



LCU-ONE CAN For MyChron5

User Manual
1.00



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1. LCU-One CAN in a few words

LCU-One CAN is the lambda controller unit designed to work exclusively with Bosch LSU 4.9 wideband probes, which are the quickest and most accurate way to analyse exhaust gases and provide a real time parameter related to engine carburetion.

Lambda probes can be applied to 2 and 4 strokes engines, gasoline, diesel, methane or alcohol based fuels.

LCU-One CAN communicates with MyChron5 via CAN, providing lambda value, Air/Fuel ratio, probe temperature and diagnostics parameters. An external 12V battery is required, this will supply power to the whole AiM system, including MyChron5 and any other AiM expansion connected to it. LCU-One CAN is the only AiM Lambda Controller compatible with MyChron5.



2. The kit contains

The kit contains:

- LCU-One Lambda controller (1)
- Bosch LSU 4.9 wide band probe (2)
- Weld on bung (3)

The kit part number is: **X08LCU05CAN**

Bosch probe and bung can be bought separately as spare parts with these part numbers:

- LSU Bosch 4.9 probe **X05LSU490**
- Weld on bung **LBS552680**





LCU-ONE



RIM-50

3. What is Lambda

Lambda represents the ratio between actual mixture of air/fuel (A/F or AFR) admitted in the engine, compared to the optimum ratio (A/F or AFR stoichiometric) indicating an efficient fuel combustion. Lambda can be written as:

$$\text{Lambda} = \frac{A/F}{A/F_{\text{STOICHITOMETRIC}}} = \frac{AFR}{A/F_{\text{STOICHITOMETRIC}}}$$

where:

A = parts of air (oxygen) in the combustion chamber

F = parts of fuel in the combustion chamber

To completely burn one part of gasoline, 14.57 parts of air (AFRstoichiometric) are required.

This optimal combustion is also indicated as **Lambda = 1** whatever is the fuel in use.

AFRstoichiometric is a fuel dependant constant. Oxygenated fuels and additives will change this value, thus it is strongly recommended to use Lambda as reference parameter.

3.1 Rich mixture

If the actual mixture has less than 14.57 air parts to 1 part of gasoline, the mixture is said rich. For example an AFR of 12.2 is a rich mixture and is also indicated as:

$$\text{Lambda} = \frac{12.2}{14.57} = 0.84$$

Lambda < 1
AFR < 14.57 (for gasoline)

3.2 Lean mixture

If the actual mixture has more than 14.57 air parts to 1 part of gasoline, the mixture is said lean. For example an AFR of 17.5 is a lean mixture and is also indicated as:

$$\text{Lambda} = \frac{17.5}{14.57} = 1.2$$

Lambda > 1
AFR > 14.57 (for gasoline)

3.3 Stoichiometric mixture

If the actual mixture has 14.57 air parts to 1 part of gasoline, the mixture is in the stoichiometric ratio. This is also indicated as Lambda = 1

3.4 Bosch LSU 4.9 probe working

Bosch LSU 4.9 is a wideband lambda probe which does not require any specific calibration procedure, it auto-calibrates on a reference electrical current which guarantees the same performance over time.

When in use the probe becomes very hot (700-800 °C or 1291-1472 °F), so **do not** touch it or place it in contact with inflammable material or fuel.

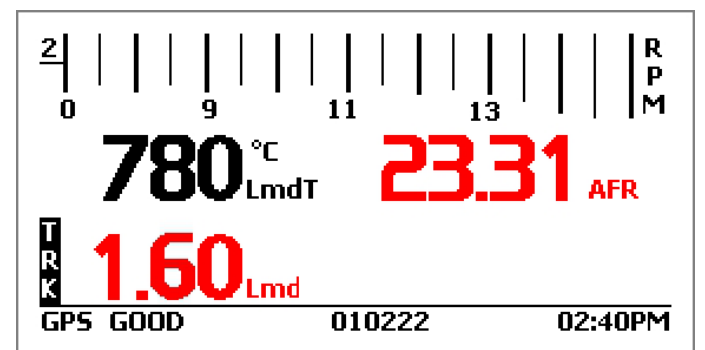
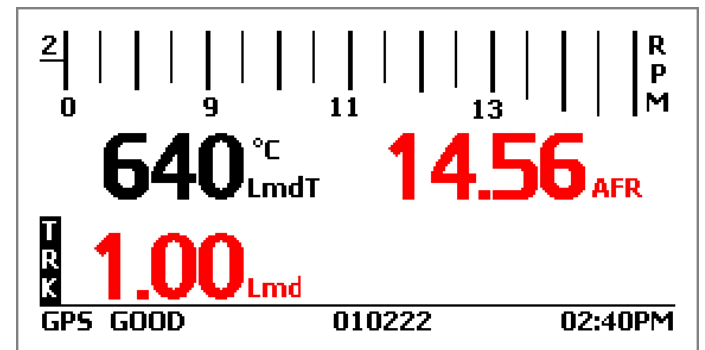
Warning: misuse can cause shocks, burnings or explosions.

