



# USER MANUAL

## Lambda to CAN

Document version: 1.0  
Published on: 22 April 2025



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# 1. Device description

The Lambda to CAN is a device designed to manage the Bosch LSU 4.9 oxygen sensor and transmit lambda readings via a CAN bus and two programmable 0-5 V analog output lines. The controller features a dedicated Bosch integrated circuit paired with an automotive-grade digital microcontroller to ensure precise sensor control and accurate calculation of Lambda and AFR (Air-Fuel Ratio).

This manual applies to all revisions of the device. Revision 2 includes minor differences, which are highlighted throughout the text. You can identify the revision of your device by checking the label on the product, the information on the packaging, or by connecting it with the Light Client. For more information refer to the [Light Client configuration \(on page 6\)](#) section.

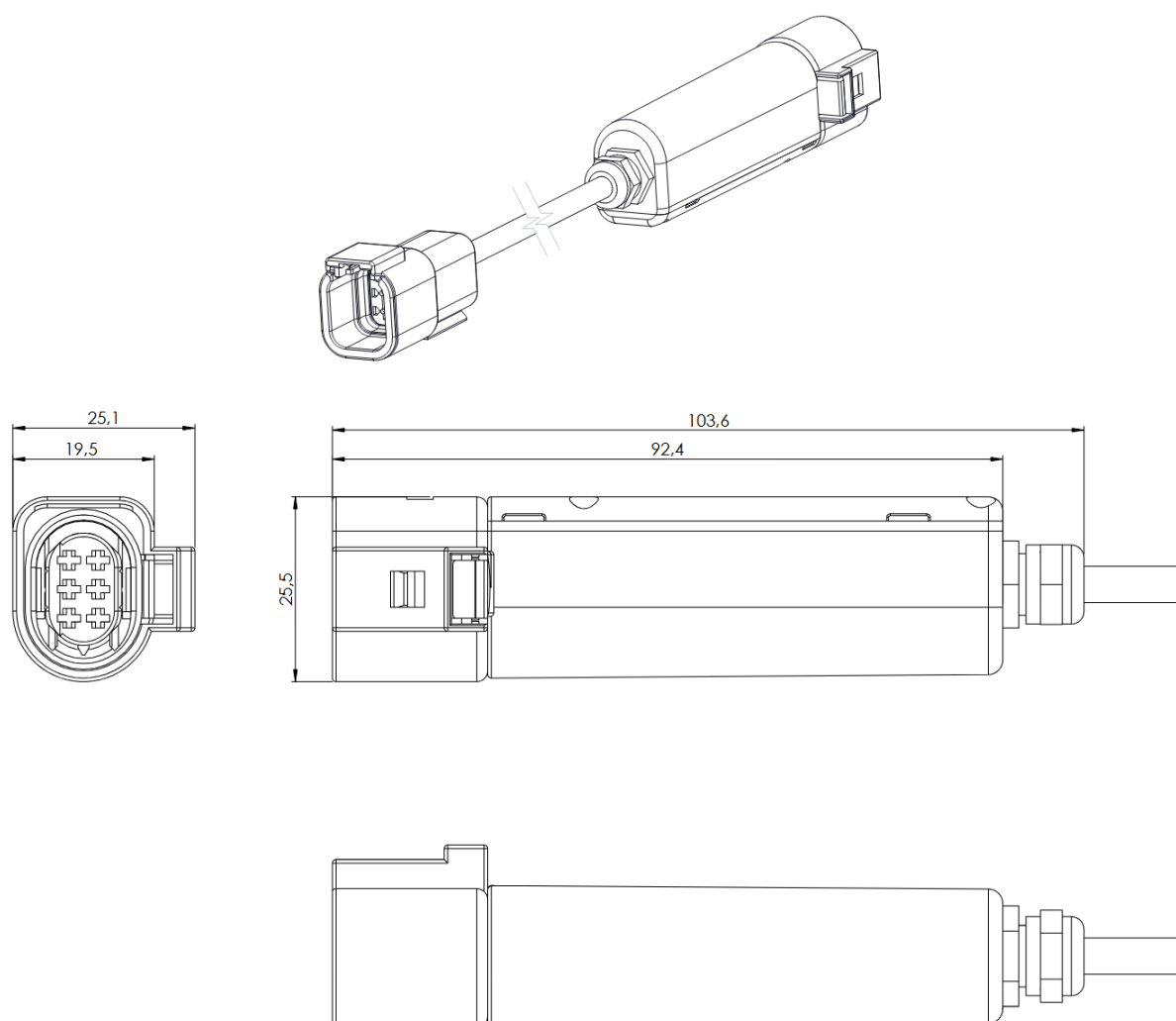
Key features:

