

## SINGLE CHANNEL LAMBDA CONTROLLER

LC1-9



LC1 controller is designed to meet the latest automotive standards and by its ruggedized structure provide a reliable and accurate solution even under harsh motorsport conditions.

The core is driven by the industrial leading Application-specific integrated circuit (ASIC) Bosch CJ125 allowing not just precision measurements to be taken but also providing an accurate closed-loop control of the internal heater. Both of those crucial elements of a lambda controller are

compatible with the latest technology from Bosch supporting their latest low-latency sensor LSU ADV.

The external structure and the measurement principle of LSU ADV is the same as the LSU 4.9. However, the LSU ADV has undergone internal redesign improving the heating efficiency and reduce power consumption. This has got a significant effect on sensor accuracy and response time.

## Description

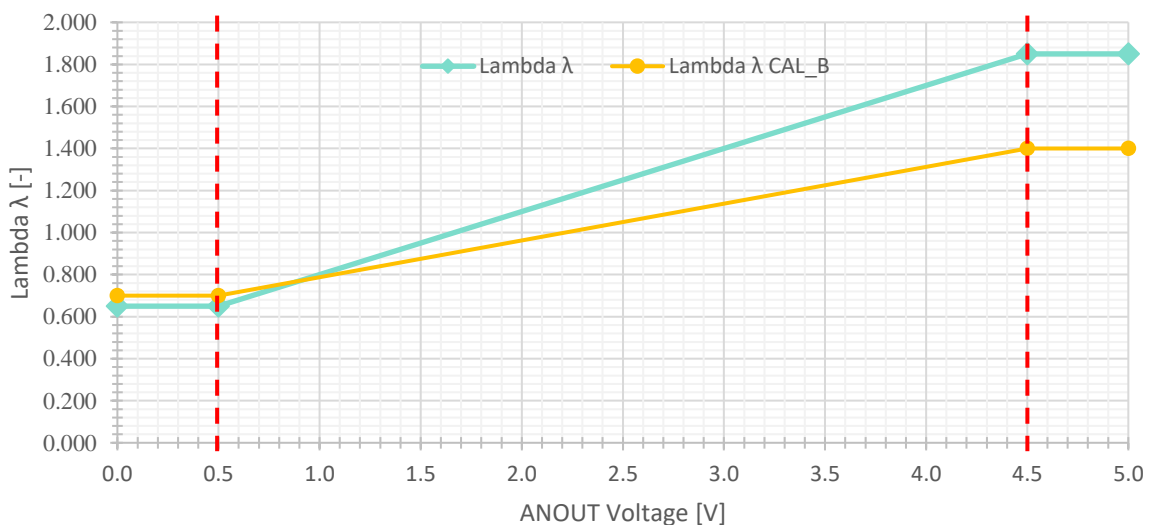
Sensor	
Sensor type	Bosch LSU ADV
Number of channels	x1
Free air calibration	Automatic
Fuel compatibility	gasoline/Diesel/E85
Exhaust gas pressure	≤ 2.5 bar (higher with decrease accuracy)
Exhaust gas temperature (operating)	≤ 930°C (≤ 980°C pre-Turbo Version)
Max. exhaust gas temperature (for short time)	≤ 1,030°C
Hexagon temperature (operating)	≤ 650°C
Max. hexagon temperature (for short time)	≤ 700°C
Electrical	
Operating Voltage Range	9 – 15V
Input current	~50mA
Measurement	
Lambda range	0.650 – ∞
Response time	5ms
Heater	
Temperature control	PID (Bosch CJ125 ASIC chip)
Current	Max 3.5A
Output	
Analogue Output	0 – 5V
Analogue Accuracy	±0.005V (10bit DAC)
Analogue reference	ECU ground
Environmental	
IP rating	IP67 (AS,DTM), IP40 (Bosch)

Communication	
CAN	CAN 2.0B
Baud rate	1M, 500k, 250k
Frame rate	100Hz, 50Hz, 20Hz, 10Hz, 2Hz, 1Hz
Base arbitration ID	0x770 (others on request)
Mechanical	
Operating Temperature	-35°C to +115°C
Maximum Dimensions	100 x 40 x 15 mm
Case material	Aluminium
Weight Controller	~160 g
Weight Sensor	~120 g
LC1 Output to ECU Connection variants – length = 600mm	
DEUTSCH AS	DEUTSCH AS610-98PN
DEUTSCH ASL	DEUTSCH ASL006-05PB
DEUTSCH DTM	DEUTSCH DTM04-4P
Flying leads	Flying leads
LC1 to Sensor Connection variants – length = 600mm	
DEUTSCH AS	DEUTSCH AS110-98SN
DEUTSCH DTM	DEUTSCH DTM06-6S
Bosch	1 928 404 669
Bosch Pre-turbo	1 254 488 136
Flying leads	Flying leads
Mating Sensor Connection variants – length = 270mm	
DEUTSCH AS	DEUTSCH AS610-98PN
DEUTSCH DTM	DEUTSCH DTM04-6P
Bosch	1 928 405 110
Bosch Pre-turbo	F 02U B00 937-01

