

DATA SHEET of the Lambda sensor DigiLSU controller

This wide band Lambda sensor control module uses **LSU4.9 Bosch Lambda sensors** to measure the engines richness.

As it is a very wide band module, it can measure richness on gasoline engines and diesel engines as well. It is a very small dimension high performance micro ECU, integrated in its connector.

It can deliver its richness measurement with an analog output or with a fully configurable CAN-BUS output.

It can work with an engine management ECU, or with a data recording system or a digital dash board as well.

By adding its specific display, the engine richness (or Lambda or O2) can be directly visualized.

KIT CONTENT

(can be separately sold)

- A LSU 4.9 sensor (length of loom: 0.60m)
- A controller DigiLSU (length 1m)
- A pre-wired loom (length 1.20m)



MECHANICAL CHARACTERISTICS

- Overall dimensions: 32x47x15 (with connector and cordless)
- Weight: 110g
- Case: font of miscellany of aluminum
- Length of loom for the probe: 1.0m
- Temperature of use maxi: 70°C

ELECTRICAL CHARACTERISTICS

- Power supply maxi: 18V
- Power supply mini: 6.5V
- Power supply Mini for heating the probe: 7.5V (can be insufficient if use on diesel engine)

- Maxi average current for heating: 3A
- Digital consumption: 50mA
- Power supply to be protected with a 3A fuse

CONNECTIC

- Loom connector: Molex MiniFit 6 contacts

References Farnell:

connector: 157-8470

contacts: 157-8527

- Connector on Lambda sensor Bosch LSU 4.9: origin VW

Reference VW: 1J0 973 713

- Jack 3.5 for the communication with the DigiLSU Monitor PC software

The communication is only made with the USB-TTL wire from FTDI.

Reference FTDI: TTL-232R-5V-AJ.

Internet link towards FTDI:

http://apple.clickandbuild.com/cnb/shop/ftdichip?Op=catalogue-products-null*prodCategoryID=47*title=Cables%3A+TTL-232R+and+variants

CHARACTERISTICS OF THE RICHNESS MEASUREMENT

- Range of measurement: air to 1.55 richness
- Precision: +/- 1 % on the gain

ANALOG OUTPUT

- Range of tension: 0-5V
- Impedance: 60 ohms
- Resolution: 1.22mV
- Offset: +/-5mV

CAN-BUS OUTPUT

- CAN-Bus 2.0A and 2.0B
- BaudRate: 1Mb, 500kb, 250kb

The CAN-bus of DigiLSU supports two protocols:

SKYNAM PROTOCOL:

See documentation of Sybele ECU:

- ID: WinjNet sensor from 1 to 16, configurable with the DigiLSU Monitor software

PROPRIETARY PROTOCOL:

1 configurable message with the DigiLSU Monitor software:

- Data of the message: Vbat, Vheat, Tinternal, Diagnoses, Tsensor, richness channel following user choice (richness, Lambda, O2, A/F)
- ID configurable by user (11bit or 29bit)
- Format configurable: Motorola (default) or Intel (option)
- Fixed frequency: 100Hz

INSTALLATION

ADVICES OF THE LAMBDA SENSOR INSTALLATION

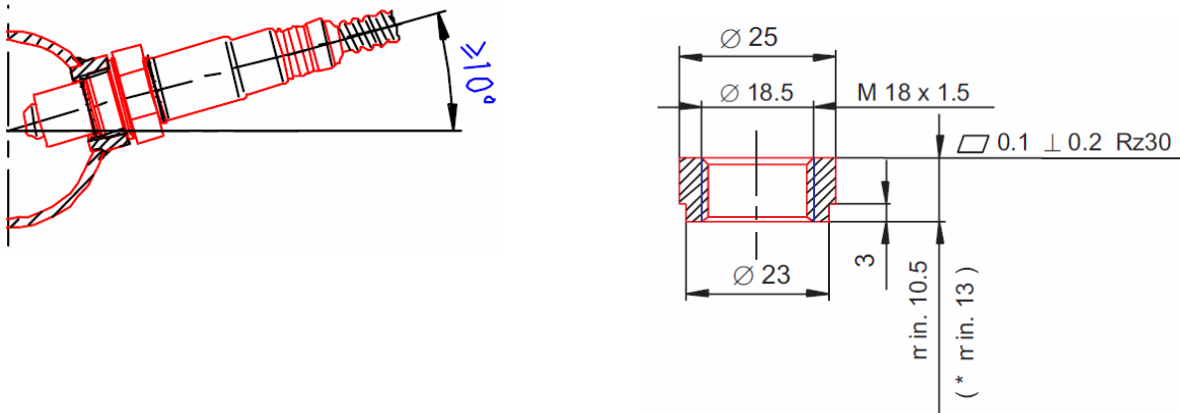
The sensor must not be placed from the output of the cylinder head because the excessive temperature of exhaust gases would destroy the sensor (T max 950°C).

