LCU–ONE Analog User manual







INDICE

Chapter 1 – LCU-ONE Description	2
Chapter 2 – LCU-ONE and Lambda probe mounting	
Chapter 3 – Configuration	
3.1 – LCU-ONE Analog standard configuration	
3.2 – LCU-ONE Analog custom configuration	
3.2.1 – Preliminary operation	8
3.2.2 – Configuring Lambda controller	8
3.2.3 – The keyboard	. 11
3.2.4 – Informative panels	. 11
3.2.5 – The analog output graph	. 12
Chapter 4 – Online values from Lambda controller	
Appendix – Part Number and technical drawings	.14
"A" – Part number of LCU-ONE Analog	
"B" – Technical drawings	.14



Chapter 1 – LCU-ONE Description

LCU-ONE is a lambda controller unit for wide band BOSCH LSU 4.9 lambda probe; it fits petrol (2 and 4 strokes), diesel and methane engines as well as alcohol based fuel engines. It is intended to check lambda probe proper working as well as to transmit the Air/fuel ratio values providing **MXL/EVO3** with lambda values through the CAN bus.

Lambda value is defined as: LAMBDA= (A/F)/(A Stoichiometric /F Stoichiometric).

where:

A = incoming parts of air;

F = parts of petrol the carburetor injects into the engine;

A Stoichiometric / F Stoichiometric = parts of air needed to burn Stoichiometric F;

Speaking about gasoline, for example, it needs 14,57 parts of air to completely burn a part of gasoline, obtaining Lambda value = 1 read by the probe.

LCU-ONE controller can detect lambda values in a range of 0.65 to 1.6 (free air).

It is reminded that LAMBDA value lower than 1 means a rich mixture, while LAMBDA value higher than 1 means a lean mixture.

Wide band Lambda probes need to be heated to work properly and not poisoned with exhaust gas; **LCU-ONE** controller precisely manages the probe heater so to keep temperature value in the optimum working range.

Lambda probe used with LCU-ONE controller becomes very hot (around 700-800 °C, 1292-1472 °F) during its working period, it is thereby necessary AVOIDING:

- touching it.
- placing it in contact with flammable stuff or fuel.

Please note:

disrespect of these warnings can cause shocks, burnings or explosions.



Chapter 2 – LCU-ONE and Lambda probe mounting

LCU-ONE controller should be installed in a flat location and far from heat sources; it should be mounted steady using the suited bracket.

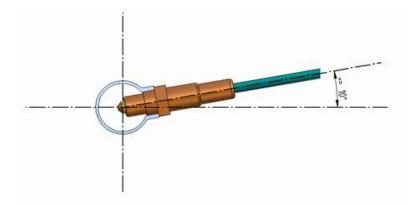
The wiring has to be arranged so to avoid it passing near to heat sources.

LCU-ONE is to be powered by the engine master switch.

BOSCH LSU 4.9 Lambda probe should be installed on the vehicle exhaust pipe using a specific adaptor that comes with the kit and should be welded on the same pipe. The probe should be sufficiently near to the engine.

Probe working temperature should not exceed 900°C (1652°F) and it should not be exposed to the free flame coming from the exhaust system.

Probe installation angle should be of at least 10° to avoid liquid condensation stuff to come in contact with the probe, polluting it.



Once the probe is installed, pay attention not to let the cable pass near to excessive heat sources (the exhaust pipe for example).

Bosch LSU 4.9 probe auto-calibrates: no calibration is then required by the user.

Solvents or additives should not be used to clean the probe connector. To protect the probe we would suggest to remove it from the vehicle when cleaning the vehicle to avoid polluting the probe with detergents.

It is reminded to never switch the vehicle on with Lambda probe installed and not connected to a correctly working **LCU-ONE** controller: a probe not heated and exposed to exhaust gas would be irremediably damaged.

N.B. BOSCH LSU 4.9 Lambda probe has been designed to be used with unleaded or diesel engine: it can be used with other kind of engines too but its duration needs to be tested by the user.



