# Lambda Sensor Interface Board HZS 561

The interface electronics can be connected to the LSM11 of a HZS function module. The electronics control the LSU4.9 Lambda sensor and provide an output signal, which corresponds to the output signal (oxygen content) of the LSM11 Lambda sensor.

# Configuration

- **Interface for the LSM11 (5-pin Phoenix plug RM3.5):**
  - 12 V AC to 14 V AC supply electronics supply
  - –10 mV / +60 mV analog output (oxygen content corresponds to the signal form the LSM11 Lambda sensor)

- **Interface for the LSU4.9 (6-pin Phoenix plug RM3.5):**
  - 0 – 12 V DC supply regulated Lambda sensor heating
  - Nernst cell LSU4.9 Lambda sensor
  - Pump cell LSU4.9 Lambda sensor

- **Connectors:**
  - Phoenix plug RM3.5

# Technical Data

## Controller performance data

| | |
|---|---|
| Controller | AT90CAN32 |
| Controller frequency | 16.0 MHz |
| Command execution time | Circa 70 ns |
| Internal program memory | 32 Kbytes (Flash) |
| Internal data or program (internal EEPROM) | 1-kbyte (Flash) no buffer battery required! |

## Electrical requirements

| | |
|---|---|
| Electronics supply | 12 V AC to 14 V AC |
| Electronics current consumption | 200 mA |
| Electronics current consumption and Lambda sensor | 1200 mA<br>(1400 mA in the heating phase) |

## Lambda sensor interface specifications (LSU 4.9 input signal)

| | |
|---|---|
| Lambda sensor type | LSM 4.9 Robert Bosch GmbH. Nr. 0 258 017 025 |
| Supply - heating | 0 - 12 V AC - switched by the controller |
| Heater current | Approximately 1.0 V DC at 1.0 A |
| Lambda sensor set temperature | 780 °C |
| Regulation range | 1.11 to ∞ (air) Lambda value λ<br>2.00 to 21.00 % oxygen |
| Nernst cell voltage | 450 mV |
| Nernst cell current | 20 µA |
| Pump cell pumping current | 0.240-2.519 mA |
| Interface IC (LSU4.9 - µC) | Bosch CJ125 |
| Transducer resolution | 10 bits |

## Lambda sensor interface specifications (output signal corresponds to LSM11)

| | |
|---|---|
| Lambda sensor type | LSM 11 Robert Bosch GmbH No. 0 258 104 002 001 |
| Regulation range | 1.11 to ∞ (air) Lambda value λ<br>2.00 to 21.00 % oxygen |
| Output voltage | -10 mV to +60 mV<br>< -20 mV (> 21 % oxygen if µC is in the Initialization phase, µC in Reset / error status, with under voltage) |
| Resolution | 10 bits |
| Capacity of the output voltage | Maximum 2.5 mA |
| Capacitive load of the output voltage | Maximum 4.7 nF |
| Short-circuit proof | Yes |

