LSU49-CA

Lambda controller for LSU4.9 with CAN* and analog output**

*: CAN functionality is optional
**: Linear output is available also as option

CHARACTERISTICS

Power supply: from 9V to 16V (device work below 9V but power could be not enough for heater regulation)
Consumption: maxi 3A on cold sensor
Measurement range: air to 1.54 richness (probe limitation with HC=2)
One analogue output
CAN bus (open, 2kOhm load built in PCB)
Offset: +/-12mV
Gain precision: +/-1%
Analogue output resistance: 1k
Maximum ambient temperature use: 100ºC
Sensor heating temperature: regulated to 780ºC (can drift with sensor aging)
Enclosure: Polyamide (Aluminium as option coming soon)
Total length: 32cm
Weight: 45g
IP: IP65
Connector:

DTM04-6P on loom side

Matting: connector : DTM06-6S
Wedge lock: WM6S
Terminals : 1062-20-0222 (0,35 to 1,5mm2)

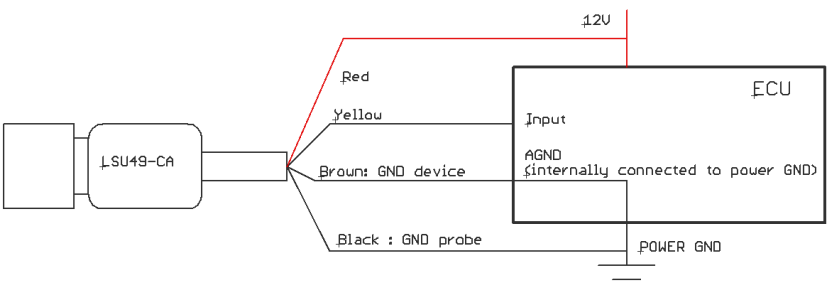
Type VW on sensor side.

Cables : 22AWG 150ºC with DR25 sleeve

Configuration is possible using freeware THQ_Monitor through USB/CAN interface (Lawicel, Skynam or PEAK System [this last is recommended])

CONNECTION OF LSU49-CA

DTM Pin	Function	Cable colour
1	CAN H	White
2	CAN L	Blue
3	Power Supply	Red
4	Probe Ground	Black
5	Device Ground	Brown
6	Analog output	Yellow



Do not connect yellow wire on 12V under threat of destruction of the analog output.
Do not connect the black wire to the analog ground but to the power ground.

The brown wire must be connected to the ECU/Logger analog ground. Then this analog ground must be internally connected to power ground. Check with your ECU supplier in case of doubt.

ADVICES

Do not use leaded gasoline.
Excessive consumption of oil by the engine decreases the life expectancy of the sensor.

Important Advice

DO NOT APPLY MECHANICAL STRESS ON THE BODY OF THE DEVICE WITH TY-RAP OR OTHER.
Do not clean with aggressive solvent.
Do not apply high pressure spray.
Do not bend the cable near to the device.

ANALOG OUTPUT LINEARISATION (Legacy mode)

Linearisation of the analog output at
- exhaust pressure (P3) = 1013mB
- HC = 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**

Preheating phase, sensor too cold: Vout = 2500mV
Unconnected sensor, or overload or regulation error: Vout < 100mV

LEGACY mode is fully compatible with previous version LSU49-5V device.

Advanced features (available as options)

- Linear analog output user settable by two points
- Failure values setup
- CAN
- Fuel type selection (HC=2 [default], Gasoline, Diesel, Ethanol, Methanol, Natural gas)
- AFR stoichiometric value (14,57 default setting)

- ADV probe management

	User Mode				
Function	**LEGACY**	**User Level 1**	**User Level 2**	**User Level 3**	**User Level 4**
Analog output	Yes	Yes	Yes	Yes	Yes
Linear output	No	Yes	Yes	Yes	Yes
Failure values setup	No	Yes	Yes	Yes	Yes
CAN	No	No	Yes	Yes	Yes
Fuel setup	No	No	No	Yes	Yes
Heater trigger	No	No	No	Yes	Yes
ADV probe	No	No	No	No	Yes
Dynamic Correction	No	No	No	No	Yes
Multifunction output	No	No	No	No	Yes

LEGACY mode is fully compatible with previous version LSU49-5V device.

CAN protocol

Baudrate: 1Mb (default), 500kb, 250kb or 125kb initial setting.
Auto baudrate capability (except with Skynam protocol).

