- English -

Lambda Controller Manual

Revision History

Revision	Description	Release Date	Author
0	Initial Release	2021-04-23	TS
1	Removed Typos	2021-06-28	TS

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Content

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1 Notes and symbols used in this Manual

These paragraphs contain tips and practical advice for working with the System

In the paragraphs highlighted with this symbol, you will find additional information and it is very important that you follow the instructions given.

Documentation reference
A user manual reference number is provided so the user can seek further assistance

“Software Parameter”	Monospaced text in quotation marks designates a software parameter, pages, tabs or tables in the 2D Software
“#Channel”	Monospaced text in quotation marks with a leading hash mark designates a channel in the 2D Software
- cross-reference -	Italic, dotted underlined text designates a cross-reference to a different Chapter of the manual

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2 Installation / Controller Setup

The 2D lambda modules can depending on the selected module control Bosch 4.2 und 4.9 lambda probes. It controls dynamically the heater temperature.

Air/Fuel ratio is precisely measured to be used as input for engine managements and data logging.

All values are sent over the CAN bus with (a) user definable CAN ID(s).

Do not communicate with the lambda controller while it is in use as communication interrupts the processor and false sensor readings will be shown.

In order to observe the sensor output while in use copy the channels from the lambda module to a CAN-logger and supervise these values.

2.1 Separate Controller and Heater Power Supply

The modules need 2 separate power supplies: one for the controller via the CAN connector and second for the probe heater.

Power Supply

Please ensure that power supplies are connector and that the probe heater supply has sufficient wiring for the current (2A per probe)

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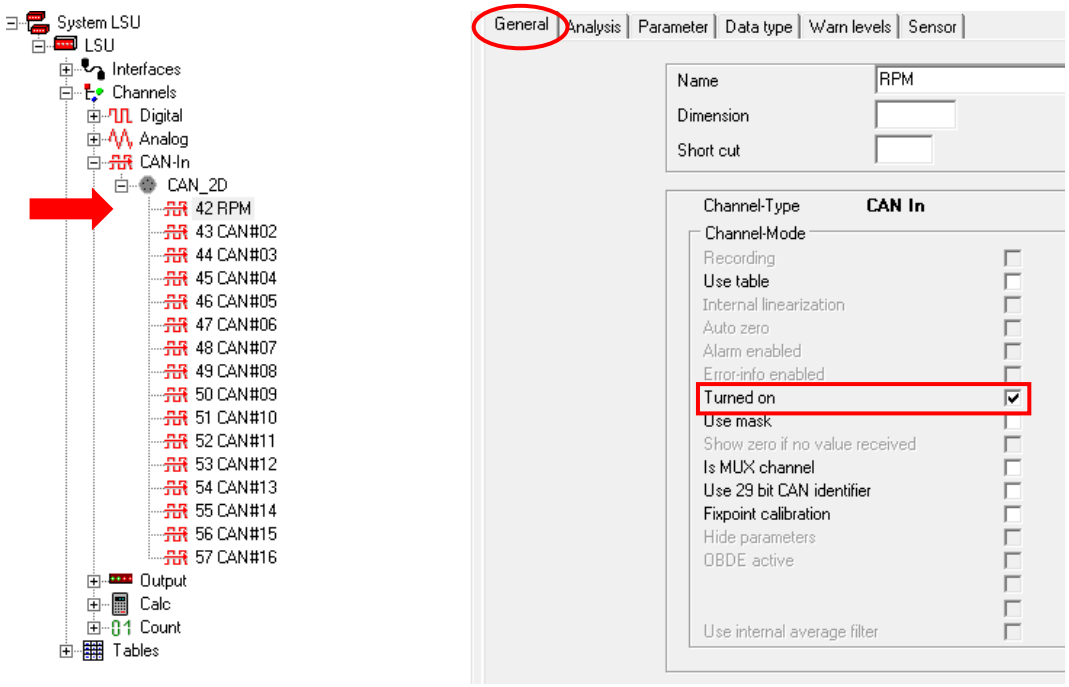
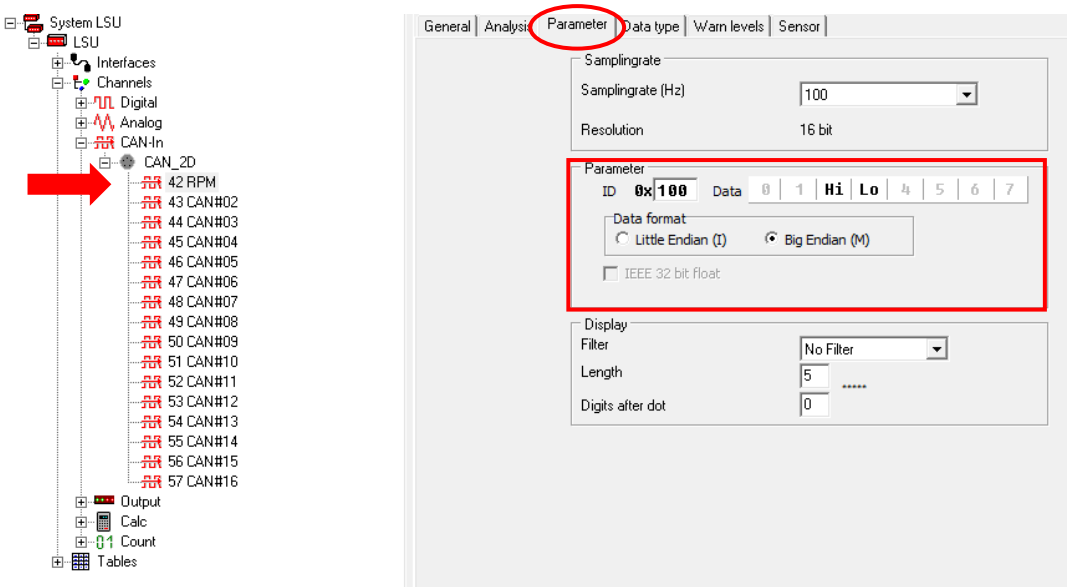
3 Automatic Probe Heater Control