Analogue Out Calibration

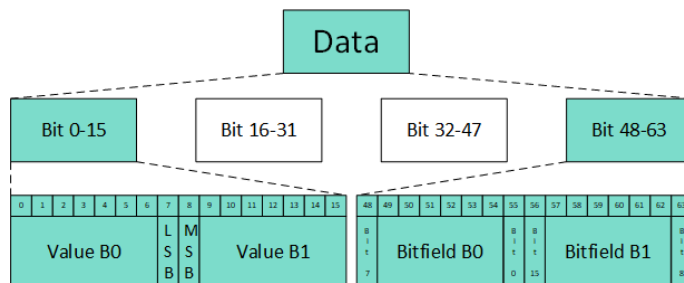
ANOUT Voltage [V] (linear)	0.500	4.500
Lambda $\lambda$ [-] <sup>(1)</sup>	0.65	1.85
Lambda $\lambda$ [-] CAL_B <sup>(1)</sup>	0.70	1.40

(1) Other options available on request



CAN Communication

All CAN Identifiers and parameters can be changed to customer requirements. The CAN description below is defined using a bit index from start of the data field in the message. All “multi-byte” channels are in LITTLE-ENDIAN (Intel) format (first byte first).



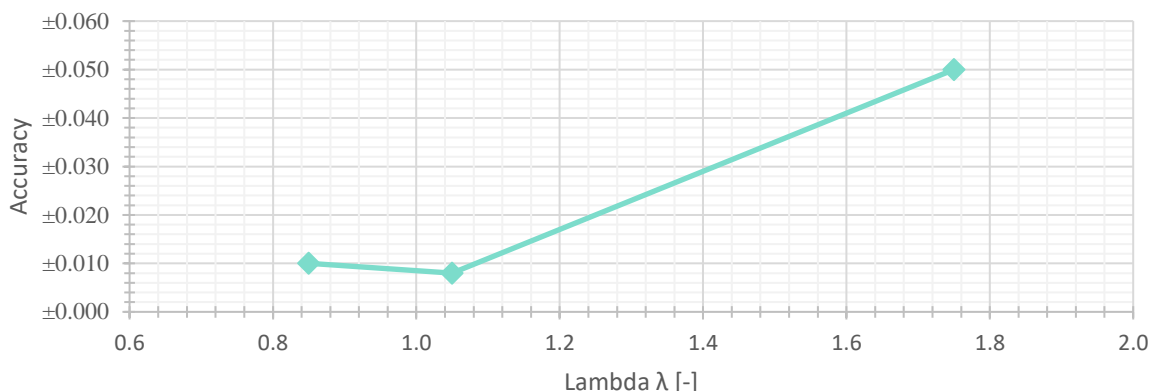
Transmit

Packet	LC1_9_DataTx			
ID	0x770			
Direction	LC1-9 Tx			
Rate	100Hz			
Bits	Name	Gain	Offset	Notes
0-15	O2	0.000514	-12	[%]
16-31	Lambda	0.000244	0	[λ]
32-47	Sensor_temperature	0.023438	-273.15	[°C]
48-51	PWM_Duty (LSB)	0.08	0	[%]
52-55	Sensor_faults			Enum
56-63	PWM_Duty (MSB)	0.08	0	[%]

Sensor\_faults

Code (dec)	Description
0	No faults
1	Internal communication error
2	Internal register error
3	LSU yellow wire (VM) short to power
4	LSU yellow wire (VM) short to GND
5	LSU black wire (UN) short to power
6	LSU black wire (UN) short to GND
7	LSU green wire (IA) short to power
8	LSU green wire (IA) short to GND
9	Operating voltage too low
10	Heater circuit damaged
11	Heater circuit short to power
12	Heater circuit short to GND