Do not clean the probe with solvents or additives, we suggest to remove it when cleaning the kart to avoid detergent pollution.

Never switch the engine on if the probe is installed but not connected to a working controller LCU-One CAN. If a probe were to be exposed to exhaust gas when not heated it would be permanently damaged. Wait for the probe to be ready, you will read the following values on the dash (Lambda = 1.6 AFR = 23.31) depending on your display set up.

- during warmup – left image below – Lambda value is 1 (14.56 AFR)
- when the probe is working – right image below – Lambda value with the engine off is 1.60 (free air) (23.31 AFR).

The Bosch LSU 4.9 detects Lambda values in a 0.65 – 1.6 range (9.5 – 23.3 AFR).



4. Powering LCU-One CAN controller

The wideband Lambda probe has a working temperature of about 780°C (1436°F); for this reason it is constantly monitored by the Lambda controller LCU-One CAN which tunes the power supplied by an external 12V battery.

The warm up can drain up to 1.6A while the average consumption is approximately 1A, thus it is recommended to install a battery which can last several hours feeding the whole logging system. To make an example a 4 cells LiPo battery with a capacity of 3000mAh can guarantee 3 hours of activity.

LCU-One CAN controller has to be connected directly to the external 12V battery, using the three leads (one red and two black) supplied with spade connectors.

They all have to be correctly connected with no dispersions, bad crimping, oxide or thin section wires causing an inadequate current supply to warm the Lambda probe. These are the most common causes of a bad reading and premature poisoning of Lambda probes. The controller also powers MyChron5 and switches off with it avoiding battery discharge.



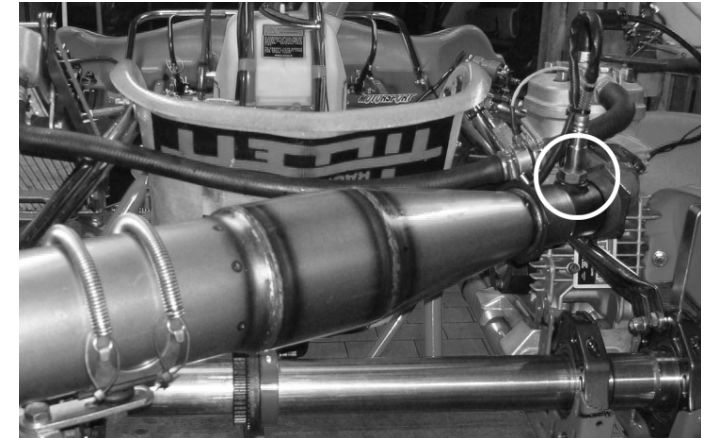
5. Installing the probe and LCU-One CAN lambda controller

Bosch LSU 4.9 Lambda probe must be installed on the kart exhaust pipe, welding the bung supplied with the kit on it.

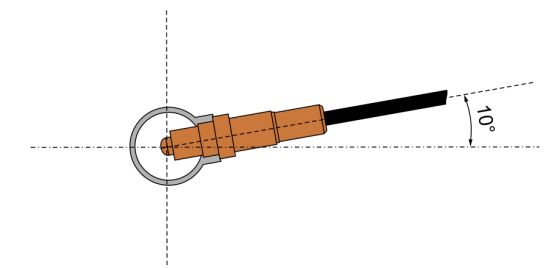
Install the probe close to the engine, avoiding its cable to be in contact with heat sources and the pipe.

The probe working temperature must not exceed 900°C (1652°F) nor be exposed to the free flame coming out of the engine port.

Suitable positions to install it are in the silencer flexible pipe, the diffuser cone or on top of the expansion. Do not place the probe at the end of the exhaust pipe or too far from the piston.