Chapter 3 – Configuration

To work properly **LCU-ONE Analog** needs to be configured. The configuration can be made both using **Race Studio 2** and using **Lambda Configurator** the free software - included in the kit - properly designed and developed by AIM to configure this device.

3.1 – LCU-ONE Analog standard configuration

Configuration through **Race Studio 2** (standard) is possible only if calibration curve default points -1.95 ± 0.65 and 4.8 ± 1.6 - have not been modified.

To configure LCU-ONE Analog with Race Studio Configuration follow this procedure:

- run the software;
- press "AIM system manager" button on the left vertical keyboard;
- select the logger LCU-ONE Analog is connected to
- activate "Channels" layer
- select the analogue channel to set the probe on
- double click on "Sensor type" column corresponding to that channel and select "AIM Lambda LCU-ONE 1.65 – 1.6 Lambda)" option as shown here below; click out of the cell to confirm the choice.

j I	'ransmit	Receive		CAN	Net inf	• 🚺 🔊	et acquisition sysl time	em			
urrent configural	tion										
Installation name	e Data logger type	e Ecu	Vehicle name	Available	time	Time with GPS	Total frequency	Mast	er frequency	Expansions freq	Tot. Expansion:
DEFAULT	MXL PISTA	SUZUKI - GSXR	DEFAULT	12.41.26	(h.m.s)	4.36.03 (h.m.s)	91 (Hz)	91 (H	tz)	0 (Hz)	1
Select configura	ation Channels Sys	stem configuration CAN	Expansions configu	urator							
Speed_1											
Wheel circumfe Pulses per whe	erence (mm) 736 el revolution 4	6									
Channel iden	Enabled/disabled	Channel name		Sampling fre		iensor type			Measure unit	Low scale	High scale
RPM	🔽 Enabled	Engine		10 Hz	_ E	ngine revolution speed			rpm	0	16000
SPD_1	🔽 Enabled	Speed_1		10 Hz	💌 S	peed		-	km/h .1	0.0	300.0
CH_1	🔽 Enabled	Oil_Press		10 Hz	_ G	ieneric linear 0-5 V		-	V.1	• 0.0	5.0
CH_2	🔽 Enabled	Fuel_Level		10 Hz	• F	uel level		-	%	0	100
CH_3	Disabled	Channel_3		10 Hz	- G	ieneric linear 0-5 V		-	V .1	• 0.0	5.0
CH_4	Disabled	Channel_4		10 Hz	L	ambda sensor NGK TL7	1111W1 - NTK TC611	0 -	A/F .1	• 0.0	5.0
CH_5	Disabled	Channel_5		10 Hz	- P	ressure VDO 0-2 bar		~	V .1	• 0.0	5.0
CH_6	Disabled	Channel_6		10 Hz	▼ P	ressure VDO 0-5 bar		-	V .1	• 0.0	5.0
CH_7	Disabled	Channel_7		10 Hz		ressure VDO 0-10 bar ARBOX pressure senso	r - X055NAB01		V .1	• 0.0	5.0
СН_8	Disabled	Channel_8		10 Hz	- A	IRBOX pressure senso	r - X055NAB00		V .1	• 0.0	5.0
CALC_GEAR	Disabled	Calculated_Gear		10 Hz	D 7	istance potentiometer ero based potentiomet	or		#	0	9
ACC_1	Enabled	LatAcc		10 Hz	- 1 -	id zeve nebenkiemeter	6		g .01	-3.00	3.00
LOG_TMP	📈 Enabled	Datalogger_Temp		10 Hz	- L	ambda sensor BOSCH ambda sensor NGK TL7	111W1 - NTV TC611		°C	• 0	50
BATT	🔽 Enabled	Battery		1 Hz	- Iv	Vater pitot speed sepsi			V .1	5.0	15.0
ECU_1	🔽 Enabled	ECT		10 Hz		iyro xternal vertical acceler			°C	• 0	130
ECU_2	📈 Enabled	GEAR		10 Hz		xternal horiz, accelero			#	0	7
ECU_9	🔽 Enabled	MODESEL		10 Hz		ieneric linear 0-5 V			#	0	3
						ieneric linear 0-500 mV ieneric linear 0-50 mV					
					M	1SI 0-100 psi sensor					
						1SI 0-150 psi sensor EAT Brake Pressure		=			
					S	EAT Engine Pressure					
						EAT Water Temperatu Vater Temp Suzuki GSX					
						vil Press Suzuki GSXR	ĸ				
						tatus signal					
						emp Weber ATS 04 (12 Nil pressure Nagano KM					
						IM Lambda LCU-ONE (0,65 - 1,6 lambda)				
						15I 0-2000 PSI sensor uel level					
						ub_H2O Lustom_001					