- Supports Bosch LSU 4.9 oxygen sensor
- Provides lambda data via CAN bus and two programmable 0-5 V analog output lines
- Suitable for a wide range of automotive and motorsport applications

# 2. Specification

Specification	
Voltage range	9-16.5 V
Input current	up to 3 A during warm-up, ~1 A nominal
Operating temperature	-40 to 85 °C
Measured lambda range	0.5 - 8.0
Analog outputs	0-5 V
Water resistance	IP67 with sensor connected
Communication and setup	CAN 2.0B
Connector	Deutsch DTM06
Dimensions	25,5 x 25 x 104 mm
Weight	120 g
CAN bus bitrate	1Mbps (default), 500kbps, 250kbps, 125kbps
CAN termination	None
PC communication	Using USB to CAN interface (Ecumaster USBtoCAN, Peak, Kvaser)

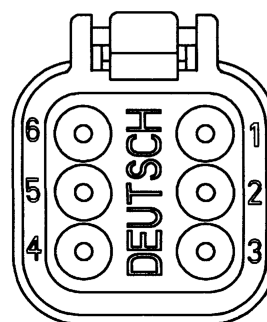
All dimensions in mm



### 3. Installation

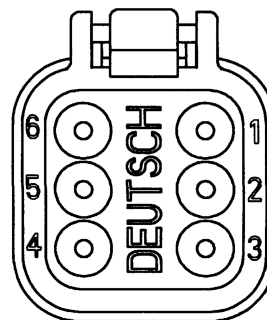
**Pinout** for revision 2

Pin	Description
1	Ground
2	CAN Low
3	Analog output
4	Analog ground
5	CAN High
6	+12V (switched power supply)