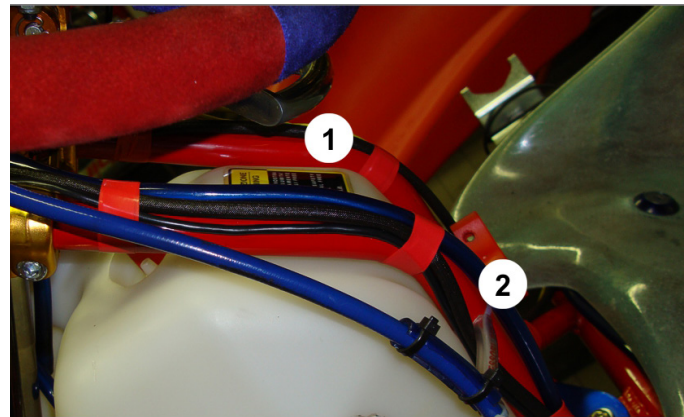


The probe installation angle should be no less than 10 degrees, as in the image on the right, to avoid that condensation come in contact with the probe, polluting it. Leaning it towards the driver can possibly save it from rear collisions.

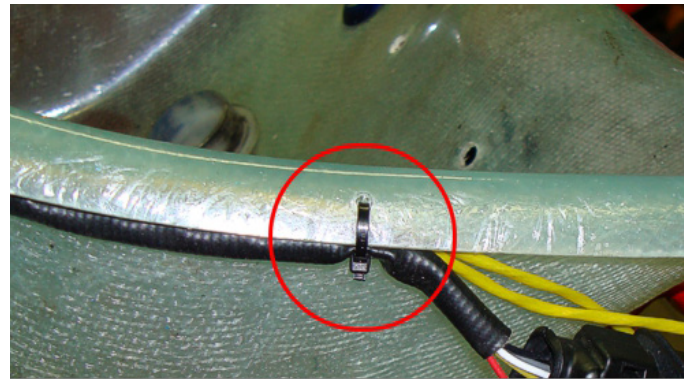


It is suggested to install LCU-One CAN under the Nassau panel.

- make the power (1) and probe (2) cables pass around the steering wheel hoop



- fix the probe cable to the kart seat.



6. LCU-One CAN and MyChron5

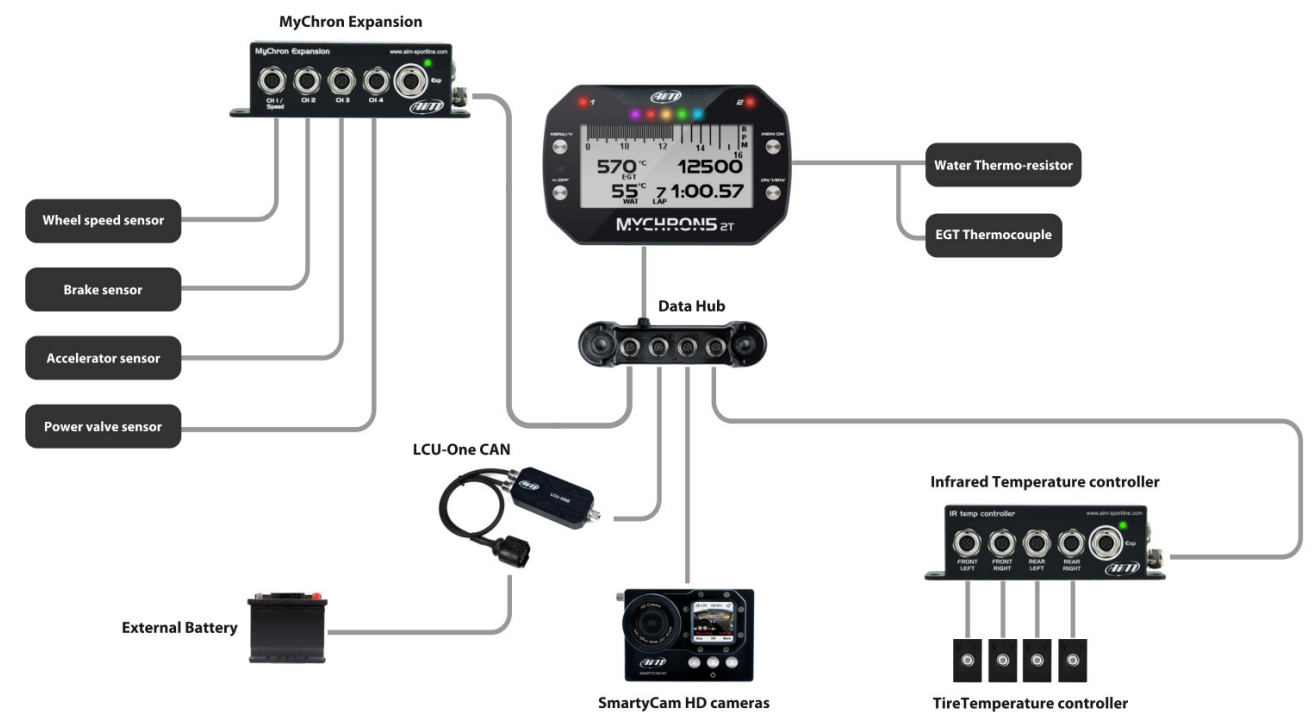
The LCU-One CAN is totally integrated with MyChron5; its connection to the AiM CAN network and the display setup allows to have everything under control on MyChron5 display.



