sensor)	0V	5V
14	IA	Trim Resistor: to LSU4.9 pin 5 (Green)	——	——
15	VM	Virtual Ground: to LSU4.9 pin 2 (Yellow)	——	——
16	GND-H	Ground (Heater circuit ground)	——	——

4. Options for ECU-ALM connections

4.1 Only use ALM to log lambda (AFR)

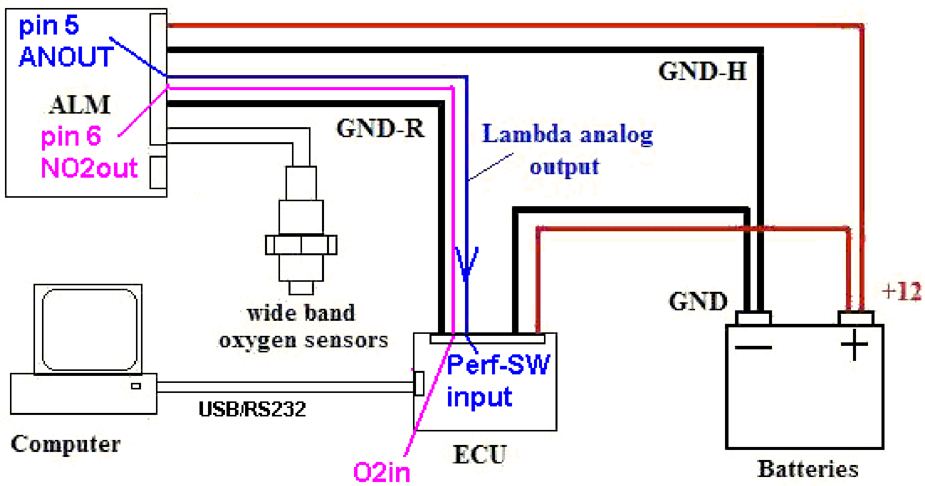


1) ALM reference ground (GND-R, black) must be connected to ECU reference ground (GND-R, Green).
2) ALM heater ground (GND-H) must be connected to the 12V negative.
3) ALM pin-5 (ANOUT, linearized analog output), must be connected to the ECU “performance switch” input.
4) Load a new calibration file, .CAL, from Ecotrons, to change the “performance switch” input as the wideband lambda input.
   Note: “performance switch” then can not be used to swap the fuel maps any more. You can always connect back to Performance Switch after the tuning is done (ALM is disconnected).

This setup only uses the ALM as the reading of lambda of actual exhaust AFR. The ECU only logs the real-time lambda, but do nothing with this signal. For ECU to use this signal as a feedback and tune the fuel automatically, you will need a special software from Ecotrons, which is available if you buy an ALM.

This setup is useful if you only want to log the real-time lambda, and then play back the logged data, and manually adjust the fuel maps afterwards.

4.2 Use ALM to log lambda (AFR) and also use the NB simulated output to run ECU in close-loop fuel as if you installed a NB O2.

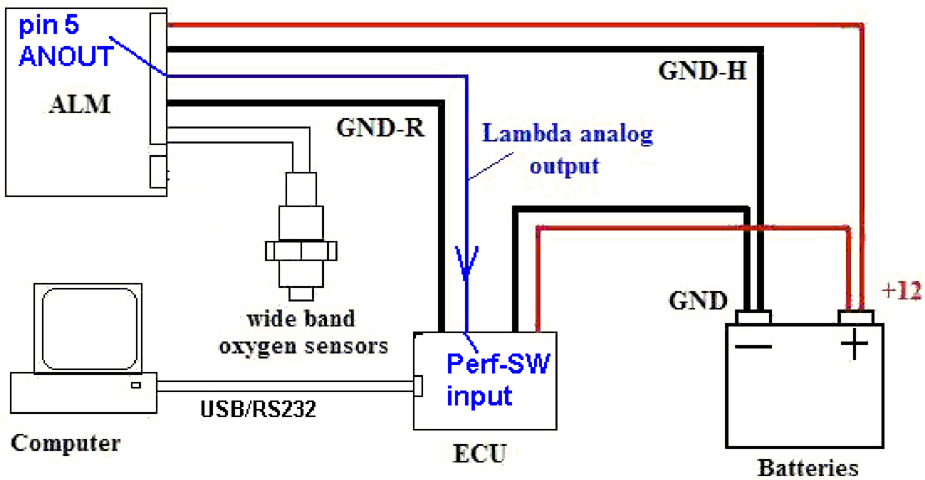


1) ALM reference ground (GND-R, black) must be connected to ECU reference ground (GND-R, Green).
2) ALM heater ground (GND-H) must be connected to the 12V negative.
3) ALM pin-5 (ANOUT, linearized analog output), must be connected to the ECU "performance switch" input.
4) ALM simulated NB O2 output (NO2OUT) must be connected to the ECU O2in1 (1 for single cylinder, for some 2 cylinder engines, where 2nd O2 is used, O2in2 for 2nd cylinder.)
5) Load a new calibration file, .CAL, from Ecotrons, to change the "performance switch" input as the wideband lambda input.
   Note: "performance switch" then can not be used to swap the fuel maps any more. You can always connect back to Performance Switch after the tuning is done (ALM is disconnected).

This setup still uses the ALM linearized analog output as the reading of lambda only. The ECU also uses the ALM simulated NB O2 output as if there were an NB O2 installed, so it can run close-loop fuel controls without an actual NB O2. ECU also logs the real-time lambda, but do nothing with this signal. It is useful that you only have one O2 sensor bung on the exhaust (almost all people have only one bung), and the bung can be used either NB O2, and WB O2. (Note, the thread size of the both type of O2 sensors are same).

This setup is useful if you want to run close-loop fuel and also want to log the real-time lambda, and then play back the logged data, see how good is your close loop fuel, and still be able to manually adjust the fuel maps afterwards.

4.3 Use ALM to log lambda (AFR) and do self-tuning (with a special ECU software)



1) ALM reference ground (GND-R, black) must be connected to ECU reference ground (GND-R, Green).
2) ALM heater ground (GND-H) must be connected to the 12V negative.
3) ALM pin-5 (ANOUT, linearized analog output), must be connected to the ECU "performance switch" input.
4) Note, with this setup, NB O2 must be disconnected from the ECU. Meaning you can not do self-tuning with both WB O2 and NB O2 together. You can only use one or the either when the self-tuning is active. Obviously the self-tuning with WB O2 has a wider lambda range. And if you have WB O2 self-tuning active, you don't need the NB O2.
5) Program a special ECU software, from Ecotrons, to use the wideband lambda input as the feedback device and self-learn the AFR errors and compensate the correct fuel; to reach the target lambda (can be defined in the desired lambda table).
   Note: "performance switch" then can not be used to swap the fuel maps any more.
   Note: the "desired lambda table" can be tuned in ProCAL, see Ecotrons' Tuning Guide document for details.

This setup uses the ALM as the feedback device for target lambda controls. The ECU reads the real-time lambda, and compared it to the desired lambda for that operating conditions, and learn the errors, and automatically adjust the fuel to slowly get close to the target lambda. This feature is only possible if you have the special ECU software from Ecotrons.

Note, to make this feature working, you must run the engine in steady-state, and traverse most operating conditions (RPM vs TPS range). Otherwise, the self-tuning only happens in certain operating points, and the AFR is only adjusted for that small range. Your engine could be running very unstable. The best way to utilize this feature is to run the engine on a dyno and traverse all the operating conditions (RPM vs TPS).

Contact us for questions: info@ecotrons.com
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