It is not either advised to place it near the output of the exhaust line because during pumpings of the column of gas, some oxygen can infiltrate into the exhaust and falsify the measurement.

To avoid the accumulation of water in the sensor, phenomenon due to the condensation of the steam generated by the combustion, it's better to respect the indicated angle in the following figure.

It is strongly advised to not let a not used probe on an exhaust because the residues after combustion would accumulate on the sensor degrading then his functioning during its re-use.

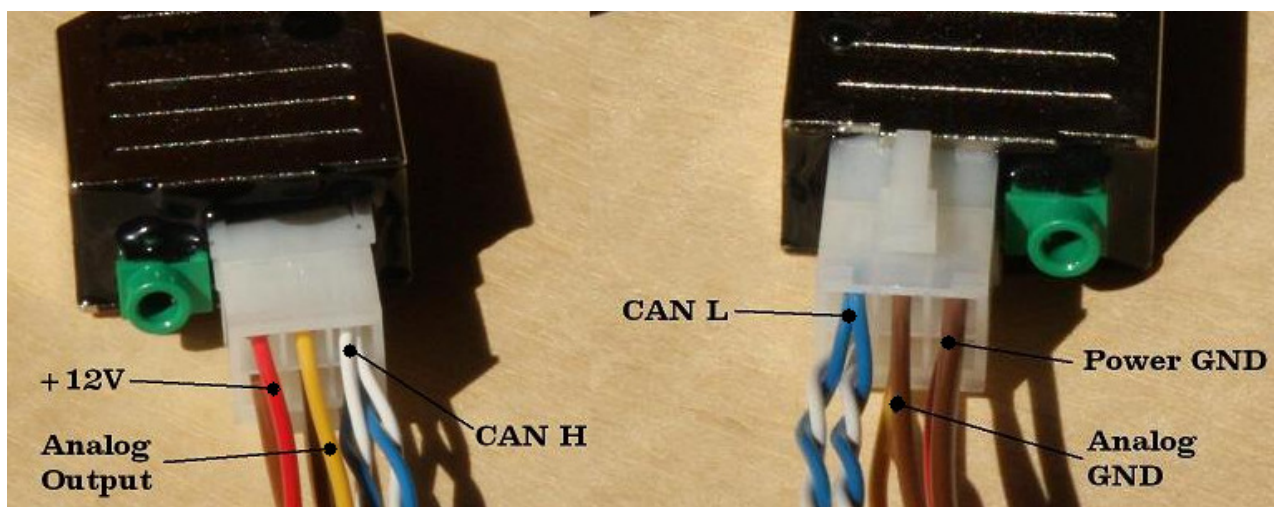
Typical join to weld on the escape if necessary.



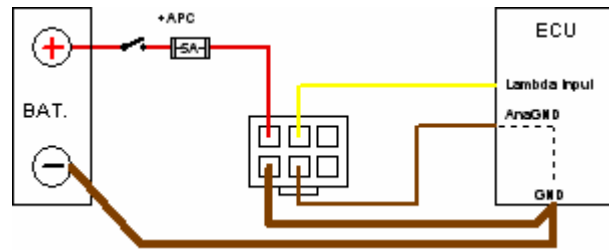
CONNECTION OF DigiLSU

USE THE 3A FUSE TO PROTECT CORRECTLY THE CONTROLLER.
NEVER PUT A FUSE HIGHER THAN 5A.