6.1 AiM Network

You can connect LCU-One CAN directly to MyChron5 "Exp" connector or add it to an extended network as shown here below.

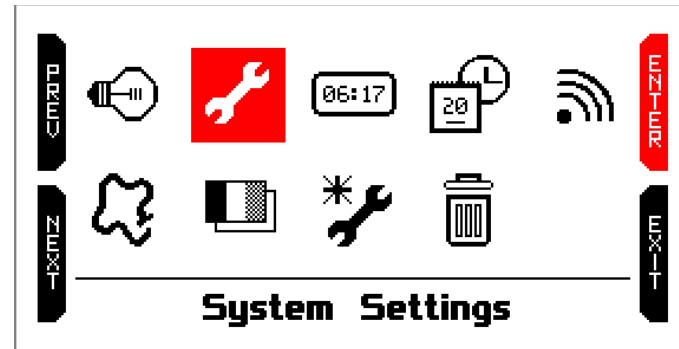
Please note: all devices are to be connected when switched off. MyChron5 automatically detects LCU-One CAN and all other expansions at start up.



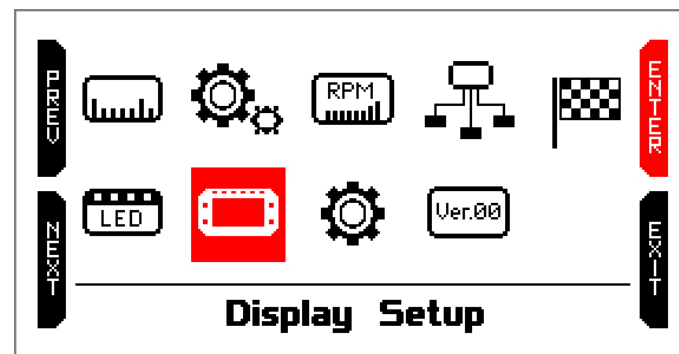
6.2 Showing LCU-One CAN values on MyChron5

To show LCU-One CAN data on MyChron5, set its Display Setup as described below:

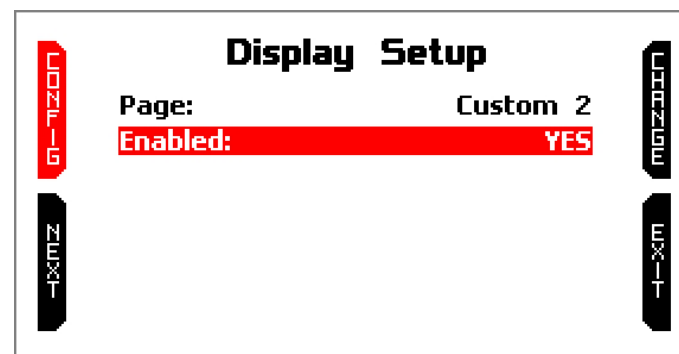
- press "MENU/>>>"
- select "System settings" icon and press "ENTER"