• Set the probe configuration panel that appears bottom left of channel layer, highlighted in the image below.

	ransmit	Receive	-transferre	CAN-N		o Set acquisition				
ment configuration							Manine Sector			
stallation name EFAULT	MXL PISTA	e Ecu SUZUKI - OSXR	Vehicle name DEFAULT	Available tim 12.41.26 (h)		Time with GPS Total frequence 4.36.03 (h.m.s) 91 (Hz)	y Master fr 91 (Hz)	squency	Expansions freq 0 (Hz)	Tot. Expension
Speed_1 Wheel circumfe	rence (mm) 73	stem configuration CAN	Expansions configu	ietor						
Channel iden	Enabled/disabled	Channel name		Sampling frequ		laners have	Measure u	ort I to	w scale H	igh scale
Undernet iden	Enabled	Engine		10 Hz	and the second	ingine revolution speed	rpm	0		gn scare
PD_1	Enabled	Speed 1		10 Hz		peed	* km/h .1	0.0		0.0
H_1	Enabled	OIL Press		10 Hz		UM Lambda LCU-ONE (0,65 - 1,6 la	- A/F .1	-10.0		
H_2	F Enabled	Fuel_Level		10 Hz		uel level	• %	0	10	
H.3	C Disabled	Channel_3		10 Hz		ieneric linear 0-5 V	- V .1	- 0.0		
H_4	C Disabled	Channel_4		10 Hz		IRBOX pressure sensor - X055NAB01	• mbar	. 0	5	
HS	Disabled	Channel 5		10 Hz		JM Lambda LCU-ONE (0.65 - 1.6 la	• A/F .1	. 0.0	5.	0
H_6	Cisabled	Channel_6		10 Hz	* G	ieneric linear 0-5 V	• V.1	- 0.0) 5.	0
H.7	Disabled	Channel_7		10 Hz	-16	ieneric linear 0-5 V	- V .1	- 0.0		0
HB	C Disabled	Channel_8		10 Hz	- 9	ieneric linear 0-5 V	- V .1	- 0.0	5.	0
ALC_GEAR	Cisabled	Calculated_Gear		10 Hz	-10	alculated Gear		0	9	
ICC_1	F Enabled	LatAcc		10 Hz	-10	ateral accelerometer	g .01	-3.	00 3.	00
OG_TMP	Enabled	Datalogger_Temp		10 Hz	-10	old joint	*C	- 0	50)
ATT	F Enabled	Battery		1 Hz	- B	lattery	¥ .1	5.0	11	5.0
CU_1	F Enabled	ECT		10 Hz	-11	emperature sensor	*C	- 0		90
CU_2	F Enabled	GEAR		10 Hz	- 0	iear sensor		0	7	
CU_9	Enabled	MODESEL		10 Hz	- R	law value		0	3	

• Activate the drop down menu pressing the arrow button circled in the image above and select the fuel used by the vehicle.

-Multiplier to calculate AFR from la	ambda
(14.57) Gasoline	Add custom value
(14.57) Gasoline	
(15.50) LPG (Propane)	
(6.40) Methanol	
(9.00) Ethanol	
(17.20) CNG	
(14.60) Diesel	



 In case the fuel used by the vehicle is not included in the database (and only in case its stoichiometric value is known) press the button "Add custom value" and the window here below appears.

Custom multiplier value				X
Custom multiplier value list		Legend for new v ew item to list emove cted item om list	ralue	
	Sector 1	ave	4	<u>C</u> ancel

- Insert the new value and the test to match. Press "Add new item to the list" button and then "Save" button.
- The fuel is now available in the drop down menu: select it.