ID: 0x200 (default)
Default format : Big endian (Motorola)

Byte	D0	D1	D2	D3	D4	D5	D6	D7
Channel	V bat	V heat	I heat	Diag	T probe (msb)	T probe (lsb)	Richness (*) (msb)	Richness (*) (lsb)
Resolution	0,1V/bit	0,1V/bit	0,1A/bit	N.A.	1ºC/bit (**)		0,001/bit	

* : Richness is default value set. This channel can be change by user setting Lambda, AFR or O2

**: If J1939 protocol, an offset of 40ºC is add on the probe temperature. (140 = 100ºC)

ID: 0x204 (default)
Default format : Big endian (Motorola)

Byte	D0	D1	D2	D3	D4	D5	D6	D7
Channel	V out (msb)	V out (lsb)	Richness (msb)	Richness (lsb)	Lambda (msb)	Lambda (lsb)	O2 (msb)	O2 (lsb)
Resolution	1mV/bit		0,001/bit		0,001/bit (*)		0,01%/bit (**)	

If intel format is chosen, msb and lsb must be inverted for each channel.

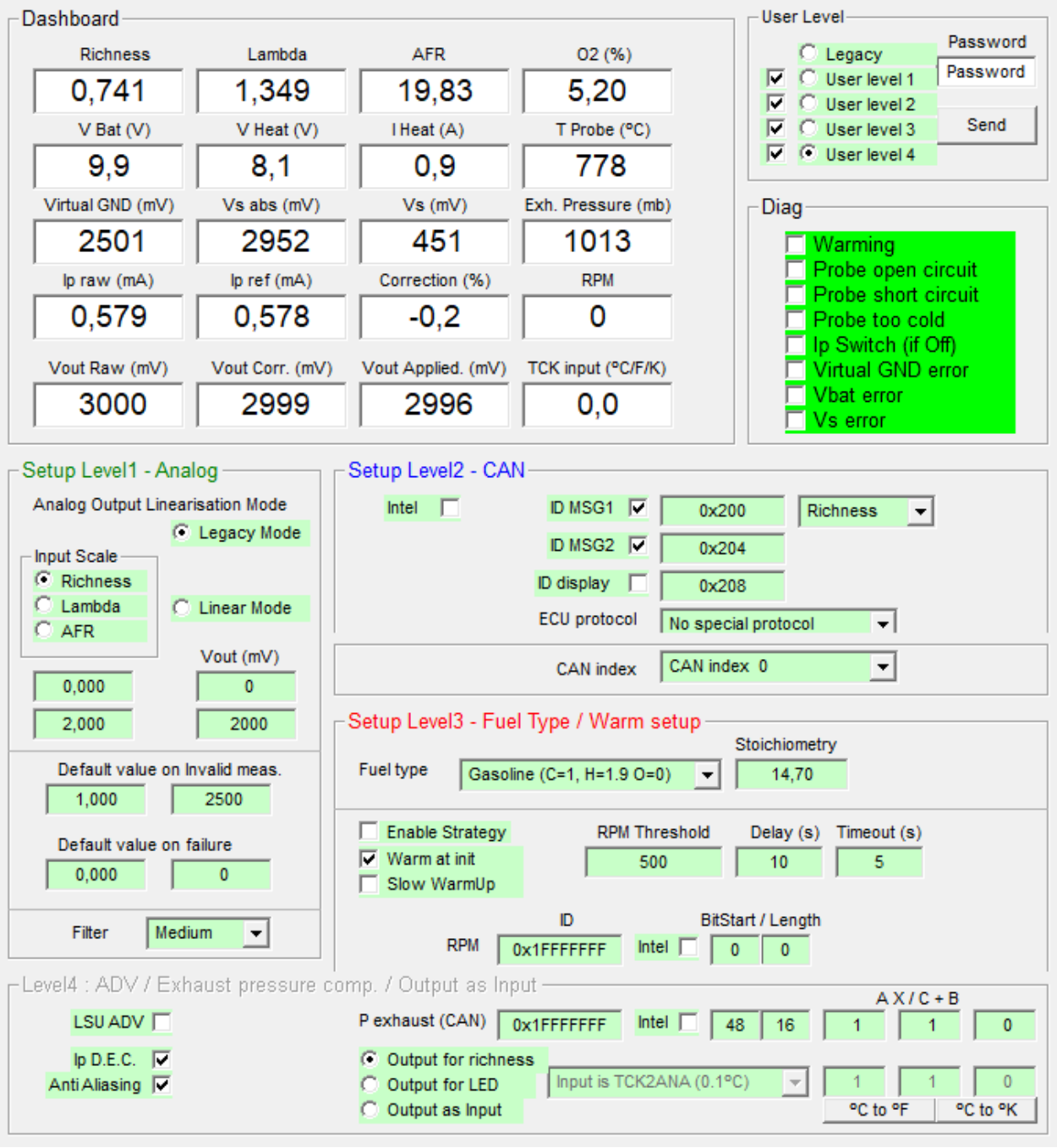
*: If J1939 protocol, lambda value will not exceed 32767
**: if J1939 protocol, O2 have an offset of 16.000 (16000=0%; 18100=21,00%)