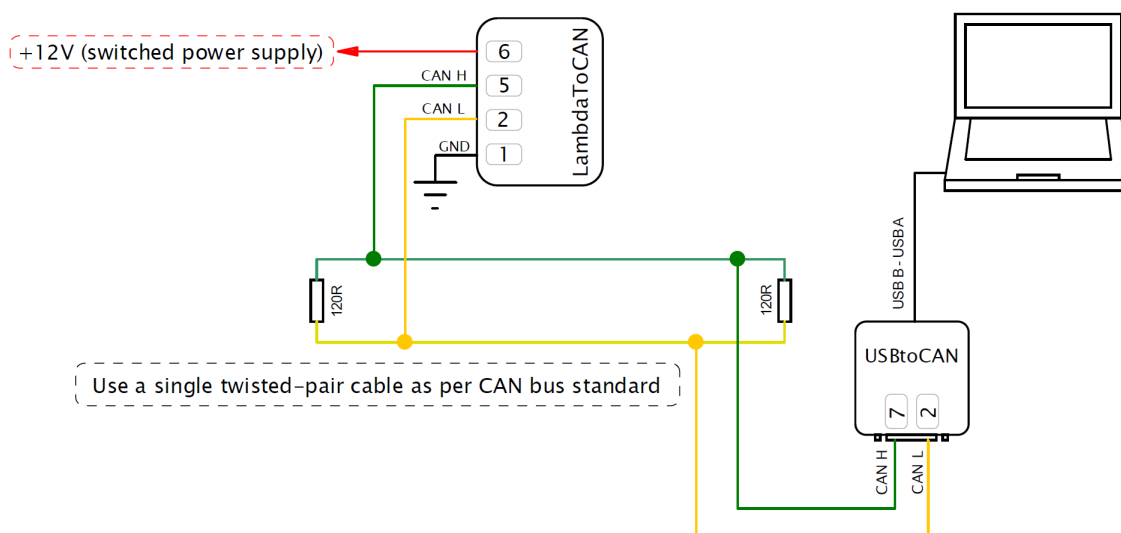


## Pinout for revision 1

Pin	Description
1	Ground
2	CAN Low
3	Analog output 1
4	Analog output 2
5	CAN High
6	+12V (switched power supply)



## Wiring diagram



## Mounting and safety guidelines

- During operation, the lambda sensor becomes extremely hot. Avoid touching the hot sensor, and do not operate it near highly flammable liquids or gases.
- The sensor installed in the exhaust must be connected to the controller. A sensor that is not connected to the controller will degrade quickly.
- Place the sensor as close to the engine as possible, while ensuring it operates within its temperature range. The temperature at the mounting point should not exceed 500°C.
- Position the sensor after the turbocharger and before the catalytic converter.
- Ensure the exhaust pipe upstream of the sensor is free from areas where condensation water can collect.
- Any leaks in the exhaust system upstream of the sensor will result in inaccurate readings.
- The sensor's front hole must not face directly into the exhaust gas stream.

- Install the sensor at an angle of at least 10° from horizontal, with the electrical connection pointing upwards.
- To reduce the risk of condensation water getting into the heated sensor, never activate the sensor heater before starting the engine.
- Protect the sensor cables from high temperatures.

## 4. Light Client configuration

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

The screenshot displays the Ecumaster Light Client software interface. The main window is titled "Ecumaster Light Client: 1 Mbps". It features several panels:

- Devices:** A table showing device information. The first entry is "lambda" with Rev "C", Serial num... "1916-0207", Firmware "FW 4.0", and Info "Out: 664-665". Buttons for "Refresh", "Set comment", "User manual", "Upgrade", and "More..." are present.
- Properties:** A table showing configuration parameters.
 

Property	Value
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:** A table showing sensor readings.
 

Channel	Value
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:** A table showing CAN bus 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
- Transmit:** A section for sending CAN frames, with columns for ID, DLC, Bytes, Freq, and Count.

At the bottom, the bit rate is set to 1 Mbps and the status is OK.

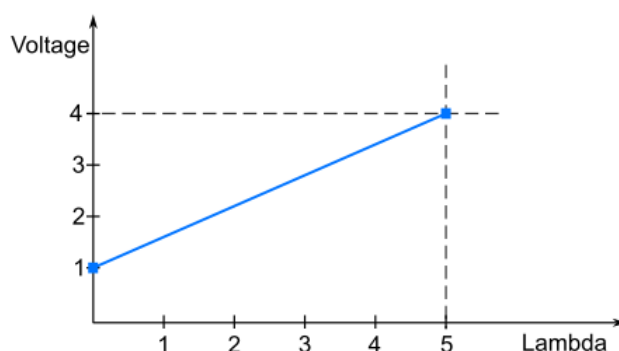
After connecting the device, the **Devices** field displays detailed information, including the device *Type*, *Serial number*, *Firmware* version, and the **device revision Rev**. The *Rev* shown in the Light Client refers to the PCB revision, which is indicated by a letter. For first-version devices, this ranges from A to F, while for second-version devices, it starts from G and continues with subsequent letters. This makes it easy to identify the exact revision of your device for configuration and troubleshooting purposes.