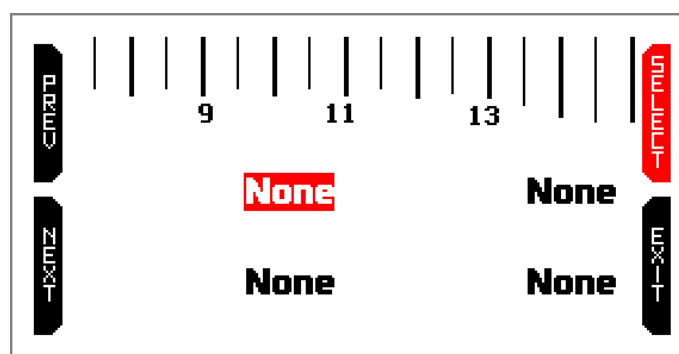
- select "Display Setup" icon and press "ENTER"



- scroll the pages up to the first custom page and press "NEXT" to switch to the bottom row
- if the page is not enabled press "CHANGE" and enable it
- press "CONFIG"



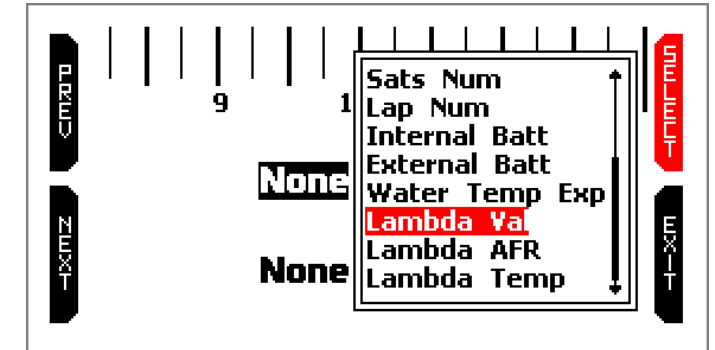
- the page shows four fields all set as "NONE" with the first top left already selected;
- press "SELECT"



Using "PREV" and "NEXT" buttons scroll the list of available data; LCU-One CAN parameters you can display are:

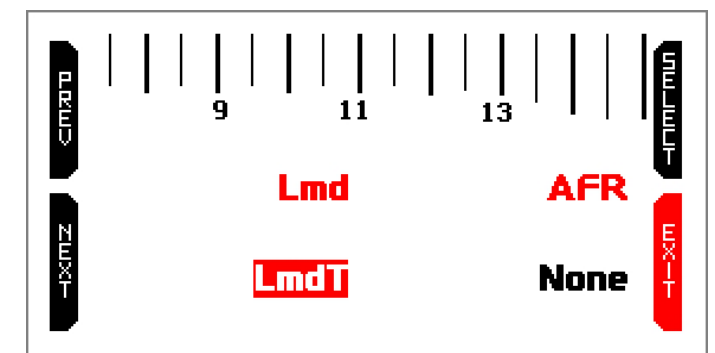
- Lambda Val: oxygen/exhaust gas ratio – reference value is 1.00
- Lambda AFR: lambda value times stoichiometric value of fuel in use (gasoline stoichiometric value is 14.57)
- Lambda Temp: probe internal temperature

Select the data you want to see and press "SELECT"; repeat the operation for the three fields

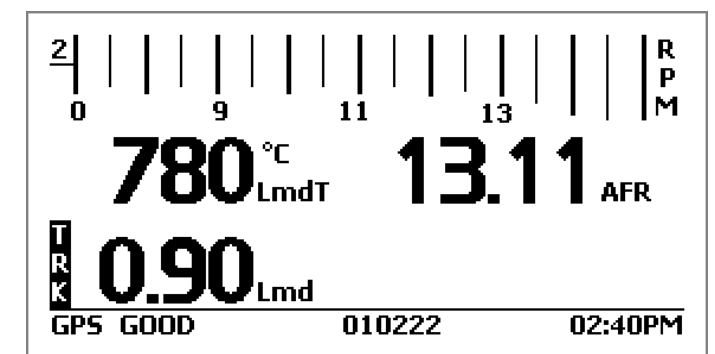


■ data are labelled as shown here on the right:

- Lambda Temp: LmdT
- Lambda Val: Lmd
- Lambda AFR: AFR
- press "EXIT" until you come back to MyChron5



- To see sampled data in real time press "ON/VIEW" until you see the custom page set.