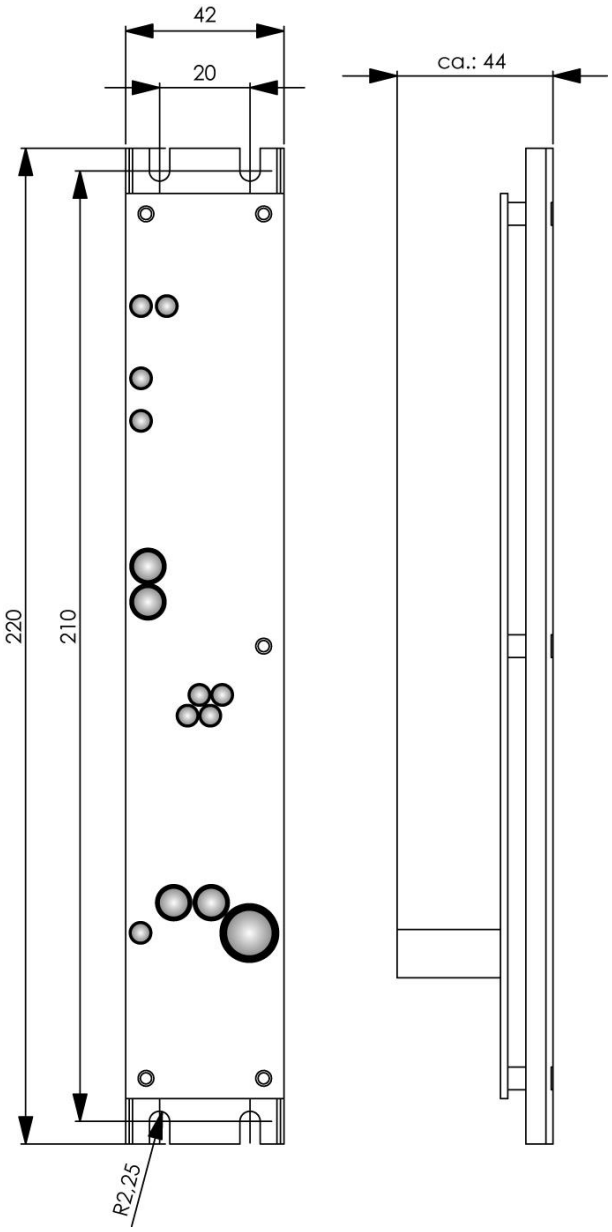
## Miscellaneous

| | |
|---|---|
| Hardware version | 1.x |
| Article number | 05-895-561 |

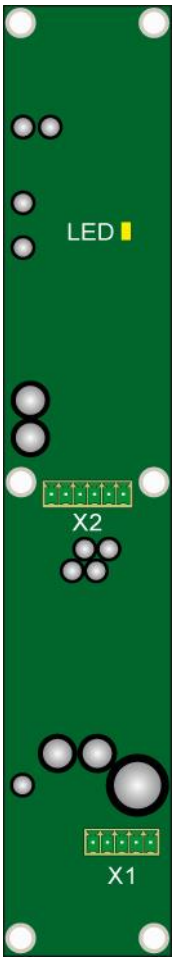
## Environmental conditions

| | | |
|---|---|---|
| Storage temperature | -20 – +70 °C | |
| Operating temperature | 0 – +60 °C | |
| Humidity | 0 - 95 %, uncondensed | |
| EMV stability | According to EN 61000-6-2 (industrial area) | |
| EMV – noise generation | According to EN 61000-6-3 (living area) | |
| Shock resistance | EN 60068-2-27 | 150 m/s² |

## Mechanical Dimensions



## Connector Layout

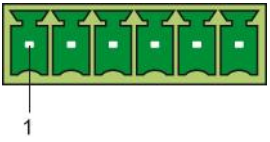


### X1 Lambda sensor interface LSM11 (5-pin Phoenix plug RM3.5)


| Pin | Signal | Function |
|---|---|---|
| 1 | GND | GND |
| 2 | AO1+ | LSM11 Lambda sensor output signal positive |
| 3 | AO1- | LSM11 Lambda sensor output signal negative |
| 4 | 12 V AC1 | Lambda sensor interface 12 V AC electronics supply |
| 5 | 12 V AC2 | Lambda sensor interface 12 V AC electronics supply |

When wiring the Lambda sensor interface, ensure that the GND pin must be connected to the GND of the function module.

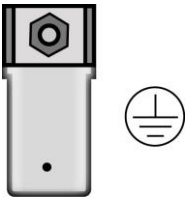
### X2 Lambda sensor interface LSU4.9 (6-pin Phoenix plug RM3.5)




| Pin | Signal | Function | Zusätzlich |
|---|---|---|---|
| 1 | APE | Pump current | R-TRIM |
| 2 | IPN | Virtual mass | - |
| 3 | H- | Heating - | - |
| 4 | H+ | Heating + | - |
| 5 | Rt | Trim resistor | R-TRIM |
| 6 | RE+ | Nernst cell voltage | - |

Der Anschlussstecker der LSU 4.9 enthält einen Trimmwiderstand (50- 170 Ω), mit dem, von Seiten Bosch, die Sonde kalibriert wurde. Der Trimmwiderstand wird von der Elektronik ausgewertet und zur Kompensation der fertigungsbedingten Toleranzen der Sonde verwendet. Der Widerstand muss zwischen PIN 1 (APE) und PIN 5 (RT) angeklemmt werden.