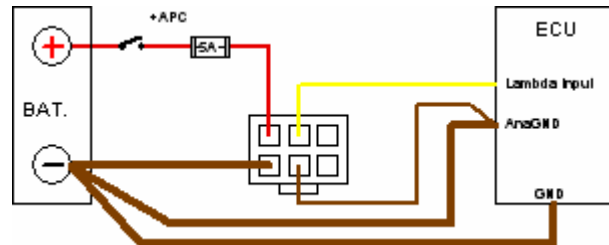
Connector MiniFit Jr PinOut:



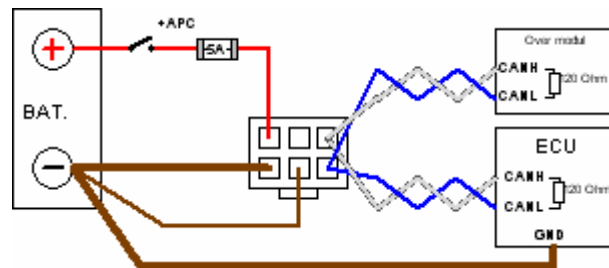
Analog output use on ECU when AnaGND and GND are internally connected:



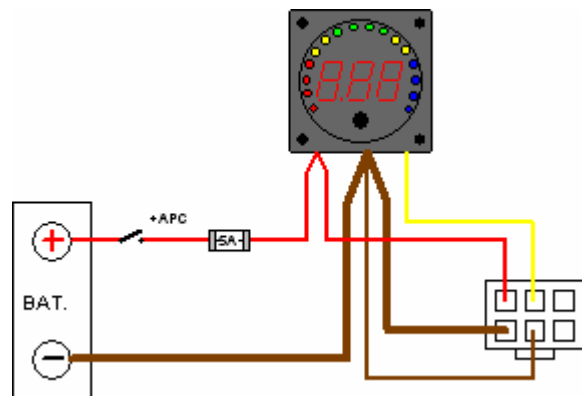
Analog output use on ECU when AnaGND and GND are not internally connected (ex: Sybele ECU):



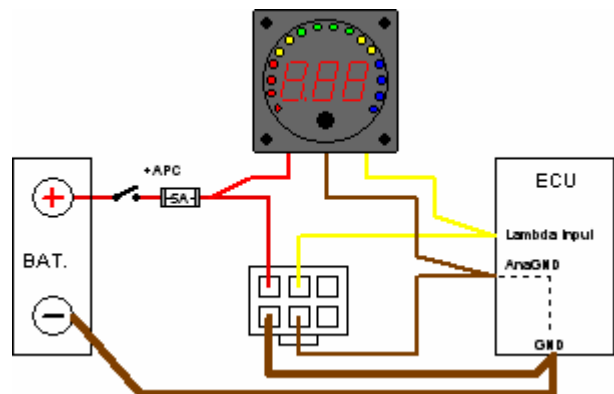
CAN output used on ECU (advisable):



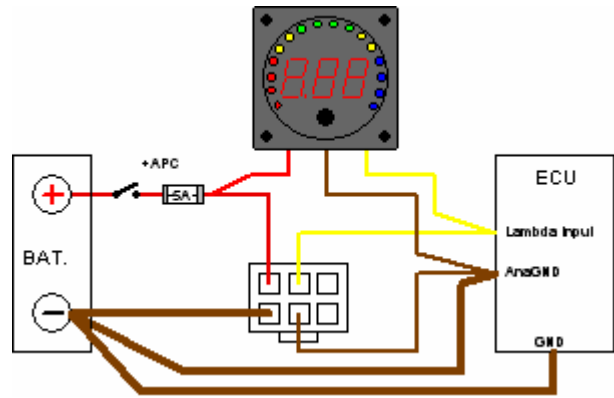
Use with only display (stand alone):



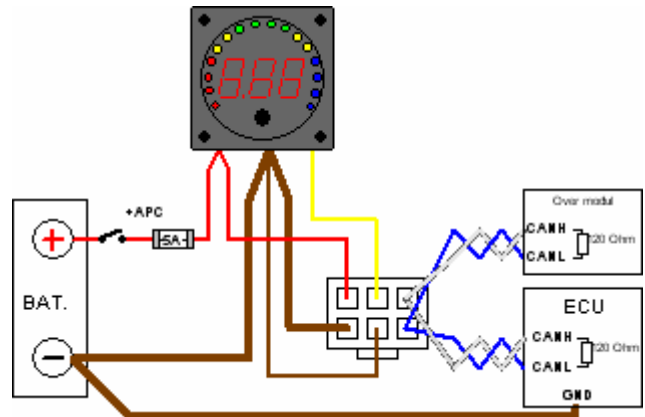
Analog output use for display and ECU (grounds internally connected):