Lambda accuracy



Pinout

LC1 Output to ECU Connection – Deutsch AS			LC1 to Sensor Connection – Deutsch AS		
Connector	DEUTSCH AS610-98PN		Connector	DEUTSCH AS110-98SN	
Mating	DEUTSCH AS110-98SN		Mating	DEUTSCH AS610-98PN	
Pin	Signal (LC1-A9)	Signal (LC1-C9)	Pin	Signal	Colour
A	+12V	+12V	A	+12V	Gy
B	GND-Heater**	GND	B	GND-Heater	Wt
C	GND-Sens**	CAN-L	C	LAM Ip	Rd
D	N/C	N/C	D	GND-Sens	Yl
E	Analogue OUT	CAN-H	E	LAM Vn	Bk
F	N/C	N/C	F	N/C	

LC1 Output to ECU Connection – Deutsch DT			LC1 to Sensor Connection – Deutsch DT		
Connector	DEUTSCH DTM04-4P		Connector	DEUTSCH DTM06-6S	
Mating	DEUTSCH DTM06-4S		Mating	DEUTSCH DTM04-6P	
Pin	Signal (LC1-A9)	Signal (LC1-C9)	Pin	Signal	Colour
1	+12V	+12V	1	+12V	Gy
2	GND-Heater**	GND	2	GND-Heater	Wt
3	GND-Sens**	CAN-L	3	LAM Ip	Rd
4	Analogue OUT	CAN-H	4	GND-Sens	Yl
			5	LAM Vn	Bk
			6	N/C	

LC1 Output to ECU Connection – Deutsch ASL			LC1 to Sensor Connection – Bosch		
Connector	DEUTSCH ASL006-05PB		Connector	Bosch 1 928 404 669	
Mating	DEUTSCH ASL606-05SB		Mating	Bosch 1 928 405 110	
Pin	Signal (LC1-A9)	Signal (LC1-C9)	Pin	Signal	Colour
1	-	+12V	1	LAM Ip	Rd
2	-	CAN-H	2	GND-Sens	Yl
3	-	N/C	3	GND-Heater	Wt
4	-	CAN-L	4	+12V	Gy
5	-	GND	5	N/C	-
-	-	N/C	6	LAM Vn	Bk

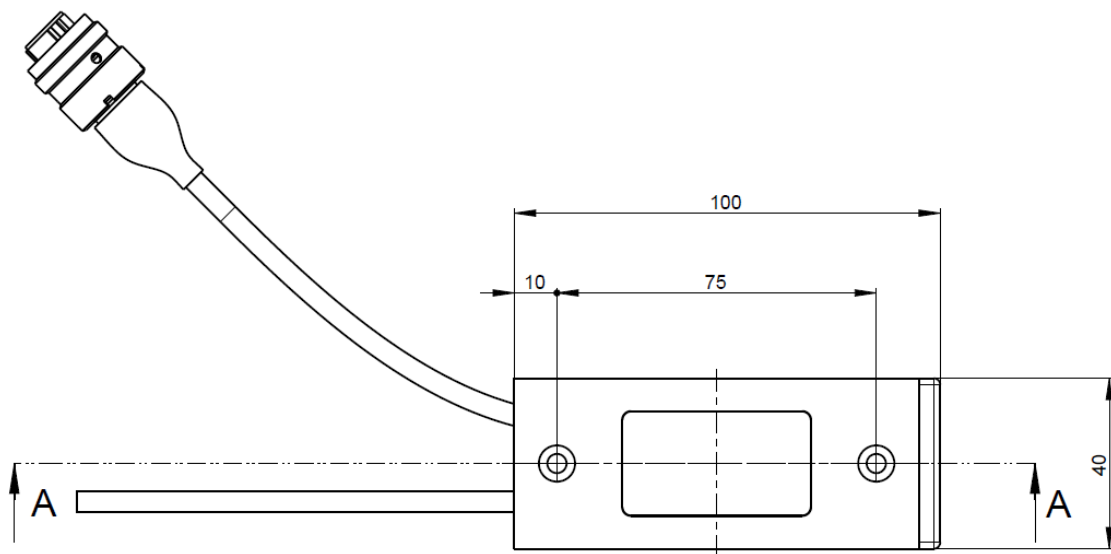
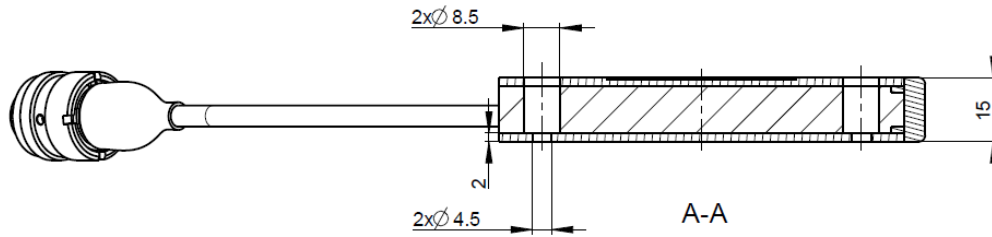
LC1 Output to ECU Connection – Flying lead				LC1 to Sensor Connection – Bosch Pre-turbo		
Connector	Flying leads			Connector	Bosch 1 254 488 136	
Mating	Flying leads			Mating	Bosch F 02U B00 937-01	
Pin	Signal (LC1-A9)	Signal (LC1-C9)	AWG	Pin	Signal	Colour
Rd	+12V	+12V	22	1	LAM Ip	Rd
Bl	GND-Heater**	GND	22	2	GND-Sens	Yl
Bk	GND-Sens**	CAN-L	22	3	GND-Heater	Wt
-	N/C	N/C	-	4	+12V	Gy
Wt	Analogue OUT	CAN-H	22	5	LAM Vn	Bk
-	N/C	N/C	-	-	N/C	-