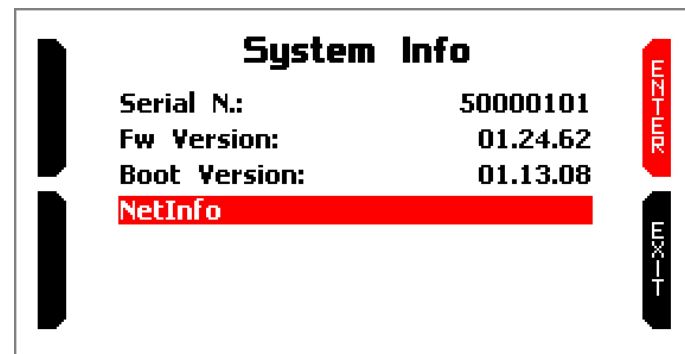


6.3 Configuration issues

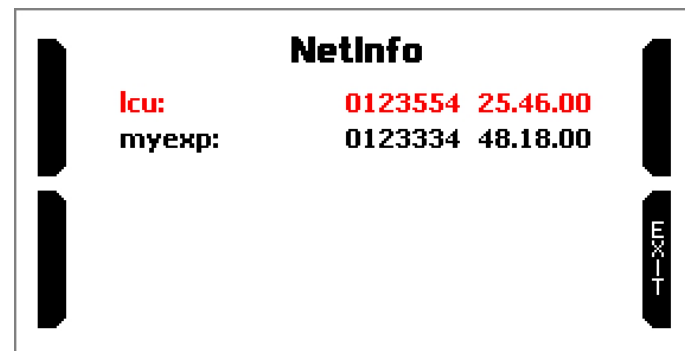
If when you try to configure MyChron 5 display you do not see Lambda channels among those available, you probably only need to wait some time for the full recognition.

To verify that MyChron5 detects LCU-One CAN:

- press "MENU/←←"
- select "System Settings" icon and press "ENTER"
- select "System Information" icon (the last one) and press "ENTER"; the page shows the bottom line "Net Info" selected: press "ENTER".



- the system shows information about all devices connected to MyChron5, LCU-One CAN included.



If LCU-One is not shown, cycle MyChron5 power and wait.

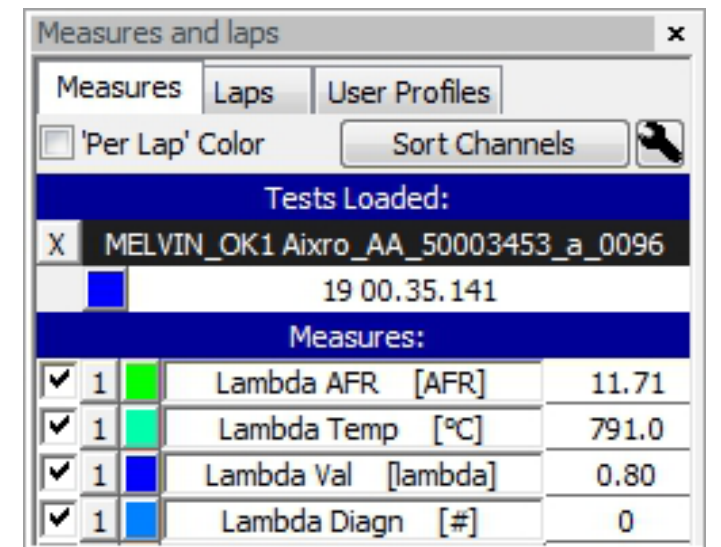
Please remember that all devices have to be connected to MyChron5 when everything is off.

7. How to analyse LCU-One CAN data

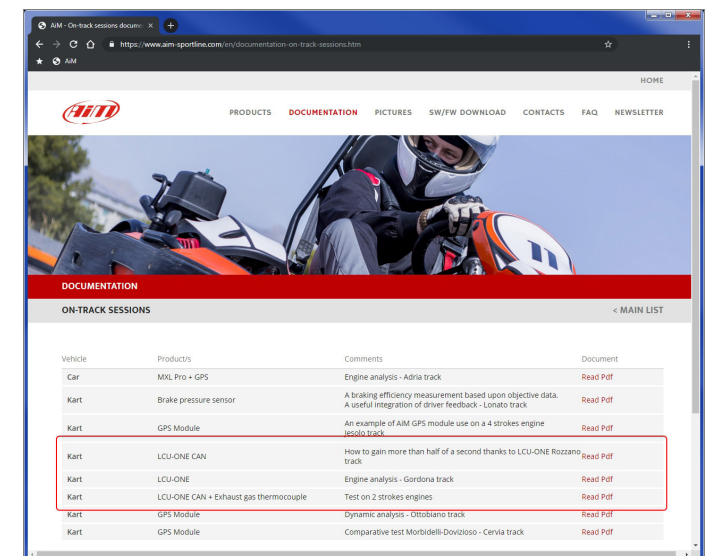
Once the session is over and data have been downloaded from MyChron5 you can analyse them using Race Studio Analysis software.