Diag byte description:

Bit	7	6	5	4	3	2	1	0
Description	Vs out of range	V bat	V gnd out of range	Ip not enabled	Probe too cold	Probe short circuit	Probe Disconnected	Warming

- Vs must close to 450mV in stable combustion situation (can deviate in dynamic situation)
- V bat error flag is set if below than 7,5V
- V gnd must be equal to 2500mV
- Ip flag is set if regulation is not allowed (warming phase, probe error,….)
- Probe is too cold if below 700ºC- Warming flag indicates warming rate active.

THQ Monitor main dashboard



How to unlock options:

Contact THQtronic giving the user level requested and the device serial number. A password code will be sent to you after payment for the requested option.
- Connect to the device. Communication must be active for done this feature.
- Select the option and left check box corresponding to this option and lower ones.
- Enter the password and click on “send”.

Check box and level setup will be updated with new level. If not, any error has occurred.

MOTEC LTC emulation:

Motec message ID is 0x460 + index offset (0..15)
The LTC CAN protocol generated have some limitation due to hardware differences.
Find below the LSU49-CA handling from LTC protocol.

Message 1

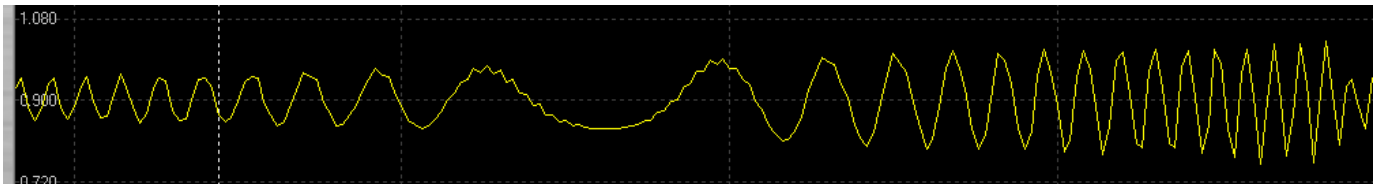
Byte	Name	Scalling		LSU49-CA
0	Compound ID=0			same as LTC
1:2	Lambda	Hi:Lo= x.xxx La		same as LTC
3:4	Ipn (Normalised pump cell current	Hi:Lo = x.xxx uA		same as LTC
5	LTC internal temperature			=0
6	Fault bit	Heater short to GND	Bit 0	same as LTC
		Heater short to Vbat	Bit 1	always =0
		Heater open circuit	Bit 2	same as LTC
		Heater failed to heat	Bit 3	Probe too cold
		Sensor wire short	Bit 4	always =0
		internal fault	Bit 5	Vbat too low or VGND not ok
7	Heater duty cycle	xxx%		same as LTC

Message 2

Byte	Name	Scalling		LSU49-CA
0	Compound ID=1			same as LTC
1	Sensor state	Start	0	NA
		Diagnostics	1	NA
		Pre Cal	2	NA
		Calibration	3	NA
		Post Cal	4	NA
		Paused	5	NA
		Heating	6	During warm up = 1
		Running	7	Operating mode = 1
		Cooling	8	NA
		PumpStart	9	NA
		Pump off	10	NA
2:3	Vbat	Hi:Lo = xx.xx mV		same as LTC
4:5	Ipn	Hi:Lo = x.xxx uA		same as LTC
6:7	Ri (cell impedance)	Hi:Lo = xx.xxx Ohms		same as LTC

D.E.C : Mean “Dynamic Error Compensation”. This feature add better accuracy in dynamic changes of richness doing an error compensation calculation. The error come from reaction time of the internal loop control.

Anti Aliasing : This feature add special filtering for reduce aliasing effect. In fact, As the richness measurement is done with a cycle time, when the RPM cycle time is similar, aliasing effect give the measurement as following picture.



Output multifunction use: In case of CAN use, analogue output still not need and can be used for connect an external sensor as measurement input. Also, the output can be set for drive a diagnosis LED as the famous DigiLSU device.
As the output have a 1k serial resistor, no external resistor is need and you can connect a high brightness LED directly between output to analogue ground.

For further information see the corresponding web page on www.THQtronic.com

Annex

Several configurations using analogue output