\*Other variants on request

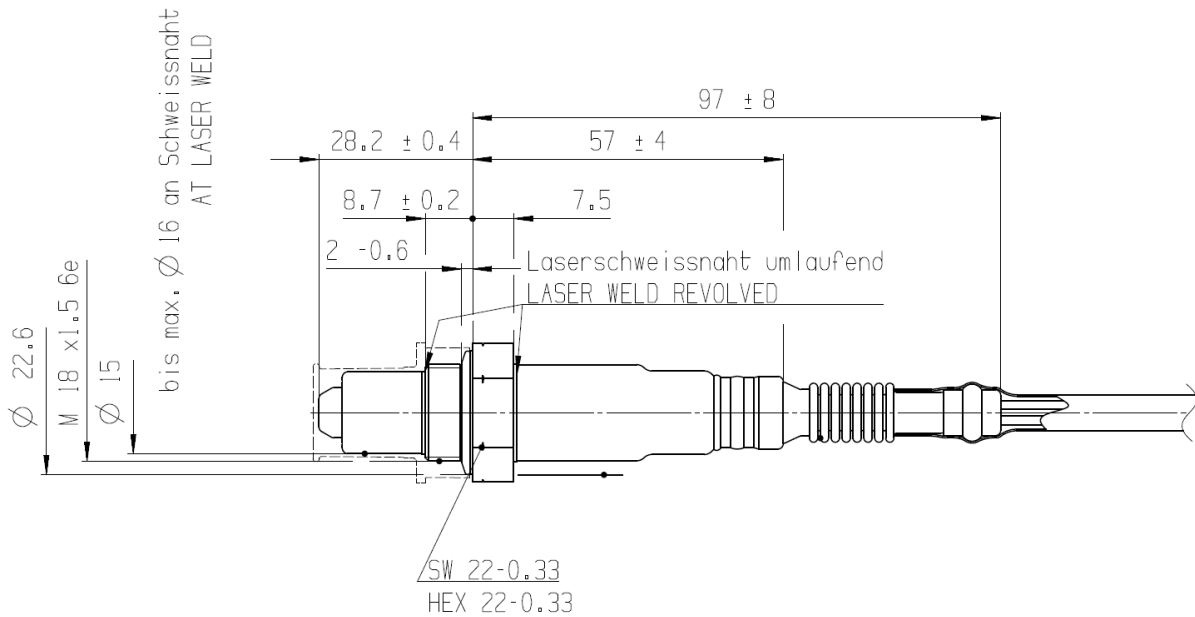
\*\*Grounds must be from common source

Drawing

LC1



Bosch LSU ADV



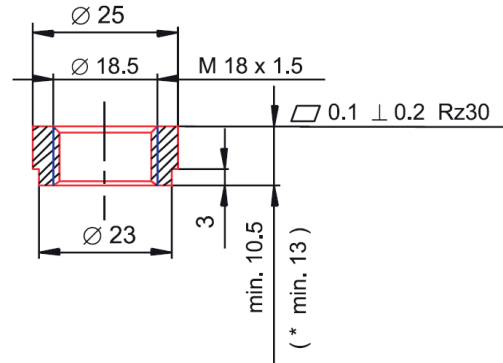
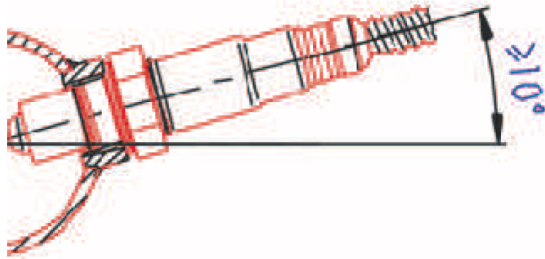
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Sensor mounting