Running the software and opening the test you will see that LCU-One CAN connection adds four channels to "Measures and laps" bar (image on the right):

- Lambda Val: shows Lambda value recorded during the test
- Lambda AFR: shows lambda value times the stoichiometric value of the fuel in use
- Lambda_Temp: shows the working probe internal temperature
- Lambda Diagn: shows the probe status; values that can be shown are:
 - 0 = ok
 - 1 = probe disconnected from controller and circuit open
 - 2 = 12V short circuit
 - 3 = GND short circuit



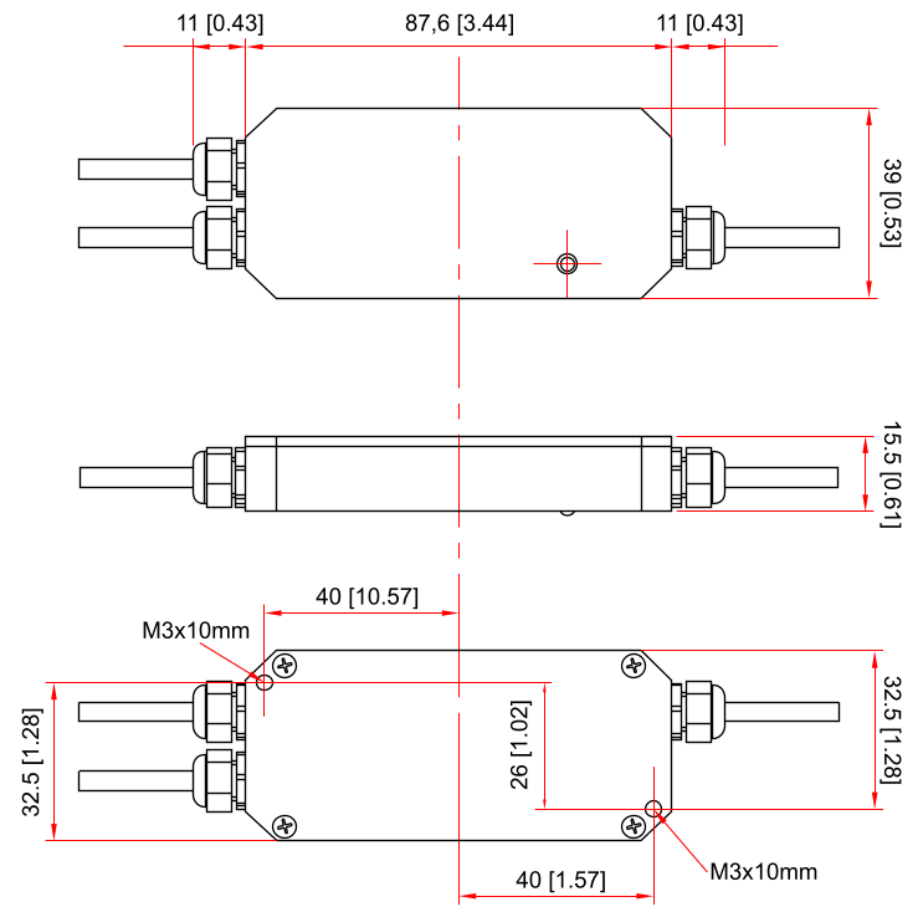
Documents and tutorials relevant to LCU-One and Lambda analysis are available at: www.aim-sportline.com – Documentation area – On-Track sessions.



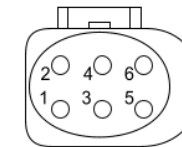
8. Technical drawings and specifications

■ Dimensions 87,6x39x15.5 mm [3.44x0.53x0.61 inches]

■ Waterproof IP67



6 pins Bosch female connector front view



Lambda	
1	IP+
2	IP-/VS
3	H-
4	H+
5	Rcal
6	VS+

Power Cable	
Red	V battery
Black	GND

5 pins Binder 712 male connector (external view)



CAN Bus	
1	CAN+
2	GND
3	+Vb
4	CAN-
5	Vbext

Our website www.aim-sportline.com is constantly updated. Please refer to it for updates on firmware, software and documentation.