The modules have an automatic probe heater control mode with which you can control when the module will start to heat up the probe though a CAN Channel

To activate the automatic probe heater control switch on CAN Channel **"#RPM"** and configure the can parameters accordingly or copy it from you logger

3.1 CAN Channel Setup





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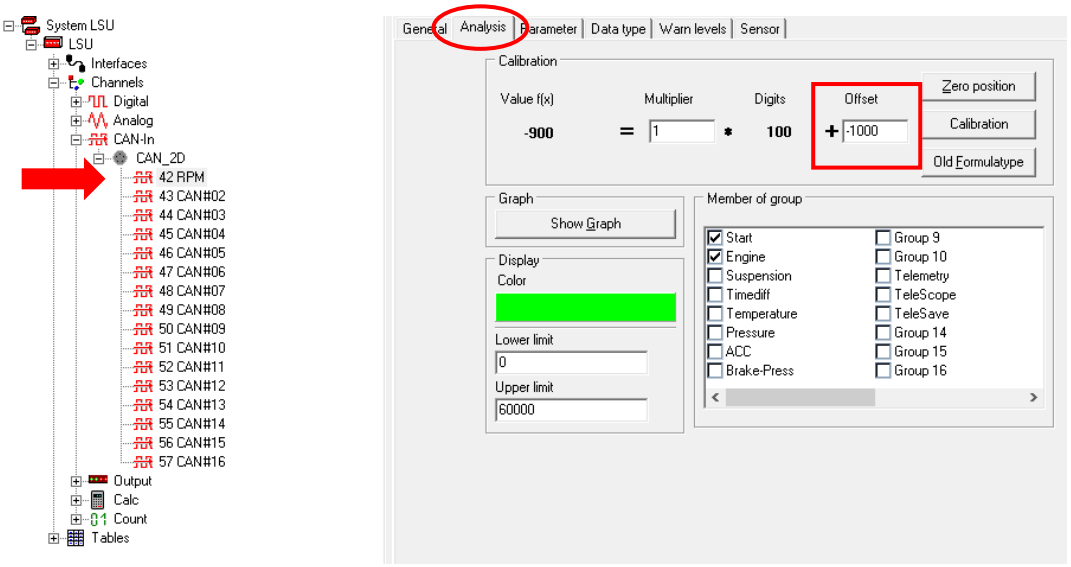
3.2 Switch Value Setup

The probe heater will be switched on when the physical value of the **"#RPM"** channel is greater than 0.

This is done with the offset value in the Analysis tab of the channel



We recommend it to set this up so that heating starts above 1000 RPM, so the battery is not drained when the engine is not running.

Save the set-up by clicking apply.