### Earth terminal (6.3 blade termnial)



### Applicable connectors

**The following screw terminals are required:**

**X1:** 5-pin FK-MCP1,5/5-ST-3.5 Phoenix Contact plug
**X2:** 6-pin FK-MCP1,5/6-ST-3.5 Phoenix Contact plug

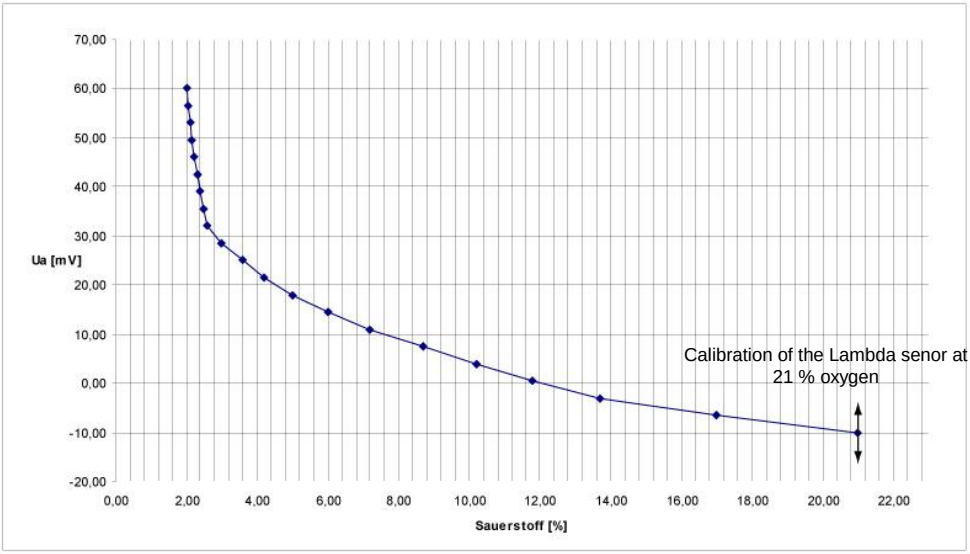
**Connector terminals are not included in delivery!**

## Status LED

| LED status | Definition |
|---|---|
| LED on | Normal operation, heating phase complete, interface board provides correct voltage for oxygen content. |
| LED blinks (1 Hz) | Lambda sensor heating phase |
| LED blinks (5 Hz) | Error status (e.g. no Lambda sensor connected) |
| LED off | Controller not active, no supply |

## Function and Calibration

This table represents the response of the interface electronics. With the LSU 4.9 Lambda sensor, the oxygen is measured and output as the voltage value corresponding to the LSM 11.




2 minutes after activation (with a cold Lambda sensor), the heating phase is completed and the Lambda sensor provides valid analog values.
With the initial start-up, the LSU4.9 Lambda sensor must be calibrated. The offset of the output voltage of the interface electronics must be determined with the connected Lambda sensor at 21 % $O_2$ based on the set value of –10 mV @ 21 % $O_2$ This offset is required by the central unit to convert mV to $O_2$.

## Wiring Guidelines

The signals recorded by the analog inputs are very small in comparison to the digital signals. To ensure error-free operation, a careful wiring method must be followed:

- The lines connected to the source of the analog signals must be as short as possible and parallel wiring to digital signal lines must be avoided.
- 230 V AC lines (power circuit and relay outputs etc.) must not be wired parallel to analog and digital input lines.