Analog output use for display and ECU (grounds not internally connected; ex: Sybele ECU):

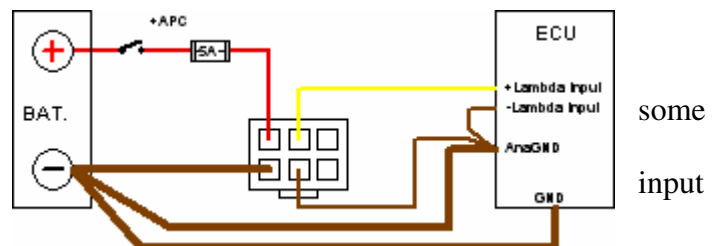


Analog output use for display and CAN output for ECU (**advisable**):



Use on a differential input:

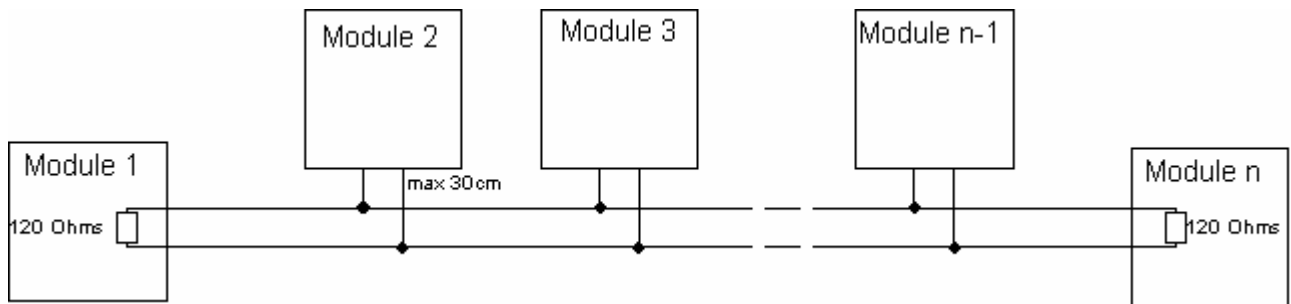
It is the case of the some Sybele ECU but also inputs of data acquisition system. In that case it is mandatory to connect the differential negative to analog ground.



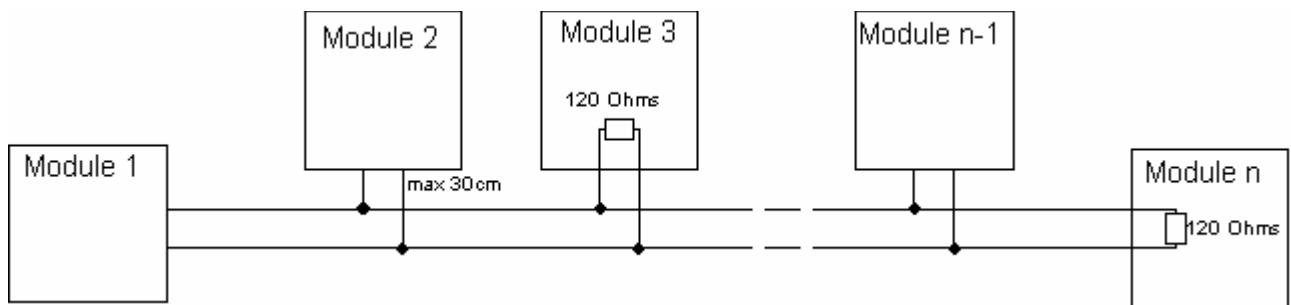
REMINDER OF THE CONNECTING ON THE BUS-CAN

Modules connected on a bus CAN must be "chained". This to say that the twisted pair of the differential line linking CAN H and CAN L has to go from a module to the other one and up to the last one. A load of 120 Ohms must be present in every endpoint of this "chain". So it is important to consult the technical documentation of every module to determine according to the presence or not to this load if the module must be placed at the beginning / the end of chain or, in the middle of this chain. If only one 120 Ohms load is present in the foreseen list of modules, it is always possible to add the second load by welding a resistor of 120hms 5 % 0,25W in the other endpoint of the chain.

Correct chaining



Incorrect chaining



The DigiLSU Lambda controller **does not own** the 120 Ohms load. It is the reason why the pre wired loom provided in the kit as 2 twisted pairs for the connecting it to the bus CAN. This allows to easily insert the pre wired loom into the "chaining" of modules.