3.2 – LCU-ONE Analog custom configuration

In case calibration curve default points have been modified it is necessary to configure LCU-ONE Analog using **Lambda Caonfigurator** software.

Warning: to correctly configure LCU-ONE Analog, please ensure you have installed a software version 1.00.07 or later.

To configure **LCU-ONE Analog** run the software. The following window appears.

🚠 AIM - Lambda Cont	'igurator - 1.00.07
Lambda controller configu	ration Online values from lambda controller
Connected to	Color options
Device have	Analog output for lambda (or AFR) values 5
Device type	4.8
Device ID number	Voit 3 2.5
N.D.	1.95
Firmware version	0 0 0 0 0.65 1 Lambda 2
Restore CONF settings	(AFR = Air Fuel Ratio = Pounds of air / pound of fuel) Use: Lambda AFR Multiplier to calculate AFR from lambda (14.57) Gasoline Add custom value
Configuration	Volt vs. lambda curve points Analog output value in particular conditions 1.95 Volt at Lambda 0.65 Warmun output: Volt 3 or high impedance
Read lambda	1.95 Volt at Lambda 0.65 4.8 Volt at Lambda 1.6 Error output: Volt 1.5 or high impedance
Upgrade firmware	Save lambda settings Load lambda settings Racing Data Power
Select language	

This is software main window. It is made up of two layers:

- Lambda controller configurator: it shows analog output graph (central) and allows the user to configure LCU-ONE Analog, read its configuration and transmit a new one, restore default Lambda settings, import and export the configurations and update LCU-ONE Analog firmware.
- Online values from Lambda controller: it shows LCU-ONE Analog-PC connection status.



3.2.1 – Preliminary operation

Lambda Configurator software, unlike all other AIM software, contains **LCU-ONE Analog** firmware. This is why we recommend you to always check our website <u>www.aim-sportline.com</u> to ensure the software release installed is the latest available. If not, please download latest release and follow carefully this procedure:

- connect LCU-ONE Analog to the PC
- read logger firmware version written in the case on the left of the central graph
- press "Upgrade Firmware" button
- this message appears:

LambdaCtrl	\mathbf{X}
	E to Vers. 25.11 ?
Ves	No

if the firmware version offered (in the figure the system offers firmware version 25.10) is more recent that the one installed on LCU-ONE Analog (supposing the one installed is version 25.08), press "Yes" and upgrade the controller firmware

3.2.2 – Configuring Lambda controller

🚵 AIM - Lambda Cont	igurator 📃 🗖 🔀
Lambda controller configu	ration Online values from lambda controller
Connected to	Color options
Device type	Analog output for lambda (or AFR) values
LCU - ONE ANALOG	
Device ID number	Vot 3 125 1.5
Firmware version	0 0.65 1 1.6 2
25.11	Lambda
Restore default lambda conf settings	(AFR = Air Fuel Ratio = Pounds of air / pound of fuel) Use: Lambda AFR Multiplier to calculate AFR from lambda (14.57) Gasoline Add custom value
Transmit Iambda	Volt vs. lambda curve points
	1.95 Volt at Lambda 0.65 Warmup output: Volt 3 or high impedance 🗆
Read lambda	4.8 Volt at Lambda 1.6 Error output: Volt 1.5 or high impedance
Upgrade firmware	Save lambda settings
Select language	



At the centre of the window are configuration panels.

(AFR = Air Fuel Ratio = Pounds of air / pound of fuel)	Multiplier to calculate AFR from lambda (14.57) Gasoline
Use: Lambda AFR	
– Volt vs. lambda curve points –	Analog output value in particular conditions
1.95 Volt at Lambda 0.65	Warmup output: Volt 3 or high impedance 🗂
4.8 Volt at Lambda 1.6	Error output: Volt 1.5 or high impedance

The first operation to perform is selecting the used fuel in a pop up menu.

(14.57) Gasoline	🔄 🔄 🤇 🔁 Add custom value
14.57) Gasoline	
15.50) LPG (Propane)	
6.40) Methanol	

In case used fuel is not included in the database and **only in case its Stoichiometric value is known** press "Add custom value" button and the window shown below appears.