# AT90CAN32 Port Assignment

| PORT | I/O | Signal | Description of functions |
|---|---|---|---|
| PA0 | I/O | N.c. | Not Connected |
| PA1 | I/O | N.c. | Not Connected |
| PA2 | I/O | N.c. | Not Connected |
| PA3 | I/O | N.c. | Not Connected |
| PA4 | I/O | N.c. | Not Connected |
| PA5 | I/O | N.c. | Not Connected |
| PA6 | I/O | N.c. | Not Connected |
| PA7 | I/O | N.c. | Not Connected |
| PB0 | Output | CJ125_\SS | CJ125: Slave Select |
| PB1 | Output | CJ125_SCK | CJ125: Serial Clock |
| PB2 | Output | CJ125_SI | CJ125: Slave Input |
| PB3 | input | CJ125_SO | CJ125: Slave Output |
| PB4 | Output | CJ125_\RESET | CJ125: Reset Nicht |
| PB5 | Output | CJ125_PWM_HEATER | PWM output: Lambda sensor heating |
| PB6 | I/O | N.C. | Not connected |
| PB7 | Output | LED | LED control |
| PC0 | I/O | N.c. | Not Connected |
| PC1 | I/O | N.c. | Not Connected |
| PC2 | I/O | N.c. | Not Connected |
| PC3 | I/O | N.c. | Not Connected |
| PC4 | I/O | N.c. | Not Connected |
| PC5 | I/O | N.c. | Not Connected |
| PC6 | I/O | N.c. | Not Connected |
| PC7 | I/O | N.c. | Not Connected |
| PD0 | I/O | N.c. | Not Connected |
| PD1 | I/O | N.c. | Not Connected |
| PD2 | I/O | N.c. | Not Connected |
| PD3 | I/O | N.c. | Not Connected |
| PD4 | I/O | N.c. | Not Connected |
| PD5 | Output | \CANTX | CAN: Transmit Data |
| PD6 | input | \CANRX | CAN: Receive Data |
| PD7 | I/O | N.c. | Not Connected |
| PE0 | Input | PDI | Controller programming: Serial Data Input |
| PE1 | Output | PDO | : Serial Data Output |
| PE2 | Output | TRIG-WD | Hardware Watch-Dog trigger |
| PE3 | Output | LSM11_PWM | PWM output: LSM11 analog output |
| PE4 | Input | /RESPER | Periphery set-input |
| PE5 | I/O | N.C. | Not Connected |
| PE6 | I/O | N.C. | Not Connected |
| PE7 | I/O | N.C. | Not Connected |

| | | | |
|---|---|---|---|
| PF0 | Input | AI01 | Analog input 1: Temperature Lambda sensor LSU4.9 |
| PF1 | Input | AI02 | Analog input 2: Oxygen content Lambda sensor LSU4.9 |
| PF2 | I/O | N.C. | Not Connected |
| PF3 | I/O | N.C. | Not Connected |
| PF4 | Input | TCK | JTAG: Test Clock |
| PF5 | Input | TMS | JTAG: Test Mode Select Input |
| PF6 | Output | TDO | JTAG: Test Data Output |
| PF7 | Input | TDI | JTAG: Test Data Input |
| PG0 | I/O | N.C. | Not Connected |
| PG1 | I/O | N.C. | Not Connected |
| PG2 | I/O | N.C. | Not Connected |
| PG3 | I/O | N.C. | Not Connected |
| PG4 | I/O | N.C | Not Connected |

## Flash in the controller

For the hardware, the offset, multiplier and divisor calibration values are determined at the manufacturer. These values are stored in a Flash in the AT90CAN32 controller.

## Module Identifications HZS: Atmel AVR AT90CAN32 (internal FLASH)

| Address | DATA | Description |
|---|---|---|
| | | Organization of data in bytes |
| 00 | $xx | Checksum from CDIAS header (addresses 1 to 5) = 5 bytes |
| 01 | 123 | Identification |
| 02 | 230 | Module group 230 = Biomass heating control |
| 03 | 61 | Variant<br>HZS561 = Lambda sensor interface |
| 04 | 2 | Number of channels<br>HZS561 = Lambda sensor interface |
| 05 | $10 | Hardware Version $XY ($10=HW 1.0, $32=HW 3.2) |

**Checksum formula:**

- See C-DIAS hardware identification

## HZS 561 Calibration Data: Atmel AVR AT90CAN32 (internal FLASH)

| Address | DATA | Description |
|---|---|---|
| | | Organization of data in Words |
| $40 | $xxxx | Header check sum (2 words) + length of reference data (16 words) = 18 words |
| $42 | 12345 | Identification |
| $44 | 16 | Length of the reference data in Words |
| $46 | 61 | Variant 61= HZS561 = Lambda sensor interface |
| $48 | -318 | AI1 Offset CJ125 (1.5V – 4.15V) |
| $4A | 1000 | AI1 Multiplier |
| $4C | 532 | AI1 Divisor |
| $4E | 265 | AO1 Offset - analog output (0 - 60 mV) |
| $50 | 560 | AO1 Multiplier |
| $52 | 1000 | AO1 Divisor |