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4 Values and Error Codes

The displayed probe temperature is not equal to the exhaust gas temperature!

- If the LED on the Module is blinking, the probe heater control is active
- The probe temperature **"**`#LAF_Temp`**"** is displayed in values between 570°C and 1050°C
- The Heat channel **"**`#LAF_Heat`**"** shows the heating value for the probe (denoted in %)
- If probe temperature is below 600°C the A/F channel **"**`#LAF`**"** shows the status as shown in table below

A/F (λ-value)	Description
0.016	The probe temperature is under 600°C
0.100	Probe is not connected or short circuit to ground or probe broken
0.110	Probe is not connected or probe heater power supply not connected
0.120	Short circuit to VBat or probe broken
0.3	Automatic probe heater mode: no CAN data The module receives no RPM information
1.0	Heating Error The probe temperature is under 600°C after the initial heating phase (approx. 20sec)
2.0	The heater control is active, the probe is heating up
3.0	Automatic probe heater mode: heater off – switch value not reached
10.0 to 38.0	Measurement range

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5 Sensor Installation Position / Design- Guidelines

Installation in the exhaust system must be at a position ensuring representative exhaust gas composition whilst also not exceeding the temperature limits. The sensor must be positioned upstream of catalyst and downstream turbocharger (if existing)

The sensor installation position design must be selected in a way to minimize exhaust side stress of the sensor with exhaust gas condensate.

Heat-Up Profile

The start of the heat-up profile must be delayed until all exhaust gas condensate is gone

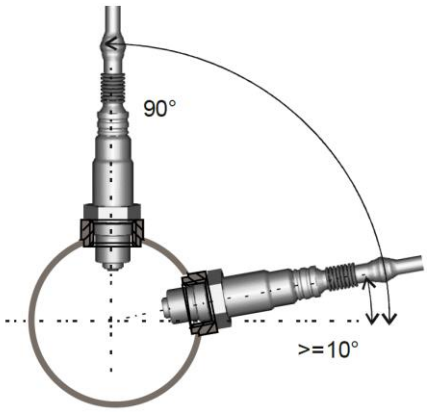
➔ All 2D LSU Modules have a special heat-up profile to minimize the influence of exhaust gas condensate

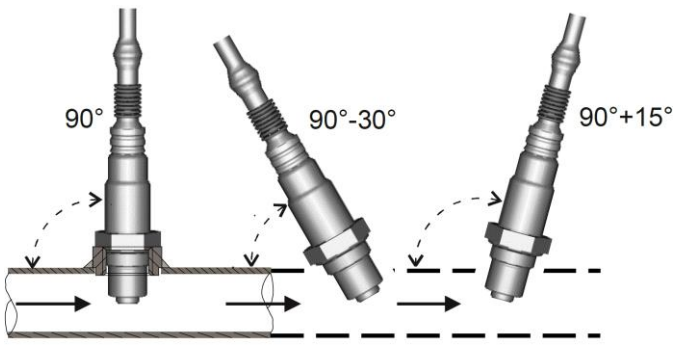
5.1 Design Guidelines

- Locate sensor as close to the engine as possible, respecting the temperature limits
- The exhaust pipe in front of the sensor must not contain any pockets, projections, protrusions, edges flex-tubes etc. to avoid accumulation of exhaust gas condensate. A downwards slope of the pipe is recommended.
- Make sure, that the front hole of the protection tube does not point against exhaust gas stream.
- Also make sure, that no accumulated water can flow back from locations downstream of the sensor
- Attempt to achieve rapid heating-up of the exhaust pipes in the area in front of the sensor and of the complete sensor thread boss area, to avoid developing of exhaust gas condensate.
- The sensor thread boss has to be designed as shown below to reach a rapid heat up of the sensor protection tube area. Make sure, that the protection tube is fully reaching into the exhaust gas stream.

Installation angle should be aimed perpendicular (90°); at least it must be inclined 10° towards horizontal to prevent the accumulation of exhaust gas condensate between the sensor housing and sensing element.

The tilt angle against the exhaust gas stream should be aimed as 90°, maximum inclination 90°+15° (protection tube opening towards exhaust gas flow 90°-30°).





