Ecumaster

Lambda

Wide Band Oxygen

Sensor Controller

Manual
Revision 0.3

1   Device description

Ecumaster Lambda sensor controller is a device used to control Bosch LSU4.9 Oxygen sensor and send lambda readout on CAN-BUS and two programmable 0-5V analog signal lines. The controller uses dedicated Bosch integrated circuit paired with automotive digital microcontroller to precisely control the oxygen sensor and calculate Lambda and AFR.

- Voltage range: 9V - 16.5V

- Input current: up to 3A during warm-up, ~1A nominal

- Operating temperature: −40°C to 85°C

- Lambda range: 0.5 - 8.0

- Programmable analog outputs: 0-5V

- Water resistance: IP64 with sensor connected
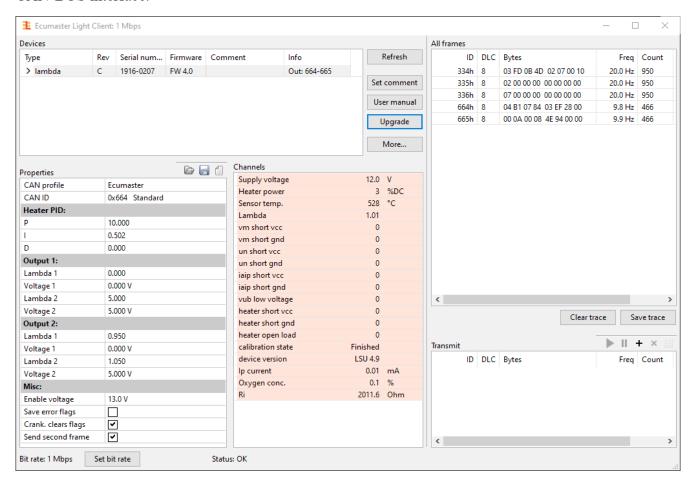
- Communication and setup: CAN-BUS 2.0B

2   Precautions and sensor installation

- During operation lambda sensor is heated to high temperature. Do not touch hot sensor and do not operate sensor near highly flammable liquids or gases.

- Sensor installed in the exhaust must be connected to the controller. Sensor not connected to the controller will degrade quickly.

- Locate the sensor as close to the engine as possible, respecting sensor temperature range. Temperature at the mounting location should not exceed 500°C

- Locate the sensor after turbocharger and before catalytic converter

- The exhaust pipe in front of the sensor must be free of places where condensation water could accumulate.

- Any leaks in exhaust system upstream of the sensor will cause inaccurate readings.

- Make sure, that front hole of the sensor does not point against exhaust gas stream.

- To reduce risk of condensation water getting into the heated sensor, newer start sensor heater before engine start.

- Sensor must be inclined ad least 10° towards horizontal with electrical connection going upwards.

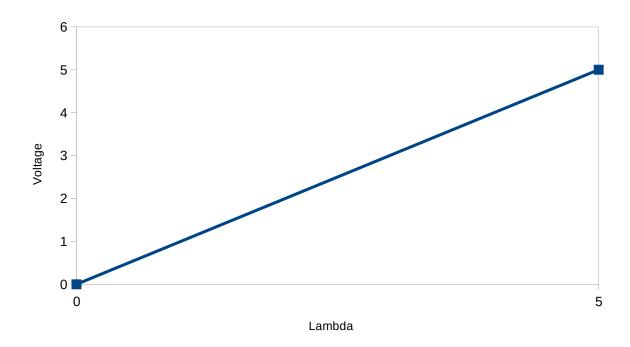- Protect sensor cables from high temperatures.

3 Configuration

Device can be configured via CAN-BUS by using Ecumaster Light Client software and compatible CAN-BUS interface.

Properties:

- **CAN profile -** allows to choose different CAN message format compatible with other ECU's

- **CAN ID** - CAN-BUS message id with measurement data. Data format can be accessed by exporting .CANX file under "More..." button.

- **Heater PID** - sensor heater PID controller settings. These are for advanced users only and should be left default if not needed.

- **Output 1,2** - analog output configurations. Two point configuration for analog output characteristic. In the example of output 1 configuration, lambda 0 correspond to output voltage 0V and for lambda 5 to voltage 5V. All points in between are interpolated. In the example output 2 is configured to emulate narrow band sensor.

- **Enable voltage** - supply voltage threshold to enable sensor heater. It is used to prevent heating the sensor when engine is not running. When the supply voltage is below **Enable voltage** value, the sensor won't be heated and the correct readings won't be available.

- **Save error flags** - When checked, the controller keeps detected sensor errors until power is cycled. Sensor will not be heated while there are errors detected.

- **Crank. clears flags** - When checked, error flags are cleared when supply voltage goes from below 10V to above 10V. Helps to clear flags resulting only from low voltage during cranking.

- **Send second frame** - sends second CAN frame with additional information

4 Ecumaster CAN profile description

Byte (bit)	Channel	Data type	Range	Multiplier	Divider	Offset	Unit
CAN ID+0 (default: 0x664)							
0..1	Supply voltage	16bit unsigned	0.00 – 655.35	1	100	0	V
2	Heater power	8bit unsigned	0 – 100	100	255	0	%DC
3	Sensor temp.	8bit unsigned	0 – 1020	4	1	0	°C
4..5	Lambda	16bit unsigned	0.000 – 65.535	1	1000	0	
6..7 (0)	vm short vcc	1bit flag	0 – 1	1	1	0	
6..7 (1)	vm short gnd	1bit flag	0 – 1	1	1	0	
6..7 (2)	un short vcc	1bit flag	0 – 1	1	1	0	
6..7 (3)	un short gnd	1bit flag	0 – 1	1	1	0	
6..7 (4)	iaip short vcc	1bit flag	0 – 1	1	1	0	
6..7 (5)	iaip short gnd	1bit flag	0 – 1	1	1	0	
6..7 (6)	vub low voltage	1bit flag	0 – 1	1	1	0	
6..7 (7)	heater short vcc	1bit flag	0 – 1	1	1	0	
6..7 (8)	heater short gnd	1bit flag	0 – 1	1	1	0	
6..7 (9)	heater open load	1bit flag	0 – 1	1	1	0	
6..7 (10)	calibration state[1]	3bit unsigned	enumeration	1	1	0	
6..7 (13)	device version[2]	3bit unsigned	enumeration	1	1	0	

CAN ID+1 (default: 0x665)							
0..1	Ip current	16bit signed	-32.768 – 32.767	1	1000	0	mA
2..3	Oxygen conc.	16bit signed	-327.68 – 327.67	1	100	0	%
4..5	Ri	16bit unsigned	0.0 – 6553.5	1	10	0	Ohm

[1] Values for channel: **calibration state**

Value	Description
0	Start
1	Wait for SPI reset
2	Finished
3	Error

[2] Values for channel: **device version**

Value	Description
0	LSU 4.2
1	LSU 4.9
2	LSU ADV

5   Pinout

1 - GND

2 - CAN low

3 – Analog output 1

4 – Analog output 2

5 - CAN high

6 - V+ (9V - 16.5V)

6 Revision history

Revision	Date	Changes
0.1	5.07.2019	Initial revision
0.2	19.12.2019	Clear flags after cranking added
0.3	15.04.2020	Manual upgraded to firmware version 4.0, stream info added