LINEARISATION OF THE BOSCH LSU 4.9 SENSOR

Linearization of the analog output in

- exhaust pressure (P3) = 1013mB
- and H/C = 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Richness	1,755	1,500	1,450	1,400	1,350	1,300	1,250	1,200	1,150	1,100	1,050	1,000	0,950	0,900	0,850	0,800
Lambda	0,570	0,667	0,690	0,714	0,741	0,769	0,800	0,833	0,870	0,909	0,952	1,000	1,053	1,111	1,176	1,250
A/F	8,4	9,8	10,1	10,5	10,9	11,3	11,8	12,3	12,8	13,4	14,0	14,7	15,5	16,3	17,3	18,4
O2 (=f(Ri,C,H))	14,1 %	9,51 %	8,58 %	7,65 %	6,72 %	5,78 %	4,83 %	3,88 %	2,92 %	1,95 %	0,98 %	0,00 %	0,98 %	1,98 %	2,97 %	3,98 %
Vout (mV) (@P3)	4	693	850	1014	1185	1360	1540	1725	1914	2107	2303	2500	2592	2686	2781	2879

	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Richness	0,750	0,700	0,650	0,600	0,550	0,500	0,450	0,400	0,350	0,300	0,250	0,200	0,150	0,100	0,050	0,001
Lambda	1,333	1,429	1,538	1,667	1,818	2,000	2,222	2,500	2,857	3,333	4,000	5,000	6,667	10,000	20,000	1000,0
A/F	19,6	21,0	22,6	24,5	26,7	29,4	32,7	36,8	42,0	49,0	58,8	73,5	98,1	147,1	294,2	14709
O2 (=f(Ri,C,H))	4,99 %	6,01 %	7,03 %	8,06 %	9,10 %	10,15 %	11,20 %	12,26 %	13,33 %	14,40 %	15,49 %	16,57 %	17,67 %	18,78 %	19,89 %	20,99 %
Vout (mV) (@P3)	2978	3079	3183	3288	3395	3504	3616	3729	3844	3961	4080	4201	4324	4449	4576	4702

SUMMARY OF USE OF the DIGILSU MONITOR SOFTWARE

MAIN WINDOW

BASE LEVEL:

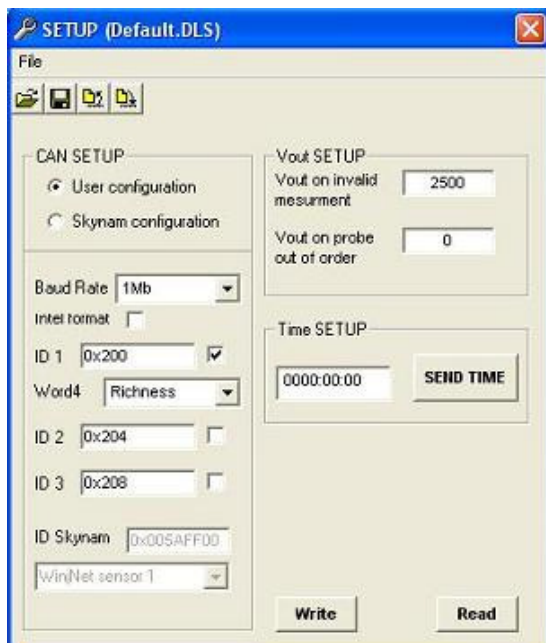


- DigiLSU Monitor allows to show: battery power supply, internal temperature, sensor temperature, heating RMS, heating command PWM, sensor SlewRate, diagnostic, richness, lambda, O2, A/F (adjustable HC), output tension, response time.
- Supplementary information: serial number of the controller, hardware and firmware versions.
- Firmware update allowed

These possibilities are available via the USB-TTL communication wire (1.8m) sold in option.

SETUP

NORMAL LEVEL (option1): Basic Level +:



- Possibility of configuring the type of protocol and parameter of the CAN (baudrate, format, IDs).
- Possibility of configuring the levels of tension or CAN value in case of not valid measurement or serious problem detected.
- Possibility of management of the time of use of sensors.

SPECIAL FUNCTIONS

EXPERT LEVEL (option2): normal Level +:

- Recording of the values coming to the PC.
- Oscilloscope window (to come)