

**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.

The screenshot shows the Ecumaster Light Client software interface. The main window is titled "Ecumaster Light Client: 1 Mbps".

**Devices:** A table lists device information:

Type	Rev	Serial num...	Firmware	Comment	Info
> lambda	C	1916-0207	FW 4.0		Out: 664-665

Buttons: Refresh, Set comment, User manual, Upgrade, More...

**Properties:**

CAN profile	Ecumaster
CAN ID	0x664 Standard
<b>Heater PID:</b>	
P	10.000
I	0.502
D	0.000
<b>Output 1:</b>	
Lambda 1	0.000
Voltage 1	0.000 V
Lambda 2	5.000
Voltage 2	5.000 V
<b>Output 2:</b>	
Lambda 1	0.950
Voltage 1	0.000 V
Lambda 2	1.050
Voltage 2	5.000 V
<b>Misc:</b>	
Enable voltage	13.0 V
Save error flags	<input type="checkbox"/>
Crank. clears flags	<input checked="" type="checkbox"/>
Send second frame	<input checked="" type="checkbox"/>

**Channels:**

Supply voltage	12.0 V
Heater power	3 %DC
Sensor temp.	528 °C
Lambda	1.01
vm short vcc	0
vm short gnd	0
un short vcc	0
un short gnd	0
iaip short vcc	0
iaip short gnd	0
vub low voltage	0
heater short vcc	0
heater short gnd	0
heater open load	0
calibration state	Finished
device version	LSU 4.9
Ip current	0.01 mA
Oxygen conc.	0.1 %
Ri	2011.6 Ohm

**All frames:**

ID	DLC	Bytes	Freq	Count
334h	8	03 FD 0B 4D 02 07 00 10	20.0 Hz	950
335h	8	02 00 00 00 00 00 00 00	20.0 Hz	950
336h	8	07 00 00 00 00 00 00 00	20.0 Hz	950
664h	8	04 B1 07 84 03 EF 28 00	9.8 Hz	466
665h	8	00 0A 00 08 4E 94 00 00	9.9 Hz	466

Buttons: Clear trace, Save trace

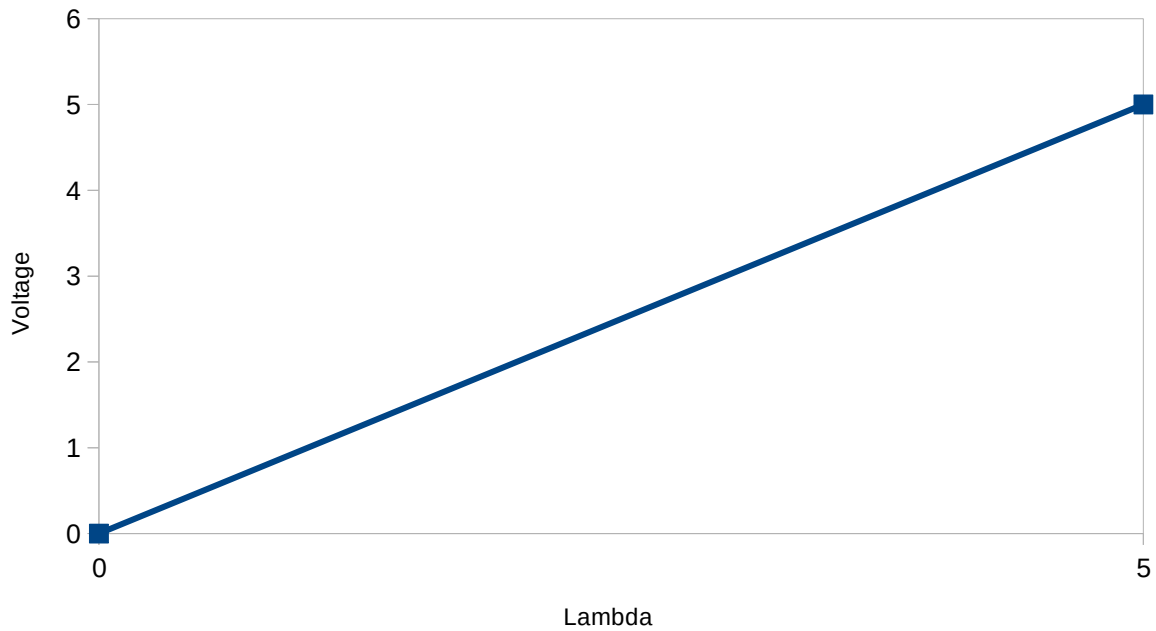
**Transmit:**

ID	DLC	Bytes	Freq	Count
----	-----	-------	------	-------

Bit rate: 1 Mbps | Set bit rate | Status: OK

#### 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
<b>CAN ID+0 (default: 0x664)</b>							
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 <sup>1)</sup>	3bit unsigned	enumeration	1	1	0	
6..7 (13)	device version <sup>2)</sup>	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**

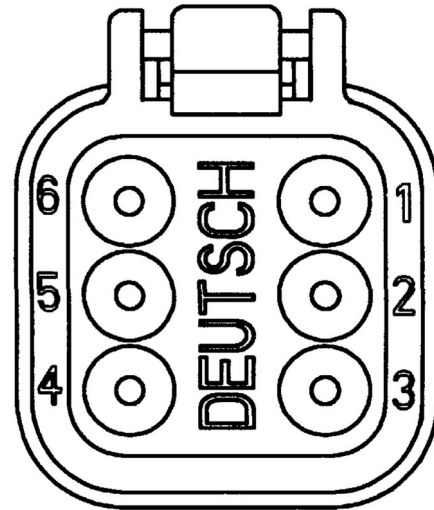
Value	Description
0	Start
1	Wait for SPI reset
2	Finished
3	Error

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