Recommended design of the mating thread in the exhaust pipe

\*: T<sub>Hexagon</sub> > 600°C or

T<sub>Gas</sub> > 930°C

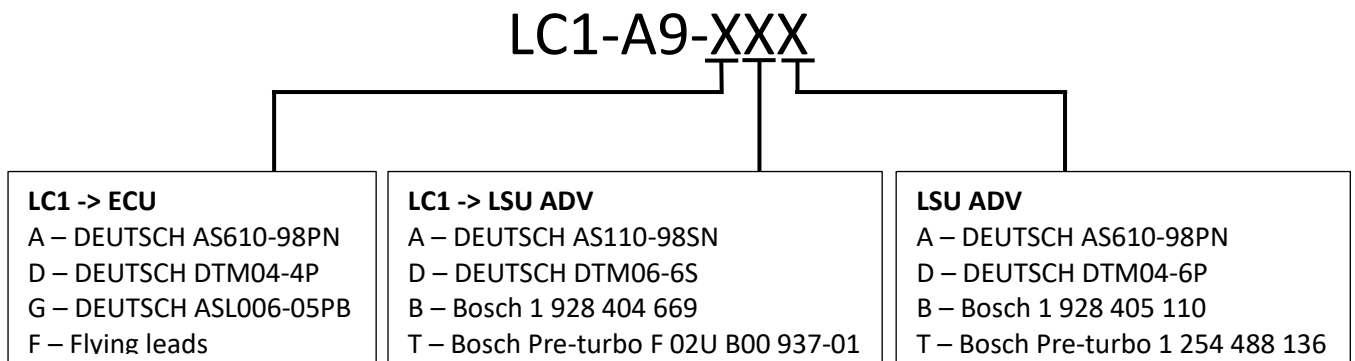


<[http://www.bosch-motorsport.de/content/downloads/Raceparts/Resources/pdf/Data%20sheet\\_IDOECW4V.pdf](http://www.bosch-motorsport.de/content/downloads/Raceparts/Resources/pdf/Data%20sheet_IDOECW4V.pdf)>

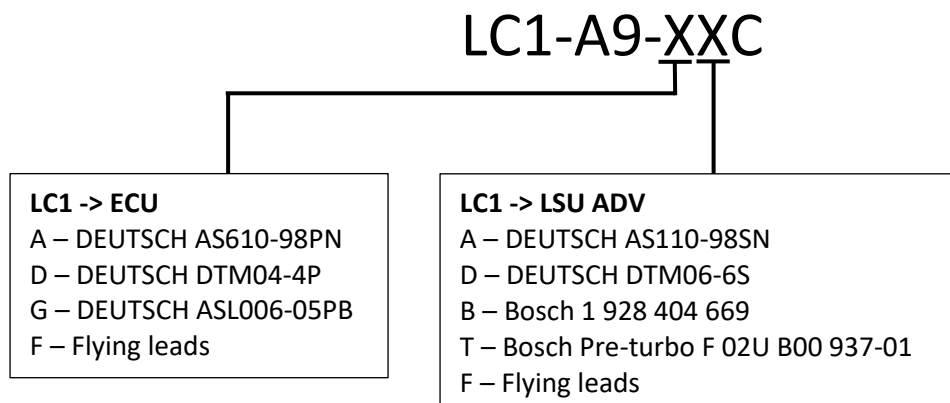
Ordering information

<b>ANOUT Variant (0-5V OUT)</b>	<b>CAN Variant (CAN 2.0B)</b>
<b>LC1-A9-XXX</b>	<b>LC1-C9-XXX</b>

KIT LC1 Controller + Bosch LSU ADV Sensor

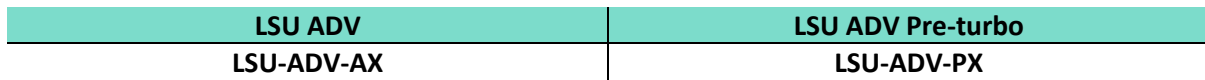


LC1 Controller



NOTE: Custom variants available on request

LSU ADV Sensor



**LSU-ADV-AX**