## Properties

Parameter	Description
<b>CAN profile</b>	Allows to choose different CAN message format compatible with other ECU's
<b>CAN ID</b>	CAN bus message id with measurement data. Data format can be accessed by exporting .CANX file under "More..." button.
<b>Heater PID</b>	Sensor heater PID controller settings. These settings are intended for advanced users and should be left at their default values unless necessary.
<b>Output</b>	Analog output configuration
<b>Output 2</b>	Analog output 2 configuration. Only available for Lambda to CAN rev.1
<b>Enable voltage</b>	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 <i>Enable voltage</i> value, the sensor won't be heated and the correct readings won't be available.
<b>Save error flags</b>	When enabled, the controller keeps detected sensor errors until power is cycled. Sensor will not be heated while there are errors detected.
<b>Crank. clears flags</b>	When enabled, error flags are cleared when supply voltage goes from below 10 V to above 10 V. Helps to clear flags resulting only from low voltage during cranking.
<b>Send second frame</b>	Sends second CAN frame with additional information

## Analog output configuration example

Two point configuration for analog output characteristic. In the example of output configuration, *Lambda* 0 correspond to output *Voltage* 1 V and for *Lambda* 5 to *Voltage* 4 V. All points in between are interpolated.



## 5. CAN Stream

The default CAN bus bitrate of the device is **1 Mbps**. The format used is **big-endian**.

Byte	Bit	Channel	Data type	Range	Multiplier /Divider	Factor	Offset	Unit
<b>CAN ID+0 (default: 0x664)</b>								
0..1		Supply voltage	16-bit U	0.00 – 655.35	1/100	0.01	0	V
2		Heater power	8-bit U	0 – 100	100/255	0.392	0	%DC
3		Sensor temp.	8-bit U	0 – 1020	4/1	4	0	°C
4..5		Lambda	16-bit U	0.000 – 65.535	1/1000	0.001	0	
6..7	0 (0x01)	vm short vcc	1-bit	0 – 1	1/1	1	0	
6..7	1 (0x02)	vm short gnd	1-bit	0 – 1	1/1	1	0	
6..7	2 (0x04)	un short vcc	1-bit	0 – 1	1/1	1	0	
6..7	3 (0x08)	un short gnd	1-bit	0 – 1	1/1	1	0	
6..7	4 (0x10)	iaip short vcc	1-bit	0 – 1	1/1	1	0	
6..7	5 (0x20)	iaip short gnd	1-bit	0 – 1	1/1	1	0	
6..7	6 (0x40)	vub low voltage	1-bit	0 – 1	1/1	1	0	
6..7	7 (0x80)	heater short vcc	1-bit	0 – 1	1/1	1	0	
6..7	8 (0x100)	heater short gnd	1-bit	0 – 1	1/1	1	0	
6..7	9 (0x200)	heater open load	1-bit	0 – 1	1/1	1	0	
6..7	10 (0x1C00)	calibration state <sup>1</sup>	3-bit U	enumeration	1/1	1	0	
6..7	13 (0xE000)	device version <sup>2</sup>	3-bit U	enumeration	1/1	1	0	
<b>CAN ID+1 (default: 0x665)</b>								
0..1		Ip current	16-bit S	-32.768 – 32.767	1/1000	0.001	0	mA
2..3		Oxygen conc.	16-bit S	-327.68 – 327.67	1/100	0.01	0	%
4..5		Ri	16-bit U	0.0 – 6553.5	1/10	0.1	0	Ohm



<sup>1</sup>Values for channel: **calibration state**

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

<sup>2</sup>Values for channel: **device version**

Value	Description
0	LSU 4.2
1	LSU 4.9
2	LSU ADV

## 6. Document history

Revision	Date	Changes
0.1	2019.07.05	Initial revision
0.2	2019.12.19	Clear flags after cranking added
0.3	2020.04.15	Manual upgraded to firmware version 4.0, stream info added
1.0	2025.04.22	Document layout updated to follow the Ecumaster standard format The structure and text have been refined and improved for better readability and clarity Added information about Rev. 2