Custom multiplier value		
Custom multiplier value list	New value Legend for new value	
	Save Can	el

Fill in the window with Multiplier value and related legend. Press "Add new item to list value" and then "Save" button.

Likewise, selecting a multiplier from the left box labelled as "Custom multiplier value list" and pressing "Remove selected multiplier from the list" button a multiplier will be removed.



Afterwards it is possible to work on the other parameters.

(AFR = Air Fuel Ratio = Pounds of air / pound of fuel)	Multiplier to calculate AFR from lambda (14.57) Gasoline
Use: Lambda AFR	
– Volt vs. lambda curve points –	Analog output value in particular conditions
1.95 Volt at Lambda 0.65	Warmup output: Volt 3 or high impedance 🥅
4.8 Volt at Lambda 1.6	Error output: Volt 1.5 or high impedance 🥅

"Use: Lambda/AFR" these buttons allow the user to decide whether showing Lambda values or AFR (Stoichiometric) ones. The appearance of the panel below depends on this choice; here down are the panels showing Lambda values (left) or AFR (right).

Volt vs. lambda curve points			- Volt vs. lambda curve points		
1.95	Volt at Lambda	0.65	1.95	Volt at AFR	9.47
4.8	Volt at Lambda	1.6	4.8	Volt at AFR	23.31

The coloured button placed on the left of the cases indicates the colour of this value on the central graph. In the example the value is showed in light blue.

Once decided which values to show, just fill in the cases.

When all the values have been inserted the configuration has to be transmitted to **LCU-ONE Analog** pressing "Transmit lambda configuration" button, placed in the left keyboard.

The system will show a confirmation message. In case **LCU-ONE Analog**-PC connection is not ok the system shows an error message (right figure).

Lambda Configurator 🛛 🔀			
(į)	Configuration transmitted		
	ОК		

Lambda Configurator 🛛 🛛 🔀		
⚠	Lambda controller not connected	
	ОК	



3.2.3 – The keyboard

On the left of the window are some buttons:

- "Restore default lambda settings": allows the user to restore default settings on **LCU-ONE Analog**.
- "Transmit lambda configuration": allows the user to transmit the configuration to the device
- "Read Lambda configuration": reads the configuration from the connected device
- "UpgradeFirmware": allows the user to upgrade the firmware of its device.

Bottom central are these buttons:

- "Save Lambda settings": allows the user to export Lambda configuration
- "Load lambda settings": allows the user to import a Lambda configuration and transmit it to the device

In the lower part of the window are thrre buttons:

- "Select language": allows the user to change the language
- "OK": allows the user to save the set parameters
- "Exit": allows the user to quit discarding changes.

3.2.4 – Informative panels

On top left of the software main window a series of panels shows the characteristics of the **LCU-ONE Analog** connected to the PC. These panels are different depending if the device is connected or not.

Here below you see (left) the panels with the controller connected to the Pc and (right) the same panels with the controller not connected to the PC.

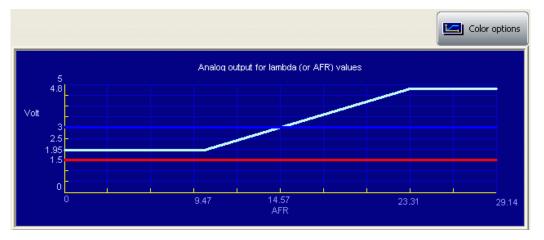
Connected to	Connected to
COM 1	NOT CONNECTED
Device type	Device type
LCU - ONE ANALOG	N.D.
Device ID number	Device ID number
1002225	N.D.
Firmware version 25.11	Firmware version

- Connected to: PC serial port
- Device type: LCU-ONE Analog (controller has been recognised)
- Device ID number: univocal serial number of the device
- Firmware Version: firmware version installed on the device.