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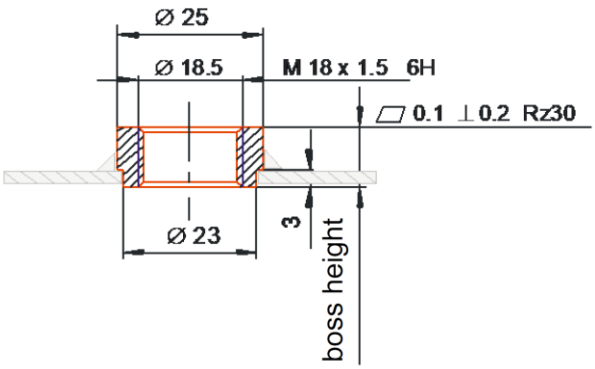
5.2 Thread Boss Design

Recommended material for the thread boss:

➔ Heat-resistant stainless steel, e.g. 1.4301; 1.4303; SAE 30304; SAE 30305



Thread boss dimensions should be as shown in the figure above.

The outer diameter of the welded-on boss should be selected so that the universal oxygen sensor gasket ring is seated solidly when mounted, e.g. Ø 25 mm. Greater diameters increase the mass and thus delay the heat-up of the boss, promoting the formation of exhaust gas condensate. The boss ends flush with the inner wall inside of the exhaust gas pipe.

The tolerance of the mating thread boss (6H) must be ensured after the thread boss is welded into the exhaust pipe (with respect to welding distortion).

5.2.1 Acceptable range for boss heights

- Minimum boss height ≥ 10.5 mm to ensure complete coverage of sensor thread and protection tube weld seam.
- Recommended boss height ≥ 13 mm
  - for hot applications ($T_{hexagon}$ > 600 °C or $T_{exhaust}$ gas > 930 °C, to avoid overheating of protection tube weld seam and sensor hexagon.
  - for tilt angles with gas entry hole towards exhaust gas stream (> 90°) to cover the protection tube weld seam.
- Maximum boss height ≤ 22 mm If the height is ≥ 16 mm the danger of thermal shock increases due to exhaust gas condensate formation inside the protection tube.

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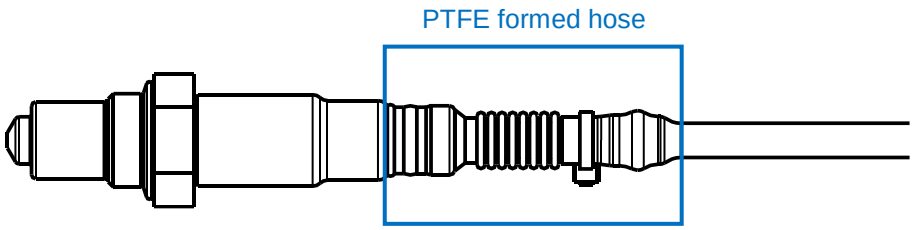
5.3 Sensor Mounting

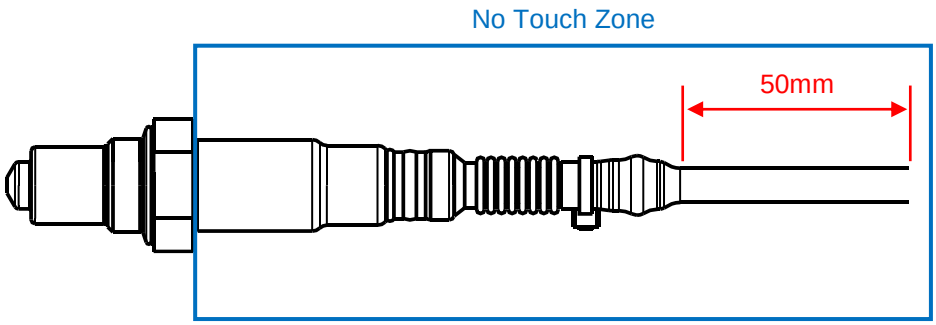
The sensor must not be exposed to strong mechanical shocks (e.g. while the sensor is installed). Otherwise the sensing element may crack without visible damage to the sensor housing.

The PTFE formed hose is part of the reference air volume of the sensor and must be kept sealed and undamaged. For installation, the minimum bending radius of the hose must be 12 mm. Keep the PTFE formed hose away from sharp edges and avoid contact/friction with the frame, engine, fairing etc.



5.3.1 No Touch Zone

To avoid damage of the sensor, no Part of the sensor in the No Touch Zone must have contact with any part of the vehicle (frame, engine, fairing, etc.) – also no cable tie is allowed in this area!



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