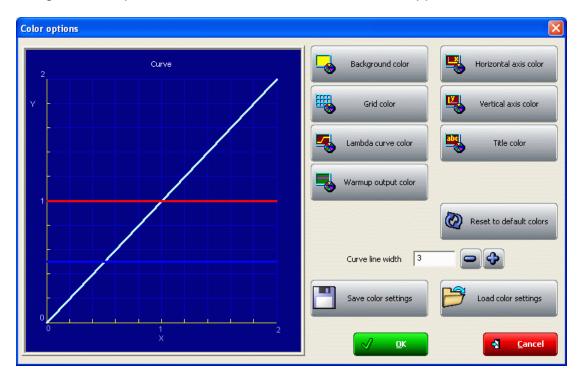
If LCU-ONE Analog is not correctly connected to the Pc or if it is not connected at all, the system shows a "not connected" message and all information concerning the controller are set on N.D. (Not available)



3.2.5 – The analog output graph



The "analog output graph" shows output tension values of the controller in correspondence of the measured Lambda values. Graph colours are customizable. Pressing "Colour options" button the window shown below appears:



Pressing each button a colour panel will appear showing all the available colours for that characteristic of the graph. Selecting the desired colour and confirming the choice graph colours will change.



Chapter 4 – Online values from Lambda controller.

🚠 AIM - Lambda Configura	ıtor - 1.00.07	
Lambda controller configuration	Online values from lambda controller	
Connected to	Lambda to AFR multiplier	14.57
COM 1 Device type LCU - ONE ANALOG Device ID number	Lambda measure	Battery measure [Volt] 12.61
1002225 Firmware version 25.11	Temperature measure	
Lambda sond status	4 O	
		Racing Data Power
Select language		

This panel shows controller status. The user is only allowed to set Lambda/AFR and temperature unit of measure for the values shown in this panel.

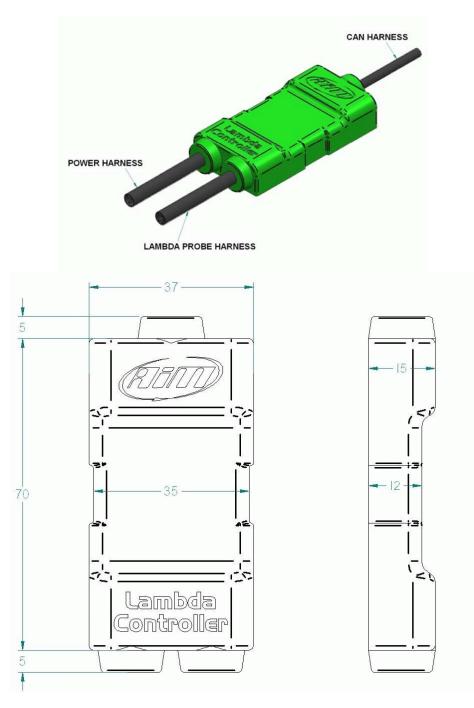


Appendix – Part Number and technical drawings

"A" – Part number of LCU-ONE Analog

Complete kit with cable for MyChron3 XGLog	X08LCU04XG
Complete kit with cable for MyChron3 Plus/Gold Auto/Moto	X08LCU04PG
Lambda Probe Bosch LSU 4.9	X05LSU490

"B" – Technical drawings





N/ev. / Rev. N. Description Data / dato Firma/ Sgn — Contr. da/ Ckd. by LCU-ONE Analog pinout Lamitida. Haine sa Lambea Combrellar Analog harness Power Haness (max_lenght100 cm) Π П ٢ ٢ ۲ Ð ٩ ٢ Power harness Analog Harness Lambdia harness V batte iy 1 IP+ red Lambda O 🕇 1 GND GND 2345 IP-WS black GND RS232 RX PC RS232TX PC 2 3 4 H-H+ black Rcal 6 VS+ RE/RE Otá / Oty Material o / Material N. articol o/ Itom N. Contr. da / Ckd. by kopro vato da / App io vo diby Data / Data Scala / Scalo Progetato da / Designed by Norre file/ Filenarre LI. Titolo / Title Pinout LCU-ONE An alog N. disegno / Drawing N. Riv. / Riv inglia / Sheet 1 di 1 Racing Data Power